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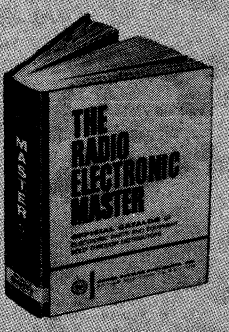

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Amerace-Esna Corp., 4425 Bandini Blvd., Los Angeles, Calif.
Barton Mines Corp., North Creek, N. Y.
Felker Mfg. Co., 1900 S. Crenshaw Blvd., Torrance, Calif.
Inland Manufacturing Co., 1108 Jackson St., Omaha, Nebr.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Norton Co., 1 New Bond St., Worcester, Mass.
Penn Scientific Products Co., Inc., 1000 Old York Rd., Abington, Pa.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.
Union Carbide Corp., Elctrns. Div., Crystal Prods. Dept., 8888 Balboa Ave., San Diego, Cal.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.
Zircoa, (Zirconium Corp. of America), Box 39217, Solon, Ohio

ABSORBERS, MICROWAVE

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y...... p 1671
Waveline Inc., Box 718, West Caldwell, N. J.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Electronautics, Newtown Rd., Littleton, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Goodrich, B. F. Sponge Prods., Plant 4, Canal St., Shelton, Conn.
Henley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Magnetic Core Corp., John St., Box 368, Newburgh, N. Y.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.

ABSORBERS, NUCLEAR RADIATION

Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Westlake Plastics Co., 133 W. Lenni Rd., Lenni, Pa.

ABSORBERS, SHOCK—SEE MOUNTS, SHOCK & VIBRATION

ACCELERATORS & ACCESSORIES, PARTICLE

Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Instrument Research Co., P. O. Box 231, Lincoln, Mass.
Radiation Dynamics, Inc., 1800 Shames Dr., Westbury Indl. Pk., Westbury, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.

ACCELEROMETERS

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Metrix Instrument Co., P.O. Box 36501, Houston, Tex. ..... p 2841
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
American Chain & Cable Co., Box 1629, Waterbury, Conn.
B & F Instruments Inc., Cornwells Hgts., Pa.
Bell Aerosystems Co., 4515 Superior Ave., Cleveland, Ohio
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
Impact-O-Graph Corp., 1762 East 18th St., Cleveland, Ohio
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Larson Aero Development, Box 135, Concord, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
MB Electronics, Box 1825, New Haven, Conn.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Massa Div., 280 Lincoln St., Hingham, Mass.
Pickering & Co., Inc., Industrial/Military Prods. Div., 101 Sunnyside Blvd., Plainview, N. Y.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Sprengnether, W. F. Instr. Co., Inc., 4567 Swan St., St. Louis, Mo.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
United Control Corporation, Redmond, Wash.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

ACOUSTIC MATERIALS—SEE MATERIALS, ACOUSTIC

ACOUSTIC NOISE GENERATORS—SEE GENERATORS, ACOUSTIC, HIGH-INTENSITY NOISE

ACOUSTIC TEST CHAMBERS—SEE CHAMBERS, ACOUSTICAL TEST. (HIGH-INTENSITY NOISE)

ACRYLIC SPRAYS—SEE INSULATING COMPOUNDS, ACRYLIC

ACTUATORS, SERVO, LINEAR

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2669
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio. ..... p 2747
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1760
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Weston-Transicoil Components Div., Worcester, Pa.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EMR Div., Box 223, Princeton, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Lisk, G. W., Co., Inc., 5019 South St., Clifton Springs, N. Y.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.

ACTUATORS, SERVO, LINEAR (Cont'd)

McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Metal Bellows Corp., 1075 Providence Hwy., Sharon, Mass.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Rae Motor Corp., Box 518, McHenry, Ill.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Royal Inds., Engineered Prods. Div., 2040 E. Dyer Rd., Santa Ana, Cal.
Servotronics, Inc., 3901 Union Rd., Buffalo, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skinner Polynoid Div., 95 Edgewood Ave., New Britain, Conn.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Task Corporation, Box 3999, Anaheim, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Weston Hydraulics, 7500 Tyrone Ave., Van Nuys, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.
Wright Components Inc., 5019 South St., Clifton Springs, N. Y.

ACTUATORS, SERVO, ROTARY

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
American Precision Inds., Inc., 77 Olean Rd., E. Aurora, N. Y.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y.
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2669
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1760
Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Weston-Transicoil Components Div., Worcester, Pa.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EMR Div., Box 223, Princeton, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Lisk, G. W., Co., Inc., 5019 South St., Clifton Springs, N. Y.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Lunkenheimer Co., Box 14360, Cincinnati, Ohio
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Meltronics, Inc., 3343 Merrick Rd., Wantagh, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Pneu-Hydro Valve Corp., 52 Horse Hill Rd., Cedar Knolls, N. J.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Task Corporation, Box 3999, Anaheim, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electrokinetics Div., 402 E. Gutierrez St., Santa Barbara, Calif.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

ADAPTERS—SEE CONNECTORS; PLUGS; SOCKETS; ETC.

ADAPTERS, FM, RECORDING

Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Vetter, A. R. Co., Box 143, Rebersburg, Pa. ..... p 2162
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Video Research Corp., 761 N. Washington St., Rockville, Md.

ADAPTERS, PANORAMIC—SEE RECEIVERS, PANORAMIC

ADAPTERS, WAVEGUIDE

American Corp., 87 Rumford Ave., Waltham, Mass. ..... p 834
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.

ADHESIVES, ALL-TYPES

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1639, 1640
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y. ..... p 2812
Dow Corning Corp., Midland, Mich. ..... p 1582, 1583
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 705
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Ablestik Adhesive Co., Inc., 833 W. 182nd St., Gardena, Cal.
Abletech, 544 West 182nd St., Gardena, Calif.
Adhesive Products Corp., 1660 Boone Ave., Bronx, N. Y.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Armstrong Products Company, Inc., P.O. Box 657, Warsaw, Ind.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Barrett Varnish Co., 1532 South 50th Ct., Cicero, Ill.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
Borden Inc., 350 Madison Ave., New York, N. Y.
Carboline Co., 328 Hanley Indl. Ct., St. Louis, Mo.
Carter's Ink Co., 239 First St., Cambridge, Mass.
Chemelex Inc., 2 Industrial Plaza Rd., Danbury, Conn.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Daubert Chemical Co., 2000 Spring Rd., Oak Brook, Ill.
Dennis Chemical Co., 2701 Papin St., St. Louis, Mo.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dow Chemical Co., Midland, Mich.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Electro Materials Corp. of America, 605 Center Ave., Mamaroneck, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Fenwal, Inc., Main St., Ashland, Mass.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
GAF Corp., 140 West 51 St., New York, N. Y.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Groendyk Mfg. Co., Inc., P.O. Box 278, Buchanan, Va.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Hightemp Resins Inc., 225 Greenwich Ave., Stamford, Conn.
Hysol Div., 211 Franklin St., Olean, N. Y.
Illinois Bronze Powder & Paint Co., 300 E. Main St., Lake Zurich, Ill.
Isochem Resins Co., Cook St., Lincoln, R. I.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kenics Corp., One Southside Rd., Danvers, Mass.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Mansol Ceramics Co., Inc., 140 Little St., Belleville, N. J.
Marbon, Box 68, Washington, W. Va.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Morgan Adhesives Co., 4560 Darrow Rd., Stow, Ohio
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Paisley, 1153 Bloomfield Ave., Clifton, N. J.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Randolph Products Co., 12th St., Carlstadt, N. J.
Rector Engrg. & Plastics Co., 318 Randolph Pl., N. E., Washington, D. C.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Rubatex Corp., Bedford, Va.
Sauereisen Cements Co., 160 Gamma Dr., Pittsburgh, Pa.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Smooth-On, Inc., 1000 Valley Rd., Gillette, N. J.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Tech Spray, 2113 W. 3rd, Amarillo, Tex.
Techform Labs., Inc., 707 S. Hampton Dr., Venice, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
3M Co., 3M Center, St. Paul, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Tra-Con, Inc., 55 North St., Medford, Mass.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wire Cloth Enterprises, Inc., 130-132 Gamma Dr., Pittsburgh, Pa.

AGING RACKS—SEE RACKS, AGING

AIR CLEANERS AND FILTERS (SHIELDED & UNSHIELDED)

Evans, G. Corp., 121 37 St., Moline, Ill. ..... p 1251
McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1253
Metex Corp., 970 New Durham Rd., Edison, N. J.
Rotron, Inc., Hasbrouck La., Woodstock, N. Y. ..... p 1273
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Agnew-Higgins, Inc., Box 857, Garden Grove, Calif.
Airflow Co., Montgomery County Airpark, Gaithersburg, Md.
Airmatic Valve Inc., 7313 Associate Ave., Cleveland, Ohio
American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.
American-Standard, Applied Air Conditioning Dept., Columbus, Ohio
Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Blocksom & Co., P.O. Box 300, Michigan City, Ind.
Cambridge Filter Corp., 7645 Seventh North Rd., Syracuse, N. Y.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Carey Elctrn. Engrg. Co., 1880 Clifton Ave., Springfield, Ohio
Cincinnati Fan & Ventilator Co., 6516 Wiehle, Cincinnati, Ohio
Clean Rooms Construction Co., Inc., Box 275, Westminster, Calif.
Electro-air Div., Olivia & Sproul Sts., McKees Rocks, Pa.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Farr Co., 2301 E. Rosecrans, El Segundo, Calif.
Flock Process Corp., Box 430, Norwalk, Conn.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Johnson Corp., 805 Wood St., Three Rivers, Mich.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Kentucky Metals, Inc., 3104 S. Preston St., Louisville, Ky.
Lisk, G. W., Co., Inc., 5019 South St., Clifton Springs, N. Y.
Marbon, Box 68, Washington, W. Va.
Midget Louver Co., 800 Main Ave., Norwalk, Conn.
North American Rockwell Corp., 25000 Miles Rd., Cleveland, Ohio
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Research Products Corp., 1015 E. Washington, Madison, Wisc.
Selas Corp. of America, Box 200, Dresher, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Torit Corp., 1133 Rankin St., St. Paul, Minn.
Trion, Inc., 1000 Island Ave., McKees Rocks, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

AIR CONDITIONERS (FOR EQUIPMENT)

Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1250
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
Airflow Co., Montgomery County Airpark, Gaithersburg, Md.
American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.
American-Standard, Applied Air Conditioning Dept., Columbus, Ohio
Astro Dynamics, Inc., 2nd Ave., Northwest Industrial Park, Burlington, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Clarage Fan Co., One Clarage Pl., Kalamazoo, Mich.
Eastern Industries, 100 Skiff St., Hamden, Conn.
Engonics Engineering Div., 9601 W. Jefferson Blvd., Culver City, Calif
Environmental Control Sys. Div., 43-22 Queens St., Long Island City, N. Y.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Kooltronic Fan Co., Box 504, Princeton, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 3333 W. Warner Ave., Santa Ana, Calif.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Task Corporation, Box 3999, Anaheim, Calif.
Typhoon Air Conditioning Co., 505 Carroll St., Brooklyn, N. Y.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

AIR FILTERING & VENTILATING PANELS (SHIELDED & UNSHIELDED)—SEE AIR CLEANERS & FILTERS

ALARMS & ALARM SYSTEMS

AEL Inc., P.O. Box 552, Lansdale, Pa.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1343
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Modules Corp., P.O. Box 141, Timonium, Md.

Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Heath Co., Dept. 180, Benton Harbor, Mich.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Metrix Instrument Co., P.O. Box 36501, Houston, Tex. ..... p 2841
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
Rosemount Plug-In Inc., Component Sales, 1418 Lebanon Rd., Nashville, Tenn.
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Theta Instrument Corp., Fairfield, N. J.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Alert Products Div., Balco Mfg. Co., P.O. Box 1851, Costa Mesa, Calif.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Peripheral Sys., Inc., 7120 Harwin, Houston, Tex.
Autocall Co., 366 Mack Ave., Shelby, Ohio
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automatic Radio Int'L, 2 Main St., Melrose, Mass.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beacon Elctrns., Inc., 121 Stanley Ave., Bellmawr, N. J.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Berkeley/Dynamics, Inc., 934 Baileyana Rd., Hillsborough, Calif.
Beta Corp., 2639 Manana Dr., Box 20427, Dallas, Tex.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Brooks Instrument Div., Emerson Elec. Co., Hatfield, Pa.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Chatham Controls Corp., 33 River Rd., Chatham, N. J.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Continental Instrs. Corp., 110 Atlantic Ave., Lynbrook, N. Y.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Datasenors Co., 735 Factory Rd., Addison, Ill.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Edwards Co., Inc., 90 Connecticut Ave., Norwalk, Conn.
Electro-Alarm Safety Devices, 745 N. Pleasant, Fresno, Calif.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electro Devices, Inc., 11805 Westline Industrial Dr., St. Louis, Mo.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Emerson Electric Co., Box 552, Honeoye Falls, N. Y.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Erdco Engrg. Corp., 136 Official Rd., Addison, Ill.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Faraday, Inc., 805 S. Maumee, Tecumseh, Mich.
Fire Control Co., Inc., 1605 Ayre St., Newport, Dela.
Foxboro, Foxboro, Mass.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
Fuel Watchman Sales & Service, Inc., 2910 Park Ave., Bronx, N. Y.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
Gillette Elctrn. Prods. Co., 201 Laurel St., Beverly, N. J.
Gold Line Connector, Inc., Muller Ave., Box 893, Norwalk, Conn.
Hamilton Industries, Box 504, Winter Haven, Fla.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Henschel Corp., 14 Cedar St., Amesbury, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Commercial Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
Industrial Components, Inc., 1675 S.E. Allen Ave., Beaverton, Ore.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Johnson Corp., 805 Wood St., Three Rivers, Mich.
Johnson-Williams Products, 2300 Leghorn St., Mountain View, Calif.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lee Elec., Inc., 309-51st St., W. New York, N. J.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Maytronics, Inc., Box 460, Colorado Springs, Colo.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Miller Assocs., Mercersburg Academy, Mercersburg, Pa.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Mosler Electronic System Div., 9 South St., Danbury, Conn.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Notifier Co., 3700 North 56th St., Lincoln, Neb.
On-Guard Corp. of America, 345 West 37 St., New York, N. Y.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Pinkerton Electro-Security Co., 61 Sutton Rd., Webster, Mass.
Puregas Equipment Corp., 1445 Strongs Rd., Copiague, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Radar Relay, Inc., 1631 10th St., Santa Monica, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Reach Electronics, Inc., Box 308, Lexington, Nebr.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Roveti Instruments, 238 West St., Annapolis, Md.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scam Instrument Corp., 7401 N. Hamlin Ave., Skokie, Ill.
Schirmer National Alarm Co., 100 Portland Ave., Bergenfield, N. J.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Southern Avionics Co., 5055 Belmont, Beaumont, Tex.
Standard Electric Time Corp., 89 Logan St., Springfield, Mass.
Stevenson Engrg. & Mfg. Co., P.O. Box 25070, Portland, Ore.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Superior Continental Corp., Box 489, Hickory, N. C.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Thomas Ind'l. Automation Ltd., Deansgate La., Timperley, Cheshire, Eng.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Union Diesel Engine Co., P. O. Box 1737, Oakland, Calif.
United Electric Controls Co., 85A School St., Watertown, Mass.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.
Worner Electrn. Devices, Rankin, Ill.

ALLIGATOR CLIPS—SEE CLIPS, ALLIGATOR

ALLOYS, BRAZING

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J. ..... p 2830
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Smelting & Refining Co., 120 Broadway, New York, N. Y.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Cerac, Inc., Box 597, Butler, Wisc.
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Tricon Mfg. Co., 2325 Wisconsin Ave., Downer Grove, Ill.
Unibraze Corp., 455 Knollwood Rd., White Plains, N. Y.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Ventron Corp., Congress St., Beverly, Mass.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Westinghouse Electric Corp., Ind. Equip. Div., Box 300, Sykesville, Md.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

ALLOYS, METAL & CERAMIC

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. .... p 1221
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Metal Climax, Inc., 1270 Ave. of The Americas, N.Y., N.Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cerac, Inc., Box 597, Butler, Wisc.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Dixon Sintaloy, Inc., 535 Hope St., Stamford, Conn.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Glidden-Durkee Div., 900 Union Commerce Bldg., Cleveland, Ohio
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
King Laboratories, Inc., 127 Solar St., Syracuse, N. Y.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
National Lead Co., 111 Broadway, New York, N. Y.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Republic Foil, Inc., 55 Triangle St., Danbury, Conn.

AMPLIFIERS, A-F (EXCLUDING HI-FI)

Ronson Metals Corp., 55 Manufacturers Pl., Newark, N. J.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Union Carbide Corp., Elctrns. Div., Crystal Prods. Dept., 8888 Balboa Ave., San Diego, Cal.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Ventron Corp., Congress St., Beverly, Mass.
Wellington Technical Inds., Inc., 55 Honeck St., Englewood, N. J.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.

ALLOYS, METAL-TO-GLASS SEALING—SEE SEALS, GLASS-TO-METAL

ALLOYS, SEMICONDUCTOR—SEE METALS, SEMICONDUCTOR

ALPHANUMERIC READOUT TUBES—SEE TUBES, READOUT

ALPHANUMERIC READOUTS—SEE READOUTS (AS MODIFIED)

ALTERNATORS—SEE GENERATORS, AC

ALTITUDE CHAMBERS—SEE CHAMBERS, ALTITUDE

ALUMINA (INCL. HIGH PURITY)—SEE INSULATION MATERIALS, CERAMIC

ALUMINIZERS, VACUUM—SEE DEPOSITION EQUIPMENT: EVAPORATION EQUIPMENT

AMMETERS—SEE METERS, AMPERE

AMPLIFIERS, A-F (EXCLUDING HI-FI)

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Allen Electronics Div., Allen Organ Co., Macungie, Pa. ..... p 718
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass. p 507-509, 511
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif. ..... p 505
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 512
B & K Instruments, Inc., 5113 West 164th St, Cleveland, Ohio .. p 1336
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. .... p 516, 519
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1888-1890
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 1949
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
Mallory, P. R. & Co., Inc., 3029 E. Washington St., Indianapolis, Ind. p 1630
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. ..... p 536
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1470
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Acoustronics, Inc., 156 Olive St., Huntington, N. Y.

AMPLIFIERS, A-F (EXCLUDING HI-FI) (Cont'd)

Action Systems Co., 34 Cambridge St., Meriden, Conn.
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Antronic Corp., 4942 Division, Chicago, Ill.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Arbor Systems, Inc., P.O. Box 1325, Ann Arbor, Mich.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
Audio Instr. Co., Inc., 311 Mountain Rd., Union City, N. J.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Bay Laboratories, Inc., 20160 Center Ridge Rd., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bell PA Prods. Corp., 1200 N. Fifth St., Columbus, Ohio
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bozak, R. T. Mfg. Co., Box 1166, Darien, Conn.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Browning Labs., Inc., Box 310, Laconia, N. H.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Calbest Elctrns., 4801 Exposition Blvd., Los Angeles, Calif.
Century Projector Corp., 729 Seventh Ave., New York, N. Y.
Clark, D. Co., Inc., 360 Franklin St., Worcester, Mass.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Continental Electronics Corp., 302 McGuinness Blvd., Brooklyn, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Davis, J. W. & Co., Box 35313, Dallas, Tex.
Defense Elctrns., Inc., Rockville, Md.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
ECCO Elctrn. Comps. Corp., 157 S. MacQuesten Pkwy., Mt. Vernon, N. Y.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
Echo Electronics Corp., 59-10 Queens Blvd., Woodside, N. Y.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electron Enterprises, Inc., 6645 Stanley Ave., Berwyn, Ill.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Fargo Co., 1162 Bryant St., San Francisco, Calif.
Femco, Inc., Box F, Irwin, Pa.
Gai-Tronics Corp., Box 31, Reading, Pa.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Johnson Electronics, Inc., Box 7, Casselberry, Fla.
Koss Electronics, Inc., 2227 North 31st St., Milwaukee, Wisc.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Loge Electronics, 2171 W. Washington Blvd., Los Angeles, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Major Electronics Corp., 649 39 St., Brooklyn, N. Y.
Mallory, P. R. & Co. Inc., Integrated Circuit Dept., 3029 E. Washington St., Indianapolis, Ind.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Midwest Audio Corp., 5707 W. Division, Chicago, Ill.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Permoflux Corp., Box 6364, Glendale, Calif.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Precision Elctrns., Inc., 9101 King Ave., Franklin Park, Ill.
Pulse Techniques, Inc., 1411 Palisade Ave., W. Englewood, N. J.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio-Matic of America, Inc., 760 Ramsey Ave., Hillside, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Republic Elctrn. Inds. Inc., 575 Broad Hollow Rd., Huntington, N. Y.
Roesch, D., Comm., Inc., 2727 San Fernando Rd., Los Angeles, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Round Hill Assoc., Inc., 325 Hudson St., New York, N. Y.
Roveti Instruments, 238 West St., Annapolis, Md.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stancil-Hoffman Corp., 921 N. Highland Ave., Hollywood, Calif.
Standard Electronics Corp., Box 677, Freehold, N. J.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tabet Mfg. Co., 1336 Ballentine Blvd., Norfolk, Va.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Tech-Master Corp., 633-33 98 Pl., Forest Hills, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Touchmaster Labs., 6750 Selma Ave., Hollywood, Calif.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Trutone Elctrns., Inc., 14660 Raymer St., Van Nuys, Calif.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.
Wilder Engrg. Prods., 715 Kedzie, Chicago, Ill.

AMPLIFIERS, ANTENNA

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Alliance Mfg. Co., Inc., Alliance, Ohio
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. ..... p 518
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1702
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Comdel Inc., Beverly Airport, Beverly, Mass.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gavin Instrs., Inc., Box 413, Somerville, N. J.
HRB-Singer, Inc., Science Park, State College, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lindsay Antenna & Specialty Prod., 50 Mary St., Lindsay, Ont., Can.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Wald Sound, 11131 Dora St., Sun Valley, Calif.

AMPLIFIERS, BIOPHYSICAL

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2838

AMPLIFIERS, CHARGE

Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 512
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 524
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532, 533
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Metrix Instrument Co., P.O. Box 36501, Houston, Tex. ..... p 2841
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
PCB Piezotronics, Inc., 3311 Walden Ave., Depew, N. Y.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Tennelec, Inc., Box D, Oak Ridge, Tenn.
United Control Corporation, Redmond, Wash.

AMPLIFIERS, COMPRESSOR

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Acoustronics, Inc., 156 Olive St., Huntington, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
CBS Labs., High Ridge Rd., Stamford, Conn.
Comdel Inc., Beverly Airport, Beverly, Mass.
Electronic Systems Engrg. Co., 120½ N. Cleveland, Cushing, Okla.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Precision Elctrns., Inc., 9101 King Ave., Franklin Park, Ill.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Stancil-Hoffman Corp., 921 N. Highland Ave., Hollywood, Calif.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
United Research Labs., 681 Fifth Ave., New York, N. Y.
Vega Elctrns. Corp., 2115 De La Cruz Blvd., Santa Clara, Calif.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.

AMPLIFIERS, CONTROL

Analog Devices Inc., 221 Fifth St., Cambridge, Mass. ..... p 509-511
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1592
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. .... p 1357
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657, 2659
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1890
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2662
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 2665
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 534
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537

Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman, Advanced Tech. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Fisher Radio Corp., 11-40 45th Rd., Long Island City, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Precision Elctrns., Inc., 9101 King Ave., Franklin Park, Ill.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Varo General, Garland Bank Bldg., Garland, Tex.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Westamp, Inc., 1542 15th St., Santa Monica, Calif.
Worner Electrn. Devices, Rankin, Ill.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

AMPLIFIERS, CURRENT

Analog Devices Inc., 221 Fifth St., Cambridge, Mass. ..... p 510
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
Tektronix, Inc., Box 500, Beaverton, Ore.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.

AMPLIFIERS, DC

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif. ..... p 505
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 512, 2838
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657, 2658
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1556, 1563
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
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Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1031
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Heath Co., Dept. 180, Benton Harbor, Mich.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
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Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
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Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. ..... p 536
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Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Quantum Devices Corp., 15 W. Main St., Bergenfield, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tektronix, Inc., Box 500, Beaverton, Ore.
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2122
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
Advance Instr. Corp., 1707 F St., Belmar, N. J.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Applied Dynamics, Inc., 2275 Platt Rd., Ann Arbor, Mich.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
B & F Instruments Inc., Cornwells Hgts., Pa.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Bay Laboratories, Inc., 20160 Center Ridge Rd., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Collins Radio Co., Dallas, Texas
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EG & G Inc., 35 Congress St., Salem, Mass.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.

AMPLIFIERS, DECADE

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Ensco, Inc., 3100 Eldredge St., Salt Lake City, Utah
Fairchild Controls, 423 National Ave., Mountain View, Calif.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
General Computers Inc., 5990 W. Pico Blvd., Los Angeles, Calif.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Locus, Inc., 906 W. College Ave., State College, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
Power Control Corp., Box 11432, Pittsburgh, Pa.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Redcor Corp., Box 1031, Canoga Park, Calif.
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Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.
Varo General, Garland Bank Bldg., Garland, Tex.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Westamp, Inc., 1542 15th St., Santa Monica, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

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Arvee Engineering Co., P.O. Box 3759, Torrance, Calif. ..... p 505
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.

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Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1470
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Roveti Instruments, 238 West St., Annapolis, Md.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.

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Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill.
Tektronix, Inc., Box 500, Beaverton, Ore.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Celco, 70 Constantine Dr., Mahwah, N. J.
Ferranti Ltd., Hollinwood, Lancs., Eng.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Information Displays, Inc., 333 N. Bedford Rd., Mt. Kisco, N. Y.
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Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
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Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.

AMPLIFIERS, DELAY LINE

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Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.

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Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass. p 507, 508, 510, 511
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. .... p 512, 764, 2838
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2658
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1563
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Computer Labs., 1109 S. Chapman St., Greensboro, N. C. ..... p 515
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
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Electronic Components Div., United Aircraft, Trevese, Pa. p 2630, 2632
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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
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INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
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Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. ..... p 536
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538, 539
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Quantum Devices Corp., 15 W. Main St., Bergenfield, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tektronix, Inc., Box 500, Beaverton, Ore.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
B & F Instruments Inc., Cornwells Hgts., Pa.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Bay Laboratories, Inc., 20160 Center Ridge Rd., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Fairchild Controls, 423 National Ave., Mountain View, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Maytronics, Inc., Box 460, Colorado Springs, Colo.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Redcor Corp., Box 1031, Canoga Park, Calif.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

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Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. ..... p 513
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. p 516, 517, 520
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
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Arvee Engineering Co., P.O. Box 3759, Torrance, Calif.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. ..... p 513
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. .... p 1357
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio p 2286
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657, 2659
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. p 516, 519-521
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1556
Cohu Electronics Inc., Box 623, San Diego, Calif.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2662

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Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 524
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1937
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. ..... p 536
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1702
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tektronix, Inc., Box 500, Beaverton, Ore.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Bay Laboratories, Inc., 20160 Center Ridge Rd., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Comdel Inc., Beverly Airport, Beverly, Mass.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
D.A.T.A., Inc., 32 Lincoln Ave., Orange, N. J.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Derivation & Tabulation Assocs., Inc., 32 Lincoln Ave., Orange, N. J.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EG & G Inc., 35 Congress St., Salem, Mass.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Optimax Inc., 258 N. Main St., Ambler, Pa.
P & H Electronics, 426 Columbia St., Lafayette, Ind.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Precision Elctrns., Inc., 9101 King Ave., Franklin Park, Ill.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Roveti Instruments, 238 West St., Annapolis, Md.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tennelec, Inc., Box D, Oak Ridge, Tenn.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

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Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Defense Elctrns., Inc., Rockville, Md.
Electronics, Missiles & Comms., Inc., Box 116, White Haven, Pa.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.

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Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 523
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679, 1681
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1695, 1703
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tektronix, Inc., Box 500, Beaverton, Ore.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Audio Instr. Co., Inc., 311 Mountain Rd., Union City, N. J.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Defense Elctrns., Inc., Rockville, Md.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
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Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
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K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
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Optimax Inc., 258 N. Main St., Ambler, Pa.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Tennelec, Inc., Box D, Oak Ridge, Tenn.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

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ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2659
Collins Radio Co., Newport Beach, Calif.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1031
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Superior Mfg. & Instr. Corp., 38-07 20th Ave., L. I. C., N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 1054
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gammatronix Inc., Dublin, Ohio
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
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Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Microdot-Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.

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Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. ..... p 513
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. .... p 517, 518
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1370
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667

Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. . . p 1674
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. . . . . . p 1679, 1682
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
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Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
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RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. . . . p 1708
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. . . p 1713
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Collins Radio Co., Dallas, Texas
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EMF Systems, Inc., Box 1009, State College, Pa.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
GAF Corp., 140 West 51 St., New York, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Locus, Inc., 906 W. College Ave., State College, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Optimax Inc., 258 N. Main St., Ambler, Pa.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
S F D Labs., Inc., 800 Rahway Ave., Union, N. J.
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Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
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Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

AMPLIFIERS, MIXING

Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. . . . . . p 1679
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
p 535
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bozak, R. T. Mfg. Co., Box 1166, Darien, Conn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorsett Electronics, Box 36, Tulsa, Okla.
EG & G Inc., 35 Congress St., Salem, Mass.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microcom Corp., Horsham Valley Industrial Park, Horsham, Pa.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
NUS Corp., Box 248, Paramus, N. J.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Precision Elctrns., Inc., 9101 King Ave., Franklin Park, Ill.
Pulse Techniques, Inc., 1411 Palisade Ave., W. Englewood, N. J.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.

AMPLIFIERS, NARROW BAND

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. . . . . . p 512
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. . . . . . p 513
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio . . p 1336
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. . . . . . p 2657, 2659
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. . . . . . p 516
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roveti Instruments, 238 West St., Annapolis, Md.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

AMPLIFIERS, NONLINEAR

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.

AMPLIFIERS, OPERATIONAL

Intronics, Inc., 57 Chapel St., Newton, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
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RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Collins Radio Co., Dallas, Texas
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tennelec, Inc., Box D, Oak Ridge, Tenn.
Ultra Audio Products, Box 921, Beverly Hills, Calif.

AMPLIFIERS, NULL

Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. . . . . p 1413
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Theta Instrument Corp., Fairfield, N. J.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Electronic Science Labs., 3920 Bryn Mawr, Dallas, Tex.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roveti Instruments, 238 West St., Annapolis, Md.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.

AMPLIFIERS, OPERATIONAL

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. . . . . p 758
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass. . . . . . p 506-511
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. . . . . . p 2658
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Computer Labs., 1109 S. Chapman St., Greensboro, N. C. . . . . . p 515
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. . . . . . p 771
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. . . p 522, 523
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
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Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. . . . . . p 2470
Fairchild Controls, 5625 Kearny Villa Rd., San Diego, Calif. . . . . p 2470
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. . . p 528
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. . . . . . p 531
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. . . . . . p 533
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1415, 2395
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. . . p 1972, 1973, 1987
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
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Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. . . . . . p 536

AMPLIFIERS, OPERATIONAL (Cont'd)

Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. ..... p 2793
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2122
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Dynamics, Inc., 2275 Platt Rd., Ann Arbor, Mich.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Fairchild Controls, 423 National Ave., Mountain View, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
General Computers Inc., 5990 W. Pico Blvd., Los Angeles, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Radiation, Inc., Microelectronics Div., Box 37, Melbourne, Fla.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Redcor Corp., Box 1031, Canoga Park, Calif.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.
United Control Corporation, Redmond, Wash.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

AMPLIFIERS, OSCILLOSCOPE, PLUG-IN—SEE OSCILLOSCOPE AMPLIFIER PLUG-INS

AMPLIFIERS, PARAMETRIC

AEL Inc., P.O. Box 552, Lansdale, Pa.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass. ..... p 506
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Lowell Elctrns. Corp., 9100 Terminal Ave., Skokie, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

AMPLIFIERS, PEAK-LIMITING

Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
CBS Labs., High Ridge Rd., Stamford, Conn.
Electronic Systems Engrg. Co., 120½ N. Cleveland, Cushing, Okla.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.

AMPLIFIERS, PHOTOCELL

AEL Inc., P.O. Box 552, Lansdale, Pa.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Sensor Technology, Inc., 7118 Gerald Ave., Van Nuys, Calif. .... p 1774
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y.
United Detector Technology, 1732 21st St., Santa Monica, Calif.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Century Projector Corp., 729 Seventh Ave., New York, N. Y.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Worner Electrn. Devices, Rankin, Ill.

AMPLIFIERS, POWER (EXCLUDING HI-FI)

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. ..... p 513
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1592
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. .... p 1357
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. p 516, 520, 521
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1888-1890
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Connor-Winfield Corp., Winfield, Ill.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 522, 523, 2665
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1937, 1940
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 1949
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Heath Co., Dept. 180, Benton Harbor, Mich.
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y. p 530
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1972, 1973, 1985, 1987
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. ..... p 536
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1695
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Transformer Electronics Co., Box 910, Boulder, Colo.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. ..... p 2141
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Acoustech, 2227 N. 31 St., Milwaukee, Wisc.
Acoustronics, Inc., 156 Olive St., Huntington, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell PA Prods. Corp., 1200 N. Fifth St., Columbus, Ohio
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Goerz Optical Co., Inc., 301 Alpha Dr., Pittsburgh, Pa.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
MB Electronics, Box 1825, New Haven, Conn.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Olektron Corp., Box 248, Dudley, Mass.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Precision Elctrns., Inc., 9101 King Ave., Franklin Park, Ill.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.

Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tech-Master Corp., 633-33 98 Pl., Forest Hills, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

AMPLIFIERS, PUBLIC ADDRESS

Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Audio Equip. Co., Inc., 75 Harbor Rd., Port Washington, N. Y.
Bell PA Prods. Corp., 1200 N. Fifth St., Columbus, Ohio
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bozak, R. T. Mfg. Co., Box 1166, Darien, Conn.
Browning Labs., Inc., Box 310, Laconia, N. H.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Electronic Systems Engrg. Co., 120½ N. Cleveland, Cushing, Okla.
Fanon Elctrn. Inds., 439 Frelinghuysen Ave., Newark, N. J.
Femco, Inc., Box F, Irwin, Pa.
Gai-Tronics Corp., Box 31, Reading, Pa.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Karg Laboratories, Inc., 162 Ely Ave., Norwalk, Conn.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loge Electronics, 2171 W. Washington Blvd., Los Angeles, Calif.
Micro-Magna Elctrns., 3311 Perkins Ave., Cleveland, Ohio
Midwest Audio Corp., 5707 W. Division, Chicago, Ill.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Precision Elctrns., Inc., 9101 King Ave., Franklin Park, Ill.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Schindlers, 195 Greenfield Ave., Los Angeles, Calif.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Tech-Master Corp., 633-33 98 Pl., Forest Hills, N. Y.
Trutone Elctrns., Inc., 14660 Raymer St., Van Nuys, Calif.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.

AMPLIFIERS, PULSE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. p 516, 518-521
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1890
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1563
Cohu Electronics Inc., Box 623, San Diego, Calif.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1370
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1680
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. p 1686, 1687
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1702
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EG & G Inc., 35 Congress St., Salem, Mass.
Eimac, 301 Industrial Way, San Carlos, Calif.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Locus, Inc., 906 W. College Ave., State College, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Telemet Co., 185 Dixon Ave., Amityville, N. Y.
Tennelec, Inc., Box D, Oak Ridge, Tenn.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

AMPLIFIERS, PULSE-LIMITING

AEL Inc., P.O. Box 552, Lansdale, Pa.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.

AMPLIFIERS, RADAR—SEE AMPLIFIERS, MICROWAVE

AMPLIFIERS, RECORDING—SEE AMPLIFIERS A-F (EXCLUDING HI-FI)

AMPLIFIERS, RESOLVER—SEE AMPLIFIERS, SERVO

AMPLIFIERS, R-F

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif. ..... p 505
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. ..... p 513
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. p 516, 517, 519-521
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 523
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674

AMPLIFIERS, R-F

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y. p 530
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679, 1682
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1702, 1703
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Comdel Inc., Beverly Airport, Beverly, Mass.
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorsett Electronics, Box 36, Tulsa, Okla.
EMF Systems, Inc., Box 1009, State College, Pa.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronics, Missiles & Comms., Inc., Box 116, White Haven, Pa.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
Essex International, Elctrn. Sys., Mt. Vernon Rd., Evansville, Ind.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gavin Instrs., Inc., Box 413, Somerville, N. J.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
HRB-Singer, Inc., Science Park, State College, Pa.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Locus, Inc., 906 W. College Ave., State College, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.

AMPLIFIERS, R-F (Cont'd)

Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Republic Elctrn. Inds. Inc., 575 Broad Hollow Rd., Huntington, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Round Hill Assoc., Inc., 325 Hudson St., New York, N. Y.
Ruxton Elctrns. Co., 2420 N. Rosemead Blvd., S. El Monte, Calif.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Standard Electronics Corp., Box 677, Freehold, N. J.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Texas Microelectronics, 1220 Majesty, Dallas, Tex.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

AMPLIFIERS, SAMPLE & HOLD

Analog Devices Inc., 221 Fifth St., Cambridge, Mass. ..... p 508, 509
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 776
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. p 797
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
Analogic Co., 296 Newton St., Waltham, Mass.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Redcor Corp., Box 1031, Canoga Park, Calif.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

AMPLIFIERS, SERVO

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657-2659
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2662
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 2665
EMR-Hathoro, E. County Line Rd., Hathoro, Pa.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1940
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Intronics, Inc., 57 Chapel St., Newton, Mass.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J. ..... p 1764
Superior Mfg. & Instr. Corp., 38-07 20th Ave., L. I. C., N. Y.
Theta Instrument Corp., Fairfield, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Advance Instr. Corp., 1707 F St., Belmar, N. J.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bell Aerosystems Co., 4515 Superior Ave., Cleveland, Ohio
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Collins Radio Co., Dallas, Texas
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMR Div., Box 223, Princeton, N. J.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Goerz Optical Co., Inc., 301 Alpha Dr., Pittsburgh, Pa.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Henschel Corp., 14 Cedar St., Amesbury, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Republic Elctrn. Inds. Inc., 575 Broad Hollow Rd., Huntington, N. Y.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Westamp, Inc., 1542 15th St., Santa Monica, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

AMPLIFIERS, SINGLE SIDEBAND

Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 512
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Comdel Inc., Beverly Airport, Beverly, Mass.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.

AMPLIFIERS, STANDING WAVE

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.

AMPLIFIERS, STRAIN GAUGE

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass. ..... p 506
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 512, 2838
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 523
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 524
Ectron Corp., 8070 Engineer Rd., San Diego, Calif. ..... p 527
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532, 533
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tektronix, Inc., Box 500, Beaverton, Ore.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
B & F Instruments Inc., Cornwells Hgts., Pa.
Bay Laboratories, Inc., 20160 Center Ridge Rd., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dixson, Inc., Box 1449, Grand Junction, Colo.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Ellis Associates, P. O. Box 77, 67 Lincoln Ave., Pelham, N. Y.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.

Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

AMPLIFIERS, SWEEP

Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. ... p 516, 521
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Optimax Inc., 258 N. Main St., Ambler, Pa.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio

AMPLIFIERS, SYNCHRO

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y.
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657-2659
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2662
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 523, 2665
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Intronics, Inc., 57 Chapel St., Newton, Mass.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Theta Instrument Corp., Fairfield, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 1054, 2677
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2683
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.

AMPLIFIERS, TELEMETERING

AEL Inc., P.O. Box 552, Lansdale, Pa.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. ..... p 513
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. ..... p 517
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Intronics, Inc., 57 Chapel St., Newton, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1682
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1702
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMR Div., Box 223, Princeton, N. J.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
HRB-Singer, Inc., Science Park, State College, Pa.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

AMPLIFIERS, THERMOCOUPLE

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 524
Ectron Corp., 8070 Engineer Rd., San Diego, Calif. ..... p 527
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.

AMPLIFIERS, TRAVELING-WAVE TUBE

Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Power Control Corp., Box 11432, Pittsburgh, Pa.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

AMPLIFIERS, THYRATRON

Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

AMPLIFIERS, TRANSDUCER

Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 524
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
Intronics, Inc., 57 Chapel St., Newton, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2122
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
B & F Instruments Inc., Cornwells Hgts., Pa.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
MB Electronics, Box 1825, New Haven, Conn.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
NUS Corp., Box 248, Paramus, N. J.
PCB Piezotronics, Inc., 3311 Walden Ave., Depew, N. Y.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.
Validyne Engrg. Corp., 18819 Napa St., Northridge, Calif.
Wharton Unitools, 8-10 Lake St., Moosup, Conn.

AMPLIFIERS, TRAVELING-WAVE TUBE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1682
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1686
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. .... p 1708
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.

AMPLIFIERS, TRAVELING-WAVE TUBE (Cont'd)

Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Collins Radio Co., Dallas, Texas
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Traveling Wave Tube Div., 611 Hansen Way, Palo, Alto, Cal.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

AMPLIFIERS, TUNNEL DIODE

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

AMPLIFIERS, ULTRASONIC

CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1890
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Research Mfg. Corp., Box 6056, San Diego, Calif.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

AMPLIFIERS, VIBRATION PICKUP

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532, 533
Metrix Instrument Co., P.O. Box 36501, Houston, Tex.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
PCB Piezotronics, Inc., 3311 Walden Ave., Depew, N. Y.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
United Control Corporation, Redmond, Wash.

AMPLIFIERS, VIDEO

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif. ..... p 505
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. ..... p 513
Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. p 517, 518, 521
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .. p 522, 523
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn. ..... p 1187
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1680, 1681
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1702
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
American Electronic Controls, 74 Tracey Rd., Huntingdon Valley, Pa.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
CBS Labs., High Ridge Rd., Stamford, Conn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Celco, 70 Constantine Dr., Mahwah, N. J.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Collins Radio Co., Dallas, Texas
Components Corp., 106 Main St., Denville, N. J.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Defense Elctrns., Inc., Rockville, Md.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
General Electric Co., Mountain View Rd., Lynchburg, Va.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Locus, Inc., 906 W. College Ave., State College, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tech-Master Corp., 633-33 98 Pl., Forest Hills, N. Y.
Telemet Co., 185 Dixon Ave., Amityville, N. Y.
Teletronics, Inc., 760 N. Main St., Orange, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

AMPLIFIERS, VOLTAGE REFERENCE

Analog Devices Inc., 221 Fifth St., Cambridge, Mass. ..... p 510
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Connor-Winfield Corp., Winfield, Ill.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532, 533
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Analogic Co., 296 Newton St., Waltham, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Varo General, Garland Bank Bldg., Garland, Tex.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

AMPLIFIERS, VSWR MEASURING

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Radiation Devices Co., Box 8450, Baltimore, Md.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Technical Material Corp., Box 142, Mamaroneck, N. Y.

AMPLIFIERS, WIDEBAND

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Analog Devices Inc., 221 Fifth St., Cambridge, Mass. ..... p 508-510
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif. ..... p 505
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 512, 2838
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif. ..... p 513
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. .. p 516-521
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1890, 1891
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Computer Labs., 1109 S. Chapman St., Greensboro, N. C. ..... p 515
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .. p 522, 523
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 524
Honeywell Test Instruments Div., Box 5227, Denver, Colo. ..... p 1403
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 529
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn. ..... p 1187
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y. p 530
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1680
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 534, 535
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. p 1686, 1687
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1470
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tektronix, Inc., Box 500, Beaverton, Ore.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. ..... p 2141

Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bay Laboratories, Inc., 20160 Center Ridge Rd., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Celco, 70 Constantine Dr., Mahwah, N. J.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EG & G Inc., 35 Congress St., Salem, Mass.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Gavin Instrs., Inc., Box 413, Somerville, N. J.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Locus, Inc., 906 W. College Ave., State College, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Massa Div., 280 Lincoln St., Hingham, Mass.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Olektron Corp., Box 248, Dudley, Mass.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Redcor Corp., Box 1031, Canoga Park, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

ANALOG COMPUTERS—SEE COMPUTERS, ANALOG

ANALOG-TO-DIGITAL CONVERTERS—SEE CONVERTERS, ANALOG-TO-DIGITAL

ANALYZERS, A-F

ADC Products, 8405 Cambridge St., Minneapolis, Minn.
A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
EMR-Hatboro, E. County Line Rd., Hatboro, Pa. ..... p 1368
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Heath Co., Dept. 180, Benton Harbor, Mich.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1470
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1489
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Audio Instr. Co., Inc., 311 Mountain Rd., Union City, N. J.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nelson-Ross Electronics, Inc., 5-05 Burns Ave., Hicksville, N. Y.
Northeast Electronics Corp., Box 649, Concord, N. H.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

ANALYZERS, ANTENNA PATTERN

Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

ANALYZERS, BEHAVIORAL, EXPERIMENTAL

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

ANALYZERS, CAPACITOR—SEE TESTERS, CAPACITOR

ANALYZERS, CIRCUIT—SEE TESTERS, SIGNAL TRACING

ANALYZERS, COINCIDENCE

Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Nuclear Supplies, Box 312, Encino, Calif.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Tennelec, Inc., Box D, Oak Ridge, Tenn.
3M Co., 3M Center, St. Paul, Minn.

ANALYZERS, COLOR—SEE COLORIMETERS

ANALYZERS, CRYSTAL

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.

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Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1379
Honeywell Test Instruments Div., Box 5227, Denver, Colo.

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Non-Linear Systems, Inc., Box N, Del Mar, Calif.
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Applied Dynamics, Inc., 2275 Platt Rd., Ann Arbor, Mich.
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Boston Digital Corp., 21 Main St., Ashland, Mass.
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Nester/Faust Mfg. Corp., 2401 Ogletown Rd., Newark, Dela.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
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ANALYZERS, DISTORTION—SEE ANALYZERS, A-F

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Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
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Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
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Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
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Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
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Friden Inc., 2350 Washington Ave., San Leandro, Calif.
GCA Technology, Burlington Rd., Bedford, Mass.
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General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
General Monitors Inc., 3019 Enterprise St., Costa Mesa, Calif.
Gow-Mac Instrument Co., 100 Kings Rd., Madison, N. J.
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Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
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Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
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Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
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Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
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Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
London Co., 811 Sharon Dr., Westlake, Ohio

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Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
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Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1470
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1489, 1490
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Federal Scientific Corp., 615 West 131 St., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
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Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
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Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
Hacker, W. J. & Co., Inc., Box 646, W. Caldwell, N. J.
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Marconi Instrs., 111 Cedar La., Engewood, N. J. ..... p 1433
Measurements, Box 180, Boonton, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1489
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. ..... p 1310
Audio Instr. Co., Inc., 311 Mountain Rd., Union City, N. J.
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Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1490, 1491
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Automation-Forster Div., Box 1025, Ann Arbor, Mich.
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Electro-Mechanics Co., Box 1546, Austin, Tex.
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Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
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Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.

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Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
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Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1489, 1490
Tektronix, Inc., Box 500, Beaverton, Ore.
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General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Nelson-Ross Electronics, Inc., 5-05 Burns Ave., Hicksville, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
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Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

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B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1468, 1469
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1489, 1490
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
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General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
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Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
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Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

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Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1467
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Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486
Theta Instrument Corp., Fairfield, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
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Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
EMR Div., Box 223, Princeton, N. J.
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Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
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Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
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Procedyne Corp., 221 Somerset St., New Brunswick, N. J.
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Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
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Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

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Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1481
Celco, 70 Constantine Dr., Mahwah, N. J.
Electron-Machine Corp., Box M, Umatilla, Fla.
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Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
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Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1481
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Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
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Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
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Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
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Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
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Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
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Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
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Hughes Aircraft Co., Ground Sys. Group, 1901 Malvern St., Fullerton, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
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Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
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Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

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Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Fabri-Tek Instruments, Inc., 5225 Verona Rd., Madison, Wisc.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.

ANALYZERS, SERVO

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2669
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Theta Instrument Corp., Fairfield, N. J.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
EMR Div., Box 223, Princeton, N. J.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

ANALYZERS, SCR

Tennelec, Inc., Box D, Oak Ridge, Tenn.

ANALYZERS, SINGLE-SIDEBAND—SEE ANALYZERS, SPECTRUM

ANALYZERS, SONIC AND SUBSONIC

A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1467, 1470
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1487, 1489
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. ..... p 1310
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Baganoff Assocs., Inc., 6809 W. Florissant, St. Louis, Mo.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Nelson-Ross Electronics, Inc., 5-05 Burns Ave., Hicksville, N. Y.
Sanders Assocs., Inc., Ocean Sys. Div., Simon St., Nashua, N. H.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Signatection, Inc., 225 Crescent St., Waltham, Mass.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
White Instruments Inc., Box 698, Austin, Tex.

ANALYZERS, SPECTRUM (INCLUDING OSCILLOSCOPES WITH PLUG-INS)

Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ..... p 1331
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
EMR-Hatboro, E. County Line Rd., Hatboro, Pa. ..... p 1368
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1467
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1487, 1489, 1490
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. ..... p 1310
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y. ..... p 1204
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Baganoff Assocs., Inc., 6809 W. Florissant, St. Louis, Mo.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Defense Elctrns., Inc., Rockville, Md.
EMR Div., Box 223, Princeton, N. J.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Lavoie Labs., Div. Spedcor, Matawan-Freehold Rd., Morganville, N. J.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nelson-Ross Electronics, Inc., 5-05 Burns Ave., Hicksville, N. Y.
Novatronics, Inc., Box 878, Pompano Beach, Fla.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Signatection, Inc., 225 Crescent St., Waltham, Mass.
Spectra-Elctrns., Inc., 923 N. San Antonio Rd., Los Altos, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Systems Engineering Ltd., Grouse Creek, Utah
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
White Instruments Inc., Box 698, Austin, Tex.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

ANALYZERS, SURFACE—SEE INDICATORS, SURFACE ROUGHNESS

ANALYZERS, TELEMETRIC DATA

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1487, 1489
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Defense Elctrns., Inc., Rockville, Md.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EMR Div., Box 223, Princeton, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft Co., Ground Sys. Group, 1901 Malvern St., Fullerton, Cal.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

ANALYZERS, TRANSFER FUNCTION

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
EMR-Hatboro, E. County Line Rd., Hatboro, Pa. ..... p 1368
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Baganoff Assocs., Inc., 6809 W. Florissant, St. Louis, Mo.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Celco, 70 Constantine Dr., Mahwah, N. J.
EMR Div., Box 223, Princeton, N. J.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
MB Electronics, Box 1825, New Haven, Conn.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.

ANALYZERS, VIDEO

Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

ANALYZERS, TRANSISTOR—SEE TESTERS, TRANSISTOR

ANALYZERS, ULTRASONIC

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1487, 1489
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y.
Tracor Inc., 6500 Tracor La., Austin, Texas
Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Chesapeake Instr. Corp., Shadyside, Md.
Delcon Div., 333 Logue Ave., Mt. View, Calif.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Nelson-Ross Electronics, Inc., 5-05 Burns Ave., Hicksville, N. Y.
Techsonics, Box 251, El Prado, N. M.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan

ANALYZERS, VIBRATION

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Metrix Instrument Co., P.O. Box 36501, Houston, Tex.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1489
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tracor Inc., 6500 Tracor La., Austin, Texas
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Baganoff Assocs., Inc., 6809 W. Florissant, St. Louis, Mo.
Bearing Inspection, Inc., 10041 Shoemaker Ave., Santa Fe Springs, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Fabri-Tek Instruments, Inc., 5225 Verona Rd., Madison, Wisc.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
International Research & Dev. Corp., 6150 Huntley Rd., Worthington, Ohio
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
MB Electronics, Box 1825, New Haven, Conn.
MPB Corp., Precision Pk., Keene, N. H.
Micro Balancing, Inc., 120 Finn Ct., Farmingdale, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nelson-Ross Electronics, Inc., 5-05 Burns Ave., Hicksville, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Scheneck Mfg. Corp., 120 Finn Ct., Farmingdale, N. Y.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wharton Unitools, 8-10 Lake St., Moosup, Conn.

ANALYZERS, VIDEO

Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1487, 1489
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
American Electronic Controls, 74 Tracey Rd., Huntingdon Valley, Pa.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Collins Radio Co., Dallas, Texas
Colorado Video, Inc., Box 928, Boulder, Colo.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Nelson-Ross Electronics, Inc., 5-05 Burns Ave., Hicksville, N. Y.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Spectra-Elctrns., Inc., 923 N. San Antonio Rd., Los Altos, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio

ANECHOIC CHAMBERS

ANALYZERS, WAVEFORM—SEE ANALYZERS, HARMONIC

ANECHOIC CHAMBERS

Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Amerind-MacKissic, Inc., Box 111, Parkerford, Pa.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Goodrich, B. F. Sponge Prods., Plant 4, Canal St., Shelton, Conn.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Lindsay Structure, 1360 Edgar St., Evansville, Ind.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Ray Proof Corp., Keeler Ave., Norwalk, Conn.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
Topatron, Inc., Box 967, Costa Mesa, Calif.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.

ANGLE-OF-ATTACK INDICATORS—SEE INDICATORS, ANGLE-OF-ATTACK

ANNUNCIATORS

Allard Instrument Corp., 770 Main St., Westbury, N. Y. ..... p 1179
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. ..... p 1783
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1188-1190
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y. p 1191
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. ..... p 1194
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. p 2751-2753
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y.... p 2298
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Shelly Assoziates Inc., 111 Eucalyptus Dr., El Segundo, Cal. p 1202, 1203
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
AEI Instrument Co., 3691 Lee Rd., Cleveland, Ohio
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Atmar Engraving Co., Inc., 91-31 121 St., Richmond Hill, N. Y.
Autocall Co., 366 Mack Ave., Shelby, Ohio
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
Beta Corp., 2639 Manana Dr., Box 20427, Dallas, Tex.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Compudyne Corp., Box 247, Hatboro, Pa.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Datasenors Co., 735 Factory Rd., Addison, Ill.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Electro Devices, Inc., 11805 Westline Industrial Dr., St. Louis, Mo.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Faraday, Inc., 805 S. Maumee, Tecumseh, Mich.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
Henschel Corp., 14 Cedar St., Amesbury, Mass.
Honeywell, Inc., Commercial Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Industrial Components, Inc., 1675 S.E. Allen Ave., Beaverton, Ore.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Kirkland, H. R. Co., 8 King St., Morristown, N. J.
Korry Mfg. Co., 223-8th Ave. N., Seattle, Wash.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Mosler Electronic System Div., 9 South St., Danbury, Conn.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Notifier Co., 3700 North 56th St., Lincoln, Neb.
On-Guard Corp. of America, 345 West 37 St., New York, N. Y.
Penn Keystone Corp., Division St., Ansonia, Conn.
Pinkerton Electro-Security Co., 61 Sutton Rd., Webster, Mass.
Radar Relay, Inc., 1631 10th St., Santa Monica, Calif.
Scam Instrument Corp., 7401 N. Hamlin Ave., Skokie, Ill.
Sensor Precision Industries Inc., 29 Janes Ave., Medfield, Mass.
Sun Dial & Panel Corp., Box 326, Caldwell, N. J.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Truco, Inc., Box 95, Simsbury, Conn.
United Control Corporation, Redmond, Wash.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Worner Electrn. Devices, Rankin, Ill.

ANODES, ELECTROPLATING

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
American Smelting & Refining Co., 120 Broadway, New York, N. Y.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Gardiner Solder Co., 4820 S. Campbell Ave., Chicago, Ill.
Garner Glass Co., 177 S. Indian Hill, Claremont, Calif.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Matthey Bishop, Inc., Malvern, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
States Co., 19 New Park Ave., Hartford, Conn.
Wellington Technical Inds., Inc., 55 Honeck St., Englewood, N. J.

ANTENNA COILS—SEE COILS, ANTENNA LOADING

ANTENNA COUPLERS—SEE COUPLERS, ANTENNA

ANTENNA DUMMY LOADS—SEE DUMMY LOADS

ANTENNA FEED SYSTEMS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1653
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Smith-Meeker Engr. Co., 157 Chambers St., New York, N. Y.
Southern Avionics Co., 5055 Belmont, Beaumont, Tex.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

ANTENNA FILTERS—SEE FILTERS, ANTENNA

ANTENNA HOUSINGS—ALSO SEE RADOMES

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Ceram Corp., 5345 Timken Sq., La Mesa, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lance Inds., Box 4156, Sylmar, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Nichols Prods. Co., 325 W. Main St., Moorestown, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.

ANTENNA LIGHTNING ARRESTERS

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Joslyn Elctrn. Sys., 6868 Cortona Dr., Goleta, Calif. ..... p 2740, 2741
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa.
Cush Craft, 621 Hayward St., Manchester, N. H.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Lance Inds., Box 4156, Sylmar, Calif.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
S & A Electronics, Inc., 202 W. Florence St., Toledo, Ohio
Stainless, Inc., 3rd St., N. Wales, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tempo TV Products Co., Box 4156, Sylmar, Calif.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.

ANTENNA PATTERN ANALYZERS—SEE ANALYZERS, ANTENNA PATTERN

ANTENNA PATTERN RECORDERS—SEE RECORDERS, ANTENNA PATTERN

ANTENNA POSITION INDICATORS—SEE INDICATORS, ANTENNA POSITION

ANTENNA REFLECTORS

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Laminair Inc., 13226 Figueroa, Los Angeles, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Master Tower Co., 121 Main St., Sioux City, Iowa
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microflect Co., 3575 25th, S. E., Salem, Ore.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

ANTENNA ROTATORS (INDUSTRIAL & MILITARY)

AEL Inc., P.O. Box 552, Lansdale, Pa.
Alliance Mfg. Co., Inc., Alliance, Ohio
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Antenna Products Co., Box 9588, Austin, Tex.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Task Corporation, Box 3999, Anaheim, Calif.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Trylon, Inc., Elverson, Pa.
USM Corp., 81 Bay State Rd., Wakefield, Mass.

ANTENNA SWITCHING MATRICES

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. ..... p 2721
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNA TOWERS AND SUPPORTS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Falstrom Co., 174 Falstrom Ct., Passaic, N. J.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Adronics, Inc., 271 Grove Ave., Verona, N. J.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Aermotor, 800 E. Dallas, Broken Arrow, Okla.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
American Tower Co., Box 29, Shelby, Ohio
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Antenna Products Co., Box 9588, Austin, Tex.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Color/Craft Antenna Corp., 13434 Raymer St., N. Hollywood, Calif.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Dresser Crane Hoist & Tower Div., 875 Michigan Ave., Columbus, Ohio
E-Z Way Products, Inc., P.O. Box 17196, Tampa, Fla.
Easy-Up, Inc., 1006 State St., Racine, Wisc.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Jontz Mfg. Co., Inc., 1101 E. McKinley Ave., Mishawaka, Ind.
Kline Iron & Steel Co., Inc., Box 1013, Columbia, S. C.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Lance Inds., Box 4156, Sylmar, Calif.
Master Tower Co., 121 Main St., Sioux City, Iowa
Microflect Co., 3575 25th, S. E., Salem, Ore.
Optimum Designs, Inc., 152 W. 42nd St., New York, N. Y.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Stainless, Inc., 3rd St., N. Wales, Pa.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.
Tempo TV Products Co., Box 4156, Sylmar, Calif.
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Trylon, Inc., Elverson, Pa.
Universal Products Engrg., 1230 Racine St., Racine, Wisc.
Up-Right Scaffolds, 1013 Pardee St., Berkeley, Calif.
Western Coil & Electrical Co., 215 State St., Racine, Wisc.

ANTENNAS, AIRBORNE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
A.R.F. Products, inc., Gardner Rd., Raton, N. M.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bendix Corp., Avionics Div., Box 9414, Ft. Lauderdale, Fla.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Control Data Corp., 400 Border St., East Boston, Mass.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Norden Div., United Aircraft Corp., Helen St., Norwalk, Conn.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Stainless, Inc., 3rd St., N. Wales, Pa.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, BROADCASTING (COMMERCIAL)

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Avanti R & D Inc., 45 W. Fullerton, Addison, Ill.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
E-Z Way Products, Inc., P.O. Box 17196, Tampa, Fla.
Electronics, Missiles & Comms., Inc., Box 116, White Haven, Pa.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Optimum Designs, Inc., 152 W. 42nd St., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Video Inds. Co., 45 Brick Oven Rd., Port Chester, N. Y.

ANTENNAS, CONICAL

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Antenna Products Co., Box 9588, Austin, Tex.

ANTENNAS, FERRITE

Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Color/Craft Antenna Corp., 13434 Raymer St., N. Hollywood, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Control Data Corp., 400 Border St., East Boston, Mass.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gavin Instrs., Inc., Box 413, Somerville, N. J.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Kay-Townes Antenna Co., Box 593, Rome Ga.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Lance Inds., Box 4156, Sylmar, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
RMS Electronics, Inc., 50 Antin Pl., Bronx, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
S & A Electronics, Inc., 202 W. Florence St., Toledo, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Trio Mfg. Co., Griggsville, Ill.
Trylon, Inc., Elverson, Pa.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

ANTENNAS, DIRECTION FINDING

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Control Data Corp., 400 Border St., East Boston, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Gold Line Connector, Inc., Muller Ave., Box 893, Norwalk, Conn.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lance Inds., Box 4156, Sylmar, Calif.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.
Trylon, Inc., Elverson, Pa.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

ANTENNAS, FERRITE

Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Diamond Coils, Inc., 540 39th St., Union City, N. J.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.

ANTENNAS, FERRITE (Cont'd)

Fair-Rite Prods Corp., 1 Commercial Row, Wallkill, N. Y.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lance Inds., Box 4156, Sylmar, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

ANTENNAS, GROUND PLANE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Antenna Products Co., Box 9588, Austin, Tex.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Avanti R & D Inc., 45 W. Fullerton, Addison, Ill.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
C/P Corp., RFD 3, Newberry, S. C.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Communications Co., Inc., Box 520, Coral Gables, Fla.
Cush Craft, 621 Hayward St., Manchester, N. H.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kreckman H., Co., Cresco, Pa.
Lindsay Antenna & Specialty Prod., 50 Mary St., Lindsay, Ont., Can.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Master Mobile Mounts, 1000 Crystals Dr., Ft. Myers, Fla.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Premax Prods. Div., Highland & College Aves., Niagara Falls, N. Y.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Trylon, Inc., Elverson, Pa.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.
Ward Prods. Corp., Edson St., Amsterdam, N. Y.
Webster Mfg. Co., 317 Roebling Rd., S. San Francisco, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, HELICAL

AEL Inc., P.O. Box 552, Lansdale, Pa.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Antenna Products Co., Box 9588, Austin, Tex.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
C/P Corp., RFD 3, Newberry, S. C.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, LOG-PERIODIC

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Antenna Products Co., Box 9588, Austin, Tex.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Collins Radio Co., Dallas, Texas
Color/Craft Antenna Corp., 13434 Raymer St., N. Hollywood, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kay-Townes Antenna Co., Box 593, Rome Ga.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Lance Inds., Box 4156, Sylmar, Calif.
Lindsay Antenna & Specialty Prod., 50 Mary St., Lindsay, Ont., Can.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
RMS Electronics, Inc., 50 Antin Pl., Bronx, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
S & A Electronics, Inc., 202 W. Florence St., Toledo, Ohio
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Stainless, Inc., 3rd St., N. Wales, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Trylon, Inc., Elverson, Pa.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, LOOP

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 893
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Tracor Inc., 6500 Tracor La., Austin, Texas
Yokowo Mfg. Co., Ltd., 5, 7-Chome Takinogawa, Kita-ku, Tokyo, Japan p 542
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
RMS Electronics, Inc., 50 Antin Pl., Bronx, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
3M Co., 3M Center, St. Paul, Minn.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1490
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Waveline Inc., Box 718, West Caldwell, N. J.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Allied Research & Engineering Co., 10300 Glasgow Pl., Los Angeles, Calif.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Stainless, Inc., 3rd St., N. Wales, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Torngren, C. W. Co., Inc., 236 Pearl St., Somerville, Mass.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, MOBILE

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio

Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Yokowo Mfg. Co., Ltd., 5, 7-Chome Takinogawa, Kita-ku, Tokyo, Japan p 542
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Avanti R & D Inc., 45 W. Fullerton, Addison, Ill.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Electronic Science Labs., 3920 Bryn Mawr, Dallas, Tex.
Francis Industries, 11855 Broad St., Pataskala, Ohio
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Master Mobile Mounts, 1000 Crystals Dr., Ft. Myers, Fla.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Premax Prods. Div., Highland & College Aves., Niagara Falls, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.
Ward Prods. Corp., Edson St., Amsterdam, N. Y.

ANTENNAS, PARABOLIC

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Collins Radio Co., Dallas, Texas
Color/Craft Antenna Corp., 13434 Raymer St., N. Hollywood, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Dresser Crane Hoist & Tower Div., 875 Michigan Ave., Columbus, Ohio
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Laminair Inc., 13226 Figueroa, Los Angeles, Calif.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Lance Inds., Box 4156, Sylmar, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Torngren, C. W. Co., Inc., 236 Pearl St., Somerville, Mass.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, PHASED ARRAY

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Antennacraft Co., Box 1005, Hwy. 34, W., Burlington, Iowa
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Collins Radio Co., Dallas, Texas
Color/Craft Antenna Corp., 13434 Raymer St., N. Hollywood, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Cush Craft, 621 Hayward St., Manchester, N. H.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Kay-Townes Antenna Co., Box 593, Rome Ga.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
S & A Electronics, Inc., 202 W. Florence St., Toledo, Ohio
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sitco Antennas, 10330 N. E. Marx St., Portland, Oregon
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trio Mfg. Co., Griggsville, Ill.
Trylon, Inc., Elverson, Pa.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa

ANTENNAS, RADAR

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. . p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bedford Div., Sanders Assocs., Inc., Crosby Rd., Bedford, Mass.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Lance Inds., Box 4156, Sylmar, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, RHOMBIC

AEL Inc., P.O. Box 552, Lansdale, Pa.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Antenna Products Co., Box 9588, Austin, Tex.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Master Tower Co., 121 Main St., Sioux City, Iowa
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.

ANTENNAS, ROTARY BEAM

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Antenna Products Co., Box 9588, Austin, Tex.
Avanti R & D Inc., 45 W. Fullerton, Addison, Ill.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
Cush Craft, 621 Hayward St., Manchester, N. H.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Kreckman H., Co., Cresco, Pa.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lance Inds., Box 4156, Sylmar, Calif.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.
Trylon, Inc., Elverson, Pa.

ANTENNAS, SCATTER PROPAGATION

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Cush Craft, 621 Hayward St., Manchester, N. H.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.

ANTENNAS, SPIRAL

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1490
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.

ANTENNAS, SPIRAL (Cont'd)

Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Telrex Communication Engrg. Labs., Asbury Park, N. J.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

ANTENNAS, TELEMETRY, TRACKING

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1719
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Cush Craft, 621 Hayward St., Manchester, N. H.
Defense Elctrns., Inc., Rockville, Md.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
GCA Technology, Burlington Rd., Bedford, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

ANTENNAS, TELESCOPIC

AEL Inc., P.O. Box 552, Lansdale, Pa.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Yokowo Mfg. Co., Ltd., 5, 7-Chome Takinogawa, Kita-ku, Tokyo, Japan p 542
Adronics, Inc., 271 Grove Ave., Verona, N. J.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
B & B Elctrn. Prods., 2161 S. Platte River Dr., Denver, Colo.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Gavin Instrs., Inc., Box 413, Somerville, N. J.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K-W Engineering Works, N50, W16328 Pin Oak Ct., Menomonee Falls, Wisc.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Lance Inds., Box 4156, Sylmar, Calif.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Peerless Products Industries, 4210 W. Chicago Ave., Chicago, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Premax Prods. Div., Highland & College Aves., Niagara Falls, N. Y.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tempo TV Products Co., Box 4156, Sylmar, Calif.
Tenatronics, Ltd., 3001 Chester Ave., Cleveland, Ohio
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Vistaco., Inc., 222 Wisconsin Ave., Lake Forest, Ill.
Ward Prods. Corp., Edson St., Amsterdam, N. Y.

ANTENNAS, TROPOSCATTER

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dresser Crane Hoist & Tower Div., 875 Michigan Ave., Columbus, Ohio
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Telrex Communication Engrg. Labs., Asbury Park, N. J.

ANTENNAS, TUNABLE DIPOLE

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Adronics, Inc., 271 Grove Ave., Verona, N. J.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Antenna Products Co., Box 9588, Austin, Tex.
Avanti R & D Inc., 45 W. Fullerton, Addison, Ill.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Gavin Instrs., Inc., Box 413, Somerville, N. J.
Hornet Antenna Prods. Co., Box 880, Duncan, Okla.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lattin Radio Laboratories, 1431 Sweeney, P.O. Box 44, Owensboro, Ky.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Peerless Products Industries, 4210 W. Chicago Ave., Chicago, Ill.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Trylon, Inc., Elverson, Pa.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

ANTI-STATIC COMPOUNDS & COATINGS—SEE COATINGS, ANTI-STATIC

ARC LAMP POWER SUPPLIES—SEE POWER SUPPLIES, ARC LAMP

ARMATURES—SEE MOTOR & GENERATOR ARMATURES, ROTORS, STATORS

ARMS, PHONO, TRANSCRIPTION—SEE PHONOGRAPH ARMS, TRANSCRIPTION

ARRESTERS, ELECTRICAL SURGE—ALSO SEE SUPPRESSORS, ARC: PROTECTORS, SURGE

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 2716
Dale Electronics Inc., Box 609, Columbus, Nebr.
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Joslyn Elctrn. Sys., 6868 Cortona Dr., Goleta, Calif. ..... p 2740, 2741
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1805
Transtector Systems, 3025 W. Mission Rd., Alhambra, Calif. .... p 2786
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Bellaire Elctrns. Inc., 62 White St., Red Bank, N. J.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electrons Co., 127 Sussex Ave., Newark, N. J.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
ITT Electron Tube, Box 100, Easton, Pa.
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Staffail Inc., 7 Woodland St., Providence, R. I.

ARRESTERS, LIGHTNING

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Consolidated Wire & Assocd. Corps., 1635 S. Clinton St., Chicago, Ill.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 2716
Dale Electronics Inc., Box 609, Columbus, Nebr.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Joslyn Elctrn. Sys., 6868 Cortona Dr., Goleta, Calif. ..... p 2740, 2741
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Transtector Systems, 3025 W. Mission Rd., Alhambra, Calif. .... p 2786
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Bellaire Elctrns. Inc., 62 White St., Red Bank, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Cush Craft, 621 Hayward St., Manchester, N. H.
Electrons Co., 127 Sussex Ave., Newark, N. J.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gold Line Connector, Inc., Muller Ave., Box 893, Norwalk, Conn.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Lance Inds., Box 4156, Sylmar, Calif.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

ASBESTOS—SEE INSULATION MATERIALS, ASBESTOS

ASPHALT INSULATION—SEE INSULATING COMPOUNDS, ASPHALT AND PITCH

ATTENUATORS, AUDIO

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1420
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Measurements, Box 180, Boonton, N. J.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C. ..... p 572, 1709
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Arbor Systems, Inc., P.O. Box 1325, Ann Arbor, Mich.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Electronic Systems Engrg. Co., 120½ N. Cleveland, Cushing, Okla.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis, Mo.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.
Visual Elctns, Labs, 40 N. Daisy Ave., Pasadena, Cal.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

ATTENUATORS, COAXIAL

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Americon Corp., 87 Rumford Ave., Waltham, Mass.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio .. p 1342, 1343
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. p 1658, 1659
Dow-Key Co., 2260 Industrial La., Broomfield, Colo.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1421
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Pyrofilm Resistor Co. Inc., 60 S. Jefferson Rd., Whippany, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif. p 1710
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Waveline Inc., Box 718, West Caldwell, N. J. ..... p 1720
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Welwyn International, Inc., 811 Sharon Dr., Westlake, Ohio
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.

Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General RF Fittings, Box 278, Port Salerno, Fla.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Holland Electronics, Inc., 675 Hinsdale St., Brooklyn, N. Y.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Quantatron, 1631 Tenth St., Santa Monica, Calif.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

ATTENUATORS, DECADE

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1668
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1420
Measurements, Box 180, Boonton, N. J.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Stoddart Electro Systems, 2645 W. Rosecrans Ave., Gardena, Calif. p 1710
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gillette Elctrn. Prods. Co., 201 Laurel St., Beverly, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Tennelec, Inc., Box D, Oak Ridge, Tenn.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

ATTENUATORS, FIXED

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1420
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Measurements, Box 180, Boonton, N. J.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RCL Electronics Inc., 700 S. 21st St., Irvington, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Resistance Prods. Co., 914 South 13th St., Harrisburg, Pa.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C. ..... p 572
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif. p 1710
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Welwyn International, Inc., 811 Sharon Dr., Westlake, Ohio .... p 2442
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Bellaire Elctrns. Inc., 62 White St., Red Bank, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Control Data Corp., 400 Border St., East Boston, Mass.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Holland Electronics, Inc., 675 Hinsdale St., Brooklyn, N. Y.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

ATTENUATORS, I-F

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1420
Measurements, Box 180, Boonton, N. J.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C. ..... p 1709
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Comdel Inc., Beverly Airport, Beverly, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

ATTENUATORS, IMPEDANCE MATCHING

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Measurements, Box 180, Boonton, N. J.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif. p 1710

ATTENUATORS, MICROWAVE

Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Holland Electronics, Inc., 675 Hinsdale St., Brooklyn, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.

ATTENUATORS, LOGARITHMIC

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.

ATTENUATORS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1653
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1664
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1420, 1421
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Measurement Specialties Lab., Inc., 14532 Erwin St., Van Nuys, Calif. p 1685
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Pyrofilm Resistor Co. Inc., 60 S. Jefferson Rd., Whippany, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif. p 1710
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Waveline Inc., Box 718, West Caldwell, N. J. ..... p 1720
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General RF Fittings, Box 278, Port Salerno, Fla.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.

ATTENUATORS, MICROWAVE (Cont'd)

Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micrometals, 228 N. Sunset, City of Industry, Calif.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

ATTENUATORS, PROGRAMMABLE

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y.
Computer Labs., 1109 S. Chapman St., Greensboro, N. C.
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Dow-Key Co., 2260 Industrial La., Broomfield, Colo.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1420, 1421
LogiMetrics, Div., 100 Forest Dr., Greenvale, N. Y. ..... p 1429
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Narda Microwave Corp., Plainview, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.

ATTENUATORS, R-F

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio .. p 1342, 1343
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dow-Key Co., 2260 Industrial La., Broomfield, Colo.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1668
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Honeywell Test Instruments Div., Box 5227, Denver, Colo. ..... p 1403
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1420, 1421
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Measurements, Box 180, Boonton, N. J.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Pyrofilm Resistor Co. Inc., 60 S. Jefferson Rd., Whippany, N. J.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C. ..... p 572, 1709
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif. p 1710
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Welwyn International, Inc., 811 Sharon Dr., Westlake, Ohio .... p 2442
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electronic Speciality Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Gremar, Inc., 10 Micro Dr., Woburn, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Holland Electronics, Inc., 675 Hinsdale St., Brooklyn, N. Y.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Quantatron, 1631 Tenth St., Santa Monica, Calif.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rafec Electronics, Box 566, Temple City, Cal.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa

ATTENUATORS, TURRET

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1421
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C. ..... p 572
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif. p 1710
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.

ATTENUATORS, VARIABLE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y.
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. .... p 1653
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H.
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa. .... p 2361
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1664
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1668
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1670
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1421
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Measurement Specialties Lab., Inc., 14532 Erwin St., Van Nuys, Calif. p 1685
Measurements, Box 180, Boonton, N. J.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C. ..... p 572
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Comdel Inc., Beverly Airport, Beverly, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.

ATTITUDE INDICATORS—SEE INDICATORS, ATTITUDE

AUDIBLE WARNING DEVICES—SEE ALARMS & ALARM SYSTEMS—ALSO SEE BELLS, BUZZERS, GONGS, SIRENS & AURAL WARNING DEVICES

AUDIO EQUIPMENT—SEE AMPLIFIERS; MICROPHONES; SPEAKERS; ETC.

AUDIOMETERS
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beltone Electronics Corp., 4201 W. Victoria, Chicago, Ill.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Electronic Science Labs., 3920 Bryn Mawr, Dallas, Tex.
Farrall Instrument Co., Box 1037, Grand Island, Nebr.
States Co., 19 New Park Ave., Hartford, Conn.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.

AUTOCOLLIMATORS—SEE COLLIMATORS

AUTOMATIC CHECKOUT EQUIPMENT—SEE TEST EQUIPMENT, AUTOMATIC CHECKOUT

AUTOTRANSFORMERS—SEE TRANSFORMERS, AUTOTRANSFORMER

AVERAGERS, SIGNAL
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
Tracor Inc., 6500 Tracor La., Austin, Texas
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Fabri-Tek Instruments, Inc., 5225 Verona Rd., Madison, Wisc.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.

AZIMUTH INDICATORS—SEE INDICATORS, AZIMUTH

BACKLIGHTED PANEL DISPLAYS—SEE DISPLAY PANELS

BADGES, RADIATION INDICATING—SEE SERVICES, FILM BADGE

BAFFLES, ACOUSTIC MATERIALS—SEE MATERIALS, ACOUSTIC, SOUND ABSORBING

BAFFLES, SPEAKER—SEE ENCLOSURES, SPEAKER

BAILS, STANDS & SUPPORTS (FOR EQUIPMENT, INSTRUMENTS, ETC.)
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio ..... p 1169
Electron-Machine Corp., Box M, Umatilla, Fla.
Sturdilite, Plainwell, Mich.

BALANCING EQUIPMENT, DYNAMIC
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Bear Mfg. Co., 2830-5th St., Rock Island, Ill.
Exact Weight Scale Co., 1005 W. Third Ave., Columbus, Ohio
General Laser Corp., 8 Erie Dr., Natick, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
International Research & Dev. Corp., 6150 Huntley Rd., Worthington, Ohio
Micro Balancing, Inc., 120 Finn Ct., Farmingdale, N. Y.
Possis Machine Corp., 825 Rhode Island Ave. S., Minneapolis, Minn.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Scheneck Mfg. Corp., 120 Finn Ct., Farmingdale, N. Y.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wharton Unitools, 8-10 Lake St., Moosup, Conn.

BALL AND SOCKET JOINTS—SEE JOINTS, BALL AND SOCKET

BALLAST TUBES—SEE TUBES, BALLAST

BALUNS—SEE TRANSFORMERS, MATCHING

BANDING TOOLS, C-CORE
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. .... p 1221
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.

BARRETTERS—SEE RESISTORS, BARRETTER

BARS, SHORTING
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. p 933, 934, 944, 946

BASES, ANTENNA—SEE MOUNTS, ANTENNA

BATHS, CONTROLLED TEMPERATURE (AIR & LIQUID)
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif. ..... p 1247
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Gruenberg Electric Co., Inc., 585 Commercial Ave., Garden City, N. Y.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Harris Mfg. Co., Inc., 308 River St., Cambridge, Mass.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hydor Therme Corp., Airport Hwy., Pennsauken, N. J.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
National Appliance Co., Box 23008, Portland, Ore.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.
3M Co., 3M Center, St. Paul, Minn.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zeva Electric Corp., 11 Park Pl., New York, N. Y.

BATHS, ULTRASONIC—SEE CLEANERS, ULTRASONIC

BATTERIES, BI-POLAR
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

BATTERIES, CHEMICALLY HEATED
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Catalyst Res. Corp., 6101 Falls Rd., Baltimore, Md.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

BATTERIES, DRY, FLASHLIGHT, TRANSISTOR, ETC.
Mallory Battery Co., S. Broadway, Tarrytown, N. Y. ..... p 2043-2045
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Acme Battery Corp., 700 Canal St., Stamford, Conn.
Bright Star Industries, Inc., 600 Getty Ave., Clifton, N. J.
Burgess Battery Div., Foot of Exchange St., Freeport, Ill.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
Gould Marathon Battery Co., 931 Vandalio St., St. Paul, Minn.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.

BATTERIES, LEAD-ACID
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
C & D Batteries, Washington & Cherry Sts., Conshohocken, Pa.
Electronic Batteries, Inc., 28-34 35th St., Brooklyn, N. Y.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
General Battery & Ceramic Corp., Box 1262, Reading, Pa.
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Hobby & Brown Electronic Corp., 15 St. Marks Ave., Rockville Ctr., N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wisco Div., 1222 18 St., Racine, Wisc.

BATTERIES, LEAD DIOXIDE
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Wisco Div., 1222 18 St., Racine, Wisc.

BATTERIES, LITHIUM
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

BATTERIES, MANGANESE ALKALINE
Mallory Battery Co., S. Broadway, Tarrytown, N. Y. ..... p 2043, 2044
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Bright Star Industries, Inc., 600 Getty Ave., Clifton, N. J.
Burgess Battery Div., Foot of Exchange St., Freeport, Ill.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.

BATTERIES, MERCURY
Mallory Battery Co., S. Broadway, Tarrytown, N. Y. ..... p 2045
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.

BATTERIES, STANDARD CELL
Burgess Battery Div., Foot of Exchange St., Freeport, Ill.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.

BATTERIES, NICKEL-ALKALINE
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland

BATTERIES, NICKEL-CADMIUM
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1911
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1955
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Sonotone Corp., Battery Div., Dept. B10, Box 200, Elmsford, N. Y. p 2092, 2093
ASCOR, Berkey Technical, 25-15 50th St., Woodside, N. Y.
Avionics Res. Prods. Corp., 6901 W. Imperial Hwy., Los Angeles, Cal.
Bright Star Industries, Inc., 600 Getty Ave., Clifton, N. J.
Burgess Battery Div., Foot of Exchange St., Freeport, Ill.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Fanon Elctrn. Inds., 439 Frelinghuysen Ave., Newark, N. J.
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Mauratron, Inc., 13333 N. Central Expwy., Dallas, Tex.
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.

BATTERIES, NICKEL-ZINC
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Yardney Electric Corp., 40-52 Leonard St., New York, N. Y.

BATTERIES, NUCLEAR
Sanders Nuclear Corp., 95 Canal St., Nashua, N. H.

BATTERIES, PHOTOFLASH
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1955
Mallory Battery Co., S. Broadway, Tarrytown, N. Y. ..... p 2043-2045
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sonotone Corp., Battery Div., Dept. B10, Box 200, Elmsford, N. Y. p 2092
Burgess Battery Div., Foot of Exchange St., Freeport, Ill.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
Gould Marathon Battery Co., 931 Vandalio St., St. Paul, Minn.
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.

BATTERIES, SILVER-CADMIUM
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1911
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Yardney Electric Corp., 40-52 Leonard St., New York, N. Y.

BATTERIES, SILVER-ZINC
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1911
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Catalyst Res. Corp., 6101 Falls Rd., Baltimore, Md.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Epic, Inc., 150 Nassau St., New York, N. Y.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Mauratron, Inc., 13333 N. Central Expwy., Dallas, Tex.
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Yardney Electric Corp., 40-52 Leonard St., New York, N. Y.

BATTERIES, SOLAR—SEE CELLS, PHOTOVOLTAIC

BATTERIES, STANDARD CELL
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Mallory Battery Co., S. Broadway, Tarrytown, N. Y. ..... p 2043, 2044
Sonotone Corp., Battery Div., Dept. B10, Box 200, Elmsford, N. Y. p 2092, 2093
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.

BATTERIES, STORAGE

BATTERIES, STORAGE

Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1955
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
Sonotone Corp., Battery Div., Dept. B10, Box 200, Elmsford, N. Y. p 2092, 2093
Electronic Batteries, Inc., 28-34 35th St., Brooklyn, N. Y.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
General Battery & Ceramic Corp., Box 1262, Reading, Pa.
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wisco Div., 1222 18 St., Racine, Wisc.

BATTERIES, THERMAL

Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1911
Catalyst Res. Corp., 6101 Falls Rd., Baltimore, Md.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Wurlitzer Co., Electronics & Defense Prods., N. Tonawanda, N. Y.

BATTERIES, TRANSISTOR—SEE BATTERIES, DRY, FLASHLIGHT, TRANSISTOR, ETC.

BATTERIES, WATER ACTIVATED

Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1911
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Burgess Battery Div., Foot of Exchange St., Freeport, Ill.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Crimpco Engrg., 7341 Canoga Ave., Canoga Park, Calif.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.

BATTERIES, ZINC-AIR

Yardney Electric Corp., 40-52 Leonard St., New York, N. Y.

BATTERY CHARGERS—SEE CHARGERS, BATTERY

BATTERY CLIPS—SEE HOLDERS, BATTERY

BATTERY ELIMINATORS—SEE ELIMINATORS, BATTERY

BATTERY HOLDERS—SEE HOLDERS, BATTERY

BATTERY PLUGS—SEE CONNECTORS, BATTERY

BATTERY RETAINERS—SEE RETAINERS, BATTERY

BATTERY TESTERS—SEE TESTERS, BATTERY

BEARINGS

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Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
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Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
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Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Abesto Corp., Ackerman St., Bloomfield, N. J.
Barden Corp., 200 Park Ave., Danbury, Conn.
Bearing Inspection, Inc., 10041 Shoemaker Ave., Santa Fe Springs, Calif.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Clevite, Cleveland Graphite Bronze, 17000 St. Clair Ave., Cleveland, O.
Dixon Sintaloy, Inc., 535 Hope St., Stamford, Conn.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Bearing Co., 32 High St., West Nyack, N. Y.
Gwilliam Co., 342 Furman St., Brooklyn, N. Y.
Industrial Tectonics, Inc., 18301 Santa Fe Ave., Compton, Calif.
Industrial Tectonics, Inc., 3686 Jackson Rd., Ann Arbor, Mich.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Janney Cylinder Co., 7401 State Rd., Philadelphia, Pa.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kaydon Engineering Corp., Muskegon, Mich.
Kwikset Powdered Metal Prods., 516 E. Santa Ana St., Anaheim, Calif.
MPB Corp., Precision Pk., Keene, N. H.
Marlin-Rockwell, Div. of TRW, Inc., 402 Chandler St., Jamestown, N. Y.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
New Hampshire Ball Bearings, Inc., Peterborough, N. H.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Poco Graphite, Inc., Box 1524, Garland, Tex.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Raway Bearing Co., Inc., 141 Chrystie St., New York, N. Y.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
St. Mary's Carbon Co., 1939 State Rd., St. Marys, Pa.
Scully-Jones Co., 5240 Belmont Rd., Downers Grove, Ill.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Southwest Products Co., 1705 S. Mountain Ave., Monrovia, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Torrington Co., Box 1008, Torrington, Conn.

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Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Larsen Importing Co., 140 Nassau St., New York, N. Y.
Moran, T. R. Co., Inc., 137 Eucalyptus Dr., El Segundo, Calif.
Moser Jewel Co., 544 Fayette St., Perth Amboy, N. J.
Swiss Jewel Co., Lafayette Bldg., Philadelphia, Pa.

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Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1174
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Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Barden Corp., 200 Park Ave., Danbury, Conn.
Beemer Engrg. Co., Industrial Pk., Fort Washington, Pa.
Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Bearing Co., 32 High St., West Nyack, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
MPB Corp., Precision Pk., Keene, N. H.
Marlin-Rockwell, Div. of TRW, Inc., 402 Chandler St., Jamestown, N. Y.
Modern Industrial Plastics, 3337 N. Dixie Dr., Dayton, Ohio
New Hampshire Ball Bearings, Inc., Peterborough, N. H.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Raway Bearing Co., Inc., 141 Chrystie St., New York, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Southwest Products Co., 1705 S. Mountain Ave., Monrovia, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Torrington Co., Box 1008, Torrington, Conn.

BEARINGS, SELF-LUBRICATING

Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Northfield Precision Instr. Corp., 4400 Austin Blvd., Island Park, N. Y. p 1751
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Barden Corp., 200 Park Ave., Danbury, Conn.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Beemer Engrg. Co., Industrial Pk., Fort Washington, Pa.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Dixon Corp., Metacom Ave., Bristol, R. I.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
Fluorocarbon Co., 1754 S. Clementine, Box 3339, Anaheim, Calif.
Helwig Carbon Prods., Inc., 2550 North 30th St., Milwaukee, Wisc.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kwikset Powdered Metal Prods., 516 E. Santa Ana St., Anaheim, Calif.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
MPB Corp., Precision Pk., Keene, N. H.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Modern Industrial Plastics, 3337 N. Dixie Dr., Dayton, Ohio
New Hampshire Ball Bearings, Inc., Peterborough, N. H.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Pure Carbon Co., Inc., 441 Hall Ave., St. Marys, Pa.
Raway Bearing Co., Inc., 141 Chrystie St., New York, N. Y.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Rogers Corp., Rogers, Conn.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
St. Mary's Carbon Co., 1939 State Rd., St. Marys, Pa.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Southwest Products Co., 1705 S. Mountain Ave., Monrovia, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.
Union Diesel Engine Co., P. O. Box 1737, Oakland, Calif.

BELLOWS

S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y.
Belfab, Unit of Bailey Meter Co., Box 1881, Daytona Beach, Fla.
Burke & James, Inc., 333 W. Lake St., Chicago, Ill.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Metal Bellows Corp., 1075 Providence Hwy., Sharon, Mass.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Sealol, Inc., Warwick Indl. Pk., Providence, R. I.
Servometer Corp., 82 Industrial E., Clifton, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Technologics Inc., Box 667, Ormond Beach, Fla.
Trish Energetics, West Bare Hill Rd., Harvard, Mass.

BELLS, BUZZERS, GONGS, SIRENS & AURAL WARNING DEVICES

Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J.
Arkay International, 2372-82 Linden Blvd., Brooklyn, N. Y.
Associated Mfg. Co., 2414 Lawrence Ave., Chicago, Ill.
Auth Electric Co., Inc., 34-20 45th St., Long Island City, N. Y.
Autocall Co., 366 Mack Ave., Shelby, Ohio
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Edwards Co., Inc., 90 Connecticut Ave., Norwalk, Conn.
Endicott Coil Co., Inc., 24 Charlotte St., Binghamton, N. Y.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Faraday, Inc., 805 S. Maumee, Tecumseh, Mich.
Fire Control Co., Inc., 1605 Ayre St., Newport, Dela.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Henschel Corp., 14 Cedar St., Amesbury, Mass.
ITT Telecommunications, Fulton Dr., Corinth, Miss.
Industrial Inventions, Inc., RD2 463 US 1, Monmouth Jct., N. J.
Lee Elec., Inc., 309-51st St., W. New York, N. J.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Mallory Electromagnetic Co., Div. P. R. Mallory, Du Quoin, Ill.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Notifier Co., 3700 North 56th St., Lincoln, Neb.
On-Guard Corp. of America, 345 West 37 St., New York, N. Y.
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.

BELTS, DIAL DRIVE—SEE CORDS AND CABLE, DIAL DRIVE

BELTS, DRIVE (ALL TYPES)

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
Altron Elctrns. Co., 1309 Jefferson Ave., Woodlyn, Pa.
American Biltrite Rubber Co., Inc., Box 1071, Boston, Mass.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.
Fife Electronic Prods., 80 Commercial St., Freeport, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.

BENCHES, OPTICAL

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Mann, David W. Co., 174 Middlesex Turnpike, Burlington, Mass.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Varo Optical, Inc., 215 E. Prospect Ave., Mt. Prospect, Ill.
Zoomar, Inc., 55 Sea Cliff Ave., Glen Cove, L. I., N. Y.

BENCHES, CONSOLES, STOOLS, TABLES (LAB & SHOP)—ALSO SEE CABINETS & ACCESSORIES, METAL

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass. p 582
Alden Systems Co., 262 N. Main St., Brockton, Mass.
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
B.J.M. Co., San Juan Darlington, Santurce, Puerto Rico
Baker Co., Inc., 106 Granite St., Biddeford, Me.
Bay Products, Somerset & Gurney Sts., Philadelphia, Pa.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Columbia-Hallowell, Div. Standard Pressed Steel Co., Hatfield, Pa.
Controlled Environment Equip Corp., 160 Pleasant St., Brockton, Mass.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Easy-Up, Inc., 1006 State St., Racine, Wisc.
Edcraft Inds., Inc., 620 Commerce Rd., Linden, N. J.
Equipto Div., Aurora Equipment Co., 225 S. Highland Ave., Aurora, Il.
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
Flotron Industries, Inc., 1201 E. Grand Ave., El Segundo, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lyon Metal Products, Inc., 47 Railroad Ave., Aurora, Ill.
Matrix Engrg. Corp., 1502 West 166 St., Gardena, Calif.
Matthews Research, Inc., 4306 Wheeler Ave., Alexandria, Va.
Pressteel Co., 9705 E. Garvey Ave., El Monte, Calif.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Stackbin Corp., P.O. Box 434, Pawtucket, R. I.
States Co., 19 New Park Ave., Hartford, Conn.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Workplace Systems, Inc., 370 Commercial St., Manchester, N. H.

BENDS & TWISTS, MICROWAVE

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Narda Microwave Corp., Plainview, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
Waveline Inc., Box 718, West Caldwell, N. J.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Allied Research & Engineering Co., 10300 Glasgow Pl., Los Angeles, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Specialty Waveguide Corp., 82 Cambridge St., Burlington, Mass.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

BERYLLIUM FABRICATING FACILITIES

International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2518
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Barden Corp., 200 Park Ave., Danbury, Conn.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Holmberg, Inc., 20 Melville Park Rd., Melville, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

BEZELS, SHIELDED & UNSHIELDED

Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y. p 1171
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1189
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2911
Metex Corp., 970 New Durham Rd., Edison, N. J. ..... p 1230
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1175
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Atmar Engraving Co., Inc., 91-31 121 St., Richmond Hill, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
National Electronics, Inc., Box 269, Geneva, Ill.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
South Shore Metal Prods.. Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.

BI-METALS, THERMOSTATIC

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Englehard Minerals & Chemicals Corp., H. A. Wilson Dept., U.S. Rte. #22, Union, N. J. ..... p 1644
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. .... p 1221
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Clevite, Cleveland Graphite Bronze, 17000 St. Clair Ave., Cleveland, O.
Essex International, Elctrn. Sys., Mt. Vernon Rd., Evansville, Ind.
Essex International, Stemco Controls, Box 1007, Mansfield, Ohio
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Scaico Div., 211 Warren St., W. Pittston, Pa.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

BINARY SCALERS—SEE SCALERS, BINARY

BINDING POSTS—SEE POSTS, BINDING

BLOCKS, TERMINAL

ADC Products, 6405 Cambridge St., Minneapolis, Minn. .... p 820, 829
AMP Incorporated, Box 3608, Harrisburg, Pa.
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Buchanan Electrical Products Corp., 1065 Floral Ave., Union, N. J. p 878
Burndy Corporation, Richards Ave., Norwalk, Conn. ..... p 884
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Continental Connector Corp., 34-63 56th St., Woodside, N. Y. ... p 894
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 904
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kulka Electric Corp., Dept. E, Box 149, Mount Vernon, N. Y. .... p 917
Matrix Science Corp., 435 Maple Ave., Torrance, Calif. ..... p 923
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1174
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 928
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Trimm Inc., 400 Lake St., Libertyville, Ill. ..... p 996
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H. p 1005
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Armel Electronics Inc., 1601-75th St., N. Bergen, N. J.
Audio Accessories, Inc., Gilsum, N. H.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Collectron Corp., 304 East 45th St., New York, N. Y.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Culver-Stearns Mfg. Co., 354 Franklin St., Worcester, Mass.
Curtis Develop. & Mfg. Co., 3278 N. 33rd St., Milwaukee, Wisc.
Diamonite Products Mfg. Co., Div. U. S. Ceramic Tile Co., Shreve, Ohio
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
ETC, Inc., 990 East 67 St., Cleveland, Ohio
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Electric Terminal Corp., Drawer E, Pilgrim Sta., Warwick, R. I.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Electrical Refractories Co., 50 E. Clark St., E. Palestine, Ohio
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Ferro Corp., Electro Refractories Div., Box 781, E. Liverpool, Ohio
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Midwest Molding & Mfg. Co., Gurnee, Ill.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Penn-Union Elec., A Teledyne Co., Box 723, Edinboro, Pa.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Sylvania Electric Prods., Inc., W. M. Chace Co. Div., 1600 Beard Ave., Detroit, Mich.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
3M Co., 3M Center, St. Paul, Minn.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.

BLOOD-PRESSURE RECORDERS—SEE RECORDERS, BLOOD PRESSURE

BLOWER CABINETS—SEE BLOWERS & FANS & ACCESSORIES

BLOWERS & FANS & ACCESSORIES

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill.
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Ashland Electric Prods. Inc., 32-02 Queens Blvd., L. I. C., N. Y. .. p 1725
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1250
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal.
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J.
Equipto Enclosure Systems, 435 Woodlawn Ave., Aurora, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1733
Globe Industries, 2275 Stanley Ave., Dayton, Ohio ..... p 1252
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y. p 1745
IMC Magnetics Corp., New Hampshire Div., Rte. 16B, Rochester, N. H. p 1745
McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1253
Morrison Prods., Inc., 16816 S. Waterloo Rd., Cleveland, Ohio .. p 1259
Pamotor Inc., 770 Airport Blvd., Burlingame, Cal. ..... p 1254-1258
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585

BOARDS, PLOTTING

Ripley Co., Inc., 1 Factory St., Middletown, Conn. ..... p 1276
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. p 1260-1263, 1754, 1755
Rotron, Inc., Hasbrouck La., Woodstock, N. Y. ..... p 1264-1274
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J. ..... p 1764
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind. ..... p 594
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. ... p 591
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
Agnew-Higgins, Inc., Box 857, Garden Grove, Calif.
Airflow Co., Montgomery County Airpark, Gaithersburg, Md.
Alpha Components Corp., 4087 Glencoe Ave., Venice, Calif.
American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.
American Airflow Corp., 515 W. 43 St., Chicago, Ill.
American-Standard, Applied Air Conditioning Dept., Columbus, Ohio
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Appalachian Elctrn. Instrs., Inc., 810 W. Monroe Ave., Ronceverte, W. Va.
Astro Dynamics, Inc., 2nd Ave., Northwest Industrial Park, Burlington, Mass.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Fan & Ventilator Co., 6516 Wiehle, Cincinnati, Ohio
Clarage Fan Co., One Clarage Pl., Kalamazoo, Mich.
Clean Rooms Construction Co., Inc., Box 275, Westminster, Calif.
Clements Mfg. Company, 6656 S. Narragansett Ave., Chicago, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio
Dynacool Mfg. Co., Inc., 1 Russell St., Saugerties, N. Y.
Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, Calif.
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Eastern Industries, 100 Skiff St., Hamden, Conn.
Electronic Cooling Devices Inc., 15443 Cabrito Rd., Van Nuys, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Engonics Engineering Div., 9601 W. Jefferson Blvd., Culver City, Calif
Fasco Inds., Inc., Augusta at North Union Sts., Rochester, N. Y.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
Ilg Industries, Inc., 2850 N. Pulaski Rd., Chicago, Ill.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Kooltronic Fan Co., Box 504, Princeton, N. J.
Mamco Corp., 532 Fourth St., Racine, Wisc.
Molon Motors & Coil Corp., 3737 Industrial Ave., Rolling Meadows, Ill.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Standard Electric Mfg. Co., Haddon Ave., W. Berlin, N. J.
Task Corporation, Box 3999, Anaheim, Calif.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Torrington Mfg. Co., 100 Franklin Dr., Torrington, Conn.
UPPCO Inc., 900 S. Des Plaines, Chicago, Ill.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

BLUEPRINT MACHINES

HJS Engineering Co., Box 96, Park Ridge, Ill.
Rotolite Sales Corp., Box 7G, Stirling, N. J.

BOARDS, GRAPHIC, VISUAL CONTROL

Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y.
Interswitch, 770 Airport Blvd., Burlingame, Cal.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
N/P Co., Inc., Box 127, Temple City, Calif.
Sanders Assocs., Inc., Data & Display Dept., Daniel Webster Hwy., S., Nashua, N. H.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Universal Drafting Machine Corp., 5200 Richmond Rd., Bedford Hgts., Ohio

BOARDS, PLOTTING

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y. ..... p 918
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J. p 1570
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.

BOARDS, PLOTTING (Cont'd)

Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Pryor Marking Products, 21 E. Hubbard, Chicago, Ill.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sillcocks-Miller Co., 350 W. Parker Ave., Maplewood, N. J.
Straube Mfg. Co., Box 69, Waynesboro, Pa.
Sun Dial & Panel Corp., Box 326, Caldwell, N. J.
Universal Drafting Machine Corp., 5200 Richmond Rd., Bedford Hgts., Ohio
Visual Inspection Prods., 112 Central Ave., Lynn, Mass.

BOARDS, PLUG-IN

ADC Products, 6405 Cambridge St., Minneapolis, Minn. ..... p 826
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa. ..... p 876
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y. ..... p 918
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill. ..... p 919
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif.
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 928
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va. p 1007
Virginia Panel Corp., Box 1106, Waynesboro, Va. ..... p 1008
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chemical & Aerospace Products, Inc., 231 E. Lomita, Wilmington, Calif.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Defense Elctrns., Inc., Rockville, Md.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Electralab Div./Tyco, Box 548, Encinitas, Calif.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Electronics, Inc. of Pa., 2440 Maryland Ave., Willow Grove, Pa.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
Golden Technology, Inc., 240 Barham Ave., Santa Rosa, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
IFE Div., Box 4265, E. Providence, R. I.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

BOARDS, PRINTED CIRCUIT—SEE PRINTED CIRCUIT BOARDS

BOARDS, PRINTED WIRING, UNIVERSAL

California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EDP Corp., Box 6485, Orlando, Fla.
Eastern Reproduction Corp., 1250 Main St., Waltham, Mass.
Electraid, Inc., Box 53, Cambridge, Mass.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronics, Inc. of Pa., 2440 Maryland Ave., Willow Grove, Pa.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
HMW Enterprises, Inc., 15 Walnut St., Steelton, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Starnetics Co., Box 9308, N. Hollywood, Calif.
3M Co., 3M Center, St. Paul, Minn.
Universal Circuits, Inc., 13305 Industrial Park Blvd., Minneapolis, Minn.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

BOARDS, PROGRAMMING

AMP Incorporated, Box 3608, Harrisburg, Pa.
Accurate Electronics Corp., Box 935J, Elyria, Ohio
Basler Electric Co., Box 269, Highland, Ill.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y. ..... p 918
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 912
Mac Panel Co., Box 5027, High Point, N. C. ..... p 920, 921
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill. ..... p 919
Matrix Science Corp., 435 Maple Ave., Torrance, Calif. ..... p 923
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va. p 1007
Virginia Panel Corp., Box 1106, Waynesboro, Va. ..... p 1008
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Century Lighting Inc., 3 Entin Rd., Clifton, N. J.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
EDP Corp., Box 6485, Orlando, Fla.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Keiser's Industries, Inc., Laumau St., Mt. Holly Springs, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Program Elctrns. Co., 1733 West End Ave., New Hyde Park, N. Y.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

BOARDS, TERMINAL

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Buchanan Electrical Products Corp., 1065 Floral Ave., Union, N. J. p 878
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Concord Electronics Corp., 37 Great Jones St., New York, N. Y.
Continental Connector Corp., 34-63 56th St., Woodside, N. Y.
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 904
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kulka Electric Corp., Dept. E, Box 149, Mount Vernon, N. Y. ... p 917
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill. ..... p 919
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass. ..... p 976
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H. p 1005
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Virginia Panel Corp., Box 1106, Waynesboro, Va.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aeronautical Electric Co., Inc., 5656 Northwest Hwy., Chicago, Ill.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
American Mica Insulation Co., Manasquan, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Chemical & Aerospace Products, Inc., 231 E. Lomita, Wilmington, Calif.
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Collectron Corp., 304 East 45th St., New York, N. Y.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Curtis Develop. & Mfg. Co., 3278 N. 33rd St., Milwaukee, Wisc.
Custom Engineering & Test Co., Inc., 3160 46 Ave. N., St. Petersburg, Fla.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Doran Mfg. Co., 1033 Bader St., Cincinnati, Ohio
ETC, Inc., 990 East 67 St., Cleveland, Ohio
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Electrical Plastics Corp., 280 Warren St., Lyndhurst, N. J.
Electrol Co., Inc., 771 Spring La., York, Pa.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Gunnar Laboratories, Inc., 5803 14th St., E., Brandenton, Fla.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Gyrotronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
Hampden Mfg. Co., Inc., Box 10, Thompsonville, Conn.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Keil Engrg. Products Co., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Red Seal Electric Co., 3835 West 150th St., Cleveland, Ohio
Rostone Corp., Route 52 S., Lafayette, Ind.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Spruce Pine Mica Co., Inc., 108 Greenwood Rd., Spruce Pine, N. C.
States Co., 19 New Park Ave., Hartford, Conn.
3M Co., 3M Center, St. Paul, Minn.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tri-Dex Co., 2146 E. Main St., Visalia, Calif.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
W & M Mfg. Corp., 187 Lafayette St., New York, N. Y.

BOATS & CRUCIBLES

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
Aircraft & Missile Consultants, 2722 Ardmore Ave., Manhattan Beach, Calif.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Carler Prods. Corp., 6200 E. Malloy Rd., E. Syracuse, N. Y.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Poco Graphite, Inc., Box 1524, Garland, Tex.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Richland Glass Co., Inc., Richland, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Zircoa, (Zirconium Corp. of America), Box 39217, Solon, Ohio

BOBBINS, WINDING, COIL AND TRANSFORMER—ALSO SEE COIL FORMS

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.

Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Booker & Wallestad, 1202 South 5th St., Hopkins, Minn. p 1237-1242
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. .... p 724,725
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Dale Electronics Inc., Box 609, Columbus, Nebr.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Thermotech Coil Forms & Components Div., 1202 S. 5th St., Hopkins, Minn. p 1237-1242
Thermotech Inds., Inc., 1202 South 5th St., Hopkins, Minn. p 1237-1242
Thermotech Plastics Co., 1202 South 5th St., Hopkins, Minn. p 1237-1242
Tohoku Metal Inds., Ltd., 13-10, 7-Cheme, Ginza-Chuo-ku, Tokyo, Japan
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Wilcox Prods. Co., 1202 South 5th St., Hopkins, Minn. ... p 1237-1242
Zaring Inds., Inc., Box 477, Carmel, Ind.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Amerline Corp., 1800 W. Fullerton Ave., Chicago, Ill.
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Bradford Components, Inc., 65 South Ave., Box 107, Salamanca, N. Y.
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Celestial Components, Inc., Box 4035, Covina, Calif.
Ceram Corp., 5345 Timken Sq., La Mesa, Calif.
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Cosmo Plastics Co., 3239 West 14th St., Cleveland, Ohio
Diamonite Products Mfg. Co., Div. U. S. Ceramic Tile Co., Shreve, Ohio
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Electrical Plastics Corp., 280 Warren St., Lyndhurst, N. J.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Form-It Products Inc., 1619 W. Walnut St., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Gorman Machine Corp., 480 S. Main St., Randolph, Mass.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kirchberger, M., & Co., Inc., 250 Humphrey St., Englewood, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
Ny-Glass, Inc., 7314 E. Madison St., Paramount, Calif.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
REM-Tronics, Inc., 192 Central Ave., Silver Creek, N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Resdel Corp., Box 2171, Rio Grande, N. J.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
Rostone Corp., Route 52 S., Lafayette, Ind.
Sag Harbor Inds., Inc., Bayview St., Sag Harbor, N. Y.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Smith, J. A. Co., Boyertown, Pa.
Space Products, Inc., 6631 Sarnia Ave., Long Beach, Calif.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Staffall Inc., 7 Woodland St., Providence, R. I.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Superior Steatite & Ceramic Corp., 83-91 W. Forest Ave., Englewood, N. J.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Wilco Corp., 4030 West 10th St., Indianapolis, Ind.

BOLOMETERS, INFRARED

Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. .. p 1708
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.

BOLOMETERS, MICROWAVE

Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Narda Microwave Corp., Plainview, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

BOLTS—SEE FASTENERS

BONDING JUMPERS—SEE JUMPERS, BONDING

BOOKS—SEE TECHNICAL BOOKS

BOOMS, STANDS, HOLDERS & ACCESSORIES, MICROPHONE

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Carpenter Co., 8030 N. Ridgeway, Skokie, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.

BOOTS, SWITCH HANDLE

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J. ..... p 2687
Metex Corp., 970 New Durham Rd., Edison, N. J. ..... p 1229
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Multi-Flex Seals, Inc., 1170 Commerce Ave., Bronx, N. Y.

BOXES, CIRCUIT BOARD—SEE BOXES, COMPONENT (SUBASSEMBLY HANDLING)

BOXES, COMPONENT (SUBASSEMBLY HANDLING, PRODUCTION)

Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Panel Controls Corp., 1000 Mt. Elliott Ave., Detroit, Mich. p 2154, 2155
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Corrugated Paper Products, Inc., 300 Babylon Tpke., Roosevelt, N. Y.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Lewis, G. B. Co., Watertown, Wisc.
Lyon Metal Products, Inc., 47 Railroad Ave., Aurora, Ill.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

BOXES, DECADE—SEE DECADE BOXES

BOXES, DRY

Baker Co., Inc., 106 Granite St., Biddeford, Me.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Edcraft Inds., Inc., 620 Commerce Rd., Linden, N. J.
Gruenberg Electric Co., Inc., 585 Commercial Ave., Garden City, N. Y.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Ramney Inds. Corp., Box 585, Farmingdale, N. J.
Ray Products, Inc., 703 S. Palm Ave., Alhambra, Calif.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

BOXES, ECHO

Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Narda Microwave Corp., Plainview, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
United Research Labs., 681 Fifth Ave., New York, N. Y.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.

BOXES, GLOVE

Abesto Corp., Ackerman St., Bloomfield, N. J.
Baker Co., Inc., 106 Granite St., Biddeford, Me.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Edcraft Inds., Inc., 620 Commerce Rd., Linden, N. J.
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Kirk & Blum Mfg. Co., 3120 Forrer St., Cincinnati, Ohio
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Ramney Inds. Corp., Box 585, Farmingdale, N. J.
Ray Products, Inc., 703 S. Palm Ave., Alhambra, Calif.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

BOXES, JUNCTION & WALL PLATE

Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Pyle-National Co., Connector Div., 1334 N. Kostner Ave., Chicago, Ill.

BRAKES, MAGNETIC

Trimm Inc., 400 Lake St., Libertyville, Ill. ..... p 573
Wiremold Co., Hartford, Conn. ..... p 1010, 1011
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Adalet Mfg. Co., 4801 West 150th St., Cleveland, Ohio
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Antronic Corp., 4942 Division, Chicago, Ill.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Danex Corp., 60 Tomlinson Rd., Huntingdon Valley, Pa.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Electrical Security Div., 1524 E. 14 Mile Rd., Madison Hgts., Mich.
Environmental Container Systems, Box 337, Union City, Calif.
Equipment & Service Co., 7118 Envoy Ct., Dallas, Tex.
General Metals, Inc., 2200 Fairfax Rd., Greensboro, N. C.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hoffman Engrg. Co., 9th & Tyler Sts., Anoka, Minn.
Jovex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Kirk & Blum Mfg. Co., 3120 Forrer St., Cincinnati, Ohio
LMB Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Midwest Electric Prods., Inc., Box 910, Mankato, Minn.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Spring City Electrical Mfg. Co., Hall & Main Sts., Spring City, Pa.
Stahlin Brothers, Inc., 500 Maple St., Belding, Mich.
Stanley Industrial Hardware Div., Stanley Works, New Britain, Conn.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Union Insulating Co., Box B, Parkersburg, W. Va.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Wadsworth Electric Mfg. Co., Inc., 20 West 11th St., Covington, Ky.

BOXES, METAL & PLASTIC—SEE CABINETS; CANS; CASES; CONTAINERS

BOXES, PLUG-IN—SEE PLUG-IN MODULE ENCLOSURES—ALSO SEE CANS

BOXES, POWER OUTLET—SEE BOXES, JUNCTION & WALL PLATE

BOXES, SHIPPING (REUSABLE)—SEE TRANSIT CASES

BOXES, TOTE—SEE BOXES, COMPONENT/SUBASSEMBLY HANDLING

BRACKETS, ANTENNA—SEE MOUNTS, ANTENNA

BRAID, CABLE & WIRE SHIELDING

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill.
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. .. p 2945
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Montgomery Co., Windsor Locks, Conn.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Titeflex, Inc., Hendee St., Springfield, Mass.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.

BRAKES, MAGNETIC

American Precision Inds., Inc., 77 Olean Rd., E. Aurora, N. Y. .... p 1724
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y. p 1729
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General-Electro Mechanical Corp., 787 Hertel Ave., Buffalo, N. Y. p 1737
General Time Corp., Rte. 8, Torrington, Conn.
Magtrol Inc., 240 Seneca St., Buffalo, N. Y. ..... p 1749
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234

BRAKES, MAGNETIC (Cont'd)

Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1766
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Altair Research & Mfg. Co., 1241 E. State St., Ontario, Calif.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Bendix Corp., Motor Components Div., Elmira, N. Y.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Dial Products Co., 19-21 Cottage St., Bayonne, N. J.
Electroid Corp., 95 Progress St., Union, N. J.
Fawick Airflex Div., 9919 Clinton Rd., Cleveland, Ohio
Hobbs Mfg. Co., 666 Lincoln St., Worcester, Mass.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
MagneTec Corp., 7751 Densmore Ave., Van Nuys, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Meltronics, Inc., 3343 Merrick Rd., Wantagh, N. Y.
Midwest Automatic, Inc., 510 Third St., Des Moines, Iowa
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Precision Specialties, Inc., Box 118, Pitman, N. J.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Simplatrol Prods. Corp., 675 Plantation St., Worcester, Mass.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Valcor Engrg. Corp., 365 Carnegie Ave., Kenilworth, N. J.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

BRAKES, MECHANICAL

American Precision Inds., Inc., 77 Olean Rd., E. Aurora, N. Y. .... p 1724
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Sterling Instr., 76 E. Second St., Mineola, N. Y.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Electroid Corp., 95 Progress St., Union, N. J.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Midwest Automatic, Inc., 510 Third St., Des Moines, Iowa
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Precision Specialties, Inc., Box 118, Pitman, N. J.

BRAZING FLUX—SEE FLUX, BRAZING & SOLDERING

BREADBOARD KITS—SEE KITS, BREADBOARDING

BREAKDOWN TESTERS—SEE TESTERS, INSULATION BREAKDOWN

BREAKERS, CIRCUIT—SEE CIRCUIT BREAKERS

BRIDGES, ADMITTANCE

Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346, 1347
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

BRIDGES, ANTENNA—SEE BRIDGES, R-F

BRIDGES, AUDIO

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

BRIDGES, BOLOMETER

Measurements, Box 180, Boonton, N. J. ..... p 1437
Narda Microwave Corp., Plainview, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

BRIDGES, CALORIMETER

Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.

BRIDGES, CAPACITANCE

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346, 1347
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Clippard Instr. Inc., 7350-90 Colerain Rd., Cincinnati, Ohio
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
D. M. Research Corp., 13703 Madison Ave., Cleveland, Ohio
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Epic, Inc., 150 Nassau St., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
New London Instrument Co., Box 189, New London, Conn.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Thomas Ind'l. Automation Ltd., Deansgate La., Timperley, Cheshire, Eng.

BRIDGES, DEVIATION

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1412
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
D. M. Research Corp., 13703 Madison Ave., Cleveland, Ohio
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
RDF Corp., 23 Elm Ave., Hudson, N. H.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

BRIDGES, IMPEDANCE

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346, 1347
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386, 1387
Heath Co., Dept. 180, Benton Harbor, Mich.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1443
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Bristol Co., Box 1790, Waterbury, Conn.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
D. M. Research Corp., 13703 Madison Ave., Cleveland, Ohio
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Instr. Corp., Harris ASW Div., 33 Southwest Pk., Westwood, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
New London Instrument Co., Box 189, New London, Conn.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.

BRIDGES, INDUCTANCE

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346, 1347
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385, 1387
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Bristol Co., Box 1790, Waterbury, Conn.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
General Instr. Corp., Harris ASW Div., 33 Southwest Pk., Westwood, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Malaker Corp., W. Main St., High Bridge, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
New London Instrument Co., Box 189, New London, Conn.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.

BRIDGES, KELVIN

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346-1348
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412, 1413, 2394
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Neutronic Corp., Box 625, St. Louis, Mo.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Epic, Inc., 150 Nassau St., New York, N. Y.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

BRIDGES, LIMIT—SEE BRIDGES (SPECIFIC TYPES)

BRIDGES, MAGNETIC SUSCEPTIBILITY

Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Malaker Corp., W. Main St., High Bridge, N. J.

BRIDGES, MEGOHM—SEE BRIDGES, RESISTANCE

BRIDGES, POWER, R-F

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Measurements, Box 180, Boonton, N. J. ..... p 1437
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

BRIDGES, PROGRAMMABLE—SEE BRIDGES (SPECIFIC TYPES)

BRIDGES, Q

Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346, 1347

Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.

BRIDGES, RATIO—SEE TESTERS, RATIO VOLTAGE—ALSO SEE METERS, RATIO

BRIDGES, RESISTANCE

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346-1349
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412, 1413, 1417, 2394
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1456
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. p 1503, 1504
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y.
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa. ..... p 2433
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Clippard Instr. Inc., 7350-90 Colerain Rd., Cincinnati, Ohio
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
D. M. Research Corp., 13703 Madison Ave., Cleveland, Ohio
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Malaker Corp., W. Main St., High Bridge, N. J.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
New London Instrument Co., Box 189, New London, Conn.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Precision Standards Corp., Box 8361, San Marino, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RDF Corp., 23 Elm Ave., Hudson, N. H.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Solatron Enterprises, 421 E. Beach Ave., Inglewood, Calif.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

BRIDGES, R-F

Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346, 1347
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1443
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. ..... p 1503
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gold Line Connector, Inc., Muller Ave., Box 893, Norwalk, Conn.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Radiation Devices Co., Box 8450, Baltimore, Md.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.

BRIDGES, SCHERING

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. p 1503, 1504
Epic, Inc., 150 Nassau St., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

BRIDGES, SELF-BALANCING

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

BRIDGES, SILICON CELL

International Rectifier, 233 Kansas St., El Segundo, Calif. p 2527-2529
Semikron International Inc., Box 323, Scarsdale, N. Y. ..... p 2587
Semtech Corp., 652 Mitchell Rd., Newbury Park, Calif. ..... p 2590
Varo, Inc., Semiconductor Div., 1000 N. Shiloh Rd., Garland, Tex. p 2629
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2649
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Power Components Inc., Box 421, Scottdale, Pa.
Standard Rectifier Div., 2200 S. Fairview, Santa Ana, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.

BRIDGES, STRAIN GAUGE

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
B & F Instruments Inc., Cornwells Hgts., Pa.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Ellis Associates, P. O. Box 77, 67 Lincoln Ave., Pelham, N. Y.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Micro-Strain, Inc., Spring City, Pa.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

BRIDGES, SYNCHRO & RESOLVER

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. .. p 1328, 1329
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 2394
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496, 1497
Theta Instrument Corp., Fairfield, N. J. ..... p 1515
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

BRIDGES, TEMPERATURE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339

BRIDGES, WHEATSTONE

Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
RFL Inds., Inc., Thermocontrol Div., Powerville Rd., Boonton, N. J. p 1473
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. p 1503, 1504
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
Gow-Mac Instrument Co., 100 Kings Rd., Madison, N. J.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Malaker Corp., W. Main St., High Bridge, N. J.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
RDF Corp., 23 Elm Ave., Hudson, N. H.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
T & T Controls Co., Inc., Box 171, Media, Pa.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.

BRIDGES, THERMISTOR

Narda Microwave Corp., Plainview, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Conax Corporation, 2300 Walden Ave., Buffalo, N. Y.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
T & T Controls Co., Inc., Box 171, Media, Pa.
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

BRIDGES, WENNER

Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.

BRIDGES, WHEATSTONE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339
Cal-R, Inc., Thermonetics Div., 1601 Olympic Blvd., Santa Monica, Calif.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Heath Co., Dept. 180, Benton Harbor, Mich.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Millivac Instruments, Box 997, Schenectady, N. Y.
Neutronic Corp., Box 625, St. Louis, Mo.
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Epic, Inc., 150 Nassau St., New York, N. Y.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.

BRIDGES, WHEATSTONE (Cont'd)

Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
New London Instrument Co., Box 189, New London, Conn.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
RDF Corp., 23 Elm Ave., Hudson, N. H.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

BRUSHES & BRUSH ASSEMBLIES

Airflyte Electronics Co., Box 207, Bayonne, N. J. ..... p 1722
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Fabricast Inc., 9835 Alpaca St., South El Monte, Calif. .... p 1730, 1731
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Airco Speer Carbon Products, 800 Theresia St., St. Marys, Pa.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Collectron Corp., 304 East 45th St., New York, N. Y.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Electro-Miniatures Corp., 600 Huyler St., S. Hackensack, N. J.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
Felton, S. A. & Son Co., 315 Wilson St., Manchester, N. Y.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Helwig Carbon Prods., Inc., 2550 North 30th St., Milwaukee, Wisc.
Jenkins, M. W. Sons, Inc., Box 70, Dept. 25, Cedar Grove, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Midwest Molding & Mfg. Co., Gurnee, Ill.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Nuclear Products Co., Box 1178, El Monte, Calif.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Ostby & Barton Co., Box 6267, Providence, R. I.
Pure Carbon Co., Inc., 441 Hall Ave., St. Marys, Pa.
St. Mary's Carbon Co., 1939 State Rd., St. Marys, Pa.
Shanda Labs., Inc., Box 24, Closter, N. J.
Sittler Corp., 18 N. Ada St., Chicago, Ill.
Stackpole Carbon Co., Carbon Div., Stackpole St., St. Marys, Pa.
Superior Carbon Prods., Inc., 9115 George Ave., Cleveland, Ohio
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.
Wendon Co., Inc., 17 Irving Ave., Stamford, Conn.

BUFFER MEMORIES, COMPUTER—ALSO SEE MEMORY SYSTEMS

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1155
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Digital Devices Div., 200 Michael Dr., Syosset, N. Y. ..... p 1162
Digital Equip. Corp., 146 Main St., Maynard, Mass.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.

BULBS—SEE LAMPS

BUMPERS

Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Atlantic India Rubber Co., 571 W. Polk St., Chicago, Ill.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Budwig Mfg. Co., Box 97, Ramona, Calif.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Mecca, P.O. Box 36393, Houston, Tex.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
Stalwart Rubber Co., 377 Northfield Rd., Bedford, Ohio
3M Co., 3M Center, St. Paul, Minn.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.

BURNISHERS, CONTACT

ADRE Co., 1005 South 26th St., Milwaukee, Wisc.
Clark, D. Co., Inc., 360 Franklin St., Worcester, Mass.
Jenkins, M. W. Sons, Inc., Box 70, Dept. 25, Cedar Grove, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Stewart-Hall Chemical Corp., 222 Washington St., Mount Vernon, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

BUS BARS & SYSTEMS

California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Janco Corp., 3111 Winona Ave., Burbank, Calif. ..... p 2738
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Chase Brass & Copper Co., 20600 Chagrin Blvd., Cleveland, Ohio
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Chemical & Aerospace Products, Inc., 231 E. Lomita, Wilmington, Calif.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Douglas Electronics, Inc., 718 Marina Blvd., San Leandro, Calif.
Eldre Components, Inc., 1239 University Ave., Rochester, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Rogers Corp., Rogers, Conn.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

BUSHINGS, GLASS, PLASTIC, METAL, ETC.

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1640
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Adalet Mfg. Co., 4801 West 150th St., Cleveland, Ohio
Adjustable Bushing Corp., 11905 Vose St., N. Hollywood, Calif.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Atlantic India Rubber Co., 571 W. Polk St., Chicago, Ill.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Clevite, Cleveland Graphite Bronze, 17000 St. Clair Ave., Cleveland, O.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Deutsch Fastener Corp., Airport Sta - Box 90925, Los Angeles, Calif.
Dixon Corp., Metacom Ave., Bristol, R. I.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
ECCO Elctrn. Comps. Corp., 157 S. MacQuesten Pkwy., Mt. Vernon, N. Y.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Fischer Special Mfg. Co., 446 Morgan St., Cincinnati, Ohio
Fluorocarbon Co., 1754 S. Clementine, Box 3339, Anaheim, Calif.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Gemp Terminals, Inc., 20 Woodworth Ave., Yonkers, N. Y.
Gillen, J. Co., 2540 South 50th Ave., Cicero, Ill.
Great Eastern Metal Prod. Co., 22 Woodworth Ave., Yonkers, N. Y.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Groov-Pin Corp., 1125 Hendricks Causeway, Ridgefield, N. J.
Heyman Mfg. Co., East Michigan Ave., Kenilworth, N. J.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Holmberg, Inc., 20 Melville Park Rd., Melville, N. Y.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Industrial Elctrn. Rubber Co., 8589 Darrow Rd., Twinsburg, Ohio
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Isolation Products, 2387 Adele Ave., Mountain View, Calif.
Janney Cylinder Co., 7401 State Rd., Philadelphia, Pa.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kelox Inds., 161 Prescott St., E. Boston, Mass.
Kerrco, Inc., Box 29178, Lincoln, Neb.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kopp Glass, Inc., Box 8255, Swissvale, Pittsburgh, Pa.
Kwikset Powdered Metal Prods., 516 E. Santa Ana St., Anaheim, Calif.
Lavezzi Machine Works, Inc., 4635 W. Lake St., Chicago, Ill.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Midwest Molding & Mfg. Co., Gurnee, Ill.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nutmeg Screw Machine Products, P.O. Box 1470, Waterbury, Conn.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Porcelain Products Co., 225 N. Patterson St., Carey, Ohio
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Red Seal Electric Co., 3835 West 150th St., Cleveland, Ohio
Resdel Corp., Box 2171, Rio Grande, N. J.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Richland Glass Co., Inc., Richland, N. J.
Rogers Corp., Rogers, Conn.
Rosan, Inc., 2901 West Coast Hwy., Newport Beach, Calif.
Rostone Corp., Route 52 S., Lafayette, Ind.
St. Mary's Carbon Co., 1939 State Rd., St. Marys, Pa.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Shur-Lok Corp., 1300 E. Normandy Pl., Santa Ana, Calif.
Sinclair Mfg. Co., Chartley, Mass.
Southwest Products Co., 1705 S. Mountain Ave., Monrovia, Calif.
Sparta Mfg. Co., Dover, Ohio
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Spring City Electrical Mfg. Co., Hall & Main Sts., Spring City, Pa.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Tridair Industries, 3000 W. Lomita Bl., Torrance, Cal.
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Union Insulating Co., Box B, Parkersburg, W. Va.
Western Sky Industries, 21300 Cloud Way, Hayward, Calif.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

BUSHINGS, HERMETICALLY SEALED

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Sealtron Corp., 188 Reading Rd. at Amity, Cincinnati, Ohio
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Consolidated Ceramics & Metalizing Corp., Box 352, Flemington, N. J.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Glass Beads Co., Ceramic Products Div., Latrobe, Pa.
Great Eastern Metal Prod. Co., 22 Woodworth Ave., Yonkers, N. Y.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kidco, Inc., Box 278, Medford, N. J.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Lundey Associates, Inc., 694 Main St., Waltham, Mass.
Mitronics, Inc., 132 Floral Ave., Murray Hill, N. J.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.

BUZZERS—SEE BELLS, BUZZERS, GONGS, SIRENS & AURAL WARNING DEVICES

CABINET COOLERS, BLOWERS & FANS—SEE BLOWERS & FANS

CABINET PRESSURIZATION SYSTEMS—SEE PRESSURIZATION SYSTEMS, EQUIPMENT CABINET

CABINETS & ACCESSORIES, METAL

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
Chassis-Trak, Inc., 525 S. Webster Ave., Indianapolis, Ind. .... p 578
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Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J. ..... p 580
Equipto Enclosure Systems, 435 Woodlawn Ave., Aurora, Ill. .. p 581
Falstrom Co., 174 Falstrom Ct., Passaic, N. J. ..... p 583
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass. p 582
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Morrison Prods., Inc., 16816 S. Waterloo Rd., Cleveland, Ohio .. p 1259
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
Power/Mate Corp., 163 Clay St., Hackensack, N. J. ..... p 2074
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga. ..... p 588
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Scientific International Mktg., Inc., Box 181, Spring House, Pa. .. p 589
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind. ..... p 594
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. .... p 591
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
Acro Products Corp., 1410 S. Aberdeen St., Chicago, Ill.
Akro-Mils Inc., Box 989, Akron, Ohio
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.

Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
B & P Precision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Baker Co., Inc., 106 Granite St., Biddeford, Me.
Ballonoff Metal Products Co., 14055 Cedar Rd., Cleveland, Ohio
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Baumker Mfg. Co., 5144 Enterprise, Toledo, Ohio
Bay Products, Somerset & Gurney Sts., Philadelphia, Pa.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bingham, J. F. Mfg. Co., 69 Bay State Rd., Lawrence, Mass.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Columbia-Hallowell, Div. Standard Pressed Steel Co., Hatfield, Pa.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Custom Metal Prods., 200 Broadway, Garden City Pk., N. Y.
Dahlstrom Mfg. Corp., Special Prods. Div., Jamestown, N. Y.
Danco Metal Products, Inc., 24020 Detroit Rd., Westlake, Ohio
Dolin Metal Products, Inc., 315 Lexington Ave., Brooklyn, N. Y.
Donnelly Manufacturing Co., P. O. Box 71, Waltham, Mass.
Electrical Security Div., 1524 E. 14 Mile Rd., Madison Hgts., Mich.
Equipto Div., Aurora Equipment Co., 225 S. Highland Ave., Aurora, Il.
Erie Artisan Corp., 11400 Madison Ave., Cleveland, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
General Metals, Inc., 2200 Fairfax Rd., Greensboro, N. C.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Granite State Machine Co., Inc., 124 Joliette St. Manchester, N. H.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gyrotronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
Hake Products, Inc., 6152 Wasigo Dr., Cincinnati, Ohio
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hoffman Engrg. Co., 9th & Tyler Sts., Anoka, Minn.
Holbrook-Merrill Co., 1150 Kifer Rd., Sunnyvale, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Ingersoll Products, 1000 West 120th St., Chicago, Ill.
Janitrol Aero Div., 4200 Surface Rd., Columbus, Ohio
Kees, F. D. Mfg. Co., 700 Park Ave., Beatrice, Neb.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Kirk & Blum Mfg. Co., 3120 Forrer St., Cincinnati, Ohio
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
LMB Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lindsay Structure, 1360 Edgar St., Evansville, Ind.
Lynch, R. H. Mfg. Co., 7831 E. Arroyo Dr., S. San Gabriel, Calif.
Lyon Metal Products, Inc., 47 Railroad Ave., Aurora, Ill.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Met-L-Wood Corp., 6755 West 65th St., Chicago, Ill.
Metal-Craft, Inc., Box 296, Wayne, N. J.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Metalcraft, Inc., Roosevelt Field, Garden City, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Middletown Mfg. Co., 27 Stack St., Middletown, Conn.
Midget Louver Co., 800 Main Ave., Norwalk, Conn.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Ohmart Corp., 4241 Allendorf Dr., Cincinnati, Ohio
Panelgraphic Corp., Box 254, Caldwell, N. J.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Procedyne Corp., 221 Somerset St., New Brunswick, N. J.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Rotary Co., Inc., 1746 Dale Rd., Buffalo, N. Y.
Spring City Electrical Mfg. Co., Hall & Main Sts., Spring City, Pa.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Stanley Industrial Hardware Div., Stanley Works, New Britain, Conn.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Straube Mfg. Co., Box 69, Waynesboro, Pa.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Sturdilite, Plainwell, Mich.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Superior Switchboard & Devices Div., Box 590, Canton, Ohio
TA Mfg. Corp., 4625 Alger St., Los Angeles, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Titchener, E. H. & Co., 8 Titchener Pl., Binghamton, N. Y.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Watson Mfg. Co., Inc., 800 Taylor St., Jamestown, N. Y.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CABINETS, BLOWER—SEE CABINETS & ACCESSORIES, METAL

CABINETS, METAL SHIELDED

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J. ..... p 580
Falstrom Co., 174 Falstrom Ct., Passaic, N. J. ..... p 583
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 586
Scientific International Mktg., Inc., Box 181, Spring House, Pa.... p 589
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
Amerind-MacKissic, Inc., Box 111, Parkerford, Pa.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
B & P Precision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Custom Metal Prods., 200 Broadway, Garden City Pk., N. Y.
Danco Metal Products, Inc., 24020 Detroit Rd., Westlake, Ohio
Donnelly Manufacturing Co., P. O. Box 71, Waltham, Mass.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Hoffman Engrg. Co., 9th & Tyler Sts., Anoka, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kirk & Blum Mfg. Co., 3120 Forrer St., Cincinnati, Ohio
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
LMB Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Lindsay Structure, 1360 Edgar St., Evansville, Ind.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Metalcraft, Inc., Roosevelt Field, Garden City, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Sell-Tronic Prods. Co., Inc., 138 31st Rd., Flushing, N. Y.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Superior Switchboard & Devices Div., Box 590, Canton, Ohio
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Watson Mfg. Co., Inc., 800 Taylor St., Jamestown, N. Y.
Welex Electronics, Box 986, Silver Spring, Md.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CABINETS, PLASTIC

Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill.
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Ace Plastic Inds., Inc., 99 Dover St., Somerville, Mass.
Akro-Mils Inc., Box 989, Akron, Ohio
Althor Products, 2260 Benson Ave., Brooklyn, N. Y.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Ballonoff Metal Products Co., 14055 Cedar Rd., Cleveland, Ohio
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Edcraft Inds., Inc., 620 Commerce Rd., Linden, N. J.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Ny-Glass, Inc., 7314 E. Madison St., Paramount, Calif.
Romar Plastics, Inc., 1311 East Main St., St. Charles, Ill.
Stahlin Brothers, Inc., 500 Maple St., Belding, Mich.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

CABINETS, SLIDING DRAWER

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill.
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J. ..... p 580
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga. ..... p 588
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. ... p 591
Accuride Div., 12311 S. Shoemaker Ave., Santa Fe Springs, Calif.
Acro Products Corp., 1410 S. Aberdeen St., Chicago, Ill.
Akro-Mils Inc., Box 989, Akron, Ohio
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
B.J.M. Co., San Juan Darlington, Santurce, Puerto Rico

CABLE, AUDIO

Ballonoff Metal Products Co., 14055 Cedar Rd., Cleveland, Ohio
Bay Products, Somerset & Gurney Sts., Philadelphia, Pa.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Hake Products, Inc., 6152 Wasigo Dr., Cincinnati, Ohio
Janel, Inc., 226 Main Ave., Stirling, N. J.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Sturdilite, Plainwell, Mich.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Taylor Millwork & Stair Co., Inc., 1305 West 132 St., Gardena, Calif.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Workplace Systems, Inc., 370 Commercial St., Manchester, N. H.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CABINETS, SPEAKER—SEE ENCLOSURES, SPEAKER

CABINETS, WOOD (EXCLUDING KITS)

Heath Co., Dept. 180, Benton Harbor, Mich.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
B.J.M. Co., San Juan Darlington, Santurce, Puerto Rico
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Cambridge Pattern Works, Inc., 55 First St., Cambridge, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Furniture Craftsmen, 3596 Alpine Rd., N. W., Grand Rapids, Mich.
Karlson Research & Mfg. Div., 388 Peninsula Blvd., Hempstead, N. Y.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis, Mo.
Major Electronics Corp., 649 39 St., Brooklyn, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Radio-Matic of America, Inc., 760 Ramsey Ave., Hillside, N. J.
Ruxton Elctrns. Co., 2420 N. Rosemead Blvd., S. El Monte, Calif.
Taylor Millwork & Stair Co., Inc., 1305 West 132 St., Gardena, Calif.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Wellcor, Inc., 1214-18 N. Wells St., Chicago, Ill.

CABLE, AUDIO

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. .. p 2929
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y. p 2952
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio ..... p 984
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y...... p 2964
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Whitmor Wire & Cable Corp., 13161 Sherman Way, N. Hollywood, Calif. p 2971
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Apex Wire & Cable Corp., 380 Vanderbilt Motor Pkwy., Hauppauge, N. Y.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Miller Electric Co., Box 231, Woonsocket, R. I.
Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.

CABLE, AUDIO (Cont'd)

NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rockland Insulated Wire & Cable Co., Inc., 36 Main St., Haverstraw, N. Y.
Rodda Co., Inc., 1005 Martin Ave., Santa Clara, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
3M Co., 3M Center, St. Paul, Minn.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

CABLE, BATTERY BOOSTER

Belden Corp., Box 5070A, Chicago, Ill.
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio . . . . . p 985
Mueller Electric Co., 1589 H East 31st St., Cleveland, Ohio . . . . p 924
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Apex Wire & Cable Corp., 380 Vanderbilt Motor Pkwy., Hauppauge, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Carol Cable Co., Box 68, Pawtucket, R. I.
General Cable Corp., 733 Third Ave., New York, N. Y.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

CABLE, COAXIAL

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. . . . . . p 2924
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif.
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. . . p 2929
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill. p 2930
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
p 2932
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
p 2944, 2946–2951
Dynatronic Cable Engrg. Corp., 136 San Fernando Rd., Los Angeles, Calif.
p 2933
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. . . . . . p 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa. . . . . . p 2957
National Wire & Cable Corp., 136 San Fernando Rd.,
Dept. EEM, Service Div., Los Angeles, Cal. . . . . . p 2958, 2960, 2961
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y.. . . . p 2964
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa.
p 2965
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y.
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn. . . . . . p 2969
Uniform Tubes Inc., Collegeville, Pa. . . . . . p 2970
Virginia Panel Corp., Box 1106, Waynesboro, Va.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Ameco, Inc., Box 13741, Phoenix, Ariz.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Columbia Electronic Cables, Box 231, Woonsocket, R. I.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Jefferson Cable Corp., 181 Greenwood St., Worcester, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Philadelphia Insulated Wire Co., 333 New Albany Rd., Moorestown, N. J.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Prodelin, Inc., Box 131, Hightstown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rockland Insulated Wire & Cable Co., Inc., 36 Main St., Haverstraw, N. Y.
Rodda Co., Inc., 1005 Martin Ave., Santa Clara, Calif.
Rome Cable, Rome, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.
Superior Insulated Wire Corp., Box 188, Stony Point, N. Y.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Thermotronic Devices, Inc., Forest & Hector Sts., Conshohocken, Pa.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.

CABLE, CONTROL—SEE CABLE, MULTICONDUCTOR

CABLE, DIAL—SEE CORDS AND CABLE, DIAL DRIVE

CABLE FAULT LOCATORS—SEE LOCATORS, CABLE & LINE FAULT

CABLE, FLAT, COLLATED (FLAT OR ROUND CONDUCTORS)

Belden Corp., Box 5070A, Chicago, Ill. . . . . . p 2924
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif. . . . . p 2925
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. . . p 2939
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Tensolite Div., W. Main St., Tarrytown, N. Y.
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Digital Sensors, Inc., 4127 N. Figueroa St., Los Angeles, Calif.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Circuits, Inc., 95 Mt. Read Blvd., Rochester, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lance Inds., Box 4156, Sylmar, Calif.
Lane Inds., Electronics Div., 7254 Atoll Ave., N., N. Hollywood, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Montgomery Co., Windsor Locks, Conn.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Okonite Co., 220 Passaic St., Passaic, N. J.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sanders Assocs., Inc., Flexprint Prod. Div., Grenier Fld., Manchester, N. H.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.

CABLE, FLAT, ETCHED

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Belden Corp., Box 5070A, Chicago, Ill.
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif. . . . . p 2925
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Dynatronic Cable Engrg. Corp., 136 San Fernando Rd., Los Angeles, Calif.
p 2933
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tensolite Div., W. Main St., Tarrytown, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Digital Sensors, Inc., 4127 N. Figueroa St., Los Angeles, Calif.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Flexprint Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Lane Inds., Electronics Div., 7254 Atoll Ave., N., N. Hollywood, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Okonite Co., 220 Passaic St., Passaic, N. J.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Rogers Corp., Rogers, Conn.
Sanders Assocs., Inc., Flexprint Prod. Div., Grenier Fld., Manchester, N. H.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Superior Insulated Wire Corp., Box 188, Stony Point, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

CABLE, FLEXIBLE—SEE CABLE, FLAT

CABLE, HEATER

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Belden Corp., Box 5070A, Chicago, Ill.
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J.
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill. . . p 2809, 2810
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Markel, L. Frank, & Sons, School La., Norristown, Pa.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Tensolite Div., W. Main St., Tarrytown, N. Y. . . . . . p 2968
Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Standard, 9000 Kings St., Franklin Park, Ill.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carol Cable Co., Box 68, Pawtucket, R. I.
Cerro Corp., 300 Park Ave., New York, N. Y.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Electro-Flex Heat, Inc., Northwood Industrial Park, Bloomfield, Conn.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Philadelphia Insulated Wire Co., 333 New Albany Rd., Moorestown, N. J.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.

CABLE, HIGH VOLTAGE

Belden Corp., Box 5070A, Chicago, Ill. . . . . . p 2924
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. . . p 2929
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2934
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
p 2939, 2940, 2942, 2944, 2947–2951
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y. p 2952
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. . . . . . p 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa. . . . . . p 2957
National Wire & Cable Corp., 136 San Fernando Rd.,
Dept. EEM, Service Div., Los Angeles, Cal. . . . . . p 2958
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. . . . . p 2964
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Tensolite Div., W. Main St., Tarrytown, N. Y. . . . . . p 2968
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y.
Whitmor Wire & Cable Corp., 13161 Sherman Way, N. Hollywood, Calif.
p 2971
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.

Columbia Electronic Cables, Box 231, Woonsocket, R. I.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Okonite Co., 220 Passaic St., Passaic, N. J.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Radix Wire Co., 26260 Lakeland Blvd., Cleveland, Ohio
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.

CABLE, IRRADIATED

Belden Corp., Box 5070A, Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. . . p 2954, 2955
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Chester Cable Co., Oakland Ave., Chester, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.

CABLE, LOW-CAPACITANCE

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. . . . . . p 2924
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif.
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2947–2950
Dynatronic Cable Engrg. Corp., 136 San Fernando Rd., Los Angeles, Calif. p 2933
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y. p 2952
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Markel, L. Frank, & Sons, School La., Norristown, Pa.
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal. . . . . . p 2958, 2960, 2961
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. . . . . . p 2968
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn. . . . . . p 2969
Uniform Tubes Inc., Collegeville, Pa. . . . . . p 2970
Whitmor Wire & Cable Corp., 13161 Sherman Way, N. Hollywood, Calif. p 2971
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Superior Continental Corp., Box 489, Hickory, N. C.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.

CABLE, MICROPHONE

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. . . . . . p 2924
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif.
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill. p 2930
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
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Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. . . . . . p 2968
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Automatic Clerical Systems, Inc., 389 N. Fair Oaks Ave., Pasadena, Calif.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rockland Insulated Wire & Cable Co., Inc., 36 Main St., Haverstraw, N. Y.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.

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Belden Corp., Box 5070A, Chicago, Ill. . . . . . p 2924
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif.
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
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Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. . . . . . p 2955
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Markel, L. Frank, & Sons, School La., Norristown, Pa. . . . . . p 2957
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal. . . . . . p 2958–2961
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. . . . . . p 2964
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. . . . . . p 2968
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn. . . . . . p 2969
Whitmor Wire & Cable Corp., 13161 Sherman Way, N. Hollywood, Calif. p 2971
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Bergen Wire Rope Co., 1234 Gregg St., Lodi, N. J.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Columbia Electronic Cables, Box 231, Woonsocket, R. I.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.

CABLE, POWER

General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
General Reliance Div., General Relay Corp., 20 Mercer St., Dover, N. J.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Jutco, Inc., 122 East 162nd St., Gardena, Calif.
Lane Inds., Electronics Div., 7254 Atoll Ave., N., N. Hollywood, Calif.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
M-T Electronics Co., 536 Lewelling Blvd., San Leandro, Calif.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Mark Products, Inc., 3935 Fairhill Dr., Houston, Tex.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Miller Electric Co., Box 231, Woonsocket, R. I.
Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.
Moore, Samuel & Co., Mantua, Ohio
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Okonite Co., 220 Passaic St., Passaic, N. J.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Philadelphia Insulated Wire Co., 333 New Albany Rd., Moorestown, N. J.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rockland Insulated Wire & Cable Co., Inc., 36 Main St., Haverstraw, N. Y.
Rome Cable, Rome, N. Y.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Superior Continental Corp., Box 489, Hickory, N. C.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

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Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. . . . . . p 2924
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif.
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. . . p 2929
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Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2946–2949
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y. p 2952
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. . . . . . p 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa.
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. . . . . p 2964
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. . . . . . p 2968
Whitmor Wire & Cable Corp., 13161 Sherman Way, N. Hollywood, Calif. p 2971
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Apex Wire & Cable Corp., 380 Vanderbilt Motor Pkwy., Hauppauge, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.

CABLE, POWER (Cont'd)

Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
General Reliance Div., General Relay Corp., 20 Mercer St., Dover, N. J.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Miller Electric Co., Box 231, Woonsocket, R. I.
Moore, Samuel & Co., Mantua, Ohio
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Okonite Co., 220 Passaic St., Passaic, N. J.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Philadelphia Insulated Wire Co., 333 New Albany Rd., Moorestown, N. J.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rome Cable, Rome, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
United States Steel Corp., 525 William Penn Pl., Pittsburgh, Pa.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

CABLE, RETRACTILE—SEE CORDS, RETRACTILE

CABLE, RIBBON—SEE CABLE, FLAT

CABLE, ROTATOR, ANTENNA

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill.
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif.
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
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Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
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Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
General Cable Corp., 733 Third Ave., New York, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lance Inds., Box 4156, Sylmar, Calif.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Superior Insulated Wire Corp., Box 188, Stony Point, N. Y.

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Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
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Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2939, 2940, 2942, 2944, 2946-2950
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Lab-Tronics, 6225 Benore Rd., Toledo, Ohio ..... p 984
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal. ..... p 2958-2961
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill.
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. .... p 2964
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa. p 2965
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
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Times Wire & Cable, 358 Hall Ave., Wallingford, Conn. ..... p 2969
Uniform Tubes Inc., Collegeville, Pa. ..... p 2970
Whitmor Wire & Cable Corp., 13161 Sherman Way, N. Hollywood, Calif. p 2971
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Columbia Electronic Cables, Box 231, Woonsocket, R. I.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Mark Products, Inc., 3935 Fairhill Dr., Houston, Tex.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.
Moore, Samuel & Co., Mantua, Ohio
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Okonite Co., 220 Passaic St., Passaic, N. J.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Philadelphia Insulated Wire Co., 333 New Albany Rd., Moorestown, N. J.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rockland Insulated Wire & Cable Co., Inc., 36 Main St., Haverstraw, N. Y.
Rome Cable, Rome, N. Y.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.
Tenna Mfg. Co., Inc., 19201 Cranwood Pkwy., Warrensville Hts., Ohio
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

CABLE, SOLID DIELECTRIC

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill. p 2930
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2939, 2944, 2946, 2949
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. ..... p 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. .... p 2964
Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa. p 2965
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn.
Uniform Tubes Inc., Collegeville, Pa. ..... p 2970
Whitmor Wire & Cable Corp., 13161 Sherman Way, N. Hollywood, Calif. p 2971
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.
Okonite Co., 220 Passaic St., Passaic, N. J.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rome Cable, Rome, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

CABLE, TFE INSULATED

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. .. p 2929
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. p 2934, 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2940, 2942, 2946-2948, 2950, 2951
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y. p 2952
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. ..... p 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. .... p 2964
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Uniform Tubes Inc., Collegeville, Pa. ..... p 2970
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
General Cable Corp., 733 Third Ave., New York, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

CABLE, TV CAMERA

Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Cohu Electronics Inc., Box 623, San Diego, Calif.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2947, 2948
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Markel, L. Frank, & Sons, School La., Norristown, Pa.
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal. ..... p 2958-2961
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. .... p 2964
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Carol Cable Co., Box 68, Pawtucket, R. I.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
GBC Closed Circuit Corp., 74 5th Ave., New York, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Jefferson Cable Corp., 181 Greenwood St., Worcester, Mass.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Mark Products, Inc., 3935 Fairhill Dr., Houston, Tex.
Maryland Telecomm. 10534 York Rd., Cockeysville, Md.

Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.

CABLE, TELEPHONE

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. p 2924
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. p 2929
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. p 2964
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Miller Electric Co., Box 231, Woonsocket, R. I.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Okonite Co., 220 Passaic St., Passaic, N. J.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.

CABLE, TRANSMISSION LINE

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. p 2924
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. p 2929
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2946, 2948, 2949
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y. p 2952
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn. p 2969
Uniform Tubes Inc., Collegeville, Pa. p 2970
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Antenna Products Co., Box 9588, Austin, Tex.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Mohawk Wire & Cable Corp., Box 707, Leominster, Mass.
Okonite Co., 220 Passaic St., Passaic, N. J.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Rodda Co., Inc., 1005 Martin Ave., Santa Clara, Calif.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Superior Continental Corp., Box 489, Hickory, N. C.
Superior Insulated Wire Corp., Box 188, Stony Point, N. Y.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

CABLE, TRIAXIAL

Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2949
Dynatronic Cable Engrg. Corp., 136 San Fernando Rd., Los Angeles, Calif. p 2933
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal. p 2960
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Tensolite Div., W. Main St., Tarrytown, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

CABLE ASSEMBLIES & HARNESSES

ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 824, 828
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. p 830
Accurate Electronics Corp., Box 935J, Elyria, Ohio
Americon Corp., 87 Rumford Ave., Waltham, Mass. p 834
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Belden Corp., Box 5070A, Chicago, Ill.
Burndy Corporation, Richards Ave., Norwalk, Conn. p 881
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif. p 2925
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. p 2929
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. p 893
Control Prods. Corp., 4431 W. Division St., Chicago, Ill. p 2807
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. p 2935
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Hughes Aircraft, Connecting Devices, Box H, Newport Beach, Calif. p 906
ITT Cannon Elec., 3208 Humboldt St., Los Angeles, Cal. p 910
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio p 984
Logic Science, Inc., Box 10096, San Diego, Calif.
Mac Panel Co., Box 5027, High Point, N. C. p 920
Matrix Science Corp., 435 Maple Ave., Torrance, Calif. p 923
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. p 968, 969
Pyle-National Co., Connector Div., 1334 N. Kostner Ave., Chicago, Ill. p 978
Reynolds Industries, Inc., Box P-850, Marina Del Ray, Cal. p 980, 981
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio p 983
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. p 2966
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn. p 2969
Uniform Tubes Inc., Collegeville, Pa. p 2970
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Wiremold Co., Hartford, Conn. p 1010, 1011
Zaring Inds., Inc., Box 477, Carmel, Ind.
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Adronics, Inc., 271 Grove Ave., Verona, N. J.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
American Standard, 9000 Kings St., Franklin Park, Ill.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Apex Wire & Cable Corp., 380 Vanderbilt Motor Pkwy., Hauppauge, N. Y.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Audio Accessories, Inc., Gilsum, N. H.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio

CABLE ASSEMBLIES AND HARNESSES

Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Barker Products Co., 344 Central St., Saugus, Mass.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Bergen Wire Rope Co., 1234 Gregg St., Lodi, N. J.
Berkshire Technical Prods., Inc., Box 60, RD 1, Reading, Pa.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bliss Electronic Corp., Box 366, Sussex, N. J.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Broxlea Ltd., Broxbourne, Herts, Eng.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Collins Radio Co., Dallas, Texas
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Cord Specialties Co., 9239 Cherry St., Franklin Park, Ill.
Culver-Stearns Mfg. Co., 354 Franklin St., Worcester, Mass.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Darling, R. E., Co., Inc., Box 666, Gaithersburg, Md.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Digital Sensors, Inc., 4127 N. Figueroa St., Los Angeles, Calif.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electro Specialties Corp., 370 Park Ave., Worcester, Mass.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Electronics, Inc. of Pa., 2440 Maryland Ave., Willow Grove, Pa.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Cable Corp., 733 Third Ave., New York, N. Y.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General RF Fittings, Box 278, Port Salerno, Fla.
General Reliance Div., General Relay Corp., 20 Mercer St., Dover, N. J.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Gillette Elctrn. Prods. Co., 201 Laurel St., Beverly, N. J.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Gunnar Laboratories, Inc., 5803 14th St., E., Brandenton, Fla.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Harco Labs, Inc., 186 Cedar St., Branford, Conn.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Computer Control Div., Peterborough, N. H.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Jansen Electronics Mfg., Inc., 2233 University Ave., St. Paul, Minn.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Judd Wire Div., S. Bedford St., Burlington, Mass.
Jutco, Inc., 122 East 162nd St., Gardena, Calif.
Keiser's Industries, Inc., Laumau St., Mt. Holly Springs, Pa.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Koontz-Wagner Elec. Co., Inc., 516 N. Michigan St., S. Bend, Ind.
Lance Inds., Box 4156, Sylmar, Calif.
Lane Inds., Electronics Div., 7254 Atoll Ave., N., N. Hollywood, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Linemaster Switch Corp., Box 52, Woodstock, Conn.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Lynn Elctrns. Corp., Box 3003, Philadelphia, Pa.
M-T Electronics Co., 536 Lewelling Blvd., San Leandro, Calif.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Mark Products, Inc., 3935 Fairhill Dr., Houston, Tex.
Mecca, P.O. Box 36393, Houston, Tex.
Mercury Elctrns. Corp., 339 E. Cottage Pl., York, Pa.
Micro-Magna Elctrns., 3311 Perkins Ave., Cleveland, Ohio
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.

CABLE ASSEMBLIES AND HARNESSES (Cont'd)

Microtech, 1425 Milldale Rd., Cheshire, Conn.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Modelectric Prods. Corp., 9 Cindy La., Asbury Park, N. J.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Multicon Div., Box 899, Ft. Wayne, Ind.
Mutron Corp., 646 Summer St., Brockton, Mass.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Network Industries, Inc., Box 397, Bayonne, N. J.
Newman, M. M. Corp., 85 Clifton Ave., Marblehead, Mass.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Perfection Electronics, Inc., 73-03 Grand Ave., Maspeth, N. Y.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Petty Geophysical Engrg. Co., 700 Tower Bldg., San Antonio, Tex.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
REM-Tronics, Inc., 192 Central Ave., Silver Creek, N. Y.
Rectico, Inc., 20 Village Park Rd., Cedar Grove, N. J.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Republic Elctrn. Inds. Inc., 575 Broad Hollow Rd., Huntington, N. Y.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Rodda Co., Inc., 1005 Martin Ave., Santa Clara, Calif.
Rogers Corp., Rogers, Conn.
Santa Fe Mfg. Co., 2343 Jerome Ave., Bronx, N. Y.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Sittler Corp., 18 N. Ada St., Chicago, Ill.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Superior Continental Corp., Box 489, Hickory, N. C.
Superior Electronics Co., 474 Getty Ave., Clifton, N. J.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tenna Mfg. Co., Inc., 19201 Cranwood Pkwy., Warrensville Hts., Ohio
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
3M Co., 3M Center, St. Paul, Minn.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tri-Dex Co., 2146 E. Main St., Visalia, Calif.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Varied Industrial Products, Inc., 445 Fifth Ave., Paterson, N. J.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Western Elctrn. Inds., 72 N. Broadway, Yonkers, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

CABLE CLAMPS & CLIPS—SEE CLAMPS AND CLIPS, CABLE—ALSO SEE WIRE & CABLE TIES

CABLE-END SEALING KITS—SEE KITS, CABLE-END SEALING

CABLE PRESSURIZATION EQUIPMENT

Andrew Corp., 10500 West 153 St., Orland Park, Ill.
General Cable Corp., 733 Third Ave., New York, N. Y.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Puregas Equipment Corp., 1445 Strongs Rd., Copiague, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.

CABLE RETRACTORS

Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind.
Accuride Div., 12311 S. Shoemaker Ave., Santa Fe Springs, Calif.
Aero-Motive Mfg. Co., P.O. Box 2678, Kalamazoo, Mich.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Grant Pulley & Hardware Corp., 525 High St., W. Nyack, N. Y.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Industrial Electric Reels Inc., 1509 Chicago St., Omaha, Neb.
Jonathan Mfg. Co., 1101 S. Acacia Ave., Fullerton, Calif.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

CABLE TESTERS—SEE TESTERS, CABLE

CAGES, CIRCUIT BOARD—SEE RACKS, CIRCUIT BOARD

CALCULATORS, ELECTRICAL & ELECTRONIC—ALSO SEE COMPUTERS, DESK TOP

Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass. .. p 815
C-Thru Ruler Co., 6 Britton Dr., Bloomfield, Conn.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Jacri Inds., Box 265, Seaford, N. Y.
Monroe Int'l., Div. Litton Inds., 550 Central Ave., Orange, N. J.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
Victor Comptometer Corp., 3900 N. Rockwell St., Chicago, Ill.

CALIBRATION SERVICES—SEE SERVICES, CALIBRATION & INSTRUMENT REPAIR

CALIBRATORS, ACCELEROMETER

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1426
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
MB Electronics, Box 1825, New Haven, Conn.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

CALIBRATORS, ATTENUATION

Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

CALIBRATORS, CRYSTAL

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Heath Co., Dept. 180, Benton Harbor, Mich.
Measurements, Box 180, Boonton, N. J. ..... p 1437
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

CALIBRATORS, CURRENT

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y.
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1378
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. ... p 1392
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1414
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1426
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

CALIBRATORS, FREQUENCY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. .... p 761
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
CML Inc., 350 Leland Ave., Plainfield, N. J.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J.
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Measurements, Box 180, Boonton, N. J.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1497
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Collins Radio Co., Dallas, Texas
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
EMR Div., Box 223, Princeton, N. J.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Micro-Now Instr. Co., Inc., 6124 N. Pulaski Rd., Chicago, Ill.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Radiation Devices Co., Box 8450, Baltimore, Md.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

CALIBRATORS, LVDT

North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.

CALIBRATORS, MAGNETIC FIELD

Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Electro-Mechanics Co., Box 1546, Austin, Tex.

CALIBRATORS, METER—SEE TESTERS, METER

CALIBRATORS, MICROPHONE

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.

CALIBRATORS, NOISE

Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.

CALIBRATORS, OSCILLOSCOPE

Accutronics, Inc., 628 North St., Geneva, Ill.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Tektronix, Inc., Box 500, Beaverton, Ore.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.

CALIBRATORS, RADAR RANGE

Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.

CALIBRATORS, SWEEP—SEE GENERATORS, SWEEP

CALIBRATORS, SYNCHRO

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 2394
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1453
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496, 1497
Theta Instrument Corp., Fairfield, N. J. ..... p 1515
Defense Elctrns., Inc., Rockville, Md.
Dorsett Electronics, Box 36, Tulsa, Okla.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.

CALIBRATORS, TELEMETERING—SEE TELEMETERING TESTERS

CALIBRATORS, TIME BASE

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Norrman, Ernst Labs., 200 Elkhorn Rd., Williams Bay, Wisc.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Radiation Devices Co., Box 8450, Baltimore, Md.

CALIBRATORS, VOLTAGE

Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1335
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.

Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1378, 1379
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1412
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Measurements, Box 180, Boonton, N. J.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1493, 1497, 1498
Tektronix, Inc., Box 500, Beaverton, Ore.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
EMR Div., Box 223, Princeton, N. J.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Horex Electronics, Inc., 1729 21st St., Santa Monica, Calif.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Precision Standards Corp., Box 8361, San Marino, Calif.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

CALIBRATORS, VSWR
Heath Co., Dept. 180, Benton Harbor, Mich.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.

CALLING SYSTEMS—SEE INTERCOMMUNICATION SYSTEMS

CALORIMETERS, HEAT TRANSFER
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hidyne Instr. & Engrg. Co., 911 Bragg Circle, Tullahoma, Tenn.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
RDF Corp., 23 Elm Ave., Hudson, N. H.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

CALORIMETERS, LASER
Hadron, 300 Shames Dr., Westbury, N. Y.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.

CALORIMETERS, MICROWAVE
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1343
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. .. p 1372, 1668
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Aircom, Inc., Rte. 16B, Union, N. H.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

CALORIMETERS, OPTICAL
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.

CAMERAS, DATA RECORDING
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y. ..... p 1780
Abtronics, Inc., Box 712, Livermore, Calif.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Agfa-Gevaert, Inc., 275 North St., Teterboro, N. J.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chadwick-Helmuth Co. Inc., 111 E. Railroad Ave., Monrovia, Calif.
Chicago Aerial Inds., Inc., 550 W. Northwest Hwy., Barrington, Ill.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Flight Research, Div. Geotel, Inc., Box 1-F, Richmond, Va.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Milliken, D. B., 131 N. Fifth Ave., Arcadia, Calif.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Photo-Sonics, Inc., 820 S. Mariposa St., Burbank, Calif.
Photomechanisms Div., Inc., 15 Stepar Pl., Huntington Sta., N. Y.
Red Lake Labs., Inc., 2971 Corvin Dr., Santa Clara, Calif.
3M Co., 3M Center, St. Paul, Minn.
Traid Corp., 777 Flower St., Glendale, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

CAMERAS, IMAGE CONVERTER
Abtronics, Inc., Box 712, Livermore, Calif.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Photo-Sonics, Inc., 820 S. Mariposa St., Burbank, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

CAMERAS, IMAGE DISSECTION
Photosystems Corp., 52 Newton Plaza, Plainview, N. Y.

CAMERAS, INFRARED
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
GBC Closed Circuit Corp., 74 5th Ave., New York, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Traid Corp., 777 Flower St., Glendale, Calif.

CAMERAS, MICROCIRCUIT PROCESSING
Brown Mfg. Co., 2000 Dempster St., Evanston, Ill.
Burke & James, Inc., 333 W. Lake St., Chicago, Ill.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
HLC Mfg. Co., Inc., 700 Davisville Rd., Willow Grove, Pa.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.

CAMERAS, OSCILLOSCOPE
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
General Atronics Corp., Elctrn. Instr. Div., 1200 E. Mermaid La., Phila., Pa.
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y. ..... p 1780
Tektronix, Inc., Box 500, Beaverton, Ore.
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Chicago Aerial Inds., Inc., 550 W. Northwest Hwy., Barrington, Ill.
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Flight Research, Div. Geotel, Inc., Box 1-F, Richmond, Va.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Photo-Sonics, Inc., 820 S. Mariposa St., Burbank, Calif.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
Red Lake Labs., Inc., 2971 Corvin Dr., Santa Clara, Calif.
Traid Corp., 777 Flower St., Glendale, Calif.

CAMERAS, ROTATING MIRROR & DRUM
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Photo-Sonics, Inc., 820 S. Mariposa St., Burbank, Calif.
Traid Corp., 777 Flower St., Glendale, Calif.

CAMERAS, TV (BLACK AND WHITE) & ACCESSORIES
Cohu Electronics Inc., Box 623, San Diego, Calif.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.

CANS, CAPACITOR
Ampex Corp., 401 Broadway, Redwood City, Calif.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CBS Labs., High Ridge Rd., Stamford, Conn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Craig Corp., 2302 East 15th St., Los Angeles, Calif.
D-Vel Research Labs, Inc., 555 Bedford Rd., Bedford Hills, N. Y.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
GBC Closed Circuit Corp., 74 5th Ave., New York, N. Y.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kalart Co., Inc., Hultenius St., Plainville, Conn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maryland Telecomm, 10534 York Rd., Cockeysville, Md.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Packard Bell Elctrn., Lawrence & Arnold Drs., Newbury Pk., Calif.
Packard-Bell Elctrns., Lawrence & Arnold Dr., Newbury Park, Calif.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Shibaden Corp. of America, 58-25 Brooklyn-Queens Expwy., Woodside, N. Y.
Sylvania Elec. Prod., Inc., Comm. Elctrns. Div., Burlington Rd., Bedford, Mass.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Teletronics, Inc., 760 N. Main St., Orange, Calif.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.
Zoomar, Inc., 55 Sea Cliff Ave., Glen Cove, L. I., N. Y.

CAMERAS, TV (COLOR) & ACCESSORIES
Cohu Electronics Inc., Box 623, San Diego, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Albion Optical Co. Inc., 260 N. Rte. 303, Box 463, W. Nyack, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
CBS Labs., High Ridge Rd., Stamford, Conn.
D-Vel Research Labs, Inc., 555 Bedford Rd., Bedford Hills, N. Y.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Packard Bell Elctrn., Lawrence & Arnold Drs., Newbury Pk., Calif.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Shibaden Corp. of America, 58-25 Brooklyn-Queens Expwy., Woodside, N. Y.
Teletronics, Inc., 760 N. Main St., Orange, Calif.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Zoomar, Inc., 55 Sea Cliff Ave., Glen Cove, L. I., N. Y.

CAMERAS, TV, INFRARED
Cohu Electronics Inc., Box 623, San Diego, Calif.
Epic, Inc., 150 Nassau St., New York, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Maryland Telecomm, 10534 York Rd., Cockeysville, Md.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.

CAMERAS, X-RAY
Abtronics, Inc., Box 712, Livermore, Calif.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Photomechanisms Div., Inc., 15 Stepar Pl., Huntington Sta., N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.

CAMS
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dixon Sintaloy, Inc., 535 Hope St., Stamford, Conn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Kwikset Powdered Metal Prods., 516 E. Santa Ana St., Anaheim, Calif.
McNally Bros. Mach. & Gear Co., 1145 E. 79th St., Minneapolis, Minn.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Parker-Hartford Corp., Box 869, Hartford, Conn.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
3M Co., 3M Center, St. Paul, Minn.

CANS & FLAT PACKS, INTEGRATED CIRCUIT—SEE PACKAGES, INTEGRATED CIRCUIT

CANS, CAPACITOR
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Mirro Aluminum Co., Manitowoc, Wisc.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.

CANS, CAPACITOR (Cont'd)

Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Sexton Can Co., Inc., 31 Cross St., Everett, Mass.
Starnetics Co., Box 9308, N. Hollywood, Calif.

CANS, CRYSTAL

G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Barnes Metal Products Co., 4425 West 16th St., Chicago, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Mirro Aluminum Co., Manitowoc, Wisc.
Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.

CANS, RELAY

IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Barnes Metal Products Co., 4425 West 16th St., Chicago, Ill.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Gemp Terminals, Inc., 20 Woodworth Ave., Yonkers, N. Y.
Great Eastern Metal Prod. Co., 22 Woodworth Ave., Yonkers, N. Y.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Johnson & Hoffman Mfg. Co., 40 Voice Rd., Carle Place, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Mirro Aluminum Co., Manitowoc, Wisc.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.

CANS, SEMICONDUCTOR

G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Barnes Metal Products Co., 4425 West 16th St., Chicago, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Johnson & Hoffman Mfg. Co., 40 Voice Rd., Carle Place, N. Y.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Mirro Aluminum Co., Manitowoc, Wisc.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
Varo, Inc., Microcircuits Prods Div., 900 N. Shiloh Rd., Garland, Tex.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.

CANS, TRANSFORMER

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1213
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 721
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Allegheny Ludlum Steel Co., H. W. Oliver Bldg., Pittsburgh, Pa.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Barnes Metal Products Co., 4425 West 16th St., Chicago, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Gemp Terminals, Inc., 20 Woodworth Ave., Yonkers, N. Y.
Great Eastern Metal Prod. Co., 22 Woodworth Ave., Yonkers, N. Y.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Johnson & Hoffman Mfg. Co., 40 Voice Rd., Carle Place, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Kling Metal Spinning & Stamping Corp., 247 Centre St., New York, N .Y.
MSL Steel Co., 3912 W. McLean Ave., Chicago, Ill.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Mirro Aluminum Co., Manitowoc, Wisc.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Sexton Can Co., Inc., 31 Cross St., Everett, Mass.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Superior Switchboard & Devices Div., Box 590, Canton, Ohio
Wadsworth Electric Mfg. Co., Inc., 20 West 11th St., Covington, Ky.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.

CAPACITANCE COMPARATORS—SEE BRIDGES, CAPACITANCE

CAPACITOR LEAKAGE INDICATORS—SEE TESTERS, CAPACITOR

CAPACITORS, AIR COOLED

Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.

CAPACITORS, CHIP (FOR MICROCIRCUITS)

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597, 600
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif. p 649-651
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 681
Monolithic Dielectrics, Inc., P.O. Box 647, Burbank, Calif. ..... p 683
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C.
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 684
Republic Electronics Corp., 176 E. 7th St., Paterson, N. J. ..... p 688
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo. ..... p 701
Union Carbide Corp., Elctrns. Div., Box 5928, Greenville, S. C.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Maida Development Co., 214 Academy St., Hampton, Va.
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Starnetics Co., Box 9308, N. Hollywood, Calif.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Varadyne, Inc., 1805 Colorado Ave., Santa Monica, Calif.
Vitramon, Inc., Box 544, Bridgeport, Conn.

CAPACITORS, FIXED, AIR

Condenser Products Co., Box 997, Brooksville, Fla.
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

CAPACITORS, FIXED, BATHTUB

AMP Incorporated, Box 3608, Harrisburg, Pa.
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 606, 609, 610
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J.
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 667
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

CAPACITORS, FIXED, CERAMIC

Airco Speer Electronic Components, 4 Hoover Ave., DuBois, Pa.
American Feldmuehle Corp., Box 2160, Glenbrook, Conn.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597, 600
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Corning Glass Works, Electronic Products Div., Corning, N. Y. p 646, 647
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif. p 652-657
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J. ..... p 668
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Monolithic Dielectrics, Inc., P.O. Box 647, Burbank, Calif. ..... p 683
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C.
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 684
Radio Materials Co., 4242 W. Bryn Mawr Ave., Chicago, Ill. ..... p 679
Republic Electronics Corp., 176 E. 7th St., Paterson, N. J. ..... p 688
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Stackpole Carbon Co., Electronic Components Div., St. Marys, Pa.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. p 696-698
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo. ..... p 701
Union Carbide Corp., Elctrns. Div., Box 5928, Greenville, S. C. ... p 702
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dilectron Div., 2669 S. Myrtle Ave., Monrovia, Calif.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
K. C. K. Co., Ltd., 16-1, Takinogawa 1-chome, Takinogawa, Kita-ku, Tokyo, Jap.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maida Development Co., 214 Academy St., Hampton, Va.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Taiyo Yuden Co., Ltd., 15-11 6-Chome, Sotokanda, Chiyoda-ku, Tokyo, Japan
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Varadyne, Inc., 1805 Colorado Ave., Santa Monica, Calif.
Vitramon, Inc., Box 544, Bridgeport, Conn.

CAPACITORS, FIXED, CERAMIC DISC

American Feldmuehle Corp., Box 2160, Glenbrook, Conn.
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J.
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
M. I. A. L., U. S. A., Inc., 165 Franklin Ave., Nutley, N. J. ..... p 678
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 680, 681
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Radio Materials Co., 4242 W. Bryn Mawr Ave., Chicago, Ill. ..... p 679
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Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
Union Carbide Corp., Elctrns. Div., Box 5928, Greenville, S. C. ... p 702
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dilectron Div., 2669 S. Myrtle Ave., Monrovia, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
K. C. K. Co., Ltd., 16-1, Takinogawa 1-chome, Takinogawa, Kita-ku, Tokyo, Jap.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maida Development Co., 214 Academy St., Hampton, Va.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Taiyo Yuden Co., Ltd., 15-11 6-Chome, Sotokanda, Chiyoda-ku, Tokyo, Japan
Telefunken Sales Corp., South St., Garden City, N. Y.
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

CAPACITORS, FIXED, CIRCUIT BOARD MOUNTING

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597, 602-604
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 607-609, 611
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 614, 615, 618, 620

Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 624, 629, 630, 632, 634, 637, 641
Components, Inc., Capacitor Prod. Div., Biddeford, Me. ..... p 644, 645
Corning Glass Works, Electronic Products Div., Corning, N. Y. p 646, 647
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif. p 652-657
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 664, 665
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J. ..... p 668
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill. ..... p 670
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y. p 671
Huntington Sta., N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Johnson, E. F., Co., 1823 10th Ave., S.W., Waseca, Minn.
M. I. A. L., U. S. A., Inc., 165 Franklin Ave., Nutley, N. J. ..... p 678
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 680, 681
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ..... p 2580
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C. p 685, 687
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 684
Presin Co., Trap Falls Rd., Shelton, Conn.
Radio Materials Co., 4242 W. Bryn Mawr Ave., Chicago, Ill. .... p 679
Republic Electronics Corp., 176 E. 7th St., Paterson, N. J. ..... p 688
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 690, 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C. ..... p 692
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. p 696-699
Union Carbide Corp., Elctrns. Div., Box 5928, Greenville, S. C. p 702, 703
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass. .... p 704
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Dilectron Div., 2669 S. Myrtle Ave., Monrovia, Calif.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Sun Capacitors, 2554 Lawrence, Chicago, Ill.
Syncro Capacitor Corp., Hicksville, Ohio
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CAPACITORS, FIXED, DECADE

AMP Incorporated, Box 3608, Harrisburg, Pa.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 606
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 620
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 641, 643
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1387
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.

CAPACITORS, FIXED, ELECTROLYTIC (ALL TYPES)

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Components, Inc., Capacitor Prod. Div., Biddeford, Me. ..... p 644, 645
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 664, 665
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill. ..... p 670
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y. p 671
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 681
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C. .... p 685
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Presin Co., Trap Falls Rd., Shelton, Conn.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C. ..... p 692
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Union Carbide Corp., Elctrns. Div., Box 5928, Greenville, S. C.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Barco, Inc., 829 N. Marshall, Milwaukee, Wisc.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Callins Industries, Inc., P.O. Box C, Greenfield, Tenn.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cosmic Radio Co., 853 Whittier St., New York, N. Y.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
Gentronics, Inc., 26 Knollwood Dr., Clinton, Conn.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
International Elctrn. Inds., Box "C", Greenfield, Tenn.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Okaya Electric Inds. Co., Ltd., 3-8-1 Chome, Shibuya, Shibuya-ku, Tokyo, Jap.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
STM Corp., 2904 Chapman St., Oakland, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sprague Electric of Canada, Ltd., 10 Bertal Rd., Toronto, Ont., Can.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Syncro Capacitor Corp., Hicksville, Ohio
Telefunken Sales Corp., South St., Garden City, N. Y.
United Elctrn. Mfg. Corp., 542 39th St., Union City, N. J.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Wells, G. Co., 90 Nepperhan Ave., Yonkers, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CAPACITORS, FIXED, FEEDTHRU

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 620
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif.
F-Dyne Elctrns. Co., 1700 Post Rd., Fairfield, Conn. ..... p 660
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J.
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 667
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 681
Monolithic Dielectrics, Inc., P.O. Box 647, Burbank, Calif.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tansitor Elctrns., Inc., West Rd., Bennington, Vt. ..... p 694
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Dolinko & Wilkens, Inc., 1901-7 Summit Ave., Union City, N. J.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Maida Development Co., 214 Academy St., Hampton, Va.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Seacor, Inc., 598 Broadway, Norwood, N. J.

CAPACITORS, FIXED, GLASS

Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Taiyo Yuden Co., Ltd., 15-11 6-Chome, Sotokanda, Chiyoda-ku, Tokyo, Japan
Telefunken Sales Corp., South St., Garden City, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Varadyne, Inc., 1805 Colorado Ave., Santa Monica, Calif.

CAPACITORS, FIXED, FILM

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 596
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y.
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 618
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 624, 625, 643
Condenser Products Co., Box 997, Brooksville, Fla.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1659
F-Dyne Elctrns. Co., 1700 Post Rd., Fairfield, Conn. ..... p 660
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 664, 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill. ..... p 670
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y. p 671
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
M. I. A. L., U. S. A., Inc., 165 Franklin Ave., Nutley, N. J.
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C. ... p 685
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Union Carbide Corp., Elctrns. Div., Box 5928, Greenville, S. C.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Corson Electric Mfg. Corp., Watrous St., E. Hampton, Conn.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
Telefunken Sales Corp., South St., Garden City, N. Y.

CAPACITORS, FIXED, GAS FILLED

Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Epic, Inc., 150 Nassau St., New York, N. Y.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

CAPACITORS, FIXED, GLASS

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Corning Glass Works, Electronic Products Div., Corning, N. Y. p 646, 647
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 667
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan

CAPACITORS, FIXED, GLASS (Cont'd)

Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Vitramon, Inc., Box 544, Bridgeport, Conn.

CAPACITORS, FIXED, HIGH CAPACITANCE-LOW VOLTAGE

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597-599, 601-604
Amperex Electron. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Arco Electronics., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 607, 608
Balco Capacitors, Div. Balco Electronics., Inc., 307 Washington St., Orange, N. J. p 616
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Centralab Electron., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 624, 627, 628, 631-633, 635-637, 639-643
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Corning Glass Works, Electronic Products Div., Corning, N. Y. p 646, 647
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
General Electric Co., Electron. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 664, 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 666
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill. ..... p 670
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
International Electrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y. p 671
International Electron., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 680, 681
Monolithic Dielectrics, Inc., P.O. Box 647, Burbank, Calif.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C. p 685, 687
Nytronics, Inc., Essex Electrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 684
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
Radio Materials Co., 4242 W. Bryn Mawr Ave., Chicago, Ill. .... p 679
Republic Electronics Corp., 176 E. 7th St., Paterson, N. J. .... p 688
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 690, 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C. ..... p 692
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass.
Tansitor Elctrns., Inc., West Rd., Bennington, Vt. ..... p 694
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. p 696-699
Union Carbide Corp., Electns. Div., Box 5928, Greenville, S. C. p 702, 703
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass. .... p 704
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Axel Electrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cosmic Radio Co., 853 Whittier St., New York, N. Y.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Dilectron Div., 2669 S. Myrtle Ave., Monrovia, Calif.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
International Electn. Inds., Box "C", Greenfield, Tenn.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maida Development Co., 214 Academy St., Hampton, Va.
NCI, Inc., 5900 Voss Rd., West Palm Beach, Fla.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Syncro Capacitor Corp., Hicksville, Ohio
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
Taiyo Yuden Co., Ltd., 15-11 6-Chome, Sotokanda, Chiyoda-ku, Tokyo, Japan
3M Co., 3M Center, St. Paul, Minn.
Underwood Electric & Mfg. Co., Inc., 148 South 8 Ave., Maywood, Ill.
United Electrn. Mfg. Corp., 542 39th St., Union City, N. J.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vitramon, Inc., Box 544, Bridgeport, Conn.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
York Electronics, 104 South 4th St., Brooklyn, N. Y.

CAPACITORS, FIXED, HIGH TEMPERATURE

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 596
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 598-604
Amperex Electron. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Arco Electrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y.
Balco Capacitors, Div. Balco Electrns., Inc., 307 Washington St., Orange, N. J. p 614, 615, 618, 619, 620, 621
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Centralab Electrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 624, 625, 627, 628, 630-633, 636, 637, 641, 643
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electro Materials, 11820 Sorrento Valley Rd., San Diego, Calif. p 652-657
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn.
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
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International Electrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
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Union Carbide Corp., Electns. Div., Box 5928, Greenville, S. C. p 702, 703
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Axel Electrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Callins Industries, Inc., P.O. Box C, Greenfield, Tenn.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Corson Electric Mfg. Corp., Watrous St., E. Hampton, Conn.
Cosmic Radio Co., 853 Whittier St., New York, N. Y.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
International Electrn. Inds., Box "C", Greenfield, Tenn.
Maida Development Co., 214 Academy St., Hampton, Va.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
Vitramon, Inc., Box 544, Bridgeport, Conn.

CAPACITORS, FIXED, HIGH VOLTAGE

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 596
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 598, 599, 601-604
Arco Electrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 606-610
Balco Capacitors, Div. Balco Electrns., Inc., 307 Washington St., Orange, N. J. p 618-621
Centralab Electrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 643
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex. p 648
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
General Electric Co., Electrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 664, 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 666, 667
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill. ..... p 670
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
International Electrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y. p 671
International Electrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
M. I. A. L., U. S. A., Inc., 165 Franklin Ave., Nutley, N. J. ..... p 678
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 680
Monolithic Dielectrics, Inc., P.O. Box 647, Burbank, Calif.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C. p 686, 687
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
Radio Materials Co., 4242 W. Bryn Mawr Ave., Chicago, Ill. .... p 679
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C. ..... p 692
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Tansitor Elctrns., Inc., West Rd., Bennington, Vt. ..... p 694
Tobe Deutschmann Labs., Box 74, Canton, Mass. ..... p 695
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Axel Electrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Callins Industries, Inc., P.O. Box C, Greenfield, Tenn.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Corson Electric Mfg. Corp., Watrous St., E. Hampton, Conn.
Cosmic Radio Co., 853 Whittier St., New York, N. Y.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Dilectron Div., 2669 S. Myrtle Ave., Monrovia, Calif.
Dolinko & Wilkens, Inc., 1901-7 Summit Ave., Union City, N. J.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Epic, Inc., 150 Nassau St., New York, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
International Electrn. Inds., Box "C", Greenfield, Tenn.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maida Development Co., 214 Academy St., Hampton, Va.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Sun Capacitors, 2554 Lawrence, Chicago, Ill.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vitramon, Inc., Box 544, Bridgeport, Conn.
York Electronics, 104 South 4th St., Brooklyn, N. Y.

CAPACITORS, FIXED, LABORATORY STANDARD

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Arco Electrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 606
Balco Capacitors, Div. Balco Electrns., Inc., 307 Washington St., Orange, N. J.
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif.
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J.
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 691
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
York Electronics, 104 South 4th St., Brooklyn, N. Y.

CAPACITORS, FIXED, MICA

AMP Incorporated, Box 3608, Harrisburg, Pa.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Arco Electrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 610
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C. ..... p 692
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Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Axel Electrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.

Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Underwood Electric & Mfg. Co., Inc., 148 South 8 Ave., Maywood, Ill.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.

CAPACITORS, FIXED, MINIATURE & SUBMINIATURE

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597-599, 602-604
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Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
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Gulton Inds., Inc., Microceramics Div., Metuchen, N. J. ..... p 668
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal.
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill. ..... p 670
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y. p 671
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
M. I. A. L., U. S. A., Inc., 165 Franklin Ave., Nutley, N. J. ..... p 678
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Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
Radio Materials Co., 4242 W. Bryn Mawr Ave., Chicago, Ill. .... p 679
Republic Electronics Corp., 176 E. 7th St., Paterson, N. J. ..... p 688
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 690, 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
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Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Callins Industries, Inc., P.O. Box C, Greenfield, Tenn.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cosmic Radio Co., 853 Whittier St., New York, N. Y.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Dilectron Div., 2669 S. Myrtle Ave., Monrovia, Calif.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
Gentronics, Inc., 26 Knollwood Dr., Clinton, Conn.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
International Elctrn. Inds., Box "C", Greenfield, Tenn.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maida Development Co., 214 Academy St., Hampton, Va.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Syncro Capacitor Corp., Hicksville, Ohio
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Varadyne, Inc., 1805 Colorado Ave., Santa Monica, Calif.
Vitramon, Inc., Box 544, Bridgeport, Conn.

CAPACITORS, FIXED, MOTOR RUN

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 680
S&EI Mfg., 18800 Parthenia St., Northridge, Calif.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Seacor, Inc., 598 Broadway, Norwood, N. J.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
York Electronics, 104 South 4th St., Brooklyn, N. Y.

CAPACITORS, FIXED, MOTOR-STARTING

Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 680
Presin Co., Trap Falls Rd., Shelton, Conn.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
STM Corp., 2904 Chapman St., Oakland, Calif.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Syncro Capacitor Corp., Hicksville, Ohio
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
York Electronics, 104 South 4th St., Brooklyn, N. Y.

CAPACITORS, FIXED, MYLAR

AMP Incorporated, Box 3608, Harrisburg, Pa.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y.
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 615, 618-621
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 624, 625, 642, 643
Condenser Products Co., Box 997, Brooksville, Fla.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex. p 648
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
F-Dyne Elctrns. Co., 1700 Post Rd., Fairfield, Conn. .. p 660, 661, 663
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 665
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Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
M. I. A. L., U. S. A., Inc., 165 Franklin Ave., Nutley, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ..... p 2580
Presin Co., Trap Falls Rd., Shelton, Conn.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 690, 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tobe Deutschmann Labs., Box 74, Canton, Mass. ..... p 695
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass. .... p 704
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cosmic Radio Co., 853 Whittier St., New York, N. Y.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.

CAPACITORS, FIXED, OIL

Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
International Elctrn. Inds., Box "C", Greenfield, Tenn.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Okaya Electric Inds. Co., Ltd., 3-8-1 Chome, Shibuya, Shibuya-ku, Tokyo, Jap.
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Sun Capacitors, 2554 Lawrence, Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
Telefunken Sales Corp., South St., Garden City, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
York Electronics, 104 South 4th St., Brooklyn, N. Y.

CAPACITORS, FIXED, MYLAR, METALLIZED

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 615, 618, 619
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 642
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Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal.
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
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Presin Co., Trap Falls Rd., Shelton, Conn.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 690, 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass. .... p 704
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Callins Industries, Inc., P.O. Box C, Greenfield, Tenn.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
International Elctrn. Inds., Box "C", Greenfield, Tenn.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Okaya Electric Inds. Co., Ltd., 3-8-1 Chome, Shibuya, Shibuya-ku, Tokyo, Jap.
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

CAPACITORS, FIXED, NIOBIUM

Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan

CAPACITORS, FIXED, OIL

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 596
Condenser Products Co., Box 997, Brooksville, Fla.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.

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Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 680, 681
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
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Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cosmic Radio Co., 853 Whittier St., New York, N. Y.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Sun Capacitors, 2554 Lawrence, Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
York Electronics, 104 South 4th St., Brooklyn, N. Y.

CAPACITORS, FIXED, PAPER

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Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
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Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Corson Electric Mfg. Corp., Watrous St., E. Hampton, Conn.
Cosmic Radio Co., 853 Whittier St., New York, N. Y.
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Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
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Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Sun Capacitors, 2554 Lawrence, Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.

CAPACITORS, FIXED, PAPER, METALLIZED

Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J.
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S&EI Mfg., 18800 Parthenia St., Northridge, Calif.
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Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
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Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
International Elctrn. Inds., Box "C", Greenfield, Tenn.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

CAPACITORS, FIXED, PHOTOFLASH

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tobe Deutschmann Labs., Box 74, Canton, Mass. ..... p 695
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Syncro Capacitor Corp., Hicksville, Ohio
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

CAPACITORS, FIXED, POLYCARBONATE

Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 616, 621
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 624, 625, 634-640, 643
Condenser Products Co., Box 997, Brooksville, Fla.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
F-Dyne Elctrns. Co., 1700 Post Rd., Fairfield, Conn. .. p 660, 662, 663
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 664, 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 666
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
M. I. A. L., U. S. A., Inc., 165 Franklin Ave., Nutley, N. J.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass. .... p 704
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.

CAPACITORS, FIXED, POLYCARBONATE, METALLIZED

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 616, 618, 619
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 634-639
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
F-Dyne Elctrns. Co., 1700 Post Rd., Fairfield, Conn. .. p 660, 662, 663
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 665
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 666
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Illinois Capacitor Sales Co., Box 352, Highland Park, Ill.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 690, 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Sun Capacitors, 2554 Lawrence, Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
Telefunken Sales Corp., South St., Garden City, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

CAPACITORS, FIXED, PORCELAIN, ENAMEL

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597-599, 602-604
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.

Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vitramon, Inc., Box 544, Bridgeport, Conn.

CAPACITORS, FIXED, POWER FACTOR CORRECTION

Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
S&EI Mfg., 18800 Parthenia St., Northridge, Calif.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
York Electronics, 104 South 4th St., Brooklyn, N. Y.

CAPACITORS, FIXED, PRECISION

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 596
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 598, 599, 602
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 606-610
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 614-616, 620, 621
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 628, 637, 641, 643
Corning Glass Works, Electronic Products Div., Corning, N. Y. p 646, 647
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
F-Dyne Elctrns. Co., 1700 Post Rd., Fairfield, Conn. ..... p 660-663
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 664, 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 666
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
M. I. A. L., U. S. A., Inc., 185 Franklin Ave., Nutley, N. J. ..... p 678
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 690, 691
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. .... p 698
Union Carbide Corp., Elctrns. Div., Box 5928, Greenville, S. C. p 702, 703
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Mepco, Inc., Columbia Rd., Morristown, N. J.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Vitramon, Inc., Box 544, Bridgeport, Conn.

CAPACITORS, FIXED, PULSE-FORMING NETWORK

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 596
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597, 601
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 641, 643
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 665
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tobe Deutschmann Labs., Box 74, Canton, Mass. ..... p 695
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Corson Electric Mfg. Corp., Watrous St., E. Hampton, Conn.
Dilectron Div., 2669 S. Myrtle Ave., Monrovia, Calif.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.

CAPACITORS, FIXED, SILVERED MICA

Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y.
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.

CAPACITORS, FIXED, TANTALUM

Components, Inc., Capacitor Prod. Div., Biddeford, Me. ..... p 644, 645
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 664
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Mallory Capacitor Co., 3029 E. Washington St., Indianapolis, Ind. p 681
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C. ... p 685
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Tansitor Elctrns., Inc., West Rd., Bennington, Vt. ..... p 694
Union Carbide Corp., Elctrns. Div., Box 5928, Greenville, S. C. ... p 703
Barco, Inc., 829 N. Marshall, Milwaukee, Wisc.
Callins Industries, Inc., P.O. Box C, Greenfield, Tenn.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
General Instr. Corp., Capacitor Grp., Walnut St., Tazewell, Va.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Gentronics, Inc., 26 Knollwood Dr., Clinton, Conn.
Hunter-Stanley Elctrns., Inc., 208 Russell St., Nashville, Tenn.
International Elctrn. Inds., Box "C", Greenfield, Tenn.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
NCI, Inc., 5900 Voss Rd., West Palm Beach, Fla.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.

CAPACITORS, FIXED TFE

Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 614, 618-621
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 624, 625, 627-633, 640, 643
Condenser Products Co., Box 997, Brooksville, Fla.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 666
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Corson Electric Mfg. Corp., Watrous St., E. Hampton, Conn.
Dearborn Electronics Inc., Box 530, Orlando, Fla.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.

CAPACITORS, FIXED TFE, METALLIZED

Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 614, 618, 619
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 627-633
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J. ..... p 659
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 666
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan

CAPACITORS, VARIABLE, AIR

Potter Co., 500 W. Florence Ave., Inglewood, Calif.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.

CAPACITORS, FIXED, TEMPERATURE COMPENSATING

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 601, 603, 604
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 606, 607, 609-611
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 614-616, 620
Cal-R, Inc., Capacitor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 613
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Component Research Co., Inc., 1717 19th St., Santa Monica, Calif. p 624, 627, 628, 632, 636
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif.
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J. ..... p 668
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C. p 686, 687
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 684
Radio Materials Co., 4242 W. Bryn Mawr Ave., Chicago, Ill. .... p 679
Republic Electronics Corp., 176 E. 7th St., Paterson, N. J. ..... p 688
S&EI Mfg., 18800 Parthenia St., Northridge, Calif. ..... p 690, 691
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. .... p 698
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dilectron Div., 2669 S. Myrtle Ave., Monrovia, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Maida Development Co., 214 Academy St., Hampton, Va.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Paktron Div., Illinois Tool Works, Inc., 1321 Leslie Ave., Alexandria, Va.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
TRW Capacitor Div., 112 W. First St., Ogallala, Nebr.
Telefunken Sales Corp., South St., Garden City, N. Y.
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vitramon, Inc., Box 544, Bridgeport, Conn.
Voltronics Corp., West St., Hanover, N. J.

CAPACITORS, FIXED, VACUUM

ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Dolinko & Wilkens, Inc., 1901-7 Summit Ave., Union City, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Telefunken Sales Corp., South St., Garden City, N. Y.

CAPACITORS, OVERVOLTAGE PROTECTED

Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.

CAPACITORS, VARIABLE, AIR

Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. ... p 673
Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, N. J. p 674, 675
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. .... p 676, 677
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 682
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
Ametek, Inc., Station Square Two, Paoli, Pa.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Underwood Electric & Mfg. Co., Inc., 148 South 8 Ave., Maywood, Ill.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Voltronics Corp., West St., Hanover, N. J.

CAPACITORS, VARIABLE, CERAMIC

CAPACITORS, VARIABLE, CERAMIC

American Feldmuehle Corp., Box 2160, Glenbrook, Conn.
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif.
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, N. J. p 674, 675
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
K. C. K. Co., Ltd., 16-1, Takinogawa 1-chome, Takinogawa, Kita-ku, Tokyo, Jap.
Maida Development Co., 214 Academy St., Hampton, Va.
3M Co., 3M Center, St. Paul, Minn.

CAPACITORS, VARIABLE, FILM

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Film Capacitors, Inc., 100 Eighth St., Passaic, N. J.
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y.

CAPACITORS, VARIABLE, GAS

Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.

CAPACITORS, VARIABLE, GLASS

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, N. J. p 674, 675
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Voltronics Corp., West St., Hanover, N. J.

CAPACITORS, VARIABLE, HIGH-TEMPERATURE

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, N. J. p 674, 675
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ... p 676, 677
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.

CAPACITORS, VARIABLE, HV (LAB-TYPE)—ALSO SEE DECADE BOXES, CAPACITANCE

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 612
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, N. J.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.

CAPACITORS, VARIABLE, MOTOR DRIVEN

Dale Electronics, Sioux Div., Box 180, Yankton, S. D.

CAPACITORS, VARIABLE, MICA

Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 612
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.

CAPACITORS, VARIABLE, NEUTRALIZING

ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. ... p 673
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 682
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Voltronics Corp., West St., Hanover, N. J.

CAPACITORS, VARIABLE, OIL

Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.

CAPACITORS, VARIABLE, PADDER

Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y.
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 682
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
Voltronics Corp., West St., Hanover, N. J.

CAPACITORS, VARIABLE, PISTON—SEE CAPACITORS, VARIABLE, TRIMMER, (ALL TYPES)

CAPACITORS, VARIABLE, QUARTZ

JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, N. J. p 674, 675
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Voltronics Corp., West St., Hanover, N. J.

CAPACITORS, VARIABLE, SILICONE

Eastron Corp., 25 Locust St., Haverhill, Mass.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.

CAPACITORS, VARIABLE, TFE

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 676

CAPACITORS, VARIABLE, TEMPERATURE COMPENSATING

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Telefunken Sales Corp., South St., Garden City, N. Y.
Voltronics Corp., West St., Hanover, N. J.

CAPACITORS, VARIABLE, TRIMMER, ALL TYPES

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 605
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 612
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electro Motive Mfg. Co. Inc., South Park St., Willimantic, Conn. p 658
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. .... p 673
Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, N. J. p 674, 675
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ... p 676, 677
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 682
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Underwood Electric & Mfg. Co., Inc., 148 South 8 Ave., Maywood, Ill.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Voltronics Corp., West St., Hanover, N. J.

CAPACITORS, VARIABLE, VACUUM

ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Dolinko & Wilkens, Inc., 1901-7 Summit Ave., Union City, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
Vacap Corp., 1905 Summit Ave., Union City, N. J.

CAPACITORS, WATER COOLED

Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Corson Electric Mfg. Corp., Watrous St., E. Hampton, Conn.

CAPS, CONNECTOR

Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 836, 838, 853, 860, 861, 870, 872, 874
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 2913
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Clover Industries Div., 600 Young St., Tonawanda, N. Y.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Massey, A. H., Inc., 111 Third St., Derby, Conn.
Mecca, P.O. Box 36393, Houston, Tex.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

CAPS, FORMS & TAPES, HEAT SHRINKABLE—ALSO SEE TUBING, HEAT SHRINKABLE

CAPS, GRID & PLATE—SEE CLIPS & CAPS, GRID & PLATE

CAPS, LENS, INDICATOR LIGHT

ADC Products, 8405 Cambridge St., Minneapolis, Minn. ..... p 820, 825
APM-Hexseal Corp., 44 Honeck St., Englewood, N. J.
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. ..... p 1783
Display Devices, Inc., 2928 Nebraska Ave., Santa Monica, Calif. p 1186
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill. ..... p 1785
Eldema Div., 18435 Susana Rd., Compton, Calif. p 1786, 1787, 1789-1791
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. p 1796, 1797
Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y. p 1801
Marco-Oak Co., P.O. Box 4011, Anaheim, Calif.
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill.
Sloan Co., 7704 San Fernando Rd., Sun Valley, Calif. p 1806, 1807, 1809
Trimm Inc., 400 Lake St., Libertyville, Ill.
Aeronautical Electric Co., Inc., 5656 Northwest Hwy., Chicago, Ill.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Genisco Technology Corp., 18435 Susana Rd., Compton, Calif.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
Kopp Glass, Inc., Box 8255, Swissvale, Pittsburgh, Pa.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Penn Keystone Corp., Division St., Ansonia, Conn.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.

CAPS, WIRE-SPLICING—SEE SPLICERS, WIRE (BUTT & CAP TYPES)

CARBIDES

Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. ... p 1578
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cerac, Inc., Box 597, Butler, Wisc.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
General Electric Co., Metallurgical Prods. Dept., Box 237, Detroit, Mich.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kennametal Inc., Lloyd Ave., Latrobe, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

CARBON

Airco Speer Carbon Products, 800 Theresia St., St. Marys, Pa.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Carter's Ink Co., 239 First St., Cambridge, Mass.
Dixon Sintaloy, Inc., 535 Hope St., Stamford, Conn.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Helwig Carbon Prods., Inc., 2550 North 30th St., Milwaukee, Wisc.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Pure Carbon Co., Inc., 441 Hall Ave., St. Marys, Pa.
St. Mary's Carbon Co., 1939 State Rd., St. Marys, Pa.
Stackpole Carbon Co., Carbon Div., Stackpole St., St. Marys, Pa.
Superior Carbon Prods., Inc., 9115 George Ave., Cleveland, Ohio
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.

CARD HOLDERS, CIRCUIT BOARD—SEE RACKS, CIRCUIT BOARD

CARD READERS—SEE PUNCHED CARD EQUIPMENT

CARDS, LINEAR FUNCTION (WITH DISCRETE COMPONENTS)

Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .. p 522, 523
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Lowell Elctrns. Corp., 9100 Terminal Ave., Skokie, Ill.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. .. p 796
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1770
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa.

A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Broxlea Ltd., Broxbourne, Herts, Eng.
Celco, 70 Constantine Dr., Mahwah, N. J.
Coltronics, Inc., Box 128, Bound Brook, N. J.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Doran Mfg. Co., 1033 Bader St., Cincinnati, Ohio
Electro-Sonics, Inc., 70 Main St., Spofford, N. H.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Electronics, Inc. of Pa., 2440 Maryland Ave., Willow Grove, Pa.
General Components, Inc., 7425 124 Ave. N., St. Petersburg, Fla.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Industrial Circuits Co., 23 Kulick Rd., Fairfield, N. J.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Komak, Inc., 9th & Ontario Sts., Philadelphia, Pa.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
North American Printed Circuit Div., Box 145, Stafford, Conn.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Roback Corp., Huntingdon Valley, Pa.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

CARDS, LINEAR FUNCTION (WITH IC'S)

Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 522
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Logic Science, Inc., Box 10096, San Diego, Calif. ..... p 788
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif... p 796
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Broxlea Ltd., Broxbourne, Herts, Eng.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Digital Products Corp., 4030 N.E. 6th Ave., Ft. Lauderdale, Fla.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Electronics, Inc. of Pa., 2440 Maryland Ave., Willow Grove, Pa.
General Components, Inc., 7425 124 Ave. N., St. Petersburg, Fla.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Roback Corp., Huntingdon Valley, Pa.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

CARDS, LOGIC (WITH DISCRETE COMPONENTS)

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind.
Digital Equip. Corp., 146 Main St., Maynard, Mass. ..... p 777
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. ... p 2242
Heath Co., Dept. 180, Benton Harbor, Mich.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. .... p 783
Logic Science, Inc., Box 10096, San Diego, Calif. ..... p 788
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif... p 796
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Stellarmetrics, 418 E. Cota St., Santa Barbara, Calif. ..... p 2795
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1770
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif. ..... p 814
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
Analogic Co., 296 Newton St., Waltham, Mass.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Broxlea Ltd., Broxbourne, Herts, Eng.
Bryant Computer Products, 850 Ladd Rd., Walled Lake, Mich.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
General Components, Inc., 7425 124 Ave. N., St. Petersburg, Fla.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Honeywell, Inc., Computer Control Div., Peterborough, N. H.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Re-el Circuits, Inc., 172 Grodon Ave., Totowa Boro, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Roback Corp., Huntingdon Valley, Pa.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Weir Elctrns. Ltd., Durban Rd., Bognor Regis, Sussex, Eng.
Welex Electronics, Box 986, Silver Spring, Md.

CARDS, LOGIC (WITH IC'S)

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 772
Digital Equip. Corp., 146 Main St., Maynard, Mass. ..... p 777
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. .... p 783
Logic Science, Inc., Box 10096, San Diego, Calif. ..... p 788
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif... p 796
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif. ..... p 814
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
Analogic Co., 296 Newton St., Waltham, Mass.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Broxlea Ltd., Broxbourne, Herts, Eng.
Bryant Computer Products, 850 Ladd Rd., Walled Lake, Mich.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Coltronics, Inc., Box 128, Bound Brook, N. J.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Digital Products Corp., 4030 N.E. 6th Ave., Ft. Lauderdale, Fla.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
General Components, Inc., 7425 124 Ave. N., St. Petersburg, Fla.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Micro Elctrn. Sys., Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Re-el Circuits, Inc., 172 Grodon Ave., Totowa Boro, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Roback Corp., Huntingdon Valley, Pa.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.
United Telecontrol Electronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Weir Elctrns. Ltd., Durban Rd., Bognor Regis, Sussex, Eng.
Welex Electronics, Box 986, Silver Spring, Md.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

CASES, DELAY LINE

CARRIAGES, PROBE

Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.

CARRIER CURRENT SYSTEMS—SEE COMM. SYSTEMS, CARRIER CURRENT

CARRIERS—SEE HOLDERS & CARRIERS

CARTRIDGES, MICROPHONE

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Astatic Corp., Box 120, Conneaut, Ohio
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sonotone Corp., Elctrn. Products Div., Elmsford, N. Y.
Stanford International, Box 266, San Carlos, Calif.

CARTRIDGES, PHONO, CERAMIC

Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Astatic Corp., Box 120, Conneaut, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Grado Laboratories, Inc., 4614 Seventh Ave., Brooklyn, N. Y.
Sonotone Corp., Elctrn. Products Div., Elmsford, N. Y.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.

CARTRIDGES, PHONO, CRYSTAL

Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Astatic Corp., Box 120, Conneaut, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sonotone Corp., Elctrn. Products Div., Elmsford, N. Y.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.

CARTRIDGES, PHONO, MAGNETIC

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1216
Audio Dynamics Corp., Pickett District Rd., New Milford, Conn.
Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa.
Elpa Mktg. Inds., Inc., Thorens & Atlantic Aves., New Hyde Park, N. Y.
Empire Scientific Corp., 1055 Stewart Ave., Garden City, N. Y.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Grado Laboratories, Inc., 4614 Seventh Ave., Brooklyn, N. Y.
Ortofon Div., Thorens & Atlantic Aves., New Hyde Park, N. Y.
Pickering & Co., Inc., 101 Sunnyside Blvd., Plainview, N. Y.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanton Magnetics, Inc., Terminal Dr., Plainview, N. Y.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.

CARTS, INSTRUMENT & EQUIPMENT

Basler Electric Co., Box 269, Highland, Ill. ..... p 1018
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif.
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Tektronix, Inc., Box 500, Beaverton, Ore.
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Baumker Mfg. Co., 5144 Enterprise, Toledo, Ohio
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Equipment Co. of America, 1075 Hialeah Dr., Hialeah, Fla.
Erie Artisan Corp., 11400 Madison Ave., Cleveland, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Flotron Industries, Inc., 1201 E. Grand Ave., El Segundo, Calif.
General Television Network, 901 Livernois Ave., Ferndale, Mich.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Metropolitan Wire Goods Corp.,
N. Washington St. & George Ave., Wilkes-Barre, Pa.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
Peerless Products Industries, 4210 W. Chicago Ave., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sturdilite, Plainwell, Mich.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Technibilt Corp., 905 Air Way, Glendale, Calif.
Technical Service Corp., 2618 S. 4 St., Louisville, Ky.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CASES, DELAY LINE

Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Digital Devices Div., 200 Michael Dr., Syosset, N. Y. ..... p 1162
Skydyne Inc., River Rd., Port Jervis, N. Y.
Algo, 50 Schrieffer St., S. Hackensack, N. J.

CASES, DELAY LINE (Cont'd)

Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Gemp Terminals, Inc., 20 Woodworth Ave., Yonkers, N. Y.
Great Eastern Metal Prod. Co., 22 Woodworth Ave., Yonkers, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Resdel Corp., Box 2171, Rio Grande, N. J.
Rotary Co., Inc., 1746 Dale Rd., Buffalo, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Wells Elctrns., Inc., Plastics Div., 1701 S. Main St., S. Bend, Ind.

CASES, EQUIPMENT, INSTRUMENT, METER (PORTABLE)

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill.
American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J. p 575
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
M M Electronic Enclosures, Inc., 111 Bloomingdale Rd., Hicksville, N. Y. p 584
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga. ..... p 588
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Ace Plastic Inds., Inc., 99 Dover St., Somerville, Mass.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Calabro Unitrack, 8738 West Chester Pike, Upper Darby, Pa.
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Custom Metal Prods., 200 Broadway, Garden City Pk., N. Y.
Davies, H. Molding Co., 4920 W. Bloomingdale Ave., Chicago, Illinois
Easco Industries, Inc., 2121 Rte. 110, Farmingdale, N. Y.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Environmental Container Systems, Box 337, Union City, Calif.
Erie Artisan Corp., 11400 Madison Ave., Cleveland, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Met-L-Wood Corp., 6755 West 65th St., Chicago, Ill.
Metal-Craft, Inc., Box 296, Wayne, N. J.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Middletown Mfg. Co., 27 Stack St., Middletown, Conn.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
New-Berg Leather Prod. Co., Inc., 61 Greenpoint Ave., Bklyn, N. Y.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Simco Leather Co., Inc., 1800 Daisy St., Chattanooga, Tenn.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Spring City Electrical Mfg. Co., Hall & Main Sts., Spring City, Pa.
Stahlin Brothers, Inc., 500 Maple St., Belding, Mich.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
TA Mfg. Corp., 4625 Alger St., Los Angeles, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Watson Mfg. Co., Inc., 800 Taylor St., Jamestown, N. Y.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Whitman Saddle Mfg., Instr. Case Div., 1725 Powers St., Cincinnati, O.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CASES, EQUIPMENT, INSTRUMENT, METER (STATIONARY)

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill.
American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J. p 575
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio ..... p 1169
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
E-Tronics, 5901 Noble Ave., Van Nuys, Calif. ..... p 1923
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
M M Electronic Enclosures, Inc., 111 Bloomingdale Rd., Hicksville, N. Y. p 584
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga. ..... p 588
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Techmar Corp., 2232 S. Cotner Ave., Los Angeles, Calif. ..... p 592
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 593
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif.

A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Adalet Mfg. Co., 4801 West 150th St., Cleveland, Ohio
Aimes Inds., Inc., Box 73, Lockport, Ill.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Cambridge Pattern Works, Inc., 55 First St., Cambridge, Mass.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Custom Metal Prods., 200 Broadway, Garden City Pk., N. Y.
Danex Corp., 60 Tomlinson Rd., Huntingdon Valley, Pa.
Daniels, C. R., Inc., Daniels, Md.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Epic, Inc., 150 Nassau St., New York, N. Y.
Erie Artisan Corp., 11400 Madison Ave., Cleveland, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Ingersoll Products, 1000 West 120th St., Chicago, Ill.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mirro Aluminum Co., Manitowoc, Wisc.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Spring City Electrical Mfg. Co., Hall & Main Sts., Spring City, Pa.
Stahlin Brothers, Inc., 500 Maple St., Belding, Mich.
Sturdilite, Plainwell, Mich.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
TA Mfg. Corp., 4625 Alger St., Los Angeles, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Welex Electronics, Box 986, Silver Spring, Md.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CASES, RELAY—SEE CANS, RELAY

CASES, SEMICONDUCTOR—SEE CANS, SEMICONDUCTOR

CASES, SHIELDED—SEE CONTAINERS, SHIELDED

CASES, TRANSIT—SEE TRANSIT CASES

CASTINGS—SEE METAL PARTS, CAST

CATHODE-RAY READOUT TUBES—SEE TUBES, READOUT

CATV SYSTEMS & EQUIPMENT

AEL Inc., P.O. Box 552, Lansdale, Pa.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa.
Cohu Electronics Inc., Box 623, San Diego, Calif.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Ameco, Inc., Box 13741, Phoenix, Ariz.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Conrac Div., 600 N. Rimsdale Ave., Covina, Calif.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Craig Corp., 2302 East 15th St., Los Angeles, Calif.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
Essex International, Elctrn. Sys., Mt. Vernon Rd., Evansville, Ind.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Jutco, Inc., 122 East 162nd St., Gardena, Calif.
Kaiser Catv, Box 9728, Phoenix, Ariz.
Kalart Co., Inc., Hultenius St., Plainville, Conn.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Raytheon Co., Comm. & Data Proc. Oper.,
1415 Boston Providence Tpke., Norwood, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Shibaden Corp. of America, 58-25 Brooklyn-Queens Expwy., Woodside, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.
Sylvania Elec. Prod., Inc., Comm. Elctrns. Div., Burlington Rd., Bedford, Mass.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

CAVITIES, MICROWAVE

Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1686
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Scientific, Inc., 460 Roland Way, Oakland, Calif.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electro-Mechanics Co., Box 1546, Austin, Tex.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
GAF Corp., 140 West 51 St., New York, N. Y.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

CELLS, ELECTROLYTIC (E-CELLS), TIMING—SEE TIMERS, ELECTROLYTIC CELL

CELLS, FUEL—SEE FUEL CELLS

CELLS, KERR

Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Kappa Scientific Corp., 5780 Thornwood Dr., Goleta, Calif.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Mithras Div., Sanders Assocs., Inc., 701 Concord Ave., Cambridge, Mass.
Thermal American Fused Quartz Co.,
Rte. 202 & Change Bridge Rd., Montville, N. J.

CELLS, LOAD

BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Lebow Assocs., Inc., 21820 Wyoming Ave., Oak Park, Mich.
Lockheed Electronics Co., 16811 El Camino Real, Houston, Tex.
Micro-Strain, Inc., Spring City, Pa.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Strainsert Co., 24 Summit Grove Ave., Bryn Mawr, Pa.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducers, Inc., 11971 E. Rivera Rd., Santa Fe Springs, Calif.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.
Wood, C. N. Mfg. Co., Rte. 332, E., Newtown, Pa.

CELLS, PHOTOCONDUCTIVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Clairex Electronics, Inc., 1239 Broadway, New York, N. Y. ..... p 1773
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1634
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
United Detector Technology, 1732 21st St., Santa Monica, Calif. p 1775
Vactec, Inc., 2423 North Line Blvd., Maryland Hgts., Mo. ..... p 1776
Amperex Elctrn. Corp., Electro-Optical Devices Div.,
Providence Pike, Slatersville, R. I.
Datasenors Co., 735 Factory Rd., Addison, Ill.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.

Hamamatsu TV Co. Ltd., 1126-Chino-cho, Hamamatsu City, Shizuoka Pref., Japan
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.
LGM Electronics, Inc., 4304 La Branch St., Houston, Tex.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Mori Physics & Chemistry Lab. Co. Ltd., 205 Tozuka-machi, Tozuka-ku, Yokohama, Japan
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Semiconductors, Ltd., 2150 Ward St., Montreal, P. Q., Can.
Pioneer Elec. & Res. Corp., 743 Circle Ave., Forest Pk., Ill.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.

CELLS, PHOTOEMISSIVE—ALSO SEE TUBES, PHOTOMULTIPLIER

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Abtronics, Inc., Box 712, Livermore, Calif.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Datasenors Co., 735 Factory Rd., Addison, Ill.
Hamamatsu TV Co. Ltd., 1126-Chino-cho, Hamamatsu City, Shizuoka Pref., Japan
Mithras Div., Sanders Assocs., Inc., 701 Concord Ave., Cambridge, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.

CELLS, PHOTOVOLTAIC

AEL Inc., P.O. Box 552, Lansdale, Pa.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
International Rectifier, 233 Kansas St., El Segundo, Calif. p 2530, 2531
Sensor Technology, Inc., 7118 Gerald Ave., Van Nuys, Calif. ... p 1774
United Detector Technology, 1732 21st St., Santa Monica, Calif. p 1775
Vactec, Inc., 2423 North Line Blvd., Maryland Hgts., Mo. ..... p 1776
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Clevite Corp., Elctrn. Res. Div., 540 East 105th St., Cleveland, Ohio
Datasenors Co., 735 Factory Rd., Addison, Ill.
Electro-Nuclear Labs., Inc., 115 Independence Dr., Menlo Park, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heliotek, 12500 Gladstone Ave., Sylmar, Calif.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Mori Physics & Chemistry Lab. Co. Ltd., 205 Tozuka-machi, Tozuka-ku, Yokohama, Japan
National Semiconductors, Ltd., 2150 Ward St., Montreal, P. Q., Can.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

CELLS, SOLAR—SEE CELLS, PHOTOVOLTAIC

CEMENTS—SEE ADHESIVES

CENTRIFUGES—ALSO SEE SIMULATORS, MOTION

EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
Goerz Optical Co., Inc., 301 Alpha Dr., Pittsburgh, Pa.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
MSE, Inc., 811 Sharon Dr., Westlake, Ohio
Pennsalt Chemicals Corp., Equip. Div. - Sharples, 955 Mearns Rd., Warminster, Pa.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Trio-Tech, Inc. of Calif., 2435 N. Naomi St., Burbank, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

CERAMIC RESONATORS

American Feldmuehle Corp., Box 2160, Glenbrook, Conn.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.

CERAMICS—SEE INSULATION PARTS, CERAMIC

CHAMBERS, ACOUSTICAL TEST, HIGH-INTENSITY NOISE

Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Flame Research, Inc., Box 10502, Pittsburgh, Pa.
General Acoustics Corp., 12248 Santa Monica Blvd., Los Angeles, Calif.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Lindsay Structure, 1360 Edgar St., Evansville, Ind.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Ray Proof Corp., Keeler Ave., Norwalk, Conn.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

CHAMBERS, ALTITUDE

Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J.
Georator Corp., Box 70, Manassas, Va.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
American Research Corp., Route 6 & New Britain Ave., Farmington, Conn.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Develco, Inc., 8 Van Tassel Ct., Norwalk, Conn.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Environmental Equip. Corp., 369 Linden St., Brooklyn, N. Y.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Vacuum Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Ideal-Aerosmith, Inc., 1505 E. Fox Farm Rd., Cheyenne, Wyo.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.
Thermotron Corp., 937 Washington Ave., Holland, Mich.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Webber Mfg. Co., Inc., 8634 Brookville Rd., Indianapolis, Ind.

CHAMBERS, ANECHOIC—SEE ANECHOIC CHAMBERS

CHAMBERS, EXPLOSION

Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Environmental Equip. Corp., 369 Linden St., Brooklyn, N. Y.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.

CHAMBERS, HUMIDITY

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J. p 1244
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
American Research Corp., Route 6 & New Britain Ave., Farmington, Conn.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Atmosphere Control Co., Inc., 5315 Chester Ave., Philadelphia, Pa.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Develco, Inc., 8 Van Tassel Ct., Norwalk, Conn.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Environmental Equip. Corp., 369 Linden St., Brooklyn, N. Y.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Jersey Technical Consultants, Box 215, Morristown, N. J.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lindsay Structure, 1360 Edgar St., Evansville, Ind.
Montford Instrs. Ltd., 79 Lots Rd., Chelsea, London, S.W. 10, Eng.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Ramney Inds. Corp., Box 585, Farmingdale, N. J.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.
Thermotron Corp., 937 Washington Ave., Holland, Mich.
Vestal Modern Design Corp., Vestal Pkwy. E., Vestal, N. Y.
Webber Mfg. Co., Inc., 8634 Brookville Rd., Indianapolis, Ind.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

CHAMBERS, IONIZATION

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Cary Instruments, 2724 So. Peck Rd., Monrovia, Calif.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
GCA Technology, Burlington Rd., Bedford, Mass.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Ohmart Corp., 4241 Allendorf Dr., Cincinnati, Ohio
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Reuter-Stokes, 18530 S. Miles Pkwy., Cleveland, Ohio

CHAMBERS

CHAMBERS, MAGNETIC ENVIRONMENT

Amerind-MacKissic, Inc., Box 111, Parkerford, Pa.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro-Mechanics Co., Box 1546, Austin, Tex.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Lindgren, E. A. & Assoc., 4515-17 N. Ravenswood Ave., Chicago, Ill.
Ray Proof Corp., Keeler Ave., Norwalk, Conn.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.

CHAMBERS, PRESSURE

Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
American Research Corp., Route 6 & New Britain Ave., Farmington, Conn.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Develco, Inc., 8 Van Tassel Ct., Norwalk, Conn.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Ramney Inds. Corp., Box 585, Farmingdale, N. J.
Red Point Corp., 105 W. Spazier, Burbank, Calif.
Reuter-Stokes, 18530 S. Miles Pkwy., Cleveland, Ohio
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Tem-Pres Res. Div., Carborundum Co., 1401 S. Atherton St., State College, Pa.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.

CHAMBERS, RADIATION

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Ray Proof Corp., Keeler Ave., Norwalk, Conn.
Reuter-Stokes, 18530 S. Miles Pkwy., Cleveland, Ohio

CHAMBERS, SALT-SPRAY

Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J.
Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Develco, Inc., 8 Van Tassel Ct., Norwalk, Conn.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Environmental Equip. Corp., 369 Linden St., Brooklyn, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.

CHAMBERS, SAND & DUST

Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
American Research Corp., Route 6 & New Britain Ave., Farmington, Conn.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Environmental Equip. Corp., 369 Linden St., Brooklyn, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Matthews Research, Inc., 4306 Wheeler Ave., Alexandria, Va.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.

CHAMBERS, SPACE SIMULATION—SEE SOLAR SIMULATORS

CHAMBERS, SUNSHINE

Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
American Research Corp., Route 6 & New Britain Ave., Farmington, Conn.
Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.
Webber Mfg. Co., Inc., 8634 Brookville Rd., Indianapolis, Ind.

CHAMBERS, TEMPERATURE

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J. p 1244
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif. ..... p 1247
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
American Research Corp., Route 6 & New Britain Ave., Farmington, Conn.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Atmosphere Control Co., Inc., 5315 Chester Ave., Philadelphia, Pa.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Develco, Inc., 8 Van Tassel Ct., Norwalk, Conn.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Electronic Control Co., Box S150, Dresher, Pa.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Environmental Equip. Corp., 369 Linden St., Brooklyn, N. Y.
Gruenberg Electric Co., Inc., 585 Commercial Ave., Garden City, N. Y.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Harris Mfg. Co., Inc., 308 River St., Cambridge, Mass.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Hydor Therme Corp., Airport Hwy., Pennsauken, N. J.
Instron Corp., 2500 Washington St., Canton, Mass.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Montford Instrs. Ltd., 79 Lots Rd., Chelsea, London, S.W. 10, Eng.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Procedyne Corp., 221 Somerset St., New Brunswick, N. J.
Products for Research, Inc., 57 N. Putnam St., Danvers, Mass.
Ramney Inds. Corp., Box 585, Farmingdale, N. J.
Research, Inc., Box 6164, Minneapolis, Minn.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.
Thermotron Corp., 937 Washington Ave., Holland, Mich.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Vestal Modern Design Corp., Vestal Pkwy. E., Vestal, N. Y.
Watkins-Johnson Co., Stewart Div., Mt. Hermon Rd., Santa Cruz, Calif.
Webber Mfg. Co., Inc., 8634 Brookville Rd., Indianapolis, Ind.

CHAMBERS, VACUUM

Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J.
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Aero Vac Corp., Box 448, Troy, N. Y.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Aireco Inc., 1660 N.E. 191st St., N. Miami Beach, Fla.
American Research Corp., Route 6 & New Britain Ave., Farmington, Conn.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Astro Dynamics, Inc., 2nd Ave., Northwest Industrial Park, Burlington, Mass.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Brew, R. D. & Co., Inc., 90 Airport Rd., Concord, N. H.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Develco, Inc., 8 Van Tassel Ct., Norwalk, Conn.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Fredericks Co., Philmont & Anne St., Huntingdon Valley, Pa.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Granville-Phillips Co., Box 1290, Boulder, Colo.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Vacuum Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Hydor Therme Corp., Airport Hwy., Pennsauken, N. J.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Montford Instrs. Ltd., 79 Lots Rd., Chelsea, London, S.W. 10, Eng.
Nelson Vacuum Pump Co., 2133 4th St., Berkeley, Calif.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Red Point Corp., 105 W. Spazier, Burbank, Calif.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Tenney Engrg., Inc., 1090 Springfield Rd., Union, N. J.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Thermotron Corp., 937 Washington Ave., Holland, Mich.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Vacuum Barrier Corp., 4 Barten La., Woburn, Mass.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Webber Mfg. Co., Inc., 8634 Brookville Rd., Indianapolis, Ind.

CHAMBERS, VIBRATION

Thermotron Corp., 937 Washington Ave., Holland, Mich.

CHARGERS, BATTERY

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. .... p 1863
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Basler Electric Co., Box 269, Highland, Ill.
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1873
CML Inc., 350 Leland Ave., Plainfield, N. J.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. p 1894, 1895
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Heath Co., Dept. 180, Benton Harbor, Mich.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill. ..... p 1971
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. ..... p 2063
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Rectifier Components Corp., 124 Albany Ave., Freeport, N. Y. .... p 2581
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J.
Sonetone Corp., Battery Div., Dept. B10, Box 200, Elmsford, N. Y. p 2092
Spar Electronics, 7969 Engineer Rd., San Diego, Calif.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Unitron, 1624 N. First St., Garland, Texas ..... p 2132
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1551
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
All American Engrg. Co., Basin Rd., Box 3126, Wilmington, Del.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
B-W Manufacturers, Inc., 721 N. Webster St., Kokomo, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C & D Batteries, Washington & Cherry Sts., Conshohocken, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Forney Industries, Inc., 1800 La Porte Ave., Fort Collins, Colo.
General Battery & Ceramic Corp., Box 1262, Reading, Pa.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hobart Brothers Co., Hobart Square, Troy, Ohio
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Ionics, Inc., Electronics Div., 65 Grove St., Watertown, Mass.
Katolight Corp., 1st Ave. at Chestnut, Mankato, Minn.
La Marche Mfg. Co., 106 Bradrock Dr., Des Plains, Ill.
Leclanche S. A., 48 Ave. de Grandson, CH 1401-Yverdon, Switzerland
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Mauratron, Inc., 13333 N. Central Expwy., Dallas, Tex.
Mega Engineering Co., 2271 Mora Dr., Mountain View, Calif.
Model Rectifier Corp., 5300 21st Ave., Brooklyn, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
ONAN, 2515 University Ave., S. E., Minneapolis, Minn.
Pace-Tronics, Inc., 46 Main St., Newark, N. J.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Power Sources, South Ave., Burlington, Mass.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Space Power Assocs., Inc., 161 Brielle Ave., Staten Island, N. Y.
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Ther Elec. & Machine Works, 17 S. Jefferson St., Chicago, Ill.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Warren Communications, Newtown Rd., Littleton, Mass.
Welex Electronics, Box 986, Silver Spring, Md.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
Yardney Electric Corp., 40-52 Leonard St., New York, N. Y.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

CHARGERS, MAGNET—SEE MAGNETIZERS

CHASSIS, CIRCUIT BOARD MOUNTING

Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio ..... p 1169
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 898
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y. ..... p 2277
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Logic Science, Inc., Box 10096, San Diego, Calif.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 586
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 593
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Aimes Inds., Inc., Box 73, Lockport, Ill.
American Electronic Controls, 74 Tracey Rd., Huntingdon Valley, Pa.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Circuit Structures Lab., 3200 N. San Fernando Blvd., Burbank, Calif.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Custom Metal Prods., 200 Broadway, Garden City Pk., N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HMW Enterprises, Inc., 15 Walnut St., Steelton, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Metal-Craft, Inc., Box 296, Wayne, N. J.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Re-el Circuits, Inc., 172 Grodon Ave., Totowa Boro, N. J.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Sell-Tronic Prods. Co., Inc., 138 31st Rd., Flushing, N. Y.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

CHASSIS MARKING KITS—SEE KITS, MARKING (DIAL, INSTRUMENT, EQUIPMENT, ETC.)

CHASSIS, METAL

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. .. p 1827
American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
Chassis-Trak, Inc., 525 S. Webster Ave., Indianapolis, Ind. .... p 578
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J.
Falstrom Co., 174 Falstrom Ct., Passaic, N. J. ..... p 583
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass.
Jan Hardware Mfg. Co., Inc., 47-27 38th St., Long Island City, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 2008, 2010
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.

Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Techmar Corp., 2232 S. Cotner Ave., Los Angeles, Calif. ..... p 592
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. ... p 593
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind. ..... p 594
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. ... p 591
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Acro Products Corp., 1410 S. Aberdeen St., Chicago, Ill.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Aracon Electronics, 344 East 49th St., New York, N. Y.
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
B & P Precision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Baumker Mfg. Co., 5144 Enterprise, Toledo, Ohio
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Circuit Structures Lab., 3200 N. San Fernando Blvd., Burbank, Calif.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Custom Metal Prods., 200 Broadway, Garden City Pk., N. Y.
Danco Metal Products, Inc., 24020 Detroit Rd., Westlake, Ohio
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Donnelly Manufacturing Co., P. O. Box 71, Waltham, Mass.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Erie Artisan Corp., 11400 Madison Ave., Cleveland, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Gyrotronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
HMW Enterprises, Inc., 15 Walnut St., Steelton, Pa.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Holbrook-Merrill Co., 1150 Kifer Rd., Sunnyvale, Calif.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Kees, F. D. Mfg. Co., 700 Park Ave., Beatrice, Neb.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
LMB Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Lynch, R. H. Mfg. Co., 7831 E. Arroyo Dr., S. San Gabriel, Calif.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Metal-Craft, Inc., Box 296, Wayne, N. J.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Metalcraft, Inc., Roosevelt Field, Garden City, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Middletown Mfg. Co., 27 Stack St., Middletown, Conn.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Rotary Co., Inc., 1746 Dale Rd., Buffalo, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sarex Corp., 1001 Roosevelt Ave., Carteret, N. J.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Titchener, E. H. & Co., 8 Titchener Pl., Binghamton, N. Y.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Watson Mfg. Co., Inc., 800 Taylor St., Jamestown, N. Y.
Welex Electronics, Box 986, Silver Spring, Md.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CHASSIS SLIDES—SEE SLIDES, CABINET, CHASSIS & DRAWER

CHECK-OUT SYSTEMS, AUTOMATIC—SEE TEST EQUIPMENT, AUTOMATIC CHECK-OUT

CHECKERS—SEE ANALYZERS; TESTERS

CHEMICALLY MILLED PARTS—SEE METAL PARTS, CHEMICALLY MILLED

CHEMICALS, ANTI-STATIC—SEE COATINGS, ANTI-STATIC

CHEMICALS, DEGREASING—SEE CLEANERS & SOLVENTS

CHEMICALS, DEHUMIDIFYING

Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Barium & Chemicals, Inc., P.O. Box 218, Steubenville, Ohio
Dow Chemical Co., Midland, Mich.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Ventron Corp., Congress St., Beverly, Mass.

CHEMICALS, ELECTROPLATING

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
American Smelting & Refining Co., 120 Broadway, New York, N. Y.
Arnold Labs, Inc., 7103 Laurel Canyon Blvd., N. Hollywood, Calif.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Baker, J. T. Chemical Co., Phillipsburg, N. J.
Barco Chemical Products Co., 701-703 S. LaSalle, Chicago, Ill.
Barium & Chemicals, Inc., P.O. Box 218, Steubenville, Ohio
City Chemical Corp., 132 West 22 St., New York, N. Y.
Colonial Alloys Co., Ridge Ave. & Crawford, Philadelphia, Pa.
Conversion Chemical Corp., 210 E. Main St., Rockville, Conn.
Dow Chemical Co., Midland, Mich.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Enthone, Inc., Box 1900, New Haven, Conn.
Fairmount Chemical Co., Inc., 117 Blanchard St., Newark, N. J.
Fidelity Chemical Products Corp., 472 Frelinghuysen Ave., Newark, N. J.
GAF Corp., 140 West 51 St., New York, N. Y.
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Hull, R. O. & Co., Inc., 3203 West 71 St., Cleveland, Ohio
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Mac Dermid, Inc., 526 Huntingdon Ave., Waterbury, Conn.
Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Marbon, Box 68, Washington, W. Va.
Matthey Bishop, Inc., Malvern, Pa.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Nitine, Inc., Rte. 46, Clifton, N. J.
Oakite Products, Inc., 50 Valley Rd., Berkeley Heights, N. J.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Selectrons, Ltd., 116 East 16th St., New York, N. Y.
Technic, Inc., Box 965, Providence, R. I.
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

CHEMICALS, EPOXY STRIPPING

Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.

CHEMICALS, ETCHING

Hunt, Philip A., Chemical Corp., Palisades Park, N. J. ..... p 708
Acton Assocs., 100 Thompson St., Pittston, Pa.
Advanced Prods., 1702 Winter St., Ft. Wayne, Ind.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Arnold Labs, Inc., 7103 Laurel Canyon Blvd., N. Hollywood, Calif.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Baker, J. T. Chemical Co., Phillipsburg, N. J.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Colonial Alloys Co., Ridge Ave. & Crawford, Philadelphia, Pa.
Conversion Chemical Corp., 210 E. Main St., Rockville, Conn.
Dow Chemical Co., Midland, Mich.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Enthone, Inc., Box 1900, New Haven, Conn.
Fairmount Chemical Co., Inc., 117 Blanchard St., Newark, N. J.
Fidelity Chemical Products Corp., 472 Frelinghuysen Ave., Newark, N. J.
GAF Corp., 140 West 51 St., New York, N. Y.
Gates, G. W. & Co., Inc., Hempstead Tpke. & Lucille Ave., Franklin Sq., N. Y.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hull, R. O. & Co., Inc., 3203 West 71 St., Cleveland, Ohio
Injectorall Electronics Corp., 4 North Rd., Great Neck, N. Y.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Mac Dermid, Inc., 526 Huntingdon Ave., Waterbury, Conn.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Nitine, Inc., Rte. 46, Clifton, N. J.
Oakite Products, Inc., 50 Valley Rd., Berkeley Heights, N. J.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia, Pa.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Selectrons, Ltd., 116 East 16th St., New York, N. Y.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Shipley Co., Inc., 2300 Washington St., Newton, Mass.

CHEMICALS, FUNGICIDAL—SEE COATINGS, FUNGICIDAL

CHEMICALS, LUMINESCENT

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Prods.. Box 45278, Chicago, Ill.
Bycoski, Casmir T., Inc., 363 Capitol Ave., Hartford, Conn.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Ceraç, Inc., Box 597, Butler, Wisc.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.

CHOKES, FILTER

Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Stroblite Co., Inc., 75 West 45th St., New York, N. Y.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

CHEMICALS, METAL STRIPPING

Hunt, Philip A., Chemical Corp., Palisades Park, N. J. ..... p 708
Advanced Prods., 1702 Winter St., Ft. Wayne, Ind.
Bycoski, Casmir T., Inc., 363 Capitol Ave., Hartford, Conn.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Conversion Chemical Corp., 210 E. Main St., Rockville, Conn.
Enthone, Inc., Box 1900, New Haven, Conn.
Fidelity Chemical Products Corp., 472 Frelinghuysen Ave., Newark, N. J.
GAF Corp., 140 West 51 St., New York, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.

CHEMICALS, PHOTOSENSITIVE

Hunt, Philip A., Chemical Corp., Palisades Park, N. J. ..... p 709
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bycoski, Casmir T., Inc., 363 Capitol Ave., Hartford, Conn.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Dow Chemical Co., Midland, Mich.
Etchomatic, Inc., Box 444, Waltham, Mass.
Fairmount Chemical Co., Inc., 117 Blanchard St., Newark, N. J.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Shipley Co., Inc., 2300 Washington St., Newton, Mass.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

CHEMICALS, SEMICONDUCTOR (PRODUCTION)

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
American Potash & Chemical Corp., 3000 West 6th St., Los Angeles, Cal.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Cerac, Inc., Box 597, Butler, Wisc.
Etchomatic, Inc., Box 444, Waltham, Mass.
Isochem Resins Co., Cook St., Lincoln, R. I.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

CHEMICALS, WIRE STRIPPING

Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Arnold Labs, Inc., 7103 Laurel Canyon Blvd., N. Hollywood, Calif.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Dow Chemical Co., Midland, Mich.
Enthone, Inc., Box 1900, New Haven, Conn.
Etchomatic, Inc., Box 444, Waltham, Mass.
Fidelity Chemical Products Corp., 472 Frelinghuysen Ave., Newark, N. J.
GAF Corp., 140 West 51 St., New York, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Mona Industries, Inc., Paterson, N. J.
Oakite Products, Inc., 50 Valley Rd., Berkeley Heights, N. J.
Starnetics Co., Box 9308, N. Hollywood, Calif.

CHESTSETS—SEE HANDSETS, CHESTSETS & OPERATOR SETS

CHIPS, CAPACITOR—SEE CAPACITORS, CHIP

CHIPS, IC—SEE CIRCUITS, INTEGRATED, SILICON MONOLITHIC, UNPACKAGED CHIPS

CHIPS, TRANSISTOR—SEE TRANSISTORS, CHIP, UNPACKAGED

CHOKES, A-F—SEE COILS, A-F

CHOKES, AIR CORE, DC

NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Magnavolt Inc., 44 Prospect St., Yonkers, N. Y.

CHOKES, FILTER

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1858
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. ... p 724, 725

CHOKES, FILTER (Cont'd)

Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif. ..... p 2860
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 737, 2863
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2883, 2884
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
North Electric Co., 553 S. Market St., Galion, Ohio
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Western Transformer Co., P.O. Box 945, Tijeras, N. Mex.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

CHOKES, R-F

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Collins Radio Co., Newport Beach, Calif.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 737, 2863
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. ..... p 740
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Shallcross, E. Preston St., Selma, N. C.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 746
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Bourns, Inc., Box 1398, Romoland, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Wilco Corp., 4030 West 10th St., Indianapolis, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

CHOKES, SWINGING

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 737, 2863
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2883, 2884
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Zaring Inds., Inc., Box 477, Carmel, Ind.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

CHOKES, WAVEGUIDE

Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Waveline Inc., Box 718, West Caldwell, N. J.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
American Radar Components, Inc., 415 E. Main St., Denville, N. J.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

CHOPPERS

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1777
Clairex Electronics, Inc., 1239 Broadway, New York, N. Y. ..... p 1773
Fork Standards Inc., 213 Main St., West Chicago, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill.
Solid State Elctrn. Corp., 15321 Raven St., Sepulveda, Cal. p 2323, 2920
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Bristol Co., Box 1790, Waterbury, Conn.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Electronic Applications Co., 2213 Edwards Ave., S. El Monte, Calif.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hobbs Mfg. Co., 666 Lincoln St., Worcester, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Valid Data Corp., 24002 Long Valley Rd., Calabasas, Calif.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

CHOPPERS, PHOTO—SEE CHOPPERS

CHROMATOGRAPHS—SEE ANALYZERS, GAS

CHRONOGRAPHS—SEE RECORDERS, TIMING

CHRONOMETERS

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa. ..... p 767
Neutronic Corp., Box 625, St. Louis, Mo.
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Wakmann Watch Co., Inc., 15 W. 47th St., New York, N. Y.

CIRCUIT ANALYZERS—SEE TESTERS, SIGNAL TRACING

CIRCUIT BOARD BOXES—SEE BOXES, COMPONENT/SUBASSEMBLY HANDLING

CIRCUIT BOARD HOLDERS, JIG TYPE—SEE HOLDERS, CIRCUIT BOARD

CIRCUIT BOARD RACKS—SEE RACKS, CIRCUIT BOARD

CIRCUIT BOARDS, STAMPED (WITHOUT COMPONENTS)

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 711
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. .. p 957
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. ..... p 595
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Atlantic Instrs. & Elctrns., 50 Hunt St., Watertown, Mass.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Douglas Electronics, Inc., 718 Marina Blvd., San Leandro, Calif.
Electralab Div./Tyco, Box 548, Encinitas, Calif.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.

Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
General Circuits, Inc., 95 Mt. Read Blvd., Rochester, N. Y.
Hampden Mfg. Co., Inc., Box 10, Thompsonville, Conn.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Rogers Corp., Rogers, Conn.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Techniques Inc., 235 Jackson St., Englewood, N. J.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
Universal Circuits, Inc., 13305 Industrial Park Blvd., Minneapolis, Minn.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CIRCUIT BREAKERS

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 2692
Allard Instrument Corp., 770 Main St., Westbury, N. Y.
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Flight Systems, Inc., Box 25, Mechanicsburg, Pa. ..... p 2238
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Heinemann Electric Co., 2636 Brunswick Pike, Trenton, N. J. ... p 2731
Littelfuse, Inc., 800 E. Northwest Hwy., Des Plaines, Ill.
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. ..... p 2752
Pyle-National Co., Connector Div., 1334 N. Kostner Ave., Chicago, Ill.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Transformer Electronics Co., Box 910, Boulder, Colo.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
E-T-A Products Co. of America, 6284 N. Cicero Ave., Chicago, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Mechanical Products, 1824 River St., Jackson, Mich.
Mel-Rain Corp., 3100 Roosevelt Ave., Indianapolis, Ind.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Roveti Instruments, 238 West St., Annapolis, Md.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Wadsworth Electric Mfg. Co., Inc., 20 West 11th St., Covington, Ky.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wood Electric Corp., Rte. One, Danvers, Mass.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

CIRCUIT LINEARITY COMPARATORS—SEE COMPARATORS, CIRCUIT LINEARITY

CIRCUIT TESTERS—SEE TESTERS, SIGNAL TRACING

CIRCUITS, ENCAPSULATED

Airflyte Electronics Co., Box 207, Bayonne, N. J.
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md. ..... p 1144
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1592, 1593
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1591
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1591
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1591
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1591
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1156
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 522, 523, 776, 2665
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1606, 1609-1629
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1406
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. .... p 783
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679
Marstan Elctrns., 307 Washington St., Orange, N. J. ..... p 2404
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1634
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Technipower, Inc., Benrus Center, Ridgefield, Conn.
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2123
Transitron Elctrn. Corp., Precision Connector Div., 144 Addison St., E. Boston, Mass. ..... p 1632, 1633
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 808, 1054, 2674-2677
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2649
Zaring Inds., Inc., Box 477, Carmel, Ind.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Atlantic Instrs. & Elctrns., 50 Hunt St., Watertown, Mass.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Bureau of Engraving, Inc., Ind'l. Div., 219 N. 2nd St., Minneapolis, Minn.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Collins Radio Co., Dallas, Texas
Coltronics, Inc., Box 128, Bound Brook, N. J.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EDP Corp., Box 6485, Orlando, Fla.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Honeywell, Inc., Computer Control Div., Peterborough, N. H.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Intellux, Inc., Box 548, Goleta, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lansdale Microelectronics, Inc., Colmar, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Redcor Corp., Box 1031, Canoga Park, Calif.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Roback Corp., Huntingdon Valley, Pa.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Rogers Corp., Rogers, Conn.
Sanders Assocs., Inc., Flexprint Prod. Div., Grenier Fld., Manchester, N. H.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Starnetics Co., Box 9308, N. Hollywood, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Tri-Tronics Lab., Inc., Box 338, Euless, Tex.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

CIRCUITS, FLEXIBLE

Airco Speer Electronic Components, 4 Hoover Ave., DuBois, Pa.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.

CIRCUITS, HYBRID, THICK FILM

Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Bureau of Engraving, Inc., Ind'l. Div., 219 N. 2nd St., Minneapolis, Minn.
Chemical Micro Milling Co., Box 770, Camden, N. J.
Conductorlab, Inc., Box 222, Groton, Mass.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Digital Sensors, Inc., 4127 N. Figueroa St., Los Angeles, Calif.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Electralab Div./Tyco, Box 548, Encinitas, Calif.
Etchit Inc., 643-13th Ave., S., Hopkins, Minn.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Flexible Products, Inc., 2678 East 7th Ave., N. St. Paul, Minn.
Flexprint Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
General Circuits, Inc., 95 Mt. Read Blvd., Rochester, N. Y.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Lockheed Elctrns. Co., 6201 E. Randolph, Los Angeles, Calif.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Rogers Corp., Rogers, Conn.
Sanders Assocs., Inc., Flexprint Prod. Div., Grenier Fld., Manchester, N. H.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

CIRCUITS, HYBRID, THICK-FILM

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1592, 1593
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1183
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1591
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1591
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1591
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1591
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 522
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. .. p 1090
Electra/Midland Corp., Cermetrik Div., 3347 Industrial Ct., San Diego, Cal. p 2469
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1595-1597, 1599-1605
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Quantum Devices Corp., 15 W. Main St., Bergenfield, N. J. ..... p 1631
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199, 1634
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2123
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
Aerovox Corp., Box 867, Myrtle Beach, S. C.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Chrysler Corp., 1312 N. Meridian St., Huntsville, Ala.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Kidco, Inc., Box 278, Medford, N. J.
Kyodo Elctrn. Labs., Inc., 5153 Kamitsuruma, Sagamihara-shi, Kanagawa-ken, Japan
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lansdale Microelectronics, Inc., Colmar, Pa.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.

CIRCUITS, HYBRID, THICK-FILM (Cont'd)

Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Silicon Transistor Corp., East Gate Blvd., Garden City, N. Y.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Texas Microelectronics, 1220 Majesty, Dallas, Tex.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varadyne, Inc., 1805 Colorado Ave., Santa Monica, Calif.
Varo, Inc., Microcircuits Prods Div., 900 N. Shiloh Rd., Garland, Tex.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

CIRCUITS, HYBRID, THIN-FILM

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Collins Radio Co., Newport Beach, Calif.
Digilog Electronics Corp., Box 9368, 701 G. Third Ave. N., Seattle, Wash.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510, 2511
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1595-1597, 1599-1605
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Quantum Devices Corp., 15 W. Main St., Bergenfield, N. J. ..... p 1631
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Sensor Technology, Inc., 7118 Gerald Ave., Van Nuys, Calif. ... p 1774
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
Aerojet-General Corp., 1100 W. Hollyvale, Azusa, Calif.
Aerovox Corp., Box 867, Myrtle Beach, S. C.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Intellux, Inc., Box 548, Goleta, Calif.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kidco, Inc., Box 278, Medford, N. J.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lansdale Microelectronics, Inc., Colmar, Pa.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varo, Inc., Microcircuits Prods Div., 900 N. Shiloh Rd., Garland, Tex.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

CIRCUITS, INTEGRATED, METAL OXIDE SEMICONDUCTOR (MOS)

Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1183
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1605, 1606, 1609-1620
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
Kyodo Elctrn. Labs., Inc., 5153 Kamitsuruma, Sagamihara-shi, Kanagawa-ken, Japan
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.

CIRCUITS, INTEGRATED, SILICON, MONOLITHIC

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1183
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .. p 522, 523
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510, 2511
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1621-1629, 2536
Lansdale Transistor & Electronics Inc., Advance La. & Rte 309, Colmar, Pa. p 2578
Mallory, P. R. & Co., Inc., 3029 E. Washington St., Indianapolis, Ind. p 1630
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Transitron Elctrn. Corp., Precision Connector Div., 144 Addison St., E. Boston, Mass. ..... p 1633
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Integrated Circuit Engrg. Corp., 4900 E. Indian School Rd., Phoenix, Ariz.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kyodo Elctrn. Labs., Inc., 5153 Kamitsuruma, Sagamihara-shi, Kanagawa-ken, Japan
Lockheed Electronics Co., Route 22, Watchung, N. J.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mallory, P. R. & Co. Inc., Integrated Circuit Dept., 3029 E. Washington St., Indianapolis, Ind.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Radiation, Inc., Microelectronics Div., Box 37, Melbourne, Fla.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Stewart-Warner, Microcircuits, Inc., 730 E. Evelyn Ave., Sunnyvale, Cal.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.

CIRCUITS, INTEGRATED, SILICON MONOLITHIC, UNPACKAGED CHIPS

Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1183
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 1605
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Transitron Elctrn. Corp., Precision Connector Div., 144 Addison St., E. Boston, Mass. ..... p 1632, 1633
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kyodo Elctrn. Labs., Inc., 5153 Kamitsuruma, Sagamihara-shi, Kanagawa-ken, Japan
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CIRCUITS, LARGE SCALE INTEGRATION (LSI)

Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1606, 1620
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., Precision Connector Div., 144 Addison St., E. Boston, Mass. ..... p 1632
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Grafo Colloids Corp., P. O. Box 195, Sharon, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.

CIRCUITS, LOGIC & COMPUTER—SEE CARDS LOGIC; CIRCUITS, HYBRID; CIRCUITS, INTEGRATED; MODULES, LOGIC

CIRCUITS, MEDIUM SCALE INTEGRATION (MSI)

Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1183
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
United Aircraft Corp., Electronics Components Div., Trevose, Pa.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.

CIRCUITS, MINIATURE (CORDWOOD, ETC.)

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1012
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md. ..... p 1144
Automation Development Co., 9805 W. Jefferson Blvd., Culver City, Calif.
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1592, 1593
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1591
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1591
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1591
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1591
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .. p 522, 523
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.

General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1030, 1036
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. .... p 783
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Quantum Devices Corp., 15 W. Main St., Bergenfield, N. J. ..... p 1631
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1634
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y.
Sensor Technology, Inc., 7118 Gerald Ave., Van Nuys, Calif. ... p 1774
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2123
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 808, 1054, 2674, 2675
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Atlantic Instrs. & Elctrns., 50 Hunt St., Watertown, Mass.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Bureau of Engraving, Inc., Ind'l. Div., 219 N. 2nd St., Minneapolis, Minn.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Chemical & Aerospace Products, Inc., 231 E. Lomita, Wilmington, Calif.
Chemical Micro Milling Co., Box 770, Camden, N. J.
Chrysler Corp., 1312 N. Meridian St., Huntsville, Ala.
Collins Radio Co., Dallas, Texas
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Conductorlab, Inc., Box 222, Groton, Mass.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Cyclo-Tronics, Inc., 3858 N. Cicero Ave., Chicago, Ill.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Circuits, Inc., 95 Mt. Read Blvd., Rochester, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sibley Co., Haddam, Conn.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Techniques Inc., 235 Jackson St., Englewood, N. J.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

CIRCUITS, MULTILAYER—SEE PRINTED CIRCUITS, MULTILAYER

CIRCUITS, PRINTED (WITH COMPONENTS)—SEE CARDS, LINEAR FUNCTION

CIRCUITS, THICK-FILM—SEE CIRCUITS, HYBRID, THICK-FILM

CIRCUITS, THIN-FILM—SEE CIRCUITS, HYBRID, THIN-FILM

CIRCUITS, WOVEN WIRE—SEE CLOTH, WOVEN WIRE

CIRCULATORS, FERRITE
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1662-1664
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Addington Labs., Inc., 1043 DiGiulio Ave., Santa Clark, Calif.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Control Data Corp., 400 Border St., East Boston, Mass.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
N-H Microwave, Inc., Box 887, Red Bank, N. J.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

CLAMPS AND CLIPS, CABLE—ALSO SEE WIRE & CABLE TIES
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 839, 842, 850, 855, 856, 860, 861, 870, 872, 874
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Burndy Corporation, Richards Ave., Norwalk, Conn.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Globe Plastics, 1342 South Signal Dr., Pomona, Calif. ..... p 2514
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill. ..... p 2963
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Zeus Industrial Products, Inc., 195 Nassau St., Princeton, N. J.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Budwig Mfg. Co., Box 97, Ramona, Calif.
Carol Cable Co., Box 68, Pawtucket, R. I.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
E. C. P. Corp., 4726 Superior Ave., Cleveland, Ohio
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
G. E. Co., Insulator Dept., 2525 Insulator Dr., Baltimore, Md.
General Staple Co., 28 East 22nd St., New York, N. Y.
Glenair, Inc., 1211 Air Way, Glendale, Calif.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Hartwell Corp., 9035 Venice Blvd., Los Angeles, Calif.
Heyman Mfg. Co., East Michigan Ave., Kenilworth, N. J.
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Laminated Shim Co., Inc., 48 Union St., Glenbrook, Conn.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Larson, Charles O. Co., P.O. Box "E", Sterling, Ill.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.
Mirro Aluminum Co., Manitowoc, Wisc.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Preformed Line Products Co., 5349 St. Clair Ave., Cleveland, Ohio
Price & Rutzebeck, Box 30, Hayward, Calif.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Shur-Lok Corp., 1300 E. Normandy Pl., Santa Ana, Calif.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Superior Continental Corp., Box 489, Hickory, N. C.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
TA Mfg. Corp., 4625 Alger St., Los Angeles, Calif.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
3M Co., 3M Center, St. Paul, Minn.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Titeflex, Inc., Hendee St., Springfield, Mass.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Trico Fuse Mfg. Co., 2948 North 5th St., Milwaukee, Wis.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Utilities Service Co., Box 627, Allentown, Pa.
Weckesser Co., Inc., 4444 W. Irving Park Rd., Chicago, Ill.

CLAMPS, COMPONENT
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590

CLEAN ROOM EQUIPMENT
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. ... p 2935
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. ... p 1732
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2518
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. ... p 2913
Mueller Electric Co., 1589 H East 31st St., Cleveland, Ohio .... p 924
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Theta Instrument Corp., Fairfield, N. J. ..... p 1513
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Accurate Spring Mfg. Co., 8747 W. Palmer St., River Grove, Ill.
Aeroquip Corp., 300 S. East Ave., Jackson, Mich.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
General Staple Co., 28 East 22nd St., New York, N. Y.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Hartwell Corp., 9035 Venice Blvd., Los Angeles, Calif.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Kerrco, Inc., Box 29178, Lincoln, Neb.
Kestler Electronics, 4226 Arica Ave., Rosemead, Calif.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kwikset Powdered Metal Prods., 516 E. Santa Ana St., Anaheim, Calif.
Naugler Engineering, Inc., Off Dunham Rd., Beverly, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Shur-Lok Corp., 1300 E. Normandy Pl., Santa Ana, Calif.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
TA Mfg. Corp., 4625 Alger St., Los Angeles, Calif.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Timber-Top, Inc., 199 N. Main St., Freeport, N. Y.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Weckesser Co., Inc., 4444 W. Irving Park Rd., Chicago, Ill.
Western Coil & Electrical Co., 215 State St., Racine, Wisc.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.

CLAMPS, SERVO
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Theta Instrument Corp., Fairfield, N. J. ..... p 1513

CLEAN ROOM EQUIPMENT & SUPPLIES—ALSO SEE WORK STATIONS, CLEAN, DUST-FREE
Agnew-Higgins, Inc., Box 857, Garden Grove, Calif.
American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.
Angelica Uniform Co., 700 Rosedale Ave., St. Louis, Mo.
Arnold Labs, Inc., 7103 Laurel Canyon Blvd., N. Hollywood, Calif.
Atlas Coverall & Uniform Supply Co., 1441 E. Adams Blvd., Los Angeles, Cal.
Baker Co., Inc., 106 Granite St., Biddeford, Me.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Branson Instruments Co., 76 Progress Dr., Stamford, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cambridge Filter Corp., 7645 Seventh North Rd., Syracuse, N. Y.
Clauss Cutlery Co., P.O. Box 667, Freemont, Ohio
Clean Rooms Construction Co., Inc., Box 275, Westminster, Calif.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Controlled Environment Equip Corp., 160 Pleasant St., Brockton, Mass.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dri-Clave Corp., 54 Kinkel St., Westbury, N. Y.
Edcraft Inds., Inc., 620 Commerce Rd., Linden, N. J.
Farr Co., 2301 E. Rosecrans, El Segundo, Calif.
Forney Industries, Inc., 1800 La Porte Ave., Fort Collins, Colo.
General Acoustics Corp., 12248 Santa Monica Blvd., Los Angeles, Calif.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Industrial Formulations Corp., 160 Terminal Dr., Plainview, N. Y.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
L & R Mfg. Co., 577 Elm St., Kearny, N. J.
Matrix Engrg. Corp., 1502 West 166 St., Gardena, Calif.
Matthews Research, Inc., 4306 Wheeler Ave., Alexandria, Va.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Metropolitan Wire Goods Corp., N. Washington St. & George Ave., Wilkes-Barre, Pa.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Ramney Inds. Corp., Box 585, Farmingdale, N. J.
Sara Scientific Co., Box 321, San Francisco, Calif.
Standard Glove Co. of N. J., 27 Haynes Ave., Newark, N. J.
Sturdilite, Plainwell, Mich.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
3M Co., 3M Center, St. Paul, Minn.
Westinghouse Elec. Corp., Environmental Systems Dept., 4300 36th St., S.E., Grand Rapids, Mich.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.
Workplace Systems, Inc., 370 Commercial St., Manchester, N. H.

CLEANERS & SOLVENTS

CLEAN ROOMS—SEE ROOMS, CLEAN, DUST-FREE

CLEANERS AND SOLVENTS

Blackstone Ultrasonics, Inc., 820 Center St., Sheffield, Pa. ..... p 2919
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Hunt, Philip A., Chemical Corp., Palisades Park, N. J. ..... p 709
Multicore Sales Corp., Dept. RY399, Westbury, N. Y.
ADRE Co., 1005 South 26th St., Milwaukee, Wisc.
Acton Assocs., 100 Thompson St., Pittston, Pa.
Advanced Prods., 1702 Winter St., Ft. Wayne, Ind.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Amerace-Esna Corp., 4425 Bandini Blvd., Los Angeles, Calif.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Analytical Chemical Labs., 22 W. Madison, Chicago, Ill.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Arnold Labs, Inc., 7103 Laurel Canyon Blvd., N. Hollywood, Calif.
Atlas Coverall & Uniform Supply Co., 1441 E. Adams Blvd., Los Angeles, Cal.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Baker, J. T. Chemical Co., Phillipsburg, N. J.
Barco Chemical Products Co., 701-703 S. LaSalle, Chicago, Ill.
Baron-Blakeslee, Inc., 1620 S. Laramie Ave., Chicago, Ill.
Beaver Labs, Inc., 160 Terminal Dr., Plainview, N. Y.
Bendix Corp., Instruments & Life Support Div.,
2734 Hickory Grove Rd., Davenport, Iowa
Biggs Co., 1547 14th St., Santa Monica, Calif.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Branson Instruments Co., 76 Progress Dr., Stamford, Conn.
Brulin & Co., Inc., 2920 Martindale Ave., Indianapolis, Ind.
CRC Chemicals, Div. C. J. Webb, Dresher, Pa.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Carter's Ink Co., 239 First St., Cambridge, Mass.
Cerac, Inc., Box 597, Butler, Wisc.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Cobehn Inc., 226 Passaic Ave., Fairfield, N. J.
Colonial Alloys Co., Ridge Ave. & Crawford, Philadelphia, Pa.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Conversion Chemical Corp., 210 E. Main St., Rockville, Conn.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dow Chemical Co., Midland, Mich.
DuPont Co., (U.K.) Ltd., DuPont House, Fetter La., London, E.C. 4, Eng.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
Dynasonics Corp., Box 672, Pipestone, Minn.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Electronic Chemical Corp., 813 Communipaw Ave., Jersey City, N. J.
Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Enthone, Inc., Box 1900, New Haven, Conn.
Fidelity Chemical Products Corp., 472 Frelinghuysen Ave., Newark, N. J.
Friend's Mfg. Co., RD 2, Box 74, Williamstown, N. J.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
GAF Corp., 140 West 51 St., New York, N. Y.
G. E. Co., Insulator Dept., 2525 Insulator Dr., Baltimore, Md.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Houghton E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Hull, R. O. & Co., Inc., 3203 West 71 St., Cleveland, Ohio
Humble Oil & Refining Co., P.O. Box 2180, Houston, Tex.
Industrial Formulations Corp., 160 Terminal Dr., Plainview, N. Y.
Injectorall Electronics Corp., 4 North Rd., Great Neck, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
Kybe Corp., 132 Calvary St., Waltham, Mass.
L & R Mfg. Co., 577 Elm St., Kearny, N. J.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Mac Dermid, Inc., 526 Huntingdon Ave., Waterbury, Conn.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Michael, Claude, Inc., 703 W. Ivy St., Glendale, Calif.
Miller, H. Corp., 4th & Bristol Sts., Philadelphia, Pa.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Multisonic Cleaning Systems, 9615 Meech Ave., Cleveland, Ohio
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Nitine, Inc., Rte. 46, Clifton, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Oakite Products, Inc., 50 Valley Rd., Berkeley Heights, N. J.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia, Pa.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Philadelphia Quartz Co., 1146 Public Ledger Bldg., Philadelphia, Pa.
Phillips Mfg. Co., 7334 N. Clark St., Chicago, Ill.
Pro-Chem Inc., 16536 Broadway Ave., Cleveland, Ohio
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Randolph Products Co., 12th St., Carlstadt, N. J.
Rawn Company, Inc., Box 9, Spooner, Wisc.
Sara Scientific Co., Box 321, San Francisco, Calif.
Shanda Labs., Inc., Box 24, Closter, N. J.
Shipley Co., Inc., 2300 Washington St., Newton, Mass.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Starnetics Co., Box 9308, N. Hollywood, Calif.
Stewart-Hall Chemical Corp., 222 Washington St., Mount Vernon, N. Y.
Superior Flux & Mfg. Co., 1536 St. Clair Ave., Cleveland, Ohio
Tech Spray, 2113 W. 3rd, Amarillo, Tex.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.

CLEANERS, MECHANICAL, MAGNETIC TAPE

Virginia Panel Corp., Box 1106, Waynesboro, Va.
Duotone Co., Inc., Box 814, S. Miami, Fla.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kybe Corp., 132 Calvary St., Waltham, Mass.
L & R Mfg. Co., 577 Elm St., Kearny, N. J.
Phillips Mfg. Co., 7334 N. Clark St., Chicago, Ill.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

CLEANERS, ULTRASONIC

Blackstone Ultrasonics, Inc., 820 Center St., Sheffield, Pa. ..... p 2919
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Barco Chemical Products Co., 701-703 S. LaSalle, Chicago, Ill.
Baron-Blakeslee, Inc., 1620 S. Laramie Ave., Chicago, Ill.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix Corp., Instruments & Life Support Div.,
2734 Hickory Grove Rd., Davenport, Iowa
Branson Instruments Co., 76 Progress Dr., Stamford, Conn.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Delta Sonics, Inc., 12918 Cerise Ave., Hawthorne, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dri-Clave Corp., 54 Kinkel St., Westbury, N. Y.
Dynasonics Corp., Box 672, Pipestone, Minn.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Electromation Components Corp., 84 Toledo St., Farmingdale, N. Y.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Fidelity Chemical Products Corp., 472 Frelinghuysen Ave., Newark, N. J.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
L & R Mfg. Co., 577 Elm St., Kearny, N. J.
Lewis Corp., Rte. 6, Woodbury, Conn.
Linden Labs. Inc., Box 920, State College, Pa.
MSE, Inc., 811 Sharon Dr., Westlake, Ohio
Marcal Electro-Sonics, P.O. Box 185, Burbank, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Mettler Electronics Corp., 123 N. Fair Oaks Ave., Pasadena, Calif.
Miller, H. Corp., 4th & Bristol Sts., Philadelphia, Pa.
Multisonic Cleaning Systems, 9615 Meech Ave., Cleveland, Ohio
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Oakite Products, Inc., 50 Valley Rd., Berkeley Heights, N. J.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Phillips Mfg. Co., 7334 N. Clark St., Chicago, Ill.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Rawn Company, Inc., Box 9, Spooner, Wisc.
Sara Scientific Co., Box 321, San Francisco, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tronic Corp., Box 247-E, Belmont, Calif.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.
Vigor Tool Co., 53 West 23 St., New York, N. Y.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

CLEANERS AND FILTERS, AIR—SEE AIR CLEANERS AND FILTERS

CLEANING & FILTERING EQUIPMENT, LIQUID

Bendix Corp., Instruments & Life Support Div.,
2734 Hickory Grove Rd., Davenport, Iowa
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Industrial Formulations Corp., 160 Terminal Dr., Plainview, N. Y.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.

CLIP INSULATORS—SEE INSULATORS, TEST AND BATTERY CLIP

CLIPS, ALLIGATOR

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. ..... p 1797
Mueller Electric Co., 1589 H East 31st St., Cleveland, Ohio .... p 924
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
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Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
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Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Associated Engineering Corp., 65 Kent St., Brookline, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Carol Cable Co., Box 68, Pawtucket, R. I.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

CLIPS, BATTERY—SEE HOLDERS, BATTERY

CLIPS, BOARD, HARNESS

ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill. ..... p 2963
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
E-Z Hook Test Products, P.O. Box 105, Covington, Ky.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Weckesser Co., Inc., 4444 W. Irving Park Rd., Chicago, Ill.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

CLIPS, COMPONENT

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Atlee Corp., 2 Lowell Ave., Winchester, Mass. ..... p 835
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. ..... p 1797
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal.
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National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Aavid Engrg. Inc., 30 Cook Ct., Laconia, N. H.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Aldrich, C. G. Mfg. Corp., Box 312, Sugar Grove, Pa.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Connor Spring & Mfg. Co., 75 14th St., San Francisco, Calif.
E-Z Hook Test Products, P.O. Box 105, Covington, Ky.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
General Staple Co., 28 East 22nd St., New York, N. Y.
Kestler Electronics, 4226 Arica Ave., Rosemead, Calif.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.

CLIPS, FAHNESTOCK, SPRING WIRE

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

CLIPS, TEST

Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
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Mueller Electric Co., 1589 H East 31st St., Cleveland, Ohio .... p 924
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. p 942, 968
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Shallcross, E. Preston St., Selma, N. C.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Contact, Inc., P.O. Box 6, Hudson, N. H.
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
E-Z Hook Test Products, P.O. Box 105, Covington, Ky.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electraid, Inc., Box 53, Cambridge, Mass.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.

Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Ostby & Barton Co., Box 6267, Providence, R. I.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Rapid Specialties Co., 327 W. Huron St., Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

CLIPS, TRANSISTOR & DIODE—SEE RETAINERS, TRANSISTOR & DIODE

CLIPS AND CAPS, GRID & PLATE

AMP Incorporated, Box 3608, Harrisburg, Pa.
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. ... p 837
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 2913
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Warren Components Corp., Box 848, Warren, Pa.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

CLIPS AND HOLDERS, FUSE—ALSO SEE PANELS, FUSE

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Atlee Corp., 2 Lowell Ave., Winchester, Mass. ..... p 835
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J.
Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo. p 2694, 2695
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 893
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Littelfuse, Inc., 800 E. Northwest Hwy., Des Plaines, Ill. ..... p 2742
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. ..... p 2751
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1176
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Chase-Shawmut Co., 374 Merrimac St., Newburyport, Mass.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Dante Electric Mfg. Co., Bantam, Conn.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

CLOCKS, ALL TYPES

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 1017
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa. ..... p 767
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 775
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1106
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450, 1451
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa. p 794
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap. p 1753
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Bulova Watch Co., Timer Lab., Bulova Park, Flushing, N. Y.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Edwards Co., Inc., 90 Connecticut Ave., Norwalk, Conn.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Faraday, Inc., 805 S. Maumee, Tecumseh, Mich.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hansen Mfg. Co., Inc., Box 23, Princeton, Ind.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Montgomery Mfg. Co., Inc., 206 S. Main St., Owensville, Ind.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sprengnether, W. F. Instr. Co., Inc., 4567 Swan St., St. Louis, Mo.
Standard Electric Time Corp., 89 Logan St., Springfield, Mass.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Time-O-Matic Inc., Box 850, Danville, Ill.
Traid Corp., 777 Flower St., Glendale, Calif.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Wakmann Watch Co., Inc., 15 W. 47th St., New York, N. Y.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

CLOSED CIRCUIT TV SYSTEMS—SEE TELEVISION SYSTEMS, CLOSED CIRCUIT

CLOTH & FABRICS—SEE INSULATION MATERIALS, FABRIC

CLOTH, SPEAKER GRILLE

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Acoustone Corp., Div. of Newcastle Fabrics, 80 Wythe Ave., Brooklyn, N. Y.
Chicopee Mfg. Co., Cornelia, Ga.
Mellotone Inc., 1220 Broadway, New York, N. Y.
Merlang Mfg. Corp., 122 S. Long Beach Rd., Rockville Centre, N. Y.
Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.

CLOTH, WOVEN WIRE

Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
Etchomatic, Inc., Box 444, Waltham, Mass.
Matthey Bishop, Inc., Malvern, Pa.
Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Tyler, W. S. Co., 8200 Tyler Blvd., Mentor, Ohio
Unique Wire Weaving Co., Inc., 759 Ramsey Ave., Hillside, N. J.
Wire Cloth Enterprises, Inc., 130-132 Gamma Dr., Pittsburgh, Pa.
Wright, G. F. Steel & Wire Co., 243 Stafford St., Worcester, Mass.

CLUTCHES, FRICTION

American Precision Inds., Inc., 77 Olean Rd., E. Aurora, N. Y. ... p 1724
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y.
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
General-Electro Mechanical Corp., 787 Hertel Ave., Buffalo, N. Y. p 1737
Magtrol Inc., 240 Seneca St., Buffalo, N. Y.
Northfield Precision Instr. Corp., 4400 Austin Blvd., Island Park, N. Y. p 1751
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Dynamic Gear Co., 175 Dixon Ave., Amityville, N. Y.
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
Formsprag Co., 23601 Hoover Rd., Warren, Mich.
Insco Corp., Main St., Groton, Mass.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
MagneTec Corp., 7751 Densmore Ave., Van Nuys, Calif.
Meltronics, Inc., 3343 Merrick Rd., Wantagh, N. Y.
Midwest Automatic, Inc., 510 Third St., Des Moines, Iowa
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Perfect Gear & Instr. Corp., 18141 Napa, Northridge, Calif.
Simplatrol Prods. Corp., 675 Plantation St., Worcester, Mass.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
WER Industrial Corp., 3036 Alt Blvd., Grand Island, N. Y.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Zero-Max Co., The, 2845 Harriet Ave., S., Minneapolis, Minn.

CLUTCHES, MAGNETIC

American Precision Inds., Inc., 77 Olean Rd., E. Aurora, N. Y. ... p 1724
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y. p 1729
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
General-Electro Mechanical Corp., 787 Hertel Ave., Buffalo, N. Y. p 1737
General Time Corp., Rte. 8, Torrington, Conn.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Magtrol Inc., 240 Seneca St., Buffalo, N. Y. ..... p 1749
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1766
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Altair Research & Mfg. Co., 1241 E. State St., Ontario, Calif.

COATINGS, ANTI-STATIC

Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Bendix Corp., Motor Components Div., Elmira, N. Y.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Dial Products Co., 19-21 Cottage St., Bayonne, N. J.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electroid Corp., 95 Progress St., Union, N. J.
Fawick Airflex Div., 9919 Clinton Rd., Cleveland, Ohio
Ferranti Ltd., Hollinwood, Lancs., Eng.
Hobbs Mfg. Co., 666 Lincoln St., Worcester, Mass.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
MagneTec Corp., 7751 Densmore Ave., Van Nuys, Calif.
Meltronics, Inc., 3343 Merrick Rd., Wantagh, N. Y.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Perfect Gear & Instr. Corp., 18141 Napa, Northridge, Calif.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Precision Specialties, Inc., Box 118, Pitman, N. J.
Simplatrol Prods. Corp., 675 Plantation St., Worcester, Mass.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Valcor Engrg. Corp., 365 Carnegie Ave., Kenilworth, N. J.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
WER Industrial Corp., 3036 Alt Blvd., Grand Island, N. Y.
Warner Electric Brake & Clutch Co., Beloit, Wisc.

CLUTCHES, POSITIVE

American Precision Inds., Inc., 77 Olean Rd., E. Aurora, N. Y. ... p 1724
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
General-Electro Mechanical Corp., 787 Hertel Ave., Buffalo, N. Y. p 1737
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Fawick Airflex Div., 9919 Clinton Rd., Cleveland, Ohio
Formsprag Co., 23601 Hoover Rd., Warren, Mich.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago, Ill.
Geartronics Corp., 112 Chelmsford Rd., N. Billerica, Mass.
MagneTec Corp., 7751 Densmore Ave., Van Nuys, Calif.
Perfect Gear & Instr. Corp., 18141 Napa, Northridge, Calif.
Precision Specialties, Inc., Box 118, Pitman, N. J.
Torrington Co., Box 1008, Torrington, Conn.
Zero-Max Co., The, 2845 Harriet Ave., S., Minneapolis, Minn.

COATINGS, ANTI-LASER BEAM

Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Isochem Resins Co., Cook St., Lincoln, R. I.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
Valpey Corp., 1400 Highland St., Holliston, Mass.

COATINGS, ANTI-STATIC

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1640
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Amerace-Esna Corp., 4425 Bandini Blvd., Los Angeles, Calif.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Analytical Chemical Labs., 22 W. Madison, Chicago, Ill.
Barco Chemical Products Co., 701-703 S. LaSalle, Chicago, Ill.
Beaver Labs, Inc., 160 Terminal Dr., Plainview, N. Y.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Carboline Co., 328 Hanley Indl. Ct., St. Louis, Mo.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
GAF Corp., 140 West 51 St., New York, N. Y.
Grafo Colloids Corp., P. O. Box 195, Sharon, Pa.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Industrial Formulations Corp., 160 Terminal Dr., Plainview, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Micro-Circuits Co., New Buffalo, Mich.
Miller, H. Corp., 4th & Bristol Sts., Philadelphia, Pa.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Nopco Chemical Div., 60 Park Pl., Newark, N. J.
Randolph Products Co., 12th St., Carlstadt, N. J.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Zenith Optical Lab., 138 Palisade St., Dobbs Ferry, N. Y.

COATINGS, CONDUCTIVE

COATINGS, CONDUCTIVE

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1639, 1640
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Carboline Co., 328 Hanley Indl. Ct., St. Louis, Mo.
Cerac, Inc., Box 597, Butler, Wisc.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Electro Materials Corp. of America, 605 Center Ave., Mamaroneck, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Enthone, Inc., Box 1900, New Haven, Conn.
Environmental Container Systems, Box 337, Union City, Calif.
Etchomatic, Inc., Box 444, Waltham, Mass.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hysol Div., 211 Franklin St., Olean, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Motson, J. F. Co., 1717 Bethlehem Pike, Flourtown, Pa.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Union Carbide Corp., Materials Sys. Div., Coatings Service, 1245 S. Main St., Indianapolis, Ind.
Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles, Calif.

COATINGS, ELECTROMAGNETIC WAVE ABSORBING—ALSO SEE MATERIALS

Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Allied Research & Engineering Co., 10300 Glasgow Pl., Los Angeles, Calif.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

COATINGS, FILMS, TRANSFERS, ETC., ETCHANT-RESISTING

Hunt, Philip A., Chemical Corp., Palisades Park, N. J. ..... p 708
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Conversion Chemical Corp., 210 E. Main St., Rockville, Conn.
Isochem Resins Co., Cook St., Lincoln, R. I.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Naz-Dar International, 1087 N. Branch, Chicago, Ill.
Randolph Products Co., 12th St., Carlstadt, N. J.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles, Calif.

COATINGS, FLUORESCENT

Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Black Light Prods., Box 45278, Chicago, Ill.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Illinois Bronze Powder & Paint Co., 300 E. Main St., Lake Zurich, Ill.
Isochem Resins Co., Cook St., Lincoln, R. I.
Randolph Products Co., 12th St., Carlstadt, N. J.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Stroblite Co., Inc., 75 West 45th St., New York, N. Y.

COATINGS, FUNGICIDAL

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y. p 706, 707
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
Analytical Chemical Labs., 22 W. Madison, Chicago, Ill.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
Carboline Co., 328 Hanley Indl. Ct., St. Louis, Mo.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dow Chemical Co., Midland, Mich.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Flock Process Corp., Box 430, Norwalk, Conn.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
GAF Corp., 140 West 51 St., New York, N. Y.
Injectorall Electronics Corp., 4 North Rd., Great Neck, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Randolph Products Co., 12th St., Carlstadt, N. J.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Stevenson Bros. & Co., 110 Race St., Philadelphia, Pa.
Techform Labs., Inc., 707 S. Hampton Dr., Venice, Calif.
3M Co., 3M Center, St. Paul, Minn.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zophar Mills, Inc., 112-130 26th St., Brooklyn, N. Y.

COATINGS, COMPOUNDS, LUBRICANTS, ETC., HEAT CONDUCTIVE

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1639
Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y. p 706, 707
Dow Corning Corp., Midland, Mich. ..... p 1581–1583
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Carboline Co., 328 Hanley Indl. Ct., St. Louis, Mo.
Cerac, Inc., Box 597, Butler, Wisc.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Electro Materials Corp. of America, 605 Center Ave., Mamaroneck, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
GAF Corp., 140 West 51 St., New York, N. Y.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Glidden-Durkee Div., 900 Union Commerce Bldg., Cleveland, Ohio
Goldak Co., Inc., 1101-A Air Way, Glendale, Calif.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Isochem Resins Co., Cook St., Lincoln, R. I.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Midsil Corp., 27 Bland St., Emerson, N. J.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Sauereisen Cements Co., 160 Gamma Dr., Pittsburgh, Pa.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Sperex Corp., 2239 Pontius Ave., Los Angeles, Calif.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Tickle, A. Engineering Works, Inc., 21 Delevan St., Brooklyn, N. Y.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

COATINGS, HIGH-TEMPERATURE, CERAMIC, PLASMA SPRAY—SEE SERVICES, COATING

COATINGS, INFRARED

Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
General Diode Corp., 18 South St., Framingham, Mass.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Isochem Resins Co., Cook St., Lincoln, R. I.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Wire Cloth Enterprises, Inc., 130-132 Gamma Dr., Pittsburgh, Pa.

COATINGS, INSULATING

Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. .. p 1578
Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y. p 706, 707
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. ..... p 1579
Dow Corning Corp., Midland, Mich. ..... p 1580–1583
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 705
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Armstrong Products Company, Inc., P.O. Box 657, Warsaw, Ind.
Beaver Labs, Inc., 160 Terminal Dr., Plainview, N. Y.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
CRC Chemicals, Div. C. J. Webb, Dresher, Pa.
Calg Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemical Products Corp., King Philip Rd., E. Providence, R. I.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Dennis Chemical Co., 2701 Papin St., St. Louis, Mo.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dow Chemical Co., Midland, Mich.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Electro Materials Corp. of America, 605 Center Ave., Mamaroneck, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Fluorocarbon Co., 1754 S. Clementine, Box 3339, Anaheim, Calif.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Hi-Test Chemical Corp., 40 Blanchard St., Newark, N. J.
Hightemp Resins Inc., 225 Greenwich Ave., Stamford, Conn.
Hysol Div., 211 Franklin St., Olean, N. Y.
Injectorall Electronics Corp., 4 North Rd., Great Neck, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
Koppers Co. Inc., Koppers Bldg., Pittsburgh, Pa.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Motson, J. F. Co., 1717 Bethlehem Pike, Flourtown, Pa.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Norton Co., 1 New Bond St., Worcester, Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Paisley, 1153 Bloomfield Ave., Clifton, N. J.
Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, Pa.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Sauereisen Cements Co., 160 Gamma Dr., Pittsburgh, Pa.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Sperex Corp., 2239 Pontius Ave., Los Angeles, Calif.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Starnetics Co., Box 9308, N. Hollywood, Calif.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Stevenson Bros. & Co., 110 Race St., Philadelphia, Pa.
Techform Labs., Inc., 707 S. Hampton Dr., Venice, Calif.
3M Co., 3M Center, St. Paul, Minn.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Union Carbide Corp., Materials Sys. Div., Coatings Service, 1245 S. Main St., Indianapolis, Ind.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Zophar Mills, Inc., 112-130 26th St., Brooklyn, N. Y.

COATINGS, MOLD RELEASING

Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y.
Dow Corning Corp., Midland, Mich. ..... p 1580, 1582
Cerac, Inc., Box 597, Butler, Wisc.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Isochem Resins Co., Cook St., Lincoln, R. I.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Miller, H. Corp., 4th & Bristol Sts., Philadelphia, Pa.
Nopco Chemical Div., 60 Park Pl., Newark, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

COATINGS, OPTICAL

Burke & James, Inc., 333 W. Lake St., Chicago, Ill.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Isochem Resins Co., Cook St., Lincoln, R. I.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Texas Instrs., Inc., Box 6015, Dallas, Tex.
Varo Optical, Inc., 215 E. Prospect Ave., Mt. Prospect, Ill.

COATINGS, PROTECTIVE

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y. p 706, 707
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. ..... p 1579
Dow Corning Corp., Midland, Mich. ..... p 1580–1583
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.

International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 705
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y.
ADRE Co., 1005 South 26th St., Milwaukee, Wisc.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
American Solder & Flux Co., Inc., 19 & Willard Sts., Philadelphia, Pa.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Armstrong Products Company, Inc., P.O. Box 657, Warsaw, Ind.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Carboline Co., 328 Hanley Indl. Ct., St. Louis, Mo.
Cerac, Inc., Box 597, Butler, Wisc.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemical Products Corp., King Philip Rd., E. Providence, R. I.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Conversion Chemical Corp., 210 E. Main St., Rockville, Conn.
Daubert Chemical Co., 2000 Spring Rd., Oak Brook, Ill.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Fidelity Chemical Products Corp., 472 Frelinghuysen Ave., Newark, N. J.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Humble Oil & Refining Co., P.O. Box 2180, Houston, Tex.
Hysol Div., 211 Franklin St., Olean, N. Y.
Illinois Bronze Powder & Paint Co., 300 E. Main St., Lake Zurich, Ill.
Isochem Resins Co., Cook St., Lincoln, R. I.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Miller, H. Corp., 4th & Bristol Sts., Philadelphia, Pa.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Nopco Chemical Div., 60 Park Pl., Newark, N. J.
Oakite Products, Inc., 50 Valley Rd., Berkeley Heights, N. J.
Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia, Pa.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.
Pro-Chem Inc., 16536 Broadway Ave., Cleveland, Ohio
Randolph Products Co., 12th St., Carlstadt, N. J.
Rawn Company, Inc., Box 9, Spooner, Wisc.
Seal-Peel, Inc., 775 Stephenson Hwy., Royal Oak, Mich.
Sperex Corp., 2239 Pontius Ave., Los Angeles, Calif.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Starnetics Co., Box 9308, N. Hollywood, Calif.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Superior Continental Corp., Box 489, Hickory, N. C.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Technic, Inc., Box 965, Providence, R. I.
3M Co., 3M Center, St. Paul, Minn.
Union Carbide Corp., Materials Sys. Div., Coatings Service, 1245 S. Main St., Indianapolis, Ind.
Western Coating Co., Box 598, Royal Oak, Mich.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles, Calif.

COATINGS, RADIOACTIVE

Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.

COATINGS, TRANSDUCER FORMING

Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Isochem Resins Co., Cook St., Lincoln, R. I.

COATINGS, WEATHERPROOFING

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y. p 706, 707
Datak Corp., 85 Highland Ave., Passaic, N. J. ..... p 1170
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. ..... p 1579
Dow Corning Corp., Midland, Mich. ..... p 1580–1583
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 705
Allaco Prods., 130 Wood Rd., Braintree, Mass.
American Solder & Flux Co., Inc., 19 & Willard Sts., Philadelphia, Pa.
Armstrong Products Company, Inc., P.O. Box 657, Warsaw, Ind.
Arnold Labs, Inc., 7103 Laurel Canyon Blvd., N. Hollywood, Calif.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
CRC Chemicals, Div. C. J. Webb, Dresher, Pa.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Carboline Co., 328 Hanley Indl. Ct., St. Louis, Mo.
Chemical Products Corp., King Philip Rd., E. Providence, R. I.
Colonial Alloys Co., Ridge Ave. & Crawford, Philadelphia, Pa.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Humble Oil & Refining Co., P.O. Box 2180, Houston, Tex.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Isochem Resins Co., Cook St., Lincoln, R. I.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kano Labs., Inc., 1000 Thompson La., Nashville, Tenn.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Markal Co., 250 N. Washtenaw Ave., Chicago, Ill.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, Pa.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Randolph Products Co., 12th St., Carlstadt, N. J.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Seal-Peel, Inc., 775 Stephenson Hwy., Royal Oak, Mich.
Sperex Corp., 2239 Pontius Ave., Los Angeles, Calif.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Stevenson Bros. & Co., 110 Race St., Philadelphia, Pa.
3M Co., 3M Center, St. Paul, Minn.
Western Coating Co., Box 598, Royal Oak, Mich.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles, Calif.
Zophar Mills, Inc., 112-130 26th St., Brooklyn, N. Y.

CODE & TAB MARKERS—SEE WIRE MARKERS (ALL TYPES)

CODED DISCS, OPTICAL

Data Technology Inc., 65 Grove St., Watertown, Mass.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Litton Industries, Encoder Div., 20745 Nordhoff St., Chatsworth, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Wayne-George Co., Christina St., Newton, Mass.

CODERS, A-F

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1082
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Multitone Electronics, Inc., 111 Broadway, New York, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Vega Elctrns. Corp., 2115 De La Cruz Blvd., Santa Clara, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

CODERS, BEACON

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
C & K Components Inc., 103 Morse St., Watertown, Mass.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Southern Avionics Co., 5055 Belmont, Beaumont, Tex.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

CODERS, R-F

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

CODERS, TRANSPONDER

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1157
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.

COIL ASSEMBLIES & FORMS

Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

COIL ASSEMBLIES & FORMS—ALSO SEE BOBBINS

Airco Speer Electronic Components, 4 Hoover Ave., DuBois, Pa.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Booker & Wallestad, 1202 South 5th St., Hopkins, Minn. p 1237, 1239, 1240
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. ... p 724, 725
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 740
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
RFL Components Div., Powerville Rd., Boonton, N. J. ..... p 1473
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
Thermotech Coil Forms & Components Div., 1202 S. 5th St., Hopkins, Minn. p 1237, 1239, 1240
Thermotech Inds., Inc., 1202 South 5th St., Hopkins, Minn. p 1237, 1239, 1240
Thermotech Plastics Co., 1202 South 5th St., Hopkins, Minn. p 1237, 1239, 1240
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Wilcox Prods. Co., 1202 South 5th St., Hopkins, Minn. p 1237, 1239, 1240
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Bourns, Inc., Box 1398, Romoland, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Celestial Components, Inc., Box 4035, Covina, Calif.
Ceram Corp., 5345 Timken Sq., La Mesa, Calif.
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Cosmo Plastics Co., 3239 West 14th St., Cleveland, Ohio
Data Magnetics Corp., 5441 West 104th St., Los Angeles, Calif.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Diamonite Products Mfg. Co., Div. U. S. Ceramic Tile Co., Shreve, Ohio
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Endicott Coil Co., Inc., 24 Charlotte St., Binghamton, N. Y.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Form-It Products Inc., 1619 W. Walnut St., Chicago, Ill.
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Howie Corp., Noble & Jackson Sts., Norristown, Pa.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Micrometals, 228 N. Sunset, City of Industry, Calif.
Ny-Glass, Inc., 7314 E. Madison St., Paramount, Calif.
National Coil Co., Box 1040, Douglas, Ariz.
National Moldite Co., Inc., 250 South St., Newark, N. J.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
REM-Tronics, Inc., 192 Central Ave., Silver Creek, N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Resdel Corp., Box 2171, Rio Grande, N. J.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
Sag Harbor Inds., Inc., Bayview St., Sag Harbor, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Smith, J. A. Co., Boyertown, Pa.
Space Products, Inc., 6631 Sarnia Ave., Long Beach, Calif.
Staffall Inc., 7 Woodland St., Providence, R. I.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.
Superior Steatite & Ceramic Corp., 83-91 W. Forest Ave., Englewood, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.

COIL ASSEMBLIES & FORMS (Cont'd)

Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.

COIL STANDARDS—SEE STANDARDS, INDUCTANCE

COIL TESTERS—SEE TESTERS, COIL

COIL-WINDING EQUIPMENT—SEE MACHINES, COIL WINDING

COILS, A-F

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Airco Speer Electronic Components, 4 Hoover Ave., DuBois, Pa. p 716, 717
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Collins Radio Co., Newport Beach, Calif. ..... p 728, 729
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 732, 733
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1387
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 736
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. .... p 744, 745
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318, 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Zaring Inds., Inc., Box 477, Carmel, Ind. ..... p 753
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EMR Div., Box 223, Princeton, N. J.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, ANTENNA LOADING

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
K-W Engineering Works, N50, W16328 Pin Oak Ct., Menomonee Falls, Wisc.
Master Mobile Mounts, 1000 Crystal Dr., Fort Myers, Fla.
Master Mobile Mounts, 1000 Crystals Dr., Ft. Myers, Fla.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Premax Prods. Div., Highland & College Aves., Niagara Falls, N. Y.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, BROADCAST

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Airco Speer Electronic Components, 4 Hoover Ave., DuBois, Pa. p 716, 717
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 746
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Diamond Coils, Inc., 540 39th St., Union City, N. J.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
National Coil Co., Box 1040, Douglas, Ariz.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, CHOKE—SEE CHOKES (AS MODIFIED)

COILS, COLOR PURITY

Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Delta Coils, 4312 Main St., Philadelphia, Pa.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Wilco Corp., 4030 West 10th St., Indianapolis, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, CROSSOVER, AUDIO

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
RFL Components Div., Powerville Rd., Boonton, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
A.P.W. Co., 72 W. Main St., Rockaway, N. J.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, FIELD

RFL Components Div., Powerville Rd., Boonton, N. J.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
A.P.W. Co., 72 W. Main St., Rockaway, N. J.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sag Harbor Inds., Inc., Bayview St., Sag Harbor, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Tur-Bo Jet Products Co., Inc., 5025 N. Earle St., Rosemead, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, FOCUSING

Cleveland Elctrns., Inc., 2000 Highland Rd., Twinsburg, Ohio p 726, 727
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. .... p 1207
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Carter, J. C. Co., 671 West 17th St., Costa Mesa, Calif.
Celco, 70 Constantine Dr., Mahwah, N. J.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, FOIL-WOUND

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio .... p 735
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.

Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
TDC Div., P.O. Box 365, Littleton, Mass.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, HIGH-Q, LOW-FREQUENCY

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Airco Speer Electronic Components, 4 Hoover Ave., DuBois, Pa. p 716, 717
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 722
Buleva Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. ... p 724, 725
Collins Radio Co., Newport Beach, Calif. ..... p 728, 729
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora. N. Y. .. p 734
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1387
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 736
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 740
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
RFL Components Div., Powerville Rd., Boonton, N. J. ..... p 1473
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 744
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 748, 749
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318, 2900
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Zaring Inds., Inc., Box 477, Carmel, Ind. ..... p 753
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Dano Electric Co., Main St., Winsted, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
EMR Div., Box 223, Princeton, N. J.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Lenox-Fugle Electronics, Inc., 475 Watchung Ave., Watchung, N. J.
Master Mobile Mounts, 1000 Crystals Dr., Ft. Myers, Fla.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.
TDC Div., P.O. Box 365, Littleton, Mass.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, HIGH TEMPERATURE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Buleva Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Collins Radio Co., Newport Beach, Calif. ..... p 728, 729
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 732, 733
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Tec Magnetics, 12117 Slauson Ave., Santa Fe Springs, Calif.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 748, 749
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 750
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Zaring Inds., Inc., Box 477, Carmel, Ind. ..... p 753
A.P.W. Co., 72 W. Main St., Rockaway, N. J.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dano Electric Co., Main St., Winsted, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Endicott Coil Co., Inc., 24 Charlotte St., Binghamton, N. Y.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Lenox-Fugle Electronics, Inc., 475 Watchung Ave., Watchung, N. J.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
REM-Tronics, Inc., 192 Central Ave., Silver Creek, N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sag Harbor Inds., Inc., Bayview St., Sag Harbor, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Tur-Bo Jet Products Co., Inc., 5025 N. Earle St., Rosemead, Calif.
U. S. Electronics Corp., 321 Orient Way, Lyndhurst, N. J.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, HYBRID & REPEAT

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. ... p 724, 725
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.

COILS, METALLIZED GLASS

Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
RFL Components Div., Powerville Rd., Boonton, N. J.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, I-F

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Buleva Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. ... p 724, 725
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Dale Electronics Inc., Box 609, Columbus, Nebr.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 740
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
RFL Components Div., Powerville Rd., Boonton, N. J. ..... p 1473
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 746
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 750
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Clippard Instr. Inc., 7350-90 Colerain Rd., Cincinnati, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Defense Elctrns., Inc., Rockville, Md.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, METALLIZED GLASS

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.

COILS, METALLIZED GLASS (Cont'd)

Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, MINIATURE & SUBMINIATURE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 722, 723
Booker & Wallestad, 1202 South 5th St., Hopkins, Minn. ..... p 1237
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. .... p 724, 725
Collins Radio Co., Newport Beach, Calif. ..... p 728, 729
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y. p 734
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 736
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 737, 2863
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 740, 1174
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
RFL Components Div., Powerville Rd., Boonton, N. J. ..... p 1473
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
Tec Magnetics, 12117 Slauson Ave., Santa Fe Springs, Calif.
Thermotech Coil Forms & Components Div., 1202 S. 5th St., Hopkins, Minn. p 1237
Thermotech Inds., Inc., 1202 South 5th St., Hopkins, Minn. p 1237
Thermotech Plastics Co., 1202 South 5th St., Hopkins, Minn. .. p 1237
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. .... p 744, 745
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 748, 749
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318, 2900
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 750
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Wilcox Prods. Co., 1202 South 5th St., Hopkins, Minn. ..... p 1237
Zaring Inds., Inc., Box 477, Carmel, Ind. ..... p 753
A.P.W. Co., 72 W. Main St., Rockaway, N. J.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dano Electric Co., Main St., Winsted, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
EMR Div., Box 223, Princeton, N. J.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Lenox-Fugle Electronics, Inc., 475 Watchung Ave., Watchung, N. J.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
REM-Tronics, Inc., 192 Central Ave., Silver Creek, N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sag Harbor Inds., Inc., Bayview St., Sag Harbor, N. Y.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Tri-Dex Co., 2146 E. Main St., Visalia, Calif.
Tur-Bo Jet Products Co., Inc., 5025 N. Earle St., Rosemead, Calif.
U. S. Electronics Corp., 321 Orient Way, Lyndhurst, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Winatic Corp., 409 Commerce Rd., Vestal, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, OSCILLATOR, PHONO TEST

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
RFL Components Div., Powerville Rd., Boonton, N. J.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y.
United Transformer Co., 150 Varick St., New York, N. Y.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, RELAY

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I. ..... p 2218
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Dow-Key Co., 2260 Industrial La., Broomfield, Colo.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
RFL Components Div., Powerville Rd., Boonton, N. J.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
A.P.W. Co., 72 W. Main St., Rockaway, N. J.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Dano Electric Co., Main St., Winsted, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Diamond Coils, Inc., 540 39th St., Union City, N. J.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Endicott Coil Co., Inc., 24 Charlotte St., Binghamton, N. Y.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Mallory Electromagnetic Co., Div. P. R. Mallory, Du Quoin, Ill.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
REM-Tronics, Inc., 192 Central Ave., Silver Creek, N. Y.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sag Harbor Inds., Inc., Bayview St., Sag Harbor, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Tur-Bo Jet Products Co., Inc., 5025 N. Earle St., Rosemead, Calif.
U. S. Electronics Corp., 321 Orient Way, Lyndhurst, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Winatic Corp., 409 Commerce Rd., Vestal, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, R-F

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Airco Speer Electronic Components, 4 Hoover Ave., DuBois, Pa. p 716, 717
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720, 723
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. .... p 724, 725
Collins Radio Co., Newport Beach, Calif. ..... p 728, 729
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730–732
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y. .. p 734
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1387
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 736
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 740
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
RFL Components Div., Powerville Rd., Boonton, N. J. ..... p 1473
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2097
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. .... p 744–746
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 748, 749
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318, 2900
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 750, 751
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Clippard Instr. Inc., 7350-90 Colerain Rd., Cincinnati, Ohio
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Connor Spring & Mfg. Co., 75 14th St., San Francisco, Calif.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Coils, Inc., 540 39th St., Union City, N. J.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Lenox-Fugle Electronics, Inc., 475 Watchung Ave., Watchung, N. J.
Master Mobile Mounts, 1000 Crystals Dr., Ft. Myers, Fla.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.

Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Wilco Corp., 4030 West 10th St., Indianapolis, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, SATURABLE REACTOR

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Collins Radio Co., Newport Beach, Calif.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif. ..... p 2860
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
RFL Components Div., Powerville Rd., Boonton, N. J.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318, 2900
Unitron, 1624 N. First St., Garland, Texas
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
TDC Div., P.O. Box 365, Littleton, Mass.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, SHIELDED

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730–732
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y. .. p 734
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 736
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
RFL Components Div., Powerville Rd., Boonton, N. J. ..... p 1473
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318, 2900
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Dano Electric Co., Main St., Winsted, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Diamond Coils, Inc., 540 39th St., Union City, N. J.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Lenox-Fugle Electronics, Inc., 475 Watchung Ave., Watchung, N. J.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
TDC Div., P.O. Box 365, Littleton, Mass.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, SOLENOID

Airco Speer Electronic Components, 4 Hoover Ave., DuBois, Pa. p 716, 717
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I. ..... p 2218
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y.
Tec Magnetics, 12117 Slauson Ave., Santa Fe Springs, Calif.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
A.P.W. Co., 72 W. Main St., Rockaway, N. J.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dano Electric Co., Main St., Winsted, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Diamond Coils, Inc., 540 39th St., Union City, N. J.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Endicott Coil Co., Inc., 24 Charlotte St., Binghamton, N. Y.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Koontz-Wagner Elec. Co., Inc., 516 N. Michigan St., S. Bend, Ind.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Lisk, G. W., Co., Inc., 5019 South St., Clifton Springs, N. Y.
Mallory Electromagnetic Co., Div. P. R. Mallory, Du Quoin, Ill.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Modelectric Prods. Corp., 9 Cindy La., Asbury Park, N. J.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Acme Co., 170 East 131 St., Cleveland, Ohio
National Coil Co., Box 1040, Douglas, Ariz.

COILS, TOROIDAL

New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
REM-Tronics, Inc., 192 Central Ave., Silver Creek, N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sag Harbor Inds., Inc., Bayview St., Sag Harbor, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
TDC Div., P.O. Box 365, Littleton, Mass.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Tri-Dex Co., 2146 E. Main St., Visalia, Calif.
Tur-Bo Jet Products Co., Inc., 5025 N. Earle St., Rosemead, Calif.
U. S. Electronics Corp., 321 Orient Way, Lyndhurst, N. J.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltronics, Inc., 7746 W. Addison St., Chicago, Ill.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Winatic Corp., 409 Commerce Rd., Vestal, N. Y.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, TELEPHONE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C. ..... p 692
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Endicott Coil Co., Inc., 24 Charlotte St., Binghamton, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
TDC Div., P.O. Box 365, Littleton, Mass.
U. S. Electronics Corp., 321 Orient Way, Lyndhurst, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, TELEPHONE PICKUP (FOR RECORDING)—SEE PICKUPS, TELEPHONE

COILS, TOROIDAL

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
Allen Electronics Div., Allen Organ Co., Macungie, Pa. ..... p 718
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720-723
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. ... p 724, 725
Collins Radio Co., Newport Beach, Calif. ..... p 728, 729
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1387
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 736
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 737
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.

COILS, TOROIDAL (Cont'd)

RFL Components Div., Powerville Rd., Boonton, N. J.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C. ..... p 692
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Tortel, Inc., 13402 South 71 Highway, Grandview, Mo. .... p 744, 745
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 748, 749
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Unitron, 1624 N. First St., Garland, Texas
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 750
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Zaring Inds., Inc., Box 477, Carmel, Ind. ..... p 753
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aerovox Corp., Box 867, Myrtle Beach, S. C.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
EMR Div., Box 223, Princeton, N. J.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Gorman Machine Corp., 480 S. Main St., Randolph, Mass.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Harder, D. C. Co., Inc., 2580 K St., San Diego, Calif.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Superior Continental Corp., Box 489, Hickory, N. C.
TDC Div., P.O. Box 365, Littleton, Mass.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Toroidal Components Co., 1374 E. Walnut St., Pasadena, Calif.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Western Transformer Co., P.O. Box 945, Tijeras, N. Mex.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, TRANSDUCER

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Tortel, Inc., 13402 South 71 Highway, Grandview, Mo.
United Transformer Co., 150 Varick St., New York, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Data Magnetics Corp., 5441 West 104th St., Los Angeles, Calif.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Endicott Coil Co., Inc., 24 Charlotte St., Binghamton, N. Y.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Tri-Dex Co., 2146 E. Main St., Visalia, Calif.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, TRANSFORMER

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics Inc., Box 609, Columbus, Nebr.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif. ..... p 2860
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
RFL Components Div., Powerville Rd., Boonton, N. J.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Dano Electric Co., Main St., Winsted, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, TV, ALL TYPES

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
RFL Components Div., Powerville Rd., Boonton, N. J.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. ... p 1207
United Transformer Co., 150 Varick St., New York, N. Y.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Beebe Instruments Inc., Box 137, N. White Plains, N. Y.
Bel-Tronics Corp., 344 W. Interstate Rd., Addison, Ill.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Clippard Instr. Inc., 7350-90 Colerain Rd., Cincinnati, Ohio
Delta Coils, 4312 Main St., Philadelphia, Pa.
Diamond Coils, Inc., 540 39th St., Union City, N. J.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, VARIABLE

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720, 722
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. ... p 724, 725
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 731, 732
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y. .. p 734
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 739
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. p 741
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
RFL Components Div., Powerville Rd., Boonton, N. J. ..... p 1473
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C. ..... p 692
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318, 2900
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 750, 751
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Clippard Instr. Inc., 7350-90 Colerain Rd., Cincinnati, Ohio
Delta Coils, 4312 Main St., Philadelphia, Pa.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Coils, Inc., 540 39th St., Union City, N. J.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Otis Radio & Elec. Corp., 222 Ave. E, Hawarden, Iowa
Profile Elctrns., Inc., Box 314, Concord, N. H.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Voltronics, Inc., 7746 W. Addison St., Chicago, Ill.
Warsaw Coil Co., Box 389, Warsaw, Ind.

Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, VIDICON ALIGNMENT

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Cleveland Elctrns., Inc., 2000 Highland Rd., Twinsburg, Ohio p 726, 727
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. ... p 1207
Celco, 70 Constantine Dr., Mahwah, N. J.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, VOICE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Dano Electric Co., Main St., Winsted, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

COILS, WATER—SEE WATER COILS, TUBE COOLING

COINCIDENCE ANALYZERS—SEE ANALYZERS, COINCIDENCE

COLD-CATHODE READOUT TUBES—SEE TUBES, READOUT

COLD TRAPS

Aero Vac Corp., Box 448, Troy, N. Y.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Baron-Blakeslee, Inc., 1620 S. Laramie Ave., Chicago, Ill.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.,) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Granville-Phillips Co., Box 1290, Boulder, Colo.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.

COLLARS

S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Naugler Engineering, Inc., Off Dunham Rd., Beverly, Mass.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.

COLLIMATORS, INFRARED

Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.
Tinsley Labs, Inc., 2448 6th St., Berkeley, Calif.

COLLIMATORS, OPTICAL

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Keuffel & Esser Co., Adams & Third Sts., Hoboken, N. J.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
National Instr. Labs., Inc., 12300 Park Lawn Dr., Rockville, Md.
Nikon, Inc., Instr. Div., 623 Stewart Ave., Garden City, N. J.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Opto-Metric Tools, Inc., 304 Hudson St., New York, N. Y.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.
Thermal American Fused Quartz Co.,
Rte. 202 & Change Bridge Rd., Montville, N. J.
Tinsley Labs, Inc., 2448 6th St., Berkeley, Calif.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

COLORIMETERS

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Coleman Instruments, 42 Madison St., Maywood, Ill.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Lektra Labs., Inc., 129-07 18th Ave., College Point, N. Y.
Magnuson Engineers, Inc., 1010 Timothy Dr., San Jose, Calif.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

COLOR TV EQUIPMENT—SEE CAMERAS, TV (COLOR); MONITORS, VIDEO; RECORDERS, VIDEO TAPE

COMBINERS, DIVERSITY, POST DETECTION

Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411

COMBUSTION INDICATORS—SEE FIRE DETECTION & FIGHTING EQUIPMENT

COMM. SYSTEMS, BROADCAST

AEL Inc., P.O. Box 552, Lansdale, Pa.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
p 1696, 1697
Ampex Corp., 401 Broadway, Redwood City, Calif.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Defense Elctrns., Inc., Rockville, Md.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
Kalart Co., Inc., Hultenius St., Plainville, Conn.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Metrotek Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Raytheon Co., Comm. & Data Proc. Oper.,
Regency Elctrns., Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Round Hill Assoc., Inc., 325 Hudson St., New York, N. Y.
Systems Engineering Ltd., Grouse Creek, Utah
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Tenatronics, Ltd., 3001 Chester Ave., Cleveland, Ohio
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.

COMM. SYSTEMS, CARRIER CURRENT

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J.
p 2791
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Fasco Inds., Inc., Augusta at North Union Sts., Rochester, N. Y.
Femco, Inc., Box F, Irwin, Pa.
General Electric Co., Mountain View Rd., Lynchburg, Va.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Telecomm., Transmission Dept., 2912 Wake Forest Rd., Raleigh, N. C.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.

COMM. SYSTEMS, DATA

Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Talk-A-Phone Co., 5013 No. Kedzie Ave., Chicago, Ill.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

COMM. SYSTEMS, DATA

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Collins Radio Co., Newport Beach, Calif.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 775
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
p 525
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Logic Science, Inc., Box 10096, San Diego, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J.
p 2791
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
p 1696, 1697
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Applied Peripheral Sys., Inc., 7120 Harwin, Houston, Tex.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bolt Beranek & Newman, Inc., 2126 S. Lyon St., Santa Ana, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Codex Corp., 222 Arsenal St., Watertown, Mass.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Colorado Instruments, Inc., 1 Park St., Broomfield, Colo.
Communitype Corp., 767 Fifth Ave., New York, N. Y.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Demex, Inc., 2130 Jefferson, Kansas City, Mo.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
EMR Div., Box 223, Princeton, N. J.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electro-Sciences Div., Sanders Assocs., Inc., 8700 Main St., Buffalo, N. Y.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Femco, Inc., Box F, Irwin, Pa.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Frederick Elctrns. Corp., Hayward Rd., Frederick, Md.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
General Electric Co., Mountain View Rd., Lynchburg, Va.
General Elec. Co., 4000 N. W. 39th Expwy., Oklahoma City, Okla.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Omnitec Inc., Sub. Nytronics, Inc., 903 N. Second St., Phoenix, Ariz.
Pioneer Elec. & Res. Corp., 743 Circle Ave., Forest Pk., Ill.

COMM. SYSTEMS, DATA (Cont'd)

Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Raytheon Co., Comm. & Data Proc. Oper.,
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Sanders Assocs., Inc., Data & Display Dept., Daniel Webster Hwy., S., Nashua, N. H.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Vega Elctrns. Corp., 2115 De La Cruz Blvd., Santa Clara, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Western Telematic, Inc., 5507 Peck Rd., Arcadia, Calif.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.

COMM. SYSTEMS, F-M

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1696, 1697
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Communications Co., Inc., Box 520, Coral Gables, Fla.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
EMR Div., Box 223, Princeton, N. J.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
General Electric Co., Mountain View Rd., Lynchburg, Va.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Pearce-Simpson, Inc., Box 800, Biscayne Annex, Miami, Fla.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Raytheon Co., Comm. & Data Proc. Oper.,
Reach Electronics, Inc., Box 308, Lexington, Nebr.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Trutone Elctrns., Inc., 14660 Raymer St., Van Nuys, Calif.
Unimetrics, Inc., 39 Werman Ct., Plainview, N. Y.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Weitermann Electronics, 4549 North 38th St., Milwaukee, Wisc.

COMM. SYSTEMS, FACSIMILE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Defense Elctrns., Inc., Rockville, Md.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Frederick Elctrns. Corp., Hayward Rd., Frederick, Md.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Raytheon Co., Comm. & Data Proc. Oper.,
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telautograph Corp., 8700 Bellanca Ave., Los Angeles, Calif.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

COMM. SYSTEMS, FREQUENCY SHIFT

Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Collins Radio Co., Dallas, Texas
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Femco, Inc., Box F, Irwin, Pa.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Frederick Elctrns. Corp., Hayward Rd., Frederick, Md.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Integrated Elctrns. Corp., 900 Walt Whitman Rd., Huntington Sta., N. Y.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Noller Control Systems, Inc., 150 E. Standard Ave., Richmond, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.

COMM. SYSTEMS, INDUCTION

Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Parcoe, Inc., 4501 Prospect Ave., Cleveland, Ohio
Round Hill Assoc., Inc., 325 Hudson St., New York, N. Y.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.

COMM. SYSTEMS, INFRARED, ULTRAVIOLET

AEL Inc., P.O. Box 552, Lansdale, Pa.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
Flame Research, Inc., Box 10502, Pittsburgh, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.

COMM. SYSTEMS, INTERCOM—SEE INTERCOMMUNICATION SYSTEMS

COMM. SYSTEMS, LASER

Electro/Data Inc., 3121 Benton St., Garland, Tex.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Flame Research, Inc., Box 10502, Pittsburgh, Pa.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Resalab, Inc., 4000 Campbell Ave., Menlo Park, Calif.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

COMM. SYSTEMS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1696, 1697
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
General Electric Co., Mountain View Rd., Lynchburg, Va.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Telecomm., Transmission Dept., 2912 Wake Forest Rd., Raleigh, N. C.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Telefunken Sales Corp., South St., Garden City, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

COMM SYSTEMS, MUTIPLEX

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Logic Science, Inc., Box 10096, San Diego, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EMR Div., Box 223, Princeton, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Farinon Electric, 935 Washington St., San Carlos, Calif.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
General Electric Co., Mountain View Rd., Lynchburg, Va.

Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
ITT Telecomm., Transmission Dept., 2912 Wake Forest Rd., Raleigh, N. C.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Superior Continental Corp., Box 489, Hickory, N. C.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Systems Engineering Ltd., Grouse Creek, Utah
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.

COMM SYSTEMS, PORTABLE (INDUSTRIAL)

Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arkay International, 2372-82 Linden Blvd., Brooklyn, N. Y.
Audio Equip. Co., Inc., 75 Harbor Rd., Port Washington, N. Y.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bennett Labs., Inc., 5800 Christie, Emeryville, Calif.
Clark, D. Co., Inc., 360 Franklin St., Worcester, Mass.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Defense Elctrns., Inc., Rockville, Md.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Fanon Elctrn. Inds., 439 Frelinghuysen Ave., Newark, N. J.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Fisher-Berkeley Corp., 5800 Christie, Emeryville, Calif.
General Electric Co., Mountain View Rd., Lynchburg, Va.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Holmin, W. A. Corp., 1325 Seventh St., Rockford, Ill.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Multitone Electronics, Inc., 111 Broadway, New York, N. Y.
North Electric Co., 553 S. Market St., Galion, Ohio
Pace Comms. Corp., 24049 S. Frampton, Harbor City, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Radio Specialty Mfg. Co., 2023 Southeast 6th Ave., Portland, Ore.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Unimetrics, Inc., 39 Werman Ct., Plainview, N. Y.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Video Research Corp., 761 N. Washington St., Rockville, Md.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.

COMM. SYSTEMS, RADIOTELEPHONE

Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Collins Radio Co., Dallas, Texas
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Gray Radio Co., Inc., 501 Forest Hill Blvd., W. Palm Beach, Fla.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Systems Engineering Ltd., Grouse Creek, Utah
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Unimetrics, Inc., 39 Werman Ct., Plainview, N. Y.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

COMM. SYSTEMS, SELECTIVE PAGING

Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Autocall Co., 366 Mack Ave., Shelby, Ohio
Bennett Labs., Inc., 5800 Christie, Emeryville, Calif.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Edwards Co., Inc., 90 Connecticut Ave., Norwalk, Conn.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fanon Elctrn. Inds., 439 Frelinghuysen Ave., Newark, N. J.
Faraday, Inc., 805 S. Maumee, Tecumseh, Mich.
Fisher-Berkeley Corp., 5800 Christie, Emeryville, Calif.
Gai-Tronics Corp., Box 31, Reading, Pa.
General Electric Co., Mountain View Rd., Lynchburg, Va.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loge Electronics, 2171 W. Washington Blvd., Los Angeles, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Metrotek Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Multitone Electronics, Inc., 111 Broadway, New York, N. Y.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
North Electric Co., 553 S. Market St., Galion, Ohio
Parcoe, Inc., 4501 Prospect Ave., Cleveland, Ohio
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
Reach Electronics, Inc., Box 308, Lexington, Nebr.
Regency Elctrns., Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Round Hill Assoc., Inc., 325 Hudson St., New York, N. Y.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Unimetrics, Inc., 39 Werman Ct., Plainview, N. Y.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Vega Elctrns. Corp., 2115 De La Cruz Blvd., Santa Clara, Calif.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

COMM. SYSTEMS, SINGLE-SIDEBAND

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Heath Co., Dept. 180, Benton Harbor, Mich.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Electric Co., Mountain View Rd., Lynchburg, Va.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.

COMM SYSTEMS, TELEMETERING

Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Squires-Sanders Inc., Martinsville Rd., Liberty Corner, N. J.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

COMM. SYSTEMS, TELEMETERING

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Collins Radio Co., Newport Beach, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Fifth Dimension Inc., Box 483, Princeton, N. J.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1696, 1697
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Raven St., Sepulveda, Cal.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. ..... p 2794
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Yejser Labs., 881 West 18th St., Costa Mesa, Calif. ..... p 1574
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Applied Peripheral Sys., Inc., 7120 Harwin, Houston, Tex.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Bristol Co., Box 1790, Waterbury, Conn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Destron Co., 25914 Chalmette La., Rolling Hills Est, Calif.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dorsett Electronics, Box 36, Tulsa, Okla.
EMR Div., Box 223, Princeton, N. J.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Railway Signal Co., Rochester, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microcom Corp., Horsham Valley Industrial Park, Horsham, Pa.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.

COMM. SYSTEMS, TELEMETERING (Cont'd)

Moore Assocs. Div., 815 American St., San Carlos, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Noller Control Systems, Inc., 150 E. Standard Ave., Richmond, Calif.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Prodelin, Inc., Box 131, Hightstown, N. J.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
3M Co., 3M Center, St. Paul, Minn.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Vega Elctrns. Corp., 2115 De La Cruz Blvd., Santa Clara, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

COMM. SYSTEMS, TELEPHONE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. ... p 1697
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Systems, Inc., 13901 Saticoy St., Van Nuys, Calif.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Nitsuko Ltd., 260 Kitamikata, Kawasaki, Japan
Auth Electric Co., Inc., 34-20 45th St., Long Island City, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Bliss Electronic Corp., Box 366, Sussex, N. J.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Continental Electronics Corp., 302 McGuinness Blvd., Brooklyn, N. Y.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Encom Prods. Co., Inc., Box 68, Oxford, Pa.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Fanon Elctrn. Inds., 439 Frelinghuysen Ave., Newark, N. J.
Faraday, Inc., 805 S. Maumee, Tecumseh, Mich.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Femco, Inc., Box F, Irwin, Pa.
Ford Inds., Inc., Box 06459, Portland, Ore.
Gai-Tronics Corp., Box 31, Reading, Pa.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Telecommunications, Fulton Dr., Corinth, Miss.
ITT Telecomm., Transmission Dept., 2912 Wake Forest Rd., Raleigh, N. C.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
North Electric Co., 553 S. Market St., Galion, Ohio
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Roche, P. C. Co., Inc., 11 Park Pl., New York, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Superior Continental Corp., Box 489, Hickory, N. C.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Systems Engineering Ltd., Grouse Creek, Utah
Ultra Audio Products, Box 921, Beverly Hills, Calif.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.

COMM. SYSTEMS, TELETYPE

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Collins Radio Co., Dallas, Texas
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Defense Elctrns., Inc., Rockville, Md.
Demex, Inc., 2130 Jefferson, Kansas City, Mo.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Frederick Elctrns. Corp., Hayward Rd., Frederick, Md.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Pioneer Elec. & Res. Corp., 743 Circle Ave., Forest Pk., Ill.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Teledata, Inc., 98-05 217th St., Queens Village, N. Y.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Western Telematic, Inc., 5507 Peck Rd., Arcadia, Calif.

COMM. SYSTEMS, VEHICLE MOUNTED

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communications Co., Inc., Box 520, Coral Gables, Fla.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Defense Elctrns., Inc., Rockville, Md.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
General Electric Co., Mountain View Rd., Lynchburg, Va.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Telecommunications, Fulton Dr., Corinth, Miss.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Metrotek Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
North Electric Co., 553 S. Market St., Galion, Ohio
Pace Comms. Corp., 24049 S. Frampton, Harbor City, Calif.
Pearce-Simpson, Inc., Box 800, Biscayne Annex, Miami, Fla.
Plectron Corp., Overton, Nebr.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Regency Elctrns., Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Squires-Sanders Inc., Martinsville Rd., Liberty Corner, N. J.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Unimetrics, Inc., 39 Werman Ct., Plainview, N. Y.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

COMMUTATORS, ROTARY

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Airflyte Electronics Co., Box 207, Bayonne, N. J.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1722
Carter Mfg. Corp., 23 Washington St., Hudson, Mass. ..... p 2459
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. ..... p 2463
Duncan Electronics Inc., 2865 Fairview Rd., Costa Mesa, Calif. .. p 2468
Fabricast Inc., 9835 Alpaca St., South El Monte, Calif. ... p 1730, 1731
Fifth Dimension Inc., Box 483, Princeton, N. J.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Theta Instrument Corp., Fairfield, N. J.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
Collectron Corp., 304 East 45th St., New York, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electro-Miniatures Corp., 600 Huyler St., S. Hackensack, N. J.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Intellux, Inc., Box 548, Goleta, Calif.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Midwest Molding & Mfg. Co., Gurnee, Ill.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
Nippert Electric Products Co., 825 Pittsburgh Dr., Delaware, Ohio
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Sibley Co., Haddam, Conn.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Toledo Commutator Co., Owosso, Mich.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.

COMMUTATORS, SWITCHING

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Airflyte Electronics Co., Box 207, Bayonne, N. J. ..... p 1722
Carter Mfg. Corp., 23 Washington St., Hudson, Mass. ..... p 2459
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. ..... p 2463
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif.
Duncan Electronics Inc., 2865 Fairview Rd., Costa Mesa, Calif. .. p 2468
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y. p 1729
Fabricast Inc., 9835 Alpaca St., South El Monte, Calif. ..... p 1731
Fifth Dimension Inc., Box 483, Princeton, N. J.
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Markite Corp., 155 Waverly Pl., New York, N. Y.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. ..... p 2795
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Theta Instrument Corp., Fairfield, N. J.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Tracor Inc., 6500 Tracor La., Austin, Texas
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Collectron Corp., 304 East 45th St., New York, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Electro-Miniatures Corp., 600 Huyler St., S. Hackensack, N. J.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Intellux, Inc., Box 548, Goleta, Calif.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
RC-95, Inc., 9 East 38th St., New York, N. Y.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Sibley Co., Haddam, Conn.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Toledo Commutator Co., Owosso, Mich.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.

COMPARATORS, ATTENUATION

Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md. .... p 1529
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

COMPARATORS, CAPACITANCE—SEE BRIDGES, CAPACITANCE

COMPARATORS, CIRCUIT LINEARITY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 523
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

COMPARATORS, DENSITY—SEE DENSITOMETERS

COMPARATORS, DIGITAL

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1334
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 523
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 772, 773
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Logic Science, Inc., Box 10096, San Diego, Calif.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. .. p 797
Specific Products, 1237 S. Shamrock Ave., Monrovia, Cal. ..... p 756
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Theta Instrument Corp., Fairfield, N. J.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
3M Co., 3M Center, St. Paul, Minn.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COMPARATORS, FREQUENCY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Heath Co., Dept. 180, Benton Harbor, Mich.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1489, 1497
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Vectron Laboratories, Inc., 146 Selleck St., Stamford, Conn. ... p 1136
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Collins Radio Co., Dallas, Texas
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Lavoie Labs., Div. Spedcor, Matawan-Freehold Rd., Morganville, N. J.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COMPARATORS, IMPEDANCE—SEE BRIDGES, IMPEDANCE

COMPARATORS, INDUCTANCE—SEE BRIDGES, INDUCTANCE

COMPARATORS, OPTICAL

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Ex-Cell-O Corp., Contour Projector Dept., Box 386, Detroit, Mich.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Mann, David W. Co., 174 Middlesex Turnpike, Burlington, Mass.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nikon, Inc., Instr. Div., 623 Stewart Ave., Garden City, N. J.
Olympus Corp. of America, Two Nevada Dr., New Hyde Park, N. Y.
Opto-Metric Tools, Inc., 304 Hudson St., New York, N. Y.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Ragen Precision Inds., Inc., 9 Porete Ave., N. Arlington, N. J.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tinsley Labs, Inc., 2448 6th St., Berkeley, Calif.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

COMPARATORS, PHASE

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 523
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1453
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1497
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Theta Instrument Corp., Fairfield, N. J.
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Collins Radio Co., Dallas, Texas
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.

COMPARATORS, VOLTAGE

RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

COMPARATORS, Q

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.

COMPARATORS, RELUCTANCE

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.

COMPARATORS, RESISTANCE—SEE BRIDGES, RESISTANCE

COMPARATORS, SURFACE—SEE INDICATORS, SURFACE ROUGHNESS

COMPARATORS, VOLTAGE

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1334
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2658
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Chronatics, 500 Nuber Ave., Mt. Vernon, N. Y.
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 523
Data Technology Inc., 65 Grove St., Watertown, Mass.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1406
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1412
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Logic Science, Inc., Box 10096, San Diego, Calif.
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. .. p 2309
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. .. p 797
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1500
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Tektronix, Inc., Box 500, Beaverton, Ore.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Analogic Co., 296 Newton St., Waltham, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Bay Laboratories, Inc., 20160 Center Ridge Rd., Cleveland, Ohio
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Control Data Corp., Magsense Prods. Oper., 775 Colorado Ave., S., Minneapolis, Minn.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Electrical Refractories Co., 50 E. Clark St., E. Palestine, Ohio
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Maytronics, Inc., Box 460, Colorado Springs, Colo.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.

COMPARATORS, VOLTAGE (Cont'd)

Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Roveti Instruments, 238 West St., Annapolis, Md.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

COMPASSES, ELECTRONIC GYRO

Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Aviation Instr. Mfg. Corp., 9033 Monroe Rd., Houston, Tex.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

COMPENSATORS, ANGULAR MOTION

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.

COMPENSATORS, LEAD RESISTANCE

Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.

COMPONENT SUBSTITUTORS—SEE TEST EQUIP., COMPONENT SUBSTITUTING

COMPOUNDS, ANTISTATIC—SEE COATINGS, ANTISTATIC

COMPOUNDS, ENCAPSULATING, MOLDING, POTTING—ALSO SEE PLASTIC RAW MATERIALS

Astrodyne Inc., 207 Cambridge St., Burlington, Mass. ..... p 2507
Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y. p 706, 707
Dow Corning Corp., Midland, Mich. ..... p 1580–1583
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 705
Ablestik Adhesive Co., Inc., 833 W. 182nd St., Gardena, Cal.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
Acme Resin Co., Div. Corn Prods. Co., 1401 Circle Ave., Forest Park, Ill.
Adams & Assoc., Inc., 1062 N. Orange Grove Ave., Hollywood, Calif.
Adhesive Products Corp., 1660 Boone Ave., Bronx, N. Y.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Analytical Chemical Labs., 22 W. Madison, Chicago, Ill.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Armstrong Products Company, Inc., P.O. Box 657, Warsaw, Ind.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
CRC Chemicals, Div. C. J. Webb, Dresher, Pa.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Daylen Co., Box 527, South Gate, Calif.
Dennis Chemical Co., 2701 Papin St., St. Louis, Mo.
Diamond Shamrock Chemical Co., 175 Schuyler Ave., N. Arlington, N. J.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dow Chemical Co., Midland, Mich.
Durez Plastics Div., 1921 Walck Rd., N. Tonawanda, N. Y.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Fiberite Corp., 515-559 W. 3 St., Winona, Minn.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
G. E. Co., Insulator Dept., 2525 Insulator Dr., Baltimore, Md.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hi-Test Chemical Corp., 40 Blanchard St., Newark, N. J.
Hightemp Resins Inc., 225 Greenwich Ave., Stamford, Conn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hysol Div., 211 Franklin St., Olean, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Kano Labs., Inc., 1000 Thompson La., Nashville, Tenn.
Kenics Corp., One Southside Rd., Danvers, Mass.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Midsil Corp., 27 Bland St., Emerson, N. J.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Molded Fiber Glass Cos., 4401 Benefit Ave., Ashtabula, Ohio
Morton Chemical Co., 110 N. Wacker Dr., Chicago, Ill.
Nitine, Inc., Rte. 46, Clifton, N. J.
Nopco Chemical Div., 60 Park Pl., Newark, N. J.
Pacific Resins & Chemicals, Inc., 3142 W. Mill Ct., Milwaukee, Wisc.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Penn-Union Elec., A Teledyne Co., Box 723, Edinboro, Pa.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Rawn Company, Inc., Box 9, Spooner, Wisc.
Rector Engrg. & Plastics Co., 318 Randolph Pl., N. E., Washington, D. C.
Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Rogers Corp., Rogers, Conn.
Sauereisen Cements Co., 160 Gamma Dr., Pittsburgh, Pa.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Seal-Peel, Inc., 775 Stephenson Hwy., Royal Oak, Mich.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Smooth-On, Inc., 1000 Valley Rd., Gillette, N. J.
Stauffer Chemical Co., Silicone Dept., 299 Park Ave., New York, N. Y.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Stevenson Bros. & Co., 110 Race St., Philadelphia, Pa.
Techform Labs., Inc., 707 S. Hampton Dr., Venice, Calif.
3M Co., 3M Center, St. Paul, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Tra-Con, Inc., 55 North St., Medford, Mass.
U S Polymeric, Inc., 700 E. Dyer Rd., Santa Ana, Calif.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Western Coating Co., Box 598, Royal Oak, Mich.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zophar Mills, Inc., 112-130 26th St., Brooklyn, N. Y.
Zurn Inds., 12th & Plum St., Erie, Pa.

COMPOUNDS, WEATHERPROOFING—SEE COATINGS, WEATHERPROOFING

COMPRESSORS, DATA & SPEECH

Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. ..... p 2794
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Signatron, Inc., 594 Marrett Rd., Lexington, Mass.
Teledyne Telemetry Co., Box 341, Princeton, N. J.

COMPUTER LOGIC CIRCUITS—SEE CARDS, LOGIC: CIRCUITS, HYBRID: CIRCUITS, INTEGRATED: MODULES, LOGIC

COMPUTER MEMORY TESTERS—SEE TESTERS, COMPUTER MEMORY

COMPUTER TAPE RECORDERS—SEE DATA RECORDERS

COMPUTER TEACHING DEVICES—SEE TEACHING MACHINES

COMPUTER TYPE INDICATORS—SEE LIGHTS; DIALS; READOUTS

COMPUTERS, ANALOG

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1029, 1033, 1036
Heath Co., Dept. 180, Benton Harbor, Mich.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 1054
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Applied Dynamics, Inc., 2275 Platt Rd., Ann Arbor, Mich.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
Bailey Meter Company, Wickliffe, Ohio
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electron-Machine Corp., Box M, Umatilla, Fla.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Ensco, Inc., 3100 Eldredge St., Salt Lake City, Utah
Ferranti Ltd., Hollinwood, Lancs., Eng.
Foxboro, Foxboro, Mass.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
General Computers Inc., 5990 W. Pico Blvd., Los Angeles, Calif.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Standard Electric Time Corp., 89 Logan St., Springfield, Mass.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

COMPUTERS, DESK TOP (DIGITAL)

Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass. .. p 815
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Computer Automation, Inc., 895 W. Sixteenth St., Newport Beach, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Olivetti Underwood Corp., One Park Ave., New York, N. Y.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

COMPUTERS, DIGITAL (GENERAL PURPOSE)

Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. .. p 797
Republic Corp., 9754 Deering Ave., Chatsworth, Calif. ..... p 800
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass. .. p 815
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Computer Automation, Inc., 895 W. Sixteenth St., Newport Beach, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
EMR Computer, 8001 Bloomington Frwy., Minneapolis, Minn.
EMR Div., Box 223, Princeton, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Lockheed Elctrns. Co., 6201 E. Randolph, Los Angeles, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Olivetti Underwood Corp., One Park Ave., New York, N. Y.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Redcor Corp., Box 1031, Canoga Park, Calif.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Spear Computers, Inc., 335 Bear Hill Rd., Waltham, Mass.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.
Systems Eng. Labs in Batch 37 should be.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor Comptometer Corp., 3900 N. Rockwell St., Chicago, Ill.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

COMPUTERS, DIGITAL (SPECIAL PURPOSE)

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J.
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
Electronic Modules Corp., P.O. Box 141, Timonium, Md.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Logic Science, Inc., Box 10096, San Diego, Calif.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa. p 794
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif... p 797
Republic Corp., 9754 Deering Ave., Chatsworth, Calif. ..... p 800
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Theta Instrument Corp., Fairfield, N. J.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass. .. p 815
AAI Corp., Box 6767, Baltimore, Md.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bailey Meter Company, Wickliffe, Ohio
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Blake Electronics Inc., Muskego, Wisc.
Boston Digital Corp., 21 Main St., Ashland, Mass.
Bristol Co., Box 1790, Waterbury, Conn.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Bunker-Ramo Corp., 445 Fairfield Ave., Stamford, Conn.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
C. E. Wire Co., 4011 McClure Ct., Fort Wayne, Ind.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Computer Automation, Inc., 895 W. Sixteenth St., Newport Beach, Calif.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
Datacraft Corp., P.O. Box 23550, Ft. Lauderdale, Fla.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Defense Elctrns., Inc., Rockville, Md.
Design Automation, Inc., 809 Massachusetts Ave., Lexington, Mass.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
EMR Computer, 8001 Bloomington Frwy., Minneapolis, Minn.
EMR Div., Box 223, Princeton, N. J.
Electromec, Inc., 209 N. Tradd St., Statesville, N. C.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fabri-Tek Instruments, Inc., 5225 Verona Rd., Madison, Wisc.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Ferranti-Packard Ltd., 121 Industry St., Toronto, Ont., Can.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Harworth Mfg. Co., 2881 El Camino Real, Redwood City, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Keuffel & Esser Co., Adams & Third Sts., Hoboken, N. J.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kybe Corp., 132 Calvary St., Waltham, Mass.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
NUS Corp., Box 248, Paramus, N. J.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
RC-95, Inc., 9 East 38th St., New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Redcor Corp., Box 1031, Canoga Park, Calif.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Spear Computers, Inc., 335 Bear Hill Rd., Waltham, Mass.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Time Share Peripherals Corp., Box 361, Wilton, Conn.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor Comptometer Corp., 3900 N. Rockwell St., Chicago, Ill.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COMPUTERS, HYBRID, ANALOG-DIGITAL

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif.
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Intronics, Inc., 57 Chapel St., Newton, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Theta Instrument Corp., Fairfield, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 1054
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
Applied Dynamics, Inc., 2275 Platt Rd., Ann Arbor, Mich.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Bailey Meter Company, Wickliffe, Ohio
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Defense Elctrns., Inc., Rockville, Md.
Design Automation, Inc., 809 Massachusetts Ave., Lexington, Mass.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Time Share Peripherals Corp., Box 361, Wilton, Conn.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

COMPUTERS, RADIAC—SEE ANALYZERS, RADIATION

COMPUTING EQUIPMENT, PERIPHERAL—SEE CONVERTERS; COUNTERS; PRINTERS; ETC.

CONDENSERS—SEE CAPACITORS

CONDUCTIVE FABRICS, FILMS & TAPES—SEE FABRICS, CONDUCTIVE

CONDUCTIVE PLASTIC PARTS—SEE MATERIALS & PARTS, CONDUCTIVE PLASTIC

CONNECTOR ADAPTERS

CONDUIT, ELECTRICAL

Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill.
Wiremold Co., Hartford, Conn. ..... p 1010, 1011
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Cerro Corp., 300 Park Ave., New York, N. Y.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Ideas, Inc., 118 Grand Ave., Laramie, Wyo.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Monsanto Co., 200 North 7th St., Kenilworth, N. J.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Taylor Electric, Inc., Fisher Rd., Howell, Mich.
Titeflex, Inc., Hendee St., Springfield, Mass.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

CONES, SPEAKER—SEE SPEAKER CONES

CONNECTOR ADAPTERS

AMP Incorporated, Box 3608, Harrisburg, Pa.
APM-Hexseal Corp., 44 Honeck St., Englewood, N. J.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Americon Corp., 87 Rumford Ave., Waltham, Mass. ..... p 834
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 836, 860, 861, 870-872, 874, 875
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 892
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. ..... p 900
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Hughes Aircraft, Connecting Devices, Box H, Newport Beach, Calif. p 906
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio ..... p 985
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 877
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. p 935-940, 942, 946, 966, 968, 970-974
Reynolds Industries, Inc., Box P-850, Marina Del Ray, Cal. .. p 980, 981
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio ..... p 983
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 988
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 986
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill. .... p 1009
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Cable-Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carol Cable Co., Box 68, Pawtucket, R. I.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General RF Fittings, Box 278, Port Salerno, Fla.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Glenair, Inc., 1211 Air Way, Glendale, Calif.
Gremar, Inc., 10 Micro Dr., Woburn, Mass.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Massey, A. H., Inc., 111 Third St., Derby, Conn.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Prodelin, Inc., Box 131, Hightstown, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Staffall Inc., 7 Woodland St., Providence, R. I.
Superior Continental Corp., Box 489, Hickory, N. C.

CONNECTOR ADAPTERS (Cont'd)

Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wiggins, E. B., Inc., 5000 Triggs St., Los Angeles, Calif.

CONNECTOR BOXES & STRIPS, POWER OUTLET

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Wiremold Co., Hartford, Conn. ..... p 1010, 1011
Antennacraft Co., Box 1005, Hwy. 34, W., Burlington, Iowa
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Electro Oceanics, Inc., 2000 S. Santa Fe Ave., Compton, Calif.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.

CONNECTORS & TERMINALS, PUSH-ON, QUICK DISCONNECT

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Americon Corp., 87 Rumford Ave., Waltham, Mass. ..... p 834
Burndy Corporation, Richards Ave., Norwalk, Conn. ..... p 880, 883
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 893
Electronic Molding Corp., 44 Church St., Pawtucket, R. I. ..... p 901
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif. p 905
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio ..... p 984
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill. .... p 925-927
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio p 930
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill. .... p 1009
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Avdel Inc., 210 S. Victory Blvd., Burbank, Calif.
Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Doran Mfg. Co., 1033 Bader St., Cincinnati, Ohio
ETC, Inc., 990 East 67 St., Cleveland, Ohio
Electric Terminal Corp., Drawer E, Pilgrim Sta., Warwick, R. I.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
General Staple Co., 28 East 22nd St., New York, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Helwig Carbon Prods., Inc., 2550 North 30th St., Milwaukee, Wisc.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Hollingsworth Solderless Terminal Co., Box 430, Phoenixville, Pa.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Marshall J. Assocs., Inc., Box 6276, Bridgeport, Conn.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Nutmeg Screw Machine Products, P.O. Box 1470, Waterbury, Conn.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Penn-Union Elec., A Teledyne Co., Box 723, Edinboro, Pa.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Wiggins, E. B., Inc., 5000 Triggs St., Los Angeles, Calif.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

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Lab-Tronics, 6225 Benore Rd., Toledo, Ohio ..... p 985
Matrix Science Corp., 435 Maple Ave., Torrance, Calif.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Accratronics Seals Corp., 2121 Kenmere Ave., Burbank, Calif.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carol Cable Co., Box 68, Pawtucket, R. I.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Penn-Union Elec., A Teledyne Co., Box 723, Edinboro, Pa.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Sittler Corp., 18 N. Ada St., Chicago, Ill.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

CONNECTORS, CIRCULAR, AUDIO

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 836, 850-854, 867, 868
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Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Barker Products Co., 344 Central St., Saugus, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.

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Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Electro Oceanics, Inc., 2000 S. Santa Fe Ave., Compton, Calif.
Equipment & Service Co., 7118 Envoy Ct., Dallas, Tex.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Mecca, P.O. Box 36393, Houston, Tex.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

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Accratronics Seals Corp., 2121 Kenmere Ave., Burbank, Calif.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Astro Seal, Inc., 1710 Chico, S. El Monte, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Electro Oceanics, Inc., 2000 S. Santa Fe Ave., Compton, Calif.
Electronic Seals Co., Inc., 13766 Saticoy St., Van Nuys, Calif.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
General RF Fittings, Box 278, Port Salerno, Fla.
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Thermal Controls Inc., 75 Rutgers St., Belleville, N. J.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.

CONNECTORS, CIRCULAR, HIGH VOLTAGE

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 831
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 850-857, 860, 861, 864, 867
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Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Delta Plastics Co., 776 Creek Rd., Bellmawr, N. J.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Electro Oceanics, Inc., 2000 S. Santa Fe Ave., Compton, Calif.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
General RF Fittings, Box 278, Port Salerno, Fla.
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Mecca, P.O. Box 36393, Houston, Tex.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.

Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.

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AMP Incorporated, Box 3608, Harrisburg, Pa.
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 836, 851-854, 857, 863-868
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Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Hughes Aircraft, Connecting Devices, Box H, Newport Beach, Calif. p 906
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Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Accratronics Seals Corp., 2121 Kenmere Ave., Burbank, Calif.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Armel Electronics Inc., 1601-75th St., N. Bergen, N. J.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Crimpco Engrg., 7341 Canoga Ave., Canoga Park, Calif.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Delta Plastics Co., 776 Creek Rd., Bellmawr, N. J.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General RF Fittings, Box 278, Port Salerno, Fla.
Gremar, Inc., 10 Micro Dr., Woburn, Mass.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Multicon Div., Box 899, Ft. Wayne, Ind.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
3M Co., 3M Center, St. Paul, Minn.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Wiggins, E. B., Inc., 5000 Triggs St., Los Angeles, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.

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Bendix Corp., Electrical Components Div., Sidney, N. Y.

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GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
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Flexible Products, Inc., 2678 East 7th Ave., N. St. Paul, Minn.
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Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
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Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
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Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
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Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
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Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
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Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.

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Samarius Inc., 300 Seymour Ave., Derby, Conn.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
ECCO Elctrn. Comps. Corp., 157 S. MacQuesten Pkwy., Mt. Vernon, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.
Nutmeg Screw Machine Products, P.O. Box 1470, Waterbury, Conn.

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ITT Cannon Elec., 3208 Humboldt St., Los Angeles, Cal. p 907, 908, 910
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American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Staffali Inc., 7 Woodland St., Providence, R. I.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

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Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Electro Oceanics, Inc., 2000 S. Santa Fe Ave., Compton, Calif.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.

Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Staffall Inc., 7 Woodland St., Providence, R. I.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

CONNECTORS, RECTANGULAR, HERMETIC

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Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Continental Connector Corp., 34-63 56th St., Woodside, N. Y.
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif. p 905
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Accratronics Seals Corp., 2121 Kenmere Ave., Burbank, Calif.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Astro Seal, Inc., 1710 Chico, S. El Monte, Calif.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Electrical Inds., 691 Central Ave., Murray Hill, N. J.
Electro Oceanics, Inc., 2000 S. Santa Fe Ave., Compton, Calif.
Electronic Seals Co., Inc., 13766 Saticoy St., Van Nuys, Calif.
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Thermal Controls Inc., 75 Rutgers St., Belleville, N. J.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

CONNECTORS, RECTANGULAR, HERMAPHRODITIC

Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
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AMP Incorporated, Box 3608, Harrisburg, Pa.
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Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
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Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Masterite Inds. Corp., 2841 W. Lomita Blvd., Torrance, Cal.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.

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Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn. ..... p 888
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Armel Electronics Inc., 1601-75th St., N. Bergen, N. J.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Eltee, Inc., 19 Fairfield Pl., W. Caldwell, N. J.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Industrial Circuits Co., 23 Kulick Rd., Fairfield, N. J.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Masterite Inds. Corp., 2841 W. Lomita Blvd., Torrance, Cal.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Staffall Inc., 7 Woodland St., Providence, R. I.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.

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Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
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Armel Electronics Inc., 1601-75th St., N. Bergen, N. J.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Eltee, Inc., 19 Fairfield Pl., W. Caldwell, N. J.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
Industrial Circuits Co., 23 Kulick Rd., Fairfield, N. J.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Masterite Inds. Corp., 2841 W. Lomita Blvd., Torrance, Cal.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.

CONTACT STRIPS, FINGER

North Electric Co., 553 S. Market St., Galion, Ohio
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Staffall Inc., 7 Woodland St., Providence, R. I.
Thermal Controls Inc., 75 Rutgers St., Belleville, N. J.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
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Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
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Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
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American Radar Components, Inc., 415 E. Main St., Denville, N. J.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
General RF Fittings, Box 278, Port Salerno, Fla.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.

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Control Prods. Corp., 4431 W. Division St., Chicago, Ill. .. p 2806, 2811
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Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo. ..... p 931
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Astrolab, Inc., 4 McCandless St., Linden, N. J.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Harco Labs, Inc., 186 Cedar St., Branford, Conn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.

CONNECTORS, TRIAXIAL

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CONNECTORS, WATERPROOF

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Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
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Astrolab, Inc., 4 McCandless St., Linden, N. J.
Electro Oceanics, Inc., 2000 S. Santa Fe Ave., Compton, Calif.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Massa Div., 280 Lincoln St., Hingham, Mass.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Roylyn Inc., 620 Paula Ave., Glendale, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.

CONSOLES, CABINET— SEE CABINETS & ACCESSORIES, METAL

CONTACT CLEANERS—SEE CLEANERS & SOLVENTS—ALSO SEE BURNISHERS, CONTACT

CONTACT STRIPS, FINGER

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.

CONTACT STRIPS, FINGER (Cont'd)

Englehard Minerals & Chemicals Corp., H. A. Wilson Dept., U.S. Rte. #22, Union, N. J. ..... p 1644
Instrument Specialties Co., Inc., 254 Bergen Blvd., Little Falls, N. J. p 1222, 1223
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eimac, 301 Industrial Way, San Carlos, Calif.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Tricon Mfg. Co., 2325 Wisconsin Ave., Downer Grove, Ill.

CONTACTORS—SEE RELAYS, POWER

CONTACTS, ELECTRICAL

AMP Incorporated, Box 3608, Harrisburg, Pa.
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
AirBorn, Inc., 2618 Manana Dr., Dallas, Tex. ..... p 833
Airflyte Electronics Co., Box 207, Bayonne, N. J.
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 837, 844, 846, 849, 862, 866
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Englehard Minerals & Chemicals Corp., H. A. Wilson Dept., U.S. Rte. #22, Union, N. J. ..... p 1644
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Hughes Aircraft, Connecting Devices, Box H, Newport Beach, Calif. p 906
ITT Cannon Elec., 3208 Humboldt St., Los Angeles, Cal. ..... p 910
Instrument Specialties Co., Inc., 254 Bergen Blvd., Little Falls, N. J. p 1222, 1223
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo. ..... p 931
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass.
Pyle-National Co., Connector Div., 1334 N. Kostner Ave., Chicago, Ill.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Armel Electronics Inc., 1601-75th St., N. Bergen, N. J.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Carol Cable Co., Box 68, Pawtucket, R. I.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Contacts, Inc., 1100 Silas Dean Hwy., Wethersfield, Conn.
Crimpco Engrg., 7341 Canoga Ave., Canoga Park, Calif.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Deringer Metallurgical Corp., 1250 Town Line Rd., Mundelein, Ill.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electric Terminal Corp., Drawer E, Pilgrim Sta., Warwick, R. I.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Flight Connector Corp., 14128 Lemoli Ave., Hawthorne, Calif.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Holmberg, Inc., 20 Melville Park Rd., Melville, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Mallory Metallurgical Co., 3029 E. Washington St., Indianapolis, Ind.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Ostby & Barton Co., Box 6267, Providence, R. I.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Servometer Corp., 82 Industrial E., Clifton, N. J.
Sinclair Mfg. Co., Chartley, Mass.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Stackpole Carbon Co., Carbon Div., Stackpole St., St. Marys, Pa.
Stanley Industrial Components Div., Stanley Works, Forestville, Conn.
Superior Carbon Prods., Inc., 9115 George Ave., Cleveland, Ohio
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.
Townsend Co., TRS Div., 530 West St., Braintree, Mass.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tricon Mfg. Co., 2325 Wisconsin Ave., Downer Grove, Ill.
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Volkert Stampings, Inc., 222-34 96th Ave., Queens Village, N. Y.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.

CONTAINERS, SHIELDED (ALL TYPES)

Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
M M Electronic Enclosures, Inc., 111 Bloomingdale Rd., Hicksville, N. Y. p 584
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. p 956-959
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Allegheny Ludlum Steel Co., H. W. Oliver Bldg., Pittsburgh, Pa.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Danex Corp., 60 Tomlinson Rd., Huntingdon Valley, Pa.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Environmental Container Systems, Box 337, Union City, Calif.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CONTAINERS, SHIPPING, METAL & FIBERGLASS (REUSABLE)—ALSO SEE TRANSIT CASES

American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J. p 575
M M Electronic Enclosures, Inc., 111 Bloomingdale Rd., Hicksville, N. Y. p 584
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Corrugated Paper Products, Inc., 300 Babylon Tpke., Roosevelt, N. Y.
Environmental Container Systems, Box 337, Union City, Calif.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Lewis, G. B. Co., Watertown, Wisc.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Royal Inds., Engineered Prods. Div., 2040 E. Dyer Rd., Santa Ana, Cal.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CONTAINERS, STORAGE

American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J. p 575
M M Electronic Enclosures, Inc., 111 Bloomingdale Rd., Hicksville, N. Y. p 584
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill.
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Akro-Mils Inc., Box 989, Akron, Ohio
Althor Products, 2260 Benson Ave., Brooklyn, N. Y.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Ballonoff Metal Products Co., 14055 Cedar Rd., Cleveland, Ohio
Bradley Inds., 11040 King St., Franklin Park, Ill.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Celluplastics, Inc., Sub. Brockway Glass Co., Brockway, Pa.
Corrugated Paper Products, Inc., 300 Babylon Tpke., Roosevelt, N. Y.
Environmental Container Systems, Box 337, Union City, Calif.
Equipment Co. of America, 1075 Hialeah Dr., Hialeah, Fla.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Flexco Div., 6855 Suva St., Bell Gardens, Calif.
Kole Enterprises, Inc., P.O. Box 152, Biscayne Annex, Miami, Fla.
Lewis, G. B. Co., Watertown, Wisc.
Lyon Metal Products, Inc., 47 Railroad Ave., Aurora, Ill.
Metropolitan Wire Goods Corp., N. Washington St. & George Ave., Wilkes-Barre, Pa.
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Robins Data Devices, Inc., 15-58 127th St., Flushing, N. Y.
Royal Inds., Engineered Prods. Div., 2040 E. Dyer Rd., Santa Ana, Cal.
Stackbin Corp., P.O. Box 434, Pawtucket, R. I.
Vlchek Plastics Co., Middlefield, Ohio
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

CONTAINERS, TRANSIT—SEE TRANSIT CASES

CONTROL EQUIPMENT, CLASSIFICATION

Basler Electric Co., Box 269, Highland, Ill.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Century Lighting Inc., 3 Entin Rd., Clifton, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Defense Elctrns., Inc., Rockville, Md.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Femco, Inc., Box F, Irwin, Pa.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Kirk & Blum Mfg. Co., 3120 Forrer St., Cincinnati, Ohio
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Maytronics, Inc., Box 460, Colorado Springs, Colo.
Moog, Inc., Box 8, E. Aurora, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Peco Corp., 111 Ortego Ave., Mt. View, Calif.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Teledyne Telemetry Co., Box 341, Princeton, N. J.

CONTROL PANELS & SYSTEMS, COMPUTER —SEE BOARDS, PROGRAMMING

CONTROLS, CAPACITANCE OPERATED

Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. ..... p 1502
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Compudyne Corp., Box 247, Hatboro, Pa.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Foxboro, Foxboro, Mass.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Recora Co., Powis Rd., St. Charles, Ill.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CONTROLS, CARBON—SEE POTENTIOMETERS: RHEOSTATS

CONTROLS, COMBUSTION

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Aerometrics, P.O. Box 216, San Ramon, Calif.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fuel Watchman Sales & Service, Inc., 2910 Park Ave., Bronx, N. Y.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hays Corp., Michigan City, Ind.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Houston Atlas, Inc., Box 19035, Houston, Tex.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.

Selas Corp. of America, Box 200, Dresher, Pa.
Sensor Precision Industries Inc., 29 Janes Ave., Medfield, Mass.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Worner Electrn. Devices, Rankin, Ill.

CONTROLS, CONSTANT IMPEDANCE—SEE ATTENUATORS

CONTROLS, COUNTING & SORTING

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ..... p 2840
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. ... p 2840
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2760
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2760
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Presin Co., Trap Falls Rd., Shelton, Conn.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Delavan Mfg. Co., 811 Fourth St., W. Des Moines, Iowa
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electronic Control Co., Box S150, Dresher, Pa.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
General Atronics Corp., Ind'l. Div., 1200 E. Mermaid La., Phila., Pa.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Industrial Components, Inc., 1675 S.E. Allen Ave., Beaverton, Ore.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Peco Corp., 111 Ortego Ave., Mt. View, Calif.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sensory, Inc., 1 Kennedy Rd., Morris Plains, N. J.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stevenson Engrg. & Mfg. Co., P.O. Box 25070, Portland, Ore.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Tri-Tronics Co., 619 Enterprise Dr., Oak Brook, Ill.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Worner Electrn. Devices, Rankin, Ill.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONTROLS, DENSITY

Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Electron-Machine Corp., Box M, Umatilla, Fla.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Cal.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus, Ohio
Kay-Ray, Inc., 740 E. Northwest Hwy., Palatine, Ill.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Machine-O-Matic, Inc., 1922 Ridge Ave., Evanston, Ill.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Princo Instrs. Inc., Indl. Pk., Southampton, Pa.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Worner Electrn. Devices, Rankin, Ill.

CONTROLS, DIMENSION

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Theta Instrument Corp., Fairfield, N. J.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio
Beta Corp., 2639 Manana Dr., Box 20427, Dallas, Tex.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electron-Machine Corp., Box M, Umatilla, Fla.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Industrial Components, Inc., 1675 S.E. Allen Ave., Beaverton, Ore.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Stevenson Engrg. & Mfg. Co., P.O. Box 25070, Portland, Ore.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Worner Electrn. Devices, Rankin, Ill.

CONTROLS, DOOR OPENING AND CLOSING (INDUSTRIAL)

Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Basler Electric Co., Box 269, Highland, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2758
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2758
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Continental Instrs. Corp., 110 Atlantic Ave., Lynbrook, N. Y.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Femco, Inc., Box F, Irwin, Pa.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Linear Corp., 347 S. Glasgow Ave., Inglewood, Calif.
Notifier Co., 3700 North 56th St., Lincoln, Neb.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Skinner Polynoid Div., 95 Edgewood Ave., New Britain, Conn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Worner Electrn. Devices, Rankin, Ill.

CONTROLS, FLUID CONDUCTIVITY

CONTROLS, ENVIRONMENTAL TEST EQUIPMENT

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif. ..... p 1247
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Chadwick-Helmuth Co. Inc., 111 E. Railroad Ave., Monrovia, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Develco, Inc., 8 Van Tassel Ct., Norwalk, Conn.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EMR Div., Box 223, Princeton, N. J.
Electronic Control Co., Box S150, Dresher, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Foxboro, Foxboro, Mass.
Gruenberg Electric Co., Inc., 585 Commercial Ave., Garden City, N. Y.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Houston Atlas, Inc., Box 19035, Houston, Tex.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
MB Electronics, Box 1825, New Haven, Conn.
Montford Instrs. Ltd., 79 Lots Rd., Chelsea, London, S.W. 10, Eng.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Research, Inc., Box 6164, Minneapolis, Minn.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
T & T Controls Co., Inc., Box 171, Media, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
United Electric Controls Co., 85A School St., Watertown, Mass.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

CONTROLS, FILM THICKNESS—SEE CONTROLS, MATERIAL THICKNESS

CONTROLS, FLAME FAILURE

Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Pioneer Elec. & Res. Corp., 743 Circle Ave., Forest Pk., Ill.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Sensor Precision Industries Inc., 29 Janes Ave., Medfield, Mass.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.

CONTROLS, FLUID CONDUCTIVITY

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Bailey Meter Company, Wickliffe, Ohio
Blake Electronics Inc., Muskego, Wisc.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Eastern Chemical Corp., 3rd & Greenwich Sts., Reading, Pa.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electron-Machine Corp., Box M, Umatilla, Fla.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Environmental Control Sys. Div., 43-22 Queens St., Long Island City, N. Y.
Foxboro, Foxboro, Mass.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McNab, Inc., 165 Spring St., New York, N. Y.

CONTROLS, FLUID CONDUCTIVITY

Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trans-Sonics, Inc., Box 326, Lexington, Mass.

CONTROLS, FLUID FLOW

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Fenwal Electronics Inc., 63 Fountain St., Framingham, Mass.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Rotron, Inc., Hasbrouck La., Woodstock, N. Y. ..... p 1275
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Adel Div., 10777 Van Owen St., Burbank, Calif.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Anderson, W. E., Inc., 320E West 80th St., Kansas City, Mo.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Bailey Meter Company, Wickliffe, Ohio
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bendix Corp., Instruments & Life Support Div.,
2734 Hickory Grove Rd., Davenport, Iowa
Brooks Instrument Div., Emerson Elec. Co., Hatfield, Pa.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Dietz, H. G., Co., Inc., 14-26 28th Ave., Long Island City, N. Y.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Electron-Machine Corp., Box M, Umatilla, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Erdco Engrg. Corp., 136 Official Rd., Addison, Ill.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Foxboro, Foxboro, Mass.
Gems Co., Inc., Spring La., Farmington, Conn.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Harwil Co., 903 Colorado Ave., Santa Monica, Calif.
Hays Corp., Michigan City, Ind.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lunkenheimer Co., Box 14360, Cincinnati, Ohio
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Power & Engrg. Equip. Co., Inc., 1826 213th St., Torrance, Calif.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Roy, Milton, Co., 5000 Park St., N., St. Petersburg, Fla.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Skinner Electric Valve Div., 95 Edgewood Ave., New Britain, Conn.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
U.O.P. Instruments Div., Greenwich, Conn.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
United Electric Controls Co., 85A School St., Watertown, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Weston Hydraulics, 7500 Tyrone Ave., Van Nuys, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

CONTROLS, FREQUENCY

Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1059, 1064
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
American Time Products, Bulova Watch Co., Inc.,
61-20 Woodside Ave., Woodside, N. Y.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
p 1104, 1330
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1105
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. ... p 1109
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2920
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Integrated Motorcontrol, Inc., 936 Industrial Ave., Palo Alto, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONTROLS, GAS

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Fenwal Electronics Inc., 63 Fountain St., Framingham, Mass.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
Hastings-Raydist, Newcomb Ave., Hampton, Va.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Houston Atlas, Inc., Box 19035, Houston, Tex.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Lektra Labs., Inc., 129-07 18th Ave., College Point, N. Y.
Lunkenheimer Co., Box 14360, Cincinnati, Ohio
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Roy, Milton, Co., 5000 Park St., N., St. Petersburg, Fla.
Selas Corp. of America, Box 200, Dresher, Pa.
Stemco Controls/Div. Essex Wire Corp., P.O. Annex 1007, Mansfield, Ohio
Trans-Sonics, Inc., Box 326, Lexington, Mass.
United Electric Controls Co., 85A School St., Watertown, Mass.
Weston Hydraulics, 7500 Tyrone Ave., Van Nuys, Calif.

CONTROLS, HARDWARE, SHAFTS & ACCESSORIES—SEE SHAFTS; DIALS; ETC.

CONTROLS, HUMIDITY

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
J. K. Electronic Controls, Inc., Box 1582, Vancouver, Wash.
Kay-Ray, Inc., 740 E. Northwest Hwy., Palatine, Ill.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Logetronics, Inc., 7001 Loisdale Rd., Springfield, Va.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Montford Instrs. Ltd., 79 Lots Rd., Chelsea, London, S.W. 10, Eng.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Warren Components Corp., Box 848, Warren, Pa.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

CONTROLS, IGNITRON FIRING

Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Research, Inc., Box 6164, Minneapolis, Minn.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.

CONTROLS, ILLUMINATION

Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif.
Arizona Elctrns., Inc., Drawer AE, Benson, Ariz.
Century Lighting Inc., 3 Entin Rd., Clifton, N. J.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Time-O-Matic Inc., Box 850, Danville, Ill.
Worner Electrn. Devices, Rankin, Ill.

CONTROLS, LEVEL, DRY MATERIAL

Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Presin Co., Trap Falls Rd., Shelton, Conn.
Theta Instrument Corp., Fairfield, N. J.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Automation Devices, Inc., Box A.D., Fairview, Pa.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Delavan Mfg. Co., 811 Fourth St., W. Des Moines, Iowa
Dietz, H. G., Co., Inc., 14-26 28th Ave., Long Island City, N. Y.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Frost Electronics, One Goddard Dr., Rockaway, N. J.
General Sensors, Inc., P.O. Box 231, Athens, Tex.
Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus, Ohio
Kay-Ray, Inc., 740 E. Northwest Hwy., Palatine, Ill.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Wintriss Controls, 20 Vandam St., New York, N. Y.
Worner Electrn. Devices, Rankin, Ill.

CONTROLS, LEVEL, LIQUID

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2696
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Cal-R, Inc., Thermonetics Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2799
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. ..... p 2470
Fairchild Controls, 5625 Kearny Villa Rd., San Diego, Calif. .... p 2470
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J.
Virtis Co., Inc., Rte. 208, Gardiner, N. Y. ..... p 1520
Adel Div., 10777 Van Owen St., Burbank, Calif.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Brooks Instrument Div., Emerson Elec. Co., Hatfield, Pa.
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Curtis Develop. & Mfg. Co., 3278 N. 33rd St., Milwaukee, Wisc.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Delavan Mfg. Co., 811 Fourth St., W. Des Moines, Iowa
Dietz, H. G., Co., Inc., 14-26 28th Ave., Long Island City, N. Y.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Dynasonics Corp., Box 672, Pipestone, Minn.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electromation Components Corp., 84 Toledo St., Farmingdale, N. Y.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Foxboro, Foxboro, Mass.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
General Sensors, Inc., P.O. Box 231, Athens, Tex.
Hays Corp., Michigan City, Ind.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus, Ohio
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Jo-Bell Prods., Inc., 5456 West 111 St., Oak Lawn, Ill.
Johnson Corp., 805 Wood St., Three Rivers, Mich.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kay-Ray, Inc., 740 E. Northwest Hwy., Palatine, Ill.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Malaker Corp., W. Main St., High Bridge, N. J.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Militest Corp., 88 Madison Ave., Hempstead, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power & Engrg. Equip. Co., Inc., 1826 213th St., Torrance, Calif.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
U.O.P. Instruments Div., Greenwich, Conn.
United Electric Controls Co., 85A School St., Watertown, Mass.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Worner Electrn. Devices, Rankin, Ill.
Peco Corp., 111 Ortego Ave., Mt. View, Calif.

CONTROLS, MACHINE TOOL

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ..... p 2840
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. ... p 2840
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif.
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1770
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Automation Devices, Inc., Box A.D., Fairview, Pa.
Baldwin Elctrns., Inc., 1101 McAlmont St., Little Rock, Ark.
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Bendix, Indl. Controls Div., 12843 Greenfield, Detroit, Mich.
Boston Digital Corp., 21 Main St., Ashland, Mass.
Bunker-Ramo Corp., 747 Alpha Dr., Cleveland, Ohio
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Excellon Inds., 23915 Garnier, Torrance, Calif.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Gettys Mfg. Co., Inc., 2700 Golf Ave., Racine, Wisc.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Industrial Components, Inc., 1675 S.E. Allen Ave., Beaverton, Ore.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Industrial Sys. Div., 5261 W. Imperial Hwy., Los Angeles, Calif.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.

CONTROLS, MOTOR SPEED

National Acme Co., 170 East 131 St., Cleveland, Ohio
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Solatron Enterprises, 421 E. Beach Ave., Inglewood, Calif.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Strippit, Div. Houdaille Industries, Inc., Akron, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Weldotron Corp., 907 Frelinghuysen Ave., Newark, N. J.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Westamp, Inc., 1542 15th St., Santa Monica, Calif.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wintriss Controls, 20 Vandam St., New York, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.
Zero-Max Co., The, 2845 Harriet Ave., S., Minneapolis, Minn.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

CONTROLS, MATERIALS THICKNESS

Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electron-Machine Corp., Box M, Umatilla, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus, Ohio
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Peco Corp., 111 Ortego Ave., Mt. View, Calif.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Stevenson Engrg. & Mfg. Co., P.O. Box 25070, Portland, Ore.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Unit Process Assemblies, Inc., 53-15 37th Ave., Woodside, N. Y.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

CONTROLS, METER—SEE METER CONTROLLERS—ALSO SEE RELAYS, METER

CONTROLS, MOISTURE—SEE CONTROLS, HUMIDITY

CONTROLS, MOTOR SPEED

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1865
Basler Electric Co., Box 269, Highland, Ill. ..... p 1018
Beckman Instr. Inc., Heliput Div., 2500 Harbor Blvd., Fullerton, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ..... p 2840
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. ... p 2840
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J.
Fifth Dimension Inc., Box 483, Princeton, N. J.

CONTROLS, MOTOR SPEED (Cont'd)

Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2816
Heath Co., Dept. 180, Benton Harbor, Mich.
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
International Rectifier, 233 Kansas St., El Segundo, Calif.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Oven Industries Div., E. Simpson Rd., Mechanicsburg, Pa.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Pyle-National Co., Connector Div., 1334 N. Kostner Ave., Chicago, Ill.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. .. p 1763
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Superior Electric Co., 1000 Middle St., Bristol, Conn. p 1770, 2098, 2894, 2896
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J.
Unitron, 1624 N. First St., Garland, Texas ..... p 2132, 2133
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2686
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Adams Rite Mfg. Co., 540 W. Chevy Chase Dr., Glendale, Calif.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Astro Electronics Inc., 1160 E. Ash, Fullerton, Calif.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Beta Corp., 2639 Manana Dr., Box 20427, Dallas, Tex.
Blake Electronics Inc., Muskego, Wisc.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Carter, J. C. Co., 671 West 17th St., Costa Mesa, Calif.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electro-Devices, Inc., 4-6 Godwin Ave., Paterson, N. J.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electron-Machine Corp., Box M, Umatilla, Fla.
Electronic Control Co., Box S150, Dresher, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Excellon Inds., 23915 Garnier, Torrance, Calif.
Fincor, Inc., 1000 E. Boundary Ave., York, Pa.
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foxboro, Foxboro, Mass.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Integrated Motorcontrol, Inc., 936 Industrial Ave., Palo Alto, Calif.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Loyola Industries, Inc., 155 Arena St., El Segundo, Calif.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
Machine-O-Matic, Inc., 1922 Ridge Ave., Evanston, Ill.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Minarik Electric Co., 226 E. Third St., Los Angeles, Calif.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Precision Specialties, Inc., Box 118, Pitman, N. J.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Quaker Electronics, Box 215, Hunlock Creek, Pa.
Ram Meter, Inc., 1100 Hilton Rd., Ferndale, Mich.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Research, Inc., Box 6164, Minneapolis, Minn.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
T & T Controls Co., Inc., Box 171, Media, Pa.
Task Corporation, Box 3999, Anaheim, Calif.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Westamp, Inc., 1542 15th St., Santa Monica, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.
Zero-Max Co., The, 2845 Harriet Ave., S., Minneapolis, Minn.

CONTROLS, OSCILLATOR

Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1059
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
J-B-T Instrs. Inc., Box 1818, New Haven, Conn. ..... p 2737
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio

CONTROLS, P-H

London Co., 811 Sharon Dr., Westlake, Ohio
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Analytical Measurements Inc., 31 Willow St., Chatham, N. J.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Bailey Meter Company, Wickliffe, Ohio
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Roy, Milton, Co., 5000 Park St., N., St. Petersburg, Fla.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

CONTROLS, PHOTOELECTRIC

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 2349
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Data Technology Inc., 65 Grove St., Watertown, Mass.
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Presin Co., Trap Falls Rd., Shelton, Conn.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Vactec, Inc., 2423 North Line Blvd., Maryland Hgts., Mo. ..... p 1776
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Appalachian Elctrn. Instrs., Inc., 810 W. Monroe Ave., Ronceverte, W. Va.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automation Devices, Inc., Box A.D., Fairview, Pa.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Berkeley/Dynamics, Inc., 934 Baileyana Rd., Hillsborough, Calif.
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills; Ont., Can.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Continental Instrs. Corp., 110 Atlantic Ave., Lynbrook, N. Y.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electroid Corp., 95 Progress St., Union, N. J.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electron-Machine Corp., Box M, Umatilla, Fla.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Control Co., Box S150, Dresher, Pa.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Electronic Machine Parts, 128-11 18th Ave., College Point, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
Fotomatic Corp., 3141 W. Tenth, Indianapolis, Ind.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
General Atronics Corp., Ind'l. Div., 1200 E. Mermaid La., Phila., Pa.
Hughey & Phillips, Inc., 3050 N. California St., Burbank, Calif.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
LGM Electronics, Inc., 4304 La Branch St., Houston, Tex.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Lektra Labs., Inc., 129-07 18th Ave., College Point, N. Y.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Machine-O-Matic, Inc., 1922 Ridge Ave., Evanston, Ill.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Optronics Inc., Box 584, Newburyport, Mass.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photo-Crystals, 605 Prairie St., Saint Charles, Ill.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Pioneer Elec. & Res. Corp., 743 Circle Ave., Forest Pk., Ill.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Tabet Mfg. Co., 1336 Ballentine Blvd., Norfolk, Va.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Tri-Tronics Co., 619 Enterprise Dr., Oak Brook, Ill.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Weldotron Corp., 907 Frelinghuysen Ave., Newark, N. J.
Wintriss Controls, 20 Vandam St., New York, N. Y.
Worner Electrn. Devices, Rankin, Ill.

CONTROLS, POSITIONING

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. .... p 1021
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif. ..... p 779
EMR-Hatboro, E. County Line Rd., Hatboro, Pa. ..... p 1368
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ..... p 2840
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. ... p 2840

Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 1466
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1770
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Adams Rite Mfg. Co., 540 W. Chevy Chase Dr., Glendale, Calif.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Arvin Systems Inc., 1482 Stanley Ave., Dayton, Ohio
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Bailey Meter Company, Wickliffe, Ohio
Baldwin Elctrns., Inc., 1101 McAlmont St., Little Rock, Ark.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix, Indl. Controls Div., 12843 Greenfield, Detroit, Mich.
Boston Digital Corp., 21 Main St., Ashland, Mass.
Bristol Co., Box 1790, Waterbury, Conn.
Bunker-Ramo Corp., 747 Alpha Dr., Cleveland, Ohio
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dimensional Control Machinery Co., Box 504, Salem, Ohio
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Machine Parts, 128-11 18th Ave., College Point, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Excellon Inds., 23915 Garnier, Torrance, Calif.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Foxboro, Foxboro, Mass.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
Gems Co., Inc., Spring La., Farmington, Conn.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hays Corp., Michigan City, Ind.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Industrial Components, Inc., 1675 S.E. Allen Ave., Beaverton, Ore.
Industrial Sys. Div., 5261 W. Imperial Hwy., Los Angeles, Calif.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Machine-O-Matic, Inc., 1922 Ridge Ave., Evanston, Ill.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Peco Corp., 111 Ortego Ave., Mt. View, Calif.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Southwest Products Co., 1705 S. Mountain Ave., Monrovia, Calif.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stevenson Engrg. & Mfg. Co., P.O. Box 25070, Portland, Ore.
Strippit, Div. Houdaille Industries, Inc., Akron, N. Y.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
3M Co., 3M Center, St. Paul, Minn.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Wintriss Controls, 20 Vandam St., New York, N. Y;
Worner Electrn. Devices, Rankin, Ill.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONTROLS, PRESSURE

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2696
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Columbus Elec. Mfg. Co., 621 N. Hamilton Rd., Columbus, Ohio
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2464
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Adel Div., 10777 Van Owen St., Burbank, Calif.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bellofram Corp., 103 Blanchard Rd., Burlington, Mass.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bristol Co., Box 1790, Waterbury, Conn.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Dietz, H. G., Co., Inc., 14-26 28th Ave., Long Island City, N. Y.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Granville-Phillips Co., Box 1290, Boulder, Colo.
Hays Corp., Michigan City, Ind.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lunkenheimer Co., Box 14360, Cincinnati, Ohio
MB Electronics, Box 1825, New Haven, Conn.
MKS Instruments, Inc., 45 Middlesex Tpke., Burlington, Mass.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.

CONTROLS, PROGRAMMABLE

Scaico Div., 211 Warren St., W. Pittston, Pa.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Controls, Inc., 2401 S. Bayview, Seattle, Wash.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Texas Instruments Inc., 34 Forest St., Attleboro, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
U.O.P. Instruments Div., Greenwich, Conn.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
United Electric Controls Co., 85A School St., Watertown, Mass.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wintriss Controls, 20 Vandam St., New York, N. Y.
Worner Electrn. Devices, Rankin, Ill.

CONTROLS, PROGRAMMABLE

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764, 2789
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2816
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1414
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Presin Co., Trap Falls Rd., Shelton, Conn.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. ... p 1763
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Superior Electric Co., 1000 Middle St., Bristol, Conn. .... p 1770, 2098
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Virginia Panel Corp., Box 1106, Waynesboro, Va. ..... p 1008
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Arvin Systems Inc., 1482 Stanley Ave., Dayton, Ohio
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Boston Digital Corp., 21 Main St., Ashland, Mass.
Computer Automation, Inc., 895 W. Sixteenth St., Newport Beach, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electrol Co., Inc., 771 Spring La., York, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Foxboro, Foxboro, Mass.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Industrial Sys. Div., 5261 W. Imperial Hwy., Los Angeles, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Signatron, Inc., 594 Marrett Rd., Lexington, Mass.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Summit Engrg. Corp., Box 115, Bozeman, Mont.

CONTROLS, PROGRAMMABLE (Cont'd)

Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONTROLS, PROPORTIONING

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1079
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2816
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Oven Industries Div., E. Simpson Rd., Mechanicsburg, Pa. ..... p 1102
Ovenaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1112
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electron-Machine Corp., Box M, Umatilla, Fla.
Electronic Control Co., Box S150, Dresher, Pa.
Foxboro, Foxboro, Mass.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hays Corp., Michigan City, Ind.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Impact-O-Graph Corp., 1762 East 18th St., Cleveland, Ohio
Jersey Technical Consultants, Box 215, Morristown, N. J.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Loyola Industries, Inc., 155 Arena St., El Segundo, Calif.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Malaker Corp., W. Main St., High Bridge, N. J.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Research, Inc., Box 6164, Minneapolis, Minn.
Roy, Milton, Co., 5000 Park St., N., St. Petersburg, Fla.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
T & T Controls Co., Inc., Box 171, Media, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
3M Co., 3M Center, St. Paul, Minn.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Electric Controls Co., 85A School St., Watertown, Mass.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.

CONTROLS, PROXIMITY—ALSO SEE CONTROLS, CAPACITANCE OPERATED

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2749
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electrol Co., Inc., 771 Spring La., York, Pa.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Peco Corp., 111 Ortego Ave., Mt. View, Calif.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Tri-Tronics Co., 619 Enterprise Dr., Oak Brook, Ill.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.
Warner Electric Brake & Clutch Co., Beloit, Wisc.

CONTROLS, REMOTE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Aemco Div., Midtec Inc., 10 State St., Mankato, Minn. ..... p 2193
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 1781
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764, 2789
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660, 2661
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2767
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. .. p 1763
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Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Trimm Inc., 400 Lake St., Libertyville, Ill.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Abtronics, Inc., Box 712, Livermore, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Peripheral Sys., Inc., 7120 Harwin, Houston, Tex.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Barrett Electronics Corp., 630 Dundee Rd., Northbrook, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Compudyne Corp., Box 247, Hatboro, Pa.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electrol Co., Inc., 771 Spring La., York, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Femco, Inc., Box F, Irwin, Pa.
Foxboro, Foxboro, Mass.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Industrial Components, Inc., 1675 S.E. Allen Ave., Beaverton, Ore.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Linear Corp., 347 S. Glasgow Ave., Inglewood, Calif.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Southern Avionics Co., 5055 Belmont, Beaumont, Tex.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
United Electric Controls Co., 85A School St., Watertown, Mass.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Warner Electric Brake & Clutch Co., Beloit, Wisc.

CONTROLS, SCR

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Basler Electric Co., Box 269, Highland, Ill. ..... p 1018
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. .... p 1930
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
International Rectifier, 233 Kansas St., El Segundo, Calif.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Lowell Elctrns. Corp., 9100 Terminal Ave., Skokie, Ill.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific-Atlanta Inc., Box 13854, Atlanta, Ga.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill.
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Blake Electronics Inc., Muskego, Wisc.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Bunker-Ramo Corp., 747 Alpha Dr., Cleveland, Ohio
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
DeSoto Electrical Products, Box 239, DeSoto, Mo.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Electro-Devices, Inc., 4-6 Godwin Ave., Paterson, N. J.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Control Co., Box S150, Dresher, Pa.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Integrated Motorcontrol, Inc., 936 Industrial Ave., Palo Alto, Calif.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Loyola Industries, Inc., 155 Arena St., El Segundo, Calif.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.

Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Minarik Electric Co., 226 E. Third St., Los Angeles, Calif.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Research, Inc., Box 6164, Minneapolis, Minn.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
T & T Controls Co., Inc., Box 171, Media, Pa.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
WER Industrial Corp., 3036 Alt Blvd., Grand Island, N. Y.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Westamp, Inc., 1542 15th St., Santa Monica, Calif.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.

CONTROLS, SERVO

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 1016
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. .... p 1021
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2659
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2463
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 2665
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y. p 1729
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 1741
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y. p 1745
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Lowell Elctrns. Corp., 9100 Terminal Ave., Skokie, Ill.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1758
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Sterling Instr., 76 E. Second St., Mineola, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2683
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix, Indl. Controls Div., 12843 Greenfield, Detroit, Mich.
Blake Electronics Inc., Muskego, Wisc.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Bristol Co., Box 1790, Waterbury, Conn.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Collins Radio Co., Dallas, Texas
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EMR Div., Box 223, Princeton, N. J.
Electrol Co., Inc., 771 Spring La., York, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Foxboro, Foxboro, Mass.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
MB Electronics, Box 1825, New Haven, Conn.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Moog, Inc., Box 8, E. Aurora, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Research, Inc., Box 6164, Minneapolis, Minn.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Sciaky Bros, Inc., 4915 West 67th St., Chicago, Ill.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
United Control Corporation, Redmond, Wash.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Westamp, Inc., 1542 15th St., Santa Monica, Calif.
Weston Hydraulics, 7500 Tyrone Ave., Van Nuys, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

CONTROLS, SMOKE & COMBUSTION
SEE CONTROLS, COMBUSTION

CONTROLS, SPECIFIC GRAVITY

Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Bailey Meter Company, Wickliffe, Ohio
Bristol Co., Box 1790, Waterbury, Conn.
Foxboro, Foxboro, Mass.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Kay-Ray, Inc., 740 E. Northwest Hwy., Palatine, Ill.
Roy, Milton, Co., 5000 Park St., N., St. Petersburg, Fla.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.

CONTROLS, STEPPING MOTOR

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660, 2661
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. .... p 1021
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J.
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 1741
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Mesa Co., Inc., 216-220 Mill St., Bristol, Pa.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1770
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Theta Instrument Corp., Fairfield, N. J.

CONTROLS, TEMPERATURE

Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2686
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Boston Digital Corp., 21 Main St., Ashland, Mass.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Computer Devices, 11925 Burke St., Santa Fe Springs, Calif.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
T & T Controls Co., Inc., Box 171, Media, Pa.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.

CONTROLS, TEMPERATURE—ALSO SEE MONITORS, TEMPERATURE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322, 1323
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1079
Cal-R, Inc., Thermonetics Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2799
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif. ..... p 1247
Columbus Elec. Mfg. Co., 621 N. Hamilton Rd., Columbus, Ohio
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y. ..... p 2812
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I. .... p 2813
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2816, 2817
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1253
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Oven Industries Div., E. Simpson Rd., Mechanicsburg, Pa. ..... p 1102
Ovenaire Inc., 706 Forrest St., Charlottesville, Va.
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
RFL Inds., Inc., Thermocontrol Div., Powerville Rd., Boonton, N. J. p 1473
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Virtis Co., Inc., Rte. 208, Gardiner, N. Y. ..... p 1520
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio

CONTROLS, TEMPERATURE (Cont'd)

Weller Electric Corp., 100 Wellco Rd., Easton, Pa.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Astro Dynamics, Inc., 2nd Ave., Northwest Industrial Park, Burlington, Mass.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bimet Electrical Res. Co., Box 269, Morris, Ill.
Blake Electronics Inc., Muskego, Wisc.
Bristol Co., Box 1790, Waterbury, Conn.
Burling Instrument Company, 21 River Road, Chatham, New Jersey
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Chatham Controls Corp., 33 River Rd., Chatham, N. J.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Control Data Corp., Magsense Prods. Oper., 775 Colorado Ave., S., Minneapolis, Minn.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Dales, F. Co., 180-85 E. Mill St., Akron, Ohio
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electro-Flex Heat, Inc., Northwood Industrial Park, Bloomfield, Conn.
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electron-Machine Corp., Box M, Umatilla, Fla.
Electronic Control Co., Box S150, Dresher, Pa.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fasco Inds., Inc., Augusta at North Union Sts., Rochester, N. Y.
Fenwal, Inc., Main St., Ashland, Mass.
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
Foxboro, Foxboro, Mass.
Fuel Watchman Sales & Service, Inc., 2910 Park Ave., Bronx, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hexacon Electric Co., 161 W. Clay Ave., Roselle Park, N. J.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Residentigl Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Loyola Industries, Inc., 155 Arena St., El Segundo, Calif.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Malaker Corp., W. Main St., High Bridge, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Modular Circuits Inc., 4420 Transmission Rd., Phoegix, Ariz.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Nanmac Corp., 9 Mayhew Rd., Framingham, Mass.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Norwalk Thermostat Co., 100 N. West St., Norwalk, Ohio
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Princo Instrs. Inc., Indl. Pk., Southampton, Pa.
Procedyne Corp., 221 Somerset St., New Brunswick, N. J.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Research, Inc., Box 6164, Minneapolis, Minn.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Stemco Controls/Div. Essex Wire Corp., P.O. Annex 1007, Mansfield, Ohio
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
T & T Controls Co., Inc., Box 171, Media, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Tempil Corp., 132 West 22nd St., New York, N. Y.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Therm-O-Disc, Inc., Box 1538, Mansfield, Ohio
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
United Control Corporation, Redmond, Wash.
United Electric Controls Co., 85A School St., Watertown, Mass.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

CONTROLS, THYRATRON GRID

Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Walters, W. A., Inc., 7713 South Western Ave., Chicago, Ill.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.

CONTROLS, TIMING—SEE TIMERS

CONTROLS, TORQUE-ELECTRONIC

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
General Time Corp., Rte. 8, Torrington, Conn.
Magtrol Inc., 240 Seneca St., Buffalo, N. Y. ..... p 1749
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Electro-Devices, Inc., 4-6 Godwin Ave., Paterson, N. J.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Hobbs Mfg. Co., 666 Lincoln St., Worcester, Mass.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
McNab, Inc., 165 Spring St., New York, N. Y.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

CONTROLS, VACUUM

Columbus Elec. Mfg. Co., 621 N. Hamilton Rd., Columbus, Ohio
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Virtis Co., Inc., Rte. 208, Gardiner, N. Y. ..... p 1520
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Bristol Co., Box 1790, Waterbury, Conn.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Dietz, H. G., Co., Inc., 14-26 28th Ave., Long Island City, N. Y.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Foxboro, Foxboro, Mass.
Fredericks Co., Philmont & Anne St., Huntingdon Valley, Pa.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Granville-Phillips Co., Box 1290, Boulder, Colo.
Hastings-Raydist, Newcomb Ave., Hampton, Va.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Vacuum Equip., 2020 Oceanside Blvd., Oceanside, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
MKS Instruments, Inc., 45 Middlesex Tpke., Burlington, Mass.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
United Electric Controls Co., 85A School St., Watertown, Mass.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.

CONTROLS, VENTILATING

Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dietz, H. G., Co., Inc., 14-26 28th Ave., Long Island City, N. Y.
Foxboro, Foxboro, Mass.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
Paragon Elec. Co., Inc., 1600 12th St., Two Rivers, Wisc.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
WER Industrial Corp., 3036 Alt Blvd., Grand Island, N. Y.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

CONTROLS, VOLTAGE REGULATING—SEE REGULATORS & STABILIZERS, VOLTAGE

CONTROLS, VOLUME & TONE—SEE POTENTIOMETERS

CONTROLS, WELDING

Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Sorensen Operation, Richards Ave., Norwalk, Conn.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Electrol Co., Inc., 771 Spring La., York, Pa.
Eutectic Corp., 40-40 172nd St., Flushing, N. Y.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
Precision Arc Co., Inc., 785 Woodend Rd., Stratford, Conn.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Sciaky Bros, Inc., 4915 West 67th St., Chicago, Ill.
Silver, G. H. & Assocs., Inc., Box 21, Newtonville, Mass.
Slee International Inc., 8010 U. S. Hwy. 130, Pennsauken, N. J.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Walters, W. A., Inc., 7713 South Western Ave., Chicago, Ill.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Westinghouse Electric Corp., Ind. Equip. Div., Box 300, Sykesville, Md.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CONTROLS, WIRE WOUND—SEE POTENTIOMETERS; RHEOSTATS

CONVECTION COOLING PACKAGES, SEMICONDUCTOR—SEE TRANSISTOR & DIODE HEAT DISSIPATORS

CONVERTERS, A-C TO D-C

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1855
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1865
Basler Electric Co., Box 269, Highland, Ill.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Deltron Inc., Wissahickon Ave., North Wales, Pa.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
General-Electro Mechanical Corp., 787 Hertel Ave., Buffalo, N. Y. p 1737
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1032
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Neutronic Corp., Box 625, St. Louis, Mo.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ..... p 2084
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ..... p 2082
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1492, 1494, 1497
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Spar Electronics, 7969 Engineer Rd., San Diego, Calif. ..... p 2111
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2114
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 1054, 2677
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2138, 2139
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
B-W Manufacturers, Inc., 721 N. Webster St., Kokomo, Ind.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Foxboro, Foxboro, Mass.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Inet-Power, 711 W. Knox St., Gardena, Calif.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Powercube Corp., 214 Calvary St., Waltham, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

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A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Airflyte Electronics Co., Box 207, Bayonne, N. J. ..... p 1722
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1593
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Cohu Electronics Inc., Box 623, San Diego, Calif.
Computer Labs., 1109 S. Chapman St., Greensboro, N. C. ... p 768, 769
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 776
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 772, 773
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 524
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Fifth Dimension Inc., Box 483, Princeton, N. J.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 2395
Marstan Elctrns., 307 Washington St., Orange, N. J.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Neutronic Corp., Box 625, St. Louis, Mo.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa. p 2411
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. p 797, 798
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. .... p 2794, 2795
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Test Equipment Corp., Box 20215, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 808
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Weston-Transicoil Components Div., Worcester, Pa.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.

CONVERTERS, ANALOG-TO-DIGITAL

Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Baldwin Elctrns., Inc., 1101 McAlmont St., Little Rock, Ark.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Bristol Co., Box 1790, Waterbury, Conn.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Collectron Corp., 304 East 45th St., New York, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Ditran Corp., Div. Clifton, 25 Adams St., Burlington, Mass.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EG & G Inc., 35 Congress St., Salem, Mass.
EMR Div., Box 223, Princeton, N. J.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fabri-Tek Instruments, Inc., 5225 Verona Rd., Madison, Wisc.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Industries, Encoder Div., 20745 Nordhoff St., Chatsworth, Calif.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Nano Fast, Inc., 416 W. Erie, Chicago, Ill.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Northern Scientific, Inc., 2551 W. Beltline, Middleton, Wisc.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Redcor Corp., Box 1031, Canoga Park, Calif.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Roback Corp., Huntingdon Valley, Pa.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Systron-Donner Corp., One Systron Dr., Concord, Calif.

CONVERTERS, ANALOG-TO-DIGITAL (Cont'd)

Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
Time Share Peripherals Corp., Box 361, Wilton, Conn.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Wayne-George Co., Christina St., Newton, Mass.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wintriss Controls, 20 Vandam St., New York, N. Y.
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

CONVERTERS, ANALOG-TO-PULSE

Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. .... p 761
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Neutronic Corp., Box 625, St. Louis, Mo.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
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Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
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Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Theta Instrument Corp., Fairfield, N. J.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Foxboro, Foxboro, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.

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A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Airflyte Electronics Co., Box 207, Bayonne, N. J.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1181, 1183
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 772, 773
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2713, 2714
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1190
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. ..... p 1194
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Logic Science, Inc., Box 10096, San Diego, Calif.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 786, 787
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J. ..... p 1802
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. p 797, 798
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Theta Instrument Corp., Fairfield, N. J.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 804
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
EMR Div., Box 223, Princeton, N. J.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Norden Div., United Aircraft Corp., Helen St., Norwalk, Conn.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Redcor Corp., Box 1031, Canoga Park, Calif.
Roback Corp., Huntingdon Valley, Pa.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
3M Co., 3M Center, St. Paul, Minn.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONVERTERS, CARD-TO-TAPE

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Logic Science, Inc., Box 10096, San Diego, Calif.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Analogic Co., 296 Newton St., Waltham, Mass.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Demex, Inc., 2130 Jefferson, Kansas City, Mo.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Roback Corp., Huntingdon Valley, Pa.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONVERTERS, COUNTER, VERTICAL-TO-HORIZONTAL READOUT

Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONVERTERS, CRT DISPLAY

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Commercial Display Sys., 2020 Oceanside Blvd., Oceanside, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Powercube Corp., 214 Calvary St., Waltham, Mass.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Time Share Peripherals Corp., Box 361, Wilton, Conn.

CONVERTERS, D-C TO D-C

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. .. p 1828
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. p1831
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1856
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1865
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
CML Inc., 350 Leland Ave., Plainfield, N. J.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ..... p 1899
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Crestronics, 744 Rocky Loop, Crestline, Calif. ..... p 1903
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Flite-Tronics Co., Inc., 3312 Burton Ave., Burbank, Calif. ..... p 1945
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1034
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y. ..... p 1965
International Rectifier, 233 Kansas St., El Segundo, Calif.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ..... p 2084
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Spar Electronics, 7969 Engineer Rd., San Diego, Calif. ..... p 2111
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Topaz Inc., 3802 Houston St., San Diego, Calif. ..... p 2118, 2119
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo. p 2120, 2121, 2124, 2125
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Alltronics of California, Inc., 841 Warrington Ave., Redwood City, Calif.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.

Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carter, J. C. Co., 671 West 17th St., Costa Mesa, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Components Corp., 106 Main St., Denville, N. J.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Great Lakes Elec. Mfg. Co., 17 S. Desplaines St., Chicago, Ill.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Mutron Corp., 646 Summer St., Brockton, Mass.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Novatronics, Inc., Box 878, Pompano Beach, Fla.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Sparton Corp., 2400 E. Ganson St., Jackson, Mich.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Starnetics Co., Box 9308, N. Hollywood, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Warren Communications, Newtown Rd., Littleton, Mass.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CONVERTERS, D-C TO FREQUENCY

AMP Incorporated, Box 3608, Harrisburg, Pa.
ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y. ..... p 1854
American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. .... p 761
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1865
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Connor-Winfield Corp., Winfield, Ill.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 1466
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Rotron, Inc., Hasbrouck La., Woodstock, N. Y. ..... p 1275
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Unitron, 1624 N. First St., Garland, Texas ..... p 2132, 2135
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vetter, A. R. Co., Box 143, Rebersburg, Pa.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Great Lakes Elec. Mfg. Co., 17 S. Desplaines St., Chicago, Ill.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.

CONVERTERS, DIGITAL TO ANALOG

Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Pacific Photometric Instrs., 3024 Ashby Ave., Berkeley, Calif.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

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A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1593
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Computer Labs., 1109 S. Chapman St., Greensboro, N. C.
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla.
Connor-Winfield Corp., Winfield, Ill. ..... p 1087
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 776
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 774
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fifth Dimension Inc., Box 483, Princeton, N. J.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 2395
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 2002
Logic Science, Inc., Box 10096, San Diego, Calif.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Marstan Elctrns., 307 Washington St., Orange, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 790
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa. p 2411
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. p 797, 798
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 808
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2686
Weston-Transicoil Components Div., Worcester, Pa.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.

CONVERTERS, DIGITAL TO ANALOG (Cont'd)

Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Components Corp., 106 Main St., Denville, N. J.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digital Products Corp., 4030 N.E. 6th Ave., Ft. Lauderdale, Fla.
Ditran Corp., Div. Clifton, 25 Adams St., Burlington, Mass.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
EMR Div., Box 223, Princeton, N. J.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Foxboro, Foxboro, Mass.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Information Displays, Inc., 333 N. Bedford Rd., Mt. Kisco, N. Y.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Redcor Corp., Box 1031, Canoga Park, Calif.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Roback Corp., Huntingdon Valley, Pa.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
Time Share Peripherals Corp., Box 361, Wilton, Conn.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

CONVERTERS, DIGITAL TO PAPER TAPE

Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
Keltron Corp., 225 Crescent St., Waltham, Mass.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONVERTERS, DIGITAL TO RESOLVER

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. ..... p 2661
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1333
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 2665
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 790
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496
Theta Instrument Corp., Fairfield, N. J.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 808, 2675
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 812
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Ditran Corp., Div. Clifton, 25 Adams St., Burlington, Mass.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.

CONVERTERS, DIGITAL TO SYNCHRO

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763, 1329
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. ..... p 2661
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1333
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Computer Labs., 1109 S. Chapman St., Greensboro, N. C. ... p 768, 769
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 776, 2665
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 790
Republic Corp., 9754 Deering Ave., Chatsworth, Calif. ..... p 800
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. .... p 2675
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Ditran Corp., Div. Clifton, 25 Adams St., Burlington, Mass.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

CONVERTERS, FACSIMILE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Frederick Elctrns. Corp., Hayward Rd., Frederick, Md.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.

CONVERTERS, FREQUENCY, LOGARITHMIC

Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CONVERTERS, FREQUENCY SHIFT KEYING

American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Frederick Elctrns. Corp., Hayward Rd., Frederick, Md.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Welex Electronics, Box 986, Silver Spring, Md.

CONVERTERS, FREQUENCY, TEST

Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif.
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1891, 1892
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Great Lakes Elec. Mfg. Co., 17 S. Desplaines St., Chicago, Ill.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Varo General, Garland Bank Bldg., Garland, Tex.

CONVERTERS, FREQUENCY TO DC

AEL Inc., P.O. Box 552, Lansdale, Pa.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1865
Basler Electric Co., Box 269, Highland, Ill.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1567
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. ...
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Georator Corp., Box 70, Manassas, Va. ..... p 1952, 1953
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1453
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 1466
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ..... p 2084
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J.
Schauer Mfg. Corp., 4518 Alpine Ave., Cincinnati, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2842

Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Terwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y...... p 1054
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Vetter, A. R. Co., Box 143, Rebersburg, Pa.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. .... p 2147
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Aerometrics, P.O. Box 216, San Ramon, Calif.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Great Lakes Elec. Mfg. Co., 17 S. Desplaines St., Chicago, Ill.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
Powercube Corp., 214 Calvary St., Waltham, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Price & Rutzebeck, Box 30, Hayward, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Rafec Electronics, Box 566, Temple City, Cal.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.

CONVERTERS, GRAPHIC TO DIGITAL

Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Wayne-George Co., Christina St., Newton, Mass.

CONVERTERS, HIGH-FREQUENCY

AEL Inc., P.O. Box 552, Lansdale, Pa.
AMP Incorporated, Box 3608, Harrisburg, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
American Time Products, Bulova Watch Co., Inc.,
61-20 Woodside Ave., Woodside, N. Y. ..... p 1887
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. .... p 1861
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ... p 1865, 1869-1872
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1891, 1892
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Gorator Corp., Box 70, Manassas, Va. ..... p 1952, 1953
Heath Co., Dept. 180, Benton Harbor, Mich.
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Unitron, 1624 N. First St., Garland, Texas ..... p 2132, 2134
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Metal Removal Co., 1801 W. Columbia, Chicago, Ill.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Olektron Corp., Box 248, Dudley, Mass.
Powercube Corp., 214 Calvary St., Waltham, Mass.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Springer Aircraft Radio Corp., RR #2, Box 98, Shelleyville, Ind.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CONVERTERS, LOW-FREQUENCY

AEL Inc., P.O. Box 552, Lansdale, Pa.
AMP Incorporated, Box 3608, Harrisburg, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
American Time Products, Bulova Watch Co., Inc.,
61-20 Woodside Ave., Woodside, N. Y. ..... p 1887
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. .... p 1861
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ... p 1865, 1869-1872
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. .... p 1357
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1891, 1892
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Gorator Corp., Box 70, Manassas, Va. ..... p 1952, 1953
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Measurements, Box 180, Boonton, N. J. ..... p 1437
Meipar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ..... p 2084
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Unitron, 1624 N. First St., Garland, Texas ..... p 2132, 2134
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Zaring Inds., Inc., Box 477, Carmel, Ind.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Great Lakes Elec. Mfg. Co., 17 S. Desplaines St., Chicago, Ill.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.

CONVERTERS, PAPER TAPE

Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Olektron Corp., Box 248, Dudley, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
TDC Div., P.O. Box 365, Littleton, Mass.
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.

CONVERTERS, MICROWAVE FREQUENCY

AEL Inc., P.O. Box 552, Lansdale, Pa.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Dallas, Texas
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

CONVERTERS, PAPER TAPE TO MAGNETIC TAPE

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 774
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Logic Science, Inc., Box 10096, San Diego, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Lance Inds., Box 4156, Sylmar, Calif.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Roback Corp., Huntingdon Valley, Pa.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONVERTERS, PAPER TAPE TO PAPER TAPE

Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif. p 799
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.

CONVERTERS, PAPER TAPE (Cont'd)

Invac Corp., 26 Fox Rd., Waltham, Mass.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONVERTERS, PHASE

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1329
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ... p 1865, 1869-1872
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1032
Guardian California, 5755 Camille Ave., Culver City, Calif.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1453
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

CONVERTERS, POLAR TO RECTANGULAR COORDINATES

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1035
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif. ..... p 800
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 2676
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

CONVERTERS, POWER FREQUENCY, ELECTRONIC

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y. ..... p 1854
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1887
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtel Corp., 1130 E. Cypress St., Covina, Calif. p 1865, 1867, 1869, 1870-1872
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. .... p 1357
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1891, 1892
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1933
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1736
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Heath Co., Dept. 180, Benton Harbor, Mich.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ..... p 2084
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Topaz Inc., 3802 Houston St., San Diego, Calif. ..... p 2118, 2119
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2138
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Zaring Inds., Inc., Box 477, Carmel, Ind.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carter, J. C. Co., 671 West 17th St., Costa Mesa, Calif.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Components Corp., 106 Main St., Denville, N. J.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Integrated Motorcontrol, Inc., 936 Industrial Ave., Palo Alto, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
TDC Div., P.O. Box 365, Littleton, Mass.
Task Corporation, Box 3999, Anaheim, Calif.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio
Topaz Inc., 3802 Houston St., San Diego, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CONVERTERS, POWER FREQUENCY, ROTARY

Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1736
Georator Corp., Box 70, Manassas, Va. ..... p 1952
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Continental Electric Co., Inc., 325 Ferry St., Newark, N. J.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Great Lakes Elec. Mfg. Co., 17 S. Desplaines St., Chicago, Ill.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inet-Power, 711 W. Knox St., Gardena, Calif.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Katolight Corp., 1st Ave. at Chestnut, Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Luminator, Inc., Box 278, Plano, Tex.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Task Corporation, Box 3999, Anaheim, Calif.
Techsonics, Box 251, El Prado, N. M.
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

CONVERTERS, POWER FREQUENCY, VIBRATOR

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.

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CONVERTERS, PRESSURE TO FREQUENCY—SEE TRANSDUCERS, PRESSURE

CONVERTERS, PULSE-TO-ANALOG

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 776
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 795
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1770
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2686
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Bristol Co., Box 1790, Waterbury, Conn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Foxboro, Foxboro, Mass.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.

CONVERTERS, PULSE-TO-DIGITAL

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Atec, Inc., 1125 Lumpkin St., Houston, Tex.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa. ..... p 767
Computer Labs., 1109 S. Chapman St., Greensboro, N. C. ... p 768, 769
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2686
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Foxboro, Foxboro, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.

CONVERTERS, RESOLVER TO DIGITAL

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1333
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 776, 2665
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778

Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 790, 791
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. .... p 2675
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Ditran Corp., Div. Clifton, 25 Adams St., Burlington, Mass.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONVERTERS, SCAN

Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Rauland Div., Zenith Radio Corp., 5610 W. Jarvis Ave., Chicago, Ill. p 1201
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Storage Tubes, 2020 Oceanside Blvd., Oceanside, Calif.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.

CONVERTERS, SIGNAL-TO-COLOR

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

CONVERTERS, SINGLE SIDEBAND RECEIVER

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.

CONVERTERS, SYNCHRO-TO-DIGITAL

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ... p 762, 1329
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1333
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 776, 2665
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Digital Equip. Corp., 146 Main St., Maynard, Mass.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 790, 791
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif. ..... p 800
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 808, 2674, 2675
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. p 812, 813, 2683
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Ditran Corp., Div. Clifton, 25 Adams St., Burlington, Mass.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.

CONVERTERS, SYNCHRO TO LINEAR DC

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1035
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 2674, 2675
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.

CONVERTERS, SYNCHRO TO SINE/COSINE

General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1035
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 2674, 2675

CONVERTERS, TAPE-TO-CARD

Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Logic Science, Inc., Box 10096, San Diego, Calif.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Demex, Inc., 2130 Jefferson, Kansas City, Mo.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

CONVERTERS, TELEMETRY

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Diamond Repeater Co., 55 Main St., Madison, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Foxboro, Foxboro, Mass.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.

CONVERTERS, UHF TO VHF

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gavin Instrs., Inc., Box 413, Somerville, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Optimax Inc., 258 N. Main St., Ambler, Pa.
RMS Electronics, Inc., 50 Antin Pl., Bronx, N. Y.

COOLERS, CRYOGENIC

R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
S & A Electronics, Inc., 202 W. Florence St., Toledo, Ohio
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.

CONVERTERS, VIBRATOR TYPE--SEE CONVERTERS, POWER FREQUENCY, VIBRATOR

CONVERTERS, VOLTAGE TO FREQUENCY

Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y. ..... p 1854
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 772, 773
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
M F Electronics Corp., 118 East 25th St., New York, N. Y. ..... p 1121
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 1466
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. ..... p 2793
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Analogic Co., 296 Newton St., Waltham, Mass.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EMR Div., Box 223, Princeton, N. J.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Metal Removal Co., 1801 W. Columbia, Chicago, Ill.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
NUS Corp., Box 248, Paramus, N. J.
Nation Wide Elctrn. Sys., Inc., 570 Bloomingdale Rd., Itasca, Ill.
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.

COOLANTS, CIRCUIT & COMPONENT

Dow Corning Corp., Midland, Mich. ..... p 1580
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electronic Chemical Corp., 813 Communipaw Ave., Jersey City, N. J.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Humble Oil & Refining Co., P.O. Box 2180, Houston, Tex.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Rawn Company, Inc., Box 9, Spooner, Wisc.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Stauffer Chemical Co., Silicone Dept., 299 Park Ave., New York, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.

COOLERS, CRYOGENIC

Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J.
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Air Products & Chemicals Inc., Box 538, Allentown, Pa.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Environmental Control Sys. Div., 43-22 Queens St., Long Island City, N. Y.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

COOLERS, CRYOGENIC (Cont'd)

International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Malaker Corp., W. Main St., High Bridge, N. J.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Tor Inc., Box 8, Irwindale, Calif.

COOLING EQUIPMENT—SEE AIR CONDITIONERS; BLOWERS & FANS

COOLING/HEATING DEVICES, THERMOELECTRIC

Augat Inc., 36 Perry Ave., Attleboro, Mass.
Borg-Warner Thermoelectrics, Wolf & Algonquin Rds., Des Plaines, Ill. p 2796, 2797
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. . . p 1250, 1372
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
London Co., 811 Sharon Dr., Westlake, Ohio
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2586
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas
American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.
American Smelting & Refining Co., 120 Broadway, New York, N. Y.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Environmental Control Sys. Div., 43-22 Queens St., Long Island City, N. Y.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Materials Electronic Products Corp., 990 Spruce St., Trenton, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Task Corporation, Box 3999, Anaheim, Calif.
3M Co., 3M Center, St. Paul, Minn.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Tor Inc., Box 8, Irwindale, Calif.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

COOLING PACKAGES, SEMICONDUCTOR—SEE TRANSISTOR & DIODE HEAT DISSIPATORS

COOLING SPRAYS—SEE COOLANTS, CIRCUIT & COMPONENT

COORDINATE MEASURING MACHINES—SEE MACHINES, MEASURING

COPPER CLAD LAMINATES—SEE LAMINATES, METAL CLAD

CORDS & CABLE, DIAL DRIVE

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Bergen Wire Rope Co., 1234 Gregg St., Lodi, N. J.
Bevin-Wilcox Line Co., 95 Skinner St., E. Hampton, Conn.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Carol Cable Co., Box 68, Pawtucket, R. I.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gudebrod Bros. Silk Co., Inc., 225 West 34th St., New York, N. Y.
Hackensack Cable Corp., 110 Orchard St., Hackensack, N. J.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Matthews, R. Corp., E. Warren St., Fall River, Mass.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.

CORDS & TAPES, LACING

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Markel, L. Frank, & Sons, School La., Norristown, Pa.
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Bevin-Wilcox Line Co., 95 Skinner St., E. Hampton, Conn.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
Gudebrod Bros. Silk Co., Inc., 225 West 34th St., New York, N. Y.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Matthews, R. Corp., E. Warren St., Fall River, Mass.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.

CORDS, LINE & SET, EXTENSION

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Apex Wire & Cable Corp., 380 Vanderbilt Motor Pkwy., Hauppauge, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Cord Specialties Co., 9239 Cherry St., Franklin Park, Ill.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electri-Cord Mfg. Co., Inc., 312 E. Main St., Westfield, Pa.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Electric Parts Corp., Box 234, Georgetown, Ky.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
General Cable Corp., 733 Third Ave., New York, N. Y.
Ideas, Inc., 118 Grand Ave., Laramie, Wyo.
Keiser's Industries, Inc., Laumau St., Mt. Holly Springs, Pa.
Koss Electronics, Inc., 2227 North 31st St., Milwaukee, Wisc.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Linemaster Switch Corp., Box 52, Woodstock, Conn.
Massey, A. H., Inc., 111 Third St., Derby, Conn.
Miller Electric Co., Box 231, Woonsocket, R. I.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Noel Mfg. Co., Inc., 1415 Blondell Ave., Bronx, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Superior Insulated Wire Corp., Box 188, Stony Point, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

CORDS, LINE (LAMP)—SEE CABLE, MULTICONDUCTOR

CORDS, LINE, RESISTANCE

Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Electri-Cord Mfg. Co., Inc., 312 E. Main St., Westfield, Pa.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.

CORDS, PATCH

ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 819, 824, 828
AMP Incorporated, Box 3608, Harrisburg, Pa.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . . p 2935
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Mac Panel Co., Box 5027, High Point, N. C. ..... p 920
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill.
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. p 947, 948, 960-962, 969-974
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Trimm Inc., 400 Lake St., Libertyville, Ill. ..... p 996
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va. p 1007
Virginia Panel Corp., Box 1106, Waynesboro, Va. ..... p 1008
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Apex Wire & Cable Corp., 380 Vanderbilt Motor Pkwy., Hauppauge, N. Y.
Associated Engineering Corp., 65 Kent St., Brookline, Mass.
Audio Accessories, Inc., Gilsum, N. H.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Barker Products Co., 344 Central St., Saugus, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
California Avionics Labs., Inc., Box 701, Palo Alto, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electri-Cord Mfg. Co., Inc., 312 E. Main St., Westfield, Pa.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Cable Corp., 733 Third Ave., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Holland Electronics, Inc., 675 Hinsdale St., Brooklyn, N. Y.
Keiser's Industries, Inc., Laumau St., Mt. Holly Springs, Pa.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Lynn Elctrns. Corp., Box 3003, Philadelphia, Pa.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rectico, Inc., 20 Village Park Rd., Cedar Grove, N. J.
Rodda Co., Inc., 1005 Martin Ave., Santa Clara, Calif.
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.

CORDS, POWER—SEE CABLE, POWER

CORDS, RETRACTILE

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. . . p 961
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Associated Engineering Corp., 65 Kent St., Brookline, Mass.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Barker Products Co., 344 Central St., Saugus, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Fabri-Tek, Inc., 5901 S. County Rd. 18, Minneapolis, Minn.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Cable Corp., 733 Third Ave., New York, N. Y.
Keiser's Industries, Inc., Laumau St., Mt. Holly Springs, Pa.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Massey, A. H., Inc., 111 Third St., Derby, Conn.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.

CORDS, SPEAKER EXTENSION—SEE CABLE, AUDIO

CORDS, TWIN LEAD—SEE CABLE, MULTICONDUCTOR

CORE ARRAYS, MEMORY—SEE MEMORY ARRAYS

CORE PLANES, MEMORY—SEE MEMORY PLANES

CORE STACKS, MEMORY—SEE MEMORY STACKS

CORE MEMORY SYSTEMS—SEE MEMORY SYSTEMS, CORE

CORES, CERAMIC

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. .. p 1578
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Stackpole Carbon Co., Electronic Components Div., St. Marys, Pa.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Data Magnetics Corp., 5441 West 104th St., Los Angeles, Calif.
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Electrical Refractories Co., 50 E. Clark St., E. Palestine, Ohio
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Ferro Corp., Electro Refractories Div., Box 781, E. Liverpool, Ohio
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Indiana General Corp., Elctrns. Div., Memory Prods., Keasbey, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kirchberger, M., & Co., Inc., 250 Humphrey St., Englewood, N. J.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Norton Co., 1 New Bond St., Worcester, Mass.
Permag Corp., 88-06 Van Wyck Expwy., Jamaica, N. Y.

Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Star Porcelain Co., 71 Muirhead Ave., Trenton, N. J.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
3M Co., 3M Center, St. Paul, Minn.
Ultrasonic Machining Co., 266 West Ave., Long Branch, N. J.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Zircoa, (Zirconium Corp. of America), Box 39217, Solon, Ohio

CORES, MAGNETIC, FERRITE, EI&E

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Stackpole Carbon Co., Electronic Components Div., St. Marys, Pa.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan p 1236
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Fair-Rite Prods Corp., 1 Commercial Row, Wallkill, N. Y.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.

CORES, MAGNETIC, FERRITE, POT & CUP

Stackpole Carbon Co., Electronic Components Div., St. Marys, Pa.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan p 1236
Fair-Rite Prods Corp., 1 Commercial Row, Wallkill, N. Y.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.

CORES, MAGNETIC, FERRITE, SLUG

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
Stackpole Carbon Co., Electronic Components Div., St. Marys, Pa.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan p 1236
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Fair-Rite Prods Corp., 1 Commercial Row, Wallkill, N. Y.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.

CORES, MAGNETIC, FERRITE, TOROID

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Stackpole Carbon Co., Electronic Components Div., St. Marys, Pa.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan p 1236
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Fair-Rite Prods Corp., 1 Commercial Row, Wallkill, N. Y.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Magnetic Core Corp., John St., Box 368, Newburgh, N. Y.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.

CORES, MAGNETIC, FERRITE, YOKE SECTION

Stackpole Carbon Co., Electronic Components Div., St. Marys, Pa.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.

CORES, MAGNETIC, METAL ALLOY (OTHER THAN SILICON & NICKEL-IRON)

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J.
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
National Moldite Co., Inc., 250 South St., Newark, N. J.

CORES, MAGNETIC, NICKEL-IRON, EI, EE, F & RING LAMINATIONS

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. ... p 1221
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.

CORES, MAGNETIC, NICKEL-IRON, TOROID (CASED & BOBBIN)

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. ... p 1221
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Infinetics, Inc., Electro-Magnetic Div., 1601 Jessup St., Wilmington, Dela.

CORES, MAGNETIC, POWDERED IRON, POT & CUP

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212, 1213
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Magnetic Core Corp., John St., Box 368, Newburgh, N. Y.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Micrometals, 228 N. Sunset, City of Industry, Calif.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Pyroferric—New York, Inc., Bronx Blvd. at 216th St., Bronx, N. Y.

CORES, MAGNETIC, POWDERED IRON, SLUG

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212, 1213
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Magnetic Core Corp., John St., Box 368, Newburgh, N. Y.
Micrometals, 228 N. Sunset, City of Industry, Calif.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Pyroferric-Illinois, Inc., 200 Madison St., Toledo, Ill.
Pyroferric—New York, Inc., Bronx Blvd. at 216th St., Bronx, N. Y.

CORES, MAGNETIC, POWDERED IRON TOROID

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212, 1213
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Magnetic Core Corp., John St., Box 368, Newburgh, N. Y.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Micrometals, 228 N. Sunset, City of Industry, Calif.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Pyroferric-Illinois, Inc., 200 Madison St., Toledo, Ill.
Pyroferric—New York, Inc., Bronx Blvd. at 216th St., Bronx, N. Y.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.

CORES, MAGNETIC, POWDERED PERMALLOY, TOROID

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Infinetics, Inc., Electro-Magnetic Div., 1601 Jessup St., Wilmington, Dela.
Magnetic Core Corp., John St., Box 368, Newburgh, N. Y.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.

CORES, MAGNETIC, SILICON, "C"

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. ... p 1221
Carstedt Research Inc., Box 1347, Long Beach, Calif.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.
Westinghouse Elec. Corp., Specialty Transformer Div., Box 231, Greenville, Pa.

CORES, MAGNETIC, SILICON, EI, EE & F LAMINATIONS

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.

CORES, MAGNETIC, SILICON, TOROID

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. ... p 1221
Carstedt Research Inc., Box 1347, Long Beach, Calif.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.

CORNERS, WAVEGUIDE—SEE BENDS & TWISTS, MICROWAVE

CORONA TESTERS—SEE TESTERS, CORONA

COULOMETERS—SEE TIMERS, ELECTROLYTIC CELL

COUNTERS, BI-DIRECTIONAL

Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1182
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025
ENM Co., Inc., 5306 W. Lawrence Ave., Chicago, Ill. ..... p 1028
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040

COUNTERS, DIGITAL

Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn.
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J. ..... p 1041
Icon Corp., 156 Sixth St., Cambridge, Mass.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Presin Co., Trap Falls Rd., Shelton, Conn. ..... p 1051
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Data Graphics Corp., Box 18324, San Antonio, Tex.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digital Products Corp., 4030 N.E. 6th Ave., Ft. Lauderdale, Fla.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
EDP Corp., Box 6485, Orlando, Fla.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Gilway Co., Electronics Div., Box 584, Newburyport, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Litton Industries, Encoder Div., 20745 Nordhoff St., Chatsworth, Calif.
Micro Elctrn. Sys., Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Technmetric Co., 2449 Harding Ave., Redwood City, Calif.
3M Co., 3M Center, St. Paul, Minn.
WER Industrial Corp., 3036 Alt Blvd., Grand Island, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COUNTERS, COIL WINDING

CMC, 12970 Bradley Ave., San Fernando, Calif.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
ENM Co., Inc., 5306 W. Lawrence Ave., Chicago, Ill. ..... p 1028
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif.
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J. ..... p 1041
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
Presin Co., Trap Falls Rd., Shelton, Conn.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Elden Mfg. Corp., 2712 N. Elston Ave., Chicago, Ill.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.

COUNTERS, DIGITAL

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
Agastat Div., 1027 Newark Ave., Elizabeth, N. J.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Amphenol Controls Div., 120 S. Main St., Janesville, Wisc.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1182
C & K Components Inc., 103 Morse St., Watertown, Mass.
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.

COUNTERS, DIGITAL (Cont'd)

Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 772, 773
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif. ..... p 779
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J. p 1571
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Fork Standards Inc., 213 Main St., West Chicago, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1038
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Heath Co., Dept. 180, Benton Harbor, Mich.
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J. ..... p 1041
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Icon Corp., 156 Sixth St., Cambridge, Mass.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Magtrol Inc., 240 Seneca St., Buffalo, N. Y. ..... p 1749
Mesa Co., Inc., 216-220 Mill St., Bristol, Pa. ..... p 1195
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 786
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Neutronic Corp., Box 625, St. Louis, Mo.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Patwin Div., Box 710, Waterbury, Conn. ..... p 1196, 1197
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa. p 794
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Presin Co., Trap Falls Rd., Shelton, Conn. ..... p 1051
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1481
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Bristol Co., Box 1790, Waterbury, Conn.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Counting Instrs. Ltd., 5, Elstree Way, Boreham Wood, Hertfordshire, Eng.
Data Graphics Corp., Box 18324, San Antonio, Tex.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
EDP Corp., Box 6485, Orlando, Fla.
EG & G Inc., 35 Congress St., Salem, Mass.
Eberline Instr. Corp., 805 Early St., Santa Fe, N. M.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Foster & Allen, Inc., Box 466, Chatham, N. J.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Melland Gear & Instr. Co., Inc., 84 Sylvester St., Westbury, N. Y.
Micro Elctrn. Sys., Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Nano Fast, Inc., 416 W. Erie, Chicago, Ill.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
National Electronics, Inc., Box 269, Geneva, Ill.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Redington Counters Inc., 130 Addison Rd., Windsor, Conn.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Roback Corp., Huntingdon Valley, Pa.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Royco Instruments Inc., 141 Jefferson Dr., Menlo Pk., Calif.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
3M Co., 3M Center, St. Paul, Minn.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Universal Mfg. Co., Inc., 1168 Grove St., Irvington, N. J.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
WER Industrial Corp., 3036 Alt Blvd., Grand Island, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COUNTERS, DIRECTIONAL

Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1182
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J. ..... p 1041
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
EDP Corp., Box 6485, Orlando, Fla.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
3M Co., 3M Center, St. Paul, Minn.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COUNTERS, ELECTRO-MAGNETIC

Agastat Div., 1027 Newark Ave., Elizabeth, N. J.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025
ENM Co., Inc., 5306 W. Lawrence Ave., Chicago, Ill. ..... p 1028
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1038
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J. ..... p 1041
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Presin Co., Trap Falls Rd., Shelton, Conn.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Automatic Timing & Controls Inc., King of Prussia, Pa.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Counting Instrs. Ltd., 5, Elstree Way, Boreham Wood, Hertfordshire, Eng.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Gilway Co., Electronics Div., Box 584, Newburyport, Mass.
Hughes Aircraft Co., Ground Sys. Group, 1901 Malvern St., Fullerton, Cal.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Peco Corp., 111 Ortego Ave., Mt. View, Calif.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Redington Counters Inc., 130 Addison Rd., Windsor, Conn.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.

COUNTERS, FREQUENCY

AEL Inc., P.O. Box 552, Lansdale, Pa.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Amphenol Controls Div., 120 S. Main St., Janesville, Wisc.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Magtrol Inc., 240 Seneca St., Buffalo, N. Y. ..... p 1749
Mesa Co., Inc., 216-220 Mill St., Bristol, Pa.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 786
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Neutronic Corp., Box 625, St. Louis, Mo.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1492
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
Micro Elctrn. Sys., Inc., 1275 Bloomfield Ave., Fairfield, N. J.

Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
New London Instrument Co., Box 189, New London, Conn.
Northeast Electronics Corp., Box 649, Concord, N. H.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
3M Co., 3M Center, St. Paul, Minn.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COUNTERS, GATING

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Neutronic Corp., Box 625, St. Louis, Mo.
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Roback Corp., Huntingdon Valley, Pa.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
3M Co., 3M Center, St. Paul, Minn.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COUNTERS, GEIGER

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Eberline Instr. Corp., 805 Early St., Santa Fe, N. M.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Development Lab., Inc., Box 7034, Kansas City, Mo.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Reuter-Stokes, 18530 S. Miles Pkwy., Cleveland, Ohio
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Wood, N. Counter Lab, Inc., 1525 East 53rd St., Chicago, Ill.

COUNTERS, MECHANICAL

Amphenol Controls Div., 120 S. Main St., Janesville, Wisc.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025
ENM Co., Inc., 5306 W. Lawrence Ave., Chicago, Ill. ..... p 1028
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J.
Planet Instr., Inc., 1521 Progress Rd., Ft. Wayne, Ind. ..... p 1752
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Presin Co., Trap Falls Rd., Shelton, Conn.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Counting Instrs. Ltd., 5, Elstree Way, Boreham Wood, Hertfordshire, Eng.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Foxboro, Foxboro, Mass.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
Melland Gear & Instr. Co., Inc., 84 Sylvester St., Westbury, N. Y.
Olympic Instruments, Inc., Vashon, Wash.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Redington Counters Inc., 130 Addison Rd., Windsor, Conn.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Stevens, Geo., Mfg. Co., Inc., 6001 N. Keystone Ave., Chicago, Ill.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.

COUNTERS, PARTICLE

Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Baker Co., Inc., 106 Granite St., Biddeford, Me.
Components Corp., 106 Main St., Denville, N. J.
Controlled Environment Equip Corp., 160 Pleasant St., Brockton, Mass.
Eberline Instr. Corp., 805 Early St., Santa Fe, N. M.
Femco, Inc., Box F, Irwin, Pa.
GCA Technology, Burlington Rd., Bedford, Mass.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nuclear Development Lab., Inc., Box 7034, Kansas City, Mo.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Royco Instruments Inc., 141 Jefferson Dr., Menlo Pk., Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Wood, N. Counter Lab, Inc., 1525 East 53rd St., Chicago, Ill.

COUNTERS, PHOTOELECTRIC

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J.
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Continental Instrs. Corp., 110 Atlantic Ave., Lynbrook, N. Y.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
GCA Technology, Burlington Rd., Bedford, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mithras Div., Sanders Assocs., Inc., 701 Concord Ave., Cambridge, Mass.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Peco Corp., 111 Ortego Ave., Mt. View, Calif.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tri-Tronics Co., 619 Enterprise Dr., Oak Brook, Ill.
Worner Electrn. Devices, Rankin, Ill.

COUNTERS, PRESET

Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1182
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025

COUNTERS, PULSE

ENM Co., Inc., 5306 W. Lawrence Ave., Chicago, Ill. ..... p 1028
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1038
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J. ..... p 1041
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Icon Corp., 156 Sixth St., Cambridge, Mass.
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Mesa Co., Inc., 216-220 Mill St., Bristol, Pa.
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Paraham Inc., 3017 E. Las Hermanas St., Compton, Cal.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Presin Co., Trap Falls Rd., Shelton, Conn. ..... p 1051
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Counting Instrs. Ltd., 5, Elstree Way, Boreham Wood, Hertfordshire, Eng.
Data Graphics Corp., Box 18324, San Antonio, Tex.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Egan Laboratory, 107-56 113th St., Richmond Hill, N. Y.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Micro Elctrn. Sys., Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
NUS Corp., Box 248, Paramus, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Nuclear Supplies, Box 312, Encino, Calif.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Roback Corp., Huntingdon Valley, Pa.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
3M Co., 3M Center, St. Paul, Minn.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
WER Industrial Corp., 3036 Alt Blvd., Grand Island, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COUNTERS, PROPORTIONAL—SEE COUNTERS, PARTICLE

COUNTERS, PULSE

Agastat Div., 1027 Newark Ave., Elizabeth, N. J.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif.
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. ..... p 2707
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.

COUNTERS, PULSE (Cont'd)

Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Curtis Instruments, Inc., 200 Kisco Ave., Mt. Kisco, N. Y. ..... p 1364
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025
ENM Co., Inc., 5306 W. Lawrence Ave., Chicago, Ill. ..... p 1028
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1038
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Icon Corp., 156 Sixth St., Cambridge, Mass.
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Magtrol Inc., 240 Seneca St., Buffalo, N. Y. ..... p 1749
Neutronic Corp., Box 625, St. Louis, Mo.
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Presin Co., Trap Falls Rd., Shelton, Conn.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1481
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
Acoustronics, Inc., 156 Olive St., Huntington, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Components Corp., 106 Main St., Denville, N. J.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Counting Instrs. Ltd., 5, Elstree Way, Boreham Wood, Hertfordshire, Eng.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Eberline Instr. Corp., 805 Early St., Santa Fe, N. M.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Foster & Allen, Inc., Box 466, Chatham, N. J.
Foxboro, Foxboro, Mass.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heli-Coil Corp., Shelter Rock La., Danbury, Conn.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Redington Counters Inc., 130 Addison Rd., Windsor, Conn.
Roback Corp., Huntingdon Valley, Pa.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Stevens, Geo., Mfg. Co., Inc., 6001 N. Keystone Ave., Chicago, Ill.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
3M Co., 3M Center, St. Paul, Minn.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.
Wintriss Controls, 20 Vandam St., New York, N. Y.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COUNTERS, RADIATION—SEE COUNTERS, GEIGER—ALSO SEE COUNTERS SCINTILLATION

COUNTERS, REVERSIBLE—SEE COUNTERS, BI-DIRECTIONAL

COUNTERS, REVOLUTION

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc. ..... p 1025
ENM Co., Inc., 5306 W. Lawrence Ave., Chicago, Ill. ..... p 1028
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J. ..... p 1041
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Presin Co., Trap Falls Rd., Shelton, Conn.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Counting Instrs. Ltd., 5, Elstree Way, Boreham Wood, Hertfordshire, Eng.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
JMR Elctrns. Corp., 1424 Blondell Ave., Bronx, N. Y.
Micro Elctrn. Sys., Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Post Electronic Prods., 12 Lothrop St., Beverly, Mass.
Redington Counters Inc., 130 Addison Rd., Windsor, Conn.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
WER Industrial Corp., 3036 Alt Blvd., Grand Island, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

COUNTERS, SCINTILLATION

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Components Corp., 106 Main St., Denville, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Eberline Instr. Corp., 805 Early St., Santa Fe, N. M.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Goldak Co., Inc., 1101-A Air Way, Glendale, Calif.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Pilot Chemicals, Inc., 36 Pleasant St., Watertown, Mass.
Velonex, 560 Robert Ave., Santa Clara, Calif.

COUPLERS & KEYERS—SEE KEYERS & COUPLERS

COUPLERS, ANTENNA

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Dalco Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Tracor Inc., 6500 Tracor La., Austin, Texas
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Aircom, Inc., Rte. 16B, Union, N. H.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Antennacraft Co., Box 1005, Hwy. 34, W., Burlington, Iowa
Antronic Corp., 4942 Division, Chicago, Ill.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Color/Craft Antenna Corp., 13434 Raymer St., N. Hollywood, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Gavin Instrs., Inc., Box 413, Somerville, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lance Inds., Box 4156, Sylmar, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maspro Co., Inc., Asada, Nissin, Nagoya-Shigai, Japan
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RMS Electronics, Inc., 50 Antin Pl., Bronx, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Squires-Sanders Inc., Martinsville Rd., Liberty Corner, N. J.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

COUPLERS, DIRECTIONAL

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.

Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. .... p 1652
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1343
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J. ..... p 1720
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Finney Co., 34 W. Interstate St., Bedford, Ohio
GAF Corp., 140 West 51 St., New York, N. Y.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
Gavin Instrs., Inc., Box 413, Somerville, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Olektron Corp., Box 248, Dudley, Mass.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

COUPLERS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1652
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1662
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J. ..... p 1720
AAI Corp., Box 6767, Baltimore, Md.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Allied Research & Engineering Co., 10300 Glasgow Pl., Los Angeles, Calif.
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Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
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Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
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Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
GAF Corp., 140 West 51 St., New York, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Gulde Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
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Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

COUPLERS, MULTI-SET—SEE COUPLERS, ANTENNA

COUPLERS, ROTARY

Data Technology Inc., 65 Grove St., Watertown, Mass.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.

COUPLINGS, MICROWAVE—SEE COUPLERS, MICROWAVE

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COUPLINGS, QUICK-DISCONNECT, LIQUID OR GAS

Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Eastern Industries, 100 Skiff St., Hamden, Conn.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Holmberg, Inc., 20 Melville Park Rd., Melville, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Roylyn Inc., 620 Paula Ave., Glendale, Calif.
Scanivalve Inc., Box 20005, San Diego, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Wiggins, E. B., Inc., 5000 Triggs St., Los Angeles, Calif.

COUPLINGS, SHAFT, RIGID & FLEXIBLE

Accurate Electronics Corp., Box 935J, Elyria, Ohio
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. .... p 1173
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2670, 2910
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 1174, 2913
Northfield Precision Instr. Corp., 4400 Austin Blvd., Island Park, N. Y. p 1751
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Theta Instrument Corp., Fairfield, N. J. ..... p 1514
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Belfab, Unit of Bailey Meter Co., Box 1881, Daytona Beach, Fla.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Britec Ltd., 17 Charing Cross Rd., London, W.C. 2, Eng.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Curtis Universal Joint Co., Inc., 19 Birnie Ave., Springfield, Mass.
Dial Products Co., 19-21 Cottage St., Bayonne, N. J.
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
Falcon Machine & Tool Co., Inc., 164 Ballardvale St., Wilmington, Mass.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
General Thermodynamics Corp., 164 Ballardvale St., Wilmington, Mass.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Helical Prods. Co., Inc., Box 4, Hermosa Beach, Calif.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Lord Mfg. Co., 1635 West 12th St., Erie, Pa.
Metal Bellows Corp., 1075 Providence Hwy., Sharon, Mass.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Naugler Engineering, Inc., Off Dunham Rd., Beverly, Mass.
Nilsen Mfg. Co., Box 127, 920 Hwy. 27, Haines City, Fla.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Renbrandt, Inc., 6 Parmelee St., Boston, Mass.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Santa Fe Mfg. Co., 2343 Jerome Ave., Bronx, N. Y.
Sealol, Inc., Warwick Indl. Pk., Providence, R. I.
Servometer Corp., 82 Industrial E., Clifton, N. J.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Stow Mfg. Co., 101 Shear St., Binghamton, N. Y.
USM Corp., 81 Bay State Rd., Wakefield, Mass.

COUPLINGS, VACUUM

Edwards High Vacuum (Can.) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Welch Scientific Co., 7300 N. Linder Ave., Skokie, Ill.

COVERS, CHASSIS

Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Erie Artisan Corp., 11400 Madison Ave., Cleveland, Ohio
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
GAF Corp., 140 West 51 St., New York, N. Y.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.

COVERS, CHASSIS (Cont'd)

Metalcraft, Inc., Roosevelt Field, Garden City, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Middletown Mfg. Co., 27 Stack St., Middletown, Conn.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
Rotary Co., Inc., 1746 Dale Rd., Buffalo, N. Y.

COVERS, JACK—SEE JACK COVERS

COVERS, PROTECTIVE

G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Globe Plastics, 1342 South Signal Dr., Pomona, Calif. ..... p 2514
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Glenair, Inc., 1211 Air Way, Glendale, Calif.
Kees, F. D. Mfg. Co., 700 Park Ave., Beatrice, Neb.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.

CRAYONS, COATINGS, PELLETS, ETC., TEMPERATURE INDICATING

Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Markal Co., 250 N. Washtenaw Ave., Chicago, Ill.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

CRIMPING MACHINES & TOOLS—SEE TOOLS, CRIMPING

CROSSBARS—SEE SCANNERS, CROSSBAR; SWITCHES, CROSSBAR

CRUCIBLES—SEE BOATS

CRYOGENIC EQUIPMENT—SEE DEWARS; PUMPS; ETC.

CRYOGENIC LIQUID CONVERTERS

Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.

CRYSTAL ANALYZERS—SEE ANALYZERS, CRYSTAL

CRYSTAL BLANKS

Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ... p 1074, 1075
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1078
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. ..... p 1077
Croven, Ltd., 500 Beech St., Whitby, Ont., Canada ..... p 1114
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Filtaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1113
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1116, 1117, 1119
Microsonics Inc., 60 Winter St., Weymouth, Mass.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1128
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
International Crystal Mfg. Co., 10 N. Lee St., Oklahoma City, Okla.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Nebel, R. E., Lab., 31 Whitehall Blvd., Garden City, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Recticon Corp., 730 E. Elm St., Conshohocken, Pa.
Texas Crystals, 1000 Crystal Dr., Fort Myers, Fla.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.

CRYSTAL FILTERS—SEE FILTERS, CRYSTAL

CRYSTAL MOUNTS—SEE MOUNTS, CRYSTAL

CRYSTAL OSCILLATORS—SEE OSCILLATORS, CRYSTAL—CONTROLLED

CRYSTAL OVENS—SEE OVENS, CRYSTAL & COMPONENT

CRYSTALS, BARIUM TITANATE

Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Linden Labs. Inc., Box 920, State College, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Rason Mfg. Co., 73 Wortman Ave., Brooklyn, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

CRYSTALS, FILTER

Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. .... p 1074, 1075
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1078
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Clark Crystal Corp., 344 Boston Post Rd., Marlborough, Mass. .. p 1103
Collins Radio Co., Newport Beach, Calif.
Croven, Ltd., 500 Beech St., Whitby, Ont., Canada ..... p 1114
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. .. p 1095
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Filtaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1113
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1109, 1605
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1116, 1117, 1119
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Northern Engineering Labs Inc., 357 Beloit St., Burlington, Wisc. p 1126
Piezo Technology, Inc., 2400 Diversified Way, Orlando, Fla. .... p 1111
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1128
Sherold Crystals Prod. Gp., Tyco Labs., Inc., 1510 McGee Trafficway, Kansas City, Mo. ..... p 1131
Tedford Crystal Labs., Inc., 4914 Gray Rd., Cincinnati, Ohio ... p 1134
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
United Transformer Co., 150 Varick St., New York, N. Y.
C-W Crystals, Rte. #2, Box 22-B, Marshfield, Mo.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Standard Crystal Co., 1105 S. Fremont Ave., Alhambra, Calif.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.

CRYSTALS, FREQUENCY CONTROL

Accutronics, Inc., 628 North St., Geneva, Ill.
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. .... p 1074, 1075
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1078
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Clark Crystal Corp., 344 Boston Post Rd., Marlborough, Mass. .. p 1103
Croven, Ltd., 500 Beech St., Whitby, Ont., Canada ..... p 1114
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. p 1092, 1095
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Filtaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1113
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1109, 1605
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1116, 1117, 1119
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1123
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Northern Engineering Labs Inc., 357 Beloit St., Burlington, Wisc. p 1126
Piezo Technology, Inc., 2400 Diversified Way, Orlando, Fla. .... p 1110
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1128
Sherold Crystals Prod. Gp., Tyco Labs., Inc., 1510 McGee Trafficway, Kansas City, Mo. ..... p 1131
Tedford Crystal Labs., Inc., 4914 Gray Rd., Cincinnati, Ohio ... p 1134
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Tracor Inc., 6500 Tracor La., Austin, Texas
C-W Crystals, Rte. #2, Box 22-B, Marshfield, Mo.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
International Crystal Mfg. Co., 10 N. Lee St., Oklahoma City, Okla.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Nebel, R. E., Lab., 31 Whitehall Blvd., Garden City, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Standard Crystal Co., 1105 S. Fremont Ave., Alhambra, Calif.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Texas Crystals, 1000 Crystal Dr., Fort Myers, Fla.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.

CRYSTALS, LASER—MASER

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Clevite Corp., Elctrn. Res. Div., 540 East 105th St., Cleveland, Ohio
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
Crystal Technology Inc., 2510 Old Middlefield Way, Mountain View, Cal.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Mithras Div., Sanders Assocs., Inc., 701 Concord Ave., Cambridge, Mass.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Union Carbide Corp., Elctrns. Div., Crystal Prods. Dept., 8888 Balboa Ave., San Diego, Cal.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio

CRYSTALS, LIQUID, TEMPERATURE INDICATING

Liquid Crystal Inds., 402 Princeton Dr., Pittsburgh, Pa.
Vari-Light Corp., 9770 Conklin Rd., Cincinnati, Ohio

CRYSTALS, PIEZOELECTRIC

Accutronics, Inc., 628 North St., Geneva, Ill.
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Croven, Ltd., 500 Beech St., Whitby, Ont., Canada ..... p 1114
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa p 1127
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1128
Sherold Crystals Prod. Gp., Tyco Labs., Inc., 1510 McGee Trafficway, Kansas City, Mo. ..... p 1131
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
C-W Crystals, Rte. #2, Box 22-B, Marshfield, Mo.
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Crystal Technology Inc., 2510 Old Middlefield Way, Mountain View, Cal.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Mithras Div., Sanders Assocs., Inc., 701 Concord Ave., Cambridge, Mass.
Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Seacor, Inc., 598 Broadway, Norwood, N. J.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Texas Crystals, 1000 Crystal Dr., Fort Myers, Fla.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
3M Co., 3M Center, St. Paul, Minn.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.

CRYSTALS, QUARTZ

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. .... p 1074, 1075
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1078
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif.
Clark Crystal Corp., 344 Boston Post Rd., Marlborough, Mass. .. p 1103
Croven, Ltd., 500 Beech St., Whitby, Ont., Canada ..... p 1114
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. p 1092, 1095
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Filtaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1113
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1109, 1605
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1116, 1117, 1119
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1123
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Northern Engineering Labs Inc., 357 Beloit St., Burlington, Wisc. p 1126
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa p 1127
Piezo Technology, Inc., 2400 Diversified Way, Orlando, Fla. .... p 1111
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1128
Sherold Crystals Prod. Gp., Tyco Labs., Inc., 1510 McGee Trafficway, Kansas City, Mo. ..... p 1131
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tedford Crystal Labs., Inc., 4914 Gray Rd., Cincinnati, Ohio ... p 1134
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.

Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Hoffman, P. R. Co., 307 Cherry St., Carlisle, Pa.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Mithras Div., Sanders Assocs., Inc., 701 Concord Ave., Cambridge, Mass.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Quaker Electronics, Box 215, Hunlock Creek, Pa.
Sawyer Research Prods., Inc., 35400 Lakeland Blvd., Eastlake, Ohio
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Texas Crystals, 1000 Crystal Dr., Fort Myers, Fla.
Thermal American Fused Quartz Co.,
Rte. 202 & Change Bridge Rd., Montville, N. J.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.
Zenith Optical Lab., 138 Palisade St., Dobbs Ferry, N. Y.

CRYSTALS, ROCHELLE SALTS

Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France

CRYSTALS, SAPPHIRE

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Alessi Industries, 418 Main St., El Segundo, Calif.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Insaco, Inc., Box 442, Quakertown, Pa.
Moser Jewel Co., 544 Fayette St., Perth Amboy, N. J.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
Nuclear Element Corp., 420 S. McKean St., Butler, Pa.
Union Carbide Corp., Elctrns. Div., Crystal Prods. Dept., 8888 Balboa Ave., San Diego, Cal.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.

CRYSTALS, SCINTILLATION COUNTER

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Nuclear Element Corp., 420 S. McKean St., Butler, Pa.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Pilot Chemicals, Inc., 36 Pleasant St., Watertown, Mass.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

CRYSTALS, SEMICONDUCTOR (INGOTS AND WAFERS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Dow Corning Corp., Midland, Mich.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1643
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. . . . p 1109
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Narda Microwave Corp., Plainview, N. Y.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
General Diode Corp., 18 South St., Framingham, Mass.
Harmon, Lichtenstein & Co., 26 Broadway, New York, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Mithras Div., Sanders Assocs., Inc., 701 Concord Ave., Cambridge, Mass.
Monsanto-Electronic Materials, Box 8, St. Peters, Mo.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
Norton Co., 1 New Bond St., Worcester, Mass.
Nuclear Element Corp., 420 S. McKean St., Butler, Pa.
Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Recticon Corp., 730 E. Elm St., Conshohocken, Pa.
Ronson Metals Corp., 55 Manufacturers Pl., Newark, N. J.
Semimetals, Inc., 172 Spruce St., Westbury, N. Y.
Semimetals, Inc., 405 National Ave., Mountain View, Calif.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.

CRYSTALS, YIG

Electro/Data Inc., 3121 Benton St., Garland, Tex.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Microwave Chemicals Lab., Inc., 282 Seventh Ave., New York, N. Y.
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio

CUPS, ENCAPSULATION

G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J.
Globe Plastics, 1342 South Signal Dr., Pomona, Calif. . . . . . p 2514
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa. . . . . . p 1228
Atlantic Optical Moulding Co., Ellis St., Dudley, Mass.
Celestial Components, Inc., Box 4035, Covina, Calif.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Delta Plastics Co., 776 Creek Rd., Bellmawr, N. J.
Electrical Plastics Corp., 280 Warren St., Lyndhurst, N. J.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Gibson-Egan Co., 34 La Porte St., Arcadia, Calif.
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Industrial Elctrn. Rubber Co., 8589 Darrow Rd., Twinsburg, Ohio
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Morris Enterprises, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Ny-Glass, Inc., 7314 E. Madison St., Paramount, Calif.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Rayclad Tubes, Inc., 300 Constitution Dr., Menlo Park, Calif.
Resdel Corp., Box 2171, Rio Grande, N. J.
Rostone Corp., Route 52 S., Lafayette, Ind.
Staffall Inc., 7 Woodland St., Providence, R. I.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Wells Elctrns., Inc., Plastics Div., 1701 S. Main St., S. Bend, Ind.

CURRENT SENSORS—SEE TRANSDUCERS, VOLT, ETC.

CURRENT SOURCES

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1378
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. . . . . p 1392
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. . . p 1960
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio . . . . . p 1968
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1414, 1417
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. . . . p 1972, 1973, 1986
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. . . . . p 2056
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. . . . . . p 2064
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Electronics for Life Sciences, Inc., Box 697, Twinbrook Sta., Rockville, Md.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrument Components Co., 15105 Broadway, Maple Hghts., Ohio
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

CUTTERS, HOLE, HAND OPERATED

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Black & Decker Mfg. Co., 701 E. Joppa Rd., Towson, Md.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Greenlee Tool Co., 2136-12th St., Rockford, Ill.
Henes Mfg. Co., 4301 E. Madison St., Phoenix, Ariz.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Zephyr Mfg. Co., 201 Hindry Ave., Box 759, Inglewood, Calif.

CUTTERS, WIRE, AUTOMATIC—SEE WIRE MEASURING & CUTTING MACHINES

CUTTERS, WIRE, HAND—SEE WIRE CUTTERS, HAND OPERATED

DAMPERS, SERVO

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2669
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. . . . . . p 1758
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. . . . p 1771, 2679
Weston-Transicoil Components Div., Worcester, Pa.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Computer Devices, 11925 Burke St., Santa Fe Springs, Calif.
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.

DATA ACQUISITION

Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

DAMPERS, STRUCTURAL, CHASSIS, PANEL, ETC.—SEE MOUNTS, SHOCK & VIBRATION

DATA ACQUISITION & REDUCTION SYSTEMS

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. . . . . p 758
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. . . . . . p 764, 1017
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. . . . . . p 762
CMC, 12970 Bradley Ave., San Fernando, Calif. . . . . . p 1353
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. . . . . . p 2663
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y. . . . . . p 2711
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. . . . . . p 774
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. . . . . . p 778
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Ectron Corp., 8070 Engineer Rd., San Diego, Calif. . . . . . p 527
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J. p 1570
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. . . . . . p 780
Fifth Dimension Inc., Box 483, Princeton, N. J.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781, 1393, 1675
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex. p 2158
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. . . p 528
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Ithaco, Inc., 735 W. Clinton St., Ithaca, N. Y. . . . . . p 532
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. . . . . . p 2161
Logic Science, Inc., Box 10096, San Diego, Calif.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 786, 787
Non-Linear Systems, Inc., Box N, Del Mar, Calif. . . . . . p 1450, 1451
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio . . . . . p 1455
Parahm Inc., 3017 E. Las Hermanas St., Compton, Cal. . . . . . p 793
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. . . p 797
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif. p 799
Republic Corp., 9754 Deering Ave., Chatsworth, Calif. . . . . . p 800
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Theta Instrument Corp., Fairfield, N. J.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. . . . . . p 807
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Vetter, A. R. Co., Box 143, Rebersburg, Pa. . . . . . p 2162
Wang Labs, Inc., Dept. G-AC, 836 North St., Tewksbury, Mass. . . p 815
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
B & F Instruments Inc., Cornwells Hgts., Pa.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Bailey Meter Company, Wickliffe, Ohio
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Bristol Co., Box 1790, Waterbury, Conn.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Cipher Data Prods., Inc., 1219 Morena Blvd., San Diego, Calif.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Colorado Instruments, Inc., 1 Park St., Broomfield, Colo.
Communitype Corp., 767 Fifth Ave., New York, N. Y.
Computer Automation, Inc., 895 W. Sixteenth St., Newport Beach, Calif.
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.

DATA ACQUISITION (Cont'd)

Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Copar Corp., 5744 West 77th St., Oak Lawn, Ill.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
D.A.T.A., Inc., 32 Lincoln Ave., Orange, N. J.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Defense Elctrns., Inc., Rockville, Md.
Derivation & Tabulation Assocs., Inc., 32 Lincoln Ave., Orange, N. J.
Design Automation, Inc., 809 Massachusetts Ave., Lexington, Mass.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Digital Products Corp., 4030 N.E. 6th Ave., Ft. Lauderdale, Fla.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
EMR Div., Box 223, Princeton, N. J.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Evans Assocs., Box 5055, Berkeley, Calif.
Fabri-Tek Instruments, Inc., 5225 Verona Rd., Madison, Wisc.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Ferranti-Packard Ltd., 121 Industry St., Toronto, Ont., Can.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
GCA Technology, Burlington Rd., Bedford, Mass.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Incre-Data Corp., 6403 Acoma Rd., S.E., Albuquerque, N. M.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Invac Corp., 26 Fox Rd., Waltham, Mass.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Mann, David W. Co., 174 Middlesex Turnpike, Burlington, Mass.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Midwestern Instruments, Inc., 6422 East 41st, Tulsa, Okla.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
NUS Corp., Box 248, Paramus, N. J.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Omnitec Inc., Sub. Nytronics, Inc., 903 N. Second St., Phoenix, Ariz.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Petty Geophysical Engrg. Co., 700 Tower Bldg., San Antonio, Tex.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Prodelin, Inc., Box 131, Hightstown, N. J.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Redcor Corp., Box 1031, Canoga Park, Calif.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Roback Corp., Huntingdon Valley, Pa.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roveti Instruments, 238 West St., Annapolis, Md.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Schneider Instr. Co., 8115 Camargo Rd., Madeira, Cincinnati, Ohio
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Spear Computers, Inc., 335 Bear Hill Rd., Waltham, Mass.
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
3M Co., 3M Center, St. Paul, Minn.
Time Share Peripherals Corp., Box 361, Wilton, Conn.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Western Telematic, Inc., 5507 Peck Rd., Arcadia, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

DATA BLOCKERS

Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.

DATA COMPRESSORS, DIGITAL

California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Digital Products Corp., 4030 N.E. 6th Ave., Ft. Lauderdale, Fla.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Signatron, Inc., 594 Marrett Rd., Lexington, Mass.
Teledyne Telemetry Co., Box 341, Princeton, N. J.

DATA DISPLAY INDICATORS—SEE LIGHTS: DIALS—ALSO SEE READOUTS

DATA DISPLAY SYSTEMS—SEE DISPLAYS

DATA PROCESSING EQUIPMENT—SEE SPECIFIC TYPES

DATA RECORDERS, COMPUTER

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1561
Cohu Electronics Inc., Box 823, San Diego, Calif.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 774
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J. p 1570
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex. p 2158
Houston Instr., 4950 Terminal Ave., Bellaire, Texas ... p 784, 785, 1572
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2160, 2161
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. ..... p 792
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
Ohr-Tronics, Inc., Box 630, Herkimer, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Presin Co., Trap Falls Rd., Shelton, Conn. ..... p 1051
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Auricord, 35-41 29th St., Long Island City, N. Y.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Bolt Beranek & Newman, Inc., 2126 S. Lyon St., Santa Ana, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Cipher Data Prods., Inc., 1219 Morena Blvd., San Diego, Calif.
Colorado Instruments, Inc., 1 Park St., Broomfield, Colo.
Communitype Corp., 767 Fifth Ave., New York, N. Y.
Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Cook Electric Co., Data-Stor Div., 6401 W. Oakton, Morton Grove, Ill.
Dasa Corp., 15 Stevens St., Andover, Mass.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Digital Products, 335 W. Seventh St., San Pedro, Calif.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Elec. Co., 4000 N. W. 39th Expwy., Oklahoma City, Okla.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Goldak Co., Inc., 1101-A Air Way, Glendale, Calif.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Incre-Data Corp., 6403 Acoma Rd., S.E., Albuquerque, N. M.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Invac Corp., 26 Fox Rd., Waltham, Mass.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kennedy Co., 540 W. Woodbury Rd., Altadena, Calif.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Litton Inds., Inc., Datalog Div., 343 Sansome St., San Francisco, Cal.
Lockheed Electronics Co., Rte. 22, Plainfield, N. J.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Mincom Div., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Omnitec Inc., Sub. Nytronics, Inc., 903 N. Second St., Phoenix, Ariz.
Peripheral Equip. Corp., 9551 Irondale, Chatsworth, Calif.
Photomechanisms Div., Inc., 15 Stepar Pl., Huntington Sta., N. Y.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Precision Instr. Co., 3170 Porter Dr., Palo Alto, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Roback Corp., Huntingdon Valley, Pa.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Sanders Assocs., Inc., Data Sys. Div., Daniel Webster Hwy., S., Nashua, N. H.
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
Time Share Peripherals Corp., Box 361, Wilton, Conn.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

DATA TRANSMISSION SYSTEMS—SEE TRANSMISSION SYSTEMS, DATA

DECADE BOXES, CAPACITANCE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375, 1376
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. .... p 1479
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.

DECADE BOXES, INDUCTANCE

Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
United Transformer Co., 150 Varick St., New York, N. Y.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.

DECADE BOXES, RESISTANCE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339

Clarostat Mfg. Co. Inc., Washington St., Dover, N. H.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2714
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376, 2473
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Heath Co., Dept. 180, Benton Harbor, Mich.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412, 1416, 2394
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 2002
Marstan Elctrns., 307 Washington St., Orange, N. J. ..... p 2404
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. .... p 1479
Shallcross, E. Preston St., Selma, N. C. ..... p 1482
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa. ..... p 2433
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Jordan Electric Company, 14707 Keswick St., Van Nuys, Calif.
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.
Marma Electronic Co., 1633 N. Halsted St., Chicago, Ill.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Vishay Intertechnology, Inc., 63 Lincoln Hwy., Malvern, Pa.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.

DECADE BOXES, TRANSFORMER

Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.

DECALCOMANIA—ALSO SEE LABELS, PRESSURE SENSITIVE

Datak Corp., 85 Highland Ave., Passaic, N. J. ..... p 1170
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Decalcraft U. S. A., Rte. 309, Hatfield, Pa.
Dennison Mfg. Co., 300 Howard St., Framingham, Mass
GM Nameplate, Inc., 2040 15th Ave., W., Seattle, Wash.
Kimball Systems, 151 Cortlandt St., Belleville, N. J.
Meyercord Co., 365 E. North Ave., Carol Stream, Wheaton, Ill.
Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.
National Decal Corp., 56th & Chestnut Sts., Philadelphia, Pa.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Stanpat Products, Inc., 366 Main St., Port Washington, N. Y.
Star Enterprises, Box 1098, Lowell, Mass.
Tekni-Labels Co., 8160 Orlon, Van Nuys, Calif.
3M Co., 3M Center, St. Paul, Minn.
Topflight Corp., 160 E. 9th Ave., York, Pa.
Westline Products, 220 S. Rose St., Los Angeles, Calif.

DECIMAL KEYBOARDS—SEE KEYBOARDS DECIMAL

DECODERS, AUDIO TONE

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1082
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. ..... p 2222
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Fifth Dimension Inc., Box 483, Princeton, N. J.
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill.
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Femco, Inc., Box F, Irwin, Pa.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Noller Control Systems, Inc., 150 E. Standard Ave., Richmond, Calif.
Plectron Corp., Overton, Nebr.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Reach Electronics, Inc., Box 308, Lexington, Nebr.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
3M Co., 3M Center, St. Paul, Minn.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Vega Elctrns. Corp., 2115 De La Cruz Blvd., Santa Clara, Calif.

DECODERS, BINARY-TO-DECIMAL—SEE CONVERTERS, BINARY-TO-DECIMAL

DECODERS, DIGITAL-TO-ANALOG—SEE CONVERTERS, DIGITAL-TO-ANALAG

DECODERS, PULSE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
C & K Components Inc., 103 Morse St., Watertown, Mass.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Bristol Co., Box 1790, Waterbury, Conn.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
EMR Div., Box 223, Princeton, N. J.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Reach Electronics, Inc., Box 308, Lexington, Nebr.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Utility Communication Systems, Inc., Box 188, Essington, Pa.

DECODERS, TELEMETRY—SEE DECODERS, AUDIO TONE

DECODERS, VIDEO

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Video Research Corp., 761 N. Washington St., Rockville, Md.

DECOMMUTATORS, TELEMETERING

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. ..... p 2794, 2795
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EMR Div., Box 223, Princeton, N. J.

DELAY LINES, CABLES

Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hughes Aircraft Co., Ground Sys. Group, 1901 Malvern St., Fullerton, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Video Research Corp., 761 N. Washington St., Rockville, Md.

DECONTAMINANTS—SEE CLEANERS & SOLVENTS

DEFLECTION YOKES, COILS & ASSEMBLIES —SEE YOKES, DEFLECTION—ALSO SEE YOKES, ROTATING COIL

DEGAUSSERS—SEE DEMAGNETIZERS

DEGREASING CHEMICALS— SEE CLEANERS & SOLVENTS

DEGREASING MACHINES—SEE MACHINES, VAPOR DEGREASING; CLEANERS, ULTRASONIC

DEHUMIDIFIERS (FOR EQUIPMENT)

Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1250
Abbeon, Inc., 179-15 Jamacia Ave., Jamacia, N. Y.
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
Airflow Co., Montgomery County Airpark, Gaithersburg, Md.
Barium & Chemicals, Inc., P.O. Box 218, Steubenville, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cargocaire Engineering Corp., 8-10 Chestnut St., Amesbury, Mass.
Clarage Fan Co., One Clarage Pl., Kalamazoo, Mich.
Dampp-Chaser Electronics, Inc., Box 1610, Hendersonville, N. C.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lectrodryer Div., Box 4599, Pittsburgh, Pa.
Logetronics, Inc., 7001 Loisdale Rd., Springfield, Va.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Puregas Equipment Corp., 1445 Strongs Rd., Copiague, N. Y.
Ross Engrg. Div., Box 751, New Brunswick, N. J.

DEHYDRATORS

Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Barium & Chemicals, Inc., P.O. Box 218, Steubenville, Ohio
Daco Instrument Co., Inc., Merritt Blvd., Trumbull, Conn.
Eastern Industries, 100 Skiff St., Hamden, Conn.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Lectrodryer Div., Box 4599, Pittsburgh, Pa.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Prodelin, Inc., Box 131, Hightstown, N. J.
Superior Continental Corp., Box 489, Hickory, N. C.

DELAY LINE CASES—SEE CASES, DELAY LINE

DELAY LINE SYNTHESIZERS

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1142
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1157
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.

DELAY LINES, CABLE

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1140
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y. p 1153
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa. p 2965
Tektronix, Inc., Box 500, Beaverton, Ore.
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn. ..... p 2969
Uniform Tubes Inc., Collegeville, Pa. ..... p 2970
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Prodelin, Inc., Box 131, Hightstown, N. J.
Rodda Co., Inc., 1005 Martin Ave., Santa Clara, Calif.

DELAY LINES, CABLES (Cont'd)

Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.

DELAY LINES, DISTRIBUTED, CONSTANT (FIXED)

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1139
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md. ..... p 1144
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y. p 1153
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1157
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1160
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can. ..... p 1165
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. ..... p 1166
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Uniform Tubes Inc., Collegeville, Pa. ..... p 2970
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vidcor Co., Inc., 1251 W. El Segundo Blvd., Gardena, Calif. .... p 1167
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
New London Instrument Co., Box 189, New London, Conn.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pace-Tronics, Inc., 46 Main St., Newark, N. J.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.

DELAY LINES, DISTRIBUTED, CONSTANT (VARIABLE)

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md. ..... p 1144
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y. p 1153
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1156
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1160
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. ..... p 1166
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pace-Tronics, Inc., 46 Main St., Newark, N. J.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.

DELAY LINES, GLASS & QUARTZ

Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ..... p 1145
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Mithras Div., Sanders Assocs., Inc., 701 Concord Ave., Cambridge, Mass.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.

DELAY LINES, LIQUID

Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Microsonics Inc., 60 Winter St., Weymouth, Mass.

DELAY LINES, LUMPED—CONSTANT (ELECTRICALLY VARIABLE)

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. p 1138, 1141, 1143
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md. ..... p 1144
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y. p 1152
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1156
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1159
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. ..... p 1166
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Ferranti Ltd., Hollinwood, Lancs., Eng.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Videon Corp., 140 E. Main St., Huntington, N. Y.

DELAY LINES, LUMPED—CONSTANT (FIXED)

A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. p 1138, 1141, 1143
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md. ..... p 1144
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y. p 1152
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1157
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1159
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can. .... p 1165
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. ..... p 1166
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vidcor Co., Inc., 1251 W. El Segundo Blvd., Gardena, Calif. .... p 1167
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
EMR Div., Box 223, Princeton, N. J.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pace-Tronics, Inc., 46 Main St., Newark, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.

DELAY LINES, LUMPED—CONSTANT (MECHANICALLY VARIABLE)

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. p 1138, 1141-1143
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md. ..... p 1144
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y. p 1152
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1156
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1159
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. ..... p 1166
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Vidcor Co., Inc., 1251 W. El Segundo Blvd., Gardena, Calif. .... p 1167
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
EMR Div., Box 223, Princeton, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.

DELAY LINES, MAGNETOSTRICTIVE

Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1151
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. p 1155, 1156
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Digital Devices Div., 200 Michael Dr., Syosset, N. Y. ..... p 1162
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Baganoff Assocs., Inc., 6809 W. Florissant, St. Louis, Mo.
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.

DELAY LINES, MINIATURE & SUBMINIATURE —ALSO SEE SPECIFIC TYPES OF DELAY LINE

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1138
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md. ..... p 1144
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1151
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y. p 1152, 1153
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. p 1156, 1157
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. p 1159–1161
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Hisonic Inc., 249 N. Troost, Olathe, Kans.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Nytronics, Inc., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can. .... p 1165
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. ..... p 1166
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Uniform Tubes Inc., Collegeville, Pa.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vidcor Co., Inc., 1251 W. El Segundo Blvd., Gardena, Calif. .... p 1167
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
EMR Div., Box 223, Princeton, N. J.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pace-Tronics, Inc., 46 Main St., Newark, N. J.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Rodda Co., Inc., 1005 Martin Ave., Santa Clara, Calif.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.

DELAY LINES, SOLID BLANK

Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ..... p 1145
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Valpey Corp., 1400 Highland St., Holliston, Mass.

DELAY LINES, STRIP

Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ..... p 1145
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1161
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.

DELAY LINES, TRIMMER

Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y. p 1153
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1156
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1161
Pace-Tronics, Inc., 46 Main St., Newark, N. J.

DELAY LINES, ULTRASONIC

Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ..... p 1145
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y. p 1154
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.

DELAY LINES, WAVEGUIDE

Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J. ..... p 1146-1150
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Uniform Tubes Inc., Collegeville, Pa.
Aircom, Inc., Rte. 16B, Union, N. H.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Control Data Corp., 400 Border St., East Boston, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio

DELAY LINES, WIRE

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. p 1156, 1157
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Digital Devices Div., 200 Michael Dr., Syosset, N. Y. ..... p 1162
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
General Radio Company, 300 Baker Ave., W. Concord, Mass.

DELAYS, TIME (EXCLUDING DELAY LINES)

Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1142
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239
General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ... p 2268, 2269
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2285
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y. ..... p 2294
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 2310
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Bulova Watch Co., Timer Lab., Bulova Park, Flushing, N. Y.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.
Jay-El Products, Inc., Box 25, Gardena, Calif.
MCG Electronics Inc., 279 Skidmore Rd., Deer Park, N. Y.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Worner Electrn. Devices, Rankin, Ill.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

DEMAGNETIZERS

Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Electronic Brazing Co., 140 Glenridge Ave., Montclair, N. J.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Irwin Laboratories, Inc., 1238 S. Gerhart Ave., Los Angeles, Calif.
Luma Electric Equipment Co., 1607 Coining Dr., Toledo, Ohio
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Magnetic Analysis Corp., 535 South 4 Ave., Mount Vernon, N. Y.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Permag Corp., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Recoton Corp., 46-23 Crane St., Long Island City, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sunbeam Equip. Corp., 212 Mercer St., Meadville, Pa.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio

DEMODULATORS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 1017, 2789
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657, 2658
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2662
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1030, 1032
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
M F Electronics Corp., 118 East 25th St., New York, N. Y. .... p 1121
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2920
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Theta Instrument Corp., Fairfield, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 1054, 2674
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Vetter, A. R. Co., Box 143, Rebersburg, Pa.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
American Chain & Cable Co., Box 1629, Waterbury, Conn.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Collins Radio Co., Dallas, Texas
Comdel Inc., Beverly Airport, Beverly, Mass.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Computer Conversions Corp., 6 Duntdn Ct., E. Northport, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Gopic Designs Co., 3679 Voltaire St., San Diego, Calif.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Validyne Engrg. Corp., 18819 Napa St., Northridge, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

DEMODULATORS, MAGNETIC

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1030, 1032, 1034

DETECTORS, COAXIAL

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.

DENSITOMETERS, ELECTRONIC

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Electronic Systems Engrg. Co., 120½ N. Cleveland, Cushing, Okla.
Fotomatic Corp., 3141 W. Tenth, Indianapolis, Ind.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Mann, David W. Co., 174 Middlesex Turnpike, Burlington, Mass.
Nester/Faust Mfg. Corp., 2401 Ogletown Rd., Newark, Dela.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
Welch Scientific Co., 7300 N. Linder Ave., Skokie, Ill.

DEPOSITION EQUIPMENT, VACUUM AND ACCESSORIES—ALSO SEE EVAPORATION EQUIPMENT, ELECTRON BEAM

Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Carler Prods. Corp., 6200 E. Malloy Rd., E. Syracuse, N. Y.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Forney Industries, Inc., 1800 La Porte Ave., Fort Collins, Colo.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Lepel High Frequency Labs., 59-21 Queens-Midtown Expwy., Maspeth, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Nuclide Corp. AGV Div., 914 Main St., N. Acton, Mass.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Thomson Electric Welder Co., Inc., 161 Pleasant St., Lynn, Mass.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.

DESOLDERING TOOLS & EQUIPMENT—SEE SOLDERING ACCESSORIES; SOLDERING EQUIP; SOLDERING GUNS; ETC.

DETECTORS, A-F—SEE DETECTORS, FREQUENCY

DETECTORS, COAXIAL

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1652
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio .. p 1342, 1343
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Narda Microwave Corp., Plainview, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1693
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.

DETECTORS, COAXIAL (Cont'd)

General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

DETECTORS, CORONA—SEE TESTERS, CORONA

DETECTORS, CRYSTAL

Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1653
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Narda Microwave Corp., Plainview, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1693
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Fuel Watchman Sales & Service, Inc., 2910 Park Ave., Bronx, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Linden Labs. Inc., Box 920, State College, Pa.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Nuclear Supplies, Box 312, Encino, Calif.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France

DETECTORS, ELECTROSTATIC—SEE METERS, VOLT, ELECTROSTATIC

DETECTORS, F-M—SEE DETECTORS, FREQUENCY

DETECTORS, FIRE & SMOKE, (ELECTRONIC)—SEE FIRE DETECTION & FIGHTING EQUIPMENT

DETECTORS, FLAW & DEFECT—ALSO SEE LOCATORS, CABLE & LINE FAULT: LOCATORS, OPEN-SHORT

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
PPM Inc., 7018 Euclid Ave., Cleveland, Ohio
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Gas & Chemicals, Inc., 511 East 72nd St., New York, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Appalachian Elctrn. Instrs., Inc., 810 W. Monroe Ave., Ronceverte, W. Va.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Automation-Forster Div., Box 1025, Ann Arbor, Mich.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Black Light Prods., Box 45278, Chicago, Ill.
Branson Instruments Co., 76 Progress Dr., Stamford, Conn.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Delcon Div., 333 Logue Ave., Mt. View, Calif.
Electron-Machine Corp., Box M, Umatilla, Fla.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Ferranti Ltd., Holliwood, Lancs., Eng.
HRB-Singer, Inc., Science Park, State College, Pa.
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jenkins, M. W. Sons, Inc., Box 70, Dept. 25, Cedar Grove, N. J.
Krautkramer Ultrasonics, Inc., 1 Research Dr., Stratford, Conn.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Magnetic Analysis Corp., 535 South 4 Ave., Mount Vernon, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
TAC Technical Instr. Corp., Scotch Rd., Mercer Airpt., Trenton, N. J.

DETECTORS, FREQUENCY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1653
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1693
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vetter, A. R. Co., Box 143, Rebersburg, Pa.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Aerometrics, P.O. Box 216, San Ramon, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gold Line Connector, Inc., Muller Ave., Box 893, Norwalk, Conn.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
MCG Electronics Inc., 279 Skidmore Rd., Deer Park, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Rafec Electronics, Box 566, Temple City, Cal.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Techsonics, Box 251, El Prado, N. M.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

DETECTORS, GAS LEAK

Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Acton Assocs., 100 Thompson St., Pittston, Pa.
Aero Vac Corp., Box 448, Troy, N. Y.
Aerometrics, P.O. Box 216, San Ramon, Calif.
American Gas & Chemicals, Inc., 511 East 72nd St., New York, N. Y.
Bacharach Instrument Co., 625 Alpha Dr., Pittsburgh, Pa.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Delcon Div., 333 Logue Ave., Mt. View, Calif.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Edwards High Vacuum (Can.) Ltd., 430 S. Service Rd. W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Erdco Engrg. Corp., 136 Official Rd., Addison, Ill.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
General Monitors Inc., 3019 Enterprise St., Costa Mesa, Calif.
Gow-Mac Instrument Co., 100 Kings Rd., Madison, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Houston Atlas, Inc., Box 19035, Houston, Tex.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Vacuum Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Johnson-Williams Products, 2300 Leghorn St., Mountain View, Calif.
Lion Research Corp., 60 Bridge St., Newton, Mass.
MKS Instruments, Inc., 45 Middlesex Tpke., Burlington, Mass.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Puregas Equipment Corp., 1445 Strongs Rd., Copiague, N. Y.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, Tex.
Stewart-Hall Chemical Corp., 222 Washington St., Mount Vernon, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Superior Continental Corp., Box 489, Hickory, N. C.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Techsonics, Box 251, El Prado, N. M.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

DETECTORS, ICE, SLEET & SNOW

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
United Control Corporation, Redmond, Wash.

DETECTORS, IMPEDANCE—SEE METERS, IMPEDANCE

DETECTORS, INFRARED

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Borg-Warner Thermoelectrics, Wolf & Algonquin Rds., Des Plaines, Ill. p 2796
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
United Detector Technology, 1732 21st St., Santa Monica, Calif. p 1775
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix Corp., Electro-Optics Div., 1975 Green Rd., Ann Arbor, Mich.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Electro-Nuclear Labs., Inc., 115 Independence Dr., Menlo Park, Calif.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electron-Machine Corp., Box M, Umatilla, Fla.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Flame Research, Inc., Box 10502, Pittsburgh, Pa.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hamamatsu TV Co. Ltd., 1126-Chino-cho, Hamamatsu City, Shizuoka Pref., Japan
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.

Sensor Precision Industries Inc., 29 Janes Ave., Medfield, Mass.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Tem-Pres Res. Div., Carborundum Co., 1401 S. Atherton St., State College, Pa.
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.

DETECTORS, ION

Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
GCA Technology, Burlington Rd., Bedford, Mass.
Hamamatsu TV Co. Ltd., 1126-Chino-cho,, Hamamatsu City, Shizuoka Pref., Japan
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Nuclear Supplies, Box 312, Encino, Calif.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.

DETECTORS, LIGHT INTENSITY—SEE METERS, LIGHT, NONPHOTOGRAPHIC

DETECTORS, MAGNETIC

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Automation-Forster Div., Box 1025, Ann Arbor, Mich.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Barringer Research, Ltd., 304 Carlingview Dr., Rexdale, Toronto, Ont., Can.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Electro-Alarm Safety Devices, 745 N. Pleasant, Fresno, Calif.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Gammatronix Inc., Dublin, Ohio
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Irwin Laboratories, Inc., 1238 S. Gerhart Ave., Los Angeles, Calif.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.

DETECTORS, METAL

Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ..... p 1027
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. p 1026, 1027
General Electric Co., Electrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Automation Devices, Inc., Box A.D., Fairview, Pa.
Automation-Forster Div., Box 1025, Ann Arbor, Mich.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Delcon Div., 333 Logue Ave., Mt. View, Calif.
Dice, J. W., Co., 16 Highwood Ave., Englewood, N. J.
EMR Div., Box 223, Princeton, N. J.
Electro-Alarm Safety Devices, 745 N. Pleasant, Fresno, Calif.
Electro-Mechanics Co., Box 1546, Austin, Tex.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Gardiner Electronics, 4729 North 7th Ave., Phoenix, Ariz.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Goldak Co., Inc., 1101-A Air Way, Glendale, Calif.
Harworth Mfg. Co., 2881 El Camino Real, Redwood City, Calif.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Indiana General, Magnetic Equip. Div., 6001 S. General Ave., Cudahy, Wisc.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Meridian Lab, Inc., 2611 University Ave., Madison, Wisc.
Peco Corp., 111 Ortego Ave., Mt. View, Calif.
Railway Communications, 9351 East 59th St., Raytown, Mo.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sensory, Inc., 1 Kennedy Rd., Morris Plains, N. J.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Weldotron Corp., 907 Frelinghuysen Ave., Newark, N. J.

DETECTORS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
General Electric Co., Electrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1693
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Rafec Electronics, Box 566, Temple City, Cal.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

DETECTORS, NULL—SEE INDICATORS, NULL

DETECTORS, PHASE-SENSITIVE

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. .... p 1708
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Theta Instrument Corp., Fairfield, N. J.
Tracor Inc., 6500 Tracor La., Austin, Texas
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Berkshire Labs, 107 Tansy Hill Rd., Milford, N. Y.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.

DETECTORS, VIDEO

Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Olektron Corp., Box 248, Dudley, Mass.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rafec Electronics, Box 566, Temple City, Cal.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

DETECTORS, PHOTOVOLTAIC—SEE CELLS, PHOTOVOLTAIC

DETECTORS, RADIATION—SEE COUNTERS, GEIGER; COUNTERS, SCINTILLATION

DETECTORS, R-F—SEE DETECTORS, FREQUENCY

DETECTORS, STANDING WAVE

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Control Data Corp., 400 Border St., East Boston, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Radiation Devices Co., Box 8450, Baltimore, Md.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

DETECTORS, TORQUE—SEE INDICATORS, TORQUE

DETECTORS, ULTRAVIOLET

AEL Inc., P.O. Box 552, Lansdale, Pa.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

DETECTORS, VACUUM

Delcon Div., 333 Logue Ave., Mt. View, Calif.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Vacuum Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.

DETECTORS, VIBRATION—SEE TRANSDUCERS, VIBRATION

DETECTORS, VIDEO

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Narda Microwave Corp., Plainview, N. Y.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.

DETECTORS, VOLTAGE

DETECTORS, VOLTAGE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2658
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374, 1376
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1958
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Transtector Systems, 3025 W. Mission Rd., Alhambra, Calif. ... p 2786
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Electrical Refractories Co., 50 E. Clark St., E. Palestine, Ohio
Electro-Alarm Safety Devices, 745 N. Pleasant, Fresno, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Knopp, Inc., 1307 66th St., Oakland, Calif.
MCG Electronics Inc., 279 Skidmore Rd., Deer Park, N. Y.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Roback Corp., Huntingdon Valley, Pa.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Roveti Instruments, 238 West St., Annapolis, Md.
Sittler Corp., 18 N. Ada St., Chicago, Ill.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

DETECTORS, WAVEGUIDE ARC

Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

DEWARS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Corning Glass Works, Laboratory Prods. Dept., Corning, N. Y.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Magnion, Inc., 144 Middlesex Tpke., Burlington, Mass.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vacuum Barrier Corp., 4 Barten La., Woburn, Mass.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Ventron Instrs. Corp., 144 Middlesex Tpke., Burlington, Mass.
Welch Scientific Co., 7300 N. Linder Ave., Skokie, Ill.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

DIAGONAL CUTTERS—SEE WIRE CUTTERS, HAND OPERATED

DIAL LOCKS—SEE LOCKS, DIAL & SHAFT

DIALS, INSTRUMENT, METAL, PLASTIC, ETC.

Amphenol Controls Div., 120 S. Main St., Janesville, Wisc. p 2445, 2447
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 2449
Datak Corp., 85 Highland Ave., Passaic, N. J.
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y. p 1171
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. ... p 1173
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 1174, 1175
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1176
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Theta Instrument Corp., Fairfield, N. J. ..... p 1513
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Ackerman Engravers, Inc., 43-22 36th St., Long Island City, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Atmar Engraving Co., Inc., 91-31 121 St., Richmond Hill, N. Y.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bodnar Prods. Corp., 30 Grove St., New Rochelle, N. Y.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Bristol Co., Box 1790, Waterbury, Conn.
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Davies, H. Molding Co., 4920 W. Bloomingdale Ave., Chicago, Illinois
Dura Engraving Corp., 133 West 20th St., New York, N. Y.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Electro Chemical Engraving Co., 1100 Brook Ave., Bronx, N. Y.
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
GM Nameplate, Inc., 2040 15th Ave., W., Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gentape Corp., 51 LaFrance Ave., Bloomfield, N. J.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Hampden Mfg. Co., Inc., Box 10, Thompsonville, Conn.
Hermes Plastics, Inc., 20 Cooper Square, New York, N. Y.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Kerrco, Inc., Box 29178, Lincoln, Neb.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kurz-Kasch, Inc., 1421 S. Broadway, Dayton, Ohio
Master Engraving, 11 Wallace St., E. Paterson, N. J.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Metalphoto Corp., 18531 S. Miles Rd., Cleveland, Ohio
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
N/P Co., Inc., Box 127, Temple City, Calif.
Ny-Glass, Inc., 7314 E. Madison St., Paramount, Calif.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Panelgraphic Corp., Box 254, Caldwell, N. J.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.
Rogan Brothers Inc., 8031 N. Monticello Ave., Skokie, Ill.
Romar Plastics, Inc., 1311 East Main St., St. Charles, Ill.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Sillcocks-Miller Co., 350 W. Parker Ave., Maplewood, N. J.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Sun Dial & Panel Corp., Box 326, Caldwell, N. J.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

DIALS, TELEPHONE-TYPE

Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif.
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan

DIALS, TURNS-COUNTING

Amphenol Controls Div., 120 S. Main St., Janesville, Wisc. p 2445, 2447
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 2449
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Duncan Electronics Inc., 2865 Fairview Rd., Costa Mesa, Calif. . p 2468
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. ..... p 2471
Fairchild Controls, 5625 Kearny Villa Rd., San Diego, Calif. ... p 2471
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. ..... p 1172
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 1174, 1175
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif. p 2497
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass. ..... p 2503
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Master Engraving, 11 Wallace St., E. Paterson, N. J.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.

DIAPHRAGMS

Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Allied Research & Engineering Co., 10300 Glasgow Pl., Los Angeles, Calif.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bellofram Corp., 103 Blanchard Rd., Burlington, Mass.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Sparta Mfg. Co., Dover, Ohio
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.

DIELECTRIC CONSTANT INDICATORS—SEE INDICATORS, DIELECTRIC CONSTANT

DIELECTRIC COOLANTS—SEE COOLANTS, CIRCUIT AND COMPONENT

DIELECTRIC HEATING EQUIPMENT

Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
Cycle-Dyne, Inc., Sub. Axel Elctrns. Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
LaRose, W. T. & Assocs., Box F, Lansingburgh Sta., Troy, N. Y.
Mann-Russell Elctrns., Inc., 1401 Thorne Rd., Tacoma, Wash.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Radio Frequency Co., Inc., 50 Park St., Medfield, Mass.
Raybond Elctrns. Inc., 930 Washington St., Norwood, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.

DIELECTRICS—SEE FILMS: INSULATION MATERIALS

DIES & TAPS

Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif. ..... p 2831
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix Corp., Cutting Tool Div., 180 Laurel St., Greenfield, Mass.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Moody Machine Prods. Co., Inc., Box 2248, Providence, R. I.
Morris, J. I. Co., 372 Elm St., Southbridge, Mass.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.

DIFFERENTIAL ANALYZERS—SEE ANALYZERS, DIFFERENTIAL

DIFFERENTIALS, MECHANICAL—SEE GEARS & GEAR MECHANISMS

DIGITAL ANALYZERS—SEE ANALYZERS, DIFFERENTIAL

DIGITAL COMPARATORS—SEE COMPARATORS, DIGITAL

DIGITAL TAPE RECORDERS—SEE DATA RECORDERS, COMPUTER

DIGITAL VOLTMETERS—SEE METERS, VOLT, DIGITAL

DIGITIZERS, PENCIL FOLLOWER (INCL. COORDINATE & GRAPHIC)

Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Egan Laboratory, 107-56 113th St., Richmond Hill, N. Y.

DIMMERS—SEE CONTROLS, PHOTOELECTRIC

DIODE ARRAYS

Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif. .... p 2530
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Toyo Elctrns. Ind. Corp., 21, Sain Misosaki-cho, Ukyo-ku, Kyoto, Japan
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
United Detector Technology, 1732 21st St., Santa Monica, Calif. p 1775
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
Kyodo Elctrn. Labs., Inc., 5153 Kamitsuruma, Sagamihara-shi, Kanagawa-ken, Japan
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Radiation, Inc., Microelectronics Div., Box 37, Melbourne, Fla.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Telefunken Sales Corp., South St., Garden City, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

DIODE TESTERS—SEE TESTERS, DIODE

DIODES, AVALANCHE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2513
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Semikron International Inc., Box 323, Scarsdale, N. Y. ..... p 2587
Semtech Corp., 652 Mitchell Rd., Newbury Park, Calif. ..... p 2590
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Syntron Div., 264 Lexington, Homer City, Pa. ..... p 2596-2600
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. .... p 2621
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. ..... p 2634
Varo, Inc., Semiconductor Div., 1000 N. Shiloh Rd., Garland, Tex. p 2629
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2626
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

DIODES, BACKWARD

Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

DIODES, DUAL

Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

DIODES, ELECTROLUMINESCENT (RADIATING)

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Electro-Nuclear Labs., Inc., 115 Independence Dr., Menlo Park, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

DIODES, GALLIUM ARSENIDE (LASER AND OPTICAL)

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

DIODES, GERMANIUM

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510, 2511, 2513
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .... p 2536
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cordover, C. & Co., 104 Liberty Ave., Mineola, N. Y.
Corvair Diode, 150 5th Ave., New York, N. Y.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
International Diode Corp., 90 Forest St., Jersey City, N. J.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Kemtron Electron Products, Inc., 14 Prince Pl., Newburyport, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

DIODES, GUNN

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
ITT Electron Tube, Box 100, Easton, Pa.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.

DIODES, HIGH VOLTAGE

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2512
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
International Rectifier, 233 Kansas St., El Segundo, Calif. .... p 2524
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Semikron International Inc., Box 323, Scarsdale, N. Y. ..... p 2587
Semtech Corp., 652 Mitchell Rd., Newbury Park, Calif. ..... p 2590

DIODES, MATCHED PAIRS

Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Syntron Div., 264 Lexington, Homer City, Pa. ..... p 2596-2600
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. .... p 2621
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. p 2634-2637
Varo, Inc., Semiconductor Div., 1000 N. Shiloh Rd., Garland, Tex. p 2629
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2639-2641, 2650, 2651
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Atlantic Semiconductor, 905 Mattison Ave., Asbury Park, N. J.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Eimac, 301 Industrial Way, San Carlos, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.

DIODES, HOT CARRIER

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
International Diode Corp., 90 Forest St., Jersey City, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.

DIODES, LIGHT-EMITTING (LED'S)

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.

DIODES, LIMITING

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio ..... p 2585
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. ..... p 2634
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.

DIODES, MATCHED PAIRS

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326, 1650
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2511
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 2536
International Rectifier, 233 Kansas St., El Segundo, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. ..... p 2634
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Eastron Corp., 25 Locust St., Haverhill, Mass.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.

DIODES, MATCHED PAIRS (Cont'd)

Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
International Diode Corp., 90 Forest St., Jersey City, N. J.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
Kemtron Electron Products, Inc., 14 Prince Pl., Newburyport, Mass.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Standard Rectifier Div., 2200 S. Fairview, Santa Ana, Calif.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.

DIODES, MATCHED QUADS

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326, 1650
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2511
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. ..... p 2634
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Eastron Corp., 25 Locust St., Haverhill, Mass.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
International Diode Corp., 90 Forest St., Jersey City, N. J.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
Kemtron Electron Products, Inc., 14 Prince Pl., Newburyport, Mass.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Standard Rectifier Div., 2200 S. Fairview, Santa Ana, Calif.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.

DIODES, MICROWAVE DETECTOR

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326, 1650
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Kemtron Electron Products, Inc., 14 Prince Pl., Newburyport, Mass.
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

DIODES MICROWAVE MIXER

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326, 1650
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, C ..
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Diode, 150 5th Ave., New York, N. Y.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Kemtron Electron Products, Inc., 14 Prince Pl., Newburyport, Mass.
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

DIODES, NOISE

Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.

DIODES, PHOTOELECTRIC

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2511
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
United Detector Technology, 1732 21st St., Santa Monica, Calif. p 1775
Abtronics, Inc., Box 712, Livermore, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

DIODES, PIN

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Unitrode Corp., Microwave Div., 580 Pleasant St., Watertown, Mass. p 1716

DIODES, SCHOTTKY

Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
United Detector Technology, 1732 21st St., Santa Monica, Calif. p 1775
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.

DIODES, SELENIUM—SEE RECTIFIERS, SELENIUM

DIODES, SILICON

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind. ..... p 2509
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2633
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2511-2513
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 2536
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif. .... p 2524
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
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AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Alpha Components Corp., 4087 Glencoe Ave., Venice, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
American Semiconductor Corp., 4 N. Hickory Ave., Arlington Heights, Ill.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Atlantic Semiconductor, 905 Mattison Ave., Asbury Park, N. J.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Cordover, C. & Co., 104 Liberty Ave., Mineola, N. Y.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Eastron Corp., 25 Locust St., Haverhill, Mass.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electronic Devices Inc., 21 Grey Oaks Ave., Yonkers, N. Y.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
International Diode Corp., 90 Forest St., Jersey City, N. J.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Kemtron Electron Products, Inc., 14 Prince Pl., Newburyport, Mass.
Kyodo Elctrn. Labs., Inc., 5153 Kamitsuruma, Sagamihara-shi, Kanagawa-ken, Japan
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Recticon Corp., 730 E. Elm St., Conshohocken, Pa.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Standard Rectifier Div., 2200 S. Fairview, Santa Ana, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.

DIODES, STEP RECOVERY

Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
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Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

DIODES, SURFACE BARRIER

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
United Detector Technology, 1732 21st St., Santa Monica, Calif.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.

DIODES, SWITCHING

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Delco Inds., Inc., 1711 West 135th St., Gardena, Calif.
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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
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Syntron Div., 264 Lexington, Homer City, Pa. ..... p 2596-2600
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Toyo Elctrns. Ind. Corp., 21, Sain Misosaki-cho, Ukyo-ku, Kyoto, Japan
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United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. p 2634-2637
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Corvair Diode, 150 5th Ave., New York, N. Y.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
International Diode Corp., 90 Forest St., Jersey City, N. J.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Standard Rectifier Div., 2200 S. Fairview, Santa Ana, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.

DIODES, TUNNEL

Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510, 2511
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Corvair Diode, 150 5th Ave., New York, N. Y.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

DIODES, VARACTOR

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Corvair Diode, 150 5th Ave., New York, N. Y.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Eastron Corp., 25 Locust St., Haverhill, Mass.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
ITT Electron Tube, Box 100, Easton, Pa.
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Parametric Inds. Inc., 742 Main St., Winchester, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

DIODES, VIDEO DETECTOR—SEE DIODES, MICROWAVE DETECTOR

DIODES, ZENER

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind.
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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2513
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 2536
International Rectifier, 233 Kansas St., El Segundo, Calif. p 2524-2526
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1415
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio ..... p 2585
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Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. .... p 2620
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2633
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. p 2634, 2635
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
American Semiconductor Corp., 4 N. Hickory Ave., Arlington Heights, Ill.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Components, Inc., Sencor Div., 3540 W. Osborn Rd., Phoenix, Ariz.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Cordover, C. & Co., 104 Liberty Ave., Mineola, N. Y.
Corvair Diode, 150 5th Ave., New York, N. Y.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
International Diode Corp., 90 Forest St., Jersey City, N. J.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Power Components Inc., Box 421, Scottdale, Pa.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.

DIPLEXERS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Collins Radio Co., Dallas, Texas
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.

DISCRIMINATORS

Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
N-H Microwave, Inc., Box 887, Red Bank, N. J.
Olektron Corp., Box 248, Dudley, Mass.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

DIRECTIONAL COUPLERS—SEE COUPLERS, DIRECTIONAL

DISCRIMINATORS

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1652
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. .. p 1090
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y. ..... p 672
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1118
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Piconics, Inc., 220 Boston Rd., No. Billerica, Mass.
Piezo Technology, Inc., 2400 Diversified Way, Orlando, Fla.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sherold Crystals Prod. Gp., Tyco Labs., Inc., 1510 McGee Trafficway, Kansas City, Mo. ..... p 1131
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Vetter, A. R. Co., Box 143, Rebersburg, Pa. ..... p 2162
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EG & G Inc., 35 Congress St., Salem, Mass.
EMR Div., Box 223, Princeton, N. J.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

DISCRIMINATORS (Cont'd)

Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Nuclear Supplies, Box 312, Encino, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

DISC PACKS, MAGNETIC

Digital Equip. Corp., 146 Main St., Maynard, Mass.
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Kybe Corp., 132 Calvary St., Waltham, Mass.
Memorex Corp., 1180 Shulman Ave., Santa Clara, Calif.
3M Co., 3M Center, St. Paul, Minn.

DISCS, COMPUTER MEMORY—ALSO SEE MEMORY SYSTEMS, DISC

Digital Equip. Corp., 146 Main St., Maynard, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Bryant Computer Products, 850 Ladd Rd., Walled Lake, Mich.
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Data Disc. Inc., 1275 California Ave., Palo Alto, Calif.
Data Disc, Inc., Standard Prods. Div., 1275 California Ave., Palo Alto, Cal.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Kybe Corp., 132 Calvary St., Waltham, Mass.
Memorex Corp., 1180 Shulman Ave., Santa Clara, Calif.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio

DISCS, OPTICAL ENCODER—SEE CODED DISCS, OPTICAL

DISPENSERS FOR EPOXY, ENCAPSULATING COMPOUNDS, ETC.

Ablestik Adhesive Co., Inc., 833 W. 182nd St., Gardena, Cal.
Airmatic Valve Inc., 7313 Associate Ave., Cleveland, Ohio
Allaco Prods., 130 Wood Rd., Braintree, Mass.
American Systems, Inc., 13901 Saticoy St., Van Nuys, Calif.
Armstrong Products Company, Inc., P.O. Box 657, Warsaw, Ind.
Delsen Testing Corp., 719 W. Broadway, Glendale, Calif.
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
Fenwal, Inc., Main St., Ashland, Mass.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Hysol Div., 211 Franklin St., Olean, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Kenics Corp., One Southside Rd., Danvers, Mass.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Otto Controls, 8611 Lincoln Ave., Morton Grove, Ill.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Sara Scientific Co., Box 321, San Francisco, Calif.
Sta-Warm Electric Co., Inc., 116 N. Chestnut St., Ravenna, Ohio
Starnetics Co., Box 9308, N. Hollywood, Calif.
Techform Labs., Inc., 707 S. Hampton Dr., Venice, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.
Zicon Corp., 63 E. Sandford Blvd., Mount Vernon, N. Y.

DISPLAY BOARDS—SEE BOARDS, PLOTTING

DISPLAY PANELS (BACK-LIGHTED & EDGE-LIGHTED)

Display Devices, Inc., 2928 Nebraska Ave., Santa Monica, Calif. p 1186
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. ..... p 1194
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 804, 805
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Milman Engrg. Co., Inc., 1669 12th, Santa Monica, Calif.
Panob Corp., 49 Beech St., Port Chester, N. Y.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Price Brothers, Inc., 1025 W. North Ave., Chicago, Ill.
Sanders Assocs., Inc., Data & Display Dept., Daniel Webster Hwy., S., Nashua, N. H.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.

DISPLAYS, PROJECTION TYPE (CRT: ELECTROMECHANICAL: FILM: LIGHT VALVE)

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. p 1895
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1190
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn. ..... p 1187
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Patwin Div., Box 710, Waterbury, Conn.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y. ... p 1204, 1205
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 804, 806
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1210
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Adage, Inc., 1079 Commonwealth Ave., Boston, Mass.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Bunker-Ramo Corp., 445 Fairfield Ave., Stamford, Conn.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Burtek, Inc., Box 1677, Tulsa, Okla.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Celco, 70 Constantine Dr., Mahwah, N. J.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Conrac Div., 600 N. Rimsdale Ave., Covina, Calif.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Counting Instrs. Ltd., 5, Elstree Way, Boreham Wood, Hertfordshire, Eng.
Data Disc, Inc., Display Div., 2626 Hanover St., Palo Alto, Calif.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
EDP Corp., Box 6485, Orlando, Fla.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Excellon Inds., 23915 Garnier, Torrance, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Ferranti Ltd., Hollinwood, Lancs., Eng.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Hughes Aircraft Co., Vacuum Tube Prods. Div., 2020 Oceanside Blvd., Oceanside, Cal.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Industrial Sys. Div., 5261 W. Imperial Hwy., Los Angeles, Calif.
Information Displays, Inc., 333 N. Bedford Rd., Mt. Kisco, N. Y.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Kaiser Aerospace & Electronics Corp., Box 11275, Palo Alto, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Luminator, Inc., Box 278, Plano, Tex.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Maytronics, Inc., Box 460, Colorado Springs, Colo.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Metatronics Mfg. Co., 141 Oregon St., El Segundo, Calif.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Milman Engrg. Co., Inc., 1669 12th, Santa Monica, Calif.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
N/P Co., Inc., Box 127, Temple City, Calif.
Norden Div., United Aircraft Corp., Helen St., Norwalk, Conn.
Nuclear Supplies, Box 312, Encino, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Penn Keystone Corp., Division St., Ansonia, Conn.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sanders Assocs., Inc., Data & Display Dept., Daniel Webster Hwy., S., Nashua, N. H.
Sanders Assocs., Inc., Data Sys. Div., Daniel Webster Hwy., S., Nashua, N. H.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.
Sturdilite, Plainwell, Mich.
Sun Dial & Panel Corp., Box 326, Caldwell, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Sylvania Elec. Prods. Inc., Ultronic Sys. Div., Box 315, Moorestown, N. J.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Time-O-Matic Inc., Box 850, Danville, Ill.
Time Share Peripherals Corp., Box 361, Wilton, Conn.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Ultra-Courtland Mfg. Corp., 153 Pearl St., Paterson, N. J.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

DISSIPATORS, HEAT—SEE HEAT SINKS—ALSO SEE TRANSISTOR & DIODE HEAT DISSIPATORS: TUBE HEAT DISSIPATORS

DISTORTION ANALYZERS—SEE ANALYZERS, A-F

DISTORTION INDICATORS—SEE ANALYZERS, A-F

DISTRIBUTION SYSTEMS, FREQUENCY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1330
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 786
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Specific Products, 1237 S. Shamrock Ave., Monrovia, Cal. ..... p 756
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Vectron Laboratories, Inc., 146 Selleck St., Stamford, Conn. ... p 1136
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Defense Elctrns., Inc., Rockville, Md.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Optimax Inc., 258 N. Main St., Ambler, Pa.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

DIVIDERS, ANGULAR

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
Intronics, Inc., 57 Chapel St., Newton, Mass. p 531
Theta Instrument Corp., Fairfield, N. J. p 1515
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.

DIVIDERS, FREQUENCY

AEL Inc., P.O. Box 552, Lansdale, Pa.
Accutronics, Inc., 628 North St., Geneva, Ill. p 1063
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. p 1083
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. p 761
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bramco Controls Div., Ledex Inc., Collega & South, Piqua, Ohio p 2286
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. p 2658
C & K Components Inc., 103 Morse St., Watertown, Mass.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Connor-Winfield Corp., Winfield, Ill.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Fork Standards Inc., 213 Main St., West Chicago, Ill. p 1099
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1107
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. p 2295
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. p 1460
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Spectrum Technology Inc., Box 368, Goleta, Calif. p 1133
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. p 1053
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. p 1717
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Norman, Ernst Labs., 200 Elkhorn Rd., Williams Bay, Wisc.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
RC-95, Inc., 9 East 38th St., New York, N. Y.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
Systron-Donner Corp., One Systron Dr., Concord, Calif.
3M Co., 3M Center, St. Paul, Minn.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

DIVIDERS, MAGNETIC

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1034, 1036
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 809

DIVIDERS, POWER (LF, HF, VHF, UHF)

Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. p 1678
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Comdel Inc., Beverly Airport, Beverly, Mass.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Olektron Corp., Box 248, Dudley, Mass.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.

DIVIDERS, POWER, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
American Corp., 87 Rumford Ave., Waltham, Mass.
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1652
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. p 1658
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1663
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
LEL Div. Varian, 75 Akron St., Copiague, N. Y. p 1681
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. p 1678
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. p 1687
Narda Microwave Corp., Plainview, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. p 1690
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Amplifier Co., Box 141, Lake Grove, N. Y. p 1694
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Transco Products, 4241 Glencoe Ave., Venice, Calif. p 1711
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. p 1714
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. p 1719
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Gremar, Inc., 10 Micro Dr., Woburn, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Indit Corp., 79 Albertson Ave., Albertson, N. Y.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

DIVIDERS, VOLTAGE—ALSO SEE TRANSFORMERS, VOLTAGE-DIVIDING

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Aritech Corp., 130 Lincoln St., Brighton, Mass. p 1285
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. p 2714
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376, 2473
Electronic Precision Components Corp., 2 Brookdale Pl., Mt. Vernon, N. Y. p 2375
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Gamble, C. T. Inds., New Jersey Ave. & Fairview St., Riverside, N. J. p 2378
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1034, 1036
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. p 1392
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc.
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal.

DOSIMETERS

Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412-1414, 1416, 1417, 2394
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Marstan Elctrns., 307 Washington St., Orange, N. J. p 2404
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452, 1453
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. p 1046
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa. p 2411
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. p 2409
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Pyrofilm Resistor Co. Inc., 60 S. Jefferson Rd., Whippany, N. J. p 2412
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. p 2322
Shallcross, E. Preston St., Selma, N. C. p 1483, 2426
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494, 1498
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. p 1714
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa. p 2433
Welwyn International, Inc., 811 Sharon Dr., Westlake, Ohio p 2442
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Aimes Inds., Inc., Box 73, Lockport, Ill.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Pacific Photometric Instrs., 3024 Ashby Ave., Berkeley, Calif.
Pearson Electronics, Inc., 4007 Transport St., Palo Alto, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Solatron Enterprises, 421 E. Beach Ave., Inglewood, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

DOLLIES & INSTRUMENT CARTS—SEE CARTS, INSTRUMENT & EQUIPMENT

DOMES, OPTICAL

Amersil, Inc., 685 Ramsey Ave., Hillside, N. J.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. p 1708
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

DOORS, CABINET, METAL—SEE CABINETS & ACCESSORIES, METAL

DOPE, COIL—SEE INSULATING COMPOUNDS, COIL DOPE

DOSIMETERS

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. p 754
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Avco Elctrns., 10700 E. Independence St., Tulsa, Okla.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Penberthy Div., 6701 Maynard, S., Seattle, Wash.
Telefunken Sales Corp., South St., Garden City, N. Y.

DOUBLERS, FREQUENCY—SEE MULTIPLIERS, FREQUENCY

DRAFTING MACHINES

DRAFTING MACHINES
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Dietzgen, E. Co., 2425 N. Sheffield Ave., Chicago, Ill.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Mechanical Enterprises, 3127 Colvin St., Alexandria, Va.
Straube Mfg. Co., Box 69, Waynesboro, Pa.
Universal Drafting Machine Corp., 5200 Richmond Rd., Bedford Hgts., Ohio

DRAFTING SYMBOLS, DRY TRANSFER, PRESSURE SENSITIVE, ETC.
Datak Corp., 85 Highland Ave., Passaic, N. J. ..... p 1170
Bishop Graphics, Inc., 7300 Radford Ave., N. Hollywood, Calif.
Etchomatic, Inc., Box 444, Waltham, Mass.
Mechanical Enterprises, 3127 Colvin St., Alexandria, Va.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Symbo Co., 7609 Orchard Ave., N., Minneapolis, Minn.
Tech-Tac, Inc., 4924 Elsinore, Orange, Calif.

DRAFTING TEMPLATES & EQUIPMENT
Dietzgen, E. Co., 2425 N. Sheffield Ave., Chicago, Ill.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Pickett Inds., Inc., Box 1515, Santa Barbara, Calif.
Stacor Corp., 285 Emmet St., Newark, N. J.
Uber Grafic Instrs., Box 4, Palo Alto, Calif.

DRAWERS, SLIDING
Chassis-Trak, Inc., 525 S. Webster Ave., Indianapolis, Ind. .... p 578
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 586
Techmar Corp., 2232 S. Cotner Ave., Los Angeles, Calif. ..... p 592
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio

DRILLS & ACCESSORIES, HAND & POWER
Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif.
Ace Drill Corp., 2600 E. Maumee St., Adrian, Mich.
Bendix Corp., Cutting Tool Div., 180 Laurel St., Greenfield, Mass.
Black & Decker Mfg. Co., 701 E. Joppa Rd., Towson, Md.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Dimensional Control Machinery Co., Box 504, Salem, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Dri-Clave Corp., 54 Kinkel St., Westbury, N. Y.
Dumore Co., 1300 17 St., Racine, Wisc.
Excellon Inds., 23915 Garnier, Torrance, Calif.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
High Speed Hammer Co., Inc., 313 Norton St., Rochester, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.
Mira Corp., 2242 N. Figueroa, Los Angeles, Calif.
Moody Machine Prods. Co., Inc., Box 2248, Providence, R. I.
Penn Scientific Products Co., Inc., 1000 Old York Rd., Abington, Pa.
Portable Electric Tools Div., 1200 East State St., Geneva, Ill.
Price & Rutzebeck, Box 30, Hayward, Calif.
Simonds Saw & Steel, Intervale Rd., Fitchburg, Mass.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Standard Pneumatic Motor Co., Box 745, Whittier, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tilden Tool Mfg. Co., Inc., 209 Los Molinos, San Clemente, Calif.
Townsend Co., Fabricated Products Div., West Newton, Pa.
Vigor Tool Co., 53 West 23 St., New York, N. Y.
Wen Products, Inc., 5810 Northwest Hwy., Chicago, Ill.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.
Zephyr Mfg. Co., 201 Hindry Ave., Box 759, Inglewood, Calif.

DRIVERS, CHOPPER
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1777
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Solid State Electrn. Corp., 15321 Rayen St., Sepulveda, Cal. p 2793, 2920
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.

DRIVERS, NUT
Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif. ..... p 2831
Black & Decker Mfg. Co., 701 E. Joppa Rd., Towson, Md.
Channellock, Inc., S. Main St., Meadville, Pa.
Crescent Niagaga Corp., 70 Niagara St., Buffalo, N. Y.
E. T. M. Corp., 144 W. Chestnut Ave., Monrovia, Calif.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Moody Machine Prods. Co., Inc., Box 2248, Providence, R. I.
Portable Electric Tools Div., 1200 East State St., Geneva, Ill.
Porter, H. K., Inc., 74 Foley St., Somerville, Mass.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Rosenberg Bros. & Co., 100 Landing Ave., Smithtown, N. Y.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Standard Pneumatic Motor Co., Box 745, Whittier, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Townsend Co., Fabricated Products Div., West Newton, Pa.
Upson Tools, Inc., Box 4750, Rochester, N. Y.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo, N. Y.
Xcelite Inc., Thorne & Bank Sts., Orchard Park, N. Y.

DRIVERS, SOLENOID—SEE SOLENOID DRIVERS

DRIVERS, SPEAKER
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Femco, Inc., Box F, Irwin, Pa.
Lansing J. B., Sound, Inc., 3249 Casitas Ave., Los Angeles, Calif.
Ruxton Elctrns. Co., 2420 N. Rosemead Blvd., S. El Monte, Calif.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.

DRIVERS, SWITCH
AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1664
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.

DRIVERS, TUBE
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1180, 1183
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

DRIVERS & ENCODERS FOR READOUTS
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1182
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Digital Equip. Corp., 146 Main St., Maynard, Mass.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla. ... p 1185
Display Devices, Inc., 2928 Nebraska Ave., Santa Monica, Calif. p 1186
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1190
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Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. ..... p 1194
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Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J. ..... p 1198
Shelly Associates Inc., 111 Eucalyptus Dr., El Segundo, Cal. .... p 1202
Theta Instrument Corp., Fairfield, N. J.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
EDP Corp., Box 6485, Orlando, Fla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
Robins Data Devices, Inc., 15-58 127th St., Flushing, N. Y.

DRIVES, DIAL
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. ... p 1173
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2670
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 1174, 1175
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Theta Instrument Corp., Fairfield, N. J. ..... p 1513
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Fife Electronic Prods., 80 Commercial St., Freeport, N. Y.
Geartronics Corp., 112 Chelmsford Rd., N. Billerica, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.

DRIVES & DRIVE MECHANISMS
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y. p 1729
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1733
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. ... p 1173
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2670
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
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Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. ... p 1763
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
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Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Fife Electronic Prods., 80 Commercial St., Freeport, N. Y.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Geartronics Corp., 112 Chelmsford Rd., N. Billerica, Mass.
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Insco Corp., Main St., Groton, Mass.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kinetic Instr. Co., 1072 Linwood St., Brooklyn, N. Y.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lavezzi Machine Works, Inc., 4635 W. Lake St., Chicago, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lisk, G. W., Co., Inc., 5019 South St., Clifton Springs, N. Y.
McNally Bros. Mach. & Gear Co., 1145 E. 79th St., Minneapolis, Minn.
Metron Instrument Inc., 1051 S. Platte River Dr., Denver, Colo.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

DRUMS, COMPUTER MEMORY—ALSO SEE MEMORY SYSTEMS, DRUM
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Bielski Memory Systems, Inc., 122 East 42 St., New York, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

DRY TRANSFER LETTERS & NUMBERS—SEE KITS, MARKING—ALSO SEE DRAFTING SYMBOLS

DRYERS, AIR, HEATLESS
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Cargocaire Engineering Corp., 8-10 Chestnut St., Amesbury, Mass.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Hayes, C. I. Inc., 870 Wellington Ave., Cranston, R. I.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Lectrodryer Div., Box 4599, Pittsburgh, Pa.
Lindsay Structure, 1360 Edgar St., Evansville, Ind.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Puregas Equipment Corp., 1445 Strongs Rd., Copiague, N. Y.
Ross Engrg. Div., Box 751, New Brunswick, N. J.
Superior Continental Corp., Box 489, Hickory, N. C.

DUCTS, FLEXIBLE
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif.
Wiremold Co., Hartford, Conn. ..... p 1010, 1011
Flexaust Co., 277 Park Ave., New York, N. Y.
Flexco Div., 6855 Suva St., Bell Gardens, Calif.

DUCTS, WIRING
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill. ..... p 2963
Wiremold Co., Hartford, Conn. ..... p 1010, 1011
Amerind-MacKissic, Inc., Box 111, Parkerford, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Danex Corp., 60 Tomlinson Rd., Huntingdon Valley, Pa.
Electrical Security Div., 1524 E. 14 Mile Rd., Madison Hgts., Mich.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hoffman Engrg. Co., 9th & Tyler Sts., Anoka, Minn.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Ideas, Inc., 118 Grand Ave., Laramie, Wyo.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stahlin Brothers, Inc., 500 Maple St., Belding, Mich.
Taylor Electric, Inc., Fisher Rd., Howell, Mich.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Wadsworth Electric Mfg. Co., Inc., 20 West 11th St., Covington, Ky.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

DUMMY LOADS
AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1342
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. .. p 1372, 1669
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671

Heath Co., Dept. 180, Benton Harbor, Mich.
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1692
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Pyrofilm Resistor Co. Inc., 60 S. Jefferson Rd., Whippany, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Spar Electronics, 7989 Engineer Rd., San Diego, Calif. ..... p 2111
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Control Data Corp., 400 Border St., East Boston, Mass.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
Electronautics, Newtown Rd., Littleton, Mass.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Ham Kits, Box 175, Cranford, N. J.
Herley Inds., Inc., 175 Elleen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Norton Co., 1 New Bond St., Worcester, Mass.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Radiation Devices Co., Box 8450, Baltimore, Md.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
States Co., 19 New Park Ave., Hartford, Conn.
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tem-Pres Res. Div., Carborundum Co., 1401 S. Atherton St., State College, Pa.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Trylon, Inc., Elverson, Pa.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

DUPLEXER EQUIPMENT—SEE RECEIVERS, TRANSMITTERS, ETC.

DUPLEXERS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Elleen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
N-H Microwave, Inc., Box 887, Red Bank, N. J.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

DUPLICATORS, MAGNETIC TAPE

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y..... p 758, 759
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159
Ampex Corp., 401 Broadway, Redwood City, Calif.
Audiotronics Corp., 7428 Bellaire Ave., N. Hollywood, Calif.
Cassettes Unlimited, Corp., 200 Claremont Ave., New York, N. Y.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Taben Recordings, 221 Rock Hill Rd., Bala Cynwyd, Pa.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.

DUPLICATORS, PAPER TAPE

Tally Corporation, 1310 Mercer St., Seattle, Wash.

DUST-FREE CHAMBERS—SEE ROOMS, CLEAN, DUST-FREE

DVM'S—SEE METERS, VOLT, DIGITAL

DYNAMOMETERS

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Magtrol Inc., 240 Seneca St., Buffalo, N. Y. ..... p 1749
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
B & F Instruments Inc., Cornwells Hgts., Pa.
Bear Mfg. Co., 2830-5th St., Rock Island, Ill.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
General Thermodynamics Corp., 164 Ballardvale St., Wilmington, Mass.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Lebow Assocs., Inc., 21820 Wyoming Ave., Oak Park, Mich.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Task Corporation, Box 3999, Anaheim, Calif.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Wood, C. N. Mfg. Co., Rte. 332, E., Newtown, Pa.

DYNAMOTORS

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Continental Electric Co., Inc., 325 Ferry St., Newark, N. J.
Dyna Technology, Inc., Box 3263, Sioux City, Iowa
Dyna Technology Inc., 2201 E. 7th St., Sioux City, Iowa
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

EARPHONES—SEE HEADPHONES & HEADSETS

ECHO BOXES—SEE BOXES, ECHO

ECHO RANGING EQUIPMENT, ULTRASONIC

Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.

ELECTROMYOGRAPHS

Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Automation Industries, Inc., Box 950, Boulder, Colo.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Massa Div., 280 Lincoln St., Hingham, Mass.
Pearce-Simpson, Inc., Box 800, Biscayne Annex, Miami, Fla.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Research Mfg. Corp., Box 6056, San Diego, Calif.
Roveti Instruments, 238 West St., Annapolis, Md.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.

ECONOMIZERS, CARBON DIOXIDE

Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.

EDITING EQUIPMENT, MAGNETIC TAPE

Ampex Corp., 401 Broadway, Redwood City, Calif.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Elpa Mktg. Inds., Inc., Thorens & Atlantic Aves., New Hyde Park, N. Y.
Video Research Corp., 761 N. Washington St., Rockville, Md.

ELASTOMERS, HEAT SHRINKABLE—SEE CAPS, FORMS & TAPES, HEAT SHRINKABLE—ALSO SEE TUBING, HEAT SHRINKABLE

ELECTRICAL SURGE ARRESTERS—SEE ARRESTERS, ELECTRICAL SURGE

ELECTROCARDIOGRAPHS (ECG)

AEL Inc., P.O. Box 552, Lansdale, Pa.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Honeywell Test.Instruments Div., Box 5227, Denver, Colo. .... p 1403
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Avionics Res. Prods. Corp., 6901 W. Imperial Hwy., Los Angeles, Cal.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Biotronics, Inc., 838 Butte St., Redding, Calif.
Dallons Instrs., 120 Kansas St., El Segundo, Calif.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Electronic Science Labs., 3920 Bryn Mawr, Dallas, Tex.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

ELECTRODES—SEE TUBE PARTS

ELECTRODES, ELECTROPLATING—SEE ELECTROPLATING EQUIPMENT & SUPPLIES

ELECTRODES, SPHERICAL

Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Avionics Res. Prods. Corp., 6901 W. Imperial Hwy., Los Angeles, Cal.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Hughes Aircraft Co., Vacuum Tube Prods. Div./Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.

ELECTROENCEPHALOGRAPHS (EEG)

Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Biotronics, Inc., 838 Butte St., Redding, Calif.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Egan Laboratory, 107-56 113th St., Richmond Hill, N. Y.
Electronic Science Labs., 3920 Bryn Mawr, Dallas, Tex.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

ELECTROMAGNETIC READOUTS—SEE READOUTS, ELECTROMECHANICAL

ELECTROMECHANICAL READOUTS—SEE READOUTS, ELECTROMECHANICAL

ELECTROMAGNETS—SEE MAGNETS, ELECTROMAGNETIC

ELECTROMETERS—SEE METERS, ELECTROMETER

ELECTROMYOGRAPHS

London Co., 811 Sharon Dr., Westlake, Ohio
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

ELECTROMYOGRAPHS (Cont'd)

Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.

ELECTRON GUNS—SEE TUBE PARTS

ELECTROPLATING EQUIPMENT & SUPPLIES

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Aubin, A. E. Co., Box 29, Glastonbury, Conn.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Enthone, Inc., Box 1900, New Haven, Conn.
Etchomatic, Inc., Box 444, Waltham, Mass.
Fidelity Chemical Products Corp., 472 Frelinghuysen Ave., Newark, N. J.
Hull, R. O. & Co., Inc., 3203 West 71 St., Cleveland, Ohio
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Selectrons, Ltd., 116 East 16th St., New York, N. Y.
Servometer Corp., 82 Industrial E., Clifton, N. J.
Sifco Metachemical, 935 East 63rd St., Cleveland, Ohio
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Technic, Inc., Box 965, Providence, R. I.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

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ADC Products, 6405 Cambridge St., Minneapolis, Minn.
ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1895
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ..... p 1936
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. .... p 1936
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. p 1950, 1951
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
Heath Co., Dept. 180, Benton Harbor, Mich.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
International Rectifier, 233 Kansas St., El Segundo, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Powertec Div., 8168 DeSoto Ave., Chatsworth, Calif.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Sonotone Corp., Battery Div., Dept. 810, Box 200, Elmsford, N. Y. p 2093
Sorensen Operation, Richards Ave., Norwalk, Conn.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Model Rectifier Corp., 5300 21st Ave., Brooklyn, N. Y.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sun Capacitors, 2554 Lawrence, Chicago, Ill.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Warren Communications, Newtown Rd., Littleton, Mass.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

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ENCLOSURES, SPEAKER, (EXCLUDING KITS)

Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Heath Co., Dept. 180, Benton Harbor, Mich.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Products Inc., 6825 S. Chicago Ave., Chicago, Ill.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Argos Products Co., Inc., 600 S. Sycamore St., Genoa, Ill.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
B.J.M. Co., San Juan Darlington, Santurce, Puerto Rico
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bozak, R. T. Mfg. Co., Box 1166, Darien, Conn.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Calbest Elctrns., 4801 Exposition Blvd., Los Angeles, Calif.
Cambridge Pattern Works, Inc., 55 First St., Cambridge, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Davis, J. W. & Co., Box 35313, Dallas, Tex.
Easco Industries, Inc., 2121 Rte. 110, Farmingdale, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Era Acoustics Corp., 311 E. Park St., Moonachie, N. J.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Fisher Radio Corp., 11-40 45th Rd., Long Island City, N. Y.
Fourjay Industries, Box 1465 Northbridge Br., Dayton, Ohio
Furniture Craftsmen, 3596 Alpine Rd., N. W., Grand Rapids, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hartley Products Corp., Barnert Pl., Hohokus, N. J.
Hawley Prods. Co., 333 North 6th St., St. Charles, Ill.
Hoffman Engrg. Co., 9th & Tyler Sts., Anoka, Minn.
Holbrook-Merrill Co., 1150 Kifer Rd., Sunnyvale, Calif.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Karlson Research & Mfg. Div., 388 Peninsula Blvd., Hempstead, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Klipsch & Associates, Inc., Box 280, Hope, Ark.
LMB Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Lansing J. B., Sound, Inc., 3249 Casitas Ave., Los Angeles, Calif.
Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis, Mo.
Major Electronics Corp., 649 39 St., Brooklyn, N. Y.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Middletown Mfg. Co., 27 Stack St., Middletown, Conn.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
New-Berg Leather Prod. Co., Inc., 61 Greenpoint Ave., Bklyn, N. Y.
Oaktron Industries, Inc., Monroe, Wisc.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Quam-Nichols Co., Marquette Rd. at Prairie Ave., Chicago, Ill.
RMS Electronics, Inc., 50 Antin Pl., Bronx, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio-Matic of America, Inc., 760 Ramsey Ave., Hillside, N. J.
Ruxton Elctrns. Co., 2420 N. Rosemead Blvd., S. El Monte, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Spring City Electrical Mfg. Co., Hall & Main Sts., Spring City, Pa.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tannoy America, Ltd., 1756 Ocean Ave., Bohemia, N. Y.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Wellcor, Inc., 1214-18 N. Wells St., Chicago, Ill.
Wilder Engrg. Prods., 715 Kedzie, Chicago, Ill.

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Airflyte Electronics Co., Box 207, Bayonne, N. J.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Theta Instrument Corp., Fairfield, N. J.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 813
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Baldwin Elctrns., Inc., 1101 McAlmont St., Little Rock, Ark.
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Collectron Corp., 304 East 45th St., New York, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Defense Elctrns., Inc., Rockville, Md.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Flight Research, Div. Geotel, Inc., Box 1-F, Richmond, Va.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Invac Corp., 26 Fox Rd., Waltham, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Litton Industries, Encoder Div., 20745 Nordhoff St., Chatsworth, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.

ENCODERS, BRUSH & MAGNETIC, DISC

Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 813
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Intellux, Inc., Box 548, Goleta, Calif.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.

ENCODERS, DIGITAL

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Fifth Dimension Inc., Box 483, Princeton, N. J.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn. p 2484, 2485
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J. ..... p 1198
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 811
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Baldwin Elctrns., Inc., 1101 McAlmont St., Little Rock, Ark.

Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Collectron Corp., 304 East 45th St., New York, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Dasa Corp., 15 Stevens St., Andover, Mass.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
EDP Corp., Box 6485, Orlando, Fla.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Flight Research, Div. Geotel, Inc., Box 1-F, Richmond, Va.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Invac Corp., 26 Fox Rd., Waltham, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Noller Control Systems, Inc., 150 E. Standard Ave., Richmond, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Secode Electronics, 908 Dragon St., Dallas, Tex.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Wayne-George Co., Christina St., Newton, Mass.

ENCODERS, DISPLACEMENT, LINEAR

Data Technology Inc., 65 Grove St., Watertown, Mass.
Theta Instrument Corp., Fairfield, N. J.
Collectron Corp., 304 East 45th St., New York, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Wayne-George Co., Christina St., Newton, Mass.

ENCODERS FOR READOUTS—SEE DRIVERS & ENCODERS FOR READOUTS

ENCODERS, KEYBOARD

Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2757
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2757
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.

ENCODERS, OPTICAL—SEE CODED DISCS, OPTICAL

ENCODERS, SHAFT, POSITION

Airflyte Electronics Co., Box 207, Bayonne, N. J. ..... p 1722
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 763
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. .... p 1021
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif. ..... p 779
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y. p 1729
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 790
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn. p 2484, 2485
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif.
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2683
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Baldwin Elctrns., Inc., 1101 McAlmont St., Little Rock, Ark.
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Collectron Corp., 304 East 45th St., New York, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
EMR Div., Box 223, Princeton, N. J.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Flight Research, Div. Geotel, Inc., Box 1-F, Richmond, Va.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Litton Industries, Encoder Div., 20745 Nordhoff St., Chatsworth, Calif.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
Norden Div., United Aircraft Corp., Helen St., Norwalk, Conn.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Trump-Ross Industrial Controls, Inc., 265 Boston Rd., Billerica, Mass.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Wayne-George Co., Christina St., Newton, Mass.

ENGINE ANALYZERS—SEE ANALYZERS, ENGINE

ENGINEERING REFERENCE BOOKS—SEE TECHNICAL BOOKS

ENGRAVING & PROFILING EQUIPMENT

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Electro Stylus, 31 Cheyenne Blvd., Colorado Springs, Colo.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Gorton Machine Corp., 1122 West 13th St., Racine, Wisc.
Hermes Plastics, Inc., 20 Cooper Square, New York, N. Y.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Metal Removal Co., 1801 W. Columbia, Chicago, Ill.
Metalphoto Corp., 18531 S. Miles Rd., Cleveland, Ohio
Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.
Preis, H. P., Engraving Mach. Co., 651 U. S. Hwy. 22, Hillside, N. J.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Star Enterprises, Box 1098, Lowell, Mass.
Wilkens, A. F., Inc., Rte. 22, Pawling, N. Y.

ENGRAVING & PROFILING SERVICES—SEE SERVICES, ENGRAVING

ENVIRONMENTAL CHAMBERS—SEE CHAMBERS

ENVIRONMENTAL ROOMS—SEE ROOMS, ENVIRONMENTAL

ENVIRONMENTAL SEALS & FEEDTHRUS—SEE FEEDTHRUS & SEALS, ENVIRONMENTAL

ENVIRONMENTAL TESTING SERVICES—SEE SERVICES, ENVIRONMENTAL TESTING

EPOXY RESINS—SEE ADHESIVES; COMPOUNDS

EQUALIZERS, AUDIO

Collins Radio Co., Newport Beach, Calif.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tracor Inc., 6500 Tracor La., Austin, Texas
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Century Projector Corp., 729 Seventh Ave., New York, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.

ESCUTCHEONS

Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Ruxton Elctrns. Co., 2420 N. Rosemead Blvd., S. El Monte, Calif.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
United Research Labs., 681 Fifth Ave., New York, N. Y.

EQUALIZERS, DELAY

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1140
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080, 1081
Collins Radio Co., Newport Beach, Calif.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. .... p 1308, 1309
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Superior Continental Corp., Box 489, Hickory, N. C.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.

EQUALIZERS, PHASE

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1140
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
Collins Radio Co., Newport Beach, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Collins Radio Co., Dallas, Texas
Defense Elctrns., Inc., Rockville, Md.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

ERASERS, MAGNETIC TAPE (BULK)

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Avionics Res. Prods. Corp., 6901 W. Imperial Hwy., Los Angeles, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rason Mfg. Co., 73 Wortman Ave., Brooklyn, N. Y.

ERROR CORRECTION EQUIPMENT, TELEPRINTER

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Codex Corp., 222 Arsenal St., Watertown, Mass.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.

ESCUTCHEONS

Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Sun Dial & Panel Corp., Box 326, Caldwell, N. J.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
Topflight Corp., 160 E. 9th Ave., York, Pa.

EVAPORATION EQUIPMENT.

ETCHANTS, PRINTED CIRCUIT—SEE PRINTED CIRCUIT ETCHANTS

EVAPORATION EQUIPMENT, ELECTRON BEAM

Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Thomson Electric Welder Co., Inc., 161 Pleasant St., Lynn, Mass.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

EXCITERS—SEE OSCILLATORS

EXCITERS, VIBRATION—SEE VIBRATION TEST SYSTEMS

EXPANDERS, DATA & SPEECH

Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.

EXPANDERS, METER—SEE MULTIPLIERS, METER

EXPLOSIVE GAS INDICATORS—SEE DETECTORS, GAS LEAK

EXTENSOMETERS, ELECTRO-OPTICAL

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Instron Corp., 2500 Washington St., Canton, Mass.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Optron Corp., 50 Fitch St., New Haven, Conn.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.

EXTRACTORS, CIRCUIT BOARD, FUSE, LAMP, TUBE—SEE PULLERS

EYELETS

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Atlas Tack Corp., Fairhaven, Mass.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Fischer Special Mfg. Co., 446 Morgan St., Cincinnati, Ohio
General Mfg. Co., 724 Ruberta Ave., Glendale, Calif.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Segal, E., Inc., 132 Lafayette St., New York, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Stimpson Co., Inc., 74 Franklin Ave., Brooklyn, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
3M Co., 3M Center, St. Paul, Minn.
USM Fastener Co., 510 River Rd., Shelton, Conn.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

FABRIC INSULATION—SEE INSULATING MATERIALS, FABRIC

FABRICS, ACOUSTIC, SOUND-TRANSPARENT

Wendell Fabrics Corp., 1220 Broadway, New York, N. Y.

FABRICS, CONDUCTIVE

Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Hartwell Corp., 9035 Venice Blvd., Los Angeles, Calif.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Plymouth Rubber Co., Inc., Canton, Mass.
3M Co., 3M Center, St. Paul, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Unique Wire Weaving Co., Inc., 759 Ramsey Ave., Hillside, N. J.
Wire Cloth Enterprises, Inc., 130-132 Gamma Dr., Pittsburgh, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

FACEPLATES

ADC Products, 6405 Cambridge St., Minneapolis, Minn. ..... p 821
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Metalphoto Corp., 18531 S. Miles Rd., Cleveland, Ohio
S & S Optical Co., Inc., 7812 Stellhorn Rd., Ft. Wayne, Ind.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Sun Dial & Panel Corp., Box 326, Caldwell, N. J.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.

FACSIMILIE EQUIPMENT—SEE RECEIVERS: TRANSMITTERS: ETC.

FANS—SEE BLOWERS & FANS

FASTENERS, METAL

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J. ..... p 2687
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Cinch-Monadnock, 18300 E. Valley Blvd., City of Industry, Calif.
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y. p 1171
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Globe Plastics, 1342 South Signal Dr., Pomona, Calif.
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill.
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass. ... p 976, 1320
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Abbott Screw & Mfg. Co., 6525 N. Clark St., Chicago, Ill.
Abscoa Industries, 1071 W Arbor Vitae, Inglewood, Calif.
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Acme Rivet & Machine Corp., 1116 Edgewater Ave., Ridgefield, N. J.
Adams Rite Mfg. Co., 540 W. Chevy Chase Dr., Glendale, Calif.
Adjustable Bushing Corp., 11905 Vose St., N. Hollywood, Calif.
Allen Mfg. Co., Drawer 570, Hartford, Conn.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Anti-Corrosive Metal Prods. Co., Inc., Box 1894, Albany, N. Y.
Armco Steel Corp., 703 Curtis St., Middletown, Ohio
Arrow Fastener Co., Inc., 271 Mayhill St., Saddle Brook, N. J.
Associated Mfg. Co., 2414 Lawrence Ave., Chicago, Ill.
Atlantic India Rubber Co., 571 W. Polk St., Chicago, Ill.
Atlas Screw & Specialty Co., Inc., 450 Broome St., New York, N. Y.
Atlas Tack Corp., Fairhaven, Mass.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Avdel Inc., 210 S. Victory Blvd., Burbank, Calif.
Bell Fasteners Corp., 352 Evelyn St., Paramus, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bland Co., 95 Granby St., Bloomfield, Conn.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Bostitch, Div. Textron, Inc., Briggs Dr., E. Greenwich, R. I.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
C. E. M. Co., Inc., 24 School St., Danielson, Conn.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Cherry Rivet Div., Box 2157, Santa Ana, Calif.
Deutsch Fastener Corp., Airport Sta - Box 90925, Los Angeles, Calif.
Dimco-Gray Co., 207 East 6th St., Dayton, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Dynaloc Inc., 511 Second St. Pike, Southampton, Pa.
Dzus Fastener Co. Inc., 425 Union Blvd., W. Islip, N. Y.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Elastic Stop Nut Div., 2330 Vauxhall Rd., Union, N. J.
Elco Tool & Screw Corp., 1111 Samuelson Rd., Rockford, Ill.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Fischer Special Mfg. Co., 446 Morgan St., Cincinnati, Ohio
Garrett, G. K. Co., 8801 Torresdale Ave., Philadelphia, Pa.
Gemp Terminals, Inc., 20 Woodworth Ave., Yonkers, N. Y.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Staple Co., 28 East 22nd St., New York, N. Y.
Gillen, J. Co., 2540 South 50th Ave., Cicero, Ill.
Great Eastern Metal Prod. Co., 22 Woodworth Ave., Yonkers, N. Y.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Groov-Pin Corp., 1125 Hendricks Causeway, Ridgefield, N. J.
H. K. Metalcraft Mfg. Co., 35 Industrial Rd., Lodi, N. J.
Harper, H. M. Co., 8200 Lehigh Ave., Morton Grove, Ill.
Hartwell Corp., 9035 Venice Blvd., Los Angeles, Calif.
Heli-Coil Corp., Shelter Rock La., Danbury, Conn.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hobbs Mfg. Co., 666 Lincoln St., Worcester, Mass.
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jacobson Mfg. Co., Inc., Box 177, Kenilworth, N. J.
Kaynar Mfg. Co., Inc., 800 S. State College Blvd., Fullerton, Calif.
Kelox Inds., 161 Prescott St., E. Boston, Mass.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Klincher Locknut Corp., 2153 Hillside Ave., Indianapolis, Ind.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Laminated Shim Co., Inc., 48 Union St., Glenbrook, Conn.
Lamson & Sessions Co., 5000 Tiedeman Rd., Cleveland, Ohio
Larson, Charles O. Co., P.O. Box "E", Sterling, Ill.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Long Lok Corp., Gateway East Bldg., Century City, Los Angeles, Cal.
Luke Line Fasteners, 201 Laurel St., Beverly, N. J.
MacLean-Fogg Lock Nut Co., 1000 Allanson Rd., Mundelein, Ill.
Mercury Div., 10459 W. Jefferson Blvd., Culver City, Calif.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Morris, J. I. Co., 372 Elm St., Southbridge, Mass.
Multi-Flex Seals, Inc., 1170 Commerce Ave., Bronx, N. Y.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Nielson Hardware Corp., 770 Wethersfield Ave., Hartford, Conn.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nylok Co. Div., USM Corp., 611 Industrial Ave., Paramus, N. J.
Pan-L-Fast, 13161 Sherman Way, N. Hollywood, Calif.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Porcelain Products Co., 225 N. Patterson St., Carey, Ohio
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Reliance Div., 25 Charles Ave., S.E., Massillon, Ohio
Republic Steel Corp., Box 6778, Cleveland, Ohio
Rosan, Inc., 2901 West Coast Hwy., Newport Beach, Calif.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Shakeproof Div., St. Charles Rd., Elgin, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shur-Lok Corp., 1300 E. Normandy Pl., Santa Ana, Calif.
Sinclair Mfg. Co., Chartley, Mass.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Stake Fastener Co., 1710 Potrero Ave., S. El Monte, Calif.
Standard Locknut & Lockwasher, Inc., 2725 Tobey Dr., Indianapolis, Ind.
Standard Screw Co., 2701 Washington Blvd., Bellwood, Ill.
Stanley Industrial Hardware Div., Stanley Works, New Britain, Conn.
Star Expansion Co., Box 108, Pleasant Hill Rd., Mountainville, N. Y.
Star Stainless Screw Co., Box 222, Totowa, N. J.
Sterling Bolt Co., 5401 W. Roosevelt Rd., Chicago, Ill.
Stimpson Co., Inc., 74 Franklin Ave., Brooklyn, N. Y.
TA Mfg. Corp., 4625 Alger St., Los Angeles, Calif.
Teale Machine Co., Inc., Box 936, Rochester, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Timber-Top, Inc., 199 N. Main St., Freeport, N. Y.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Townsend Co., Box 2157, Santa Ana, Calif.
Townsend Co., Fabricated Products Div., West Newton, Pa.
Townsend Co., TRS Div., 530 West St., Braintree, Mass.
Tridair Industries, 3000 W. Lomita Bl., Torrance, Cal.
USM Fastener Co., 510 River Rd., Shelton, Conn.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Utilities Service Co., Box 627, Allentown, Pa.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C., N. Y.
Waterbury Pressed Metal Co., 407 Brookside Rd., Waterbury, Conn.
Western Sky Industries, 21300 Cloud Way, Hayward, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wrought Washer Mfg. Co., 2252 South Bay St., Milwaukee, Wis.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

FASTENERS, NON-METALLIC

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Globe Plastics, 1342 South Signal Dr., Pomona, Calif. ..... p 2514
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill. ..... p 2963
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill. .... p 1009
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Abbott Screw & Mfg. Co., 6525 N. Clark St., Chicago, Ill.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Acme Rivet & Machine Corp., 1116 Edgewater Ave., Ridgefield, N. J.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anti-Corrosive Metal Prods. Co., Inc., Box 1894, Albany, N. Y.
Austin Continental Industries, Inc., 3636 N. Talman Ave., Chicago, Ill.
Bell Fasteners Corp., 352 Evelyn St., Paramus, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bland Co., 95 Granby St., Bloomfield, Conn.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Dzus Fastener Co. Inc., 425 Union Blvd., W. Islip, N. Y.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Gaskets, Inc., Middletown, Conn.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Hanscom, H. F. Co., Inc., 225 Chapman St., Providence, R. I.
Harper, H. M. Co., 8200 Lehigh Ave., Morton Grove, Ill.

Hartwell Corp., 9035 Venice Blvd., Los Angeles, Calif.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Kerrco, Inc., Box 29178, Lincoln, Neb.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Luke Line Fasteners, 201 Laurel St., Beverly, N. J.
Multi-Flex Seals, Inc., 1170 Commerce Ave., Bronx, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nylogrip Prods. Co., 281 Winter, Waltham, Mass.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Nyltite Corp. of America, 3451 S. Clinton Ave., S. Plainfield, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Shakeproof Div., St. Charles Rd., Elgin, Ill.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Shur-Lok Corp., 1300 E. Normandy Pl., Santa Ana, Calif.
Sinclair Mfg. Co., Chartley, Mass.
Stalwart Rubber Co., 377 Northfield Rd., Bedford, Ohio
Star Expansion Co., Box 108, Pleasant Hill Rd., Mountainville, N. Y.
Star Stainless Screw Co., Box 222, Totowa, N. J.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Tridair Industries, 3000 W. Lomita Bl., Torrance, Cal.
Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C., N. Y.
Weckesser Co., Inc., 4444 W. Irving Park Rd., Chicago, Ill.

FAULT LOCATORS—SEE DETECTORS, FLAW & DEFECT

FEEDTHRUS & SEALS, ENVIRONMENTAL

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif. p 905
ITT Cannon Elec., 3208 Humboldt St., Los Angeles, Cal.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Conax Corporation, 2300 Walden Ave., Buffalo, N. Y.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Bellows Corp., 1075 Providence Hwy., Sharon, Mass.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Vacuum Research Mfg. Co., 3100 Crow Canyon Rd., San Ramon, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Vernay Labs., E. South College St., Yellow Springs, Ohio

FEEDTHRUS, TERMINAL—SEE TERMINALS, FEEDTHRU

FELT & FELT PARTS

Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
Felters Co., 22 West St., Millbury, Mass.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
GAF Corp., 140 West 51 St., New York, N. Y.
Morris, J. I. Co., 372 Elm St., Southbridge, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Press-On Products, 39 Factory Rd., Addison, Ill.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.

FERRITE PARTS—ALSO SEE MATERIALS, FERRITE; CORES, FERRITE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Fair-Rite Prods Corp., 1 Commercial Row, Wallkill, N. Y.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Microwave Chemicals Lab., Inc., 282 Seventh Ave., New York, N. Y.
Seacor, Inc., 598 Broadway, Norwood, N. J.
3M Co., 3M Center, St. Paul, Minn.

FIBER OPTIC BUNDLES

Albion Optical Co. Inc., 260 N. Rte. 303, Box 463, W. Nyack, N. Y.
American Cystoscope Makers, Inc., 8 Pelham Pky., Pelham Manor, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Bendix Corp., Mosaic Fabrications Div., Galileo Pk., Sturbridge, Mass.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro Fiberoptics Corp., 45 Water St., Worcester, Mass.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

FIBER OPTIC INSPECTION EQUIPMENT

American Cystoscope Makers, Inc., 8 Pelham Pky., Pelham Manor, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Bendix Corp., Mosaic Fabrications Div., Galileo Pk., Sturbridge, Mass.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Eder Instrument Co., Inc., 2293 N. Clybourn Ave., Chicago, Ill.
Electro Fiberoptics Corp., 45 Water St., Worcester, Mass.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

FIBERS—SEE INSULATING MATERIALS, FIBER

FIELD PLOTTERS, ELECTRIC & MAGNETIC

Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

FILM BADGES—SEE SERVICES, FILM BADGE

FILM THICKNESS INDICATORS—SEE INDICATORS, FILM THICKNESS

FILMS, CAPACITOR

Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Celanese Plastics Co., 550 Broad St., Newark, N. J.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Dixon Corp., Metacom Ave., Bristol, R. I.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Hercules Inc., 910 Market St., Wilmington, Dela.
Metallzied Products Co., Inc., Box 391, Norwalk, Conn.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Schweitzer, Peter J. Div., Kimberly Clark Corp., Lee, Mass.
3M Co., 3M Center, St. Paul, Minn.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.

FILMS, MASKING (INCL. PHOTOGRAPHIC)

Ulano Prods. Co., Inc., 210 East 86 St., New York, N. Y.

FILMS, RESISTANCE

Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Caddock Electronics, Inc., 3127 Chicago Ave., Riverside, Calif. p 2357, 2358
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1659
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. ..... p 2393
Resistance Prods. Co., 914 South 13th St., Harrisburg, Pa.
Welwyn International, Inc., 811 Sharon Dr., Westlake, Ohio .... p 2442
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Celanese Plastics Co., 550 Broad St., Newark, N. J.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.

FILTER SYNTHESIZERS

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1278
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan

FILTERS, A-F

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
A. P. Circuit Corp., 865 West End Ave., New York, N. Y. ..... p 1277
American Time Products, Bulova Watch Co., Inc.,
61-20 Woodside Ave., Woodside, N. Y. ..... p 1082
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.

FILTERS, ANTENNA

Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio p 1303, 2286
Bulova Watch Co., Inc., Electrn. Div., Freq. Control Products,
61-20 Woodside Ave., Woodside, N. Y. ..... p 1080
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio p 1085, 1286
Collins Radio Co., Newport Beach, Calif.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1287
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y. .. p 1289
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1297
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Multimetrix, Inc., 401 Concord Ave., Bronx, N. Y. ..... p 1301
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1129
Resistance Prods. Co., 914 South 13th St., Harrisburg, Pa.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. .... p 1312, 1313
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Tracor Inc., 6500 Tracor La., Austin, Texas
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Century Projector Corp., 729 Seventh Ave., New York, N. Y.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Control Science Corp., 4810 Beauregard St., Alexandria, Va.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Linear Networks Co., Box 1103, Bozeman, Mont.
National Coil Co., Box 1040, Douglas, Ariz.
Novatronics, Inc., Box 878, Pompano Beach, Fla.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Pulse Techniques, Inc., 1411 Palisade Ave., W. Englewood, N. J.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Trion, Inc., 1000 Island Ave., McKees Rocks, Pa.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.

FILTERS, ACTIVE (ALL TYPES)

A. P. Circuit Corp., 865 West End Ave., New York, N. Y. ..... p 1277
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 512, 2838
Burr-Brown Research Corp., Int'L Airport Ind. Pk., Tucson, Ariz. p 514
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans.
Multimetrix, Inc., 401 Concord Ave., Bronx, N. Y. ..... p 1301
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1481
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. ... p 1310, 1311
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
White Instruments Inc., Box 698, Austin, Tex.

FILTERS, AIR—SEE AIR CLEANERS & FILTERS

FILTERS, ANALOG—SEE FILTERS, CONTINUOUSLY VARIABLE

FILTERS, ANTENNA

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y.

FILTERS, ANTENNA (Cont'd)

Honeywell Test Instruments Div., Box 5227, Denver, Colo. ..... p 1403
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Transco Products, 4241 Glencoe Ave., Venice, Calif.
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Collins Radio Co., Cedar Rapids, Iowa
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
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General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
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I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northwale, N. J.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

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Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
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Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind.
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Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Control Science Corp., 4810 Beauregard St., Alexandria, Va.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Defense Elctrns., Inc., Rockville, Md.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Enterprises, 775 South Madison Ave., Pasadena, Calif.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
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HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northwale, N. J.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
National Coil Co., Box 1040, Douglas, Ariz.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TDC Div., P.O. Box 365, Littleton, Mass.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

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Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Bourns, Inc., Box 1398, Romoland, Calif.
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Control Science Corp., 4810 Beauregard St., Alexandria, Va.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Defense Elctrns., Inc., Rockville, Md.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Enterprises, 775 South Madison Ave., Pasadena, Calif.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Linear Networks Co., Box 1103, Bozeman, Mont.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Coil Co., Box 1040, Douglas, Ariz.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roveti Instruments, 238 West St., Annapolis, Md.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TDC Div., P.O. Box 365, Littleton, Mass.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FILTERS, CERAMIC

American Feldmuehle Corp., Box 2160, Glenbrook, Conn. ..... p 1576
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio p 1286
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif. .. p 651
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. p 1316, 1317
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Star Porcelain Co., 71 Muirhead Ave., Trenton, N. J.

FILTERS, COAXIAL

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1342
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. ... p 1704
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1706
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind. p 1314

FILTERS, COMB

Transco Products, 4241 Glencoe Ave., Venice, Calif.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. .... p 1316
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Springer Aircraft Radio Corp., RR #2, Box 98, Shelleyville, Ind.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FILTERS, COMB

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Blackhawk Networks Corp., 14 N. Parker Dr., Janesville, Wisc. .. p 1069
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ... p 1072, 1073
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif.
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio p 1286
Collins Radio Co., Newport Beach, Calif.
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass. p 1088
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Filtaire Inc., 706 Forrest St., Charlottesville, Va.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 1108
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
Control Science Corp., 4810 Beauregard St., Alexandria, Va.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.

FILTERS, COMB (Cont'd)

Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Elmag Corp., 54 Clark St., Newark, N. J.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.

FILTERS, CONTINUOUSLY VARIABLE

A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Multimetris, Inc., 401 Concord Ave., Bronx, N. Y. ..... p 1301
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1704
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1481
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. ..... p 1311
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind.
Tracor Inc., 6500 Tracor La., Austin, Texas
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Electro-Mechanics Co., Box 1546, Austin, Tex.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

FILTERS, CRYSTAL (INCL. MONOLITHIC DEVICES)

AEL Inc., P.O. Box 552, Lansdale, Pa.
Blackhawk Networks Corp., 14 N. Parker Dr., Janesville, Wisc. .. p 1069
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. .... p 1072, 1073
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. ... p 1077
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio p 1085
Collins Radio Co., Newport Beach, Calif.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass. p 1088
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. p 1090, 1094
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Filtaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1113
Holix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 1108
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. .. p 1298, 1299
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1118
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1123
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Piezo Technology, Inc., 2400 Diversified Way, Orlando, Fla. p 1110, 1111
RFL Components Div., Powerville Rd., Boonton, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1129
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sherold Crystals Prod. Gp., Tyco Labs., Inc., 1510 McGee Trafficway, Kansas City, Mo. ..... p 1131
Tedford Crystal Labs., Inc., 4914 Gray Rd., Cincinnati, Ohio
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
United Transformer Co., 150 Varick St., New York, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
C-F Networks Inc., 3102 North 29th Ave., Phoenix, Ariz.
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.

FILTERS, ELECTRIC WAVE SECTION

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Collins Radio Co., Newport Beach, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Holix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1297
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Zaring Inds., Inc., Box 477, Carmel, Ind.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.

FILTERS, EQUALIZER

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080
Collins Radio Co., Newport Beach, Calif.
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1297
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Multimetris, Inc., 401 Concord Ave., Bronx, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1704
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. .... p 1308, 1309
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Tracor Inc., 6500 Tracor La., Austin, Texas
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Bourns, Inc., Box 1398, Romoland, Calif.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Linear Networks Co., Box 1103, Bozeman, Mont.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Pulse Techniques, Inc., 1411 Palisade Ave., W. Englewood, N. J.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

FILTERS, FLUID, NONMETALLIC

Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
EMR Div., Box 223, Princeton, N. J.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Vanton Pump & Equip. Corp., 201 Sweetland Ave., Hillside, N. J.

FILTERS, HARMONIC

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
Collins Radio Co., Newport Beach, Calif.
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Holix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1297
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Multimetris, Inc., 401 Concord Ave., Bronx, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FILTERS, HIGH-PASS

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
A. P. Circuit Corp., 865 West End Ave., New York, N. Y. ..... p 1277
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1278, 1279
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2838
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1342
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 1303
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080, 1081
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Collins Radio Co., Newport Beach, Calif.

Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1287
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y. .. p 1289
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 1293
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1297
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Multimetrix, Inc., 401 Concord Ave., Bronx, N. Y. ..... p 1301
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 1304
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
RFL Components Div., Powerville Rd., Boonton, N. J.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1706
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1129
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307, 1481
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ... p 1308, 1309
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. .... p 1310, 1311
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. .... p 1312, 1313
Tedford Crystal Labs., Inc., 4914 Gray Rd., Cincinnati, Ohio ... p 1315
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bourns, Inc., Box 1398, Romoland, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Control Science Corp., 4810 Beauregard St., Alexandria, Va.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Drake, R. L. Co., 540 Richard St., Miamisburg, Ohio
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elmag Corp., 54 Clark St., Newark, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Instruments Inc., 3434 Midway Dr., San Diego, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Linear Networks Co., Box 1103, Bozeman, Mont.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
National Coil Co., Box 1040, Douglas, Ariz.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TDC Div., P.O. Box 365, Littleton, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FILTERS, I-F

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Blackhawk Networks Corp., 14 N. Parker Dr., Janesville, Wisc. .. p 1069
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1077
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio p 1286
Collins Radio Co., Newport Beach, Calif.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Filtaire Inc., 706 Forrest St., Charlottesville, Va.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y. .. p 1289
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
RFL Components Div., Powerville Rd., Boonton, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1704
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
United Transformer Co., 150 Varick St., New York, N. Y.

FILTERS, INTERFERENCE

Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Defense Elctrns., Inc., Rockville, Md.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Renco Efctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

FILTERS, INDUSTRIAL, HEAVY DUTY (ELECTRONIC)

ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. .... p 2147
American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Barrett, Leon J., Co., 1450 Grafton Rd., Worcester, Mass.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
North American Rockwell Corp., 25000 Miles Rd., Cleveland, Ohio
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Trion, Inc., 1000 Island Ave., McKees Rocks, Pa.

FILTERS, INTERFERENCE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa.
A. P. Circuit Corp., 865 West End Ave., New York, N. Y. ..... p 1277
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Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Collins Radio Co., Newport Beach, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1287
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif. .. p 651
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Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. ..... p 1297
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
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TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Tobe Deutschmann Labs., Box 74, Canton, Mass. ..... p 695
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. p 1316, 1317
United Transformer Co., 150 Varick St., New York, N. Y.
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Collins Radio Co., Dallas, Texas
Components Córp., 2857 N. Halsted St., Chicago, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gold Line Connector, Inc., Muller Ave., Box 893, Norwalk, Conn.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Interference Measurement Lab., Inc., 850 Shepherd Ave., Brooklyn, N. Y.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Standard Electronics Co., 3012 West 77th St., Chicago, Ill.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Welex Electronics, Box 986, Silver Spring, Md.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

FILTERS, INTERSTAGE & LINE—SEE FILTERS, TELEMETERING

FILTERS, LINE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1858
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1942
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
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Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 667
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. .... p 1308, 1309
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. p 1316, 1317
United Transformer Co., 150 Varick St., New York, N. Y.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Bourns, Inc., Box 1398, Romoland, Calif.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Components Córp., 2857 N. Halsted St., Chicago, Ill.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Standard Electronics Co., 3012 West 77th St., Chicago, Ill.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.

FILTERS, LINEAR PHASE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2838
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080, 1081
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Collins Radio Co., Newport Beach, Calif.
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass. p 1088
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Filtaire Inc., 706 Forrest St., Charlottesville, Va.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Microsonics Inc., 60 Winter St., Weymouth, Mass. ..... p 1164
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Multimetrix, Inc., 401 Concord Ave., Bronx, N. Y. ..... p 1301
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 1304
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. ..... p 1311
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Bourns, Inc., Box 1398, Romoland, Calif.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Components Córp., 2857 N. Halsted St., Chicago, Ill.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Linear Networks Co., Box 1103, Bozeman, Mont.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.

FILTERS, LOW-PASS

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
A. P. Circuit Corp., 865 West End Ave., New York, N. Y. ..... p 1277
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1278, 1279
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
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Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
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Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 1303
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Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Collins Radio Co., Newport Beach, Calif.
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J. ..... p 1158
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. p 1287
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 667
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J. ... p 1294, 1295
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y. .. p 1289
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 1293
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1297
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. .. p 1298, 1299
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Metrix Instrument Co., P.O. Box 38501, Houston, Tex.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Multimetrix, Inc., 401 Concord Ave., Bronx, N. Y. ..... p 1301
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 1304
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1706
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. ... p 1705
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1129
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307, 1481
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ... p 1308, 1309
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. .... p 1310, 1311
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. .... p 1312, 1313
Tedford Crystal Labs., Inc., 4914 Gray Rd., Cincinnati, Ohio ... p 1315
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind. p 1314
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Zaring Inds., Inc., Box 477, Carmel, Ind.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.

Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bourns, Inc., Box 1398, Romoland, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby. Ohio
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Control Science Corp., 4810 Beauregard St., Alexandria, Va.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Drake, R. L. Co., 540 Richard St., Miamisburg, Ohio
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elmag Corp., 54 Clark St., Newark, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Linear Networks Co., Box 1103, Bozeman, Mont.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
National Coil Co., Box 1040, Douglas, Ariz.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TDC Div., P.O. Box 365, Littleton, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FILTERS, MECHANICAL

Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 1303
Collins Radio Co., Newport Beach, Calif.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan p 1300
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.

FILTERS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Collins Radio Co., Newport Beach, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
LEL Div. Varian, 75 Akron St., Coplague, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. ... p 1704
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1706
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. ... p 1705
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind. p 1314
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Waveline Inc., Box 718, West Caldwell, N. J.
AAI Corp., Box 6767, Baltimore, Md.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
GAF Corp., 140 West 51 St., New York, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.

FILTERS, R-F

N-H Microwave, Inc., Box 887, Red Bank, N. J.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FILTERS, MINIATURE—SEE FILTERS (SPECIFIC TYPES)

FILTERS, OPTICAL

Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Ednalite Research Corp., 200 N. Water St., Peekskill, N. Y.
Electro-Nuclear Labs., Inc., 115 Independence Dr., Menlo Park, Calif.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Kaiser Aerospace & Electronics Corp., Box 11275, Palo Alto, Calif.
Kopp Glass, Inc., Box 8255, Swissvale, Pittsburgh, Pa.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Polacoat, Inc., 9750 Conklin Rd., Blue Ash, Ohio
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Republic Lens Co., Inc., 31 East 169th St., Bronx, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
Tinsley Labs, Inc., 2448 6th St., Berkeley, Calif.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.
University Laboratories, Inc., 733 Allston Way, Berkeley, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.
Zenith Optical Lab., 138 Palisade St., Dobbs Ferry, N. Y.

FILTERS, R-F

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1278
American Trans-Coil Corp., 124-08 101st Ave., Richmond Hill, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Basler Electric Co., Box 269, Highland, Ill.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1342
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio p 1085, 1286
Collins Radio Co., Newport Beach, Calif.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1287
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif. .. p 651
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Filtaire Inc., 706 Forrest St., Charlottesville, Va.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill. p 667
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J. ... p 1294, 1295
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y. .. p 1289
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 1293

FILTERS, R-F (Cont'd)

Honeywell Test Instruments Div., Box 5227, Denver, Colo. ..... p 1403
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1297
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1118
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal. ..... p 738
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Multimetris, Inc., 401 Concord Ave., Bronx, N. Y. ..... p 1301
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 1304
Nytronics, Inc., Capacitor Div., Orange St., Darlington, S. C.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
RFL Components Div., Powerville Rd., Boonton, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1704
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1706
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1312
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind. p 1314
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap. p 1135
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. p 1316, 1317
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Aladdin Electronics/Skyborne, 9841 Alburtis Ave., Santa Fe Springs, Calif.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Capcon, Inc., 61 Stanton St., New York, N. Y.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Defense Elctrns., Inc., Rockville, Md.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorsett Electronics, Box 36, Tulsa, Okla.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electromec, Inc., 209 N. Tradd St., Statesville, N. C.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Elmag Corp., 54 Clark St., Newark, N. J.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Industrial Condenser Corp., 3243 N. California Ave., Chicago, Ill.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
National Coil Co., Box 1040, Douglas, Ariz.
North American Rockwell Corp., 25000 Miles Rd., Cleveland, Ohio
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rafec Electronics, Box 566, Temple City, Cal.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FILTERS, REACTOR

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Collins Radio Co., Newport Beach, Calif.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Varo General, Garland Bank Bldg., Garland, Tex.

FILTERS, SCREENROOM

All-Tronics Inc., 45 Bond St., Westbury, N. Y. ..... p 1284
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Captor Corp., 5040 S. County Rd., Tipp City, Ohio
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Lindgren, E. A. & Assoc., 4515-17 N. Ravenswood Ave., Chicago, Ill.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.

FILTERS, SINGLE SIDEBAND

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa.
A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Blackhawk Networks Corp., 14 N. Parker Dr., Janesville, Wisc. .. p 1069
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Collins Radio Co., Newport Beach, Calif.
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1287
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. .. p 1090
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Filtaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1113
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hertz Filter Corp., 50 Washington Ave., Garden City Pk., N. Y.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 1108
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. .. p 1298, 1299
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Piezo Technology, Inc., 2400 Diversified Way, Orlando, Fla. .... p 1111
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
RFL Components Div., Powerville Rd., Boonton, N. J.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1129
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Tedford Crystal Labs., Inc., 4914 Gray Rd., Cincinnati, Ohio ... p 1315
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Collins Radio Co., Cedar Rapids, Iowa
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
National Coil Co., Box 1040, Douglas, Ariz.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.

FILTERS, SYNCHRONOUS TRACKING

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
Multimetris, Inc., 401 Concord Ave., Bronx, N. Y.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.

FILTERS, TELEMETERING

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080, 1081
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio p 1085
Collins Radio Co., Newport Beach, Calif.
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1287
Filtaire Inc., 706 Forrest St., Charlottesville, Va.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J. .. p 1294, 1295
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 1292
Hisonic Inc., 249 N. Troost, Olathe, Kans. ..... p 1293
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal. ... p 1296
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans. ..... p 1298
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1118
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.

RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
RFL Components Div., Powerville Rd., Boonton, N. J.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. ..... p 1310
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. .... p 1312, 1313
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind. p 1314
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Bourns, Inc., Box 1398, Romoland, Calif.
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Defense Elctrns., Inc., Rockville, Md.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Linear Networks Co., Box 1103, Bozeman, Mont.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
National Coil Co., Box 1040, Douglas, Ariz.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Piezo Crystal Co., 100 K St., Carlisle, Pa.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Rytron Co. Inc., 7303 Lankershim Blvd., N. Hollywood, Calif.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
White Instruments Inc., Box 698, Austin, Tex.

FILTERS, TONE, TELEGRAPH

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
A. P. Circuit Corp., 865 West End Ave., New York, N. Y.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 1303
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1080, 1081
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ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Filtaire Inc., 706 Forrest St., Charlottesville, Va.
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Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Multimetris, Inc., 401 Concord Ave., Bronx, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y.
RFL Components Div., Powerville Rd., Boonton, N. J.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. .... p 1308, 1309
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
United Transformer Co., 150 Varick St., New York, N. Y. p 752, 1318
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Filtech Corp., 10103 W. Pacific, Franklin Park, Ill.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

FILTERS, TUNABLE—SEE FILTERS, CONTINUOUSLY VARIABLE

FILTERS, TUNING FORK

American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1082
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1068
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio p 2286
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Murata Mfg. Co., Nagaoka, Kyoto, Japan ..... p 1125
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Spectrum Technology Inc., Box 368, Goleta, Calif. ..... p 1133
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.

FILTERS, UHF & VHF

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1342
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio p 1085
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Electro Materials, 11620 Sorrento Valley Rd., San Diego, Calif.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1118
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Piezo Technology, Inc., 2400 Diversified Way, Orlando, Fla. p 1110, 1111
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Interonics, Inc., 100 Pine Aire Dr., Bay Shore, N. Y. ..... p 1306
RFL Components Div., Powerville Rd., Boonton, N. J.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1129
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal. p 689
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
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Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind. p 1314
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
U. S. Capacitor Corp., 2151 N. Lincoln St., Burbank, Calif. p 1316, 1317
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronics, Missiles & Comms., Inc., Box 116, White Haven, Pa.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.

FILTERS, VARIABLE, BAND PASS

Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
National Coil Co., Box 1040, Douglas, Ariz.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Springer Aircraft Radio Corp., RR #2, Box 98, Shelleyville, Ind.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FILTERS, VARIABLE, BAND PASS

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
A. P. Circuit Corp., 865 West End Ave., New York, N. Y. ..... p 1277
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 733
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1297
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Multimetris, Inc., 401 Concord Ave., Bronx, N. Y. ..... p 1301
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Components Div., Powerville Rd., Boonton, N. J.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1704
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1706
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307, 1481
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ..... p 1308
Spectrum Instruments, Inc., Box 474, Tuckahoe, N. Y. .... p 1310, 1311
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Texscan Microwave Prods. Corp., 4610 N. Franklin Rd., Indianapolis, Ind. p 1314
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Tracor Inc., 6500 Tracor La., Austin, Texas
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Dawe Instruments Ltd., Western Ave., Acton, London W3, Eng.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Millidale Rd., Cheshire, Conn.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.

FILTERS, VARIABLE, BAND PASS (Cont'd)

Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

FILTERS, VESTIGIAL SIDEBAND

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AEL Inc., P.O. Box 552, Lansdale, Pa.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J.
Knox Electronics, Inc., P.O. Box 6184, Leawood, Kans.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.

FILTERS, WAVEGUIDE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .... p 1704
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1706
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
GAF Corp., 140 West 51 St., New York, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
N-H Microwave, Inc., Box 887, Red Bank, N. J.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

FINDERS, RANGE—SEE RANGE FINDER SYSTEMS

FINGER CONTACT STRIPS—SEE CONTACT STRIPS, FINGER

FINISHES—SEE COATINGS: PAINTS: PLATING SOLUTIONS

FIRE CONTROL SYSTEMS, AIRCRAFT, MISSILE, ROCKET

California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

FIRE DETECTION & FIGHTING EQUIP.

Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Meipar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Autocall Co., 366 Mack Ave., Shelby, Ohio
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Edwards Co., Inc., 90 Connecticut Ave., Norwalk, Conn.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Faraday, Inc., 805 S. Maumee, Tecumseh, Mich.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Fenwal, Inc., Main St., Ashland, Mass.
Fire Control Co., Inc., 1605 Ayre St., Newport, Dela.
Fuel Watchman Sales & Service, Inc., 2910 Park Ave., Bronx, N. Y.
Honeywell, Inc., Commercial Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Lee Elec., Inc., 309-51st St., W. New York, N. J.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Notifier Co., 3700 North 56th St., Lincoln, Neb.
On-Guard Corp. of America, 345 West 37 St., New York, N. Y.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
Pyrotronics, Inc., 2343 Morris Ave., Union, N. J.
Roesch, D., Comm., Inc., 2727 San Fernando Rd., Los Angeles, Calif.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Schirmer National Alarm Co., 100 Portland Ave., Bergenfield, N. J.
Standard Electric Time Corp., 89 Logan St., Springfield, Mass.
Worner Electrn. Devices, Rankin, Ill.

FLAME SPRAYING EQUIPMENT

Metco, Inc., 1101 Prospect Ave., Westbury, N. Y.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.

FLANGES, WAVEGUIDE

Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Narda Microwave Corp., Plainview, N. Y.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Waveline Inc., Box 718, West Caldwell, N. J.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
American Radar Components, Inc., 415 E. Main St., Denville, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Connector Corp. of America, 12959 Sherman Way, N. Hollywood, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

FLASH PHOTOLYSIS SYSTEMS & COMPONENTS

Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill. ..... p 1779

FLASHERS

Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill. ..... p 1779
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Arizona Elctrns., Inc., Drawer AE, Benson, Ariz.
Assembly Elctrns., 807 Kent St., Niagara Falls, Ont., Can.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
Hughey & Phillips, Inc., 3050 N. California St., Burbank, Calif.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Mel-Rain Corp., 3100 Roosevelt Ave., Indianapolis, Ind.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Time-O-Matic Inc., Box 850, Danville, Ill.
Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

FLAT PACKAGES, INTEGRATED CIRCUIT—SEE PACKAGES, INTEGRATED CIRCUIT

FLAW DETECTION EQUIPMENT—SEE DETECTORS, FLAW & DEFECT

FLUID CONDUCTIVITY INDICATORS—SEE INDICATORS, FLUID CONDUCTIVITY

FLUID FLOW INDICATORS—SEE METERS, FLUID FLOW

FLUIDIC CONTROL SYSTEMS & EQUIP.

Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Francis Industries, 11855 Broad St., Pataskala, Ohio
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Howie Corp., Noble & Jackson Sts., Norristown, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Segal, E., Inc., 132 Lafayette St., New York, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Trish Energetics, West Bare Hill Rd., Harvard, Mass.

FLUORESCENT COMPOUNDS & PHOSPHORS

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Prods., Box 45278, Chicago, Ill.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Carter's Ink Co., 239 First St., Cambridge, Mass.
City Chemical Corp., 132 West 22 St., New York, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio

Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Pilot Chemicals, Inc., 36 Pleasant St., Watertown, Mass.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Stroblite Co., Inc., 75 West 45th St., New York, N. Y.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.

FLUOROMETERS

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Process & Instruments Corp., 1943 Broadway, Bklyn., N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

FLUX, BRAZING & SOLDERING

Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1735
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Multicore Sales Corp., Dept. RY399, Westbury, N. Y. ..... p 2833
Acton Assocs., 100 Thompson St., Pittston, Pa.
All-State Welding Alloys Co., Inc., P.O. Box 350, White Plains, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
American Smelting & Refining Co., 120 Broadway, New York, N. Y.
American Solder & Flux Co., Inc., 19 & Willard Sts., Philadelphia, Pa.
Bow Solder Products Co. Inc., 25 Amsterdam St., Newark, N. J.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Dunton, M. W. Co., 350 Kinsley Ave., Providence, R. I.
Eutectic Corp., 40-40 172nd St., Flushing, N. Y.
Fairmount Chemical Co., Inc., 117 Blanchard St., Newark, N. J.
Farrelloy Co., 1243 North 26 St., Philadelphia, Pa.
Gardiner Solder Co., 4820 S. Campbell Ave., Chicago, Ill.
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Hobart Brothers Co., Hobart Square, Troy, Ohio
Johnson Mfg. Co., Box 96, Princeton, Iowa
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Kestler Electronics, 4226 Arica Ave., Rosemead, Calif.
LMB Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Lake Chemical Co., 250 N. Washtenaw Ave., Chicago, Ill.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
National Lead Co., 111 Broadway, New York, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Ruby Chemical Co., 68 McDowell St., Columbus, Ohio
Shanda Labs., Inc., Box 24, Closter, N. J.
Stewart-Hall Chemical Corp., 222 Washington St., Mount Vernon, N. Y.
Superior Flux & Mfg. Co., 1536 St. Clair Ave., Cleveland, Ohio
Tricon Mfg. Co., 2325 Wisconsin Ave., Downer Grove, Ill.
Unibraze Corp., 455 Knollwood Rd., White Plains, N. Y.
Zeva Electric Corp., 11 Park Pl., New York, N. Y.

FLUXMETERS—SEE METERS, FLUX

FOIL, CAPACITOR ELECTRODE

Amax Aluminum Co., Inc., 6106 S. Broadway, St. Louis, Mo.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Amax Aluminum/Foil Prods., 6106 S. Broadway, St. Louis, Mo.
Paul, F. H. & Stein Bros., Inc., 235 S Ave., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Wellington Technical Inds., Inc., 55 Honeck St., Englewood, N. J.

FOIL, MAGNETIC

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1213
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J.
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. ... p 1221
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1226
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Allegheny Ludlum Steel Co., H. W. Oliver Bldg., Pittsburgh, Pa.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Hamilton Precision Metals, Div. Hamilton Watch Co., Lancaster, Pa.
Hamilton Watch Co., Lancaster, Pa.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Wellington Technical Inds., Inc., 55 Honeck St., Englewood, N. J.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.

FOIL, MAGNETIC SHIELDING—SEE SHIELDS, MAGNETIC

FORKS, TUNING—SEE TUNING FORKS

FORMS, COIL—SEE COIL FORMS

FORMS, WIRE (NONCONDUCTING)

Art Wire & Stamping Co., 28 Boyden Pl., Newark, N. J. ..... p 1635
Accurate Spring Mfg. Co., 8747 W. Palmer St., River Grove, Ill.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
CE-JA Springs Inc., 169 Day St., Newington, Conn.
Connor Spring & Mfg. Co., 75 14th St., San Francisco, Calif.
Dudek & Bock Spring Mfg. Co., 4014 W. Grand Ave., Chicago, Ill.
E. C. P. Corp., 4726 Superior Ave., Cleveland, Ohio
Eastern Tool & Mfg. Co., 1 Montgomery St., Belleville, N. J.
Eltee, Inc., 19 Fairfield Pl., W. Caldwell, N. J.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Hunter Spring, One Spring Ave., Hatfield, Pa.
James Electrn. Tool Co., Box 1482, Palo Alto, Calif.
Kersting Mfg. Co., 504 S. Date Ave., Alhambra, Calif.
King Laboratories, Inc., 127 Solar St., Syracuse, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Stanley Industrial Components Div., Stanley Works, Forestville, Conn.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Zims Manufacturing Co., 26 Paine Ave., Irvington, N. J.

FRAMES, CABINET & RACK

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Atlee Corp., 2 Lowell Ave., Winchester, Mass. ..... p 835
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J.
Falstrom Co., 174 Falstrom Ct., Passaic, N. J. ..... p 583
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass.
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y. ..... p 2277
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Techmar Corp., 2232 S. Cotner Ave., Los Angeles, Calif. ..... p 592
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Abtronics, Inc., Box 712, Livermore, Calif.
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
B & P Precision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Danco Metal Products, Inc., 24020 Detroit Rd., Westlake, Ohio
Epic, Inc., 150 Nassau St., New York, N. Y.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Kersting Mfg. Co., 504 S. Date Ave., Alhambra, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Metalcraft, Inc., Roosevelt Field, Garden City, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Rotary Co., Inc., 1746 Dale Rd., Buffalo, N. Y.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.

FREQUENCY ANALYZERS—SEE ANALYZERS, SPECTRUM

FREQUENCY CALIBRATION SERVICES—SEE SERVICES, CALIBRATION AND INSTRUMENT REPAIR

FREQUENCY DISTRIBUTION SYSTEMS—SEE DISTRIBUTION SYSTEMS, FREQUENCY

FREQUENCY EXTENDERS—SEE DIVIDERS, FREQUENCY

FREQUENCY SOURCES—SEE OSCILLATORS

FREQUENCY STANDARDS—SEE STANDARDS, FREQUENCY

FREQUENCY SYNTHESIZERS—SEE SYNTHESIZERS, FREQUENCY

FUEL CELLS

Allis-Chalmers, Box 512, Milwaukee, Wisc.
Astro Dynamics, Inc., 2nd Ave., Northwest Industrial Park, Burlington, Mass.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Zircoa, (Zirconium Corp. of America), Box 39217, Solon, Ohio

FURNACES, BRAZING

Aerometrics, P.O. Box 216, San Ramon, Calif.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Astro Inds., Inc., 606 Olive St., Santa Barbara, Calif.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.

FURNACES, GAS (PRODUCTION)

Hayes, C. I. Inc., 870 Wellington Ave., Cranston, R. I.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Pacific Scientific Co., Furn. Div., 6280 Chalet Dr., City of Commerce, Cal.
Selas Corp. of America, Box 200, Dresher, Pa.
Sunbeam Equip. Corp., 212 Mercer St., Meadville, Pa.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Watkins-Johnson Co., Stewart Div., Mt. Hermon Rd., Santa Cruz, Calif.

FURNACES, DIFFUSION

Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Hayes, C. I. Inc., 870 Wellington Ave., Cranston, R. I.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

FURNACES, ELECTRIC (LABORATORY)

Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Ampere Electric Industries, 410 Communipaw Ave., Jersey City, N. J.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Astro Inds., Inc., 606 Olive St., Santa Barbara, Calif.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
L & L Mfg. Co., Box 348, Twin Oaks, Pa.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Pacific Scientific Co., Furn. Div., 6280 Chalet Dr., City of Commerce, Cal.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Tem-Pres Res. Div., Carborundum Co., 1401 S. Atherton St., State College, Pa.
Trent, Inc., 201 Leverington Ave., Philadelphia, Pa.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

FURNACES, ELECTRIC (PRODUCTION)

Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Aerometrics, P.O. Box 216, San Ramon, Calif.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Astro Inds., Inc., 606 Olive St., Santa Barbara, Calif.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hayes, C. I. Inc., 870 Wellington Ave., Cranston, R. I.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
L & L Mfg. Co., Box 348, Twin Oaks, Pa.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Litton Engrg. Labs., Box 949, Grass Valley, Calif.
Mech-Tronic Equipment Co., P. O. Box 510, Silver Spring, Md.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Neo-Technology, Inc., Box 266, Montvale, N. J.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Pacific Scientific Co., Furn. Div., 6280 Chalet Dr., City of Commerce, Cal.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Research, Inc., Box 6164, Minneapolis, Minn.
Sara Scientific Co., Box 321, San Francisco, Calif.
Semimetals, Inc., 405 National Ave., Mountain View, Calif.
Sunbeam Equip. Corp., 212 Mercer St., Meadville, Pa.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Surface Combustion Div., 2375 Dorr St., Toledo, Ohio
Trent, Inc., 201 Leverington Ave., Philadelphia, Pa.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Watkins-Johnson Co., Stewart Div., Mt. Hermon Rd., Santa Cruz, Calif.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio

FURNACES, GAS (PRODUCTION)

Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Despatch Oven Co., Box 1320, Minneapolis, Minn.

FURNACES, GAS (PRODUCTION) (Cont'd)

Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Pacific Scientific Co., Furn. Div., 6280 Chalet Dr., City of Commerce, Cal.
Selas Corp. of America, Box 200, Dresher, Pa.
Sunbeam Equip. Corp., 212 Mercer St., Meadville, Pa.
Surface Combustion Div., 2375 Dorr St., Toledo, Ohio
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

FURNACES, HIGH-FREQUENCY

Ajax Magnethermic Corp., 1745 Overland Ave., N. E., Warren, Ohio
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Cycle-Dyne, Inc., Sub. Axel Elctrns. Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Laboratory Equipment Corp., Lakeview & Hilltop Rd., St. Joseph, Mich.
Lepel High Frequency Labs., 59-21 Queens-Midtown Expwy., Maspeth, N. Y.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Sunbeam Equip. Corp., 212 Mercer St., Meadville, Pa.
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

FURNACES, VACUUM

Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Ajax Magnethermic Corp., 1745 Overland Ave., N. E., Warren, Ohio
Astro Inds., Inc., 606 Olive St., Santa Barbara, Calif.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Brew, R. D. & Co., Inc., 90 Airport Rd., Concord, N. H.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.,) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Hayes, C. I. Inc., 870 Wellington Ave., Cranston, R. I.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Nuclide Corp. AGV Div., 914 Main St., N. Acton, Mass.
Pacific Scientific Co., Furn. Div., 6280 Chalet Dr., City of Commerce, Cal.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Surface Combustion Div., 2375 Dorr St., Toledo, Ohio
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Tem-Pres Res. Div., Carborundum Co., 1401 S. Atherton St., State College, Pa.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Watkins-Johnson Co., Stewart Div., Mt. Hermon Rd., Santa Cruz, Calif.

FURNITURE, ELECTRONIC LAB – SEE BENCHES, CONSOLES, STOOLS, TABLES (LAB & SHOP)

FUSE CLIPS—SEE CLIPS & HOLDERS, FUSE

FUSE PANELS—SEE PANELS, FUSE

FUSED PLUGS—SEE PLUGS, FUSED

FUSED QUARTZ—SEE QUARTZ, FUSED

FUSES

Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1592
Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J.
Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo. p 2694, 2695
Electra/Midland Corp., Cermetrik Div., 3347 Industrial Ct., San Diego, Cal. p 2377
Electra/Midland Corp., Electra Div., Box 760, Mineral Wells, Tex.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Littelfuse, Inc., 800 E. Northwest Hwy., Des Plaines, Ill. ..... p 2742
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Auto Products Co., 2735 Olive, St. Louis, Mo.
Bedford Div., Sanders Assocs., Inc., Crosby Rd., Bedford, Mass.
Bellaire Elctrns. Inc., 62 White St., Red Bank, N. J.
Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Chase-Shawmut Co., 374 Merrimac St., Newburyport, Mass.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Economy Fuse Div., 2070 Maple St., Des Plaines, Ill.
Electrey, S. A., Apartado 1393, Monterrey, Mexico
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Micro Devices Corp., Box 501, Far Hill Sta., Dayton, Ohio
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Thermal Controls Inc., 75 Rutgers St., Belleville, N. J.
Trico Fuse Mfg. Co., 2948 North 5th St., Milwaukee, Wis.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

FUSES, FAILURE INDICATING

Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo. p 2694, 2695
Littelfuse, Inc., 800 E. Northwest Hwy., Des Plaines, Ill. ..... p 2742
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. ..... p 2751
Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Economy Fuse Div., 2070 Maple St., Des Plaines, Ill.
Electrey, S. A., Apartado 1393, Monterrey, Mexico
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.

FUSES, THERMAL

Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Electrey, S. A., Apartado 1393, Monterrey, Mexico
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
Micro Devices Corp., Box 501, Far Hill Sta., Dayton, Ohio

FUSES, TIME DELAY

Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo. p 2694, 2695
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Littelfuse, Inc., 800 E. Northwest Hwy., Des Plaines, Ill.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo.
Chase-Shawmut Co., 374 Merrimac St., Newburyport, Mass.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Economy Fuse Div., 2070 Maple St., Des Plaines, Ill.
Electrey, S. A., Apartado 1393, Monterrey, Mexico
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
Starnetics Co., Box 9308, N. Hollywood, Calif.

GALVANOMETERS—SEE METERS, GALVANOMETER

GAMMA RAY TUBES—SEE TUBES, RADIATION DETECTION

GARNET PARTS—ALSO SEE MATERIALS, GARNET

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
Microwave Chemicals Lab., Inc., 282 Seventh Ave., New York, N. Y.

GAS ANALYZERS—SEE ANALYZERS, GAS

GASES, INERT

Air Products & Chemicals Inc., Box 538, Allentown, Pa.
Baker, J. T. Chemical Co., Phillipsburg, N. J.
Blackburn, P. W., Inc., 67 Main St., Dobbs Ferry, N. Y.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.

GASKETS—SEE SEALS

GASKETS, SHIELDING, R-F— ALSO SEE SHIELDS, R-F

Chomerics, Inc., 85 Mystic St., Arlington, Mass. .. p 1639, 1641, 1642
Instrument Specialties Co., Inc., 254 Bergen Blvd., Little Falls, N. J.
McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1253
Metex Corp., 970 New Durham Rd., Edison, N. J. ..... p 1229-1233
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 586
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Abesto Corp., Ackerman St., Bloomfield, N. J.
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.

GATES, COMPUTER CIRCUIT (AND, OR, NOR, ETC.)—SEE CARDS, LOGIC: CIRCUITS, INTEGRATED: MODULES LOGIC

GAUGES, BETA

American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Industrial Gauging & Control, 296 Westport Ave., Norwalk, Conn.
Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus, Ohio
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Ohmart Corp., 4241 Allendorf Dr., Cincinnati, Ohio
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Unit Process Assemblies, Inc., 53-15 37th Ave., Woodside, N. Y.

GAUGES, CONNECTOR

Measurement Specialties Lab., Inc., 14532 Erwin St., Van Nuys, Calif. p 1684

GAUGES, DISPLACEMENT, LINEAR

Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio
Bendix Corp., Industrial Metrology Div., Box 1067, Ann Arbor, Mich.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Optron Corp., 50 Fitch St., New Haven, Conn.
P. I. Tape, 7951 North Ave., Lemon Grove, Calif.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Wintriss Controls, 20 Vandam St., New York, N. Y.

GAUGES, FUEL

Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Ametek, Inc., Station Square Two, Paoli, Pa.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Brooks Instrument Div., Emerson Elec. Co., Hatfield, Pa.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Simmonds Precision Prods., Inc., Rockingham Rd., Bellows Falls, Vt.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.

GAUGES, IONIZATION

Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2917
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.,) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
GCA Technology, Burlington Rd., Bedford, Mass.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Granville-Phillips Co., Box 1290, Boulder, Colo.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Vacuum Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Ohmart Corp., 4241 Allendorf Dr., Cincinnati, Ohio
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.

GAUGES, PHOTOELECTRIC

Abtronics, Inc., Box 712, Livermore, Calif.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.

Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Optron Corp., 50 Fitch St., New Haven, Conn.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

GAUGES. PIRANI

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2917
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Edwards High Vacuum (Can.,) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.

GAUGES. PRESSURE—ALSO SEE TRANSDUCERS, PRESSURE

Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Aero Mechanism, Inc., 7750 Burnett Ave., Van Nuys, Calif.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Ametek, Inc., Station Square Two, Paoli, Pa.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Bailey Meter Company, Wickliffe, Ohio
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Biotronics, Inc., 838 Butte St., Redding, Calif.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynisco, Div. Microdot Inc., 20 S. West Park, Westwood, Mass.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Foxboro, Foxboro, Mass.
General Thermodynamics Corp., 164 Ballardvale St., Wilmington, Mass.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kulite Semiconductor Products, Inc., 1030 Hoyt Ave., Ridgefield, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Lion Research Corp., 60 Bridge St., Newton, Mass.
MB Electronics, Box 1825, New Haven, Conn.
MKS Instruments, Inc., 45 Middlesex Tpke., Burlington, Mass.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Puregas Equipment Corp., 1445 Strongs Rd., Copiague, N. Y.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Roylyn Inc., 620 Paula Ave., Glendale, Calif.
Scanivalve Inc., Box 20005, San Diego, Calif.
Superior Continental Corp., Box 489, Hickory, N. C.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J.
Weksler Instrs. Corp., 195 E. Merrick Rd., Freeport, N. Y.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

GAUGES. RADIATION. MICROWAVE

Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.

GAUGES. STRAIN

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Foxboro, Foxboro, Mass.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Janel, Inc., 226 Main Ave., Stirling, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kulite Semiconductor Products, Inc., 1030 Hoyt Ave., Ridgefield, N. J.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Micro-Strain, Inc., Spring City, Pa.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
United Control Corporation, Redmond, Wash.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

GAUGES. TENSION

Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Ametek, Inc., Station Square Two, Paoli, Pa.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
E. T. M. Corp., 144 W. Chestnut Ave., Monrovia, Calif.
Electromatic Equip. Co., 562 Albemarle Rd., Cedarhurst, N. Y.
Imtra Corp., 151 Mystic Ave., Medford, Mass.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Pacific Scientific Co., Aerospace Div., 1346 S. State College Blvd., Anaheim, Calif.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Wharton Unitools, 8-10 Lake St., Moosup, Conn.
Wintriss Controls, 20 Vandam St., New York, N. Y.

GAUGES. THICKNESS (ELECTRONIC)—SEE INDICATORS. FILM THICKNESS: INDICATORS. MATERIAL THICKNESS

GAUGES, VACUUM

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Virtis Co., Inc., Rte. 208, Gardiner, N. Y. ..... p 1520
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2917
Abbeon, Inc., 179-15 Jamacia Ave., Jamacia, N. Y.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Ametek, Inc., Station Square Two, Paoli, Pa.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Bailey Meter Company, Wickliffe, Ohio
Beach-Russ Co., 420 Lexington Ave., New York, N. Y.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Bristol Co., Box 1790, Waterbury, Conn.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.,) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Foxboro, Foxboro, Mass.
Fredericks Co., Philmont & Anne St., Huntingdon Valley, Pa.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Granville-Phillips Co., Box 1290, Boulder, Colo.
Hastings-Raydist, Newcomb Ave., Hampton, Va.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
MKS Instruments, Inc., 45 Middlesex Tpke., Burlington, Mass.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Nelson Vacuum Pump Co., 2133 4th St., Berkeley, Calif.
Nester/Faust Mfg. Corp., 2401 Ogletown Rd., Newark, Dela.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.

GENERATORS. A-C

Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J.
Weksler Instrs. Corp., 195 E. Merrick Rd., Freeport, N. Y.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

GAUGES, WIRE MEASURING—SEE WIRE MEASURING GAUGES

GEAR MEASURING WIRE

Superior Mfg. & Instr. Corp., 38-07 20th Ave., L. I. C., N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio

GEARS & GEAR MECHANISMS (PRECISION)

Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc.
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. ... p 1173
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1175
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J.
Planet Instr., Inc., 1521 Progress Rd., Ft. Wayne, Ind. ..... p 1752
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1758
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1766
Superior Mfg. & Instr. Corp., 38-07 20th Ave., L. I. C., N. Y. .... p 2673
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Weston-Transicoil Components Div., Worcester, Pa.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Beaver Gear Works Inc., 5459-11th St., Rockford, Ill.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Computer Devices, 11925 Burke St., Santa Fe Springs, Calif.
Dynamic Gear Co., 175 Dixon Ave., Amityville, N. Y.
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
Electronic Machine Parts, 128-11 18th Ave., College Point, N. Y.
Equitable Engineering Co., 4350 Delemere Blvd., Royal Oak, Mich.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
GAF Corp., 140 West 51 St., New York, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago, Ill.
Geartronics Corp., 112 Chelmsford Rd., N. Billerica, Mass.
Gibson-Egan Co., 34 La Porte St., Arcadia, Calif.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Insco Corp., Main St., Groton, Mass.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Juall Gear Co. Inc., 1108 Goffle Rd., Hawthorne, N. J.
Kerrco, Inc., Box 29178, Lincoln, Neb.
Kinetic Instr. Co., 1072 Linwood St., Brooklyn, N. Y.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kwikset Powdered Metal Prods., 516 E. Santa Ana St., Anaheim, Calif.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lavezzi Machine Works, Inc., 4635 W. Lake St., Chicago, Ill.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
McNally Bros. Mach. & Gear Co., 1145 E. 79th St., Minneapolis, Minn.
Melland Gear & Instr. Co., Inc., 84 Sylvester St., Westbury, N. Y.
Meltronics, Inc., 3343 Merrick Rd., Wantagh, N. Y.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Perfect Gear & Instr. Corp., 18141 Napa, Northridge, Calif.
Perkins Machine & Gear Co., Circuit Ave., W. Springfield, Mass.
Rae Motor Corp., Box 518, McHenry, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Santa Fe Mfg. Co., 2343 Jerome Ave., Bronx, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Winzeler Mfg. & Tool Co., 7355 W. Wilson Ave., Chicago, Ill.
Zero-Max Co., The, 2845 Harriet Ave., S., Minneapolis, Minn.

GEIGER COUNTERS—SEE COUNTERS, GEIGER

GEIGER-MUELLER TUBES—SEE TUBES, GEIGER-MUELLER

GENERATORS, A-C

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1329
CML Inc., 350 Leland Ave., Plainfield, N. J.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Georator Corp., Box 70, Manassas, Va. ..... p 1953
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc.

GENERATORS, A-C (Cont'd)

Honeywell Test Instruments Div., Box 5227, Denver, Colo.
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1754
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Bendix Corp., Electric Power Div., Hwy. 35, Eatontown, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Columbia Electric Mfg. Co., 4519 Hamilton Ave., Cleveland, Ohio
Dyna Technology, Inc., Box 3263, Sioux City, Iowa
Dyna Technology Inc., 2201 E. 7th St., Sioux City, Iowa
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Forney Industries, Inc., 1800 La Porte Ave., Fort Collins, Colo.
Great Lakes Elec. Mfg. Co., 17 S. Desplaines St., Chicago, Ill.
Homelite Div., Riverdale Ave., Port Chester, N. Y.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inet-Power, 711 W. Knox St., Gardena, Calif.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leece-Neville Co., 1374 East 51st St., Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Motor Generator Div., EE-61, Troy, Ohio
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
ONAN, 2515 University Ave., S. E., Minneapolis, Minn.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Superior Continental Corp., Box 489, Hickory, N. C.
Task Corporation, Box 3999, Anaheim, Calif.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Winpower Mfg. Co., 1207 First Ave. E., Newton, Iowa
Zeus Generator Co., 12435 Euclid Ave., Cleveland, Ohio

GENERATORS, A-M

AEL Inc., P.O. Box 552, Lansdale, Pa.
CML Inc., 350 Leland Ave., Plainfield, N. J.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
LogiMetrics, Div., 100 Forest Dr., Greenvale, N. Y. ..... p 1428
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
Measurements, Box 180, Boonton, N. J. ..... p 1437
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1532-1534
Alban Electronics, 111 Cedar La., Englewood, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.

GENERATORS, A-M/F-M

CML Inc., 350 Leland Ave., Plainfield, N. J.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Defense Elctrns., Inc., Rockville, Md.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

GENERATORS, ACOUSTIC, HIGH INTENSITY NOISE

Sanders Nuclear Corp., 95 Canal St., Nashua, N. H.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

GENERATORS, AUDIO

American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
CML Inc., 350 Leland Ave., Plainfield, N. J.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Connor-Winfield Corp., Winfield, Ill.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1418
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1476
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1532-1542
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Defense Elctrns., Inc., Rockville, Md.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electromec, Inc., 209 N. Tradd St., Statesville, N. C.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Northeast Electronics Corp., Box 649, Concord, N. H.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.

GENERATORS, CHARACTER

Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781, 1393
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Data Disc, Inc., Display Div., 2626 Hanover St., Palo Alto, Calif.
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
EDP Corp., Box 6485, Orlando, Fla.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
General Elec. Co., 4000 N. W. 39th Expwy., Oklahoma City, Okla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Information Displays, Inc., 333 N. Bedford Rd., Mt. Kisco, N. Y.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.

GENERATORS, COLOR TV

Cohu Electronics Inc., Box 623, San Diego, Calif.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telemet Co., 185 Dixon Ave., Amityville, N. Y.

GENERATORS, CROSS HATCH

Cohu Electronics Inc., Box 623, San Diego, Calif.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telemet Co., 185 Dixon Ave., Amityville, N. Y.

GENERATORS, D-C

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Bendix Corp., Electric Power Div., Hwy. 35, Eatontown, N. J.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Winpower Mfg. Co., 1207 First Ave. E., Newton, Iowa

GENERATORS, DIGITAL DELAY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
Defense Elctrns., Inc., Rockville, Md.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Nano Fast, Inc., 416 W. Erie, Chicago, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

GENERATORS, EMERGENCY POWER

CML Inc., 350 Leland Ave., Plainfield, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Aircraft & Missile Consultants, 2722 Ardmore Ave., Manhattan Beach, Calif.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.

Bendix Corp., Electric Power Div., Hwy. 35, Eatontown, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Detroit Diesel Engine Div., 13400 W. Outer Dr., Detroit, Mich.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Forney Industries, Inc., 1800 La Porte Ave., Fort Collins, Colo.
Homelite Div., Riverdale Ave., Port Chester, N. Y.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inet-Power, 711 W. Knox St., Gardena, Calif.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
ONAN, 2515 University Ave., S. E., Minneapolis, Minn.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Task Corporation, Box 3999, Anaheim, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Varo, Inc., Electrokinetics Div., 402 E. Gutierrez St., Santa Barbara, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Winpower Mfg. Co., 1207 First Ave. E., Newton, Iowa
Zeus Generator Co., 12435 Euclid Ave., Cleveland, Ohio

GENERATORS, F-M

AEL Inc., P.O. Box 552, Lansdale, Pa.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
CML Inc., 350 Leland Ave., Plainfield, N. J.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1418
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1545
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Defense Elctrns., Inc., Rockville, Md.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

GENERATORS, F-M & F-M/STEREO

AEL Inc., P.O. Box 552, Lansdale, Pa.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
Measurements, Box 180, Boonton, N. J. ..... p 1437
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.

GENERATORS, FREQUENCY, HARMONIC

AEL Inc., P.O. Box 552, Lansdale, Pa.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Data-Control Systems, Inc., E. Liberty St., Danbury, Conn.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electric Motors & Specialties, Inc., King & Hamsher Sts., Garrett, Ind.
GAF Corp., 140 West 51 St., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Now Instr. Co., Inc., 6124 N. Pulaski Rd., Chicago, Ill.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

GENERATORS, FREQUENCY-OFFSET

Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.

GENERATORS, FUNCTION

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
C & K Components Inc., 103 Morse St., Watertown, Mass.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electronic Modules Corp., P.O. Box 141, Timonium, Md.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore. .... p 1383
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 2003, 2004
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
Wavetek, 8159 Engineer Rd., San Diego, Calif. .... p 1532, 1534-1542
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Celco, 70 Constantine Dr., Mahwah, N. J.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Fitchburg Coated Products, Inc., Box 1106, Scranton, Pa.
General Computers Inc., 5990 W. Pico Blvd., Los Angeles, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Research, Inc., Box 6164, Minneapolis, Minn.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

GENERATORS, HALL—ALSO SEE MAGNETORESISTORS; MULTIPLIERS, HALL; PROBES, HALL

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 2839
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 2516, 2517
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2586
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.

GENERATORS, MARKER

GENERATORS, IMPULSE—ALSO SEE GENERATORS, PULSE

Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y. ..... p 1360
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1370
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Chesapeake Instr. Corp., Shadyside, Md.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Instrument Research Co., P. O. Box 231, Lincoln, Mass.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Velonex, 560 Robert Ave., Santa Clara, Calif.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

GENERATORS, INFRARED—SEE LAMPS, INFRARED

GENERATORS, INTERFERENCE RASTER

Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

GENERATORS, KEYED VIDEO SIGNAL—SEE GENERATORS, TV SIGNAL

GENERATORS, LOW-FREQUENCY

Accutronics, Inc., 628 North St., Geneva, Ill.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
CML Inc., 350 Leland Ave., Plainfield, N. J.
Connor-Winfield Corp., Winfield, Ill.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore. .... p 1383
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1418
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
LogiMetrics, Div., 100 Forest Dr., Greenvale, N. Y. ..... p 1428
Measurements, Box 180, Boonton, N. J. ..... p 1437
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Spectrum Technology Inc., Box 368, Goleta, Calif.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 1771
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1532-1542
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Defense Elctrns., Inc., Rockville, Md.
Digiac Corp., Ames Ct., Plainview, N. Y.
Electric Motors & Specialties, Inc., King & Hamsher Sts., Garrett, Ind.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inet-Power, 711 W. Knox St., Gardena, Calif.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Procedyne Corp., 221 Somerset St., New Brunswick, N. J.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

GENERATORS, MARKER

Accutronics, Inc., 628 North St., Geneva, Ill.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Greenray Industries Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Kay Electric Co., Maple Ave., Pine Brook, N. J. ... p 1418, 1419, 1422
London Co., 811 Sharon Dr., Westlake, Ohio

GENERATORS, MARKER (Cont'd)

Meipar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Tektronix, Inc., Box 500, Beaverton, Ore.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1544
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jackson Electrical Instrument Co., 35 Windson Ave., Mineola, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

GENERATORS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1370
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1418, 1422
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. .... p 1683
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1805
Sorensen Operation, Richards Ave., Norwalk, Conn.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Collins Radio Co., Dallas, Texas
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
GAF Corp., 140 West 51 St., New York, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Magnion, Inc., 144 Middlesex Tpke., Burlington, Mass.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Now Instr. Co., Inc., 6124 N. Pulaski Rd., Chicago, Ill.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Ventron Instrs. Corp., 144 Middlesex Tpke., Burlington, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

GENERATORS, NEUTRON

High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Instrument Research Co., P. O. Box 231, Lincoln, Mass.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.

GENERATORS, NOISE, RANDOM (ELECTRICAL)

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Elgenco Inc., 1550 Euclid, Santa Monica, Calif. ..... p 1380, 1381
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1423
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1470
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1805
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Waveline Inc., Box 718, West Caldwell, N. J.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Baganoff Assocs., Inc., 6809 W. Florissant, St. Louis, Mo.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Northeast Electronics Corp., Box 649, Concord, N. H.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
S F D Labs., Inc., 800 Rahway Ave., Union, N. J.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.

GENERATORS, PHASE

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 790
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Theta Instrument Corp., Fairfield, N. J. ..... p 1514
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 1771
Wavetek, 8159 Engineer Rd., San Diego, Calif.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Defense Elctrns., Inc., Rockville, Md.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

GENERATORS, PLASMA

Instrument Research Co., P. O. Box 231, Lincoln, Mass.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.

GENERATORS, PORTABLE, ENGINE DRIVEN

Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dyna Technology, Inc., Box 3263, Sioux City, Iowa
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Forney Industries, Inc., 1800 La Porte Ave., Fort Collins, Colo.
Homelite Div., Riverdale Ave., Port Chester, N. Y.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Katolight Corp., 1st Ave. at Chestnut, Mankato, Minn.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
ONAN, 2515 University Ave., S. E., Minneapolis, Minn.
Superior Continental Corp., Box 489, Hickory, N. C.
Winpower Mfg. Co., 1207 First Ave. E., Newton, Iowa
Zeus Generator Co., 12435 Euclid Ave., Cleveland, Ohio

GENERATORS, POWER, HIGH

CML Inc., 350 Leland Ave., Plainfield, N. J.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electronic Enterprises, 775 South Madison Ave., Pasadena, Calif.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Varo, Inc., Electrokinetics Div., 402 E. Gutierrez St., Santa Barbara, Calif.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

GENERATORS, PULSE—ALSO SEE GENERATORS, IMPULSE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Accutronics, Inc., 628 North St., Geneva, Ill.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1354
CML Inc., 350 Leland Ave., Plainfield, N. J.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y. ..... p 1360
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y.
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1370
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore. .... p 1383
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Icon Corp., 156 Sixth St., Cambridge, Mass.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ... p 1418, 1419, 1423
Kilovolt Corp., 238 High St., Hackensack, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
Measurements, Box 180, Boonton, N. J. ..... p 1437
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Abtronics, Inc., Box 712, Livermore, Calif.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, Calif.
Berkshire Labs, 107 Tansy Hill Rd., Milford, N. Y.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Collins Radio Co., Dallas, Texas
Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
DTI Corp., 2201 S. Grand Ave., Santa Ana, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
Digiac Corp., Ames Ct., Plainview, N. Y.
Dynamics Research Corp., 38 Montvale Ave., Stoneham, Mass.
Eberline Instr. Corp., 805 Early St., Santa Fe, N. M.
Electronic Enterprises, 775 South Madison Ave., Pasadena, Calif.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.

Foster & Allen, Inc., Box 466, Chatham, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Horex Electronics, Inc., 1729 21st St., Santa Monica, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Instrument Research Co., P. O. Box 231, Lincoln, Mass.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Kappa Scientific Corp., 5780 Thornwood Dr., Goleta, Calif.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lavoie Labs., Div. Spedcor, Matawan-Freehold Rd., Morganville, N. J.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Lepel High Frequency Labs., 59-21 Queens-Midtown Expwy., Maspeth, N. Y.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Nichicon Capacitor Ltd., Oikedori, Karasuma Higashi-iru, Nakagyo-ku, Kyoto, Japan
Northeast Electronics Corp., Box 649, Concord, N. H.
Novatronics, Inc., Box 878, Pompano Beach, Fla.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

GENERATORS, R-F

Accutronics, Inc., 628 North St., Geneva, Ill.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Kay Electric Co., Maple Ave., Pine Brook, N. J. p 1418, 1419, 1422, 1423
LogiMetrics, Div., 100 Forest Dr., Greenvale, N. Y. ..... p 1428, 1429
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
Measurements, Box 180, Boonton, N. J. ..... p 1437
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. .... p 1683
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1476
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Tektronix, Inc., Box 500, Beaverton, Ore.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Ajax Magnethermic Corp., 1745 Overland Ave., N. E., Warren, Ohio
Alban Electronics, 111 Cedar La., Englewood, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Clemens Mfg. Co., 630 So. Berry Rd., St. Louis, Mo.
Collins Radio Co., Dallas, Texas
Cycle-Dyne, Inc., Sub. Axel Elctrns. Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Mann-Russell Elctrns., Inc., 1401 Thorne Rd., Tacoma, Wash.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Raybond Elctrns. Inc., 930 Washington St., Norwood, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.

GENERATORS, SAWTOOTH

Accutronics, Inc., 628 North St., Geneva, Ill.
Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore. .... p 1383
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1418
Tektronix, Inc., Box 500, Beaverton, Ore.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1532-1542
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, Calif.
Celco, 70 Constantine Dr., Mahwah, N. J.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Procedyne Corp., 221 Somerset St., New Brunswick, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.

GENERATORS, SIGNAL, STANDARD TYPE

Accutronics, Inc., 628 North St., Geneva, Ill.
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore. .... p 1383
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
LogiMetrics, Div., 100 Forest Dr., Greenvale, N. Y. ..... p 1428, 1429
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
Measurements, Box 180, Boonton, N. J. ..... p 1437
Meipar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. .... p 1476
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Clemens Mfg. Co., 630 So. Berry Rd., St. Louis, Mo.
Collins Radio Co., Dallas, Texas
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Jackson Electrical Instrument Co., 35 Windson Ave., Mineola, N. Y.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.

GENERATORS, SINE WAVE

Mercury Electronics Corp., 315 Roslyn Rd., Mineola, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
New London Instrument Co., Box 189, New London, Conn.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass

GENERATORS, SINE WAVE

Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1063
American Time Products, Bulova Watch Co., Inc.,
61-20 Woodside Ave., Woodside, N. Y.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
CML Inc., 350 Leland Ave., Plainfield, N. J.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Connor-Winfield Corp., Winfield, Ill. ..... p 1087
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore. .... p 1383
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
LogiMetrics, Div., 100 Forest Dr., Greenvale, N. Y. ..... p 1428
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
M F Electronics Corp., 118 East 25th St., New York, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Measurements, Box 180, Boonton, N. J.
Meipar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1476
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Spectrum Technology Inc., Box 368, Goleta, Calif.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1532-1542
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Collins Radio Co., Dallas, Texas
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Procedyne Corp., 221 Somerset St., New Brunswick, N. J.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

GENERATORS, SINGLE-SIDEBAND

GENERATORS, SINGLE-SIDEBAND

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

GENERATORS, SPECTRUM—SEE GENERATORS, SWEEP

GENERATORS, SQUARE WAVE

Accutronics, Inc., 628 North St., Geneva, Ill.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore. ..... p 1383
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
Measurements, Box 180, Boonton, N. J. ..... p 1437
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1476
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Spectrum Technology Inc., Box 368, Goleta, Calif.
Tektronix, Inc., Box 500, Beaverton, Ore.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1532-1542
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Digiac Corp., Ames Ct., Plainview, N. Y.
Electronic Enterprises, 775 South Madison Ave., Pasadena, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Components, Inc., 1675 S.E. Allen Ave., Beaverton, Ore.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.

GENERATORS, SWEEP

AEL Inc., P.O. Box 552, Lansdale, Pa.
Accutronics, Inc., 628 North St., Geneva, Ill.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ... p 1418, 1419, 1422
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 2003
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. .... p 1683
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1442
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1476
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
Wavetek, 8159 Engineer Rd., San Diego, Calif. p 1533-1542, 1544, 1545
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Celco, 70 Constantine Dr., Mahwah, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jackson Electrical Instrument Co., 35 Windson Ave., Mineola, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Nelson-Ross Electronics, Inc., 5-05 Burns Ave., Hicksville, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

GENERATORS, THERMOELECTRIC

Best Electrics Div., 1211 E. Denny Way, Seattle, Wash. ..... p 2798
Electro Impulse, Inc., 116 Chestnut St, Red Bank, N. J. ..... p 1250
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
General Instr. Corp., Thermoelectric Div., 65 Gouverneur St., Newark, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Materials Electronic Products Corp., 990 Spruce St., Trenton, N. J.
Sanders Nuclear Corp., 95 Canal St., Nashua, N. H.
3M Co., 3M Center, St. Paul, Minn.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

GENERATORS, TIME CODE

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 1016, 1017
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa. ..... p 767
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 775
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Neutronic Corp., Box 825, St. Louis, Mo. ..... p 1448
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Collins Radio Co., Dallas, Texas
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
EDP Corp., Box 6485, Orlando, Fla.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Red Lake Labs., Inc., 2971 Corvin Dr., Santa Clara, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.

GENERATORS, TIME DELAY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1354
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Elderado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Abtronics, Inc., Box 712, Livermore, Calif.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Collins Radio Co., Dallas, Texas
Conrac Corp., 330 Madison Ave., New York, N. Y.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.

GENERATORS, TIME DELAY & GATE

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ... p 2142, 2143
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Collins Radio Co., Dallas, Texas
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

GENERATORS, TIMING, DIGITAL

Accutronics, Inc., 628 North St., Geneva, Ill.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 1016, 1017
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa. ..... p 767
Connor-Winfield Corp., Winfield, Ill.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 775
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781, 1393
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Spectrum Technology Inc., Box 368, Goleta, Calif. ..... p 1133
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Collins Radio Co., Dallas, Texas
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
Digiac Corp., Ames Ct., Plainview, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

GENERATORS, TONE

Accutronics, Inc., 628 North St., Geneva, Ill.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Connor-Winfield Corp., Winfield, Ill.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Wavetek, 8159 Engineer Rd., San Diego, Calif.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Collins Radio Co., Dallas, Texas
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Northeast Electronics Corp., Box 649, Concord, N. H.
Plectron Corp., Overton, Nebr.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.

GENERATORS, TONE-BURST

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1534, 1537
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Data Royal Corp., 8014 Armour St., San Diego, Calif.

GENERATORS, TV SIGNAL

Accutronics, Inc., 628 North St., Geneva, Ill.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1419, 1422
Measurements, Box 180, Boonton, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1544
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Colorado Video, Inc., Box 928, Boulder, Colo.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telemet Co., 185 Dixon Ave., Amityville, N. Y.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Videon Corp., 140 E. Main St., Huntington, N. Y.

GENERATORS, TV SYNCH

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Colorado Video, Inc., Box 928, Boulder, Colo.
Craig Corp., 2302 East 15th St., Los Angeles, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maryland Telecomm, 10534 York Rd., Cockeysville, Md.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sylvania Elec. Prod., Inc., Comm. Elctrns. Div., Burlington Rd., Bedford, Mass.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telemet Co., 185 Dixon Ave., Amityville, N. Y.
Teletronics, Inc., 760 N. Main St., Orange, Calif.

GENERATORS, UHF-VHF

Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J. ... p 1418, 1419, 1422
LogiMetrics, Div., 100 Forest Dr., Greenvale, N. Y. ..... p 1428
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1432
Measurements, Box 180, Boonton, N. J. ..... p 1437
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1544, 1545
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

GENERATORS, ULTRASONIC

Accutronics, Inc., 628 North St., Geneva, Ill.
Blackstone Ultrasonics, Inc., 820 Center St., Sheffield, Pa. ..... p 2919
CML Inc., 350 Leland Ave., Plainfield, N. J.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Sorensen Operation, Richards Ave., Norwalk, Conn.
Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Automation Industries, Inc., Box 950, Boulder, Colo.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Branson Instruments Co., 76 Progress Dr., Stamford, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dynasonics Corp., Box 672, Pipestone, Minn.
Electromation Components Corp., 84 Toledo St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
L & R Mfg. Co., 577 Elm St., Kearny, N. J.
Lewis Corp., Rte. 6, Woodbury, Conn.
Linden Labs. Inc., Box 920, State College, Pa.
Marcal Electro-Sonics, P.O. Box 185, Burbank, Calif.
Phillips Mfg. Co., 7334 N. Clark St., Chicago, Ill.
Sara Scientific Co., Box 321, San Francisco, Calif.
TAC Technical Instr. Corp., Scotch Rd., Mercer Airpt., Trenton, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.

GENERATORS, WORD

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1155
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1451
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.

GREASES

Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
Datapulse Div., 10150 Jefferson Blvd., Culver City, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Welex Electronics, Box 986, Silver Spring, Md.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

GEOPHYSICAL EQUIP.—SEE HYDROPHONES: TRANSDUCERS

GERMANIUM—SEE CRYSTALS, SEMICONDUCTOR

GERMANIUM SEMICONDUCTORS—SEE DIODES: TRANSISTORS

GLASS FIBERS—SEE INSULATION MATERIALS, GLASS FIBER IMPREGNATED

GLASS PARTS—SEE INSULATION PARTS, GLASS

GLOVE BOXES—SEE BOXES, GLOVE

GLOVES, PROTECTIVE, PARTS HANDLING

Edmont-Wilson, 3157 Walnut, Coshocton, Ohio
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Standard Glove Co. of N. J., 27 Haynes Ave., Newark, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Unibraze Corp., 455 Knollwood Rd., White Plains, N. Y.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

GLUES—SEE ADHESIVES

GOLD-PLATING SOLUTIONS—SEE PLATING SOLUTIONS

GONIOMETERS—SEE METERS, GONIOMETER

GOVERNORS, CENTRIFUGAL

Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.

GRAPHALLOY PRODUCTS

Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Pure Carbon Co., Inc., 441 Hall Ave., St. Marys, Pa.
Stackpole Carbon Co., Carbon Div., Stackpole St., St. Marys, Pa.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.

GRAPHIC RECORDING INSTRUMENTS—SEE RECORDERS (AS MODIFIED)

GRAPHITE PARTS

Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y. .. p 1645
Airco Speer Carbon Products, 800 Theresia St., St. Marys, Pa.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
Grafo Colloids Corp., P. O. Box 195, Sharon, Pa.
Helwig Carbon Prods., Inc., 2550 North 30th St., Milwaukee, Wisc.
Kano Labs., Inc., 1000 Thompson La., Nashville, Tenn.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Poco Graphite, Inc., Box 1524, Garland, Tex.
Pro-Chem Inc., 16536 Broadway Ave., Cleveland, Ohio
Pure Carbon Co., Inc., 441 Hall Ave., St. Marys, Pa.
Servwell Products Co., 16309 Friend Ave., Cleveland, Ohio
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Stackpole Carbon Co., Carbon Div., Stackpole St., St. Marys, Pa.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
3M Co., 3M Center, St. Paul, Minn.
Ultra Carbon Corp., Box 747, Bay City, Mich.
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.

GREASES—ALSO SEE LUBRICANTS

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1640
Dow Corning Corp., Midland, Mich. ..... p 1583
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Cerac, Inc., Box 597, Butler, Wisc.
Humble Oil & Refining Co., P.O. Box 2180, Houston, Tex.
MPB Corp., Precision Pk., Keene, N. H.
Midsil Corp., 27 Bland St., Emerson, N. J.
Nye, W. F., Inc., Box G 927, New Bedford, Mass.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

GRILLES, METAL/PLASTIC

GRILLES, METAL/PLASTIC

McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1253
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Fourjay Industries, Box 1465 Northbridge Br., Dayton, Ohio
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Holbrook-Merrill Co., 1150 Kifer Rd., Sunnyvale, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Merlang Mfg. Corp., 122 S. Long Beach Rd., Rockville Centre, N. Y.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Romar Plastics, Inc., 1311 East Main St., St. Charles, Ill.

GRILLES, SPEAKER

Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y.
Acoustone Corp., Div. of Newcastle Fabrics, 80 Wythe Ave., Brooklyn, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Era Acoustics Corp., 311 E. Park St., Moonachie, N. J.
Flock Process Corp., Box 430, Norwalk, Conn.
Fourjay Industries, Box 1465 Northbridge Br., Dayton, Ohio
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis, Mo.
Merlang Mfg. Corp., 122 S. Long Beach Rd., Rockville Centre, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.

GROMMETS

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Cinch-Monadnock, 18300 E. Valley Blvd., City of Industry, Calif.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Atlantic India Rubber Co., 571 W. Polk St., Chicago, Ill.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Budwig Mfg. Co., Box 97, Ramona, Calif.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Dixon Corp., Metacom Ave., Bristol, R. I.
Dzus Fastener Co. Inc., 425 Union Blvd., W. Islip, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
Fischer Special Mfg. Co., 446 Morgan St., Cincinnati, Ohio
Heyman Mfg. Co., East Michigan Ave., Kenilworth, N. J.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Lord Mfg. Co., 1635 West 12th St., Erie, Pa.
Mecca, P.O. Box 36393, Houston, Tex.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Segal, E., Inc., 132 Lafayette St., New York, N. Y.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Stimpson Co., Inc., 74 Franklin Ave., Brooklyn, N. Y.
3M Co., 3M Center, St. Paul, Minn.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Weckesser Co., Inc., 4444 W. Irving Park Rd., Chicago, Ill.
Western Sky Industries, 21300 Cloud Way, Hayward, Calif.

GROUND RODS—SEE RODS & CLAMPS, GROUND

GUIDES, CIRCUIT BOARD

Atlee Corp., 2 Lowell Ave., Winchester, Mass. ..... p 835
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio ..... p 1169
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 898
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal.
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 586
Taurus Corp., Academy Hill, Lambertville, N. J. ..... p 803
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas ..... p 2628
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. ..... p 595
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Calabro Unitrack, 8738 West Chester Pike, Upper Darby, Pa.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Circuit Structures Lab., 3200 N. San Fernando Blvd., Burbank, Calif.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Gibson-Egan Co., 34 La Porte St., Arcadia, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Space Products, Inc., 6631 Sarnia Ave., Long Beach, Calif.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.

GUNS, ELECTRON—SEE TUBE PARTS

GUNS, ELECTRON BEAM (FOR VACUUM EQUIP.)

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Nuclide Corp. AGV Div., 914 Main St., N. Acton, Mass.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.

GUNS, SOLDERING—SEE SOLDERING GUNS

GYRATORS, MICROWAVE

Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.

GYRO COMPASSES—SEE COMPASSES, ELECTRONIC GYRO

GYRO TESTERS—SEE TESTERS, GYRO

GYROS, DIRECTIONAL

Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Allen, R. C. Business Machines, Inc., 678 Front Ave., N.W., Grand Rapids, Mich.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Aviation Instr. Mfg. Corp., 9033 Monroe Rd., Houston, Tex.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Larson Aero Development, Box 135, Concord, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

GYROS, DISPLACEMENT

Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Aviation Instr. Mfg. Corp., 9033 Monroe Rd., Houston, Tex.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
Larson Aero Development, Box 135, Concord, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

GYROS, INTEGRATING

Cedar Div., Control Data, 5606 W. 36th St., Minneapolis, Mnnn. p 1726
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
AC Electronics Div., 7929 S. Howell Ave., Milwaukee, Wisc.
American Chain & Cable Co., Box 1629, Waterbury, Conn.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

GYROS, RATE

Cedar Div., Control Data, 5606 W. 36th St., Minneapolis, Mnnn. p 1726
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Allen, R. C. Business Machines, Inc., 678 Front Ave., N.W., Grand Rapids, Mich.
American Chain & Cable Co., Box 1629, Waterbury, Conn.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Condor Pacific Inds. of Cal., Inc., 8740 Remmet Ave., Canoga Pk., Cal.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Larson Aero Development, Box 135, Concord, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

HALL EFFECT DEVICES—SEE GENERATORS, HALL: MAGNETORESISTORS, HALL: MULTIPLIERS, HALL: PROBES, HALL

HAMMERS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Channellock, Inc., S. Main St., Meadville, Pa.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Owatonna Tool Co., 395 Eisenhower Dr., Owatonna, Minn.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Rosenberg Bros. & Co., 100 Landing Ave., Smithtown, N. Y.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo, N. Y.

HAND TOOLS—SEE SPECIFIC TYPES—ALSO SEE TOOLS (AS MODIFIED)

HANDLES FOR CABINETS, CIRCUIT BOARDS, RACKS, ETC.

Chassis-Trak, Inc., 525 S. Webster Ave., Indianapolis, Ind.
Collins Radio Co., Newport Beach, Calif.
Concord Electronics Corp., 37 Great Jones St., New York, N. Y.
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y. p 1171
Globe Plastics, 1342 South Signal Dr., Pomona, Calif. ..... p 2514
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y.
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass. .... p 976
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Techmar Corp., 2232 S. Cotner Ave., Los Angeles, Calif. ..... p 592
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind. ..... p 594
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Adams Rite Mfg. Co., 540 W. Chevy Chase Dr., Glendale, Calif.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Davies, H. Molding Co., 4920 W. Bloomingdale Ave., Chicago, Illinois
Deutsch Fastener Corp., Airport Sta - Box 90925, Los Angeles, Calif.
Dimco-Gray Co., 207 East 6th St., Dayton, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Mfg. Co., 724 Ruberta Ave., Glendale, Calif.
Goe Engineering Co., 250 South 9th St., City of Industry, Calif.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hartwell Corp., 9035 Venice Blvd., Los Angeles, Calif.
Kurz-Kasch, Inc., 1421 S. Broadway, Dayton, Ohio
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Nielson Hardware Corp., 770 Wethersfield Ave., Hartford, Conn.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
TA Mfg. Corp., 4625 Alger St., Los Angeles, Calif.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

HANDSETS, CHESTSETS & OPERATORS SETS

Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Audiosears Corp., Stamford, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Continental Electronics Corp., 302 McGuinness Blvd., Brooklyn, N. Y.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
ITT Telecommunications, Fulton Dr., Corinth, Miss.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Roanwell Corp., 180 Varick St., New York, N. Y.
Roche, P. C. Co., Inc., 11 Park Pl., New York, N. Y.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Sharpe Instruments, Creekside Blvd., Buffalo, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Telephone Components, Inc., 9 Norfolk Dr., Northport, N. Y.
Telephone Dynamics Corp., 1333 Newbridge Rd., N. Bellmore, N. Y.

HARDNESS INDICATORS—SEE INDICATORS, HARDNESS

HARDWARE, ANTENNA—SEE CLAMPS; GROUND RODS; MOUNTS; ETC.—ALSO SEE ANTENNA TOWERS & SUPPORTS

HARDWARE—SEE BOLTS; BRACKETS; CLAMPS; FASTENERS; TERMINALS; ETC.

HARMONIC ANALYZERS—SEE ANALYZERS, HARMONIC

HARNESSES, WIRE—SEE CABLE ASSEMBLIES

HEADERS, HERMETIC—SEE SEALS, HERMETIC, METAL-TO-GLASS—ALSO SEE SERVICES, HERMETIC SEALING

HEADERS, RELAY & TRANSFORMER

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif. p 905
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1214
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa. ..... p 1228
Sealtron Corp., 188 Reading Rd. at Amity, Cincinnati, Ohio
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Astro Seal, Inc., 1710 Chico, S. El Monte, Calif.
Atlas/Uni-Seal, Atlas Chemical Ind. Inc., Valley Forge, Pa.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Eimac, 301 Industrial Way, San Carlos, Calif.
Eltee, Inc., 19 Fairfield Pl., W. Caldwell, N. J.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.

HEADERS, TRANSISTOR & DIODE

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Eimac, 301 Industrial Way, San Carlos, Calif.
Eltee, Inc., 19 Fairfield Pl., W. Caldwell, N. J.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Herrhetic Seal Div., 317 Main St., Wilmington, Mass.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kidco, Inc., Box 278, Medford, N. J.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.

HEADPHONES & HEADSETS

Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Heath Co., Dept. 180, Benton Harbor, Mich.
Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Trimm Inc., 400 Lake St., Libertyville, Ill. ..... p 573
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
AKG, 100 E. 42 St., New York, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Astatic Corp., Box 120, Conneaut, Ohio
Audiosears Corp., Stamford, N. Y.
Audiotronics Corp., 7428 Bellaire Ave., N. Hollywood, Calif.
Cannon, C. F., Co., Springwater, N. Y.
Clark, D. Co., Inc., 360 Franklin St., Worcester, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Continental Electronics Corp., 302 McGuinness Blvd., Brooklyn, N. Y.
Duotone Co., Inc., Box 814, S. Miami, Fla.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Fisher Radio Corp., 11-40 45th Rd., Long Island City, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Knowles Electronics, Inc., 3100 N. Mannheim Rd., Franklin Park, Ill.
Koss Electronics, Inc., 2227 North 31st St., Milwaukee, Wisc.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Murdock Corp., 158 Carter St., Chelsea, Mass.
P. M. & E. Electronics, Inc., 10 Tripps Lane, East Providence, R. I.
Permoflux Corp., Box 6364, Glendale, Calif.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
Radioear Corp., 375 Valley Brook Rd., Canonsburg, Pa.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Roanwell Corp., 180 Varick St., New York, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Sharpe Instruments, Creekside Blvd., Buffalo, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stanford International, Box 266, San Carlos, Calif.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Telephone Components, Inc., 9 Norfolk Dr., Northport, N. Y.
Telephone Dynamics Corp., 1333 Newbridge Rd., N. Bellmore, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
V-M Corporation, 305 Territorial Rd., Benton Harbor, Mich.
Wells, G. Co., 90 Nepperhan Ave., Yonkers, N. Y.

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Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Lipps, Inc., 1630 Euclid St., Santa Monica, Calif.
Micro Elctrns., Inc., Box 8236, Albuquerque, N. M.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Saki Magnetics, Inc., 1649 12th St., Santa Monica, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
United Control Corporation, Redmond, Wash.
World Magnetics, Inc., 215 N. Pike St., Charlotte, Mich.

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Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Lipps, Inc., 1630 Euclid St., Santa Monica, Calif.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Opto-Metric Tools, Inc., 304 Hudson St., New York, N. Y.

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Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Data Magnetics Corp., 5441 West 104th St., Los Angeles, Calif.
Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.

HEADS, VIDEO RECORDING/PLAYBACK

Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lipps, Inc., 1630 Euclid St., Santa Monica, Calif.
Micro Elctrns., Inc., Box 8236, Albuquerque, N. M.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Saki Magnetics, Inc., 1649 12th St., Santa Monica, Calif.
World Magnetics, Inc., 215 N. Pike St., Charlotte, Mich.

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Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Cassettes Unlimited, Corp., 200 Claremont Ave., New York, N. Y.
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Lipps, Inc., 1630 Euclid St., Santa Monica, Calif.
Micro Elctrns., Inc., Box 8236, Albuquerque, N. M.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Saki Magnetics, Inc., 1649 12th St., Santa Monica, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
United Control Corporation, Redmond, Wash.
Video Research Corp., 761 N. Washington St., Rockville, Md.
World Magnetics, Inc., 215 N. Pike St., Charlotte, Mich.

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Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lipps, Inc., 1630 Euclid St., Santa Monica, Calif.
Micro Elctrns., Inc., Box 8236, Albuquerque, N. M.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Saki Magnetics, Inc., 1649 12th St., Santa Monica, Calif.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
United Control Corporation, Redmond, Wash.
Video Research Corp., 761 N. Washington St., Rockville, Md.
World Magnetics, Inc., 215 N. Pike St., Charlotte, Mich.

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Alpha Data, Inc., 19005 Ventura Blvd., Tarzana, Calif.
Astatic Corp., Box 120, Conneaut, Ohio
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Data Disc, Inc., Standard Prods. Div., 1275 California Ave., Palo Alto, Cal.
Data Magnetics Corp., 5441 West 104th St., Los Angeles, Calif.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Micro Elctrns., Inc., Box 8236, Albuquerque, N. M.
Saki Magnetics, Inc., 1649 12th St., Santa Monica, Calif.

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Ampex Corp., 401 Broadway, Redwood City, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Data Disc, Inc., Display Div., 2626 Hanover St., Palo Alto, Calif.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Gardiner Solder Co., 4820 S. Campbell Ave., Chicago, Ill.
Lipps, Inc., 1630 Euclid St., Santa Monica, Calif.
Micro Elctrns., Inc., Box 8236, Albuquerque, N. M.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Saki Magnetics, Inc., 1649 12th St., Santa Monica, Calif.

HEADS, VIDEO RECORDING (Cont'd)

United Control Corporation, Redmond, Wash.
Video Research Corp., 761 N. Washington St., Rockville, Md.
World Magnetics, Inc., 215 N. Pike St., Charlotte, Mich.

HEAT DISSIPATORS—SEE TRANSISTOR & DIODE HEAT DISSIPATORS; TUBE HEAT DISSIPATORS—ALSO SEE HEAT SINKS, SOLDERING

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McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1253

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Technipower, Inc., Benrus Center, Ridgefield, Conn.
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
Airflow Co., Montgomery County Airpark, Gaithersburg, Md.
American-Standard, Applied Air Conditioning Dept., Columbus, Ohio
Astro Dynamics, Inc., 2nd Ave., Northwest Industrial Park, Burlington, Mass.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Cargocaire Engineering Corp., 8-10 Chestnut St., Amesbury, Mass.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastern Industries, 100 Skiff St., Hamden, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Environmental Control Sys. Div., 43-22 Queens St., Long Island City, N. Y.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Heatron, Inc., Box 54, York, Pa.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Janitrol Aero Div., 4200 Surface Rd., Columbus, Ohio
Jersey Technical Consultants, Box 215, Morristown, N. J.
Johnson Corp., 805 Wood St., Three Rivers, Mich.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Lockhart Industries, Inc., 15707 Texaco Ave., Paramount, Calif.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Research, Inc., Box 6164, Minneapolis, Minn.
Ross Engrg. Div., Box 751, New Brunswick, N. J.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Standard-Thomson Corp., 152 Grove St., Waltham, Mass.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Tor Inc., Box 8, Irwindale, Calif.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Union Diesel Engine Co., P. O. Box 1737, Oakland, Calif.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

HEAT GUNS, PRODUCTION

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Wall Manufacturing Co., Box 3349, Kinston, N. C. ..... p 2835
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Aerometrics, P.O. Box 216, San Ramon, Calif.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Clements Mfg. Company, 6656 S. Narragansett Ave., Chicago, Ill.
Commercial Electrical Heating Devices & Mfg., Inc., 1008 E. Garvey Blvd., Monterey Park, Calif.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
Henes Mfg. Co., 4301 E. Madison St., Phoenix, Ariz.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Michael, Claude, Inc., 703 W. Ivy St., Glendale, Calif.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Sara Scientific Co., Box 321, San Francisco, Calif.
Sigma Systems Corp., 3163 Adams Ave., San Diego, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Weldotron Corp., 907 Frelinghuysen Ave., Newark, N. J.

HEAT SHRINKABLE ELASTOMERS—SEE CAPS, FORMS & TAPES, HEAT SHRINKABLE—ALSO SEE TUBING, HEAT SHRINKABLE

HEAT SHRINKABLE PLASTICS—SEE CAPS, FORMS & TAPES, HEAT SHRINKABLE—ALSO SEE TUBING, HEAT SHRINKABLE

HEAT SINKS—SEE HEAT SINKS, SOLDERING—ALSO SEE TRANSISTOR & DIODE HEAT DISSIPATORS; TUBE HEAT DISSIPATORS

HEAT SINKS, SOLDERING

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Channellock, Inc., S. Main St., Meadville, Pa.
Clauss Cutlery Co., P.O. Box 667, Freemont, Ohio
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.

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American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Ajax Magnethermic Corp., 1745 Overland Ave., N. E., Warren, Ohio
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Clarage Fan Co., One Clarage Pl., Kalamazoo, Mich.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Cycle-Dyne, Inc., Sub. Axel Elctrns. Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
Ionic Electrostatic Corp., 111 Monroe St., Garfield, N. J.
Lepel High Frequency Labs., 59-21 Queens-Midtown Expwy., Maspeth, N. Y.
Miller, L. C., Co., 717 Monterey Pass Rd., Monterey Park, Calif.
Radio Frequency Co., Inc., 50 Park St., Medfield, Mass.
Raybond Elctrns. Inc., 930 Washington St., Norwood, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Sunbeam Equip. Corp., 212 Mercer St., Meadville, Pa.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Zephyr Mfg. Co., 201 Hindry Ave., Box 759, Inglewood, Calif.

HEATERS, ANTENNA RADOME

Airflow Co., Montgomery County Airpark, Gaithersburg, Md.
Corvair Diode, 150 5th Ave., New York, N. Y.
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
Safeway Heat Elements, Inc., Middlefield St., Middletown, Conn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Airflow Co., Montgomery County Airpark, Gaithersburg, Md.
American Standard, 9000 Kings St., Franklin Park, Ill.
Ampere Electric Industries, 410 Communipaw Ave., Jersey City, N. J.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Capps & Co., Inc., 20 Addison Pl., Valley Stream, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Chemelex Inc., 2 Industrial Plaza Rd., Danbury, Conn.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Dampp-Chaser Electronics, Inc., Box 1610, Hendersonville, N. C.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, Calif.
Electric Parts Corp., Box 234, Georgetown, Ky.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
Electro-Flex Heat, Inc., Northwood Industrial Park, Bloomfield, Conn.
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
Gruenberg Electric Co., Inc., 585 Commercial Ave., Garden City, N. Y.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hotwatt, Inc., 128 Maple St., Danvers, Mass.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Master Appliance Corp., 1745 Flett Ave., Racine, Wisc.
Merco Prods. Co., Inc., 1298 Bethel Dr., Eugene, Ore.
Michigan Oven Co., 1st Oven Pl., Romulus, Mich.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Peninsular Mfg. Co., Inc., 7920 Empire Ave., Orlando, Fla.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Rama Corp., 39651 Esplanade St., San Jacinto, Calif.
Rogers Corp., Rogers, Conn.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Safeway Heat Elements, Inc., Middlefield St., Middletown, Conn.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Sta-Warm Electric Co., Inc., 116 N. Chestnut St., Ravenna, Ohio
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Therm-O-Lab Corp., 6940 Farmdale Ave., N. Hollywood, Calif.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Thermolab Corp., 6940 Farmdale Ave., N. Hollywood, Calif.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Trent, Inc., 201 Leverington Ave., Philadelphia, Pa.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
Watlow Electric Mfg. Co., 12001 Lackland Rd., St. Louis, Mo.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

HEATERS, INFRARED (PRODUCTION)

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Aerometrics, P.O. Box 216, San Ramon, Calif.
Ampere Electric Industries, 410 Communipaw Ave., Jersey City, N. J.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
HJS Engineering Co., Box 96, Park Ridge, Ill.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hotwatt, Inc., 128 Maple St., Danvers, Mass.
Merco Prods. Co., Inc., 1298 Bethel Dr., Eugene, Ore.
Miskella Infra-Red Co., 7301 Grand Ave., Cleveland, Ohio
North American Electric Lamp Co., 1520 North 13 St., St. Louis, Mo.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Research, Inc., Box 6164, Minneapolis, Minn.
Selas Corp. of America, Box 200, Dresher, Pa.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Trent, Inc., 201 Leverington Ave., Philadelphia, Pa.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

HEATING ELEMENTS

Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Caddock Electronics, Inc., 3127 Chicago Ave., Riverside, Calif.
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. .. p 2803
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y. ..... p 2812
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Wall Manufacturing Co., Box 3349, Kinston, N. C. ..... p 2835
Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
American Standard, 9000 Kings St., Franklin Park, Ill.
Ampere Electric Industries, 410 Communipaw Ave., Jersey City, N. J.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Chemelex Inc., 2 Industrial Plaza Rd., Danbury, Conn.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
Electro-Flex Heat, Inc., Northwood Industrial Park, Bloomfield, Conn.
Electrofilm Inc., 7116 Laurel Canyon Blvd., N. Hollywood, Calif.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hotwatt, Inc., 128 Maple St., Danvers, Mass.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Logan Elctrn. Corp., 100 Mill St., Revere, Mass.
Master Appliance Corp., 1745 Flett Ave., Racine, Wisc.
Merco Prods. Co., Inc., 1298 Bethel Dr., Eugene, Ore.
Miskella Infra-Red Co., 7301 Grand Ave., Cleveland, Ohio
Norton Co., 1 New Bond St., Worcester, Mass.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Pyro Electric, Muskin Rd., Walkerton, Ind.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Rama Corp., 39651 Esplanade St., San Jacinto, Calif.
Sunbeam Equip. Corp., 212 Mercer St., Meadville, Pa.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Therm-O-Lab Corp., 6940 Farmdale Ave., N. Hollywood, Calif.
Thermal Engrg. & Design Co., 217 Ash St., Akron, Ohio
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Thermolab Corp., 6940 Farmdale Ave., N. Hollywood, Calif.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Trent, Inc., 201 Leverington Ave., Philadelphia, Pa.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
Waage Electric, Inc., 820 Colfax Ave., Kenilworth, N. J.
Watlow Electric Mfg. Co., 12001 Lackland Rd., St. Louis, Mo.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
Zephyr Mfg. Co., 201 Hindry Ave., Box 759, Inglewood, Calif.
Zeva Electric Corp., 11 Park Pl., New York, N. Y.

HERMETIC SEALING—SEE MACHINES; SEALS: SERVICES, HERMETIC SEALING

HIGH-PRESSURE EQUIPMENT

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.

Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Bendix Corp., Instruments & Life Support Div.,
2734 Hickory Grove Rd., Davenport, Iowa
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.

HINGES—SEE FASTENERS

HOLDERS & CARRIERS, CHIP (CAPACITOR, IC, LSI)

Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Engineering Consultants Ltd., 1132 Turmont St., Gardena, Cal.
Wells Elctrns., Inc., Plastics Div., 1701 S. Main St., S. Bend, Ind.

HOLDERS & CARRIERS, IC, LSI (PACKAGED)

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa. ..... p 876
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 898
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1594
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 587
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Engineering Consultants Ltd., 1132 Turmont St., Gardena, Cal.
Gibson-Egan Co., 34 La Porte St., Arcadia, Calif.
IFE Div., Box 4265, E. Providence, R. I.
Irad, Inc., 1500 Story Rd., San Jose, Calif.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Matrix Engrg. Corp., 1502 West 166 St., Gardena, Calif.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Metropolitan Wire Goods Corp.,
N. Washington St. & George Ave., Wilkes-Barre, Pa.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.

HOLDERS, BATTERY—SEE RETAINERS, BATTERY—ALSO SEE CONNECTORS, BATTERY

HOLDERS, BRUSH—SEE BRUSHES & BRUSH ASSEMBLIES

HOLDERS, CHASSIS (PRODUCTION TYPE)

Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Flotron Industries, Inc., 1201 E. Grand Ave., El Segundo, Calif.
Matrix Engrg. Corp., 1502 West 166 St., Gardena, Calif.
Metropolitan Wire Goods Corp.,
N. Washington St. & George Ave., Wilkes-Barre, Pa.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.

HOLDERS, CIRCUIT BOARD (PRODUCTION TYPE)

Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 898
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Calabro Unitrack, 8738 West Chester Pike, Upper Darby, Pa.
Flotron Industries, Inc., 1201 E. Grand Ave., El Segundo, Calif.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Gibson-Egan Co., 34 La Porte St., Arcadia, Calif.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Matrix Engrg. Corp., 1502 West 166 St., Gardena, Calif.
Metropolitan Wire Goods Corp.,
N. Washington St. & George Ave., Wilkes-Barre, Pa.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Space Products, Inc., 6631 Sarnia Ave., Long Beach, Calif.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Technical Devices Co., 11242 Playa Ct., Culver City, Calif.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.

HOLDERS, CRYSTAL

AEL Inc., P.O. Box 552, Lansdale, Pa.
Accurate Electronics Corp., Box 935J, Elyria, Ohio.
Atlee Corp., 2 Lowell Ave., Winchester, Mass. ..... p 835
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1078
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. .. p 1095
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1128
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Waveline Inc., Box 718, West Caldwell, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Kay Electronics, Inc., 2600 Grand Ave., Kansas City, Mo.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

HOLDERS (EXCLUDING RETAINERS)—SEE HOLDERS: SOCKETS

HOLDERS, FUSE—SEE CLIPS & HOLDERS, FUSE: PANELS, FUSE

HOLDERS, LAMP—SEE SOCKETS, LAMP, & LAMP ASSEMBLIES

HOLDERS, TUBE—SEE RETAINERS, TUBE

HOLE CUTTERS—SEE CUTTERS, HOLE

HONEYCOMB SHEETS, PANELS, ETC.

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1253
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kentucky Metals, Inc., 3104 S. Preston St., Louisville, Ky.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

HOODS CRT VIEWING—SEE VIEWING HOODS, CATHODE-RAY TUBE

HORNS, MICROWAVE—ALSO SEE ANTENNAS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Narda Microwave Corp., Plainview, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Waveline Inc., Box 718, West Caldwell, N. J.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Elleen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Laminair Inc., 13226 Figueroa, Los Angeles, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.

HYBRID JUNCTIONS, MICROWAVE

Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

HORNS, SPEAKER

Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Fourjay Industries, Box 1465 Northbridge Br., Dayton, Ohio
Hawley Prods. Co., 333 North 6th St., St. Charles, Ill.
Heppner Mfg. Co., Box Q, Round Lake, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Kling Metal Spinning & Stamping Corp., 247 Centre St., New York, N .Y.
Klipsch & Associates, Inc., Box 280, Hope, Ark.
Lansing J. B., Sound, Inc., 3249 Casitas Ave., Los Angeles, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.

HOUSINGS, CIRCUIT MODULE—SEE PLUG-IN MODULE ENCLOSURES

HOUSINGS, INSTRUMENT & METER—SEE CABINETS: CASES

HOUSINGS, METAL—SEE CABINETS: CASES

HOUSINGS, METAL, SMALL—SEE CANS

HOUSINGS, PHOTOMULTIPLIER TUBE—SEE PHOTOMULTIPLIER TUBE HOUSINGS

HOUSINGS, SPEAKER—SEE ENCLOSURES, SPEAKER

HUMIDITY INDICATORS—SEE INDICATORS, HUMIDITY (ELECTRONIC)

HYBRID JUNCTIONS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. .... p 1652
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1682
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Amplifier Co., Box 141, Lake Grove, N. Y. ..... p 1694
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ... p 1714, 1715
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Allied Research & Engineering Co., 10300 Glasgow Pl., Los Angeles, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
GAF Corp., 140 West 51 St., New York, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Elleen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.

HYBRID JUNCTIONS, MICROWAVE (Cont'd)

Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

HYDROPHONES & ACCESSORIES

Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Chesapeake Instr. Corp., Shadyside, Md.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Empire Scientific Corp., Indl. Instr. Div., 1055 Stewart Ave., Garden City, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
General Instr. Corp., Harris ASW Div., 33 Southwest Pk., Westwood, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
International Transducer Corp., Box 3385, Santa Barbara, Calif.
Linden Labs. Inc., Box 920, State College, Pa.
Mark Products, Inc., 3935 Fairhill Dr., Houston, Tex.
NUS Corp., Box 248, Paramus, N. J.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Research Mfg. Corp., Box 6056, San Diego, Calif.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

HYSTERESISGRAPHS

Lowell Elctrns. Corp., 9100 Terminal Ave., Skokie, Ill. ..... p 1431
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.

IGNITERS, ARC LAMP—SEE POWER SUPPLIES, ARC LAMP

ILLUMINATION INDICATORS—SEE METERS, LIGHT

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IMPEDANCE COMPARATORS—SEE BRIDGES, IMPEDANCE

IMPEDANCE CONVERTERS, MICROWAVE

Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Aircom, Inc., Rte. 16B, Union, N. H.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

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Superior Electric Co., 1000 Middle St., Bristol, Conn.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.

INDICATOR LIGHTS—SEE LIGHTS, DIAL, PANEL, ETC.

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Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
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Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
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Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Ametek, Inc., Station Square Two, Paoli, Pa.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Baldwin Elctrns., Inc., 1101 McAlmont St., Little Rock, Ark.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Penn Keystone Corp., Division St., Ansonia, Conn.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Wayne-George Co., Christina St., Newton, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

INDICATORS, ANGLE-OF-ATTACK

Avion Inc., 58-15 Northern Blvd., Woodside, N. Y.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
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Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Theta Instrument Corp., Fairfield, N. J.
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1522
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Avco Elctrns., 10700 E. Independence St., Tulsa, Okla.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Penn Keystone Corp., Division St., Ansonia, Conn.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
United Control Corporation, Redmond, Wash.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

INDICATORS, ANNUNCIATOR—SEE ANNUNCIATORS

INDICATORS, ANTENNA POSITION

Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass.
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Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 791
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. ..... p 2673
Theta Instrument Corp., Fairfield, N. J.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif.
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
Weston-Transicoil Components Div., Worcester, Pa.
Ametek, Inc., Station Square Two, Paoli, Pa.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Collins Radio Co., Dallas, Texas
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dorne & Margolin, Inc., 2950 Veterans Memorial Hwy., Bohemia, N. Y.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Wayne-George Co., Christina St., Newton, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

INDICATORS, ATTITUDE

Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Technology Inc., 65 Grove St., Watertown, Mass.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1462
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Theta Instrument Corp., Fairfield, N. J.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
Allen, R. C. Business Machines, Inc., 678 Front Ave., N.W., Grand Rapids, Mich.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Avco Elctrns., 10700 E. Independence St., Tulsa, Okla.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Kaiser Aerospace & Electronics Corp., Box 11275, Palo Alto, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
3M Co., 3M Center, St. Paul, Minn.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

INDICATORS, AZIMUTH

Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
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GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Theta Instrument Corp., Fairfield, N. J.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Weston-Transicoil Components Div., Worcester, Pa.

Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

INDICATORS, CAPACITOR LEAKAGE—SEE TESTERS, CAPACITOR

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Allard Instrument Corp., 770 Main St., Westbury, N. Y. ..... p 1179
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Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo. p 2694, 2695
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. ..... p 1782, 1783
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill. ..... p 1785
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2757, 2760
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Corona, N. Y.
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. ..... p 1194
Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y. p 1801
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2757, 2760
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y. .. p 2298
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1527
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 1206
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Computer Devices, 11925 Burke St., Santa Fe Springs, Calif.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Daco Instrument Co., Inc., Merritt Blvd., Trumbull, Conn.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electro Devices, Inc., 11805 Westline Industrial Dr., St. Louis, Mo.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Inventions, Inc., RD2 463 US 1, Monmouth Jct., N. J.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
MagneTec Corp., 7751 Densmore Ave., Van Nuys, Calif.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Penn Keystone Corp., Division St., Ansonia, Conn.
Roveti Instruments, 238 West St., Annapolis, Md.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.

INDICATORS, COMPUTER TYPE—SEE LIGHTS: DIALS—ALSO SEE READOUTS

INDICATORS, DATA DISPLAY—SEE LIGHTS: DIALS—ALSO SEE READOUTS: TUBES, READOUT

INDICATORS, DENSITY

Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio .. p 2844

INDICATORS, DIELECTRIC CONSTANT

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Marconi Instrs., 111 Cedar La., Englewood, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Delsen Testing Corp., 719 W. Broadway, Glendale, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
3M Co., 3M Center, St. Paul, Minn.

INDICATORS, DISTANCE, LINE-OF-SIGHT

Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Collins Radio Co., Dallas, Texas
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.

INDICATORS, DISTORTION—SEE ANALYZERS, A-F

INDICATORS, ELAPSED—TIME

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Bissett-Berman Corp., 3860 Centinela Ave., Los Angeles, Cal. .... p 1019
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Curtis Instruments, Inc., 200 Kisco Ave., Mt. Kisco, N. Y. ..... p 1364
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 775
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General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
J-B-T Instrs. Inc., Box 1818, New Haven, Conn. ..... p 2737
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa. p 794
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bulova Watch Co., Timer Lab., Bulova Park, Flushing, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Epic, Inc., 150 Nassau St., New York, N. Y.
Hamilton Watch Co., Lancaster, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Thomas Ind'l. Automation Ltd., Deansgate La., Timperley, Cheshire, Eng.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.

INDICATORS, ELECTROMECHANICAL—SEE INDICATORS, CIRCUIT CONDITION, ON-OFF

INDICATORS, GROUND DETECTOR

INDICATORS, FILM THICKNESS

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Amthor Testing Instr. Co., Inc., 45-53 Van-Sinderen Ave., Brooklyn, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Automation-Forster Div., Box 1025, Ann Arbor, Mich.
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio
Bendix Corp., Industrial Metrology Div., Box 1067, Ann Arbor, Mich.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dice, J. W., Co., 16 Highwood Ave., Englewood, N. J.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Electron-Machine Corp., Box M, Umatilla, Fla.
Empire Scientific Corp., Ind. Elctrn. Gage Div., 1055 Stewart Ave., Garden City, N. Y.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus, Ohio
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
3M Co., 3M Center, St. Paul, Minn.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Unit Process Assemblies, Inc., 53-15 37th Ave., Woodside, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

INDICATORS, FIRE—SEE FIRE DETECTION & FIGHTING EQUIPMENT

INDICATORS, FLUORESCENT, SWITCH MOUNTING

Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.

INDICATORS, FLUID CONDUCTIVITY

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Bailey Meter Company, Wickliffe, Ohio
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Bristol Co., Box 1790, Waterbury, Conn.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Environmental Control Sys. Div., 43-22 Queens St., Long Island City, N. Y.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
McNab, Inc., 165 Spring St., New York, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Schneider Instr. Co., 8115 Camargo Rd., Madeira, Cincinnati, Ohio
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

INDICATORS, FLUID FLOW—SEE METERS, FLUID FLOW

INDICATORS, FREQUENCY—SEE METERS, FREQUENCY

INDICATORS, GROUND DETECTOR

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1325
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1459
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1462
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Anderson, W. E., Inc., 320E West 80th St., Kansas City, Mo.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.

INDICATORS, GROUND DETECTOR (Cont'd)

Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lark Electronics, Inc., 45 Walker St., New York, N. Y.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

INDICATORS, HARDNESS

Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Branson Instruments Co., 76 Progress Dr., Stamford, Conn.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Epic, Inc., 150 Nassau St., New York, N. Y.
Irwin Laboratories, Inc., 1238 S. Gerhart Ave., Los Angeles, Calif.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Opto-Metric Tools, Inc., 304 Hudson St., New York, N. Y.
Pacific Transducer Corp., 2301 Federal, Los Angeles, Calif.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

INDICATORS, HUMIDITY (ELECTRONIC)

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Abbeon, Inc., 179-15 Jamacia Ave., Jamacia, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Bacharach Instrument Co., 625 Alpha Dr., Pittsburgh, Pa.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Warren Components Corp., Box 848, Warren, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

INDICATORS, ILLUMINATION—SEE METERS, LIGHT

INDICATORS, INSTRUMENT (FLAG, POINTER, ETC.)

Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1462
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1527

INDICATORS, LEVEL POSITION

Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1481
Theta Instrument Corp., Fairfield, N. J.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif.
A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, LINEAR DISPLACEMENT

Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ..... p 1027
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. p 1026, 1027
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. ..... p 1502
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Theta Instrument Corp., Fairfield, N. J.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055

A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Industrial Metrology Div., Box 1067, Ann Arbor, Mich.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Collins, G. L. Corp., 5875 Obispo Ave., Long Beach, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Gems Co., Inc., Spring La., Farmington, Conn.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
Impact-O-Graph Corp., 1762 East 18th St., Cleveland, Ohio
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Mann, David W. Co., 174 Middlesex Turnpike, Burlington, Mass.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Optron Corp., 50 Fitch St., New Haven, Conn.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Solid Controls, Inc., 6112 West 14th St., Minneapolis, Minn.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Starrett, L. S. Co., 1-165 Crescent St., Athol, Mass.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Wayne-George Co., Christina St., Newton, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

INDICATORS, LIQUID LEVEL

Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Fenwal Electronics Inc., 63 Fountain St., Framingham, Mass.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1457
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Theta Instrument Corp., Fairfield, N. J.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif.
A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Ametek, Inc., Station Square Two, Paoli, Pa.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Automation Industries, Inc., Box 950, Boulder, Colo.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bristol Co., Box 1790, Waterbury, Conn.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
Gems Co., Inc., Spring La., Farmington, Conn.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Haledy Elctrns. Co., 99 Wall St., New York, N. Y.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hays Corp., Michigan City, Ind.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus, Ohio
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Roylyn Inc., 620 Paula Ave., Glendale, Calif.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Thomas Ind'l. Automation Ltd., Deansgate La., Timperley, Cheshire, Eng.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
U.O.P. Instruments Div., Greenwich, Conn.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, MAGNETIC FIELD

Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 1408
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Automation-Forster Div., Box 1025, Ann Arbor, Mich.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Barringer Research, Ltd., 304 Carlingview Dr., Rexdale, Toronto, Ont., Can.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Irwin Laboratories, Inc., 1238 S. Gerhart Ave., Los Angeles, Calif.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Magnion, Inc., 144 Middlesex Tpke., Burlington, Mass.
Miniature Elctrn. Components Corp., 600 South St., Holbrook, Mass.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Ventron Instrs. Corp., 144 Middlesex Tpke., Burlington, Mass.

INDICATORS, MATERIAL THICKNESS

Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Automation Industries, Inc., Box 950, Boulder, Colo.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio
Bendix Corp., Industrial Metrology Div., Box 1067, Ann Arbor, Mich.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Branson Instruments Co., 76 Progress Dr., Stamford, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Electron-Machine Corp., Box M, Umatilla, Fla.
Empire Scientific Corp., Ind. Elctrn. Gage Div., 1055 Stewart Ave., Garden City, N. Y.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Hays Corp., Michigan City, Ind.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Industrial Gauging & Control, 296 Westport Ave., Norwalk, Conn.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Krautkramer Ultrasonics, Inc., 1 Research Dr., Stratford, Conn.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Optron Corp., 50 Fitch St., New Haven, Conn.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Starrett, L. S. Co., 1-165 Crescent St., Athol, Mass.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Unit Process Assemblies, Inc., 53-15 37th Ave., Woodside, N. Y.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, MODULATION

Heath Co., Dept. 180, Benton Harbor, Mich.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Collins Radio Co., Dallas, Texas
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

Lampkin Labs., Inc., Perico Rd., Bradenton, Fla.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

INDICATORS, MOISTURE (ELECTRONIC)

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Delmhorst Instr. Co., 763 Cedar St., Boonton, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus, Ohio
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Mann-Russell Elctrns., Inc., 1401 Thorne Rd., Tacoma, Wash.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Moisture Register Co., 1510 W. Chestnut St., Alhambra, Calif.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, MOTOR LOAD

Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

INDICATORS, NOISE-FIGURE—SEE METERS, NOISE-FIGURE

INDICATORS, NULL

Ammon Instrs., Inc., 345 Kelley St., Manchester, N. H. ..... p 1327
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1379
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412, 1413, 1416, 1417
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1497
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Theta Instrument Corp., Fairfield, N. J.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1522
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1527
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Collins Radio Co., Dallas, Texas
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
MB Electronics, Box 1825, New Haven, Conn.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roveti Instruments, 238 West St., Annapolis, Md.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, NUMERIC READOUT—SEE READOUTS

INDICATORS, OXYGEN/OZONE

Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Hays Corp., Michigan City, Ind.
Johnson-Williams Products, 2300 Leghorn St., Mountain View, Calif.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Schneider Instr. Co., 8115 Camargo Rd., Madeira, Cincinnati, Ohio
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

INDICATORS, PHASE

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1325
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1497
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Theta Instrument Corp., Fairfield, N. J. ..... p 1513
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1521
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md. ... p 1529
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Brunswick Instruments, Box 813, New Brunswick, N. J.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Collins Radio Co., Dallas, Texas
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Lark Electronics, Inc., 45 Walker St., New York, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

INDICATORS, POWER LEVEL

Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Walters, W. A., Inc., 7713 South Western Ave., Chicago, Ill.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

INDICATORS, POSITIONING

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. .. p 1763
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Theta Instrument Corp., Fairfield, N. J. ..... p 1513
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1522
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1527
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass.
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Ametek, Inc., Station Square Two, Paoli, Pa.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Boston Digital Corp., 21 Main St., Ashland, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Gems Co., Inc., Spring La., Farmington, Conn.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
I.R.A. Systems Inc., 332 Second Ave., Waltham, Mass.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Wayne-George Co., Christina St., Newton, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

INDICATORS, POWER LEVEL

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1342
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1668
Heath Co., Dept. 180, Benton Harbor, Mich.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Superior Electric Co., 1000 Middle St., Bristol, Conn.

INDICATORS, POWER LEVEL (Cont'd)

Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Bristol Co., Box 1790, Waterbury, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Gems Co., Inc., Spring La., Farmington, Conn.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Thermodynamics Corp., 164 Ballardvale St., Wilmington, Mass.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

INDICATORS, PRESSURE—ALSO SEE GAUGES, PRESSURE

Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Metrix Instrument Co., P.O. Box 36501, Houston, Tex. ..... p 2841
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
MKS Instruments, Inc., 45 Middlesex Tpke., Burlington, Mass.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J.

INDICATORS, PROXIMITY

Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. p 1026, 1027
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2760
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2760
Robertshaw Controls Co., I-71 S. at Stringtown Rd., Columbus, Ohio
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Assembly Elctrns., 807 Kent St., Niagara Falls, Ont., Can.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Collins Radio Co., Dallas, Texas
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Drexelbrook Engrg. Co., 600 Brooke Rd., Glenside, Pa.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Larson Aero Development, Box 135, Concord, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sensory, Inc., 1 Kennedy Rd., Morris Plains, N. J.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

INDICATORS, PULSE RISE TIME

Tektronix, Inc., Box 500, Beaverton, Ore.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 806
Aerometrics, P.O. Box 216, San Ramon, Calif.
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Inventions, Inc., RD2 463 US 1, Monmouth Jct., N. J.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

INDICATORS, RADIATION—ALSO SEE COUNTERS, GEIGER: COUNTERS, SCINTILLATION

Electro/Data Inc., 3121 Benton St., Garland, Tex.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Narda Microwave Corp., Plainview, N. Y.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Welex Electronics, Box 986, Silver Spring, Md.

INDICATORS, R-F—SEE METERS, FREQUENCY

INDICATORS, ROTARY SHAFT POSITION—SEE ENCODERS, SHAFT POSITION

INDICATORS, SERVO

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ... p 762, 1329
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. .... p 2663
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1457
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. .. p 1763
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Sterling Instr., 76 E. Second St., Mineola, N. Y.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Theta Instrument Corp., Fairfield, N. J. ..... p 1513
Vernitron Corp., 50 Central Ave., Farmingdale, N. Y. ..... p 2683
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif.
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Collins Radio Co., Dallas, Texas
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electro-Devices, Inc., 4-6 Godwin Ave., Paterson, N. J.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Henschel Corp., 14 Cedar St., Amesbury, Mass.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Wayne-George Co., Christina St., Newton, Mass.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, SHAFT SPEED—SEE TACHOMETERS, ELECTRONIC

INDICATORS, SHORTED TURN—SEE TESTERS, COIL

INDICATORS, SMOKE & COMBUSTION (ELECTRONIC)—ALSO SEE FIRE DETECTION & FIGHTING EQUIPMENT

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Melpar, Inc., Special Products Dept., 7778 Arlington Blvd., Falls Church, Va.
A. R. P. Inds., Inc., 36 Bay Dr., E., Huntington, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Edwards Co., Inc., 90 Connecticut Ave., Norwalk, Conn.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Worner Electrn. Devices, Rankin, Ill.

INDICATORS, SOUND LEVEL—SEE METERS, AUDIO LEVEL

INDICATORS, SPECIFIC GRAVITY

Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Brooks Instrument Div., Emerson Elec. Co., Hatfield, Pa.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Calif.
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, STRAIN (FOR USE WITH STRAIN GAUGES)

Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Tektronix, Inc., Box 500, Beaverton, Ore.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
B & F Instruments Inc., Cornwells Hgts., Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Ellis Associates, P. O. Box 77, 67 Lincoln Ave., Pelham, N. Y.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Lockheed Electronics Co., 16811 El Camino Real, Houston, Tex.
Micro-Strain, Inc., Spring City, Pa.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Orbitran Co., Inc., 11487 Woodside Ave., Lakeside, Calif.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Strainsert Co., 24 Summit Grove Ave., Bryn Mawr, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, SURFACE ROUGHNESS

Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Bendix Corp., Industrial Metrology Div., Box 1067, Ann Arbor, Mich.
Clevite Corp., Gaging & Controls Div., 4601 N. Arden Dr., El Monte, Cal.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
Heli-Coil Corp., Shelter Rock La., Danbury, Conn.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Marduth Prods., 1387 Ledge Rd., R. D. 1, Hinckley, Ohio
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Nikon, Inc., Instr. Div., 623 Stewart Ave., Garden City, N. J.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

INDICATORS, TELEMETERING—SEE ANALYZERS, TELEMETRIC DATA

INDICATORS, TEMPERATURE—SEE METERS, TEMPERATURE

INDICATORS, TIME DELAY MEASUREMENT

Bissett-Berman Corp., 3860 Centinela Ave., Los Angeles, Cal. ... p 1019
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.

INDICATORS, TORQUE

Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
B & F Instruments Inc., Cornwells Hgts., Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.

Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Daytronic Corp.,2875 Culver Ave., Kettering, Ohio
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
General Thermodynamics Corp., 164 Ballardvale St., Wilmington, Mass.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lebow Assocs., Inc., 21820 Wyoming Ave., Oak Park, Mich.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
McNab, Inc., 165 Spring St., New York, N. Y.
Mecca, P.O. Box 36393, Houston, Tex.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Sturtevant, P. A. Div., Dresser Inds., Inc., Addison, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transducers, Inc., 11971 E. Rivera Rd., Santa Fe Springs, Calif.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Williams, J. H. & Co., 400 Vulcan St., Buffalo, N. Y.

INDICATORS, TRANSIENT VOLTAGE

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Roveti Instruments, 238 West St., Annapolis, Md.

INDICATORS, VACUUM—ALSO SEE GAUGES, VACUUM

Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Virtis Co., Inc., Rte. 208, Gardiner, N. Y. ..... p 1520
Abbeon, Inc., 179-15 Jamacia Ave., Jamacia, N. Y.
Ametek, Inc., Station Square Two, Paoli, Pa.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beach-Russ Co., 420 Lexington Ave., New York, N. Y.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Bristol Co., Box 1790, Waterbury, Conn.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.,) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fredericks Co., Philmont & Anne St., Huntingdon Valley, Pa.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Granville-Phillips Co., Box 1290, Boulder, Colo.
Hastings-Raydist, Newcomb Ave., Hampton, Va.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
MKS Instruments, Inc., 45 Middlesex Tpke., Burlington, Mass.
Nelson Vacuum Pump Co., 2133 4th St., Berkeley, Calif.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J.
Weksler Instrs. Corp., 195 E. Merrick Rd., Freeport, N. Y.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, VISCOSITY

Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Brookfield Engrg. Labs., Inc., 240 Cushing St., Stoughton, Mass.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instron Corp., 2500 Washington St., Canton, Mass.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Norcross Corp., 255 Newtonville Ave., Newton, Mass.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.

INDICATORS, VSWR—SEE METERS, STANDING WAVE RATIO

INDICATORS, WEIGHT—SEE SCALES, PRODUCTION WEIGHT

INDICATORS, WIND DIRECTION (ELECTRONIC)

Theta Instrument Corp., Fairfield, N. J.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Belfort Instrument Co., 4 N. Central Ave., Baltimore, Md.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDICATORS, WIND SPEED (ELECTRONIC)

Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Ametek, Inc., Station Square Two, Paoli, Pa.
Belfort Instrument Co., 4 N. Central Ave., Baltimore, Md.
Cambridge Systems Inc., 50 Hunt St., Newton, Mass.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hastings-Raydist, Newcomb Ave., Hampton, Va.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
ThermoSystems, Inc., 2500 Cleveland Ave. N., St. Paul, Minn.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

INDUCTANCE COMPARATORS—SEE BRIDGES, INDUCTANCE

INDUCTANCE STANDARDS—SEE STANDARDS, INDUCTANCE

INDUCTION HEATING EQUIPMENT—SEE HEATERS & ACCESSORIES, INDUCTION

INDUCTION POTENTIOMETERS—SEE RESOLVERS, SYNCHRO

INDUCTORS—SEE COILS

INFRARED EQUIPMENT—SEE COMM. SYSTEMS: DETECTORS: LAMPS: SPECTROMETERS: ETC. (AS MODIFIED BY INFRARED)

INKS FOR THICK FILM MICROCIRCUITS

Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Etchomatic, Inc., Box 444, Waltham, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Naz-Dar International, 1087 N. Branch, Chicago, Ill.
Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles, Calif.

INKS, MARKING

Gamble, C. T. Inds., New Jersey Ave. & Fairview St., Riverside, N. J. p 2378
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Apex Machine Co., 3000 N.E. 12th Terr., Ft. Lauderdale, Fla.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Prods.. Box 45278, Chicago, Ill.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Carter's Ink Co., 239 First St., Cambridge, Mass.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eastern Marking Machine Corp., 30 Alabama Ave., Island Park, N. Y.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Etchomatic, Inc., Box 444, Waltham, Mass.
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
Geartronics Corp., 112 Chelmsford Rd., N. Billerica, Mass.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Independent Ink Inc., 14705 S. Avalon Blvd., Gardena, Calif.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Koh-I-Noor, Inc., 100 North St., Bloomsbury, N. J.
Lake Chemical Co., 250 N. Washtenaw Ave., Chicago, Ill.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Markal Co., 250 N. Washtenaw Ave., Chicago, Ill.
Markem Corp., 194 Congress St., Keene, N. H.
Master Engraving, 11 Wallace St., E. Paterson, N. J.
Matthews, Jas. & Co., 6619 Penn Ave., Pittsburgh, Pa.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.

INSULATING COMPOUNDS, COIL DOPE

Organic Products Co., Box 428, Irving, Tex.
Phillips Process Co., Inc., 192 Mill St., Rochester, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Podgor, J. E. Co., Inc., Box 1714, Philadelphia, Pa.
Popper & Sons, Inc., 300 Park Ave., S., New York, N. Y.
Pryor Marking Products, 21 E. Hubbard, Chicago, Ill.
Randolph Products Co., 12th St., Carlstadt, N. J.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Star Enterprises, Box 1098, Lowell, Mass.
Techform Labs., Inc., 707 S. Hampton Dr., Venice, Calif.
3M Co., 3M Center, St. Paul, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles, Calif.

INSERTION LOSS MEASUREMENT SYSTEMS

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Narda Microwave Corp., Plainview, N. Y.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md. ... p 1529
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lenox Instrument Co., 122 E. Luray St., Philadelphia, Pa.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

INSERTS—SEE BUSHINGS

INSPECTION LIGHTING & EQUIPMENT—SEE FIBER OPTIC INSPECTION EQUIPMENT: LAMPS, MAGNIFYING; COMPARATORS, OPTICAL: ULTRAVIOLET LIGHTING EQUIPMENT

INSTRUMENT CASES—SEE CABINETS: CASES, INSTRUMENT

INSTRUMENT PARTS, PRECISION—SEE BEARINGS: GEARS: SPRINGS: ETC.

INSTRUMENTS, ELECT. MEASURING—SEE ANALYZERS: BRIDGES: COMPARATORS: METERS: ETC.

INSTRUMENTS, GRAPHIC RECORDING—SEE RECORDERS, GRAPHIC

INSULATING COMPOUNDS, ACRYLIC

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Isochem Resins Co., Cook St., Lincoln, R. I.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Sperex Corp., 2239 Pontius Ave., Los Angeles, Calif.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Tech Spray, 2113 W. 3rd, Amarillo, Tex.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATING COMPOUNDS, ASPHALT & PITCH

Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Hi-Test Chemical Corp., 40 Blanchard St., Newark, N. J.
Isochem Resins Co., Cook St., Lincoln, R. I.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, Pa.
Sauereisen Cements Co., 160 Gamma Dr., Pittsburgh, Pa.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Stevenson Bros. & Co., 110 Race St., Philadelphia, Pa.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zophar Mills, Inc., 112-130 26th St., Brooklyn, N. Y.

INSULATING COMPOUNDS, COIL DOPE

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Barrett Varnish Co., 1532 South 50th Ct., Cicero, Ill.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.

INSULATING COMPOUNDS (Cont'd)

Sauereisen Cements Co., 160 Gamma Dr., Pittsburgh, Pa.
Tech Spray, 2113 W. 3rd, Amarillo, Tex.
3M Co., 3M Center, St. Paul, Minn.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATING COMPOUNDS, ENAMEL

Datak Corp., 85 Highland Ave., Passaic, N. J.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
Barrett Varnish Co., 1532 South 50th Ct., Cicero, Ill.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, Pa.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Sperex Corp., 2239 Pontius Ave., Los Angeles, Calif.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATING COMPOUNDS, EPOXY

Astrodyne Inc., 207 Cambridge St., Burlington, Mass. ..... p 2507
Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 705
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Ablestik Adhesive Co., Inc., 833 W. 182nd St., Gardena, Cal.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Armstrong Products Company, Inc., P.O. Box 657, Warsaw, Ind.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dow Chemical Co., Midland, Mich.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hysol Div., 211 Franklin St., Olean, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Mansol Ceramics Co., Inc., 140 Little St., Belleville, N. J.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Randolph Products Co., 12th St., Carlstadt, N. J.
Rector Engrg. & Plastics Co., 318 Randolph Pl., N. E., Washington, D. C.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Rogers Corp., Rogers, Conn.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Techform Labs., Inc., 707 S. Hampton Dr., Venice, Calif.
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATING COMPOUNDS, LACQUER

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
Barrett Varnish Co., 1532 South 50th Ct., Cicero, Ill.
CRC Chemicals, Div. C. J. Webb, Dresher, Pa.
Chemical Products Corp., King Philip Rd., E. Providence, R. I.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Dennis Chemical Co., 2701 Papin St., St. Louis, Mo.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Isochem Resins Co., Cook St., Lincoln, R. I.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Randolph Products Co., 12th St., Carlstadt, N. J.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATING COMPOUNDS, SILICONE

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Dow Corning Corp., Midland, Mich. ..... p 1580–1583
Abesto Corp., Ackerman St., Bloomfield, N. J.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Isochem Resins Co., Cook St., Lincoln, R. I.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Midsil Corp., 27 Bland St., Emerson, N. J.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Sperex Corp., 2239 Pontius Ave., Los Angeles, Calif.
Stauffer Chemical Co., Silicone Dept., 299 Park Ave., New York, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATING COMPOUNDS, VARNISH

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Datak Corp., 85 Highland Ave., Passaic, N. J.
Dow Corning Corp., Midland, Mich. ..... p 1581–1583
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 705
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
Barrett Varnish Co., 1532 South 50th Ct., Cicero, Ill.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
CRC Chemicals, Div. C. J. Webb, Dresher, Pa.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Illinois Bronze Powder & Paint Co., 300 E. Main St., Lake Zurich, Ill.
Isochem Resins Co., Cook St., Lincoln, R. I.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Midsil Corp., 27 Bland St., Emerson, N. J.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, Pa.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Randolph Products Co., 12th St., Carlstadt, N. J.
Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
3M Co., 3M Center, St. Paul, Minn.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATING COMPOUNDS, WAX

Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
CRC Chemicals, Div. C. J. Webb, Dresher, Pa.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Hi-Test Chemical Corp., 40 Blanchard St., Newark, N. J.
Humble Oil & Refining Co., P.O. Box 2180, Houston, Tex.
International Wax Refining Co., 99 E. Hawthorne Ave., Valley Stream, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Stevenson Bros. & Co., 110 Race St., Philadelphia, Pa.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zophar Mills, Inc., 112-130 26th St., Brooklyn, N. Y.

INSULATION MATERIALS, ADHESIVE

Astrodyne Inc., 207 Cambridge St., Burlington, Mass. ..... p 2507
Dow Corning Corp., Midland, Mich. ..... p 1582, 1583
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 705
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ... p 1224, 1225
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Ablestik Adhesive Co., Inc., 833 W. 182nd St., Gardena, Cal.
Adhesive Products Corp., 1660 Boone Ave., Bronx, N. Y.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Armstrong Products Company, Inc., P.O. Box 657, Warsaw, Ind.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
By-Buk Co., 4326 W. Pico Blvd., Los Angeles, Calif.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Hysol Div., 211 Franklin St., Olean, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Mansol Ceramics Co., Inc., 140 Little St., Belleville, N. J.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Midsil Corp., 27 Bland St., Emerson, N. J.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Morgan Adhesives Co., 4560 Darrow Rd., Stow, Ohio
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, Pa.
Permacel, U.S. Hwy. 1, New Brunswick, N. J.
Press-On Products, 39 Factory Rd., Addison, Ill.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Sauereisen Cements Co., 160 Gamma Dr., Pittsburgh, Pa.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Sterling Varnish Co., The, Haysville Borough, Sewickley, Pa.
Techform Labs., Inc., 707 S. Hampton Dr., Venice, Calif.
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wire Cloth Enterprises, Inc., 130-132 Gamma Dr., Pittsburgh, Pa.

INSULATION MATERIALS, ASBESTOS

Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Smelting & Refining Co., 120 Broadway, New York, N. Y.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
Fiberite Corp., 515-559 W. 3 St., Winona, Minn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Rostone Corp., Route 52 S., Lafayette, Ind.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATION MATERIALS, CERAMIC

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Electrical Refractories Co., 50 E. Clark St., E. Palestine, Ohio
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Longene Elctrns. Inc., 266 West Ave., Long Branch, N. J.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Porcelain Products Co., 225 N. Patterson St., Carey, Ohio
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.

INSULATION MATERIALS, FABRIC

Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.

Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Fiberite Corp., 515-559 W. 3 St., Winona, Minn.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kendall Co., Fiber Products Div., Walpole, Mass.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Permacel, U.S. Hwy. 1, New Brunswick, N. J.
Plymouth Rubber Co., Inc., Canton, Mass.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Press-On Products, 39 Factory Rd., Addison, Ill.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
3M Co., 3M Center, St. Paul, Minn.
Westinghouse Electric Corp., Industrial Plastics Div.,
1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATION MATERIALS, FELT—SEE FELT

INSULATION MATERIALS, FIBER

Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
p 1584
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. ..... p 1587
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Fiberite Corp., 515-559 W. 3 St., Winona, Minn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Hercules Inc., 910 Market St., Wilmington, Dela.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kendall Co., Fiber Products Div., Walpole, Mass.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Press-On Products, 39 Factory Rd., Addison, Ill.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Rogers Corp., Rogers, Conn.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
3M Co., 3M Center, St. Paul, Minn.
Westinghouse Electric Corp., Industrial Plastics Div.,
1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATION MATERIALS, FILM

Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. ..... p 1579
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
American Mica Insulation Co., Manasquan, N. J.
Arlin Mfg. Co., Inc., 239 Industrial Ave., E., Lowell, Mass.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Celanese Plastics Co., 550 Broad St., Newark, N. J.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fluorocarbon Co., 1754 S. Clementine, Box 3339, Anaheim, Calif.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hercules Inc., 910 Market St., Wilmington, Dela.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Morgan Adhesives Co., 4560 Darrow Rd., Stow, Ohio
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Plymouth Rubber Co., Inc., Canton, Mass.
Press-On Products, 39 Factory Rd., Addison, Ill.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Schweitzer, Peter J. Div., Kimberly Clark Corp., Lee, Mass.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
3M Co., 3M Center, St. Paul, Minn.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div.,
1585 Lebanon School Rd., W. Mifflin, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

INSULATION MATERIALS, FOAM

Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Ablestik Adhesive Co., Inc., 833 W. 182nd St., Gardena, Cal.
Air-O-Plastik Corp., Asia Place, Carlstadt, N. J.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Diamond Shamrock Chemical Co., 175 Schuyler Ave., N. Arlington, N. J.
Dow Chemical Co., Midland, Mich.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Groendyk Mfg. Co., Inc., P.O. Box 278, Buchanan, Va.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Nopco Chemical Div., 60 Park Pl., Newark, N. J.
Press-On Products, 39 Factory Rd., Addison, Ill.
Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Siemens America, Measuring Inst. Div., 350 Fifth Ave., N. Y., N. Y.
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div.,
1585 Lebanon School Rd., W. Mifflin, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

INSULATION MATERIALS, GLASS BONDED MICA

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Acim Paper Co., Mica Paper Div., 1400 Plaza Ave., New Hyde Park, N. Y.
American Mica Insulation Co., Manasquan, N. J.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Haveg Inds., Inc., Precision Molding Div., 336 Weir St., Taunton, Mass.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Molecular Dielectrics Inc., 101 Clifton Blvd., Clifton, N. J.
Mycalex Corp. of America, 125 Clifton Blvd., Clifton, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div.,
1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATION MATERIALS, GLASS FIBER IMPREGNATED

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Markel, L. Frank, & Sons, School La., Norristown, Pa.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
American Mica Insulation Co., Manasquan, N. J.
Atlas Fibre Co., 6970 N. Central Park Ave., Chicago, Ill.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Baer, N. S. Co., 9 Montgomery St., Hillside, N. J.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
C/P Corp., RFD 3, Newberry, S. C.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.
Cottrell Paper Co., Inc., 10 Purchase St., Fall River, Mass.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.

INSULATION MATERIALS, MYLAR

Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fiberite Corp., 515-559 W. 3 St., Winona, Minn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Glastic Corp., 4321 Glenridge Rd., Cleveland, Ohio
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Longene Elctrns. Inc., 266 West Ave., Long Branch, N. J.
Mica Corp., 4031 Elenda St., Culver City, Calif.
New England Laminates Co., Inc., 481 Canal St., Stamford, Conn.
Norplex Div., Universal Oil Prods., Norplex Dr., LaCrosse, Wisc.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Permacel, U.S. Hwy. 1, New Brunswick, N. J.
Plymouth Rubber Co., Inc., Canton, Mass.
Rogers Corp., Rogers, Conn.
Rostone Corp., Route 52 S., Lafayette, Ind.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Taylor Corp., Valley Forge, Pa.
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div.,
1585 Lebanon School Rd., W. Mifflin, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.
Zurn Inds., 12th & Plum St., Erie, Pa.

INSULATION MATERIALS, MICA (NATURAL & SYNTHETIC)

Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1225
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Acim Paper Co., Mica Paper Div., 1400 Plaza Ave., New Hyde Park, N. Y.
American Mica Insulation Co., Manasquan, N. J.
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Cleveland Mica Co., 1360 Hird Ave., Lakewood, Ohio
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Ford Radio & Mica Corp., 536 63rd St., Brooklyn, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Industrial Mica, 223 S. Van Brunt St., Englewood, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Micacraft Products, Inc., 49-51 Liberty St., Newark, N. J.
Molecular Dielectrics Inc., 101 Clifton Blvd., Clifton, N. J.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Mycalex Corp. of America, 125 Clifton Blvd., Clifton, N. J.
Spruce Pine Mica Co., Inc., 108 Greenwood Rd., Spruce Pine, N. C.
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div.,
1585 Lebanon School Rd., W. Mifflin, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

INSULATION MATERIALS, MYLAR

Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. ..... p 1587
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Arlin Mfg. Co., Inc., 239 Industrial Ave., E., Lowell, Mass.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Celanese Plastics Co., 550 Broad St., Newark, N. J.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Inmanco Inc., 3800 West 42nd St., Chicago, Ill.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Morgan Adhesives Co., 4560 Darrow Rd., Stow, Ohio
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Press-On Products, 39 Factory Rd., Addison, Ill.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
3M Co., 3M Center, St. Paul, Minn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

INSULATION MATERIALS, MYLAR (Cont'd)

Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

INSULATION MATERIALS, NYLON

ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Norplex Div., Universal Oil Prods., Norplex Dr., LaCrosse, Wisc.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Taylor Corp., Valley Forge, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

INSULATION MATERIALS, PAPER

Natvar Corp., 211 Randolph Ave., Woodbridge, N. J.
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Acme Chemical & Insulation Co., 166 Chapel St., New Haven, Conn.
American Mica Insulation Co., Manasquan, N. J.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Brown-Bridge Mills Inc., E. Water St., Troy, Ohio
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Cottrell Paper Co., Inc., 10 Purchase St., Fall River, Mass.
Dennison Mfg. Co., 300 Howard St., Framingham, Mass
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Mosinee Paper Mills Co., Mosinee, Wisc.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Rogers Corp., Rogers, Conn.
Schweitzer, Peter J. Div., Kimberly Clark Corp., Lee, Mass.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Taylor Corp., Valley Forge, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATION MATERIALS, PHENOLIC

ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Atlas Fibre Co., 6970 N. Central Park Ave., Chicago, Ill.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Baer, N. S. Co., 9 Montgomery St., Hillside, N. J.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Cottrell Paper Co., Inc., 10 Purchase St., Fall River, Mass.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Fiberite Corp., 515-559 W. 3 St., Winona, Minn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric Co., Laminated Products Dept., Coshocton, Ohio
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Norplex Div., Universal Oil Prods., Norplex Dr., LaCrosse, Wisc.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Raybestos-Manhattan, Inc., Plastic Products Div., Manheim, Pa.
Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Rogers Corp., Rogers, Conn.
Rostone Corp., Route 52 S., Lafayette, Ind.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Taylor Corp., Valley Forge, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
Vernay Labs., E. South College St., Yellow Springs, Ohio
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATION MATERIALS, PLASTIC, MISC.

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. ..... p 1579
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Markel, L. Frank, & Sons, School La., Norristown, Pa.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J.
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Arlin Mfg. Co., Inc., 239 Industrial Ave., E., Lowell, Mass.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Baer, N. S. Co., 9 Montgomery St., Hillside, N. J.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Biwax Corp., 45 E. Bradrock Dr., Des Plaines, Ill.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Blum, J. & Co., Inc., Box 292, Carlstadt, N. J.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brand-Rex Div., Box 498, Willimantic, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Celanese Plastics Co., 550 Broad St., Newark, N. J.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemical Products Corp., King Philip Rd., E. Providence, R. I.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Cryo-Therm Inc., Fogelsville, Pa.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Dow Chemical Co., Midland, Mich.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fiberite Corp., 515-559 W. 3 St., Winona, Minn.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
General Electric Co., Laminated Products Dept., Coshocton, Ohio
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Glastic Corp., 4321 Glenridge Rd., Cleveland, Ohio
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hercules Inc., 910 Market St., Wilmington, Dela.
Hysol Div., 211 Franklin St., Olean, N. Y.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Marbon, Box 68, Washington, W. Va.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Modern Industrial Plastics, 3337 N. Dixie Dr., Dayton, Ohio
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Norplex Div., Universal Oil Prods., Norplex Dr., LaCrosse, Wisc.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Plymouth Rubber Co., Inc., Canton, Mass.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Press-On Products, 39 Factory Rd., Addison, Ill.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rayclad Tubes, Inc., 300 Constitution Dr., Menlo Park, Calif.
Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y.
Resdel Corp., Box 2171, Rio Grande, N. J.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Rogers Corp., Rogers, Conn.
Rostone Corp., Route 52 S., Lafayette, Ind.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Taylor Corp., Valley Forge, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vernay Labs., E. South College St., Yellow Springs, Ohio
Western Coating Co., Box 598, Royal Oak, Mich.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Westlake Plastics Co., 133 W. Lenni Rd., Lenni, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.
Zurn Inds., 12th & Plum St., Erie, Pa.

INSULATION MATERIALS, POLYETHYLENE

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Air-O-Plastik Corp., Asia Place, Carlstadt, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Arlin Mfg. Co., Inc., 239 Industrial Ave., E., Lowell, Mass.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Celanese Plastics Co., 550 Broad St., Newark, N. J.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Dow Chemical Co., Midland, Mich.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Emerson Electric Co., Box 552, Honeoye Falls, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Groendyk Mfg. Co., Inc., P.O. Box 278, Buchanan, Va.
Hercules Inc., 910 Market St., Wilmington, Dela.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Plymouth Rubber Co., Inc., Canton, Mass.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Press-On Products, 39 Factory Rd., Addison, Ill.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
3M Co., 3M Center, St. Paul, Minn.

Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
United Mineral & Chemical Corp., 129 Hudson St.,New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div.,
1585 Lebanon School Rd., W. Mifflin, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

INSULATION MATERIALS, POLYSTYRENE

ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Blum, J. & Co., Inc., Box 292, Carlstadt, N. J.
Brand-Rex Div., Box 498, Willimantic, Conn.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Dow Chemical Co., Midland, Mich.
Emerson Electric Co., Box 552, Honeoye Falls, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.

INSULATION MATERIALS, POWDERED METAL OXIDE

Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. .. p 1578
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
City Chemical Corp., 132 West 22 St., New York, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Diamonite Products Mfg. Co., Div. U. S. Ceramic Tile Co., Shreve, Ohio
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Michigan Chemical Corp., 351 E. Ohio St., Chicago, Ill.
Norton Co., 1 New Bond St., Worcester, Mass.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Zircoa, (Zirconium Corp. of America), Box 39217, Solon, Ohio

INSULATION MATERIALS, RUBBER (ALL TYPES)

Dow Corning Corp., Midland, Mich. ..... p 1581–1583
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Abesto Corp., Ackerman St., Bloomfield, N. J.
Adhesive Products Corp., 1660 Boone Ave., Bronx, N. Y.
Air-O-Plastik Corp., Asia Place, Carlstadt, N. J.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Darling, R. E., Co., Inc., Box 666, Gaithersburg, Md.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Groendyk Mfg. Co., Inc., P.O. Box 278, Buchanan, Va.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Hysol Div., 211 Franklin St., Olean, N. Y.
Industrial Elctrn. Rubber Co., 8589 Darrow Rd., Twinsburg, Ohio
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Kelm, G. R. Machine Works, Inc., 347 E. Railway Ave., Paterson, N. J.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Plymouth Rubber Co., Inc., Canton, Mass.
Press-On Products, 39 Factory Rd., Addison, Ill.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Stauffer Chemical Co., Silicone Dept., 299 Park Ave., New York, N. Y.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.

INSULATION MATERIALS, STEATITE—SEE INSULATION PARTS, CERAMIC

INSULATION MATERIALS, TFE

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. ..... p 1579
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
Zeus Industrial Products, Inc., 195 Nassau St., Princeton, N. J. p 1589
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Atlas Fibre Co., 6970 N. Central Park Ave., Chicago, Ill.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brand-Rex Div., Box 498, Willimantic, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Dixon Corp., Metacom Ave., Bristol, R. I.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Modern Industrial Plastics, 3337 N. Dixie Dr., Dayton, Ohio
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Raybestos-Manhattan, Inc., Plastic Products Div., Manheim, Pa.
Rogers Corp., Rogers, Conn.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Sparta Mfg. Co., Dover, Ohio
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
3M Co., 3M Center, St. Paul, Minn.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

INSULATION MATERIALS, VINYL

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Blum, J. & Co., Inc., Box 292, Carlstadt, N. J.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brand-Rex Div., Box 498, Willimantic, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemical Products Corp., King Philip Rd., E. Providence, R. I.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Plymouth Rubber Co., Inc., Canton, Mass.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Press-On Products, 39 Factory Rd., Addison, Ill.
Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

INSULATION PARTS, CERAMIC

American Feldmuehle Corp., Box 2160, Glenbrook, Conn. ..... p 1576
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. .. p 1578
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1594
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2518
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas ..... p 2628
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.

INSULATION PARTS, GLASS

Akron Porcelain Co., 2739 Cory Ave., Akron, Ohio
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Mica Insulation Co., Manasquan, N. J.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Ceram Corp., 5345 Timken Sq., La Mesa, Calif.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Consolidated Ceramics & Metalizing Corp., Box 352, Flemington, N. J.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Data Magnetics Corp., 5441 West 104th St., Los Angeles, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Diamonite Products Mfg. Co., Div. U. S. Ceramic Tile Co., Shreve, Ohio
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electrical Refractories Co., 50 E. Clark St., E. Palestine, Ohio
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
G. E. Co., Insulator Dept., 2525 Insulator Dr., Baltimore, Md.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Haveg Inds., Inc., Precision Molding Div., 336 Weir St., Taunton, Mass.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Insaco, Inc., Box 442, Quakertown, Pa.
Isolantite Mfg. Corp., 337 Warren Ave., Stirling, N. J.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kirchberger, M., & Co., Inc., 250 Humphrey St., Englewood, N. J.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Mitronics, Inc., 132 Floral Ave., Murray Hill, N. J.
Mycalex Corp. of America, 125 Clifton Blvd., Clifton, N. J.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
National Ceramic Co., 500 Southard St., Trenton, N. J.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Palmer Electronics, Inc., 156 Belmont Ave., Garfield, N. J.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Porcelain Products Co., 225 N. Patterson St., Carey, Ohio
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
Star Porcelain Co., 71 Muirhead Ave., Trenton, N. J.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co.,
Rte. 202 & Change Bridge Rd., Montville, N. J.
3M Co., 3M Center, St. Paul, Minn.
Trans-Tech, Inc., P.O. Box 457, 12 Meem Ave., Gaithersburg, Md.
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Zircoa, (Zirconium Corp. of America), Box 39217, Solon, Ohio

INSULATION PARTS, GLASS

Bird, Richard H. & Co., Inc., 1 Spruce St., Waltham, Mass. ..... p 1215
Fusite Corp., 6000 Fernview Ave., Cincinnati, Ohio ..... p 1637
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1594
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
American Mica Insulation Co., Manasquan, N. J.
Atlantic Optical Moulding Co., Ellis St., Dudley, Mass.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Garner Glass Co., 177 S. Indian Hill, Claremont, Calif.
Glass Beads Co., Ceramic Products Div., Latrobe, Pa.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Kopp Glass, Inc., Box 8255, Swissvale, Pittsburgh, Pa.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Richland Glass Co., Inc., Richland, N. J.
S & S Optical Co., Inc., 7812 Stellhorn Rd., Ft. Wayne, Ind.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
3M Co., 3M Center, St. Paul, Minn.
Ultrasonic Machining Co., 266 West Ave., Long Branch, N. J.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Voltronics Corp., West St., Hanover, N. J.
Wilmad Glass Co., Inc., Buena, N. J.

INSULATION PARTS, GLASS BONDED MICA

INSULATION PARTS, GLASS BONDED MICA
Molecular Dielectrics Inc., 101 Clifton Blvd., Clifton, N. J.
Spruce Pine Mica Co., Inc., 108 Greenwood Rd., Spruce Pine, N. C.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.

INSULATION PARTS, GLASS FIBER
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
C/P Corp., RFD 3, Newberry, S. C.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Flexco Div., 6855 Suva St., Bell Gardens, Calif.
Glastic Corp., 4321 Glenridge Rd., Cleveland, Ohio
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Spruce Pine Mica Co., Inc., 108 Greenwood Rd., Spruce Pine, N. C.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.

INSULATION PARTS, INSULATING SLEEVES—SEE TUBING

INSULATION PARTS, MICA (NATURAL & SYNTHETIC)
Columbia Technical Corp., 26-60 Brooklyn-Queens Expwy., Woodside, N. Y.
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1225
Abesto Corp., Ackerman St., Bloomfield, N. J.
Acim Paper Co., Mica Paper Div., 1400 Plaza Ave., New Hyde Park, N. Y.
American Mica Insulation Co., Manasquan, N. J.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Cleveland Mica Co., 1360 Hird Ave., Lakewood, Ohio
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Industrial Mica, 223 S. Van Brunt St., Englewood, N. J.
Inmanco Inc., 3800 West 42nd St., Chicago, Ill.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Micacraft Products, Inc., 49-51 Liberty St., Newark, N. J.
Molecular Dielectrics Inc., 101 Clifton Blvd., Clifton, N. J.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Spruce Pine Mica Co., Inc., 108 Greenwood Rd., Spruce Pine, N. C.
3M Co., 3M Center, St. Paul, Minn.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATION PARTS, PAPER
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Abesto Corp., Ackerman St., Bloomfield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Gaskets, Inc., Middletown, Conn.
Inmanco Inc., 3800 West 42nd St., Chicago, Ill.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Mosinee Paper Mills Co., Mosinee, Wisc.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Spruce Pine Mica Co., Inc., 108 Greenwood Rd., Spruce Pine, N. C.
3M Co., 3M Center, St. Paul, Minn.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

INSULATION PARTS, PLASTIC
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. ..... p 2707
Concord Electronics Corp., 37 Great Jones St., New York, N. Y.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. ..... p 1579
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Industrial Devices Inc., 982 River Rd., Edgewater, N. J.
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas ..... p 2628
Abesto Corp., Ackerman St., Bloomfield, N. J.
Adhesive Products Corp., 1660 Boone Ave., Bronx, N. Y.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Akron Porcelain Co., 2739 Cory Ave., Akron, Ohio
American Mica Insulation Co., Manasquan, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Arlin Mfg. Co., Inc., 239 Industrial Ave., E., Lowell, Mass.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Baer, N. S. Co., 9 Montgomery St., Hillside, N. J.
Beaver Labs, Inc., 160 Terminal Dr., Plainview, N. Y.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Buckeye Bobin Div., 761 Sharon Dr., Westlake, Ohio
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Celestial Components, Inc., Box 4035, Covina, Calif.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Dixon Corp., Metacom Ave., Bristol, R. I.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fluorocarbon Co., 1754 S. Clementine, Box 3339, Anaheim, Calif.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
G. E. Co., Insulator Dept., 2525 Insulator Dr., Baltimore, Md.
General Gaskets, Inc., Middletown, Conn.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Hampden Mfg. Co., Inc., Box 10, Thompsonville, Conn.
Haveg Inds., Inc., Precision Molding Div., 336 Weir St., Taunton, Mass.
Heyman Mfg. Co., East Michigan Ave., Kenilworth, N. J.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Industrial Elctrn. Rubber Co., 8589 Darrow Rd., Twinsburg, Ohio
Inmanco Inc., 3800 West 42nd St., Chicago, Ill.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Isolation Products, 2387 Adele Ave., Mountain View, Calif.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Mecca, P.O. Box 36393, Houston, Tex.
Ny-Glass, Inc., 7314 E. Madison St., Paramount, Calif.
Norplex Div., Universal Oil Prods., Norplex Dr., LaCrosse, Wisc.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nylogrip Prods. Co., 281 Winter, Waltham, Mass.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
Red Seal Electric Co., 3835 West 150th St., Cleveland, Ohio
Resdel Corp., Box 2171, Rio Grande, N. J.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Rostone Corp., Route 52 S., Lafayette, Ind.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Sinclair Mfg. Co., Chartley, Mass.
Sparta Mfg. Co., Dover, Ohio
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Spruce Pine Mica Co., Inc., 108 Greenwood Rd., Spruce Pine, N. C.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.
Zurn Inds., 12th & Plum St., Erie, Pa.

INSULATION PARTS, QUARTZ
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Eimac, 301 Industrial Way, San Carlos, Calif.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Garner Glass Co., 177 S. Indian Hill, Claremont, Calif.
Insaco, Inc., Box 442, Quakertown, Pa.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Longene Elctrns. Inc., 266 West Ave., Long Branch, N. J.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Richland Glass Co., Inc., Richland, N. J.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
Ultrasonic Machining Co., 266 West Ave., Long Branch, N. J.
Wilmad Glass Co., Inc., Buena, N. J.

INSULATION PARTS, SAPPHIRE
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Alessi Industries, 418 Main St., El Segundo, Calif.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Eimac, 301 Industrial Way, San Carlos, Calif.
Insaco, Inc., Box 442, Quakertown, Pa.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Moser Jewel Co., 544 Fayette St., Perth Amboy, N. J.
Nuclear Element Corp., 420 S. McKean St., Butler, Pa.
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.

INSULATION PARTS, SILICONE RUBBER
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Dow Corning Corp., Midland, Mich. ..... p 1581–1583
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Abesto Corp., Ackerman St., Bloomfield, N. J.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Darling, R. E., Co., Inc., Box 666, Gaithersburg, Md.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
General Gaskets, Inc., Middletown, Conn.
Groendyk Mfg. Co., Inc., P.O. Box 278, Buchanan, Va.
Haveg Inds., Inc., Precision Molding Div., 336 Weir St., Taunton, Mass.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Industrial Elctrn. Rubber Co., 8589 Darrow Rd., Twinsburg, Ohio
Inmanco Inc., 3800 West 42nd St., Chicago, Ill.
Isochem Resins Co., Cook St., Lincoln, R. I.
Isolation Products, 2387 Adele Ave., Mountain View, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Mecca, P.O. Box 36393, Houston, Tex.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Press-On Products, 39 Factory Rd., Addison, Ill.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
3M Co., 3M Center, St. Paul, Minn.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

INSULATION PARTS, STEATITE—SEE INSULATION PARTS, CERAMIC

INSULATORS—SEE INSULATION PARTS: INSULATORS

INSULATORS, ANTENNA & SPRING ASSEMBLIES
Accurate Electronics Corp., Box 935J, Elyria, Ohio
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
C/P Corp., RFD 3, Newberry, S. C.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
G. E. Co., Insulator Dept., 2525 Insulator Dr., Baltimore, Md.
Glastic Corp., 4321 Glenridge Rd., Cleveland, Ohio
Insulator Div., Sanders Assocs., Inc., 11101 Sunset Hills Rd., Reston, Va.
Isolantite Mfg. Corp., 337 Warren Ave., Stirling, N. J.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kidco, Inc., Box 278, Medford, N. J.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Modern Industrial Plastics, 3337 N. Dixie Dr., Dayton, Ohio
National Ceramic Co., 500 Southard St., Trenton, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Porcelain Products Co., 225 N. Patterson St., Carey, Ohio
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
S & A Electronics, Inc., 202 W. Florence St., Toledo, Ohio
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Trylon, Inc., Elverson, Pa.

INSULATORS, ANTENNA TOWER—SEE INSULATORS, ANTENNA

INSULATORS, BUSHING (METALLIZED)—SEE BUSHINGS

INSULATORS, TEST & BATTERY CLIP
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Mueller Electric Co., 1589 H East 31st St., Cleveland, Ohio .... p 924
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Carol Cable Co., Box 68, Pawtucket, R. I.

Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Modern Industrial Plastics, 3337 N. Dixie Dr., Dayton, Ohio
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

INTEGRATED CIRCUIT PACKAGING SYSTEMS

Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 898
Electronic Modules Corp., P.O. Box 141, Timonium, Md.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218, 1594
ITT Cannon Elec., 3208 Humboldt St., Los Angeles, Cal.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 587
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
Holmberg, Inc., 20 Melville Park Rd., Melville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Irad, Inc., 1500 Story Rd., San Jose, Calif.
Kidco, Inc., Box 278, Medford, N. J.
Kollsman Motor Corp., Mill St., Dublin, Pa.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

INTEGRATED CIRCUITS—SEE CIRCUITS, INTEGRATED

INTEGRATORS, ELECTRO-MECHANICAL

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. .... p 1771, 2686
Weston-Transicoil Components Div., Worcester, Pa.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Collins Radio Co., Dallas, Texas
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio

INTEGRATORS, ELECTRONIC

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bissett-Berman Corp., 3860 Centinela Ave., Los Angeles, Cal. ... p 1019
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Curtis Instruments, Inc., 200 Kisco Ave., Mt. Kisco, N. Y. ..... p 1364
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J. . . . p 1471
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. .... p 1771, 2686
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
B & F Instruments Inc., Cornwells Hgts., Pa.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Carolina Medical Elctrns., Inc., U. S. 52 Expwy., King, N. C.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Collins Radio Co., Dallas, Texas
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
MB Electronics, Box 1825, New Haven, Conn.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Nester/Faust Mfg. Corp., 2401 Ogletown Rd., Newark, Dela.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Self-Organizing Systems, Inc., 3121 Benton, Garland, Tex.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Welex Electronics, Box 986, Silver Spring, Md.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

INTEGRATORS, MECHANICAL

Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif.
Planet Instr., Inc., 1521 Progress Rd., Ft. Wayne, Ind. ..... p 1752
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Collins Radio Co., Dallas, Texas
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.

INTEGRATORS, OPTICAL

Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1209
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.

INTENSIFIERS, IMAGE

Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Varo, Inc., Electron Devices Div., 2203 Walnut St., Garland, Tex. p 2918
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Bendix Corp., Electro-Optics Div., 1975 Green Rd., Ann Arbor, Mich.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
EMR Div., Box 223, Princeton, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Storage Tubes, 2020 Oceanside Blvd., Oceanside, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Varo, Inc., Electron Devices Div., 2203 Walnut St., Garland, Tex.

INTERCOMMUNICATION SYSTEMS, (INDUSTRIAL)

Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.

INTERFEROMETER SYSTEMS

RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Altec Lansing, Div. LTV Ling Altec, Inc., 85 Channel Dr.,
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Audio Equip. Co., Inc., 75 Harbor Rd., Port Washington, N. Y.
Automatic Clerical Systems, Inc., 389 N. Fair Oaks Ave., Pasadena, Calif.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
B-W Manufacturers, Inc., 721 N. Webster St., Kokomo, Ind.
Bell PA Prods. Corp., 1200 N. Fifth St., Columbus, Ohio
Bennett Labs., Inc., 5800 Christie, Emeryville, Calif.
Bliss Electronic Corp., Box 366, Sussex, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Clark, D. Co., Inc., 360 Franklin St., Worcester, Mass.
Collins Radio Co., Dallas, Texas
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Continental Electronics Corp., 302 McGuinness Blvd., Brooklyn, N. Y.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Encom Prods. Co., Inc., Box 68, Oxford, Pa.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fanon Elctrn. Inds., 439 Frelinghuysen Ave., Newark, N. J.
Farrall Instrument Co., Box 1037, Grand Island, Nebr.
Fasco Inds., Inc., Augusta at North Union Sts., Rochester, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Fisher-Berkeley Corp., 5800 Christie, Emeryville, Calif.
Flush Wall Radio Co., 1012 Cleveland St., Clearwater, Fla.
Gai-Tronics Corp., Box 31, Reading, Pa.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Henschel Corp., 14 Cedar St., Amesbury, Mass.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Lake Mfg. Co., 909 King St., Oakland, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loge Electronics, 2171 W. Washington Blvd., Los Angeles, Calif.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Parcoe, Inc., 4501 Prospect Ave., Cleveland, Ohio
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Roesch, D., Comm., Inc., 2727 San Fernando Rd., Los Angeles, Calif.
Schindlers, 195 Greenfield Ave., Los Angeles, Calif.
Smith-Meeker Engr. Co., 157 Chambers St., New York, N. Y.
Spivey, J. S., Inc., Box 6298, Washington, D. C.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Talk-A-Phone Co., 5013 No. Kedzie Ave., Chicago, Ill.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.
Touchmaster Labs., 6750 Selma Ave., Hollywood, Calif.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
Victor Comptometer Corp., 3900 N. Rockwell St., Chicago, Ill.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Worner Electrn. Devices, Rankin, Ill.

INTERFEROMETER SYSTEMS

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Hacker, W. J. & Co., Inc., Box 646, W. Caldwell, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Mann, David W. Co., 174 Middlesex Turnpike, Burlington, Mass.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

INTERLOCKS—SEE CONNECTORS, INTERLOCK

INVERTERS D-C TO A-C, D-C TO D-C

INTERMODULATION ANALYZERS—SEE ANALYZERS, INTERMODULATION

INTERROGATOR EQUIPMENT—SEE RECEIVERS: TRANSMITTERS: ETC.

INTERVALOMETERS—SEE TIMERS

INVERTERS, D-C TO A-C, D-C TO D-C

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1848–1850
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y. ..... p 1854
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1887
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1857
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ... p 1865, 1868, 1872
Basler Electric Co., Box 269, Highland, Ill. ..... p 1018
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
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Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Heath Co., Dept. 180, Benton Harbor, Mich.
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Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Neutronic Corp., Box 625, St. Louis, Mo.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
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ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
American Chain & Cable Co., Box 1629, Waterbury, Conn.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Aviation Instr. Mfg. Corp., 9033 Monroe Rd., Houston, Tex.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bendix Corp., Electric Power Div., Hwy. 35, Eatontown, N. J.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carter, J. C. Co., 671 West 17th St., Costa Mesa, Calif.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Collins Radio Co., Dallas, Texas
Components Corp., 106 Main St., Denville, N. J.
Continental Electric Co., Inc., 325 Ferry St., Newark, N. J.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Delta Products, Inc., P.O. Box 1147, Grand Junction, Colo.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Dyna Technology Inc., 2201 E. 7th St., Sioux City, Iowa
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Emerson Electric Co., Box 552, Honeoye Falls, N. Y.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
La Marche Mfg. Co., 106 Bradrock Dr., Des Plains, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Linear Alpha, Inc., 823 Emerson, Evanston, Ill.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Luminator, Inc., Box 278, Plano, Tex.
Mauratron, Inc., 13333 N. Central Expwy., Dallas, Tex.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
ONAN, 2515 University Ave., S. E., Minneapolis, Minn.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Power Sources, South Ave., Burlington, Mass.
Powercube Corp., 214 Calvary St., Waltham, Mass.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
Task Corporation, Box 3999, Anaheim, Calif.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Ther Elec. & Machine Works, 17 S. Jefferson St., Chicago, Ill.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Warren Communications, Newtown Rd., Littleton, Mass.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

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Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Royco Instruments Inc., 141 Jefferson Dr., Menlo Pk., Calif.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.

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ISOLATORS, D-C SIGNAL

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Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.

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Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
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OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
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Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Control Data Corp., 400 Border St., East Boston, Mass.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
N-H Microwave, Inc., Box 887, Red Bank, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

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Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Barker Products Co., 344 Central St., Saugus, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

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Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J.
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Virginia Panel Corp., Box 1106, Waynesboro, Va.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.

JACK PANEL ASSEMBLIES & ACCESSORIES—SEE PANELS, JACK

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ADC Products, 6405 Cambridge St., Minneapolis, Minn.
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Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
Virginia Panel Corp., Box 1106, Waynesboro, Va.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Audio Accessories, Inc., Gilsum, N. H.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Porter, H. K., Inc., 74 Foley St., Somerville, Mass.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Standard Electric Time Corp., 89 Logan St., Springfield, Mass.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
W & M Mfg. Corp., 187 Lafayette St., New York, N. Y.
Whitso, Inc., 9330 Byron St., Schiller Park, Ill.

JACKS, BANANA

Connector Corp., 6025 N. Keystone Ave., Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif.
p 934, 938, 941-943, 945, 946
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
p 1176
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
DonMar Prods., Inc., Box 10125, Denver, Colo.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

JEWELS, INSTRUMENT BEARING—SEE BEARINGS & ASSEMBLIES, JEWEL

JIGS AND FIXTURES, CHASSIS & CIRCUIT BOARD

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill.
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Flotron Industries, Inc., 1201 E. Grand Ave., El Segundo, Calif.
Hedquist Machine & Tool Co., 13110 Dierickx Dr., Mountain View, Calif.
Industrial Tools, Inc., 201 Bryant St., Ojai, Calif.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Matrix Engrg. Corp., 1502 West 166 St., Gardena, Calif.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Podgor, J. E. Co., Inc., Box 1714, Philadelphia, Pa.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

JOINT COMPOUNDS, SEMICONDUCTOR—SEE COATINGS, HEAT CONDUCTIVE

JOINTS, BALL & SOCKET

General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
Carler Prods. Corp., 6200 E. Malloy Rd., E. Syracuse, N. Y.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
Industrial Tectonics, Inc., 3686 Jackson Rd., Ann Arbor, Mich.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

JOINTS, ROTARY, MICROWAVE

Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Waveline Inc., Box 718, West Caldwell, N. J.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.

KEYBOARD, DECIMAL

Aircom, Inc., Rte. 16B, Union, N. H.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Gremar, Inc., 10 Micro Dr., Woburn, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

JUMPERS, BONDING

Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Helitronics Corp., 916 McCarter Hwy., Newark, N. J.
Janco Corp., 3111 Winona Ave., Burbank, Calif. ..... p 2738
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
Sittler Corp., 18 N. Ada St., Chicago, Ill.
Spring City Electrical Mfg. Co., Hall & Main Sts., Spring City, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

JUMPERS, CIRCUIT BOARD

Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Cicoil Corp., 9324 Topanga Canyon Bl., Chatsworth, Calif.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif.
p 947, 963, 964, 968
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Virginia Panel Corp., Box 1106, Waynesboro, Va. ..... p 1008
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
General Staple Co., 28 East 22nd St., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.

JUMPERS, WIRE, TERMINATED—SEE CORDS, PATCH

JUNCTION BOXES—SEE BOXES, JUNCTION & WALL PLATE

JUNCTIONS, HYBRID, MICROWAVE—SEE HYBRID JUNCTIONS, MICROWAVE

KEYBOARDS, ALPHA-NUMERIC

Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2761
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2761
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2773
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITT Telecommunications, Fulton Dr., Corinth, Miss.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Milli-Switch Corp., Box 67, Gladwyne, Pa.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Roytron, Litton Automated Business Sys., 31 Styertowne Rd., Clifton, N. J.
Shepard Div., 480 Morris Ave., Summit, N. J.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

KEYBOARDS, DECIMAL

Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif.
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Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2761
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2761
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2773
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass. .. p 815
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.

KEYBOARD, DECIMAL (Cont'd)

Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Milli-Switch Corp., Box 67, Gladwyne, Pa.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

KEYERS & COUPLERS

Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Collins Radio Co., Dallas, Texas
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Novatronics, Inc., Box 878, Pompano Beach, Fla.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

KEYS, TELEGRAPH

Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Telcolab Corp., 405 Lexington Ave., New York, N. Y.
Vibroplex Co. Inc., 833 Broadway, New York, N. Y.

KITS, ANTENNA (FOR ENGINEERS)

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.

KITS, BREADBOARDING (FOR ENGINEERS)

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 1168
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa. ..... p 876
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Fenwal Electronics Inc., 63 Fountain St., Framingham, Mass.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif.
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
AEI Instrument Co., 3691 Lee Rd., Cleveland, Ohio
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Circuit Structures Lab., 3200 N. San Fernando Blvd., Burbank, Calif.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Electraid, Inc., Box 53, Cambridge, Mass.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Keil Engrg. Products Co., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Roback Corp., Huntingdon Valley, Pa.
Semitronics Corp., 265 Canal St., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Wittek Products Co., 14750 Keswick St., Van Nuys, Calif.

KITS, CABLE-END SEALING

Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Hysol Div., 211 Franklin St., Olean, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.

KITS, COMPUTER

Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
Heath Co., Dept. 180, Benton Harbor, Mich.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.

KITS, MARKING (DIAL, INSTRUMENT, EQUIPMENT, ETC.)

Datak Corp., 85 Highland Ave., Passaic, N. J. ..... p 1170
Globe Plastics, 1342 South Signal Dr., Pomona, Calif. ..... p 2514
Heath Co., Dept. 180, Benton Harbor, Mich.
Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Eastern Marking Machine Corp., 30 Alabama Ave., Island Park, N. Y.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.
N/P Co., Inc., Box 127, Temple City, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Star Enterprises, Box 1098, Lowell, Mass.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Techniques Inc., 235 Jackson St., Englewood, N. J.
Tekni-Labels Co., 8160 Orion, Van Nuys, Calif.
Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles, Calif.

KITS, POTENTIOMETER

New England Instrument Co., 14 Kendall Lane, Natick, Mass. .. p 2488
Keltron Corp., 225 Crescent St., Waltham, Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.

KITS, POWER SUPPLY

Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.

KITS, PRINTED CIRCUIT

Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
HMW Enterprises, Inc., 15 Walnut St., Steelton, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Keil Engrg. Products Co., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Micro-Circuits Co., New Buffalo, Mich.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Techniques Inc., 235 Jackson St., Englewood, N. J.
3M Co., 3M Center, St. Paul, Minn.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.

KITS, PROGRAMMING BOARD

Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y. ..... p 918
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

KITS, PUMP

Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.

KITS, RECEIVER

Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.

KITS, SHIELDING

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.

KITS, SWITCH ASSEMBLING

Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. ..... p 2707
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2761
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2734
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2761
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. .. p 2783
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
States Co., 19 New Park Ave., Hartford, Conn.

KITS, TERMINAL

AMP Incorporated, Box 3608, Harrisburg, Pa.
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 1168
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
ETC, Inc., 990 East 67 St., Cleveland, Ohio
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Hoffman Engrg. Co., 9th & Tyler Sts., Anoka, Minn.
Hollingsworth Solderless Terminal Co., Box 430, Phoenixville, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
3M Co., 3M Center, St. Paul, Minn.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

KITS, TEST EQUIPMENT

Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1475, 1476
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Develco, Inc., 8 Van Tassel Ct., Norwalk, Conn.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
States Co., 19 New Park Ave., Hartford, Conn.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
U S Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

KITS, TRAINING AID

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1479
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Arkay International, 2372-82 Linden Blvd., Brooklyn, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Burtek, Inc., Box 1677, Tulsa, Okla.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electraid, Inc., Box 53, Cambridge, Mass.
Gillette Elctrn. Prods. Co., 201 Laurel St., Beverly, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Semitronics Corp., 265 Canal St., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Worner Electrn. Devices, Rankin, Ill.

KITS, TRANSISTOR MOUNTING—SEE PADS, TRANSISTOR MOUNTING

KNIVES & KNIFE SETS

Boker Mfg. Co., In-Dus-Tronic Div., 200 Burnett Ave., Maplewood, N. J.
Channellock, Inc., S. Main St., Meadville, Pa.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Uber Grafic Instrs., Box 4, Palo Alto, Calif.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.

KNOBS

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 1168
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio ..... p 1169
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y. p 1171
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Industrial Devices Inc., 982 River Rd., Edgewater, N. J.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2910
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 1174, 1175
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1176
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Ackerman Engravers, Inc., 43-22 36th St., Long Island City, N. Y.
Aerospace Knob Co., 1710 Potrero St., S. El Monte, Calif.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bodnar Prods. Corp., 30 Grove St., New Rochelle, N. Y.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Davies, H. Molding Co., 4920 W. Bloomingdale Ave., Chicago, Illinois
Dimco-Gray Co., 207 East 6th St., Dayton, Ohio
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Injection Plastic Corp., 8124-30 N. Ridgeway Ave., Skokie, Ill.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kerrco, Inc., Box 29178, Lincoln, Neb.
Kurz-Kasch, Inc., 1421 S. Broadway, Dayton, Ohio
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nutmeg Screw Machine Products, P.O. Box 1470, Waterbury, Conn.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Rogan Brothers Inc., 8031 N. Monticello Ave., Skokie, Ill.
Rohden Mfg. Co., 4630 N. Lamon Ave., Chicago, Ill.
Romar Plastics, Inc., 1311 East Main St., St. Charles, Ill.
Rostone Corp., Route 52 S., Lafayette, Ind.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Westmoreland Plastics Co., 135 Gertrude St., Latrobe, Pa.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.
Whitso, Inc., 9330 Byron St., Schiller Park, Ill.

KLYSTRONS, SOLID STATE, MICROWAVE—SEE OSCILLATORS, MICROWAVE

KLYSTRONS, TUBE—SEE TUBES, KLYSTRON

LABELS, PRESSURE-SENSITIVE

Datak Corp., 85 Highland Ave., Passaic, N. J. ..... p 1170
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Bishop Graphics, Inc., 7300 Radford Ave., N. Hollywood, Calif.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
By-Buk Co., 4326 W. Pico Blvd., Los Angeles, Calif.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Decalcraft U. S. A., Rte. 309, Hatfield, Pa.
Dennison Duramatic Corp., P.O. Box 20, Princeton, N. J.
Dennison Mfg. Co., 300 Howard St., Framingham, Mass
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Electro Chemical Engraving Co., 1100 Brook Ave., Bronx, N. Y.
Ever Ready Label Corp., 357 Cortlandt St., Belleville, N. J.
GM Nameplate, Inc., 2040 15th Ave., W., Seattle, Wash.
Hermes Plastics, Inc., 20 Cooper Square, New York, N. Y.
Industrial Commerce Corp., 105-07 Metropolitan Ave., Forest Hills, N. Y.
Kimball Systems, 151 Cortlandt St., Belleville, N. J.
Labelon Corp., 10 Chapin St., Canandaigua, N. Y.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Master Tape Printers, Inc., 4517 Elston Ave., Chicago, Ill.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Metalcraft, Inc., 149 4th St., S. W., Mason City, Iowa
Metalphoto Corp., 18531 S. Miles Rd., Cleveland, Ohio
Meyercord Co., 365 E. North Ave., Carol Stream, Wheaton, Ill.
Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.
N/P Co., Inc., Box 127, Temple City, Calif.
National Decal Corp., 56th & Chestnut Sts., Philadelphia, Pa.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Sillcocks-Miller Co., 350 W. Parker Ave., Maplewood, N. J.
Star Enterprises, Box 1098, Lowell, Mass.
Tekni-Labels Co., 8160 Orion, Van Nuys, Calif.
3M Co., 3M Center, St. Paul, Minn.
Topflight Corp., 160 E. 9th Ave., York, Pa.
Westline Products, 220 S. Rose St., Los Angeles, Calif.

LABELS, TEMPERATURE INDICATING

Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Camwil Inc., 835 Keeaumoku, Honolulu, Haw.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Ever Ready Label Corp., 357 Cortlandt St., Belleville, N. J.
Metalphoto Corp., 18531 S. Miles Rd., Cleveland, Ohio
Sillcocks-Miller Co., 350 W. Parker Ave., Maplewood, N. J.
Star Enterprises, Box 1098, Lowell, Mass.
Tempil Corp., 132 West 22nd St., New York, N. Y.
Wahl, William Corp., 1001 Colorado Blvd., Santa Monica, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

LABORATORIES, MOBILE & FIELD

Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. ..... p 1417
Parahm Inc., 3017 E. Las Hermanas St., Compton, Cal.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Lindsay Structure, 1360 Edgar St., Evansville, Ind.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
Sturdilite, Plainwell, Mich.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

LABORATORIES, TESTING—SEE SERVICES, ELECTRICAL MEASUREMENT: SERVICES ENVIRONMENTAL TESTING

LABORATORY FURNITURE—SEE BENCHES, CONSOLES, STOOLS, TABLES, (LAB AND SHOP)

LACING, CABLE—SEE CORDS & TAPES, LACING

LACQUER—SEE INSULATING COMPOUNDS, LACQUER

LAMINAR FLOW WORK STATIONS—SEE WORK STATIONS

LAMINATES, METAL CLAD

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Nickeloid Co., Box 333, Peru, Ill.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Cimastra Div., 4760 Marburg Ave., Cincinnati, Ohio
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Duralith Corp., 1025 Race St., Philadelphia, Pa.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric Co., Laminated Products Dept., Coshocton, Ohio
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Laminair Inc., 13226 Figueroa, Los Angeles, Calif.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Laminated Shim Co., Inc., 48 Union St., Glenbrook, Conn.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Met-L-Wood Corp., 6755 West 65th St., Chicago, Ill.
Mica Corp., 4031 Elenda St., Culver City, Calif.
Morgan Adhesives Co., 4560 Darrow Rd., Stow, Ohio
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
New England Laminates Co., Inc., 481 Canal St., Stamford, Conn.
Norplex Div., Universal Oil Prods., Norplex Dr., LaCrosse, Wisc.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.

LAMINATES, TRANSFORMER

Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Rogers Corp., Rogers, Conn.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Taylor Corp., Valley Forge, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Wellington Technical Inds., Inc., 55 Honeck St., Englewood, N. J.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

LAMINATES, PLASTIC IMPREGNATED (UNCLAD)

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1639, 1642
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abesto Corp., Ackerman St., Bloomfield, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Baer, N. S. Co., 9 Montgomery St., Hillside, N. J.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Cimastra Div., 4760 Marburg Ave., Cincinnati, Ohio
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fabritron, Inc., 11650 Genesee St, Alden, N. Y.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric Co., Laminated Products Dept., Coshocton, Ohio
Glastic Corp., 4321 Glenridge Rd., Cleveland, Ohio
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Mica Corp., 4031 Elenda St., Culver City, Calif.
Molded Fiber Glass Cos., 4401 Benefit Ave., Ashtabula, Ohio
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
New England Laminates Co., Inc., 481 Canal St., Stamford, Conn.
Norplex Div., Universal Oil Prods., Norplex Dr., LaCrosse, Wisc.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Rogers Corp., Rogers, Conn.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Sillcocks-Miller Co., 350 W. Parker Ave., Maplewood, N. J.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Taylor Corp., Valley Forge, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
U S Polymeric, Inc., 700 E. Dyer Rd., Santa Ana, Calif.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zurn Inds., 12th & Plum St., Erie, Pa.

LAMINATES, PLASTIC (WITH INTEGRAL HEATING ELEMENTS)

Cox & Company, Inc., 215 Park Ave. S., New York, N. Y. ..... p 2812
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.

LAMINATIONS, MAGNETIC RECORDING HEAD

G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. ... p 1221
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.

LAMINATIONS, TRANSFORMER & INDUCTOR

Arnold Engineering Co., Box 6, Marengo, Ill. ..... p 1213
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J. p 1217
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. ... p 1221
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.

LAMINATIONS, TRANSFORMER (Cont'd)

Allegheny Ludlum Steel Co., H. W. Oliver Bldg., Pittsburgh, Pa.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Chemical Micro Milling Co., Box 770, Camden, N. J.
Electronetics Corp., 555 Santa Rosa Dr., Des Plaines, Ill.
Laminated Shim Co., Inc., 48 Union St., Glenbrook, Conn.
MSL Steel Co., 3912 W. McLean Ave., Chicago, Ill.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.
Tempel Steel Co., 5353 N. Elston Ave., Chicago, Ill.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.

LAMP ADAPTERS

Display Devices, Inc., 2928 Nebraska Ave., Santa Monica, Calif. p 1186
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Sloan Co., 7704 San Fernando Rd., Sun Valley, Calif. p 1806-1808
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
International Prods., Inc., Box 405, Atchison, Kans.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Noel Mfg. Co., Inc., 1415 Blondell Ave., Bronx, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

LAMP HOLDERS—SEE SOCKETS, LAMP & LAMP ASSEMBLIES

LAMP PULLERS—SEE PULLERS, LAMP

LAMPS, DIAL & PILOT, INCANDESCENT

AMP Incorporated, Box 3608, Harrisburg, Pa.
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 1781
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. p 1319
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
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Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
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Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 1811
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Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Genisco Technology Corp., 18435 Susana Rd., Compton, Calif.
Herzog Miniature Lamp Works, Inc., 50-17 5th St., Long Island City, N. Y.
International Prods., Inc., Box 405, Atchison, Kans.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Kirkland, H. R. Co., 8 King St., Morristown, N. J.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Los Angeles Miniature Products, Inc., 17000 S. Western Ave., Gardena, Calif.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
National Acme Co., 170 East 131 St., Cleveland, Ohio
North American Electric Lamp Co., 1520 North 13 St., St. Louis, Mo.
Okaya Electric Inds. Co., Ltd., 3-8-1 Chome, Shibuya, Shibuya-ku, Tokyo, Jap.
Oshino Electric Lamp Works, Ltd., 2-5-2 Minami-Shinagawa, Shinagawa-ku, Tokyo, Japan
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Truco, Inc., Box 95, Simsbury, Conn.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Vitality Bulbs Ltd., Beetons Way, Bury Saint Edmunds, Suffolk, Eng.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

LAMPS, ELECTROLUMINESCENT—SEE PANELS, ELECTROLUMINESCENT

LAMPS, EXCITER, PHOTOGRAPHIC

Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill. p 1779
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. p 1895
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Lamps, Inc., 17000 S. Western Ave., Gardena, Calif. p 1799
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
General Electric Co., Photo Lamp Dept., Nela Pk., Cleveland, Ohio
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Radiant Lamp Corp., 199 Bank St., Hightstown, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sylvania Electric Prods., Inc., Photolamp Div., 730 3rd Ave., New York, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

LAMPS, FLASHTUBE

Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill. p 1779
Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. p 1795
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. p 1804
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Abtronics, Inc., Box 712, Livermore, Calif.
Aerolux Light Co., Inc., 653 11th Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
General Electric Co., Photo Lamp Dept., Nela Pk., Cleveland, Ohio
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
ILC, Inc., 164 Commercial St., Sunnyvale, Calif.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Sylvania Electric Prods., Inc., Photolamp Div., 730 3rd Ave., New York, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

LAMPS, GLOW—SEE LAMPS, NEON

LAMPS, INFRARED

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. p 1795
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
Aerolux Light Co., Inc., 653 11th Ave., New York, N. Y.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hamilton Industries, Box 504, Winter Haven, Fla.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Merco Prods. Co., Inc., 1298 Bethel Dr., Eugene, Ore.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
North American Electric Lamp Co., 1520 North 13 St., St. Louis, Mo.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Radiant Lamp Corp., 199 Bank St., Hightstown, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

LAMPS, LUMINESCENT

Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
General Electric Co., Miniature Lamp Dept., M9-1 Nela Park, Cleveland, O. p 1793
Lamps, Inc., 17000 S. Western Ave., Gardena, Calif. p 1799
Acme Lite Prods. Co., Inc., Congers, N. Y.
Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Dri-Clave Corp., 54 Kinkel St., Westbury, N. Y.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.

LAMPS, MAGNIFYING

Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill. p 1784
Acme Lite Prods. Co., Inc., Congers, N. Y.
Black Light Prods., Box 45278, Chicago, Ill.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Dazor Mfg. Corp., 4455-99 Duncan Ave., St. Louis, Mo.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Ednalite Research Corp., 200 N. Water St., Peekskill, N. Y.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Glidelite Inds., Inc., 180 Central Ave., Hackensack, N. J.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Keuffel & Esser Co., Adams & Third Sts., Hoboken, N. J.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Swing-O-Lite, Inc., 13 E. Moonachie Rd., Hackensack, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

LAMPS, MERCURY VAPOR

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. p 1895
Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. p 1795
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Aerolux Light Co., Inc., 653 11th Ave., New York, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
Epic, Inc., 150 Nassau St., New York, N. Y.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Gates, G. W. & Co., Inc., Hempstead Tpke. & Lucille Ave., Franklin Sq., N. Y.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Nuclear Supplies, Box 312, Encino, Calif.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Radiant Lamp Corp., 199 Bank St., Hightstown, N. J.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

LAMPS, MINIATURE & SUBMINIATURE

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 1781
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. p 1319
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Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y. p 1801
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Precision Lamp Engineers, 25 Wayland St., San Francisco, Calif. p 1803
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Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 1816
American Cystoscope Makers, Inc., 8 Pelham Pky., Pelham Manor, N. Y.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Dazor Mfg. Corp., 4455-99 Duncan Ave., St. Louis, Mo.
Eder Instrument Co., Inc., 2293 N. Clybourn Ave., Chicago, Ill.
Ednalite Research Corp., 200 N. Water St., Peekskill, N. Y.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Genisco Technology Corp., 18435 Susana Rd., Compton, Calif.
Herzog Miniature Lamp Works, Inc., 50-17 5th St., Long Island City, N. Y.
International Prods., Inc., Box 405, Atchison, Kans.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Los Angeles Miniature Products, Inc., 17000 S. Western Ave., Gardena, Calif.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Okaya Electric Inds. Co., Ltd., 3-8-1 Chome, Shibuya, Shibuya-ku, Tokyo, Jap.
Oshino Electric Lamp Works, Ltd., 2-5-2 Minami-Shinagawa, Shinagawa-ku, Tokyo, Japan
Oxford Transducer Co., 3911 S. Michigan Ave., Chicago, Ill.
Radiant Lamp Corp., 199 Bank St., Hightstown, N. J.
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Swing-O-Lite, Inc., 13 E. Moonachie Rd., Hackensack, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Tech-Neon, 16th Ave. & F St., S. Belmar, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.
Vitality Bulbs Ltd., Beetons Way, Bury Saint Edmunds, Suffolk, Eng.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

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Marco-Oak Co., P.O. Box 4011, Anaheim, Calif.
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif.
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Aerolux Light Co., Inc., 653 11th Ave., New York, N. Y.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Genisco Technology Corp., 18435 Susana Rd., Compton, Calif.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Los Angeles Miniature Products, Inc., 17000 S. Western Ave., Gardena, Calif.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Okaya Electric Inds. Co., Ltd., 3-8-1 Chome, Shibuya, Shibuya-ku, Tokyo, Jap.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Tech-Neon, 16th Ave. & F St., S. Belmar, N. J.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Vitality Bulbs Ltd., Beetons Way, Bury Saint Edmunds, Suffolk, Eng.

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Eimac, 301 Industrial Way, San Carlos, Calif.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
General Electric Co., Photo Lamp Dept., Nela Pk., Cleveland, Ohio
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
ITT Electron Tube, Box 100, Easton, Pa.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Radiant Lamp Corp., 199 Bank St., Hightstown, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Strong Electric Corp., Box 1003, Toledo, Ohio
Sylvania Electric Prods., Inc., Photolamp Div., 730 3rd Ave., New York, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

LAMPS, SOLID-STATE

General Electric Co., Miniature Lamp Dept., M9-1 Nela Park, Cleveland, O. p 1793

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Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1501
Abtronics, Inc., Box 712, Livermore, Calif.
Aerolux Light Co., Inc., 653 11th Ave., New York, N. Y.
Arizona Elctrns., Inc., Drawer AE, Benson, Ariz.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Eimac, 301 Industrial Way, San Carlos, Calif.
ILC, Inc., 164 Commercial St., Sunnyvale, Calif.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

LAMPS, TUNGSTEN HALOGEN

Sylvania Electric Prods., Inc., Photolamp Div., 730 3rd Ave., New York, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.

LAMPS, ULTRAVIOLET

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
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Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. ..... p 1795
Aerolux Light Co., Inc., 653 11th Ave., New York, N. Y.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Alpine Laboratories Ltd., Box 2052, Colorado Springs, Colo.
Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Black Light Prods.. Box 45278, Chicago, Ill.
Coleman Instruments, 42 Madison St., Maywood, Ill.
EMR Div., Box 223, Princeton, N. J.
Ednalite Research Corp., 200 N. Water St., Peekskill, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
GCA Technology, Burlington Rd., Bedford, Mass.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Gates, G. W. & Co., Inc., Hempstead Tpke. & Lucille Ave., Franklin Sq., N. Y.
ILC, Inc., 164 Commercial St., Sunnyvale, Calif.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
McPherson Instr. Corp., 530 Main St., Acton, Mass.
Nuclear Supplies, Box 312, Encino, Calif.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Sara Scientific Co., Box 321, San Francisco, Calif.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Stroblite Co., Inc., 75 West 45th St., New York, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Xenon Corp., 39 Commercial St., Medford, Mass.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

LASER ENERGY MONITORS—SEE MONITORS, LASER ENERGY

LASER Q SWITCHES

Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2143
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Kappa Scientific Corp., 5780 Thornwood Dr., Goleta, Calif.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.

LASERS, GAS

Hadron, 300 Shames Dr., Westbury, N. Y. ..... p 1676
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Electro-Nuclear Labs., Inc., 115 Independence Dr., Menlo Park, Calif.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Keuffel & Esser Co., Adams & Third Sts., Hoboken, N. J.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Resalab, Inc., 4000 Campbell Ave., Menlo Park, Calif.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
University Laboratories, Inc., 733 Allston Way, Berkeley, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.

LASERS, SOLID-STATE

Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill. ..... p 1779
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Hadron, 300 Shames Dr., Westbury, N. Y. ..... p 1676
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Resalab, Inc., 4000 Campbell Ave., Menlo Park, Calif.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

LENSES, OPTICAL & CAMERA

LEAD ASSEMBLIES & RECEPTACLES, HIGH VOLTAGE—ALSO SEE CONNECTORS: CABLE ASSEMBLIES

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 830
Accurate Electronics Corp., Box 935J, Elyria, Ohio
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 851–853, 856, 869, 874
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1594
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Reynolds Industries, Inc., Box P-850, Marina Del Ray, Cal. .. p 980, 981
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Lynn Elctrns. Corp., Box 3003, Philadelphia, Pa.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Western Elctrn. Inds., 72 N. Broadway, Yonkers, N. Y.

LEADS, TEST—SEE TEST LEADS

LENS CAPS, INDICATOR LIGHT—SEE CAPS, LENS, INDICATOR LIGHT

LENSES, INSPECTION—SEE MAGNIFYING GLASSES, INSPECTION—ALSO SEE LAMPS, MAGNIFYING

LENSES, OPTICAL & CAMERA

Amersil, Inc., 685 Ramsey Ave., Hillside, N. J.
Cohu Electronics Inc., Box 623, San Diego, Calif.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.
Agfa-Gevaert, Inc., 275 North St., Teterboro, N. J.
Albion Optical Co. Inc., 260 N. Rte. 303, Box 463, W. Nyack, N. Y.
Bache, Semon & Co., 636 Greenwich St., New York, N. Y.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Bendix Corp., Electro-Optics Div., 1975 Green Rd., Ann Arbor, Mich.
Buhl Optical Co., 1009 Beech Ave., Pittsburgh, Pa.
Burke & James, Inc., 333 W. Lake St., Chicago, Ill.
Chicago Aerial Inds., Inc., 550 W. Northwest Hwy., Barrington, Ill.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Cosmicar Optical Co., Ltd., 568, 2-chome, Shimoochiai Shinjuku-ku, Tokyo, Japan
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Ednalite Research Corp., 200 N. Water St., Peekskill, N. Y.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
GBC Closed Circuit Corp., 74 5th Ave., New York, N. Y.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Glidelite Inds., Inc., 180 Central Ave., Hackensack, N. J.
Goerz Optical Co., Inc., 301 Alpha Dr., Pittsburgh, Pa.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Lancaster Glass Corp., 220-226 W. Main St., Lancaster, Ohio
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Photo-Sonics, Inc., 820 S. Mariposa St., Burbank, Calif.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
Photosystems Corp., 52 Newton Plaza, Plainview, N. Y.
Red Lake Labs., Inc., 2971 Corvin Dr., Santa Clara, Calif.
Republic Lens Co., Inc., 31 East 169th St., Bronx, N. Y.
S & S Optical Co., Inc., 7812 Stellhorn Rd., Ft. Wayne, Ind.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.

LENSES OPTICAL & CAMERA (Cont'd)

Shibaden Corp. of America, 58-25 Brooklyn-Queens Expwy., Woodside, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
Sylvania Elec. Prod., Inc., Comm. Elctrns. Div., Burlington Rd., Bedford, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.
Texas Instrs., Inc., Box 6015, Dallas, Tex.
3M Co., 3M Center, St. Paul, Minn.
Varo General, Garland Bank Bldg., Garland, Tex.
Varo Optical, Inc., 215 E. Prospect Ave., Mt. Prospect, Ill.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.
Zenith Optical Lab., 138 Palisade St., Dobbs Ferry, N. Y.
Zoomar, Inc., 55 Sea Cliff Ave., Glen Cove, L. I., N. Y.

LENSES, R-F

Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Ednalite Research Corp., 200 N. Water St., Peekskill, N. Y.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
Republic Lens Co., Inc., 31 East 169th St., Bronx, N. Y.
Valpey Corp., 1400 Highland St., Holliston, Mass.

LENSES, READOUT & DISPLAY

Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill.
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1188, 1189
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y. p 1191
Shelly Associates Inc., 111 Eucalyptus Dr., El Segundo, Cal. p 1202
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn. p 1810
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
General-Laser Corp., 8 Erie Dr., Natick, Mass.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.

LIGHT SOURCES, ISOTOPE EXCITED—SEE SOURCES, LIGHT

LIGHTING EQUIPMENT, EMERGENCY

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. p 1832
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn. p 2063
Pyle-National Co., Connector Div., 1334 N. Kostner Ave., Chicago, Ill.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
American Atomics Corp., 425 S. Plumer Ave., Tucson, Ariz.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hobby & Brown Electronic Corp., 15 St. Marks Ave., Rockville Ctr., N. Y.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
North Electric Co., 553 S. Market St., Galion, Ohio
Ray-O-Vac Co., 3310 University Ave., Madison, Wisc.
Standard Electric Time Corp., 89 Logan St., Springfield, Mass.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.

LIGHTING EQUIPMENT, STUDIO

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Burke & James, Inc., 333 W. Lake St., Chicago, Ill.
Century Lighting Inc., 3 Entin Rd., Clifton, N. J.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Hico Corp., 76 Coolidge Hill Rd., Watertown, Mass.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Sylvania Elec. Prod., Inc., Comm. Elctrns. Div., Burlington Rd., Bedford, Mass.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Xenon Corp., 39 Commercial St., Medford, Mass.

LIGHTING EQUIPMENT, TOWER

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Hughey & Phillips, Inc., 3050 N. California St., Burbank, Calif.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Trylon, Inc., Elverson, Pa.
Xenon Corp., 39 Commercial St., Medford, Mass.

LIGHTNING ARRESTERS—SEE ARRESTERS, LIGHTNING

LIGHTS, ARC

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. p 1895
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
ASCOR, Berkey Technical, 25-15 50th St., Woodside, N. Y.
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
Gates, G. W. & Co., Inc., Hempstead Tpke. & Lucille Ave., Franklin Sq., N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Strong Electric Corp., Box 1003, Toledo, Ohio
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Xenon Corp., 39 Commercial St., Medford, Mass.

LIGHTS, DIAL, PANEL, PILOT & ACCESSORIES

ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 820
AMP Incorporated, Box 3608, Harrisburg, Pa.
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 1781
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. p 2706
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. p 1319
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. p 1782, 1783
Display Devices, Inc., 2928 Nebraska Ave., Santa Monica, Calif. p 1186
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill. p 1784
Eldema Div., 18435 Susana Rd., Compton, Calif. p 1786, 1788-1791
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1792
General Electric Co., Miniature Lamp Dept., M9-1 Nela Park, Cleveland, O. p 1793
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. p 1796
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1798
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y. p 1191
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. p 1194
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2735
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. p 2909
Lamps, Inc., 17000 S. Western Ave., Gardena, Calif.
Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y. p 1801
Marco-Oak Co., P.O. Box 4011, Anaheim, Calif. p 2750
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. p 2751-2753
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Shelly Associates Inc., 111 Eucalyptus Dr., El Segundo, Cal. p 1203
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. p 1804
Sloan Co., 7704 San Fernando Rd., Sun Valley, Calif. p 1806-1809
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn. p 1810
Sylvania Elec. Prods., Inc., Estes St., Ipswich, Mass. p 1812, 1813
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 1811
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 1816
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Adronics, Inc., 271 Grove Ave., Verona, N. J.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aeronautical Electric Co., Inc., 5656 Northwest Hwy., Chicago, Ill.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Atmar Engraving Co., Inc., 91-31 121 St., Richmond Hill, N. Y.
Bodnar Prods. Corp., 30 Grove St., New Rochelle, N. Y.
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Culver-Stearns Mfg. Co., 354 Franklin St., Worcester, Mass.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
E. C. P. Corp., 4726 Superior Ave., Cleveland, Ohio
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Genisco Technology Corp., 18435 Susana Rd., Compton, Calif.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
International Prods., Inc., Box 405, Atchison, Kans.
Korry Mfg. Co., 223-8th Ave. N., Seattle, Wash.
Luminator, Inc., Box 278, Plano, Tex.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Penn Keystone Corp., Division St., Ansonia, Conn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Vitality Bulbs Ltd., Beetons Way, Bury Saint Edmunds, Suffolk, Eng.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Westmoreland Plastics Co., 135 Gertrude St., Latrobe, Pa.

LIGHTS, EDGE LIGHTING, PANEL

Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. p 1782
Lamps, Inc., 17000 S. Western Ave., Gardena, Calif.
Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y. p 1801
Marco-Oak Co., P.O. Box 4011, Anaheim, Calif.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. p 1804
Sloan Co., 7704 San Fernando Rd., Sun Valley, Calif. p 1809
Sylvania Elec. Prods., Inc., Estes St., Ipswich, Mass. p 1812, 1813
Ackerman Engravers, Inc., 43-22 36th St., Long Island City, N. Y.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Atmar Engraving Co., Inc., 91-31 121 St., Richmond Hill, N. Y.
B & B Elctrn. Prods., 2161 S. Platte River Dr., Denver, Colo.
Bodnar Prods. Corp., 30 Grove St., New Rochelle, N. Y.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
N/P Co., Inc., Box 127, Temple City, Calif.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Sun Dial & Panel Corp., Box 326, Caldwell, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Vitality Bulbs Ltd., Beetons Way, Bury Saint Edmunds, Suffolk, Eng.

LIGHTS, INDICATOR—SEE LIGHTS, DIAL, PANEL, ETC.—ALSO SEE READOUTS

LIGHTS, INFRARED

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Egan Laboratory, 107-56 113th St., Richmond Hill, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hamilton Industries, Box 504, Winter Haven, Fla.
Miskella Infra-Red Co., 7301 Grand Ave., Cleveland, Ohio
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Xenon Corp., 39 Commercial St., Medford, Mass.

LIGHTS, INSPECTION—SEE LAMPS, MAGNIFYING

LIGHTS, NEON, TEST—SEE LIGHTS, PRESS-TO-TEST

LIGHTS OIL-TIGHT

Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. p 1782, 1783
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill. p 1784
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1792
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y. p 1801
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Pyle-National Co., Connector Div., 1334 N. Kostner Ave., Chicago, Ill.
Sloan Co., 7704 San Fernando Rd., Sun Valley, Calif. p 1809
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.

LIGHTS, PLACARD—SEE LIGHTS, DIAL, PANEL, PILOT & ACCESSORIES

LIGHTS, PRESS-TO-TEST

Carling Elec., Inc., 505 New Park Ave., West Hartford, Conn.
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. p 1783
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill. p 1784, 1785
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1792
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. p 2727
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2757
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. p 1796
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Marco-Oak Co., P.O. Box 4011, Anaheim, Calif. p 2750
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. p 2753
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2757

Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn. p 1810

Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 1811
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Korry Mfg. Co., 223-8th Ave. N., Seattle, Wash.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.

LIGHTS, STROBOSCOPIC SOURCE

Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill. ..... p 1779
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
CML Inc., 350 Leland Ave., Plainfield, N. J.
Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. ..... p 1795
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1501
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Arizona Elctrns., Inc., Drawer AE, Benson, Ariz.
B & B Elctrn. Prods., 2161 S. Platte River Dr., Denver, Colo.
Berkshire Labs, 107 Tansy Hill Rd., Milford, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Chadwick-Helmuth Co. Inc., 111 E. Railroad Ave., Monrovia, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Delta Products, Inc., P.O. Box 1147, Grand Junction, Colo.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electronic Brazing Co., 140 Glenridge Ave., Montclair, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
ILC, Inc., 164 Commercial St., Sunnyvale, Calif.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.
Xenon Corp., 39 Commercial St., Medford, Mass.

LIGHTS, ULTRAVIOLET

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. ..... p 1795
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
ASCOR, Berkey Technical, 25-15 50th St., Woodside, N. Y.
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.
American Atomics Corp., 425 S. Plumer Ave., Tucson, Ariz.
Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
EMR Photoelectric, EMR Div., Box 44, Princeton, N. J.
Eimac, 301 Industrial Way, San Carlos, Calif.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
Etchomatic, Inc., Box 444, Waltham, Mass.
GCA Technology, Burlington Rd., Bedford, Mass.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Gates, G. W. & Co., Inc., Hempstead Tpke. & Lucille Ave., Franklin Sq., N. Y.
ILC, Inc., 164 Commercial St., Sunnyvale, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
McPherson Instr. Corp., 530 Main St., Acton, Mass.
Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.
Nester/Faust Mfg. Corp., 2401 Ogletown Rd., Newark, Dela.
Nuclear Supplies, Box 312, Encino, Calif.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Sara Scientific Co., Box 321, San Francisco, Calif.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

LIMIT STOPS, MECHANICAL

Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2670
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Northfield Precision Instr. Corp., 4400 Austin Blvd., Island Park, N. Y. p 1751
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1766
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gai-Tronics Corp., Box 31, Reading, Pa.
McNally Bros. Mach. & Gear Co., 1145 E. 79th St., Minneapolis, Minn.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
National Acme Co., 170 East 131 St., Cleveland, Ohio
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.

LIMITERS, CURRENT

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1858
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1972, 1973, 1992, 1993, 1997, 1999, 2001
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. .. p 2041
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. ..... p 2109
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.

LIMITERS, MICROWAVE

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Collins Radio Co., Dallas, Texas
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

LIMITERS, NOISE

Collins Radio Co., Dallas, Texas
Defense Elctrns., Inc., Rockville, Md.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.

LIMITERS, PULSE

Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. ..... p 2109
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.

LIMITERS, SURGE

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Joslyn Elctrn. Sys., 6868 Cortona Dr., Goleta, Calif. ..... p 2740, 2741
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. ..... p 2109
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.

LINE FAULT LOCATORS—SEE LOCATERS, CABLE & LINE FAULT

LINE STRETCHERS, MICROWAVE—SEE MICROWAVE LINE STRETCHERS

LINEAR DISPLACEMENT INDICATORS—SEE INDICATORS, LINEAR DISPLACEMENT

LINERS, TUBE SHIELD—SEE SHIELDS, TUBE

LINES, SLOTTED—SEE SLOTTED LINES, MICROWAVE

LOCATORS, OPEN-SHORT

LINKS, ANTENNA

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 540
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Dallas, Texas
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

LINKS, RELAY

Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1695-1697
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Collins Radio Co., Dallas, Texas
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

LIQUID CONVERTERS, CRYOGENIC—SEE CRYOGENIC LIQUID CONVERTERS

LIQUID CRYSTALS—SEE CRYSTALS, LIQUID, TEMPERATURE INDICATING

LIQUID-LEVEL INDICATORS—SEE INDICATORS, LIQUID-LEVEL

LOAD CELLS—SEE CELLS, LOAD

LOADS, DUMMY—SEE DUMMY LOADS

LOCATORS, CABLE & LINE FAULT

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. p 1324, 1325
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1340
Cablemaster Div., 13215 Leadwell St., N. Hollywood, Calif. .... p 1355
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. p 1399, 1400, 1401
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. .... p 1500, 1501
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Delcon Div., 333 Logue Ave., Mt. View, Calif.
Electro-Alarm Safety Devices, 745 N. Pleasant, Fresno, Calif.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Northeast Electronics Corp., Box 649, Concord, N. H.
Petty Geophysical Engrg. Co., 700 Tower Bldg., San Antonio, Tex.
Railway Communications, 9351 East 59th St., Raytown, Mo.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.

LOCATORS, METAL—SEE DETECTORS, METAL

LOCATORS, OPEN-SHORT

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. p 1324, 1325
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Cablemaster Div., 13215 Leadwell St., N. Hollywood, Calif. .... p 1355
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. p 1399, 1400, 1401
Intronics, Inc., 57 Chapel St., Newton, Mass.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. .... p 1500, 1501
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Delcon Div., 333 Logue Ave., Mt. View, Calif.

LOCATORS, OPEN-SHORT (Cont'd)

Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.

LOCATORS, PIPE & CABLE—SEE DETECTORS, METAL

LOCKS, DIAL & SHAFT

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y.
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2670
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 1174, 1175, 2913
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1176
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass. ..... p 2503
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Adams Rite Mfg. Co., 540 W. Chevy Chase Dr., Glendale, Calif.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.

LOGIC CIRCUITS—SEE CARDS, LOGIC; CIRCUITS, INTEGRATED; MODULES, LOGIC

LOUDSPEAKERS—SEE SPEAKERS

LOUVERS, VENTS, & WINDOWS (FOR EQUIP.)—SEE CABINETS & ACCESSORIES, METAL

LSI CIRCUITS—SEE CIRCUITS, LARGE SCALE INTEGRATION

LUBRICANTS—ALSO SEE GREASES

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1640
Dow Corning Corp., Midland, Mich. ..... p 1582, 1583
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
CRC Chemicals, Div. C. J. Webb, Dresher, Pa.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Cerac, Inc., Box 597, Butler, Wisc.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Electronic Chemical Corp., 813 Communipaw Ave., Jersey City, N. J.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Houghton E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Humble Oil & Refining Co., P.O. Box 2180, Houston, Tex.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kano Labs., Inc., 1000 Thompson La., Nashville, Tenn.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Midsil Corp., 27 Bland St., Emerson, N. J.
Miller, H. Corp., 4th & Bristol Sts., Philadelphia, Pa.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Nelson Vacuum Pump Co., 2133 4th St., Berkeley, Calif.
Nye, W. F., Inc., Box G 927, New Bedford, Mass.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Poxylube, Inc., 541 S. Webster Ave., Indianapolis, Ind.
Pro-Chem Inc., 16536 Broadway Ave., Cleveland, Ohio
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Rawn Company, Inc., Box 9, Spooner, Wisc.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Stevenson Bros. & Co., 110 Race St., Philadelphia, Pa.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
Vitramon, Inc., Box 544, Bridgeport, Conn.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.

LUGS—SEE TERMINALS, LUG

LUMINESCENT CHEMICALS—SEE CHEMICALS, LUMINESCENT

LUMINOUS PAINTS—SEE PAINTS, LUMINOUS

LVDT'S—SEE TRANSDUCERS, DISPLACEMENT

MACHINES, AXIAL LEAD STRAIGHTENING, AUTOMATIC

Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. p 2156, 2157

MACHINES, BALANCING—SEE BALANCING EQUIPMENT

MACHINES, BLUEPRINT—SEE BLUEPRINT MACHINES

MACHINES, CHEMICAL MILLING

Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Chemcut Corp., 500 Science Park Rd., State College, Pa.
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Etchomatic, Inc., Box 444, Waltham, Mass.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Plat Engrg. Co., 518 Ryers Ave., Cheltenham, Pa.
Western Technology, Inc., 220 W. Central, Santa Ana, Calif.
Zicon Corp., 63 E. Sandford Blvd., Mount Vernon, N. Y.

MACHINES, CLEANING—ALSO SEE CLEANERS, ULTRASONIC: MACHINES, VAPOR—DEGREASING

Blackstone Ultrasonics, Inc., 820 Center St., Sheffield, Pa. ..... p 2919
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Aubin, A. E. Co., Box 29, Glastonbury, Conn.
Barrett, Leon J., Co., 1450 Grafton Rd., Worcester, Mass.
Cobehn Inc., 226 Passaic Ave., Fairfield, N. J.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Dynasonics Corp., Box 672, Pipestone, Minn.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Etchomatic, Inc., Box 444, Waltham, Mass.
Industrial Washing Machine Corp., 32 Main St., Matawan, N. J.
Inland Manufacturing Co., 1108 Jackson St., Omaha, Nebr.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Lewis Corp., Rte. 6, Woodbury, Conn.
Marcal Electro-Sonics, P.O. Box 185, Burbank, Calif.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Oakite Products, Inc., 50 Valley Rd., Berkeley Heights, N. J.
Sara Scientific Co., Box 321, San Francisco, Calif.
Technic, Inc., Box 965, Providence, R. I.
Tronic Corp., Box 247-E, Belmont, Calif.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.

MACHINES, COIL-WINDING

Amacoil Machinery, Inc., 111 Plain Ave., New Rochelle, N. Y.
Coil Winding Equip. Co., Railroad Plaza, Oyster Bay, N. Y.
Elden Mfg. Corp., 2712 N. Elston Ave., Chicago, Ill.
Eubanks Engineering Co., Box 563, 225 W. Duarte Rd., Monrovia, Calif.
Gorman Machine Corp., 480 S. Main St., Randolph, Mass.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Halm Instrument Co., Inc., Glen Head Rd., Glen Head, N. Y.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Leesona Corp., Mirybrook Rd., Danbury, Conn.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Micafil, Ltd., c/o Universal Mfg. Co., Inc., 1168 EM Grove St., Irvington, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Possis Machine Corp., 825 Rhode Island Ave. S., Minneapolis, Minn.
Rea Magnet Wire Co., Inc., 3600 E. Pontiac St., Ft. Wayne, Ind.
Solatron Enterprises, 421 E. Beach Ave., Inglewood, Calif.
Stevens, Geo., Mfg. Co., Inc., 6001 N. Keystone Ave., Chicago, Ill.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Universal Mfg. Co., Inc., 1168 Grove St., Irvington, N. J.
Wellington Technical Inds., Inc., 55 Honeck St., Englewood, N. J.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

MACHINES, COIL-WINDING, TOROIDAL

Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. ..... p 1858
Coil Winding Equip. Co., Railroad Plaza, Oyster Bay, N. Y.
Elden Mfg. Corp., 2712 N. Elston Ave., Chicago, Ill.
Harder, D. C. Co., Inc., 2580 K St., San Diego, Calif.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Leesona Corp., Mirybrook Rd., Danbury, Conn.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Torrington Mfg. Co., 100 Franklin Dr., Torrington, Conn.
Universal Mfg. Co., Inc., 1168 Grove St., Irvington, N. J.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

MACHINES, COMPONENT HANDLING & FEEDING

Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1348
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 899
Eraser Co. Inc., Box 1342, Syracuse, N. Y.
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. p 2156, 2157
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Automation Devices, Inc., Box A.D., Fairview, Pa.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
C. E. M. Co., Inc., 24 School St., Danielson, Conn.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Federal Machine Co., Inc., 807 Garfield Ave., Jersey City, N. J.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
General Staple Co., 28 East 22nd St., New York, N. Y.
Halm Instrument Co., Inc., Glen Head Rd., Glen Head, N. Y.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Heller Industries Inc., 30 N. 15th St., East Orange, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Midwest Automatic, Inc., 510 Third St., Des Moines, Iowa
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Ragen Precision Inds., Inc., 9 Porete Ave., N. Arlington, N. J.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Universal-Automatic Corp., 2064 S. Mannheim Rd., Des Plaines, Ill.

MACHINES, COMPONENT INSERTING

Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 899
Eraser Co. Inc., Box 1342, Syracuse, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1003
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. .. p 2156
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
C. E. M. Co., Inc., 24 School St., Danielson, Conn.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Federal Machine Co., Inc., 807 Garfield Ave., Jersey City, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Midwest Automatic, Inc., 510 Third St., Des Moines, Iowa
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Ragen Precision Inds., Inc., 9 Porete Ave., N. Arlington, N. J.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

MACHINES, CRIMPING—SEE TOOLS, CRIMPING

MACHINES, CRYSTAL MANUFACTURING

Felker Mfg. Co., 1900 S. Crenshaw Blvd., Torrance, Calif.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Plat Engrg. Co., 518 Ryers Ave., Cheltenham, Pa.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.

MACHINES, CUTTING

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Black & Decker Mfg. Co., 701 E. Joppa Rd., Towson, Md.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Di-Acro, 316 8th Ave., Lake City, Minn.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Felker Mfg. Co., 1900 S. Crenshaw Blvd., Torrance, Calif.
Fitchburg Engrg. Corp., Cleghorn St., Fitchburg, Mass.
Foredom Electric Co., Inc., Bethel, Conn.
Foster & Allen, Inc., Box 466, Chatham, N. J.
Heller Industries Inc., 30 N. 15th St., East Orange, N. J.
Hobbs Mfg. Co., 666 Lincoln St., Worcester, Mass.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Micromech Mfg. Corp., Box 97, Union, N. J.
Miller-Stephenson Chem. Co., Inc., 16 Sugar Hollow Rd., Danbury, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Porter, H. K., Inc., 74 Foley St., Somerville, Mass.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Tempress Research Co., 980 University Ave., Los Gatos, Calif.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

MACHINES, DEFLASHING

Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Aubin, A. E. Co., Box 29, Glastonbury, Conn.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.

MACHINES, DEGREASING, VAPOR—SEE MACHINES, VAPOR—DEGREASING

MACHINES, DRYING

Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Neo-Technology, Inc., Box 266, Montvale, N. J.
Plat Engrg. Co., 518 Ryers Ave., Cheltenham, Pa.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

MACHINES, ELECTRICAL DISCHARGE

Siltronics, Inc., 140 Pennsylvania Ave., Oakmont, Pa.

MACHINES, ENCAPSULATING

G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 2151
Adams & Assoc., Inc., 1062 N. Orange Grove Ave., Hollywood, Calif.
Conforming Matrix Corp., Box 37, Sta. G, Toledo, Ohio
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Kenics Corp., One Southside Rd., Danvers, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Possis Machine Corp., 825 Rhode Island Ave. S., Minneapolis, Minn.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
3M Co., 3M Center, St. Paul, Minn.
Tra-Con, Inc., 55 North St., Medford, Mass.
Warren Components Corp., Box 848, Warren, Pa.

MACHINES, ENGRAVING & PROFILING—SEE ENGRAVING & PROFILING EQUIPMENT

MACHINES, ETCHING, PRINTED CIRCUIT

Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Virginia Panel Corp., Box 1106, Waynesboro, Va.
Baron-Blakeslee, Inc., 1620 S. Laramie Ave., Chicago, Ill.
Chemcut Corp., 500 Science Park Rd., State College, Pa.
Cyclo-Tronics, Inc., 3858 N. Cicero Ave., Chicago, Ill.
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Etchomatic, Inc., Box 444, Waltham, Mass.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Plat Engrg. Co., 518 Ryers Ave., Cheltenham, Pa.
Western Technology, Inc., 220 W. Central, Santa Ana, Calif.

MACHINES, EYELET-INSTALLING

Superior Electric Co., 1000 Middle St., Bristol, Conn.
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Segal, E., Inc., 132 Lafayette St., New York, N. Y.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Stimpson Co., Inc., 74 Franklin Ave., Brooklyn, N. Y.
Townsend Co., TRS Div., 530 West St., Braintree, Mass.
USM Fastener Co., 510 River Rd., Shelton, Conn.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

MACHINES, HELIXING LATHE

Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Halm Instrument Co., Inc., Glen Head Rd., Glen Head, N. Y.

MACHINES, HERMETIC SEALING

G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 2151
Conforming Matrix Corp., Box 37, Sta. G, Toledo, Ohio
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Litton Engrg. Labs., Box 949, Grass Valley, Calif.
Mitronics, Inc., 132 Floral Ave., Murray Hill, N. J.
Precision Arc Co., Inc., 785 Woodend Rd., Stratford, Conn.
Scully-Jones Co., 5240 Belmont Rd., Downers Grove, Ill.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio

MACHINES, HOT-STAMPING

Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Apex Machine Co., 3000 N.E. 12th Terr., Ft. Lauderdale, Fla.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Defiance Machine & Tool Co., 430 Industrial Dr., Maryland Heights, Mo.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Kingsley Machine Co., 850 Cahuenga Blvd., Hollywood, Calif.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Markem Corp., 194 Congress St., Keene, N. H.
Matthews, Jas. & Co., 6619 Penn Ave., Pittsburgh, Pa.
Noble & Westbrook, 20 Westbrook St., E. Hartford, Conn.

MACHINES, IMPREGNATING

Barrett, Leon J., Co., 1450 Grafton Rd., Worcester, Mass.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Micafil, Ltd., c/o Universal Mfg. Co., Inc., 1168 EM Grove St., Irvington, N. J.
National Vacuum Platers, Inc., 2641 E. Hagert St., Philadelphia, Pa.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Possis Machine Corp., 825 Rhode Island Ave. S., Minneapolis, Minn.
Red Point Corp., 105 W. Spazier, Burbank, Calif.
Universal Mfg. Co., Inc., 1168 Grove St., Irvington, N. J.

MACHINES, INDUCTION HEATING (ELECTRONIC)

Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Raybond Elctrns. Inc., 930 Washington St., Norwood, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio

MACHINES, LEAD CUTTING & FORMING

Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Eraser Co. Inc., Box 1342, Syracuse, N. Y.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
D-Vel Research Labs, Inc., 555 Bedford Rd., Bedford Hills, N. Y.
Harwil Co., 903 Colorado Ave., Santa Monica, Calif.
Heller Industries Inc., 30 N. 15th St., East Orange, N. J.
James Electrn. Tool Co., Box 1482, Palo Alto, Calif.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Pico Crimping Tools Co., 9832 Jersey Ave., Santa Fe Springs, Calif.
Technical Devices Co., 11242 Playa Ct., Culver City, Calif.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.
Wybar Electronics, Inc., Oliva Dr., Syracuse, N. Y.

MACHINES, MARKING & NUMBERING

Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. .. p 2156
Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Apex Machine Co., 3000 N.E. 12th Terr., Ft. Lauderdale, Fla.
Black & Webster, Inc., 281 Winter St., Waltham, Mass.
Bostitch, Div. Textron, Inc., Briggs Dr., E. Greenwich, R. I.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Chartpak Rotex, 2620 S. Susan St., Santa Ana, Calif.
Defiance Machine & Tool Co., 430 Industrial Dr., Maryland Heights, Mo.
Dennison Duramatic Corp., P.O. Box 20, Princeton, N. J.
Eastern Marking Machine Corp., 30 Alabama Ave., Island Park, N. Y.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
Gillies, D. M., Co., Inc., 66 Central St., W. Boylston, Mass.
Gorton Machine Corp., 1122 West 13th St., Racine, Wisc.
Halm Instrument Co., Inc., Glen Head Rd., Glen Head, N. Y.
Hermes Plastics, Inc., 20 Cooper Square, New York, N. Y.
Independent Ink Inc., 14705 S. Avalon Blvd., Gardena, Calif.
Kimball Systems, 151 Cortlandt St., Belleville, N. J.
Kingsley Machine Co., 850 Cahuenga Blvd., Hollywood, Calif.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Markem Corp., 194 Congress St., Keene, N. H.
Matthews, Jas. & Co., 6619 Penn Ave., Pittsburgh, Pa.
Noble & Westbrook, 20 Westbrook St., E. Hartford, Conn.
Popper & Sons, Inc., 300 Park Ave., S., New York, N. Y.
Preis, H. P., Engraving Mach. Co., 651 U. S. Hwy. 22, Hillside, N. J.
Protronic Inds. Inc., 2415 S. Manchester Ave., Anaheim, Calif.
Pryor Marking Products, 21 E. Hubbard, Chicago, Ill.
Star Enterprises, Box 1098, Lowell, Mass.
Wilkens, A. F., Inc., Rte. 22, Pawling, N. Y.

MACHINES, MASK ALIGNMENT & EXPOSURE

Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Chemcut Corp., 500 Science Park Rd., State College, Pa.
Conforming Matrix Corp., Box 37, Sta. G, Toledo, Ohio
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.

MACHINES, MATERIAL HANDLING (ELECTRONIC CONTROL)

Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Barrett Electronics Corp., 630 Dundee Rd., Northbrook, Ill.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Linear Alpha, Inc., 823 Emerson, Evanston, Ill.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.

MACHINES, METALLIZING, VACUUM—SEE DEPOSITION EQUIPMENT, VACUUM

MACHINES, MEASURING

Nikon, Inc., Instr. Div., 623 Stewart Ave., Garden City, N. J.
Opto-Metric Tools, Inc., 304 Hudson St., New York, N. Y.

MACHINES, PARTS CLEANING—SEE MACHINES, CLEANING

MACHINES, PLASTIC MOLDING

Adams & Assoc., Inc., 1062 N. Orange Grove Ave., Hollywood, Calif.
Alden Systems Co., 262 N. Main St., Brockton, Mass.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Di-Acro, 316 8th Ave., Lake City, Minn.
H-P-M Div., Koehring Co., Marion Rd., Mt. Gilead, Ohio
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Morris Enterprises, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Newbury Inds., Inc., 10975 Kinsman Rd., Newbury, Ohio
Orbit Inc., 211 Los Molinos, San Clemente, Calif.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Wabash Metal Products Co., Inc., 1569 Morris St., Wabash, Ind.
Warren Components Corp., Box 848, Warren, Pa.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

MACHINES, PLATING

Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Aubin, A. E. Co., Box 29, Glastonbury, Conn.
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Selectrons, Ltd., 116 East 16th St., New York, N. Y.
Technic, Inc., Box 965, Providence, R. I.
3M Co., 3M Center, St. Paul, Minn.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

MACHINES, POLISHING & BUFFING

Hoffman, P. R. Co., 307 Cherry St., Carlisle, Pa.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

MACHINES, PRINTED CIRCUIT DRILLING & PUNCHING

Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. .. p 2156
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Dimensional Control Machinery Co., Box 504, Salem, Ohio
Dumore Co., 1300 17 St., Racine, Wisc.
Elpac Controls, 18651 von Karman Ave., Irvine, Calif.
Etchomatic, Inc., Box 444, Waltham, Mass.
Excellon Inds., 23915 Garnier, Torrance, Calif.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
Gorton Machine Corp., 1122 West 13th St., Racine, Wisc.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Metal Removal Co., 1801 W. Columbia, Chicago, Ill.
Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Universal-Automatic Corp., 2064 S. Mannheim Rd., Des Plaines, Ill.

MACHINES, SOLDERABILITY TESTING

Wabash Metal Products Co., Inc., 1569 Morris St., Wabash, Ind.
Wilkens, A. F., Inc., Rte. 22, Pawling, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland, Ohio

MACHINES, PUNCHING

Allen, Alva Inds., 1001-15 N. Third St., Clinton, Mo.
Blum, J. & Co., Inc., Box 292, Carlstadt, N. J.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Strippit, Div. Houdaille Industries, Inc., Akron, N. Y.
Whitney Metal Tool Co., 2833 Huffman Blvd., Rockford, Ill.

MACHINES, REEL PACKAGING

Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. .. p 2157
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.

MACHINES, RESISTANCE ADJUSTING—ALSO SEE RESISTANCE ADJUSTING EQUIP. FOR HYBRID MICROCIRCUITS

Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.

MACHINES, RIVETING

Acme Rivet & Machine Corp., 1116 Edgewater Ave., Ridgefield, N. J.
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Black & Webster, Inc., 281 Winter St., Waltham, Mass.
Cherry Rivet Div., Box 2157, Santa Ana, Calif.
Chicago Rivet & Machine Co., 950 South 25 Ave., Bellwood, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
High Speed Hammer Co., Inc., 313 Norton St., Rochester, N. Y.
Milford Rivet & Machine Co., 857 Bridgeport Ave., Milford, Conn.
Segal, E., Inc., 132 Lafayette St., New York, N. Y.
Stimpson Co., Inc., 74 Franklin Ave., Brooklyn, N. Y.
Townsend Co., TRS Div., 530 West St., Braintree, Mass.
Universal-Automatic Corp., 2064 S. Mannheim Rd., Des Plaines, Ill.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

MACHINES & ACCESSORIES, SEMICONDUCTOR MANUFACTURING

G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 2151
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y.
p 2156, 2157
Dixie Diamond Tool Co., Inc., 6875 S.W. 81st St., Miami, Fla.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Fitchburg Engrg. Corp., Cleghorn St., Fitchburg, Mass.
HLC Mfg. Co., Inc., 700 Davisville Rd., Willow Grove, Pa.
Hoffman, P. R. Co., 307 Cherry St., Carlisle, Pa.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Lepel High Frequency Labs., 59-21 Queens-Midtown Expwy., Maspeth, N. Y.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Mechanization Assocs., 140 S. Whisman Rd., Mt. View, Calif.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.
Moser Jewel Co., 544 Fayette St., Perth Amboy, N. J.
Neo-Technology, Inc., Box 266, Montvale, N. J.
Norton Co., 1 New Bond St., Worcester, Mass.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Plat Engrg. Co., 518 Ryers Ave., Cheltenham, Pa.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Tempress Research Co., 980 University Ave., Los Gatos, Calif.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Zicon Corp., 63 E. Sandford Blvd., Mount Vernon, N. Y.

MACHINES, SHOCK TESTING—SEE TESTERS, SHOCK

MACHINES, SILK SCREENING AND ACCESSORIES (FOR PRINTED CIRCUITS & THICK FILM MICROCIRCUITS)

Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Eastern Marking Machine Corp., 30 Alabama Ave., Island Park, N. Y.
Mech-Tronic Equipment Co., P. O. Box 510, Silver Spring, Md.
Mechanization Assocs., 2622 Frontage Rd., Mt. View, Calif.
Naz-Dar International, 1087 N. Branch, Chicago, Ill.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Podgor, J. E. Co., Inc., Box 1714, Philadelphia, Pa.
Tekni-Labels Co., 8160 Orion, Van Nuys, Calif.
Wyrco Projects, Inc., Forsythe Ave., Owego, N. Y.

MACHINES, SLEEVE CUTTING

Eraser Co. Inc., Box 1342, Syracuse, N. Y. ..... p 2150
Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Foster & Allen, Inc., Box 466, Chatham, N. J.
Hedquist Machine & Tool Co., 13110 Dericx Dr., Mountain View, Calif.
Heller Industries Inc., 30 N. 15th St., East Orange, N. J.
Kingsley Machine Co., 850 Cahuenga Blvd., Hollywood, Calif.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.

MACHINES, SOLDERABILITY TESTING

Multicore Sales Corp., Dept. RY399, Westbury, N. Y. ..... p 2833
Cimron Div., 1152 Morena Blvd., San Diego, Calif.

MACHINES, SOLDERING—SEE SOLDERING EQUIP.

MACHINES, SORTING

MACHINES, SORTING
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1348, 1349
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. . . p 2157
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Automated Packaging Systems, Inc., 8400 Darrow Rd., Twinsburg, Ohio
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
General Atronics Corp., Ind'l. Div., 1200 E. Mermaid La., Phila., Pa.
Heller Industries Inc., 30 N. 15th St., East Orange, N. J.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.

MACHINES, SPINNER, PHOTO-RESIST
Headway Research, Inc., 3713 Forest La., Garland, Tex.

MACHINES, SWAGING
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Fair-Rite Prods Corp., 1 Commercial Row, Wallkill, N. Y.
Torrington Co., Box 1008, Torrington, Conn.

MACHINES, TAPE WINDING
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y.
Cycle Equipment Co., Box 307, Los Gatos, Calif.
Hedquist Machine & Tool Co., 13110 Diericx Dr., Mountain View, Calif.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Universal Mfg. Co., Inc., 1168 Grove St., Irvington, N. J.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

MACHINES, TAPE-WINDING, TOROIDAL
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Leesona Corp., Mirybrook Rd., Danbury, Conn.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Universal Mfg. Co., Inc., 1168 Grove St., Irvington, N. J.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

MACHINES, TERMINAL-INSTALLING
AMP Incorporated, Box 3608, Harrisburg, Pa.
Burndy Corporation, Richards Ave., Norwalk, Conn. ..... p 2828, 2829
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 899
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 994
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. . . p 2157
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Black & Webster, Inc., 281 Winter St., Waltham, Mass.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Electric Terminal Corp., Drawer E, Pilgrim Sta., Warwick, R. I.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
General Staple Co., 28 East 22nd St., New York, N. Y.
Halm Instrument Co., Inc., Glen Head Rd., Glen Head, N. Y.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Segal, E., Inc., 132 Lafayette St., New York, N. Y.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

MACHINES, TRANSISTOR ASSEMBLING
Eraser Co. Inc., Box 1342, Syracuse, N. Y.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y.
Heller Industries Inc., 30 N. 15th St., East Orange, N. J.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.
Plat Engrg. Co., 518 Ryers Ave., Cheltenham, Pa.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Tempress Research Co., 980 University Ave., Los Gatos, Calif.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.

MACHINES, ULTRASONIC BONDING
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. . . p 1605
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Sorensen Operation, Richards Ave., Norwalk, Conn.
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y.
Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Aerometrics, P.O. Box 216, San Ramon, Calif.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Delta Sonics, Inc., 12918 Cerise Ave., Hawthorne, Calif.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Marcal Electro-Sonics, P.O. Box 185, Burbank, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Sonobond Corp., 310 E. Rosedale Ave., West Chester, Pa.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.

MACHINES, VAPOR-DEGREASING—ALSO SEE CLEANERS, ULTRASONIC
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Baron-Blakeslee, Inc., 1620 S. Laramie Ave., Chicago, Ill.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Cyclo-Tronics, Inc., 3858 N. Cicero Ave., Chicago, Ill.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dynasonics Corp., Box 672, Pipestone, Minn.
Headway Research, Inc., 3713 Forest La., Garland, Tex.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Lewis Corp., Rte. 6, Woodbury, Conn.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Michael, Claude, Inc., 703 W. Ivy St., Glendale, Calif.
Multisonic Cleaning Systems, 9615 Meech Ave., Cleveland, Ohio
Phillips Mfg. Co., 7334 N. Clark St., Chicago, Ill.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Sara Scientific Co., Box 321, San Francisco, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tronic Corp., Box 247-E, Belmont, Calif.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

MACHINES, VIBRATION FATIGUE TESTING—SEE VIBRATION TEST SYSTEMS

MACHINES, WHITEPRINT—SEE WHITEPRINT MACHINES

MACHINES, WIRE MARKING, HAND & AUTOMATIC—SEE WIRE MARKING MACHINES

MACHINES, WIRE MEASURING & CUTTING—SEE WIRE MEASURING & CUTTING MACHINES

MACHINES, WIRE WRAPPING—ALSO SEE WIRE WRAPPING TOOLS
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. . . p 2157
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Industrial Sys. Div., 5261 W. Imperial Hwy., Los Angeles, Calif.
Theta Inds., Inc., Box 392, Great Neck, N. Y.

MACROSCOPIC EQUIP.—SEE MAGNIFYING GLASSES, INSPECTION

MAGNETIC ANALYZERS—SEE ANALYZERS, MAGNETIC

MAGNETIC CORE TESTERS—SEE TESTERS, MAGNETIC CORE

MAGNETIC DISC STORAGE SYSTEMS
Applied Magnetics Corp., 75 Robin Hill Rd., Goleta, Calif.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Mac Panel Co., Box 5027, High Point, N. C.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Data Disc. Inc., 1275 California Ave., Palo Alto, Calif.
Data Disc, Inc., Standard Prods. Div., 1275 California Ave., Palo Alto, Cal.
Digital Development Corp., 5575 Kearny Villa Rd., San Diego, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Environmental Container Systems, Box 337, Union City, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Memorex Corp., 1180 Shulman Ave., Santa Clara, Calif.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.

MAGNETIC FIELD INDICATORS—SEE INDICATORS, MAGNETIC FIELD

MAGNETIC FOIL—SEE FOIL, MAGNETIC

MAGNETIC IRON OXIDES
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y. . . p 1645
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Columbian Carbon Co., 380 Madison Ave., New York, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Fuji Photo Film, 3-6, Ginza 2-chome, Tokyo 104, Jap.
Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif.

MAGNETIC RECORDING TAPE—SEE TAPES, RECORDING, MAGNETIC

MAGNETIC SHIELDS & MATERIALS—SEE SHIELDS, MAGNETIC

MAGNETIC TAPE RECORDERS—SEE RECORDERS, MAGNETIC TAPE—ALSO SEE DATA RECORDERS

MAGNETIZERS
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Dura Magnetics, Inc., 5355 Whiteford Rd., Sylvania, Ohio
Electronic Brazing Co., 140 Glenridge Ave., Montclair, N. J.
Epic, Inc., 150 Nassau St., New York, N. Y.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Permag Corp., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.

MAGNETOMETERS
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 1408
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Automation-Forster Div., Box 1025, Ann Arbor, Mich.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Barringer Research, Ltd., 304 Carlingview Dr., Rexdale, Toronto, Ont., Can.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
EMR Div., Box 223, Princeton, N. J.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Gammatronix Inc., Dublin, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Infinetics, Inc., Electro-Magnetic Div., 1601 Jessup St., Wilmington, Dela.
Irwin Laboratories, Inc., 1238 S. Gerhart Ave., Los Angeles, Calif.
Schonstedt Instr. Co., 1775 Wiehle Ave., Reston, Va.
Sharpe Instruments, Creekside Blvd., Buffalo, N. Y.
Sparton Corp., 2400 E. Ganson St., Jackson, Mich.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Analytical Instr. Div., 611 Hansen Way, Palo Alto, Cal.

MAGNETORESISTORS, HALL
American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 2516, 2517
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.

MAGNETRON TESTERS—SEE TESTERS, MAGNETRON

MAGNETRONS—SEE TUBES, MAGNETRON

MAGNETS, ELECTROMAGNETIC
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
A.P.W. Co., 72 W. Main St., Rockaway, N. J.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Alpha Scientific, Inc., 460 Roland Way, Oakland, Calif.
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Daylen Co., Box 527, South Gate, Calif.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
IMC Magnetics Corp., 1900 East 5th St., Tempe, Ariz.
Magnion, Inc., 144 Middlesex Tpke., Burlington, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Process & Instruments Corp., 1943 Broadway, Bklyn., N. Y.
Reed Switch Developments Co., Inc., 34 Lincoln Ave., Greenwich, Conn.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Analytical Instr. Div., 611 Hansen Way, Palo Alto, Cal.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Ventron Instrs. Corp., 144 Middlesex Tpke., Burlington, Mass.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.

MAGNETS, FOCUSING—SEE MAGNETS, PERMANENT

MAGNETS (LAB TYPE)
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y.
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Dura Magnetics, Inc., 5355 Whiteford Rd., Sylvania, Ohio
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Magnion, Inc., 144 Middlesex Tpke., Burlington, Mass.
Maryland Magnet Co., 5412 Gist Ave., Baltimore, Md.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Analytical Instr. Div., 611 Hansen Way, Palo Alto, Cal.
Ventron Instrs. Corp., 144 Middlesex Tpke., Burlington, Mass.

MAGNETS, PERMANENT
Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1212
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1219
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Bunting Magnetics Co., 9245 Cherry St., Franklin Park, Ill.
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.

Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Dura Magnetics, Inc., 5355 Whiteford Rd., Sylvania, Ohio
Edwards Co., Inc., 90 Connecticut Ave., Norwalk, Conn.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
General Electric Co., Metallurgical Prods. Dept., Box 237, Detroit, Mich.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
General Magnetic Corp., 10001 Erwin Ave., Detroit, Mich.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Hamilton Precision Metals, Div. Hamilton Watch Co., Lancaster, Pa.
Hamilton Watch Co., Lancaster, Pa.
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Magno-Ceram Co., 2614 S. Clinton Ave., S. Plainfield, N. J.
Maryland Magnet Co., 5412 Gist Ave., Baltimore, Md.
Moody Machine Prods. Co., Inc., Box 2248, Providence, R. I.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Permag Corp., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stackpole Carbon Co., Magnet Div., Kane, Pa.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.
3M Co., 3M Center, St. Paul, Minn.
3M Co., DM&S Div., 5178 Crookshank Rd., Cincinnati, Ohio
Trico Fuse Mfg. Co., 2948 North 5th St., Milwaukee, Wis.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.

MAGNETS, SUPERCONDUCTING

Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Magnion, Inc., 144 Middlesex Tpke., Burlington, Mass.
Ogallala Electronics Mfg. Inc., Box 59, Ogallala, Neb.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Ventron Instrs. Corp., 144 Middlesex Tpke., Burlington, Mass.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.

MAGNIFYING GLASSES, INSPECTION—ALSO SEE LAMPS, MAGNIFYING

Agfa-Gevaert, Inc., 275 North St., Teterboro, N. J.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Buhl Optical Co., 1009 Beech Ave., Pittsburgh, Pa.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Dazor Mfg. Corp., 4455-99 Duncan Ave., St. Louis, Mo.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Ednalite Research Corp., 200 N. Water St., Peekskill, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Glidelite Inds., Inc., 180 Central Ave., Hackensack, N. J.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Moffatt Prods., Inc., 727 Winnetka Ave., N., Minneapolis, Minn.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

MARKER STRIPS—SEE STRIPS, MARKER & FANNING

MARKERS, DRY TRANSFER—SEE DRY TRANSFER LETTERS—ALSO SEE DRAFTING SYMBOLS; LABELS, PRESSURE-SENSITIVE

MARKERS, IDENTIFICATION—SEE LABELS & NAMEPLATES

MARKERS, LUMINOUS

Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
GM Nameplate, Inc., 2040 15th Ave., W., Seattle, Wash.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
3M Co., 3M Center, St. Paul, Minn.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.

MARKERS, R-F—SEE GENERATORS, MARKER

MARKERS, TERMINAL—SEE KITS, MARKING, ETC.

MARKERS, WIRE, TAB & SLEEVE—SEE WIRE MARKERS

MARKING INKS—SEE INKS, MARKING

MASERS

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

MASK ALIGNMENT & EXPOSURE SYSTEMS—SEE MACHINES, MASK ALIGNMENT & EXPOSURE

MASKING FILMS—SEE FILMS, MASKING

MASKS, APERTURE, COLOR T.V

Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Conforming Matrix Corp., Box 37, Sta. G, Toledo, Ohio
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.

MASKS, FABRICATION, DEPOSITION—SEE SERVICES, MASK MAKING

MASTS, ANTENNA—SEE ANTENNA TOWERS & SUPPORTS

MATERIAL THICKNESS INDICATORS—SEE INDICATORS, MATERIAL THICKNESS

MATERIALS, ACOUSTIC, SOUND-ABSORBING

Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Acoustone Corp., Div. of Newcastle Fabrics, 80 Wythe Ave., Brooklyn, N. Y.
Air-O-Plastik Corp., Asia Place, Carlstadt, N. J.
American Smelting & Refining Co., 120 Broadway, New York, N. Y.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
GAF Corp., 140 West 51 St., New York, N. Y.
General Acoustics Corp., 12248 Santa Monica Blvd., Los Angeles, Calif.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Hartley Products Corp., Barnert Pl., Hohokus, N. J.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Lord Mfg. Co., 1635 West 12th St., Erie, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

MATERIALS, CONDUCTIVE PLASTIC

Chomerics, Inc., 85 Mystic St., Arlington, Mass. .. p 1639, 1640, 1642
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
New England Instrument Co., 14 Kendall Lane, Natick, Mass. .. p 2488
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Isochem Resins Co., Cook St., Lincoln, R. I.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

MATERIALS, ELECTROMAGNETIC WAVE ABSORBING—ALSO SEE COATINGS

Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
Blocksom & Co., P.O. Box 300, Michigan City, Ind.
Electronautics, Newtown Rd., Littleton, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.

MATERIALS, FERRITE—ALSO SEE FERRITE PARTS

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y. .. p 1645
Stackpole Carbon Co., Electronic Components Div., St. Marys, Pa.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Columbian Carbon Co., 380 Madison Ave., New York, N. Y.
Countis Industries, Box 1444, San Luis Obispo, Calif.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Data Magnetics Corp., 5441 West 104th St., Los Angeles, Calif.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fair-Rite Prods Corp., 1 Commercial Row, Wallkill, N. Y.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Insaco, Inc., Box 442, Quakertown, Pa.
International Precision Ferrite, Inc., 573 Albany Ave. Ext., Kingston, N. Y.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magno-Ceram Co., 2614 S. Clinton Ave., S. Plainfield, N. J.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.
Trans-Tech, Inc., P.O. Box 457, 12 Meem Ave., Gaithersburg, Md.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio

MATERIALS, GARNET—ALSO SEE GARNET PARTS

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y. .. p 1645

MEMORY ARRAYS, PLATED WIRE

Scientific-Atlanta Inc., Box 13854, Atlanta, Ga.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Barton Mines Corp., North Creek, N. Y.
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Countis Industries, Box 1444, San Luis Obispo, Calif.
International Precision Ferrite, Inc., 573 Albany Ave. Ext., Kingston, N. Y.
Microwave Chemicals Lab., Inc., 282 Seventh Ave., New York, N. Y.
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Trans-Tech, Inc., P.O. Box 457, 12 Meem Ave., Gaithersburg, Md.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio

MATERIALS, GRAPHITE

Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y. .. p 1645
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.

MATERIALS, SELF-LUBRICATING

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Cerac, Inc., Box 597, Butler, Wisc.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Dixon Corp., Metacom Ave., Bristol, R. I.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
GAF Corp., 140 West 51 St., New York, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Modern Industrial Plastics, 3337 N. Dixie Dr., Dayton, Ohio
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Pure Carbon Co., Inc., 441 Hall Ave., St. Marys, Pa.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

MATRICES, COMPUTER—ALSO SEE BOARDS, PROGRAMMING

California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y. ..... p 918
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2761
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif. .. p 1407
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 912
Mac Panel Co., Box 5027, High Point, N. C. ..... p 920, 921
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2761
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Virginia Panel Corp., Box 1106, Waynesboro, Va. ..... p 1008
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
EDP Corp., Box 6485, Orlando, Fla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

MASTER ANTENNA TV SYSTEMS & EQUIPMENT

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Gavin Instrs., Inc., Box 413, Somerville, N. J.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Western Elctrn. Inds., 72 N. Broadway, Yonkers, N. Y.

MEASURING WIRE, GEAR—SEE GEAR MEASURING WIRE

MECHANICAL READOUTS—SEE READOUTS, ELECTROMECHANICAL

MEDICAL ELECTRONIC RESEARCH EQUIPMENT—SEE SPECIFIC TYPES

MEGAPHONES, ELECTRICAL—SEE COMM. SYSTEMS, PORTABLE

MEMORY ARRAYS, CORE

Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Fabri-Tek, Inc., 5901 S. County Rd. #18, Minneapolis, Minn.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.

MEMORY ARRAYS, PLATED WIRE

Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.

MEMORY ARRAYS, THIN-FILM, PLANAR

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Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.

MEMORY PLANES, CORE
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.

MEMORY PLANES, PLATED WIRE
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.

MEMORY STACKS, CORE
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.

MEMORY STACKS, PLATED WIRE
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.

MEMORY SYSTEMS, CORE
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif. ..... p 814
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Fabri-Tek, Inc., 5901 S. County Rd. 18, Minneapolis, Minn.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Ferroxcube Corp., Systems Div., 5455 S. Valentia Way, Englewood, Colo.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.

MEMORY SYSTEMS, DELAY LINE
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1155
Digital Devices Div., 200 Michael Dr., Syosset, N. Y. ..... p 1162

MEMORY SYSTEMS, DISC
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.

MEMORY SYSTEMS, DRUM
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.

MEMORY SYSTEMS, INTEGRATED CIRCUIT
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Ferroxcube Corp., Systems Div., 5455 S. Valentia Way, Englewood, Colo.

MEMORY SYSTEMS, TAPE
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif. p 799
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.

MEMORY SYSTEMS, THIN-FILM, PLANAR
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.

MEMORY SYSTEMS, THIN-FILM, PLATED WIRE
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Ferroxcube Corp., Systems Div., 5455 S. Valentia Way, Englewood, Colo.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.

METAL COMPOUNDS, FOILS, POWDERS, SHEET, STOCK
Chomerics, Inc., 85 Mystic St., Arlington, Mass.
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y. .. p 1645
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Amax Aluminum/Foil Prods., 6106 S. Broadway, St. Louis, Mo.
American Metal Climax, Inc., 1270 Ave. of The Americas, N.Y., N.Y.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Glidden-Durkee Div., 900 Union Commerce Bldg., Cleveland, Ohio
Goldak Co., Inc., 1101-A Air Way, Glendale, Calif.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Infinetics, Inc., Electro-Magnetic Div., 1601 Jessup St., Wilmington, Dela.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kennametal Inc., Lloyd Ave., Latrobe, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Materials Technology, Inc., Box 187, Somerset, N. J.
Matthey Bishop, Inc., Malvern, Pa.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Ventron Corp., Congress St., Beverly, Mass.
Wellington Technical Inds., Inc., 55 Honeck St., Englewood, N. J.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

METAL OXIDES
American Feldmuehle Corp., Box 2160, Glenbrook, Conn. ..... p 1576
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1643
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal.
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y. .. p 1645
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Metal Climax, Inc., 1270 Ave. of The Americas, N.Y., N.Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Baker, J. T. Chemical Co., Phillipsburg, N. J.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Chemical Commerce, 123 Sussex Ave., Newark, N. J.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Diamonite Products Mfg. Co., Div. U. S. Ceramic Tile Co., Shreve, Ohio
Dow Chemical Co., Midland, Mich.
Glidden-Durkee Div., 900 Union Commerce Bldg., Cleveland, Ohio
Grace, W. R. & Co., 4000 N. Hawthorne St., Chattanooga, Tenn.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Harmon, Lichtenstein & Co., 26 Broadway, New York, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kennametal Inc., Lloyd Ave., Latrobe, Pa.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Michigan Chemical Corp., 351 E. Ohio St., Chicago, Ill.
Michigan Chemical Corp., Rare Earth Sales, 351 E. Ohio St., Chicago, Ill.
Norton Co., 1 New Bond St., Worcester, Mass.
Nuclear Element Corp., 420 S. McKean St., Butler, Pa.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Union Carbide Corp., Elctrns. Div., Crystal Prods. Dept., 8888 Balboa Ave., San Diego, Cal.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Ventron Corp., Congress St., Beverly, Mass.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.

METAL PARTS, CAST
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Bean, Morris & Co., Hyde Rd., Yellow Springs, Ohio
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cerro Corp., 300 Park Ave., New York, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Dixon Sintaloy, Inc., 535 Hope St., Stamford, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Hadlock & Temte, Inc., 3332 W. Franklin Blvd., Chicago, Ill.
Hitchiner Mfg. Co., Inc., Box 232, Milford, N. H.
Investment Casting Co., 60 Brown Ave., Springfield, N. J.
Janney Cylinder Co., 7401 State Rd., Philadelphia, Pa.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Misco Div., Howmet Corp., 221 W. Webster Ave., Muskegon, Mich.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Rode Inc., 5 Green St., Woburn, Mass.
Ronson Metals Corp., 55 Manufacturers Pl., Newark, N. J.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Spring City Electrical Mfg. Co., Hall & Main Sts., Spring City, Pa.
Tickle, A. Engineering Works, Inc., 21 Delevan St., Brooklyn, N. Y.
Unimold Castings, 74 Tracey Rd., Huntingdon Valley, Pa.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

METAL PARTS, CHEMICALLY MILLED
Arnold Engineering Co., Box 6, Marengo, Ill. ..... p 1213
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Chemical & Aerospace Products, Inc., 231 E. Lomita, Wilmington, Calif.
Chemical Micro Milling Co., Box 770, Camden, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Etchit Inc., 643 - 13th Ave., S., Hopkins, Minn.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
Golden Technology, Inc., 240 Barham Ave., Santa Rosa, Calif.
Hamilton Watch Co., Lancaster, Pa.
Hartzell Elctrns., Inc., 5200 West 74th St., Minneapolis, Minn.
Komak, Inc., 9th & Ontario Sts., Philadelphia, Pa.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.
Techniques Inc., 235 Jackson St., Englewood, N. J.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.

METAL PARTS, DEEP DRAWN
American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J.
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Alpha Products Inc., 6825 S. Chicago Ave., Chicago, Ill.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Baumker Mfg. Co., 5144 Enterprise, Toledo, Ohio
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Clover Industries Div., 600 Young St., Tonawanda, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eastern Tool & Mfg. Co., 1 Montgomery St., Belleville, N. J.
Eimac, 301 Industrial Way, San Carlos, Calif.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Johnson & Hoffman Mfg. Co., 40 Voice Rd., Carle Place, N. Y.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
King Laboratories, Inc., 127 Solar St., Syracuse, N. Y.
Kling Metal Spinning & Stamping Corp., 247 Centre St., New York, N .Y.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Mirro Aluminum Co., Manitowoc, Wisc.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Romac Electronics, Inc., 48-01 25th Ave., Long Island City, N. Y.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Sexton Can Co., Inc., 31 Cross St., Everett, Mass.
Sinclair Mfg. Co., Chartley, Mass.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Stanley Industrial Hardware Div., Stanley Works, New Britain, Conn.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Vernitron Electrical Components, Box 878, Norwalk, Conn.
Volkert Stampings, Inc., 222-34 96th Ave., Queens Village, N. Y.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

METAL PARTS, LAMINATED
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Baumker Mfg. Co., 5144 Enterprise, Toledo, Ohio
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Clevite, Cleveland Graphite Bronze, 17000 St. Clair Ave., Cleveland, O.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eldre Components, Inc., 1239 University Ave., Rochester, N. Y.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
HPL Jersey Co., 1087 Globe Ave., Mountainside, N. J.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
Laminated Shim Co., Inc., 48 Union St., Glenbrook, Conn.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.

METAL PARTS, MACHINED
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Falstrom Co., 174 Falstrom Ct., Passaic, N. J.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2519
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.

Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Adjustable Bushing Corp., 11905 Vose St., N. Hollywood, Calif.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
Aero Vac Corp., Box 448, Troy, N. Y.
Aldrich, C. G. Mfg. Corp., Box 312, Sugar Grove, Pa.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Associated Mfg. Co., 2414 Lawrence Ave., Chicago, Ill.
Austin Continental Industries, Inc., 3636 N. Talman Ave., Chicago, Ill.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
Baumker Mfg. Co., 5144 Enterprise, Toledo, Ohio
Bell Fasteners Corp., 352 Evelyn St., Paramus, N. J.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Burtek, Inc., Box 1677, Tulsa, Okla.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Diebel Mfg. Co., 6505 Oakton St., Morton Grove, Ill.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Electronic Parts Mfg. Co., Inc., 508-10 25th St., Union City, N. J.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Federal Machine Co., Inc., 807 Garfield Ave., Jersey City, N. J.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Fitchburg Engrg. Corp., Cleghorn St., Fitchburg, Mass.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gyrotronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Industrial Tools, Inc., 201 Bryant St., Ojai, Calif.
Inland Manufacturing Co., 1108 Jackson St., Omaha, Nebr.
Janney Cylinder Co., 7401 State Rd., Philadelphia, Pa.
Jansen Electronics Mfg., Inc., 2233 University Ave., St. Paul, Minn.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lavezzi Machine Works, Inc., 4635 W. Lake St., Chicago, Ill.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Lockhart Industries, Inc., 15707 Texaco Ave., Paramount, Calif.
M-T Electronics Co., 536 Lewelling Blvd., San Leandro, Calif.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
McNally Bros. Mach. & Gear Co., 1145 E. 79th St., Minneapolis, Minn.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metalcraft, Inc., Roosevelt Field, Garden City, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Morris, J. I. Co., 372 Elm St., Southbridge, Mass.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Ostby & Barton Co., Box 6267, Providence, R. I.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Philips Metalonics, 888 S. Columbus Ave., Mt. Vernon, N. Y.
Principal Mfg. Corp., 2701 Gardner Rd., Broadview, Ill.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Ragen Precision Inds., Inc., 9 Porete Ave., N. Arlington, N. J.
Red Devil Mfg. Co., Inc., 1416 N. Ogden Ave., Chicago, Ill.
Romac Electronics, Inc., 48-01 25th Ave., Long Island City, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Tickle, A. Engineering Works, Inc., 21 Delevan St., Brooklyn, N. Y.
Torrington Co., Box 1008, Torrington, Conn.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tridair Industries, 3000 W. Lomita Bl., Torrance, Cal.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Upson Tools, Inc., Box 4750, Rochester, N. Y.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wood, C. N. Mfg. Co., Rte. 332, E., Newtown, Pa.
Youngwood Electronic Metals, Inc., 302 N. Fifth St., Youngwood, Pa.

METAL PARTS, POWDERED

Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Barden Corp., 200 Park Ave., Danbury, Conn.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Clevite Ltd., 1177 Talbot St., St. Thomas, Ont., Can.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dixon Sintaloy, Inc., 535 Hope St., Stamford, Conn.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Ferraloy, Inc., W. Market St., Salem, Ind.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
General Electric Co., Metallurgical Prods. Dept., Box 237, Detroit, Mich.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Kwikset Powdered Metal Prods., 516 E. Santa Ana St., Anaheim, Calif.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mallory Metallurgical Co., 3029 E. Washington St., Indianapolis, Ind.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
National Moldite Co., Inc., 250 South St., Newark, N. J.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Philips Metalonics, 888 S. Columbus Ave., Mt. Vernon, N. Y.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
St. Mary's Carbon Co., 1939 State Rd., St. Marys, Pa.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.

METAL PARTS, SCREW MACHINE

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Concord Electronics Corp., 37 Great Jones St., New York, N. Y. p 891
Dow-Key Co., 2260 Industrial La., Broomfield, Colo.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y. p 1171
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass. .... p 1320
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas ..... p 2628
U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1003
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Abscoa Industries, 1071 W Arbor Vitae, Inglewood, Calif.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Adjustable Bushing Corp., 11905 Vose St., N. Hollywood, Calif.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
American Metal Climax, Inc., 1270 Ave. of The Americas, N.Y., N.Y.
Associated Mfg. Co., 2414 Lawrence Ave., Chicago, Ill.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Baumker Mfg. Co., 5144 Enterprise, Toledo, Ohio
Bell Fasteners Corp., 352 Evelyn St., Paramus, N. J.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Celestial Components, Inc., Box 4035, Covina, Calif.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Cerro Corp., 300 Park Ave., New York, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Continental Swiss Prec. Products, 71 Romanelli Ave., S. Hackensack, N. J.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Davis & Hemphill, Inc., 2000 Furnace Ave., Elkridge, Md.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
General Mfg. Co., 724 Ruberta Ave., Glendale, Calif.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Inland Manufacturing Co., 1108 Jackson St., Omaha, Nebr.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
K-W Engineering Works, N50, W16328 Pin Oak Ct., Menomonee Falls, Wisc.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Larsen Importing Co., 140 Nassau St., New York, N. Y.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Mercury Div., 10459 W. Jefferson Blvd., Culver City, Calif.

METAL PARTS, STAMPED

Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Morris, J. I. Co., 372 Elm St., Southbridge, Mass.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nutmeg Screw Machine Products, P.O. Box 1470, Waterbury, Conn.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Ostby & Barton Co., Box 6267, Providence, R. I.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Red Devil Mfg. Co., Inc., 1416 N. Ogden Ave., Chicago, Ill.
Rosan, Inc., 2901 West Coast Hwy., Newport Beach, Calif.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Sinclair Mfg. Co., Chartley, Mass.
Standard Screw Co., 2701 Washington Blvd., Bellwood, Ill.
Stanley Industrial Components Div., Stanley Works, Forestville, Conn.
Star Stainless Screw Co., Box 222, Totowa, N. J.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Torrington Co., Box 1008, Torrington, Conn.
Tridair Industries, 3000 W. Lomita Bl., Torrance, Cal.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Upson Tools, Inc., Box 4750, Rochester, N. Y.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.

METAL PARTS, SPUN

American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Kling Metal Spinning & Stamping Corp., 247 Centre St., New York, N .Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metalcraft, Inc., Roosevelt Field, Garden City, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Romac Electronics, Inc., 48-01 25th Ave., Long Island City, N. Y.
Rotary Co., Inc., 1746 Dale Rd., Buffalo, N. Y.

METAL PARTS, STAMPED

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J.
Art Wire & Stamping Co., 28 Boyden Pl., Newark, N. J. ..... p 1635
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Falstrom Co., 174 Falstrom Ct., Passaic, N. J.
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2519
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Admiral Tool & Manufacturing Co., 3652 N. Talman, Chicago, Ill.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Aldrich, C. G. Mfg. Corp., Box 312, Sugar Grove, Pa.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Alpha Products Inc., 6825 S. Chicago Ave., Chicago, Ill.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
American Airflow Corp., 515 W. 43 St., Chicago, Ill.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Barden Corp., 200 Park Ave., Danbury, Conn.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Baumker Mfg. Co., 5144 Enterprise, Toledo, Ohio
Bell Fasteners Corp., 352 Evelyn St., Paramus, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.

METAL PARTS, STAMPED (Cont'd)

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Clover Industries Div., 600 Young St., Tonawanda, N. Y.
Connor Spring & Mfg. Co., 75 14th St., San Francisco, Calif.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Die-Mate Corp., 9230 Chestnut St., Franklin Park, Ill.
Diebel Mfg. Co., 6505 Oakton St., Morton Grove, Ill.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Dolin Metal Products, Inc., 315 Lexington Ave., Brooklyn, N. Y.
Dudek & Bock Spring Mfg. Co., 4014 W. Grand Ave., Chicago, Ill.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Eastern Tool & Mfg. Co., 1 Montgomery St., Belleville, N. J.
Electro Chemical Engraving Co., 1100 Brook Ave., Bronx, N. Y.
Electronic Parts Mfg. Co., Inc., 508-10 25th St., Union City, N. J.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Etchit Inc., 643 - 13th Ave., S., Hopkins, Minn.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Federal Stampings, 2000 West 94th St., Minneapolis, Minn.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
General Metals, Inc., 2200 Fairfax Rd., Greensboro, N. C.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gyrotronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
H. K. Metalcraft Mfg. Co., 35 Industrial Rd., Lodi, N. J.
HPL Jersey Co., 1087 Globe Ave., Mountainside, N. J.
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
Holmberg, Inc., 20 Melville Park Rd., Melville, N. Y.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Hunter Spring, One Spring Ave., Hatfield, Pa.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Johnson & Hoffman Mfg. Co., 40 Voice Rd., Carle Place, N. Y.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
King Laboratories, Inc., 127 Solar St., Syracuse, N. Y.
Kling Metal Spinning & Stamping Corp., 247 Centre St., New York, N .Y.
Laminated Shim Co., Inc., 48 Union St., Glenbrook, Conn.
M-T Electronics Co., 536 Lewelling Blvd., San Leandro, Calif.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Merco Prods. Co., Inc., 1298 Bethel Dr., Eugene, Ore.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Metalcraft, Inc., Roosevelt Field, Garden City, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mirro Aluminum Co., Manitowoc, Wisc.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Network Industries, Inc., Box 397, Bayonne, N. J.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Peerless Products Industries, 4210 W. Chicago Ave., Chicago, Ill.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Principal Mfg. Corp., 2701 Gardner Rd., Broadview, Ill.
Romac Electronics, Inc., 48-01 25th Ave., Long Island City, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Sinclair Mfg. Co., Chartley, Mass.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
South Shore Metal Prods., Inc., 88-90 Allen Blvd., Farmingdale, N. Y.
Stanley Industrial Components Div., Stanley Works, Forestville, Conn.
Stanley Industrial Hardware Div., Stanley Works, New Britain, Conn.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Titchener, E. H. & Co., 8 Titchener Pl., Binghamton, N. Y.
Torrington Co., Box 1008, Torrington, Conn.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Upson Tools, Inc., Box 4750, Rochester, N. Y.
Vernitron Electrical Components, Box 878, Norwalk, Conn.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Volkert Stampings, Inc., 222-34 96th Ave., Queens Village, N. Y.
W L S Stamping Co., 3292 E. 80th St., Cleveland, Ohio
Wabash Metal Products Co., Inc., 1569 Morris St., Wabash, Ind.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.
Winzeler Mfg. & Tool Co., 7355 W. Wilson Ave., Chicago, Ill.
Worcester Pressed Steel Co., 101 Barber Ave., Worcester, Mass.
Wrought Washer Mfg. Co., 2252 South Bay St., Milwaukee, Wis.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.
Youngwood Electronic Metals, Inc., 302 N. Fifth St., Youngwood, Pa.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.
Zims Manufacturing Co., 26 Paine Ave., Irvington, N. J.

METALS, CLAD

Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Englehard Minerals & Chemicals Corp., H. A. Wilson Dept., U.S. Rte. #22, Union, N. J. ..... p 1644
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Clevite, Cleveland Graphite Bronze, 17000 St. Clair Ave., Cleveland, O.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Materials Technology, Inc., Box 187, Somerset, N. J.
Montgomery Co., Windsor Locks, Conn.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Tricon Mfg. Co., 2325 Wisconsin Ave., Downer Grove, Ill.

METALS, HIGH PURITY

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1643
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y. .. p 1645
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Amax Aluminum/Foil Prods., 6106 S. Broadway, St. Louis, Mo.
American Metal Climax, Inc., 1270 Ave. of the Americas, N.Y., N.Y.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cerac, Inc., Box 597, Butler, Wisc.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Fairmount Chemical Co., Inc., 117 Blanchard St., Newark, N. J.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kennametal Inc., Lloyd Ave., Latrobe, Pa.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Michigan Chemical Corp., Rare-Earth Sales, 351 E. Ohio St., Chicago, Ill.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Nuclear Element Corp., 420 S. McKean St., Butler, Pa.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Ventron Corp., Congress St., Beverly, Mass.
Wellington Technical Inds., Inc., 55 Honeck St., Englewood, N. J.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

METALS, PRECIOUS—ALSO SEE POWDERS, PRECIOUS METAL

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O. p 1643
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Englehard Minerals & Chemicals Corp., H. A. Wilson Dept., U.S. Rte. #22, Union, N. J. ..... p 1644
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
American Metal Climax, Inc., 1270 Ave. of the Americas, N.Y., N.Y.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Attleboro Refining Co., 150 Union St., Attleboro, Mass.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cerac, Inc., Box 597, Butler, Wisc.
Cerro Corp., 300 Park Ave., New York, N. Y.
Chemical Commerce, 123 Sussex Ave., Newark, N. J.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Fairmount Chemical Co., Inc., 117 Blanchard St., Newark, N. J.
General Diode Corp., 18 South St., Framingham, Mass.
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Hamilton Precision Metals, Div. Hamilton Watch Co., Lancaster, Pa.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Technic, Inc., Box 965, Providence, R. I.
Tricon Mfg. Co., 2325 Wisconsin Ave., Downer Grove, Ill.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
United Refining & Smelting Co., 3700 N. Runge Ave., Franklin Pk., Ill.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

METALS, RARE

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Metal Climax, Inc., 1270 Ave. of the Americas, N.Y., N.Y.
American Potash & Chemical Corp., 3000 West 6th St., Los Angeles, Cal.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cerac, Inc., Box 597, Butler, Wisc.
Chemical Commerce, 123 Sussex Ave., Newark, N. J.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Grace, W. R. & Co., 4000 N. Hawthorne St., Chattanooga, Tenn.
Harmon, Lichtenstein & Co., 26 Broadway, New York, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
King Laboratories, Inc., 127 Solar St., Syracuse, N. Y.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Michigan Chemical Corp., 351 E. Ohio St., Chicago, Ill.
Michigan Chemical Corp., Rare Earth Sales, 351 E. Ohio St., Chicago, Ill.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
Ronson Metals Corp., 55 Manufacturers Pl., Newark, N. J.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Technic, Inc., Box 965, Providence, R. I.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Ventron Corp., Congress St., Beverly, Mass.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.

METALS, REFRACTORY

American Metal Climax, Inc., 1270 Ave. of the Americas, N.Y., N.Y.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cerac, Inc., Box 597, Butler, Wisc.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Cross, H. Co., 365 Park Ave., Weehawken, N. J.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Hamilton Precision Metals, Div. Hamilton Watch Co., Lancaster, Pa.
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kennametal Inc., Lloyd Ave., Latrobe, Pa.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Mallory Metallurgical Co., 3029 E. Washington St., Indianapolis, Ind.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
Norton Co., 1 New Bond St., Worcester, Mass.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Philips Metalonics, 888 S. Columbus Ave., Mt. Vernon, N. Y.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Rembar Co., Inc., 67 Main St., Dobbs Ferry, N. Y.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Ventron Corp., Congress St., Beverly, Mass.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

METALS, SEMICONDUCTOR—SEE CRYSTALS, SEMICONDUCTOR

METAL-TO-GLASS ALLOYS—SEE SEALS, GLASS-TO-METAL

METER CASES—SEE CASES, EQUIPMENT

METER CONTROLLERS—SEE RELAYS, METER

METER EXPANDERS—SEE MULTIPLIERS, METER

METER SHUNTS—SEE SHUNTS, METER

METER TESTERS—SEE TESTERS, METER

METERS, ACCELERATION

Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Metrix Instrument Co., P.O. Box 36501, Houston, Tex.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
B & F Instruments Inc., Cornwells Hgts., Pa.
Bell Aerosystems Co., 4515 Superior Ave., Cleveland, Ohio
Bendix Corp., Instruments & Life Support Div.,
2734 Hickory Grove Rd., Davenport, Iowa
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Impact-O-Graph Corp., 1762 East 18th St., Cleveland, Ohio
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
MB Electronics, Box 1825, New Haven, Conn.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.

METERS, ADMITTANCE

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Parzen Research, Inc., 48 Urban Ave., Westbury, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

METERS, AIR PERMEABILITY

Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.

METERS, AMPERE A-C

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Ammon Instrs., Inc., 345 Kelley St., Manchester, N. H. ..... p 1327
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
DVM Div., Darcy Inds., 1723 Cloverfield Blvd., Santa Monica, Calif. p 1362, 1363
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N.Y. p 1219, 1388
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1414, 1416
Modutec Inc., 18 Marshall St., Norwalk, Conn. ..... p 1445
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif. ..... p 1454
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1463
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. ... p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494, 1495
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. p 1521-1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1526, 1527
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Automatic Coil Mfg. Ltd., 50 Wingold Ave., Toronto, Ont., Canada
Bristol Co., Box 1790, Waterbury, Conn.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, AMPERE, D-C

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Ammon Instrs., Inc., 345 Kelley St., Manchester, N. H. ..... p 1327
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ..... p 1331
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Cohu Electronics Inc., Box 623, San Diego, Calif.
DVM Div., Darcy Inds., 1723 Cloverfield Blvd., Santa Monica, Calif. p 1362, 1363
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1414, 1416
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Modutec Inc., 18 Marshall St., Norwalk, Conn. ..... p 1444
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Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
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Power/Mate Corp., 163 Clay St., Hackensack, N. J. ..... p 2074
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1477
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. ... p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
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Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
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Wacline Inc., 35 S. St. Clair St., Dayton, Ohio .... p 1525, 1527, 1528
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Automatic Coil Mfg. Ltd., 50 Wingold Ave., Toronto, Ont., Canada
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dixson, Inc., Box 1449, Grand Junction, Colo.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, AMPERE, R-F

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1465
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494

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Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, AMPERE, TRUE RMS

Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1465
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, AMPERE-HOUR

Curtis Instruments, Inc., 200 Kisco Ave., Mt. Kisco, N. Y. ..... p 1364
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 2844
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, ATTENUATION

Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md. ... p 1529
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.

METERS, AUDIO LEVEL

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Modutec Inc., 18 Marshall St., Norwalk, Conn. ..... p 1444
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap. p 1753
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dixson, Inc., Box 1449, Grand Junction, Colo.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Northeast Electronics Corp., Box 649, Concord, N. H.

METERS, AUDIO LEVEL (Cont'd)

Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roveti Instruments, 238 West St., Annapolis, Md.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
United Telecontrol Electronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

METERS, CABLE TESTING—SEE TESTERS, CABLE

METERS, CAPACITANCE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1456
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tektronix, Inc., Box 500, Beaverton, Ore.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1547
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Foxboro, Foxboro, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, CAVITATION INTENSITY

Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.

METERS, CONDUCTANCE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
London Co., 811 Sharon Dr., Westlake, Ohio
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, CONDUCTIVITY—SEE INDICATORS, FLUID CONDUCTIVITY

METERS, COUNTING RATE, NUCLEAR

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Welex Electronics, Box 986, Silver Spring, Md.

METERS, DECIBEL INDICATING

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
London Co., 811 Sharon Dr., Westlake, Ohio
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. ... p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1524
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Northeast Electronics Corp., Box 649, Concord, N. H.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.

METERS, DISTORTION & NOISE

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1387
Heath Co., Dept. 180, Benton Harbor, Mich.
London Co., 811 Sharon Dr., Westlake, Ohio
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1468
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Northeast Electronics Corp., Box 649, Concord, N. H.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

METERS, DYNAMOMETER—SEE DYNAMOMETERS

METERS, EDGE-WISE

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H. ... p 1341
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. .. p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1521
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, ELAPSED TIME—SEE INDICATORS, ELAPSED TIME

METERS, ELECTROMETER

Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. .. p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Cary Instruments, 2724 So. Peck Rd., Monrovia, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roveti Instruments, 238 West St., Annapolis, Md.
Thomas Ind'l. Automation Ltd., Deansgate La., Timperley, Cheshire, Eng.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, ELECTRONIC MICROMETER—SEE MICROMETERS, ELECTRONIC

METERS, EVENTS-PER-UNIT-TIME—SEE COUNTERS, MECHANICAL: ETC.

METERS, FIELD STRENGTH

Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1490, 1491
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Defense Elctrns., Inc., Rockville, Md.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

METERS, FLUID FLOW

Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1669
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Bailey Meter Company, Wickliffe, Ohio
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Brooks Instrument Div., Emerson Elec. Co., Hatfield, Pa.
Carolina Medical Elctrns., Inc., U. S. 52 Expwy., King, N. C.
Cox Instrument, 15300 Fullerton, Detroit, Mich.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Dynasonics Corp., Box 672, Pipestone, Minn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Erdco Engrg. Corp., 136 Official Rd., Addison, Ill.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Fleetwood Labs Inc., 35 Rockwood Pl., New Rochelle, N. Y.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Foxboro, Foxboro, Mass.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ideas, Inc., 118 Grand Ave., Laramie, Wyo.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
National Instr. Labs., Inc., 12300 Park Lawn Dr., Rockville, Md.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
Selas Corp. of America, Box 200, Dresher, Pa.
Singer-General Precision, Inc., 808 Western Ave., Glendale, Calif.

Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
ThermoSystems, Inc., 2500 Cleveland Ave. N., St. Paul, Minn.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

METERS, FLUTTER & WOW

Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Video Research Corp., 761 N. Washington St., Rockville, Md.

METERS, FLUX

Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 1408
Lowell Elctrns. Corp., 9100 Terminal Ave., Skokie, Ill. ..... p 1431
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
All-State Welding Alloys Co., Inc., P.O. Box 350, White Plains, N. Y.
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Empire Scientific Corp., Indl. Instr. Div., 1055 Stewart Ave., Garden City, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.
Varian Assocs., Analytical Instr. Div., 611 Hansen Way, Palo Alto, Cal.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, F-M DEVIATION

Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Measurements, Box 180, Boonton, N. J. ..... p 1437
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1498
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Lampkin Labs., Inc., Perico Rd., Bradenton, Fla.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
New London Instrument Co., Box 189, New London, Conn.
Radio Specialty Mfg. Co., 2023 Southeast 6th Ave., Portland, Ore.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.

METERS, FREQUENCY

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif.
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1340
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1330
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
International Rectifier, 233 Kansas St., El Segundo, Calif.
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Measurements, Box 180, Boonton, N. J. ..... p 1437
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1490, 1498
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2792
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-che, Nerima-ku, Tokyo, Jap.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. p 1521-1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
Waveline Inc., Box 718, West Caldwell, N. J.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1546-1548
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Control Data Corp., 400 Border St., East Boston, Mass.
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lampkin Labs., Inc., Perico Rd., Bradenton, Fla.
Lavoie Labs., Div. Spedcor, Matawan-Freehold Rd., Morganville, N. J.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
New London Instrument Co., Box 189, New London, Conn.
Nord Instr. 422 Broad St., Salem, Va.
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Sell-Tronic Prods. Co., Inc., 138 31st Rd., Flushing, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sparton Corp., 2400 E. Ganson St., Jackson, Mich.
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, FREQUENCY DEVIATION

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif.
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1330
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Measurements, Box 180, Boonton, N. J. ..... p 1437
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1490, 1498
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Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tracor Inc., 6500 Tracor La., Austin, Texas
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530, 1531
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lampkin Labs., Inc., Perico Rd., Bradenton, Fla.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
New London Instrument Co., Box 189, New London; Conn.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

METERS, FREQUENCY, DIGITAL

Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. .... p 761
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1353
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024

METERS, GAUSS

Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Neutronic Corp., Box 625, St. Louis, Mo.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1546-1548
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Northeast Electronics Corp., Box 649, Concord, N. H.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
3M Co., 3M Center, St. Paul, Minn.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

METERS, GALVANOMETER

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Cohu Electronics Inc., Box 623, San Diego, Calif.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. ..... p 1403
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 2516
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. ..... p 1412
London Co., 811 Sharon Dr., Westlake, Ohio
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Rockland Labs., Inc., Box 57, Tappan, N. Y.
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. ... p 1522
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
New London Instrument Co., Box 189, New London, Conn.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, GAUSS

Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.

METERS, GAUSS (Cont'd)

Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y.
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Empire Scientific Corp., Indl. Instr. Div., 1055 Stewart Ave., Garden City, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Irwin Laboratories, Inc., 1238 S. Gerhart Ave., Los Angeles, Calif.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Magnetic Analysis Corp., 535 South 4 Ave., Mount Vernon, N. Y.
Permanent Magnet Co., Inc., The, 4437 Bragdon St., Indianapolis, Ind.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.
Varian Assocs., Analytical Instr. Div., 611 Hansen Way, Palo Alto, Cal.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.
Wharton Unitools, 8-10 Lake St., Moosup, Conn.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, GONIOMETER

Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn. p 2484, 2485
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

METERS, GRID DIP

Heath Co., Dept. 180, Benton Harbor, Mich.
Measurements, Box 180, Boonton, N. J. ..... p 1437
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1443
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.

METERS, HEAT TRANSFER (SEMICONDUCTOR)

International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

METERS, ILLUMINATED SCALE

Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Modutec Inc., 18 Marshall St., Norwalk, Conn. ..... p 1446, 1447
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, IMPEDANCE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Narda Microwave Corp., Plainview, N. Y.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

METERS, INDUCTANCE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. p 1502, 1503
Tektronix, Inc., Box 500, Beaverton, Ore.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, INFRARED

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Magnemetrics Div., Rockdale St., Worcester, Mass.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.

METERS, INTERMODULATION

Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Measurements, Box 180, Boonton, N. J. ..... p 1437
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.

METERS, KILOVOLT

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. ..... p 1402
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. .. p 967
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1478
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1495
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. .. p 1519
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1521
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1525
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, KILOWATT

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio .. p 1342, 1343
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1521
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, LASER ENERGY—SEE MONITORS, LASER ENERGY

METERS, LIGHT, (NON PHOTOGRAPHIC)

Gamma Scientific, Inc., Dept. 301, 2165 Kurtz St., San Diego, Calif. p 1778
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Optronics Inc., Box 584, Newburyport, Mass.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
Pacific Photometric Instrs., 3024 Ashby Ave., Berkeley, Calif.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photo Research Corp., 3000 N. Hollywood Way, Burbank, Calif.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Rockwell Engineering Co., 2125 East 45th St., Indianapolis, Ind.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, MEGOHM

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1325
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
CML Inc., 350 Leland Ave., Plainfield, N. J.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. ..... p 1402
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Neutronic Corp., Box 625, St. Louis, Mo.
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1449
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1456
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1477, 1478
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1500
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
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Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
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Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
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Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
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Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.
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Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
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A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Abtronics, Inc., Box 712, Livermore, Calif.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
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Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
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Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
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Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
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Shurite Meters, 428 Chapel St., New Haven, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Welex Electronics, Box 986, Silver Spring, Md.
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Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Dice, J. W., Co., 16 Highwood Ave., Englewood, N. J.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Meditor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

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IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
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Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

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Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
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Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Waveline Inc., Box 718, West Caldwell, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md. ... p 1529
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

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Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
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A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Bristol Co., Box 1790, Waterbury, Conn.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
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Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
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Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
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RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.

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Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
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Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Radiation Devices Co., Box 8450, Baltimore, Md.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

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Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Ammon Instrs., Inc., 345 Kelley St., Manchester, N. H. ..... p 1327
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
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Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1049
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Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. .. p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
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Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

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Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Measurements, Box 180, Boonton, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1521
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lampkin Labs., Inc., Perico Rd., Bradenton, Fla.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
New London Instrument Co., Box 189, New London, Conn.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.

METERS, MOISTURE (ELECTRONIC)— SEE INDICATORS, MOISTURE

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Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1462
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. .. p 1484
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, MULTITESTER

Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
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Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
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California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
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Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
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Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1449
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1477, 1478
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio p 2842, 2843
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1546, 1548
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Abbey Electronics Div., 200 Shames Dr., Westbury, N. Y.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Arkay International, 2372-82 Linden Blvd., Brooklyn, N. Y.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Delta Products, Inc., P.O. Box 1147, Grand Junction, Colo.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Epic, Inc., 150 Nassau St., New York, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St., Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Model Rectifier Corp., 5300 21st Ave., Brooklyn, N. Y.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Radiation Devices Co., Box 8450, Baltimore, Md.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, MULTITESTER (DIGITAL)

Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Mesa Co., Inc., 218-220 Mill St., Bristol, Pa.
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1449
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1546, 1548
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

METERS, MULTITESTER, (POTENTIOMETRIC)

Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Neutronic Corp., Box 625, St. Louis, Mo.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1548
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio

METERS, NANOAMPERE

Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Neutronic Corp., Box 625, St. Louis, Mo.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif. ..... p 1454
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.

METERS, NANOVOLT

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.

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Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
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Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
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Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1491
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

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API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Ammon Instrs., Inc., 345 Kelley St., Manchester, N. H. ..... p 1327
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ..... p 1331
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412-1414, 1416
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Modutec Inc., 18 Marshall St., Norwalk, Conn. ..... p 1444, 1446
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
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RFL Inds., Inc., Powerville Rd., Boonton, N. J.
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Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1497
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Theta Instrument Corp., Fairfield, N. J.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1522
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Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1547, 1548
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Bristol Co., Box 1790, Waterbury, Conn.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
MB Electronics, Box 1825, New Haven, Conn.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Precision Standards Corp., Box 8361, San Marino, Calif.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

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Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1325
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Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Cohu Electronics Inc., Box 623, San Diego, Calif.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J. p 1571
Heath Co., Dept. 180, Benton Harbor, Mich.
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RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1478
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Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1500
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1548
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A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Anderson, W. E., Inc., 320E West 80th St., Kansas City, Mo.
Automatic Coil Mfg. Ltd., 50 Wingold Ave., Toronto, Ont., Canada
Bliss Electronic Corp., Box 366, Sussex, N. J.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, PANEL (d'ARSONVAL MOVEMENT)

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Ammon Instrs., Inc., 345 Kelley St., Manchester, N. H. ..... p 1327
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H. ... p 1341
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388

METERS, PEAK POWER

Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Modutec Inc., 18 Marshall St., Norwalk, Conn. .... p 1444, 1446, 1447
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1463-1465
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. ... p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1521
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1524-1528
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Bristol Co., Box 1790, Waterbury, Conn.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, PANEL (DIGITAL)

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1323
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla.
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 1365
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Mesa Co., Inc., 216-220 Mill St., Bristol, Pa. ..... p 1195
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif. ..... p 1454
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Trymetrics Corp., 204 Babylon Tpke., Roosevelt, N. Y. .... p 1517
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1549
Abbey Electronics Div., 200 Shames Dr., Westbury, N. Y.
Analogic Co., 296 Newton St., Waltham, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Foxboro, Foxboro, Mass.
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio

METERS, PEAK POWER

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio .. p 1342, 1343
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1372
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047, 2844
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1692
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio

METERS, PEAK POWER (Cont'd)

Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.

METERS, PERIOD

Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Neutronic Corp., Box 625, St. Louis, Mo.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.

METERS, PERMEAMETER

Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 1408
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Thomas & Skinner, Inc., 1100 East 23rd St., Indianapolis, Ind.

METERS, PHASE-ANGLE

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Control Electronics Co. Inc., 153 Florida St., Farmingdale, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1453
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1467
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1497
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. ..... p 2792
Theta Instrument Corp., Fairfield, N. J. ..... p 1514
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. ..... p 2109
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1521
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1549
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Collins Radio Co., Dallas, Texas
Cox, C. E. Co., 1514-C N. Harper St., Santa Ana, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, PHASE VECTOR VOLT

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Theta Instrument Corp., Fairfield, N. J.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

METERS, PHOTOELECTRIC, REFLECTION

Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

METERS, PICOAMPERE

Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

METERS, POCKET

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, POWER DENSITY

Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.

METERS, POWER FACTOR

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1325
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. p 1521, 1522
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Bristol Co., Box 1790, Waterbury, Conn.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, POWER, R-F

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio .. p 1342, 1343
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1372
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Heath Co., Dept. 180, Benton Harbor, Mich.
Measurements, Box 180, Boonton, N. J.
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1692
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Comdel Inc., Beverly Airport, Beverly, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gillette Elctrn. Prods. Co., 201 Laurel St., Beverly, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
MSI Electronics, Inc., 34-32 57th St., Woodside, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

METERS, PYROMETER

API Instruments Co., 11855 Chillicothe Rd., Chesterland, Ohio p 1322
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H. ... p 1341
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1049
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bristol Co., Box 1790, Waterbury, Conn.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electronic Development Labs., Inc., 19 Newton Rd., Plainview, N. Y.
Epic, Inc., 150 Nassau St., New York, N. Y.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hydor Therme Corp., Airport Hwy., Pennsauken, N. J.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, Q

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
Marconi Instrs., 111 Cedar La., Englewood, N. J.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
New London Instrument Co., Box 189, New London, Conn.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.

METERS, RADIATION, NUCLEAR—SEE COUNTERS, GEIGER; COUNTERS, SCINTILLATION

METERS, RATIO

Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Cohu Electronics Inc., Box 623, San Diego, Calif.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374, 1375
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412-1414
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1453
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1497, 1498
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1546, 1548
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md. ... p 1529
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.

Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

METERS, RECORDERS AND COMPARATORS, P-H

Heath Co., Dept. 180, Benton Harbor, Mich.
London Co., 811 Sharon Dr., Westlake, Ohio
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Analytical Measurements Inc., 31 Willow St., Chatham, N. J.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, RECORDING

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1389
Houston Instr., 4950 Terminal Ave., Bellaire, Texas ..... p 784, 785
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Abbey Electronics Div., 200 Shames Dr., Westbury, N. Y.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, REFLECTOMETER

Gamma Scientific, Inc., Dept. 301, 2165 Kurtz St., San Diego, Calif. p 1778
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

METERS, REFRACTOMETER

Electron-Machine Corp., Box M, Umatilla, Fla.

METERS, R-F

Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Alban Electronics, 111 Cedar La., Englewood, N. J.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

METERS, RFI

Electro/Data Inc., 3121 Benton St., Garland, Tex.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1491
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

METERS, ROENTGEN—SEE METERS, X-RAY INTENSITY

METERS, S-UNITS

Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, SNAP-AROUND

Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Columbia Electric Mfg. Co., 4519 Hamilton Ave., Cleveland, Ohio
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, SOUND VELOCITY

NUS Corp., Box 248, Paramus, N. J.

METERS, SPECTRAL

Electro/Data Inc., 3121 Benton St., Garland, Tex.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.

METERS, STANDING WAVE RATIO

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Narda Microwave Corp., Plainview, N. Y.
Phiico/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1692
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md. ... p 1529
Aircom, Inc., Rte. 16B, Union, N. H.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gillette Elctrn. Prods. Co., 201 Laurel St., Beverly, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Radiation Devices Co., Box 8450, Baltimore, Md.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

METERS, TACHOMETER—SEE TACHOMETERS, ELECTRONIC

METERS, TEMPERATURE, DIAL-TYPE (CONTACTING)

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ..... p 1331
Ectron Corp., 8070 Engineer Rd., San Diego, Calif.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1668
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans.
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I.

METERS, THERMAL TRANSFER

Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1457
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
RFL Inds., Inc., Thermocontrol Div., Powerville Rd., Boonton, N. J. p 1473
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1522
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Bailey Meter Company, Wickliffe, Ohio
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Brookline Instr. Co., Inc., 33 Virginia Rd., White Plains, N. Y.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Fenwal, Inc., Main St., Ashland, Mass.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Marshall Instrs., Inc., 14203 Bessemer St., Van Nuys, Calif.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Ogden Technology Labs., Inc., 573 Monterey Pass Rd., Monterey Pk., Cal.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Pacific Transducer Corp., 2301 Federal, Los Angeles, Calif.
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
RDF Corp., 23 Elm Ave., Hudson, N. H.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Temtech, 2208 S. Wright, Santa Ana, Calif.
United Electric Controls Co., 85A School St., Watertown, Mass.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

METERS, TEMPERATURE, DIAL-TYPE (NONCONTACTING)—SEE PYROMETERS

METERS, TEMPERATURE, DIGITAL (CONTACTING)

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1406
Neutronic Corp., Box 625, St. Louis, Mo.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1457
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Analogic Co., 296 Newton St., Waltham, Mass.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Temtech, 2208 S. Wright, Santa Ana, Calif.

METERS, TENSION

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
Electromatic Equip. Co., 562 Albemarle Rd., Cedarhurst, N. Y.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Master Tower Co., 121 Main St., Sioux City, Iowa
Orbitran Co., Inc., 11487 Woodside Ave., Lakeside, Calif.
Pacific Scientific Co., Aerospace Div., 1346 S. State College Blvd., Anaheim, Calif.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

METERS, THERMAL COEFFICIENT OF EXPANSION

Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.

METERS, THERMAL TRANSFER

Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal.

METERS, THERMAL TRANSFER (Cont'd)

Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Nanmac Corp., 9 Mayhew Rd., Framingham, Mass.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

METERS, THERMOCOUPLE

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Ectron Corp., 8070 Engineer Rd., San Diego, Calif.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1406
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Narda Microwave Corp., Plainview, N. Y.
Penn Airborne Products Co., Industrial Highway, Southampton, Pa.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1049
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bristol Co., Box 1790, Waterbury, Conn.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Electronic Development Labs., Inc., 19 Newton Rd., Plainview, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Foxboro, Foxboro, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Nanmac Corp., 9 Mayhew Rd., Framingham, Mass.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, TILT

Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1481

METERS, TIME DELAY RATE

E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.

METERS, TIME INTERVAL—SEE TIMERS, INTERVAL

METERS, TORQUE—SEE INDICATORS, TORQUE

METERS, ULTRAVIOLET

Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

METERS, VACUUM TUBE VOLT (VTVM)

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ..... p 1331
Cohu Electronics Inc., Box 623, San Diego, Calif.
Hathaway, 5250 E. Evans Ave., Denver, Colo.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Marconi Instrs., 111 Cedar La., Englewood, N. J.
Measurements, Box 180, Boonton, N. J. ..... p 1437
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1478
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. ..... p 2109
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arkay International, 2372-82 Linden Blvd., Brooklyn, N. Y.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan

METERS, VIBRATION

Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Metrix Instrument Co., P.O. Box 36501, Houston, Tex.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dri-Clave Corp., 54 Kinkel St., Westbury, N. Y.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Epic, Inc., 150 Nassau St., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
International Research & Dev. Corp., 6150 Huntley Rd., Worthington, Ohio
Larson Aero Development, Box 135, Concord, Calif.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
MB Electronics, Box 1825, New Haven, Conn.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.

METERS, VISCOSITY (ELECTRONIC)—SEE INDICATORS, VISCOSITY

METERS, VOLT

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Ammon Instrs., Inc., 345 Kelley St., Manchester, N. H. ..... p 1327
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ..... p 1331
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
DVM Div., Darcy Inds., 1723 Cloverfield Blvd., Santa Monica, Calif. p 1362, 1363
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J. p 1571
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
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General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1414, 1416
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Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2025, 2027, 2028, 2037
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Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Modutec Inc., 18 Marshall St., Norwalk, Conn. ..... p 1445
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Newport Labs., Inc., 830 E. Young St., Santa Ana, Calif. ..... p 1454
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1449
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1453
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1464
Power/Mate Corp., 163 Clay St., Hackensack, N. J. ..... p 2074
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1477, 1478
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
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Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. .. p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1492-1495
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Theta Instrument Corp., Fairfield, N. J.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. ..... p 2109
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
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Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1531
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1546, 1548
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Automatic Coil Mfg. Ltd., 50 Wingold Ave., Toronto, Ont., Canada
Bristol Co., Box 1790, Waterbury, Conn.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Columbia Electric Mfg. Co., 4519 Hamilton Ave., Cleveland, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dittmore-Freimuth Corp., 2517 E. Norwich St., Milwaukee, Wisc.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Precision Standards Corp., Box 8361, San Marino, Calif.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Radiation Devices Co., Box 8450, Baltimore, Md.
Roback Corp., Huntingdon Valley, Pa.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

METERS, VOLT, DEVIATION

Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
DVM Div., Darcy Inds., 1723 Cloverfield Blvd., Santa Monica, Calif. p 1362, 1363
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1379
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
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A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, VOLT, DIFFERENTIAL—SEE METERS, VOLT

METERS, VOLT, DIGITAL (DVM) & ACCESSORIES

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1329
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
DVM Div., Darcy Inds., 1723 Cloverfield Blvd., Santa Monica, Calif. p 1362, 1363
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 1365
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J. p 1571
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1377
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1379
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Instrument Prods., 3M-Co., 300 S. Lewis Rd., Camarillo, Calif.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Mesa Co., Inc., 216-220 Mill St., Bristol, Pa.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif. ..... p 1454
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1449-1451
Presin Co., Trap Falls Rd., Shelton, Conn. ..... p 1051
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1492
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Trymetrics Corp., 204 Babylon Tpke., Roosevelt, N. Y. .... p 1517
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Abbey Electronics Div., 200 Shames Dr., Westbury, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Bristol Co., Box 1790, Waterbury, Conn.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Nord Instr. 422 Broad St., Salem, Va.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Roback Corp., Huntingdon Valley, Pa.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Weir Elctrns. Ltd., Durban Rd., Bognor Regis, Sussex, Eng.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, VOLT, ELECTROSTATIC

Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, VOLT, FREQUENCY SELECTIVE

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1463-1465
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1692
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, VOLT, LOG-CONVERSION

Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.

METERS, VOLT, POTENTIOMETRIC

Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1379
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1416
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Neutronic Corp., Box 625, St. Louis, Mo.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bristol Co., Box 1790, Waterbury, Conn.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Electronic Science Labs., 3920 Bryn Mawr, Dallas, Tex.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

METERS, VOLT, R-F

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ..... p 1331
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Measurements, Box 180, Boonton, N. J.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1463-1465
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng. p 1492, 1494
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio

METERS, VOLT-AMMETER

Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1526
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Radiation Devices Co., Box 8450, Baltimore, Md.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, VOLT, SAMPLING

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

METERS, VOLT, STATISTICAL

Micom, Inc., 855 Commercial St., Palo Alto, Calif.

METERS, VOLT, TRUE RMS

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1414, 1416
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1463, 1464
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. .. p 2309
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1477, 1478
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1492-1494
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1521
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1526, 1528
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, VOLT-AMMETER

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ..... p 1331
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1477, 1478
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494, 1495
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio

METERS, VOLT-AMMETER (Cont'd)

Trymetrics Corp., 204 Babylon Tpke., Roosevelt, N. Y. .... p 1517
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
Columbia Electric Mfg. Co., 4519 Hamilton Ave., Cleveland, Ohio
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Elco Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, VOLT-OHM

Aul Instrs., Inc., 138-30 34th Rd., Flushing, N. Y. ..... p 1331
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1375
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Measurements, Box 180, Boonton, N. J.
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1449
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1477, 1478
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Trymetrics Corp., 204 Babylon Tpke., Roosevelt, N. Y. .... p 1517
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Automatic Coil Mfg. Ltd., 50 Wingold Ave., Toronto, Ont., Canada
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Bacharach Instrument Co., 625 Alpha Dr., Pittsburgh, Pa.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Delta Products, Inc., P.O. Box 1147, Grand Junction, Colo.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Northeast Electronics Corp., Box 649, Concord, N. H.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Roback Corp., Huntingdon Valley, Pa.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
3M Co., 3M Center, St. Paul, Minn.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, VOLT-OHM-MILLIAMPERE (VOM)

California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
Neutronic Corp., Box 625, St. Louis, Mo.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1478, 1479
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. .... p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Systron-Donner Corp., One Systron Dr., Concord, Calif.

METERS, VU

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Ammon Instrs., Inc., 345 Kelley St., Manchester, N. H. ..... p 1327
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Electro-Mechanical Inst. Co. Inc., 8th & Chestnut Sts., Perkasie, Pa. p 1373
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Modutec Inc., 18 Marshall St., Norwalk, Conn. ..... p 1447
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1463, 1464
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. .... p 1484
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio .... p 1516
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1524
A & D Electrical Instrs., 73-07 88th St., Glendale, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Northeast Electronics Corp., Box 649, Concord, N. H.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Shurite Meters, 428 Chapel St., New Haven, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, WATT

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 1345, 2839
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio .. p 1342, 1343
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 2516
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio .. p 2844
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1692
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2843
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. p 1521-1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Nelson Elctrns. Labs., Inc., 1717 Dallas N. Pkwy., Plano, Tex.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

METERS, WATT-HOUR

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio p 2842, 2843
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

METERS, WATT VAR

Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio p 2842, 2843
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. p 1521-1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

METERS, WAVE

Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Narda Microwave Corp., Plainview, N. Y. ..... p 1688
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.

METERS, WAVEGUIDE—SEE METERS, MICROWAVE

METERS, X-RAY INTENSITY

Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

MICA, GLASS BONDED—SEE INSULATION MATERIALS, GLASS BONDED MICA

MICROCIRCUIT PRODUCTION EQUIP.

Hadron, 300 Shames Dr., Westbury, N. Y.
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Baron-Blakeslee, Inc., 1620 S. Laramie Ave., Chicago, Ill.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Bycoski, Casmir T., Inc., 363 Capitol Ave., Hartford, Conn.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
HLC Mfg. Co., Inc., 700 Davisville Rd., Willow Grove, Pa.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Mann, David W. Co., 174 Middlesex Turnpike, Burlington, Mass.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Podgor, J. E. Co., Inc., Box 1714, Philadelphia, Pa.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Visual Inspection Prods., 112 Central Ave., Lynn, Mass.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Western Technology, Inc., 220 W. Central, Santa Ana, Calif.

MICROCIRCUITS—SEE CIRCUITS, INTEGRATED: CIRCUITS, HYBRID

MICROMETERS, ELECTRONIC

Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dice, J. W., Co., 16 Highwood Ave., Englewood, N. J.
Dixson, Inc., Box 1449, Grand Junction, Colo.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.

Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Starrett, L. S. Co., 1-165 Crescent St., Athol, Mass.

MICROMOSAIC OPTICS

Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.

MICROPHONE CALIBRATORS—SEE CALIBRATORS, MICROPHONE

MICROPHONES, AIRCRAFT TYPE

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Audiosears Corp., Stamford, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Roanwell Corp., 180 Varick St., New York, N. Y.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

MICROPHONES, CARBON

Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan ..... p 556
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Astatic Corp., Box 120, Conneaut, Ohio
Audiosears Corp., Stamford, N. Y.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
ITT Telecommunications, Fulton Dr., Corinth, Miss.
P. M. & E. Electronics, Inc., 10 Tripps Lane, East Providence, R. I.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Roanwell Corp., 180 Varick St., New York, N. Y.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Telephone Dynamics Corp., 1333 Newbridge Rd., N. Bellmore, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

MICROPHONES, CARDIOID

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan ..... p 556
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
AKG, 100 E. 42 St., New York, N. Y.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Astatic Corp., Box 120, Conneaut, Ohio
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Holmin, W. A. Corp., 1325 Seventh St., Rockford, Ill.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanford International, Box 266, San Carlos, Calif.
Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.

MICROPHONES, CERAMIC

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan ..... p 556
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Astatic Corp., Box 120, Conneaut, Ohio
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Chesapeake Instr. Corp., Shadyside, Md.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Linden Labs. Inc., Box 920, State College, Pa.
P. M. & E. Electronics, Inc., 10 Tripps Lane, East Providence, R. I.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sonotone Corp., Elctrn. Products Div., Elmsford, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

MICROPHONES, CONDENSER

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan ..... p 556
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
AKG, 100 E. 42 St., New York, N. Y.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Automatic Clerical Systems, Inc., 389 N. Fair Oaks Ave., Pasadena, Calif.
Capps & Co., Inc., 20 Addison Pl., Valley Stream, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Stanford International, Box 266, San Carlos, Calif.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Vega Elctrns. Corp., 2115 De La Cruz Blvd., Santa Clara, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

MICROPHONES, CONTACT

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Recoton Corp., 46-23 Crane St., Long Island City, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.

MICROPHONES, CRYSTAL

Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Astatic Corp., Box 120, Conneaut, Ohio
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Goldak Co., Inc., 1101-A Air Way, Glendale, Calif.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Massa Div., 280 Lincoln St., Hingham, Mass.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Tandberg of America, Inc., 8 Third Ave., Pelham, N. Y.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

MICROPHONES, DIFFERENTIAL

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
AKG, 100 E. 42 St., New York, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Roanwell Corp., 180 Varick St., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

MICROPHONES, DYNAMIC

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan ..... p 556
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
AKG, 100 E. 42 St., New York, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Astatic Corp., Box 120, Conneaut, Ohio
Audiosears Corp., Stamford, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Holmin, W. A. Corp., 1325 Seventh St., Rockford, Ill.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
P. M. & E. Electronics, Inc., 10 Tripps Lane, East Providence, R. I.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Roanwell Corp., 180 Varick St., New York, N. Y.
Roesch, D., Comm., Inc., 2727 San Fernando Rd., Los Angeles, Calif.

MICROPHONES, NOISE CANCELLING

Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanford International, Box 266, San Carlos, Calif.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Telephone Dynamics Corp., 1333 Newbridge Rd., N. Bellmore, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.

MICROPHONES, HANDSETS, HEADSETS—SEE HEADSETS

MICROPHONES, HEARING AID

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Knowles Electronics, Inc., 3100 N. Mannheim Rd., Franklin Park, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sonotone Corp., Elctrn. Products Div., Elmsford, N. Y.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England

MICROPHONES, LAPEL

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
AKG, 100 E. 42 St., New York, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Astatic Corp., Box 120, Conneaut, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Recoton Corp., 46-23 Crane St., Long Island City, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanford International, Box 266, San Carlos, Calif.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.

MICROPHONES, LAVALIER

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Astatic Corp., Box 120, Conneaut, Ohio
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Holmin, W. A. Corp., 1325 Seventh St., Rockford, Ill.
Loge Electronics, 2171 W. Washington Blvd., Los Angeles, Calif.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanford International, Box 266, San Carlos, Calif.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.

MICROPHONES, LIP

Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Astatic Corp., Box 120, Conneaut, Ohio
Audiosears Corp., Stamford, N. Y.
Roanwell Corp., 180 Varick St., New York, N. Y.

MICROPHONES, MAGNETIC

Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Knowles Electronics, Inc., 3100 N. Mannheim Rd., Franklin Park, Ill.
P. M. & E. Electronics, Inc., 10 Tripps Lane, East Providence, R. I.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Roanwell Corp., 180 Varick St., New York, N. Y.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sonotone Corp., Elctrn. Products Div., Elmsford, N. Y.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Tandberg of America, Inc., 8 Third Ave., Pelham, N. Y.
Unex Labs., Inc., 321 Newburyport Tpke., Hathorne, Mass.

MICROPHONES, NOISE-CANCELLING

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
AKG, 100 E. 42 St., New York, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Astatic Corp., Box 120, Conneaut, Ohio
Audiosears Corp., Stamford, N. Y.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.

MICROPHONES, NOISE CANCELLING (Cont'd)

Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
P. M. & E. Electronics, Inc., 10 Tripps Lane, East Providence, R. I.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Roanwell Corp., 180 Varick St., New York, N. Y.
Roesch, D., Comm., Inc., 2727 San Fernando Rd., Los Angeles, Calif.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Sharpe Instruments, Creekside Blvd., Buffalo, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanford International, Box 266, San Carlos, Calif.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

MICROPHONES, PRESSURE

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
AKG, 100 E. 42 St., New York, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Knowles Electronics, Inc., 3100 N. Mannheim Rd., Franklin Park, Ill.
Massa Div., 280 Lincoln St., Hingham, Mass.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Roanwell Corp., 180 Varick St., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

MICROPHONES, RIBBON

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanford International, Box 266, San Carlos, Calif.

MICROPHONES, SOUND-POWERED

Action Systems Co., 34 Cambridge St., Meriden, Conn.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.

MICROPHONES, THROAT

Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Sonotone Corp., Elctrn. Products Div., Elmsford, N. Y.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.

MICROPHONES, TRANSISTORIZED

Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Roanwell Corp., 180 Varick St., New York, N. Y.
Roesch, D., Comm., Inc., 2727 San Fernando Rd., Los Angeles, Calif.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanford International, Box 266, San Carlos, Calif.
Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

MICROPHONES, VELOCITY

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanford International, Box 266, San Carlos, Calif.

MICROPHONES, WIRELESS

Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Automatic Clerical Systems, Inc., 389 N. Fair Oaks Ave., Pasadena, Calif.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Port-O-Vox Enterprises, Corp., 130 West 57th St., New York, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Sharpe Instruments, Creekside Blvd., Buffalo, N. Y.
Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif.
Vega Elctrns. Corp., 2115 De La Cruz Blvd., Santa Clara, Calif.

MICROSCOPES—ALSO SEE STEREOSCOPES

American Optical Corp., Eggert & Sugar Rds., Buffalo, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Bycoski, Casmir T., Inc., 363 Capitol Ave., Hartford, Conn.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Controlled Environment Equip Corp., 160 Pleasant St., Brockton, Mass.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Hacker, W. J. & Co., Inc., Box 646, W. Caldwell, N. J.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Nikon, Inc., Instr. Div., 623 Stewart Ave., Garden City, N. J.
Olympus Corp. of America, Two Nevada Dr., New Hyde Park, N. Y.
Opto-Metric Tools, Inc., 304 Hudson St., New York, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tempress Research Co., 980 University Ave., Los Gatos, Calif.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.
Unitron Instrument Co., 66 Needham St., Newton Highlands, Mass.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

MICROSCOPES, ELECTRON

Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Siemens America, Measuring Inst. Div., 350 Fifth Ave., N. Y., N. Y.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

MICROSCOPES, INFRARED

Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.

MICROSCOPES, LASER

RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
General Laser Corp., 8 Erie Dr., Natick, Mass.

MICROSCOPES, MEASURING—ALSO SEE MACHINES, MEASURING

Opto-Metric Tools, Inc., 304 Hudson St., New York, N. Y.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.

MICROSCOPES, ULTRAVIOLET

American Optical Corp., Eggert & Sugar Rds., Buffalo, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

MICROWAVE LINE STRETCHERS

Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Narda Microwave Corp., Plainview, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

MIRRORS, PRISM

Bache, Semon & Co., 636 Greenwich St., New York, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Buhl Optical Co., 1009 Beech Ave., Pittsburgh, Pa.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Pacific Universal Prods. Corp., 168 Vista Ave., Pasadena, Calif.
Republic Lens Co., Inc., 31 East 169th St., Bronx, N. Y.
S & S Optical Co., Inc., 7812 Stellhorn Rd., Ft. Wayne, Ind.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tinsley Labs, Inc., 2448 6th St., Berkeley, Calif.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Varo Optical, Inc., 215 E. Prospect Ave., Mt. Prospect, Ill.
Zenith Optical Lab., 138 Palisade St., Dobbs Ferry, N. Y.
Zoomar, Inc., 55 Sea Cliff Ave., Glen Cove, L. I., N. Y.

MISMATCHES, MICROWAVE, PRECISION

Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

MIXER-PREAMPLIFIERS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. .... p 1679, 1681, 1682
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RF Amplifier Co., Box 141, Lake Grove, N. Y. ..... p 1694
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.. p 1695, 1700, 1701
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

MIXERS, AUDIO

Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Collins Radio Co., Dallas, Texas
Davis, J. W. & Co., Box 35313, Dallas, Tex.
Dorsett Electronics, Box 36, Tulsa, Okla.
Electronic Systems Engrg. Co., 120½ N. Cleveland, Cushing, Okla.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stancil-Hoffman Corp., 921 N. Highland Ave., Hollywood, Calif.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.

MIXERS, FOR EPOXIES—SEE DISPENSERS

MIXERS, MICROWAVE

Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1652
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.

Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. ... p 1674
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1682
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Amplifier Co., Box 141, Lake Grove, N. Y. ..... p 1694
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
p 1695, 1700
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. ... p 1705
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sylvania Electric Prods., Inc., Semiconductor Div., 100 Sylvan Rd., Woburn, Mass. ..... p 2592
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

MIXERS, R-F

Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RF Amplifier Co., Box 141, Lake Grove, N. Y. ..... p 1694
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1700
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Comdel Inc., Beverly Airport, Beverly, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

MOBILE EQUIPMENT—SEE RECEIVERS: TRANSMITTERS: ETC.

MODEMS—SEE MODULATOR/DEMODULATORS

MODULATION INDICATORS—SEE INDICATORS, MODULATION

MODULATION TRANSFER ANALYZERS—SEE ANALYZERS, TRANSFER FUNCTION

MODULATOR/DEMODULATORS, DATA

Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2662
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Ise-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
p 809, 1054, 2674
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

MODULATORS/DEMODULATORS, LASER

LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Kappa Scientific Corp., 5780 Thornwood Dr., Goleta, Calif.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Savant Engrg., Inc., 825 N. Second St., St. Charles, Mo.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

MODULATORS, A-M

Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657, 2658
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2662
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Measurements, Box 180, Boonton, N. J. ..... p 1437
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1443
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RF Amplifier Co., Box 141, Lake Grove, N. Y. ..... p 1694
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 809, 1054
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Gopic Designs Co., 3679 Voltaire St., San Diego, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.

MODULATORS, MICROWAVE

Relcom, 2329 Charleston Rd., Mountain View, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

MODULATORS, F-M

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

MODULATORS, FERRITE

General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Addington Labs., Inc., 1043 DiGiulio Ave., Santa Clark, Calif.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Control Data Corp., 400 Border St., East Boston, Mass.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Xtalonix Products, 1215 Chesapeake Ave., Columbus, Ohio

MODULATORS, LIGHT

Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn.
p 1137
Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. ..... p 1795
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
Crystal Technology Inc., 2510 Old Middlefield Way, Mountain View, Cal.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.

MODULATORS, MAGNETIC

AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
p 1321
American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
p 1030, 1031
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 2844
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
p 809, 1054, 2674
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.

MODULATORS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. .. p 1653
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Kilovolt Corp., 238 High St., Hackensack, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. ... p 1677
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.

MODULATORS, MICROWAVE (Cont'd)

E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
GAF Corp., 140 West 51 St., New York, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

MODULATORS, PHASE

E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Theta Instrument Corp., Fairfield, N. J.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Addington Labs., Inc., 1043 DiGiulio Ave., Santa Clark, Calif.
Chadwick-Helmuth Co. Inc., 111 E. Railroad Ave., Monrovia, Calif.
Collins Radio Co., Dallas, Texas
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Gopic Designs Co., 3679 Voltaire St., San Diego, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

MODULATORS, PULSE

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Narda Microwave Corp., Plainview, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2920
Tobe Deutschmann Labs., Box 74, Canton, Mass. ..... p 695
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Collins Radio Co., Dallas, Texas
Comdel Inc., Beverly Airport, Beverly, Mass.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronics for Life Sciences, Inc., Box 697, Twinbrook Sta., Rockville, Md.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.

MODULATORS, R-F

AEL Inc., P.O. Box 552, Lansdale, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. .... p 1653
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Narda Microwave Corp., Plainview, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2920
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Defense Elctrns., Inc., Rockville, Md.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Packard Bell Elctrn., Lawrence & Arnold Drs., Newbury Pk., Calif.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.

MODULATORS, TELEMETERING

Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. .... p 1653
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Teledyne Telemetry Co., Box 341, Princeton, N. J.

MODULATORS, TV

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Electronics, Missiles & Comms., Inc., Box 116, White Haven, Pa.
Cordover, C. & Co., 104 Liberty Ave., Mineola, N. Y.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynamco Inc., 10052 Monroe Dr., Dallas, Tex.
EG & G Inc., 35 Congress St., Salem, Mass.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Packard Bell Elctrn., Lawrence & Arnold Drs., Newbury Pk., Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

MODULATORS, VIBRATING CAPACITOR

Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y.
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

MODULES, LOGIC (ENCAPSULATED)—ALSO SEE CARDS; CIRCUITS; NETWORKS

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1012
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif. ..... p 2352
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1593
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1591
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1591
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1591
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1591
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1156
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 523, 2665
Digital Equip. Corp., 146 Main St., Maynard, Mass. ..... p 777
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. ..... p 783
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. p 796, 797
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Sylvania Electric Prods., Inc., Semiconductor Div., 103 Sylvan Rd., Woburn, Mass.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 1054, 2676
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Honeywell, Inc., Computer Control Div., Peterborough, N. H.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Roback Corp., Huntingdon Valley, Pa.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.

MOISTURE INDICATORS—SEE INDICATORS, MOISTURE

MONITORS, FREQUENCY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. ... p 1674
Measurements, Box 180, Boonton, N. J.
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1489
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Toyo Comm. Equip. Co., Ltd., 15, Shiba-Toranomon, Minato-ku, Tokyo, Jap.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.

English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lampkin Labs., Inc., Perico Rd., Bradenton, Fla.
MCG Electronics Inc., 279 Skidmore Rd., Deer Park, N. Y.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

MONITORS, HUMIDITY—SEE INDICATORS, HUMIDITY

MONITORS, LASER ENERGY

Gamma Scientific, Inc., Dept. 301, 2165 Kurtz St., San Diego, Calif. p 1778
Abtronics, Inc., Box 712, Livermore, Calif.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Resalab, Inc., 4000 Campbell Ave., Menlo Park, Calif.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.

MONITORS, LINE & PROGRAM

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Collins Radio Co., Dallas, Texas
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.

MONITORS, MODULATION

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio
Marconi Instrs., 111 Cedar La., Englewood, N. J.
Measurements, Box 180, Boonton, N. J.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Lampkin Labs., Inc., Perico Rd., Bradenton, Fla.
Collins Radio Co., Dallas, Texas
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Metron Instrument Inc., 1051 S. Platte River Dr., Denver, Colo.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.

MONITORS, NUCLEAR RADIATION

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Abtronics, Inc., Box 712, Livermore, Calif.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.

MONITORS, PHASE-ANGLE

Aritech Corp., 130 Lincoln St., Brighton, Mass.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1453
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Theta Instrument Corp., Fairfield, N. J. ..... p 1514
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. ..... p 2109
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

MONITORS, PHASE-SEQUENCE & LOSS

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1325
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.

MONITORS, POWER, A-C & D-C

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1012
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 2844
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio p 2842, 2843
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Lark Electronics, Inc., 45 Walker St., New York, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

MONITORS, POWER, A-F

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Collins Radio Co., Dallas, Texas
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Roveti Instruments, 238 West St., Annapolis, Md.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

MONITORS, POWER, R-F

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1342
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Collins Radio Co., Dallas, Texas
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Chatham Controls Corp., 33 River Rd., Chatham, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Rafec Electronics, Box 566, Temple City, Cal.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Southern Avionics Co., 5055 Belmont, Beaumont, Tex.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

MONITORS, PULSE CODE MODULATION

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789

MONITORS, TAPE-RECORDER

California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
Auricord, 35-41 29th St., Long Island City, N. Y.
Avionics Res. Prods. Corp., 6901 W. Imperial Hwy., Los Angeles, Cal.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Roveti Instruments, 238 West St., Annapolis, Md.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.

MONITORS, TEMPERATURE—ALSO SEE CONTROLS, TEMPERATURE

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1323
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y.
Electronic Modules Corp., P.O. Box 141, Timonium, Md.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I.

MONITORS, VIDEO

Fenwal Electronics Inc., 63 Fountain St., Framingham, Mass.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1406
Oven Industries Div., E. Simpson Rd., Mechanicsburg, Pa. ..... p 1102
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
RFL Inds., Inc., Thermocontrol Div., Powerville Rd., Boonton, N. J. p 1473
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Virtis Co., Inc., Rte. 208, Gardiner, N. Y. ..... p 1520
Weller Electric Corp., 100 Wellco Rd., Easton, Pa.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Burling Instrument Company, 21 River Road, Chatham, New Jersey
Compudyne Corp., Box 247, Hatboro, Pa.
Control Data Corp., Magsense Prods. Oper., 775 Colorado Ave., S., Minneapolis, Minn.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Dales, F. Co., 180-85 E. Mill St., Akron, Ohio
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electro-Flex Heat, Inc., Northwood Industrial Park, Bloomfield, Conn.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Fenwal, Inc., Main St., Ashland, Mass.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
Foxboro, Foxboro, Mass.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Nanmac Corp., 9 Mayhew Rd., Framingham, Mass.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Norwalk Thermostat Co., 100 N. West St., Norwalk, Ohio
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RDF Corp., 23 Elm Ave., Hudson, N. H.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scam Instrument Corp., 7401 N. Hamlin Ave., Skokie, Ill.
Schneider Instr. Co., 8115 Camargo Rd., Madeira, Cincinnati, Ohio
Stemco Controls/Div. Essex Wire Corp., P.O. Annex 1007, Mansfield, Ohio
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Tempil Corp., 132 West 22nd St., New York, N. Y.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

MONITORS, VIDEO

Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Cohu Electronics Inc., Box 623, San Diego, Calif.
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tektronix, Inc., Box 500, Beaverton, Ore.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Conrac Div., 600 N. Rimsdale Ave., Covina, Calif.
Craig Corp., 2302 East 15th St., Los Angeles, Calif.
Dallons Instrs., 120 Kansas St., El Segundo, Calif.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
GBC Closed Circuit Corp., 74 5th Ave., New York, N. Y.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

MONITORS, VIDEO (Cont'd)

Hughes Aircraft Co., Vacuum Tube Prods. Div., Commercial Display Sys., 2020 Oceanside Blvd., Oceanside, Calif.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
MCG Electronics Inc., 279 Skidmore Rd., Deer Park, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maryland Telecomm, 10534 York Rd., Cockeysville, Md.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Packard-Bell Elctrns., Lawrence & Arnold Dr., Newbury Park, Calif.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Setchell-Carlson, Inc., New Brighton, St. Paul, Minn.
Shibaden Corp. of America, 58-25 Brooklyn-Queens Expwy., Woodside, N. Y.
Tech-Master Corp., 633-33 98 Pl., Forest Hills, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Ultra-Courtland Mfg. Corp., 153 Pearl St., Paterson, N. J.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.

MONITORS, VOLTAGE

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ... p 2268, 2269
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1413, 1416
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. ..... p 2109
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1523
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Inventions, Inc., RD2 463 US 1, Monmouth Jct., N. J.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
MCG Electronics Inc., 279 Skidmore Rd., Deer Park, N. Y.
Maytronics, Inc., Box 460, Colorado Springs, Colo.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Roveti Instruments, 238 West St., Annapolis, Md.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

MONITORS, WAVEFORM—SEE OSCILLOSCOPES

MOS CIRCUITS—SEE CIRCUITS, INTEGRATED, METAL OXIDE SILICON

MOTION SIMULATORS—SEE SIMULATORS, MOTION

MOTOR & GENERATOR ARMATURES, ROTORS, STATORS

Ashland Electric Prods. Inc., 32-02 Queens Blvd., L. I. C., N. Y. .. p 1725
Fabricast Inc., 9835 Alpaca St., South El Monte, Calif. ..... p 1730
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1735
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1754
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal.
Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Continental Electric Co., Inc., 325 Ferry St., Newark, N. J.
Dumore Co., 1300 17 St., Racine, Wisc.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inet-Power, 711 W. Knox St., Gardena, Calif.
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
MSL Steel Co., 3912 W. McLean Ave., Chicago, Ill.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Mamco Corp., 532 Fourth St., Racine, Wisc.
Rae Motor Corp., Box 518, McHenry, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Task Corporation, Box 3999, Anaheim, Calif.
Tempel Steel Co., 5353 N. Elston Ave., Chicago, Ill.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

MOTOR ELECTRIC GENERATOR SETS

Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1735
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Georator Corp., Box 70, Manassas, Va. ..... p 782, 1953
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2679
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal.
Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Columbia Electric Mfg. Co., 4519 Hamilton Ave., Cleveland, Ohio
Continental Electric Co., Inc., 325 Ferry St., Newark, N. J.
Detroit Diesel Engine Div., 13400 W. Outer Dr., Detroit, Mich.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inet-Power, 711 W. Knox St., Gardena, Calif.
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Katolight Corp., 1st Ave. at Chestnut, Mankato, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leece-Neville Co., 1374 East 51st St., Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Motor Generator Div., EE-61, Troy, Ohio
Motoresearch Mfg. Co., Inc., 1600 Junction Ave., Racine, Wisc.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Rae Motor Corp., Box 518, McHenry, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Task Corporation, Box 3999, Anaheim, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

MOTOR SPEED DRIVES—SEE CONTROLS, MOTOR SPEED

MOTOR TACHOMETER GENERATORS—SEE TACHOMETERS, ELECTRICAL (SELF-GENERATING)

MOTOR UNITS, MULTIPLE

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660, 2661
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1735
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Vocaline Co. of America, Coulter St., Old Saybrook, Conn.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Hansen Mfg. Co., Inc., Box 23, Princeton, Ind.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Linear Alpha, Inc., 823 Emerson, Evanston, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

MOTORS, A-C AND D-C

Alliance Mfg. Co., Inc., Alliance, Ohio ..... p 1723
Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
Dale Electronics Inc., Box 609, Columbus, Nebr.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1734, 1735
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1733
General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
Globe Industries, 2275 Stanley Ave., Dayton, Ohio ..... p 1738, 1739
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y. p 1745
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1754
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap. p 1753
Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif. ..... p 1762
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. .. p 1763
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2679
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill. .. p 2682
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Bendix Corp., Electric Power Div., Hwy. 35, Eatontown, N. J.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brevel Products Corp., Broad & 16th St., Carlstadt, N. J.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Continental Electric Co., Inc., 325 Ferry St., Newark, N. J.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Doerr Electric Corp., 1201 S. Doerr Rd., Cedarburg, Wisc.
Dumore Co., 1300 17 St., Racine, Wisc.
Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, Calif.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electric Motors & Specialties, Inc., King & Hamsher Sts., Garrett, Ind.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fasco Inds., Inc., Augusta at North Union Sts., Rochester, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General Inds. Co., Taylor & Olive Sts., Elyria, Ohio
Hansen Mfg. Co., Inc., Box 23, Princeton, Ind.
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
L & R Mfg. Co., 577 Elm St., Kearny, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Leece-Neville Co., 1374 East 51st St., Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Mamco Corp., 532 Fourth St., Racine, Wisc.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Rae Motor Corp., Box 518, McHenry, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Calif.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Task Corporation, Box 3999, Anaheim, Calif.
Tenna Mfg. Co., Inc., 19201 Cranwood Pkwy., Warrensville Hts., Ohio
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Torque/Tronics, 168 S. San Gabriel Blvd., San Gabriel, Calif.
Universal Electric Co., 300 E. Main St., Owosso, Mich.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

MOTORS, BRUSHLESS, D-C

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y. .. p 1721
Alliance Mfg. Co., Inc., Alliance, Ohio ..... p 1723
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio ..... p 1739
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Hurst Mfg. Corp., P.O. Box 326, Princeton, Ind. ..... p 1744
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. p 1261, 1754, 1755
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brevel Products Corp., Broad & 16th St., Carlstadt, N. J.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Carter, J. C. Co., 671 West 17th St., Costa Mesa, Calif.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Mamco Corp., 532 Fourth St., Racine, Wisc.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Transco Motor Mfg. Inc., 5445 Peck Rd., Arcadia, Calif.
Universal Electric Co., 300 E. Main St., Owosso, Mich.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

MOTORS, CLOCK & TIMING

Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1735
General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Hurst Mfg. Corp., P.O. Box 326, Princeton, Ind. ..... p 1744
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap. p 1753
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Gleason-Avery Co., Auburn, N. Y.
Hansen Mfg. Co., Inc., Box 23, Princeton, Ind.
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Torque/Tronics, 168 S. San Gabriel Blvd., San Gabriel, Calif.
Transco Motor Mfg. Inc., 5445 Peck Rd., Arcadia, Calif.

MOTORS, CONTROL

Ashland Electric Prods. Inc., 32-02 Queens Blvd., L. I. C., N. Y. .. p 1725
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1734
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1733
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1754
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap. p 1753
Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif. ..... p 1762
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J. ..... p 1765
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1769
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2679
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill. .. p 2682
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electro-Mechanics Co., Box 1546, Austin, Tex.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Inds. Co., Taylor & Olive Sts., Elyria, Ohio
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Servotronics, Inc., 3901 Union Rd., Buffalo, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Torque/Tronics, 168 S. San Gabriel Blvd., San Gabriel, Calif.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.

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Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1734
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa.
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Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Weston-Transicoil Components Div., Worcester, Pa.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England

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Ashland Electric Prods. Inc., 32-02 Queens Blvd., L. I. C., N. Y. .. p 1725
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
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Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1734, 1736
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Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. .. p 1754-1758
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Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif. ..... p 1762
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J. ..... p 1765
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1769
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ... p 2679, 2681
Vocaline Co. of America, Coulter St., Old Saybrook, Conn.
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill. .. p 2682
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.

MOTORS, GEARHEAD

American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Beau Motor Div., 460 Sackett Pt. Rd., N. Haven, Conn.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brevel Products Corp., Broad & 16th St., Carlstadt, N. J.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Daylen Co., Box 527, South Gate, Calif.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Doerr Electric Corp., 1201 S. Doerr Rd., Cedarburg, Wisc.
Dri-Clave Corp., 54 Kinkel St., Westbury, N. Y.
Dumore Co., 1300 17 St., Racine, Wisc.
Dyna Technology, Inc., Box 3263, Sioux City, Iowa
Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, Calif.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Motors & Specialties, Inc., King & Hamsher Sts., Garrett, Ind.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fasco Inds., Inc., Augusta at North Union Sts., Rochester, N. Y.
General Inds. Co., Taylor & Olive Sts., Elyria, Ohio
Gleason-Avery Co., Auburn, N. Y.
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
L & R Mfg. Co., 577 Elm St., Kearney, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Leece-Neville Co., 1374 East 51st St., Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Mamco Corp., 532 Fourth St., Racine, Wisc.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Molon Motors & Coil Corp., 3737 Industrial Ave., Rolling Meadows, Ill.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Rae Motor Corp., Box 518, McHenry, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Standard Pneumatic Motor Co., Box 745, Whittier, Calif.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Task Corporation, Box 3999, Anaheim, Calif.
Tenna Mfg. Co., Inc., 19201 Cranwood Pkwy., Warrensville Hts., Ohio
Torque/Tronics, 168 S. San Gabriel Blvd., San Gabriel, Calif.
UPPCO Inc., 900 S. Des Plaines, Chicago, Ill.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.
Universal Electric Co., 300 E. Main St., Owosso, Mich.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Zero-Max Co., The, 2845 Harriet Ave., S., Minneapolis, Minn.

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Alliance Mfg. Co., Inc., Alliance, Ohio ..... p 1723
Ashland Electric Prods. Inc., 32-02 Queens Blvd., L. I. C., N. Y. .. p 1725
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 1728
Dale Electronics Inc., Box 609, Columbus, Nebr.
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y. p 1729
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1734-1736
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio ..... p 1738, 1739
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 1741
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743

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Hurst Mfg. Corp., P.O. Box 326, Princeton, Ind. ..... p 1744
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y.
Planet Instr., Inc., 1521 Progress Rd., Ft. Wayne, Ind. ..... p 1752
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y.
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Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif. ..... p 1762
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. .. p 1763
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J. ..... p 1765
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1769
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Vocaline Co. of America, Coulter St., Old Saybrook, Conn.
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Beau Motor Div., 460 Sackett Pt. Rd., N. Haven, Conn.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Brevel Products Corp., Broad & 16th St., Carlstadt, N. J.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Doerr Electric Corp., 1201 S. Doerr Rd., Cedarburg, Wisc.
Dumore Co., 1300 17 St., Racine, Wisc.
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Geartronics Corp., 112 Chelmsford Rd., N. Billerica, Mass.
General Inds. Co., Taylor & Olive Sts., Elyria, Ohio
Gleason-Avery Co., Auburn, N. Y.
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kinetic Instr. Co., 1072 Linwood St., Brooklyn, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Molon Motors & Coil Corp., 3737 Industrial Ave., Rolling Meadows, Ill.
Motoresearch Mfg. Co., Inc., 1600 Junction Ave., Racine, Wisc.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Rae Motor Corp., Box 518, McHenry, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Task Corporation, Box 3999, Anaheim, Calif.
Torque/Tronics, 168 S. San Gabriel Blvd., San Gabriel, Calif.
UPPCO Inc., 900 S. Des Plaines, Chicago, Ill.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

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Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1735
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1754
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2679
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Torque/Tronics, 168 S. San Gabriel Blvd., San Gabriel, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

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Ashland Electric Prods. Inc., 32-02 Queens Blvd., L. I. C., N. Y. .. p 1725
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
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Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 1728
Dale Electronics Inc., Box 609, Columbus, Nebr.
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Globe Industries, 2275 Stanley Ave., Dayton, Ohio ..... p 1738
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Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
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Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ... p 1754-1757
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap.
Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif. ..... p 1762
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
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Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Beau Motor Div., 460 Sackett Pt. Rd., N. Haven, Conn.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hansen Mfg. Co., Inc., Box 23, Princeton, Ind.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Task Corporation, Box 3999, Anaheim, Calif.
Torque/Tronics, 168 S. San Gabriel Blvd., San Gabriel, Calif.
UMC Electronics Co., 462 Sackett Point Rd., N. Haven, Conn.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England

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Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1734
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General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
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Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn.
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IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y. p 1745
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J.
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Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
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Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Weston-Transicoil Components Div., Worcester, Pa.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brevel Products Corp., Broad & 16th St., Carlstadt, N. J.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Continental Electric Co., Inc., 325 Ferry St., Newark, N. J.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Doerr Electric Corp., 1201 S. Doerr Rd., Cedarburg, Wisc.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Inds. Co., Taylor & Olive Sts., Elyria, Ohio
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Mamco Corp., 532 Fourth St., Racine, Wisc.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Molon Motors & Coil Corp., 3737 Industrial Ave., Rolling Meadows, Ill.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skinner Polynoid Div., 95 Edgewood Ave., New Britain, Conn.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Task Corporation, Box 3999, Anaheim, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
UPPCO Inc., 900 S. Des Plaines, Chicago, Ill.
Universal Electric Co., 300 E. Main St., Owosso, Mich.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

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Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
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Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York, N. Y.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brevel Products Corp., Broad & 16th St., Carlstadt, N. J.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
General Inds. Co., Taylor & Olive Sts., Elyria, Ohio
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Leece-Neville Co., 1374 East 51st St., Cleveland, Ohio
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Rae Motor Corp., Box 518, McHenry, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Standard Precision Div., 4105 W. Pawnee, Wichita, Kans.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Union Carbide Corp., Consumer Products Div., 270 Park Ave., New York, N. Y.

Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

MOTORS, PRINTED CIRCUIT

Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.

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MOTORS, SERVO ELECTRIC

Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 869, 871, 872
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 1728
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y. p 1729
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1733
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Harowe Servo Conts., Westtown Rd. W. Chestar Pke., W. Chester, Pa. p 1741
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y. p 1745
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 1747
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. .. p 1754, 1758
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Yaskawa Electric America, Inc., 100 Bliss Dr., Oak Brook, Ill. .. p 2682
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Precision Meter Div., Grenier Field, Manchester, N. H.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Servotronics, Inc., 3901 Union Rd., Buffalo, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

MOTORS, SQUIRREL CAGE

Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc.
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1754
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Brevel Products Corp., Broad & 16th St., Carlstadt, N. J.
Century Electric Co., 1806 Pine St., St. Louis, Mo.
Continental Electric Co., Inc., 325 Ferry St., Newark, N. J.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Doerr Electric Corp., 1201 S. Doerr Rd., Cedarburg, Wisc.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Singer-General Precision, Inc., Kearfott Div., 12690 Elmwood Ave., N.W., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Task Corporation, Box 3999, Anaheim, Calif.
Transco Motor Mfg. Inc., 5445 Peck Rd., Arcadia, Calif.
Universal Electric Co., 300 E. Main St., Owosso, Mich.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electrokinetics Div., 402 E. Guterrez St., Santa Barbara, Calif.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

MOTORS, STEPPING

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Breadway, Clifton Hghts., Pa. ..... p 1727
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 1741
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Heinemann Electric Co., 2636 Brunswick Pike, Trenton, N. J. ... p 2731
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Icon Corp., 156 Sixth St., Cambridge, Mass. ..... p 1042
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 1747
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J. ..... p 1765
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Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal.
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Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Computer Devices, 11925 Burke St., Santa Fe Springs, Calif.
Doerr Electric Corp., 1201 S. Doerr Rd., Cedarburg, Wisc.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Kollsman Motor Corp., Mill St., Dublin, Pa.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

MOTORS, SYNCHRONOUS

Ashland Electric Prods. Inc., 32-02 Queens Blvd., L. I. C., N. Y. .. p 1725
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 1728
Dale Electronics Inc., Box 609, Columbus, Nebr.
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1735, 1736
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1733
General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
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Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 1741
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040

MOTORS, TORQUE

Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743
Hurst Mfg. Corp., P.O. Box 326, Princeton, Ind. ..... p 1744
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y. p 1745
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1750
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. .. p 1754–1756
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap. p 1753
Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif. ..... p 1762
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J. .... p 1764, 1765
Superior Electric Co., 1000 Middle St., Bristol, Conn. .... p 1768, 1769
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. .... p 2679, 2681
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Beau Motor Div., 460 Sackett Pt. Rd., N. Haven, Conn.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Brushless Motors Elctrns., Inc., 241 Lake Howell Rd., Casselberry, Fla.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Doerr Electric Corp., 1201 S. Doerr Rd., Cedarburg, Wisc.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Glidden-Durkee Div., 900 Union Commerce Bldg., Cleveland, Ohio
Hansen Mfg. Co., Inc., Box 23, Princeton, Ind.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Kato Engrg. Co., 1415 1st Ave., Mankato, Minn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Molon Motors & Coil Corp., 3737 Industrial Ave., Rolling Meadows, Ill.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Task Corporation, Box 3999, Anaheim, Calif.
Torque/Tronics, 168 S. San Gabriel Blvd., San Gabriel, Calif.
UMC Electronics Co., 462 Sackett Point Rd., N. Haven, Conn.
UPPCO Inc., 900 S. Des Plaines, Chicago, Ill.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Universal Electric Co., 300 E. Main St., Owosso, Mich.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

MOTORS, SYNCHRONOUS POLARIZED—SEE MOTORS, SYNCHRONOUS

MOTORS, TIMING—SEE MOTORS, CLOCK AND TIMING

MOTORS, TORQUE

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y. .. p 1721
Ashland Electric Prods. Inc., 32-02 Queens Blvd., L. I. C., N. Y. .. p 1725
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1736
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1733
Globe Industries, 2275 Stanley Ave., Dayton, Ohio ..... p 1738
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y. p 1745
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. ..... p 1754
Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif. ..... p 1762
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.

MOTORS, TORQUE (Cont'd)

Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1769
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. .... p 2679-2681
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal. ..... p 1772
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Beau Motor Div., 460 Sackett Pt. Rd., N. Haven, Conn.
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Doerr Electric Corp., 1201 S. Doerr Rd., Cedarburg, Wisc.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Inds. Co., Taylor & Olive Sts., Elyria, Ohio
Hobbs Mfg. Co., 666 Lincoln St., Worcester, Mass.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Servotronics, Inc., 3901 Union Rd., Buffalo, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Stancil-Hoffman Corp., 921 N. Highland Ave., Hollywood, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Task Corporation, Box 3999, Anaheim, Calif.
UMC Electronics Co., 462 Sackett Point Rd., N. Haven, Conn.
Varo General, Garland Bank Bldg., Garland, Tex.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

MOTORS, UNIVERSAL (A-C OR D-C OPERATION)

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Howard Inds., Div. MSL Inds., Inc., 2420 18th St., Racine, Wisc. p 1743
Sawyer Inds., Inc., 5445 Peck Rd., Arcadia, Calif. ..... p 1762
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Bodine Electric Co., 2500 W. Bradley Pl., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Dri-Clave Corp., 54 Kinkel St., Westbury, N. Y.
Dumore Co., 1300 17 St., Racine, Wisc.
Dyna Technology Inc., 2201 E. 7th St., Sioux City, Iowa
Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, Calif.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General Inds. Co., Taylor & Olive Sts., Elyria, Ohio
Heller, G. K., Corp., Box 14746, Las Vegas, Nev.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Mamco Corp., 532 Fourth St., Racine, Wisc.
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.
Rae Motor Corp., Box 518, McHenry, Ill.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Task Corporation, Box 3999, Anaheim, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

MOTORS, VACUUM

Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Ametek, Inc., Station Square Two, Paoli, Pa.
Ametek/Lamb Elec., 627 Lake St., Kent, Ohio
Porter, H. K. Company, Inc., Porter Bldg., Pittsburgh, Pa.

MOUNTS, ANTENNA (NON-CONSUMER APPLICATIONS)

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Barry Controls Div., 700 Pleasant St., Watertown, Mass. ..... p 576
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.

Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Adronics, Inc., 271 Grove Ave., Verona, N. J.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Dallas, Texas
Connor Spring & Mfg. Co., 75 14th St., San Francisco, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jerrold Eleetronics Corp., 401 Walnut St., Philadelphia, Pa.
K-W Engineering Works, N50, W16328 Pin Oak Ct., Menomonee Falls, Wisc.
Lord Mfg. Co., 1635 West 12th St., Erie, Pa.
Master Mobile Mounts, 1000 Crystal Dr., Fort Myers, Fla.
Master Mobile Mounts, 1000 Crystals Dr., Ft. Myers, Fla.
Microflect Co., 3575 25th, S. E., Salem, Ore.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Premax Prods. Div., Highland & College Aves., Niagara Falls, N. Y.
Prodelin, Inc., Box 131, Hightstown, N. J.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
S & A Electronics, Inc., 202 W. Florence St., Toledo, Ohio
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Sitco Antennas, 10330 N. E. Marx St., Portland, Oregon
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Tempo TV Products Co., Box 4156, Syimar, Calif.
Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, Calif.
Tryion, Inc., Elverson, Pa.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Webster Mfg. Co., 317 Roebling Rd., S. San Francisco, Calif.

MOUNTS, CRT & ACCESSORIES

Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.

MOUNTS, CRYSTAL

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Accurate Electronics Corp., Box 935J, Elyria, Ohio
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Waveline Inc., Box 718, West Caldwell, N. J.
Aircom, Inc., Rte. 16B, Union, N. H.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Herley Inds., Inc., 175 Elleen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Quaker Electronics, Box 215, Hunlock Creek, Pa.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

MOUNTS, INTEGRATED CIRCUIT—SEE SOCKETS, INTEGRATED CIRCUIT—ALSO SEE HOLDERS & CARRIERS, I-C

MOUNTS, KLYSTRON

Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Narda Microwave Corp., Plainview, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.

MOUNTS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1650
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Narda Microwave Corp., Plainview, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Waveline Inc., Box 718, West Caldwell, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Elleen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microflect Co., 3575 25th, S. E., Salem, Ore.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

MOUNTS, MOBILE ANTENNA—SEE MOUNTS, ANTENNA

MOUNTS, MOTOR

Barry Controls Div., 700 Pleasant St., Watertown, Mass. ..... p 576
Theta Instrument Corp., Fairfield, N. J. ..... p 1513
Henrite Products Corp., Box 1196, Morristown, Tenn.
Lord Mfg. Co., 1635 West 12th St., Erie, Pa.
Metropolitan Wire Goods Corp., N. Washington St. & George Ave., Wilkes-Barre, Pa.

MOUNTS, SHOCK & VIBRATION

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Barry Controls Div., 700 Pleasant St., Watertown, Mass. ..... p 576
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Atlantic India Rubber Co., 571 W. Polk St., Chicago, Ill.
Collins Radio Co., Cedar Rapids, Iowa
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Henrite Products Corp., Box 1196, Morristown, Tenn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Lord Mfg. Co., 1635 West 12th St., Erie, Pa.
MB Electronics, Box 1825, New Haven, Conn.
Matthews, R. Corp., E. Warren St., Fall River, Mass.
Mecca, P.O. Box 36393, Houston, Tex.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Robintech, Incorporated, 3310 Vanowen St., Burbank, Calif.
Shur-Lok Corp., 1300 E. Normandy Pl., Santa Ana, Calif.
3M Co., 3M Center, St. Paul, Minn.

MOUNTS, TAPE HEAD

International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 549
Nortronics Co. Inc., 8101 10th Ave. N., Minneapolis, Minn. p 557-559, 561, 564
Auricord, 35-41 29th St., Long Island City, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

MOUNTS, THERMISTOR

Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
G T I Corporation, 310 Chestnut St., Meadville, Pa.
Narda Microwave Corp., Plainview, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Elleen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.

MOUNTS, TRANSISTOR—SEE PADS, TRANSISTOR MOUNTING

MSI CIRCUITS—SEE CIRCUITS, MEDIUM SCALE INTEGRATION

MULTIPLEXERS (EXCLUDING HI-FI)

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 762
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla.
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 776
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. p 797, 798
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. ..... p 2794
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Texscan Microwave Prods. Corp., 4810 N. Franklin Rd., Indianapolis, Ind.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Vetter, A. R. Co., Box 143, Rebersburg, Pa. ..... p 2162
Aerojet-General Corp., 1100 W. Hollyvale, Azusa, Calif.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Codex Corp., 222 Arsenal St., Watertown, Mass.
Collins Radio Co., Dallas, Texas
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Peninsula Microwave Labs., 855 Maude Ave., Mountain View, Calif.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
RC-95, Inc., 9 East 38th St., New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Redcor Corp., Box 1031, Canoga Park, Calif.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Roback Corp., Huntingdon Valley, Pa.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Video Research Corp., 761 N. Washington St., Rockville, Md.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

MULTIPLIERS, ANALOG

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1033, 1034
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. p 528, 529
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 809, 1054
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.

MULTIPLIERS, CRYSTAL

Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1704
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Collins Radio Co., Dallas, Texas
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

MULTIPLIERS, DIODE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1704
Semtech Corp., 652 Mitchell Rd., Newbury Park, Calif. ..... p 2590
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 809
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Applied Dynamics, Inc., 2275 Platt Rd., Ann Arbor, Mich.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
General Computers Inc., 5990 W. Pico Blvd., Los Angeles, Calif.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

MULTIPLIERS, FREQUENCY

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz. p 514
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Frequency Sources Inc., P.O. Box 159, N. Chelmsford, Mass. .. p 1673
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1704
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Semtech Corp., 652 Mitchell Rd., Newbury Park, Calif. ..... p 2590
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Tracor Inc., 6500 Tracor La., Austin, Texas
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1714
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717

MULTIPLIERS, SERVO

Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Ajax Magnethermic Corp., 1745 Overland Ave., N. E., Warren, Ohio
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microcom Corp., Horsham Valley Industrial Park, Horsham, Pa.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

MULTIPLIERS, HALL

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 2839
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 2516
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 2844
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2586
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

MULTIPLIERS, MAGNETIC

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1033, 1034
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 809, 1054
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.

MULTIPLIERS, METER

Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1488
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

MULTIPLIERS, SERVO

Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2662
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1034
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 529
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531

MULTIPLIERS, SERVO (Cont'd)

Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 809
Weston-Transicoil Components Div., Worcester, Pa.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
EMR Div., Box 223, Princeton, N. J.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

NAMEPLATES

Anodyne, Inc., 1270 Northwest 165th St., N. Miami Beach, Fla. p 1211
Datak Corp., 85 Highland Ave., Passaic, N. J. ..... p 1170
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Sterling Instr., 76 E. Second St., Mineola, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Bell Co., Inc., Box 92, 106 Morrow Ave., Trussville, Ala.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Dennison Mfg. Co., 300 Howard St., Framingham, Mass
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Dura Engraving Corp., 133 West 20th St., New York, N. Y.
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Duramark, Inc., 2 Secatoag Ave., Port Washington, N. Y.
E. C. P. Corp., 4726 Superior Ave., Cleveland, Ohio
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Electro Chemical Engraving Co., 1100 Brook Ave., Bronx, N. Y.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Ever Ready Label Corp., 357 Cortlandt St., Belleville, N. J.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Hermes Plastics, Inc., 20 Cooper Square, New York, N. Y.
Industrial Commerce Corp., 105-07 Metropolitan Ave., Forest Hills, N. Y.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Kimball Systems, 151 Cortlandt St., Belleville, N. J.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Master Tape Printers, Inc., 4517 Elston Ave., Chicago, Ill.
Matthews, Jas. & Co., 6619 Penn Ave., Pittsburgh, Pa.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Metalcraft, Inc., 149 4th St., S. W., Mason City, Iowa
Metalphoto Corp., 18531 S. Miles Rd., Cleveland, Ohio
Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.
N/P Co., Inc., Box 127, Temple City, Calif.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Panelgraphic Corp., Box 254, Caldwell, N. J.
Pantographic Reproduction Co., 35 Elm Ridge Terr., Newington, Conn.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.
Romar Plastics, Inc., 1311 East Main St., St. Charles, Ill.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Star Enterprises, Box 1098, Lowell, Mass.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.
3M Co., 3M Center, St. Paul, Minn.
Topflight Corp., 160 E. 9th Ave., York, Pa.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.

NEEDLES—SEE STYLI

NETWORKS, CROSSOVER

Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290, 1291
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 2394, 2395, 2397
Marstan Elctrns., 307 Washington St., Orange, N. J. .. p 2404, 2405
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Bozak, R. T. Mfg. Co., Box 1166, Darien, Conn.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Hartley Products Corp., Barnert Pl., Hohokus, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Lansing J. B., Sound, Inc., 3249 Casitas Ave., Los Angeles, Calif.
Oxford Transducer Co., 3911 S. Michigan Ave., Chicago, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

NETWORKS, DIRECTIONAL ANTENNA PHASING

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
GAF Corp., 140 West 51 St., New York, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

NETWORKS, LADDER

Airco Speer Elctrn. Components, Resistor Plant, Bradford, Pa. ..... p 710
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif. ..... p 2352
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 617
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1593
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Cal-R, Inc., Cal. Resistor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2360
Caddock Electronics, Inc., 3127 Chicago Ave., Riverside, Calif. .. p 2357
Dale Electronics Inc., Box 609, Columbus, Nebr. ..... p 2374
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Digilog Electronics Corp., Box 9368, 701 G. Third Ave. N., Seattle, Wash.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Electra/Midland Corp., Cermetrik Div., 3347 Industrial Ct., San Diego, Cal. p 2469
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 2473
Electronic Precision Components Corp., 2 Brookdale Pl., Mt. Vernon, N. Y. p 2375
Gamble, C. T. Inds., New Jersey Ave. & Fairview St., Riverside, N. J. p 2378
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 2398
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Kelvin, 5919 Noble Ave., Van Nuys, Calif. ..... p 2399
Marstan Elctrns., 307 Washington St., Orange, N. J. .. p 2404, 2405
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa. p 2411
Pyrofilm Resistor Co. Inc., 60 S. Jefferson Rd., Whippany, N. J. p 2412
Quantum Devices Corp., 15 W. Main St., Bergenfield, N. J. ..... p 1631
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y. .... p 2491
Resistance Prods. Co., 914 South 13th St., Harrisburg, Pa.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo. ..... p 2440
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa. ..... p 2433
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
EMR Div., Box 223, Princeton, N. J.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

NETWORKS, LC

Airco Speer Elctrn. Components, Resistor Plant, Bradford, Pa. ..... p 710
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif. ..... p 2352
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 617
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1081
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Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y.
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Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
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United Transformer Co., 150 Varick St., New York, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

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Cal-R, Inc., Cal. Resistor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2360
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
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Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
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Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa. p 2411
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Pyrofilm Resistor Co. Inc., 60 S. Jefferson Rd., Whippany, N. J. p 2412
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Resistance Prods. Co., 914 South 13th St., Harrisburg, Pa.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo. ..... p 2440
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa. ..... p 2433
Zaring Inds., Inc., Box 477, Carmel, Ind.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Collins Radio Co., Dallas, Texas
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Gold Line Connector, Inc., Muller Ave., Box 893, Norwalk, Conn.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

NETWORKS, PHASE

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y. p 611
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.

Balco Capacitors, Div. Balco Elctrns., Inc., 307 Washington St., Orange, N. J. p 617
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y.
Data Delay Devices, 253 Crooks Ave., Clifton, N. J.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
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Marstan Elctrns., 307 Washington St., Orange, N. J. ..... p 2404, 2405
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa. p 2411
TT Electronics, Inc., P.O. Box 180, Culver City, Calif. ..... p 1313
Theta Instrument Corp., Fairfield, N. J.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Collins Radio Co., Dallas, Texas
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
EMR Div., Box 223, Princeton, N. J.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

NETWORKS, PULSE FORMING

AEL Inc., P.O. Box 552, Lansdale, Pa.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Columbia Components Corp., 60 Madison Ave., Hempstead, N. Y.
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Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
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Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Collins Radio Co., Dallas, Texas
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Kappa Scientific Corp., 5780 Thornwood Dr., Goleta, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Velonex, 560 Robert Ave., Santa Clara, Calif.

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Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
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Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
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Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal. p 751
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Alpha Eleetronic Services, 344 N. State College Blvd., Orange, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Axel Elctrns., Inc., 134-20 Jamaica Ave., Jamaica, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
EMR Div., Box 223, Princeton, N. J.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Elpac Components, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Intellux, Inc., Box 548, Goleta, Calif.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Kidco, Inc., Box 278, Medford, N. J.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Midwec Corp., Industrial Div., Box 417, Scottsbluff, Neb.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Skottie Elctrns., Div. Sunshine Mining Co., Archbald, Pa.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Welex Electronics, Box 986, Silver Spring, Md.
White Instruments Inc., Box 698, Austin, Tex.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

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Cal-R, Inc., Thermonetics Div., 1601 Olympic Blvd., Santa Monica, Calif.
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CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 2355
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Caddock Electronics, Inc., 3127 Chicago Ave., Riverside, Calif. .. p 2357
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y.
Dale Electronics Inc., Box 609, Columbus, Nebr. ..... p 2374
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Digilog Electronics Corp., Box 9368, 701 G. Third Ave. N., Seattle, Wash.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 2473
Electronic Precision Components Corp., 2 Brookdale Pl., Mt. Vernon, N. Y. p 2375
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 2398

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Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 2394, 2395, 2397
Kelvin, 5919 Noble Ave., Van Nuys, Calif. ..... p 2399
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Quantum Devices Corp., 15 W. Main St., Bergenfield, N. J. ..... p 1631
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y. .... p 2491
Resistance Prods. Co., 914 South 13th St., Harrisburg, Pa. ..... p 2422
Sage Electronics Corp., Box 3926, Rochester, N. Y.
Shallco, Inc., Hwy. 301 South, Smithfield, N. C.
Shallcross, E. Preston St., Selma, N. C. ..... p 2426, 2427
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo. ..... p 2440
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa. ..... p 2433
Weiwyn International, Inc., 811 Sharon Dr., Westlake, Ohio
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
C-F Electronics, Inc., 14707 Keswick St., Van Nuys, Calif.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electro Cube Inc., 1710 S. Del Mar Ave., San Gabriel, Cal.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Intellux, Inc., Box 548, Goleta, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Miller Electro-Res. Labs., 14800 W. Grange, New Berlin, Wisc.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

NEUTRON DETECTION TUBES—SEE TUBES, RADIATION DETECTION

NOISE ANALYZERS—SEE ANALYZERS, NOISE

NUCLEAR EQUIPMENT—SEE SPECIFIC TYPES

NUCLEAR RADIATION SHIELDING—SEE SHIELDS, NUCLEAR RADIATION

NULL DETECTORS—SEE INDICATORS, NULL

NUMERIC READOUTS—SEE READOUTS—ALSO SEE TUBES, READOUT

NUTS, METAL—SEE FASTENERS, METAL

NUTS, PLASTIC—SEE FASTENERS, PLASTIC

O-RINGS—SEE SEALS, OIL

OCEANOGRAPHIC EQUIPMENT (ELECTRONIC)

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
ITT Cannon Elec., 3208 Humboldt St., Los Angeles, Cal.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
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Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307, 1481
ASCOR, Berkey Technical, 25-15 50th St., Woodside, N. Y.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Beckman, Advanced Tech. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Bissett-Berman Corp., "G" Street Pier, San Diego, Calif.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.

OCEANOGRAPHIC EQUIPMENT (Cont'd)

Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EG&G International, Geodyne Div., 151 Bear Hill Rd., Waltham, Mass.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
Egan Laboratory, 107-56 113th St., Richmond Hill, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Lenox Instrument Co., 122 E. Luray St., Philadelphia, Pa.
NUS Corp., Box 248, Paramus, N. J.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Research Mfg. Corp., Box 6056, San Diego, Calif.
Sanders Assocs., Inc., Ocean Sys. Div., Simon St., Nashua, N. H.
Schneider Instr. Co., 8115 Camargo Rd., Madeira, Cincinnati, Ohio
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

OILS—SEE LUBRICANTS

OPEN-SHORT LOCATORS—SEE LOCATORS, OPEN-SHORT

OPTICAL CODED DISCS—SEE CODED DISCS, OPTICAL

OPTICAL COMPARATORS—SEE COMPARATORS, OPTICAL

OPTICAL IMAGE EXPANDERS

Egan Laboratory, 107-56 113th St., Richmond Hill, N. Y.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.

OPTICS, FIBER—SEE FIBER OPTIC BUNDLES: FIBER OPTIC INSPECTION EQUIP.

OPTICS, MICROMOSAIC—SEE MICROMOSAIC OPTICS

OSCILLATORS, ADJUSTABLE—SEE OSCILLATORS (AS MODIFIED)

OSCILLATORS, AUDIO

Accutronics, Inc., 628 North St., Geneva, Ill. p 1059, 1060, 1062, 1063, 1067
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American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1083
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B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
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Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1084
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1888, 1889, 1891
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. ..... p 1077
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CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. ..... p 1077
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Connor-Winfield Corp., Winfield, Ill. ..... p 1086, 1087
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1097
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1940, 1941
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho ..... p 1089
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Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1106, 1107
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1100, 1101
Heath Co., Dept. 180, Benton Harbor, Mich.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
M F Electronics Corp., 118 East 25th St., New York, N. Y. p 1120, 1121
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1119
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1122, 1123
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1129
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. ..... p 2793
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1533-1542
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Arbor Systems, Inc., P.O. Box 1325, Ann Arbor, Mich.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Femco, Inc., Box F, Irwin, Pa.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Northeast Electronics Corp., Box 649, Concord, N. H.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Plectron Corp., Overton, Nebr.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

OSCILLATORS, BEAT FREQUENCY (BFO)

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1084
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

OSCILLATORS, BIAS

Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1100
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
Nortronics Co. Inc., 8101 10th Ave. N., Minneapolis, Minn. .. p 557-560
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

OSCILLATORS, BRIDGE

Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

OSCILLATORS, CAVITY

Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Frequency Sources Inc., P.O. Box 159, N. Chelmsford, Mass. ... p 1672
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. p 1686, 1687
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
GAF Corp., 140 West 51 St., New York, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.

OSCILLATORS, CRYSTAL-CONTROLLED

AEL Inc., P.O. Box 552, Lansdale, Pa.
Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1058, 1066
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Arvin Frequency Devices, 2505 N. Salisbury St., W. Lafayette, Ind. p 1057
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1068
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. .... p 1070, 1071
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CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. ..... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. ... p 1077
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Collins Radio Co., Newport Beach, Calif.
Connor-Winfield Corp., Winfield, Ill. ..... p 1086
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass. p 1088
Electra/Midland Corp., 3151 Fibergiass Rd., Kansas City, Kans. p 1091-1093
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1097
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho ..... p 1089
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Frequency Sources Inc., P.O. Box 159, N. Chelmsford, Mass. ... p 1673
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1105-1107
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1100, 1101
Heath Co., Dept. 180, Benton Harbor, Mich.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 1109
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
M F Electronics Corp., 118 East 25th St., New York, N. Y. 1120, 1121
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1119
Measurements, Box 180, Boonton, N. J.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1122, 1123
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Northern Engineering Labs Inc., 357 Beloit St., Burlington, Wisc. p 1126
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Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa p 1127
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa. ..... p 1129
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio

Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Spectrum Technology Inc., Box 388, Goleta, Calif. ..... p 1132, 1133
Tedford Crystal Labs., Inc., 4914 Gray Rd., Cincinnati, Ohio .... p 1315
Tracor Inc., 6500 Tracor La., Austin, Texas
Trak Microwave Corporation, 4728 Kennedy Rd., Tampa, Fla.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Vectron Laboratories, Inc., 146 Selleck St., Stamford, Conn. ... p 1136
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dorsett Electronics, Box 36, Tulsa, Okla.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microtek Electronics, Inc., 138 Alewife Brook Pkwy., Cambridge, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Norrman, Ernst Labs., 200 Elkhorn Rd., Williams Bay, Wisc.
Northeast Electronics Corp., Box 649, Concord, N. H.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rodelca, 356A Commack Rd., Deer Park, N. Y.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Somerset Radiation Labs., Inc., 2060 North 14th St., Arlington, Va.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Standard Crystal Co., 1105 S. Fremont Ave., Alhambra, Calif.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

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Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1059, 1060
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1940, 1941
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
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Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

OSCILLATORS, GRID DIP—SEE METERS, GRID-DIP

OSCILLATORS, KLYSTRON—SEE TUBES, KLYSTRON

OSCILLATORS, MAGNETRON—SEE TUBES, MAGNETRON

OSCILLATORS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1370
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Frequency Sources Inc., P.O. Box 159, N. Chelmsford, Mass. p 1672, 1673
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. .... p 1683
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. p 1686, 1687
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
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Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Collins Radio Co., Dallas, Texas
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
EMF Systems, Inc., Box 1009, State College, Pa.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
GAF Corp., 140 West 51 St., New York, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITT Electron Tube, Box 100, Easton, Pa.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Now Instr. Co., Inc., 6124 N. Pulaski Rd., Chicago, Ill.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

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Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1063
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
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CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1888, 1889, 1891
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
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Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Frequency Sources Inc., P.O. Box 159, N. Chelmsford, Mass. p 1672, 1673
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1106
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1101
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
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Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.

OSCILLATORS, R-F

Applied Microwave Lab, Inc., Andover St., Andover, Mass.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
EMF Systems, Inc., Box 1009, State College, Pa.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

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Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1063, 1065
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Arvin Frequency Devices, 2505 N. Salisbury St., W. Lafayette, Ind. p 1057
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1068
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1888
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Connor-Winfield Corp., Winfield, Ill. ..... p 1086, 1087
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1106, 1107
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1101
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Vectron Laboratories, Inc., 146 Selleck St., Stamford, Conn.
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

OSCILLATORS, REED

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.

OSCILLATORS, R-F

American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Arvin Frequency Devices, 2505 N. Salisbury St., W. Lafayette, Ind. p 1057
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. .... p 1070, 1071
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1084
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1077
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.

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Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. p 1091, 1092
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1097
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho ..... p 1089
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1098
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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1106, 1107
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1100, 1101
Heath Co., Dept. 180, Benton Harbor, Mich.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Measurements, Box 180, Boonton, N. J.
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. ..... p 1683
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. ... p 1687
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1122, 1123
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Ovenaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1112
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa p 1127
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. ..... p 2793
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. ... p 1713
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Vectron Laboratories, Inc., 146 Selleck St., Stamford, Conn. ... p 1136
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Raybond Elctrns. Inc., 930 Washington St., Norwood, Mass.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Tocco Div., 3800 Harvard Ave., Cleveland, Ohio
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

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Accutronics, Inc., 628 North St., Geneva, Ill. p 1058-1062, 1064-1067
Allen Electronics Div., Allen Organ Co., Macungie, Pa. ..... p 718
American Time Products, Bulova Watch Co., Inc.,
61-20 Woodside Ave., Woodside, N. Y. ..... p 1083
Arvin Frequency Devices, 2505 N. Salisbury St., W. Lafayette, Ind. p 1057
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1068
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. .... p 1357
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products,
61-20 Woodside Ave., Woodside, N. Y. ..... p 1084
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1888, 1889
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1077
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Connor-Winfield Corp., Winfield, Ill. ..... p 1086, 1087
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
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Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1940, 1941
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho ..... p 1089
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1098
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Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1106, 1107
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1101
Heath Co., Dept. 180, Benton Harbor, Mich.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
M F Electronics Corp., 118 East 25th St., New York, N. Y. ..... p 1120
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Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Ovenaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1112
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. ..... p 2793
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Wavetek, 8159 Engineer Rd., San Diego, Calif. ... p 1533, 1535-1542
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Collins Radio Co., Dallas, Texas
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

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CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
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CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1077
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Connor-Winfield Corp., Winfield, Ill. ..... p 1086, 1087
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Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1097
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho ..... p 1089
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Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1106, 1107
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1100, 1101
Heath Co., Dept. 180, Benton Harbor, Mich.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
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Ovenaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1112
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RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. ..... p 2793
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Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1533-1542
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dorsett Electronics, Box 36, Tulsa, Okla.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.

OSCILLATORS, SWEEP

E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1370
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. .... p 1683
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1534-1542
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
EMF Systems, Inc., Box 1009, State College, Pa.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Northeast Electronics Corp., Box 649, Concord, N. H.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.

Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

OSCILLATORS, TELEMETRY

Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1058, 1063-1067
Arvin Frequency Devices, 2505 N. Salisbury St., W. Lafayette, Ind. p 1057
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2838
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtal Corp., 1130 E. Cypress St., Covina, Calif.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. .. p 1092
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
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Frequency Sources Inc., P.O. Box 159, N. Chelmsford, Mass. .. p 1672
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
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Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1101
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
M F Electronics Corp., 118 East 25th St., New York, N. Y. .... p 1120
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Vectron Laboratories, Inc., 146 Selleck St., Stamford, Conn.
Wavetek, 8159 Engineer Rd., San Diego, Calif.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Defense Elctrns., Inc., Rockville, Md.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EMF Systems, Inc., Box 1009, State College, Pa.
EMR Div., Box 223, Princeton, N. J.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RFD Inc., 1501 W. Cass St., Tampa, Fla.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

OSCILLATORS, TEMPERATURE COMPENSATED

Arvin Frequency Devices, 2505 N. Salisbury St., W. Lafayette, Ind. p 1057
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1068
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ..... p 1070
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1084
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1077
Collins Radio Co., Newport Beach, Calif.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. p 1091
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1097
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Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Standard Crystal Co., 1105 S. Fremont Ave., Alhambra, Calif.

OSCILLATORS, TEST

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1068
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. ... p 1357
CML Inc., 350 Leland Ave., Plainfield, N. J.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
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Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
London Co., 811 Sharon Dr., Westlake, Ohio
M F Electronics Corp., 118 East 25th St., New York, N. Y. .... p 1120
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Measurements, Box 180, Boonton, N. J.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
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Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
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Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
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Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Collins Radio Co., Dallas, Texas
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dorsett Electronics, Box 36, Tulsa, Okla.
EMF Systems, Inc., Box 1009, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Northeast Electronics Corp., Box 649, Concord, N. H.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

OSCILLATORS, TUNING-FORK CONTROLLED

Accutronics, Inc., 628 North St., Geneva, Ill.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1082, 1083
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Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1889, 1891
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1098
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va. p 1115
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Murata Mfg. Co., Nagaoka, Kyoto, Japan ..... p 1125
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Spectrum Technology Inc., Box 368, Goleta, Calif. ..... p 1132, 1133
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Collins Radio Co., Dallas, Texas
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.

OSCILLATORS, UHF, VHF

Accutronics, Inc., 628 North St., Geneva, Ill. p 1058, 1061, 1062, 1064-1066
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.

OSCILLATORS ULTRA-LOW-FREQUENCY

Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1084
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Frequency Sources Inc., P.O. Box 159, N. Chelmsford, Mass. p 1672, 1673
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1101
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
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Measurements, Box 180, Boonton, N. J.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
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Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa p 1127
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
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Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
EMF Systems, Inc., Box 1009, State College, Pa.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wavetek, Indiana Inc., 3000 Shelby St., Indianapolis, Ind.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

OSCILLATORS, ULTRA-LOW-FREQUENCY

Accutronics, Inc., 628 North St., Geneva, Ill. p 1059, 1060, 1062, 1063, 1067
Agastat Div., 1027 Newark Ave., Elizabeth, N. J.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1083
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1068
CML Inc., 350 Leland Ave., Plainfield, N. J.
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1155
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans. p 1091
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho ..... p 1089
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1098
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1106, 1107
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1100
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
I-B-T Instrs. Inc., Box 1818, New Haven, Conn. ..... p 2737

OSCILLATORS ULTRA-LOW-FREQUENCY (Cont'd)

Kay Electric Co., Maple Ave., Pine Brook, N. J.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1119
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1122
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ovenaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1112
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1533-1542
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Collins Radio Co., Dallas, Texas
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

OSCILLATORS, ULTRASONIC

Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif.
CML Inc., 350 Leland Ave., Plainfield, N. J.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Waveforms, 11922 Valerio St., N. Hollywood, Calif.
Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
TAC Technical Instr. Corp., Scotch Rd., Mercer Airpt., Trenton, N. J.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.

OSCILLATORS, VOLTAGE CONTROLLED

Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1065-1067
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Arvin Frequency Devices, 2505 N. Salisbury St., W. Lafayette, Ind. p 1057
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2838
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1068
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ... p 1070, 1071
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1084
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1889, 1891
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 1077
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Connor-Winfield Corp., Winfield, Ill. ..... p 1087
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass. p 1088
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Electronic Components Div., United Aircraft, Trevose, Pa. ..... p 2630
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1097
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Fenwalt, W. H. Inc., Webb Rd., Lapwai, Idaho ..... p 1089
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Frequency Sources Inc., P.O. Box 159, N. Chelmsford, Mass. .. p 1673
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1107
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1100, 1101
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 1109
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
M F Electronics Corp., 118 East 25th St., New York, N. Y. ..... p 1121
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa.
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. ..... p 1683
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1122
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill. p 1124
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Ovenaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1112
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2793
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630
Vectron Laboratories, Inc., 146 Selleck St., Stamford, Conn. .... p 1136
Vetter, A. R. Co., Box 143, Rebersburg, Pa. ..... p 2162
Waveforms, 11922 Valerio St., N. Hollywood, Calif.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1533-1542
Yeiser Labs., 881 West 18th St., Costa Mesa, Calif.
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Collins Radio Co., Dallas, Texas
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EMF Systems, Inc., Box 1009, State College, Pa.
EMR Div., Box 223, Princeton, N. J.
FKS Communications, Inc., 3 Delaware Dr., New Hyde Park, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
ITT Electron Tube, Box 100, Easton, Pa.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Micom, Inc., 855 Commercial St., Palo Alto, Calif.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microcom Corp., Horsham Valley Industrial Park, Horsham, Pa.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Resdel Engineering Corp., Box 24000, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
TMC Systems (Ariz), Inc., 930 West 23rd St., Unit 26, Tempe, Ariz.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

OSCILLOGRAPHS, DIRECT WRITING

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1554, 1569
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
B & F Instruments Inc., Cornwells Hgts., Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

OSCILLOGRAPHS, DIRECT WRITING MULTICHANNEL

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1554, 1569
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Hathaway, 5250 E. Evans Ave., Denver, Colo.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
B & F Instruments Inc., Cornwells Hgts., Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

OSCILLOGRAPHS, PORTABLE

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1554, 1569
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
B & F Instruments Inc., Cornwells Hgts., Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

OSCILLOSCOPE AMPLIFIER PLUG-INS

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
General Atronics Corp., Elctrn. Instr. Div., 1200 E. Mermaid La., Phila., Pa. p 1391
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1442
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y. ..... p 1204
Tektronix, Inc., Box 500, Beaverton, Ore. ..... p 1510
Telequipment, Ltd., Box 500, Beaverton, Ore. ..... p 1510
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Alban Electronics, 111 Cedar La., Englewood, N. J.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Ensco, Inc., 3100 Eldredge St., Salt Lake City, Utah
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.

OSCILLOSCOPE CAMERAS—SEE CAMERAS, OSCILLOSCOPE

OSCILLOSCOPE IMAGE EXPANDERS

Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1498
Ednalite Research Corp., 200 N. Water St., Peekskill, N. Y.

OSCILLOSCOPE OSCILLATOR PLUG-INS

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. ..... p 2141

OSCILLOSCOPE PREAMPLIFIER PLUG-INS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1442
Tektronix, Inc., Box 500, Beaverton, Ore. ..... p 1510
Telequipment, Ltd., Box 500, Beaverton, Ore. ..... p 1510
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.

OSCILLOSCOPE PROBES

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Heath Co., Dept. 180, Benton Harbor, Mich.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1442
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Waterman Instrument Corp., 400 S. Warminster Rd., Hatboro, Pa.

OSCILLOSCOPE TIME-BASE GENERATOR PLUG-INS

Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1064
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Heath Co., Dept. 180, Benton Harbor, Mich.
Tektronix, Inc., Box 500, Beaverton, Ore.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.

OSCILLOSCOPES, DIGITAL-READOUT

Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Tektronix, Inc., Box 500, Beaverton, Ore.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.

OSCILLOSCOPES, GENERAL PURPOSE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
General Atronics Corp., Elctrn. Instr. Div., 1200 E. Mermaid La., Phila., Pa. p 1391
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1442
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. .... p 1475
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
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Tektronix, Inc., Box 500, Beaverton, Ore. ..... p 1510
Telequipment, Ltd., Box 500, Beaverton, Ore. ..... p 1510
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Alban Electronics, 111 Cedar La., Englewood, N. J.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Waterman Instrument Corp., 400 S. Warminster Rd., Hatboro, Pa.

OSCILLOSCOPES, HIGH FREQUENCY

E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
General Atronics Corp., Elctrn. Instr. Div., 1200 E. Mermaid La., Phila., Pa. p 1391
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. .... p 1475
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y. ..... p 1204
Tektronix, Inc., Box 500, Beaverton, Ore.
Telequipment, Ltd., Box 500, Beaverton, Ore.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.

OSCILLOSCOPES, LOW FREQUENCY

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
General Atronics Corp., Elctrn. Instr. Div., 1200 E. Mermaid La., Phila., Pa. p 1391
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y. ..... p 1204
Tektronix, Inc., Box 500, Beaverton, Ore. ..... p 1510
Telequipment, Ltd., Box 500, Beaverton, Ore. ..... p 1510
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1508
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Coldspring Instr. Corp., 800 W. Jericho Tpke., Huntington, N. Y.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Waterman Instrument Corp., 400 S. Warminster Rd., Hatboro, Pa.

OSCILLOSCOPES, MEDICAL

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Tektronix, Inc., Box 500, Beaverton, Ore.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Tracor Inc., 6500 Tracor La., Austin, Texas
Alban Electronics, 111 Cedar La., Englewood, N. J.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Dallons Instrs., 120 Kansas St., El Segundo, Calif.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Ensco, Inc., 3100 Eldredge St., Salt Lake City, Utah
Essential Elctrns. Corp., 3001 Chester Ave., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Waterman Instrument Corp., 400 S. Warminster Rd., Hatboro, Pa.

OSCILLOSCOPES, MULTI-BEAM

Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1425
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. .... p 1475
Tektronix, Inc., Box 500, Beaverton, Ore. ..... p 1510
Telequipment, Ltd., Box 500, Beaverton, Ore. ..... p 1510
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Dallons Instrs., 120 Kansas St., El Segundo, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.

OSCILLOSCOPES, MULTIPLE CHANNEL

AEL Inc., P.O. Box 552, Lansdale, Pa.
Applied Magnetics Corp., 75 Robin Hill Rd., Goleta, Calif.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
General Atronics Corp., Elctrn. Instr. Div., 1200 E. Mermaid La., Phila., Pa. p 1391
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. .... p 1475
Tektronix, Inc., Box 500, Beaverton, Ore. ..... p 1510
Telequipment, Ltd., Box 500, Beaverton, Ore. ..... p 1510
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Dallons Instrs., 120 Kansas St., El Segundo, Calif.
Ensco, Inc., 3100 Eldredge St., Salt Lake City, Utah
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Waterman Instrument Corp., 400 S. Warminster Rd., Hatboro, Pa.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.

OSCILLOSCOPES, PORTABLE, BATTERY OPERATED

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
General Atronics Corp., Elctrn. Instr. Div., 1200 E. Mermaid La., Phila., Pa. p 1391
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Tektronix, Inc., Box 500, Beaverton, Ore.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Wharton Unitools, 8-10 Lake St., Moosup, Conn.

OSCILLOSCOPES, PROGRAMMABLE

Tektronix, Inc., Box 500, Beaverton, Ore.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.

OSCILLOSCOPES, SAMPLING

E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Tektronix, Inc., Box 500, Beaverton, Ore.
Tracor Inc., 6500 Tracor La., Austin, Texas
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.

OSCILLOSCOPES, STORAGE

Applied Magnetics Corp., 75 Robin Hill Rd., Goleta, Calif.
Tektronix, Inc., Box 500, Beaverton, Ore.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.

OVENS, INFRARED DRYING

OSCILLOSCOPES, THREE-DIMENSIONAL

Tektronix, Inc., Box 500, Beaverton, Ore.
Optical Electronics Inc., Box 11140, Tucson, Ariz.

OSCILLOSCOPES, WIDE-BAND

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
General Atronics Corp., Elctrn. Instr. Div., 1200 E. Mermaid La., Phila., Pa. p 1391
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. .... p 1475
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Tektronix, Inc., Box 500, Beaverton, Ore. ..... p 1510
Telequipment, Ltd., Box 500, Beaverton, Ore. ..... p 1510
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1545
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Waterman Instrument Corp., 400 S. Warminster Rd., Hatboro, Pa.

OVENS, CRYSTAL AND COMPONENT

Accutronics, Inc., 628 North St., Geneva, Ill.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, Pa. ..... p 1076
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y. ..... p 1079, 1084
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 1077
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 1077
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 1077
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. ... p 1077
Clark Crystal Corp., 344 Boston Post Rd., Marlborough, Mass. .. p 1103
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y. ..... p 2812
Croven, Ltd., 500 Beech St., Whitby, Ont., Canada ..... p 1114
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1097
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho ..... p 1089
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1107
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
McCoy Electronics Co., Chestnut & Watts St., Mount Holly Springs, Pa. p 1119
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Monitor Products Co. Inc., 815 Fremont Ave., S. Pasadena, Calif. p 1123
Northern Engineering Labs Inc., 357 Beloit St., Burlington, Wisc. p 1126
Oven Industries Div., E. Simpson Rd., Mechanicsburg, Pa. ..... p 1102
Ovenaire Inc., 706 Forrest St., Charlottesville, Va. ..... p 1112
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Collins Radio Co., Dallas, Texas
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Isotemp Research, Inc., 1216 Harris St., Charlottesville, Va.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Safeway Heat Elements, Inc., Middlefield St., Middletown, Conn.
Semimetals, Inc., 405 National Ave., Mountain View, Calif.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trent, Inc., 201 Leverington Ave., Philadelphia, Pa.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.

OVENS, ELECTRIC—SEE FURNACES, ELECTRIC

OVENS, INFRARED DRYING

Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Etchomatic, Inc., Box 444, Waltham, Mass.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.

OVENS, INFRARED DRYING (Cont'd)

Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Merco Prods. Co., Inc., 1298 Bethel Dr., Eugene, Ore.
Miskella Infra-Red Co., 7301 Grand Ave., Cleveland, Ohio
Neo-Technology, Inc., Box 266, Montvale, N. J.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Research, Inc., Box 6164, Minneapolis, Minn.
Ross Engrg. Div., Box 751, New Brunswick, N. J.
Selas Corp. of America, Box 200, Dresher, Pa.
Trent, Inc., 201 Leverington Ave., Philadelphia, Pa.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

OVENS, LABORATORY

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J. p 1244
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
BTU Engineering Corp., 179 Bear Hill Rd., Waltham, Mass.
Baron-Blakeslee, Inc., 1620 S. Laramie Ave., Chicago, Ill.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Despatch Oven Co., Box 1320, Minneapolis, Minn.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.
Gruenberg Electric Co., Inc., 585 Commercial Ave., Garden City, N. Y.
Hydor Therme Corp., Airport Hwy., Pennsauken, N. J.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Kirk & Blum Mfg. Co., 3120 Forrer St., Cincinnati, Ohio
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Michigan Oven Co., 1st Oven Pl., Romulus, Mich.
National Appliance Co., Box 23008, Portland, Ore.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Oal Assocs., Inc., 155 Sullivan La., Westbury, N. Y.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Ross Engrg. Div., Box 751, New Brunswick, N. J.
Sara Scientific Co., Box 321, San Francisco, Calif.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

OVENS, MICROWAVE

Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
Despatch Oven Co., Box 1320, Minneapolis, Minn.
FECO, A Bangor Punta Co., 5855 Grant Ave., Cleveland, Ohio
LaRose, W. T. & Assocs., Box F, Lansingburgh Sta., Troy, N. Y.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.

OVENS, PARTICLE REDUCTION

Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.

OVENS, VACUUM

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. p 1245
Oven Industries Div., E. Simpson Rd., Mechanicsburg, Pa. p 1102
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Baker Co., Inc., 106 Granite St., Biddeford, Me.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Environmental Equip. Corp., 369 Linden St., Brooklyn, N. Y.
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa.
Grieve Corp., 1350 N. Elston Ave., Chicago, Ill.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Hydor Therme Corp., Airport Hwy., Pennsauken, N. J.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Kewaunee Scientific Equipment, 4014 Logan St., Adrian, Mich.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
National Appliance Co., Box 23008, Portland, Ore.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Red Point Corp., 105 W. Spazier, Burbank, Calif.
Standard Cabinet Co., Inc., 392 Minnisink Rd., Totowa, N. J.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

OXIDE, ALUMINUM—SEE INSULATING MATERIALS, POWDERED METAL OXIDE

OXIDES, MAGNETIC—SEE MAGNETIC IRON OXIDES

OXYGEN INDICATORS—SEE INDICATORS, OXYGEN/OZONE

PACKAGES, INTEGRATED CIRCUIT

Augat Inc., 36 Perry Ave., Attleboro, Mass. p 1590
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. p 1591
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. p 1591
CTS Corp., 905 N. West Blvd., Elkhart, Ind. p 1591
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. p 1591
G T I Corporation, 310 Chestnut St., Meadville, Pa. p 1218, 1594
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 587
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Atlantic Instrs. & Elctrns., 50 Hunt St., Watertown, Mass.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Varo, Inc., Microcircuits Prods Div., 900 N. Shiloh Rd., Garland, Tex.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

PACKAGES, SEMICONDUCTOR—SEE CANS, SEMICONDUCTOR

PACKAGING, CUSHIONING

Air-O-Plastik Corp., Asia Place, Carlstadt, N. J.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Blocksom & Co., P.O. Box 300, Michigan City, Ind.
Cryo-Therm Inc., Fogelsville, Pa.
Daubert Chemical Co., 2000 Spring Rd., Oak Brook, Ill.
Dow Chemical Co., Midland, Mich.
Environmental Container Systems, Box 337, Union City, Calif.
Press-On Products, 39 Factory Rd., Addison, Ill.
Sealed Air Corp., 179 Goffle Rd., Hawthorne, N. J.
Western Coil & Electrical Co., 215 State St., Racine, Wisc.

PADS, I & T—SEE ATTENUATORS

PADS, TRANSISTOR MOUNTING

Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Cinch-Monadnock, 18300 E. Valley Blvd., City of Industry, Calif.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Globe Plastics, 1342 South Signal Dr., Pomona, Calif. p 2514
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. p 2582
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa. p 2583
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. p 987
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas p 2628
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Aavid Engrg. Inc., 30 Cook Ct., Laconia, N. H.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Circuit Structures Lab., 3200 N. San Fernando Blvd., Burbank, Calif.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Eltee, Inc., 19 Fairfield Pl., W. Caldwell, N. J.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Gudebrod Bros. Silk Co., Inc., 225 West 34th St., New York, N. Y.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Nippert Electric Products Co., 825 Pittsburgh Dr., Delaware, Ohio
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.

PAGING SYSTEMS—SEE COMM. SYSTEMS, SELECTIVE PAGING

PAINTS, CONDUCTIVE, ELECTRIC—SEE COATINGS, CONDUCTIVE, ELECTRIC

PAINTS, FLUORESCENT—SEE COATINGS, FLUORESCENT

PAINTS, LUMINOUS

Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Black Light Prods., Box 45278, Chicago, Ill.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Stroblite Co., Inc., 75 West 45th St., New York, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.

PAINTS, METALLIC

Chomerics, Inc., 85 Mystic St., Arlington, Mass. p 1640
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Illinois Bronze Powder & Paint Co., 300 E. Main St., Lake Zurich, Ill.
Isochem Resins Co., Cook St., Lincoln, R. I.
Micro-Circuits Co., New Buffalo, Mich.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Randolph Products Co., 12th St., Carlstadt, N. J.
3M Co., 3M Center, St. Paul, Minn.
Wornow Process Paint Co., 1218 Long Beach Ave., Los Angeles, Calif.

PAINTS, RADIOACTIVE—SEE COATINGS, RADIOACTIVE

PAINTS, REFLECTIVE

Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Randolph Products Co., 12th St., Carlstadt, N. J.
3M Co., 3M Center, St. Paul, Minn.

PAINTS, RESISTIVE—ALSO SEE INKS FOR THICK-FILM MICROCIRCUITS

Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electro Materials Corp. of America, 605 Center Ave., Mamaroneck, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Etchomatic, Inc., Box 444, Waltham, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Holbrook-Merrill Co., 1150 Kifer Rd., Sunnyvale, Calif.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Micro-Circuits Co., New Buffalo, Mich.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Randolph Products Co., 12th St., Carlstadt, N. J.
Sauereisen Cements Co., 160 Gamma Dr., Pittsburgh, Pa.
Sprayon Prods., Inc., 26300 Fargo Ave., Bedford Hgts., Ohio
3M Co., 3M Center, St. Paul, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

PANEL EQUIPMENT—SEE DIALS; CONNECTORS: JACKS: LIGHTS: ETC.

PANEL MARKING KITS—SEE KITS, MARKING, (DIAL, INSTRUMENT, EQUIPMENT, ETC.)

PANELS, ELECTROLUMINESCENT

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 805
Ackerman Engravers, Inc., 43-22 36th St., Long Island City, N. Y.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Gilway Co., Electronics Div., Box 584, Newburyport, Mass.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
N/P Co., Inc., Box 127, Temple City, Calif.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Panelgraphic Corp., Box 254, Caldwell, N. J.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

PANELS, FUSE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Accurate Electronics Corp., Box 935J, Elyria, Ohio
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill.
Littelfuse, Inc., 800 E. Northwest Hwy., Des Plaines, Ill. p 2742
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
B & F Instruments Inc., Cornwells Hgts., Pa.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.

Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Wadsworth Electric Mfg. Co., Inc., 20 West 11th St., Covington, Ky.

PANELS, JACK

ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 817,821,825
AMP Incorporated, Box 3608, Harrisburg, Pa.
Accurate Electronics Corp., Box 9351, Elyria, Ohio
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Interswitch, 770 Airport Blvd., Burlingame, Cal.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 913
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill. ..... p 919
National Tel-Tronics Corp., 58 St. Casimir Ave., Yonkers, N. Y. .. p 928
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Trimm Inc., 400 Lake St., Libertyville, Ill. ..... p 996
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Virginia Panel Corp., Box 1106, Waynesboro, Va. ..... p 1008
Acro Products Corp., 1410 S. Aberdeen St., Chicago, Ill.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Audio Accessories, Inc., Gilsum, N. H.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Holland Electronics, Inc., 675 Hinsdale St., Brooklyn, N. Y.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Lynn Elctrns. Corp., Box 3003, Philadelphia, Pa.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.

PANELS, METAL—SEE CABINETS & ACCESSORIES, METAL

PANELS, METER—SEE CASES, EQUIPMENT, INSTRUMENT, METER

PANELS, PATCH—SEE PANELS, JACK

PANELS, POWER BUS

Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.

PANELS, RELAY RACK

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
Interswitch, 770 Airport Blvd., Burlingame, Cal.
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. ... p 591
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
B & P Precision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.
Hoffman Engrg. Co., 9th & Tyler Sts., Anoka, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ingersoll Products, 1000 West 120th St., Chicago, Ill.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Metalphoto Corp., 18531 S. Miles Rd., Cleveland, Ohio
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Middletown Mfg. Co., 27 Stack St., Middletown, Conn.
Miller Dial & Name Plate Co., 4400 N. Temple City Blvd., El Monte, Calif.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
N/P Co., Inc., Box 127, Temple City, Calif.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Wood, C. N. Mfg. Co., Rte. 332, E., Newtown, Pa.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.

PANORAMIC ADAPTERS—SEE RECEIVERS, PANORAMIC

PAPER INSULATION—SEE INSULATION MATERIALS, PAPER

PAPERS, GRAPHIC RECORDING

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1555
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Houston Instr., 4950 Terminal Ave., Bellaire, Texas ..... p 784,785
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Tracor Inc., 6500 Tracor La., Austin, Texas
Agfa-Gevaert, Inc., 275 North St., Teterboro, N. J.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Alfax Paper & Engrg. Co., Inc., Box A, Washington St., Westboro, Mass.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Calibrated Charts, Batavia, N. Y.
California Computer Products Inc., 305 N. Muller St., Anaheim, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Dietzgen, E. Co., 2425 N. Sheffield Ave., Chicago, Ill.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fitchburg Coated Products, Inc., Box 1106, Scranton, Pa.
Foxboro, Foxboro, Mass.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Graphic Controls Corp., 189 Van Rensselaer St., Buffalo, N. Y.
Gubelman Charts Div., Nashua Corp., 100 E. Kinney St., Newark, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Keuffel & Esser Co., Adams & Third Sts., Hoboken, N. J.
Labelon Corp., 10 Chapin St., Canandaigua, N. Y.
Ludlow Corp., Paper Div., Ware, Mass.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Telautograph Corp., 8700 Bellanca Ave., Los Angeles, Calif.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.

PARTS CLEANING MACHINES—SEE CLEANERS, ULTRASONIC; MACHINES, CLEANING—ALSO SEE MACHINES, VAPOR-DEGREASING

PASSIVE REFLECTORS—SEE ANTENNA REFLECTORS

PATCH BOARDS—SEE BOARDS, PLUG-IN BOARDS, PROGRAMMING

PATCH CORDS—SEE CORDS, PATCH

PEDESTALS, RADAR

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.

PHONOGRAPH PARTS & ACCESSORIES

Amecom Div., Litton Sys. Inc., 5115 Calvert Rd., College Park, Md.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

PERFORATORS, PAPER TAPE (ELECTRICALLY POWERED)

Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. ..... p 792
Ohr-Tronics, Inc., Box 630, Herkimer, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Colorado Instruments, Inc., 1 Park St., Broomfield, Colo.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Excellon Inds., 23915 Garnier, Torrance, Calif.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roytron, Litton Automated Business Sys., 31 Styertowne Rd., Clifton, N. J.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio

PERFORATORS, PAPER TAPE (MANUALLY OPERATED)

Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1353
Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. ..... p 792
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ohr-Tronics, Inc., Box 630, Herkimer, N. Y.
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif. p 799
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Robins Data Devices, Inc., 15-58 127th St., Flushing, N. Y.
Telcolab Corp., 405 Lexington Ave., New York, N. Y.

PERMEAMETERS—SEE METERS PERMEAMETER

PHASE & VOLTAGE ANALYZERS—SEE ANALYZERS, PHASE & VOLTAGE

PHASE COMPARATORS—SEE COMPARATORS, PHASE

PHASE INDICATORS—SEE INDICATORS PHASE

PHASE-LOCK FREQUENCY STABILIZERS—SEE STABILIZERS, FREQUENCY

PHASE SHIFTERS—SEE SHIFTERS, PHASE

PHONES—SEE HEADPHONES & HEADSETS

PHONOGRAPH ARMS, PLAYBACK

Astatic Corp., Box 120, Conneaut, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Rek-O-Kut Div., 2227 North 31st St., Milwaukee, Wisc.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.

PHONOGRAPH ARMS, TRANSCRIPTION

Astatic Corp., Box 120, Conneaut, Ohio
Empire Scientific Corp., 1055 Stewart Ave., Garden City, N. Y.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.

PHONOGRAPH PARTS & ACCESSORIES

Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Duotone Co., Inc., Box 814, S. Miami, Fla.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.
Empire Scientific Corp., 1055 Stewart Ave., Garden City, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.

PHONOGRAPH PARTS & ACCESSORIES (Cont'd)

Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
Major Electronics Corp., 649 39 St., Brooklyn, N.Y.
Murdock Corp., 158 Carter St., Chelsea, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Recoton Corp., 46-23 Crane St., Long Island City, N. Y.
Rek-O-Kut Div., 2227 North 31st St., Milwaukee, Wisc.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Symphonic Radio & Electronic Corp., 470 Park Ave., S., New York, N. Y.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

PHONOGRAPHS

Audiotronics Corp., 7428 Bellaire Ave., N. Hollywood, Calif.
Auricord, 35-41 29th St., Long Island City, N. Y.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Electron Enterprises, Inc., 6645 Stanley Ave., Berwyn, Ill.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
MP Audio Corporation, Fairfield, Conn.
Major Electronics Corp., 649 39 St., Brooklyn, N. Y.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Symphonic Radio & Electronic Corp., 470 Park Ave., S., New York, N. Y.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
V-M Corporation, 305 Territorial Rd., Benton Harbor, Mich.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

PHOSPHORS—SEE FLUORESCENT COMPOUNDS

PHOTO EMULSIONS, STENCIL

Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Electroid Corp., 95 Progress St., Union, N. J.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Naz-Dar International, 1087 N. Branch, Chicago, Ill.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Podgor, J. E. Co., Inc., Box 1714, Philadelphia, Pa.
Wire Cloth Enterprises, Inc., 130-132 Gamma Dr., Pittsburgh, Pa.
Xenon Corp., 39 Commercial St., Medford, Mass.

PHOTOCELLS & PHOTOTUBES—SEE CELLS, PHOTOCONDUCTIVE; ETC.—ALSO SEE TUBES, PHOTOMULTIPLIER

PHOTOELECTRIC EQUIPMENT—SEE ALARMS; CONTROLS; COUNTERS; ETC.

PHOTOFLASH EQUIPMENT, ELECTRONIC

Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill. ..... p 1779
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
ASCOR, Berkey Technical, 25-15 50th St., Woodside, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Agfa-Gevaert, Inc., 275 North St., Teterboro, N. J.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Burke & James, Inc., 333 W. Lake St., Chicago, Ill.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Flight Research, Div. Geotel, Inc., Box 1-F, Richmond, Va.
Hico Corp., 76 Coolidge Hill Rd., Watertown, Mass.
Honeywell, Inc., Photographic Prods. Div., 5501 S. Broadway, Littleton, Colo.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Sage Instruments Inc., 2 Spring St., White Plains, N. Y.
Xenon Corp., 39 Commercial St., Medford, Mass.

PHOTOGRAPHIC EQUIPMENT—SEE CAMERAS; ETC.

PHOTOMETERS—SEE METERS, LIGHT

PHOTOMULTIPLIER POWER SUPPLIES—SEE POWER SUPPLIES, PHOTOMULTIPLIER

PHOTOMULTIPLIER TUBE HOUSINGS

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Gamma Scientific, Inc., Dept. 301, 2185 Kurtz St., San Diego, Calif. p 1778
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Components Corp., 106 Main St., Denville, N. J.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Egan Laboratory, 107-56 113th St., Richmond Hill, N. Y.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
Pacific Photometric Instrs., 3024 Ashby Ave., Berkeley, Calif.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Products for Research, Inc., 57 N. Putnam St., Danvers, Mass.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
Velonex, 560 Robert Ave., Santa Clara, Calif.

PHOTOMULTIPLIERS—SEE TUBES, PHOTOMULTIPLIER

PHYSIOLOGICAL EQUIPMENT—SEE SPECIFIC TYPES

PICKUP CARTRIDGES—SEE CARTRIDGES, PHONO

PICKUPS, INDUSTRIAL—SEE TRANSDUCERS

PICKUPS, MAGNETIC—SEE TRANSDUCERS, MAGNETIC PICKUP

PICKUPS, PHONOGRAPH—SEE PHONOGRAPH ARMS, PLAYBACK

PICKUPS, PROXIMITY—SEE TRANSDUCERS, DISPLACEMENT

PICKUPS, TELEPHONE (FOR RECORDING)

Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
A.P.W. Co., 72 W. Main St., Rockaway, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.

PICKUPS, TORQUE—SEE TRANSDUCERS, TORQUE

PICKUPS, VIBRATION—SEE TRANSDUCERS, VIBRATION: ACCELEROMETERS

PIEZOELECTRIC CRYSTALS—SEE CRYSTALS, PIEZOELECTRIC

PILOT LAMPS—SEE LAMPS, DIAL & PILOT

PIN STRAIGHTENERS, CONNECTOR

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.

PIN STRAIGHTENERS, TUBE

Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.

PINS, COTTER, DOWEL, TAPER, ETC.—SEE PINS, MECHANICAL

PINS, ELECTRICALLY CONDUCTIVE

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
AirBorn, Inc., 2618 Manana Dr., Dallas, Tex. ..... p 833
Art Wire & Stamping Co., 28 Boyden Pl., Newark, N. J. ..... p 1635
Concord Electronics Corp., 37 Great Jones St., New York, N. Y. p 890
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill. ..... p 919
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill. ..... p 1009
Associated Mfg. Co., 2414 Lawrence Ave., Chicago, Ill.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Larsen Importing Co., 140 Nassau St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Moser Jewel Co., 544 Fayette St., Perth Amboy, N. J.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.

PINS, MECHANICAL

Art Wire & Stamping Co., 28 Boyden Pl., Newark, N. J. ..... p 1635
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Helitronics Corp., 916 McCarter Hwy., Newark, N. J.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Allen Mfg. Co., Drawer 570, Hartford, Conn.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Anti-Corrosive Metal Prods. Co., Inc., Box 1894, Albany, N. Y.
Associated Mfg. Co., 2414 Lawrence Ave., Chicago, Ill.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Avdel Inc., 210 S. Victory Blvd., Burbank, Calif.
Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.
Bell Fasteners Corp., 352 Evelyn St., Paramus, N. J.
Bland Co., 95 Granby St., Bloomfield, Conn.
C. E. M. Co., Inc., 24 School St., Danielson, Conn.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Control Data Corp., 400 Border St., East Boston, Mass.
Deutsch Fastener Corp., Airport Sta - Box 90925, Los Angeles, Calif.
Elastic Stop Nut Div., 2330 Vauxhall Rd., Union, N. J.
Gillen, J. Co., 2540 South 50th Ave., Cicero, Ill.
Groov-Pin Corp., 1125 Hendricks Causeway, Ridgefield, N. J.
Hartwell Corp., 9035 Venice Blvd., Los Angeles, Calif.
Kaydon Engineering Corp., Muskegon, Mich.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Mecca, P.O. Box 36393, Houston, Tex.
Mercury Div., 10459 W. Jefferson Blvd., Culver City, Calif.
Moser Jewel Co., 544 Fayette St., Perth Amboy, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Shur-Lok Corp., 1300 E. Normandy Pl., Santa Ana, Calif.
Standard Screw Co., 2701 Washington Blvd., Bellwood, Ill.
Star Stainless Screw Co., Box 222, Totowa, N. J.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Torrington Co., Box 1008, Torrington, Conn.
Tridair Industries, 3000 W. Lomita Bl., Torrance, Cal.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

PITCH—SEE INSULATING COMPOUNDS, ASPHALT & PITCH

PITCH & TEMPO REGULATORS—SEE REGULATORS, PITCH & TEMPO

PLASTIC FILMS, RODS, SHEETS, ETC.

Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. ..... p 1579
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Adam Spence Corp., 3856 Park Ave., Edison, N. J.
American Mica Insulation Co., Manasquan, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Avisun Corp., 21 South 12th, Philadelphia, Pa.
Blum, J. & Co., Inc., Box 292, Carlstadt, N. J.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Celanese Plastics Co., 550 Broad St., Newark, N. J.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hercules Inc., 910 Market St., Wilmington, Dela.
Hysol Div., 211 Franklin St., Olean, N. Y.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Molded Fiber Glass Cos., 4401 Benefit Ave., Ashtabula, Ohio
Monsanto Co., 200 North 7th St., Kenilworth, N. J.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
New England Laminates Co., Inc., 481 Canal St., Stamford, Conn.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Resdel Corp., Box 2171, Rio Grande, N. J.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Rohm & Haas Co., Independence Mall West, Philadelphia, Pa.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Synthane Corp., 12 River Rd., Oaks, Pa.
3M Co., 3M Center, St. Paul, Minn.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

PLASTIC FILTERS: PUMPS: VALVES—SEE FILTERS, FLUID, NONMETALLIC: PUMPS, NONMETALLIC: VALVES, NONMETALLIC

PLASTIC RAW MATERIALS, LIQUIDS, PELLETS, POWDERS, RESINS

Dow Corning Corp., Midland, Mich. ..... p 1582, 1583
Acme Resin Co., Div. Corn Prods. Co., 1401 Circle Ave., Forest Park, Ill.
Adhesive Products Corp., 1660 Boone Ave., Bronx, N. Y.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Avisun Corp., 21 South 12th, Philadelphia, Pa.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Belding Chemical Inds., 1407 Broadway, New York, N. Y.
Biggs Co., 1547 14th St., Santa Monica, Calif.
Bodnar Prods. Corp., 30 Grove St., New Rochelle, N. Y.
Borden Inc., 350 Madison Ave., New York, N. Y.
Celanese Plastics Co., 550 Broad St., Newark, N. J.
Chemical Products Corp., King Philip Rd., E. Providence, R. I.
Cincinnati Devel. & Mfg. Co., 5614 Wooster Pike, Cincinnati, Ohio
City Chemical Corp., 132 West 22 St., New York, N. Y.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Cosmic Plastics, Inc., 12314 Gladstone St., San Fernando, Calif.
Dennis Chemical Co., 2701 Papin St., St. Louis, Mo.
Diamond Shamrock Chemical Co., 175 Schuyler Ave., N. Arlington, N. J.
Dolph, J. C. Co., New Rd., Monmouth Junction, N. J.
Dow Chemical Co., Midland, Mich.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Durez Plastics Div., 1921 Walck Rd., N. Tonawanda, N. Y.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
F M C Corp., Organic Chemicals Div., 633 Third Ave., New York, N. Y.
Fiberite Corp., 515-559 W. 3 St., Winona, Minn.
Furane Plastics, Inc., 5121 San Fernando Rd., W. Los Angeles, Calif.
GAF Corp., 140 West 51 St., New York, N. Y.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Hardman, Inc., 600 Cortland St., Belleville, N. J.

Hercules Inc., 910 Market St., Wilmington, Dela.
Hightemp Resins Inc., 225 Greenwich Ave., Stamford, Conn.
Hysol Div., 211 Franklin St., Olean, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
Klenk Chemical Corp., 31140 Fraser Dr., Fraser, Mich.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Mansol Ceramics Co., Inc., 140 Little St., Belleville, N. J.
Marbon, Box 68, Washington, W. Va.
Mereco Products Corp., 538 Wellington Ave., Cranston, R. I.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Midsil Corp., 27 Bland St., Emerson, N. J.
Molded Fiber Glass Cos., 4401 Benefit Ave., Ashtabula, Ohio
Morton Chemical Co., 110 N. Wacker Dr., Chicago, Ill.
Nopco Chemical Div., 60 Park Pl., Newark, N. J.
Packaged Resins Co., 130 Wood Rd., Braintree, Mass.
Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia, Pa.
Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, Pa.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Ram Chemicals Mfg. Co., Inc., 210 E. Alondra Blvd., Gardena, Calif.
Rawn Company, Inc., Box 9, Spooner, Wisc.
Rector Engrg. & Plastics Co., 318 Randolph Pl., N. E., Washington, D. C.
Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Rohm & Haas Co., Independence Mall West, Philadelphia, Pa.
Rosenberg Bros. & Co., 100 Landing Ave., Smithtown, N. Y.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Schenectady Chemicals, Inc., Box 1046, Schenectady, N. Y.
Smooth-On, Inc., 1000 Valley Rd., Gillette, N. J.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Tra-Con, Inc., 55 North St., Medford, Mass.
U S Polymeric, Inc., 700 E. Dyer Rd., Santa Ana, Calif.
Union Carbide Corp., Chemical & Plastics, 270 Park Ave., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

PLASTICS, ENCAPSULATING—SEE COMPOUNDS, ENCAPSULATING

PLASTICS, HEAT SHRINKABLE—SEE CAPS, FORMS & TAPES, HEAT SHRINKABLE—ALSO SEE TUBING, HEAT SHRINKABLE

PLATED WIRE MEMORY SYSTEMS—SEE MEMORY SYSTEMS

PLATES, INSTRUCTIONAL—SEE NAMEPLATES

PLATES, NAME—SEE NAMEPLATES

PLATES, SILK SCREEN—SEE NAMEPLATES

PLATES, SWITCH MOUNTING

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Massey, A. H., Inc., 111 Third St., Derby, Conn.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.

PLATING SOLUTIONS

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Conversion Chemical Corp., 210 E. Main St., Rockville, Conn.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Collins Radio Co., Dallas, Texas
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hull, R. O. & Co., Inc., 3203 West 71 St., Cleveland, Ohio
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Mac Dermid, Inc., 526 Huntingdon Ave., Waterbury, Conn.
Matthey Bishop, Inc., Malvern, Pa.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Shipley Co., Inc., 2300 Washington St., Newton, Mass.
Sifco Metachemical, 935 East 63rd St., Cleveland, Ohio
Technic, Inc., Box 965, Providence, R. I.

PLAYERS, MAGNETIC TAPE—SEE RECORDERS, MAGNETIC TAPE (LAB TYPE)

PLIERS

Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif. ..... p 2831
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Boker Mfg. Co., In-Dus-Tronic Div., 200 Burnett Ave., Maplewood, N. J.
Channellock, Inc., S. Main St., Meadville, Pa.
Crescent Niagara Corp., 70 Niagara St., Buffalo, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
E. T. M. Corp., 144 W. Chestnut Ave., Monrovia, Calif.
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Owatonna Tool Co., 395 Eisenhower Dr., Owatonna, Minn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Universal Shellac & Supply Co., 540 Irving Ave., Brooklyn, N. Y.
Utica Tool Co., Inc., Cameron Rd., Orangeburg, S. C.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Vigor Tool Co., 53 West 23 St., New York. N. Y.
Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C., N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo, N. Y.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.
Xcelite Inc., Thorne & Bank Sts., Orchard Park, N. Y.

PLOTTERS, IMPEDANCE—SEE RECORDERS, GRAPHIC

PLOTTING BOARDS—SEE BOARDS, PLOTTING

PLUG ADAPTERS

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J.
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Americon Corp., 87 Rumford Ave., Waltham, Mass. ..... p 834
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 892
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
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Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif.
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Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
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Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
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Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Associated Engineering Corp., 65 Kent St., Brookline, Mass.
Barker Products Co., 344 Central St., Saugus, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
DonMar Prods., Inc., Box 10125, Denver, Colo.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Massey, A. H., Inc., 111 Third St., Derby, Conn.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.

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ADC Products, 6405 Cambridge St., Minneapolis, Minn. ..... p 820
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 913
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio ..... p 984, 985
Mallory Controls Co., Box 327, Frankfort, Ind. ..... p 2482
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y.
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif.
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Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Trimm Inc., 400 Lake St., Libertyville, Ill. ..... p 996
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.

PLUGS, ELECTRICAL (ALL TYPES)

Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Magnavolt Inc., 44 Prospect St., Yonkers, N. Y.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Morse, Frank W. Co., 354 Congress St., Boston, Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Standard Electric Time Corp., 89 Logan St., Springfield, Mass.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Telephone Components, Inc., 9 Norfolk Dr., Northport, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
W & M Mfg. Corp., 187 Lafayette St., New York, N. Y.
Wald Sound, 11131 Dora St., Sun Valley, Calif.

PLUG CAPS & SHELLS

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif.
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Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H. p 1004
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Clover Industries Div., 600 Young St., Tonawanda, N. Y.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Wells, G. Co., 90 Nepperhan Ave., Yonkers, N. Y.

PLUG-IN MODULE ENCLOSURES

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. p 949-959
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 593
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y.
B & P Précision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
3M Co., 3M Center, St. Paul, Minn.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

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Burndy Corporation, Richards Ave., Norwalk, Conn. ..... p 881
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GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 913
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio ..... p 984, 985
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1174
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif.
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Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
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Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H. p 1004
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Wiremold Co., Hartford, Conn. ..... p 1010, 1011
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Audio Accessories, Inc., Gilsum, N. H.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Barker Products Co., 344 Central St., Saugus, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
General Cable Corp., 733 Third Ave., New York, N. Y.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sta-Tite Mfg. Co., Box "G", South Hwy., Lexington, Mo.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

PLUGS, FUSED

Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Deutsch Co., Electrn. Comp. Div., Mun. Airport Banning, Calif.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.

POINTERS, DIAL

Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y. p 1171
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1174
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bodnar Prods. Corp., 30 Grove St., New Rochelle, N. Y.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Injection Plastic Corp., 8124-30 N. Ridgeway Ave., Skokie, Ill.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.
Rogan Brothers Inc., 8031 N. Monticello Ave., Skokie, Ill.
Smith, J. A. Co., Boyertown, Pa.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

POLARIMETERS

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Epic, Inc., 150 Nassau St., New York, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Process & Instruments Corp., 1943 Broadway, Bklyn., N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

POLYESTER INSULATING FILM—SEE INSULATION MATERIALS, FILM

PORCELAIN—SEE INSULATION MATERIALS, CERAMIC

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American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.

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U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1003
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Kaye, Joseph, & Co., Inc., 737 Concord Ave., Cambridge, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
States Co., 19 New Park Ave., Hartford, Conn.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
W & M Mfg. Corp., 187 Lafayette St., New York, N. Y.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

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Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.

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U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1003
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.

POTENTIOMETER TESTERS—SEE TESTERS, POTENTIOMETER

POTENTIOMETERS, CARBON CERAMIC

CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 2456
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 2456
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 2456
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 2456
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.

POTENTIOMETERS, CARBON FILM

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
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Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif. p 2252
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif.
Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2455
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Daven, Grenier Field, Dept. EEM 87, Manchester, N. H.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Mallory Controls Co., Box 327, Frankfort, Ind. ..... p 2482
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y. .... p 2491
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass. ..... p 2503
Weston Components Div., Weston-Archbald, Archbald, Pa.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

POTENTIOMETERS, CERAMIC METAL (CERMET)

Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
p 2448-2451
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif. p 2253
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 2456, 2457
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. p 2456, 2457
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 2456, 2457
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. p 2456, 2457
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2462
Dale Electronics Inc., Box 609, Columbus, Nebr. ..... p 2466, 2467
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electra/Midland Corp., Cermetrik Div., 3347 Industrial Ct., San Diego, Cal.
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Fairchild Controls, 225 Park Ave., Hicksville, N. Y. ..... p 2471
Fairchild Controls, 5625 Kearny Villa Rd., San Diego, Calif. .... p 2471
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal.
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Precision Electronic Components Ltd., 19 Hafis Rd., Toronto, Ont., Can.
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Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y.
Samarius Inc., 300 Seymour Ave., Derby, Conn. ..... p 2500
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif.
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Weston Components Div., Weston-Archbald, Archbald, Pa. p 2504, 2505
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Colvern Ltd., Spring Gardens, Romford, Essex, Eng.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan

POTENTIOMETERS, COMPOSITION, CARBON

Airco Speer Elctrn. Components, Resistor Plant, Bradford, Pa.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif. p 2252
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 2456, 2457
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. p 2456, 2457
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 2456, 2457
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. p 2456, 2457
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2455
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H. ..... p 2460
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Precision Electronic Components Ltd., 19 Hafis Rd., Toronto, Ont., Can.
p 2490
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y. .... p 2491
Stackpole Components Co., Box 14466, Raleigh, N. C.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

POTENTIOMETERS, CONDUCTING PLASTIC

Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
p 2448, 2449
Carter Mfg. Corp., 23 Washington St., Hudson, Mass. .... p 2458, 2459
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2463
Duncan Electronics Inc., 2865 Fairview Rd., Costa Mesa, Calif. .. p 2468
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
p 2443
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. ..... p 2470
Fairchild Controls, 5625 Kearny Villa Rd., San Diego, Calif. .... p 2470
Markite Corp., 155 Waverly Pl., New York, N. Y. ..... p 2483
New England Instrument Co., 14 Kendall Lane, Natick, Mass.
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Nytronics, Inc./Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn.
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Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y. .... p 2491
Samarius Inc., 300 Seymour Ave., Derby, Conn. ..... p 2500
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif.
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Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass. .. p 2502, 2503
Ace Elctrn. Assocs., Inc., 99 Dover St., Somerville, Mass.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
Logan Elctrn. Corp., 100 Mill St., Revere, Mass.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.

POTENTIOMETERS, HOT MOLDED

Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2455
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H. ..... p 2460
Precision Electronic Components Ltd., 19 Hafis Rd., Toronto, Ont., Can.
p 2490
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Keltron Corp., 225 Crescent St., Waltham, Mass.

POTENTIOMETERS, LAB TYPE

Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
p 1339
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.

CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Duncan Electronics Inc., 2865 Fairview Rd., Costa Mesa, Calif. . . p 2468
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412, 1413
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. . . . . p 1426
RFL Inds., Inc., Powerville Rd., Boonton, N. J. . . . . . p 1472
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. . . . . p 1504
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Bristol Co., Box 1790, Waterbury, Conn.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Rex Rheostat Co., 149 Babylon Tpke., Roosevelt, N. Y.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

POTENTIOMETERS, METAL FILM

Amphenol Controls Div., 120 S. Main St., Janesville, Wisc. . . . . . p 2447
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Digilog Electronics Corp., Box 9368, 701 G. Third Ave. N., Seattle, Wash. p 2465
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. . . . . . p 2471
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal.
Samarius Inc., 300 Seymour Ave., Derby, Conn. . . . . . p 2500
Weston Components Div., Weston-Archbald, Archbald, Pa.
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Miniature Elctrn. Components Corp., 600 South St., Holbrook, Mass.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

POTENTIOMETERS, METAL, GLAZED—SEE POTENTIOMETERS, CERAMIC-METAL

POTENTIOMETERS, MOTORIZED—SEE POTENTIOMETERS, SERVO MOUNT

POTENTIOMETERS, NON-LINEAR—SEE POTENTIOMETERS (AS MODIFIED)

POTENTIOMETERS, RECTILINEAR

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 2349
Amphenol Controls Div., 120 S. Main St., Janesville, Wisc. . . . . p 2444
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 2448, 2450, 2451
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif. p 2252-2254
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. . . . . . p 2456, 2457
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. p 2456, 2457
CTS Corp., 905 N. West Blvd., Elkhart, Ind. . . . . . p 2456, 2457
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. p 2456, 2457
Carter Mfg. Corp., 23 Washington St., Hudson, Mass. . . . . p 2458, 2459
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H. . . . . . p 2461
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. p 2462, 2463
Dale Electronics Inc., Box 609, Columbus, Nebr. . . . . . p 2466, 2467
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 2443
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. . . . . . p 2470, 2471
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. p 2474, 2475, 2477-2481
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Markite Corp., 155 Waverly Pl., New York, N. Y. . . . . . p 2483
New England Instrument Co., 14 Kendall Lane, Natick, Mass. p 2487-2489
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn. p 2484, 2485
Precision Electronic Components Ltd., 19 Hafis Rd., Toronto, Ont., Can. p 2490
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif. p 2494, 2495
Weston Components Div., Weston-Archbald, Archbald, Pa. p 2504, 2505
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Keltron Corp., 225 Crescent St., Waltham, Mass.

POTENTIOMETERS, RHEOSTAT —SEE RHEOSTATS

POTENTIOMETERS, SERVO-MOUNT

Amphenol Controls Div., 120 S. Main St., Janesville, Wisc. p 2444, 2445
Automation Development Co., 9905 W. Jeffersen Blvd., Culver City, Calif. p 2661
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 2448
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif. p 2254
Carter Mfg. Corp., 23 Washington St., Hudson, Mass. . . . . . p 2458
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H. . . . . . p 2461
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. p 2462, 2463
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. . . . . . p 1728
Dale Electronics Inc., Box 609, Columbus, Nebr. . . . . . p 2466, 2467
Duncan Electronics Inc., 2865 Fairview Rd., Costa Mesa, Calif. . . p 2468
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 2443
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. . . . . . p 2470
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. . . . . . p 2481
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
New England Instrument Co., 14 Kendall Lane, Natick, Mass. p 2487-2489
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn. p 2484, 2485
Samarius Inc., 300 Seymour Ave., Derby, Conn. . . . . . p 2500
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif. p 2494-2497
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass. . . . . . p 2503
Weston Components Div., Weston-Archbald, Archbald, Pa. p 2504, 2505
Ace Elctrn. Assocs., Inc., 99 Dover St., Somerville, Mass.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Astro Electronics Inc., 1160 E. Ash, Fullerton, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Logan Elctrn. Corp., 100 Mill St., Revere, Mass.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Voak Engrg. Co., Inc., 129 A St., Upland, Calif.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Voltronics, Inc., 7746 W. Addison St., Chicago, Ill.

POTENTIOMETERS, TRIMMER

Airco Speer Elctrn. Components, Resistor Plant, Bradford, Pa.
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 2349
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Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 2450, 2451
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CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. . . . . . p 2456, 2457
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CTS Corp., 905 N. West Blvd., Elkhart, Ind. . . . . . p 2456, 2457
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. p 2456, 2457
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Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2455
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Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. . . . . p 2462
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa. . . . . p 2361
Dale Electronics Inc., Box 609, Columbus, Nebr. . . . . . p 2467
Digilog Electronics Corp., Box 9368, 701 G. Third Ave. N., Seattle, Wash. p 2465
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 2443
Electra/Midland Corp., Cermetrik Div., 3347 Industrial Ct., San Diego, Cal. p 2469
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. . . . . . p 2470, 2471
Fairchild Controls, 5625 Kearny Villa Rd., San Diego, Calif. p 2470, 2471
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. . . p 2474-2481
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Mallory Controls Co., Box 327, Frankfort, Ind. . . . . . p 2482
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Precision Electronic Components Ltd., 19 Hafis Rd., Toronto, Ont., Can. p 2490
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y. . . . . p 2491
Samarius Inc., 300 Seymour Ave., Derby, Conn. . . . . . p 2500
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif. p 2492-2497
Techno-Components Corp., 7803 Lemona, Van Nuys, Calif. p 2498, 2499
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa.
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass. . . p 2502, 2503
Weston Components Div., Weston-Archbald, Archbald, Pa. p 2504, 2505
Atohm Electronics, 3030 Empire, Burbank, Calif.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Diplohmatic Div., 1211 E. Denny Way, Seattle, Wash.
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Mel-Rain Corp., 3100 Roosevelt Ave., Indianapolis, Ind.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Miniature Elctrn. Components Corp., 600 South St., Holbrook, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

POWDERS, PRECIOUS METAL

POTENTIOMETERS, WIREWOUND

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Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 2448, 2449
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CTS Corp., 905 N. West Blvd., Elkhart, Ind. . . . . . p 2456, 2457
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. p 2456, 2457
Carter Mfg. Corp., 23 Washington St., Hudson, Mass. . . . . p 2458, 2459
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Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
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Duncan Electronics Inc., 2865 Fairview Rd., Costa Mesa, Calif. . . p 2468
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 2443
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 2473
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. . . . . . p 2470, 2471
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. . . . p 2476-2481
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind.
Mallory Controls Co., Box 327, Frankfort, Ind. . . . . . p 2482
Murata Mfg. Co., Nagaoka, Kyoto, Japan
New England Instrument Co., 14 Kendall Lane, Natick, Mass. p 2487-2489
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn. p 2485
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y. . . . . p 2491
Samarius Inc., 300 Seymour Ave., Derby, Conn. . . . . . p 2500
San Fernando Electric Mfg. Co., 1501 First St., San Fernando, Cal.
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif. p 2492-2497
Techno-Components Corp., 7803 Lemona, Van Nuys, Calif. p 2498, 2499
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass. . . . p 2502, 2503
Weston Components Div., Weston-Archbald, Archbald, Pa. p 2504, 2505
Ace Elctrn. Assocs., Inc., 99 Dover St., Somerville, Mass.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Astro Electronics Inc., 1160 E. Ash, Fullerton, Calif.
Atohm Electronics, 3030 Empire, Burbank, Calif.
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Colvern Ltd., Spring Gardens, Romford, Essex, Eng.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Diplohmatic Div., 1211 E. Denny Way, Seattle, Wash.
Electro Techniques, 215 Via Del Norte, Oceanside, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
Logan Elctrn. Corp., 100 Mill St., Revere, Mass.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Mel-Rain Corp., 3100 Roosevelt Ave., Indianapolis, Ind.
Miniature Elctrn. Components Corp., 600 South St., Holbrook, Mass.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Rex Rheostat Co., 149 Babylon Tpke., Roosevelt, N. Y.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Voak Engrg. Co., Inc., 129 A St., Upland, Calif.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
Voltronics, Inc., 7746 W. Addison St., Chicago, Ill.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

POWDERS, PRECIOUS METAL

Chomerics, Inc., 85 Mystic St., Arlington, Mass.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Metal Climax, Inc., 1270 Ave. of The Americas, N.Y., N.Y.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Cerac, Inc., Box 597, Butler, Wisc.
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
United Refining & Smelting Co., 3700 N. Runge Ave., Franklin Pk., Ill.

POWDERS, PRECIOUS METAL (Cont'd)

Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

POWER LEVEL INDICATORS—SEE INDICATORS, POWER LEVEL

POWER OUTLET BOXES—SEE BOXES, POWER OUTLET

POWER SUPPLIES, AC OUTPUT, 60 CPS

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1850
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 1833
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1887
Associated Specialties Co., 1751 Main St., Orefield, Pa.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. .... p 1861
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1329
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1866-1872
Basler Electric Co., Box 269, Highland, Ill.
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. .... p 1357
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
CML Inc., 350 Leland Ave., Plainfield, N. J. p 1888, 1889, 1891, 1893
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Cohu Electronics Inc., Box 623, San Diego, Calif.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1935
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1937-1940
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. ... p 1950
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1736
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1957, 1959
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill. ..... p 1970
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. .. p 2041
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1439
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Neutronic Corp., Box 625, St. Louis, Mo.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2059, 2060
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ..... p 2084
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ..... p 2083
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2105
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Stace, Incorporated, 2240 East 3rd St., Dayton, Ohio
Superior Electric Co., 1000 Middle St., Bristol, Conn. p 2098, 2895, 2896
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Topaz Inc., 3802 Houston St., San Diego, Calif. ..... p 2118, 2119
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Unitron, 1624 N. First St., Garland, Texas ..... p 2134, 2135
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. p 2140, 2141
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. .... p 2147
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Ameco, Inc., Box 13741, Phoenix, Ariz.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Components Corp., 106 Main St., Denville, N. J.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
Dyna Technology Inc., 2201 E. 7th St., Sioux City, Iowa
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Essex International, Elctrn. Sys., Mt. Vernon Rd., Evansville, Ind.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hobby & Brown Electronic Corp., 15 St. Marks Ave., Rockville Ctr., N. Y.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Loyola Industries, Inc., 155 Arena St., El Segundo, Calif.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Space Power Assocs., Inc., 161 Brielle Ave., Staten Island, N. Y.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Task Corporation, Box 3999, Anaheim, Calif.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Zeus Generator Co., 12435 Euclid Ave., Cleveland, Ohio

POWER SUPPLIES, AC OUTPUT, 400 CPS

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1848, 1849
Acme Electric Corp., 28 Water St., Cuba, N. Y.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1887
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1857
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. .... p 1861
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1329
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1866-1872
Basler Electric Co., Box 269, Highland, Ill. ..... p 1018
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. .... p 1357
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
CML Inc., 350 Leland Ave., Plainfield, N. J. p 1888, 1889, 1891, 1893
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Cohu Electronics Inc., Box 623, San Diego, Calif.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1935
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1937-1940
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Gaylor-Rives, 422 S. Pasadena Ave., Pasadena, Cal. ..... p 1736
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1959
Georator Corp., Box 70, Manassas, Va. ..... p 1952, 1953
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
NWL, Inc., Box 455, Trenton, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2059, 2060
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ..... p 2084
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ..... p 2083
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2105
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn. .... p 2098, 2895
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Topaz Inc., 3802 Houston St., San Diego, Calif. ..... p 2118, 2119
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Unitron, 1624 N. First St., Garland, Texas ..... p 2134, 2135
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. p 2140, 2141
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Components Corp., 106 Main St., Denville, N. J.
Data Royal Corp., 8014 Armour St., San Diego, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.

EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis, Minn.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Motor Generator Div., EE-61, Troy, Ohio
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Savant Engrg., Inc., 825 N. Second St., St. Charles, Mo.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Space Power Assocs., Inc., 161 Brielle Ave., Staten Island, N. Y.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Task Corporation, Box 3999, Anaheim, Calif.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

POWER SUPPLIES, AC OUTPUT, OTHER THAN 60 OR 400 CPS

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1849
Acme Electric Corp., 28 Water St., Cuba, N. Y.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1887
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1857
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1861
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1866-1872
Behlman-Invertron Div., 3511 Midway Dr., San Diego, Calif. ... p 1357
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1888-1891
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Cohu Electronics Inc., Box 623, San Diego, Calif.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1937-1940
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1957, 1959
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
NWL, Inc., Box 455, Trenton, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2059, 2060
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ..... p 2084
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ..... p 2003
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2105
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 2098
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Topaz Inc., 3802 Houston St., San Diego, Calif. ..... p 2118
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Unitron, 1624 N. First St., Garland, Texas ..... p 2134
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. p 2140, 2141
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Armec Corp., 195 W. Hills Rd., Huntington Sta., N. Y.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Invertronics, Box 342, Pine Brook, N. J.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Luminator, Inc., Box 278, Plano, Tex.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Task Corporation, Box 3999, Anaheim, Calif.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

POWER SUPPLIES, DC OUTPUT, OTHER THAN 60 OR 400 CPS INPUT

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1848
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 1833

POWER SUPPLIES, 60 OR 60/400 CPS

Acopian Corp., P.O. Box 585, Easton, Pa.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1855
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1862
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Drossen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. ..... p 1925
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. .... p 1929
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 1949
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1961
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. .. p 2016
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J. p 2049
NWL, Inc., Box 455, Trenton, N. J.
North Electric Co., Electronetics Div., 553 S. market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2059, 2060
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 2087
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Spar Electronics, 7969 Engineer Rd., San Diego, Calif. ..... p 2111
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2115
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Femco, Inc., Box F, Irwin, Pa.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Pace-Tronics, Inc., 46 Main St., Newark, N. J.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.

POWER SUPPLIES, 60 OR 60/400 CPS INPUT, UP TO 30 VDC OUTPUT, VOLTAGE REGULATED

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. p 1818-1826, 1828
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834-1838
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 1833
Acopian Corp., P.O. Box 585, Easton, Pa. ..... p 1852, 1853
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285

POWER SUPPLIES, 60 OR 60/400 (Cont'd)

Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1860
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ... p 1331
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ... p 1332
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Basler Electric Co., Box 269, Highland, Ill. ... p 1018
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1864
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio p 2286
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1874-1878, 1881, 1883, 1884
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla. p 1897
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn. p 1896
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ... p 1898, 1899
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Deltron Inc., Wissahickon Ave., North Wales, Pa. ... p 1904, 1905
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif. p 1906-1909
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn. p 1912-1916, 1918
E-Tronics, 5901 Noble Ave., Van Nuys, Calif. ... p 1921, 1922
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. ... p 1924-1926
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ... p 1936
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. ... p 1936
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ... p 1927
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. p 1928, 1929, 1931
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1932-1935
Electrostatics, 7969 Engineer Rd., San Diego, Calif. ... p 1944
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. p 1946-1949
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. p 1950, 1951
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1956
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Heath Co., Dept. 180, Benton Harbor, Mich. ... p 1397
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1961-1963
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ... p 1404
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ... p 1968
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. ... p 531
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. ... p 1414
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1972, 1973, 1975-1979, 1981-1984, 1986-1996, 1998, 2000, 2001
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ... p 1969
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill. ... p 1970
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2015, 2017, 2019-2026, 2028, 2030, 2032, 2034, 2036-2040
Litton Data Systems Div., 8000 Woodley, Van Nuys, Calif. p 2012, 2013
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J. p 2046-2049
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
NJE Corp., 20 Boright Ave., Kenilworth, N. J. p 2050-2052, 2054, 2055
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Neutronic Corp., Box 625, St. Louis, Mo.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. ... p 2056
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y. ... p 2057
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. p 2309
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. p 2064-2069
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. ... p 2084
Power/Mate Corp., 163 Clay St., Hackensack, N. J. p 2072, 2073, 2075-2078
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ... p 2080-2083
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ... p 2086-2088
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1474
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn. p 2085
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. p 2090, 2901
Sorensen Operation, Richards Ave., Norwalk, Conn. ... p 2100-2104
Spar Electronics, 7969 Engineer Rd., San Diego, Calif. ... p 2110, 2111
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Technipower, Inc., Benrus Center, Ridgefield, Conn. ... p 2113
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ... p 2114-2116
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y. p 2127-2131
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ... p 2138
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Viking Modules, Inc., 223 Crescent St., Waltham, Mass. .. p 2144, 2145
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2117
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Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Abtronics, Inc., Box 712, Livermore, Calif.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Arbor Systems, Inc., P.O. Box 1325, Ann Arbor, Mich.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
B & F Instruments Inc., Cornwells Hgts., Pa.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Chalco Engrg. Corp., 15126 S. Broadway, Gardena, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Digiac Corp., Ames Ct., Plainview, N. Y.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro Specialties Corp., 370 Park Ave., Worcester, Mass.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
Gilway Co., Electronics Div., Box 584, Newburyport, Mass.
Gleason-Avery Co., Auburn, N. Y.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
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Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
La Marche Mfg. Co., 106 Bradrock Dr., Des Plains, Ill.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Mauratron, Inc., 13333 N. Central Expwy., Dallas, Tex.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Model Rectifier Corp., 5300 21st Ave., Brooklyn, N. Y.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Motor Generator Div., EE-61, Troy, Ohio
Motoresearch Mfg. Co., Inc., 1600 Junction Ave., Racine, Wisc.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pace Comms. Corp., 24049 S. Frampton, Harbor City, Calif.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Precision Apparatus, 1801 W. Belle Plaine, Chicago, Ill.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Scintillonics, Inc., Box 701, Ft. Collins, Colo.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
TDC Div., P.O. Box 365, Littleton, Mass.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Technitron Associates, Ltd., 769 Lajoie Ave., Dorval, Que., Can.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Ther Elec. & Machine Works, 17 S. Jefferson St., Chicago, Ill.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Weir Elctrns. Ltd., Durban Rd., Bognor Regis, Sussex, Eng.
Welex Electronics, Box 986, Silver Spring, Md.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

POWER SUPPLIES, 60 OR 60/400 CPS INPUT, UP TO 100 VDC OUTPUT, VOLTAGE REGULATED

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. p 1825, 1828
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1836-1838
Acme Electric Corp., 28 Water St., Cuba, N. Y. ... p 1833
Acopian Corp., P.O. Box 585, Easton, Pa. ... p 1852, 1853
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Associated Specialties Co., 1751 Main St., Orefield, Pa. ... p 1859
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. p 1860, 1862
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. ... p 1331
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Basler Electric Co., Box 269, Highland, Ill.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1864
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1874-1879, 1881, 1883, 1884
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn. p 1896
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ... p 1898, 1899
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Deltron Inc., Wissahickon Ave., North Wales, Pa. ... p 1904, 1905
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif.
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif. p 1906-1909
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn. p 1913-1915, 1918
E-Tronics, 5901 Noble Ave., Van Nuys, Calif. ... p 1921, 1922
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. ... p 1926
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ... p 1936
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. ... p 1936
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. p 1929, 1931

Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1932–1935
Electrostatics, 7969 Engineer Rd., San Diego, Calif. ..... p 1944
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. p 1946–1949
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. p 1950, 1951
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1956
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1961, 1963
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1414
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1972, 1973, 1975–1979, 1981–1984, 1986–1996, 1998, 2000, 2001
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1969
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill. ..... p 1970
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2015, 2017, 2019–2026, 2028, 2030, 2032, 2034, 2036–2040
Litton Data Systems Div., 8000 Woodley, Van Nuys, Calif. p 2012, 2013
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J. p 2046–2049
NJE Corp., 20 Boright Ave., Kenilworth, N. J. ..... p 2050–2055
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Neutronic Corp., Box 625, St. Louis, Mo.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y. ..... p 2057
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. p 2064–2067, 2069
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Power/Mate Corp., 163 Clay St., Hackensack, N. J. p 2073, 2076–2079
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. .... p 2080, 2081
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. p 2090, 2091
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2100–2104
Spar Electronics, 7969 Engineer Rd., San Diego, Calif.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2113
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2114–2116
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y. p 2127–2131
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Viking Modules, Inc., 223 Crescent St., Waltham, Mass. ..... p 2144
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal. p 2149
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Advance Instr. Corp., 1707 F St., Belmar, N. J.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Alpha Scientific, Inc., 460 Roland Way, Oakland, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
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Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
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AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1830
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1838, 1839
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Associated Specialties Co., 1751 Main St., Orefield, Pa. ..... p 1859
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1862
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Basler Electric Co., Box 269, Highland, Ill.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1864

POWER SUPPLIES, 60 OR 60/400 CPS

C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1874, 1875, 1877, 1879, 1881
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Cohu Electronics Inc., Box 623, San Diego, Calif.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ... p 1898, 1899
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900, 1901
Deltron Inc., Wissahickon Ave., North Wales, Pa. ..... p 1904, 1905
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif.
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif. p 1906, 1907, 1909
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn. p 1913–1915, 1918
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. ..... p 1926
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. p 1929, 1931
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1932, 1933
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. p 1947–1949
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. p 1950, 1951
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1956
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1961, 1963, 1964
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. ..... p 1966
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1414
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1972, 1973, 1981, 1984, 1987–1991, 1995, 1996, 1998
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1969
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill. ..... p 1970
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2015, 2020, 2022–2026, 2028, 2030, 2034, 2037–2039
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J. p 2046, 2048, 2049
NJE Corp., 20 Boright Ave., Kenilworth, N. J. ..... p 2052, 2053, 2055
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Neutronic Corp., Box 625, St. Louis, Mo.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y. ..... p 2057
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2059, 2060
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2061
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. p 2066, 2070
Power/Mate Corp., 163 Clay St., Hackensack, N. J. .... p 2077, 2079
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2091
Sorensen Operation, Richards Ave., Norwalk, Conn. p 2101–2103, 2106
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2097
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2113
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2114–2116
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y. p 2127–2131
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Viking Modules, Inc., 223 Crescent St., Waltham, Mass.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Chalco Engrg. Corp., 15126 S. Broadway, Gardena, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Computer Power Systems, Inc., 722 E. Evelyn Ave., Sunnyvale, Calif.

POWER SUPPLIES, 60 OR 60/400 (Cont'd)

Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronics for Life Sciences, Inc., Box 697, Twinbrook Sta., Rockville, Md.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Microdot Maghetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Moran Instrument Corp., 170 E. Orange Grove Ave., Pasadena, Calif.
Neutronic Assocs., 4 Hawthorne St., Farmingdale, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
North Electric Co., 553 S. Market St., Galion, Ohio
Northeast Scientific Corp., 30 Wetherbee St., Acton, Mass.
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Scintillonics, Inc., Box 701, Ft. Collins, Colo.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Space Power Assocs., Inc., 161 Brielle Ave., Staten Island, N. Y.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Ther Elec. & Machine Works, 17 S. Jefferson St., Chicago, Ill.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Western Technical Assocs., Box 727, Miraleste, Calif.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

POWER SUPPLIES, 60 OR 60/400 CPS INPUT, UP TO 10,000 VDC OUTPUT, VOLTAGE REGULATED

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1830
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1839
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 1833
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1855
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1324
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1864
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900, 1901
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1961, 1964
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. ..... p 1966
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio ... p 1424
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1972, 1973, 1987-1989
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
Lowell Elctrns. Corp., 9100 Terminal Ave., Skokie, Ill. ..... p 1431
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. .... p 1683
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y. ..... p 2057
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2059, 2060
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2061
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. p 2070, 2071
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2102, 2106
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2094-2097
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2136, 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. ..... p 2147
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y. p 1954
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Alfred Electronics, Stanford Indl. Pk., 3176 Porter Dr., Palo Alto, Calif.
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Computer Power Systems, Inc., 722 E. Evelyn Ave., Sunnyvale, Calif.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Moran Instrument Corp., 170 E. Orange Grove Ave., Pasadena, Calif.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Neutronic Assocs., 4 Hawthorne St., Farmingdale, N. Y.
North Electric Co., 553 S. Market St., Galion, Ohio
Northeast Scientific Corp., 30 Wetherbee St., Acton, Mass.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pacific Photometric Instrs., 3024 Ashby Ave., Berkeley, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Ther Elec. & Machine Works, 17 S. Jefferson St., Chicago, Ill.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Western Technical Assocs., Box 727, Miraleste, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.

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Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1864
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Condenser Products Co., Box 997, Brooksville, Fla.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900, 1901
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. ..... p 1966
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
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Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2059, 2060
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2061
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
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Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2136, 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y. p 1954
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Computer Power Systems, Inc., 722 E. Evelyn Ave., Sunnyvale, Calif.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Instrument Research Co., P. O. Box 231, Lincoln, Mass.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Moran Instrument Corp., 170 E. Orange Grove Ave., Pasadena, Calif.
Neutronic Assocs., 4 Hawthorne St., Farmingdale, N. Y.

North Electric Co., 553 S. Market St., Galion, Ohio
Northeast Scientific Corp., 30 Wetherbee St., Acton, Mass.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Sloan Instruments Corp., 535 E. Montecito St., Santa Barbara, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Xenon Corp., 39 Commercial St., Medford, Mass.

POWER SUPPLIES, 60 OR 60/400 CPS INPUT, UP TO 500.000 VDC OUTPUT, VOLTAGE REGULATED

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1324
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900, 1901
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. .... p 1966
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2061
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2106
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2094, 2096
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2136, 2137
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Gauging & Control, 296 Westport Ave., Norwalk, Conn.
Ionic Electrostatic Corp., 111 Monroe St., Garfield, N. J.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. ... ... p 2071

POWER SUPPLIES, 60 OR 60/400 CPS INPUT, OVER 500.000 VDC OUTPUT, VOLTAGE REGULATED

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1324
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. .... p 1966
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2106
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2136, 2137
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.

POWER SUPPLIES, 60-400 CPS INPUT, UNREGULATED D-C OUTPUT

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Acopian Corp., P.O. Box 585, Easton, Pa. ..... p 1852
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Basler Electric Co., Box 269, Highland, Ill.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1864
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Condenser Products Co., Box 997, Brooksville, Fla.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif.
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif. p 1908
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. ..... p 1936
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. ... p 1936
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1933
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 1947
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. .... p 1951
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. ..... p 1967
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2059, 2060
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power/Mate Corp., 163 Clay St., Hackensack, N. J.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2094, 2095
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112, 2113
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Viking Modules, Inc., 223 Crescent St., Waltham, Mass.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Abtronics, Inc., Box 712, Livermore, Calif.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Alpha Scientific, Inc., 460 Roland Way, Oakland, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.

POWER SUPPLIES, 400 CPS INPUT ONLY,

Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Model Rectifier Corp., 5300 21st Ave., Brooklyn, N. Y.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Motor Generator Div., EE-61, Troy, Ohio
Neutronic Assocs., 4 Hawthorne St., Farmingdale, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
North Electric Co., 553 S. Market St., Galion, Ohio
Northeast Scientific Corp., 30 Wetherbee St., Acton, Mass.
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pace Comms. Corp., 24049 S. Frampton, Harbor City, Calif.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scintillonics, Inc., Box 701, Ft. Collins, Colo.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
TDC Div., P.O. Box 365, Littleton, Mass.
Ther Elec. & Machine Works, 17 S. Jefferson St., Chicago, Ill.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Welex Electronics, Box 986, Silver Spring, Md.
Xenon Corp., 39 Commercial St., Medford, Mass.

POWER SUPPLIES, 400 CPS INPUT ONLY, D-C OUTPUT, VOLTAGE REGULATED

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1840-1843
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 1833
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Basler Electric Co., Box 269, Highland, Ill. ..... p 1018
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2659
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1874, 1884
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn. p 1896
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif.
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.

POWER SUPPLIES, 400 CPS INPUT (Cont'd)

Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill. ..... p 1970
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y.
p 2018-2020
Litton Data Systems Div., 8000 Woodley, Van Nuys, Calif. p 2012, 2013
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
p 2058-2060
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 795
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif.
Power/Mate Corp., 163 Clay St., Hackensack, N. J.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ..... p 2082
RD Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Technipower, Inc., Benrus Center, Ridgefield, Conn.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2115
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Viking Modules, Inc., 223 Crescent St., Waltham, Mass.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
p 2117
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
La Marche Mfg. Co., 106 Bradrock Dr., Des Plains, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Novatronics, Inc., Box 878, Pompano Beach, Fla.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

POWER SUPPLIES, 400 CPS INPUT ONLY, D-C OUTPUT, VOLTAGE UNREGULATED

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
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Acme Electric Corp., 28 Water St., Cuba, N. Y.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Basler Electric Co., Box 269, Highland, Ill. ..... p 1018
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Condenser Products Co., Box 997, Brooksville, Fla.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Gudeman Div., Gulton Inds., Inc., 340 W. Huron St., Chicago, Ill.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Litton Data Systems Div., 8000 Woodley, Van Nuys, Calif. .... p 2013
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
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Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Power/Mate Corp., 163 Clay St., Hackensack, N. J.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112, 2113
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Viking Modules, Inc., 223 Crescent St., Waltham, Mass.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Chicago Condenser Corp., 3255 W. Armitage Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Model Rectifier Corp., 5300 21st Ave., Brooklyn, N. Y.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Motor Generator Div., EE-61, Troy, Ohio
Neutronic Assocs., 4 Hawthorne St., Farmingdale, N. Y.
North Electric Co., 553 S. Market St., Galion, Ohio
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Universal Elctrns. Co., 1720 22nd St., Santa Monica, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.

POWER SUPPLIES, 60 OR 400 CPS INPUT, D-C OUTPUT, CURRENT REGULATED

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. p 1820
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 1833
Aerospace Avionics Inc., 1500 Ocean Ave., Bohemia, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. p 1860, 1862
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Basler Electric Co., Box 269, Highland, Ill.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
p 1864
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif.
p 1874, 1882, 1884
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn. p 1896
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Deltron Inc., Wissahickon Ave., North Wales, Pa.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. ..... p 1925
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. .... p 1931
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 1947
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1386
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. .... p 1951
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
Heath Co., Dept. 180, Benton Harbor, Mich.
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1964
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
p 1972, 1973, 1977, 1980, 1982-1984, 1986, 1989, 1990, 1994, 1997
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan ..... p 1969
Kilovolt Corp., 238 High St., Hackensack, N. J.
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill. ..... p 1970
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y.
p 2036, 2038-2040
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
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Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
NJE Corp., 20 Boright Ave., Kenilworth, N. J. ..... p 2052
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.

Neutronic Corp., Box 625, St. Louis, Mo.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. ..... p 2069
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif.
Power/Mate Corp., 163 Clay St., Hackensack, N. J.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn. p 2085
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2090
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2100-2103
Spar Electronics, 7969 Engineer Rd., San Diego, Calif.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2095
Stace, Incorporated, 2240 East 3rd St., Dayton, Ohio
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2116
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y. p 2127, 2128, 2131
Unitron, 1624 N. First St., Garland, Texas
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2139
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Aerospace Avionics, Inc., 1500 Ocean Ave., Bohemia, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Alpha Scientific, Inc., 460 Roland Way, Oakland, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
B & F Instruments Inc., Cornwells Hgts., Pa.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carter, J. C. Co., 671 West 17th St., Costa Mesa, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Collins, G. L. Corp., 5875 Obispo Ave., Long Beach, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Gas Analysis Systems, Inc., Box 146, Basking Ridge, N. J.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, Ohio
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
Instrument Components Co., 15105 Broadway, Maple Hghts., Ohio
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
La Marche Mfg. Co., 106 Bradrock Dr., Des Plains, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Magnion, Inc., 144 Middlesex Tpke., Burlington, Mass.
Mauratron, Inc., 13333 N. Central Expwy., Dallas, Tex.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Motor Generator Div., EE-61, Troy, Ohio
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
North Electric Co., 553 S. Market St., Galion, Ohio
Northeast Scientific Corp., 30 Wetherbee St., Acton, Mass.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Physical Electronic Labs., 1185 O'Brien Dr., Menlo Park, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Scintillonics, Inc., Box 701, Ft. Collins, Colo.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Power Assocs., Inc., 161 Brielle Ave., Staten Island, N. Y.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Universal Elctrns. Co., 1720 22nd St., Santa Monica, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Ventron Instrs. Corp., 144 Middlesex Tpke., Burlington, Mass.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.

POWER SUPPLIES, 28 VDC INPUT, UP TO 100 VDC OUTPUT, VOLTAGE REGULATED

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1844, 1846
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1862
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ..... p 1899
Crestronics, 744 Rocky Loop, Crestline, Calif. ..... p 1903
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Ectron Corp., 8070 Engineer Rd., San Diego, Calif.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Litton Data Systems Div., 8000 Woodley, Van Nuys, Calif.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 795, 2062
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif.
Power/Mate Corp., 163 Clay St., Hackensack, N. J.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 2086
Spar Electronics, 7969 Engineer Rd., San Diego, Calif. ..... p 2111
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2113
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo. p 2120-2122, 2124
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2138
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.

POWER SUPPLIES, 28 VDC INPUT

Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Fairchild Controls, 423 National Ave., Mountain View, Calif.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
Instrument Components Co., 15105 Broadway, Maple Hghts., Ohio
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Powercube Corp., 214 Calvary St., Waltham, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Ther Elec. & Machine Works, 17 S. Jefferson St., Chicago, Ill.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Universal Elctrns. Co., 1720 22nd St., Santa Monica, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

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ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834, 1844-1847
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1862
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1865
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ..... p 1899
Crestronics, 744 Rocky Loop, Crestline, Calif. ..... p 1903
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.

POWER SUPPLIES, 28 VDC INPUT (Cont'd)

North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
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Power/Mate Corp., 163 Clay St., Hackensack, N. J.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2113
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo. p 2120, 2121, 2124
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Instrument Components Co., 15105 Broadway, Maple Hghts., Ohio
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Novatronics, Inc., Box 878, Pompano Beach, Fla.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Powercube Corp., 214 Calvary St., Waltham, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ram Meter, Inc., 1100 Hilton Rd., Ferndale, Mich.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Power Assocs., Inc., 161 Brielle Ave., Staten Island, N. Y.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Ther Elec. & Machine Works, 17 S. Jefferson St., Chicago, Ill.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Xenon Corp., 39 Commercial St., Medford, Mass.

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Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ..... p 1899
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
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Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2095
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Transformer Electronics Co., Box 910, Boulder, Colo. p 2120, 2121, 2124
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Computer Power Systems, Inc., 722 E. Evelyn Ave., Sunnyvale, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Introl Corp., 5555 West 78th St., Minneapolis, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
North Electric Co., 553 S. Market St., Galion, Ohio
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ram Meter, Inc., 1100 Hilton Rd., Ferndale, Mich.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.

POWER SUPPLIES, 28 VDC INPUT, OVER 10,000 VDC OUTPUT, VOLTAGE REGULATED

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
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Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1862
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
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Kilovolt Corp., 238 High St., Hackensack, N. J.
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Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wesco Electrical Co. Inc., 27 Olive St., Greenfield, Mass.
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Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
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Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
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Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
North Electric Co., 553 S. Market St., Galion, Ohio
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Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
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Scott Electronics Labs., Box 8474, Universal City, Calif.
TDC Div., P.O. Box 365, Littleton, Mass.
Varo General, Garland Bank Bldg., Garland, Tex.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.

POWER SUPPLIES, 28 VDC INPUT, D-C OUTPUT, UNREGULATED

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Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Crestronics, 744 Rocky Loop, Crestline, Calif.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Litton Data Systems Div., 8000 Woodley, Van Nuys, Calif.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal.
p 2059, 2060
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Spar Electronics, 7969 Engineer Rd., San Diego, Calif.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2095
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dyna Technology Inc., 2201 E. 7th St., Sioux City, Iowa
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Horlick, W. I. Co., Inc., 266 Summer St., Boston, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Inet-Power, 711 W. Knox St., Gardena, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Invertronics, Box 342, Pine Brook, N. J.

Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Powercube Corp., 214 Calvary St., Waltham, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Scott Electronics Labs., Box 8474, Universal City, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solidstate Controls, Inc., 600 Oakland Park Ave., Columbus, Ohio
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Xenon Corp., 39 Commercial St., Medford, Mass.

POWER SUPPLIES, ARC LAMP

AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1888
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. p 1894, 1895
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. ..... p 1795
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 1991
Kilovolt Corp., 238 High St., Hackensack, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
NWL, Inc., Box 455, Trenton, N. J.
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2107
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y... p 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.
Aimes Inds., Inc., Box 73, Lockport, Ill.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
Gates, G. W. & Co., Inc., Hempstead Tpke. & Lucille Ave., Franklin Sq., N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Ionics, Inc., Electronics Div., 65 Grove St., Watertown, Mass.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
LP Associates, Inc., 11830 W. Pico Blvd., Los Angeles, Calif.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
Mutron Corp., 646 Summer St., Brockton, Mass.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Strong Electric Corp., Box 1003, Toledo, Ohio
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Xenon Corp., 39 Commercial St., Medford, Mass.

POWER SUPPLIES, BI-POLAR

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1874
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. .. p 1972, 1973, 1985
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. ..... p 2071
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Technipower, Inc., Benrus Center, Ridgefield, Conn.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Collins Electronics, Inc., Old Love Point Rd., Stevensville, Md.
Components Corp., 106 Main St., Denville, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dial Products Co., 19-21 Cottage St., Bayonne, N. J.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Inet-Power, 711 W. Knox St., Gardena, Calif.
Instrument Components Co., 15105 Broadway, Maple Hghts., Ohio
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

POWER SUPPLIES, CRT

AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. p 1830, 1831
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1855
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1862
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
Crestronics, 744 Rocky Loop, Crestline, Calif.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1901
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2058
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. ..... p 2071
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2094, 2096, 2097
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y... p 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2138
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ... p 2142, 2143
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y... p 1954
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
American Electronic Controls, 74 Tracey Rd., Huntingdon Valley, Pa.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Computer Power Systems, Inc., 722 E. Evelyn Ave., Sunnyvale, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.

POWER SUPPLIES, D-C INPUT, A-C OUTPUT—SEE INVERTERS, D-C TO A-C, D-C TO D-C

POWER SUPPLIES, DC WELDING

Basler Electric Co., Box 269, Highland, Ill.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y... p 2136
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Electro Specialties Corp., 370 Park Ave., Worcester, Mass.
Eutectic Corp., 40-40 172nd St., Flushing, N. Y.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Hughes Aircratt Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Model Rectifier Corp., 5300 21st Ave., Brooklyn, N. Y.
Motor Generator Div., EE-61, Troy, Ohio
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.

POWER SUPPLIES, ENERGY STORAGE

Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Westinghouse Electric Corp., Ind. Equip. Div., Box 300, Sykesville, Md.

POWER SUPPLIES, ELECTROPLATING EQUIPMENT

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1862
Basler Electric Co., Box 269, Highland, Ill.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. .... p 1950
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

POWER SUPPLIES, ENERGY STORAGE

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1830
Acme Electric Corp., 28 Water St., Cuba, N. Y.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Amgio Corp., 4333 N. Ravenswood Ave., Chicago, Ill. ..... p 1779
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Hadron, 300 Shames Dr., Westbury, N. Y. ..... p 1676
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 1991
Kilovolt Corp., 238 High St., Hackensack, N. J.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2061
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Sorensen Operation, Richards Ave., Norwalk, Conn.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2096
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2136
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Abtronics, Inc., Box 712, Livermore, Calif.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Burmac Elctrns., 80 Montauk Hwy., Lindenhurst, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Resalab, Inc., 4000 Campbell Ave., Menlo Park, Calif.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.

POWER SUPPLIES, ENERGY STORAGE (Cont'd)

Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.

POWER SUPPLIES, INTEGRATED CIRCUIT

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. . . p 1818
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1834
Acme Electric Corp., 28 Water St., Cuba, N. Y. . . . . . p 1833
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass. . . . . . p 1285
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. . . . p 1860
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. . . . . . p 2659
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1874, 1883, 1884
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. . . . p 1894
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla. p 1897
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn. p 1896
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. . . . . . p 1898
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. . . . . . p 773
Deltron Inc., Wissahickon Ave., North Wales, Pa. . . . . . p 1904, 1905
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. . . . . . p 1924–1926
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. . . . . . p 1928
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1932
Electrostatics, 7969 Engineer Rd., San Diego, Calif. . . . . . p 1944
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. . . p 1947
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1961, 1963
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. . . p 1972, 1973, 1999
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2015, 2016, 2018, 2019, 2032
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J. p 2046
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 795, 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. . . . . . p 2068
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif.
Power/Mate Corp., 163 Clay St., Hackensack, N. J. . . . . p 2075, 2076
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. . . . . . p 2080
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. . . . . p 2086–2088
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. . . . . p 1474
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal. p 801
Sorensen Operation, Richards Ave., Norwalk, Conn. . . . . . p 2107
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Technipower, Inc., Benrus Center, Ridgefield, Conn. . . . . . p 2112
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. . . . . . p 2114
Transformer Electronics Co., Box 910, Boulder, Colo. . . . p 2122, 2124
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y. p 2127, 2129
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Viking Modules, Inc., 223 Crescent St., Waltham, Mass. . . . . . p 2144
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. . . . . p 2147
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div./Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Savant Engrg., Inc., 825 N. Second St., St. Charles, Mo.
Scintillonics, Inc., Box 701, Ft. Collins, Colo.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Universal Elctrns. Co., 1720 22nd St., Santa Monica, Calif.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

POWER SUPPLIES, KLYSTRON—ALSO SEE POWER SUPPLIES BY OUTPUT VOLTAGE RANGE

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. . . . . . p 1831
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. . . . . p 1894
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. . . . . . p 1657
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Crestronics, 744 Rocky Loop, Crestline, Calif.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. . . . . p 1929
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. . . . . p 1683
Narda Microwave Corp., Plainview, N. Y. . . . . . p 1689
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Sorensen Operation, Richards Ave., Norwalk, Conn. . . . . . p 2107
Transformer Electronics Co., Box 910, Boulder, Colo. . . . . . p 2124
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. . . p 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Alpha Scientific, Inc., 460 Roland Way, Oakland, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Burmac Elctrns., 80 Montauk Hwy., Lindenhurst, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Northeast Scientific Corp., 30 Wetherbee St., Acton, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.

POWER SUPPLIES, LAB, MULTIPLE OUTPUT

AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. . . p 1830, 1831
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Acopian Corp., P.O. Box 585, Easton, Pa. . . . . . p 1852
Aritech Corp., 130 Lincoln St., Brighton, Mass. . . . . . p 1285
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. . . . p 1860
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y. . . . . . p 1331
Avtel Corp., 1130 E. Cypress St., Covina, Calif. . . . . . p 1865, 1872
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1864
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1881
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. . . . . . p 1657
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. . . . p 1898, 1899
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1901
Deltron Inc., Wissahickon Ave., North Wales, Pa. . . . . . p 1904
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif. p 1909
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn. . . . . . p 1918
E-Tronics, 5901 Noble Ave., Van Nuys, Calif. . . . . . p 1922
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. . . . . . p 1925, 1926
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. . . . . . p 1927
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. . . . . p 1931
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. . . . . p 1950
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. . . p 1960
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1961, 1962, 1964
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. . . p 1972, 1973, 1991
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2015, 2028–2030, 2034, 2036, 2037
Litton Data Systems Div., 8000 Woodley, Van Nuys, Calif.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J. p 2046
NJE Corp., 20 Boright Ave., Kenilworth, N. J. . . . . . p 2050, 2053, 2055
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. . . . . p 2056
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. p 2064, 2070
Power Systems Inc., 4023 Del Rey Ave., Venice, Calif. . . . . . p 2084
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. . . . . p 2087, 2088
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. . . . p 1474
Sorensen Operation, Richards Ave., Norwalk, Conn. . . . . . p 2107
Spar Electronics, 7969 Engineer Rd., San Diego, Calif. . . . p 2110, 2111
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2096
Technipower, Inc., Benrus Center, Ridgefield, Conn. . . . . . p 2112
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. . . . . . p 2115
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. . . . . . p 2109
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y. p 2127–2131
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. . . . . . p 2142
Viking Modules, Inc., 223 Crescent St., Waltham, Mass. . . . . . p 2145
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2117
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. . . . . p 2147
Abtronics, Inc., Box 712, Livermore, Calif.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Buck Engrg. Co., Inc., Box 686, Farmingdale, N. J.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electronic Science Labs., 3920 Bryn Mawr, Dallas, Tex.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
Savant Engrg., Inc., 825 N. Second St., St. Charles, Mo.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Universal Elctrns. Co., 1720 22nd St., Santa Monica, Calif.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.
Yardney Electric Corp., 40-52 Leonard St., New York, N. Y.

POWER SUPPLIES, LASER

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. . . . . . p 1830
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Amglo Corp., 4333 N. Ravenswood Ave., Chicago, Ill. . . . . . p 1779
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. . . . . . p 1657
Condenser Products Co., Box 997, Brooksville, Fla. . . . . . p 623
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Crestronics, 744 Rocky Loop, Crestline, Calif. . . . . . p 1903
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Hadron, 300 Shames Dr., Westbury, N. Y. . . . . . p 1676
Kilovolt Corp., 238 High St., Hackensack, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. . . p 1677
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2096
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. . . . . . p 2140
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
Electro-Nuclear Labs., Inc., 115 Independence Dr., Menlo Park, Calif.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Electronic Enterprises, 775 South Madison Ave., Pasadena, Calif.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Resalab, Inc., 4000 Campbell Ave., Menlo Park, Calif.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Seed Electronics Corp., 9 Cypress Dr., Burlington, Mass.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Xenon Corp., 39 Commercial St., Medford, Mass.

POWER SUPPLIES, OPERATIONAL

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Acme Electric Corp., 28 Water St., Cuba, N. Y.
Analog Devices Inc., 221 Fifth St., Cambridge, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass. . . . . . p 1285
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. . . . . . p 1657
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn. . . . . . p 1918
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.

Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. ..... p 1925, 1926
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Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
p 1946, 1948
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1961
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass. ..... p 531
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
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Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y.
p 2015, 2028, 2030, 2032
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
p 2046
Neutronic Corp., Box 625, St. Louis, Mo.
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. .. p 2309
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. ..... p 2067
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ..... p 2083
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2100-2104
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2122
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2139
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. ..... p 2140
Viking Modules, Inc., 223 Crescent St., Waltham, Mass. ..... p 2145
Abtronics, Inc., Box 712, Livermore, Calif.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
GPS Instrument Co., Inc., 14 Burr St., Framingham, Mass.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Inet-Power, 711 W. Knox St., Gardena, Calif.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.

POWER SUPPLIES, PHOTOMULTIPLIER

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1830
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 1833
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
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C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Cohu Electronics Inc., Box 623, San Diego, Calif.
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ..... p 1899
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1900
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn. ..... p 1918
E-Tronics, 5901 Noble Ave., Van Nuys, Calif. ..... p 1920, 1922
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
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InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
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NJE Corp., 20 Boright Ave., Kenilworth, N. J.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Power/Mate Corp., 163 Clay St., Hackensack, N. J.
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 2086
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2107
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2097
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2124
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. ... p 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. ..... p 2140
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. .... p 2142, 2143
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Celco, 70 Constantine Dr., Mahwah, N. J.
Chalco Engrg. Corp., 15126 S. Broadway, Gardena, Calif.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Computer Power Systems, Inc., 722 E. Evelyn Ave., Sunnyvale, Calif.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Loyola Industries, Inc., 155 Arena St., El Segundo, Calif.
Malaker Corp., W. Main St., High Bridge, N. J.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Northeast Scientific Corp., 30 Wetherbee St., Acton, Mass.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.

POWER SUPPLIES, PROGRAMMABLE

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
p 1818-1826, 1828
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 1833
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1856
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif. ... p 1860
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1329
Basler Electric Co., Box 269, Highland, Ill.
Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif.
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Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn.
p 1896
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1901
Deltron Inc., Wissahickon Ave., North Wales, Pa. ..... p 1904
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
p 1906, 1909
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn. ..... p 1926
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J.
p 1928, 1929, 1931
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
p 1932-1935
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1937-1940
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J.
p 1961-1964
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
INCOR Instrumentation Amplifiers & Supplies, Inc.,
29 Newtown Rd., Plainview, N. Y. ..... p 1404
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
p 1972, 1973, 1975, 1976, 1978, 1979, 1981-1985, 1987-1990, 1992-1994, 1997, 1998, 2000, 2001
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y.
p 2016, 2018, 2024, 2026, 2028, 2030, 2032, 2034, 2036-2040
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
p 2046-2049
NJE Corp., 20 Boright Ave., Kenilworth, N. J. ..... p 2053-2055
Neutronic Corp., Box 625, St. Louis, Mo.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. .. p 2064-2069
Power/Mate Corp., 163 Clay St., Hackensack, N. J. ..... p 2075
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ..... p 2083
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 2088
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2090
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2101-2105
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2095
Tektronix, Inc., Box 500, Beaverton, Ore.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2115, 2116
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y. p 2127-2131
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2138
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142

POWER SUPPLIES R-F

Viking Modules, Inc., 223 Crescent St., Waltham, Mass. ..... p 2145
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
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Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
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Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. ..... p 2147
Abtronics, Inc., Box 712, Livermore, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Computer Power Systems, Inc., 722 E. Evelyn
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal
Inet-Power, 711 W. Knox St., Gardena, Calif.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
North Electric Co., 553 S. Market St., Galion, Ohio
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Program Elctrns. Co., 1733 West End Ave., New Hyde Park, N. Y.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Universal Elctrns. Co., 1720 22nd St., Santa Monica, Calif.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.
Weir Elctrns. Ltd., Durban Rd., Bognor Regis, Sussex, Eng.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.

POWER SUPPLIES, PROGRAMMABLE, HIGH-SPEED

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. p 1828
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1830
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Deltron Inc., Wissahickon Ave., North Wales, Pa. ..... p 1905
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. .... p 1931
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
p 1972, 1973, 1977, 1986, 1989, 1992, 1993
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
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Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. p 2064-2069
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2100-2103
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2116
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y. p 2127, 2128
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2142
Viking Modules, Inc., 223 Crescent St., Waltham, Mass.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Computer Power Systems, Inc., 722 E. Evelyn Ave., Sunnyvale, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.

POWER SUPPLIES, R-F

Acme Electric Corp., 28 Water St., Cuba, N. Y.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Condenser Products Co., Box 997, Brooksville, Fla. ..... p 623
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Kilovolt Corp., 238 High St., Hackensack, N. J.
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif. ..... p 2082
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2095
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2138
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. ..... p 2140
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Scintillonics, Inc., Box 701, Ft. Collins, Colo.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio

POWER SUPPLIES R-F (Cont'd)

Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Walden Elctrns. Corp., 223 Crescent St., Waltham, Mass.

POWER SUPPLIES, READOUT & DISPLAY

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. . . p 1828
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. . . p 1183
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla. p 1897
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1901
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 2088
Sorensen Operation, Richards Ave., Norwalk, Conn.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y. p 2097
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 806
Venus Scientific Inc., 399 Smith St., Hicksville, N. Y. ..... p 2143
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y. . . p 1954
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Celco, 70 Constantine Dr., Mahwah, N. J.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Instrument Displays, Inc., 18-36 Granite St., Haverhill, Mass.
North Electric Co., 553 S. Market St., Galion, Ohio
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Velonex, 560 Robert Ave., Santa Clara, Calif.

POWER SUPPLIES, STRAIN GAUGE & TRANSDUCER

Acopian Corp., P.O. Box 585, Easton, Pa. ..... p 1852
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2838
Avtel Corp., 1130 E. Cypress St., Covina, Calif. ..... p 1872
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1874, 1884
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn. ..... p 1899
Crestronics, 744 Rocky Loop, Crestline, Calif. ..... p 1903
Deltron Inc., Wissahickon Ave., North Wales, Pa. ..... p 1905
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Ectron Corp., 8070 Engineer Rd., San Diego, Calif. ..... p 527
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa. ..... p 1927
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1962
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1968
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y. ..... p 1965
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.... p 1972, 1973, 2000
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2015-2018, 2020, 2032
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn. p 2085
Spar Electronics, 7969 Engineer Rd., San Diego, Calif. ..... p 2111
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2116
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. . . p 2137
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. ..... p 2140
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif. p 2148
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
B & F Instruments Inc., Cornwells Hgts., Pa.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Instrument Components Co., 15105 Broadway, Maple Hghts., Ohio
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
MB Electronics, Box 1825, New Haven, Conn.
Micro-Strain, Inc., Spring City, Pa.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
RdF West, 9371 Kramer Ave., Westminster, Calif.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Scintillonics, Inc., Box 701, Ft. Collins, Colo.
Semiconductor Circuits, Inc., 163 Merrimac St., Woburn, Mass.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Validyne Engrg. Corp., 18819 Napa St., Northridge, Calif.
Welex Electronics, Box 986, Silver Spring, Md.

POWER SUPPLIES, SWITCH-OVER, AUTOMATIC (SELF-CONTAINED BATTERY)

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1894
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. ..... p 2042
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power, Inc., 12809 Eagle Ridge Dr., Burnsville, Minn.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Instrs. Ltd., Stanley Rd., Bromley, Kent, England
Inet-Power, 711 W. Knox St., Gardena, Calif.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Mauratron, Inc., 13333 N. Central Expwy., Dallas, Tex.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.

POWER SUPPLIES, THERMOELECTRIC

Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.

POWER SUPPLIES, TWT

AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1830
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Crestronics, 744 Rocky Loop, Crestline, Calif.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif.
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y. ..... p 1965
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 1988
Kilovolt Corp., 238 High St., Hackensack, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. .... p 1683
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J. p 2046
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 2062
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Sorensen Operation, Richards Ave., Norwalk, Conn. ..... p 2107
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. .. p 2137
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Engineering, Inc., 58 Brown Ave., Springfield, N. J. ..... p 2140
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
ASCOR, Berkey Technical, 25-15 50th St., Woodside, N. Y.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
Northeast Scientific Corp., 30 Wetherbee St., Acton, Mass.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Plastic Capacitors, Inc., 2620 N. Clybourn Ave., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
SBD Systems, Inc., 90 Rome St., Farmingdale, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Traveling Wave Tube Div., 611 Hansen Way, Palo, Alto, Cal.
Velonex, 560 Robert Ave., Santa Clara, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Welex Electronics, Box 986, Silver Spring, Md.

POWER SUPPLIES, XENON LAMP—SEE POWER SUPPLIES, ARC LAMP

PREAMPLIFIERS, AUDIO

Arvee Engineering Co., P.O. Box 3759, Torrance, Calif.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Mallory, P. R. & Co., Inc., 3029 E. Washington St., Indianapolis, Ind. p 1630
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Millivac Instruments, Box 997, Schenectady, N. Y. ..... p 1441
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. ..... p 536
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Audio Instr. Co., Inc., 311 Mountain Rd., Union City, N. J.
Auricord, 35-41 29th St., Long Island City, N. Y.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Century Projector Corp., 729 Seventh Ave., New York, N. Y.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Lansing J. B., Sound, Inc., 3249 Casitas Ave., Los Angeles, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

PREAMPLIFIERS, D-C

Arvee Engineering Co., P.O. Box 3759, Torrance, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1563–1566
Cohu Electronics Inc., Box 623, San Diego, Calif.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
EMR-Hathoro, E. County Line Rd., Hathoro, Pa.
Ectron Corp., 8070 Engineer Rd., San Diego, Calif. ..... p 527
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y.
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 538
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.

Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
B & W Elctrn. Res. Labs, 10807 Royal Park, Dallas, Tex.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EMR Div., Box 223, Princeton, N. J.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nuclear Supplies, Box 312, Encino, Calif.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Optical Electronics Inc., Box 11140, Tucson, Ariz.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.

PREAMPLIFIERS, I-F

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1680
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. ..... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1700, 1701
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
HRB-Singer, Inc., Science Park, State College, Pa.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

PREAMPLIFIERS, METER

Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Computer Dynamics, Inc., 179 Water St., Torrington, Conn.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Scott Instr. Labs., 111 Powdermill Rd., Maynard, Mass.

PREAMPLIFIERS, MICROPHONE

Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. ..... p 536
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Scintrex, Inc., John Glenn Dr., Buffalo, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
United Recording Electronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.

PREAMPLIFIERS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ... p 1679, 1680, 1682
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. ..... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RF Amplifier Co., Box 141, Lake Grove, N. Y. ..... p 1694
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1700, 1701
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Locus, Inc., 906 W. College Ave., State College, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

PREAMPLIFIERS, OSCILLOSCOPE PLUG-IN—SEE OSCILLOSCOPE PREAMPLIFIER PLUG-INS

PREAMPLIFIERS, RECEIVER

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. ... p 518, 521
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679, 1682
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1700, 1701
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
HRB-Singer, Inc., Science Park, State College, Pa.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Locus, Inc., 906 W. College Ave., State College, Pa.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.

PREAMPLIFIERS, TELEMETRY

Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

PREAMPLIFIERS, R-F

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Arvee Engineering Co., P.O. Box 3759, Torrance, Calif.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. p 518, 520, 521
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679, 1682
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1700, 1701
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Arenberg Ultrasonic Lab., Inc., 94 Green St., Jamaica Plain, Mass.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Cushman Electronics Inc., 166 San Lazaro Ave., Sunnyvale, Calif.
Entron, Inc., 2141 Industrial Pkwy., Silver Spring, Md.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Radio Company, 300 Baker Ave., W. Concord, Mass.
HRB-Singer, Inc., Science Park, State College, Pa.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Locus, Inc., 906 W. College Ave., State College, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

PREAMPLIFIERS, SERVO

Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2657
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 2665
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.

PREAMPLIFIERS, TELEMETRY

AEL Inc., P.O. Box 552, Lansdale, Pa.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
C-Cor Electronics Inc., 60 Decibel Rd., State College, Pa. .... p 518, 521
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1679, 1682
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1700, 1701
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.

PREAMPLIFIERS, TELEMETRY (Cont'd)

Defense Elctrns., Inc., Rockville, Md.
Dorsett Electronics, Box 36, Tulsa, Okla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMR Div., Box 223, Princeton, N. J.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
HRB-Singer, Inc., Science Park, State College, Pa.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Varo General, Garland Bank Bldg., Garland, Tex.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

PREAMPLIFIERS, TRANSDUCER SIGNAL—ALSO SEE SIGNAL CONDITIONERS

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1563-1566
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. ..... p 1403
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. ..... p 1404
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
Princeton Applied Research Corp., Box 565, Princeton, N. J. ..... p 1471
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
United Detector Technology, 1732 21st St., Santa Monica, Calif.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C. G. S. Scientific Corp., Industrial Blvd., Southampton, Pa.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Chesapeake Instr. Corp., Shadyside, Md.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Glentek, Inc., 1557 7th St., Santa Monica, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Massa Div., 280 Lincoln St., Hingham, Mass.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
NUS Corp., Box 248, Paramus, N. J.
Neff Instrument Corp., 1088 E. Hamilton Rd., Duarte, Calif.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Research Mfg. Corp., Box 6056, San Diego, Calif.
Roveti Instruments, 238 West St., Annapolis, Md.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Tennelec, Inc., Box D, Oak Ridge, Tenn.

PREAMPLIFIERS, TRANSISTOR

Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 533
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Melcor Electronics Corporation, 1750 New Highway, Farmingdale, N. Y. p 535
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Princeton Applied Research Corp., Box 565, Princeton, N. J. .... p 1471
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1700, 1701
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Auricord, 35-41 29th St., Long Island City, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Century Projector Corp., 729 Seventh Ave., New York, N. Y.
Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Finney Co., 34 W. Interstate St., Bedford, Ohio
HRB-Singer, Inc., Science Park, State College, Pa.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Locus, Inc., 906 W. College Ave., State College, Pa.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
NUS Corp., Box 248, Paramus, N. J.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Nuclear Diodes, Inc., Box 135, Prairie View, Ill.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Perry Amplifier, 138 Fuller St., Brookline, Mass.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Roveti Instruments, 238 West St., Annapolis, Md.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
United Recording Eleotronics Inds., 11922 Valerio St., N. Hollywood, Calif.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

PREBONDING ETCHANTS—SEE CHEMICALS, ETCHING

PREDETECTION EQUIPMENT, RECORDERS/PLAYBACKS

Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2160, 2161
Auricord, 35-41 29th St., Long Island City, N. Y.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S. and Co., 2500 Estes Ave., Elk Grove Village, Ill.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

PREFORMS, PRECIOUS METAL—ALSO SEE SOLDER PREFORMS

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

PREPARATION SYSTEMS, PAPER-TAPE

Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. ..... p 792
Ohr-Tronics, Inc., Box 630, Herkimer, N. Y.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Invac Corp., 26 Fox Rd., Waltham, Mass.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.
Warner Electric Brake & Clutch Co., Beloit, Wisc.

PRESCALERS

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Nuclear Supplies, Box 312, Encino, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

PRESELECTOR—MIXERS

Electro/Data Inc., 3121 Benton St., Garland, Tex.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Olektron Corp., Box 248, Dudley, Mass.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

PRESELECTORS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. .. p 1687
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.

PRESSURE INDICATORS—SEE GAUGES, PRESSURE

PRESSURE SENSITIVE PAINT—SEE COATINGS, TRANSDUCER FORMING

PRESSURE VESSELS—SEE CHAMBERS, PRESSURE

PRESSURIZATION EQUIPMENT, CABLE—SEE CABLE PRESSURIZATION EQUIPMENT

PRESSURIZATION SYSTEMS, EQUIPMENT CABINET

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Eastern Industries, 100 Skiff St., Hamden, Conn.
Hotpack Corp., 5075 Cottman Ave., Philadelphia, Pa.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Superior Continental Corp., Box 489, Hickory, N. C.
Tem-Pres Res. Div., Carborundum Co., 1401 S. Atherton St., State College, Pa.

PRESSURIZATION UNITS—SEE CHAMBERS, PRESSURE

PRIMERS, BONDING & POTTING

Biggs Co., 1547 14th St., Santa Monica, Calif.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Fuller-O'Brien Corp., 1342 Willow Rd., Menlo Park, Calif.
General-Electric Co., Silicone Products Dept., Waterford, N. Y.
Isochem Resins Co., Cook St., Lincoln, R. I.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.

PRINTED CIRCUIT BOARDS, ADDITIVE PROCESS (WITHOUT COMPONENTS)

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.

Digital Equip. Corp., 146 Main St., Maynard, Mass.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 711
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
Kulka Electric Corp., Dept. E, Box 149, Mount Vernon, N. Y. ... p 917
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Agard Electronics Corp., 40 Nassau Terminal Rd., New Hyde Park, N. Y.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Conductorlab, Inc., Box 222, Groton, Mass.
Datasenors Co., 735 Factory Rd., Addison, Ill.
Defiance Circuit Corp., 12 Shepard St., S. Lawrence, Mass.
Dorsett Electronics, Box 36, Tulsa, Okla.
Electralab Div./Tyco, Box 548, Encinitas, Calif.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Flexprint Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Circuits, Inc., 95 Mt. Read Blvd., Rochester, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
North American Printed Circuit Div., Box 145, Stafford, Conn.
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rogers Corp., Rogers, Conn.
Security Elctrns. Co., Inc., 5424 North 95th St., Kansas City, Kans.
Sibley Co., Haddam, Conn.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Techniques Inc., 235 Jackson St., Englewood, N. J.
3M Co., 3M Center, St. Paul, Minn.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

PRINTED CIRCUIT BOARDS, ETCHED PROCESS (WITHOUT COMPONENTS)

AEL Inc., P.O. Box 552, Lansdale, Pa.
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 711
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
Lowell Elctrns. Corp., 9100 Terminal Ave., Skokie, Ill.
Midwest Circuits Inc., 1111 E. Excelsior Blvd., Hopkins, Minn. .. p 712
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Nutronics Mfg. Co., 1703 Peoria Rd., Springfield, Ill. ..... p 713
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. ..... p 2795
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Aerojet-General Corp., 1100 W. Hollyvale, Azusa, Calif.
Agard Electronics Corp., 40 Nassau Terminal Rd., New Hyde Park, N. Y.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
American Systems, Inc., 13901 Saticoy St., Van Nuys, Calif.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Bureau of Engraving, Inc., Ind'l. Div., 219 N. 2nd St., Minneapolis, Minn.
Chemical & Aerospace Products, Inc., 231 E. Lomita, Wilmington, Calif.
Chemical Micro Milling Co., Box 770, Camden, N. J.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Circuits, Inc., 59 Deming Rd., Berlin, Conn.
Cleveland Metal Specialties Co., 15516 Indl. Pkwy., Cleveland, Ohio
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conductorlab, Inc., Box 222, Groton, Mass.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Custom Engineering & Test Co., Inc., 3160 46 Ave. N., St. Petersburg, Fla.
Datasenors Co., 735 Factory Rd., Addison, Ill.
Defiance Circuit Corp., 12 Shepard St., S. Lawrence, Mass.
Digiac Corp., Ames Ct., Plainview, N. Y.
Dorsett Electronics, Box 36, Tulsa, Okla.
Douglas Electronics, Inc., 718 Marina Blvd., San Leandro, Calif.
EDP Corp., Box 6485, Orlando, Fla.
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
Eagle-Picher Inds., Inc., "C" & Porter Sts., Joplin, Mo.
Eastern Reproduction Corp., 1250 Main St., Waltham, Mass.
Eder Industries, Inc., 4864 South 10 St., Milwaukee, Wisc.
Electralab Div./Tyco, Box 548, Encinitas, Calif.
Electro Chemical Engraving Co., 1100 Brook Ave., Bronx, N. Y.
Electro-Sonics, Inc., 70 Main St., Spofford, N. H.
Electrol Co., Inc., 771 Spring La., York, Pa.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Electronics, Inc. of Pa., 2440 Maryland Ave., Willow Grove, Pa.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Flexible Products, Inc., 2678 East 7th Ave., N. St. Paul, Minn.
Flexprint Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Circuits, Inc., 95 Mt. Read Blvd., Rochester, N. Y.
General Components, Inc., 7425 124 Ave. N., St. Petersburg, Fla.
General Plastics Corp., 55 La France Ave., Bloomfield, N. J.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
Golden Technology, Inc., 240 Barham Ave., Santa Rosa, Calif.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
HMW Enterprises, Inc., 15 Walnut St., Steelton, Pa.
Hampden Mfg. Co., Inc., Box 10, Thompsonville, Conn.
Hartzell Elctrns., Inc., 5200 West 74th St., Minneapolis, Minn.
Honeywell, Inc., Computer Control Div., Peterborough, N. H.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Circuits Co., 23 Kulick Rd., Fairfield, N. J.
Intellux, Inc., Box 548, Goleta, Calif.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Keil Engrg. Products Co., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Komak, Inc., 9th & Ontario Sts., Philadelphia, Pa.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Lockheed Elctrns. Co., 6201 E. Randolph, Los Angeles, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Micro-Strain, Inc., Spring City, Pa.
Microflame, Inc., 7800 Computer Ave., Minneapolis, Minn.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
North American Printed Circuit Div., Box 145, Stafford, Conn.
Northern Scientific, Inc., 2551 W. Beltline, Middleton, Wisc.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Philway Prods., Inc., 701 Virginia Ave., Ashland, Ohio
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Printed Circuits, Inc., 7800 Computer Ave., Minneapolis, Minn.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ragen Precision Inds., Inc., 9 Porete Ave., N. Arlington, N. J.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sanders Assocs., Inc., Flexprint Prod. Div., Grenier Fld., Manchester, N. H.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Security Elctrns. Co., Inc., 5424 North 95th St., Kansas City, Kans.
Sibley Co., Haddam, Conn.
Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, Tex.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Tech-Etch, Inc., 10 Industrial Park Rd., Hingham, Mass.
Techniques Inc., 235 Jackson St., Englewood, N. J.
Technograph, Inc., P.O. Box 5376, Ardmore Sta., Winston-Salem, N. C.
Techron Corp., 20 Simmons St., Boston, Mass.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
3M Co., 3M Center, St. Paul, Minn.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
Trans/Circuits, Inc., 3509 Carlyn Spring Rd., Falls Church, Va.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tri-Tronics Lab., Inc., Box 338, Euless, Tex.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Circuits, Inc., 13305 Industrial Park Blvd., Minneapolis, Minn.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.
Western Technology, Inc., 220 W. Central, Santa Ana, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

PRINTED CIRCUIT ETCHANTS

Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Hunt, Philip A., Chemical Corp., Palisades Park, N. J. ..... p 708
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.

PRINTERS, DIAL, METER SCALE

Allied Chemical Corp., Specialty Chemicals Div., Box 70, Morristown, N. J.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Amicon Corp., 25 Hartwell Ave., Lexington, Mass.
Conversion Chemical Corp., 210 E. Main St., Rockville, Conn.
Mac Dermid, Inc., 526 Huntingdon Ave., Waterbury, Conn.
Nitine, Inc., Rte. 46, Clifton, N. J.
Podgor, J. E. Co., Inc., Box 1714, Philadelphia, Pa.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Shipley Co., Inc., 2300 Washington St., Newton, Mass.
Techniques Inc., 235 Jackson St., Englewood, N. J.

PRINTED CIRCUIT SCREENS

Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y. .. p 2152
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
Broxlea Ltd., Broxbourne, Herts, Eng.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Dorsett Electronics, Box 36, Tulsa, Okla.
Electro-Sonics, Inc., 70 Main St., Spofford, N. H.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Kepro Circuit Sys., Inc., 3630 Scarlet Oak Blvd., St. Louis, Mo.
Mech-Tronic Equipment Co., P. O. Box 510, Silver Spring, Md.
Naz-Dar International, 1087 N. Branch, Chicago, Ill.
Podgor, J. Co., Inc., 7895 Browning Rd., Pennsauken, N. J.
Podgor, J. E. Co., Inc., Box 1714, Philadelphia, Pa.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Techniques Inc., 235 Jackson St., Englewood, N. J.
Tyler, W. S. Co., 8200 Tyler Blvd., Mentor, Ohio

PRINTED CIRCUITS (WITH COMPONENTS)—SEE CARDS, LINEAR FUNCTION

PRINTED CIRCUITS, MULTILAYER

Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Collins Radio Co., Newport Beach, Calif.
Electronic Modules Corp., P.O. Box 141, Timonium, Md.
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. ..... p 1748
Midwest Circuits Inc., 1111 E. Excelsior Blvd., Hopkins, Minn. .. p 712
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Texas Instruments Incorporated, Advance Circuit Board Dept., Box 5303, Dallas, Tex. ..... p 714, 715
United Aircraft Corp., Electronics Components Div., Trevose, Pa.
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Agard Electronics Corp., 40 Nassau Terminal Rd., New Hyde Park, N. Y.
Allegri-Tech, Inc., 141 River Rd., Nutley, N. J.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Bureau of Engraving, Inc., Ind'l. Div., 219 N. 2nd St., Minneapolis, Minn.
Chemical & Aerospace Products, Inc., 231 E. Lomita, Wilmington, Calif.
Circuits, Inc., 59 Deming Rd., Berlin, Conn.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Conductorlab, Inc., Box 222, Groton, Mass.
Electralab Div./Tyco, Box 548, Encinitas, Calif.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Flexible Products, Inc., 2678 East 7th Ave., N. St. Paul, Minn.
Flexprint Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
General Circuits, Inc., 95 Mt. Read Blvd., Rochester, N. Y.
General Components, Inc., 7425 124 Ave. N., St. Petersburg, Fla.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Hartzell Elctrns., Inc., 5200 West 74th St., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Circuits Co., 23 Kulick Rd., Fairfield, N. J.
Intellux, Inc., Box 548, Goleta, Calif.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Lockheed Elctrns. Co., 6201 E. Randolph, Los Angeles, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
North American Printed Circuit Div., Box 145, Stafford, Conn.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Philway Prods., Inc., 701 Virginia Ave., Ashland, Ohio
Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y.
Printed Circuits, Inc., 7800 Computer Ave., Minneapolis, Minn.
Rogers Corp., Rogers, Conn.
Sanders Assocs., Inc., Flexprint Prod. Div., Grenier Fld., Manchester, N. H.
Security Elctrns. Co., Inc., 5424 North 95th St., Kansas City, Kans.
Sibley Co., Haddam, Conn.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Trans/Circuits, Inc., 3509 Carlyn Spring Rd., Falls Church, Va.
Universal Circuits, Inc., 13305 Industrial Park Blvd., Minneapolis, Minn.
Western Technology, Inc., 220 W. Central, Santa Ana, Calif.

PRINTERS, DIAL, METER SCALE

A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Coltronics, Inc., Box 128, Bound Brook, N. J.
Detecto Scales, Inc., 540 Park Ave., Brooklyn, N. Y.
Eastern Marking Machine Corp., 30 Alabama Ave., Island Park, N. Y.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.

PRINTERS, DIAL, METER SCALE (Cont'd)

Motson, J. F. Co., 1717 Bethlehem Pike, Flourtown, Pa.
Podgor, J. E. Co., Inc., Box 1714, Philadelphia, Pa.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.

PRINTERS, DIGITAL

Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. .. p 761
Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1353
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif.
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. ..... p 792
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
Ohr-Tronics, Inc., Box 630, Herkimer, N. Y.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Presin Co., Trap Falls Rd., Shelton, Conn. ..... p 1051
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veeder-Root Inc., 70 Sargeant St., Hartford, Conn.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Datamark, Inc., Cantiague Rd., Westbury, N. Y.
Detecto Scales, Inc., 540 Park Ave., Brooklyn, N. Y.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Fabri-Tek Instruments, Inc., 5225 Verona Rd., Madison, Wisc.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Litton Inds., Inc., Datalog Div., 343 Sansome St., San Francisco, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mohawk Data Science Corp., E. Fourth St., Bridgeport, Pa.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Omnitec Inc., Sub. Nytronics, Inc., 903 N. Second St., Phoenix, Ariz.
Pacific Photometric Instrs., 3024 Ashby Ave., Berkeley, Calif.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Royco Instruments Inc., 141 Jefferson Dr., Menlo Pk., Calif.
Roytron, Litton Automated Business Sys., 31 Styertowne Rd., Clifton, N. J.
Shepard Div., 480 Morris Ave., Summit, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Victor Comptometer Corp., 3900 N. Rockwell St., Chicago, Ill.

PRINTERS, HIGH SPEED—SEE PRINTERS, DIGITAL

PRINTERS, KEYBOARD

Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Datamark, Inc., Cantiague Rd., Westbury, N. Y.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Litton Inds., Inc., Datalog Div., 343 Sansome St., San Francisco, Cal.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Omnitec Inc., Sub. Nytronics, Inc., 903 N. Second St., Phoenix, Ariz.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Roytron, Litton Automated Business Sys., 31 Styertowne Rd., Clifton, N. J.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.

PRINTERS, LINE—SEE PRINTERS, DIGITAL

PRINTERS, MICROFILM TO PAPER

Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.

PRINTERS, TAPE-LISTING—SEE PRINTERS, DIGITAL

PRINTING, DRY TRANSFER—SEE KITS, MARKING (DIAL, INSTRUMENT, EQUIPMENT, ETC.)

PRISMS

Bache, Semon & Co., 636 Greenwich St., New York, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Bendix Corp., Electro-Optics Div., 1975 Green Rd., Ann Arbor, Mich.
Crystalab Prods. Corp., 19 Legion Pl., Rochelle Park, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Industrial Optics Corp., 377 Fifth St., Newark, N. J.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Photo Technical Products, Inc., 623 Stewart Ave., Garden City, N. Y.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Republic Lens Co., Inc., 31 East 169th St., Bronx, N. Y.
S & S Optical Co., Inc., 7812 Stellhorn Rd., Ft. Wayne, Ind.
Sawyer Research Prods., Inc., 35400 Lakeland Blvd., Eastlake, Ohio
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Spectra-Physics, Inc., 1250 W. Middlefield Rd., Mt. View, Calif.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Zenith Optical Lab., 138 Palisade St., Dobbs Ferry, N. Y.

PROBABILITY DISTRIBUTION ANALYZERS—SEE ANALYZERS, PROBABILITY DENSITY

PROBES, CRYSTAL

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Narda Microwave Corp., Plainview, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1478
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Waveline Inc., Box 718, West Caldwell, N. J.
Alessi Industries, 418 Main St., El Segundo, Calif.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Semimetals, Inc., 405 National Ave., Mountain View, Calif.

PROBES, HALL

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1013
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 2839
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 2516, 2517
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio ... p 2586
Tektronix, Inc., Box 500, Beaverton, Ore.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Empire Scientific Corp., Indl. Instr. Div., 1055 Stewart Ave., Garden City, N. Y.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.

PROBES, HIGH VOLTAGE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Heath Co., Dept. 180, Benton Harbor, Mich.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. .. p 967
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. p 1478, 1479
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.

PROBES, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
Narda Microwave Corp., Plainview, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Waveline Inc., Box 718, West Caldwell, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

PROBES, OSCILLOSCOPE—SEE OSCILLOSCOPE PROBES

PROBES, R-F

Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1347
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Heath Co., Dept. 180, Benton Harbor, Mich.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Narda Microwave Corp., Plainview, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1478
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro-Mechanics Co., Box 1546, Austin, Tex.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nichols Prods. Co., 325 W. Main St., Moorestown, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.

PROBES, TEMPERATURE—ALSO SEE THERMOCOUPLES & TRANSDUCERS

Cal-R, Inc., Thermonetics Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2799
Control Prods. Corp., 4431 W. Division St., Chicago, Ill. ..... p 2804
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1372
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Fenwal Electronics Inc., 63 Fountain St., Framingham, Mass. ... p 2814
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
RFL Inds., Inc., Thermocontrol Div., Powerville Rd., Boonton, N. J. p 1473
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Virtis Co., Inc., Rte. 208, Gardiner, N. Y. ..... p 1520
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Beacon Elctrns., Inc., 121 Stanley Ave., Bellmawr, N. J.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bristol Co., Box 1790, Waterbury, Conn.

Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
Burns Engrg., Inc., 5301 Edina Indl. Blvd., Minneapolis, Minn.
Conax Corporation, 2300 Walden Ave., Buffalo, N. Y.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electric Thermometers, Inc., 10 Glover Ave., Norwalk, Conn.
Electronic Development Labs., Inc., 19 Newton Rd., Plainview, N. Y.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Gow-Mac Instrument Co., 100 Kings Rd., Madison, N. J.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Harco Labs, Inc., 186 Cedar St., Branford, Conn.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Malaker Corp., W. Main St., High Bridge, N. J.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Marshall Instrs., Inc., 14203 Bessemer St., Van Nuys, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Norwalk Thermostat Co., 100 N. West St., Norwalk, Ohio
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
RDF Corp., 23 Elm Ave., Hudson, N. H.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
T & T Controls Co., Inc., Box 171, Media, Pa.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Temtech, 2208 S. Wright, Santa Ana, Calif.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Thermotronic Devices, Inc., Forest & Hector Sts., Conshohocken, Pa.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
United Electric Controls Co., 85A School St., Watertown, Mass.
United Sensor & Control Co., 85 School St., Watertown, Mass.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Versitherm, Inc., 51 Toledo St., Farmingdale, N. Y.
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

PROBES, TEST LEADS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Electronic Molding Corp., 44 Church St., Pawtucket, R. I. ..... p 901
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. p 965, 966
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1478
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Shallcross, E. Preston St., Selma, N. C.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Desco Mfg. Co., 1530 Flower St., Glendale, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
E-Z Hook Test Products, P.O. Box 105, Covington, Ky.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Horex Electronics, Inc., 1729 21st St., Santa Monica, Calif.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Moser Jewel Co., 544 Fayette St., Perth Amboy, N. J.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Ostby & Barton Co., Box 6267, Providence, R. I.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.

PROBES, ULTRASONIC

Blackstone Ultrasonics, Inc., 820 Center St., Sheffield, Pa. ..... p 2919
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Automation Industries, Inc., Box 950, Boulder, Colo.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

PROFILEOMETERS—SEE INDICATORS, SURFACE ROUGHNESS

PROFILING—SEE ENGRAVING

PROGRAMMERS, BROADCASTING

AMP Incorporated, Box 3608, Harrisburg, Pa.
Agastat Div., 1027 Newark Ave., Elizabeth, N. J.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.

PROGRAMMERS, COMPUTER

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Logic Science, Inc., Box 10096, San Diego, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Virginia Panel Corp., Box 1106, Waynesboro, Va. ..... p 1008
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Computer Methods Corp., 470 Mamaroneck Ave., White Plains, N. Y.
Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Design Automation, Inc., 809 Massachusetts Ave., Lexington, Mass.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Frankel Engrg. Labs., Inc., 125 South 5th St., Reading, Pa.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Petty Geophysical Engrg. Co., 700 Tower Bldg., San Antonio, Tex.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
RCA Service Co., Div. Radio Corp of America, Camden, N. J.
Signatron, Inc., 594 Marrett Rd., Lexington, Mass.
Strippit, Div. Houdaille Industries, Inc., Akron, N. Y.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio

PROGRAMMERS, CURVE FOLLOWING

Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Boston Digital Corp., 21 Main St., Ashland, Mass.
Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
EMR Div., Box 223, Princeton, N. J.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.

PROGRAMMERS, POWER SUPPLY

Agastat Div., 1027 Newark Ave., Elizabeth, N. J.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1940, 1941
Guardian California, 5755 Camille Ave., Culver City, Calif.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1972, 1973, 2002-2004
Kilovolt Corp., 238 High St., Hackensack, N. J.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.

PROGRAMMERS, PUNCHED CARD

AMP Incorporated, Box 3608, Harrisburg, Pa. ..... p 760
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Taurus Corp., Academy Hill, Lambertville, N. J. ..... p 803
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
Automatic Timing & Controls Inc., King of Prussia, Pa.
EMR Div., Box 223, Princeton, N. J.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Program Elctrns. Co., 1733 West End Ave., New Hyde Park, N. Y.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

PROJECTION UNITS, TV

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.

PULLERS, LAMP

Century Projector Corp., 729 Seventh Ave., New York, N. Y.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
General Television Network, 901 Livernois Ave., Ferndale, Mich.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
Kalart Co., Inc., Hultenius St., Plainville, Conn.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Traid Corp., 777 Flower St., Glendale, Calif.

PROTECTORS, CONTACT—SEE SUPPRESSORS, ARC

PROTECTORS, SURGE—ALSO SEE SUPPRESSORS, ARC; ARRESTERS, ELECTRICAL SURGE

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 1851
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 2692
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif. p 1592
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 2716
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif. p 1907
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. ..... p 1930
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Josiyn Elctrn. Sys., 6868 Cortona Dr., Goleta, Calif. ..... p 2740, 2741
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ... p 1972, 1973, 2007
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2027, 2028
Presin Co., Trap Falls Rd., Shelton, Conn.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 2086
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1805
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y. ..... p 2115
Transtector Systems, 3025 W. Mission Rd., Alhambra, Calif. ... p 2786
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
MCG Electronics Inc., 279 Skidmore Rd., Deer Park, N. Y.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Wuerth Products Corp., 1931 Pembroke Rd., Hollywood, Fla.

PROXIMITY INDICATORS—SEE INDICATORS, PROXIMITY

PUBLIC ADDRESS SYSTEMS

Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Electro Mechanics Inc., 2350 Duke St., Alexandria, Va.
Argos Products Co., Inc., 600 S. Sycamore St., Genoa, Ill.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Femco, Inc., Box F, Irwin, Pa.
Gai-Tronics Corp., Box 31, Reading, Pa.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Holmin, W. A. Corp., 1325 Seventh St., Rockford, Ill.
Jansen Electronics Mfg., Inc., 2233 University Ave., St. Paul, Minn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Port-O-Vox Enterprises, Corp., 130 West 57th St., New York, N. Y.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

PULLERS, CIRCUIT BOARD

Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. ..... p 595
Flotron Industries, Inc., 1201 E. Grand Ave., El Segundo, Calif.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Titchener, E. H. & Co., 8 Titchener Pl., Binghamton, N. Y.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.

PULLERS, FUSE

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Trico Fuse Mfg. Co., 2948 North 5th St., Milwaukee, Wis.

PULLERS, LAMP

Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2735

PULLERS, LAMP (Cont'd)

Atocon Co., 527 N. Union St., Galion, Ohio
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.

PULLERS, TUBE

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Foster & Allen, Inc., Box 466, Chatham, N. J.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.

PULSE ANALYZERS—SEE ANALYZERS, PULSE

PULSE-FORM RESTORERS—SEE RESTORERS, PULSE-FORM

PULSE NETWORKS—SEE NETWORKS, PULSE

PULSE RISE TIME INDICATORS—SEE INDICATORS, PULSE RISE TIME

PUMPS, CRYOGENIC

Aero Vac Corp., Box 448, Troy, N. Y.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Task Corporation, Box 3999, Anaheim, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.

PUMPS, NONMETALLIC

Elmeco Engrg., 539 Beall Ave., Rockville, Md.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Vanton Pump & Equip. Corp., 201 Sweetland Ave., Hillside, N. J.

PUMPS, SEALLESS—SEE PUMPS, NONMETALLIC

PUMPS, VACUUM

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Air-Vac Engineering Co., Inc., 100 Gulf St., Milford, Conn.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Beach-Russ Co., 420 Lexington Ave., New York, N. Y.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Crowell Mfg. Corp., 115 Clifton Pl., Brooklyn, N. Y.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.) Ltd., 430 S. Service Rd., W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Granville-Phillips Co., Box 1290, Boulder, Colo.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Heatron, Inc., Box 54, York, Pa.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hull Corp., 9140 Davisville Rd., Hatboro, Pa.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Lindberg Hevi-Duty, 2450 W. Hubbard St., Chicago, Ill.
Nelson Vacuum Pump Co., 2133 4th St., Berkeley, Calif.
Nester/Faust Mfg. Corp., 2401 Ogletown Rd., Newark, Dela.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Red Point Corp., 105 W. Spazier, Burbank, Calif.
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Roy, Milton, Co., 5000 Park St., N., St. Petersburg, Fla.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Welch Scientific Co., 7300 N. Linder Ave., Skokie, Ill.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

PUNCHED CARD EQUIPMENT

AMP Incorporated, Box 3608, Harrisburg, Pa. ..... p 760
Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1396
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y. ..... p 2277
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438, 1439
Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. ..... p 792
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Ohr-Tronics, Inc., Box 630, Herkimer, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 802
Taurus Corp., Academy Hill, Lambertville, N. J. ..... p 803
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Demex, Inc., 2130 Jefferson, Kansas City, Mo.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Electrologic, Inc., 4732 Indianapolis Blvd., E. Chicago, Ind.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
General Elec. Co., 4000 N. W. 39th Expwy., Oklahoma City, Okla.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Omnitec Inc., Sub. Nytronics, Inc., 903 N. Second St., Phoenix, Ariz.
Program Elctrns. Co., 1733 West End Ave., New Hyde Park, N. Y.
Roytron, Litton Automated Business Sys., 31 Styertowne Rd., Clifton, N. J.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Telcolab Corp., 405 Lexington Ave., New York, N. Y.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Uptime Corp., 8455 E. Prentice, Englewood, Colo.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

PUNCHED TAPE EQUIPMENT—SEE PERFORATORS, PAPER TAPE; READERS, PUNCHED TAPE

PUNCHES, CHASSIS

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Di-Acro, 316 8th Ave., Lake City, Minn.
Greenlee Tool Co., 2136-12th St., Rockford, Ill.
Wittek Products Co., 14750 Keswick St., Van Nuys, Calif.

PYROMETERS, INFRARED

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2816
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Bailey Meter Company, Wickliffe, Ohio
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bristol Co., Box 1790, Waterbury, Conn.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Epic, Inc., 150 Nassau St., New York, N. Y.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Williamson Development Co., 317 Main St. W., Concord, Mass.

PYROMETERS, OPTICAL, NON-INFRARED

Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Bailey Meter Company, Wickliffe, Ohio
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Epic, Inc., 150 Nassau St., New York, N. Y.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Larson Instrument Co., Inc., Greenbush Rd., Orangeburg, N. Y.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

PYROMETERS, RECORDING

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1389
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H. p 1573
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bristol Co., Box 1790, Waterbury, Conn.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Milletron, Inc., 540 Alpha Dr., Pittsburgh, Pa.
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

PYROMETERS, RESISTANCE-TYPE

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1049
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beacon Elctrns., Inc., 121 Stanley Ave., Bellmawr, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Burns Engrg., Inc., 5301 Edina Indl. Blvd., Minneapolis, Minn.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Foxboro, Foxboro, Mass.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

PYROMETERS, THERMOCOUPLE TYPE

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H. .... p 1341
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Millivac Instruments, Box 997, Schenectady, N. Y.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1049
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bristol Co., Box 1790, Waterbury, Conn.
Burling Instrument Company, 21 River Road, Chatham, New Jersey
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Electronic Development Labs., Inc., 19 Newton Rd., Plainview, N. Y.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Fenwal, Inc., Main St., Ashland, Mass.
Foxboro, Foxboro, Mass.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Larson Instrument Co., Inc., Greenbush Rd., Orangeburg, N. Y.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Pacific Transducer Corp., 2301 Federal, Los Angeles, Calif.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

QUARTZ, FUSED

Amersil, Inc., 685 Ramsey Ave., Hillside, N. J. ..... p 1638
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Carler Prods. Corp., 6200 E. Malloy Rd., E. Syracuse, N. Y.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Dynasil Corp. of America, Box D, Berlin, N. J.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Oriel Optics Corp., 1 Market St., Stamford, Conn.

Pan American Trade Development Corp., 2 Park Ave., New York, N. Y.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co.,
Rte. 202 & Change Bridge Rd., Montville, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

QUARTZ, RAW—SEE CRYSTALS, QUARTZ

QUICK DISCONNECTS—SEE CONNECTORS, CIRCULAR, QUICK-DISCONNECT

RFI MEASURING EQUIPMENT

Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Elgenco Inc., 1550 Euclid, Santa Monica, Calif.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1490, 1491
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
HRB-Singer, Inc., Science Park, State College, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Rafec Electronics, Box 566, Temple City, Cal.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

RFI SHIELDING—SEE SHIELDS, R-F

RACKS, AGING

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J.
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif.
Micro Instrument Company, 12901 Cranshaw Blvd., Hawthorne, Calif. p 1439
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
Lyon Metal Products, Inc., 47 Railroad Ave., Aurora, Ill.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

RACKS, CABINET

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J. ..... p 580
Equipto Enclosure Systems, 435 Woodlawn Ave., Aurora, Ill. .. p 581
Falstrom Co., 174 Falstrom Ct., Passaic, N. J. ..... p 583
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass. p 582
Power/Mate Corp., 163 Clay St., Hackensack, N. J. ..... p 2074
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga. ..... p 588
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Technipower, Inc., Benrus Center, Ridgefield, Conn.
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind. ..... p 594
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. ... p 591
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Acro Products Corp., 1410 S. Aberdeen St., Chicago, Ill.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
B & P Précision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Custom Metal Prods., 200 Broadway, Garden City Pk., N. Y.
Danco Metal Products, Inc., 24020 Detroit Rd., Westlake, Ohio
Donnelly Manufacturing Co., P. O. Box 71, Waltham, Mass.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Erie Artisan Corp., 11400 Madison Ave., Cleveland, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Holbrook-Merrill Co., 1150 Kifer Rd., Sunnyvale, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Ingersoll Products, 1000 West 120th St., Chicago, Ill.
Kirk & Blum Mfg. Co., 3120 Forrer St., Cincinnati, Ohio
Lynch, R. H. Mfg. Co., 7831 E. Arroyo Dr., S. San Gabriel, Calif.
Lyon Metal Products, Inc., 47 Railroad Ave., Aurora, Ill.
Metal-Craft, Inc., Box 296, Wayne, N. J.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Middletown Mfg. Co., 27 Stack St., Middletown, Conn.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Newcomb Audio Products Co., 12881 Bradley Ave., Sylmar, Calif.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Rotary Co., Inc., 1746 Dale Rd., Buffalo, N. Y.
Stackbin Corp., P.O. Box 434, Pawtucket, R. I.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Watson Mfg. Co., Inc., 800 Taylor St., Jamestown, N. Y.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

RACKS, DESK & CONSOLE

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill. ..... p 577
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J. ..... p 580
Equipto Enclosure Systems, 435 Woodlawn Ave., Aurora, Ill. .. p 581
Falstrom Co., 174 Falstrom Ct., Passaic, N. J. ..... p 583
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass. p 582
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga. ..... p 588
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind. ..... p 594
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. ... p 591
Abtronics, Inc., Box 712, Livermore, Calif.
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
Acro Products Corp., 1410 S. Aberdeen St., Chicago, Ill.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Danco Metal Products, Inc., 24020 Detroit Rd., Westlake, Ohio
Donnelly Manufacturing Co., P. O. Box 71, Waltham, Mass.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ingersoll Products, 1000 West 120th St., Chicago, Ill.
Kirk & Blum Mfg. Co., 3120 Forrer St., Cincinnati, Ohio
Lyon Metal Products, Inc., 47 Railroad Ave., Aurora, Ill.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
Riester & Thesmacher Co., 1526 West 25th St., Cleveland, Ohio
Rotary Co., Inc., 1746 Dale Rd., Buffalo, N. Y.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

RACKS, CIRCUIT BOARD

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Atlee Corp., 2 Lowell Ave., Winchester, Mass. ..... p 835
Buckeye Stamping Co., 555 Marion Rd., Columbus, Ohio ..... p 1169
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Datascan, Inc., 1111 Paulison Ave., Clifton, N. J. ..... p 773
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 898
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
Electronic Modules Corp., P.O. Box 141, Timonium, Md.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill. ..... p 919
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. ..... p 537
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 586
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Techmar Corp., 2232 S. Cotner Ave., Los Angeles, Calif. ..... p 592
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 593
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Virginia Panel Corp., Box 1106, Waynesboro, Va.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
B & P Précision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Calabro Unitrack, 8738 West Chester Pike, Upper Darby, Pa.

RACKS, RELAY AND MOUNTING

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Donnelly Manufacturing Co., P. O. Box 71, Waltham, Mass.
Douglas Electronics, Inc., 718 Marina Blvd., San Leandro, Calif.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Circuits Co., 23 Kulick Rd., Fairfield, N. J.
Matrix Engrg. Corp., 1502 West 166 St., Gardena, Calif.
Metropolitan Wire Goods Corp.,
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Roback Corp., Huntingdon Valley, Pa.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Titchener, E. H. & Co., 8 Titchener Pl., Binghamton, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

RACKS, MODULE—ALSO SEE RACKS, CIRCUIT BOARD

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill.
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 898
Electronic Modules Corp., P.O. Box 141, Timonium, Md.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 2009
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y.
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif. p 586
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Technipower, Inc., Benrus Center, Ridgefield, Conn.
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Viking Modules, Inc., 223 Crescent St., Waltham, Mass. ..... p 2144
Abtronics, Inc., Box 712, Livermore, Calif.
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
B & P Précision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Industrial Circuits Co., 23 Kulick Rd., Fairfield, N. J.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Roback Corp., Huntingdon Valley, Pa.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

RACKS, RELAY & MOUNTING

Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill. ..... p 574
Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Deltron Inc., Wissahickon Ave., North Wales, Pa.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn. ..... p 1917
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. ..... p 1930
Enclosure Corp., 1701 Industrial Blvd., Pennsauken, N. J. ..... p 580
Equipto Enclosure Systems, 435 Woodlawn Ave., Aurora, Ill. .. p 581
Falstrom Co., 174 Falstrom Ct., Passaic, N. J.
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 2010
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2027, 2028, 2031
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga. ..... p 588
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind.
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. .... p 591
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Accessory Controls & Equip. Corp., 805 Bloomfield Ave., Windsor, Conn.
Ambox, Inc., 6040 Telephone Rd., Houston, Tex.
B & P Précision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Donnelly Manufacturing Co., P. O. Box 71, Waltham, Mass.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Erie Artisan Corp., 11400 Madison Ave., Cleveland, Ohio
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Feiner, P. & Sons, Inc., 522 West 45 St., New York, N. Y.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Holbrook-Merrill Co., 1150 Kifer Rd., Sunnyvale, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Ingersoll Products, 1000 West 120th St., Chicago, Ill.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Metal Works, Inc., 9th & Jefferson, Hermann, Mo.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Middletown Mfg. Co., 27 Stack St., Middletown, Conn.

RACKS, RELAY AND MOUNTING (Cont'd)

Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Watson Mfg. Co., Inc., 800 Taylor St., Jamestown, N. Y.
York Metal Prods., Inc., 34-20 12th St., Long Island City, N. Y.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

RADAR EQUIPMENT—SEE ANALYZERS; TESTERS; SIMULATORS; ETC.

RADAR SYSTEMS

AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541, 786
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .... p 1705
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bedford Div., Sanders Assocs., Inc., Crosby Rd., Bedford, Mass.
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group, 1901 Malvern St., Fullerton, Cal.
ITT Gilfillan, Inc., 7821 Orion Ave., Van Nuys, Calif.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Moran Instrument Corp., 170 E. Orange Grove Ave., Pasadena, Calif.
Nano Fast, Inc., 416 W. Erie, Chicago, Ill.
Norden Div., United Aircraft Corp., Helen St., Norwalk, Conn.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Signatron, Inc., 594 Marrett Rd., Lexington, Mass.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
United Telecontrol Electronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

RADAR TESTERS—SEE TESTERS, RADAR

RADIATION EQUIP., NUCLEAR—SEE DOSIMETERS; COUNTERS, GEIGER; COUNTERS, SCINTILLATION; FILM BADGES

RADIOACTIVE LIGHT SOURCES—SEE SOURCES, LIGHT, RADIOACTIVE

RADIO COMM. SYSTEMS—SEE COMM. SYSTEMS (AS MODIFIED)

RADIOGRAPHIC EQUIPMENT—SEE X-RAY INSPECTION EQUIPMENT

RADIOMETERS

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Beckman, Advanced Tech. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.
Williamson Development Co., 317 Main St. W., Concord, Mass.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

RADOMES

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Amersil, Inc., 685 Ramsey Ave., Hillside, N. J.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
Air-Tech Inds., Inc., 9 Brighton Rd., Clifton, N. J.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
C/P Corp., RFD 3, Newberry, S. C.
Ceram Corp., 5345 Timken Sq., La Mesa, Calif.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Daniels, C. R., Inc., Daniels, Md.
Decibel Products, Inc., 3184 Quebec St., Dallas, Tex.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Laminair Inc., 13226 Figueroa, Los Angeles, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
McMillan Radiation Labs, Inc., Brownville Ave., Ipswich, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Nichols Prods. Co., 325 W. Main St., Moorestown, N. J.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

RANGE FINDER SYSTEMS

Astronautics Corp. of America, 907 S. First St., Milwaukee, Wisc.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Litton Systems, Inc., Guidance & Control Sys. Div., 5500 Canoga Ave., Woodland Hills, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Nano Fast, Inc., 416 W. Erie, Chicago, Ill.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

RARE EARTHS—SEE METALS, RARE

RATE-OF-TURN TABLES—SEE TABLES, RATE-OF-TURN

REACTORS, CHARGING

AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2873, 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Unitron, 1624 N. First St., Garland, Texas
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
TDC Div., P.O. Box 365, Littleton, Mass.

REACTORS, EPITAXIAL—SEE MACHINES, SEMICONDUCTOR MANUFACTURING

REACTORS, FILTER

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2857
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. .... p 2866
NWL, Inc., Box 455, Trenton, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2875, 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Miller, S., Corp., 89 Throop Ave., Brooklyn, N. Y.
North Electric Co., 553 S. Market St., Galion, Ohio
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.

REACTORS, LOADING

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
NWL, Inc., Box 455, Trenton, N. J.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
TDC Div., P.O. Box 365, Littleton, Mass.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.

REACTORS, SATURABLE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853

Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2857
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. p 1290
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
NWL, Inc., Box 455, Trenton, N. J. p 2868
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
United Transformer Co., 150 Varick St., New York, N. Y. p 2900
Unitron, 1624 N. First St., Garland, Texas
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
TDC Div., P.O. Box 365, Littleton, Mass.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.

READERS, CHARACTER

AMP Incorporated, Box 3608, Harrisburg, Pa.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. p 778
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. p 802
Bendix Corp., Electro-Optics Div., 1975 Green Rd., Ann Arbor, Mich.
Farrington, 6707 Electronics Dr., Springfield, Va.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.

READERS, MAGNETIC TAPE (COMPUTER TYPE)

Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Cipher Data Prods., Inc., 1219 Morena Blvd., San Diego, Calif.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Cook Electric Co., Data-Stor Div., 6401 W. Oakton, Morton Grove, Ill.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Lockheed Electronics Co., Rte. 22, Plainfield, N. J.
Lockheed Electronics Co., Route 22, Watchung, N. J.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.

READERS, MICROFINCHE

Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Johnson Research Corp., 2099 New Hwy., Farmingdale, N. Y.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.
3M Co., 3M Center, St. Paul, Minn.

READERS, PUNCHED CARD— SEE PUNCHED CARD EQUIPMENT

READERS, PUNCHED TAPE

Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
Clairex Electronics, Inc., 1239 Broadway, New York, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. p 792
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Ohr-Tronics, Inc., Box 630, Herkimer, N. Y.
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif. p 799
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass. p 815
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Chalco Engrg. Corp., 15126 S. Broadway, Gardena, Calif.
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Cook Electric Co., Data-Stor Div., 6401 W. Oakton, Morton Grove, Ill.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
Ferranti-Packard Ltd., 121 Industry St., Toronto, Ont., Can.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
General Elec. Co., 4000 N. W. 39th Expwy., Oklahoma City, Okla.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Photologic Co., 3704 E. Walnut Ave., Orange, Cal.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Roytron, Litton Automated Business Sys., 31 Styertowne Rd., Clifton, N. J.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Tech Serv., Inc., 5451 Holland Dr., Beltsville, Md.
Telcolab Corp., 405 Lexington Ave., New York, N. Y.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.

READOUTS & READOUT DEVICES—ALSO SEE SPECIFIC TYPES

AMP Incorporated, Box 3608, Harrisburg, Pa.
Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Amphenol Controls Div., 120 S. Main St., Janesville, Wisc.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Display Devices, Inc., 2928 Nebraska Ave., Santa Monica, Calif.
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Icon Corp., 156 Sixth St., Cambridge, Mass.
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill.
Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla.
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y.
Patwin Div., Box 710, Waterbury, Conn.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 806
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Ackerman Engravers, Inc., 43-22 36th St., Long Island City, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Analogic Co., 296 Newton St., Waltham, Mass.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio
Bristol Co., Box 1790, Waterbury, Conn.
Bunker-Ramo Corp., 445 Fairfield Ave., Stamford, Conn.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Coleman Engrg. Co., Inc., 3121 W. Central Ave., Santa Ana, Calif.
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Detecto Scales, Inc., 540 Park Ave., Brooklyn, N. Y.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digiac Corp., Ames Ct., Plainview, N. Y.

READOUTS, LIGHTED, SEGMENTED

Digital Products Corp., 4030 N.E. 6th Ave., Ft. Lauderdale, Fla.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Fairbanks Morse Weighing Sys., 711 E. St. Johnsbury Rd., St. Johnsbury, Vt.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Foxboro, Foxboro, Mass.
Hughes Aircraft Co., Vacuum Tube Prods. Div., 2020 Oceanside Blvd., Oceanside, Cal.
Information Displays, Inc., 333 N. Bedford Rd., Mt. Kisco, N. Y.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Kinetic Instr. Co., 1072 Linwood St., Brooklyn, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
LeCroy Res. Sys. Corp., 126 North Rte. 303, W. Nyack, N. Y.
Litton Inds., Inc., Datalog Div., 343 Sansome St., San Francisco, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Penn Keystone Corp., Division St., Ansonia, Conn.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solar Systems, Inc., 8241 Kimball Ave., Skokie, Ill.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transducers, Inc., 11971 E. Rivera Rd., Santa Fe Springs, Calif.
Victor Comptometer Corp., 3900 N. Rockwell St., Chicago, Ill.
Vogue Instrument Corp., 31 Commercial St., Plainview, N. Y.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Welex Electronics, Box 986, Silver Spring, Md.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

READOUTS, EDGE-LIGHTED

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 1178
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. p 1021
Display Devices, Inc., 2928 Nebraska Ave., Santa Monica, Calif. p 1186

READOUTS, ELECTROLUMINESCENT

Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. p 1194
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

READOUTS, ELECTROMECHANICAL

Allard Instrument Corp., 770 Main St., Westbury, N. Y. p 1179
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. p 1021
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. p 2664
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. p 2713-2715
ENM Co., Inc., 5306 W. Lawrence Ave., Chicago, Ill. p 1028
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. p 2666
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. p 2153
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y. p 2298
Patwin Div., Box 710, Waterbury, Conn. p 1196, 1197
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif. p 1462
Presin Co., Trap Falls Rd., Shelton, Conn. p 1051
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. p 2672
Theta Instrument Corp., Fairfield, N. J. p 1513
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. p 1055
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. p 811
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1210

READOUTS, LIGHTED, SEGMENTED

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1323
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 1178
Allard Instrument Corp., 770 Main St., Westbury, N. Y. p 1179
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1183
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. p 1783
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla. p 1185
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y. p 1191
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. p 1409
Mesa Co., Inc., 216-220 Mill St., Bristol, Pa. p 1195
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J. p 1198
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 806
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 1206
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Penn Keystone Corp., Division St., Ansonia, Conn.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.

READOUTS, REAR-PROJECTION

READOUTS, REAR-PROJECTION

Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J.
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1188, 1189
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y. p 1191
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Shelly Associates Inc., 111 Eucalyptus Dr., El Segundo, Cal. p 1202, 1203
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Storage Tubes, 2020 Oceanside Blvd., Oceanside, Calif.

READOUTS, SEMICONDUCTOR TYPE (INCL. LIGHT-EMITTING DIODES & SWITCHES)

International Rectifier, 233 Kansas St., El Segundo, Calif. ..... p 2530
Sensor Technology, Inc., 7118 Gerald Ave., Van Nuys, Calif. ... p 1774
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 806
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.

RECEIVERS, A-M (PRECISION TEST)

Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Calbest Elctrns., 4801 Exposition Blvd., Los Angeles, Calif.
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.

RECEIVERS, BEACON

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group, 1901 Malvern St., Fullerton, Cal.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sparton Corp., 2400 E. Ganson St., Jackson, Mich.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.

RECEIVERS, CARRIER TELEGRAPH

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.

RECEIVERS, COMMAND

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1654
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Control Science Corp., 4810 Beauregard St., Alexandria, Va.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Linear Corp., 347 S. Glasgow Ave., Inglewood, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.

RECEIVERS, COMMUNICATION & AMATEUR

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Heath Co., Dept. 180, Benton Harbor, Mich.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Atlantic Instrs. & Elctrns., 50 Hunt St., Watertown, Mass.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Communications Co., Inc., Box 520, Coral Gables, Fla.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Fisher Radio Corp., 11-40 45th Rd., Long Island City, N. Y.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Metrotek Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Pearce-Simpson, Inc., Box 800, Biscayne Annex, Miami, Fla.
Plectron Corp., Overton, Nebr.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Regency Elctrns., Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Squires-Sanders Inc., Martinsville Rd., Liberty Corner, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Unimetrics, Inc., 39 Werman Ct., Plainview, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Weitermann Electronics, 4549 North 38th St., Milwaukee, Wisc.

RECEIVERS, DIPLEXER

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

RECEIVERS, DIVERSITY RECEPTION

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.

RECEIVERS, DUPLEXER

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

RECEIVERS, FACSIMILE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Telautograph Corp., 8700 Bellanca Ave., Los Angeles, Calif.

RECEIVERS, FIELD INTENSITY, MICROWAVE —SEE RECEIVERS, MICROWAVE

RECEIVERS, FIXED FREQUENCY

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1699
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Specific Products, 1237 S. Shamrock Ave., Monrovia, Cal. ..... p 756
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Calbest Elctrns., 4801 Exposition Blvd., Los Angeles, Calif.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Communications Co., Inc., Box 520, Coral Gables, Fla.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
HRB-Singer, Inc., Science Park, State College, Pa.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
International Ground Systems Div., 11101 Sunset Hills Rd., Reston, Va.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.

Johnson Electronics, Inc., Box 7, Casselberry, Fla.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
Karg Laboratories, Inc., 162 Ely Ave., Norwalk, Conn.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Metrotek Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Multitone Electronics, Inc., 111 Broadway, New York, N. Y.
Olektron Corp., Box 248, Dudley, Mass.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Plectron Corp., Overton, Nebr.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Regency Elctrns., Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Specific Prods., 1237 S. Shamrock Ave., Monrovia, Calif.
Squires-Sanders Inc., Martinsville Rd., Liberty Corner, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Taffet Electronics, Inc., 27-01 Brooklyn-Queens Expwy., W., Woodside, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

RECEIVERS, FM (PRECISION TEST)

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Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
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Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
p 1695, 1696, 1699
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
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Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Calbest Elctrns., 4801 Exposition Blvd., Los Angeles, Calif.
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Communications Co., Inc., Box 520, Coral Gables, Fla.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Fisher Radio Corp., 11-40 45th Rd., Long Island City, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Karg Laboratories, Inc., 162 Ely Ave., Norwalk, Conn.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Standard Electronics Corp., Box 677, Freehold, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Trans-Aire Elctrns., Inc., 85 Denton Ave., New Hyde Park, N. Y.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
V-M Corporation, 305 Territorial Rd., Benton Harbor, Mich.
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Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

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Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Collins Radio Co., Dallas, Texas
Femco, Inc., Box F, Irwin, Pa.
Frederick Elctrns. Corp., Hayward Rd., Frederick, Md.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Teledyne Telemetry Co., Box 341, Princeton, N. J.

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RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1699
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
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Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
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De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
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TE Co., 515 E. Montecito St., Santa Barbara, Calif.

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Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Electro-Ceramics, Box 15096, Salt Lake City, Utah
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
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Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

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RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1699
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
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Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
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Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
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Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
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ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
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Electro/Data Inc., 3121 Benton St., Garland, Tex. ..... p 1666
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
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Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
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Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. ... p 1705
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
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Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.

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Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
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Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Astro Communication Lab., 9125 Gaither Rd., Gaithersburg, Md.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Control Data Corp., 400 Border St., East Boston, Mass.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
Farinon Electric, 935 Washington St., San Carlos, Calif.
Foxboro, Foxboro, Mass.
General Electric Co., Mountain View Rd., Lynchburg, Va.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
HRB-Singer, Inc., Science Park, State College, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Micro-Now Instr. Co., Inc., 6124 N. Pulaski Rd., Chicago, Ill.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Optimax Inc., 258 N. Main St., Ambler, Pa.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
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Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
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Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Telefunken Sales Corp., South St., Garden City, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
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Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

RECEIVERS, MONITORING, COMMUNICATIONS

AEL Inc., P.O. Box 552, Lansdale, Pa.
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Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Conrac Div., 600 N. Rimsdale Ave., Covina, Calif.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Femco, Inc., Box F, Irwin, Pa.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
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White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

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Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
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Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
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Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
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Browning Labs., Inc., Box 310, Laconia, N. H.
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Collins Radio Co., Dallas, Texas
Electron Enterprises, Inc., 6645 Stanley Ave., Berwyn, Ill.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
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Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
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ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
Johnson Electronics, Inc., Box 7, Casselberry, Fla.
Karg Laboratories, Inc., 162 Ely Ave., Norwalk, Conn.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
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Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
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Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
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Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y. p 1384
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Marconi Instrs., 111 Cedar La., Englewood, N. J.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1490
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Collins Radio Co., Dallas, Texas
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Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
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Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
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Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Specific Products, 1237 S. Shamrock Ave., Monrovia, Cal. ..... p 756
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Products Group, 115 Old Country Rd., Carle Place, N. Y.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
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Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541, 786
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
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Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
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Aertech Inds., 815 Stewart Dr., Sunnyvale, Calif.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
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Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
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Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
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Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Railway Communications, 9351 East 59th St., Raytown, Mo.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

RECORDERS, DISC

Squires-Sanders Inc., Martinsville Rd., Liberty Corner, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

RECORDERS, WWV

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1393
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Specific Products, 1237 S. Shamrock Ave., Monrovia, Cal. ..... p 756 p 1497
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Collins Radio Co., Dallas, Texas
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Karg Laboratories, Inc., 162 Ely Ave., Norwalk, Conn.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Specific Prods., 1237 S. Shamrock Ave., Monrovia, Calif.
Weitermann Electronics, 4549 North 38th St., Milwaukee, Wisc.

RECEPTACLES—SEE CONNECTORS: JACKS: SOCKETS

RECEPTACLES, ANTENNA TAPPING

Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.

RECORDERS, ANTENNA PATTERN

Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.

RECORDERS, BLOOD PRESSURE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Avionics Res. Prods. Corp., 6901 W. Imperial Hwy., Los Angeles, Cal.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Biotronics, Inc., 838 Butte St., Redding, Calif.
Dallons Instrs., 120 Kansas St., El Segundo, Calif.
Ensco, Inc., 3100 Eldredge St., Salt Lake City, Utah
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.

RECORDERS, CODE

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1556–1562
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2160
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Litton Inds., Inc., Datalog Div., 343 Sansome St., San Francisco, Cal.
Lockheed Electronics Co., Rte. 22, Plainfield, N. J.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.

RECORDERS, COMPUTER DATA—SEE DATA RECORDERS, COMPUTER

RECORDERS, DISC

Burroughs Corp., OEM Sales Dept., 1649 Wilshire Blvd., Los Angeles, Calif. p 765
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Data Disc, Inc., Display Div., 2626 Hanover St., Palo Alto, Calif.
Data Disc, Inc., Standard Prods. Div., 1275 California Ave., Palo Alto, Cal.
Duotone Co., Inc., Box 814, S. Miami, Fla.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.

RECORDERS, DISC (Cont'd)

Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

RECORDERS, ELECTRONIC, ROTARY STYLUS

Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
A & M Instrument, Inc., Community Dr., Great Neck, N.Y.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Theta Inds., Inc., Box 392, Great Neck, N. Y.

RECORDERS, ELECTROSTATIC

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
General Elec. Co., 4000 N. W. 39th Expwy., Oklahoma City, Okla.
Information Displays, Inc., 333 N. Bedford Rd., Mt. Kisco, N. Y.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.

RECORDERS, EVENT

Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1554, 1556, 1557
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H. p 1573
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Incre-Data Corp., 6403 Acoma Rd., S.E., Albuquerque, N. M.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

RECORDERS, FM—SEE RECORDERS, MAGNETIC TAPE (LAB TYPE)

RECORDERS, FACSIMILE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Alden Systems Co., 262 N. Main St., Brockton, Mass.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Mincom Div., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
3M Co., 3M Center, St. Paul, Minn.

RECORDERS, FILM

Beta Instrument Corp., 377 Elliot St., Newton Upper Falls, Mass. p 1184
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Photo-Sonics, Inc., 820 S. Mariposa St., Burbank, Calif.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Sprengnether, W. F. Instr. Co., Inc., 4567 Swan St., St. Louis, Mo.
Stancil-Hoffman Corp., 921 N. Highland Ave., Hollywood, Calif.
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

RECORDERS, FILM STRIP, MAGNETIC

Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.

RECORDERS, FLIGHT

Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2160
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Collins Radio Co., Cedar Rapids, Iowa
Conrac Corp., 330 Madison Ave., New York, N. Y.
Cook Electric Co., Data-Stor Div., 6401 W. Oakton, Morton Grove, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Incre-Data Corp., 6403 Acoma Rd., S.E., Albuquerque, N. M.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Lockheed Electronics Co., Rte. 22, Plainfield, N. J.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Mincom Div., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Nuclear Supplies, Box 312, Encino, Calif.
Pemco, 942 Commercial St., Palo Alto, Calif.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
United Control Corporation, Redmond, Wash.
United Control Winston Div., 6711 S. Sepulveda Blvd., Los Angeles, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

RECORDERS, FREQUENCY

CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1353
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N.Y.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Larson Instrument Co., Inc., Greenbush Rd., Orangeburg, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Siemens America, Measuring Inst. Div., 350 Fifth Ave., N. Y., N. Y.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

RECORDERS, GRAPHIC—SEE RECORDERS (AS MODIFIED)

RECORDERS, HUMIDITY (ELECTRONIC)

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Bacharach Instrument Co., 625 Alpha Dr., Pittsburgh, Pa.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Foxboro, Foxboro, Mass.
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

RECORDERS, LONG-TERM TAPE—SEE RECORDERS, MAGNETIC TAPE (LAB TYPE)

RECORDERS, MAGNETIC TAPE (LAB. TYPE)

Applied Magnetics Corp., 75 Robin Hill Rd., Goleta, Calif.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex. p 2158
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Vetter, A. R. Co., Box 143, Rebersburg, Pa. ..... p 2162
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Audiotronics Corp., 7428 Bellaire Ave., N. Hollywood, Calif.
Auricord, 35-41 29th St., Long Island City, N. Y.
Avionics Res. Prods. Corp., 6901 W. Imperial Hwy., Los Angeles, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Cassettes Unlimited, Corp., 200 Claremont Ave., New York, N. Y.
Cipher Data Prods., Inc., 1219 Morena Blvd., San Diego, Calif.
Cook Electric Co., Data-Stor Div., 6401 W. Oakton, Morton Grove, Ill.
Defense Elctrns., Inc., Rockville, Md.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Incre-Data Corp., 6403 Acoma Rd., S.E., Albuquerque, N. M.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Lockheed Electronics Co., Rte. 22, Plainfield, N. J.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Major Electronics Corp., 649 39 St., Brooklyn, N. Y.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Mincom Div., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Ortofon Div., Thorens & Atlantic Aves., New Hyde Park, N. Y.
Pemco, 942 Commercial St., Palo Alto, Calif.
P & H Electronics, 426 Columbia St., Lafayette, Ind.
Peripheral Equip. Corp., 9551 Irondale, Chatsworth, Calif.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Precision Instr. Co., 3170 Porter Dr., Palo Alto, Calif.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Stancil-Hoffman Corp., 921 N. Highland Ave., Hollywood, Calif.
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif.
Symphonic Radio & Electronic Corp., 470 Park Ave., S., New York, N. Y.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Tandberg of America, Inc., 8 Third Ave., Pelham, N. Y.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
United Control Corporation, Redmond, Wash.
United Control Winston Div., 6711 S. Sepulveda Blvd., Los Angeles, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.

RECORDERS, MOISTURE (ELECTRONIC)

Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Foxboro, Foxboro, Mass.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Hygrodynamics, Inc., Dept. D-24, 949 Selim Rd., Silver Spring, Md.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

RECORDERS, OXYGEN/OZONE

Anderson, W. E., Inc., 320E West 80th St., Kansas City, Mo.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Hays Corp., Michigan City, Ind.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.

RECORDERS, POLAR

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
London Co., 811 Sharon Dr., Westlake, Ohio
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Bendix Corp., Industrial Metrology Div., Box 1067, Ann Arbor, Mich.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.

RECORDERS, POWER—LEVEL

Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H. p 1573
A & M Instrument, Inc., Community Dr., Great Neck, N.Y.
Bristol Co., Box 1790, Waterbury, Conn.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.

RECORDERS, PRESSURE (ELECTRONIC)

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1389
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H. p 1573
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Biotronics, Inc., 838 Butte St., Redding, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
Hays Corp., Michigan City, Ind.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

RECORDERS, PYROMETER—SEE PYROMETERS, RECORDING

RECORDERS, SMOKE & COMBUSTION (ELECTRONIC)

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1389

Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Hays Corp., Michigan City, Ind.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

RECORDERS, SOUND LEVEL

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Meguro Denpa Sokki K. K., 51 2-chome, Meguro-ku, Tokyo, Jap.
Sprengnether, W. F. Instr. Co., Inc., 4567 Swan St., St. Louis, Mo.
United Control Corporation, Redmond, Wash.
United Control Winston Div., 6711 S. Sepulveda Blvd., Los Angeles, Calif.
Waters Conley Co., Inc., 501 1st Ave., N.W., Rochester, Minn.

RECORDERS, STEREOPHONIC TAPE (NON-ENTERTAINMENT)

Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Logic Science, Inc., Box 10096, San Diego, Calif. ..... p 788
Vetter, A. R. Co., Box 143, Rebersburg, Pa. ..... p 2162
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Auricord, 35-41 29th St., Long Island City, N. Y.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Fargo Co., 1162 Bryant St., San Francisco, Calif.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Lockheed Electronics Co., Rte. 22, Plainfield, N. J.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Orrtronics, Inc., Box 864, Toledo, Ohio
Stancil-Hoffman Corp., 921 N. Highland Ave., Hollywood, Calif.
Tandberg of America, Inc., 8 Third Ave., Pelham, N. Y.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
3M Co., 3M Center, St. Paul, Minn.
United Control Corporation, Redmond, Wash.
United Control Winston Div., 6711 S. Sepulveda Blvd., Los Angeles, Calif.
V-M Corporation, 305 Territorial Rd., Benton Harbor, Mich.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.

RECORDERS, STRAIN

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1556–1562
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Houston Instr., 4950 Terminal Ave., Bellaire, Texas .. p 784, 785, 1572
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H. p 1573
B & F Instruments Inc., Cornwells Hgts., Pa.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

RECORDERS, STRIP-CHART

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1554–1562
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1389
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Heath Co., Dept. 180, Benton Harbor, Mich. ..... p 1397
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Houston Instr., 4950 Terminal Ave., Bellaire, Texas .. p 784, 785, 1572
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H. p 1573
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Tracor Inc., 6500 Tracor La., Austin, Texas
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Yeiser Labs., 881 West 18th St., Costa Mesa, Calif. ..... p 1574
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Automatic Timing & Controls Inc., King of Prussia, Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bacharach Instrument Co., 625 Alpha Dr., Pittsburgh, Pa.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Biotronics, Inc., 838 Butte St., Redding, Calif.
Bolt Beranek & Newman, Inc., 2126 S. Lyon St., Santa Ana, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fairbanks Morse Weighing Sys., 711 E. St. Johnsbury Rd., St. Johnsbury, Vt.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Cal.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Impact-O-Graph Corp., 1762 East 18th St., Cleveland, Ohio
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Larson Instrument Co., Inc., Greenbush Rd., Orangeburg, N. Y.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photovolt Corp., 1115 Broadway, New York, N. Y.
Photron Instrument Co., 6516 Detroit Ave., Cleveland, Ohio
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Ross Labs, Inc., 3138 Fairview Ave. E., Seattle, Wash.
San-ei Instr. Co., Ltd., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

RECORDERS, SYNCHRONIZED FILM-TAPE

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Orrtronics, Inc., Box 864, Toledo, Ohio
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Stancil-Hoffman Corp., 921 N. Highland Ave., Hollywood, Calif.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.

RECORDERS, TEMPERATURE, ELECTRONIC

V-M Corporation, 305 Territorial Rd., Benton Harbor, Mich.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.

RECORDERS, TAPE LOOP (LAB TYPE)

Applied Magnetics Corp., 75 Robin Hill Rd., Goleta, Calif.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2160
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Vetter, A. R. Co., Box 143, Rebersburg, Pa. ..... p 2162
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Amplifier Corp. of America, 75 Frost St., Westbury, N. Y.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Precision Instr. Co., 3170 Porter Dr., Palo Alto, Calif.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Tandberg of America, Inc., 8 Third Ave., Pelham, N. Y.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
3M Co., 3M Center, St. Paul, Minn.
United Control Corporation, Redmond, Wash.
United Control Winston Div., 6711 S. Sepulveda Blvd., Los Angeles, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
Wide Range Elctrns. Corp., 12200 Dorsett Rd., Maryland Hgts., Mo.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

RECORDERS, TELEMETERING

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1556–1562
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2160
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Vetter, A. R. Co., Box 143, Rebersburg, Pa. ..... p 2162
Ampex Corp., 401 Broadway, Redwood City, Calif.
Astro-Science Corp., 9700 Factorial Way, S. El Monte, Calif.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Foxboro, Foxboro, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Leupold & Stevens Instrs., Inc., P.O. Box 25347, Portland, Ore.
Litton Inds., Inc., Datalog Div., 343 Sansome St., San Francisco, Cal.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Lockheed Electronics Co., Rte. 22, Plainfield, N. J.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Mincom Div., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Pemco, 942 Commercial St., Palo Alto, Calif.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
United Control Corporation, Redmond, Wash.
United Control Winston Div., 6711 S. Sepulveda Blvd., Los Angeles, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.

RECORDERS, TELETYPE

Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.

RECORDERS, TEMPERATURE (ELECTRONIC)

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1556–1562

RECORDERS, TEMPERATURE, (Cont'd)

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1389
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2816, 2817
Houston Instr., 4950 Terminal Ave., Bellaire, Texas .. p 784, 785, 1572
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H. p 1573

Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bacharach Instrument Co., 625 Alpha Dr., Pittsburgh, Pa.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bristol Co., Box 1790, Waterbury, Conn.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Integrated Development & Mfg. Co., 510 E. Washington, Chagrin Falls, Ohio
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
United Electric Controls Co., 85A School St., Watertown, Mass.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

RECORDERS, TIMING

Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1556–1562
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H. p 1573

Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Alden Systems Co., 262 N. Main St., Brockton, Mass.
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio
Bristol Co., Box 1790, Waterbury, Conn.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Larson Instrument Co., Inc., Greenbush Rd., Orangeburg, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Wakmann Watch Co., Inc., 15 W. 47th St., New York, N. Y.

RECORDERS, TORQUE (ELECTRONIC)

Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1556–1562
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
B & F Instruments Inc., Cornwells Hgts., Pa.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
McNab, Inc., 165 Spring St., New York, N. Y.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

RECORDERS, TRANSIENT

E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1438
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Data Disc, Inc., Display Div., 2626 Hanover St., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
NUS Corp., Box 248, Paramus, N. J.
Sprengnether, W. F. Instr. Co., Inc., 4567 Swan St., St. Louis, Mo.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
United Control Winston Div., 6711 S. Sepulveda Blvd., Los Angeles, Calif.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

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B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1389
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1248
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Epic, Inc., 150 Nassau St., New York, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
International Research & Dev. Corp., 6150 Huntley Rd., Worthington, Ohio
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Sprengnether, W. F. Instr. Co., Inc., 4567 Swan St., St. Louis, Mo.
Techni-Rite Elctrns., Inc., 65 Centerville Rd., Warwick, R. I.
United Control Winston Div., 6711 S. Sepulveda Blvd., Los Angeles, Calif.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

RECORDERS, VIDEO TAPE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Borg-Warner Controls, 3300 S. Halladay, Santa Ana, Calif.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Craig Corp., 2302 East 15th St., Los Angeles, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Precision Instr. Co., 3170 Porter Dr., Palo Alto, Calif.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Shibaden Corp. of America, 58-25 Brooklyn-Queens Expwy., Woodside, N. Y.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
3M Co., 3M Center, St. Paul, Minn.
United Control Corporation, Redmond, Wash.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

RECORDERS, X-Y

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J. p 1570
Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. ..... p 1403
Houston Instr., 4950 Terminal Ave., Bellaire, Texas .. p 784, 785, 1572
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Tracor Inc., 6500 Tracor La., Austin, Texas
Yeiser Labs., 881 West 18th St., Costa Mesa, Calif. ..... p 1574
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Bolt Beranek & Newman, Inc., 2126 S. Lyon St., Santa Ana, Calif.
California Computer Products Inc., 305 N. Muller St., Anaheim, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Nuclear Supplies, Box 312, Encino, Calif.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Universal Drafting Machine Corp., 5200 Richmond Rd., Bedford Hgts., Ohio
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Aerograph, 2700 Mitchell Dr., Walnut Creek, Calif.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

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RECORDING TAPE, MAGNETIC—SEE TAPES, RECORDING, MAGNETIC

RECORDS, FREQUENCY TEST

CBS Labs., High Ridge Rd., Stamford, Conn.
Components Corp., 106 Main St., Denville, N. J.
Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

RECORDS, INSTRUCTION—CODE, LANGUAGE, ETC.

Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.
Hayden Book Co., Inc., 116 West 14th St., New York, N. Y.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.

RECTIFIER POWER UNITS (POWER SUPPLY TYPE)

Basler Electric Co., Box 269, Highland, Ill. ..... p 1018
Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. .... p 1894
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif. p 1908
Electronic Measurements, 2 Crescent Pl., Oceanport, N. J. .... p 1929
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J. p 1933
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y. p 1950, 1951
Hewlett-Packard, N. J. Div., 110 Locust Ave., Berkeley Hgts., N. J. p 1963
International Rectifier, 233 Kansas St., El Segundo, Calif. .... p 2531
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. .. p 1972, 1973, 1983
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NJE Corp., 20 Boright Ave., Kenilworth, N. J. ..... p 2054
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y. ..... p 2069
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rectifier Components Corp., 124 Albany Ave., Freeport, N. Y.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2090
Sorensen Operation, Richards Ave., Norwalk, Conn. p 2101–2103, 2105
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Technipower, Inc., Benrus Center, Ridgefield, Conn. ..... p 2112
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Allis, Louis Co., 6702 Industrial Loop, Greendale, Wisc.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electroid Corp., 95 Progress St., Union, N. J.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Engineering Assocs., 434 Patterson Rd., Dayton, Ohio
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Inet-Power, 711 W. Knox St., Gardena, Calif.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Miller, S., Corp., 89 Throop Ave., Brooklyn, N. Y.
Motoresearch Mfg. Co., Inc., 1600 Junction Ave., Racine, Wisc.
Philips Electronics Industries, Ltd., 116 Vanderhoof Ave., Toronto, Ont., Can.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
SRC Div., Moxon Elctrns. Corp., 2309 Pontius Ave., Los Angeles, Cal.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Sifco Metachemical, 935 East 63rd St., Cleveland, Ohio
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Standard Electronics Corp., Box 677, Freehold, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Warren Communications, Newtown Rd., Littleton, Mass.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Westinghouse Electric Corp., Ind. Equip. Div., Box 300, Sykesville, Md.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

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Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RECTIFIERS, COPPER SULFIDE

Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio

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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2511
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
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Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

RECTIFIERS, GERMANIUM STACK

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
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Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

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Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alpha Components Corp., 4087 Glencoe Ave., Venice, Calif.
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electronic Devices Inc., 21 Grey Oaks Ave., Yonkers, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Rectico, Inc., 20 Village Park Rd., Cedar Grove, N. J.
Recticon Corp., 730 E. Elm St., Conshohocken, Pa.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.

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Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hull, R. O. & Co., Inc., 3203 West 71 St., Cleveland, Ohio
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Miller, S., Corp., 89 Throop Ave., Brooklyn, N. Y.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Recticon Corp., 730 E. Elm St., Conshohocken, Pa.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

RECTIFIERS, SILICON

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Delco Radio Div., 700 E.Firmin St., Kokomo, Ind. ..... p 2509
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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
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International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
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Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. p 2620, 2621, 2624
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. p 2634, 2636
Varo, Inc., Semiconductor Div., 1000 N. Shiloh Rd., Garland, Tex. p 2629
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2627
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2639-2641, 2652, 2653
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Alpha Components Corp., 4087 Glencoe Ave., Venice, Calif.
American Semiconductor Corp., 4 N. Hickory Ave., Arlington Heights, Ill.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Atlantic Semiconductor, 905 Mattison Ave., Asbury Park, N. J.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Cordover, C. & Co., 104 Liberty Ave., Mineola, N. Y.
Darrah Elec. Co., Inc., 5914 Merrill Ave., Cleveland, Ohio
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electronic Devices Inc., 21 Grey Oaks Ave., Yonkers, N. Y.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hull, R. O. & Co., Inc., 3203 West 71 St., Cleveland, Ohio
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
KSC Semiconductor Corp., KSC Way, Chelmsford, Mass.
LaRose, W. T. & Assocs., Box F, Lansingburgh Sta., Troy, N. Y.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Power Components Inc., Box 421, Scottdale, Pa.
Price & Rutzebeck, Box 30, Hayward, Calif.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sel-Rex Corporation, 75 River Rd., Nutley, N. J.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Standard Rectifier Div., 2200 S. Fairview, Santa Ana, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

RECTIFIERS, SILICON CONTROLLED—SEE THYRISTORS

RECTIFIERS, SILICON STACK

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International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
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Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
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Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2650, 2651
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Atlantic Semiconductor, 905 Mattison Ave., Asbury Park, N. J.
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electronic Devices Inc., 21 Grey Oaks Ave., Yonkers, N. Y.

REFERENCES, D-C VOLTAGE

General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Hull, R. O. & Co., Inc., 3203 West 71 St., Cleveland, Ohio
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Isofilm International, 20131 Bahama St., Chatsworth, Calif.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Miller, S., Corp., 89 Throop Ave., Brooklyn, N. Y.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Power Components Inc., Box 421, Scottdale, Pa.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Recticon Corp., 730 E. Elm St., Conshohocken, Pa.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Standard Rectifier Div., 2200 S. Fairview, Santa Ana, Calif.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Varo General, Garland Bank Bldg., Garland, Tex.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

RECTIFIERS, THYRATRON—SEE TUBES, THYRATRON

REDUCERS, SPEED—ALSO SEE GEAR MECHANISMS

Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. ... p 1732
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y. p 1745
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Planet Instr., Inc., 1521 Progress Rd., Ft. Wayne, Ind. ..... p 1752
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1766
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Geartronics Corp., 112 Chelmsford Rd., N. Billerica, Mass.
Holtzer-Cabot Corp., 125 Amory St., Boston, Mass.
Insco Corp., Main St., Groton, Mass.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Juall Gear Co. Inc., 1108 Goffle Rd., Hawthorne, N. J.
Kinetic Instr. Co., 1072 Linwood St., Brooklyn, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
McNally Bros. Mach. & Gear Co., 1145 E. 79th St., Minneapolis, Minn.
Meltronics, Inc., 3343 Merrick Rd., Wantagh, N. Y.
Metron Instrument Inc., 1051 S. Platte River Dr., Denver, Colo.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Precision Specialties, Inc., Box 118, Pitman, N. J.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Wolfson, P. J. Co., Inc., 150 Broadway, New York, N. Y.
Zero-Max Co., The, 2845 Harriet Ave., S., Minneapolis, Minn.

REDUCTION SYSTEMS, DATA—SEE DATA REDUCTION SYSTEMS

REELS, CORD & CABLE

Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Aero-Motive Mfg. Co., P.O. Box 2678, Kalamazoo, Mich.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Hykon Mfg. Co., 163 E. State St., Alliance, Ohio
Industrial Electric Reels Inc., 1509 Chicago St., Omaha, Neb.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Olympic Instruments, Inc., Vashon, Wash.

REELS, TAPE—SEE TAPE RECORDING ACCESSORIES

REFERENCE BOOKS—SEE TECHNICAL BOOKS

REFERENCES, D-C VOLTAGE

C. E. A. Div Berkleonics, Inc., 1221 S. Shamrock, Monrovia, Calif. p 1874, 1875, 1877
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1378
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392

REFERENCES, D-C VOLTAGE (Cont'd)

Heath Co., Dept. 180, Benton Harbor, Mich.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. . . . p 528
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio . . . . . p 1406
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
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Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
p 1972, 1973, 1989, 2001
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. . . . . p 1046
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
p 538
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. . . . . . p 1472
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Analogic Co., 296 Newton St., Waltham, Mass.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Emcee Electronics, Inc., 177 Old Churchman Rd., New Castle, Del.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Power Components Inc., Box 421, Scottdale, Pa.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

REFLECTORS, PASSIVE—SEE ANTENNA REFLECTORS

REFRIGERANTS, SPRAY

LMB Heeger, Inc., 729 Ceres Ave., Los Angeles, Calif.

REFRIGERATED COOLING EQUIPMENT—SEE AIR CONDITIONERS

REGULATORS, CURRENT

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1012
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Diversified Elctrns. Co., Inc., 154 San Lazaro Ave., Sunnyvale, Calif. p 1910
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. . . p 1636
Flight Systems, Inc., Box 25, Mechanicsburg, Pa. . . . . . p 2238
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio . . . . . p 1406
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
p 1972, 1973, 1977, 1982, 1984, 1997
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. . . . p 2041
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
p 2047
NWL, Inc., Box 455, Trenton, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. p 1046, 2056
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
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Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif. p 1466
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. . . . . p 1504
Superior Electric Co., 1000 Middle St., Bristol, Conn. . . . . . p 2098
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo. . . . . . p 2122
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. . . . . . p 2109
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
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Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. . . . . p 2147
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Carter, J. C. Co., 671 West 17th St., Costa Mesa, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Grafix, Inc., Box 3296, Albuquerque, N. M.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Loyola Industries, Inc., 155 Arena St., El Segundo, Calif.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
North Electric Co., 553 S. Market St., Galion, Ohio
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Varo General, Garland Bank Bldg., Garland, Tex.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Western Technical Assocs., Box 727, Miraleste, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

REGULATORS, FREQUENCY

American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. . . . . . p 1083
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
CML Inc., 350 Leland Ave., Plainfield, N. J. . . . . . p 1891, 1892
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
p 1935
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. . . . . . p 1942, 1943
Fork Standards Inc., 213 Main St., West Chicago, Ill. . . . . . p 1099
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1105
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. . . . p 2041
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Transformer Electronics Co., Box 910, Boulder, Colo.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
American Electronics, Inc.,'1600 E. Valencia Dr., Fullerton, Calif.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Collins Radio Co., Dallas, Texas
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Nova Elec. Mfg. Co., 102 Rte. 46, Saddle Brook, N. J.
Task Corporation, Box 3999, Anaheim, Calif.
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

REGULATORS & REFERENCES, SILICON—ALSO SEE DIODES, ZENER

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
International Rectifier, 233 Kansas St., El Segundo, Calif. p 2524-2526
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. . . p 1983, 1992, 1993
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. . . . p 2620
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. . . . . . p 2109
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Componenents, Inc., Sencor Div., 3540 W. Osborn Rd., Phoenix, Ariz.
Computer Diode Corp., Pollitt Dr., Fair Lawn, N. J.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Eastern Dynamics, Inc., Box 276, Bloomfield, Conn.
Eastron Corp., 25 Locust St., Haverhill, Mass.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Microsemiconductor Corp., 11250 Playa Ct., Culver City, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Power Components Inc., Box 421, Scottdale, Pa.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tech-Neon, 16th Ave. & F St., S. Belmar, N. J.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.

REGULATORS & STABILIZERS, VOLTAGE—ALSO SEE TRANSFORMERS, VOLTAGE REGULATING

Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avtel Corp., 1130 E. Cypress St., Covina, Calif. . . . . . p 1865
Basler Electric Co., Box 269, Highland, Ill. . . . . . p 1018
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
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Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
CML Inc., 350 Leland Ave., Plainfield, N. J. . . . . . p 1890
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal.
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California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. . . . . . p 1657
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 776, 2665
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
p 1907
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
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Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. . . . . . p 1942, 1943
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. . . p 1636
Flight Systems, Inc., Box 25, Mechanicsburg, Pa. . . . . . p 2238
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1387
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif. . . . . . p 1390
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
p 1957–1959
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
p 1034, 1036
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. . . p 1960
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
International Rectifier, 233 Kansas St., El Segundo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. . . . . p 1414
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
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Kilovolt Corp., 238 High St., Hackensack, N. J.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y. . . . . . p 2042
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. . . . . . p 2295
Mid-Eastern Industries, Inc., 660 Jerusalem Rd., Scotch Plains, N. J.
p 2047, 2049
NWL, Inc., Box 455, Trenton, N. J. . . . . . p 2868
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass.
p 538
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal. . . . . . p 2086
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. . . . . . p 2089
Sorensen Operation, Richards Ave., Norwalk, Conn. . . . . . p 2105
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. . . . . . p 2921
Superior Electric Co., 1000 Middle St., Bristol, Conn. . . . . . p 2098
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y.
Technipower, Inc., Benrus Center, Ridgefield, Conn. . . . . . p 2112
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. . . . . . p 1053
Todd Prods. Corp., 28 Laurel St., Hicksville, N. Y.
Transformer Electronics Co., Box 910, Boulder, Colo. . . . p 2122, 2123
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. . . . p 2620
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y. . . . . . p 2109
Trygon Electronics Inc., 111 Pleasant Ave., Roosevelt, N. Y.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. p 2137
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
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Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
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Wanlass Elec. Co., Instrs. Div., 1540 E. Edinger Ave., Santa Ana, Cal.
p 2149
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. . . . . p 2147
Ward Leonard, 31 South St., Mount Vernon, N. Y.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Arizona Elctrns., Inc., Drawer AE, Benson, Ariz.
Atlas Controls & Twinco, 10 Cheney St., Dorchester, Mass.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Data Royal Corp., 8014 Armour St., San Diego, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Firing Circuits, Inc., Muller Ave., Norwalk, Conn.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Leece-Neville Co., 1374 East 51st St., Cleveland, Ohio
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Loyola Industries, Inc., 155 Arena St., El Segundo, Calif.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.

Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pace-Tronics, Inc., 46 Main St., Newark, N. J.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Radiation Devices Co., Box 8450, Baltimore, Md.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
T & T Controls Co., Inc., Box 171, Media, Pa.
Task Corporation, Box 3999, Anaheim, Calif.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varadyne, Inc., 1805 Colorado Ave., Santa Monica, Calif.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Western Semiconductors, Inc., 2200 S. Fairview St., Santa Ana, Calif.
Western Technical Assocs., Box 727, Miraleste, Calif.

RELAY COVERS, CASES, ENCLOSURES—SEE CANS, RELAY

RELAY TOOLS—SEE TOOLS, RELAY SERVICING

RELAYS, ANTENNA—SEE RELAYS, R-F (INCLUDING ANTENNA & COAXIAL)

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Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
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Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. p 2205
Babcock Relays, 3501 Harbor Blvd., Costa Mesa, Calif. p 2200-2203
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. p 2209-2214
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I. p 2218
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Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. p 2223
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Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore. p 2225
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Guardian California, 5755 Camille Ave., Culver City, Calif. p 1039
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Hathaway, 5250 E. Evans Ave., Denver, Colo. p 2257
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. p 2258-2263, 2265-2267
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y. p 2270
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. p 2273
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. p 783
Kelvin, 5919 Noble Ave., Van Nuys, Calif. p 2399
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y. p 2281
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Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. p 2292
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind. p 2297
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. p 2300
Pareico Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif. p 2302-2304, 2306, 2307
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. p 2309
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2311-2318
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md. p 2320
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2228, 2230, 2334
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2228, 2230, 2234
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. p 2321
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324, 2325
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. p 2327
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. p 2323
Teledyne Relays, 3155 W. El Segundo Blvd., Hawthorne, Calif. p 2328, 2329
Universal Relay Corp., 42 White St., New York, N. Y. p 2332
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2334-2344, 2346, 2347
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J. p 2333
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Branson Corporation, P.O. Box 845, Denville, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Compac Engrg., 845 Commercial St., San Jose, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electro-Tec Corp., Box 667, Ormond Beach, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Reed Co., Box 858, Clark, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Self-Organizing Systems, Inc., 3121 Benton, Garland, Tex.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Thermosen Inc., 375 Fairfield Ave., Stamford, Conn.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.

RELAYS, COAXIAL—SEE RELAYS, R-F (INCLUDING ANTENNA & COAXIAL)

RELAYS, CONTACT—SEE RELAYS, POWER

RELAYS, CRYSTAL CAN—SEE RELAYS, MINIATURE & SUBMINIATURE

RELAYS, CURRENT SENSING

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. p 1023
Flight Systems, Inc., Box 25, Mechanicsburg, Pa. p 2238
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2241
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. p 2260, 2263
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. p 2287
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2315
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. p 1053
Universal Relay Corp., 42 White St., New York, N. Y.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.

RELAYS, DIFFERENTIAL

Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Fifth Dimension Inc., Box 483, Princeton, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. p 2247
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. p 783
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1999
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Pareico Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Universal Relay Corp., 42 White St., New York, N. Y.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.

RELAYS, GENERAL PURPOSE

La Marche Mfg. Co., 106 Bradrock Dr., Des Plains, Ill.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.

RELAYS, ELECTROSTRICTIVE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.

RELAYS, FREQUENCY SELECTIVE

Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio p 2286
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. p 2222
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2241
Guardian California, 5755 Camille Ave., Culver City, Calif. p 1039
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. p 2287
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. p 1046
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. p 1705
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. p 2323, 2792
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. p 1053
Universal Relay Corp., 42 White St., New York, N. Y.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Alpha Electronic Services, 344 N. State College Blvd., Orange, Calif.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Inet-Power, 711 W. Knox St., Gardena, Calif.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

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Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2175, 2191
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. p 2193
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Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
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Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. p 2259, 2261, 2262, 2265, 2267
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Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y. p 2279, 2281
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Liberty Controls, RFD 5, Joliet, Ill. p 2288-2290
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. p 2292, 2293
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. p 2300
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Pareico Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif. p 2302-2304, 2306, 2307
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.

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Price Electric Corp., E. Church & 2nd Sts., Frederick, Md. ..... p 2320
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Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. ... p 2326
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn.
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass.
Teledyne Relays, 3155 W. El Segundo Blvd., Hawthorne, Calif. .. p 2329
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2334-2341, 2345-2347
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J. p 2333
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Branson Corporation, P.O. Box 845, Denville, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davis Electric Co., P.O. Box 38, Cape Girardeau, Mo.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electro-Tec Corp., Box 667, Ormond Beach, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Relay Corp., 20 Mercer St., Dover, N. J.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Midtex/Aemco, 10 State St., Mankato, Minn.
Pacific Relays, Inc., 13915 Saticoy, Van Nuys, Calif.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Sealectric Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Warco Mfg. Co., 7607 Page Ave., St. Louis, Mo.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.
Wells, G. Co., 90 Nepperhan Ave., Yonkers, N Y.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, HIGH SPEED

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2175-2182, 2187-2192
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2205
Babcock Relays, 3501 Harbor Blvd., Costa Mesa, Calif. p 2201-2203
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. .. p 2210, 2212, 2213
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Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. ..... p 2222
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Flight Systems, Inc., Box 25, Mechanicsburg, Pa. ..... p 2238
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2240, 2241
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Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2250, 2253-2255
Hathaway, 5250 E. Evans Ave., Denver, Colo. ..... p 2257
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ..... p 2267
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif. p 2274, 2275
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ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. ..... p 783
Kelvin, 5919 Noble Ave., Van Nuys, Calif. ..... p 2399
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2282
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Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. p 2309
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2316, 2318
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RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2234, 2236
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. ..... p 2327
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif. p 2330, 2331
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Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2342, 2346, 2347
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J. p 2333
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Compac Engrg., 845 Commercial St., San Jose, Calif.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Reed Co., Box 858, Clark, N. J.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Thermosen Inc., 375 Fairfield Ave., Stamford, Conn.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.
Welex Electronics, Box 986, Silver Spring, Md.

RELAYS, HIGH VOLTAGE

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. .... p 2195
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y. .. p 2217
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. ..... p 2222
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
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Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2249, 2250
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ..... p 2267
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif. p 2274, 2275
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2292
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Parelco Inc., 26181 Avenida Aeropuerto, San Juan Capistrano, Calif.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind.
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2325
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif. p 2330, 2331
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J.
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Compac Engrg., 845 Commercial St., San Jose, Calif.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Midtex/Aemco, 10 State St., Mankato, Minn.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.

RELAYS, IMPULSE

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. p 2309
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2314
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2325
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.

RELAYS, INDICATING LIGHT

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2207
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
Fifth Dimension Inc., Box 483, Princeton, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2241
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2312
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.

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Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2170-2174
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American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. p 2194, 2195
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. p 2206, 2207
Couch, S. Div., 3 Arlington St., North Quincy, Mass. ..... p 2219
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
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Guardian California, 5755 Camille Ave., Culver City, Calif.
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Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y. .. p 2270
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. p 669, 2273
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1972, 1973, 2006
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2283, 2284
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Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2293
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Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
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Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2342, 2345
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davis Electric Co., P.O. Box 38, Cape Girardeau, Mo.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Midtex/Aemco, 10 State St., Mankato, Minn.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Sealectric Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Wells, G. Co., 90 Nepperhan Ave., Yonkers, N Y.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

RELAYS, KEYING & BREAK-IN

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Flight Systems, Inc., Box 25, Mechanicsburg, Pa.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
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Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. ..... p 783
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2284
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Universal Relay Corp., 42 White St., New York, N. Y.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.

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A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. ..... p 2193
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Babcock Relays, 3501 Harbor Blvd., Costa Mesa, Calif. p 2200, 2202
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
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Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. .. p 2220, 2221
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 2204
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore. p 2225
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Fifth Dimension Inc., Box 483, Princeton, N. J.
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Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2282, 2283
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Liberty Controls, RFD 5, Joliet, Ill.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. .. p 2292, 2293
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Parelco Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif.
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Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2314-2316
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RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2234
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324, 2325
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Teledyne Relays, 3155 W. El Segundo Blvd., Hawthorne, Calif. p 2328, 2329
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Branson Corporation, P.O. Box 845, Denville, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Reed Co., Box 858, Clark, N. J.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Midtex/Aemco, 10 State St., Mankato, Minn.
North Electric Co., 553 S. Market St., Galion, Ohio
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Sealectric Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Touch-Plate Electro-Sys., Inc., 16530 Garfield Ave., Paramount, Calif.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, LATCHING, MECHANICAL

American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. ... p 2194
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. .... p 2199
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2206
Fifth Dimension Inc., Box 483, Princeton, N. J.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2247
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 2273
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2284
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2288, 2290
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Davis Electric Co., P.O. Box 38, Cape Girardeau, Mo.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Wells, G. Co., 90 Nepperhan Ave., Yonkers, N Y.

RELAYS, MERCURY DISPLACEMENT

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2163-2174
Fifth Dimension Inc., Box 483, Princeton, N. J. ..... p 2237
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Universal Relay Corp., 42 White St., New York, N. Y.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Haledy Elctrns. Co., 99 Wall St., New York, N. Y.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.

RELAYS, MINIATURE AND SUBMINIATURE

Mercury Contacts, Inc., 1950 Neva Dr., Dayton, Ohio
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.

RELAYS, MERCURY-WETTED CONTACTS

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2175-2191
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. ..... p 2193
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Babcock Relays, 3501 Harbor Blvd., Costa Mesa, Calif. ..... p 2203
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. ..... p 2208-2210
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. .. p 2220, 2221
Fifth Dimension Inc., Box 483, Princeton, N. J. ..... p 2237
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ..... p 2267
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2292
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Parelco Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif. p 2303, 2304
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. p 2309
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2318
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J. p 2333
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Compac Engrg., 845 Commercial St., San Jose, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Hays Corp., Michigan City, Ind.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Midtex/Aemco, 10 State St., Mankato, Minn.
Self-Organizing Systems, Inc., 3121 Benton, Garland, Tex.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

RELAYS, METER

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio p 1322
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H. ... p 1341
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1388
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Universal Relay Corp., 42 White St., New York, N. Y.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
General Reed Co., Box 858, Clark, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Larson Instrument Co., Inc., Greenbush Rd., Orangeburg, N. Y.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, MINIATURE & SUBMINIATURE

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. ..... p 2193
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. p 2194, 2195
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2205
Babcock Relays, 3501 Harbor Blvd., Costa Mesa, Calif. p 2200-2203
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. ..... p 2211, 2213
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y. .. p 2217
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Couch, S. Div., 3 Arlington St., North Quincy, Mass. ..... p 2219
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. .. p 2220, 2221
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore. p 2225
Fifth Dimension Inc., Box 483, Princeton, N. J. ..... p 2237
Flight Systems, Inc., Box 25, Mechanicsburg, Pa. ..... p 2238
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2240, 2241

RELAYS, MINIATURE (Cont'd)

Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. ... p 2242
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2244, 2249, 2253-2256
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ... p 2258-2267
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y. p 2270, 2271
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 2273
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. ..... p 783
Kelvin, 5919 Noble Ave., Van Nuys, Calif. ..... p 2399
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y. ..... p 2281
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2282
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2290
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. .. p 2292, 2293
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio p 2299
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Parelco Inc., 26181 Avenida Aeropuerto, San Juan Capistrano, Calif. p 2302
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. p 2309
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2311, 2315-2317
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md. ..... p 2320
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2234, 2236
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2234, 2236
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. ..... p 2327
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Teledyne Relays, 3155 W. El Segundo Blvd., Hawthorne, Calif.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif. .. p 2331
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2334-2347
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J. p 2333
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Branson Corporation, P.O. Box 845, Denville, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Compac Engrg., 845 Commercial St., San Jose, Calif.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Davis Electric Co., P.O. Box 38, Cape Girardeau, Mo.
Dialtron Corp., 203 Harrison Pl., Brooklyn, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electro-Tec Corp., Box 667, Ormond Beach, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Reed Co., Box 858, Clark, N. J.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Midtex/Aemco, 10 State St., Mankato, Minn.
Miniature Elctrn. Components Corp., 600 South St., Holbrook, Mass.
North Electric Co., 553 S. Market St., Galion, Ohio
Pacific Relays, Inc., 13915 Saticoy, Van Nuys, Calif.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Sealectric Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Self-Organizing Systems, Inc., 3121 Benton, Garland, Tex.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Thermosen Inc., 375 Fairfield Ave., Stamford, Conn.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.
Wells, G. Co., 90 Nepperhan Ave., Yonkers, N Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, MOTOR-DRIVEN

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. ..... p 2193
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y.
Universal Relay Corp., 42 White St., New York, N. Y.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Midtex/Aemco, 10 State St., Mankato, Minn.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

RELAYS, MULTI-POLE (8 OR MORE POLES)

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Dale Electronics Inc., Box 609, Columbus, Nebr.
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. ... p 2242
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2244
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y. ..... p 2276
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Parelco Inc., 26181 Avenida Aeropuerto, San Juan Capistrano, Calif. p 2306
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2325
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Universal Relay Corp., 42 White St., New York, N. Y.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Thermosen Inc., 375 Fairfield Ave., Stamford, Conn.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

RELAYS, OVERLOAD

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2163, 2164, 2169-2174
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2207
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Flight Systems, Inc., Box 25, Mechanicsburg, Pa.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2241
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Heinemann Electric Co., 2636 Brunswick Pike, Trenton, N. J. ... p 2731
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2312
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2325
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Universal Relay Corp., 42 White St., New York, N. Y.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, OVER-CURRENT & UNDER-CURRENT

Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.

RELAYS, OVER-FREQUENCY & UNDER-FREQUENCY

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J.
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Liberty Controls, RFD 5, Joliet, Ill.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. p 2323, 2792
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Lark Electronics, Inc., 45 Walker St., New York, N. Y.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Motor Generator Div., EE-61, Troy, Ohio
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, OVER-VOLTAGE & UNDER-VOLTAGE

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Deltron Inc., Wissahickon Ave., North Wales, Pa.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Fifth Dimension Inc., Box 483, Princeton, N. J.
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ... p 2268, 2269
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
California Electronic Mfg. Co., Box 555, Alamo, Calif.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Reed Co., Box 858, Clark, N. J.
General Relay Corp., 20 Mercer St., Dover, N. J.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio

Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Lark Electronics, Inc., 45 Walker St., New York, N. Y.
Larson Aero Development, Box 135, Concord, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Motor Generator Div., EE-61, Troy, Ohio
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Roveti Instruments, 238 West St., Annapolis, Md.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

RELAYS, PHASE-SENSING

Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. ... p 2242
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ... p 2268, 2269
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2920
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
Lark Electronics, Inc., 45 Walker St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.

RELAYS, PHOTOELECTRIC

Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Hughey & Phillips, Inc., 3050 N. California St., Burbank, Calif.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Lark Electronics, Inc., 45 Walker St., New York, N. Y.
Larson Instrument Co., Inc., Greenbush Rd., Orangeburg, N. Y.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Tri-Tronics Co., 619 Enterprise Dr., Oak Brook, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, PLATE CIRCUIT

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Couch, S. Div., 3 Arlington St., North Quincy, Mass. ..... p 2219
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 2204
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2292
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
Pareico Inc., 26181 Avenida Aeropuerto, San Juan Capistrano, Calif.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2314, 2315
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md. ..... p 2320
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Universal Relay Corp., 42 White St., New York, N. Y.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Davis Electric Co., P.O. Box 38, Cape Girardeau, Mo.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electro-Tec Corp., Box 667, Ormond Beach, Fla.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Relay Corp., 20 Mercer St., Dover, N. J.
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Midtex/Aemco, 10 State St., Mankato, Minn.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.

RELAYS, PLUG-IN

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2180, 2183-2186, 2189-2191
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. ..... p 2193
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 1781
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. p 2194, 2195
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. p 2206, 2207
Babcock Relays, 3501 Harbor Blvd., Costa Mesa, Calif. p 2200-2203
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. .. p 2208, 2214, 2215
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y. .. p 2217
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Couch, S. Div., 3 Arlington St., North Quincy, Mass. ..... p 2219
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. ..... p 2222
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 2204
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. .....
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Fifth Dimension Inc., Box 483, Princeton, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2240, 2241
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill. .. p 2243
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2446, 2247
Heinemann Electric Co., 2636 Brunswick Pike, Trenton, N. J. .... p 2731
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. .... p 2266, 2267
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y. p 2270, 2271
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 2273
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. ..... p 783
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y. .. p 2279, 2280
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2288-2290
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. .. p 2292, 2293
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y. ..... p 2294
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Pareico Inc., 26181 Avenida Aeropuerto, San Juan Capistrano, Calif. p 2306, 2307
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. .. p 2309
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2312, 2314-2316, 2318, 2319
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md. ..... p 2320
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2228, 2234, 2235
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2228, 2234, 2235
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. ..... p 2327

RELAYS, POLARIZED (Cont'd)

Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. ... p 2326
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2345
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Branson Corporation, P.O. Box 845, Denville, N. J.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Davis Electric Co., P.O. Box 38, Cape Girardeau, Mo.
Dialtron Corp., 203 Harrison Pl., Brooklyn, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electro-Tec Corp., Box 667, Ormond Beach, Fla.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
Gems Co., Inc., Spring La., Farmington, Conn.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Reed Co., Box 858, Clark, N. J.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Midtex/Aemco, 10 State St., Mankato, Minn.
Pacific Relays, Inc., 13915 Saticoy, Van Nuys, Calif.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Sealectric Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, PLUNGER

Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2229, 2231-2233
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2229, 2231-2233

RELAYS, POLARIZED

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Babcock Relays, 3501 Harbor Blvd., Costa Mesa, Calif.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. ..... p 2215
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Flight Systems, Inc., Box 25, Mechanicsburg, Pa.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2285
Liberty Controls, RFD 5, Joliet, Ill.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2315, 2316, 2318
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md.
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Branson Corporation, P.O. Box 845, Denville, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electronic Applications Co., 2213 Edwards Ave., S. El Monte, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.

RELAYS, POLARIZED (Cont'd)

General Automatic Corp., 235 W. First St., Bayonne, N. J.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Midtex/Aemco, 10 State St., Mankato, Minn.
Pacific Relays, Inc., 13915 Saticoy, Van Nuys, Calif.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.

RELAYS, POWER

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2170-2174
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. ..... p 2193
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. .... p 2195
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. p 2206, 2207
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 2204
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2241
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. ... p 2242
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill. .. p 2243
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., CrystalLake, Ill. ..... p 2244, 2248, 2249
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. .... p 2262, 2269
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y. .. p 2270
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. p 669, 2273
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2283, 2284
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2288, 2289
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. .. p 2292, 2293
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Parelco Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2313
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md. ..... p 2320
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2230-2233
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2230-2233
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2325
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn. .... p 2326
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif. .. p 2330
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2340, 2345, 2346
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J. p 2333
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davis Electric Co., P.O. Box 38, Cape Girardeau, Mo.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electro-Tec Corp., Box 667, Ormond Beach, Fla.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Gems Co., Inc., Spring La., Farmington, Conn.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Midtex/Aemco, 10 State St., Mankato, Minn.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

RELAYS, PROXIMITY

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2760
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2760
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hyde Park Electronics, Inc., Box 44, Dayton View Sta., Dayton, Ohio
Larson Aero Development, Box 135, Concord, Calif.
Luminator, Inc., Box 278, Plano, Tex.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.

RELAYS, PULSE & TELEGRAPH

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2290
Parelco Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif. .. p 2330
Universal Relay Corp., 42 White St., New York, N. Y.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Western Telematic, Inc., 5507 Peck Rd., Arcadia, Calif.

RELAYS, R-F (INCLUDING ANTENNA & COAXIAL)

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. ..... p 2193
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. ..... p 2718
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2250
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. .... p 2264, 2267
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2293
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Parelco Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif. p 2306
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Teledyne Relays, 3155 W. El Segundo Blvd., Hawthorne, Calif. p 2328, 2329
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Universal Relay Corp., 42 White St., New York, N. Y.
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
General Reed Co., Box 858, Clark, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Midtex/Aemco, 10 State St., Mankato, Minn.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.

RELAYS, REED

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. .... p 2192
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2205
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. ..... p 2212, 2213
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y. .. p 2217
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I. ..... p 2218
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. ... p 2220-2222
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2240, 2241
Gordos Corp., 250 Glenwood Ave., Bloomfield, N. J.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. ... p 2242
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Hathaway, 5250 E. Evans Ave., Denver, Colo. ..... p 2257
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. .... p 2266, 2267
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y. ..... p 2276
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Kelvin, 5919 Noble Ave., Van Nuys, Calif. ..... p 2399
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Liberty Controls, RFD 5, Joliet, Ill.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2292
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind. p 2296, 2297
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. p 2309
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2317
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2236
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2236
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2325
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J. p 2333
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Compac Engrg., 845 Commercial St., San Jose, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electronic Applications Co., 2213 Edwards Ave., S. El Monte, Calif.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Reed Co., Box 858, Clark, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
MKC Electronics Corp., 454 E. Donovan Rd., Kansas City, Kans.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Midtex/Aemco, 10 State St., Mankato, Minn.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Self-Organizing Systems, Inc., 3121 Benton, Garland, Tex.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Thermosen Inc., 375 Fairfield Ave., Stamford, Conn.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Western Transformer Co., P.O. Box 945, Tijeras, N. Mex.

RELAYS, RESISTANCE-SENSITIVE

Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. ... p 2242
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill.
Parelco Inc., 26181 Avenida Aeropuorto, San Juan Capistrano, Calif.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Compac Engrg., 845 Commercial St., San Jose, Calif.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Haledy Elctrns. Co., 99 Wall St., New York, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, REVERSE-CURRENT

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2241
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

RELAYS, ROTARY

Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Couch, S. Div., 3 Arlington St., North Quincy, Mass. ..... p 2219
Dale Electronics Inc., Box 609, Columbus, Nebr.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind.
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324
Universal Relay Corp., 42 White St., New York, N. Y.
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2334-2342, 2345-2347
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Branson Corporation, P.O. Box 845, Denville, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
North Electric Co., 553 S. Market St., Galion, Ohio
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.

RELAYS, SENSITIVE

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2176-2188, 2190-2192
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2207
Babcock Relays, 3501 Harbor Blvd., Costa Mesa, Calif. p 2200-2203
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. .. p 2208, 2210, 2211
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y. .. p 2217
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Couch, S. Div., 3 Arlington St., North Quincy, Mass. ..... p 2219
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Dale Electronics Inc., Box 609, Columbus, Nebr.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. ..... p 2222
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore. p 2225
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Flight Systems, Inc., Box 25, Mechanicsburg, Pa. ..... p 2238
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2240
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1034
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2251, 2253-2256
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. p 2258-2260, 2263-2265
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y. p 2270, 2271
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 2273
Kelvin, 5919 Noble Ave., Van Nuys, Calif. ..... p 2399
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y. .. p 2280, 2281
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill.
Liberty Controls, RFD 5, Joliet, Ill.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill.
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind. .. p 2297
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
Parelco Inc., 26181 Avenida Aeropuerto, San Juan Capistrano, Calif. p 2306
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2314-2316, 2318
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md. ..... p 2320
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2234, 2235
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2234, 2235
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. ..... p 2327
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. ..... p 2323
Teledyne Relays, 3155 W. El Segundo Blvd., Hawthorne, Calif. p 2328, 2329
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Air Brake Co., Aerospace Dept., Swissvale P.O., Pittsburgh, Pa. p 2344, 2345, 2347
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J. .. p 2333
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Barber-Colman Co., Dept. S, 12116 Rock St., Rockford, Ill.
Bristol Co., Box 1790, Waterbury, Conn.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Dialtron Corp., 203 Harrison Pl., Brooklyn, N. Y.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Reed Co., Box 858, Clark, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
La Marche Mfg. Co., 106 Bradrock Dr., Des Plains, Ill.
Larson Aero Development, Box 135, Concord, Calif.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Midtex/Aemco, 10 State St., Mankato, Minn.
North Electric Co., 553 S. Market St., Galion, Ohio
Pacific Relays, Inc., 13915 Saticoy, Van Nuys, Calif.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Princo Instrs. Inc., Indl. Pk., Southampton, Pa.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

RELAYS, SEQUENCE

Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2314
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Universal Relay Corp., 42 White St., New York, N. Y.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Midtex/Aemco, 10 State St., Mankato, Minn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

RELAYS, SOLENOID—SEE RELAYS, PLUNGER

RELAYS, SOLID-STATE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Agastat Div., 1027 Newark Ave., Elizabeth, N. J.
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2206
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Deltron Inc., Wissahickon Ave., North Wales, Pa.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778

RELAYS, SOLID-STATE

Eagle Signal Div., E. W. Bliss Co., 738 Federal St., Davenport, Iowa
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Flight Systems, Inc., Box 25, Mechanicsburg, Pa. ..... p 2238
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J. p 1034
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. ... p 2242
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Heinemann Electric Co., 2636 Brunswick Pike, Trenton, N. J. ... p 2731
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ... p 2268, 2269
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2760
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. ..... p 783
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal. ..... p 2285
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2293
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .. p 2760
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y. .. p 2298
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1046
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 2310
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2316, 2319
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2233
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2233
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Branson Corporation, P.O. Box 845, Denville, N. J.
Collins Radio Co., Dallas, Texas
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
Electronic Control Systems, Inc., P.O. Box 1232, Fairmont, W. Va.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Frost Electronics, One Goddard Dr., Rockaway, N. J.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Lark Electronics, Inc., 45 Walker St., New York, N. Y.
Liebel-Flarsheim Co., 111 E. Amity Rd., Cincinnati, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Midtex/Aemco, 10 State St., Mankato, Minn.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Princo Instrs. Inc., Indl. Pk., Southampton, Pa.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.

RELAYS, SOLID-STATE (Cont'd)

Welex Electronics, Box 986, Silver Spring, Md.
Western Telematic, Inc., 5507 Peck Rd., Arcadia, Calif.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, STEPPING, RATCHET

Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 1728
Dale Electronics Inc., Box 609, Columbus, Nebr.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 2273
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2314
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md. ..... p 2320
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Imtra Corp., 151 Mystic Ave., Medford, Mass.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
North Electric Co., 553 S. Market St., Galion, Ohio
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

RELAYS, TELEPHONE

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2207
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. ..... p 2214, 2215
Dale Electronics Inc., Box 609, Columbus, Nebr.
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Flight Systems, Inc., Box 25, Mechanicsburg, Pa.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2244, 2245, 2249
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 2273
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y. ..... p 2281
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2288-2290
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2293
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio p 2299
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Parelco Inc., 26181 Avenida Aeropuerto, San Juan Capistrano, Calif.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2315
Price Electric Corp., E. Church & 2nd Sts., Frederick, Md.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Branson Corporation, P.O. Box 845, Denville, N. J.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Davis Electric Co., P.O. Box 38, Cape Girardeau, Mo.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
North Electric Co., 553 S. Market St., Galion, Ohio
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Relay Sales, Inc., 604 Danley Dr., Ft. Myers, Fla.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Relays, Inc., 162 West 83rd St., New York, N. Y.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Sealectro Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Welex Electronics, Box 986, Silver Spring, Md.

RELAYS, TEMPERATURE COMPENSATED

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore. p 2225
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ..... p 2265
La Marche Mfg. Co., 102 Bradrock Dr., Des Plaines, Ill.
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2321
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Branson Corporation, P.O. Box 845, Denville, N. J.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hi-Spec Electronics Corp., 1000 Lawrence Dr., Newbury Park, Calif.
Hi-Spec Electronics Corp., E. Church & 2nd Sts., Frederick, Md.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
La Marche Mfg. Co., 106 Bradrock Dr., Des Plains, Ill.
Larson Instrument Co., Inc., Greenbush Rd., Orangeburg, N. Y.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Livingston Electronic, Box 7, 56 Rte. 10, Hanover, N. J.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Welch Relay Div., 1871 S. Orange Dr., Los Angeles, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RELAYS, THERMAL

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I.
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2251
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ..... p 2262
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill.
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2325
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Branson Corporation, P.O. Box 845, Denville, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Dales, F. Co., 180-85 E. Mill St., Akron, Ohio
Dialtron Corp., 203 Harrison Pl., Brooklyn, N. Y.
E-T-A Products Co. of America, 6284 N. Cicero Ave., Chicago, Ill.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Livingston Electronic, Box 7, 56 Rte. 10, Hanover, N. J.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
Norwalk Thermostat Co., 100 N. West St., Norwalk, Ohio
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Princo Instrs. Inc., Indl. Pk., Southampton, Pa.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Thermal Controls Inc., 75 Rutgers St., Belleville, N. J.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.

RELAYS, TIME-DELAY

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind. p 2163-2167
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn. ..... p 2193
Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. p 2206, 2207
Bissett-Berman Corp., 3860 Centinela Ave., Los Angeles, Cal. .... p 1019
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y. ..... p 2658
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Connor-Winfield Corp., Winfield, Ill.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Flight Systems, Inc., Box 25, Mechanicsburg, Pa.
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2241
General Time Corp., Rte. 8, Torrington, Conn.
Guardian California, 5755 Camille Ave., Culver City, Calif. .... p 1039
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2251
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn.
Heinemann Electric Co., 2636 Brunswick Pike, Trenton, N. J. .... p 2731
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ..... p 2268
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2288
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill. ..... p 2293
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y. ..... p 2294
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 928
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y. ... p 2298
Neutronic Corp., Box 625, St. Louis, Mo.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2300
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif. p 2309
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 2310
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2319
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2233
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2233
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. .... p 2323
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Wheelock Signals Inc., 273 Branchport Ave., Long Branch, N. J.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Amperite Co., Inc., 600 Palisade Ave., Union City, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Branson Corporation, P.O. Box 845, Denville, N. J.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Dialtron Corp., 203 Harrison Pl., Brooklyn, N. Y.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
E-T-A Products Co. of America, 6284 N. Cicero Ave., Chicago, Ill.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hartman Electrical Mfg. Co., 173 N. Diamond St., Mansfield, Ohio
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Livingston Electronic, Box 7, 56 Rte. 10, Hanover, N. J.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Midtex/Aemco, 10 State St., Mankato, Minn.
Norwalk Thermostat Co., 100 N. West St., Norwalk, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Rhodes, M. H. Inc., 30 Bartholomew Ave., Hartford, Conn.
Savant Engrg., Inc., 825 N. Second St., St. Charles, Mo.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Thermal Controls Inc., 75 Rutgers St., Belleville, N. J.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, N. Y.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

RELAYS, TRANSMITTING—SEE RELAYS, KEYING & BREAK-IN

RELAYS, VACUUM CONTACT

Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill.

High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif. p 2274, 2275
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. p 669, 2273
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill.
Phipps Precision Prods., 7641 Densmore Ave., Van Nuys, Calif.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif. p 2330, 2331
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Livingston Electronic, Box 7, 56 Rte. 10, Hanover, N. J.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Penn Keystone Corp., Division St., Ansonia, Conn.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.

RELAYS, VIBRATING REED

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Universal Relay Corp., 42 White St., New York, N. Y.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.

RELAYS, VIBRATION-SENSITIVE

Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y.
Metrix Instrument Co., P.O. Box 36501, Houston, Tex.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Standard Relay Corp., 40 Dale St., Pinelawn, N. Y.

RELAYS, VOLTAGE SENSITIVE

American Zettler, Inc., 687 Randolph Ave., Costa Mesa, Calif.
Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill.
Control Data Corp., Magnetic Products Oper., 775 Colorado Ave. S., Minneapolis, Minn. ..... p 1023
Flight Systems, Inc., Box 25, Mechanicsburg, Pa. ..... p 2238
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. p 2268, 2269
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Logitek, Div., 42 Central Ave., Farmingdale, N. Y. ..... p 2287
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2315, 2316
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Universal Relay Corp., 42 White St., New York, N. Y.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Barron Controls & Relay Corp., 3 N. Barron Blvd., Grayslake, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Automatic Corp., 235 W. First St., Bayonne, N. J.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Gilway Co., Electronics Div., Box 584, Newburyport, Mass.
Hillburn Relay Corp., 125 Schmitt Blvd., Farmingdale, N. Y.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.

RELAYS, WIRE CONTACT

IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y. ..... p 2276, 2277
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2234
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2234

REPEATERS, PASSIVE, MICROWAVE

Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
International Microwave Corp., 33 River Rd., Cos Cob, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.

REPEATERS, SERVO

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2669
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Theta Instrument Corp., Fairfield, N. J.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Orbit Instrument Corp., 131 Eileen Way, Syosset, N. Y.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.

REPEATERS, TELETYPE

Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Diamond Repeater Co., 55 Main St., Madison, N. J.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Teledata, Inc., 98-05 217th St., Queens Village, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Western Telematic, Inc., 5507 Peck Rd., Arcadia, Calif.

REPEATING EQUIPMENT, BROADCAST

CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

RESINS, ENCAPSULATING—SEE COMPOUNDS, ENCAPSULATING

RESINS, SYNTHETIC—SEE PLASTIC RAW MATERIALS

RESISTANCE ADJUSTING EQUIPMENT FOR HYBRID MICROCIRCUITS—ALSO SEE MACHINES, RESISTANCE ADJUSTING

Hadron, 300 Shames Dr., Westbury, N. Y.
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
Alessi Industries, 418 Main St., El Segundo, Calif.
Arvin Systems Inc., 1482 Stanley Ave., Dayton, Ohio

RESISTANCE COMPARATORS—SEE BRIDGES, RESISTANCE

RESISTANCE THERMOMETERS—SEE THERMOMETERS, RESISTANCE

RESISTOR NETWORKS—SEE NETWORKS, RESISTANCE

RESISTORS, ADJUSTABLE—ALSO SEE POTENTIOMETERS

Airco Speer Elctrn. Components, Resistor Plant, Bradford, Pa.
Amphenol Controls Div., 120 S. Main St., Janesville, Wisc.
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif. .. p 2352, 2353
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 2355
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .. p 2355
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 2355
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 2355
Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Dale Electronics Inc., Box 609, Columbus, Nebr. ..... p 2371
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 2473
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. .. p 2389, 2390
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind. .. p 2406
Lectrohm, Inc., Sub. Cook Elec., 5562 Northwest Hwy., Chicago, Ill. p 2400, 2402, 2403
Mallory Controls Co., Box 327, Frankfort, Ind. ..... p 2408
New England Instrument Co., 14 Kendall Lane, Natick, Mass.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2409
Precision Electronic Components Ltd., 19 Hafis Rd., Toronto, Ont., Can. p 2490
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y. .... p 2491
Resistors Inc., 5226 W. 26th St., Chicago, Ill. ..... p 2423
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Techno-Components Corp., 7803 Lemona, Van Nuys, Calif. ... p 2499
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Weston Components Div., Weston-Archbald, Archbald, Pa.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Atohm Electronics, 3030 Empire, Burbank, Calif.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Rotohmeters, Inc., 46 Prospect St., Yonkers, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Tech-Ohm Elctrns., Inc., 36-11 33rd St., Long Island City, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vacco Electronics, 10390 Vacco St., S. El Monte, Cal.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

RESISTORS, BALLAST TUBE—SEE TUBES, BALLAST

RESISTORS, BARRETTER

Dale Electronics Inc., Box 609, Columbus, Nebr.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Narda Microwave Corp., Plainview, N. Y.
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.

RESISTORS, BERYLLIA CORE—SEE RESISTORS, INTEGRAL HEAT DISSIPATOR

RESISTORS, CARBON FILM

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 2349
Angstrohm Precision Inc., 7811 Lemona, Van Nuys, Calif.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa.
Dale Electronics Inc., Box 609, Columbus, Nebr. ..... p 2373
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
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Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Tech-Ohm Elctrns., Inc., 36-11 33rd St., Long Island City, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

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Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
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American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
C-F Electronics, Inc., 14707 Keswick St., Van Nuys, Calif.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Hamilton Hall Resistor Corp., 227 N. Water St., Milwaukee, Wisc.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
States Co., 19 New Park Ave., Hartford, Conn.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Tech-Ohm Elctrns., Inc., 36-11 33rd St., Long Island City, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

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Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Tech-Ohm Elctrns., Inc., 36-11 33rd St., Long Island City, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

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C-F Electronics, Inc., 14707 Keswick St., Van Nuys, Calif.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Tech-Ohm Elctrns., Inc., 36-11 33rd St., Long Island City, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.

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Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

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Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
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Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
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Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
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Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
C-F Electronics, Inc., 14707 Keswick St., Van Nuys, Calif.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
Diplohmatic Div., 1211 E. Denny Way, Seattle, Wash.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electro Materials Corp. of America, 605 Center Ave., Mamaroneck, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Hamilton Hall Resistor Corp., 227 N. Water St., Milwaukee, Wisc.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Miller Electro-Res. Labs., 14800 W. Grange, New Berlin, Wisc.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Tech-Ohm Elctrns., Inc., 36-11 33rd St., Long Island City, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Vishay Intertechnology, Inc., 63 Lincoln Hwy., Malvern, Pa.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

RESISTORS, METAL-GLAZED

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Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa.

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Dictograph Products, Inc., Shelter Rock La., Danbury, Conn.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electro Materials Corp. of America, 605 Center Ave., Mamaroneck, N. Y.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.

RESISTORS, MICROWAVE

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio .. p 1342, 1343
Caddock Electronics, Inc., 3127 Chicago Ave., Riverside, Calif.
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
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Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.

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Atohm Electronics, 3030 Empire, Burbank, Calif.
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
C-F Electronics, Inc., 14707 Keswick St., Van Nuys, Calif.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
Diplohmatic Div., 1211 E. Denny Way, Seattle, Wash.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Kidco, Inc., Box 278, Medford, N. J.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
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Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
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Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Tech-Ohm Elctrns., Inc., 36-11 33rd St., Long Island City, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
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Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
Film Microelectronics, Inc., 17 A St., Burlington, Mass.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Kidco, Inc., Box 278, Medford, N. J.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nucleonic Prods. Co., Inc., 3133 East 12th St., Los Angeles, Calif.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
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Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Constanta Co. of Canada Ltd., 280 Regina Ave., Montreal, Que., Can.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Miller Electro-Res. Labs., 14800 W. Grange, New Berlin, Wisc.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
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Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Precision Resistor Co., Inc., 109 U. S. Hwy. 22, Hillside, N. J.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
States Co., 19 New Park Ave., Hartford, Conn.
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Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Vishay Intertechnology, Inc., 63 Lincoln Hwy., Malvern, Pa.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
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Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Vishay Intertechnology, Inc., 63 Lincoln Hwy., Malvern, Pa.

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Dale Electronics Inc., Box 609, Columbus, Nebr.
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Electronic Precision Components Corp., 2 Brookdale Pl., Mt. Vernon, N. Y.
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American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
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Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
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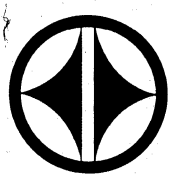

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Bradford Components, Inc., 65 South Ave., Box 107, Salamanca, N. Y.
C-F Electronics, Inc., 14707 Keswick St., Van Nuys, Calif.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Colber Corp., 26 Buffington St., Irvington, N. J.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Diplohmatic Div., 1211 E. Denny Way, Seattle, Wash.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Hamilton Hall Resistor Corp., 227 N. Water St., Milwaukee, Wisc.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Kidco, Inc., Box 278, Medford, N. J.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
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United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

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A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Components, Inc., 8th Ave. & Harry St., Conshohocken, Pa.
C-F Electronics, Inc., 14707 Keswick St., Van Nuys, Calif.
Colber Corp., 26 Buffington St., Irvington, N. J.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Diplohmatic Div., 1211 E. Denny Way, Seattle, Wash.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Ionetics Corp., 55 Randolph Ave., Avenel, N. J.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Kidco, Inc., Box 278, Medford, N. J.
Logan Elctrn. Corp., 100 Mill St., Revere, Mass.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Micro-Strain, Inc., Spring City, Pa.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Precision Resistor Co., Inc., 109 U. S. Hwy. 22, Hillside, N. J.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Vishay Intertechnology, Inc., 63 Lincoln Hwy., Malvern, Pa.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

RESISTORS, RECTILINEAR

Airco Speer Elctrn. Components, Resistor Plant, Bradford, Pa. ..... p 2350
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 2349
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif.
Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Dale Electronics Inc., Box 609, Columbus, Nebr.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. ..... p 2387
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
New England Instrument Co., 14 Kendall Lane, Natick, Mass.
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y.
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Weston Components Div., Weston-Archbald, Archbald, Pa.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Astro Electronics Inc., 1160 E. Ash, Fullerton, Calif.
Atohm Electronics, 3030 Empire, Burbank, Calif.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.

RESISTORS, RHEOSTAT—SEE RHEOSTATS

RESISTORS, STANDARDS—SEE STANDARDS, RESISTANCE

RESISTORS, STRIP

Cal-R, Inc., Cal. Resistor Div., 1601 Olympic Blvd., Santa Monica, Calif.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. ..... p 2393
Lectrohm, Inc., Sub. Cook Elec., 5562 Northwest Hwy., Chicago, Ill. p 2403

RESISTORS, VOLTAGE SENSITIVE

Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y.
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

RESISTORS, SUPPRESSOR

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 2349
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa. .... p 2361
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

RESISTORS, SURGE

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. .. p 2388, 2391
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Ward Leonard, 31 South St., Mount Vernon, N. Y. ..... p 2354
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.

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Cal-R, Inc., Thermonetics Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2799
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 2355
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 2355
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 2355
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 2355
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H.
Dale Electronics Inc., Box 609, Columbus, Nebr. ..... p 2371
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Gamble, C. T. Inds., New Jersey Ave. & Fairview St., Riverside, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. .. p 2386, 2392
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 2395, 2396
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind. .. p 2406
Lectrohm, Inc., Sub. Cook Elec., 5562 Northwest Hwy., Chicago, Ill. p 2403
Marstan Elctrns., 307 Washington St., Orange, N. J. ..... p 2404, 2405
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2409
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. ..... p 2419
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y.
Resistors Inc., 5226 W. 26th St., Chicago, Ill. ..... p 2423
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Shallcross, E. Preston St., Selma, N. C.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Atohm Electronics, 3030 Empire, Burbank, Calif.
C-F Electronics Inc., 14707 Keswick St., Van Nuys, Calif.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Hamilton Hall Resistor Corp., 227 N. Water St., Milwaukee, Wisc.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

RESISTORS, TEMPERATURE-SENSITIVE—SEE THERMISTORS

RESISTORS, TIN OXIDE

Corning Glass Works, Electronic Products Div., Corning, N. Y. p 2364, 2365
Welwyn International, Inc., 811 Sharon Dr., Westlake, Ohio .... p 2442
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.

RESISTORS, VARIABLE—SEE POTENTIOMETERS

RESISTORS, VOLTAGE-SENSITIVE

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 2349
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. p 2362, 2363
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.

RESISTORS, VOLTAGE SENSITIVE (Cont'd)

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2815
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 2398
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Resistance Prods. Co., 914 South 13th St., Harrisburg, Pa.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio ..... p 2585
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Colber Corp., 26 Buffington St., Irvington, N. J.
General Electric Co., Metallurgical Prods. Dept., Box 237, Detroit, Mich.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.

RESISTORS, WIREWOUND

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Cal-R, Inc., Cal. Resistor Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2360
Caddock Electronics, Inc., 3127 Chicago Ave., Riverside, Calif. .. p 2357
Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H. ..... p 2461
Dale Electronics Inc., Box 609, Columbus, Nebr. ..... p 2366-2371
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 2473
Electronic Precision Components Corp., 2 Brookdale Pl., Mt. Vernon, N. Y. p 2375
Gamble, C. T. Inds., New Jersey Ave. & Fairview St., Riverside, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 2398
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
IRC Div. TRW Inc., 1100 Glendon Ave., Los Angeles, Cal. p 2383-2385, 2387-2390
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 2396
Kelvin, 5919 Noble Ave., Van Nuys, Calif. ..... p 2399
LTV Electrosystems, Inc., 1320 Flaxmill Rd., Huntington, Ind. .. p 2406
Lectrohm, Inc., Sub. Cook Elec., 5562 Northwest Hwy., Chicago, Ill. p 2400-2402
Mallory Controls Co., Box 327, Frankfort, Ind. ..... p 2408
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Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2409
Omtronics Manufacturing Inc., 2406 Leavenworth, Omaha, Nebr. p 2413-2416
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. ..... p 2418-2420
Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y.
Resistance Prods. Co., 914 South 13th St., Harrisburg, Pa. .... p 2422
Resistors Inc., 5226 W. 26th St., Chicago, Ill. ..... p 2423
Sage Electronics Corp., Box 3926, Rochester, N. Y. ..... p 2424
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Shallcross, E. Preston St., Selma, N. C. ..... p 2426, 2427
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Ultronix, Inc., 461 North 22nd St., Grand Junction, Colo. p 2434-2439
Ward Leonard, 31 South St., Mount Vernon, N. Y. ..... p 2354
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Astro Electronics Inc., 1160 E. Ash, Fullerton, Calif.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Atohm Electronics, 3030 Empire, Burbank, Calif.
Bradford Components, Inc., 65 South Ave., Box 107, Salamanca, N. Y.
C-F Electronics, Inc., 14707 Keswick St., Van Nuys, Calif.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Colber Corp., 26 Buffington St., Irvington, N. J.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Consolidated Resistance Co. of America, Inc., 44 Prospect St., Yonkers, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Diplohmatic Div., 1211 E. Denny Way, Seattle, Wash.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hamilton Hall Resistor Corp., 227 N. Water St., Milwaukee, Wisc.
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Instrument Resistors Co., Inc., 503 Adamston Rd., Brick Town, N. J.
Jordan Electric Company, 14707 Keswick St., Vun Nuys, Calif.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
Logan Elctrn. Corp., 100 Mill St., Revere, Mass.
Mel-Rain Corp., 3100 Roosevelt Ave., Indianapolis, Ind.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Miller Electro-Res. Labs., 14800 W. Grange, New Berlin, Wisc.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Penn Resistor Corp., 526 N. Broad St., Lansdale, Pa.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Precision Resistor Co., Inc., 109 U. S. Hwy. 22, Hillside, N. J.
Priester, H. E. Corp., 250 Station Plaza, Hartsdale, N. Y.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Voltronics, Inc., 7746 W. Addison St., Chicago, Ill.
Welwyn Electric, Ltd., Bedlington, Northumberland, Eng.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

RESISTORS, WIRE WOVEN

Cal-R, Inc., Cal. Resistor Div., 1601 Olympic Blvd., Santa Monica, Calif.
Dale Electronics Inc., Box 609, Columbus, Nebr.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Compu Tek, 300 Northern Blvd., Great Neck, N. Y.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
States Co., 19 New Park Ave., Hartford, Conn.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.

RESISTS—SEE COATINGS, ETCHANT RESISTING

RESOLVER TESTERS—SEE TESTERS, SYNCHRO/RESOLVER

RESOLVERS, SYNCHRO

Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 2667
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif.
Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif.
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 2675
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. p 2679, 2684-2686
Weston-Transicoil Components Div., Worcester, Pa.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Computer Devices, 11925 Burke St., Santa Fe Springs, Calif.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England

RESONATORS, MICROWAVE

E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Collins Radio Co., Dallas, Texas
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

RESTORERS, PULSE-FORM

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Electronic Enterprises, 775 South Madison Ave., Pasadena, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

RETAINERS, BATTERY

Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.

RETAINERS, RELAY

American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. ... p 2196

RETAINERS, TRANSISTOR & DIODE

Atlee Corp., 2 Lowell Ave., Winchester, Mass. ..... p 835
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2518-2520
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Gudebrod Bros. Silk Co., Inc., 225 West 34th St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.

RETAINERS, TUBE

International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Kestler Electronics, 4226 Arica Ave., Rosemead, Calif.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

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Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1340
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind.
Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
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Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 2473
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Reon Resistor Corp., 155 Saw Mill River Rd., Yonkers, N. Y.
Samarius Inc., 300 Seymour Ave., Derby, Conn.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Techno-Components Corp., 7803 Lemona, Van Nuys, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y. ..... p 2354
Ace Elctrn. Assocs., Inc., 99 Dover St., Somerville, Mass.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Mel-Rain Corp., 3100 Roosevelt Ave., Indianapolis, Ind.
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, Wisc.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.

RINGS, BRAZING

Handy & Harman, 850 3rd Ave., New York, N. Y.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.

RINGS, CARBON PACKING—SEE SEALS, CARBON

RINGS, OIL SEALING—SEE SEALS, OIL

RINGS, RETAINING

Helitronics Corp., 916 McCarter Hwy., Newark, N. J.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Industrial Retaining Ring Co., 57 Cordier St., Irvington, N. J.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Reliance Div., 25 Charles Ave., S.E., Massillon, Ohio
Rotor Clip Co., Inc., 1323 Randall Ave., Bronx, N. Y.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Superior Carbon Prods., Inc., 9115 George Ave., Cleveland, Ohio
Templeman, D. R. Co., 8 Park St., Plainville, Conn.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Tridair Industries, 3000 W. Lomita Bl., Torrance, Cal.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C., N. Y.

RINGS, SLIP-BRUSH ASSEMBLIES—SEE SLIP RING ASSEMBLIES

RIVETS

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J.
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Englehard Minerals & Chemicals Corp., H. A. Wilson Dept., U.S. Rte. #22, Union, N. J.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Helitronics Corp., 916 McCarter Hwy., Newark, N. J.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Abbott Screw & Mfg. Co., 6525 N. Clark St., Chicago, Ill.
Abscoa Industries, 1071 W Arbor Vitae, Inglewood, Calif.
Acme Rivet & Machine Corp., 1116 Edgewater Ave., Ridgefield, N. J.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.

Armco Steel Corp., 703 Curtis St., Middletown, Ohio
Atlas Tack Corp., Fairhaven, Mass.
Bell Fasteners Corp., 352 Evelyn St., Paramus, N. J.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Century Fastener Corp., 20 Grand Ave., Brooklyn, N. Y.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Cherry Rivet Div., Box 2157, Santa Ana, Calif.
Chicago Rivet & Machine Co., 950 South 25 Ave., Bellwood, Ill.
Deutsch Fastener Corp., Airport Sta - Box 90925, Los Angeles, Calif.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
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Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Harper, H. M. Co., 8200 Lehigh Ave., Morton Grove, Ill.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Luke Line Fasteners, 201 Laurel St., Beverly, N. J.
Milford Rivet & Machine Co., 857 Bridgeport Ave., Milford, Conn.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
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Controlled Environment Equip Corp., 160 Pleasant St., Brockton, Mass.
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ROTATORS—SEE ANTENNA ROTATORS

ROTORS, MOTOR & GENERATOR—SEE MOTOR & GENERATOR ARMATURES, ROTORS, STATORS

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Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1216
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Abesto Corp., Ackerman St., Bloomfield, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
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Multi-Flex Seals, Inc., 1170 Commerce Ave., Bronx, N. Y.
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Groendyk Mfg. Co., Inc., P.O. Box 278, Buchanan, Va.
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Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
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Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J. ..... p 1802
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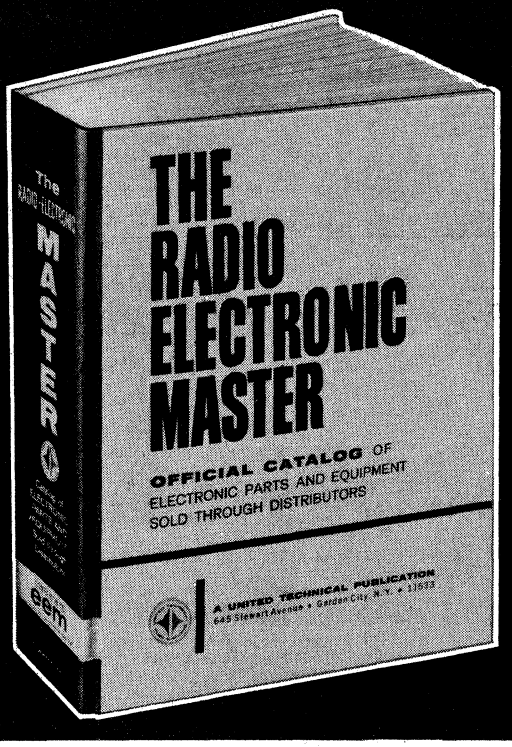

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Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bendix Corp., Aerospace Sys. Div., 3300 Plymouth Rd., Ann Arbor, Mich.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Egan Laboratory, 107-56 113th St., Richmond Hill, N. Y.
HRB-Singer, Inc., Science Park, State College, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Sensor Precision Industries Inc., 29 Janes Ave., Medfield, Mass.

SCANNERS, INSTRUMENT, INPUT/OUTPUT

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. ... p 758, 759
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1777
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. ..... p 2216
Cohu Electronics Inc., Box 623, San Diego, Calif.
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif. ..... p 1247
Computer Prods., Inc., 2801 E. Oakland Park Blvd., Ft. Lauderdale, Fla.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Fifth Dimension Inc., Box 483, Princeton, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif. .. p 1407
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. ..... p 1414
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Paraham Inc., 3017, E. Las Hermanas St., Compton, Cal.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1049
Sigma International Instrs., 88 Marsh Hill Rd., Orange, Conn.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. ..... p 2795
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Colorado Instruments, Inc., 1 Park St., Broomfield, Colo.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
D. M. Research Corp., 13703 Madison Ave., Cleveland, Ohio
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Howell Instruments, Inc., 3479 W. Vickery Blvd., Ft. Worth, Texas
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Parker Instrument Corp., 200 Harvard Ave., Stamford, Conn.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Scanivalve Inc., Box 20005, San Diego, Calif.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

SCANNERS, MAGNETIC TAPE—SEE READERS, MAGNETIC TAPE

SCANNERS, SOLID STATE

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif.
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Fifth Dimension Inc., Box 483, Princeton, N. J.
Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1049
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynisco, Div. Microdot Inc., 20 S. West Park, Westwood, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Warner Electric Brake & Clutch Co., Beloit, Wisc.

SCINTILLATION CRYSTALS—SEE CRYSTALS, SCINTILLATION

SCISSORS

Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
Boker Mfg. Co., In-Dus-Tronic Div., 200 Burnett Ave., Maplewood, N. J.
Clauss Cutlery Co., P.O. Box 667, Freemont, Ohio
Compton, W. H., Shear Co., Box 1096 No. Sta., New Bedford, Mass.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

SCOPE DOLLIES—SEE CARTS, INSTRUMENT & EQUIPMENT

SCOPES—SEE OSCILLOSCOPES

SCR'S—SEE THYRISTORS

SCR FIRING CONTROLS—SEE CONTROLS, SCR

SCRAMBLERS, SPEECH

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Collins Radio Co., Dallas, Texas
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

SCREEN ROOM FILTERS—SEE FILTERS, SCREEN ROOM

SCREEN ROOMS

Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Amerind-MacKissic, Inc., Box 111, Parkerford, Pa.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Lindgren, E. A. & Assoc., 4515-17 N. Ravenswood Ave., Chicago, Ill.
Ray Proof Corp., Keeler Ave., Norwalk, Conn.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Topatron, Inc., Box 967, Costa Mesa, Calif.

SCREWDRIVERS

Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif.
Allen Mfg. Co., Drawer 570, Hartford, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Black & Decker Mfg. Co., 701 E. Joppa Rd., Towson, Md.
Channellock, Inc., S. Main St., Meadville, Pa.
Crescent Niagaga Corp., 70 Niagara St., Buffalo, N. Y.
Desco Mfg. Co., 1530 Flower St., Glendale, Calif.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Foredom Electric Co., Inc., Bethel, Conn.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kedman Co., 762 S. Redwood Rd., Salt Lake City, Utah
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Larsen Importing Co., 140 Nassau St., New York, N. Y.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Moody Machine Prods. Co., Inc., Box 2248, Providence, R. I.
Owatonna Tool Co., 395 Eisenhower Dr., Owatonna, Minn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Portable Electric Tools Div., 1200 East State St., Geneva, Ill.
Printact Relay Div., Executone, Inc., 47-37 Austell Pl., L. I. C., N. Y.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.

SEALS, CERAMIC TO METAL

Rosenberg Bros. & Co., 100 Landing Ave., Smithtown, N. Y.
Shakeproof Div., St. Charles Rd., Elgin, Ill.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Standard Pneumatic Motor Co., Box 745, Whittier, Calif.
Stanley Tools, New Britain, Conn.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Upson Tools, Inc., Box 4750, Rochester, N. Y.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo, N. Y.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.
Xcelite Inc., Thorne & Bank Sts., Orchard Park, N. Y.
Zephyr Mfg. Co., 201 Hindry Ave., Box 759, Inglewood, Calif.

SCREWS, LEAD, FEED & TRANSLATORY—SEE DRIVES & DRIVE MECHANISMS

SCREWS—SEE FASTENERS

SCRIBERS, WAFER—SEE MACHINES & ACCESSORIES, SEMICONDUCTOR MANUFACTURING

SEALERS—SEE COATINGS

SEALING KITS, CABLE END—SEE KITS, CABLE-END SEALING

SEALING SERVICE, HERMETIC—SEE SERVICES, HERMETIC SEALING

SEALS & FEEDTHRUS, ENVIRONMENTAL—SEE FEEDTHRUS & SEALS, ENVIRONMENTAL

SEALS, CARBON

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Helwig Carbon Prods., Inc., 2550 North 30th St., Milwaukee, Wisc.
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Poco Graphite, Inc., Box 1524, Garland, Tex.
Pure Carbon Co., Inc., 441 Hall Ave., St. Marys, Pa.
St. Mary's Carbon Co., 1939 State Rd., St. Marys, Pa.
Sealol, Inc., Warwick Indl. Pk., Providence, R. I.
Stackpole Carbon Co., Carbon Div., Stackpole St., St. Marys, Pa.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.

SEALS, CERAMIC-TO-METAL

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 2692
American Feldmuehle Corp., Box 2160, Glenbrook, Conn. ..... p 1576
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1594
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif. p 905
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1214
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Accratronics Seals Corp., 2121 Kenmere Ave., Burbank, Calif.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Consolidated Ceramics & Metalizing Corp., Box 352, Flemington, N. J.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electrical Inds., 691 Central Ave., Murray Hill, N. J.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Glass Beads Co., Ceramic Products Div., Latrobe, Pa.
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Isochem Resins Co., Cook St., Lincoln, R. I.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Kidco, Inc., Box 278, Medford, N. J.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Mitronics, Inc., 132 Floral Ave., Murray Hill, N. J.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Power & Engrg. Equip. Co., Inc., 1826 213th St., Torrance, Calif.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
3M Co., 3M Center, St. Paul, Minn.

SEALS, CERAMIC TO METAL (Cont'd)

Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Vernitron Electrical Components, Box 878, Norwalk, Conn.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Xenon Corp., 39 Commercial St., Medford, Mass.

SEALS, GLASS-TO-METAL

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 2692
Fusite Corp., 6000 Fernview Ave., Cincinnati, Ohio ..... p 1637
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1594
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif. p 905
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y.
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1214
Pfizer Minerals, Dept. 56, 235 East 42nd St., New York, N. Y.
Sealtron Corp., 188 Reading Rd. at Amity, Cincinnati, Ohio
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Accratronics Seals Corp., 2121 Kenmere Ave., Burbank, Calif.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Astro Seal, Inc., 1710 Chico, S. El Monte, Calif.
Atlas/Uni-Seal, Atlas Chemical Ind. Inc., Valley Forge, Pa.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Cerro Corp., 300 Park Ave., New York, N. Y.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Dolinko & Wilkens, Inc., 1901-7 Summit Ave., Union City, N. J.
Electrical Inds., 691 Central Ave., Murray Hill, N. J.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Electronic Parts Mfg. Co., Inc., 508-10 25th St., Union City, N. J.
Electronic Seals Co., Inc., 13766 Saticoy St., Van Nuys, Calif.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hermetic Seal Div., 317 Main St., Wilmington, Mass.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Isochem Resins Co., Cook St., Lincoln, R. I.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Mansol Ceramics Co., Inc., 140 Little St., Belleville, N. J.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Nester, L. G. Co., Box 666, Millville, N. J.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Owens-Illinois, Inc., P.O. Box 1035, Toledo, Ohio
Richland Glass Co., Inc., Richland, N. J.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Sinclair Mfg. Co., Chartley, Mass.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Superior Electronics Co., 474 Getty Ave., Clifton, N. J.
Thermal American Fused Quartz Co.,
Rte. 202 & Change Bridge Rd., Montville, N. J.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Refining & Smelting Co., 3700 N. Runge Ave., Franklin Pk., Ill.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Ventron Corp., Congress St., Beverly, Mass.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Warren Components Corp., Box 848, Warren, Pa.
Xenon Corp., 39 Commercial St., Medford, Mass.

SEALS, HERMETIC—ALSO SEE SERVICES, HERMETIC SEALING

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J. ..... p 2687
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Fusite Corp., 6000 Fernview Ave., Cincinnati, Ohio ..... p 1637
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 2151
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif. p 905
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1214
Sealtron Corp., 188 Reading Rd. at Amity, Cincinnati, Ohio ..... p 991
Abscoa Industries, 1071 W Arbor Vitae, Inglewood, Calif.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electrical Inds., 691 Central Ave., Murray Hill, N. J.
Electronic Seals Co., Inc., 13766 Saticoy St., Van Nuys, Calif.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Hermetic Seal Div., 317 Main St., Wilmington, Mass.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Kidco, Inc., Box 278, Medford, N. J.
Mansol Ceramics Co., Inc., 140 Little St., Belleville, N. J.
Metal Bellows Corp., 1075 Providence Hwy., Sharon, Mass.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
WABCO - Westinghouse Air Brake Co., Swissvale P.O., Pittsburgh, Pa.
Warren Components Corp., Box 848, Warren, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

SEALS, METAL-TO-METAL

All-State Welding Alloys Co., Inc., P.O. Box 350, White Plains, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Associate General Labs., Inc., 8934 W. Ogden Ave., Brookfield, Ill.
Belfab, Unit of Bailey Meter Co., Box 1881, Daytona Beach, Fla.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Clarkson Labs, Inc., 1450 Ferry Ave., Camden, N. J.
Clevite, Cleveland Graphite Bronze, 17000 St. Clair Ave., Cleveland, O.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
General Electric Co., Metallurgical Prods. Dept., Box 237, Detroit, Mich.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Isochem Resins Co., Cook St., Lincoln, R. I.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Mansol Ceramics Co., Inc., 140 Little St., Belleville, N. J.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Metallo Gasket Co., 16 Bethany St., New Brunswick, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.
Power & Engrg. Equip. Co., Inc., 1826 213th St., Torrance, Calif.
Scully-Jones Co., 5240 Belmont Rd., Downers Grove, Ill.
Sealol, Inc., Warwick Indl. Pk., Providence, R. I.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vernitron Electrical Components, Box 878, Norwalk, Conn.

SEALS, MICROWAVE—SEE GASKETS, SHIELDING, R-F: SEALS, WAVEGUIDE

SEALS, OIL

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J. ..... p 2687
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Abesto Corp., Ackerman St., Bloomfield, N. J.
Abscoa Industries, 1071 W Arbor Vitae, Inglewood, Calif.
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Bal Seal Engrg. Co., 9929 Greenleaf Ave., Santa Fe Springs, Calif.
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Cottrell Paper Co., Inc., 10 Purchase St., Fall River, Mass.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
GAF Corp., 140 West 51 St., New York, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Houghton E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
Multi-Flex Seals, Inc., 1170 Commerce Ave., Bronx, N. Y.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.
Penn Fibre & Specialty Co., 2020 E. Westmoreland St., Philadelphia, Pa.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
St. Mary's Carbon Co., 1939 State Rd., St. Marys, Pa.
Sealol, Inc., Warwick Indl. Pk., Providence, R. I.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Vibra Seal Corp., 2832 E. Grand Blvd., Detroit, Mich.
Wells Elctrns., Inc., Plastics Div., 1701 S. Main St., S. Bend, Ind.

SEALS, PLASTIC

Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Lundey Associates, Inc., 694 Main St., Waltham, Mass.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

SEALS, RUBBER

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J. ..... p 2687
Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1639, 1641
Abesto Corp., Ackerman St., Bloomfield, N. J.
Abscoa Industries, 1071 W Arbor Vitae, Inglewood, Calif.
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Adhesive Products Corp., 1660 Boone Ave., Bronx, N. Y.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Atlantic India Rubber Co., 571 W. Polk St., Chicago, Ill.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Bal Seal Engrg. Co., 9929 Greenleaf Ave., Santa Fe Springs, Calif.
Bellofram Corp., 103 Blanchard Rd., Burlington, Mass.
Continental Rubber Works, Sub. Continental Copper & Steel, Erie, Pa.
Edwards High Vacuum (Can.) Ltd., 430 S. Service Rd.W., Oakville, Ont., Can.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
General Gaskets, Inc., Middletown, Conn.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Groendyk Mfg. Co., Inc., P.O. Box 278, Buchanan, Va.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Houghton E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Industrial Elctrn. Rubber Co., 8589 Darrow Rd., Twinsburg, Ohio
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kelm, G. R. Machine Works, Inc., 347 E. Railway Ave., Paterson, N. J.
Kirkhill Rubber Co., 300 E. Cypress St., Brea, Calif.
Lundey Associates, Inc., 694 Main St., Waltham, Mass.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minnesota Rubber Co., 3630 Wooddale Ave., Minneapolis, Minn.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
Multi-Flex Seals, Inc., 1170 Commerce Ave., Bronx, N. Y.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.
Paul, F. H. & Stein Bros., Inc., 235 S Ave., New York, N. Y.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Press-On Products, 39 Factory Rd., Addison, Ill.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Seals Eastern, Inc., 7 Peach St., New Shrewsbury, N. J.
Stalwart Rubber Co., 377 Northfield Rd., Bedford, Ohio
Vernay Labs., E. South College St., Yellow Springs, Ohio
Vibra Seal Corp., 2832 E. Grand Blvd., Detroit, Mich.

SEALS, RUBBER TO METAL

Adhesive Products Corp., 1660 Boone Ave., Bronx, N. Y.
Continental Rubber Works, Sub. Continental Copper & Steel, Erie, Pa.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Isochem Resins Co., Cook St., Lincoln, R. I.
Kelm, G. R. Machine Works, Inc., 347 E. Railway Ave., Paterson, N. J.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minnesota Rubber Co., 3630 Wooddale Ave., Minneapolis, Minn.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
Multi-Flex Seals, Inc., 1170 Commerce Ave., Bronx, N. Y.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Seals Eastern, Inc., 7 Peach St., New Shrewsbury, N. J.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Townsend Co., Fabricated Products Div., West Newton, Pa.
Vacuum Research Mfg. Co., 3100 Crow Canyon Rd., San Ramon, Calif.
Vernay Labs., E. South College St., Yellow Springs, Ohio

SEALS, SILICONE RUBBER

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J. ..... p 2687
Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1640-1642
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
Reynolds Industries, Inc., Box P-850, Marina Del Ray, Cal.
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Abesto Corp., Ackerman St., Bloomfield, N. J.
Abscoa Industries, 1071 W Arbor Vitae, Inglewood, Calif.
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Armstrong Cork Co., W. Liberty St., Lancaster, Pa.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Bellofram Corp., 103 Blanchard Rd., Burlington, Mass.
Continental Rubber Works, Sub. Continental Copper & Steel, Erie, Pa.
Control Data Corp., 400 Border St., East Boston, Mass.
Fel-Pro, Inc., 7450 N. McCormick Blvd., Skokie, Ill.
General Electric Co., Silicone Products Dept., Waterford, N. Y.
General Gaskets, Inc., Middletown, Conn.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Houghton E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Industrial Elctrn. Rubber Co., 8589 Darrow Rd., Twinsburg, Ohio
Isochem Resins Co., Cook St., Lincoln, R. I.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Kelm, G. R. Machine Works, Inc., 347 E. Railway Ave., Paterson, N. J.
Kirkhill Rubber Co., 300 E. Cypress St., Brea, Calif.
Lundey Associates, Inc., 694 Main St., Waltham, Mass.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minnesota Rubber Co., 3630 Wooddale Ave., Minneapolis, Minn.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
Multi-Flex Seals, Inc., 1170 Commerce Ave., Bronx, N. Y.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.
Paul, F. H. & Stein Bros., Inc., 235 S Ave., New York, N. Y.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Press-On Products, 39 Factory Rd., Addison, Ill.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Seals Eastern, Inc., 7 Peach St., New Shrewsbury, N. J.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Stalwart Rubber Co., 377 Northfield Rd., Bedford, Ohio
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Vernay Labs., E. South College St., Yellow Springs, Ohio

SEALS, WAVEGUIDE

Abscoa Industries, 1071 W Arbor Vitae, Inglewood, Calif.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.

Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

SEARCH UNITS, MAGNETIC TAPE—SEE TAPE SEARCH EQUIPMENT

SELECTIVE CALLING DEVICES—SEE COMM. SYSTEMS, SELECTIVE PAGING

SELF-LUBRICATING MATERIALS—SEE MATERIALS, SELF-LUBRICATING

SELSYNS—SEE MOTORS, SYNCHRONOUS

SEMICONDUCTOR CASES—SEE CANS, SEMICONDUCTOR

SEMICONDUCTOR JOINT COMPOUND

Chisso Corp., 3-2, Marunouchi 2-Chome, Chiyoda-ku, Tokyo, Jap.
Isochem Resins Co., Cook St., Lincoln, R. I.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Midsil Corp., 27 Bland St., Emerson, N. J.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.

SEMICONDUCTOR MATERIAL—SEE CRYSTALS, SEMICONDUCTOR

SEMICONDUCTOR READOUTS—SEE READOUTS, SEMICONDUCTOR

SEMICONDUCTORS—SEE DIODES: RECTIFIERS: TRANSISTORS—ALSO SEE CIRCUITS, INTEGRATED

SENSORS, ICE, SLEET & SNOW—SEE DETECTORS, ICE, SLEET & SNOW

SENSORS, TEMPERATURE—SEE BOLOMETERS: THERMISTORS: TRANSDUCERS

SERVICES, ASSEMBLY & FABRICATION

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Art Wire & Stamping Co., 28 Boyden Pl., Newark, N. J. ..... p 1635
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Borg-Warner Thermoelectrics, Wolf & Algonquin Rds., Des Plaines, Ill. p 2796
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. .... p 523
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynatronic Cable Engrg. Corp., 136 San Fernando Rd., Los Angeles, Calif. p 2933
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 899
Electronic Enclosures, Inc., 225 S. Aviation Blvd., El Segundo, Cal. p 579
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
FAE Instrument Corp., 16 Norden Lane, Huntington Sta., N. Y. .. p 1732
Falstrom Co., 174 Falstrom Ct., Passaic, N. J. ..... p 583
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Formica Metal Products Co. Inc., Corporation Way, Dept. M, Medford, Mass.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
G T I Corporation, 310 Chestnut St., Meadville, Pa.
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1105
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 2667
Honeywell Test Instruments Div., Box 5227, Denver, Colo. ..... p 1403
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. ..... p 1797
Infodex Incorporated, 7 Cherry Ave., Waterbury, Conn. ..... p 1187
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Kelvin, 5919 Noble Ave., Van Nuys, Calif.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Logic Science, Inc., Box 10096, San Diego, Calif.
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Microsonics Inc., 60 Winter St., Weymouth, Mass.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa. .... p 2867
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2766, 2767
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Oven Industries Div., E. Simpson Rd., Mechanicsburg, Pa. ..... p 1102
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa. p 2965
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Rectifier Components Corp., 124 Albany Ave., Freeport, N. Y. .. p 2581
Ripley Co., Inc., 1 Factory St., Middletown, Conn. ..... p 1276
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio ..... p 983
Samarius Inc., 300 Seymour Ave., Derby, Conn. ..... p 2500
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. ..... p 2795
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn. ..... p 2969
Trio Laboratories Inc., 80 DuPont St., Plainview, N. Y.
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Universal Instrs. Corp., 139 E. Frederick St., Binghamton, N. Y. .. p 2157
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2138, 2139
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif. ..... p 2147
Waveline Inc., Box 718, West Caldwell, N. J. ..... p 1720
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal.
Abalon Precision Mfg. Corp., 540 Casanova St., Bronx, N. Y.
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Aero Vac Corp., Box 448, Troy, N. Y.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aerolux Light Co., Inc., 653 11th Ave., New York, N. Y.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Aidlin Automation, Inc., 1613 E. New York Ave., Brooklyn, N. Y.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Algo, 50 Schrieffer St., S. Hackensack, N. J.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Products Inc., 6825 S. Chicago Ave., Chicago, Ill.
Altron Elctrns. Co., 1309 Jefferson Ave., Woodlyn, Pa.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Aubin, A. E. Co., Box 29, Glastonbury, Conn.
Auricord, 35-41 29th St., Long Island City, N. Y.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Blickman, S., Inc., 201 Gregory Ave., Weehawken, N. J.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Broxlea Ltd., Broxbourne, Herts, Eng.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Celestial Components, Inc., Box 4035, Covina, Calif.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Chrysler Corp., 1312 N. Meridian St., Huntsville, Ala.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Colorado Instruments, Inc., 1 Park St., Broomfield, Colo.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conductorlab, Inc., Box 222, Groton, Mass.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Datasenors Co., 735 Factory Rd., Addison, Ill.
Design Automation, Inc., 809 Massachusetts Ave., Lexington, Mass.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Diebel Mfg. Co., 6505 Oakton St., Morton Grove, Ill.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Dynacool Mfg. Co., Inc., 1 Russell St., Saugerties, N. Y.
EDP Corp., Box 6485, Orlando, Fla.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
E. O. Electronics, Inc., Mountain Lakes, N. J.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.

SERVICES, ASSEMBLY

Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electro Specialties Corp., 370 Park Ave., Worcester, Mass.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Electrochemical Industries, Inc., 665 Cambridge St., Worcester, Mass.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Control Co., Box S150, Dresher, Pa.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
Electronic Parts Mfg. Co., Inc., 508-10 25th St., Union City, N. J.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Electronics, Inc. of Pa., 2440 Maryland Ave., Willow Grove, Pa.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
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Logical System Concepts, Inc., 12417 Cedar Rd., Cleveland, Ohio
McNally Bros. Mach. & Gear Co., 1145 E. 79th St., Minneapolis, Minn.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Neo-Technology, Inc., Box 266, Montvale, N. J.
Parks, Henry Francis Laboratory, Box 25665, Seattle, Wash.
Phoenix Materials Corp., Box 39, Forbes Road, Pa.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Re-el Circuits, Inc., 172 Grodon Ave., Totowa Boro, N. J.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Varo Optical, Inc., 215 E. Prospect Ave., Mt. Prospect, Ill.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.
Western Engrg. Assocs., 13101 Rose Ave., Los Angeles, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

SERVICES, ELECTRICAL MEASUREMENT

AEL Inc., P.O. Box 552, Lansdale, Pa.
API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
All-Tronics Inc., 45 Bond St., Westbury, N. Y. ..... p 1284
Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J.
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal.

SERVICES, ELECTRICAL (Cont'd)

ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Altron Elctrns. Co., 1309 Jefferson Ave., Woodlyn, Pa.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Calitronics Corp., 44 Prospect Ave., Yonkers, N. Y.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
Delsen Testing Corp., 719 W. Broadway, Glendale, Calif.
Detroit Testing Lab. Inc., 12800 Northend Ave., Detroit, Mich.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, N. Y.
Electrical Testing Labs., Inc., 2 East End Ave., New York, N. Y.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronic Science Services Co., Inc., 210 Michael Dr., Syosset, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
G. E. Co., Insulator Dept., 2525 Insulator Dr., Baltimore, Md.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
HRB-Singer, Inc., Science Park, State College, Pa.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Interference Measurement Lab., Inc., 850 Shepherd Ave., Brooklyn, N. Y.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
National Astro Labs., Inc., 2201 Hollywood Way, Burbank, Calif.
New York Testing Labs, Inc., 81 Urban Ave., Westbury, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Ogden Technology Labs., Inc., 573 Monterey Pass Rd., Monterey Pk., Cal.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
RCA Service Co., Div. Radio Corp of America, Camden, N. J.
Rockwell Engineering Co., 2125 East 45th St., Indianapolis, Ind.
SSCO Standards Lab., Inc., 12800 Northend Ave., Detroit, Mich.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spectra-Elctrns., Inc., 923 N. San Antonio Rd., Los Altos, Calif.
Standard Electronics Co., 3012 West 77th St., Chicago, Ill.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Topatron, Inc., Box 967, Costa Mesa, Calif.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tucker Elctrns. Co., Box 1050, 326 Kirby St., Garland, Tex.
U S Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.
Welex Electronics, Box 986, Silver Spring, Md.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Wiss Janney Elstner & Assoc., 330 Pfingsten Rd., Northbrook, Ill.

SERVICES, ENCAPSULATION

Airflyte Electronics Co., Box 207, Bayonne, N. J.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 2151
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Rectifier Components Corp., 124 Albany Ave., Freeport, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y.
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn, N. Y.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Bacon Industries Inc., 192 Pleasant St., Watertown, Mass.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
Electrical Plastics Corp., 280 Warren St., Lyndhurst, N. J.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
General Reliance Div., General Relay Corp., 20 Mercer St., Dover, N. J.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Hardman, Inc., 600 Cortland St., Belleville, N. J.
Hightemp Resins Inc., 225 Greenwich Ave., Stamford, Conn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Isochem Resins Co., Cook St., Lincoln, R. I.
Isolation Products, 2387 Adele Ave., Mountain View, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
M-T Electronics Co., 536 Lewelling Blvd., San Leandro, Calif.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Mercury Elctrns. Corp., 339 E. Cottage Pl., York, Pa.
Molded Fiber Glass Cos., 4401 Benefit Ave., Ashtabula, Ohio
Mutron Corp., 646 Summer St., Brockton, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Rector Engrg. & Plastics Co., 318 Randolph Pl., N. E., Washington, D. C.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Santa Fe Mfg. Co., 2343 Jerome Ave., Bronx, N. Y.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Twin City Metalseal, Inc., 825 11th Ave., S.E., Minneapolis, Minn.
U. S. Electronics Corp., 321 Orient Way, Lyndhurst, N. J.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
Walkirt Co., 10321 S. La Cienega, Los Angeles, Calif.
Warren Components Corp., Box 848, Warren, Pa.

SERVICES, ENGRAVING & PROFILING

Nutronics Mfg. Co., 1703 Peoria Rd., Springfield, Ill. ..... p 713
Ackerman Engravers, Inc., 43-22 36th St., Long Island City, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Atmar Engraving Co., Inc., 91-31 121 St., Richmond Hill, N. Y.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
B & P Precision Sheet Metal Fabricators, 709 E. Nields St., W. Chester, Pa.
Bell Co., Inc., Box 92, 106 Morrow Ave., Trussville, Ala.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Dura Engraving Corp., 133 West 20th St., New York, N. Y.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fisher & Crome, 2427 N. Mascher St., Philadelphia, Pa.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Gorton Machine Corp., 1122 West 13th St., Racine, Wisc.
Hermes Plastics, Inc., 20 Cooper Square, New York, N. Y.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Master Engraving, 11 Wallace St., E. Paterson, N. J.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
N/P Co., Inc., Box 127, Temple City, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Pantographic Reproduction Co., 35 Elm Ridge Terr., Newington, Conn.
Parker-Hartford Corp., Box 869, Hartford, Conn.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Visual Inspection Prods., 112 Central Ave., Lynn, Mass.
Western Coil & Electrical Co., 215 State St., Racine, Wisc.

SERVICES, ENVIRONMENTAL TESTING

AEL Inc., P.O. Box 552, Lansdale, Pa.
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J. p 1244
Barry Controls Div., 700 Pleasant St., Watertown, Mass. ..... p 576
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif. ..... p 1247
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
Tracor Inc., 6500 Tracor La., Austin, Texas
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Airflow Co., Montgomery County Airpark, Gaithersburg, Md.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Calif. Testing Labs., Inc., 619 E. Washington Blvd., Los Angeles, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Controlled Environment Equip Corp., 160 Pleasant St., Brockton, Mass.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Detroit Testing Lab. Inc., 12800 Northend Ave., Detroit, Mich.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
Electrical Testing Labs., Inc., 2 East End Ave., New York, N. Y.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronic Science Services Co., Inc., 210 Michael Dr., Syosset, N. Y.
Electronics Div., LFE, 1605 Trapelo Rd., Waltham, Mass.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epoxylite Corp., 1428 N. Tyler Ave., S. El Monte, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Foxboro, Foxboro, Mass.
GPL Div., 63 Bedford Rd., Pleasantville, N. Y.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
G. E. Co., Insulator Dept., 2525 Insulator Dr., Baltimore, Md.
General Testing Labs., 5252 Port Royal Rd., Springfield, Va.
General Testing Labs., 49 Commercial Ave., Moonachie, N. J.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hafstrom Technical Prod., Inc., 4616 Sante Fe St., San Diego, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Lockhart Industries, Inc., 15707 Texaco Ave., Paramount, Calif.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Mepco, Inc., Columbia Rd., Morristown, N. J.
Mid-Continent Lab, Inc., 840 North 48th St., Lincoln, Neb.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
Montford Instrs. Ltd., 79 Lots Rd., Chelsea, London, S.W. 10, Eng.
New York Testing Labs, Inc., 81 Urban Ave., Westbury, N. Y.
Ogden Technology Labs., Inc., 573 Monterey Pass Rd., Monterey Pk., Cal.
Ogden Technology Labs, Inc., 100 Smith St., Farmingdale, N. Y.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
RCA Service Co., Div. Radio Corp of America, Camden, N. J.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
SSCO Standards Lab., Inc., 12800 Northend Ave., Detroit, Mich.
Sanders Assocs., Inc., Daniel Webster Hwy., S., Nashua, N. H.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Sparton Corp., 2400 E. Ganson St., Jackson, Mich.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Standard Electronics Co., 3012 West 77th St., Chicago, Ill.
Superior Circuits, 2821 Ladybird La., Dallas, Tex.
Testing Equip. & Supplies Corp., 6 Huron Dr., Natick, Mass.
U S Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.
Welex Electronics, Box 986, Silver Spring, Md.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Wiss Janney Elstner & Assoc., 330 Pfingsten Rd., Northbrook, Ill.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

SERVICES, FILM BADGE

Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
LTV Electrosystems, Inc., Garland Div., Box 6118, Dallas, Tex.
Landauer, R. S. Jr. & Co., Science Rd., Glenwood, Ill.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
U S Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.

SERVICES, GLASS BLOWING & FABRICATION

G T I Corporation, 310 Chestnut St., Meadville, Pa.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Corning Glass Works, Laboratory Prods. Dept., Corning, N. Y.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Longene Elctrns. Inc., 266 West Ave., Long Branch, N. J.
Nester, L. G. Co., Box 666, Millville, N. J.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Richland Glass Co., Inc., Richland, N. J.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Van Waters & Rogers, P.O. Box 3200, San Francisco, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.

SERVICES, HERMETIC SEALING

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y.
Fusite Corp., 6000 Fernview Ave., Cincinnati, Ohio ..... p 1637
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif. p 905
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1214
Sealtron Corp., 188 Reading Rd. at Amity, Cincinnati, Ohio .... p 991
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Accratronics Seals Corp., 2121 Kenmere Ave., Burbank, Calif.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Associate General Labs., Inc., 8934 W. Ogden Ave., Brookfield, Ill.
Astro Seal, Inc., 1710 Chico, S. El Monte, Calif.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Consolidated Ceramics & Metalizing Corp., Box 352, Flemington, N. J.

Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Electrical Inds., 691 Central Ave., Murray Hill, N. J.
Electronic Seals Co., Inc., 13766 Saticoy St., Van Nuys, Calif.
Epoxy Cast Elctrn. Case Co., 44 Prospect St., Yonkers, N. Y.
Glass Beads Co., Ceramic Products Div., Latrobe, Pa.
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Hermetic Seal Div., 317 Main St., Wilmington, Mass.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Lundey Associates, Inc., 694 Main St., Waltham, Mass.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Mitronics, Inc., 132 Floral Ave., Murray Hill, N. J.
National Vacuum Platers, Inc., 2641 E. Hagert St., Philadelphia, Pa.
New York Testing Labs, Inc., 81 Urban Ave., Westbury, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Warren Components Corp., Box 848, Warren, Pa.

SERVICES, HIGH-VACUUM

Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Aero Vac Corp., Box 448, Troy, N. Y.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Fredericks Co., Philmont & Anne St., Huntingdon Valley, Pa.
GCA Technology, Burlington Rd., Bedford, Mass.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
General Testing Labs., 49 Commercial Ave., Moonachie, N. J.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
National Astro Labs., Inc., 2201 Hollywood Way, Burbank, Calif.
National Vacuum Platers, Inc., 2641 E. Hagert St., Philadelphia, Pa.
New York Testing Labs, Inc., 81 Urban Ave., Westbury, N. Y.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Ogden Technology Labs, Inc., 100 Smith St., Farmingdale, N. Y.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Twin City Metalseal, Inc., 825 11th Ave., S.E., Minneapolis, Minn.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Zenith Optical Lab., 138 Palisade St., Dobbs Ferry, N. Y.

SERVICES, HYDRAULIC ASSEMBLY

United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Auto Control Labs, 5251 W. Imperial Highway, Los Angeles, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
New York Testing Labs, Inc., 81 Urban Ave., Westbury, N. Y.
Ogden Technology Labs, Inc., 100 Smith St., Farmingdale, N. Y.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Western Coil & Electrical Co., 215 State St., Racine, Wisc.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

SERVICES, MASK MAKING

Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Chemical Micro Milling Co., Box 770, Camden, N. J.
Conforming Matrix Corp., Box 37, Sta. G, Toledo, Ohio
Etchit Inc., 643 - 13th Ave., S., Hopkins, Minn.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Mann, David W. Co., 174 Middlesex Turnpike, Burlington, Mass.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Press-On Products, 39 Factory Rd., Addison, Ill.
Visual Inspection Prods., 112 Central Ave., Lynn, Mass.

SERVICES, METALLIZING

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
G T I Corporation, 310 Chestnut St., Meadville, Pa.
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Abesto Corp., Ackerman St., Bloomfield, N. J.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Bron-Shoe Co., 1313 Alum Creek Dr., Columbus, Ohio
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Kidco, Inc., Box 278, Medford, N. J.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Matthey Bishop, Inc., Malvern, Pa.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Mitronics, Inc., 132 Floral Ave., Murray Hill, N. J.
National Vacuum Platers, Inc., 2641 E. Hagert St., Philadelphia, Pa.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Pacific Universal Prods. Corp., 168 Vista Ave., Pasadena, Calif.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Tickle, A. Engineering Works, Inc., 21 Delevan St., Brooklyn, N. Y.
Union Carbide Corp., Materials Sys. Div., Coatings Service, 1245 S. Main St., Indianapolis, Ind.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.

SERVICES, MOLDING

Booker & Wallestad, 1202 South 5th St., Hopkins, Minn. ..... p 1237
Thermotech Coil Forms & Components Div., 1202 S. 5th St., Hopkins, Minn. p 1237
Thermotech Inds., Inc., 1202 South 5th St., Hopkins, Minn. ..... p 1237
Thermotech Plastics Co., 1202 South 5th St., Hopkins, Minn. .. p 1237
Wilcox Prods. Co., 1202 South 5th St., Hopkins, Minn. ..... p 1237

SERVICES, PLASTICS FABRICATION

AEL Inc., P.O. Box 552, Lansdale, Pa.
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y.
Electronic Hardware Corp., 180-08 Liberty Ave., Jamaica, N. Y. .. p 1171
Globe Plastics, 1342 South Signal Dr., Pomona, Calif. ..... p 2514
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. ..... p 1797
Paraham Inc., 3017 E. Las Hermanas St., Compton, Cal.
Reynolds Industries, Inc., Box P-850, Marina Del Ray, Cal. ..... p 981
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
United Prods. Co., 451 S. Jefferson St., Orange, N. J. ..... p 747
Ace Plastic Co., Inc., 91-54 Van Wyck Expwy., Jamaica, N. Y.
Acme Mfg. & Gasket Co., 738 North 41 St., Philadelphia, Pa.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Atmar Engraving Co., Inc., 91-31 121 St., Richmond Hill, N. Y.
Aubin, A. E. Co., Box 29, Glastonbury, Conn.
Bell Co., Inc., Box 92, 106 Morrow Ave., Trussville, Ala.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Best Mfg. Co., 3214 Troost, Kansas City, Mo.
Bodnar Prods. Corp., 30 Grove St., New Rochelle, N. Y.
Boonton Molding Co., Inc., 300 Myrtle Ave., Boonton, N. J.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Celestial Components, Inc., Box 4035, Covina, Calif.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Comco Plastics, Inc., 98-36 C Jamaica Ave., Richmond Hill, N. Y.
Conap, Inc., 184 E. Union St., Allegany, N. Y.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Dynaloy, Inc., 7 Great Meadow La., Hanover, N. J.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Emeloid Co., Inc., 1239 Central Ave., Hillside, N. J.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epoxy Products Co., 119 Coit St., Irvington, N. J.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Federal Machine Co., Inc., 807 Garfield Ave., Jersey City, N. J.
Felsenthal Instruments Co., 7450 W. Wilson Ave., Chicago, Ill.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher & Crome, 2427 N. Mascher St., Philadelphia, Pa.
Fluoro Plastics Inc., G & Venango Sts., Philadelphia, Pa.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Hampden Mfg. Co., Inc., Box 10, Thompsonville, Conn.
Haveg Inds., Inc., Precision Molding Div., 336 Weir St., Taunton, Mass.
Hermes Plastics, Inc., 20 Cooper Square, New York, N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.

SERVICES, RENTAL, ELECTRONIC

Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Isolation Products, 2387 Adele Ave., Mountain View, Calif.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Lockheed Aircraft Service Co., Ontario Intl. Airport, Ontario, Calif.
M-T Electronics Co., 536 Lewelling Blvd., San Leandro, Calif.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Mecca, P.O. Box 36393, Houston, Tex.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Midwest Molding & Mfg. Co., Gurnee, Ill.
Miller, R. A. Inds., Inc., 1525 Marion, Grand Haven, Mich.
Molded Fiber Glass Cos., 4401 Benefit Ave., Ashtabula, Ohio
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
Ny-Glass, Inc., 7314 E. Madison St., Paramount, Calif.
Nichols Prods. Co., 325 W. Main St., Moorestown, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Panelgraphic Corp., Box 254, Caldwell, N. J.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Pantographic Reproduction Co., 35 Elm Ridge Terr., Newington, Conn.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Rostone Corp., Route 52 S., Lafayette, Ind.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Sparta Mfg. Co., Dover, Ohio
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Spruce Pine Mica Co., Inc., 108 Greenwood Rd., Spruce Pine, N. C.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tri-Dex Co., 2146 E. Main St., Visalia, Calif.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
U. S. Dielectric, Inc., 16 Fantasia Dr., Worcester, Mass.
Unex Labs., Inc., 321 Newburyport Tpke., Hathorne, Mass.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Vichek Plastics Co., Middlefield, Ohio
Warren Components Corp., Box 848, Warren, Pa.
Western Coil & Electrical Co., 215 State St., Racine, Wisc.
Westlake Plastics Co., 133 W. Lenni Rd., Lenni, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Winzeler Mfg. & Tool Co., 7355 W. Wilson Ave., Chicago, Ill.
Zurn Inds., 12th & Plum St., Erie, Pa.

SERVICES, PLATING

G T I Corporation, 310 Chestnut St., Meadville, Pa.
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
All Star Prods., Inc., P.O. Drawer 487, Defiance, Ohio
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Bron-Shoe Co., 1313 Alum Creek Dr., Columbus, Ohio
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Burton Research Labs., 11240 Playa Ct., Culver City, Calif.
Cambridge Plating Co., Inc., 39 Hittinger St., Belmont, Mass.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Electrochemical Industries, Inc., 665 Cambridge St., Worcester, Mass.
Etchit Inc., 643 - 13th Ave., S., Hopkins, Minn.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Ford Inds., Inc., Box 06459, Portland, Ore.
General RF Fittings, Box 278, Port Salerno, Fla.
Harper-Leader, Inc., 1046 S. Main St., Waterbury, Conn.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
M-W Labs., Inc., 1824 Milwaukee Ave., Chicago, Ill.
Materials Technology, Inc., Box 187, Somerset, N. J.
Merit Plating Co., Inc., 212 East 141st St., Bronx, N. Y.
Metaplast Electrochemicals Corp., 915 Westchester Ave., Bronx, N. Y.
Platronics, Inc., 500 Commerce Rd., Linden, N. J.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Sifco Metachemical, 935 East 63rd St., Cleveland, Ohio
Union Carbide Corp., Materials Sys. Div., Coatings Service, 1245 S. Main St., Indianapolis, Ind.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.

SERVICES, QUALIFICATION—SEE SERVICES, ENVIRONMENTAL TESTING

SERVICES, RENTAL, ELECTRONIC INSTRUMENTATION

Cohu Electronics Inc., Box 623, San Diego, Calif.
Continental Leasing Co., Inc., 30 Park Ave., Arlington, Mass. .. p 1361
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Electro-Mechanics Co., Box 1546, Austin, Tex.
Electronic Science Services Co., Inc., 210 Michael Dr., Syosset, N. Y.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.

SERVICES, RENTAL, ELECTRONIC (Cont'd)

Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
National Astro Labs., Inc., 2201 Hollywood Way, Burbank, Calif.
New York Testing Labs, Inc., 81 Urban Ave., Westbury, N. Y.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Rental Electronics Corp., 15203 Frederick Rd., Rockville, Md.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
3M Co., 3M Center, St. Paul, Minn.
Tucker Elctrns. Co., Box 1050, 326 Kirby St., Garland, Tex.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.
Wiss Janney Elstner & Assoc., 330 Pfingsten Rd., Northbrook, Ill.

SERVICES, RFI MEASURING—SEE SERVICES, ELECTRICAL MEASUREMENT

SERVICES, SILK SCREENING

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. ... p 1636
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Mac Panel Co., Box 5027, High Point, N. C.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Atmar Engraving Co., Inc., 91-31 121 St., Richmond Hill, N. Y.
Avionics Ltd., Box 200, Niagara-on-the-Lake, Ont., Can.
Bodnar Prods. Corp., 30 Grove St., New Rochelle, N. Y.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Conductorlab, Inc., Box 222, Groton, Mass.
Cook, T. N., Inc., 3520 E. Fulton St., Columbus, Ohio
Decalcraft U. S. A., Rte. 309, Hatfield, Pa.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Douglas Electronics, Inc., 718 Marina Blvd., San Leandro, Calif.
Dura Engraving Corp., 133 West 20th St., New York, N. Y.
Dura Plastics of N. Y., Inc., 49 Richmondville Ave., Westport, Conn.
Duralith Corp., 1025 Race St., Philadelphia, Pa.
Edwards, T. J., Inc., 25 Williams St., Boston, Mass.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Eljay Corp., 9062 Old Annapolis Rd., Columbia, Md.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Emeloid Co., Inc., 1239 Central Ave., Hillside, N. J.
Engineered Plastics, Inc., 213 Chase St., Gibsonville, N. C.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
GM Nameplate, Inc., 2040 15th Ave., W., Seattle, Wash.
Hampden Mfg. Co., Inc., Box 10, Thompsonville, Conn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
M-T Electronics Co., 536 Lewelling Blvd., San Leandro, Calif.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Motson, J. F. Co., 1717 Bethlehem Pike, Flourtown, Pa.
N/P Co., Inc., Box 127, Temple City, Calif.
Norgus Silk Screen Co., Inc., 58 Sylvan Ave., Dept. E, Clifton, N. J.
Ogden Technology Labs, Inc., 100 Smith St., Farmingdale, N. Y.
Panelgraphic Corp., Box 254, Caldwell, N. J.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville, Ill.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Photo Chemical Prods. of Calif., 1715 Berkeley, Santa Monica, Calif.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
Sillcocks-Miller Co., 350 W. Parker Ave., Maplewood, N. J.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Techron Corp., 20 Simmons St., Boston, Mass.
Tri-Tronics Lab., Inc., Box 338, Euless, Tex.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.
Western Coil & Electrical Co., 215 State St., Racine, Wisc.
Wire Cloth Enterprises, Inc., 130-132 Gamma Dr., Pittsburgh, Pa.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

SERVICES, TOWER ERECTION & MAINTENANCE

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Advance Industries, 2301 Bridgeport Dr., Sioux City, Iowa
American Tower Co., Box 29, Shelby, Ohio
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
E-Z Way Products, Inc., P.O. Box 17196, Tampa, Fla.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kline Iron & Steel Co., Inc., Box 1013, Columbia, S. C.
Master Tower Co., 121 Main St., Sioux City, Iowa
Microflect Co., 3575 25th, S. E., Salem, Ore.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Stainless, Inc., 3rd St., N. Wales, Pa.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Trylon, Inc., Elverson, Pa.
Victor Comptometer Corp., 3900 N. Rockwell St., Chicago, Ill.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.

SERVICES, TRAINING AIDS

Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
AAI Corp., Box 6767, Baltimore, Md.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Auricord, 35-41 29th St., Long Island City, N. Y.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Collins Radio Co., Dallas, Texas
Digiac Corp., Ames Ct., Plainview, N. Y.
Electraid, Inc., Box 53, Cambridge, Mass.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Film Assocs., Inc., 4600 S. Dixie Hwy., Dayton, Ohio
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Jacri Inds., Box 265, Seaford, N. Y.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Ogden Technology Labs, Inc., 100 Smith St., Farmingdale, N. Y.
RCA Service Co., Div. Radio Corp of America, Camden, N. J.
Rel-Qual Assocs., 18 Hamilton St., Bound Brook, N. J.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Sands, L. G. & Assocs., Inc., 250 Park Ave., New York, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.

SERVICES, VIBRATION SURVEYS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Detroit Testing Lab. Inc., 12800 Northend Ave., Detroit, Mich.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Research & Dev. Corp., 6150 Huntley Rd., Worthington, Ohio
Lockheed Electronics Co., Route 22, Watchung, N. J.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
New York Testing Labs, Inc., 81 Urban Ave., Westbury, N. Y.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Ogden Technology Labs, Inc., 100 Smith St., Farmingdale, N. Y.
U S Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.
Westinghouse Elec. Corp., Industrial Group, Box 868, Pittsburgh, Pa.
Wiss Janney Elstner & Assoc., 330 Pfingsten Rd., Northbrook, Ill.
Wyle Labs., 128 Maryland St., El Segundo, Calif.

SERVICES, WAVEFORM ANALYSIS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
HRB-Singer, Inc., Science Park, State College, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Ogden Technology Labs, Inc., 100 Smith St., Farmingdale, N. Y.
Petty Geophysical Engrg. Co., 700 Tower Bldg., San Antonio, Tex.
Signatron, Inc., 594 Marrett Rd., Lexington, Mass.
Spectra-Elctrns., Inc., 923 N. San Antonio Rd., Los Altos, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

SERVICES, WIRE CUTTING & STRIPPING

Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Drake Mfg. Co., 4626 N. Olcott Ave., Harwood Hgts., Ill.
Eraser Co. Inc., Box 1342, Syracuse, N. Y. ..... p 2150
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Mac Panel Co., Box 5027, High Point, N. C.
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Auricord, 35-41 29th St., Long Island City, N. Y.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Broxlea Ltd., Broxbourne, Herts, Eng.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Electro Specialties Corp., 370 Park Ave., Worcester, Mass.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
Glar-Ban Corp., 496 Kennedy Rd., Buffalo, N. Y.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Hi-Lo Mfg. Corp., 1122 W. Newport, Chicago, Ill.
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Jansen Electronics Mfg., Inc., 2233 University Ave., St. Paul, Minn.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Keiser's Industries, Inc., Laumau St., Mt. Holly Springs, Pa.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
M-T Electronics Co., 536 Lewelling Blvd., San Leandro, Calif.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Merco Prods. Co., Inc., 1298 Bethel Dr., Eugene, Ore.
Mercury Elctrns. Corp., 339 E. Cottage Pl., York, Pa.
Mid-West Metal Products, Inc., 450 E. Donovan Rd., Kansas City, Kans.
Mutron Corp., 646 Summer St., Brockton, Mass.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Paraplegics Mfg. Co., Inc., 304 N. York Rd., Bensenville Ill.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.
Perfection Electronics, Inc., 73-03 Grand Ave., Maspeth, N. Y.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Ram Meter, Inc., 1100 Hilton Rd., Ferndale, Mich.
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Tricraft Products Corp., 1124 W. Newport, Chicago, Ill.
Varied Industrial Products, Inc., 445 Fifth Ave., Paterson, N. J.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
Western Elctrn. Inds., 72 N. Broadway, Yonkers, N. Y.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Wiring Services Co., 17281 Eastman St., Santa Ana, Calif.

SERVICES, WIRE WRAPPING

Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 899
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Broxlea Ltd., Broxbourne, Herts, Eng.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Electro Specialties Corp., 370 Park Ave., Worcester, Mass.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Ostby & Barton Co., Box 6267, Providence, R. I.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Varied Industrial Products, Inc., 445 Fifth Ave., Paterson, N. J.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
Western Elctrn. Inds., 72 N. Broadway, Yonkers, N. Y.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Wiring Services Co., 17281 Eastman St., Santa Ana, Calif.

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SERVO MOTORS—SEE MOTORS, SERVO

SERVO MULTIPLIERS—SEE MULTIPLIERS, SERVO

SERVO REPEATERS—SEE REPEATERS, SERVO

SERVO SYSTEMS

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 2664
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Dynamic Instrument Corp., Dept. EEM, 115 E. Bethpage Rd., Plainview, N. Y.
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 2667
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y.
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Sterling Instr., 76 E. Second St., Mineola, N. Y.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Theta Instrument Corp., Fairfield, N. J. ..... p 1512
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 2675-2677
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2683
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Chain & Cable Co., Box 1629, Waterbury, Conn.
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Aviation Elec., Ltd., 200 Laurentien Blvd., Montreal, Que., Can.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Collins Radio Co., Dallas, Texas
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Data Disc, Inc., Display Div., 2626 Hanover St., Palo Alto, Calif.

EMR Div., Box 223, Princeton, N. J.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Goerz Optical Co., Inc., 301 Alpha Dr., Pittsburgh, Pa.
Goldak Co., Inc., 1101-A Air Way, Glendale, Calif.
Golden, I. Corp., 1054 38th St., Brooklyn, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Henschel Corp., 14 Cedar St., Amesbury, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
Inland Motor Corp. of Va., 501 First St., Radford, Va.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kinetic Instr. Co., 1072 Linwood St., Brooklyn, N. Y.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Power Equip. Div., 17600 Broadway, Cleveland, Ohio
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Moog, Inc., Box 8, E. Aurora, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Sequential Information Sys., Inc., 66 Saw Mill River Rd., Elmsford, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solatron Enterprises, 421 E. Beach Ave., Inglewood, Calif.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sweo Assocs. Inc., 465 Convention Way, Redwood City, Calif.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Warner Electric Brake & Clutch Co., Beloit, Wisc.
Westamp, Inc., 1542 15th St., Santa Monica, Calif.
Weston Hydraulics, 7500 Tyrone Ave., Van Nuys, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

SERVO TESTERS—SEE TESTERS, SERVO

SHAFT COUPLINGS—SEE COUPLINGS, SHAFT

SHAFT ENCODERS—SEE ENCODERS, SHAFT POSITION

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Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2670
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1174
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y.
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Britec Ltd., 17 Charing Cross Rd., London, W.C. 2, Eng.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Stow Mfg. Co., 101 Shear St., Binghamton, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Zephyr Mfg. Co., 201 Hindry Ave., Box 759, Inglewood, Calif.

SHAFTS, RIGID—ALSO SEE COUPLINGS, SHAFT

Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dynamic Gear Co., Inc., 4571 N.W. 8th Ave., Ft. Lauderdale, Fla.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Torrington Co., Box 1008, Torrington, Conn.

SHAFTS, THREADED

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Helitronics Corp., 916 McCarter Hwy., Newark, N. J. ..... p 1220
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Abbott Products, Inc., 14-10 123rd St., College Point, N. Y.
Advance Gear & Machine Corp., 5851 Holmes Ave., Los Angeles, Calif.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Star Stainless Screw Co., Box 222, Totowa, N. J.
Torrington Co., Box 1008, Torrington, Conn.

SHAKE TABLES—SEE VIBRATION TEST SYSTEMS

SHELLS, ENCAPSULATION—SEE CUPS, ENCAPSULATION

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Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1213
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Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Allegheny Ludlum Steel Co., H. W. Oliver Bldg., Pittsburgh, Pa.
Amuneal Mfg. Corp., 2042 W. Jefferson St., Philadelphia, Pa.
Celco, 70 Constantine Dr., Mahwah, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.

SHIELDS, COIL

Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. .... p 724, 725
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1226
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
United Transformer Co., 150 Varick St., New York, N. Y.
Barnes Metal Products Co., 4425 West 16th St., Chicago, Ill.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Mirro Aluminum Co., Manitowoc, Wisc.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.

SHIELDS, CORONA

Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Isolation Products, 2387 Adele Ave., Mountain View, Calif.

SHIELDS, ELECTROSTATIC—SEE SHIELDS, TUBE

SHIELDS, HEAT—SEE TUBE HEAT DISSIPATORS

SHIELDS, INDICATOR LIGHT

Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.

SHIELDS, MAGNETIC

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1213
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J.
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. ... p 1221
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
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Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. .... p 1224, 1225
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
United Transformer Co., 150 Varick St., New York, N. Y.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
Allegheny Ludlum Steel Co., H. W. Oliver Bldg., Pittsburgh, Pa.
Amuneal Mfg. Corp., 2042 W. Jefferson St., Philadelphia, Pa.
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Chemical Micro Milling Co., Box 770, Camden, N. J.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Eldre Components, Inc., 1239 University Ave., Rochester, N. Y.
Electro-Nuclear Labs., Inc., 115 Independence Dr., Menlo Park, Calif.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Ray Proof Corp., Keeler Ave., Norwalk, Conn.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Suckle Corp., Suckle & National Hwys., Pennsauken, N. J.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

SHIELDS, NUCLEAR RADIATION

Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
American Nuclear Corp., Box 426, Oak Ridge, Tenn.

SHIELDS, TUBE

Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brooks & Perkins, Inc., 1950 W. Fort St., Detroit, Mich.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Kennametal Inc., Lloyd Ave., Latrobe, Pa.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Nuclear Data, Inc., 100 W. Golf Rd., Palatine, Ill.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Penberthy Div., 6701 Maynard, S., Seattle, Wash.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Ray Proof Corp., Keeler Ave., Norwalk, Conn.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.

SHIELDS, R-F— ALSO SEE GASKETS, SHIELDING, R-F

APM-Hexseal Corp., 44 Honeck St., Englewood, N. J. ..... p 2687
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Chomerics, Inc., 85 Mystic St., Arlington, Mass. .. p 1639, 1641, 1642
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Instrument Specialties Co., Inc., 254 Bergen Blvd., Little Falls, N. J.
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
McLean Engineering Labs, 70 Washington Rd., Princeton Junction, N. J. p 1253
Metex Corp., 970 New Durham Rd., Edison, N. J. p 1229, 1230, 1232, 1233
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Allaco Prods., 130 Wood Rd., Braintree, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Custom Components, Inc., P.O. Box 248, Caldwell, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Electro Magnetic Filter Co., 231 S. Whisman Rd., Mountain View, Calif.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Glenair, Inc., 1211 Air Way, Glendale, Calif.
Hoffman Engrg. Co., 9th & Tyler Sts., Anoka, Minn.
Kentucky Metals, Inc., 3104 S. Preston St., Louisville, Ky.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Lindgren, E. A. & Assoc., 4515-17 N. Ravenswood Ave., Chicago, Ill.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Ray Proof Corp., Keeler Ave., Norwalk, Conn.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Shielding Corp., 345 New Albany Rd., Morristown, N. J.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
3M Co., 3M Center, St. Paul, Minn.
Topatron, Inc., Box 967, Costa Mesa, Calif.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

SHIELDS, SWITCH

Metex Corp., 970 New Durham Rd., Edison, N. J. ..... p 1229
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.

SHIELDS, TRANSFORMER

Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1213
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
G-L Industries, Inc., G-L Elctrn. Div., 300 Harvard Ave., Westville, N. J.
Inter-Technical Group Inc., Box 23, Irvington-on-Hudson, N. Y. .. p 1221
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
United Transformer Co., 150 Varick St., New York, N. Y.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Allegheny Ludlum Steel Co., H. W. Oliver Bldg., Pittsburgh, Pa.
Amuneal Mfg. Corp., 2042 W. Jefferson St., Philadelphia, Pa.
Barnes Metal Products Co., 4425 West 16th St., Chicago, Ill.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Lectro Magnetics Inc., 6056 W. Jefferson Blvd., Los Angeles, Cal.
MSL Steel Co., 3912 W. McLean Ave., Chicago, Ill.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.

SHIELDS, TUBE

Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. .... p 838
Arnold Engineering Co., Box G, Marengo, Ill. ..... p 1213
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520

SHIELDS, TUBE (Cont'd)

Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y. p 2911
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. . . p 1226
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. . . . . . p 1224
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Ainslie Corp., 531 Pond St., S. Braintree, Mass.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Amuneal Mfg. Corp., 2042 W. Jefferson St., Philadelphia, Pa.
Barnes Metal Products Co., 4425 West 16th St., Chicago, Ill.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Collins Radio Co., Dallas, Texas
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Kinetron Corp., 1416 Roller Rd., Asbury Park, N. J.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Mirro Aluminum Co., Manitowoc, Wisc.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Waterbury Pressed Metal Co., 407 Brookside Rd., Waterbury, Conn.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

SHIELDS, WIRE—SEE BRAID, CABLE & WIRE SHIELDING

SHIFTERS, PHASE, MICROWAVE

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. . . . . . p 1646
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1664
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Measurement Specialties Lab., Inc., 14532 Erwin St., Van Nuys, Calif. p 1685
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Waveline Inc., Box 718, West Caldwell, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Addington Labs., Inc., 1043 DiGiulio Ave., Santa Clark, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

SHIFTERS, PHASE, R-F

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass. . . . . . p 1285
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. . . . . . p 1658
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio . . . . . p 1367
Narda Microwave Corp., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. . . . . p 1046
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Collins Radio Co., Dallas, Texas
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gremar, Inc., 10 Micro Dr., Woburn, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Nilsen Mfg. Co., Box 127, 920 Hwy. 27, Haines City, Fla.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

SHIFTERS, PHASE 60/400 CPS

Aritech Corp., 130 Lincoln St., Brighton, Mass. . . . . . p 1285
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio . . . . . p 1367
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Theta Instrument Corp., Fairfield, N. J. . . . . . p 1514
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
States Co., 19 New Park Ave., Hartford, Conn.

SHIPPING CONTAINERS—SEE CONTAINERS, METAL & FIBERGLASS SHIPPING (RE-USABLE)

SHOCK MOUNTS—SEE MOUNTS, SHOCK

SHOCK TESTERS—SEE TESTERS, SHOCK

SHORTING BARS—SEE BARS, SHORTING

SHREDDERS, PAPER—SEE PAPER SHREDDERS

SHRINKABLE PLASTICS & ELASTOMERS—SEE CAPS, FORMS & TAPES, HEAT SHRINKABLE—ALSO SEE TUBING, HEAT SHRINKABLE

SHUNTS, METER

Electronic Precision Components Corp., 2 Brookdale Pl., Mt. Vernon, N. Y. p 2375
Empro Mfg. Co., Inc., Box 26064, Indianapolis, Ind. . . . . . p 1382
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1389
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. . . . . . p 1398
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1350, 1351
Janco Corp., 3111 Winona Ave., Burbank, Calif. . . . . . p 2738
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. . . . . p 2397
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
Tel Labs, Inc., 1050-1060 Second St., Manchester, N. H.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio . . . . . p 1528
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Empro Mfg. Co., Inc., Box 26064, Indianapolis, Ind.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Ram Meter, Inc., 1100 Hilton Rd., Ferndale, Mich.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

SHUTTERS, MICROWAVE

Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Waveline Inc., Box 718, West Caldwell, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Magnion, Inc., 144 Middlesex Tpke., Burlington, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

SIGNAL AVERAGERS—SEE AVERAGERS, SIGNAL

SIGNAL CONDITIONERS & EQUIPMENT

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. . . . . . p 2838
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. . . . p 762, 1328
California Instruments Corp., 3511 Midway Dr., San Diego, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio p 1563–1568
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. . . p 522, 776
Ectron Corp., 8070 Engineer Rd., San Diego, Calif. . . . . . p 527
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. . . . . . p 2470
Fifth Dimension Inc., Box 483, Princeton, N. J.
Gamma Scientific, Inc., Dept. 301, 2165 Kurtz St., San Diego, Calif. p 1778
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif. p 2790
Honeywell Test Instruments Div., Box 5227, Denver, Colo. . . . . p 1403
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass.
INCOR Instrumentation Amplifiers & Supplies, Inc., 29 Newtown Rd., Plainview, N. Y. . . . . . p 1404
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. . . . . . p 532, 533
London Co., 811 Sharon Dr., Westlake, Ohio
Natel Elctrn. Industries, Inc., 7129 Gerald Ave., Van Nuys, Calif. p 789
Newport Labs., Inc., 630 E. Young St., Santa Ana, Calif.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio . . . . . p 1455
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Princeton Applied Research Corp., Box 565, Princeton, N. J. . . . . p 1471
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal. . . . . p 2793
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. . . . . p 2794, 2795
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. . . . . . p 1248
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. . . p 1521
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
B & F Instruments Inc., Cornwells Hgts., Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bay Laboratories, Inc., 20160 Center Ridge Rd., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Bristol Co., Box 1790, Waterbury, Conn.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Defense Elctrns., Inc., Rockville, Md.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dynisco, Div. Microdot Inc., 20 S. West Park, Westwood, Mass.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EDP Corp., Box 6485, Orlando, Fla.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Foxboro, Foxboro, Mass.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Gilway Co., Electronics Div., Box 584, Newburyport, Mass.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
MB Electronics, Box 1825, New Haven, Conn.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Micro-Strain, Inc., Spring City, Pa.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Novatronics, Inc., Box 878, Pompano Beach, Fla.
Nytron, Inc., 795 San Antonio Rd., Palo Alto, Calif.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.

Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

SIGNAL TRACERS—SEE TESTERS, SIGNAL TRACING

SILICA, FUSED

Amersil, Inc., 685 Ramsey Ave., Hillside, N. J. ..... p 1638
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Dynasil Corp. of America, Box D, Berlin, N. J.
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
S & S Optical Co., Inc., 7812 Stellhorn Rd., Ft. Wayne, Ind.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co.,
Rte. 202 & Change Bridge Rd., Montville, N. J.

SILICON SEMICONDUCTORS—SEE DIODES: TRANSISTORS

SILICONE INSULATORS & INSULATION—SEE INSULATING COMPOUNDS, SILICONE

SILICONE RUBBER—SEE RUBBER, SILICONE

SILK SCREEN PROCESSING SERVICES—SEE SERVICES, SILK SCREENING

SIMULATORS, LINE

Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1155
Seg Electronics Div., 2589 Pitkin Ave., Brooklyn, N. Y. ... p 1308, 1309
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Burtek, Inc., Box 1677, Tulsa, Okla.
Curtiss-Wright Corp., Electrons Div., 35 Market St., E. Paterson, N. J.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.

SIMULATORS, MOTION

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Andersen Laboratories, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. p 1137
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Icon Corp., 156 Sixth St., Cambridge, Mass.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
AAI Corp., Box 6767, Baltimore, Md.
Accuride Div., 12311 S. Shoemaker Ave., Santa Fe Springs, Calif.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Curtiss-Wright Corp., Electrons Div., 35 Market St., E. Paterson, N. J.
EMR Div., Box 223, Princeton, N. J.
Goerz Optical Co., Inc., 301 Alpha Dr., Pittsburgh, Pa.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
MB Electronics, Box 1825, New Haven, Conn.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

SIMULATORS, RADAR

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1354
Computer Devices Corp., 63 Austin Blvd., Commack, N. Y. .... p 1155
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif.
Elgenco Inc., 1550 Euclid, Santa Monica, Calif.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
AAI Corp., Box 6767, Baltimore, Md.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Curtiss-Wright Corp., Electrons Div., 35 Market St., E. Paterson, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
HRB-Singer, Inc., Science Park, State College, Pa.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Miller Assocs., Mercersburg Academy, Mercersburg, Pa.
Nano Fast, Inc., 416 W. Erie, Chicago, Ill.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

SIMULATORS, SOLAR—SEE SOLAR SIMULATORS

SIMULATORS & TRAINERS

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1329
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y. ..... p 2666
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Weston-Transicoil Components Div., Worcester, Pa.
AAI Corp., Box 6767, Baltimore, Md.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Analog General Corp., 7 Neil Ct., Oceanside, N. Y.
Arkay International, 2372-82 Linden Blvd., Brooklyn, N. Y.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Burtek, Inc., Box 1677, Tulsa, Okla.
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Curtiss-Wright Corp., Electrons Div., 35 Market St., E. Paterson, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Digiac Corp., Ames Ct., Plainview, N. Y.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
EMR Div., Box 223, Princeton, N. J.
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Nord Instr. 422 Broad St., Salem, Va.
Photomechanisms Div., Inc., 15 Stepar Pl., Huntington Sta., N. Y.
Plasmadyne, 3839 S. Main, Santa Ana, Calif.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Zeltex Inc., 1000 Chalomar Rd., Concord, Calif.

SINKS, HEAT—SEE TRANSITOR & DIODE HEAT DISSIPATORS: TUBE HEAT DISSIPATORS—ALSO SEE HEAT SINKS, SOLDERING

SLEEVES—SEE TUBING

SLIDE RULES (CIRCUITRY COMPUTING)

EMR Div., Box 223, Princeton, N. J.
Pickett Inds., Inc., Box 1515, Santa Barbara, Calif.
Printloid, Inc., 10-10 44th Ave., Long Island City, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

SLIDES, CABINET & CHASSIS

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif. .. p 1827
Amco Engineering Co., 7333 W. Ainslie St., Chicago, Ill.
Cabtron Corp., 1057 W. Grand Ave., Chicago, Ill.
Chassis-Trak, Inc., 525 S. Webster Ave., Indianapolis, Ind. .... p 578
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn. ..... p 1917
GC Electronics, Dept. 10-1, 400 S. Wyman St., Rockford, Ill.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2027, 2028
Power/Mate Corp., 163 Clay St., Hackensack, N. J. ..... p 2074
Premier Metal Prods. Co., 337 Manida St., Bronx, N. Y. ..... p 585
Scanbe Mfg. Corp., 1161 Monterey Pass Rd., Monterey Park, Calif.
Stantron, Box 9158 VC, N. Hollywood, Calif. ..... p 591
Techmar Corp., 2232 S. Cotner Ave., Los Angeles, Calif. ..... p 592
Vent-Rak Inc., 525 S. Webster Ave., Indianapolis, Ind. ..... p 594
Wyco Metal Products, 6914 Beck Ave., N. Hollywood, Calif. .... p 591
Accuride Div., 12311 S. Shoemaker Ave., Santa Fe Springs, Calif.
Acro Products Corp., 1410 S. Aberdeen St., Chicago, Ill.
Barnes Engineering Co., 3012 S. Halladay St., Santa Ana, Calif.
Donnelly Manufacturing Co., P. O. Box 71, Waltham, Mass.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Grant Pulley & Hardware Corp., 525 High St., W. Nyack, N. Y.
Gries Reproducer Co., 162 Beechwood Ave., New Rochelle, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.

SOCKET, ADAPTERS

Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Ingersoll Products, 1000 West 120th St., Chicago, Ill.
Jonathan Mfg. Co., 1101 S. Acacia Ave., Fullerton, Calif.
Par-Metal Products Div., 32-62 49th St., Long Island City, N. Y.
Standard Record Mfg. Co., 11411 Cumpston St., N. Hollywood, Calif.
Watson Mfg. Co., Inc., 800 Taylor St., Jamestown, N. Y.

SLIDING LOADS, MICROWAVE

Waveline Inc., Box 718, West Caldwell, N. J. ..... p 1720
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.

SLIP & SHAKER TABLES—SEE VIBRATION TEST SYSTEMS

SLIP RINGS & ASSEMBLIES

Airflyte Electronics Co., Box 207, Bayonne, N. J. ..... p 1722
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Electronic Specialty Co., 18900 N. E. Sandy Blvd., Portland, Ore.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Fabricast Inc., 9835 Alpaca St., South El Monte, Calif. ... p 1730, 1731
Graphite Metallizing Corp., 1036 Nepperhan Ave., Yonkers, N. Y. p 1740
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Aero-Motive Mfg. Co., P.O. Box 2678, Kalamazoo, Mich.
American Circuit-Tronics Corp., 723 E. Ten Mile Rd., Royal Oak, Mich.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
Collectron Corp., 304 East 45th St., New York, N. Y.
Electro-Miniatures Corp., 600 Huyler St., S. Hackensack, N. J.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Hansen Mfg. Co., Inc., Box 23, Princeton, Ind.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Industrial Electric Reels Inc., 1509 Chicago St., Omaha, Neb.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Lebow Assocs., Inc., 21820 Wyoming Ave., Oak Park, Mich.
Meridian Lab, Inc., 2611 University Ave., Madison, Wisc.
Michigan Scientific Corp., 730 Bellevue Ave., Milford, Mich.
Midwest Molding & Mfg. Co., Gurnee, Ill.
Nippert Electric Products Co., 825 Pittsburgh Dr., Delaware, Ohio
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Rostone Corp., Route 52 S., Lafayette, Ind.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superior Carbon Prods., Inc., 9115 George Ave., Cleveland, Ohio
Toledo Commutator Co., Owosso, Mich.
Tricon Mfg. Co., 2325 Wisconsin Ave., Downer Grove, Ill.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Wendon Co., Inc., 17 Irving Ave., Stamford, Conn.

SLOTTED LINES, MICROWAVE

Narda Microwave Corp., Plainview, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Nichols Prods. Co., 325 W. Main St., Moorestown, N. J.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.

SMITH CHART IMPEDANCE PLOTTERS, AUTOMATIC

Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

SMOKE INDICATORS—SEE FIRE DETECTION & FIGHTING EQUIPMENT

SNIPS—SEE WIRE CUTTERS

SOCKET ADAPTERS

Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
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Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 892
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. .. p 941
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Morse, Frank W. Co., 354 Congress St., Boston, Mass.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.

SOCKETS, BREADBOARD

Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa. ..... p 876
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. .. p 941
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Douglas Electronics, Inc., 718 Marina Blvd., San Leandro, Calif.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electraid, Inc., Box 53, Cambridge, Mass.
IFE Div., Box 4265, E. Providence, R. I.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

SOCKETS, CAPACITOR

Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.

SOCKETS, CRYSTAL

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. ... p 837
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 893
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 2913
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
DonMar Prods., Inc., Box 10125, Denver, Colo.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.

SOCKETS, DIODE

Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa. ..... p 876
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif. p 889
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill. ..... p 889
Cinch-Monadnock, 18300 E. Valley Blvd., City of Industry, Calif. p 889
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn. ..... p 889
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 893
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass. .. p 889
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 995
U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1002
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

SOCKETS, INTEGRATED CIRCUIT

AMP Incorporated, Box 3608, Harrisburg, Pa.
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa. ..... p 876
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif. p 889
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill. ..... p 889
Cinch-Monadnock, 18300 E. Valley Blvd., City of Industry, Calif. p 889
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn. ..... p 889
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I. ..... p 901
Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass. .. p 889
Robinson-Nugent, Inc., 800 E. 8th St., New Albany, Ind. ..... p 977
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas ..... p 2628
U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1002
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electraid, Inc., Box 53, Cambridge, Mass.
IFE Div., Box 4265, E. Providence, R. I.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.

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Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. ..... p 2707
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Info-Lite, Cartelli Technology Inc., 45-12 108th St., Cornoa, N. Y.
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2735
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Kulka Electric Corp., Dept. E, Box 149, Mount Vernon, N. Y.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y. p 1800, 1801
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
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Abtronics, Inc., Box 712, Livermore, Calif.
Adronics, Inc., 271 Grove Ave., Verona, N. J.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Aeronautical Electric Co., Inc., 5656 Northwest Hwy., Chicago, Ill.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Chicago Miniature Lamp Works, 4433 Ravenswood Ave., Chicago, Ill.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Coastal Dynamics Corp., 219 Rose Ave., Venice, Calif.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Culver-Stearns Mfg. Co., 354 Franklin St., Worcester, Mass.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Genisco Technology Corp., 18435 Susana Rd., Compton, Calif.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Korry Mfg. Co., 223-8th Ave. N., Seattle, Wash.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Morse, Frank W. Co., 354 Congress St., Boston, Mass.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
Oshino Electric Lamp Works, Ltd., 2-5-2 Minami-Shinagawa, Shinagawa-ku, Tokyo, Japan
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Union Insulating Co., Box B, Parkersburg, W. Va.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

SOCKETS, MINIATURE & SUBMINIATURE—SEE SOCKETS, DIODE; IC; TRANSISTOR

SOCKETS, RELAY

AirBorn, Inc., 2618 Manana Dr., Dallas, Tex.
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Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Burndy Corporation, Richards Ave., Norwalk, Conn. ..... p 881
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Continental Connector Corp., 34-63 56th St., Woodside, N. Y.
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
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Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2244
Hi-G Industrial Prods., 112 Parkway Dr. S., Hauppauge, N. Y. ..... p 2271
Hughes Aircraft, Connecting Devices, Box H, Newport Beach, Calif.
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Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2312
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Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
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Transitron Elctrn. Corp., Precision Connector Div., 144 Addison St., E. Boston, Mass.
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Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Armel Electronics Inc., 1601-75th St., N. Bergen, N. J.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Branson Corporation, P.O. Box 845, Denville, N. J.
Curtis Develop. & Mfg. Co., 3278 N. 33rd St., Milwaukee, Wisc.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Photologic Co., 3704 E. Walnut Ave., Orange, Cal.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Viking Industries, Inc., 21001 Nordhoff St., Chatsworth, Calif.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.

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Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
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U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1002
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electraid, Inc., Box 53, Cambridge, Mass.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
IFE Div., Box 4265, E. Providence, R. I.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Photologic Co., 3704 E. Walnut Ave., Orange, Cal.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.

USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

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Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill. ..... p 889
Cinch-Monadnock, 18300 E. Valley Blvd., City of Industry, Calif. p 889
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Plaxial Cable Dept., 70 Jaconnet St., Newton Highlands, Mass. .. p 889
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Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
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Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 995
U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio p 1002, 1003
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

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Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 837, 838
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
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Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 2913
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif. .. p 941
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie Pa.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Livingston Electronic, Box 7, 56 Rte. 10, Hanover, N. J.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.

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Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
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Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
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Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
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Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Azimuth Electronics, Inc., Rte. 10, Box 463, Denville, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jettron Products Inc., 58 Route 10, Box 7, Hanover, N. J.
Livingston Electronic, Box 7, 56 Rte. 10, Hanover, N. J.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
National Electronics, Inc., Box 269, Geneva, Ill.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Penta Labs., 722 E. Gutierrez St., Santa Barbara, Calif.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.

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Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 892
Eby, H. H. Co., 4701 Germantown Ave., Philadelphia, Pa. ..... p 896
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.

SOLAR CELLS—SEE CELLS, PHOTOVOLTAIC

SOLAR SIMULATORS

Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Aerospace Controls Corp., 215 W. 131 St., Los Angeles, Calif.
Atlas Engineering Corp., 26 Custer St., W. Hartford, Conn.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Dynamic System Electronics Corp., Box 780, Tempe, Ariz.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ionics, Inc., Electronics Div., 65 Grove St., Watertown, Mass.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Research, Inc., Box 6164, Minneapolis, Minn.
Strong Electric Corp., Box 1003, Toledo, Ohio
Tinsley Labs, Inc., 2448 6th St., Berkeley, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

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Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Multicore Sales Corp., Dept. RY399, Westbury, N. Y. ..... p 2833
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
All-State Welding Alloys Co., Inc., P.O. Box 350, White Plains, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
American Smelting & Refining Co., 120 Broadway, New York, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Bow Solder Products Co. Inc., 25 Amsterdam St., Newark, N. J.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Chemtronics, Inc., 1260 Ralph Ave., Brooklyn, N. Y.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Dunton, M. W. Co., 350 Kinsley Ave., Providence, R. I.
Eutectic Corp., 40-40 172nd St., Flushing, N. Y.
Farrelloy Co., 1243 North 26 St., Philadelphia, Pa.
Gardiner Solder Co., 4820 S. Campbell Ave., Chicago, Ill.
Johnson Mfg. Co., Box 96, Princeton, Iowa
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Lenk Mfg. Co., Franklin, Ky.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Michael, Claude, Inc., 703 W. Ivy St., Glendale, Calif.
Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
New York Solder Co., 684 East 133rd St., Bronx, N. Y.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Rayline, Inc., 80 E. Old Country Rd., Mineola, N. Y.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
Stewart-Hall Chemical Corp., 222 Washington St., Mount Vernon, N. Y.
Unibraze Corp., 455 Knollwood Rd., White Plains, N. Y.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
Zeva Electric Corp., 11 Park Pl., New York, N. Y.

SOLDER POTS

American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich. .. p 2827
Blackstone Ultrasonics, Inc., 820 Center St., Sheffield, Pa.
Adcola Prods. Pty. Ltd., 22 Firth St., Doncaster 3108, Victoria, Australia
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Electric Soldering Iron Co., Inc., Box 247, Deep River, Conn.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rayclad Tubes, Inc., 300 Constitution Dr., Menlo Park, Calif.
Sta-Warm Electric Co., Inc., 116 N. Chestnut St., Ravenna, Ohio
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Ungar, 2701 W. El Segundo Blvd., Hawthorne, Calif.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Waage Electric, Inc., 820 Colfax Ave., Kenilworth, N. J.
Wenesco, Inc., Box 303 Northtown Sta., Chicago, Ill.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
Zeva Electric Corp., 11 Park Pl., New York, N. Y.

SOLDER PREFORMS (INCLUDING RINGS)—ALSO SEE PREFORMS, PRECIOUS METAL

Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Metex Corp., 970 New Durham Rd., Edison, N. J.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Amax Aluminum/Foil Prods., 6106 S. Broadway, St. Louis, Mo.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Bow Solder Products Co. Inc., 25 Amsterdam St., Newark, N. J.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.

SOLDERING EQUIP.

Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Gardiner Solder Co., 4820 S. Campbell Ave., Chicago, Ill.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Michael, Claude, Inc., 703 W. Ivy St., Glendale, Calif.
National Lead Co., 111 Broadway, New York, N. Y.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Semi Alloys, Inc., 20 N. MacQuesten Pkwy., Mt. Vernon, N. Y.

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Wall Manufacturing Co., Box 3349, Kinston, N. C. ..... p 2835
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Adcola Prods. Pty. Ltd., 22 Firth St., Doncaster 3108, Victoria, Australia
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Air-Vac Engineering Co., Inc., 100 Gulf St., Milford, Conn.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
By-Buk Co., 4326 W. Pico Blvd., Los Angeles, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Electric Soldering Iron Co., Inc., Box 247, Deep River, Conn.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
Enterprise Development Corp., 5149 East 65th St., Indianapolis, Ind.
Hexacon Electric Co., 161 W. Clay Ave., Roselle Park, N. J.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Michael, Claude, Inc., 703 W. Ivy St., Glendale, Calif.
Miller, L. C., Co., 717 Monterey Pass Rd., Monterey Park, Calif.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Newman, M. M. Corp., 85 Clifton Ave., Marblehead, Mass.
Ohmweve Co., Inc., 43 Darcy St., W. Hartford, Conn.
Photomation, Inc., 280 Polaris Ave., Mountain View, Calif.
Rayline, Inc., 80 E. Old Country Rd., Mineola, N. Y.
Scientific Inds., Inc., 15 Park St., Springfield, Mass.
Selas Corp. of America, Box 200, Dresher, Pa.
Superior Flux & Mfg. Co., 1536 St. Clair Ave., Cleveland, Ohio
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Thermal Industrial Prod., Box 405, Atchison, Kans.
Titchener, E. H. & Co., 8 Titchener Pl., Binghamton, N. Y.
Ungar, 2701 W. El Segundo Blvd., Hawthorne, Calif.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.
Wilder Mfg. Co., Inc., Mechanic St. & Erie R. R., Port Jervis, N. Y.
Zephyr Mfg. Co., 201 Hindry Ave., Box 759, Inglewood, Calif.
Zeva Electric Corp., 11 Park Pl., New York, N. Y.

SOLDERING EQUIP., HOT GAS

Janel, Inc., 226 Main Ave., Stirling, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.

SOLDERING EQUIP., INDUCTION HEATING

Janel, Inc., 226 Main Ave., Stirling, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

SOLDERING EQUIP., PRINTED CIRCUIT

American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich. p 2826, 2827
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Multicore Sales Corp., Dept. RY399, Westbury, N. Y. ..... p 2833
Wall Manufacturing Co., Box 3349, Kinston, N. C. ..... p 2835
Weller Electric Corp., 100 Wellco Rd., Easton, Pa. ..... p 2836, 2837
Adcola Prods. Pty. Ltd., 22 Firth St., Doncaster 3108, Victoria, Australia
Air-Vac Engineering Co., Inc., 100 Gulf St., Milford, Conn.
Anchor Alloys Inc., 968 Meeker Ave., Brooklyn, N. Y.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Enterprise Development Corp., 5149 East 65th St., Indianapolis, Ind.
Etchomatic, Inc., Box 444, Waltham, Mass.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Hollis Engineering, Inc., Charron Ave., Box 742, Nashau, N. H.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Jacri Inds., Box 265, Seaford, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Newman, M. M. Corp., 85 Clifton Ave., Marblehead, Mass.
Pentronics Corp., 10 Cheney St., Dorchester, Mass.

SOLDERING EQUIP. (Cont'd)

Roche, P. C. Co., Inc., 11 Park Pl., New York, N. Y.
Selectrons, Ltd., 116 East 16th St., New York, N. Y.
Superior Flux & Mfg. Co., 1536 St. Clair Ave., Cleveland, Ohio
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Ungar, 2701 W. El Segundo Blvd., Hawthorne, Calif.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Wenesco, Inc., Box 303 Northtown Sta., Chicago, Ill.
Zeva Electric Corp., 11 Park Pl., New York, N. Y.

SOLDERING EQUIP. REFLOW

Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Ferro Corp., Electro Refractories Div., Box 781, E. Liverpool, Ohio
Hollis Engineering, Inc., Charron Ave., Box 742, Nashau, N. H.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.

SOLDERING EQUIP., RESISTANCE

American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich. p 2826, 2827
Americon Corp., 87 Rumford Ave., Waltham, Mass.
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2832
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wall Manufacturing Co., Box 3349, Kinston, N. C. ..... p 2835
Contact, Inc., P.O. Box 6, Hudson, N. H.
Electro-Miniatures Corp., 600 Huyler St., S. Hackensack, N. J.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Luma Electric Equipment Co., 1607 Coining Dr., Toledo, Ohio
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Zephyr Mfg. Co., 201 Hindry Ave., Box 759, Inglewood, Calif.

SOLDERING EQUIP., TEMPERATURE CONTROLLED

American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich. .. p 2827
Americon Corp., 87 Rumford Ave., Waltham, Mass.
Weller Electric Corp., 100 Wellco Rd., Easton, Pa. ..... p 2836, 2837
Cimron Div., 1152 Morena Blvd., San Diego, Calif.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.

SOLDERING EQUIP., ULTRASONIC

Blackstone Ultrasonics, Inc., 820 Center St., Sheffield, Pa.
Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.
Delta Sonics, Inc., 12918 Cerise Ave., Hawthorne, Calif.
Electromation Components Corp., 84 Toledo St., Farmingdale, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Sonobond Corp., 310 E. Rosedale Ave., West Chester, Pa.

SOLDERING FLUX—SEE FLUX, BRAZING & SOLDERING

SOLDERING GUNS

Wall Manufacturing Co., Box 3349, Kinston, N. C. ..... p 2835
Weller Electric Corp., 100 Wellco Rd., Easton, Pa. ..... p 2837
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Portable Electric Tools Div., 1200 East State St., Geneva, Ill.
Roche, P. C. Co., Inc., 11 Park Pl., New York, N. Y.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Wen Products, Inc., 5810 Northwest Hwy., Chicago, Ill.

SOLDERING IRONS

American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich. .. p 2826
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2832
Heath Co., Dept. 180, Benton Harbor, Mich.
Telvac Instr. Co., 18531-E Ventura Blvd., Tarzana, Calif. ..... p 2834
Wall Manufacturing Co., Box 3349, Kinston, N. C. ..... p 2835
Weller Electric Corp., 100 Wellco Rd., Easton, Pa. ..... p 2836, 2837
Adcola Prods. Pty. Ltd., 22 Firth St., Doncaster 3108, Victoria, Australia
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Electric Soldering Iron Co., Inc., Box 247, Deep River, Conn.
Enterprise Development Corp., 5149 East 65th St., Indianapolis, Ind.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Hexacon Electric Co., 161 W. Clay Ave., Roselle Park, N. J.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Lenk Mfg. Co., Franklin, Ky.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Newman, M. M. Corp., 85 Clifton Ave., Marblehead, Mass.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Roche, P. C. Co., Inc., 11 Park Pl., New York, N. Y.
Selas Corp. of America, Box 200, Dresher, Pa.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Ungar, 2701 W. El Segundo Blvd., Hawthorne, Calif.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.
Zeva Electric Corp., 11 Park Pl., New York, N. Y.

SOLENOID DRIVERS, SOLID STATE

Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal. p 766
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Guardian California, 5755 Camille Ave., Culver City, Calif.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Tec Magnetics, 12117 Slauson Ave., Santa Fe Springs, Calif.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Voltex Co., Inc., 115 Marine St., Farmingdale, N. Y.
Warner Electric Brake & Clutch Co., Beloit, Wisc.

SOLENOIDS, LINEAR

American Precision Inds., Inc., 77 Olean Rd., E. Aurora, N. Y.
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. p 2194, 2195
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2199
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill. .. p 2243
Hart Components, Advance Relay Div., Oak Electro/Netics Corp., Crystal Lake, Ill. ..... p 2249, 2252
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 1746
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2288, 2291
Naybor, E. V., Labs, Inc., 26 Manorhaven Blvd., Pt. Wash., N. Y.
Tec Magnetics, 12117 Slauson Ave., Santa Fe Springs, Calif. ... p 2272
Universal Relay Corp., 42 White St., New York, N. Y.
A.P.W. Co., 72 Main St., Rockaway, N. J.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Coil Co. of America, Inc., 221 Washington St., Northwale, N. J.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Electro-Mechanisms, Inc., 407 W. Chestnut Ave., Monrovia, Calif.
Electroid Corp., 95 Progress St., Union, N. J.
General Relay Corp., 20 Mercer St., Dover, N. J.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
IMC Magnetics Corp., 1900 East 5th St., Tempe, Ariz.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Koontz-Wagner Elec. Co., Inc., 516 N. Michigan St., S. Bend, Ind.
Lem Instr. Corp., 20 Sarah Dr., Farmingdale, N. Y.
Lisk, G. W., Co., Inc., 5019 South St., Clifton Springs, N. Y.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
MagneTec Corp., 7751 Densmore Ave., Van Nuys, Calif.
Meltronics, Inc., 3343 Merrick Rd., Wantagh, N. Y.
Modelectric Prods. Corp., 9 Cindy La., Asbury Park, N. J.
National Acme Co., 170 East 131 St., Cleveland, Ohio
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Servotronics, Inc., 3901 Union Rd., Buffalo, N. Y.
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
U. S. Electronics Corp., 321 Orient Way, Lyndhurst, N. J.
Valcor Engrg. Corp., 365 Carnegie Ave., Kenilworth, N. J.
Velmex, Inc., Box 78, Holcomb, N. Y.
West Coast Electrical Mfg. Co., 233 West 116th Pl., Los Angeles, Calif.

SOLENOIDS, ROTARY

Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 1746
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2767
Tec Magnetics, 12117 Slauson Ave., Santa Fe Springs, Calif. .... p 2272
Universal Relay Corp., 42 White St., New York, N. Y.
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Daco Instrument Co., Inc., Merritt Blvd., Trumbull, Conn.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
HJS Engineering Co., Box 96, Park Ridge, Ill.
IMC Magnetics Corp., 1900 East 5th St., Tempe, Ariz.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lisk, G. W., Co., Inc., 5019 South St., Clifton Springs, N. Y.
Magnuson Engineers, Inc., 1010 Timothy Dr., San Jose, Calif.
Plessey, Inc., 170 Finn Ct., Farmingdale, N. Y.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Velmex, Inc., Box 78, Holcomb, N. Y.

SOLVENTS—SEE CLEANERS & SOLVENTS

SONIC ANALYZERS—SEE ANALYZERS, SONIC & SUBSONIC

SORTERS—SEE MACHINES, SORTING

SOUND LEVEL INDICATORS—SEE METERS, AUDIO LEVEL

SOUND RECORDING EQUIP.—SEE MICROPHONES; RECORDERS; ETC.

SOURCES, LIGHT, ISOTOPE EXCITED

American Atomics Corp., 425 S. Plumer Ave., Tucson, Ariz.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
ILC, Inc., 164 Commercial St., Sunnyvale, Calif.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.

SOURCES, LIGHT, RADIOACTIVE

CML Inc., 350 Leland Ave., Plainfield, N. J.
American Atomics Corp., 425 S. Plumer Ave., Tucson, Ariz.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
3M Co., 3M Center, St. Paul, Minn.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

SOURCES, LIGHT, STROBOSCOPIC—SEE STROBOSCOPES

SOURCES, RADIOACTIVE

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
American Atomics Corp., 425 S. Plumer Ave., Tucson, Ariz.
American Nuclear Corp., Box 426, Oak Ridge, Tenn.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gai-Tronics Corp., Box 31, Reading, Pa.
General Nuclear Corp., 2640 Park Ave., New York, N. Y.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Nuclear Products Co., Box 1178, El Monte, Calif.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Sanders Nuclear Corp., 95 Canal St., Nashua, N. H.
Solid State Radiations, Inc., 2261 S. Carmelina, Los Angeles, Calif.
U. S. Radium Corp., 170 E. Hanover Ave., Morristown, N. J.

SPACERS

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Concord Electronics Corp., 37 Great Jones St., New York, N. Y.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I. ..... p 901
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 2909
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
S.E.C.S., Inc., 19-58 38th St., Long Island City, N. Y. ..... p 1234
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Auburn Mfg. Co., Pease Ave. & Stack St., Middleton, Conn.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Bell Fasteners Corp., 352 Evelyn St., Paramus, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
C. E. M. Co., Inc., 24 School St., Danielson, Conn.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Crystal Optic Research, Inc., 1360 N. Main St., Ann Arbor, Mich.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Ferroxcube Corp., Lock Box 359, Saugerties, N. Y.
Fischer Special Mfg. Co., 446 Morgan St., Cincinnati, Ohio
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
General Gaskets, Inc., Middletown, Conn.
General Mfg. Co., 724 Ruberta Ave., Glendale, Calif.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Nylomatic Corp., 137 Nolan Ave., Morrisville, Pa.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Resdel Corp., Box 2171, Rio Grande, N. J.
Shur-Lok Corp., 1300 E. Normandy Pl., Santa Ana, Calif.
Stop Components Inc., 100 Commercial St., Freeport, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
3M Co., 3M Center, St. Paul, Minn.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Weckesser Co., Inc., 4444 W. Irving Park Rd., Chicago, Ill.

SPAGHETTI—SEE TUBING, SPAGHETTI

SPARK GAP CAPACITORS—SEE CAPACITORS, OVER-VOLTAGE PROTECTED

SPARK GAPS

Bel Fuse Inc., 203 Van Vorst St., Jersey City, N. J.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 2716
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Joslyn Elctrn. Sys., 6868 Cortona Dr., Goleta, Calif. ..... p 2740, 2741
Kilovolt Corp., 238 High St., Hackensack, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1805
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tobe Deutschmann Labs., Box 74, Canton, Mass. ..... p 695
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

SPEAKER CONES & PARTS

Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Bossert Mfg. Co., 1030 Oswego St., Utica, N. Y.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Hawley Prods. Co., 333 North 6th St., St. Charles, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Lansing J. B., Sound, Inc., 3249 Casitas Ave., Los Angeles, Calif.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Welsh, W. H. Co., Inc., 2241 Indiana Ave., Chicago, Ill.

SPEAKER DRIVERS—SEE DRIVERS. SPEAKER

SPEAKER ENCLOSURES—SEE ENCLOSURES. SPEAKER

SPEAKER HORNS—SEE HORNS. SPEAKER

SPEAKER SYSTEMS (INDUSTRIAL)

Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Action Systems Co., 34 Cambridge St., Meriden, Conn.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Argos Products Co., Inc., 600 S. Sycamore St., Genoa, Ill.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Audio Dynamics Corp., Pickett District Rd., New Milford, Conn.
Bell PA Prods. Corp., 1200 N. Fifth St., Columbus, Ohio
Bennett Labs., Inc., 5800 Christie, Emeryville, Calif.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Collins Radio Co., Dallas, Texas
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Era Acoustics Corp., 311 E. Park St., Moonachie, N. J.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Femco, Inc., Box F, Irwin, Pa.
Fisher-Berkeley Corp., 5800 Christie, Emeryville, Calif.
Gai-Tronics Corp., Box 31, Reading, Pa.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Klipsch & Associates, Inc., Box 280, Hope, Ark.
Koss Electronics, Inc., 2227 North 31st St., Milwaukee, Wisc.
Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis, Mo.
Major Electronics Corp., 649 39 St., Brooklyn, N. Y.
Micro-Magna Elctrns., 3311 Perkins Ave., Cleveland, Ohio
Minneapolis Speaker Co., 3806 Grand Ave., S., Minneapolis, Minn.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Quam-Nichols Co., Marquette Rd. at Prairie Ave., Chicago, Ill.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Smith-Meeker Engr. Co., 157 Chambers St., New York, N. Y.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Tannoy America, Ltd., 1756 Ocean Ave., Bohemia, N. Y.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Wharfedale, Div. British Inds. Co., Westbury, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wilder Engrg. Prods., 715 Kedzie, Chicago, Ill.

SPEAKERS, CERAMIC

Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Minneapolis Speaker Co., 3806 Grand Ave., S., Minneapolis, Minn.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.

SPEAKERS, COLUMN

American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Argos Products Co., Inc., 600 S. Sycamore St., Genoa, Ill.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Hamilton Elctrns. Corp., 2726 W. Pratt Ave., Chicago, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Micro-Magna Elctrns., 3311 Perkins Ave., Cleveland, Ohio
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Port-O-Vox Enterprises, Corp., 130 West 57th St., New York, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Wilder Engrg. Prods., 715 Kedzie, Chicago, Ill.

SPEAKERS, DYNAMIC, ELECTRO

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Acoustech, 2227 N. 31 St., Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Era Acoustics Corp., 311 E. Park St., Moonachie, N. J.
Fisher Radio Corp., 11-40 45th Rd., Long Island City, N. Y.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Port-O-Vox Enterprises, Corp., 130 West 57th St., New York, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.

SPEAKERS, DYNAMIC, P-M

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif.
Heath Co., Dept. 180, Benton Harbor, Mich.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bozak, R. T. Mfg. Co., Box 1166, Darien, Conn.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Davis, J. W. & Co., Box 35313, Dallas, Tex.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Empire Scientific Corp., 1055 Stewart Ave., Garden City, N. Y.
Era Acoustics Corp., 311 E. Park St., Moonachie, N. J.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Fisher Radio Corp., 11-40 45th Rd., Long Island City, N. Y.
Hartley Products Corp., Barnert Pl., Hohokus, N. J.
Heppner Mfg. Co., Box Q, Round Lake, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Klipsch & Associates, Inc., Box 280, Hope, Ark.
Lansing J. B., Sound, Inc., 3249 Casitas Ave., Los Angeles, Calif.
Micro-Magna Elctrns., 3311 Perkins Ave., Cleveland, Ohio
Minneapolis Speaker Co., 3806 Grand Ave., S., Minneapolis, Minn.
Murdock Corp., 158 Carter St., Chelsea, Mass.
Oaktron Industries, Inc., Monroe, Wisc.
Oxford Transducer Co., 3911 S. Michigan Ave., Chicago, Ill.
Permoflux Corp., Box 6364, Glendale, Calif.
Quam-Nichols Co., Marquette Rd. at Prairie Ave., Chicago, Ill.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Rola Div., 21010 Miles Pkwy., Cleveland, Ohio
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Tannoy America, Ltd., 1756 Ocean Ave., Bohemia, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Wilder Engrg. Prods., 715 Kedzie, Chicago, Ill.

SPEAKERS, EXPLOSION & FLAME PROOF

ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Heppner Mfg. Co., Box Q, Round Lake, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.

SPEAKERS, HORN

American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fanon Elctrn. Inds., 439 Frelinghuysen Ave., Newark, N. J.
Femco, Inc., Box F, Irwin, Pa.
Fourjay Industries, Box 1465 Northbridge Br., Dayton, Ohio
Heppner Mfg. Co., Box Q, Round Lake, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Oxford Transducer Co., 3911 S. Michigan Ave., Chicago, Ill.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.

SPECTRAL LIGHT SOURCES

SPEAKERS, PAGING & TALK BACK

American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Audio Equip. Co., Inc., 75 Harbor Rd., Port Washington, N. Y.
Bennett Labs., Inc., 5800 Christie, Emeryville, Calif.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fanon Elctrn. Inds., 439 Frelinghuysen Ave., Newark, N. J.
Femco, Inc., Box F, Irwin, Pa.
Fisher-Berkeley Corp., 5800 Christie, Emeryville, Calif.
Fourjay Industries, Box 1465 Northbridge Br., Dayton, Ohio
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Minneapolis Speaker Co., 3806 Grand Ave., S., Minneapolis, Minn.
Oxford Transducer Co., 3911 S. Michigan Ave., Chicago, Ill.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

SPEAKERS, PILLOW

Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Trimm Inc., 400 Lake St., Libertyville, Ill. ..... p 573
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Bennett Labs., Inc., 5800 Christie, Emeryville, Calif.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fisher-Berkeley Corp., 5800 Christie, Emeryville, Calif.
Murdock Corp., 158 Carter St., Chelsea, Mass.
Parcoe, Inc., 4501 Prospect Ave., Cleveland, Ohio
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.

SPEAKERS, SUBMERGENCE-PROOF

CTS Corp., 905 N. West Blvd., Elkhart, Ind.
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Audio Equip. Co., Inc., 75 Harbor Rd., Port Washington, N. Y.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.

SPEAKERS, WEATHERPROOF

CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
ADEC Inc., 86 Frelinghuysen Ave., Newark, N. J.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Audio Equip. Co., Inc., 75 Harbor Rd., Port Washington, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bozak, R. T. Mfg. Co., Box 1166, Darien, Conn.
Cleveland Electronics, Inc., 1974 East 61st St., Cleveland, Ohio
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dukane Corp., 103 11th Ave., St. Charles, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Era Acoustics Corp., 311 E. Park St., Moonachie, N. J.
Executone, Inc., 47-37 Austell Pl., Long Island City, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
Heppner Mfg. Co., Box Q, Round Lake, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Klipsch & Associates, Inc., Box 280, Hope, Ark.
Lansing J. B., Sound, Inc., 3249 Casitas Ave., Los Angeles, Calif.
Micro-Magna Elctrns., 3311 Perkins Ave., Cleveland, Ohio
Minneapolis Speaker Co., 3806 Grand Ave., S., Minneapolis, Minn.
Oaktron Industries, Inc., Monroe, Wisc.
Oxford Transducer Co., 3911 S. Michigan Ave., Chicago, Ill.
Quam-Nichols Co., Marquette Rd. at Prairie Ave., Chicago, Ill.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Remler Co., 2101 Bryant St., San Francisco, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Tannoy America, Ltd., 1756 Ocean Ave., Bohemia, N. Y.
University Sound, Div. LTV, Box 26105, Oklahoma City, Okla.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.

SPECIFIC GRAVITY INDICATORS—SEE INDICATORS, SPECIFIC GRAVITY

SPECTRAL LIGHT SOURCES

Gamma Scientific, Inc., Dept. 301, 2165 Kurtz St., San Diego, Calif. p 1778
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
American Atomics Corp., 425 S. Plumer Ave., Tucson, Ariz.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Cintra Physics International Co., 440 Logue Ave., Mt. View, Calif.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.

SPECTRAL LIGHT SOURCES (Cont'd)

Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
McPherson Instr. Corp., 530 Main St., Acton, Mass.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Quartz Radiation Corp., 1275 Bloomfield Ave., Fairfield, N. J.
Sara Scientific Co., Box 321, San Francisco, Calif.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Xenon Corp., 39 Commercial St., Medford, Mass.

SPECTROGRAPHS & SPECTROMETERS

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Electronic Assocs., Inc., 185 Monmouth Pkwy., Long Branch, N. J.
Aero Vac Corp., Box 448, Troy, N. Y.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman, Advanced Tech. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
GCA Technology, Burlington Rd., Bedford, Mass.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
McPherson Instr. Corp., 530 Main St., Acton, Mass.
Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis, Ind.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Process & Instruments Corp., 1943 Broadway, Bklyn., N. Y.
Siemens America, Measuring Inst. Div., 350 Fifth Ave., N. Y., N. Y.
TRW Instruments, 139 Illinois St., El Segundo, Calif.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Tinsley Labs, Inc., 2448 6th St., Berkeley, Calif.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Analytical Instr. Div., 611 Hansen Way, Palo Alto, Cal.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Ventron Instrs. Corp., 144 Middlesex Tpke., Burlington, Mass.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

SPECTROMETERS, INFRARED

Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Tinsley Labs, Inc., 2448 6th St., Berkeley, Calif.

SPECTROMETERS, MASS

Varian Assocs., Analytical Instr. Div., 611 Hansen Way, Palo Alto, Cal.

SPECTROPHOTOMETERS

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
Gamma Scientific, Inc., Dept. 301, 2165 Kurtz St., San Diego, Calif. p 1778
Heath Co., Dept. 180, Benton Harbor, Mich.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Beckman, Advanced Tech. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman, Clinical Instrs. Oper., 2500 Harbor Blvd., Fullerton, Cal.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Brower Labs, Inc., 237 Riverview Ave., Waltham, Mass.
Canal Industrial Corp., 5635 Fisher La., Rockville, Md.
Cary Instruments, 2724 So. Peck Rd., Monrovia, Calif.
Coleman Instruments, 42 Madison St., Maywood, Ill.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Grace Elctrns., Inc., 4380 Warner Rd., Cleveland, Ohio
International Light Inc., Lord Timothy Dexter Ind'l. Green, Newburyport, Mass.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
McPherson Instr. Corp., 530 Main St., Acton, Mass.
Olympus Corp. of America, Two Nevada Dr., New Hyde Park, N. Y.
Perkin-Elmer Corp., Main Ave., Norwalk, Conn.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Photo Research Corp., 3000 N. Hollywood Way, Burbank, Calif.
Process & Instruments Corp., 1943 Broadway, Bklyn., N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

SPECTRORADIOMETERS

Gamma Scientific, Inc., Dept. 301, 2165 Kurtz St., San Diego, Calif. p 1778
Cary Instruments, 2724 So. Peck Rd., Monrovia, Calif.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.

SPECTRUM ANALYZERS—SEE ANALYZERS, SPECTRUM

SPEECH SCRAMBLERS—SEE SCRAMBLERS, SPEECH

SPEED DRIVES, MOTOR—SEE CONTROLS, MOTOR SPEED

SPIRAL WRAP—SEE TUBING, SPIRAL WRAP

SPLICERS, COAXIAL CABLE

AMP Incorporated, Box 3608, Harrisburg, Pa.
Burndy Corporation, Richards Ave., Norwalk, Conn. ..... p 885, 2828
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Staple Co., 28 East 22nd St., New York, N. Y.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Superior Continental Corp., Box 489, Hickory, N. C.

SPLICERS, WIRE (BUTT & CAP TYPES)

AMP Incorporated, Box 3608, Harrisburg, Pa.
Buchanan Electrical Products Corp., 1065 Floral Ave., Union, N. J. p 879
Burndy Corporation, Richards Ave., Norwalk, Conn. ..... p 885, 2828
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
General Staple Co., 28 East 22nd St., New York, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

SPLICING EQUIPMENT, MAGNETIC TAPE

GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Duotone Co., Inc., Box 814, S. Miami, Fla.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Magnecessories, Box 6960, Washington, D. C.
Prestoseal Manufacturing Corp., 37-12 108th St., Corona, N. Y.
Rason Mfg. Co., 73 Wortman Ave., Brooklyn, N. Y.
Recoton Corp., 46-23 Crane St., Long Island City, N. Y.
Reiter, F. Co., 3340 Bonnie Hill Dr., Hollywood, Calif.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Tall Co., 158 S. Terrace Ave., Mt. Vernon, N. Y.
Telephone Dynamics Corp., 1333 Newbridge Rd., N. Bellmore, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.

SPLICING EQUIPMENT, PAPER TAPE

Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Prestoseal Manufacturing Corp., 37-12 108th St., Corona, N. Y.
Robins Data Devices, Inc., 15-58 127th St., Flushing, N. Y.

SPOOLERS, PUNCHED TAPE—SEE READERS, PUNCHED TAPE

SPRAY SYSTEMS, ELECTROSTATIC PAINT

Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Borden Chemical Co., Krylon Dept., Ford & Washington, Norristown, Pa.
Conforming Matrix Corp., Box 37, Sta. G, Toledo, Ohio
Despatch Oven Co., Box 1320, Minneapolis, Minn.
DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio
Fischer, H. G. & Co., 9451-9491 W. Belmont Ave., Franklin Park, Ill.
Ionic Electrostatic Corp., 111 Monroe St., Garfield, N. J.

SPRINGS (ALL TYPES)

Accurate Spring Mfg. Co., 8747 W. Palmer St., River Grove, Ill.
Ace Spring Mfg. Co., Inc., 150 32nd St., Brooklyn, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Ametek, Inc., Station Square Two, Paoli, Pa.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
CE-JA Springs Inc., 169 Day St., Newington, Conn.
Connor Spring & Mfg. Co., 75 14th St., San Francisco, Calif.
Dudek & Bock Spring Mfg. Co., 4014 W. Grand Ave., Chicago, Ill.
Dzus Fastener Co. Inc., 425 Union Blvd., W. Islip, N. Y.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Larsen Importing Co., 140 Nassau St., New York, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Newcomb Spring of Conn., Inc., 2 Spring St., Southington, Conn.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
PIC Design Corp., 477 Atlantic Ave., E. Rockaway, N. Y.
Stanley Industrial Components Div., Stanley Works, Forestville, Conn.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Templeman, D. R. Co., 8 Park St., Plainville, Conn.

SPRINGS, COMPRESSION (HELICAL)

Instrument Specialties Co., Inc., 254 Bergen Blvd., Little Falls, N. J. p 1222
Accurate Spring Mfg. Co., 8747 W. Palmer St., River Grove, Ill.
Ace Spring Mfg. Co., Inc., 150 32nd St., Brooklyn, N. Y.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Ametek, Inc., Station Square Two, Paoli, Pa.
Connor Spring & Mfg. Co., 75 14th St., San Francisco, Calif.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Helical Prods. Co., Inc., Box 4, Hermosa Beach, Calif.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Newcomb Spring of Conn., Inc., 2 Spring St., Southington, Conn.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Perkins Machine & Gear Co., Circuit Ave., W. Springfield, Mass.
Stanley Industrial Components Div., Stanley Works, Forestville, Conn.

SPRINGS, FLAT

Instrument Specialties Co., Inc., 254 Bergen Blvd., Little Falls, N. J. p 1222
Accurate Spring Mfg. Co., 8747 W. Palmer St., River Grove, Ill.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
American Silver Co. Div., 36-07 Prince St., Flushing, N. Y.
Ametek, Inc., Station Square Two, Paoli, Pa.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
Chemical Micro Milling Co., Box 770, Camden, N. J.
Connor Spring & Mfg. Co., 75 14th St., San Francisco, Calif.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
H. K. Metalcraft Mfg. Co., 35 Industrial Rd., Lodi, N. J.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Holmberg, Inc., 20 Melville Park Rd., Melville, N. Y.
Hunter Spring, One Spring Ave., Hatfield, Pa.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Newcomb Spring of Conn., Inc., 2 Spring St., Southington, Conn.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Stanley Industrial Components Div., Stanley Works, Forestville, Conn.
3M Co., 3M Center, St. Paul, Minn.
Tricon Mfg. Co., 2325 Wisconsin Ave., Downer Grove, Ill.

SPUTTERING EQUIPMENT

Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Lepel High Frequency Labs., 59-21 Queens-Midtown Expwy., Maspeth, N. Y.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.

STABILIZERS, FREQUENCY

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1083
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
CML Inc., 350 Leland Ave., Plainfield, N. J. ..... p 1891, 1892
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1942, 1943
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Micro-Now Instr. Co., Inc., 6124 N. Pulaski Rd., Chicago, Ill.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.

STABILIZERS, LINE IMPEDANCE

Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.

STABILIZERS, VOLTAGE—SEE REGULATORS & STABILIZERS, VOLTAGE—ALSO SEE TRANSFORMERS, VOLTAGE REGULATING

STALOS—SEE OSCILLATORS, MICROWAVE

STAMPED CIRCUIT BOARDS—SEE CIRCUIT BOARDS, STAMPED

STANDARDS, ATOMIC BEAM

Atomichron, Inc., 3 Delaware Dr., New Hyde Park, N. Y. ..... p 1330
Tracor Inc., 6500 Tracor La., Austin, Texas
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

STANDARDS, CAPACITANCE

Arco Elctrns., Inc., Manufacturing Div., Community Dr., Great Neck, N. Y.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1346, 1348, 1349
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

STANDARDS, CURRENT

Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1378, 1379
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1417, 2394
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. p 1426, 2056

Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Knopp, Inc., 1307 66th St., Oakland, Calif.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

STANDARDS, DELAY LINE

Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J. .... p 1163

STANDARDS, FREQUENCY

Accutronics, Inc., 628 North St., Geneva, Ill. ..... p 1059, 1064
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. ..... p 1083
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1015
Atomichron, Inc., 3 Delaware Dr., New Hyde Park, N. Y. ..... p 1330
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Connor-Winfield Corp., Winfield, Ill. ..... p 1087
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1098
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y. p 1104, 1330
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1105, 1106
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa. p 1100
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Iowa p 1127
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Vectron Laboratories, Inc., 146 Selleck St., Stamford, Conn. ... p 1136
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Collins Radio Co., Dallas, Texas
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill Electronics Inc., 300 No. Chestnut St., Mechanicsburg, Pa.
Micro-Now Instr. Co., Inc., 6124 N. Pulaski Rd., Chicago, Ill.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Norrman, Ernst Labs., 200 Elkhorn Rd., Williams Bay, Wisc.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Systems Electronics, Inc., 9801 Walford Ave., Cleveland, Ohio
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.

STANDARDS, INDUCTANCE

North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Lionmount & Co., Ltd., Bellevue Rd., New Southgate, London, Eng.

STANDARDS, NOISE

Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.

STANDARDS, PHASE

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y. p 1405
Theta Instrument Corp., Fairfield, N. J.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.

STANDARDS, Q

Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

STANDARDS, RESISTANCE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1339
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1417, 2394, 2395
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Marstan Elctrns., 307 Washington St., Orange, N. J. ..... p 2404
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1457
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Vishay Resistor Prods. Div., 64 Lincoln Hwy., Malvern, Pa.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Miller Electro-Res. Labs., 14800 W. Grange, New Berlin, Wisc.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

STANDARDS, RESISTANCE TRANSFER

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1417
Nytronics, Inc., Precision Resistor Div., Industrial Ave., Kutztown, Pa.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.

STANDARDS, SYNCHRO & RESOLVER

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 2394
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496
Theta Instrument Corp., Fairfield, N. J.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

STANDARDS, TEMPERATURE

Cohu Electronics Inc., Box 623, San Diego, Calif.
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Weksler Instrs. Corp., 195 E. Merrick Rd., Freeport, N. Y.

STANDARDS, TIME

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Atomichron, Inc.,/3 Delaware Dr., New Hyde Park, N. Y. ..... p 1330
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex. ..... p 1332
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa. ..... p 767
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
Fork Standards Inc., 213 Main St., West Chicago, Ill. ..... p 1099
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1105
Greenray Industries, Inc., 840 W. Church Rd., Mechanicsburg, Pa.
Metric Engrg., 5235 E. Simpson Rd., Mechanicsburg, Pa. ..... p 1440
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Reeves-Hoffman Div., 400 W. North St., Carlisle, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tracor Inc., 6500 Tracor La., Austin, Texas ..... p 1511
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Norrman, Ernst Labs., 200 Elkhorn Rd., Williams Bay, Wisc.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.

STANDARDS, VOLTAGE

Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1335
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Connor-Winfield Corp., Winfield, Ill. ..... p 1087
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1378, 1379
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671

STANDARDS, VOLTAGE REFERENCE

General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1406
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1417, 2394
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Kilovolt Corp., 238 High St., Hackensack, N. J.
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. p 1426, 2056
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. ..... p 1485
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1493, 1494, 1498
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Analogic Co., 296 Newton St., Waltham, Mass.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IB Instruments Inc., 7016 Euclid Ave., Cleveland, Ohio
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Precision Standards Corp., Box 8361, San Marino, Calif.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

STANDARDS, VOLTAGE RATIO

Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1376
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1417, 2394
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Marstan Elctrns., 307 Washington St., Orange, N. J. ..... p 2404
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Collins, G. L. Corp., 5875 Obispo Ave., Long Beach, Calif.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

STANDARDS, VOLTAGE REFERENCE

Chronetics, 500 Nuber Ave., Mt. Vernon, N. Y.
Cohu Electronics Inc., Box 623, San Diego, Calif. ..... p 1356
Dynage Inc., 1331 Blue Hills Ave., Bloomfield, Conn.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Electronic Development Corp., 423 W. Broadway, Boston, Mass. p 1378, 1379
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio ..... p 1406
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1417, 2394
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. p 1426, 2056
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
RFL Inds., Inc., Powerville Rd., Boonton, N. J. ..... p 1472
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Analogic Co., 296 Newton St., Waltham, Mass.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.

STANDARDS, VOLTAGE REFERENCE (Cont'd)

Modular Circuits Inc., 4420 Transmission Rd., Phoenix, Ariz.
Monroe Electronics Inc., 5 Vernon St., Middleport, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Power Components Inc., Box 421, Scottdale, Pa.
Stable Dynamics Corp., 8098 Engineer Rd., San Diego, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

STANDING WAVE DETECTORS—SEE DETECTORS, STANDING WAVE

STANDS, WAVEGUIDE

Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Narda Microwave Corp., Plainview, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Waveline Inc., Box 718, West Caldwell, N. J.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Control Data Corp., 400 Border St., East Boston, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.

STATORS, MOTOR & GENERATOR—SEE MOTOR & GENERATOR ARMATURES, ROTORS, STATORS

STEATITE—SEE INSULATION PARTS, CERAMIC

STEREOSCOPES, MAGNIFYING

American Optical Corp., Eggert & Sugar Rds., Buffalo, N. Y.
Bausch and Lomb Inc., 87969 Bausch St., Rochester, N. Y.
Buhl Optical Co., 1009 Beech Ave., Pittsburgh, Pa.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N. J.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Nikon, Inc., Instr. Div., 623 Stewart Ave., Garden City, N. J.
Olympus Corp. of America, Two Nevada Dr., New Hyde Park, N. Y.
Opto-Metric Tools, Inc., 304 Hudson St., New York, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Titan Tool Supply Co. Inc., 68 Comet, Buffalo, N. Y.
Unitron Instrument Co., 66 Needham St., Newton Highlands, Mass.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zeiss, C., Inc., 444 Fifth Avenue, New York, N. Y.

STOOLS—SEE BENCHES, CONSOLES, STOOLS, TABLES (LAB & SHOP)

STOPS, LIMIT—SEE LIMIT STOPS, MECHANICAL

STRAIGHTENERS, TUBE PIN—SEE PIN STRAIGHTENERS, TUBE

STRAIN GAUGES—SEE GAUGES, STRAIN

STRAIN INDICATORS—SEE INDICATORS, STRAIN

STRAIN RELIEFS, CABLE & WIRE

Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
Heyman Mfg. Co., East Michigan Ave., Kenilworth, N. J.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.

STRETCHERS, MICROWAVE—SEE MICROWAVE LINE STRETCHERS

STRIP-LINE COMPONENTS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y. p 597, 601
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1652, 1653
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. p 1658, 1659
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1663
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
LEL Div. Varian, 75 Akron St., Copiague, N. Y. ..... p 1681
Narda Microwave Corp., Plainview, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hybridyne, Inc., 1950 Cotner Ave., W. Los Angeles, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Megadyne Inds., Inc., 1665 Buffalo Rd., Rochester, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Micro Science Assocs., 2274 Mora Dr., Mountain View, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microneticș Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rowe Engravers, 68 Union Ave., Clifton, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Vac-Ohm Elctrns. Co., Box 444, Haddonfield, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

STRIPPERS AND TWISTERS WIRE—SEE WIRE STRIPPERS

STRIPPERS, WIRE—SEE WIRE STRIPPERS

STRIPPERS, WIRE, CHEMICAL—SEE CHEMICALS, WIRE STRIPPING

STRIPS, GROUND

Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Braun, H. Tool & Instr. Co., 140 Fifth Ave., Hawthorne, N. J.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.

STRIPS, MARKER & FANNING

Accurate Electronics Corp., Box 935J, Elyria, Ohio
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Duramark, Inc., 2 Secatoag Ave., Port Washington, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
States Co., 19 New Park Ave., Hartford, Conn.

STRIPS, TERMINAL

ADC Products, 8405 Cambridge St., Minneapolis, Minn.
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 1168
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Buchanan Electrical Products Corp., 1065 Floral Ave., Union, N. J. p 878
Burndy Corporation, Richards Ave., Norwalk, Conn. ..... p 884
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 904
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y. ... p 1173
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kulka Electric Corp., Dept. E, Box 149, Mount Vernon, N. Y. ... p 917
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 1174, 2913
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 928
Power/Mate Corp., 163 Clay St., Hackensack, N. J. ..... p 2074
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass. .... p 976
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H. p 1005
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Advanced Circuitry Div., Litton Inds., 4811 W. Kearney St., Springfield, Mo.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Apahouser Corp. of N. E., 1312 Boylston St., Boston, Mass.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
British Radio Elctrns. Ltd., 1742 Wisconsin Ave., N. W., Washington, D. C.
Curtis Develop. & Mfg. Co., 3278 N. 33rd St., Milwaukee, Wisc.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Doran Mfg. Co., 1033 Bader St., Cincinnati, Ohio
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electric Terminal Corp., Drawer E, Pilgrim Sta., Warwick, R. I.
Electrical Plastics Corp., 280 Warren St., Lyndhurst, N. J.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Gunnar Laboratories, Inc., 5803 14th St., E., Brandenton, Fla.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Holmberg, Inc., 20 Melville Park Rd., Melville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Kaye, Joseph, & Co., Inc., 737 Concord Ave., Cambridge, Mass.
Kent Corp., 169 Lake St., Mundelein, Ill.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Mechanical Engraving Co., Inc., 10 Van Cortlandt Ave. E., Bronx, N. Y.
Midwest Molding & Mfg. Co., Gurnee, Ill.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
N/P Co., Inc., Box 127, Temple City, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Seastrom Mfg. Co. Inc., 701 Sonora Ave., Glendale, Calif.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
States Co., 19 New Park Ave., Hartford, Conn.
3M Co., 3M Center, St. Paul, Minn.
Tri-Dex Co., 2146 E. Main St., Visalia, Calif.
Tri-Tronics Lab., Inc., Box 338, Euless, Tex.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
W & M Mfg. Corp., 187 Lafayette St., New York, N. Y.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

STROBOSCOPES—SEE LIGHTS, STROBOSCOPIC SOURCE

STUDIO EQUIPMENT—SEE CONSOLES; CAMERAS: LIGHTING EQUIP.: ETC.

STYLI, RECORDING & PLAYBACK

Aldshir Mfg. Co., Inc., 111 Lake Ave., Tuckahoe, N. Y.
American Phono-Ton Inc., Kiamesha Lake, N. Y.
Astatic Corp., Box 120, Conneaut, Ohio
Audio Dynamics Corp., Pickett District Rd., New Milford, Conn.
Capps & Co., Inc., 20 Addison Pl., Valley Stream, N. Y.
Dixie Diamond Tool Co., Inc., 6875 S.W. 81st St., Miami, Fla.
Duotone Co., Inc., Box 814, S. Miami, Fla.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Empire Scientific Corp., 1055 Stewart Ave., Garden City, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Fife Electronic Prods., 80 Commercial St., Freeport, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Pickering & Co., Inc., 101 Sunnyside Blvd., Plainview, N. Y.
Recoton Corp., 46-23 Crane St., Long Island City, N. Y.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Stanton Magnetics, Inc., Terminal Dr., Plainview, N. Y.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
Walco Elctrns. Co., 1234 State Hwy. 46, Clifton, N. J.

SUBSTRATES, CERAMIC

American Feldmuehle Corp., Box 2160, Glenbrook, Conn. ..... p 1576
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. .. p 1578
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, N. J.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Diamonite Products Mfg. Co., Div. U. S. Ceramic Tile Co., Shreve, Ohio
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro-Science Labs., Inc., 1133 Arch St., Philadelphia, Pa.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Insaco, Inc., Box 442, Quakertown, Pa.
Kidco, Inc., Box 278, Medford, N. J.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.
3M Co., 3M Center, St. Paul, Minn.
Ultrasonic Machining Co., 266 West Ave., Long Branch, N. J.
Valpey Corp., 1400 Highland St., Holliston, Mass.
Varadyne, Inc., 1805 Colorado Ave., Santa Monica, Calif.

Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.

SUBSTRATES, FLEXIBLE

Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Ford Inds., Inc., Box 06459, Portland, Ore.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

SUBSTRATES, GLASS

American Technical Ceramics, 1 Norden La., Huntington Sta., N. Y.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
General Acoustics Corp., 12248 Santa Monica Blvd., Los Angeles, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Kopp Glass, Inc., Box 8255, Swissvale, Pittsburgh, Pa.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Owens-Illinois, Inc., P.O. Box 1035, Toledo, Ohio
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.

SUPERCONDUCTING MAGNETS—SEE MAGNETS, SUPERCONDUCTING

SUPPORTS, TUBE—SEE RETAINERS, TUBE

SUPPRESSORS, ARC

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 2716
Dale Electronics Inc., Box 609, Columbus, Nebr.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal.
International Rectifier, 233 Kansas St., El Segundo, Calif.
Joslyn Elctrn. Sys., 6868 Cortona Dr., Goleta, Calif. ..... p 2740, 2741
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2579
Presin Co., Trap Falls Rd., Shelton, Conn.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1805
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Transtector Systems, 3025 W. Mission Rd., Alhambra, Calif. ... p 2786
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.

SUPPRESSORS, HARMONIC

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1942, 1943
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.

SUPPRESSORS, NOISE

Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1942, 1943
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Hopkins Engrg. Co., 12900 Foothill Blvd., San Fernando, Cal.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Standard Condenser Corp., 1065 W. Addison St., Chicago, Ill.
White Electromagnetics, Inc., 656 Lofstrand La., Rockville, Md.

SUPPRESSORS, TRANSIENT VOLTAGE (RECTIFIER TYPE)

California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal. p 1358
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa. ... p 2361
Dale Electronics Inc., Box 609, Columbus, Nebr.
Elgar Corp., 8159 Engineer Rd., San Diego, Calif. ..... p 1942, 1943
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
International Rectifier, 233 Kansas St., El Segundo, Calif. .... p 2523
Joslyn Elctrn. Sys., 6868 Cortona Dr., Goleta, Calif. ..... p 2740, 2741
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2579
Semikron International Inc., Box 323, Scarsdale, N. Y. ..... p 2587
Transtector Systems, 3025 W. Mission Rd., Alhambra, Calif. ... p 2786
Bradley Semiconductor Corp., 275 Welton St., New Haven, Conn.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Power Conversion Prods. Inc., Forty Two East St., Crystal Lake, Ill.
Rectifier Engrg. & Supply, 8754 Big Bend Blvd., St. Louis, Mo.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.

SURFACE ANALYZERS—SEE INDICATORS, SURFACE ROUGHNESS

Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa. .... p 2361

SURGE ARRESTERS, ELECTRICAL—SEE ARRESTERS, ELECTRICAL SURGE

SWITCHBOARDS

Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill.
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Technology Corp., 73-03 Grand Ave., Maspeth, N. Y.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Devco Engrg., Inc., Pier Lane W., Caldwell, N. J.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
N/P Co., Inc., Box 127, Temple City, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
North Electric Co., 553 S. Market St., Galion, Ohio
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Siemens America, Inc., Telecom Div., 350 Fifth Ave., New York, N. Y.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stevenson Engrg. & Mfg. Co., P.O. Box 25070, Portland, Ore.
Strom Communications Corp., 10th & Walnut Sts., Chester, Pa.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

SWITCHERS, R-F

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn. .... p 1648, 1649
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. ..... p 2718
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fifth Dimension Inc., Box 483, Princeton, N. J.
Hamlin Inc., 670 Lake St., Lake Mills, Wisc.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Quantatron, 1631 Tenth St., Santa Monica, Calif.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.

SWITCHERS, VIDEO

AMP Incorporated, Box 3608, Harrisburg, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Cohu Electronics Inc., Box 623, San Diego, Calif.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y. .. p 2710, 2711
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. .....
Fifth Dimension Inc., Box 483, Princeton, N. J.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Packard Bell Elctrn., Lawrence & Arnold Drs., Newbury Pk., Calif.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telemet Co., 185 Dixon Ave., Amityville, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Videon Corp., 140 E. Main St., Huntington, N. Y.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.

SWITCHES, ACCELERATION

Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Metrix Instrument Co., P.O. Box 36501, Houston, Tex.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.

SWITCHES, CAM

Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Larson Aero Development, Box 135, Concord, Calif.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
United Control Corporation, Redmond, Wash.

SWITCHES, AIR FLOW ACTUATED

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2696
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Columbus Elec. Mfg. Co., 621 N. Hamilton Rd., Columbus, Ohio
Corning Glass Works, Electronic Products Div., Corning, N. Y.
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239
Rotron, Inc., Hasbrouck La., Woodstock, N. Y. ..... p 1275
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y. p 2784
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Automation Devices, Inc., Box A.D., Fairview, Pa.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Dynacool Mfg. Co., Inc., 1 Russell St., Saugerties, N. Y.
Gems Co., Inc., Spring La., Farmington, Conn.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Michigan Oven Co., 1st Oven Pl., Romulus, Mich.
Wintriss Controls, 20 Vandam St., New York, N. Y.

SWITCHES, ANTENNA CHANGEOVER

AEL Inc., P.O. Box 552, Lansdale, Pa.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 622
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. p 2718, 2720, 2721
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fifth Dimension Inc., Box 483, Princeton, N. J.
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Quantatron, 1631 Tenth St., Santa Monica, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Scherma, F. A. Mfg. Co., Inc., 424 Broome St., New York, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Trylon, Inc., Elverson, Pa.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.

SWITCHES, BAROMETRIC

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2696
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2464
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
NUS Corp., Box 248, Paramus, N. J.
Precision Sensors, Inc., Box 297, Trumbull, Conn.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
U.O.P. Instruments Div., Greenwich, Conn.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.

SWITCHES, CAM

Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill. p 2704
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 893
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2756
Licon Div., Ill. Tool Works, Inc., 8615 W. Irving Pk., Chicago, Ill. p 2748, 2749

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Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. ... p 2756
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
General Control Co., 1196 Soldiers Field Rd., Boston, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Midtex/Aemco, 10 State St., Mankato, Minn.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
Sealectro Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

SWITCHES, CAM, ADJUSTABLE—SEE SWITCHES, CAM

SWITCHES, CANOPY

Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.

SWITCHES, CENTRIFUGAL

Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.

SWITCHES, COAXIAL CABLE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn. .... p 1648, 1649
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1343
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. ..... p 2719–2721
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fifth Dimension Inc., Box 483, Princeton, N. J.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1707
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Gold Line Connector, Inc., Muller Ave., Box 893, Norwalk, Conn.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Quantatron, 1631 Tenth St., Santa Monica, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.
Winslow Tele-Tronics, Inc., 1000 First Ave., Asbury Park, N. J.

SWITCHES, CODE

Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. .. p 2705
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2713–2715
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 912, 2736
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio p 2762
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
North Electric Co., 553 S. Market St., Galion, Ohio
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.

SWITCHES, COMMUTATOR—SEE COMMUTATORS, SWITCHING

SWITCHES, CROSSBAR

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y. .. p 2710, 2711
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Fifth Dimension Inc., Box 483, Princeton, N. J.
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 2273
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif. .. p 1407
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio p 2762
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2301
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Universal Relay Corp., 42 White St., New York, N. Y.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
North Electric Co., 553 S. Market St., Galion, Ohio
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.

SWITCHES, DATA-SAMPLING

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Airflyte Electronics Co., Box 207, Bayonne, N. J.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. .. p 2705
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y. .. p 2710, 2711
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2713–2715
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Honeywell Test Instruments Div., Box 5227, Denver, Colo.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif. .. p 1407
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif. ..... p 783
Markite Corp., 155 Waverly Pl., New York, N. Y. ..... p 2483
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Reed Co., Box 858, Clark, N. J.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Diversity Systems, Box 167, Totowa, N. J.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.

SWITCHES, DECADE

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
C & K Components Inc., 103 Morse St., Watertown, Mass.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2713, 2714
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn.
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2766
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Shallcross, E. Preston St., Selma, N. C.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.

SWITCHES, ELECTRONIC—SEE CONTROLS

SWITCHES, EXPLOSION PROOF

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2696
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2464
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2760
Janco Corp., 3111 Winona Ave., Burbank, Calif.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. ... p 2760
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2771
Stackpole Components Co., Box 14466, Raleigh, N. C. ..... p 2780
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Wild Rover Corp., Herbert Ave., Closter, N. J. ..... p 2788
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Denison, R. B., Inc., 103 Broadway, Bedford, Ohio
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Linemaster Switch Corp., Box 52, Woodstock, Conn.
Luminator, Inc., Box 278, Plano, Tex.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Wavetronics Inds. Inc., 211 Warren St., W. Pittston, Pa.

SWITCHES, FLOAT

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1805
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Autocall Co., 366 Mack Ave., Shelby, Ohio
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Precision Sensors, Inc., Box 297, Trumbull, Conn.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
U.O.P. Instruments Div., Greenwich, Conn.

SWITCHES, FOOT—PEDAL, MAT, RIBBON, ETC.

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2690
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. ..... p 2707
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2758
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. ... p 2758
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y. p 2784
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Control Co., 1196 Soldiers Field Rd., Boston, Mass.
Lektra Labs., Inc., 129-07 18th Ave., College Point, N. Y.
Line Electric Co., U.S. Hwy. 287, Parsippany, N. J.
Linemaster Switch Corp., Box 52, Woodstock, Conn.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
On-Guard Corp. of America, 345 West 37 St., New York, N. Y.
Pioneer Foot Switch Co., 3720 N. New England Ave., Chicago, Ill.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.

SWITCHES, GANG & ASSEMBLIES

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2690
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. ... p 2693
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 2700
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 2700
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 2700
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 2700
Capitol Machine & Switch Co., 87 Newtown Rd., Danbury, Conn. p 2701
Carter Mfg. Corp., 23 Washington St., Hudson, Mass. ..... p 2459
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill. p 2704
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. .. p 2705
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. ..... p 2707
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2713–2715
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
Electro Switch Corp., King Ave., Weymouth, Mass. ..... p 2722
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2756, 2759
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2732–2735
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 2736

J-B-T Instrs. Inc., Box 1818, New Haven, Conn. ..... p 2737
Janco Corp., 3111 Winona Ave., Burbank, Calif. ..... p 2739
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2748
Markite Corp., 155 Waverly Pl., New York, N. Y. ..... p 2483
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. ..... p 2753
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2756, 2759
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J. p 2723
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2764-2766
Pamotor Inc., 770 Airport Blvd., Burlingame, Cal.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr.
Robertshaw Controls Co., I-71 S. at Stringtown Rd., Columbus, Ohio p 2775
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Shallcross, E. Preston St., Selma, N. C.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. ..... p 2777
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. .. p 2783
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn.
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Wilmington Controls Div., Ledex, Inc., 111 S. Nelson Rd., Wilmington, Ohio p 2743
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Milli-Switch Corp., Box 67, Gladwyne, Pa .
Mossman, D. P., Inc., Box 265, Brewster, N. Y.
Relay Service Co., 1310 N. Pulaski, Chicago, Ill.
States Co., 19 New Park Ave., Hartford, Conn.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superior Switchboard & Devices Div., Box 590, Canton, Ohio
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Westronics, Inc., 3605 McCart St., Fort Worth, Tex.

SWITCHES, HIGH TEMPERATURE

Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2755, 2756, 2760, 2761
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2749
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2755, 2756, 2760, 2761
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
RCL Electronics, Inc., 700 S. 21st St, Irvington, N. J. ..... p 2769
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Wilmington Controls Div., Ledex, Inc., 111 S. Nelson Rd., Wilmington, Ohio p 2746
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Milli-Switch Corp., Box 67, Gladwyne, Pa .
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
U. S. Switch Corp., 351 Boston Post Rd., Milford, Conn.
Wavetronics Inds. Inc., 211 Warren St., W. Pittston, Pa.

SWITCHES, HIGH VOLTAGE

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. ..... p 2700
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. .... p 2700
CTS Corp., 905 N. West Blvd., Elkhart, Ind. ..... p 2700
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. .... p 2700
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Hamlin Inc., 670 Lake St., Lake Mills, Wisc. ..... p 2729, 2730
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2760
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
Kilovolt Corp., 238 High St., Hackensack, N. J.
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .... p 2760
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 1175
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Shallcross, E. Preston St., Selma, N. C.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Kentrox Inds., Inc., 8735 S.W. Canyon La., Portland, Ore.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.

SWITCHES, ILLUMINATED

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2689
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. ... p 2693
Capitol Machine & Switch Co., 87 Newtown Rd., Danbury, Conn. p 2701
Carling Elec., Inc., 505 New Park Ave., West Hartford, Conn. ... p 2702
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. .. p 2705
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. ..... p 2706
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. ..... p 1783
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2713-2715
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2726
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2757, 2760, 2761
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. ..... p 1796
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2732, 2735
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 912
Leecraft Mfg. Co. Inc., 21-16 44th Rd., Long Island City, N. Y. p 1801
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2748, 2749
Marco-Oak Co., P.O. Box 4011, Anaheim, Calif. ..... p 2750
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. p 2751-2753
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2757, 2760, 2761
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill. ..... p 2754
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2766
Pamotor Inc., 770 Airport Blvd., Burlingame, Cal.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2772
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn. p 1810
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 1811
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Economy Fuse Div., 2070 Maple St., Des Plaines, Ill.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Farwest Mfg. Div., Inc., 32nd at 124th, S.E., Bellevue, Wash.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Control Co., 1196 Soldiers Field Rd., Boston, Mass.
Genisco Technology Corp., 18435 Susana Rd., Compton, Calif.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Korry Mfg. Co., 223-8th Ave. N., Seattle, Wash.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Luminator, Inc., Box 278, Plano, Tex.
Mossman, D. P., Inc., Box 265, Brewster, N. Y.
Radar Relay, Inc., 1631 10th St., Santa Monica, Calif.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Truco, Inc., Box 95, Simsbury, Conn.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.

SWITCHES, INERTIA

Metrix Instrument Co., P.O. Box 36501, Houston, Tex. ..... p 2841
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.

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Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2691
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. .... p 2693
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
Fifth Dimension Inc., Box 483, Princeton, N. J.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2757
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Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
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Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 805
Unimax Switch Div., Ives Rd., Wallingford, Conn.
Wild Rover Corp., Herbert Ave., Closter, N. J. ..... p 2788

SWITCHES, LEVER

Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Luminator, Inc., Box 278, Plano, Tex.
Mossman, D. P., Inc., Box 265, Brewster, N. Y.

SWITCHES, KEY-LOCK

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2689
Chicago Lock Co., 4311 W. Belmont, Chicago, Ill. ..... p 2708
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif.
Electro Switch Corp., King Ave., Weymouth, Mass. ..... p 2722
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Janco Corp., 3111 Winona Ave., Burbank, Calif. ..... p 2739
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Trimm Inc., 400 Lake St., Libertyville, Ill.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Culver-Stearns Mfg. Co., 354 Franklin St., Worcester, Mass.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
National Acme Co., 170 East 131 St., Cleveland, Ohio
On-Guard Corp. of America, 345 West 37 St., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Robot Inds., Inc., 7041 Orchard, Dearborn, Mich.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Truco, Inc., Box 95, Simsbury, Conn.

SWITCHES, KNIFE

Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
J-B-L Instr. Co., Sycamore & Mill Rds., Clifton Hgts., Pa.
Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
States Co., 19 New Park Ave., Hartford, Conn.
Superior Switchboard & Devices Div., Box 590, Canton, Ohio
Wadsworth Electric Mfg. Co., Inc., 20 West 11th St., Covington, Ky.

SWITCHES, LEVER

American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif.
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Capitol Machine & Switch Co., 87 Newtown Rd., Danbury, Conn. p 2701
Carling Elec., Inc., 505 New Park Ave., West Hartford, Conn.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2703
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill. p 2704
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn.
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2755, 2756
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2733
J-B-T Instrs. Inc., Box 1818, New Haven, Conn. ..... p 2737
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2749
Mallory Controls Co., Box 327, Frankfort, Ind. ..... p 2482
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2755, 2756
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J. p 2723
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2764-2766
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2763
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn.
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. .. p 2783
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
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Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Denison, R. B., Inc., 103 Broadway, Bedford, Ohio
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Control Co., 1196 Soldiers Field Rd., Boston, Mass.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Milli-Switch Corp., Box 67, Gladwyne, Pa .
Mossman, D. P., Inc., Box 265, Brewster, N. Y.
Network Industries, Inc., Box 397, Bayonne, N. J.
Reed Switch Developments Co., Inc., 34 Lincoln Ave., Greenwich, Conn.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Telephone Components, Inc., 9 Norfolk Dr., Northport, N. Y.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.

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Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2690
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill. p 2704
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Fifth Dimension Inc., Box 483, Princeton, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2755, 2756, 2760, 2761
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2749
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2755, 2756, 2760, 2761
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2770
Risk, George, Industries, 672 15 Ave., Columbus, Nebr.
Robertshaw Controls Co., I-71 S. at Stringtown Rd., Columbus, Ohio
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. ..... p 2777
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Sterling Instr., 76 E. Second St., Mineola, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Chatham Controls Corp., 33 River Rd., Chatham, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Denison, R. B., Inc., 103 Broadway, Bedford, Ohio
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Control Co., 1196 Soldiers Field Rd., Boston, Mass.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Luminator, Inc., Box 278, Plano, Tex.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Otto Controls, 8611 Lincoln Ave., Morton Grove, Ill.
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Reed Switch Developments Co., Inc., 34 Lincoln Ave., Greenwich, Conn.
Sealectric Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Thermal Engrg. & Design Co., 217 Ash St., Akron, Ohio
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.

SWITCHES, LIQUID LEVEL/PRESSURE

Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2696
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2464
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Autocall Co., 366 Mack Ave., Shelby, Ohio
Automatic Timing & Controls Inc., King of Prussia, Pa.
Automation Products Inc., 3030 Max Roy St., Houston, Tex.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Dietz, H. G., Co., Inc., 14-26 28th Ave., Long Island City, N. Y.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Cal.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
NUS Corp., Box 248, Paramus, N. J.
Precision Sensors, Inc., Box 297, Trumbull, Conn.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Roylyn Inc., 620 Paula Ave., Glendale, Calif.
Simmonds Precision Prods., Inc., Rockingham Rd., Bellows Falls, Vt.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
U.O.P. Instruments Div., Greenwich, Conn.
United Electric Controls Co., 85A School St., Watertown, Mass.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.

SWITCHES, LOCK—SEE SWITCHES, KEY-LOCK

SWITCHES, MAGNETIC REED

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 2690, 2691
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I. ..... p 2218
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif.
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gordos Corp., 250 Glenwood Ave., Bloomfield, N. J. ..... p 2725
Hamlin Inc., 670 Lake St., Lake Mills, Wisc. ..... p 2728-2730
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. ... p 2761
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. ... p 2761
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind. .. p 2296
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2771
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
General Reed Co., Box 858, Clark, N. J.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.
Wintriss Controls, 20 Vandam St., New York, N. Y.

SWITCHES, MAGNETICALLY ACTUATED

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2690
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Chicago Lock Co., 4311 W. Belmont, Chicago, Ill. ..... p 2708
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Disc Instrs., Inc., 2701 S. Halladay St., Santa Ana, Calif.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif.
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn.
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I. .... p 2813
Fifth Dimension Inc., Box 483, Princeton, N. J. ..... p 2724
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hamlin Inc., 670 Lake St., Lake Mills, Wisc. ..... p 2728-2730
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. ... p 2759
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Kurman Instruments Corp., 15 Burke La., Syosset, N. Y.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Liberty Controls, RFD 5, Joliet, Ill. ..... p 2288
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2748
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. ... p 2759
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr.
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 805, 1811
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
General Reed Co., Box 858, Clark, N. J.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Leece-Neville Co., 1374 East 51st St., Cleveland, Ohio
Luminator, Inc., Box 278, Plano, Tex.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Mosler Electronic System Div., 9 South St., Danbury, Conn.
Reed Switch Developments Co., Inc., 34 Lincoln Ave., Greenwich, Conn.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wintriss Controls, 20 Vandam St., New York, N. Y.

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A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 759
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill. p 2704
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y. .. p 2710, 2711
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. ..... p 2721
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Fifth Dimension Inc., Box 483, Princeton, N. J.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2757
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif. .. p 1407
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 912
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. ... p 2757
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio p 2762
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 805, 1811
Unimax Switch Div., Ives Rd., Wallingford, Conn.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va. p 1007
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
General Reed Co., Box 858, Clark, N. J.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Luminator, Inc., Box 278, Plano, Tex.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Mossman, D. P., Inc., Box 265, Brewster, N. Y.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Space Diversity Systems, Box 167, Totowa, N. J.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.
Whistler Elctrns., Inc., 8613 Yolanda Ave., Northridge, Calif.

SWITCHES, MERCURY DISPLACEMENT

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Fifth Dimension Inc., Box 483, Princeton, N. J. ..... p 2724
Gordos Corp., 250 Glenwood Ave., Bloomfield, N. J. ..... p 2725
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Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2771
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Mercury Contacts, Inc., 1950 Neva Dr., Dayton, Ohio
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Waber Electronics, Inc., 2000 N. Second St., Philadelphia, Pa.

SWITCHES, MERCURY-WETTED CONTACTS

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind.
Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Fifth Dimension Inc., Box 483, Princeton, N. J. ..... p 2724
Hamlin Inc., 670 Lake St., Lake Mills, Wisc. ..... p 2728, 2730
Elec-Trol, Inc., 21018 Soledad Canyon Rd., Saugus, Calif.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

SWITCHES, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn. .... p 1648, 1649
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1343
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. ..... p 2720, 2721
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fifth Dimension Inc., Box 483, Princeton, N. J.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1707
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Texscan Corp., 2448 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J. ..... p 1720
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Addington Labs. Inc., 1043 DiGiulio Ave., Santa Clara, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Control Data Corp., 400 Border St., East Boston, Mass.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
GAF Corp., 140 West 51 St., New York, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Maxson Electronics Div., Sunrise Hwy., Great River, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Quantatron, 1631 Tenth St., Santa Monica, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

SWITCHES, MOMENTARY CONTACT

ADC Products, 6405 Cambridge St., Minneapolis, Minn. ..... p 819
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 2688-2691
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. .... p 2693
C & K Components Inc., 103 Morse St., Watertown, Mass. p 2697-2699
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Capitol Machine & Switch Co., 87 Newtown Rd., Danbury, Conn. p 2701
Carling Elec., Inc., 505 New Park Ave., West Hartford, Conn. .... p 2702
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill. p 2704
Chicago Lock Co., 4311 W. Belmont, Chicago, Ill. ..... p 2708
Columbus Elec. Mfg. Co., 621 N. Hamilton Rd., Columbus, Ohio .. p 2709
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. ..... p 1783
Eldema Div., 18435 Susana Rd., Compton, Calif. ..... p 1787
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
Electro Switch Corp., King Ave., Weymouth, Mass. ..... p 2722
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Fifth Dimension Inc., Box 483, Princeton, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2726
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2756-2760
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2732, 2734, 2735
J-B-T Instrs. Inc., Box 1818, New Haven, Conn. ..... p 2737
Janco Corp., 3111 Winona Ave., Burbank, Calif. ..... p 2739
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2748, 2749
Mallory Controls Co., Box 327, Frankfort, Ind. ..... p 2482
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. ..... p 2751
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2756-2760
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J. p 2723
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2765
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2763
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2770
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2771
Robertshaw Controls Co., I-71 S. at Stringtown Rd., Columbus, Ohio p 2775
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn.
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. p 2782, 2783
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y. p 2784
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 1811
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Wild Rover Corp., Herbert Ave., Closter, N. J. ..... p 2788
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Carter Precision Elec. Co., 3401 W. Madison St., Skokie, Ill.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Culver-Stearns Mfg. Co., 354 Franklin St., Worcester, Mass.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Denison, R. B., Inc., 103 Broadway, Bedford, Ohio
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eastern Marking Machine Corp., 30 Alabama Ave., Island Park, N. Y.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
General Reed Co., Box 858, Clark, N. J.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Luminator, Inc., Box 278, Plano, Tex.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Milli-Switch Corp., Box 67, Gladwyne, Pa .
Mossman, D. P., Inc., Box 265, Brewster, N. Y.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Otto Controls, 8611 Lincoln Ave., Morton Grove, Ill.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
Truco, Inc., Box 95, Simsbury, Conn.

SWITCHES, MOTOR-DRIVEN

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Airflyte Electronics Co., Box 207, Bayonne, N. J.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electro Switch Corp., King Ave., Weymouth, Mass.
Fifth Dimension Inc., Box 483, Princeton, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Globe Industries, 2275 Stanley Ave., Dayton, Ohio
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Heinemann Electric Co., 2636 Brunswick Pike, Trenton, N. J. .... p 2731
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif.
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y. p 2671
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Shallcross, E. Preston St., Selma, N. C.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056

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Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Collectron Corp., 304 East 45th St., New York, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Midtex/Aemco, 10 State St., Mankato, Minn.
Montgomery Mfg. Co., Inc., 206 S. Main St., Owensville, Ind.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England

SWITCHES, MOTOR-REVERSING

Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif. ..... p 1056
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Stevenson Engrg. & Mfg. Co., P.O. Box 25070, Portland, Ore.

SWITCHES, OIL IMMERSED

Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2726
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif.
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Wavetronics Inds. Inc., 211 Warren St., W. Pittston, Pa.

SWITCHES, PHOTOELECTRIC—SEE CELLS, PHOTOCONDUCTIVE; ETC.—ALSO SEE CONTROLS, PHOTOELECTRIC

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ADC Products, 6405 Cambridge St., Minneapolis, Minn. ..... p 819
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Hamlin Inc., 670 Lake St., Lake Mills, Wisc.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2755, 2756, 2760
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2734
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2748, 2749
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2755, 2756, 2760
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2766
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2763
Risk, George, Industries, 672 15 Ave., Columbus, Nebr.
Robertshaw Controls Co., I-71 S. at Stringtown Rd., Columbus, Ohio p 2774, 2775
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. .. p 2782

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Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.

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ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2689
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill.
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H.
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2759-2761
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2732, 2735
Janco Corp., 3111 Winona Ave., Burbank, Calif. ..... p 2739
Leach Corp., 5915 Avalon Blvd., Los Angeles, Cal.
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2748, 2749
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2759-2761
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2766
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Shallcross, E. Preston St., Selma, N. C.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
J-B-L Instr. Co., Sycamore & Mill Rds., Clifton Hgts., Pa.
Mack Elec. Devices, Inc., 32 Glenside Ave., Wyncote, Pa.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Pioneer Foot Switch Co., 3720 N. New England Ave., Chicago, Ill.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.

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Automatic Controls Div., 200 E. Daniels Rd., Palatine, Ill. ..... p 2696
Columbus Elec. Mfg. Co., 621 N. Hamilton Rd., Columbus, Ohio .. p 2709
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. ..... p 2464
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. ..... p 2470
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind. .. p 1045
Tapeswitch Corp. of America, 320 Broad Hollow Rd., Farmingdale, N. Y. p 2784
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Aero Mechanism, Inc., 7750 Burnett Ave., Van Nuys, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Control Prods., Inc., Box 72, Hanover, N. J.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Dietz, H. G., Co., Inc., 14-26 28th Ave., Long Island City, N. Y.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Fasco Inds., Inc., Augusta at North Union Sts., Rochester, N. Y.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
IMC Magnetics Corp., 1900 East 5th St., Tempe, Ariz.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Lear Siegler, Inc., Romec Div., 241 S. Abbe Rd., Elyria, Ohio
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Meletron Corp., 940 N. Orange Dr., Los Angeles, Calif.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
NUS Corp., Box 248, Paramus, N. J.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Precision Sensors, Inc., Box 297, Trumbull, Conn.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
U.O.P. Instruments Div., Greenwich, Conn.
U. S. Switch Corp., 351 Boston Post Rd., Milford, Conn.
United Electric Controls Co., 85A School St., Watertown, Mass.
Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J.
Wavetronics Inds. Inc., 211 Warren St., W. Pittston, Pa.
Wintriss Controls, 20 Vandam St., New York, N. Y.

SWITCHES, PRINTED CIRCUIT MOUNTING

AEL Inc., P.O. Box 552, Lansdale, Pa.
Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind.
Airflyte Electronics Co., Box 207, Bayonne, N. J.
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 2689, 2690
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. .... p 2693
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
C & K Components Inc., 103 Morse St., Watertown, Mass. p 2697-2699
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2703
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill. p 2704
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. .. p 2706, 2707
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa. .... p 2712
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Digilog Electronics Corp., Box 9368, 701 G. Third Ave. N., Seattle, Wash.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2713-2715
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif.
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Fifth Dimension Inc., Box 483, Princeton, N. J.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2755
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. ..... p 1194
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2734
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 2736
J-B-T Instrs. Inc., Box 1818, New Haven, Conn. ..... p 2737
Janco Corp., 3111 Winona Ave., Burbank, Calif. ..... p 2738
Mallory Controls Co., Box 327, Frankfort, Ind. ..... p 2482
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .... p 2755
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J. p 2723
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn.
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2764, 2766
Pamotor Inc., 770 Airport Blvd., Burlingame, Cal.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2763
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2772
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Shallcross, E. Preston St., Selma, N. C.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. ..... p 2777
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif. p 2497
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 1811
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Virginia Panel Corp., Box 1106, Waynesboro, Va.
Wilmington Controls Div., Ledex, Inc., 111 S. Nelson Rd., Wilmington, Ohio p 2743, 2744
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
General Reed Co., Box 858, Clark, N. J.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Torsion Balance Co., 35 Monhegan St., Clifton, N. J.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.

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Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
Airflyte Electronics Co., Box 207, Bayonne, N. J.
Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. .. p 2705
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. .. p 2757
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 912
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. .... p 2757
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va. p 1007
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Collectron Corp., 304 East 45th St., New York, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Montgomery Mfg. Co., Inc., 206 S. Main St., Owensville, Ind.
Paragon Elec. Co., Inc., 1600 12th St., Two Rivers, Wisc.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.

SWITCHES, PROXIMITY

Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind.
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2690
Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Cote-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I.
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. p 1026, 1027
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. p 1026, 1027
Fifth Dimension Inc., Box 483, Princeton, N. J. ..... p 2724
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gordos Corp., 250 Glenwood Ave., Bloomfield, N. J. ..... p 2725
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2760, 2761
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2749
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2760, 2761
Robertshaw Controls Co., I-71 S. at Stringtown Rd., Columbus, Ohio
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Assembly Elctrns., 807 Kent St., Niagara Falls, Ont., Can.
Automation Devices, Inc., Box A.D., Fairview, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Denison, R. B., Inc., 103 Broadway, Bedford, Ohio
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Electronic Control Corp., 15341 Dale, Detroit, Mich.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Gems Co., Inc., Spring La., Farmington, Conn.
General Equipment & Mfg. Co., Inc., 3300 Fern Valley Rd., Louisville, Ky.
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
Jo-Bell Prods., Inc., 5456 West 111 St., Oak Lawn, Ill.
Luminator, Inc., Box 278, Plano, Tex.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Photobell Co., Inc., 12M East 22 St., New York, N. Y.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Recora Co., Inc., Powis Rd., St. Charles, Ill.
Reed Switch Developments Co., Inc., 34 Lincoln Ave., Greenwich, Conn.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.

Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Westinghouse Electric Corp., General Control Div., Buffalo, N. Y.

SWITCHES, PUSHBUTTON, ALL TYPES

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 2689, 2691
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. p 2693
C & K Components Inc., 103 Morse St., Watertown, Mass. p 2697-2699
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Capitol Machine & Switch Co., 87 Newtown Rd., Danbury, Conn. p 2701
Carling Elec., Inc., 505 New Park Ave., West Hartford, Conn. p 2702
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2703
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill. p 2704
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. p 2705
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. p 2707
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. p 893
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. p 550
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y. p 1783
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. p 2715
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Eldema Div., 18435 Susana Rd., Compton, Calif. p 1787
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif. p 2717
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. p 2224
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2726
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. p 2727
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2755-2758, 2760, 2761
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. p 1796
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2732-2735
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Janco Corp., 3111 Winona Ave., Burbank, Calif.
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill. p 2749
Mallory Controls Co., Box 327, Frankfort, Ind. p 2482
Marco-Oak Co., P.O. Box 4011, Anaheim, Calif. p 2750
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. p 2751-2753
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2755-2758, 2760, 2761
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill. p 2754
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J. p 2723
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2764-2766
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. p 2770
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. p 2771, 2772
Robertshaw Controls Co., I-71 S. at Stringtown Rd., Columbus, Ohio p 2774, 2775
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Shallcross, E. Preston St., Selma, N. C.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan p 2776
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. p 993
Sorenson Lighted Controls, Inc., 530 Oakwood Ave., West Hartford, Conn.
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. p 2782
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. p 1811
Trimm Inc., 400 Lake St., Libertyville, Ill.
Unimax Switch Div., Ives Rd., Wallingford, Conn. p 2787
Universal Relay Corp., 42 White St., New York, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Wild Rover Corp., Herbert Ave., Closter, N. J. p 2788
Adalet Mfg. Co., 4801 West 150th St., Cleveland, Ohio
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Control Prods., Inc., Box 72, Hanover, N. J.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Culver-Stearns Mfg. Co., 354 Franklin St., Worcester, Mass.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Control Co., 1196 Soldiers Field Rd., Boston, Mass.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Reed Co., Box 858, Clark, N. J.
Genisco Technology Corp., 18435 Susana Rd., Compton, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
ITT Telecommunications, Fulton Dr., Corinth, Miss.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Korry Mfg. Co., 223-8th Ave. N., Seattle, Wash.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Methode Electronics, Inc., 7447 W. Wilson Ave., Chicago, Ill.
Milli-Switch Corp., Box 67, Gladwyne, Pa .
Mossman, D. P., Inc., Box 265, Brewster, N. Y.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
Otto Controls, 8611 Lincoln Ave., Morton Grove, Ill.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Pioneer Foot Switch Co., 3720 N. New England Ave., Chicago, Ill.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Radar Relay, Inc., 1631 10th St., Santa Monica, Calif.
Reed Switch Developments Co., Inc., 34 Lincoln Ave., Greenwich, Conn.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Telefunken Sales Corp., South St., Garden City, N. Y.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Touch-Plate Electro-Sys., Inc., 16530 Garfield Ave., Paramount, Calif.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
Truco, Inc., Box 95, Simsbury, Conn.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Vitramon, Inc., Box 544, Bridgeport, Conn.

SWITCHES, R-F

Amphenol RF Div., 33 E. Franklin St., Danbury, Conn. p 1648, 1649
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. p 1660
Dow-Key Co., 2260 Industrial La., Broomfield, Colo. p 2718, 2719
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fifth Dimension Inc., Box 483, Princeton, N. J.
Hamlin Inc., 670 Lake St., Lake Mills, Wisc.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. p 1678
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. p 1175
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. p 1707
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Transco Products, 4241 Glencoe Ave., Venice, Calif. p 1711
Addington Labs., Inc., 1043 DiGiulio Ave., Santa Clark, Calif.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Mini-Circuits Lab., 152 West 42nd St., New York, N. Y.
Raybond Elctrns. Inc., 930 Washington St., Norwood, Mass.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

SWITCHES, REED

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. p 759
ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 819
Adams & Westlake Co., 1025 N. Michigan St., Elkhart, Ind.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Coto-Coil Co., Inc., 57 Pavilion Ave., Providence, R. I. p 2218
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif.
Douglas Randall, Inc., 6 Pawcatuck Ave., Westerly, R. I. p 2222
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Gordos Corp., 250 Glenwood Ave., Bloomfield, N. J. p 2725
Hamlin Inc., 670 Lake St., Lake Mills, Wisc. p 2728-2730
Hathaway, 5250 E. Evans Ave., Denver, Colo. p 2257
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2761
IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y. p 2276
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2761
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind. p 2296
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
RBM Controls, Distr. Mktg. Sec., 3501 W. Addison St., Chicago, Ill. p 2235
RBM Controls Div., Essex Int'l. Inc., 131 Godfrey, Logansport, Ind. p 2235
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. p 2771
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Compac Engrg., 845 Commercial St., San Jose, Calif.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
General Reed Co., Box 858, Clark, N. J.
Industrial Circuits Co., 23 Kulick Rd., Fairfield, N. J.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Struthers-Dunn, Inc., Lambs Rd., Pitman, N. J.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Wabash Magnetics Inc., Box 708, Wabash, Ind.

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Stackpole Components Co., Box 14466, Raleigh, N. C. p 2779
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Luminator, Inc., Box 278, Plano, Tex.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.

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Airflyte Electronics Co., Box 207, Bayonne, N. J. p 1722
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 2690
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
CTS of Berne, Inc., 406 Parr Rd., Berne, Ind. p 2700
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can. p 2700
CTS Corp., 905 N. West Blvd., Elkhart, Ind. p 2700
CTS Elctrns., Inc., 1010 Sycamore Ave., S. Pasadena, Calif. p 2700
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Carter Mfg. Corp., 23 Washington St., Hudson, Mass. p 2459
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2703
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. p 2705
Chicago Lock Co., 4311 W. Belmont, Chicago, Ill. p 2708
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. p 2707
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Clarostat Mfg. Co. Inc., Washington St., Dover, N. H. p 2461
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Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. p 893
Couch, S. Div., 3 Arlington St., North Quincy, Mass. p 2219
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. p 550
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Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. p 2715
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Electro-mech Components Inc., 1039 E. Valley Blvd., San Gabriel, Calif.
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Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
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Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2759, 2761
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. p 2273
Industrial Devices Inc., 982 River Rd., Edgewater, N. J. p 1797
J-B-T Instrs. Inc., Box 1818, New Haven, Conn. p 2737
Janco Corp., 3111 Winona Ave., Burbank, Calif. p 2738, 2739
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill.
Mallory Controls Co., Box 327, Frankfort, Ind. p 2482
Marco-Oak Co., P.O. Box 4011, Anaheim, Calif.
Markite Corp., 155 Waverly Pl., New York, N. Y. p 2483
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Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J. p 2723
New England Instrument Co., 14 Kendall Lane, Natick, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio p 2762
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn. p 2484, 2485
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Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J. p 2768-2769
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Shallcross, E. Preston St., Selma, N. C.

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Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1504
Spectrol Elctrns. Corp., 17070 E. Gale Ave., City of Industry, Calif. p 2497
Stackpole Components Co., Box 14466, Raleigh, N. C. ..... p 2780
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. p 2782
Tec Magnetics, 12117 Slauson Ave., Santa Fe Springs, Calif.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn.
Wilmington Controls Div., Ledex, Inc., 111 S. Nelson Rd., Wilmington, Ohio p 2743-2746
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
ASM Corp., 525 Truck La., Smithfield, N. C.
Ace Elctrn. Assocs., Inc., 99 Dover St., Somerville, Mass.
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Collectron Corp., 304 East 45th St., New York, N. Y.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Control Data Corp., 400 Border St., East Boston, Mass.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Electro-Miniatures Corp., 600 Huyler St., S. Hackensack, N. J.
Electro-Tec Corp., 1600 N. Main St., Blacksburg, Va.
Electronic Memories, Inc., 12621 Chadron Ave., Hawthorne, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Evaporated Coatings Inc., 798 Welsh Rd., Huntingdon Valley, Pa.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Reed Co., Box 858, Clark, N. J.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
J-B-L Instr. Co., Sycamore & Mill Rds., Clifton Hgts., Pa.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Lem Instrument Corp., 20 Sarah Dr., Farmingdale, N. Y.
Langevin, 1801 E. Carnegie Ave., Santa Ana, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Meletron Corp., 940 N. Orange Dr., Los Angeles, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Miniature Elctrn. Components Corp., 600 South St., Holbrook, Mass.
Mossman, D. P., Inc., Box 265, Brewster, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
National Acme Co., 170 East 131 St., Cleveland, Ohio
Northern Precision Labs, Inc., 202 Fairfield Rd., Fairfield, N. J.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Sealectric Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Tabet Mfg. Co., 1336 Ballentine Blvd., Norfolk, Va.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.

SWITCHES, ROTARY CHOPPER

Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill. p 2766
Assembly-Overland, 3650 Hildrege Ave., Los Angeles, Calif.
Collectron Corp., 304 East 45th St., New York, N. Y.
Metrological Data Corp., 70 Plauderville Ave., Garfield, N. J.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.

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Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 2689
CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
Carling Elec., Inc., 505 New Park Ave., West Hartford, Conn. .. p 2702
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc. p 2703
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. .. p 2706, 2707
Continental-Wirt Elctrns. Corp., 26 W. Queen La., Phila., Pa. .... p 2712
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2755, 2756
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn. p 2734
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Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
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Stackpole Components Co., Box 14466, Raleigh, N. C. ..... p 2778
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. p 2783
Wilmington Controls Div., Ledex, Inc., 111 S. Nelson Rd., Wilmington, Ohio
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Ansley Div., Aci Inc., Park Ave. & Ridge Rd., Perkasie, Pa.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.

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CTS of Canada, Ltd., 80 Thomas St., Streetsville, Ont., Can.
CTS Corp., 905 N. West Blvd., Elkhart, Ind.
Cherry Electrical Prod. Corp., 1650 Old Deerfield Rd., Highland Pk., Ill.
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Clarostat Mfg. Co. Inc., Washington St., Dover, N. H.
Columbus Elec. Mfg. Co., 621 N. Hamilton Rd., Columbus, Ohio .. p 2709
Connector Corp., 6025 N. Keystone Ave., Chicago, Ill. ..... p 893
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Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Digilog Electronics Corp., Box 9368, 701 G. Third Ave. N., Seattle, Wash.
Electro Switch Corp., King Ave., Weymouth, Mass.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
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Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. ..... p 2751
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2755, 2756, 2761
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Potter & Brumfield Div., AMF, 1200 E. Broadway, Princeton, Ind. p 2763
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2770
Risk, George, Industries, 672 15 Ave., Columbus, Nebr.
Robertshaw Controls Co., I-71 S. at Stringtown Rd., Columbus, Ohio p 2774, 2775
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Shallcross, E. Preston St., Selma, N. C.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass. ..... p 2777
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Stackpole Components Co., Box 14466, Raleigh, N. C. ..... p 2779
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. p 2783
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 1811
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Universal Relay Corp., 42 White St., New York, N. Y. ..... p 2332
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Clare-Pendar Co., P.O. Box 785, Post Falls, Idaho
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Control Prods., Inc., Box 72, Hanover, N. J.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Denison, R. B., Inc., 103 Broadway, Bedford, Ohio
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eastman Chemical Prods., Inc., Kingsport, Tenn.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
General Reed Co., Box 858, Clark, N. J.
Hi-Tek Corp., 2220 S. Anne St., Santa Ana, Calif.
J-B-L Instr. Co., Sycamore & Mill Rds., Clifton Hgts., Pa.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Luminator, Inc., Box 278, Plano, Tex.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Milli-Switch Corp., Box 67, Gladwyne, Pa .
National Acme Co., 170 East 131 St., Cleveland, Ohio
Norwalk Thermostat Co., 100 N. West St., Norwalk, Ohio
Otto Controls, 8611 Lincoln Ave., Morton Grove, Ill.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Reed Switch Developments Co., Inc., 34 Lincoln Ave., Greenwich, Conn.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Sealectric Switch & Relay Co., 6025 N. Keystone, Chicago, Ill.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Standard Controls, Inc., 2401 S. Bayview, Seattle, Wash.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Therm-O-Disc, Inc., Box 1538, Mansfield, Ohio
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.
Truco, Inc., Box 95, Simsbury, Conn.
UID Electronics Corp., 4105 Pembroke Rd., Hollywood, Fla.
U. S. Switch Corp., 351 Boston Post Rd., Milford, Conn.
United Control Corporation, Redmond, Wash.
United Electric Controls Co., 85A School St., Watertown, Mass.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
Wavetronics Inds. Inc., 211 Warren St., W. Pittston, Pa.

SWITCHES, SOLID STATE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
Alco Electronic Products Inc., Box 1348, Lawrence, Mass.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Anaren Microwave, Inc., 478 E. Brighton Ave., Syracuse, N. Y. p 1653
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Burr-Brown Research Corp., Int'l. Airport Ind. Pk., Tucson, Ariz.
Daico Inds., Inc., 1711 West 135th St., Gardena, Calif. ..... p 1660
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1664
Electronic Modules Corp., P.O. Box 141, Timonium, Md. ..... p 780
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal. p 1667
Fifth Dimension Inc., Box 483, Princeton, N. J.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1291
Grigsby-Barton Inc., 107 N. Hickory St., Arlington Hgts., Ill. .... p 2242
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill.
Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. .. p 528
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Risk, George, Industries, 672 15 Ave., Columbus, Nebr.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. ..... p 2674
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2649
Zenrad Controls Co., 1575 A.P.S., Santa Barbara, Calif.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.

Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Analogic Co., 296 Newton St., Waltham, Mass.
Arbor Systems, Inc., P.O. Box 1325, Ann Arbor, Mich.
Assembly Elctrns., 807 Kent St., Niagara Falls, Ont., Can.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Betamite Elctrn. Devices, 6321 W. Slauson Ave., Culver City, Cal.
Blake Electronics Inc., Muskego, Wisc.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Collins Radio Co., Dallas, Texas
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Denison, R. B., Inc., 103 Broadway, Bedford, Ohio
Design Products Corp., 1925 W. Maple Rd., Troy, Mich.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gems Co., Inc., Spring La., Farmington, Conn.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Instrument Components Co., 15105 Broadway, Maple Hghts., Ohio
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Lancer Electronics Corp., 1416 W. Main St., Norristown, Pa.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Lutron Electronics Co. Inc., 6th & Minor Sts., Emmaus, Pa.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
Maytronics, Inc., Box 460, Colorado Springs, Colo.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Products, Inc., 9533 Irondale Ave., Chatsworth, Calif.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Monsanto-Elctrn. Special Prods., 10131 Bubb Rd., Cupertino, Calif.
Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Norbatrol Electronics Corp., Norbatrol Ave. at Carson St., Murrysville, Pa.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Power Control Corp., Box 11432, Pittsburgh, Pa.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Rochester Instr. Systems, Inc., 275 N. Union St., Rochester, N. Y.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Sever-Hall Inc., 463 Brewster Ave., Redwood City, Calif.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

SWITCHES, SPEED-ACTUATED

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. p 1026, 1027, 2840
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. p 1026, 1027, 2840
International Rectifier, 233 Kansas St., El Segundo, Calif.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Euclid Electric & Mfg. Div., 50 Edwards St., Madison, Ohio
General Devices Inc., P.O. Box 253, Princeton, N. J.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
Instrumentation & Control Sys. Inc., 129 W. Laura, Addison, Ill.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Metron Instrument Inc., 1051 S. Platte River Dr., Denver, Colo.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Teikoku Tsushin Kogyo Co., 335, Nishi-Nakamachi, Aza Kariyado, Kawasaki-shi, Kanagawa Pref., Japan
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.

SWITCHES, STEP TYPE

Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. .. p 2705
Chicago Switch, Inc., 2035 Wabansia Ave., Chicago, Ill. ..... p 2707
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill. ..... p 2216
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Electro Switch Corp., King Ave., Weymouth, Mass. ..... p 2722
Fifth Dimension Inc., Box 483, Princeton, N. J.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 2273
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. ..... p 2753
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio p 2762
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y. p 2324
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Shallcross, E. Preston St., Selma, N. C.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Universal Relay Corp., 42 White St., New York, N. Y.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Breeze Corps., Inc., 700 Liberty Ave., Union, N. J.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Imtra Corp., 151 Mystic Ave., Medford, Mass.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.

SWITCHES, TAP

Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. .. p 2705
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Electro Switch Corp., King Ave., Weymouth, Mass. ..... p 2722
Grayhill Inc., 569 Hillgrove Ave., La Grange, Ill. ..... p 2727
Mallory Controls Co., Box 327, Frankfort, Ind. ..... p 2482
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
RCL Electronics, Inc., 700 S. 21st St., Irvington, N. J.
Shallcross, E. Preston St., Selma, N. C.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Wild Rover Corp., Herbert Ave., Closter, N. J. ..... p 2788
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
J-B-L Instr. Co., Sycamore & Mill Rds., Clifton Hgts., Pa.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Subminiature Instrs. Corp., 3236 Kansas Ave., Riverside, Calif.

SWITCHES, THERMALLY ACTUATED

Cox & Company, Inc., 215 Park Ave. S., New York, N. Y.
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I. .... p 2813
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2816
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
International Rectifier, 233 Kansas St., El Segundo, Calif.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 1048
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Aladdin Controls, 703 Murfreesboro Rd., Nashville, Tenn.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Bimet Electrical Res. Co., Box 269, Morris, Ill.
Burling Instrument Company, 21 River Road, Chatham, New Jersey
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Chatham Controls Corp., 33 River Rd., Chatham, N. J.
Control Prods., Inc., Box 72, Hanover, N. J.
Dales, F. Co., 180-85 E. Mill St., Akron, Ohio
Dialtron Corp., 203 Harrison Pl., Brooklyn, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Fenwal, Inc., Main St., Ashland, Mass.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, Ill.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Networks Electronic Corp., 9750 De Soto, Chatsworth, Calif.
Norwalk Thermostat Co., 100 N. West St., Norwalk, Ohio
Princo Instrs. Inc., Indl. Pk., Southampton, Pa.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Standard Controls, Inc., 2401 S. Bayview, Seattle, Wash.
Stemco Controls/Div. Essex Wire Corp., P.O. Annex 1007, Mansfield, Ohio
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Thermal Engrg. & Design Co., 217 Ash St., Akron, Ohio

SWITCHES, TOGGLE

Therm-O-Disc, Inc., Box 1538, Mansfield, Ohio
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
U. S. Switch Corp., 351 Boston Post Rd., Milford, Conn.
United Control Corporation, Redmond, Wash.
United Electric Controls Co., 85A School St., Watertown, Mass.
Valverde Labs., 60 Main St., Oakfield, N. Y.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
Wavetronics Inds. Inc., 211 Warren St., W. Pittston, Pa.

SWITCHES, THUMBWHEEL

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill. .. p 2705
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Digitran Co., 855 S. Arroyo Pkwy., Pasadena, Calif. ..... p 2713-2715
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2726
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Inter-Market Inc., 312 Waukegan Rd., Glenview, Ill. ..... p 1194
Interswitch, 770 Airport Blvd., Burlingame, Cal. ..... p 2736
Marco-Oak Co., P.O. Box 4011, Anaheim, Calif.
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill.
Pamotor Inc., 770 Airport Blvd., Burlingame, Cal.
Presin Co., Trap Falls Rd., Shelton, Conn.
Standard Grigsby Co., Dept. A, 920 Rathbone Ave., Aurora, Ill. p 2783
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Electronic Engrg. Co. of Calif., 1441 E. Chestnut Ave., Santa Ana, Calif.
Ewing Products, Inc., 1014 W. Burbank Blvd., Burbank, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.

SWITCHES, TIME DELAY

Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 2310
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Ewing Products, Inc., 1014 W. Burbank Blvd., Burbank, Calif.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Norwalk Thermostat Co., 100 N. West St., Norwalk, Ohio
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

SWITCHES, TIMING—SEE TIMERS

SWITCHES, TOGGLE

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. p 2688, 2689
American Zettler, Inc., 697 Randolph Ave., Costa Mesa, Calif. .. p 2693
C & K Components Inc., 103 Morse St., Watertown, Mass. p 2697-2699
Carling Elec., Inc., 505 New Park Ave., West Hartford, Conn. ... p 2702
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H.
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
Electrospace Corp., 956 Brush Hollow Rd., Westbury, N. Y. .... p 754
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Honeywell, Micro Switch Div., 11 W. Spring St., Freeport, Ill. p 2759, 2761
J-B-T Instrs. Inc., Box 1818, New Haven, Conn. ..... p 2737
Kay Electric Co., Maple Ave., Pine Brook, N. J.
Kulka Electric Corp., Dept. E, Box 149, Mount Vernon, N. Y. ... p 917
Licon Div., Ill. Tool Works, Inc., 6615 W. Irving Pk., Chicago, Ill.
Master Specialties Co., 1640 Monrovia, Costa Mesa, Calif. ..... p 2751
Micro Switch, Div. Honeywell, 11 W. Spring St., Freeport, Ill. p 2759, 2761
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J.
Remvac Components, Inc., 37-55 61st St., Woodside, N. Y. ..... p 2770
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan ..... p 2776
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Unimax Switch Div., Ives Rd., Wallingford, Conn. ..... p 2787
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Arcolectric Switch Co., Ltd., P.O. Box 348, N. Hollywood, Calif.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Circle F Inds., P.O. Box 591, Trenton, N. J.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Control Prods., Inc., Box 72, Hanover, N. J.
Controls Co. of Amer., Cont. Switch Div., 1420 Delmar Dr., Folcroft, Pa.
Culver-Stearns Mfg. Co., 354 Franklin St., Worcester, Mass.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Eugene Engineering Co., Inc., 50 Church St., Rockland, Mass.
General Control Co., 1196 Soldiers Field Rd., Boston, Mass.
Indak Mfg. Corp., 1915 Techny Rd., Northbrook, Ill.
Jay-El Products, Inc., Box 25, Gardena, Calif.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.

SWITCHES, TOGGLE (Cont'd)

Massey, A. H., Inc., 111 Third St., Derby, Conn.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Milli-Switch Corp., Box 67, Gladwyne, Pa .
Network Industries, Inc., Box 397, Bayonne, N. J.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Painton, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Seacor, Inc., 598 Broadway, Norwood, N. J.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.
Superior Switch Co., 1001 W. Broad St., Richmond, Va.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.
Texas Instruments, Inc., 34 Forest St., Attleboro, Mass.
Torsion Balance Co., 35 Monhegan St., Clifton, N. J.
Tower Mfg. Corp., 158 Pine St., Providence, R. I.

SWITCHES, TOUCH ACTUATED

Wild Rover Corp., Herbert Ave., Closter, N. J. ..... p 2788

SWITCHES, TRANSFER

Dow-Key Co., 2260 Industrial La., Broomfield, Colo. ..... p 2721
Electro Switch Corp., King Ave., Weymouth, Mass. ..... p 2722
Fifth Dimension Inc., Box 483, Princeton, N. J.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N. J. p 2785
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Wilmington Controls Div., Ledex, Inc., 111 S. Nelson Rd., Wilmington, Ohio p 2743
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
American Solenoid Co., Inc., 245 E. Inman Ave., Rahway, N. J.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Cyberex Inc., 4399 Industrial Pkwy., Willoughby, Ohio
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
J-B-L Instr. Co., Sycamore & Mill Rds., Clifton Hgts., Pa.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Luminator, Inc., Box 278, Plano, Tex.
Matrix Div., Schafer Elctrns., 9119 De Soto Ave., Chatsworth, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

SWITCHES, TRANSFORMER

Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.

SWITCHES, TRIGGER

Carling Elec., Inc., 505 New Park Ave., West Hartford, Conn. .. p 2702
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Guardian Electric Mfg. Co., 1550 W. Carroll Ave., Chicago, Ill.
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Conectrix Inc., 201 N. Gables, Wheaton, Ill.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Display Control, Div. Luminator, Inc., Box 278, Plano, Texas
General Devices Inc., P.O. Box 253, Princeton, N. J.
Luminator, Inc., Box 278, Plano, Tex.
Mason Elec. Co. Inc., 3839 Verdugo Rd., Los Angeles, Calif.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
McGill Mfg. Co., Inc., 909 N. Lafayette St., Valparaiso, Ind.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Pacific Switch Controls, Inc., 14048 Burbank Blvd., Van Nuys, Calif.
Specialties Mfg. Co., 8821 Fenkell, Detroit, Mich.
Stettner-Trush, Inc., 67 Albany St., Cazenovia, N. Y.

SWITCHES, ULTRASONIC

Abtronics, Inc., Box 712, Livermore, Calif.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Delavan Mfg. Co., 811 Fourth St., W. Des Moines, Iowa
Linden Labs. Inc., Box 920, State College, Pa.

SWITCHES, VACUUM

Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hamlin Inc., 670 Lake St., Lake Mills, Wisc.
High Vacuum Electronics Inc., 538 Mission St., S. Pasadena, Calif. p 2275
ITT Jennings Div., 970 McLaughlin Ave., San Jose, Calif. ..... p 669

Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif. .. p 2330
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Fredericks Co., Philmont & Anne St., Huntingdon Valley, Pa.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Meletron Corp., 940 N. Orange Dr., Los Angeles, Calif.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
NUS Corp., Box 248, Paramus, N. J.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Pollak, J. Corp., 195 Freeport St., Boston, Mass.
Precision Sensors, Inc., Box 297, Trumbull, Conn.
United Electric Controls Co., 85A School St., Watertown, Mass.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

SWITCHES, WAVEGUIDE

AEL Inc., P.O. Box 552, Lansdale, Pa.
ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn. .... p 1648, 1649
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Fifth Dimension Inc., Box 483, Princeton, N. J.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y. ..... p 1707
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Waveline Inc., Box 718, West Caldwell, N. J. ..... p 1720
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Blass Antenna Elctrns. Corp., 500 Willow Tree Rd., Leonia, N. J.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Control Data Corp., 400 Border St., East Boston, Mass.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Ferrotec, Inc., 80 Bridge St., Newton, Mass.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
I-Tel, Inc., 10504 Wheatley St., Kensington, Md.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Quantatron, 1631 Tenth St., Santa Monica, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sedco Systems, Inc., 130 Schmitt Blvd., Farmingdale, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.

SWITCHLIGHTS—SEE SWITCHES, ILLUMINATED

SYNCHRO ERROR TESTERS—SEE TESTERS, SYNCHRO ERROR

SYNCHRO/RESOLVER TESTERS—SEE TESTERS, SYNCHRO/RESOLVER

SYNCHRO RESOLVERS—SEE RESOLVERS, SYNCHRO

SYNCHRO TRANSMITTERS, SOLID STATE

Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y. ..... p 2663
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif. ..... p 800
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Theta Instrument Corp., Fairfield, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y. p 2674, 2675
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y.
Ametek, Inc., Station Square Two, Paoli, Pa.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Ten Bosch M., Inc., Vermilyea St., Pleasantville, N. Y.

SYNCHRONIZERS, KLYSTRON & BWO

Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Microwave/Systems, Inc., 1 Adler Dr., E. Syracuse, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Spectra-Elctrns., Inc., 923 N. San Antonio Rd., Los Altos, Calif.

SYNCHROS

Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 2667
IMC Magnetic Corp., Western Div., 6058 Walker Ave., Maywood, Calif. p 1745
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. p 2679, 2684-2686
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
American Electronics, Inc., 1600 E. Valencia Dr., Fullerton, Calif.
Ametek, Inc., Station Square Two, Paoli, Pa.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Bowmar Canada Ltd., Rideau River Rd., Ottawa, Ontario, Can.
Computer Devices, 11925 Burke St., Santa Fe Springs, Calif.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Henschel Corp., 14 Cedar St., Amesbury, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

SYNCHROSCOPES

Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1523
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.

SYNTHESIZERS, DELAY LINE—SEE DELAY LINE SYNTHESIZERS

SYNTHESIZERS, FILTER—SEE FILTER SYNTHESIZERS

SYNTHESIZERS, FREQUENCY

Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Damon Engineering, Inc., 115 4th Ave., Needham Heights, Mass.
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Electronic Design Labs., Inc., Box 7837, Philadelphia, Pa.
Frequency Electronics, Inc., 3 Delaware Dr., Lake Success, N. Y.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J. .. p 1674
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1419
Lorch-Adret Corp., 105 Cedar La., Englewood, N. J. ..... p 1430
Measurements, Box 180, Boonton, N. J. ..... p 1437
Micro-Power Inc., 25-14 Broadway, Long Island City, N. Y. .... p 1683
Parzen Research Inc., 48 Urban Ave., Westbury, N. Y. ..... p 1460
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Solid State Elctrn. Corp., 15321 Raven St., Sepulveda, Cal.
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap. p 1505
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Technology, 3412 Hillview Ave., Palo Alto, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Dana Laboratories Inc., 2401 Campus Dr., Irvine, Calif.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Fluke, John Mfg. Co., Inc., Box 7428, Seattle, Wash.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Itek Corp., 10 Maguire Rd., Lexington, Mass.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Monsanto Co., Elctrn. Instrs., 620 Passaic Ave., W. Caldwell, N. J.
Nihon Dempa Kogyo Co., Ltd., 1-21 Nishihara, Shibuya-ku, Tokyo, Japan
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
RF Comms., Inc., 1680 University Ave., Rochester, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Schlumberger Overseas GMBH, 211 Park Ave., Scotch Plains, N. J.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.

SYNTHESIZERS, WAVEFORM

Exact Elctrns. Inc., 455 Southeast 2nd Ave., Hillsboro, Ore.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1542, 1543
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Integrated Elctrns. Corp., 900 Walt Whitman Rd., Huntington Sta., N. Y.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.

SYSTEMS, TEMPERATURE CONTROL—SEE CONTROLS, TEMPERATURE

TABLES, LABORATORY—SEE BENCHES: CONSOLES. STOOLS. TABLES (LAB AND SHOP)

TABLES, RATE-OF-TURN

Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
BFC-Bernard Franklin Co., Inc., 4045 Torresdale Ave., Philadelphia, Pa.
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Hughes Aircraft Co., Industrial Sys. Div., Box 92904, Airport Sta., Los Angeles, Calif.

TABLES, X-Y AXIS—SEE SIMULATORS, MOTION

TACHOMETERS, ELECTRICAL (NON-GENERATING)

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. p 1754, 1759-1761
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2686
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. p 1522, 1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Electromatic Equip. Co., 562 Albemarle Rd., Cedarhurst, N. Y.
Epic, Inc., 150 Nassau St., New York, N. Y.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Ideal Precision Meter Co., Inc., 214-218 Franklin St., Bklyn., N. Y.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
McNab, Inc., 165 Spring St., New York, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Metron Instrument Inc., 1051 S. Platte River Dr., Denver, Colo.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Tachtronic Instrs., Inc., 1500 N. Front St., New Ulm, Minn.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

TACHOMETERS, ELECTRICAL (SELF-GENERATING)

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y. .. p 1721
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
Cedar Div., Control Data, 5806 W. 36th St., Minneapolis, Mnnn. p 1726
Clifton Div., Marple at Broadway, Clifton Hghts., Pa. ..... p 1727
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Harowe Servo Conts., Westtown Rd. W. Chester Pke., W. Chester, Pa. p 1741
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, N. Y.
Rotating Components, 1560 Fifth Ave., Bay Shore, N. Y. p 1754, 1759, 1761
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. .. p 1763
Singer Co., Diehl Div., Finderne Ave., Somerville, N. J. ... p 1764, 1765
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. .... p 2679, 2686
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Western Gear Corp., Electro Prod. Div., Dept. E, 75 W. Green St., Pasadena, Cal.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Weston-Transicoil Components Div., Worcester, Pa. ..... p 2678
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Bristol Co., Box 1790, Waterbury, Conn.
Carter Motor Co., 2711 W. George St., Chicago, Ill.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Dixson, Inc., Box 1449, Grand Junction, Colo.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Eastern Air Devices, Inc., 385 Central Ave., Dover, N. H.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Electric Tachometer Corp., 68th & Upland Sts., Philadelphia, Pa.
Electro-Devices, Inc., 4-6 Godwin Ave., Paterson, N. J.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electromatic Equip. Co., 562 Albemarle Rd., Cedarhurst, N. Y.
Epic, Inc., 150 Nassau St., New York, N. Y.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
McMaster Products Corp., 4200 W. Victoria Ave., Chicago, Ill.
McNab, Inc., 165 Spring St., New York, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Robbins & Meyers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Skurka Engineering Co., 4002 N. Mission Rd., Los Angeles, Calif.
Solvere, Inc., 2440 W. Carson St., Torrance, Calif.
Standard Electric Time Corp., 89 Logan St., Springfield, Mass.
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.
Zero-Max Co., The, 2845 Harriet Ave., S., Minneapolis, Minn.

TACHOMETERS, ELECTRONIC, INDICATING

API Instruments Co., 11655 Chillicothe Rd., Chesterland, Ohio
Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Data Technology Inc., 65 Grove St., Watertown, Mass. ..... p 1024
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill.
Heath Co., Dept. 180, Benton Harbor, Mich.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J. .. p 1763
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2686
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Baldwin Elctrns., Inc., 1101 McAlmont St., Little Rock, Ark.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix Corp., Electrical Components Div., Sidney, N. Y.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Delta Products, Inc., P.O. Box 1147, Grand Junction, Colo.
Diamond Inds., Inc., 540 39th St., Union City, N. J.
Digitrol Systems, Inc., W. Main St., Amenia, N. Y.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
EMD Components, Inc., 1450 East 289th St., Wickliffe, Ohio
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electromatic Equip. Co., 562 Albemarle Rd., Cedarhurst, N. Y.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hill, E. V. Inc., Box 14248, San Francisco, Calif.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Metron Instrument Inc., 1051 S. Platte River Dr., Denver, Colo.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
PMF Electronics, Inc., 124 E. Third St., Dayton, Ohio
Pioneer Elec. & Res. Corp., 743 Circle Ave., Forest Pk., Ill.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Reliance Elec. Co., 24701 Euclid Ave., Cleveland, Ohio
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Strandberg Engrg. Labs., Inc., 1001 S. Elm St., Greensboro, N. C.
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

TACHOMETERS, STROBOSCOPIC

Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1501
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499

TAPE TRANSPORTS (COMPUTER)

Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optomechanisms, Inc., 40 Skyline Dr., Plainview, N. Y.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

TAPE DECKS—SEE TAPE TRANSPORTS

TAPE DUPLICATORS—SEE DUPLICATORS. MAGNETIC TAPE: PERFORATORS. PAPER TAPE

TAPE EDITING EQUIPMENT—SEE EDITING EQUIPMENT. MAGNETIC TAPE

TAPE ERASERS, MAGNETIC—SEE ERASERS. MAGNETIC TAPE (BULK)

TAPE PERFORATORS—SEE PERFORATORS. PAPER TAPE

TAPE PROGRAMMED TESTERS—SEE TEST EQUIP. AUTOMATIC CHECKOUT. TESTERS. INTEGRATED CIRCUIT

TAPE RECORDING ACCESSORIES

Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Amerline Corp., 1800 W. Fullerton Ave., Chicago, Ill.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Audio Devices, Inc., 235 East 42nd St., New York, N. Y.
Auricord, 35-41 29th St., Long Island City, N. Y.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Duotone Co., Inc., Box 814, S. Miami, Fla.
Electronics Engineers, Inc., 1639 W. Evergreen Ave., Chicago, Ill.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Laminated Shim Co., Inc., 48 Union St., Glenbrook, Conn.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
Precision Instr. Co., 3170 Porter Dr., Palo Alto, Calif.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Recoton Corp., 46-23 Crane St., Long Island City, N. Y.
Reeves Soundcraft, 15 Great Pasture Rd., Danbury, Conn.
Standard Record Mfg. Co., 11411 Cumpston St., N. Hollywood, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
3M Co., 3M Center, St. Paul, Minn.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.

TAPE RECORDERS—SEE RECORDERS. MAGNETIC TAPE: DATA RECORDERS

TAPE SEARCH EQUIPMENT

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 1016, 1017
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa. ..... p 767
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 774, 775
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781, 1393
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif. p 799
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Auricord, 35-41 29th St., Long Island City, N. Y.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Collins Radio Co., Dallas, Texas
Electronic Engrg. Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.
Ensco, Inc., 3100 Eldredge St., Salt Lake City, Utah
Kyros Corp., Box 406, Madison, Wisc.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

TAPE TRANSPORTS, COMPUTER

Burroughs Corp., OEM Sales Dept., 1849 Wilshire Blvd., Los Angeles, Calif. p 765
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind. ..... p 2159

TAPE TRANSPORTS (COMPUTER) (Cont'd)

Digital Equip. Corp., 146 Main St., Maynard, Mass.
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. p 2161
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif. p 799
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Auricord, 35-41 29th St., Long Island City, N. Y.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Chuo Elctrn. Co., Ltd., 21 Motohongomachi Hachioji-Shi, Tokyo, Jap.
Cook Electric Co., Data-Stor Div., 6401 W. Oakton, Morton Grove, Ill.
Cycle Equipment Co., Box 307, Los Gatos, Calif.
Data Products Corp., 6219 De Soto Ave., Woodland Hills, Calif.
Defense Elctrns., Inc., Rockville, Md.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Fen-Tone Corp., 106 Fifth Ave., New York, N. Y.
General Elec. Co., 4000 N. W. 39th Expwy., Oklahoma City, Okla.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
International Radio & Elctrns. Corp., 1718 W. Mishawaka Rd., Elkhart, Ind.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
National Cash Register Co., Indl. Prods. Div., Main & K Sts., Dayton, Ohio
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.

TAPES, ELECTRICAL INSULATION

Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. p 1579
Markel, L. Frank, & Sons, School La., Norristown, Pa. p 1585
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Tensolite Div., W. Main St., Tarrytown, N. Y. p 2968
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
American Biltrite Rubber Co., Inc., Box 1071, Boston, Mass.
Arlin Mfg. Co., Inc., 239 Industrial Ave., E., Lowell, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Borden Inc., 350 Madison Ave., New York, N. Y.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
By-Buk Co., 4326 W. Pico Blvd., Los Angeles, Calif.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.
Corkpak Co., Inc., 70 Argyle Ave., New Rochelle, N. Y.
Dennison Mfg. Co., 300 Howard St., Framingham, Mass
Devon Tape Corp., 649 S. Commercial Ave., Carlstadt, N. J.
Dixon Corp., Metacom Ave., Bristol, R. I.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Franklin GNO Corp., 6620 Lakeside Rd., W. Palm Beach, Fla.
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Joy Mfg. Co., 338 S. Broadway, New Philadelphia, Ohio
Kendall Co., 309 W. Jackson Blvd., Chicago, Ill.
Lundy Elect. & Systems, Inc., Robert La., Glen Head, N. Y.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Mystik Tape, Borden Inc., 1700 Winnetka Ave., Northfield, Ill.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Okonite Co., 220 Passaic St., Passaic, N. J.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Plymouth Rubber Co., Inc., Canton, Mass.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Porcelain Products Co., 225 N. Patterson St., Carey, Ohio
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Schjeldahl, G. T. Co., Electrical Prods Div., Box 170, Northfield, Minn.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Sparta Mfg. Co., Dover, Ohio
Technical Tape Corp., 1 Le Fevre La., New Rochelle, N. Y.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
3M Co., 3M Center, St. Paul, Minn.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

TAPES, FILMS & FOILS, PRESSURE SENSITIVE

Dilectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. p 1579
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Bishop Graphics, Inc., 7300 Radford Ave., N. Hollywood, Calif.
By-Buk Co., 4326 W. Pico Blvd., Los Angeles, Calif.
Canrad Precision Inds., Inc., 630 Fifth Ave., New York, N. Y.
Chartpak Rotex, 2620 S. Susan St., Santa Ana, Calif.
Chase & Sons, Inc., 19 Highland Ave., Randolph, Mass.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Devon Tape Corp., 649 S. Commercial Ave., Carlstadt, N. J.
Flexco Div., 6855 Suva St., Bell Gardens, Calif.
Ideal Chemical Co., 9400 Steinway, Cleveland, Ohio
Kendall Co., 309 W. Jackson Blvd., Chicago, Ill.
Master Tape Printers, Inc., 4517 Elston Ave., Chicago, Ill.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Mystik Tape, Borden Inc., 1700 Winnetka Ave., Northfield, Ill.
National Laminating Mfg. Co., 339 S. Robertson Blvd., Beverly Hills, Cal.
Norton Coated Abrasive & Tape Div., Dept. 6875, Troy, N. Y.
Plymouth Rubber Co., Inc., Canton, Mass.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Press-On Products, 39 Factory Rd., Addison, Ill.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Seton Name Plate Co., Inc., 592 Boulevard, New Haven, Conn.
3M Co., 3M Center, St. Paul, Minn.
Topflight Corp., 160 E. 9th Ave., York, Pa.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.

TAPES, HEAT SHRINKABLE—SEE CAPS, FORMS & TAPES, HEAT SHRINKABLE

TAPES, PAPER, PLASTIC, ETC. (FOR PUNCHING)

Arvey Corp., 3500 N. Kimball Ave., Chicago, Ill.
Bemis Company, Inc., 800 Northstar Center, Minneapolis, Minn.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Norton Coated Abrasive & Tape Div., Dept. 6875, Troy, N. Y.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.

TAPES, RECORDING, MAGNETIC (ALL TYPES)

Mac Panel Co., Box 5027, High Point, N. C.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Agfa-Gevaert, Inc., 275 North St., Teterboro, N. J.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
American Geloso Electronics Inc., 251 Park Ave. S., New York, N. Y.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Audio Devices, Inc., 235 East 42nd St., New York, N. Y.
Audio Instr. Co., Inc., 311 Mountain Rd., Union City, N. J.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Cassettes Unlimited, Corp., 200 Claremont Ave., New York, N. Y.
Duotone Co., Inc., Box 814, S. Miami, Fla.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Kennedy Co., 540 W. Woodbury Rd., Altadena, Calif.
Lash Labs., 6152 Mission Gorge Rd., San Diego, Calif.
Memorex Corp., 1180 Shulman Ave., Santa Clara, Calif.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Recoton Corp., 46-23 Crane St., Long Island City, N. Y.
Reeves Soundcraft, 15 Great Pasture Rd., Danbury, Conn.
Stuart, Matthew & Co., 3650 Dyre Ave., Bronx, N. Y.
Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Tape-Athon Corp., 523 S. Hindry Ave., Inglewood, Calif.
Telephone Dynamics Corp., 1333 Newbridge Rd., N. Bellmore, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
U.S. Magnetic Tape Co., Box 128, Huntley, Ill.
Wabash Magnetics Inc., Box 708, Wabash, Ind.

TAPE-TO-FILM TRANSFER EQUIP.

R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Stromberg Datagraphics, Inc., Box 2449, San Diego, Calif.
Video Research Corp., 761 N. Washington St., Rockville, Md.

TAPS—SEE DIES & TAPS

TEACHING MACHINES

Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1417
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Varian Data Machines, 2722 Michelson Dr., Irvine, Calif.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Beltronix Systems Inc., 123 Marcus Blvd., Hauppauge, N. Y.
Bolt Beranek & Newman, Inc., 2126 S. Lyon St., Santa Ana, Calif.
Burtek, Inc., Box 1677, Tulsa, Okla.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Cisin, H. G. Publisher, Oak La., Amagansett, N. Y.
EPEC Inds., Inc., New Bedford Industrial Park, New Bedford, Mass.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hughes Aircraft Co., Vacuum Tube Prods. Div., 2020 Oceanside Blvd., Oceanside, Cal.
Jansen Electronics Mfg., Inc., 2233 University Ave., St. Paul, Minn.
Link Group, Singer-General Precision, Inc., Binghamton, N. Y.
Mast Development Co., 2212 East 12th St., Davenport, Iowa
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Merchant, R. C. Co., Box 246, Carmel Valley, Calif.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
P & H Electronics, 426 Columbia St., Lafayette, Ind.
P. M. & E. Electronics, Inc., 10 Tripps Lane, East Providence, R. I.
Pastoriza Div. Analog Devices, Inc., 221 Fifth St., Cambridge, Mass.
R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, Ill.
Reflex Controls Corp., 15 Stepar Pl., Huntington Sta., N. Y.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sylvania Elec. Prod., Inc., Comm. Elctrns. Div., Burlington Rd., Bedford, Mass.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Viewlex, Inc., Veterans Memorial Hwy. & Broadway, Holbrook, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Visual Elctns. Labs, 40 N. Daisy Ave., Pasadena, Cal.
Webster Electric Co., Inc., 1900 Clark St., Racine, Wisc.

TECHNICAL BOOKS

Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
American Radio Relay League, 225 Main St., Newington, Conn.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Cisin, H. G. Publisher, Oak La., Amagansett, N. Y.
D.A.T.A., Inc., 32 Lincoln Ave., Orange, N. J.
Derivation & Tabulation Assocs., Inc., 32 Lincoln Ave., Orange, N. J.
Editors & Engineers, Box 68003, New Augusta, Ind.
Hayden Book Co., Inc., 116 West 14th St., New York, N. Y.
Johnson Research Corp., 2099 New Hwy., Farmingdale, N. Y.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Quality Documents Co., 18 Hamilton St., Bound Brook, N. J.
Rel-Qual Assocs., 18 Hamilton St., Bound Brook, N. J.
Sams, H. W. & Co., Inc., 4300 West 62 St., Indianapolis, Ind.
Sands, L. G. & Assocs., Inc., 250 Park Ave., New York, N. Y.
Supreme Publications, 1760 Balsam Rd., Highland Park, Ill.

TEES, COAXIAL

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. p 1646
Americon Corp., 87 Rumford Ave., Waltham, Mass. p 834
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1663
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. p 1671
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. p 1690
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
General RF Fittings, Box 278, Port Salerno, Fla.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

TEES, WAVEGUIDE

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. p 1646
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1663
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Waveline Inc., Box 718, West Caldwell, N. J.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Allied Research & Engineering Co., 10300 Glasgow Pl., Los Angeles, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Miles Reproducer Co., Inc., 598 Broadway, New York, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.

Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

TELEGRAPH KEYS—SEE KEYS, TELEGRAPH

TELEMETERING INDICATORS—SEE ANALYZERS, TELEMETRIC DATA

TELEMETERING SYSTEMS, ELECTRONIC—SEE COMM. SYSTEMS, TELEMETERING

TELEMETERING TESTERS & CALIBRATORS

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio ..... p 1367
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Helix Research Assocs., Inc., 8384 Hercules St., La Mesa, Calif.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Primo Co., Ltd., 1-25, 6-Chome, Mitaka-shi, Tokyo, Japan
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1489
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Stellarmetrics, 416 E. Cota St., Santa Barbara, Calif. .... p 2794, 2795
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Advanced Measurement Instrs., Inc., 109 Dover St., Somerville, Mass.
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Defense Elctrns., Inc., Rockville, Md.
Destron Co., 25914 Chalmette La., Rolling Hills Est, Calif.
Dorsett Electronics, Box 36, Tulsa, Okla.
EMR Div., Box 223, Princeton, N. J.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Ericsson Centrum Inc., 16 E. 40th St., New York, N. Y.
General Devices Inc., P.O. Box 253, Princeton, N. J.
Gulf Aerospace Corp., 5440 Alder, Houston, Tex.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Mayberry Electronics Co., 543 W. Manchester Blvd., Inglewood, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microcom Corp., Horsham Valley Industrial Park, Horsham, Pa.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Norden Div., United Aircraft Corp., Helen St., Norwalk, Conn.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Video Research Corp., 761 N. Washington St., Rockville, Md.

TELEMETRIC DATA ANALYZERS—SEE ANALYZERS, TELEMETRIC DATA

TELEMETRY PREAMPLIFIERS—SEE PREAMPLIFIERS, TELEMETRY

TELEPHONE, HANDSETS—SEE HANDSETS

TELEPHONE SYSTEMS—SEE COMM. SYSTEMS, TELEPHONE

TELEPHONES, SOUND POWERED—SEE COMM. SYSTEMS, TELEPHONE

TELEPRINTER ERROR CORRECTION EQUIPMENT—SEE ERROR CORRECTION EQUIPMENT

TELEPRINTERS

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Adtrol Electronics, Inc., 116 North 7th St., Philadelphia, Pa.
Century Electronics & Instrs., Inc., Box C, Admiral Sta., Tulsa, Okla.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Computronics Engrg. 4949 Hollywood Blvd., Los Angeles, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Datamark, Inc., Cantiague Rd., Westbury, N. Y.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Litton Inds., Inc., Datalog Div., 343 Sansome St., San Francisco, Cal.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Notifier Co., 3700 North 56th St., Lincoln, Neb.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Shepard Div., 480 Morris Ave., Summit, N. J.
Telcolab Corp., 405 Lexington Ave., New York, N. Y.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

TELETYPEWRITER TESTERS—SEE TESTERS, TELETYPEWRITER

TELETYPEWRITERS & EQUIPMENT

Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Boehme, H. O., Inc., 200 Shames Dr., Westbury, N. Y.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Omnitec Inc., Sub. Nytronics, Inc., 903 N. Second St., Phoenix, Ariz.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Teletype Corp., 5555 Touhy Ave., Skokie, Ill.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.

TELEVISION EQUIPMENT—SEE ANTENNAS: CAMERAS: COILS: MONITORS: RECORDERS, VIDEO

TELEVISION SYSTEMS, CLOSED-CIRCUIT

Cohu Electronics Inc., Box 623, San Diego, Calif.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Logic Science, Inc., Box 10096, San Diego, Calif.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
American Systems, Inc., 13901 Saticoy St., Van Nuys, Calif.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Bionic Instruments, Inc., 221 Rock Hill Rd., Bala Cynwyd, Pa.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Central Dynamics, Ltd., 147 Hymus Blvd., Pte. Claire, Que., Canada
Collins Radio Co., Dallas, Texas
Colorado Video, Inc., Box 928, Boulder, Colo.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
Connecticut Consolidated Inds., Inc., 60 Cambridge St., Meriden, Conn.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Data Disc, Inc., Display Div., 2626 Hanover St., Palo Alto, Calif.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Dynair Elctrns., Inc., 6360 Federal Blvd., San Diego, Calif.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electro-Craft Corp., 1600 2nd St., S., Hopkins, Minn.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
GBC Closed Circuit Corp., 74 5th Ave., New York, N. Y.
GPL Television, Education & Training Prods. Group., Pleasantville, N. Y.
General Television Network, 901 Livernois Ave., Ferndale, Mich.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Hamamatsu TV Co. Ltd., 1126-Chino-cho,, Hamamatsu City, Shizuoka Pref., Japan
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Integrated Elctrns. Corp., 900 Walt Whitman Rd., Huntington Sta., N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lear Siegler, Inc., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Maryland Telecomm, 10534 York Rd., Cockeysville, Md.
Massey Dickinson Co., Inc., 9-11 Elm St., Saxonville, Mass.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Nelson-Hershfield Electronics, 1848 W. Campbell Ave., Phoenix, Ariz.
Packard Bell Elctrn., Lawrence & Arnold Drs., Newbury Pk., Calif.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Shibaden Corp. of America, 58-25 Brooklyn-Queens Expwy., Woodside, N. Y.
Spencer-Kennedy Labs., Inc., 1320 Soldiers Field Rd., Boston, Mass.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Sylvania Elec. Prod., Inc., Comm. Elctrns. Div., Burlington Rd., Bedford, Mass.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Tech-Master Corp., 633-33 98 Pl., Forest Hills, N. Y.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Teletronics, Inc., 760 N. Main St., Orange, Calif.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
Unimetrics, Inc., 39 Werman Ct., Plainview, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Wald Sound, 11131 Dora St., Sun Valley, Calif.
Western Elctrn. Inds., 72 N. Broadway, Yonkers, N. Y.
Westinghouse Elec. Corp., 7800 Susquehanna St., Pittsburgh, Pa.
Winegard Co., 3000 Kirkwood St., Burlington, Iowa

TEMPERATURE CONTROLS—SEE CONTROLS, TEMPERATURE

TERMINAL EQUIPMENT, DIGITAL

TEMPERATURE INDICATORS—SEE METERS, TEMPERATURE

TEMPERATURE SENSORS—SEE TRANSDUCERS, TEMPERATURE

TEMPLATES, DRAFTING—SEE DRAFTING EQUIPMENT

TEMPO REGULATORS—SEE REGULATORS, PITCH & TEMPO

TENSILE TESTERS—SEE TESTERS, MATERIAL

TERMINAL BLOCKS—SEE BLOCKS, TERMINAL

TERMINAL BOARDS—SEE BOARDS, TERMINAL

TERMINAL BOARDS, PREPUNCHED

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Interswitch, 770 Airport Blvd., Burlingame, Cal.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 928
Showa Musen Kogyo Co., Ltd., 5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, Japan
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal. .. p 1006
Vero Electronics Inc., 176 Central Ave., Farmingdale, N. Y. .... p 595
Aracon Electronics, 344 East 49th St., New York, N. Y.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Continental Rubber Works, Sub. Continental Copper & Steel, Erie, Pa.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Electri-Wire Assemblies Co., Inc., 700 W. Virginia St., Milwaukee, Wisc.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Lockhart Industries, Inc., 15707 Texaco Ave., Paramount, Calif.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Synthane Corp., 12 River Rd., Oaks, Pa.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

TERMINAL EQUIPMENT, DIGITAL

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 764, 1017
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif. ..... p 800
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 804
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Applied Peripheral Sys., Inc., 7120 Harwin, Houston, Tex.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Clary Corp., 320 W. Clary Ave., San Gabriel, Calif.
Codex Corp., 222 Arsenal St., Watertown, Mass.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communication Systems Corp., 8100 N. Lehigh Ave., Morton Grove, Ill.
Computer Prods. Int'l., Inc., 3444 De La Cruz Blvd., Santa Clara, Cal.
Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Datamark, Inc., Cantiague Rd., Westbury, N. Y.
Demex, Inc., 2130 Jefferson, Kansas City, Mo.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Ideas, Inc., Box 137, Wyncote, Pa.
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
General Elec. Co., 4000 N. W. 39th Expwy., Oklahoma City, Okla.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Gleason-Avery Co., Auburn, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Invac Corp., 26 Fox Rd., Waltham, Mass.
Measurement Technology Corp., 7124 Owensmouth Ave., Canoga Park, Cal.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Olivetti Underwood Corp., One Park Ave., New York, N. Y.
Potter Instrument Co., Inc., E. Bethpage Rd., Plainview, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.

TERMINAL EQUIPMENT, DIGITAL (Cont'd)

Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Teledata, Inc., 98-05 217th St., Queens Village, N. Y.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Western Telematic, Inc., 5507 Peck Rd., Arcadia, Calif.
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

TERMINAL STRIPS—SEE STRIPS, TERMINAL

TERMINALS, FEEDTHRU

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Art Wire & Stamping Co., 28 Boyden Pl., Newark, N. J.
Atlee Corp., 2 Lowell Ave., Winchester, Mass.
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Concord Electronics Corp., 37 Great Jones St., New York, N. Y. p 890
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Electronic Molding Corp., 44 Church St., Pawtucket, R. I. ..... p 901
Fusite Corp., 6000 Fernview Ave., Cincinnati, Ohio ..... p 902
G T I Corporation, 310 Chestnut St., Meadville, Pa. ..... p 1218
Helitronics Corp., 916 McCarter Hwy., Newark, N. J.
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn. ..... p 913
Malco Mfg. Co. Inc., 5150 W. Roosevelt Rd., Chicago, Ill.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 928
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass. .... p 976
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 995
Sterling Instr., 76 E. Second St., Mineola, N. Y.
Taurus Corp., Academy Hill, Lambertville, N. J.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1002
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Armel Electronics Inc., 1601-75th St., N. Bergen, N. J.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Cary Instruments, 2724 So. Peck Rd., Monrovia, Calif.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Curtis Develop. & Mfg. Co., 3278 N. 33rd St., Milwaukee, Wisc.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Dixon Corp., Metacom Ave., Bristol, R. I.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electrical Inds., 691 Central Ave., Murray Hill, N. J.
Electronic Seals Co., Inc., 13766 Saticoy St., Van Nuys, Calif.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Gemp Terminals, Inc., 20 Woodworth Ave., Yonkers, N. Y.
General Mfg. Co., 724 Ruberta Ave., Glendale, Calif.
General Staple Co., 28 East 22nd St., New York, N. Y.
Glass Beads Co., Ceramic Products Div., Latrobe, Pa.
Glasseal Prods. Co., Inc., 725 Commerce Rd., Linden, N. J.
Gleason-Avery Co., Auburn, N. Y.
Goe Engineering Co., 250 South 9th St., City of Industry, Calif.
Great Eastern Metal Prod. Co., 22 Woodworth Ave., Yonkers, N. Y.
Henry & Thomas Ltd., Yeo St., London E. 3, England
Heyman Mfg. Co., East Michigan Ave., Kenilworth, N. J.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Isotronics, Inc., 12 Coffin Ave., New Bedford, Mass.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Lundey Associates, Inc., 694 Main St., Waltham, Mass.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Nanmac Corp., 9 Mayhew Rd., Framingham, Mass.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Pylon Co., Inc., 51 Newcomb St., Attleboro, Mass.
Rostone Corp., Route 52 S., Lafayette, Ind.
Silicone Seals, Inc., 3694 Milwaukee Ave., Chicago, Ill.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Staffall Inc., 7 Woodland St., Providence, R. I.
Teale Machine Co., Inc., Box 936, Rochester, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Tinnerman Prods., Inc., Box 6688, Cleveland, Ohio
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Whitso, Inc., 9330 Byron St., Schiller Park, Ill.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

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Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Eimac, 301 Industrial Way, San Carlos, Calif.
General Staple Co., 28 East 22nd St., New York, N. Y.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.

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American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Buchanan Electrical Products Corp., 1085 Floral Ave., Union, N. J. p 878
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Electronic Molding Corp., 44 Church St., Pawtucket, R. I.
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General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif.
Jackson Bros. (London) Ltd., 258 Broadway, New York, N. Y.
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Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Carol Cable Co., Box 68, Pawtucket, R. I.
Cole-Hersee Co., 20 Old Colony Ave., S. Boston, Mass.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Dante Electric Mfg. Co., Bantam, Conn.
ETC, Inc., 990 East 67 St., Cleveland, Ohio
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Electric Terminal Corp., Drawer E, Pilgrim Sta., Warwick, R. I.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Gemp Terminals, Inc., 20 Woodworth Ave., Yonkers, N. Y.
General Mfg. Co., 724 Ruberta Ave., Glendale, Calif.
General Staple Co., 28 East 22nd St., New York, N. Y.
Great Eastern Metal Prod. Co., 22 Woodworth Ave., Yonkers, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
Hollingsworth Solderless Terminal Co., Box 430, Phoenixville, Pa.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Jan Engrg., 2018 Pico Blvd., Santa Monica, Calif.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Kent Corp., 169 Lake St., Mundelein, Ill.
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Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
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Molecu-Wire Corp., Box 495, Farmingdale, N. J.
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Network Industries, Inc., Box 397, Bayonne, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Penn-Union Elec., A Teledyne Co., Box 723, Edinboro, Pa.
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Rayclad Tubes, Inc., 300 Constitution Dr., Menlo Park, Calif.
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Staffall Inc., 7 Woodland St., Providence, R. I.
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Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
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Rayclad Tubes, Inc., 300 Constitution Dr., Menlo Park, Calif.
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ACI Incorporated, 206 Industrial Ctr., Princeton, N. J.
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
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Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.
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Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
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Dante Electric Mfg. Co., Bantam, Conn.
Doran Mfg. Co., 1033 Bader St., Cincinnati, Ohio
ETC, Inc., 990 East 67 St., Cleveland, Ohio
Electraid, Inc., Box 53, Cambridge, Mass.
Electric Terminal Corp., Drawer E, Pilgrim Sta., Warwick, R. I.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
General Staple Co., 28 East 22nd St., New York, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Hollingsworth Solderless Terminal Co., Box 430, Phoenixville, Pa.
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Kent Corp., 169 Lake St., Mundelein, Ill.
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Kolton Elec. Mfg. Co., 123 N. J. Railroad Ave., Newark, N. J.
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Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Network Industries, Inc., Box 397, Bayonne, N. J.
Painton & Co., Ltd., Bembridge Dr., Kingsthorpe, Northampton, Eng.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Shakeproof Div., St. Charles Rd., Elgin, Ill.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Whitso, Inc., 9330 Byron St., Schiller Park, Ill.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.
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Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Allmetal Screw Prods. Co., Inc., 821 Stewart Ave., Garden City, N. Y.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Armel Electronics Inc., 1601-75th St., N. Bergen, N. J.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Dixon Corp., Metacom Ave., Bristol, R. I.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
General Mfg. Co., 724 Ruberta Ave., Glendale, Calif.
Goe Engineering Co., 250 South 9th St., City of Industry, Calif.
Grayhill Moldtronics, Inc., 707 Rogers St., Downers Grove, Ill.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Isolation Products, 2387 Adele Ave., Mountain View, Calif.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Jones, H., Electronics, 3086 N. Lima St., Burbank, Cal.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
National Connector Corp., Science Industry Ctr., Minneapolis, Minn.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Permonite Mfg. Co., 910 W. Jackson Blvd., Chicago, Ill.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Positive Connector, 304 Seymour Ave., Derby, Conn.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Staffall Inc., 7 Woodland St., Providence, R. I.
3M Co., 3M Center, St. Paul, Minn.
Tri-Point Inds., Inc., One Teflon Way, Commack, N. Y.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Vacuum Ceramics, Inc., 15 East Main St., Cary, Ill.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.
Whitso, Inc., 9330 Byron St., Schiller Park, Ill.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

TERMINALS, THREADED

Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
Concord Electronics Corp., 37 Great Jones St., New York, N. Y. p 890
Electronic Molding Corp., 44 Church St., Pawtucket, R. I. ..... p 901
Fusite Corp., 6000 Fernview Ave., Cincinnati, Ohio ..... p 902
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass. .. p 2913
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y.
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass. .... p 976
Sterling Instr., 76 E. Second St., Mineola, N. Y. ..... p 1767
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
General Nucleonics Div., Tyco Labs., 115 S. Spring St., Claremont, Cal.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Staffall Inc., 7 Woodland St., Providence, R. I.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.
Zierick Mfg. Corp., Radio Circle, Mt. Kisco, N. Y.

TERMINALS, TURRET

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y.
Accurate Electronics Corp., Box 935J, Elyria, Ohio ..... p 832
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Concord Electronics Corp., 37 Great Jones St., New York, N. Y. p 890, 891
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1663
Electronic Molding Corp., 44 Church St., Pawtucket, R. I. ..... p 901
Fusite Corp., 6000 Fernview Ave., Cincinnati, Ohio ..... p 902
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 928
Positronic Inds., Inc., 1906 S. Stewart, Springfield, Mo.
Precision Metal Prods. Co., 41 Elm St., Stoneham, Mass. .... p 976
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 987
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993, 995
U. S. Terminals Inc., 7502 Camargo Rd., Cincinnati, Ohio ..... p 1002
United Prods. Co., 451 S. Jefferson St., Orange, N. J.
Abacus Electronics Corp., 10 Hudson Terr., Dobbs Ferry, N. Y.
Aracon Electronics, 344 East 49th St., New York, N. Y.
Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, Conn.

TERMINATIONS, MICROWAVE

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
General Mfg. Co., 724 Ruberta Ave., Glendale, Calif.
Henry & Thomas, Ltd., Yeo St., London E. 3, England
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Staffall Inc., 7 Woodland St., Providence, R. I.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

TERMINATIONS, ANTENNA—ALSO SEE DUMMY LOADS

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1669
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif. p 1710
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
EPSCO, Inc., Data Systems Div., 411 Providence Hwy., Westwood, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Javex Elctrns., 9509 Oak Glen Rd., Cherry Valley, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Trylon, Inc., Elverson, Pa.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

TERMINATIONS, HIGH VOLTAGE

Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. .. p 1372, 1669
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. ..... p 1966
Kilovolt Corp., 238 High St., Hackensack, N. J.
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif. ..... p 2322
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. .. p 1519
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
General Electric, Insulating Materials, 1 Campbell Rd., Schenectady, N. Y.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Jones, Norman, Inc., Box 1, South Merrimack, N. H.

TERMINATIONS, MICROWAVE

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Americon Corp., 87 Rumford Ave., Waltham, Mass. ..... p 834
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1343
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal. p 1662, 1663
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1669
Fairchild/Electro-Metrics Corp., 100 Church St., Amsterdam, N. Y.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microwave Devices Div., Bendix Corp., Hurricane Rd., Franklin, Ind. p 1656
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690

TERMINATIONS, MICROWAVE (Cont'd)

Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1692
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif. p 1710
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Transco Products, 4241 Glencoe Ave., Venice, Calif. ..... p 1711
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Aviel Elctrns., Inc., 150 W. Cypress Ave., Burbank, Calif.
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Collins Radio Co., Dallas, Texas
Control Data Corp., 400 Border St., East Boston, Mass.
Core-Tronics Inc., 241 N. Day St., Orange, N. J.
Custom Materials, Inc., Alpha Indl Park, Chelmsford, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
EMC Technology, Inc., 1300 Arch St., Philadelphia, Pa.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Electronic Stds Corp. of Amer., 1426-30 W. Front St., Plainfield, N. J.
Film Components Div., 155 Saw Mill River Rd., Yonkers, N. Y.
General RF Fittings, Box 278, Port Salerno, Fla.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
H & S Wire Cutting Service, Inc., 42 East 12th St., New York, N. Y.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Telecomm., Transmission Dept., 2912 Wake Forest Rd., Raleigh, N. C.
Insulating Shapes, Inc., 1381 Seabury Ave., Bronx, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Mi-Kro Connectors Div., 40-09 21st St., Long Island City, N. Y.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Minax Devices Inc., 226R Merrick Rd., Lynbrook, N. Y.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radiation Devices Co., Box 8450, Baltimore, Md.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Specialty Waveguide Corp., 82 Cambridge St., Burlington, Mass.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Wheeler Labs, Inc., 122 Cutter Mill Rd., Great Neck, N. Y.

TERMINATIONS, VHF, VIDEO, PULSE

Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1669
Narda Microwave Corp., Plainview, N. Y. ..... p 1689
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa. ..... p 1692
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Barth Electronics, Inc., 7777 Wall St., Cleveland, Ohio
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Collins Radio Co., Dallas, Texas
Fairlane Electronics, Inc., Box 335, Long Valley, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Holland Electronics, Inc., 675 Hinsdale St., Brooklyn, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Lundey Associates, Inc., 694 Main St., Waltham, Mass.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Radiation Devices Co., Box 8450, Baltimore, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Telonic Engineering Co., Box 277, Laguna Beach, Calif.
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, Calif.

TEST EQUIPMENT, AUTOMATIC CHECKOUT

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
AEL Inc., P.O. Box 552, Lansdale, Pa.
Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1324
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2660, 2661
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1348, 1349
CMC, 12970 Bradley Ave., San Fernando, Calif.
Cablemaster Div., 13215 Leadwell St., N. Hollywood, Calif. .... p 1355
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1371
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374, 1375
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. ..... p 1398
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412, 1414
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1434
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1439
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459
Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio p 2842, 2843
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1486, 1487, 1490, 1498
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. .... p 1500, 1501
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1502
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Stoddart Electro Systems, 2045 W. Rosecrans Ave., Gardena, Calif.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Tektronix, Inc., Box 500, Beaverton, Ore.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Test Equipment Corp., Box 20215, Dallas, Tex. ..... p 1506, 1507
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
AAI Corp., Box 6767, Baltimore, Md.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arizona Elctrns., Inc., Drawer AE, Benson, Ariz.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bendix Corp., Navigation & Control Div., Teterboro, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Brooks Research & Mfg. Inc., 5612 Brighton Terr., Kansas City, Mo.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
California Computer Products Inc., 305 N. Muller St., Anaheim, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Dalmo Victor, 1515 Industrial Way, Belmont, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dit-Mco Intl., 5612 Brighton Terr., Kansas City, Mo.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
EDP Corp., Box 6485, Orlando, Fla.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Ferranti-Packard Ltd., 121 Industry St., Toronto, Ont., Can.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
Industrial Sys. Div., 5261 W. Imperial Hwy., Los Angeles, Calif.
Information Instruments, Inc., 62 Enterprise Dr., Ann Arbor, Mich.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Kybe Corp., 132 Calvary St., Waltham, Mass.
Lavoie Labs., Div. Spedcor, Matawan-Freehold Rd., Morganville, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Monitor Systems Inc., 401 Commerce Dr., Fort Washington, Pa.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pacific Electro Dynamics, Inc., 14220 Sunset Hwy., Bellevue, Wash.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Solatron Enterprises, 421 E. Beach Ave., Inglewood, Calif.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Vestal Modern Design Corp., Vestal Pkwy. E., Vestal, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

TEST EQUIPMENT, COLOR TV

Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Kay Electric Co., Maple Ave., Pine Brook, N. J. ..... p 1422
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Tektronix, Inc., Box 500, Beaverton, Ore.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
American Electronic Controls, 74 Tracey Rd., Huntingdon Valley, Pa.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Jackson Electrical Instrument Co., 35 Windson Ave., Mineola, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Kollmorgen Color Sys., 67 Mechanic St., Attleboro, Mass.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Mercury Electronics Corp., 315 Roslyn Rd., Mineola, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Photo Research Corp., 3000 N. Hollywood Way, Burbank, Calif.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Riker Video, 100 Parkway Dr., S., Hauppauge, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Telonic Inds., Inc., 60 N. First Ave., Beech Grove, Ind.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.

TEST EQUIPMENT, COMPONENT SUBSTITUTING

London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Jackson Electrical Instrument Co., 35 Windson Ave., Mineola, N. Y.
Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y.
Montford Instrs. Ltd., 79 Lots Rd., Chelsea, London, S.W. 10, Eng.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

TEST EQUIPMENT, ENVIRONMENTAL—SEE SPECIFIC TYPE OF EQUIPMENT

TEST EQUIPMENT, MECHANICAL IMPEDANCE

Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
MB Electronics, Box 1825, New Haven, Conn.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.

TEST LEAD PROBES—SEE PROBES, TEST LEAD

TEST LEADS & ADAPTERS

AEL Inc., P.O. Box 552, Lansdale, Pa.
Accurate Electronics Corp., Box 935J, Elyria, Ohio
Aul Instrs., Inc., 139-30 34th Rd., Flushing, N. Y.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
Helitronics Corp., 916 McCarter Hwy., Newark, N. J.
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio ..... p 984
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
Pomona Electronics Co. Inc., 1500 E. 9th St., Pomona, Calif.
p 940, 963-966, 968, 969, 972-974
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 993
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
Amatom Elctrn. Hardware Co., 81 Rockdale Ave., New Rochelle, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bruno-New York Inds. Corp., 636 Eleventh Ave., New York, N. Y.
California Avionics Labs., Inc., Box 701, Palo Alto, Calif.
Collins Radio Co., Dallas, Texas
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Cooke Engineering Co., 735 N. Saint Asaph St., Alexandria, Va.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Desco Mfg. Co., 1530 Flower St., Glendale, Calif.
DonMar Prods., Inc., Box 10125, Denver, Colo.
ECCO Elctrn. Comps. Corp., 157 S. MacQuesten Pkwy., Mt. Vernon, N. Y.
E-Z Hook Test Products, P.O. Box 105, Covington, Ky.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Empire Electronics Co., Inc., 60 Spruce St., Paterson, N. J.
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Lynn Elctrns. Corp., Box 3003, Philadelphia, Pa.
Network Industries, Inc., Box 397, Bayonne, N. J.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Seven Assocs, Inc., 568 San Xavier Ave., Sunnyvale, Calif.
Shigoto Industries, Inc., 350 Fifth Ave., New York, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
States Co., 19 New Park Ave., Hartford, Conn.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Textool Products, Inc., 1410 Pioneer Dr., Irving, Tex.

TEST SETS—SEE TESTERS

TEST SETS, MULTIPURPOSE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1325
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1329
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
California Instruments Corp., 3511 Midway Dr., San Diego, Calif. p 1359
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
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General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. p 1399, 1402
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
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Power Designs Inc., 1700 Shames Dr., Westbury, N. Y.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn.
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Test Equipment Corp., Box 20215, Dallas, Tex. ..... p 1506, 1507
Texscan Corp., 2446 N. Shadeland Ave., Indianapolis, Ind. ..... p 1509
Wavetek, 8159 Engineer Rd., San Diego, Calif. ..... p 1546
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
EDP Corp., Box 6485, Orlando, Fla.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITI Electronics Inc., 369 Lexington Ave., Clifton, N. J.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Nano Fast, Inc., 416 W. Erie, Chicago, Ill.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

TESTERS, ACCELEROMETER—SEE CALIBRATORS, ACCELEROMETER

TESTERS, BATTERY

Christie Electric Corp., 3404A W. 67 St., Los Angeles, Calif. ... p 1895
Eagle-Picher Ind., Inc., American Bldg., Central Pkwy., Dept. EEM-69, Cincinnati, O.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Macarr, Inc., 4380 Bullard Ave., New York, N. Y. ..... p 2042
Servo-Tek Products Company, 1086 Goffle Rd., Hawthorne, N. J.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sonotone Corp., Battery Div., Dept. B10, Box 200, Elmsford, N. Y. p 2092
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
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Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Exide Power Sys. Div., Box 5723, Philadelphia, Pa.
Gulton Inds., Engrd. Magnetics Div., 13041 Cerise Ave., Hawthorne, Cal.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Moran Products Co., 2878 Detroit Ave., Cleveland, Ohio
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Q. V. S., Inc., 20 North 15th St., East Orange, N. J.
Ram Meter, Inc., 1100 Hilton Rd., Ferndale, Mich.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sun Electric Corp., 6323 Avondale, Chicago, Ill.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Unex Labs., Inc., 321 Newburyport Tpke., Hathorne, Mass.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.

TESTERS, BURN-IN/AGING

Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J. p 1244
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Kilovolt Corp., 238 High St., Hackensack, N. J.
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif.
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Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1451
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1500
Test Equipment Corp., Box 20215, Dallas, Tex. ..... p 1507
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Vestal Modern Design Corp., Vestal Pkwy. E., Vestal, N. Y.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.

TESTERS, CABLE

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
AEL Inc., P.O. Box 552, Lansdale, Pa.
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill.
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Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
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Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
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Cablemaster Div., 13215 Leadwell St., N. Hollywood, Calif. .... p 1355
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif. ..... p 1390
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. p 1399, 1400
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
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Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1500
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.

TESTERS, COIL

Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. .. p 1519
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
Ametek, Inc., Station Square Two, Paoli, Pa.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Audio Accessories, Inc., Gilsum, N. H.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Bliss Electronic Corp., Box 366, Sussex, N. J.
Brooks Research & Mfg. Inc., 5612 Brighton Terr., Kansas City, Mo.
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Engrg. Co., 2930 Anthony La., Minneapolis, Minn.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Cox, C. E. Co., 1514-C N. Harper St., Santa Ana, Calif.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Dit-Mco Intl., 5612 Brighton Terr., Kansas City, Mo.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Network Industries, Inc., Box 397, Bayonne, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Northeast Electronics Corp., Box 649, Concord, N. H.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Sterling Mfg. Co., 2880 Detroit Ave., Cleveland, Ohio
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.

TESTERS, CAPACITOR

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
AEL Inc., P.O. Box 552, Lansdale, Pa.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
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Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J.
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Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
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Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif. ..... p 1390
Heath Co., Dept. 180, Benton Harbor, Mich.
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif.
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Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
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Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1501
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Test Equipment Corp., Box 20215, Dallas, Tex. ..... p 1507
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
D. M. Research Corp., 13703 Madison Ave., Cleveland, Ohio
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Mercury Electronics Corp., 315 Roslyn Rd., Mineola, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Teradyne, Inc., 183 Essex St., Boston, Mass.

TESTERS, CIRCUIT—SEE TESTERS, SIGNAL TRACING

TESTERS, COIL

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J.
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Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J. p 1366
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
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Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Intronics, Inc., 57 Chapel St., Newton, Mass.
Kilovolt Corp., 238 High St., Hackensack, N. J.
New Product Engrg., Inc., 812 Manchester Ave., Wabash, Ind.
RO Assocs., Inc., 3705 Haven Ave., Menlo Park, Cal.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1500
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Collins Radio Co., Dallas, Texas
General Radio Company, 300 Baker Ave., W. Concord, Mass.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.

TESTERS, COIL (Cont'd)

Kartron, Box 1338, Huntington Beach, Calif.
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Wabash Magnetics Inc., Box 708, Wabash, Ind.

TESTERS, COMPONENT LINEARITY

London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Microdyne Instruments Inc., 203 Middlesex Tpke., Burlington, Mass.

TESTERS, COMPUTER MEMORY

Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1371
Scientific Data Systems Inc., 701 S. Aviation Bl., El Segundo, Cal.
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
Datametrics Corp., 7632 Gloria Ave., Van Nuys, Calif.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Elpac Data Systems, 18651 Von Karman Ave., Irvine, Cal.
Ferroxcube Corp., Systems Div., 5455 S. Valentia Way, Englewood, Colo.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Research Engineering Div., 12 Manheim Rd., Essex Fells, N. J.
United Telecontrol Electronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.

TESTERS, CORONA

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1324
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1340
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif. ..... p 1390
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. p 1399, 1400
Kilovolt Corp., 238 High St., Hackensack, N. J.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Delcon Div., 333 Logue Ave., Mt. View, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Neptune Electronics Co., 30 West 15 St., New York, N. Y.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Techsonics, Box 251, El Prado, N. M.

TESTERS, CRYSTAL—SEE ANALYZERS, CRYSTAL

TESTERS, DIODE

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1348
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1371
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Kilovolt Corp., 238 High St., Hackensack, N. J.
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1469
RCA Elctr. Components, 415 South 5th St., Harrison, N. J.
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Tektronix, Inc., Box 500, Beaverton, Ore.
Telvac Instr. Co., 18531-E Ventura Blvd., Tarzana, Calif. ..... p 2834
Test Equipment Corp., Box 20215, Dallas, Tex. ..... p 1506
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Advanced Technology Corp., 1495 Lincoln Way East, Chambersberg, Pa.
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Alessi Industries, 418 Main St., El Segundo, Calif.
American Electronic Controls, 74 Tracey Rd., Huntingdon Valley, Pa.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Britec Ltd., 17 Charing Cross Rd., London, W.C. 2, Eng.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Cox, C. E. Co., 1514-C N. Harper St., Santa Ana, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Instrument Research Co., P. O. Box 231, Lincoln, Mass.
J-Omega Company, 2271 Mora Dr., Mt. View, Calif.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Quaker Electronics, Box 215, Hunlock Creek, Pa.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Sensory Systems, Inc., Box 2071, Costa Mesa, Calif.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.

TESTERS, ELECTRIC POWER—SEE MONITORS, POWER, AC & DC

TESTERS, ENCODER

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Discon Corp., 1150 Northwest 70th St., Fort Lauderdale, Fla.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Theta Instrument Corp., Fairfield, N. J.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Wayne-George Co., Christina St., Newton, Mass.

TESTERS, FLUTTER—SEE METERS, WOW & FLUTTER

TESTERS, GROUND RESISTANCE—SEE METERS, OHM

TESTERS, GYRO

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
California Instruments Corp., Elin Div., 3511 Midway Dr., San Diego, Cal.
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Theta Instrument Corp., Fairfield, N. J.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Advanced Energy Conversion, 1918 Menalto Ave., Menlo Park, Calif.
American Chain & Cable Co., Box 1629, Waterbury, Conn.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Goerz Optical Co., Inc., 301 Alpha Dr., Pittsburgh, Pa.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Ideal-Aerosmith, Inc., 1505 E. Fox Farm Rd., Cheyenne, Wyo.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
NH Research, Inc., 1510 S. Lyon St., Santa Ana, Calif.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

TESTERS, HI-POT—SEE TESTERS, INSULATION BREAKDOWN

TESTERS, INSULATION BREAKDOWN

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1324
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill.
Cablemaster Div., 13215 Leadwell St., N. Hollywood, Calif. .... p 1355
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif. ..... p 1390
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. p 1399-1402
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Janco Corp., 3111 Winona Ave., Burbank, Calif.
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Kilovolt Corp., 238 High St., Hackensack, N. J. ..... p 2014
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
London Co., 811 Sharon Dr., Westlake, Ohio
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1439
Opad Electric Co. Inc., 43-12 Walker St., New York, N. Y.
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1456
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. .... p 1500, 1501
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Sticht, H. H. Co., Inc., 27 Park Pl., New York, N. Y. ..... p 1499
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. .. p 1519
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y. .. p 1954
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bliss Electronic Corp., Box 366, Sussex, N. J.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Brooks Research & Mfg. Inc., 5612 Brighton Terr., Kansas City, Mo.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dit-Mco Intl., 5612 Brighton Terr., Kansas City, Mo.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Electronic Brazing Co., 140 Glenridge Ave., Montclair, N. J.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Instrument Labs. Corp., 315 W. Walton Pl., Chicago, Ill.
Instrument Research Co., P. O. Box 231, Lincoln, Mass.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Multi-Amp Corp., 61 Myrtle St., Cranford, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Ostby & Barton Co., Box 6267, Providence, R. I.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

TESTERS, INTEGRATED CIRCUIT (AUTOMATIC)

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
Aritech Corp., 130 Lincoln St., Brighton, Mass.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1334
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. ..... p 1371
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1439
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1451
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1468
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Test Equipment Corp., Box 20215, Dallas, Tex. ..... p 1506, 1507
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
AAI Corp., Box 6767, Baltimore, Md.
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Bulova Watch Co., Inc., Sys. & Instrs. Div., Sunrise Hwy., Valley Stream, N. Y.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Lavoie Labs., Div. Spedcor, Matawan-Freehold Rd., Morganville, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.
Microdyne Instruments Inc., 203 Middlesex Tpke., Burlington, Mass.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Redcor Corp., Box 1031, Canoga Park, Calif.
Signetics Corp., 811 E. Arques Ave., Sunnyvale, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.

TESTERS, INTEGRATED CIRCUIT (MANUAL)

Aritech Corp., 130 Lincoln St., Brighton, Mass. ..... p 1285
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Avien Inc., 58-15 Northern Blvd., Woodside, N. Y. ..... p 1334
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1451
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 1426
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
AEI Instrument Co., 3691 Lee Rd., Cleveland, Ohio
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Alessi Industries, 418 Main St., El Segundo, Calif.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.
Microdyne Instruments Inc., 203 Middlesex Tpke., Burlington, Mass.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Ostby & Barton Co., Box 6267, Providence, R. I.
Redcor Corp., Box 1031, Canoga Park, Calif.
Semimetals, Inc., 405 National Ave., Mountain View, Calif.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.

TESTERS, LEAKAGE

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. . . p 1324
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Cablemaster Div., 13215 Leadwell St., N. Hollywood, Calif. . . . . p 1355
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385
Gar Enterprises, 2031 N. Lincoln Ave., Pasadena, Calif. . . . . . p 1390
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. p 1399-1402
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kilovolt Corp., 238 High St., Hackensack, N. J. . . . . . p 2014
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1439
Penn Airborne Products Co., Industrial Highway, Southampton, Pa.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458
Ross Engrg. Corp., 11915 Shadybrook, Saratoga, Calif.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. . . . . . p 1501
Test Equipment Corp., Box 20215, Dallas, Tex. . . . . . p 1507
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Brooks Research & Mfg. Inc., 5612 Brighton Terr., Kansas City, Mo.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
D. M. Research Corp., 13703 Madison Ave., Cleveland, Ohio
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dit-Mco Intl., 5612 Brighton Terr., Kansas City, Mo.
Erdco Engrg. Corp., 136 Official Rd., Addison, Ill.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Sys. Div., 5261 W. Imperial Hwy., Los Angeles, Calif.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Northeast Electronics Corp., Box 649, Concord, N. H.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

TESTERS, LIFE, COMPONENT

AEL Inc., P.O. Box 552, Lansdale, Pa.
American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Associated Testing Laboratories Inc., 200 Route 46, Wayne, N. J. p 1244
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. . . . . . p 1245
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. . . . . . p 1436
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1439
Test Equipment Corp., Box 20215, Dallas, Tex. . . . . . p 1507
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Vestal Modern Design Corp., Vestal Pkwy. E., Vestal, N. Y.

TESTERS, LOGARITHMIC AMPLIFIER

Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio p 1424
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. . . p 1703

TESTERS, LOGIC CARD

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
AEL Inc., P.O. Box 552, Lansdale, Pa.
Aritech Corp., 130 Lincoln St., Brighton, Mass. . . . . . p 1285
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. . . . . . p 774
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
AAI Corp., Box 6767, Baltimore, Md.
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
CGS Units, Inc., 73 Saginaw Dr., Rochester, N. Y.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
EDP Corp., Box 6485, Orlando, Fla.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Inventions, Inc., RD2 463 US 1, Monmouth Jct., N. J.
Lockheed Aircraft Service Co., Ont. Intl. Airport, Ontario, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
MCG Electronics Inc., 279 Skidmore Rd., Deer Park, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

TESTERS, LSI (AUTOMATIC)

Aritech Corp., 130 Lincoln St., Brighton, Mass.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif. . . . . . p 1371
AAI Corp., Box 6767, Baltimore, Md.
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Microdyne Instruments Inc., 203 Middlesex Tpke., Burlington, Mass.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.

TESTERS, MAGNETIC CORE

Magnemetrics Div., Rockdale St., Worcester, Mass. . . . . . p 1435
Shallcross, E. Preston St., Selma, N. C. . . . . . p 1483
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
ADAR Associates Inc., 73 Union Sq., Somerville, Mass.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Chronetics, Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Horex Electronics, Inc., 1729 21st St., Santa Monica, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

TESTERS, MAGNETRON

Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Kilovolt Corp., 238 High St., Hackensack, N. J.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.

TESTERS, MATERIAL

American Instr. Co., Inc., 8030 Georgia Ave., Silver Spring, Md. p 1243
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. . . p 1324
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Ametek, Inc., Station Square Two, Paoli, Pa.
Amthor Testing Instr. Co., Inc., 45-53 Van-Sinderen Ave., Brooklyn, N. Y.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Automation-Forster Div., Box 1025, Ann Arbor, Mich.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Delta Sonics, Inc., 12918 Cerise Ave., Hawthorne, Calif.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
Inspection Systems, 12918 Cerise Ave., Hawthorne, Calif.
Instron Corp., 2500 Washington St., Canton, Mass.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Microwave Instruments Co., 3111 Second Ave., Corona del Mar, Cal.
Pacific Scientific Co., Aerospace Div., 1346 S. State College Blvd., Anaheim, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.

TESTERS, MEMORY—SEE TESTERS, COMPUTER MEMORY

TESTERS, METER

Augat Inc., 36 Perry Ave., Attleboro, Mass.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Holt Instrument Labs, P.O. Box 230, Oconto, Wisc. . . . . . p 1398
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. . . . . p 1414
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. . . . . p 1426
RFL Inds., Inc., Powerville Rd., Boonton, N. J. . . . . . p 1472
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1498
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Abbey Electronics Div., 200 Shames Dr., Westbury, N. Y.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.

TESTERS, POWER SUPPLY

Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
States Co., 19 New Park Ave., Hartford, Conn.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

TESTERS, MICROPHONE—SEE CALIBRATORS, MICROPHONE

TESTERS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. . . . . . p 1657
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. . . . . . p 1658
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. . . . . . p 1668
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Kilovolt Corp., 238 High St., Hackensack, N. J.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. . . . p 1708
Waveline Inc., Box 718, West Caldwell, N. J. . . . . . p 1720
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md. . . . p 1529
AAI Corp., Box 6767, Baltimore, Md.
Airborne Instruments Lab., Div. Cutler-Hammer, Inc., Deer Park, N. Y.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Carco Elctrns., 1180 O'Brien Dr., Menlo Park, Calif.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Collins Radio Co., Dallas, Texas
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Geospace Elctrns. Div., 1 Fairchild Ave., Plainview, N. Y.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Elleen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hyletronics Corp., 100 Ainsworth Rd., Wilmington, Mass.
Kruse-Storke Elctrns., 790 Hemmeter La., Mountain View, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Spectra-Elctrns., Inc., 923 N. San Antonio Rd., Los Altos, Calif.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

TESTERS, MOTOR

Kintron Co., 29 S. Pasadena Ave., Pasadena, Calif. . . . . . p 1748
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio p 2842, 2843
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. . . . . . p 1500
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
Delta Products, Inc., P.O. Box 1147, Grand Junction, Colo.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

TESTERS, MULTIPURPOSE—SEE TEST SETS, MULTIPURPOSE

TESTERS, POTENTIOMETER

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. . . p 1325
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. . . . . p 2056
Nytronics, Inc., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn.
Advance Instr. Corp., 1707 F St., Belmar, N. J.
Ametek, Inc., Station Square Two, Paoli, Pa.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bristol Co., Box 1790, Waterbury, Conn.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Millitest Corp., 88 Madison Ave., Hempstead, N. Y.
Solatron Enterprises, 421 E. Beach Ave., Inglewood, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Vari-Ohm Electronics, Inc., 65 Brightside Ave., E. Northport, N. Y.
Yewter Corp., 1885 Palmer Ave., Larchmont, N. Y.

TESTERS, POWER SUPPLY

Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1901
Electronic Development Corp., 423 W. Broadway, Boston, Mass.
Hipotronics, Inc., Rte. 22, P.O. Drawer A, Brewster, N. Y. p 1399, 1401, 1402
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. . . . . . p 2006
NJE Corp., 20 Boright Ave., Kenilworth, N. J.
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459, 2061
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y. . . p 1519
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Pacific Measurements, Inc., 940 Industrial Ave., Palo Alto, Cal.

TESTERS, PULSE JITTER

TESTERS, PULSE JITTER

Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.

TESTERS, RADAR

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
Bird Electronic Corp., 30303 Aurora Rd., Cleveland, Ohio ..... p 1342
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif.
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
Kilovolt Corp., 238 High St., Hackensack, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
AAI Corp., Box 6767, Baltimore, Md.
Bedford Div., Sanders Assocs., Inc., Crosby Rd., Bedford, Mass.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Miller Assocs., Mercersburg Academy, Mercersburg, Pa.
Nichols Prods. Co., 325 W. Main St., Moorestown, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Sperry Microwave Elctns. Div., Box 4648, Clearwater, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
United Telecontrol Electronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.

TESTERS, RATIO VOLTAGE

Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1338
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. p 1412-1414
Non-Linear Systems, Inc., Box N, Del Mar, Calif. ..... p 1450
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Philbrick/Nexus Research, 17 Allied Dr. at Rte. 128, Dedham, Mass. p 539
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496, 1497
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.

TESTERS, RELAY

Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1325
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Couch, S. Div., 3 Arlington St., North Quincy, Mass.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Hathaway, 5250 E. Evans Ave., Denver, Colo.
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
Bliss Electronic Corp., Box 366, Sussex, N. J.
Brooks Research & Mfg. Inc., 5612 Brighton Terr., Kansas City, Mo.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.
Flexco Div., 6855 Suva St., Bell Gardens, Calif.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kemper Engineering Co., 9337 Shoshone Ave., Northridge, Calif.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Multi-Amp Corp., 61 Myrtle St., Cranford, N. J.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Ostby & Barton Co., Box 6267, Providence, R. I.
Photologic Co., 3704 E. Walnut Ave., Orange, Cal.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Sittler Corp., 18 N. Ada St., Chicago, Ill.
Solatron Enterprises, 421 E. Beach Ave., Inglewood, Calif.
States Co., 19 New Park Ave., Hartford, Conn.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Technitron Co., 213½ 42nd St., Newport Beach, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

TESTERS, RESISTIVITY

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. p 1324, 1325
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif. p 2661
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa. p 1388
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1348
Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, Ohio
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1456
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Semimetals, Inc., 405 National Ave., Mountain View, Calif.

TESTERS, RESISTOR

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y. .... p 758
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Boonton Electronics Corp., Rte. 287 at Smith Rd., Parsippany, N. J. p 1348, 1349
California Instrs. Corp., 3511 Midway Dr., San Diego, Calif.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 1374
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 1385
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y. .... p 1392
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Industrial Test Equipt. Co., 20 Beechwood Ave., Port Washington, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1412
Magnemetrics Div., Rockdale St., Worcester, Mass. ..... p 1435
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1439
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Penn Airborne Products Co., Industrial Highway, Southampton, Pa. p 1456
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1469
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Shallcross, E. Preston St., Selma, N. C. ..... p 1483
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. ..... p 1500
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Brunswick Instruments, Box 813, New Brunswick, N. J.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Luft Instruments, Inc., Old Winter St., Lincoln, Mass.
Mercury Electronics Corp., 315 Roslyn Rd., Mineola, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Teradyne, Inc., 183 Essex St., Boston, Mass.

TESTERS, SERVO

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. .. p 1328, 1329
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
EMR-Hathoro, E. County Line Rd., Hathoro, Pa.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2668
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Superior Mfg. & Instr. Corp., 36-07 20th Ave., L. I. C., N. Y. .... p 2673
Theta Instrument Corp., Fairfield, N. J. ..... p 1515
Advance Instr. Corp., 1707 F St., Belmar, N. J.
Aetna Elctrns. Corp., Readington Rd., N. Branch, N. J.
Ametek, Inc., Station Square Two, Paoli, Pa.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Collins Radio Co., Dallas, Texas
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kollsman Motor Corp., Mill St., Dublin, Pa.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

TESTERS, SHOCK

Barry Controls Div., 700 Pleasant St., Watertown, Mass.
Blue M Engrg. Co., 138th & Chatham St., Blue Island, Ill. ..... p 1245
Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Avco Elctrns., 10700 E. Independence St., Tulsa, Okla.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Impact-O-Graph Corp., 1762 East 18th St., Cleveland, Ohio
L. A. B. Corp., 981 Onondaga St., Skaneateles, N. Y.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Mechanization Assocs., 140 S. Whisman Rd., Mt. View, Calif.
Monterey Research Lab., Inc., P.O. Box 72, Monterey, Calif.
New England Trawler Equip. Co., 291 Eastern Ave., Chelsea, Mass.

TESTERS, SIGNAL TRACING

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Barnes & Reinecke Inc., 351 E. Ohio St., Chicago, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bright Star Industries, Inc., 600 Getty Ave., Clifton, N. J.
Brooks Research & Mfg. Inc., 5612 Brighton Terr., Kansas City, Mo.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Coast Electronics, Inc., 1305 Fifth St., Manhattan Beach, Calif.
Collins Radio Co., Dallas, Texas
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Desco Mfg. Co., 1530 Flower St., Glendale, Calif.
Dit-Mco Intl., 5612 Brighton Terr., Kansas City, Mo.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Industrial Inventions, Inc., RD2 463 US 1, Monmouth Jct., N. J.
Industrial Sys. Div., 5261 W. Imperial Hwy., Los Angeles, Calif.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Northeast Electronics Corp., Box 649, Concord, N. H.
Ostby & Barton Co., Box 6267, Providence, R. I.
Precision Elctrns., Inc., 9101 King Ave., Franklin Park, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.
Ultra Audio Products, Box 921, Beverly Hills, Calif.
Versa-Tronics, 3016 Deer Pass Rd., Marengo, Ill.
Wandel & Goltermann/Tel-Com, 6 Great Meadow La., Hanover, N. J.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

TESTERS, SOLDERABILITY—SEE MACHINES, SOLDERABILITY TESTING

TESTERS, SPARK

Clinton Instrument Co., Boston Post Rd., Clinton, Conn.
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Sentron, Inc., P. O. Drawer 610, New Milford, Conn.

TESTERS, SYNCHRO ERROR

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. .. p 1328, 1329
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 2394
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 1452
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496, 1498
Theta Instrument Corp., Fairfield, N. J. ..... p 1515
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Farrand Controls, Inc., 99 Wall St., Valhalla, N. Y.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

TESTERS, SYNCHRO/RESOLVER

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. .. p 1328, 1329
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y. p 791
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1496, 1498
Theta Instrument Corp., Fairfield, N. J. ..... p 1515
Carbonara, Victor E., Instr. Engrg. Labs., 90 Harbor Rd., Port Washington, N. Y.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kybe Corp., 132 Calvary St., Waltham, Mass.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Projects Unlimited, Inc., 1926 E. Siebenthaler Ave., Dayton, Ohio
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Republic Corp., 9754 Deering Ave., Chatsworth, Calif.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.

TESTERS, TAPE-PROGRAMMED—SEE TEST EQUIPMENT, AUTOMATIC CHECKOUT, TESTERS, INTEGRATED CIRCUIT

TESTERS, TELEMETERING—SEE TELEMETERING TESTERS & CALIBRATORS

TESTERS, TELETYPEWRITER

Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Lab Electro-Acoustique, 5 Rue Jules-Parent, 92-Rueil, Malmaison, France

TESTERS, TENSILE—SEE TESTERS, MATERIAL

TESTERS, TORQUE

Magtrol Inc., 240 Seneca St., Buffalo, N. Y. ..... p 1749
Waters Mfg. Inc., 533 Boston Post Rd., Wayland, Mass.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Ametek, Inc., Station Square Two, Paoli, Pa.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
B & F Instruments Inc., Cornwells Hgts., Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Thermodynamics Corp., 164 Ballardvale St., Wilmington, Mass.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Instron Corp., 2500 Washington St., Canton, Mass.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kahn & Co., Inc., P. O. Box 516, Hartford, Conn.
MPB Corp., Precision Pk., Keene, N. H.
Matrix Corp., 520 North 11th Ave., Beech Grove, Ind.
McFadden Electronics Co., 8953 S. Atlantic Blvd., South Gate, Calif.
Owatonna Tool Co., 395 Eisenhower Dr., Owatonna, Minn.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Sturtevant, P. A. Div., Dresser Inds., Inc., Addison, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

TESTERS, TRACKING & EROSION, RESISTANCE (INSULATION)

Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
London Co., 811 Sharon Dr., Westlake, Ohio ..... p 1427
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio

TESTERS, TRANSISTOR

AEL Inc., P.O. Box 552, Lansdale, Pa. ..... p 1326
Barnes Corp., 24 N. Lansdowne Ave., Lansdowne, Pa.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
Kikusui Elctrns. Corp., 3-1175, Shinmaruko-Higashi, Kawasaki-City, Kanagawa-Pref., Japan
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Mastech Inc., Box 178, E. Molloy Rd., Syracuse, N. Y. ..... p 1436
Measurements, Box 180, Boonton, N. J.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2056
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Quan-Tech Laboratories Inc., 43 S. Jefferson Rd., Whippany, N. J. p 1468
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J. ... p 1480
Southfield Elctrns., 21250 10 ½ Mile Rd., Southfield, Mich. .... p 1503
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Telvac Instr. Co., 18531-E Ventura Blvd., Tarzana, Calif. ..... p 2834
Test Equipment Corp., Box 20215, Dallas, Tex. ..... p 1506
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Abbey Electronics Div., 200 Shames Dr., Westbury, N. Y.
Aerotronic Associates, Inc., Box 367, Contoocook, N. H.
Alessi Industries, 418 Main St., El Segundo, Calif.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Automated Measurements Corp., P.O. Box 1289, Oakland, Calif.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Beckman Instruments, Inc., Spinco Div., 1117 California Ave., Palo Alto, Calif.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Britec Ltd., 17 Charing Cross Rd., London, W.C. 2, Eng.
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Bulova Watch Co., Inc., Sys. & Instrs. Div., Sunrise Hwy., Valley Stream, N. Y.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Cox, C. E. Co., 1514-C N. Harper St., Santa Ana, Calif.
Custom Scientific Instruments, Inc., Box A, Whippany, N. J.
Daymarc Corp., Bear Hill Rd., Waltham, Mass.
Desco Mfg. Co., 1530 Flower St., Glendale, Calif.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Ensco, Inc., 3100 Eldredge St., Salt Lake City, Utah
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Geauga Elctrns. Co., 7336 Samuel Lord Dr., Chagrin Falls, Ohio
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Leader Instrs. Corp., 24-20 Jackson Ave., Long Island City, N. Y.
Leland Airborne Products, Div. of AMF Co., Box 128, Vandalia, Ohio
Levell Elctrns. Ltd., Park Rd., High Barnet, Herts, Eng.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Optimized Devices, Inc., 220 Marble Ave., Pleasantville, N. Y.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Semitronics Corp., 265 Canal St., New York, N. Y.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Sensory Systems, Inc., Box 2071, Costa Mesa, Calif.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Teradyne, Inc., 183 Essex St., Boston, Mass.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
Velonex, 560 Robert Ave., Santa Clara, Calif.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

TESTERS, TRANSMISSION & DELAY

Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif.
Daven, Grenier Field, Dept. EEM 67, Manchester, N. H. ..... p 550
Marconi Instrs., 111 Cedar La., Englewood, N. J. ..... p 1433
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Waveforms, 11922 Valerio St., N. Hollywood, Calif. ..... p 1530
Western Reserve Electronics Inc., 12430 Euclid Ave., Cleveland, Ohio p 1550
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Metro-Tel Corp., 409 Railroad Ave., Westbury, N. Y.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Northeast Electronics Corp., Box 649, Concord, N. H.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Railway Communications, 9351 East 59th St., Raytown, Mo.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

TESTERS, TUBE

Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Heath Co., Dept. 180, Benton Harbor, Mich.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1395
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Triplett Electrical Instr. Co., 280 Harmon Rd., Bluffton, Ohio
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y. p 1954
American Electronic Controls, 74 Tracey Rd., Huntingdon Valley, Pa.
Antronic Corp., 4942 Division, Chicago, Ill.
B & K, 1801 W. Belle Plaine Ave., Chicago, Ill.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
ECCO Elctrn. Comps. Cprp., 157 S. MacQuesten Pkwy., Mt. Vernon, N. Y.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electro Specialties Corp., 370 Park Ave., Worcester, Mass.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
Jackson Electrical Instrument Co., 35 Windson Ave., Mineola, N. Y.
Jetronic Industries, Inc., Main & Cotton Sts., Philadelphia, Pa.
Joliet Control Corp., Maple & Benton, Box 751, Joliet, Ill.
Lattin Radio Laboratories, 1431 Sweeney, P.O. Box 44, Owensboro, Ky.
Lectrotech, Inc., 1221 W. Devon Ave., Chicago, Ill.
Loranger Mfg. Corp., P.O. Box 948, Warren, Pa.
Mercury Electronics Corp., 315 Roslyn Rd., Mineola, N. Y.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Precise Electronics, 76 E. 2nd St., Mineola, N. Y.
Ril Elctrns., Inc., Street Rd. at 2nd St. Pike, Southampton, Pa.
Seco Electronics Corp., 1001 2nd St. S., Hopkins, Minn.
Sencore, Inc., 426 S. Westgate Dr., Addison, Ill.
Stark Electronic Instruments, Ltd., 180 Station St., Ajax, Ont., Can.
Viz Mfg. Co., 335 E. Price St., Philadelphia, Pa.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Wiltron Co., 930 East Meadow Dr., Palo Alto, Calif.

TESTERS, UNIVERSAL

EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Instrument Prods., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y. .... p 1414
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Ametek, Inc., Station Square Two, Paoli, Pa.
Anchor Specialty Mfg. Co., 300 Hollister Rd., Teterboro, N. J.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
DeSoto Electrical Products, Box 239, DeSoto, Mo.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
Electronic Measurements Corp., 625 Broadway, New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instron Corp., 2500 Washington St., Canton, Mass.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
Welex Electronics, Box 986, Silver Spring, Md.

TESTERS, VIBRATION—SEE VIBRATION TEST SYSTEMS

TESTERS, VOLTAGE BREAKDOWN

Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill. .. p 1324
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J. p 1337
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Crown Int'l., Box 1000, Dept. EEM, Elkhart, Ind.
Cunningham Corp., 10 Carriage St., Honeoye Falls, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Industrial Devices Inc., 982 River Rd., Edgewater, N. J.
Micro Instrument Company, 12901 Crenshaw Blvd., Hawthorne, Calif. p 1439
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 1458, 1459
Slaughter Co., Moore & Hailey Sts., Ardmore, Okla. .... p 1500, 1501
Spedcor Elctrns., Inc., 70-31 84th St., Glendale, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
Avtron Mfg., Inc., 10409 Meech Ave., Cleveland, Ohio
British Physical Labs., Houseboat Works, Radlett, Herts, Eng.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Cincinnati Sub-Zero Products, Inc., 2612 Gilbert Ave., Cincinnati, Ohio
Cole Instrument, 2034 Placentia Ave., Costa Mesa, Calif.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Randam Electronics, Inc., 3091 Shadycrest Dr., Cincinnati, Ohio

THERMOCOUPLE REFERENCE JUNCTIONS

Sentron, Inc., P. O. Drawer 610, New Milford, Conn.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Teleproducts, Inc., 351 New Albany Rd., Moorestown, N. J.
Teradyne, Inc., 183 Essex St., Boston, Mass.

TESTING, ENVIRONMENTAL—SEE SERVICES, ENVIRONMENTAL TESTING

THERMISTORS

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y. p 2349
Cal-R, Inc., Thermonetics Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2799
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. p 2800-2803
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I.
Fenwal Electronics Inc., 63 Fountain St., Framingham, Mass. ... p 2814
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2815
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J. ..... p 2824
Interelectronics Corp., 550 U.S. Rte. 303, Congers, N. Y.
Keystone Carbon Co., Thermistor Div., St. Marys, Pa. ... p 2818-2823
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Marstan Elctrns., 307 Washington St., Orange, N. J. ..... p 2405
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Bacharach Instrument Co., 625 Alpha Dr., Pittsburgh, Pa.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
Conax Corporation, 2300 Walden Ave., Buffalo, N. Y.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
General Electric Co., Metallurgical Prods. Dept., Box 237, Detroit, Mich.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Gow-Mac Instrument Co., 100 Kings Rd., Madison, N. J.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Palmer Electronics, Inc., 156 Belmont Ave., Garfield, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Toa Elctrns. Ltd., 235, Suwa-Cho, Shinjuku-ku, Tokyo, Japan
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Victory Engineering Corp., 128 Victory Rd., Springfield, N. J.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

THERMO-COMPRESSION BONDING EQUIPMENT

Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.

THERMOCOUPLE REFERENCE JUNCTIONS

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill. .. p 2805, 2808
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Resistance Inc., 500 Nuber Ave., Mt. Vernon, N. Y.
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
Rosemount Plug-In Inc., Component Sales, 1416 Lebanon Rd., Nashville, Tenn.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Kaye, Joseph, & Co., Inc., 737 Concord Ave., Cambridge, Mass.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Nanmac Corp., 9 Mayhew Rd., Framingham, Mass.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
RDF Corp., 23 Elm Ave., Hudson, N. H.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Research, Inc., Box 6164, Minneapolis, Minn.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Theta Inds., Inc., Box 392, Great Neck, N. Y.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

THERMOCOUPLE

THERMOCOUPLES, ELEMENTS & ACCESSORIES

Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 860, 861
Best Electrics Div., 1211 E. Denny Way, Seattle, Wash. ..... p 2798
Control Prods. Corp., 4431 W. Division St., Chicago, Ill. .. p 2804-2811
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1669
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y. ..... p 1671
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
ITT Cannon Elec., 3208 Humboldt St., Los Angeles, Cal. ..... p 910
InstruLab, Inc., 1205 Lamar St., Dayton, Ohio
J-B-T Instrs. Inc., Box 1818, New Haven, Conn.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
American Standard, 9000 Kings St., Franklin Park, Ill.
Astro Inds., Inc., 606 Olive St., Santa Barbara, Calif.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Beckman Instrs., Inc., Scientific Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Bristol Co., Box 1790, Waterbury, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Conax Corporation, 2300 Walden Ave., Buffalo, N. Y.
Consolidated Controls Corp., 2938 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Consolidated Ohmic Devices, 115 Old Country Rd., Carle Place, N. Y.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Electric Thermometers, Inc., 10 Glover Ave., Norwalk, Conn.
Electronic Brazing Co., 140 Glenridge Ave., Montclair, N. J.
Electronic Development Labs., Inc., 19 Newton Rd., Plainview, N. Y.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Foxboro, Foxboro, Mass.
Harco Labs, Inc., 186 Cedar St., Branford, Conn.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Nanmac Corp., 9 Mayhew Rd., Framingham, Mass.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Pyro Electric, Muskin Rd., Walkerton, Ind.
Pyrometer Instr. Inc., 23 Industrial Pkwy., Northvale, N. J.
RDF Corp., 23 Elm Ave., Hudson, N. H.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
TemTex, 5619 Dyer St., Dallas, Tex.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Thermotronic Devices, Inc., Forest & Hector Sts., Conshohocken, Pa.
United Electric Controls Co., 85A School St., Watertown, Mass.
United Sensor & Control Co., 85 School St., Watertown, Mass.
Vacuum Prods., Inc., 25 Dock St., Mt. Vernon, N. Y.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Zircoa, (Zirconium Corp. of America), Box 39217, Solon, Ohio

THERMOCOUPLES, VACUUM—ALSO SEE THERMOCOUPLES, ELEMENTS & ACCESSORIES

Best Electrics Div., 1211 E. Denny Way, Seattle, Wash. ..... p 2798
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1494
American Thermo Electric Co., 7269 Santa Monica, Los Angeles, Calif.
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Harco Labs, Inc., 186 Cedar St., Branford, Conn.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
United Electric Controls Co., 85A School St., Watertown, Mass.
Vacuum Prods., Inc., 25 Dock St., Mt. Vernon, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

THERMOELECTRIC DEVICES & MATERIALS—SEE COOLING/HEATING DEVICES, THERMOELECTRIC

THERMOELECTRIC GENERATORS—SEE GENERATORS, THERMOELECTRIC

THERMOMETERS, RESISTANCE

Beede Electrical Instr. Co., Inc., S. Main St., Penacook, N. H.
Cal-R, Inc., Thermonetics Div., 1601 Olympic Blvd., Santa Monica, Calif. p 2799
Control Prods. Corp., 4431 W. Division St., Chicago, Ill. ..... p 2804
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Harrel Inc., 16 Fitch St., East Norwalk, Conn.
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
RFL Inds., Inc., Powerville Rd., Boonton, N. J.
RFL Inds., Inc., Thermocontrol Div., Powerville Rd., Boonton, N. J. p 1473
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
American Standard, 9000 Kings St., Franklin Park, Ill.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
Bacharach Instrument Co., 625 Alpha Dr., Pittsburgh, Pa.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beacon Elctrns., Inc., 121 Stanley Ave., Bellmawr, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
Burns Engrg., Inc., 5301 Edina Indl. Blvd., Minneapolis, Minn.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Conax Corporation, 2300 Walden Ave., Buffalo, N. Y.
Consolidated Controls Corp., 2338 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Cryotronics, Inc., W. Main St., High Bridge, N. J.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Ealing Corp., 2225 Massachusetts Ave., Cambridge, Mass.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electric Thermometers, Inc., 10 Glover Ave., Norwalk, Conn.
Fabri-Tek Instruments, Inc., 5225 Verona Rd., Madison, Wisc.
Fenwal, Inc., Main St., Ashland, Mass.
Foxboro, Foxboro, Mass.
Hallikainen Instrs., 750 National Ct., Richmond, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Malaker Corp., W. Main St., High Bridge, N. J.
Marshall Instrs., Inc., 14203 Bessemer St., Van Nuys, Calif.
Maurey Instr. Corp., 4555 West 60th St., Chicago, Ill.
Melabs, 3300 Hillview Ave., Palo Alto, Calif.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Midwest Audio Corp., 5707 W. Division, Chicago, Ill.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
RDF Corp., 23 Elm Ave., Hudson, N. H.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Solitron Devices, Inc., 1177 Blue Heron Rd., Riviera Beach, Fla.
T & T Controls Co., Inc., Box 171, Media, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
TemTex, 5619 Dyer St., Dallas, Tex.
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Time-O-Matic Inc., Box 850, Danville, Ill.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
United Systems Corp., 918 Woodley Rd., Dayton, Ohio
Versitherm, Inc., 51 Toledo St., Farmingdale, N. Y.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

THERMOPILES

Biddle, James G. Co., Township Line & Jolly Rds., Plymouth Meeting, Pa.
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1669
Bristol Co., Box 1790, Waterbury, Conn.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Eppley Lab., Inc., Box 419—Main P.O., Newport, R. I.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Nanmac Corp., 9 Mayhew Rd., Framingham, Mass.
Nichols, R. H. Co., Ltd., 4544 Dufferin St., Toronto, Ont., Can.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
RDF Corp., 23 Elm Ave., Hudson, N. H.
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.

THERMOSTATS—ALSO SEE SWITCHES, THERMALLY ACTUATED; CONTROLS TEMPERATURE

Electronic Research Co., 10000 W. 75th St., Overland Park, Kans. p 1096
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I. .... p 2813
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239

THIN-FILM MEMORY SYSTEMS, PLANAR—SEE MEMORY SYSTEMS

THYRATRONS—SEE TUBES, THYRATRON

THYRISTORS—(INCLUDES SILICON-CONTROLLED RECTIFIERS)

American Feldmuehle Corp., Box 2160, Glenbrook, Conn.
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510-2513
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
International Rectifier, 233 Kansas St., El Segundo, Calif. p 2521, 2522, 2529
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Semikron International Inc., Box 323, Scarsdale, N. Y. ..... p 2587
Solid State Prods., One Pingree St., Salem, Mass. ..... p 2588
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Syntron Div., 264 Lexington, Homer City, Pa. ..... p 2594, 2595, 2600
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. p 2624, 2625
Unitrode Corporation, 582 Pleasant St., Watertown, Mass. p 2636, 2637
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2642, 2643, 2644, 2650, 2651, 2653-2655
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
M & T Chemicals, Inc., Sub. American Can Co., Rahway, N. J.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Electronics, Inc., Box 269, Geneva, Ill.
Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.
Semicon Inc., Sweetwater Ave., Bedford, Mass.
Semitronics Corp., 265 Canal St., New York, N. Y.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

TIES, WIRE & CABLE—SEE WIRE & CABLE TIES

TIMER SWITCHES—SEE SWITCHES, TIME DELAY

TIMERS, COIN OPERATED

Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.

TIMERS, COUNTING

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
C & K Components Inc., 103 Morse St., Watertown, Mass.
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Fork Standards Inc., 213 Main St., West Chicago, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa. p 794
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Presin Co., Trap Falls Rd., Shelton, Conn. ..... p 1051
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap. p 1753
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022

A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bulova Watch Co., Timer Lab., Bulova Park, Flushing, N. Y.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Davis Electronics Corp., 4711 East 5th St., Austin, Texas
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heli-Coil Corp., Shelter Rock La., Danbury, Conn.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Preston Scientific, Inc., 805 E. Cerritos Ave., Anaheim, Calif.
Scientific Measurements, Inc., 9701 N. Kenton, Skokie, Ill.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Time-O-Matic Inc., Box 850, Danville, Ill.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

TIMERS, CYCLE

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
C & K Components Inc., 103 Morse St., Watertown, Mass.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
Fork Standards Inc., 213 Main St., West Chicago, Ill.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Haydon Switch & Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. p 1742
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind. .. p 1045
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. p 989
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Bristol Co., Box 1790, Waterbury, Conn.
Bulova Watch Co., Timer Lab., Bulova Park, Flushing, N. Y.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Hughey & Phillips, Inc., 3050 N. California St., Burbank, Calif.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Liebel-Flarsheim Co., 111 E. Amity Rd., Cincinnati, Ohio
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Midtex/Aemco, 10 State St., Mankato, Minn.
Minarik Electric Co., 226 E. Third St., Los Angeles, Calif.
Montgomery Mfg. Co., Inc., 206 S. Main St., Owensville, Ind.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Rhodes, M. H. Inc., 30 Bartholomew Ave., Hartford, Conn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Technitron Co., 213½ 42nd St., Newport Beach, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Walters, W. A., Inc., 7713 South Western Ave., Chicago, Ill.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

TIMERS, ELECTROLYTIC CELL

Bissett-Berman Corp., 3860 Centinela Ave., Los Angeles, Cal. .... p 1019
Curtis Instruments, Inc., 200 Kisco Ave., Mt. Kisco, N. Y. ..... p 1364
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1038

TIMERS, IMPULSE

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y. ..... p 1278
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
C & K Components Inc., 103 Morse St., Watertown, Mass.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa. p 794
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Heli-Coil Corp., Shelter Rock La., Danbury, Conn.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Liebel-Flarsheim Co., 111 E. Amity Rd., Cincinnati, Ohio
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Slee International Inc., 8010 U. S. Hwy. 130, Pennsauken, N. J.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

TIMERS, INTERVAL

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014, 1015
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
C & K Components Inc., 103 Morse St., Watertown, Mass.
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chrono-Log Corp., 2583 W. Chester Pike, Broomall, Pa.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Corning Glass Works, Electronic Products Div., Corning, N. Y.
Curtis Instruments, Inc., 200-Kisco Ave., Mt. Kisco, N. Y. ..... p 1364
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369

TIMERS, INTERVAL (Cont'd)

Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Ferwalt, W. H. Inc., Webb Rd., Lapwai, Idaho
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
Gibbs Mfg. & Research Corp., 450 N. Main St., Janesville, Wisc. p 1038
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. ..... p 2269
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio p 1394
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn.
Itron Corp., 11675 Sorrento Valley Rd., San Diego, Calif. ..... p 1043
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind. .. p 1045
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa. p 794
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Sigma Instruments Inc., 170 Pearl St., Braintree, Mass.
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Bulova Watch Co., Timer Lab., Bulova Park, Flushing, N. Y.
Burke & James, Inc., 333 W. Lake St., Chicago, Ill.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Corning Glass Works, Fluidic Prods. Dept., Corning, N. Y.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dimco-Gray Co., 207 East 6th St., Dayton, Ohio
Diversified Elctrns., Inc., Box 6231, Evansville, Ind.
Dri-Clave Corp., 54 Kinkel St., Westbury, N. Y.
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Electronics for Life Sciences, Inc., Box 697, Twinbrook Sta., Rockville, Md.
Elron Inc., 9701 N. Kenton Ave., Skokie, Ill.
Engler Instrument Corp., 250 Culver Ave., Jersey City, N. J.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Federal Screw Prods., Inc., 3917 N. Kedzie Ave., Chicago, Ill.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Gralex Inds., Inc., 28 Di Tomas Ct., Copiague, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Elctrn. Data Process. Div., 60 Walnut St., Wellesley Hills, Mass.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lear Siegler, Inc., 4141 Eastern Ave., S.E., Grand Rapids, Mich.
Lehigh Valley Electronics, Inc., Box 125, Fogelsville, Pa.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Lektra Labs., Inc., 129-07 18th Ave., College Point, N. Y.
Liebel-Flarsheim Co., 111 E. Amity Rd., Cincinnati, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Lisk, G. W., Co., Inc., 5019 South St., Clifton Springs, N. Y.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Midtex/Aemco, 10 State St., Mankato, Minn.

TIMERS, INTERVAL (Cont'd)

Nano Fast, Inc., 416 W. Erie, Chicago, Ill.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Northeast Electronics Corp., Box 649, Concord, N. H.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Paragon Elec. Co., Inc., 1600 12th St., Two Rivers, Wisc.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Rhodes, M. H. Inc., 30 Bartholomew Ave., Hartford, Conn.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Sunshine Scientific Instruments, Inc., 1810 Grant Ave., Philadelphia, Pa.
Symbolic Displays, Inc., 1188 N. Batavia St., Orange, Calif.
Systron-Donner Corp., One Systron Dr., Concord, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Technic, Inc., Box 965, Providence, R. I.
Time Systems Corp., 265 Whisman Rd., Mountain View, Calif.
Tokyo Elec. Co., Ltd., 14-8, 1-Chome, Uchi-Kanda, Chiyoda-ku, Tokyo, Jap.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
USM Corp., 81 Bay State Rd., Wakefield, Mass.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Walters, W. A., Inc., 7713 South Western Ave., Chicago, Ill.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

TIMERS, PROGRAMMED

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
General Time Corp., Rte. 8, Torrington, Conn.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind. .. p 1045
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 787
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Aimes Inds., Inc., Box 73, Lockport, Ill.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electronics for Life Sciences, Inc., Box 697, Twinbrook Sta., Rockville, Md.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
International Register Co., 4700 W. Montrose Ave., Chicago, Ill.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Midtex/Aemco, 10 State St., Mankato, Minn.
Minarik Electric Co., 226 E. Third St., Los Angeles, Calif.
Montgomery Mfg. Co., Inc., 206 S. Main St., Owensville, Ind.
Noble Electronics, Inc., 5025 Seventh St., Carpinteria, Calif.
Program Elctrns. Co., 1733 West End Ave., New Hyde Park, N. Y.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

TIMERS, RESET

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
C & K Components Inc., 103 Morse St., Watertown, Mass.
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Time Corp., Rte. 8, Torrington, Conn. ..... p 1037
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn. .... p 2268, 2269
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y. ..... p 1409
International Electro Exchange Corp., 6851 Oxford St., Minneapolis, Minn.
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind. .. p 1045
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap. p 1753
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y. ..... p 989
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y. ..... p 2672
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Cutler-Hammer, Inc., 4201 N. 27 St., Milwaukee, Wisc.
Di/An Controls, Inc., 944 Dorchester Ave., Boston, Mass.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Globe-Union Inc., 5757 N. Green Bay Ave., Milwaukee, Wisc.
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Lab-Line Instrs., Inc., Lab-Line Plaza, Melrose Park, Ill.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Liebel-Flarsheim Co., 111 E. Amity Rd., Cincinnati, Ohio
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Machinery Electrification, Inc., 56 Hudson St., Northboro, Mass.
McKee-Pedersen Instruments, P.O. Box 322, Danville, Calif.
Midtex/Aemco, 10 State St., Mankato, Minn.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Paragon Elec. Co., Inc., 1600 12th St., Two Rivers, Wisc.
Precision Scientific Co., 3737 W. Cortland St., Chicago, Ill.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Techmetric Co., 2449 Harding Ave., Redwood City, Calif.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

TIMERS, SEQUENCE

A D Data Systems, Inc., 830 Linden Ave., Rochester, N. Y.
Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind. ... p 1021
C & K Components Inc., 103 Morse St., Watertown, Mass.
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Chicago Dynamic Inds. Inc., 1725 Diversey Blvd., Chicago, Ill.
Clare, C. P., & Co., 3101 Pratt Blvd., Chicago, Ill.
Co-Ord Switch Div., 102-48 43 Ave., Corona, N. Y.
Colburn Instrs., Inc., 354 Coral Circle, El Segundo, Calif. ..... p 1247
Deltrol Controls, 2745 South 19th St., Milwaukee, Wisc. ..... p 2223
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
E-Tronics, 5901 Noble Ave., Van Nuys, Calif.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Time Corp., Rte. 8, Torrington, Conn.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn. ..... p 1040
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Ledex Div., Ledex Inc., 126 Webster St., Dayton, Ohio ..... p 2747
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind. .. p 1045
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 2310
Precision Mechanisms Corp., 44 Brooklyn Ave., Westbury, N. Y.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap.
Sealectro Corp., 225 Hoyt St., Mamaroneck, N. Y.
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Vocaline Co. of America, Coulter St., Old Saybrook, Conn. .... p 1022
Abrams Instrument Corp., 606 E. Shiawassee St., Lansing, Mich.
Acton Laboratories, Inc., 531 Main St., Acton, Mass.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
American Communications Corp., 178-15 Eveleth Rd., Jamaica, N. Y.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Autotron, Inc., 3629 N. Vermilion, Danville, Ill.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Bristol Co., Box 1790, Waterbury, Conn.
Bulova Watch Co., Timer Lab., Bulova Park, Flushing, N. Y.
California Electro-Scientific Corp., 2203 S. Grand Ave., Santa Ana, Calif.
Clare-ElectroSeal Corp., 946 North Ave., Des Plaines, Ill.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Condor Industrial Corp., 649 Childs St., Wheaton, Ill.
Controlomag Labs., 2459 Susquehanna, Roslyn, Pa.
Controlotron Corp., 35 Central Ave., Farmingdale, N. Y.
Controls Company of America, 9655 Soreng Ave., Schiller Park, Ill.
Cramer Div., Conrac Corp., Old Saybrook, Conn.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
De-Tec-Tronic Corp., 2512 N. Halsted St., Chicago, Ill.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electronic Counters, Inc., 235 Jackson St., Englewood, N. J.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Gammatronix Inc., Dublin, Ohio
Godfrey Mfg. Co., 1633 N. Halsted St., Chicago, Ill.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Midtex/Aemco, 10 State St., Mankato, Minn.
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
Montgomery Mfg. Co., Inc., 206 S. Main St., Owensville, Ind.
National Time & Signal Corp., 21803 Wyoming Ave., Detroit, Mich.
Paragon Elec. Co., Inc., 1600 12th St., Two Rivers, Wisc.
Raymond Engrg., Inc., 217 Smith St., Middletown, Conn.
Reach Electronics, Inc., Box 308, Lexington, Nebr.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Rhodes, M. H. Inc., 30 Bartholomew Ave., Hartford, Conn.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Saturn Electronics Corp., 3111 Benton St., Garland, Tex.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Tenor Co., Inc., 17020 W. Rogers Dr., New Berlin, Wisc.
Transystems Elctrn. Co., 2200 Central Rd., Fort Lee, N. J.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Walters, W. A., Inc., 7713 South Western Ave., Chicago, Ill.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.
Zenith Controls Inc., 830 West 40th St., Chicago, Ill.

TIMERS, SOLID STATE

American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y.
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J. ..... p 2198
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bulova Watch Co., Inc., Elctrns. Div., Servo Prods., 61-20 Woodside Ave., Woodside, N. Y.
Control Logic, Inc., 3 Strathmore Rd., Natick, Mass. ..... p 771
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Digital Instrs., Inc., 13735 Victory Blvd., Van Nuys, Calif. ..... p 778
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa p 1020
Electra/Midland Corp., 3151 Fiberglass Rd., Kansas City, Kans.
Guardian California, 5755 Camille Ave., Culver City, Calif.
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Intercontinental Elctrn. Corp., Box 151, Fairport, N. Y.
Magnecraft Elec. Co., 5575 N. Lynch Ave., Chicago, Ill.
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind. .. p 1045
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J. .... p 2310
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Servo Development Corp., 2 Willis Ct., Hicksville, N. Y.
Solid State Elctrn. Corp., 15321 Raven St., Sepulveda, Cal.
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y. .... p 1052
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y. ..... p 1053
Aimes Inds., Inc., Box 73, Lockport, Ill.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Allen-Bradley Co., 1201 South 2nd St., Milwaukee, Wisc.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Autronics Corp., 180 N. Vinedo Ave., Pasadena, Calif.
Bayside Timers, Inc., 43-69 162 St., Flushing, N. Y.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
EDP Corp., Box 6485, Orlando, Fla.
Farmer Electric Products Co., Inc., Tech Circle, Natick, Mass.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Gulton Inds., Inc., Data Sys. Div., 15000 Central, E., Albuquerque, N. M.
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Industrial Solid State Controls, Inc., Box 934, York, Pa.
Instrument Components Co., 15105 Broadway, Maple Hghts., Ohio
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Midtex/Aemco, 10 State St., Mankato, Minn.

Neill Engrg. Co., Old Town Rd., E. Hartland, Conn.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Starnetics Co., Box 9308, N. Hollywood, Calif.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Time-O-Matic Inc., Box 850, Danville, Ill.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Venner Elctrns. Ltd., Kingston By-Pass, New Malden, Surrey, Eng.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

TIMERS, THERMAL

Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
G-V Controls Inc., 101 Okner Pkwy., Livingston, N. J. ..... p 2239
Sankyo Seiki Mfg. Co., Ltd., 17-2 1-Chome Shinbashi Minato-ku, Tokyo, Jap.
Dialtron Corp., 203 Harrison Pl., Brooklyn, N. Y.
E-T-A Products Co. of America, 6284 N. Cicero Ave., Chicago, Ill.
Ebert Elctrns. Corp., 130 Jericho Tpke., Floral Park, N. Y.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hoagland Instrument Co., 65 Chestnut St., P.O. Box 830, Red Bank, N. J.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Relay Specialties, Inc., 3 Godwin Ave., Fair Lawn, N. J.
Scaico Div., 211 Warren St., W. Pittston, Pa.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.

TIMERS, WELDING (ELECTRONIC)

Aemco Div., Midtex Inc., 10 State St., Mankato, Minn.
Agastat Div., 1027 Newark Ave., Elizabeth, N. J. ..... p 2197
Artisan Elctrns. Corp., 5 Eastman's Rd., Parsippany, N. J.
Plessey Airborne Corp., 1414 Chestnut Ave., Hillside, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn.
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y.
Tempo Instr. Inc., E. Bethpage Rd., Plainview, N. Y.
Air-O-Tronics Products, Inc., Box K, Morrisville, N. Y.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Precision Arc Co., Inc., 785 Woodend Rd., Stratford, Conn.
Price & Rutzebeck, Box 30, Hayward, Calif.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.

TIMING SWITCHES—SEE TIMERS

TINSEL—SEE WIRE, TINSEL

TONOMETERS

Biotronics, Inc., 838 Butte St., Redding, Calif.

TOOL KITS & SETS

Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 839, 868
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif.
Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif. ..... p 2831
Nanasi, Div. Electrospace Corp., 6308 Jackson St., W. New York, N. J.
Telvac Instr. Co., 18531-E Ventura Blvd., Tarzana, Calif. ..... p 2834
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
Ace Drill Corp., 2600 E. Maumee St., Adrian, Mich.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bearing Inspection, Inc., 10041 Shoemaker Ave., Santa Fe Springs, Calif.
Boker Mfg. Co., In-Dus-Tronic Div., 200 Burnett Ave., Maplewood, N. J.
By-Buk Co., 4326 W. Pico Blvd., Los Angeles, Calif.
Channellock, Inc., S. Main St., Meadville, Pa.
Cole-Parmer Instr. Co., 7425 N. Oak Park Ave., Chicago, Ill.
Dixie Diamond Tool Co., Inc., 6875 S.W. 81st St., Miami, Fla.
Fedtro, Inc., Federal Elctrns. Bldg., Rockville Centre, N. Y.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Multi-Amp Corp., 61 Myrtle St., Cranford, N. J.
Owatonna Tool Co., 395 Eisenhower Dr., Owatonna, Minn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Rosenberg Bros. & Co., 100 Landing Ave., Smithtown, N. Y.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Transcriber Co., Inc., Attleboro Industrial Pk., County St., Attleboro, Mass.
Uber Grafic Instrs., Box 4, Palo Alto, Calif.
Ungar, 2701 W. El Segundo Blvd., Hawthorne, Calif.
Upson Tools, Inc., Box 4750, Rochester, N. Y.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Wharton Unitools, 8-10 Lake St., Moosup, Conn.
Williams, J. H. & Co., 400 Vulcan St., Buffalo, N. Y.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.

TOOLS, ALIGNMENT & TUNING

Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif. ..... p 2831
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y. ..... p 994
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. ... p 1207
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.
Injectorall Electronics Corp., 4 North Rd., Great Neck, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

TOOLS, CRIMPING

AMP Incorporated, Box 3608, Harrisburg, Pa.
Amphenol Connector Div., 2801 S. 25th Ave., Broadview, Ill. p 839, 866, 868
Buchanan Electrical Products Corp., 1065 Floral Ave., Union, N. J. p 879
Burndy Corporation, Richards Ave., Norwalk, Conn. p 880, 882, 885, 2828, 2829
Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif.
Elco Corp., Maryland Rd. & Computer Ave., Willow Grove, Pa. .. p 899
Electronic Controls Inc., 141 Danbury Rd., Wilton, Conn. ..... p 2224
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y. .... p 914
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill. .... p 1009
Amphenol Cadre Div., 20 Valley St., Box 150, Endicott, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Ark-Les Switch Corp., 51 Water Street, Watertown, Mass.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Boker Mfg. Co., In-Dus-Tronic Div., 200 Burnett Ave., Maplewood, N. J.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Crimpco Engrg., 7341 Canoga Ave., Canoga Park, Calif.
ETC, Inc., 990 East 67 St., Cleveland, Ohio
Electric Terminal Corp., Drawer E, Pilgrim Sta., Warwick, R. I.
Ewing Products, Inc., 1014 W. Burbank Blvd., Burbank, Calif.
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Gemp Terminals, Inc., 20 Woodworth Ave., Yonkers, N. Y.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
General Staple Co., 28 East 22nd St., New York, N. Y.
Hollingsworth Solderless Terminal Co., Box 430, Phoenixville, Pa.
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Pico Crimping Tools Co., 9832 Jersey Ave., Santa Fe Springs, Calif.
Porter, H. K., Inc., 74 Foley St., Somerville, Mass.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Superior Continental Corp., Box 489, Hickory, N. C.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Winchester Elctrn. Div., Main & Hillside Aves., Oakville, Conn.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.

TOOLS, HAND OR MECHANICAL—SEE CUTTERS; SCREWDRIVERS; WRENCHES; ETC.

TOOLS, HEAT SEALING

Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Berg Electronics, Inc., York Expwy., New Cumberland, Pa.
Harwil Co., 903 Colorado Ave., Santa Monica, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

TOOLS, MICROELECTRONIC HANDLING

Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
E. T. M. Corp., 144 W. Chestnut Ave., Monrovia, Calif.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Orbit Industries, Box 1444, San Luis Obispo, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Tempress Research Co., 980 University Ave., Los Gatos, Calif.
Ungar, 2701 W. El Segundo Blvd., Hawthorne, Calif.
Vigor Tool Co., 53 West 23 St., New York, N. Y.
Wendon Co., Inc., 17 Irving Ave., Stamford, Conn.

TOOLS, PARTS-HANDLING, VACUUM OPERATED

Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill.
Telvac Instr. Co., 18531-E Ventura Blvd., Tarzana, Calif. ..... p 2834
Air-Vac Engineering Co., Inc., 100 Gulf St., Milford, Conn.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Atlantic India Rubber Co., 571 W. Polk St., Chicago, Ill.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Foredom Electric Co., Inc., Bethel, Conn.
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Henes Mfg. Co., 4301 E. Madison St., Phoenix, Ariz.
Hydro Molding Co., Inc., Plattsburgh, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

TOOLS, RELAY SERVICING

Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif. ..... p 1319
Automatic Electric Co., 400 N. Wolf Rd., Northlake, Ill.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.

TOTALIZERS, DIGITAL

TOOLS, RESISTANCE SOLDERING—SEE SOLDERING EQUIP., RESISTANCE

TOOLS, SOLDERING—SEE SPECIFIC TYPES

TOOLS, SWAGING

Circon Comp. Corp., Santa Barbara Airport, Goleta, Calif.
Helitronics Corp., 916 McCarter Hwy., Newark, N. J.
Vector Electronic Co. Inc., 12460 Gladstone Ave., Sylmar, Cal.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
D-Cemco, 3200 N. San Fernando Blvd., Burbank, Calif.
ETC, Inc., 990 East 67 St., Cleveland, Ohio
Eyelet Tool Co., Inc., 76 Rogers St., Cambridge, Mass.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Keystone Elctrns. Corp., 49 Bleeker St., New York, N. Y.
Litton Inds., USECO Div., 13536 Saticoy St., Van Nuys, Calif.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Tridair Industries, 3000 W. Lomita Bl., Torrance, Cal.
USECO Div., Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

TOROIDS—SEE COILS, TOROIDAL

TORQUE INDICATORS—SEE INDICATORS, TORQUE

TORQUE METERS—SEE INDICATORS, TORQUE

TORQUE TESTERS—SEE TESTERS, TORQUE

TORQUERS, GYRO—SEE MOTORS, GYRO

TOTALIZERS, DIGITAL

Anadex Instruments Inc., 7833 Haskell Ave., Van Nuys, Calif. ... p 761
Atec, Inc., 1125 Lumpkin St., Houston, Tex. ..... p 1014
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1183
CMC, 12970 Bradley Ave., San Fernando, Calif. ..... p 1352, 1353
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Digital Equip. Corp., 146 Main St., Maynard, Mass.
Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa
Eldorado Elctrns., 601 Chalomar Rd., Concord, Calif. ..... p 1369
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 781
Haydon, A. W. Co., 232 N. Elm St., Waterbury, Conn.
Hecon Corp., 31 Park Rd., New Shrewsbury, N. J. ..... p 1041
Hickok Electrical Instr. Co., 10514 DuPont Ave., Cleveland, Ohio
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Mesa Co., Inc., 216-220 Mill St., Bristol, Pa.
Neutronic Corp., Box 625, St. Louis, Mo. ..... p 1448
PPM Inc., 7016 Euclid Ave., Cleveland, Ohio ..... p 1455
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal. ..... p 793
Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh, Pa.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Precision Timer Co., Inc., 400 Wesley Ave., Westbrook, Conn. .. p 1050
Presin Co., Trap Falls Rd., Shelton, Conn. ..... p 1051
Takeda Riken Ind. Co. Ltd., 1-32-1 Asahi-cho, Nerima-ku, Tokyo, Jap.
Veedor-Root Inc., 70 Sargeant St., Hartford, Conn. ..... p 1055
Wang Labs, Inc., Dept. 6-AC, 836 North St., Tewksbury, Mass. .. p 815
Acoustronics, Inc., 156 Olive St., Huntington, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Binary Elctrns. of Calif., 1429 N. State College Blvd., Anaheim, Calif.
Bio-Medical Elctrns., Inc., 653 Lofstrand La., Rockville, Md.
Bristol Co., Box 1790, Waterbury, Conn.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Datum, Inc., 170 E. Liberty Ave., Anaheim, Calif.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Digital Data Systems, 18819 Bryant St., Northridge, Cal.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Electron-Machine Corp., Box M, Umatilla, Fla.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Fisher-Akin Co., P.O. Box 698, Manhattan Beach, Calif.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Foxboro, Foxboro, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
Instrumentation Technology Corp., 18811 Napa St., Northridge, Calif.
Jersey Technical Consultants, Box 215, Morristown, N. J.
Keltron Corp., 225 Crescent St., Waltham, Mass.
Kessler-Ellis Prods. Co., 120 First Ave., Atlantic Highlands, N. J.
Kingmann-White, Inc., 653 S. Melrose St., Placentia, Calif.
McNab, Inc., 165 Spring St., New York, N. Y.
Micro Elctrn. Sys., Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
3M Co., 3M Center, St. Paul, Minn.
Whittaker Corp., Ind. Prod. Div., 12838 Saticoy St., N. Hollywood, Cal.
Zehntel, Inc., 1450-6th St., Berkeley, Calif.

TOTE BOXES—SEE BOXES, COMPONENT/SUBASSEMBLY HANDLING

TOWER ERECTION & MAINTENANCE SERVICES—SEE SERVICES, TOWER ERECTION & MAINTENANCE

TOWERS, ANTENNA—SEE ANTENNA TOWERS

TRACERS, CURVE, TUBE & TRANSISTOR

TRACERS, CURVE, TUBE & TRANSISTOR

AEL Inc., P.O. Box 552, Lansdale, Pa.
Tektronix, Inc., Box 500, Beaverton, Ore.
Fairchild Instrumentation, 974 E. Arques Ave., Sunnyvale, Calif.
Iwatsu Elec. Co., Ltd., 7-41, 1-chome, Kagayama, Suginami-ku, Tokyo, Japan

TRACERS, SIGNAL—SEE TESTERS, SIGNAL TRACING

TRACERS, VOLTAGE CURVE

TRACKING SYSTEMS

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 2789
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1655
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Technology Co. Inc., 41-16 29th St., L. I. C., N. Y.
Geo Space Systems, Inc., 6301 49th St. N., St. Petersburg, Fla. p 1675
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y. p 2669
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541, 787
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
EMR Photoelectric, EMR Div., Box 44, Princeton, N. J.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jasik Labs., Inc., 100 Shames Dr., Westbury, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Optron Corp., 50 Fitch St., New Haven, Conn.
Philips Broadcast Equip. Corp., 11 Park Pl., Paramus, N. J.
Photo-Sonics, Inc., 820 S. Mariposa St., Burbank, Calif.
Radiation Systems, Inc., 1755 Old Meadow Rd., McLean, Va.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Rantec Div., 24003 Ventura Blvd., Calabasas, Calif.
Razdow Labs., Inc., 377 Fifth St., Newark, N. J.
Reeves Instr. Div., East Gate Blvd., Garden City, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

TRAILERS, INSTRUMENTATION—SEE LABORATORIES, MOBILE & FIELD

TRAINERS—SEE SIMULATORS & TRAINERS

TRANSCEIVERS, AIRBORNE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Bendix Corp., Avionics Div., Box 9414, Ft. Lauderdale, Fla.
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
ISC/Telephonics Div., 770 Park Ave., Huntington, N. Y.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Regency Elctrns., Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Republic Elctrn. Inds. Inc., 575 Broad Hollow Rd., Huntington, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

TRANSCEIVERS, FACSIMILE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

TRANSCEIVERS, INFRARED

Electro/Data Inc., 3121 Benton St., Garland, Tex.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Loral Elctrn. Sys., 825 Bronx River Ave., Bronx, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

TRANSCEIVERS, SINGLE—SIDEBAND

Delco Radio Div., 700 E.Firmin St., Kokomo, Ind.
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
Automatic Radio Int'l., 2 Main St., Melrose, Mass.
Avco Corp., 2630 Glendale Milford Rd., Cincinnati, Ohio
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Eico Electronic Instrument Co., Inc., 283 Malta St., Brooklyn, N. Y.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
FRL Inc., 1890 Embarcadero Ave., Palo Alto, Calif.
Game Industries, Inc., 80 Commercial St., Freeport, N. Y.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Raytheon Co., Comm. & Data Proc. Oper., 1415 Boston Providence Tpke., Norwood, Mass.
Regency Elctrns., Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
SUNAIR Electronics, Inc., 3101 S. W. 3 Ave., Fort Lauderdale, Fla.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Weitermann Electronics, 4549 North 38th St., Milwaukee, Wisc.

TRANSCRIPTION ARMS—SEE PHONOGRAPH ARMS, TRANSCRIPTION

TRANSDUCERS, ACCELERATION—SEE ACCELEROMETERS

TRANSDUCERS, DISPLACEMENT

Carter Mfg. Corp., 23 Washington St., Hudson, Mass.
Clevite Corp., Brush Insts. Div., 37th & Perkins, Cleveland, Ohio
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2464
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Hamlin Inc., 670 Lake St., Lake Mills, Wisc.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif.
Theta Instrument Corp., Fairfield, N. J.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
American Chain & Cable Co., Box 1629, Waterbury, Conn.
Applied Control Co., 98 E. Lindsley Rd., Cedar Grove, N. J.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Automatic Timing & Controls Inc., King of Prussia, Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Collins, G. L. Corp., 5875 Obispo Ave., Long Beach, Calif.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Davidson Electronic Development Co., 2211 Peninsular Dr., Erie, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Foxboro, Foxboro, Mass.
Gammatronix Inc., Dublin, Ohio
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Humphrey, Inc., 2805 Canon St., San Diego, Calif.
IKL, Inc., 4360 Campus Dr., Newport Beach, Calif.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Larson Aero Development, Box 135, Concord, Calif.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Litton Inds., Potentiometer Div., 226 E. 3rd Ave., Mt. Vernon, N. Y.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Lockheed Electronics Co., 16811 El Camino Real, Houston, Tex.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Mark Products, Inc., 3935 Fairhill Dr., Houston, Tex.
Massa Div., 280 Lincoln St., Hingham, Mass.
Mechanics For Elctrns., Inc., 152 Sixth St., Cambridge, Mass.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Optron Corp., 50 Fitch St., New Haven, Conn.
Pickering & Co., Inc., Industrial/Military Prods. Div., 101 Sunnyside Blvd., Plainview, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Research, Inc., Box 6164, Minneapolis, Minn.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Servotronics, Inc., 3901 Union Rd., Buffalo, N. Y.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Space Craft, Inc., 8620 S. Memorial Pkwy., Huntsville, Ala.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Sprengnether, W. F. Instr. Co., Inc., 4567 Swan St., St. Louis, Mo.
Systems Res. Labs, Inc., 7001 Indian Ripple Rd., Dayton, Ohio
Task Corporation, Box 3999, Anaheim, Calif.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Wayne-George Co., Christina St., Newton, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.
Wintriss Controls, 20 Vandam St., New York, N. Y.

TRANSDUCERS, FLOW

Avien Inc., 58-15 Northern Blvd., Woodside, N. Y.
Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2464
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Autocon Industries, Inc., 995 University, St. Paul, Minn.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bristol Co., Box 1790, Waterbury, Conn.
Carolina Medical Elctrns., Inc., U. S. 52 Expwy., King, N. C.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Cox Instrument, 15300 Fullerton, Detroit, Mich.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Foxboro, Foxboro, Mass.
Hays Corp., Michigan City, Ind.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Micro-Strain, Inc., Spring City, Pa.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

TRANSDUCERS, FORCE

Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Stow Labs., Inc., 182 Barton Rd., Stow, Mass.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.

Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Foxboro, Foxboro, Mass.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Instron Corp., 2500 Washington St., Canton, Mass.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kulite Semiconductor Products, Inc., 1030 Hoyt Ave., Ridgefield, N. J.
Larson Aero Development, Box 135, Concord, Calif.
Lebow Assocs., Inc., 21820 Wyoming Ave., Oak Park, Mich.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Lockheed Electronics Co., 16811 El Camino Real, Houston, Tex.
MB Electronics, Box 1825, New Haven, Conn.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Micro-Strain, Inc., Spring City, Pa.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Orbitran Co., Inc., 11487 Woodside Ave., Lakeside, Calif.
PCB Piezotronics, Inc., 3311 Walden Ave., Depew, N. Y.
Scientific Advances, Inc., 1400 Holly Ave., Columbus, Ohio
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Strainsert Co., 24 Summit Grove Ave., Bryn Mawr, Pa.
Task Corporation, Box 3999, Anaheim, Calif.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transducers, Inc., 11971 E. Rivera Rd., Santa Fe Springs, Calif.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.
Wood, C. N. Mfg. Co., Rte. 332, E., Newtown, Pa.

TRANSDUCERS, IMPEDANCE

Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Linden Labs. Inc., Box 920, State College, Pa.
Lockheed Electronics Co., Route 22, Watchung, N. J.
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.

TRANSDUCERS, INCREMENTAL DIGITAL POSITION, ROTARY

Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif.
Theta Instrument Corp., Fairfield, N. J.
Collectron Corp., 304 East 45th St., New York, N. Y.
Computer Conversions Corp., 6 Dunton Ct., E. Northport, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Singer-General Precision Inc., 1150 McBride Ave., Little Falls, N. J.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Trump-Ross Industrial Controls, Inc., 265 Boston Rd., Billerica, Mass.
Wayne-George Co., Christina St., Newton, Mass.

TRANSDUCERS, MAGNETIC PICKUP

Airpax Electronics, Inc., Seminole Div., Box 8488, Ft. Lauderdale, Fla. p 1321
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Electro Products Labs, Inc., Power Supply Div., 6125 KP Howard St., Chicago, Ill. p 1026, 1027, 2840
Electro Prods. Labs., Inc., 6125 KP, Howard St., Chicago, Ill. p 1026, 1027, 2840
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 1044
International Electro-Magnetics Inc., Eric Dr. & Cornell Ave., Palatine, Ill. p 548
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 2844
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y. ..... p 982
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Alban Electronics, 111 Cedar La., Englewood, N. J.
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Bourns, Inc., Box 1398, Romoland, Calif.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Data Magnetics Corp., 5441 West 104th St., Los Angeles, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Dolan-Jenner Industries, Inc., 10 Ingalls Ct., Melrose, Mass.
Dynalog Corp., 4107 Northeast 6th Ave., Ft. Lauderdale, Fla.
Dynapar Digital Center, 1675 Delany Rd., Gurnee, Ill.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Flow Technology, Inc., 401 S. Hayden Rd., Tempe, Ariz.
Gammatronix Inc., Dublin, Ohio
General Instr. Corp., Harris ASW Div., 33 Southwest Pk., Westwood, Mass.
Grado Laboratories, Inc., 4614 Seventh Ave., Brooklyn, N. Y.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Life Instrument Co., Inc., 165 Brook St., Franklin, Mass.
Pickering & Co., Inc., Industrial/Military Prods. Div., 101 Sunnyside Blvd., Plainview, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Potter Aeronautical Corp., U. S. Rte. 22, Union, N. J.
Power Instruments Inc., 7352 No. Lawndale Ave., Skokie, Ill.
Sensor Corp., 97 Indian Field Rd., Greenwich, Conn.
Sensory, Inc., 1 Kennedy Rd., Morris Plains, N. J.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

TRANSDUCERS, POWER—SEE TRANSDUCERS, VOLT. WATT. CURRENT. ETC.

TRANSDUCERS, PRESSURE

Computer Instr. Corp., 92 Madison Ave., Hempstead, N. Y. .... p 2464
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y. ..... p 2470
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Metrix Instrument Co., P.O. Box 36501, Houston, Tex. ..... p 2841
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rockland Labs., Inc., Box 57, Tappan, N. Y. ..... p 1307, 1481
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Stow Labs., Inc., 182 Barton Rd., Stow, Mass.
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Aero Mechanism, Inc., 7750 Burnett Ave., Van Nuys, Calif.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
Ametek, Inc., Station Square Two, Paoli, Pa.
U. S. Gauge, 746A Clymer Ave., Sellersville, Pa.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automatic Timing & Controls Inc., King of Prussia, Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Biotronics, Inc., 838 Butte St., Redding, Calif.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Celtic Industries, Inc., 14743 Oxnard St., Van Nuys, Calif.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Collins, G. L. Corp., 5875 Obispo Ave., Long Beach, Calif.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Datametrics, Inc., 87 Beaver St., Waltham, Mass.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Dynisco, Div. Microdot Inc., 20 S. West Park, Westwood, Mass.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Foxboro, Foxboro, Mass.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Hays Corp., Michigan City, Ind.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hidyne Instr. & Engrg. Co., 911 Bragg Circle, Tullahoma, Tenn.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Kulite Semiconductor Products, Inc., 1030 Hoyt Ave., Ridgefield, N. J.
Linden Labs. Inc., Box 920, State College, Pa.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Lockheed Electronics Co., Route 22, Watchung, N. J.
MB Electronics, Box 1825, New Haven, Conn.
MKS Instruments, Inc., 45 Middlesex Tpke., Burlington, Mass.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Massa Div., 280 Lincoln St., Hingham, Mass.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Medistor Instrument Co., 4503 8th Ave. N.W., Seattle, Wash.
Micro-Strain, Inc., Spring City, Pa.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
PCB Piezotronics, Inc., 3311 Walden Ave., Depew, N. Y.
RC-95, Inc., 9 East 38th St., New York, N. Y.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Scanivalve Inc., Box 20005, San Diego, Calif.
Scientific Advances, Inc., 1400 Holly Ave., Columbus, Ohio
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.

TRANSDUCERS, STRAIN GAUGE

Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Sostman, H. E. & Co., 347 E. Lincoln Ave., Cranford, N. J.
Sparton Southwest, Inc., 9621 Coors Rd. N.W., Albuquerque, N. M.
Standard Controls, Inc., 2401 S. Bayview, Seattle, Wash.
Strainsert Co., 24 Summit Grove Ave., Bryn Mawr, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Teledyne Systems Co., 200 N. Aviation Blvd., El Segundo, Calif.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
3M Co., 3M Center, St. Paul, Minn.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Transducers, Inc., 11971 E. Rivera Rd., Santa Fe Springs, Calif.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
United Control Corporation, Redmond, Wash.
Vacco Electronics, 10350 Vacco St., S. El Monte, Cal.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Validyne Engrg. Corp., 18819 Napa St., Northridge, Calif.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.
Viatran Corp., 1720 Military Rd., Buffalo, N. Y.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.
Wintriss Controls, 20 Vandam St., New York, N. Y.

TRANSDUCERS, PROXIMITY

Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio .. p 1047
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.

TRANSDUCERS, SONAR

Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Benmar Div., 3000 W. Warner Ave., Santa Ana, Calif.
Benthos, Inc., Edgerton Dr., N. Falmouth, Mass.
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Empire Scientific Corp., Indl. Instr. Div., 1055 Stewart Ave., Garden City, N. Y.
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
International Transducer Corp., Box 3385, Santa Barbara, Calif.
Massa Div., 280 Lincoln St., Hingham, Mass.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Research Mfg. Corp., Box 6056, San Diego, Calif.
Sanders Assocs., Inc., Ocean Sys. Div., Simon St., Nashua, N. H.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

TRANSDUCERS, SOUND VELOCITY

Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.
Biotronics, Inc., 838 Butte St., Redding, Calif.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Chesapeake Instr. Corp., Shadyside, Md.
Collins, G. L. Corp., 5875 Obispo Ave., Long Beach, Calif.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Globe Exploration Co., Inc., Box 12338, El Paso, Tex.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Linden Labs. Inc., Box 920, State College, Pa.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Mark Products, Inc., 3935 Fairhill Dr., Houston, Tex.
Massa Div., 280 Lincoln St., Hingham, Mass.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.

TRANSDUCERS, STRAIN GAUGE

Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
A.O.I.P., 23 Pl. Jeanne d'Arc, Paris, France
Automation Industries, Inc., Box 950, Boulder, Colo.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Dillon, W. C. & Co., Inc., 14620-EP Keswick St., Van Nuys, Calif.
Doric Scientific Corp., 7969 Engineer Rd., San Diego, Calif.
Dytro Corp., 63 Tec St., Hicksville, N. Y.
Fairchild Controls, 423 National Ave., Mountain View, Calif.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Kell, George, Ltd., 48 Lesmill Rd., Don Mills, Ont., Can.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Lebow Assocs., Inc., 21820 Wyoming Ave., Oak Park, Mich.
Lockheed Electronics Co., 16811 El Camino Real, Houston, Tex.
MB Electronics, Box 1825, New Haven, Conn.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Micro-Strain, Inc., Spring City, Pa.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Scientific Advances, Inc., 1400 Holly Ave., Columbus, Ohio
Servonic Div., 1644 Whittier Ave., Costa Mesa, Calif.
Sigma Sys. Corp., 1703 Oak Lawn Ave., Dallas, Tex.
Strainsert Co., 24 Summit Grove Ave., Bryn Mawr, Pa.
Thwing-Albert Instr. Co., 10960 Dutton Rd., Philadelphia, Pa.

TRANSDUCERS, STRAIN GAUGE (Cont'd)

Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transidyne-General Corp., 462 Jackson Plaza, Ann Arbor, Mich.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Viatran Corp., 1720 Military Rd., Buffalo, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.
Wood, C. N. Mfg. Co., Rte. 332, E., Newtown, Pa.

TRANSDUCERS, TEMPERATURE

Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Control Prods. Corp., 4431 W. Division St., Chicago, Ill. ..... p 2804
Cox & Company, Inc., 215 Park Ave. S., New York, N. Y. ..... p 2812
Elmwood Sensors, Inc., 1653 Elmwood Ave., Cranston, R. I.
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Harrel Inc., 16 Fitch St., East Norwalk, Conn. ..... p 2817
Keystone Carbon Co., Thermistor Div., St. Marys, Pa.
Pennsylvania Electronics Technology, Inc., 1397 Frey Rd., Pittsburgh, Pa. p 2825
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Alpha-Monarch Corp., 10044 Monroe, Dallas, Tex.
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N. Y.
Andonian Assocs. Inc., 26 Thayer Rd., Waltham, Mass.
Atkins Technical, Inc., 100 Stengel & S. W. Archer Rd., Gainesville, Fla.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bailey Meter Company, Wickliffe, Ohio
Barber-Colman Co., Indl Insts Div., 1300 Rock St., Rockford, Ill.
Beacon Elctrns., Inc., 121 Stanley Ave., Bellmawr, N. J.
Beckman Instrs., Inc., Process Instrs. Div., 2500 Harbor Blvd., Fullerton, Cal.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Biotronics, Inc., 838 Butte St., Redding, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Brookline Instr. Co., Inc., 33 Virginia Rd., White Plains, N. Y.
Burns Engrg., Inc., 5301 Edina Indl. Blvd., Minneapolis, Minn.
Charter Laboratories Inc., 65 Brightside Ave., E. Northport, N. Y.
Clark Elctrns. Lab., 1365 E. Edinger Ave., Santa Ana, Calif.
Climet Instruments Inc., 1240 Birchwood Dr., Sunnyvale, Calif.
Conax Corporation, 2300 Walden Ave., Buffalo, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Dentronics, Inc., 60 Oak St., Hackensack, N. J.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
Electric Thermometers, Inc., 10 Glover Ave., Norwalk, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Foxboro, Foxboro, Mass.
General Transducer Co., 2961 Corvin Dr., Santa Clara, Calif.
Genisco Technology, Instr. Div., 1533 26th St., Santa Monica, Calif.
Hays Corp., Michigan City, Ind.
Heat Technology Lab., Inc., 4308 Governor Dr., Huntsville, Ala.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hidyne Instr. & Engrg. Co., 911 Bragg Circle, Tullahoma, Tenn.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hy-Cal Engineering, 12105 Los Nietos Rd., Santa Fe Springs, Calif.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Ircon Inc., 207 Lawrencewood Ctr., Niles, Ill.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Kulite Semiconductor Prcducts, Inc., 1030 Hoyt Ave., Ridgefield, N. J.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Micro-Strain, Inc., Spring City, Pa.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
RDF Corp., 23 Elm Ave., Hudson, N. H.
RdF West, 9371 Kramer Ave., Westminster, Calif.
Ramsey Engineering Co., 707 N. Anaheim Blvd., Anaheim, Calif.
Relco Products, Inc., 5594 E. Jefferson Ave., Denver, Colo.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Rosemount Engineering Co., 4900 West 78th St., Minneapolis, Minn.
Sostman, H. E. & Co., 347 E. Lincoln Ave., Cranford, N. J.
Sparton Corp., 2400 E. Ganson St., Jackson, Mich.
T & T Controls Co., Inc., Box 171, Media, Pa.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Technology/Versatronics, Inc., 506 S. High St., Yellow Springs, Ohio
Temtech, 2208 S. Wright, Santa Ana, Calif.
Thermal Systems, Inc., 13920 S. Broadway, Los Angeles, Calif.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
3M Co., 3M Center, St. Paul, Minn.
Tia Electric Co., 178-M Alexander St., Princeton, N. J.
Trans-Sonics, Inc., Box 326, Lexington, Mass.
Triac Elctrn. Sys., Inc., 330 Glenwood Ave., Bloomfield, N. J.
Tylan Corp., 4203 Spencer St., Torrance, Calif.
United Control Corporation, Redmond, Wash.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.
Versitherm, Inc., 51 Toledo St., Farmingdale, N. Y.
Waters Co., Div. Flo-Tronics, Inc., Box 529, Rochester, Minn.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Whittaker Corp., Instr. Sys. Div., 9601 Canoga Ave., Chatsworth, Cal.
Yellow Springs Instr. Co., Inc., P.O. Box 279, Yellow Springs, Ohio

TRANSDUCERS, THERMOELECTRIC—SEE TRANSDUCERS, TEMPERATURE

TRANSDUCERS, TORQUE

Aero Mechanism, Inc., 7750 Burnett Ave., Van Nuys, Calif.
B & F Instruments Inc., Cornwells Hgts., Pa.
BLH Electronics Inc., 42 Fourth Ave., Waltham, Mass.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bergen Labs., Inc., 60 Spruce St., Paterson, N. J.
Bytrex, Inc., 223 Crescent St., Waltham, Mass.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
Chatillon, J. & Sons, 83-30 Kew Gardens Rd., Kew Gardens, N. Y.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Dixson, Inc., Box 1449, Grand Junction, Colo.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
Edison, T. A. Industries, Instr. Div., 36 Lakeside Ave., W. Orange, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Larson Aero Development, Box 135, Concord, Calif.
Lebow Assocs., Inc., 21820 Wyoming Ave., Oak Park, Mich.
Measurement Systems, Inc., 523 West Ave., Norwalk, Conn.
Micro-Strain, Inc., Spring City, Pa.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Servotronics, Inc., 3901 Union Rd., Buffalo, N. Y.
Strainsert Co., 24 Summit Grove Ave., Bryn Mawr, Pa.
Tensitron, Inc., Box 185—Dept. EEM, Harvard, Mass.
Toledo Scale Div., 5225 Telegraph Rd., Toledo, Ohio
Transducer Controls Corp., 737 N. Dodsworth, Covina, Calif.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Vibrac Corp., Alpha Industrial Park, Alpha Dr., Chelmsford, Mass.
West Coast Resch. Corp., Box 25061, Los Angeles, Calif.

TRANSDUCERS, ULTRASONIC

Clevite Corp., Piezoelectric Div., 232 Forbes Rd., Bedford, Ohio
Digital Devices Div., 200 Michael Dr., Syosset, N. Y.
Electronic Research Assoc. Inc., 67 Sand Park Rd., Cedar Grove, N. J.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Stow Labs., Inc., 182 Barton Rd., Stow, Mass.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Automation Industries, Inc., Box 950, Boulder, Colo.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Erie Technological Products Inc., 644 W. 12th St., Erie, Pa.
Euphonics Corp., Box 233, Guaynabo, Puerto Rico.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
International Transducer Corp., Box 3385, Santa Barbara, Calif.
Lewis Corp., Rte. 6, Woodbury, Conn.
Linden Labs. Inc., Box 920, State College, Pa.
Marcal Electro-Sonics, P.O. Box 185, Burbank, Calif.
Massa Div., 280 Lincoln St., Hingham, Mass.
Mechanical Technology, Inc., 968 Albany-Shaker Rd., Latham, N. Y.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Ultrasonic Appl. of Amer., Inc., 121 W. Sunrise Hwy., Lindenhurst, N. Y.
Valpey-Fisher Corp., 1015 First St., Holliston, Mass.
Wheelabrator Corp., 1478 S. Byrkit St., Mishawaka, Ind.

TRANSDUCERS, VIBRATION

B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Dytronics Co., Inc., 4800 Evanswood Dr., Columbus, Ohio
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Honeywell Test Instruments Div., Box 5227, Denver, Colo. .... p 1403
Metrix Instrument Co., P.O. Box 36501, Houston, Tex.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
Amstro Corp., 114 Clinton Rd., Fairfield, N. J.
Aperco Co., 1383 Luddington Rd., East Meadow, N. Y.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bell & Howell Co., 1400 S. Shamrock St., Monrovia, Cal.
Biocom Inc., 5883 Blackwelder St., Culver City, Calif.
Channel Inds., Inc., 839 Ward Dr., Santa Barbara, Calif.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Commander Labs., Inc., 1177 Santa Fe Ave., Escondido, Calif.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Dynamic Precision Controls Corp., 449 E. Main St., Hagerstown, Ind.
E. B. L. Co., 78 Tolland St., R., E. Hartford, Conn.
Electro-Sonic Control, 1625 N. Main, Manteca, Cal.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Fidelity Amplifier Co., 1633 N. Halsted St., Chicago, Ill.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
H H Controls Co., Inc., 16 Frost St., Arlington, Mass.
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
International Research & Dev. Corp., 6150 Huntley Rd., Worthington, Ohio
Kaman Nuclear, 1700 Garden of the Gods Rd., Colorado Springs, Colo.
Kistler Instrument Co., 8967 Sheridan Dr., Clarence, N. Y.
Larson Aero Development, Box 135, Concord, Calif.
Linden Labs. Inc., Box 920, State College, Pa.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
Lion Research Corp., 60 Bridge St., Newton, Mass.
Lockheed Electronics Co., Route 22, Watchung, N. J.
MB Electronics, Box 1825, New Haven, Conn.
Marathon Instruments Div., 9626 E. Beverly Rd., Pico Rivera, Cal.
Mark Products, Inc., 3935 Fairhill Dr., Houston, Tex.
Massa Div., 280 Lincoln St., Hingham, Mass.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Optron Corp., 50 Fitch St., New Haven, Conn.
PCB Piezotronics, Inc., 3311 Walden Ave., Depew, N. Y.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sprengnether, W. F. Instr. Co., Inc., 4567 Swan St., St. Louis, Mo.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Wintriss Controls, 20 Vandam St., New York, N. Y.

TRANSDUCERS, VOLT, WATT, CURRENT, VAR, POWER FACTOR, FREQUENCY

American Aerospace Cont. Inc., 129 Verdi St., Farmingdale, N. Y. p 1012
Bell, F. W., Inc., 1356 Norton Ave., Columbus, Ohio ..... p 2839
Fairchild Controls, 225 Park Ave., Hicksville, N. Y.
Flight Systems, Inc., Box 25, Mechanicsburg, Pa.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Instrument Systems Corp., Magnetics Div., 770 Park Ave., Huntington, N. Y. p 2516
International Rectifier, 233 Kansas St., El Segundo, Calif.
Narda Microwave Corp., Plainview, N. Y.
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio p 1047, 2844
Phaostron Instr. & Elctrn. Co., 151 Pasadena Ave., S. Pasadena, Calif.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Rustrak Instr. Div., Gulton Inds. Inc., Municipal Airport, Manchester, N. H.
Scientific Columbus Inc., 1035 W. Third Ave., Columbus, Ohio p 2842, 2843
Voltron Products, Inc., 403 S. Raymond Ave., Pasadena, Calif. .. p 1523
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Westinghouse Elec. Corp., Relay-Instr. Div., Plane & Orange Sts., Newark, N. J. p 1552
A & M Instrument, Inc., Community Dr., Great Neck, N. Y.
Acromag, Inc., 30765 Wixom Rd., Wixom, Mich.
Bristol Co., Box 1790, Waterbury, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Halmar Electronics, Inc., 1544 W. Mound St., Columbus, Ohio
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Noller Control Systems, Inc., 150 E. Standard Ave., Richmond, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

TRANSFORMERS, AUDIO

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 2846, 2847
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Control Circuits, Inc., 66 Tuttle Rd., Middletown, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Hisonic Inc., 249 N. Troost, Olathe, Kans.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. .. p 2861
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2864
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. .... p 2866
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2873, 2875-2877
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y. p 2890, 2891
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. ..... p 2897
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.

Davis, J. W. & Co., Box 35313, Dallas, Tex.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Harder, D. C. Co., Inc., 2580 K St., San Diego, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permoflux Corp., Box 6364, Glendale, Calif.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Quam-Nichols Co., Marquette Rd. at Prairie Ave., Chicago, Ill.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

TRANSFORMERS, AUTOTRANSFORMER

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Arnold Magnetics Corp., 11284 Playa Ct., Culver City, Cal.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 731, 732
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Hisonic Inc., 249 N. Troost, Olathe, Kans.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. .. p 1972, 1973, 2006
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2885, 2886
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Stace, Incorporated, 2240 East 3rd St., Dayton, Ohio ..... p 2893
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. ..... p 2897
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A C Transformer Corp., 89 Madison St., Newark, N. J.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Eastern Specialty Co., 3619 N. Eight St., Philadelphia, Pa.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughey & Phillips, Inc., 3050 N. California St., Burbank, Calif.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Invertronics, Box 342, Pine Brook, N. J.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Lee Elec., Inc., 309-51st St., W. New York, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Model Rectifier Corp., 5300 21st Ave., Brooklyn, N. Y.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polygon Services Ltd., 50 Northline Rd., Toronto, Ont., Can.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.

TRANSFORMERS, BRIDGING

Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

TRANSFORMERS, BIAS

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 2848, 2852
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nortronics Co. Inc., 8101 10th Ave. N., Minneapolis, Minn. .. p 557-560
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Zaring Inds., Inc., Box 477, Carmel, Ind.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Invertronics, Box 342, Pine Brook, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Magnedyne, Inc., 5580 El Camino Real, Carlsbad, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, BRIDGING

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.

TRANSFORMERS, BRIDGING (Cont'd)

Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2886
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. p 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.

TRANSFORMERS, CHOPPER

Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. p 2866
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. p 2921
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. p 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.

TRANSFORMERS, CONSTANT VOLTAGE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
Acme Electric Corp., 28 Water St., Cuba, N. Y. p 2845
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. p 1290
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1995
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. p 2861
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa. p 2867
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2887, 2888
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. p 2879
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Davis, J. W. & Co., Box 35313, Dallas, Tex.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

TRANSFORMERS, CONTROL

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Acme Electric Corp., 28 Water St., Cuba, N. Y. p 2845
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Basler Electric Co., Box 269, Highland, Ill. p 2853
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Data Device Corp., Dept. 17, 100 Tech St., Hicksville, N. Y. p 776, 2665
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2858, 2859
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. p 1995
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. p 2866
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2880, 2882, 2887, 2888
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y. p 2890, 2891
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. p 2897
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. p 2139
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. p 2686
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Zaring Inds., Inc., Box 477, Carmel, Ind. p 2901
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Dano Electric Co., Main St., Winsted, Conn.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Furnas Electric Co., 1197 McKee St., Batavia, Ill.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hyperion Inds. Corp., 134 Coolidge Ave., Watertown, Mass.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Elec. Corp., Specialty Transformer Div., Box 231, Greenville, Pa.

TRANSFORMERS, CONVERTER, D-C TO D-C

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. p 720, 723
Basler Electric Co., Box 269, Highland, Ill.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio p 735
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. p 2866
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.

Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2124
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind...... p 2901
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Beebe Instruments Inc., Box 137, N. White Plains, N. Y.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrac, Inc., 1614 Orangethorpe Way, Anaheim, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Western Transformer Co., P.O. Box 945, Tijeras, N. Mex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, CURRENT—SEE TRANSFORMERS, INSTRUMENT

TRANSFORMERS, CURRENT-LIMITING

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Basler Electric Co., Box 269, Highland, Ill.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2857
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1957
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 1995
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa. ... p 2867
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. ..... p 2881
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2879
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Invertronics, Box 342, Pine Brook, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Magnetics, Inc., Components Div., Box 391, Butler, Pa.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Ratelco, Inc., 610 Pontius Ave., N., Seattle, Wash.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, DECADE

Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Basler Electric Co., Box 269, Highland, Ill.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 2473
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins, G. L. Corp., 5875 Obispo Ave., Long Beach, Calif.

TRANSFORMERS, DISCRIMINATOR

Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Varo General, Garland Bank Bldg., Garland, Tex.

TRANSFORMERS, DIFFERENTIAL

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Aimes Inds., Inc., Box 73, Lockport, Ill.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Instrument Div., 6135 Magnolia, Riverside, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Daytronic Corp., 2875 Culver Ave., Kettering, Ohio
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Minnetech Labs. Inc., 6140 Wayzata Blvd., Minneapolis, Minn.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pickering & Co., Inc., Industrial/Military Prods. Div., 101 Sunnyside Blvd., Plainview, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Robinson-Halpern Co., 5 Union Hill Rd., W. Conshohocken, Pa.
Transducer Specialties, Inc., Easton & Wyandotte Rds., Willow Grove, Pa.
Varo General, Garland Bank Bldg., Garland, Tex.

TRANSFORMERS, DISCRIMINATOR

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Collins Radio Co., Dallas, Texas
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

TRANSFORMERS, DONUT—SEE TRANSFORMERS, TOROIDAL

TRANSFORMERS, DRIVER

TRANSFORMERS, DRIVER

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Basler Electric Co., Box 269, Highland, Ill.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2857
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif. ..... p 2860
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Zaring Inds., Inc., Box 477, Carmel, Ind.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, FILAMENT

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 2848, 2852
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal.
Basler Electric Co., Box 269, Highland, Ill.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. p 1902
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1957
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2875-2877
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2879
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. ..... p 2897
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A C Transformer Corp., 89 Madison St., Newark, N. J.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, 400 CPS

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 2848, 2849
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1858
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2872, 2873, 2876, 2877
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y. p 2890, 2891
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 2899
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Harder, D. C. Co., Inc., 2580 K St., San Diego, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.

New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.

TRANSFORMERS, FLYBACK

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Automatic Coil Mfg. Ltd., 50 Wingold Ave., Toronto, Ont., Canada
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Rollan Electric Co., 8233 S. Princeton Ave., Chicago, Ill.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.

TRANSFORMERS, HUM REDUCING

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.

TRANSFORMERS, HV

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Beckman Instr., Inc., Cedar Grove Oper., 89 Commerce Rd., Cedar Grove, N. J.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.... p 1902
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. ... p 1677
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2872, 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla. p 2878
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Transformer Electronics Co., Box 910, Boulder, Colo.
United Transformer Co., 150 Varick St., New York, N. Y.
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Beebe Instruments Inc., Box 137, N. White Plains, N. Y.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Fischer, H. G. & Co., 9451-9491 W. Belmont Ave., Franklin Park, Ill.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Harder, D. C. Co., Inc., 2580 K St., San Diego, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Modelectric Prods. Corp., 9 Cindy La., Asbury Park, N. J.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.

TRANSFORMERS, I-F

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. .... p 743
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Delta Coils, 4312 Main St., Philadelphia, Pa.

TRANSFORMERS, INPUT

Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

TRANSFORMERS, INPUT

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 2855
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2875-2877
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Stace, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Topaz Inc., 3802 Houston St., San Diego, Calif. ..... p 2119
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.

TRANSFORMERS, INPUT (Cont'd)

Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, INSTRUMENT

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Associated Research Inc., 3773 W. Belmont Ave., Chicago, Ill.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.

Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Hoyt Electrical Instr. Works Inc., 42 Carleton St., Cambridge, Mass. p 1351
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. .... p 2866
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Princeton Applied Research Corp., Box 565, Princeton, N. J.
Sangamo Electric Co., P.O. Box 128, Pickens, S. C.
Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass.
Superior Electric Co., 1000 Middle St., Bristol, Conn. .... p 2894, 2895
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wacline Inc., 35 S. St. Clair St., Dayton, Ohio ..... p 1528
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Zaring Inds., Inc., Box 477, Carmel, Ind.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Annis, R. B. Co., 1101 N. Delaware St., Indianapolis, Ind.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Canadian Resch. Inst., 85 Curlew Dr., Don Mills, Ont., Can.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Esterline Angus Div., Esterline Corp., Box 24000, Indianapolis, Ind.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Invertronics, Box 342, Pine Brook, N. J.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Midwest Electric Prods., Inc., Box 910, Mankato, Minn.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pearson Electronics, Inc., 4007 Transport St., Palo Alto, Calif.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Welex Electronics, Box 986, Silver Spring, Md.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

TRANSFORMERS, INTERSTAGE

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876, 2877
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Zaring Inds., Inc., Box 477, Carmel, Ind.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Inst. Corp., Automatic Mfg., 65 Gouverneur St., Newark, N. J.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, ISOLATION

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn. ..... p 2846
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. .. p 1902
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. ..... p 2885
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2879
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio ..... p 2893
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y. p 2890, 2891
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. ..... p 2897

Topaz Inc., 3802 Houston St., San Diego, Calif. ..... p 2119
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Zaring Inds., Inc., Box 477, Carmel, Ind.

Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Argonaut Assocs., Inc., P.O. Box K, Beaverton, Ore.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dano Electric Co., Main St., Winsted, Conn.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Harder, D. C. Co., Inc., 2580 K St., San Diego, Calif.
Hughey & Phillips, Inc., 3050 N. California St., Burbank, Calif.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
K & M Electronics Corp., 408 Paulding Ave., Northvale, N. J.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Miller, S., Corp., 89 Throop Ave., Brooklyn, N. Y.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polygon Services Ltd., 50 Northline Rd., Toronto, Ont., Can.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Solar Electronics Co., 901 N. Highland, Hollywood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Welex Electronics, Box 986, Silver Spring, Md.
Westinghouse Elec. Corp., Specialty Transformer Div., Box 231, Greenville, Pa.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, LINE

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Basler Electric Co., Box 269, Highland, Ill.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2858, 2859
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2881-2883, 2885
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2124
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.

Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Better Coil & Transformer Corp., Goodland, Ind.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oaktron Industries, Inc., Monroe, Wisc.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Quam-Nichols Co., Marquette Rd. at Prairie Ave., Chicago, Ill.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utah Electronics, 1124 E. Franklin St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, MATCHED, PRECISION

TRANSFORMERS, LINEAR

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.

Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Automatic Timing & Controls Inc., King of Prussia, Pa.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
Bullock Magnetics Corp., 2805 Metropolitan Pl., Pomona, Calif.
C-E Electronics, 363 W. Glenside Ave., Glenside, Pa.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Invertronics, Box 342, Pine Brook, N. J.
Kavlico Elctrns., Inc., 20869 Plummer St., Chatsworth, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.

TRANSFORMERS, MAGNETIC AMPLIFIER—SEE TRANSFORMERS, SATURABLE

TRANSFORMERS, MATCHED, PRECISION

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.

A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Invertronics, Box 342, Pine Brook, N. J.

TRANSFORMERS, MATCHED (Cont'd)

J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.

TRANSFORMERS, MATCHING

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn. ..... p 2846
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y. p 1651
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Electro Impulse, Inc., 116 Chestnut St., Red Bank, N. J. ..... p 1669
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2869
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2873, 2876, 2877
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif. .. p 1705
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Aerolite Electronics Corp., 2207 Summit Ave., Union City, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Antennacraft Co., Box 1005, Hwy. 34, W., Burlington, Iowa
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Atlas Sound Div., 10 Pomeroy Rd., Parsippany, N. J.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Delta Coils, 4312 Main St., Philadelphia, Pa.
Delta Electronics Inc., 4206 Wheeler Ave., Alexandria, Va.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gavin Instrs., Inc., Box 413, Somerville, N. J.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hy-Gain Electronics Corp., N.E. Hwy. 6 at Stevens Creek, Lincoln, Nebr.
Invertronics, Box 342, Pine Brook, N. J.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Koss Electronics, Inc., 2227 North 31st St., Milwaukee, Wisc.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pico Elctrns., Inc., 316 W. First St., Mt. Vernon, N. Y.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Quam-Nichols Co., Marquette Rd. at Prairie Ave., Chicago, Ill.
RMS Electronics, Inc., 50 Antin Pl., Bronx, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Scala Radio Corp., 1970 Republic Ave., San Leandro, Calif.
Sitco Antennas, 10330 N. E. Marx St., Portland, Oregon
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Trylon, Inc., Elverson, Pa.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.

TRANSFORMERS, MATRIX

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.

TRANSFORMERS, MERCURY VAPOR

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
NWL, Inc., Box 455, Trenton, N. J.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Invertronics, Box 342, Pine Brook, N. J.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.

TRANSFORMERS, METERED

H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2871
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio ..... p 2893
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 2896
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.

TRANSFORMERS, MICROPHONE

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Schrack Electrical Sales Corp., 1140 Broadway, New York, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
United Transformer Co., 150 Varick St., New York, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.

TRANSFORMERS, MICROWAVE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Transco Products, 4241 Glencoe Ave., Venice, Calif.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Collins Radio Co., Dallas, Texas
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SNC Mfg. Co., Box 470, Oshkosh, Wisc.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

TRANSFORMERS, MINIATURE, SUBMINIATURE & MICROMINIATURE

ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 2846, 2847
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 2848-2852
Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 1781
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1858
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 723
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn. p 2854
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730, 731
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. ... p 2855
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.

Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862, 2864
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2869
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2872, 2873, 2875-2877
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. ..... p 2880
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio ..... p 2893
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y. ... p 2890
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 2899
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N. Y.
Dano Electric Co., Main St., Winsted, Conn.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Vactric Control Equipment Ltd., Garth Rd., Morden, Surrey, England
Varo General, Garland Bank Bldg., Garland, Tex.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Western Transformer Co., P.O. Box 945, Tijeras, N. Mex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, MIXING

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Invertronics, Box 342, Pine Brook, N. J.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Todd Electric Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.

TRANSFORMERS, MODULATION

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Basler Electric Co., Box 269, Highland, Ill.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas

TRANSFORMERS, OUTPUT

Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Invertronics, Box 342, Pine Brook, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.

TRANSFORMERS, OUTPUT

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856, 2857
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2858, 2859
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2864
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa. ... p 2867
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2875, 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. ..... p 2897
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio

TRANSFORMERS, OUTPUT (Cont'd)

Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jensen Mfg. Div., 5655 W. 73 St., Chicago, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, PHASE CONVERSION

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1498
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2139
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Invertronics, Box 342, Pine Brook, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Merrimac Research & Development, Inc., 41 Fairfield Pl., W. Caldwell, N. J.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Varo General, Garland Bank Bldg., Garland, Tex.

TRANSFORMERS, PHOTOFLASH POWER

Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Modelectric Prods. Corp., 9 Cindy La., Asbury Park, N. J.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.

TRANSFORMERS, PLATE

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2872, 2873, 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2879
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Zaring Inds., Inc., Box 477, Carmel, Ind.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Knopp, Inc., 1307 66th St., Oakland, Calif.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

TRANSFORMERS, POWER

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 2850-2852
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. .... p 1858
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y... p 1902
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa. .. p 1636
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 2855
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2859
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif. ..... p 2860
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. ... p 1677
Lambda Electronics Corp., 515 Broadhollow Rd., Melville, N. Y. .. p 2861
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2869
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2873, 2874, 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2880-2886
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn. .... p 2894-2896
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. ..... p 2897
Topaz Inc., 3802 Houston St., San Diego, Calif. ..... p 2119
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.

Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 2899
Transformer Electronics Co., Box 910, Boulder, Colo.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Universal Voltronics Corp., 27 Radio Circle Dr., Mt. Kisco, N. Y.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Zaring Inds., Inc., Box 477, Carmel, Ind. ..... p 2901
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
A C Transformer Corp., 89 Madison St., Newark, N. J.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Harder, D. C. Co., Inc., 2580 K St., San Diego, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Permoflux Corp., Box 6364, Glendale, Calif.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polygon Services Ltd., 50 Northline Rd., Toronto, Ont., Can.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Topaz Inc., 3802 Houston St., San Diego, Calif.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Westinghouse Elec. Corp., Specialty Transformer Div., Box 231, Greenville, Pa.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

TRANSFORMERS, PRINTED CIRCUIT MOUNTING

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 2846, 2847
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Basler Electric Co., Box 269, Highland, Ill.
Bourns, Inc., Trimpot Div., 1200 Columbia Ave., Riverside, Calif.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y. ... p 724, 725
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn. p 2854
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730, 731
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 2855
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. ... p 1677
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862, 2864
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2869
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. ..... p 2880
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo. ..... p 2898
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 2899
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2124
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
National Coil Co., Box 1040, Douglas, Ariz.

TRANSFORMERS, PULSE

New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

TRANSFORMERS, PULSE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa. ..... p 1831
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 723
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Contemporary Electronics, 4838 West 35th St., Minneapolis, Minn. p 2854
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
E-H Research Laboratories Inc., Box 1289, Oakland, Calif.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856, 2857
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Gulton Inds., Inc., Microceramics Div., Metuchen, N. J.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
LAD Electro-Systems Inc., 7 Commercial St., Hicksville, N. Y. .. p 1677
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2869
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2875, 2876
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Powertec Div., 9168 DeSoto Ave., Chatsworth, Calif.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass. ..... p 693
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Tobe Deutschmann Labs., Box 74, Canton, Mass. ..... p 695
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vidcor Co., Inc., 1251 W. El Segundo Blvd., Gardena, Calif. ..... p 1167
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Advanced Electrns. Inc., 1765 Silas Deane Hwy., Rocky Hill, Conn.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Labs, 107 Tansy Hill Rd., Milford, N. Y.
Bourns, Inc., Box 1398, Romoland, Calif.
Burmac Elctrns., 80 Montauk Hwy., Lindenhurst, N. Y.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
Consolidated Resistance Sales Corp., 44 Prospect St., Yonkers, N. Y.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.

TRANSFORMERS, PULSE (Cont'd)

Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electroid Corp., 95 Progress St., Union, N. J.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Fuji Electrochem. Co., 36-11 Shinbashi 5-Chome, Minato-ku, Tokyo, Jap.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Magnavolt Inc., 44 Prospect St., Yonkers, N. Y.
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Modelectric Prods. Corp., 9 Cindy La., Asbury Park, N. J.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
Nanosecond Systems, Inc., 176 Linwood Ave., Fairfield, Conn.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Pearson Electronics, Inc., 4007 Transport St., Palo Alto, Calif.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Toroidal Components Co., 1374 E. Walnut St., Pasadena, Calif.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
Xenon Corp., 39 Commercial St., Medford, Mass.

TRANSFORMERS, RECTIFIER

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Basler Electric Co., Box 269, Highland, Ill.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 2855
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Peschel Instrs., Inc., Cape Coral Ind. Park, Box 847, Cape Coral, Fla.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. ..... p 2886
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo.
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2139
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
A C Transformer Corp., 89 Madison St., Newark, N. J.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
EDC (Electro Development Corp.), Box 100, Lynnwood, Wash.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
HJS Engineering Co., Box 96, Park Ridge, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Miller, S., Corp., 89 Throop Ave., Brooklyn, N. Y.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polygon Services Ltd., 50 Northline Rd., Toronto, Ont., Can.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Rapid Electric Co., 1300 Herschell St., Bronx, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

TRANSFORMERS, REFERENCE

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2880, 2882, 2885
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2139
Zaring Inds., Inc., Box 477, Carmel, Ind.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Inet-Power, 711 W. Knox St., Gardena, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Varo General, Garland Bank Bldg., Garland, Tex.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

TRANSFORMERS, R-F

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 2846, 2847
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y. p 719
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 720
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730-733
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J. ..... p 1678
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2869
Nytronics of Canada Ltd., 68 Wall St., Trenton, Ont., Can.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Spellman High-Voltage Elctrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Stanwyck Winding Div., 137 Walsh Ave., Newburgh, N. Y. ..... p 743
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex. ..... p 2139
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Avionics, Inc., 1915 Bendix Dr., South Bend, Ind.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Collins Radio Co., Dallas, Texas
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Finney Co., 34 W. Interstate St., Bedford, Ohio
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Fugle-Miller Labs., Inc., 130 Market St., Kenilworth, N. J.
Gavin Instrs., Inc., Box 413, Somerville, N. J.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Morey Corp., 2659 Wisconsin Ave., Downers Grove, Ill.
Mutron Corp., 646 Summer St., Brockton, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optimax Inc., 258 N. Main St., Ambler, Pa.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Raybond Elctrns. Inc., 930 Washington St., Norwood, Mass.
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Relcom, 2329 Charleston Rd., Mountain View, Calif.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
TDK Electronics Co., Ltd., 14-6 2 Chome Uchi-kanda, Chiyoda-ku, Tokyo, Japan
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.

Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Warsaw Coil Co., Box 389, Warsaw, Ind.
Wells Elctrns. Inc., 1701 S. Main St., South Bend, Ind.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.
Y. T. & T. Corp., Box 306, Rosiyn Hgts., N. Y.

TRANSFORMERS, ROTARY

Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Data Technology Inc., 65 Grove St., Watertown, Mass.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Electric Indicator Co., Inc., 195 Danbury Rd., Wilton, Conn.
Gyrex, Inc., 38 Irving Pl., Garfield, N. J.
Himmelstein S., and Co., 2500 Estes Ave., Elk Grove Village, Ill.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.

TRANSFORMERS, SATURABLE

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Basler Electric Co., Box 269, Highland, Ill.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Magnetics Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Hisonic Inc., 249 N. Troost, Olathe, Kans.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif. ..... p 2860
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y.
Macarr, Inc., 4360 Bullard Ave., New York, N. Y.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transmagnetics Inc., 134-25 Northern Blvd., Flushing, N. Y.
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electroid Corp., 95 Progress St., Union, N. J.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, SERVO

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
Clifton Div., Marple at Broadway, Clifton Hghts., Pa.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
GAP Instrument Corp., 17 Brooklyn Ave., Westbury, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y. p 2890, 2891
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Vernitron Corp., 59 Central Ave., Farmingdale, N. Y. ..... p 2686
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Bendix Corp., Flight & Engine Instrs. Div., S. Montrose, Pa.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sunbeam Electronics, Box 8364, Ft. Lauderdale, Fla.
Varo General, Garland Bank Bldg., Garland, Tex.

TRANSFORMERS, STEP-DOWN, STEP-UP

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 2846, 2847
Abbott Transistor Labs, Inc., 5200 W. Jefferson Blvd., Los Angeles, Calif. p 2848-2852
Acme Electric Corp., 28 Water St., Cuba, N. Y.
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Astro-Metrix Corp., 125 W. Providencia Ave., Burbank, Calif.
Basler Electric Co., Box 269, Highland, Ill. ..... p 2853
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. .. p 1902
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Elcor Div., Halliburton Co., 2431 Linden Lane, Silver Spring, Md. p 1919
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Ferrotran Electronic Co. Inc., 683 Broadway, New York, N. Y. .. p 2855
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
Gates Electronic Co., Inc., 256 Van Nest Ave., Bronx, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Hisonic Inc., 249 N. Troost, Olathe, Kans.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif. ..... p 2860
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862, 2864
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J.
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa. .... p 2867
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. ..... p 2869
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J. p 2870
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876, 2877
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. 2880-2885, 2887
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2879
Solid State Elctrn. Corp., 15321 Raven St., Sepulveda, Cal.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y. p 2890, 2891
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. ..... p 2897
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J. ..... p 2899
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2124
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Unitron, 1624 N. First St., Garland, Texas
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Wanlass Electric Co., Industrial Prods. Div., 1540 E. Edinger, Santa Ana, Calif.
Wanlass Electric Co., 2175 S. Grand Ave., Santa Ana, Calif.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Zaring Inds., Inc., Box 477, Carmel, Ind. ..... p 2901
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
A C Transformer Corp., 89 Madison St., Newark, N. J.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dano Electric Co., Main St., Winsted, Conn.
Daylen Co., Box 527, South Gate, Calif.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Components Corp., 520 Interstate Rd., Addison, Ill.
Electronic Corp. of America, 5726 W. Washington Blvd., Los Angeles, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Jerome Electric Corp., 391 Lakeside Ave., Orange, N. J.
Lee Elec., Inc., 309-51st St., W. New York, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Magnetics Inc., Kemco Div., Sandy Lake, Pa.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Merrimack Magnetics, 361 Aiken St., Lowell, Mass.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.

TRANSFORMERS (Cont'd)

Polygon Services Ltd., 50 Northline Rd., Toronto, Ont., Can.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sierra Elec., 15100 S. Figueroa St., Gardena, Calif.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Stancor, Essex Int'l, Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Touch-Plate Electro-Sys., Inc., 16530 Garfield Ave., Paramount, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Westinghouse Elec. Corp., Specialty Transformer Div., Box 231, Greenville, Pa.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.

TRANSFORMERS, TOROIDAL

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
AMP Incorporated, Box 3608, Harrisburg, Pa.
Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Arnold Magnetics Corp., 11264 Playa Ct., Culver City, Cal. ..... p 1858
Artronic Instr. Co., 11232 Triangle La., Silver Spring, Md.
Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y. ..... p 723
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Collins Radio Co., Newport Beach, Calif.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D. ..... p 730
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Dressen-Barnes Elctrns. Corp., 250 N. Vinedo Ave., Pasadena, Calif.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif. ..... p 1290
Glentronics Inc., 748 E. Alosta, U.S. Hwy. 66, Glendora, Calif. .. p 1960
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio ... p 735
Hisonic Inc., 249 N. Troost, Olathe, Kans.
Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N. Y.
JFD Electronics Co., 1484 62nd St., Brooklyn, N. Y.
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y.
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Transformer Electronics Co., Box 910, Boulder, Colo. ..... p 2124
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A. C. Electronics Co., 11766 W. Pico Blvd., Los Angeles, Calif.
Ace Coil & Electronics Corp., 916 Lincoln Hwy., Metuchen, N. J.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Ballastran Corp., Executive Blvd., Fort Wayne, Ind.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
Bundy Elctrns. Corp., 44 Fadem Rd., Springfield, N. J.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins Radio Co., Dallas, Texas
Components Corp., 2857 N. Halsted St., Chicago, Ill.
DeCoursey Engrg. Lab., 11828 W. Jefferson Blvd., Culver City, Calif.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
EMP Electronics, Inc., Box 2346, Phoenix, Ariz.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electro Windings & Components, Inc., 725 Federal Ave., Kenilworth, N. J.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grafix, Inc., Box 3296, Albuquerque, N. M.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Harder, D. C. Co., Inc., 2580 K St., San Diego, Calif.
Inductor Engrg., Inc., 117 Schley Ave., Lewes, Del.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
McCarron Electric Co., 721 Monterey Pass Rd., Monterey Park, Calif.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Midwest Electric Prods., Inc., Box 910, Mankato, Minn.
Novatronics, Inc., Box 878, Pompano Beach, Fla.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Olektron Corp., Box 248, Dudley, Mass.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Osborne Transformer Corp., 3834 Mitchell Ave., Detroit, Mich.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Profile Elctrns., Inc., Box 314, Concord, N. H.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
RMS Engineering, Inc., 486 14th St., N.W., Atlanta, Ga.
Ram Meter, Inc., 1100 Hilton Rd., Ferndale, Mich.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Riedon Avionics, Inc., 7932 Haskell Ave., Van Nuys, Calif.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Skyway Magnetics, 637 Isis Ave., Inglewood, Calif.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Stanford Applied Engineering, 340 Martin Ave., Santa Clara, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Torelco Inc., Box 108, 51 Smith St., Irvington, N. J.
Toroidal Components Co., 1374 E. Walnut St., Pasadena, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Western Transformer Co., P.O. Box 945, Tijeras, N. Mex.
Weston-Magnetics, 14617 Keswick Ave., Van Nuys, Calif.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

TRANSFORMERS, TRANSISTOR

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Computer Comp. Inc., 88-06 Van Wyck Expwy., Jamaica, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
KGS Elctrns., 2029 N. Lincoln Ave., Pasadena, Calif.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2864
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Solid State Elctrn. Corp., 15321 Rayen St., Sepulveda, Cal.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Argonne Electric Mfg. Corp., 1 Lafayette Rd., Syosset, N. Y.
Bourns, Inc., Box 1398, Romoland, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Kessler, Frank Co., Inc., 41-45 47th St., Long Island City, N. Y.
Mid-West Coil & Transformer Co., 1642 N. Halstead St., Chicago, Ill.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Power Electronics Co., 5701 Savoy La., Houston, Tex.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Preferred Electronics, Inc., Main Line Dr., Westfield, Mass.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Sage Electronics Corp., Micromagnetics Prods., Box 3926, Rochester, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.

TRANSFORMERS, ULTRASONIC

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Basler Electric Co., Box 269, Highland, Ill.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y. p 2856
H & H Toroidal Winding Co., 1410 Chardon Rd., Euclid, Ohio
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Beebe Instruments Inc., Box 137, N. White Plains, N. Y.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Invertronics, Box 342, Pine Brook, N. J.
J B Elctrn. Transformers Inc., 2310 Armitage Ave., Chicago, Ill.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Precision Electronics, Inc., 1 Di Tomas Ct., Amityville, N. Y.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Redman Elctrns. Corp., Box 72, Thompsonville, Conn.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spectran Elctrns. Div., Box 878, Pompano Beach, Fla.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, VARIABLE

Allen Avionics Inc., 255 East 2nd St., Mineola, N. Y.
American Trans-Coil Corp., 124-06 101st Ave., Richmond Hill, N. Y.
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. .. p 1902
Delevan Electronics Corp., 270 Quaker Rd., East Aurora, N. Y.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2858, 2859
Genisco Technology Corp., Components/Genistron Divs., 18435 Susana Rd., Compton, Calif.
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ..... p 1995
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
Miller, J. W., Co., 5917 South Main St., Los Angeles, Cal.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2871
Piconics Inc., 220 Boston Rd., No. Billerica, Mass. ..... p 742
Spellman High-Voltage Electrns. Corp., 1930 Adee Ave., Bronx, N. Y.
Staco, Incorporated, 2240 East 3rd St., Dayton, Ohio ..... p 2893
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Superior Electric Co., 1000 Middle St., Bristol, Conn. .... p 2894-2896
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Virginia Electronics Co., Inc., 2908 Telestar Ct., Falls Church, Va.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Caig Laboratories, Inc., 155 Sullivan La., Westbury, N. Y.
Carson Mfg. Co., Inc., 2426 East 55 St., Indianapolis, Ind.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Collins, G. L. Corp., 5875 Obispo Ave., Long Beach, Calif.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Eder Instrument Co., Inc., 2293 N. Clybourn Ave., Chicago, Ill.
Electro-Applications, Inc., P.O. Drawer 401, Canonsburg, Pa.
Electro Assemblies, Inc., 4338 W. Montrose Ave., Chicago, Ill.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
General Coil Prods. Corp., 156 Hinsdale St., Brooklyn, N. Y.

General Radio Company, 300 Baker Ave., W. Concord, Mass.
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Model Rectifier Corp., MRC Elctrns. Div., 5300 21st Ave., Brooklyn, N. Y.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Renco Elctrns. Inc., 240-1 Old Country Rd., Hicksville, N. Y.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.

TRANSFORMERS, VIBRATOR

Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Kidde, Walter & Co., Inc., 675 Main St., Belleville, N. J.
NWL, Inc., Box 455, Trenton, N. J.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Jnited Transformer Co., 150 Varick St., New York, N. Y.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Berkshire Transformer Corp., Rte. 341, Kent, Conn.
Better Coil & Transformer Corp., Goodland, Ind.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, Ill.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Grand Tran, Inc., Box 307, Coloma, Mich.
Grand Transformers, Inc., Beechtree & Marion Sts., Grand Haven, Mich.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Invertronics, Box 342, Pine Brook, N. J.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Rae Co., Inc., 3725 East 13th St., Indianapolis, Ind.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Stancor, Essex Int'l., Inc., 3501 W. Addison St., Chicago, Ill.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Universal Transistor Prods., Div. Link, 380 Oak St., Copiague, N. Y.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, VOLTAGE-DIVIDING

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Astrosystems, Inc., 6 Nevada Dr., New Hyde Park, N. Y. ..... p 1328
Basler Electric Co., Box 269, Highland, Ill.
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Electro Scientific Inds., 13900 N.W. Science Park Dr., Portland, Ore. p 2473
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Julie Research Lab Inc., 211 W. 61st St., New York, N. Y.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal.
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y.
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y.
NWL, Inc., Box 455, Trenton, N. J.
North Atlantic Industries Inc., 200 Terminal Dr., Plainview, N. Y.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. .... p 2869
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y.
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1498
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Varo Inc., 1600 Dallas North Pkwy., Plano, Tex.
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Automatic Control Electronics, Inc., Box 1198, San Antonio, Tex.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Cal-Power Corp., 140 Kansas St., El Segundo, Calif.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Dormeyer Inds., 3418 Milwaukee Ave., Chicago, Ill.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Coils Inc., 33 Lyman St., Springfield, Mass.
Electronic Transformer Corp., 460 Totowa Ave., Paterson, N. J.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Fullmer Electronics, Inc., 18125 Napa St., Northridge, Calif.
Gladding-Keystone Corp., 179 River St., Oneonta, N. Y.
Guildline Instruments Ltd., Box 99, Smith Falls, Ont., Can.
Hallmark Standard Inc., 145 Library Lane, Mamaroneck, N. Y.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Idalee Electronics Corp., 891 Fulton St., Valley Stream, N. Y.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Optimation Inc., 9421 Telfair Ave., Sun Valley, Calif.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Varo General, Garland Bank Bldg., Garland, Tex.
Welco Inds. Inc., 9027 Shell Ave., Cincinnati, Ohio
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass.
Wintron Co., Inc., 9759 Rush St., S. El Monte, Calif.

TRANSFORMERS, VOLTAGE-REGULATING—ALSO SEE REGULATORS & STABILIZERS, VOLTAGE

ADC Products, 6405 Cambridge St., Minneapolis, Minn.
Acme Electric Corp., 28 Water St., Cuba, N. Y. ..... p 2845
Elasco, Inc., 5 Northwood Rd., Bloomfield, Conn.
Elgin Electronics, Inc., 2035 W. 12th St., Box 1318, Erie, Pa.
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 1957, 2858, 2859
Kepco Inc., 131-38 Sanford Ave., Flushing, N. Y. ... p 1972, 1973, 1995
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa. ... p 2867
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Ohmite Manufacturing Co., 3635 Howard St., Skokie, Ill. ..... p 2871
Signal Transformer Co., Inc., 1 Junius St., Brooklyn, N. Y. p 2887, 2888
Sola Electric Div., 1717 Busse Rd., Elk Grove Village, Ill. ..... p 2879
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y. ..... p 2897
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
United Transformer Co., 150 Varick St., New York, N. Y.
Unitron, 1624 N. First St., Garland, Texas
Ward Leonard, 31 South St., Mount Vernon, N. Y.
Zaring Inds., Inc., Box 477, Carmel, Ind.
A C Transformer Corp., 89 Madison St., Newark, N. J.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Altec Lansing, 1515 S. Manchester Ave., Anaheim, Calif.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
American Rectifier Corp., 116-15 15th Ave., College Point, N. Y.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Barwood Electronics, Inc., 120 S. Maryland, Glendale, Calif.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Cycle Transformer Corp., 177 Main St., W. Orange, N. J.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Electronic Devices, Inc., Box 78, North Ridgeville, Ohio
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Era Electric Corp., 67 Sand Park Rd., Cedar Grove, N. J.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Foster Transformer Co., 3820 Colerain Ave., Cincinnati, Ohio
Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Glenn Pacific, 703-37th Ave., Oakland, Calif.
Goslin Elec. & Mfg. Co., 2921 W. Olive St., Burbank, Calif.
Invertronics, Box 342, Pine Brook, N. J.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Mag-Con Engineering Co., 85 Richardson St., S.E., St. Paul, Minn.
Merit Coil & Transformer Corp., 2040 Sherman St., Hollywood, Fla.
Microdot Magnetics, Inc., 5960 Bowcroft St., Los Angeles, Calif.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Pacific Assemblers Co., Inc., 450 Campus Dr. #524, Newport Beach, Cal.
Permavolt Transformers, Inc., 1901 S. Lafayette St., S. Bend, Ind.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Queensboro Transformer & Mach. Corp., 115-25 15 Ave., College Pt., N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
SNC Mfg. Co., Inc., Box 470, Oshkosh, Wisc.
Sartron, Inc., 114 N. Main St., Newberg, Ore.

TRANSFORMERS, WIDE BAND

Spatron, Inc., 715 S. Raymond Ave., Alhambra, Calif.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.
Varo General, Garland Bank Bldg., Garland, Tex.

TRANSFORMERS, WELDING

Basler Electric Co., Box 269, Highland, Ill.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y. .. p 1902
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
NWL, Inc., Box 455, Trenton, N. J. ..... p 2868
Neshaminy Transformer Co., Edison-Furlong Rd., Furlong, Pa.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Nytronics, Inc., Custom Components Group, Third Ave., Alpha, N. J.
Sorensen Operation, Richards Ave., Norwalk, Conn.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Test Equipment Corp., Box 20215, Dallas, Tex.
Torwico Electronics, Inc., Rte. 70, Lakewood, N. J.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Century Coil Corp., 1522 N. Clybourn Ave., Chicago, Ill.
Chu Assocs., Box 387, Whitcomb Ave., Littleton, Mass.
Coil Co. of America, Inc., 221 Washington St., Northvale, N. J.
Daylen Co., Box 527, South Gate, Calif.
Diversified Power Co., Inc., 15223 Grevillea Ave., Lawndale, Calif.
Edko Elctrns., Inc., 397 Bedford Ave., Brooklyn, N. Y.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Energy Dynamics Corp., 63 Main St., Ansonia, Conn.
Epco Products, Inc., Box 298, Wallkill, N. Y.
Eutectic Corp., 40-40 172nd St., Flushing, N. Y.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Ferrodyne Corp., 4240 Glencoe Ave., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forest Elec. Co., 1001 North 25th Ave., Melrose Park, Ill.
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
Hobart Brothers Co., Hobart Square, Troy, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Light Electric Corp., 214 Lackawanna Ave., Newark, N. J.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Maxwell Labs., Inc., 9244 Balboa Ave., San Diego, Calif.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
North Electric Co., 553 S. Market St., Galion, Ohio
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Phoenix Transformer Co., 1818 E. Madison, Phoenix, Ariz.
Precision Elctrns. Co., 427 Plain St., Marshfield, Mass.
Prototype Transformer Corp., 545 N. Arlington Ave., E. Orange, N. J.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sciaky Bros, Inc., 4915 West 67th St., Chicago, Ill.
Slee International Inc., 8010 U. S. Hwy. 130, Pennsauken, N. J.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Transformer Mfrs., Inc., 7051 W. Wilson Ave., Chicago, Ill.
Transformer Technicians, Inc., 4447 W. Armitage Ave., Chicago, Ill.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Wabash Magnetics, Inc., 1375 Swan St., Huntington, Ind.
Westinghouse Electric Corp., Ind. Equip. Div., Box 300, Sykesville, Md.

TRANSFORMERS, WIDE BAND

ACDC Electronics Inc., 2979 North Ontario St., Burbank, Calif.
ADC Products, 6405 Cambridge St., Minneapolis, Minn. p 2846, 2847
Bulova Watch Co., Inc., Elctrn. Div., Freq. Control Products, 61-20 Woodside Ave., Woodside, N. Y.
Caddell-Burns Mfg. Co. Inc., 40 E. 2nd St., Mineola, N. Y.
Dranetz Engineering Labs, Inc., 1233 North Ave., Plainfield, N. J.
Dynographic Elctrn. Corp., 57 Bloomingdale Rd., Hicksville, N. Y. p 1661
Freed Transformer Co., Inc., 1795 Weirfield St., Brooklyn, N. Y.
Kappa Networks Inc., 165 Roosevelt Ave., Carteret, N. J.
Lorch Electronics Corp., 105 Cedar La., Englewood, N. J.
Magnetic Circuit Elements Inc., 2455 A Garden Rd., Monterey, Cal. p 2862
Magnetico Inc., 6 Richter Ct., E. Northport, N. Y. ..... p 2865
Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N. Y. ... p 2866
NWL, Inc., Box 455, Trenton, N. J.
North Hills Electronics Inc., Alexander Pl., Glen Cove, N. Y. ..... p 2869
Peerless Electrical Prods., 1515 S. Manchester Ave., Anaheim, Cal. p 2876
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, N. Y.
Todd Elec. Co., Inc., 20 Harrison Ave., Yonkers, N. Y.
Torotel, Inc., 13402 South 71 Highway, Grandview, Mo.
United Transformer Co., 150 Varick St., New York, N. Y. ..... p 2900
Vanguard Electronics Div., 930 W. Hyde Pk. Blvd., Inglewood, Cal.
Vari-L Co. Inc., 207 Greenwich Ave., Stamford, Conn. ..... p 1715
Zaring Inds., Inc., Box 477, Carmel, Ind.
Aladdin Electronics, 701 Murfreesboro Rd., Nashville, Tenn.
American Magnetics Corp., P.O. Box 8, Carterville, Ill.
Anzac Electronics, 121 Water St., Norwalk, Conn.
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Bourns, Inc., Box 1398, Romoland, Calif.
C B C Industries Inc., 2601 N. Howard St., Philadelphia, Pa.
CP Electronics, Inc., 2851 Southeastern Ave., Columbus, Ind.
Central Transformer Co., 850 W. Jackson Blvd., Chicago, Ill.
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, Calif.
Comdel Inc., Beverly Airport, Beverly, Mass.
Dietz Design Inc., 100 Electronics Pkwy., Belton, Mo.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Winders Co., Inc., 854 W. Front Street, Covina, Calif.
Elnetic Electronics, Inc., 2100 Zeno Pl., Venice, Calif.
Florida Transformer Co., Box 518, DeLeon Springs, Fla.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Gavin Instrs., Inc., Box 413, Somerville, N. J.

TRANSFORMERS, WIDE BAND (Cont'd)

Geo Space Corp., 5803 Glenmont Dr., Houston, Texas
Hammond Mfg. Co. Ltd., 394 Edinburgh Rd. N., Guelph, Ont. Can.
National Coil Co., Box 1040, Douglas, Ariz.
Oeco Corp., 712 S. E. Hawthorne Blvd., Portland, Ore.
Olektron Corp., Box 248, Dudley, Mass.
PCA Electronics, Inc., 16799 Schoenborn St., Sepulveda, Calif.
Polyphase Instr. Co., 126 E. Fourth St., Bridgeport, Pa.
Pulse Engineering, Inc., 560 Robert Ave., Santa Clara, Calif.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Radio Research Co., 189 Mt. Pleasant Ave., Rockaway, N. J.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sartron, Inc., 114 N. Main St., Newberg, Ore.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
TDC Div., P.O. Box 365, Littleton, Mass.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.
Transformer Design Inc. of Milwaukee, 7377 N. 76 St., Milwaukee, Wisc.
Translab, Inc., 4740 Federal Blvd., San Diego, Calif.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.
Whitewater Electronics, Inc., 136 W. Main St., Whitewater, Wisc.

TRANSISTOR & DIODE HEAT DISSIPATORS

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Astrodyne Inc., 207 Cambridge St., Burlington, Mass. ..... p 2507
Atlee Corp., 2 Lowell Ave., Winchester, Mass.
Augat Inc., 36 Perry Ave., Attleboro, Mass. ..... p 1590
Beckman Instr. Inc., Helipot Div., 2500 Harbor Blvd., Fullerton, Calif.
Cinch-Graphik, 200 S. Turnbull Canyon Rd., City of Industry, Calif.
Cinch Mfg. Co., 1501 Morse Ave., Elk Grove Village, Ill.
Cinch-Monadnock, 18300 E. Valley Blvd., City of Industry, Calif.
Cinch-NuLine, 1015 South 6th St., Minneapolis, Minn.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. ... p 2935
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind. ..... p 2509
E-Tronics, 5901 Noble Ave., Van Nuys, Calif. ..... p 1923
Inland Elctrn. Prods. Corp., 403 S. Raymond St., Pasadena, Calif. p 2515
International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2518-2520
International Rectifier, 233 Kansas St., El Segundo, Calif. .... p 2532
Risk, George, Industries, 672 15 Ave., Columbus, Nebr. ..... p 2582
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa. ..... p 2583
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Thermalloy Company, 8719 Diplomacy Row, Dallas, Texas ..... p 2628
Aavid Engrg. Inc., 30 Cook Ct., Laconia, N. H.
Accel Elctrn. Prods. Co., 3040 N. San Gabriel Blvd., S. San Gabriel, Calif.
Alpha Components Corp., 4087 Glencoe Ave., Venice, Calif.
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
Blinn, Delbert Co., Box 2007, Pomona, Calif.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Consolidated Ceramics & Metalizing Corp., Box 352, Flemington, N. J.
Cordover, C. & Co., 104 Liberty Ave., Mineola, N. Y.
Daylen Co., Box 527, South Gate, Calif.
Eastern Industries, 100 Skiff St., Hamden, Conn.
Eltee, Inc., 19 Fairfield Pl., W. Caldwell, N. J.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Fischer Special Mfg. Co., 446 Morgan St., Cincinnati, Ohio
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
Gibson Electric, Talon, Div. of Textron, Delmont, Pa.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Gudebrod Bros. Silk Co., Inc., 225 West 34th St., New York, N. Y.
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
Horex Electronics, Inc., 1729 21st St., Santa Monica, Calif.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Industrial Mica, 223 S. Van Brunt St., Englewood, N. J.
Lockhart Industries, Inc., 15707 Texaco Ave., Paramount, Calif.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Mauratron, Inc., 13333 N. Central Expwy., Dallas, Tex.
Modular Devices, Inc., 1265 West 135th St., Gardena, Calif.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Space Products, Inc., 6631 Sarnia Ave., Long Beach, Calif.
Stauffer Chemical Co., Silicone Dept., 299 Park Ave., New York, N. Y.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Tekna Products Co., 82 St. Paul St., Rochester, N. Y.
Tor Inc., Box 8, Irwindale, Calif.
Vemaline Prods. Co., Inc., 455 W. Main St., Wyckoff, N. J.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
Waterbury Pressed Metal Co., 407 Brookside Rd., Waterbury, Conn.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

TRANSISTOR MOUNTING PADS—SEE PADS, TRANSISTOR MOUNTING

TRANSISTOR TESTERS—SEE TESTERS, TRANSISTOR

TRANSISTORS, CHIP, UNPACKAGED

Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 1605
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kyodo Elctrn. Labs., Inc., 5153 Kamitsuruma, Sagamihara-shi, Kanagawa-ken, Japan
Micro Electronics Ltd., 84 Hung To Rd., Kwun Tong, Hong Kong
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.

TRANSISTORS, DUAL

Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1606, 1608
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass.
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
Micro Electronics Ltd., 84 Hung To Rd., Kwun Tong, Hong Kong
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Semicoa, 940 S. Ajax Ave., City of Industry, Calif.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Solitron Devices, Inc., 1177 Blue Heron Rd., Riviera Beach, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.

TRANSISTORS, FIELD EFFECT

Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. p 1606-1609
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
American Micro-Systems, Inc., 3800 Homestead Rd., Santa Clara, Calif.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Dickson Electronics Corp., P.O. Box 1390, Scottsdale, Ariz.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Micro Electronics Ltd., 84 Hung To Rd., Kwun Tong, Hong Kong
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.

TRANSISTORS, GERMANIUM, PHOTO

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Corvair Diode, 150 5th Ave., New York, N. Y.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Vidaire Elctrns. Mfg. Corp., 150 Buffalo Ave., Freeport, N. Y.

TRANSISTORS, GERMANIUM, POWER

Delco Radio Div., 700 E.Firmin St., Kokomo, Ind. ..... p 2508
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Diode, 150 5th Ave., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
KSC Semiconductor Corp., KSC Way, Chelmsford, Mass.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semicoa, 940 S. Ajax Ave., City of Industry, Calif.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Solitron Devices, Inc., 1177 Blue Heron Rd., Riviera Beach, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

TRANSISTORS, GERMANIUM, R-F

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Lansdale Transistor & Electronics Inc., Advance La. & Rte 309, Colmar, Pa. p 2578
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Corvair Diode, 150 5th Ave., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.

TRANSISTORS, GERMANIUM, SWITCHING

Delco Radio Div., 700 E.Firmin St., Kokomo, Ind. ..... p 2508
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Lansdale Transistor & Electronics Inc., Advance La. & Rte 309, Colmar, Pa. p 2578
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Corvair Diode, 150 5th Ave., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semicoa, 940 S. Ajax Ave., City of Industry, Calif.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Solitron Devices, Inc., 1177 Blue Heron Rd., Riviera Beach, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.

TRANSISTORS, PRESSURE SENSITIVE

Stow Labs., Inc., 182 Barton Rd., Stow, Mass. ..... p 2591

TRANSISTORS, SILICON, PHOTO

Clairex Electronics, Inc., 1239 Broadway, New York, N. Y. ..... p 1773
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2511
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Solid State Prods., One Pingree St., Salem, Mass. ..... p 2588
Toyo Elctrns. Ind. Corp., 21, Sain Misosaki-cho, Ukyo-ku, Kyoto, Japan
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.

Corvair Diode, 150 5th Ave., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
General Sensors, Inc., P.O. Box 231, Athens, Tex.
Gilway Co., Electronics Div., Box 584, Newburyport, Mass.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Micro Electronics Ltd., 84 Hung To Rd., Kwun Tong, Hong Kong
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.

TRANSISTORS, SILICON, POWER

Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind. ..... p 2508
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630-2632
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510, 2511
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 2536
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Lansdale Transistor & Electronics Inc., Advance La. & Rte 309, Colmar, Pa. p 2578
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Solid State Prods., One Pingree St., Salem, Mass. ..... p 2589
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. p 2622, 2623
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2645-2648
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630-2632
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cordover, C. & Co., 104 Liberty Ave., Mineola, N. Y.
Corvair Diode, 150 5th Ave., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semicoa, 940 S. Ajax Ave., City of Industry, Calif.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Silicon Transistor Corp., East Gate Blvd., Garden City, N. Y.
Slater Electric, Inc., 45 Sea Cliff Ave., Glen Cove, N. Y.
Solid Power Corp., 440 Eastern Pkwy., Farmingdale, N. Y.
Solitron Devices, Inc., 1177 Blue Heron Rd., Riviera Beach, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

TRANSISTORS, SILICON, R-F

Avantek Inc., 2981 Copper Rd., Santa Clara, Calif.
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 2536
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Lansdale Transistor & Electronics Inc., Advance La. & Rte 309, Colmar, Pa. p 2578
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. .. p 2622
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Corvair Diode, 150 5th Ave., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
General Sensors, Inc., P.O. Box 231, Athens, Tex.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Micro Electronics Ltd., 84 Hung To Rd., Kwun Tong, Hong Kong
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semicoa, 940 S. Ajax Ave., City of Industry, Calif.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Solitron Devices, Inc., 1177 Blue Heron Rd., Riviera Beach, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.

TRANSISTORS, SILICON, SWITCHING

Delco Radio Div., 700 E.Firmin St., Kokomo, Ind. ..... p 2508
Electronic Components Div., United Aircraft, Trevose, Pa. p 2630, 2632
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. .. p 2536
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
Lansdale Transistor & Electronics Inc., Advance La. & Rte 309, Colmar, Pa. p 2578
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Solid State Prods., One Pingree St., Salem, Mass. ..... p 2589
Sprague Electric Co., 481 Marshall St., N. Adams, Mass.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Transitron Elctrn. Corp., 168-182 Albion St., Wakefield, Mass. .... p 2622
United Aircraft Corp., Electronics Components Div., Trevose, Pa. p 2630, 2632
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Electric Corp., Semiconductor Div., Youngwood, Pa. p 2645-2648
AMC Semiconductor Corp., 106 East 18th St., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Bendix Corp., Semiconductor Div., South St., Holmdel, N. J.
Burns & Towne, Inc., 18-36 Granite St., Haverhill, Mass.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Continental Device, 12515 Chadron Ave., Hawthorne, Calif.
Corvair Diode, 150 5th Ave., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Crystalonics Div., Teledyne, Inc., 147 Sherman St., Cambridge, Mass.
Decker Corp., 101 Monument Rd., Bala Cynwyd, Pa.
Delta Semiconductors, 225 Paularino Ave., Costa Mesa, Calif.
Devices For Industry, 175 McClellan Hwy., Boston, Mass.
Electronic Transistors Corp., 153-13 Northern Blvd., Flushing, N. Y.
Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif.
Frathom, Inc., 500 Hillside Ave., Atlantic Highlands, N. J.
General Instr. Corp., Semi. Prods. Grp., Box 600, Hicksville, N. Y.
General Sensors, Inc., P.O. Box 231, Athens, Tex.
ITT Semiconductors, 3301 Electronic Way, W. Palm Beach, Fla.
Intersil Inc., 10900 N. Tantau, Cupertino, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
KMC Semiconductor Corp., RD 2, Long Valley, N. Y.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Kyodo Elctrn. Labs., Inc., 5153 Kamitsuruma, Sagamihara-shi, Kanagawa-ken, Japan
Micro Electronics Ltd., 84 Hung To Rd., Kwun Tong, Hong Kong
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Semiconductor Corp., 2975 San Ysidro Way, Santa Clara, Calif
Qualidyne Corp., 3699 Tahoe Way, Santa Clara, Calif.
Raytheon Co., Semiconductor Oper., 350 Ellis St., Mountain View, Calif.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Semicoa, 940 S. Ajax Ave., City of Industry, Calif.
Semiconductor Devices, Inc., 1353 E. Edinger St., Santa Ana, Calif.
Semitronics Corp., 265 Canal St., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Silicon Transistor Corp., East Gate Blvd., Garden City, N. Y.
Siliconix, Inc., 1140 W. Evelyn Ave., Sunnyvale, Calif.
Solid Power Corp., 440 Eastern Pkwy., Farmingdale, N. Y.
Solitron Devices, Inc., 1177 Blue Heron Rd., Riviera Beach, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
TRW Electronics, 1100 Glendon Ave., Los Angeles, Calif.
TRW Semiconductors Inc., 14520 Aviation Blvd., Lawndale, Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Uni-Tran Semiconductor Corp., 1 Charles St., W. Orange, N. J.
Union Carbide Elctrns., Semi. Dept., 8888 Balboa Ave., San Diego, Cal.
Workman Electronic Prods., Inc., Box 3828, Sarasota, Fla.

TRANSISTORS, UNIJUNCTION

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2510
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y. ... p 2580
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Texas Instruments Incorporated, Components Group, Box 5012, Dallas, Tex. p 2602
Motorola Semiconductor Prod., Inc., Box 20912, Phoenix, Ariz.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.

TRANSMISSION SYSTEMS, DATA

TRANSIT CASES—ALSO SEE CONTAINERS, SHIPPING

American Aluminum Co., 230 Sheffield St., Dept. EEM, Mountainside, N. J. p 575
M M Electronic Enclosures, Inc., 111 Bloomingdale Rd., Hicksville, N. Y. p 584
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill.
Skydyne Inc., River Rd., Port Jervis, N. Y. ..... p 590
Applied Design Co. Inc., 2461 Sheridan Dr., Tonawanda, N. Y.
Bal, W. Corp., 947 Newark Ave., Elizabeth, N. J.
Baltic Metal Products Co.,120 Sutton St., Brooklyn, N. Y.
Bud Radio, Inc., 4605 East 355th St., Willoughby, Ohio
Craig Systems Corp., 360 Merrimack St., Lawrence, Mass.
Elzee Metal Products Co., Inc., 775 39th St., Brooklyn, N. Y.
Environmental Container Systems, Box 337, Union City, Calif.
Golding Mfg. Co., 90 Porete Ave., N. Arlington, N. J.
Goldsman, Inc., 1328-34 N. 4th St., Philadelphia, Pa.
Muckle Mfg. Co., 334 Medford, Owatonna, Minn.
REF Dynamics, 393 Jericho Tpke., Mineola, N. Y.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
TA Mfg. Corp., 4625 Alger St., Los Angeles, Calif.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Warwick Products Co., 7909 Rockside Rd., Independence, Ohio
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

TRANSITIONS—SEE COUPLINGS

TRANSLATORS, DATA

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif. ..... p 1017
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Control Equipment Corp., 32 Kearney Rd., Needham Hgts., Mass. p 770
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 775
Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541, 786, 787
Non-Linear Systems, Inc., Box N, Del Mar, Calif.
Parabam Inc., 3017 E. Las Hermanas St., Compton, Cal.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Superior Electric Co., 1000 Middle St., Bristol, Conn. ..... p 1770
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y.
Theta Instrument Corp., Fairfield, N. J.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Codamite, 1747K1 W. Lincoln Ave., Anaheim, Calif.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Intrex Systems Inc., 729 Centinela Ave., Inglewood, Calif.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Navcor Inc., Valley Forge Ind. Pk., Norristown, Pa.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Summit Engrg. Corp., Box 115, Bozeman, Mont.

TRANSLATORS, TV—SEE TRANSMITTERS, UHF: TRANSMITTERS, VHF

TRANSMISSION LINE, WIRE & CABLE—SEE CABLE, TRANSMISSION LINE

TRANSMISSION SYSTEMS, DATA

Astrodata, Inc., 240 E. Palais Rd., Anaheim, Calif.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Collins Radio Co., Newport Beach, Calif.
Dynamics Instrumentation, 583 Monterey Pass Rd., Monterey Pk., Cal. p 525
Hi-G Inc., Spring St. & Route 75, Windsor Locks, Conn.
Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Metric Systems Corp., 736 N. Beal St., Fort Walton Beach, Fla. p 541, 786
Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. ..... p 792
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
North Electric Co., Electronetics Div., 553 S. Market St., Galion, Ohio
Ohr-Tronics, Inc., Box 630, Herkimer, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Theta Instrument Corp., Fairfield, N. J.
Towson Labs Inc., 1400 Taylor Ave., Baltimore, Md. ..... p 807
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Applied Peripheral Sys., Inc., 7120 Harwin, Houston, Tex.
Austin Elctrns., 450 W. First Ave., Roselle, N. J.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Bristol Co., Box 1790, Waterbury, Conn.
Brown Engrg. Co., Inc., Research Park, Huntsville, Ala.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Cardion Elctrns., L. I. Expwy., Woodbury, N. Y.
Codex Corp., 222 Arsenal St., Watertown, Mass.
Communitype Corp., 767 Fifth Ave., New York, N. Y.
Computer Test Corp., 3 Computer Dr., Cherry Hill, N. J.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dasa Corp., 15 Stevens St., Andover, Mass.

TRANSMISSION SYSTEMS, DATA (Cont'd)

Demex, Inc., 2130 Jefferson, Kansas City, Mo.
Diamond Repeater Co., 55 Main St., Madison, N. J.
Digi-Data Corporation, 4315 Baltimore Ave., Bladensburg, Md.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Essex Engineering Co., Inc., Box 28, Essex, Conn.
Fairchild Space & Defense Systems, 300 Robbins La., Syosset, N. Y.
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
General Atronics Corp., Military Elctrns. Div., 1200 E. Mermaid La., Phila., Pa.
General Electric Co., Mountain View Rd., Lynchburg, Va.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
Kennedy Co., 540 W. Woodbury Rd., Altadena, Calif.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
Lynch Communication Systems, 695 Bryant St., San Francisco, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Meterology Research, Inc., 464 W. Woodbury Rd., Altadena, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Mincom Div., 3M Co., 300 S. Lewis Rd., Camarillo, Calif.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Motorola, Inc., Control Sys. Div., 3102 North 56th St., Phoenix, Ariz.
Motorola Instrumentation & Control, Inc., Box 5409, Phoenix, Ariz.
Noller Control Systems, Inc., 150 E. Standard Ave., Richmond, Calif.
North Electric Co., 553 S. Market St., Galion, Ohio
Omnitec Inc., Sub. Nytronics, Inc., 903 N. Second St., Phoenix, Ariz.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RC-95, Inc., 9 East 38th St., New York, N. Y.
Radio Communication Co., 1020 E. Land Pl., Milwaukee, Wisc.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Reflectone, Inc., 580 Sylvan Ave., Englewood Cliffs, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rixon Electronics, Inc., 2120 Industrial Pkwy., Silver Spring, Md.
Sanders Assocs., Inc., Data & Display Dept., Daniel Webster Hwy., S., Nashua, N. H.
Sanders Assocs., Inc., Data Sys. Div., Daniel Webster Hwy., S., Nashua, N. H.
Schneider Instr. Co., 8115 Camargo Rd., Madeira, Cincinnati, Ohio
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Sperry Rand Corp., Univac Div., Box 8100, Philadelphia, Pa.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Tally Corporation, 1310 Mercer St., Seattle, Wash.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Teledyne Telemetry Co., Box 341, Princeton, N. J.
Texas Instruments Inc., Industrial Prods. Div., Box 66027, Houston, Tex.
Trepac Corp. of Amer., 30 W. Hamilton Ave., Englewood, N. J.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Western Telematic, Inc., 5507 Peck Rd., Arcadia, Calif.

TRANSMITTERS, BROADCAST, A-M, F-M & TV

AEL Inc., P.O. Box 552, Lansdale, Pa.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
P & H Electronics, 426 Columbia St., Lafayette, Ind.
Pearce-Simpson, Inc., Box 800, Biscayne Annex, Miami, Fla.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Standard Electronics Corp., Box 677, Freehold, N. J.
Systems Engineering Ltd., Grouse Creek, Utah
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.

TRANSMITTERS, DIGITAL DATA—SEE TRANSMISSION SYSTEMS, DATA

TRANSMITTERS, DIPLEXER

Electronic Resources, Inc., 4561 Colorado Blvd., Los Angeles, Cal.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.
Standard Electronics Corp., Box 677, Freehold, N. J.
Wilmad Glass Co., Inc., Buena, N. J.

TRANSMITTERS, DIRECTION FINDING

AEL Inc., P.O. Box 552, Lansdale, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

TRANSMITTERS, DUPLEXER

Iso-Switch Corp., 2955 Randolph St., Costa Mesa, Calif.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Sinclair Radio Labs. Inc., 675 Ensminger Rd., Tonawanda, N. Y.
Sinclair Radio Labs, Ltd., 122 Rayette Rd., Maple, Ont., Can.

TRANSMITTERS, FACSIMILIE

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Alden Elctrn. & Impulse Recording Equip., Westboro, Mass.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif.
International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla.
International Scanatron Systems Corp., 1623 Straight Path, Wyandanch, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Radio Corp. of America, Technical Prods. Service Dept., Cherry Hill Offices, Camden, N. J.
Telautograph Corp., 8700 Bellanca Ave., Los Angeles, Calif.

TRANSMITTERS, FIXED FREQUENCY

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1655
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. .. p 1698
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Bristol Co., Box 1790, Waterbury, Conn.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communications Co., Inc., Box 520, Coral Gables, Fla.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Dorsett Electronics, Box 36, Tulsa, Okla.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Multitone Electronics, Inc., 111 Broadway, New York, N. Y.
Prodelin, Inc., Box 131, Hightstown, N. J.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Southern Avionics Co., 5055 Belmont, Beaumont, Tex.
Standard Electronics Corp., Box 677, Freehold, N. J.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.

TRANSMITTERS, FIXED STATION COMM.

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communications Co., Inc., Box 520, Coral Gables, Fla.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Electric Co., Mountain View Rd., Lynchburg, Va.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Standard Electronics Corp., Box 677, Freehold, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.

TRANSMITTERS, INFRARED

Electro/Data Inc., 3121 Benton St., Garland, Tex.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Collins Radio Co., Dallas, Texas
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.

TRANSMITTERS, INTERROGATION

AEL Inc., P.O. Box 552, Lansdale, Pa.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

TRANSMITTERS, MICROWAVE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1655
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y. p 1695, 1696, 1698
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla. .. p 1713
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Applied Microwave Lab, Inc., Andover St., Andover, Mass.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Collins Radio Co., Dallas, Texas
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
E. F. E. Labs., Inc., Horsham Valley Industrial Center, Horsham, Pa.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
General Electric Co., Mountain View Rd., Lynchburg, Va.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Elctrn. Res. Ent., 881 Hurlingame Ave., Redwood City, Cal.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Micronetics Div., 7155 Mission Gorge Rd., San Diego, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.

Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Raytheon Co., Comm. & Data Proc. Oper.,
1415 Boston Providence Tpke., Norwood, Mass.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Telefunken Sales Corp., South St., Garden City, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

TRANSMITTERS, MULTIPLEX

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. ..... p 757
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Bristol Co., Box 1790, Waterbury, Conn.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Collins Radio Co., Dallas, Texas
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Smallwood, S. G., Ltd., 391-397 King St., E., Kitchener, Ont., Can.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Telefunken Sales Corp., South St., Garden City, N. Y.

TRANSMITTERS, PULSE CODE MODULATION

Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

TRANSMITTERS, PULSE PHASE MODULATION

Aerospace Research Inc., 130 Lincoln St., Boston, Mass.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Dorsett Electronics, Box 36, Tulsa, Okla.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Comm. & Data Proc. Oper.,
1415 Boston Providence Tpke., Norwood, Mass.
Robertshaw Controls Co., Santa Ana Frwy. & Euclid Ave., Anaheim, Cal.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

TRANSMITTERS, PULSE TIME MODULATION

Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Landis & Gyr, Inc., 45 West 45th St., New York, N. Y. ..... p 2153
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Bristol Co., Box 1790, Waterbury, Conn.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.

TRANSMITTERS, RADAR—SEE RADAR SYSTEMS

TRANSMITTERS, RADIO-CONTROL

Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1655
Heath Co., Dept. 180, Benton Harbor, Mich.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Chamberlain Mfg. Corp., 5740 N. Tripp Ave., Chicago, Ill.
Collins Radio Co., Dallas, Texas
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Femco, Inc., Box F, Irwin, Pa.
Heitz, Karl, Inc., 979 Third Ave., New York, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Linear Corp., 347 S. Glasgow Ave., Inglewood, Calif.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Robicon Corp., Plum Industrial Park, Pittsburgh, Pa.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Ventron Elctrns. Corp., Box 529, Bradford, Pa.

TRANSMITTERS, RADIO RANGE

Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1655
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.

TRANSMITTERS, RAILROAD

Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md.
McElroy Elctrns. Corp., Fredonian St., Shirley, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Milgo Elctrn. Corp., 7620 N.W. 36th Ave., Miami, Fla.

TRANSMITTERS, SINGLE-SIDEBAND

AEL Inc., P.O. Box 552, Lansdale, Pa.
Delco Radio Div., 700 E.Firmin St., Kokomo, Ind.
Heath Co., Dept. 180, Benton Harbor, Mich.
Johnson, E. F., Co., 1923 10th Ave., S.W., Waseca, Minn.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
Brelonix, Inc., 106 North 36th St., Seattle, Wash.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Delta Elctrns. Ltd., 70 Ronson Dr., Rexdale, Ont., Can.
Drake, R. L. Co., 540 Richard St., Miamisburg, Ohio
Galaxy Electronics, 10 South 34th St., Council Bluffs, Iowa
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Kahn Research Labs., Inc., 81 S. Bergen Pl., Freeport, N. Y.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
Linear Systems, Inc., Box 1103, Watsonville, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
National Radio Co., Inc., 37 Washington St., Melrose, Mass.
P & H Electronics, 426 Columbia St., Lafayette, Ind.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
Racal Communications, Inc., 8440 Second Ave., Silver Spring, Md.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Raytheon Co., Comm. & Data Proc. Oper.,
1415 Boston Providence Tpke., Norwood, Mass.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telectro Systems Corp., 96-18 43rd Ave., Corona, N. Y.
Weitermann Electronics, 4549 North 38th St., Milwaukee, Wisc.

TRANSMITTERS, TELEMETRY

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Avtel Corp., 1130 E. Cypress St., Covina, Calif.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1655
Bramco Controls Div., Ledex Inc., College & South, Piqua, Ohio .. p 2286
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RFL Industries, Communications Div., Powerville Rd., Boonton, N. J. p 2791
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Solid State Elctrn. Corp., 15321 Raven St., Sepulveda, Cal.
Tele-Signal Corp., 250 Crossways Park Dr., Woodbury, N. Y. .... p 757
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
AMBAC Inds. Inc., 900 Old Country Rd., Garden City, N. Y.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Alto Scientific Co., Inc., 4083 Transport St., Palo Alto, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Autocon Industries, Inc., 995 University, St. Paul, Minn.
Automation Dynamics Corp., 35 Industrial Pkwy., Northvale, N. J.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Bristol Co., Box 1790, Waterbury, Conn.
Collins Radio Co., Dallas, Texas
Concord Control, Inc., 1282 Soldiers Field Rd., Boston, Mass.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Continental Data Systems, Inc., 19 W. Fourth St., Dayton, Ohio
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Defense Elctrns., Inc., Rockville, Md.
Dorsett Electronics, Box 36, Tulsa, Okla.

TRANSMITTERS, UHF

EMR Div., Box 223, Princeton, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hathaway Pacific Corp., 4055 Fabian Way, Palo Alto, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
Mennen-Greatbatch Elctrns. Inc., 10123 Main St., Clarence, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Microcom Corp., Horsham Valley Industrial Park, Horsham, Pa.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Moore Assocs. Div., 815 American St., San Carlos, Calif.
Noller Control Systems, Inc., 150 E. Standard Ave., Richmond, Calif.
Northern Radio Co., Inc., 143 West 22nd St., New York, N. Y.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Quindar Electronics Inc., 60 Fadem Rd., Springfield, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Schneider Instr. Co., 8115 Camargo Rd., Madeira, Cincinnati, Ohio
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Stoelting, C. H., Co., 424 N. Homan Ave., Chicago, Ill.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Telemet Co., 185 Dixon Ave., Amityville, N. Y.
Utility Communication Systems, Inc., Box 188, Essington, Pa.
Video Research Corp., 761 N. Washington St., Rockville, Md.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

TRANSMITTERS, TROPOSPHERIC SCATTER

Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.

TRANSMITTERS, UHF

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1655
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn. ..... p 1657
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Trak Microwave Corporation, 4726 Kennedy Rd., Tampa, Fla.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Ampex Corp., 401 Broadway, Redwood City, Calif.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communications Co., Inc., Box 520, Coral Gables, Fla.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
EMR Div., Box 223, Princeton, N. J.
Electronic Comms., Inc., 1501 72nd St., N., St. Petersburg, Fla.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Electronics, Missiles & Comms., Inc., Box 116, White Haven, Pa.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
General Electric Co., Mountain View Rd., Lynchburg, Va.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Multitone Electronics, Inc., 111 Broadway, New York, N. Y.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Radio Engineering Labs., 29-01 Borden Ave., Long Island City, N. Y.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Somerset Radiation Lab., Inc., 2060 North 14th St., Arlington, Va.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Standard Electronics Corp., Box 677, Freehold, N. J.

TRANSMITTERS, UHF (Cont'd)

Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Visual Elctrns. Corp., 356 West 40th St., New York, N. Y.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Zeta Labs., Inc., 616 National Ave., Mountain View, Calif.

TRANSMITTERS, ULF

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

TRANSMITTERS, VHF

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
Applied Research, Inc., 76 S. Bayles Ave., Port Washington, N. Y.
Babcock Electronics Corp., 3501 Harbor Blvd., Costa Mesa, Calif. p 1655
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Electro/Data Inc., 3121 Benton St., Garland, Tex.
Heath Co., Dept. 180, Benton Harbor, Mich.
Instruments For Industry, Inc., 151 Toledo St., Farmingdale, N. Y.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
LEL Div. Varian, 75 Akron St., Copiague, N. Y.
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Millen, James, Mfg. Co. Inc., 150 Exchange St., Malden, Mass.
Motorola Comm. & Elctrns., Inc., 4501 N. Augusta Blvd., Chicago, Ill.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
ACR Elctrns. Corp., 160 5th Ave., New York, N. Y.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
Aerocom, 3090 Southwest 37th Ave., Miami, Fla.
Aeronautical Comms. Equip. Inc., 3090 S.W. 37th Ave., Miami, Fla.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Arvin Industries, Inc., 13th St. & Big Four Railroad, Columbus, Ind.
BF Electronics, 415 S. Nardo, Solana Beach, Calif.
Barker & Williamson, Beaver Dam & Canal Rds., Bristol, Pa.
Bayside Elctrns., Inc., 1598 Lindburgh, Stockton, Calif.
Benco Television Assoc., 27 Taber Rd., Rexdale, Ont., Can.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Cardion Communications, Long Island Expressway, Woodbury, N. Y.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Communications Co., Inc., Box 520, Coral Gables, Fla.
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Conic Corp., 9020 Balboa Ave., San Diego, Calif.
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dorsett Electronics, Box 36, Tulsa, Okla.
EMR Div., Box 223, Princeton, N. J.
Electronics Dev. Corp., 1533 Monrovia Ave., Newport Beach, Cal.
Electronics, Missiles & Comms., Inc., Box 116, White Haven, Pa.
Emcee Electronics, Inc., 177 Old Churchman Rd., New Castle, Del.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Fargo Co., 1162 Bryant St., San Francisco, Calif.
Farinon Electric, 935 Washington St., San Carlos, Calif.
General Electric Co., Mountain View Rd., Lynchburg, Va.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Giannini-Voltex, 12140 E. Rivera Rd., Whittier, Calif.
Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N. C.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Kaar Electronics Corp., 2250 Charleston Rd., Mt. View, Calif.
Marconi Div., English Electric Corp., 1 Park Ave., New York, N. Y.
Metrotek Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Micro State Electronics, 152 Floral Ave., Murray Hill, N. J.
Micro-Tel Corp., 1406 Shoemaker Rd., Baltimore, Md.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Mobil Electronics, Inc., Box 1132, Anderson, Ind.
Multitone Electronics, Inc., 111 Broadway, New York, N. Y.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Oklahoma Aerotronics, Inc., 632 Pennsylvania Ave., Hartshorne, Okla.
Olektron Corp., Box 248, Dudley, Mass.
Pearce-Simpson, Inc., Box 800, Biscayne Annex, Miami, Fla.
Port-O-Vox Enterprises, Corp., 130 West 57th St., New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Regency Elctrns., Inc., 7900 Pendleton Pike, Indianapolis, Ind.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Robertson Instrument Co., 1760 W. First St., Azusa, Calif.
Rodelco, 356A Commack Rd., Deer Park, N. Y.
Rohde & Schwarz Sales Co., 111 Lexington Ave., Passaic, N. J.
Sonex Inc., 20 East Herman St., Philadelphia, Pa.
Standard Electronics Corp., Box 677, Freehold, N. J.
Standard Winding Co., 44-62 Johnes St., Newburgh, N. Y.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
TRF, Inc., 5265 Port Royal Rd., Springfield, Va.
Tele-Dynamics, 5000 Parkside Ave., Philadelphia, Pa.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

TRANSMITTERS, VLF

AEL Inc., P.O. Box 552, Lansdale, Pa.
Aerospace Research Inc., 130 Lincoln St., Boston, Mass. ..... p 1647
CML Inc., 350 Leland Ave., Plainfield, N. J.
Cober Elctrns., Inc., 7 Gleason Ave., Stamford, Conn.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Aeroscience Elctrns., Inc., Box 29765, Atlanta, Ga.
Allis, Louis Co., Div. Litton Inds., 427 E. Stewart St., Milwaukee, Wisc.
Anritsu Elec. Co., Ltd., 12-20, Minamiazabu 4 chome, Minato-ku, Tokyo, Jap.
Bogue Electric Mfg. Co., 52 Iowa St., Paterson, N. J.
CCA Electronics Corp., 716 Jersey Ave., Gloucester, N. J.
Collins Radio Co., Dallas, Texas
Continental Electronics Mfg. Co., P.O. Box 17040, Dallas, Tex.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Energy Systems, Inc., 3180 Hanover St., Stanford Indl. Pk., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
Micromega, 4134 Del Rey Ave., Venice, Calif.
Multitone Electronics, Inc., 111 Broadway, New York, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Southern Avionics Co., 5055 Belmont, Beaumont, Tex.
Standard Electronics Corp., Box 677, Freehold, N. J.
Summit Engrg. Corp., Box 115, Bozeman, Mont.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.

TRANSPONDERS

ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. .. p 1161
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Raven Electronics, Inc., 101 W. Alameda Ave., Burbank, Calif.
Vega Precision Labs., Inc., 239 Maple Ave., Vienna, Va. ..... p 1718
AAI Corp., Box 6767, Baltimore, Md.
A.R.F. Products, Inc., Gardner Rd., Raton, N. M.
Admiral Corp., Government Elctrns. Div., 3800 Cortland St., Chicago, Ill.
Advanced Comm Inc., 9257 Independence Ave., Chatsworth, Calif.
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Bendix Corp., Comms. Div., E. Joppa Rd., Towson, Md.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Collins Radio Co., Cedar Rapids, Iowa
Collins Radio Co., Dallas, Texas
Conductron Corp., 2600 North 3rd St., St. Charles, Mo.
Control Science Corp., 4810 Beauregard St., Alexandria, Va.
Cubic Corp., 9233 Balboa Ave., San Diego, Calif.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Dorsett Electronics, Box 36, Tulsa, Okla.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
Electronic Services, Inc., 1258 Fitzgerald Ave., San Francisco, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
ITT Avionics Div., 390 Washington Ave., Nutley, N. J.
International Transducer Corp., Box 3385, Santa Barbara, Calif.
King Radio Corp., Inc., 400 N. Rogers Rd., Olathe, Kans.
Massa Div., 280 Lincoln St., Hingham, Mass.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microwave Div., Sanders Assocs., Inc., Ledge St., Nashua, N. H.
Narco Avionics, Commerce Dr., Ft. Washington, Pa.
Prodelin, Inc., Box 131, Hightstown, N. J.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Resdel Engineering Corp., Box 2400D, Pasadena, Calif.
Rodale Electronics, Inc., 603 Chestnut St., Garden City, N. Y.
Scope, Inc., 1860 Michael Faraday Dr., Reston, Va.
Southern Avionics Co., 5055 Belmont, Beaumont, Tex.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
United Telecontrol Electronics, Inc., 3500 Sunset Ave., Asbury Park, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

TRAPS, ION—SEE ION TRAPS

TRAPS, WAVE—SEE FILTERS, ANTENNA; FILTERS, MICROWAVE; ETC.

TRIACS—SEE THYRISTORS

TRIGGERS, SCR—SEE CONTROLS, SCR

TRIMMER POTENTIOMETERS—SEE POTENTIOMETERS, TRIMMER

TRIPODS (FOR INSTRUMENTS)

Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Gordon, A. Enterprises, 5362 N. Cahuenga Blvd., N. Hollywood, Cal.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Keuffel & Esser Co., Adams & Third Sts., Hoboken, N. J.
Multi Media Engrg., Inc., 2385 Lewis Ave., Rockville, Md.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Red Lake Labs., Inc., 2971 Corvin Dr., Santa Clara, Calif.

TUBE HEAT DISSIPATORS

International Elctrn. Res. Corp., 135 W. Magnolia Blvd., Burbank, Cal. p 2520
Birtcher Corp., P.O. Box D, Monterey Park, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Hobson Bros., Inc., 4940 W. Lawrence Ave., Chicago, Ill.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Tor Inc., Box 8, Irwindale, Calif.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.
Waterbury Pressed Metal Co., 407 Brookside Rd., Waterbury, Conn.

TUBE PARTS

Art Wire & Stamping Co., 28 Boyden Pl., Newark, N. J.
Augat Inc., 36 Perry Ave., Attleboro, Mass.
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
National Tel-Tronics Corp., 56 St. Casimir Ave., Yonkers, N. Y. .. p 929
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Amphenol Industrial Div., 1830 South 54th Ave., Chicago, Ill.
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
Buckbee-Mears Co., 245 East 6th St., St. Paul, Minn.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Coleman Instruments, 42 Madison St., Maywood, Ill.
Corning Glass Works, Television Prods. Div., Corning, N. Y.
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Eby Sales Co., 148-05 Archer Ave., Jamaica, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Electronic Parts Mfg. Co., Inc., 508-10 25th St., Union City, N. J.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Energy Beams Inc., Microperv, 1141 Ringwood Ave., Haskell, N. J.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
Industrial Electronic Hardware Corp., 109 Prince St., New York, N. Y.
Johnson & Hoffman Mfg. Co., 40 Voice Rd., Carle Place, N. Y.
King Laboratories, Inc., 127 Solar St., Syracuse, N. Y.
Kirchberger, M., & Co., Inc., 250 Humphrey St., Englewood, N. J.
Lancaster Glass Corp., 220-226 W. Main St., Lancaster, Ohio
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Matthey Bishop, Inc., Malvern, Pa.
Micacraft Products, Inc., 49-51 Liberty St., Newark, N. J.
National Electronics, Inc., Box 269, Geneva, Ill.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
O'Hara Metal Products Co., 540 Brannan St., San Francisco, Calif.
Owens-Illinois, Inc., P.O. Box 1035, Toledo, Ohio
Philips Metalonics, 888 S. Columbus Ave., Mt. Vernon, N. Y.
R. I. Metpro, Inc., 139 Jefferson Blvd., Warwick, R. I.
Richland Glass Co., Inc., Richland, N. J.
S & S Optical Co., Inc., 7812 Stellhorn Rd., Ft. Wayne. Ind.
Semicon Assoc, Inc., P. O. Box 832, Lexington, Ky.
Staver Co., Inc., The, 41 No. Saxon Ave., Bay Shore, N. Y.
Superior Electronics Co., 474 Getty Ave., Clifton, N. J.
Superior Tube Co., Box 191, Norristown, Pa.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.

TUBE PULLERS—SEE PULLERS, TUBE

TUBE TESTERS—SEE TESTERS, TUBE

TUBES, BACKWARD WAVE

International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2914
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Alltronics of California, Inc., 841 Warrington Ave., Redwood City, Calif.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Klystronics, Inc., Box 534, Eatontown, N. J.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
S F D Labs., Inc., 800 Rahway Ave., Union, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

TUBES, BALLAST

Electronic Enterprises Inc., 65 Seventh Ave., Newark, N. J. ..... p 2905
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Amperite Co., Inc., 600 Palisade Ave., Union City, N. J.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Thermal Controls Inc., 75 Rutgers St., Belleville, N. J.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.

TUBES, BATTERY CHARGER

Gordos Corp., 250 Glenwood Ave., Bloomfield, N. J.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Electro-Standards Labs., Inc., 3560 Northwest 34th St., Miami, Fla.

English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.

TUBES, CATHODE-RAY, DATA-STORAGE

Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1190
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rauland Div., Zenith Radio Corp., 5610 W. Jarvis Ave., Chicago, Ill. p 1200
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208, 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Amperex Elctrn. Corp., Electro-Optical Devices Div., Providence Pike, Slatersville, R. I.
Bunker-Ramo Corp., 445 Fairfield Ave., Stamford, Conn.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft Co., Vacuum Tube Prods. Div., 2020 Oceanside Blvd., Oceanside, Cal.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Storage Tubes, 2020 Oceanside Blvd., Oceanside, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Union Elec. Corp., Elctrns. Div., Bloomington, Ill.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thomas Electronics, Inc., 100 Riverview Dr., Wayne, N. J.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.
Westinghouse Electric Intl. Co., 200 Park Ave., New York, N. Y.

TUBES, CATHODE-RAY, INSTRUMENT USE

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rauland Div., Zenith Radio Corp., 5610 W. Jarvis Ave., Chicago, Ill. p 1200
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208, 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Amperex Elctrn. Corp., Electro-Optical Devices Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
General Atronics Corp., Elctrn. Tube Div., 1200 E. Mermaid La., Phila., Pa.
Gilway Co., Electronics Div., Box 584, Newburyport, Mass.
Glidden-Durkee Div., 900 Union Commerce Bldg., Cleveland, Ohio
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Storage Tubes, 2020 Oceanside Blvd., Oceanside, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
National Union Elec. Corp., Elctrns. Div., Bloomington, Ill.
Rayonic Corp., 1934 E. Hagert St., Philadelphia, Pa.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomas Electronics, Inc., 100 Riverview Dr., Wayne, N. J.
Ultra-Courtland Mfg. Corp., 153 Pearl St., Paterson, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.

TUBES, CATHODE-RAY, MULTIPLE GUN

Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1190
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rauland Div., Zenith Radio Corp., 5610 W. Jarvis Ave., Chicago, Ill. p 1200
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208, 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Albion Optical Co. Inc., 260 N. Rte. 303, Box 463, W. Nyack, N. Y.
Amperex Elctrn. Corp., Electro-Optical Devices Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
General Atronics Corp., Elctrn. Tube Div., 1200 E. Mermaid La., Phila., Pa.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Storage Tubes, 2020 Oceanside Blvd., Oceanside, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Rayonic Corp., 1934 E. Hagert St., Philadelphia, Pa.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.

TUBES, CATHODE-RAY, PROJECTION

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1190
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208, 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Albion Optical Co. Inc., 260 N. Rte. 303, Box 463, W. Nyack, N. Y.
Amperex Elctrn. Corp., Electro-Optical Devices Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
General Atronics Corp., Elctrn. Tube Div., 1200 E. Mermaid La., Phila., Pa.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Storage Tubes, 2020 Oceanside Blvd., Oceanside, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thomas Electronics, Inc., 100 Riverview Dr., Wayne, N. J.

TUBES, CATHODE-RAY, SCAN CONVERSION

Rauland Div., Zenith Radio Corp., 5610 W. Jarvis Ave., Chicago, Ill. p 1201
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1209

TUBES, CATHODE-RAY, SHAPED-BEAM

Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1190
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208, 1209
Albion Optical Co. Inc., 260 N. Rte. 303, Box 463, W. Nyack, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
General Atronics Corp., Elctrn. Tube Div., 1200 E. Mermaid La., Phila., Pa.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft Co., Vacuum Tube Prods. Div., Storage Tubes, 2020 Oceanside Blvd., Oceanside, Calif.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.

TUBES, CATHODE-RAY, STUDIO OR THEATRE

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208, 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.

TUBES, DIODES, TEMPERATURE LIMITED

TUBES, CATHODE RAY, TV PICTURE & COLOR

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. . . . p 2902-2904
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rauland Div., Zenith Radio Corp., 5610 W. Jarvis Ave., Chicago, Ill. p 1200
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208, 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Rayonic Corp., 1934 E. Hagert St., Philadelphia, Pa.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thomas Electronics, Inc., 100 Riverview Dr., Wayne, N. J.
Ultra-Courtland Mfg. Corp., 153 Pearl St., Paterson, N. J.

TUBES, CERAMIC (ELECTRON)

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. . . . p 2902-2904
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. . . . . . p 2908
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn. . . . p 2912
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

TUBES, COUNTING

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. . . . p 2902-2904
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1182
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. . . . . . p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Okaya Electric Inds. Co., Ltd., 3-8-1 Chome, Shibuya, Shibuya-ku, Tokyo, Jap.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

TUBES, DIODE, TEMPERATURE LIMITED

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.

TUBES, DIODES (Cont'd)

Eimac, 301 Industrial Way, San Carlos, Calif.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thermosen Inc., 375 Fairfield Ave., Stamford, Conn.

TUBES, ELECTROMETER

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

TUBES, ELECTRON MULTIPLIER

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
DuMonf Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EMR Div., Box 223, Princeton, N. J.
EMR Photoelectric, EMR Div., Box 44, Princeton, N. J.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Hamamatsu TV Co. Ltd., 1126-Chino-cho,, Hamamatsu City, Shizuoka Pref., Japan
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

TUBES, FLASH

Illumination Inds. Inc., 610 Vaqueros, Sunnyvale, Calif. ..... p 1795
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
PEK, Inc., 825 E. Evelyn Ave., Sunnyvale, Calif.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

TUBES, FORWARD WAVE

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Alltronics of California, Inc., 841 Warrington Ave., Redwood City, Calif.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
S F D Labs., Inc., 800 Rahway Ave., Union, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.

TUBES, GAMMA RAY

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Development Lab., Inc., Box 7034, Kansas City, Mo.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Wood, N. Counter Lab, Inc., 1525 East 53rd St., Chicago, Ill.

TUBES, GAS

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1804, 1805
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electrons Co., 127 Sussex Ave., Newark, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Union Elec. Corp., Elctrns. Div., Bloomington, Ill.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.

TUBES, GEIGER-MUELLER

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Kahl Scientific Instr. Corp., P. O. Box 1166, El Cajon, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.
Nuclear Development Lab., Inc., Box 7034, Kansas City, Mo.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Nuclear Supplies, Box 312, Encino, Calif.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Wood, N. Counter Lab, Inc., 1525 East 53rd St., Chicago, Ill.

TUBES, GLOW OR DISCHARGE—SEE TUBES, GAS

TUBES, HOLLOW CATHODE, SPECTROSCOPIC

Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Hamamatsu TV Co. Ltd., 1126-Chino-cho,, Hamamatsu City, Shizuoka Pref., Japan
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

TUBES, IGNITRON

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2917
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
National Electronics, Inc., Box 269, Geneva, Ill.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

TUBES, IMAGE CONVERTER

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Rauland Div., Zenith Radio Corp., 5610 W. Jarvis Ave., Chicago, Ill. p 1201
Varo, Inc., Electron Devices Div., 2203 Walnut St., Garland, Tex. p 2918
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Amperex Elctrn. Corp., Electro-Optical Devices Div., Providence Pike, Slatersville, R. I.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
DuMonf Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EMR Div., Box 223, Princeton, N. J.
EMR Photoelectric, EMR Div., Box 44, Princeton, N. J.
Electro-Optical Systems, A Xerox Co., Pasadena, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Enthone, Inc., Box 1900, New Haven, Conn.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Hamamatsu TV Co. Ltd., 1126-Chino-cho,, Hamamatsu City, Shizuoka Pref., Japan
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Varo General, Garland Bank Bldg., Garland, Tex.
Varo, Inc., Electron Devices Div., 2203 Walnut St., Garland, Tex.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.

TUBES, INDICATOR

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1180
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 806
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Mura Corporation, 355 Great Neck Rd., Great Neck, N. Y.
Okaya Electric Inds. Co., Ltd., 3-8-1 Chome, Shibuya, Shibuya-ku, Tokyo, Jap.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thomas Electronics, Inc., 100 Riverview Dr., Wayne, N. J.

TUBES, INDUSTRIAL POWER

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
Electronic Enterprises Inc., 65 Seventh Ave., Newark, N. J. ..... p 2905
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn. ... p 2912
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2916
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electrons Co., 127 Sussex Ave., Newark, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
General Electronics, Inc., 42 Spring St., Newark, N. J.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.

ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Electronics, Inc., Box 269, Geneva, Ill.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
United Elecrns. Co., 42 Spring St., Newark, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

TUBES, INFRARED

General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Varo, Inc., Electron Devices Div., 2203 Walnut St., Garland, Tex. p 2918
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Amperex Elctrn. Corp., Electro-Optical Devices Div., Providence Pike, Slatersville, R. I.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EMR Photoelectric, EMR Div., Box 44, Princeton, N. J.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Merco Prods. Co., Inc., 1298 Bethel Dr., Eugene, Ore.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varo, Inc., Electron Devices Div., 2203 Walnut St., Garland, Tex.

TUBES, IONIZATION

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2917
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Hughes Aircraft Co., Research Labs., 3011 Malibu Canyon Rd., Malibu, Cal.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.

TUBES, KLYSTRON

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2914
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Beam Tube Corp., 11 Beach St., Milford, Mass.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Klystronics, Inc., Box 534, Eatontown, N. J.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

TUBES, LASER

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Coleman Instruments, 42 Madison St., Maywood, Ill.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
Edwin Inds. Corp., 11933 Tech Rd., Silver Spring, Md.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro Optics Assocs., 974 Commercial Ave., Palo Alto, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Jodon Engineering Assocs., 145 Enterprise Dr., Ann Arbor, Mich.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Optics Technology, Inc., 901 Calif. Ave., Palo Alto, Calif.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
University Laboratories, Inc., 733 Allston Way, Berkeley, Calif.
Xenon Corp., 39 Commercial St., Medford, Mass.

TUBES, MAGNETRON

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2914
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Kriss Electronics, Inc., 169 Lake St., Upper Saddle River, N. J.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
S F D Labs., Inc., 800 Rahway Ave., Union, N. J.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Technology Instr. Corp., 850 Lawrence Dr., Newbury Pk., Calif.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

TUBES, MICROWAVE

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn. .... p 2912
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2914
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J. ..... p 1805
Alltronics of California, Inc., 841 Warrington Ave., Redwood City, Calif.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Klystronics, Inc., Box 534, Eatontown, N. J.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.

TUBES, PRINTER

Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
S F D Labs., Inc., 800 Rahway Ave., Union, N. J.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Traveling Wave Tube Div., 611 Hansen Way, Palo, Alto, Cal.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

TUBES, NOISE SOURCE

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2914
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Waveline Inc., Box 718, West Caldwell, N. J.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
S F D Labs., Inc., 800 Rahway Ave., Union, N. J.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.

TUBES, PENCIL

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.

TUBES, PHOTOMULTIPLIER

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EMR Div., Box 223, Princeton, N. J.
EMR Photoelectric, EMR Div., Box 44, Princeton, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Hamamatsu TV Co. Ltd., 1126-Chino-cho,, Hamamatsu City, Shizuoka Pref., Japan
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

TUBES, PIRANI—SEE GAUGES, PIRANI

TUBES, PRINTER

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.

TUBES, PRINTER (Cont'd)

English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Environmental Container Systems, Box 337, Union City, Calif.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Ultra-Courtland Mfg. Corp., 153 Pearl St., Paterson, N. J.

TUBES, RADIATION DETECTION

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. ... p 2902-2904
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1208
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Nuclear Development Lab., Inc., Box 7034, Kansas City, Mo.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Nuclear Supplies, Box 312, Encino, Calif.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.
Reactor Controls Inc., Box 427, Oak Ridge, Tenn.
Wood, N. Counter Lab, Inc., 1525 East 53rd St., Chicago, Ill.

TUBES, READOUT (CRT: COLD-CATHODE: VACUUM FLURESCENT: ETC.)

Alco Electronic Products Inc., Box 1348, Lawrence, Mass. ..... p 1178
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. ... p 2902-2904
Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J. p 1180, 1181
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y.
Industrial Electronic Engineers Inc., 7720 Lemona Ave., Van Nuys, Calif. p 1190
Integrated Circuit Elctrns., Inc., 237 Riverview Ave., Newton, Mass. p 1193
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass. p 1199, 1634
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn. .... p 806
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 1206
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Baird-Atomic, Inc., 33 University Rd., Cambridge, Mass.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft Co., Vacuum Tube Prods. Div., 2020 Oceanside Blvd., Oceanside, Cal.
Integrated Circuit Elctrn. Inc., Box 647, Waltham, Mass.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thomas Electronics, Inc., 100 Riverview Dr., Wayne, N. J.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

TUBES, RECEIVING

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. ... p 2902-2904
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Sampson Electronic Products Div., 2244 S. Western Ave., Chicago, Ill.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

TUBES, RECTIFYING, GAS FILLED

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. ... p 2902-2904
Electronic Enterprises Inc., 65 Seventh Ave., Newark, N. J. ..... p 2905
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
Gordos Corp., 250 Glenwood Ave., Bloomfield, N. J.
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Schauer Mfg. Corp., 4516 Alpine Ave., Cincinnati, Ohio
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2917
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electrons Co., 127 Sussex Ave., Newark, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
General Electronics, Inc., 42 Spring St., Newark, N. J.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Electronics, Inc., Box 269, Geneva, Ill.
National Union Elec. Corp., Elctrns. Div., Bloomington, Ill.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
United Elecrns. Co., 42 Spring St., Newark, N. J.

TUBES, RECTIFYING, VACUUM

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. ... p 2902-2904
Electronic Enterprises Inc., 65 Seventh Ave., Newark, N. J. ..... p 2905
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn. .... p 2912
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2917
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Comet Co., Waldeggstr. 72, 3097 Liebefeld, Switzerland
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Eureka X-Ray Tube Corp., 3250 N. Kilpatrick Ave., Chicago, Ill.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
General Electronics, Inc., 42 Spring St., Newark, N. J.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Klystronics, Inc., Box 534, Eatontown, N. J.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
United Elecrns. Co., 42 Spring St., Newark, N. J.

TUBES, SCINTILLATION

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EMR Photoelectric, EMR Div., Box 44, Princeton, N. J.
ITT Electron Tube, Box 100, Easton, Pa.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Packard Instrument Co., Inc., 2200 Warrenville Rd., Downers Grove, Ill.

TUBES, STROBE—SEE LIGHTS, STROBOSCOPIC

TUBES, SWITCHING

Burroughs Corp., Elctrn. Comp. Div., Box 1226, Plainfield, N. J.
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn. ... p 2912
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2916
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Weltronic Co., 19500 W. Eight Mile Rd., Southfield, Mich.

TUBES, TV CAMERA PICKUP

Cleveland Elctrns., Inc., 2000 Highland Rd., Twinsburg, Ohio ... p 726
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa. p 1209
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Amperex Elctrn. Corp., Electro-Optical Devices Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Electronics Homes Co., 200 Claremont Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
GBC Closed Circuit Corp., 74 5th Ave., New York, N. Y.
Hamamatsu TV Co. Ltd., 1126 Chino-cho,, Hamamatsu City, Shizuoka Pref., Japan
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Shibaden Corp. of America, 58-25 Brooklyn-Queens Expwy., Woodside, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Sylvania Electric Prods. Inc., Elctrn. Tube Div., Seneca Falls, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

TUBES, THYRATRON

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. ... p 2902-2904
Electronic Enterprises Inc., 65 Seventh Ave., Newark, N. J. ..... p 2905
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2916
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EG & G, Inc., 160 Brookline Ave., Boston, Mass.
EG & G, Inc., Elctrn. Prods. Div., 160 Brookline Ave., Boston, Mass.
Electrons Co., 127 Sussex Ave., Newark, N. J.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Electronics, Inc., Box 269, Geneva, Ill.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

TUBES, TRANSMIT-RECEIVE (TR)

International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Lewis & Kaufman, Ltd., Box 337, Los Gatos, Calif.
Metcom, Inc., 76 Lafayette St., Salem. Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
Unity Electronics, 107 Trumbull St., Elizabeth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

TUBES, TRANSMITTING

Electronic Enterprises Inc., 65 Seventh Ave., Newark, N. J. ..... p 2905
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn. ... p 2912
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.

Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2916, 2917
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Fairchild DuMont Electron Tubes, 750 Bloomfield Ave., Clifton, N. J.
General Electronics, Inc., 42 Spring St., Newark, N. J.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
JSH Electronics Co., 8549 Higuera St., Culver City, Cal.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Penta Labs., 722 E. Gutierrez St., Santa Barbara, Calif.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
State Labs, Inc., 215 Park Ave., S., New York, N. Y.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.
United Elecrns. Co., 42 Spring St., Newark, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Traveling Wave Tube Div., 611 Hansen Way, Palo, Alto, Cal.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

TUBES, TRAVELING WAVE AMP.

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla. p 2914
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Alltronics of California, Inc., 841 Warrington Ave., Redwood City, Calif.
American Radio Co., Inc., 445 Park Ave., New York, N. Y.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., Torrance, Calif.
ITT Electron Tube, Box 100, Easton, Pa.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, Cal.
Microwave Assocs., Northwest Ind. Park, Burlington, Mass.
Microwave Elctrn., 3165 Porter Dr., Palo Alto, Cal.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sperry Electronic Tube Div., Sperry Rand Corp., Gainesville, Fla.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thomson Elec. Co., Inc., 50 Rockefeller Plaza, New York, N. Y.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Traveling Wave Tube Div., 611 Hansen Way, Palo, Alto, Cal.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

TUBES, ULTRAVIOLET

Amersil, Inc., 685 Ramsey Ave., Hillside, N. J. ..... p 1638
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Whittaker Corp., Gencom Div., 80 Express St., Plainview, N. Y.
Abtronics, Inc., Box 712, Livermore, Calif.
Amperex Elctrn. Corp., Electro-Optical Devices Div., Providence Pike, Slatersville, R. I.
Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Cetron Elctrn. Corp., 715 Hamilton St., Geneva, Ill.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
EMR Div., Box 223, Princeton, N. J.
EMR Photoelectric, EMR Div., Box 44, Princeton, N. J.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Ikor, Inc., N. W. Industrial Pk., Burlington, Mass.
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, Ill.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Xenon Corp., 39 Commercial St., Medford, Mass.

TUBES, VIDICON—SEE TUBES, TELEVISION CAMERA PICKUP

TUBES, VOLTAGE REFERENCE OR REGULATING

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
General Electric Co., Elctrn. Comp. Sales Oper., 1 River Rd., Schenectady, N. Y. p 2906
International Elctrns. Corp., I.E.C. Comp., 316 S. Service Rd., Melville, N. Y.
International Elctrn., Mullard Electron Tubes, 316 S. Service Rd., Huntington Sta., N. Y. ..... p 2908
RCA Elctrn. Components, 415 South 5th St., Harrison, N. J.
Raytheon Co., Ind. Components Oper., 465 Centre St., Quincy, Mass.
Signalite, Inc., 1933 Heck Ave., Neptune, N. J.
Victoreen Instr. Div., 10101 Woodland Ave., Cleveland, Ohio
Wagner Electric Corp., Tung-Sol Div., 630 W. Mt. Pleasant Ave., Livingston, N. J. p 2915
Westinghouse Elec. Corp., Comp. & Materials, 3 Gateway Ctr., Pittsburgh, Pa.
Westinghouse Elec. Corp., Electronic Tube Div., Box 284, Elmira, N. Y. p 2916, 2917
Amperex Elctrn. Corp., Semiconductor & Microcircuits Div., Providence Pike, Slatersville, R. I.
Calvert Electronics, Inc., 220 East 23rd St., New York, N. Y.
Corvair Electronics, Inc., 150 Fifth Ave., New York, N. Y.
Dutrex Ind. Inc., 150 Fifth Ave., New York, N. Y.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Heintz & Kaufman, Ltd., 3650 Hayden Ave., Culver City, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National Union Elec. Corp., Elctrns. Div., Bloomington, Ill.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Telefunken Sales Corp., South St., Garden City, N. Y.
Thor Electronics Corp., 741 Livingston St., Elizabeth, N. J.

TUBES, X-RAY

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y. .... p 2902-2904
Machlett Laboratories Inc., 1063 Hope St., Stamford, Conn. ... p 2912
Syracuse Electronics Corp., P.O. Box 566, Syracuse, N. Y.
Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Abtronics, Inc., Box 712, Livermore, Calif.
Comet Co., Waldeggstr. 72, 3097 Liebefeld, Switzerland
Eureka X-Ray Tube Corp., 3250 N. Kilpatrick Ave., Chicago, Ill.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
Warnecke Electron Tubes, 175 W. Oakton St., Des Plaines, Ill.

TUBING, ALUMINUM

Uniform Tubes Inc., Collegeville, Pa.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Metal Climax, Inc., 1270 Ave. of The Americas, N.Y., N.Y.
Blum, J. & Co., Inc., Box 292, Carlstadt, N. J.
LaPointe Inds., Inc., 155 W. Main St., Rockville, Conn.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

TUBING, ASBESTOS

Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Abesto Corp., Ackerman St., Bloomfield, N. J.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Flexco Div., 6855 Suva St., Bell Gardens, Calif.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Plastics Corp., 55 La France Ave., Bloomfield, N. J.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUBING, BRASS

Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa.
Uniform Tubes Inc., Collegeville, Pa.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Blum, J. & Co., Inc., Box 292, Carlstadt, N. J.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Chase Brass & Copper Co., 20600 Chagrin Blvd., Cleveland, Ohio
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Helenor Metals Corp., 60 Marbledale Rd., Tuckahoe, N. Y.
Janney Cylinder Co., 7401 State Rd., Philadelphia, Pa.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Smith, J. A. Co., Boyertown, Pa.

TUBING, CERAMIC

American Feldmuehle Corp., Box 2160, Glenbrook, Conn. ..... p 1576
American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn. p 1575
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J. ..... p 1577
Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. .. p 1578
Centralab Elctrn., Div., 5757 N. Green Bay Ave., Milwaukee, Wisc.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Consolidated Ceramics & Metalizing Corp., Box 352, Flemington, N. J.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Diamonite Products Mfg. Co., Div. U. S. Ceramic Tile Co., Shreve, Ohio
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Duramic Products, Inc., 430 Commercial Ave., Palisades Park, N. J.
Electrical Refractories Co., 50 E. Clark St., E. Palestine, Ohio
Ferro Corp., Electro Refractories Div., Box 781, E. Liverpool, Ohio
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
Kirchberger, M., & Co., Inc., 250 Humphrey St., Englewood, N. J.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
National Ceramic Co., 500 Southard St., Trenton, N. J.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Porcelain Products Co., 225 N. Patterson St., Carey, Ohio
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Rosenthal China Corp., 411 East 76th St., New York, N. Y.
Star Porcelain Co., 71 Muirhead Ave., Trenton, N. J.
Steward, D. M., Mfg. Co., East 36th St., Chattanooga, Tenn.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
3M Co., 3M Center, St. Paul, Minn.

TUBING, FLUOROCARBON, FLEXIBLE

Union Carbide Corp., Carbon Prods. Div., 270 Park Ave., New York, N. Y.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Zircoa, (Zirconium Corp. of America), Box 39217, Solon, Ohio

TUBING, COLUMBIUM

Uniform Tubes Inc., Collegeville, Pa.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Superior Tube Co., Box 191, Norristown, Pa.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

TUBING, COPPER

Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa.
Uniform Tubes Inc., Collegeville, Pa.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Chase Brass & Copper Co., 20600 Chagrin Blvd., Cleveland, Ohio
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Okonite Co., 220 Passaic St., Passaic, N. J.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Smith, J. A. Co., Boyertown, Pa.

TUBING, FABRIC—ALSO SEE TUBING, SPAGHETTI

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
General Plastics Corp., 55 La France Ave., Bloomfield, N. J.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Westline Products, 220 S. Rose St., Los Angeles, Calif.

TUBING, FIBER

Carborundum Co. Elctrns Plant, Box 339, Niagara Falls, N. Y. .. p 1578
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Abesto Corp., Ackerman St., Bloomfield, N. J.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
Paramount Inds., Inc., 1430 Progress Rd., Ft. Wayne, Ind.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Westinghouse Electric Corp., Industrial Plastics Div., 1585 Lebanon School Rd., W. Mifflin, Pa.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUBING, FLUOROCARBON, FLEXIBLE

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Smith, H. H., Inc., 812 Snediker Ave., Brooklyn, N. Y.
Zeus Industrial Products, Inc., 195 Nassau St., Princeton, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Adam Spence Corp., 3856 Park Ave., Edison, N. J.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brand-Rex Div., Box 498, Willimantic, Conn.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
General Plastics Corp., 55 La France Ave., Bloomfield, N. J.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUBING, FUSED QUARTZ

TUBING, FUSED QUARTZ

Amersil, Inc., 685 Ramsey Ave., Hillside, N. J. ..... p 1638
Basic Ceramics Inc., 221 Seventh Ave., Hawthorne, N. J.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Garner Glass Co., 177 S. Indian Hill, Claremont, Calif.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France
Quartzite Processing, Inc., 6 Holyoke St., Malden, Mass.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Thermal American Fused Quartz Co.,
Rte. 202 & Change Bridge Rd., Montville, N. J.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Xenon Corp., 39 Commercial St., Medford, Mass.

TUBING, GLASS FIBER INSULATION

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. ... p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Markel, L. Frank, & Sons, School La., Norristown, Pa. .... p 1585, 2957
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport. N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
C/P Corp., RFD 3, Newberry, S. C.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Johns-Manville Sales Corp., 22 East 40th St., New York, N. Y.
Laminated Fabricators, 1145 San Mateo Ave., San Bruno, Calif.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUBING, GLASS, PRECISION

G T I Corporation, 310 Chestnut St., Meadville, Pa.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio p 1584
Corning Glass Works, Laboratory Prods. Dept., Corning, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Fischer & Porter Co., 115 Warminster Rd., Warminster, Pa.
Garner Glass Co., 177 S. Indian Hill, Claremont, Calif.
Jenaer Glaswerk Schott & Gen. Inc., 200 Park Ave., New York, N. Y.
Owens-Illinois, Inc., P.O. Box 1035, Toledo, Ohio
Richland Glass Co., Inc., Richland, N. J.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Wilmad Glass Co., Inc., Buena, N. J.

TUBING, HEAT SHRINKABLE—ALSO SEE CAPS, FORMS & TAPES, HEAT SHRINKABLE

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1639, 1640
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. ... p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Dow Corning Corp., Midland, Mich.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Zeus Industrial Products, Inc., 195 Nassau St., Princeton, N. J. p 1589
Abesto Corp., Ackerman St., Bloomfield, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemelec Products Inc., 8 Fellowship Rd., Cherry Hill, N. J.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Plastics Corp., 55 La France Ave., Bloomfield, N. J.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rayclad Tubes, Inc., 300 Constitution Dr., Menlo Park, Calif.
Rehau Plastiks, Inc., 50-22 49th St., Woodside, N. Y.
Resin Formulators Co., 9601 Jefferson Blvd., Culver City, Cal.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
3M Co., 3M Center, St. Paul, Minn.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUBING, MAGNESIUM

Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Dow Chemical Co., Midland, Mich.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

TUBING, METAL—SEE TUBING, BRASS: TUBING, COPPER: ETC.

TUBING, METAL ALLOY

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa.
Uniform Tubes Inc., Collegeville, Pa.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Armco Steel Corp., 703 Curtis St., Middletown, Ohio
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
Cerro Corp., 300 Park Ave., New York, N. Y.
Chase Brass & Copper Co., 20600 Chagrin Blvd., Cleveland, Ohio
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Division Lead Co., 7742 West 61st Pl., Summit, Ill.
Dow Chemical Co., Midland, Mich.
Extrudonics Inc., 1002 Jersey Ave., New Brunswick, N. J.
Huntington Alloy Prods Div., Guyan River Rd., Huntington, W. Va.
Janney Cylinder Co., 7401 State Rd., Philadelphia, Pa.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Ohio Steel Tube, Div. Copperweld Steel Co., Shelby, Ohio
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Republic Steel Corp., Box 6778, Cleveland, Ohio
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Superior Tube Co., Box 191, Norristown, Pa.
3M Co., 3M Center, St. Paul, Minn.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

TUBING, METAL HOSE, FLEXIBLE

Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Flexaust Co., 277 Park Ave., New York, N. Y.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Titeflex, Inc., Hendee St., Springfield, Mass.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.

TUBING, MICA

Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1225
American Mica Insulation Co., Manasquan, N. J.
Asheville-Schoonmaker Mica Co., 900 Jefferson Ave., Newport News, Va.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Cleveland Mica Co., 1360 Hird Ave., Lakewood, Ohio
Mica Fabricating Co., 53 Central Ave., Rochelle Park, N. J.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
3M Co., 3M Center, St. Paul, Minn.

TUBING, MOLYBDENUM

Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Rembar Co., Inc., 67 Main St., Dobbs Ferry, N. Y.
Superior Tube Co., Box 191, Norristown, Pa.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
3M Co., 3M Center, St. Paul, Minn.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

TUBING, MONEL

Uniform Tubes Inc., Collegeville, Pa.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Huntington Alloy Prods Div., Guyan River Rd., Huntington, W. Va.
Janney Cylinder Co., 7401 State Rd., Philadelphia, Pa.
Matthey Bishop, Inc., Malvern, Pa.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Superior Tube Co., Box 191, Norristown, Pa.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

TUBING, MYLAR

Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
American Mica Insulation Co., Manasquan, N. J.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
3M Co., 3M Center, St. Paul, Minn.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUBING, NICKEL

Precision Tube Co. Inc., Church Rd. & Wissahickon Ave., N. Wales, Pa.
Tohoku Metal Inds., Ltd., 13-10, 7-Chome, Ginza-Chuo-ku, Tokyo, Japan
Uniform Tubes Inc., Collegeville, Pa.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Huntington Alloy Prods Div., Guyan River Rd., Huntington, W. Va.
Janney Cylinder Co., 7401 State Rd., Philadelphia, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N. J.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Russell Inds., Inc., 96 Station Plaza, Lynbrook, N. Y.
Smith, J. A. Co., Boyertown, Pa.
Superior Tube Co., Box 191, Norristown, Pa.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

TUBING, NYLON—ALSO SEE TUBING, SPAGHETTI

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. ... p 2935
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 1585
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Abesto Corp., Ackerman St., Bloomfield, N. J.
Adam Spence Corp., 3856 Park Ave., Edison, N. J.
American Mica Insulation Co., Manasquan, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Moore, Samuel & Co., Mantua, Ohio
New England Tape Co., 30 Tower St., Hudson, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Westline Products, 220 S. Rose St., Los Angeles, Calif.

TUBING, PAPER

Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
American Mica Insulation Co., Manasquan, N. J.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Jonesville Paper Tube Corp., 474 Beck Rd., Jonesville, Mich.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Paramount Inds., Inc., 1430 Progress Rd., Ft. Wayne, Ind.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.

TUBING, PHENOLIC

ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. .... p 1587
Abesto Corp., Ackerman St., Bloomfield, N. J.
Ace Plastic Co., Inc., 91-54 Van Wyck Expwy., Jamaica, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
American Mica Insulation Co., Manasquan, N. J.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Edal Industries, Inc., 4 Short Beach Rd., E. Haven, Conn.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric Co., Laminated Products Dept., Coshocton, Ohio
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
NVF Co., Maryland Ave. & Beech St., Wilmington, Del.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Panelyte Industrial Div., Enterprise Ave., Trenton, N. J.
Paramount Inds., Inc., 1430 Progress Rd., Ft. Wayne, Ind.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Red Seal Electric Co., 3835 West 150th St., Cleveland, Ohio
Resdel Corp., Box 2171, Rio Grande, N. J.

Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Richardson Co., 2640 Lake St., Melrose Pk., Ill.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.

TUBING, PLASTIC—ALSO SEE TUBING, SPAGHETTI

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. . . . . . p 2953
Markel, L. Frank, & Sons, School La., Norristown, Pa. . . p 1585, 2957
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. . . . . . p 1586
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. . . . . p 1587
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Varflex Corp., 514 W. Court St., Rome, N. Y. . . . . . p 1588
Zeus Industrial Products, Inc., 195 Nassau St., Princeton, N. J. p 1589
Abesto Corp., Ackerman St., Bloomfield, N. J.
Ace Plastic Co., Inc., 91-54 Van Wyck Expwy., Jamaica, N. Y.
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Adam Spence Corp., 3856 Park Ave., Edison, N. J.
American Mica Insulation Co., Manasquan, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Blum, J. & Co., Inc., Box 292, Carlstadt, N. J.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brand-Rex Div., Box 498, Willimantic, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Celluplastics, Inc., Sub. Brockway Glass Co., Brockway, Pa.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Plastics Corp., 55 La France Ave., Bloomfield, N. J.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Moore, Samuel & Co., Mantua, Ohio
New England Tape Co., 30 Tower St., Hudson, Mass.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Okonite Co., 220 Passaic St., Passaic, N. J.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Rehau Plastiks, Inc., 50-22 49th St., Woodside, N. Y.
Resdel Corp., Box 2171, Rio Grande, N. J.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.
Taylor Electric, Inc., Fisher Rd., Howell, Mich.
3M Co., 3M Center, St. Paul, Minn.
Titeflex, Inc., Hendee St., Springfield, Mass.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUBING, PLATINUM

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Uniform Tubes Inc., Collegeville, Pa.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

TUBING, PORCELAIN

Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Du-Co Ceramics Co., Box 278, Saxonburg, Pa.
Ferro Corp., Electro Refractories Div., Box 781, E. Liverpool, Ohio
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Porcelain Products Co., 225 N. Patterson St., Carey, Ohio
Star Porcelain Co., 71 Muirhead Ave., Trenton, N. J.
Thermal American Fused Quartz Co., Rte. 202 & Change Bridge Rd., Montville, N. J.
3M Co., 3M Center, St. Paul, Minn.

TUBING, PRECIOUS METAL

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Uniform Tubes Inc., Collegeville, Pa.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Handy & Harman, 850 3rd Ave., New York, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

TUBING, REFRACTORY METAL

Uniform Tubes Inc., Collegeville, Pa.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Matthey Bishop, Inc., Malvern, Pa.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

TUBING, RUBBER, NATURAL & SYNTHETIC

Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Varflex Corp., 514 W. Court St., Rome, N. Y. . . . . . p 1588
Abesto Corp., Ackerman St., Bloomfield, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City, N. Y.
Atlantic India Rubber Co., 571 W. Polk St., Chicago, Ill.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Continental Rubber Works, Sub. Continental Copper & Steel, Erie, Pa.
Darling, R. E., Co., Inc., Box 666, Gaithersburg, Md.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Goodrich, B. F. Industrial Products Co., 500 S. Main St., Akron, Ohio
Groendyk Mfg. Co., Inc., P.O. Box 278, Buchanan, Va.
Hecht Rubber Corp., 482-484 Riverside Ave., Jacksonville, Fla.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Kirkhill Rubber Co., 300 E. Cypress St., Brea, Calif.
Minisink Rubber Co., Inc., 2 Orange County, Unionville, N. Y.
Minor Rubber Co., Inc., 69 Ackerman St., Bloomfield, N. J.
National Gasket & Washer Corp., 124 East 25 St., New York, N. Y.
Nelson Vacuum Pump Co., 2133 4th St., Berkeley, Calif.
Pelmor Labs, Inc., 401 Lafayette St., Newtown, Pa.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Stalwart Rubber Co., 377 Northfield Rd., Bedford, Ohio
Stevens Products Inc., 128 N. Park St., East Orange, N. J.
Titeflex, Inc., Hendee St., Springfield, Mass.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.

TUBING, SHRINKABLE—SEE TUBING, HEAT SHRINKABLE

TUBING, SPAGHETTI

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. . . . . . p 2953
Markel, L. Frank, & Sons, School La., Norristown, Pa. . . p 1585, 2957
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Varflex Corp., 514 W. Court St., Rome, N. Y. . . . . . p 1588
Zeus Industrial Products, Inc., 195 Nassau St., Princeton, N. J. p 1589
Abesto Corp., Ackerman St., Bloomfield, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Adam Spence Corp., 3856 Park Ave., Edison, N. J.
American Mica Insulation Co., Manasquan, N. J.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brand-Rex Div., Box 498, Willimantic, Conn.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Fluoro Plastics Inc., G & Venango Sts., Philadelphia, Pa.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.

TUBING,

Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Sparta Mfg. Co., Dover, Ohio
Star Porcelain Co., 71 Muirhead Ave., Trenton, N. J.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Superior Continental Corp., Box 489, Hickory, N. C.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Titeflex, Inc., Hendee St., Springfield, Mass.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

TUBING, SPIRAL WRAP

AMP Incorporated, Box 3608, Harrisburg, Pa.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. . . . . . p 2953
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill.
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. . . . . . p 1225
Precision Paper Tube Co., 1033 S. Noel Ave., Wheeling, Ill. . . . . p 1587
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Abesto Corp., Ackerman St., Bloomfield, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Budd Co., 2450 Hunting Park Ave., Philadelphia, Pa.
Budd Co., Polychem Div., 70 S. Chapel St., Newark, Del.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Fabritron, Inc., 11650 Genesee St., Alden, N. Y.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Higbie Mfg. Co., Wagner Rd., Rochester, Mich.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Maynard Plastics Inc., 49 Congress St., Salem, Mass.
Newman, M. M. Corp., 85 Clifton Ave., Marblehead, Mass.
Paramount Inds., Inc., 1430 Progress Rd., Ft. Wayne, Ind.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Resinite Corp., 1047 S. Noel Ave., Wheeling, Ill.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Stone Industrial Corp., 900 Franklin St., N. E., Washington, D. C.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.

TUBING, TANTALUM

Uniform Tubes Inc., Collegeville, Pa.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Superior Tube Co., Box 191, Norristown, Pa.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

TUBING, TFE—ALSO SEE TUBING, SPAGHETTI

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Dielectrix Corp., 69 Allen Blvd., Farmingdale, N. Y. . . . . . p 1579
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. . . . . . p 2953
Markel, L. Frank, & Sons, School La., Norristown, Pa.
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. . . . . p 2966
Zeus Industrial Products, Inc., 195 Nassau St., Princeton, N. J. p 1589
Abesto Corp., Ackerman St., Bloomfield, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Adam Spence Corp., 3856 Park Ave., Edison, N. J.

TUBING, TFE (Cont'd)

Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brand-Rex Div., Box 498, Willimantic, Conn.
Brandywine Fibre Prods. Co., 1501 Popular St., Wilmington, Dela.
Central Plastics Dists. Co., 527 S. Wells St., Chicago, Ill.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Dixon Corp., Metacom Ave., Bristol, R. I.
Electrical Insulation Co., Inc., 1245 Marconi Blvd., Copiague, N. Y.
Electronized Chemical Corp., S. Bedford St., Burlington, Mass.
Fluoro Plastics Inc., G & Venango Sts., Philadelphia, Pa.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Plastics Corp., 55 La France Ave., Bloomfield, N. J.
General Scientific Equip. Co., Limekiln Pike & Williams Ave., Phila., Pa.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Icore Electro-Plastics, Inc., 1050 Kifer Rd., Sunnyvale, Calif.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
Insulating Fabricators, Inc., 150 Union Ave., E. Rutherford, N. J.
Jodee Plastics, Inc., 9903 Foster Ave., Brooklyn, N. Y.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Long, T. J., Inc., 215 Stonehinge La., Carle Place, N. Y.
Norrich Plastics Corp., 206 Babylon Tpke., Roosevelt, N. Y.
Plastic Associates, Inc., 60 Inip Dr., Inwood, N. Y.
Polymer Corp., 2120 Fairmont Ave., Reading, Pa.
Port Plastics, Inc., 8037 E. Slauson, Montebello, Calif.
Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Royal Inds., 2051 E. Maple Ave., El Segundo, Calif.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
Shamban, W. S. & Co., 11543 W. Olympic Blvd., Los Angeles, Calif.
Sparta Mfg. Co., Dover, Ohio
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
3M Co., 3M Center, St. Paul, Minn.
Titeflex, Inc., Hendee St., Springfield, Mass.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Tri-Tech of Florida, Inc., 3190 Tyrone Blvd. Box 12729, St. Petersburg, Fla.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUBING, TITANIUM

Uniform Tubes Inc., Collegeville, Pa.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Superior Tube Co., Box 191, Norristown, Pa.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
3M Co., 3M Center, St. Paul, Minn.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.

TUBING, TUNGSTEN

Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Fansteel Inc., One Tantalum Pl., N. Chicago, Ill.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Rembar Co., Inc., 67 Main St., Dobbs Ferry, N. Y.
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Thermo Electron Corp., 85 First Ave., Waltham, Mass.
3M Co., 3M Center, St. Paul, Minn.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

TUBING, VARNISHED CAMBRIC INSULATION —ALSO SEE TUBING, SPAGHETTI

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. . . . p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Varflex Corp., 514 W. Court St., Rome, N. Y. . . . . . p 1588
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
B & C Insulation Prods., Inc., 490 Lincoln Hwy., Iselin, N. J.
Bentley-Harris Mfg. Co., 1050 Colwell La., Conshohocken, Pa.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Brand-Rex Div., Box 498, Willimantic, Conn.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
3M Co., 3M Center, St. Paul, Minn.

TUBING, WAVEGUIDE

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Narda Microwave Corp., Plainview, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Uniform Tubes Inc., Collegeville, Pa.
Waveline Inc., Box 718, West Caldwell, N. J.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Allied Research & Engineering Co., 10300 Glasgow Pl., Los Angeles, Calif.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
American Radar Components, Inc., 415 E. Main St., Denville, N. J.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Superior Tube Co., Box 191, Norristown, Pa.

TUBING, ZIPPER

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. . . . . . p 2953
Metex Corp., 970 New Durham Rd., Edison, N. J. . . . . . p 1229
Brand Dielectrics, Inc., Rte. 203, N. Windham, Conn.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

TUNERS, MICROWAVE

Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Automation Development Co., 9905 W. Jefferson Blvd., Culver City, Calif.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. . . . . . p 1658
Frequency Engineering Labs, P.O. Box 527, Farmingdale, N. J.
LEL Div. Varian, 75 Akron St., Copiague, N. Y. . . . . . p 1681
Microwave Cavity Labs, Inc., 10 N. Beach Ave., La Grange, Ill. . . p 1687
Narda Microwave Corp., Plainview, N. Y.
Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. . . . . . p 1586
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
RHG Electronics Lab Inc., 94 Milbar Blvd., Farmingdale, N. Y.
RLC Electronics Inc., 25 Martin Pl., Port Chester, N. Y.
Waveline Inc., Box 718, West Caldwell, N. J.
Weinschel Engrg. Co. Inc., P.O. Box 577, Gaithersburg, Md.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Coax Devices, Inc., Box 234-EEM, Chelsea, Mass.
Collins Radio Co., Dallas, Texas
Communication Electronics, 6006 Executive Blvd., Rockville, Md.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Elpac RF/Microwave, 18651 Von Karman Ave., Irvine, Calif.
General Instrument Corp., Elctrn. Sys. Div., Andrews Rd., Hicksville, N. Y.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Polarad Elctrns. Instr., 34-02 Queens Blvd., Long Island City, N. Y.
Quantatron, 1631 Tenth St., Santa Monica, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Watkins-Johnson Co., 3333 Hillview, Palo Alto, Calif.

TUNERS, TV & FM

Heath Co., Dept. 180, Benton Harbor, Mich.
Mallory Timers Co., 3029 E. Washington St., Indianapolis, Ind.
Murata Mfg. Co., Nagaoka, Kyoto, Japan
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill.
Acoustech, 2227 N. 31 St., Milwaukee, Wisc.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Calbest Elctrns., 4801 Exposition Blvd., Los Angeles, Calif.
Davis, J. W. & Co., Box 35313, Dallas, Tex.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Gavin Instrs., Inc., Box 413, Somerville, N. J.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.
Koss Electronics, Inc., 2227 North 31st St., Milwaukee, Wisc.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Riemer, David Co., Inc., Box 112, N. Miami Beach, Fla.
Sherwood Electronic Labs., Inc., 4300 N. California Ave., Chicago, Ill.
Tech-Master Corp., 633-33 98 Pl., Forest Hills, N. Y.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Trutone Elctrns., Inc., 14660 Raymer St., Van Nuys, Calif.
Waller Corp., Ridgefield, Box 340, Crystal Lake, Ill.

TUNING FORKS

Accutronics, Inc., 628 North St., Geneva, Ill.
American Time Products, Bulova Watch Co., Inc., 61-20 Woodside Ave., Woodside, N. Y. . . . . . p 1082
Austron, Inc., 10214 N. Interregional Hwy., Austin, Tex.
Fork Standards Inc., 213 Main St., West Chicago, Ill.
Melpar, Inc., Special Products Dept., 7776 Arlington Blvd., Falls Church, Va.
Meson Elctrns., Inc., 380 Cottage St., Rochester, N. Y.
Murata Mfg. Co., Nagaoka, Kyoto, Japan . . . . . p 1125
Philamon Laboratories Inc., 90 Hopper St., Westbury, N. Y. p 1130, 1305, 1461
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Riverbank Labs., Dept. of Engrg., P. O. Box 65, Geneva, Ill.
Varo General, Garland Bank Bldg., Garland, Tex.

TURNTABLES, RECORDING & TRANSCRIPTION

Alcor, Inc., 215 S. Tioga St., Ithaca, N. Y.
Bogen Communications Div., Lear Siegler, Inc., Box 500, Paramus, N. J.
Collins Radio Co., Dallas, Texas
Elpa Mktg. Inds., Inc., Thorens & Atlantic Aves., New Hyde Park, N. Y.
Empire Scientific Corp., 1055 Stewart Ave., Garden City, N. Y.
Garrard, Div. British Inds., Westbury, N. Y.
Gotham Audio Corp., 2 West 46th St., New York, N. Y.
Gray Res. & Dev. Co., 150 Park Ave., E. Hartford, Conn.
Koss Electronics, Inc., 2227 North 31st St., Milwaukee, Wisc.
Ortofon Div., Thorens & Atlantic Aves., New Hyde Park, N. Y.
R. C. A. Brdcst & Comm. Prods., Front & Cooper Sts., Camden, N. J.
Rek-O-Kut Div., 2227 North 31st St., Milwaukee, Wisc.

TWEEZERS, HAND & VACUUM

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Telvac Instr. Co., 18531-E Ventura Blvd., Tarzana, Calif. . . . . . p 2834
Vernitron Electrical Components, 117 Union Ave., Laconia, N. H.
Air-Vac Engineering Co., Inc., 100 Gulf St., Milford, Conn.
Clauss Cutlery Co., P.O. Box 667, Freemont, Ohio
Compton, W. H., Shear Co., Box 1096 No. Sta., New Bedford, Mass.
E. T. M. Corp., 144 W. Chestnut Ave., Monrovia, Calif.
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Larsen Importing Co., 140 Nassau St., New York, N. Y.
Micro Tech Mfg., Inc., 703 Plantation St., Worcester, Mass.
Orbit Industries, Box 1444, San Luis Obispo, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Vigor Tool Co., 53 West 23 St., New York, N. Y.
X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City, N. Y.

TWISTERS, WIRE—SEE WIRE TWISTERS

TWISTS, WAVEGUIDE—SEE BENDS & TWISTS, MICROWAVE

TYPEWRITERS, INPUT-OUTPUT (ALL TYPES)

IBM Corp., Ind. Prods. Mktg., Dept. EEM, 1271 Ave. of Americas, New York, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Transistor Electronics Corp., Box 6191, Minneapolis, Minn.
Tyco Instrument Div., 16 Hickory Dr., Waltham, Mass.
Communitype Corp., 767 Fifth Ave., New York, N. Y.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Digitronics Corp., 1 Albertson Ave., Albertson, N. Y.
Friden Inc., 2350 Washington Ave., San Leandro, Calif.
Northern Scientific, Inc., 2551 W. Beltline, Middleton, Wisc.

ULTRASONIC BONDING MACHINES—SEE MACHINES, ULTRASONIC BONDING

ULTRASONIC CLEANERS—SEE CLEANERS, ULTRASONIC

ULTRASONIC EQUIP.—SEE AMPLIFIERS; ANALYZERS; CONTROLS; INDICATORS; SOLDERING EQUIP.; ETC.

ULTRASONIC GUNS

Advanced Patent Technology, Inc., 919 W. Bonanza Rd., Las Vegas, Nev.
Aerometrics, P.O. Box 216, San Ramon, Calif.
Delta Sonics, Inc., 12918 Cerise Ave., Hawthorne, Calif.
Marcal Electro-Sonics, P.O. Box 185, Burbank, Calif.

ULTRAVIOLET INSPECTION LIGHTING—ALSO SEE MICROSCOPES, ULTRAVIOLET

Atlantic Ultraviolet Corp., 24-10 40 Ave., Long Island City, N. Y.
Black Light Corp., 5114 Walnut Grove Ave., San Gabriel, Calif.
Black Light Eastern, 29 New York Ave., Westbury, N. Y.
Black Light Prods., Box 45278, Chicago, Ill.
Engelhard Hanovia, Inc., 100 Chestnut St., Newark, N. J.

Etchomatic, Inc., Box 444, Waltham, Mass.
Gaertner Scientific Corp., 1261A Wrightwood Ave., Chicago, Ill.
Gates, G. W. & Co., Inc., Hempstead Tpke. & Lucille Ave., Franklin Sq., N. Y.
Magnaflux Corp., 7328 W. Lawrence Ave., Chicago, Ill.
Oriel Optics Corp., 1 Market St., Stamford, Conn.
Schoeffel Instrument Corp., 24 Booker St., Westwood, N. J.
Shannon Luminous Matls Co., 7356 Santa Monica Blvd., Hollywood, Cal.
Stroblite Co., Inc., 75 West 45th St., New York, N. Y.
Sylvania Lighting Prods., Sylvania Electric Prods., Inc., Danvers, Mass.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.
Will Scientific, Inc., 39 Russell St., Rochester, N. Y.

ULTRAVIOLET SPECTROPHOTOMETERS—SEE SPECTROPHOTOMETERS

UNDERWATER COMMUNICATION, DETECTION, NAVIGATION, ETC. EQUIP.

AEL Inc., P.O. Box 552, Lansdale, Pa.
California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Ithaco Inc., 735 W. Clinton St., Ithaca, N. Y. ..... p 532
Kinelogic Corp., 873 S. Fair Oaks, Pasadena, Calif. ..... p 2161
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Tracor Inc., 6500 Tracor La., Austin, Texas
American Machine & Foundry Co., 1025 N. Royal St., Alexandria, Va.
Apelco Co., 213 E. Grand Ave., S. San Francisco, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bludworth Marine Div., 10 Adams St., Linden, N. J.
Bunker-Ramo Corp., 8433 Fallbrook Ave., Canoga Park, Calif.
Canoga Electronics Corp., 8966 Comanche, Chatsworth, Calif.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
E.M.I. Electronics Can., Ltd., Box 1005, Dartmouth, N.S., Can.
El-Rad Mfg. Co., 4300 N. California, Chicago, Ill.
Electro-Ceramics, Box 15096, Salt Lake City, Utah
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
General Instr. Corp., Harris ASW Div., 33 Southwest Pk., Westwood, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Gulton Inds. Inc., Research & Dev. Div., Metuchen, N. J.
Honeywell, Inc., Aerospace & Def. Grp., 2701 4th Ave. S., Minneapolis, Minn.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Integrated Elctrns. Corp., 900 Walt Whitman Rd., Huntington Sta., N. Y.
Isotopes, 50 Van Buren Ave., Westwood, N. J.
Johnston Labs., Inc., 3 Industry La., Cockeysville, Md.
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Lear Siegler, Inc., 3171 S. Bundy Dr., Santa Monica, Calif.
Lek-Trol, Inc., Rte. 2, Grapevine, Tex.
Linden Labs. Inc., Box 920, State College, Pa.
Massa Div., 280 Lincoln St., Hingham, Mass.
Mecca, P.O. Box 36393, Houston, Tex.
Nold, Walter Co., 24 Birch Rd., Natick, Mass.
Pickard & Burns Elctrns., 103 Fourth Ave., Waltham, Mass.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Communications Inc., 1680 University Ave., Rochester, N. Y.
RCA, Defense Elctrn. Prods., Marne Hwy., Morristown, N. J.
Raytheon Co., Government Marketing, 141 Spring St., Lexington, Mass.
Research Mfg. Corp., Box 6056, San Diego, Calif.
Ross Labs, Inc., 3138 Fairview Ave. E., Seattle, Wash.
Sanders Assocs., Inc., Ocean Sys. Div., Simon St., Nashua, N. H.
Scientific Research Instrs. Co., 700 Turner Rd., Richmond, Va.
Sparton Corp., 2400 E. Ganson St., Jackson, Mich.
Sperry Marine Sys. Div., Rte. 29 North & Hydraulic Rd., Charlottesville, Va.
Straza Industries, 790 Greenfield Dr. - P.O. Box 666, El Cajon, Calif.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Technical Material Corp., Box 142, Mamaroneck, N. Y.
Telex Communications Div., 9600 Aldrich Ave., S., Minneapolis, Minn.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Victor Comptometer Corp., 3900 N. Rockwell St., Chicago, Ill.
Westinghouse Elec. Corp., Defense Prods., Box 2278, Pittsburgh, Pa.
Wright Radio Co., 224 Beaver Dam, Scituate, Mass.
Zero Mfg. Co., 1121 Chestnut St., Burbank, Calif.

UREA FORMALDEHYDE—SEE PLASTIC RAW MATERIALS

VACUUM EQUIP., DEPOSITION—SEE DEPOSITION EQUIPMENT, VACUUM

VACUUM FLUORESCENT READOUT TUBES—SEE TUBES, READOUT

VACUUM INDICATORS—SEE INDICATORS, VACUUM

VACUUM PARTS—HANDLING TOOLS—SEE TOOLS, PARTS—HANDLING, VACUUM OPERATED

VACUUM-TUBE VOLTMETERS—SEE METERS, VACUUM-TUBE VOLT

VALVES, CRYOGENIC

Atkomatic Valve Co., Inc., Box 11258, Indianapolis, Ind.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Circle Seal Products Co., Inc., Box 3666, Anaheim, Calif.
Consolidated Controls Corps., 2338 Alaska Ave., El Segundo, Calif.
Essex Mfg. Co., Inc., 8213 Gravois, St. Louis, Mo.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Foxboro, Foxboro, Mass.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Janitrol Aero Div., 4200 Surface Rd., Columbus, Ohio
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Pesco Products, 24700 N. Miles Rd., Bedford, Ohio
Pneu-Hydro Valve Corp., 52 Horse Hill Rd., Cedar Knolls, N. J.
Royal Inds., Engineered Prods. Div., 2040 E. Dyer Rd., Santa Ana, Cal.
Task Corporation, Box 3999, Anaheim, Calif.
U.O.P. Instruments Div., Greenwich, Conn.
United Electric Controls Co., 85A School St., Watertown, Mass.
Valcor Engrg. Corp., 365 Carnegie Ave., Kenilworth, N. J.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wright Components Inc., 5019 South St., Clifton Springs, N. Y.

VALVES, EPITAXIAL REACTOR

Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Valcor Engrg. Corp., 365 Carnegie Ave., Kenilworth, N. J.

VALVES, NONMETALLIC

Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Pneu-Hydro Valve Corp., 52 Horse Hill Rd., Cedar Knolls, N. J.
Valcor Engrg. Corp., 365 Carnegie Ave., Kenilworth, N. J.
Vanton Pump & Equip. Corp., 201 Sweetland Ave., Hillside, N. J.
Wright Components Inc., 5019 South St., Clifton Springs, N. Y.

VALVES, SERVO

EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Adel Div., 10777 Van Owen St., Burbank, Calif.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Consolidated Controls Corps., 2338 Alaska Ave., El Segundo, Calif.
EMR Div., Box 223, Princeton, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Instrument Div., Sanders Assocs., Inc., Grenier Field, Manchester, N. H.
Knapton Assocs., 11 Mulberry St., Nashua, N. H.
Moog, Inc., Box 8, E. Aurora, N. Y.
Servotronics, Inc., 3901 Union Rd., Buffalo, N. Y.
Standard-Thomson Corp., 152 Grove St., Waltham, Mass.

VALVES, SOLENOID

Adel Div., 10777 Van Owen St., Burbank, Calif.
Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.
Aeronautical Div., 400 Enterprise St., Bryan, Ohio
Airmatic Valve Inc., 7313 Associate Ave., Cleveland, Ohio
Alco Controls Corp., Box 12700, St. Louis, Mo.
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Atkomatic Valve Co., Inc., Box 11258, Indianapolis, Ind.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Bendix, Electrodynamics Div., 11600 Sherman Way, N. Hollywood, Cal.
Bendix Corp., Fluid Power Div., 211 Seward Ave., Utica, N. Y.
Caltron Products Co., 3518 W. Pico Blvd., Los Angeles, Calif.
Circle Seal Products Co., Inc., Box 3666, Anaheim, Calif.
Clark Control Div., A. O. Smith Corp., 1146 E. 152 St., Cleveland, Ohio
Consolidated Controls Corps., 2338 Alaska Ave., El Segundo, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Dynamco Inc., 10052 Monroe Dr., Dallas, Texas
Dynamic Controls Corp., 8 Nutmeg Rd., S. Windsor, Conn.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Fluorocarbon Co., 1754 S. Clementine, Box 3339, Anaheim, Calif.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Foxboro, Foxboro, Mass.
H-P-M Div., Koehring Co., Marion Rd., Mt. Gilead, Ohio
Hartman Systems Co., Inc., 360 Wolf Rd., Huntington Sta., N. Y.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Honeywell, Apparatus Cont. Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Honeywell, Residential Div., 2701 Fourth Ave., S., Minneapolis, Minn.
Hydro-Aire Div., 3000 Winona Ave., Burbank, Calif.
IMC Magnetics Corp., 1900 East 5th St., Tempe, Ariz.
ITT Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif.
Janitrol Aero Div., 4200 Surface Rd., Columbus, Ohio
Johnson Corp., 805 Wood St., Three Rivers, Mich.
Koontz-Wagner Elec. Co., Inc., 516 N. Michigan St., S. Bend, Ind.
Laketown Mfg. Corp., Box 27A, RFD 1, Waconia, Minn.
Lucifer, Int'l., Ackerstrasse 42, CH-8610 Uster ZH, Switzerland
MagneTec Corp., 7751 Densmore Ave., Van Nuys, Calif.
Marotta Valve Corp., Boonton Ave., Boonton, N. J.
National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Phoenix Precision Instr. Co., Inc., 3803 North 5 St., Philadelphia, Pa.
Pneu-Hydro Valve Corp., 52 Horse Hill Rd., Cedar Knolls, N. J.
Robintech, Incorporated, 3310 Vanowen St., Burbank, Calif.
Scanivalve Inc., Box 20005, San Diego, Calif.
Skinner Electric Valve Div., 95 Edgewood Ave., New Britain, Conn.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
U.O.P. Instruments Div., Greenwich, Conn.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Valcor Engrg. Corp., 365 Carnegie Ave., Kenilworth, N. J.

VERIFICATION SYSTEMS, TAPE

Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Victor Controls, 2336 Auburn Ave., Sacramento, Calif.
Weston Hydraulics, 7500 Tyrone Ave., Van Nuys, Calif.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wright Components Inc., 5019 South St., Clifton Springs, N. Y.

VALVES, VACUUM

Airmatic Valve Inc., 7313 Associate Ave., Cleveland, Ohio
Allied Control Co. Inc., 2 East End Ave., New York, N. Y.
Allis-Chalmers, Box 512, Milwaukee, Wisc.
Aremco Products, Inc., Box 145, Briarcliff Manor, N. Y.
Automatic Switch Co., 50-56 Hanover Rd., Florham Park, N. J.
Beach-Russ Co., 420 Lexington Ave., New York, N. Y.
Bemco, Inc., 9908 San Fernando Rd., Pacoima, Calif.
Bendix Corp., Instruments & Life Support Div., 2734 Hickory Grove Rd., Davenport, Iowa
Bendix Corp., Vacuum Div., 1775 Mt. Read Blvd., Rochester, N. Y.
Central Scientific Co., 2600 S. Kostner Ave., Chicago, Ill.
Circle Seal Products Co., Inc., Box 3666, Anaheim, Calif.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Edwards High Vacuum (Can.,) Ltd., 430 S. Service Rd.,W., Oakville, Ont., Can.
Edwards High Vacuum, Inc., 3279 Grand Island Blvd., Grand Island, N. Y.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Fox Valve Development Co., Inc., 2 Great Meadow La., Hanover, N. J.
Gardner Cryogenics Corp., 2136 City Line Rd., Bethlehem, Pa.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Granville-Phillips Co., Box 1290, Boulder, Colo.
Heraeus-Engelhard Vacuum, Inc., Seco Rd., Monroeville, Pa.
High Vacuum Equip. Corp., 2 Churchill Rd., Hingham, Mass.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kinney Vacuum Co., 3529 Washington St., Boston, Mass.
Laketown Mfg. Corp., Box 27A, RFD 1, Waconia, Minn.
Lucifer, Int'l., Ackerstrasse 42, CH-8610 Uster ZH, Switzerland
Lunkenheimer Co., Box 14360, Cincinnati, Ohio
Nelson Vacuum Pump Co., 2133 4th St., Berkeley, Calif.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Pennsalt Chemicals Corp., Equip. Div., 5500 Tabor Rd., Philadelphia, Pa.
Pneu-Hydro Valve Corp., 52 Horse Hill Rd., Cedar Knolls, N. J.
Skinner Electric Valve Div., 95 Edgewood Ave., New Britain, Conn.
Sunbeam Vacuum Technology Corp., 49 Pollard St., N. Billerica, Mass.
T-M Vacuum Products, Warrington & Rowland, Riverton, N. J.
Taylor Instr. Process Control Div., 95 Ames St., Rochester, N. Y.
Ultek Div., Perkin-Elmer Corp., Box 10920, Palo Alto, Calif.
Vactronic Lab. Equip., Inc., 21 Monmouth Ct., E. Northport, N. Y.
Vacuum Equip. Div., Norton Co., 160 Charlemont St., Newton, Mass.
Vacuum Industries, Inc., 34 Linden St., Somerville, Mass.
Vacuum Research Mfg. Co., 3100 Crow Canyon Rd., San Ramon, Calif.
Valcor Engrg. Corp., 365 Carnegie Ave., Kenilworth, N. J.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veeco Instrs., Inc., Terminal Dr., Plainview, N. Y.
Whittaker Corp., 9229 Sunset Bl., Los Angeles, Calif.
Wright Components Inc., 5019 South St., Clifton Springs, N. Y.

VAPOR COOLING SYSTEMS, VACUUM TUBE

Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Astro Dynamics, Inc., 2nd Ave., Northwest Industrial Park, Burlington, Mass.
Eimac, 301 Industrial Way, San Carlos, Calif.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.

VAPOR DEGREASERS—SEE MACHINES, VAPOR DEGREASING

VARACTORS—SEE DIODES, VARACTOR

VARISTORS—SEE RESISTORS, VOLTAGE SENSITIVE

VARNISH—SEE INSULATING COMPOUNDS, VARNISH

VEHICLE GUIDANCE SYSTEMS (INDUSTRIAL)—SEE MACHINES, MATERIAL HANDLING (ELECTRONIC CONTROL)

VERIFICATION SYSTEMS, TAPE

California Sys. Comp., Inc., 9176 Independence, Chatsworth, Cal.
Datatron, Inc., 1562 Reynolds St., Santa Ana, Calif. ..... p 774
Interstate Electronics Corp., 707 E. Vermont Ave., Anaheim, Calif. p 1411
Remex Electronics, 5250 W. El Segundo Blvd., Hawthorne, Calif. p 799
Applied Elctrns. Corp. of N. J., Box 43, Metuchen, N. J.
Boston Digital Corp., 21 Main St., Ashland, Mass.
Connecticut Technical Corp., 3000 Main St., Hartford, Conn.
Defense Elctrns., Inc., Rockville, Md.
Gerber Scientific Instrument Co., Box 305, Hartford, Conn.
Invac Corp., 26 Fox Rd., Waltham, Mass.
Kybe Corp., 132 Calvary St., Waltham, Mass.
Micro Metrics, Inc., 165 Pennsylvania Ave., Paterson, N. J.
Sanders Assocs., Inc., Data Sys. Div., Daniel Webster Hwy., S., Nashua, N. H.
Sylvania Electric Prod., Inc., Elctrn. Sys., 40 Sylvan Rd., Waltham, Mass.
Teledyne Telemetry Co., Box 341, Princeton, N. J.

VIBRATION TEST SYSTEMS

VHF EQUIPMENT—SEE GENERATORS: RECEIVERS: ETC.

VIBRATION ANALYZERS—SEE ANALYZERS, VIBRATION

VIBRATION MEASUREMENT INSTRUMENTS—SEE METERS, VIBRATION

VIBRATION MOUNTS—SEE MOUNTS, SHOCK & VIBRATION

VIBRATION TEST SYSTEMS—ALSO SEE SERVICES, ENVIRONMENTAL TEST

Aeroflex Laboratories, Inc., South Service Rd., Plainview, N. Y.
B & K Instruments, Inc., 5113 West 164th St., Cleveland, Ohio .. p 1336
Barry Controls Div., 700 Pleasant St., Watertown, Mass.
EMR-Hatboro, E. County Line Rd., Hatboro, Pa.
Elgenco Inc., 1550 Euclid, Santa Monica, Calif.
Geotech, A Teledyne Co., Dept. 14, 3401 Shiloh Rd., Garland, Tex.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Singer Co., Instrumentation Div., 915 Pembroke St., Bridgeport, Conn. p 1489
Tektronix, Inc., Box 500, Beaverton, Ore.
Unholtz-Dickie Corp., 3000 Whitney Ave., Hamden, Conn. ..... p 1249
Agac-Derritron, Inc., 1332 N. Henry St., Alexandria, Va.
All American Tool & Mfg. Co., Inc., 8027 Lawndale, Skokie, Ill.
Allied Elctrns. Ltd., 28 Upper Richmond Rd., London, S.W. 15, Eng.
Ametek, Inc., Station Square Two, Paoli, Pa.
Bafco, Inc., 80 Second Street Pike, Southampton, Pa.
Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Calif.
Chadwick-Helmuth Co. Inc., 111 E. Railroad Ave., Monrovia, Calif.
Columbia Research Labs., Inc., Macdade Blvd. & Bullens La., Woodlyn, Pa.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
EMR Div., Box 223, Princeton, N. J.
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
Environmental Engineering Div., 225 West 2nd St., Bethlehem, Pa.
Epic, Inc., 150 Nassau St., New York, N. Y.
Federal Scientific Corp., 615 West 131 St., New York, N. Y.
Federal Tool Engrg. Co., Inc., 1384 Pompton Ave., Cedar Grove, N. J.
General Radio Company, 300 Baker Ave., W. Concord, Mass.
Gulton Industries, Inc., Instrumentation Div., Metuchen, N. J.
Gulton Inds., Inc., Instrum. Div., 1644 Whittier Ave., Costa Mesa, Cal.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Indikon Co. Inc., 76 Coolidge Hill Rd., Watertown, Mass.
Industrial Electronetics Corp., 1363 S. Patrick Dr., Satellite Beach, Fla.
International Research & Dev. Corp., 6150 Huntley Rd., Worthington, Ohio
Kollsman Instr. Corp., 575 Underhill Blvd., Syosset, N. Y.
Krohn-Hite Corp., 580 Massachusetts Ave., Cambridge, Mass.
L. A. B. Corp., 981 Onondaga St., Skaneateles, N. Y.
Ling Electronics, 1515 S. Manchester Ave., Anaheim, Calif.
MB Electronics, Box 1825, New Haven, Conn.
Massa Div., 280 Lincoln St., Hingham, Mass.
Muirhead Instrs., Inc., 1101 Bristol Rd., Mountainside, N. J.
Optron Corp., 50 Fitch St., New Haven, Conn.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio
Rawco Instruments, Inc., Box 1286, Fort Worth, Tex.
Signal Analysis Inds. Corp., 12 Di Tomas Ct., Copiague, N. Y.
Spectral Dynamics Corp. of San Diego, P.O. Box 671, San Diego, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.
Weston Instrs., Inc., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass
Wyle Labs., 128 Maryland St., El Segundo, Calif.
Zonic Technical Labs., 965 N. Bend Rd., Cincinnati, Ohio

VIBRATING CAPACITORS

Stevens-Arnold, Inc., 7 Elkins St., S. Boston, Mass. ..... p 2921
Tel-Instrument Elctrns. Corp., 728 Garden St., Carlstadt, N. J.

VIBRATORS (FREQUENCY CONVERTING)

ATR Electronics, Inc., 300 East 4th St., St. Paul, Minn. ..... p 1832
Oak Manufacturing Co., Dept. EL, E. Crystal Lake Ave., Crystal Lake, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Cambridge Scientific Ind. Inc., 527 Poplar St., Cambridge, Md.
Cornell-Dubilier Electronics, 50 Paris St., Newark, N. J.
Mallory Electromagnetic Co., Div. P. R. Mallory, Du Quoin, Ill.
Terado Corp., 1068 Raymond Ave., St. Paul, Minn.
Vokar Products, Inc., 2801 S. State St., Ann Arbor, Mich.

VIDEO ANALYZERS—SEE ANALYZERS, VIDEO

VIDICON TUBES—SEE TUBES, TELEVISION CAMERA PICKUP

VIEWING HOODS, CATHODE-RAY TUBE

Jan Hardware Mfg. Co., Inc., 47-27 36th St., Long Island City, N. Y.
Tektronix, Inc., Box 500, Beaverton, Ore.
Data Instrument Div., 7300 Crescent Blvd., Pennsauken, N. J.
Dero Research & Development Corp., Broadway & Park Ave., Huntington, N. Y.
Flexco Div., 6855 Suva St., Bell Gardens, Calif.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Measurement Control Devices, Inc., 2445 Emerald St., Philadelphia, Pa.

VINYL COMPOUNDS—SEE PLASTIC RAW MATERIALS

VISCOSITY INDICATORS—SEE INDICATORS, VISCOSITY

VISUAL CONTROL BOARDS, CHARTS & GRAPHS—SEE BOARDS, GRAPHIC, VISUAL CONTROL

VLF EQUIPMENT—SEE RECEIVERS: TRANSMITTERS: ETC.

VOLTAGE COMPARATORS—SEE COMPARATORS, VOLTAGE

VOLTAGE REGULATORS—SEE REGULATORS & STABILIZERS, VOLTAGE

VOLTMETERS—SEE METERS, VOLT

WASHERS—SEE FASTENERS

WATER COILS, TUBE COOLING

American-Standard, Applied Air Conditioning Dept., Columbus, Ohio
Environmental Control Sys. Div., 43-22 Queens St., Long Island City, N. Y.
International Energy Conversion, Inc., 430 Kirby St., Garland, Tex.
Lapp Insulator Co., Inc., Radio Specialties Div., 350 Sumner St., LeRoy, N. Y.
Wakefield Engineering, Inc., Teal & Audubon Rds., Wakefield, Mass.

WAVE SOLDERING EQUIPMENT—SEE SOLDERING EQUIP., PRINTED CIRCUIT

WAVEFORM ANALYZERS—SEE ANALYZERS, WAVEFORM

WAVEGUIDE-COAX ADAPTERS

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Americon Corp., 87 Rumford Ave., Waltham, Mass. ..... p 834
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
E & M Laboratories, 5388 Sterling Center Dr., Westlake Village, Cal.
Kings Elctrns. Co., Inc., 40 Marbledale Rd., Tuckahoe, N. Y.
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich. .... p 1690
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
Scientific-Atlanta Inc., Box 13654, Atlanta, Ga.
Vector Industries, 821 San Antonio Rd., Palo Alto, Calif. ..... p 1717
Waveline Inc., Box 718, West Caldwell, N. J.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alford Mfg. Co., 120 Cross St., Winchester, Mass.
Alpha Industries, Inc., 381 Elliot St., Newton Upper Falls, Mass.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
CES Electronics, 2968 Ave. Z, Brooklyn, N. Y.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
General Microwave Corp., 155 Marine St., Farmingdale, N. Y.
General RF Fittings, Box 278, Port Salerno, Fla.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Kevlin Mfg. Co., 26 Conn St., Woburn, Mass.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Microwave Filter Co., Inc., 135 W. Manlius St., East Syracuse, N. Y.
Microwave Labs. of America, Box 13, Bay Sta., Brooklyn, N. Y.
N-H Microwave, Inc., Box 887, Red Bank, N. J.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
PRD Electronics, Inc., 1200 Prospect Ave., Westbury, N. Y.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Specialty Waveguide Corp., 82 Cambridge St., Burlington, Mass.
Tru-Connector Corp., 245 Lynnfield St., Peabody, Mass.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

WAVEGUIDES, CIRCULAR

Aircom, Inc., Rte. 16B, Union, N. H.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meca Electronics, Inc., 459 E. Main St., Denville, N. J.
Micro-Radionics, Inc., 14844 Oxnard St., Van Nuys, Cal.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Narda Microwave Corp., 625 Stewart Ave., Garden City, N. Y.
Omni Spectra, Inc., 24600 Hallwood Ct., Farmington, Mich.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
Phelps Dodge Electr. Prods. Corp., 60 Dodge Ave., N. Haven, Conn.
Prodelin, Inc., Box 131, Hightstown, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Reeve Elctrns., Inc., 601-EEM-W. Lake St., Chicago, Ill.
Sage Labs. Inc., Instr. Div., 14 Huron Dr., Natick, Mass.
Specialty Waveguide Corp., 82 Cambridge St., Burlington, Mass.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.

WAVEGUIDES, FLEXIBLE

Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes Aircraft Co., Ground Sys. Group. 1901 Malvern St., Fullerton, Cal.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Servometer Corp., 82 Industrial E., Clifton, N. J.
Specialty Waveguide Corp., 82 Cambridge St., Burlington, Mass.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.

WAVEGUIDES, RECTANGULAR

Narda Microwave Corp., Plainview, N. Y.
OKI Elctrns. of America Inc., 500/506 S.E. 24th St., Ft. Lauderdale, Fla.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Micro-Link Systems, 19 Wartburg Ave., Copiague, N. Y.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Specialty Waveguide Corp., 82 Cambridge St., Burlington, Mass.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.

WAVEGUIDES, RIGID

ARRA, Inc., 15 Harold Ct., Bayshore, N. Y. ..... p 1646
Amphenol RF Div., 33 E. Franklin St., Danbury, Conn.
Douglas Microwave Co., Railroad Pl., Mamaroneck, N. Y. ..... p 1658
Narda Microwave Corp., Plainview, N. Y.
Nippon Elec. New York Inc., 200 Park Ave., New York, N. Y.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y. p 1691
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y. p 1691
Uniform Tubes Inc., Collegeville, Pa.
Waveline Inc., Box 718, West Caldwell, N. J.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Andrew Corp., 10500 West 153 St., Orland Park, Ill.
Astrolab, Inc., 4 McCandless St., Linden, N. J.
Beckman Instrs., Inc., Elctrn. Instrs. Div., 2200 Wright Ave., Richmond, Calif.
Cardwell Condenser Corp., 80 E. Montauk Hwy., Lindenhurst, N. Y.
Chemalloy Electronics Corp., Gillespie Airport, Santee, Calif.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Connolly & Co., Inc., 914 Rengstorff Ave., Mt. View, Calif.
Control Data Corp., 400 Border St., East Boston, Mass.
Diamond Antenna & Microwave Corp., 35 River St., Winchester, Mass.
Electronic Specialty Co., Conn. Div., 401 Watertown Rd., Thomaston, Conn.
GAF Corp., 140 West 51 St., New York, N. Y.
Gabriel Electronics, Div. Maremont Corp., Saco, Me.
Gombos Microwave Inc., 48 Webro Rd., Clifton, N. J.
Granite State Machine Co., Inc., 124 Joliette St., Manchester, N. H.

Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Hughes-Treitler Mfg. Corp., 300 Endo Blvd., Garden City, N. Y.
Jerrold Electronics Corp., 401 Walnut St., Philadelphia, Pa.
Laminair Inc., 13226 Figueroa, Los Angeles, Calif.
Lenkurt Electric Co., Inc., 1105 County Rd., San Carlos, Calif.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif.
Meridian Metalcraft, Inc., 8739 S. Millergrove Dr., Whittier, Calif.
Microlab/FXR, 10 Microlab Rd., Livingston, N. J.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
Omega Labs., Inc., Haverhill St., Rowley, Mass.
Pabst Engrg. Eqpt. Co., Inc., 676 Pennsylvania Ave., Elizabeth, N. J.
Pem Machine Tool Co., Inc., 39A Myrtle St., Cranford, N. J.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Ramcor, Inc., 270 E. Pulaski Rd., Huntington, N. Y.
Specialty Waveguide Corp., 82 Cambridge St., Burlington, Mass.
Surface Conduction, Inc., 1501 Broadway, New York, N. Y.
Technical Appliance Corp., One Taco St., Sherburne, N. Y.
Varian Assocs., Radiation Div., 611 Hansen Way, Palo Alto, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.
Victor, R. F. & Microwave Co., 38 W. Water St., Wakefield, Mass.

WAVE TRAPS—SEE FILTERS, ANTENNA: FILTERS, MICROWAVE: ETC.

WAX—SEE INSULATING COMPOUNDS, WAX

WEATHERSTRIP, ELECTRONIC

Chomerics, Inc., 85 Mystic St., Arlington, Mass. ..... p 1641
Metex Corp., 970 New Durham Rd., Edison, N. J. p 1229, 1230, 1232, 1233
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Maynard Plastics Inc., 49 Congress St., Salem, Mass.

WELDING EQUIP. & ACCESS.—ALSO SEE CONTROLS, WELDING: TIMERS, WELDING

American Lava Corp., Cherokee Blvd. & Mfgrs. Rd., Chattanooga, Tenn.
Falstrom Co., 174 Falstrom Ct., Passaic, N. J. ..... p 583
Sorensen Operation, Richards Ave., Norwalk, Conn.
Aerometrics, P.O. Box 216, San Ramon, Calif.
All-State Welding Alloys Co., Inc., P.O. Box 350, White Plains, N. Y.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
American Electric & Machine Co., Inc., 320-324 State Hwy. 17, Upper Saddle River, N. J.
Arizona Elctrns., Inc., Drawer AE, Benson, Ariz.
Arvin Systems, Inc., 1771 Springfield St., Dayton, Ohio
Atlantic Instrs. & Elctrns., 50 Hunt St., Watertown, Mass.
Auto Arc-Weld Mfg. Co., 9615 Meech Ave., Cleveland, Ohio
Becker Bros. Carbon Co., 3450 S. Laramie Ave., Cicero, Ill.
Carol Cable Co., Box 68, Pawtucket, R. I.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Dawe Instruments, Ltd., Western Ave., Acton, London W3, Eng.
Electro Powerpacs, Inc., 253 Norfolk St., Cambridge, Mass.
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
Eutectic Corp., 40-40 172nd St., Flushing, N. Y.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Forney Industries, Inc., 1800 La Porte Ave., Fort Collins, Colo.
Henes Mfg. Co., 4301 E. Madison St., Phoenix, Ariz.
Hobart Brothers Co., Hobart Square, Troy, Ohio
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Kahle Engrg. Co., 3322 Hudson Ave., Union City, N. J.
Lenco, Inc., 319 W. Main, Jackson, Mo.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Mallory Metallurgical Co., 3029 E. Washington St., Indianapolis, Ind.
Maryland Lava Co., Inc., P.O. Box 527, Dept. EEM, Bel Air, Md.
Microflame, Inc., 7800 Computer Ave., Minneapolis, Minn.
Miller Electric Mfg. Co., 718 S. Bounds, Box 1087, Appleton, Wisc.
Multisonic Cleaning Systems, 9615 Meech Ave., Cleveland, Ohio
National-Standard Co., Niles, Mich.
Precision Arc Co., Inc., 785 Woodend Rd., Stratford, Conn.
Price & Rutzebeck, Box 30, Hayward, Calif.
Printed Circuits, Inc., 7800 Computer Ave., Minneapolis, Minn.
Protronic Inds. Inc., 2415 S. Manchester Ave., Anaheim, Calif.
Robotron Corp., 21300 West 8 Mile Rd., Box 4782, Detroit, Mich.
Sciaky Bros, Inc., 4915 West 67th St., Chicago, Ill.
Silver, G. H. & Assocs., Inc., Box 21, Newtonville, Mass.
Slee International Inc., 8010 U. S. Hwy. 130, Pennsauken, N. J.
Square D Co., 205 S. Northwest Hwy., Park Ridge, Ill.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Tempil Corp., 132 West 22nd St., New York, N. Y.
Tempress Research Co., 980 University Ave., Los Gatos, Calif.
Thermatron Div., Willcox & Gibbs, 1040 Ave. of the Americas, N. Y., N. Y.
Thomson Electric Welder Co., Inc., 161 Pleasant St., Lynn, Mass.
Trindl Prods., Ltd., 1807 S. Clark St., Chicago, Ill.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Walters, W. A., Inc., 7713 South Western Ave., Chicago, Ill.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.
Westberg Mfg. Co., 3400 Westach Way, Sonoma, Calif.
Westinghouse Electric Corp., Ind. Equip. Div., Box 300, Sykesville, Md.

WELDING EQUIP., SEMICONDUCTOR DEVICES

G T I Corporation, 310 Chestnut St., Meadville, Pa.
Hadron, 300 Shames Dr., Westbury, N. Y. ..... p 1676
Hughes Aircraft Co., 500 Superior Ave., Newport Beach, Calif. ... p 1605
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Sorensen Operation, Richards Ave., Norwalk, Conn.
Arvin Systems Inc., 1482 Stanley Ave., Dayton, Ohio
Associate General Labs., Inc., 8934 W. Ogden Ave., Brookfield, Ill.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Hughes Aircraft Co., Vacuum Tube Prods. Div.,/Welding Equip., 2020 Oceanside Blvd., Oceanside, Calif.
Korad Dept., Elctrns. Div., 2520 Colorado Ave., Santa Monica, Calif.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Multisonic Cleaning Systems, 9615 Meech Ave., Cleveland, Ohio
Sonobond Corp., 310 E. Rosedale Ave., West Chester, Pa.
Tempress Research Co., 980 University Ave., Los Gatos, Calif.
Thomson Electric Welder Co., Inc., 161 Pleasant St., Lynn, Mass.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.
Wells Elctrns., Inc., Equip. Div., 1701 S. Main St., S. Bend, Ind.

WELDING & REFINING EQUIP., ELECTRON BEAM

Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Atlantic Instrs. & Elctrns., 50 Hunt St., Watertown, Mass.
Cooke Vacuum Prods., Inc., 13 Merritt St., S. Norwalk, Conn.
Denton Vacuum, Inc., Cherry Hill Indl. Ctr., Cherry Hill, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Norton Co., Vacuum Equip. Div., 160 Charlemont St., Newton, Mass.
Sciaky Bros, Inc., 4915 West 67th St., Chicago, Ill.
Thomson Electric Welder Co., Inc., 161 Pleasant St., Lynn, Mass.
Walters, W. A., Inc., 7713 South Western Ave., Chicago, Ill.

WHIP ANTENNAS—SEE ANTENNAS, MOBILE

Natvar Corp., 211 Randolph Ave., Woodbridge, N. J. ..... p 1586

WHITEPRINT MACHINES

HJS Engineering Co., Box 96, Park Ridge, Ill.
Rotolite Sales Corp., Box 7G, Stirling, N. J.

WIND DIRECTION INDICATORS—SEE INDICATORS, WIND DIRECTION

WIND SPEED INDICATORS—SEE INDICATORS, WIND SPEED

WINDINGS, TRANSFORMER

Automatic Coil Co., 76 E. 2nd St., Mineola, N. Y.
Dale Electronics, Sioux Div., Box 180, Yankton, S. D.
Del Electronics Corp., 250 E. Sandford Blvd., Mt. Vernon, N. Y.
Piconics Inc., 220 Boston Rd., No. Billerica, Mass.
A.P.W. Co., 72 Main St., Rockaway, N. J.
Bicron Elctrns. Co., Barlow St., Canaan, Conn.
Delta Coils, 4312 Main St., Philadelphia, Pa.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Electro-Pacific, Inc., 5782 Thornwood Dr., Goleta, Calif.
Electrocom Inds., 1105 N. Ironwood Dr., South Bend, Ind.
Forbes & Wagner, Inc., 345 Central Ave., Silver Creek, N. Y.
Keiser's Industries, Inc., Laumau St., Mt. Holly Springs, Pa.
Mystic Transformers, Inc., 114 West St., Wilmington, Mass.
National Coil Co., Box 1040, Douglas, Ariz.
New York Coil Co., 40-48 Second Ave., Phoenixville, Pa.
Precision, Inc., 3415 48 Ave. N., Minneapolis, Minn.
Rho Engineering Co., 2234 Colby Ave., Los Angeles, Cal.
Ramm Rectifier Co., Inc., 340 Coster St., Bronx, N. Y.
Raytheon Co., Microwave & Power Tube Div., 141 Spring St., Lexington, Mass.
SKG Associates, Inc., 206 Eustis St., Boston, Mass.
Topper Mfg. Co., Inc., 889 Northern Blvd., Great Neck, N. Y.
Trindl Prods., Ltd., 1807 S. Clark St., Chicago, Ill.
Tur-Bo Jet Products Co., Inc., 5025 N. Earle St., Rosemead, Calif.
Universal Toroid Coil Winding, Inc., 1190 Grove St., Irvington, N. J.

WINDOWS, INFRARED

Amersil, Inc., 685 Ramsey Ave., Hillside, N. J.
General Elec. Co., Lamp Glass Dept., 24400 Highland Rd., Richmond Hgts., Ohio
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, Ohio
Servo Corp. of America, 111 New South Rd., Hicksville, N. Y. ... p 1708
Advanced Kinetics Inc., 1231 Victoria St., Costa Mesa, Calif.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Ceramics International Div., 39 Siding Pl., Mahwah, N. J.
Corning Glass Works, Technical Prods. Div., Corning, N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Eimac, 301 Industrial Way, San Carlos, Calif.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Flexi-Optics Labs., Inc., 117 Dover St., Somerville, Mass.
General Laser Corp., 8 Erie Dr., Natick, Mass.
Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Infrared Inds., Inc., Box 989, Santa Barbara, Calif.
Insaco, Inc., Box 442, Quakertown, Pa.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Jones, A. D. Optical Works, Inc., 64 Cambridge St., Burlington, Mass.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
Metavac, Inc., 45-68 162nd St., Flushing, N. Y.
Moser Jewel Co., 544 Fayette St., Perth Amboy, N. J.
NPC Metals & Chemicals Co., 3133 East 12th St., Los Angeles, Calif.
Nuclear Element Corp., 420 S. McKean St., Butler, Pa.
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Quartz & Silice, 8 Rue d' Anjou, Paris 8e, France

WIRE, ANTENNA—ALL TYPES

Republic Lens Co., Inc., 31 East 169th St., Bronx, N. Y.
Santa Barbara Research Ctr., 75 Coromar Dr., Goleta, Calif.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Syncor Prods. Co., Inc., 44 Eastern Ave., Malden, Mass.
TE Co., 515 E. Montecito St., Santa Barbara, Calif.
Texas Instrs., Inc., Box 6015, Dallas, Tex.
Union Carbide Corp., Elctrns. Div., Crystal Prods. Dept., 8888 Balboa Ave., San Diego, Cal.
Valpey Corp., 1400 Highland St., Holliston, Mass.

WINDOWS, PRESSURE-TYPE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
Glass Technology Div., 1644 Whittier Ave., Costa Mesa, Calif.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Device Seals, Inc., 11684 Tuxford St., Sun Valley, Calif.
Eimac, 301 Industrial Way, San Carlos, Calif.
Electro-Optical Div., Kollmorgen Corp., 347 King St., Northampton, Mass.
Electron Technology, Inc., 626 Schuyler Ave., Kearny, N. J.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
Goodyear Aerospace Corp., 1210 Massillon Rd., Akron, Ohio
Granville-Phillips Co., Box 1290, Boulder, Colo.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Liberty Mirror Div., 851 Third Ave., Brackenridge, Pa.
MCS Corp., 1307 S. Myrtle Ave., Monrovia, Calif.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Richland Glass Co., Inc., Richland, N. J.
Varian Assocs., Vacuum Div., 611 Hansen Way, Palo Alto, Calif.
Veritron West Inc., 20245 Sunburst St., Chatsworth, Calif.

WINDOWS, SHIELDED

Metex Corp., 970 New Durham Rd., Edison, N. J. ..... p 1229
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Franklin Fibre-Lamitex Corp., 901-905 East 13th St., Wilmington, Del.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Optics for Industry, Inc., 1929 N. Buffum St., Milwaukee, Wisc.
Penberthy Div., 6701 Maynard, S., Seattle, Wash.

WINDOWS, WAVEGUIDE

AEL Inc., P.O. Box 552, Lansdale, Pa.
Filmohm Div., 37-11 47th Ave., Long Island City, N. Y.
Portchester Instr. Corp., 114 Wilkins Ave., Port Chester, N. Y.
Premier Microwave Corp., 35 New Broad St., Port Chester, N. Y.
Aircom, Inc., Rte. 16B, Union, N. H.
Airtec Inc., 264 Columbus Ave., Roselle, N. J.
Airtron Div., Litton Industries, 200 E. Hanover Ave., Morris Plains, N. J.
Alberox Corp., New Bedford Indl. Pk., New Bedford, Mass.
American Mica Insulation Co., Manasquan, N. J.
Andrew California Corp., 941 E. Marylind Ave., Claremont, Cal.
Ceramaseal, Inc., Box 25, New Lebanon Ctr., N. Y.
Christian Precision Mfg. Co., Inc., 12th & Federal Sts., Camden, N. J.
Dell Optics Co., Inc., 9226 Kennedy Blvd., North Bergen, N. J.
Electromagnetic Technology Corp., 486 Ellis St., Mt. View, Calif.
Frenchtown/CFI, Inc., 8th & Harrison Sts., Frenchtown, N. J.
Guide Industries, Inc., 11855 Wicks St., Sun Valley, Calif.
Herley Inds., Inc., 175 Eileen Way, Syosset, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Metcom, Inc., 76 Lafayette St., Salem, Mass.
Microtech, 1425 Milldale Rd., Cheshire, Conn.
Microwave Assocs., Inc., Northwest Ind. Park, Burlington, Mass.
Microwave Dev. Labs. Inc., 87 Cresent Rd., Needham Hgts., Mass.
O & S Research, Inc., 1912 Bannard St., Riverton, N. J.
Pacific Universal Prods. Corp., 168 Vista Ave., Pasadena, Calif.
RF Systems, Inc., 155 King St., Cohasset, Mass.
Richland Glass Co., Inc., Richland, N. J.
Rogers Corp., Rogers, Conn.
Severna Div., Bunker-Rhmo Corp., 45 Glenwood Pl., E. Orange, N. J.
3M Co., 3M Center, St. Paul, Minn.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Varian Industrial Microwave Operation, 301 Industrial Way, San Carlos, Calif.

WIRE, ANTENNA (ALL TYPES)

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill. p 2930
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. .. p 2942
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. ..... p 2964
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.

WIRE, ANTENNA—ALL TYPES (Cont'd)

Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Finney Co., 34 W. Interstate St., Bedford, Ohio
General Cable Corp., 733 Third Ave., New York, N. Y.
Hackensack Cable Corp., 110 Orchard St., Hackensack, N. J.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Miller Electric Co., Box 231, Woonsocket, R. I.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Nichols Aluminum Co., 15 Spinning Wheel Rd., Hinsdale, Ill.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Superior Insulated Wire Corp., Box 188, Stony Point, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.

WIRE, ASBESTOS-INSULATED

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Carol Cable Co., Box 68, Pawtucket, R. I.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Miller Electric Co., Box 231, Woonsocket, R. I.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Radix Wire Co., 26260 Lakeland Blvd., Cleveland, Ohio
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Thermotronic Devices, Inc., Forest & Hector Sts., Conshohocken, Pa.
United States Steel Corp., 525 William Penn Pl., Pittsburgh, Pa.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.

WIRE, BARE, ALUMINUM

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
All-State Welding Alloys Co., Inc., P.O. Box 350, White Plains, N. Y.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Asco Wire & Cable Co., Box 2127, Noble Sta., Bridgeport, Conn.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Essex Int'l., Inc., Magnet Wire Div., 1601 Wall St., Ft. Wayne, Ind.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Nichols Aluminum Co., 15 Spinning Wheel Rd., Hinsdale, Ill.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Rea Magnet Wire Co., Inc., 3600 E. Pontiac St., Ft. Wayne, Ind.
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Unibraze Corp., 455 Knollwood Rd., White Plains, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.
York Wire Co., Box 982, Clifton, N. J.

WIRE, BARE, BERYLLIUM COPPER

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Brush Beryllium Co., 17876 St. Clair Ave., Cleveland, Ohio
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Hamilton Precision Metals, Div. Hamilton Watch Co., Lancaster, Pa.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

WIRE, BARE, BRASS

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Chase Brass & Copper Co., 20600 Chagrin Blvd., Cleveland, Ohio
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Helenor Metals Corp., 60 Marbledale Rd., Tuckahoe, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.

WIRE, BARE, COLUMBIUM

Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cross, H. Co., 365 Park Ave., Weehawken, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Vaf-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

WIRE, BARE, COMPOSITE METALS

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.

WIRE, BARE, COPPER

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill. p 2930
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2936, 2938, 2943
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Asco Wire & Cable Co., Box 2127, Noble Sta., Bridgeport, Conn.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Carol Cable Co., Box 68, Pawtucket, R. I.
Cerro Corp., 300 Park Ave., New York, N. Y.
Chase Brass & Copper Co., 20600 Chagrin Blvd., Cleveland, Ohio
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Chester Cable Co., Oakland Ave., Chester, N. Y.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Essex Int'l., Inc., Magnet Wire Div., 1601 Wall St., Ft. Wayne, Ind.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hamilton Precision Metals, Div. Hamilton Watch Co., Lancaster, Pa.
Helenor Metals Corp., 60 Marbledale Rd., Tuckahoe, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Okonite Co., 220 Passaic St., Passaic, N. J.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Rea Magnet Wire Co., Inc., 3600 E. Pontiac St., Ft. Wayne, Ind.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Rome Cable, Rome, N. Y.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Viking Wire Co., Inc., Shelter Rock Rd., Danbury, Conn.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

WIRE, BARE, COPPER-CLAD

Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2938, 2944
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Alpha Metals, Inc., 56 Water St., Jersey City, N. J.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Asco Wire & Cable Co., Box 2127, Noble Sta., Bridgeport, Conn.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Carol Cable Co., Box 68, Pawtucket, R. I.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Crown Metal Prods. Co., Wyano, Pa.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
National-Standard Co., Niles, Mich.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.

WIRE, BARE, FINE, SPECIALTIES

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Colonial Alloys Co., Ridge Ave. & Crawford, Philadelphia, Pa.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Essex Int'l., Inc., Magnet Wire Div., 1601 Wall St., Ft. Wayne, Ind.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.

Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Micro Contacts, Inc., 62 Alpha Plaza, Hicksville, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
Mullard, Inc., 100 Finn Ct., Farmingdale, N. Y.
National-Standard Co., Niles, Mich.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Viking Wire Co., Inc., Shelter Rock Rd., Danbury, Conn.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.
York Wire Co., Box 982, Clifton, N. J.

WIRE, BARE, GOLD & GOLD PLATED

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

WIRE, BARE, MOLYBDENUM

Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cross, H. Co., 365 Park Ave., Weehawken, N. J.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Rembar Co., Inc., 67 Main St., Dobbs Ferry, N. Y.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.

WIRE, BARE, NICKEL

Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Montgomery Co., Windsor Locks, Conn.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.
York Wire Co., Box 982, Clifton, N. J.

WIRE, BARE, NICKEL-CHROME

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Hamilton Precision Metals, Div. Hamilton Watch Co., Lancaster, Pa.
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Howmet Corp., Alloy Div., Roy St., Dover, N. J.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Huntington Alloy Prods Div., Guyan River Rd., Huntington, W. Va.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Reliance Div., 25 Charles Ave., S.E., Massillon, Ohio
Republic Steel Corp., Box 6778, Cleveland, Ohio
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.

WIRE, BARE, NICKEL-CLAD COPPER

Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

WIRE, BARE, PHOSPHOR BRONZE

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Anaconda American Brass Co., 414 Meadow St., Waterbury, Conn.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Chase Brass & Copper Co., 20600 Chagrin Blvd., Cleveland, Ohio
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Helenor Metals Corp., 60 Marbledale Rd., Tuckahoe, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Reliance Div., 25 Charles Ave., S.E., Massillon, Ohio
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Unibraze Corp., 455 Knollwood Rd., White Plains, N. Y.

WIRE, BARE, PLATINUM

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.

WIRE, BARE, STAINLESS-STEEL

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Englehard Minerals & Chemicals Corp., H. A. Wilson Dept., U.S. Rte. #22, Union, N. J. ..... p 1644
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Electric Thermometers, Inc., 10 Glover Ave., Norwalk, Conn.
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Handy & Harman, 850 3rd Ave., New York, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Ney, J. M. Co., Maplewood Ave., Bloomfield, Conn.
Nuclear Equipment Chemical Corp., 165 Marine St., Farmingdale, N. Y.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Western Gold & Platinum Co., 525 Harbor Blvd., Belmont, Calif.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.

WIRE, BARE, SILVER-PLATED

Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. ... p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2940, 2941, 2943
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Brainin, C. S. Corp., 320 Washington St., Mt. Vernon, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Goldsmith Div., National Lead Co., 900 West 18th St., Chicago, Ill.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.

WIRE, BARE, STAINLESS-STEEL

Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Armco Steel Corp., 703 Curtis St., Middletown, Ohio
Berkley & Co., Spirit Lake, Iowa
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Hamilton Precision Metals, Div. Hamilton Watch Co., Lancaster, Pa.
Harper, H. M. Co., 8200 Lehigh Ave., Morton Grove, Ill.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
National-Standard Co., Niles, Mich.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Reliance Div., 25 Charles Ave., S.E., Massillon, Ohio
Republic Steel Corp., Box 6778, Cleveland, Ohio
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.

WIRE, BARE, STAINLESS-STEEL (Cont'd)

Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
York, O. H. Co., Inc., 6 Central Ave., W. Orange, N. J.
York Wire Co., Box 982, Clifton, N. J.

WIRE, BARE, STEEL (EXCLUDING GUY WIRE)

Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Armco Steel Corp., 703 Curtis St., Middletown, Ohio
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
CF & I Steel Corp., Box 1920, Denver, Colo.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
National-Standard Co., Niles, Mich.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Reliance Div., 25 Charles Ave., S.E., Massillon, Ohio
Republic Steel Corp., Box 6778, Cleveland, Ohio
Ryerson, J. T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
United States Steel Corp., 525 William Penn Pl., Pittsburgh, Pa.
York, O. H. Co., Inc., 6 Central Ave., W. Orange, N. J.

WIRE, BARE, TANTALUM

Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cross, H. Co., 365 Park Ave., Weehawken, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Kennametal Inc., Lloyd Ave., Latrobe, Pa.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Paul, F. H. & Stein Bros., Inc., 235 5 Ave., New York, N. Y.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Rembar Co., Inc., 67 Main St., Dobbs Ferry, N. Y.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

WIRE, BARE, TITANIUM

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Armco Steel Corp., 703 Curtis St., Middletown, Ohio
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Crucible Steel Corp., Box 88, Pittsburgh, Pa.
Howmet Corp., Alloy Div., Roy St., Dover, N. J.
Japan Vacuum Engrg. Co. Ltd., 1, 1-Chome, Kyobashi, Chuo-Ku, Tokyo, Jap.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
National-Standard Co., Niles, Mich.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
York Wire Co., Box 982, Clifton, N. J.

WIRE, BARE, TUNGSTEN

Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Cross, H. Co., 365 Park Ave., Weehawken, N. J.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Rembar Co., Inc., 67 Main St., Dobbs Ferry, N. Y.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.

WIRE, BARE, ZIRCONIUM

Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
City Chemical Corp., 132 West 22 St., New York, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Materials Research Corp., Rte. 303, Orangeburg, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

WIRE, BRAID (EXCLUDING SHIELDING)

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Belden Corp., Box 5070A, Chicago, Ill.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. .. p 2945
Intercontinental Harness & Cable Co., 31 W. Mall, Plainview, N. Y. p 2956
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
CF & I Steel Corp., Box 1920, Denver, Colo.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Cerro Corp., 300 Park Ave., New York, N. Y.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Montgomery Co., Windsor Locks, Conn.
National-Standard Co., Niles, Mich.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Thermotronic Devices, Inc., Forest & Hector Sts., Conshohocken, Pa.
Transvac Electronics, 270 Newtown Rd., Plainview, N. Y.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.

WIRE, BRAID (SHIELDING)—SEE BRAID, CABLE & WIRE SHIELDING

WIRE, BRIDGE

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Alloys Unlimited, Inc., 16661 Ventura Blvd., Encino, Cal.
Armco Steel Corp., 703 Curtis St., Middletown, Ohio
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.

WIRE, CERAMIC INSULATED

Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Tensolite Div., W. Main St., Tarrytown, N. Y.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Standard, 9000 Kings St., Franklin Park, Ill.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
National Beryllia Corp., Greenwood Ave., Haskell, N. J.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Rea Magnet Wire Co., Inc., 3600 E. Pontiac St., Ft. Wayne, Ind.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.

WIRE, ENAMEL INSULATED—SEE WIRE, HOOKUP, PUSHBACK (ALL TYPES)

WIRE, FIBERGLASS INSULATED—SEE WIRE, GLASS INSULATED

WIRE, FINE, BARE OR INSULATED—SEE WIRE, BARE, FINE, SPECIALTIES

WIRE, FLAT STRIP—SEE CABLE, FLAT

WIRE, FLOOR, INSULATED

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Ideas, Inc., 118 Grand Ave., Laramie, Wyo.
Judd Wire Div., S. Bedford St., Burlington, Mass.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.

WIRE, FUSE

Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo.
Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Bussman Mfg., McGraw-Edison, University at Jefferson, St. Louis, Mo.
CF & I Steel Corp., Box 1920, Denver, Colo.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
National-Standard Co., Niles, Mich.
United American Metals Div., 970 Meeker Ave., Brooklyn, N. Y.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.

WIRE, GEAR MEASURING—SEE GEAR MEASURING WIRE

WIRE, GLASS INSULATED

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2937, 2940, 2943
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. .... p 2964
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Varflex Corp., 514 W. Court St., Rome, N. Y. ..... p 1588
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Carol Cable Co., Box 68, Pawtucket, R. I.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Radix Wire Co., 26260 Lakeland Blvd., Cleveland, Ohio
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Suflex Corp., 33-40 57th St., Woodside, N. Y.
Thermotronic Devices, Inc., Forest & Hector Sts., Conshohocken, Pa.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.

WIRE, GUY

Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Tensolite Div., W. Main St., Tarrytown, N. Y.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.

Armco Steel Corp., 703 Curtis St., Middletown, Ohio
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
CF & I Steel Corp., Box 1920, Denver, Colo.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Crown Metal Prods. Co., Wyano, Pa.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hackensack Cable Corp., 110 Orchard St., Hackensack, N. J.
IE Manufacturing Co., 3039 W. Carroll Ave., Chicago, Ill.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Lance Antenna Corp., 13001 Bradley Ave., Sylmar, Cal.
Lance Inds., Box 4156, Sylmar, Calif.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
National-Standard Co., Niles, Mich.
Nichols Aluminum Co., 15 Spinning Wheel Rd., Hinsdale, Ill.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Southwire Co., 4 Fertilla St., Carrollton, Ga.
Tempo TV Products Co., Box 4156, Sylmar, Calif.
Wright, G. F. Steel & Wire Co., 243 Stafford St., Worcester, Mass.

WIRE, HEATER—SEE CABLE, HEATER

WIRE, HIGH TEMPERATURE

Alpha Wire Div., Loral Corp., 711 Ldgerwood Ave., Elizabeth, N. J. p 2923
Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Coleman Cable & Wire Co., 1900 N. River Rd., River Grove, Ill. .. p 2929
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2940, 2943
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. .. p 2954, 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y..... p 2964
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
American Standard, 9000 Kings St., Franklin Park, Ill.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brand-Rex Div., Box 498, Willimantic, Conn.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Howmet Corp., Alloy Div., Roy St., Dover, N. J.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Miller Electric Co., Box 231, Woonsocket, R. I.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
National-Standard Co., Niles, Mich.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Philadelphia Insulated Wire Co., 333 New Albany Rd., Moorestown, N. J.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Radix Wire Co., 26260 Lakeland Blvd., Cleveland, Ohio
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rea Magnet Wire Co., Inc., 3600 E. Pontiac St., Ft. Wayne, Ind.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Thermotronic Devices, Inc., Forest & Hector Sts., Conshohocken, Pa.
Union Carbide Corp., Materials Sys. Div., 1020 W. Park Ave., Kokomo, Ind.
Viking Wire Co., Inc., Shelter Rock Rd., Danbury, Conn.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.

WIRE, HIGH VOLTAGE

AMP Inc., Capitron Div., 155 Park St., Elizabethtown, Pa.
Alpha Wire Div., Loral Corp., 711 Ldgerwood Ave., Elizabeth, N. J.
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2936–2941, 2943
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. .. p 2954, 2955
Lab-Tronics, 6225 Benore Rd., Toledo, Ohio
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y..... p 2964
Rowe Industries Inc., 1702 Airport Hwy., Toledo, Ohio
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. ... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Columbia Electronic Cables, Box 231, Woonsocket, R. I.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Okonite Co., 220 Passaic St., Passaic, N. J.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Radix Wire Co., 26260 Lakeland Blvd., Cleveland, Ohio
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rome Cable, Rome, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.

WIRE, HOOKUP-PUSHBACK (ALL TYPES)

Alpha Wire Div., Loral Corp., 711 Ldgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill. p 2930
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2936–2941
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. .. p 2954, 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Philco/Ford Corp., C & Tioga Sts., Philadelphia, Pa.
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y..... p 2964
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Whitmor Wire & Cable Corp., 13181 Sherman Way, N. Hollywood, Calif.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Columbia Electronic Cables, Box 231, Woonsocket, R. I.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City, N. Y.
Electric Parts Corp., Box 234, Georgetown, Ky.
Essex Int'l., Inc., Magnet Wire Div., 1601 Wall St., Ft. Wayne, Ind.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Jefferson Cable Corp., 181 Greenwood St., Worcester, Mass.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.

WIRE, MAGNET

Judd Wire Div., S. Bedford St., Burlington, Mass.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Miller Electric Co., Box 231, Woonsocket, R. I.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Oneida Electronic Mfg. Co., 843 N. Cottage St., Meadville, Pa.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rockland Insulated Wire & Cable Co., Inc., 36 Main St., Haverstraw, N. Y.
Rome Cable, Rome, N. Y.
Sag Harbor Inds., Inc., Bayview St., Sag Harbor, N. Y.
Superior Insulated Wire Corp., Box 188, Stony Point, N. Y.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

WIRE, IRRADIATED

Alpha Wire Div., Loral Corp., 711 Ldgerwood Ave., Elizabeth, N. J.
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. .. p 2954, 2955
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Chester Cable Co., Oakland Ave., Chester, N. Y.
General Cable Corp., 733 Third Ave., New York, N. Y.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.

WIRE, LEAD-IN & GROUND

Alpha Wire Div., Loral Corp., 711 Ldgerwood Ave., Elizabeth, N. J.
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. .. p 2954, 2955
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y..... p 2964
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Electronic Parts Mfg. Co., Inc., 508-10 25th St., Union City, N. J.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lance Inds., Box 4156, Sylmar, Calif.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Parker Metal Goods Co., 85 Prescott St., Worcester, Mass.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Rohn Mfg. Co., 6718 W. Plank Rd., Peoria, Ill.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.

WIRE, LITZ

Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Asco Wire & Cable Co., Box 2127, Noble Sta., Bridgeport, Conn.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Montgomery Co., Windsor Locks, Conn.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Slepian, A. & Co., Box 2127, Noble Sta., Bridgeport, Conn.

WIRE, MAGNET

Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935

WIRE, MAGNET (Cont'd)

Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Aluminum Co. of America, 1628 Alcoa Building, Pittsburgh, Pa.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Asco Wire & Cable Co., Box 2127, Noble Sta., Bridgeport, Conn.
Barker Electric Sales Co., 339 Broad Ave., Ridgefield, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Essex Int'l., Inc., Magnet Wire Div., 1601 Wall St., Ft. Wayne, Ind.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Montgomery Co., Windsor Locks, Conn.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
New Haven Wire & Cable, Inc., Box 266, New Haven, Ind.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Rea Magnet Wire Co., Inc., 3600 E. Pontiac St., Ft. Wayne, Ind.
Siemens America Inc., 350 Fifth Ave., New York, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Slepian, A. & Co., Box 2127, Noble Sta., Bridgeport, Conn.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Viking Wire Co., Inc., Shelter Rock Rd., Danbury, Conn.

WIRE, MESH

Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Kressilk Prods., Inc., 420 Saw Mill River Rd., Elmsford, N. Y.
Metex Corp., 970 New Durham Rd., Edison, N. J. ..... p 1229-1232
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
CF & I Steel Corp., Box 1920, Denver, Colo.
Chase Metals Service Div., 20600 Chagrin Blvd., Cleveland, Ohio
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
Flock Process Corp., Box 430, Norwalk, Conn.
Helix Spring Corp., 35-10 10th St., Long Island City, N. Y.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
National-Standard Co., Niles, Mich.
Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Taiyo Elctrn. Corp., 5-1 Togoshi 6-Chome, Shinagawa-ku, Tokyo, Jap.
Tyler, W. S. Co., 8200 Tyler Blvd., Mentor, Ohio
Unique Wire Weaving Co., Inc., 759 Ramsey Ave., Hillside, N. J.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Wire Cloth Enterprises, Inc., 130-132 Gamma Dr., Pittsburgh, Pa.
Wright, G. F. Steel & Wire Co., 243 Stafford St., Worcester, Mass.
York, O. H. Co., Inc., 6 Central Ave., W. Orange, N. J.

WIRE, MULTICONDUCTOR—SEE CABLE, MULTICONDUCTOR

WIRE, PLASTIC INSULATED—SEE WIRE, HOOKUP-PUSHBACK

WIRE, POTENTIOMETER WINDING

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.

WIRE, RADIATION-RESISTANT

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. .. p 2954, 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Standard, 9000 Kings St., Franklin Park, Ill.
Brand-Rex Div., Box 498, Willimantic, Conn.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.

WIRE, RECORDING

Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.

WIRE, REFRACTORY METAL

Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.

WIRE, RESISTANCE AND FILAMENT

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Electric Parts Corp., Box 234, Georgetown, Ky.
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.

WIRE, RESISTANCE THERMOMETER

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.

WIRE, RESISTOR WINDING

Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Materials for Elctrns., Inc., 149-32 132nd St., Jamaica, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.

WIRE, RIBBON

Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. .. p 2939
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Berkshire Electric Cable Co., Leeds, Mass.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Brand-Rex Div., Box 498, Willimantic, Conn.
Brookfield Wire Co., Inc., Box 248, Brookfield, Mass.
CF & I Steel Corp., Box 1920, Denver, Colo.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Colonial Alloys Co., Ridge Ave. & Crawford, Philadelphia, Pa.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Cross, H. Co., 365 Park Ave., Weehawken, N. J.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Flexible Circuits, Inc., Paul Valley Ind. Park, Warrington, Pa.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Improved Seamless Wire Co., 775 Eddy St., Providence, R. I.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lance Inds., Box 4156, Sylmar, Calif.
Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Montgomery Co., Windsor Locks, Conn.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Steel Heddle Mfg. Co., 2100 W. Allegheny Ave., Philadelphia, Pa.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Wilkinson Co., 31011 Agoura Rd., Westlake Village, Calif.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

WIRE, SEMICONDUCTOR LEAD

Art Wire & Stamping Co., 28 Boyden Pl., Newark, N. J.
Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tensolite Div., W. Main St., Tarrytown, N. Y.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Auto-Swage Products, Inc., 502 River Rd., Shelton, Conn.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Copperweld Steel Co., 422 Frick Bldg., Pittsburgh, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Haydu Prod. Corp. Inc., 1150 Ali Baba Ave., Opa Locka, Fla.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Kentucky Elctrns., Inc., Box 511, Owensboro, Ky.
Leico Industries, Inc., 250 W. 57th St., New York, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
National-Standard Co., Niles, Mich.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Sylvania Electric Products, Inc., Parts Div., 12 Second Ave., Warren, Pa.
Vernitron Electrical Components, Box 878, Norwalk, Conn.

WIRE, SHIELDED

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill. p 2930
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2936-2939, 2944
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. .. p 2954, 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. ..... p 2964
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Times Wire & Cable, 358 Hall Ave., Wallingford, Conn.
Whitmor Wire & Cable Corp., 13161 Sherman Way, N. Hollywood, Calif.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
Cable Electric Prods., Inc., 234 Daboll St., Providence, R. I.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Dielectric Materials Co., 1811 W. Bryn Mawr Ave., Chicago, Ill.
Estes Engrg. Co., 543 West 184th St., Gardena, Calif.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Cable Corp., 733 Third Ave., New York, N. Y.
G. E. Co., Wire & Cable Dept., 1285 Boston Ave., Bridgeport, Conn.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hatfield Wire & Cable Div., 360 Hurst St., Linden, N. J.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Microdot Inc., 220 Pasadena Ave., S. Pasadena, Cal.
Miller Electric Co., Box 231, Woonsocket, R. I.

Montgomery Co., Windsor Locks, Conn.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Nesor Alloy Corp., 666 Passaic Ave., W. Caldwell, N. J.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Okonite Co., 220 Passaic St., Passaic, N. J.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Philadelphia Insulated Wire Co., 333 New Albany Rd., Moorestown, N. J.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Plastic Wire & Cable Corp., E. Main St., Jewett City, Conn.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Rockland Insulated Wire & Cable Co., Inc., 36 Main St., Haverstraw, N. Y.
Rome Cable, Rome, N. Y.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Superior Continental Corp., Box 489, Hickory, N. C.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Western Insulated Wire Co., 2425 E. 30 St., Los Angeles, Calif.
Wiegand, E. L., Co., 7705 Thomas Blvd., Pittsburgh, Pa.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

WIRE, STRAIN GAUGE

Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y.
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Dynatronic Cable Engrg. Corp., 136 San Fernando Rd., Los Angeles, Calif. p 2933
Tensolite Div., W. Main St., Tarrytown, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Cooper, J. B. & Sons, Inc., 180 Varick St., New York, N. Y.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.

WIRE, TFE INSULATED

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
Cimco Wire & Cable Co., 250 W. Crescent Ave., Allendale, N. J. p 2926
Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. ... p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill. p 2940, 2941
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass. ... p 2954, 2955
Markel, L. Frank, & Sons, School La., Norristown, Pa. ..... p 2957
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Plastoid Corporation, 42-61 24th St., Long Island City, N. Y. ..... p 2964
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. ..... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Anaconda Wire & Cable Co., 605 Third Ave., New York, N. Y.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Brand-Rex Div., Box 498, Willimantic, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
Cerro Corp., 300 Park Ave., New York, N. Y.
Cerro Wire & Cable Co., 285 Nicoll St., New Haven, Conn.
Chemplast, Inc., 923-150 Dey Rd., Wayne, N. J.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Cable Corp., 733 Third Ave., New York, N. Y.
Gore, W. L. & Associates, Inc., 555 Paper Mill Rd., Newark, Del.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
NRA, Inc., 12 Nevada Dr., New Hyde Park, N. Y.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Philadelphia Insulated Wire Co., 333 New Albany Rd., Moorestown, N. J.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
Spectra-Strip Corp., P.O. Box 415, Garden Grove, Calif.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Wirecraft Products, Inc., Route 9, West Brookfield, Mass.

WIRE, TEST LEAD

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Belden Corp., Box 5070A, Chicago, Ill. ..... p 2924
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Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
National Wire & Cable Corp., 136 San Fernando Rd., Dept. EEM, Service Div., Los Angeles, Cal.
Rye Industries Inc., 125 Spencer Pl., Mamaroneck, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Apex Wire & Cable Corp., 380 Vanderbilt Motor Pkwy., Hauppauge, N. Y.
Associated Engineering Corp., 65 Kent St., Brookline, Mass.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Berkshire Electric Cable Co., Leeds, Mass.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carol Cable Co. West, 1747 Flower St., Glendale, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Judd Wire Div., S. Bedford St., Burlington, Mass.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Pace Wire & Cable Corp., 3590 Oceanside Rd., Oceanside, N. Y.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Rhode Island Insulated Wire Co., 50 Burnham Ave., Cranston, R. I.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.

WIRE, THERMOCOUPLE

Amperex Elctrn. Corp., 230 Duffy Ave., Hicksville, N. Y.
Cohn, Sigmund, Corp., 121 S. Columbus Ave., Mt. Vernon, N. Y. p 2927
Consolidated Reactive Metals, Inc., 116 Hoyt Ave., Mamaroneck, N. Y. p 2931
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Control Prods. Corp., 4431 W. Division St., Chicago, Ill. .. p 2804, 2805
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Engelhard Minerals & Chemicals Corp., Engelhard Inds. Div., 231 New Jersey RR Ave., Newark, N. J.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
ITT Wire & Cable Div., 172 Sterling St., Clinton, Mass.
Markel, L. Frank, & Sons, School La., Norristown, Pa.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y. .... p 2966
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal. p 2967
Tensolite Div., W. Main St., Tarrytown, N. Y. ..... p 2968
Akron Wire & Rubber Co., Inc., 105 Schmitt Blvd., Farmingdale, N. Y.
Alnor Instrument Co., 420 N. LaSalle St., Chicago, Ill.
American Standard, 9000 Kings St., Franklin Park, Ill.
Berkley & Co., Spirit Lake, Iowa
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Bristol Co., Box 1790, Waterbury, Conn.
British Insulated Callender's Cables, 21 Bloomsbury St., London, Eng.
CF & I Steel Corp., Box 1920, Denver, Colo.
California Fine Wire Co., 338 S. Fourth St., Grover City, Calif.
Chester Cable Co., Oakland Ave., Chester, N. Y.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
Conax Corporation, 2300 Walden Ave., Buffalo, N. Y.
Consolidated Controls Corp., 12 Durant Ave., Bethel, Conn.
Continental Wire & Cable, Box 1863 Gulton Rd., York, Pa.
Driver, Wilbur B. Co., 1875 McCarter Highway, Newark, N. J.
Electric Thermometers, Inc., 10 Glover Ave., Norwalk, Conn.
Exotic Materials, Inc., 2968 Randolph Ave., Costa Mesa, Calif.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
Harco Labs, Inc., 186 Cedar St., Branford, Conn.
Hitemp Div., 1200 Shames Dr., Westbury, N. Y.
Honeywell, Inc., Industrial Div., 1100 Virginia Dr., Ft. Washington, Pa.
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Inso Electronic Prods., Inc., 103 Park Ave., Nutley, N. J.
International Wire Prods. Corp., 500 W. Main St., Wyckoff, N. J.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Lewis Engineering Co., 550 Spring St., Naugatuck, Conn.
Mackay, A. D., Inc., 198 Broadway, New York, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Marlin Mfg. Corp., 12404 Triskett Rd., Cleveland, Ohio
Matthey Bishop, Inc., Malvern, Pa.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Molecu-Wire Corp., Box 495, Farmingdale, N. J.
Moore, Samuel & Co., Mantua, Ohio
Omega Engineering, Inc., Box 4047, Stamford, Conn.
Pall Corp., 30 Sea Cliff Ave., Glen Cove, N. Y.
Pall Trinity Micro Corp., Rte. 281, Cortland, N. Y.
Physical Sciences Corp., 312-314 E. Live Oak Ave., Arcadia, Calif.
Prestolite Wire & Cable Div., P.O. Box 649, Port Huron, Mich.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Revere Corp. of America, 845 N. Colony Rd., Wallingford, Conn.
Richards, Arklay S. Co., Inc., 1 Winchester St., Newton Highlands, Mass.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass.
TemTex, 5619 Dyer St., Dallas, Tex.
Thermal Wire & Elctrns. Corp., Keelers Bay, S. Hero, Vt.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Thermo Electric Co. Inc., 109 Fifth St., Saddle Brook, N. J.
Thermology, Inc., 2558 W. Middlefield, Mountain View, Calif.
Thermotronic Devices, Inc., Forest & Hector Sts., Conshohocken, Pa.
West Instrument Corp., 3860 N. River Rd., Schiller Park, Ill.

WIRE, TINSEL

Columbia Wire Products Co., 4045 N. Rockwell St., Chicago, Ill.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill.
Dearborn Wire & Cable Co., 3333 West Ohio St., Chicago, Ill.
Garrett Elctrns. & Cable Corp., 24 Central Dr., Farmingdale, N. Y.
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Tensolite Div., W. Main St., Tarrytown, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.

WIRE CUTTERS, HAND OPERATED

Carol Cable Co., Box 68, Pawtucket, R. I.
Gavitt Wire & Cable Div., Amerace Esna Corp., Brookfield, Mass.
General Cable Corp., 733 Third Ave., New York, N. Y.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Metal Ceram, Inc., 17 N. West St., Mount Vernon, N. Y.
Miller Electric Co., Box 231, Woonsocket, R. I.
Montgomery Co., Windsor Locks, Conn.
Pacific Electricord Co., 747 W. Redondo Beach Blvd., Gardena, Calif.

WIRE, TRANSMISSION— SEE CABLE, TRANSMISSION LINE

WIRE, TUNGSTEN

Allen-Jones Electronics, 17171 S. Western Ave., Gardena, Calif.
Associated Engrg. & Mfg. Corp., Glen Ridge, N. J.
Atomergic Chemetals Co., 584 Mineola Ave., Carle Place, N. Y.
Bram Metallurgical-Chemical Co., 245 Chelten Ave., Philadelphia, Pa.
Cleveland Refractory Metals Div., 28850 Aurora Rd., Solon, Ohio
G. E. Co., Lamp Metals & Comp., 21800 Tungsten Rd., Cleveland, Ohio
Magnet Wire Inc., 25 Walker St., New York, N. Y.
Norton Co., Metals Div., 45 Industrial Pl., Newton, Mass.
Philips Elmet Corp., Lisbon Rd., Lewiston, Me.
Pyco, Inc., 604 E. Lincoln Hwy., Penndel, Pa.
Rembar Co., Inc., 67 Main St., Dobbs Ferry, N. Y.
Sylvania Electric Prods., Inc., Chem. & Metallurgical Div., Towanda, Pa.
Unique Wire Weaving Co., Inc., 759 Ramsey Ave., Hillside, N. J.
United Mineral & Chemical Corp., 129 Hudson St., New York, N. Y.
Var-Lac-Oid Chemical Co., 666 S. Front St., Elizabeth, N. J.
Westinghouse Electric Corp., 1 Westinghouse Plaza, Bloomfield, N. J.

WIRE & CABLE TIES

Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. ... p 2935
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill. ... p 903
ICO/Rally, 1015 Corporation Way, Palo Alto, Calif. ..... p 2953
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill. ..... p 2963
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Zeus Industrial Products, Inc., 195 Nassau St., Princeton, N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Bergen Wire Rope Co., 1234 Gregg St., Lodi, N. J.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
E. C. P. Corp., 4726 Superior Ave., Cleveland, Ohio
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Fastex Div., 195 Algonquin Rd., Des Plaines, Ill.
Gudebrod Bros. Silk Co., Inc., 225 West 34th St., New York, N. Y.
Hanscom, H. F. Co., Inc., 225 Chapman St., Providence, R. I.
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Kent Corp., 169 Lake St., Mundelein, Ill.
Leviton Mfg. Co., Inc., 236 Greenpoint Ave., Brooklyn, N. Y.
Richco Plastic Co., 5825 N. Tripp Ave., Chicago, Ill.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Transcon Mfg. Co., 2655 Perth St., Dallas, Tex.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.

WIRE CUTTERS, AUTOMATIC

Eraser Co. Inc., Box 1342, Syracuse, N. Y. ..... p 2150
Automatic Die Cutting Machine Co., 149 Church St., New York, N. Y.
Caton Industries, Inc., 648 W. First Ave., Roselle, N. J.
Eubanks Engineering Co., Box 563, 225 W. Duarte Rd., Monrovia, Calif.
Heller Industries Inc., 30 N. 15th St., East Orange, N. J.
Janel, Inc., 226 Main Ave., Stirling, N. J.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Porter, H. K., Inc., 74 Foley St., Somerville, Mass.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.
Wybar Electronics, Inc., Oliva Dr., Syracuse, N. Y.

WIRE CUTTERS, HAND OPERATED

Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif. ..... p 2831
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Bailey Co., 5919 Massachusetts Ave., Washington, D. C.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Boker Mfg. Co., In-Dus-Tronic Div., 200 Burnett Ave., Maplewood, N. J.
Carol Cable Co., Box 68, Pawtucket, R. I.
Channellock, Inc., S. Main St., Meadville, Pa.
Clauss Cutlery Co., P.O. Box 667, Freemont, Ohio
Compton, W. H., Shear Co., Box 1096 No. Sta., New Bedford, Mass.
Crescent Niagaga Corp., 70 Niagara St., Buffalo, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
E. T. M. Corp., 144 W. Chestnut Ave., Monrovia, Calif.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
James Electrn. Tool Co., Box 1482, Palo Alto, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Larsen Importing Co., 140 Nassau St., New York, N. Y.

WIRE CUTTERS, HAND OPERATED (Cont'd)

Owatonna Tool Co., 395 Eisenhower Dr., Owatonna, Minn.
Porter, H. K., Inc., 74 Foley St., Somerville, Mass.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Utica Tool Co., Inc., Cameron Rd., Orangeburg, S. C.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Vigor Tool Co., 53 West 23 St., New York. N. Y.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Williams, J. H. & Co., 400 Vulcan St., Buffalo, N. Y.

WIRE CUTTING & STRIPPING SERVICES—SEE SERVICES, WIRE CUTTING & STRIPPING

WIRE FORMS—SEE FORMS, WIRE

WIRE MARKERS (ALL TYPES)—ALSO SEE STRIPS, MARKER & FANNING

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J.
Markel, L. Frank, & Sons, School La., Norristown, Pa.
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill. ..... p 2963
Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Actioncraft Prods., Inc., 2 Yennicock Ave., Port Washington, N. Y.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Defiance Machine & Tool Co., 430 Industrial Dr., Maryland Heights, Mo.
Duramark, Inc., 2 Secatoag Ave., Port Washington, N. Y.
E. C. P. Corp., 4726 Superior Ave., Cleveland, Ohio
Electrovert, Inc., 86 Hartford Ave., Mt. Vernon, N. Y.
Excel Specialty Corp., 6335 N. Broadway, Chicago, Ill.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
National Band & Tag Co., 721 York St., Newport, Ky.
Plymouth Rubber Co., Inc., Canton, Mass.
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif.
Rayclad Tubes, Inc., 300 Constitution Dr., Menlo Park, Calif.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Tri-State Elctrns. Corp., Broadway & Jefferson Sts., Camden, N. J.
Tyton Corp. of America, 46 Liberty St., Metuchen, N. J.
Westline Products, 220 S. Rose St., Los Angeles, Calif.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

WIRE-MARKING MACHINES, AUTOMATIC

Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Artos Engrg. Co., 15600 W. Lincoln Ave., New Berlin, Wisc.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Defiance Machine & Tool Co., 430 Industrial Dr., Maryland Heights, Mo.
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
Geartronics Corp., 112 Chelmsford Rd., N. Billerica, Mass.
Gillies, D. M., Co., Inc., 66 Central St., W. Boylston, Mass.
Kingsley Machine Co., 850 Cahuenga Blvd., Hollywood, Calif.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Matthews, Jas. & Co., 6619 Penn Ave., Pittsburgh, Pa.
Wharton Unitools, 8-10 Lake St., Moosup, Conn.

WIRE-MARKING MACHINES, HAND OPERATED

Ackerman-Gould Co., Inc., 10 Neil Ct., Box 188, Oceanside, N. Y.
Acromark Co., 60 Locust Ave., Berkeley Hgts., N. J.
Brady, W. H., Co., 710 W. Glendale Ave., Milwaukee, Wisc.
Defiance Machine & Tool Co., 430 Industrial Dr., Maryland Heights, Mo.
Formulabs Industrial Inks, Inc., 529 W. Fourth Ave., Escondido, Calif.
Gillies, D. M., Co., Inc., 66 Central St., W. Boylston, Mass.
Kingsley Machine Co., 850 Cahuenga Blvd., Hollywood, Calif.
Matthews, Jas. & Co., 6619 Penn Ave., Pittsburgh, Pa.

WIRE-MEASURING & CUTTING MACHINES

Durant Digital Inst. 625 N. Cass St., Milwaukee, Wisc.
Eraser Co. Inc., Box 1342, Syracuse, N. Y. ..... p 2150
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Conrac Corp., 330 Madison Ave., New York, N. Y.
Foster & Allen, Inc., Box 466, Chatham, N. J.
Heller Industries Inc., 30 N. 15th St., East Orange, N. J.
Hykon Mfg. Co., 163 E. State St., Alliance, Ohio
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Laser Technology, Inc., 10624 Ventura Blvd., N. Hollywood, Calif.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Olympic Instruments, Inc., Vashon, Wash.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.
Wybar Electronics, Inc., Oliva Dr., Syracuse, N. Y.

WIRE MEASURING GAUGES

Multicore Sales Corp., Dept. RY399, Westbury, N. Y. ..... p 2833
Bendix Corp., Automation & Meas. Div., Box 893, Dayton, Ohio
Dice, J. W., Co., 16 Highwood Ave., Englewood, N. J.
Electron-Machine Corp., Box M, Umatilla, Fla.
Fostoria-Fannon, Inc., 1200 N. Main St., Fostoria, Ohio
General Instr., Systematics, 13040 S. Cerise Ave., Hawthorne, Cal.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Precision Systems Div., 1183 Chesapeake Ave., Columbus, Ohio

WIRE SHIELDING

Alpha Wire Div., Loral Corp., 711 Lidgerwood Ave., Elizabeth, N. J. p 2923
Belden Corp., Box 5070A, Chicago, Ill.
Consolidated Wire & Assocs. Corps., 1635 S. Clinton St., Chicago, Ill. p 2932
Daburn Elctrns. & Cable Corp., 2360 Hoffman St., Bronx, N. Y. .. p 2935
Metex Corp., 970 New Durham Rd., Edison, N. J. .. p 1229, 1231, 1233
Perfection Mica Co., 740 Thomas Dr., Bensonville, Ill. ..... p 1224
Saxton Wire & Cable Div., 215 N. Route 303, Congers, N. Y.
Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, Cal.
Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J. p 1235
Aerospace Systems, A Teledyne Co., 1007 East 10th St., Fairmont, Minn.
Aircraft & Elctrn. Specialties, Inc., 12675 W. U.S. Hwy. 36, Plainfield, Ind.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Atlas Wire & Cable Co., Inc., 72 N. Broadway, Yonkers, N. Y.
Birnbach Co. Inc., 177 Hanse Ave., Freeport, N. Y.
Calcon Mfg. Corp., 100 Oakland Ave., Washington, Pa.
Co-Operative Industries, Inc., 100 Oakdale Rd., Chester, N. J.
Consolidated Prods. Corp., 17360 S. Gramercy Pl., Gardena, Calif.
Copperweld Steel Co., Wire & Cable Div., Glassport, Pa.
International Wire & Cable Co., 1300 W. Fletcher St., Chicago, Ill.
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Montgomery Co., Windsor Locks, Conn.
New England Electric Wire Corp., 367 Main St., Lisbon, N. H.
Potter Co., 500 W. Florence Ave., Inglewood, Calif.
Templet Ind., Inc., 201 E. Bethpage Rd., Plainview, N. Y.
Thermax Wire Corp., 32-02 Linden Pl., Flushing, N. Y.
Westinghouse Elec. Corp., R.D. #2, Box 45, Blairsville, Pa.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

WIRE STRIPPERS, AUTOMATIC

American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich.
Eraser Co. Inc., Box 1342, Syracuse, N. Y. ..... p 2150
Addison Electric Co., Inc., 1101 Bristol Rd., Mountainside, N. J.
Artos Engrg. Co., 15600 W. Lincoln Ave., New Berlin, Wisc.
Carpenter Mfg. Co., Inc., Fairgrounds Dr., Manlius, N. Y.
English Elec. Co., Ltd., English Elec. House Strand, London, W.C. 2, Eng.
Eubanks Engineering Co., Box 563, 225 W. Duarte Rd., Monrovia, Calif.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
High Speed Hammer Co., Inc., 313 Norton St., Rochester, N. Y.
Hughes Aircraft, Aerospace Gp., Centinela Ave. & Teale St., Culver City, Cal.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Industrial Winding Machinery Corp., Box 45, River Edge, N. J.
Janel, Inc., 226 Main Ave., Stirling, N. J.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Manger Electric Co., Inc., W. Henry St., Stamford, Conn.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, Ohio
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Technical Devices Co., 11242 Playa Ct., Culver City, Calif.
Thomas Instr. Co., Rte. 1, Phoenix, N. Y.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.
Wybar Electronics, Inc., Oliva Dr., Syracuse, N. Y.

WIRE STRIPPERS, HAND OPERATED

American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich.
Eraser Co. Inc., Box 1342, Syracuse, N. Y.
GC Electronics, Dept. ID-1, 400 S. Wyman St., Rockford, Ill.
Teivac Instr. Co., 18531-E Ventura Blvd., Tarzana, Calif. ..... p 2834
Waldom Electronics, Inc., 4633 West 53rd St., Chicago, Ill.
Blonder-Tongue Labs Inc., 9 Alling St., Newark, N. J.
Carol Cable Co., Box 68, Pawtucket, R. I.
Carpenter Mfg. Co., Inc., Fairgrounds Dr., Manlius, N. Y.
Channellock, Inc., S. Main St., Meadville, Pa.
Clauss Cutlery Co., P.O. Box 667, Freemont, Ohio
Contact, Inc., P.O. Box 6, Hudson, N. H.
Engineering & Elctrn. Devices Inc., 1024 N. McCadden Pl., Los Angeles, Calif.
English Electric Valve Co., Ltd., Chelmsford, Essex, Eng.
Ewald Instruments Corp., Rte. 7-R, Kent, Conn.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Hammel Riglander & Co., Inc., 435 Hudson St., New York, N. Y.
Helenor Metals Corp., 60 Marbledale Rd., Tuckahoe, N. Y.
Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
James Electrn. Tool Co., Box 1482, Palo Alto, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kinetics Corp. of California, 410 S. Cedros Ave., Solana Beach, Calif.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Labgear, Ltd., Cromwell Rd., Cambridge, Eng.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Miller, K. Tool & Mfg. Co., Inc., 857 Elm St., W. Springfield, Mass.
Owatonna Tool Co., 395 Eisenhower Dr., Owatonna, Minn.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.
Triple-A Specialty Co., 5750 West 51st St., Chicago, Ill.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Western Elctrn. Prods. Co., 107 Los Molinos, San Clemente, Calif.
Whitaker Cable Corp., 1301 Burlington St., N. Kansas City, Mo.
Wybar Electronics, Inc., Oliva Dr., Syracuse, N. Y.

WIRE STRIPPERS, THERMAL

American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich.
Pioneer Magnetics Inc., 1745 Berkeley St., Santa Monica, Calif.
Adcola Prods. Pty. Ltd., 22 Firth St., Doncaster 3108, Victoria, Australia
Advanced Packaging Div., 139 Maryland St., El Segundo, Calif.
Contact, Inc., P.O. Box 6, Hudson, N. H.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Janel, Inc., 226 Main Ave., Stirling, N. J.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Unitek Corp., Weldmatic Div., 1820 S. Myrtle Ave., Monrovia, Calif.

WIRE STRIPPING CHEMICALS—SEE CHEMICALS, WIRE STRIPPING

WIRE TWISTERS, AUTOMATIC

Eraser Co. Inc., Box 1342, Syracuse, N. Y. ..... p 2150
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Carpenter Mfg. Co., Inc., Fairgrounds Dr., Manlius, N. Y.
Hanscom, H. F. Co., Inc., 225 Chapman St., Providence, R. I.
Ideal Inds., Inc., 4450 Becker Pl., Sycamore, Ill.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
MacDonald & Co., 213 South Brand Blvd., Glendale, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Wybar Electronics, Inc., Oliva Dr., Syracuse, N. Y.

WIRE TWISTERS, HAND OPERATED

Eraser Co. Inc., Box 1342, Syracuse, N. Y.
American Elec. Cable Co., 181 Appleton St., Holyoke, Mass.
Carpenter Mfg. Co., Inc., Fairgrounds Dr., Manlius, N. Y.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Janel, Inc., 226 Main Ave., Stirling, N. J.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Permaluster, Inc., 1844 N. Keystone St., Burbank, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Wybar Electronics, Inc., Oliva Dr., Syracuse, N. Y.

WIRE WRAPPING SERVICES—SEE SERVICES, WIRE WRAPPING

WIRE WRAPPING TOOLS & ACCESSORIES—ALSO SEE MACHINES, WIRE WRAPPING

Kokusai Elec. Co., Ltd., 9 Nishikubo-Sakuragwa-cho, Minato-ku, Tokyo, Japan
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill. ..... p 2963
Ross, Milton Co., 511 Second St. Pike, Southampton, Pa.
Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, Mass.
Gardner-Denver Company, Gardner Expwy., Quincy, Ill.
Ideal-Hellerman Can., Ltd., 331 Frankcom St., Ajax, Ont., Can.
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Ostby & Barton Co., Box 6267, Providence, R. I.
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N. Y.
Sjoberg, C., & Son, Inc., 415 Station St., Cranston, R. I.
Standard Pneumatic Motor Co., Box 745, Whittier, Calif.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Torrington Co., Box 1008, Torrington, Conn.
Utica Tool Co., Inc., Cameron Rd., Orangeburg, S. C.
Zippertubing Co., 13000 S. Broadway, Los Angeles, Calif.

WIRING PANELS & BOARDS, COMPUTER—SEE BOARDS, PROGRAMMING

WORK POSITIONERS, CIRCUIT BOARD & CHASSIS—SEE HOLDERS & JIGS

WORK STATIONS, CLEAN, DUST FREE

Agnew-Higgins, Inc., Box 857, Garden Grove, Calif.
American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.
Amsco Industrial Co., 2820 West 23 St., Erie, Pa.
Baker Co., Inc., 106 Granite St., Biddeford, Me.
Clean Rooms Construction Co., Inc., Box 275, Westminster, Calif.
Controlled Environment Equip Corp., 160 Pleasant St., Brockton, Mass.
Edcraft Inds., Inc., 620 Commerce Rd., Linden, N. J.
Farr Co., 2301 E. Rosecrans, El Segundo, Calif.
Flotron Industries, Inc., 1201 E. Grand Ave., El Segundo, Calif.
General Acoustics Corp., 12248 Santa Monica Blvd., Los Angeles, Calif.
Interlab, Inc., 109 Wheeler Ave., Pleasantville, N. Y.
Janel, Inc., 226 Main Ave., Stirling, N. J.
Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa.
Kulicke & Soffa Inds., Inc., 135 Commerce Dr., Fort Washington, Pa.
Laminated Sheet Products Corp., 449 Neponset St., Norwood, Mass.
Pressteel Co., 9705 E. Garvey Ave., El Monte, Calif.
Ramney Inds. Corp., Box 585, Farmingdale, N. J.
Ray Products, Inc., 703 S. Palm Ave., Alhambra, Calif.
Sara Scientific Co., Box 321, San Francisco, Calif.
Sturdilite, Plainwell, Mich.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Torit Corp., 1133 Rankin St., St. Paul, Minn.
Westinghouse Elec. Corp., Environmental Systems Dept., 4300 36th St., S.E., Grand Rapids, Mich.
Zicon Corp., 63 E. Sandford Blvd., Mount Vernon, N. Y.

WRENCHES

Dialight Corp., 60 Stewart Ave., Brooklyn, N. Y.
Erikson Specialized Tool Co., Box 424, Pico-Rivera, Calif. ..... p 2831
Allen Mfg. Co., Drawer 570, Hartford, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Boker Mfg. Co., In-Dus-Tronic Div., 200 Burnett Ave., Maplewood, N. J.
Channellock, Inc., S. Main St., Meadville, Pa.
Crescent Niagaga Corp., 70 Niagara St., Buffalo, N. Y.
Desco Mfg. Co., 1530 Flower St., Glendale, Calif.
E. T. M. Corp., 144 W. Chestnut Ave., Monrovia, Calif.
Emporium Specialties, Inc., 2800 East 116th St., Cleveland, Ohio
Endevco, 801 S. Arroyo Pkwy., Pasadena, Calif.
General Hardware Mfg. Co., Inc., 80 White St., New York, N. Y.
Glenair, Inc., 1211 Air Way, Glendale, Calif.
Hi-Shear Corp., 2600 Skypark Dr., Torrance, Calif.
Hunter Tools, 9851 Alburtis Ave., Sante Fe Springs, Calif.
Janel, Inc., 226 Main Ave., Stirling, N. J.

Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N. Y.
Kawecki Berylco Inds., Inc., Box 1462, Reading, Pa.
Klein, Mathias, & Sons, Inc., 7200 McCormick Rd., Chicago, Ill.
Moody Machine Prods. Co., Inc., Box 2248, Providence, R. I.
Owatonna Tool Co., 395 Eisenhower Dr., Owatonna, Minn.
Proto Tool Co., 2209 Sante Fe Ave., Los Angeles, Calif.
Signal Indicator Corp., 42 Stewart Ave., Brooklyn, N. Y.
Snap-On Tools Corp., 8120 28th Ave., Kenosha, Wisc.
Techni-Tool, Inc., 1216 Arch St., Philadelphia, Pa.
Upson Tools, Inc., Box 4750, Rochester, N. Y.
Utica Tool Co., Inc., Cameron Rd., Orangeburg, S. C.
Vaco Products Co., 510 N. Dearborn St., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo, N. Y.
Xcelite Inc., Thorne & Bank Sts., Orchard Park, N. Y.

X-RAY INSPECTION EQUIPMENT

Torr Laboratories, Inc., 2228 Cotner Ave., Los Angeles, Calif.
Automation Inds., Inc., 1901 Bldg., Century City, Los Angeles, Calif.
Automation Inds., Inc., Shelter Rock Rd., Danbury, Conn.
Automation Industries, Inc., Box 950, Boulder, Colo.
Balteau Elec. Corp., 10-14 Meadow St., Stamford, Conn.
Bendix Corp., Aerospace Sys. Div., 3300 Plymouth Rd., Ann Arbor, Mich.
Continental X-Ray Corp., 1536 Clybourn Ave., Chicago, Ill.
E. I. Dupont De Nemours & Co., Inc., 1007 Market St., Wilmington, Del.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Ercona Corp., 2121 Bellmore Ave., Bellmore, N. Y.
Fleetwood Labs Inc., 35 Rockwood Pl., New Rochelle, N. Y.
General Electric Co., Analytical Measurement Business Sec., 25 Federal St., W. Lynn, Mass.
High Voltage Engrg. Corp., S. Bedford St., Burlington, Mass.
Hoffman, P. R. Co., 307 Cherry St., Carlisle, Pa.
Industrial Gauging & Control, 296 Westport Ave., Norwalk, Conn.
Isomet Corp., 433 Commercial Ave., Palisades Park, N. J.
Merix Chemical Co., 2234 East 75th St., Chicago, Ill.
Neumade Products Corp., 720 White Plains Rd., Scarsdale, N. Y.
New York Testing Labs, Inc., 81 Urban Ave., Westbury, N. Y.
Nuclear Research Corp., Street Rd. & 2nd St. Pike, Southampton, Pa.
Philips Electronic Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Press-On Products, 39 Factory Rd., Addison, Ill.
Testing Equip. & Supplies Corp., 6 Huron Dr., Natick, Mass.
Universal X-Ray Prods., Inc., 1140 N. Western Ave., Chicago, Ill.
Varian Assocs., 611 Hansen Way, Palo Alto, Calif.
Weston Instrs. Div., Weston Instr. Inc., 614 Frelinghuysen Ave., Newark, N. J.

X-RAY INTENSITY METERS—SEE METERS, X-RAY INTENSITY

X-Y AXIS TABLES—SEE SIMULATORS, MOTION

XENON LAMP POWER SUPPLIES—SEE POWER SUPPLIES, ARC LAMP

YIG CRYSTALS—SEE CRYSTALS, YIG

YOKES, DEFLECTION, CATHODE-RAY TUBE

Amperex Elctrn. Corp., Component Div., 35 Hoffman Ave., Hauppauge, N. Y.
Molex Prods. Co., 5224 Katrine Ave., Downers Grove, Ill.
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. . . . p 1207
Advance Ross Electronics Corp., 135 S. La Salle St., Chicago, Ill.
American Electronic Controls, 74 Tracey Rd., Huntingdon Valley, Pa.
Automatic Coil Mfg. Ltd., 50 Wingold Ave., Toronto, Ont., Canada
Celco, 70 Constantine Dr., Mahwah, N. J.
Denson Electronics Corp., P.O. Box 122, Rockville, Conn.
Ferranti Elec., Inc., E. Bethpage Rd., Plainview, N. Y.
General Instrument of Canada Ltd., 151 Weber St., S. Waterloo, Ont., Can.
General Instrument Corp., F. W. Sickles Div., 165 Front St., Chicopee, Mass.

YOKES, ROTATING COIL

Rola Div., 21010 Miles Pkwy., Cleveland, Ohio
Triad Distributor Div., 305 N. Briant St., Huntington, Ind.
Utrad Corp., 305 N. Briant St., Huntington, Ind.

YOKES, DEFLECTION, OSCILLOSCOPE

Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. . . . p 1207
Celco, 70 Constantine Dr., Mahwah, N. J.
ITT Instruments, ITT Aerospace/Optical Div., 15191 Bledsoe St.,
Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

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Y. T. & T. Corp., Box 306, Roslyn Hgts., N. Y.

YOKES, DEFLECTION, TV CAMERA

Cleveland Elctrns., Inc., 2000 Highland Rd., Twinsburg, Ohio p 726, 727
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. . . . p 1207

YOKES, ROTATING COIL

Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. . . . p 1207
Atlas Coil Inc., 63 Main St., Ansonia, Conn.
Celco, 70 Constantine Dr., Mahwah, N. J.
Tele Coil Co., Inc., 2733 Saunders St., Camden, N. J.

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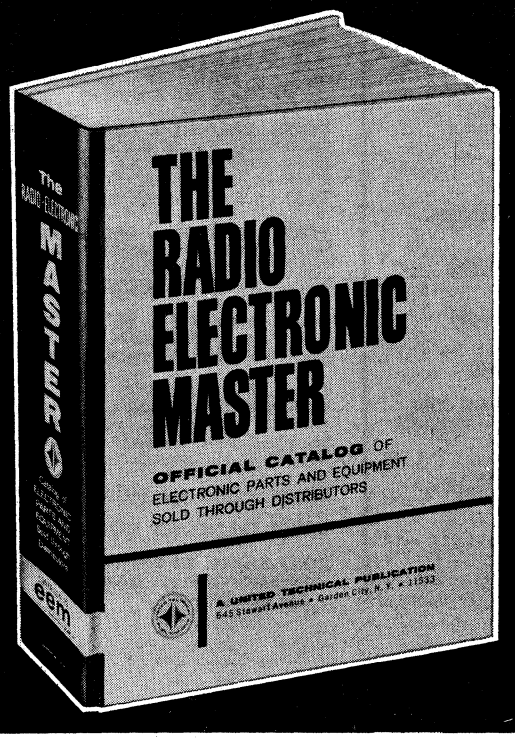

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Mock Electr., 2310 Memorial Pkwy., Southwest
Radio Elec. Service Co. of Baltimore, Inc.,
803A N. Memorial Parkway
Mobile—
Electronic Supply Co., 561 Holcomb Ave.
Nelson Radio & Supply, 1541 S. Beltline Hwy.
Montgomery—Southeastern Radio, Box 1464
Selma—Southeastern Radio, Box 923
Sheffield—
Mock Radio & Elecr., 107 N. Montgomery Ave.

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Fairbanks—Yukon Radio Supply, 1112 Cushman

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Phoenix—
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710 N. Thompson
Texarkana—Lavender Electr., 520 E. 4th St.

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Shanks & Wright, 2045 Kettner Blvd.
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Zach Electronics, 1444 Market St.

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Quemont Industrial Electronics,
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Weatherbie Indust. Electr., 1280 N. 4th
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Cam Gard Supply Ltd., 605 Victoria St.
Edmonton—Cam Gard Sup. Ltd., 10505 111 St.
Canadian Elect., Ltd., 10633 109th
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Matteau Radio Electr. Ltee, 2045 Rue Royale
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Kierulff Electronics, 1200 Stout St.
Newark-Denver, 2170 S. Grape

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Southeastern Radio Parts Co., 248 North 5th Ave.
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Precision Radio, Ltd., 1160 S. King St.
Radio Wholesale & Supply Co.,
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North Platte—
Scott Electronic Supply Corp., 516 N. Poplar St.
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513-15 Cooper St.
Radio Electric Service Co. of Pennsylvania
30 Market St.
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Sterling Electronics, 1712 Lomas Blvd., N.E.
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102 Granite Ave., N.W., P.O. Box 921

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Federal Electronics, Inc., Vestal Parkway
Stack Electronics, Inc., 45 Washington St.
Morris Electronics of Binghamton, Inc.
295 Court St.

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Brooklyn—Brooklyn Electrs., Inc., 4222 10 Ave.
Buffalo—Genesee Radio & Parts Company, Inc.
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Standard Electronics, 1497-1501 Main St.
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Hempstead—Davis Electronics Corp., 204 Main St.
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Jamaica—
Norman Radio Distr., Inc., 94-29 Merrick Rd.
Long Island City—
H. L. Dalis, Inc., 35-35 24th St.
Spera Electronics, 32-20 37 Ave.
Lynbrook—Peerless Radio Corp., 19 Wilbur St.
Mineola—Arrow Electrs., Inc., 525 Jericho Tpke.
Newburgh—Chief Electr., Inc., 248 Washington
New York—Arrow Electrs., Inc., 97 Chambers St.
Blan Electronics Corp., 52 Warren St.
Center Indust. Electrs. Corp., 15-17 E. 16th S.t
Harrison Electronics Corp., 8 Barclay St.
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Midway Radio & Television Corp., 58 W. 45th St.
Milgray Electronics, Inc., 160 Varick St.
Milo Electronics Corp., 530 Canal St.
Terminal-Hudson Electrs., Inc., 236 W. 17th St.
Terminal Radio Int'l. Ltd., 3 W. 61 St.
Niagara Falls—Niagara Falls Radio Eqt. Co., 1720 Pierce Ave.
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N. Tonowanda—Radio Equip. Corp., 110 Webster
Olean—
B & O Radio Eqpt. Co., Inc., 1615 W. State
Standard Electronics Inc., 410 N. Union St.
Poughkeepsie—Chief Electr., 14 N. Bridge St.
Richmond Hill—
Anchor Electronic Dist. Corp., 116-01 101st Ave.
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Allied Electronics Corp., 255 N. Goodman St.
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Morris Electronics of Syracuse, Inc.
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Woodbury—
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Southeastern Radio Supply Co., 401 Foster St.
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Southeastern Radio Supply Co., Inc., 325 Rowan
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Dixie Radio Supply Co., Inc., 507 W. Airline Ave.
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Southeastern Radio Supply Co., Inc.
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Southeastern Radio Sup. Co., Inc., P.O. Box 1214
Kinston—Southeastern Radio Supply Co., Inc.
1005 E. Highland Ave.
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414 Hillsboro St. — Box 9205
Roswell—R & R Electronic Sup. Co., 605 E. Second
Salisbury—Southeastern Radio Supply Co., Inc.
P.O. Box 97
Shelby—
Freck Radio & Sup. Co., Inc., 402 W. Dixon Blvd.
Wilmington—Southeastern Radio Supply Co., Inc.
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938 Burke St. — P.O. Box 2780

OHIO

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Pioneer/Standard Electronics, Inc.,
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Warren Radio Co., 5842 Ridge Rd.
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Dayton—
Allied Electronics Corp., 2975 Far Hills Ave.
Srepco Electronics Div. Pioneer-Standard
Electronics, Inc., 314 Leo St.
Stotts-Friedman Co., 108-112 N. Jefferson St.
Delaware—
Servex Electronic Distrib., Inc., 175 E. Winter
Hamilton—Srepco Electronics, 145 Highland Ave.
Lima—Warren Radio Co., 565 So. Metcalf St.
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Pioneer-Standard Electronics, 3847 Pearl Ave.
Mansfield—
Wholesaling Electronics, 775 Springmill Rd.
Marion—
Servex Elec. Distributing Co., 224 N. Porspect
Middletown—Srepco Electronics, 2104 Brentwood
Mt. Vernon—
Servex Electronic Distrib., Inc., 516 S. Main St.
Parma—
Winteradio Electr. Supply Corp., 5373 Ridge Rd.
Piqua—Srepco Electronics, R. R. #66
Sandusky—
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534 Columbus Ave.
South Euclid—
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Tiffin—Servex Electr. Distr., Inc., 215 Jefferson St.
Toledo—Warren Radio Co., 1002 Adams St.
Warren—Rem Electronic Sup. Co., 264 W. Market
Wooster—
Servex Electr. Distrib., Inc., 230 N. Buckeye St.

OKLAHOMA

Ada—Trice Wholesale Electronics, 231 N. Francis
Ardmore—Trice Wholesale Electronics, 709 Grand
Bartlesville—Cummins Electronic Supply, Inc.
700 E. Frank Phillips Blvd.
Enid—
Trice Wholesale Electrs., 322 S. Independence
Lawton—Trice Wholesale Electr., 28 "E" St.
McAlester—
McAlester Radio & TV Supply, 407 N. Main St.
Trice Wholesale Electronics, 529 N. Main
Muskogee—
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Oklahoma City—Radio, Inc., 903 N. Hudson
Trice Wholesale Electronics, 4701 N. Stiles
Trice Wholesale Electronics, 800 N. Hudson
Okmulgee—
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Ponca City—Trice Wholesale Electrs., 607 N. First
Tulsa—Radio, Inc., 1000 South Main
Trice Wholesale Electronics, 738 S. Boston

OREGON

Eugene—United Radio Supply, Inc., 974 W. 6th St.
Medford—Central Distributors, 605 N. Fir St.
Verl G. Walker, 205 W. Jackson
Portland—
Central Distributors, 955 N.E. Union Ave.
United Radio Supply Inc., 829 W. Burnside

PENNSYLVANIA

Allentown—A. A. Peters, Inc., 231 N. 7th St.
Radio Electric Serv. Co. of Lehigh Valley, Inc.
425 Hanover Ave.
Altoona—
Allegheny Electronics, Inc., 1720-22 Union Ave.
Braddock—
M. Leff Radio Parts Co., 225 Braddock Ave.
Drexel Hill—Kass Electronics Distributors, Inc.
2502 Township Line Rd.
Easton—Radio Electric Service Co. of
Lehigh Valley, Inc., 1700 Northampton St.
Erie—J. V. Duncombe Co., 721 Parade St.
Mace Electronics, 24th and French Sts.
Harrisburg—
Radio Distributing Company, 915 South 13th St.
Johnstown—
Allegheny Electronics, Inc., 46 Valley Pike
Lancaster—Barbey Electronics, The George D.
Barbey Co., Inc., 618-622 Columbus Ave.
Lebanon—Barbey Electronics, The George D.
Barbey Co., Inc., 821 Quentin Rd.

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Norristown—Phila. Electronics, 624 West Airy St.
Philadelphia—
Milgray/Delaware Valley, 2532 N. Broad St.
Phila. Electronics, Inc., 1225 Vine St.
Radio Electric Service Co. of Pennsylvania
Div. of Astrex, Inc., Seventh & Arch Sts.
Radio Electric Service Co. of Pennsylvania
5930 Market St.
Radio Electric Service Co. of Pennsylvania
6587 Roosevelt Blvd.
Simco Electronics, Inc., 3907-11 N. Broad St.
Eugene G. Wile, 218 South 11th St.
Pittsburg—Cameradio, 1121 Penn Ave.
Pottstown—Barbey Electr., 157 N. York St.
Pottsville—Moyer Electronic Supply Co., Inc.
330 E. Norwegian St.
Reading—Barbey Electr., 333 N. 4th St.
Scranton—Consolidated Distributing Co.
1148-1150 Capouse Ave.
Pursell Electronics, 1221-37 N. Washington Ave.
Upper Darby—
Radio Electric Service Co. of Pennsylvania
7911 W. Chester Pike
Wilkes Barre—
Shelborne Electronics 169 N. Pennsylvania Ave.
Willow Grove—
Radio Electric Service of Pennsylvania
29 York Rd.
York—Rosin Electronics Co., 215 S. George St.

RHODE ISLAND

Providence—Wm. Dandreta & Co., 28 Wolcott St.
W. H. Edwards Co., Inc., 116 Hartford Ave.

SOUTH CAROLINA

Anderson—
Dixie Radio Sup. Co., Inc., 1206 S. Murray Ave.
Charleston—Radio Laboratories
475 E. Bay St., P.O. Box 2305
Columbia—
Dixie Radio Supply Co., Inc., 1900 Barnwell St.
Southeastern Radio Parts Co., 1696 Gregg St.
Florence—
Dixie Radio Supply Co., Inc., 531 E. Palmetto St.
Greenville—Carolina Radio Supply Co.
221 W. Washington St. — P.O. Box 2670
Dixie Radio Supply Co., Inc., Box 46
Greenwood—
Dixie Radio Supply Co., Inc., 116 Circular St.
Spartanburg—Dixie Radio Supply Co., Inc.
P.O. Box 2746 — Kennedy St. Sta.
Sumter—Dixie Radio Sup. Co., Inc., P.O. Box 1545

TENNESSEE

Chattanooga—
Harpe Elec. Distributors, Inc., 1845 Central Ave.
Dyersburg—Warren Radio Co., 1216 St. John
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Kingsport—Chemcity Electronics, 536 E. Main St.
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Knoxville—Bondurant Bros. Co., 906 Sevier Ave.
Chemcity Electronics, 2211 Dutch Valley Rd.
Memphis—Bluff City Distributing Co., 234 East St.
Lavender Electronics, Inc., 180 S. Cooper
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Nashville—Electra Distrib. Co., 1914 W. End Ave.
Randolph & Rice, 1213 McGavock St.
Union City—
Bluff City Distributing Co., 306 S. Second St.

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Abilene—
R & R Electronic Supply Co., 1441 Butternut
Amarillo—R & R Electronic Supply Co. 920 W. 7th
Austin—Sterling Electronics, 5408 Burnet Rd.
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Bryan—Sterling Electronics, 903 S. Main
Corpus Christ—
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Wicks Radio Equipment Co. 513-515 S. Staples
Dallas—Adleta Electrs. Co., 1914 Cedar Springs
Allied Electrs. Corp., 6162 E. Mockingbird La.
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J. Y. Schoonmaker Co., 2995 Ladybird Lane
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Trice Wholesale Electronics, 220 Sunset
Denison—Denison Radio Supply, 310 W. Woodward
El Paso—McNichol, Inc., 811 N. Estrella
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Fort Worth—Scooter's Radio Supply Co.
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Trice Wholesale Electronics, 104 S. Main

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Greenville—
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Houston—Geophysical Sup. Co., 1500 Crawford St.
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Sterling Electrs., Inc., 4201 Southwest Freeway
Johnson City—
Chemcity Electronics, 429 W. Walnut St.
Lubbock—Nunn Electric Supply Corp.
1817 4th St. — P.O. Box 5727
R & R Electronic Supply Co., 1607 Ave. G
Lufkin—Sterling Electronics, 430 Atkinson Dr.
McAllen—Rio Radio Supply, Inc.
608 South Broadway — Box 1808
Electronic Equip. & Engineering, 519 S. Main
Midland—
R & R Electronic Supply Co., 30 Industrial Loop
Odessa—
Midland Specialty Co., 2101 Andrews Highway
R & R Electronic Supply Co., 300 E. 23rd St.
Paris—Lavender Electronics, Inc., 250 S. Main
Port Arthur—Diehl Radio & TV Supply
P.O. Box 430, 2120 Seventh St.
San Angelo—
Electron Sales Inc., 643 S. Chadbourne
San Antonio—Modern Electronics Co.
910 W. Laurel, P.O. Box 1361
Sterling Electronics, 4600 San Pedro
Sherman—Lavender Electrs., Inc., 308 E. Houston
Tyler—Lavender Electronics, Inc., 503 E. Oakwood
Victoria—Electronic Equipment & Engineering
1007 N. William
Lavender Electronics, Inc., 1005 N. Williams
Wichita Falls—
R & R Electronic Supply Vo., 1911 9th St.

UTAH

Provo—Central Utah Electronics Supply
Box "N", 735 S. State St.
Salt Lake City—
Kimball Electronics, Inc., 350 Pierpont Ave.
S. R. Ross, 1212 S. State

VIRGINIA

Alexandria—
Certified Electronics Inc., 1313 Powhatan St.
Charlottesville—Virginia Radio Supply Co.
P.O. Box 1189, 715 Henry Ave.
Danville—Southeastern Radio Supply Co., Inc.
215 Craghead St.
Norfolk—Avec Electronics Corp., 711 Granby St.
Cain Electronics, 1530 Ingleside Rd.
Radio Parts Distributing Co.
5652 Virginia Beach Blvd.
World Electronics, Inc., 2440 Ingleside Rd.
Priest Electronics, Inc., 6431 Tidewater Dr.
Portsmouth—Distributors, Inc., 710 County St.
Richmond—Avec Electronics Corp., 3302 W. Broad
Roanoke—
Avec Electronics Corp., 2009 Williamson Rd.
H. C. Baker Sales Co., P.O. Box 1870
Southeastern Radio Supply Co.
1330 Courtland Rd. N.E.

WASHINGTON

Seattle—
Allied Electronics Corp., 4000 Aurora Ave., N.
Kierulff Electronics Pacific Northwest
528 S. Front St.
Radar Electric Co., 168 Western Ave. West
Seattle Radio Supply, Inc., 2117 Second Ave.
Western Electronics Co., 717 Dexter Ave., North
Westlake Elec. Sup., Inc., 415 Westlake Ave. N.
Tacoma—C & G Electronics, 2502 Jefferson Ave.

WEST VIRGINIA

Beckley—Chemcity Electronics, 1708 S. Kanawha
Charleston—Chemcity Electronics, 1637 4th Ave.
Mountain Electronics, 1605-07 Fourth Ave.
Clarksburg—Mountain Electronics, 414 N. 5th St.
Huntington—Mountain Electronics, 611 7th Ave.
Parkersburg—Chemcity Electronics 1235 Seventh
Pt. Pleasant—Chemcity Electronics, P.O. Box 25

WISCONSIN

Fond du Lac—
Wisconsin Electronic Supply, 223 N. Seymour
Green Bay—
Northern Radio & Television Co., 1585 Main St.
Milwaukee—
Allied Electronics Corp., 3709 W. Fond du Lac
Marsh Radio Supply Co., 6047 W. Beloit Rd.
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2430

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56

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Varo, Inc., Electron Devices Div. 2918
Special Products Div....2629
Static Power Div. 2138, 2139
Vector Electronic Co., Inc...593, 1006
Vector Engineering, Inc....2140, 2141
Vector Industries, Teledyne Co...1717
Vectron Laboratories Inc....1136
Veeder-Root 1055
Vega Precision Labs., Inc...1718, 1719
Vent-Rak Inc. 594
Venus Scientific, Inc....2142, 2143
Vernitron Electrical Components 1004, 1005
Vernitron Corp....811-813, 1771, 2679-2681
Control Components 2683-2686
Vero Electronics, Inc. 595
Vetter Co., A. R....2162
Victoreen Instrument Div....2441
Vidcor Co., Inc....1167
Viking Modules, Inc....2144, 2145
Virginia Electronics Co., Inc....1007
Virginia Panel Corp. 1008
Virtis Co., Inc. 1520
Vishay Resistor Products....2433
Vocaline Co. of America Bristol Motor Div....1022
Voltron Products, Inc....1521-1523

W

WABCO—Westinghouse Air Brake Co. 1210, 2334-2348
Wabash Magnetics 2296, 2297
WacLine, Div. Simmonds Precision 1524-1528
Waldom Electronics, Inc....1009
Walker Co., Inc., O. S....1435
Wall Manufacturing 2835
Wang Laboratories, Inc....815
Wanlass Electric Co. Custom Products Div....2147
Industrial Products Div....2148
Instruments Div. 2149
Ward Leonard Electric Co....2354
Waters Manufacturing Inc...2502, 2503
Waveforms 1530, 1531
Waveline Inc. 1720
Wavetek Inc. 1532-1549
Wayne Kerr 1502-1504
Weinschel Engineering 1529
Weller Electric Corp....2836, 2837
Welwyn International Inc....2442
Wesco Electrical Co., Inc....704
Western Gear Corp. 1772
Western Reserve Electronics, Inc. 1550, 1551
Westinghouse Electric Corp. Components and Materials Dist. 1208, 1209, 2916, 2917
Electric Utility Group, Relay....1552
Semiconductor Div. 2639-2656
Weston Instruments Inc. Archbald Div. 2504, 2505
EMR-Hatboro Div. 1368
Transcoil Div. 2678
Wheelock Signals, Inc....2333
Whitmore Wire & Cable Corp....2971
Whittaker Corp., Gencom Div....1954
Wilmington Controls 2743-2746
Wilcox 1237-1242
Wild Rover Corp....2788
Wiremold Co. 1010, 1011
Wyco Metal Products 591
Wyle Laboratories 750, 751

Y

Yaskawa Electric America....2682
Yeiser Laboratories 1574
Yokowo Mfg. Co., Ltd....542

Z

Zaring Industries, Inc....753, 2901
Zenith Radio Corp., Rauland Div. 1200, 1201
Zenrad Controls Co....1056
Zeus Industrial Products, Inc....1589

ARVEE AMPLIFIERS for dependable service

Wideband and Video Amplifiers use type BNC connectors others on request.

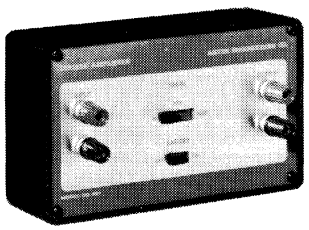
Response flatness typically ±.5 DB.

Supply voltage usually single ended plus 15 volts.

Additional RFI shielding available for critical environments.

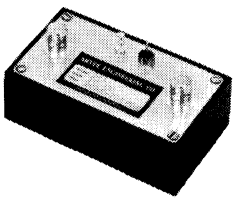
Output capability refers to 1 DB compression of gain.

FIGURE 1



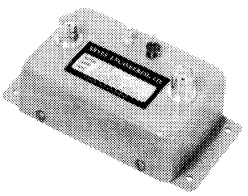
Laboratory instrument case with internal battery and shield.
3¾ x 6¼ x 2

FIGURE 2



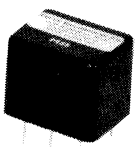
Machined aluminum case for maximum strength and RFI protection. 3¼ x 2 x 1

FIGURE 3



Rugged drawn aluminum case for economical commercial use.
4 x 2⅛ x 1 1/16

FIGURE 4



Encapsulated module for printed circuit mounting.
1¼ x 1¼ x 1⅝

WIDEBAND AMPLIFIERS

Model Number	Frequency Response	Gain	Input Impedance	Load Impedance	Output Capability	Equivalent Input Noise (microvolts)	Case Style	Price
521	20 Hz - 200 MHz	20 DB	50	50	1 Vp-p	45	Fig. 2	$250
520	20 Hz - 120 MHz	20 DB	50	50	1 Vp-p	40	Fig. 2	200
508	.2 MHz - 200 MHz	20 DB	50	50	1 Vp-p	35	Fig. 2	190
507	.2 MHz - 150 MHz	20 DB	50	50	1 Vp-p	30	Fig. 2	175
506	.1 MHz - 100 MHz	20 DB	50	50	1.2 Vp-p	25	Fig. 2	170
505	.1 MHz - 50 MHz	20 DB	50	50	1.5 Vp-p	20	Fig. 2	150
504	1 MHz - 35 MHz	20 DB±.5	50	50	2 Vp-p	15	Fig. 2	140
301	.5 MHz - 10 MHz	40 DB	50	50	2 Vp-p	15	Fig. 3	75
311	20 Hz - 150 MHz	20 DB	50	50	1 Vp-p	50	Fig. 3	140
310	20 Hz - 100 MHz	20 DB	50	50	1 Vp-p	50	Fig. 3	120
308	.25 MHz - 200 MHz	20 DB	50	50	1 Vp-p	50	Fig. 3	120
307	.25 MHz - 150 MHz	20 DB	50	50	1 Vp-p	40	Fig. 3	100
306	.25 MHz - 100 MHz	20 DB	50	50	1.2 Vp-p	35	Fig. 3	90
305	.25 MHz - 50 MHz	20 DB	50	50	1.4 Vp-p	30	Fig. 3	75
304	2 MHz - 32 MHz	20 DB±.5	50	50	2 Vp-p	20	Fig. 3	75

AUDIO & VIDEO AMPLIFIERS

Model Number	Frequency Response	Gain	Input Impedance	Load Impedance	Output Capability	Distortion	Equivalent Input Noise (microvolts)	Case Style	Price
502	20 Hz - 10 MHz	X 10	93	93	4 Vp-p	5%	20	Fig. 2	$150
501	20 Hz - 5 MHz	X 100	93	93	5 Vp-p	5%	20	Fig. 2	140
302	20 Hz - 10 MHz	X 10	93	93	4 Vp-p	5%	25	Fig. 3	85
M 85	5 Hz - 1 MHz	X 100 adj.	100 K	10 K	10 Vp-p	1%	8	Fig. 4	45
201	20 Hz - 50 KHz	X 100	50 K	8	1 Watt	1%	10	not shown	80
202	10 Hz - 30 KHz	X 100	50 K	8	10 Watt	1%	10	not shown	150
203	20 Hz - 30 KHz	X 100	50 K	8	50 Watt	1%	15	not shown	290

DC AMPLIFIERS

Model Number	Frequency Response	Gain	Input Impedance	Load Impedance	Output Capability	Drift	Equivalent Input Noise (microvolts)	Case Style	Price
701	DC - 100 KHz	X 1000 Adj.	10 K	1 K	±5v	10 uv/°C	10	not shown	$150
702	DC - 1 MHz	X 100 Adj.	1 K	1 K	±3v	10 uv/°C	15	not shown	125

DECADE AMPLIFIERS

Model Number	Frequency Response	Gain	Input Impedance	Load Impedance	Output Capability	Distortion	Equivalent Input Noise (microvolts)	Case Style	Price
851 B	5 Hz - 1 MHz	X1 X10 X100	100 K	10 K	10 Vp-p	1%	5	Fig. 1	$ 79.50
852	20 Hz - 5 MHz	X1 X10 X100	600	600	5 Vp-p	5%	20	Fig. 1	150.00

In addition to the standard items shown special designs can often be supplied with very reasonable lead time.

ARVEE ENGINEERING CO. • P. O. BOX 3759 • TORRANCE, CALIFORNIA 90510 • (213) 373-1324

LOW COST / MODERATE PERFORMANCE OPERATIONAL AMPLIFIERS

MODEL	114			115			118 (NEW)			119 (NEW)			150	153 (NEW)			183			801 (NEW)		
								K			K			J	K		J	K	L			S
	A	B	C	A	B	C	A			A							◇	◇	◇	A	B	
All specifications typical @ 25°C and nominal supply voltage unless otherwise specified.	LOW BIAS CURRENT 20mA OUTPUT			LOW COST LOW BIAS CURRENT			LOWEST COST GENERAL APPLICATION			LOWEST COST 20mA OUTPUT			BATTERY OPERATED LOW VOLTAGE	BATTERY OPERATED LOW CURRENT DRAIN			LOW VOLTAGE DRIFT			LOW BIAS CURRENT I.C. MICROCIRCUIT		
OPEN LOOP GAIN																						
dc, rated load, min	5×10^5			10^5			2.5×10^5			5×10^5			10^4	5×10^4☆			2×10^5			1.5×10^4		
RATED OUTPUT, min	±10V @ 20mA			±10V @ 2.5mA			±10V @ 5mA			±10V @ 20mA			±1.5V @ 2.5mA	±1V@ 1mA☆			±10V @5mA			±10V @ 5mA		
FREQUENCY RESPONSE																						
Unity gain, small signal	500kHz			500kHz			1.5MHz			1.5MHz			1.5MHz	150kHz			500kHz			500kHz		
Full power response, min	2kHz			2kHz			100kHz■			100kHz■			50kHz	5kHz (peak)			5kHz			3kHz		
Slew rate, min	.12V/μsec			.12V/μsec			6V/μsec■			6V/μsec■			1.2V/μsec	.02V/μsec			.3V/μsec			.25V/μsec		
Overload recovery	5msec			30msec			.5msec			.5msec			1msec	2msec			2msec			50μsec ⊕		
INPUT OFFSET VOLTAGE @ 25°C, max	Adj to 0			Adj to 0			Adj to 0			Adj to 0			Adj to 0	±1mV	±250μV		±3mV	±.5mV	±.5mV	±5mV		
Average vs. temp 10 to 60°C, max, μV/°C								±5			±5			±5	±2		±5	±3	±1.5			±20□
−25 to 85°C, max, μV/°C	±15	±10	±5	±20	±10	±5	±20			±20			±20				◇	◇	◇	±40	±10	
vs. supply	±20μV/%			±20μV/%			±10μV/%			±10μV/%			±20μV/%	±1μV/%			±10μV/%			±30μV/%		
vs. time	±100μV/mo			±250μV/mo			±200μV/mo			±200μV/mo			±250μV/mo	±10μV/mo			±10μV/mo			±100μV/mo		
INPUT BIAS CURRENT @ 25°C, max	±2nA			(0,+) 12nA			(0,+) 35nA			(0,+) 35nA			(0,+) 50nA	±3nA			(0,+) 40nA			(0,+) 4nA		
Average vs. temp 10 to 60°C, max, nA/°C								±.5			±.5				±.1nA/°C		±.5nA/°C			±.15nA/°C□		
−25 to 85°C, max, nA/°C	±.15nA/°C			±.2nA/°C			±.6			±.6			±.7nA/°C				◇			±.15nA/°C		
INPUT DIFFERENCE CURRENT @ 25°C	±2nA			±2nA			±3nA			±3nA			±5nA	±3nA			±4nA			±2nA★		
Average vs. temp 10 to 60°C, nA/°C								±.05			±.05			±.05nA/°C			±.05nA/°C					±.03□
−25 to 85°C, nA/°C	±.05nA/°C			±.05nA/°C			±.1			±.1			±.2nA/°C				◇			±.1	±.02	
INPUT IMPEDANCE																						
Differential	4MΩ			4MΩ			1MΩ			1MΩ			1MΩ	1MΩ			2MΩ			25MΩ		
Common mode	500MΩ			1000MΩ			1000MΩ			1000MΩ			100MΩ	200MΩ			1000MΩ			500MΩ		
INPUT NOISE																						
Voltage .01Hz to 1Hz p-p	2μV			2μV			1μV			1μV			2μV	1μV			1μV			30μV		
5Hz to 50kHz rms	4μV			4μV			3μV			3μV			4μV	2μV●			12μV			26μV		
Current .01Hz to 1Hz p-p	30pA			10pA			20pA			20pA			150pA	10pA			50pA			4pA		
INPUT VOLTAGE RANGE																						
Absolute max. differential	±15V			±15V			±15V			±15V			±15V	±15V			±15V			±10V		
Common mode voltage	>10V			>10V			>10V			>10V			>1V	>1V☆			>10V			>10V		
Common mode rejection	10,000 @ ±10V			10,000 @ ±10V			20,000 @ ±10V			20,000 @ ±10V			10,000 @ ±1V	50,000 @ ±1V			100,000 @ ±10V			15,000 @ ±8V		
POWER SUPPLY	±15V @ ±4mA			±15V @ ±4mA			±15V @ ±4mA			±15V @ ±2mA			±3.3V @ ±.8mA	±2.7V @ ±70μA☆			±15V @ ±9mA			±15V @ ±3mA		
STORAGE TEMPERATURE RANGE	−55°C to +125°C			−55°C to +125°C			−55°C to +125°C			−55°C to +125°C			−55°C to +125°C	−55°C to +125°C			−55°C to +125°C			−65°C to +150°C		
CASE STYLE	L-4			M-1			M-1			F-1			Q-1	F-1			F-1			Low Profile. TO −99		
PRICE																						
1-9	$45.	$50.	$55.	$18.	$23.	$28.	$11.	$21.		$24.	$34.		$22.	$40.	$50.		$35.	$45.	$65.	$14.	$19.	$23.
10-24	$43.	$48.	$52.	$17.	$22.	$27.	$10.50	$19		$20.	$29.		$21.	$38.	$48.		$33.	$43.	$62.	$14.	$19.	$23.

NOTES:
■20kHz and 1.2V/μsec for non-inverting operation.
●10Hz to 10kHz.
◇Models A/B/C available with same specifications over the temperature range of −25°C to +85°C. Add $5.00
□Model S temperature range −55°C to +125°C.
★±1nA for Model S.
⊕Requires error point clamp diodes.

ANALOG DEVICES INC

OPERATIONAL AMPLIFIERS

221 FIFTH STREET • CAMBRIDGE • MASSACHUSETTS 02142 • (617) 492-6000

LOW VOLTAGE DRIFT OPERATIONAL AMPLIFIERS

MODEL	MODEL 146 (NEW)			MODEL 180			MODEL 183			MODELS 211/210			MODEL 220			MODEL 230 (NEW)			MODEL 231 (NEW)			MODEL 232 (NEW)		
		K		J	K			K	L				J			J	K	L	J	K		J	K	
				A	B			◇	◇					B		□	□	□	□	□		□	□	
All specifications typical @ 25°C and nominal supply voltage unless otherwise specified.	LOW BIAS CURRENT FET INPUT			ULTRA LOW DRIFT DIFFERENTIAL			LOW DRIFT DIFFERENTIAL			GENERAL PURPOSE CHOPPER STABILIZED			FAST SETTLING CHOPPER STABILIZED			LOW COST CHOPPER STABILIZED			25mA OUTPUT CHOPPER STABILIZED			LOWEST COST CHOPPER STABILIZED		
OPEN LOOP GAIN																								
dc, rated load, min	10^5			3×10^5			2×10^5			10^8			10^8			10^7			10^7			10^7		
RATED OUTPUT, min	±10V @ 20mA			±10V @ 2.5mA			±10V @5mA			±10V @ 20mA			±10V @ 25mA			±10V @ 4mA			±10V @ 25mA			±10V @ 4mA		
FREQUENCY RESPONSE																								
Unity gain, small signal	5MHz			1MHz			500kHz			20MHz			10MHz/100MHz			500kHz			500kHz			500kHz		
Full power response, min	150kHz			10kHz			5kHz			500kHz			4MHz (peak)			3kHz			3kHz			3kHz		
Slew rate, min	10V/μsec			.6V/μsec			.3V/μsec			100V/μsec			250V/μsec			.2V/μsec			.2V/μsec			.2V/μsec		
Overload recovery	1.5msec			2msec			2msec			.2μsec			2μsec			3sec			3sec			3 sec		
INPUT OFFSET VOLTAGE @ 25°C, max, μV	±700■			see notes■●			±500■			±100★				±25★		±15★	±15★	±10★	±15★	±10★		±15★	±10★	
Average vs. temp 10 to 60°C, max, μV/°C		±2■		±1.5■	±.5■			±3■	±1.5■				±.5			±.25	±.25	±.1	±.25	±.1		±.25	±.1	
–25 to 85°C, max, μV/°C				±1.5■	±.5■			◇	◇	±1/.5▲				±.2		□	□	□	□	□		□	□	
vs. supply	±15μV/%			±2μV/%			±10μV/%			±10μV/%			±.1μV/%			±.1μV/%			±.1μV/%			±.1μV/%		
vs. time	±100μV/mo			±5μV/mo			±10μV/mo			±5μV/mo			±5μV/mo			±1μV/mo			±1μV/mo			±1μV/mo		
INPUT BIAS CURRENT @ 25°C, max	(0,–) 20pA			±4nA			(0,+) 40nA			±150/100pA			±100pA			±100pA	±50pA	±50pA	±100pA	±50pA		±100pA	±50pA	
Average vs. temp 10 to 60°C, max	doubles every 10°C			±.1/.05nA/°C			±.5nA/°C						±1pA/°C			±1/.5/.5pA/°C			±1/.5pA/°C			±1/.5pA/°C		
–25 to 85°C, max				±.2nA/°C			◇			±3/1pA/°C			±.5pA/°C			□			□			□		
INPUT DIFFERENCE CURRENT @ 25°C	±10pA			±1nA			±4nA			NA			NA			NA			NA			NA		
Average vs. temp 10 to 60°C	doubles every 10°C			±.02nA/°C			±.05nA/°C			NA			NA			NA			NA			NA		
–25 to 85°C				±.05nA/°C			◇			NA			NA			□			□			□		
INPUT IMPEDANCE																								
Differential	$10^{11}\Omega \parallel 3.5pF$			2MΩ			2MΩ			500kΩ			300kΩ @ dc⊕			300kΩ			300kΩ			300kΩ		
Common mode	$10^{11}\Omega \parallel 3.5pF$			1000MΩ			1000MΩ			NA			NA			NA			NA			NA		
INPUT NOISE																								
Voltage .01Hz to 1Hz p-p	6μV			1μV			1μV			10/5μV			3μV			1.5μV			1.5μV			1.5μV		
5Hz to 50kHz rms	16μV			4μV			12μV			10μV			4μV			5μV			5μV			5μV		
Current .01Hz to 1Hz p-p	.1pA			50pA			50pA			10pA			6pA			10pA			10pA			10pA		
INPUT VOLTAGE RANGE																								
Absolute max. differential	±15V			±15V			±15V			±15V			±15V			±15V			±15V			±15V		
Common mode voltage	>10V			>10V			>10V			NA			NA			NA			NA			NA		
Common mode rejection	10,000 @ ±5V			100,000 @ ±10V			100,000 @±10V			NA			NA			NA			NA			NA		
POWER SUPPLY	±15V @ ±5mA			±15V @ ±6mA			±15V @ ±9mA			±15V @ $^{+30}_{-4}$ mA			±15V @ ±20mA			±15V @ $^{+3}_{-6}$ mA			±15V @ $^{+8}_{-10}$ mA			±15V @ $^{+3}_{-6}$ mA		
STORAGE TEMPERATURE RANGE	–55°C to +125°C			–55°C to +85°C			–55°C to +125°C			–55°C to +85°C			–55°C to +125°C			–55°C to +125°C			–55°C to +125°C			–55°C to +125°C		
CASE STYLE	F-1			Q-1			F-1			R-7			W-3			FA-1			WA-1			WA-1		
PRICE				A	B	J	K			211	210													
1-9	$70.			$80.	$110.	$75.	$95.		$45.	$65.	$113.	$157.	$140.	$160.		$89.	$109.	$139.	$80.	$115.		$64.	$99.	
10-24	$66.			$76.	$104.	$72.	$90.		$43.	$62.	$107.	$148.	$133.	$151.		$84.	$105.	$132.	$74.	$105.		$58.	$90.	

NOTES: ■With trim resistor supplied.
●Model A - ±1mV; Model B - ±100μV; Model J- ±250μV; Model K - ±100μV. Model AO available with ±250μV offset voltage. Add $5.00.
◇Models B/C available with the same specifications over the temperature range of –25°C to +85°C. Add $5.00.
▲Over the temperature range of +10°C to +85°C; ±2/1μV/°C over the temperature range of –25°C to +10°C.
□Models are available with the same specifications over the temperature range of –25°C to +85°C. Consult factory.
★Adjustable to zero.
⊕10kΩ ∥ 3pF above 10Hz.

ANALOG DEVICES INC
OPERATIONAL AMPLIFIERS
221 FIFTH STREET • CAMBRIDGE • MASSACHUSETTS 02142 • (617) 492-6000

WIDEBAND / FAST RESPONSE OPERATIONAL AMPLIFIERS

MODEL	110			120			121	147			148			149			211/210	220		
																		J		
	A	B	C	A	B	C		A	B	C	A	B	C	A	B	C			B	
All specifications typical @ 25°C and nominal supply voltage unless otherwise specified.	INVERTING ONLY			FAST SETTLING .01% IN 1μsec INVERTING ONLY			FAST DIFFERENTIAL	HIGHEST CMRR LOW DRIFT FET			FAST SETTLING .01% IN 1μsec FET DIFFERENTIAL			FAST SETTLING .01% IN 1.5μsec FET DIFFERENTIAL			GENERAL PURPOSE CHOPPER STABILIZED	FAST SETTLING .01% IN 1μsec CHOPPER STABILIZED		
OPEN LOOP GAIN																				
dc, rated load, min	5×10^5			3×10^4			2.5×10^4	10^6			3×10^4			10^5			10^8	10^8		
RATED OUTPUT, min	±10V @ 20mA			±10V @ 25mA			±10V @ 20mA	±10V @ 10mA			±10V @ 20mA			±10V @15mA			±10V @ 20mA	±10V @ 25mA		
FREQUENCY RESPONSE																				
Unity gain, small signal	20MHz			10MHz/100MHz				10MHz			10MHz			15MHz			20MHz	10MHz/100MHz		
Full power response, min	1MHz			4MHz (peak)			4MHz (peak)	150kHz			500kHz			1.5MHz◇			500kHz	4MHz (peak)		
Slew rate, min	100V/μsec			250V/μsec			250V/μsec	10V/μsec			50V/μsec			100V/μsec			100V/μsec	250V/μsec		
Overload recovery	100μsec			10μsec			.3 μsec	.4msec			5μsec			.5μsec			.2μsec	2μsec★		
INPUT OFFSET VOLTAGE @ 25°C, max	Adj to 0			Adj to 0			Adj to 0	±1mV☆			Adj to 0			Adj to 0			Adj to 0	Adj to 0		
Average vs. temp 10 to 60°C, max, μV/°C																		±.5		
–25 to 85°C, max, μV/°C	±20	±10	±5	±15	±8		± 25	±15	±10☆●	±5☆●	±50	±25	±15	±25	±15	±7	±1/.5▲		±.2	
vs. supply	±40μV/%			±20μV/%			±25μV/%	±30μV/%			±75μV/%			±20μV/%			±10μV/%	±.1μV/%		
vs. time	±250μV/mo			±50μV/mo			±100μV/mo	±100μV/mo			±250μV/mo			±250μV/mo			±5μV/mo	±5μV/mo		
INPUT BIAS CURRENT @ 25°C, max	(0,+) 30nA			(0,+) 55nA			±2μA	–30pA	–15pA	–15pA	–50pA	–25pA	–25pA	–30pA	–15pA	–15pA	±150/100pA	±100pA		
Average vs. temp 10 to 60°C, max																		±1pA/°C		
–25 to 85°C, max	±.5nA/°C			±.9/.7nA/°C			±35nA/°C	doubles every 10°C			doubles every 10°C			doubles every 10°C			±3/1pA/°C	±.5pA/°C		
INPUT DIFFERENCE CURRENT @ 25°C	±5nA			±4nA			±4μA	±10pA	±3pA	±3pA	±10pA			±10pA			NA	NA		
Average vs. temp 10 to 60°C																	NA	NA		
–25 to 85°C	.1nA/°C			±.2nA/°C			±30nA/°C	doubles every 10°C			doubles every 10°C			doubles every 10°C			NA	NA		
INPUT IMPEDANCE																				
Differential	1MΩ			200kΩ @ dc□			5kΩ ‖ 5pF	10^{11}Ω ‖ 3.5pF			10^{11}Ω ‖ 3.5pF			10^{11}Ω ‖ 3.5pF			500kΩ	300kΩ @ dc□		
Common mode	NA			NA			2MΩ ‖ 5pF	10^{12}Ω‖3.5pF			10^{11}Ω ‖ 3.5pF			10^{11}Ω ‖3.5pF			NA	NA		
INPUT NOISE																				
Voltage .01Hz to 1Hz p-p	3μV			.5μV			5μV	3μV			6μV			3μV			10/5μV	3μV		
5Hz to 50kHz rms	4μV			3μV			2μV	12μV			8μV			4μV			10μV	4μV		
Current .01Hz to 1Hz p-p	45pA			100pA			680pA	.1pA			.05pA			.05pA			10pA	6pA		
INPUT VOLTAGE RANGE																				
Absolute max. differential	±15V			±15V			±15V	±15V			±15V			±15V			±15V	±15V		
Common mode voltage	NA			NA			>10V	>10V			>10V			>10V			NA	NA		
Common mode rejection	NA			NA			5000 @ ±10V	300,000 @ ±9V			2000 @ ±9V			15,000 @ ±9V			NA	NA		
POWER SUPPLY	±15V @ ±3.5mA			±15V @ ±17mA			±15V @ ±35mA	±15V @ ±22mA			±15V @ ±5mA			±15V @ ±13mA			±15V @ $^{+30}_{-4}$ mA	±15V @ ±20mA		
STORAGE TEMPERATURE RANGE	–55°C to +125°C			–55°C to +125°C			–55°C to +100°C	–55°C to +125°C			–55°C to +125°C			–55°C to +125°C			–55°C to +85°C	–55°C to +125°C		
CASE STYLE	Q-1			F-3			L-4	L-5			QB-1			F-1			R-7	W-3		
PRICE																	211 210			
1-9	$45.	$50.	$55.	$65.	$75.		$98.	$95.	$115.	$135.	$42.	$47.	$52.	$75.	$85.	$95.	$113. $157.	$140.	$160	
10-24	$43.	$48.	$53.	$62.	$71.		$93.	$90.	$109.	$128.	$40.	$45.	$50.	$71.	$81.	$90.	$107. $148.	$133.	$151	

NOTES: ☆With trim resistor specified for Model B and supplied for Model C. ●Model B - ±7μV/°C and Model C - ±2μV/°C over the temperature range of +10°C to +60°C. ◇1MHz for non-inverting operation. ▲Over the temperature range of +10°C to +85°C; ±2/1μV/°C over the temperature range of –25°C to +10°C. □10kΩ ‖ 3pF above 10Hz. ★With fast overload recovery pin connected.

See YELLOW SECTION for Local Offices, Phones

ANALOG DEVICES INC
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LOW BIAS CURRENT / FET INPUT OPERATIONAL AMPLIFIERS

MODEL	MODEL 141			MODEL 142			MODEL 143			MODEL 144 (NEW)			MODEL 146 (NEW)			MODEL 147			MODEL 148			MODEL P501 (NEW)		
											K		J	K		•	•	•						
	A	B	C	A	B	C	A	B	C	A						A	B	C	A	B	C	A	B	C
All specifications typical @ 25°C and nominal supply voltage unless otherwise specified.	LOW COST			LOW COST 20mA OUTPUT			HIGH CMRR			LOWEST COST FET			LOW VOLTAGE DRIFT FET			BEST FET PERFORMANCE			WIDEBAND FAST SETTLING			MICROCIRCUIT FET HYBRID		
OPEN LOOP GAIN																								
dc, rated load, min	8×10^4			8×10^4			10^5			5×10^4			10^5			10^6			3×10^4			2.5×10^4		
RATED OUTPUT, min	±10V @ 2mA			±10V @ 20mA			±10V @ 20mA			±10V @ 5mA			±10V @ 20mA			±10V @ 10mA			±10V @ 20mA			±10V @ 5mA		
FREQUENCY RESPONSE																								
Unity gain, small signal	3MHz			5MHz			5MHz			4MHz			5MHz			10MHz			10MHz			4MHz		
Full power response, min	50kHz			150kHz			100kHz			100kHz			150kHz			150kHz			500kHz			70kHz		
Slew rate, min	3V/μsec			10V/μsec			7V/μsec			6V/μsec			10V/μsec			10V/μsec			50V/μsec			3V/μsec		
Overload recovery	1.4msec			1.5msec			1.5msec			100μsec			1.5msec			.4msec			5μsec			.5msec		
INPUT OFFSET VOLTAGE @ 25°C, max	Adj to 0			Adj to 0			Adj to 0			Adj to 0			±.7mV■			±1mV☆			Adj to 0			±2mV	±1mV	±1mV
Average vs. temp, 10 to 60°C, max, μV/°C											±30		±7■	±2■		±15•	±7•	±2•						
−25 to 85°C, max, μV/°C	±75	±40	±25	±50	±25	±15	±25	±15	±7	±100						±15	±10☆	±5☆	±50	±25	±15	±75	±25	±25
vs. supply	±150μV/%			±75μV/%			±20μV/%			±100μV/%			±15μV/%			±30μV/%			±75μV/%			±50μV/%		
vs. time	±250μV/mo			±250μV/mo			±250μV/mo			±250μV/mo			±100μV/mo			±100μV/mo			±250μV/mo			±250μV/mo		
INPUT BIAS CURRENT @ 25°C, max, pA	−50	−30	−30	−50	−25	−25	−30	−15	−15	(0,−) 100pA			−30	−20		−30	−15	−15	−50	−25	−25	−25	−10	−5
Average vs. temp 10 to 60°C, max										doubles every 10°C			doubles every 10°C											
−25 to 85°C, max	doubles every 10°C			doubles every 10°C			doubles every 10°C			doubles every 10°C						doubles every 10°C			doubles every 10°C			doubles every 10°C		
INPUT DIFFERENCE CURRENT @ 25°C	±10pA			±10pA			±10pA			±25pA			±10pA			±10pA	±3pA	±3pA	±10pA					
Average vs. temp 10 to 60°C										doubles every 10°C			doubles every 10°C											
−25 to 85°C	doubles every 10°C			doubles every 10°C			doubles every 10°C			doubles every 10°C						doubles every 10°C			doubles every 10°C					
INPUT IMPEDANCE																								
Differential	$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 4$pF		
Common mode	$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{12}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 3.5$pF			$10^{11}\Omega \parallel 4$pF		
INPUT NOISE																								
Voltage .01Hz to 1Hz p-p	14μV			6μV			3μV			3μV			6μV			3μV			6μV			6μV		
5Hz to 50kHz rms	10μV			16μV			8μV			3μV			16μV			12μV			8μV			6μV		
Current .01Hz to 1Hz p-p	.1pA			.1pA			.1pA			.1pA			.1pA			.1pA			.05pA			.05pA		
INPUT VOLTAGE RANGE																								
Absolute max. differential	±15V			±15V			±15V			±15V			±15V			±15V			±15V			±15V		
Common mode voltage	$^{+8}_{-10}$ V			>10V			>10V			$^{+7}_{-10}$ V			>10V			>10V			>10V			>10V		
Common mode rejection	1000 @ ±7V			2000 @ ±9V			40,000 @ ±9V			1000 @ ±5V			10,000 @ ±5V			300,000 @ ±9V			2000 @ ±9V			10,000 @ ±5V		
POWER SUPPLY	±15V @ ±4.5mA			±15V @ ±4.5mA			±15V @ ±12mA			±15V @ ±4.5mA			±15V @ ±5mA			±15V @ ±22mA			±15V @ ±5mA			±15V @ ±7mA		
STORAGE TEMPERATURE RANGE	−55°C to +125°C			−55°C to +125°C			−55°C to +125°C			−55°C to +125°C			−55°C to +125°C			−55°C to +125°C			−55°C to +125°C			−55°C to +125°C		
CASE STYLE	M-1			QB-1			FA-1			M-1			F-1			L-5			QB-1			P-1		
PRICE																								
1-9	$25.	$30.	$35.	$35.	$40.	$45.	$55.	$65.	$80.	$18.	$28.		$57.	$70.		$95.	$115.	$135.	$42.	$47.	$52.	$30.	$35.	$50.
10-24	$24.	$29.	$33.	$33.	$38.	$42.	$52.	$62	$76.	$17.	$26.		$55.	$66.		$90.	$109.	$128.	$40.	$45.	$50.	$28.	$33.	$47.

NOTES: ■With trim resistor specified for Model K. ☆With trim resistor specified for Model B and supplied for Model C. •High performance over 10°C to 60°C temperature range is indicated.

Specifications subject to change without notice.

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ULTRA LOW BIAS CURRENT / VARACTOR BRIDGE ELECTROMETER AMPLIFIERS

MODEL	301	302 A	302 B	303 A	303 B	310 (NEW) J	310 (NEW) K	311 (NEW) J	311 (NEW) K
All specifications typical @ 25°C and nominal supply voltage unless otherwise specified.	HIGH PERFORMANCE DIFFERENTIAL	WIDEBAND INVERTING		WIDEBAND NON-INVERTING		LOW COST INVERTING		LOW COST NON-INVERTING	
OPEN LOOP GAIN									
dc, rated load, min	5×10^5	10^4		10^4		10^5		10^5	
RATED OUTPUT, min	±10V @ 20mA	±10V @ 2.5mA		±10V @ 2.5mA		±10V @ 5mA		±10V @ 5mA	
FREQUENCY RESPONSE									
Unity gain, small signal	500kHz	20kHz		15kHz		2kHz		2kHz	
Full power response, min	5kHz	80Hz		60Hz		7Hz		7Hz	
Slew rate, min	.3V/μsec	5V/msec		4V/msec		.4V/msec		.4V/msec	
Overload recovery	200μsec	5msec		5msec		10msec		10msec	
INPUT OFFSET VOLTAGE @ 25°C, max	Adj to 0	Adj to 0		Adj to 0		Adj to 0		Adj to 0	
Average vs. temp 10 to 60°C, max, μV/°C						±30	±10	±30	±10
–25 to 85°C, max, μV/°C	±50■	±60	±30	±60	±30				
vs. supply	±30μV/%	±100μV/%		±100μV/%		±100μV/%		±100μV/%	
vs. time	±500μV/mo	±200μV/mo		±200μV/mo		±100μV/mo		±100μV/mo	
INPUT BIAS CURRENT @ 25°C, max	±2pA	±.5pA	±.25pA	±.5pA	±.25pA	±.01pA		±.01pA	
Average vs. temp 10 to 60°C, max						doubles every 7°C		doubles every 7°C	
–25 to 85°C, max	doubles every 7°C■	doubles every 7°C		doubles every 7°C					
INPUT DIFFERENCE CURRENT @ 25°C	NA	NA		NA		NA		NA	
Average vs. temp 10 to 60°C	NA	NA		NA		NA		NA	
–25 to 85°C	NA	NA		NA		NA		NA	
INPUT IMPEDANCE									
Differential	$10^{10}\Omega \parallel 500pF$	$10^{10}\Omega \parallel 500pF$		$10^{10}\Omega \parallel 500pF$		$3 \times 10^{11}\Omega \parallel 30pF$		$3 \times 10^{11}\Omega \parallel 30pF$	
Common mode	$10^{12}\Omega \parallel 10pF$	NA		$10^{13}\Omega \parallel 3.5pF$●		NA		$10^{14}\Omega \parallel 2pF$◇	
INPUT NOISE									
Voltage .01Hz to 1Hz p-p	1μV	2μV		2μV		7μV		7μV	
5Hz to 50kHz rms	25μV	above .5Hz→.36μV/√Hz		above .5Hz→.36μV/√Hz		above 1Hz →1μV/√Hz		above 1Hz →1μV/√Hz	
Current .01Hz to 1Hz p-p	.01pA	.01pA		.01pA		.001pA		.001pA	
INPUT VOLTAGE RANGE									
Absolute max. differential	±20V	±75V or ±7.5mA		±75V or ±7.5mA		±300V		±300V☆	
Common mode voltage	>300V	NA		>200V		NA		NA	
Common mode rejection	10^8 @ ±300V	NA		10^6 @ ±200V		NA		100,000 @ ±25V☆	
POWER SUPPLY	±15V @ $^{+8}_{-11}$ mA	±15V @ $^{+8}_{-18}$ mA		±15V @ $^{+8}_{-18}$ mA		±15V @ $^{+15}_{-6}$ mA		±15V @ $^{+15}_{-6}$ mA	
STORAGE TEMPERATURE RANGE	–55°C to +85°C	–55°C to +85°C		–55°C to +85°C		–55°C to +85°C		–55°C to +85°C	
CASE STYLE	R-9	R-9		R-9		W-1		W-1	
PRICE									
1-9	$198.	$110.	$135.	$110.	$135	$75.	$125.	$75.	$125.
10-24	$193.	$105.	$128.	$105.	$128	$70.	$113.	$70.	$113.

NOTES: ■Over the temperature range of 0°C to +85°C. ◇$10^9\Omega \parallel 20{,}000pF$ for negative input.
☆Negative input must not exceed 25V. ●$10^9\Omega \parallel 1000pF$ for negative input.

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HIGH OUTPUT CAPABILITY OPERATIONAL AMPLIFIERS

MODEL			MODEL B100	MODEL 116	MODEL 163 (NEW)	MODEL 165 (NEW)	MODEL 170	MODEL 207M
					A K	A K		
All specifications typical @ 25°C and nominal supply voltage unless otherwise specified.			100mA CURRENT BOOSTER	LOW NOISE 100mA OUTPUT	20V @ 20mA DIFFERENTIAL	LOW COST 20V OUTPUT	100V OUTPUT DIFFERENTIAL	100V OUTPUT CHOPPER STABILIZED
OPEN LOOP GAIN								
dc, rated load, min			.85	10^5	5×10^5	2.5×10^5	10^5	10^9
RATED OUTPUT, min			±10V @ 100mA	±11V @ 100mA	±20V @ 20mA	±20V @ 5mA	±100V @ 10mA	±100V @ 10mA
FREQUENCY RESPONSE								
Unity gain, small signal			1MHz	25MHz	1.5MHz	1.5MHz	3MHz	3MHz
Full power response, min				500kHz	50kHz■	50kHz■	30kHz	30kHz
Slew rate, min				30V/μsec	6V/μsec■	6V/μsec■	18V/μsec	18V/μsec
Overload recovery				.2μsec	.5msec	.5msec	200μsec	.5μsec
INPUT OFFSET VOLTAGE @ 25°C, max			±200mV	±10mV	Adj to 0	Adj to 0	±5mV	±20μV
Average vs. temp 10 to 60°C, max, μV/°C					±5	±5		
–25 to 85°C, max, μV/°C			±1mV/°C	±100	±20	±20	±20	±.2
vs. supply			NA	±500μV/%	±10 μV/%	±10μV/%	±5μV/%	±1μV/%
vs. time				±250μV/mo	±200μV/mo	±200μV/mo	±250 μV/mo	±5μV/mo
INPUT BIAS CURRENT @ 25°C, max			±500μA	±300nA	(0,+) 35nA	(0,+) 35nA	(0,+) 150nA	±50pA
Average vs. temp 10 to 60°C, max, nA/°C					±.5nA/°C	±.5nA/°C		
–25 to 85°C, max, nA/°C			NA	±40nA/°C	±.6nA/°C	±.6nA/°C	±1.5nA/°C	±.5pA/°C
INPUT DIFFERENCE CURRENT @ 25°C			NA	±300nA	±3nA	±3nA	±20nA	NA
Average vs. temp 10 to 60°C, nA/°C			NA		±.05	±.05		NA
–25 to 85°C, nA/°C			NA	±5nA/°C	±.1	±.1	±.5nA/°C	NA
INPUT IMPEDANCE								
Differential			9kΩ	20kΩ	1MΩ	1MΩ	150kΩ	220kΩ
Common mode			NA	5MΩ	1000MΩ	1000MΩ	100MΩ	NA
INPUT NOISE								
Voltage .01Hz to 1Hz p-p			NA	2μV	1μV	1μV	3μV	10μV
5Hz to 50kHz rms			NA	2μV	3μV	3μV	3μV	10μV
Current .01Hz to 1Hz p-p			NA	300pA	20pA	20pA	500pA	20pA
INPUT VOLTAGE RANGE								
Absolute max. differential			±15V	±15V	±40V	±40V	±20V	±15V
Common mode voltage			NA	>10V	>20V	>20V	>20V	NA
Common mode rejection			NA	10,000 @ ±10V	20,000 @ ±20V	20,000 @ ±20V	40,000 @ ±20V	NA
POWER SUPPLY			±15V @ ±8mA	±15V @ ±14mA	±24V @ ±2mA	±24V @ ±4mA	±120V @ ±6mA	±120V @ ±7mA
STORAGE TEMPERATURE RANGE			–55°C to +125°C	–55°C to +125°C	–55°C to +125°C	–55°C to +125°C	–55°C to +125°C	–55°C to +85°C
CASE STYLE			Q-1	T-10	F-1	M-1	T-10	R–7
PRICE								
1-9			$30.	$98.	$36. $46.	$24. $34.	$125.	$235.
10-24			$29.	$95.	$34. $43.	$20. $29.	$119.	$224.

NOTES: ■10kHz and 1.2V/μsec for non-inverting operation.

Specifications subject to change without notice.

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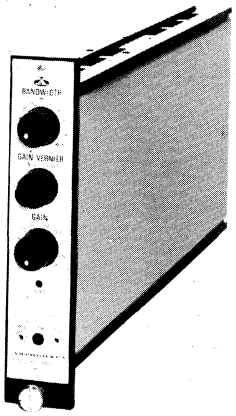
ASTRODATA

SERIES 889 AMPLIFIERS

A Family of Flexible Low Cost Chopperless Amplifiers



Model 505-900 Rack Module: Holds 12 amplifiers and Model 8200-146 Power Supply in standard 19-inch rack.

Dimensions (including power supply): 7 inches high x 21.5 inches deep.

Model 8200-146 Power Supply: Mounted on rear of companion Rack Module 505-900. Supplies power to 12 amplifiers.

Model 505-901 Rack Module: Holds 12 Model 889 Amplifiers fitted with individual amplifier power supplies, Model 8228-100.

Dimensions: 7 inches high x 21.5 inches deep.

Model 8228-100 Individual Amplifier Power Supply: Attaches to the rear of each amplifier. Supplies power for one amplifier.

Dimensions: 1.4 inches wide x 6.9b inches high. When the Model 8228-100 Power Supply is connected with the Model 889 Amplifier, the resultant composite assembly is a single unit nominally 1.4 inches x 6.96 inches x 20 inches. (W x H x D).

The Series 889 Amplifier is a chopperless, high-performance, differential instrument designed especially for use in systems requiring reproducible data of very high accuracy. The 889 Amplifier is capable of supplying either single or dual outputs. The single output model delivers a wideband signal of ±10 volts at ±100 ma. The dual output model provides ±100 ma output as well as ±10 volts at ±5 ma or ±100 ma selectable bandwidth output for multiplexers, VCO's, analog-to-digital converters and other comparable output devices.

HIGH PERFORMANCE

The 889 Amplifiers feature a wide frequency response, high common mode rejection, fast settling and overload recovery time. A low drift rate, low temperature coefficient and low input currents are obtained through application of the latest developments in integrated circuits.

GAIN FROM 1 TO 2500

The 889 Amplifier features a gain range of from 1 to 2500, which enables any desired output up to ±10 volts to be achieved.

3-POLE ACTIVE FILTER

Superior signal-to-noise ratio can be obtained with the 889 Amplifier through use of a 3-pole, active filter with 9 positions: 1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1000 Hz, 3000 Hz, and 10,000 Hz, as well as a wideband position.

120 DB COMMON MODE REJECTION

The 889 Amplifier provides at least 120 db of common mode rejection.

COMPLETE USEABLE BANDWIDTH

In the 889 Amplifier, no slew limiting will occur for differential full scale inputs of up to 40 kHz, which means that the entire selected bandwidth is usable up to 40 kHz.

32 DIFFERENT CONFIGURATIONS TO CHOOSE FROM

The ASTRODATA 889 Series of amplifiers features flexibility of design. There are 32 different configurations to choose from to fill specific needs. All of the configurations plug into the same rack adapter. Options such as gain vernier, gain readout, filtered output, etc. are covered in detail on the following pages.

SPACE SAVING PACKAGING

Twelve of the 889 Amplifiers occupy only seven inches of rack height and mount into the ASTRODATA standard Model 505-900 Rack Adapter or 505-901 Rack Adapter. A choice of individual or common power supplies is another of the outstanding features of the ASTRODATA 889 Amplifier.

HOW TO ORDER YOUR SERIES 889 AMPLIFIERS

Model	Description	Price	Dash No. Change For Gain Vernier Add $30.00	Dash No. Change For Gain Readout Add $20.00	Dash No. Change For Gain Vernier And Readout Add $50.00
889-100	Single output Gain Range 50-1000	$330	101	102	103
889-110	Single output Gain Range 1-1000	$385	111	112	113
889-200	Dual output, 5 ma Filtered Output, Gain range 50-1000	$420	201	202	203
889-205	Dual output, 100 ma Filtered Output, Gain range 50-1000	$435	206	207	208
889-210	Dual output, 5 ma Filtered Output, Gain range 1-1000	$475	211	212	213
889-215	Dual output, 100 ma Filtered Output, Gain range 1-1000	$490	216	217	218
889-220	Dual output, buffer amp, 5 ma Filtered Output, Gain range 50-1000	$470	221	222	223
889-230	Dual output, buffer amp, 5 ma Filtered Output, Gain range 1-1000	$525	231	232	233

Power Supply: 8200-146—$520 8228-100—$100 **Rack Module:** 505-900 —$295 505-901 —$295

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SUMMARY OF CURRENT AVANTEK TRANSISTOR AMPLIFIERS WITH GUARANTEED PERFORMANCE SPECIFICATIONS

DISCRETE COMPONENT TYPES

	AVANTEK MODELS	MINIMUM FLAT FREQUENCY RESPONSE (MHz)	NOISE FIGURE (dB) MAX.	NOISE FIGURE (dB) AVE.	GAIN (dB) MIN.	GAIN (dB) TYP. MIN.	GAIN FLATNESS (±dB) MAX.	GAIN FLATNESS (±dB) TYP.	POWER OUTPUT FOR 1 dB GAIN COMPRESSION (dBm) MIN.	POWER OUTPUT FOR 1 dB GAIN COMPRESSION (dBm) AVE.	TYPICAL AVANTEK INTERCEPT POINT FOR IM (dBm)	MAXIMUM VSWR (50 ohms) INPUT	MAXIMUM VSWR (50 ohms) OUTPUT	DC INPUT POWER Vdc[3]	DC INPUT POWER ma	STANDARD RF CONNECTOR[2]
MICROWAVE — LOW NOISE - MEDIUM POWER	**AM-1000N**	1000 to 2000	5.5	5.0	26	28	1.0	0.5	−5	−2	+7	2.0	2.5	−15	30	N
	AM-1200N	1200 to 1400	4.5	4.2	26	28	0.5	0.3	−3	0	+12	2.0	2.0	−15	25	OSM
	AM-1435N	1435 to 1550	5.0	4.5	25	28	0.75	0.5	−3	0	+12	2.0	2.0	−15	25	N
	AM-1540N [5,1]	1435 to 1540	4.5		30		0.2		+9		+21	2.0	2.0	+15	50	N
	AM-2200N	2200 to 2300	6.5		26	28	1.0	0.5	−3	0	+12	2.0	2.0	−15	30	N
	AM-2300N [5,1]	2200 to 2300	6.0		30		0.3		+8		+17	2.0	2.0	+15	65	N
	AM-2300N-07 [5,1]	1435 to 2300	6.2		30		1.0		+6		+17	2.0	2.0	+15	65	N
	AS-1000N	1000 to 2000	7.5	6.0	22	24	1.0	0.5	−9	−5	+5	2.0	2.5	−15	30	N
	AMM-2000M Series	1000 to 2000	6.2		Options from 7 to 48		1.0		+10		+24	1.3	1.3	−15	100	OSM
	AMM-2300M Series	1435 to 2300	6.5 L Band 7.5 S Band		Options from 5 to 25		0.8		+10 L Band +15 S Band		+23 L Band +28 S Band	1.3	1.3	−12	90	OSM
	AMP-1000N	1000 to 2000	6.0	5.0	25	27	1.0	0.5	+7	+10	+20	2.0	2.0	+15	60	N
	AMP-1500N [5]	500 to 1500	8.0	5.0	25	27	1.0	0.5	+8	+10	+20	2.0	2.0	+15	60	N
	AMP-2300N	1400 to 2300	8.0	6.0	25	26	1.0	0.5	+8	+9	+20	2.0	2.0	+15	50	N
	AMP-2600N	1000 to 2600	9.0	7.5	30	33	1.5	1.0	+6	+9	+17	2.5	2.5	+15	80	N
	AMP-3500N	2000 to 3500	10.0	8.0	Options from 5 to 35		1.5	1.0	+8	+10	+18	1.75	2.5	−15	110	N or OSM
ULTRA LOW NOISE	**AG-10M**	100 to 200	2.5	2.0	24	26	1.0	0.5	−3	+2	+15	2.0	2.0	+15	25	OSM
	AG-15M	150 to 300	2.5	2.0	24	26	1.0	0.5	−3	+2	+15	2.0	2.0	+15	25	OSM
	AG-20M	200 to 400	2.5	2.0	24	28	1.0	0.5	−3	+2	+15	2.0	2.0	+15	25	OSM
	AG-25M	250 to 500	2.5	2.0	24	28	1.0	0.5	0	+2	+15	2.0	2.0	+15	25	OSM
	AG-50M	500 to 1000	4.0	3.5	22	24	1.0	0.5	−6	−3	+5	2.5	2.5	+15	25	OSM
LOW NOISE - MEDIUM POWER	**AT-1000N**	755 to 985	3.5		23		0.5		+5		+15	1.25	1.5	+15	25	N
	AL-5M	50 to 150	3.5	3.0	25	26	1.0	0.5	0	+2	+10	2.5	2.0	+15	20	OSM
	AL-10M	100 to 200	3.5	3.3	25	26	1.0	0.5	−3	0	+8	2.0	2.0	+15	20	OSM
	AL-15M	150 to 300	4.0	3.5	25	26	1.0	0.5	−3	0	+10	2.0	2.0	+15	25	OSM
	AL-20M	200 to 400	4.0	3.5	24	26	1.0	0.5	−3	+1	+10	2.0	2.0	+15	25	OSM
	AL-25M	250 to 500	4.5	3.8	24	26	1.0	0.5	−3	+4	+10	2.0	2.0	+15	25	OSM
	AL-50M	500 to 1000	8.0	7.0	24	25	1.5	1.0	+3	+6	+15	2.5	2.5	±12	30	OSM
	AL-50M-A	500 to 1000	6.0	5.0	24	25	1.5	1.0	+3	+6	+15	2.5	2.5	±12	30	OSM
	AL-70M	700 to 900	8.0	7.0	24	25	1.0	0.5	0	+2	+12	2.0	2.0	±12	30	OSM
	ADL-3M	30 to 300	5.0	4.0	25	26	1.0	0.5	0	+5	+12	2.0	2.0	±12	30	OSM
	AWL-500M	0.001 to 500	5.0	4.5	25	26	1.5	1.0	+5	+7	+15	2.0	2.0	+15	40	OSM
	AWL-1200M	0.1 to 1200	6.0	5.0	25	26	1.5	1.0	+5	+7	+15	2.0	2.0	+15	40	OSM
MEDIUM TO HIGH POWER	**AP-5T**	50 to 150	4.0	3.5	30	31	1.0	0.5	+20	+21	+30	2.0	2.0	+24	150	TNC
	AP-10T	100 to 200	5.5	5.0	30	31	1.0	0.5	+20	+22	+30	2.0	2.0	+24	175	TNC
	AP-15T	150 to 300	6.0	5.0	30	31	1.0	0.5	+20	+22	+30	2.0	2.0	+24	175	TNC
	AP-20T	200 to 400	6.5	6.0	30	31	1.0	0.5	+20	+22	+30	2.0	2.0	+24	250	TNC
	AP-25T	250 to 500	6.5	6.0	30	31	1.0	0.5	+20	+22	+30	2.0	2.0	+24	250	TNC
	ADP-3T	30 to 300	5.5	5.0	30	31	1.0	0.5	+20	+21	+30	2.5	2.0	+24	250	TNC
	AWP-400T	10 to 400	10.0 Typ.	8.0	25	26	1.0	0.8	+27	+28	+37 odd +55 even	2.0	3.0	+28	560	TNC
	AWP-1000T [1]	10 to 1000	7.5	6.0	30		1.0		+20		+32 odd +50 even	2.0	2.0	+24	300	TNC
	AV-1T	0.01 to 300	8.0	7.0	29	31	1.0	0.5	+19	+21	+30	2.0	2.0	+28	200	TNC
	AV-3T	0.01 to 300	20-30 mvolts		29	30	Pulse Optimized		±2.5 V Peak		NA	50 ohms		+28	200	TNC
	AV-4T	0.02 to 300	8.0	7.0	30	31	1.0	0.8	+29	+31	+37	2.0	2.5	+28	650	TNC
	AV-5T [6]	1.25 Nsec SSRT 1.60 Nsec LSRT	25 mvolts		30	31	Pulse Optimized		±9 V Peak		NA	50 ohms		+28	650	TNC
	AV-6T	0.02 to 400 MHz	8.5		24	25	1.0	0.75	24	25	+35 odd +50 even	2.5	2.5	+28	325	TNC
	AV-7T [6]	1.1 Nsec SSRT 1.25 Nsec LSRT	30 mvolts		24	25	Pulse Optimized		±5 V Peak		NA	50 ohms		+28	325	TNC

NOTES:
1 Pre-Production Specifications
2 Connector Options Available
3 DC Power Supplies available
4 Designed for use with Avantek Amplifiers which set System Noise Figure and Overall Gain
5 Amplifier Internal-By-pass Switch available
6 SSRT—Small Signal Rise Time
LSRT—Large Signal Rise Time

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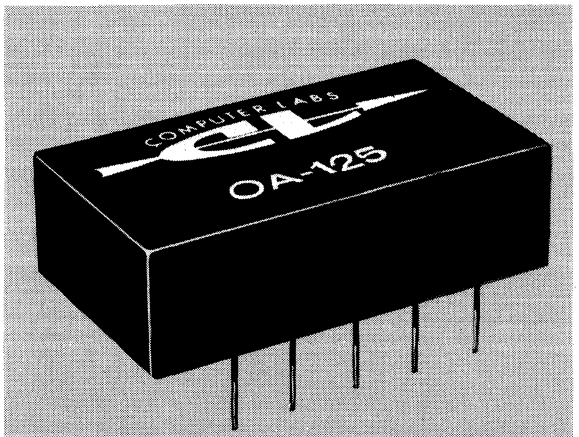
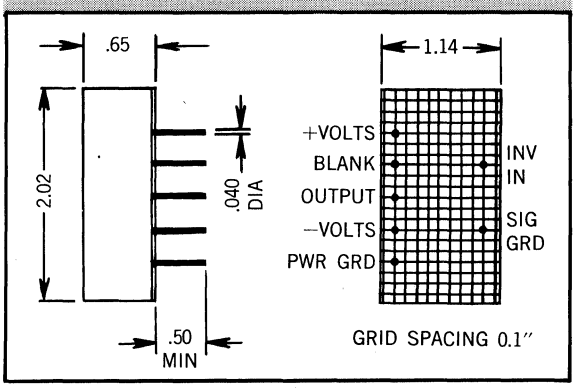
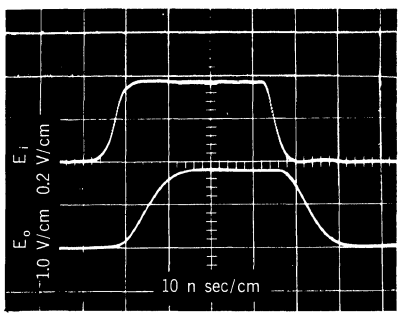
GAIN-BANDWIDTH PRODUCT: 125 MHz
OUTPUT VOLTAGE RANGE (±15-volt supply):
±2.0 volts into 100 ohms
±3.5 volts into 1000 ohms or greater
OUTPUT VOLTAGE RANGE (±12-volt supply):
±1.5 volts into 100 ohms
±2.0 volts into 1000 ohms or greater
VOLTAGE GAIN (DC open loop):
100,000 with 100-ohm load
SLEW RATE: 250 volts/u sec.
INPUT VOLTAGE OFFSET: 3 mv max.
(no adjustment required)
vs. temperature: 10 uv/°C
INPUT CURRENT OFFSET: 100 na max.
(no adjustment required)
vs. temperature: 20 na/°C
INPUT IMPEDANCE (DC): 50,000 ohms min.
INPUT NOISE: 40 uv rms
(for 1 MHz bandwidth)
INPUT-OUTPUT STRUCTURE: Single-ended
TEMPERATURE RANGE:
Operating: −25 C to +85 C
Storage: −60 C to +125 C
POWER: ±12 volts to ±15 volts (voltages used should be equal within 2%)

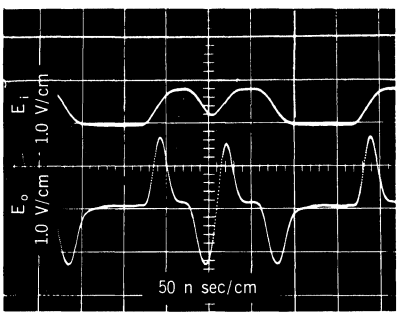


Operational Amplifier OA-125
Small lot price $135.00

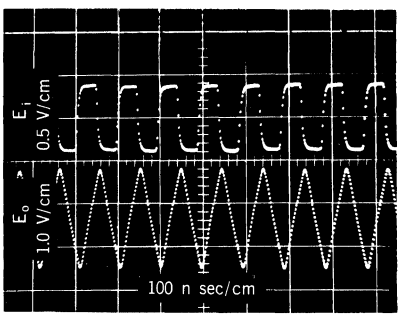




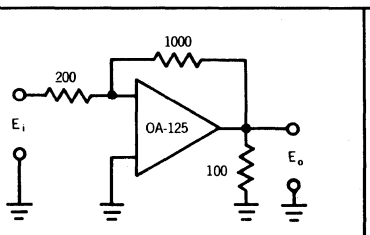
OA-125 IN CONSTANT GAIN APPLICATION

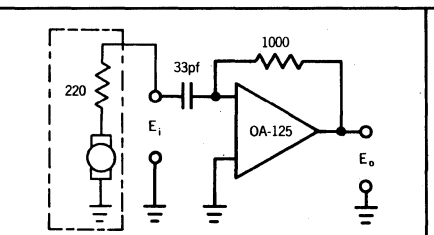


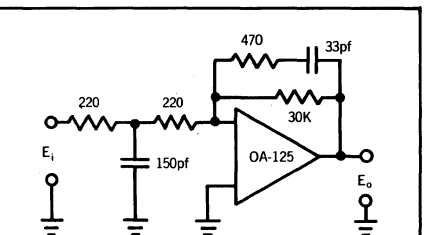
OA-125 AS A DIFFERENTIATOR



OA-125 AS AN INTEGRATOR









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WIDEBAND POWER C-COR AMPLIFIERS

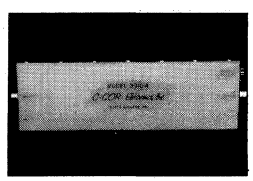
LINEAR OPERATION (UP TO 60 WATTS)—*SOLID STATE, TUBE, & HYBRID*

Model	Passband 3 dB Nom.	Power Output Max. dBm	Power Output @ 1 dB Comp. dBm	Gain Nom. dB	Z in	Z out	Dimensions & Wt. H in.	W in.	L in.	Wt. lb.	Desc.	Other Amp. Pkg.
1029	100-300 MHz	+47	+44	8	50	50	21	19	17	185	dist.* tube, bandpass	1
1029-A	0.1-250 MHz	+47	+44	10	50	93	21	19	17	185	dist.* tube, low pass	1
1029-B	1-160 MHz	+49	+48	16	75	50	21	19	17	185	dist.* tube, low pass	1
1012	0.001-185 MHz	+40	+41	7.5	50	93	8¾	19	12½	24	dist.* tube, low pass	1
1012-A	0.1-60 MHz	+41	+44	12	75	50	8¾	19	12½	24	dist.* tube low pass	1
1028	30-300 MHz	+37	+35	30	50	50	8¾	19	12½	18	distributed hybrid	1
4009	1-40 MHz	—	+35 to +38.5	40, 20 Select.	50	50	5¼	16½	13	15	push-pull	1
3008	1-40 MHz	+38.5	+35 to +38.5	20	50	50	3½	4½	12	4	push-pull.	1, 4
4013-SA	1-425 MHz	—	+27	40, 20 Select.	50	50	5¼	16½	13	12	without ALC & gain adj.	1
4013-SB	4-470 MHz	—	+27	40, 20 Select.	50	50	5¼	16½	13	12	see 4013-S, "Lab Amps"	1
3010-A	1-425 MHz	—	+27	25	50	50	1½	3½	11½	4	distributed	1, 4
4375-S	0.1-230 MHz	—	+26 to +30	60, 40, 20 Select.	50, 75 Select.	50, 75 Select.	5¼	15½	10	10	distributed	1
3016-S	0.1-240 MHz	—	+26 to +30	23	50	50	1¼	3½	10	3	distributed	1, 4
3007	0.1-230 MHz	—	+22 to +28	20	75	75	1¾	3½	10½	3	distributed	1, 4
Avail. with 1 kHz response, and 50 Ω Z												
3502	1-300 MHz	—	+20	6	50	50	1¼	2¼	3¼	0.5	Min-Econ	1, 4

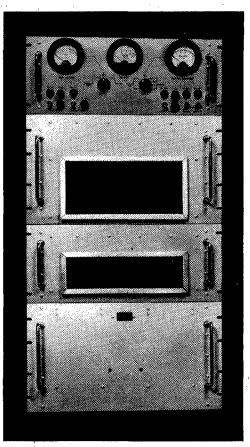
*DISTRIBUTED AMPLIFIERS

The distributed amplifier is an effective means of paralleling state-of-the-art solid-state and tube devices to obtain very high output powers. C-COR has been designing and manufacturing this type of device since 1953, and now offers a complete line ranging from 50 watt vacuum tube models to 5 watt solid-state units, most of which are listed in the tables.

New designs are coming out of our laboratory on a regular basis. Contact us for the most difficult requirements regarding power and bandpass. Some of our amplifiers are being used by NASA at Cape Kennedy in many critical applications.



The Model 3010-A is a solid-state distributed amplifier module which provides an output of ½ watt of linear power from 1 MHz to 425 MHz. The module design is such that efficient heat transfer can be accomplished in practically any mounting situation. The Model 3010-AP is available for pulse use.

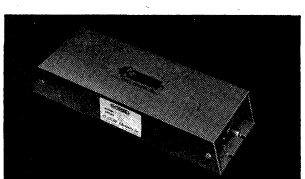


The illustration shows Model 1029 integrated into a complex amplifying system, designed and built for NASA, which delivers in excess of 20 watts of linear power. Available in several bandpass configurations, Model 1029 is capable of supplying up to 50 watts of power. It is adaptable for operation at lower powers on the order of 5 watts with intermod products of -40 dB. Many special requirements can be met, including RFI shielding.

NARROW-BAND POWER AMPLIFIERS

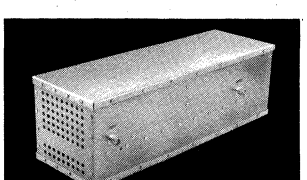
INTERSTAGE FILTER DESIGNS FOR SELECTIVE AMPLIFICATION—*SOLID STATE*

Model	Center Freq. Range	Bandwidth 3 dB Nom.	Power Output Max. dBm	Power Output @ 1 dB Comp. dBm	Gain Nom. dB	Z in	Z out	Dimensions & Wt. H in.	W in.	L in.	Wt. lb.	Desc.	Pkg.
3228	100-150 MHz	2%-10%	+31	+30	32	50	50	1¾	3½	9¾	1.5	available for class C ceramic tube	1, 4
3228-A	150-300 MHz	2%-10%	+30	+27	32	50	50	1¾	3½	9¾	1.5		1, 4
3228-B	300-500 MHz	2%-10%	+30	+27	25	50	50	1¾	3½	9¾	1.5		1, 4
3115	75-500 MHz	10-100 MHz	+43	+25 to +33	21	50	50	5	5	12	6		1, 4



Model 3228 is a high output, narrow band RF amplifier capable of operating at a customer selected fixed frequency between 100 MHz and 500 MHz. It operates as a linear amplifier for low levels and in a more efficient mode for high level signals.

The Model 3115 is a ceramic tube amplifier with multi-pole interstage filters with output capabilities up to 20 watts. The three stage amplifier module can be supplied in a wide range of center frequencies up to 500 MHz. Specify bandwidth required.



C-COR AMPLIFIERS

GENERAL PURPOSE WIDEBAND

WIDE DYNAMIC RANGE FOR SUPER VIDEO R.F. WIDEBAND USE—*SOLID STATE*

Model	Passband 3 dB Nom.	Output Capability Nom. Power dBm	Output Capability @ 1 dB Comp. dBm Test Spec. @ Z_L	Gain Nom. dB	Noise (rms) (μV)	Z In:Out	H in.	W in.	L in.	Wt. lb.	Pkg.
3203-A	0.2-1 GHz	+8	1.4 Vp-p @ 50 Ω	20	4-7 dB	50:50	1 5/8	2½	1½	1	1, 4
3371-A	0.02-550 MHz	+20 ea. output	6 Vp-p @ 50 Ω	20	60	50:50	2	3	9	2	1, 4
3374-A	0.02-500 MHz	+17	12 Vp-p @ 100 Ω	20	60	1 MΩ:50 7 pF	1¾	3	4¾	1	1, 4
4013-SB	4-475 MHz	+27	14 Vp-p @ 50 Ω	40, 20 select.	50	50:50	5¼	16½	13	12	1
4013-SA	1-425 MHz	+27	14 Vp-p @ 50 Ω	40, 20 select.	50	50:50	5¼	16½	13	12	1
3010-A	1-425 MHz	+27	14 Vp-p @ 50 Ω	23	60	5-:50	1½	3½	11½	4	1, 4
3596	6-300 MHz	+4	1 Vp-p @ 50 Ω	20	30	50:50	1¼	2¼	3¼	0.5	1, 4
3320	30-300 MHz	+25 to +27	14 Vp-p @ 75 Ω	25	6 dB	50:75	2	3	6	1	1, 4
4375-S	0.1-230 MHz	+30 @ 50 MHz	25 Vp-p @ 75 Ω	60, 40, 20 select.	35	50:50 75:75	5¼	15½	10	10	1
3016-A	0.1-240 MHz	+26 @ 200 MHz	15 Vp-p @ 75 Ω	23	50	50:50	2½	4	10	2.5	1, 4
3007	0.08-230 MHz	+22 to +28	20 Vp-p @ 50 MHz 10 Vp-p @ 75 Ω 200 MHz	20	40	75:75	1¾	3½	10½	3	1, 4
4223	20-240 MHz	+2	7.5 Vp-p @ 75 Ω	20-25 adj.	10 dB	75:75	3½	3¾	9¼	3	1
3362-E	1-kHz-200 MHz	+20 min.	6.3 Vp-p min.	20	35	50:50	1¾	3½	6	1	1, 4
3364-E	1-kHz-200 MHz	+20 min.	@ 50 Ω	40	35	50:50	1¾	3½	9	1	1, 4
3366-E	1 kHz-200 MHz	+20 min.	to 175 MHz	60	35	50:50	1¾	3½	12	1	1. 4
4376	10 Hz-200 MHz	+13	2.8 Vp-p @ 50 Ω 1.4 Vp-p @ 50 Ω 5% distn.	40, 20 select.	60	1 M:50	5¼	6	10	3	1
3580	25 kHz-175 MHz	+4 to +10	1 Vp-p @ 50 Ω	20	35	50:50	1¼	2¼	3¼	0.5	1, 4
3329-E 3368-E 3388-E	5 Hz-130 MHz	+25 min. to 70 MHz	10 Vp-p @ 50 Ω 5% distn. to 70 MHz	20 40 60	40 35 35	50:50 50:50 50:50	1¾ 1¾ 1¾	3½ 3½ 3½	7½ 10½ 13½	1 1.5 2	1, 4 1, 4 1, 4
3329	5 Hz-70 MHz	+20 to +25	12 Vp-p to 10 MHz 6 Vp-p to 50 MHz	20	30	50:50	1¾	3½	7½	1	1, 4
3378-A	18 kHz-100 MHz	+32	40 Vp-p @ 150 & 10 pF, 5% distn.	34	—	50:<50	3¼	4	8	1	1, 4
3528	100 Hz-100 MHz	+12	2.5 Vp-p min. @ 50 Ω	20	25	50:50	1¼	2¼	3¼	0.5	1, 4
3581-E	20 kHz-60 MHz	+4	1 Vp-p @ 50 Ω	20	20	50:50	1¼	2¼	3¼	0.5	1, 4
3582	15 Hz-20 MHz	+17 to +20	2 Vp-p @ 50 Ω 1% distn.	10x	25	5k:50	1¼	2¼	3¼	0.5	1, 4
1319-F	2 Hz-20 MHz	+23	8 Vp-p min. @ 75 Ω 2% distn.	25-40 adj.	10	75:75	3½	19	11	7	—
1390	2 Hz-20 MHz	+28 to +30	20 Vp-p @ 75 Ω 5% distn.	20	50	75:75	3½	19	10	7	—
3501	20 Hz-20 MHz	+5	1 Vp-p @ 50 Ω 5% distn.	35	35	50:50	1¼	2¼	3¼	0.5	1, 4
3577	15 Hz-12 MHz	+18 to +21	4 Vp-p @ 50 Ω 5% distn. 2 Vp-p @ 50 Ω 1% distn.	20	20	2.2M:50 4 pF	1¼	2¼	3¼	0.5	1, 4



The 3007-L features a 1 kHz to 200 MHz solid-state distributed amplifier with 75 ohm output capability. Its low frequency response makes it very useful as a video amplifier, as well as an RF amplifier. The enclosure has efficient heat transfer and easy accessibility, which are featured in many of the modules listed. The Model 3329-E, which incorporates RC coupled transistor stages also uses this package.

IF AMPLIFIERS

HIGH OUTPUT FOR POST AMPLIFICATION—*SOLID STATE*

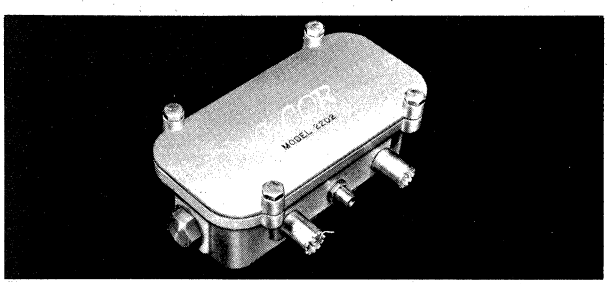
Model	Center Freq. MHz	Bandwidth 3 dB Nom. MHz	Power Output @ 1 dB Comp dBm	Gain Nom. dB	Noise Figure dB	Z In	Z Out	H in.	W in.	L in.	Wt. lb.	Other Amp. Pkg.
3607	20	13	+19	4-10	10	50	50	1¾	2½	6	1.0	1, 4
3607-A	24	11	+19	24-30	10	50	50	1¾	2½	6	1.0	1, 4
3603	30	10	+20	40-60	7	50	50	1 5/8	2½	11	1.5	1, 4
3606	60	1	+18	50-70	8	50	50	1 5/8	2½	11	1.5	1, 4
3606-A	60	1	+20	50-70	8	50	50	1 5/8	2½	11	1.5	1, 4

LOW NOISE C-COR AMPLIFIERS

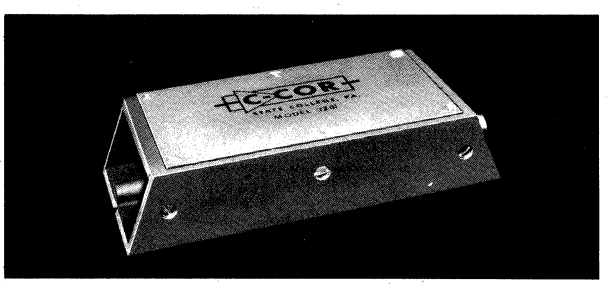
FOR ANTENNA PREAMPS AND LOW NOISE INSTRUMENTATION

SOLID STATE AND CERAMIC TUBE

Model	Center Freq. MHz	BW 3 dB Nom.	Pass-band	Power Output @ 1 dB Comp. dBm	Gain Nom. dB	Noise dB	Z In:Out	Dimensions & Wt. H in.	W in.	L in.	Wt. lb.	Desc.	Pkg.
3203-A	–	–	200 MHz-1 GHz	+8	20	4-7	50:50	1½	2	4	0.5	wideband	1, 2 & 4
2202	500-650	20 MHz	–	-4 to +1	20	4.5-6	50:50	2½	3 5/8	6½	1.5	antenna*	–
2202-A	400-500	20 MHz	–	-4 to +2	23	3.5-4.5	50:50	2½	3 5/8	6½	1.5	antenna	–
2202-B	250-400	20 MHz	–	-2 to +1	23	3-4	50:50	2½	3 5/8	6½	1.5	antenna	–
3204	470-890	10-20 MHz	–	0	9/stage	5-7	50:50	3¼	4	8	1	antenna FET cavity	1, 2, & 4
3201-A	100-650	20 MHz	–	0	25-30	2-5	50:50	1¼	2½	6	1	low noise**	1, 4
3578	250-500	20 MHz	–	-4	20	4	50:50	1¼	2¼	3¼	0.5	Min-Econ	1, 4
3579	100-250	20 MHz	–	-2	25	3	50:50	1¼	2¼	3¼	0.5	Min-Econ	1, 4
3583	–	–	1.5 MHz-50 MHz	+4	20	4	50:50	1¼	2¼	3¼	0.5	Min-Econ	1, 4
3583-AA						2.5							
3103	470-1000	10-20 MHz	–	+5	24	7-10	50:50	3	3	8	1.5	ceramic	1, 2
2113	470-1000	10-20 MHz	–	+5	12	7-10	50:50	3½	5	12	2	tube	–
3110	50-500	10-20 MHz	–	+5	15-35	3-7	50:50	3	3	5¾	1.5	cavity	1, 2



*The Model 2202 solid-state UHF preamplifier provides the ultimate in low-noise performance in an economical package suitable for outdoor mounting. This amplifier is ideally suited for any communication requirement where low-level signals must be amplified. The PS-25 dc power supply is a companion unit which is housed in an identical package.



**Model 3201-A is available in any center frequency from 100 MHz to 650 MHz with a noise figure of from 2 dB to 5 dB, depending on frequency and other specs. The module is housed in a rugged aluminum extrusion which features accessibility for repair and tuning. Similar to 2202 except Pkg. Other circuit designs available in Min-Econ packaging.

VIDEO AMPLIFIERS

FOR AMPLIFICATION AND DISTRIBUTION OF EXTENDED BANDWIDTH TV VIDEO AND OTHER SIGNALS—*SOLID STATE*

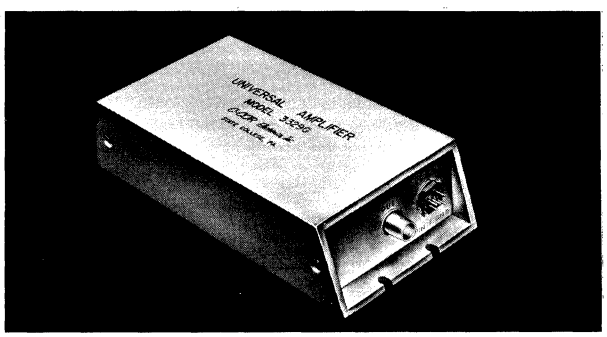
Model	Passband 3 dB Nom. MHz	Output Capability Nom. Power dBm	Test Spec @ Z_L @ 1 dB Comp.	No. of Out-puts	Gain Nom. dB	Noise µV rms	Z In:Out	Dimensions & Wt. H in.	W in.	L in.	Wt. lb.	Desc.	Pkg.
3407	100 Hz-60 MHz	+20	5.5 Vp-p @ 50	8	5.5	100 Nom	50:50	2	4	10	–	distribution	1
3471	60 Hz-35 MHz	+13	2.8 Vp-p @ 50 <1% distn.	4	-3 to +3 adj.	75	200:50	3½	2½	9	–	distribution	1
1319-F	2 Hz-20 MHz	+23	8 Vp-p @ 75 2% distortion	1	25-40 adj.	10	75:75	3½	19	11	7	video & pulse	–
1390	2 Hz-20 MHz	+28 to +30	20 Vp-p @ 75 5% distortion	1	20	50	75:75	3½	19	10	7	video & pulse	–
3453	5 Hz-20 MHz	+16	4 Vp-p @ 75 5% distortion	4	0-8 adj.	125 Nom.	40 k:75	3½	2½	9	–	distribution	1
4454	5 Hz-3 MHz	+24	10 Vp-p @ 75 2% distortion	4	0-6 adj.	100 Nom.	2 k:75	3½	4	9	–	distribution	1
3593-A	5 Hz-20 MHz	+13	1 Vp-p @ 75	1	0-5 @ 10 MHz	50 Nom.	75:75	1¼	2¼	3¼	0.5	cable equalizer	1, 4
3592	5 Hz-30 MHz	+12 to +15	2 Vp-p @ 50	1	unity volt gain	100	70 k:50	1¼	2¼	3¼	0.5	Min-Econ	1, 4

C-COR AMPLIFIERS

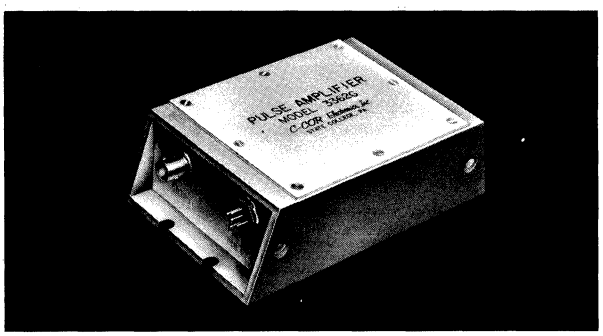
FAST RISE TIME PULSE

1 TO 10 ns RISE TIMES, OPTIMIZED FOR MINIMUM RINGING AND DISTORTION—*SOLID STATE*

Model	Rise Time nanosec. Typ.	Rise Time nanosec. Max.	Droop % @ PW	Linear Output	Gain Nom. dB	Noise μ Volts rms	Z In:Out	Dimensions & Wt. H in.	W in.	L in.	Wt. lb.	Other Amp. Pkg.
4013-P	1-1.2	1.3	10% @ 350 ns	±6 VP @ 50	40, 20 select.	50	50:50	5¼	16½	13	12	1
3010-AP	1-1.2	1.3	10% @ 350 ns	±6 VP @ 50	23	60	50:50	1½	3½	11½	4	1, 4
3371-AP	1-1.2	1.3	10% @ 0.5 μs	±4 VP @ 50 ±8 VP @ 100	20	60	50:50	2	3	9	2	1, 4
3374-AP	1-1.2	1.3	10% @ 1 μs	±2 VP @ 50	20	60	1 MΩ:50 7 pF	1¾	3	4¾	1	1, 4
3693-AP	2	2	10% @ 2 μs	±5 VP @ 50	unity	60	1 MΩ:50 7 pF	¾ (dia.)	—	6	0.5	
4375-P	2.1	2.5	10% @ 100 ns	±7.5 VP @ 75	60, 40, 20 select.	35	50:50 75:75	5¼	15½	10	10	1
3016-AP	2.1	2.5	10% @ 350 ns	±7.5 VP @ 75	23	45	50:75	1½	3½	10	2	1, 4
Available aligned to drive a capacitive load (5-50 pF)												
3596-A	1.8	2	10% @ 1 μs	±0.5 VP @ 50	20	30	50:50	1¼	2¼	3¼	0.5	1, 4
3692-AP	2	2	10% @ 20 μs	±0.5 VP @ 50	unity	50	1 MΩ:50 7 pF	¾ (dia.)	—	6	0.5	
3362-F	2	3	10% @ 3 μs	±3 VP @ 50 -6 VP @ 50 (G Model)	23	30	50:50	1¾	3½	6	1	1, 4
3364-F	2	3	10% @ 3 μs		40	35	50:50	1¾	3½	9	1.5	1, 4
3366-F	2.2	3	10% @ 1 μs		60	35	50:50	1¾	3½	12	2	1, 4
3329-F	3	5	2% @ 2 ms	+4, -8 VP @ 50 -12 VP @ 50 (G Model)	20	40	50:50	1¾	3½	7½	1	1, 4
3368-F	3.5	5	2% @ 1 ms		40	35	50:50	1¾	3½	10 5/8	1.5	1, 4
3388-F	4	5	2% @ 1 ms		60	20	50:50	1¾	3½	13 5/8	2	1, 4
3518	3-4	5	2% @ 20 μs	±1.5 VP @ 50	20	20	50:50	1¼	2¼	3¼	0.5	1, 4
3587-A	25	35	10% @ 1 μs	±25 VP @ 0.5 MΩ, 50 pF	20-48 adj.	100	100:100	1¼	2¼	3¼	0.5	1, 4



The Model 3329-G is one of a family of broad-band RC coupled amplifiers with extremely low frequency response which enables it to handle extremely wide as well as very fast rise time pulses. It features 5 ns rise time, an output capability of -12 volts peak across 50 ohms and 2 percent tilt in a 1 millisecond pulse. The Models 3368-G and 3388-G are the 40 and 60 dB versions in this family.



The Model 3362-G is a 20 dB gain version in a family of broad-band RC coupled amplifiers. It features a negative 6 volt peak output across 50 ohms with a rise time of 3 ns. The low frequency response of 1 kHz makes this unit useful for video amplification as well as fast rise pulse instrumentation. The Models 3364-G and 3366-G are the 40 and 60 dB versions in this family.

WIDEBAND TV DISTRIBUTION AMPLIFIERS
FOR PRODUCTION LINE OR LABORATORY DISTRIBUTION OF TV RF SIGNALS

Model	Passband 3 dB Nom. MHz	Outputs	Channels	Z In	Z Out	Typical Operation X-Mod	Description
1324	100 kHz-230 MHz	1	1-12	50, 75 select	50, 75 select	53-63 dBmV @ -57 dB	Rack Mount. 23 dB gain. Similar to Model 4375-S.
2306	50-220 MHz	2	1-12	75	75	53 dBmV @ -63 dB	Plug-in chassis. 117 Vac powered.
4223	20-240 MHz	1	1-12	75	75	43 dBmV @ -57 dB	Self-powered. 25 dB gain.

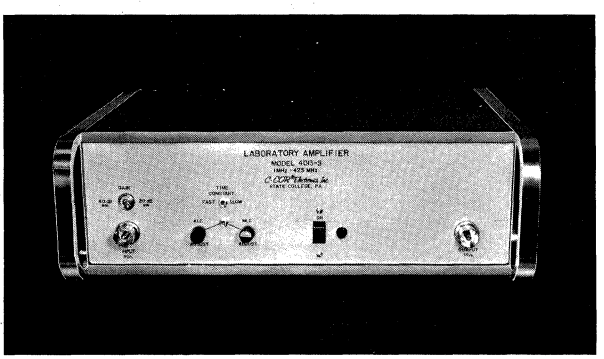
C-COR LABORATORY AMPLIFIERS

GENERAL PURPOSE WIDEBAND AND FAST PULSE AMPLIFIERS
INTEGRAL POWER SUPPLIES, SPECIAL FEATURES—VERSATILE LABORATORY INSTRUMENTS

Model	Passband 3 dB Nom.	Flatness dB	Nom. Power dBm	Output Capability @ 1 dB Comp. Test Spec. @ Z_L	Gain Nom. dB	Noise μ Volts rms	Z In:Out	Description
4013-S	1-425 MHz	±.25 ALC, ±1.5 dB @ 10 MHz-400 MHz	+27	14 Vp-p @ 50	40, 20 select.	50	50:50	smooth, flat response; vernier gain adj.
4013-SB	4-480 MHz	±1 dB @ 10 MHz-470 MHz	+27	14 Vp-p @ 50	40, 20 select.	53	50:50	extended bandwidth
4028	30-300 MHz	±1 dB @ 50 MHz-285 MHz	+35	33 Vp-p @ 50	35	N.F. 6 dB	50:50	wide dynamic range power or low-level amplifier
4375-S	0.1-230 MHz	±0.5 dB @ 1 MHz-200 MHz	+26 to +30	15 to 25 Vp-p @ 75	60, 40 or 20 select.	35	50:50 75:75	excellent wideband amplifier; smooth, flat response
4376-A	10 Hz-200 MHz	±0.5 dB @ 50 Hz-150 MHz	+13	2.8 Vp-p @ 50 1.4 Vp-p @ 50 5% distortion	40, 20 select.	60	1 M:50 10 pF	high performance; moderate cost; high input Z
4009	1-40 MHz	±1 dB @ 2 MHz-30 MHz	+35 to +38	38 Vp-p @ 50	40, 20 select.	70	50:50	linear, push-pull, ideal for HF band
4013-P	1.3 ns RT, 10% ringing: 10% droop @ 350 ns			±6 VPulse @ 50 @ spec. pulse	40, 20 select.	50	50:50	ultimate for fast pulse instrumentation; typical RT: 1.2 ns
4375-P	2.5 ns RT, 10% ringing: 10% droop @ 200 ns			±7.5 VPulse @ 75 ±6 VPulse @ 50 @ spec. pulse	60, 40 or 20 select.	35	50:50 75:75	excellent fast pulse amplifier; typical RT: 2.1 ns



The Model 4375-S is designed for laboratory and systems use. It combines high output and wide bandwidth in an all solid-state unit. C-COR's unique solid-state distributed amplifier circuitry is used in the output stage to provide high output capability. A gain of 20, 40, and 60 dB is available in switched steps (by use of a step attenuator) with a vernier control of 0 to 6 dB for each step. The 4375-S is calibrated for flat response to serve as a general purpose sine wave amplifier or preamplifier. The 4375-P is calibrated for use as a fast rise time pulse amplifier.



The Model 4013-S is a general purpose laboratory instrument providing ½ watt of linear power from 1 MHz to 425 MHz.

The amplifier includes an internal electronic gain control circuit which provides convenient automatic levelling with CW and swept input signals. A manual gain vernier control and a step attenuator are also provided to increase the versatility of this instrument.

The Model 4013-P is an extremely versatile laboratory instrument with a 1.3 ns rise time and an output of ±6V into 50 ohms.

AUXILIARY EQUIPMENT

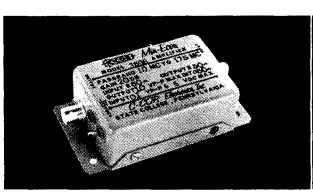
Model	Description	Specifications
3692-A	high impedance probe preamplifier	10 Hz-200 MHz @ 3 dB nom. passband, unity voltage gain. 3692-AB available aligned for pulse use 2 ns rise time.
3693-A	high impedance, probe amplifier	10 kHz-400 MHz @ 3 dB nom. passband, unity voltage gain. Model 3693-AB available for pulse use.
4622	battery powered preamplifier with rechargeable battery	10 Hz-60 MHz @ 3 dB nom. passband, 20 dB gain @ 75Ω. Use PS-22 charger for AC or battery operation.
A-760	matching transformer	50-75Ω, 100 kHz-220 MHz passband
WT-1	matching transformer	50-75Ω, 1 MHz-425 MHz passband
WT-2	matching transformer	25-50Ω, 100 kHz-400 MHz passband
PS-22	battery charger and power supply	for Model 4622 preamplifier
PS-22B	power supply for Min-Econ amplifiers	voltage range: 6 Vdc to 36 Vdc; current range: 30 mA to 90 mA
TGR	crystal controlled VHF signal source	solid state. Filtered output at specified frequency from 50 MHz-250 MHz

C-COR MIN-ECON AMPLIFIERS

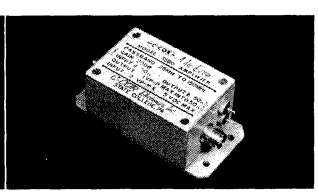
THE COMPLETE LINE OF LOW COST "OFF THE SHELF" AMPLIFIERS—*SOLID STATE*

Model	Passband 3 dB Nom.	Output Capability Nom. Power dBm	Output Capability @ 1 dB Comp. Test Spec. @ Z_L	Gain Nom. dB	Noise (rms) (μV)	Z In:Out	Power Req'd.	Description
3596	6-300 MHz	+4	1 Vp-p @ 50	20	30	50:50	+15 VDC @ 50 mA	ultra wide passband.
3502	1-300 MHz	+20	6.3 Vp-p @ 50	6	—	50:50	+22 VDC @ 200 mA	linear power amplifier.
3580	25 kHz-175 MHz	+4 to +10	1 Vp-p min. @ 50	20	35	50:50	+15 VDC @ 40 mA	flat align. for RF or pulse.
3528	100 Hz-100 MHz	+12	2.5 Vp-p min. @ 50	20	25	50:50	+15 VDC @ 150 mA	wide dynamic range
3581-E	10 Hz-60 MHz	+4 to +11	1 Vp-p min. @ 50	20	20	50:50	+10 VDC @ 25 mA	unusually low freq. response.
3592	5 Hz-30 MHz	+12 to +15	2 Vp-p @ 50	unity V gain	100	70 k:50	+15 VDC @ 20 mA	impedance transformation.
3599	Any part of band 1 kHz-30 MHz	+10	1.5 Vp-p @ 50 5% distortion	20 5 dB adj.	—	50:50	+12 VDC @ 35 mA	active filter (custom passband).
3593-A	5 Hz-20 MHz	+13	1 Vp-p @ 75 undistorted TV	0-5 @ 10 MHz	50	75:75	+24 VDC @ 50 mA	variable cable equalizer.
3582	15 Hz-20 MHz	+17 to +20	2 Vp-p @ 50 1% distortion	10x V gain	25	5 k:50	+25 VDC @ 70 mA	high output video and RF.
3501	20 Hz-20 MHz	+5	1 Vp-p @ 50 5% distortion	40	35	50:50	±6 VDC @ 50 mA	bal. or unbal. input. high gain IC.
3577	15 Hz-12 MHz	+18 to +21	4 Vp-p @ 50 5% distortion 2 Vp-p @ 50 1% distortion	20x V gain	20	2.2 MΩ:50 4 pF	+25 VDC @ 70 mA	high Z input with FET
3589	5 Hz-2.5 MHz	—	6-15 Vp-p @ 10 k 25 pF 5% distortion	100x V gain	50	1 MΩ:50 25 pF	-36 VDC @ 15 mA	highly stable and flat
3595	50 Hz-120 kHz	+20	5 Vp-p @ 50 5% distortion 2.8 Vp-p @ 50 0.3% distortion	10x V gain	20 μ V 50 Ω source	5 kΩ ≤ 10 to 100 kHz	+15 VDC @ 60 mA	audio-ultrasonic use
3579	Fc range 100-250 MHz	-2 to +1	0.5 Vp-p @ 50	25	3 dB	50:50	+15 VDC @ 12 mA	VHF preamp. (specify Fc)
3578	Fc range 250-500 MHz	-4 to +2	0.4 Vp-p @ 50	20	4 dB	50:50	+15 VDC @ 12 mA	UHF preamp. (specify Fc)
3583	1.5-50 MHz	+4 min.	1 Vp-p @ 50 5% distortion	20	4 dB	50:50	+10 VDC @ 30 mA	HF preamp.
3597	300 Hz-10 MHz w/500 Ω source	1 Vrms @ 2 k Ω	+1.5 VPulse @ 2 k Ω lin.	100x V gain	2 dB avg.	2 k:50 nom.	-15 VDC @ 25 mA	low noise video detector
3596-A	2 ns RT 10% droop @ 1 μ s	—	±0.5 VP @ 50, lin.	20	30	50:50	+15 VDC @ 50 mA	ultra fast pulse
3518	5 ns RT 2% droop @ 20 μ s	—	±1.5 VP @ 50, lin.	20	20	50:50	+15 VDC @ 150 mA	wide dynamic range
3587-A	35 ns RT 10% droop @ 1 μ s	—	+25 VP @ 500 kΩ, 50 pF, linear	10-250x V gain adj.	100	100: 100	+50 VDC @ 20 mA	high voltage pulse

PS-22B Power Supply for up to Six Min-Econ Amplifiers



Min-Econ 1¼" x 2¼" x 3¼"



Mil Type Package

NOTES: Pricing, see Yellow Pages under C-COR.

1. Model No. Designation: 3000 series is amplifier module only; 1000 series 19" panel for rack mounting and power supply; 2000 series weatherproof enclosure with power supply; 4000 series lab instrument case and power supply.
2. Many Amps meet MIL SPECS. & we specialize in taylor-made designs; consult us with complex amplifier problems.
3. Technical Bulletin on I.M. distortion & other technical specs available on request.
4. Laboratory Instrument Case, includes power supply.

POWER CONVERSION CHART

dBm	mW	V rms 50 ohms	Vp-p 50 ohms
-4	.40	.14	.40
-3	.50	.16	.45
-2	.63	.18	.50
-1	.79	.20	.62
0	1.0	.22	.63
+1	1.25	.25	.70
+2	1.60	.28	.79
+3	2.0	.31	.98
+4	2.5	.36	1.0
+5	3.2	.40	1.12
+6	3.9	.44	1.26
+7	5.0	.5	1.41
+8	6.3	.56	1.58
+9	7.9	.63	1.77
+10	10.0	.71	2.0
+13	19.9	.98	2.82
+16	39.8	1.41	3.99
+20	100.0	2.24	6.32
+30	1.0W	7.1	20.0
+40	10W	22.4	62.2
+43	20W	31.6	98.0

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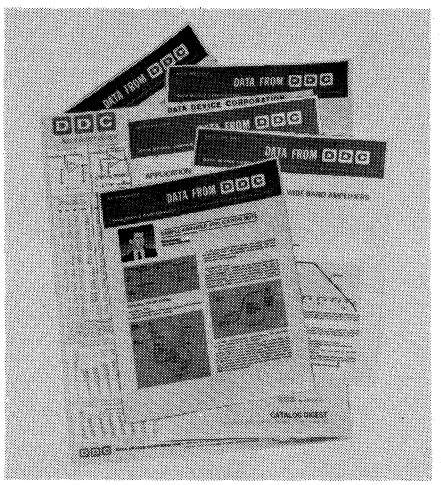
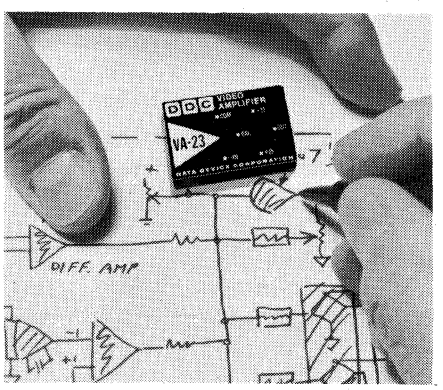
WE OFFER YOU COMPLETE APPLICATIONS ASSISTANCE.

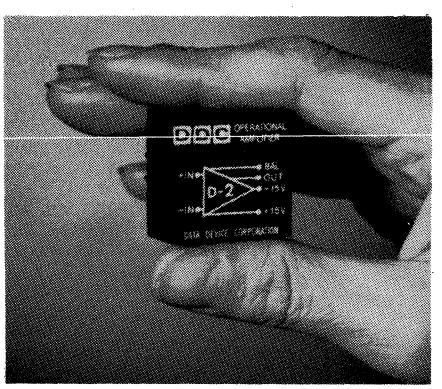
APPLICATIONS INFORMATION



APPLICATIONS ENGINEERING



DEMONSTRATION UNITS



A FEW OF OUR

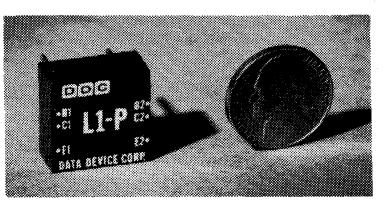
DISCRETE AMPLIFIER

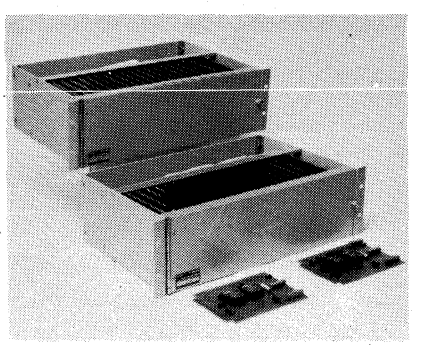
DESCRIPTION	Model
WIDE-BAND, INVERTING	
Video Amplifier	VA-23
Coax Line Driver	CD-23
Moderate Cost	D-24
Low Cost	D-14
HIGH PERFORMANCE	
High CMV FET (±10V)	D-15
Very High CMRR FET (106dB)	D-17
Very High CMRR FET (106dB)	D-19
High Current FET	D-25
Very Low Drift FET	D-27
Differential Ultra-Stable	D-28
HIGH POWER	
100 mA Surge Capability	D-30
200 mA Surge Capability	D-31
65 mA Surge Capability	D-32
200 mA Surge Capability	D-33
650 mA Surge Capability	D-34
1.5 A Surge Capability	D-35
ECONOMY	
Lowest cost	D-2
Low Cost FET	D-4
Moderate Cost	D-5
High CMRR (97dB)	D-8
High Current	D-11

HYBRID AMPLIFIER

Bipolar Input	007A-2/B/C
FET Input	008A-1/B-1/B-3
Darlington Input	009A/B/C
Hermetic Seal Bipolar	207
Hermetic Seal FET	208
Hermetic Seal Darlington	209

NOTES: * Other grades available.





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AMPLIFIERS

STANDARD PRODUCTS ARE SHOWN BELOW:

MODULES

RATED OUTPUT		Open Loop Gain	FREQUENCY RESPONSE			Input Volt. Drift vs Temp.	Input Curr.		Input Imped.		Case Size	Price (1-9)
Volts Min.	mA Min.	dB Min.	Unity Gain MHz Min.	FFO KHz Min.	Slew Rate v/μs Min.	μv/°C Max.	Initial Offset nA Max.	Drift vs Temp. nA/°C Max.	Diff. MΩ Typ.	CM MΩ Typ.		
±10	50	100	100	10,000	600	25	15	0.5	.35	—	1.2 x 1.8 x 0.6	$125.00
±10	100	100	100	10,000	600	25	15	0.5	.35	—	1.2 x 1.8 x 0.6	$125.00
±10	20	100	100	1,000	60	10	15	0.5	.35	—	1.115 x 1.115 x 0.515	$ 75.00
±10	5	86	20	500	30	20	20	1.5	.27	—	1.115 x 1.115 x 0.630	$ 48.00
±10	5	92	3	100	6	30*	0.05	**	10^5	10^5	1.115 x 1.115 x 0.515	$ 75.00
±10	5	92	3	100	6	30*	0.05	**	10^5	10^5	1.115 x 1.115 x 0.515	$ 85.00
±10	10	106	4	100	6	30*	0.05	**	10^5	10^5	1.115 x 1.115 x 0.515	$ 95.00
±10	20	90	2.5	100	6	30*	0.05	**	10^5	10^5	1.115 x 1.115 x 0.515	$ 85.00
±11	11	100	1.5	30	2	5*	20	**	10^5	10^5	1.115 x 1.115 x 0.630	$ 98.00
±10	2	110	1	4.5	0.3	1.5*	60	0.5	1	100	1.115 x 1.115 x 0.515	$ 80.00
±18	60	84	1	15	1	10	25	0.8	1	100	1.2 x 1.8 x 0.6	$ 80.00
±18	150	86	0.75	1.5	0.1	25	750	10	1	100	1.115 x 1.115 x 0.515	$ 95.00
±11	40	88	0.8	2	0.1	25	750	10	.4	25	1.115 x 1.115 x 0.420	$ 67.00
±11	110	88	0.8	2	0.1	25	750	10	.4	25	1.115 x 1.115 x 0.515	$ 67.00
±18	280	86	1	4	0.3	50*	750	10	.4	25	1.65 x 2.8 x 0.6	$125.00
±18	250	86	0.8	8	0.5	65	50	3	1	100	1.65 x 3.3 x 0.630	$110.00
±11	5.5	85	1	30	1.8	30*	60	1	.4	60	1.115 x 1.115 x 0.420	$ 9.75
±12	5	106	1.5	30	2	40	0.01	**	10^5	10^5	1.115 x 1.115 x 0.420	$ 14.50
±10	5	86	2	20	1.2	20	50	3	.25	12	1.115 x 1.115 x 0.515	$ 17.00
±11	2.2	86	5	18	1	20*	20	1.2	.3	25	1.115 x 1.115 x 0.515	$ 27.00
±10	20	90	0.8	10	0.6	25	25	0.8	1	100	1.115 x 1.115 x 0.630	$ 25.00

MODULES

±10	5	88	1	30	1	1/5/10*	150	4	.5	200	0.6 x 0.6 x 0.25	$85/$21/$16
±10	5	88	2	70	3	5/25/75*	0.005	**	10^5	10^5	0.6 x 0.6 x 0.25	$75/$35/$30
±10	5	83	3	150	7	1/5/10*	2	0.5	30	200	0.6 x 0.6 x 0.25	$85/$21/$16
±10	5	88	1	30	1	5*	150	4	.5	200	TO-8	$125.00
±10	5	88	2	70	3	25*	0.005	**	10^5	10^5	TO-8	$150.00
±10	5	83	3	150	7	5*	2	0.5	30	200	TO-8	$125.00

These amplifiers manufactured by Bell & Howell, are internally trimmed and phase compensated. The Models 007, 008 and 009 have axial leads. For radial leads, specify 107, 108 or 109.

** Bias current at 25°C doubles every 10°C.
All specifications subject to change without notice.

OTHER MODULES

Dual-output cards, cubes and encapsulated modules price (1-9) from $35.00 (±15 VDC at 50 mA).

Integrated circuits; also logarithmic elements, Models L1-N and L1-P, price (1-9) $37.50; and Pico-Power Comparators, price (1-9) $35.00.

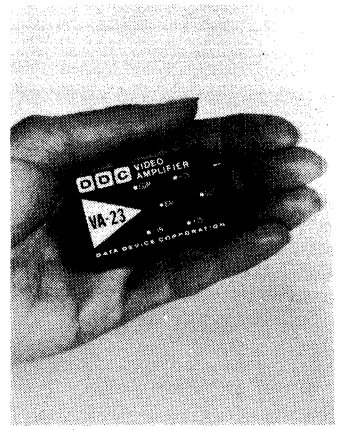
PLEASE SEE SECTIONS 2000 AND 4900

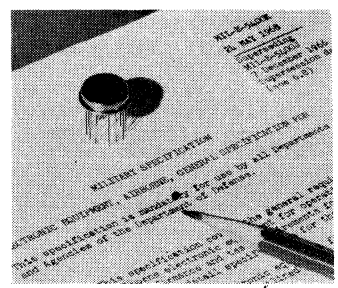
CUSTOM DESIGNED MODULES & SUB-ASSEMBLIES

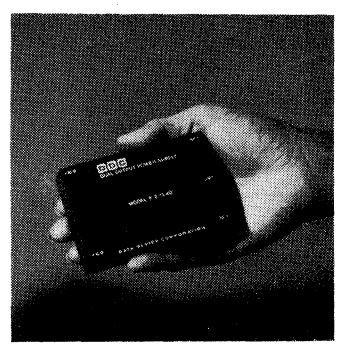
DDC designs modules and sub-assemblies tailored to particular requirements. A natural outgrowth of our capabilities has been the development of data conversion modules and special purpose assemblies to accomplish specific functions.

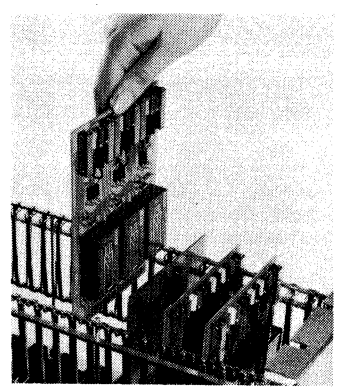
We have supplied hundreds of special devices, including units for use in sophisticated electronics systems on A7A, Mark II, P3C, AAFSS, C5A and other programs.

DDC's staff and facilities are geared to build modules and sub-assemblies to satisfy unique customer requirements.









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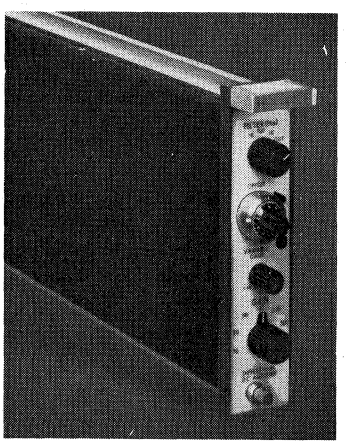
a MULTITECH company

Dynamics Instrumentation

DIFFERENTIAL AMPLIFIERS

Universal Buffer DIFFERENTIAL DC AMPLIFIER Model 7504

DC to 100 kHz. Gains from 0.1 to 33. Source Impedance — 100 k-ohms. Output — 10 V, 100 mA. FET input circuit eliminates zero errors from pump-out current flowing in signal source. Tolerates floating sources, long input cables. Typical applications include buffering single-ended amplifiers for ground isolation, driving galvanometers, long lines, and tape recorder preamplification. Gain accuracy: ±0.1%. Size: 5¼"H. From $235.00*



High Gain — Solid State DIFFERENTIAL DC AMPLIFIER Model 7514 Two Sizes — Eighteen Options

Model 7514 Differential DC Amplifiers are highly suited for many applications in instrumentation systems. Advanced multiple-feedback design rejects common-mode signals, and provides excellent input-to-output isolation. Operation from floating sources is permissible. Low pump-out current is maintained over a wide temperature range, permitting low drift operation from high source impedances.

Model 7514 is available in two sizes — 5¼" high and 7" high — with single or dual outputs and may be mounted 10 channels to standard 19" RETMA rack mounts. Optional features include gain step sequences of 10, 20, 50 . . . 1000 or 10, 30, 100 . . . 1000, lower gains (0.1-1000) 0.01% gain step accuracy, variable or fixed current limiting, offset control and 5 or 7 position low-pass filters.

Basic specifications: Gain accuracy, ±0.1%; CM level, ±20 V; CMR at gain 1000, 120 dB with up to 1000 ohms unbalance from dc to 60 Hz; Output Capability, ±10 V at ±100 mA, frequency response dc to 75 kHz.

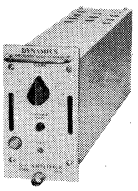
Model 7514 from $405.00*

300 Volt Common-mode Level DIFFERENTIAL DC AMPLIFIER Model 6050/PD and 6122/PD

These instruments operate from floating sources and permit the use of long input and output cables. Applications include conditions where high common-mode signals are encountered. Dual outputs 10V at 100 mA; Frequency Response DC to 10 KC, fast overload recovery, gains from 1.0 to 3300, Low Drift, Low Noise and .01% Linearity. Other models available with filters and wider bandwidth.

Price: Model 6050/PD $775.00
Price: Model 6122/PD $810.00

Megahertz DIFFERENTIAL DC AMPLIFIER Model 7575



Five variations permit gains from 0.2 to 1250. Typical specifications include DC to 1 MHz Bandwidth; Common-Mode Level ±50 V dc or peak ac; Slewing Rate: 50 V/μs; FS Output: ±10 V, ±100 mA. Applications include wideband data links, accurate video buffer amplifier, direct reference recording, and applied research in turbulence, blast or shock studies.

From $835.00*

DC AMPLIFIERS GALVO DRIVERS

GALVO DRIVER, D.C. AMPLIFIER Model 7202

The 7202 is ideally suited for driving galvanometers. DC to 35 KHz, gains 0.1-330, Input Impedance 100 K-ohms, Output 10V, 100 ma. Options include variable offset, current limiting, filtering, output pad networks and output reversal switch.

From $195.00*

DIFFERENTIAL CHARGE AMPLIFIERS

ISOLATED CHARGE AMPLIFIER Model 7306

Model 7306 Charge Amplifier is an all solid-state wideband instrument suitable for use with piezoelectric transducers. Input, output isolation is provided eliminating ground loop problems.

Automatic gain switching is available with this series of charge amplifier. One option provides the capability to automatically switch up or down one 10 DB step from a switch selected center position. Another option provides fully automatic gain ranging from 1 G to 1000 G full scale in seven 10 DB steps. Calibration provisions are available to test the input cable, transducer condition and amplifier gain. Programable calibration is available for systems application.

From $750.00*

ANALOG TO DIGITAL CONVERTERS

ANALOG-TO-DIGITAL CONVERTER, Model 6539

The Dynamics Model 6539 Analog-to-Digital Converter is a high-speed, isolating, differential instrument. It achieves a 0.01% accuracy at word rates of 31,200 wps, using successive approximation techniques. The accuracy and high word rate are realizable during system operation because of the excellent input signal isolation.

Optional features include sample and hold, up to 28 volt output logic levels, and variations in output codes. Standard instruments with varying word lengths in binary or BCD output coded are available.

Reliability is obtained through extensive use of integrated circuits. Accuracy is realized through the use of state-of-the-art resistors that are specially wound and encapsulated for the ultimate in low-temperature coefficients. The internal reference voltage is derived from a temperature controlled Zener diode. From $3,250.00*

Triple Mode DIFFERENTIAL AMPLIFIER Model 7350

This unit combines all the features of a differential dc amplifier, charge amplifier and ac amplifier in one compact plug-in module.

Model 7350, is an all purpose instrument amplifier designed to work from a wide variety of signal sources such as strain gauges, thermocouples and piezoelectric transducers.

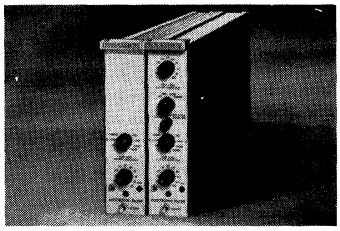
Wide Dynamic Range, 60 dB; ±20 V Common-Mode Operating Level; Isolated Charge Calibration Circuitry; Low-Level AC Measurements with long input cables and fully isolated input/output circuitry.

Front panel controls are arranged to read directly in full-scale input units required to produce a 1.0 volt, full-scale output signal. A seven position switch covers a range of 1 to 1000 in 10 dB steps and represents either full-scale millivolts for the ac and dc modes or full-scale "g" for the charge mode. A direct reading sensitivity control multiplies the step switch setting for the ac and dc modes or reads pC/g for the charge modes. A second direct reading dial is included to vary full-scale output over the range of 0 to 1.0 volt. Selection of the three operating modes is also accomplished by a front panel switch.

Optional features which can be supplied in the standard package configuration include active 2-pole filters at the output, power supplies for bridge excitation and full-scale offset controls for galvo positioning. Custom built packages can be supplied with automatic gain switching (up or down one 10 dB step as a function of peak signal level), average reading or peak holding meters or other special functions or controls.

From $780.00*

ELECTRONIC FILTERS



Variable, Direct-Coupled
ELECTRONIC FILTERS
Models 6364 and 6371

Low-pass/ High-pass/Bandpass/Band Reject
Variable through Four Decades
Direct-Coupled Low-pass Cutoff, from
1 Hz to 1 MHz
Sixth-order Butterworth/Linear Phase
in One Package

Dynamics' new Model 6364 and 6371 series of Electronic Filters are variable direct-coupled active filters with Butterworth and Linear Phase characteristics. Terminal slope on each skirt is 36 dB per octave. Cutoff frequencies can be selected over four decades in 0.1 decade steps. Model 6371 is a low-pass instrument only. Model 6364 has both low and high-pass circuits with switching provisions providing bandpass and band reject capabilities as well. Low-pass or high-pass filtering can be independently switched out.
Both Models 6364 and 6371 are available in two frequency ranges. Low frequency units cover four decades from 1 Hz to 10 kHz. High frequency units cover four decades from 100 Hz to 1 MHz. Versatile packaging enables these filters to be mounted in single, dual, or eight-channel rackmount configurations. A portable bench-mount is also available. From $800.00*

DIGITAL ISOLATION SWITCHES

500 ns Response
DIGITAL ISOLATION SWITCH
Model 601

The Model 601 Digital Isolation Switch is an isolating digital circuit with 500 nanosecond response, capable of transmitting dc logic levels. Eight models provide all combinations of inversion, translation and bipolar operation. The dimensions, 0.4" x 1⅛" x 1½", make it suitable for mounting on printed circuit cards. Proper operation requires power be supplied separately on both input and output sides.

The Isolation Switch is the equivalent of a nanosecond relay with very small reactive coupling between the drive circuit and the switch closure. It is transformer-coupled, but effective at dc. Excellent common-mode rejection capability is provided. Noise on the input logic line does not appear in the output logic line. Fan-out capability is adequate to drive many circuits or match to a transmission line.

High Speed
DIGITAL ISOLATION SWITCH
Model 602

The Model 602, Hi Speed, Digital Isolation Switch provides an isolating interface for digital logic signals with 100 nanosecond response. Input-to-Output Isolation prevents signal contamination in interface processes by eliminating ground loops. Input has variable threshold Schmitt trigger characteristics. Output is fully floating — power is carrier-derived from the input side and is sufficient to provide a dc to 3 MHz response. A single 602 can be used to provide signal inversion, translation, compression or expansion as required, with simple external adjustments.

Compact size, 2" x 2½" x ¾", makes the 602 Digital Isolation Switch ideally suitable for mounting on printed circuit cards, offering greater systems design flexibility. Connector pins are located on 0.4" centers and are "keyed" to eliminate possible plug-in errors. The unit weighs less than two ounces.
Price: $39.00 to $135.00*

HYBRID MICROELECTRONIC SYSTEMS

MULTITECH MICROELECTRONICS offers:

- Advanced custom circuit design utilizing hybrid techniques.
- Optimized military and commercial system mechanizations utilizing hybrid circuits.
- 45 day delivery for prototype hybrid circuits.
- 30 day 1st article delivery for build-to-print hybrid circuits.
- Both **thick** and **thin** film processes, depending on the application.
- Both standard and custom packages, including flat packs and stacked TO-5 and TO-8 configurations.
- Microelectronic design consulting.
- Microelectronic process equipment, including pull-testers and large array automatic test equipments.
- Large production facilities.
- Knowledgeable and objective system circuit and packaging analysis which may or may not utilize hybrid mechanizations.
- ". . . and because complex hybrids are not components but subsystems, only a system oriented company can best apply the theory of hybrid microelectronics — we are that company."

DATA/COM SYSTEMS

Data Transmission with
Multitech Data Products
DATA/COM Equipment

The bulk of data transmission problems can be conveniently grouped in accordance with several characteristics:

Transmission Method Tone Keying — Acoustic Coupled / Wired. Teletype Keying (Loop Keying). Frequency Shift Keying (FSK) — Acoustic Coupled / Wired. Phase Shift Keying (PSK). **Conversion Requirements** Serial-Parallel / Parallel-Serial / Encoding / Decoding / Format. **Error Control Requirements** Conventional Parity Checks / Self-Parity Techniques / Signal Regeneration / Retransmission Control. **Special Addresses & Messages** Special Word Generators / Variable Address Answerback / "Stunt Boxes" (Function response to selected characters or words). **Switching Requirements** Many Lines to One User / Many Users to One Line / Traffic Net Among Many Users. **Electronic:** High switching speed, high reliability and flexibility. **Stepping Switch;** Electronically Controlled: Low cost, high reliability, high crosspoint density, relatively low switching speed. **Word Generators** Many communications require a header message to precede the message text. If the message header is dependent on the type of message, these word generators can ensure reliable transmission of a message header, in accordance with a preselected, settable code. **Variable Address Decoders** Occasionally messages are routed to coded addresses and the addresses are message dependent. The variable address decoder allows a data terminal to receive only those messages routed by the variable address decoder. **Data Converters** Data characteristics must be altered in many systems. The alteration may be logical and/or electrical. Data converters provide electrical and logical alteration. Data keyers are used for serial data transmission in teletypewriter loops, and for isolation of signals from one loop system to another. Most computers, printers, card readers provide parallel by character or word data transmission. Teletypewriters receive and send bits serially. The data converter will convert parallel data to serial data format and serial data to parallel data format. The DATA/COM Converters are efficient in assembling and disassembling characters.

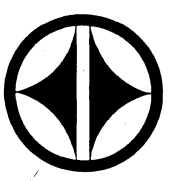
a MULTITECH company

Dynamics Instrumentation

583 Monterey Pass Road, Monterey Park
California 91754 Telephone: (213) 283-7773

*check with factory for current price
Multitech Data Products and Multitech Microelectronics are divisions of Dynamics Instrumentation, a Multitech Company.

Look in the Yellow Section for Manufacturers' Sales Offices

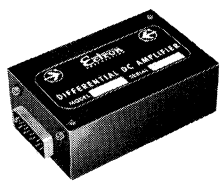


Tell them you found them in eem

Ectron
CORPORATION

FLIGHT TEST INSTRUMENTATION
DIFFERENTIAL DC AMPLIFIERS
ISOLATION AMPLIFIERS
TRANSDUCER SIGNAL CONDITIONING
DATA ACQUISITION SYSTEMS

Ectron has developed advanced instrumentation for high accuracy signal conditioning despite environmental extremes. To produce precise data in typical airborne environments, Ectron amplifiers feature low dc drift, high common mode rejection and a true differential input completely isolated from output, power and case. Rugged cordwood construction, conservative design, and rigorous testing assure high reliability.



MODEL A444-12 MINIATURE INSTRUMENTATION AMPLIFIER

Combining a precision differential dc amplifier with an integral strain gage power supply, the A444-12 provides outstanding performance in a size only .85″ x 1.4″ x 2.0″. DC drift is only 0.5 microvolts/°C, common mode rejection is 120db at 60 Hz and linearity is 0.05%. Input to the amplifier is completely isolated (typically 10,000 megohms) and can be floated to 100 volts.



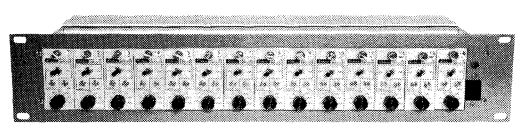
A414 SERIES INSTRUMENTATION AMPLIFIERS

Designed for flight test and other severe environment applications, the A414 Series offers a variety of differential dc amplifiers with signal conditioning to suit a wide range of instrumentation needs. Operating environment includes temperature from −55° to +100°C, vibration to 100 g and shock to 1000 g. Electrical performance offers gain ranges to 20,000, common mode rejection to 140db and drift to 0.5 microvolts/°C. Conditioning for strain gage, thermocouple and RT transducers is available.



A418 SERIES SIGNAL CONDITIONERS

These models offer the versatility of laboratory type amplifiers combined with ruggedness and miniature size suitable for vehicle and portable equipment uses. Features include front panel controls for gain and zero, integral transducer conditioning and rugged construction.



SPECIAL CONDITIONERS, DATA SYSTEMS

Ectron offers a variety of signal conditioners, microvolt level dc amplifiers and dc to dc isolators for specialized applications. Also available are data acquisition systems to meet exacting requirements from laboratory to missile environments. Consult your local engineering representative or contact Ectron for detailed information.

8070 ENGINEER ROAD, SAN DIEGO, CALIF. 92111
AREA CODE 714 PHONE 278-0600

Ectron
CORPORATION

SOLID-STATE FUNCTIONAL MODULES



Hybrid Systems specializes in epoxy encapsulated functional modules for use by system and instrument designers. These high performance, versatile, low cost units embody performance heretofore unavailable or confined to expensive and inconvenient rack mounted equipment.

Hybrid Systems' functional modules are powered from ±15 volt power supplies and feature voltage swings and driving capability which are compatible with operational amplifiers, standard digital IC logic, as well as all other Hybrid Systems' units.

These modular system components are high quality units incorporating the most advanced analog & hybrid analog/digital circuitry. In many cases analog and digital techniques are internally combined in a proprietary manner so as to produce performance advantages over either approach alone.

In addition to the off-the-shelf units described in the Hybrid Systems Catalog, modified versions and complete customized circuits tailored to meet specific requirements are offered. Quantity & OEM Discounts are available.

SERIES 100 ANALOG MULTIPLIERS

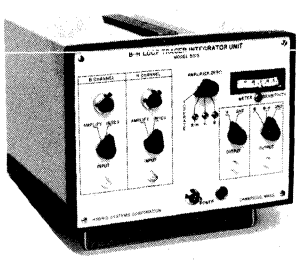
Hybrid Systems' line of analog multipliers includes models offering bandwidths to 10 megacycles and accuracies up to ±0.1%. Most units are extremely versatile and are capable of operation as a multiplier (XY/10), a divider (10X/Y), a squarer ($X^2/10$), or a square-rooter ($\sqrt{10X}$), without requiring any external amplifiers or reference supplies. These multipliers operate in all four quadrants with a full ±10 volts dynamic range in both inputs. No external balance, gain, trim, or adjustments are required.

SERIES 200 REFERENCE SUPPLIES

These units produce stable accurate 10.000 volt references capable of driving loads up to 150 mA without requiring any external buffer amplifiers or adjustments. The units are epoxy modules and are powered from conventional ±15 volt power supplies; thus insuring compatibility with operational amplifier circuits. An optional remote sensing feature is available at no additional cost.

SERIES 600 MODULAR COUNTERS

These solid-state Counters are primarily intended for use in conjunction with other Hybrid Systems' modular components for producing such functions as ramp or stairstep generators, long-term integrators, etc. Unidirectional (up only) and bidirectional (up-down) units are available in both natural binary and BCD. The bidirectional counters utilize a sign bit plus magnitude code. These modular counters are packaged with 3 decades (BCD versions) or 12 bits (natural binary) in each module with cascade capability. Every unit is electronically resettable to zero and have gated inputs.



SERIES 300 MULTIPLYING D TO A CONVERTERS

These Multiplying Digital-to-Analog Converters (MDAC) produce an output voltage which is proportional to the mathematical product of the applied analog reference and the digital input. If a constant reference is employed, conventional D to A conversion is accomplished. Inasmuch as these units feature the ability to accept a completely varying bipolar reference, the use of an analog signal as the reference results in hybrid multiplication (analog x digital = analog). Standard models exist for either binary or BCD coding with accuracies up to ±.025%. The units are epoxy encapsulated modules and are powered from ±15 volts.

SERIES 400 VOLTAGE-TO-FREQUENCY CONVERTERS

This Series of V to F Converters produces a train of square waves whose repetition rate is directly proportional to the magnitude of the input voltage. Zero input voltage yields zero output frequency. A variety of full scale output frequencies are available. Units which accept bipolar input voltages and, in addition to the appropriate output frequency, produce a "sign bit" for polarity display, reversing counters, logical operations, etc., are included in this Series. Accuracies are better than ±0.1%. All models generate square wave outputs which are DTL and TTL compatible. These units are epoxy encapsulated modules and are powered from ±15 volts.

SERIES 500 ELECTRONIC SWITCHES

Hybrid Systems' line of Electronic Switches are all solid-state devices. This Series includes Analog Multiplexers, Integrator Reset Switches, ±1 Unity Gain devices, etc. All units operate from ±15 volt power supplies.

SERIES 900 PHASE SENSITIVE DEMODULATORS

These units convert phase sensitive suppressed carrier AC signals to a linearly proportional bipolar DC voltage. High accuracy, linearity, and gain and null stability are featured. Output impedance of all units is less than 1Ω.

SERIES 700 SAMPLE-INFINITE HOLDS

Hybrid Systems' Sample-Infinite Holds are similar in operation to conventional sample-holds, but offer the additional unique feature of no droop (decay) of the stored value in the "Hold" mode. Hence, the term "Infinite Hold." Specifically, the units will, upon command, sample the input analog voltage and indefinitely hold that value until commanded to sample again. Hybrid analog/digital techniques are employed to produce the no droop feature.

SERIES 800 PEAK DETECTORS

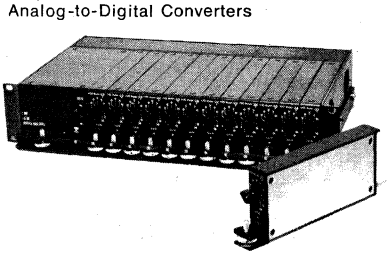
These units continuously monitor an input analog voltage and automatically store the peak value attained by this signal. The hybrid analog/digital techniques utilized in these units produce the unique feature of no decay (droop) of the stored peak value, regardless of the duration of the holding period. Upon command, the circuit is reset to zero volts and re-commences monitoring the analog input.

SERIES 1000 SYNCHRO CONVERTERS

Included in this Series are solid-state Synchro-to-DC, Synchro-to-Sin ϕ and Cos ϕ, Synchro-to-Digital, and Digital-to-Synchro converters. Both 3 wire synchro and 4 wire resolver input units are available.

OTHER PRODUCTS INCLUDE

- Customized Modules
- Special Purpose Computers
- Data Logging Systems
- Customized High Performance Operational Amplifiers
- Analog-to-Digital Converters



Our skilled staff of engineers will be pleased to discuss your requirements with you. Hybrid Systems is constantly expanding its line, offering improved performance, and lower prices. For the latest catalogs, data sheets, technical notes, and engineering assistance, contact us directly or your nearest Hybrid Systems Representative.

HYBRID SYSTEMS CORP., 95 Terrace Hall Ave., Burlington, Mass. 01803 • Tel: (617) 272-1522 TWX: 710-332-7584

SOLID-STATE FUNCTIONAL MODULES

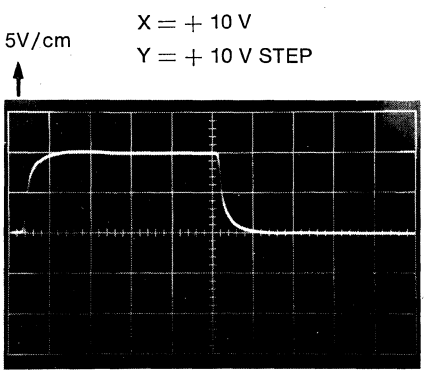
NEW MODEL 105 WIDEBAND (DC TO 10 MEGAHERTZ) MULTIPLIER

SPECIFICATIONS	
Bandwidth (—3db)	DC to 10 MHz
Slewing Rate	250 V/μsec.
Outputs	+XY/10 and —XY/10
Input Voltage Range	±10 volts.
Output Range	±10 volts at ±10 mA.
Accuracy	±1% of F.S.
Power Supply	±15 V
Price (1-9)	$295

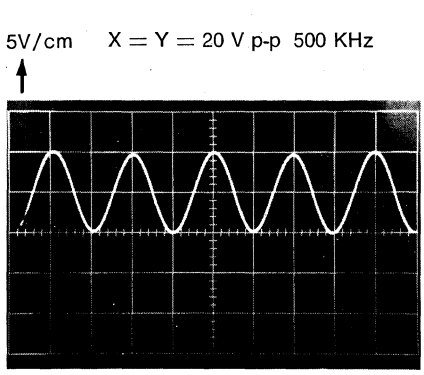
Hybrid Systems' Model 105 offers unmatched analog multiplier performance — full ± 10 volt four quadrant operation with wide bandwidth and high slewing rate. The excellent transient response of this unit makes possible a wide range of real-time signal processing heretofore impractical with existing limited bandwidth devices. The Model 105, unlike "quarter-square" devices, produces a minimum of unwanted harmonics; thus, also making it ideal for amplitude modulation applications in communications systems.

TYPICAL APPLICATIONS

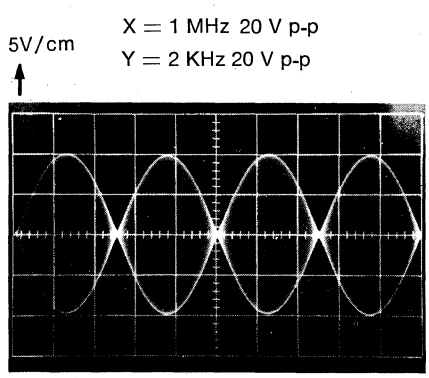
• CORRELATION • REAL-TIME RADAR & VIDEO SIGNAL PROCESSING
• SUPPRESSED CARRIER MODULATION • DISPLAY GENERATION



TRANSIENT RESPONSE



SQUARING AT 500 KHz



AMPLITUDE MODULATION

NARROW BAND MULTIPLIERS/DIVIDERS

• MULTIPLY • DIVIDE • SQUARE • SQUARE ROOT

Hybrid Systems' Series 100 Analog Multiplier/Dividers feature high accuracy & versatility at low cost. All Models are full ±10 volt four quadrant devices. Specified accuracy requires no external balance or gain trim adjustments and includes all sources of error (gain, linearity, offset, etc.) in the "worst case" combination. All units are capable of multiplication, division, squaring, and square-rooting without any traditional external amplifiers.

All units are 2.5" x 3.5" x .825".

MODEL	101	102	103	104
Max Error[1]	0.2%	0.2%	0.1%	0.1%
Scale Factor[2]	+XY/10	—XY/10	+XY/10	—XY/10
Y Input Imped.	10 megΩ	10 megΩ	10 megΩ	10 megΩ
X Input Imped.	50kΩ	50kΩ	50kΩ	50kΩ
Output Current	±10 mA	±10 mA	±10 mA	±10 mA
Bandwidth	100 Hz	100 Hz	100 Hz	100 Hz
Power Supply	±15 V	±15 V	±15 V	±15 V
Price (1-9)	$265	$265	$325	$325

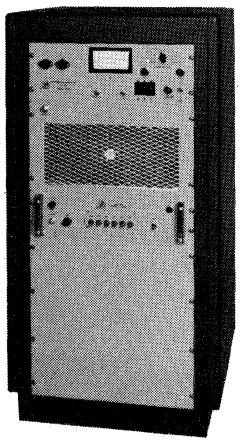
(1) % of F.S. (includes gain, linearity, & offset)
(2) In multiply mode

Our skilled staff of engineers will be pleased to discuss your requirements with you. Hybrid Systems is constantly expanding its line, offering improved performance, and lower prices. For the latest catalogs, data sheets, technical notes, and engineering assistance, contact us directly or your nearest Hybrid Systems Representative.

HYBRID SYSTEMS CORP., 95 Terrace Hall Ave., Burlington, Mass. 01803 • Tel: (617) 272-1522 TWX: 710-332-7584

BROADBAND POWER AMPLIFIERS

(no tuning, no plug-in's, no bandswitching)

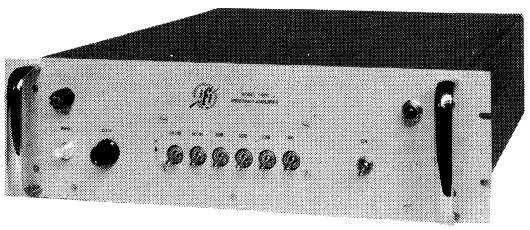


BANDPASS.....10 kHz to 220 MHz

POWER OUTPUT.....up to 400 watts continuous

POWER GAIN.....up to 64 db

The M404A shown at left is the most powerful and most versatile broadband amplifier on the market. Standard unit produces 200 to 400 watts continuous power output with minimum of 50-db power gain from 200 kHz to 220 MHz.



The M5000L is a low-cost broadband power amplifier capable of 5 to 10 watts continuous output with 30-db gain from 10 kHz to 220 MHz.

BROADBAND, LABORATORY POWER AMPLIFIER SPECIFICATIONS

MODEL	M530	M510	M500	M5000	M402	M404A	M404P
Power Output in Watts:	0.08	0.75	3	10	50	200	1,000
Power Gain (minimum):	16 db	14 db	10 db	30 db	40 db	50 db	50 db
Frequency Maximum:	300 MHz	220 MHz					
Frequency Minimum:	10 kHz	200 kHz standard. For 10 kHz lower limit, add suffix "L" to Model number					
Bandpass Ripple:	±2 db maximum; ±1 db typical						
Input for full rated Output:	2 mW	30 mW	300 mW	2 mW standard; for 0.1 mW add suffix "G"			
Input Impedance, Nominal:	135 ohms	90 ohms		50 ohms			
Output Impedance:	150 ohms	135 ohms		50 ohms			
Duty Factor:	No Restrictions						Limited
Rise/Fall Time:	Less than 10 nanoseconds						
Mismatch Tolerance:	Protected against damage from *any* mismatch; can operate continuously at 4:1 vswr (reduced pwr)						
Distortion:	All harmonic products down 20 db minimum at ½ rated output						
Input Connector:	Type BNC standard; others on special order						
Output Connector:	Type BNC standard; others available				Type N standard; others available		
Cooling:	None required			Internal fans	Internal fans and blower and filter		
Weight in Pounds:	13			33	200	375	
Packaging:	Rack mount				Bench Cabinet	Floor cabinet on casters	
Dimensions: H" x W" x D":	3½ x19x10			5¼x19x20	36x23½x22	49x23½x22	
Metering:	None required				All major voltages and currents		
Primary Protection:	Fuse				Front-panel circuit breakers		
Secondary Protection:	All secondaries fused				Final protected by overload relay		
Safety Features:	Completely enclosed				Cabinet electrically interlocked		
Power Requirements:	115 V ±10%, 50/60 Hz, single phase				115/230 V	208 V, 50/60 Hz, 3 phase	
Gain Control:	Cont. 16 db	Cont. 14 db	Cont. 10 db	41 db calibrated input atten. plus gain control			

INSTRUMENTS FOR INDUSTRY, INC.

151 Toledo Street, Farmingdale, N. Y. 11735 ■ Tel. 516-694-1414 ■ Cable: Electronic, Hicksville, N. Y.

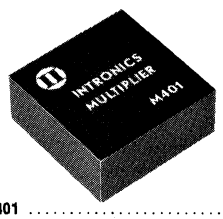
INTRONICS BLACK BOXES

provide a known cost and performance solution to system design problems

Intronics modules feature MIL quality construction and advanced solid state circuitry. Operation from ±15 volt supply voltages is standard, with ±10 volt input and output voltages. Modules are designed for compatible operation, minimizing interface problems. No customer furnished feedback networks, pots, or other adjustments are normally required. All units have short circuit proof outputs. −55°C to +125°C storage and −25°C to +85°C specified operation is standard, with −55°C to +125°C operation available for most models. Other options include operation from ±12 volt supply voltages.

MULTIPLY / DIVIDE / SQUARE / SQUARE ROOT

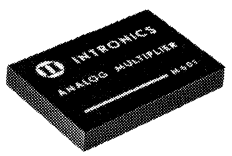
ECONOMY dc to 20 kHz



Transconductance multiplier featuring adjustable accuracy to better than 1%, temperature stability of 0.03%/°C, and small signal response to 125 kHz. Available in divider model D401.

M401 ..... **$95**

GENERAL PURPOSE dc to 100 kHz



Medium priced transconductance multiplier featuring small signal response to 500 kHz, 1% accuracy, and 0.02%/°C temperature stability. Higher accuracy model M602. Military versions M601-M, M602-M.

M601 ..... **$165**

WIDEBAND dc to 1 MHz



Transconductance multiplier with frequency response beyond 1 MHz, 1% accuracy, and 0.02%/°C temperature stability. Higher accuracy model M502. Military versions M501-M, M502-M.

M501 ..... **$295**

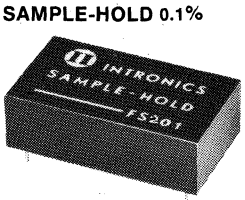
PRECISION 0.1% accuracy



Pulse height-width type with best accuracy, linearity, and temperature stability. DC to 1 kHz. Other lower accuracy lower priced models M301, M302.

M303 ..... **$325**

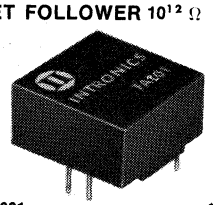
SAMPLE-HOLD 0.1%



Low priced unit featuring accuracy to 0.1%, 5 μs acquisition, 50 ns aperture, and provision for external holding capacitor.

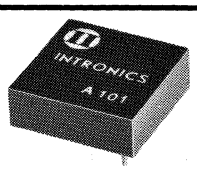
FS201 ..... **$95**

FET FOLLOWER $10^{12}\ \Omega$



High impedence voltage follower series featuring accuracies to 0.01%, input currents to 2 pA, and 100 kHz full output frequency.

FA201 ..... **$24.50**



OP AMPS priced from $13.50

Amplifiers having the following features:

- High input impedance
- High output current
- Fast slewing/wide bandwidth/fast settling time
- Low drift
- High gain

POWER SUPPLIES



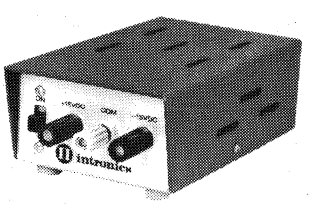
MODULAR

Complete regulated dual output power supply module, ±12, 15, 18, and 24 VDC at 60, 75, and 100 mA, 0.05% regulation, short circuit protected in encapsulated module.

Prices start at **$45**

BENCH TYPE

Dual output ±15 VDC power supplies in compact metal cases for bench use. Line and load regulation 0.1%. Output currents from 50 mA to 500 mA.



PS50 ..... **$59**

Other solid state function modules available for: precision voltage/current amplification, linear-log conversion, sin/cos generation, absolute value, A-D, D-A conversion, binary-BCD conversion, coordinate rotation and transformation subsystems.

Contact our applications engineering department to discuss your requirements.

intronics

57 CHAPEL STREET • NEWTON, MASS. 02158

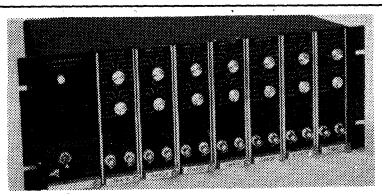
TEL: 617-332-7350 • TWX: 710-335-6835

735 W. CLINTON ST., ITHACA, N.Y. 14850 — 607-272-7640

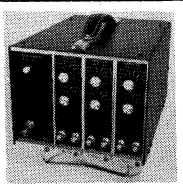
ITHACO

INSTRUMENTATION for *DYNAMIC DATA ACQUISITION & SIGNAL CONDITIONING

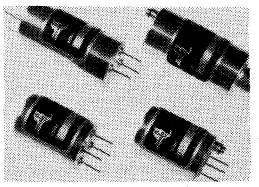
* ACOUSTIC, VIBRATION, SHOCK, SEISMIC, AND GENERAL SCIENTIFIC APPLICATIONS



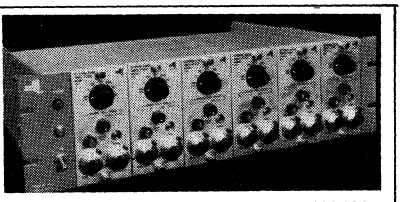
450 SERIES AMPLIFIERS



MODEL 450S2 PORTABLE CASE



MODEL 143/144 PREAMPLIFIERS



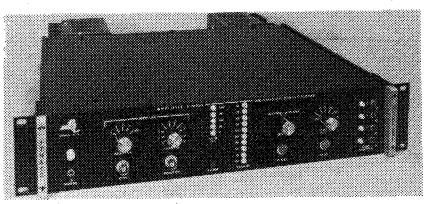
MODEL 241 DYNAMIC STRAIN GAGE AMPLIFIERS

ITHACO dynamic data acquisition amplifiers and preamplifiers generally operate in the 1Hz to 200KHz range, and are used in a wide variety of applications requiring:

- Shaping of frequency and phase response
- Voltage or charge inputs; single-ended or differential
- State-of-the-art noise performance at any impedance level
- Fully automatic (ITHACO's AUTO-GAIN® Amplifiers) computer oriented, data acquisition systems
- All products provide stable and precise gain; as low as −20 db and as high as 100 db

ITHACO manufactures high and low impedance, single-ended or differential, voltage or charge preamplifiers in various packages. The 250, 450 and 430 Series are general purpose amplifiers for dynamic data, available with a choice of electrical configurations — including single-ended or differential front ends. The 260 Series are charge amplifiers for shock and vibration measurements. The Model 241 is specifically designed for acquisition of dynamic strain data over a 60 KHz bandwidth.

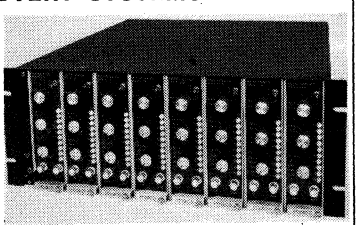
FULLY AUTOMATIC DYNAMIC DATA ACQUISITION AND RECOVERY SYSTEMS



MODEL 541
AMPLIFIER STATUS MULTIPLEXER-DEMULTIPLEXER

Automatic Gain Ranging, 32 Channel Status Recovery

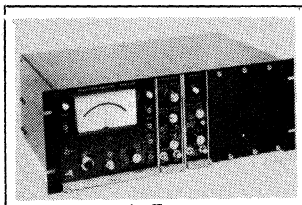
ITHACO's fully automatic data acquisition and recovery systems condition wide-dynamic range signals to amplitudes suitable for recording processing and display. They prevent loss of costly data due to operator error and manual response time. Model 441 Amplifiers automatically condition the amplitude of signals in the range of 1 Hz to 100 KHz to a level within the limited dynamic range of the tape recorder (or A/D converter, real-time analyzer, etc.). Gain is automatically switched in the precise steps as required to hold output signal amplitude in the range 0.2 to 1.0 volts. The Model 541 multiplexes the amplifier status signals and supplies the data processing equipment with amplifier status for each data channel.



MODEL 441 AUTO-GAIN® AMPLIFIERS

PHASE-LOCK (Lock-in) AMPLIFIERS

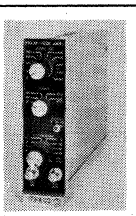
For Synchronous Detection of Noise Buried Periodic Signals



MODEL 353
PHASE-LOCK AMPLIFIER

Model 353 Phase-Lock Amplifier measures amplitude and phase of repetitive signals in the presence of high noise levels. The design of the 353 represents a significant departure from that of conventional lock-in amplifiers. Synchronization with an external reference signal is substantially automatic, and the instrument will track this reference signal over a 10:1 frequency range without affecting accuracy or phase calibration. Set-up time is minimum and no frequency tuning is required. The instrument will accommodate peak to peak coherent signals or noise of 1000 times the full scale signal setting without saturating. Modular in construction, the 353 can be adapted to a wide variety of specialized applications. Standard sensitivity of 1 microvolt can be increased to 10 nanovolts with remote preamplifiers in the 1Hz to 200KHz frequency range.

For multichannel applications, the Model 361 provides up to 7 synchronous demodulation channels in a single 19″ standard rack adapter.

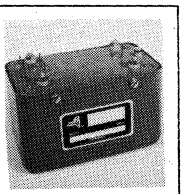


MODEL 361

LOGARITHMIC, VOLTAGE-CONTROLLED AMPLIFIERS

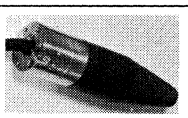
Logarithmic Conversion, Compression and AGC

The Models 314 and 316 are wideband AC amplifiers with true logarithmic gain control characteristics. Gain is controlled by a 0.5 volt DC control signal. The Model 316 is capable of slewing gain at rates of over one million db per second with no coupling of the control signal into the output. Bandwidths are from 2Hz to 100KHz. Control voltage vs. gain is accurate to within ±0.5db. The addition of an external feedback loop (detector and integrating op amp) permits logarithmic signal conversion, signal compression and automatic gain control.



MODEL 316
VOLTAGE-CONTROLLED AMPLIFIER

WIDEBAND, OMNIDIRECTIONAL, SENSITIVE HYDROPHONE

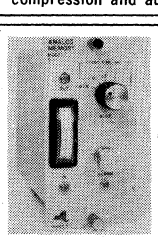


MODEL 601-1
WIDEBAND HYDROPHONE

30 Hz to 150KHz Response, Internal 20db Preamplifiers

The Model 601-1 is a sensitive, wideband, omnidirectional hydrophone incorporating a low noise ITHACO preamplifier within its molded structure to provide optimum noise performance. The midband sensitivity of the Model 601-1 is −69dbv/μbar at preamplifier output (−89db at amplifier input). Frequency response is ±3db from 30Hz to 100KHz with usable response to 150 KHz. Spectral noise, 1.0 Hz bandwidth, at preamplifier output is less than Sea State Zero at frequencies below 10KHz.

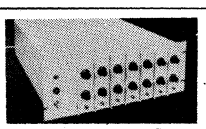
PEAK HOLDING ANALOG MEMORY



MODEL 511
ANALOG MEMORY

Stores and Displays Peak Amplitude of Varying Signals

The Model 511 Analog Memory is a dual purpose instrument providing either a long term memory of transient output signal voltages or an envelope-detected output for signals in the 4Hz to 5KHz range.



MODEL 6061-48 DISTRIBUTION AMPLIFIER

MULTI-CHANNEL VIDEO DISTRIBUTION AMPLIFIER

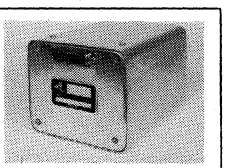
For Generation of Instrumentation Tape Recorder Copy Tapes

One input and 6 outputs per channel. Bandwidth is over 2MHz.

ULTRA-LOW NOISE SEISMIC AMPLIFIERS

Low Frequency Preamplifier Free of I/f Effects

The Model 1541 has a .001Hz to 100Hz basic frequency range. High/low pass plug-in filters are available at up to 24 db/octave rolloff. Gain is 60-100db.



MODEL 1541
ULTRA-LOW NOISE
SEISMIC AMPLIFIER

ITHACO LOW NOISE VOLTAGE PREAMPLIFIERS, CHARGE PREAMPLIFIERS, VELOCITY PREAMPLIFIERS AND SEISMIC PREAMPLIFIERS

MODEL NO.	DESCRIPTION	FREQUENCY RESPONSE	GAIN	NOISE[1] 1Hz BW	NOISE[1] BROADBAND	OUTPUT RATED LOAD AND OUTPUT Z[2]	MAXIMUM INPUT	DC POWER	CAN SIZE[3]
123K 123L 125K 125L	1000 meg Input Z. Unity Gain, Utility Preamplifiers	—1 db @ 0.1Hz, 200KHz	0.0 ±0.1db	—158dbv @ 10KHz	8μv rms	5v rms into 10K. 100 ohms in series with 100μf	5v rms, ±75v abs. max.	—12v to —24v 2.5 to 5ma +12v to +24v 2.5 to 5ma	1.13" dia. 2.25" long
137 138	100K Input Z 60db gain	—3db at 0.1Hz, 10KHz	60 ±0.1db	Not Specified	0.8μv rms 0.5μv rms	5v rms into 5K. 50 ohms dc coupled	5mv rms; ±1v abs. max.	+20v to +30v —20v to —30v	3"x2.05" x .55"
143E 143F 143L 143N[4] 144E 144F 144L 144N[4]	1000 meg Input Z, Premium Noise, 20 and 40db Preamplifiers	—3db @ 0.5Hz, 200KHz	20 ±0.2db 40 ±0.2db		2.5μv rms	5v rms into 5K. 50 ohms dc coupled 5v rms into 1K. 50 ohms, 40μf 5v rms into 5K. 50 ohms dc coupled 5v rms into 1K. 50 ohms, 40μf	0.5v rms, ±75v abs. max. 50mv rms, ±75v abs. max.	+12 to +25v 4 to 8ma +20 to +28v 15 to 20ma +12 to +25v 4 to 8ma +20 to +28v 15 to 20ma	1.13" dia. 1.57" long 1.13" dia. 2.25" long 1.13" dia. 1.57" long 1.13" dia. 2.25" long
146	Gain selected by connections at socket	—2db@ 0.5Hz, 100KHz	20/30/40db	—164dbv @ 10KHz		5v rms into 5K. 50 ohms dc coupled	.5v rms @ 20db, ±75v abs. max.	+12 to +25v 4 to 8 ma	1.13" dia. 2.25" long
150[3]	100 meg Input Z, high pressure package	—1db @ 5Hz, 75KHz	14 ±0.5db		2μv rms	3v rms into 50 ohms. 50 ohms dc coupled	.6v rms, ±75v abs. max.	26 ±2v, 60ma	1.5" dia. 4.5" long
155L 155N[4]	1000 meg Input Z. Remotely switched gain	—3db max @ 0.5Hz 200KHz	20 ±0.5db		2.5μv rms	5v rms into 1K. 50 ohms, 40μf	.56v rms, ±75v abs. max.	+20 to +28v 12 to 18ma	1.13" dia. 2.25" long
161	1000 meg Z in flat, miniature package	—3db @ 0.2Hz, 200KHz	10 to 40db			5v rms into 5K. 50 ohms	1.2v rms, ±75v abs. max.	+12 to +28v 7 to 10ma	2.25" x 1" x .38"
901D	1000 meg, Adjustable Gain	0.1Hz to 200KHz	0db to —10db		8μv rms	5 rms into 10K. 100 ohms	5v rms, ±75v abs max.	+12 to +28v 15 to 20ma	1.13" dia. 2.25" long
1391 1392	Low Cost Charge Converters	—1% @ 5Hz, 20KHz —1% @ 15Hz, 20KHz	1mv/pc 10mv/pc		25μv rms 200μv rms	5v rms into 1K. 50 ohms, 40μf	±5000pc[5] ±500pc[5]	+28±5v, 15ma regulated	1.13" dia. 2.25" long
1395 1396	Charge Converters 85°C flight rated	—1% @ 5Hz, 20KHz —1% @ 15Hz, 20KHz	1mv/pc 10mv/pc		25μv rms 200μv rms	±5v into 5K, 50 ohms, 16pf	±5000pc[5] ±500pc[5]	+28v, 15ma unregulated	1.13" dia. 3.00" long
1451 1452	High Z preamps w/both ACCELERATION and VELOCITY outputs for Vibration Measurements	acc (2% @ 5Hz,20KHz) vel(10% @ 5Hz,10KHz)	acc(gain x 1.0) vel(x1.00 @ 61.4Hz) acc(gain x 1.0) vel(x3.0 to 12 adj. @ 100KHz)	Not Specified	7μv rms 8μv rms ±10mv pk	±5v into 5K, both outputs. 100 ohms, 40μf	±5v peak, ±75v abs. max.	+28 ±5v 8ma	1.13" dia. 2.25" long
1474 1475 1476	Charge Converters, 85°C flight rated w/ both ACCELERATION & VELOCITY outputs for Vibration Measurement	acc(—1%5Hz, 20KHz) vel(±2%5Hz, 5KHz), acc(—1%5Hz, 20KHz) vel(—1%5Hz, 5KHz), acc(—1%5Hz, 20KHz) vel(—1%50Hz, 5KHz),	acc(1mv/pc) vel(1mv/pc @ 61.4Hz),		acc(25μv rms) vel(200μv rms) acc(25μv rms) vel(±10mv pk) acc(25μv rms) vel(±3mv pk)	±5v into 5K load @ midband acc(50 ohms, 16pf) vel(50 ohms, 160μf)	±5000pc[5]	+28v, unregulated 15ma	1.75" dia. 3.6" long
1541[7]	Very low Frequency, premium noise, diff. 5 meg .01μf Input Z.	—3db @ .001Hz, 100Hz. High/Low pass filters available	60-100db factory set	—156db in passband	.16μv rms	60v pk to pk into 100K. 200 ohms balanced, dc coupled	20mv rms, diode protection	±20vdc, 15ma each	6" x 4" x 4.6"

ITHACO RACK-MOUNTED VOLTAGE, CHARGE, STRAIN GAGE AND VIBRATION AMPLIFIERS FOR DYNAMIC DATA ACQUISITION AND SIGNAL CONDITIONING

MODEL No.	DESCRIPTION	FREQUENCY RESPONSE —3 db Points	GAIN RANGE	GAIN COARSE	GAIN FINE	NOISE[2]	OUTPUT, RATED LOAD	MAX. LIN. INPUT	POWER SUPPLY AND MOUNTING
431	1 meg input Z, Selectable LF Rolloff	LF 1, 10, 100, 1K, 10KHz HF 100KHz [3]	—10 to +90db		1.0db steps (10db vernier available)	3μv rms			INDIVIDUAL ISOLATED ±15v DC POWER SUPPLY IN EACH CHANNEL. Primary Power 95v to 130v, 50Hz to 400Hz Model 430S1—rack adapter holds up to 8 channels, 7" high
432	500 meg input Z, General Purpose	1Hz to 100KHz				4μv rms			
433	500 meg input Z, Selectable LF Rolloff	LF 1, 10, 100, 1K, 10KHz HF 100KHz [3]				3μv rms			
434	1 meg input Z, Post Amplifier	1Hz to 100KHz				10μv rms			
435[5] 436[5]	20 meg Z differential input, 100db CMR	LF 1, 10, 100, 1K, 10KHz HF 100KHz [3] 1Hz to 100KHz							
441[4] 442	Automatic gain ranging Post Amplifiers	LF 1, 10, 100, 1K, 10KHz HF 100KHz [3]	—10 to +80db		Special order only	3μv rms		5v rms sinewave	Similar to 430 Series. Uses 440S1 rack adapter
451	1 meg input Z, Selectable LF Rolloff	LF 1, 10, 100, 1K, 10KHz HF 100KHz [3]	—10 to +90db	10±0.1 db steps	1.0db steps (10db vernier available)		Output Z is 20 ohms dc coupled. Max. offset ±10mv. 5v rms sinewave output into 500 ohm load, 1v rms into 100 ohm load		COMMON ±15 VDC POWER SUPPLY FOR UP TO 7 CHANNELS, ±50 ma/channel Additional—55v for Models 455/456 Model 450S1—rack adapter holds up to 7 channels, 7" high Model 450S2—portable case holds 3 channels plus 450R power supply Models 450S1 and 450S2—takes plug-in power supplies: Model 450P1—AC type Model 450P2—AC type with preamp power Model 450R—Battery with charger Model 450P4—for Models 455/456
452	500 meg input Z, General Purpose	1Hz to 100KHz				4μv rms			
453	500 meg input Z, Selectable LF Rolloff	LF 1, 10, 100, 1K, 10KHz HF 100KHz [3]				3μv rms			
454	1 meg input Z, Post Amplifier	1Hz to 100KHz				10.0 μv rms			
455[5]	20 meg Z differential input, 100db CMR	LF 1, 10, 100, 1K, 10KHz HF 100KHz [3]							
456[5]		1Hz to 100KHz							
457[6]	Low-noise Vibration Post Amplifier for ITHACO Preamps	1Hz to 50KHz (±3% 5Hz to 20KHz)	.01 to 3000 g's or ips for 1v out		10-turn normalizing dial	.0001 pk g's .003 pk ips			
491[7]	4 meg input Z, Remote Control of Gain	LF 1, 10, 100, 1K, 10KHz HF 100KHz [3]	0 to +80db	20±0db steps in response to static BCD commands		3μv rms			Similar to 430 Series. Uses 490S1 rack adapter
241[8]	Dynamic Strain Gage Amplifier complete with Constant Current Source. Very High Gain.	0.5Hz to 60KHz (±3% 2Hz to 10KHz)	1 volt out for 10 to 30,000μ strain		2 normalizing dials set GF (1 to 4) and gage R (100 to 1000 ohm)	0.25μ strain rms w/120 ohm gage	Output Z is 100 ohms, 100μf. 5v pk output into a 10K load (full scale is 1v pk)	30,000 strain for 1v out	105 to 125v, 60-400 Hz Model 240T—6 channel rack adapter w/power, 5¼" high Model 240P A & B—one channel system
261[9] 262	Charge Amplifiers. Rack-mount and Portable Types	0.5Hz to 100KHz (±3% 2Hz to 20KHz)	5v out for 3 to 10,000 g using 1 to 10 pc/g accelerometer		10-turn dial sets accelerometer sensitivity, pc/g	10mv rms **at output** w/1000 pf at input	Output Z is 100 ohms series with 40μf (full scale output is 5v pk into 5K min.)	10,000 g w/1 to 10 pc/g accelerometer	105 to 125v, 60 to 400 Hz[9] Model 260T—6 channel rack adapter w/power, 5¼" high or Model 250R—portable case



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MELCOR OPERATIONAL AMPLIFIERS

These versatile solid state modules are used in a wide range of applications for control instrumentation, computation, test equipment, medical instruments, data logging, etc. Melcor has developed and produced in large quantities, one of the broadest and most up-to-date product lines in the industry. These are available for OFF-THE-SHELF delivery. In addition, Melcor manufactures many customized modules to industry specifications.

- **FET INPUTS**
- **ECONOMY UNITS**
- **HIGH VOLTAGE SWING**
- **CHOPPER STABILIZED**
- **HIGH SLEW – LOW DRIFT**
- **CURRENT BOOSTERS**
- **PACKAGE CONFIGURATIONS**
  standard cases with matching plug-in sockets

CASE	SIZE
A, B, C, I	1.13″x1.13″x.5″
D	.75″x.75″x.35″
E	.6″x.6″x.25″
F	2.56″x1.87″x.87″
H	.5″x.5″x.4″

	GENERAL PURPOSE				FET INPUT							HIGH POWER				MIL	
SPECIFICATIONS (Typical at 25°C Unless Noted) MODEL ▸	1573	1614	1616	1779	1810	1821	1619-1671	1672	1719 1720 1765	1764	1841 1842 1843	1527	1731	1757	1490	1732	1787
Rated Output																	
Voltage ±V Min	10	10	10	2 to 10	10	10	10	10	5 to 21	10	10	100	10	20	10	10	10
Current ±ma Min	2	5	10	2 to 4	5	5	10	20	20	5	5	10	100	200	200	2	20
Voltage Gain																	
Open Loop at Rated Load Min	10K	20K	100K	75K to 140K	40K	20K	50K	50K	100K	300K	300K	100K	50K	50K	0.85	50K	50K
Frequency Response																	
Small Signal Unity Gain MHz	1.0	4.0	1.5	0.5	8	10	10	25	10	1.5	1.5	1.0	2	2	5	5	25
Power Bandwidth KHz	10	20	20	15	300	200	200	2000	300	50	40	15	50	50	100	100	2000
Input Voltage Offset																	0,+1 MV Max
Ext Trim Pot K ohms	1000	50	50	1000	5	0.5	2	0.5	2	5		1.0	50	50	N.A.	50	0.5
Avg vs. Temp µV/°C Max	30	15	15	15	40	75	50-15	50	25-15-5	25	10-5-3	30	20	20		2	50
Input Current Offset																	
Initial Difference nA	70	50	10	25	0.015	0.1	0.03	0.03	0.03	0.03	0.03	30	150	150	N.A.	10	0.1
Avg vs. Temp nA/°C	1.0	1.5	1.0	0.5	2X/10°C	2X/10°C	2X/10°C	2X/10°C	2X/10°C	2X/10°C	2X/10°C	1.0	1.5	1.5		0.06	2X/10°C
Input Bias Current																	
Initial Bias nA Max	125	100	20	50	0.025	0.1	0.1	0.1	0.05	0.05	0.05	200	300	300	N.A.	60	0.1
Avg vs. Temp nA/°C Max	2.0	2.5	1.0	1.5	2X/10°C	2X/10°C	2X/10°C	2X/10°C	2X/10°C	2X/10°C	2X/10°C	4	3.0	3.0		0.85	2X/10°C
Input Impedance																	
Differential K ohms	200	100	200	1000	10^8	10^8	10^8	10^8	10^8	10^8	10^8	250	200	200	20K	300	10^8
Common Mode M ohms	100	100	30	100	10^5	10^5	10^5	10^5	10^5	10^5	10^5	100	10	10	N.A.	100	10^5
Input Voltage Range																	
Common Mode Voltage ±V Min	5	10	10	2 to 10	10	10	10	10	5 to 21	10	10	10	4	8	N.A.	10	10
Common Mode Rejection Ratio	2K	10K	20K	10K	3K	5K	5K	5K	100K	5K	5K	10K	10K	10K		10K	5K
Input Noise Voltage																	
10 KC Bandwidth µV ms	5	1	2	1	5	5	4	4	4	4	4	10	0.5	0.5	N.A.	4	4
Power Supply																	
Voltage ±V	15	15	15	4.5 to 15	15	15	15	15	10 to 26	15	15	125	15	25	15	15	15
Current—Full Load	+5, −15	12	15	2.5 to 5.5	12	12	15	30	25	12	12	18	115	225	240	10	30
Temperature Range °C	−25,+85	−25,+85	−25,+85	−25,+85	−25,+85	−25,+85	−25,+85	−55,+85	−55,+85	−25,+85	−0,+85	−25,+85	−25,+85	−25,+85	−25,+85	−55,+85	−55,+85
Case	D	A	A	I	E	B	A	A	C	H	B	F	A	A	A	A	A
Unit Price	$15.00	$12.00	$20.00	$35.00	$33.00	$14.25	$48.00 $85.00	$70.00	$80.00 $90.00 $98.00	$60.00	$65.00 $80.00 $95.00	$88.00	$34.00	$49.00	$25.00	$110.00	$105.00

Partial listing only—write for complete catalog.

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Partial listing only—write for complete catalog.

MODEL	OUTPUT		INPUT			GAIN		PHASE SHIFT	TEMP. RANGE	SUPPLY		SIZE	UNIT PRICE (1-9)
	Voltage RMS	Power Watts	Freq. Hz	Impedance Ω	Voltage Max. RMS	Initial 25°C	Stability plus Initial Tol. DB	Degrees	°C	Volts DC	Current MA Max.	LxWxH Inches	
1030	40	6.3	380-420	10K	26	1-2.5K	±3	0 ±10	−55 +125	28	400	1.25Dx1⅜	$85.00
1033	40	16	380-420	10K	26	1-20K	±3	0 ±10	−55 +125	28	1000	2.78x1x2	$110.00
1034	40	3.5	380-420	20K	26	1-750	±3	90 ±10	−55 +125	28	235	2 1/16x1 1/16x5/8	$60.00
1035	40	3.5	380-420	10K	26	1-5K	±3	0 ±10	−55 +125	28	235	1Dx1 3/16	$57.00
1399	40	6.0	57-63	10K	26	1-1K	±3	0 ±10	−55 +125	28	400	1.5Dx2 5/8	$98.00
1483	40	3.5	380-420	10K	26	1-3K	±3	0 ±10	−55 +100	28	235	0.83x.46x.97	$89.00

MELCOR SERVO AMPLIFIERS

To drive servo motors in closed loop position and velocity control.

- **RESOLVER DRIVE AMPLIFIERS**
- **QUADRATURE REJECTION AMPLIFIERS**
- **AUTOMATIC GAIN CONTROL AMPLIFIERS**
- **AC OPERATIONAL AMPLIFIERS**

	MODEL	GAIN	INPUT NOISE	INPUT IMPED.	RATED OUTPUT	DIST.	FREQ. RESPONSE	SUPPLY		SIZE	UNIT PRICE	
		DB	DBM Max. 20 to 20KHz	Ohms	DBM Min.	% Max. 30 to 20KHz	30 to 20KHz DB Max.	Voltage ±V	Current Full Load ±MA	LxWxH Inches		NOTES
Pre-Amp	AM-20	20 to 60	−129	1500	20	0.3	±0.5	15	20	4x2¾x¾	$ 74.00	Input Transformer
	AML-27	25 to 60	−129	1500/6000	27	0.5	±0.5	15	36	4x2¾x1⅜	100.00	Input and Output Transformer
	ATP-20	0 DBM Out Tape 6MV Phono 3MV	−125	300K/47K	20	0.5	±1.0 NAB RIAA	15	20	4x2¾x¾	77.50	NAB or RIAA Equalization
Mixer	MM-20	−6 to 20	−105	20 Inputs 6.2K	20	0.25	±.25	15	20	4x2¾x¾	81.00	
Line Amp	AL-27	20 to 50	−125	10K	27	0.5	±0.5	15	36	4x2¾x1⅜	74.00	Output Transformer
Speaker Drive	PM-37	100 MV 11 Watts Peak Output	−125	10K	11 Watts Peak 8Ω	0.5	±0.5	15	175	4x2¾x¾	107.00	Drives an 8 Ohm Speaker Program Material
	PM-40	100 MV 16 Watts Peak Output	−125	10K	16 Watts Peak 16Ω	0.5	±0.5	25	150	4x2¾x¾	125.00	Drives a 16 Ohm Speaker Program Material

Partial listing only—write for complete catalog.

MELCOR AUDIO AMPLIFIERS

A complete line of Microphone Preamplifiers, Mixers, Line Amplifiers, Equalizers, Compressors, Monitor Amplifiers, Channel Select Switching for Custom Audio Consoles. Modules feature ultra low noise and distortion, flat frequency response, output power to 16 watts on plug-in PC cards. Rack mounted power amplifiers to 100 watts output. Line Transformers, Power Supplies, Rack Mounting Frame and numerous accessory items available.

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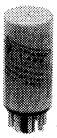
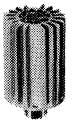


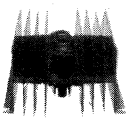
MODEL 360M
Microphone Preamplifier



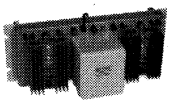
MODEL 416
D.C. Thru Audio Operational Power Amplifier



MODEL 435
Medium Voltage D.C. Operational Amplifier

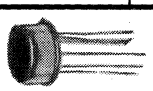


MODEL 440
D.C. Thru Audio Operational Power Amplifier



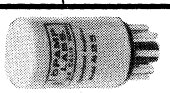
MODEL S-50K
Dual Channel 50 W RMS Power Amplifier Kit

	MODEL 360M Microphone Preamplifier	MODEL 416 D.C. Thru Audio Operational Power Amplifier	MODEL 435 Medium Voltage D.C. Operational Amplifier	MODEL 440 D.C. Thru Audio Operational Power Amplifier	MODEL S-50K Dual Channel 50 W RMS Power Amplifier Kit
POWER REQUIREMENTS	±12v to ±24v @ 30ma or +12v to +50v @ 30ma or −12v to −50v @ 30ma	±12v to ±36v ±12 ma to ±30 ma plus load current	+12v to ±25v ±8 ma to ±15 ma plus load current	±12v to ±36v ±12ma to ±30ma plus load current	115v - 60 Cy. - 1 Phase @ 2.0 Amps
OPERATING TEMPERATURE RANGE (Case)	−20°C to +85°C	−20° to +85°C	−55°C to +85°C	−55°C to +85°C	−20°C to +70°C
INPUT					Per Channel
Impedance (Open Loop)	50 to 600 Ohms	20K	20K	20K	100K
Offset Voltage		±100 mv	±20 mv	±100mv	
(R_S = 10K)		0.2 μa	0.5 μa	0.2 μa	
Bias Current					
Common Mode Voltage Range		Up to ±30v	Up to ±20v	Up to ±30v	
Equivalent Drift (R_S = 10K)		±0.5 mv/°C	±20 μv/°C	±0.5 mv/°C	
Equivalent Noise	−125 DBM	20 μv	2 μv (−115 dbm)	20 μv	20 μv
Common Mode Rejection Ratio		80 DB	80 DB	80 DB	
	Has internal input isolation transformer				
TRANSFER					
Voltage Gain		650	20,000	650	10 (20 DB)
Unity — Gain BandWidth	20 cy to 25 kc (−3 DB)	2 mc	2 mc	2 mc	May be changed via Fead Back Resistor
OUTPUT					
Impedance (open loop)	10 ohms	0.5 Ohm	50 Ohms	0.1 Ohm	0.1 Ohm
Voltage Swing/Load		Up to ±20v/8 Ohms	±20v/50 Ohms	±24v/4 Ohms	±28v/8 Ohms
Slewing Rate		5v/μsec	5v/μsec	5v/μs	
Full Power		D.C. to 25 kc	D.C. to 25 kc	D.C. to 25 kc	D.C. to 20 kc
Maximum Current		2 Amps	±400 ma	15 Amps	10 Amps
Peak Power		40w music	2 w	120 Watts	100 Watts
RMS Power		10w	+33 dbm	60 Watts	50 Watts
Level	+14 DBM with	+40 dbm			
Total Harmonic distortion at full power.	B± = ±24v	0.5%	0.05% @ +24 dbm	< 0.5% any supply voltage & power level	0.5%
SIZE	1" Dia. x 1⅝" Seated Height	2" dia. x 3" Seated height	5-Pin Modified TO-3 Case Mates with 9-Pin Noval Tube Socket	4¾" x 5½" x 2⅝" Seated Height	7" H x 19" w Panel—Chassis Plug-in Ampl. and Power Supply
PRICE	$30.00/1 to 99 $27.00/100 to 999	$30.00/1 to 99 $25.00/100 to 999	$30.00/1-99 $25.00/100-999	$60.00 Model 440 $30.00 Model 440K Kit	Kit $155.00/ea. Wired $230.00/ea.



MODEL 4009
Medium Voltage D.C. Operational Amplifier

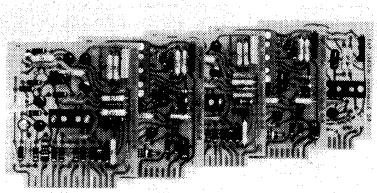
POWER REQUIREMENTS			
Power Supply Voltage	±12v	±24v	±36v
Power Supply Current	±2.5 ma	±5 ma	±8 ma
OPERATING TEMPERATURE RANGE (Case)	−55°C to +125°C	−55°C to +125°C	−55°C to +70°C
INPUT			
Input Offset Voltage	< 100 mv	< 100 mv	< 100 mv
Input Bias Current	0.2 μa	0.2 μa	0.2 μa
Input Impedance	20 K	20K	20K
Input Common Mode Voltage Range	±10v	±20v	±30v
Equivalent Input Drift	< 0.5 mv/°C	< 0.5 mv/°C	< 0.5 mv/°C
Equivalent Input Noise	10 μv	10 μv	10 μv
TRANSFER			
Internal Power Dissipation	60 mw	240 mw	600 mw
Open Loop Voltage Gain	500	650	800
Unity-Gain Bandwidth	30 mc	30 mc	30 mc
Common Mode Rejection Ratio	60 DB	80 DB	80 DB
OUTPUT			
Output Impedance	2.5K	2.5K	2.5K
Output Voltage Swing/Load	±10v/50K ± 8v/10K ± 3v/ 2K	±20v/50K ±15v/10K ± 8v/ 2K	±30v/50K ±20v/10K ±10v/ 2K
Output Capacitance Loading	0.1 μf	0.1 μf	0.1 μf
Output Slewing Rate	10v/μs	10v/μs	10v/μs
Overload Recovery	5 μs	5 μs	5 μs
SIZE	Low Silhouette Modified TO-5 Can	Low Silhouette Modified TO-5 Can	Low Silhouette Modified TO-5 Can
PRICE	$10.00/1 to 999 $8.00/1K to 10K		



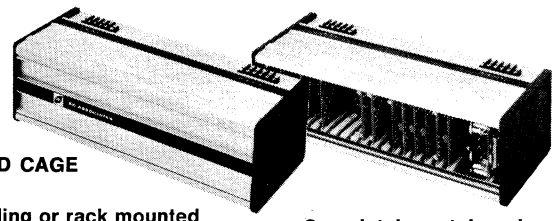
MODEL 425
Medium Voltage D.C. Operational Amplifier

POWER REQUIREMENTS		
Power Supply Voltage	±12v	±25v
Power Supply Current (Standby)	±8 ma	±15 ma
OPERATING TEMPERATURE RANGE (Case)	−20°C to +85°C	−20°C to +85°C
INPUT		
Input Offset Voltage	±20 mv	±20 mv
Input Bias Current	0.5 μa	0.5 μa
Input Impedance (Open Loop)	20K	20K
Input Common Mode Voltage Range	±10v	±20v
Equivalent Input Drift (R_S = 10K)	±20 μv/°C	±20 μv/°C
Equivalent Input Noise (R_S = 1K)	2 μv (−115 dbm)	2 μv (−115 dbm)
TRANSFER		
Internal Power Dissipation	200 mw	750 mw
Open Loop Voltage Gain	5,000	20,000
Unity-Gain Bandwidth	2 mc	2 mc
Common Mode Rejection Ratio	80 DB	80 DB
OUTPUT		
Output Impedance (Open Loop)	100 Ohms	100 Ohms
Output Voltage Swing/Load	±10v/1K ±8v/600 Ohms (+16 dbm) ±3v/50 Ohms	±20v/1K ±18v/600 Ohms (+24 dbm) ±7v/50 Ohms
Output Slewing Rate	5v/μs	5v/μs
Full Power Output	D.C. to 25 kc	D.C. to 25 kc
SIZE	1" Dia. x 1⅝" Seated Height	1" Dia. x 1⅝" Seated Height
PRICE	$25.00/1 to 99 $22.00/100 to 999	

Analog Modules for Control Systems: 900 and 800 Series



Complete line of standard cards
Instant analog systems
Off-the-shelf delivery
Compatible power supplies available



CARD CAGE

Free standing or rack mounted
Rack mounting flanges available for standard 19-inch rack
Holds power supply and 17 boards or 20 boards alone

Completely metal enclosed
Excellent flexibility for connectors, switches, meters, etc.

Size	Price
5½" x 6½" x 18"	**$75.00**

900 Series / Precision modules for system accuracies of 0.01% to 0.1%

	901	905	933	950	955
Function:	**Single-Ended Operational Amplifier**	**Differential Operational Amplifier**	**Voltage Follower**	**Voltage Comparator**	**Controlled Hysteresis**
Gain:	300,000	300,000	1 ±0.002%	∞	
Output [4]:	±10 v @ ±15 ma	±10 v @ ±15 ma	±10 v @ ±20 ma	±14 v @ 14 ma min.	The Model 955 is used in conjunction with the 950. It provides reference voltage, adj hysteresis and a 400 ma power output; 2 circuits are contained on each board.
Frequency:	2 MHz gain bandwidth	1 MHz gain bandwidth	200 KHz 3 db	2 μsec rise & fall time	
Offset: Voltage	adj. [1]	adj. [1]	adj. [1]	adj. [1]	
Offset: Current	adj. [1]	<5 na diff.	adj. [1]	—	
Drift: Voltage [2]	±10 μv/°C	<5 μV/°C	±5 μv/°C	±5 μv/°C	
Drift: Current [2]	±0.2 na/°C	±0.15 na/°C	±0.12 na/°C	—	
Input Impedance:	0.2 MΩ	0.5 MΩ diff.	4000 MΩ	>10 MΩ	
Power Supply [3] Rqmts:	±24 V @ 8 ma + Load	±24 vdc @ 3 ma + Load	±24 v @ 10 ma + Load	±24 v @ 10 ma + Load	
Price: (small quantity) [5]	**$49.50**	**$49.50**	**$62.00**	**$49.50**	**$59.00**

[1] *Adjustable with built in potentiometer.*
[2] *Each model operates from −25° to +85°C.*
[3] *Each model operates from ±15 to ±30 volt power supply with modified input and output swings.*
[4] *Input and output completely protected on all models.*
[5] *Individual prices shown. Up to 25% discount when purchased in quantity.*

800 Series / Low cost industrial models for system accuracies of 0.1 to 1%

	801	802	833	834	850
Function:	**Dual Diff Operational Amplifiers**	**Voltage to Current Converter or Voltage to Voltage Converter**	**Dual Voltage Follower**	**Dual Analog Memory**	**Dual Comparator**
Features:	High gain, frequency, compensated, 2 circuits/board	All common current outputs available. Span and zero adjusts included	FET input Unity Gain 2 circuits/board	LONG Hold Time Accuracy 2 circuits/board	Self contained references, power output, adj. hysteresis 2 circuits/board
Specs:	Gain: 50,000 Output: ±10 V, @ 5 ma Freq: 1 MC	Inputs: 0 to 10, 100, 1000, 10,000 mv Outputs: 1–5, 4–20, 10–50 ma; 0 to 10, 100, 1000, 10,000 mv	Input Impedance: 10^{12} Ω Range: ±10 V Gain: 1 ±.04%	Decay: 500 μv/sec Out: ±10 V @ 5 ma Gain: 1 ±.04%	Input imp: 0.5 Megohms Output: 7 V @ 8 ma and ±24 @ 400 ma
Price:	**$30.00/board**	**$85.00**	**$60.00/board**	**$62.50/board**	**$93.50/board**

Note: All units operate from ±24 volt power supplies. Compatible units available from RO see Sect. 4000.

ORDER FROM FACTORY OR LOCAL RO REPRESENTATIVE

Boston, Massachusetts
(617) 782-2244

Chicago, Illinois
(312) 774-1500

Dallas, Texas
(214) 363-1526

Houston, Texas
(713) 667-3420

Los Angeles, California
(213) 670-1700

New York, New York
(201) 845-6668

Philadelphia, Pennsylvania
(215) 687-3535

San Francisco, California
(415) 467-1880

Seattle, Washington
(206) 746-6770

St. Louis, Missouri
(314) 423-7200

Toronto, Canada
(416) 699-5521

Washington, D.C.
(703) 527-3262

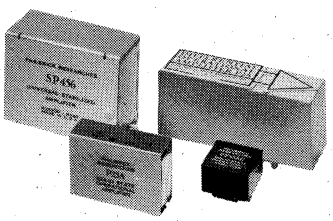
RO

RO Associates, Inc.
3705 Haven Avenue
Menlo Park, California 94025
Phone: (415) 322-5321
TWX: 910-378-5929

PHILBRICK/NEXUS: BEST SOURCE FOR YOUR

Philbrick/Nexus can fill your needs for anything analog from the industry's broadest range of analog products—ranging from simple operational amplifiers to the most sophisticated analog systems. Philbrick/Nexus' 26 years of combined experience offer you the advanced-technology of the pioneer and the vitality of a customer-oriented organization dedicated to producing the answers to any of your unsolved problems. For prompt, competent applications, engineering assistance or advice, call your local Philbrick/Nexus field-engineering representative or write, Philbrick/Nexus Research, Allied Drive at Route 128, Dedham, Massachusetts 02026.

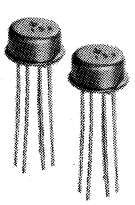
DISCRETE-COMPONENT OPERATIONAL AMPLIFIERS



High-gain, low-gain, low-drift amplifiers for stable feedback loops. Provide precise, predictable operations on one or more input signals. The solid state line includes general purpose, high performance and military grades of differential amplifiers, matching chopper stabilizers and output current boosters.

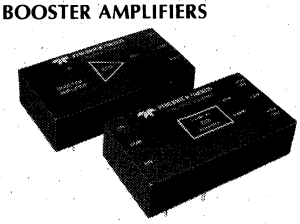
The solid state discrete component amplifiers employ all silicon semiconductors and are available in a wide variety of economy or premium grades ranging from economical general purpose types such as PF55AU and SQ10A to the most sophisticated designs such as the high speed chopper-stabilized SP456 and the parametric P2A. They come in plug-in or wire-in models in every style of package.

IC OPERATIONAL AMPLIFIERS



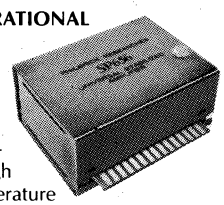
Monolithic devices offer the promise of high performance, reliability and small size at low cost. Philbrick/Nexus now offers state of the art IC op amps. Monolithics are available in two models. T-52's are packaged in TO-5 cans. S-52's come in dual in-line packages.

DC POWER SUPPLIES, REGULATORS AND BOOSTER AMPLIFIERS



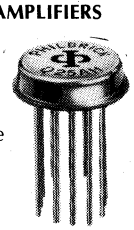
Compound-regulated, stable, noise-free power supplies designed to meet the needs of high-performance, low-level analog systems. The Philbrick/Nexus 2001 current booster with 500 Ma power is the only one of its kind in the industry. The 2101 is an encapsulated 100 Ma dual voltage regulator that is completely short-circuit protected. Rack, cabinet, modular, plug-in or built-in models available. NPS 300 is a dual voltage power supply for powering analog circuits.

LOW-ERROR OPERATIONAL AMPLIFIERS



Ideal where drift and offset must be held over long operating periods through wide ambient temperature fluctuations. Philbrick/Nexus offers 19 stock models offset-stabilized, mechanical chopper, parametrically modulated RD carrier, temperature-compensated, FET front-end. With a range so wide, there's a "low-error" model offering unusually high input impedance and low input current for virtually every design situation. The SP456 offers high-speed chopper stabilization.

HYBRID OPERATIONAL AMPLIFIERS



Philbrick/Nexus combines the best of monolithic and discrete technologies to create third generation op amps—the hybrids. They're microminiature and low cost, yet their overall performance is equal to or better than their discrete predecessors. And, built-in stabilization simplifies circuit design by eliminating external components.

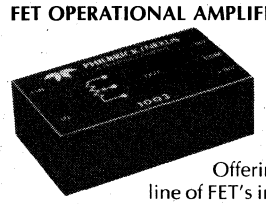
The 1402, for example, features a quiescent current drain of only 500 μA with a power supply voltage range of ±4V to ±24V, full output frequency of 80 KHz and output capability of ±14V at ±5mA with a ±15V power supply.

TO-8 packaging. Price: $75.00 each in lots of 1-9.

The Q25AH and Q85AH are Micro-Hybrids which combine linear monolithic chip and discrete microminiature component technologies to offer immunity to overloads, shorts and supply voltage stresses. They are available in TO-8 size cans.

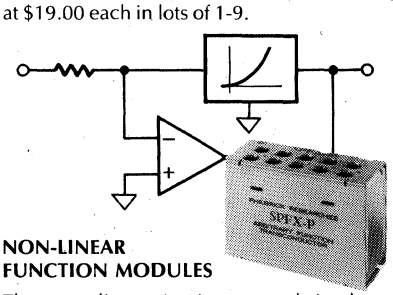
Other hybrids provide a 50μA power drain, bandwidth of 30 MHz, low cost differential FET output and FET with wideband, high reliability performance.

FET OPERATIONAL AMPLIFIERS



Offering the broadest line of FET's in the industry, Philbrick/Nexus can meet—and exceed—nearly every needed specification. Whether its lowest noise, lowest offset voltages, lowest input current, or highest CMRR . . . you'll find your needs here.

QFT-2B's, for example, offer the lowest offset voltage—5 μV/°C max. 1003's exhibit the highest CMRR you'll find anywhere—1,000,000:1. The industry's lowest priced FET operational amplifier is the QFT-5, selling at $19.00 each in lots of 1-9.

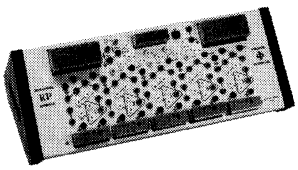


NON-LINEAR FUNCTION MODULES

These non-linear circuits accurately implement such operations as multiquadrant squaring, generating sine and cosine functions, quadratic or logarithmic response and the linearization of amplitude of non-linear transducers. They fall into two general classes: (1) natural continuous function types, based on the continuous-function characteristics inherent in certain semiconductors operated in specific parametric regions, and (2) precise-linear-approximation types, using diode-resistor networks proportioned to approximate the desired function by a series of straight lines. Scaled and biased for use in conjunction with ±10-volt operational amplifiers, they constitute a convenient and effective means for generation of exponential, transcendental, and high-order mathematical functions. All units are manufactured in two forms—"P" and "N"—one for each polarity of input signal.

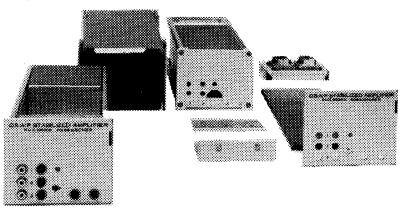
ANALOG NEEDS

MODEL RP OPERATIONAL MANIFOLDS

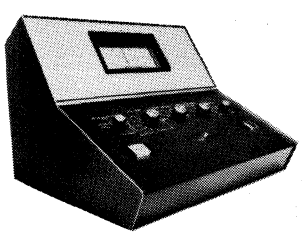


These 5-amplifier self-powered units are self-contained analog instruments for research, development, industrial control, simulation and teaching that virtually eliminate wiring problems. They are real whizzes as lab assistants. They are also excellent for breadboarding. Complex problems can be breadboarded in a fraction of the time required by conventional methods. They combine high reliability, small size, low drift and noise, light weight and low power-requirements. A variety of amplifier combinations meet specific requirements.

Q3 MODULAR SYSTEMS

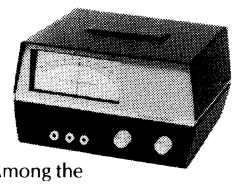


These are modular components for use in both analog and hybrid computors, simulators and analyzers. Each package consists of a carefully optimized combination of amplifiers, networks, components, and power supplies. Representative units include a self-powered, low-noise, low current-offset, differential amplifier; switch-programable, self-powered integrator-differentiator; switch-programable, self-powered unit capable of performing non-linear functions.



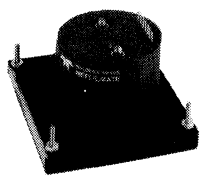
INTEGRATED CIRCUIT TESTER

Philbrick/Nexus IC Tester performs all tests automatically without calibration or manual programming. Dial setting is required to select the test and for minimum scale changing for offset and current measurements. This is the only tester available that performs both CMMR and PSRR tests. Instrument includes direct reading meter, external terminals to display IC output, oscillation indicator and integral power supply. Price: $1400.



New
METERED INSTRUMENTS

Among the many metered instruments in the Philbrick/Nexus line are the 5101 log null meter and the 5100 log ratio meter. The 5101 will permit nulling to 10 μV with a sensitive and stable null. The 5100 provides a four-decade display of voltage, current, voltage ratio and current ratio or resistance.



New
METERMATES

Series 4100 Metermates are packaged signal conditioning units that adapt standard panel meters to making certain types of non-linear measurements and/or to extend sensitivity. They convert standard meters into very high impedance instruments. They bolt to meter studs and mount flush at the rear. Metermates are available in a variety of configurations: single-ended D.C. amplifier, log scale D.C., and point-to-point logarithmic A.C.

TECHNICAL SUPPORT SERVICES

Philbrick/Nexus Research welcomes opportunities to bid on special system requirements to help you apply analog technique and products in such areas as industrial and scientific instrumentation, process and quality control systems and in-line analog data processing. Customer services of Philbrick/Nexus include: applications engineering, technical bulletins, applications manuals, the "Lightning Empiricist", and factory or on-site applications seminars.

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Cal., Pasadena, Ward-Davis Associates, (213) 684-2840
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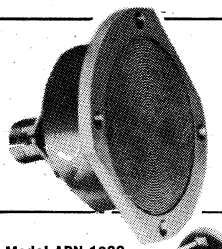
Ill., Northfield, Torkelson Associates, (312) 446-8450
Ind., Indianapolis, Torkelson Associates, (317) 244-7867
Md., Kensington, Electronic Marketing Associates, (301) 946-0300
Mass., Lexington, Yewell Electronic Sales, Inc. (617) 861-8620
Mich., Southfield, S. Sterling Company, (313) 357-3700
Minn., Minneapolis, Torkelson Associates, (612) 920-1046
Mo., St. Louis, S. Sterling Company, (314) 542-3399
N. M., Albuquerque, Hytronic Measurements, Inc. (505) 268-3941
N. Y., Elmont, Crane & Egert Corporation, (516) 488-2100
N. Y., New Hartford, KIM Associates, (315) 735-8525
N. Y., N. Syracuse, KIM Associates, (315) 458-6214
N. Y., Palmyra, KIM Associates, (315) 597-9776
N. C., Winston-Salem, W. A. Brown & Associates, (919) 725-5384/5385
Ohio, Cleveland, S. Sterling Company, (216) 442-8080
Ohio, Dayton, S. Sterling Company, (513) 298-7573
Pa., King of Prussia, Electronic Marketing Associates, (215) 265-1600
Pa., Pittsburgh, S. Sterling Company, (412) 922-5720
Texas, Dallas, Applied Science Associates, (214) 526-8316
Texas, Houston, Applied Science Associates, (713) 781-1441
Utah, Salt Lake City, Hytronic Measurements, Inc., (801) 466-4924
Wash., Bellevue, Delta Mark Company, (206) Sherwood 7-4875

PHILBRICK/NEXUS RESEARCH

A TELEDYNE COMPANY

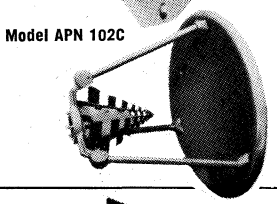
AEL® STOCK and CUSTOM ANTENNAS



Model ASN 118A

BROADBAND CAVITY-BACKED SPIRALS

These circularly polarized spirals have performance characteristics that lend themselves to broadband applications and provide compact, lightweight circularly polarized antenna configurations which can be easily flush-mounted. Applications include airborne surveillance, ECM, telemetry, direction-finding, command/control, and a variety of others. They are available in octave or 10:1 bandwidths in the frequencies between 200 MHz and 11 GHz. Several models of these antennas are available to meet MIL-E-5400 specifications.

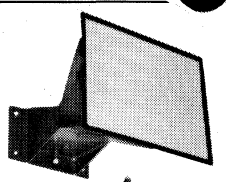


Model APN 102C

PARABOLIC REFLECTORS with BROADBAND FEEDS

High gain, broadband antennas utilizing the frequency independent feeds – gain proportional to frequency squared – available with 18", 36", and 72" parabolic reflectors.

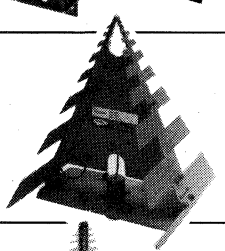
Frequency Range (GHz)	Linear Polarization Model Nos.	Circular Polarization Model Nos.
.3-3	APN 112B	ALN 123B
1-11 (6 feet)	APN 111B	ALN 122B
1-11 (3 feet)	APN 110B	ALN 121B
1-11 (18 inches)	APN 102C	ALN 111C



'OPTIMUM' LINEAR HORNS

Broadband linear horns utilizing Tchebycheff step transformers—unidirectional "tear drop" pattern—equal E and H plane half-power beamwidths. Useful for standard gain measurements.

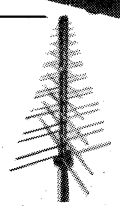
Frequency Range (GHz)	Militarized Model No.	Commercial Model No.
.25-.5	—	H4801
.5-1	—	H4901
1-2	H5000	H5001
2-4.5	H5100	H5101
4-10	H5200	H5201



PYRAMIDAL LOG PERIODIC

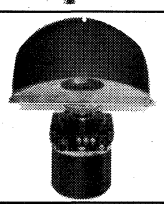
Frequency independent linearly polarized antennas providing unidirectional "tear drop" pattern—60° half-power beamwidth, E and H planes—gain 9 db.

Frequency Range (GHz)	Model No.
.05-3.0	APN 105B
.09-3.0	APN 109A
.3-3.0	APN 106A
.4-3.0	APN 106AA
.9-12.4	APN 101AB
1.0-12.4	APN 101B



SIGNAL SENTRY CROSS-PLANAR LOG PERIODIC ANTENNAS

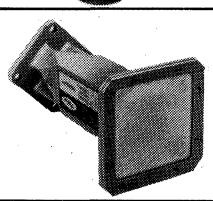
Isolation between orthogonal planes is better than 25 db across the band. Fifth boom in transmission line helps maintain constant impedance over entire band, and provides optimum isolation between the two planes. Applications include: air surveillance, ECM, and parabolic dish feeds where frequency and polarization diversity are a requirement. AEL can build a Crossed Planar to meet your requirements. Send us your specifications.



AEL CUSTOM ANTENNAS... ON TIME... WITHIN BUDGET

AEL has an enviable record of successful one-time, within-budget deliveries of highly customized antennas to meet specific user requirements. These custom requirements have encompassed several or all of the following broad parameters:

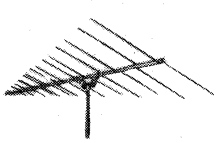
- Extreme frequency coverage (from 8 KHz to 70 GHz)
- Sophisticated packaging design specifications
- Applications in very unusual or adverse environmental conditions.



CIRCULAR HORNS

A complete line of circularly-polarized, unidirectional horn antennas for operation over range 8.2 GHz to 40 GHz in four bands. The 3 db beamwidths vary from 50° at low frequency to 40° at high frequency end.

Frequency Range (GHz)	Model No.
8.2-12.4	H6000
12.4-18	H6100
18.0-26.5	H6200
26.5-40	H6300



LOG PERIODIC COPLANAR

Extremely large frequency coverage from .02 GHz through 1.1 GHz Gain and beamwidth remain constant throughout entire frequency range. Rugged, militarized, lightweight construction. Both folding and rigid types of antennas are available. Folding types are man-portable. AEL also makes custom models to your exact needs.

Frequency Range (GHz)	Model No.	Frequency Range (GHz)	Model No.
.02-1	APN-509	.05-1.1	APN-113A
	APN-1202		APN-107C
.03-.076	APN-1235	.05-1.1	APN-107B
.03-1.1	APN-995	.1-1.1	APN-113B
	APN-534	.1-1.1	APN-107BA
	APN-107A	.25-1.1	APN-113C
		.5-1.1	

AMERICAN ELECTRONIC LABORATORIES, INC.

Main Offices: P.O. Box 552, Lansdale, Pa. 19446 (215) 822-2929 • TWX: 510-661-4976 • Cable: AMERLAB
Washington, D.C. Division: 6629 Iron Place, Springfield, Va. 22151 • (703) 354-5700

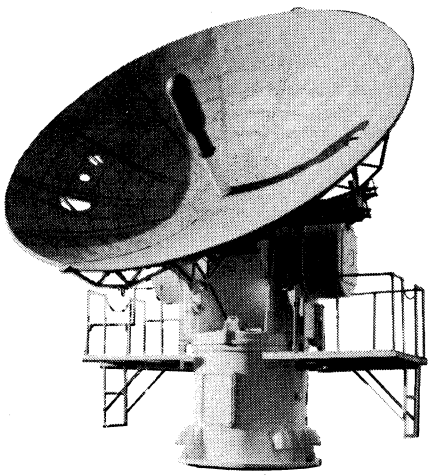
METRIC

Systems Corporation

Radar Systems — Range Instrumentation Equipment — Precision Pedestals

METRIC SYSTEM'S LONG RANGE PRECISION TRACKING RADAR

AN/FPQ-11



ANTENNA

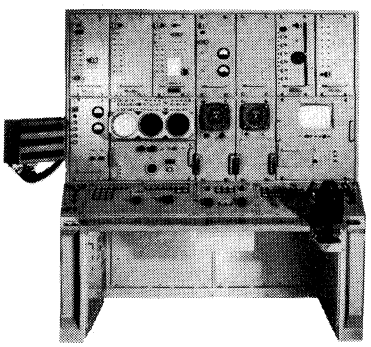
The AN/FPQ-11 Precision Tracking Radar offers features most needed in a modern Instrumentation Radar. Important features of the AN/FPQ-11 are: Dual Receivers for simultaneous reception of skin and beacon signals — Selectable 3 mc and 8 mc IF Bandwidth — Parametric Preamplifier with 3.5 db noise figure — 14 foot dish with 40 db gain — 1000 nautical mile Nth-time-around range tracker with digital readout — Digital Data Outputs in Range, Azimuth, and Elevation — Television Boresight Camera with console mounted Monitor — Handwheel and Joystick Control modes — Selectable automatic tracking in angle using either radar or infrared tracking.

This set is capable of tracking targets at rates in excess of 30 degrees per second in azimuth and 15 degrees per second in elevation with errors less than approximately 0.3 mills. The pedestal accuracy is 10 seconds of arc with levels provided to permit leveling to approximately 6 seconds of arc.

Digital outputs provide 17-bit words in azimuth and elevation and 20 bits in range.

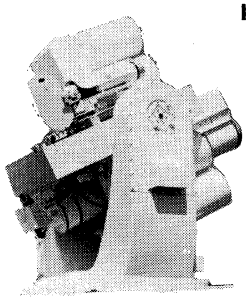
Included is a secondary data system providing analog sine/cos outputs to 0.05%, range 0.005% to 400 K yds. and 0.05% to 2000 K yds.

Synchro inputs and outputs are available to permit slaving to another radar or slaving a remotely located radar from the AN/FPQ-11.



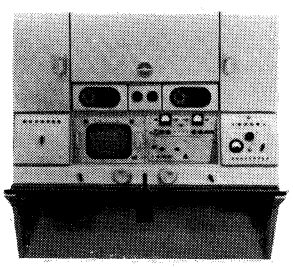
CONTROL CONSOLE

INFRARED TRACKER & SIGNATURE MEASURING SYSTEM



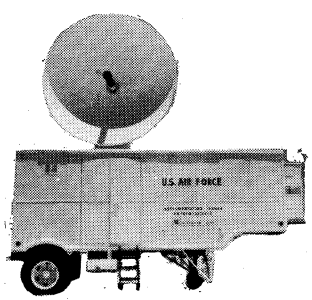
INFRARED TRACKER PEDESTAL

The Signature Measuring System produced by Metric Systems on Contract AF 08(606)-4732, automatically tracks a ballistic missile re-entry and records radiated energy over a spectrum ranging from infrared to ultraviolet. Six optical instruments are mounted on a modified Nike-Ajax Pedestal. Automatic target acquisition and track capability is provided by a dual field of view IR Tracker. A console mounted television monitor and joystick permits manual or automatic control of the pedestal as desired. The system features slaving capabilities to external tracking equipment and 17-bit serial or parallel digital data outputs on both azimuth and elevation.



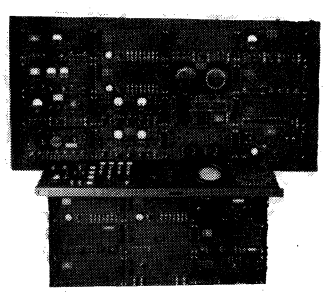
INFRARED TRACKER CONTROL CONSOLE

PRECISION TRACKING RADARS



AN/MPQ-31 RADAR VAN

The AN/MPQ-31 Precision Target Tracking Radar, designed and fabricated by Metric Systems, meets the need for a moderately priced instrumentation radar capable of providing target coordinate data in the wide variety of forms required by modern missile tracking ranges. The MPQ-31 radar provides visual readouts for operator use, multiple speed synchro outputs for slaving external equipment, analog voltage outputs for computer and plotting board operation, and digital outputs for use with digital data systems. Features of the radar are: 750 KW Peak Power, Push-button PRF Selection from 320 pps to 1707 pps, Dual receivers (Beacon and Skin), 10 foot reflector, nutating feed with variable polarization, 5 million yard range unit (nth time-around tracking range unit optional) and Binary Digital Data outputs for range, azimuth, and elevation.



AN/MPQ-31 CONTROL CONSOLE

Metric Systems has produced an assortment of missile range instrumentation equipment with particular emphasis on radars and radar modifications. Metric Systems has outstanding qualifications in the design of radar range measuring equipment, having produced high performance range units for radars such as the SCR-584, MPQ-31, MPS-9, MSQ-1A, the Nike-Ajax Radar, and others. For expert advice on the adaptability of a particular radar to your instrumentation requirement, contact Metric Systems Sales Department.

METRIC

Systems Corporation

736 N. BEAL STREET

FORT WALTON BEACH, FLORIDA

Tel: (904) 242-2111

HIGH SENSITIVITY, HIGH RELIABILITY !!

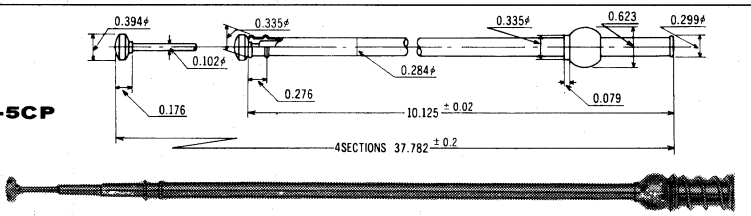


YOKOWO ANTENNA

Yokowo Mfg. Co., Ltd., Japan's leading manufacturers of Antenna field, offer you the finest products at reasonable price. All Yokowo antennas are backed by the progressive research staff and produced under rigid quality control.

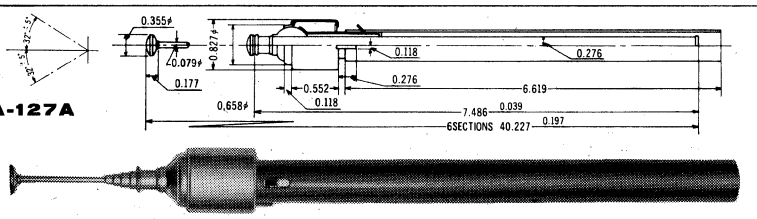
TELESCOPIC ROD ANTENNA FOR TV SET

Model BA-5CP



Any collapsed length available, provided the extended length of antenna is limited by the collapsed length, diameter of outer tubing, and number of sections.

Model SA-127A



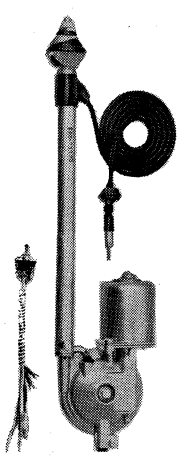
Material:
Antenna elements and tips are made of brass (65～35 alloy) if otherwise not stated.

Finish:
All the visible parts are chrome plated, if otherwise not stated.

CAR RADIO ANTENNA

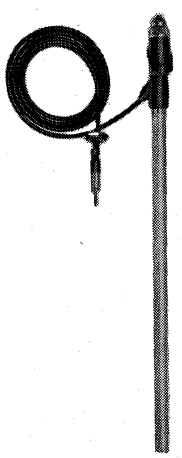
Automatic Type

Model YA-1000A

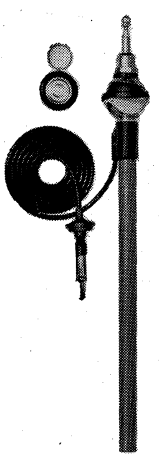


Ring-Key Type

Model VW-300



Model RA-52



YOKOWO CAR ANTENNA
Car Antennas are available in various kinds and those are designed for use on all sorts of cars, from small to large sizes. YOKOWO Car Antenna will always prove its highest efficiency even on the street surrounded by tall buildings and in the remote mountain areas where the electric wave is so weak.

● *For further information, write to:*

YOKOWO MFG. CO., LTD.

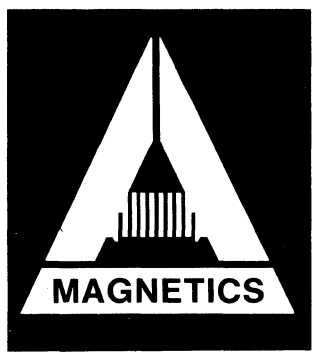
No. 5, 7-chome, Takinogawa, Kita-ku, Tokyo, Japan
Cable: "SHINEBRIGHT" Tokyo
Tel: 984-3111 (Rep.) Telex: 272-2197

When Your Problem Comes to a Head...Solve it with Arvin

Where the total capability exists to...

Custom design
Custom engineer
Custom manufacture

Magnetic heads to your specifications



Offering total services to the computer industry in the areas of...

FLYING HEADS

Hong Kong facility offers sophisticated manufacturing skills and significant savings. Arvin Magnetics—Hong Kong was established during 1968 as part of Arvin International, Inc.'s facility in Hong Kong to provide the computer industry with a low cost source of flying heads and assemblies. Employees and facilities in Hong Kong are being continually improved to provide the finest in manufacturing capability. The customer deals only with Arvin Magnetics-Columbus which had developed a sophisticated system of parts movement, importing, air shipping, and communications to assure performance to the customer's schedule. A proven approach of prototype construction in the United States followed by training in Hong Kong by engineers assures tight adherence to performance and fast production start-up.

TAPE HEADS

Double your head life by having your head manufactured as an Arvin "Hard Head." Arvin Magnetics has developed a new head construction that greatly extends head life by a special head construction that has a very low coefficient of friction. Heads constructed in this manner are called Arvin "Hard Heads." If you are a user of precision heads, Arvin Magnetics would like to quote your head manufactured as an Arvin "Hard Head."

Arvin Magnetics concentrates on multi-channel heads for the computer and instrumentation industry. Capability exists to manufacture to your design and/or specifications and to design to your system requirements. Experience with all types of core materials and head construction techniques enables Arvin Magnetics to utilize the best approach to your magnetic head needs.

FERRITE PRODUCTS

Core Material With the Big Future

Arvin Magnetics is dedicated to anticipating trends in the magnetic head area and being ready to serve our customers' future needs. A major part of this policy is the belief, based upon outside market surveys and our knowledge of the field, that ferrites will play a major role as the core material of the future in magnetic heads.

We have a multi-faceted program in the ferrite area that includes:

a. Sources of ferrite—Both internal and external sources are utilized to assure our customers of the widest range of ferrite material.

b. Machining—Trained personnel and slicers and dicers, parallel lapping machines, toroid cutters, etc., enable us to process ferrite for any application.

c. Glass-Bonding—Arvin Magnetics is licensed by North American Philips Company, Incorporated, to do glass-bonding.

Interested in seeing how Arvin Magnetics would solve your head problem? Contact Manager, Arvin Magnetics, to arrange for a presentation on the total capability of Arvin Magnetics and a discussion on how this capability can be applied to your problems.

ARVIN MAGNETICS • ELECTRONIC SYSTEMS DIVISION • ARVIN INDUSTRIES, INC.
13th Street, Columbus, Indiana 47201 • Phone: (812) 372-7271 • TWX 810-352-1275

When Your Problem Comes to a Head...Solve it with Arvin®



MAGNETICS

RESEARCH, IMAGINATION AND EXPERIENCE HAVE BEEN COMBINED IN THE DEVELOPMENT OF ARVIN'S NEWEST "LONG LIFE, LOW MAINTENANCE" DUPLICATING HEAD LINE.

Professional people, in the tape duplicating field, were invited to air their suggestions, opinions, and expectations regarding mechanical and electrical parameters desirable in this product. From these discussions and our own experience was born a line of, what we feel to be, the new standard of HIGH QUALITY, REASONABLY PRICED professional stereo tape duplicating heads.

3 inductances currently available

.240 mH 1.0 mH 1.5 mH

This provides a range coverage from .5 to above 2.0 MHz Bias frequency. (Up to 10 MHz Bias will be available this year.)

MECHANICAL FEATURES

Head tape surface is completely exposed for ease of cleaning.

Heads are relief slotted to avoid tape edge abrasion on head surface.

Lapped in, pre-established Azimuth control.

Increased tape to head contact surface for extended life and less bias re-adjustment.

Precision dowel pin head positioning.

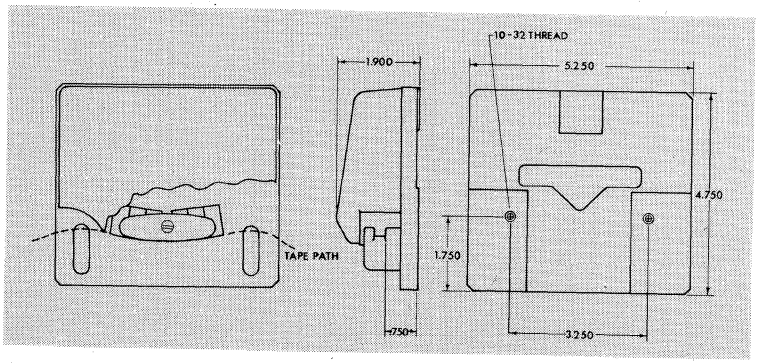
Mounting base and cable assemblies are compatible with Ampex 3000 series recording deck—however, your requirements can be met at little or no additional cost.

Tape guides of high wear resistance material—designed to prevent incorrect tape loading.

All accessories removable and replaceable from the top.

Top cap spring hinged for convenient head replacement and cleaning.

Assembly configuration consists of 2 stacks with 4 poles in each. Head positions are interchangeable and may be "flip-flopped" to desired base to track format.



TRACK LOCATIONS ARE IN COMPLIANCE WITH R.I.A.A. STANDARDS

Arvin Magnetics • Electronic Systems Division • Arvin Industries, Inc. • 13th Street, Columbus, Indiana 47201
Phone (812) 372-7271 • TWX 810-352-1275

From the people who pioneered magnetic recording

Brush magnetic heads.

designed and fabricated to your specifications

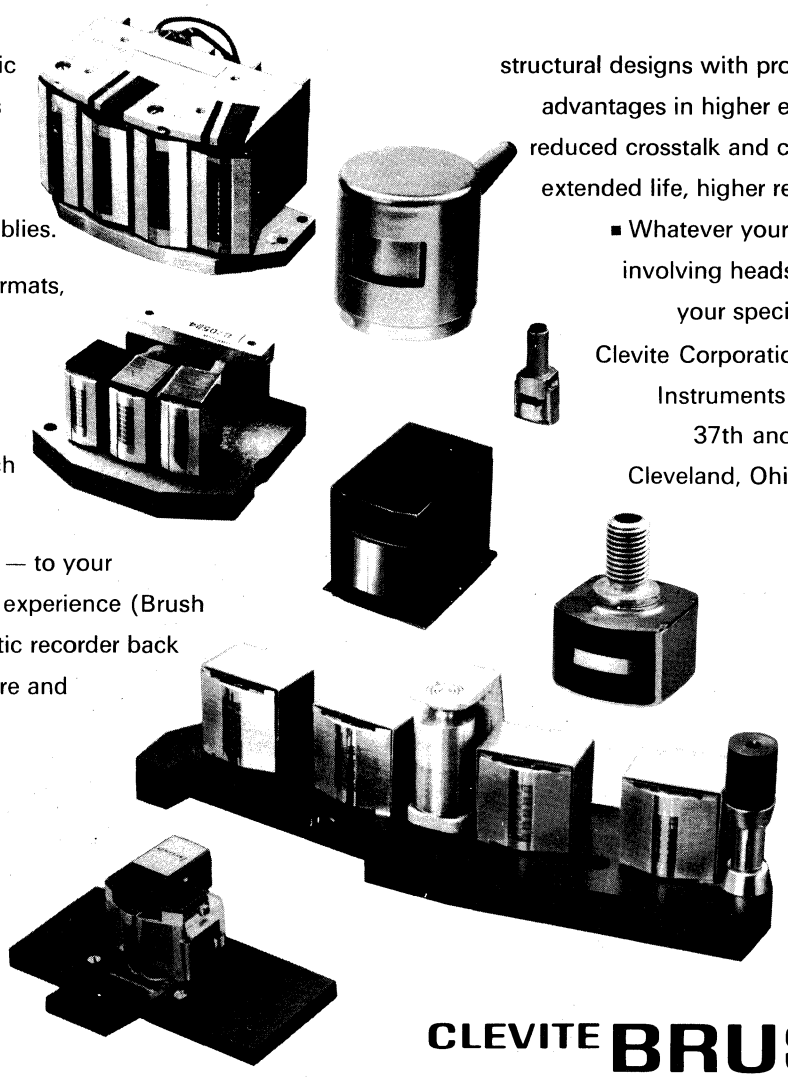
Brush designs and fabricates magnetic heads to *your* particular requirements . . . from low cost single-track audio models to highly sophisticated multi-track heads and multiple-head assemblies.

- Digital heads in IBM compatible formats, or format of your choice — with packing densities to 6000 fci.
- Wideband instrumentation heads — from IRIG formats to 42 tracks/inch — out to 2MHz.

Full range of electrical characteristics — to your specifications. ■ A quarter-century of experience (Brush developed the first successful magnetic recorder back in 1942) has produced proprietary core and structural designs with pronounced advantages in higher efficiency, reduced crosstalk and crossfeed, extended life, higher resolution.

■ Whatever your problem involving heads, give us your specifications.

Clevite Corporation, Brush Instruments Division, 37th and Perkins, Cleveland, Ohio 44114.



CLEVITE BRUSH

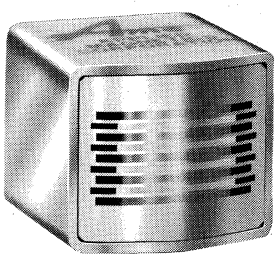
APPLIED MAGNETICS CORPORATION Amc

GOLD SERIES MAGNETIC HEADS FOR 1/4 INCH TAPE

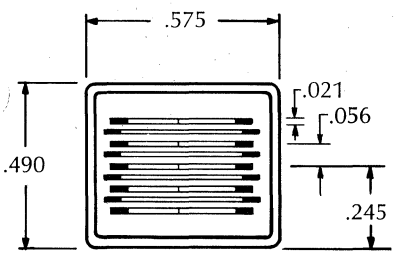
A SERIES OF PRECISION, LOW COST MAGNETIC HEADS FOR 1/4 INCH TAPE

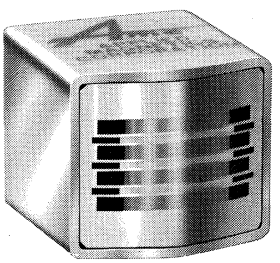
FEATURING:

- The AMC reputation for quality and service
- Increased wear life
- All metal faces
- Outstanding gap collinearity
- Extended frequency response
- Superior crosstalk rejection
- Unusually high temperature stability
- Uniform track widths

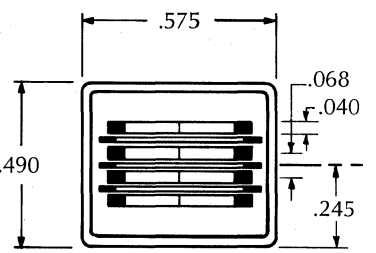


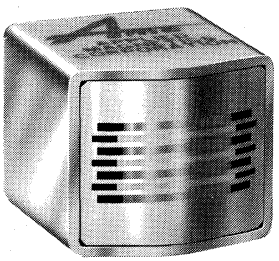
G5500 SERIES
5-Track, 5-Channel



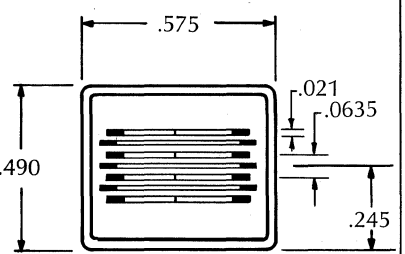


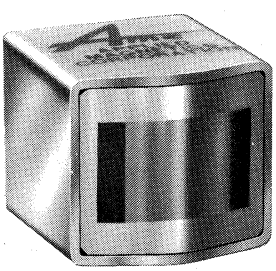
G4400 SERIES
4-Track, 4-Channel



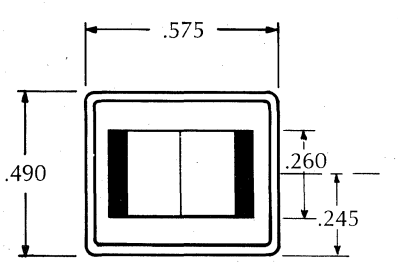


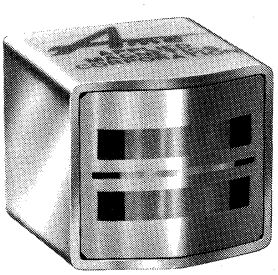
G8400 SERIES
8-Track, 4-Channel



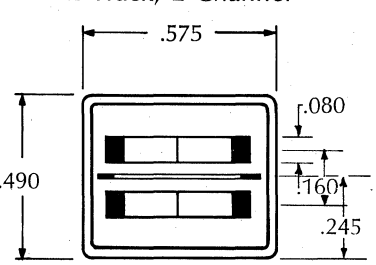


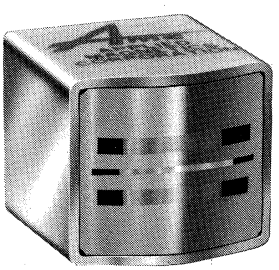
G1100 SERIES
Full Track



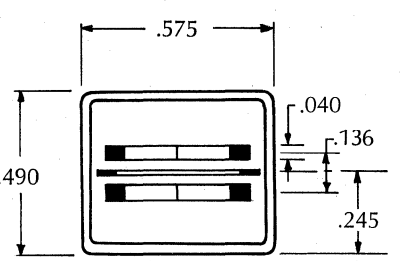


G2200 SERIES
2-Track, 2-Channel





G4200 SERIES
4-Track, 2-Channel



AMC WILL TAILOR THE GOLD SERIES TO MEET YOUR SPECIFIC ELECTRICAL REQUIREMENTS.

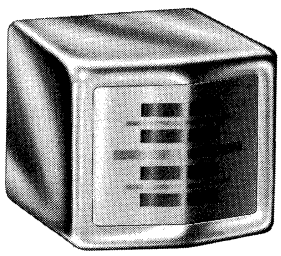
APPLIED MAGNETICS CORPORATION Amc

CASSETTE HEADS FOR COMPUTER PERIPHERALS

A LINE OF CASSETTE HEADS SPECIFICALLY DESIGNED TO SERVE THE NEEDS OF THE COMPUTER INDUSTRY.

FEATURING:

- Computer grade construction
- Track formats established to meet critical digital requirements
- Reduced gap scatter
- Designed for maximum packing density
- All metal faces
- Superior intertrack shielding
- Increased wear life

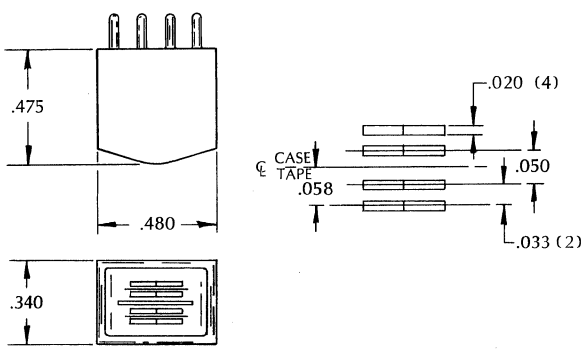


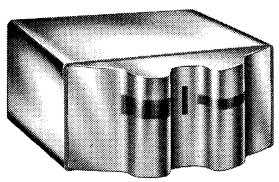
In-Line
Read, Write, or Read/Write

C4400 SERIES
4-Track, 4-Channel

Also offered in

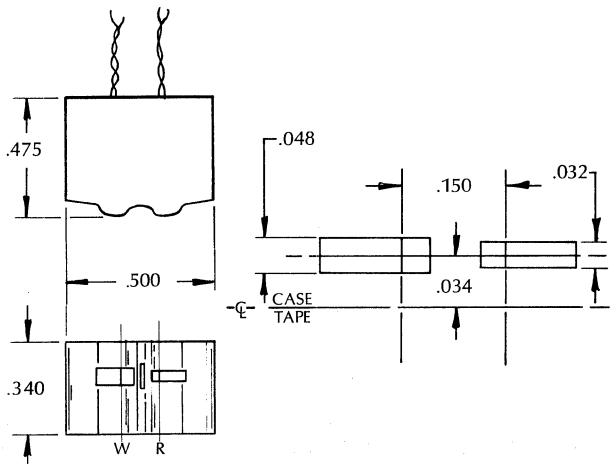
C4200 SERIES and **C2100 SERIES**
4-Track, 2-Channel 2-Track, 1-Channel





Read after Write

CRW2100 SERIES
2-Track, 1-Channel



Applied Magnetics, the leading independent producer of digital recording heads, combines computer design know-how with mass production techniques to bring you an economical magnetic head for off-line data acquisition systems. For further information contact Department 602.

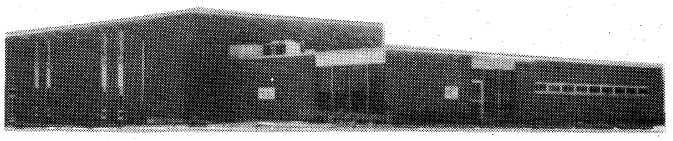
APPLIED MAGNETICS CORPORATION Amc

75 Robin Hill Road, Goleta, Calif. 93017, Telephone: (805) 964-4881, TWX: 910-334-1195

SYSTEMS COMPONENTS

PRECISION MAGNETIC

FACILITIES • CAPABILITIES QUALTY



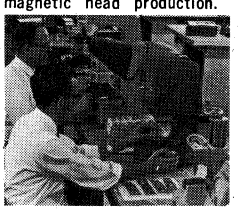
iem in its ten years of steady growth has become a major supplier not only for standard magnetic recording components but also for special types built to your specification. In 1968 facilities were quadrupled to meet the demand for our products. IEM operates under a formal Quality Assurance plan. The documented Q.A. manual has been accepted for Aerospace production. Inhouse electrical-mechanical standards are traceable to the National Bureau of Standards.



Completely equipped machine shop meets the demand for precision parts required for magnetic head production.



Proficient line personnel perform the delicate assembly operation of putting magnetic heads together.



Ultra precise mechanical checkout.



Electrical testing under laboratory conditions.

SPECIAL PRODUCTS

iem with its complete facilities for both engineering and fabrication makes *iem* an ideal partner in your special short run requirements. Below are a few items developed with both customer and company sponsored programs.



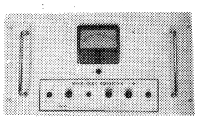
General Purpose Digital-Analog Cartridge Tape Transport



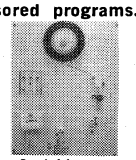
Miniature Personal Recorder Measures ⅞″ x 3⅛″ x 5″



Feed Back System for Linear Position Control



Bias Amplifier Mega Cycle Range Rated 50 Watts

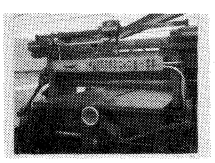


Cartridge or Cassette Tape Loader

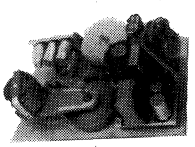
FLUX RESPONSIVE SYSTEMS

iem **The flux sensitive system represents an efficient method of sensing static magnetic information, making data output independent of tape speed.**

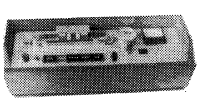
The system is flexible, simple, and economical, the accuracy being mainly a function of the drive element. All circuitry is solid state utilizing plug in board, thus reducing maintenance and trouble shooting to within the scope of the average user.



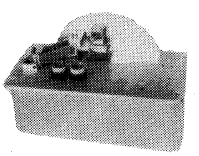
Flux Sensitive Programmable Machine Control System



Analog Ultra Low Frequency Playback System



Flux-Sensitive Linear Resolver for Machine Control and Measuring Applications



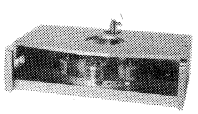
Angular Resolver

— USES —

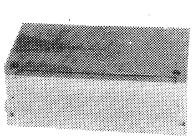
- **FEEDBACK SYSTEM FOR POSITION CONTROL**
- **LOAD ACTUATION TO INITIATE AN OPERATION**
- **METERED OUTPUT FOR QUANTITATIVE MEASUREMENT**
- **LOGIC SYSTEM FOR NUMERICAL CONTROL**
- **TRIGGER CIRCUIT FOR COUNTING**
- **LINEAR RESOLVER**
- **ANGULAR RESOLVER**
- **ANALOG ULTRA LOW FREQUENCY PLAYBACK**

RECORDING ASSEMBLIES

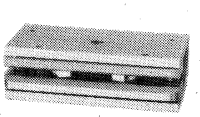
iem **professional recording assemblies represent the state of the art for precision magnetic components. They encompass most of the standard and special recording formats and electronics. They can be incorporated for upgrading most existing professional equipment. They are also available as OEM equipment for systems manufacturers. All parts are precision ground for accuracy and permanent alignment. • Guide surfaces are of tungsten carbide for maximum life and accuracy. • IEM unique MEGA-BIAS design permits head change in seconds with positive azimuth and zenith lock-in.**



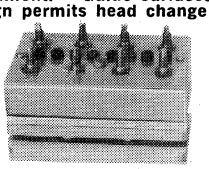
Turret Head Mount



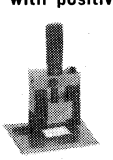
Magnetically Shielded Erase, Record and Playback Assembly



Quick Change Nonobsolescent Head Mount



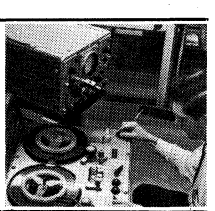
Quick Change Mount with Integrated Bias Current Control Panel



Micrometer Calibration Head

RECONDITIONING REFURBISHING SERVICES

iem **offers complete service for refurbishing, including cleaning, relapping, replacement of guides and inspection. Standard audio types — all formats. Duplicator types — slave and master assemblies. Video tape recorder audio heads. Complete conversion service for various tape formats.**



iem

INTERNATIONAL ELECTRO-MAGNETICS, INC.

ERIC DRIVE AND CORNELL AVENUE, PALATINE, ILL., 60067, AC #312-358-4622

RECORDING COMPONENTS

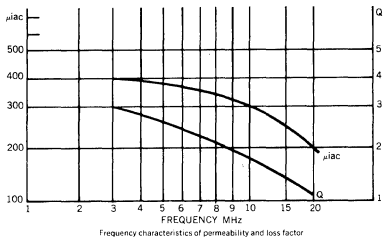
MAGNETIC HEAD TYPES

iem manufactures head structures utilizing axis oriented manganese-zinc single crystal ferrite as well as the sintered ferrite types. The advantages of the single crystal are

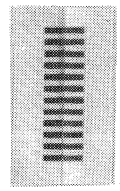
- **Linearity of gap equivalent to metallic core structure. No grain pull out.**
- **Lower core loss at high frequency.**
- **Excellent wear characteristics for long life.**

Saturation magnetic flux density B_{10}(G)	4,700
Coercive force Hc(Oe)	0.1
Curie temperature Tc(°C)	265
Electrical resistivity $\rho(\Omega \cdot cm)$	≥ 0.1
Density d(g/cm³)	5.07
Vicker's hardness Hv	700

Fundamental Characteristics



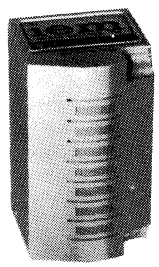
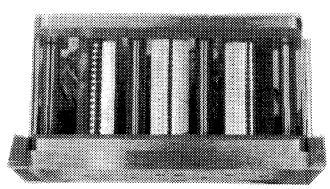
Frequency characteristics of permeability and loss factor


12 track ferrite magnetic head

FERRITE • SINGLE CRYSTAL AND POLY-CRYSTAL

ANALOG • AUDIO • MASTER • IRIG

Type Designation	Application	No. of Tracks	Track Width	Track Spacing	Inductance @ 1KC	Bias	Output		Tape Speed IPS
R4N5	Record	4	.080	.130	10 mh	3.5 ma @ 100KC	—		15
P4N5	Playback	4	.080	.130	700 mh		1KC 5.5 mv	20KC 12 mv	15
E8N1	Erase	8	.080	.130	1.5 mh	30 ma @ 100KC	—		15
R8N1	Record	8	.070	.130	15 mh	3.5 ma @ 100KC	—		15
P8N1	Playback	8	.070	.130	1.2 henry		1KC	5 mv	15
E12L1	Erase	12	.050	.085	100 uh	200 ma @ 60KC	—		15
R12M1	Record	12	.040	.085	3.5 mh	7 ma @ 120KC	—		15
P12H1	Playback	12	.040	.085	800 mh	—	1KC 3 mv	15KC 8 mv	15
R7/14L1	Record	7/7	.050	.070/.140	1.4 mh	3.8 ma @ 375KC	—		60
P7/14L1	Playback	7/7	.044	.070/.140	20 mh		1KC 0.6 mv	100KC 2 mv	30
R16L1	Record	16	.025	.0625	3.6 mh	4.2 ma @ 150KC	—		15
P16L1	Playback	16	.025	.0625	3.8 mh		1KC	0.2 mv	15
E16L1	Erase	16	.030	.0625	0.7 mh	25 ma @ 150KC	—		15
R16L2	Record	16	.070	.127	3.5/15 mh	6.0/2 ma @ 150KC	—		15
P16L2	Playback	16	.070	.127	3.8/900 mh		0.4/6.0 mv 1KC		15
E16L2	Erase	16	.080	.127	0.6/1.2 mh	75/50 ma @ 150KC	—		15
E24L2	Erase	24	.050	.084	0.6 mh	75 ma @ 150KC	—		15



16 track, 2 inch erase, record and playback assembly

VIDEO — FLUX SENSITIVE

VIDEO

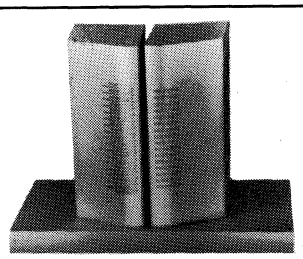
Application	No. of Tracks	Track Width	Gap Shim	Inductance at 1 KC	Saturation Current	Playback	Tape Speed IPS
Video	1	.050	100 u in.	67 uh	8 ma		120
Record	1	.025	100 u in.	100 uh	5 ma		60
Video	1	.050	36 u in.	1.9 mh		1mc .15mv	120
Playback	1	.025	20 u in.	4 5 mh		1mc .06mv	60

FLUX SENSITIVE

Application	No. of Tracks	Track Width	Track Spacing	Carrier Freq.	Carrier Current	Output Level
Flux Sensitive	1	.250	—	100 KC	80 ma	10 mv
	2	.050	.140	228 KC	40 ma	3 mv
	4	.077	.250	100 KC	80 ma	5 mv
	7	.040	.070	228 KC	40 ma	3 mv

COMPUTER • DIGITAL

Application	No. of Tracks	Track Width	Track Spacing	Inductance 1 KC	Bit Density BPI	Read Output MV p/P	Saturation Current NRTZ	Tape Speed IPS
Hi Density Read	20	.020	.049	3 mh	900	10 mv		150
Hi Density Write	20	.027	.049	150 uh	900		100 ma	150
Med. Density Read	7	.030	.070	12 mh	556	40 mv		120
Med. Density Write	7	.048	.070	150 uh	556		50 ma	120
Hi Density Read/Write	30	.012	.042	80 mh	800	4.5 mv	3.0 ma	7½
Hi Density Read/Write	4	.025	.062	50 mh	5000	4.0 mv	1.8 ma	7½
Read	9	.040	.055	12 mh	1000	40 mv		120
Write	9	.042	.055	300 uh	1000		100 ma	120



HI-SPEED DUPLICATION

Application	Tape Width	Type No.	Track Width	Track Spacing
Full Track	.250	R1H2	.260	—
2 Track Stereo	.250	R2H2	.100	.160
4 Track Stereo	.250	R2/4H2	.043	.136
8 Track Stereo	.250	R2/8H2	.022	.127
2 Track Mono	.150	R1/2H15	.059	.091
4 Track Stereo	.150	R2/4H15	.024	.035

Electrical Specifications

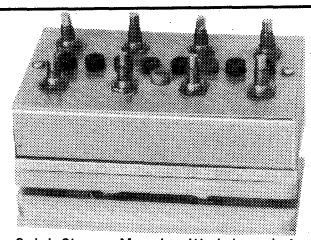
Inductance: 3 MH nominal

Bias Freq.: Standard up to 1.5 MC
Special 2 MC

Bias Current: 6-8 MA RMS

Signal Current: 0.6 MA RMS

Note: All formats can be designed to meet customer's special requirements.

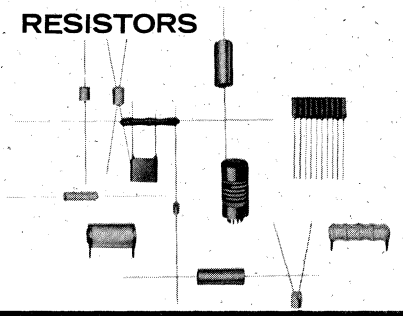

Quick Change Mount with Integrated Bias Current Control Panel

INTERNATIONAL ELECTRO-MAGNETICS, INC.
ERIC DRIVE AND CORNELL AVENUE, PALATINE, ILL., 60067, AC #312-358-4622

iem

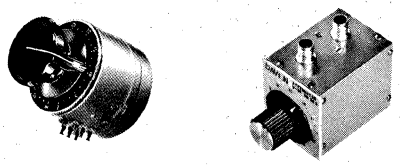
DAVEN MEANS DEPENDABLE

RESISTORS



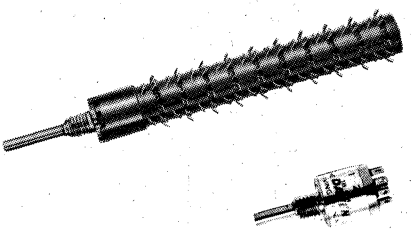
PRECISION WIRE WOUND RESISTORS & High Reliability Series — from .03 to 1.0 watts. Failure rates $\leq$0.02%/1,000 hrs. @ rated power and 125°C: Encapsulated Styles — non-inductively wound — meet or exceed MIL-R-93 and MIL-R-39005. Wide range of axial and lug terminal types: Subminiature Styles — Sizes from .1" dia. x .235"L at .03 watts for micro-circuit applications: Printed Circuit Styles — wide range of standard sizes, specials to customer order: Instrument Grade Styles — Daven DAX design provides wire wound performance at popular prices: Power Resistors — Fuse Resistors — High Frequency Resistors — Write for industry "Bible" — Catalog WW-55.

ATTENUATORS



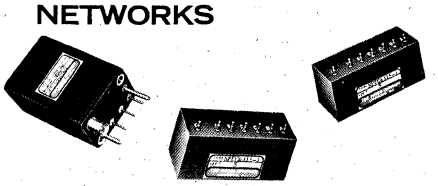
A/V and RF ATTENUATORS — Performance proven Audio/Video pots featuring noise levels below circuit noises. Balanced and Unbalanced Ladders; "T" and Balanced "H" types in Bridged, Cueing and Precision (±1%) Models. Cat No. A-15. RF ATTENUATORS, rotary single and multi dial, rotary coaxial, remote programmable and electronic models for operation from DC to 500 MHz. Cat No. RFA-768.

SWITCHES



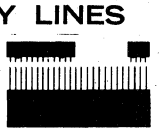
ROTARY SWITCHES — Standard Switches featuring rugged construction, multi leaf rotor blades, shaft mounted detents. Shorting and non-shorting types in 1 through 8 pole per section models. SUBMINIATURE — High carrying capacity and dielectric strength. Shorting and Non-shorting 2 through 20 positions/pole, 1 through 4 poles, single and multi deck models — Cat No. SWSM 267. HERMETIC — Rotary types with leak rates to 1×10^{8} cc/min. Thumbwheel models, pushbutton models and lever models, all with near absolute hermeticity. Cat No. HR-15.

NETWORKS



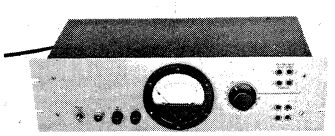
PRECISION WIRE WOUND NETWORKS — DAV-PAKS in miniaturized packages, simplify assembly, inspection and storage problems. Resistance values are available matched to ±.002%, TC matched to ±1PPM/0°C to 60°C. Wide range of circuit types and packages to function as divider, adder, current source, compensation etc, networks.

DELAY LINES



LUMPED CONSTANT DELAY LINES — Various package configurations with delay times from 1 to 100 nanoseconds. Rise times less than 1 nanosecond. Frequency response better than 1,000 mc. Impedances from 50 to 2,000 Ohms. Bulletin No. DL-95.

LAB EQUIPMENT



LAB EQUIPMENT — Transistorized Interphone Amplifiers; Volume Level Indicators; AF, AVF, and RF Attenuation Networks; Noise and Transmission Measuring Sets; Output Power Meters. Bulletin No. LE-34.

DAVEN — McGRAW EDISON

DIVISION OF THOMAS A. EDISON INDUSTRIES

DEPT. EEM 67

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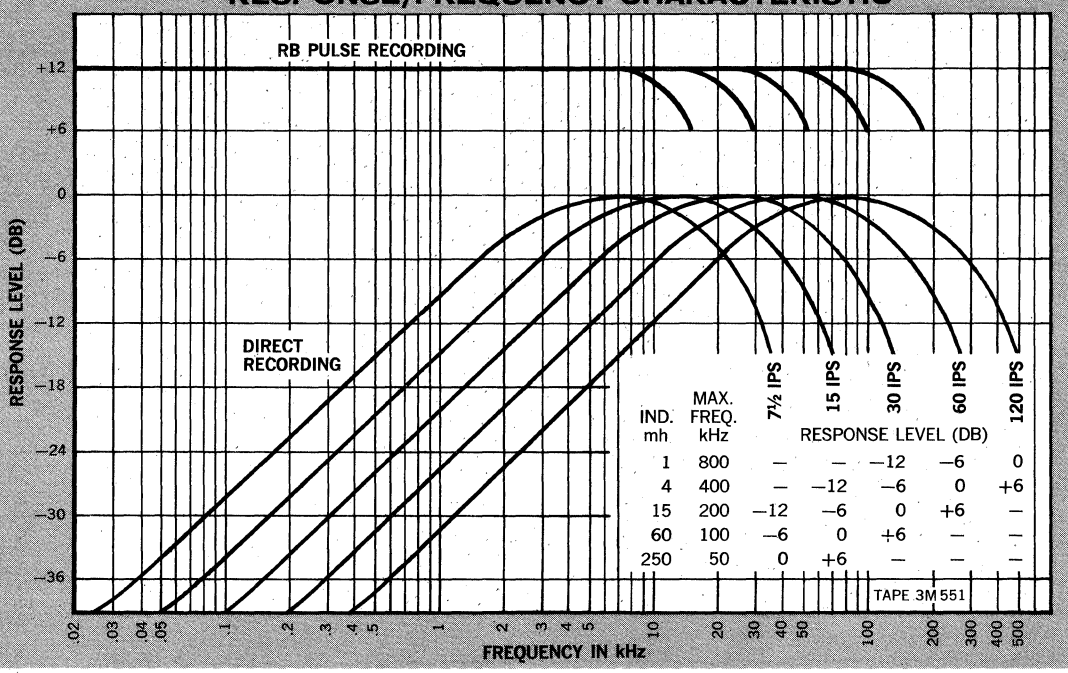
A DIVISION OF VSI CORPORATION

NORTON® MAGNETIC HEADS

MULTITRACK

SERIES 2000/7500 ERASE RECORD PLAY

RESPONSE/FREQUENCY CHARACTERISTIC



IND. mh	MAX. FREQ. kHz	7½ IPS	15 IPS	30 IPS	60 IPS	120 IPS
		RESPONSE LEVEL (DB)				
1	800	—	—	−12	−6	0
4	400	—	−12	−6	0	+6
15	200	−12	−6	0	+6	—
60	100	−6	0	+6	—	—
250	50	0	+6	—	—	—

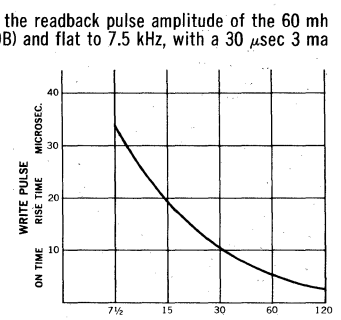
The Response/Frequency characteristics above, illustrate the exceptional performance of the Series 2000 thru 7500 Norton Magnetic Heads in direct and digital recording. The upper curves relate to the readback pulse amplitude for RB (return to bias) writing with the digital models and the lower curves relate to the unequalized playback amplitude of the analog models for constant current direct recording, both as a function of frequency (or rep rate). The five standard impedances available, together with the five tape speeds illustrated, total 25 different curves in each group, too many to clearly represent on a single chart. Pairs of inductance and tape speed are selected, which result in a set of curves peaking at the same level and having upper frequency limits proportional to tape speed. Therefore, the 1 mh inductance record/play response is at 120 ips; the 4 mh at 60 ips, and so on to the 250 mh response at 7½ ips. The other inductances are related to each as set forth in the included table. Each curve is at the same mv level as the others and so enables a quick comparison of level, frequency response, and required tape speed to achieve a desired performance goal. To read the curves, first refer to any Series found on the following pages, and note the Typical Operation data and the 0 DB playback reference level in mv rms for direct recording or +12 DB reference level in mv p-p for RB pulse recording. Then referring to the curves, calculate the response obtainable at the inductance and tape speed contemplated.

DIGITAL RECORDING

Selecting the 5500 Series from the following pages for analysis, the 60 mh track for RB pulse recording has a +12 DB reference level of 10 mv p-p at 15 ips. The readback pulse at 15 ips is 10 mv p-p and constant up to a 15 kHz rep rate, equivalent to a 1000 ppi recording density, with a 20 μsec, 3 ma p-p write pulse (rise time 20 μsec). At a faster rep rate of 30 kHz (2000 ppi) at 15 ips and a 10 μsec, 3 ma p-p pulse (rise time 10 μsec) the readback pulse is 5 mv p-p (10 mv less 6 DB) with all pulses present, and 10 mv p-p for an isolated pulse.

Writing and reading at 7½ ips the readback pulse amplitude of the 60 mh track is 5 mv p-p (10 mv less 6 DB) and flat to 7.5 kHz, with a 30 μsec 3 ma p-p pulse (rise time 30 μsec).

Full output is obtained up to a recording density of 1000 ppi with equal pulse on time and rise time at the values shown in the graph below. Operation up to 2000 ppi at reduced read amplitude requires halving these times. Increasing the times will reduce the recording density and readback level, and is not recommended. A better solution is to choose a lower inductance to preserve the recording density capability.

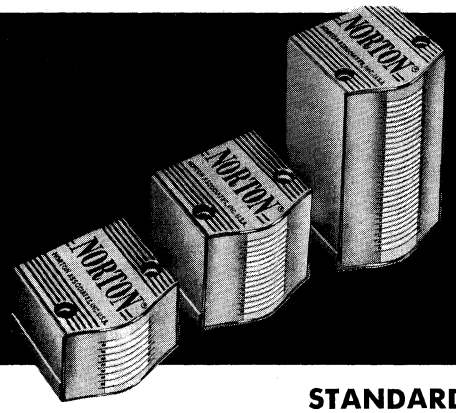


DIRECT RECORDING

Selecting the 2000 Series from the following pages for analysis, the 15 mh track for direct (bias) recording has a stated playback 0 DB reference level of 1.8 mv rms which at 30 ips is at 30 kHz. At 1 kHz the playback level drops to 0.15 mv rms (21 db below 1.8 mv). Operated at 7½ ips its 1 kHz and 30 kHz levels are both 0.15 mv rms (1.8 mv less 12 db less 9 DB). Increasing the inductance to 250 mh would increase the 1 and 30 kHz play level to 0.6 mv rms (1.8 mv less 9 DB) at 7½ ips. It can be seen that the short wavelength response to over 4000 cpi together with a maximum contour effect deviation of ±2 DB from the 6 DB/octave slope permits a useful bandwidth of over 10 octaves at any tape speed, and with the range of inductances available, permits the highest play level consistent with the frequency range of the system.

NORTON® SERIES SELECTOR

NUMBER OF TRACKS	TAPE WIDTH		
	¼ INCH	½ INCH	1 INCH
2	2000		
3	3500		
4	4500 5000	2000	
5	5500	3500	
6	6500		
7	7500	4500	
8		5000	2000
9		5200	
10		5500	3500
12		6500	
14		7500	4500
16			5000
18			5200
20			5500
24			6500
28			7500

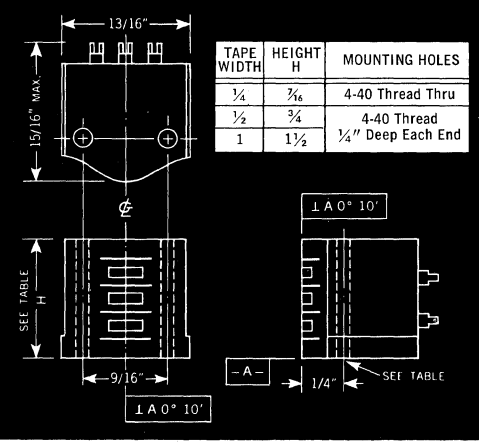


NORTON®
MAGNETIC HEADS
MULTITRACK
ERASE RECORD PLAY

STANDARD FEATURES SERIES 2000/7500

Standard features include extremely low crosstalk ratings and +75°C temperature operation without derating, plus a mechanical accuracy permitting hard mount or adjustable mount installation. Rugged solid metal construction, shock and vibration resistant, provides a hard, stable, low friction, long wear surface for the tape. The cores, shields and all metallic members are mechanically and electrically bonded together for effective electrostatic shielding and grounding of static charges. Precision finishing of the recording face to micro-inch tolerance insures intimate contact of the tape with every channel for uniformly excellent response independent of track location.

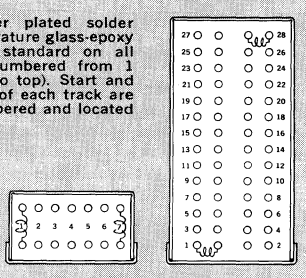
OUTLINE & MOUNTING DIMENSIONS



TAPE WIDTH	HEIGHT H	MOUNTING HOLES
¼	7/16	4-40 Thread Thru
½	¾	4-40 Thread
1	1½	¼" Deep Each End

TERMINAL BOARD CONNECTION DIAGRAM

TERMINATION: Silver plated solder lugs on a high temperature glass-epoxy terminal board are standard on all series. Tracks are numbered from 1 through 28 (bottom to top). Start and finish terminal pairs of each track are correspondingly numbered and located as illustrated.



SELECTIVE ERASE HEADS

Multitrack selective erase heads to match the formats of the NORTON Series 2000/7500 units are available. All heads offer erase track widths at least 10 mils wider than the record tracks to insure full erasure. Outline and mounting dimensions are the same, and a standard 1 mh inductance is stock with other impedances available on request.

Erase heads for the Series 2000 and 3500 heads are a single unit with the same number of tracks and track spacing as the record head. Erase heads for the Series 4500 thru 7500 units consists of a pair of heads, each with double track spacing. Odd number tracks are on one unit, and even number tracks on the other.

Catalog numbers for the erase heads have the same Series number as the record head except for the suffix which changes to 1E as in the following example: Catalog #3510-1E is a 1mh erase head for use with the 10 track 1" tape head in the Series 3500.

ORDERING INFORMATION

To specify the complete catalog number for ordering purposes designate the Series number of the head you require, the inductance in mh and the function ie. Record (AR) only, Record/Play (ARP), or Play (AP) only for audio and analog applications: or Record (DR) only, Record/Play (DRP), or Play (DP) only for digital applications, as in the following example: Catalog #4507—15 DP which is the Series 4500, 7 tracks, 15mh Digital Play Head for ½" tape.

NORTON ASSOCIATES, INC.
10 Di Tomas Court, Copiague, New York • (516) 598-1600

SERIES 2000

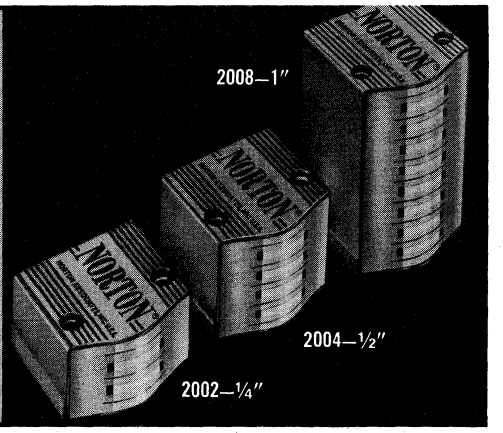
CROSSTALK — 60 DB

TRACK WIDTH — 2002 — .080
2004, 2008 — .070

TRACK SPACING — 2002 — .160 ctoc
2004, 2008 — .130 ctoc

INDUCTANCE mh	MAXIMUM RATING AT 75°C ma rms	TYPICAL OPERATION				
		BIAS RECORDING			RB PULSE RECORDING	
		Bias Current ma rms	Record Current ma rms	Playback 0 DB mv rms	Write Pulse ma p-p	Read Pulse +12DB mv p-p
1	60	10	1.5	1.8	40	18
4	40	5	.8		20	
15	20	2.5	.4		10	
60	10	1.3	.2		5	
250	5	.7	.1		2.5	

NUMBER OF TRACKS	TAPE WIDTH	CATALOG NUMBER			
		SERIES	INDUCTANCE	ANALOG OR DIGITAL	FUNCTION
2	¼"	2002	1, 4, 15, 60 or 250	A or D	R, R/P or P
4	½"	2004			
8	1"	2008			



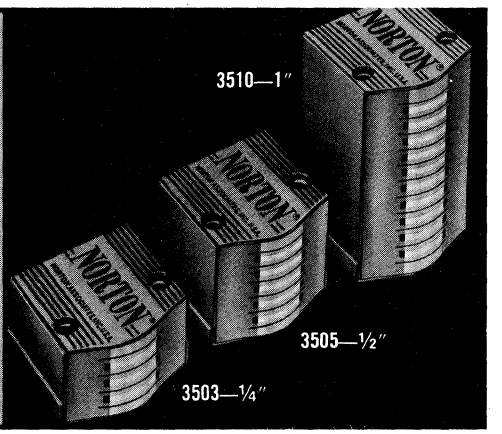
SERIES 3500

CROSSTALK — 60 DB

TRACK WIDTH — .040 TRACK SPACING — .100 ctoc

INDUCTANCE mh	MAXIMUM RATING AT 75°C ma rms	TYPICAL OPERATION				
		BIAS RECORDING			RB PULSE RECORDING	
		Bias Current ma rms	Record Current ma rms	Playback 0 DB mv rms	Write Pulse ma p-p	Read Pulse +12DB mv p-p
1	50	8	1	1.2	32	12
4	40	4	.5		16	
15	20	2	.25		8	
60	10	1	.12		4	
250	5	.5	.06		2	

NUMBER OF TRACKS	TAPE WIDTH	CATALOG NUMBER			
		SERIES	INDUCTANCE	ANALOG OR DIGITAL	FUNCTION
3	¼"	3503	1, 4, 15, 60 or 250	A or D	R, R/P or P
5	½"	3505			
10	1"	3510			



NORTON® MAGNETIC HEADS

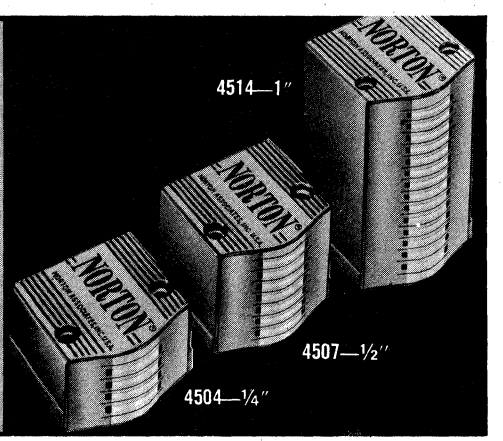
SERIES 4500

CROSSTALK — 50 DB

TRACK WIDTH — .032 TRACK SPACING — .070 ctoc

INDUCTANCE mh	MAXIMUM RATING AT 75°C ma rms	TYPICAL OPERATION				
		BIAS RECORDING			RB PULSE RECORDING	
		Bias Current ma rms	Record Current ma rms	Playback 0 DB mv rms	Write Pulse ma p-p	Read Pulse +12DB mv p-p
1	40	6	.8	1.0	24	10
4	20	3	.4		12	
15	10	1.5	.2		6	
60	5	.8	.1		3	
250	5	.4	.05		1.5	

NUMBER OF TRACKS	TAPE WIDTH	CATALOG NUMBER			
		SERIES	INDUCTANCE	ANALOG OR DIGITAL	FUNCTION
4	¼"	4504	1, 4, 15, 60 or 250	A or D	R, R/P or P
7	½"	4507			
14	1"	4514			



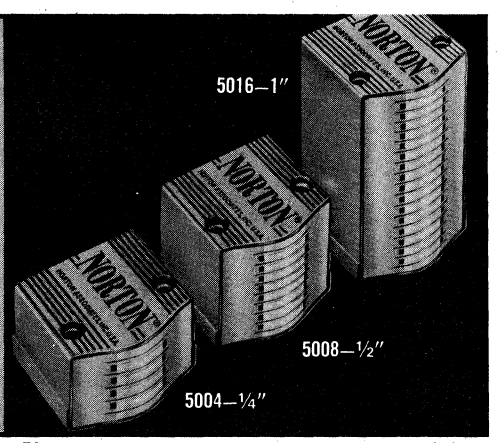
SERIES 5000

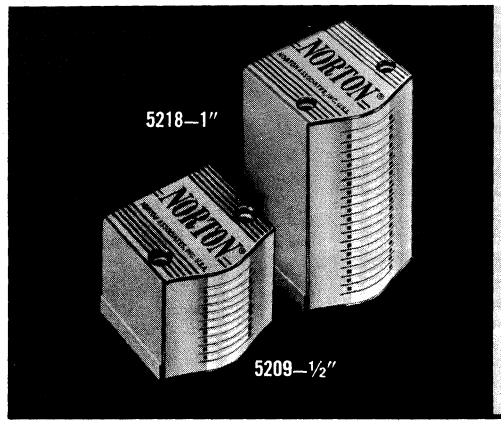
CROSSTALK—50 DB

TRACK WIDTH — .024 TRACK SPACING — 5004 — .0635 ctoc
5008, 5016 — .064 ctoc

INDUCTANCE mh	MAXIMUM RATING AT 75°C ma rms	TYPICAL OPERATION				
		BIAS RECORDING			RB PULSE RECORDING	
		Bias Current ma rms	Record Current ma rms	Playback 0 DB mv rms	Write Pulse ma p-p	Read Pulse +12DB mv p-p
1	40	6	.8	1.0	24	10
4	20	3	.4		12	
15	10	1.5	.2		6	
60	5	.8	.1		3	
250	5	.4	.05		1.5	

NUMBER OF TRACKS	TAPE WIDTH	CATALOG NUMBER			
		SERIES	INDUCTANCE	ANALOG OR DIGITAL	FUNCTION
4	¼"	5004	1, 4, 15, 60 or 250	A or D	R, R/P or P
8	½"	5008			
16	1"	5016			





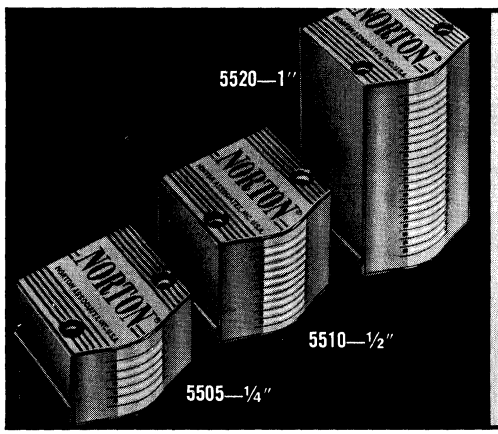
SERIES 5200

CROSSTALK—40 DB

TRACK WIDTH—.024 TRACK SPACING—.055 ctoc

INDUCTANCE mh	MAXIMUM RATING AT 75°C ma rms	TYPICAL OPERATION				
		BIAS RECORDING			RB PULSE RECORDING	
		Bias Current ma rms	Record Current ma rms	Playback 0 DB mv rms	Write Pulse ma p-p	Read Pulse +12DB mv p-p
1	40	6	.8	1.0	24	10
4	20	3	.4		12	
15	10	1.5	.2		6	
60	5	.8	.1		3	
250	5	.4	.05		1.5	

NUMBER OF TRACKS	TAPE WIDTH	CATALOG NUMBER			
		SERIES	INDUCTANCE	ANALOG OR DIGITAL	FUNCTION
9	½″	5209	1, 4, 15, 60 or 250	A or D	R, R/P or P
18	1″	5218			



SERIES 5500

CROSSTALK—40 DB

TRACK WIDTH—.024 TRACK SPACING—.050 ctoc

INDUCTANCE mh	MAXIMUM RATING AT 75°C ma rms	TYPICAL OPERATION				
		BIAS RECORDING			RB PULSE RECORDING	
		Bias Current ma rms	Record Current ma rms	Playback 0 DB mv rms	Write Pulse ma p-p	Read Pulse +12DB mv p-p
1	40	6	.8	1.0	24	10
4	20	3	.4		12	
15	10	1.5	.2		6	
60	5	.8	.1		3	
250	5	.4	.05		1.5	

NUMBER OF TRACKS	TAPE WIDTH	CATALOG NUMBER			
		SERIES	INDUCTANCE	ANALOG OR DIGITAL	FUNCTION
5	¼″	5505	1, 4, 15, 60 or 250	A or D	R, R/P or P
10	½″	5510			
20	1″	5520			

MULTITRACK
ERASE RECORD PLAY

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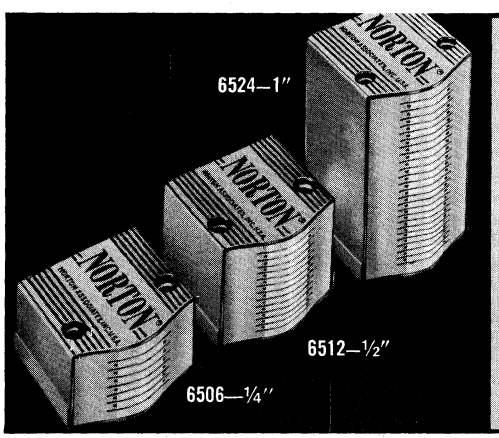


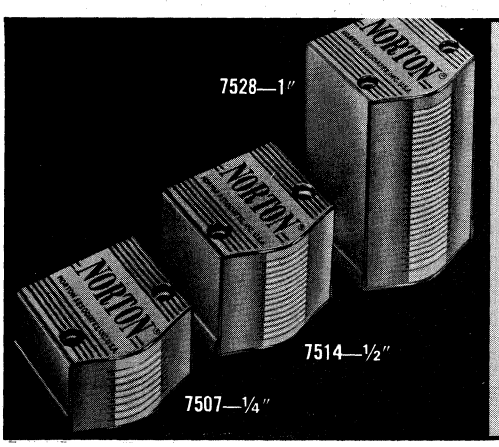
SERIES 6500

CROSSTALK—40 DB

TRACK WIDTH—.018 TRACK SPACING—6506—.045 ctoc
6512, 6524—.042 ctoc

INDUCTANCE mh	MAXIMUM RATING AT 75°C ma rms	TYPICAL OPERATION				
		BIAS RECORDING			RB PULSE RECORDING	
		Bias Current ma rms	Record Current ma rms	Playback 0 DB mv rms	Write Pulse ma p-p	Read Pulse +12DB mv p-p
1	40	5	.6	0.9	20	9
4	30	2.5	.3		10	
15	10	1.3	.15		5	
60	5	.7	.08		2.5	
250	5	.4	.04		1.3	

NUMBER OF TRACKS	TAPE WIDTH	CATALOG NUMBER			
		SERIES	INDUCTANCE	ANALOG OR DIGITAL	FUNCTION
6	¼″	6506	1, 4, 15, 60 or 250	A or D	R, R/P or P
12	½″	6512			
24	1″	6524			



SERIES 7500

CROSSTALK—40 DB

TRACK WIDTH—.012 TRACK SPACING—7507 —.038 ctoc
7514, 7528 —.036 ctoc

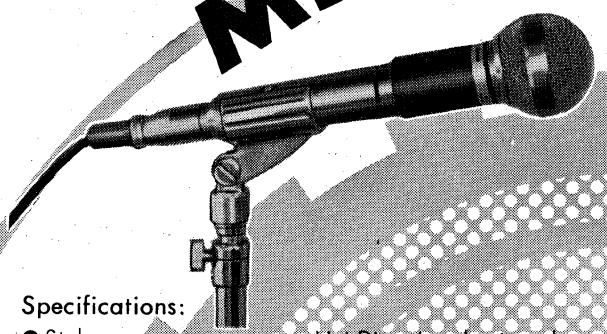
INDUCTANCE mh	MAXIMUM RATING AT 75°C ma rms	TYPICAL OPERATION				
		BIAS RECORDING			RB PULSE RECORDING	
		Bias Current ma rms	Record Current ma rms	Playback 0 DB mv rms	Write Pulse ma p-p	Read Pulse +12DB mv p-p
1	30	4	.6	0.7	16	7
4	15	2	.3		8	
15	10	1	.15		4	
60	5	.5	.08		2	
250	5	.3	.04		1	

NUMBER OF TRACKS	TAPE WIDTH	CATALOG NUMBER			
		SERIES	INDUCTANCE	ANALOG OR DIGITAL	FUNCTION
7	¼″	7507	1, 4, 15, 60 or 250	A or D	R, R/P or P
14	½″	7514			
28	1″	7528			

Prime

—A Leader in Microphone Field—

MICROPHONES



UD-900

UNI-DIRECTIONAL MICROPHONE

Superlative "Beautiful" The final microphone. Try and see yourself if the followings are true to its wording.

Specifications:

- Style ..... Uni-Directional microphone
- Impedance ..... 600 ohm
- Frequency Response ..... 50~15,000Hz ±5dB
- Sensitivity ..... −73dB ±2dB
- Cable ..... 6m shielded with Cannon type 3-P plug.
- Measurement ..... 260mm long, 50mm dia.
- Weight ..... 490g.

Features:

- The unique acoustic circuit for this particular model achieved the unrivalled super-directional character.
- Free from all ambient reflections, with sturdy construction.
- Highest Sensitivity allowed for unidirectional microphone theory and practice.

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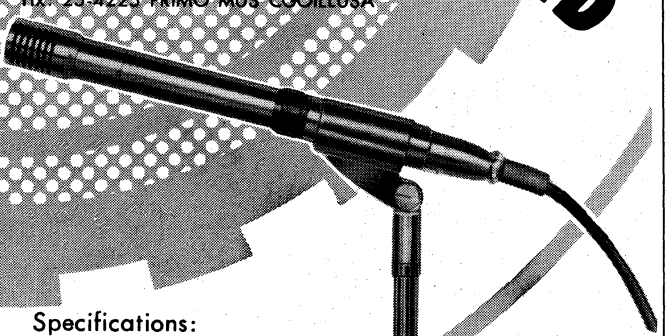


CMU-500

CONDENSER MICROPHONE

Uni-Directional, Self-contained Supply. FET application.

Features:

- Solid-state construction enhanced the reliability against the vibration.
- Lesser S/N ratio approved wider dynamic range.
- A single type switch at the middle of the body serves for on-off and tone-control transferring.
- Beautiful super-slim type fits to stage extraordinary.

Specifications:

- Style ..... Uni-Directional microphone
- Frequency Response ..... 30~15,000Hz ±4dB
- Impedance ..... 600 ohm
- Cable ..... 6m shielded with Cannon type 3-P plug.
- Power Supply ..... Eveready 504" 300 hours.
- Measurement ..... 295mm long, 25mm dia.
- Weight ..... 310g.

"THE FUTURE OF MAGNETIC RECORDING...AND MAGNETIC HEADS...DEPENDS NOT SO MUCH ON WHAT WE CAN DO, AS ON WHAT WE CAN THINK OF DOING."

COMPLETE RANGE OF MECHANICAL CONFIGURATIONS AND ELECTRICAL SPECIFICATIONS

The following pages indicate the enormous variety of head styles and types catalogued by and available from Nortronics. This is the industry's most complete and comprehensive grouping of types, functions, sizes, etc. Our catalogued line includes two, four, eight and full track units; multi-channel, stereo, mono; inductances of 10, 50, 100, 200, 400, and 800 mhy; Standard, Premium, and Professional performance criteria; base mount, side mount, rear mount, and no mount; Erase, Record, Record/Playback, and R/P/E.

VALUE ANALYSIS AND HEADS FOR SPECIAL REQUIREMENTS

Our Marketing Engineering department will assist you in determining the head best suited to your application. It is easy to over-specify, particularly on tape heads for many instrumentation applications. We can frequently demonstrate how a slight modification in the circuitry will permit enormous reductions in the cost of the tape heads.
If your requirements cannot be met by our catalogued line, our engineers will evaluate your problems and will develop special designs to satisfy your needs.

NORTRONICS

THE WORLD'S LARGEST MANUFACTURER OF MAGNETIC TAPE HEADS

MASTER FILE

OF CATALOGUED

TAPE HEADS

THE PRODUCT IS THE END RESULT OF THESE NORTRONICS ACCOMPLISHMENTS

Unequalled Research and Manufacturing Facilities

The new 40,000 square foot Nortronics building was designed to provide control of dust, noise, humidity and temperature. Equipment, from the research laboratory's binocular Unitron metallurgical microscope with Xenon light source, to the production line's 10-7 Torr vacuum quartz gap depositors, is the best available, much of it designed and built at Nortronics, to accommodate new departures in product design requiring equally dramatic departures in manufacturing technique.

QUALITY CONTROL

Between incoming inspection and use tests just before packaging, each head undergoes an average of 30 inspections, and is subjected to an average of seven different microscopic, visual, and electrical tests. Mechanically, the two half sections of a Nortronics head must be precision lapped to flatness tolerances of one-quarter wave length of monochromatic helium light. Electrically, completed heads are checked for inductance, impedance. DC resistance, long and short wave length response, record and biasing parameters, interchannel and adajacent channel cross talk, shorts, opens and proper grounding.

INNOVATIVE LEADERSHIP SINCE 1957

Many Nortronics innovations have become standards of the industry: the "B" case, hyperbolic tape head face to eliminate pressure pads; laminated cores, and quartz-deposited gaps for popular priced tape heads; all-metal-face heads; 8-track stereo tape heads for automobiles; "no-mount" snap-in heads; quick-kit mounting adapters; terminal plugs with standard pin spacing and centering; and "Z combo" stereo record-play-erase heads in a single case.

Nortronics COMPANY, INC.

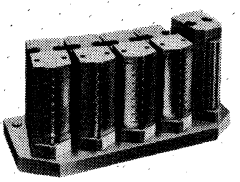
MASTER FILE OF CATALOGUED TAPE HEADS

PRODUCT LOCATOR

INSTRUMENTATION & COMPUTER HEADS

Mini-digital heads described on Page 3 of this MASTER FILE.

Consult Nortronics Marketing Engineering Department for technical information and product literature on other instrumentation and complete heads.

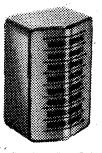


- Custom built to your specifications
- Digital and analog designs, IRIG and IBM formats
- Read, write, and erase heads
- Available with adjustable mount, fixed precision ground base, and as complete assemblies

Head assembly pictured illustrates two seven channel read heads and two seven channel write heads which interlace to provide fourteen channels on one inch tape. Full track ferrite core erase head completes the head configuration precision aligned on machined base plate.

STUDIO SERIES HEADS

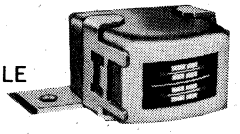
Fully described on Page 4 of this MASTER FILE



- Uncompromised excellence for use with two-inch, one-inch or half-inch tape
- For professional audio and mastering recorders
- Standard SMPTE formats

CASSETTE HEADS

Fully described on Page 5 of this MASTER FILE



- Units for mono, stereo, and language lab track configurations
- Unique bi-directional design permits record-play-erase in both directions without flipover

MINIATURE HEADS

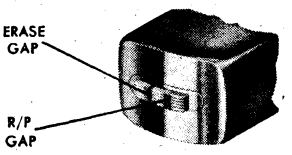
Fully described on Page 6 of this MASTER FILE



- Flush face for use with tape
- Relieved face for drum, disc, and film stripe applications

NARROW TRACK HEADS

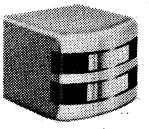
Fully described on Page 7 of this MASTER FILE



- Ideal for dictation machines, card readers, film stripe
- Close-coupled gaps for simplified circuitry, accurate editing
- Extended tip or flush face

PROFESSIONAL SERIES HEADS

Fully described as PR Series heads, Pages 8 and 13 of this MASTER FILE.

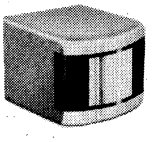


- Unexcelled response from 20 Hz to 20 KHz
- Designed for maximum head life
- Full track and two track models for ¼" tape

HEADS FOR ¼" TAPE

Fully described on Pages 8 through 13 of this MASTER FILE

8 TRACK 9
3, 4 TRACK 10, 11
2 TRACK 12, 13
FULL TRACK 8



- Heads for recording, duplicating, and computer instrumentation applications
- All track and channel configurations
- New concepts in Stereo Z Combo, with R/P/E functions in a single stereo head

NORTRONICS ACCESSORIES

Fully described on Pages 14-15 of this MASTER FILE



- Bias Oscillator Transformers
- Cartridge and Universal Mounting Brackets
- Plugs, Clips, and Cable Assemblies
- Contactor Heads, Guide Posts, etc.

This MASTER FILE is designed to describe — but not to limit — Nortronics capabilities.

FOR ANY TAPE HEAD REQUIREMENT... HEAD FIRST FOR NORTRONICS!

Nortronics COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

HOW TO SPECIFY MINI-DIGITAL HEADS

Selecting the proper tape head for your application can be accomplished by referring to the information below. Technical data on all Nortronics tape heads listed in the following index is contained on the individual pages referenced.

In determining the part number for your application, please refer to the step-by-step selection guide below. Please note that on most items listed in specification charts, **Basic** part numbers are shown. The guide below can be referred to for exact head characteristics.

PART NUMBER SELECTION

STEP 1 — DESIGNATE SERIES	P = Premium series XP = Extended tip-premium PR or WP = Professional series (Standard Has No Prefix)
STEP 2 — DESIGNATE CASE STYLE	List proper letter designation from case outline dwgs on each page
STEP 3 — NUMBER OF CHANNEL	1 = mono 3 = 3 channel 2 = stereo 4 = 4 channel
STEP 4 — NUMBER OF TRACKS	H = 2 track (half track) Q = 4 track (quarter track) L = 8 track
STEP 5 — TRACK LOCATION (mono heads only)	NONE = Standard stereo offset Y = .020 off center (GIHY) C = Centered track .040 off center (BIHY)
STEP 6 — ERASE ELECTRICAL CODE (combo heads only)	List code from specification chart
STEP 7 — R/P ELECTRICAL CODE	List code from specification chart
STEP 8 — MOUNTING STYLE	List proper mounting code shown on individual pages

EXAMPLE

P	—	A	I	Q	C	4	6K	—	SL
series		case style	channels	tracks	tr. location	case code	elect. code		mounting

= PREMIUM SERIES; "A" case style; I channel (mono); 4 track; centered tracks; combination erase - R/P head; No. 4 erase electrical code; No. 6K R/P electrical code; side mount with erase section to the left

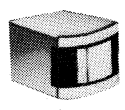
MINI-DIGITAL MAGNETIC HEADS

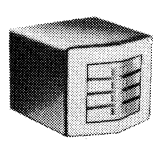
For read/write applications in desk-top calculators, input/output systems, and peripheral equipment.

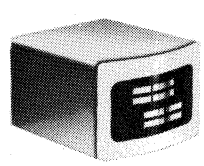
• Open reel, cartridge, and cassette formats • Excellent electrical characteristics and mechanical tolerances.

MODEL NUMBER	PR-B1F B7487	P-B2H C5387	P-B2H C5383	P-B2Q C1387	BQQN B3187	P-BQL B3587	W2R B1884	W4J B2484
Tape Width (Inches)	.250	.250	.250	.250	.250	.250	.150	.150
Number of Tracks on Tape	1	2	2	4	4	8	2	4
Number of Channels in Head	1	2	2	2	4	4	2	4
Track Width (Inches)	.250	.080	.080	.042	.037	.020	.056	.021
Channel Spacing (Center to Center-Inches)	—	.160	.160	.136	.071	.0635	.088	.035
Gap Spacer	0.5 Mil	0.5 Mil	0.1 Mil	0.5 Mil	0.5 Mil	0.5 Mil	0.2 Mil	0.2 Mil
Inductance, 1 KHZ	10 Mhy	10 Mhy	20 Mhy	10 Mhy	85 Mhy	10 Mhy	10 Mhy	10 Mhy
Resistance, D.C. (Ohms)	10	28	25	32	290	70	39	68
Saturation Current—ma. to Produce 90% Peak Output @ 200 BPI (Measured O-P, Alternate Polarity)	4.8 ma.	2.7	2.1	2.1	0.9	2.6	2.7	2.8
Write Current—ma. 150% Saturation Current @ 200 BPI	7.2	4.0	3.2	3.1	1.4	3.9	4.0	4.2
Read Output—mv. P-P (Open Circuit) NRZI 3.75 ips.	11.2	6.5	6.3	4.6	11.8	2.3	4.2	2
@ 200 BPI 15 ips.	40	24	21	17	44	8.5	15	7.4
Read Output—mv. P-P 800 BPI Ref. 200 BPI.	85% min	85% min	85% min	85% min	85% min	85% min	85% min	85% min

READ/WRITE MEASUREMENTS MADE ON TYPE 3M870 TAPE







For additional details, request Bulletin 7253, or consult Nortronics Marketing Engineering Department.

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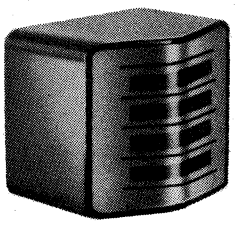
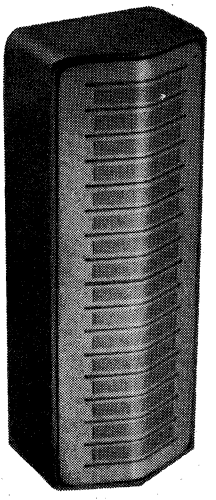
STUDIO SERIES TAPE HEADS
for ½, 1 and 2 inch tape

FOR ½", 1" AND 2" TAPE


STR-4B


STR-8B


STR-16B

DESIGNED ESPECIALLY...

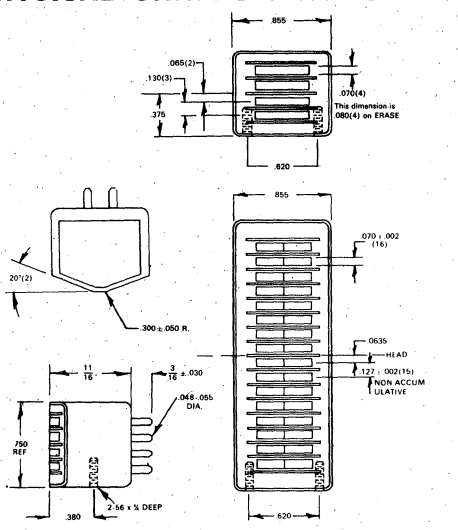
for professional audio or mastering recorders using one half, one, or two inch tape. Uncompromised quality dictates only the finest in design, materials and technology. Custom built to your electrical specifications and mechanical mounting requirements, the Studio Series is available in standard SMPTE track formats; 3 or 4 channels on one half inch tape, 8 or 12 channels on one inch tape, or 16 channels on two inch tape. Record and Playback heads feature ultra thin HY MU 800 laminated precision-lapped cores for minimum eddy current loss, deposited silicon monoxide gaps for maximum frequency definition and hyperbolic face contour for uniform intimate tape contact. Compatible companion erase heads are available with selective (independent) channels or full width. Ferrite core structures reduce ultra high frequency bias losses while providing erasure to virgin tape level.

SPECIFICATIONS

	BASIC MODEL NUMBER			
TAPE WIDTH	ERASE	RECORD	PLAYBACK	
ONE HALF INCH TAPE	STE- 3B6 STE- 4B6	STR- 3B7 STR- 4B7	STP- 3B3 STP- 4B3	STP- 3B8 STP- 4B8
ONE INCH TAPE	STE- 8B6 STE-12B6	STR- 8B7 STR-12B7	STP- 8B3 STP-12B3	STP- 8B8 STP-12B8
TWO INCH TAPE	STE-16B6	STR-16B7	STP-16B3	STP-16B8
Inductance, 1 KHZ	215 UHY	4.0 MHY	300 MHY	650 MHY
Resistance, D.C. (OHMS)	1.3	8.3	245	530
Track Width (Inches	.080	.070	.070	.070
Track Spacing (Inches)	.130	.130	.130	.130
Gap Width (Microinches)	—	500	100	200
AVERAGE RECORD/PLAYBACK CHARACTERISTICS, USING 3M 201 TAPE, BIASED FOR PEAK 1 KHZ OUTPUT AT A LEVEL OF 12 DB BELOW TAPE SATURATION @ 1 KHZ				
Erase Voltage @ 100 KHZ	11 Volts	—	—	—
Erase Current @ 100 KHZ	100 MA	—	—	—
Bias Voltage @ 180 KHZ @ 15 IPS	—	17 Volts	—	—
Bias Voltage @ 180 KHZ @ 7.5 IPS	—	16 Volts	—	—
Bias Current @ 180 KHZ @ 15 IPS	—	8.0 MA	—	—
Bias Current @ 180 KHZ @ 7.5 IPS	—	7.5 MA	—	—
Audio Record Current @ 15 IPS	—	.40 MA	—	—
Audio Record Current @ 7.5 IPS	—	.38 MA	—	—
1 KHZ OUTPUT (15 IPS)	—	—	2.1 MV	3.2 MV
1 KHZ OUTPUT (7.5 IPS)	—	—	1.9 MV	3.0 MV
10 KHZ/1 KHZ Output (15 IPS)	—	—	+11 DB	+10 DB
10 KHZ/1 KHZ Output (7.5 IPS)	—	—	+5 DB	+3 DB
15 KHZ/10 KHZ Output (15 IPS)	—	—	+1 DB	−1.5 DB
15 KHZ/10 KHZ Output (7.5 IPS)	—	—	−1 DB	−4 DB

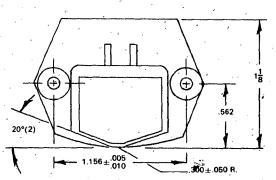
Specifications subject to change without notice.

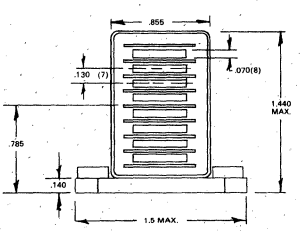
PHYSICAL CHARACTERISTICS



Typical Mounting Base Illustrated.

Other Mount Styles Available.





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8107 Tenth Avenue North, Minneapolis, Minnesota 55427

SPECIAL PURPOSE TAPE HEADS
cassette types

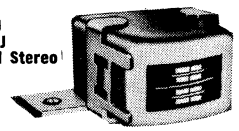
CASSETTE TYPE

TRACK CONFIGURATIONS

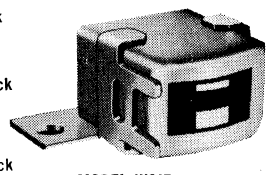
The track configurations of the cassette system have been defined on an international basis. The following configurations are available:

Model WIR
2 Track Monaural Record/Playback
Model ZWIR
2 Track Monaural Erase/Record/Playback
Model W2R
2 Track, Dual Channel Record/Playback
Model W2J
4 Track, 2 Channel Stereo Record/Playback
Model ZW2J
4 Track, 2 Channel Stereo Erase/Record/Playback
Model W4J
4 Track 4 Channel Stereo Record/Playback
Model ZW4J
4 Track, 4 Channel Stereo Erase/Record/Playback
Model W2JR
2 Channel Record/Playback Head for Language Laboratory Applications
Model ZW2JR
2 Channel Erase/Record/Playback Head for Language Laboratory Applications

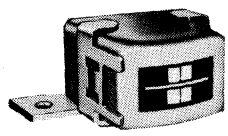
Designed to provide usable frequency response from 50-12,000 Hz at 1.875 ips. with an excellent signal-to-noise ratio.



MODEL W4J
MODEL ZW4J
4 Track, 4 Channel Stereo



MODEL W2JR
MODEL ZW2JR*
2 Channel Head for Language Laboratory Applications



MODEL W2R
2 Track Dual Channel

Nortronics features a complete line of heads for the cassette system, including a new bi-directional design that permits automatic changing, since the cassette need not be flipped over to play the second half of the tape.*

The Nortronics bi-directional design puts all three functions on one head, permitting two capstans to be used, thus providing for automatic reversing. Nortronics also produces conventional compatible cassette heads.

Typical operating speed for commercial applications is 1.875 ips.

TYPICAL APPLICATIONS

ENTERTAINMENT

For monaural applications; one or two recorded tracks, .059 inches wide separated by a guard band of .030 inches on the standard .150 inch tape. For compatible stereophonic recording; four recorded tracks, each .023 inches wide, are grouped in identical adjacent pairs with .012 guard bands — permits playing monaural and stereo tapes on the same equipment without loss of program material. Despite close spacing, crosstalk rejection of stereo models is in excess of 36 db.

LANGUAGE LABORATORY

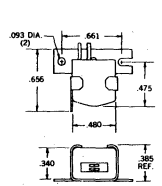
Heads provide playback of the teacher's voice on one track while recording the student's voice on the other. Teacher channel is .023 inches wide to play back a pre-recorded program. Student record and playback channel is .059 inches wide, (and is located at the far edge of the tape for maximum separation of .065 inches.)

ELECTRICAL SPECIFICATIONS

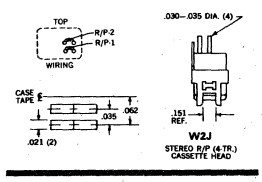
	MODEL NUMBER	W2JR46F	W1R6F	ZW2JR46K	ZW1R6K	W4J8N W2J8N	W1R8N W2R8N	ZW4J34F ZW2J34F	W4J4F W2J4F
	FUNCTION	R/P	R/P	E/R/P	E/R/P	R	R	E/R/P	P
R/P	Track Width (Inches)	.021	.056	.021	.056	.021	.056	.021	.021
R/P	Inductance (MHY) @ 100 MV-1 KHz	100	200	50	100	10	20	50	80
R/P	Resistance, DC (OHMS)	240	270	160	200	60	50	140	150
R/P	Interchannel Crosstalk @ 1 KHz Rejection (DB)	50	50	50	50	50	50	1-2/3-4 2-3	30 DB 50 DB
R/P	Gap (Micro Inches)	50	50	100	100	200	200	50	50
ERASE	Induction (MHY) @ 100 MV, 1 KHz	—	—	1.2	1.5	—	—	2	—
ERASE	Resistance DC (OHMS)	—	—	28	30	—	—	38	—
ERASE	Erasure From Sat. 400 Hz (DB)	—	—	50	50	—	—	50	—
ERASE		Average constant-current unequalized R/P characteristics using 3M 272 tape. Biased for peak 1 KHz output at level 10-12 DB below tape saturation. Tape speed, 1.875 inches per second							
ERASE	Bias Voltage @ 60 KHz (Volts Rms)	10	20	20*	25*	3.5	7.0	30*	—
ERASE	Bias Current @ 60 KHz (Ma Rms)	41	33	70*	70*	1.6	1.5	60*	—
ERASE	Record Current (MA)	.026	.028	.070	.070	.130	1.40	.070	—
	1 KHz Playback Output (MV)	.2	.4	.2	.4	—	—	.15	.17
	5 KHz Output Vs. 1 KHz Output (DB)	−1	−1	−8	−8	—	—	—	—
	10 KHz Output Vs. 1 KHz Output (DB)	—	—	—	—	—	—	−14	−14

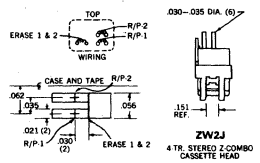
* R/P section normally receives sufficient bias thru magnetic leakage from the erase section, 50 pf across R/P coil during record.

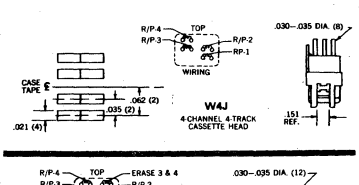
PHYSICAL CHARACTERISTICS

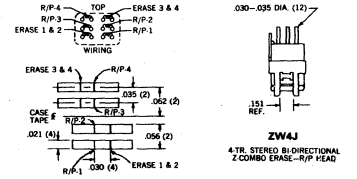


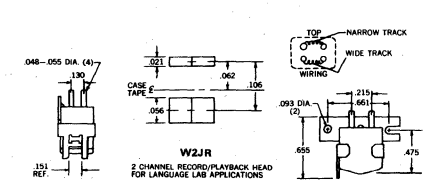
The mounting bracket/tape guide (illustrated) is supplied pre-aligned. The tape guide for .150 is positioned for proper track height when gap is azimuth aligned. (Specify "A" following basic model number).

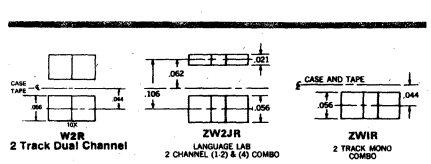












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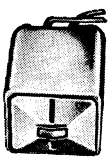
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

SPECIAL PURPOSE TAPE HEADS
miniature heads

MINIATURE TYPES

SIZES



"L" SERIES (5/16"W x 5/16"H x 3/8"D)



"M" SERIES (1/4"W x 1/4"H x 1/4"D)

"M" SERIES — Features small size — ¼ inch cubed. R/P track widths are .045 or .070 with compatible erase track widths of .055 or .090 inch. Face contour is either flush (as illustrated) or relieved. Standard relief for 16 mm stripe is .050 inch notch across top of face from case to core. To specify a relieved face add the number "3" to part number shown below. Available as no mount or base, side or rear mount (No. 2-56 stud).

"L" SERIES — Incorporates laminated cores, deposited quartz gaps and either a flush face for use with tape or a relieved face (as illustrated) for use in drum, disc or film stripe applications. The flush face contour is hyperbolic, while the pole-tip projection is .010 to 020 inch on relieved heads. To specify a relieved face add the number "5" to part number shown below. Available as no mount or base or rear mount (No. 2-56 stud). Special track widths or specifications on custom order basis. Six-inch leads std.

TYPICAL APPLICATIONS — Magnetic drums and discs, magnetic stripes on motion picture film and miniature tape recorders. When used with magnetic drums, discs and film stripes, it is recommended that a projecting track version be selected.

TYPICAL SPECIFICATIONS

TYPICAL MINIATURE RECORD/PLAY HEADS

MODEL NUMBER	L42R8L	L24R2K	L24R8L	L12R8K	M70R4L
TYPE OF HEAD	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback
Inductance, 1 KC	80 MHY	200 MHY	40 MHY	30 MHY	20 MHY
Impedance, 1 KC	500 Ω	1.2 K	250 Ω	200 Ω	130 Ω
Resistance, D.C.	128 Ω	400 Ω	125 Ω	125 Ω	80 Ω
Gap Spacer	0.16 MIL	0.10 MIL	0.16 MIL	0.10 MIL	0.16 MIL
Track Width	.042 INCH	.024 INCH	.024 INCH	.012 INCH	.070 INCH
Average 7.5 IPS constant current Record/Playback characteristics using 3M190 tape at 1 KC and recorded 12 DB below tape saturation at 1 KC.					
Peak Bias, 60 KC	.070 MA	0.33 MA	0.65 MA	0.75 MA	2.0 MA
Record Current	60 UA	30 UA	50 UA	60 UA	100 UA
1 KC Output	1.0 MV	1.0 MV	0.45 MV	0.25 MV	0.6 MV
10 KC/1 KC Ratio	0 DB	+2 DB	0 DB	0 DB	−8 DB

Specifications subject to change without notice.

MINIATURE ERASE HEADS

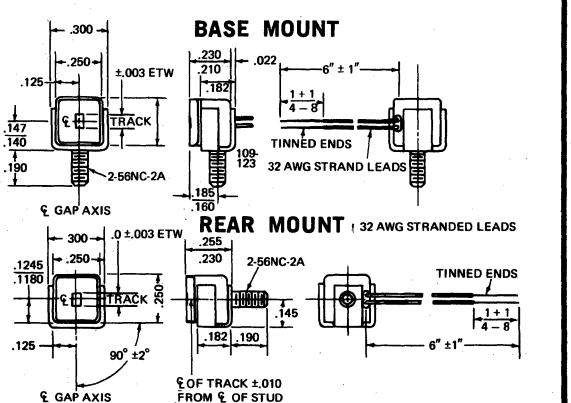
NORTRONICS MODEL NUMBER	L42E6U	M90E3U
Track Width	.042 INCH	.090 INCH
Inductance, 1 KC	5 MHY	16 MHY
Resistance, D.C.	38 Ω	315 Ω
†Erase Current Oper.	28-42 MA	12 MA
Impedance, 60 KC	1.2 K	4 K
Voltage, 60 KC RMS	32-48 VOLTS	50 VOLTS

† For 56 DB Erasure of Saturated Tape.

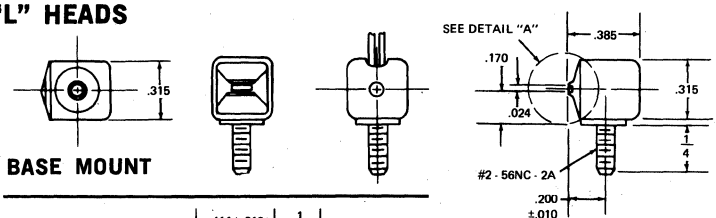
STANDARD MOUNTS

Variations of the mountings shown can be furnished — write for details.

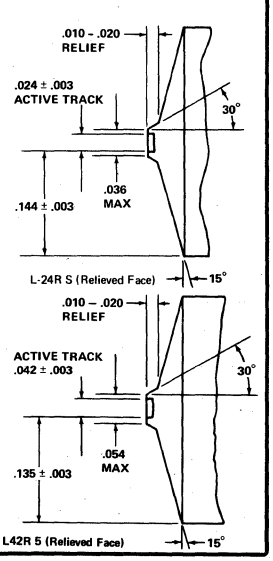
"M" HEADS



"L" HEADS

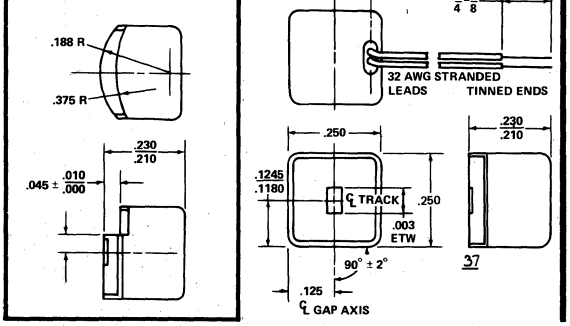


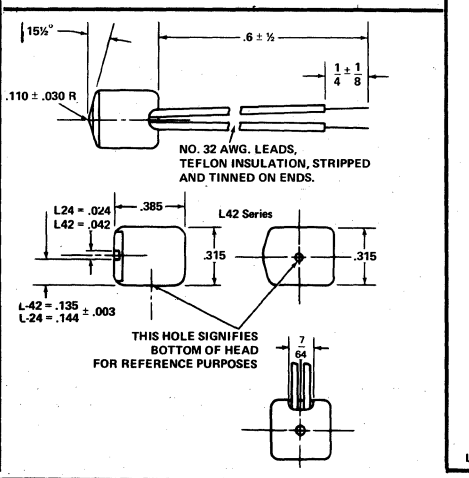
Typical relieved face / heads designated by "5" in part number.



PHYSICAL CHARACTERISTICS

Typical Relieved Face Heads (Designated by number "3" in Part No.)



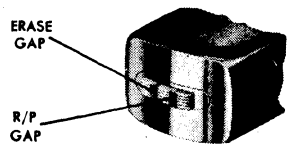


Nortronics COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

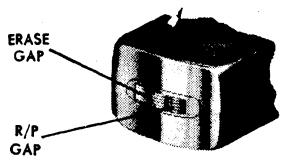
SPECIAL PURPOSE TAPE HEADS
narrow track video recorder

NARROW TRACK HEADS

Extended tip or flush face — Mu Metal or Alfenol Cores
Standard track widths: .0135 inches, .020 inches, .080 inches



"XZ" Extended Pole



"Z" Flush Face

*Z Combo — Type Z — Combination erase and R/P head places all three functions within a single head. Ideal for dictation machines, card readers and film stripe applications. "Close-coupled" gap provides internal bias coupling that simplifies required circuitry and permits accurate editing.

Type XZ offers additional advantage of extended pole tip (.010-.020 inches) for gap to oxide contact on hard or non-compliant surfaces.

*R/P Heads — Type X — Extended pole tip R/P heads feature high sensitivity mu-metal cores.

Type XA — Extended pole tip R/P heads feature long wearing alfenol cores.

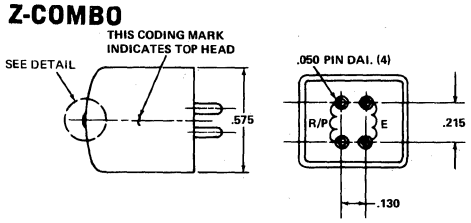
SPECIFICATIONS

BASIC MODEL NO.	ZRINC	ZRILC	XACILC CILC RILC	ZRIHC
Track Width (Inches)	.0135	.020	.020	.080
Electrical Code	47 K	96 K	7 K	47 K
Head Function	Erase—R/P	Erase—R/P	R/P	Erase—R/P
R/P Inductance	400 MHY	200 MHY	400 MHY	400 MHY
R/P Gap Spacer	0.1 MIL	0.1 MIL	0.1 MIL	0.1 MIL
Erase Inductance	10 MHY	8 MHY	—	4 MHY
Erase Current (Bias)	30 MA	35 MA	—	30 MA
Erase Voltage (Bias)	45 V	50 V	—	40 V
Record Current	23 UA	30 UA	—	40 UA
1 KHZ Output	0.65 MV	0.6 MV	0.9 MV	2.2 MV
10 KHZ/KHZ Ratio	−3 DB	−3 DB	−3 DB	−3 DB

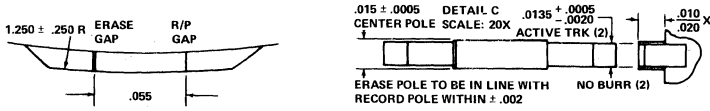
Typical 7.5 IPS constant current R/P characteristic using 3M190 tape.
Peak biased at 60 KHZ at 1 KC and recorded 12 DB below tape saturation.

PHYSICAL CHARACTERISTICS

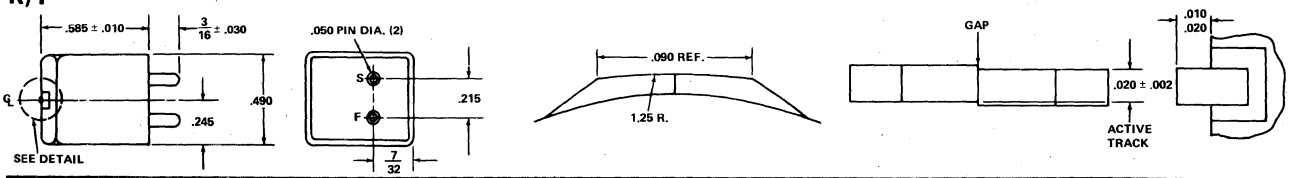
Z-COMBO



TYPICAL POLE PIECE DETAIL



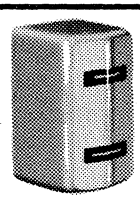
R/P



SPECIAL Z COMBO HEADS

Features include

- Special wide cases give full-width tape support
- In-line gaps permit precise timing accuracy
- Z combo close-spaced erase gap controls editing and alignment
- Provides maximum center tape area for video information

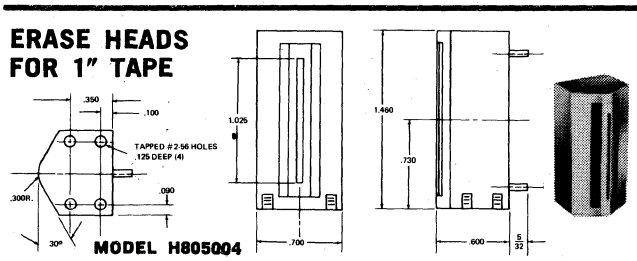


AUDIO & SYNC FOR VIDEO RECORDERS

Custom built to your specifications, this series of special Z combo & R/P heads is designed specifically for video recorders. Two or three channels of sound and/or sync information can be recorded along the edges of one-half or one-inch tape.

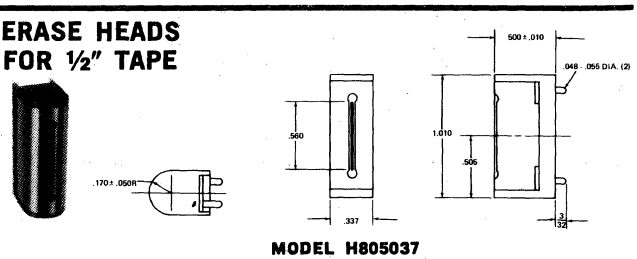
Check with Nortronics for your special-purpose head requirements.

ERASE HEADS FOR 1" TAPE



MODEL H805004

ERASE HEADS FOR ½" TAPE



MODEL H805037

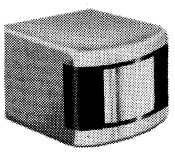
Nortronics COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

GENERAL PURPOSE TAPE HEADS

full track heads for 1/4" tape

TRACK SYSTEM	FULL TRACK			
BASIC MODEL NUMBER	PR-B1F			
ELECTRICAL CODE	4R	11R	7K	12N
HEAD FUNCTION	Record Only	Record Only	Playback	Playback
TYPE OF CIRCUIT	Tubes/ Transistors	Tubes/ Transistors	Tubes/ Transistors	Tubes/ Transistors
Inductance, 1 KHz	55 MHY	4.0 MHY	400 MHY	650 MHY
Impedance, 1 KHz	330 Ω	27 Ω	2.5 K	4 K
Max. Bias Frequency	250 KHz	500 KHz	—	—
Resistance, D.C.	125 Ω	3.35 Ω	220 Ω	275 Ω
Gap Spacer	0.5 MIL	0.5 MIL	0.1 MIL	0.2 MIL
Average 7.5 IPS Constant Current Record/Playback Characteristics Using 3M 201 Tape, Peak Biased at 1 KHz and Recorded 12 DB Below Tape Saturation.				
Peak Bias Current, 60 KHz	.95 MA	9.0 MA	—	—
Bias Voltage RMS, 60 KHz	43 V	25 V	—	—
Record Record Current	.15 MA	.540 MA	—	—
1 KHz Output	—	—	3.5 MV	5.0 MV
10 KHz/1 KHz Ratio	—	—	+3DB	+3 DB

Specifications subject to change without notice.



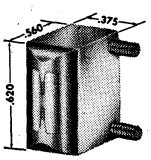
PR-BIF

PR SERIES

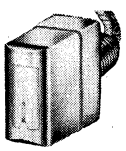
- Sets a new standard for high performance magnetic heads.
- Unexcelled response from 20HZ to 20KHZ.

Professional series full track — PR-B1F, designed especially for long wave length response with extra wide pick-up poles, smooth response characteristics are obtained to below 20HZ. Fine precision lapped laminated core stacks and deposited gaps extend short wavelength response. Extra deep deposited quartz gap.

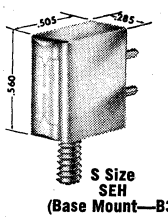
Companion PR-B1EF ERASE also available.



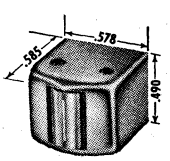
L Size
SEQ
(Side Mount—S23)



S Size
MEH
(Rear Mount—R-12S)



S Size
SEH
(Base Mount—B3)



B Style
BIEF
(No Mount—N)

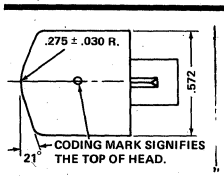
All Nortronics erase heads have efficient double-gap construction plus metal faces and cases for superior heat transfer. They will operate effectively at erase frequencies up thru 100 kc, and also on d.c. **Two low-cost standard case sizes, "L" and "S,"** in the various mounting styles as illustrated to the right and indicated below. All erase models are also available in the B-case style to match the r/p heads; example, B2EQ4-N which is identical electrically to the SEQ4.
Erase heads are shown with various mounts, but all are available in your choice of **base, side, rear or no mount.**

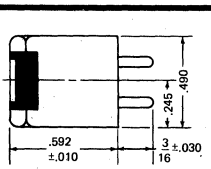
TRACK SYSTEM	FULL TRACK			
BASIC MODEL NUMBER	MEF-BIEF		PR BIEF	
ELECTRICAL CODE	1	4	14	4
Inductance, 1 KHz	40 MHY	3.6 MHY	.200 MHY	1.2 MHY
Resistance, D.C.	88 Ω	25 Ω	1.8 Ω	3.8 Ω
†Erase Current Oper.	13 MA	40 MA	120 MA	95 MA
Impedance, 60 KHz	12 K	1 K	80 Ω	42 Ω
Voltage, 60 KC RMS	120 V	40 V	9.3 V	40 V

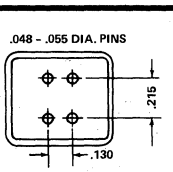
Specifications subject to change without notice. †For 56 DB erasure of Saturated Tape.

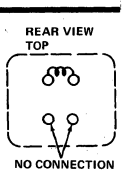
To determine erase model number, select a basic model number, add the erase electrical code, add a dash (—) and add mounting designator (below). Following are typical examples:
MEF1-S23U, Full-track mono erase head, No. 1 erase electrical code, "L case," **side mount,** track **up** (studs are to **left**).
Erase Mounting Designator follows model number in this fashion:

"MEF1-N9", no mount (S Size)
"-N", no mount (L Size)
"-B3", standard base mount (Supplied S Size only). For mono heads, add a U for up or D for down after the B3 to denote track up or track down.
"-S23", standard side mount (Supplied L Size only). For mono heads, add a U for up or a D for down after S23 to denote track up or track down.
"-R-12S", standard rear mount and 12 inch shielded leads (Supplied S Size only).
"-R-4U", standard rear mount and 4 inch unshielded leads (Supplied S Size only).
For "B" style erase heads, mounts are the same as for R/P heads.



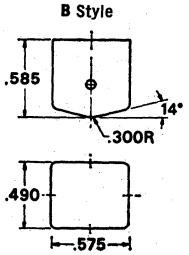




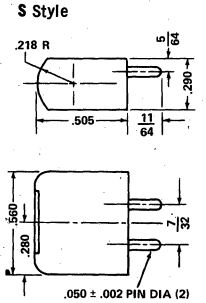


CASE OUTLINE STYLES

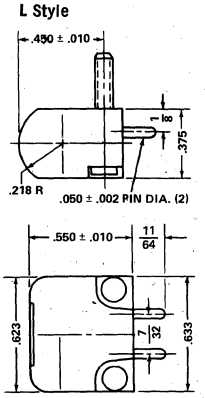
B Style



S Style



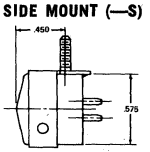
L Style



SPECIAL CASE STYLES AVAILABLE—CONSULT NORTRONICS

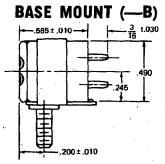
MOUNT

SIDE MOUNT (—S)



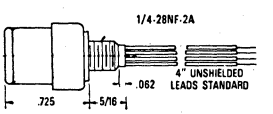
L or R Combo erase on left or right side
U or D Mono track up or down

BASE MOUNT (—B)

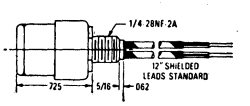


L or R Combo erase on left or right side
U or D Mono track up or down

REAR MOUNT (—R—4U)



REAR MOUNT (—R—12S)



Nortronics COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

GENERAL PURPOSE TAPE HEADS

8-track heads for ¼" tape

8-TRACK HEADS FOR ¼" TAPE

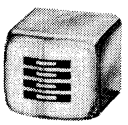
MODEL ZJ2L Z-Combo

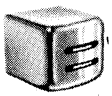
The type **ZJ2L** offers combination erase and record/playback functions in one head for 8-track stereo applications. Its patented unique "Z-Combo" construction places the erase and R/P gaps only .030 apart in the same pole structure, resulting in extremely accurate height alignment and tracking. Recording and erasing for the 8-track stereo system thereby become fully practicable. Standard B-size case fits most mountings.

Advantages of Z-Combo Close-Coupled Gaps

- Intimate tape contact with single or no pressure pad
- Insures overlap alignment of erase when R/P section is azimuth aligned
- Prevents adjacent channel erasure in close spaced track configurations when R/P section is azimuth aligned

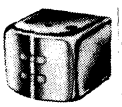
8-Track 4-Channel P-BQL-N (No Mount)





8-Tr. Stereo Z-Combo ZJ2L (No Mount)

8-Tr. Stereo B2L-N (No Mount)



MODEL P-B2L

SUITABLE FOR HIGH SPEED DUPLICATORS, LOW SPEED LOGGING APPLICATIONS, AND GENERAL PURPOSE RECORDING AND PLAYBACK.

The NORTRONICS Premium Quality P-BQL four-channel magnetic tape head utilizes the most advanced design and manufacturing techniques. Fine-laminated cores and precision-deposited gaps give extended frequency response capability. Ideal as high speed slave heads for duplication of 8-track stereo at speeds up to 8X or 16X, with bias frequencies up to 750 KHz.

MODEL B2L-N

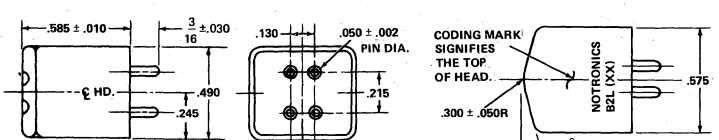
Standard playback — only or record/playback head for automobile or home type Stereo — 8 tape cartridge players. Premium version of above head is available with extra-fine laminated cores for improved high frequency response to 15 KHz at 3.75 ips tape speed. Also available Alfenol Premium record-only head for heavy-duty high speed duplicating applications. Give five times normal life.

BASIC MODEL NUMBER	8-TRACK (.021 INCH WIDTH) P-BQL 2 HEADS INTERLACE FOR 8 TRACKS ON ¼" TAPE				8-TRACK STEREO Z-J2L	8-TRACK (.020 INCH TRACK WIDTH) STEREO B2L			8 TRACK STEREO Special Duplicating
ELECTRICAL CODE	8R	4R	4K	6K	47 K	8R	4R	7K	AP-B2L14R
HEAD FUNCTION	Duplicating Record	Record Only	Record/ Playback	Record/ Playback	Erase/ Record/ Playback	Duplicating Record	Record Only	Record/ Playback	Record Only
TYPE OF CIRCUIT	Tubes/ Transistors	Tubes/ Transistors	Transistors	Tubes/ Transistors	R/P Section Data	Tubes/ Transistors	Tubes/ Transistors	Tubes/ Transistors	Alfenol/ Duplicating
Inductance, 1 KC	10 MHY	50 MHY	100 MHY	200 MHY	400 MHY	10 MHY	50 MHY	400 MHY	2 MHY
Impedance, 1 KC	65 Ω	300 Ω	650 Ω	1.5 K	2.5 K	75 Ω	400 Ω	2.5 K	—
Maximum Bias Frequency	500 KC	200 KC	100 KC	100 KC	100 KC	750 KC	250 KC	100 KC	—
Resistance, D.C. Mono					—	20 Ω	100 Ω	520 Ω	10 Ω
Resistance, D.C. Stereo	60 Ω	250 Ω	250 Ω	500 Ω	680 Ω	42 Ω	220 Ω	700 Ω	—
Gap Spacer	0.5 MIL	0.5 MIL	0.1 MIL	0.1 MIL	0.1 MIL	0.5 MIL	0.5 MIL	0.1 MIL	500 U-IN
Track Spacing	.0635 INCH	.0635 INCH	.0635 INCH	0.635 INCH	.127 INCH	.127 INCH	.127 INCH	.127 INCH	—
1 KC Crosstalk Rej.	50 DB	50 DB	50 DB	50 DB	50 DB	55 DB	55 DB	55 DB	—
For "WP" AND PREMIUM — Average 7.5 IPS Constant Current Record/Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.									
Peak Bias Current, 60 KC	1.8 MA	0.7 MA	0.55 MA	0.35 MA	*15 MA	1.1 MA	0.5 MA	0.15 MA	40 MA @ 30 IPS
Bias Voltage RMS, 60 KC	5 VOLTS	15 VOLTS	15 VOLTS	22 VOLTS	*45 VOLTS	2.6 VOLTS	8 VOLTS	21 VOLTS	30 VOLTS @ 500 KHz
Record Current	140 UA	55 UA	45 UA	35 UA	30 UA	88 UA	40 UA	19 UA	0.3 MA
1 KC Output	—	—	0.6 MV	0.8 MV	0.9 MV	—	—	1.0 MV	—
10 KC/1 KC Ratio	—	—	0 DB	0 DB	−3 DB	—	—	0 DB	—
For "WP" AND PREMIUM — Average 3.75 IPS Constant Current Record/Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.									
Peak Bias Current, 60 KC	1.5 MA	0.6 MA	0.50 MA	0.30 MA	*10 MA	1.0 MA	0.4 MA	0.12 MA	6 MA
Bias Voltage RMS, 60 KC	4.5 VOLTS	10 VOLTS	13 VOLTS	20 VOLTS	*40 VOLTS	2.3 VOLTS	7 VOLTS	18 VOLTS	3 VOLTS
Record Current	120 UA	45 UA	40 UA	32 UA	20 UA	86 UA	35 UA	35 UA	0.3 MA
1 KC Output	—	—	0.5 MV	0.6 MV	0.8 MV	—	—	0.8 MV	—
10 KC/1 KC Ratio	—	—	−12 DB	−12 DB	−12 DB	—	—	−9 DB	—
For STANDARD HEADS — Average 7.5 IPS Constant Current Record/Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.									
Peak Bias Current, 60 KC					Z-J2L			.55 MA	
Bias Voltage RMS, 60 KC	Not Available				ERASE SECTION DATA	Not Available		32 VOLTS	
Record Current	in				Inductance @ 60 KC 12 MHY	in		30 UA	
1 KC Output	Standard Series				Erasure @ 60 KC 50 DB	Standard Series		0.9 MV	
10 KC/1 KC Ratio								−4 DB	

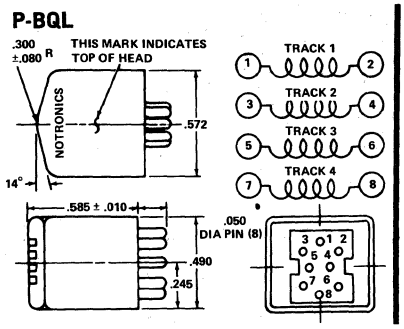
* Provides internal bias coupling from erase to R/P section. Bias data above is fed to erase section.

PHYSICAL CHARACTERISTICS

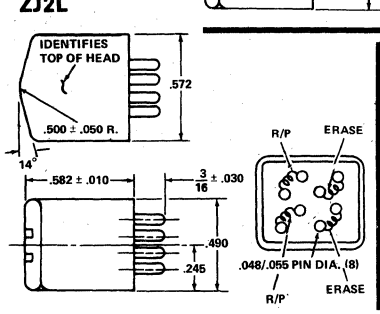
B2L



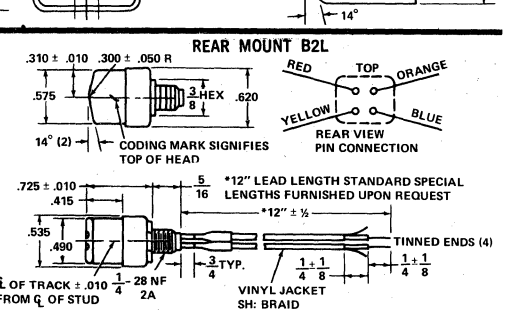
P-BQL



ZJ2L



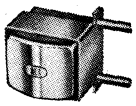
REAR MOUNT B2L



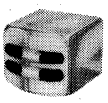
Nortronics COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

GENERAL PURPOSE TAPE HEADS

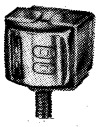
3, 4 track heads for ¼" tape



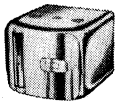
4-Tr. Mono
B1QC-S
(Side Mount)



4-Tr. Stereo
WP-B2Q
(No Mount)



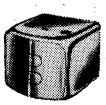
4-Tr. Stereo Combo
A2Q-BL
(Base Mount)



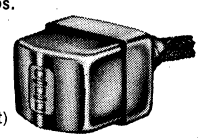
4-Tr. Mono Combo
A1QC-N
(No Mount)

The B2Q, C2Q, G2Q heads shown represent a broad new series of 4-track stereo and monophonic record/playback heads. Each type of head is available in either a PREMIUM or STANDARD version. The PREMIUM series is a fully professional line of tape heads giving unsurpassed performance for broadcast and studio applications. Long life and extended high frequency response at slower tape speeds, are among the benefits of the features listed: • Fine laminated, precision-lapped, low loss core structures • Deposited quartz gaps, as fine as 50 micro-inches • Hyperbolic face contour • Highly polished all-metal faces • Compatible mechanically and electrically with older model Nortronics heads • Superbly shielded against external magnetic fields. The STANDARD versions are recommended for less critical applications where cost is a primary factor. They offer improved high frequency performance over that of conventional solid-core heads, plus the added features of hyperbolic all-metal face and precision deposited quartz gaps.

4-Tr. Stereo
B2Q-N
(No Mount)



3-Track
3-Channel
P-B3Q-R
(Rear Mount)



The P-A2Q, A2Q, P-A1QC and A1QC 4-track series of NORTRONICS Combination Magnetic Tape Heads contain record/playback and erase sections in one miniature case. Internal construction is based on the low-loss, laminated core design. PREMIUM Series P-A2Q and P-A1QC heads offer fully professional fine-laminated core construction where the ultimate in high frequency performance is required. STANDARD A2Q and A1QC series heads are recommended for less critical applications where cost is a primary factor. STANDARD type heads have laminated cores, providing a superior high frequency response over that of conventional solid-core heads. Deposited quartz gaps as fine as 50 micro-inches. Precision-polished metal faces for freedom from oxide buildup. Hyperbolic face contours, available on PREMIUM models, for optimum tape-to-gap contact without need for pressure pads.

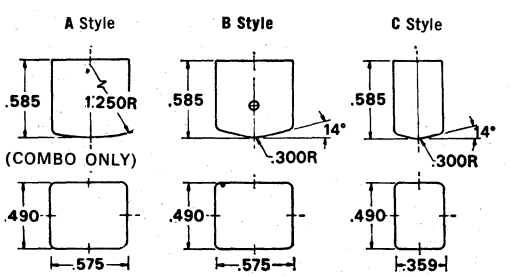
P-B3Q SERIES

Premium series three channel R/P heads designed especially to meet N.A.B. (USA) track configuration for stereo cartridge machines, two channels for stereo program plus control channel. Precision gap co-linearity eliminates phase cancellation distortion of stereo signal, all metal face insures maximum shielding. B case to fit all mounting accessories.

TRACK SYSTEM / BASIC MODEL NUMBER	4-TRACK (.043 INCH TRACK WIDTH) MONO — B1QY, B1QC, A1QC STEREO — B2Q, C2Q, G2Q, A2Q (For Premium Series Add "P" Prefix to Above Numbers)								3-TRACK (.043 INCH WIDTH) P-B3Q 3 CHANNELS FOR ¼" TAPE		
ELECTRICAL CODE	8R	4R	8K	4K	6K	7K	7F2	2K	4R	6K	7K
HEAD FUNCTION	Duplicating Record	Record Only	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Playback Only	Record/ Playback	Record Only	Record/ Playback	Record/ Playback
TYPE OF CIRCUIT	Tubes/ Transistors	Tubes Transistors	Transistors	Transistors	Transistors	Tubes/ Transistors	Tubes/ Transistors	Tubes	Tubes/ Transistors	Transistors	Tubes/ Transistors
Inductance, 1 KC	10 MHY	50 MHY	20 MHY	100 MHY	200 MHY	400 MHY	500 MHY	800 MHY	50 MHY	200 MHY	340 MHY
Impedance, 1 KC	70 Ω	400 Ω	150 Ω	650 Ω	1.3 K	2.5 K	3.3 K	5 K	400 Ω	1.3 K	2.0 K
Maximum Bias Frequency	500 KC	250 KC	250 KC	140 KC	120 KC	100 KC	100 KC	80 KC	250 KC	120 KC	100 KC
*Resistance, D.C.	22 Ω	90 Ω	22 Ω	90 Ω	110 Ω	210 Ω	210 Ω	520 Ω	260 Ω	450 Ω	800 Ω
**Resistance, D.C.	32 Ω	90 Ω	32 Ω	90 Ω	200 Ω	390 Ω	390 Ω	700 Ω			
Gap Spacer	0.5 MIL	0.5 MIL	0.1 MIL	0.1 MIL	0.1 MIL	0.1 MIL	0.05 MIL	0.1 MIL	0.5 MIL	0.1 MIL	0.1 MIL
**Track Spacing	.136 INCH	.136 INCH	.136 INCH	.136 MIL	.136 MIL	.136 MIL	.136 INCH	.136 INCH	.100 INCH	.100 INCH	.100 INCH
1 KC Crosstalk Rej.	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB
For "WP" AND PREMIUM — Average 7.5 IPS Constant Current Record / Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.											
Peak Bias Current, 60 KC	1.3 MA	0.65 MA	1.6 MA	0.70 MA	0.40 MA	0.25 MA	0.25 MA	0.16 MA	.065 MA	0.40 MA	0.25 MA
Bias Voltage RMS, 60 KC	3 V	7.5 V	6 V	18 V	25 V	35 V	50 V	45 V	1.5 V	20 V	35 V
Record Current	140 UA	60 UA	150 UA	70 UA	50 UA	35 UA	30 UA	25 UA	60 UA	50 UA	35 UA
1 KC Output	—	—	0.5 MV	0.9 MV	1.3 MV	1.8 MV	1.8 MV	2.6 MV	—	1.3 MV	1.8 MV
10 KC/1 KC Ratio	—	—	0 DB	0 DB	+1 DB	+1 DB	+2 DB	+1 DB	—	+1 DB	+1 DB
For "WP" AND PREMIUM — Average 3.75 IPS Constant Current Record / Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.											
Peak Bias Current, 60 KC	1.2 MA	0.50 MA	1.25 MA	0.50 MA	0.32 MA	0.20 MA	0.20 MA	0.12 MA	0.50 MA	0.32 MA	0.20 MA
Bias Voltage RMS, 60 KC	2.5 V	7.0 V	5 V	13 V	20 V	25 V	35 V	35 V	7.0 V	15 V	25 V
Record Output	130 UA	50 UA	130 UA	50 UA	44 UA	30 UA	25 UA	22 UA	.50 UA	44 UA	30 UA
1 KC Output	—	—	0.4 MV	0.7 MV	1.0 MV	1.4 MV	1.4 MV	2.1 MV	—	1.0 MV	1.4 MV
10 KC/1 KC Ratio	—	—	−10 DB	−10 DB	−9 DB	−9 DB	−7 DB	−9 DB	—	−9 DB	−9 DB
For STANDARD HEADS — Average 7.5 IPS Constant Current Record / Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.											
Peak Bias Current, 60 KC	Not Available in Standard Series			1.1 MA	0.70 MA	0.42 MA	Not Available	0.30 MA	Not Available in Standard Series		
Bias Voltage RMS, 60 KC				20 V	25 V	35 V		45 V			
Record Current				70 UA	50 UA	35 UA		25 UA			
1 KC Output				0.8 MV	1.2 MV	1.6 MV		2.4 MV			
10 KC/1 KC Ratio				−4 DB	−3 DB	−3 DB		−3 DB			

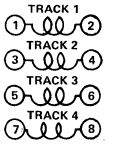
* Mono ** Stereo

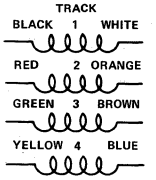
CASE OUTLINE STYLES



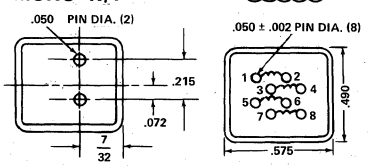
SPECIAL CASE STYLES AVAILABLE—CONSULT NORTRONICS

PBQQ & BQQN

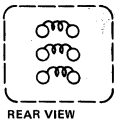




MONO R/P

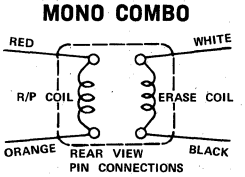


P-B3Q



REAR VIEW
PIN CONNECTIONS

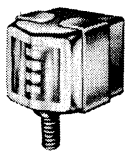
MONO COMBO



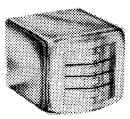
Nortronics COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

GENERAL PURPOSE TAPE HEADS

4 track heads for ¼" tape



4-Track
4-Channel
BQQN-B
(Base Mount)



P-BQQ
(No Mount)

Nortronics Model P-BQQ is an instrument quality, 4-channel in-line record/reproduce magnetic tape head for ¼-inch tape. Its fine laminated-core construction is designed for professional applications with the ultimate in high frequency performance. Deposited quartz gaps as fine as 50 micro-inches result in exceptionally clean "smear-free" gap edges. The all-metal face greatly reduces oxide loading problems and the hyperbolic contour promotes intimate tape-to-gap contact allowing reduced tape tension and elimination of pressure pads.

Typical Applications — Instrumentation recording including carrier modulated types such as AM, FM or Pulse, as well as straight digital and analog recording. Tracks of the P-BQQ head are compatible with the 4-track stereo system making it ideal for audio duplication, background music and 4-channel in-line stereo.

Two versions are available, offering a choice between the minimum interchannel crosstalk and lower price. The P-BQQ style has the superior interchannel crosstalk rejection of 55 db. For some applications, such as pulse recording, the 18 db crosstalk rejection of the more economical BQQN model may be acceptable.

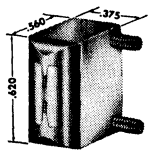
SERIES / BASIC MODEL NUMBER	Standard Premium 4-TRACK STEREO Z-J2Q	PREMIUM 4-TRACK (.037 INCH WIDTH) BQQ 4 CHANNELS FOR ¼" TAPE			
ELECTRICAL CODE	47K	23R	4R	4K	3K
HEAD FUNCTION	ERASE RECORD PLAYBACK	Duplicating Record	Record Only	Record/ Playback	Record/ Playback
TYPE OF CIRCUIT	R/P Section Data	Tubes/ Transistors	Tubes/ Transistors	Transistors	Tubes/ Transistors
Inductance, 1 KC	400 MHY	12 MHY	50 MHY	90 MHY	370 MHY
Impedance, 1 KC	2.5 K	75 Ω	320 Ω	600 Ω	2.2 K
Maximum Bias Frequency	100 KC	500 KC	150 KC	100 KC	80 KC
Resistance, D.C.	390 Ω	55 Ω	220 Ω	220 Ω	690 Ω
Gap Spacer	0.1 MIL	0.5 MIL	0.5 MIL	0.1 MIL	0.1 MIL
Track Spacing	.136 INCH	.071 INCH	.071 INCH	.071 INCH	.071 INCH
1 KC Crosstalk Rej.	55 DB	55 DB	55 DB	55 DB	55 DB
For "WP" AND PREMIUM — Average 7.5 IPS Constant Current Record/ Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.					
Peak Bias Current, 60 KC	*20 MA	2.0 MA	0.60 MA	0.70 MA	0.30 MA
Bias Voltage RMS, 60 KC	*45 V	4 V	7 V	15 V	30 V
Record Current	35 UA	110 UA	60 UA	60 UA	34 UA
1 KC Output	1.8 MV	—	—	0.7 MV	1.4 MV
10 KC/1 KC Ratio	−3 DB	—	—	0 DB	0 DB
For "WP" AND PREMIUM — Average 3.75 IPS Constant Current Record/ Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.					
Peak Bias Current, 60 KC	*15 MA	1.6 MA	0.50 MA	0.50 MA	0.22 MA
Bias Voltage RMS, 60 KC	*40 V	3 V	6 V	10 V	25 V
Record Current	25 UA	90 UA	50 UA	50 UA	30 UA
1 KC Output	1.4 MV	—	—	0.5 MV	1.1 MV
10 KC/1 KC Ratio	−12 DB	—	—	−10 DB	−9 DB
ERASE SECTION DATA					
Inductance @ 1 KC	6 MHY	Not Available In Standard Version			
Erasure @ 1 KC	50 DB				

* Provides internal bias coupling from erase to R/P section. Bias data above is fed to erase section.

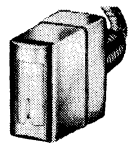
ERASE HEADS

All Nortronics erase heads have efficient double-gap construction plus metal faces and cases for superior heat transfer. They will operate effectively at erase frequencies up thru 100 kc. and also on d.c. **Two low-cost standard case sizes, "L" and "S,"** in the various mounting styles as illustrated to the right and indicated below. All erase models are also available in the B-case style to match the r/p heads; example, B2EQ4-N which is identical electrically to the SEQ4.

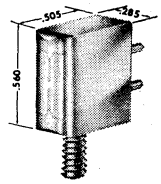
Erase heads are shown with various mounts, but all are available in your choice of **base, side, rear** or **no mount.**



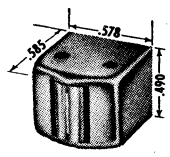
L Size
SEQ
(Side Mount—S23)



S Size
MEH
(Rear Mount—R-12S)



S Size
SEH
(Base Mount—B3)



B Style
BIEF
(No Mount—N)

To determine erase model number, select a basic model number, add the erase electrical code, add a dash (—) and add mounting designator (below). Following is a typical example:

SEQ4-R-12S, 4-track (quarter track) stereo erase head, No. 4 erase electrical code, "S" case, rear mount, 12 inch shielded leads.

Erase Mounting Designator follows model number in this fashion:

"SEQ4-N9", no mount (S Size)

"-N", no mount (L Size)

"-B3", standard base mount (Supplied S Size only). For mono heads, add a U for up or D for down after the B3 to denote track up or track down.

"-S23", standard side mount (Supplied L Size only). For mono heads, add a U for up or a D for down after S23 to denote track up or track down.

"-R-12S", standard rear mount and 12 inch shielded leads (Supplied S Size only).

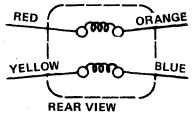
"-R-4U", standard rear mount and 4 inch unshielded leads (Supplied S Size only).

For "B" style erase heads, mounts are the same as for R/P heads.

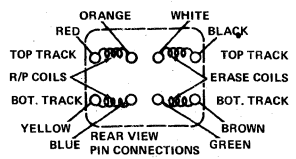
ERASE HEADS			
TRACK SYSTEM	4-TRACK		
NORTRONICS BASIC MODEL NO.	MONO — MEQ STEREO — SEQ; B2EQ		
ELECTRICAL CODE	1	2	4
Inductance, 1 KC	80 MHY	0.13 MHY	10 MHY
Resistance, D.C.	240 Ω	1.8 Ω	38 Ω
†Erase Cur. Oper.	5 MA	120 MA	13 MA
Impedance, 60 KC	30 K	40 Ω	3 K
Volt., 60 KC RMS	120 V	5 V	40 V

† For 56 DB erasure of Saturated Tape.

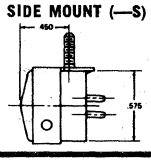
STEREO R/P



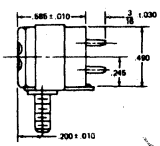
STEREO COMBO



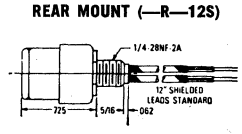
SIDE MOUNT (—S)



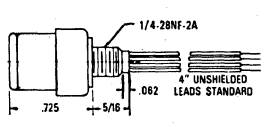
BASE MOUNT (—B)



REAR MOUNT (—R—12S)

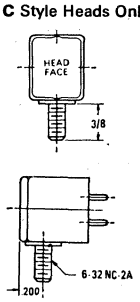


REAR MOUNT (—R—4U)



(Base Mount—B3)

G or C Style Heads Only



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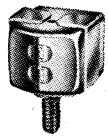
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

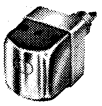
GENERAL PURPOSE TAPE HEADS
2 track heads for ¼″ tape



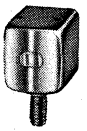
2-Tr. Stereo B2H-B (Base Mount)



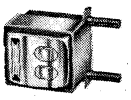
2-Tr. Mono B1HY-N (No Mount)



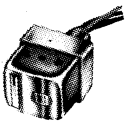
2-Tr. Mono G1H-R (Rear Mount)



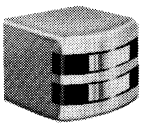
2-Tr. Mono G1HY-B3 (Base Mount)



2-Tr. Stereo Combo A2H-SR (Side Mount)



2-Tr. Mono Combo A1HC-R (Rear Mount)



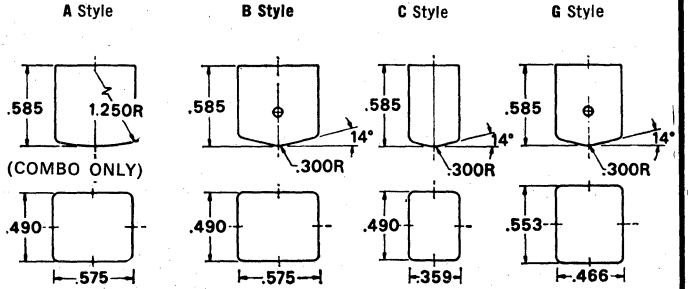
P-B2H SERIES
Premium series R/P heads, widely used in reel to reel and cartridge applications. Typical usage configuration is with one channel for program, the other for control tones. All metal face insures maximum shielding. B case to fit all mounting accessories.

BASIC MODEL NUMBER	2-TRACK (.080 INCH TRACK WIDTH) MONO — B1HY, G1H, G1HY, A1HC STEREO — B2H, A2H (See opposite page for PR-B2H series)								2 Track STEREO Z-J2H
ELECTRICAL CODE	8R	4R	8K	4K	6K	7K	7F2	2K	46K
HEAD FUNCTION	Duplicating Record	Record Only	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	Record/ Playback	ERASE
TYPE OF CIRCUIT	Tubes/ Transistors	Tubes/ Transistors	Transistors	Transistors	Transistors	Tubes/ Transistors	Tubes/ Transistors	Tubes	R/P Section Data
Inductance, 1 KC	10 MHY	50 MHY	20 MHY	100 MHY	200 MHY	400 MHY	450 MHY	800 MHY	200 MHY
Impedance, 1 KC	72 Ω	320 Ω	150 Ω	650 Ω	1.3 K	2.5 K	3.3 K	5 K	1.3 K
Maximum Bias Frequency	500 KC	200 KC	250 KC	150 KC	100 KC	100 KC	80 KC	60 KC	100 KC
Resistance, D.C. Mono	14 Ω	70 Ω	14 Ω	70 Ω	110 Ω	165 Ω	165 Ω	400 Ω	—
Resistance, D.C. Stereo	27 Ω	130 Ω	27 Ω	130 Ω	245 Ω	410 Ω	410 Ω	720 Ω	260 Ω
Gap Spacer	0.5 MIL	0.5 MIL	0.1 MIL	0.1 MIL	0.1 MIL	0.1 MIL	0.05 MIL	0.1 MIL	0.1 MIL
Track Spacing Stereo	.160 INCH	.160 INCH	.160 INCH	.160 INCH	.160 INCH	.160 INCH	.160 INCH	.160 INCH	.160 INCH
1 KC Crosstalk Rej.	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB	55 DB	50 DB
For "WP" AND PREMIUM — Average 7.5 IPS Constant Current Record/Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.									
Peak Bias Current, 60 KC	1.7 MA	0.70 MA	2.0 MA	0.80 MA	0.40 MA	0.33 MA	0.46 MA	0.25 MA	*30 MA
Bias Voltage RMS, 60 KC	3.3 V	9 V	7.5 V	20 V	30 V	40 V	55 V	55 V	*40 V
Record Current	200 UA	75 UA	220 UA	80 UA	60 UA	40 UA	46 UA	30 UA	UA
1 KC Output	—	—	0.7 MV	1.2 MV	1.8 MV	2.4 MV	2.2 MV	3.6 MV	MV
10 KC/1 KC Ratio	—	—	0 DB	0 DB	+1 DB	+1 DB	+2 DB	+1 DB	−3 DB
For "WP" AND PREMIUM — Average 3.75 IPS Constant Current Record/Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.									
Peak Bias Current, 60 KC	1.5 MA	0.60 MA	1.8 MA	0.70 MA	0.30 MA	0.22 MA	0.37 MA	0.20 MA	*80 MA
Bias Voltage RMS, 60 KC	2.8 V	8 V	6.5 V	15 V	25 V	30 V	45 V	40 V	*35 V
Record Current	180 UA	60 UA	200 UA	66 UA	45 UA	30 UA	37 UA	22 UA	40 UA
1 KC Output	—	—	0.6 MV	0.9 MV	1.2 MV	1.8 MV	1.5 MV	2.5 MV	1.2 MV
10 KC/1 KC Ratio	—	—	−10 DB	−10 DB	−9 DB	−9 DB	−7 DB	−9 DB	−12 DB
For Standard Heads — Average 7.5 IPS Constant Current Record/Playback Characteristics Using 3M190 Tape (3M111 Within 5%) Peak Biased at 1 KC and Recorded 12 DB Below Tape Saturation.									
Peak Bias Current, 60 KC	—	—	—	1.1 MA	0.80 MA	0.6 MA	—	0.4 MA	ERASE SECTION DATA
Bias Voltage RMS, 60 KC	—	—	—	20 V	30 V	45 V	—	65 V	INDUCTANCE @ 1 KC
Record Current	—	—	—	80 UA	60 UA	40 UA	—	30 UA	0.9 MHY
1 KC Output	—	—	—	1.1 MV	1.7 MV	2.2 MV	—	3.4 MV	ERASURE
10 KC/1 KC Ratio	—	—	—	−4 DB	−3 DB	−3 DB	—	−3 DB	50 DB

* Provides internal bias coupling from erase to R/P section. Bias data above is fed to erase section.

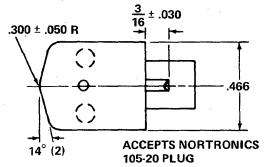
Specifications Subject to Change Without Notice.

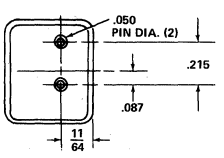
CASE OUTLINE STYLES



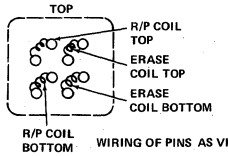
SPECIAL CASE STYLES AVAILABLE—CONSULT NORTRONICS

NO MOUNT (—N) MONO R/P
G CASE





ZJ2H



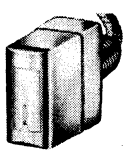
WIRING OF PINS AS VIEWED FROM REAR OF HEAD

Nortronics
COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

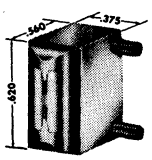
GENERAL PURPOSE TAPE HEADS

2 track heads for ¼" tape

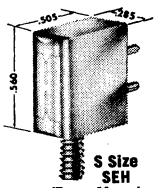
BASIC MODEL NUMBER	PROFESSIONAL — PRB2H 2 TRACK (.080 INCH TRACK WIDTH)				
ELECTRICAL CODE	8R	4R	11R	7K	12L
HEAD FUNCTION	Record Only	Record Only	Record Only	Record/ Playback	Playback
Inductance, 1 KHz	10 MHY	50 MHY	4.5 MHY	400 MHY	700 MHY
Impedance, 1 KHz	68 Ω	320 Ω	33 Ω	2500 Ω	4400 Ω
Resistance, D.C.	24 Ω	130 Ω	15 Ω	410 Ω	570 Ω
Gap Spacer	.5 MIL	.5 MIL	.5 MIL	.1 MIL	.160 MIL
Track Spacing	.160	.160	.160	.160	.160
1 KHz Crosstalk Rej.	55 DB	55 DB	55 DB	55 DB	55 DB
For **PROFESSIONAL HEADS** — Average **7.5 IPS** Constant Current Record/Playback Characteristics Using 3M 201 Tape, Peak Biased at 1 KHz and Recorded 12 DB Below Tape Saturation.					
Peak Bias Current, 60 KHz	3.3 MA	0.7 MA	5.8 MA	.33 MA	—
Bias Voltage RMS, 60 KHz	14 V	9 V	18 V	40 V	—
Record Current	.190 MA	.075 MA	.360 MA	.040 MA	—
1 KHz Output	—	—	—	2.4 MV	2.9 MV
10 KHz/1 KHz Ratio	—	—	—	+1 DB	+3 DB



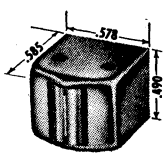
S Size
MEH
(Rear Mount—R—12S)



L Size
(Side Mount—S23)



S Size
SEH
(Base Mount—B3)



B Style
(No Mount—N)

ERASE HEADS

TRACK SYSTEM — 2-TRACK

NORTRONICS BASIC MODEL NO.	MONO — MEH STEREO — SEH; B2EH			STEREO — PRB2EH	
ELECTRICAL CODE	1	2	4	14	4
Inductance, 1 KC	50 MHY	0.20 MHY	8 MHY	.225 MHY	5.5 MHY
Resistance, D.C.	160 Ω	1.8 Ω	30 Ω	3.6 Ω	30 Ω
†Erase Cur. Oper.	6 MA	120 MA	20 MA	70 MA	17 MA
Impedance, 60 KC	20 K	50 Ω	2 K	85 Ω	2 K
Volt., 60 KC RMS	120 V	6 V	40 V	6 V	34 V

† For 56 DB Erase of Saturated Tape.

PR SERIES

- Sets a new standard for high performance magnetic heads.
- Unexcelled response from 20 HZ to 20KHZ.

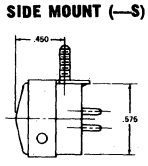
Professional series R/P heads. Designed especially for long wave length response with extra wide pickup poles, smooth response characteristics are obtained to below 20HZ. Fine precision lapped laminated core stacks and deposited gaps extend short wavelength response. Extra deep deposited quartz gap.

All Nortronics erase heads have efficient double-gap construction plus metal faces and cases for superior heat transfer. They will operate effectively at erase frequencies up thru 100 kc, and also on d.c. **Two low-cost standard case sizes, "L" and "S,"** in the various mounting styles as illustrated to the right and indicated below. All erase models are also available in the B-case style to match the r/p heads; example, B2EQ4-N which is identical electrically to the SEQ4.
Erase heads are shown with various mounts, but all are available in your choice of **base, side, rear** or **no mount.**

To determine erase model number, select a basic model number, add the erase electrical code, add a dash (—) and add mounting designator (below). Following are typical examples:
MEH1-S23U, 2-track (half track) mono erase head, No. 1 erase electrical code, "L case," **side mount, track up** (studs are to **left**).
Erase Mounting Designator follows model number in this fashion:
For "B" style erase heads, mounts are the same as for R/P heads.

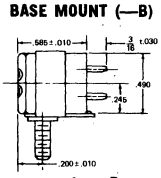
"SEH2-N9", no mount (S Size)
"-N", no mount (L Size)
"-B3", standard base mount (Supplied S Size only). For mono heads, add a U for up or D for down after the B3 to denote track up or track down.
"-S23", standard side mount (Supplied L Size only). For mono heads, add a U for up or a D for down after S23 to denote track up or track down.
"-R-12S", standard rear mount and 12 inch shielded leads (Supplied S Size only).
"-R-4U", standard rear mount and 4 inch unshielded leads (Supplied S Size only).

SIDE MOUNT (—S)



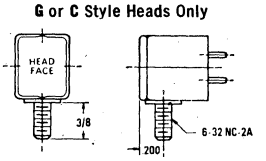
L or **R**
Combo erase on left or right side
U or **D**
Mono track up or down

BASE MOUNT (—B)



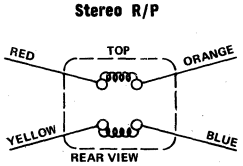
L or **R**
Combo erase on left or right side
U or **D**
Mono track up or down

BASE MOUNT (—B3)
G or **C** Style Heads Only

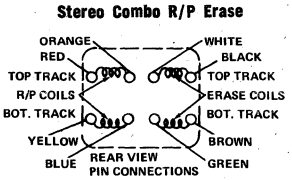


U or **D**
Mono track up or down

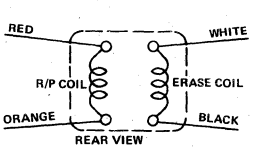
Stereo R/P



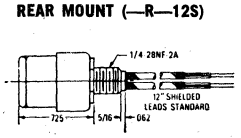
Stereo Combo R/P Erase



Mono Combo



REAR MOUNT (—R—12S)



S Size
W/12" Leads
(—R—40) W/4" Leads (unshielded)

Nortronics COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

ACCESSORIES

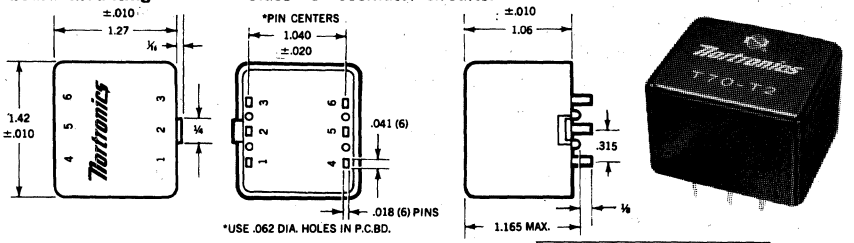
BIAS OSCILLATOR TRANSFORMERS

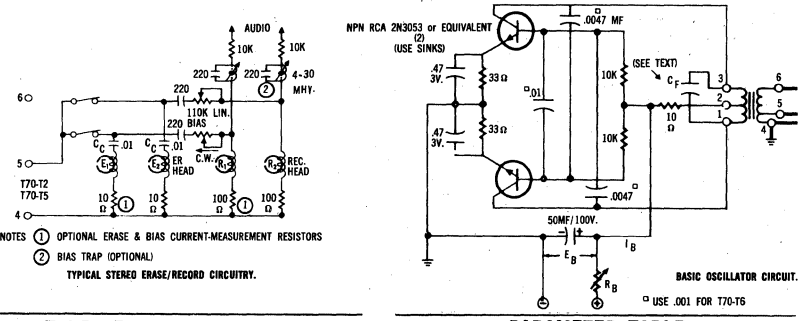
TO DRIVE RECORD AND ERASE HEADS

- Heavy-duty Ferrite E-core construction assures minimum external magnetic field.
- High efficiency, high Q, clean waveform, and good voltage regulation.
- Wide frequency and voltage range.
- Output voltage at secondary of transformer may be varied by adjustment of the D.C. power supply voltage to the oscillator.
- Power handling up to 3 watts.

T-70 SERIES

- Pin terminals provide for plug-in and soldering
- Nylon case measures 1¼" x 1½" x 1⅛"
- **for printed circuit board mounting**
- May be used with standard transistor push-pull or single-ended Class "C" oscillator circuits.





T70-T2 ERASE OPERATION

Frequency ER. V. RMS	EB D.C. Volts	SEC. Taps	CC MF.
60 KHZ.	20 V.	4 - 5*	.01
40 V.A.C.	15 V.	4 - 5	.002
	10 V.	5 - 6	.01
80 KHZ.	25 V.	4 - 5*	.01
50 V.A.C.	20 V.	4 - 5	.002
	13 V.	5 - 6	.01
100 KHZ.	30 V.	4 - 5*	.0047
60 V.A.C.	25 V.	4 - 5	.002
	18 V.	5 - 6	.0047

* Preferred

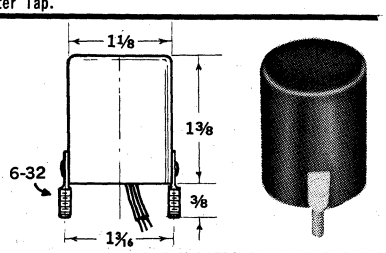
PARAMETER TABLE

	T70-T2	T70-T5	T70-T6
Pri. Induct. (1-3)	130 UHY.	60 UHY.	18 UHY.
Pri. D.C. Res. (1-3) Ohms	0.35	0.2	0.06
Sec. D.C. Res. (4-6) Ohms	15	0.3	0.22
Turns Ratio (1-3):(4-5)	1:15	1:0.5	—
Turns Ratio (1-3):(5-6)	1:3	1:1	—
Turns Ratio (1-3):(4-6)	1:45	1:15	1:1.67
*Out Volts (4-5)	40 V.	12 V.	—
*Out Volts (5-6)	80 V.	24 V.	—
*Out Volts (4-6)	120 V.	36 V.	50 V.
Tun. Cap. CF (60 KHZ.)	.047	—	—
Tun. Cap. CF (100 KHZ.)	.015	.038	—
Tun. Cap. CF (150 KHZ.)	—	.016	—
Tun. Cap. CF (250 KHZ.)	—	.0047	.033
Tun. Cap. CF (500 KHZ.)	—	—	.0075

*No Load RMS Oscillator Voltages with 20 Volt D.C. Supply Output Voltage is Directly Proportional to D.C. Supply Voltage at Transformer Center Tap.

T-60 SERIES for chassis mounting

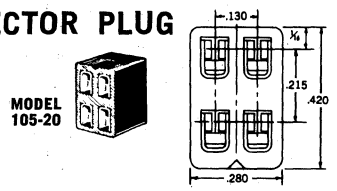
- Color coded leads, anodized aluminum case (1⅛" diameter, 1⅜" high)
- Two 6-32 x ⅜" spade lugs
- Units for transistor and vacuum tube applications



Model Number	Circuit Type and Mount	Application	Typical Operating Frequency (KHz)	Secondary Voltage (RMS)	Compatible Nortronics Heads
T70-T2	Transistor, PC Board	General Purpose	50-120	40, 80, 120	No. 4 & No. 1 Erase
T60-T2	Transistor, Can & Lug	General Purpose	60-110	40, 80, 120	No. 4 & No. 1 Erase
T70-T6	Transistor, PC Board	Duplicating	230-500	70	Drives 10 No. 8R Record
T60-T6	Transistor, Can & Lug	Duplicating	230-500	70	Drives 10 No. 8R Record
T70-T5	Transistor, PC Board	Professional	150-200	—	PR Series Erase
T60-E	Vacuum Tube, Can & Lug	General Purpose	40-70	7 & 120	No. 2 & No. 1 Erase
T60-F	Vacuum Tube, Can & Lug	General Purpose	60-100	60 & 150	No. 4 & No. 1 Erase

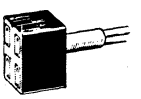
Table and circuit list the various methods of operation for the T70-T2 oscillator circuit, to obtain power for Nortronics #4 erase heads, at three different frequencies.

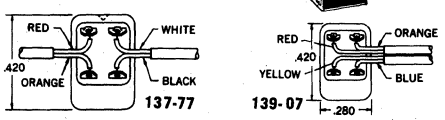
CONNECTOR PLUG



4-Pin Black Phenolic Plugs permit instant connection to all 4 pins of Stereo Heads and 2 pins of Mono Heads. **105-20** plug is for all Nortronics heads except BQQ, P-B3Q and P-BQL.

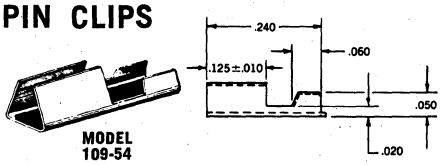
PLUG & CABLE ASSEMBLY





Assemblies ready to plug onto Head Terminal Pins. Consist of proper plug and two shielded cables (nominal length 18" each). **139-70** is used with all Nortronics stereo heads, with cable pairs connected to the upper pair of pins and lower pair of pins. **139-77** is used with Nortronics mono-combo heads, with cable pairs connected to the right pair of pins and left pair of pins.

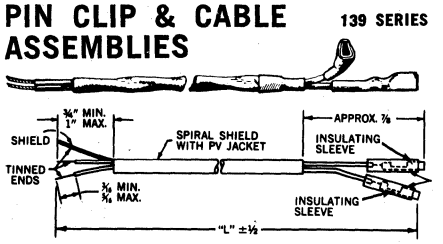
PIN CLIPS



The **109-54** is a gold plated beryllium copper push-on clip formed to fit the terminal pins of all Nortronics heads. Lead wires may be soldered easily to the small end of the clip, leaving the larger end open to push on to the terminal pins. Pin clips permit ready attachment or removal of leads to terminals of heads, and also eliminate damage to head caused by soldering leads directly to pins.

PIN CLIP & CABLE ASSEMBLIES

139 SERIES



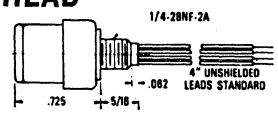
Provided to make neat and simple electrical connections to the terminal pins of Nortronics heads. Two conductor (No. 26) shielded wire insulated with vinyl jacket, with 109-54 pin clips. Available in 2 lengths, 4 color combinations:

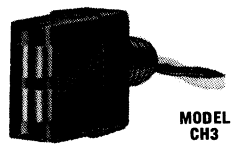
	9 inch	24-inch
Red-Orange	139-55	139-78
Yellow-Blue	139-56	139-79
White-Black	139-57	139-80
Red-Black	139-58	139-81

Nortronics COMPANY, INC.
8107 Tenth Avenue North, Minneapolis, Minnesota 55427

ACCESSORIES

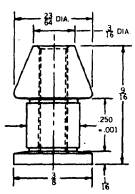
CONTACTOR HEAD

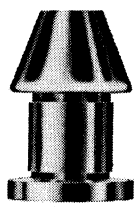




Use with metal-foil cueing to operate relay. Has two isolated contactor shoes. Model CH3-R-4U has rear mount and 4" leads. Model CH3-N9 is no-mount small-case size. CH3-B3 is base mount.

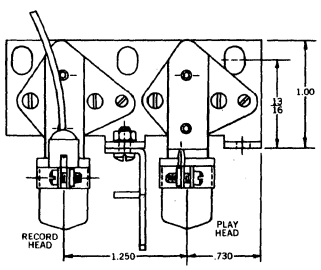
TAPE GUIDE POST

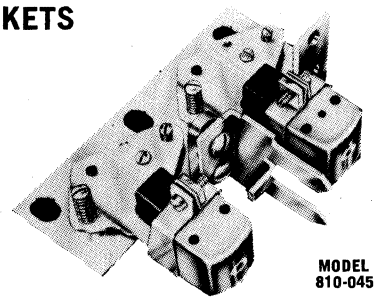


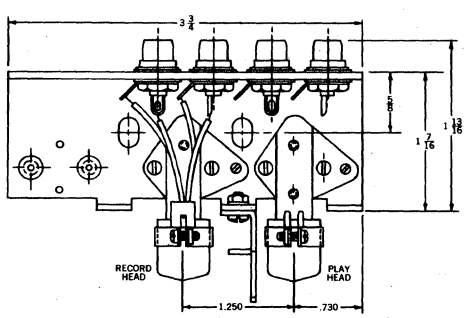


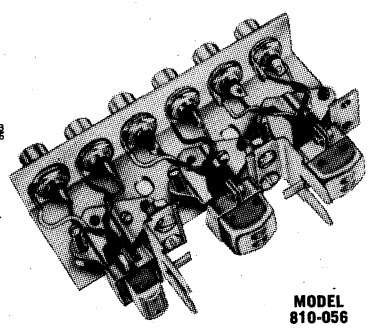
A universal precision-made guide post for ¼" tape — may readily be mounted to control the path of tape travel. Chrome plated brass insures long life and friction-free operation. Height is readily adjustable by loosening the locking set screw and rotating the threaded post.

CARTRIDGE MOUNTING BRACKETS









Unique head mounting assembly for endless loop cartridge tape handlers (Fidelipac and Viking types). Eliminates awkward mounting and adjustment problems of rear-mount style heads. Offers "Micrometer" adjustments of head height, azimuth, and face perpendicularity. Lock screw on each head bracket "freezes" adjustments.

Heads fastened to bracket with quick-release screw clamp. Replacement time is a matter of seconds when heads are connected with plug and cable assemblies provided with kits.

#810-045 "B" Cartridge-Mount Kit. Up to three heads may be mounted on this assembly, using two no-mount R/P heads of the "A" or "B" size. A small case erase head may be added in the third position on the channel base by means of a #810-044 head bracket. Kit supplied unassembled, includes base channel, four jacks, two #810-042 brackets for the R/P or Combo heads, one #173-16 tape guide fork, and two plug and cable assemblies.

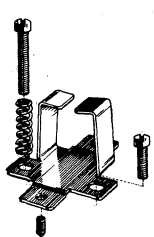
#810-046 "G" Cartridge-Mount Kit. As above, but with two #810-043 brackets for "G" or "T" size mono R/P heads.

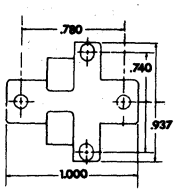
#810-055 "B" Two Head Cartridge-Mount Kit. Accommodating two no-mount R/P heads of "A" or "B" size. Vertical back rail and jacks have been eliminated. Connection to the heads may be made by use of the 18" shielded plug and cable assemblies (provided).

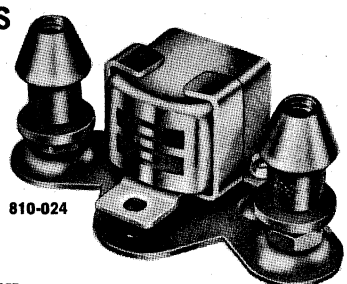
#810-056 "G" Two Head Cartridge-Mount Kit. As above, but with #810-043 brackets "G" or "T" size mono R/P heads.

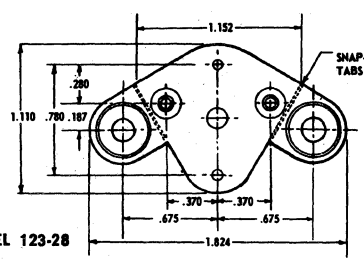
#173-17 Brake-Release Guide — for larger Viking metal cartridges.

UNIVERSAL MOUNTING BRACKETS

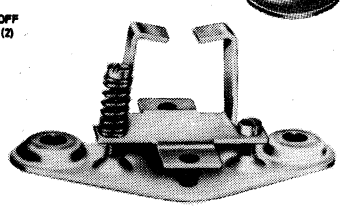








SUB PLATE MODEL 123-28



Designed for simplified mounting plus ease in adjustments.

These universal head mounting brackets provide for convenient adjustment of head azimuth height and tilt. Heads are easily snapped in and out of brackets, which are accurately positioned by means of "Micrometer" adjustment screws. Brackets are made of cadmium-plated steel and are supplied with mounting screws and spring—and can be combined with other Nortronics accessories to make various mounting assemblies.

#810-024 Head Nest. Includes bracket, guide posts and mounting plate for "A" and "B" Heads.
#810-027 Bracket. For "A", "B",, and "E" style no-mount heads.
#810-028 Bracket. For "G" size heads.
#810-041 Bracket. For small-case no-mount erase heads.

Shallco HIGHWAY 301 SOUTH • SMITHFIELD, NORTH CAROLINA 27577 • (919) 934-3135

SHALLCO, INC. was established to provide a modern, capable source of AUDIO and R. F. ATTENUATORS, DELAY LINES and related devices. All designs, tools and "know-how" for these products was acquired from the Shallcross Manufacturing Company and located in specially arranged facilities for the efficient designing and production of this class of product. In addition, all areas of activity have been up-dated with new designs, equipment and tooling. A dynamic organization is now ready to serve the industry.

PRECISION AUDIO ATTENUATORS

APPLICATIONS

SHALLCO Precision Audio Attenuators for industrial, commercial and military usage are ideal for applications where circuitry demands precision and highest reliability.

STOCK TYPES

SHALLCO attenuators are available in both variable and fixed units. There are four rotary models of 10, 15, 20, or 30 steps . . . linear or tapered . . . with attenuation as small as 0.1 db per step, plus one slide-type attenuator of 10 to 30 steps. "Cue" positions are available on all SHALLCO attenuators. Circuit types include Ladder, Balanced Ladder, T, Bridged T, Potentiometer, and Dual Potentiometer.

DESIGN FEATURES

Advanced design of SHALLCO Attenuators results in extreme accuracy, with resistor tolerances ranging from ±½% to ±5% depending on specifications and types indicated. The new design employs: a minimum of machined parts, resistive elements continuously wound on a one-piece card, stops and detents (where specified) mounted inside front hub. Operation is incredibly smooth and noise free, and maintenance requirements are minimal.

ELECTRICAL CONSIDERATIONS

Frequency Response: Precision winding and the efficient use of highest quality materials assure flat frequency response throughout the entire audio range and a usable response to over 200 KC.

Noise Level: 130 db or better below zero level.

Impedances: All standard impedances. "Custom" impedances tailored to special order.

RELIABILITY

The highest degree of Electrical and Mechanical reliability is assured through SHALLCO's multiple in-process and final inspections. Conformance with published specifications is guaranteed.

PRICING

You'll appreciate SHALLCO pricing. Twenty-five years of experience, ultra-modern equipment, innovations in design and production methods, and the efficient use of materials . . . all combine to offer you the world's finest precision audio attenuators at lowest possible cost. SHALLCO is pleased to pass these savings along to you.

SERVICE

Jet-quick "off-the-shelf" delivery of standard components is assured by SHALLCO's computer-modern shipping system.

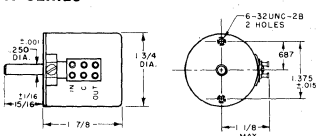
ORDERING INFORMATION

Ordering information should include:

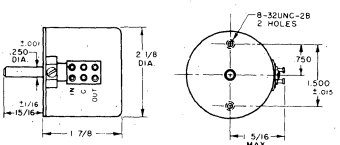
1. Size (See outline drawings).
2. Type of circuit (Ladder, Bridged T, Potentiometer, etc.).
3. Number of steps; with or without detent and cueing.
4. DB per step.
5. Attenuation characteristics (Linear attenuation with CCW shaft rotation, no "off" position, etc.).
6. Mounting per outline drawing or single hole (⅜-32 bushing) with length.
7. Number of gangs (4 gangs maximum).
8. Impedance input and output in ohms.
9. Shaft details when different from outline drawings.
10. Any special frequency requirements.
11. Knobs and dials supplied only when specified.

VARIABLE AND FIXED ATTENUATORS

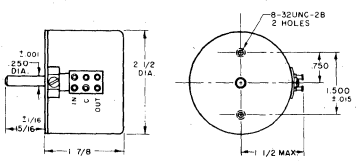
A SERIES



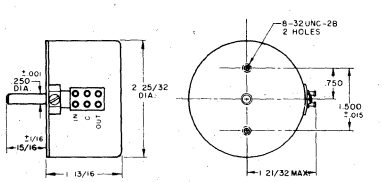
B SERIES



C SERIES



D SERIES



	Type	No. of Steps	DB/ Step	Contact Spacing	Taper & Detent
LADDER	120-2A3	20	2.0	15°	With Or
DUAL LADDER	130-1.5A3	30	1.5	11¼°	Without
	2-120-2A3	20	2.0	15°	
	Impedances available 600/600, 300/600, 500/500, 150/600, 250/500, 300/300, 150/300, 250/250, 200/200, 125/125, 75/75, 50/100, 50/50, 30/60, 30/30				
POTENTIOMETER	720-2A1	20	2.0	15°	With Or
	730-1.5A3	30	1.5	11¼°	Without
	Impedances available 1,000, 2,500, 5K, 10K, 25K, 50K, 100K, 250K, 500K & 1.0 Megohm — Other impedances, specify				
BRIDGED T	410-1A2	10	1.0	15°	With Or
	415-2A1	15	2.0	11¼°	Without
	410-4B1	10	4.0	15°	With Or
BRIDGED T	420-2B1	20	2.0	15°	
	430-2B1	30	2.0	11¼°	Without
BALANCED H	2-430-2B1	30	2.0	11¼°	
	Other attenuation/step available, 1.0 db, 0.1, 0.2, 0.5, 1.5, 3.0, 5.0. Specify if other desired.				
BALANCED LADDER	220-2B3	20	2.0	15°	
DUAL POTENTIOMETER	820-3B1	20	3.0	15°	
	810-2B1	10	2.0	15°	
BALANCED LADDER	230-0.1C4	30	0.1	15°	With Or
	230-1.5C3	30	1.5	11¼°	Without
POTENTIOMETER	745-1D1	45	1.0	7½°	
BRIDGED T	445-1D1	45	1.0	7½°	

Also available — VU Meter Multiplier Networks, Decade Audio and Radio Frequency Attenuators, Impedance Matching Networks, Video Variable Attenuators. Special impedances or decibel steps other than those shown are available.

TRIMM INC.

HEADSETS ACOUSTIC PRODUCTS

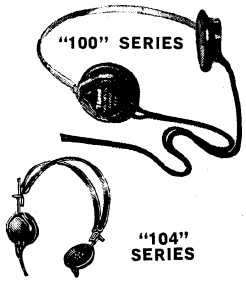
TRIMM headsets, acoustical items and related accessories are the result of over 47 years continuous production of these products. A selection of the many basic magnetic types available are listed on this page. In addition there are numerous special types originally developed to fill specific commercial or military requirements. TRIMM is your headquarters for all types and varieties of headsets and related components. Request BULLETIN AC-1A for additional information. (See also SECTION 2100 page 996 for TRIMM jacks, plugs, panels, patch cords, terminal blocks and coaxial products.)



"L" SERIES—Extended frequency range magnetic type headset. Available in an assortment of ohmages in both double and single earphone styles, as well as with different types of headbands, cords, and plugs. Recommended for use in language and other educational training systems, broadcast monitoring, and high quality communication work.



FEATHERWEIGHT — Commercial "100" and "104" Series are the two best known lightweight headsets. Available in a wide range of ohmages, in both double and single earphone styles with various types of headbands, cords and plugs. Recommended for commercial communication use, amateur radio and electronic testing.



DEPENDABLE — The original TRIMM headset manufactured continuously for over 47 years. Available in all the standard ohmages in both double and single earphone styles. Used on centralized radio systems, electronic organs, for low cost language and educational labs, and code training.



REX — Lowest cost TRIMM bi-polar lightweight type headset. Available in standard ohmages in both double and single earphone styles. Used extensively in low cost teaching systems, institutional radio systems, electronic organs, educational code teaching units and similar low cost applications requiring better performance than the ACME line.



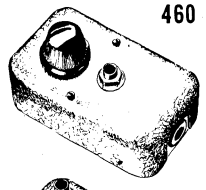
ACME — The best known American built low cost headset. Available in standard ohmages in both double and single earphone styles. Widely used on educational toys, low cost Geiger counters, crystal sets and a variety of industrial applications where cost is a major factor.

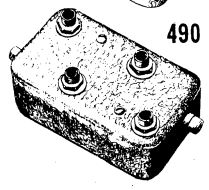


GROUP LISTENING AIDS

SINGLE EARPHONES—There are two basic types of earphones for group hearing aid use. The lorgnette handle type for churches and mortuaries; and the headband type for theatres and auditoriums. The Featherweight and "L" models are available for this application.







CONTROL AND OUTLET BOXES —Numerous types, some containing volume control and jack, others just jacks, and still others with selector switches, jacks, or volume controls. Basic box 3¾x2½x1¼" with rounded edges and corners. Used in group hearing aid and centralized radio systems, language labs and stereo control systems.

PILLOWPHONE—With these TRIMM units acting as a personal loudspeaker, radio, TV, tape recorder, or phonograph can be enjoyed without disturbing others. Has gray vinyl cord, plugs, and shell with stainless steel cap. Complete unit is waterproof and may be readily cleaned with disinfecting solution.

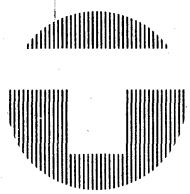


ALL OF THE ABOVE HEADSETS AVAILABLE IN BOTH MONAURAL AND STEREO MODELS

DYNAMIC TYPES — Hi-Fi and educational types available by requesting special bulletins on these headsets.

REPLACEMENT PARTS — We provide a complete line of replacement parts for our products plus cords for competitive and special products.

Manufacturers of Precision Electronic Instruments and Components since 1922.



TRIMM INC.

400 WEST LAKE STREET
LIBERTYVILLE, ILLINOIS 60048
Phone (312) 362-3700

Southern California Factory Sales Office
1226 S. ATLANTIC BLVD.
LOS ANGELES, CALIFORNIA 90022
Phone (213) 261-9176

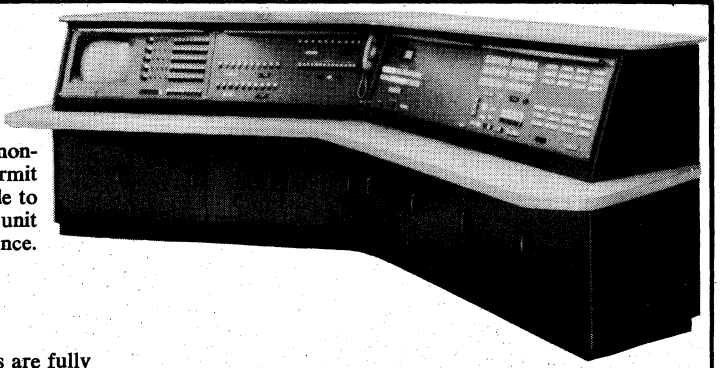
Amco has a complete line of standard or styled enclosure systems...

Standard Amco Enclosure Lines . . .

fast delivery!

styling!

Custom enclosures have non-structural exteriors that permit units up to five frames wide to have a one-piece, single unit appearance.



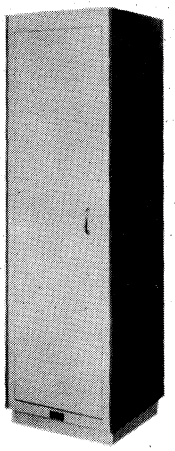


strength!

Semi-Custom enclosures are fully gusseted for superior strength and conformance to Mil-E-5772C shock and vibration requirements.

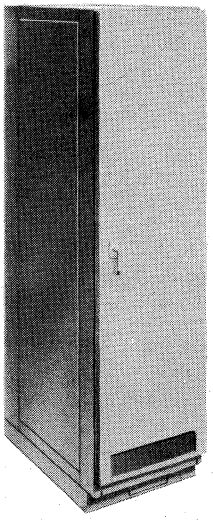
versatility!

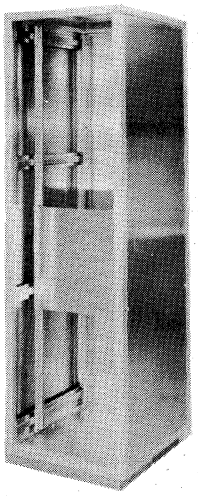
FJ enclosures offer economy, versatility and off-the-shelf delivery for a wide variety of applications. These units are ideally suited for back-up equipment where conformance to rigid environmental specifications is not required.



E. M. I.!

E.M.I. enclosures provide complete radiation protection in excess of E.M.I. MIL-STD 285. Amco pioneered modular E.M.I. enclosures and offer the most complete line.

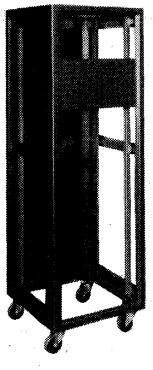




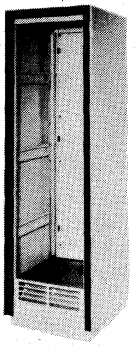
economy!

Heavy-duty aluminum enclosure system that you can assemble from a wide variety of corner castings, extruded square tubing and panels. Special locking clips eliminate the need for assembly tools. Continuous sections from 6 in. to 20 ft. with angles or slopes to 90° are possible.

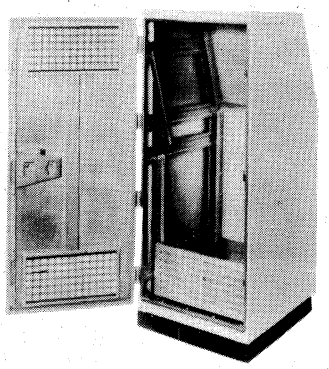
Styled Aluminum Enclosure



Styled FJ Enclosure



Styled E.M.I. Enclosure



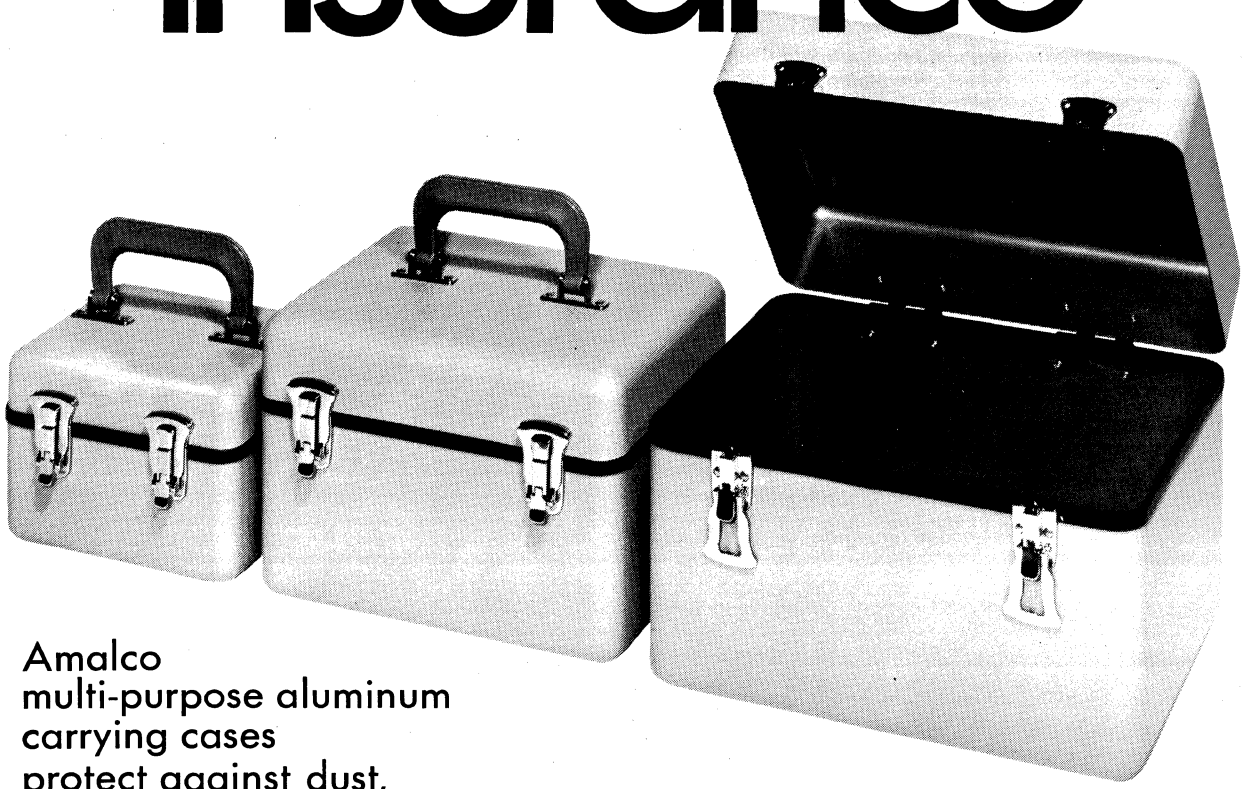
Before and after styling. Just an example of Amco's design approach for unique identification. Both the enclosures and styling are modular which permits a complete range of design possibilities to meet the most stringent structural needs or the most unique styling moods.

Amco Engineering Co.

Amco ENGINEERING CO.

7333 W. Ainslie St. • Chicago, Ill. 60656
Phone: (312) UN 7-8500 • TWX: 910-221-5192

Light weight insurance



Amalco multi-purpose aluminum carrying cases protect against dust, sprays, rust and vibration

Economical, light in weight, rugged, AMALCO Deep Drawn Aluminum Carrying Cases are ideal for hundreds of industrial uses including electronic instrument cases, precious mechanical instrument cases, scientific instruments, photographic equipment and more. Their sturdy seamless construction includes a tight neoprene gasket, protective chromate treatment inside, plated hinges and others. Eleven standard sizes available for immediate delivery. Special sizes to comply with MIL-C-4150F can be produced to your specifications.

Part No.	W	L	H1	H2	ICR	Gauge
727-40	5	7	5	3 13/32	7/16	064
727-50	5 1/2	7 3/4	5 1/2	3 29/32	7/16	064
727-60	6	8 1/2	6	4 5/32	7/16	064
727-70	6 1/2	9 1/4	6 1/2	4 21/32	7/16	064
727-80	7	10	7	4 29/32	9/16	064
727-90	7 1/2	10 5/8	7 1/2	5 5/32	9/16	064
727-100	8	11 3/8	8	5 21/32	9/16	064
727-110	8 1/2	12	8 1/2	5 29/32	9/16	064

Write Dept. EEM

AMERICAN ALUMINUM COMPANY

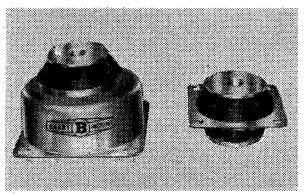
Manufacturer of Aluminum Products for Industry Since 1910
230 Sheffield St., Mountainside, N. J. 07092
Phone (201) 233-3500

CONTROL
Shock and Vibration

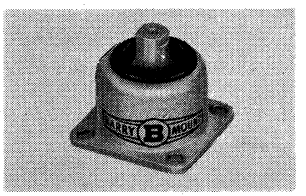
We have a wide range of standard products for controlling shock and vibration effectively, and most of them meet or exceed MIL Specs. They are available off the shelf. Non-standard products to meet special needs are routine with us.

For unusual or critical applications we provide design, development, and testing services that are backed by over 20 years of experience and staffed with specialists.

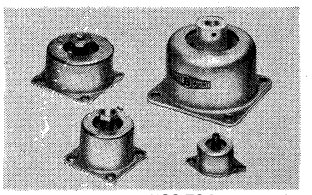
STANDARD UNIT ISOLATORS:



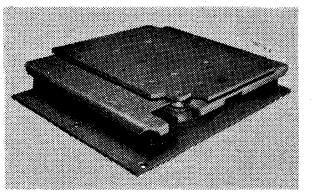
Isolator—series 5200 protects and isolates equipment from shock and vibration in all directions; load ratings from 7 to 50 lbs. per mount.



Isolator—series H44 and H64 for helicopters and similar applications. 14 sizes, ¼ to 40 lbs. per mount. Low natural frequency, low transmissibility.

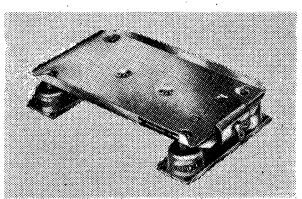


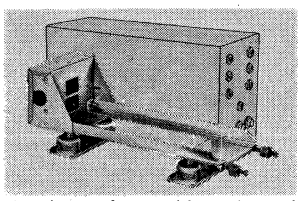
Isolator—series T22-T94 are all-angle mounts using Barry HI-DAMP® elastomer for high isolation efficiency and excellent resistance to harsh environments. For use in aircraft, shipboard, or ground vehicle applications. Four sizes, loads from 1.0 to 150 lbs. per mount.



Isolation Systems — series 2K-S. Provides excellent protection from **both** shock and vibration for shipboard or mobile electronic equipment.

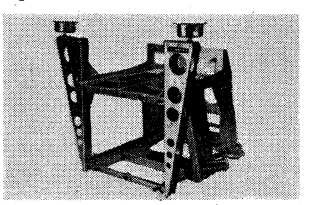
Standard Mounting Bases:

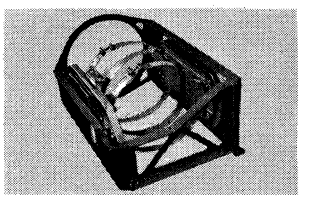




A complete line of MS and ATR mounting bases for a wide variety of aircraft electronic equipment.

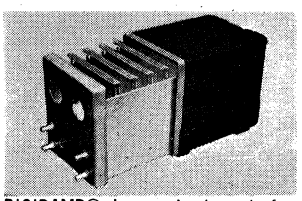
Special Mounting Bases:

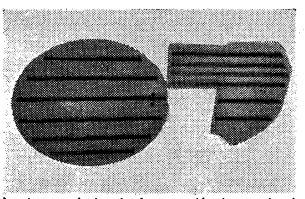




Designed and developed to match your requirements. Prototype or production quantities. Our testing lab will prove efficient performance.

Structural Damping:

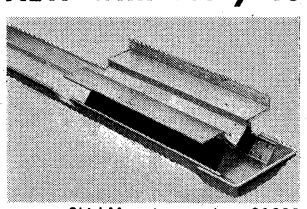




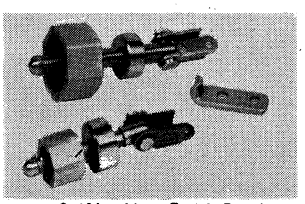
RIGIDAMP® is our trademark for products and techniques that control vibratory response in structures. Available built-in or in add-on form to add damping to any structural material.

Barry Controls is a one-stop source to solve **all** your shock and vibration problems. Shown here is only a representative sampling of our products and services. For a broader picture, ask for a copy of our latest Product Digest.

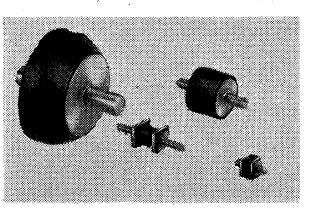
NEW with Barry Controls:

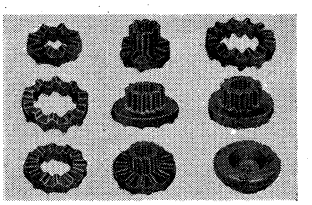


. . . Skid-Mounts—series 91200 are shock-attenuating devices to protect para-dropped electronic equipment shelters from free-fall impact or while being dragged over rough terrain. Fully proven, low cost, reuseable.



. . . Self-Locking Front Retainers eliminate safety-wiring and provide a quick, fail-safe means of clamping electronic "black boxes" to equipment racks or mounting bases. Meets all applicable specs. and NAS573.





For appliances, office equipment, vehicles, industrial applications, etc. there are many other configurations of mountings featuring low unit cost, high-volume manufacture, and consistent quality.

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A Division of Barry Wright Corporation BW

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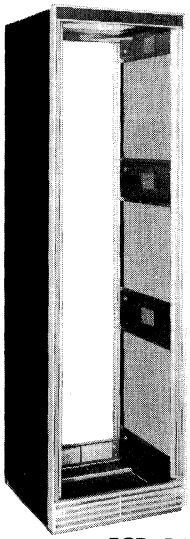
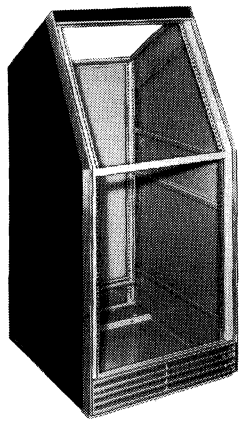
CABTRON MODULAR ELECTRONIC CABINETS

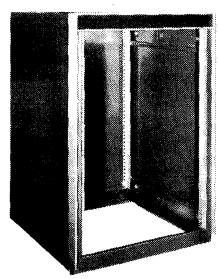


FCB RACK

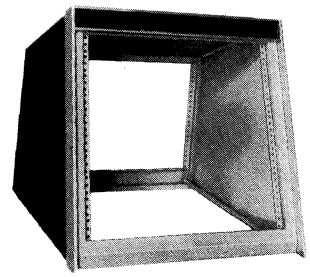


FCC. CONSOLE

"C" SERIES CABINETS
ONE OF SIX STYLES

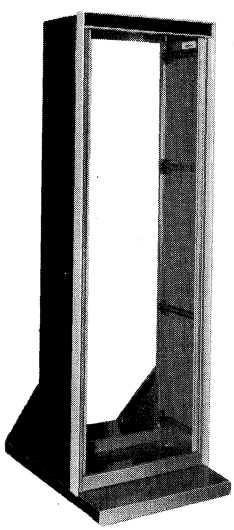


FCA BENCH

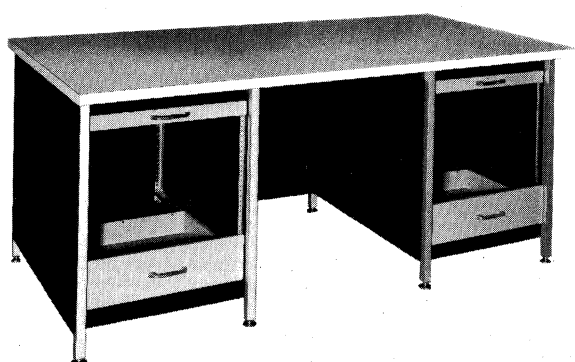


FCT TURRET

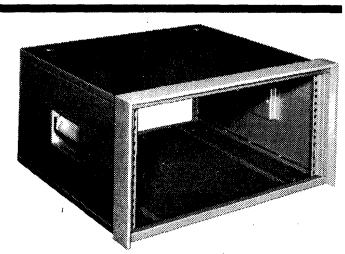
SIX STYLES						
	C series	**SQUARE ALUM. TRIM**	**S** series	**SQUARE**	**R** series	**BALL CORNERED**
	HC series	**SQUARE/HEAVY-DUTY ALUM. TRIM**	**H** series	**SQUARE HEAVY-DUTY**	**RF** series	**RFI SHIELDED**



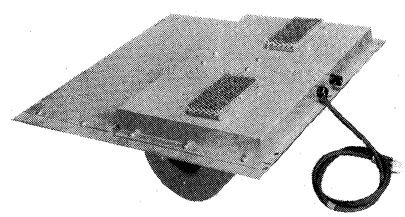
RRCB OPEN RACK



FCD DESK



XC INSTRUMENT CABINETS



BL BLOWERS

THE LARGEST SELECTION OF ACCESSORY PARTS IN THE INDUSTRY

1000 STANDARD SIZES

19" • 24" • 30" PANEL WIDTHS
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8¾" To 78¾" PANEL HEIGHTS

Cabtron, a leading manufacturer of electronic cabinets, offers the most complete line of cabinets for either commercial or military applications. All Cabtron cabinets are available in the exclusive FILTERED BASE construction which will house the most compact Cabtron blower system in the industry. (NO vertical panel space required for its air intake.)

All Cabtron Cabinets are constructed of prime cold rolled steel and finished in ten different colors. One week delivery on some models from Cabtron plant, Chicago, Ill.

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chassis Trak inc.

ENGINEERING FACTS AND FIGURES

Construction—Chassis-Trak Slides are made of hard, cold-rolled steel for maximum strength and wearing qualities and are cadmium-plated for extra corrosion resistance. Smooth operation is achieved by means of Poxylube 75 dry film lubricant which becomes increasingly slick with use. This permanent formulation is dust-repellent and withstands pressure loading of more than 50,000 psi at 25 ft./min. Finish has passed JAN 100-hour salt spray test and is approved for military use.

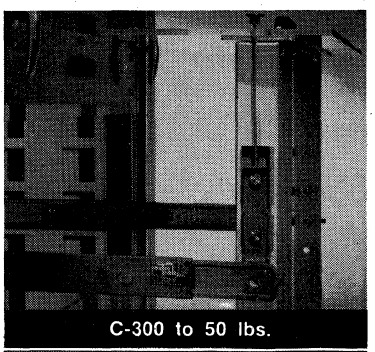
Installation—"Pencil thin" Chassis-Trak design permits installation of standard 17" chassis in standard 19" panel racks without modification. Standard slides bolt to front rail and rear of cabinet. On most models, a prefabricated gusset assembly can be furnished for use where load does not exceed 100 lbs. Gusset automatically aligns slides and permits mounting at front rail only. Templates, rear mounting brackets and all hardware furnished together with complete assembly instructions.

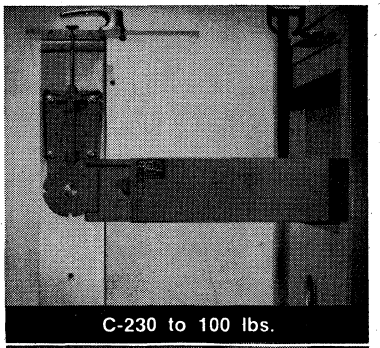
Operation—Chassis-Trak Slides are available in non-tilt, tilt, and tilt-detent models. Slides with "B" in the model designation tilt upward only; "D" models tilt and lock in seven different service postions. Choice of solid bearing or roller bearing operation. Roller bearings are recommended for equipment requiring frequent service. Chassis of any length can be fully extended without disconnecting rear cables. Pushbutton spring mechanism releases chassis for convenient slip-out, slip-in servicing.

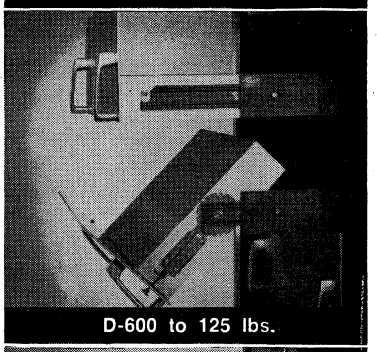
For additional engineering information, accessories hardware catalog, and prices, write:

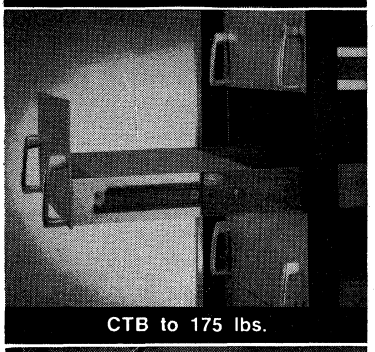
chassis Trak inc.

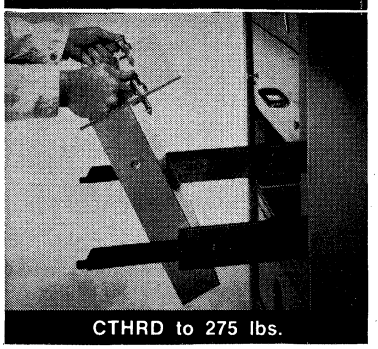
525 SOUTH WEBSTER AVENUE
INDIANAPOLIS, INDIANA 46219

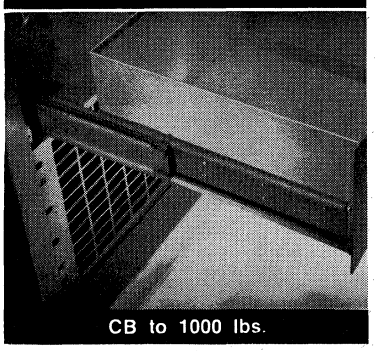

C-300 to 50 lbs.


C-230 to 100 lbs.


D-600 to 125 lbs.


CTB to 175 lbs.


CTHRD to 275 lbs.


CB to 1000 lbs.

ROLLER BEARING SLIDES	Model	SLIDE LENGTH								LBS. MAX. LOAD
		10	12	14	16	18	20	22	24	
Basic	CTRB	X	X	X	X	X	X	X	X	175
Detent	CTRD		X	X	X	X	X	X	X	175
Cradle Track	CTEZ			X	X	X	X	X	X	125
Heavy Duty Basic	CTHRB			X	X	X	X	X	X	275
Heavy Duty Detent	CTHRD			X	X	X	X	X	X	275
Lightweight	C-357		X	X	X	X	X	X	X	150
Circulating Ball	CB	16" to 60"								1000

SOLID BEARING SLIDES	Model	SLIDE LENGTH								LBS. MAX. LOAD
		10	12	14	16	18	20	22	24	
Basic	CTB	X	X	X	X	X	X	X	X	175
Detent	CTD		X	X	X	X	X	X	X	175
Lightweight	CTL			X	X	X	X	X	X	100
Heavy Duty Basic	CTHB			X	X	X	X	X	X	250
Heavy Duty Detent	CTHD			X	X	X	X	X	X	250
1¾ Inch	C-300	X	X	X	X	X	X	X	X	50
Light-Duty	C-300	X	X	X	X	X	X	X	X	50
Aluminum	D-600	X	X	X	X	X	X	X	X	125
Utility	C-230		X	X	X	X	X	X	X	100

DESIGN/ENGINEERING/FABRICATION

Small bench cabinets — free standing, bench mounted or integrated with other consoles.

Intermediate size cabinets, useful as mobile roll-aways, work-top units or arranged in varied configurations.

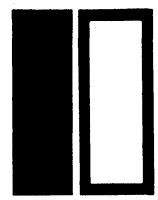
Vertical enclosures adaptable to systems by adding suitable accessories from our varied line of custom hardware.

Sloping front consoles form functional arrangements. Used for process control, data logging and read-out devices.

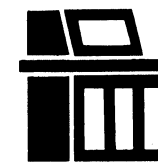
Adaptations of standard consoles to meet special customer requirements. Infinite variations available from our Industrial Design Department.

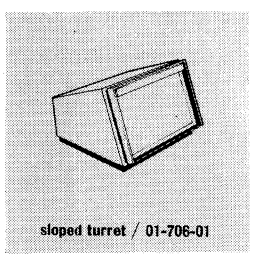




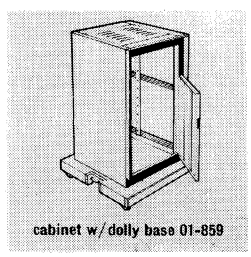




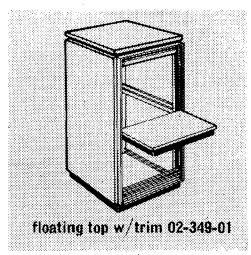




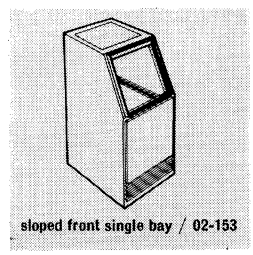
sloped turret / 01-706-01



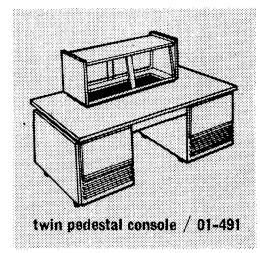
cabinet w/dolly base 01-859



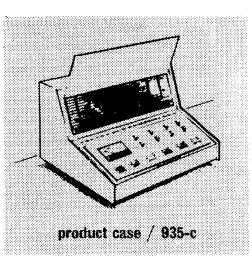
floating top w/trim 02-349-01



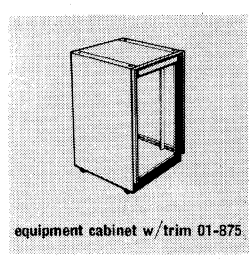
sloped front single bay / 02-153



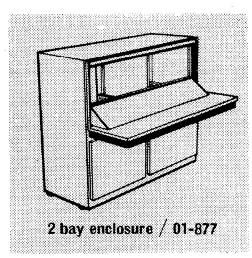
twin pedestal console / 01-491



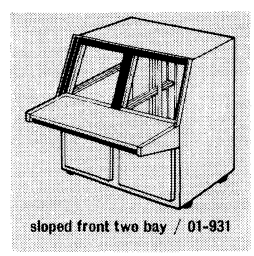
product case / 935-c



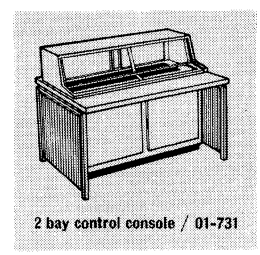
equipment cabinet w/trim 01-875



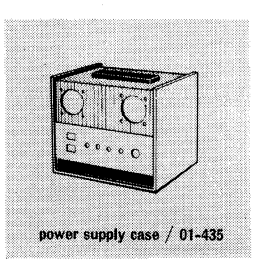
2 bay enclosure / 01-877



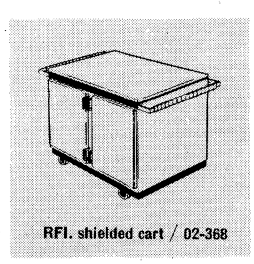
sloped front two bay / 01-931



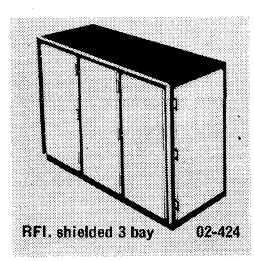
2 bay control console / 01-731



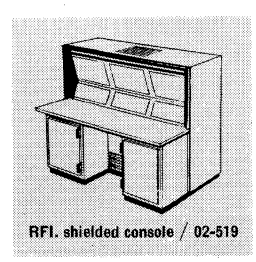
power supply case / 01-435



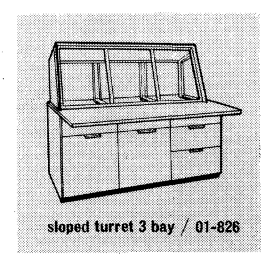
RFI. shielded cart / 02-368



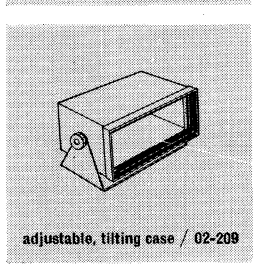
RFI. shielded 3 bay 02-424



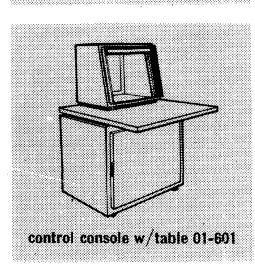
RFI. shielded console / 02-519



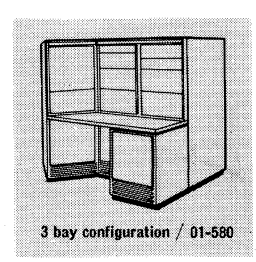
sloped turret 3 bay / 01-826



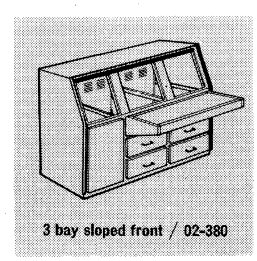
adjustable, tilting case / 02-209



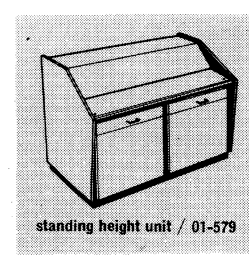
control console w/table 01-601



3 bay configuration / 01-580



3 bay sloped front / 02-380



standing height unit / 01-579

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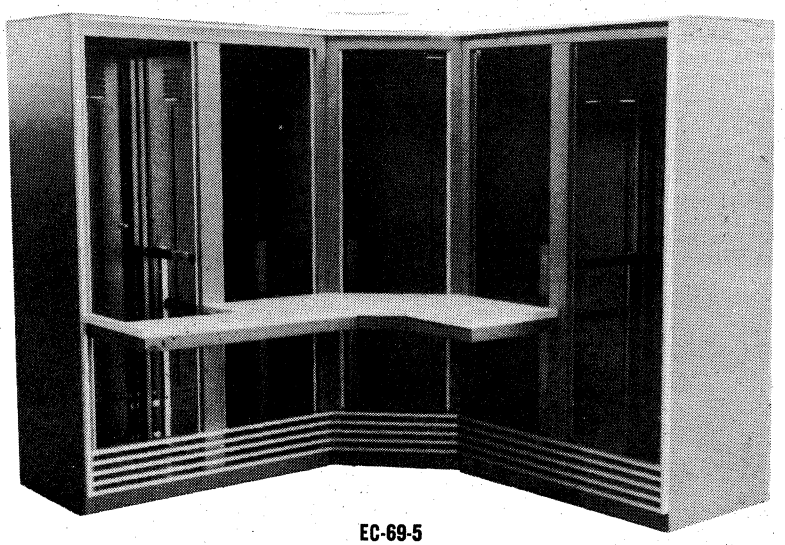

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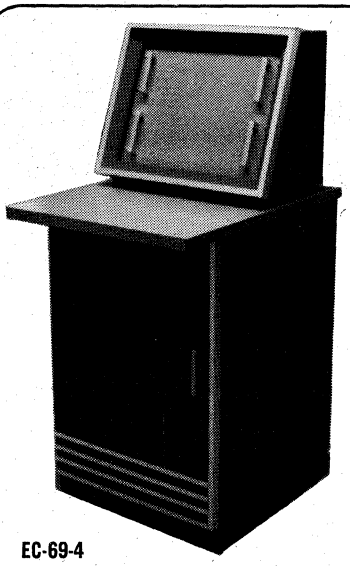
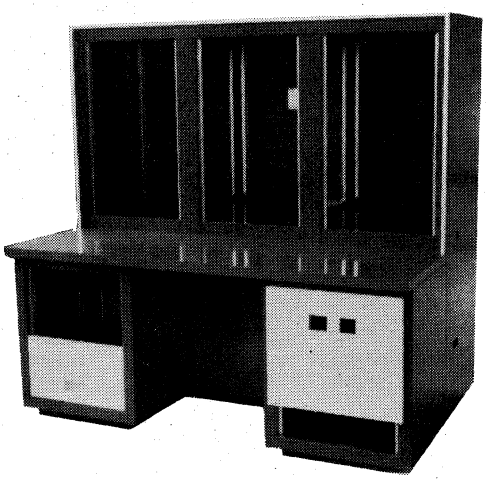


EC-69-4



EC-69-3



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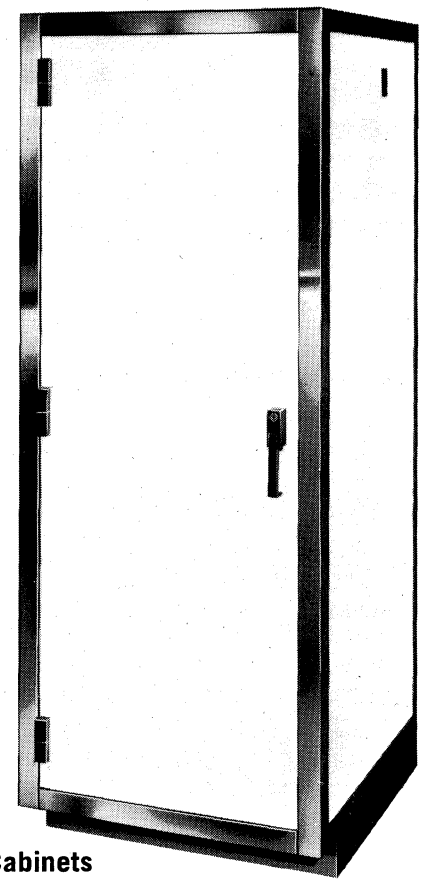
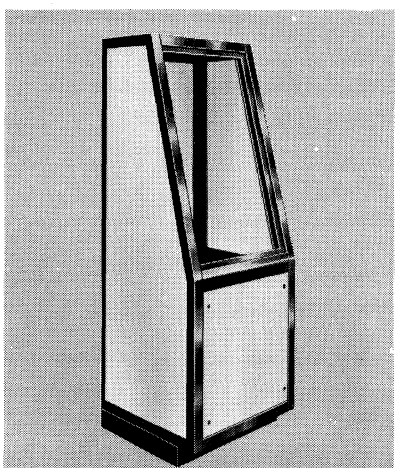
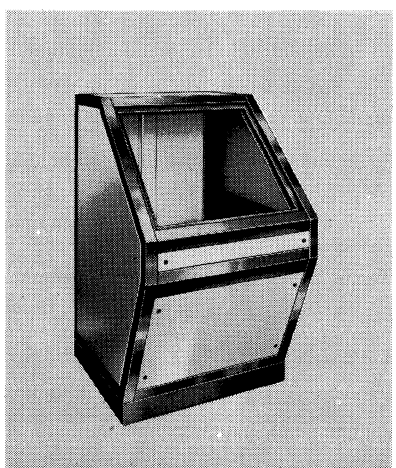


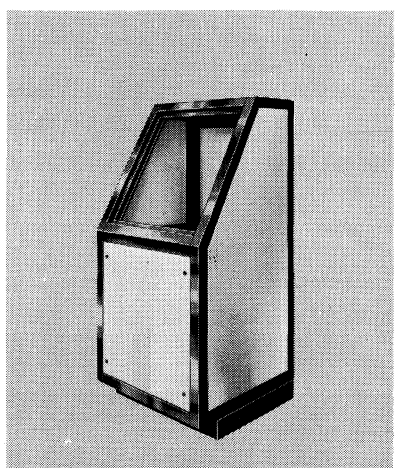
Vertical Rack Cabinets



Sloped Front Vertical Racks



Machine Control Consoles



Sloped Front Consoles

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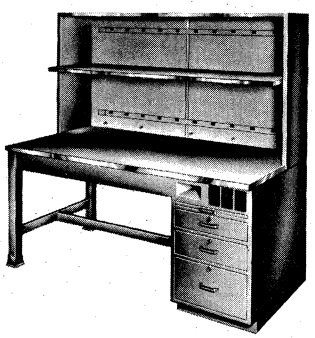

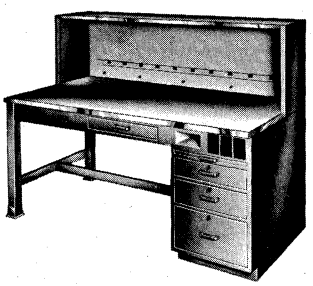

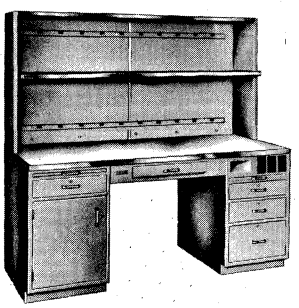

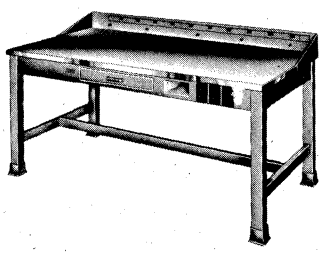

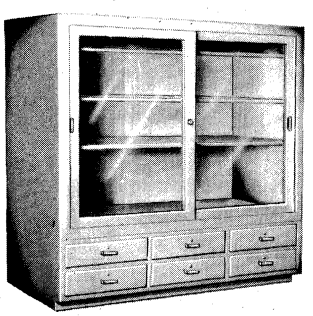

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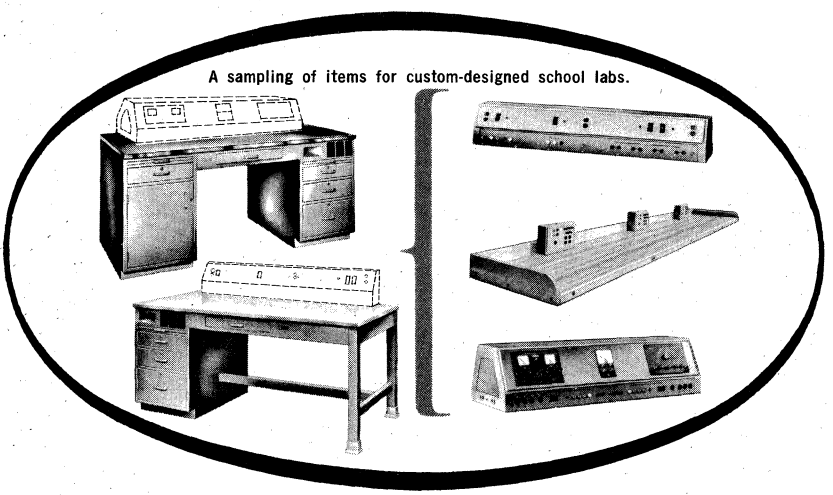

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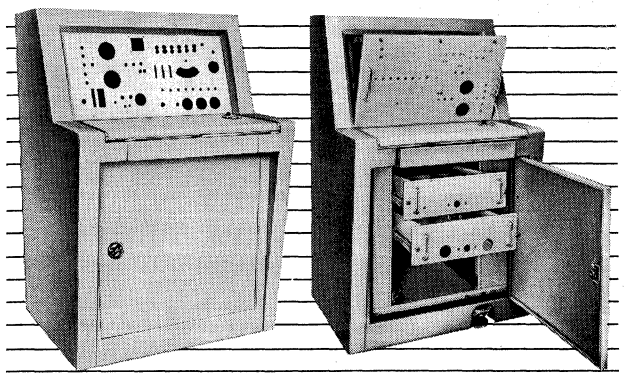

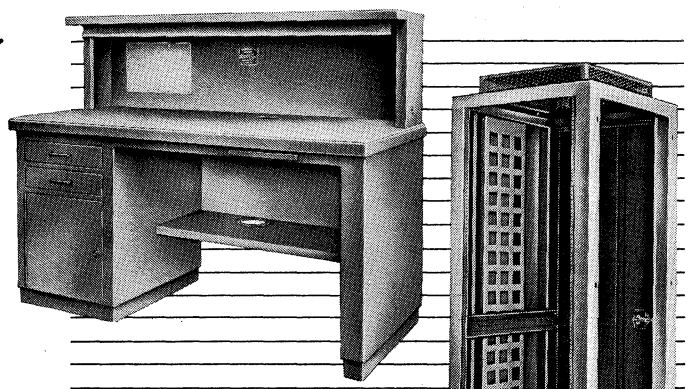

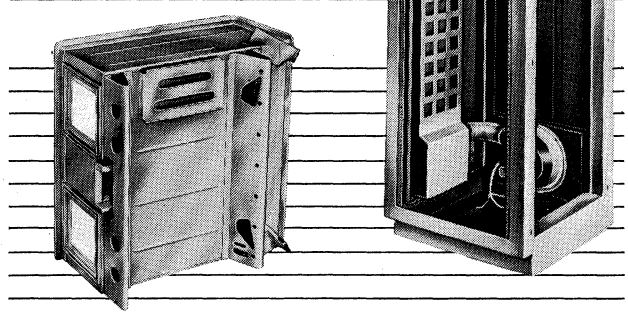

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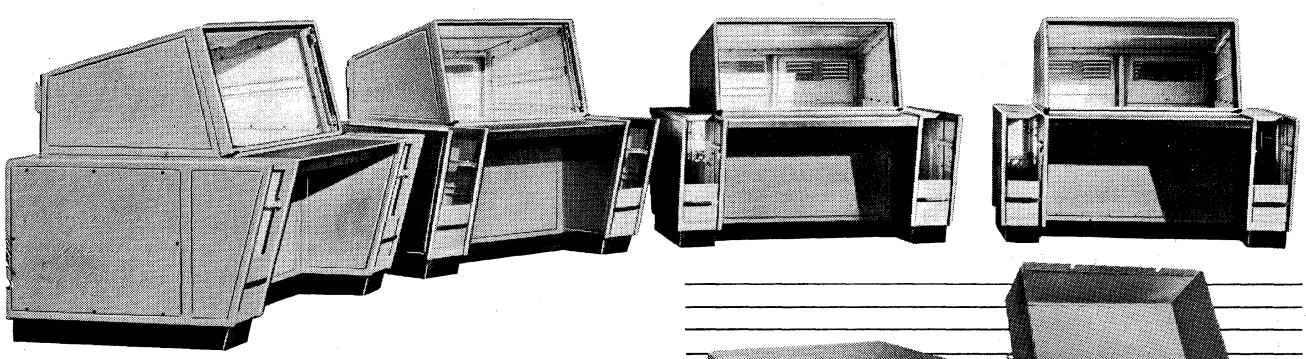

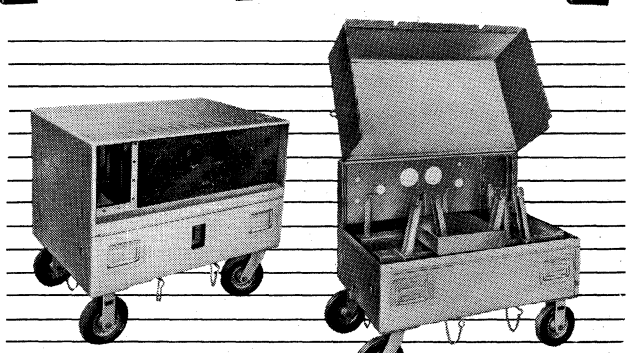

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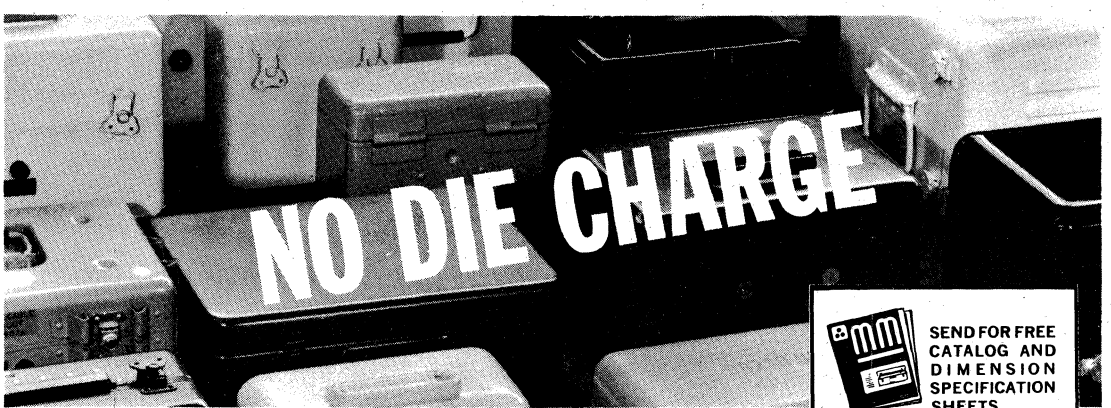

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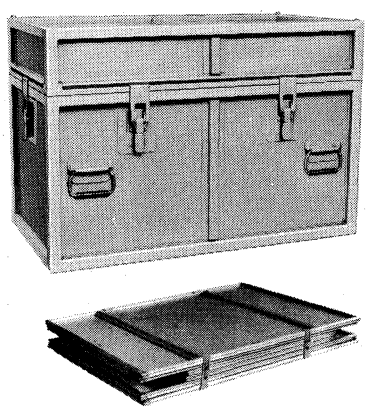

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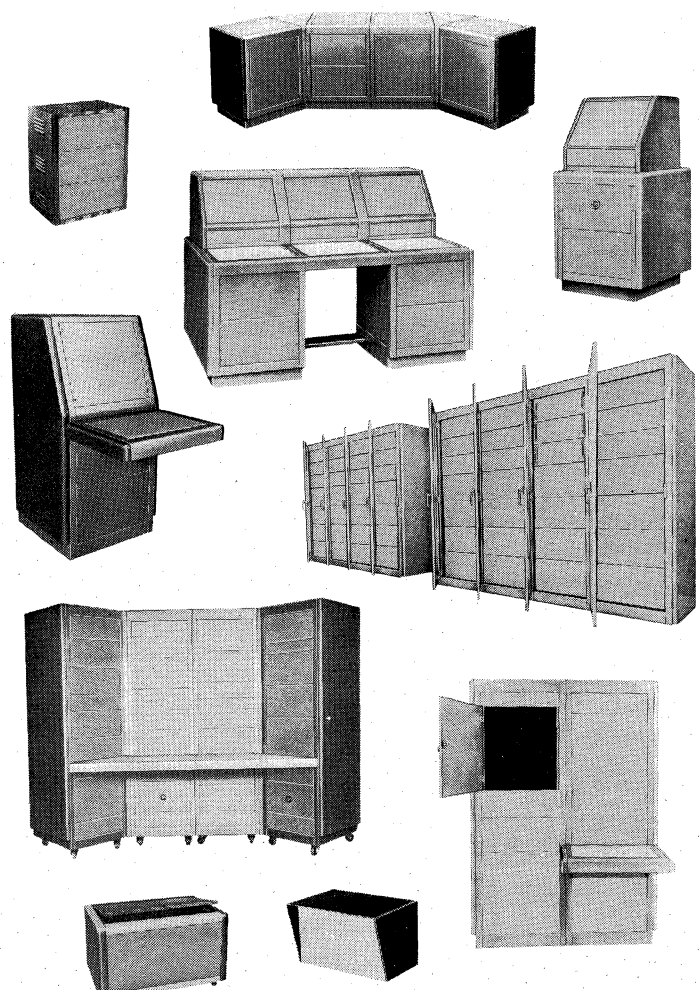

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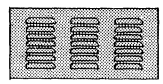
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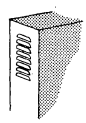
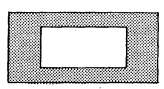
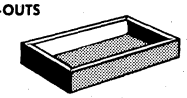
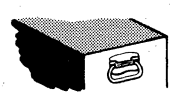
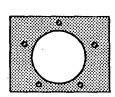
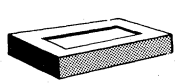

LOUVRES ON SIDES

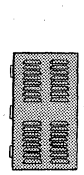

CUT-OUTS

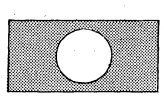

SOLID BOTTOM (NO CUT-OUT)

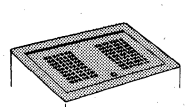

DROP HANDLES (HW-5)

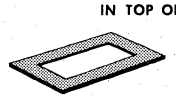

MOUNTING HOLES FOR FANS

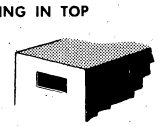

INVERTED BASES


LOUVRES ON DOORS


ROUND HOLE


PERFORATIONS IN TOP OF DCR


OPENING IN TOP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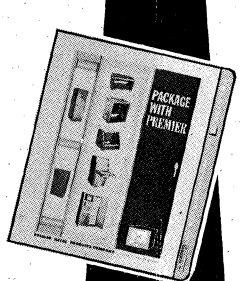

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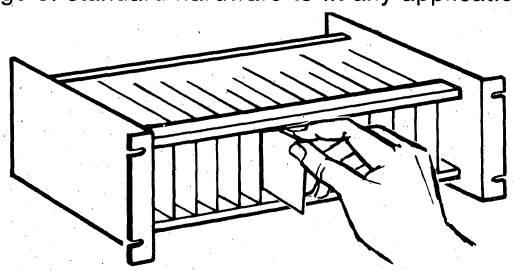

CARD FILE ENCLOSURES OF ANY SIZE AND DESCRIPTION.

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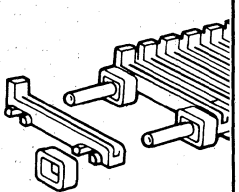	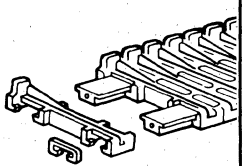	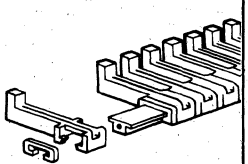	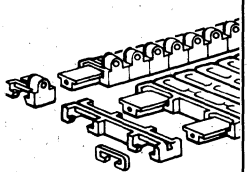	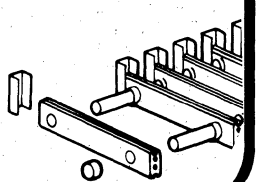

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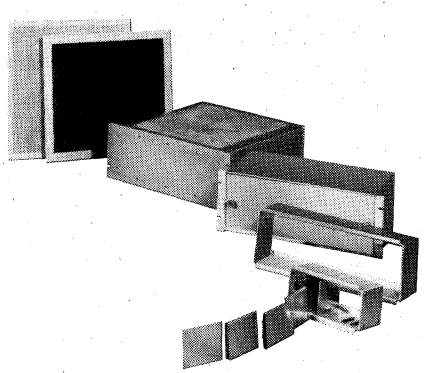
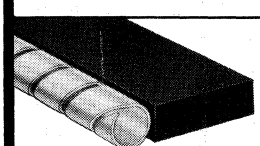
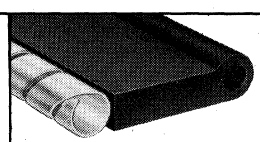




STANDARD



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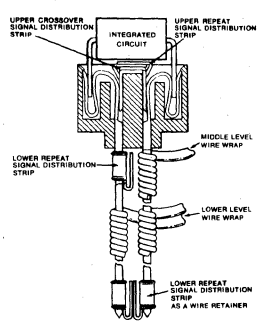
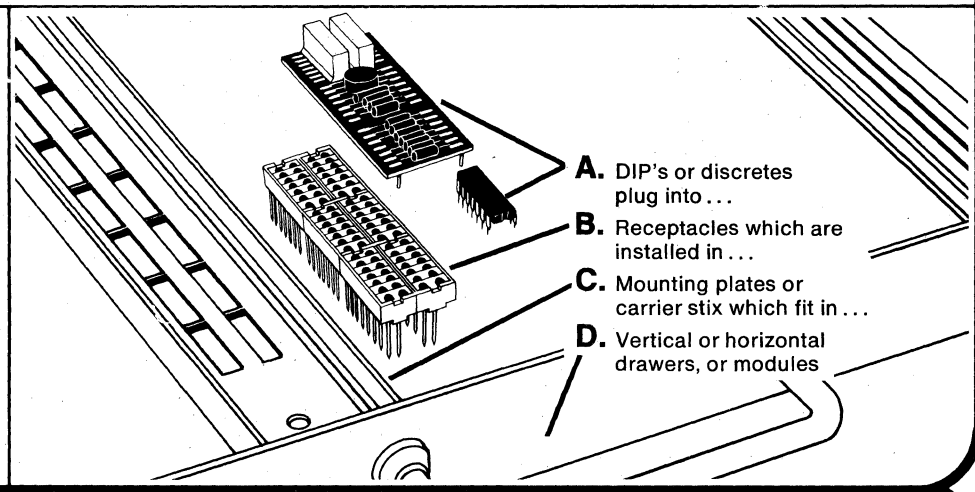


Bussing and power distribution strips save up to 75% of common circuit interconnection wiring



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B. Receptacles which are installed in...

C. Mounting plates or carrier stix which fit in...

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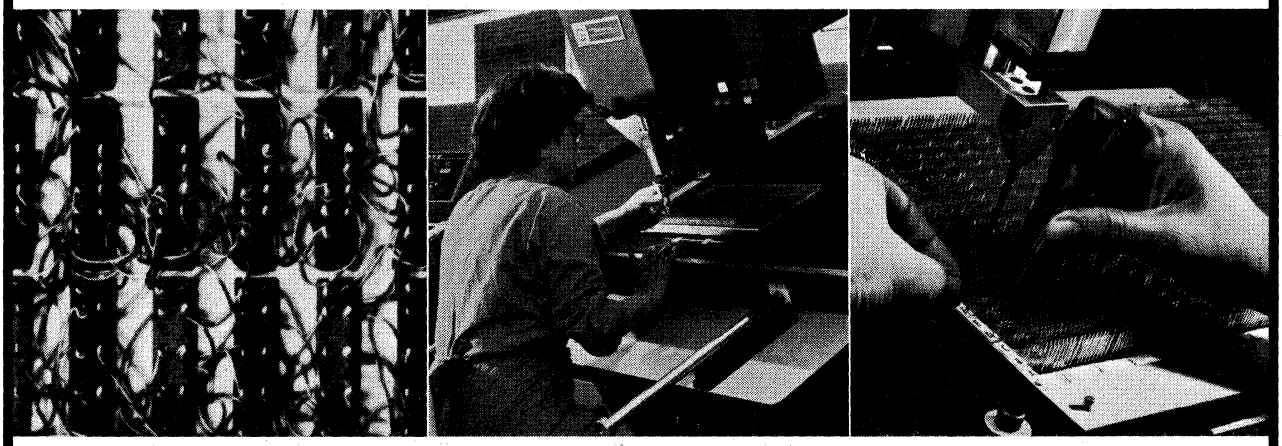

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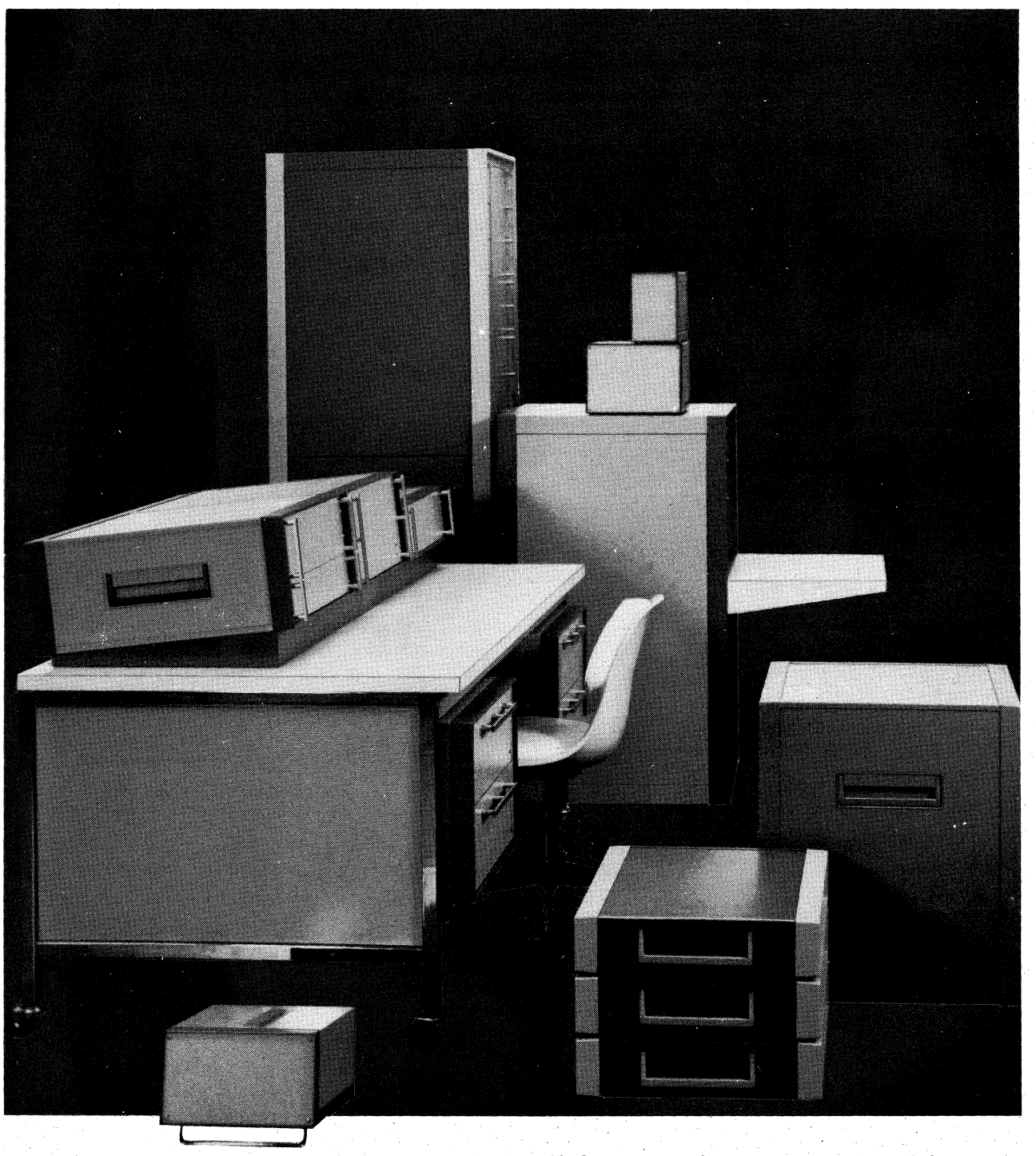

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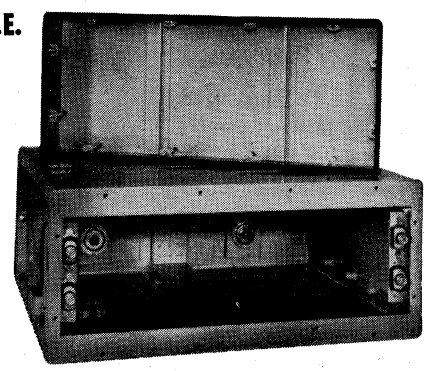
R.A.E. EQUIPMENT CASES

complicated electronic equipment fits standard cases using own or supplied chassis at the design stage • can be used in the field or with 19″ rack mounts without modification • sealing panel gasket completely weatherproofs your chassis when cover is secured, unit is submersible • front panels can be machined, engraved and finished to your specifications • spring loaded chassis support pins provide protection during excessive vibration and shock conditions • designed to permit easy handling in confined spaces such as tanks, aircraft and submarines • internal finish is black, to insure adequate heat dissipation, external finish to order • choice of cover depth to suit internal stowage fittings for accessories • rack mount brackets hinged to fold back when not in use are available as option

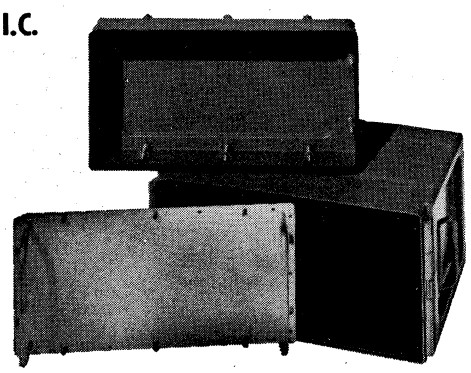
19 INCH EQUIPMENT CASES (E.I.C.)

accepts assemblies with standard 19″ panels for field use or transportation • when cover is secured unit is submersible • both panel and chassis are shock mounted • permits easy handling in confined spaces such as tanks, aircraft and submarines • special clamps provided to permit stacking • adequate circulation to insure heat dissipation • internal and external finish to order • standard cover depth permits stowage fittings for accessories

R.A.E.



E.I.C.



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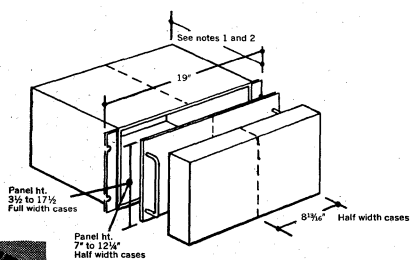
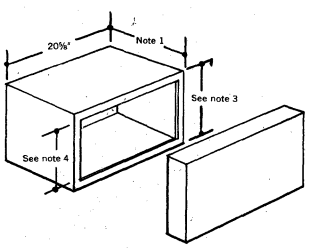
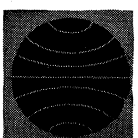
OPTIONS provisions for rear entry can be supplied to order • modifications based around existing design concept can be incorporated • special fittings within cover can be supplied to order

NOTES:

1. Outside depths 4¾″ to 18⅜″ in 2″ increments for full width cases
2. Outside depths 7″ to 15⅜″ in 3″ increments for half width cases
3. Outside heights 8⁹⁄₁₆″ to 17⁵⁄₁₆″ for 19 inch cases
4. Panel heights 5¼″ to 14″ for 19 inch cases







For further information on C & N's Industrial Equipment Cases Contact:

IN NORTH AMERICA: **SCIENTIFIC INTERNATIONAL MARKETING, INC.**
Box 181, Spring House, Pa. 19477 A/C 215-MI 6-1713

OTHER AREAS: **C & N (ELECTRICAL) LTD.** Gosport, Hants, England

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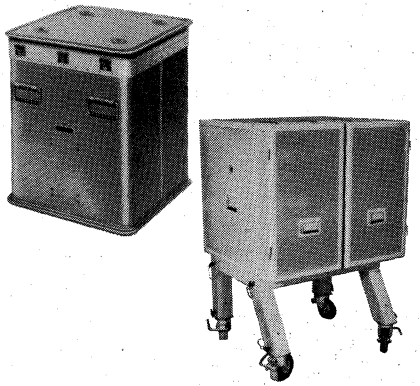
to Military and Industrial Specifications

SANDWICH PANEL



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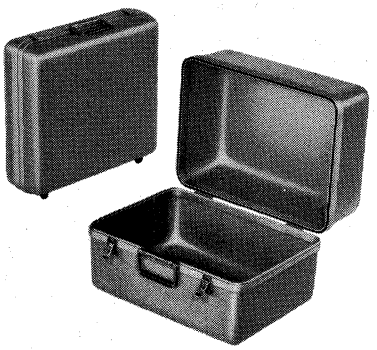

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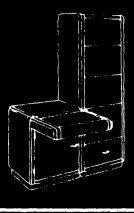
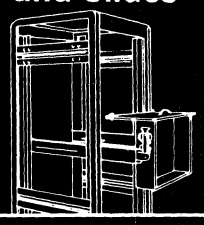


or



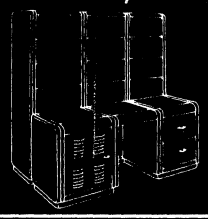
and Slides



Ball Corner Design

For Example:

or This, too



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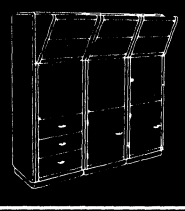

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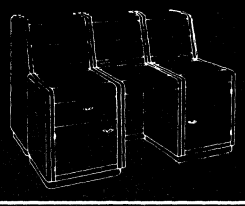

Square Corner Design

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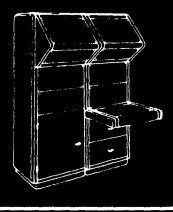

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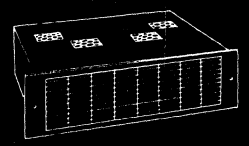

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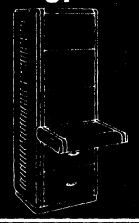
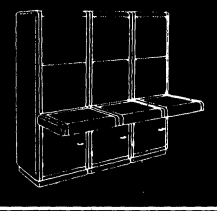


or Square Corner Design with Shadow Box Trim

or



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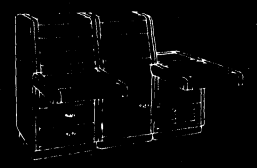
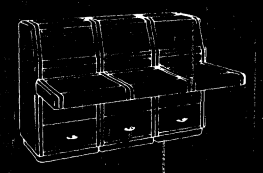


or Fans



or This



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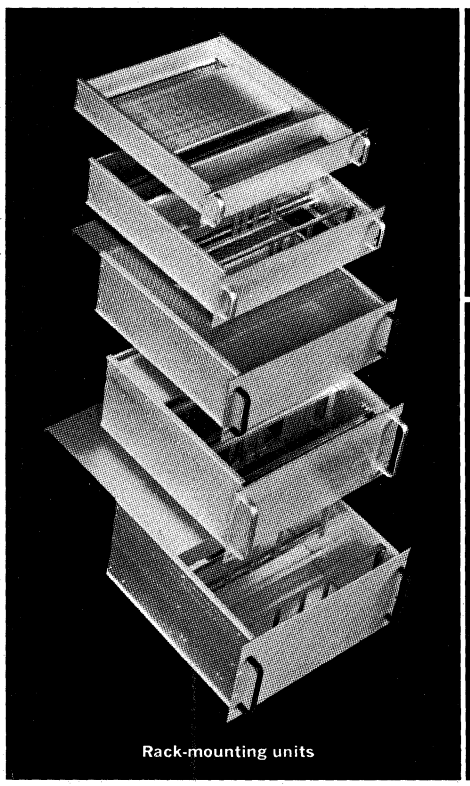
Prefab chassis kits and parts ▪ Featuring the "Erector Set" concept ▪ IN STOCK FOR ONE-DAY SHIPPING

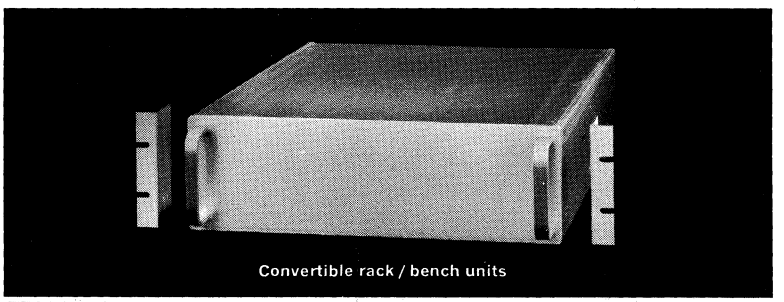
FEATURES □ Customized appearance at off-the-shelf prices for immediate delivery □ Modular dimensioning and pre-punched hole patterns permit hundreds of possible configurations □ Satin-surfaced aluminum with clear iridite finish □ Covers optionally slide or screw down □ Pre-mounted captive nuts for easy assembly □ Hardware included □ Many options for mounting components or PC Boards.

USE THEM TO... □ Eliminate chassis development and fabrication costs: design, tooling, production supervision □ Cut stocking costs: floor space, handling, inventory control, capital tie-up □ Prevent schedule delays caused by late delivery □ Standardize chassis among depts. and divs.

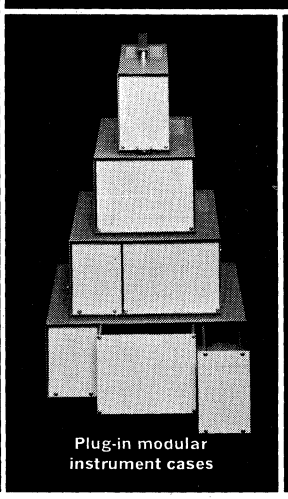
APPLICATIONS □ Prototypes □ Special-purpose systems □ Short to medium production runs □ Professional-looking breadboards □ Laboratory instrumentation, GSE, communications, data processing, medical electronics.



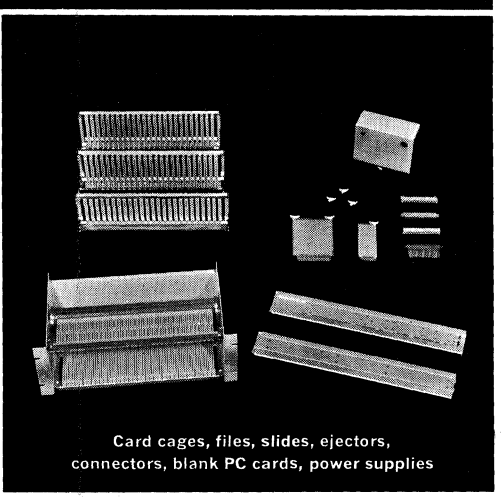
Rack-mounting units



Convertible rack / bench units



Plug-in modular instrument cases



Card cages, files, slides, ejectors, connectors, blank PC cards, power supplies

KITS Each basic kit consists of 1 front panel, 2 side frames, 2 cross plates, 2 sliding covers, 1 pair handles, hardware.

KIT NUMBERS			DIMENSIONS		
Rack Mount Kit No.	Bench Kit No.	Convertible Kit No.	Front Panel Height	Side Frame Height	Side Frame* Depth
RK 3	BK 3	CK 3	3½"	3.15	19.00
RK 5	BK 5	CK 5	5¼"	4.90	19.00
RK 7			7"	6.65	19.00
RK 8			8¾"	8.40	19.00
RK 10			10½"	10.15	19.00

*To adjust depth, side frame can be sawed off on ½" increments and rear panel can be reattached without redrilling.

Card File Kit (CF-7) includes end plates, chrome plated steel guide frames and connector rails, plastic snap-in guides, hardware.

Modular Instrument Cases (Mod Boxes) with plug-in chassis modules. Single modules are 7" high, 4⅜" wide, 12½" deep. Cases are 1, 2, 3 or 4 modules wide. Plug-ins are ½, 1, 2, 3 or 4 modules wide. Top and bottom ventilation. Optional handles for portable applications.

CARD CAGES (To make chassis into card drawers.) Each cage sub-kit includes guide frames, connector rails, snap-in guides, hardware.

Card Cage # (add as dash # to kit #)	Height of Mating Chassis	No. of Card Rows	Max. Cards p/ Row	Min. Card-to-Card Centers-Edge Type	Min. Card-to-Card Centers-Offset Type
CC4-1R	5¼"	1	37	.4	.6
CC4-2R	5¼"	2	37	.4	.6
CC4-3R	5¼"	3	37	.4	.6
CC5-1R	7" or Higher	1	37	.4	.6
CC5-2R	7" or Higher	2	37	.4	.6
CC5-3R	7" or Higher	3	37	.4	.6

KIT OPTIONS (Add one or more dash numbers to basic kits)

Front panel thickness—3/16" instead of 1/8" ..... add -316
Full bottom plate instead of 1 cover and 1 cross plate ..... –FB
Solid covers instead of perforated ..... —SC
Black anodized handles instead of clear anodized ..... –BH
No "erector set" hole patterns in side frames ..... –NH
Locking Slides (ball-bearing) ..... —LS
Quick-disconnect locking slides ..... —QDLS
Tilting quick-disconnect locking slides ..... —TQDLS
Ejectors ..... (quantity & —E)
Connectors ..... (specify type)
Power Supplies ..... (specify voltage & current)

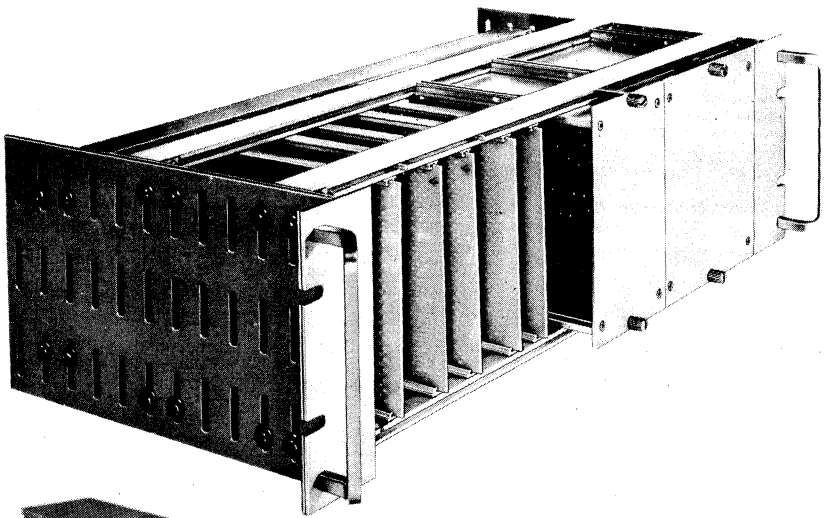
ONE DAY SHIPPING – Standard kits and parts in small to medium quantities are shipped one day after receipt of order. Catalog includes prices. On larger quantities, specials, connectors and power supplies, contact factory for price and shipping date.

Send for Free Catalog. Includes Price List

OMNICLOSURE

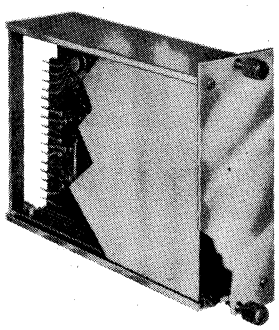
TECHMAR CORPORATION
2232 SO. COTNER AVENUE
LOS ANGELES, CALIF. 90064
TELEPHONE: (213) 478-0046

Vector PACKAGING SYSTEM FOR CARDS AND MODULES



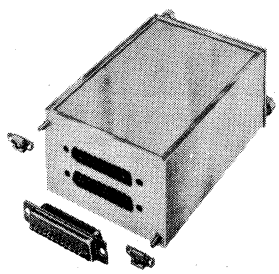
Vector Strut Cages are uniquely adjustable aluminum frames designed for mounting in 19" equipment racks which accommodate "EFP" Modules shown below, or cards. Vector Strut Cages are sold in kit form in three heights, 3-15/32", 5-7/32", 8-23/32", and three depths, 8.975", 11.975", and 15.725". Kits consist of the slotted side walls, cross members (Triple Tee Struts) and brackets, plus necessary assembly hardware. Vector Strut Cages sell for $19.00 to $27.00 in small quantities. Extruded aluminum card and case guides, EFP Modules, and handles are ordered separately as required. Each cage provides adjustment for varying module heights, and adjustment for varying module or card positions from side to side.

Special Models Available to Order



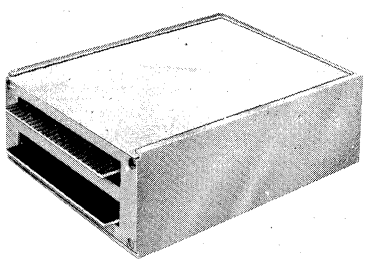
VECTOR "EFP" (EXTENDED FRONT PANEL) CASES

Vector "EFP" aluminum module cases are made in 60 different sizes to accommodate circuit boards from 2.7" to 7.9" wide and 4.6" to 14" long. All EFP cases will fit Vector Strut Cages shown above. EFP cases have identical top and bottom extruded rails with parallel .062" longitudinal grooves spaced as shown at bottom of page for holding circuit boards, slide out .062" side covers, front and rear panels. Captive thumb screws are provided.



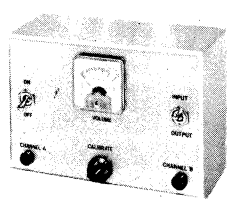
HI FREQUENCY CASES

For optimum IF shielding up to 400 megacycles of printed circuit cards. Unusual design with quickly removable top, slide out sides and inside 1/16" grooves for multiple circuit boards or boards and shields. Standard off-the-shelf sizes for 3" x 4-1/2", and 4-1/2" x 6-1/2" cards.



WRAP AROUND VECTOR PAK CASES

Wrap-around "Vector-Pak" Bottom Access cases are formed by mitering and bending aluminum extrusions shown below into a "U" shaped member and attaching a bottom plate. The finished result is a handsome plug-in case for circuit cards or an attractive instrument case with parallel .062" grooves. Covers slide off or may be blocked by using a wide bottom plate. Standard cases of various sizes are available.



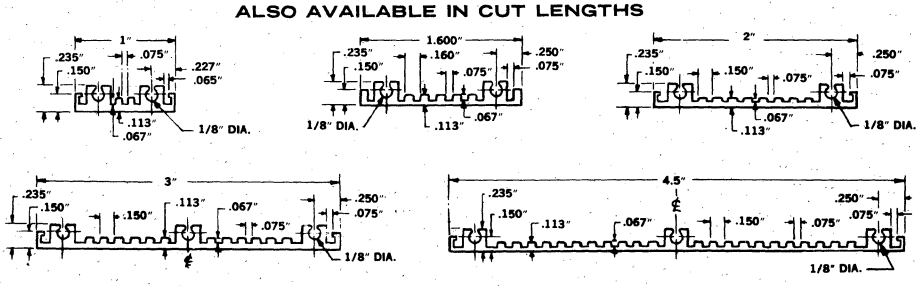
(Packaged Instrument in Multi-Mod Case)

MULTI-MOD CASES

Versatile Multi-Mod Cases can be used for small instruments and circuit packaging where appearance and utility are important. Slotted inner surfaces on four sides hold circuit cards or mounting ing plates, eliminating unsightly screws in case exterior. Access is easy by removing base plate. Available in extrusion widths below and lengths from 3.1" to 14"; and heights from 3.1" to 8".

All listed widths are stocked two ways: (a) with square cut ends and overall lengths of 4.525", 6.525", 9.640", 13.840", 24"; (b) with 45° miter plus corner fasteners in overall lengths of 2.87", 3.11", 4.61", 4.91", 6.61", 8.0", 8.61", 10.0", 14.0", 17.1". Extrusion details apply to all plug-in cases shown above.

VECTOR ALUMINUM FRAME LOC EXTRUSIONS USED IN ABOVE CASES
ALSO AVAILABLE IN CUT LENGTHS



Vector ELECTRONIC CO., INC. 12460 Gladstone Ave., Sylmar, Calif. 91342 Area 213 Phone 365-9661
TWX 910-496-1539

VENT RAK ®

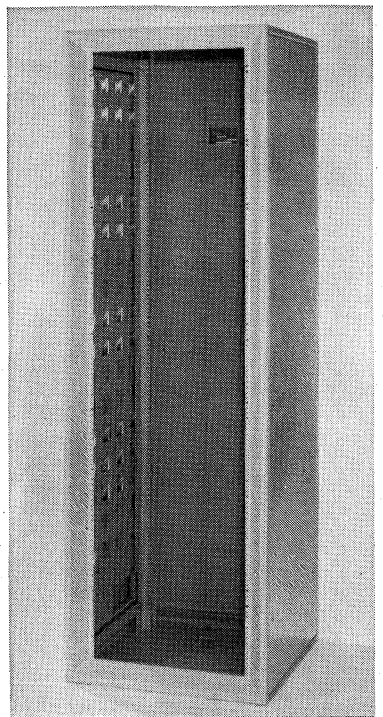
VENT-RAK CABINET LINE ENGINEERING DATA SHEET

VENT-RAK OFFERS A FULL LINE OF ELECTRONIC PACKAGING COMPONENTS

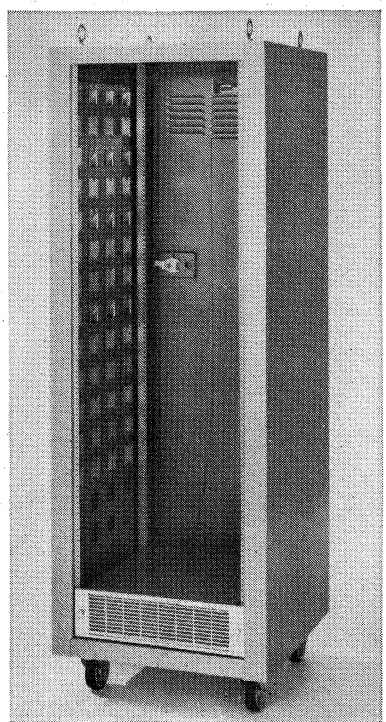
Included in Vent-Rak's full line of electronic packaging components are cabinets, slides, chassis, cable retractors, handles, dollies, blower assemblies and front panels.

The Vent-Rak line of heavy-duty enclosures meets commercial and military specifications. The heart of the Vent-Rak line is the unique frame design, rugged construction, ease of accessibility and economy.

Offering a single source for all your electronic packaging requirements, Vent-Rak will supply standard or semi-standard cabinets as shown on this page, or will custom design an enclosure to meet your own specifications.



1000 SERIES



3000 SERIES

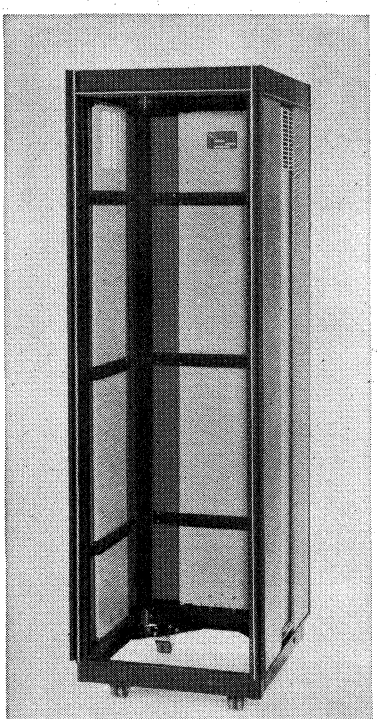
1000 Series—All heli-arc welded fabrication—Perfect for military application—Steel fabrication is standard, aluminum optional—Side panels engineered for ease of installation and accessibility, front door optional—Flush chrome door latches with or without keylock—In forced-ventilation models, air flow panel is permanently fastened to side panel, and does not sacrifice interior space—

3000 Series—Medium-duty industrial or military cabinet—heli-arc welded fabrication—precision drilled and tapped RETMA pattern on front rails—hinged rear door—solid side panels—provisions for casters and eyebolts—optional louvered top or sides—optional rear mounting angles—

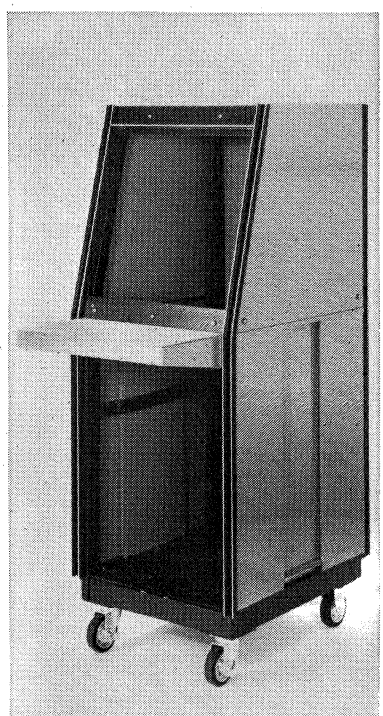
5000 Series—Rugged, self-aligning, all-steel frame with unique cross-section construction—Assembled quickly with ordinary hand tools—Instantly removable side panels—Louvers standard on sides and optional on tops—Single or multiple installation—Full line of accessories—

5050 Series—Used for housing complete package, or supplement to your present installation—Exceptionally rugged frame and all-steel construction—Removable side panels—Interior components interchangeable with Vent-Rak 5000 Series Cabinets—

Some of these models are available from distributors, or for more information, write:



5000 SERIES



5050 SERIES

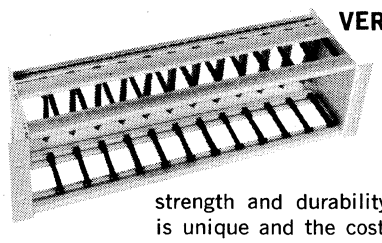
VENT RAK ®

525 South Webster Avenue • Indianapolis, Indiana 46219

NEW *Fast, Simple and Economical* COMPLETE PACKAGING SYSTEMS *From* VERO

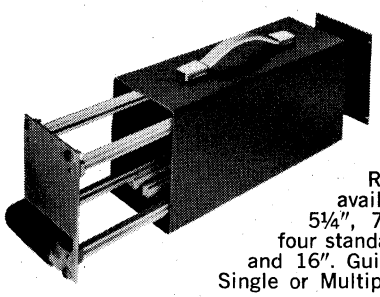
VERO INTRODUCES THE ULTIMATE PC CARD FRAMES • VERORACK SYSTEM 3

VERORACK SYSTEM 3



The ultimate PC card frame featuring variable card spacing from .4" up. This rack combines beauty, strength and durability. Connector mounting is unique and the cost is low.

VERO MODULE CASES



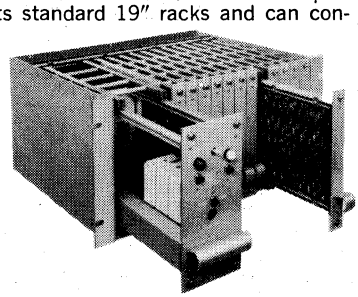
A line of Portable Module Cases has been designed for use in conjunction with standard modules from the Vero Module Rack. The cases are available in three heights, 5¼", 7" and 8¾" and in four standard widths, 4", 6", 8" and 16". Guides are included for Single or Multiple Module Mounting.

VERO MODULE RACK

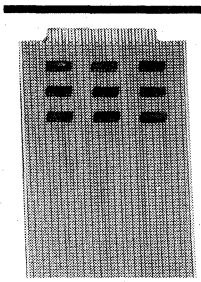
OVER 450 ASSEMBLY COMBINATIONS — DELIVERY FROM STOCK — GREATEST FLEXIBILITY AT LOWEST COST

The Vero Module Assembly — another phase of the Vero circuit concept — provides a fast, simple and inexpensive method of circuit packaging.

The Vero principle of versatile standardization has produced a module which fits standard 19" racks and can contain any combinations of 1", 2", 4", 8" or 16" pull out modules. It is available in 5¼", 7" or 8¾" heights and 11" or 14" depths.



This rugged ⅛" aluminum units is also available as a composite of modules and printed circuit cards for the ultimate in flexible circuit assembly.



VEROBOARD*

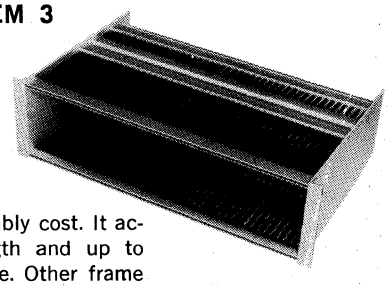
Hole Patterns — .050 x .050, .1 x .1, .150 x .150, .156 x .1, .2 x .2, .2 x .1.

Over 200 Standard Sizes — Single and Double Sided x-y pattern.

Material — XXXP and FR-4 Epoxy Glass.

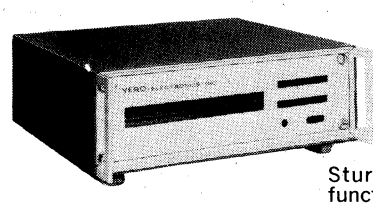
*Patented.

VERORACK SYSTEM 3



Features standard .5" card spacing with polycarbonate guide slabs that slide with precision extrusions. This rack is versatile, rigid and low in assembly cost. It accepts cards any length and up to 4½" high in ¼" frame. Other frame heights are also available.

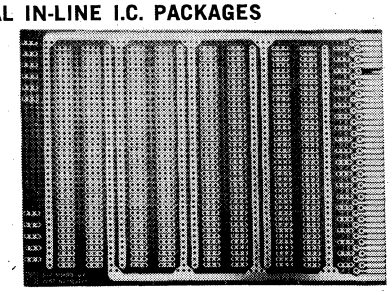
VERO INSTRUMENT CASE



An attractive new range of of instrument cases available in heights from 3½" to 10½" to accept 19" wide racks. Sturdy construction and functional design are featured.

VERO D.I.P. BOARD

FOR DUAL IN-LINE I.C. PACKAGES



- .1 x .1 hole pattern with .041 dia. holes
- Accepts D.I.P. socket or direct I.C. plug in
- Gold plated contacts with connectors to match
- Boards available in epoxy glass ⅛ thick or low cost paper
- Complete versatility with continuous isolated pads on .1 centers holds 20 D.I.P.s on 4.5 x 6.5 board
- Power and ground buss plus test points all on one side of board
- Reverse side printed with grid to ease component location
- Vero handle location indicated

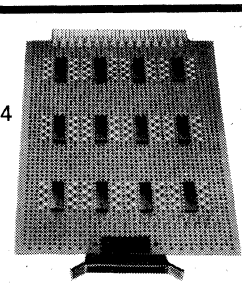
VERO "FINGER BOARDS"

Hole Patterns — .1 x .1, .052 dia.

Material — ⅛ Epoxy Glass, FR-4.

Connector Fingers — 22 x .156, 44 x .156, 16 x .1, 32 x .1.

OFF THE SHELF IN SIZES TO FIT ALL CARD FILE SYSTEMS



COMPLETE RANGE OF CONNECTORS, TERMINAL PINS, MODULE CASES AND ACCESSORIES. BASIC VERO SYSTEMS CAN BE QUICKLY MODIFIED TO MEET CUSTOMER REQUIREMENTS.

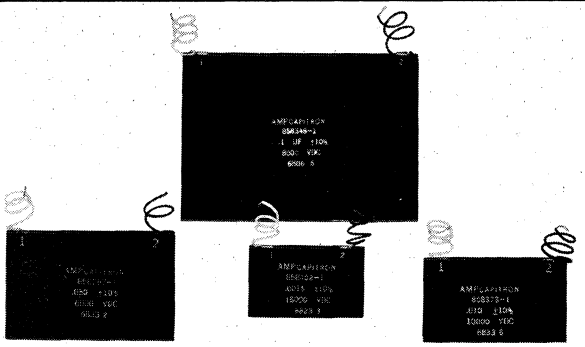
VERO ELECTRONICS INC.

176 Central Ave., Farmingdale, N. Y. • Tel.: 516 MY 4-6550 • TWX: 510-224-6425

AMPLIFILM★ HIGH VOLTAGE CAPACITORS 2,500 to 60,000 VDC

INDUSTRIAL • MILITARY • COMMERCIAL

The CAPITRON★ Division of AMP Incorporated has specialized in the development of a diversified line of high voltage capacitors that provide outstanding performance characteristics. AMPLIFILM dielectric capacitors feature monolithic construction which results in substantial size and weight reduction, making them particularly suitable for use in high voltage power supplies, modulators, pulse forming networks, etc. AMPLIFILM capacitors, custom or stock, are designed to your exacting requirements as to size, shape and performance.

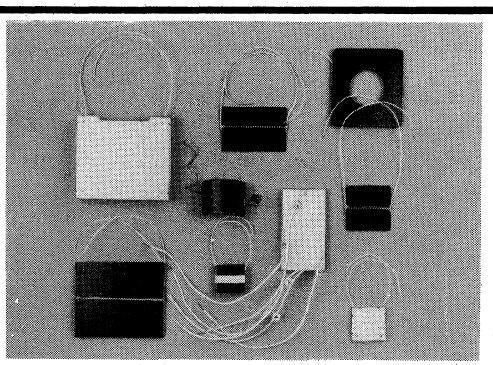


AMPLIFILM★

WAFER CAPACITORS FOR TEMPERATURES UP TO 125° C

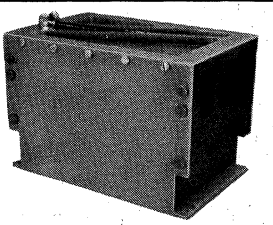
The basic element in these capacitors is AMP's AMPLIFILM dielectric, interleaved with copper foils and bonded with a non-polar thermoplastic resin specially selected for its excellent dielectric qualities. Heavy gage foil and molded construction combine to make these components ideal for rugged high voltage oil-filled or encapsulated assemblies.

- Operating temperature: —55° C to +125° C
- Capacitance range: 100 $\mu\mu$f to 1.0 μf
- Voltage range: 2,500 to 60,000 volts DC
- Power factor: 0.5% max.
- High insulation resistance
- Conforms to MIL-C-19978 where applicable
- Moisture resistant
- Very low dielectric absorption: less than 0.2%
- Wafer sizes from 1 sq. in. to 36 sq. in.
- Many configurations available



Configuration variety of AMPLIFILM ★ wafers

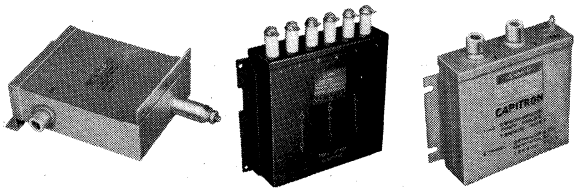
For complete information write for 858 Series AMPLIFILM capacitor catalog.



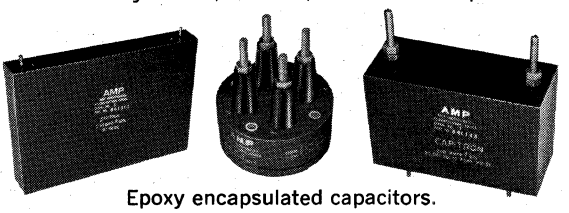
A typical AMPLIFILM capacitor assembly. Even **before encapsulation,** the exclusive dielectric construction provides moisture resistance meeting MIL-STD-202 (Method 106), making possible an energy efficiency greater than 0.6 joules per cubic inch without the encumbrance of a metal case.

- Capacitance: 0.1 μf ± 5%
- Voltage rating: 40,000 volts DC
- Power factor: 0.5% max.
- Temperature Range: —55° C to +100° C
- Size: 4½" x 4½" x 6½" max. (exclusive of frame)
- Weight: 9½ lbs. (exclusive of frame)

CUSTOM-PACKAGED AMPLIFILM HIGH VOLTAGE CAPACITORS



Hermetically sealed, oil-filled, metal cased capacitors.



Epoxy encapsulated capacitors.

CAPITRON DIVISION, AMP INCORPORATED
155 PARK STREET, ELIZABETHTOWN, PA. 17022.
TWX: 510-657-4561 • PHONE: 717-367-1105.

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AMP INCORPORATED

NOTE: See other CAPITRON High Voltage products under Catalog Sections 2100 and 4000.

american technical ceramics

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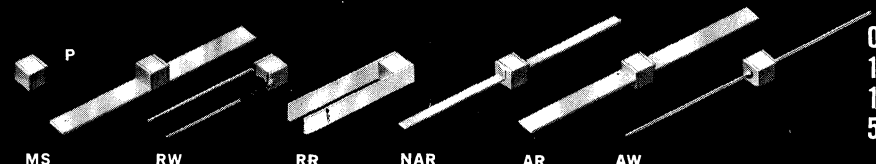
TOMORROW'S CAPACITORS...TODAY

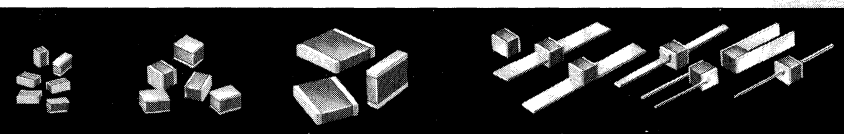
MICROWAVE PORCELAIN ATC-100



0.03 dB INSERTION LOSS
1.05:1 VSWR
10,000 Qu
50. WATT POWER INPUT

SEE PAGE 2

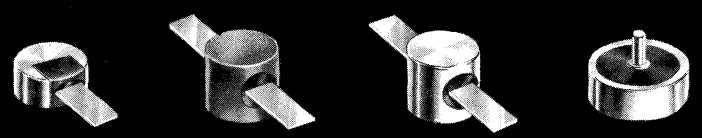
UHF CERAMIC ATC-200
HIGH PACKAGING DENSITY ATC-300



—0.06 dB COUPLING
1000 MFD/CUBIC INCH
1.07:1 VSWR
EXCELLENT BY-PASSING

SEE PAGE 4

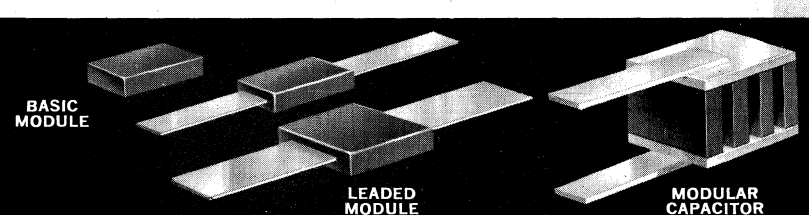
STRIPLINE CAPACITORS AND FILTERS ATC-400



100. WATT POWER INPUT
0.03 dB INSERTION LOSS
1.05:1 VSWR
60. dB BY-PASSING

SEE PAGE 5

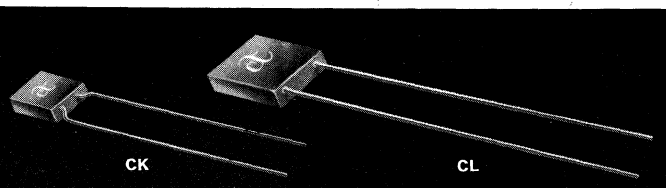
RF POWER MODULAR CAPACITORS ATC-500



1000 KVA/CUBIC INCH.
VIRTUALLY UNLIMITED
CURRENT AND CAPACITY RATINGS

SEE PAGE 6

HIGH Q PRECISE TOLERANCE ATC-600

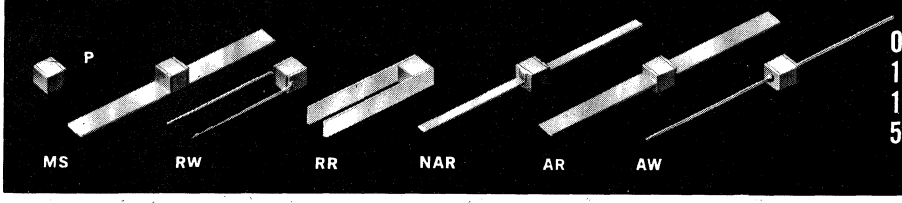


.25% TOLERANCES
.1% DRIFT
.1% RETRACE
5000 Q

SEE PAGE 7

AMERICAN TECHNICAL CERAMICS PAGE 1

MICROWAVE PORCELAIN ATC-100



0.03 dB INSERTION LOSS
1.05:1 VSWR
10,000 Qu
50. WATT POWER INPUT

MICROWAVE CHARACTERISTICS

ATC Microwave Porcelain Capacitors are designed to advance the state-of-the-art in broadband, high power and low noise applications. Unique construction techniques provide ultra-high unloaded-Q (10,000 at 100 MHz in a 10 PF unit), with loss tangents lower than 0.0001, and self-resonance near X-Band.

ELECTRICAL CHARACTERISTICS

EXCEEDS MIL-C-11272B (Complete Test Data available)

INSERTION LOSS: Less than 0.03 dB @ 10 watts @ 1 GHz

VSWR: 1.05:1

POWER HANDLING CAPABILITY: 50 Watts for $X_c < 1\ \Omega$

TEMPERATURE RANGE: From —55°C to 125°C (no derating of working voltage)
From 125°C to 200°C derate linearly to 50% @ 200°C

TEMPERATURE COEFFICIENT OF CAPACITY: (Measured @ 1 MHz) + 90 ±20 PPM/°C (—55°C to 125°C)

QUALITY FACTOR (Qu): Greater than 10,000 @ 100 MHz (10PF)

INSULATION RESISTANCE: For 200, 300, 500 WVDC Units: 1,000,000 megohms min @ 25°C, 100,000 megohms @ 125°C, for 100 WVDC units: 10^5 Meg. Ω @ 25°C, and 10^4 Meg. Ω @ 125°C

CAPACITY RANGE: From .1 PF to 1000 PF (for higher values, consult factory)

TOLERANCES AVAILABLE: ±.1 PF, ±.25 PF, ±.5 PF, 1%, 2%, 5%, 10%, and 20%

OPERATING VOLTAGES: From .1 PF to 100 PF (500 WVDC), 110 PF to 200 PF (300 WVDC), 220 PF to 470 PF (200 WVDC), 510 PF to 1000 PF (100 WVDC)

CASE SIZE: (.1" by .1" square: "B" Case)—See ATC Lead Types. For special sizes consult factory.

DIELECTRIC TEST VOLTAGE: All units tested at 250% of WVDC rating for 5 secs.

SELF RESONANT FREQUENCY: From 2 to 10 GHz (determined by value and lead style)

PIEZO-ELECTRIC EFFECTS: None

ELECTRICAL CHARACTERISTICS AFTER LIFE TEST*

CHANGE IN CAPACITANCE: At 25°C — 0.1% max

QUALITY FACTOR: Greater than 10,000 @ 1 MHz

INSULATION RESISTANCE: 1,000,000 megohms min @ 25°C, 100,000 megohms min @ 125°C (for 100 WVDC units, 10^5 Meg Ω @ 25°C, and 10^4 Meg Ω @ 125°C)

*Life tested at 150% of rated voltage for 2000 hours at +125°C as per MIL-STD-202C method 108A (test condition F.)

APPLICATIONS

Constant-capacitance matching and coupling in octave bandwidth microstrip and stripline L and S-Band amplifiers, swept L.O.'s, mixers, synthesizers, and switches.

Low-loss signal paths for low noise receivers.

Coupling and by-passing for low and high power UHF transmitters.

Excellent first base-shunt elements in low-pass Matthaei wideband interstages.

Utilization in base and emitter by-passing, as well as coupling applications, where extremely low inductance is required.

Applications in ultra-stable oscillator sources where absolute retrace and minimal drift (less than .1%), as well as low inductance, are an important factor, particularly over environmental extremes.

Use in RF tank circuits where high circulating currents or where stability and Q are important factors. Use in timing and control circuits demanding high stability under extreme environmental conditions.

High Q DC blocks in wideband varactor-tuned sweepers.

Compact stable elements for use in low-distortion and narrow pulse width, high PRF delay lines.

Low and high values of capacity where close tolerances and high stability are required in HF and VHF filter design. (See ATC-100 Capacity Values)

Single-replacement for multiple-capacitor collector and base by-passes.

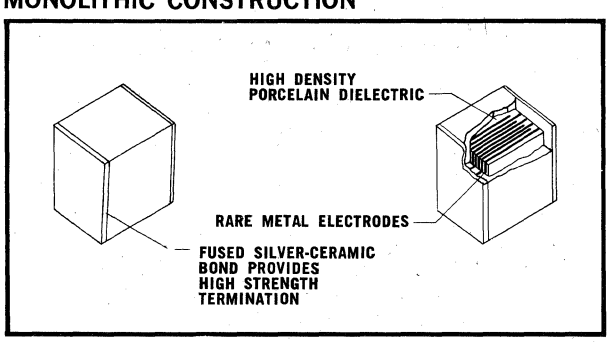
Pellet styles for input-matching and pseudo-idler circuits of high-ratio step-recovery multipliers.

Where state-of-the-art high Q_U capacity-vs-size microminiaturization is required.

SELF-ENCAPSULATED MONOLITHIC BLOCK

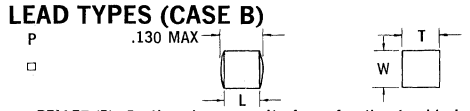
Self-encapsulated by its own extremely dense, low-loss porcelain, molecularly fused into a homogeneous miniature cube; provides a very rugged non-porous block unaffected by moisture, contaminants, shock, vibration, and altitude.

SELF-ENCAPSULATED MONOLITHIC CONSTRUCTION

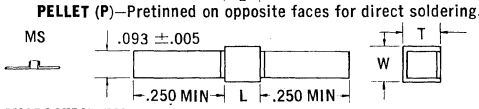


TO ORDER ANY AMERICAN TECHNICAL CERAMICS CAPACITOR SEE PAGE 8

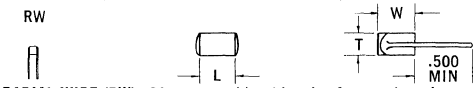
ATC LEAD TYPES (CASE B)



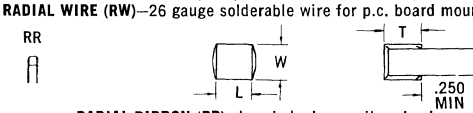
PELLET (P)—Pretinned on opposite faces for direct soldering.



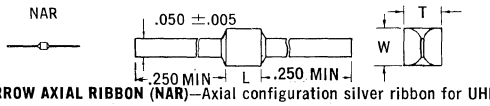
MICROSTRIP (MS)—Silver ribbon leads for single-sided UHF substrates.



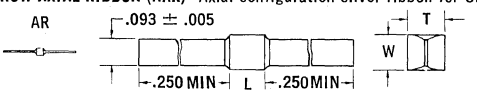
RADIAL WIRE (RW)—26 gauge solderable wire for p.c. board mounting.



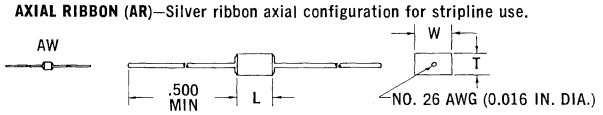
RADIAL RIBBON (RR)—Low inductance silver leads.



NARROW AXIAL RIBBON (NAR)—Axial configuration silver ribbon for UHF circuits.



AXIAL RIBBON (AR)—Silver ribbon axial configuration for stripline use.



AXIAL WIRE (AW)—26 gauge solderable wire for cordwood packaging and point-to-point wiring. (Weldable wire available)

All dimensions are inches: Length (L) = .100 ±.010; Width (W) = .100 ±.010; Thickness (T) = .100 maximum. All lead types (except Pellets) available with body insulation where the capacitor body may come in contact with a chassis or other metal parts. All ribbon leads are .004" ±.001" thick silver.

ATC-100 CAPACITY VALUES

LOW CAPACITANCE CLOSE TOLERANCE

Cap. PF	Tolerances Available	WVDC 125°C	Cap. PF	Tolerances Available	WVDC 125°C	Cap. PF	Tolerances Available	WVDC 125°C
0.1	B	500	4.7	CD	500	75	FGJKM	500
0.2	B	500	5.1	CD	500	82	FGJKM	500
0.3	BC	500	5.6	CJK	500	91	FGJKM	500
0.4	BC	500	6.2	CJK	500	100	FGJKM	500
0.5	BCD	500	6.8	CJKM	500	110	FGJKM	300
0.6	BCD	500	7.5	CJKM	500	120	FGJKM	300
0.7	BCD	500	8.2	CJKM	500	130	FGJKM	300
0.8	BCD	500	9.1	CJKM	500	150	FGJKM	300
0.9	BCD	500	10	FCJKM	500	160	FGJKM	300
1.0	BCD	500	11	FCJKM	500	180	FGJKM	300
1.1	BCD	500	12	FCJKM	500	200	FGJKM	300
1.2	BCD	500	13	FGJKM	500	220	FGJKM	200
1.3	BCD	500	15	FGJKM	500	240	FGJKM	200
1.4	BCD	500	16	FGJKM	500	270	FGJKM	200
1.5	BCD	500	18	FGJKM	500	300	FGJKM	200
1.6	BCD	500	20	FGJKM	500	330	FGJKM	200
1.7	BCD	500	22	FGJKM	500	360	FGJKM	200
1.8	BCD	500	24	FGJKM	500	390	FGJKM	200
1.9	BCD	500	27	FGJKM	500	430	FGJKM	200
2.0	BCD	500	30	FGJKM	500	470	FGJKM	200
2.1	BCD	500	33	FGJKM	500	510	FGJKM	100
2.2	BCD	500	36	FGJKM	500	560	FGJKM	100
2.7	CD	500	39	FGJKM	500	620	FGJKM	100
3.0	CD	500	43	FGJKM	500	680	FGJKM	100
3.3	CD	500	47	FGJKM	500	750	FGJKM	100
3.6	CD	500	51	FGJKM	500	820	FGJKM	100
3.9	CD	500	56	FGJKM	500	910	FGJKM	100
4.3	CD	500	62	FGJKM	500	1000	FGJKM	100
			68	FGJKM	500			

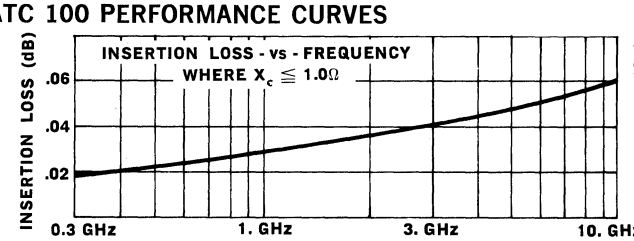
BASIC BODY LENGTHS (L) (all dimensions in inches as measured across terminations):

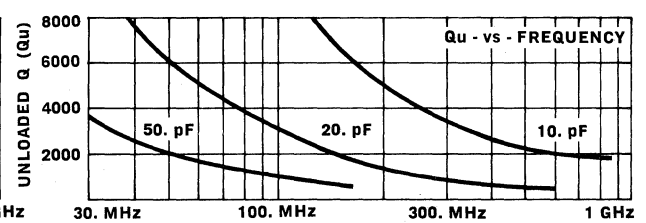
Porcelain element: .100 (±.010), **Chips:** .120 max, **Pretinned pellets:** .130 max

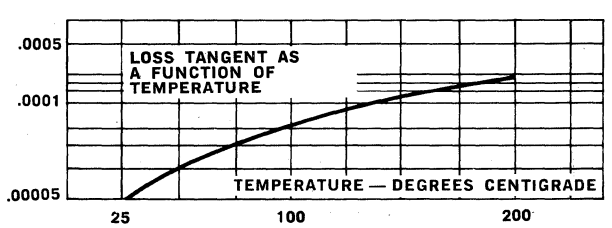
OTHER TERMINATIONS

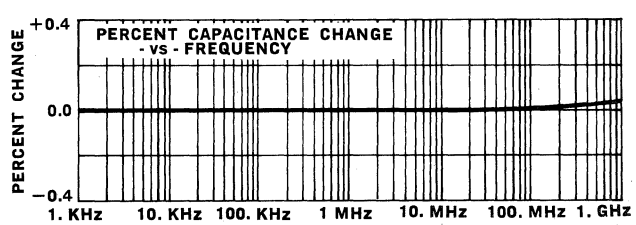
for welding and thermocompression bonding are available, including rare metal alloy terminations.

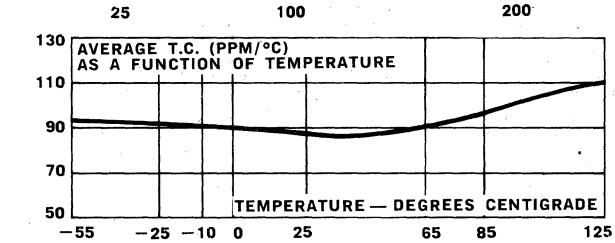
ATC 100 PERFORMANCE CURVES

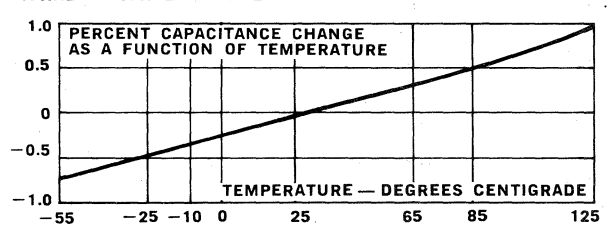


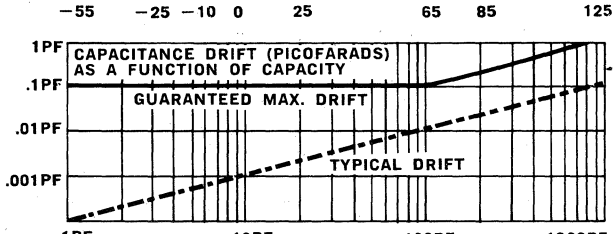


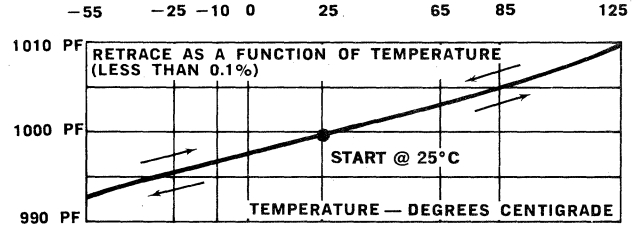




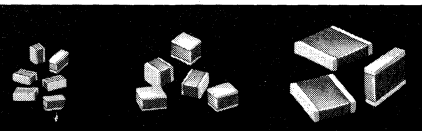


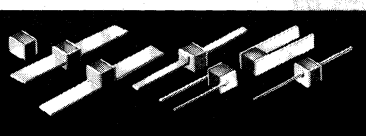






UHF CERAMIC ATC-200
HIGH PACKAGING DENSITY ATC-300


CHIPS


LEADED CAPACITORS

—0.06 dB COUPLING
1000 MFD/CUBIC INCH
1.07:1 VSWR
EXCELLENT BY-PASSING

UHF CHARACTERISTICS

INSERTION LOSS: .05 dB at 10 Watts at 1.GHz
VSWR: 1.07:1
SELF-RESONANT FREQUENCY: 14 GHz (case A)

ELECTRICAL CHARACTERISTICS

CAPACITY RANGE: 10 PF to 1.2 MFDS
DISSIPATION FACTOR: 2.5% Max @ 1 KHz
TOLERANCES: 10%, 20%, 30%, GMV
MILITARY SPECIFICATIONS: Applicable portions of MIL-C-11015D
WORKING VOLTAGES: 50, 100, 200, WVDC. 50 WVDC is standard and will be supplied if WVDC is not specified.
TEST VOLTAGE: 3 x rated, 5 sec
INSULATION RESISTANCE: 10,000 megohms min (10 PF to .1 MF), 1,000 megohms min (.12 MF to 1.2 MF)
TEMPERATURE COEFFICIENT: ±15% Max (—55°C to 125°C)
VOLUMETRIC EFFICIENCY: 100 MFDS/Cu. in.
CONSTRUCTION: Self-encapsulated monolithic block
LEAD TYPES: See ATC lead types (Case B) page 3
TESTING SEQUENCE: CAP., D.F., I.R., V.D.C.

APPLICATIONS

UHF/VHF amplifier emitter and collector RFC by-passes and coupling; common-base oscillator RF by-pass.
C_{ob}-cancelling-inductor by-pass
High capacity, miniature low-pass filter shunt elements
Tantalum replacements

CAPACITOR ELEMENT SIZES
(ALL DIMENSIONS ±.010 inches)

CASE A 50 MIL SQUARE Scale 1:1
L = .050, **W** = .050, **T** = .020 to .050

Capacity Range—
50 WVDC (10 PF—10,000 PF)
100 WVDC (10 PF—3900 PF)
200 WVDC (10 PF—1200 PF)

CASE B 100 MIL SQUARE Scale 1:1
L = .100, **W.** = .100, **T** = .020 to .100

Capacity Range—
50 WVDC (100 PF-100,000 PF)
100 WVDC (100 PF- 56,000 PF)
200 WVDC (100 PF- 15,000 PF)

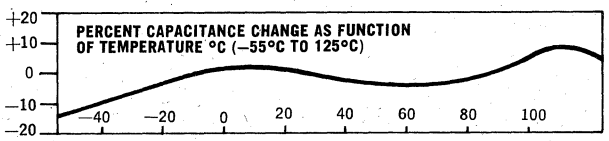
CASE C 250 MIL SQUARE Scale 1:1
L = .250, **W** = .250, **T** = .050 to .100

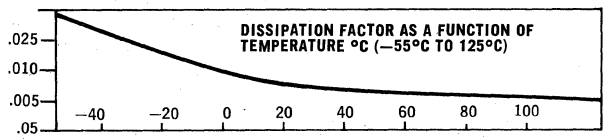


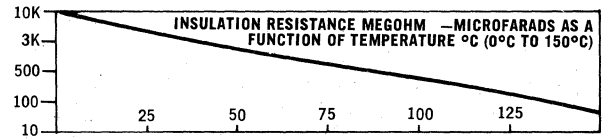
Capacity Range—
50 WVDC (120,000 PF—1,200,000 PF)
100 WVDC (120,000—500,000)

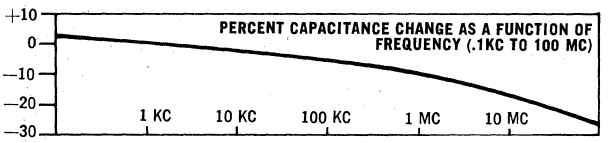
STANDARD VALUES (PF)	
10	3,900
12	4,700
15	5,000
18	5,600
20	6,800
22	8,200
27	10,000
33	12,000
39	15,000
47	18,000
50	20,000
56	22,000
68	27,000
82	33,000
100	39,000
120	47,000
150	50,000
180	56,000
200	68,000
220	82,000
270	100,000
330	120,000
390	150,000
470	180,000
500	200,000
560	220,000
680	270,000
820	330,000
1,000	390,000
1,200	470,000
1,500	500,000
1,800	560,000
2,000	680,000
2,200	820,000
2,700	1,000,000
3,300	1,200,000

ATC-200 PERFORMANCE CURVES









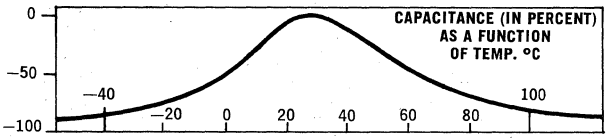
HIGH PACKAGING DENSITY ATC-300

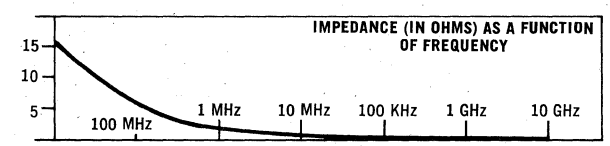
The ATC-300 Series is designed to attain extremely high values of capacity in a minimal case size for use over a moderate temperature range. Values from .1 MF to 1.0 MF are available in .1" square case.

ELECTRICAL CHARACTERISTICS

CAPACITY RANGE: .1 MF to 1.0 MF
TOLERANCES: 20%, 30%, GMV
WORKING VOLTAGE: 50 WVDC
TEST VOLTAGE: 3 x rated, for 5 secs.
INSULATION RESISTANCE: 1000 Megohms min
VOLUMETRIC EFFICIENCY: 1000 MFD/Cu inch
RECOMMENDED OPERATING RANGE: 10°C to 60°C
SELF-RESONANT FREQUENCY: Above 1 GHz
DISSIPATION FACTOR: 3% max @ 1 KHz
CASE SIZE: B case, .1" by .1" square
LEAD TYPES: See ATC lead types (Case B) page 3
CONSTRUCTION: Self-encapsulated monolithic block
TESTING SEQUENCE: CAP., D.F., I.R., V.D.C.

ATC-300 PERFORMANCE CURVES





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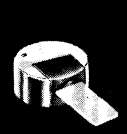
STRIPLINE CAPACITORS AND FILTERS ATC-400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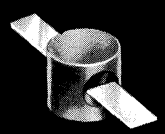
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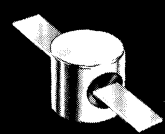
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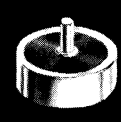

FR

100. WATT POWER INPUT
0.03 dB INSERTION LOSS
1.05:1 VSWR
60. dB BY-PASSING

CONSTRUCTION

All ATC-400 styles have a rugged case with fused-in capacitor elements of self-encapsulated monolithic construction that can withstand the most severe military environmental tests.

This unique construction is extremely rugged mechanically; all leaded devices are capable of meeting a **10 lb. PULL TEST** along the axis of the lead.

The 400 Series **withstand great thermal shock,** insuring no intermittencies in your circuit caused by thermal stress due to high operating temperatures, heat generated by high RF current levels, or by installation of component.

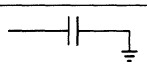
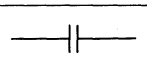
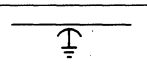
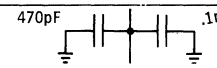
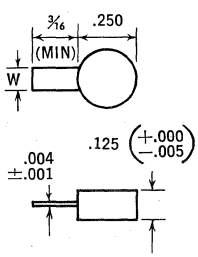
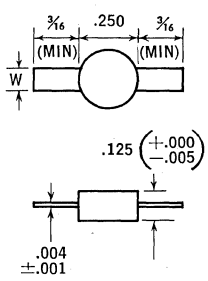
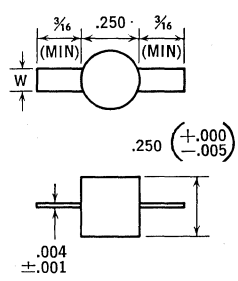
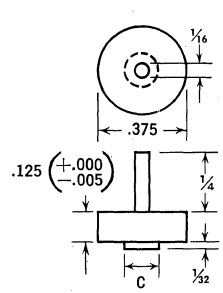
MICROWAVE APPLICATIONS (by case style):

SERIES COUPLING:
CASE SS: DC block/RF coupling/RF tuning and matching. Conservatively rated at 100. watts of RF input power, and equally rugged mechanically. Typical UHF performance: VSWR of 1.05:1 with a 1.05:1 load; Insertion Loss less than 0.03 dB (e.g. less than 70. milliwatts of dissipation at full rated input power); Unloaded Q of 10,000 at 100. MHz (10 PF.); Loss Tangent of 0.00005, and inductance so low that self-resonance is well above frequencies of application.

SHUNT BY-PASS:
CASE FR: low inductance RF by-pass and dc connection through the STRIPLINE metallic backing directly onto the center stripline at any desired point, such as for Vcc input at end of Cob cancelling stub or at a $\frac{\lambda}{4}$ stub-end point.

CASE FR: low inductance RF by-pass and dc connection through the STRIPLINE features which typify the ATC-400 coupling capacitor also characterize the shunt-by-pass models, thus providing up to 60 dB of signal reduction in a single unit, depending upon line impedance level.

ELECTRICAL CHARACTERISTICS

	CASE TYPE SH	CASE TYPE SS	CASE TYPE FT	CASE TYPE FR
CIRCUIT FUNCTION	Shunt capacitor	Series capacitor	Shunt capacitor	Thru-board filter
SCHEMATIC SYMBOL				
APPLICATION	tuning or by-passing	dc block, RF coupling or matching	feed-thru by-pass	dc input to Triplate®
CAPACITY VALUES AVAILABLE	3—1000.pF (see ATC-100 standard values)		1000.pF 470.pF 100.pF	470.pF in parallel with 0.1uF
TOLERANCES AVAILABLE	5%, 10%, 20%		20%, 30%	30%
RATED RF POWER INPUT	100 WATTS (no derating to 150°C)			50. WATTS
FREQUENCY RANGE	DC TO 12 GHz			
INSERTION LOSS	0.03db			up to 60.dB
VSWR	1.05:1			—
WVDC	500 WVDC for: 3- 100pF 300 WVDC for: 110- 200pF 200 WVDC for: 220- 470pF 100 WVDC for: 510-1000pF		500VDC for: 100pF 200VDC for: 470pF 100VDC for: 1000pF	50 WVDC
MAX RECOMMENDED PEAK VOLTAGE	1500VDC for: 3- 100pF 900VDC for: 110- 200pF 600VDC for: 220- 470pF 300VDC for: 510-1000pF		1500VDC for: 100pF 600VDC for: 470pF 300VDC for: 1000pF	150 VDC
TEMPERATURE COEFFICIENT	LESS THAN 1% FROM +25°C TO +125°C, OR TO −55°C			±15% (−55°C TO 125°C)
SPECIALS	Extended range units available for SH, SS, and FT up to 100,000.pF with a BX Temperature Coefficient (±1500. ppm from −55°C to +125°C)			Values to 0.5 uF with BX Temperature Coefficient
CASE DIMENSIONS				

OPTIONAL DIMENSIONS

C = Per customer's drawing and line width.
W = .093 specify AR as lead style in part number.
W = .075 specify SAR as lead style in part number.
W = .050 specify NAR as lead style in part number.

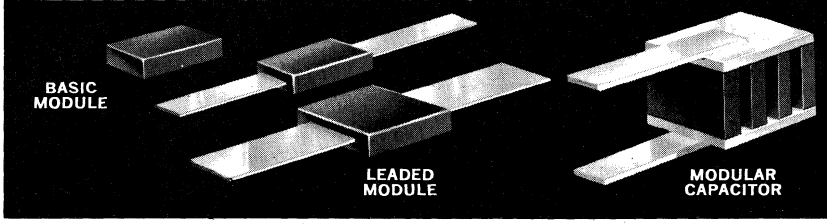
CASE MATERIAL: brass and epoxy.
PLATING: gold flashed.
HARDWARE AVAILABLE: All necessary mounting hardware is available from factory.

ENVIRONMENTAL CAPABILITIES (PER MIL-STD 202)

TEMPERATURE CYCLING: Method 102 (Test Cond C)
HUMIDITY (STEADY STATE): Method 103 (Test Cond C)
IMMERSION: Method 104A (Test Cond C)
BAROMETER PRESSURE: Method 105 (Test Cond C) (70,000 Ft.)
MOISTURE RESISTANCE: Method 106B
THERMAL SHOCK: Method 107B (Test Cond C), temperature steps: (1) −65°C (2) +25°C (3) +200°C (4) +25°C
LIFE: Method 108A (Test Cond F) (2000 Hrs @ 125°C @ 1.5x rated voltage)
VIBRATION: Method 201A*
SHOCK: Method 202B*

*Exceeds spec mounted by body, or in stripline package.

RF POWER MODULAR CAPACITORS ATC-500



1000 KVA/CUBIC INCH. VIRTUALLY UNLIMITED CURRENT AND CAPACITY RATINGS

WITH ATC MODULAR CAPACITORS...

...YOU CAN BUILD A CAPACITOR OF VIRTUALLY ANY VALUE, CURRENT AND VOLTAGE RATING...

Each modular capacitor (regardless of capacity value, voltage and current rating) is engineered for rapid, versatile interconnection. They may be paralleled to increase current and capacity ratings, series connected to increase voltage capabilities, or used in combinations of both series and parallel. For example: to obtain a capacitor with the following ratings: 1000 PF, continuous current rating of 150 Amps, and a peak test voltage of 5000 Volts. By paralleling eight Type MD modular capacitors of 125 PF [each MD module is .6" x .45" x .15" with a peak test voltage of 7000 and a maximum recommended current of 20 Amps], you can build a 1000 PF capacitor rated at 160 Amps and 7000 Volts.

...PACK UP TO 1000 KVA IN A CUBIC INCH...

The 1000 PF capacitor designed, occupies a volume of less than ⅓ of a cubic inch. ATC modular capacitors are often 10 to 100 times smaller than any other RF power capacitor of equivalent ratings (including pressurized gas and vacuum types). In fact, the 1000 PF capacitor you just designed, has higher power ratings than a standard ceramic vacuum fixed type that is 3¾" Dia. and over 2½" thick.

...AND IN THE SHAPE YOU WANT

This same 1000 PF capacitor may be made by electrically paralleling modules vertically, horizontally, or a combination of both, to attain a desired form factor.

SPECIAL HIGH VOLTAGE AND HIGH ALTITUDE TYPES

High voltage modular capacitors and high altitude types for operation in excess of 50,000 Ft., and Customer calculated design values are also available.* (SEE PAGE 8)

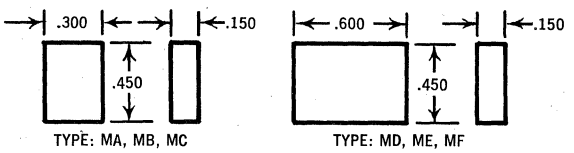
CONSTRUCTION AND RATINGS

Every ATC-500 modular capacitor has its internal structure completely embedded in a homogeneous dielectric of low-loss, high-voltage porcelain, so constructed as to prevent the RF arc-over, common at plate edges in stacked dielectric capacitors. The modular capacitors are available in two physical sizes and three RF voltage ratings (3000, 1000, 250). The MA, MB, MC sizes are all .300" x .450" x .150" with a capacity range from 10 to 5000 PF, and the MD, ME, MF sizes are all .600" x .450" x .150" with a capacity range from 20 to 10,000 PF.

MOUNTING HARDWARE: Gold flashed copper strap for individual axial leaded modular capacitors.

Gold flashed copper bus-bars for interconnecting modular capacitors. (Consult factory for all mounting applications)

ATC-500 MODULAR CAPACITORS



TYPE: MA, MB, MC — TYPE: MD, ME, MF

STANDARD VALUES PF

5.1	13	36	91	240	620	1600	4300
5.6	15	39	100	270	680	1800	4700
6.2	16	43	110	300	750	2000	5100
6.8	18	47	120	330	820	2200	5600
7.5	20	51	130	360	910	2400	6200
8.2	22	56	150	390	1000	2700	6800
9.1	24	62	160	430	1100	3000	7500
10	27	68	180	470	1200	3300	8200
11	30	75	200	510	1300	3600	9100
12	33	82	220	560	1500	3900	10000

APPLICATIONS

ATC-500 Modular Capacitors are used wherever high voltage, high RF current, low-loss capacitors are demanded, but space is limited, or the environment severe. Examples are: P.A. tank circuits; grid and plate blocks; fixed neutralizing capacitors; output matching, tuning, and trap circuits; low inductance high current by-passes; RF voltage dividers; in and beyond the BC and HF ranges.

ELECTRICAL CHARACTERISTICS:

TEMPERATURE COEFFICIENT OF CAPACITY: +90 PPM ±20 PPM @ 1. MHz (−55°C to 125°C)

TEMPERATURE COEFFICIENT TRACKING: Difference between capacitors less than 10 PPM

RETRACE: Less than 0.1%

CAPACITANCE DRIFT: Less than 0.1% or 0.1 PF, whichever is greater

VOLTAGE COEFFICIENT: From 0 Volts to full WVDC, no measurable change

SELF RESONANCE: Up to 1000 MHz

INSULATION RESISTANCE: (+25°C) — 10^6 megohms min
(+125°C) — 10^5 megohms min

VOLUMETRIC EFFICIENCY: 1000 KVA per cubic inch

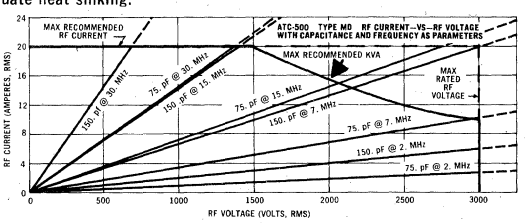
QUALITY FACTOR: Greater than 10,000 @ 1 MHz

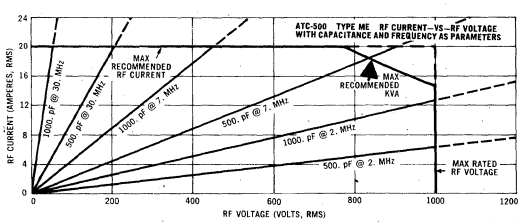
TOLERANCES AVAILABLE: 1%, 2%, 5%, 10% (customer selected non-standard values are available in tolerances as close as 1%)

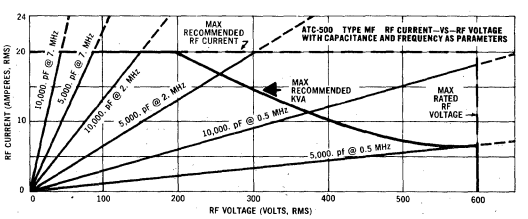
MAXIMUM RECOMMENDED RATINGS

Modular Capacitors	Range of Values PF	WVDC	Dielectric Test Voltage DC	RF Voltage RMS	RF Current	KVA
MA	5-75	3500	7000	3000	10	15
MD	10-150	3500	7000	3000	20	30
MB	150-500	1200	2400	1000	10	7.5
ME	300-1000	1200	2400	1000	20	15
MC	1000-5000	300	600	250	10	2
MF	2000-10000	300	600	250	20	4

NOTE: All power ratings are based on "still air" measurements with minimal heat sinking. Since circuit mounting techniques, RF current levels, ambient temperatures, humidity, and altitude conditions, all have an effect on actual current and voltage ratings, a safe Design/Test procedure is to monitor the module body temperature, and insure it does not exceed 125°C by providing adequate heat sinking.

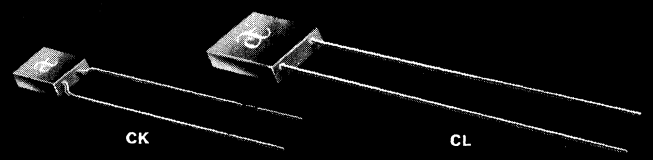






TO ORDER ANY AMERICAN TECHNICAL CERAMICS CAPACITOR SEE PAGE 8

HIGH Q PRECISE TOLERANCE ATC-600



.25% TOLERANCES
.1% DRIFT
.1% RETRACE
5000 Q

ATC-600 offers greater volumetric efficiency and lower losses [(D.F. = 0.0002) in a CK05 case size (.2″ by .2″ by .125″)] than conventional glass, porcelain, ceramic, and mica types, while meeting all environmental and electrical parameters of MIL-C-11272B.

Precise capacity tolerances as close as ±¼ of 1% are available. The ATC 600 maintains its capacitance value under extreme changes in temperature, time, voltage, frequency, shock/vibration and hostile environments. Their guaranteed minimum Q of 5000 @ 1 MHz, negligible drift (less than 0.1%) perfect retrace (less than 0.1%), and unexcelled capacitance stability, means narrower bandwidth, drift free oscillators. An extremely broad range of values (1PF to 5000PF) is available in two small precise case sizes for upright mounting on 100 MIL GRID P.C. boards. Repeatability is assured since each ATC capacitor is manufactured under strict Quality Control standards starting with the formulation of the porcelain dielectric to 100% electrical testing of each capacitor.

ELECTRICAL CHARACTERISTICS

Exceeds: MIL-C-11272B
Temperature Coefficient of Capacity = +90PPM ±20PPM measured @ 1MHz
Temperature Coefficient Tracking: Difference between capacitors is less than 10PPM
Quality Factor: Greater than 5000 @ 1 MHz
Retrace: Less than 0.1%
Capacitance Drift: Less than 0.1% or 0.1PF (whichever is greater)
Capacity Range: 1 PF to 5000 PF
Dielectric Test Voltage: 250% x WVDC for 5 sec
Voltage Coefficient: From 0 volts to full WVDC, no measurable change
Voltage Derating: No derating to 125°C
Working Voltage Ratings Available: Case CK 500 V for 1-100PF, 300 V for 110 200PF, 200 V for 220-470PF, 100 V for 510-1000PF
Case CL 300 V for 1000-5000PF
Tolerances Available: ±.25% (20PF to 5,000PF), .5%, 1%, 2%, 5%, 10% and 20% are available from 10PF to 5000PF. Values from 1PF to 9.1PF (available only in ±.25PF and ±.5PF tolerances).
Insulation Resistance: 1,000,000 megohms minimum, @ 25°C, 100,000 megohms minimum @ 125°C
Dissipation Factor: @ 1KHz less than .0002
Moisture Resistance: 1R exceeds 10^{10} ohms, after Moisture Resistance Test per MIL-STD 202 Method 106, when measured at 25°C and 50% R.H.
Life: After 2000 hours @ 125°C with 150% x WVDC, capacitance change less than .1%

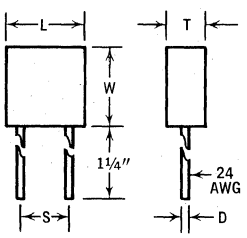
APPLICATIONS

Both the CK and CL case styles are designed for insertion in 100 MIL GRID P.C. boards and are ideal for high stability oscillators, extremely accurate delay lines, precision phase shifters, precise RC time constants, specific ratio dividers, sharp cut off filters, and low noise LF receiver front ends.

STANDARD VALUES (PF)

CASE "CK"				CASE "CL"
1.0	9.1	47	240	1100
1.5	10	51	270	1200
2.2	11	56	300	1300
2.7	12	62	330	1500
3.0	13	68	360	1600
3.3	15	75	390	1800
3.6	16	82	430	2000
3.9	18	91	470	2200
4.3	20	100	510	2400
4.7	22	110	560	2700
5.1	24	120	620	3000
5.6	27	130	680	3300
6.2	30	150	750	3600
6.8	33	160	820	3900
7.5	36	180	910	4300
8.2	39	200	1000	4700
	43	220		5000

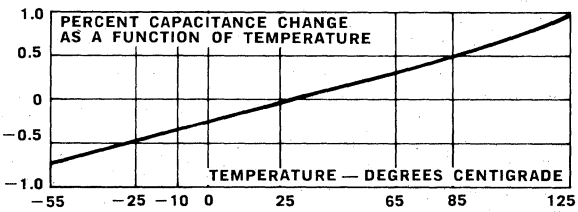
CASE TYPES

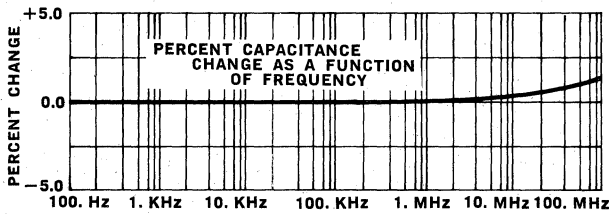


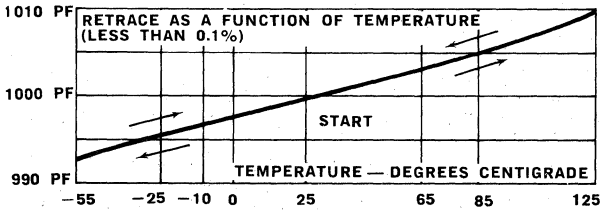
Style	Cap. Range	L/W	T (Max)	S	D
Case "CK"	1 PF to 1000 PF	.200	.150	.200	.020
Case "CL"	1100 PF to 5000 PF	.300	.150	.200	.020

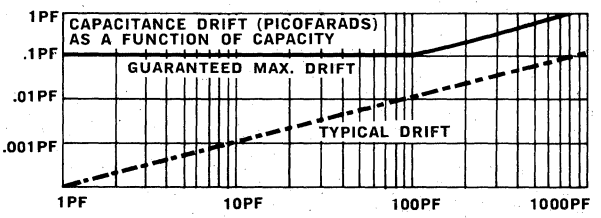
*Customer calculated design values available in tolerances as close as ±0.25%

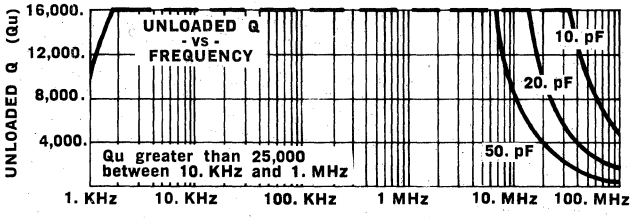
ATC-600 PERFORMANCE CURVES

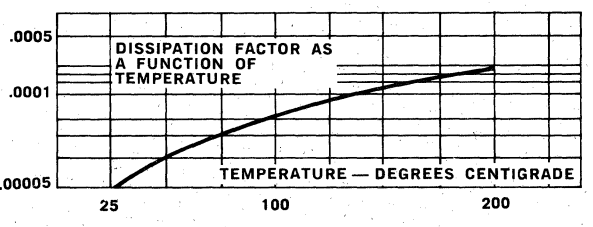


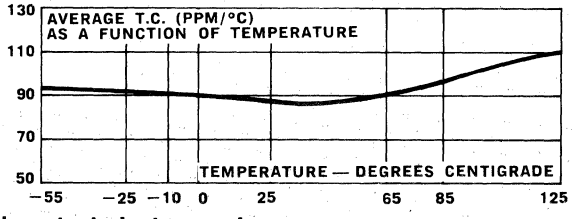


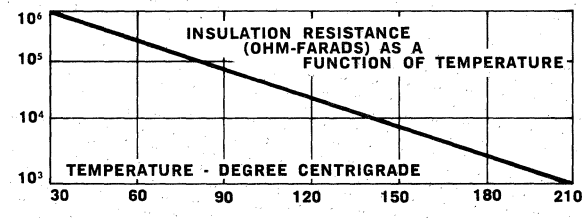












ATC CAPACITORS

advance the state-of-the-art with the widest range of parameters in the smallest packages available in the industry.

- **Q greater than 10,000 @ 1 MHz**
- **Insertion Loss less than .03 dB @ 1. GHz @ 10 Watts**
- **Highest volumetric efficiency: 1000 MFDS/CUBIC INCH**
- **Highest KVA/Unit volume: greater than 1000 KVA/CUBIC INCH**
- **Self-resonant frequencies up to 20 GHz**
- **Retrace and Drift below 0.1%**

TECHNICAL ASSISTANCE
An ATC microwave application engineer is available to answer any questions you may have regarding the use of ATC capacitors in your circuit.

If your capacitor requirements cannot be met with a standard ATC component, a capacitor design engineer is available to assist you.

SCREENED UNITS
Screening to your specifications, A, B, and C testing, and accelerated life testing for any of the ATC series are available. (ATC also maintains a separate RF test lab for screening all high current, high voltage ATC-500 modular capacitors.)

CUSTOMER CALCULATED DESIGN VALUES:
Are available for the ATC-500 Series and the ATC-600 Series; e.g. if your circuit requires a non-standard value such as 85.6 PF, (standard values being 82 and 91) ATC will supply it in extremely close tolerances (±¼ of 1% for ATC-600, ±1% for ATC-500 Series).

HOW TO ORDER ATC CAPACITORS

EXAMPLE: 6-ATC 100-B - 91 0 - F - AR - 500 - BI

- **QUANTITY**
- **ATC SERIES**
- **CASE TYPE**
- **FIRST TWO DIGITS OF THE CAPACITANCE IN PICOFARADS**
- **INDICATES NUMBER OF ZEROS FOLLOWING DIGITS OF CAPACITANCE IN PICOFARADS**

FOR VALUES LESS THAN 10. PF, or FRACTIONAL VALUES, USE LETTER "R" FOR DECIMAL POINT:

e.g.: 0.3 PF = 0R3
7.5 PF = 7R5

THE ABOVE EXAMPLE DESIGNATES: 6 ATC-100 "B" CASE CAPACITORS, 91 PF ±1%, AXIAL RIBBON LEADS, 500 WVDC AND BODY INSULATION.

NOTE: CHIPS ARE SILVERED CAPACITOR ELEMENTS.
PELLETS ARE PRE-TINNED CHIPS.

- **INDICATES SPECIAL BODY INSULATION. AVAILABLE ONLY ON ATC-100, 200, 300 SERIES, (EXCEPT CHIPS AND PELLETS)**
- **WVDC (ONLY SPECIFIED IF NON-STANDARD)**
- **LEAD STYLE**
- **DESIGNATES CAPACITANCE TOLERANCE:**

B = ±0.1 PF	G = ±2%
C = ±0.25 PF	J = ±5%
D = ±0.5 PF	K = ±10%
E = ±½%	M = ±20%
F = ±1%	N = ±30%

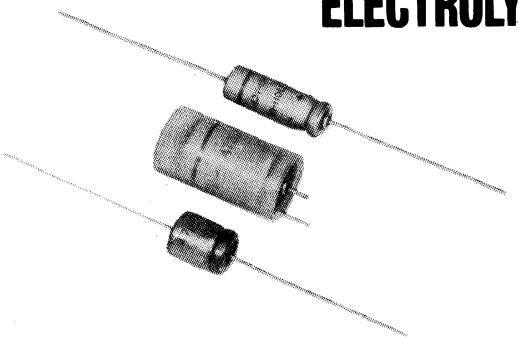
Z = GUARANTEED MINIMUM VALUE (–20% TO +80%)

T = ±¼% (600 SERIES ONLY)

american technical ceramics
ONE NORDEN LANE, HUNTINGTON STATION, N.Y. 11746 · 516/271-9600 · TWX 510-226-6993
TOMORROW'S CAPACITORS...TODAY
AMERICAN TECHNICAL CERAMICS PAGE 8

Amperex Capacitors

ELECTROLYTIC CAPACITORS



Amperex high quality, low cost electrolytic capacitors feature small size, high capacitance and long service life. Low leakage currents are achieved through the use of highly purified materials and carefully controlled manufacturing processes. They are the "dry" type with the liquid electrolyte absorbed into a layer of paper between cathode and anode foils. Winding is sealed in an aluminum can.

They are designed to operate at varied efficiences over a temperature range of −40°C to +85°C. The min. and max. temp. depends on the application; increase of impedance and losses are the limiting factors.

C426AR Series

	DIMENSIONS*		CAPACITANCES — μf							
CAN SIZE	Length (in.)	Dia. (in.)	2.5 Volts	4.0 Volts	6.4 Volts	10 Volts	16 Volts	25 Volts	40 Volts	64 Volts
1	0.394	0.122	10	8	6.4	4	2.5	1.6	1	0.64
2	0.394	0.173	40	32	25	16	10	6.4	4	2.5
3	0.394	0.228	80	64	50	32	20	12.5	8	5
4	0.709	0.248	160	125	100	64	40	25	16	10
5	0.709	0.315	320	250	200	125	80	50	32	20
6	0.709	0.394	500	400	320	200	125	80	50	32

C437AR Series

	DIMENSIONS*		CAPACITANCES — μf							
CAN SIZE	Length (in.)	Dia. (in.)	2.5 Volts	4.0 Volts	6.4 Volts	10 Volts	16 Volts	25 Volts	40 Volts	64 Volts
00	1.18	0.394	1000	800	640	400	250	160	100	64
01	1.18	0.492	1600	1250	1000	640	400	250	160	100
02	1.18	0.591	2500	2000	1600	1000	640	400	250	160
03	1.18	0.709	4000	3200	2500	1600	1000	640	400	250

**Includes Insulation*

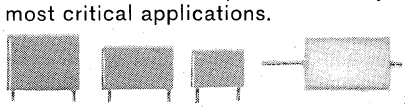
FILM CAPACITORS

Fixed Film Dielectric Capacitors

METALLIZED POLYCARBONATE

Metallized polycarbonate capacitors offer 125°C operation with no voltage de-rating, extreme capacitance stability with temperature, and low dissipation factor. High insulation resistance coupled with small physical size make these capacitors ideally suited for the most critical applications.

C280M Series



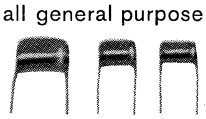
C281 Series

100VDC from .047 mfd to 6.8 mfd
400VDC from .01 mfd to 1.0 mfd
630VDC from .01 mfd to .47 mfd

METALLIZED POLYESTER

Available in 250VDC rating from .001 mfd to 2.2 mfd. Offer small size and cost advantages and are suitable for all general purpose applications.

C280AE Series



(Also available in C280M and C281 packaging configuration)

Variable Capacitors

CERAMIC DIELECTRIC

For high freq. temp.-compensating applications requiring low Zero capacitance. Feature high breakdown voltage, stability and accuracy of adjustment.



C004 Series (typical configurations)

FILM DIELECTRIC

The CO10 is a general trimmer used when large Delta 'C' variations are required and space is limited. Adjustable top and bottom, available in following min.-max. ranges: 2pf-10pf, 5pf-20pf, 5pf-60pf.



C010/HT10 Series

HT10 TEFLON® SERIES

For applications requiring guaranteed Delta 'C' and where capacitance-variation is unaffected by temp. of 125° and higher. Same ranges as CO10 (above).

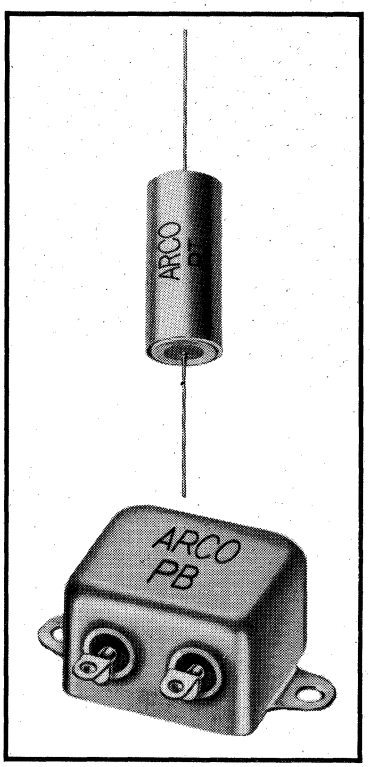
®Dupont Trademark

AMPEREX ELECTRONIC CORPORATION
Component Division: 35 Hoffman Ave., Hauppauge, N.Y.
Telephone: 516-234-7000 TWX 510-227-8552

Amperex®
TOMORROW'S THINKING IN TODAY'S PRODUCTS

ARCO precision polystyrene capacitors

MANUFACTURING DIVISION



for military applications and hostile environments

type PT, CT and ST tubular

type PB, CB and SB rectangular bathtub cans

hermetically-sealed — metal case

Design innovations and extreme care in production have enabled ARCO to approach the optimum performance characteristics of the polystyrene film. These capacitors will exceed all performance requirements of MIL-C-19978 under ALL ENVIRONMENTAL CONDITIONS specified therein. ARCO polystyrene capacitors were specifically designed for the most critical applications where requirements for extremely high insulation resistance, high Q, extraordinary stability, close tolerance, and low dielectric absorption and dissipation factor are mandatory. These capacitors are intended primarily for use in ANALOG and DIGITAL COMPUTERS, CALCULATORS, HIGH Q TUNED CIRCUITS, INTEGRATORS, PRECISION FILTER CIRCUITS, PULSE NETWORKS, SERVO SYSTEMS, and as REFERENCE CAPACITORS.

specifications

DISSIPATION FACTOR: When measured at or referred to 1kHz the dissipation factor shall not exceed the following
.0001 at 23°C
.0002 at 85°C

INSULATION RESISTANCE: Insulation resistance when measured at the applicable test temperature, shall equal or exceed the following values

	23°C	*85°C
megohm x mfd	10^6	1.5×10^5
except the insulation resistance in megohms need not exceed	10^8	10^6

*NOTE: verified on 100% of production

DIELECTRIC ABSORPTION: When tested in accordance with paragraph 4.6.15 of MIL-C-19978, the dielectric absorption shall not exceed 0.05% over the entire operating temperature range.

OPERATING TEMPERATURE RANGE: The ARCO capacitor types listed can be used for continuous operation from −55°C to +85°C without derating. Transient exposure to +95°C will have NO DELETERIOUS effect.

TEMPERATURE COEFFICIENT: The following temperature coefficient variants are available —

Type PT & PB	negative 120 ±15 PPM/°C
Type ST & SB	negative 120 ±15 PPM/°C
Type CT & CB	negative 175 ±15 PPM/°C

STABILITY: Long term (1 year) capacitance drift under maximum operating conditions shall not exceed the following limits for the types listed.

Type PT & PB	±0.1%
Type CT & CB	±0.1%
Type ST & SB	±0.05%

VOLTAGE RATING: All ARCO capacitors are available in 100, 200, 400, 600 and 1,000 Volts DC ratings. Special voltages can be supplied upon request or to specification.

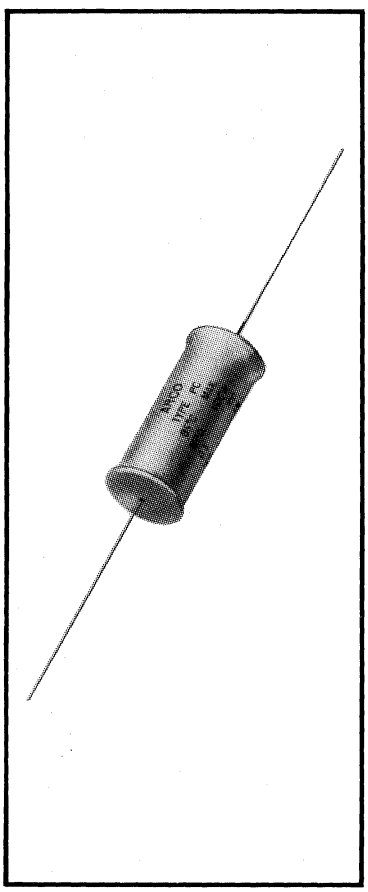
CAPACITANCE TOLERANCE: ARCO specializes in precision capacitors. Available from standard production are tolerances of ±10%, ±5%, ±3%, ±2%, ±1%, ±½%, ±¼%, ±0.1%.

BURN-IN: All ARCO capacitors are subjected to a minimum of two 16 hour burn-in periods with 300% of rated voltage applied at 85°C.

CONSTRUCTION: All ARCO precision polystyrene capacitor types here listed are hermetically sealed in metal cases with compression glass-to-metal, solder-sealed terminals. They are wound with a SOLID CORE in the center for optimum stability, and are terminated with a disc lead assembly soldered directly to the extended foil for a completely NON-INDUCTIVE construction resulting in the lowest possible contact resistance and exhibiting complete FREEDOM FROM MICROPHONISM.

ARCO precision polystyrene capacitors

MANUFACTURING DIVISION



superior environmental protection at low cost—smallest size

type PC & PJ tubular
type SC & SJ tubular

The unique design of Arco Type PC capacitors provides physical and electrical stability, ruggedness and strength of termination, and excellent uniformity in production. All these features enable tight control of the narrow specification limits published. Type PC offers the smallest, lowest cost construction available, while retaining optimum performance characteristics.

The Type PC enclosure provides unusual protection against moisture, solvents and inadvertent contact with a soldering iron. The rugged, heat resistant jacket material makes Type PC particularly suited to printed circuit dip-solder assemblies subject to solvent cleaning and also to densely packed component structures where there is danger of damage to adjacent units while making solder connections.

Extensive evaluation has confirmed the excellent moisture resistance of the type PC (surpassed only by metal cased enclosures) and its conformance to the most stringent shock and vibration specifications. Type PC capacitors are exceptionally well suited for PRECISION FILTERS, DELAY LINES, and PRECISION TIMING CIRCUITS, where small size and excellence of performance are mandatory at LOW COST.

specifications (See Page 606 for Electrical Characteristics)

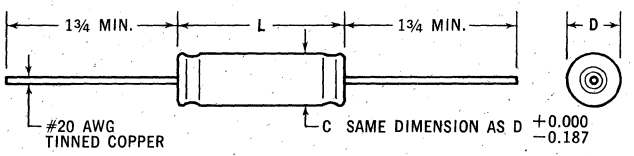
CONSTRUCTION: The ARCO precision polystyrene capacitors types PC & SC are encased in an irradiated polyolefin jacket sealed with bonded silicone rubber. Types PJ & SJ are encased in a silicone treated fused polystyrene jacket. This unique construction economically protects the excellent electrical characteristics exhibited in types PC and SC and is primarily intended for use where they will not be subjected to the following hazards:

1. Physical damage due to excessive heat during dip or flow solder assembly.
2. Solvent damage during cleaning operations
3. Exposure to excessive humidity for prolonged periods of time.

All types herein listed are wound with a SOLID CORE in the center for optimum stability, and are terminated with a disc lead assembly soldered directly to the extended foil for a completely NON-INDUCTIVE construction resulting in the lowest possible contact resistance and exhibiting complete FREEDOM FROM MICROPHONISM.

ARCO precision polystyrene capacitors continued

MANUFACTURING DIVISION



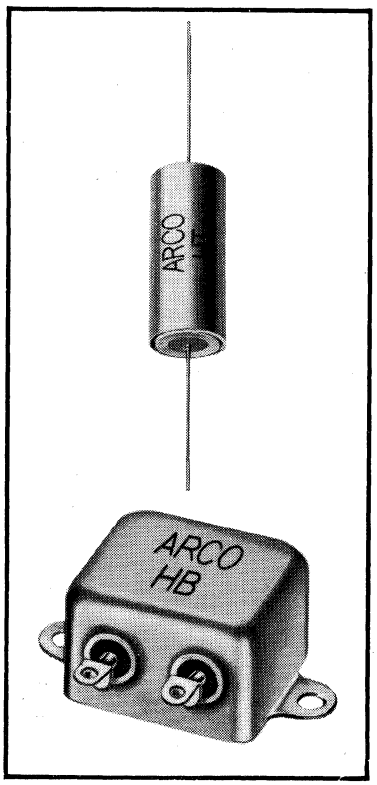
dimensions—types PC, PJ, SC & SJ

Cap. in mfd.	100 VDCW			200 VDCW			400 VDCW			600 VDCW			1000 VDCW		
	D			D			D			D			D		
	MIN.	MAX.	L ±1/16	MIN.	MAX.	L ±1/16	MIN.	MAX.	L ±1/16	MIN.	MAX.	L ±1/16	MIN.	MAX.	L ±1/16
.001*	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4
.0015	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4
.002	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4
.0022	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4
.0027	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4
.0033	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.265	.344	3/4
.0039	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.265	.344	3/4
.0047	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.265	.344	3/4	.265	.344	3/4
.005	.234	.313	3/4	.234	.313	3/4	.234	.313	3/4	.265	.344	3/4	.265	.344	3/4
.0068	.234	.313	3/4	.234	.313	3/4	.265	.344	3/4	.265	.344	3/4	.265	.344	7/8
.0082	.234	.313	3/4	.265	.344	3/4	.265	.344	3/4	.265	.344	7/8	.296	.375	7/8
.01	.234	.313	3/4	.265	.344	3/4	.265	.344	7/8	.296	.375	7/8	.328	.406	7/8
.012	.265	.344	3/4	.265	.344	7/8	.296	.375	7/8	.328	.406	7/8	.328	.406	1 1/64
.015	.265	.344	3/4	.265	.344	7/8	.296	.375	7/8	.328	.406	7/8	.328	.406	1 1/64
.02	.265	.344	3/4	.328	.406	7/8	.328	.406	7/8	.328	.406	1 1/64	.390	.469	1 1/64
.022	.265	.344	3/4	.328	.406	7/8	.328	.406	7/8	.359	.438	1 1/64	.359	.438	1 1/4
.027	.265	.344	7/8	.328	.406	7/8	.328	.406	1 1/64	.390	.469	1 1/64	.390	.469	1 1/4
.033	.265	.344	7/8	.328	.406	1 1/64	.359	.438	1 1/64	.390	.469	1 1/4	.453	.531	1 1/4
.039	.328	.406	7/8	.328	.406	1 1/64	.390	.469	1 1/64	.453	.531	1 1/4	.500	.625	1 1/4
.047	.328	.406	7/8	.390	.469	1 1/64	.390	.469	1 1/4	.500	.625	1 1/4	.500	.625	1 11/16
.05	.328	.406	7/8	.390	.469	1 1/64	.390	.469	1 1/4	.500	.625	1 1/4	.562	.688	1 11/16
.068	.359	.438	7/8	.390	.469	1 1/4	.453	.531	1 1/4	.500	.625	1 11/16	.687	.813	1 13/16
.082	.328	.406	1 1/64	.453	.531	1 1/4	.500	.625	1 1/4	.562	.688	1 11/16			
.1	.390	.469	1 1/64	.453	.531	1 1/4	.453	.531	1 11/16	.625	.750	1 13/16			
.12	.421	.500	1 1/64	.468	.594	1 1/4	.500	.625	1 11/16	.687	.813	1 13/16			
.15	.390	.469	1 1/4	.500	.625	1 1/4	.562	.688	1 11/16						
.2	.453	.531	1 1/4	.500	.625	1 11/16	.625	.750	1 13/16						
.22	.453	.531	1 1/4	.562	.688	1 11/16	.625	.750	1 13/16						
.27	.500	.625	1 1/4	.625	.750	1 13/16									
.33	.468	.594	1 11/16	.687	.813	1 13/16				Type PJ & SJ are 1/8" shorter for dimension L.					
.39	.500	.625	1 11/16												
.47	.562	.688	1 11/16												
.5	.562	.688	1 11/16												

Non-standard capacitance values between these listed are also available at no additional cost.
Sizes may lie between the limits of either the next higher or lower value.
* Values below .001 mfd. down to 10 pf. are available on special order in same case size as .001 mfd.

ARCO modified polystyrene capacitors

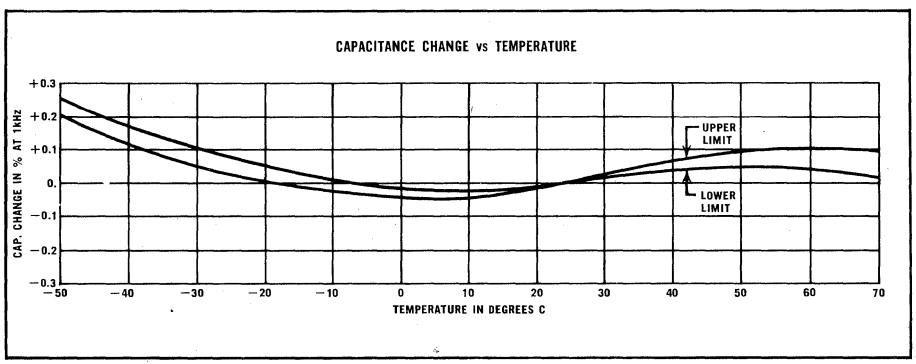
MANUFACTURING DIVISION



temperature-stable
small size
type HT tubular
type HB rectangular bathtub cans
hermetically sealed — metal case

An exclusive ARCO design modifying the temperature characteristics of the dielectric film to provide capacitors insensitive to temperature changes (±0.1% change to 85°C). Type HT and HB capacitors will meet ALL ENVIRONMENTAL REQUIREMENTS OF MIL-C-19978.

ARCO Type HT and HB capacitors are specifically designed for INTEGRATORS, PRECISION TIMING CIRCUITS, and PRECISION RC NETWORKS.



specifications

DISSIPATION FACTOR: When measured at or referred to 1kHz the dissipation factor shall not exceed 0.002 at 23°C

INSULATION RESISTANCE: Insulation resistance when measured at the applicable test temperature, shall equal or exceed the following values

	23°C	*85°C
megohm x mfd	10^6	1.5×10^5
except the insulation resistance in megohms need not exceed	10^8	10^6

*NOTE: verified on 100% of production

OPERATING TEMPERATURE RANGE: The ARCO capacitor types listed can be used for continuous operation from −55°C to +85°C without derating. Transient exposure to +95°C will have NO DELETERIOUS effect.

TEMPERATURE COEFFICIENT: The temperature coefficient of ARCO type HT and HB capacitors is controlled so that the variation of capacitance from room temperature to 85°C. is less than ±0.1%; from room temperature to −55°C. variation is less than ±0.25%. Tighter control is available to special order (±0.05% from 10°C to 50°C).

DIELECTRIC ABSORPTION: When tested in accordance with paragraph 4.6.15 of MIL-C-19978, the dielectric absorption shall not exceed 0.05% over the entire operating temperature range.

STABILITY: Long term (1 year) capacitance drift under maximum operating conditions shall not exceed ±0.1%.

VOLTAGE RATING: ARCO type HT and HB capacitors are produced in 100 Volt DC rating. Other voltages to 1,000 volts can be supplied upon request.

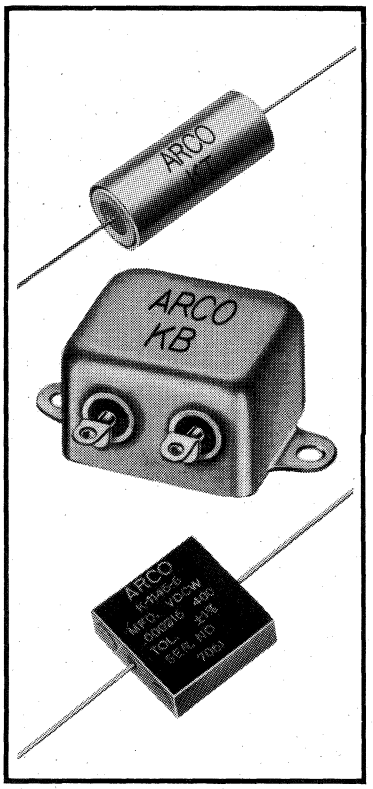
CAPACITANCE TOLERANCE: ARCO specializes in precision capacitors. Available from standard production are tolerances of ±10%, ±5%, ±3%, ±2%, ±1%, ±½%, ±¼%, ±0.1%.

BURN-IN: All ARCO capacitors are subjected to a minimum of two 16 hour burn-in periods with 300% of rated voltage applied at 85°C.

CONSTRUCTION: ARCO type HT and HB capacitors are hermetically sealed in metal cases with compression glass-to-metal, solder-sealed terminals. They are wound with a SOLID CORE in the center for optimum stability, and are terminated with a disc lead assembly soldered directly to the extended foil for a completely NON-INDUCTIVE construction resulting in the lowest possible contact resistance and exhibiting complete FREEDOM FROM MICROPHONISM.

ARCO polystyrene and mica precision capacitors

MANUFACTURING DIVISION



zero temperature coefficient

type KT tubular

type KB rectangular bathtub cans

hermetically sealed — metal case

type KE flat epoxy encapsulated

A unique combination of Polystyrene and Mica dielectrics resulting in a capacitor offering a truly ZERO TEMPERATURE COEFFICIENT (±10 ppm/°C from −55°C to +85°C standard production) with the ultimate in long term STABILITY. Type KT and KB capacitors will meet or exceed all requirements of MIL-C-19978, where applicable, under ALL ENVIRONMENTAL CONDITIONS specified therein.

ARCO Type KT, KB, and KE capacitors provide the utmost in performance for PRECISION-OSCILLATORS, TIMING CIRCUITS, and RC NETWORKS.

specifications

DISSIPATION FACTOR: When measured at or referred to 1kHz the dissipation factor shall not exceed the following
.001 @ 23°C

INSULATION RESISTANCE: Insulation resistance when measured at the applicable test temperature, shall equal or exceed the following values

	23°C	*85°C
megohm x mfd	10^5	10^3
except the insulation resistance in megohms need not exceed	10^6	10^4

***NOTE:** verified on 100% of production

OPERATING TEMPERATURE RANGE: The ARCO capacitor types listed can be used for continuous operation from −55°C to +85°C without derating. Transient exposure to +95°C will have NO DELETERIOUS effect.

TEMPERATURE COEFFICIENT: The temperature coefficient of Arco Type KT, KB, and KE capacitors is truly zero, they are usually produced to a tolerance of ±10 ppm/°C. They can also be produced to zero ±5 ppm°/C. The linearity of the temperature coefficient regardless of tolerance is ±1 ppm/°C. Other temperature coefficient centers may be supplied within the range of −100 to +20 ppm/°C THE TEMPERATURE COEFFICIENT OF THESE CAPACITORS **is tested on a 100% basis.** Data verifying these tests can be supplied at NO EXTRA COST as requested.

DIELECTRIC ABSORPTION: When tested in accordance with paragraph 4.6.15 of MIL-C-19978, the dielectric absorption shall not exceed 1.0% over the entire operating temperature range.

STABILITY: Long term (1 year) capacitance drift under maximum operating conditions shall not exceed ±0.05%.

VOLTAGE RATING: Arco Type KT, KB, and KE capacitors are available in 100, 200, and 400 volts DC ratings (all supplied in the same case size). Other voltages up to 1,000 volts can be supplied upon request.

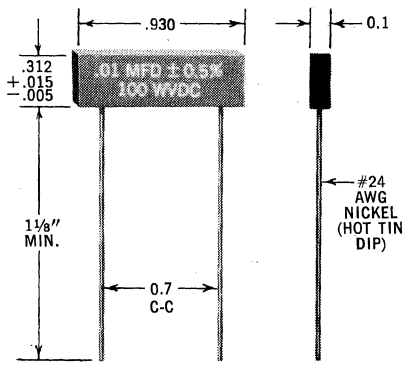
CAPACITANCE TOLERANCE: ARCO specializes in precision capacitors. Available from standard production are tolerances of ±10%, ±5%, ±3%, ±2%, ±1%, ±½%, ±¼%, ±0.1%.

BURN-IN: All ARCO capacitors are subjected to a minimum of two 16 hour burn-in periods with 300% of rated voltage applied at 85°C.

CONSTRUCTION: The Arco Type KT, KB, and KE capacitors are constructed by a unique combination of polystyrene dielectric sections with a linear negative temperature coefficient cross compensating a mica dielectric capacitor section with a linear positive TC. The polystyrene capacitor section is wound with a SOLID CORE in the center for optimum stability, and is terminated with a disc lead assembly soldered directly to the extended foil for a completely NON-INDUCTIVE construction resulting in the lowest possible contact resistance. The mica capacitor section is the well known Arco-Elmenco capacitor exhibiting highest reliability and performance characteristics. The individual capacitor sections as well as their combination have been constructed so as to guarantee all performance characteristics listed as well as complete FREEDOM FROM MICROPHONISM.

ARCO polystyrene capacitors

MANUFACTURING DIVISION



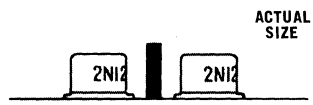
ALL tolerances except where otherwise specified ±0.005

type PE

Arco PFC Division announces availability of a new polystyrene dielectric capacitor with a thin configuration specifically designed for conservation of space in printed circuits and in filters. Flat polystyrene sections are encapsulated in uniform epoxy preforms to provide the following features:

0.1" thickness

Uniform lead spacing for p-c use.
Uniform size and flush mounting.
Both weldable and solderable leads.
Rugged, moisture proof construction.



WELDABLE LEADS
Nickel "A" (solderable, too) 0.7" spacing

SPACE SAVERS
10 capacitors per inch .312" high Flush mount

specifications

CAPACITANCE RANGE: .001 to .01 mfd (lower and higer values are available upon request). Maximum value .015 mfd.
TOLERANCE: ±5%, ±2%, ±1%, ±½%, ±¼%, ±0.1%.
VOLTAGE RATING: 100VDCW
INSULATION RESISTANCE: 10^{13} ohms minimum at 25°C — 10^{12} ohms at 85°C.
DISSIPATION FACTOR: 0.01% maximum at 25°C, — 0.02 maximum at 85°C.
DIELECTRIC ABSORPTION: 0.05% maximum at all temperatures.
TEMPERATURE COEFFICIENT: Negative 190 ±30 ppm/°C
LONG TERM OPERATING STABILITY: ±0.1% maximum drift under fixed or variable operating conditions within specified maximum limits.

All the above design advantages are accompanied by modest prices and quick delivery. Any value within the standard range (.001 mfd. to .01 mfd.) is in stock in all tolerances for immediate delivery (72 hours).

In addition to the physical advantages of this design, the electrical excellence of ARCO polystyrenes has been retained. High long term stability under maximum operating conditions, low dissipation factor and dielectric absorption, extremely high insulation resistance, close tolerance are featured. And also important is the ARCO control of quality which results in close uniformity not only from unit to unit, but from production lot to production lot as well.

The Nickel "A" leads of ARCO Type PE capacitors are welded directly to the capacitor section. The strength and permanence of electrical contact is thereby entirely independent of encapsulation.

All Arco Type PE capacitors are "debugged" 100% prior to shipment by accelerated life test at stress levels exceeding ratings to eliminate potential early failures. Extensive data on reliability of Arco polystyrene capacitors is available for documentation

precision RC networks

the ultimate in temperature coefficient control of RC product.

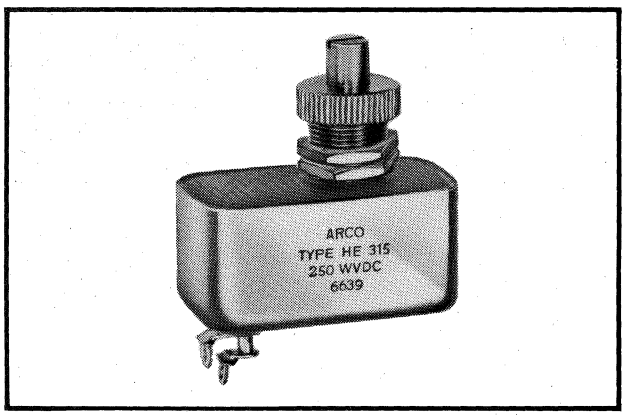
linear TC of ±5 ppm/°C over temperature range of −55°C to +85°C.

ARCO's ability to produce capacitors with adjustable and closely uniform characteristics has facilitated the design of highly precise RC networks. By matching zero temperature coefficient resistors and capacitors, or by balancing temperature coefficients to obtain a zero (or other specified) T.C. on the RC product, networks which have long term stability independent of temperature are obtained. At the same time, RC products of better than ±0.05% accuracy can be supplied. Testing is performed on a 100% basis on both resistors and capacitors with temperature coefficient data recorded at the temperature extremes.

ARCO variable compression-type mica capacitors

MANUFACTURING DIVISION

hermetically sealed



ARCO introduces the first hermetically-sealed variable compression-type mica capacitor. Designated as Types HE-30 and HE-30M, these units employ a specially designed enclosure that protects them against the effects of moisture, pressure variation, fungus, salt spray, dust, and mechanical damage. Additionally, the case provides effective electrostatic shielding.

The basic capacitor design is the time-tested Type 30 padder with established reliability verified by more than 25 years of operational experience.

The enclosure measures 1 9/16" by 15/16" by 3/4" deep. The drawn brass can is hot tin dipped and all mechanical parts are nickel-plated brass. The capacitor element is completely insulated from the case and connection is made at the rear by means of two lugs mounted on glass-to-metal seals. The unit is designed for single-hole panel mounting using a 15/32" — 32 bushing. A bushing nut is furnished as part of the assembly. Rotational control can be either by means of a screwdriver slot at the end of the 1/4" shaft or by means of a standard knob of the user's own choice. The rotary shaft seal enhances the stability of the shaft setting under conditions of shock and vibration. For complete locking of the shaft after adjustment, an accessory shaft lock is available. This shaft lock also provides redundant humidity protection where the ultimate in reliability is needed.

The HE-30 is a 250VDC rated series in 14 discreet capacitance ranges from 15-130 PF to 1400-3055 PF. The HE-30M is a 500VDC rated series, also in 14 similar ranges from 15-120 PF to 1200-2525 PF. These are guaranteed minimum ranges in three turns of adjustment. Dissipation factor at 1MC is better than .001. Insulation resistance is better than 100,000 megohms.

Stability of the capacitance varies with the particular setting, however, a conservative design limit is a maximum of ±3% change caused by all combinations of temperature cycling, vibration, shock, hysteresis, etc. As the extremes of environment are reduced toward laboratory conditions, the stability will be improved at least ten-fold or to ±0.3%. Operating temperature range is −55°C. to +85°C.

type HE-30

500 Volts DC Flash-Test — 250 WVDC

PART NUMBER	NUMBER OF PLATES	GUARANTEED RANGE: At 3 Inch Pounds Cap. Will Be More Than MMF.	GUARANTEED RANGE: At 3 Turns Open Cap. Will Be Less Than MMF.	NET PRICE (1-24)
HE-302	2 Pl.	130	15	$6.63
HE-303	3 Pl.	340	65	6.66
HE-304	4 Pl.	550	100	6.72
HE-305	5 Pl.	760	190	6.78
HE-306	6 Pl.	970	275	6.84
HE-307	7 Pl.	1180	350	6.90
HE-308	8 Pl.	1390	450	6.96
HE-309	9 Pl.	1600	550	7.02
HE-310	10 Pl.	1890	650	7.08
HE-311	11 Pl.	2110	780	7.17
HE-312	12 Pl.	2330	880	7.23
HE-313	13 Pl.	2605	1150	7.29
HE-314	14 Pl.	2830	1300	7.38
HE-315	15 Pl.	3055	1400	7.47

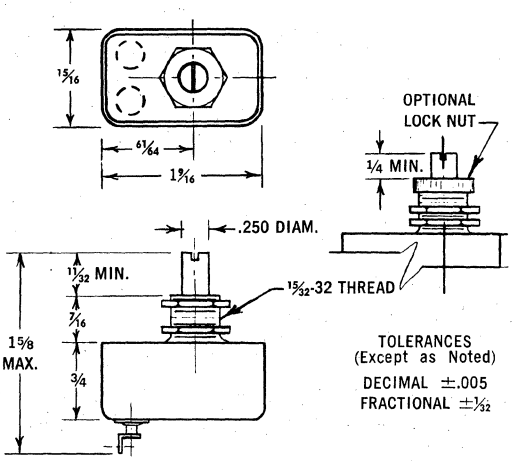
Screw is insulated from capacitor element by mica washer. Above maximum capacity values are based on using 1½ to 1¾ Mil Mica films.

type HE-30M

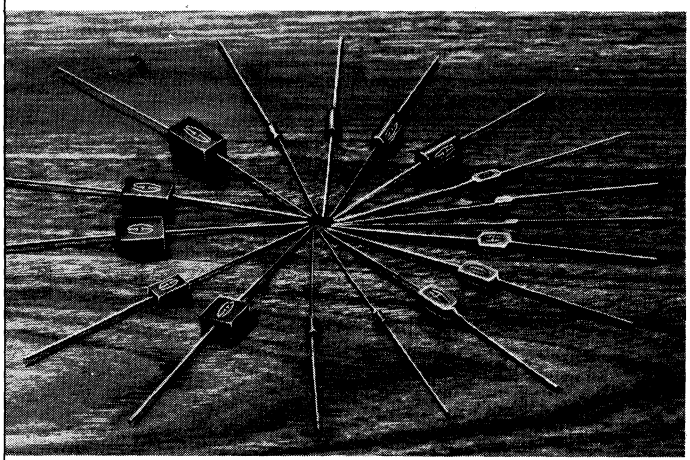
1000 Volts DC Flash-Test — 500 WVDC

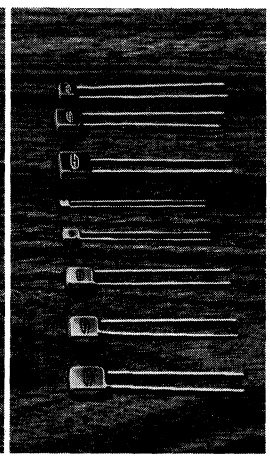
PART NUMBER	NUMBER OF PLATES	GUARANTEED RANGE: At 3 Inch Pounds Cap. Will Be More Than MMF.	GUARANTEED RANGE: At 3 Turns Open Cap. Will Be Less Than MMF.	NET PRICE (1-24)
HE-302-M	2 Pl.	120	15	$6.63
HE-303-M	3 Pl.	320	65	6.69
HE-304-M	4 Pl.	500	100	6.75
HE-305-M	5 Pl.	690	180	6.81
HE-306-M	6 Pl.	880	265	6.90
HE-307-M	7 Pl.	1070	340	6.96
HE-308-M	8 Pl.	1260	425	7.02
HE-309-M	9 Pl.	1415	525	7.11
HE-310-M	10 Pl.	1600	615	7.17
HE-311-M	11 Pl.	1785	730	7.26
HE-312-M	12 Pl.	1970	800	7.35
HE-313-M	13 Pl.	2155	1000	7.41
HE-314-M	14 Pl.	2340	1100	7.50
HE-315-M	15 Pl.	2525	1200	7.62

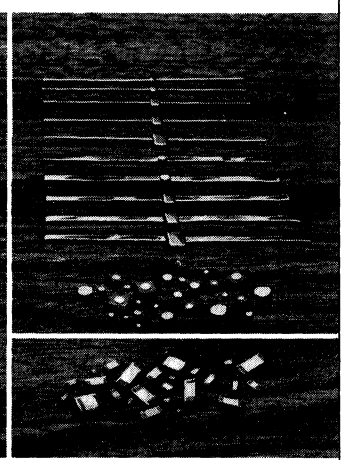
Screw is insulated from capacitor element by mica washer. Above capacity values are based on using 2 to 2¼ Mil Mica.



CAL-R® INC. CERAMIC CAPACITORS







Cal-R microminiature ceramic capacitors are manufactured using unique proprietary methods of construction resulting in highly reliable performance characteristics. ■ Having developed advanced technologies in ceramic materials, Cal-R manufactures all the ceramic ware used in their capacitors. This in-house ceramic capability guarantees uniformity and reliability. ■ Cal-R ceramic capacitors have outstanding performance history on major military, space and industrial electronic programs where small package size and high reliability are essential.

AXIAL LEAD CAPACITORS

250 and 300 Series — DIPPED
Size: 7 sizes — from .190 long x .075 diameter.
Capacitance Range: From 1 pF thru 1.0 mFd.
Voltage: 50 WVDC and 200 WVDC.
Capacitance Tolerance: From ±5%.
Dissipation Factor: 2.5% maximum.
Temperature Range: —55°C to +150°C.
with no derating.

250 and 300 Series — MOLDED
Size: 7 sizes — from .200 long x .100 diameter.
Capacitance Range: 1 pF thru 1.0 mFd.
Voltage: 50 WVDC and 200 WVDC.
Capacitance Tolerance: From ±5%.
Dissipation Factor: 2.5% maximum.
Temperature Range: —55°C to +150°C
with no derating.

500 Series — MOLDED
Size: .260 long x .100 diameter.
Capacitance Range: 10 pF thru 22000 pF.
Voltage: 50 WVDC and 100 WVDC.
Capacitance Tolerance: ±10% and ±20%.
Dissipation Factor: Less than 2.5%.
Temperature Range: —55°C to +125°C
with no derating.

CK12/CK15 Mil-type — MOLDED
Size: 4 sizes — from .160 long x .090 diameter.
Capacitance Range: 10 pF thru 1.0 mFd.
Voltage: 50 WVDC and 100 WVDC.
Capacitance Tolerance: ±10% and ±20%.
Dissipation Factor: 2.5% maximum.
Temperature Range: —55°C to +125°C
with no derating.

RADIAL LEAD CAPACITORS

CK07/CK10 Mil-type — DIPPED
Size: 4 sizes from .080 high x .080 wide x .050 thick.
Capacitance Range: 27 pF thru 15000 pF.
Voltage: 50 WVDC.
Capacitance Tolerance: ±10% and ±20%.
Dissipation Factor: 2.0% maximum.
Temperature Range: —55°C to +125°C
with no derating.

710 Series — DIPPED
(NPO and Temperature Stable)
Size: 4 sizes from .080 high x .080 wide x .050 thick.
Capacitance Range: 10 pF thru 1.0 mFd.
Voltage: 25 WVDC and 50 WVDC.
Capacitance Tolerance: From ±5%.
Dissipation Factor: As low as .1%.
Temperature Range: —55°C to +125°C
with no derating.
Temperature Characteristics: From 0 ±30 PPM/°C.

CK05 and CK06 Mil-type — MOLDED
Size: CK05 dimensions .200 high x .200 wide x .100 thick.
CK06 dimensions .300 high x .300 wide x .100 thick.
Capacitance Range: CK05 values 10 pF thru .1 mFd.
CK06 values 1200 pF thru 1.0 mFd.
Voltage: 50 WVDC and 200 WVDC.
Capacitance Tolerance: ±10% and ±20%.
Dissipation Factor: 2.5% maximum.
Temperature Range: —55°C to +125°C
with no derating.

PELLET CAPACITORS

Pellet Series — DIPPED
Size: Various round and rectangular configurations from .050 diameter x .020 thick and .100 long x .100 wide x .030 thick.
Capacitance Range: 22 pF thru .1 mFd (other values available on special order).
Voltage: 50 WVDC.
Capacitance Tolerance: ±10% and ±20% (other tolerances available on special order).
Dissipation Factor: 2.5% maximum.
Temperature Range: —55°C to +150°C
with no derating.
Leads: Disc terminations, ribbon or wire leads.

MONOLITHIC CHIP CAPACITORS

S-Cap. 100 Series
Size: Various sizes from .080 long x .050 wide x .050 thick maximum.
Capacitance Range: 10 pF thru .22 mFd (to 1.0 mFd special).
Voltage: 25 WVDC and 50 WVDC.
Capacitance Tolerance: From ±5%.
Dissipation Factor: From .1%.
Temperature Range: —55°C to +125°C
with no derating.
Temperature Characteristics: From 0 ±30 PPM/°C.
Terminations: Palladium Gold standard (others available).

CAL-R® INC.
a subsidiary of CapTech Inc.
CAPACITOR DIVISION

1601 Olympic Blvd.
Santa Monica, California 90404
(213) 451-9761 TWX 910-343-6966

SPECIAL APPLICATIONS
Cal-R has developed many unique capacitor packages not shown here. We have specialists to solve special capacitor design problems. — Contact your local representative or Cal-R directly for more information.

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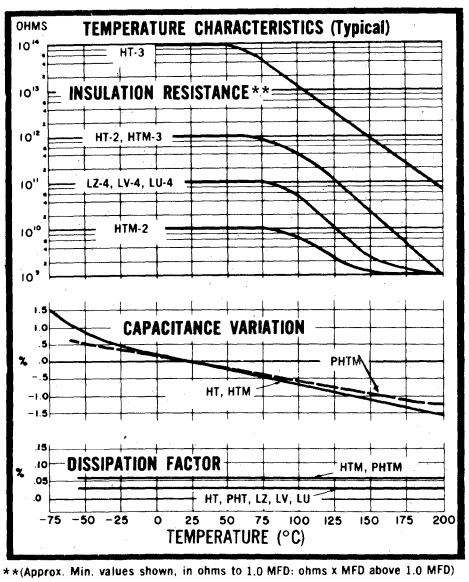
- POLARIS
- F-111
- TITAN
- MOL
- HAWK
- VENUS PROBE

AND OTHERS

PROCESSED TEFLON† CAPACITORS

TEMP. RANGE: —70°C to 200°C WITHOUT DERATING (SPECIALS TO 250°C)

- LOW TEMPERATURE COEFFICIENT
- HIGHEST INSULATION RESISTANCE
- SUBMINIATURE SIZE
- HIGH STABILITY
- LOW DISSIPATION FACTOR
- LOW DIELECTRIC ABSORPTION
- MIL-C-19978C TYPES AVAILABLE



**(Approx. Min. values shown, in ohms to 1.0 MFD; ohms x MFD above 1.0 MFD)

HT SERIES (EXTENDED FOIL)—HIGHEST INSULATION RESISTANCE

HT series capacitors exhibit the highest insulation resistance obtainable in the present state of the art (to $>10^{14}$ ohms** min. for the HT-3). Other outstanding characteristics include dissipation factor <0.02%, dielectric absorption <0.03%, and low capacitance variation with temperature. For detailed performance characteristics of the basic (HT-2) type, and for higher performance types (HT-3 to HT-9) available—see tables and chart, this page.

LV, LZ SERIES—MINIATURE/LOW VOLTAGE VERSIONS OF HT SERIES

Series LV (50 WVDC) and LZ (15 WVDC) capacitors are designed to occupy minimum physical volume, while retaining most of the excellent electrical characteristics of the HT series. For detailed performance characteristics of the basic (LZ-4 and LV-4) types, and for higher performance types (LZ-5, 8, & 9 and LV-5, 8, & 9) available—see tables and chart, this page.

PHT SERIES—PRECISION/HIGH STABILITY EXTENSION OF HT SERIES

PHT series capacitors are specially processed to obtain very high stability (retrace <0.2%)†, and low capacitance variation with temperature (see table at right). For detailed performance characteristics of the basic (PHT-2) type, and for higher performance types (PHT-3 to PHT-9) available—see tables and chart, this page.

HTM SERIES (METALIZED)—HIGH STABILITY AND SUBMINIATURE SIZE

HTM series capacitors offer very low temperature coefficient (approx. —70 PPM/°C) and high insulation resistance (to $>10^{12}$ ohms** for the HTM-3), in addition to extremely small physical size. For detailed performance characteristics of the basic (HTM-2) type, and for higher performance types (HTM-3 to HTM-9) available—see tables and chart, this page.

PHTM SERIES—PRECISION/LINEAR T.C. EXTENSION OF HTM SERIES

PHTM series capacitors exhibit ultra-stable retrace (<0.02%)† and a low linear temperature coefficient (—70 PPM/°C ±30)†, supplementing the excellent characteristics of the HTM series. For detailed performance characteristics of the basic (PHTM-2) type and for higher performance types (PHTM-3 to PHTM-9) available—see tables and chart, this page.

For Dimensions and Ordering Information of All Types— Refer to Balco Page 4

BASIC CAPACITOR CHARACTERISTICS (TYPICAL)

BALCO SERIES ▸	HT	LV, LZ	PHT	HTM	PHTM
TEMP. COEFF. (neg.) OR % △C vs TEMP. (Max. Approx.)	1.0%, RT to 150°C 1.5%, RT to 200°C 1.5%, RT to -70°C		1.0% RT to 160°C RT to -60°C	-70 PPM/°C† (approx.)	-70 PPM/°C† ±30 (Most sizes)
RETRACE (After Temp. Cycling†)	<0.3% (HT-6)	<0.3% LV-6, LZ-6	<0.2% (PHT-6)	<0.1% (HTM-6)	<0.02% (PHTM-6)
DISSIPATION FACTOR (at 25°C & 1000 CPS)	<0.02%	<0.02%	<0.02%	<0.1%	<0.05%
DIELECTRIC ABSORPTION (at 25°C)	<0.03%	<0.03%	<0.03%	<0.03%	<0.03%
INSULATION RESISTANCE ** (Min. at 25°C)	$1x10^{12}$	$1x10^{11}$	$1x10^{12}$	$1x10^{10}$	$1x10^{10}$
TOLERANCES TO:	1/2%	1/2%	1/4%	1/4%	1/10%

†Over restricted temperature ranges

** IN OHMS TO 1.0 MFD; OHMS X MFD ABOVE 1.0 MFD

HIGHER PERFORMANCE TYPES AVAILABLE

Char. No.	Additional Performance Over the Basic	TYPES HT-	HTM-	LZ-	LV-	PHT-	PHTM-
—2	B A S I C	HT-2	HTM-2	—	—	PHT-2	PHTM-2
—3	Basic + Hi. I.R. (a)	HT-3	HTM-3	—	—	PHT-3	PHTM-3
—4	Basic + Sm. Size (b)	HT-4	HTM-4	LZ-4	LV-4	PHT-4	PHTM-4
—5	Basic + Hi. I.R. + Sm. Size	HT-5*	HTM-5	LZ-5*	LV-5*	PHT-5	PHTM-5
—6	Basic + Hi. Stab. (c)	HT-6	HTM-6	LZ-6	LV-6	PHT-6	PHTM-6
—7	Basic + Hi. I.R. + Hi. Stab.	HT-7	HTM-7	—	—	PHT-7	PHTM-7
—8	Basic + Sm. Siz. + Hi. Stab.	HT-8	HTM-8	LZ-8	LV-8	PHT-8	PHTM-8
—9	Basic + Hi. I.R. + Sm. Siz. + Hi. Stab.	HT-9*	HTM-9	LZ-9*	LV-9*	PHT-9	PHTM-9

(a) Hi. I.R. = Highest insulation resistance—one to two orders above the basic.
(b) Sm. Siz. = 25 to 40% smaller than the basic (at reduced voltage)
(c) Hi. Stab. = Highest Retrace—appreciably better than the basic.

*Available in most capacity and voltage ratings

† DuPont Reg. Trademark

MAIN PLANT: 307 WASHINGTON STREET, ORANGE, NEW JERSEY 07050, TEL. (201) 677-1200

Balco CAPACITORS

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- MARINER
- MARS PROBE
- POLARIS
- F-111
- TITAN
- MOL
- HAWK
- VENUS PROBE

AND OTHERS

PROCESSED MYLAR† CAPACITORS

TEMP. RANGE: —70°C to 125°C

- **SUBMINIATURE AND ULTRA-MINIATURE SIZE**
- **HIGH INSULATION RESISTANCE**
- **PRECISION HIGH STABILITY TYPES**
- **MIL-C-19978C TYPES AVAILABLE**

QT SERIES (EXTENDED FOIL)—HIGH INSULATION RESISTANCE

QT series capacitors provide high insulation resistance (>1 x 10^{11} ohms), miniature physical size, and will operate to 125°C. Extremely modest cost qualifies this series for general purpose applications where high performance is essential. For detailed characteristics of the basic (QT-1) type, and for higher performance types (QT-3 to QT-7) available — see tables and chart, to right.

PQT SERIES—PRECISION/HIGH STABILITY EXTENSION OF QT SERIES

PQT series capacitors are processed for optimum stability, retaining the excellent characteristics of the QT series. Retrace is <0.25%, with very low long term drift effects. The unit exhibits some delayed thermal response during temperature cycling that may require longer than normal stabilization times, which should be considered in sophisticated applications. For detailed performance characteristics of the basic (PQT-1) type, and for higher performance types (PQT-3 to PQT-7) available—see tables and chart, to right.

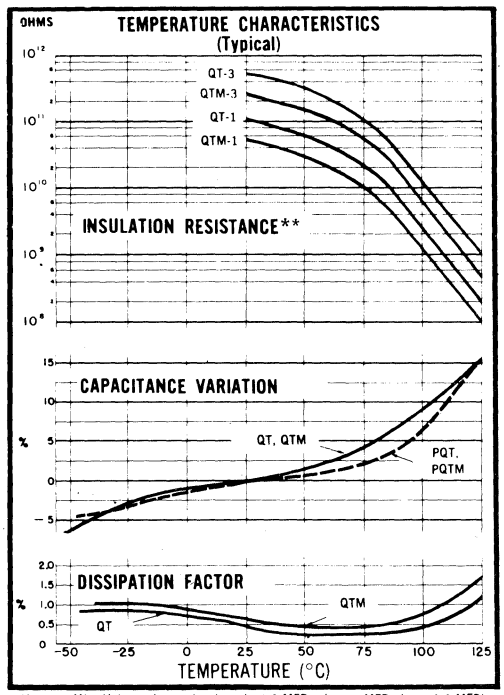
QTM SERIES (METALIZED)—SUBMINIATURE

QTM series capacitors offer subminiature and ultra-miniature size (type QTM-4), in capacitance ratings to >20.0 mfd. Outstanding electrical characteristics include insulation resistance >5 x 10^{10} ohms. For detailed performance characteristics of the basic (QTM-1) type, and for higher performance types (QTM-3 to QTM-7) available—see tables and chart, to right.

PQTM SERIES—PRECISION/HIGH STABILITY EXTENSION OF QTM SERIES

PQTM series capacitors provide very good stability in addition to the small physical size of the QTM series. Retrace is <0.2%, with very low long term drift effects. The unit exhibits some delayed thermal response during temperature cycling that may require longer than normal stabilization times, which should be considered in sophisticated applications. For detailed performance characteristics of the basic (PQTM-1) type, and for higher performance types (PQTM-3 to PQTM-7) available—see tables and chart, to right.

For Dimensions and Ordering Information of All Types— Refer to Balco Page 4



**(Approx. Min. Values shown, in ohms to 1.0 MFD; ohms x MFD above 1.0 MFD)

BASIC CAPACITOR CHARACTERISTICS (Typical)

BALCO TYPE	QT	QTM	PQT	PQTM
%Δ C vs TEMP. (max., approx.)	15% RT. to 125°C 5% RT. to 85°C —6% RT. to —55°C		15% RT. to 125°C 3% RT. to 85°C 1% RT. to 60°C —2% RT. to 0°C —3% RT. to —20°C —6% RT. to —55°C	
RETRACE (After Temp. Cycling)	<0.3% (QT-6)	<0.25% (QTM-6)	<0.25% (PQT-6)	<0.20% (PQTM-6)
DISSIPATION FACTOR (at 25°C and 1 KC)	<0.6%	<1.0%	<0.5%	<0.7%
DIELECTRIC ABSORPTION (at 25°C)	<0.2%	<0.5%	<0.2%	<0.5%
INSULATION RESISTANCE** (min. at 25°C)	1 x 10^{11}	5 x 10^{10}	1 x 10^{11}	5 x 10^{10}
TOLERANCES TO:	1%	1%	1%	1%

** IN OHMS TO 1.0 MFD; OHMS X MFD ABOVE 1.0 MFD

HIGHER PERFORMANCE TYPES AVAILABLE

Char. No.	Additional Performance Over the Basic	TYPES QT	QTM	PQT	PQTM
—1	BASIC	QT-1	QTM-1	PQT-1	PQTM-1
—3	Basic + Hi. I.R. (a)	QT-3*	QTM-3*	PQT-3	PQTM-3
—4	Basic + Sm. Siz. (b)	QT-4	QTM-4	PQT-4	PQTM-4
—6	Basic + Hi. Stab. (c)	QT-6	QTM-6	PQT-6	PQTM-6
—7	Basic + Hi. I.R. + Hi. Stab.	QT-7*	QTM-7	PQT-7	PQTM-7

(a) Hi I.R. = Highest insulation resistance—one to two orders above the basic.
(b) Sm. Siz. = 25 to 40% smaller than the basic (at reduced voltage)
(c) Hi Stab. = Highest Retrace—appreciably better than the basic.

*Available in most capacity and voltage ratings. †Dupont Reg. Trademark.

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- TITAN
- MOL
- HAWK
- VENUS PROBE

AND OTHERS

STABILIZED POLYSTYRENE CAPACITORS

TEMP. RANGE: —70°C to 85°C

- LINEAR TEMPERATURE COEFFICIENT
- HIGH STABILITY
- HIGH INSULATION RESISTANCE
- MIL-C-19978C TYPES AVAILABLE

PT SERIES (EXTENDED FOIL)— HIGH STABILITY

PT series capacitors exhibit high insulation resistance (to $> 5 \times 10^{12}$ ohms for the PT-3), low dissipation factor and very low dielectric absorption, and very good retrace (< .05% for type PT-6). For detailed performance characteristics of the basic (PT-1) type, and for higher performance types (PT-3 to PT-7) available — see tables and chart, to right.

PPT SERIES — PRECISION/HIGHEST STABILITY EXTENSION OF PT SERIES

PPT series capacitors are specially processed and fabricated to obtain highest stability (<0.025% total retrace) and highly linear temperature coefficient (—105 PPM/°C ±15). For detailed performance characteristics of the basic (PPT-1) type, and for higher performance types (PPT-3 to PPT17) available—see tables and chart, to right.

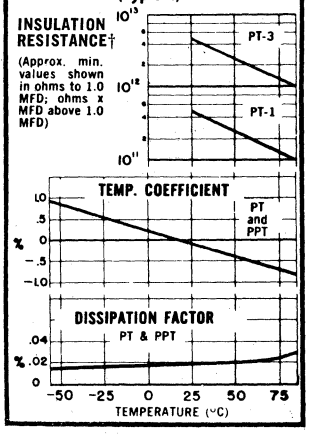
For dimensions and Ordering Information of All Types — Refer to Balco Page 4.

BASIC CAPACITOR CHARACTERISTICS (TYPICAL)

BALCO TYPE ➧	PT	PPT
TEMPERATURE COEFFICIENT	—105 PPM/°C ±25	—105 PPM/°C ±15
RETRACE (After Temp. Cycling)	<.05% (PT-6)	<0.025% (PPT-6)
DISSIPATION FACTOR (at 25°C & 1 KC)	<.02%	<.02%
DIELECTRIC ABSORPTION (at 25°C)	<.05%	<.05%
INSULATION RESISTANCE† (min. at 25°C)	5×10^{11}	5×10^{11}
TOLERANCES TO:	1/4%	1/10%

†IN OHMS TO 1.0 MFD; OHMS X MFD ABOVE 1.0 MFD

TEMPERATURE CHARACTERISTICS (Typical)



HIGHER PERFORMANCE TYPES AVAILABLE

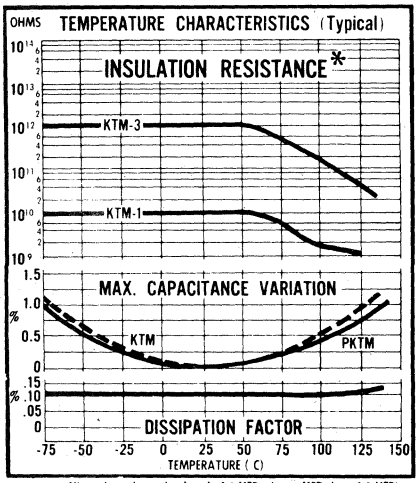
CHAR. NO.	ADD'L. PERFORMANCE OVER THE BASIC	PT	PPT
-1	BASIC	PT-1	PPT-1
-3	BASIC +HIGH I.R. (a)	PT-3	PPT-3
-6	BASIC + HIGH STAB. (b)	PT-6	PPT-6
-7	BASIC + HIGH I.R. + HIGH STAB.	PT-7	PPT-7

(a) HIGH I.R. = High insulation resistance—one to two orders above the basic.
(b) HIGH STAB. = Retrace—appreciably better than the basic.

PROCESSED POLYCARBONATE CAPACITORS —70°C to 125°C

- HIGH STABILITY
- LOW TEMPERATURE COEFFICIENT
- SUBMINIATURE SIZE
- HIGH INSULATION RESISTANCE
- MIL-C-19978C TYPES AVAILABLE

TEMPERATURE CHARACTERISTICS (Typical)



*(Approx. Min. values shown, in ohms to 1.0 MFD; ohms x MFD above 1.0 MFD)

BASIC CAPACITOR CHARACTERISTICS (Typical)

BALCO TYPE ➧	KTM	PKTM
% △ C vs TEMPERATURE (max. approx.)	.5% RT. to 85°C 1.0% RT. to 125°C 1.0% RT. to —55°C	.25% RT. to 85°C .75% RT. to 125°C .75% RT. to —55°C
RETRACE (After Temp. Cycling)	<0.10% (KTM-6)	<0.05% (PKTM-6)
DISSIPATION FACTOR (at 25°C & 1 KC)	<0.5%	<0.5%
DIELECTRIC ABSORPTION (at 25°C)	<0.5%	<0.5%
INSULATION RESISTANCE† (min. at 25°C)	1×10^{10}	1×10^{10}
TOLERANCES TO:	½%	¼%

KTM SERIES (METALIZED)—

KTM series capacitors provide high insulation resistance, very low capacitance change with temperature, and good stability—in addition to minimum physical size for a wide range of capacitance values to >20.0 mfd. For detailed performance characteristics of the basic (KTM-1) type, and for higher performance types (KTM-3 to KTM-7) available.

PKTM SERIES — HIGH STABILITY/LOW TEMP. COEFF. EXTENSION OF KTM SERIES

PKTM series capacitors are processed for very high stability (retrace <0.05%) and extremely low temperature coefficient (see table at right), while retaining the outstanding characteristics of KTM series. For detailed performance characteristics of the basic (PKTM-1) type, and for higher performance types (PKTM-3 to PKTM-7) available.

For Dimensions and Ordering Information of All Types Refer to Balco Page 4.

HIGHER PERFORMANCE TYPES AVAILABLE

CHAR. NO.	ADD'L. PERFORMANCE OVER THE BASIC	KTM	PKTM
-1	BASIC	KTM-1	PKTM-1
-3	BASIC + HIGH I.R. (a)	KTM-3	PKTM-3
-6	BASIC + HIGH STAB. (b)	KTM-6	PKTM-6
-7	BASIC + HIGH I.R. + HIGH STAB.	KTM-7	PKTM-7

(a) HIGH I.R. = High insulation resistance—one to two orders above the basic.
(b) HIGH STAB. = High stability—appreciably better than the basic.

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- F-111
- TITAN
- MOL
- HAWK
- VENUS PROBE

AND OTHERS

CAPACITOR DIMENSIONS* AND ORDERING INFORMATION

POPULAR VALUES SHOWN (INTERMEDIATE AND OTHER VALUES AVAILABLE)

- ALL UNLISTED IN-BETWEEN SIZES AVAILABLE
- REPRESENTATIVE SIZES FOR SOME BASIC TYPES SHOWN
- LARGER MFD AND WVDC RATINGS AVAILABLE
- MANY ITEMS IN STOCK

MOST PRECISION AND EXTENDED PERFORMANCE TYPES HAVE THE SAME DIMENSIONS AS THEIR BASIC TYPES.

Processed Teflon† Types LZ-4, LV-4, HT-4, HT-2, HTM-4, and HTM-2 (—70°C to 200°C)

FOR DETAILED TECHNICAL INFORMATION, REFER TO PAGE 1

	LZ-4	LV-4	HT-4	HT-2			HTM-4	HTM-2		
MFD	15 WVDC	50 WVDC	100 WVDC	200 WVDC	400 WVDC	600 WVDC	50 WVDC	200 WVDC	400 WVDC	600 WVDC
.0005	.170 x 3/16	.170 x 3/16	.170 x 5/16	.190 x 3/4	.190 x 3/4	.190 x 3/4	**	**	**	**
.001	.170 x 3/16	.170 x 3/16	.190 x 5/16	.235 x 3/4	.235 x 3/4	.235 x 3/4	**	**	**	**
.006	.190 x 7/8	.190 x 7/8	.235 x 1	.312 x 7/8	.400 x 15/16	.400 x 15/16	**	**	**	**
.01	.190 x 1 3/8	.190 x 1 3/8	.312 x 7/8	.312 x 1	.400 x 1 1/8	.400 x 1 1/8	**	**	**	**
.022	.312 x 3/16	.312 x 7/8	.312 x 1 1/8	.400 x 1 1/8	.500 x 1 1/8	.500 x 1 1/8	**	**	**	**
.05	.312 x 1 3/16	.312 x 1 1/4	.400 x 1 1/4	.500 x 1 3/8	.562 x 1 1/2	.562 x 1 1/2	.235 x 1 7/16	.312 x 1 7/16	.400 x 1 7/16	.500 x 1 7/16
.1	**	.400 x 1 5/8	**	.670 x 1 3/8	.750 x 1 1/2	1.0 x 2	.312 x 1 7/16	.400 x 1 7/16	.500 x 1 7/16	.670 x 1 7/16
.25	**	**	**	.750 x 2	1.0 x 1 7/8	1.375 x 2	.400 x 1 7/16	.500 x 1 7/16	.670 x 1 7/16	.750 x 1 15/16
.5	**	**	**	1.0 x 2	1.375 x 1 7/8	1 3/8 x 2 1/2 x 2	.500 x 1 7/16	.562 x 1 15/16	.875 x 1 7/16	1.0 x 1 15/16
1.0	**	**	**	2 x 2 x 1 1/8	1 3/8 x 2 1/2 x 2	**	.500 x 1 15/16	.750 x 1 15/16	1.0 x 1 15/16	1 3/8 x 1 15/16
2.0	**	**	**	2 x 2 x 2 1/16	**	**	.670 x 1 15/16	1.0 x 1 15/16	1 3/8 x 1 15/16	1 3/8 x 2 1/2 x 2
4.0	**	**	**	**	**	**	.875 x 2 1/16	1.375 x 1 15/16	1 3/8 x 2 1/2 x 2	**

Processed Mylar† Types QTM-4 and QTM-1 (—70°C to 125°C)

FOR DETAILED TECHNICAL INFORMATION, REFER TO PAGE 2

	QTM-4	QTM-1			
MFD	50 WVDC	200 WVDC	300 WVDC	400 WVDC	600 WVDC
.05	.190 x 7/8	.235 x 1	.312 x 7/8	.400 x 7/8	.400 x 1 3/8
.10	.235 x 7/8	.312 x 7/8	.400 x 7/8	.400 x 1 3/8	.500 x 1 3/8
.25	.312 x 1	.400 x 1	.400 x 1 3/8	.500 x 1 1/2	.562 x 2 3/8
.50	.400 x 1	.400 x 1 3/8	.500 x 1 1/2	.562 x 1 7/8	.750 x 2 3/8
1.0	.400 x 1 3/8	.500 x 1 1/2	.562 x 1 7/8	.750 x 1 7/8	1.0 x 2 3/8
2.0	.500 x 1 3/8	.562 x 1 7/8	.750 x 1 7/8	1.0 x 1 7/8	**
4.0	.670 x 1 3/8	.750 x 1 7/8	1.0 x 1 7/8	**	**
5.0	.670 x 1 3/4	.750 x 2 3/8	1.25 x 1 7/8	**	**
8.0	.750 x 1 3/4	1.0 x 1 7/8	**	**	**
10.0	.750 x 2	1.0 x 2 3/8	**	**	**
12.0	**	1.0 x 2 5/8	**	**	**
20.0	**	1.375 x 2 5/8	**	**	**

Processed Mylar† Types QT-4, and QT-1 (—70°C to 125°C)

FOR DETAILED TECHNICAL INFORMATION, REFER TO PAGE 2

	QT-4	QT-1			
MFD	50 WVDC	100 WVDC	200 WVDC	400 WVDC	600 WVDC
.001	.170 x 3/16	.170 x 3/16	.170 x 3/16	.170 x 3/4	.190 x 7/8
.0033	.170 x 5/16	.170 x 5/16	.170 x 5/16	.190 x 5/16	.235 x 7/8
.006	.190 x 3/4	.190 x 3/4	.190 x 5/16	.235 x 7/8	.312 x 7/8
.01	.190 x 5/16	.190 x 5/16	.190 x 1	.235 x 1	.312 x 1 1/8
.015	.235 x 3/4	.235 x 3/4	.235 x 1	.235 x 1 3/8	.312 x 1 3/8
.022	.235 x 7/8	.235 x 7/8	.312 x 7/8	.312 x 7/8	.400 x 1 1/8
.05	.235 x 7/8	.312 x 7/8	.312 x 1 1/8	.400 x 1 1/8	.500 x 1 1/4
.10	.312 x 7/8	.312 x 1 1/16	.400 x 1 1/4	.500 x 1 5/16	.670 x 1 3/8
.25	.312 x 1 1/8	.400 x 1 1/8	.562 x 1 3/8	.670 x 1 13/16	.750 x 1 7/8
.50	.400 x 1 3/8	.500 x 1 5/16	.750 x 1 3/8	.750 x 2 3/8	1.0 x 2 3/8
1.0	.562 x 1 3/8	.670 x 1 3/8	.750 x 2 3/8	1.25 x 1 7/8	1.375 x 2 3/8
2.0	**	**	1.25 x 1 3/4	**	**

Stabilized Polystyrene Type PT-1 (—70°C to 85°C)

FOR DETAILED TECHNICAL INFORMATION, REFER TO PAGE 3

	PT-1			
MFD	100 WVDC	200 WVDC	400 WVDC	600 WVDC
.0005	.170 x 7/8	.170 x 7/8	.190 x 7/8	.190 x 7/8
.001	.170 x 7/8	.190 x 7/8	.235 x 7/8	.235 x 1
.006	.190 x 1	.312 x 7/8	.400 x 7/8	.400 x 1
.010	.235 x 1	.312 x 1	.400 x 1	.400 x 1 1/4
.022	.312 x 1	.400 x 1	.500 x 1 1/8	.500 x 1 3/8
.05	.400 x 1	.500 x 1 1/8	.562 x 1 3/8	.670 x 1 1/2
.10	.500 x 1	.670 x 1 1/8	.750 x 1 3/8	.875 x 1 1/2
.25	.670 x 1 1/8	.875 x 1 1/2	1.25 x 1 1/2	1.375 x 1 3/8
.5	.750 x 1 3/8	1.0 x 1 7/8	1.375 x 1 7/8	1 3/8 x 2 1/2 x 2
1.0	**	2 x 2 x 1 1/8	1 3/8 x 2 1/2 x 2	**
2.0	**	2 x 2 x 2 1/16	**	**
5.0	**	2 x 2 x 5	**	**

Processed Polycarbonate Type KTM-1 (—70°C to 125°C)

FOR DETAILED TECHNICAL INFORMATION, REFER TO PAGE 3

	KTM-1			
MFD.	50 WVDC	100 WVDC	200 WVDC	400 WVDC
.05	.235 x 3/4	.312 x 3/4	.312 x 7/8	.400 x 1
.068	.312 x 3/4	.312 x 7/8	.400 x 7/8	.400 x 1
.10	.312 x 3/4	.312 x 7/8	.400 x 7/8	.500 x 1
.22	.312 x 7/8	.400 x 1	.400 x 1 3/8	.562 x 1 3/8
.33	.400 x 7/8	.400 x 1	.400 x 1 3/8	.562 x 1 7/8
.47	.400 x 1	.500 x 1	.500 x 1 3/8	.670 x 1 7/8
.50	.400 x 1	.500 x 1	.500 x 1 3/8	.670 x 1 7/8
1.0	.500 x 1	.562 x 1 1/8	.562 x 1 7/8	.875 x 1 7/8
2.0	.670 x 1 1/8	.670 x 1 3/8	.670 x 1 7/8	1.00 x 2 3/8
4.0	.750 x 1 3/8	.750 x 1 7/8	.875 x 1 7/8	**
5.0	.750 x 1 3/8	.750 x 1 7/8	1.00 x 1 7/8	**
10.0	.875 x 1 7/8	1.00 x 2 3/8	1.25 x 2 3/8	**

To Order Specify:

(1) SERIES (HT, HTM, QT, QTM, PT, KTM, ETC.)

(2) CHARACTERISTIC NO. (-1, -2, etc., e.g. PT-1, HT-2)

(3) MFD, WVDC, AND TOLERANCE RATINGS

(4) CONSTRUCTION TYPE: (1—Hermetically Sealed Metal Case, 2-Film Wrap, 3-Epoxy Case, or 4-Film Wrap/Epoxy Ends). Type 1 supplied unless otherwise specified.

(5) CATALOG No. 69-I

† DuPont Reg. Trademark

**Available on Request

GENERAL INFORMATION:

***(1) All dimensions given are for Type 1 construction, i.e., Hermetic Metal Case (epoxy filled); Compression Glass Seals; Floating Circuit.**

(2) Tubular cases are brass—100% tinned—(chrome plated brass cans and Stainless Steel cans are available on special request).

(3) The standard tolerances on physical dimensions are ±1/64" on diameter and 1/32" on length. Closer tolerances are available on request.

(4) Leads are tinned copper-clad steel—#20 AWG by 1½" minimum length. #22 AWG standard for cases less than .400 dia. Other types available on request (e.g. Dumet, Nickel, etc.).

PAGE 4

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AND OTHERS

ULTRA-STABLE LINEAR TEMPERATURE COEFFICIENT CAPACITORS

- **EXCEPTIONAL TEMPERATURE COEFFICIENT LINEARITY (TO <±4 PPM/°C)**
- **ULTRA-STABLE RETRACE (TO <0.01%)**
- **TYPES AVAILABLE TO 165°C**

Balco's ultra-stable/linear temperature coefficient line, types 1US-1 through 6US-1, offers stability far exceeding the previous state of the art. The outstanding retrace characteristics shown in the table (right) represent the maximum difference between room temperature capacitance values before and after any one complete temperature cycle over the full temperature range. These values are closely approached even after as many as ten complete temperature cycles.

Temperature coefficient linearity is maintained within the definite limits shown in the table (right) for a wide range of ratings. The nominal temperature coefficient value, however, is somewhat dependent on various parameters such as capacitance, size, etc., and for this reason these values are indicated as "approximate." For additional information, write for details.

BASIC CAPACITOR CHARACTERISTICS (Typical)

BALCO TYPE ▸	1US-1	2US-1	3US-1	4US-1	5US-1	6US-1
OPERATING TEMP. RANGE	—70°C to +75°C	—70°C to +85°C	—70°C to +100°C	—70°C to +125°C	—70°C to +150°C	—70°C to +165°C
APPROX. NOMINAL TEMP. COEFFICIENT	—100 PPM/°C (0°C to +60°C)	—100 PPM/°C (—40°C to +70°C)	—70 PPM/°C (—55°C to +100°C)	—70 PPM/°C (—55°C to +125°C)	—70 PPM/°C (—55°C to +150°C)	—70 PPM/°C (—55°C to +165°C)
TEMPERATURE COEFFICIENT LINEARITY	<±4 PPM/°C	<±6 PPM/°C	<±10 PPM/°C	<±15 PPM/°C	<±20 PPM/°C	<±30 PPM/°C
RETRACE (After Temp. Cycling)	<0.01%	<0.02%	<0.02%	<0.02%	<0.03%	<0.03%
DISSIPATION FACTOR (At 25°C and 1 KC)	<0.01%	<0.01%	<0.05%	<0.05%	<0.05%	<0.05%
DIELECTRIC ABSORPTION (At 25°C)	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
INSULATION RESISTANCE† (Min., at 25°C)	$1x10^{11}$	$1x10^{11}$	$1x10^{10}$	$1x10^{10}$	$1x10^{10}$	$1x10^{10}$
TOLERANCES TO:	1/10%	1/10%	1/10%	1/10%	1/10%	1/10%

†IN OHMS TO 1.0 MFD; OHMS X MFD ABOVE 1.0 MFD

DIMENSIONS — 50 AND 100 WVDC*

MFD	1US-1 DIA LG	2US-1 DIA LG	3US-1 DIA LG	4US-1 DIA LG	5US-1 DIA LG	6US-1 DIA LG
.01	.400 x 1.0	.400 x 1.0	.400 x 7/8	.400 x 7/8	.400 x 1 7/16	.400 x 1 7/16
.022	.500 x 1 1/8	.500 x 1 1/8	.400 x 7/8	.400 x 7/8	.400 x 1 7/16	.400 x 1 7/16
.033	.500 x 1 3/8	.500 x 1 3/8	.400 x 7/8	.400 x 7/8	.400 x 1 7/16	.400 x 1 7/16
.047	.562 x 1 3/8	.562 x 1 5/8	.400 x 7/8	.400 x 7/8	.400 x 1 7/16	.400 x 1 7/16
.068	.670 x 1 3/8	.670 x 1 3/8	.400 x 1 7/16	.400 x 1 7/16	.500 x 1 7/16	.500 x 1 7/16
.082	.750 x 1 3/8	.750 x 1 3/8	.400 x 1 7/16	.400 x 1 7/16	.500 x 1 7/16	.500 x 1 7/16
.1	.750 x 1 3/8	.750 x 1 3/8	.400 x 1 7/16	.400 x 1 7/16	.500 x 1 7/16	.500 x 1 7/16
.22	.750 x 1 7/8	.750 x 1 7/8	.500 x 1 7/16	.500 x 1 7/16	.500 x 1 15/16	.500 x 1 15/16
.33	.875 x 1 7/8	.875 x 1 7/8	.500 x 1 15/16	.500 x 1 15/16	.875 x 1 15/16	.875 x 1 15/16
.47	1.0 x 1 7/8	1.0 x 1 7/8	.562 x 1 15/16	.562 x 1 15/16	.875 x 1 15/16	.875 x 1 15/16
.68	1.25 x 1 7/8	1.25 x 1 7/8	.670 x 1 15/16	.670 x 1 15/16	1.0 x 1 15/16	1.0 x 1 15/16
.82	2 x 2 x 1 1/8	2 x 2 x 1 1/8	.750 x 1 15/16	.750 x 1 15/16	1.0 x 1 15/16	1.0 x 1 15/16
1.0	2 x 2 x 1 1/8	2 x 2 x 1 1/8	.750 x 1 15/16	.750 x 1 15/16	1.0 x 1 15/16	1.0 x 1 15/16

*HIGHER VOLTAGE RATINGS AND OTHER CAPACITANCE VALUES AVAILABLE ON REQUEST

OTHER CAPACITOR TYPES

CAPACITORS TO MIL-C-19978B—Teflon, mylar, and polystyrene types available (styles CQ05, CQ08, CQ09, CQ10, CQ11, CQ12, and CQ13)—all capacitance values, voltages, and circuit diagrams.

HIGHEST INSULATION RESISTANCE AT ELEVATED TEMPERATURES—Capacitor types available with insulation resistance exceeding 1×10^{14} ohms at 85°C. Higher temperature types are also available.

MATCHED PAIRS AND SETS—Capacitor types can be matched in pairs with 0.075%. Capacitance at 25°C, and on temperature coefficient within ±10PPM/°C from 25°C to +125°C.

HIGH VOLTAGE CAPACITORS—Types available to 6000 WVDC, with very high insulation resistance, good stability and minimum physical size.

SPECIAL CONFIGURATIONS—Types can be supplied in special enclosures specifically designed for stringent customer space requirements.

HIGHEST RELIABILITY CAPACITORS EXCEEDING MIL-C-19978B—Types available to very tight A.Q.L.'s for advanced environmental requirements, e.g. extended life tests, severe shock and vibration at elevated temperatures, 100% burn-in, etc.

For Special Applications or Additional Information—Write For Details

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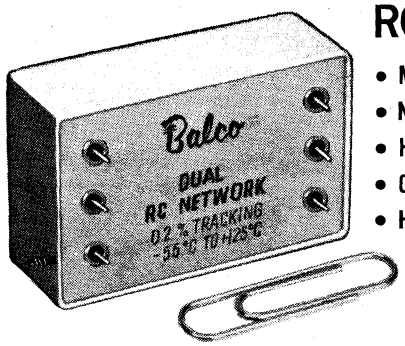
- VENUS PROBE

AND OTHERS

TEMPERATURE STABLE RC NETWORKS



- MINIATURE SIZE
- NEAR ZERO TEMP. COEFFICIENT
- HIGH TRACKING ACCURACY
- CLOSE TOLERANCE
- HIGH TEMPERATURE (TO >125°C)

NOW FOR THE FIRST TIME IN ONE FACILITY, BALCO COMBINES MANUFACTURING CAPABILITIES IN PRECISION FILM CAPACITORS AND PRECISION RESISTORS.

It is no longer necessary to purchase separate components whose compatibility is a matter of chance. Attempting to closely match dissimilar parts is expensive and risky. AT BALCO WE ARE SPECIALISTS. Your RC application will be reviewed by a staff experienced in the pitfalls of network design.

The combined operations of BALCO CAPACITORS and its newly acquired resistor division, MARSTAN ELECTRONICS, represents a truly unique capability to provide the finest in RC networks. With both divisions located in one central manufacturing plant, state-of-the-art RC network performance can now be realized on a production basis.

Our unique side by side processing insures the ultimate in component compatibility and over-all performance. Our files of applications include Integrators, Phase Shifters, Oscillators, Twin-T Filters, etc.

RC product accuracy and stability is dependent on practical restraints on the individual components and, to aid the circuit designer in realistically computing system accuracy, the table to the right has been developed.

NETWORK RC PRODUCT TOLERANCES CAN BE SUPPLIED to ±0.03% of the specified nominal value at any constant temperature. Tolerances on individual capacitive or resistive components can be supplied to <0.02% at any specified constant temperature.

RC PRODUCT VALUES VIRTUALLY TEMPERATURE IMMUNE e.g. ±0.05% max. change from 25°C to 75°C, ±0.10% from 25°C to 125°C, and ±0.15% from 25°C to —55°C. Types are available with combined retrace and hysteresis effects to less than <0.02% even after repeated temperature cycling.

NETWORK PAIRS ("DUAL" NETWORKS) can be supplied with individual RC products matched to within ±0.03% at any specified constant temperature. Absolute tracking accuracy between RC products can be provided to within ±0.10% from —15°C to 85°C and ±0.15% from —55°C to 125°C, including initial tolerance match.

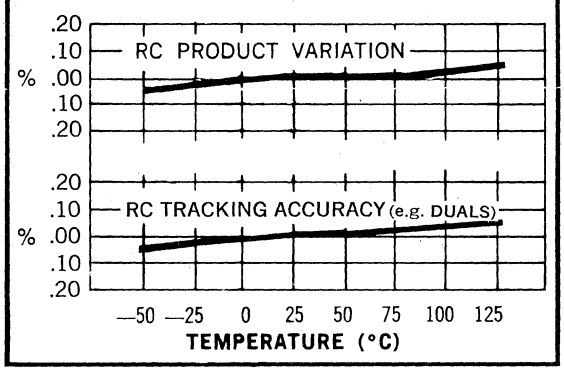
RC NETWORK SETS PACKAGING These devices can be supplied in compact hermetically sealed cases or printed circuit cases, or supplied as individual components.

RELIABILITY & DOCUMENTATION can be supplied to meet and exceed high reliability specifications of standard mil spec. requirements. On special request, documented test data on serialized RC networks can be supplied with each lot shipped.

RC NETWORK (GENERAL CHARACTERISTICS*)

TEMP. RANGE	NOMINAL TIME CONSTANT	CLOSEST INITIAL TOLERANCE	RC PRODUCT STABILITY AFTER TEMP. CYCLING	RC PRODUCT VARIATION WITH TEMP.
—55°c To +85°c	1.0 μ sec. to 100 sec.	±0.03%	±0.03%	0±25ppm/°c
	101 μ sec. to 1m sec.	±0.03%	±0.03%	0±15ppm/°c
	1.1 m sec. to 5 sec.	±0.02%	±0.02%	0±10ppm/°c
—55°c To +125°c	5.1 sec. to 20 sec.	±0.03%	±0.03%	0±15ppm/°c
	100 μ sec. to 1 ms	±0.04%	±0.04%	0±20ppm/°c
	1.1 m sec. to 5 sec.	±0.03%	±0.03%	0±15ppm/°c
	5.1 sec. to 20 sec.	±0.05%	±0.05%	0±30ppm/°c
	21 sec. to 200 sec.	±0.15%	±0.15%	0±50ppm/°c

RC NETWORK (TEMPERATURE CHARACTERISTICS*)



RC NETWORK (DETAILED CHARACTERISTICS*)

RESISTANCE VALUES AVAILABLE:	10 OHMS TO 10 MEGOHMS
CAPACITANCE VALUES AVAILABLE:	500pf TO >10.0 MFD
RC PRODUCT CHANGE WITH TEMPERATURE AVAILABLE TO:	<±0.05%, 25°C TO 75°C <±0.075%, 25°C TO 100°C <±0.10%, 25°C TO 125°C <±0.15%, 25°C TO —55°C
RESISTOR TOLERANCES AVAILABLE	TO <±0.01%
CAPACITOR RETRACE TOLERANCES AVAILABLE	TO <±0.02%
RC PRODUCT TOLERANCES AVAILABLE	TO <±0.03%
RC PRODUCT TRACKING ACCURACY (FOR "DUAL" OR MATCHED NETWORKS) AVAILABLE TO:	<±0.03% AT CONSTANT TEMPERATURE <±0.10%, —15°C TO 85°C <±0.15%, —55°C TO 125°C
RC PRODUCT STABILITY (RETRACE) AFTER TEMP. CYCLING:	AVAILABLE TO <±0.02%

*AVAILABLE FOR MOST SIZES

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Balco **CAPACITORS**

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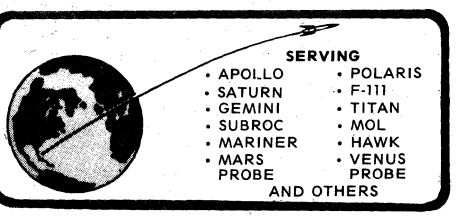

HELLCAP

"WRAP AND FILL" CAPACITORS

FILM WRAP EPOXY END SEAL CONSTRUCTION

• SMALLEST SIZE • EXCEPTIONAL PERFORMANCE • LOW COST • FAST DELIVERY

	TEMP. RANGE	MFD. RANGE	VOLTAGE RANGE	DISSIPATION FACTOR	INSULATION RESISTANCE	% Δ C vs. TEMP.
MYLAR TYPES RTWM (TUBULAR) AND FTWWM (FLAT)	−60°C TO +125°C (50% Derating Above 100°C)	.0047 TO >1.0	TO >600 VDC	1.0% MAX. AT 1KC & 25°C	$1x10^5$ MEGS MIN. AT +25°C	−4.0% MAX. 25°C TO −55°C +15.0% MAX. 25°C TO 125°C
POLYSTYRENE TYPE RTWP (TUBULAR)	−60°C TO +85°C (Without Derating)	.001 TO >.47	TO >600 VDC	0.05% MAX. AT 1KC & 25°C	$5x10^5$ MEGS MIN. AT +25°C	−105 PPM/°C ±30
METALIZED MYLAR TYPES RTWMM (TUBULAR) AND FTWMM (FLAT)	−60°C TO +125°C (50% Derating Above 100°C)	.01 TO >5.0	TO >600 VDC	1.0% MAX. AT 1KC & 25°C	$3x10^4$ MEGS MIN. AT +25°C	−4.0% MAX. 25°C TO −55°C +15.0% MAX. 25°C TO 125°C
METALIZED POLYCARBONATE TYPE RTWKM (TUBULAR)	−60°C TO +125°C (Without Derating)	.01 TO >5.0	TO >600 VDC	0.5% MAX. AT 1KC & 25°C	$1x10^4$ MEGS MIN. AT +25°C	+1.5% MAX. 25°C TO −55°C ±1.5% MAX. 25°C TO 125°C
HIGH TEMPERATURE (150° C)* TEFLON† TYPE RTWG (EXTENDED FOIL) & METALIZED TEFLON† (TYPE RTWGM) *SPECIALS TO +175°C	−60°C TO +150°C (Without Derating)	.001 TO >.15	TO >600 WVDC	.1% MAX. AT 25°C	$5 x 10^5$ MEGS MIN AT +125°C	±1.5% MAX. 25°C TO −55°C AND 125°C
		.047 TO >4.0	TO 600 WVDC	.15% MAX. AT 25°C	$1 x 10^4$ MEGS MIN. AT +25°C	−150 PPM/°C MAX.

FOR FLAT TYPES REFER TO PREFIX F—ADDITIONAL INFORMATION AVAILABLE ON REQUEST.

 FOR COMPLETE SPECIFICATIONS, INCLUDING DIMENSIONS, REQUEST BROCHURE NO. TW-68

MAIN PLANT: 307 WASHINGTON STREET, ORANGE, NEW JERSEY 07050, TEL. (201) 677-1200

Balco CAPACITORS
DIVISION OF BALCO ELECTRONICS, INC.



SERVING
- APOLLO
- SATURN
- GEMINI
- SUBROC
- MARINER
- MARS PROBE
- POLARIS
- F-111
- TITAN
- MOL
- HAWK
- VENUS PROBE

AND OTHERS

HELLCAP CAPACITOR DIMENSIONS

POPULAR VALUES SHOWN (INTERMEDIATE & OTHER VALUES AVAILABLE)

MYLAR† TYPE RTWM (—55°C to 125°C)

CAPACITY IN MFDS.	100 VDC D	100 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.0047	.187	7/16	.187	7/16	.203	9/16	.203	11/16
.01	.203	7/16	.203	7/16	.234	9/16	.234	11/16
.022	.234	7/16	.203	9/16	.265	11/16	.265	13/16
.033	.203	9/16	.203	11/16	.281	13/16	.296	15/16
.047	.203	11/16	.250	11/16	.343	13/16	.343	15/16
.10	.265	13/16	.312	13/16	.421	15/16	.421	1 3/16
.22	.343	15/16	.391	1 1/16	.484	1 5/16	.546	1 5/16
.47	.421	1 3/16	.500	1 3/16	.625	1 9/16	.671	1 11/16
1.0	.546	1 5/16	.562	1 11/16	.781	1 13/16	.890	1 13/16

METALIZED MYLAR† TYPE RTWMM (—55°C to 125°C)

CAPACITY IN MFDS.	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.0068	**	**	.234	9/16	.296	9/16
.01	**	**	.234	9/16	.234	11/16
.022	.203	7/16	.234	11/16	.359	11/16
.047	.187	9/16	.250	15/16	.359	15/16
.1	.281	9/16	.312	15/16	.500	15/16
.22	.312	11/16	.375	1 3/16	.593	1 3/16
.33	.375	11/16	.406	1 7/16	.625	1 7/16
.47	.453	11/16	.468	1 7/16	.750	1 7/16
.68	.421	15/16	.562	1 7/16	.875	1 7/16
1.0	.421	1 3/16	.625	1 11/16	.953	1 11/16
2.0	.562	1 3/16	.875	1 11/16	1.343	1 11/16
5.0	.734	1 11/16	**	**	**	**

POLYSTYRENE TYPE RTWP (—55°C to 85°C)

CAPACITY IN MFDS.	100 VDC D	100 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.001	.187	11/16	.187	11/16	.187	11/16	.187	11/16
.0022	.187	11/16	.187	11/16	.187	11/16	.203	11/16
.0047	.187	11/16	.187	11/16	.234	11/16	.234	13/16
.01	.218	11/16	.234	11/16	.281	13/16	.328	13/16
.022	.265	13/16	.281	13/16	.343	15/16	.406	15/16
.047	.343	13/16	.359	15/16	.453	1 1/16	.484	1 3/16
.1	.453	15/16	.468	1 1/16	.578	1 3/16	.656	1 5/16
.22	.515	1 3/16	.625	1 3/16	.671	1 11/16	.812	1 11/16
.47	.671	1 7/16	.750	1 11/16	**	**	**	**

METALIZED POLYCARBONATE TYPE RTWKM (—55°C to 125°C)

CAPACITY IN MFDS.	50 WVDC D	50 WVDC L	100 WVDC D	100 WVDC L	200 WVDC D	200 WVDC L	400 WVDC D	400 WVDC L
.05	.170	9/16	.280	9/16	.200	11/16	.290	13/16
.10	.210	9/16	.210	11/16	.240	11/16	.400	13/16
.22	.230	11/16	.250	13/16	.240	1 3/16	.440	1 3/16
.47	.300	13/16	.360	13/16	.345	1 3/16	.520	1 11/16
1.0	.400	13/16	.440	15/16	.400	1 11/16	.760	1 11/16
2.0	.50	15/16	.540	1 3/16	.550	1 11/16	.900	2 3/16
4.0	.600	1 3/16	.580	1 11/16	.750	1 11/16	**	**
5.0	.660	1 3/16	.660	1 11/16	.840	1 11/16	**	**
10.0	.750	1 11/16	.810	2 3/16	1.00	2 3/16	**	**

TEFLON† TYPE RTWG (—55°C to 150°C)

CAPACITY IN MFDS.	50 VDC D	50 VDC L	100 VDC D	100 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.001	.187	9/16	.187	9/16	.187	9/16	.187	11/16	.187	11/16
.0022	.187	9/16	.187	9/16	.187	9/16	.203	11/16	.203	11/16
.0047	.187	9/16	.187	9/16	.187	11/16	.234	13/16	.234	13/16
.01	.187	9/16	.187	11/16	.234	13/16	.281	15/16	.281	15/16
.022	.203	11/16	.250	11/16	.312	13/16	.343	1 3/16	.343	1 3/16
.033	.250	11/16	.265	13/16	.343	15/16	.406	1 3/16	.406	1 3/16
.047	.265	13/16	.296	15/16	.375	1 3/16	.421	1 7/16	.421	1 7/16
.068	.296	13/16	.343	15/16	.406	1 3/16	.453	1 11/16	.453	1 11/16
.082	.296	15/16	.343	1 3/16	.406	1 7/16	.500	1 11/16	.500	1 11/16
.1	.312	15/16	.343	1 3/16	.437	1 7/16	.546	1 11/16	.671	2 3/16
.15	.391	15/16	.406	1 3/16	.515	1 7/16	.625	1 15/16	.812	2 3/16

METALIZED TEFLON† TYPE RTWGM (—70°C to 150°C)

CAPACITY IN MFDS.	50 VDC D	50 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.047	.218	11/16	.281	11/16	.312	1.0	.375	1 1/4
.082	.281	11/16	.375	11/16	.406	1.0	.485	1 1/4
.1	.296	11/16	.421	11/16	.453	1.0	.546	1 1/4
.22	.328	15/16	.453	15/16	.546	1 1/4	.687	1 1/2
.47	.391	1 3/16	.578	1 3/16	.703	1 1/2	.859	1 3/4
.82	.531	1 3/16	.640	1 7/16	.812	1 3/4	**	**
1.0	.578	1 3/16	.671	1 7/16	.859	1 3/4	**	**
2.0	.703	1 7/16	.875	1 11/16	**	**	**	**
3.0	.781	1 11/16	**	**	**	**	**	**
4.0	.859	1 11/16	**	**	**	**	**	**

DIMENSIONAL TOLERANCES
DIAMETER: ≤.234; ±.031 TOL.
>.234; ±.050 TOL.
LENGTH: ±1/16 TOL.

LEAD GAUGE
#22 AWG FOR CASES ≤.312 DIA.
#20 AWG FOR CASES >.312 DIA.
LEAD LENGTH: 1 5/8 + 1, —0

**Available on Request
†Dupont Registered Trademar

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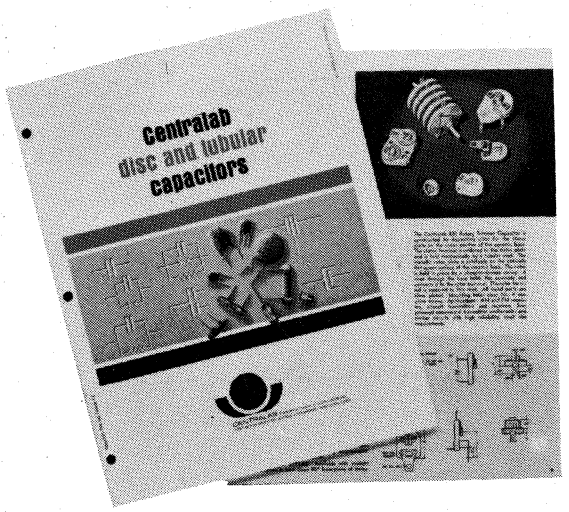
Centralab Ceramic Capacitors Can fill your Capacitor Needs!



Centralab disc and tubular capacitor catalog, as well as the special purpose catalogs cover hundreds of types of ceramic capacitors for military, industrial and commercial applications.

Request your copy through Centralab's advertising department.

Here are typical Centralab Capacitors. Types listed here are not necessarily available, in all extremes of temperature coefficients, capacitance ranges, and tolerances.

Temperature Compensating Discs

WORKING VOLTAGE	TEMPERATURE COEFFICIENTS	CAPACITANCE RANGE pf	CAPACITANCE TOLERANCES
DISCS			
500V	NPO to N5250	1.1-3100	
1KV	NPO to N5250	2.5-2150	±.25 pf and ±.5 pf when nominal capacitance is 10 pf or less. Over 10 pf ±5%, ±10% or ±20%
2KV	N750, N1500, N2200*	17-450	
3KV	N750, N1500, N2200*	12-310	
4KV	N750, N1500, N2200*	12-210	
5KV	N750, N1500, N2200*	18-165	
6KV	N750, N1500, N2200*	17-135	

*Available in all standard TC's in other capacitance ranges.

General Purpose Discs

EIA FORMULATION & T. C.	TOLERANCE	CAPACITANCE TOLERANCE	CAPACITANCE RANGE IN pf	WORKING VOLTAGE
Y5D	±3.3%	±10%, ±20%, GMV	150 to 9700	150, 500V
X5F	±7.5%	±10%, ±20%, +80 −20% GMV	70-6100	150V-6KV
X5P	±10%	±10%, ±20%, +80 −20%	45-3000	150V-6KV
Z5P	±10%	±10%, ±20%, +80 −20%	175-14,650	150V-6KV
X5S	±22%	±10%, ±20%, +80 −20%	150-11,000	150V-6KV
X5U	+22 −56%	±20%, +80 −20%, GMV	375-20,000	150V-6KV
Z5U	+22 −56%	±20%, +80 −20%, GMV	650-34,800	150V-6KV
Z5V	+22 −82%	±20%, +80 −20%	.005MFD-.1MFD	100V

Not all capacitance values at all voltages: maximum capacitance shown available in 500V rated units.

Low Voltage General Purpose Discs (Ultra Kaps)

DC WORKING VOLTAGE	APPROX. DIAMETER	CAPACITANCE TOLERANCE	MAXIMUM DISSIPATION FACTOR	CAPACITANCE RANGE MFD
3	.3 to .9"	+100 −0%	5%	.22 to 2.2
10	.3 to .9"	+80 −20%	10%	.05 to .47
16	.6 to .9"	+80 −20%	10%	.05 to .2
20	.6 to .9"	+80 −20%	10%	.05 to .2
25	.3 to 1.0"	±30% or ±20%	5%	.015 to .2

High Temperature

Wide range of capacities, tolerances, TC & Hi-K bodies for operation at 125°C. Exceptionally stable Hi-K bodies with maximum change in capacity of ±15% from −55°C to +125°C are available.

Polystyrene Capacitors are also available in the Centralab line. These long life, low cost units are the ideal replacements for paper, mica, and Mylar capacitors.

FOR IMMEDIATE DELIVERY — many of these are available through Centralab Industrial Distributors.

TYPE	CAP. RANGE pF.	TOLERANCES % @ 25°C	TEMP. CO-EFFICIENT	WORKING VOLTAGE —DC
Feed-Thrus				
DA—717 series (Bushing types)	10-500	±5, ±10, ±20		500
	10-4000	±20, GMV		500
DA—720 series (Bushing types)	10-820	±5, ±10, ±20		500
	10-820	±5, ±10, ±20		1000
	10-400	±5, ±10, ±20		1500
	10-5000	±20, GMV		500
	10-3000	±20, GMV		1000
	10-2500	±20, GMV		1500
DA—721-722 (High Reliability)	5-400	±5, ±10, ±20		500
	5-1000	±20, GMV		500
DA—740 (Ring Type)	5-1000	±5, ±10, ±20 +80, −20, GMV		500
DA—784, 785, 787 (Eyelet Type)	5-400	±5, ±10, ±20		500
	5-2000	±20, GMV		500
DA—742 (Eyelet) (MIL Type)	5-400	±5, ±10, ±20		500
	5-2000	±20, GMV		500
Trimmers				
Type 829 (Tubular)	.5-3/3-20		NPO, 220, 660	500
Type 820 (Rotary)	1-3.5/70-90			500
Type 821 (Rotary)	3-12/7-35		NPO, 750	500
Type 822 (Rotary)	1.5-3/8.0-50		NPO, 650	500
Type 823 (Rotary)	5-12/20-125		NPO, 650	500
Type 824 (Rotary)	1.5-3/7-45		NPO, 650	500
Type 826 (Rotary)	10-30/225-400		NPO, 650	500
Transmitting Capacitors				
Type 850	25-1000	±5, ±10, ±20	NPO, 750	5K-7.5K
Type 851, 857	25-200	±5, ±10	NPO, 750	7.5K-15K
Type 853, 854, 855	3-40	±5, ±10	NPO, 750	5K
Type 858, (Hi-K)	500-1000	±20, GMV		5K
Type 859	50-500	±10	NPO, 750	20K
Discoidal				
	5-1000	±10, ±20, GMV		500

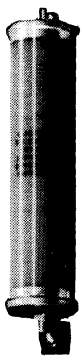
Antenna Coupling & Line Bypass Components UL Yellow card listed

DISC-R-CAP & TUBE-R-CAP®: parallel resistor, capacitor, and spark gap available with 50 to 2500 pf capacitance, 1.4 KVDC, 1 KVDC, 150 VAC, 60 HZ voltage rating.

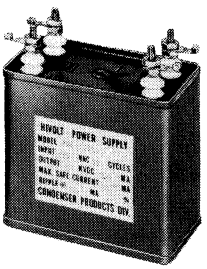
AC LINE DISC CAPACITORS 380-10,000 pf.

CENTRALAB Electronics Division • GLOBE-UNION INC.
5757 NORTH GREEN BAY AVENUE • MILWAUKEE, WISCONSIN 53201

We have the CAPABILITY, RELIABILITY and VERSATILITY for all your high voltage component needs

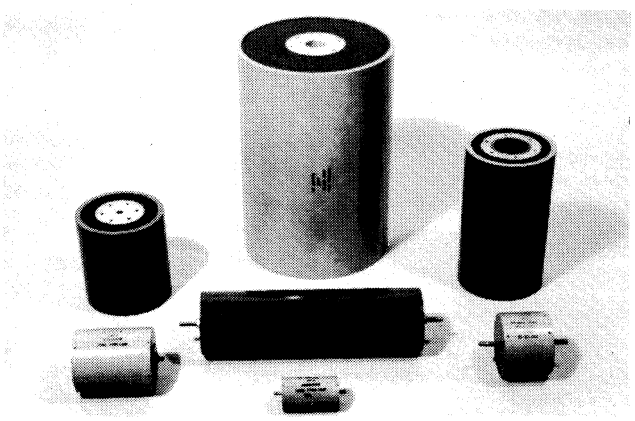


DC FILTER CAPACITORS Miniature glass — 1 to 50 KV standard; Rugged bakelite — 40 to 150 KV standard; CP70 type — 600 V to 50 KV standard
TRANSMITTING CAPACITORS Pulse or RF series — 1 to 30 KV standard; Temperature ranges up to 210°C without derating
LABORATORY AND INSTRUMENTATION CAPACITORS Glass or CP70 containers to 60 KV at 0.1 mfd



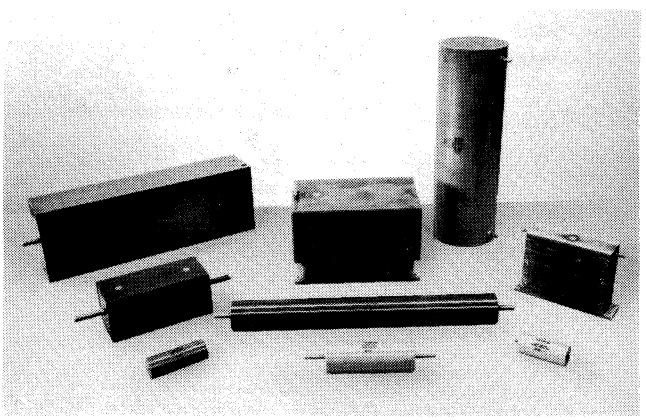
HIGH VOLTAGE POWER SUPPLIES Modular Compact and Capacitor Charging — Output from 1 to 75 KV standard OEM specials promptly quoted
PULSE FORMING NETWORKS Designed to your specifications and application

ULTRA LOW INDUCTION ENERGY STORAGE CAPACITORS



For laser, simulation and spark discharge technology.
FAST DISCHARGE E-Type capacitors feature fast discharge and are designed for quantum electronics in the scientific and industrial optical community.
GUARANTEED ONE YEAR Up to 85°C at up to 100 pps. Ring frequency is measured on every unit — tested one minute at twice rated voltage.

SPECIAL OEM DESIGN



Designed to suit customer applications and space limitations. A wide range of voltages and capacities as well as constructional styles are available to meet your specifications. Call or write for complete technical information. Special requirements tailored to your applications and specifications are promptly quoted.

CONDENSER PRODUCTS CORPORATION

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- NEW YORK: 212—245-3866
- CALIFORNIA: 213—391-1641

COMPONENT RESEARCH COMPANY

HIGH RELIABILITY — HERMETICALLY SEALED FILM CAPACITORS

• NEW DEVELOPMENTS

During the early part of 1968 complete re-tooling of our production and test facility was undertaken to further advance the state of the art in film capacitor reliability, electrical performance and miniaturization. This catalog, revision D, reflects several tightened specification areas and new capacitor types added as a result of this expansion effort. By mid 1969, catalog E will be issued to further define existing specifications and to include additional capacitors now in limited production such as re-constituted MICA, 200°C teflon, high voltage, and high current handling capacitors for SCR applications.

• LOW TEMPERATURE COEFFICIENT

CRC capacitor windings are firmly supported within their hermetic enclosures to withstand grade 3 vibration levels per MIL-C-19978. The capacitors are uniquely constructed to provide winding support for the thinnest dielectric films and have stress-free lead terminations that can withstand extended temperature cycling. CRC capacitors are exclusively manufactured under one or more of the following patents and additional patents pending: 3,238,428; 3,260,906; 3,292,063.

• HIGH INSULATION RESISTANCE

CRC has supplied custom made capacitors as large as 1400 Mfd with less than 5 picoamps/Mfd leakage current for ramp and integrating circuit applications. Capacitors are available with insulation resistance values as high as 100,000,000 megohms and capacitors can be supplied with dielectric absorption as low as 0.005%.

• LOW DISSIPATION FACTOR

A measure of the reliability and quality of termination of the electrodes is determined by the 1KHz and 10KHz dissipation factor ratios. Continuous temperature cycling that destroys the electrode bond leading to open circuits of ordinary capacitors, does not impair the dissipation factor of CRC capacitors.

• LONG TERM STABILITY

All capacitors are temperature cycled to obtain improved capacitance retrace. CRC capacitors are frequently purchased for use as secondary standards due to their ability to maintain capacitance value indefinately.

• HIGH PERFORMANCE IN SMALL SIZE

Despite their small size CRC capacitors outperform much larger conventional capacitors proving that reduction in size does not have to result in compromise with performance or quality.

• MASS SPECTROMETER LEAK DETECTION

Component Research is now 100% testing capacitors utilizing the Veeco MS-12AB-P mass spectrometer leak test station with a sensitivity of 5×10^{-12} ATM-CC/SEC which far exceeds the hot oil immersion test method in accuracy and reliability. Maximum leak test rate for each capacitor type is listed in each specification section.

• EXCEEDS MIL-SPEC RELIABILITY

CRC capacitors are manufactured to meet CRC specifications which exceed military specifications in quality limits and measurement accuracy. Freedom from momentary breakdown when used in low level high impedance circuits, low noise and microphonics are contributing factors to their widespread use.

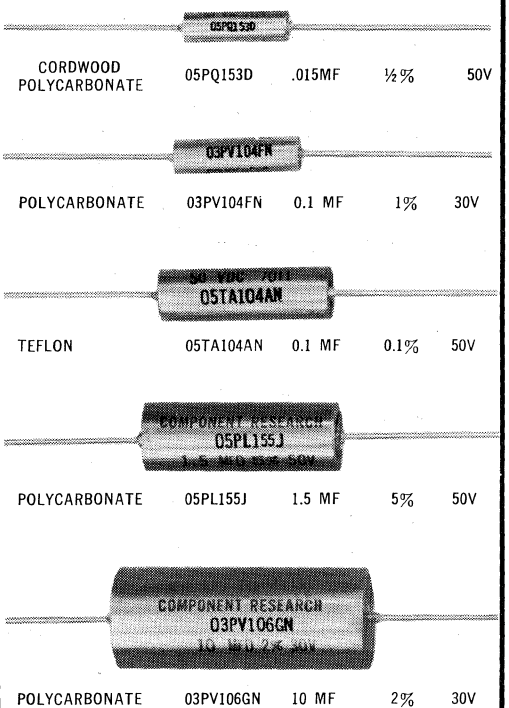
• FULLY QUALIFIED FOR AEROSPACE

CRC capacitors are qualified for use in the following critical applications.

PROJECT	SPECIFICATION	QUALIFIED CAPACITOR DESCRIPTION
APOLLO	441-0849	High-Rel 05TJ Teflon
APOLLO	958026	High-Rel 05TJ Teflon
APOLLO	1986945	High-Rel 05TJ Teflon
LUNAR ORBITER	27-30100	High-Rel 05TU Teflon
LEM	60-00002	High-Rel 05PK Polycarbonate
APOLLO	60-00077	High-Rel 05PK Polycarbonate
SUBROC	2291328	Standard TA Teflon
F-111	419159	Standard TA Teflon
A-7A	500633	Standard TA Teflon
LANCE	212-0017	Standard PL Polycarbonate
LANCE	10165806-TC	High-Rel PA Polystyrene
TOW	917319	Standard TA Teflon
SHILLELAGH	11070319	Standard TA Teflon

TYPICAL CAPACITORS

ACTUAL SIZE



CORDWOOD POLYCARBONATE	05PQ153D	.015MF	½%	50V
POLYCARBONATE	03PV104FN	0.1 MF	1%	30V
TEFLON	05TA104AN	0.1 MF	0.1%	50V
POLYCARBONATE	05PL155J	1.5 MF	5%	50V
POLYCARBONATE	03PV106GN	10 MF	2%	30V

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COMPONENT RESEARCH CO., INC. 1717 19th Street, Santa Monica, Calif. 90404 • Phone: (213) 393-3755 • TWX: (910) 343-6864

COMPONENT RESEARCH COMPANY

COMPARISON OF CAPACITOR TYPES

Component Research Company makes an ever increasing variety of film capacitors to provide the project engineer, designer and reliability engineer with a wide latitude of choice in the selection of a capacitor best suited for his application. New items are added to the catalog as significant developments in miniaturization, performance and lower cost result in a product available for immediate delivery.

Although we have recently manufactured plastic cased subminiature capacitors and special high voltage capacitors they will not be listed in this catalog until we have accumulated sufficient data to provide comprehensive engineering information.

The following data has been compiled and tabulated from tests conducted on thousands of capacitors developed and manufactured by Component Research Company. This data takes into account normal production variations from lot to lot which are constantly monitored to afford feedback leading to product improvement and tighter quality control.

The data shown may vary with each catalog revision to reflect improvements in the state of the art of capacitance measurement and our constant effort to further perfect our products.

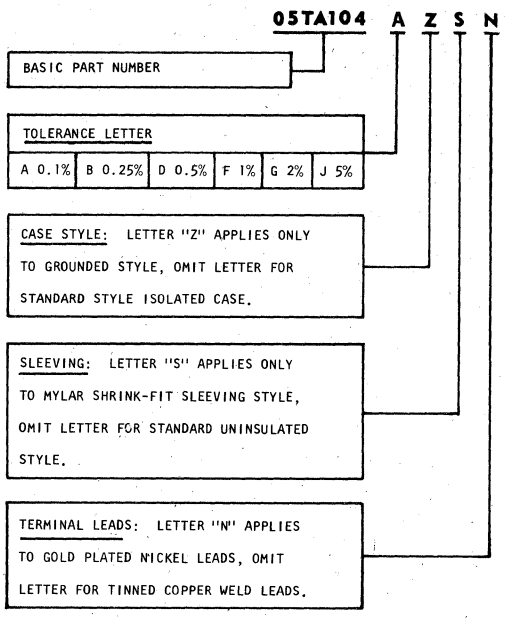
As a quick guide to the reliability engineer we have set up a "quality level" column in the capacitor comparison data section to indicate where the capacitors are primarily used and the applications they are recommended for. Listed below is a description of the quality level code letters.

CODE LETTER	CODE DESCRIPTIONS
A	Highest reliability level, capacitors have burn-in, extended temperature cycling, redundant quality inspection, serialization. Used in space and critical systems.
B	High reliability, identical in construction to level "A" capacitors. Used in military aircraft, missiles and ground equipment.
C	Our commercial grade which is higher in quality level than MIL-Specification types. Used in military and industrial applications.

*MEASURE VALUES ABOVE 1 MFD AT 0.1 KHz

Dielectric	Type	Volts DC	Quality Level	Typical Temperature Coefficient Limits Max. % Capacitance Change Relative to 25°C							*Typical Leakage Current in Nanoamps for 1 MFD capacitors (1 Nanoamp = 0.001 Microamps)				% Max Drift 5 cycles −10°C to 85°C	% Max Diel. Absorption at 25°C	% Max* Dissipation factor at 1 KHz
				−55°C	−25°C	−10°C	0°C	55°C	85°C	125°C	25°C	55°C	85°C	125°C			
TEFLON −62°C to 125°C at full rated volts	05TA	50	B	+0.6	+0.4	+0.3	+0.2	−0.25	−0.5	−0.6	0.20	0.30	0.50	1.0	0.02	0.02	0.03
	1TA	100	B	+0.6	+0.4	+0.3	+0.2	−0.25	−0.5	−0.6	0.10	0.20	0.30	1.0	0.02	0.02	0.03
	2TA	200	B	+0.6	+0.4	+0.3	+0.2	−0.25	−0.5	−0.6	0.10	0.20	0.30	1.0	0.02	0.02	0.03
	05TJ	50	A	+0.4	+0.25	+0.2	+0.1	−0.15	−0.25	−0.35	0.10	0.20	0.30	1.0	0.01	0.02	0.03
	05TC	50	A	+0.7	+0.5	+0.3	+0.25	−0.25	−0.5	−0.6	0.20	0.30	0.50	1.0	0.02	0.02	0.05
	05TL	50	C	+1.0	+0.7	+0.5	+0.3	−0.4	−0.7	−1.0	0.50	0.80	1.0	5.0	0.05	0.05	0.15
	05TQ	50	B	+0.8	+0.6	+0.5	+0.3	−0.3	−0.6	−0.9	0.20	0.30	0.50	1.0	0.05	0.05	0.10
	1TU	100	B	+0.8	+0.6	+0.3	+0.2	−0.2	−0.5	−0.8	0.10	0.15	0.20	1.0	0.05	0.01	0.005
	2TU	200	B	+1.0	+0.6	+0.4	+0.3	−0.3	−0.6	−1.0	0.05	0.10	0.15	1.0	0.05	0.01	0.005
	1TF	100	C	+1.2	+0.8	+0.6	+0.4	−0.4	−0.7	−1.2	0.10	0.10	0.20	1.0	0.1	0.03	0.02
POLY-CARBONATE −62°C to 100°C at full rated volts. Derate by 50% at 125°C	03PV	30	A	−1.0	−0.4	−0.2	−0.1	±0.1	±0.25	±0.5	0.20	0.40	0.50	5.0	0.03	0.15	0.20
	05PK	50	A	−1.0	−0.4	−0.2	−0.1	±0.1	±0.25	±0.5	0.20	0.40	0.50	5.0	0.03	0.15	0.20
	05PQ	50	B	−2.0	−0.8	−0.5	−0.3	±0.3	±0.8	±1.5	0.20	0.40	0.50	5.0	0.05	0.20	0.20
	03PL	30	B	−1.5	−0.5	−0.3	−0.2	±0.2	±0.5	±1.0	0.20	0.40	0.50	5.0	0.05	0.20	0.20
	05PL	50	B	−1.5	−0.5	−0.3	−0.2	±0.2	±0.5	±1.0	0.20	0.40	0.50	5.0	0.05	0.20	0.20
	1PL	100	B	−1.5	−0.5	−0.3	−0.2	±0.2	±0.5	±1.0	0.20	0.40	0.50	5.0	0.05	0.20	0.20
	2PL	200	B	−1.5	−0.5	−0.3	−0.2	±0.2	±0.5	±1.0	0.20	0.40	0.50	5.0	0.05	0.20	0.20
	4PL	300	B	−1.5	−0.5	−0.3	−0.2	±0.2	±0.5	±1.0	0.20	0.40	0.50	5.0	0.05	0.20	0.20
	03PG	30	C	−2.0	−0.8	−0.5	−0.3	±0.5	±1.0	±2.0	1.0	3.0	10	50	0.10	0.20	0.30
	05PG	50	C	−2.0	−0.8	−0.5	−0.3	±0.5	±1.0	±2.0	1.0	3.0	10	50	0.10	0.20	0.30
	1PG	100	C	−2.0	−0.8	−0.5	−0.3	±0.5	±1.0	±2.0	1.0	3.0	10	50	0.10	0.20	0.30
	2PG	200	C	−2.0	−0.8	−0.5	−0.3	±0.5	±1.0	±2.0	1.0	3.0	10	50	0.10	0.20	0.30
	4PG	400	C	−2.0	−0.8	−0.5	−0.3	±0.5	±1.0	±2.0	1.0	3.0	10	50	0.10	0.20	0.30
MYLAR −62°C to 85°C at full rated volts Derate by 50% at 125°C	1MA	100	B	−5.0	−3.0	−2.0	−1.0	+1.0	+2.0	+14	2.0	5.0	3.0	600	0.10	0.50	0.8
	2MM	200	B	−5.0	−3.5	−2.5	−1.5	+1.0	+3.0	+15	1.0	3.0	2.0	500	0.10	0.50	0.8
POLY-STYRENE −62°C to 85°C at full rated volts.	05PA	50	B	+1.0	+0.55	+0.4	+0.3	−0.3	−0.6	—	0.05	0.08	0.15	—	0.05	0.02	0.02
	1PA	100	B	+1.0	+0.55	+0.4	+0.3	−0.3	−0.6	—	0.05	0.08	0.15	—	0.05	0.02	0.02

HOW TO SPECIFY COMPLETE PART NUMBER



Example 1—Part 05TA104AZSN shown above is a 50 volt, "TA" Teflon capacitor, 0.1mfd, ± 0.1% tolerance, with a grounded case, mylar sleeving, and gold-plated nickel leads.

Example 2—Part 1PL106F would be a 100 volt, "PL" Polycarbonate capacitor, 10mfd, ± 1% tolerance, standard isolated case, and tinned copperweld leads.

Example 3—Part 05PL1354DS would be a 50 volt polycarbonate capacitor, 1.35 mfd, ± 0.5%, standard case, sleeving, and tinned copperweld leads.

Note: 1354 represents 1,350,000 picofarads. The last digit, 4, indicates the number of zeros.

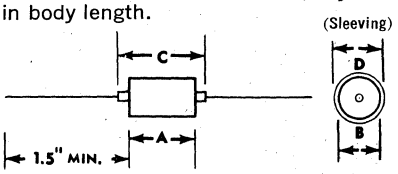
CONSTRUCTION INFORMATION

TERMINALS

#22 AWG leads are supplied with 0.312" and smaller case diameters.
#20 AWG leads are supplied with 0.400" and larger case diameters.
All teflon capacitors other than type "TF" are now manufactured with nickel, gold-plated leads in accordance with MIL-STD-1276 Type N2. Due to existing inventories of capacitors with tinned copper, tinned copperweld and gold-plated nickel leads, either type may be shipped on orders not specifying a particular style lead.

ENCLOSURE

All capacitors listed are hermetically sealed in brass, tin fuse plated cases. The metal case can be supplied with a mylar covering by adding "S" in the part number as shown above. This covering increases the case diameters listed by a maximum of .010". All capacitor dimensions shown are for the standard case style with both leads isolated from the case. Special capacitors can be provided with one lead connected to the case, style "Z", .062" shorter in body length.



MECHANICAL TOLERANCES

A Case length dimensions vary ±.03" max
B Case diameter dimensions vary ±.01" max
C Allow 0.2" overall increase to case length "A" for solder beads
D Mylar sleeve increases case diameter .01" max

PRICES AND TERMS

To expedite the ordering of prototype quantities we have listed small quantity prices. Immediate quotation for any quantity required will be given upon request. Our terms are ½% 10 Days, Net 30, F.O.B. our plant. Minimum order is $10.00.
For best delivery of stock items, please specify that either type leads are acceptable.

AVAILABILITY

A large stock is maintained of most catalog types in standard and non-standard values for immediate delivery Teflon and polystyrene capacitors can be supplied as accurate as ±0.1%, other types ±0.25%.

MEASUREMENT OF CAPACITORS

The high quality of CRC capacitors is difficult to evaluate unless sufficiently sensitive and accurate equipment is utilized with proper measurement techniques. Component Research Company has developed sophisticated methods of 100% testing capacitors to the following accuracies:

1. Capacitance tolerance and dissipation factor	±0.05% of NBS Standards (±0.01% when required)
2. Leakage current	0.1 picoamps
3. Insulation Resistance	10^8 megohms
4. Temperature Coefficient	±0.01%
5. Dielectric Absorption	0.005%

Component Research Company will provide technical assistance to laboratories or inspection departments interested in establishing adequate facilities for measurement and calibration of capacitors.

MEASUREMENT INSTRUCTIONS

Prior to measurement of insulation resistance thoroughly clean the glass surface of the hermetic seals to remove contamination which frequently results from burn-in or life tests, operator handling or flux vapors from soldering near the capacitors. We have found that vapor degreasing in itself does not always remove the contamination and it may require a rubbing action to eliminate the films.
Capacitance bridges equal to the General Radio 1620A are recommended for best accuracy of capacitance and dissipation factor. The dissipation factor of capacitors in values above 1 mfd should be measured at 0.1 KHz due to the inability of capacitance bridges available at this time to accurately measure larger capacitors for dissipation factor at 1 KHz.
At 1 KHz the series resistance of the bridge internal wiring, contact resistance of the test terminals, and connecting cables affect dissipation factor accuracy to a far greater extent than at 0.1 KHz.
When measuring temperature coefficient of capacitors a guard circuit should be used which removes the errors due to cable capacitance in remote measurements performed with capacitors in environmental chambers. Condensation of moisture on the glass surface of the hermetic seals during transit temperatures from cold to ambient may cause appreciable capacitance and dissipation factor reading error. This can be avoided by coating the surfaces with a suitably clean silicone grease and maintaining a dry air condition within the chamber during cycling.
Dielectric absorption measurements are subject to the same errors listed above for insulation resistance and in addition are extremely susceptible to error resulting from moisture absorption of the insulation used in cabling, switching and supporting the test circuit components.

POWER AGING

(Burn-in) is 100% performed on TJ, PK and other high reliability types. This conditioning screens out marginal capacitors and also tends to improve temperature coefficient and stability.

RELIABILITY

See reliability general information section, page 20

COMPONENT RESEARCH COMPANY

TJ TEFLON CAPACITORS

TJ Teflon capacitors meet the highest quality standards of the industry. TJ capacitors are 100% reliability screened, power aged, stabilized, and certified for performance by 100% test. The TJ capacitors are rated at 50 volts, but are also available in 100 volt and 200 volt ratings in the same case sizes as TA Teflon Capacitors.

TJ SPECIFICATIONS

1. **OPERATING TEMPERATURE** —62°C to 125°C at full rated voltage
2. **TEMPERATURE COEFFICIENT OF CAPACITANCE**

+0.4%	max at −55°C	0.0% ref. at	25°C
+0.25%	max at −25°C	−0.15% max at	55°C
+0.2%	max at −10°C	−0.25% max at	85°C
+0.1%	max at 0°C	−0.40% max at	125°C

3. **STABILITY**—Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

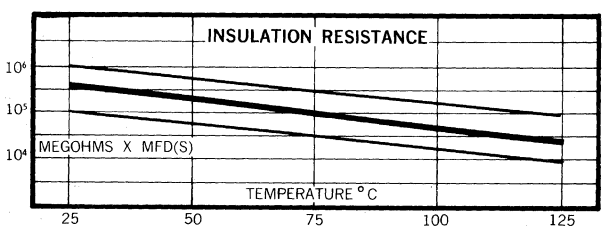
Range	Retrace
−10°C to 85°C	0.01% Max
−62°C to 125°C	0.05% Max

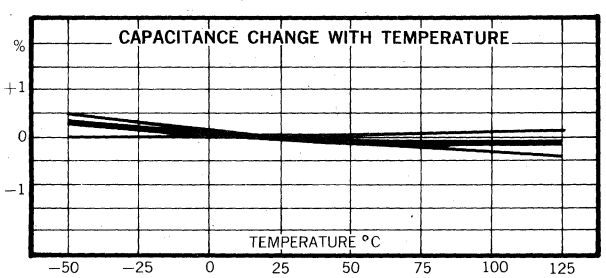
4. **INSULATION RESISTANCE (IR)**

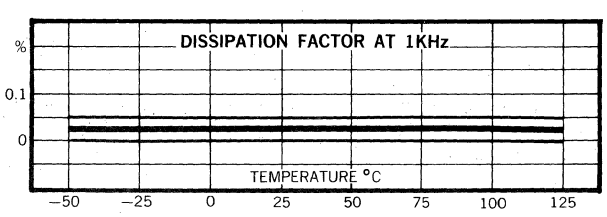
Min IR at 25°C.....250,000 Megohms
at 85°C.....100,000 Megohms
at 125°C..... 25,000 Megohms

5. **DIELECTRIC ABSORPTION**—0.02% max at 25°C.
6. **DISSIPATION FACTOR** — 0.03% max at 1 KHz and 25°C. Values greater tham 1 mfd measure at 0.1 KHz.
7. **DIELECTRIC STRENGTH**—200% of rated volts.
8. **CONSTRUCTION** — Hermetically sealed, extended metal film electrodes, leads isolated from case. Lead material is nickel, gold-plated, per Mil-Std-1276, Type N2.
9. **SEAL TEST** 1 x 10^{-6} ATM-CC/SEC max leak rate.
10. **ENVIRONMENTAL** — Capacitors shall meet all applicable requirements of Mil-C-19978, including Grade 3 vibration.

FOR ADDITIONAL DETAILS SEE GENERAL INFORMATION SECTION, PAGE 3.







Quality Assurance

"TJ" TEFLON CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

RELIABILITY SCREENING

1. *Stabilization by temperature cycling from —62°C to 125°C, 5 cycles minimum.*
2. *Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C, procedure III A.*
3. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.*
4. *Insulation resistance at rated voltage and 25°C.*
5. *Capacitance tolerance at 1KHz and 25°C.*
6. *Dissipation factor at 25°C.*

POWER AGING AND STABILIZATION

7. *Burn-in at 125°C and 140% of rated voltage for a minimum of 48 hours.*
8. *Verification of stability by temperature cycling from —62°C to 125°C, 20 cycles minimum.*

PERFORMANCE CERTIFICATION

9. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.*
10. *Insulation resistance at rated voltage and 25°C.*
11. *Capacitance tolerance at 1KHz and 25°C.*
12. *Dissipation factor at 25°C.*
13. *Temperature coefficient measured from —55°C to 125°C at a minimum of 5 temperature points.*
14. *Visual inspection for dimensions, marking, and packaging.*
15. *Traceability to production and test records by permanent marking of parts with lot control number.*
16. *Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.*
17. *Capacitors are serialized and packaged with certified test data to accompany each shipment.*

50 VOLT TJ TEFLON

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 2% tol. *GN	1% tol. *FN	½% tol. *DN	¼% tol. *BN
05TJ102	.001	.235	.687	$19.90	$22.89	$25.87	$29.85
05TJ202	.002	.235	.687	19.90	22.89	25.87	29.85
05TJ502	.005	.235	.687	19.90	22.89	25.87	29.85
05TJ103	.01	.235	.687	19.90	22.89	25.87	29.85
05TJ123	.012	.235	.687	19.90	22.89	25.87	29.85
05TJ153	.015	.312	.687	19.90	22.89	25.87	29.85
05TJ203	.02	.312	.687	19.90	22.89	25.87	29.85
05TJ223	.022	.312	.687	19.90	22.89	25.87	29.85
05TJ333	.033	.312	.687	19.90	22.89	25.87	29.85
05TJ473	.047	.312	.687	19.90	22.89	25.87	29.85
05TJ503	.05	.312	.687	19.90	22.89	25.87	29.85
05TJ683	.068	.312	.813	21.89	25.17	28.46	32.84
05TJ823	.082	.312	.937	21.89	25.17	28.46	32.84
05TJ104	.1	.312	.937	21.89	25.17	28.46	32.84
05TJ154	.15	.312	1.063	23.88	26.27	28.66	33.43
05TJ204	.2	.400	1.063	24.88	27.37	29.86	34.83
05TJ224	.22	.400	1.063	24.88	27.37	29.86	34.83
05TJ334	.33	.500	1.125	25.87	28.46	31.04	36.22
05TJ474	.47	.562	1.125	27.86	30.65	33.43	39.00
05TJ504	.5	.562	1.125	27.86	30.65	33.43	39.00
05TJ105	1.0	.67	1.375	37.81	41.59	45.37	49.15
05TJ205	2.0	.67	1.875	57.71	63.48	69.25	75.02

COMPONENT RESEARCH COMPANY

TA TEFLON CAPACITORS

Type TA miniature teflon capacitors are widely used in aircraft and satellite navigational guidance applications which require low loss factor, low temperature coefficient, exceptional stability, and reliability from −62°C to 125°C. (See TJ and TC specifications for high reliability equivalent.)

TA SPECIFICATIONS

OPERATING TEMPERATURE

−62°C to 125°C at full rated voltage

TEMPERATURE COEFFICIENT OF CAPACITANCE

+0.6%	Max at	−55°C
+0.4%	Max at	−25°C
+0.3%	Max at	−10°C
+0.2%	Max at	0°C
0.0%	Reference	25°C
−0.25%	Max at	55°C
−0.5%	Max at	85°C
−0.6%	Max at	125°C

STABILITY

When temperature cycled from −62°C to 125°C for 5 temperature cycles, capacitance drift measured after stabilization shall not exceed:

Range	Retrace
−10°C to 85°C	0.02% Max
−62°C to 125°C	0.1% Max

INSULATION RESISTANCE (IR)

Minimum values for 1 mfd or less. Readings in megohms.

STYLE	VOLTAGE	25°C	85°C	125°C
05TA	50	200,000	100,000	10,000
1TA	100	500,000	300,000	50,000
2TA	200	1,000,000	500,000	100,000

For values above 1 mfd, use meg x mfd, and divide table readings by capacitance in mfd.

Example: A 1 mfd, 200V capacitor at 25°C is 1,000,000 megohms.
A 2 mfd, 200V capacitor at 25°C is 500,000 megohms.

DIELECTRIC ABSORPTION

0.02% maximum at 25°C

DISSIPATION FACTOR 0.03% max at 1 KHz and 25°C. Values greater than 1 mfd measure at 0.1 KHz.

DIELECTRIC STRENGTH

200% of rated voltage.

CONSTRUCTION

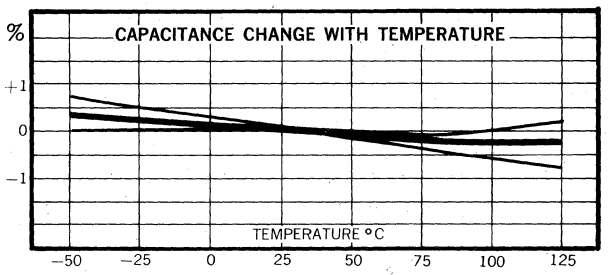
Teflon dielectric, hermetically sealed, extended metal film electrodes, leads isolated from case. Lead material is nickel, gold-plated, per Mil-Std-1276, Type N2.

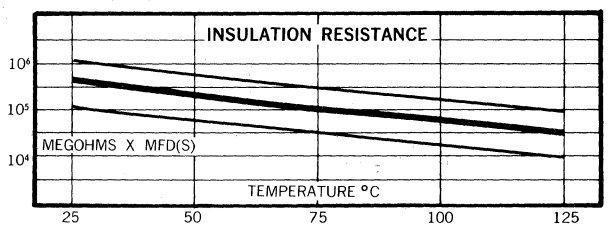
SEAL TEST — 1 x 10^{-6} ATM-CC/SEC max leak rate.

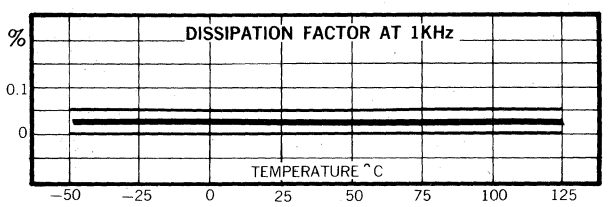
ENVIRONMENTAL

Capacitors shall meet all applicable requirements of Mil-C-19978, including Grade 3 vibration.

FOR ADDITIONAL DETAILS,
SEE GENERAL INFORMATION SECTION, PAGE 3







Quality Assurance

"TA" TEFLON CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

1. *Stabilization by temperature cycling from −62°C to 125°C, 5 cycles minimum.*
2. *Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C. procedure III A.*
3. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.*
4. *Insulation resistance at rated voltage and 25°C.*
5. *Capacitance tolerance at 1KHz and 25°C.*
6. *Dissipation factor at 25°C.*
7. *Visual inspection for dimensions, marking and packaging.*
8. *Traceability to production and test records by permanent marking of parts with lot control number.*
9. *Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.*

COMPONENT RESEARCH COMPANY

TA TEFLON CAPACITORS

TA INFORMATION

TA Teflon Capacitors are designed for miniature computers and filter networks in space and military electronic applications. The capacitors are extremely reliable for operation in low level high impedance circuits where they are completely free of momentary breakdown or noise. The TA capacitors can safely operate at rated temperatures and voltage indefinately. Destructive type tests recently conducted at up to ten times of rated voltage on typical 0.05Mfd capacitors did not result in capacitor degradation or noticeable parameter shift.

Type TA capacitors are extremely stable, rugged, and can be supplied in production quantities to tolerances as close as 0.1% and in values ranging from 0.001Mfd or more.

The TA Capacitors are frequently used in twin T filters where low dissipation factor and high stability is needed for sharp notch filtering.

Capacitors can be supplied with capacitance values individually marked with significant figures out to five places.

For the ultimate in high reliability, capacitors which meet the TA specifications are subjected to further screening to become type TJ or TC capacitors.

See specifications elsewhere in the catalog for further information.

100 VOLT TA TEFLON

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1–6 2% tol. *GN	1% tol. *FN	½% tol. *DN	¼% tol. *BN
1TA102	.001	.235	.687	$5.10	$5.70	$7.50	$9.95
1TA202	.002	.235	.687	5.10	5.70	7.50	9.95
1TA502	.005	.235	.687	5.10	5.70	7.50	9.95
1TA103	.01	.235	.687	5.10	5.70	7.50	9.95
1TA123	.012	.235	.687	5.10	5.70	7.50	9.95
1TA153	.015	.312	.687	5.40	6.00	7.75	9.95
1TA203	.02	.312	.687	5.60	6.20	7.95	9.95
1TA223	.022	.312	.687	5.70	6.30	8.35	9.95
1TA333	.033	.312	.813	6.23	7.20	8.95	10.85
1TA473	.047	.400	.813	6.60	7.50	9.60	11.80
1TA503	.05	.400	.813	6.60	7.50	9.60	11.80
1TA683	.068	.400	.813	8.35	9.50	11.50	13.10
1TA823	.082	.400	1.063	9.20	10.35	12.75	14.95
1TA104	.1	.400	1.063	9.90	10.75	12.75	14.95
1TA154	.15	.500	1.125	11.10	12.00	14.00	16.00
1TA204	.2	.562	1.125	13.35	14.25	16.15	18.10
1TA224	.22	.562	1.125	13.90	14.90	16.85	18.80
1TA334	.33	.562	1.125	16.75	17.75	19.75	21.60
1TA474	.47	.67	1.375	18.83	19.95	21.95	23.85
1TA504	.5	.67	1.375	18.83	19.95	21.95	23.85
1TA105	1.0	.67	1.875	29.90	30.95	33.95	36.90
1TA205	2.0	1.0	1.875	46.85	47.90	50.60	52.25

50 VOLT TA TEFLON

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1–6 2% tol. *GN	1% tol. *FN	½% tol. *DN	¼% tol. *BN
05TA102	.001	.235	.687	$5.10	$5.70	$7.50	$9.95
05TA202	.002	.235	.687	5.10	5.70	7.50	9.95
05TA502	.005	.235	.687	5.10	5.70	7.50	9.95
05TA103	.01	.235	.687	5.10	5.70	7.50	9.95
05TA123	.012	.235	.687	5.10	5.70	7.50	9.95
05TA153	.015	.312	.687	5.40	6.00	7.75	9.95
05TA203	.02	.312	.687	5.60	6.20	7.95	9.95
05TA223	.022	.312	.687	5.70	6.30	8.35	9.95
05TA333	.033	.312	.687	6.23	7.20	8.95	10.85
05TA473	.047	.312	.687	6.60	7.50	9.60	11.80
05TA503	.05	.312	.687	6.60	7.50	9.60	11.80
05TA683	.068	.312	.813	8.35	9.50	11.50	13.10
05TA823	.082	.312	.937	9.20	10.35	12.75	14.95
05TA104	.1	.312	.937	9.90	10.75	12.75	14.95
05TA154	.15	.312	1.063	11.10	12.00	14.00	16.00
05TA204	.2	.400	1.063	13.35	14.25	16.15	18.10
05TA224	.22	.400	1.063	13.90	14.90	16.85	18.80
05TA334	.33	.500	1.125	16.75	17.75	19.75	21.60
05TA474	.47	.562	1.125	18.83	19.95	21.95	23.85
05TA504	.5	.562	1.125	18.83	19.95	21.95	23.85
05TA105	1.0	.67	1.375	29.90	30.95	33.95	36.90
05TA205	2.0	.67	1.875	46.85	47.90	50.60	52.25

200 VOLT TA TEFLON

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1–6 2% tol. *GN	1% tol. *FN	½% tol. *DN	¼% tol. *BN
2TA102	.001	.235	.687	$5.10	$5.70	$7.50	$9.95
2TA202	.002	.235	.687	5.10	5.70	7.50	9.95
2TA502	.005	.235	.813	5.10	5.70	7.50	9.95
2TA103	.01	.235	.813	5.10	5.70	7.50	9.95
2TA123	.012	.235	.813	5.10	5.70	7.50	9.95
2TA153	.015	.312	.813	5.40	6.00	7.75	9.95
2TA203	.02	.312	.813	5.60	6.20	7.95	9.95
2TA223	.022	.400	.813	5.70	6.30	8.35	9.95
2TA333	.033	.400	.813	6.23	7.20	8.95	10.85
2TA473	.047	.400	1.063	6.60	7.50	9.60	11.80
2TA503	.05	.400	1.063	6.60	7.50	9.60	11.80
2TA683	.068	.400	1.063	8.35	9.50	11.50	13.10
2TA104	.1	.500	1.125	9.90	10.75	12.75	14.95
2TA154	.15	.562	1.375	11.10	12.00	14.00	16.00
2TA204	.2	.562	1.375	13.35	14.25	16.15	18.10
2TA224	.22	.562	1.375	13.90	14.90	16.85	18.80
2TA334	.33	.670	1.375	16.75	17.75	19.75	21.60
2TA474	.47	.670	1.875	18.83	19.95	21.95	23.85
2TA504	.5	.670	1.875	18.83	19.95	21.95	23.85
2TA105	1.0	1.0	1.875	29.90	30.95	33.95	36.90

SPECIAL CASE SIZE SECTION TA CAPACITORS

We have been able to fabricate the TA Teflon capacitors in smaller and non-standard case sizes for applications where our standard items cannot fit. In this section typical combinations are shown for capacitance and case size and in the 05TQ Cordwood section on page 17 as well as the macro-value section on page 20 to provide additional packaging choice. Please contact our sales office for complete information covering part number, specifications and prices when you require a special capacitor.

FOR ADDITIONAL DETAILS,
SEE GENERAL INFORMATION SECTION, PAGE 3

The range of capacitance available for various case sizes is shown below:

Diameter ± .01	Length ± .03	05TA 50 Volt	1TA 100 Volt	2TA 200 Volt
.193	.562	.0033 Mfd	.0033 Mfd	.0022 Mfd
.193	.687	.0068 Mfd	.0068 Mfd	.0033 Mfd
.235	.813	.05 Mfd	.015 Mfd	.01 Mfd
.312	.625	.10 Mfd	.027 Mfd	.015 Mfd
.312	1.063	.12 Mfd	.033 Mfd	.022 Mfd
.400	.937	.18 Mfd	.082 Mfd	.047 Mfd
.400	1.375	.50 Mfd	.22 Mfd	.10 Mfd
.500	.937	.33 Mfd	.12 Mfd	.082 Mfd
.500	1.375	.75 Mfd	.33 Mfd	.20 Mfd
.500	2.00	1.35 Mfd	.50 Mfd	.33 Mfd
.562	1.375	1.0 Mfd	.42 Mfd	.25 Mfd
.562	1.875	1.50 Mfd	.65 Mfd	.50 Mfd

COMPONENT RESEARCH COMPANY

TC TEFLON CAPACITORS

Type TC Teflon Capacitors are type TA capacitors which have been 100% reliability screened, stabilized, and certified for stability by 100% test. Each capacitor is serialized and is shipped with test data certifying to 0.1% maximum drift after 5 temperature cycles from −62°C to 125°C. The type TC Teflon capacitors are available in the same voltage ratings and case sizes as type TA capacitors.

For a higher reliability level and lower temperature coefficient see type TJ teflon capacitors.

TC SPECIFICATIONS

OPERATING TEMPERATURE −62°C to 125°C at full rated Voltage.

TEMPERATURE COEFFICIENT OF CAPACITANCE

+0.7% Max at	−55°C
+0.5% Max at	−25°C
+0.3% Max at	−10°C
+0.25% Max at	0°C
0.0% Ref. at	25°C
−0.25% Max at	55°C
−0.50% Max at	85°C
−0.60% Max at	125°C

STABILITY — Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
0°C to 50°C	0.02% Max
−10°C to 85°C	0.05% Max
−62°C to 125°C	0.1% Max

INSULATION RESISTANCE (IR)

Min IR at 25°C	250,000 Megohms
at 85°C	100,000 Megohms
at 125°C	25,000 Megohms

DIELECTRIC ABSORPTION — 0.02% Max at 25°C.

DISSIPATION FACTOR — 0.03% max at 1 KHz and 25°C. Values greater than 1 mfd measure at 0.1 KHz.

DIELECTRIC STRENGTH — 200% of rated voltage.

CONSTRUCTION — Teflon dielectric, hermetically sealed, extended metal film electrodes, leads isolated from case. Lead material is nickel, gold-plated, per Mil-Std-1276, Type N2.

SEAL TEST — 1 x 10^{-6} ATM-CC/SEC Max leak rate.

ENVIRONMENTAL — Capacitors shall meet all applicable requirements of Mil-C-19978, including Grade 3 vibration. For additional details, see General information Section, Page 3.

Quality Assurance

"TC" TEFLON CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

RELIABILITY SCREENING

1. Stabilization by temperature cycling from —62°C to 125°C, 5 cycles minimum.

2. Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C. procedure III A.

3. Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.

4. Insulation resistance at rated voltage and 25°C.

5. Capacitance tolerance at 1KHz and 25°C.

6. Dissipation factor at 25°C.

POWER AGING

7. Burn-in at 125°C and 140% of rated voltage for a minimum of 48 hours.

8. Verification of stability by temperature cycling from −62°C to 125°C, 5 cycles minimum.

PERFORMANCE CERTIFICATION

9. Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.

10. Insulation resistance at rated voltage and 25°C.

11. Capacitance tolerance at 1KHz and 25°C.

12. Dissipation factor at 25°C.

13. Capacitors are 100% tested for 0.1% maximum drift with cycling from −62°C to 125°C.

14. Visual inspection for dimensions, marking, and packaging.

15. Traceability to production and test records by permanent marking of parts with lot control number.

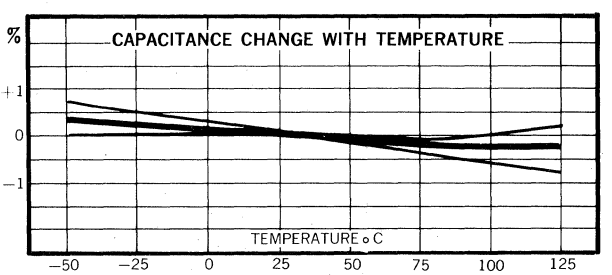
16. Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.

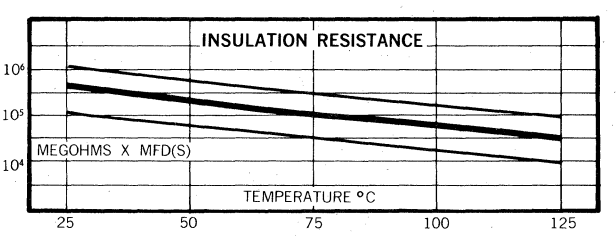
17. Capacitors are serialized and packaged with certified test data to accompany each shipment.

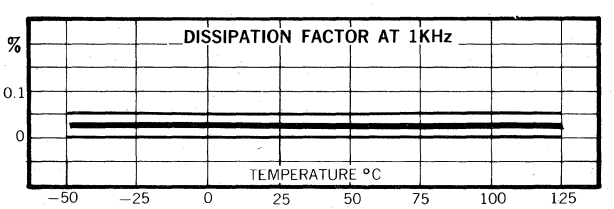
50 VOLT TC TEFLON

***ADD TOLERANCE LETTER AFTER PART NO.**

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 2% tol. *GN	1% tol. *FN	½% tol. *DN	¼% tol. *BN
05TC102	.001	.235	.687	$7.65	$8.55	$11.25	$14.93
05TC202	.002	.235	.687	7.65	8.55	11.25	14.93
05TC502	.005	.235	.687	7.65	8.55	11.25	14.93
05TC103	.01	.235	.687	7.65	8.55	11.25	14.93
05TC123	.012	.235	.687	7.65	8.55	11.25	14.93
05TC153	.015	.312	.687	8.10	9.00	11.66	14.93
05TC203	.02	.312	.687	8.40	9.30	11.96	14.93
05TC223	.022	.312	.687	8.55	9.45	12.56	14.93
05TC333	.033	.312	.687	9.36	10.80	13.46	16.26
05TC473	.047	.312	.687	9.90	11.26	14.40	17.70
05TC503	.05	.312	.687	9.90	11.26	14.40	17.70
05TC683	.068	.312	.813	12.56	14.25	17.25	19.65
05TC823	.082	.312	.937	13.80	15.53	19.13	22.43
05TC104	.1	.312	.937	14.85	16.13	19.13	22.43
05TC154	.15	.312	1.063	16.65	18.00	21.00	24.00
05TC204	.2	.400	1.063	20.03	21.38	24.23	27.15
05TC224	.22	.400	1.063	20.85	22.35	25.28	28.20
05TC334	.33	.500	1.125	21.78	23.08	25.68	29.08
05TC474	.47	.562	1.125	24.48	25.94	28.54	31.01
05TC504	.5	.562	1.125	24.48	25.94	28.54	31.01
05TC105	1.0	.67	1.375	35.88	37.14	40.74	44.28
05TC205	2.0	.67	1.875	51.54	52.69	55.66	57.48







COMPONENT RESEARCH COMPANY

TL TEFLON CAPACITORS

TL Teflon capacitors are the economy version of the TA capacitors and are recommended for industrial applications which do not require the high levels of performance met by TA capacitors. Due to their low cost they are being used in computers as a substitute for larger, more temperature sensitive polystyrene capacitors. TL capacitors are available in 50V and 100V in tolerances of 0.25% to 2% and values from .001 mfd to 2 mfd.

TL SPECIFICATIONS

OPERATING TEMPERATURE
−62°C to 125°C at full rated voltage.

TEMPERATURE COEFFICIENT OF CAPACITANCE
± 1% Max −55°C to 125°C

STABILITY — Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
−10°C to 85°C	0.05% Max
−62°C to 125°C	0.25% Max

INSULATION RESISTANCE (IR)
Min IR at 25°C ..... 50,000 Megohms
at 85°C ..... 10,000 Megohms
at 125°C ..... 5,000 Megohms

DIELECTRIC ABSORPTION
0.1% Max at 25°C

DISSIPATION FACTOR
0.15% Max at 1KHz and 25°C

DIELECTRIC STRENGTH
200% of rated voltage

CONSTRUCTION — Teflon dielectric, hermetically sealed, extended metal film electrodes, leads isolated from case. Leads are solderable gold-plated nickel or tinned copper-weld as available from stock at time of shipment.

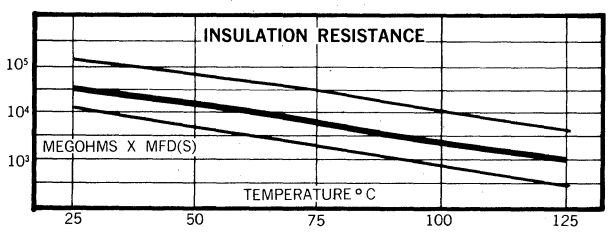
SEAL TEST — 1 x 10^{-5} ATM-CC/SEC max leak rate.

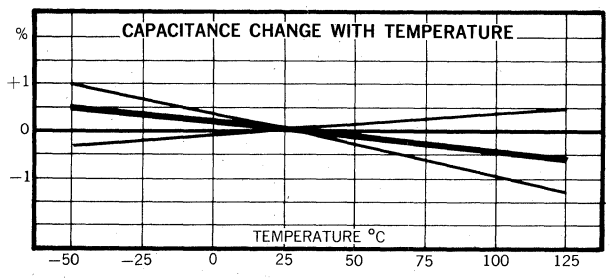
FOR ADDITIONAL DETAIL,
SEE GENERAL INFORMATION SECTION, PAGE 3

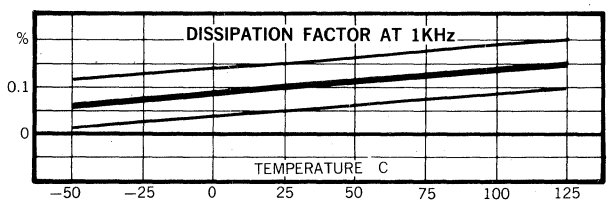
Quality Assurance

"TL" TEFLON CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

1. *Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C, procedure III A.*
2. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.*
3. *Insulation resistance at rated voltage and 25°C.*
4. *Capacitance tolerance at 1KHz and 25°C.*
5. *Dissipation factor at 1KHz and 25°C.*
6. *Visual inspection for dimensions, marking, and packaging.*







50 VOLT TL TEFLON

*ADD TOLERANCE LETTER AFTER PART NO.

100 VOLT TL TEFLON

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 2% tol. *G	1% tol. *F	½% tol. *D	¼% tol. *B
05TL102	.001	.235	.687	$4.15	$4.90	$5.85	$7.50
05TL1451	.00145	.235	.687	4.15	4.90	5.85	7.50
05TL152	.0015	.235	.687	4.15	4.90	5.85	7.50
05TL202	.002	.235	.687	4.15	4.90	5.85	7.50
05TL452	.0045	.235	.687	4.15	4.90	5.85	7.50
05TL502	.005	.235	.687	4.15	4.90	5.85	7.50
05TL103	.01	.235	.687	4.15	4.90	5.85	7.50
05TL1052	.0105	.235	.687	4.15	4.90	5.85	7.50
05TL123	.012	.235	.687	4.15	4.90	5.85	7.50
05TL153	.015	.312	.687	4.15	4.90	5.85	7.50
05TL223	.022	.312	.687	4.25	5.00	5.95	7.60
05TL2252	.0225	.312	.687	4.25	5.00	5.95	7.60
05TL333	.033	.312	.687	4.35	5.10	6.05	7.70
05TL473	.047	.312	.687	4.60	5.35	6.30	7.95
05TL683	.068	.312	.813	6.65	7.40	8.30	9.95
05TL104	.1	.312	.937	6.65	7.40	8.30	9.95
05TL154	.15	.312	1.063	8.90	9.70	10.50	11.30
05TL224	.22	.400	1.063	10.95	11.75	12.50	13.35
05TL334	.33	.500	1.125	12.95	13.75	14.55	15.40
05TL504	.50	.562	1.125	14.75	15.50	16.50	17.65

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 2% tol. *G	1% tol. *F	½% tol. *D	¼% tol. *B
1TL102	.001	.235	.687	$4.15	$4.90	$5.85	$7.50
1TL1451	.00145	.235	.687	4.15	4.90	5.85	7.50
1TL152	.0015	.235	.687	4.15	4.90	5.85	7.50
1TL202	.002	.235	.687	4.15	4.90	5.85	7.50
1TL452	.0045	.235	.687	4.15	4.90	5.85	7.50
1TL502	.005	.235	.687	4.15	4.90	5.85	7.50
1TL103	.01	.235	.687	4.15	4.90	5.85	7.50
1TL1052	.0105	.235	.687	4.15	4.90	5.85	7.50
1TL123	.012	.235	.687	4.15	4.90	5.85	7.50
1TL153	.015	.312	.687	4.15	4.90	5.85	7.50
1TL223	.022	.312	.687	4.25	5.00	5.95	7.60
1TL2252	.0225	.312	.687	4.25	5.00	5.95	7.60
1TL333	.033	.312	.813	4.35	5.10	6.05	7.70
1TL473	.047	.400	.813	4.60	5.35	6.30	7.95
1TL683	.068	.400	.813	6.65	7.40	8.30	9.95
1TL104	.1	.400	1.063	6.65	7.40	8.30	9.95
1TL154	.15	.500	1.125	8.90	9.70	10.50	11.30
1TL224	.22	.562	1.125	10.95	11.75	12.50	13.35
1TL334	.33	.562	1.125	12.95	13.75	14.55	15.40
1TL504	.5	.67	1.375	14.75	15.50	16.50	17.65

COMPONENT RESEARCH COMPANY

TU TEFLON CAPACITORS

TU Teflon foil capacitors are unexcelled for high insulation resistance and low loss over a wide temperature range. Thousands of close tolerance TU capacitors have been used in F-104 aircraft and other critical applications. TU capacitors are frequently used in high quality analog computer applications where time constant variations due to dielectric absorption and leakage are critical. TU capacitors are available in 100V, 200V, and 400V in tolerances of 0.1% to 2% and values from .001 mfd to 1 mfd.

TU SPECIFICATIONS

OPERATING TEMPERATURE —62°C to 125°C at full rated voltage.

TEMPERATURE COEFFICIENT OF CAPACITANCE

+0.8% Max at	−55°C
+0.6% Max at	−25°C
+0.3% Max at	−10°C
+0.2% Max at	0°C
0.0% Reference at	25°C
−0.2% Max at	55°C
−0.5% Max at	85°C
−0.8% Max at	125°C

STABILITY — Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
—10°C to 85°C	0.05% Max
—62°C to 125°C	.25% Max

INSULATION RESISTANCE (IR) Readings in Megohms

	100 Volt	200 Volt
Min IR at 25°C	4,000,000	10,000,000
at 85°C	1,000,000	2,000,000
at 125°C	100,000	500,000

DIELECTRIC ABSORPTION — 0.01% Max at 25°C.

DISSIPATION FACTOR — 0.005% Max as IKHz and 25°C

DIELECTRIC STRENGTH — 200% of rated volts.

CONSTRUCTION — Teflon dielectric, extended foil electrodes, hermetically sealed, leads isolated from case, leads are nickel, gold-plated, per Mil Std 1276 Type N2.

SEAL TEST — 1 x 10^{-6} ATM-CC/SEC Max leak rate.

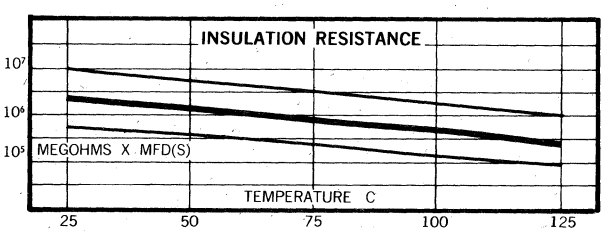
ENVIRONMENTAL — Capacitors shall meet all applicable requirements of Mil-C-19978 including Grade 3 vibration.

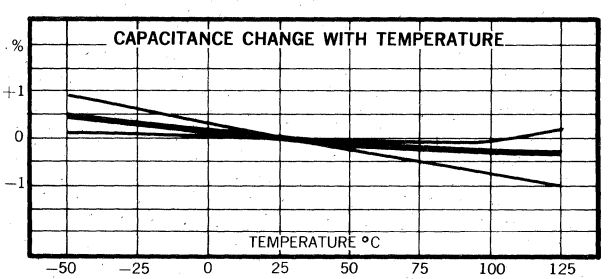
FOR ADDITIONAL DETAILS,
SEE GENERAL INFORMATION SECTION, PAGE 3

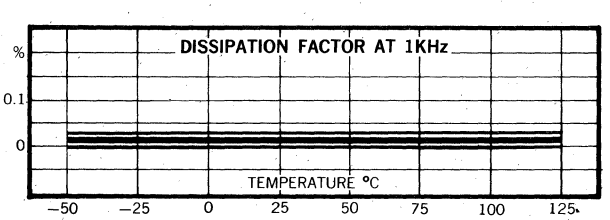
Quality Assurance

"TU" TEFLON CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

1. Stabilization by temperature cycling from −62°C to 125°C, 5 cycles minimum.
2. Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C. procedure III A.
3. Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.
4. Insulation resistance at rated voltage and 25°C.
5. Capacitance tolerance at 1KHz and 25°C.
6. Dissipation factor at 1KHz and 25°C.
7. Visual inspection for dimensions, marking, and packaging.
8. Traceability to production and test records by permanent marking of parts with lot control number.
9. Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.







*ADD TOLERANCE LETTER AFTER PART NO.

100 VOLT TU TEFLON

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1–6 2% tol. *GN	1% tol. *FN	½% tol. *DN	¼% tol. *BN
1TU102	.001	.235	.813	$5.10	$5.70	$7.50	$9.95
1TU202	.002	.235	.813	5.10	5.70	7.50	9.95
1TU502	.005	.235	.813	5.10	5.70	7.50	9.95
1TU103	.01	.235	.813	5.10	5.70	7.50	9.95
1TU153	.015	.312	.813	5.40	6.00	7.75	9.95
1TU223	.022	.312	.813	5.70	6.30	8.35	9.95
1TU333	.033	.400	.813	6.23	7.20	8.95	10.85
1TU393	.039	.400	1.063	6.60	7.50	9.60	11.80
1TU473	.047	.400	1.063	6.60	7.50	9.60	11.80
1TU503	.05	.400	1.063	6.90	7.80	9.90	12.10
1TU683	.068	.400	1.063	8.35	9.50	11.50	13.10
1TU104	.1	.562	1.125	9.90	10.75	12.75	14.95
1TU154	.15	.562	1.375	11.10	12.00	14.00	16.00
1TU224	.22	.562	1.875	13.90	14.90	16.85	18.80
1TU334	.33	.670	1.875	16.75	17.75	19.75	21.60
1TU474	.47	.750	1.875	20.83	21.95	23.95	25.85
1TU504	.50	.750	1.875	20.83	21.95	23.95	25.85

200 VOLT TU TEFLON

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1–6 2% tol. *GN	1% tol. *FN	½% tol. *DN	¼% tol. *BN
2TU102	.001	.235	.813	$5.10	$5.70	$7.50	$9.95
2TU202	.002	.235	.813	5.10	5.70	7.50	9.95
2TU502	.005	.235	.813	5.10	5.70	7.50	9.95
2TU103	.01	.312	.813	5.10	5.70	7.50	9.95
2TU153	.015	.312	.813	5.40	6.00	7.75	9.95
2TU223	.022	.400	.813	5.70	6.30	8.35	9.95
2TU333	.033	.400	1.063	6.23	7.20	8.95	10.85
2TU393	.039	.400	1.063	6.60	7.50	9.60	11.80
2TU473	.047	.400	1.063	6.60	7.50	9.60	11.80
2TU503	.05	.400	1.063	6.90	7.80	9.90	12.10
2TU683	.068	.562	1.125	8.35	9.50	11.50	13.10
2TU104	.1	.562	1.375	9.90	10.75	12.75	14.95
2TU154	.15	.562	1.875	11.10	12.00	14.00	16.00
2TU224	.22	.670	1.875	13.90	14.90	16.85	18.80
2TU334	.33	.75	1.875	16.75	17.75	19.75	21.60
2TU474	.47	1.00	2.250	20.83	21.95	23.95	25.85
2TU504	.50	1.00	2.250	20.83	21.95	23.95	25.85

COMPONENT RESEARCH COMPANY

TF TEFLON CAPACITORS

TF teflon capacitors are recommended for industrial instrument applications where high quality low loss characteristics are desirable at lowest cost.TF capacitors are also being used in military ground communication and check out equipment. (For smaller size and high reliability equivalent see type "TU" or "TA" teflon capacitors).

TF SPECIFICATIONS

OPERATING TEMPERATURE
—62°C to 125°C at full rated voltage.

TEMPERATURE COEFFICIENT OF CAPACITANCE
25°C reference ± 1.2% maximum from —62°C to 125°C.

STABILITY — Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
—10°C to 85°C	0.1% Max
—62°C to 125°C	0.25% Max

INSULATION RESISTANCE (IR)

Min IR at 25°C	500,000 megohms
at 85°C	100,000 megohms
at 125°C	10,000 megohms

DIELECTRIC ABSORPTION — 0.03% at 25°C

DISSIPATION FACTOR — 0.02% Max at 1KHz and 25°C

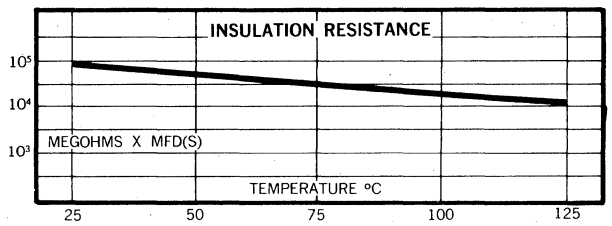
DIELECTRIC STRENGTH — 200% of rated volts

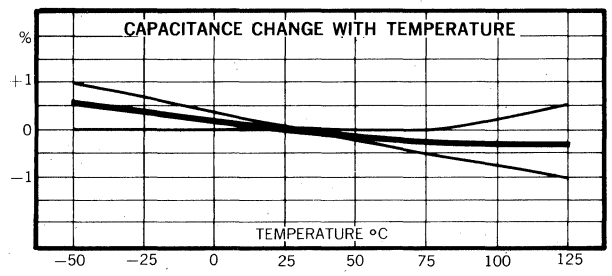
CONSTRUCTION— "FEP" teflon dielectric film, extended foil electrodes, hermetically sealed with leads isolated from case, leads are tinned copperweld.

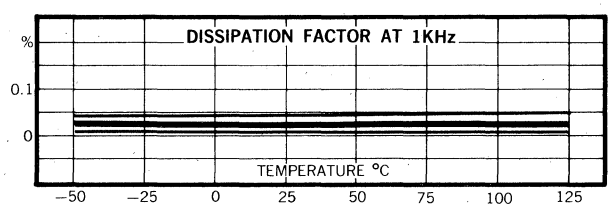
SEAL TEST — 1 x 10^{-5} ATM-CC/SEC max leak rate.

ENVIRONMENTAL — Capacitors shall meet all applicable requirements of Mil-C-19978.

FOR ADDITIONAL DETAILS,
SEE GENERAL INFORMATION SECTION, PAGE 3







100 VOLT TF TEFLON

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1–6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
1TF502	.005	.235	.813	$3.50	$4.50	$5.50	$6.90
1TF682	.0068	.235	.813	3.50	4.50	5.50	6.90
1TF103	.01	.312	.813	3.50	4.50	5.50	6.90
1TF153	.015	.312	.813	3.50	4.50	5.50	6.90
1TF203	.02	.312	.813	3.50	4.50	5.50	6.90
1TF223	.022	.312	1.063	3.50	4.50	5.50	6.90
1TF303	.03	.400	1.063	3.50	4.50	5.50	6.90
1TF333	.033	.400	1.063	3.50	4.50	5.50	6.90
1TF393	.039	.400	1.063	3.50	4.50	5.50	6.90
1TF473	.047	.400	1.063	3.75	4.75	5.75	7.15
1TF503	.05	.400	1.063	3.75	4.75	5.75	7.15
1TF683	.068	.562	1.125	4.00	5.00	6.00	7.40
1TF104	.1	.562	1.375	4.25	5.28	6.25	7.65
1TF154	.15	.562	1.875	4.75	5.55	6.45	8.25
1TF204	.2	.670	1.875	5.45	6.10	6.60	8.80
1TF224	.22	.670	1.875	5.55	6.20	6.60	9.30
1TF334	.33	.750	1.875	6.10	6.75	7.41	9.95
1TF474	.47	.750	1.875	7.20	8.10	8.75	11.30
1TF504	.5	.750	1.875	7.20	8.10	8.75	11.30
1TF105	1.0	1.0	2.25	10.10	11.11	12.22	14.85
1TF205	2.0	2 x 2 x	1.125	19.00	20.80	22.50	26.00

Quality Assurance

"TF" TEFLON CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

1. *Stabilization by temperature cycling from —62°C to 125°C, 5 cycles minimum.*
2. *Mass spectrometer hermetic seal per MIL-STD-202, Method 112, condition C, procedure III A.*
3. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.*
4. *Insulation resistance at rated voltage and 25°C.*
5. *Capacitance tolerance at 1KHz and 25°C.*
6. *Dissipation factor at 1KHz and 25°C.*
7. *Visual inspection for dimensions, marking, and packaging.*
8. *Traceability to production and test records by permanent marking of parts with lot control number.*
9. *Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.*

COMPONENT RESEARCH COMPANY

PL POLYCARBONATE CAPACITORS

Type PL miniature polycarbonate capacitors are recommended in circuit applications where there is limited space and electrical characteristics must nearly equal that of teflon or polystyrene capacitors.

The PL capacitors have been tested for qualification and approved for use in space, aerospace, and missile programs which required the highest quality and best performance in minimum package size. See type PK polycarbonate for high reliability version. See type PV polycarbonate for smallest precision film capacitors available.

PL SPECIFICATIONS

OPERATING TEMPERATURE —62°C to 100°C at full rated voltage. Derate linearly from 100°C to 50% of rated voltage at 125°C.

TEMPERATURE COEFFICIENT OF CAPACITANCE

−1.5%	Max. at −55°C
−0.5%	Max. at −25°C
−0.35%	Max. at −10°C
−0.25%	Max. at 0°C
0.0%	Reference at 25°C
+0.2%	Max. at 55°C
+0.5%	Max. at 85°C
+1.0%	Max. at 125°C

STABILITY — Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
—10°C to 85°C	0.05% Max.
—62°C to 125°C	0.25% Max.

INSULATION RESISTANCE (IR) — readings in megohms

	30V	50V	100V	200V	400V
Min IR at 25°C	100,000		200,000	500,000	1,000,000
at 85°C	10,000		50,000	100,000	200,000
at 125°C	1,000		10,000	30,000	50,000

Readings shown are for 1 mfd or less. For values over 1 mfd, divide readings by mfd to obtain min IR.

Example: A 10 mfd, 100 volt capacitor at 25°C is

$$\frac{200{,}000 \text{ megs}}{10} = 20{,}000 \text{ megohms}$$

DIELECTRIC ABSORPTION — 0.2% Max. at 25°C.

DISSIPATION FACTOR — 0.2% max at 1 KHz and 25°C. Values greater than 1 mfd measure at 0.1 KHz.

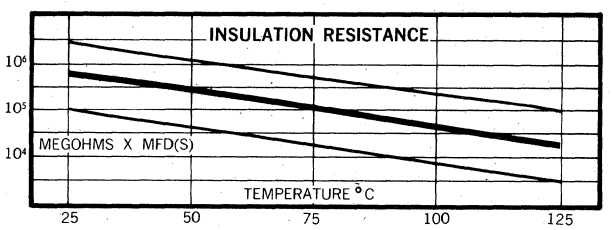
DIELECTRIC STRENGTH — 200% of rated volts.

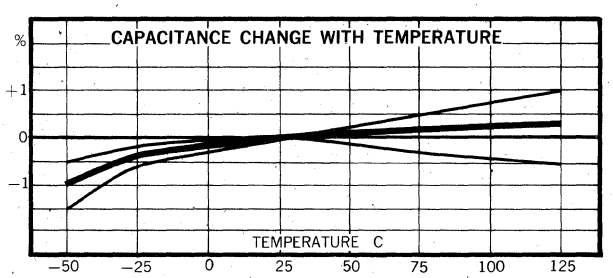
CONSTRUCTION — Polycarbonate dielectric, extended metal film electrodes, hermetically sealed, leads isolated from case. Leads may be tinned copperweld or gold-plated nickel per Mil Std 1276 type N2.

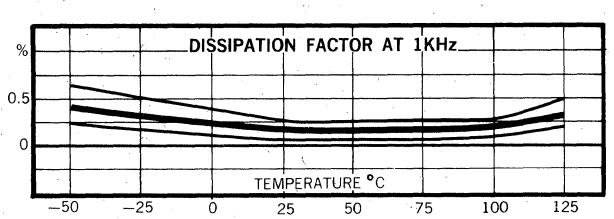
SEAL TEST — 1 x 10^{-6} ATM-CC/SEC Max leak rate.

ENVIRONMENTAL — Capacitors shall meet all applicable requirements of Mil-C-19978 including grade 3 vibration.

FOR ADDITIONAL DETAILS, SEE GENERAL INFORMATION SECTION, PAGE 3.







Quality Assurance

"PL" POLYCARBONATE CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

1. *Stabilization by temperature cycling from −62°C to 125°C, 5 cycles minimum.*
2. *Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C. procedure III A.*
3. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.*
4. *Insulation resistance at rated voltage and 25°C.*
5. *Capacitance tolerance at 1KHz and 25°C.*
6. *Dissipation factor at 25°C.*
7. *Visual inspection for dimensions, marking, and packaging.*
8. *Traceability to production and test records by permanent marking of parts with lot control number.*
9. *Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.*

COMPONENT RESEARCH COMPANY

PL POLYCARBONATE CAPACITORS

50 VOLT PL POLYCARBONATE

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
05PL102	.001	.170	.500	$4.15	$4.90	$5.85	$7.50
05PL202	.002	.170	.500	4.15	4.90	5.85	7.50
05PL502	.005	.170	.500	4.15	4.90	5.85	7.50
05PL103	.01	.170	.562	4.15	4.90	5.85	7.50
05PL153	.015	.170	.562	4.15	4.90	5.85	7.50
05PL223	.022	.193	.562	4.15	4.90	5.85	7.50
05PL273	.027	.193	.562	4.15	4.90	5.85	7.50
05PL333	.033	.193	.562	4.15	4.90	5.85	7.50
05PL393	.039	.170	.687	4.15	4.90	5.85	7.50
05PL473	.047	.170	.687	4.15	4.90	5.85	7.50
05PL503	.05	.170	.687	4.15	4.90	5.85	7.50
05PL683	.068	.193	.687	4.15	4.90	5.85	7.50
05PL823	.082	.193	.813	4.15	4.90	5.85	7.50
05PL104	.1	.193	.813	4.25	4.95	5.90	7.60
05PL154	.15	.235	.687	4.37	5.05	6.00	7.80
05PL224	.22	.235	.813	4.46	5.15	6.15	8.05
05PL274	.27	.312	.687	4.66	5.35	6.35	8.25
05PL334	.33	.312	.687	4.92	5.75	6.75	8.55
05PL474	.47	.312	.813	5.29	6.20	7.20	9.10
05PL504	.50	.400	.813	5.29	6.20	7.20	9.10
05PL105	1.0	.400	1.063	5.78	7.40	8.40	10.30
05PL155	1.5	.400	1.063	6.90	7.95	8.95	10.95
05PL205	2.0	.500	1.125	7.43	8.60	9.60	11.65
05PL305	3.0	.500	1.375	8.60	9.65	10.65	12.70
05PL405	4.0	.562	1.375	9.75	10.80	11.80	13.85
05PL505	5.0	.670	1.375	10.95	12.50	13.50	15.55
05PL106	10.0	.670	1.875	16.85	18.95	19.95	21.05

100 VOLT PL POLYCARBONATE

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
1PL102	.001	.170	.500	$3.75	$4.50	$5.50	$7.50
1PL202	.002	.170	.500	3.75	4.50	5.50	7.20
1PL502	.005	.170	.500	3.75	4.50	5.50	7.00
1PL103	.01	.170	.687	3.75	4.50	5.50	6.90
1PL153	.015	.170	.687	3.75	4.50	5.50	6.90
1PL223	.022	.193	.687	3.75	4.50	5.50	6.90
1PL273	.027	.193	.687	3.75	4.50	5.50	6.90
1PL333	.033	.193	.687	3.75	4.50	5.50	6.90
1PL393	.039	.235	.687	3.75	4.50	5.50	6.90
1PL473	.047	.235	.687	3.75	4.50	5.50	6.90
1PL503	.05	.235	.813	3.75	4.50	5.50	6.90
1PL683	.068	.235	.813	3.75	4.50	5.50	6.90
1PL823	.082	.312	.687	3.80	4.50	5.50	6.90
1PL104	.1	.312	.687	3.90	4.60	5.60	6.95
1PL154	.15	.312	.813	4.05	4.65	5.65	7.00
1PL224	.22	.312	.813	4.10	4.70	5.70	7.10
1PL274	.27	.312	1.063	4.15	4.75	5.75	7.10
1PL334	.33	.312	1.063	4.36	4.80	5.90	7.20
1PL474	.47	.400	1.063	4.39	5.20	5.95	7.40
1PL504	.5	.400	1.063	4.39	5.20	5.95	7.40
1PL105	1.0	.562	1.125	4.69	5.32	6.32	7.60
1PL155	1.5	.562	1.375	5.19	5.95	6.95	8.05
1PL205	2.0	.670	1.375	5.45	6.50	7.50	8.50
1PL305	3.0	.670	1.875	5.95	6.98	7.98	8.98
1PL405	4.0	.75	1.875	6.55	7.65	8.25	9.35
1PL505	5.0	.75	1.875	7.02	8.12	9.20	10.30
1PL106	10.0	1.0	2.375	9.18	10.50	11.85	12.95

200 VOLT PL POLYCARBONATE

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
2PL102	.001	.170	.562	$3.75	$4.50	$5.50	$7.50
2PL202	.002	.170	.562	3.75	4.50	5.50	7.20
2PL502	.005	.170	.562	3.75	4.50	5.50	7.00
2PL103	.01	.193	.562	3.75	4.50	5.50	6.90
2PL153	.015	.235	.562	3.75	4.50	5.50	6.90
2PL223	.022	.235	.687	3.75	4.50	5.50	6.90
2PL333	.033	.312	.687	3.75	4.50	5.50	6.90
2PL473	.047	.312	.687	3.75	4.50	5.50	6.90
2PL503	.05	.312	.813	3.75	4.50	5.50	6.90
2PL683	.068	.312	.813	3.80	4.50	5.50	6.90
2PL104	.1	.312	.813	3.90	4.60	5.60	6.95
2PL154	.15	.400	1.063	4.05	4.65	5.65	7.00
2PL224	.22	.400	1.375	4.10	4.70	5.70	7.10
2PL334	.33	.500	1.375	4.36	4.80	5.90	7.20
2PL474	.47	.500	1.375	4.59	5.30	6.25	7.60
2PL504	.5	.500	1.375	4.59	5.30	6.25	7.60
2PL105	1.0	.562	1.875	4.79	5.49	6.59	7.90
2PL155	1.5	.670	1.875	5.29	6.05	7.05	8.20
2PL205	2.0	.750	1.875	5.69	6.65	7.70	8.70
2PL255	2.5	.750	1.875	6.19	7.15	8.20	9.10
2PL305	3.0	1.00	1.875	6.80	7.85	8.45	9.55
2PL405	4.0	1.00	2.375	7.40	8.50	9.30	10.40

400 VOLT PL POLYCARBONATE

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
4PL102	.001	.193	.562	$3.75	$4.50	$5.50	$7.50
4PL202	.002	.193	.562	3.75	4.50	5.50	7.20
4PL502	.005	.235	.687	3.75	4.50	5.50	7.00
4PL103	.01	.235	.687	3.75	4.50	5.50	6.90
4PL153	.015	.235	.813	3.75	4.50	5.50	6.90
4PL223	.022	.312	.813	3.75	4.50	5.50	6.90
4PL273	.027	.312	.813	3.75	4.50	5.50	6.90
4PL333	.033	.312	.813	3.75	4.50	5.50	6.90
4PL393	.039	.312	.813	3.75	4.50	5.50	6.90
4PL473	.047	.400	.813	3.75	4.50	5.50	6.90
4PL503	.05	.400	.813	3.75	4.50	5.50	6.90
4PL683	.068	.400	.813	3.80	4.50	5.50	6.90
4PL823	.082	.400	1.063	3.80	4.50	5.50	6.90
4PL104	.10	.400	1.063	4.05	4.65	5.65	7.00
4PL154	.15	.400	1.375	4.10	4.70	5.70	7.10
4PL224	.22	.500	1.375	4.36	4.80	5.90	7.20
4PL334	.33	.562	1.375	4.59	5.30	6.25	7.60
4PL474	.47	.562	1.875	4.79	5.49	6.59	7.90
4PL504	.50	.562	1.875	4.79	5.49	6.59	7.90
4PL105	1.0	.750	1.875	6.19	7.15	8.20	9.10
4PL205	2.0	1.00	2.375	7.40	8.50	9.30	10.40

30 VOLT PL SUBMINIATURE POLYCARBONATE CAPACITORS

*ADD TOLERANCE LETTER AFTER PART NO.

The subminiature 30 volt PL series capacitors utilize a 2 micron dielectric film thickness yet achieve excellent performance and reliability exceeded only by the "PV", series for their size. The capacitors are normally supplied with gold plated nickel wire and are also available in larger values shown in the macro-value section on page 20 and cordwood lengths shown on page 17.

FOR ADDITIONAL DETAILS,
SEE GENERAL INFORMATION SECTION, PAGE 3

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *JN	2% tol. *GN	1% tol. *FN	½% tol. *DN
03PL333	.033	.170	.562	$ 4.15	$ 4.90	$ 5.85	$ 7.50
03PL393	.039	.170	.562	4.15	4.90	5.85	7.50
03PL473	.047	.170	.562	4.15	4.90	5.85	7.50
03PL503	.05	.170	.562	4.15	4.90	5.85	7.50
03PL683	.068	.170	.687	4.15	4.90	5.85	7.50
03PL823	.082	.170	.687	4.15	4.90	5.85	7.50
03PL104	.1	.193	.687	4.25	4.95	5.90	7.60
03PL154	.15	.235	.562	4.37	5.05	6.00	7.80
03PL224	.22	.235	.687	4.46	5.15	6.15	8.05
03PL334	.33	.235	.687	4.92	5.75	6.75	8.55
03PL474	.47	.312	.687	5.29	6.20	7.20	9.10
03PL504	.5	.312	.687	5.29	6.20	7.20	9.10
03PL105	1.0	.312	.813	5.78	7.40	8.40	10.30
03PL155	1.5	.400	.813	6.90	7.95	8.95	10.95
03PL205	2.0	.400	.813	7.43	8.60	9.60	11.65
03PL305	3.0	.400	1.063	8.60	9.65	10.65	12.70
03PL405	4.0	.400	1.375	9.75	10.80	11.80	13.85
03PL505	5.0	.500	1.375	10.95	12.50	13.50	15.55
03PL805	8.0	.562	1.375	13.50	15.60	16.85	18.25
03PL106	10.0	.562	1.375	16.85	18.95	19.95	21.05
03PL156	15.0	.562	1.875	19.50	21.60	23.60	27.70
03PL206	20.0	.670	1.875	21.90	25.00	27.00	31.10

COMPONENT RESEARCH CO., INC. 1717 19th Street, Santa Monica, Calif. 90404 • Phone: (213) 393-3755 • TWX: (910) 343-6864

COMPONENT RESEARCH COMPANY

PK POLYCARBONATE CAPACITORS

PK Polycarbonate capacitors are "PL" capacitors which have been power aged and temperature cycled to provide higher reliability and lower temperature coefficient. The "PK" capacitors have remarkably low temperature coefficient from 0°C to 125°C, particularly for values above 1Mfd. Specially selected PK capacitors in this range can be provided with a temperature coefficient of zero ±10 to ±25 PPM/°C.

PK SPECIFICATIONS

OPERATING TEMPERATURE

−62°C to 100°C at full rated voltage. Derate linearly from 100°C to 50% of rated voltage at 125°C.

TEMPERATURE COEFFICIENT OF CAPACITANCE — 25°C Reference

−0.75%	±0.25% at	−55°C
−0.35%	±0.15% at	−25°C
−0.25%	±0.15% at	−10°C
−0.15%	±0.1% at	0°C
+0.05%	±0.1% at	55°C
+0.15%	±0.15% at	85°C
+0.25%	±0.25% at	125°C

STABILITY

Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
−10°C to 85°C	0.03% Max
−62°C to 125°C	0.2% Max

INSULATION RESISTANCE (IR) — For 1 mfd or less.

	Voltage Range 50V	100V
Min IR at 25°C	200,000 Megs	500,000 Megs
at 85°C	10,000 Megs	100,000 Megs
at 125°C	5,000 Megs	10,000 Megs

Use Meg x Mfd for greater than 1 Mfd.

DIELECTRIC ABSORPTION — 0.2% Max at 25°C.

DISSIPATION FACTOR — 0.2% max at 1 KHz and 25°C. Values greater than 1 mfd measure at 0.1 KHz.

DIELECTRIC STRENGTH — 200% of rated voltage.

CONSTRUCTION—Polycarbonate dielectric, hermetically sealed, extended metal film electrodes, leads isolated from case, leads may be tinned copperweld or nickel, gold plated per Mil-Std 1276, Type N2.

SEAL TEST — 1 x 10^{-6} ATM-CC/SEC Max leak rate.

ENVIRONMENTAL — Capacitors shall meet all applicable requirements of Mil-C-19978, including grade 3 vibration.

FOR ADDITIONAL DETAILS, SEE GENERAL INFORMATION SECTION, PAGE 3

Quality Assurance

PK POLYCARBONATE CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

RELIABILITY SCREENING

1. *Stabilization by temperature cycling from −62°C to 125°C, 5 cycles minimum.*
2. *Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C. procedure III A.*
3. *Dielectric strength test at a minimum of 200% of rated voltage. lead to lead and leads to case.*
4. *Insulation resistance at rated voltage and 25°C.*
5. *Capacitance tolerance at 1KHz and 25°C.*
6. *Dissipation factor at 25°C.*

POWER AGING AND STABILIZATION

7. *Burn-in at 125°C and 140% of rated voltage for a minimum of 48 hours.*
8. *Verification of stability by temperature cycling from −62°C to 125°C, 5 cycles minimum.*

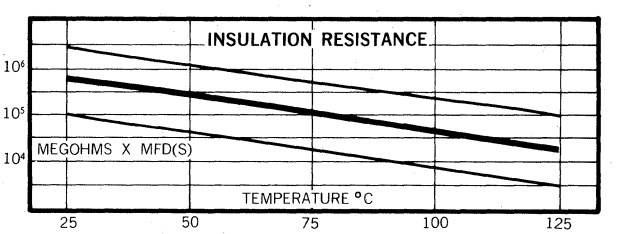
PERFORMANCE CERTIFICATION

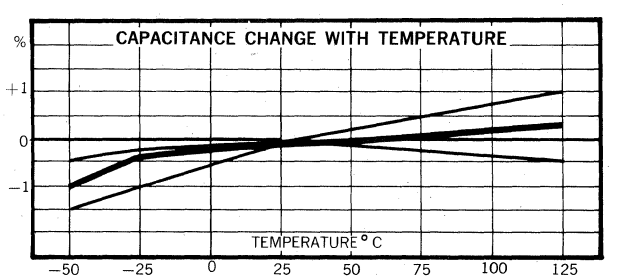
9. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.*
10. *Insulation resistance at rated voltage and 25°C.*
11. *Capacitance tolerance at 1KHz and 25°C.*
12. *Dissipation factor at 25°C*
13. *Temperature coefficient measured from −55°C to 125°C at a minimum of 5 temperature points. (Performed on lot sampling basis, minimum 10 pieces per lot.)*
14. *Visual inspection for dimensions, marking, and packaging.*
15. *Traceability to production and test records by permanent marking of parts with lot control number.*
16. *Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.*
17. *Capacitors are serialized and packaged with certified test data to accompany each shipment.*

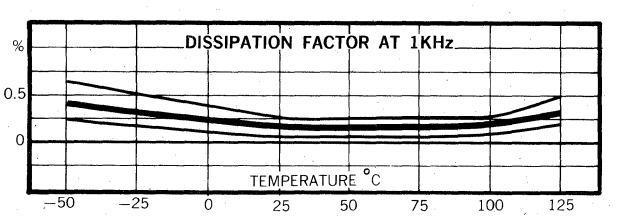
50 VOLT PK POLYCARBONATE

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
05PK103	.01	.170	.562	$8.30	$9.80	$11.70	$15.00
05PK153	.015	.170	.562	8.30	9.80	11.70	15.00
05PK223	.022	.193	.562	8.30	9.80	11.70	15.00
05PK273	.027	.193	.562	8.30	9.80	11.70	15.00
05PK333	.033	.193	.562	8.30	9.80	11.70	15.00
05PK393	.039	.170	.687	8.30	9.80	11.70	15.00
05PK473	.047	.170	.687	8.30	9.80	11.70	15.00
05PK503	.05	.170	.687	8.30	9.80	11.70	15.00
05PK683	.068	.193	.687	8.30	9.80	11.70	15.00
05PK823	.082	.193	.813	8.30	9.80	11.70	15.00
05PK104	.1	.193	.813	8.50	9.90	11.80	15.20
05PK154	.15	.235	.687	8.74	10.10	12.00	15.60
05PK224	.22	.235	.813	8.92	10.30	12.30	16.10
05PK274	.27	.312	.687	9.32	10.70	12.70	16.50
05PK334	.33	.312	.687	9.84	11.50	13.50	17.10
05PK474	.47	.312	.813	10.58	12.40	14.40	18.20
05PK504	.50	.400	.813	10.58	12.40	14.40	18.20
05PK105	1.0	.400	1.063	11.56	14.80	16.80	20.60
05PK155	1.5	.400	1.063	13.80	15.90	17.90	21.90
05PK205	2.0	.500	1.125	14.86	17.20	19.30	23.30
05PK305	3.0	.500	1.375	17.20	19.30	21.30	25.40
05PK405	4.0	.562	1.375	19.50	21.60	23.60	27.70
05PK505	5.0	.670	1.375	21.90	25.00	27.00	31.10
05PK106	10.0	.670	1.875	33.70	37.90	39.90	42.10







COMPONENT RESEARCH COMPANY

PV SUBMINIATURE POLYCARBONATE CAPACITORS

.312 x .813

ACTUAL SIZE 1 MFD CAPACITOR 03PV105

Type PV polycarbonate capacitors represent a breakthrough in the art of precision film capacitor miniaturization. The capacitors are processed and manufactured utilizing the basic CRC patents plus CRC state of the art techniques to wind web materials less than 0.0001 inches in thickness including metal film electrodes. The PV specifications listed do not represent the ultimate in performance the capacitors are capable of. By 100% test and selection we can supply capacitors with an insulation resistance greater than 100,000 megohms at +125°C, higher in stability and lower in temperature coefficient. In the interest of highest reliability we have assigned a 30 volt rating to the PV capacitors although they can safely operate continuously at 50 volts for the same rated conditions. For a lower cost equivalent to the PV type see 03PL and 03PG polycarbonate capacitors elsewhere in the catalog.

PV SPECIFICATIONS

OPERATING TEMPERATURE —55°C to 100°C at 30VDC. Derate linearly by 50% to 125°C.

TEMPERATURE COEFFICIENT OF CAPACITANCE

—1.2% Max. at —55°C	±.15% Max. at 55°C
—0.25% Max. at —10°C	±.25% Max. at 85°C
0% Ref. at 25°C	±.50% Max. at 125°C

STABILITY — Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
—10°C to 85°C	0.03% Max.
—62°C to 125°C	0.2% Max.

INSULATION RESISTANCE (IR) — For 1 mfd or less.

25°C	1,000,000 megs min.	85°C	25,000 megs min.
55°C	500,000 megs min.	125°C	1,000 megs min.

Use meg x mfd for greater than 1 mfd

DIELECTRIC ABSORPTION — 0.2% Max. at 25°C.

DISSIPATION FACTOR — 0.2% max at 1 KHz and 25°C. Values greater than 1 mfd measure at 0.1 KHz.

DIELECTRIC STRENGTH — 400% of rated voltage.

CONSTRUCTION — Polycarbonate dielectric, extended metalfilm electrodes, hermetically sealed, leads isolated from case. Leads are gold plated nickel per Mil Std 1276 type N2.

SEAL TEST — 1 x 10^{-6} ATM-CC/SEC Max leak rate.

ENVIRONMENTAL — Capacitors shall meet all applicable requirements of Mil-C-19978 including grade 3 vibration.

30 VOLT PV POLYCARBONATE

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *JN	2% tol. *GN	1% tol. *FN	½% tol. *DN
03PV333	.033	.170	.562	$ 8.30	$ 9.80	$11.70	$15.00
03PV393	.039	.170	.562	8.30	9.80	11.70	15.00
03PV473	.047	.170	.562	8.30	9.80	11.70	15.00
03PV503	.05	.170	.562	8.30	9.80	11.70	15.00
03PV683	.068	.170	.687	8.30	9.80	11.70	15.00
03PV823	.082	.170	.687	8.30	9.80	11.70	15.00
03PV104	.1	.193	.687	8.50	9.90	11.80	15.20
03PV154	.15	.235	.562	8.74	10.10	12.00	15.60
03PV224	.22	.235	.687	8.92	10.30	12.30	16.10
03PV334	.33	.235	.687	9.84	11.50	13.50	17 10
03PV474	.47	.312	.687	10.58	12.40	14.40	18.20
03PV504	.5	.312	.687	10.58	12.40	14.40	18.20
03PV105	1.0	.312	.813	11.56	14.80	16.80	20.60
03PV155	1.5	.400	.813	13.80	15.90	17.90	21.90
03PV205	2.0	.400	.813	14.86	17.20	19.20	23.30
03PV305	3.0	.400	1.063	17.20	19.30	21.30	25.40
03PV405	4.0	.400	1.375	19.50	21.60	23.60	27.70
03PV505	5.0	.500	1.375	21.90	25.00	27.00	31.10
03PV805	8.0	.562	1.375	27.00	31.20	33.70	36.50
03PV106	10.0	.562	1.375	33.70	37.90	39.90	42.10
03PV156	15.0	.562	1.875	39.00	43.20	47.20	55.40
03PV206	20.0	.670	1.875	43.80	50.00	54.00	62.20

Quality Assurance

"PV" POLYCARBONATE CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

RELIABILITY SCREENING

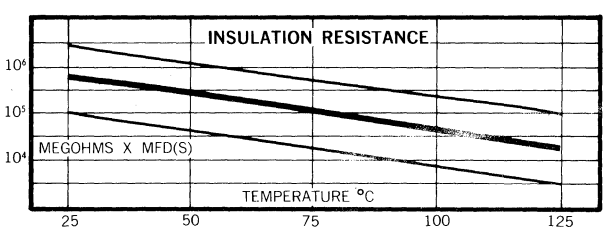
1. *Stabilization by temperature cycling from —62°C to 125°C, 5 cycles minimum.*
2. *Mass spectrometer hermetic seal test per MIL-STD-202, method 112, condition C, procedure III A.*
3. *Dielectric strength test at a minimum of 400% of rated voltage lead to lead and leads to case.*
4. *Insulation resistance at rated voltage and 25°C.*
5. *Capacitance tolerance at 1 KHz and 25°C.*
6. *Dissipation factor at 25°C.*

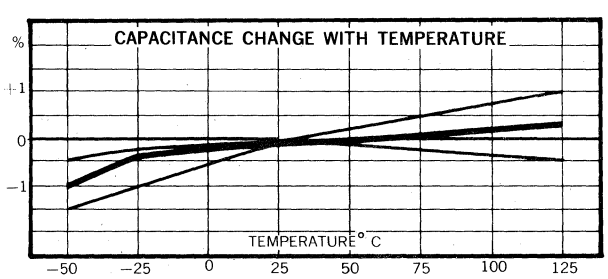
POWER AGING AND STABILIZATION

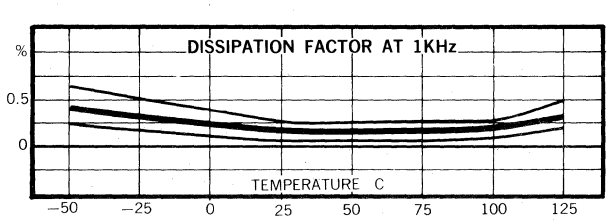
7. *Burn-in at 125°C and 140% of rated voltage for a minimum of 48 hours.*
8. *Verification of stability by temperature cycling from —62°C to 125°C, 5 cycles minimum.*

PERFORMANCE CERTIFICATION

9. *Dielectric strength test at a minimum of 400% of rated voltage lead to lead and leads to case.*
10. *Insulation resistance at rated voltage and 25°C.*
11. *Capacitance tolerance at 1 KHz and 25°C.*
12. *Dissipation factor at 25°C.*
13. *Temperature coefficient measured from —55°C to 125°C at a minimum of 5 temperature points. (Performed on lot sampling basis, minimum 10 pieces per lot.)*
14. *Visual inspection for dimensions, marking, and packaging.*
15. *Traceability to production and test records by permanent marking of parts with lot control number.*
16. *Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.*
17. *Capacitors are serialized and packaged with certified test data to accompany each shipment.*







FOR ADDITIONAL DETAILS,
SEE GENERAL INFORMATION SECTION, PAGE 3

COMPONENT RESEARCH COMPANY

PG POLYCARBONATE CAPACITORS

PG polycarbonate capacitors are lower in specification and quality assurance level than type "PL" capacitors to enable industrial and military usage at lower cost. The PG capacitors utilize the patented CRC supported winding and stress-free lead design and are designed to fill the need for capacitors better than the MIL-SPEC variety yet lower in cost than the "PL" type.

For higher reliability types see "PL", "PK" and "PV" polycarbonate specifications.

PG SPECIFICATIONS

OPERATING TEMPERATURE — −62°C to 100°C at full rated voltage, derate linearly from 100°C to 50% of rated voltage at 125°C.

TEMPERATURE COEFFICIENT OF CAPACITANCE —

± 2% max −55°C to 125°C
± 1% max −25°C to 85°C
±0.5% max 0°C to 55°C

STABILITY — Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
−10°C to 85°C	0.25% max
−62°C to 125°C	0.50% max

INSULATION RESISTANCE (IR) AT RATED VOLTAGE

Temperature	Meg X Mfd	Need not Exceed
25°C	100,000	200,000 megohms
85°C	10,000	20,000 megohms
125°C	1,000	2,000 megohms

DIELECTRIC ABSORPTION — 0.2% max at 25°C.

DISSIPATION FACTOR — 0.3% max at 1 KHz and 25°C. Values greater than 1 mfd measure at 0.1 KHz.

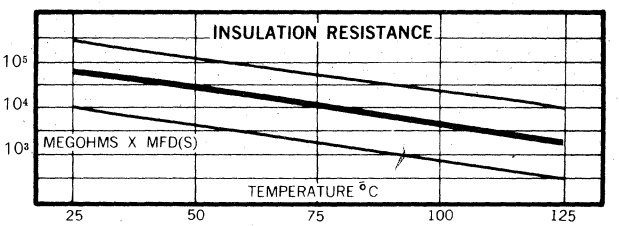
DIELECTRIC STRENGTH — 200% of rated volts.

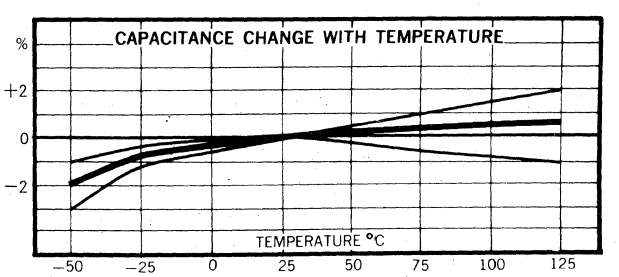
CONSTRUCTION — Polycarbonate dielectric, extended metal film electrodes, hermetically sealed, leads isolated from case. Leads are tinned copperweld, except for gold plated nickel for 30 volt type.

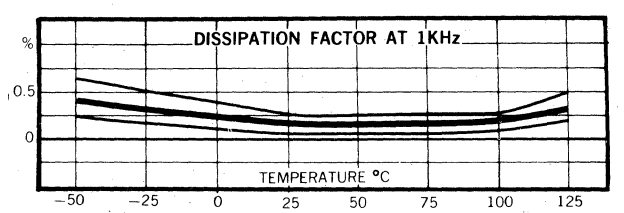
SEAL TEST — 1×10^{-5} ATM-CC/SEC max leak rate.

ENVIRONMENTAL — Capacitors shall meet all applicable requirements of MIL-C-19978 including grade 3 vibration.

FOR ADDITIONAL DETAILS,
SEE GENERAL INFORMATION SECTION, PAGE 3







QUALITY ASSURANCE

"PG" POLYCARBONATE CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

1. *Stabilization by temperature cycling from −62°C to 125°C, 2 cycles minimum.*
2. *Mass spectrometer hermetic seal test per MIL-STD-202, method 112, condition C, procedure III A.*
3. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead, leads to case.*
4. *Insulation resistance at rated voltage and 25°C.*
5. *Capacitance tolerance at 1 KHz and 25°C.*
6. *Dissipation factor at 25°C.*
7. *Visual inspection for dimensions, marking and packaging.*

COMPONENT RESEARCH COMPANY

PG POLYCARBONATE CAPACITORS

30V PG

*ADD TOLERANCE LETTER AFTER PART No.

Part No.	MFD	Diam. ± .01	Length ± .03	PRICES 1-6 *KN 10% tol.	*JN 5% tol.	*GN 2% tol.	*FN 1% tol.	*DN ½% tol.
03PG333	.033	.170	.562	$3.38	$3.75	$4.50	$5.50	$6.90
03PG393	.039	.170	.562	3.38	3.75	4.50	5.50	6.90
03PG473	.047	.170	.562	3.38	3.75	4.50	5.50	6.90
03PG503	.05	.170	.562	3.38	3.75	4.50	5.50	6.90
03PG683	.068	.170	.687	3.38	3.75	4.50	5.50	6.90
03PG823	.082	.170	.687	3.42	3.80	4.55	5.55	6.90
03PG104	.1	.193	.687	3.51	3.90	4.60	5.60	6.95
03PG154	.15	.235	.562	3.65	4.05	4.65	5.65	7.00
03PG224	.22	.235	.687	3.69	4.10	4.70	5.70	7.10
03PG334	.33	.235	.687	3.92	4.36	4.80	5.90	7.20
03PG474	.47	.312	.687	3.95	4.39	5.20	5.95	7.40
03PG504	.5	.312	.687	3.95	4.39	5.20	5.95	7.40
03PG105	1.0	.312	.813	4.22	4.69	5.32	6.32	7.60
03PG155	1.5	.400	.813	4.67	5.19	5.95	6.95	8.05
03PG205	2.0	.400	.813	4.91	5.45	6.50	7.50	8.50
03PG305	3.0	.400	1.063	5.36	5.95	6.98	7.98	8.98
03PG405	4.0	.400	1.375	5.90	6.55	7.65	8.25	9.35
03PG505	5.0	.500	1.375	6.32	7.02	8.12	9.20	10.30
03PG805	8.0	.562	1.375	7.74	8.60	9.65	10.70	12.40
03PG106	10.0	.562	1.375	8.26	9.18	10.50	12.15	13.95
03PG156	15.0	.562	1.875	10.71	11.90	13.96	15.96	17.96
03PG206	20.0	.670	1.875	12.64	14.04	16.24	18.40	20.60

50V PG

*ADD TOLERANCE LETTER AFTER PART No.

Part No.	MFD	Diam. ± .01	Length ± .03	PRICES 1-6 *K 10% tol.	*J 5% tol.	*G 2% tol.	*F 1% tol.	*D ½% tol.
05PG102	.001	.170	.500	$2.99	$3.32	$3.92	$4.68	$6.00
05PG152	.0015	.170	.500	2.99	3.32	3.92	4.68	6.00
05PG202	.002	.170	.500	2.99	3.32	3.92	4.68	6.00
05PG272	.0027	.170	.500	2.99	3.32	3.92	4.68	6.00
05PG332	.0033	.170	.500	2.99	3.32	3.92	4.68	6.00
05PG392	.0039	.170	.500	2.99	3.32	3.92	4.68	6.00
05PG472	.0047	.170	.500	2.99	3.32	3.92	4.68	6.00
05PG502	.005	.170	.500	2.99	3.32	3.92	4.68	6.00
05PG682	.0068	.170	.562	2.99	3.32	3.92	4.68	6.00
05PG822	.0082	.170	.562	2.99	3.32	3.92	4.68	6.00
05PG103	.01	.170	.562	2.99	3.32	3.92	4.68	6.00
05PG153	.015	.170	.562	2.99	3.32	3.92	4.68	6.00
05PG223	.022	.193	.562	2.99	3.32	3.92	4.68	6.00
05PG273	.027	.193	.562	2.99	3.32	3.92	4.68	6.00
05PG333	.033	.193	.562	2.99	3.32	3.92	4.68	6.00
05PG393	.039	.193	.562	2.99	3.32	3.92	4.68	6.00
05PG473	.047	.170	.687	2.99	3.32	3.92	4.68	6.00
05PG503	.05	.170	.687	2.99	3.32	3.92	4.68	6.00
05PG683	.068	.193	.687	2.99	3.32	3.92	4.68	6.00
05PG823	.082	.193	.813	2.99	3.32	3.92	4.68	6.00
05PG104	.1	.193	.813	3.06	3.40	3.96	4.72	6.08
05PG154	.15	.235	.687	3.15	3.50	4.04	4.80	6.24
05PG224	.22	.235	.813	3.21	3.57	4.12	4.92	6.44
05PG274	.27	.312	.687	3.36	3.73	4.28	5.08	6.60
05PG334	.33	.312	.687	3.55	3.94	4.60	5.40	6.84
05PG474	.47	.312	.813	3.81	4.23	4.96	5.76	7.28
05PG504	.5	.400	.813	3.81	4.23	4.96	5.76	7.28
05PG684	.68	.400	.813	4.01	4.45	5.25	6.05	7.60
05PG824	.82	.400	1.063	4.13	4.59	5.85	6.61	8.09
05PG105	1.0	.400	1.063	4.16	4.62	5.92	6.72	8.24
05PG155	1.5	.400	1.063	4.67	5.19	5.95	6.95	8.05
05PG205	2.0	.500	1.125	4.91	5.45	6.50	7.50	8.50
05PG305	3.0	.500	1.375	5.36	5.95	6.98	7.98	8.98
05PG405	4.0	.562	1.375	5.90	6.55	7.65	8.25	9.35
05PG505	5.0	.670	1.375	6.32	7.02	8.12	9.20	10.30
05PG805	8.0	.670	1.875	7.74	8.60	9.65	10.70	12.40
05PG106	10.0	.670	1.875	8.26	9.18	10.50	11.85	12.95

100V PG

*ADD TOLERANCE LETTER AFTER PART No.

Part No.	MFD	Diam. ± .01	Length ± .03	PRICES 1-6 *K 10% tol.	*J 5% tol.	*G 2% tol.	*F 1% tol.	*D ½% tol.
1PG102	.001	.170	.500	$2.70	$3.00	$3.60	$4.40	$6.00
1PG202	.002	.170	.500	2.70	3.00	3.60	4.40	5.76
1PG502	.005	.170	.500	2.70	3.00	3.60	4.40	5.60
1PG103	.01	.170	.687	2.70	3.00	3.60	4.40	5.52
1PG153	.015	.170	.687	2.70	3.00	3.60	4.40	5.52
1PG223	.022	.193	.687	2.70	3.00	3.60	4.40	5.52
1PG273	.027	.193	.687	2.70	3.00	3.60	4.40	5.52
1PG333	.033	.193	.687	2.70	3.00	3.60	4.40	5.52
1PG393	.039	.235	.687	2.70	3.00	3.60	4.40	5.52
1PG473	.047	.235	.687	2.70	3.00	3.60	4.40	5.52
1PG503	.05	.235	.813	2.70	3.00	3.60	4.40	5.52
1PG683	.068	.235	.813	2.70	3.00	3.60	4.40	5.52
1PG823	.082	.312	.687	2.74	3.04	3.60	4.40	5.52
1PG104	.1	.312	.687	2.81	3.12	3.68	4.48	5.56
1PG154	.15	.312	.813	2.92	3.24	3.72	4.52	5.60
1PG224	.22	.312	.813	2.95	3.28	3.76	4.56	5.68
1PG274	.27	.312	1.063	2.99	3.32	3.80	4.60	5.68
1PG334	.33	.312	1.063	3.14	3.49	3.84	4.72	5.76
1PG474	.47	.400	1.063	3.16	3.51	4.16	4.76	5.92
1PG504	.5	.400	1.063	3.16	3.51	4.16	4.76	5.92
1PG105	1.0	.562	1.125	3.38	3.75	4.26	5.06	6.08
1PG155	1.5	.562	1.375	3.74	4.15	4.76	5.56	6.44
1PG205	2.0	.670	1.375	3.92	4.36	5.20	6.00	6.44
1PG305	3.0	.670	1.875	4.28	4.76	5.58	6.38	7.18
1PG405	4.0	.750	1.875	4.72	5.24	6.12	6.60	7.48
1PG505	5.0	.750	1.875	5.06	5.62	6.50	7.36	8.24
1PG106	10.0	1.0	2.375	6.61	7.34	8.40	9.48	10.36

200V PG

*ADD TOLERANCE LETTER AFTER PART No.

Part No.	MFD	Diam. ± .01	Length ± .03	PRICES 1-6 *K 10% tol.	*J 5% tol.	*G 2% tol.	*F 1% tol.	*D ½% tol.
2PG102	.001	.170	.562	$2.70	$3.00	$3.60	$4.40	$6.00
2PG202	.002	.170	.562	2.70	3.00	3.60	4.40	5.76
2PG502	.005	.170	.562	2.70	3.00	3.60	4.40	5.60
2PG103	.01	.193	.562	2.70	3.00	3.60	4.40	5.52
2PG153	.015	.235	.562	2.70	3.00	3.60	4.40	5.52
2PG223	.022	.235	.687	2.70	3.00	3.60	4.40	5.52
2PG333	.033	.312	.687	2.70	3.00	3.60	4.40	5.52
2PG473	.047	.312	.687	2.70	3.00	3.60	4.40	5.52
2PG503	.05	.312	.813	2.70	3.00	3.60	4.40	5.52
2PG683	.068	.312	.813	2.74	3.04	3.60	4.40	5.52
2PG104	.1	.312	.813	2.81	3.12	3.68	4.48	5.56
2PG154	.15	.400	1.063	2.92	3.24	3.72	4.52	5.60
2PG224	.22	.400	1.375	2.95	3.28	3.76	4.56	5.68
2PG334	.33	.500	1.375	3.14	3.49	3.84	4.72	5.76
2PG474	.47	.500	1.375	3.30	3.67	4.24	5.00	6.08
2PG504	.5	.500	1.375	3.30	3.67	4.24	5.00	6.08
2PG105	1.0	.562	1.875	3.45	3.83	4.39	5.27	6.32
2PG155	1.5	.670	1.875	3.81	4.23	4.84	5.64	6.56
2PG205	2	.750	1.875	4.10	4.55	5.32	6.11	6.96
2PG255	2.5	.750	1.875	4.46	4.95	5.72	6.56	7.28
2PG305	3.0	1.0	1.875	4.90	5.44	6.28	6.76	7.64
2PG405	4.0	1.0	2.375	5.33	5.92	6.80	7.44	8.32

400V PG

*ADD TOLERANCE LETTER AFTER PART No.

Part No.	MFD	Diam. ± .01	Length ± .03	PRICES 1-6 *K 10% tol.	*J 5% tol.	*G 2% tol.	*F 1% tol.	*D ½% tol.
4PG102	.001	.193	.562	$2.70	$3.00	$3.60	$4.40	$6.00
4PG202	.002	.193	.562	2.70	3.00	3.60	4.40	5.76
4PG502	.005	.235	.687	2.70	3.00	3.60	4.40	5.60
4PG103	.01	.235	.687	2.70	3.00	3.60	4.40	5.52
4PG153	.015	.235	.813	2.70	3.00	3.60	4.40	5.52
4PG223	.022	.312	.813	2.70	3.00	3.60	4.40	5.52
4PG273	.027	.312	.813	2.70	3.00	3.60	4.40	5.52
4PG333	.033	.312	.813	2.70	3.00	3.60	4.40	5.52
4PG393	.039	.312	.813	2.70	3.00	3.60	4.40	5.52
4PG473	.047	.400	.813	2.70	3.00	3.60	4.40	5.52
4PG503	.05	.400	.813	2.70	3.00	3.60	4.40	5.52
4PG683	.068	.400	.813	2.74	3.04	3.60	4.40	5.52
4PG823	.082	.400	1.063	2.74	3.04	3.60	4.40	5.52
4PG104	.1	.400	1.063	2.92	3.24	3.72	4.52	5.60
4PG154	.15	.400	1.375	2.95	3.28	3.76	4.56	5.68
4PG224	.22	.500	1.375	3.14	3.49	3.84	4.72	5.76
4PG334	.33	.562	1.375	3.30	3.67	4.24	5.00	6.08
4PG474	.47	.562	1.875	3.45	3.83	4.39	5.27	6.32
4PG504	.5	.562	1.875	3.45	3.83	4.39	5.27	6.32
4PG105	1.0	.750	1.875	4.46	4.95	5.72	6.56	7.28
4PG205	2.0	1.00	2.375	5.33	5.92	6.80	7.44	8.32

COMPONENT RESEARCH CO., INC. 1717 19th Street, Santa Monica, Calif. 90404 • Phone: (213) 393-3755 • TWX: (910) 343-6864

COMPONENT RESEARCH COMPANY

CORDWOOD CAPACITORS
HERMETICALLY SEALED

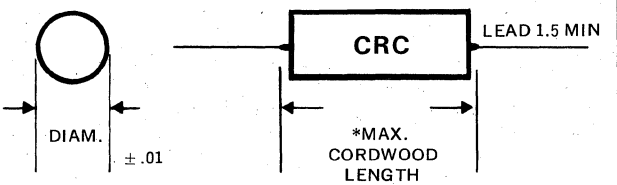
INFORMATION FOR THE PACKAGING ENGINEER

CORDWOOD LENGTH
In applications where length must be held to a minimum we have devised special hermetic seals which provide a maximum increase of 0.063" over the case length for the solder beads and wicking. Any of the capacitors shown elsewhere in the catalog may be obtained with this cordwood maximum on special order.

WELD APPLICATIONS
Capacitors with gold plated nickel leads can be welded within 0.030" of the cordwood dimensions without interference from solder wicking and resultant poor weld reliability. Capacitors with tinned copperweld leads (tinned copper clad steel) can also be welded and wicking is not a problem since it generally increases wire diameter by less than 0.002". Wire samples of either type will be supplied free of charge to assist you in setting up a weld schedule.

MODULAR LENGTHS
A wide variety of custom lengths and configurations can be fabricated. We have listed suggested sizes in an attempt at standardization.

GROUNDED STYLE CASE
The type Z case utilizes one lead soldered to the case and affords a reduction in length of approximately 0.070" from the standard floating style case (cordwood lengths shown below).



*Dimensions listed below apply to floating style case only.

ORDERING INFORMATION Add tolerance letter after Part No. for desired tolerance, J=5%, G=2%, F=1%, D=½%, B=¼%. When mylar thinwall sleeving is required add "S" after tolerance letter, when gold plated leads are needed add "N". See general information for further details. Parts listed have floating case. For grounded case style, max length is 0.070 less. Add "Z" to part number and increase prices shown by 15%.

05PQ POLYCARBONATE 50V CAPACITORS

Type 05PQ capacitors have the same electrical characteristics as type 05PL polycarbonate capacitors. Other voltage ratings, higher reliability types such as PK and other cordwood lengths can be supplied if you furnish us with complete details of your requirements.

Part No.	MFD	Diam.	*Cordwood Length	PRICES 1-6 5% tol. J	2% tol. G	1% tol. F	½% tol. D
05PQ102	.001	.170	.600	$ 4.15	$ 4.90	$ 5.85	$ 7.50
05PQ202	.002	.170	.600	4.15	4.90	5.85	7.50
05PQ222	.0022	.170	.600	4.15	4.90	5.85	7.50
05PQ332	.0033	.170	.600	4.15	4.90	5.85	7.50
05PQ472	.0047	.170	.600	4.15	4.90	5.85	7.50
05PQ502	.005	.170	.600	4.15	4.90	5.85	7.50
05PQ682	.0068	.170	.600	4.15	4.90	5.85	7.50
05PQ103	.01	.170	.600	4.15	4.90	5.85	7.50
05PQ153	.015	.170	.600	4.15	4.90	5.85	7.50
05PQ223	.022	.193	.600	4.15	4.90	5.85	7.50
05PQ273	.027	.193	.600	4.15	4.90	5.85	7.50
05PQ333	.033	.193	.600	4.15	4.90	5.85	7.50
05PQ393	.039	.193	.670	4.15	4.90	5.85	7.50
05PQ473	.047	.193	.670	4.15	4.90	5.85	7.50
05PQ503	.05	.193	.670	4.15	4.90	5.85	7.50
05PQ683	.068	.235	.670	4.15	4.90	5.85	7.50
05PQ823	.082	.235	.670	4.15	4.90	5.85	7.50
05PQ104	.1	.235	.670	4.25	4.95	5.90	7.60
05PQ154	.15	.312	.670	4.37	5.05	6.00	7.80
05PQ224	.22	.312	.670	4.46	5.15	6.15	8.05
05PQ274	.27	.312	.670	4.66	5.35	6.35	8.25
05PQ334	.33	.312	.750	4.92	5.75	6.75	8.55
05PQ474	.47	.312	.750	5.29	6.20	7.20	9.10
05PQ504	.50	.312	.750	5.29	6.20	7.20	9.10
05PQ105	1.0	.400	.750	5.78	7.40	8.40	10.30

05TQ TEFLON 50V CAPACITORS

Type 05TQ capacitors have the same electrical characteristics as type 05TA except that the temperature coefficient is approximately 20% more negative, custom capacitors with higher voltage ratings, higher reliability level or different lengths can be supplied.

Part No.	MFD	Diam.	*Cordwood Length	PRICES 1-6 5% tol. J	2% tol. G	1% tol. F	¼% tol. B
05TQ102	.001	.193	.600	$ 4.59	$ 5.10	$ 5.70	$ 9.95
05TQ152	.0015	.193	.600	4.59	5.10	5.70	9.95
05TQ202	.002	.193	.600	4.59	5.10	5.70	9.95
05TQ222	.0022	.193	.600	4.59	5.10	5.70	9.95
05TQ332	.0033	.193	.600	4.59	5.10	5.70	9.95
05TQ392	.0039	.235	.600	4.59	5.10	5.70	9.95
05TQ472	.0047	.235	.600	4.59	5.10	5.70	9.95
05TQ502	.005	.235	.600	4.59	5.10	5.70	9.95
05TQ682	.0068	.235	.600	4.59	5.10	5.70	9.95
05TQ822	.0082	.235	.600	4.59	5.10	5.70	9.95
05TQ103	.01	.235	.600	4.59	5.10	5.70	9.95
05TQ123	.012	.235	.600	4.66	5.35	6.35	9.95
05TQ153	.015	.235	.670	4.86	5.40	6.00	9.95
05TQ223	.022	.235	.670	5.13	5.70	6.30	9.95
05TQ333	.033	.312	.670	5.61	6.23	7.20	10.85
05TQ393	.039	.312	.670	5.94	6.60	7.50	11.80
05TQ473	.047	.312	.670	5.94	6.60	7.50	11.80
05TQ503	.05	.312	.670	5.94	6.60	7.50	11.80
05TQ683	.068	.312	670.	7.52	8.35	9.50	13.10
05TQ823	.082	.312	.670	8.28	9.20	10.35	14.95
05TQ104	.10	.312	.670	8.91	9.90	10.75	14.95
05TQ154	.15	.312	1.00	9.99	11.10	12.00	16.00
05TQ204	.20	.400	1.00	12.02	13.35	14.25	18.10
05TQ224	.22	.400	1.00	12.51	13.90	14.90	18.80
05TQ334	.33	.500	1.00	15.08	16.75	17.75	21.60

COMPONENT RESEARCH CO., INC. 1717 19th Street, Santa Monica, Calif. 90404 • Phone: (213) 393-3755 • TWX: (910) 343-6864

COMPONENT RESEARCH COMPANY

PA POLYSTYRENE CAPACITORS

PA Polystyrene capacitors are used in missile and industrial applications for operational amplifiers and network fabrication. Special capacitor modules have been fabricated for a missile program which met extremely rigid qualification requirements for low noise and high insulation resistance within a limited case size. This is another example where our capacitors have demonstrated their superior characteristics. Capacitor modules, decades, and networks can be supplied which exceed industrial and military specifications. PA capacitors are available in 50V and 100V in tolerances of 0.25% to 5% and values from .001 mfd to 10 mfd.

PA SPECIFICATIONS

OPERATING TEMPERATURE — 62°C to 85°C at full rated volts.

TEMPERATURE COEFFICIENT OF CAPACITANCE

+1.0% Max. at	−55°C
+0.5% Max. at	−25°C
+0.35% Max. at	−10°C
+0.25% Max. at	0°C
0.0% Reference at	25°C
−0.3% Max. at	55°C
−0.7% Max. at	85°C

STABILITY — Capacitance values measured at any two corresponding temperature points taken in five successive temperature cycles shall be as follows:

Range	Retrace
−10°C to 85°C	0.05%
−62°C to 85°C	0.15%

INSULATION RESISTANCE (IR)

	50V	100V
Min IR at 25°C	1,000,000 megs	1,000,000 megs
at 85°C	250,000 megs	250,000 megs

Readings shown are for 1 mfd or less. For values over 1 mfd, divide readings by mfd to obtain min IR.

Example: A 10 mfd, 100 volt capacitor at 25°C is $\frac{1{,}000{,}000 \text{ megs}}{10} = 100{,}000$ megohms.

DIELECTRIC ABSORPTION — 0.02% Max. at 25°C.

DISSIPATION FACTOR — 0.02% Max. at 1KHz and 25°C.

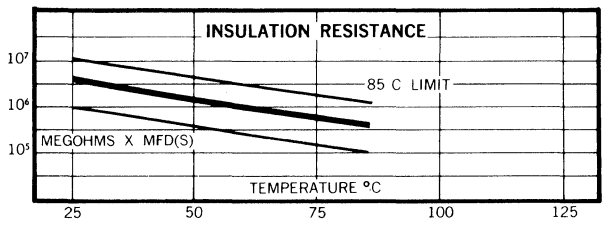
DIELECTRIC STRENGTH — 200% of rated voltage.

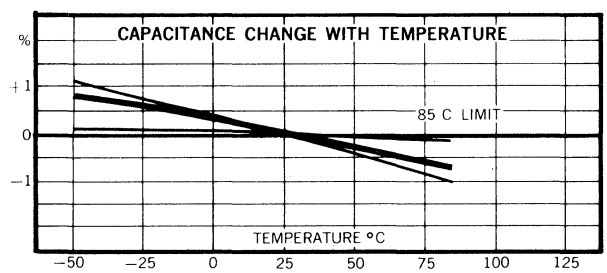
CONSTRUCTION — Polystyrene dielectric, extended foil electrodes, hermetically sealed. Leads isolated from case. Leads are tinned copperweld.

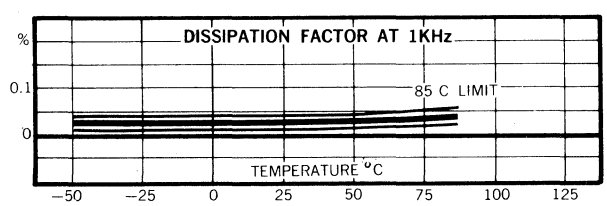
SEAL TEST — 1×10^{-6} ATM-CC/SEC Max leak rate.

ENVIRONMENTAL — Shall meet all applicable requirements of Mil-C-19978 including grade 3 vibration.

FOR ADDITIONAL DETAILS,
SEE GENERAL INFORMATION SECTION, PAGE 3







Quality Assurance

"PA" POLYSTYRENE CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS:

1. Temperature cycling from -62°C to 85°C, 5 cycles minimum.
2. Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C. Procedure III A.
3. Dielectric strength test at a minimum of 200%of rated voltage, lead to lead and leads to case.
4. Insulation resistance at rated voltage and 25°C.
5. Capacitance tolerance at 1KHz and 25°C.
6. Dissipation factor at 1KHz and 25°C.
7. Visual inspection for dimensions, marking, and packaging.
8. Traceability to production and test records by permanent marking of parts with lot control number.
9. Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.

50 VOLT PA POLYSTYRENE

*ADD TOLERANCE LETTER AFTER PART NO.

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
05PA102	.001	.193	.687	$3.75	$4.50	$5.50	$6.90
05PA222	.0022	.193	.687	3.75	4.50	5.50	6.90
05PA332	.0033	.193	.687	3.75	4.50	5.50	6.90
05PA502	.005	.193	.687	3.75	4.50	5.50	6.90
05PA103	.01	.193	.813	3.75	4.50	5.50	6.90
05PA153	.015	.235	.813	3.75	4.50	5.50	6.90
05PA223	.022	.312	.813	3.75	4.50	5.50	6.90
05PA333	.033	.312	.813	3.75	4.50	5.50	6.90
05PA393	.039	.312	.813	3.75	4.50	5.50	6.90
05PA473	.047	.312	.813	3.75	4.50	5.50	6.90
05PA503	.05	.312	.813	3.75	4.50	5.50	6.90
05PA683	.068	.400	.813	3.75	4.50	5.50	6.90
05PA104	.1	.400	1.063	3.75	4.50	5.50	6.90
05PA154	.15	.400	1.375	3.85	4.60	5.60	7.00
05PA224	.22	.500	1.375	3.90	4.65	5.65	7.05
05PA334	.33	.562	1.375	3.95	4.70	5.70	7.10
05PA474	.47	.562	1.875	4.10	4.85	5.85	7.25
05PA504	.5	.562	1.875	4.10	4.85	5.85	7.25
05PA105	1.0	.750	1.875	5.20	6.10	7.15	9.10
05PA205	2.0	1.0	2.250	7.85	8.30	9.10	11.40

COMPONENT RESEARCH COMPANY

MA Mylar and MM Mylar CAPACITORS

MA miniature metallized mylar capacitors are extremely compact and rugged. 1MA capacitors are available in 100V in tolerances of 0.5% to 5% and values from .001 mfd to 10 mfd

MM metallized mylar capacitors are reliable, accurate and rugged. Many thousands are used in military equipment where an extra measure of dependability is needed. MM capacitors are available in 200V, 400V, and 600V in tolerances of 0.5% to 5% and values from .001 mfd. to 10 mfd.

FOR ADDITIONAL DETAILS SEE GENERAL INFORMATION SECTION

SPECIFICATIONS		MA	MM
OPERATING TEMPERATURE —62°C to 85°C at full rated voltage. Derate linearly to 50% of rated volts at 125°C		100 Volt MA	200 Volt MM
TEMPERATURE COEFFICIENT OF CAPACITANCE 25°C reference	— 62°C	—5% Max	—5% Max
	— 25°C	—3% Max	—3.5% Max
	— 10°C	—2% Max	—2.5% Max
	0°C	—1% Max	—1.5% Max
	55°C	+1% Max	+1% Max
	85°C	+2% Max	+3% Max
	125°C	+14% Max	+15% Max
STABILITY — Capacitance values measured at any two corresponding temperature points taken in any two successive temperature cycles from —10°C to 85°C shall differ a maximum of:		0.1%	0.1%
INSULATION RESISTANCE Min at	25°C	25,000 meg x mfd	50,000 meg x mfd
Values 1 mfd or more	85°C	1,000	5,000
	125°C	100	100
Values less than 1 mfd Min at	25°C	50,000 meg	100,000 meg
	85°C	2,000	4,000
	125°C	200	400
DIELECTRIC ABSORPTION at 25°C		0.5% Max	0.5% Max
***DISSIPATION FACTOR AT 1KHz** 25°C		0.8% Max	0.8% Max

CONSTRUCTION — Mylar dielectric, hermetically sealed, extended metal film electrodes, leads isolated from case, leads are tinned copperweld.

SEAL TEST — 1 x 10^{-6} ATM-CC/SEC Max leak rate.

ENVIRONMENTAL — Capacitors shall meet all applicable requirements of Mil-C-19978, including grade 3 vibration.

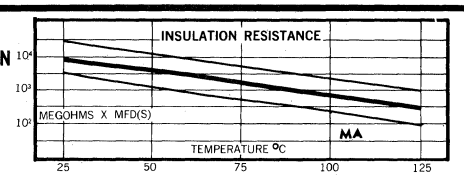
FOR ADDITIONAL DETAILS, SEE GENERAL INFORMATION SECTION, PAGE 3.

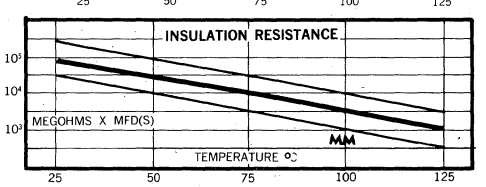
Quality Assurance

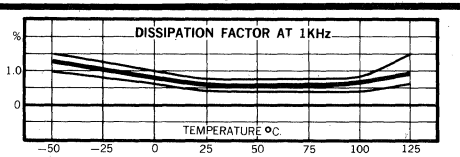
"MM" AND "MA" MYLAR CAPACITORS ARE 100% PROCESSED AND TESTED AS FOLLOWS;

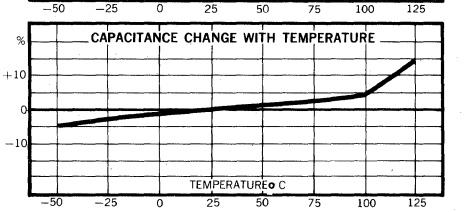
1. *Stabilization by temperature cycling from .62°C to 125°C, 5 cycles minimum.*
2. *Mass spectrometer hermetic seal test per MIL-STD-202, Method 112, condition C. procedure III A.*
3. *Dielectric strength test at a minimum of 200% of rated voltage, lead to lead and leads to case.*
4. *Insulation resistance of rated voltage and 25°C.*
5. *Capacitance tolerance at 1KHz and 25°C.*
6. *Dissipation factor at 25°C.*
7. *Visual inspection for dimensions, marking, and packaging.*
8. *Traceability to production and test records by permanent marking of parts with lot control number.*
9. *Process and inspection data is maintained on file per NPC-200-3 and Mil-Q-9858 quality control standards.*

*VALUES GREATER THAN 1 MFD AT 0.1KHz









100 VOLT MA MYLAR

*ADD TOLERANCE LETTER AFTER PART NO.

200 VOLT MM MYLAR

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
1MA103	.01	.170	.562	$4.15	$4.90	$5.85	$7.50
1MA153	.015	.170	.562	4.15	4.90	5.85	7.50
1MA223	.022	.170	.562	4.15	4.90	5.85	7.50
1MA333	.033	.193	.562	4.15	4.90	5.85	7.50
1MA393	.039	.193	.562	4.15	4.90	5.85	7.50
1MA473	.047	.193	.687	4.15	4.90	5.85	7.50
1MA503	.05	.193	.687	4.15	4.90	5.85	7.50
1MA683	.068	.193	.687	4.15	4.90	5.85	7.50
1MA104	.1	.235	.687	4.25	4.95	5.90	7.60
1MA154	.15	.312	.687	4.37	5.05	6.00	7.80
1MA224	.22	.312	.687	4.46	5.15	6.15	8.05
1MA334	.33	.312	.813	4.92	5.75	6.75	8.55
1MA474	.47	.400	.813	5.29	6.20	7.20	9.10
1MA504	.5	.400	.813	5.29	6.20	7.20	9.10
1MA105	1.0	.400	1.063	5.78	7.40	8.40	10.30
1MA155	1.5	.500	1.125	6.90	7.95	8.95	10.95
1MA205	2.0	.500	1.125	7.43	8.60	9.60	11.65
1MA305	3.0	.562	1.125	8.60	9.65	10.65	12.70
1MA505	5.0	.670	1.375	10.95	12.50	13.50	15.55
1MA106	10.0	.670	1.875	16.85	18.95	19.95	21.05

Part No.	MFD	± .01 Diam.	± .03 Length	PRICES 1-6 5% tol. *J	2% tol. *G	1% tol. *F	½% tol. *D
2MM103	.01	.193	.562	$3.75	$4.50	$5.50	$6.90
2MM153	.015	.193	.562	3.75	4.50	5.50	6.90
2MM223	.022	.235	.562	3.75	4.50	5.50	6.90
2MM333	.033	.235	.562	3.75	4.50	5.50	6.90
2MM393	.039	.235	.687	3.75	4.50	5.50	6.90
2MM473	.047	.235	.687	3.75	4.50	5.50	6.90
2MM503	.05	.235	.813	3.75	4.50	5.50	6.90
2MM683	.068	.235	.813	3.75	4.50	5.50	6.90
2MM104	.1	.312	.687	3.90	4.60	5.60	6.95
2MM154	.15	.312	.813	4.05	4.65	5.65	7.00
2MM224	.22	.312	.813	4.10	4.70	5.70	7.10
2MM334	.33	.312	.813	4.36	4.80	5.90	7.20
2MM474	.47	.400	1.063	4.39	5.20	5.95	7.40
2MM504	.5	.500	1.125	4.39	5.20	5.95	7.40
2MM105	1.0	.562	1.125	4.69	5.32	6.32	7.60
2MM155	1.5	.562	1.375	5.19	5.95	6.95	8.05
2MM205	2.0	.670	1.375	5.45	6.50	7.50	8.50
2MM305	3.0	.670	1.625	5.95	6.98	7.98	8.98
2MM505	5.0	.750	1.875	7.02	8.12	9.20	10.30
2MM106	10.0	1.0	2.375	9.18	10.50	11.85	12.95

COMPONENT RESEARCH CO., INC. 1717 19th Street, Santa Monica, Calif. 90404 • Phone: (213) 393-3755 • TWX: (910) 343-6864

MACRO-VALUE
FILM CAPACITORS

COMPONENT RESEARCH CO.

Capacitors 5 Mfd or more, termed macro-value, can be supplied to meet the electrical requirements of our standard metal cased tubular capacitors shown throughout this catalog. The macro-valued capacitors can be supplied in values exceeding 1000 Mfd in voltages ranging in the kilovolt region with case configurations to suit your special requirements.

Custom designs have been fabricated taking into consideration heat sinking problems, high acceleration and shock, extremely low leakage and dielectric absorption, minimum weight and size. Special modules which contain decade values, matched sets or capacitor networks of extreme accuracy can be furnished. We have been supplying space science and military research establishments with polycarbonate capacitors ranging from 20 Mfd to 1400 Mfd and polystyrene capacitors from 10 Mfd to 100 Mfd. These special capacitors have very high insulation resistance, low loss, and high reliability in minimum package size.

The following data will serve as a guide for packaging engineers in calculating the space required for larger valued capacitors. Included are volume ratios for type "PD" polycarbonate which is currently being tested for radar modulator and SCR applications.

RATED VOLTS	CAPACITOR TYPES	MICRO-FARADS PER CUBIC INCH OF VOLUME	CUBIC INCHES PER MICRO-FARAD
	POLYCARBONATE		
30	03PG, 03PL	33	0.03
50	05PG, 05PL	16	0.06
100	1PG, 1PL	7	0.13
200	2PG, 2PL	3	0.35
400	4PG, 4PL	1.5	0.67
1000	10PD	1.3	0.73
1500	15PD	0.5	2.0
2000	20PD	0.3	3.3
	TEFLON		
50	05TA, 05TL	4.5	0.22
100	1TA	2	0.5
200	2TA	1.0	1.0
100	1TU	0.46	2.2
200	2TU	0.25	4.0
100	1TF	0.46	2.2
	POLYSTYRENE		
50	05PA	1.0	1.0
100	1PA	0.46	2.2
200	2PA	0.25	4.0
	MYLAR		
100	1MA	16	0.06
200	2MM	7	0.13
400	4MM	3	0.35

The following capacitors can be fabricated in a hermetically sealed rectangular case approximately 2.88" x 2.25" x 2". in size to assist further in the custom design of large valued capacitors.

CAPACITOR TYPE	MFD	VOLTS	DIELECTRIC
03PL	300	30	Polycarbonate
05PL	150	50	"
1PL	60	100	"
2PL	30	200	"
4PL	12	400	"
05TA	50	50	Teflon
1TA	20	100	"
2TA	10	200	"
05PA	10	50	Polystyrene
1PA	4	100	"

RELIABILITY INFORMATION

Qualification tests are an excellent source for capacitor reliability data if sufficiently sensitive and accurate instrumentation is utilized by test technicians thoroughly familiar with measurement techniques so as to avoid the errors so prevalent with test reports. The measurement section shown on page 3 will provide useful information to technicians contemplating capacitor testing. Further engineering assistance can be provided to engineers in establishing a test flow plan or in test details for qualification or acceptance testing.

The following data covering type "PL" polycarbonate capacitors recently tested and qualified for use in a missile program is included here in condensed form as a guide to the type of changes to be anticipated with life testing. Test conditions were 140% of rated voltage at 105°C for 50 Volt and 100 Volt polycarbonate film capacitors, after 250 hours and 1000 hours of test time. Data is shown for four samples of our 05PL105G, 1 MFD ±2% 50 Volts, and eight samples of our 1PL224F, 0.22 MFD, 1% 100 Volts, capacitors.

Serial No.	% Cap. change after 250 hours	% Cap. change after 1000 hours	% Dissipation factor initial	% Dissipation factor after 1000 hours	Insulation resistance in megohms initial	Insulation resistance in megohms after 1000 hours
1 MFD						
1	−.30	−.40	.10	.08	5×10^5	5×10^5
2	−.36	−.45	.10	.08	6×10^5	2×10^6
3	−.27	−.57	.09	.08	7×10^5	2×10^6
4	−.12	−.16	.09	.08	6×10^5	1×10^6
0.22 MFD						
1	+.11	+.06	.09	.08	1×10^6	1×10^6
2	+.03	.00	.09	.08	2×10^6	3×10^6
3	−.65	+.01	.09	.08	2×10^6	4×10^6
4	−.01	+.16	.08	.07	2×10^6	3×10^6
5	.00	−.08	.09	.08	2×10^6	5×10^6
6	+.04	+.17	.09	.07	5×10^6	5×10^6
7	+.06	+.07	.08	.07	3×10^6	4×10^6
8	−.59	−.19	.09	.07	1×10^6	1×10^6

From analysis of this life test data and many other tests conducted, it appears that most of the capacitance drift occurs within the first 250 hours. We therefore note that burn-in tends to improve stability and have found that burn-in at 125°C will further accelerate the stabilization cycle.

If capacitors have poor quality the life testing generally increases the dissipation factor and decreases the insulation resistance.

The dissipation factor showed improvement for these capacitors and was well within the 0.25% maximum limit for our catalog specifications.

The insulation resistance did not decrease for any unit and instead increased in value for most of the test capacitors.

The capacitors tested are typical of our 1968 production quality level and we believe this quality level will be further upgraded with time as we refine our manufacturing process.

Please contact our sales office for further information concerning the unique performance and reliability of our capacitor products.

COMPONENT RESEARCH CO., INC. 1717 19th Street, Santa Monica, Calif. 90404 • Phone: (213) 393-3755 • TWX: (912) 343-6864

SOLID Tantalum capacitors FROM COMPONENTS, INC.

MINITAN® MICROMINIATURE Solid Tantalum

POLAR MODULAR

Case	Ratings from	Ratings to
W U .100 X .050 X .040	.068 MFD @ 20 VDC	.47 MFD @ 2 VDC
F .165 X .120 X .070	.47 MFD @ 35 VDC	10 MFD @ 2 VDC
M .225 X .185 X .075	1.5 MFD @ 35 VDC	22 MFD @ 2 VDC
L .290 X .220 X .110	4.7 MFD @ 35 VDC	47 MFD @ 4 VDC
S .310 X .230 X .130	6.8 MFD @ 35 VDC	68 MFD @ 4 VDC
J .475 X .375 X .150	22 MFD @ 35 VDC	220 MFD @ 3 VDC

ASK FOR DATA SHEET #PPD11

NON-POLAR MODULAR

Case	Ratings from	Ratings to
.220 X .125 X .125 (AXIAL) NF .180 X .125 X .125 (RADIAL)	.22 MFD @ 35 VNP	4.7 MFD @ 2 VNP
.280 X .140 X .180 (AXIAL) NM .240 X .140 X .180 (RADIAL)	.68 MFD @ 35 VNP	10 MFD @ 2 VNP
.370 X .180 X .220 (AXIAL) NL .315 X .180 X .220 (RADIAL)	3.3 MFD @ 25 VNP	22 MFD @ 4 VNP
.390 X .230 X .230 (AXIAL) NS .335 X .230 X .230 (RADIAL)	6.8 MFD @ 20 VNP	33 MFD @ 4 VNP

ASK FOR DATA SHEET #PPD15

POLAR CORDWOOD

Case	Ratings from	Ratings to
Y .125 X .070	.22 MFD @ 20 VDC	2.2 MFD @ 2 VDC
P .160 X .070	.01 MFD @ 50 VDC	4.7 MFD @ 2 VDC
B .200 X .080	.47 MFD @ 35 VDC	10 MFD @ 2 VDC
A .225 X .100	1.0 MFD @ 35 VDC	22 MFD @ 2 VDC
G .250 X .150	2.2 MFD @ 35 VDC	47 MFD @ 3 VDC

ASK FOR DATA SHEET #PPD14

NON-POLAR CORDWOOD

Case	Ratings from	Ratings to
.175 X .120 X .070 (AXIAL) NY .135 X .120 X .070 (RADIAL)	.10 MFD @ 20 VNP	1.0 MFD @ 2 VNP
.210 X .120 X .070 (AXIAL) NP .160 X .120 X .070 (RADIAL)	.0047 MFD @ 50 VNP	2.2 MFD @ 2 VNP
.240 X .140 X .080 (AXIAL) NB .200 X .140 X .080 (RADIAL)	.22 MFD @ 35 VNP	4.7 MFD @ 2 VNP
.275 X .190 X .105 (AXIAL) NA .235 X .190 X .105 (RADIAL)	.47 MFD @ 35 VNP	10 MFD @ 2 VNP
.310 X .290 X .155 (AXIAL) NG .270 X .290 X .155 (RADIAL)	3.3 MFD @ 20 VNP	22 MFD @ 3 VNP

ASK FOR DATA SHEET #PPD15

RIBBON LEAD — 50μ/in. gold over kovar

Case	Ratings from	Ratings to	Case	Ratings from	Ratings to
RU .125 X .070 X .045	.22 MFD @ 20 VDC	1.5 MFD @ 3 VDC	RL .290 X .220 X .115	4.7 MFD @ 35 VDC	47 MFD @ 4 VDC
RF .165 X .120 X .075	.47 MFD @ 35 VDC	10 MFD @ 2 VDC	RS .310 X .230 X .135	6.8 MFD @ 35 VDC	68 MFD @ 4 VDC
RM .225 X .185 X .080	1.5 MFD @ 35 VDC	22 MFD @ 2 VDC	RJ .475 X .375 X .155	22 MFD @ 35 VDC	220 MFD @ 3 VDC

ASK FOR DATA SHEET #PPD8

ECONOTAN® C SUBMINIATURE, Metal-cased, Epoxy-sealed

Case	Ratings from	Ratings to	Case	Ratings from	Ratings to
CT .260 X .095	.47 MFD @ 35 VDC	10 MFD @ 2 VDC	CL .345 X .180	3.3 MFD @ 35 VDC	68 MFD @ 2 VDC
CM .320 X .133	1.5 MFD @ 35 VDC	33 MFD @ 2 VDC	CB .420 X .183	6.8 MFD @ 35 VDC	68 MFD @ 4 VDC

ASK FOR DATA SHEET #PPD7

DIPATAN® TSD Dipped Epoxy

Case	Ratings from	Ratings to	Case	Ratings from	Ratings to
TSD1 .275 X .275 X .180	1.2 MFD @ 50 VDC	18 MFD @ 6 VDC	TSD4 .400 X .400 X .250	6.8 MFD @ 35 VDC	100 MFD @ 6 VDC
TSD2 .325 X .325 X .200	2.2 MFD @ 50 VDC	39 MFD @ 6 VDC	TSD5 .450 X .450 X .325	15 MFD @ 35 VDC	250 MFD @ 6 VDC
TSD3 .400 X .400 X .200	4.7 MFD @ 50 VDC	68 MFD @ 6 VDC			

ASK FOR DATA SHEET #PPD110

HERMETICALLY-SEALED

Tantalum capacitors

FROM COMPONENTS, INC.

MILITAN® TS Series — Hermetically-Sealed CS 12/13

POLAR			NON-POLAR		
Case	Ratings from	Ratings to	Case	Ratings from	Ratings to
TS1 .286 X .135	.56 MFD @ 100 VDC	6.8 MFD @ 6 VDC	**TSN1** .610 X .150	.28 MFD @ 100 VNP	3.4 MFD @ 6 VNP
TS2 .474 X .185	2.7 MFD @ 100 VDC	56 MFD @ 6 VDC	**TSN2** .961 X .197	1.3 MFD @ 100 VNP	28 MFD @ 6 VNP
TS3 .686 X .289	10 MFD @ 75 VDC	180 MFD @ 6 VDC	**TSN3** 1.425 X .303	5.0 MFD @ 75 VNP	90 MFD @ 6 VNP
TS4 .786 X .351	15 MFD @ 75 VDC	330 MFD @ 6 VDC	**TSN4** 1.635 X .365	7.5 MFD @ 75 VNP	340 MFD @ 6 VNP
ASK FOR DATA SHEET #PPD101			ASK FOR DATA SHEET #PPD106		

MILITAN® TSR Series — Hermetically-Sealed CSR 13

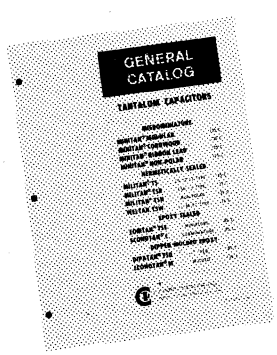
Case	Ratings from	Ratings to	Case	Ratings from	Ratings to
TSR1 .286 X .135	.56 MFD @ 100 VDC	6.8 MFD @ 6 VDC	**TSR3** .686 X .289	10 MFD @ 75 VDC	180 MFD @ 6 VDC
TSR2 .474 X .185	2.7 MFD @ 100 VDC	56 MFD @ 6 VDC	**TSR4** .786 X .351	15 MFD @ 75 VDC	330 MFD @ 6 VDC
ASK FOR DATA SHEET #PPD109			Levels L, M, and P Available		

WELTAN® TW Series — Gelled Electrolyte-Hermetically-Sealed CL 66/67

Case	Ratings from	Ratings to	Case	Ratings from	Ratings to
TW1 .484 X .200	3.6 MFD @ 125 VDC	68 MFD @ 6 VDC	**TW3** .797 X .390	25 MFD @ 125 VDC	560 MFD @ 6 VDC
TW2 .672 X .297	14 MFD @ 125 VDC	270 MFD @ 6 VDC			
ASK FOR DATA SHEET #PPD108					

FOR MORE INFORMATION . . .

See Components, Inc. data in VSMF Directron. Write for specific data sheets listed above.
Or ask for new General Catalog.



For fast service, call your nearest C. I. Sales Representative, listed in the back of your EEM catalog.

COMPONENTS, INC.
CAPACITOR PRODUCTS
BIDDEFORD, MAINE 04005 – TEL: (207) 284-5956 – TWX: 710-229-1559

We make guys who can't

CHARACTERISTICS

CORNING® CYFM Capacitors give you environment-proof performance at substantial savings. They provide economical stability and reliability in coupling, decoupling, filtering, timing, switching, and many other critical circuits. The CYFM's are electrically and environmentally interchangeable with the CYFR type. We have boiled them in salt water, immersed them in saturated steam and subjected them to 96-hour salt spray and 1200 hours of moisture resistance tests without failure or degradation.

CORNING® CYFR Capacitors give you guaranteed reliability. They have contributed, and continue to contribute to marked improvement in MTBF in many military and space programs such as Titan, Surveyor, Syncom, Mariner, Apollo, and Gemini. Over 64-million unit-hours from lot acceptance tests over a five year period for Minuteman have demonstrated the reliability and reproducibility of the CYFR capacitor from a process under control.

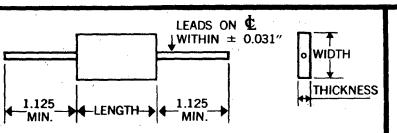
CORNING® TYO Capacitors are ideal for printed circuit applications because of their miniaturization and radial lead configuration. Their design permits upright, flush mounting on circuit boards. Standard gold plated Dumet leads give reliable soldering or welding, and are spaced symmetrically with the case on .1" grids for fast installation on printed circuit boards. The lower prices of CORNING TYO Capacitors now provide a glass capacitor at comparable ceramic prices.

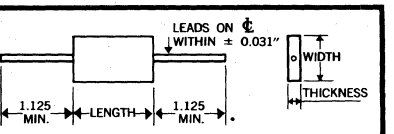
CORNING® CY60 and CY70 Capacitors are excellent for a large variety of radio frequency applications. They are used for power amplifiers, low power transmitters, and many electronic devices in grid, plate coupling, tank, and bypass functions. Because of their small size and minimum weight, these CORNING Capacitors are also suited for airborne equipment and all types of mobile transmitters.

The Glass-K is a miniature stable capacitor that exhibits a high capacitance-to-volume ratio. It offers the size advantages of ceramic types and the consistent performance associated with glass dielectrics.

The Glass-K's physical size and values of capacitance meet the requirements of both military and commercial applications. The larger capacitance values are suitable for point-of-use filtering in computers, and for bypassing and coupling elements in miniaturized circuitry. The smaller capacitance values are suitable for more critical circuit functions.

The Glass-K is designed for general purpose use in bypass, coupling, and filtering applications where the miniature size of ceramics is required and where **better performance** characteristics are desired at **competitive prices.**

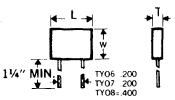


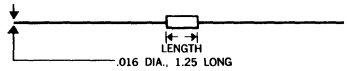


	CYFM10	CYFM25	CYFM20	CYFM30	CYFR10	CYFR15	CYFR20	CYFR30
	Meets or exceeds electrical and environmental requirements of MIL-C-11272 with							
LENGTH	.2969"-.3906"	.4219"-.5156"	.6719"-.7968"	.7032"-.8281"	.2969"-.3906"	.4219"-.5156"	.6719"-.7968"	.7032"-.8281"
WIDTH	.1406"-.2031"	.2344"-.2968"	.3750"-.4687"	.6719"-.8281"	.1406"-.2031"	.2344"-.2968"	.3750"-.4687"	.6719"-.8281"
THICKNESS (DIA.)	.0469"-.1093"	.0625"-.1562"	.0938"-.1875"	.0938"-.1875"	.0469"-.1093"	.0625"-.1562"	.0938"-.1875"	.0938"-.1875"
WEIGHT (GRAMS)	0.25-0.50	0.75-1.25	2.50-4.00	5.00-7.00	0.25-0.50	0.75-1.25	2.50-4.00	5.00-7.00
TERMINALS (INCHES)	0.020 #24AWG	0.020 #24AWG	0.025 #22AWG	0.025 #22AWG	0.020 #24AWG	0.020 #24AWG	0.025 #22AWG	0.025 #22AWG
VOLTAGE RATING	500v from 0.5 to 200 pf; 300v from 220 to 300 pf	500v from 220 to 510 pf; 300v from 560 to 1200 pf	500v from 560 to 3300 pf; 300v from 3600 to 5100 pf	500v from 3600 to 6200 pf; 300v from 6800 to 10,000 pf	500v from 0.5 to 200 pf; 300v from 160 to 240 pf	500v from 220 to 510 pf; 300v from 560 to 1200 pf	500v from 560 to 3300 pf; 300v from 3600 to 5100 pf	500v from 3600 to 6200 pf; 300v from 6800 to 10,000 pf
CAPACITANCE RANGE	0.5 pf to 300 pf	220 pf to 1200 pf	560 pf to 5100 pf	3600 pf to 10,000 pf	0.5 pf to 240 pf	220 pf to 1200 pf	560 pf to 5100 pf	3600 pf to 10,000 pf
CAPACITANCE TOLERANCE	Standard tolerance is ±5% or ±0.25% pf, whichever is greater. Also available ±10%, ±2%, ±1%, but in no case less than ±.25 pf.				Capacitance tolerances available are ±.25 pf, ±.50 pf, ±1%, ±2%, ±5%. Specific tolerances available for specific values are shown on Corning Reference File CE-1.01.			
TEMPERATURE COEFFICIENT	Temperature coefficient is +140 ±25 ppm/°C at 100 KC. At any given temperature T. C. will not deviate from the curve by more than 5 ppm. Capacitance drift is less than 0.1% or 0.1 pf, whichever is greater.				Temperature coefficient is +140 ±225 ppm/°C at 100 KC. At any given temperature T. C. will not deviate from the curve by more than 5 ppm. Capacitance drift is less than 0.1% or 0.1 pf, whichever is greater.			
INSULATION RESISTANCE	High I. R. over entire operating temperature range; at 25°C, I. R. is greater than 100,000 megohms; at 125°C, I. R. is greater than 10,000 megohms.				High I. R. over entire operating temperature range; at 25°C, I. R. is greater than 100,000 megohms; at 125°C, I. R. is greater than 10,000 megohms.			
DISSIPATION FACTOR	Losses are extremely low and remain relatively low at elevated temperatures and high frequencies. D.F. less than 0.001 at 1 KC and 25°C.				Losses are extremely low and remain relatively low at elevated temperatures and high frequencies. D. F. less than 0.001 at 1 KC and 25°C.			
LIFE	After 2000 hrs. at 125°C with 150% of full rated voltage, capacitance change is less than 0.5%.				After 2000 hrs. at 125°C with 150% of full rated voltage, capacitance change is less than 0.5%.			
MOISTURE RESISTANCE	Exceeds all requirements of Mil-C-11272B and Mil-Std 202 Method 106. Corning CYFM capacitors are guaranteed to withstand Mil-Std 202 (Method 106) conditions for over 1200 hours. They have been immersed in boiling salt water for 450 hours and saturated in steam at 15 pounds gauge pressure for 150 hours without altering their performance.				Exceeds all requirements of Mil-C-11272B and Mil-Std 202 Method 106. Corning CYFR capacitors are guaranteed to withstand Mil-Std-202 (Method 106) conditions for over 1200 hours. They have been immersed in boiling salt water for 450 hours and saturated in steam at 15 pounds gauge pressure for 150 hours without altering their performance.			
VOLTAGE COEFFICIENT	Zero.				Zero.			

CORNING ELECTRONICS
Houghton Park, Corning, New York 14830 / Phone 607, 962-4444

capacitors for stand failures.







	TY06	TY07	TY08	CYK01-BT	CYK02-BT	CYK01-BU	CYK02-BU	CYK01-BV	CYK02-BV
	parametric as detailed.			Meets or exceeds environmental requirements MIL-C-11015.					
LENGTH	.295″-.305″	.295″-.305″	.495″-.505″	.250″	.250″	.250″	.250″	.250″	.250″
WIDTH	.190″-.210″	.290″-.310″	.290″-.310″	N/A	N/A	N/A	N/A	N/A	N/A
THICKNESS (DIA.)	.110″-.120″	.110″-.120″	.110″-.120″	.100″	.140″	.100″	.140″	.100″	.140″
WEIGHT (GRAMS)	0.3-0.4	0.4-0.5	0.7-0.8	0.2 Max.	0.3 Max.	0.2 Max.	0.3 Max.	0.2 Max.	0.3 Max.
TERMINALS (INCHES)	0.020 #24AWG	0.020 #24AWG	0.020 #24AWG	0.016	0.016	0.016	0.016	0.016	0.016
VOLTAGE RATING	300v	300v	300v	50VDC	50VDC	50VDC	50VDC	50VDC	50VDC
CAPACITANCE RANGE	1.0 pf to 560 pf	561 pf to 1000 pf	1001 pf to 2400 pf	270 pf to 10,000 pf	12,000 pf to 20,000 pf	12,000 pf to 20,000 pf	22,000 pf to 39,000 pf	22,000 pf to 51,000 pf	56,000 pf to 100,000 pf
CAPACITANCE TOLERANCE	Standard tolerance is ±5% or ±0.25 pf, whichever is greater. Available as ±20%, ±10%, ±15%, ±2%, ±1%, but in no case less than ±.25 pf.			Standard tolerances are ±10% and ±20%		Standard tolerances are ±10% and ±20%		Standard tolerances are ±10% and ±20%	
TEMPERATURE COEFFICIENT	Temperature coefficient is +140 ±25 ppm/°C at 100 KC. At any given temperature T. C. will not deviate from the curve by more than 5 ppm. Capacitance drift is less than 0.1% or 0.1 pf, whichever is greater.			Temperature coefficient is +2, −10%		Temperature coefficient is +2, −15%		Temperature coefficient is +10, −40%	
INSULATION RESISTANCE	High I. R. over entire operating temperature range; at 25°C, I.R. is greater than 100,000 megohms; at 125°C, I. R. is greater than 10,000 megohms.			Insulation resistance is greater than 100,000 megohms with 50VDC and 25°C.		Insulation resistance is greater than 100,000 megohms with 50VDC and 25°C.		Insulation resistance is greater than 10,000 megohms with 50VDC and 25°C.	
DISSIPATION FACTOR	Losses are extremely low and remain relatively low at elevated temperatures. D.F. less than 0.001 for values greater than 100 pf; 0.002 for values of 100 pf and below at 1 KC and 25°C.			D. F. Max is 1.0%		D. F. Max is 1.5%		D. F. Max is 3.0%	
LIFE	After 2000 hrs. at 125°C with 150% of full rated voltage, capacitance change is less than 0.5%.			When tested per Mil Std. 202, Method 108 at 200% rated voltage, 125°C for 1000 hours; maximum change in capacitance is less than 2%.		When tested per Mil Std. 202, Method 108 at 200% rated voltage, 125°C for 1000 hours; maximum change in capacitance is less than 5%.		When tested per Mil Std. 202, Method 108 at 200% rated voltage, 125°C for 1000 hours; maximum change in capacitance is less than 20%.	
MOISTURE RESISTANCE	I. R. exceeds 10,000 megohms after moisture resistance test per Mil-Std 202, Method 106 when measured at 25°C and 50% rh.			Meets requirements of 20 day moisture test per Mil-Std-202, Method 106. Delta C is less than 2%.		Meets requirements of 20 day moisture test per Mil-Std-202, Method 106. Delta C is less than 2%.		Meets requirements of 20 day moisture test per Mil-Std-202, Method 106. Delta C ±5%.	
VOLTAGE COEFFICIENT	Zero.			Zero.		Zero.		Less than 10% to 50 volts.	

Radiation: The completely inorganic materials used make them highly resistant to nuclear radiation. Exposures to levels of 10^{18} NVTth result in no significant change in properties.

CORNING ELECTRONICS

Houghton Park, Corning, New York 14830 / Phone 607, 962-4444

POLYSTYRENE FILM CAPACITORS

TYPE SF. ±5% Tolerance*

CAPACITANCE	ELECTRA MIDLAND PART NUMBER		
PF	50 volt	200 volt	500 volt
10	SF7-100FP50*	SF7-100FP200*	SF7-100FP500*
12	SF7-120FP50*	SF7-120FP200*	SF7-120FP500*
15	SF7-150FP50*	SF7-150FP200*	SF7-150FP500*
18	SF7-180FP50*	SF7-180FP200*	SF7-180FP500*
22	SF7-220J50	SF7-220J200	SF7-220J500
27	SF7-270J50	SF7-270J200	SF7-270J500
33	SF7-330J50	SF7-330J200	SF7-330J500
39	SF7-390J50	SF7-390J200	SF7-390J500
47	SF7-470J50	SF7-470J200	SF7-470J500
50	SF7-500J50	SF7-500J200	SF7-500J500
56	SF7-560J50	SF7-560J200	SF7-560J500
68	SF7-680J50	SF7-680J200	SF7-680J500
82	SF7-820J50	SF7-820J200	SF7-820J500
100	SF7-101J50	SF7-101J200	SF7-101J500
120	SF7-121J50	SF7-121J200	SF10-121J500
150	SF7-151J50	SF7-151J200	SF10-151J500
180	SF7-181J50	SF7-181J200	SF10-181J500
220	SF7-221J50	SF10-221J200	SF10-221J500
270	SF7-271J50	SF10-271J200	SF10-271J500
330	SF7-331J50	SF10-331J200	SF10-331J500
390	SF7-391J50	SF10-391J200	SF10-391J500
470	SF7-471J50	SF10-471J200	SF10-471J500
500	SF7-501J50	SF10-501J200	SF10-501J500
560	SF7-561J50	SF10-561J200	SF10-561J500
680	SF7-681J50	SF15-681J200	SF10-681J500
820	SF7-821J50	SF15-821J200	SF10-821J500
1,000	SF10-102J50	SF10-102J200	SF10-102J500
1,200	SF10-122J50	SF10-122J200	SF10-122J500
1,500	SF10-152J50	SF10-152J200	SF10-152J500
1,800	SF10-182J50	SF10-182J200	SF10-182J500
2,200	SF10-222J50	SF20-222J200	SF20-222J500
2,700	SF10-272J50	SF20-272J200	SF20-272J500
3,300	SF10-332J50	SF20-332J200	SF20-332J500
3,900	SF10-392J50	SF20-392J200	SF20-392J500
4,700	SF10-472J50	SF20-472J200	SF20-472J500
5,000	SF10-502J50	SF20-502J200	SF20-502J500
5,600	SF10-562J50	SF20-562J200	SF20-562J500
6,800	SF10-682J50	SF20-682J200	SF20-682J500
8,200	SF10-822J50	SF20-822J200	SF20-822J500
10,000	SF10-103J50	SF20-103J200	SF20-103J500
12,000	SF10-123J50	SF25-123J200	SF25-123J500
15,000	SF10-153J50	SF25-153J200	SF25-153J500
18,000	SF10-183J50	SF25-183J200	SF25-183J500
22,000	–	SF25-223J200	SF25-223J500
27,000	–	SF25-273J200	SF25-273J500
33,000	–	SF25-333J200	–
39,000	–	SF25-393J200	–

*Tolerance ±1PF

Temperature Range
−40°C to +85°C.

Voltage Ratings	Test Voltage
Voltage Ratings	Test Voltage
50V	a minimum
200V	of twice
500V	Working Voltage
750V	

Dissipation Factor < 0.1% at 1000Hz

Temperature Coefficient
−150 ±60 parts per million per °C.

Cyclic Stability
Better than ±0.3%
If 75°C not exceeded and better than 0.5% @ 85°C for 30V Series.

SHIELDING
The outer foil on these capacitors can be indicated by a colored end marking. This will be supplied to special order only.

Insulation Resistance > 10^5 **Megohms**

Ordering Code
This is a five-section code which will serve to identify all the main features of the capacitor.
Type No. / Finish / Wire arrangement / Capacity / Voltage.

Type No. is the letters SF followed by style number; e.g. SF7.

Capacity to be written in picofarads using standard EIA identification code. Tolerance letter follows the capacity value.
e.g. 301J = 300 PF ±5%.
302K = 3000 PF ±10%.

Voltage to be written in Working Volts D.C.
Examples:
SF5-301F20
= Size 5/300pF ±1% 20V.

Tolerances ±5% = J
±1% = F ±10% = K
±2% = G ±20% = M
with a lower limit of ±1PF = F

FLAT METALLIZED MYLAR FILM CAPACITORS

200WVDC @ 100°C 100WVDC @ 125°C

TYPE	CAPACITY IN MICROFARADS	WORKING VOLTAGE 200 V.D.C. T	W	L
WA-103	.01	.109	.171	7/16"
WA-123	.012	.125	.187	7/16"
WA-153	.015	.140	.203	7/16"
WA-183	.018	.156	.218	7/16"
WA-223	.022	.171	.234	7/16"
WA-273	.027	.187	.250	7/16"
WA-333	.033	.187	.265	7/16"
WA-393	.039	.109	.234	9/16"
WA-473	.047	.125	.250	9/16"
WA-563	.056	.140	.265	9/16"
WA-683	.068	.156	.281	9/16"
WA-823	.082	.187	.312	9/16"

TYPE	CAPACITY IN MICROFARADS	WORKING VOLTAGE 200 V.D.C. T	W	L
WA-104	.1	.203	.328	9/16"
WA-124	.12	.218	.343	9/16"
WA-154	.15	.234	.359	9/16"
WA-184	.18	.203	.343	11/16"
WA-224	.22	.218	.359	11/16"
WA-274	.27	.234	.375	11/16"
WA-334	.33	.265	.406	11/16"
WA-394	.39	.296	.453	11/16"
WA-474	.47	.343	.500	11/16"
WA-564	.56	.312	.468	15/16"
WA-684	.68	.328	.500	15/16"
WA-824	.82	.343	.546	15/16"
WA-105	1.00	.375	.562	15/16"

Ordering Code: List type; picofarads using standard EIA identification code; tolerance; and, working volts DC.

Example: WA−wrapped actual mylar
104−10,000 pf (10+0000)
K−5% tolerance
200−200 WVDC

Available Tolerances: M = ±20% K = ±10% J = ±5%

Electro Materials
NPO Chip Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to +150°C
Test frequency: 100 pf and less — 1 MHz, over 100 pf — 1 KHz
Temperature coefficient: 0 ±30 ppm/°C (EIA char. COG)
Dissipation factor: 0.15% max. @ 25°C
Insulation resistance: 100 K megohms or 1000 ohm-farads (whichever is less) @ 25°C
Test voltage: 4 x rated W. DC below 12000 pf
2.5 x rated WVDC for 12000 pf and above

E.I.A. Code

Capacitance Code examples

below 10 pf:
339 = 3.3 pf
"9" digit signifies .1 multiplier
10 pf and above:
101 = 100 pf
3rd digit signifies number of zeros

Capacitance Tolerance

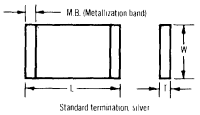
10 pf or less:
D = ±.5 pf
F = ±1.0 pf
above 10 pf:
J = ±5%
K = ±10%
M = ±20%

How to Order:

0905 EO 100 U 101 K

Type
NPO Ceramic
WVDC
Chip
Capacitance (EIA) Code
Tolerance (EIA Code)

Dimensions and Availability



Type No.	0805	0905	1505	1706	2709	3914	5918	5830	1209	1712	2221	3942
Old EMC Type	0-3	0-0	0	1	3-2	4-2	5-1	5	1-1	2	3-0	4
L(±.010")	.080"	.095"	.150"	.170"	.275"	.395"	.595"	.585"	.122"	.175"	.225"	.390"
W(±.010")	.050"	.050"	.050"	.065"	.095"	.145"	.185"	.298"	.095"	.125"	.210"	.425"
t(max)	.050"	.060"	.060"	.060"	.060"	.060"	.070"	.070"	.065"	.065"	.065"	.065"
MB(±.010")	.020"	.020"	.025"	.020"	.035"	.035"	.035"	.035"	.020"	.035"	.035"	.035"
	← RECTANGULAR TYPES →								← NEAR SQUARE TYPES →			

Capacitance in pf	Capacitance Code (EIA)	0805 WVDC 50 100 200	0905 WVDC 50 100 200	1505 WVDC 50 100 200	1706 WVDC 50 100 200	2709 WVDC 50 100 200	3914 WVDC 50 100 200	5918 WVDC 50 100 200	5830 WVDC 50 100 200	1209 WVDC 50 100 200	1712 WVDC 50 100 200	2221 WVDC 50 100 200	3942 WVDC 50 100 200
1.0	109												
2.2	229												
4.7	479												
10	100												
12	120												
15	150												
18	180												
22	220												
27	270												
33	330												
39	390												
47	470												
56	560												
68	680												
82	820												
100	101												
120	121												
150	151												
180	181												
220	221												
270	271												
330	331												
390	391												
470	471												
560	561												
680	681												
820	821												
1000	102												
1200	122												
1500	152												
1800	182												
2200	222												
2700	272												
3300	332												
3900	392												
4700	472												
5600	562												
6800	682												
8200	822												
10,000	103												
12,000	123												
15,000	153												
18,000	183												
22,000	223												

Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

Electro Materials K1200 (W5P) Chip Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to +125°C
Temperature characteristics: W5P (±10%)
Dissipation factor: 1.5% max. @ 1 KHz, 25°C
Insulation resistance: 100 K megohms or 1000 ohm-farads, whichever is less, @ 25°C
Test voltage: 4 x rated WVDC for values <0.5 μf, 2.5 x rated WVDC for 0.5 μf and above.
Tolerance available: ±5%, ±10%, ±20%

E.I.A. Code

Capacitance Code Example

333 = 33,000 pf i.e., third digit signifies number of zeros

Capacitance Tolerance Code

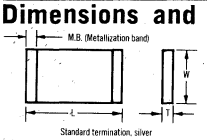
J = ±5%
K = ±10%
M = ±20%

How to Order:

0905 EL 50 U 102 K

Type
K1200 Ceramic
WVDC
Chip
Capacitance (EIA Code)
Tolerance (EIA Code)

Dimensions and Availability



Type No.	0805	0905	1505	1706	2709	3914	5918	5830	1209	1712	2221	3942
Old EMC Type	0-3	0-0	0	1	3-2	4-2	5-1	5	1-1	2	3-0	4
L(±.010")	.080"	.095"	.150"	.170"	.275"	.395"	.595"	.585"	.122"	.175"	.225"	.390"
W(±.010")	.050"	.050"	.050"	.065"	.095"	.145"	.185"	.298"	.095"	.125"	.210"	.425"
t(max)	.050"	.060"	.060"	.060"	.060"	.060"	.070"	.070"	.065"	.065"	.065"	.065"
MB(±.010")	.020"	.020"	.025"	.020"	.035"	.035"	.035"	.035"	.020"	.035"	.035"	.035"
	← RECTANGULAR TYPES →								← NEAR SQUARE TYPES →			

Capacitance in pf	Capacitance Code (EIA)	0805 WVDC 50 100 200	0905 WVDC 50 100 200	1505 WVDC 50 100 200	1706 WVDC 50 100 200	2709 WVDC 50 100 200	3914 WVDC 50 100 200	5918 WVDC 50 100 200	5830 WVDC 50 100 200	1209 WVDC 50 100 200	1712 WVDC 50 100 200	2221 WVDC 50 100 200	3942 WVDC 50 100 200
120	121	■ ■	■ ■										
150	151	■ ■	■ ■										
180	181	■ ■	■ ■										
220	221	■ ■	■ ■										
270	271	■ ■	■ ■										
330	331	■ ■	■ ■										
390	391	■ ■	■ ■										
470	471	■ ■	■ ■										
560	561	■ ■	■ ■										
680	681	■ ■	■ ■							■ ■	■ ■		
820	821	■ ■	■ ■							■ ■	■ ■		
1000	102	■ ■	■ ■							■ ■	■ ■		
1200	122	■ ■	■ ■							■ ■	■ ■		
1500	152	■ ■	■ ■							■ ■	■ ■		
1800	182	■ ■	■ ■							■ ■	■ ■		
2200	222	■ ■	■ ■							■ ■	■ ■		
2700	272	■ ■	■ ■		■					■ ■	■ ■		
3300	332	■ ■	■ ■		■					■ ■	■ ■		
3900	392	■ ■	■ ■		■					■ ■	■ ■		
4700	472	■ ■	■ ■	■		■				■ ■	■ ■		
5600	562	■ ■	■ ■	■		■				■ ■	■ ■		
6800	682	■ ■	■ ■	■		■				■ ■	■		
8200	822	■	■	■	■	■				■ ■	■		
10,000	103	■	■	■	■	■				■ ■	■		
12,000	123	■	■	■	■	■				■ ■	■		
15,000	153	■	■	■	■	■				■ ■	■		
18,000	183	■	■	■	■	■				■ ■	■	■	
22,000	223			■	■	■	■			■ ■	■	■	
27,000	273			■	■	■	■			■ ■	■	■	
33,000	333			■	■	■	■			■ ■	■	■	
39,000	393				■	■	■			■ ■	■	■	■
47,000	473				■	■	■			■ ■	■	■	■
56,000	563					■	■	■			■	■	■
68,000	683					■	■	■			■	■	■
82,000	823					■	■	■			■	■	■
100,000	104					■	■	■			■	■	■
120,000	124						■	■	■			■	■
150,000	154						■	■	■			■	■
180,000	184							■	■			■	■
220,000	224							■	■				■
270,000	274							■	■				■
330,000	334							■	■				■
390,000	394							■	■				■
470,000	474							■	■				■
560,000	564							■	■				■
680,000	684								■				■
820,000	824								■				■
1.0 μf	105												

Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

Electro Materials, Division Illinois Tool Works Inc., 11620 Sorrento Valley Road, San Diego, California 92121, Phone (714) 459-4355, TWX 910 322-1130

Electro Materials K1800 (W5R) Chip Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to +125°C
Temperature characteristics: W5R (±15%)
Dissipation factor: ≤2.5% @ 1 KHz, 25°C
Insulation resistance: 100,000 megohms or 1000 ohm-farads, whichever is less, @ 25°C
Test voltage: 4 x rated WVDC for values <0.5 μf, 2.5 x rated WVDC for 0.5 and above

E.I.A. Code

Capacitance Code Example

333 = 33,000 pf i.e., third digit signifies number of zeros

Capacitance Tolerance Code

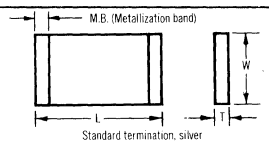
J = ±5%
K = ±10%
M = ±20%

How to Order:

0905 EM 50 U 152 K

Type
K1800 Ceramic
WVDC
Chip
Capacitance (EIA Code)
Tolerance (EIA Code)

Dimensions and Availability



Standard termination, silver

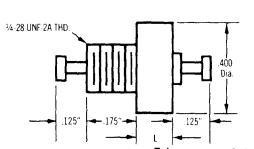
Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

Type No.	0805	0905	1505	1706	2709	3914	5918	5830	1209	1712	2221	3942
Old EMC Type	0-3	0-0	0	1	3-2	4-2	5-1	5	1-1	2	3-0	4
L(±.010″)	.080″	.095″	.150″	.170″	.275″	.395″	.595″	.585″	.122″	.175″	.225″	.390″
W(±.010″)	.050″	.050″	.050″	.065″	.095″	.145″	.185″	.298″	.095″	.125″	.210″	.425″
t(max)	.050″	.060″	.060″	.060″	.060″	.060″	.070″	.070″	.065″	.065″	.065″	.065″
MB(±.010″)	.020″	.020″	.025″	.020″	.035″	.035″	.035″	.035″	.020″	.035″	.035″	.035″
	← RECTANGULAR TYPES →								← NEAR SQUARE TYPES →			

Capacitance in pf	Capacitance Code (EIA)	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200
1000	102																											
1200	122																											
1500	152																											
1800	182																											
2200	222																											
2700	272																											
3300	332																											
3900	392																											
4700	472																											
5600	562																											
6800	682																											
8200	822																											
10,000	103																											
12,000	123																											
15,000	153																											
18,000	183																											
22,000	223																											
27,000	273																											
33,000	333																											
39,000	393																											
47,000	473																											
56,000	563																											
68,000	683																											
82,000	823																											
100,000	104																											
120,000	124																											
150,000	154																											
180,000	184																											
220,000	224																											
270,000	274																											
330,000	334																											
390,000	394																											
470,000	474																											
560,000	564																											
680,000	684																											
820,000	824																											
1.0 μf	105																											
1.2 μf	125																											

75000 Series EMC/RFI Filters

EMC has developed a new series of EMC/RFI filters for use in low-voltage circuits. A combination of these high-capacitance, low-voltage multi-layer ceramic capacitors and high-current inductors is utilized. These new filters provide more insertion loss in a smaller package than has been attainable previously. The DC resistance is the lowest of any comparable filter currently offered.



Specifications

Meets or exceeds applicable requirements of MIL-F-15733
Operating temperature: −55°C to +125°C
Operating temperature: −55°C 125°C
Dielectric strength: 100 VDC @ 25°C (50 ma max. charging current)
Working voltage: 50 VDC @ 85°C — 35 VDC @ 105°C — 28 VDC @ 125°C
Insulation resistance: 100 megohms min. @ 25°C — after 2 minutes @ 50 VDC (50 ma max. charging current)

Electro Materials, Division Illinois Tool Works Inc., 11620 Sorrento Valley Road, San Diego, California 92121, Phone (714) 459-4355, TWX 910 322-1130

Electro Materials Axial Lead Tubular NPO (COG) Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to +150°C
Test frequency: 100 pf and less — 1 MHz, over 100 pf — 1 KHz
Temperature coefficient: 0 ±30 ppm/°C (EIA char. COG)
Dissipation factor: 0.15% max. @ 25°C
Insulation resistance: 100 K megohms or 1000 ohm-farads (whichever is less) @ 25°C
Test voltage: 4 x rated WVDC below 12000 pf
2.5 x rated WVDC for 12000 pf and above

E.I.A. Code

Capacitance Code Examples

below 10 pf:
339 = 3.3 pf
"9" digit signifies .1 multiplier
10 pf and above:
101 = 100 pf
3rd digit signifies number of zeros

Capacitance Tolerance

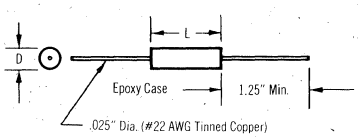
10 pf or less:
D = ±.5pf
F = ±1.0 pf
above 10 pf:
J = ±5%
K = ±10%
M = ±20%

How to Order:

203 EO 200 AT 331 J

Type
NPO Ceramic
WVDC
Axial Tubular
Capacitance (EIA Code)
Tolerance (EIA Code)

Dimensions and Availability



Type No.	202	202 Extended Range	203	205	206	207	208	209
Old EMC Type No.	A	A	B	D	E	F	G	H
L(±.015")	.250"	.255"	.390"	.500"	.500"	.690"	.690"	.690"
D(±.015")	.090"	.100"	.140"	.200"	.250"	.250"	.350"	.480"

Capacitance in pf	Capacitance Code (EIA)	202 WVDC 50 100 200	202 Ext. WVDC 50 100 200	203 WVDC 50 100 200	205 WVDC 50 100 200	206 WVDC 50 100 200	207 WVDC 50 100 200	208 WVDC 50 100 200	209 WVDC 50 100 200
1.0	109	■ ■ ■							
2.2	229	■ ■ ■							
4.7	479	■ ■ ■							
10	100	■ ■ ■							
12	120	■ ■ ■							
15	150	■ ■ ■							
18	180	■ ■ ■							
22	220	■ ■ ■							
27	270	■ ■ ■							
33	330	■ ■ ■							
39	390	■ ■ ■							
47	470	■ ■ ■							
56	560	■ ■ ■							
68	680	■ ■ ■							
82	820	■ ■ ■							
100	101	■ ■		■					
120	121	■ ■		■					
150	151	■ ■		■					
180	181	■ ■		■					
220	221	■ ■		■					
270	271	■ ■		■					
330	331	■ ■		■					
390	391	■	■	■	■				
470	471	■	■	■	■				
560	561	■	■	■	■				
680	681		■	■	■				
820	821		■	■	■				
1000	102		■	■	■				
1200	122			■	■				
1500	152			■	■				
1800	182			■	■	■			
2200	222			■	■	■			■
2700	272		■	■	■		■		
3300	332				■				
3900	392				■			■	
4700	472				■				
5600	562				■			■	
6800	682				■	■		■	
8200	822				■	■			■
10,000	103				■	■			■
12,000	123						■		■
15,000	153					■		■	■
18,000	183					■		■	
22,000	223						■	■	
27,000	273							■	■
33,000	333							■	■
39,000	393							■	■
47,000	473								■
56,000	563								■ ■
68,000	683								■
82,000	823								■
100,000	104								■
120,000	124								■

Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

Electro Materials, Division Illinois Tool Works Inc., 11620 Sorrento Valley Road, San Diego, California 92121, Phone (714) 459-4355, TWX 910 322-1130

Electro Materials Axial Lead Tubular K1200 (W5P) Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to x 125°C
Temperature characteristics: W5P (±10%)
Dissipation factor: 1.5% max. @ 1 KHz, 25°C
Insulation resistance: 100 K megohms or 1000 ohm-farads, whichever is less, at 25°C
Test voltage: 4 x rated WVDC for value <0.5 μf, 2.5 x rated WVDC for 0.5 μf and above.
Tolerance available: ±5%, ±10%, ±20%

E.I.A. Code

Capacitance Code Example

333 = 33,000 pf i.e., third digit signifies number of zeros

Capacitance Tolerance Code

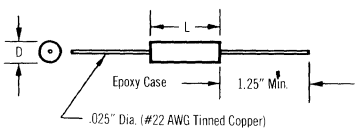
J = ±5%
K = ±10%
M = ±20%

How to Order:

203 EL 100 AT 333 K

Type
K1200 Ceramic
WVDC
Axial Tubular
Capacitance (EIA Code)
Tolerance (EIA Code)

Dimensions and Availability



Type No.	202	202 Extended Range	203	205	206	207	208	209
Old EMC Type No.	A	A	B	D	E	F	G	H
L(±.015")	.250"	.255"	.390"	.500"	.500"	.690"	.690"	.690"
D(±.015")	.090"	.100"	.140"	.200"	.250"	.250"	.350"	.480"

Capacitance in pf	Capacitance Code (EIA)	202 WVDC 50 100 200	202 Extended Range WVDC 50 100 200	203 WVDC 50 100 200	205 WVDC 50 100 200	206 WVDC 50 100 200	207 WVDC 50 100 200	208 WVDC 50 100 200	209 WVDC 50 100 200
120	121								
150	151								
180	181								
220	221								
270	271								
330	331								
390	391								
470	471								
560	561								
680	681								
820	821								
1000	102								
1200	122								
1500	152								
1800	182								
2200	222								
2700	272								
3300	332								
3900	392								
4700	472								
5600	562								
6800	682								
8200	822								
10,000	103								
12,000	123								
15,000	153								
18,000	183								
22,000	223								
27,000	273								
33,000	333								
39,000	393								
47,000	473								
56,000	563								
68,000	683								
82,000	823								
100,000	104								
120,000	124								
150,000	154								
180,000	184								
220,000	224								
270,000	274								
330,000	334								
390,000	394								
470,000	474								
560,000	564								
680,000	684								
820,000	824								
1.0 mfd	105								
1.5 mfd	155								
2.2 mfd	225								
3.3 mfd	335								
4.7 mfd	475								

Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

Electro Materials Axial Lead Tubular K1800 (W5R) Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to +125°C
Temperature characteristics: W5R (±15%)
Dissipation factor: ≤2.5% @ 1 KHz, 25°C
Insulation resistance: 100,000 megohms or 1000 ohm-farads whichever is less, @ 25°C
Test voltage: 4 x rated WVDC for values <0.5 μf, 2.5 x rated WVDC for 0.5 and above

E.I.A. Code

Capacitance Code Example

333 = 33,000 pf i.e., third digit signifies number of zeros

Capacitance Tolerance Code

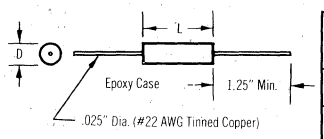
J = ±5%
K = ±10%
M = ±20%

How to Order:

203 EM 100 AT 333 K

Type
K1800 Ceramic
WVDC
Axial Tubular
Capacitance (EIA Code)
Tolerance (EIA Code)

Dimensions and Availability



Type No.	202	202 Extended Range	203	205	206	207	208	209
Old EMC Type No.	A	A	B	D	E	F	G	H
L(±.015")	.250"	.255"	.390"	.500"	.500"	.690"	.690"	.690"
D(±.015")	.090"	.100"	.140"	.200"	.250"	.250"	.350"	.480"

Capacitance in pf	Capacitance Code (EIA)	202 WVDC 50 100 200	202 Extended Range WVDC 50 100 200	203 WVDC 50 100 200	205 WVDC 50 100 200	206 WVDC 50 100 200	207 WVDC 50 100 200	208 WVDC 50 100 200	209 WVDC 50 100 200
1000	102	■ ■ ■							
1200	122	■ ■ ■							
1500	152	■ ■ ■							
1800	182	■ ■ ■							
2200	222	■ ■ ■							
2700	272	■ ■ ■							
3300	332	■ ■ ■							
3900	392	■ ■ ■							
4700	472	■ ■ ■							
5600	562	■ ■ ■							
6800	682	■ ■		■					
8200	822	■ ■		■					
10,000	103	■ ■		■					
12,000	123	■ ■		■					
15,000	153	■ ■		■					
18,000	183	■ ■		■					
22,000	223	■ ■		■					
27,000	273	■	■	■	■				
33,000	333	■		■	■				
39,000	393	■		■	■				
47,000	473		■	■	■				
56,000	563		■	■	■				
68,000	683			■	■				
82,000	823			■	■				
100,000	104			■	■	■			
120,000	124			■	■	■			
150,000	154			■	■	■			
180,000	184				■		■		
220,000	224				■			■	
270,000	274				■			■	
330,000	334				■			■	
390,000	394				■	■		■	
470,000	474				■	■			■
560,000	564				■	■			■
680,000	684						■		■
820,000	824							■	■
1.0 mfd	105					■			■
1.5 mfd	155						■		
2.2 mfd	225							■	■
3.3 mfd	335								■ ■
4.7 mfd	475								■
6.8 mfd	685								

Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

Electro Materials
Radial Lead
NPO (COG) Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to +150°C
Test frequency: 100 pf and less — 1 MHz, over 100 pf — 1 KHz
Temperature coefficient: 0 ±30 ppm/°C (EIA char. COG)
Dissipation factor: 0.15% max. @ 25°C
Insulation resistance: 100 K megohms or 1000 ohm-farads (whichever is less) @ 25°C
Test voltage: 4 x rated WVDC below 12000 pf
2.5 x rated WVDC for 12000 pf and above

E.I.A. Code

Capacitance Code examples

below 10 pf:
339 = 3.3 pf
"9" digit signifies .1 multiplier
10 pf and above:
101 = 100 pf
3rd digit signifies number of zeros

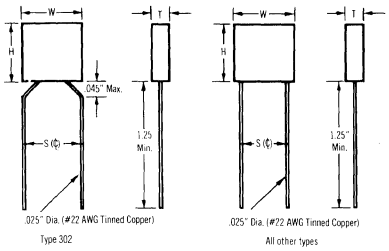
Capacitance Tolerance

10 pf or less:
D = ±.5 pf
F = ±1.0 pf
above 10 pf:
J = ±5%
K = ±10%
M = ±20%

How to Order:

303 EO 200 RC 681 J

Type
NPO Ceramic
WVDC
Radial Case
Capacitance (EIA Code)
Tolerance (EIA Code)



Dimensions and Availability

Type No.	302	302 Extended Range	303	303 Extended Range	304	305	306	307
EMC Old Type	I	I	J	J	O	K	L	M
H(±.015″)	.190″	.190″	.290″	.290″	.400″	.500″	.500″	.500″
W(±.015″)	.190″	.190″	.290″	.290″	.400″	.500″	.500″	.500″
T(±.015″)	.090″	.090″	.090″	.090″	.150″	.150″	.250″	.500″
S(±.015″)	.200″	.200″	.200″	.200″	.300″	.400″	.400″	.400″

Capacitance in pf	Capacitance Code (EIA)	302 WVDC 50	100	200	302 Ext. WVDC 50	100	200	303 WVDC 50	100	200	303 Ext. WVDC 50	100	200	304 WVDC 50	100	200	305 WVDC 50	100	200	306 WVDC 50	100	200	307 WVDC 50	100	200
10	100																								
12	120																								
15	150																								
18	180																								
22	220																								
27	270																								
33	330																								
39	390																								
47	470																								
56	560																								
68	680																								
82	820																								
100	101																								
120	121																								
150	151																								
180	181																								
220	221																								
270	271																								
330	331																								
390	391																								
470	471																								
560	561																								
680	681																								
820	821																								
1000	102																								
1200	122																								
1500	152																								
1800	182																								
2200	222																								
2700	272																								
3300	332																								
3900	392																								
4700	472																								
5600	562																								
6800	682																								
8200	822																								
10,000	103																								
12,000	123																								
15,000	153																								
18,000	183																								
22,000	223																								
27,000	273																								
33,000	333																								
39,000	393																								
47,000	473																								
56,000	563																								
68,000	683																								
82,000	823																								
100,000	104																								
120,000	124																								

Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

Electro Materials
Radial Lead
K1200 (W5P) Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to +125°C
Temperature characteristics: W5P (±10%)
Dissipation factor: 1.5% max. @ 1 KHz, 25°C
Insulation resistance: 100 K megohms or 1000 ohm-farads, whichever is less, @ 25°C
Test voltage: 4 x rated WVDC for values <0.5 μf, 2.5 x rated WVDC for 0.5 μf and above
Tolerances available: ±5%, ±10%, ±20%

E.I.A. Code

Capacitance Code Example

333 = 33,000 pf i.e., third digit signifies number of zeros

Capacitance Tolerance Code

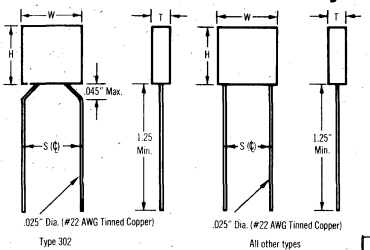
J = ±5%
K = ±10%
M = ±20%

How to Order:

303 EL 200 RC 223 K

Type
K1200 Ceramic
WVDC
Radial Case
Capacitance (EIA Code)
Tolerance (EIA Code)

Dimensions and Availability



Type No.	302	302 Extended Range	303	303 Extended Range	304	305	306	307
EMC Old Type	I	I	J	J	O	K	L	M
H(±.015″)	.190″	.190″	.290″	.290″	.400″	.500″	.500″	.500″
W(±.015″)	.190″	.190″	.290″	.290″	.400″	.500″	.500″	.500″
T(±.015″)	.090″	.090″	.090″	.090″	.150″	.150″	.250″	.500″
S(±.015″)	.200″	.200″	.200″	.200″	.300″	.400″	.400″	.400″

Capacitance in pf	Capacitance Code (EIA)	302 WVDC 50	100	200	302 Ext. WVDC 50	100	200	303 WVDC 50	100	200	303 Ext. WVDC 50	100	200	304 WVDC 50	100	200	305 WVDC 50	100	200	306 WVDC 50	100	200	307 WVDC 50	100	200
120	121	■	■	■																					
150	151	■	■	■																					
180	181	■	■	■																					
220	221	■	■	■																					
270	271	■	■	■																					
330	331	■	■	■																					
390	391	■	■	■																					
470	471	■	■	■																					
560	561	■	■	■																					
680	681	■	■	■																					
820	821	■	■	■																					
1000	102	■	■	■																					
1200	122	■	■	■																					
1500	152	■	■	■																					
1800	182	■	■	■																					
2200	222	■	■	■																					
2700	272	■	■	■																					
3300	332	■	■	■																					
3900	392	■	■	■																					
4700	472	■	■	■																					
5600	562	■	■	■																					
6800	682	■	■				■			■															
8200	822	■	■				■			■															
10,000	103	■	■							■															
12,000	123	■	■							■															
15,000	153	■	■							■															
18,000	183	■	■							■															
22,000	223	■				■			■	■															
27,000	273	■				■			■	■															
33,000	333	■				■			■	■															
39,000	393	■							■				■			■									
47,000	473	■							■							■									
56,000	563				■			■	■							■									
68,000	683				■			■	■							■									
82,000	823				■			■	■							■									
100,000	104							■	■							■									
120,000	124							■	■							■									
150,000	154							■				■			■			■							
180,000	184							■							■			■							
220,000	224							■							■			■							
270,000	274							■							■						■				
330,000	334										■				■						■				
390,000	394														■	■					■				
470,000	474														■	■									■
560,000	564														■			■							■
680,000	684														■			■							■
820,000	824														■			■							■
1.0 mfd	105														■						■				
1.5 mfd	155																■				■				
2.2 mfd	225																				■			■	
3.3 mfd	335																							■	
4.7 mfd	475																							■	

Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

Electro Materials
Radial Lead
K1800 (W5R) Capacitors

Distributed and stocked by COMPAR

Specifications

Temperature range: −55°C to +125°C
Temperature characteristics: W5R (±15%)
Dissipation factor: ≤2.5% @ 1 KHz, 25°C
Insulation resistance: 100,000 megohms or 1000 ohm-farads, whichever is less, @ 25°C
Test voltage: 4 x rated WVDC for values <0.5 μf, 2.5 x rated WVDC for 0.5 and above

E.I.A. Code

Capacitance Code Example

333 = 33,000 pf i.e., third digit signifies number of zeros

Capacitance Tolerance Code

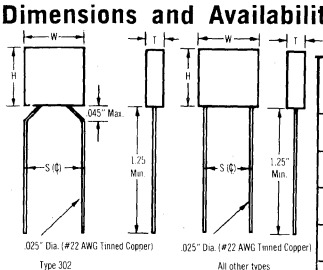
J = ±5%
K = ±10%
M = ±20%

How to Order:

303 EM 200 RC 103 K

Type
K1800 Ceramic
WVDC
Radial Case
Capacitance (EIA Code)
Tolerance (EIA Code)

Dimensions and Availability



Type No.	302	302 Extended Range	303	303 Extended Range	304	305	306	307
EMC Old Type	I	I	J	J	O	K	L	M
H(±.015″)	.190″	.190″	.290″	.290″	.400″	.500″	.500″	.500″
W(±.015″)	.190″	.190″	.290″	.290″	.400″	.500″	.500″	.500″
T(±.015″)	.090″	.090″	.090″	.090″	.150″	.150″	.250″	.500″
S(±.015″)	.200″	.200″	.200″	.200″	.300″	.400″	.400″	.400″

Capacitance in pf	Capacitance Code (EIA)	302 WVDC 50	100	200	302 Ext. WVDC 50	100	200	303 WVDC 50	100	200	303 Ext. WVDC 50	100	200	304 WVDC 50	100	200	305 WVDC 50	100	200	306 WVDC 50	100	200	307 WVDC 50	100	200
1000	102	■	■	■																					
1200	122	■	■	■																					
1500	152	■	■	■																					
1800	182	■	■	■																					
2200	222	■	■	■																					
2700	272	■	■	■																					
3300	332	■	■	■																					
3900	392	■	■	■																					
4700	472	■	■	■																					
5600	562	■	■	■																					
6800	682	■	■	■																					
8200	822	■	■	■																					
10,000	103	■	■	■			■			■															
12,000	123	■	■	■			■			■															
15,000	153	■	■	■			■			■															
18,000	183	■	■	■			■			■															
22,000	223	■	■	■			■			■															
27,000	273	■	■	■			■			■															
33,000	333	■	■	■		■	■		■	■															
39,000	393	■	■	■		■	■		■	■															
47,000	473	■	■	■		■	■		■	■															
56,000	563	■	■	■		■	■		■	■			■			■									
68,000	683	■	■	■		■	■		■	■			■			■									
82,000	823				■	■	■	■	■	■			■			■									
100,000	104				■	■	■	■	■	■			■			■									
120,000	124				■	■	■	■	■	■			■			■									
150,000	154				■	■	■	■	■	■			■			■									
180,000	184				■	■	■	■	■	■			■			■			■						
220,000	224				■	■	■	■	■	■		■	■			■			■						
270,000	274				■	■	■	■	■	■		■	■			■			■						
330,000	334															■						■			
390,000	394										■	■	■	■	■	■						■			
470,000	474										■	■	■	■	■	■						■			
560,000	564										■	■	■	■	■	■						■			
680,000	684													■	■	■									■
820,000	824													■	■	■		■	■						■
1.0 mfd	105													■	■	■		■	■						■
1.5 mfd	155																■	■	■		■	■			
2.2 mfd	225																■	■	■		■	■			
3.3 mfd	335																	■	■		■	■		■	■
4.7 mfd	475																						■		
6.8 mfd	685																						■		

Note: Case sizes shown are at recommended voltage and temperature stress levels. For smaller case sizes at higher stress levels, contact factory.

For Capacitors with GREATER RELIABILITY . . .

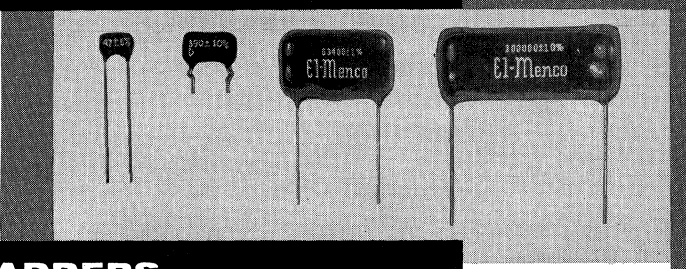
Choose El-Menco

The Capacitors You Find Wherever There's Electronics!

EL-MENCO DUR-MICA CAPACITORS

Only 1 Failure Per 43,000,000 Unit-Hours!

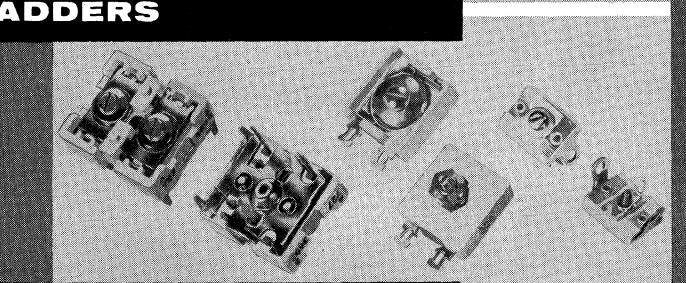
- It has been computed that "debugged" DM30, 10,000 MMF units, when subjected to 257,000 hours of life at 85°C with 100% of the rated DC voltage applied, will yield only 1 FAILURE PER 43,000,000 UNIT-HOURS!
- DM15, DM16, DM19, DM20 . . . perfect for miniaturization and for new designs using printed wiring circuits. Also available in DM30, DM42 and DM43.
- New "hairpin" parallel leads insure easy application.
- Exceed all electrical requirements of military specification MIL-C-5A.



EL-MENCO TRIMMERS & PADDERS

Design Versatility!

- Available in 350 VDC and 500 VDC as well as other test voltages.
- All bases are of low-loss steatite.
- Special lugs are obtainable for printed circuitry.
- Miniature units are available.
- Solder Lugs can be bent in any position without affecting the capacity setting due to the rigid construction.
- Various types of mounting brackets are available for all trimmers.
- Units can be constructed for special applications.

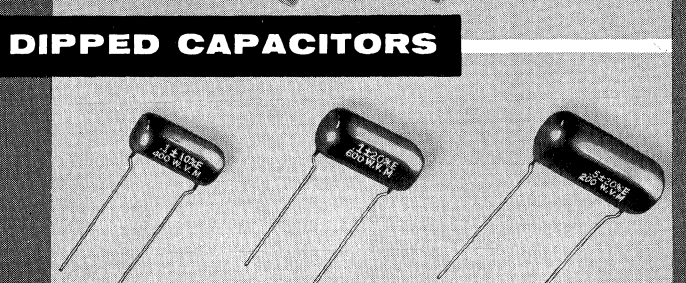


EL-MENCO *MYLAR-PAPER DIPPED CAPACITORS

Only 1 Failure in 14,336,000 Unit-Hours!

- Life tests at 105°C with rated voltage applied have yielded only 1 FAILURE PER 1,433,600 UNIT-HOURS for 1 MFD. Since the number of unit-hours for these capacitors is inversely proportional to the capacitance, 0.1 MFD Mylar-Paper Dipped capacitors will yield only 1 FAILURE PER 14,336,000 UNIT-HOURS!
- Working volts DC: 200, 400, 600, 1000 and 1600.
- Durez phenolic resin impregnated.
- Tolerances: ± 10% and ± 20% (closer tolerances available).
- Dielectric strength: 2 or 2½ times rated voltage, depending upon working voltage.
- Exceed all electrical requirements of E.I.A. specification RS-164 and military specifications MIL-C-91A and MIL-C-25A.

*Registered Trademark of DuPont Co.

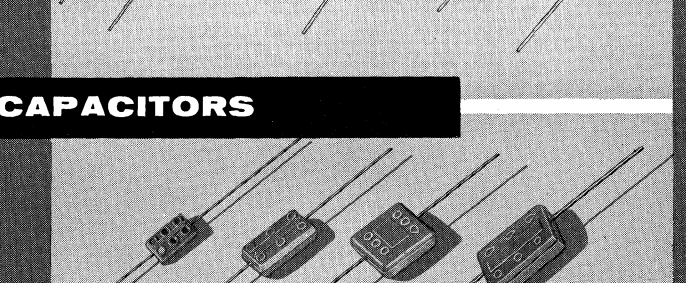


EL-MENCO MOLDED MICA CAPACITORS

Superior Performance!

- Unmatched for excellent stability, dielectric strength, high insulation resistance, extremely high "Q" and correspondingly low power factor.
- Units can be subjected to a short "debugging" life test at elevated voltage and temperature for removal of early life failures and for improved reliability.

Write for Free Samples and Booklets on Any of The Above Capacitors



EL-MENCO OFFERS A COMPLETE LINE OF CAPACITORS . . . STANDS READY TO SERVE ALL YOUR CAPACITOR NEEDS

THE ELECTRO MOTIVE MFG. CO., INC.

WILLIMANTIC, CONNECTICUT

Dipped Mica • Molded Mica • Silvered Mica Films • Mica Trimmers & Padders
Mylar-Paper Dipped • Paper Dipped • Mylar Dipped • Tubular Paper

MANUFACTURERS OF El-Menco Capacitors

West Coast Manufacturers contact: **COLLINS & HYDE CO.**, 900 N. San Antonio Rd., Los Altos, California 94022
5380 Whittier Blvd., Los Angeles, California 90022

ALSO SOLD NATIONALLY THROUGH ELECTRONIC PARTS DISTRIBUTORS

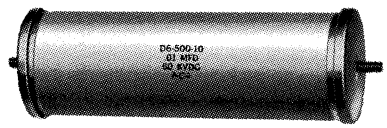
fci FILM CAPACITORS, INC.

HERMETICALLY SEALED TUBULAR CAPACITORS



Type MD4	Metallized polyester film
Type D4	Polyester film
Type ME4	Metallized polycarbonate film
Type E4	Polycarbonate film
Type A4	Polystyrene film
Type C4	Teflon film

TYPE D6 Available to 60,000 VDC



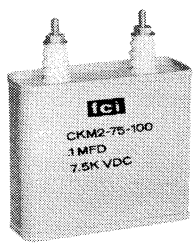
Type D6 Capacitors were designed to assure reliable operation where space is at a premium. The steatite hermetic housing allows for operation under extreme humidity. These capacitors are of extended foil and short lead construction which keeps the inductance to minimum and produces a very high ringing frequency, so desirable for energy storage and pulse capacitors. Specify D6H for 125°C operation.

EPOXY-CASE, RECTANGULAR CAPACITORS, AXIAL LEAD



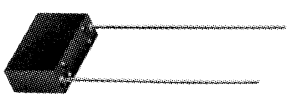
Type ME13	Metallized polycarbonate film
Type MD13	Metallized polyester film
Type D13	Polyester film
Type E13	Polycarbonate film
Type A13	Polystyrene film

TYPE CKM2 Available to 50,000 VDC



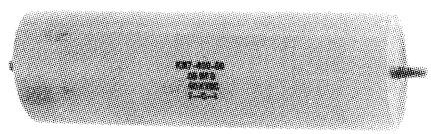
Type CKM2 Capacitors have been designed specifically to meet the need for smaller and more reliable capacitors that will withstand the severe operating conditions encountered in military and industrial electronic power equipment. Rectangular CP70 style cases with solder seal terminals are used to assure a true hermetic seal. Finish is gray lacquer over prime coat. CP07 brackets are available upon request. Specify CKMH for 125°C operation.

EPOXY-CASE, RECTANGULAR CAPACITORS, RADIAL LEAD



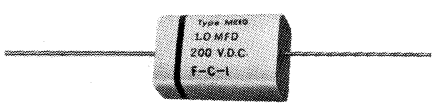
Type ME14	Metallized polycarbonate film
Type MD14	Metallized polyester film
Type D14	Polyester film
Type E14	Polycarbonate film
Type A14	Polystyrene film

TYPE KM7 Available to 150,000 VDC



Type KM7 Capacitors are housed in cylindrical electrical grade phenolic tubes with ¼-20 x ⅞ bolts for terminations. Corona is held to an absolute minimum by the internal construction of the capacitor elements and the elimination of most metals. These capacitors are ideal for use in X-Ray equipment, high voltage power supplies, energy storage etc.

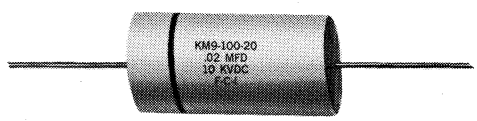
WRAP-AND-FILL OVAL CAPACITORS



Type ME10	Metallized polycarbonate film
Type E10	Polycarbonate film
Type MD10	Metallized polyester film
Type D10	Polyester film
Type A10	Polystyrene film

Add "R" to specify round configuration

TYPE KM9 Available to 12,500 VDC



These popular and economical capacitors were designed primarily for use as filters for power supplies used in electrostatic copiers and precipitators. They are housed in specially treated plastic tubes and end filled with epoxy resin. Copperweld leads are used for convenient terminations. Will meet the humidity requirements of EIA Specification RS-164 with 500 hours exposure at 95% relative humidity and +40°C temperature.

Our unique capability can fulfill your requirement for special designs. A complete file of engineering bulletins is available on all of the above types.

fci FILM CAPACITORS, INC.

100 EIGHTH STREET, PASSAIC, N. J. 07055 • TEL: (201) 779-2240

FILM CAPACITORS

F-DYNE quality film capacitors are designed and manufactured to provide optimum electrical characteristics with reliable performance.

The smallest housing that has been developed to date, providing superior performance, is the thermo Mylar® tape wrap. It adds approximately .010" to the diameter of the winding and is capable of meeting all MIL-C-27287 requirements including moisture resistance, vibration, insulation resistance, etc.

F-DYNE capacitors are made with copperweld leads electrically welded to aluminum foil. No high series resistance or high power factor problems are ever encountered with this construction. Even if the leads are cut very short and then soldered into your application with an extra hot soldering iron, the lead connection to the foil will not be affected. In fact, the end of the lead can be burned off with a gas torch flame without effecting the power factor or series resistance. Metallized Mylar, Metallized Polycarbonate and tin lead foil Polystyrene capacitors are the only F-Dyne Capacitors that are made in the conventional manner with leads soldered to the foil. Normal care should be taken when soldering these capacitors into your circuits.

THREE BASIC FILMS ARE USED IN F-DYNE CAPACITORS:

- MYLAR
- POLYCARBONATE
- POLYSTYRENE

ELECTRICAL & MECHANICAL CHARACTERISTICS

All F-Dyne capacitors pass the following requirements.

A. **Dielectric Strength**
F-Dyne quality capacitors will pass a life test at 140% of their DC rated voltage. In addition, they are designed to withstand a voltage of 200% of their rated DC voltage for one minute without any interruption or damage.

B. **Capacitance Tolerance**
When measured at a frequency of 1000 cps at 25°C, capacity will be within the specified tolerance. See charts for variation with temperature and frequency. The standard tolerances are ±½%, 1%, 2%, 5%, 10%. Other tolerances, closer and wider, are available.

C. **Lead Strength**
F-Dyne capacitor leads withstand a five pound pull for a full minute.

D. **Lead Flexibility**
Leads are designed to have full flexibility to insure maximum use without danger of damage or fatigue failure.

E. **% Dissipation factor @ 1000 cps and 25°C**

	FOIL		METALLIZED	
Type	Typical	Spec. limit	Typical	Spec. limit
Mylar	.45	1%	.55	1%
Polycarbonate	.05	.3	.15	.3
Polystyrene	.03	.1	—	—

Note: Capacitors over 5mfd. are tested at 60 cycles.

F. **Insulation Resistance (Megohms x Microfarads)**

	FOIL		NEED NOT EXCEED	METALLIZED		NEED NOT EXCEED
Type	Typical	Spec. limit	Megohms	Typical	Spec. limit	Megohms
Mylar	100,000	50,000	100,000	50,000	25,000	50,000
Polycarbonate	400,000	75,000	500,000	80,000	30,000	150,000
Polystyrene	800,000	100,000	500,000	—	—	—

The above values are read after a two-minute charge at rated voltage at 25°C.

G. **Humidity Resistance**
All foil capacitors meet requirements of MIL-C-27287. Metallized capacitors will exceed requirements of E.I.A. specifications RS-164.

H. **Voltage temperature derating**
All Mylar and Polycarbonate capacitors are rated at 85°C for continuous operation. If ambient temperatures higher than 85°C are encountered, in order to realize the normal life expectancy of the capacitor, the voltage must be derated as follows:

85°C	95°C	105°C	115°C	125°C
80	68	58	48	40
100	88	75	62	50
200	170	140	120	100
400	335	285	240	200

POLYSTYRENE
Standard—Type T

Capacitance	100 Volts Dimensions	Lead AWG	200 Volts Dimensions	Lead AWG	400 Volts Dimensions	Lead AWG
.001	.187 x ½	24	.187 x ½	24	.187 x ½	24
.0015	.187 x ½	24	.187 x ½	24	.187 x ½	24
.0022	.187 x ½	24	.187 x ½	24	.187 x ½	24
.0027	.187 x ½	24	.187 x ½	24	.187 x ½	24
.0033	.187 x ½	24	.187 x ½	24	.203 x ½	24
.0039	.187 x ½	24	.187 x ½	24	.219 x ⅝	24
.0047	.187 x ½	24	.187 x ½	24	.234 x ⅝	24
.0056	.187 x ½	24	.187 x ½	24	.250 x ⅝	24
.0068	.187 x ½	24	.203 x ⅝	24	.234 x ¾	24
.0087	.203 x ½	24	.219 x ⅝	24	.250 x ¾	24
.01	.219 x ½	24	.234 x ⅝	24	.281 x ¾	22
.015	.250 x ½	24	.250 x ¾	24	.328 x ¾	22
.022	.219 x ⅝	24	.281 x ¾	22	.343 x ⅞	22
.027	.250 x ⅝	24	.312 x ¾	22	.375 x ⅞	22
.033	.265 x ⅝	22	.343 x ¾	22	.406 x ⅞	22
.039	.296 x ⅝	22	.375 x ¾	22	.453 x ⅞	20
.047	.296 x ¾	22	.359 x ⅞	22	.453 x 1⅛	20
.056	.343 x ¾	22	.390 x ⅞	22	.484 x 1⅛	20
.068	.296 x ⅞	22	.421 x ⅞	22	.484 x 1¼	20
.082	.343 x ⅛	22	.421 x 1	22	.531 x 1¼	20
.1	.406 x ⅞	22	.468 x 1	20	.578 x 1¼	20
.12	.437 x ⅞	22	.515 x 1	20	.625 x 1¼	20
.15	.437 x 1	22	.531 x 1¼	20		
.18	.468 x 1	20	.578 x 1¼	20		
.27	.500 x 1¼	20	.625 x 1¼	20		
.33	.562 x 1¼	20	.671 x 1½	20		
.39	.625 x 1¼	20	.718 x 1½	20		
.47	.687 x 1¼	20	.750 x 1 5/16	20		
.68	.750 x 1½	20				
1.00	.875 x 1½	18				

LENGTH TOLERANCE	DIAMETER TOLERANCE	LEAD
+.046 −.094	.249 & under ±.032 .250 to .500 ±.046 .501 & over ±.062	Copperweld 100% tin coating Length 2.000 ±.125

GENERAL APPLICATION INFORMATION

SIZE AND PRICES of the three dielectrics vary in the following order.

1. Mylar least expensive and smallest.
2. Polycarbonate approximately 12% larger than mylar and more expensive.
3. Polystyrene approximately three times as large as Mylar and most expensive of the three dielectrics.

COST AND SIZE

For each of the three dielectrics there are size and price variations.
Standard — least expensive Small — more expensive
Miniature — most expensive

In applications where none of the above types can be used because space is limited, F-Dyne supplies metallized foil capacitors for both the Mylar and Polycarbonate dielectrics. These again vary as follows:
Standard — least expensive Small — more expensive
Miniature — most expensive

F-DYNE ELECTRONICS CO.
1700 POST ROAD, FAIRFIELD, CONN. 06430 AREA 203 259-7804

MYLAR DIMENSIONS

MYLAR—Aluminum Foil, Standard Size Type A

Capacitance	100 V Dia.-Lgth.	Lead AWG	200 V Dia.-Lgth.	Lead AWG	400 V Dia.-Lgth.	Lead AWG
.001 to .010	187x ½	24	.187x ½	24	.187x ½	24
.015	.187x ½	24	.187x ½	24	.218x ½	24
.022	.203x ½	24	.203x ½	24	.250x ¾	24
.033	.218x ½	24	.218x ½	24	.296x ¾	22
.039	.218x ⅝	24	.218x ⅝	24	.265x ⅞	22
.047	.234x ⅝	24	.234x ⅝	24	.281x ⅞	22
.056	.250x ⅝	24	.250x ⅝	24	.312x ⅞	22
.068	.265x ⅝	22	.265x ⅝	22	.328x ⅞	22
.082	.296x ⅝	22	.296x ⅝	22	.359x1	22
.10	.281x ¾	22	.281x ¾	22	.390x1	22
.12	.296x ¾	22	.296x ¾	22	.343x1¼	22
.15	.328x ¾	22	.328x ¾	22	.375x1¼	22
.18	.296x1	22	.375x1	22	.406x1¼	22
.22	.328x1	22	.406x1	22	.437x1¼	22
.27	.343x1⅛	22	.453x1⅛	20	.468x1 1/16	20
.33	.375x1⅛	22	.484x1⅛	20	.500x1 1/16	20
.39	.406x1⅛	22	.437x1¼	20	.546x1 1/16	20
.47	.406x1¼	22	.484x1¼	20	.609x1 1/16	20
.56	.453x1¼	20	.531x1¼	20		
.68	.484x1¼	20	.453x1 1/16	20		
.82	.515x1¼	20	.500x1 1/16	20		
1.00	.515x1½	20	.562x1 1/16	20		
1.25	.562x1½	20	.625x1 1/16	20		
1.50	.593x1 1/16	20	.671x1 1/16	20		
1.80	.656x1 1/16	20	.734x1 1/16	20		
2.00	.687x1 1/16	20	.750x1 1/16	20		

LENGTH TOLERANCE	DIAMETER TOLERANCE	LEAD
+.046 −.094	.249 & under ±0.32 .250 to .500 ±.046 .501 & over ±.062	Copperweld 100% tin coating Length 2.000 ±.125

METALLIZED MYLAR—Standard Size Type D

Capacitance	100 & 200 Volts Dia.-Length	Lead AWG	400 Volts Dia.-Length	Lead AWG
.033			.250 x .687	22
.039			.281 x .687	22
.047			.296 x .687	22
.056			.312 x .687	22
.068			.343 x .687	20
.082			.343 x .812	20
.1	.265 x .500	22	.375 x .812	20
.12	.281 x .500	22	.406 x .812	20
.15	.312 x .500	22	.375 x 1.062	20
.18	.296 x .625	22	.406 x 1.062	20
.22	.312 x .625	22	.437 x 1.062	20
.27	.359 x .625	22	.437 x 1.187	20
.33	.281 x .875	22	.484 x 1.187	20
.39	.312 x .875	22	.531 x 1.187	20
.47	.343 x .875	20	.468 x 1.562	20
.56	.375 x .875	20	.500 x 1.562	20
.68	.421 x .875	20	.562 x 1.562	20
.82	.390 x 1.187	20	.625 x 1.562	20
1.00	.421 x 1.187	20	.687 x 1.562	20
1.50	.500 x 1.187	20	.750 x 1.875	20
2.00	.578 x 1.187	20	.875 x 1.875	18
3.00	.593 x 1.562	20		
4.00	.687 x 1.562	20		
5.00	.750 x 1.562	20		
6.00	.750 x 1.875	20		
8.00	.875 x 1.875	18		
10.00	1.000 x 1.875	18		

LENGTH TOLERANCE	DIAMETER TOLERANCE	LEAD
+.046 −.094	.249 & under ±.032 .250 to .50 ±.046 .501 & over ±.062	Copperweld solder coating Length 2.000 ±.125

METALLIZED MYLAR FLAT—Standard Type G

Capacitance	100 & 200 Volts T X W X L	Lead AWG	400 Volts T X W X L	Lead AWG
.033			.203 x .312 x .687	22
.039			.218 x .327 x .687	22
.047			.234 x .343 x .687	22
.056			.250 x .359 x .687	20
.068			.265 x .374 x .687	20
.082			.265 x .406 x .812	20
.1	.203 x .312 x .500	22	.312 x .453 x .812	20
.12	.218 x .328 x .500	22	.328 x .470 x .812	20
.15	.250 x .359 x .500	22	.312 x .453 x 1.062	20
.18	.234 x .343 x .625	22	.328 x .470 x 1.062	20
.22	.250 x .359 x .625	20	.328 x .470 x 1.188	20
.27	.281 x .390 x .625	20	.359 x .500 x 1.188	20
.33	.218 x .359 x .875	20	.406 x .547 x 1.188	20
.39	.250 x .390 x .875	20	.328 x .470 x 1.562	20
.47	.281 x .421 x .875	20	.359 x .500 x 1.562	20
.56	.312 x .453 x .875	20	.422 x .562 x 1.562	20
.68	.343 x .484 x .875	20	.469 x .609 x 1.562	20
.82	.312 x .453 x 1.125	20	.531 x .671 x 1.562	20
1.00	.328 x .470 x 1.125	20	.562 x .703 x 1.562	20
1.50	.390 x .531 x 1.125	20		
2.00	.359 x .500 x 1.500	20		
3.00	.453 x .593 x 1.500	20		
4.00	.562 x .703 x 1.500	20		
5.00	.578 x .718 x 1.812	20		

LENGTH TOLERANCE	T & W TOLERANCE	LEAD
+.046 −.094	.249 & under ±.032 .250 to .500 ±.046 .501 & over ±.062	Copperweld solder coating Length 2.000 ±.125

MYLAR—Aluminum Foil

Capacitance	Type B SMALL 100 Volts Dia.-Length	Lead AWG	Type C MINIATURE 80 & 50 Volts Dia.-Length	Lead AWG
.001 to .01	.187 x 3/8	24	.156 x 3/8	24
.012	.187 x 7/16	24	.156 x 3/8	24
.015	.187 x 7/16	24	.171 x 3/8	24
.022	.187 x ½	24	.187 x 3/8	24
.033	.203 x ½	24	.187 x 7/16	24
.039	.218 x ½	24	.203 x 7/16	24
.047	.234 x ½	24	.203 x ½	24
.056	.250 x ½	24	.218 x ½	24
.068	.265 x ½	22	.218 x ½	24
.082	.281 x ½	22	.250 x ½	24
.1	.281 x ½	22	.265 x ½	22
.12	.281 x ⅝	22	.281 x ½	22
.15	.312 x ⅝	22	.250 x ⅝	22
.18	.343 x ⅝	22	.281 x ⅝	22
.22	.296 x ⅞	22	.296 x ⅝	22
.27	.312 x ⅞	22	.296 x ⅞	22
.33	.375 x ⅞	22	.312 x ⅞	22
.39	.343 x 1⅛	22	.265 x 1⅛	22
.47	.375 x 1⅛	22	.296 x 1⅛	22
.56	.406 x 1⅛	22		
.68	.453 x 1⅛	20		
.82	.500 x 1⅛	20		
1.00	.562 x 1⅛	20		

LENGTH TOLERANCE	DIAMETER TOLERANCE	LEAD
+.046 −.046	.249 & under ±.032 .250 to .500 ±.046 .501 & over ±.062	Copperweld 100% tin coating Length 2.000 ±.125

METALLIZED MYLAR

Capacitance	Type E SMALL 100-150 Volts Dia.-Length	Lead AWG	Type F MINIATURE 50-80 Volts Dia.-Length	Lead AWG
.1	.218 x .500	22	.218 x .437	22
.12	.234 x .500	22	.234 x .437	22
.15	.250 x .500	22	.250 x .437	22
.18	.281 x .500	22	.234 x .500	22
.22	.250 x .625	22	.250 x .500	22
.27	.281 x .625	22	.281 x .500	22
.33	.312 x .625	22	.312 x .500	22
.39	.328 x .625	20	.328 x .500	20
.47	.375 x .625	20	.312 x .625	20
.56	.343 x .750	20	.328 x .625	20
.68	.390 x .750	20	.343 x .625	20
.82	.406 x .875	20	.343 x .750	20
1.00	.421 x .875	20	.375 x .750	20
1.50	.406 x 1.125	20	.453 x .750	20
2.00	.468 x 1.125	20	.406 x 1.125	20
3.00	.562 x 1.312	20	.484 x 1.125	20
4.00	.687 x 1.312	20	.515 x 1.312	20
5.00	.687 x 1.562	20	.562 x 1.312	20
6.00	.718 x 1.562	18	.625 x 1.312	20
8.00	.781 x 1.812	18	.656 x 1.562	20
10.00	.843 x 1.812	18	.750 x 1.562	20

LENGTH TOLERANCE	DIAMETER TOLERANCE	LEAD
+.046 −.046	.249 & under ±.032 .250 to .500 ±.046 .501 & cover ±.062	Copperweld solder coating Length 2.000 ±.125

METALLIZED MYLAR FLAT

Capacitance	Type H SMALL 100-150 Volts T X W x L	Lead AWG	Type I MINIATURE 50-80 Volts T X W X L	Lead AWG
*.1	.140 x .250 x .500	22	.140 x .234 x .437	22
*.12	.156 x .265 x .500	22	.156 x .250 x .437	22
*.15	.171 x .281 x .500	22	.187 x .296 x .437	22
.18	.187 x .296 x .625	22	.156 x .250 x .500	22
.22	.171 x .281 x .625	22	.171 x .281 x .500	22
.27	.203 x .312 x .625	22	.203 x .312 x .500	22
.33	.234 x .343 x .625	22	.234 x .343 x .500	22
.39	.250 x .359 x .625	20	.250 x .359 x .500	20
.47	.281 x .421 x .625	20	.234 x .343 x .625	20
.56	.250 x .390 x .750	20	.250 x .359 x .625	20
.68	.296 x .437 x .750	20	.250 x .390 x .625	20
.82	.312 x .453 x .875	20	.250 x .390 x .750	20
1.00	.328 x .468 x .875	20	.281 x .421 x .750	20
1.50	.343 x .484 x 1.125	20	.359 x .500 x .750	20
2.00	.406 x .564 x 1.125	20	.312 x .453 x 1.125	20
3.00	.468 x .609 x 1.250	20	.390 x .531 x 1.125	20
4.00	.578 x .718 x 1.250	20	.421 x .562 x 1.250	20
5.00	.578 x .718 x 1.500	20	.484 x .625 x 1.250	20
6.00	.593 x .734 x 1.500	20	.531 x .671 x 1.250	20
8.00	.671 x .812 x 1.781	18	.546 x .687 x 1.500	20
10.00	.734 x .875 x 1.781	18	.625 x .765 x 1.500	20

* Values .15 and lower refer to section "Ultra Miniature Flat Mylar Foil Capacitors".

LENGTH TOLERANCE	T & W TOLERANCE	LEAD
+.046 −.046	.249 & under ±.032 .250 to .500 ±.046 .501 & over ±.062	Copperweld solder coating Length 2.000 ±.125

F-DYNE

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POLYCARBONATE DIMENSIONS

POLYCARBONATE ALUMINUM FOIL

CAPACITANCE	Type K STANDARD 100 VOLTS DIA.-LENGTH	LEAD AWG	200 VOLTS DIA.-LENGTH	LEAD AWG	Type L SMALL 50-100 VOLTS DIA.-LENGTH	LEAD AWG
.001 to .010	.187 x ½	24	.187 x ½	24	.187 x ⅜	24
.015	.187 x ½	24	.234 x ½	24	.187 x 7/16	24
.022	.203 x ½	24	.250 x ½	24	.187 x ½	24
.033	.218 x ½	24	.234 x ¾	24	.203 x ½	24
.039	.218 x ⅝	24	.265 x ¾	22	.234 x ½	24
.047	.234 x ⅝	24	.296 x ¾	22	.250 x ½	24
.056	.250 x ⅝	24	.312 x ¾	22	.265 x ½	22
.068	.265 x ⅝	22	.281 x 1	22	.281 x ½	22
.082	.296 x ⅝	22	.312 x 1	22	.296 x ½	22
.10	.281 x ¾	22	.343 x 1	22	.296 x ½	22
.12	.296 x ¾	22	.375 x 1	22	.312 x ⅝	22
.15	.343 x ¾	22	.359 x 1¼	22	.329 x ⅝	22
.18	.312 x 1	22	.390 x 1¼	22		
.22	.343 x 1	22	.437 x 1¼	22		
.27	.484 x 1¼	22				
.33	.531 x 1¼	22				

LENGTH TOLERANCE
+.046
−.094

DIAMETER TOLERANCE
.249 & under ±.032
.250 to .500 ±.046
.501 & over ±.062

LEAD
Copperweld 100% tin coating
Length 2.000 ±.125

METALLIZED POLYCARBONATE ROUND

Capacitance	Type M STANDARD 100 & 200 Volts Dia.-Length	Lead AWG	Type N SMALL 100-150 Volts Dia.-Length	Lead AWG	Type O MINIATURES 50-80 Volts Dia.-Length	Lead AWG
.1	.265 x .500	22	.218 x .500	22	.218 x .437	22
.12	.296 x .500	22	.250 x .500	22	.234 x .437	22
.15	.328 x .500	22	.265 x .500	22	.265 x .437	22
.18	.296 x .625	22	.281 x .500	22	.234 x .500	22
.22	.328 x .625	20	.265 x .625	22	.250 x .500	22
.27	.375 x .625	20	.296 x .625	22	.281 x .500	22
.33	.296 x .875	20	.328 x .625	20	.312 x .500	22
.39	.328 x .875	20	.343 x .625	20	.328 x .500	20
.47	.359 x .875	20	.390 x .625	20	.312 x .625	20
.56	.390 x .875	20	.359 x .750	20	.328 x .625	20
.68	.437 x .875	20	.406 x .750	20	.343 x .625	20
.82	.421 x 1.187	20	.421 x .875	20	.343 x .750	20
1.00	.437 x 1.187	20	.437 x .875	20	.375 x .750	20
1.25	.453 x 1.187	20	.390 x 1.25	20	.421 x .750	20
1.50	.531 x 1.187	20	.421 x 1.25	20	.453 x .750	20
2.00	.609 x 1.187	20	.484 x 1.25	20	.406 x 1.125	20
3.00	.625 x 1.562	20	.593 x 1.312	20	.484 x 1.125	20
4.00	.718 x 1.562	20	.718 x 1.312	20	.515 x 1.312	20
5.00	.781 x 1.562	18	.718 x 1.562	20	.578 x 1.312	20
6.00	.781 x 1.812	18	.750 x 1.562	20	.625 x 1.312	20
8.00	.875 x 1.812	18	.812 x 1.812	18	.656 x 1.562	20
10.00			.875 x 1.812	18	.750 x 1.562	20

METALLIZED POLYCARBONATE FLAT

Capacitance	Type P STANDARD 100 & 200 Volts T X W X L	Lead AWG	Type Q SMALL 100-150 Volts T X W X L	Lead AWG	Type R MINIATURE 50-80 Volts T X W X L	Lead AGW
*.1	.156 x .265 x .500	22	.140 x .250 x .500	22	.140 x .234 x .437	22
*.12	.234 x .343 x .500	22	.171 x .281 x .500	22	.156 x .250 x .437	22
*.15	.265 x .375 x .500	20	.187 x .281 x .500	22	.187 x .296 x .437	22
.18	.234 x .343 x .625	20	.203 x .312 x .500	22	.156 x .250 x .500	22
.22	.265 x .375 x .625	20	.187 x .296 x .625	22	.171 x .281 x .500	22
.27	.296 x .437 x .625	20	.219 x .328 x .625	22	.203 x .312 x .500	22
.33	.218 x .359 x .875	20	.250 x .359 x .625	22	.234 x .343 x .500	22
.39	.250 x .390 x .875	20	.250 x .390 x .625	20	.250 x .359 x .500	20
.47	.281 x .421 x .875	20	.296 x .437 x .625	20	.234 x .343 x .625	20
.56	.312 x .453 x .875	20	.265 x .406 x .750	20	.250 x .359 x .625	20
.68	.359 x .500 x .875	20	.312 x .453 x .750	20	.250 x .390 x .625	20
.82	.343 x .484 x 1.125	20	.328 x .468 x .875	20	.250 x .390 x .750	20
1.00	.359 x .500 x 1.125	20	.343 x .484 x .875	20	.281 x .421 x .750	20
1.50	.453 x .593 x 1.125	20	.359 x .500 x 1.25	20	.359 x .500 x .750	20
2.00	.531 x .671 x 1.125	20	.421 x .562 x 1.25	20	.312 x .453 x 1.125	20
3.00	.531 x .671 x 1.562	20	.500 x .640 x 1.250	20	.390 x .531 x 1.125	20
4.00	.625 x .765 x 1.562	20	.609 x .750 x 1.250	20	.421 x .562 x 1.250	20
5.00	.687 x .828 x 1.562	20	.609 x .750 x 1.500	20	.484 x .625 x 1.250	20
6.00			.640 x .781 x 1.500	20	.531 x .671 x 1.250	20
8.00			.703 x .843 x 1.781	18	.546 x .687 x 1.500	20
10.00			.750 x .890 x 1.781	18	.625 x .765 x 1.500	20

* Values .15 and lower refer to section "Ultra Miniature Flat Polycarbonate Aluminum Foil Capacitors".

LENGTH TOLERANCE
+.046
−.094

DIAMETER TOLERANCE
.249 & under ±.032
.250 to .500 ±.046
.501 & over ±.062

LEAD
Copperweld solder coating
Length 2.000 ±.125

F-DYNE

F-DYNE ELECTRONICS CO.
1700 POST ROAD, FAIRFIELD, CONN. 06430 AREA 203 259-7804

ULTRA MINIATURE FLAT

ULTRA MINIATURE FLAT MYLAR AND FLAT POLYCARBONATE ALUMINUM FOIL

Equal to or smaller in size than conventional miniature metallized mylar and metallized polycarbonate capacitors, these capacitors are superior to metallized capacitors because they have a solid aluminum foil conductor approximately .00025 in thickness. Each foil extends beyond the dielectric and the leads are electrically welded to the aluminum foil extensions. Because of this construction these capacitors have the following advantages over comparable sized metallized mylar and metallized polycarbonate capacitors.

	Mylar Foil	Metallized Mylar
Dissipation factor	less than .5% @ 25°C measured at 1000CPS.	less than 1% @ 25°C measured at 1000CPS.
Insulation* Resistance	50,000 megohm micro farads at 25°C rated voltage after 2 min. charging time I.R. need not exceed 100,000 megohms.	25,000 megohm microfarads at 25°C at rated voltage after 2 min. charging time. I.R. need not exceed 50,000 megohms.
Humidity Resistance	meets or exceeds requirements of MIL-C-27287	Exceeds requirements of E.I.A. Spec. 164 para. 2, 3, 8.
Stability of Internal Connections	Welded connection of lead to aluminum foil cannot be disturbed when the capacitor leads are soldered into the circuit regardless of how much they are overheated.	All metallized capacitors are terminated with a metallic spray on the ends and a lead attached with solder. If the lead is overheated when being soldered into the application, the internal connection may be unsoldered causing high series resistance and subsequent failure.

NOTE: Other characteristics same as standard mylar capacitors.

OTHER ADVANTAGES

In addition to the above advantages the foil type capacitors give more dependable stable equipment functioning. On some rare occasions, metallized capacitors have been known to short and clear in application. As a result the equipment malfunctions and the cause of malfunctioning cannot be traced. This cannot happen with foil type capacitors listed on pages 22 and 23.

PRICE

The price of the foil type is lower than the price of metallized capacitors because of the less expensive straight forward simpler construction.

*These characteristics are the same for polycarbonate flat capacitors, except for insulation resistance see page 1.

FLAT MYLAR ALUMINUM FOIL ULTRA MINIATURE

Capacitors	Type W STANDARD 100 & 200 Volts T X W X L	Lead AWG	Type X SMALL 50 & 80 Volts T X W X L	Lead AWG
.001	.109 x .218 x .375	24	.109 x .218 x .375	24
.0015	.109 x .218 x .375	24	.109 x .218 x .375	24
.0022	.109 x .218 x .375	24	.109 x .218 x .375	24
.0033	.109 x .218 x .375	24	.109 x .218 x .375	24
.0047	.109 x .218 x .375	24	.109 x .218 x .375	24
.0068	.109 x .218 x .375	24	.109 x .218 x .375	24
.0082	.109 x .218 x .375	24	.109 x .218 x .375	24
.01	.109 x .218 x .375	24	.109 x .218 x .375	24
.015	.109 x .218 x .375	24	.109 x .218 x .375	24
.022	.125 x .234 x .375	24	.109 x .218 x .375	24
.033	.109 x .218 x .500	24	.125 x .234 x .375	24
.047	.125 x .234 x .500	24	.109 x .218 x .500	24
.056	.140 x .250 x .500	24	.125 x .234 x .500	24
.068	.156 x .265 x .500	24	.140 x .250 x .500	24
.082	.187 x .266 x .500	22	.156 x .265 x .500	24
.1	.203 x .312 x .500	22	.171 x .281 x .500	22
.12	.234 x .343 x .500	22	.203 x .312 x .500	22
.15	.203 x .312 x .625	22	.234 x .343 x .500	22

FLAT POLYCARBONATE FOIL ULTRA MINIATURE Standard—Type Y

Capacitors	50 & 100 Volts T X W X L	Lead AWG
.001	.109 x .218 x .375	24
.0015	.109 x .218 x .375	24
.022	.109 x .218 x .375	24
.0033	.109 x .218 x .375	24
.0047	.109 x .218 x .375	24
.0068	.109 x .218 x .375	24
.0082	.109 x .218 x .375	24
.01	.109 x .218 x .375	24
.015	.109 x .218 x .375	24
.022	.125 x .218 x .375	24
.033	.125 x .234 x .500	24
.047	.108 x .218 x .625	24
.056	.125 x .234 x .625	24
.068	.140 x .250 x .625	24
.082	.156 x .265 x .625	22
.1	.171 x .281 x .625	22
.12	.203 x .312 x .625	22
.15	.234 x .343 x .625	22

TYPE AND ORDERING DESIGNATION

A -2.621 -200 -1

- A — Type
- -2.621 — Capacitance in Micro-Farads (Use as many digits as required)
- -200 — D.C. Voltage Rating
- -1 — % Tolerance

LENGTH TOLERANCE	DIAMETER TOLERANCE	LEAD
+.046	218 & under ±.032	Copperweld 100% tin coating
−.000	219 & over ±.046	Leads Length 2″ ±⅛″

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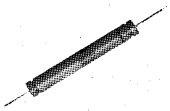
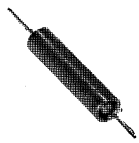
CAPACITORS



29F



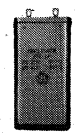
29F



6K, 16K



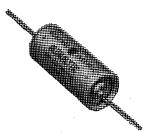
69F



69F



62F, 69F900



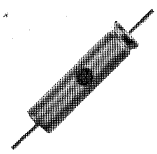
43F



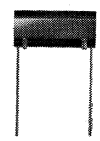
43F



86F



76F, 77F



75F, AA

Application	Catalog Type	Description	Voltage Range	UF Range	Temperature Range	Bulletin Reference	Market Usage
For polar and nonpolar coupling, filtering, decoupling, bypass, energy storage and timing in military and high-performance industrial amplifiers, transmitters, receivers, servo systems, and navigation systems. Hermetic seal available.	29F	Standard and high-voltage tantalum foil; MIL-C-3965: CL20, CL21, CL22, CL23, CL24, CL25, CL26, CL27, CL30, CL31, CL32, CL33, CL34, CL35, CL36, CL37 CL51, CL52, CL53, CL54 Tubular and rectangular	Up to 450 VDC	0.15 to 3500 μf	−55C to 85C or 125C	GET-2997	Military, Industrial
High-reliability type of 29F for military or aerospace use where hermetic seal and extreme reliability are prime factors.	6K 16K	High-reliability tantalum foil electrotlytic Hermetic seal available	Up to 300 VDC	1.2 to 450 μf	−55C to 125C	Consult GE Sales Engineer	Military
For polar only — where no reverse voltage is expected — coupling, decoupling, filtering, bypass, energy storage and timing in military and high-performance industrial amplifiers, transmitters, receivers, servo systems, and navigation systems.	69F	Tantalum porous anode; MIL-C-3965: CL64, CL65, CL55 Tubular and rectangular	Up to 150 VDC	1.7 to 2400 μf	−55C to 85C or 125C	GET-2997	Military, Industrial
	69F900	Subminiature tantalum porous anode	Up to 60 VDC	3.3 to 450 μf	−55C to 85C	GEC-1798	
For polar only—where no reverse voltage is expected—coupling, filtering, decoupling, bypass, energy storage and timing in standard and high-performance industrial and entertainment amplifiers, transmitters, receivers, servo systems, and navigation systems, within temperature capabilities.	62F	Porous anode tantalum electrolytic Subminiature Lightest weight Highest volumetric efficiency	Up to 60 VDC	0.01 to 325 μf	−55C to 85C	GEC-1798	Industrial, Entertainment
For bulk filtering and energy storage in military and high-performance or standard industrial power supplies, including computer usage and welding equipment.	86F	High performance, high volumetric efficiency	Up to 450 VDC	75 to 540,000 μf	−40C to 65C, 85C	GEC-1798	Industrial
For polar coupling, filtering, decoupling, bypass, energy storage and timing in standard and high-performance industrial and entertainment amplifiers, transmitters, receivers, servo systems, and navigation systems, within temperature capabilities.	76F 77F	Miniature aluminum electrolytic	Up to 160 VDC	1 to 560 μf	−20C/ 40C to 85C	GEC-1798	Industrial, Entertainment
For filtering, bypass, decoupling, and coupling in entertainment-type radio, TV, high-fidelity systems, and in industrial instruments and test equipment.	43F	Can style and Tubular Aluminum electrolytics for radio, TV, and other communications equipment	Up to 450 VDC	2 to 15,000 μf	−20C to 85C	GEC-1798	Industrial, Entertainment
For circuits in test, measurement, control, and communications equipment of all types, where high-quality film-foil units are an economic choice.	75F	Polyester film-foil roll is epoxy-encapsulated. Welded leads. Units have mounting feet and precise dimensions, for high-density packaging.	50 to 600V	.0010 to 1 μf	−55C to 125C	GEC-1798	Industrial
	AA	Same as 75F except with polycarbonate film dielectric	100 or 200V	.0010 to 1 μf	−55C to 125C	GEC-1798	Industrial

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

CAPACITORS



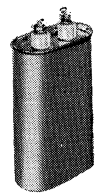
65F



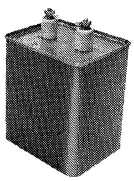
61F, 63F, 64F, 74F51



BA, 74F01



23F



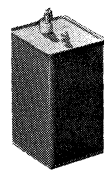
23F



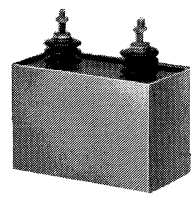
28F



45F



14F



14F

Application	Catalog Type	Description	Voltage Range	UF Range	Temperature Range	Bulletin Reference	Market Usage
For printed-circuit board circuitry where size, weight, cost, and reliability give advantage over metallized film capacitors.	65F	Polyester film and aluminum foil roll, compressed and packaged in a rectangular epoxy case with radial leads.	50V only	.0010 to 1.5 μf	−55C to 85C	GEC-1798	Industrial
For use where size, weight, cost, and reliability give advantage over metal-clad tubulars, molder, or ceramic case units.	61F 63F 64F	Polyester film-foil roll, wrap and-pot, with axial leads. 63F only meets performance requirements of MIL-C-27287.	Up to 300V	.0010 to 2 μf	−55C to 125C	GEC-1798	Industrial, Military
	74F51	Same as 61F except with polycarbonate film dielectric	100 or 200V	.0010 to 1 μf	−55C to 125C	GEC-1798	Industrial
For manufacturing and test equipment, electronic timers and control, communications equipment, and other forms of industrial electronic equipment.	BA	Metallized polyester film roll, wrap-and-pot, with axial leads.	100 or 200V	.010 to 10 μf	−55C to 125C	GEA-8577	Industrial
	74F01	Same as BA except with metallized polycarbonate film.	200V	.010 to 10 μf	−55C to 125C	GEC-1798	Industrial
For energy storage for gas discharge tubes, such as camera attachments.	85F	Aluminum electrolytic photoflash energy-storage capacitors to provide low d-c leakage current and low ESR.	300 to 550 VDC	5 to 700 μf	−20C to 45C	Consult GE Sales Engineer	Industrial, Entertainment
General-purpose d-c capacitors for filtering, blocking, bypass, and arc-suppression in power supplies, control circuits, and other d-c circuit functions.	23F	Paper/Pyranol® in drawn steel cases.	400 to 12,500 VDC, 236 to 1900 VAC	0.05 to 35 μf	−55C to 85C	GEC-1798	Industrial
Specially designed for such SCR applications as phase control, frequency multipliers and changers, power supply filters, time ratio controls, inverters, and rectifier spike suppression.	28F	Paper, metallized paper, and polycarnate film dielectrics with very low internal losses and high peak current carrying capability.	200 to 2000 VDC, 115 to 700 VAC	0.5 to 125 μf	−55C to 80C	GEC-1798	Industrial
General-purpose a-c capacitors for motor and transformer applications. New Pyranol II impregnant multiplies life and increases reliability.	45F	Paper/Pyranol II in drawn oval cases.	200 to 720 VDC	3.0 to 55 μf	−30C to 70C	GEC-1798	Industrial
For high-voltage d-c rectifier power supply filters, and high-voltage blocking and bypass in communications, radar and other high-voltage circuits.	14F	Paper/Mylar* oil impregnated in all-welded steel rectangular case of leak-proof construction.	5000 to 20,000 VDC	0.67 to 150 μf	−40C to 105C	GEC-1798	Industrial
For light-duty energy storage-discharge duty, such as photoflash applications.	14F	Paper/Pyranol in fabricated steel cases.	1000 to 10,000 VDC	12.5 to 640 μf	0 to 40C	GEC-1798	Industrial

** Trade-mark of DuPont Co.*

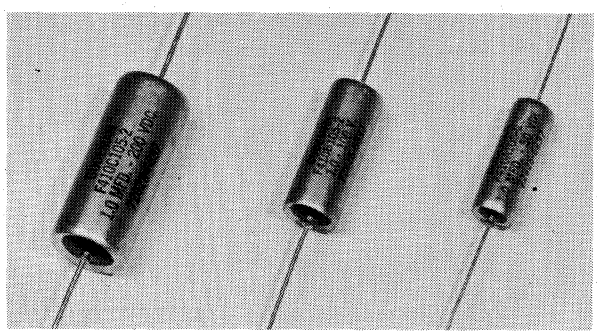
For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

GUDEMAN

CAPACITORS

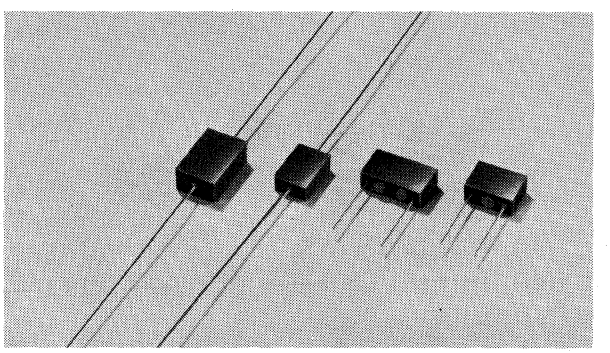
• Polycarbonate • mylar* • paper • teflon • polystyrene
• metallized polycarbonate • metallized mylar • metallized paper • metallized teflon



METALLIZED POLYCARBONATE

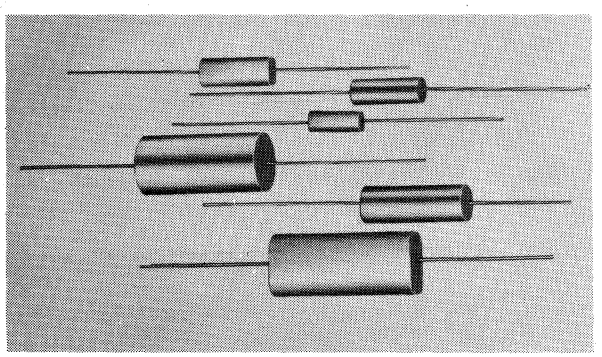
Featuring the new .00008″ film, 50V design, Series 410 offers hermetic sealed miniature metal cases for reliable, stable performance from −55°C to +125°C with no voltage derating. Designs to 400 VDC are backed by life test data.

New optional ceramic end seals offer you the ultimate in volumetric efficiency with no compromise in reliability.



METALLIZED MYLAR AND POLYCARBONATE

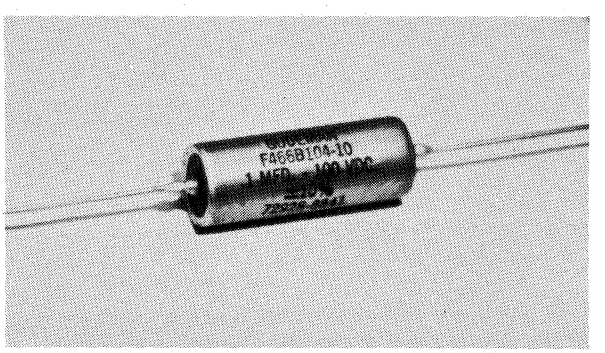
Miniature 50 volt designs of new .00008″ film in rugged epoxy cases and a variety of lead configurations are offered in Series 317-323. Molded standoffs are included on radial lead units for printed circuit board applications. Available in a wide range to 200 VDC and +125°C. Extensive tests back reliability data.



METALLIZED POLYCARBONATE

New 50 volt .00008″ film designs lead our Series 396 and 397 in both flat and tubular configurations. These wrap and fills, epoxy sealed in non-metallic cases, are available to 600 VDC, −55°C to +125°C. Reliability data available.

New undermarked tape guarantees performance to any marking specification.



FLAT TC POLYCARBONATE

Series 466 achieves a uniquely low (+50, −75 ppm/°C), temperature coefficient through use of balanced polycarbonate extended foil design. AC applicability is provided by low DF and proven negligible internal temperature rise. Ideal for space conscious SCR's. DC and AC reliability backed by extensive life tests. 100-600 volts, −55°C to +125°C.

* Dupont trademark

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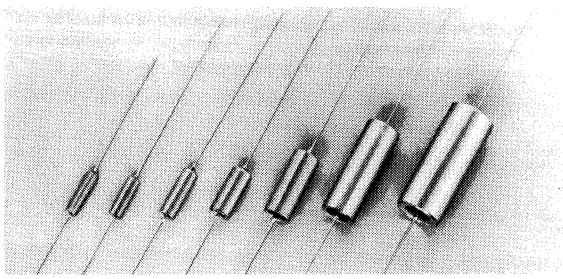
Gulton Industries, Inc.
340 W. Huron Street, Chicago, Illinois 60610
AREA CODE 312 337-7400 TWX 910-221-3863

GUDEMAN

CAPACITORS

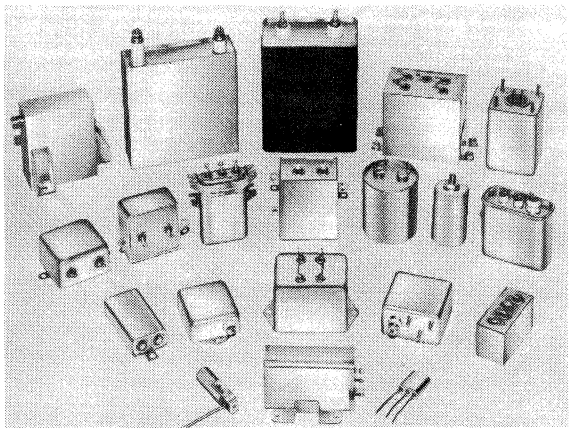
Commercial and Military Grades

• Mil-C-18312 • Mil-C-19978 • Mil-C-27287 • Mil-C-14157 • Mil-C-11693 • Mil-C-25



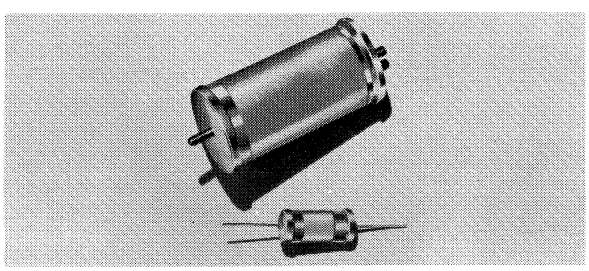
METALLIZED MYLAR

Designed to military standards, Series 68 is also popular in industrial systems where stability, size and life are critical factors. Hermetic seals, metal case, superior insulation resistance and dissipation factor insure performance in severe environments. 100 - 600 VDC from −55°C to +125°C.



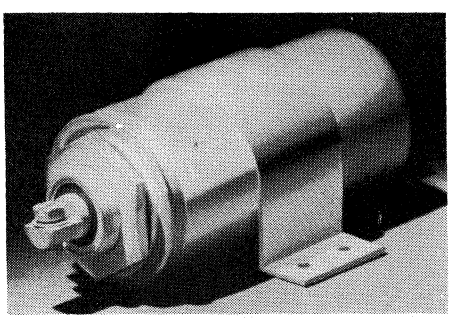
SPECIALS

Thousands of special designs and proven fabrication techniques offer you unique flexibility of choice in solving your capacitor problems. Consult our Engineering staff. Our unusual "design comparison" file can save you time and money.



HI VOLTAGE

Glass case designs of Series 145/146 offer substantial reduction in size and weight compared with comparable voltage ratings of metal cased units. Values to 10,000 WVDC, −55°C to +125°C.



RFI FILTERS

Gudeman offers a full line of commercial and military filters designed to MIL-F-15733E. Many low pass FLO types are stocked for immediate delivery. Insertion loss is guaranteed in accordance with MIL STD-220.

a division of

Gulton Industries, Inc.

340 W. Huron Street, Chicago, Illinois 60610

AREA CODE 312 337-7400 TWX 910-221-3863

Gulton

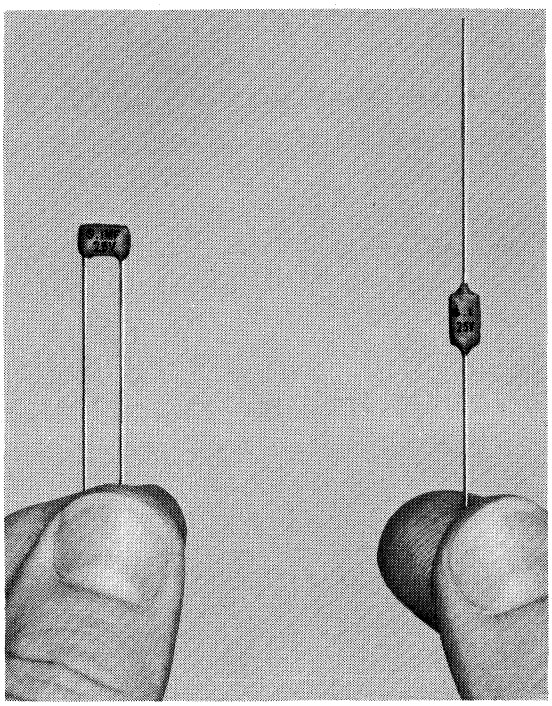
CERAMIC CAPACITORS

Subminiature ML02 and ML03 Series

WORKING VOLTAGE: ---------- 25 VDC
TEMPERATURE RANGE: ---------- -55°C to +85°C
INSULATION RESISTANCE: -------- 2500 megohms-microfarads or 5000 megohms, whichever is less
DISSIPATION FACTOR: ---------- 4% at 1 KC and +25°C (measured at 0.5 VRMS)
TEMPERATURE CHARACTERISTICS: --- Maximum capacitance change -55°C to +85°C, +22%, -56% with zero applied voltage
LIFE TEST: ---------- 2 x WVDC at +85°C for 1000 hours
LEAD SIZE
Radial Leads: ---------- #24 AWG tinned copper
Axial Leads: ---------- #22 AWG tinned copper
ENCAPSULATION: ---------- Wax impregnated phenolic
MILITARY SPECIFICATIONS: ------- Meet or exceed requirements of MIL-C-11015 (latest revision), where applicable

CAP. µf	GULTON PART NO.	L. max.	W. max.	T. max.	S. ±.030
.01	ML02N103	.300	.300	.125	.200
.015	ML02N153	.300	.300	.125	.200
.022	ML02N223	.300	.300	.125	.200
.033	ML02N333	.300	.300	.125	.200
.047	ML02N473	.300	.300	.125	.200
.068	ML02N683	.300	.300	.125	.200
.1	ML02N104	.300	.300	.125	.200
.15	ML02N154	.300	.300	.125	.200
.01	ML03N103	.390	.202	.125	.250
.015	ML03N153	.390	.202	.125	.250
.022	ML03N223	.390	.202	.125	.250
.033	ML03N333	.390	.202	.125	.250
.047	ML03N473	.390	.202	.125	.250
.068	ML03N683	.390	.202	.125	.250
.1	ML03N104	.390	.202	.125	.250
.15	ML03N154	.390	.202	.156	.250

NOTE
Tolerance: Add suffix "M" for ±20%; "Z" for -20%, +80%.
For axial leads, add suffix "A" after tolerance designation.



The two capacitor series listed are but a small segment of Gulton's total capacitor line. Special capacitors such as dual inline networks are available on special order. Gulton engineers are available to discuss your capacitor requirements, and when necessary, to custom design units for your special application.

Subminiature ML12 and ML13 Series

WORKING VOLTAGE: ---------- 100 VDC
TEMPERATURE RANGE: ---------- -55°C to +125°C
INSULATION RESISTANCE: -------- 2500 megohm-microfarads or 100,000 meg., whichever is less
DISSIPATION FACTOR: ---------- 2.0% at 1 KC and +25°C (at 0.5 V rms)
TEMPERATURE CHARACTERISTICS: -- Maximum capacitance change -55°C to +125°C, +10%, -15% with zero applied voltage
LIFE TEST: ---------- 2 x WVDC at +125°C for 1000 hours
LEAD SIZE
Radial Leads: ---------- #24 AWG tinned copper
Axial Leads: ---------- #22 AWG tinned copper
ENCAPSULATION: ---------- Wax impregnated phenolic
MILITARY SPECIFICATIONS: ------- Meet or exceed requirements of MIL-C-11015 (latest revision), where applicable

CAP. µf	GULTON PART NO.	L. max.	W. max.	T. max.	S. ±.030
.0012	ML12M122	.300	.300	.125	.200
.0015	ML12M152	.300	.300	.125	.200
.0018	ML12M182	.300	.300	.125	.200
.0022	ML12M222	.300	.300	.125	.200
.0027	ML12M272	.300	.300	.125	.200
.0033	ML12M332	.300	.300	.125	.200
.0039	ML12M392	.300	.300	.125	.200
.0047	ML12M472	.300	.300	.125	.200
.0056	ML12M562	.300	.300	.125	.200
.0068	ML12M682	.300	.300	.125	.200
.0082	ML12M822	.300	.300	.125	.200
.01	ML12M103	.300	.300	.125	.200
.015	ML12M153	.300	.300	.125	.200
.018	ML12M183	.300	.300	.125	.200
.022	ML12M223	.300	.300	.125	.200
.027	ML12M273	.300	.300	.125	.200
.033	ML12M333	.300	.300	.125	.200
.039	ML12M393	.300	.300	.125	.200
.047	ML12M473	.300	.300	.125	.200
.056	ML12M563	.300	.300	.135	.200
.068	ML12M683	.300	.300	.135	.200
.082	ML12M823	.300	.300	.135	.200
.1	ML12M104	.300	.300	.135	.200

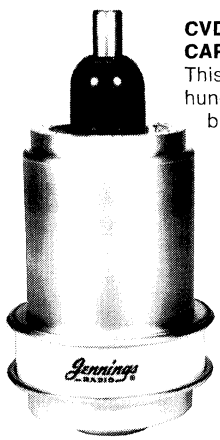
CAP. µf	GULTON PART NO.	L. max.	W. max.	T. max.	S. ±.030
.0012	ML13M122	.390	.202	.125	.250
.0015	ML13M152	.390	.202	.125	.250
.0018	ML13M182	.390	.202	.125	.250
.0022	ML13M222	.390	.202	.125	.250
.0027	ML13M272	.390	.202	.125	.250
.0033	ML13M332	.390	.202	.125	.250
.0039	ML13M392	.390	.202	.125	.250
.0047	ML13M472	.390	.202	.125	.250
.0056	ML13M562	.390	.202	.125	.250
.0068	ML13M682	.390	.202	.125	.250
.0082	ML13M822	.390	.202	.125	.250
.01	ML13M103	.390	.202	.125	.250
.015	ML13M153	.390	.202	.125	.250
.018	ML13M183	.390	.202	.125	.250
.022	ML13M223	.390	.202	.140	.250
.027	ML13M273	.390	.202	.140	.250
.033	ML13M333	.390	.202	.150	.250
.039	ML13M393	.390	.202	.150	.250
.047	ML13M473	.390	.202	.150	.250
.056	ML13M563	.390	.202	.170	.250
.068	ML13M683	.390	.202	.170	.250
.082	ML13M823	.390	.202	.170	.250
.1	ML13M104	.390	.202	.170	.250

NOTE: Tolerance; add suffix "M" for ±20%, "K" for ±10%. For axial leads, add suffix "A" after tolerance designation.

Gulton Industries, Inc. **Microceramics Division**
Metuchen, New Jersey 08840
Phone: 201-548-2800 • TWX-710-998-0592

Your best single source for vacuum capacitors, vacuum relays and vacuum contactors.

ITT Jennings is the leading designer and manufacturer of vacuum electronic components, which includes vacuum capacitors, relays, coax relays, contactors, and specialized measuring instruments. Following is a brief sampling of some of the hundreds of standard components available from ITT Jennings. For specific information in any area request the catalog listed.



CVDD VACUUM VARIABLE CAPACITOR (Catalog 101)
This capacitor is one of several hundred different vacuum variable capacitors available from Jennings. It possesses all the advantages that have made vacuum variable capacitors famous such as small size, high rf voltage and current ratings, extremely low losses, and high maximum to minimum capacity change ratio. CVDD 500 has a capacity range of 20 pf to 500 pf, peak test voltage to 15 kv, and rf current rating of 80 amps rms at 16 MHz.

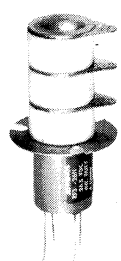


CFS SERIES VACUUM FIXED CAPACITORS (Catalog 101)
This series includes the highest capacity vacuum capacitors ever devised. An almost unlimited choice of capacities is available from 250 pf to 25,000 pf. They are much smaller than other capacitors with comparable capacity, voltage, current and dissipation ratings. Peak voltage ratings from 1 kv to 45 kv are also available depending on the unit. Current ratings of 200 amps rms at 1 MHz are typical. The CFS series is characterized by very low losses and internal inductance of less than 10 nanohenries.

Typical uses include plate blocking in medium power transmitters or in tank circuits in induction heating equipment.

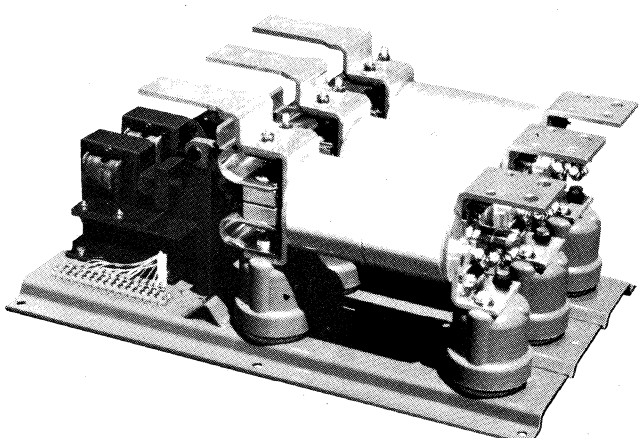
RC63 VACUUM COAXIAL RELAY (Catalog 103)
This tiny single pole double throw coaxial relay operates in a frequency range from 0 to 2400 megahertz. Only 2½ inches long and 4 ounces in weight it will handle 2 kilowatts cw power at 30 MHz. The vacuum dielectric environment shields the contacts from contamination and assures high reliability.

The relay is designed for such applications as antenna-receiver-transmitter switching, data acquisition, and radar transducer circuits.



RF3A NEW MINIATURE RELAY (Catalog 102)
Amazing "powerhouse" of unusual capability and economy. Measures only 2½" long, weighs just 1¾ ounces, but will interrupt 18,000 watts of dc power. Also carries 17 amps rms, withstands 7,500 peak volts at 15 MHz.

Aided by vacuum dielectric, this "mitey mite" will withstand 60 cycle peak voltages of 12,000 volts. Its vibration rating is 10 G to 500 cps; life expectancy is more than a million operations. Ideal for high voltage switching where space and weight are critical.



SERIES 900 VACUUM CONTACTOR (Catalog 104)
Three rugged, single-pole vacuum interrupters ganged in the new Series 900 contactor enable it to perform the switching duties of a NEMA size 6 contactor. This 95-pound, 3-phase unit packs a minimum of 600-volt capacity. The Series 900 includes models that will operate at 1500, 2300 or 5000 volts, 3-cycle operate time and operating currents up to 800 amperes with interrupting abiilty of 12,000 amperes, rms.

Contact ITT Jennings, a division of International Telephone and Telegraph Corporation, 970 McLaughlin Ave., San Jose, California 95108, Telephone: (408) 292-4025.

JENNINGS ITT

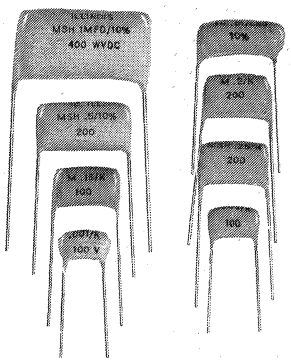
ILLINOIS POLYESTER CAPACITORS

"TIME TESTED QUALITY"

TYPE MSH

RADIAL LEAD METALLIZED POLYESTER CAPACITORS. FORMED OR UNFORMED LEADS. ENCAPSULATED IN HIGH TEMPERATURE THERMO-SET RESIN.

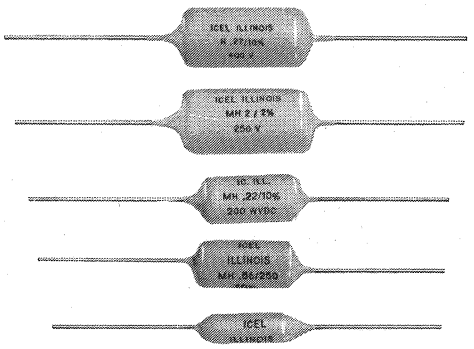
VOLTAGE RANGE 250, 400, 600, and 1000 VOLTS D.C. CAPACITY RANGE .001 MFD to 3 MFD. TOLERANCE OF ±20%, ±10%, ±5%, ±2%, OR ±1%.



TYPE MH

METALLIZED POLYESTER CAPACITORS. AXIAL LEAD. ENCAPSULATED IN HIGH TEMPERATURE THERMO-SET RESIN.

VOLTAGE RANGE 250, 400, 600, and 1000 VOLTS D.C. CAPACITY RANGE .001 MFD to 3 MFD. TOLERANCE OF ±20%, ±10%, ±5%, ±2%, and ±1%.

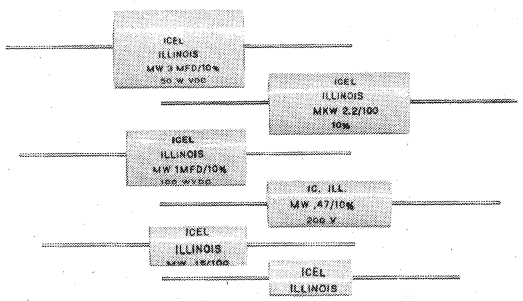


WIDE TEMPERATURE RANGE
LONG LIFE
HIGH DIELECTRIC STRENGTH
LOW DISSIPATION FACTOR
NON-INDUCTIVE WINDING

TYPE MW

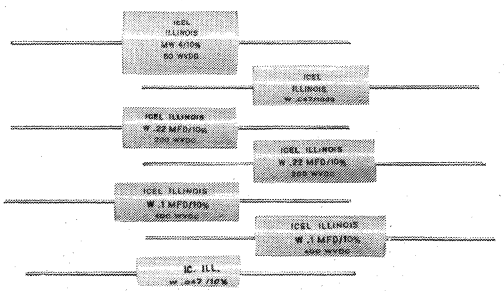
METALLIZED POLYESTER CAPACITORS "WRAP AND FILL CONSTRUCTION." PLASTIC RESIN END SEALS. FLAT AND TUBULAR CONSTRUCTION.

VOLTAGE RANGE 250, 400, 600, 1000, AND 1500 VOLTS D.C. CAPACITY RANGE .01 MFD TO 7 MFD. TOLERANCE ±20%, ±10%, ±5%, ±2%, ±1%.



TYPE W

"WRAP AND FILL" POLYESTER CAPACITORS. PLASTIC RESIN SEALS. FLAT OR TUBULAR CONSTRUCTION. VOLTAGE RANGE 250, 400, 600, 1000, and 1500 VOLTS D.C. CAPACITY RANGE .01 MFD TO .47 MFD. TOLERANCE OF ±20%, ±10%, ±5%, ±2%, ±1%.

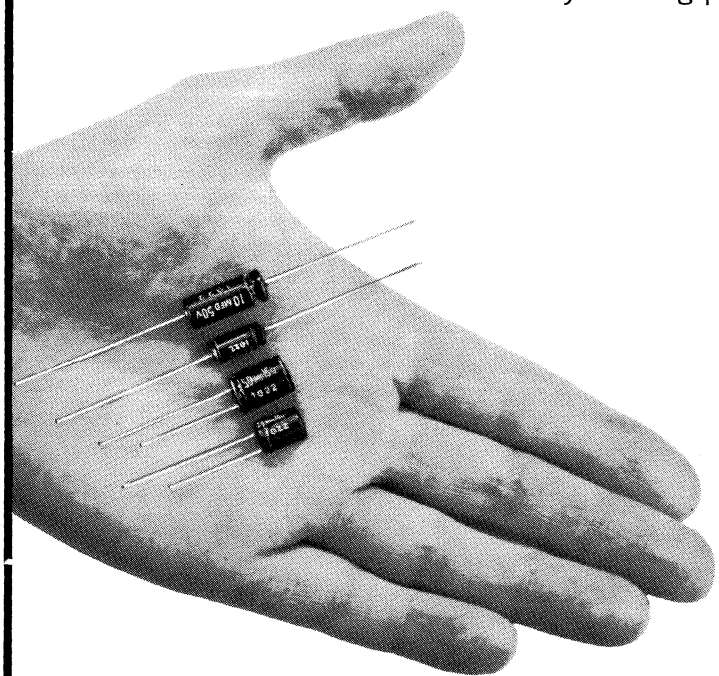


ILLINOIS CAPACITOR SALES COMPANY
P.O. BOX 352, HIGHLAND PARK, ILLINOIS 60035
PHONE A/C 312—432-4360

Miniature Aluminum Electrolytic, Polyester Film & Metalized Polyester

CAPACITORS

Ideal where any high quality capacitors are required. Dependable in every application from vacuum tube to solid state circuitry utilizing point-to-point or printed circuit mounting.

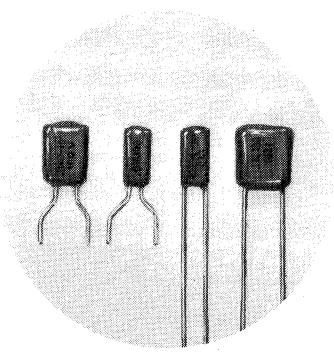


ALUMINUM ELECTROLYTICS

- Vinyl covered aluminum case, axial and radial leads
- Moisture tight end seal
- Welded construction
- Extremely low leakage characteristics
- High purity etched foil
- Excellent performance and long life over specified ranges

	Miniature Low Voltage	General Purpose	Non-Polarized
Voltage Range	3 to 50 volts d.c.	100 to 500 volts d.c.	3 to 50 volts d.c.
Capacitance	0.5 to 3000 uf.	1.0 to 1000 uf.	1.0 to 500 uf.
Operating Temp.	−25°C to +70°C −10°C to +85°C	−25°C to +70°C −10°C to +85°C	−10°C to +70°C −10°C to +85°C

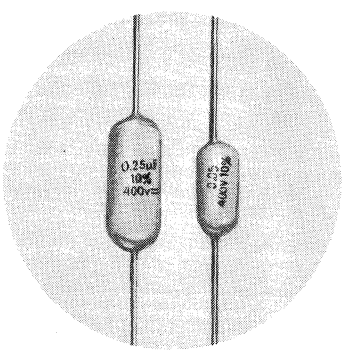
POLYESTER FILM



A broad range of miniature polyester film capacitors, with radial leads. Voltage ranges: 100, 200, 400, 600 volts d.c. Capacitance range: .001 μf. to 0.5 μf. Operating temperature from −40°C to +85°C with no derating. Standard tolerances of ±20%, ±10%; closer tolerances available.

- Temperature stable, low dissipation factor, low leakage, high insulation resistance.

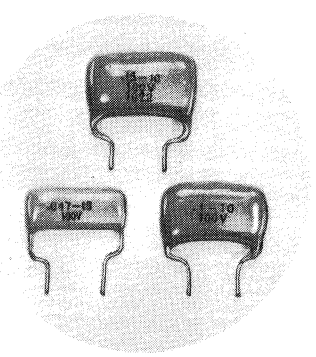
METALIZED POLYESTER



A complete line of sub-miniature metalized polyester film capacitors with axial leads. Wide temperature range, temperature stable, long life. These capacitors have a high dielectric strength, low dissipation factor, and a high insulation resistance. Highly reliable, non-inductive self-healing characteristics.

In voltage ranges of 250, 400, and 600 volts d.c. Tolerances of ±20%, 10% and 5% available. Capacitors will withstand, without injury, flash voltages 1½ times the working voltage, for as long as 5 seconds. Temperature stability of less than ±5% deviation from the 25°C value in the range of −20°C to +85°C.

POLYESTER FILM



A complete line on non-inductively wound polyester film capacitors. These capacitors have uniformly cut and crimped leads which are ideally suited for printed circuit applications. Available in voltages of 100, 200, 400 and 600 Volts "DC" with capacitor tolerance ±20%, ±10%, and ±5%. Operating temperature range −40+85% without derating. They are temperature stable and highly reliable.

IEC Components Division

INTERNATIONAL ELECTRONICS CORPORATION

316 SOUTH SERVICE ROAD, HUNTINGTON STA., MELVILLE L. I., N. Y., 11749
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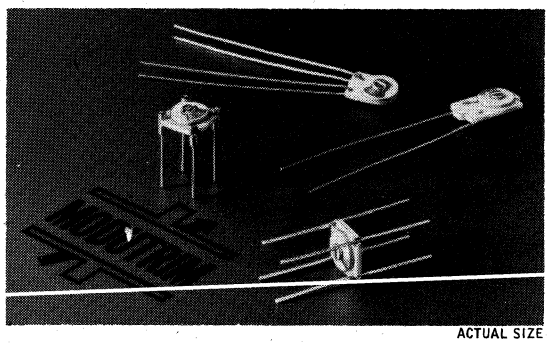
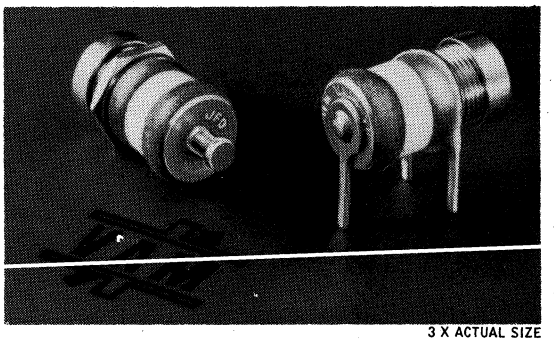
JFD



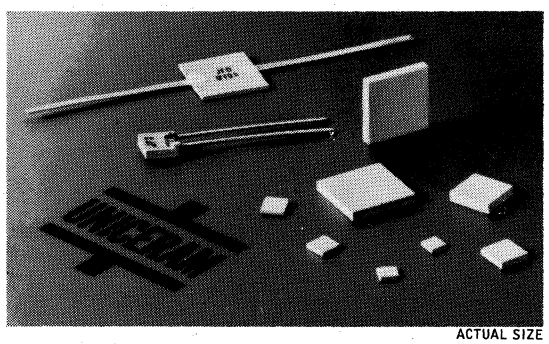
ACTUAL SIZE

Modutrim Ceramic Variable Capacitors feature wide delta C in extremely small and ultra stable circuits. Now 9 models in 4 configurations. Write for complete catalog #MT-67.



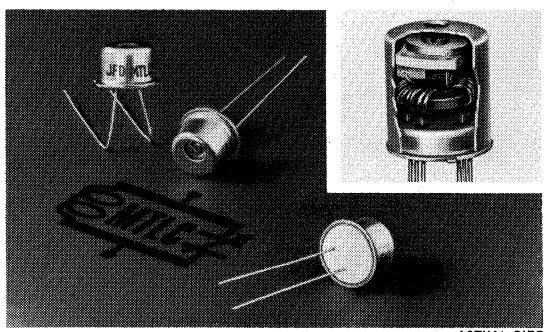
3 X ACTUAL SIZE

New JFD VAM Air Variable Capacitors maintain highest Q at high frequencies, offer ultra stability, smallest size. Write for complete catalog #VAM-66-A.



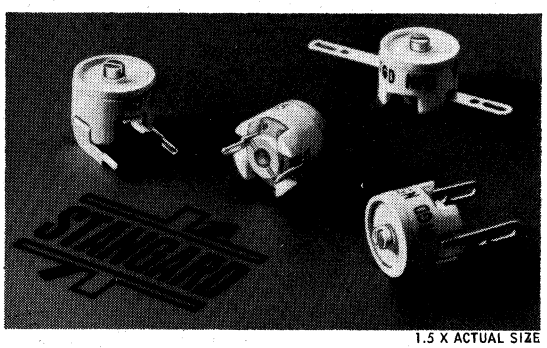
ACTUAL SIZE

Uniceram High-Q ceramic fixed capacitors combine exceptional stability, small size with minimum Q of 5000. Write for complete catalog #UNM-H/Q-67.



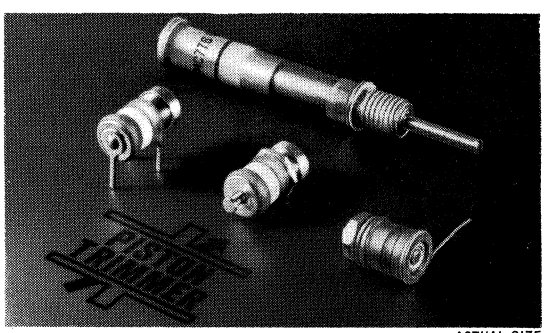
ACTUAL SIZE

MTLC's offer complete LC tuned circuits within TO-5 can. Standard frequency ranges from 2 MC to 300 MC. Various other complex networks such as discriminators, phase detectors are also available on special order. Write for complete catalog #MTLC-67.



1.5 X ACTUAL SIZE

Low-cost Stangard miniature ceramic variable series for commercial and industrial applications provide 8 wide delta C in 4 versatile configurations. Write for complete catalog #STD-DV/67.



ACTUAL SIZE

JFD has available the largest selection of Precision Piston Trimmers in the industry — more than 2,500 standard and special designs that meet or exceed MIL-C-14409B. Write for complete catalog #C-67 "Precision Piston Trimmer and Tuning Capacitors."

For details, see "Radio-Electronic MASTER", 1969 edition — pages 322-324

JFD ELECTRONICS CO./COMPONENTS DIVISION

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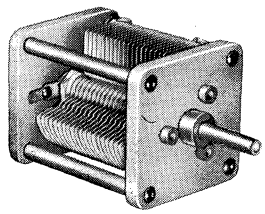
VARIABLE CAPACITORS FOR ALL PURPOSES MADE IN ENGLAND

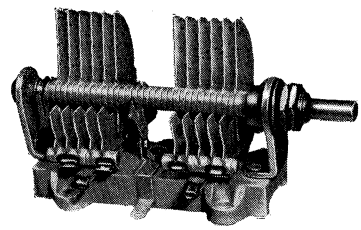
FOR TRANSMITTING

Type C.9. 1 Gang and Split Stator. Capacitances up to 1,000 pF. End Plate 2⅛" Square.

Type C.603. Split Stator. One Hole and Chassis Fixing. For L.P. Transmitting and Receiving.



Type C.9

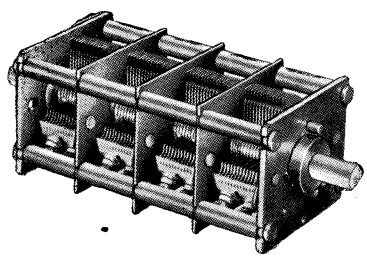


Type C.603

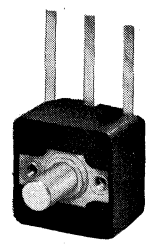
FOR TUNING

Type I.R. 1, 2, 3 or 4 Gang. Communications, with Rotors Insulated.

Type S.D. and Dilemin. Solid Dielectric. Miniature 1 and 2 Gang.



Type I.R.

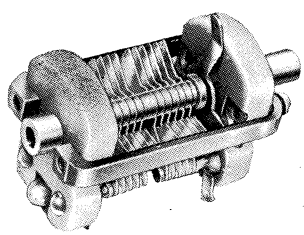


Type S.D. and Dilemin

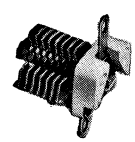
FOR TRIMMING

Type C.808. Split Stator. Small Split Stator Trimmer. For H.F. and V.H.F.

Type C.16. Trimmer ⅜" Square Spindle Slotted Both Ends.



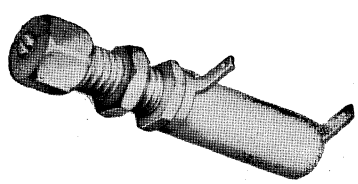
Type C.808



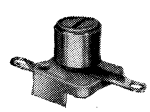
Type C.16

PISTON TUBULAR

P.T.F.E. Trimmers. High Precision Piston Type. With Low Loss Fluorocarbon Dielectric.



P.T.F.E.



Type C.16

WE SHOW ONLY A FEW FROM A COMPREHENSIVE RANGE —
If you need to Transmit, Tune or Trim R.F. to Micro Wave, contact:—

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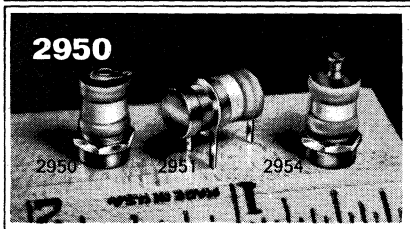
When Reliability is the Rule...

SPECIFY **Johanson** *A COMPLETE LINE OF*

HIGH Q VARIABLE CAPACITORS
AIR • GLASS • QUARTZ

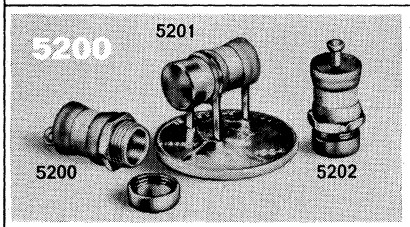
IMPORTANT

All models feature 570°F Solder. Prevents distortion. Not affected by conventional soldering temperature.



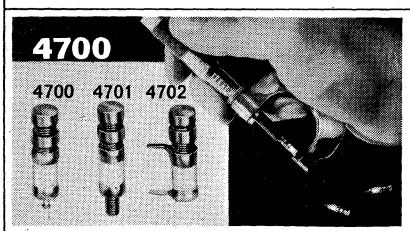
Miniature size, exceptionally high Q, superior ruggedness for protection against shock and vibration, −55°C to +125°C operating temperature range, protection against fungus, salt spray and humidity.

Capacitance Range: 0.8—10.0 pF
Breakdown: > 500 VDC
Q @ 100 mc: > 2000
Moisture Resistance: Ten 24 hour cycles
Shock: 50 g's 11 millisec.
Vibration: 15 g's 10-2000 cps



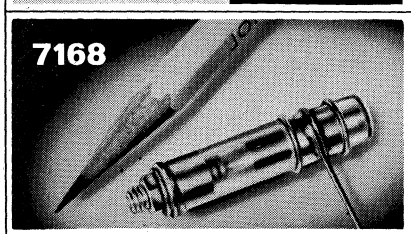
Improved one piece rotor construction with built-in torque for longer and more reliable adjustment life. Reliability tested and certified by independent laboratory. (Results available on request.)

Capacitance Range: 0.8 to 10.0 pF
Breakdown: > 500 VDC
Insulation Resistance: > 10^6 megohms @ 500 VDC
Q @ 100 mc: > 3000
Temperature Coefficient: 0 ±20 ppm/°C
Shock: > 275 g (6.0 millisec.)



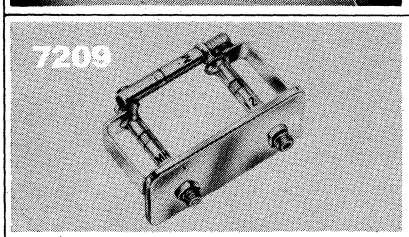
10:1 capacitance ratio in micro miniature size—extra fine tuning < .35 pF per turn. High Q, (greater than 1500 at 500 mc).

Capacitance Range: 0.35 pF to 3.5 pF
Working Voltage: 250 VDC (test voltage 500 VDC)
Q @ 100 mc: > 5000; @ 250 mc: > 2000
Insulation Resistance: > 10^6 megohms
Temperature Range: —55°C to +125°C
Temperature Coefficient: 50 ±50 ppm/°C



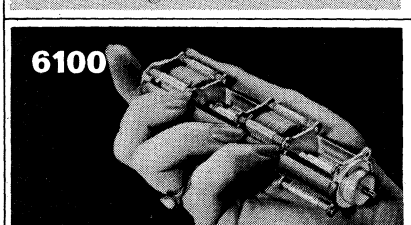
High RF voltage (models available to 4500 volts RF peak at 30 MHz). Low minimum capacitance (.5 pF). High current (models available to 10 amp. RMS).

Capacitance Range: 0.5 pF to 5.0 pF
Working Voltage: 2500 VDC & 2500 v peak RF @ 30 mc applied simultaneously and at 200°C
Q @ 1 mc: > 2000
Dielectric Strength: > 7000 VDC
Temperature Coefficient: 0 ±100 ppm/°C
Operating Temperature: —40°C to +200°C



Unique design provides minimal capacitance drift during vibration. Negative temperature coefficient (Model 7210). The self-resonance exceeds 1200 MHz.

Capacitance Range: .5—7.5 pF (7209)
.3—3.0 pF (7210)
Temperature Coefficient:
0 ±100 ppm/°C (7209)
—300 ±100 ppm/°C (7210)
Working Voltage: 250 VDC (Test voltage 500 VDC)
Finish: gold with coin silver electrode bands
Q @ 20 mc: > 500



Modular design. Available in one to five section modules in a wide variety of capacitance ranges (SLC & SLF).

Capacitance Range:
Max. 145 pF, Min. 9.5 pF per section (180° Rotation)
Capacity Variation: Straight line capacity
Temperature Range: —55°C to +125°C
Breakdown: 1000 VDC
Low Torque: 3-5 oz. in.

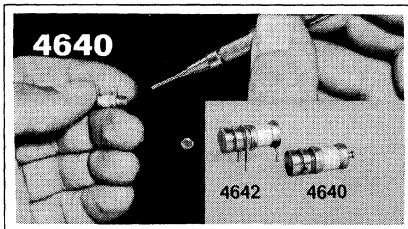
JOHANSON MANUFACTURING CORPORATION

Johanson

HIGH Q VARIABLE CAPACITORS

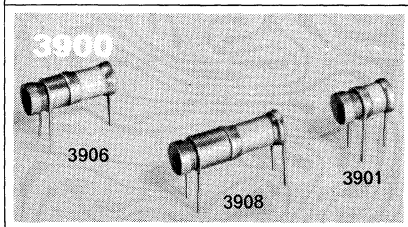
Johanson Capacitors provide construction and performance features that have become the industry standard for excellence.

No compromise is made in materials, design or workmanship assuring, in all cases, the finest performance available for the price. Test Johanson capacitors yourself—under your worst-case test conditions.



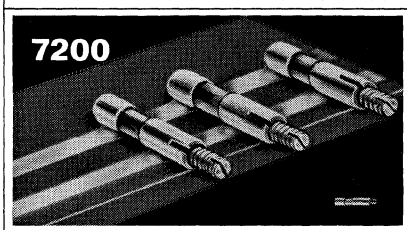
High capacity in a small package—exclusive round nut permits installation in tight places or miniaturized packaging. Ultra-rugged construction.

Capacitance Range: .4 pF to 6 pF (> 8 turns)
Working Voltage: 250 VDC (Test Voltage 500 VDC)
Q @ 100 mc: > 5000
Insulation Resistance: > 10^6 megohms
Temperature Coefficient: 50 ±50 ppm/°C
Temperature Range: –65°C to +125°C



Extended range to 30 pF
- Q (20 pF) > 1200 at 100 mc
- Low temperature coefficient
- All units have a "true" hermetic seal

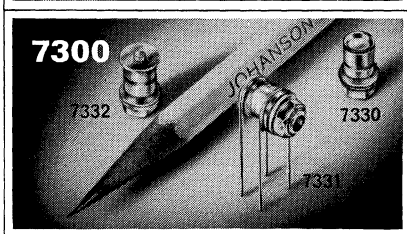
Capacity: 1-14 pF (3901); 1-20 pF (3906); 1-30 pF (3908)
Voltage Rating: 250 VDC (test voltage 500 VDC)
Insulation Resistance: > 10^6 megohms
Operating Temperature Range: –55°C to +125°C
Temperature Coefficient: 0 ±50 ppm/°C (Average @ 75% max. C)



ACTUAL SIZE

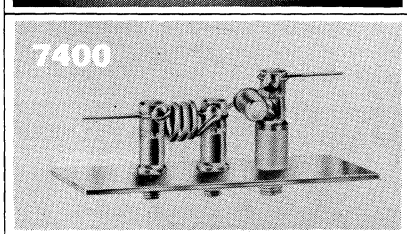
Applications:
- UHF oscillators
- Coupling (VHF & UHF)
- Terminations for UHF coupling links
- Strip lines and modular blocks
- Balancing of semiconductors and microwave components

Capacitance Range: 0.1 pF to 1.3 pF
Working Voltage: 200 VDC
Q @ 200 MHz: > 500
Temperature Coefficient: 50 ±50 ppm/°C
Torque: .1-1 in. oz.
Finish: 24K gold plate



For Military and Commercial Applications. The unique solid metal band design meets electrical and physical requirements beyond the capability of conventional trimmers.

Capacitance Range: 1.0—10.0 pF
Temperature Coefficient: 0 ±50 ppm/°C
Dielectric Strength: 1000 VDC @ 50% RH and maximum rated capacitance
Torque: 1—5 in. oz.
Q @ 1MHz: > 1000



The problems created by lead length at microwave frequencies can be minimized by soldering components directly to the capacitor.

Capacitance Range:
.5-4.5 pF—7400 (PC40J4R5)
.5-8.5 pF—7401 (PC40J8R5)
.7-12.0 pF—7402 (PC40H120)
.7-18.0 pF—7403 (PC40H180)
Vibration: 15 g's 20-2000 cps
Finish: 24K gold plate
Q @ 20 mc: > 500

CONFIGURATIONS



JMC 4140
C_1 = .8—5 pF; C_2 = 1—10 pF
(ranges available for C_1 & C_2 5 to 30 pF.)



JMC 6371
1—10 pF Vertical mount above panel



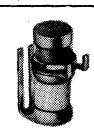
JMC 4581
4—40 thread
Cap: 0.8—10 pF
Filter application



JMC 4840
Cap: 0.8—10 pF
Non-magnetic



JMC 5046
Cap: 0.8—10 pF



JMC 6230
4.5—23.5 pF
Vertical mount below panel

Other Lines: • Tuners and ganged tuners; linear within ± .3% • Differential capacitors • Mil spec capacitors • Wide range of precision plate capacitors (gear driven). All lines available with special high reliability processing. Includes 100% burn-in and screening and historical test data.

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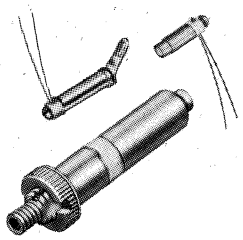
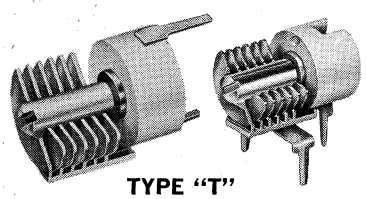
E. F. JOHNSON COMPANY
1923 Tenth Ave. S.W., Waseca, Minnesota 56093

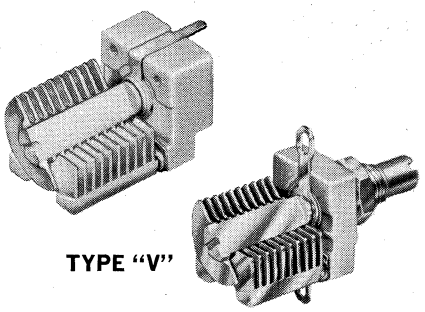
Variable capacitors



TEFLON TRIMMER



TYPE "T"



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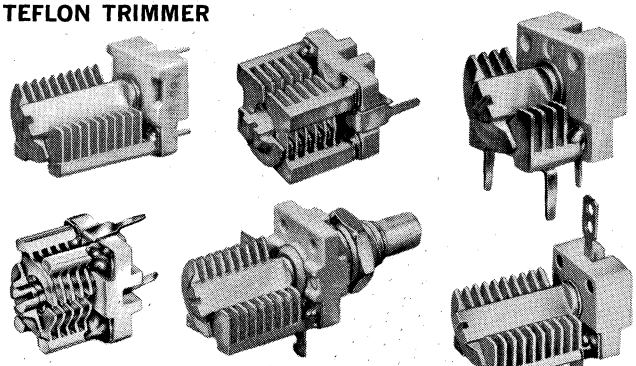
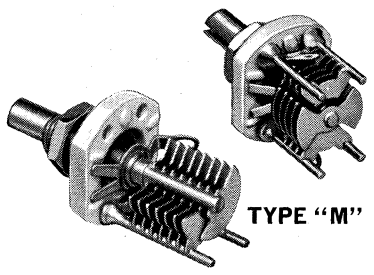


TYPE "U"



TYPE "M"

Sub-miniature PC types to large, heavy duty units

Whatever the choice . . . sub-miniature capacitors for printed circuit use—or large heavy duty types . . . design and development engineers specify Johnson variable capacitors.

More than eleven basic capacitor series available in a wide selection of single section, dual section, butterfly and differential types. Stock capacitors in a wide range of plate spacings, capacity per section, breakdown ratings, and finishes meet many military and commercial applications . . . specials available in production quantities.

TEFLON TRIMMERS—Ideal for VHF and UHF applications requiring low minimum capacity and delta C . . . high Q (2000 at 1 mHz) . . . linear tuning . . . temperature range —55° to +150°C. Voltage breakdown 2000 VDC. PC mount .25 to 1.5 pf; solder lug .25 to 1.5 pf; panel mount .30 to 2.9 pf.

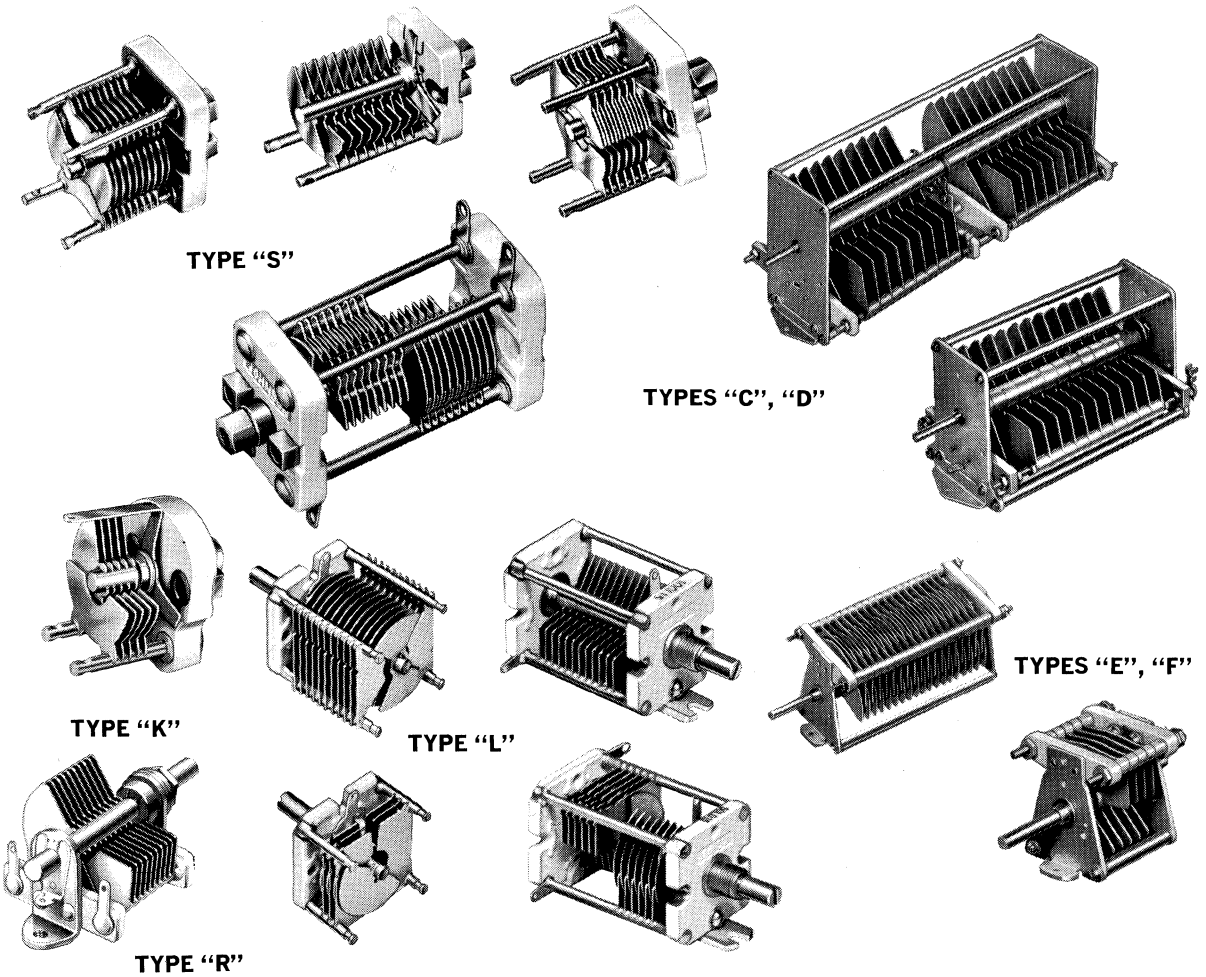
TYPE "T"—New sub-miniature air dielectric trimmer for VHF and UHF applications that call for small size (.310" dia.), high Q (greater than 1500 at 1 mHz), low TC, and low cost. Mounting dimensions of vertical mount "T" identical with ⅜" dia. PC ceramic disc trimmers. Nominal capacities from 1.3 pF to 15.7 pF. Minimum voltage breakdown is 250 VDC. End frame is 95% alumina, grade L624 or better, DC200 treated. Silver plated, Iridited metal parts resist discoloration. Plates are from one piece solid brass for uniformity, stability, and no moisture entrapment. Temp. coefficient is plus 30 ± 15 ppm/°C. Excellent retrace. Outstanding stability during vibration from 10 to 2000 Hz. Withstand the applicable portions of EIA-RS 204, MIL Std. 202C Methods 204A and 201A.

TYPE "U"—less than 0.23 sq. inch mounting area required. Rotors and stators machined from one piece of solid brass. Outstanding reliability with exceptionally uniform delta C and voltage characteristics. Highly resistant to shock and vibration—provide freedom from moisture entrapment. Voltage breakdown to 1100 VDC. Silver-plated metal parts—ceramic is steatite Grade L-423 or better. Single Section types available in: Printed Circuit (vertical and horizontal mounting models), Two-Hole, and Bushing Mount styles—Differential type for Printed Circuit mounting.

TYPE "V"—High capacity in minimum space. Printed circuit and panel mount types mount in less than 0.3 sq. in. area. Rotors and stators precision machined from one piece of solid brass for high reliability and outstanding mechanical stability! High "Q" (greater than 1500 at 1 mHz.) . . . low temperature coefficient (plus 50 ± 20 PPM/°C) . . . exceptionally uniform delta C and voltage characteristics. Metal parts, silver-plated—ceramic is steatite grade L-423, or better. Voltage breakdown rating 650 VDC. Freedom from moisture entrapment. Slotted rotor or shaft extension for convenient adjustment.

Detailed components catalog is available free . . .

CAPACITORS • TUBE SOCKETS • CONNECTORS • PILOT LIGHTS • INSULATORS



TYPE "M"—Mount in 5/8" x 3/4" area. Peak voltage ratings to 1250 volts on .017" spaced units. Soldered plate construction; securely anchored stator supports; DC-200 treated insulator; nickel-plated brass plates. Single Section, Butterfly, and Differential types with straight, locking and screwdriver shafts.

TYPE "S"—Slightly larger than the "M". Peak voltage rating: 850 volts—plate spacing .013", other spacings available. Solder plate construction; securely anchored stator supports; DC-200 treated insulator; nickel-plated brass plates. Single Section, Butterfly, Differential and Dual Types with straight locking and screwdriver shafts.

TYPE "K"—Single Section—widely used for military and commercial applications. DC-200 treated insulator, notched stator terminals; extra rigid soldered plate construction. Peak voltage ratings: 1000 volts. Plate spacing .015". Available in production quantities to MIL-C-92A specifications . . . variations available.

TYPE "R"—Single Section—extra-heavy steatite stator support insulators—soldered .023" thick brass plates. Metal parts heavily nickel-plated. Sturdy brass end frames—double bearing construction—silver-plated beryllium copper wiping contacts. Peak voltage rating 1200 volts. Specials available in production quantities.

TYPE "L"—Extreme stability and strength—rotor bearings and stator support rods soldered directly to heavy 3/16" steatite insulators. Split-sleeve bearing, silver-plated beryllium copper rotor contact for constant torque, smooth capacity variation. Plate spacing .030". Peak voltage rating 1500 volts. Single Section, Dual, Butterfly, and Differential types. Specials available in production quantities.

TYPES "C" AND "D"—Heavy .051" aluminum plates and 5/16" diameter aluminum tie rods; 1/4" cadmium-plated steel shafts; laminated phosphor bronze rotor contact springs; and steatite insulation. Type "C"—overall width: 5 1/2"—height: 5-13/32"—height bottom to shaft center: 3-3/32". Type "D"—overall width: 4 1/4"—height: 4"—height bottom to shaft center: 2-5/32". Dual types have center rotor connection for better balance. End frames tapped 8-32, 3 holes, for panel mounting—brackets furnished for chassis mounting.

TYPE "E" AND "F" CAPACITORS—Large amount of capacity per cubic inch and low capacity to chassis. Heavy aluminum plates .032" thick with rounded edges and large 1/4" tie rods; stainless steel shafts; sturdy phosphor bronze rotor contact springs; and center rotor contact on dual types. End frames tapped 8-32, 3 holes for panel mounting—brackets furnished for chassis mounting.

Write on company letterhead

• TERMINALS • INDUCTORS • HARDWARE

E. F. JOHNSON COMPANY®

1923 Tenth Ave. S.W., Waseca, Minnesota 56093

MIAL polystyrene capacitors

that out-perform...cost less than other capacitors.

General purpose polystyrene capacitor style 611



- *Capacitance Range:* 20 to 100,000 pF
- *Temperature Coefficient:* N150 ±50 ppm/°C
- *Capacity Tolerance:* from ±1pF to ±20%
- *Voltage Range:* 33, 63, 160, 630 & 1000 VDCW
- *Q Factor:* Over 2,000 at 100 KC +25°C

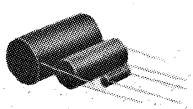
The MIAL Style 611 general purpose polystyrene capacitor with a temperature coefficient: N150 ±50 ppm/°C has a better tolerance characteristic than Mica Class B, C or D. Ideally suited for TV, radio, stereo and instrumentation applications requiring long life, high reliability, and complete freedom from drift. All this, for a cost of only pennies per unit.

For Your Convenience

- Popular values are stocked in depth at Nutley, N. J. for same day shipment.

TYPE	Capacitance pF Min. – Max.	Dimensions in Inches: Max. Length "L"	Max. Diameter "D"	Lead Diameter "d" ±.002
33 VDCW	100 – 1,000	.315	.106 – .165	.008 – .012
	1,001 – 2,200	.394	.150 – .193	.008 – .016
	2,201 – 5,000	.473	.173 – .260	.012 – .016
	5,001 – 30,000	.670	.210 – .476	.020
	30,001 – 100,000	.867	.380 – .676	.020
63 VDCW	70 – 820	.315	.122 – .186	.008 – .012
	821 – 5,000	.473	.160 – .315	.012
	5,001 – 10,000	.670	.270 – .319	.020
	10,001 – 25,000	.867	.292 – .410	.020
160 VDCW	20 – 600	.315	.146 – .217	.012
	601 – 2,000	.474	.195 – .285	.016
	2,001 – 5,000	.670	.220 – .350	.020
	5,001 – 15,000	.867	.290 – .453	.020
	15,001 – 25,000	1.260	.400 – .500	.020
630 VDCW	20 – 500	.470	.173 – .251	.016
	501 – 3,000	.670	.215 – .381	.020
	3,001 – 10,000	.867	.332 – .555	.020
	10,001 – 25,000	1.260	.500 – .693	.020 – .024
1000 VDCW	50 – 500	.670	.193 – .291	.020
	471 – 4,000	.867	.260 – .496	.020
	4,001 – 25,000	1.260	.370 – .970*	.020 – .024

Other MIAL polystyrenes



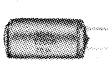
MIAL 602
High Reliability Precision Type



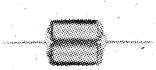
MIAL 603
Printed Circuit Mounting—High Reliability Precision Type



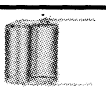
MIAL 610
Sub-Miniature



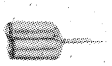
MIAL 612
Printed Circuit Board Mounting



MIAL 613
Axial Lead Close Tolerance



MIAL 614
Radial Lead Close Tolerance

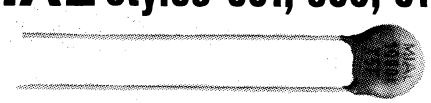


MIAL 615
End Lead Close Tolerance



MIAL 616
Axial Lead

Miniature ceramic disc capacitors feature .240 max. diameter MIAL styles 501, 506, 511



A new series of low cost ceramic disc capacitors featuring a .240 max. diameter unit in each style in addition to standard .275 thru .690 diameter types.

Long or stub leads for printed circuits are available in all three styles.

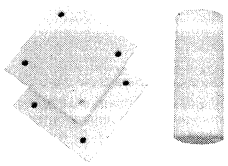
	Capacitance Range	Voltage Rating	Capacitance Tolerance
501 NPO	up to 110 pF	500 VDCW	¼ pF to 20%
501 N750	up to 270 pF	500 VDCW	¼ pF to 20%
506 X5F	up to 4700 pF	500 VDCW	10% to 20%
511 Z5U	up to 15,000 pF	500 VDCW	20% to +80% –20%

WRITE OR CALL FOR INFORMATION AND COMPLETE MIAL CATALOG

MIAL MIAL U.S.A., INC.

165 FRANKLIN AVENUE NUTLEY, NEW JERSEY 07110 201/667-1600

RMC DISCAPS



NEW!!

Alumina Ceramics

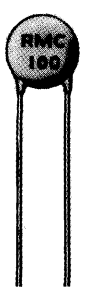
RMC's expanded capabilities include the production of High Alumina substrates with a range of finishes suitable for both thick and thin film deposition. Flat plate and extruded rod shapes are available.



Low Voltage Subminiatures

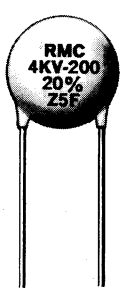
For applications requiring components with higher capacitance values at lower voltages ratings, RMC lists:

TYPES CM, SM, BT, or TA



Temperature Compensating TYPE C or CG

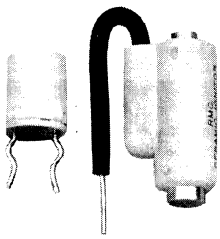
Type C DISCAPS are designed for applications requiring a rating of 1000 volts D.C. Where a 500 volt D.C. rating is adequate. Type CG can be specified. Both types meet or exceed EIA specifications and are ideal for VHF or UHF applications.



High K-High Voltage

Maximum capacities combined with high voltage ratings are available in this line. Rated from 2000 to 6000 VDC in Z5F or Z5U temperature coefficients. Tolerances are ±10%, ±20%, +80-20% or GMV. **NEW! Additional ratings of 7½, 10 and 15 KV are now available for high voltage supply applications.**

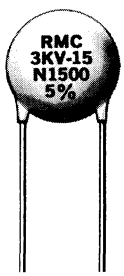
THE STANDARD OF PERFORMANCE THROUGHOUT THE ENTIRE ELECTRONICS INDUSTRY



NEW!!

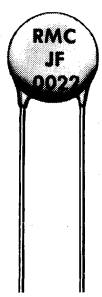
Piezoelectric Ceramics

RMC can now supply your requirements for a variety of Piezoelectric Devices. Radial mode resonators for filter applications and spark ignition devices are currently available.



T.C. High Voltage

These components are suited to high frequency, corona free applications. Available in working voltages from 2000 to 6000 VDC in temperature coefficients of N-750, N-1500 or N-2200.



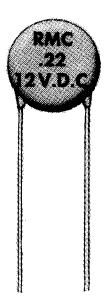
High Dielectric Constant

The industry's broadest line of high dielectric constant ceramic disc capacitors in wide capacitance ranges, select working voltages and tolerances.

Featured are:

TYPES B, JL, JF, JE, JK, BA, JG, BG

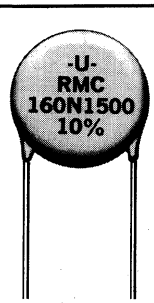
Complete specifications listed in detailed RMC catalog.



Magnacaps

Designed for application in low voltage circuits, Magnacaps combine very high capacitances with small physical sizes. These components are available in 3, 12, 16 and 25 volt ratings in wide capacity ranges.

TYPES M3, M12, M16 and M25



Specials

Widest variety of special components for varied applications. Featured are Type U, TC Solder-Ins, Sparkcaps, and Low Voltage "Chip" Capacitors. For special requirements, contact RMC.

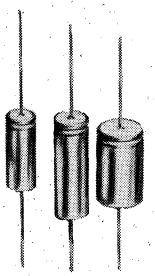
Standard Mallory components are available from authorized Mallory distributors throughout the United States.

RADIO MATERIALS COMPANY
a division of P. R. MALLORY & CO. INC.
4242 W. Bryn Mawr, Chicago, Illinois 60646; Telephone: 312-478-3600

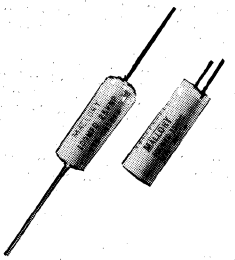
MALLORY

MALLORY ELECTROLYTIC CAPACITORS

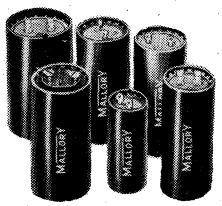
Aluminum Electrolytics



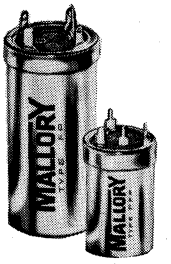
TCW — Axial lead, tubulars. Sizes from ½" to 1" diameter. Voltages to 450 VDC. Wide range of capacity ratings, temperature to 85°C. All welded terminations. **Bulletin 4-66**



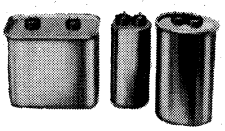
MTA-MTV — Low cost, plastic molded capacitors. Axial or radial leads. For printed circuit board insertion. **Bulletin 4-74**



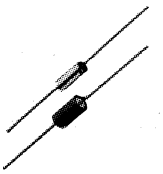
AC Motor Start — A/C capacitor for motor starting and other intermittent service. Plastic case. Various mounting hardware available. **Bulletin 4-22.**



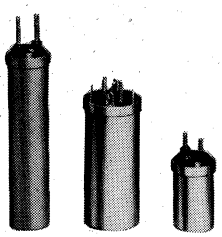
FP & PFP — The original 85°C capacitor for radio and TV applications. Twist prong or printed circuit type terminals, multiple ratings in one case. **Bulletin 4-11**



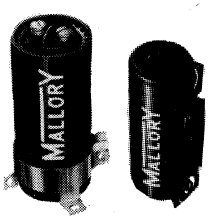
AC Oil — Paper dielectric capacitors for continuous operation in AC powered equipment. Used for air conditioners, refrigeration equipment, business machines and industrial controls. **Bulletin 4-14**



TT-TTX-TTQ — Axial lead miniature tubular capacitors for transistor circuitry, computer and entertainment applications — TTQ type for longer life reliability, TTX for better cold temperature impedance. **Bulletins 4-33, 4-75**



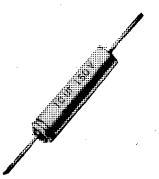
PG — Premium grade, long life, high reliability capacitors developed specifically for the telephone systems industry. Suited for use in other high reliability applications. **Bulletin 4-56**



HC & NP — For heavy duty industrial electrical applications. Type HC is polarized. Type NP is non-polarized. **Bulletin 4-46**



CG & CGS — The original computer grade capacitor. Widely used for high reliability energy storage and filtering in power supply circuits. Temperature ranges to 65°C and 85°C. Voltages top to 450 VDC. **Bulletins 4-80, 4-81**



TPG & VPG — Long life 85°C tubular capacitors both axial and radial leads. Ultimate in reliability for a miniature aluminum electrolytic capacitor. Molded elastomer end seals, all welded terminations, safety vents. **Bulletin 4-67.**

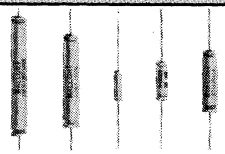
Standard Mallory components are available from authorized Mallory distributors throughout the United States.

MALLORY CAPACITOR COMPANY
a division of P. R. MALLORY & CO. INC.
3029 E. Washington St., Indianapolis, Indiana 46206; Telephone: 317-636-5353

MALLORY ELECTROLYTIC CAPACITORS

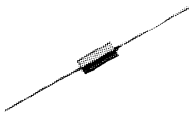
Tantalum Electrolytics

FOIL TYPES

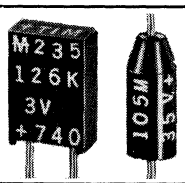


TFS-TFE — Available in plain or etched foil; polarized or non-polarized. All ratings and sizes of MIL-C-3965. Higher capacity ratings available on special order. **Bulletin 4-65**

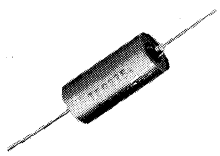
SOLID ELECTROLYTE TYPES



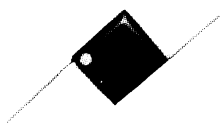
TAS — Hermetically sealed, designed for miniaturized equipment. Extremely high capacitance per unit volume. Sintered anode type. **Bulletin 4-40.**



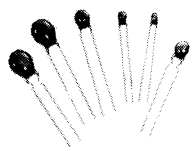
TIM & TAC — Molded epoxy case. Three axial lead sizes, four radial lead sizes. Uniform size for automatic assembly methods. **Bulletin 4-82**



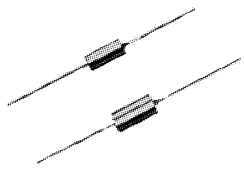
TER — Four hermetically sealed case sizes for high reliability and aerospace applications. Meets MIL-C-39003 L, M & P failure rates. **See military specification.**



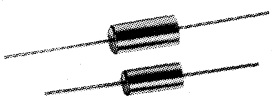
TUR — Chip capacitors for applications involving IC's thin film circuits and other microelectronic circuitry. Unencapsulated, variety of geometrics.



TDC — Dip coated with radial leads for printed circuit commercial and consumer applications. Inexpensive, four sizes. **Bulletin 4-810**

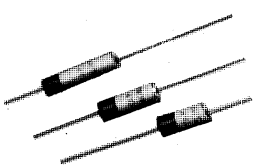


THF — Hermetically sealed. Excellent frequency response characteristics, higher ripple current, low ESR. Available in military C & D case sizes. **Bulletin 4-83**



TAE — Rugged construction for proven reliability in high vibration and/or shock environments. Axial load, metal case, epoxy end poured construction. **Bulletin 4-85**

LIQUID ELECTROLYTE TYPES



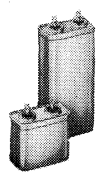
TNT & TAP — Miniature liquid electrolyte capacitors. Five sizes, high capacity per unit volume, elastomer sealed, economical for industrial and ground communications gear. **Bulletin 4-38, 4-52**



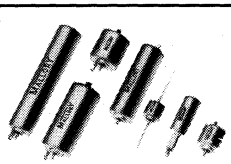
MTP & MTPH — Extremely high capacitance per unit volume. Ideal for microelectronic applications where size and reliability is needed. **Bulletin 4-70**



TLS — Meets MIL-C-3965 specifications, styles CL 64 and 65. Low DC leakage is especially suited for low current timing circuits. **Bulletin 4-71**



TL — Hermetically sealed package. Equivalent to style CL 55 of MIL-C-3965. Six ratings in each of 5 case sizes. Large capacity ratings for filtering applications. **Bulletin 4-79**

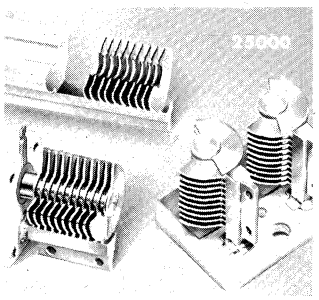


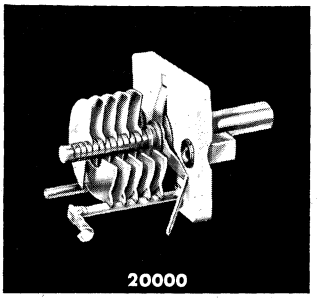
XT Series (XTM, XTK, XTH, XTL, XTV) — Hermetically sealed capacitors in a wide variety of ratings and sizes. For extreme aerospace environments or precision industrial equipment. Temperature range to 175°C. MIL-C-3965, styles CL 10 through CL 18. **Bulletin 4-84**

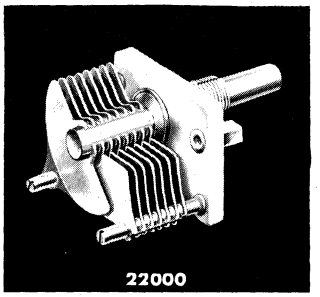
Standard Mallory components are available from authorized Mallory distributors throughout the United States.

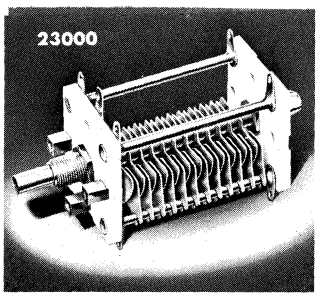
MALLORY CAPACITOR COMPANY
a division of P. R. MALLORY & CO. INC.
3029 E. Washington St., Indianapolis, Indiana 46206; Telephone: 317-636-5353

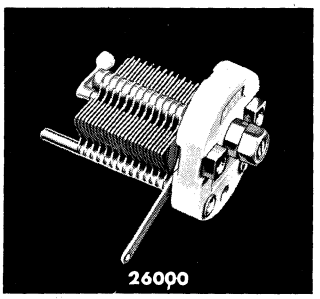
MALLORY

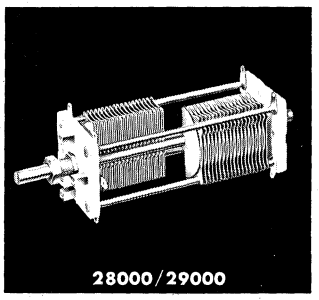


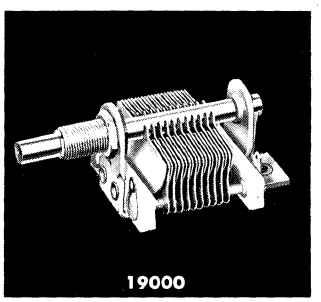


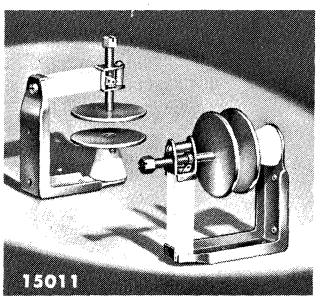


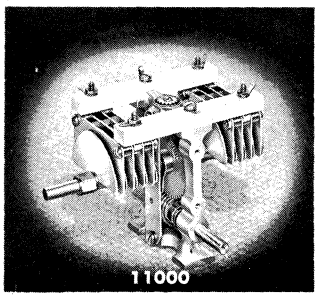


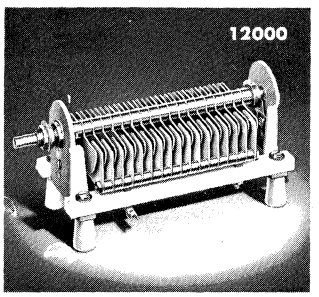


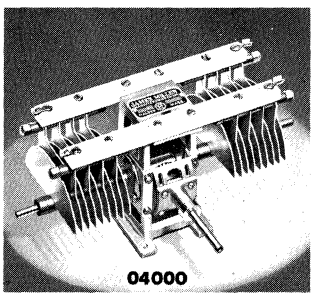


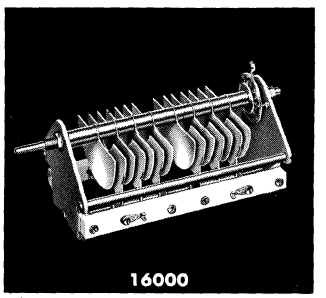












"Designed for Application"® CAPACITORS

No. 25000 miniature, precision, high Q variable air dielectric capacitors with high reliability are machined from solid bars of extruded brass. Knob or screw-driver adjust from the front. Single hole mount, mount with two screws, or with tabs. 0.010" air gap. 350V. 21 plate **25035** is 4.0 to 35.8pf. 0.750" x 0.562" x 23/32"L.

No. 20000 Ceramic end plate 1-3/16" x 1-5/16". Silver plated plates. 0.015" air gap — 600V. peak or 0.045" air gap — 1400V. peak.

20005 2.0-4.5pf. 600V. ¾"L—**20100** 5.2- 111pf. 600V. 1½"L

20904 2.5-3.8pf. 1400V. ⅞"L—**20935** 6.7-39.5pf. 1400V. 2⅛"L

No. 22000 Ceramic end plate 1-1/16" x 1-7/16". Single bearing or double bearing. Air gap 0.020"—800V. peak or 0.060"—2000V. peak.

22006 2.8- 7.5pf. 800V. 1⅛"L—**22200MK** 11-207pf. 800V. 2-9/16"

22910 4.1-12.5pf. 2000V. 1¼"L—**22950MK** 8.5-57.0pf. 2000V. 3"L

No. 23000 Ceramic end plate 1-7/16" x 1½". Single bearing or double bearing. Single or dual section. Balanced or inline rotor. Air gap 0.020"-800V. peak or 0.060"—2000V. peak.

23907MKY 3.5-7pf. 2000V. 1-9/16"L—**23140MK** 10-146.5pf. 800V. 2⅛"L

No. 26000 Ceramic end plate 15/16" x 1-7/32". Silver plated plates. 0.015" air gap — 600V. peak or 0.045" air gap — 1400V. peak.

26010 2.9-11pf. 600V. ⅞"L—**26100** 5.5-109pf. 600V. 1-9/16"L

26910 3.3-11pf. 1400V. 1⅛"L—**26935** 6.8-39.5pf. 1400V. 2-3/16"L

No. 28000 Straight line capacity or **No. 29000** straight line frequency. Double ceramic end plates 1-9/16" x 1-11/16". Double bearing. Single or double section. Balanced or inline rotor. Air gap 0.022"-850V. peak, 0.040"-1350V. peak or 0.066"—2250V. peak.

28227MKW 16-227pf. 1350V. 4-1/16"L—**29025KM** 3.9-23.3pf. 850V. 1-9/16L

No. 19000 Ceramic insulators. Cross section 1-9/16" x 1-11/16". Double bearing. Air gap 0.022"-850V. peak, 0.040" — 1350 V. peak or 0.066" — 2250V. peak. Single section. Tapped mounting brackets.

19335 14.7-339pf. 850 V. 2⅜"L—**19950** 11.6-60pf. 2250V. 2¼"L

No. 15000 NEUTRALIZING CAPACITORS. Parallel discs or concentric cylinders. **15011 Disc** 3.5pf. at 0.4" gap to 18pf. at 0.04" gap.

15005 Cylindrical Capacitor — 3.5pf. to 16.2pf. — 4000V. peak.

15006 Cylindrical Capacitor — 3.2pf. to 9.7pf. — 6000V. peak.

No. 11000 TRANSMITTING CAPACITORS. 16/1 or 48/1 ratio center gear drive. Ceramic insulation. Air gap 0.077"-3000V. peak or 0.176"-6000V. peak. Polished aluminum plates 0.040" thick. Dual section.

11035 5.3-34pf. 3000V. 5-7/16"L—**11090** 10-93pf. 3000V. 7⅜"L

No. 12000 TRANSMITTING CAPACITORS. Rigid, heavy channeled aluminum end plates. Ceramic insulation. Single or dual section. Air gap 0.077"-3000V. peak or 0.176"-6000V. peak. Polished aluminum plates 0.040" thick. Unpolished plates available for 3000V. gap.

12536 9.7-28pf. 6000V. 4"L—**12515** 16-150pf. 3000V. 5¼"L

No. 04000 BALANCED TRANSMITTING CAPACITORS. 1/1 right angle center gear drive. Adjustable drive angle for sloping panel. Sturdy cast aluminum frame. Ceramic insulation. Air gap 0.077"-3000V. peak, 0.171"-6000V. peak or 0.265"-9000V. peak. Polished plates.

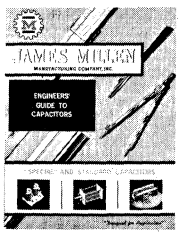
No. 16000 TRANSMITTING CAPACITORS. Ceramic insulation. Air gap 0.077"-3000V. peak, 0.171"-6000V. peak or 0.265"-9000V. peak. Polished aluminum plates 0.050" thick. Single or dual section.

16550 13-52pf. 6000V. 3⅜"L—**16530** 45-297pf. 6000V. 12½"L

16559 11-65pf. 9000V. 6¼"L—**16512** 40-128pf. 9000V. 11½"L

NEW James Millen Mfg. Co., Inc.
ENGINEERS' GUIDE
TO CAPACITORS

"Special" and Standard
CAPACITOR CATALOG



JAMES MILLEN MFG. CO., INC.
MAIN OFFICE AND FACTORY
150 EXCHANGE ST., MALDEN, MASSACHUSETTS, U. S. A.

MONOLITHIC CERAMIC CHIP CAPACITORS • TYPE K • 1200

MDI offers a truly solid-state capacitor featuring monolithic construction which is inherently impervious to moisture and contamination — yet without space and cost consuming exterior encapsulation.

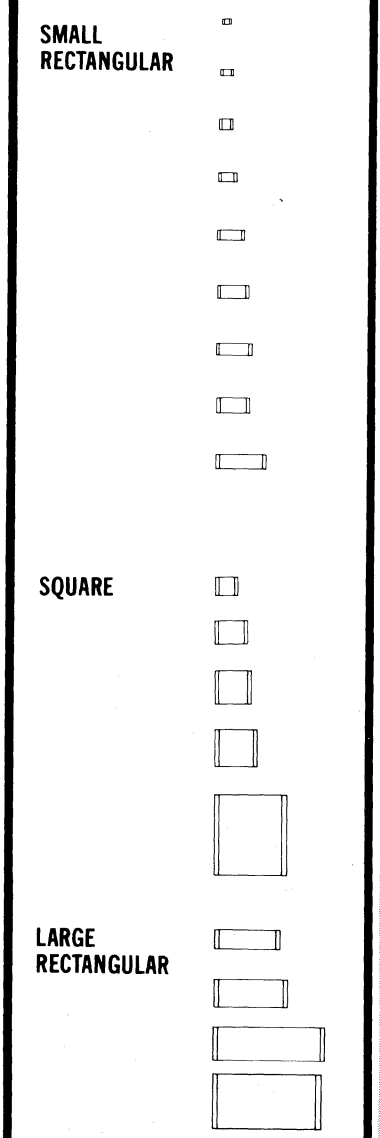
A new breakthrough in the state-of-the-art enables MDI to provide capacitance ranges previously unattainable in comparable sizes and characteristics.

GENERAL SPECIFICATIONS

Capacitance Range: 5 pF to 2.5 Mfd
Tolerance: ±20% std., ±10%, ±5% and GMV
Dissipation Factor: Less than 2% @ 1 kHz
Insulation Resistance: 1000 megohm-mfd or 100,000 megohms @ 25°C and VDCW (÷10 for 125°C)
Temperature Coefficient: ±15% max, −55°C to 125°C
Voltage-Temperature Coefficient: +15%, −25%, −55°C to 125°C
MIL Specifications: Meets applicable portions MIL-C-11015 and MIL-C-39014
Working Voltage: 25/50/100/200 VDC

Flash Test: 3 × VDCW below .1 Mfd
2.5 × VDCW .1 Mfd and above
(5 sec @ 25°C, 50 ma max)
Life Test: 2 × VDCW @ 125°C, 1000 hrs
Electrodes: .015 min silver band-width standard; other noble metals available
Inspection Sequence:
1. Capacitance
2. Dissipation Factor
3. Insulation Resistance
4. Flash Test

ACTUAL PHYSICAL SIZE



MDI SIZE	DIMENSIONS L*	W*	T(MAX)	MAX. CAPACITANCE VALUE AVAILABLE (5 pF MIN.) 25VDCW	50 VDCW	100 VDCW	200VDCW
R10	.050	.035	.040	.01†	8200pF	2700pF	820pF
R12	.070	.035	.040	.015Mfd†	.012Mfd	3900pF	1200pF
R14	.077	.054	.050	.033Mfd	.015Mfd	4700pF	1500pF
R16	.100	.050	.060	.034Mfd	.027Mfd	.012Mfd	2700pF
R23	.150	.050	.050	.068Mfd	.056Mfd	.022Mfd	.01 Mfd
R25	.170	.065	.065	.12 Mfd	.1 Mfd	.039Mfd	.012Mfd
R27	.190	.065	.065	.15 Mfd	.12 Mfd	.056Mfd	.015Mfd
R29	.180	.080	.065	.18 Mfd	.12 Mfd	.056Mfd	.015Mfd
R31	.270	.080	.070	.33 Mfd	.2 Mfd	.1 Mfd	.033Mfd
S41	.125	.095	.065	.15 Mfd	.1 Mfd	.056Mfd	.012Mfd
S43	.175	.125	.065	.22 Mfd	.15 Mfd	.068Mfd	.018Mfd
S45	.197	.180	.065	.50 Mfd	.22 Mfd	.1 Mfd	.047Mfd
S47	.225	.210	.065	.68 Mfd	.39 Mfd	.18 Mfd	.056Mfd
S49	.390	.425	.065	2.5 Mfd	1.5 Mfd	.68 Mfd	.18 Mfd
L64	.350	.095	.070	.5 Mfd	.27 Mfd	.12 Mfd	.056Mfd
L68	.395	.145	.060	1.0 Mfd	.56 Mfd	.22 Mfd	.1 Mfd
L72	.595	.185	.070	1.5 Mfd	.68 Mfd	.47 Mfd	.12 Mfd
L76	.585	.298	.070	2.5 Mfd	1.5 Mfd	1.0 Mfd	.18 Mfd

*±.010 or ±7%, whichever is greater

† This specific value exceeds max. thickness.

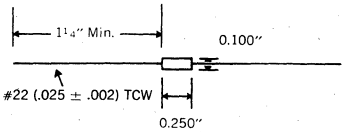
Monolithic Dielectrics Inc. Post Office Box 647 ▪ Burbank, California 91503 ▪ (213) 848-4465

NYTRONICS, INC.
STANDARD COMPONENTS GROUP

CERAMIC CAPACITORS

The DECI-CAP

4.7pf to 27,000pf in 46 values. Standardized size 0.100" by 0.250". Designed to meet the requirements of MIL-C-11015. Epoxy molded for highest performance and reliability. High density cordwood packaging.



The **DECI-CAP** offers the design engineer unique epoxy-molded reliability and a new high standard in performance. This subminiature ceramic capacitor features a low power factor and exhibits outstanding stability over its entire —55° to +125°C operating range. Its rugged epoxy molded envelope and high quality ceramic dielectric insure that the DECI-CAP meets the environmental requirements of MIL-C-11015D.

ELECTRICAL CHARACTERISTICS

Capacitance Range: 4.7pf to 27,000pf.

Tolerance: ±10%.

Working Voltage: 4.7pf to 470pf: 200 Volts D.C. 560pf to 27,000pf: 100 Volts D.C.

Insulation Resistance: 20,000 Megohms Minimum.

Dielectric Strength: Withstands an applied voltage of 500 Volts D.C. to 470pf; 250 Volts D.C. from 560pf to 27,000pf.

Dissipation Factor: .025 Max.

Capacitance Change with Temperature: ±15%; −55 to +125°C.

Note: Also available at 50 WVDC to 47,000 pf.

DENSITY CHARACTERISTICS

Volume: 0.002 Cubic Inches **Weight:** 0.352 Grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Life Test: 1000 hours at 125°C under twice rated voltage.

Moisture Vibration, and Shock Resistance: Meets the requirements of MIL-C-11015.

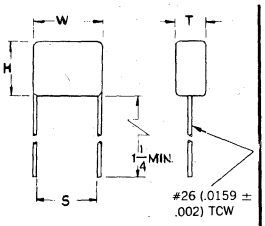
Nytronics Cat. No.	Capacitance pf at 25°C	Nytronics Cat. No.	Capacitance pf at 25°C
DC-047	4.7	DC-391	390
DC-056	5.6	DC-471	470
DC-068	6.8	DC-561	560
DC-082	8.2	DC-681	680
DC-100	10	DC-821	820
DC-120	12	DC-102	1000
DC-150	15	DC-122	1200
DC-180	18	DC-152	1500
DC-220	22	DC-182	1800
DC-270	27	DC-222	2200
DC-330	33	DC-272	2700
DC-390	39	DC-332	3300
DC-470	47	DC-392	3900
DC-560	56	DC-472	4700
DC-680	68	DC-562	5600
DC-820	82	DC-682	6800
DC-101	100	DC-822	8200
DC-121	120	DC-103	10000
DC-151	150	DC-123	12000
DC-181	180	DC-153	15000
DC-221	220	DC-183	18000
DC-271	270	DC-223	22000
DC-331	330	DC-273	27000

The HY-CAP

High Capacity Ceramic Capacitor Capacitance Range .01 mfd to 2.5 mfd.* Less than ±15% capacitance change from —55°C to 125°C. Voltage: 100 Volts D.C. No derating to 125°C. Designed to meet MIL-C-11015.

Nytronics offers the **HY-CAP** Ceramic Capacitor to accommodate design application in coupling, bypass, and filter circuits where temperature stability and high capacitance are mandatory.

ELECTRICAL CHARACTERISTICS



Capacitance Range: .01 mfd to 2.5 mfd.*
Tolerance: ±20%.
Working Voltage: 100 Volts D.C. (No derating to 125°C).
Dissipation Factor: .025 Max.

For values down to 4.7 pf and ±10% tolerance, check Nytronics new **FLAT-CAP** line.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Life Test: 1000 hours at 125°C under twice rated voltage.

Moisture, Vibration, and Shock Resistance: Meets the requirements of MIL-C-11015 (body mounted).
*Higher values available on special order.

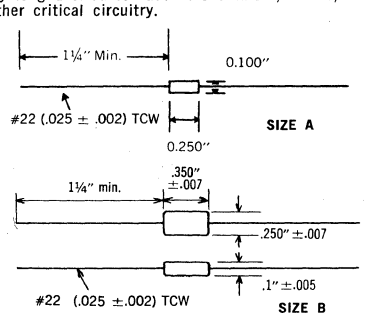
Nytronics Part No.	Cap. (mfd.)	Case	Nytronics Part No.	Cap. (mfd.)	Case
HC-A-103-M	.01	A	HC-B-124-M	.12	B
HC-A-123-M	.012	A	HC-C-154-M	.15	C
HC-A-153-M	.015	A	HC-C-184-M	.18	C
HC-A-183-M	.018	A	HC-C-224-M	.22	C
HC-A-223-M	.022	A	HC-C-274-M	.27	C
HC-A-273-M	.027	A	HC-C-334-M	.33	C
HC-A-333-M	.033	A	HC-C-394-M	.39	C
HC-B-393-M	.039	B	HC-C-474-M	.47	C
HC-B-473-M	.047	B	HC-D-105-M	1.0	D
HC-B-563-M	.056	B	HC-E-155-M	1.5	E
HC-B-683-M	.068	B	HC-F-205-M	2.0	F
HC-B-823-M	.082	B	HC-G-255-M	2.5	G
HC-B-104-M	.100	B			

Types	W max.	H max.	T max.	S nom.
A	0.225	0.175	0.110	0.200
B	0.325	0.310	0.150	0.300
C	0.670	0.355	0.150	0.625
D	0.800	0.550	0.225	0.625
E	0.800	0.550	0.250	0.625
F	0.800	0.550	0.300	0.625
G	0.800	0.550	0.375	0.625

The NYT-CAP

Ultra High Stability — TC of 0±25 ppm/°C. Miniature Molded Epoxy Case suitable for high component density applicaitons. 200 Volt D.C. rating.

A new development from Nytronics' ceramic research laboratory now makes possible the manufacture of an extremely stable ceramic capacitor in a miniature package size. Now you can have the capacitor stability long desired for use in oscillators, filters, and other critical circuitry.



ELECTRICAL CHARACTERISTICS

Capacitance Range: 4.7 pf to 4700 pf.
Capacitance Tolerance: ±10% standard.
Working Voltage: 200 Volts D.C.
Temperature Coefficient: 0±25 ppm/°C over temperature range of −55°C to +125°C.
Dissipation Factor: Less than 0.001 at 25°C.
Insulation Resistance: 1,000,000 Megohms at 25°C.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Case Size: A: 0.1" dia. x 0.250" long.
B: 0.350" x 0.250" x 0.1".
Case Material: Epoxy.
Volume A: 0.002 cubic inches.
B: 0.0088 cubic inches.
Weight (Maximum): 0.352 grams.
B: 0.69 grams.

Nytronics Part No.	Capacity (pF)	Case Size	Nytronics Part No.	Capacity (pF)	Case Size
NC-047	4.7	A	NC-330	33	A
NC-056	5.6	A	NC-390	39	A
NC-068	6.8	A	NC-470	47	A
NC-082	8.2	A	NC-560	56	A
NC-100	10	A	NC-680	68	A
NC-120	12	A	NC-820	82	A
NC-150	15	A	NC-101	100	A
NC-180	18	A	NC-121	120	A
NC-220	22	A	NC-151	150	A
NC-270	27	A	NC-181	180	A

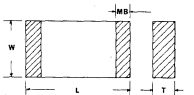
Nytronics Part No.	Capacity (pF)	Case Size	Nytronics Part No.	Capacity (pF)	Case Size
NC-221	220	A	NC-152	1500	B
NC-271	270	B	NC-182	1800	B
NC-331	330	B	NC-222	2200	B
NC-391	390	B	NC-272	2700	B
NC-471	470	B	NC-332	3300	B
NC-561	560	B	NC-392	3900	B
NC-681	680	B	NC-472	4700	B
NC-821	820	B			
NC-102	1000	B			
NC-122	1200	B			

The NYT-CHIP

Ultra High Stability — TC of 0±25 ppm/°C. 200 Volt D.C. rating. Compatible with: Integrated Circuitry; Thick and Thin Film Microcircuits; LSI.

The **NYT-CHIP** provides in slug form all of the high stability and low loss features of the epoxy molded **NYT-CAP.** This configuration yields the greatest possible packaging density and has the highest degree of mounting flexibility for use with all presently used packaging techniques. **NYT-CHIPS** are supplied with "wrap-around" tinned terminals permitting connection to either face or to the ends of the chip.

ELECTRICAL CHARACTERISTICS



Capacitance Range: 4.7 pf. to 4700 pf.
Capacitance Tolerance: ±10% standard.
Working Voltage: 200 Volts D.C.
Temperature Coefficient: 0±25 ppm/°C over temperature range of −55°C to +125°C.
Dissipation Factor: Less than 0.001 at 25°C.
Insulation Resistance: 1,000,000 Megohms at 25°C.

PHYSICAL CHARACTERISTICS

	L	W	T	MB
Size A:	.170±.015	.065±.015	.070 max.	.035+.020 −.010
Size B:	.280±.020	.195±.020	.070 max.	.035+.020 −.010

Note Dimensions are for slugs with tinned terminals.

Nytronics Part No.	Capacity (pF)	Chip Size	Nytronics Part No.	Capacity (pF)	Chip Size
NCU-047	4.7	A	NCU-181	180	A
NCU-056	5.6	A	NCU-221	220	A
NCU-068	6.8	A	NCU-271	270	B
NCU-082	8.2	A	NCU-331	330	B
NCU-100	10	A	NCU-391	390	B
NCU-120	12	A	NCU-471	470	B
NCU-150	15	A	NCU-561	560	B
NCU-180	18	A	NCU-681	680	B
NCU-220	22	A	NCU-821	820	B
NCU-270	27	A	NCU-102	1000	B
NCU-330	33	A	NCU-122	1200	B
NCU-390	39	A	NCU-152	1500	B
NCU-470	47	A	NCU-182	1800	B
NCU-560	56	A	NCU-222	2200	B
NCU-680	68	A	NCU-272	2700	B
NCU-820	82	A	NCU-332	3300	B
NCU-101	100	A	NCU-392	3900	B
NCU-121	120	A	NCU-472	4700	B
NCU-151	150	A			

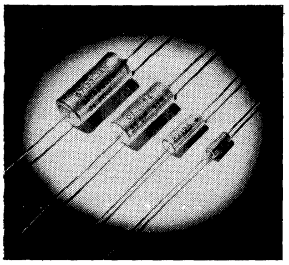
ALSO CONTACT US FOR R.F. INDUCTORS; THIN FILM RESISTORS; AND DELAY LINES . . .

Essex Electronics Division
NYTRONICS, INC.
550 Springfield Ave., Berkeley Heights, N. J. 07922
Tel.: 201-464-9300 / TWX: 710-984-7977

NYTRONICS, INC.
STANDARD COMPONENTS GROUP

Capacitors

Established Reliability Solid Electrolyte Tantalum Capacitors Type CSR13 to MIL-C-39003A



- Hermetically Sealed
- Insulated Metal Case
- Axial Leads
- −55°C to +125°C
- 6 to 50 Volts
- Four Case Configurations

TYPE DESIGNATION

CSR13	B	565	L	L*
STYLE	DC RATED & SURGE VOLTAGES	CAPACITANCE	CAPACITANCE TOLERANCE	FAILURE RATE LEVEL

SYMBOL	RATED	SURGE
B	6	8
C	10	13
D	15	20
E	20	26
F	35	46
G	50	65
H	75	98
J	100	130

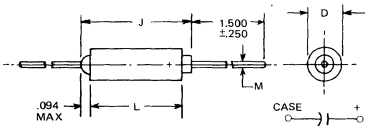
NOMINAL CAPACITANCE IN PICOFARADS. FIRST TWO DIGITS ARE SIGNIFICANT FIGURES. LAST DIGIT SPECIFIES NUMBER OF ZEROS TO FOLLOW.
EXAMPLE:
565 = 5,600,000 pF
OR
5.6 µF

K = ±10%
M = ±20%

ESTABLISHED AT 60% CONFIDENCE LEVEL IN % PER 1000 HOURS.
L = .2%
M = .1%
P = .1%
R = .01%
S = .001%

*COMPLETE TYPE NUMBER INCLUDES A FOUR-DIGIT SUFFIX FOLLOWING THE FAILURE-RATE DESIGNATION. SEE STANDARD RATING TABLES BELOW.

STANDARD DIMENSIONS



Case size	Dimensions L ±.031	D +.016 −.015	M ±.002	J Max
A	.286	.135	.020	.422
B	.474	.185	.020	.610
C	.686	.289	.025	.822
D	.786	.351	.025	.922

NOTES:
1. Dimensions are in inches.
2. These capacitors are not intended to be mounted by their leads.
3. The case insulation shall extend .015 inch (.38 mm) minimum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.
4. Example of marking:

83125	+	Source Code (Federal Supply Code)+
67139-JAN		Date (2 Digits) & Lot No. (3 Digits)
M39003/	+	Part of Part No. (Polarity)+
01-2001		Balance of Part No.
5.6 µF 6VDC 10%		Capacitance, Voltage, Tolerance

When size of can does not provide sufficient space for complete marking shown above, the following alternate markings are used:

83125+		J+
67139-J	OR	M390
M39003/		03/01
01-2001		-2001

5. Case: Type – Tubular, insulated.
   Material – Metal.
   Type of seal – Hermetic.
6. Leads: Nickel, Tin-lead coated.
7. DC rated voltage: Above 85°C voltage derating is required, as follows:

AT 125°C	
SYMBOL	RATED	SURGE
B	4	5
C	7	9
D	10	12
E	13	16
F	23	28
G	33	40
H	50	64
J	67	81

STANDARD RATINGS

Type designation 1/	DC rated voltage	Capacitance 2/	Capacitance tolerance	DC leakage at +25°C	DC leakage at +85°C	DC leakage at +125°C	Dissipation factor at −55°C +25°C	Dissipation factor at +85°C +125°C	Case size	Dash number failure rate level (%/1,000 hours) 3/ L	M	P	R	S
	volts	µF	percent	µA	µA	µA	percent	percent		2.0	1.0	0.1	0.01	0.001
CSR13B565K-	6	5.6	10	.5	6	7.5	4	4	A	2001	2241	2481	2721	2961
B685K-	6	6.8	10	.5	6	7.5	6	6	A	2002	2242	2482	2722	2962
B685M-	6	6.8	20	.5	6	7.5	6	6	A	2003	2243	2483	2723	2963
B476K-	6	47.0	10	3.0	24	30.0	6	6	B	2004	2244	2484	2724	2964
B476M-	6	47.0	20	3.0	24	30.0	6	6	B	2005	2245	2485	2725	2965
B566K-	6	56.0	10	3.0	24	30.0	6	6	C	2006	2246	2486	2726	2966
B157K-	6	150.0	10	9.0	90	113.0	8	8	C	2007	2247	2487	2727	2967
B157M-	6	150.0	20	9.0	90	113.0	8	8	C	2008	2248	2488	2728	2968
B187K-	6	180.0	10	11.0	110	138.0	8	8	C	2009	2249	2489	2729	2969
B277K-	6	270.0	10	13.0	130	163.0	8	8	D	2010	2250	2490	2730	2970
B337K-	6	330.0	10	15.0	150	188.0	8	8	D	2011	2251	2491	2731	2971
B337M-	6	330.0	20	15.0	150	188.0	8	8	D	2012	2252	2492	2732	2972
C395K-	10	3.9	10	.6	6	7.5	4	4	A	2013	2253	2493	2733	2973
C475K-	10	4.7	10	.7	7	8.8	4	4	A	2014	2254	2494	2734	2974
C475M-	10	4.7	20	.7	7	8.8	4	4	A	2015	2255	2495	2735	2975
C276K-	10	27.0	10	4.0	40	50.0	6	6	B	2016	2256	2496	2736	2976
C336K-	10	33.0	10	5.0	50	63.0	6	6	B	2017	2257	2497	2737	2977
C336M-	10	33.0	20	5.0	50	63.0	6	6	B	2018	2258	2498	2738	2978
C396K-	10	39.0	10	5.0	50	63.0	6	6	B	2019	2259	2499	2739	2979
C826K-	10	82.0	10	8.0	80	100.0	6	6	C	2020	2260	2500	2740	2980
C107K-	10	100.0	10	10.0	100	125.0	8	8	C	2021	2261	2501	2741	2981
C107M-	10	100.0	20	10.0	100	125.0	8	8	C	2022	2262	2502	2742	2982
C127K-	10	120.0	10	12.0	120	150.0	8	8	C	2023	2263	2503	2743	2983
C187K-	10	180.0	10	18.0	180	225.0	8	8	D	2024	2264	2504	2744	2984
C227K-	10	220.0	10	20.0	200	250.0	8	8	D	2025	2265	2505	2745	2985
C227M-	10	220.0	20	20.0	200	250.0	8	8	D	2026	2266	2506	2746	2986
D275K-	15	2.7	10	.6	6	7.5	4	4	A	2027	2267	2507	2747	2987
D335K-	15	3.3	10	.8	8	10.0	4	4	A	2028	2268	2508	2748	2988
D335M-	15	3.3	20	.8	8	10.0	4	4	A	2029	2269	2509	2749	2989
D186K-	15	18.0	10	3.5	35	44.0	6	6	B	2030	2270	2510	2750	2990
D226K-	15	22.0	10	4.0	40	50.0	6	6	B	2031	2271	2511	2751	2991
D226M-	15	22.0	20	4.0	40	50.0	6	6	B	2032	2272	2512	2752	2992
D566K-	15	56.0	10	8.0	80	100.0	6	6	C	2033	2273	2513	2753	2993
D686K-	15	68.0	10	10.0	100	125.0	6	6	C	2034	2274	2514	2754	2994
D686M-	15	68.0	20	10.0	100	125.0	6	6	C	2035	2275	2515	2755	2995
D127K-	15	120.0	10	18.0	180	226.0	8	8	D	2036	2276	2516	2756	2996
D157K-	15	150.0	10	20.0	200	250.0	8	8	D	2037	2277	2517	2757	2997
D157M-	15	150.0	20	20.0	200	250.0	8	8	D	2038	2278	2518	2758	2998
E125K-	20	1.2	10	.6	6	7.5	4	4	A	2039	2279	2519	2759	2999
E155K-	20	1.5	10	.6	6	7.5	4	4	A	2040	2280	2520	2760	3000
E155M-	20	1.5	20	.6	6	7.5	4	4	A	2041	2281	2521	2761	3001
E185K-	20	1.8	10	.6	6	7.5	4	4	A	2042	2282	2522	2762	3002
E225K-	20	2.2	10	.8	8	10.0	4	4	A	2043	2283	2523	2763	3003
E225M-	20	2.2	20	.8	8	10.0	4	4	A	2044	2284	2524	2764	3004
E825K-	20	8.2	10	2.0	8	25.0	6	6	B	2045	2285	2525	2765	3005
E106K-	20	10.0	10	3.0	30	38.0	6	6	B	2046	2286	2526	2766	3006
E106M-	20	10.0	20	3.0	30	38.0	6	6	B	2047	2287	2527	2767	3007
E126K-	20	12.0	10	3.5	35	44.0	6	6	B	2048	2288	2528	2768	3008
E156K-	20	15.0	10	4.0	40	50.0	6	6	B	2049	2289	2529	2769	3009
E156M-	20	15.0	20	4.0	40	50.0	6	6	B	2050	2290	2530	2770	3010
E276K-	20	27.0	10	5.0	50	63.0	6	6	C	2051	2291	2531	2771	3011
E336K-	20	33.0	10	7.0	70	88.0	6	6	C	2052	2292	2532	2772	3012
E336M-	20	33.0	20	7.0	70	88.0	6	6	C	2053	2293	2533	2773	3013
E396K-	20	39.0	10	8.0	80	100.0	6	6	C	2054	2294	2534	2774	3014
E476K-	20	47.0	10	9.0	90	113.0	6	6	C	2055	2295	2535	2775	3015
E476M-	20	47.0	20	9.0	90	113.0	6	6	C	2056	2296	2536	2776	3016
E566K-	20	56.0	10	11.0	110	138.0	6	6	D	2057	2297	2537	2777	3017
E686K-	20	68.0	10	14.0	140	175.0	6	6	D	2058	2298	2538	2778	3018
E686M-	20	68.0	20	14.0	140	175.0	6	6	D	2059	2299	2539	2779	3019
E826K-	20	82.0	10	16.0	160	200.0	6	6	D	2060	2300	2540	2780	3020
E107K-	20	100.0	10	20.0	200	250.0	8	8	D	2061	2301	2541	2781	3021
E107M-	20	100.0	20	20.0	200	250.0	8	8	D	2062	2302	2542	2782	3022
F565K-	35	5.6	10	2.5	25	32.0	4	4	B	2063	2303	2543	2783	3023
F685K-	35	6.8	10	3.0	30	38.0	6	6	B	2064	2304	2544	2784	3024
F685M-	35	6.8	20	3.0	30	38.0	6	6	B	2065	2305	2545	2785	3025
F226K-	35	22.0	10	8.0	80	100.0	6	6	C	2066	2306	2546	2786	3026
F226M-	35	22.0	20	8.0	80	100.0	6	6	C	2067	2307	2547	2787	3027
F276K-	35	27.0	10	9.0	90	113.0	6	6	D	2068	2308	2548	2788	3028
F336K-	35	33.0	10	11.0	110	138.0	6	6	D	2069	2309	2549	2789	3029
F336M-	35	33.0	20	11.0	110	138.0	6	6	D	2070	2310	2550	2790	3030

Type designation 1/	DC rated voltage	Capacitance 2/	Capacitance tolerance	DC leakage at +25°C	DC leakage at +85°C	DC leakage at +125°C	Dissipation factor at −55°C +25°C	Dissipation factor at +85°C +125°C	Case size	Dash number failure rate level (%/1,000 hours) 3/ L	M	P	R	S
	volts	µF	percent	µA	µA	µA	percent	percent		2.0	1.0	0.1	0.01	0.001
CSR13F396K-	35	39.0	10	14.0	140	175.0	6	6	D	2071	2311	2551	2791	3031
F476K-	35	47.0	10	16.0	160	200.0	6	6	D	2072	2312	2552	2792	3032
G476M-	35	47.0	20	16.0	160	200.0	6	6	D	2073	2313	2553	2793	3033
G472K-	50	.0047	10	.5	5	6.3	2	4	A	2074	2314	2554	2794	3034
G472M-	50	.0047	20	.5	5	6.3	2	4	A	2075	2315	2555	2795	3035
G562K-	50	.0056	10	.5	5	6.3	2	4	A	2076	2316	2556	2796	3036
G682K-	50	.0068	10	.5	5	6.3	2	4	A	2077	2317	2557	2797	3037
G682M-	50	.0068	20	.5	5	6.3	2	4	A	2078	2318	2558	2798	3038
G822K-	50	.0082	10	.5	5	6.3	2	4	A	2079	2319	2559	2799	3039
G103K-	50	.01	10	.5	5	6.3	2	4	A	2080	2320	2560	2800	3040
G103M-	50	.01	20	.5	5	6.3	2	4	A	2081	2321	2561	2801	3041
G123K-	50	.012	10	.5	5	6.3	2	4	A	2082	2322	2562	2802	3042
G153K-	50	.015	10	.5	5	6.3	2	4	A	2083	2323	2563	2803	3043
G153M-	50	.015	20	.5	5	6.3	2	4	A	2084	2324	2564	2804	3044
G183K-	50	.018	10	.5	5	6.3	2	4	A	2085	2325	2565	2805	3045
G223K-	50	.022	10	.5	5	6.3	2	4	A	2086	2326	2566	2806	3046
G223M-	50	.022	20	.5	5	6.3	2	4	A	2087	2327	2567	2807	3047
G273K-	50	.027	10	.5	5	6.3	2	4	A	2088	2328	2568	2808	3048
G333K-	50	.033	10	.5	5	6.3	2	4	A	2089	2329	2569	2809	3049
G333M-	50	.033	20	.5	5	6.3	2	4	A	2090	2330	2570	2810	3050
G393K-	50	.039	10	.5	5	6.3	2	4	A	2091	2331	2571	2811	3051
G473K-	50	.047	10	.5	5	6.3	2	4	A	2092	2332	2572	2812	3052
G473M-	50	.047	20	.5	5	6.3	2	4	A	2093	2333	2573	2813	3053
G563K-	50	.056	10	.5	5	6.3	2	4	A	2094	2334	2574	2814	3054
G683K-	50	.068	10	.5	5	6.3	2	4	A	2095	2335	2575	2815	3055
G683M-	50	.068	20	.5	5	6.3	2	4	A	2096	2336	2576	2816	3056
G823K-	50	.082	10	.5	5	6.3	2	4	A	2097	2337	2577	2817	3057
G104K-	50	.1	10	.5	5	6.3	2	4	A	2098	2338	2578	2818	3058
G104M-	50	.1	20	.5	5	6.3	2	4	A	2099	2339	2579	2819	3059
G124K-	50	.12	10	.5	5	6.3	2	4	A	2100	2340	2580	2820	3060
G154K-	50	.15	10	.5	5	6.3	2	4	A	2101	2341	2581	2821	3061
G154M-	50	.15	20	.5	5	6.3	2	4	A	2102	2342	2582	2822	3062
G184K-	50	.18	10	.5	5	6.3	2	4	A	2103	2343	2583	2823	3063
G224K-	50	.22	10	.5	5	6.3	2	4	A	2104	2344	2584	2824	3064
G224M-	50	.22	20	.5	5	6.3	2	4	A	2105	2345	2585	2825	3065
G274K-	50	.27	10	.5	5	6.3	2	4	A	2106	2346	2586	2826	3066
G334K-	50	.33	10	.5	5	6.3	2	4	A	2107	2347	2587	2827	3067
G334M-	50	.33	20	.5	5	6.3	2	4	A	2108	2348	2588	2828	3068
G394K-	50	.39	10	.5	5	6.3	2	4	A	2109	2349	2589	2829	3069
G474K-	50	.47	10	.5	5	6.3	2	4	A	2110	2350	2590	2830	3070
G474M-	50	.47	20	.5	5	6.3	2	4	A	2111	2351	2591	2831	3071
G564K-	50	.56	10	.5	5	6.3	2	4	A	2112	2352	2592	2832	3072
G684K-	50	.68	10	.5	5	6.3	2	4	A	2113	2353	2593	2833	3073
G684M-	50	.68	20	.5	5	6.3	2	4	A	2114	2354	2594	2834	3074
G824K-	50	.82	10	.5	5	6.3	2	4	A	2115	2355	2595	2835	3075
G105K-	50	1.0	10	.8	8	10.0	2	4	A	2116	2356	2596	2836	3076
G105M-	50	1.0	20	.8	8	11.0	2	4	A	2117	2357	2597	2837	3077
G125K-	50	1.2	10	.9	9	11.0	4	4	B	2118	2358	2598	2838	3078
G155K-	50	1.5	10	1.2	12	15.0	4	4	B	2119	2359	2599	2839	3079
G155M-	50	1.5	20	1.2	12	15.0	4	4	B	2120	2360	2600	2840	3080
G185K-	50	1.8	10	1.4	14	18.0	4	4	B	2121	2361	2601	2841	3081
G225K-	50	2.2	10	1.7	17	22.0	4	4	B	2122	2362	2602	2842	3082
G225M-	50	2.2	20	1.7	17	22.0	4	4	B	2123	2363	2603	2843	3083
G275K-	50	2.7	10	2.0	20	25.0	4	4	B	2124	2364	2604	2844	3084
G335K-	50	3.3	10	2.5	25	32.0	4	4	B	2125	2365	2605	2845	3085
G335M-	50	3.3	20	2.5	25	32.0	4	4	B	2126	2366	2606	2846	3086
G395K-	50	3.9	10	3.0	30	38.0	4	4	B	2127	2367	2607	2847	3087
G475K-	50	4.7	10	3.5	35	44.0	4	4	B	2128	2368	2608	2848	3088
G475M-	50	4.7	20	3.5	35	44.0	4	4	B	2129	2369	2609	2849	3089
G565K-	50	5.6	10	4.5	45	56.0	4	4	C	2130	2370	2610	2850	3090
G685K-	50	6.8	10	4.5	45	56.0	6	6	C	2131	2371	2611	2851	3091
G685M-	50	6.8	20	4.5	45	56.0	6	6	C	2132	2372	2612	2852	3092
G825K-	50	8.2	10	5.0	50	63.0	6	6	C	2133	2373	2613	2853	3093
G106K-	50	10.0	10	5.0	50	63.0	6	6	C	2134	2374	2614	2854	3094
G106M-	50	10.0	20	5.0	50	63.0	6	6	C	2135	2375	2615	2855	3095
G126K-	50	12.0	10	6.0	60	75.0	6	6	C	2136	2376	2616	2856	3096
G156K-	50	15.0	10	8.0	80	100.0	6	6	C	2137	2377	2617	2857	3097
G156M-	50	15.0	20	8.0	80	100.0	6	6	C	2138	2378	2618	2858	3098
G186K-	50	18.0	10	9.0	90	113.0	6	6	C	2139	2379	2619	2859	3099
G226K-	50	22.0	10	11.0	110	138.0	6	6	D	2140	2380	2620	2860	3100
G226M-	50	22.0	20	11.0	110	138.0	6	6	D	2141	2381	2621	2861	3101

1/ Complete type designation will include an additional symbol to indicate failure rate level.
2/ For information only.
3/ Dash numbers – 2001 through – 3193 of this specification shall unilaterally supersede and be acceptable alternates for dash numbers – 0001 through – 1045 of MIL-C-39003/1 for units of equivalent capacitance, capacitance tolerance, voltage rating, failure rate level, and case size.

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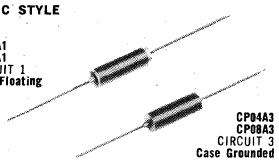
GLASSEAL PAPER CAPACITORS
OIL-PAPER CAPACITORS

SUBMINIATURE GLASSEAL PAPER CAPACITORS
MIL-C-25 LATEST REVISION

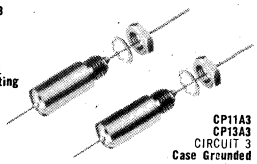
BASIC STYLE



CP04A1
CP08A1
CIRCUIT 1
Case Floating

CP04A3
CP08A3
CIRCUIT 3
Case Grounded

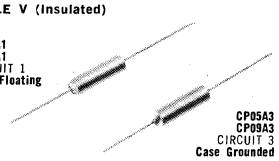
STYLE 3



CP11A1
CP13A1
CIRCUIT 1
Case Floating

CP11A3
CP13A3
CIRCUIT 3
Case Grounded

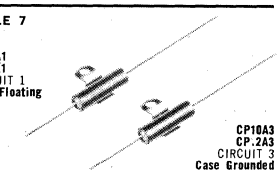
STYLE V (Insulated)



CP05A1
CP09A1
CIRCUIT 1
Case Floating

CP05A3
CP09A3
CIRCUIT 3
Case Grounded

STYLE 7



CP10A1
CP12A1
CIRCUIT 1
Case Floating

CP10A3
CP12A3
CIRCUIT 3
Case Grounded

MILITARY DESIGNATION BREAKDOWN	CP	04	A	1	E	B	333	K/3
	Style	Case	Terminal (Axial wire lead)	Circuit	Characteristic	Voltage	Capacitance	Tolerance

Characteristics
Circuit 1: E = −55°C. to + 85°C. K = −55°C. to +125°C.
Circuit 3:

Voltage
B = 100 V.
C = 200 V.
E = 400 V.
F = 600 V.
G = 1000 V.

Tolerance
K = ±10%
M = ±20%

Vibration Grade*
1 10-55 cps
3 10-2000 cps

INSERTED TABS (CP04 — Uninsulated; CP05 — Insulated)

Cap.	100V-	200V-	400V-	600V-	1000V-
.001				F102	
.0012				F122K/3	
.0015				F152	
.0018				F182K/3	
.0022				F222	
.0027				F272K/3	
.0033				F332	
.0039				F392K/3	
.0047				F472	
.0056				F562K/3	
.0068				F682	
.0082			E822K/3	F822K/3	
.01			E103	F103	
.012		C123K/3		F123K/3	
.015		C153		F153	G153
.018		C183K/3		F183K/3	G183K/3
.022		C223		F223	G223
.027	B273K/3		E273K/3	F273K/3	G273K/3
.033	B333		E333	F333	G333
.039		C393K/3	E393K/3	F393K/3	G393K/3
.047		C473	E473	F473	G473
.056		C563K/3	E563K/3	F563K/3	G563K/3
.068		C683	E683	F683	G683
.082	B823K/3	C823K/3	E823K/3	F823K/3	G823K/3
.1	B104	C104	E104	F104	G104
.12	B124K/3	C124K/3	E124K/3	F124K/3	G124K/3
.15	B154	C154	E154	F154	G154
.18	B184K/3	C184K/3	E184K/3	F184K/3	G184K/3
.22	B224	C224	E224	F224	G224
.27	B274K/3	C274K/3	E274K/3	F274K/3	G274K/3
.33	B334	C334	E334	F334	G334
.39	B394K/3	C394K/3	E394K/3	F394K/3	G394K/3
.47	B474	C474	E474	F474	G474
.56	B564K/3	C564K/3	E564K/3	F564K/3	
.68	B684	C684	E684	F684	
.82	B824K/3	C824K/3	E824K/3		
1.0	B105	C105	E105		

EXTENDED TABS (CP08 — Uninsulated; CP09 — Insulated)

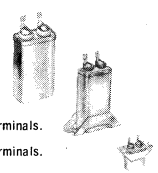
Cap.	100V-	200V-	400V-	600V-	1000V-
.001				F102	G102
.0012				F122K/3	G122K/3
.0015				F152	G152
.0018				F182K/3	G182K/3
.0022				F222	G222
.0027			E272K/3	F272K/3	G272K/3
.0033			E332	F332	G332
.0039		C392K/3		F392K/3	G392K/3
.0047		C472		F472	G472
.0056		C562K/3		F562K/3	G562K/3
.0068		C682		F682	G682
.0082	B822K/3			F822K/3	G822K/3
.04	B103			F103	G103
.012	B123K/3		E123K/3	F123K/3	G123K/3
.015	B153		E153	F153	G153
.018		C183K/3		F183K/3	G183K/3
.022		C223		F223	G223
.027		C273K/3	E273K/3	F273K/3	G273K/3
.033		C333	E333	F333	G333
.039	B393K/3	C393K/3	E393K/3	F393K/3	G393K/3
.047	B473	C473	E4.3	F473	G473
.056		C563K/3	E563K/3	F563K/3	G563K/3
.068		C683	E683	F683	G683
.082	B823K/3	C823K/3	E823K/3	F823K/3	G823K/3
.1	B104	C104	E104	F104	G104
.12	B124K/3	C124K/3	E124K/3	F124K/3	G124K/3
.15	B154	C154	E154	F154	G154
.18	B184K/3	C184K/3	E184K/3	F184K/3	G184K/3
.22	B224	C224	E224	F224	G224
.27	B274K/3	C274K/3	E274K/3	F274K/3	G274K/3
.33	B334	C334	E334	F334	G334
.39	B394K/3	C394K/3	E394K/3	F394K/3	G394K/3
.47	B4 4	C474	E474	F474	G474
.56	B564K/3	C564K/3			
.68	B684	C684			
.82	B824K/3	C824K/3			
1.0	B105	C105			

K/3 designates available per MIL-C-25C, which specifies K characteristic, K tolerance, and vibration grades 1 or 3 only.

Type PKM Small-Base Oil-Paper Capacitors (CP61, CP63, CP65 also CP90 and CP91)

Section assembled in hermetically sealed tin-coated container. Mineral-oil impregnated and filled. Lug-type terminal seals. Suitable for use in compact equipment. Meets electrical requirements of MIL-C-25C.

Temperature Rating: −55°C to +85°C.
Standard Tolerance: −10% to +20%.



PKM VARIATIONS

PKM Basic type similar to MIL Type CP61. Example: PKM4-S5
PKMF Similar to CP61 with CP06F footed bracket. To order: add F after PKM. Example: PKMF4-S5
PKMS Similar to CP61 with CP06S spade bracket. To order: add S after PKM. Example: PKMS4-S5
PKMT Similar to CP63 with channel bracket on end opposite terminals. To order: add T after PKM. Example: PKMT4-S5
PKMB Similar to CP65 with channel bracket on same end as terminals. To order: add B after PKM. Example: PKMB4-S5
PKMT, PKMB Channel Bracket Dimensions:
Overall Length: 2 5/16".
Overall Width: 45/64" (max.).
Length between Mounting Slot Centers: 1 15/16".
Mounting Slot Width: 3/32".

Catalog Number	Cap. in UF	Size in Inches Length	Width	Height	Dealer Net
400 Volts DC Working					
PKM4-S5	.05	1 3/16	47/64	1 1/16	1.73
PKM4-P1	.1	1 3/16	47/64	1 1/16	1.82
PKM4-P25	.25	1 3/16	47/64	1 3/8	1.87
PKM4-P5	.5	1 3/16	47/64	1 5/8	1.95
PKM4-1	1.0	1 3/16	47/64	2 1/2	2.14
600 Volts DC Working					
PKM6-S5	.05	1 3/16	47/64	1 1/16	1.76
PKM6-P1	.1	1 3/16	47/64	1 1/16	1.87
PKM6-P25	.25	1 3/16	47/64	1 5/8	1.93
PKM6-P5	.5	1 3/16	47/64	2	2.00
PKM6-1	1.0	1 3/16	47/64	2 3/4	2.24
1,000 Volts DC Working					
PKM10-S5	.05	1 3/16	47/64	1 1/16	1.83
PKM10-P1	.1	1 3/16	47/64	1 3/8	1.91
PKM10-P25	.25	1 3/16	47/64	2	1.92
PKM10-P5	.5	1 3/16	47/64	2 1/2	2.43

Type PEM Small-Base Oil-Paper Capacitors (CP67, CP69)

Section assembled in hermetically sealed tin-coated container. Mineral-oil impregnated and filled. Lug-type terminal seals. Suitable for use in compact equipment. Meets electrical requirements of MIL-C-25A.

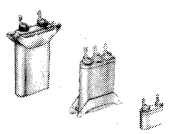
PEM VARIATIONS

PEM Basic Type. To order: see Catalog Listing. Example: PEM6-S5

PEMT Similar to MIL Type CP67, with channel bracket on end opposite terminals. To order: add T after PEM. Example: PEMT6-S5.

PEMB Similar to CP69, with channel bracket on same end as terminals. To order: add B after PEM. Example: PEMB6-S5

Standard Tolerance: −10% to +20%.
Temperature Rating: −55°C to +85°C.



PEMT, PEMB Channel Bracket Dimensions:
Overall Length: 2 5/16".
Overall Width: 1/64" (max.).
Length between Mounting Slot Centers: 2 1/8".
Mounting Slot Width: 3/32.

Catalog Number	Cap. in UF	Size in Inches Length	Width	Height	Dealer Net
PEM SINGLE-CAPACITOR UNITS					
600 Volts DC Working					
PEM6-S5	.05	1 3/16	5/8	1 1/16	1.86
PEM6-P1	.1	1 3/16	5/8	1 1/16	1.92
PEM6-P25	.25	1 3/16	5/8	1 1/2	1.95
PEM6-P5	.5	1 3/16	5/8	2	2.01
PEM6-1	1.0	1 3/16	5/8	2 1/2	2.25
1,000 Volts DC Working					
PEM10-S5	.05	1 3/16	5/8	1 1/16	1.89
PEM10-P1	.1	1 3/16	5/8	1 1/16	1.95
PEM10-P25	.25	1 3/16	5/8	1 1/2	2.01
PEM10-P5	.5	1 3/16	5/8	2 1/2	2.19
PEM DUAL-CAPACITOR UNITS					
600 Volts DC Working					
2PEM6-S5	.05-.05	1 3/16	5/8	1 1/16	2.64
2PEM6-P1	.1-.1	1 3/16	5/8	1 1/2	2.69
2PEM6-P25	.25-.25	1 3/16	5/8	2	2.90
2PEM6-P5	.5-.5	1 3/16	5/8	2 1/2	3.25
1,000 Volts DC Working					
2PEM10-S5	.05-.05	1 3/16	5/8	1 1/16	2.69
2PEM10-P1	.1-.1	1 3/16	5/8	1 1/2	2.79
2PEM10-P25	.25-.25	1 3/16	5/8	2 1/2	2.97
PEM TRIPLE-CAPACITOR UNITS					
600 Volts DC Working					
3PEM6-S5	.05-.05-.05	1 3/16	5/8	1 1/16	3.16
3PEM6-P1	.1-.1-.1	1 3/16	5/8	1 1/2	3.25
3PEM6-P25	.25-.25-.25	1 3/16	5/8	2 1/2	3.53
1,000 Volts DC Working					
3PEM10-S5	.05-.05-.05	1 3/16	5/8	1 1/2	3.25
3PEM10-P1	.1-.1-.1	1 3/16	5/8	2	3.38

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STANDARD COMPONENTS GROUP

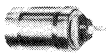
GLASSEAL PAPER CAPACITORS
OIL-PAPER CAPACITORS

CP 25 to CP 29 (TYPE PTM)



Available in capacitances from .003 thru 0.1 mf and voltages of 1500 V.D.C.

CP 40, CP41 (TYPES PCM, PCIM)



Available in capacitances from .25 mf thru 4.0 mf and voltages of 600 V.D.C. thru 1500 V.D.C.

Type PDM Bathtub-Type Oil-Paper Capacitors MIL TYPE CP53 54 55

Section assembled in hermetically sealed tin-coated drawn-shell container. Mineral-oil impregnated and filled. Lug-type terminal seals. Meets requirements of MIL-C-25C.

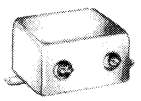
Temperature Rating: −55°C to +85°C.
Standard Tolerance: −10% to +20%.

PDM VARIATIONS

PDM Similar to MIL Type CP53, with terminals on side. Example: PDM4-S5

PDMT (CP54) With terminals on top. To order: add T after PDM. Example: PDMT4-S5

PDMB (CP55) With terminals on the bottom. To order add B after PDM. Example: PDMB4-S5.



PDM SINGLE-CAPACITOR UNITS

Catalog Number	Cap. in UF	Size in Inches Length	Width	Height
400 Volts DC Working				
PDM4-S5	.05	1 13/16	1	3/4
PDM4-P1	.1	1 13/16	1	3/4
PDM4-P25	.25	1 13/16	1	3/4
PDM4-P5	.5	1 13/16	1	15/16
PDM4-1	1.0	2	1 3/4	15/16
PDM4-2	2.0	2	2	1 3/16*
600 Volts DC Working				
PDM6-S5	.05	1 13/16	1	3/4
PDM6-P1	.1	1 13/16	1	3/4
PDM6-P25	.25	1 13/16	1	3/4
PDM6-P5	.5	1 13/16	1	1
PDM6-1	1.0	2	1 3/4	1
PDM6-2	2.0	2	2	1 3/16*
1,000 Volts DC Working				
PDM10-S5	.05	1 13/16	1	3/4
PDM10-P1	.1	1 13/16	1	3/4
PDM10-P25	.25	1 13/16	1	13/16
PDM10-P5	.5	2	1 3/4	7/8
PDM10-1	1.0	2	2	1 1/8*

PDM DUAL-CAPACITOR UNITS

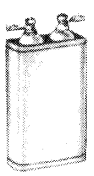
Catalog Number	Cap. in UF	Size in Inches Length	Width	Height
400 Volts DC Working				
2PDM4-S5	.05-.05	1 13/16	1	3/4
2PDM4-P1	.1-.1	1 13/16	1	3/4
2PDM4-P25	.25-.25	1 13/16	1	1
2PDM4-P5	.5-.5	2	1 3/4	15/16
2PDM4-1	1.0-1.0	2	2	1 3/16*
600 Volts DC Working				
2PDM6-S5	.05-.05	1 13/16	1	3/4
2PDM6-P1	.1-.1	1 13/16	1	3/4
2PDM6-P25	.25-.25	1 13/16	1	1
2PDM6-P5	.5-.5	2	1 3/4	15/16
2PDM6-1	1.0-1.0	2	2	1 3/16
1,000 Volts DC Working				
2PDM10-S5	.05-.05	1 13/16	1	3/4
2PDM10-P1	.1-.1	1 13/16	1	7/8
2PDM10-P25	.25-.25	2	1 3/4	7/8
2PDM10-P5	.5-.5	2	2	1 1/8*

PDM TRIPLE-CAPACITOR UNITS

400 Volts DC Working				
3PDM4-P1	.1-.1-.1	1 13/16	1	13/16
3PDM4-P25	.25-.25-.25	2	1 3/4	7/8
3PDM4-P5	.5-.5-.5	2	2	1
600 Volts DC Working				
3PDM6-P1	.1-.1-.1	1 13/16	1	13/16
3PDM6-P25	.25-.25-.25	2	1 3/4	7/8
3PDM6-P5	.5-.5-.5	2	2	1
1,000 Volts DC Working				
3PDM10-P1	.1-.1-.1	2	1 3/4	7/8
3PDM10-P25	.25-.25-.25	2	2	1 1/8*

* Add 1/16" to Height for units with top or bottom terminals.

Type PLM High-Voltage Oil-Paper Capacitors (CP70 SERIES)



Section assembled in lacquer-finished terneplate case. Mineral-oil impregnated and filled. Ceramic terminal insulators with screw studs. Designed for heavy-duty continuous service. Fulfills the exacting requirements of power-supply and filter applications. Meets electrical requirements of MIL-C-25C. For higher voltage ratings and enginering data write to Sales Engineering Department.

PLM VARIATIONS

PLM Basic type similar to MIL Type CP70. Example: PLM6-P5.

PLMF Similar to CP70 with CP47F footed bracket. To order: add F after PLM. Example: PLMF6-P5.

PLMS Similar to CP70 with CP07S spade bracket. To order: Add S after PLM. Example: PLMS6-P5.

PLMU With universal mounting bracket. To order: add U after PLM. Example: PLMU6-P5.

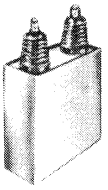
PLMR With solder-lug MIL Type B terminals (furnished only through 2,000 VDCW rating). To order: add R after PLM. Example: PLMR6-P5.

Temperature Rating: −55°C. to +85°C.
Standard Tolerance: ±10%.

Catalog Number	Cap. in UF	Case Size in Inches Length	Width	Height
600 Volts DC Working				
PLM6-P5	.5	1 13/16	1 1/16	1 5/8
PLM6-1	1.0	1 13/16	1 1/16	1 5/8
PLM6-2	2.0	1 13/16	1 1/16	3 1/4
PLM6-3	3.0	1 13/16	1 1/16	4 3/4
PLM6-4	4.0	2 1/2	1 3/16	3 1/2
PLM6-5	5.0	2 1/2	1 3/16	4 1/4
PLM6-6	6.0	2 1/4	1 3/16	4 3/4
PLM6-8	8.0	3 3/4	1 1/4	4 1/4
PLM6-10	10.0	3 3/4	1 3/4	4
1,000 Volts DC Working				
PLM10-P1	.1	1 13/16	1 1/16	1 5/8
PLM10-P25	.25	1 13/16	1 1/16	1 5/8
PLM10-P5	.5	1 13/16	1 1/16	2 1/4
PLM10-1	1.0	1 13/16	1 1/16	2 7/8
PLM10-2	2.0	1 13/16	1 1/16	4 3/4
PLM10-3	3.0	2 1/2	1 3/16	4 1/4
PLM10-4	4.0	3 3/4	1 1/4	3 7/8
PLM10-5	5.0	3 3/4	1 1/4	4 3/4
PLM10-6	6.0	3 3/4	1 3/4	4
PLM10-8	8.0	3 3/4	1 3/4	4 3/4
PLM10-10	10.0	3 3/4	2 1/4	4 3/4
PLM10-12	12.0	3 3/4	2 1/4	5 1/8
PLM10-15	15.0	3 3/4	3 3/16	4 3/4
1,500 Volts DC Working				
PLM15-P5	.5	1 13/16	1 1/16	2 7/8
PLM15-1	1.0	1 13/16	1 1/16	4 3/4
PLM15-2	2.0	2 1/2	1 3/16	4 3/4
PLM15-3	3.0	3 3/4	1 1/4	4 3/4
PLM15-4	4.0	3 3/4	1 3/4	4 1/4
PLM15-5	5.0	3 3/4	2 1/4	4 1/2
PLM15-6	6.0	3 3/4	2 1/4	4 3/4
PLM15-8	8.0	3 3/4	2 1/2	5 3/4
PLM15-10	10.0	3 3/4	3 3/16	5 1/2
PLM15-12	12.0	4 5/16	3 3/4	4 3/4
PLM15-15	15.0	4 5/16	3 3/4	6
2,000 Volts DC Working				
PLM20-P1	.1	1 13/16	1 1/16	2 1/4
PLM20-P25	.25	1 13/16	1 1/16	2 7/8
PLM20-P5	.5	1 13/16	1 1/16	3 7/8
PLM20-1	1.0	2 1/2	1 3/16	4 1/4
PLM20-2	2.0	3 3/4	1 1/4	4 3/4
PLM20-3	3.0	3 3/4	1 3/4	4 3/4
PLM20-4	4.0	3 3/4	2 1/4	5 1/8
PLM20-5	5.0	3 3/4	3 3/16	4 3/4
PLM20-6	6.0	3 3/4	3 3/16	5 1/2
PLM20-8	8.0	4 5/16	3 3/4	5 1/8
PLM20-10	10.0	4 5/16	3 3/4	6 1/2
PLM20-12	12.0	4 5/16	3 3/4	7 1/2
2,500 Volts DC Working				
PLM25-P5	.5	2 1/2	1 3/16	3 7/8
PLM25-1	1.0	3 3/4	1 3/4	3 1/4
PLM25-2	2.0	3 3/4	2 1/4	4 3/4
PLM25-4	4.0	4 5/16	3 3/4	4 3/8
PLM25-10	10.0	4 5/16	3 3/4	8 1/2
3,000 Volts DC Working				
PLM30-1	.1	1 13/16	1 1/16	2 7/8
PLM30-P25	.25	2 1/2	1 3/16	3 1/2
PLM30-P5	.5	2 1/2	1 3/16	4 3/4
PLM30-1	1.0	3 3/4	2 1/4	4 1/2
PLM30-2	2.0	3 3/4	3 3/16	4 3/4
PLM30-4	4.0	4 5/16	3 3/4	6 1/2
4,000 Volts DC Working				
PLM40-P1	.1	3 3/4	2 1/4	2 3/4
PLM40-P25	.25	3 3/4	2 1/4	2 3/4
PLM40-P5	.5	3 3/4	2 1/4	4 3/4
PLM40-1	1.0	3 3/4	3 3/16	4 3/4
PLM40-2	2.0	4 5/16	3 3/4	6
PLM40-4	4.0	4 5/16	3 3/4	9 5/8
5,000 Volts DC Working				
PLM50-P5	.5	3 3/4	2 1/4	5 1/8
PLM50-1	1.0	4 5/16	3 3/4	5 1/8
PLM50-2	2.0	4 5/16	3 3/4	9 5/8

Type PJ High-Voltage Oil-Paper Capacitors—6000 thru 25,000 Volt Series

Section assembled in container of heavy gage steel, welded oil tight and hot tinned. Mineral-oil impregnated and mineral-oil filled. Case and terminals are bonded together. Low leakage current and negligible capacity change over wide range of operating temperature. Fir higher voltage ratings and engineering data write to Sales Engineering Department.



Available in:	Cat. No.
6,000 Volts DC Working	PJ 60
7,500 Volts DC Working	PJ 100
10,000 Volts DC Working	PJ 100
12,500 Volts DC Working	PJ 125
15,000 Volts DC Working	PJ 150
20,000 Volts DC Working	PJ 200
25,000 Volts DC Working	PJ 250

Temperature Range: −55°C. to +85°C.
Capacity Tolerance: ±10%

NYTRONICS, INC.
Orange Street, Darlington, South Carolina 29532
Tel.: 803-393-5421/TWX: 710-995-4589

MUCON® SUBminiature CERAMIC CAPACITORS

MU-CAPS ®

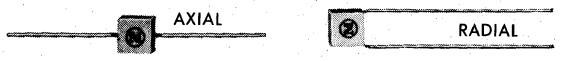
BX CHARACTERISTIC ±15% ΔC.

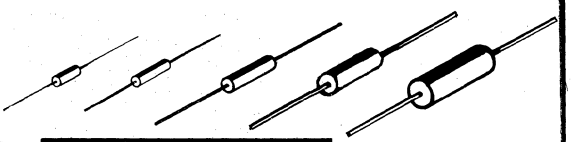
CK05 and CK06

CK05 to .1 MF. at 50 WVDC
" to .01 MF. at 100 WVDC
" to .001 MF. at 200 WVDC
CK06 to 1.0 MF. at 50 WVDC
" to .1 MF. at 100 WVDC
" to .01 MF. at 200 WVDC

CK12 thru CK16

CK12 to .01 MF. . . . .160" L. x .090" Dia.
CK13 to .047 MF. . . . .250" L. x .090" Dia.
CK14 to .27 MF. . . . .390" L. x .140" Dia.
CK15 to 1.0 MF. . . . .500" L. x .250" Dia.
CK16 to 3.3 MF. . . . .690" L. x .350" Dia.





ULTRA-STABLE MU-CAPS ® ±.3% STABILITY

CK05 and CK06 Styles

CK05 Style to 1200 PF.
CK06 Style to 12,000 PF.

WORKING VOLTAGE: 50 WVDC

CK12 thru CK16 Styles

CK12 Style to 330 PF. . . . .160" L. x .090" Dia.
CK13 Style to 470 PF. . . . .250" L. x .090" Dia.
CK14 Style to 3,300 PF. . . . .390" L. x .140" Dia.
CK15 Style to 10,000 PF. . . . .500" L. x .250" Dia.
CK16 Style to 56,000 PF. . . . .690" L. x .350" Dia.

THINLINE



Mucon's Thinline Capacitors are made of the following 13 different ceramic bodies for a broad choice of size and electrical properties:

Temperature-Compensating Materials:			
	NP0	N080	N150
	N220	N330	N450
	N750	N1400	N2400
	N3300	N4700	N5600

General Purpose Materials LOW-VAR, STABLE-K, HIGH-K & SUPER-K for wide range of stability and capacitance.

SPECIFICATIONS

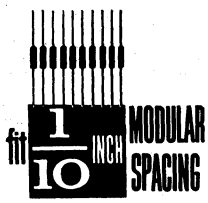
Capacitance Range: TEMP.-COMP. BODIES 1/2 pf - 2200 pf; GEN. PURPOSE BODIES 50 pf - 150,000 pf
Voltages: 25 WVDC, 50WVDC, 200 WVDC and 500 WVDC
Leads: Tinned Copper, Nickel or Dumet to MIL Spec.
Shapes: Square, rectangular, single or multiple element.

CHIPS SINGLE LAYER



Sizes: .030" Sq. and up
Capacitance: SUPER-K Ceramic 150 PF. to 10,000 PF.
HIGH-K " 100 PF. to 5,000 PF.
STABLE-K " 50 PF. to 2,700 PF.
LOW-VAR " 20 PF. to 1,000 PF.
TEMP. COMP. " 1 PF. to 330 PF.
Electrodes: Normally silver. Other precious metals on request
Voltage: 50 WVDC

NARROW-CAPS®



NARROW-CAPS are designed for 1/10" modular spacing on printed circuits, or for cordwood applications.

SPECIFICATIONS

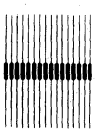
Capacitance Range: 5 pf - 100.000 pf
Voltages: 10 WVDC - 50 WVDC
Sizes: .095" max. wide x 1/4" max. long x .095" max. thick through 750 pf. Larger values 5/16" max. long.
Leads: #26 Tinned Copper, Nickel or Dumet to MIL Spec.

CHIPS MONOLITHIC MULTILAYER



Sizes: From .050" x .050" x .050" to .610" x .310" x .080"
Capacitance: STABLE-K Ceramic 10 PF. to 2 MF.
NPO " 1 PF. to .027 MF.
Electrodes: Normally silver. Other precious metals on request
Voltage: 50 WVDC

SLIM-CAPS ®



Designed for applications which require capacitors slimmer than NARROW-CAPS. SLIM-CAPS are .065" wide x .065" thick max. Body lengths from .100"—.250" max.

SPECIFICATIONS

Capacitance Range: 1/2 pf - 20,000 pf
Voltages: 50 WVDC
Leads: #30 Tinned Copper, Nickel or Dumet to MIL Spec.

STANDOFFS



Standoffs are furnished in the shapes shown above, using any one of the Mucon temperature-compensating bodies or general purpose bodies.

RIBBON LEADS

Style RLA



Size and specifications same as "Thinline" capacitors shown above, except radial and axial tinned copper ribbon leads, approximately .006" thick x 3/32" wide for units with max. size of .150" and up; .045" wide for smaller units.

WRITE FOR FREE CATALOG LISTING COMPLETE DETAILED SPECIFICATIONS FOR ALL MUCON SUB-MINIATURE CERAMIC CAPACITORS and ELEMENTS

REPUBLIC ELECTRONICS CORP.

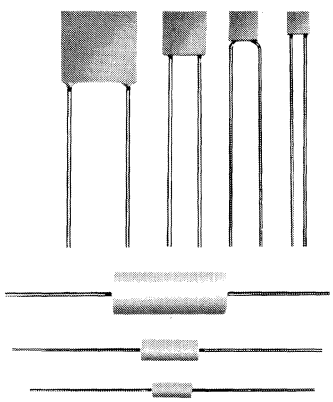
176 E. 7th St. PATERSON, N. J. 07524
201 - 279-0300 TWX 710-988-5908

san fernando
electric manufacturing company

WEST-CAP© CAPACITORS AND FILTERS

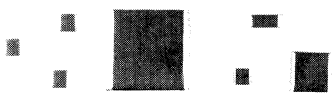
CERAMIC CAPACITORS

RECTANGULAR AND TUBULAR STANDARDS



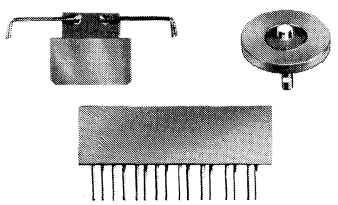
CAPACITANCE VALUES
from 5pf to 10μf
(medium "K" dielectric)
from 1pf to .2μf (NPO)
VOLTAGE: 50 to 500 VDC
TOLERANCE: down to 1%
TEMPERATURE RANGE:
—55°C to 150°C
Meets or exceeds
MIL-C-11015,
MIL-C-39014

CHIPS FOR HYBRID CIRCUITRY



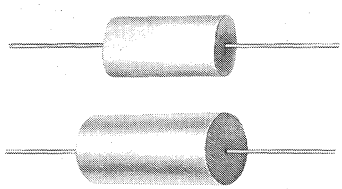
CAPACITANCE VALUES
from 5pf to 2μf
(medium "K" dielectric)
from 1 pf to .2μf (NPO)
VOLTAGE 50 to 500 VDC
TOLERANCE: down to 1%
TEMPERATURE RANGE:
—55°C to 150°C

SPECIAL DESIGNS
We invite you to consult with us on your special requirements.



"RAP-N-FIL" CAPACITORS

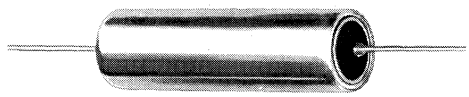
CAPACITANCE VALUES
from .001μf to 12μf
VOLTAGE: 50 to 1000 VDC
TOLERANCE: down to 1%
MYLAR: — 55°C to 125°C
(CMT style meets
MIL-C-27287)
POLYSTYRENE:
—55°C to 85°C
METALIZED MYLAR:
—55°C to 125°C
POLYCARBONATE:
METALIZED
POLYCARBONATE
—55°C to 125°C



HERMETIC CAPACITORS

Metal case
with compression glass seals
APPLICABLE MIL SPECIFICATIONS
MIL-C-25
MIL-C-14157C
MIL-C-18312
MIL-C-19978
Available in all capacitance values, voltages, and tolerances per applicable MIL specifications.

- Paper-Foil
- Metalized Paper
- Mylar
- Metalized Mylar
- Polycarbonate
- Metalized Polycarbonate
- Polystyrene
- Metalized Polystyrene
- Teflon
- Metalized Teflon



EMI / RFI FILTERS

RFI POWER LINE FILTERS
Meets applicable portions of MIL-F-15733E.
ATTENUATION: 100db at 14KC up to 10GC, 30KC up to 10GC, 100KC up to 10GC. 20, 30, 50, 75, & 100 amp ratings in single, dual or triple circuit models.



SUBMINIATURE RFI FILTERS
VOLTAGE RATING:
20, 100,
200 VDC — 115 VAC
OPERATING CURRENT:
60 mA thru 15.0 amps.
OPERATING TEMPERATURE:
—55°C to +125°C

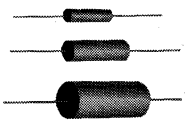


San Fernando Electric Manufacturing Company
1501 First Street, San Fernando, California
Tel. (213) 365-9411/TWX (213) 764-5963

S&EI Manufacturing / CAPACITORS

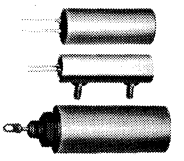
18800 Parthenia Street, Northridge, California • 91324 • P.O. Box 832 • (213) 349-4111 • TWX 910-493-1252

CASE STYLES → FEATURES ↓



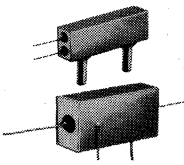
R

Wrap and Fill, round



E

Hermetically, sealed, tubular



G*

Hermetically, sealed, rectangular

17 SERIES — METALIZED MYLAR

For circuits that require the ultimate electrical properties Non Polar coupled with the smallest size over a wide temp. range.

- IR: 50K Meg × MFD Min. +25° C
- DF Less Than 1% IKHZ at +25°C
- Dielectric Strength: 200% of rated VDC 1 Min. Max.
- Temperature Range: −55° C to +125° C
- Voltage versus Temp.: 100% rated Voltage to 100° C 50% derating to +125° C
- Capacity versus Temp.: −55° C to +25° C, +5% change; +25°C to +85° C, +3%, and +25° C to +105° C, +7% change
- Quality Control and Production Tests consist of 100% group A requirements of MIL C 18312 on hermetic seal style E and all tests except for moisture leak tests on styles W-U-R-N-B-D.

17R

CASE SIZES DIA.	LGTH.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.17	.40	.001	.001	.001	.001
.17	.40	.022	.0068	.0033	.0012
.22	.40	.039	.027	.01	.0047
.23	.54	.12	.033	.027	.0082
.27	.54	.18	.12	.047	.01
.32	.67	.50	.22	.056	.015
.34	.83	.68	.33	.12	.039
.46	.83		.39	.18	.047
.28	.97	.82			
.39	.97	1.5	.47	.22	
.47	.97		.68	.27	
.41	1.17	2.0	.82	.33	.082
.56	1.17	5.0	1.5	.50	.18
.60	1.17			.56	
.65	1.68	10.0	4.0	1.0	.68
.89	1.68	20.0	8.0	3.0	1.5

17E

CASE SIZES DIA.	LGTH.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.175	.500	.022	.0068	.0033	.001
.195	.500	.039	.0082	.0068	.0049
.235	.500		.027	.01	
.195	.625	.056			.0056
.235	.625	.12	.056	.018	.01
.312	.625	.18	.12	.047	
.312	.750	.33	.18	.056	.015
.400	.750	.50	.27	.1	.033
.400	.875	.68	.39	.12	.047
.400	1.125	1.5	.68		.056
.400	1.375	2.0			.1
.500	1.375	4.0	1.5	.39	.15
.562	1.375			.50	.18
.67	1.375	5.0		.56	
.562	1.875		.20	.82	.39
.670	1.875	10.0	4.0	1.0	.56
.750	1.875	12.0	5.0	1.5	.82

17G

CASE SIZES TK.	WD.	LG.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.22	.34	.562	.082	.027	.01	.0047
.22	.34	.687	.22	.056	.033	.018
.22	.34	.812	.33	.10	.056	.027
.22	.34	.937	.50	.12	.068	.033
.22	.34	1.125	.68	.18	.1	.047
.31	.41	.937	.82	.27	.15	.068
.31	.41	1.125	1.0	.39	.18	.1
.31	.41	1.312	1.5	.50	.27	.12
.40	.57	1.125	2.0	.75	.39	.18
.40	.57	1.312	3.0	.82	.56	.27
.40	.57	1.562		1.0	.68	.33
.40	.57	1.812	5.0	1.5	.82	.39
.50	.65	1.562		2.0	1.0	.50
.50	.65	1.812				.56
.50	.65	2.062	8.0		1.5	.75
.50	.65	2.312		3.0		.82
.60	.80	2.062	12.0		2.0	1.0
.60	.80	2.312	15.0	5.0		

22 SERIES — METALIZED POLYCARBONATE

For circuits that require flat T.C., low losses, small size over a wide temperature and frequency range. Used in many wave filter, discriminator and critical timing circuits.

- IR: 100K Meg × MFD Min. at +25° C
- DF less than .3% measured IKHZ at 25° C
- Dielectric Strength: Up to 200% of rated VDC Max. I Min.
- Temperature Range: −55° C to +105° C. When properly encased will operate to +125° C
- Temperature Coefficient: From −55° C to +25° C, 1.5% max change; +25° C to +105° C, −.7% max. change.
- QC & Production Tests consist of 100% to group A requirements MIL C 18312 on hermetic seal style E and to all except moisture leak test on styles W-U-R-N-B-D.

22R

CASE SIZE DIA.	LGTH.	200 VDC MFD	400 VDC MFD
.18	.40	.01	.0047
.21	.40	.022	.01
.18	.54	.027	.015
.24	.54	.056	.027
.38	.54	.082	.047
.24	.67	.1	.056
.29	.67	.15	.1
.32	.67	.25	.12
.32	.83	.27	.15
.39	.83	.39	.18
.41	.97	.47	.22
.48	.97	.56	.33
.38	1.16	.68	.39
.45	1.16	1.0	.5
.50	1.16	1.5	.68
.44	1.78	2.0	.75
.675	1.78	4.0	

22E

CASE SIZES DIA.	LGTH.	200 VDC MFD	400 VDC MFD	600 VDC MFD
.175	.500	.001	.001	
.175	.500	.0082	.0015	
.195	.500	.012	.0022	.001
.235	.500	.022	.01	.0052
.195	.625	.027	.015	.0082
.235	.625		.027	.01
.312	.625	.056	.047	.012
.312	.750	.18	.1	.022
.400	.750	.25	.12	.033
.400	.875	.39	.15	.039
.500	.875		.18	.047
.400	1.125	.47	.27	.068
.500	1.125	.56	.33	.12
.400	1.375	.68	.39	.15
.500	1.375	1.0	.50	.18
.562	1.375	1.5	.56	.27
.562	1.875	2.0	.82	
.670	1.875	3.0		
.750	1.875	5.0		

22G

CASE SIZES TK.	WD.	LG.	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.22	.34	.562	.39	.039	.015	.0068	.0047
.22	.34	.687	.56	.056	.056	.015	.01
.22	.34	.812	.82	.18	.082	.022	.015
.22	.34	.937	1.0	.39	.12	.033	.022
.22	.34	1.125			.18	.047	.027
.31	.41	.937	2.0	.68	.39	.056	.030
.31	.41	1.125	3.0	1.0	.50	.082	.056
.31	.41	1.312				.12	.068
.40	.57	1.125	5.0		.75	.18	.12
.40	.57	1.312		2.0	.82	.25	.15
.40	.57	1.562	7.0	3.0	1.0	.33	.18
.40	.57	1.812			1.5	.39	.25
.50	.65	1.562	10.0	7.0		.47	.27
.50	.65	1.812		10.0	2.0	.56	.33
.50	.65	2.062				.68	.39
.50	.65	2.312			3.0	.75	.50
.60	.80	2.062			5.0	1.0	.75

13 SERIES — POLYSTYRENE

For the instruments that require long term stability, low leakage, minimum dielectric absorption.

Used in many critical computer timing and hybrid circuits.

- Temperature Range: −55° C to +85° C
- IR: 100K Meg × MFD Min +25° C
- DF: .05% Max IKHZ at +25° C
- TC: 130 PPM / ° C ±20 PPM
- Quality and Production test consists of 100% to group A level of MIL C 19978 on style E and all requirements except moisture leak test on style R.

13R

CASE SIZES DIA.	LGTH.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.280	.680	.001	.001	.001*	.001
.280	.680	.01	.0068	.005	.0039
.312	.680	.022	.01	.0082	.0068
.312	.875	.033	.015	.01	.082
.343	.875	.039	.027	.015	.01
.375	.875	.05	.033	.022	.015
.468	.875	.082	.039	.025	
.406	1.0	.1	.047	.033	.02
.468	1.0	.12	.05	.039	.027
.437	1.25	.15	.068	.05	.033
.50	1.25	.20	.1	.068	.039
.531	1.25	.27	.15	.082	.05

13E

CASE SIZES DIA.	LGTH.	100 VDC MFD	200 VDC MFD	400 VDC MFD
.195	.625	.0027	.0015	
.195	.625	.0039	.0018	
.195	.75	.0082	.0033	.0015
.235	.75	.012	.0068	.0027
.312	.75	.022	.015	.01
.400	.87	.068	.033	.018
.560	1.0	.12	.068	.033
.562	1.12	.22	.1	.068
.562	1.375	.33	.15	.1

10 SERIES — MYLAR FOIL

For the instrument that requires high reliability, precise characteristics year after year. Used in many communication, telephone, tracking and test instrument devices.

- Temperature Range: −55° C to +125° C
- IR: 50K Meg × MFD Min. at +25° C
- Dielectric Strength: 200% of rated VDC max. I Min.
- DF less than .5% IKHZ at 25° C
- Temperature Coefficient:
  +5% change from −55° C to +25° C
  +5% change from +25° C to +85° C
  +9% change from +25° C to +105° C
  +14% change from +25° C to + 125° C
- QC and Production Tests are 100% to group A of MIL C 19978 on hermetic style E and all tests except moisture leak requirement style R.

10R

CASE SIZES DIA.	LGTH.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD	1000 VDC MFD
.156	.500	.001	.001			
.156	.500	.01	.0082			
.203	.500	.015	.015			
.203	.625	.022	.022	.0068		
.265	.625	.039	.027	.01		
.218	.750	.047	.03	.02	.0047	.001
.296	.750	.082	.047	.022	.0032	.0015
.312	.750		.068	.025	.01	
.281	.875	.1	.075	.027	.015	.0022
.375	.875	.15	.1	.047	.022	.01
.359	1.0	.22		.068	.027	.015
.50	1.0			.12	.068	
.406	1.125	.39	.22			
.468	1.250	.47	.33	.15	.082	.047
.625	1.250	.82	.47	.1		
.609	1.375		.56	.27	.15	

10E

CASE SIZES DIA.	LGTH.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.195	.625	.001	.001	.001	.001
.195	.625	.015	.01	.0047	.0015
.235	.625		.015	.0068	
.312	.625		.027	.015	
.312	.750	.082	.033		.0082
.312	.875	.12	.047	.027	
.400	.875	.15	.082	.047	.022
.400	1.125	.22	.15	.068	.027
.400	1.375	.33	.22	.1	.033
.500	1.375	.50	.33	.15	.068
.562	1.375	.56	.47	.22	.082
.670	1.375	.90		.27	
.670	1.875	1.0	.56		.12
.670	1.875	1.25	.82	.39	.15
.750	1.875	1.5	1.0	.56	.33
1.0	1.875	2.0	1.5	.82	.39

*The pictorial "G" style series displayed are not standard; however depicts two popular methods of mounting features. Many mounting and terminal features can be designed and manufactured to your specifications by request to our representatives or factory direct, without delivery delay.

IMPORTANT NOTICE: The NEW 50VDC and 100VDC miniature sizes are now displayed in our 22 series case styles, G, N, B, D, and are also available in case styles R, E, W, U, metalized polycarbonate only.

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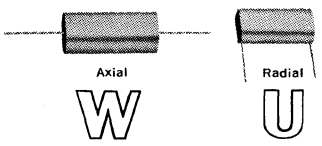
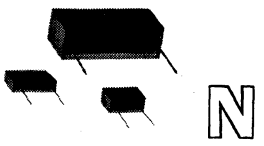
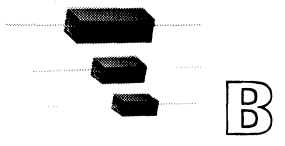


Wrap and Fill, rectangular



Molded, radial leads



Molded, axial leads.



Epoxy Dip Case

17W/17U

CASE SIZES T'HK.	WDTH.	LGTH.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.12	.22	.40	.001	.001	.001	
.12	.22	.40	.022	.0056	.0033	.001
.17	.27	.40	.039	.027	.01	.0047
.17	.28	.54	.12	.039	.018	.0082
.21	.32	.54	.18	.12	.047	.01
.25	.38	.67	.39	.18	.056	.012
.30	.42	.67	.50	.27	.082	.015
.27	.38	.83	.56	.29	.1	.033
.42	.50	.83	.68	.39	.18	.047
.22	.35	.97	.82	.47	.2	
.32	.46	.97	1.5	.68	.22	
.34	.5	1.17	2.0	.82	.33	.1
.47	.65	1.17	5.0	1.5	.56	.18
.47	.56	1.68	8.0	2.0	.82	.27
.50	.65	1.68	10.0	4.0	1.0	.39
.65	.85	1.68	15.0	5.0	1.5	.82
.75	1.0	1.68	20.0	8.0	2.0	1.5

17N

CASE SIZE LGTH.	T'HK.	HT.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.395	.095	.295	.039	.01	.0027	
.42	.16	.31	.047	.027	.012	.0047
.55	.16	.31	.12	.033	.022	.012
.55	.19	.38	.18	.056		
.55	.24	.38	.27	.12	.047	
.55	.30	.40	.39		.1	
.68	.19	.50	.68			
.67	.30	.50		.27		.018
.82	.30	.70			.18	.039
.88	.25	.50	1.0	.39		
1.0	.37	.50	2.0	.68	.27	.056
1.24	.40	.75	5.0	1.5	.68	.18
1.75	.57	.75	8.0	3.0	1.5	.39

17B

CASE SIZES TK.	WD.	LG.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.17	.29	.42	.001	.001	.001	.001
.17	.29	.42	.047	.027	.01	.0047
.17	.29	.57	.056	.033	.012	.0062
.17	.29	.57	.12	.039	.015	.0082
.23	.36	.57	.15	.047	.018	.009
.23	.36	.57	.27	.082	.039	.01
.29	.42	.57	.39	.15	.047	
.29	.42	.67	.68	.27	.1	.015
.39	.54	.82	1.0	.5	.18	.047
.39	.54	1.04	2.0	.68	.27	
.39	.54	1.19	2.5	1.0	.39	.1
.56	.72	1.24	5.4	1.5	.56	.18
.56	.72	1.75	10.0	4.0	1.0	.5

17D

CASE SIZES T'HK.	HGHT.	LGTH.	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.17	.35	.39	.022	.01	.0068	.0022
.19	.38	.39	.039	.027	.01	.0047
.17	.35	.52	.082	.047	.015	.0056
.26	.45	.52	.18	.10	.047	.01
.23	.42	.65	.22	.12	.056	.012
.25	.45	.65	.39	.15	.082	.015
.35	.55	.65	.5	.27	.1	
.27	.43	.81	.56			.027
.42	.60	.81	.68	.39	.18	.047
.37	.53	.95	1.0	.56		
.38	.59	.95	1.5	.68	.22	
.46	.66	.95			.27	
.34	.55	1.15				.082
.39	.60	1.15	2.0	.75	.33	.10
.43	.65	1.15	3.0	1.0	.39	.12

22W/22U

CASE SIZE T'HK.	WDTH.	LGTH.	200 VDC MFD	400 VDC MFD
.12	.22	.40	.01	.001
.15	.27	.40	.022	.01
.13	.23	.54	.027	.015
.16	.28	.54	.047	.027
.21	.32	.54	.082	.047
.18	.29	.67	.1	.056
.22	.40	.67	.25	.12
.28	.38	.83	.27	.15
.32	.45	.83	.39	.18
.33	.48	.97	.47	.27
.40	.55	.97	.56	.36
.32	.43	1.16	.68	.50
.437	.95	1.16	1.5	.63

22N

CASE SIZES T'HK.	WDTH.	HGT.	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.395	.095	.295	.068	.01	.0068	.0015	
.42	.16	.31	.075	.047	.01	.0022	
.42	.18	.31	.1		.022	.0047	.0022
.55	.16	.31		.12	.039	.018	.0047
.55	.18	.31	.22	.15	.056	.027	
.55	.185	.38		.18	.068		
.55	.24	.38	.50	.22	.082	.039	.012
.55	.30	.40	.68	.27		.047	.018
.67	.30	.45		.39	.22		.027
.67	.30	.50		.56		.068	
.82	.30	.42	1.0		.27	.1	.039
.82	.40	.50	1.5	1.0	.50	.15	.068
1.0	.37	.50	3.0	1.5	.68		.1
1.24	.40	.50	5.0	2.0	.82	.22	
1.24	.57	.75	10.0	4.0	1.5	.50	.27
1.75	.57	.75	18.0	6.8	3.0	.82	.33
1.75	.57	1.0	22.0	10.0			

22B

CASE SIZES T'HK.	WDTH.	LGTH.	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.17	.29	.42	.1	.047	.022	.01	.0033
.17	.29	.57	.22	.1	.039	.022	.0068
.23	.36	.57	.33	.22	.082	.047	.01
.29	.42	.57	.68	.27	.1		.018
.29	.42	.67			.25		.027
.29	.42	.82	1.0	.75	.27	.068	
.39	.54	.82	1.5	1.0	.50	.12	.082
.39	.54	1.04	2.0		.68	.18	
.39	.54	1.19	5.0	3.0	.82	.33	.15
.56	.72	1.24	10.0	5.0	1.5	.5	.27
.56	.72	1.75	18.0	8.0	3.0	.82	.39
.56	.72	1.93	22.0				

22D

CASE SIZES +.032 −.096 T'HK.	HGT.	LGTH.	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.19	.36	.39	.068	.01	.01	.0022	.0015
.18	.39	.39			.015	.0047	.0022
.23	.45	.39	.1	.0	.022	.01	
.18	.39	.52	.18	.12	.033		.0047
.28	.45	.52	.50	.22	.082	.027	.01
.35	.58	.52	.68	.27		.047	.018
.35	.53	.64			.25		.027
.49	.72	.64		.56		.12	
.35	.55	.81	.75		.33		.039
.40	.63	.81	1.0		.39	.15	.056
.44	.68	.81	1.5	1.0		.18	.082
.38	.61	.95			.47	.25	
.42	.66	.95	3.0	1.5	.56	.33	
.37	.63	1.15			.75		.1
.43	.65	1.15	5.0	2.0	1.0	.39	.12

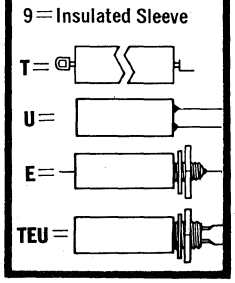
ORDERING AND PART NUMBER INFORMATION

The sizes shown are maximum capacity for each size versus VDC. The dimensional tolerances for case styles R-W-U-D are ±.05. Styles G-B-N-E are ±.031, on length, and ±.015 for other dimensions. All units are available in any value, ranging from .001 MFD to their maximum capacity, with tolerances to ±1%. Standard tolerance is ±20%. Other types of leads, configurations, and encasements are available upon request to meet your special requirements.

***9**

Hermetic case Style Accessories

9 = Insulated Sleeve



17

Dielectric

17 = Metalized Mylar
22 = Metalized Polycarbonate
10 = Mylar Foil
13 = Polystyrene Foil

E

Case Style

E = Hermetic Rnd.
G = Hermetic Rect.
W = Wrap Fill, Oval, Axial
U = Wrap Fill, Oval, Radial
N = Molded Radial
B = Molded Axial
R = Wrap Fill, Round
D = Epoxy Dip

***1**

Circuits

1 = Case Floating
2 = Case ground
3 = Case ground With Lead
5 = Feed Through

B

Voltage

B = 100 VDC
C = 200 VDC
D = 300 VDC
E = 400 VDC
F = 600 VDC
G = 1000 VDC

103

Capacitance

Expressed in MMFD
103 = .01 MFD
Last digit No. Zeros

K

Tolerance

Standard ±20%
K = ±10%
J = ± 5%
H = ± 3%
G = ± 2%
F = ± 1%

**Use these key part numbers only when ordering style E,G, hermetic seal encasements. Remaining part numbers are applicable when ordering case styles R-W-U-N-B-D.*

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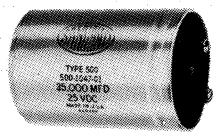


Type 500—Electrolytic
Computer Grade 85° C
BULLETIN 2236



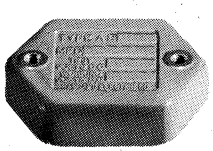
Type 557—Electrolytic
−55°C to +125°C
BULLETIN 2240



Type 505—Electrolytic
Instrument Grade
BULLETIN 2235



Type R—Mica Molded
BULLETIN 2320



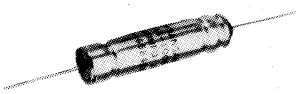
Type A & H—Mica
Molded Fixed Terminal
BULLETIN 2321



Type 291—Cast Mica
Transmitting
BULLETIN 2324



Type DCM—Electrolytic
Computer Grade 65° C
BULLETIN 2231



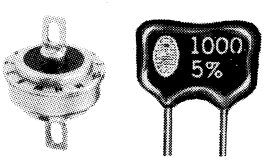
Type 556—Electrolytic
Commercial Grade
BULLETIN 2239



Type HVC—Paper
Commercial and Military
BULLETIN 2425



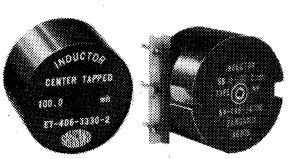
Type S —Paper
Hermetically Sealed
BULLETIN 2421



Type M—Mica Button
Type D—Mica Dipped
BULLETINS 2311, 2323, & 2312



Type G—Mica
Transmitting
BULLETIN 2322



Type ET & NV Inductors
Fixed & Tunable
BULLETINS 2721A & 5103

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- Vitreous Enamel, Axial-lead 1200, 1201

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TEST EQUIPMENT
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TANTALUM CAPACITORS?

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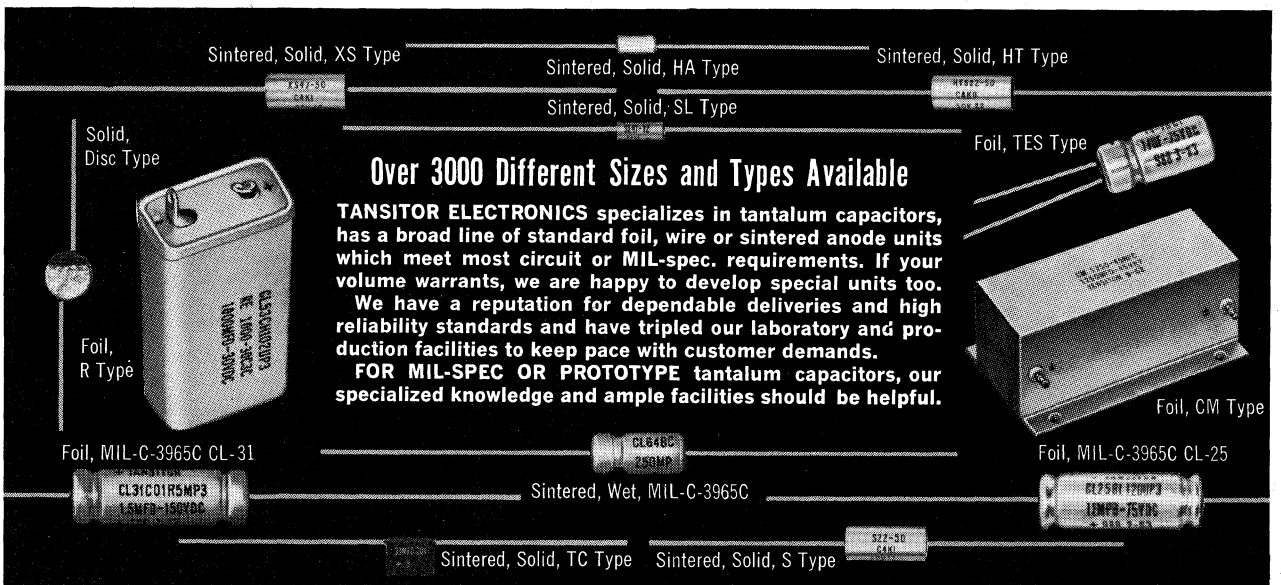


Over 3000 Different Sizes and Types Available

TANSITOR ELECTRONICS specializes in tantalum capacitors, has a broad line of standard foil, wire or sintered anode units which meet most circuit or MIL-spec. requirements. If your volume warrants, we are happy to develop special units too.

We have a reputation for dependable deliveries and high reliability standards and have tripled our laboratory and production facilities to keep pace with customer demands.

FOR MIL-SPEC OR PROTOTYPE tantalum capacitors, our specialized knowledge and ample facilities should be helpful.

Type	Tansitor Part No.	Temp. Rating	Voltage Range	Capacitance Range, Mfds		Size Range Inches
				Plain	Etched	
MIL-C-3965D Foil CL20, 21, 22, 23, 30, 31, 32, 33	TE 20, 21, 22, 23, 30, 31, 32, 33	−55 – +85°C +125°C derated	3–300	0.25 to 440	0.5 to 1,750	0.188 x 0.688 to 0.375 x 2.750
Foil	TH	−55 – +125°C	3–150	0.15 to 350	0.28 to 1,750	0.188 x 0.688 to 0.531 x 2.781
Foil Radial	TES	−55 – +85°C	3–150	1.0 to 90	1.8 to 14,000	0.312 x 0.650 to 0.625 x 2.438
Foil Axial	THH	−55 – +150°C	3–150	0.15 to 350	0.28 to 580	0.187 x 1.00 to 0.375 x 3.250
Foil Axial	HV	−55 – +125°C	200–300	0.13 to 35	None	0.187 x 0.750 to 0.531 x 2.875
Mil-C-3965D CL70, 71, 72, 73 High Etch	TE 70, 71, 72, 73	−55 – +85°C +125°C derated	15–150	.25 to 440	0.75 to 920	0.188 x 0.688 to 0.375 x 2.750
Custom Made	CM	−55 – +125°C	3–300	19 to 1,400	120 to 310,000	1.062 x 1.062 x 3.875 to 3.562 x 3.875
Foil, Rectangular	R	−55 – +125°C	10–100	13 to 460	6 to 3,500	1.312 x 0.75 x 1.375 to 1.312 x 0.75 x 2.50
Mil-C-3965D Foil CL51, 52, 53, 54	TE 51, 52, 53, 54	−55 – +85°C +125°C derated	10–150	13 to 460	6 to 3,500	1.312 x 0.75 x 1.375 to 1.312 x 0.75 x 2.50
Foil Axial	WF	−55 – +125°C	6–300	0.1 to 560		0.188 x 0.453 to 0.375 x 0.766
Foil Axial	WFH Hermetic	−55 – +125°C	6–200	0.1 to 5,600		0.188 x 0.453 to 0.375 x 3.000
Solid (P)	S	−80 – +125°C	6–50	0.0047 to 330		0.125 x 0.250 to 0.341 x 0.75
Solid (NP)	S	−80 – +125°C	6–50	0.16 to 160		0.145 x 0.540 to 0.366 x 1.520
Solid (P & NP)	XS	−80 – +125°C	6–50	1.2 to 450		0.125 x 0.250 to 0.341 x 0.750
Solid	HA	−55 – +125°C	2–50	0.010 to 47		0.067 x 0.110 to 0.150 x 0.250
Solid	TC	−55 – +125°C	2–35	0.0047 to 1.5		0.125 x 0.070 x 0.040 to 0.375 x 0.150
Solid	Disc	−80 – +175°C	3–35	0.12 to 40		0.100 x 0.06 to 0.50 x 0.10
Wet	W	−55 – +125°C	6–125	1.7 to 1,200		0.188 x 0.453 to 0.375 x 1.250
Mil-C-3965D	TE 66, 67	−55 – +125°C	6–125	1.7 to 560		0.188 x 0.453 to 0.375 x 0.766
Mil-C-3965D Wet, CL64, 65	TE 64, 65	−55 – +125°C	6–125	1.7 to 560		0.188 x 0.453 to 0.375 x 0.766
Rect. Wet	RW	−55 – +125°C	6–150	130 to 22,000		0.720 x 1.306 to 1.062 x 3.75
Mil-C-3965D Rect. CL55	TE 55	−55 – +125°C	10–100	35 to 2,400		0.720 x 1.305 x 1.062 to 0.720 x 1.305 x 2.50

FOR TECHNICAL DATA . . .
and further information or prices
write to TANSITOR ELECTRONICS, INC.
at the address on right.

TANSITOR

TANSITOR ELECTRONICS, INC.
WEST ROAD / BENNINGTON, VERMONT
TEL. 802-442-5473 • TWX 710-360-1782

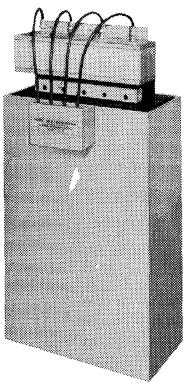
HIGH-VOLTAGE FAST-DISCHARGE CAPACITORS

Developed in response to customers' inquiries, these capacitors meet exacting requirements in energy discharge applications.



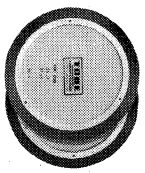
PULSE LASER CAPACITOR
(Pat Pending)

Model ESC-302: 0.01μf, 20kv, 3 nanohenries; life: 10^8 shots at a repetition of 100 pps. Size: 4½" dia x 3" high.



LOW INDUCTANCE CAPACITOR & DISCHARGE SWITCH
(U.S. Patent 3 343 051)

Model ESC-248A: 3 kilojoule, 20kv, 5 nh, with Model SBG-5 discharge switch and trigger assembly. Size: 14" x 7" x 31" high overall.



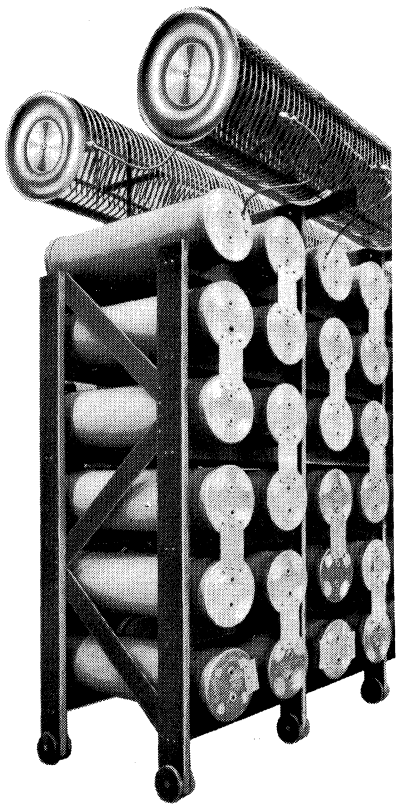
COAXIAL-DISC CAPACITOR
(U.S. Patent 3 346 790)

Model ESC-328A: 0.1μf, 20kv, 1 nh.

A new version of our patented coaxial-disc capacitor — it is expressly designed to facilitate assembly of low inductance capacitor stacks to operate at the megavolt levels required in EMP research. Photo shows 2 capacitors slightly offset. A single capacitor measures 11¼" dia x 0.437" thick. Units available to 50kv.

PULSE-FORMING NETWORKS

...from the smallest to the largest



Model PCE-1: Pulse-forming network installed at Griffis AFB. Peak charge voltage: 252kv; peak power: 180 megawatts; PRF: 180 pps; ripple: less than 1%.

TOBE DEUTSCHMANN pulse-forming networks range from miniature units to high-power installations like the one shown above. This unit, designed and built to a rigid performance specification, is more than 8 feet high, 5 feet wide, and 22 feet long.

Whatever your requirements for PFN's, low-Z pulse lines, or pulse capacitors, we can design and build reliable units to satisfy your need.

MICA-PAPER PLASTIC FILM CAPACITORS

rated for high-voltage pulse & dc applications feature:

- High Reliability.
- Encapsulated Construction.
- Extremely Low Dissipation Factor.
- Close Tolerance Matching Between Sections.
- Compact Size.



Size 4½" x 2 9/16" x 2¼" high.

Developed for airborne radar modulators, TDL mica-paper capacitors are available as multiple section E-line pulse networks with internal or external coil. Prototype quantities to your specifications can be supplied on short delivery.

Model PRN-368: Five-section pulse capacitor; capacitance per section: 0.0225μF; difference between adjacent sections: less than 450pf; life: 10,000 hrs min at 65C; PRF: 200pps at 4100 volts; pulse width: 5.7 μ sec.

RADIO INTERFERENCE FILTERS...

The name TOBE DEUTSCHMANN has been synonymous with pioneering efforts in the field of RFI filters.

TDL has currently under development a new series of filters to meet the advanced requirements of industry and the military. If you have an application for radio interference filters write or call on your specific needs.

Our units have proved their reliability worldwide in both research and industrial installations. For high voltage capacitors, discharge switches, pulse networks, pulse capacitors, and RFI filters, write or call...

TOBE DEUTSCHMANN LABORATORIES

BOX 74 • CANTON, MASSACHUSETTS 02021 / TEL 617 828-3366

Miniature Ceramic Capacitors

USCC

GENERAL SPECIFICATIONS: Temperature: —55° to 125°C ■ Weldable and Solderable ■ Case Markings: Capacitance, tolerance and voltage, "USCC" / **K1200 DIELECTRIC CHARACTERISTICS:** Dissipation Factor: Less than 2.5% at 1 kHz ■ Insulation Resistance: 100,000 megohms or 1000 megohm-Mfd at 25°C, whichever is less ■ Voltage Temperature Limits: 15%, —25%; —55° to 125°C, with voltage / **NPO DIELECTRIC CHARACTERISTICS:** Dissipation Factor: Less than .15%, 1 MHz ■ Insulation Resistance: 100,000 megohms or 1000 megohm-Mfd at 25°C whichever is less ■ TC: 0 ± 30PPM/°C; —55° to 125°C ■ Dielectric Strength: 2.5 x rated voltage—meets or exceeds applicable requirements of MIL-C-20.

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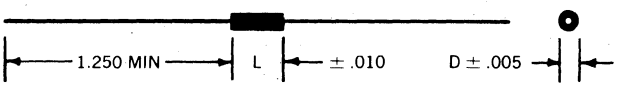
Tubular

PRECISION EPOXY CASE/AXIAL LEADS



C10 Series — K1200

	CAPACITANCE	D	L
50 WVdc	.15 Mfd-.25	.200	.500
	.27-.56	.250	.500
	.68-1.0	.250	.690
	1.5	.300	.690
	2.0	.350	.690
	2.5 and 3.0	.400	.690
100 WVdc	1 pF-.012 Mfd	.095	.185
	.015-.022	.095	.250
	.027-.056	.125	.250
	.068-.12	.140	.425
	.15-.22	.250	.500
	.25-.39	.250	.690
	.47-.82	.350	.690
	1.0-2.5	.450	.690
	3.0	.500	.690
200 WVdc	1 pF-1200 pF	.095	.250
	1500-.015 Mfd	.125	.250
	.018-.047	.140	.425
	.056-.120	.225	.425

Capacitance Tolerances: J, K (std) and M

C20 Series — K1200

	CAPACITANCE	D	L
50 WVdc	10 pF-.012 Mfd	.080	.150
	.015-.027	.095	.185
	.033-.056	.095	.250
	.068-.12	.125	.250
	.15-.22	.140	.250

Capacitance Tolerances: J, K (std) and M

C22 Series — K1200

	CAPACITANCE	D	L
50 WVdc	10 pF-.039 Mfd	.100	.250
	.047-.12	.140	.400
100 WVdc	10 pF-.022 Mfd	.100	.250
	.027-.12	.140	.400

Capacitance Tolerances: J, K and M (std)

C13 Series — NPO

	CAPACITANCE	D	L
50 WVdc	.5 pF-430	.090	.185
	470-680	.090	.250
	750-1100	.125	.250
	1200-3300	.125	.375
	3600-5600	.140	.425
	6200-.012 Mfd	.200	.500
	.013-.027	.250	.500
	.030-.039	.250	.690
	.043-.075	.350	.690
	.082-.15	.480	.690
	.16-.20	.540	.690
100 WVdc	.5 pF-470	.090	.250
	510-1200	.125	.375
	1300-2700	.140	.425
	3000-5600	.200	.500
	6200-.01 Mfd	.250	.500
	.011-.013	.250	.690
	.015-.024	.350	.690
	.027-.062	.480	.690
200 WVdc	.5 pF-100	.090	.250
	110-330	.125	.375
	360-470	.140	.425
	510-1800	.200	.500
	2000-3000	.250	.500
	3300-3600	.250	.690
	3900-6800	.350	.690
	7500-.020 Mfd	.480	.690

CERAMOLITHIC

Capacitance Tolerances:

.5pF-4.7 pF	C,D
5.1-6.8	J,K
7.5-12.0	H,J,K
13-27	G,H,J,K
30-.2 Mfd	F,G,H,J,K

FOR RFI/EMI FILTERS SEE THE USCC LISTING IN SECTION 2700.

To order, specify: series, voltage, capacitance and tolerance.

Capacitance Tolerances: C = ±.25 pF, D = ±0.5 pF, F = ±1%, G = ±2%, H = ±3%, J = ±5%, K = ±10%, M = ±20%

U.S. CAPACITOR CORPORATION ■ 2151 N. LINCOLN STREET, BURBANK, CALIF. 91504 ■ (213) 843-4222 ■ TWX: 910-498-2222

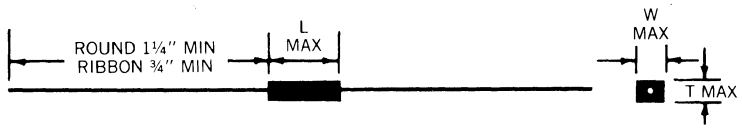
Miniature Ceramic Capacitors

USCC

GENERAL SPECIFICATIONS: Temperature: —55° to 125°C ■ Weldable and Solderable ■ Case Markings: Capacitance, tolerance and voltage, "USCC" / **K1200 DIELECTRIC CHARACTERISTICS:** Dissipation Factor: Less than 2.5% at 1 kHz ■ Insulation Resistance: 100,000 megohms or 1000 megohm-Mfd at 25°C, whichever is less ■ Voltage Temperature Limits: 15%, —25%; —55° to 125°C, with voltage / **NPO DIELECTRIC CHARACTERISTICS:** Dissipation Factor: Less than .15%, 1 MHz ■ Insulation Resistance: 100,000 megohms or 1000 megohm-Mfd at 25°C whichever is less ■ TC: 0 ± 30PPM/°C; —55° to 125°C ■ Dielectric Strength: 2.5 x rated voltage—meets or exceeds applicable requirements of MIL-C-20.

Rectangular

RESIN COATED/AXIAL LEADS



C11 Series — K1200

	CAPACITANCE	W	T	L
50 WVdc	.12 Mfd	.120	.090	.425
	.15-.25	.185	.080	.450
	.27-.33	.185	.140	.450
	.39-.56	.210	.080	.650
	.68-1.0	.210	.140	.650
100 WVdc	1 pF-39	.100	.060	.200
	47-.012 Mfd	.070	.070	.160
	.015-.022	.070	.070	.210
	.027-.047	.120	.080	.230
	.056-.12	.120	.090	.425
	.15-.33	.200	.080	.680
	.39-.50	.330	.080	.680
	.56-1.0	.330	.160	.680
200 WVdc	1 pF-100	.100	.060	.200
	120-.012 Mfd	.080	.080	.255
	.015-.018	.170	.090	.265
	.022-.047	.120	.090	.425
	.056-.1	.170	.120	.425

To order, specify: series, voltage, capacitance, tolerance and leads (round or ribbon)
Capacitance Tolerances: J, K (std) and M

C21 Series — K1200

100 WVdc & 200 WVdc

ROUND LEADS

CAPACITANCE	W	T	L
10 pF-180	.075	.075	.130
220-470*	.075	.075	.180
560-1000*	.080	.080	.230

RIBBON LEADS

CAPACITANCE	W	T	L
10 pF-180	.065	.065	.085
220-470*	.065	.065	.150
560*-1000*	.065	.065	.200

*470 pF—1000 pF available only at 100 Vdc at 125°C

To order, specify: series, voltage, capacitance, tolerance and leads (round or ribbon).
Capacitance Tolerances: K (std) and M

C18 Series — NPO

	CAPACITANCE	W	T	L
50 WVdc	5 pF-390	.070	.070	.160
	430-560	.070	.070	.210
	620-1000	.080	.080	.255
	1100-3300	.100	.090	.355
	3600-4700	.120	.090	.425
	5100-.011 Mfd	.185	.080	.450
100 WVdc	5 pF-200	.070	.070	.160
	220-300	.070	.070	.210
	330-470	.080	.080	.255
	510-1200	.100	.090	.355
	1300-2700	.120	.090	.425
	3000-4700	.185	.080	.450
	5100-.011 Mfd	.190	.170	.455
200 WVdc	5 pF-100	.070	.070	.210
	110-150	.080	.080	.255
	160-330	.100	.090	.355
	360-1000	.120	.090	.425
	1100-2200	.185	.080	.450
	2400-4300	.190	.170	.455
	4700-6800	.210	.170	.650
	7500-.011 Mfd	.330	.160	.680

To order, specify: series, voltage, capacitance and tolerance
Capacitance Tolerances:

5 pF	J, K
10-12	H, J, K
13-27	G, H, J, K
30-.011 Mfd	F, G, H, J, K

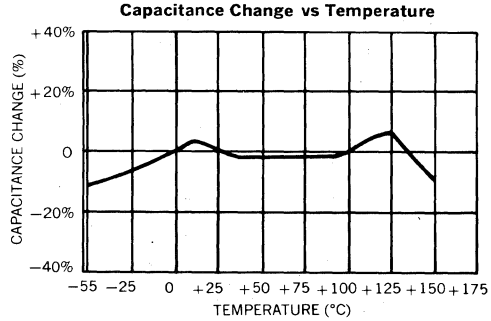
Capacitance Tolerances: C = ±.25 pF, D = ±0.5 pF, F = ±1%, G = ±2%, H = ±3%, J = ±5%, K = ±10%, M = ±20%

CERAMOLITHIC

SEE SECTION 2700 FOR USCC's RFI/EMI FILTERS.

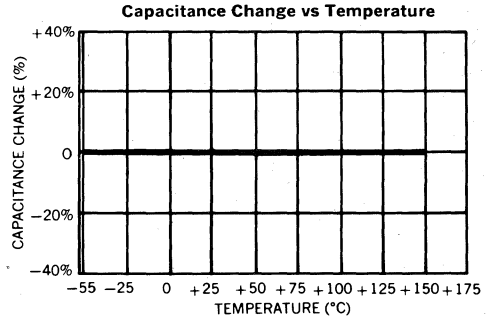
Capacitance Change vs Temperature

K1200



Capacitance Change vs Temperature

NPO



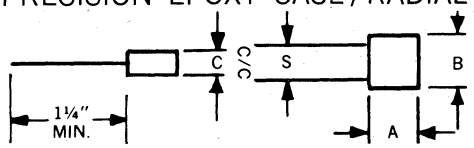
Miniature Ceramic Capacitors

USCC

GENERAL SPECIFICATIONS: Temperature: —55° to 125°C ■ Weldable and Solderable ■ Case Markings: Capacitance, tolerance and voltage, "USCC" / **K1200 DIELECTRIC CHARACTERISTICS:** Dissipation Factor: Less than 2.5% at 1 kHz ■ Insulation Resistance: 100,000 megohms or 1000 megohm-Mfd at 25°C, whichever is less ■ Voltage Temperature Limits: 15%, —25%; —55° to 125°C, with voltage / **NPO DIELECTRIC CHARACTERISTICS:** Dissipation Factor: Less than .15%, 1 MHz ■ Insulation Resistance: 100,000 megohms or 1000 megohm-Mfd at 25°C whichever is less ■ TC: 0 ± 30PPM/°C; —55° to 125°C ■ Dielectric Strength: 2.5 x rated voltage—meets or exceeds applicable requirements of MIL-C-20.

Rectangular

PRECISION EPOXY CASE / RADIAL LEADS



C12 Series — K1200

	CAPACITANCE	A (max)	B (max)	C (max)	S (±.015)
100 WVdc	1 pF-.010 Mfd	.200	.200	.100	.200
	.012-.15	.300	.300	.100	.200
	.18-.27	.300	.300	.150	.200
	.33-.56	.500	.500	.100	.400
	.68-1.0	.500	.500	.150	.400
	1.5	.500	.500	.200	.400
	2.0	.500	.500	.250	.400
	2.5	.500	.500	.300	.400
	3.0	.400	.700	.350	.600
	4.0	.400	.700	.400	.600
	5.0	.400	.700	.500	.600
	6.0	.400	.700	.700	.600
	8.0	.400	.700	.800	.600
	10.0	.400	.700	1.000	.600

Capacitance Tolerances: G, H, J, K (std) and M.

C17 Series — NPO

	CAPACITANCE	A (max)	B (max)	C (max)	S (±.015)
50 WVdc	5pF-1000	.2	.2	.1	.2
	1100-6800	.3	.3	.1	.2
	7500-.012 Mfd	.3	.3	.15	.2
	.013-.022	.5	.5	.1	.4
	.024-.039	.5	.5	.15	.4
	.043-.056	.5	.5	.2	.4
	.062-.082	.5	.5	.25	.4
	.091-.110	.5	.5	.3	.4
	.120-.160	.5	.5	.5	.4
	.180-.220	.4	.7	1.0	.6
100 WVdc	5 pF-680	.2	.2	.1	.2
	750-3300	.3	.3	.1	.2
	3600-6200	.3	.3	.15	.2
	6800-.012 Mfd	.5	.5	.1	.4
	.013-.022	.5	.5	.15	.4
	.024-.030	.5	.5	.2	.4
	.033-.039	.5	.5	.25	.4
	.043-.051	.5	.5	.3	.4
	.056-.10	.5	.5	.5	.4
	.11-.22	.4	.7	1.0	.6
200 WVdc	5 pF-180	.2	.2	.1	.2
	200-620	.3	.3	.1	.2
	680-1000	.3	.3	.15	.2
	1100-2200	.5	.5	.1	.4
	2400-3900	.5	.5	.15	.4
	4300-5100	.5	.5	.2	.4
	5600-6800	.5	.5	.25	.4
	7500-9100	.5	.5	.3	.4
	.01 Mfd-.015	.5	.5	.5	.4
	.016-.22	.4	.7	1.0	.6

Capacitance Tolerances:
5 pF to 10 C, D
11-12 J, K
13-27 H, J, K
30-51 G, H, J, K
56 pF-.220 Mfd F, G, H, J, K

C12 HiD Series — K1200

	CAPACITANCE	A	B	C	S (±.015)
25 WVdc & 50 WVdc	.18 Mfd- 1.0	.300	.300	.100	.200
	1.5	.300	.300	.150	.200

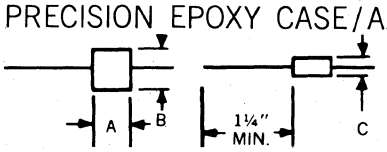
Capacitance Tolerances: J, K (std) and M

C16 Series — K1200

	CAPACITANCE	A	B	C	S
200 WVdc	10 pF-1000	.200	.200	.100	.200
	1200-.12 Mfd	.300	.300	.100	.200

Capacitance Tolerances: J, K (std) and M

PRECISION EPOXY CASE / AXIAL LEADS



C19 Series High Current — K1200

	CAPACITANCE (Mfd)	A (max)	B (max)	C (max)
400 Hz 70 Vrms	.01-.15	.300	.300	.100
	.18-.27	.300	.300	.150
	.33-.56	.500	.500	.100
	.68-1.0	.500	.500	.150
	1.5	.500	.500	.200
	2.0	.500	.500	.250
	2.5	.500	.500	.300
	3.0	.700	.350	.400
	4.0	.700	.400	.400
	5.0	.700	.500	.400
	6.0	.700	.700	.400
	8.0	.700	.800	.400
	10.0	.700	1.000	.400
1200 Hz 70 Vrms	.01-.12	.300	.300	.100
	.15-.27	.500	.500	.100
	.33-.56	.500	.500	.150
	.68-.82	.500	.500	.200
	1.0	.500	.500	.250
	1.5	.500	.500	.300
	2.0	.700	.350	.400
	2.5	.700	.400	.400
	3.0	.700	.500	.400
	4.0	.700	.700	.400

Capacitance Tolerances: J, K (std) and M
Frequency: R = 400 Hz, S = 1200 Hz

C27 Series — K1200

	CAPACITANCE	A (max)	B (max)	C (max)
50 WVdc	.01-.056	.200	.200	.100
	.068-.27	.300	.300	.100
	.33-.68	.300	.300	.150
	.82-1.0	.500	.500	.100
	1.5	.500	.500	.150
	2.0	.500	.500	.200
	2.5	.500	.500	.250
100 WVdc	.01-.15	.300	.300	.100
	.18-.27	.300	.300	.150
	.33-.56	.500	.500	.100
	.68-1.0	.500	.500	.150
	1.5	.500	.500	.200
	2.0	.500	.500	.250
	2.5	.500	.500	.300

Capacitance Tolerances: J, K (std) and M.

To order, specify: series, capacitance, tolerance and voltage (frequency for C19).

Miniature Ceramic Capacitors

USCC

GENERAL SPECIFICATIONS—Temperature Range: —55° to 125° C ■ End Terminations: silver, standard; gold and palladium gold optional.

K1200—Capacitance Tolerances: 10% standard, 5% and 20% ■ Dissipation Factor: Less than 2.5% at 1kHz ■ Insulation Resistance: 100,000 megohms or 1000 megohm-Mfd at 25° C, whichever is less ■ Voltage Temp. Limits: +15%, —25%; —55° to 125° C.

NPO—Capacitance Tolerances: ±5% standard, ±1%, ±2%, ±3% and ±10% ■ Dissipation Factor: Less than .15%, 1 MHz ■ Insulation Resistance: 100,000 megohms or 1000 megohm-Mfd at 25° C, whichever is less ■ TC: 0 ±30 PPM/°C: —55° to 125° C.

CERAMOLITHIC Chips

SUMMARY OF CHIP CAPACITOR VALUES

(Maximum Capacitance)

USCC SIZE	L nom	W nom	T max	K1200 50V	K1200 100V	K1200 200V	NPO 50V	NPO 100V	NPO 200V
CA	.075	.035	.040	.01 Mfd	4700 pF	n/a	120 pF	68 pF	n/a
BC	.085	.050	.045	.012	6800	n/a	180 pF	100 pF	n/a
BF	.100	.050	.060	.015	.01 Mfd	2700 pF	390	270	68 pF
FH	.125	.095	.065	.1	.056	.012 Mfd	1200	1200	270
BI	.150	.050	.060	.056	.027	.01	1000	560	270
CJ	.170	.065	.065	.1	.039	.012	1500	1000	270
HJ	.175	.125	.065	.1	.056	.012	3300	1800	470
DJ	.180	.080	.065	.12	.068	.015	3300	2200	390
FP	.350	.095	.070	.27	.15	.056	5600	3300	1200
IR	.395	.145	.060	.56	.27	.1	.01 Mfd	5600	1500
KY	.585	.185	.070	.68	.47	.12	.015	8200	2700
OY	.585	.298	.070	1.5	1.0	.18	.027	.018 Mfd	3300
YZ	.865	.595	.080	3.3	n/a	n/a	.068	n/a	n/a
KI	.197	.180	.065	.22	.15	.027	4700 pF	2200 pF	680
LL	.225	.210	.065	.56	.27	.056	8200	5600	1200
LM	.250	.220	.070	.68	.33	n/a	.012 Mfd	8200	n/a
RS	.390	.425	.065	1.5	.68	.18	.027	.018 Mfd	4700

n/a = not available

To order, specify as shown below using standard EIA capacitance values.

W 050 BF 103 M

MATERIAL CHARACTERISTIC
W = ±15% TC
NPO = 0 ±30 PPM/C°

WORKING VOLTAGE
050 = 50 VDC at 125°C
100 = 100 VDC at 125°c
200 = 200 VDC at 125°C

SIZE DESIGNATION

CAPACITANCE IN PICOFARADS
The first two figures are significant, last digit is the multiplier.
Example: 103 = 10,000pF

TOLERANCE
M = ±20%
K = ±10%
J = ±5%
GMV
(For NPO add:)
H = ±3%
G = ±2%
F = ±1%

CERAMOLITHIC

Chip Capacitors with Mounting Pads

Chip capacitors with microscopic gold mounting bumps for ultrasonic and thermal compression bonding. Available in the following sizes: CA BC BF FH BI CJ

Look in the Green Section for Products and their Manufacturers



Tell them you found them in eem

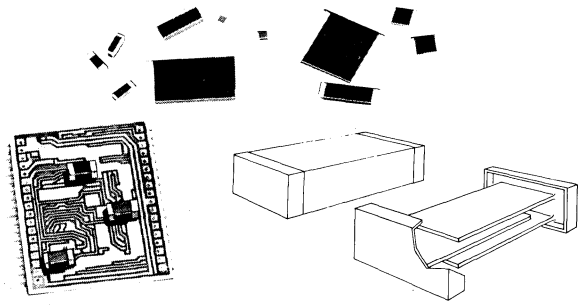
ULTRONIX INC. CERAMIC CAPACITORS

TECHNOLOGICAL LEADERSHIP IN PASSIVE COMPONENTS

P.O. BOX 1090 ■ 461 NORTH 22ND ST., GRAND JUNCTION, COLO. 81501 ■ PH. (303) 242-0810 ■ TWX (910) 929-6965
West Coast Marketing Office: 1723 CLOVERFIELD BLVD., SANTA MONICA, CAL. 90404 ■ PH. (213) 870-9346 or 393-9611

MULTILAYER CERAMIC CAPACITOR ELEMENTS

- ☐ HIGH CAPACITANCE TO SIZE RATIO
- ☐ TEMPERATURE COEFFICIENTS TO 30 PPM/°C
- ☐ ACCURACIES TO 5%
- ☐ RADIATION RESISTANT
- ☐ MIL-C-11015 PERFORMANCE
- ☐ VOLTAGE RATINGS TO 200VDC
- ☐ 12 STANDARD SIZES
- ☐ CAPACITANCE FROM 5 PICOFARAD TO 2 MICROFARAD



DESCRIPTION — Multilayer Ceramic Capacitor Elements, often referred to as "chips", are barium titanate ceramic capacitors designed for use in all miniaturized circuitry. Connections to chip capacitors are made via metallized end terminations and are accomplished by conductive epoxy bonding, ultrasonic alloying, or specialized soldering techniques. Chips offer the circuit designer the highest volumetric efficiency available in capacitors today.

APPLICATION — The primary application for chip capacitors is in hybrid integrated circuits.

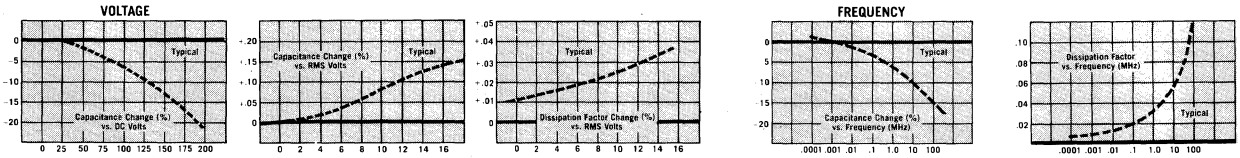
Hi K CAPACITORS fill the circuit requirements when large capacitance is needed in small size, and accuracy and stability are not critical. Characteristic curves for Hi K chips are given on the bottom of the page. Careful evaluation of these curves will yield most of the information necessary for proper utilization. Typical circuit uses for Hi K chips are coupling and bypass applications.

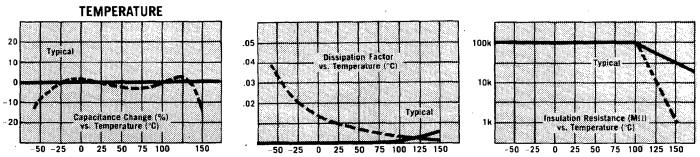
NPO CAPACITORS do not give the volumetric efficiency of Hi K units; however, they are smaller than other comparable capacitor types, by a ratio of approximately three to one based on volume, and are virtually unaffected by environment (see specifications for exact figures). Capacitors of NPO ceramic will satisfy the accuracy and stability need for all but the most stringent circuit requirements.

DESIGN AND OPERATIONAL FEATURES — Chips are manufactured by "stacking" thin layers of "green", barium titanate base ceramic which have been deposited with noble metal plates and firing the stacks to form dense multilayer ceramic blocks. The alternate capacitor plates of these blocks are exposed at opposite ends only. The exposed ends of the plates are then coated with metallized paste and fired. This process forms electrical continuity between alternate capacitor plates and seals the ends of the chips. Capacitors made in this manner are resistant to environment per MIL-STD-202 tests and inherently more reliable than their encapsulated counterparts. Chips are available with various alloy metallized ends for substrate compatability. Complete traceability is maintained on all components manufactured by Ultronix.

SPECIFICATIONS

TYPICAL CHARACTERISTIC CURVES NPO —— HIGH K -----





TYPICAL STANDARD ULTRONIX PART NUMBER BREAKDOWN

UC	B	09	113	K	50
Ultronix Multilayer Ceramic Capacitor Element	Ceramic Type Designator A — NPO B — High K	Physical Size Designator From Configuration Tables	Capacitance in Pico-Farads With First Two Figures Significant and the Third Incating No. of Zeros	Tolerance J — 5% K — 10% M — 20%	Voltage Rating 50 — 50VDC 10 — 100VDC 20 — 200VDC

STANDARD CAPACITOR VALUES IN PFD (*ARE PREFERRED VALUES)

5	*33	120	*470	1.8K	*6.8K	27K	*100K	390K
*10	39	*150	560	*2.2K	8.2K	*33K	120K	*470K
12	*47	180	*680	2.7K	*10K	39K	*150K	500K
*15	56	*220	820	*3.3K	12K	*47K	180K	*560K
18	*68	270	*1.0K	3.9K	*15K	56K	*220K	680K
*22	82	*330	1.2K	*4.7K	18K	*68K	270K	*820K
27	*100	390	*1.5K	5.6K	*22K	82K	*330K	1,000K

Special Sizes and Values Are Available.

**Metallized end for termination.

NOTE: Because of small size of parts, units will be packaged and identified on the package with part number.

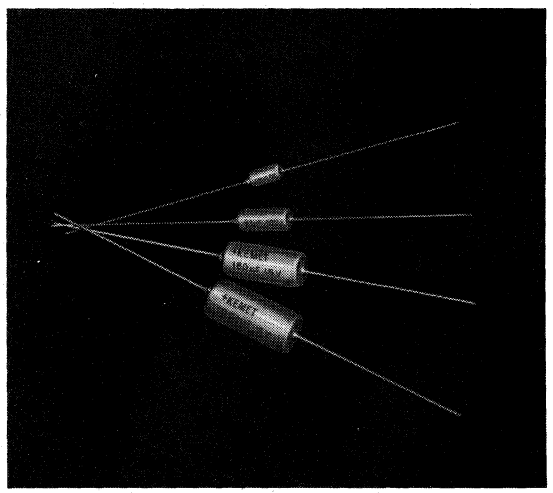
CHIP SIZE TO CAPACITANCE CHART

Style	Length ±.010	Width ±.010	Thick. Max.	** S ±.010	WVDC	Capacitance range in picofarads NPO	HIGH K
00	.080	.050	.05	.020	50 100 200	2-225 2-126 2-39	50-7.3K 50-4.1K 50-1.2K
01	.100	.050	.07	.030	50 100 200	2-504 2-282 2-88	100-17.7K 100-9.9K 100-3.1K
02	.175	.125	.07	.030	50 100 200	15-4.0K 15-2.1K 15-675	680-136.8 680-76.1K 680-23.4K
03	.150	.050	.07	.030	50 100 200	5-10.0K 5-585 5-180	180-36.9K 180-20.7K 180-6.4K
04	.220	.210	.07	.030	50 100 200	45-10.0K 45-5.7K 45-1.7K	1080-362.3K 1080-200K 1080-63K
05	.175	.065	.07	.030	50 100 200	7-1.6K 7-900 7-279	270-56.8K 270-31.9K 270-9.9K
06	.330	.310	.07	.030	50 100 200	110-26.5K 110-15K 110-4.6K	2.7K-900K 2.7K-526.5K 2.7K-159.3K
07	.210	.160	.07	.030	50 100 200	30-6.9K 30-3.8K 30-1.1K	930-243K 930-136.8K 930-24.3K
08	.440	.400	.07	.030	50 100 200	200-48.9K 200-27.5K 200-8.46K	6.7K-1.71x10⁶ 6.7K-.9x10⁶ 6.7K-297K
09	.350	.100	.07	.030	50 100 200	27-6.3K 27-3.6K 27-1.0K	1.0K-222.3K 1.0K-125.1K 1.0K-38.7K
10	.385	.120	.07	.030	50 100 200	220-10.1K 220-5.7K 220-1.7K	1.7K-355.5K 1.7K-200K 1.7K-61.6K
11	.610	.310	.07	.030	50 100 200	220-52.2K 220-29.5K 220-9K	8.8K-1.8x10⁶ 8.8K-1.0x10⁶ 8.8K-315K

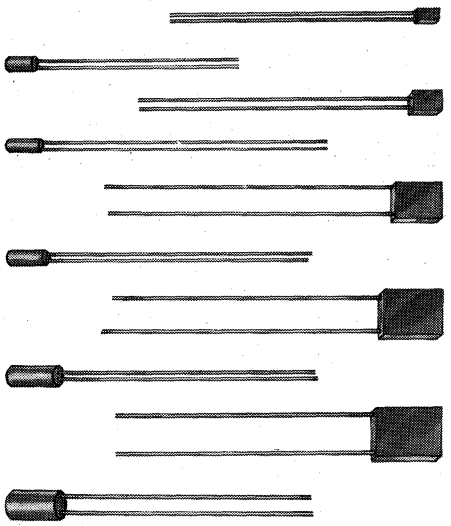
KEMET® UNION CARBIDE ELECTRONICS UNION CARBIDE

KEMET® SOLID TANTALUM CAPACITORS

- Complete Line for all Industrial, Military, and Commercial Applications
- Available to Mil-C-39003A (Styles CSR13 & CSR09) • National Sales & Distribution Network



KEMET J-Series



KEMET Micron Series

Series	Description & Features	Capacitance & Voltage Range	Size Range (Inches)	Leads	Request Catalog
C	Molded epoxy, polar, self insulating. Ideal for commercial and industrial applications which do not require performance standards of hermetically sealed capacitors. Precision dimensions suitable for automatic insertion equipment. Bullet shaped for positive polarity identification.	.1—220 μF 6—50 VDC	4-case sizes .138 x .390 to .365 x .875	Axial	F-2622B
D	Extended range molded sub miniature sizes featuring extremely high capacitance-to-volume ratio. Dimensions and tight lead wire-to-body concentricity permit automatic insertion by same equipment used for diodes and resistors. Suitable for decoupling, blocking,by-passing and filtering applications.	.0047—68 μF 6—50 VDC	3-case sizes .100 x .290 to .190 x .530	Axial	F-2632
E	Dip coated plastic encapulation providing the widely recognized shelf and operational life performance characteristics inherent in solid tantalum capacitors at prices competitive with conventional electrolytics. The dipped plastic case provides a tough barrier coating against moisture and shock and maintains precision lead spacing.	.1—330 μF 6—50 VDC	4-case sizes .175 x .350 to .760 x .600 x .275	Radial	F-2638B
J	Popular military hermetic sealed A, B, C & D case solid tantalum capacitors conforming to all requirements of Mil-C-39003A. Designed for miniaturized circuitry, they exhibit excellent stability, long life, extremely low DC leakage and D.F. over a wide temperature and frequency range.	.0047—330 μF 6—125 VDC	4-case sizes .125 x .250 to .341 x .750	Axial	F-1851D
MICRON	A complete line of microminiature capacitors designed for use in high density military, industrial and consumer circuits. Combines space saving advantages of .003 Mil MYLAR cases and KEMET's reliability engineering to achieve outstanding performance. Available in a wide variety of case styles, sizes and lead configurations.	.001—220 μF 2—100 VDC	29-case sizes .125 x .070 x .040 to .475 x .374 x .150	Axial & Radial	F-2710

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KEMET® UNION CARBIDE ELECTRONICS UNION CARBIDE

KEMET® MONOLITHIC CERAMIC CAPACITORS

- Ideal for Bypass, Filtering & Coupling in Low Voltage and Transistorized Circuits
- Designed, Manufactured & Tested to Mil-C-11015D & Mil-C-39014A
- Capacitance Range from 10 pf to 3.3 μF
- Temperature Range -55° to +125°C

CKR05



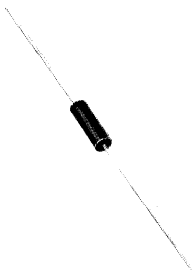
10–1000 pf

CKR06



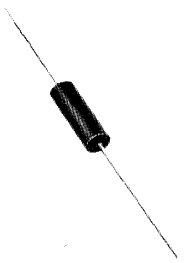
1200–100,000 pf

CKR12



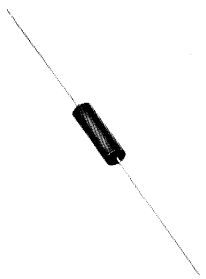
10–10,000 pf

CKR13



.015–.1 μf

CKR19



.012–.1 μf

Category	Designation	Capacitance Range	Voltage Range	Size (max.)	Leads	Request Catalog
Commercial	K01	.25–1.0μF	50	.375 x .500 x .200	Radial	F-2724
	K02	1.0–2.0μF	50	.375 x .690 x .200	Radial	
	K05	10 pf–.056μF	50–200	.200 x .200 x .100	Radial	
	K06	1200 pf–1.0μF	25–200	.300 x .300 x .100	Radial	
	K11	10–10,000 pf	100	.100 x .170	Axial	
	K12	10 pf–.027 μF	50–100	.100 x .250	Axial	
	K13	.012–.5 μF	50–100	.200 x .500	Axial	
	K19	.012–.1 μF	100	.140 x .400	Axial	
	K20	.25–.5 μF	50	.260 x .495	Axial	
	K21	.5–1.0 μF	50	.260 x .690	Axial	
	K22	1.0–2.0 μF	50	.350 x .690	Axial	
MIL-C-11015D	CK05	10–56,000	50–200	.200 x .200 x .100	Radial	F-2724
	CK06	1200–470,000 pf	50–200	.300 x .300 x .100	Radial	
	CK12	10–10,000 pf	50–100	.100 x .170	Axial	
	CK13	5600–47,000 pf	50–100	.100 x .260	Axial	
	CK14	12,000–270,000 pf	50–100	.150 x .400	Axial	
	CK15	100,000 pf–1.0 μF	50–100	.265 x .520	Axial	
	CK16	470,000 pf–3.3 μF	50–100	.370 x .720	Axial	
MIL-C-39014A (To "P" (0.1%/1000 hr.) Failure Rate Level)	CKR05	10–1,000 pf	200	.200 x .200 x .100	Radial	F-2707
	CKR06	1200–100,000 pf	100–200	.300 x .300 x .100	Radial	
	CKR12	10–10,000 pf	100	.100 x .270	Axial	
	CKR13	15,000–100,000 pf	100	.200 x .500	Axial	
	CKR19	12,000–100,000 pf	100	.160 x .410	Axial	

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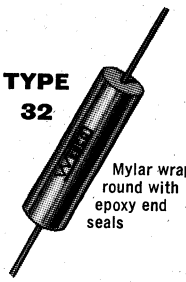
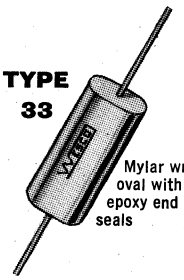
WESCO CAPACITORS



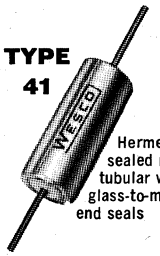
TYPE 32 — Mylar wrap round with epoxy end seals



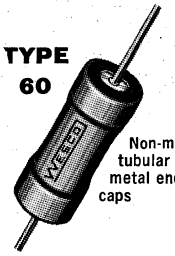
TYPE 33 — Mylar wrap oval with epoxy end seals



TYPE 26 — Molded phenolic case with epoxy end seals



TYPE 41 — Hermetically sealed metal tubular with glass-to-metal end seals



TYPE 60 — Non-metallic tubular with metal end caps

MYLAR
TYPE 32M

CAPACITY IN MFDS.	100 VDC D	100 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.0047	.203	7/16	.203	7/16	.218	9/16	.218	11/16
.01	.218	7/16	.218	7/16	.250	9/16	.250	11/16
.022	.250	7/16	.218	9/16	.281	11/16	.281	13/16
.033	.218	9/16	.218	11/16	.296	13/16	.312	15/16
.047	.218	11/16	.265	11/16	.359	13/16	.359	15/16
.10	.281	13/16	.328	13/16	.437	15/16	.437	1 1/4
.22	.359	15/16	.406	1 1/16	.531	1 3/8	.578	1 3/8
.47	.453	1 1/4	.546	1 1/4	.671	1 5/8	.718	1 3/4
1.0	.578	1 3/8	.625	1 3/4	.828	2	.906	1 7/8

POLYSTYRENE
TYPE 32P

CAPACITY IN MFDS.	100 VDC D	100 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.001	.187	11/16	.187	11/16	.187	11/16	.187	11/16
.0022	.187	11/16	.187	11/16	.187	11/16	.203	11/16
.0047	.187	11/16	.187	11/16	.234	11/16	.234	13/16
.01	.219	11/16	.234	11/16	.281	13/16	.328	13/16
.022	.265	13/16	.281	13/16	.343	15/16	.406	15/16
.047	.343	13/16	.359	15/16	.453	1 1/16	.484	1 1/4
.1	.453	15/16	.468	1 1/16	.578	1 1/4	.656	1 3/8
.22	.515	1 1/4	.625	1 1/4	.671	1 3/4	.812	1 3/4
.47	.671	1 1/2	.750	1 3/4				

METALIZED MYLAR
TYPE 32MM

CAPACITY IN MFDS.	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.01	———		.250	9/16	.250	11/16
.022	.218	7/16	.250	11/16	.375	11/16
.047	.203	9/16	.265	15/16	.375	15/16
.1	.296	9/16	.328	15/16	.531	15/16
.22	.328	11/16	.390	1 1/4	.625	1 1/4
.33	.390	11/16	.421	1 1/2	.656	1 1/2
.47	.468	11/16	.500	1 1/2	.781	1 1/2
1.0	.437	1 1/4	.656	1 3/4	1.0	1 3/4
2.0	.593	1 1/4	.921	1 3/4	1.406	1 3/4

POLY-CARBONATE
TYPE 32PC

CAPACITY IN MFDS.	50 VDC D	50 VDC L	100 VDC D	100 VDC L
.0033	—	—	.218	7/16
.0047	.171	7/16	.250	7/16
.01	.234	7/16	.218	9/16
.022	.218	9/16	.296	9/16
.047	.234	11/16	.343	11/16
.1	.281	13/16	.406	13/16
.22	.359	15/16	.484	1 1/16
.47	.437	1 3/16	.640	1 3/16
1.0	.593	1 5/16	.734	1 11/16

MYLAR
TYPE 60M

CAPACITY IN MFDS.	100 VDC D	100 VDC L
.0047	.170	7/16
.01	.170	7/16
.015	.204	7/16
.022	.204	9/16
.033	.225	9/16
.047	.290	1/2
.1	.318	5/8
.15	.318	7/8
.22	.318	1 3/16

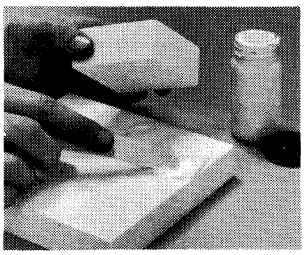
Write for complete information on the above items and others that are not listed.

WESCO

WESCO ELECTRICAL COMPANY, Inc.
27 OLIVE STREET • GREENFIELD, MASSACHUSETTS 01301 • PHONE: (413) 774-4358

Melbond ceramic adhesive

TYPE CA-100

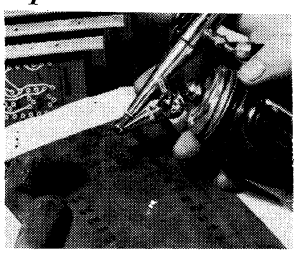


- **High service temperature**
- **Low curing temperature**
- **Excellent bonding strength**

MELBOND CA-100 is a ceramic adhesive with excellent bonding strength when used with refractory materials such as ceramics. Service temperature exceeds 2600°F after being cured at only 250°F. MELBOND has a paste like consistency and can be used for coating items requiring a high temperature protection.

Mel-Ink marking compound

TYPE M-100A



- **Heat Resistant**
- **Excellent Solvent Resistance**
- **Long Pot Life**

Permanent marking is no problem with nonconductive MEL-INK M-100A. This epoxy base marking compound can be sprayed on metals, plastics, glass, and wood. MEL-INK M-100A is available in black and white and a wide range of colors.*

Its hard-setting epoxy base eliminates smeared stencil information and resists the action of ultrasonic cleaning solutions such as xylene, toluene, Chlorothene, Solox, methylisobutylketone, and butyl and isopropyl alcohol. MEL-INK markings on aluminum and epoxy glass laminated test specimens can withstand more than fifty hours in a salt spray environment. Markings are color stable on surfaces exposed to temperatures up to 425°F for the black compound and 350°F for the white compound. MEL-INK M-100A markings satisfy the requirements for permanence of MIL-STD-130 **without** the use of a protective coating.

Typical uses of MEL-INK include identifying nomenclature on printed circuit boards, sheet metal chassis, and components of most types. Meets rigid government specifications for permanent marking applications.

*Color chart on MEL-INK M-100A is available on request.

Mel-Ink marking compound

TYPE M-300



- **Solvent Resistant**
- **Resist Salt Spray**
- **Permanent Marking**

MEL-INK M-300 is a permanent marking compound with a viscosity* suitable for machine and hand stamping as well as screen application. Presently available in black and white, this MEL-INK can be used to imprint identifying nomenclature on printed circuit boards, sheet metal chassis, glass, plastics, and components of most types.

The hard-setting epoxy of MEL-INK M-300 prevents smearing of stamped information upon completion of the curing cycle. Preliminary tests have indicated the excellent solvent resistance of this marking compound. Meets rigid government specifications for permanent marking applications.

Distributor quantities are presently available for immediate delivery from Newark Electronics Corp., 500 N. Pulaski Road, Chicago, Illinois 60624.

Melpar epoxy cement

TYPE MC-400

- **High Service Temperature**
- **Strong Bond**
- **Easy to Use**

MC-400 provides a strong bond to metals, plastics, glass and wood. Tests indicate that it has excellent heat and solvent resistance characteristics. Thousands of applications exist in the electronics industry for this epoxy insulating adhesive.

Melpak® casting resin

TYPE E-200



- **Room temperature curing**
- **Low shrinkage**
- **Self-extinguishing**

One of a series of Melpar epoxy resins, MELPAK E-200 satisfies the requirements for most general purpose potting, encapsulating, and casting applications. Easy to mix and use, and with relatively low toxicity, this versatile unfilled epoxy provides crack-free castings without an oven cure. MELPAK E-200 offers superior electrical and physical properties, as well as excellent adhesion to most plastics, metals, and ceramics. It is readily machinable, meets the self-extinguishing requirements of ASTM D63556, and produces bubble-free castings without vacuum treatment.

Melvar insulating varnish

TYPE V-500

- **Alcohol resistant**
- **Wear resistant**
- **Heat resistant**

MELVAR V-500 is a clear epoxy insulating varnish that provides high resistance to heat and solvents. This versatile material provides a lustrous finish, and can be applied to metals, plastics, glass, or wood by dipping, brushing, or spraying. Tests indicate that MELVAR V-500 exhibits superior weather and salt spray resistance and is fungus non-nutrient, making it particularly applicable in semi-tropical or marine environments. The excellent alcohol, heat, and wear resistance of MELVAR V-500 has led to its use as protective coating in industry as well as in the home. Typical applications include use on boats, indoor and outdoor furniture, bowling alleys, printed circuit boards, and truck trailers.

FOR PRICE AND DELIVERY INFORMATION CONTACT
SPECIAL PRODUCTS DEPARTMENT
MELPAR, INC.
AN AMERICAN STANDARD CO.
7776 ARLINGTON BOULEVARD
FALLS CHURCH, VIRGINIA 22046
Area CODE 703 534-6000

HumiSeal Coatings
GENERAL CHART

Listed in this General Chart of Properties are ten of the most frequently used HumiSeal Protective Coatings and their principal properties. These have been tabulated in order to facilitate comparison of their characteristics and selection of the most suitable type for a specific application. In addition to these HumiSeal types we manufacture a variety of coatings for special purposes, including high temperature applications. Should none of the coatings listed in this chart fulfill your requirements, we suggest that you contact us for recommendations.

	PROPERTIES OF LIQUID HumiSeal										THERMAL PROPERTIES		
HumiSeal Type[1]	Specific Weight (lbs. per gallon)[2]	Solids Content (% by weight)[3]	Viscosity, with catalyst when applicable (centistokes)[4]	Flash Point (°F)[5]	Drying Time for Handling[6]	Recommended Curing Conditions	Time Required to Reach Optimum Properties	Pot Life, at Room Temperature	Shelf Life, at Room Temperature	Coverage per gallon (in sq. ft.) After One Dip	Continuous Use Temperature Range (°F)	Thermal Shock Test[7]	Solderability[8]
1B12	7.3	20	30	40	10 min.	24 hrs. at room temp. or 30 min. at 170°F	24 hrs.	1 year	1 year	550	−75°F to +280°F	Passes	Good
1B15	7.6	35	470	30	10 min.	24 hrs. at room temp. or 30 min. at 170°F	24 hrs.	1 year	1 year	450	−75°F to +270°F	Passes	Good
1B31	7.6	35	160	30	10 min.	24 hrs. at room temp. or 30 min. at 170°F	24 hrs.	1 year	1 year	450	−75°F to +270°F	Passes	Good
1A20	8.5	50	120	90	60 min.	24 hrs. at room temp.	1 week	6 mos.	6 mos.	375	−70°F to +250°F	Passes	Excellent
1A27	8.0	50	5000	100	15 min.	24 hrs. at room temp.	1 week	1 year	1 year	450	−90°F to +250°F	Passes	Excellent
1A33	7.7	44	160	30	15 min.	24 hrs. at room temp.	1 week	1 year	1 year	300	−90°F to +250°F	Passes	Excellent
2A56	7.8	36	<20	70	60 min.	24 hrs. at room temp. or 2 hrs at 170°F	1 week	4 hrs.	6 mos.	650	−70°F to +250°F	Passes	Excellent
2B13	7.5	42	50	40	30 min.	90 min. at 200°F	1 week	24 hrs.	1 year	480	−70°F to +270°F	Passes	Poor
2A51	9.2	100	6000	non flam-mable	2 hrs.	24 hrs. at room temp. or 2 hrs. at 200°F	1 week	6 hrs.	6 mos.	200	−70°F to +250°F	Passes	Poor
2A53	7.8	54	300	70	30 min.	2 hrs. at 200°F	1 week	24 hrs.	1 year	400	−70°F to +250°F	Passes	Poor

HumiSeal TYPES LISTED IN BOLD PRINT COMPLY WITH THE REQUIREMENTS OF MIL-I-46058B

All technical data in this bulletin are based on test results using the stated standards and are believed to be correct. However, since the end use of HumiSeal materials (and the manner of storing and handling them) is beyond our control, we make no warranty — expressed or implied — as to the fitness of use, results to be obtained from or effects of use with respect to these materials. Their use shall be solely by the judgment of and at the risk of the end-user notwithstanding any statement contained in this bulletin.

1. The first digit in the type number specifies whether the product is a one-, or a two-component system.
2. Fed-Std 141a, Method 4184.
3. Fed-Std 141a, Method 4044.
4. Fed.Std 141a, Method 4287.
5. Fed-Std 141a, Method 4291.
6. Fed-Std 141a, Method 4061.
7. Mil-I-46058B.
8. Visual evaluation for ease of soldering with an 85 watt iron through a 2 mil film.
9. Fluorescent or color coding dye may be added if required.
10. Fed-Std 141a, Method 2121.
11. Fed-Std 406, Method 7031, Procedure A.
12. Fed-Std 141a, Method 6303.
13. ASTM-D150-65T, at 1 MHz and 25°C.
14. Mil-I-46058B. Insulation resistance during 10th cycle, at 65°C and 98% RH.

FOR ELECTRONICS

OF PROPERTIES

HumiSeal Protective Coatings are available in one-quart or one-gallon cans, five-gallon pails, or fifty-five gallon drums. HumiSeal types 1B15 and 1A27 are also available in 16-ounce aerosol containers. All HumiSeal types listed in this chart may be applied by dip, brush or spray. Our recommended techniques for the proper application of coatings and the preparation of the substrates are described in our booklet titled "How to Use Protective Coatings Efficiently" which will be mailed to you on request (Ask for Bulletin No. 79).

PROPERTIES OF CURED HumiSeal COATING

PHYSICAL PROPERTIES							ELECTRICAL PROPERTIES					CHEMICAL PROPERTIES			
Color[9]	Specific Gravity	Average Build After One Dip (mils)[10]	Water Absorption (%)[11]	Flexibility[7]	Adhesion[12]	Mar Resistance[12]	Dielectric Constant[13]	Dissipation Factor[13]	Dielectric Strength (volts)[7]	Insulation Resistance (teraohms)[7]	Moisture Resistance (gigaohms)[14]	Main Constituent	Fungus Resistance[7]	Resistance to Solvents	HumiSeal Type[1]
Water Clear	1.05	0.5	.18	Very Good	Excellent	Very Good	2.8	.010	6000	250	30	Acrylic	Excellent	Very Good	**1B12**
Water Clear	1.05	2	.20	Fair	Excellent	Fair	2.3	.010	8000	350	40	Acrylic	Excellent	Fair	**1B15**
Water Clear	1.06	2	.20	Excellent	Excellent	Very Good	2.5	.010	7500	800	60	Acrylic	Excellent	Good	**1B31**
Water Clear	1.05	2	.30	Excellent	Very Good	Excellent	3.5	.028	8000	300	48	Polyurethane	Excellent	Excellent	**1A20**
Green Tinge	1.05	5	.31	Excellent	Excellent	Fair	3.6	.020	7500	200	12	Polyurethane	Fair	Good	**1A27**
Yellow Tinge	1.05	2	.31	Excellent	Excellent	Fair	3.6	.030	7500	200	16	Polyurethane	Excellent	Good	**1A33**
Pink Tinge	1.09	0.5	.30	Excellent	Excellent	Good	3.6	.024	3500	300	56	Polyurethane	Excellent	Excellent	**2A56**
Yellow Tinge	1.06	2	.20	Excellent	Excellent	Excellent	3.0	.030	8000	300	33	Epoxy	Excellent	Excellent	**2B13**
Yellow Tinge	1.10	15	.31	Fair	Good	Good	3.0	.030	6000	400	6	Epoxy	Excellent	Good	**2A51**
Yellow Tinge	0.95	1	.30	Excellent	Excellent	Excellent	3.0	.030	8000	200	28	Epoxy	Excellent	Excellent	**2A53**

HUMISEAL DIVISION
COLUMBIA TECHNICAL CORPORATION
WOODSIDE, NEW YORK 11377
(212) 932-0800

Copyright

A STRONG LINE-UP OF ETCHANTS



ULTRA-SPEED ETCHANT

Ultra-Speed Etchant is a superior ferric chloride-type etchant that combines an extremely fast etch rate with cleaner etching and a high capacity for copper. It is ideally suited for high production etching of the inner layers of multi-layer printed circuit boards and flexible circuitry.

HI-SPEED CIRCUIT ETCH

Hi-speed Circuit Etch is a fast etching ferric chloride-type etchant that has a high capacity for copper. It is compatible with all types of silk screen inks, photo resists, plus certain precious metal plated resists.

R.C.E.® SOLUTION

R.C.E.® Solution is a versatile ferric chloride-type etchant designed for the etching of both ferrous and non-ferrous alloys, in addition to being a dependable etchant for copper laminates. Its controlled quality and consistency make it ideal for precision etching of printed circuits and micro devices.

NO. 826 ETCHANT

No. 826 Etchant is a special ready-to-use chrome-type etchant with a very high capacity for copper. It etches very rapidly and maintains a fast etch rate over a longer period. It is compatible with all common plated metallic and organic resists.

MULTI-CIRCUIT ETCH

Multi-Circuit Etch is a versatile chrome-type etchant that offers greater economy as a concentrate. It is compatible with all circuit-plating metals, silk screen inks and photo resists. It etches rapidly and has a good capacity for copper.

S.C.E.® SOLUTION

S.C.E.® Solution is a chrome-type etchant similar to Multi-Circuit Etch in etching properties, but packaged as a convenient ready-to-use solution. It eliminates inconsistencies due to improper mixing of the etching solution and is compatible with all common plated metallic and organic resists.

ALK-ETCH

Alk-Etch is an alkaline etchant for copper laminates especially recommended where plated bimetallic resists are specified. It has a high capacity for copper, etches rapidly, and produces a minimum of undercut. (Licensed for use under Patent No. 3231503).

K-1 ETCHANT CONCENTRATE

K-1 Etchant Concentrate is a concentrated chrome-type solution for the precision etching of expansion alloys. It etches rapidly and produces smooth etched surfaces throughout the life of the etching bath.

PHILIP A. HUNT CHEMICAL CORPORATION

WE HOLD THAT LINE WITH A POWERHOUSE OF PHOTO RESISTS

WAYCOAT IC RESIST

Waycoat IC Resist, a recent development of Hunt Research, is a highly purified photosensitive material for high yield production of integrated circuits, semi-conductors and other sophisticated devices in the microelectronic field.

WAYCOAT RC RESIST

Waycoat RC Resist is a photosensitive material specifically designed for use in roller coaters. It forms a resilient coating of uniform thickness capable of prolonged exposure to commonly used etching and electroplating solutions.

WAYCOAT PHOTO RESIST NO. 20

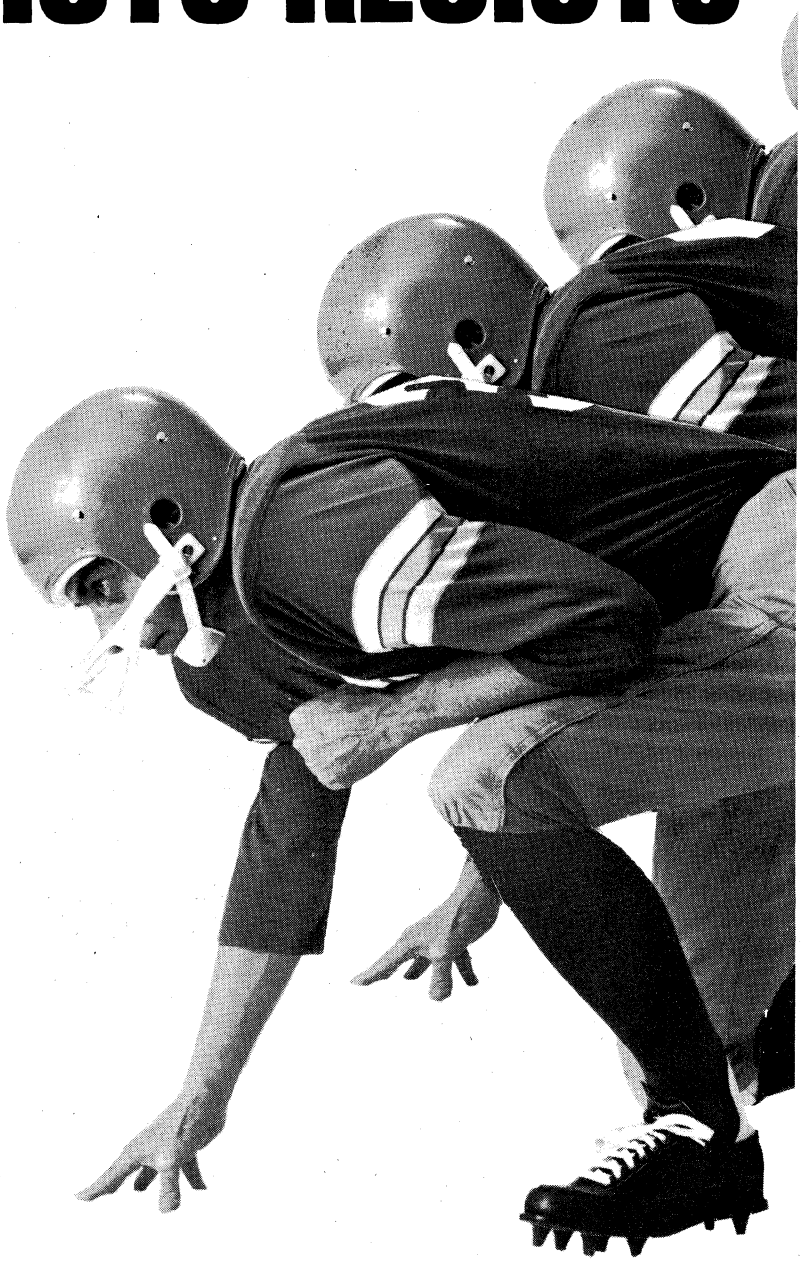
Waycoat Photo Resist No. 20 is a photosensitive material with improved covering power that provides maximum resistance to commonly used electroplating baths and etching solutions. It can be applied full strength by dip coating or diluted for spray coating to give a variety of coating thicknesses.

WAYCLEAN . . . a chemical cleaner that provides a tarnish-free and chemically clean surface for maximum adhesion of any photo resist on copper surfaces.

WAYCOAT PHOTO RESIST STRIPPER . . . an easy-to-use stripper for the complete removal of all resists used in the production of printed circuit boards. (Works at room temperature).

MICROSTRIP . . . a highly refined blend of solvents and surface active agents formulated for the removal of Waycoat IC Resist and other resists used in the microelectronic field.

And don't forget that Hunt manufactures a complete line of complementary photo resist chemicals, such as Thinner, Developer, Dye and Strippers.



Palisades Park, New Jersey • Branches in Principal Cities • PHILIP A. HUNT COMPANY (CANADA) LTD.

JEFFERS PRECISION METAL FILM NETWORKS

PARAMETERS OF THE STANDARD JPN NETWORK SERIES

No. of Bits	Accuracy to ½ LSB	Airco Standard Accuracy	Temperature Range	Case Style "A" 0.45" High	Case Style "B" and "C" 1.00" Wide
4	±3.200%	±2.000%	−55 to +125°C	0.375W × 0.75L	0.500L × 0.25H
5	±1.600%	±1.000%	−55 to +125°C	0.375W × 1.00L	0.600L × 0.25H
6	±0.800%	±0.600%	−55 to +125°C	0.375W × 1.00L	0.700L × 0.25H
7	±0.400%	±0.300%	−55 to +125°C	0.375W × 1.00L	0.875L × 0.25H
8	±0.200%	±0.150%	−55 to +125°C	0.375W × 1.25L	0.875L × 0.25H
9	±0.100%	±0.070%	−55 to +125°C	0.375W × 1.25L	1.000L × 0.25H
10	±0.050%	±0.035%	−55 to +125°C	0.375W × 1.50L	1.250L × 0.25H
11	±0.025%	±0.020%	−25 to + 85°C	0.500W × 1.50L	1.250L × 0.25H
12	±0.012%	±0.010%	−25 to + 85°C	0.500W × 1.50L	1.400L × 0.35H
13	±0.006%	±0.005%	0 to + 50°C	0.500W × 1.75L	1.400L × 0.35H
14	±0.003%	±0.003%	Temp. ± 5°C(2)	0.500W × 1.75L	1.500L × 0.35H

Specify Part Numbers as Follows: JPN—(Number of Bits)—(Case Style)—(R Value)(1)

NOTES: (1) R values for the standard series extend to 75 K ohms. For higher resistance values, and other configurations and accuracies, see the section on custom networks.
(2) Fourteen bit networks are designed for operation in a controlled temperature environment. (Any nominal temperature can be specified from +20°C to +85°C.)

CONSTRUCTION: The basic resistive element used in the JPN network is the JXP precision metal film resistor. The reliability of these resistive elements is documented by data gathered over 27,000,000 unit test hours, under a wide variety of load conditions.

☐ **Case:** Hard Diallyl phthalate. ☐ **Leads:** Standard lead material is No. 22 AWG, 100% low oxygen content copper, gold plated over a nickel flash. Other lead materials are available upon request. ☐ **Internal Construction:** All welded assembly. ☐ **Potting Material:** Mineral filled epoxy compound. ☐ **Potting Process:** High vacuum potting to provide void free encapsulation.

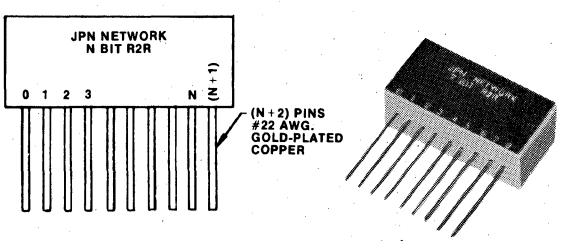
STABILITY: The ratio stability of the component resistors has been established to be well within tolerances required to maintain long term network accuracies under normal operating conditions.

ACCURACY: The accuracy of R2R networks is given as a worst case cumulative error, stated in terms of a percentage of the full-scale network output. For most applications, an accuracy which will give a resolution better than one-half the least significant bit is deemed adequate.

NETWORK RESPONSE TIME: The settling time of a network is normally specified as that period of time for an applied input pulse to go from its starting point to the stated accuracy percentage of its final value.

The response of any network depends upon several parameters, such as resistance values of the resistors used and stray capacitance due to the number of resistors and their physical arrangement. However, the settling time of a JPN network is generally below 100 nanoseconds. Settling times below 50 nanoseconds are possible in the lower impedance levels.

N BIT R2R NETWORK—STYLE "A"



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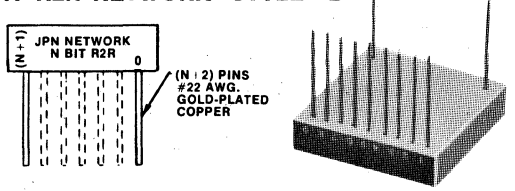

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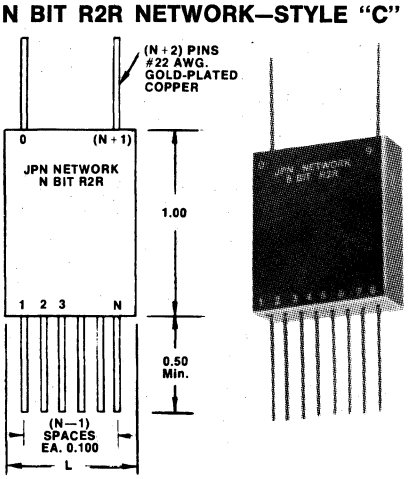


AIRCO Speer Electronic Components

DUBOIS, PENNSYLVANIA TEL 814-371-2100 TWX 510-693-3096

Formerly Jeffers Electronics Division Speer Carbon Co.

GTI CORPORATION
Dytronics Division

DIE STAMPED AND ETCHED CIRCUITS

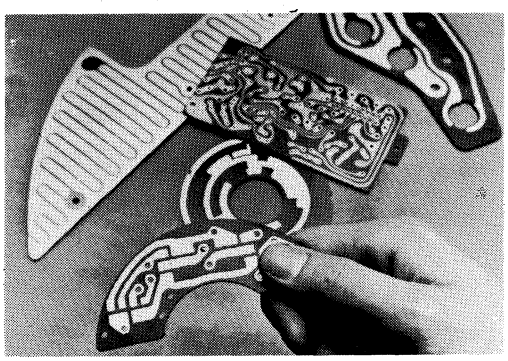
Die stamped circuits by GTI have these advantages over etched circuits:

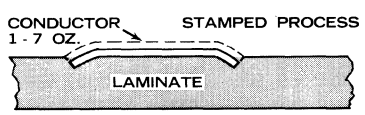
Tucked-in edge conductor that's ideal for cams, commutators, switches, slip rings.

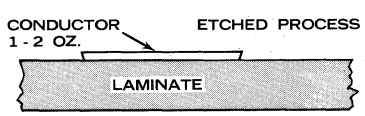
Thicker conductors up to 10 oz./sq. ft. and 0.150 in. thickness with heavier current carrying ability, increased life in switching functions and greater thermal capacity and heat dissipation.

Die stamping is a dry process — chemicals are not used to print or laminate circuitry. Voids are eliminated, as well as pinholes, shorts, or undercuts. There are no chemicals that can leach out later, when circuits are in use.

Positive and accurate registration is maintained throughout the production run. Conductors are embossed and the board is blanked from the same locator holes.







TEST SPECIFICATIONS

The following specifications have been certified by Detroit Testing Laboratory, Detroit, Michigan.

HUMIDITY **Die stamped boards will withstand:**
1. 100°F @ 100% R.H. for 2 hours.
2. 160°F @ 100% R.H. in 1 hour for 3 hours.
3. 100°F @ 100% R.H. over 6 hour period.

Repeat cycle five times, totalling 60 hours, and following this:

THERMAL **Die stamped boards will withstand:**
1. From −40°F to +160°F over 3 hour period.
2. +160°F for 1 hour to −40°F over 3 hour period.
3. −40°F for 1 hour.

Repeat cycle five times, totalling 60 hours.

Die stamp circuits will pass these tests and show no broken conductors, no adhesive bond failures, no base material delamination, no excessive warpage. There will also be no loss of electrical continuity in hardware connections.

This is true also in economy grade base laminates: IE: XP, XXP.

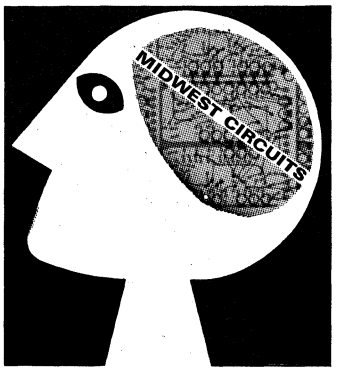
TECHNICAL COMPARISON

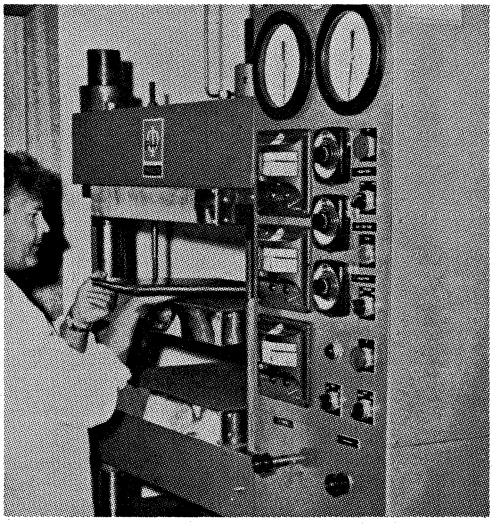
	DIE STAMPED	ETCHED
LAMINATES		
Standard	XP, XXP, XXXP, FR-2, FR-3, CE, LE, G10, FR4 and glass polyester.	Same
Special	Epoxy coated metals Nylon paper Flexibles	Flexibles only
CONDUCTORS	1 oz., 10 oz. electrolytic copper.	1 - 2 oz. electrolytic; aluminum; nickel
FINISHES	Solder hot flow, silver plate, solder mask, seal brite, tin, lead, precious metals.	Same
HARDWARE	Connector pins, terminals, eyelets, blades, contacts.	Same
HOLES		
Punched	.020 holes in 1/16" thick paper phenolics, .030 holes in 1/16" thick glass base	Same
Drilled	.0132 in any material	
TOLERANCES		
1. Registration (Hole to conductor)	**Standard** / **Special**	
Temporary Tools	±.015 / ±.010 ±.005	Same
Permanent Tools	±.010 / ±.005	
1a. Repeatability of registration (throughout production run)	±.003	Same
2. Punching	±.003 minimum / ±.005 standard	Same
3. Angular	±1° / ±0°30′	Same
4. Line width	.030" minimum, 1-2 oz. (Slightly wider on heavier copper)	Less than .030"
5. Line spacing	.030" minimum, 1-2 oz. (Slightly wider on heavier copper)	Less than .030"
ECONOMIC	If the board can either be etched or die stamped, die stamping becomes more economical at about 3500 square feet of circuitry/yr./part., where die stamping has features superior to etching, such as ramp angle, heavier copper, or dry processing, it is economical in lesser quantities	
CONTAMINATES	None	Inks, etchants, and cleaners
ADHESION	Exceeds NEMA standard	Equal to or greater than NEMA standards
TOOLING		
1. Prototype (Temporary)		
Artwork	Yes	Yes
Emboss section	Yes	No
Drill template	Yes	Yes
Router guide	Yes	Yes
2. Production (Permanent)		
Artwork	Yes	Yes
Emboss die	Yes	Prepunch die
Pierce & blank die	Yes	Yes
FLATNESS (NEMA standards) .025"/Lin. inch)	Exceeds NEMA standards	Equal NEMA standards
ENVIRONMENTAL TEST	Dytronics D100 specification (See test specifications)	XP and XXP will not pass D100
UNDERWRITERS LABORATORY APPROVAL	Yes	Yes

NOTE: We do not supply precious metals in either our etching or die stamping with the exception of silver on die stamped circuits.

KEEP US IN MIND

when your printed circuit job demands exceptional quality





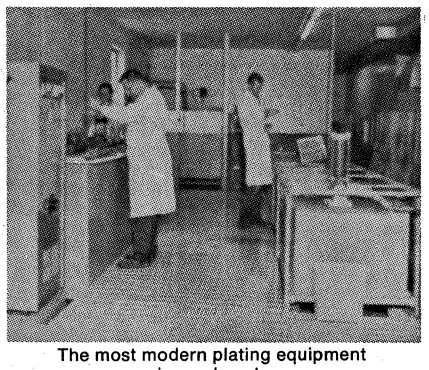
DESIGN and ENGINEERING

Midwest Circuits has the engineering and production capability to handle all or part of your printed circuit board requirements.

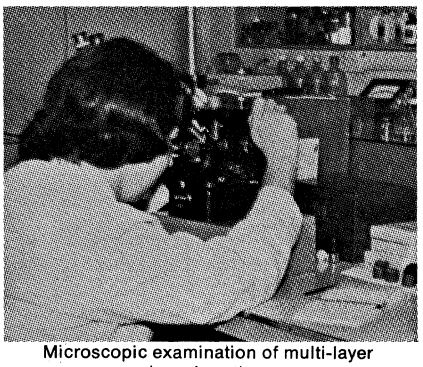
This broad capability covers development of customer schematics or rough drawings to the finished board, including multi-layered, plated-thru-hole, double or single sided.

FACILITIES

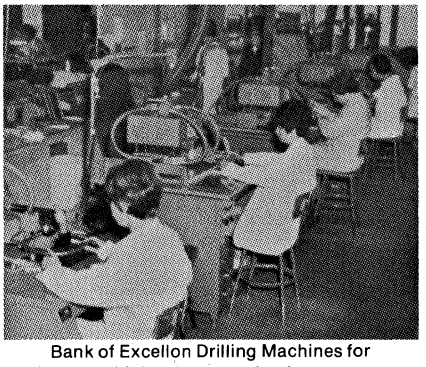
Midwest Circuits maintains two of the finest design and production plants in the industry. Both contain the latest equipment for precision multi-layer production. Teamed to this specialized equipment are skilled technicians, engineers, chemists and photographic experts prepared to give you "on-time" delivery of a quality product.



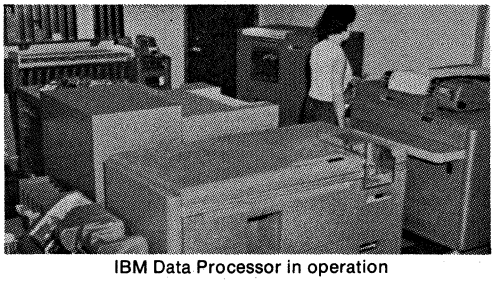
The most modern plating equipment is employed



Microscopic examination of multi-layer board section



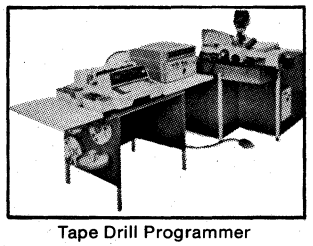
Bank of Excellon Drilling Machines for high volume production



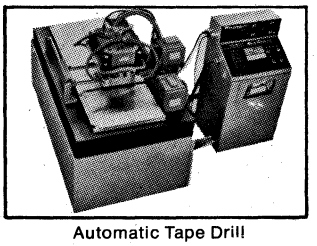
IBM Data Processor in operation

QUALITY CONTROL

Midwest Circuits meets and exceeds "industry standards" and the requirements of all military and NASA specifications. This is accomplished through constant monitoring of all production processes. Product precision and tolerances are maintained through the use of "in-process" inspection stations coupled with special IBM computer equipment. The results from each inspection is compiled and analyzed to assure product perfection prior to delivery. It's just one more reason why we'd like you to KEEP US IN MIND when your job demands exceptional quality.



Tape Drill Programmer



Automatic Tape Drill

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A COMPLETE SOURCE OF RELIABLE PRINTED CIRCUIT BOARDS

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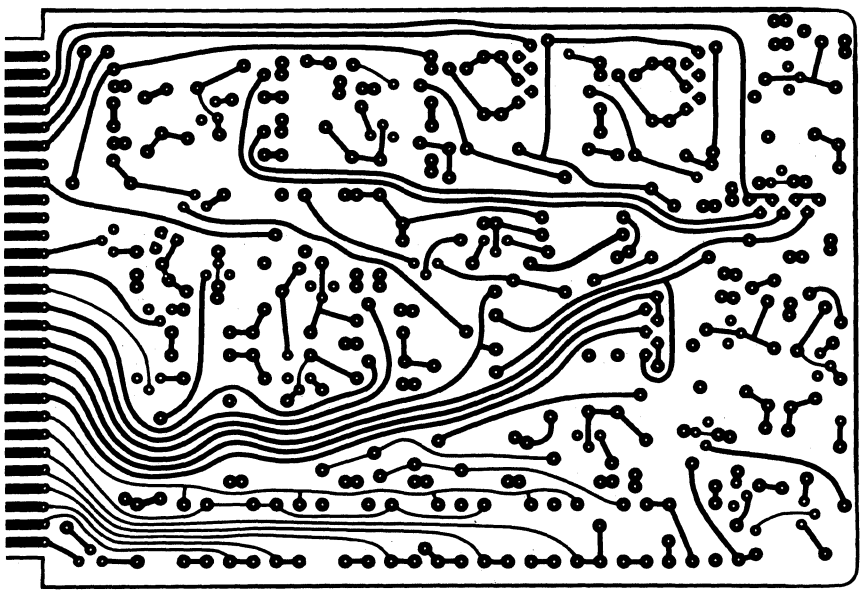

Nutronics, has been a manufacturer of printed circuit boards for a number of years to the electronic industries manufacturers of equipment for industrial and military use. Nutronics maintains constant quality control through strict adherence to specification to meet exacting requirements by highly trained personnel, with continuous inspection at all times. Specialized technicians maintain highest quality workmanship. Volume production facilities utilizing latest manufacturing equipment enable us to economically price our circuit boards.

All printed circuits are manufactured by direct photographic process method to precision requirements.

We offer all phases of manufacture with any type of board or finish to meet your requirements. Plating of precious metals is processed in our own plant.

Nutronics quality control is an essential part under constant supervision.

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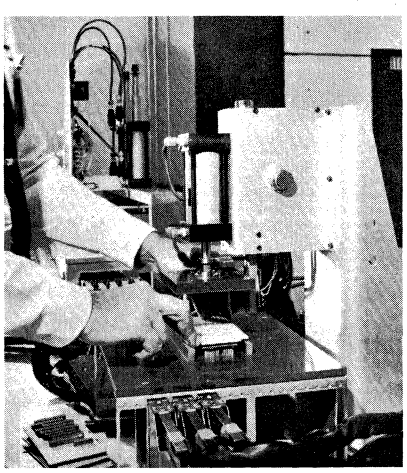
...whether you need one in two weeks–or 2,500 a week!

When your needs are critical for fast delivery of high performance, reliable multilayer boards, specify Texas Instruments. Recently for one customer, TI went from schematic, through design, to delivered prototype of an automatrix multilayer board in just two weeks. For another customer, TI is currently delivering 2,500 complex multilayer boards a week!

Whatever your program requirements, call upon Texas Instruments for complete interconnection system support. Customer services available include complete computer design from schematic or data list level, computer generated artwork from your layouts, or manufacture of boards from your artwork.



Reliability assured — through 100 percent electrical test of every board.

Processes, production facilities, and manufacturing procedures meet military specifications.

How about TI multilayer board reliability? Through 15 October we have recorded 400 million joint hours of operational testing *without a single joint failure.*

When you need multilayer boards, many or just one fast prototype, and you require quick, accurate design and high reliability, call (214) 238-2903, or write: Advanced Circuit Board Department, Texas Instruments Incorporated, P. O. Box 5303, M.S. 979, Dallas, Texas 75222.

TEXAS INSTRUMENTS
INCORPORATED

JEFFERS MOLDED INDUCTORS

JEFFERS inductors are for use at radio frequencies and in pulse circuitry. The listed standard inductors, in values from 0.1 μh through 10,000 μh, are designed to meet the requirements of MIL-C-15305 Revision C.

Important features of JEFFERS standard inductors.

- High Reliability, proven by over 253,470,000 unit test hours.
- High Q and SRF.
- Maximum protection with minimum dimension as a result of full encapsulation in a thermosetting mineral filled plastic jacket.
- Assured uniformity of product, a result of stringent Quality Control and Inspection procedures at every production stage.

Suffix letter on part number denotes standard tolerance. J = 5%, K = 10%, M = 20%.

These inductors, in standard tolerances, are available for immediate delivery from your local Airco Speer Distributor.

TYPE 09 — Dia. .095 ± .005 - Length .250 ± .010

Jeffers P/N	Lμh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms	Direct Current (MA)
4416-1K	0.10	125°	25.0	34	680	0.08	1315
4416-2K	0.12	125°	25.0	34	640	0.09	1240
4416-3K	0.15	125°	25.0	34	600	0.10	1170
4416-4K	0.18	125°	25.0	34	550	0.12	1070
4416-5K	0.22	125°	25.0	32	510	0.14	990
4416-6K	0.27	125°	25.0	30	460	0.16	925
4416-7K	0.33	125°	25.0	28	410	0.22	790
4426-1K	0.39	125°	25.0	35	355	0.30	675
4426-2K	0.47	125°	25.0	35	325	0.34	635
4426-3K	0.56	125°	25.0	34	310	0.40	585
4426-4K	0.68	125°	25.0	33	280	0.54	500
4426-5K	0.82	125°	25.0	32	260	0.63	465
4426-6K	1.00	125°	25.0	32	240	0.74	430
4436-1K	1.20	105°	7.9	32	150	0.18	875
4436-2K	1.50	105°	7.9	32	140	0.22	790
4436-3K	1.80	105°	7.9	32	125	0 28	700
4436-4K	2.20	105°	7.9	32	115	0.38	600
4436-5K	2.70	105°	7.9	40	100	0.55	500
4436-6K	3.30	105°	7.9	45	90	0.80	415
4436-7K	3.90	105°	7.9	45	82	1.00	370
4436-8K	4.70	105°	7.9	45	75	1.20	340
4446-1K	5.60	105°	7.9	50	67	1.50	300
4446-2K	6.80	105°	7.9	50	60	1.80	275
4446-3K	8.20	105°	7.9	60	55	2.40	240
4446-4K	10.0	105°	7.9	60	50	3.10	210
1316-1K	12.0	105°	2.5	40	40	2.40	240
1316-2K	15.0	105°	2.5	40	36	2.75	225
1316-3K	18.0	105°	2.5	50	32	3.00	215
1316-4K	22.0	105°	2.5	50	28	3.30	205
1316-5K	27.0	105°	2.5	50	24	3.60	195
1326-1K	33.0	105°	2.5	45	29	2.80	225
1326-2K	39.0	105°	2.5	45	26	3.10	210
1326-3K	47.0	105°	2.5	45	24	4.30	180
1326-4K	56.0	105°	2.5	45	22	5.30	160
1326-5K	68.0	105°	2.5	50	19	6.00	152
1326-6K	82.0	105°	2.5	50	17	6.70	144
1326-7K	100.0	105°	2.5	50	14	7.50	135

TYPE 15 — Dia. .156 ± .010 - Length .375 ± .010

Jeffers P/N	Lμh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms	Direct Current (MA)
4415-1M	0.15	125°	25.0	50	525	0.03	2450
4415-2M	0.22	125°	25.0	50	450	0.055	1900
4425-1M	0.33	125°	25.0	45	360	0.09	1400
4425-2M	0.47	125°	25.0	45	310	0.12	1225
4425-3K	0.56	125°	25.0	50	280	0.135	1220
4425-4K	0.68	105°	25.0	50	250	0.15	1100
4425-5K	0.82	125°	25.0	50	220	0.22	900
4425-6K	1.00	125°	25.0	50	200	0.29	830
4425-7K	1.20	125°	7.9	33	180	0.42	650
4425-8K	1.50	125°	7.9	33	160	0.50	600
4425-9K	1.80	125°	7.9	33	150	0.65	525
4425-10K	2.20	125°	7.9	33	135	0.95	435
4425-11K	2.70	125°	7.9	33	120	1.20	385
4425-12K	3.30	125°	7.9	33	110	2.00	300
4425-13K	3.90	125°	7.9	33	100	2.30	280
4425-14K	4.70	125°	7.9	33	90	2.60	260
4435-1K	5.60	125°	7.9	45	60	0.32	750
4435-2K	6.80	125°	7.9	50	55	0.50	600
4445-1K	8.20	125°	7.9	50	50	0.60	545
4445-2K	10.0	125°	7.9	55	45	0.90	445
4445-3K	12.0	125°	2.5	65	42	1.10	404
4445-4K	15.0	125°	2.5	65	40	1.40	370
4445-5J	18.0	125°	2.5	75	34	2.25	280
4445-6J	20.0	125°	2.5	80	34	2.30	275
4445-7J	22.0	125°	2.5	75	30	2.50	265
4455-1J	24.0	125°	2.5	65	27	2.20	265
4455-2J	27.0	125°	2.5	60	25	2.60	260
4465-1J	30.0	125°	2.5	70	20	2.80	255
4465-2J	33.0	125°	2.5	65	19	3.00	250
1315-1J	36.0	105°	2.5	60	15.5	2.50	180
1315-2J	39.0	105°	2.5	60	14.5	2.60	176
1315-3J	43.0	105°	2.5	60	13.7	2.70	172
1315-4J	47.0	105°	2.5	60	13.0	2.75	170
1315-5J	51.0	105°	2.5	55	12.7	2.85	167
1315-6J	56.0	105°	2.5	55	12.0	3.00	164
1315-7J	62.0	105°	2.5	55	11.5	3.15	160
1315-8J	68.0	105°	2.5	55	11.0	3.30	156
1315-9J	75.0	105°	2.5	55	10.5	3.70	147
1315-10J	82.0	105°	2.5	50	10.3	3.90	143
1315-11J	91.0	105°	2.5	50	10.0	4.30	136
1315-12J	100.0	105°	2.5	50	9.5	4.50	133
1315-13J	110.0	105°	.790	60	8.9	4.90	128
1315-14J	120.0	105°	.790	65	8.7	5.20	124
1315-15J	130.0	105°	.790	65	8.5	5.45	121
1315-16J	150.0	105°	.790	65	8.0	6.05	114
1315-17J	160.0	105°	.790	65	7.5	6.40	111
1315-18J	180.0	105°	.790	65	7.0	6.75	108
1315-19J	200.0	105°	.790	65	6.5	7.10	106
1315-20J	220.0	105°	.790	65	6.2	7.45	103
1315-21J	240.0	105°	.790	65	5.9	7.80	101

TYPE 19 — Dia. .190 ± .010 - Length .440 ± .010

Jeffers P/N	Lμh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms	Direct Current (MA)
4411-1M	0.15	125°	25.0	55	510	0.030	3000
4411-2M	0.22	125°	25.0	50	415	0.035	2800
4411-3M	0.33	125°	25.0	50	350	0.065	2000
4411-4M	0.47	125°	25.0	50	300	0.085	1700
4411-5K	0.56	125°	25.0	50	270	0.125	1450
4411-6K	0.68	125°	25.0	45	250	0.150	1300
4411-7K	0.82	125°	25.0	40	210	0.205	1100
4411-8K	1.00	125°	25.0	40	200	0.290	930
4411-9K	1.20	125°	7.9	30	180	0.400	785
4411-10K	1.50	125°	7.9	30	170	0.485	700
4411-11K	1.80	125°	7.9	30	150	0.740	580
4411-12K	2.20	125°	7.9	30	140	0.970	505
4411-13K	2.70	125°	7.9	30	120	1.200	460
4421-1K	3.30	125	7.9	30	70	0.140	1350
4421-2K	3.90	125	7.9	30	65	0.155	1250
4421-3K	4.70	125	7.9	30	60	0.210	1100
4421-4K	5.60	125	7.9	30	50	0.280	935
4421-5K	6.80	125	7.9	30	50	0.375	810
4421-6K	8.20	125	7.9	30	48	0.440	750
4421-7K	10.0	125	7.9	30	42	0.605	640
4421-8K	12.0	125	2.5	50	36	1.050	490
4421-9K	15.0	125	2.5	55	30	1.200	460
4421-10K	18.0	125	2.5	60	30	1.950	360
4421-11K	22.0	125	2.5	60	24	2.200	335
4421-12K	27.0	125	2.5	65	22	2.750	300
1331-21J	270.0	105°	.790	65	5.6	8.2	110
1331-22J	300.0	105°	.790	65	5.3	8.7	107
1331-23J	330.0	105°	.790	65	5.0	9.1	105
1331-24J	360.0	105°	.790	65	4.7	9.6	102
1331-25J	390.0	105°	.790	65	4.5	10.0	100
1331-26J	430.0	105°	.790	65	4.3	10.6	97
1331-27J	470.0	105°	.790	65	4.0	11.1	95
1331-28J	510.0	105°	.790	65	3.8	11.6	93
1331-29J	560.0	105°	.790	65	3.6	12.3	91
1331-30J	620.0	105°	.790	60	3.5	13.0	88
1331-31J	680.0	105°	.790	60	3.4	13.7	85
1331-32J	750.0	105°	.790	60	3.3	14.4	83
1331-33J	820.0	105°	.790	60	3.1	15.1	81
1331-34J	910.0	105°	.790	60	2.9	15.8	79
1331-35J	1000.0	105°	.790	60	2.8	16.5	78

TYPE 22 — Dia. .220 ± .010 - Length .560 ± .010

Jeffers P/N	L μh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms	Direct Current (MA)
4412-1K	0.47	125°	25.0	65	300	0.06	1970
4412-2K	0.56	125°	25.0	65	270	0.08	1850
4412-3K	0.68	125°	25.0	65	240	0.08	1700
4412-4K	0.82	125°	25.0	65	220	0.11	1520
4412-5K	1.00	125°	25.0	65	200	0.14	1290
4412-6K	1.20	125°	7.9	40	180	0.19	1120
4412-7K	1.50	125°	7.9	40	160	0.28	925
4412-8K	1.80	125°	7.9	40	150	0.37	790
4412-9K	2.20	125°	7.9	40	135	0.50	680
4412-10K	2.70	125°	7.9	40	120	0.65	600
4412-11K	3.30	125°	7.9	40	105	1.00	480
4412-12K	3.90	125°	7.9	40	100	1.20	440
4412-13K	4.70	125°	7.9	40	90	1.80	360
4422-1K	5.60	125°	7.9	35	55	0.13	1340
4422-2K	6.80	125°	7.9	35	50	0.20	1080
4422-3K	8.20	125°	7.9	35	44	0.22	1030
4422-4K	10.0	125°	7.9	35	42	0.26	950
4422-5K	12.0	125°	2.5	45	34	0.45	720
4422-6K	15.0	125°	2.5	45	32	0.52	670
4422-7K	18.0	125°	2.5	50	28	0.70	580
4422-8K	22.0	125°	2.5	60	24	1.00	480
4422-9K	27.0	125°	2.5	65	22	1.30	420
4422-10K	33.0	125°	2.5	65	20	1.50	390
4422-11K	39.0	125°	2.5	70	18	2.00	340
1312-20J	1100	105°	.250	60	2.8	21.0	78
1312-21J	1200	105°	.250	60	2.7	22.0	76
1312-22J	1300	105°	.250	60	2.6	23.0	75
1312-23J	1500	105°	.250	65	2.4	25.0	72
1312-24J	1600	105°	.250	65	2.3	26.0	70
1312-25J	1800	105°	.250	65	2.2	28.0	68
1312-26J	2000	105°	.250	65	2.1	29.0	67
1312-27J	2200	105°	.250	70	2.0	30.0	66
1312-28J	2400	105°	.250	70	1.9	31.0	64
1312-29J	2700	105°	.250	70	1.8	33.0	62
1312-30J	3000	105°	.250	70	1.7	35.0	61
1312-31J	3300	105°	.250	70	1.6	38.0	58
1312-32J	3600	105°	.250	70	1.5	40.0	57

TYPE 24 — Dia. .240 ± .010 - Length .740 ± .010

Jeffers P/N	L μh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms	Direct Current (MA)
1313-20J	3900	105°	.250	80	1.45	44	61
1313-21J	4300	105°	.250	80	1.40	46	59
1313-22J	4700	105°	.250	80	1.35	48	58
1313-23J	5100	105°	.250	80	1.30	50	57
1313-24J	5600	105°	.250	80	1.25	53	56
1313-25J	6200	105°	.250	80	1.20	56	54
1313-26J	6800	105°	.250	80	1.15	59	52
1313-27J	7500	105°	.250	80	1.10	62	51
1313-28J	8200	105°	.250	80	1.05	65	50
1313-29J	9100	105°	.250	80	1.00	68	49
1313-30J	10000	105°	.250	80	0.95	72	47

TYPE 25 — Dia. .250 ± .010 - Length .560 ± .010

Jeffers P/N	L μh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms at 25°C	Direct Current (MA)
25-A-470K	47	125°	2.5	18	13.5	5.9	195
25-A-560K	56	125°	2.5	18	13.0	6.4	185
25-A-680K	68	125°	2.5	70	13.0	3.3	255
25-A-820K	82	125°	2.5	65	11.7	3.5	245
25-A-101K	100	125°	2.5	65	10.7	3.8	235
25-A-121K	120	125°	.790	75	9.3	4.7	215
25-A-151K	150	125°	.790	75	8.3	5.3	200

TYPE 28 — Dia. .280 ± .010 - Length .940 ± .010

Jeffers P/N	L μh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms	Direct Current (MA)
4414-1K	1.20	125°	7.9	60	170	0.075	2400
4414-2K	1.50	125°	7.9	60	160	0.090	2150
4414-3K	1.80	125°	7.9	60	140	0.135	1750
4414-4K	2.20	125°	7.9	60	125	0.160	1600
4414-5K	2.70	125°	7.9	60	115	0.220	1350
1414-6K	3.30	125°	7.9	60	100	0.305	1150
4414-7K	3.90	125°	7.9	60	95	0.450	955
4414-8K	4.70	125°	7.9	60	90	0.560	860
4414-9K	5.60	125°	7.9	60	80	0.745	745
4414-10K	6.80	125°	7.9	60	75	1.050	635
4414-11K	8.20	125°	7.9	60	68	1.400	550
4414-12K	10.0	125°	7.9	60	60	1.900	460
4414-13K	12.0	125°	2.5	40	53	2.650	395
4414-14K	15.0	125°	2.5	40	50	3.250	355
4414-15K	18.0	125°	2.5	40	45	4.150	315
4424-1K	22.0	125°	2.5	50	24	0.295	1150
4424-2K	27.0	125°	2.5	50	22	0.295	1050
4424-3K	33.0	125°	2.5	60	19	0.550	865
4424-4K	39.0	125°	2.5	55	18	0.650	810
4424-5K	47.0	125°	2.5	65	16	1.000	640
4424-6K	56.0	125°	2.5	65	14	1.150	610
4424-7K	68.0	125°	2.5	75	13	1.850	470
4424-8K	82.0	125°	2.5	75	12	2.100	440
4424-9K	100.0	125°	2.5	75	12	2.500	405
4424-10K	120.0	125°	.790	95	10	4.100	315

TYPE 31 — Dia. .310 ± .010 - Length .560 ± .010

Jeffers P/N	L μh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms at 25°C	Direct Current (MA)
31-A-181K	180	125°	.790	80	6.0	5.5	225
31-A-221K	220	125°	.790	80	5.5	5.9	220
31-A-271K	270	125°	.790	80	5.1	6.6	210
31-A-331K	330	125°	.790	75	4.2	7.8	185
31-A-391K	390	125°	.790	75	3.9	8.7	180

TYPE 37 — Dia. .375 ± .010 - Length .625 ± .010

Jeffers P/N	L μh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms at 25°C	Direct Current (MA)
37-A-471K	470	125°	.790	80	3.7	9.0	190
37-A-561K	560	125°	.790	80	3.5	10.0	180
37-A-681K	680	125°	.790	75	3.2	11.2	170
37-A-821K	820	125°	.790	75	3.0	13.0	155
37-A-102K	1000	125°	.790	70	2.7	14.5	145

TYPE 46 — Dia. .468 ± .010 - Length .687 ± .010

Jeffers P/N	L μh	Max. Oper. Temp. °C	Test Freq. (MHz)	Q Min	SRF Min (MHz)	DCR Max Ohms at 25°C	Direct Current (MA)
46-A-152K	1500	125°	.250	85	2.2	22.0	127
46-A-222K	2200	125°	.250	85	1.8	27.0	115
46-A-272K	2700	125°	.250	85	1.6	32.0	105
46-A-512K	5100	125°	.250	70	1.0	66.0	73
46-A-103K	10000	125°	.250	70	0.8	70.0	71

INDUCTOR LEAD MATERIAL

Standard All leads are 1⅝" minimum length.

The leads of standard sizes cataloged, are 99.9% oxygen free copper. Before manufacturing, the coating is pure tin hot dipped to a minimum thickness of 0.0006 inch. After manufacturing into molded inductors the leads are hot dip coated with 60/40 tin-lead solder with a minimum thickness of 0.0006 inch.

AIRCO Speer Electronic Components
DUBOIS, PENNSYLVANIA TEL 814-371-2100 TWX 510-693-3096
Formerly Jeffers Electronics Division Speer Carbon Co.

TOROIDS, OSCILLATORS, AMPLIFIERS

ALWAYS IN STOCK AT ALLEN ELECTRONICS.

Allen Electronics Division manufactures these components in quantity, under the most rigid quality controls, including thorough inspection and testing, for use in the world's finest electronic organs. For this reason we constantly maintain a complete inventory, which is also available to you who desire the added benefits of lower-than-competitive prices and immediate out-of-stock delivery.

TOROIDS

Available from stock. They have been used successfully in such areas as: telemetry, sound and intercommunication systems; geophysical applications; mobile communications; filters; oscillators; and test equipment.

CENTER-TAPPED

Inductance	Q	Core	O.D.	Price
58.2 Hy.	50	P	1-5/8"	4.65
47.0 Hy.	50	P	1-5/8"	4.65
43.0 Hy.	50	P	1-5/8"	4.65
37.6 Hy.	50	P	1-5/8"	4.65
35.4 Hy.	50	P	1-5/8"	4.65
25.6 Hy.	60	P	1-1/4"	3.45
23.2 Hy.	55	P	1-1/4"	3.45
21.2 Hy.	55	P	1-1/4"	3.45
19.3 Hy.	55	P	1-1/4"	3.45
17.8 Hy.	52	P	1-1/4"	3.45
16.7 Hy.	46	P	1-1/4"	2.85
15.6 Hy.	48	P	1-1/4"	2.85
13.5 Hy.	45	P	1-1/4"	2.85
12.2 Hy.	42	P	1-1/4"	2.85
10.5 Hy.	41	P	1-1/4"	2.85
9.59 Hy.	35	P	1-1/4"	2.85
8.95 Hy.	34	P	1-1/4"	2.85
8.20 Hy.	33	P	1-1/4"	2.85
7.88 Hy.	32	P	1-1/4"	2.85
7.07 Hy.	30.5	P	1-1/4"	2.85
6.88 Hy.	29	P	1-1/4"	2.85
3.11 Hy.	50	P	1-1/4"	2.45
2.91 Hy.	48	P	1-1/4"	2.45
2.64 Hy.	46	P	1-1/4"	2.45
2.42 Hy.	43.5	P	1-1/4"	2.45
2.27 Hy.	43	P	1-1/4"	2.45
2.19 Hy.	40	P	1-1/4"	2.45
1.98 Hy.	41	P	1-1/4"	2.45
1.81 Hy.	38	P	1-1/4"	2.45
1.66 Hy.	37	P	1-1/4"	2.45
1.48 Hy.	36	P	1-1/4"	2.45
1.43 Hy.	36	P	1-1/4"	2.45
1.29 Hy.	33	P	1-1/4"	2.45
1.18 Hy.	34	P	1-1/8"	2.27
1.03 Hy.	31.5	P	1-1/8"	2.27
927 M.H.	31	P	1-1/8"	2.27
856 M.H.	30	P	1-1/8"	2.27
804 M.H.	29	P	1-1/8"	2.27
738 M.H.	28.75	P	1-1/8"	2.27
694 M.H.	27	P	1-1/8"	2.27
642 M.H.	27.25	P	1-1/8"	2.27
590 M.H.	26	P	1-1/8"	2.27
545 M.H.	24	P	1-1/8"	2.27
494 M.H.	23	P	1-1/8"	2.27
457 M.H.	21	P	1"	2.04
426 M.H.	20.7	P	1"	2.04
394 M.H.	20	P	1"	2.04
362 M.H.	19	P	1"	2.04
334 M.H.	18.5	P	1"	2.04
317 M.H.	17.5	P	1"	2.04
286 M.H.	17	P	1"	2.04
266 M.H.	16.5	P	1"	2.04
248 M.H.	16	P	1"	2.04
232 M.H.	15.5	P	1"	2.04
206 M.H.	15	P	1"	2.04
196 M.H.	14.5	P	1"	2.04
184 M.H.	14	P	1"	2.04
167 M.H.	13.5	P	1"	2.04
157 M.H.	13	P	1"	2.04
147 M.H.	12.5	P	1"	2.04
138 M.H.	12	P	1"	2.04
126 M.H.	11.5	P	1"	2.04
110 M.H.	11	P	1"	2.04
106 M.H.	11	P	1"	2.04
100 M.H.	10.5	P	1"	2.04
91 M.H.	10.5	P	1"	2.04
82 M.H.	10	P	1"	2.04
78 M.H.	10	P	1"	2.04
70 M.H.	9.3	P	1"	2.04
65 M.H.	9.0	P	1"	2.04
60 M.H.	8.7	P	1"	2.04
56 M.H.	8.3	P	1"	2.04
53 M.H.	8.1	P	1"	2.04
50 M.H.	7.8	P	1"	2.04
46 M.H.	7.5	P	1"	2.04
43 M.H.	7.2	P	1"	2.04
39 M.H.	7.0	P	1"	2.04
37 M.H.	6.7	P	1"	2.04
34 M.H.	6.5	P	1"	2.04
31 M.H.	6.2	P	1"	2.04
29 M.H.	4.6	P	11/16"	3.30
27 M.H.	4.6	P	11/16"	3.30
25 M.H.	4.5	P	11/16"	3.30
22 M.H.	4.1	P	11/16"	3.30
20 M.H.	3.9	P	11/16"	3.30
19 M.H.	3.8	P	11/16"	3.30
17 M.H.	3.7	P	11/16"	3.30
15 M.H.	3.6	P	11/16"	3.30
14 M.H.	3.3	P	11/16"	3.30
12 M.H.	3.1	P	11/16"	3.30
11 M.H.	2.9	P	11/16"	3.30
10 M.H.	2.8	P	11/16"	3.30
9 M.H.	2.7	P	11/16"	3.30
8 M.H.	2.6	P	11/16"	3.30
7 M.H.	2.5	P	11/16"	3.30
6 M.H.	2.4	P	11/16"	3.30

NO-CENTER-TAP

Inductance	Q	Core	O.D.	Price
10 M.H.	5.7	I	1"	1.05
20 M.H.	6.1	I	1"	1.05
30 M.H.	6.7	I	1"	1.05
35 M.H.	7.2	I	1"	1.05
40 M.H.	7.6	I	1"	1.05
50 M.H.	8.9	I	1"	1.05
75 M.H.	5.7	I	1"	1.10
100 M.H.	6.4	I	1"	1.10
150 M.H.	7.5	I	1"	1.10
200 M.H.	8.4	I	1"	1.10
250 M.H.	9	I	1"	1.10
300 M.H.	9.8	I	1"	1.10
400 M.H.	11	I	1"	1.10
500 M.H.	23	P	1-1/8"	2.25
600 M.H.	25	P	1-1/8"	2.25
800 M.H.	29	P	1-1/8"	2.25
1 Hy.	18.6	F	1-1/16"	1.81
1.2 Hy.	16.1	F	1-1/16"	1.81
1.5 Hy.	15	F	1-1/16"	1.81
2 Hy.	16.5	F	1-1/16"	1.81
2.5 Hy.	24.3	F	1-1/16"	1.81
3 Hy.	26.2	F	1-1/16"	1.81
4 Hy.	25.7	F	1-1/16"	1.81
5 Hy.	18.8	F	1-1/16"	1.81
8 Hy.	35	F	1-1/16"	1.81

(±10%)

CORE DETAILS
P = Permalloy
F = Ferrite
I = Powdered Iron

DISCOUNT SCHEDULE
1 — 24 . . . . . LIST
25 — 99 . . . . . LESS 15%
100 — 249 . . . . . LESS 20%
WRITE FOR HIGHER QUANTITY DISCOUNTS

Inductance and "Q" measured at 1 Volt 1,000 c.p.s. — Inductance Tolerance ± 2%
58.2 Hy. to 10.5 Hy. Tolerance ± 5%
Ferrite Core — Inductance Tolerance ± 5%

OSCILLATORS

TYPE "C" AUDIO OSCILLATOR

This compact unit is designed for applications that have moderate requirements for stability in respect to temperature and frequency drift. The transistorized package is completely encapsulated and provides a construction that is extremely rugged.

SPECIFICATIONS
- Frequency — Any frequency from 15 Hz. to 10 kHz.
- Frequency Accuracy — ± .2% of specified frequency with 12V. D.C. input, resistive load of 200K ohms and 24° C. ambient.
- Frequency Drift — Approximately 1% from -20°C. to +45°C. Less than 0.3% with input voltages from 10 to 14V. D.C.
- Frequency Adjustment Range (using external components) — ± 2.0% (see arrangements two and three below)
- Input Voltage — 5 to 15V. D.C.
- Input Current — Does not exceed 5 ma. @12V. D.C.
- Output Voltage — Proportional to input voltage. Typically 1.5 to 2.0V. RMS with 12V. D.C. input and a load resistance of 200K ohms.
- Output Wave Shape — Sinusoidal. Total distortion approximately 2.0% with 12V. D.C. input.
- Dimensions — 15 — 249 cps. 4 3/8" x 2 13/16" x 1½" 250 — 10,000 cps. 3 9/16" x 2½" x 1 1/8"

The Type "C" oscillators can be produced in the following arrangements:
1. Any specific frequency in the range at an ambient temperature of 24° C. and with no provision for frequency adjustment.
2. Provision for frequency adjustment of ±2% of a specified frequency by means of an externally connected capacitor (Type "C"). A capacitor will be furnished which will provide the specified frequency at 24° C. ambient.
3. Provision for continuously variable frequency adjustment of ± 2% of a specified frequency by means of an externally connected variable resistance and a fixed capacitor. External components not furnished but component values are specified. This feature is very convenient when a "front panel" fine adjustment of frequency is desirable.

PRICE — Order by specifying type, frequency and arrangement number.

Frequency	Price
15 — 20 Hz.	$37.00
21 — 100 Hz.	$25.00
101 — 500 Hz.	$20.00
501 — 10,000 Hz.	$25.00

QUANTITY DISCOUNT
Discount is applicable for quantities of one frequency only.

Quantity	Discount
1 — 10	Net
11 — 50	Less 15%
51 — 99	Less 20%
100 — up	Less 25%

TYPE "P" SINE WAVE OSCILLATOR

A plug-in unit with a standard octal tube base type connector. A knurled thumbscrew type adjustment on top of the unit provides for variable, fine adjustment of frequency, plus or minus two per cent of the specified frequency.

SPECIFICATIONS
- Frequency — Any frequency from 20Hz. to 200 kHz.
- Frequency Drift — Approximately 1% from -20° C. to +45°C. Less than 0.3% with input voltages from 10 to 14V. D.C.
- Input Voltage — 5 to 15V. D.C.
- Input Current — Does not exceed 5 ma. @ 12V. D.C.
- Output Voltage — Proportional to input voltage. Typically 1.5 to 2.0V. RMS, with 12V. D.C. input and load resistance of 200K ohms.
- Output Wave Shape — Sinusoidal. Total distortion approximately 2.0% with 12V. D.C. input.
- Dimensions — Mounting area — 2 3/16" square. Overall height — 4 3/4" max. Height above octal mounting socket — 4" max.

PRICE — $33.00. Order by specifying type and frequency.
QUANTITY DISCOUNT—Same discount schedule as Type "C"

AMPLIFIERS

The T-20 and T-50 transistorized amplifiers utilize the latest developments in solid-state technology. This outstanding equipment demonstrates all the characteristics normally associated with such circuitry, namely compact design and low heat dissipation. Conservatively rated, these units have demonstrated their ability to operate over a wide ambient temperature range.

TYPICAL SPECIFICATIONS — T-50 AUDIO AMPLIFIER
- Power Output — 50 W. @ 8 ohms; 35 W. @ 15 ohms.
- Frequency Response — ± 0.75 db. 20 cps. to 20 kcs.
- Harmonic Distortion — 0.38% 1 db. below clipping.
- Intermodulation Distortion — 1.1% 1 db. below clipping.
- Noise — Less Than 2 mv.
- Input Sensitivity — 50 mv. for 1 db. below clipping.
- Output Impedance — 8 to 16 ohms.
- Input — 117v. 60 cps.
- Maximum Dimensions — 10¼" L. x 7¼" W. x 6 1/8" H.
- Weight — 7 3/4 lbs.

PRICE — $98.00 net
DISCOUNT SCHEDULE: 1 — 4 net; 5 — 9 less 5%; 10 — 24 less 7.5%; 25 — up less 10%

TYPICAL SPECIFICATIONS — T-20 AUDIO AMPLIFIER
- Power Output — 18 W. @ 8 ohms.
- Frequency Response — ± 1.0 db. 20 cps. to 20 kcs.
- Harmonic Distortion — 0.3% 1 db. below clipping
- Intermodulation Distortion — 0.4% 1 db. below clipping.
- Noise — Less than 2 mv.
- Input Sensitivity — 50 mv. for 1 db. below clipping.
- Output Impedance — 8 ohms.
- Input — 117 v. 60 cps.
- Maximum Dimensions — 8" L. x 7" W. x 6 1/8" H.
- Weight — 4 lbs.

PRICE — $76.00 net
DISCOUNT SCHEDULE — Same as for T-50.

ORDER TODAY FROM:

ALLEN electronics division

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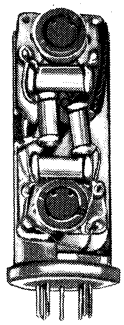
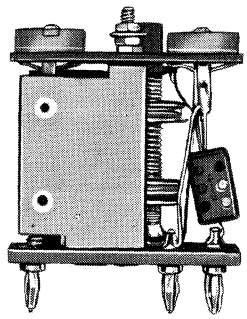
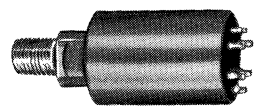
Macungie, Penna. 18062







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- R.F. Oscillators
- Discriminator Transformers
- Magnetic Amplifiers
- Networks
- Filters
- Torroids
- All to the tightest Military or Commercial Specifications

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R-388	T-279	PRC-8, 9, 10	RT-323	AM-1565	GRA-53	TRD-4, 15, 17, 23
R-390	T-893	PRC-25	RT-441	AM-1955	GRC-9	TS-1777
R-390A		PRC-77	RT-581	AM-1956	GRC-10	UPM-32
R-391		RT-77	RT-618	AM-1957	GRC-26	URM-48
R-392		RT-198	RT-771	AM-1958	GRC-50	URM-103
R-666		RT-246		AM-2014	GRC-86	USM-159
R-746				ARN-21	GRC-109	UQN-1 J
R-1148				ARN-32	LS-127	VRC-12
R-1331				APX-294	MD-239	VRC-24
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URC-32				CN-371	SRC-20/21	
WLR-1						
WR-3						

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SPECIAL ASSEMBLIES

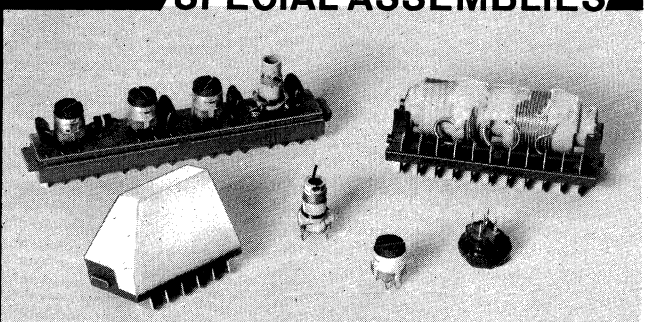
In addition to its standard line of off-the-shelf components, Autonatic specializes in the design and manufacture of almost any type of coil (variable pitch winding, RF coils and toroids in a wide variety of ranges, encapsulated, etc.). The range of transformers, discriminators and filters custom tailored to your requirements is virtually unlimited. Automatic has the facilities to design and produce complete I-F assemblies, printed circuit modules and others to your specifications.

Automatic's Royal line is designed especially for projects where specifications call for high reliability or for rigid temperature coefficients.

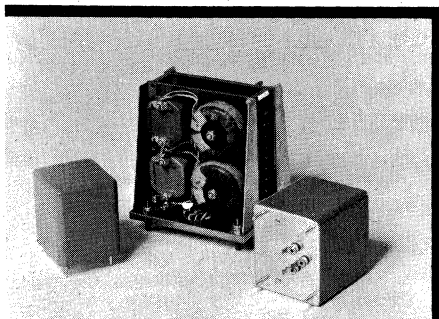
Where capacitors, inductors or toroids are combined to make up a network such as a filter or delay line, all items are seasoned and de-bugged through four cycles providing assurance that all questionable sections will be detected.

A unique encapsulation technique contributes to greater reliability. When an end product is to be encapsulated in epoxy resin, each component is covered with unsintered teflon and coated with a semi-rigid epoxy resin. The assembly is then encased in a rigid epoxy. This shell-within-a-shell relieves the end product from the strains caused during temperature variations normally experienced in rigid epoxy encapsulation.

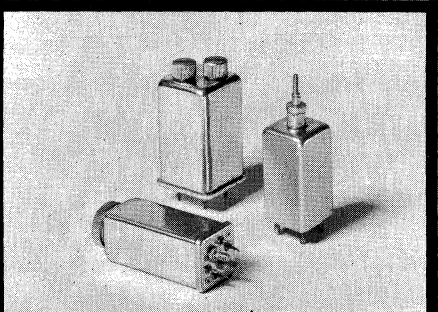
Where items are hermetically sealed in metal cases, stainless steel studs are provided. Pressure type header terminal assemblies are used to meet the most rigid requirements of MIL T-27A specifications.



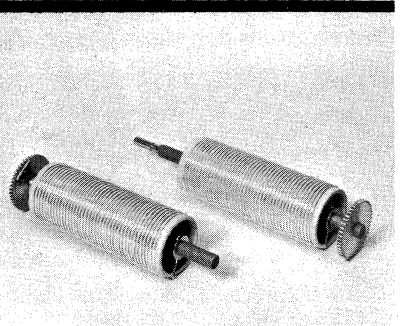
COIL ASSEMBLIES
Shown here are typical special coil assemblies manufactured for use in the U.S. Navy WRC-1 Receiver-Transmitter System (Receiver R1051, Transmitter 827, Amplifier AM-3007, Antenna Coupler CU-937)



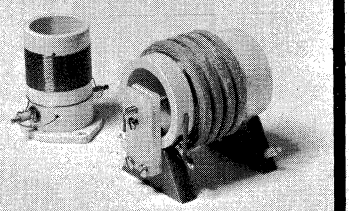
DISCRIMINATORS & FILTERS
Band Pass, Band Rejection, Low Pass, High Pass. Various types of discriminators from 1000 hertz to 3000 hertz seasoned and hermetically sealed.



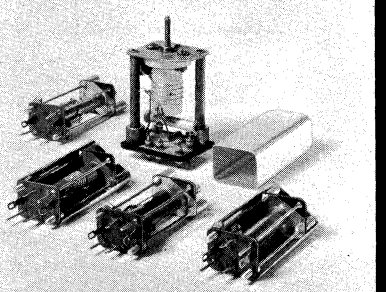
R-F & I-F XFMRS
Hermetically sealed R-F and I-F transformers for military and high quality commercial application.



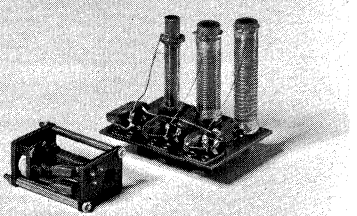
RF COIL ASSEMBLIES
These high frequency, precision coil assemblies are produced for the U.S. Navy PRC-47 Personnel Radio Communication System.



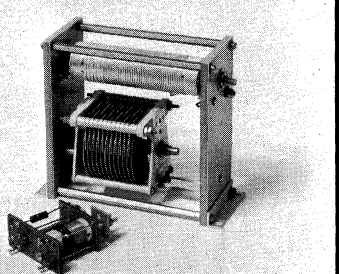
R-F HIGH VOLTAGE XFMRS
Radio frequency high voltage power supply transformers, used on the Radar Jitter Tester.



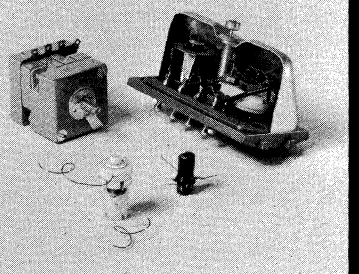
TRANSFORMERS
The complete set of 11 transformers, consisting of R-F, I-F, Limiter & Discriminator for the GRC/R108, R109 and R110 Radio Receiver Signal Corps.



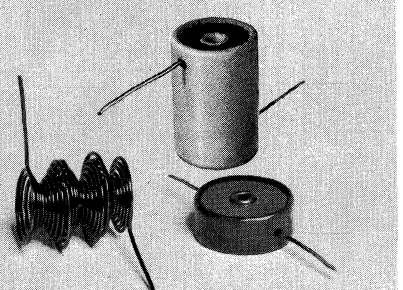
VARIABLE PITCH COILS
Complete facilities for variable pitch winding, to customer's specific requirements.



VARIABLE INDUCTOR & CAPACITOR ASSEMBLY
Link transformer, variable inductor and capacitor assembly for a 10 K.W. Transmitter manufactured for the Navy. (FRT-17)



MICA FILLED SUPPORTS & ASSEMBLIES
for low loss transformers and R-F coils.



R-F CHOKE COILS
Low distributed capacity R-F Choke Coils — for the Radio AN/GRR-5.

AUTOMATIC COIL

DIVISION OF DESIGNATRONICS
76 E. Second Street, Mineola, New York 11501/Telephone (516) 741-7070/TWX 510-222-5889

TOROIDAL INDUCTORS

OPEN CONSTRUCTION STYLES

OC

OCW

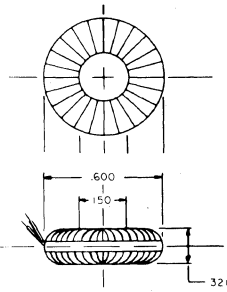
EC

OC—Wound to approx. inductance and specified turns—supplies w/18" self leads for induc. —trimming by user.

OCW—Wound to 1% inductance, banded w/glass tape & wax impreg—supplied w/6" plastic leads.

EC — same as OCW, except epoxy dipped, 2 coats.

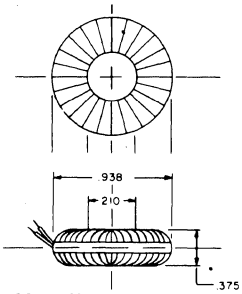
SIZE 1



CORE (090)—Low frequency-highest Q up to 6 KHz

Part No.	Inductance ±1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
090-103	10mH	2.9	242
090-203	20mH	5.7	165
090-503	50mH	14.3	100
090-503	50mH	14.3	100
090-104	100mH	29	69
090-204	200mH	57	47
090-504	500mH	103	29
090-105	1H	286	20
090-205	2H	562	14
090-505	5H	1430	8.8

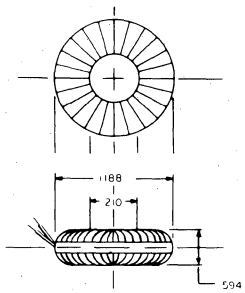
SIZE 2



CORE (109)—Low frequency-highest Q up to 5 KHz

Part No.	Inductance ±1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
109-103	10mH	1.33	221
109-203	20mH	1.33	221
109-503	50mH	6.03	91
109-503	50mH	6.03	91
109-104	100mH	13.3	64
109-204	200mH	23.9	44
109-504	500mH	60.1	27
109-105	1H	131.8	18
109-205	2H	235	13
109-505	5H	660	11

SIZE 3



CORE (251)—Low frequency-highest Q up to 4 KHz

Part No.	Inductance ± 1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
251-103	10mH	0.77	172
251-203	20mH	1.54	127
251-503	50mH	4.22	72
251-503	50mH	4.22	72
251-104	100mH	6.85	50
251-204	200mH	12.3	34
251-504	500mH	30	21
251-105	1H	68.6	15
251-205	2H	123	10
251-505	5H	300	6

EPOXY CASED STYLES

ECC

ECS

ECT

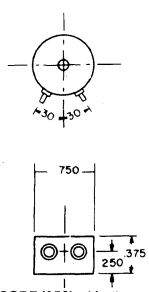
ECC provided w/clearance hole

ECS provided w/MTG stud

ECT provided w/tapped insert

Ambient temp. range 55° C to 105° C.

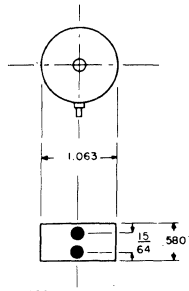
SIZE 1



CORE (056)—Medium frequency-highest Q from 6 KHz to 20 KHz

Part No.	Inductance ±1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
056-502	5mH	2.3	360
056-103	10mH	4.9	242
056-203	20mH	11.2	165
056-503	50mH	25	100
056-104	100mH	49	69
056-204	200mH	115	47
056-504	500mH	290	29
056-105	1H	520	20
056-205	2H	1050	14

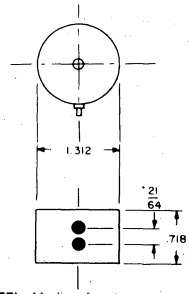
SIZE 2



CORE (068)—Medium frequency-highest Q from 5 KHz to 20 KHz

Part No.	Inductance ±1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
068-502	5mH	.92	320
068-103	10mH	2.1	221
068-203	20mH	3.7	151
068-503	50mH	9.4	91
068-104	100mH	21	64
068-204	200mH	46	44
068-504	500mH	90	27
068-105	1H	213	18
068-205	2H	475	13

SIZE 3



CORE (157)—Medium frequency-highest Q from 4 KHz to 20 KHz

Part No.	Inductance ± 1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
157-502	5mH	0.6	255
157-103	10mH	1.07	172
157-203	20mH	1.89	127
157-503	50mH	6	72
157-104	100mH	10.6	50
157-204	200mH	23.9	34
157-504	500mH	60.2	21
157-105	1H	107	15
157-505	5H	605	6

HERMETICALLY SEALED STYLES

HCL

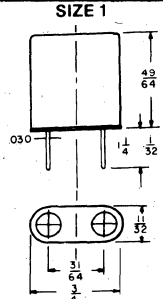
HCT

HCL - hermetically sealed in crystal case w/lead type terminals.

HCT - hermetic sealed in larger crystal case w/glass compression terms and threaded Mtg. inserts.

Ambient temp range 55° C to 105° C.

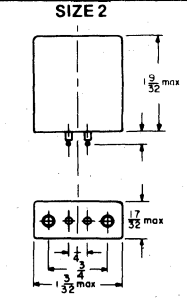
SIZE 1



CORE (027)—High frequency-highest Q from 20 KHz to 100 KHz

Part No.	Inductance ±1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
027-102	1mH	1.2	942
027-202	2mH	2.1	625
027-502	5mH	5.3	374
027-103	10mH	12	251
027-203	20mH	22	172
027-503	50mH	51	103
027-104	100mH	115	71
027-204	200mH	210	48
027-304	300mH	330	41
027-504	500mH	510	30

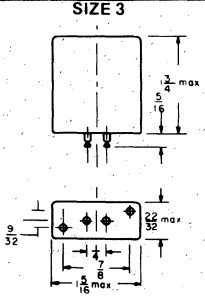
SIZE 2



CORE (032)—High frequency-highest Q from 20 KHz to 100 KHz

Part No.	Inductance ±1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
032-202	2mH	.92	514
032-502	5mH	2.29	308
032-103	10mH	5.10	216
032-203	20mH	9.06	149
032-503	50mH	22.9	93
032-104	100mH	57.8	64
032-204	200mH	92	44
032-304	300mH	143	36
032-504	500mH	234	26

SIZE 3



CORE (075)—High frequency-highest Q from 20 KHz to 75 KHz

Part No.	Inductance ± 1% at 1 KHz	DCR ±20% Ohms	SRF Min KHz
075-502	5MH	1.0	260
075-103	10MH	2.3	178
075-203	20MH	4.3	120
075-303	30MH	6.6	97
075-503	50MH	11	73
075-104	100MH	24	50
075-204	200MH	44	35
075-304	300MH	67	28
075-504	500MH	110	21

To order: Prefix part # with style, Example: HCL-090-503

AUTOMATIC COIL DIVISION OF DESIGNATRONICS

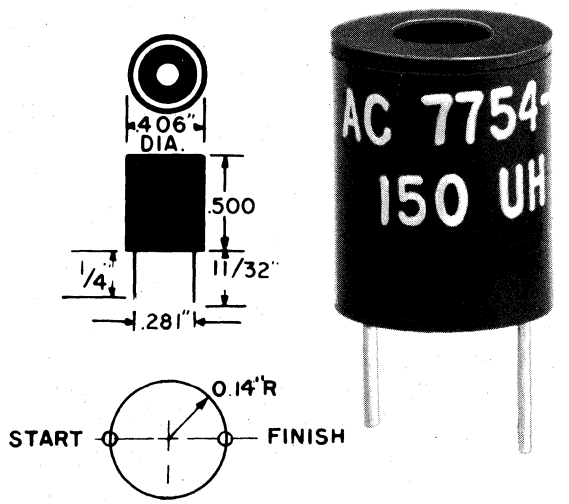
76 E. Second Street, Mineola, New York 11501/Telephone (516) 741-7070/TWX 510-222-5889

MINIATURE VARIABLE INDUCTORS

Available in inductance ranges from 0.1 to 4700 uH
Designed to meet MIL-C-15305C

Designed for printed circuit application, this Automatic Coil series offers high reliability and exceptional stability over extreme temperature variations. For high reliability, inductors are fully epoxy-encapsulated. They are shock-proof and moisture-proof.

Ideal for printed circuit application, these high-Q units measure 13/32" in diameter by 1/2" high. Two mounting terminals are spaced 9/32" on center for vertical mount. The tuning access is from either end.



ELECTRICAL CHARACTERISTICS

Inductance Range: 0.33 to 4700μH Tunable Range ±20%
0.15 to 0.22μH Tunable Range ±15%
0.1μH Tunable Range ±10%
All measurements at 25°C on Q-Meter using miniature alligator clips mounted ¼" from body.

Self-Resonant Frequency: Minimum f_o to be not less than 80% of published data as measured with Grid-Dip Meter

DENSITY CHARACTERISTICS

Volume: 0.063 cubic inches

Weight: 2.6 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Torque: 0.75 to 5.0 inch-ounces

Operating Temperature: −55°C to +125°C

Terminal Strength: Meets five pound pull tests.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305C, Grade 1, Class B. Vibration: Low frequency 10 Hz to 55 Hz at .06" total excursion at rate of 1 linear sweep per minute for 2 hours repeated for each of 3 mutually perpendicular planes. Shock: 50G, 11ms.

Marking: Manufacturer data printed.

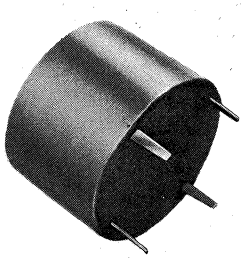
Part No.	L nom uH	Q at L nom Hz	Q at L nom MHz	Approx. Fo. L nom MHz	Max DCR at 25° C
AC 7754-D10	0.10	85	25.	500.	0.02
AC 7754-D15	0.15	100	25.	500.	0.035
AC 7754-D22	0.22	100	25.	500.	0.04
AC 7754-D33	0.33	100	25.	334.	0.04
AC 7754-D47	0.47	100	25.	285.	0.05
AC 7754-D68	0.68	100	25.	237.	0.07
AC 7754-1	1.	90	25.	205.	0.13
AC 7754-1.5	1.5	70	7.9	168.	0.24
AC 7754-2.2	2.2	73	7.9	135.	0.3
AC 7754-3.3	3.3	80	7.9	112.	0.45
AC 7754-4.7	4.7	75	7.9	100.	0.8
AC 7754-6.8	6.8	80	7.9	80.	1.1
AC 7754-10	10.	82	7.9	67.	1.9
AC 7754-15	15.	65	2.5	54.2	3.2
AC 7754-22	22.	55	2.5	17.5	3.4
AC 7754-33	33.	54	2.5	15.	3.6
AC 7754-47	47.	51	2.5	13.2	4.5
AC 7754-68	68.	55	2.5	12.0	5.5
AC 7754-100	100.	50	2.5	10.5	6.7
AC 7754-150	150.	50	2.5	10.5	6.7
AC 7754-220	220.	50	.79	3.0	11.
AC 7754-330	330.	48	.70	2.24	16.
AC 7754-470	470.	45	.79	1.9	18.
AC 7754-680	680.	42	.79	1.9	21.
AC 7754-1000	1000.	40	.79	1.4	38.
AC 7754-1500	1500.	40	.25	1.14	54.
AC 7754-2200	2200.	44	.25	0.96	66.
AC 7754-3300	3300.	46	.25	0.86	85.
AC 7754-4700	4700.	48	.25	0.76	99.

MPC SERIES COLOR-CODED TOROIDS

Molded printed circuit toroids available in ten coded E.I.A. colors. Designed to speed production of printed circuit assemblies, the color coding can be used to indicate the correct value toroid to use and where to position it on the PC board.

Inductance values range from 100 microhenries to 500 millihenries. The toroid can be furnished tapped or with a secondary winding to satisfy requirements.

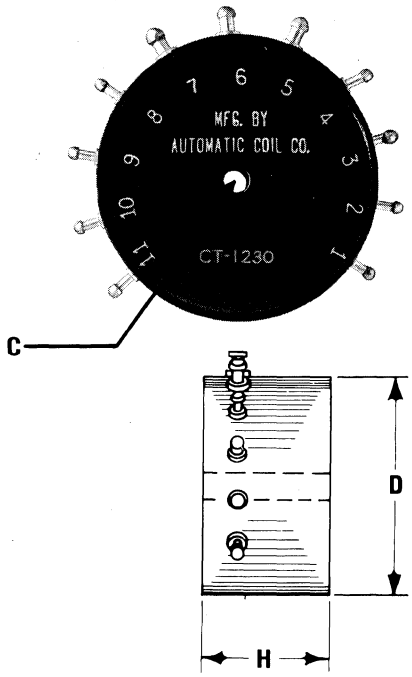
Dimensions are: O.D. 27/32"; height: 5/8" max.; pins: 1/8" long +1/16"−0.



AUTOMATIC COIL DIVISION OF DESIGNATRONICS

76 E. Second Street. Mineola, New York 11501/Telephone (516) 741-7070/TWX 510-222-5889

TOROIDS



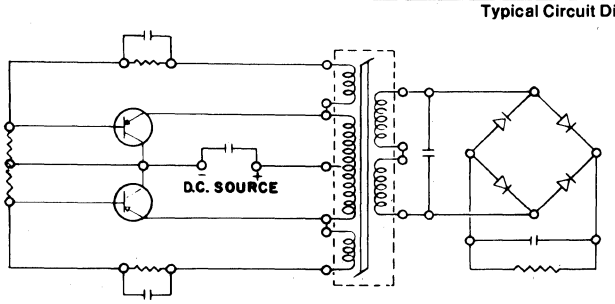
HIGH TEMPERATURE PLASTIC-CASED CONVERTER

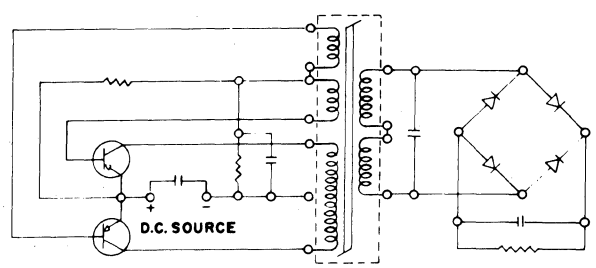
Toroids designed to exceed MIL-T-27A grade 5 class R requirements with added life expectancy thru increased efficiency and reliability.

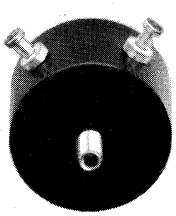
Normal operation frequency between 1500 and 5000 Hz. Special designs obtain operating frequency to 10,000 Hz.

Part No.	DC Input Volts	DC Output Volts Bridge/FW C.T.	DC Output Current (MA)	Dimension D	Dimension H	Mtg. Hole "C"
CT-630	6.3	300/150	100	2	1	#8
CT-632	6.3	325/162.5	150	2	1	#8
CT-637	6.3	375/187.5	200	2 3/4	1 3/8	#8
CT-645	6.3	450/225	150	2 3/4	1 3/8	#8
CT-1225	12.6	250/125	100	1 3/4	7/8	#6
CT-1230	12.6	300/150	200	2	1	#8
CT-1232	12.6	325/162.5	150	2	1	#8
CT-1237	12.6	375/187.5	200	2	1	#8
CT-1245	12.6	450/225	150	2	1	#8
CT-1250	12.6	500/250	250	2 3/4	1 3/8	#8
CT-1260	12.6	600/300	200	2 3/4	1 3/8	#8
CT-2825	28	250/125	80	1 1/2	3/4	#4
CT-2830	28	300/150	100	2	1	#8
CT-2832	28	325/162.5	200	2	1	#8
CT-2837	28	375/187.5	200	2	1	#8
CT-2845	28	450/225	200	2	1	#8
CT-2850	28	500/250	250	2 3/4	1 3/8	#8
CT-2860	28	600/300	200	2 3/4	1 3/8	#8

Typical Circuit Diagrams for CT Toroids







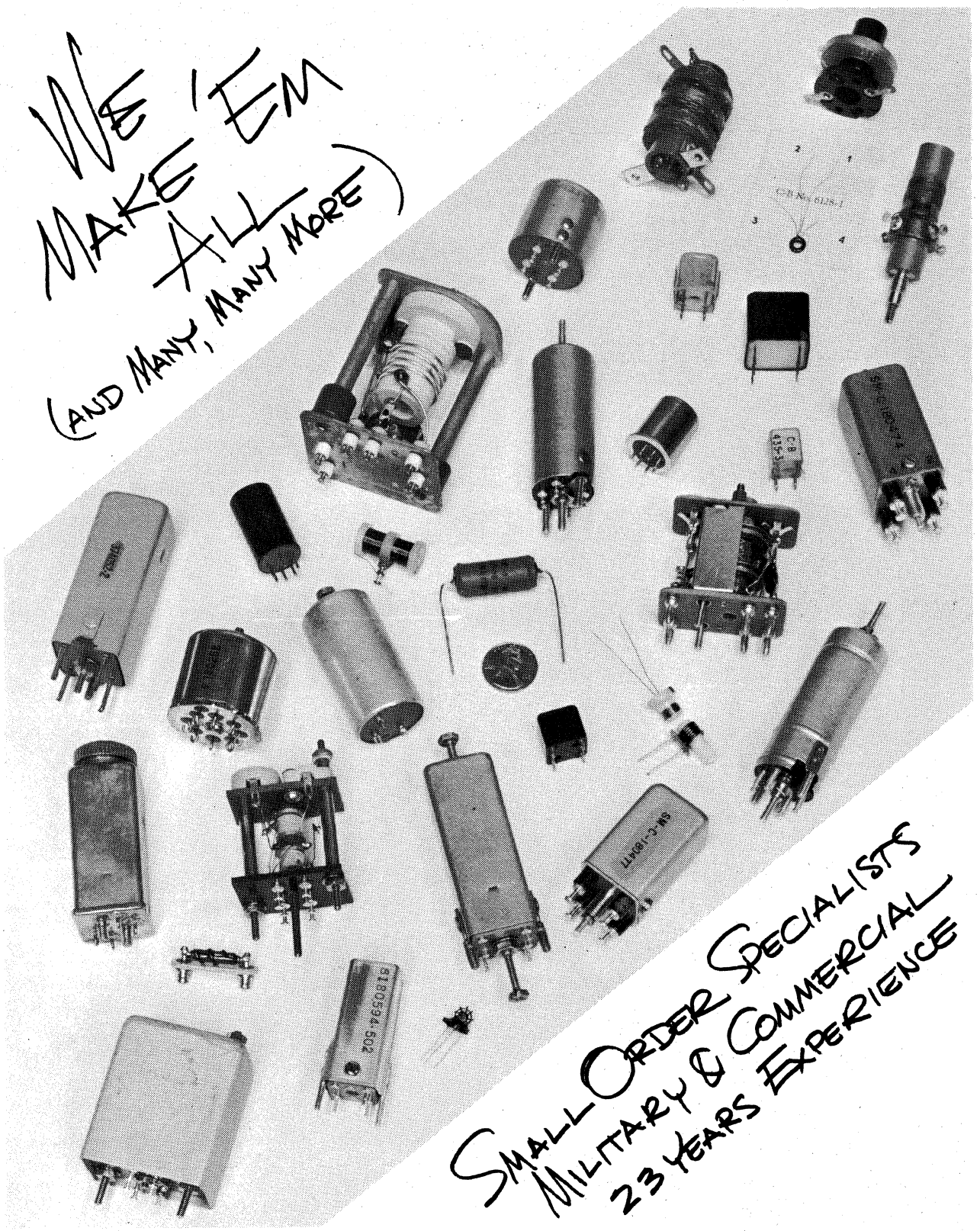
HF SERIES HIGH FREQUENCY MINIATURE TOROIDS

The HF5 high frequency toroids are precision wound to specific inductance and held to ±0.5% at 1000 Hz.

Improved stability results from the unique method of enclosing the wound toroid in a teflon jacket which is then encased in a semi-rigid epoxy coating prior to rigid encapsulation. The dual method of encapsulation results in uniform properties from toroid to toroid and from year to year.

Case size 5/8" O.D. x 1/2" high. Center stud 4-40 x 5/16" long. Turret type 7/32" long terminals spaced 90°.

Model	Inductance Value ±0.5% F = 1000 Hertz	Apparent Luft at RF	C Typical
HF-5-25	25 μH	25.5 at 2.5 MHz	3 pF
HF5-50	50 μH	52.0 at 2.5 MHz	3 pF
HF5-75	75 μH	77.5 at 2.5 MHz	3 pF
HF5-100	100 μH	106 at 790 KHz	4.5 pF
HF5-125	125 μH	130 at 790 KHz	8.5 pF
HF5-150	150 μH	157 at 790 KHz	10 pF
HF5-200	200 μH	212 at 790 KHz	10 pF
HF5-250	250 μH	270 at 790 KHz	15 pF



CADDELL-BURNS

40 East 2nd Street Mineola, N. Y. 11501— Area Code 516 Pioneer 6-2310

CADDELL-BURNS

40 East 2nd Street Mineola, N. Y. 11501— Area Code 516 Pioneer 6-2310

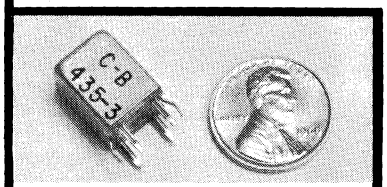
TYPE - CB100

Standard Single Pi Chokes - 5% Tolerance
Phenolic Form .156"D x ½"L. Wire Size 3/41

Stock No.	Inductance Microhenries	Q	Self Res. MHz	D.C. Res.
CB 101	10	50	22	1.6
CB 102	15	48	21	1.9
CB 103	20	46	19	2.1
CB 104	25	45	16	2.3
CB 105	30	45	15	2.5
CB 106	35	45	14	2.7
CB 107	40	42	13	2.9
CB 108	45	40	12.5	3.1
CB 109	50	40	12	3.3
CB 110	60	35	11.5	3.7
CB 111	70	35	11	4.0
CB 112	75	35	10	4.1
CB 113	80	35	9.5	4.2
CB 114	90	37	9.5	4.7
CB 115	100	37	9	4.9
CB 116	125	57	8.5	5.7
CB 117	150	60	7.5	6.3
CB 118	200	60	6.5	7.7
CB 119	225	60	6	8.1
CB 120	250	55	6	8.5
CB 121	300	52	5.5	9.5
CB 122	325	52	5.5	10.1
CB 123	350	50	5	10.4
CB 124	375	50	5	10.7
CB 125	400	52	4.5	11.2
CB 126	425	52	4.5	11.5
CB 127	450	55	4.5	11.9
CB 128	475	60	4.5	12.2
CB 129	500	60	4.5	12.9
CB 130	550	57	4	13.4
CB 131	600	57	4	14.0
CB 132	650	57	3.5	14.5
CB 133	700	57	3.5	14.9
CB 134	750	57	3.5	15.3
CB 135	800	57	3.5	16.0
CB 136	850	57	3.5	16.5
CB 137	900	57	3.3	17.0
CB 138	950	57	3.3	17.5
CB-139	1000	60	2.7	21.0
CB 140	1200	60	2.7	22.0
CB 141	1300	65	2.7	23.0
CB 142	1400	65	2.4	24.0
CB 143	1500	65	2.4	24.5
CB 144	1800	70	2.1	27.2
CB 145	2000	70	2.0	28.7
CB 146	2200	75	—	30.5
CB 147	2400	75	—	32.0
CB 148	2500	75	—	32.8

HIGH - Q MINIATURE FERRITE CHOKES, 10% Tol.

HIGH INDUCTANCE AND LOW D.C. RESISTANCE IN A MAGNETICALLY SHIELDED PACKAGE ESPECIALLY SUITED FOR LOW FREQUENCY FILTER APPLICATIONS AND TRANSISTORIZED CIRCUITS.



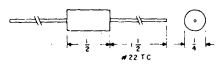


TYPE - 435

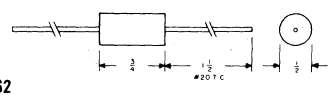
Subminiature Variable Coil
Printed Circuit—Nylon Form
Brass Tinned Shield .420 sq. x .575 h.

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q"	Wire Size AWG
435-1	0.25	0.5	90	60	26
435-2	0.48	1.0	85	60	30
435-3	0.9	2.1	85	60	32
435-4	1.7	3.9	55	65	36
435-5	3.5	8.5	60	50	38
435-6	7.5	17.0	60	50	38
435-7	16.5	35.0	55	60	7/44
435-8	33.0	70.0	50	50	7/44

TYPE 1670

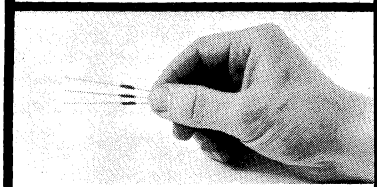


Stock No.	Inductance Milli-henries	Min. Q	A.C. Test Volts	Max. D.C. Res. Ohms	Current Rating MA	Wire Size AWG
1670-1	.25	3.0	.007	.22	800	28
1670-2	.50	3.0	.014	.40	500	30
1670-3	1.0	3.0	.028	.75	315	32
1670-4	2.5	3.5	.07	2.2	250	33
1670-5	5.0	3.5	.14	3.9	200	34
1670-6	10.0	3.5	.15	7.0	125	36
1670-7	25.0	3.5	.30	18	125	36
1670-8	50.0	4.0	.40	35	75	38
1670-9	100.0	4.0	.24	60	50	40



TYPE 1662

1662-1	5.0	10.0	.14	.75	800	28
1662-2	10.0	10.0	.16	2.2	500	30
1662-3	25.0	10.0	.32	4.0	315	32
1662-4	50.0	10.0	.42	9.5	200	34
1662-5	100.0	10.0	.24	26	125	36
1662-6	250.0	10.0	.40	50	75	38
1662-7	500.0	10.0	.46	150	50	40
1662-8	1000.0	10.0	.25	220	30	42



TYPE - 620

Microminiature Ferrite Chokes—10% Tol.

Form Size .075" D x 1/32" D. L.

Stock No.	Inductance Microhenries	Q	Self Res. MHz	D.C. Res.	Wire Size AWG
620-1	1	40	235	.12	36
620-2	2.5	40	150	.19	36
620-3	5	40	100	.26	36
620-4	7.5	40	90	.33	36
620-5	10	45	75	.38	36
620-6	15	60	60	.66	38
620-7	20	55	53	.80	38
620-8	25	50	49	.93	38
620-9	50	90	34	2.85	42
620-10	75	90	28	5.80	44
620-11	100	90	23	7.50	44

TYPE - 20

Epoxy Dip Choke — 5% Tol.
Powdered Iron Form Size .125"D. x 5/16"L.



Stock No.	Inductance Microhenries	Min. Q	Max. DC Ohms	Self Res. MHz	Wire Size
20-1	1.0	75	.06	142	30
20-2	1.5	75	.08	125	30
20-3	2.2	75	.13	102	32
20-4	3.3	85	.25	86	34
20-5	4.7	75	.50	70	36
20-6	5.6	80	.53	66	36
20-7	6.8	65	.52	57	36
20-8	10.0	65	0.7	50	36
20-9	15.0	80	1.3	38	38
20-10	10	105	0.7	24	7/44
20-11	15	110	0.8	19	7/44
20-12	22	110	1.1	15	7/44
20-13	33	105	1.3	12	7/44
20-14	47	95	1.7	11	7/44
20-15	56	90	1.8	10	7/44
20-16	68	85	2.0	9	7/44
20-17	82	80	2.2	8	7/44
20-18	100	105	2.4	7	7/44
20-19	150	105	3.3	6	7/44

COIL FORMS

Ceramic, Phenolic, Printed Circuit, Shielded Molded Choke Forms

COIL PARTS

Tubing
Cores; powdered iron, brass, ferrite
Ferrite Threaded Cores
Coil Tube Bushing and Mounting Clips
Terminal Boards, Coil Shields, Spade Bolts
Terminal Rings, Terminals, Collars
Coil Wire, Varnish, Cement, Wax, Tuning Tools

TYPE - 660

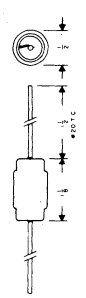
Miniature Choke, Single Layer—10% Tol.

Phenolic Form .095" D. x 5/16" L.

Stock No.	Inductance Microhenries	Q	Self Res. MHz	DC Res. Ohms	Wire Size AWG
660-1	0.1	65	....	.03	26
660-2	0.2	60	....	.03	28
660-3	0.3	55	....	.06	30
660-4	0.4	55	>400	.06	30
660-5	0.5	55	360	.13	32
660-6	0.75	50	300	.22	34
660-7	1.0	30	260	.37	36
660-8	1.5	30	210	.72	38
660-9	2.0	30	180	.95	38

TYPE 6150

HI CURRENT CHOKES — 10% Tolerance
VINYL INSULATED JACKET
Ferrite Form Size 3/8" D x 1" L



Stock No.	Inductance Micro-henries	Max. D.C. Res. Ohms	Current Rating Amps.	Min. Q	Wire Size AWG
6150-1	10.0	0.020	10.0	32	18
6150-2	20.0	0.035	6.0	25	20
6150-3	30.0	0.060	4.0	28	22
6150-4	40.0	0.105	2.5	30	24
6150-5	50.0	0.110	2.5	20	24
6150-6	75.0	0.180	1.5	25	26
6150-7	100.0	0.360	1.0	30	28

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TV CAMERA DEFLECTION COMPONENTS

Cletron Part Number	Description See Note ① & ②	Horizontal Coils ⑥ Ind (Mh)	Res (Ohm)	Ip (Ma)	Vertical Coils ⑥ Ind (Mh)	Res (Ohms)	Ip (Ma)	Focus Coils Res (Ohms)	Iave (Ma)	Gauss	Align. Coils ⑦ Res (Ohm)	Ip (Ma)
VY-127	1"V Yoke	.8	3.5	200	40.0	165	25	–	–	–		
VYL-160	1"Vid. Yoke Long	1.0	3.75	170	50.0	200	15	–	–	–	–	–
VF-115-7	1"V Focus Coil	–	–	–	–	–	–	385	40	40	–	–
VF-115-4AL	1"V. Focus Coil Long.	–	–	–	–	–	–	385	40	40	–	–
VA-132	1"V. Alignment Coil	–	–	–	–	–	–	–	–	–	140	40
VYLFA-231-1	1"VA Long Coil	.9	2.58	190	61.0	200	15	670	40	40	440	25
VYLFA-823	1"VA Long Coil	.9	2.5	190	50.0	145	19	100	80	40	440	25
VYLFAM-629	1"VA Long Coil - PM	.9	2.5	190	61.0	200	15	88	78	40	PM ③	
VYLFA-848	1"VA Long Coil - Rear Load	.9	2.58	190	61.0	200	15	440	35	40	2400	14 T.C. ④
VYLFA-643	1"VA Long Coil - Skewable	1.2	3.6	170	61.0	200	15	690	40	40	440	30
VF-558-1	1"SV Focus Coil	–	–	–	–	–	–	385	40	40	–	–
SVDA-761	1"SYA	1.2	3.75	170	61.0	200	15	385	40	40	140	40
HVYAA-750-1	1"HVA with Centering Coils	1.0	3.5	100	50.0	160	10	–	–	–	130	40 C.C. ⑤
VYLFA-722-PC	1"VA Printed Circuit Yoke	0.3	12.0	250	0.3	12.0	200	110	100	40	130	40
PYLFA-708	1.2"PA Color	0.94	3.4	170	15.0	49	30	150	100	40	2300	12 T.C. ④
PYLFA-846	1.2"PA	0.925	2.6	170	61.0	170	15	340	60	40	140	50
PYLFAM-805	1.2"PA	0.925	2.6	170	61.0	170	15	440	54	40	PM ③	
15VY-208	1.5"V Yoke	1.0	3.3	300	50.0	190	30	–	–	–	–	–
15VY-258	1.5"V Yoke	3.0	11.2	170	30.0	95	40	–	–	–	–	–
15VFA-295	1.5"VA Focus - Alignment	–	–	–	–	–	–	700	46	46	160	70
15VFA-599	1.5"SVA Focus - Align.	–	–	–	–	–	–	55	200	46	160	70
OV-1	3"O Yoke	1.4	5.25	–	28.5	37.3	–	–	–	–	–	–
OF-2	3"O Focus Coil	–	–	–	–	–	–	1850	75	75	–	–
OA-3	3"O Alignment Coil	–	–	–	–	–	–	–	–	–	75.5	80

NOTE

① V = Vidicon
SV = S.E.C. Vidicon
HV = Hybrid Vidicon
P = Lead Oxide
O = Image Orthicon

② Any of above followed by A = Assembly (Yoke, Focus and Alignment Coils) or (Focus - Alignment Coils)

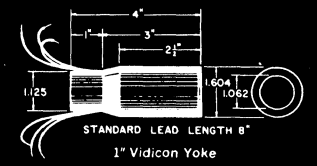
③ PM = Permanent Magnet Alignment.

④ T.C. = Temperature Compensated Alignment Coils

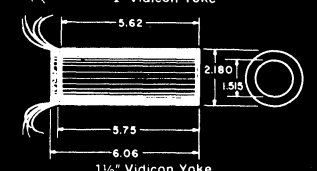
⑤ C.C. = Also has Centering Coil same as Alignment Coils

⑥ Yoke Coil readings are per pair wired in series

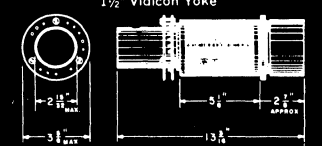
⑦ Alignment Coil readings are per pair wired in series providing a 4 gauss field



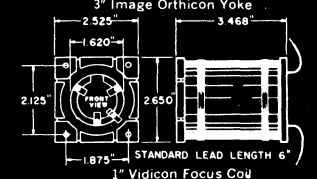
1" Vidicon Yoke



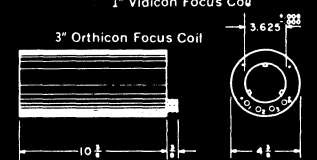
1½" Vidicon Yoke



3" Image Orthicon Yoke

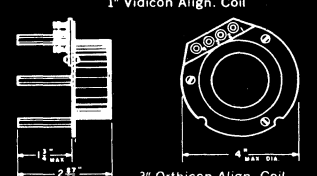


1" Vidicon Focus Coil

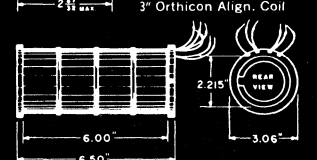




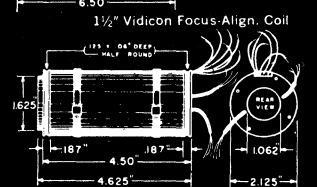
1" Vidicon Align. Coil



3" Orthicon Align. Coil



1½" Vidicon Focus-Align. Coil



1" Vidicon Deflection Ass'y (Yoke, Focus & Align. Coil)

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COLLINS TOROIDS

Collins' many core types and case configurations offer the designer a wide choice of characteristics for his specific application. The standard types are listed below.

Types MP and MPF

These toroids are built and tested to the requirements of MIL-T-27B, Grade 5, Class R, Life Expectancy X. Parts are transfer molded in high temperature thermo-setting resin. Available with internal screw threads (specify B) or with a clearance type mounting hole (specify A).

Type PCT

These toroids are built and tested to the requirements of MIL-T-27B, Grade 5, Class S, Life Expectancy X. The units are transfer molded of hi-temp epoxy. The leads are spaced to match 0.1 inch circuit board grids.

Types HS, HSA, HSD

These hermetically-sealed toroids are built and tested to the requirements of MIL-T-27B, Grade 4, Class R, Life Expectancy X. The metal case provides excellent magnetic and electrostatic shielding and extremely long-term stability.

Types MIC and MIH

The MIC micro inductor is built and tested in accordance with MIL-T-27B, Grade 4, Class R, Life Expectancy X. The MIH, designed for higher frequency applications, is built and tested in accordance with MIL-C-15305, Type LT7J. Both are hermetically sealed in nickel steel TO-5 type cases for improved magnetic and electrostatic shielding.

Type MIC Micro Inductors

Standard inductance values are available in 20% increments from 1 MH to 500 MH for frequencies up to 200 kHz. MIC case (TO-5) type (see left). Combines high Q (more than 30 at 20 kHz; 120 at 200 kHz) with small size for nearly any use. Dielectric strength, 100 V rms. Insulation resistance 10,000 megs min. at 100 VDC. Temp. range, −55°C to +85°C ambient, with inductance change ±2% over −20°C to +85°C range. Inductance tolerance: ±5%.

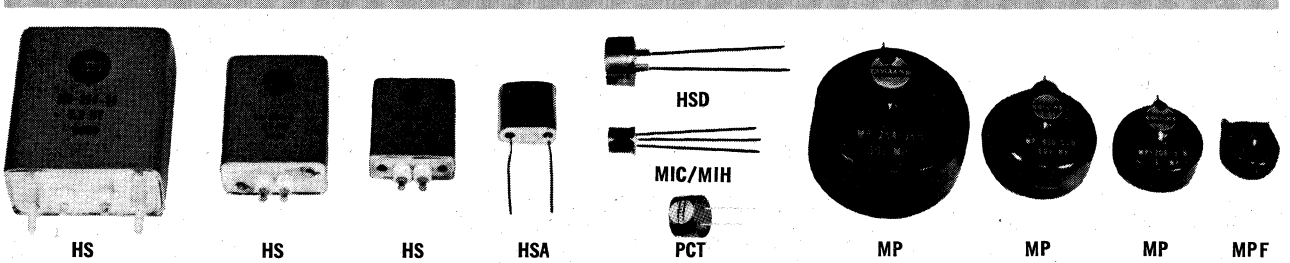
Collins Number	Induct. at 1 V rms		R_{dc}, Ohms*
MIC-1	1	mH	2.8
MIC-2	1.2	mH	3.0
MIC-3	1.5	mH	4.0
MIC-4	1.75	mH	4.4
MIC-5	2.0	mH	4.8
MIC-6	2.4	mH	6.6
MIC-7	3.0	mH	7.4
MIC-8	3.6	mH	8.2
MIC-9	4.3	mH	11.4
MIC-10	5.0	mH	12.3
MIC-11	6.0	mH	16.7
MIC-12	7.2	mH	18.2
MIC-13	8.6	mH	20.0
MIC-14	10	mH	27.0
MIC-15	12	mH	29.0
MIC-16	15	mH	32.6
MIC-17	17.5	mH	46.0
MIC-18	20	mH	50.0
MIC-19	24	mH	54
MIC-20	30	mH	72
MIC-21	36	mH	80
MIC-22	43	mH	110
MIC-23	50	mH	120
MIC-24	60	mH	130
MIC-25	72	mH	144
MIC-26	86	mH	195
MIC-27	100	mH	210
MIC-28	120	mH	230
MIC-29	150	mH	257
MIC-30	175	mH	280
MIC-31	200	mH	380
MIC-32	240	mH	410
MIC-33	300	mH	584
MIC-34	360	mH	800
MIC-35	430	mH	875
MIC-36	500	mH	940

*±20% tol. †±5% tol.

Type MIH Micro Inductors

Standard inductance values available in 20% increments from 1 UH to 1 MH for frequencies to 10 MHz. MIH case (TO-5) type (see left). Ambient temperature range −55°C to +85°C. Temperature stability of inductance is within ±2% from −20°C to +85°C.

Collins Number	Inductance Value	Tol. (±%)	R_{dc} (±20%)	I_{MAX} MA
MIH-1	1. uH	20	<.1	640
MIH-2	1.5 uH	20	<.1	640
MIH-3	2.2 uH	20	<.15	640
MIH-4	3.3 uH	20	<.35	320
MIH-5	4.7 uH	20	1.1	320
MIH-6	6.8 uH	20	1.3	200
MIH-7	10 uH	10	1.5	156
MIH-8	12 uH	10	1.6	125
MIH-9	15 uH	10	1.8	100
MIH-10	18 uH	10	1.9	100
MIH-11	22 uH	10	2.0	100
MIH-12	27 uH	10	2.1	100
MIH-13	33 uH	10	2.2	100
MIH-14	39 uH	5	2.9	80
MIH-15	47 uH	5	3.1	80
MIH-16	56 uH	5	3.3	80
MIH-17	68 uH	5	3.7	80
MIH-18	82 uH	5	5.0	61
MIH-19	.1 mH	5	5.5	61
MIH-20	.11 mH	5	5.8	61
MIH-21	.12 mH	5	6.0	61
MIH-22	.13 mH	5	6.2	61
MIH-23	.15 mH	3	6.6	61
MIH-24	.16 mH	3	8.6	48
MIH-25	.18 mH	3	9.2	48
MIH-26	.2 mH	3	9.7	48
MIH-27	.22 mH	3	10.3	48
MIH-28	.24 mH	3	10.8	48
MIH-29	.27 mH	3	11.7	48
MIH-30	.3 mH	3	14.2	39
MIH-31	.33 mH	3	15.2	39
MIH-32	.36 mH	3	16.1	39
MIH-33	.39 mH	3	16.5	39
MIH-34	.43 mH	3	17.8	39
MIH-35	.47 mH	3	23.0	31
MIH-36	.51 mH	3	23.9	31
MIH-37	.56 mH	3	24.8	31
MIH-38	.62 mH	3	26.4	31
MIH-39	.68 mH	3	27.9	31
MIH-40	.75 mH	3	29.3	31
MIH-41	.82 mH	3	39.0	24
MIH-42	.91 mH	3	41.0	24
MIH-43	1. mH	3	43.5	24



For further information, write or call your nearest Collins Distributor, or Components Marketing, Collins Radio Company, Newport Beach, California 92663. Telephone (714) 833-0600.

COLLINS

Type 050 Toroids

Normally used for frequencies up to 30 kHz. Available as MPF, PCT, HSD or HSA case types (see left). Temperature range −55°C to +105°C ambient.

Collins Number	Induct. at 1 V rms		R_{dc}, Ohms*
MPF-050-1B	5	mH†	2.3
MPF-050-2B	6	mH†	3.1
MPF-050-3B	7.2	mH†	3.5
MPF-050-4B	8.6	mH	4.2
MPF-050-5B	10	mH	4.9
MPF-050-6B	12	mH	5.4
MPF-050-7B	15	mH	7.3
MPF-050-8B	17.5	mH	8.5
MPF-050-9B	20	mH	11.2
MPF-050-10B	24	mH	13.1
MPF-050-11B	30	mH	14.3
MPF-050-12B	36	mH	18.0
MPF-050-13B	43	mH	22.0
MPF-050-14B	50	mH	25.0
MPF-050-15B	60	mH	33.0
MPF-050-16B	72	mH	35.0
MPF-050-17B	86	mH	39.0
MPF-050-18B	100	mH	49.0
MPF-050-19B	120	mH	59.0
MPF-050-20B	150	mH	78.0
MPF-050-21B	175	mH	85.0
MPF-050-22B	200	mH	115
MPF-050-23B	240	mH	130
MPF-050-24B	300	mH	150
MPF-050-25B	360	mH	190
MPF-050-26B	430	mH	210
MPF-050-27B	500	mH	290
MPF-050-28B	600	mH	320
MPF 050-29B	720	mH	350
MPF-050-30B	860	mH	380
MPF-050-31B	1.0	H	520
MPF-050-32B	1.2	H	580
MPF-050-33B	1.5	H	780
MPF-050-34B	1.75	H	880
MPF-050-35B	2.0	H	1050
MPF-050-36B	2.4	H	1230
MPF-050-37B	3.0	H	1700

Type 051 and 054 Toroids

Physically identical to type 050 but with different permeability core. Available as MPF, PCT, HSD or HSA case types (see left). Type 051 normally used for frequencies up to 100 kHz. Type 054 normally used for frequencies up to 5 MHz.

CORE TYPE 051 (Frequencies to 100 kHz)

Collins Number	Induct. at 1 V rms		R_{dc}, Ohms*
MPF-051-1B	1	mH‡	1.2
MPF-051-2B	1.2	mH†	1.3
MPF-051-3B	1.5	mH†	1.8
MPF-051-4B	1.75	mH†	2.0
MPF-051-5B	2.0	mH†	2.1
MPF-051-6B	2.4	mH†	2.9
MPF-051-7B	3.0	mH†	3.2
MPF-051-8B	3.6	mH†	4.6
MPF-051-9B	4.3	mH	4.8
MPF-051-10B	5.0	mH	5.3
MPF-051-11B	6.0	mH	7.2
MPF-051-12B	7.2	mH	8.1
MPF-051-13B	8.6	mH	8.7
MPF-051-14B	10	mH	12
MPF-051-15B	12	mH	12.5
MPF-051-16B	15	mH	14.0
MPF-051-17B	17.5	mH	19.5
MPF-051-18B	20	mH	22
MPF-051-19B	24	mH	24
MPF-051-20B	30	mH	32
MPF-051-21B	36	mH	34
MPF-051-22B	43	mH	47
MPF-051-23B	50	mH	51
MPF-051-24B	60	mH	73
MPF-051-25B	72	mH	79
MPF-051-26B	86	mH	86
MPF-051-27B	100	mH	115
MPF-051-28B	120	mH	130
MPF-051-29B	150	mH	180
MPF-051-30B	175	mH	190
MPF-051-31B	200	mH	210
MPF-051-32B	240	mH	300
MPF-051-33B	300	mH	330
MPF-051-34B	360	mH	350
MPF-051-35B	430	mH	470
MPF-051-36B	500	mH	510

CORE TYPE 054 (Frequencies to 5 MHz)

MPF-054-1B	0.05	mH‡	0.8
MPF-054-2B	0.06	mH‡	0.9
MPF-054-3B	0.072	mH‡	1.0
MPF-054-4B	0.086	mH‡	1.05
MPF-054-5B	0.1	mH‡	1.1
MPF-054-6B	0.12	mH‡	1.25
MPF-054-7B	0.15	mH‡	1.7
MPF-054-8B	0.175	mH‡	2.0
MPF-054-9B	0.2	mH†	2.2
MPF-054-10B	0.24	mH†	2.4
MPF-054-11B	0.3	mH†	2.7
MPF-054-12B	0.36	mH†	2.9
MPF-054-13B	0.43	mH†	3.2
MPF-054-14B	0.5	mH†	4.4
MPF-054-15B	0.6	mH†	5.0
MPF-054-16B	0.72	mH†	5.4
MPF-054-17B	0.86	mH	7.1
MPF-054-18B	1.0	mH	7.8
MPF-054-19B	1.2	mH	8.2
MPF-054-20B	1.5	mH	11.0
MPF-054-21B	1.75	mH	11.7
MPF-054-22B	2.0	mH	12.8
MPF-054-23B	2.4	mH	14.0
MPF-054-24B	3.0	mH	18.7
MPF-054-25B	3.6	mH	20.6
MPF-054-26B	4.3	mH	22.4
MPF-054-27B	5.0	mH	30.0
MPF-054-28B	6.0	mH	33.6
MPF-054-29B	7.2	mH	37.6
MPF-054-30B	8.6	mH	50.5
MPF-054-31B	10.0	mH	54.5

*±20% tol. †±1.5% tol. ‡±2.5% tol.

Type 206 Toroids

Normally used for frequencies up to 20 kHz. Available as MP or HS case types (see left). Temp. range −55°C to +105°C ambient.

Collins Number	Induct. at 1 V rms		R_{dc}, Ohms*
MP-206-1B	5	mH†	0.92
MP-206-2B	6	mH†	1.3
MP-206-3B	7.2	mH†	1.4
MP-206-4B	8.6	mH†	2.0
MP-206-5B	10	mH†	2.1
MP-206-6B	12.0	mH	2.3
MP-206-7B	15.0	mH	3.3
MP-206-8B	17.5	mH	3.5
MP-206-9B	20	mH	3.7
MP-206-10B	24	mH	5.2
MP-206-11B	30	mH	5.8
MP-206-12B	36	mH	8.0
MP-206-13B	43	mH	9.0
MP-206-14B	50	mH	9.4
MP-206-15B	60	mH	13.0
MP-206-16B	72	mH	14.1
MP-206-17B	86	mH	19.5
MP-206-18B	100	mH	21
MP-206-19B	120	mH	23
MP-206-20B	150	mH	33
MP-206-21B	175	mH	35.2
MP-206-22B	200	mH	46
MP-206-23B	240	mH	51
MP-206-24B	300	mH	57
MP-206-25B	360	mH	80
MP-206-26B	430	mH	86
MP-206-27B	500	mH	90
MP-206-28B	600	mH	128
MP-206-29B	720	mH	142
MP-206-30B	860	mH	195
MP-206-31B	1	H	213
MP-206-32B	1.2	H	292
MP-206-33B	1.5	H	326
MP-206-34B	1.75	H	370
MP-206-35B	2.0	H	475
MP-206-36B	2.4	H	520
MP-206-37B	3.0	H	750

Type 848 Toroids

Physically identical to Type 206 but lower permeability core material. Normally used for frequencies up to 100 kHz. Available as MP or HS case types (see left).

Collins Number	Induct. at 1 V rms		R_{dc}, Ohms*
MP-848-1B	2.0	mH†	0.92
MP-848-2B	2.4	mH†	1.27
MP-848-3B	3.0	mH†	1.39
MP-848-4B	3.6	mH†	1.57
MP-848-5B	4.3	mH†	2.14
MP-848-6B	5.0	mH	2.29
MP-848-7B	6.0	mH	2.52
MP-848-8B	7.2	mH	3.47
MP-848-9B	8.6	mH	3.75
MP-848-10B	10	mH	5.1
MP-848-11B	12	mH	5.6
MP-848-12B	15	mH	6.2
MP-848-13B	17.5	mH	8.6
MP-848-14B	20	mH	9.06
MP-848-15B	24	mH	10.1
MP-848-16B	30	mH	14.0
MP-848-17B	36	mH	15.5
MP-848-18B	43	mH	21.4
MP-848-19B	50	mH	22.9
MP-848-20B	60	mH	25.2
MP-848-21B	72	mH	27.5
MP-848-22B	86	mH	38.7
MP-848-23B	100	mH	51.8
MP-848-24B	120	mH	56.0
MP-848-25B	150	mH	80.0
MP-848-26B	175	mH	86.5
MP-848-27B	200	mH	92.0
MP-848-28B	240	mH	128
MP-848-29B	300	mH	143
MP-848-30B	360	mH	156
MP-848-31B	430	mH	215
MP-848-32B	500	mH	234

*±20% tol. †±1.5% tol.

Type 930 Toroids

Normally used for frequencies up to 15 kHz. Available as MP or HS case types (see left). Temp. range −55°C to +105°C ambient.

Collins Number	Induct. at 1 V rms		R_{dc}, Ohms*
MP-930-1B	5	mH‡	0.6
MP-930-2B	6	mH‡	0.67
MP-930-3B	7.2	mH†	0.88
MP-930-4B	8.6	mH†	1.0
MP-930-5B	10	mH†	1.07
MP-930-6B	12	mH†	1.19
MP-930-7B	15	mH†	1.65
MP-930-8B	17.5	mH†	1.79
MP-930-9B	20	mH†	1.89
MP-930-10B	24	mH	2.62
MP-930-11B	30	mH	2.93
MP-930-12B	36	mH	4.07
MP-930-13B	43	mH	4.38
MP-930-14B	50	mH	6.0
MP-930-15B	60	mH	6.61
MP-930-16B	72	mH	7.2
MP-930-17B	86	mH	9.91
MP-930-18B	100	mH	10.6
MP-930-19B	120	mH	14.66
MP-930-20B	150	mH	16.5
MP-930-21B	175	mH	17.76
MP-930-22B	200	mH	23.9
MP-930-23B	240	mH	26.2
MP-930-24B	300	mH	37
MP-930-25B	360	mH	40.5
MP-930-26B	430	mH	44.2
MP-930-27B	500	mH	60.2
MP-930-28B	600	mH	65.9
MP-930-29B	720	mH	91
MP-930-30B	860	mH	99.7
MP-930-31B	1.0	H	107
MP-930-32B	1.2	H	148
MP-930-33B	1.5	H	185
MP-930-34B	1.75	H	225
MP-930-35B	2.0	H	240
MP-930-36B	2.4	H	260
MP-930-37B	3.0	H	372
MP-930-38B	3.6	H	407
MP-930-39B	4.3	H	562
MP-930-40B	5.0	H	605
MP-930-41B	6.0	H	664
MP-930-42B	7.2	H	916
MP-930-43B	8.6	H	1002
MP-930-44B	10	H	1085
MP-930-45B	12	H	1190
MP-930-46B	15	H	1700
MP-930-47B	17.5	H	1800

*±20% tol. †±1.5% tol. ‡±2.5% tol.

Type 254 Toroids

Normally used for frequencies up to 10 kHz. Available as MP or HS case types (see left). Temp. range −55°C to +105°C.

Collins Number	Induct. at 1 V rms		R_{dc}, Ohms*
MP-254-1B	20	mH‡	1.01
MP-254-2B	24	mH‡	1.3
MP-254-3B	30	mH†	1.5
MP-254-4B	36	mH†	1.7
MP-254-5B	43	mH†	2.3
MP-254-6B	50	mH†	2.5
MP-254-7B	60	mH†	3.2
MP-254-8B	72	mH†	3.5
MP-254-9B	86	mH†	4.0
MP-254-10B	100	mH†	5.5
MP-254-11B	120	mH	6.1
MP-254-12B	150	mH	6.8
MP-254-13B	175	mH	9.5
MP-254-14B	200	mH	9.9
MP-254-15B	240	mH	10.2
MP-254-16B	300	mH	15.0
MP-254-17B	360	mH	16.7
MP-254-18B	430	mH	23.0
MP-254-19B	500	mH	25.0
MP-254-20B	600	mH	34.0
MP-254-21B	720	mH	38.0
MP-254-22B	860	mH	41.0
MP-254-23B	1.0	H	56.0
MP-254-24B	1.2	H	61.0
MP-254-25B	1.5	H	86.0
MP-254-26B	1.75	H	94.0
MP-254-27B	2.0	H	100
MP-254-28B	2.4	H	135
MP-254-29B	3.0	H	155
MP-254-30B	3.6	H	170
MP-254-31B	4.3	H	235
MP-254-32B	5.0	H	250
MP-254-33B	6.0	H	340
MP-254-34B	7.2	H	380
MP-254-35B	8.6	H	410
MP-254-36B	10	H	560
MP-254-37B	12	H	620
MP-254-38B	15	H	860
MP-254-39B	17.5	H	940
MP-254-40B	20	H	1000
MP-254-41B	24	H	1380
MP-254-42B	30	H	1550
MP-254-43B	36	H	2150

*±20% tol. †±1.5% tol. ‡±2.5% tol.

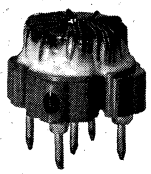
DALE® SIOUX DIVISION

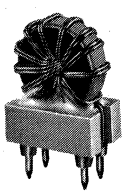
INDUCTIVE COMPONENTS

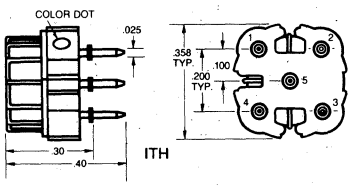
TYPES ITH/ITV Toroidal RF Coils and Transformers

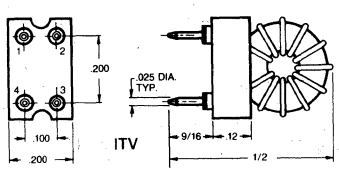
FEATURES

- Gold - plated terminals
- PC mounting
- Rugged
- High Q
- Precision built
- MIL-C-15305, Grade 2, Class 0







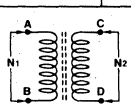


ITH 1041 SERIES
RF INDUCTOR



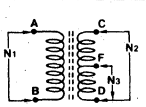
TEST FREQ. MHz	L (μH)	TOL. %	Q (Min.)	MODEL NO.
25	.775	±10	85	ITH-1041-1

ITH 1042 SERIES
RF TRANSFORMER (UNTAPPED)



TEST FREQ. MHz	L (μH)	Q (Min.)	TURNS RATIO N2:N1	TURNS RATIO N3:N2	TERMINAL CONNECT A	B	C	D	F	MODEL NO.
50	.465	100	1.00	—	1	4	2	3	—	ITH-1042-5
25	2.38	66	.50	—	4	1	3	2	—	ITH-1042-6

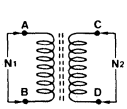
ITH 1042 SERIES
RF TRANSFORMER (TAPPED)



TEST FREQ. MHz	L (μH)	Q (Min.)	TURNS RATIO N2:N1	TURNS RATIO N3:N2	TERMINAL CONNECT A	B	C	D	F	MODEL NO.
25	.600	86	2.0	.50	2	3	1	4	5	ITH-1042-2
25	.950	36	.666	.50	2	3	1	4	5	ITH-1042-4
30	1.22	15	1.45	.50	3	2	4	1	5	ITH-1042-1
25	.600	100	.46	.50	4	3	2	1	5	ITH-1042-3

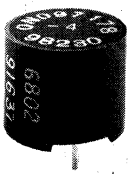
ITV 1000 SERIES

ITV 1042 SERIES
RF TRANSFORMER



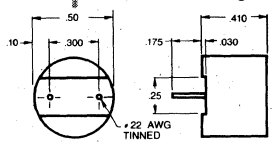
TEST FREQ. MHz	L (μH)	Q (Min.)	TURNS RATIO N2:N1	TERMINAL CONNECT A	B	C	D	MODEL NO.
50	.52	85	1	1	2	3	4	ITV-1042-1

TYPE ITP Toroidal Filter Inductor Encapsulated



FEATURES

- Meet MIL-T-27, Grades 2 & 5, Classes Q, R, S, V.
- PC mounting
- High Q
- Moisture relief pads
- Compact
- Exceptional magnetic stability

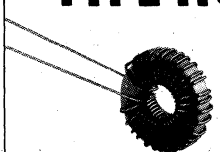


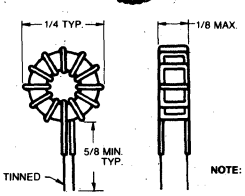
ITP 1021 SERIES
TOROIDAL FILTER INDUCTORS



TEST FREQ. kHz	L(μH) ±10%	TEST CURRENT DC AMPERES	DCR (Max.) (OHMS)	MODEL NO.
10	13	1.50	.02	ITP-1021-0
10	24	2.20	.05	ITP-1021-5
10	40	1.00	.05	ITP-1021-6
10	100	.245	.12	ITP-1021-2
10	150	.290	.18	ITP-1021-3
10	150	.085	.17	ITP-1021-4
10	200	.320	.25	ITP-1021-1

TYPE ITU Toroidal RF Coils and Transformers



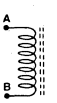


FEATURES

- Very compact
- High Q
- Tunable (Uncoated)
- Wide frequency range
- For printed or wired circuits
- Low cost

NOTE: TERMINAL CONFIGURATION CAN BE SUPPLIED TO YOUR SPECIFICATION.

ITU 1041 SERIES
RF INDUCTORS TOROIDAL

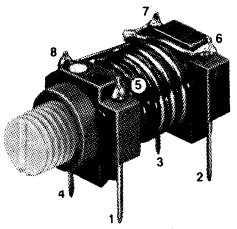


TEST FREQ. MHz	L (μH)	Q (Min.)	MODEL NO.
250	.050	85	ITU-1041-8
100	.053	95	ITU-1041-9
100	.08	105	ITU-1041-10
180	.10	75	ITU-1041-6
100	.14	85	ITU-1041-2
50	.22	85	ITU-1041-7
100	.32	40	ITU-1041-3
25	.44	120	ITU-1041-4
25	.54	125	ITU-1041-5
10	1.25	95	ITU-1041-1
40	1.8	75	ITU-1041-11

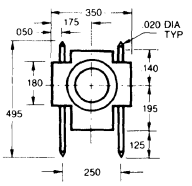
DALE® SIOUX DIVISION

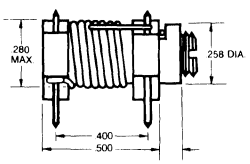
INDUCTIVE COMPONENTS

TYPE IDH RF Inductor/Transformer Unshielded/Tunable



FEATURES
- High Q
- Compact
- Positive tuning. High resolution
- Gold-plated terminals
- PC mounting
- Molded coil form
- Meets MIL-C-15305



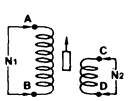


IDH 1041 SERIES
RF INDUCTORS



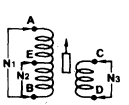
TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
53	.142	5	160	NA	1	2	–	–	–	–	IDH-1041-1
25	.15	5	50	NA	8	7	–	–	–	–	IDH-1041-4
25	.39	5	50	NA	8	7	–	–	–	–	IDH-1041-5
53	.398	5	153	NA	1	2	–	–	–	–	IDH-1041-2
25	.47	5	50	NA	8	7	–	–	–	–	IDH-1041-6
25	1.0	5	50	NA	8	7	–	–	–	–	IDH-1041-7
7.9	2.2	7.5	40	NA	8	7	–	–	–	–	IDH-1041-8
2.5	39	10	45	NA	8	7	–	–	–	–	IDH-1041-9
2.5	82	10	40	NA	8	7	–	–	–	–	IDH-1041-10

IDH 1042 SERIES
RF TRANSFORMERS
(UNTAPPED)



TEST FREQ. MHz	L pri. (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
53	.192	5	138	.381	–	–	4	3	1	2	–	–	IDH-1042-1
45	1.43	5	122	.083	–	–	4	3	1	2	–	–	IDH-1042-3

IDH 1042 SERIES
RF TRANSFORMERS
(1 TAP)



TEST FREQ. MHz	L pri. (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
75	.117	5	117	.071	1.00	–	4	2	1	4	3	–	IDH-1042-4
75	.122	5	126	.88	1.00	–	2	4	1	4	3	–	IDH-1042-5
65	.135	5	164	.06	.235	–	3	1	2	1	4	–	IDH-1042-8
40	.345	5	111	.69	.345	–	2	5	4	5	3	–	IDH-1042-7
53	.388	5	144	.5	.243	–	4	3	1	2	5	–	IDH-1042-2

NOTES: 1. **L** = Effective inductance as measured on a "Q" meter.

2. **ΔL** = Tuning range above and below nominal "L" value, expressed in % of nominal value. Percentage shown is the minimum amount of ΔL available for the respective model number.

3. **Turns Ratio** = The actual ratio of the turns as wound on the coil. In calculating impedance ratios, allow for about 90% coupling in the coil.

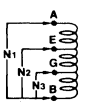
IPB 1000 SERIES CONTINUED ON NEXT PAGE

IDH 1043 SERIES
RF AUTO TRANSFORMERS
(1 TAP)



TEST FREQ. MHz	L pri. (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	G	MODEL NO.
53	.161	5	144	.685	–	–	4	2	–	–	1	–	IDH-1043-2
53	.164	5	162	.558	–	–	5	2	–	–	8	–	IDH-1043-16
53	.164	5	152	.526	–	–	4	3	–	–	1	–	IDH-1043-1
53	.287	5	175	.440	–	–	1	2	–	–	4	–	IDH-1043-17
40	.590	5	135	.473	–	–	4	3	–	–	1	–	IDH-1043-18
40	.800	5	119	.500	–	–	4	3	–	–	5	–	IDH-1043-13

IDH 1043 SERIES
RF AUTO TRANSFORMERS
(2 TAPS)

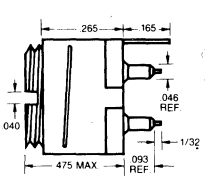


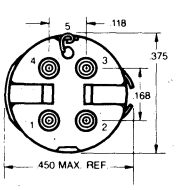
TEST FREQ. MHz	L pri. (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	G	MODEL NO.
65	.100	5	162	.857	.643	–	5	3	–	–	4	2	IDH-1043-9
75	.110	5	154	.785	.356	–	5	3	–	–	8	2	IDH-1043-3
65	.115	5	155	.785	.0715	–	4	2	–	–	1	3	IDH-1043-15
75	.120	5	146	.357	.214	–	4	2	–	–	1	3	IDH-1043-7
40	.305	5	165	.89	.703	–	4	2	–	–	1	3	IDH-1043-10
53	.328	5	162	.853	.407	–	4	2	–	–	1	3	IDH-1043-4
53	.338	5	162	.517	.31	–	1	3	–	–	4	2	IDH-1043-6
53	.342	5	158	.517	.345	–	1	3	–	–	4	2	IDH-1043-8
53	.342	5	149	.69	.310	–	1	3	–	–	4	2	IDH-1043-5
50	.27	5	90	.66	.200	–	3	1	–	–	2	4	IDH-1043-14

TYPE IPB 1000 SERIES
RF Inductor/Transformer Shielded/Tunable

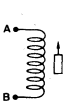


FEATURES
- Magnetically shielded
- Electrostatically shielded
- PC mounting
- Compact
- Stay-put tuning
- Meets MIL-C-15305
- Temperature coefficient < 250 PPM/° C





IPB 1041 SERIES
RF INDUCTORS

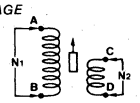


TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
47.0	0.38	2	70	NA	2	1	–	–	–	–	IPB-1041-1
5.6	5.25	10	94	NA.	4	2	–	–	–	–	IPB-1041-2

DALE® SIOUX DIVISION INDUCTIVE COMPONENTS

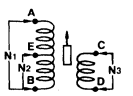
IPB 1000 SERIES CONTINUED FROM PREVIOUS PAGE

IPB 1042 SERIES
RF TRANSFORMERS
(UNTAPPED)



TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
5.0	0.38	2	63	0.45	–	–	1	3	2	4	–	–	IPB-1042-12
11.5	0.47	10	79	1.63	–	–	1	2	3	4	–	–	IPB-1042-11
11.5	0.62	10	70	1.38	–	–	3	2	1	4	–	–	IPB-1042-1
11.5	0.64	10	32	5.94	–	–	3	4	1	2	–	–	IPB-1042-7
5.6	2.95	10	55	3.13	–	–	1	2	3	4	–	–	IPB-1042-10
11.5	3.60	10	84	7.57	–	–	1	2	4	3	–	–	IPB-1042-5
5.6	5.75	10	34	1.00	–	–	1	2	3	4	–	–	IPB-1042-6
11.5	7.60	10	75	14.20	–	–	2	3	1	4	–	–	IPB-1042-3
11.5	7.60	10	70	10.71	–	–	3	2	1	4	–	–	IPB-1042-4
5.6	58	10	29	11.35	–	–	1	2	3	4	–	–	IPB-1042-2

IPB 1042 SERIES
RF TRANSFORMERS
(1 TAP)



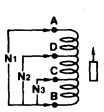
TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
11.5	1.19	10	78	0.5	3.25	–	4	2	3	5	1	–	IPB-1042-8
11.5	6.7	10	62	0.5	6.85	–	4	2	3	5	1	–	IPB-1042-9

IPB 1043 SERIES
RF AUTO TRANSFORMERS
(1 TAP)



TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
11.5	.780	10	115	0.41	–	–	2	4	3	–	–	–	IPB-1043-4
47.0	1.60	2	46	0.15	–	–	1	2	4	–	–	–	IPB-1043-11
5.6	2.83	10	64	0.22	–	–	2	4	1	–	–	–	IPB-1043-1
5.6	4.80	10	56	0.90	–	–	1	4	3	–	–	–	IPB-1043-3
5.6	13.9	10	67	0.17	–	–	1	4	2	–	–	–	IPB-1043-5
11.5	23.5	10	44	0.17	–	–	2	1	4	–	–	–	IPB-1043-7
11.5	24.5	10	49.5	0.50	–	–	2	1	4	–	–	–	IPB-1043-2
5.6	31.5	10	40	0.30	–	–	4	3	1	–	–	–	IPB-1043-6
5.6	33.0	10	61	0.15	–	–	1	4	2	–	–	–	IPB-1043-10
5.6	37.5	10	39	0.19	–	–	4	3	2	–	–	–	IPB-1043-8
1.0	138.0	7	50	0.14	–	–	2	3	4	–	–	–	IPB-1043-12

IPB 1043 SERIES
RF AUTO TRANSFORMERS
(2 TAPS)

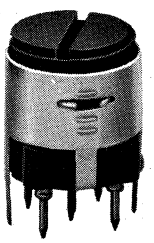


TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
50.0	3.5	10	8.94	0.31	0.17	–	4	2	1	3	–	–	IPB-1043-13
5.6	20.5	10	77	0.48	0.12	–	1	4	2	3	–	–	IPB-1043-9

IPB 2042 SERIES CONTINUED ON NEXT PAGE

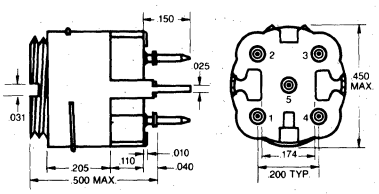
TYPE IPB 2000 SERIES

RF Inductor/Transformer
Shielded/Tunable



FEATURES

- Magnetically shielded
- Electrostatically shielded
- PC Mounting
- Compact
- Gold-plated terminals
- Stay-put tuning
- Meets MIL-C-15305
- Temperature coefficient <250 PPM/° C

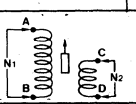


IPB 2041 SERIES
RF INDUCTORS



TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
28.0	.455	10	87.5	NA	2	1	–	–	–	–	IPB-2041-27
29.0	.461	10	77.4	NA	2	1	–	–	–	–	IPB-2041-28
27.0	.481	10	85.8	NA	2	1	–	–	–	–	IPB-2041-26
26.0	.501	10	85.6	NA	2	1	–	–	–	–	IPB-2041-25
25.0	.531	10	95.9	NA	2	1	–	–	–	–	IPB-2041-24
24.0	.548	10	96.9	NA	2	1	–	–	–	–	IPB-2041-23
23.0	.589	10	94.0	NA	2	1	–	–	–	–	IPB-2041-22
22.0	.620	10	93.3	NA	2	1	–	–	–	–	IPB-2041-21
21.0	.665	10	102.6	NA	2	1	–	–	–	–	IPB-2041-20
20.0	.669	10	102.5	NA	2	1	–	–	–	–	IPB-2041-19
19.0	.750	10	100.6	NA	2	1	–	–	–	–	IPB-2041-18
18.0	.803	10	110.0	NA	2	1	–	–	–	–	IPB-2041-17
17.0	.883	10	106.0	NA	2	1	–	–	–	–	IPB-2041-16
16.0	.936	10	106.4	NA	2	1	–	–	–	–	IPB-2041-15
15.0	1.01	10	105.2	NA	2	1	–	–	–	–	IPB-2041-14
14.0	1.10	10	103.4	NA	2	1	–	–	–	–	IPB-2041-13
13.0	1.19	10	102.9	NA	2	1	–	–	–	–	IPB-2041-12
12.0	1.37	10	102.9	NA	2	1	–	–	–	–	IPB-2041-11
11.0	1.51	10	95.9	NA	2	1	–	–	–	–	IPB-2041-10
10.0	1.69	10	94.3	NA	2	1	–	–	–	–	IPB-2041-9
9.0	1.84	10	96.2	NA	2	1	–	–	–	–	IPB-2041-8
8.0	2.09	10	95.2	NA	2	1	–	–	–	–	IPB-2041-7
7.0	2.44	10	93.2	NA	2	1	–	–	–	–	IPB-2041-6
6.0	2.86	10	92.8	NA	2	1	–	–	–	–	IPB-2041-5
5.0	3.56	10	89.5	NA	2	1	–	–	–	–	IPB-2041-4
4.0	4.44	10	89.7	NA	2	1	–	–	–	–	IPB-2041-3
3.0	5.86	10	90.6	NA	2	1	–	–	–	–	IPB-2041-2
2.0	8.41	10	94.7	NA	2	1	–	–	–	–	IPB-2041-1
7.0	32.0	10	49.76	NA	2	1	–	–	–	–	IPB-2041-29

IPB 2042 SERIES
RF TRANSFORMERS
(UNTAPPED)



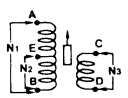
TEST FREQ. MHz	L pri. (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
32.8	.398	10	103.6	.470	–	–	1	4	2	3	–	–	IPB-2042-2
10.75	.555	10	45.3	.613	–	–	2	1	4	3	–	–	IPB-2042-8

DALE® SIOUX DIVISION INDUCTIVE COMPONENTS

IPB 2042 SERIES CONTINUED FROM PREVIOUS PAGE

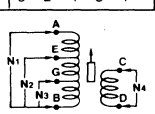
TEST FREQ. MHz	L pri. (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
15.7	.663	10	87.2	.119	–	–	4	3	2	1	–	–	IPB-2042-31
22.8	.727	10	91.3	.453	–	–	4	1	2	3	–	–	IPB-2042-5
9.0	.80	10	76.89	.35	–	–	1	2	4	3	–	–	IPB-2042-22
7.1	1.12	10	56.06	0.27	–	–	2	1	4	3	–	–	IPB-2042-25
7.1	1.12	10	56.06	.0885	–	–	2	1	4	3	–	–	IPB-2042-26
7.1	1.12	10	56.06	.695	–	–	2	1	4	3	–	–	IPB-2042-27
10.0	1.125	10	77.8	.0863	–	–	2	1	4	3	–	–	IPB-2042-21
32.8	3.46	10	28.0	.224	–	–	4	1	2	3	–	–	IPB-2042-3
4.6	3.5	10	75.15	0.145	–	–	4	1	2	3	–	–	IPB-2042-23
4.0	4.22	10	51.8	.23	–	–	4	3	2	1	–	–	IPB-2042-19
22.8	6.24	10	39.2	.257	–	–	4	1	2	3	–	–	IPB-2042-6
27.8	16.4	10	8.73	.284	–	–	4	1	2	3	–	–	IPB-2042-7
1.5	23.4	10	77.7	.415	–	–	2	1	4	3	–	–	IPB-2042-33
1.75	44.0	10	45.5	.156	–	–	2	1	4	3	–	–	IPB-2042-28
1.5	36.3	10	77.9	.170	–	–	1	2	4	3	–	–	IPB-2042-32
.50	149.0	10	35.8	.0167	–	–	5	1	2	5	–	–	IPB-2042-18

IPB 2042 SERIES
RF TRANSFORMERS
(1 TAP)



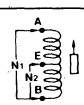
TEST FREQ. MHz	L pri. (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	F	MODEL NO.
27.85	.696	10	98.6	.5	.435	–	4	1	3	2	5	–	IPB-2042-11
22.8	2.21	10	31.6	.5	.395	–	4	1	2	5	3	–	IPB-2042-4
27.85	2.42	10	52.0	.5	.124	–	4	1	2	3	5	–	IPB-2042-12
17.85	2.74	10	65.1	.5	.113	–	4	1	3	2	5	–	IPB-2042-9
10.75	4.48	10	82.7	.5	.166	–	4	1	3	2	5	–	IPB-2042-13
27.85	7.27	10	19.7	.5	.483	–	4	1	3	5	2	–	IPB-2042-1
5.0	26.0	10	34.99	.5	1.23	–	2	5	4	3	1	–	IPB-2042-15
7.85	28.4	10	9.43	.5	.166	–	4	1	2	3	5	–	IPB-2042-10
2.53	30.7	10	49.2	.5	.045	–	4	1	2	3	5	–	IPB-2042-30
1.97	47.0	10	34.39	.492	.287	–	2	1	4	3	5	–	IPB-2042-24
1.75	97.3	10	14.0	.5	.024	–	2	1	4	3	5	–	IPB-2042-29
1.75	110.0	10	13.23	.5	7.87	–	4	1	3	2	5	–	IPB-2042-14
2.0	117.0	10	9.55	0278	.183	–	5	2	4	3	1	–	IPB-2042-17

IPB 2042 SERIES
RF TRANSFORMERS
(2 TAPS)



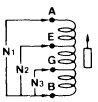
TEST FREQ. MHz	L pri. (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N1	TERMINAL CONNECT A	B	C	D	E	G	MODEL NO.
5.0	13.7	10	43.0	.583	.0179	.0403	1	5	3	2	4	5	IPB-2042-16
1.0	42.2	10	53.2	.955	.825	.060	5	2	5	4	1	3	IPB-2042-20

IPB 2043 SERIES
RF AUTO TRANSFORMERS
(1 TAP)



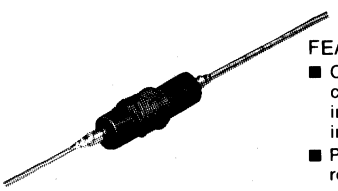
TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	G	MODEL NO.
32.8	.420	10	104	.5	–	–	4	1	–	–	5	–	IPB-2043-1
22.8	.727	10	91.3	.51	–	–	2	3	–	–	5	–	IPB-2043-2
1.5	38.1	10	41.7	.5	–	–	4	1	–	–	5	–	IPB-2043-13
1.75	54.0	10	26.9	.070	–	–	5	1	–	–	2	–	IPB-2043-7
1.75	101.0	10	14.41	.048	–	–	3	1	–	–	2	–	IPB-2043-4
1.75	110.0	10	13.23	.076	–	–	2	1	–	–	4	–	IPB-2043-8
1.75	112.0	10	13.00	.075	–	–	5	1	–	–	2	–	IPB-2043-5
1.75	113.0	10	12.89	.793	–	–	5	1	–	–	4	–	IPB-2043-6
3.0	158.0	10	16.8	.683	–	–	4	1	–	–	5	–	IPB-2043-14
1.0	220.0	10	15.2	0.91	–	–	4	1	–	–	5	–	IPB-2043-12
.50	350.0	10	20.8	.091	–	–	4	3	–	–	5	–	IPB-2043-11

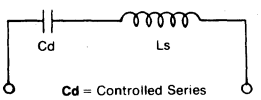
IPB 2043 SERIES
RF AUTO TRANSFORMERS
(2 TAPS)



TEST FREQ. MHz	L (μH)	ΔL ±%	Q (Min.)	TURNS RATIO N2:N1	N3:N1	N4:N3	TERMINAL CONNECT A	B	C	D	E	G	MODEL NO.
5.0	6.15	10	77.63	0.10	.055	–	3	2	–	–	5	1	IPB-2043-10
2.0	28.1	10	45.33	.086	.012	–	2	1	–	–	3	5	IPB-2043-9
1.75	120.0	10	12.16	.125	.076	–	2	1	–	–	4	3	IPB-2043-3

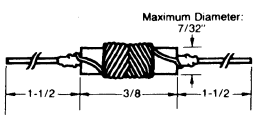
SERIES RESONANT TRAPS





Cd = Controlled Series Capacitance

Ls = Series Inductance



FEATURES

- Combines the electrical characteristics of an inductor and a capacitor in series
- Provides controlled self-resonance in a miniaturized circuit
- Saves space, reduces inventory
- Speeds assembly

BASIC SPECIFICATIONS

- Can be designed for any resonant frequency from .4 MHz to 50 MHz.
- Impedance at design frequency: 15 ohms or less.
- Impedance at ±50% of design frequency: 1500 ohms minimum.
- Frequencies readily available: 10.7, 12, 14, 18 MHz.

ORDERING INFORMATION

WHERE TO ORDER:
- From your Dale Representative
- From DALE ELECTRONICS, INC.
  Sioux Division, Box 180
  Yankton, South Dakota 57078

  Phone: 605–665-9301

TERMS: 1/2% 10-Net 30 F.O.B. POINT Yankton, S.D.

NOTE: Prices and specifications on all products are subject to change without notice.

SPECIAL CHARGES: Minimum Order Charge...$10.00
Minimum Item Charge ...$ 7.50

NON-STANDARD PRODUCTS
When your requirements are for special products not covered here, please send an outline of your needs to Sales Department, Dale Electronics, Inc., Sioux Division, Box 180, Yankton, South Dakota 57078.

DELEVAN

COILS

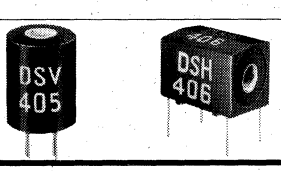
Delevan Series Parts	Nominal Size Dia. - Length	Inductance Range UH	Number Values Available	Q Minimum Range	Military Designation
MICRO I ™					
100	.065 x .100 sq.	.015 - 10.0	30	35 - 40	—
150	.065 x .150 sq.	12.0 - 100	12	45	—
250	.065 x .250 sq.	120 - 1000	12	35 - 45	—
FIXED SERIES					
1025	.095 x .250 sq.	.10 - 1000.0	49	25 - 50	—
1537	.155 x .375 sq.	.15 - 240.0	51	33 - 75	18130 90538
1840	.185 x .437 sq.	.15 - 27.0	25	35 - 65	75008
2150	.215 x .560 sq.	.47 - 39.0	26	35 - 70	90542
2500	.190 x .440 sq. .215 x .560 sq. .240 x .740 sq.	270 - 1000 1000 - 3600 3900 - 10,000	16 14 12	60 - 65 60 - 70 80	90539 90540 90541
2890	.280 x .900 sq.	1.2 - 120.0	25	40 - 95	91189
3500	.250 x .560 sq. .310 x .560 sq. .375 x .625 sq. .468 x .687 sq. .375 x .687 sq.	47 - 150 180 - 390 470 - 1000 1500 - 10,000 10,000	7 5 5 8 1	18 - 75 75 - 80 70 - 80 70 - 85 70	75052 75053 75054 75055 —
SHIELDED					
2307	.157 x .395 sq.	.10 - 10,000	61	39 - 67	90537
PLUG IN					
4500	.235 x .725 sq. .282 x .625 sq. .375 x .625 sq. .437 x .625 sq. .500 x .825 sq.	.47 - 39.0 47 - 150 180 - 390 470 - 1000 1500 - 10,000	20 7 5 5 8	35 - 60 15 - 60 55 - 60 35 - 50 40 - 55	— — 18100 — —
2534	.250 x .345 sq.	100 - 150,000	39	< 10 - 80	—
VARIABLE					
4000/4100	.400 x .952 sq.	.18 - 70,000	62	20 - 110	90543 - 46
4450	.330 x .750 sq.	.10 - 1000	48	30 - 50	LT 4K
DSV 405	.380 x .500 sq.	.10 - 10,000	31	38 - 110	—
DSH 406	.375 sq. x .500	.10 - 10,000	31	38 - 110	—

Designed to fit inside or outside IC's.

.100″ Square .150″ Square .250″ Square

For chassis or AC mounting, crimp on terminals.

Fine tuning — 80 threads per inch.



Delevan coils offer the designer a wide choice of characteristics for specific applications. Standard coils are listed above. For information on custom designed coils, contact your nearest Delevan Representative . . . he's listed in the back of this book . . . or, call Delevan Electronics direct.

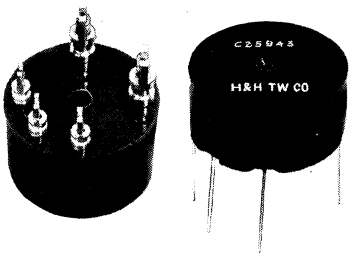
To obtain factory prices in quantities up to 2,500, contact the Delevan Distributor listed in the back of this book. To order, indicate series number and inductance desired. Many items are available from Distributor inventories.

Delevan Electronics Division
AMERICAN PRECISION INDUSTRIES INC.
270 QUAKER ROAD, EAST AURORA, NEW YORK 14052
TEL. 716 — 652-3600 Telex 091-293

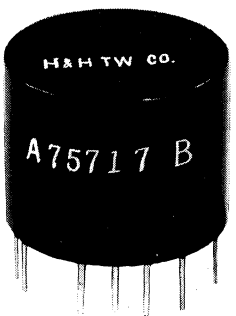
First on the list... (even the moon's)

H. & H. specializes in the design and manufacture of magnetic components for military and industrial applications. When the successful Lunar Excursion Module hit the front pages, H. & H. made the newspapers . . . after much hard work.

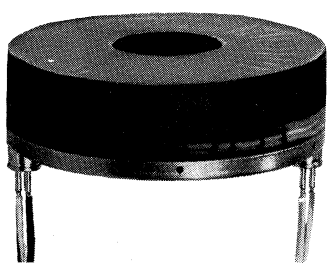
H. & H. isn't only "first on the moon." It's first on many, many lists. If we aren't first on yours . . . we really should be.



✓ *Both of these H. & H. units feature extremely critical electrical characteristics. Fully encapsulated and using unusual pin design, both are now being used aboard the U.S. Navy's underwater missiles.*



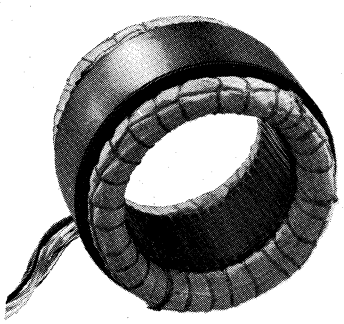
✓ *The trick to turning out this magamp (for motor speed controls) both economically and with minimal lead-time, is production "know-how."*



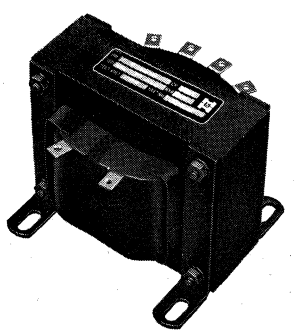
✓ *H. & H. won the bid for this alternator-stator. It's an encapsulated energy supply source for one of the DOD's latest undersea operations*



✓ *H. & H. toroids used in solid-state controls for total energy systems are climbing in demand. Assembly methods are the very latest. Prices are unusually low and quotes are "hand tailored."*



✓ *This H. & H. stator —featuring high reliability—was quickly accepted by one of the nation's leading areospace component manufacturers. Its quality is hard to surpass.*



✓ *Transformers ("C", "EI" and three-phase "E" core) for static converters, inverters and machine control. These highlight close tolerance both on electrical and mechanical characteristics.*

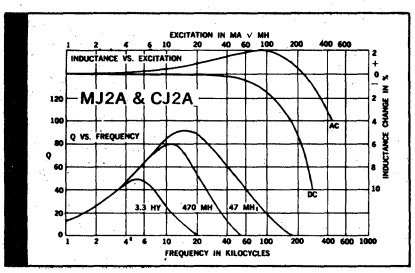
When you have a question . . . call us. We can help you find the answers. We're at 216/486-0744.

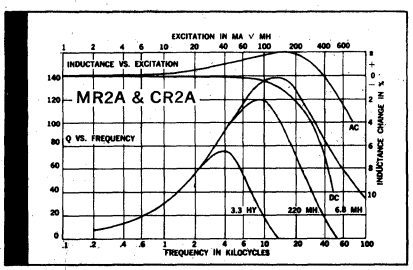
H & H TOROIDAL WINDING CO
1410 Chardon Road / Euclid, Ohio 44117

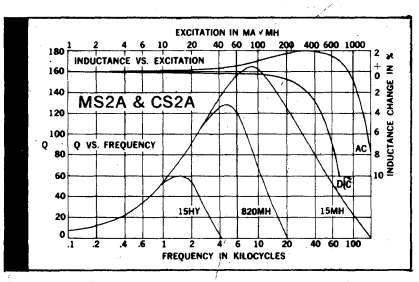
hisonic inc.

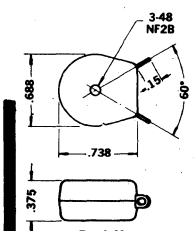
TOROIDAL INDUCTORS

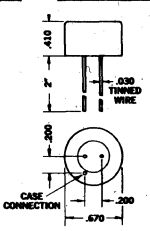
Hisonic Toroidal Inductors are wound on either nickel-iron molybdenum (molybdenum permalloy) or carbonyl iron powder cores. Standard tolerance is 1% and values are true inductance. Units are available uncased, molded or cased as shown. Molded units are compression molded in high strength, high temperature thermosetting resin and pass requirements of MIL T 27 Grade 5 Class R. Cased units are hermetically sealed in shield cans and pass requirements of MIL T 27 Grade 4 Class R.

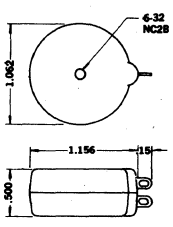


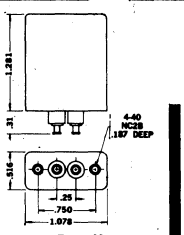


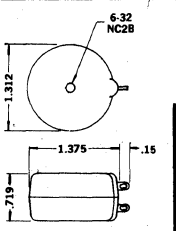


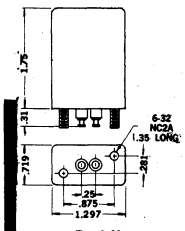












Ind. Val.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
5.6 MH	MJ2A41	CJ2A41	—	—	—	—
6.8 MH	MJ2A42	CJ2A42	MR2A42	CR2A42	MS2A42	CS2A42
8.2 MH	MJ2A43	CJ2A43	MR2A43	CR2A43	MS2A43	CS2A43
10 MH	MJ2A44	CJ2A44	MR2A44	CR2A44	MS2A44	CS2A44
12 MH	MJ2A45	CJ2A45	MR2A45	CR2A45	MS2A45	CS2A45
15 MH	MJ2A46	CJ2A46	MR2A46	CR2A46	MS2A46	CS2A46
18 MH	MJ2A47	CJ2A47	MR2A47	CR2A47	MS2A47	CS2A47
22 MH	MJ2A48	CJ2A48	MR2A48	CR2A48	MS2A48	CS2A48
27 MH	MJ2A49	CJ2A49	MR2A49	CR2A49	MS2A49	CS2A49
33 MH	MJ2A50	CJ2A50	MR2A50	CR2A50	MS2A50	CS2A50
39 MH	MJ2A51	CJ2A51	MR2A51	CR2A51	MS2A51	CS2A51
47 MH	MJ2A52	CJ2A52	MR2A52	CR2A52	MS2A52	CS2A52
56 MH	MJ2A53	CJ2A53	MR2A53	CR2A53	MS2A53	CS2A53
68 MH	MJ2A54	CJ2A54	MR2A54	CR2A54	MS2A54	CS2A54
82 MH	MJ2A55	CJ2A55	MR2A55	CR2A55	MS2A55	CS2A55
100 MH	MJ2A56	CJ2A56	MR2A56	CR2A56	MS2A56	CS2A56
120 MH	MJ2A57	CJ2A57	MR2A57	CR2A57	MS2A57	CS2A57
150 MH	MJ2A58	CJ2A58	MR2A58	CR2A58	MS2A58	CS2A58
180 MH	MJ2A59	CJ2A59	MR2A59	CR2A59	MS2A59	CS2A59
220 MH	MJ2A60	CJ2A60	MR2A60	CR2A60	MS2A60	CS2A60
270 MH	MJ2A61	CJ2A61	MR2A61	CR2A61	MS2A61	CS2A61
330 MH	MJ2A62	CJ2A62	MR2A62	CR2A62	MS2A62	CS2A62
390 MH	MJ2A63	CJ2A63	MR2A63	CR2A63	MS2A63	CS2A63
470 MH	MJ2A64	CJ2A64	MR2A64	CR2A64	MS2A64	CS2A64
560 MH	MJ2A65	CJ2A65	MR2A65	CR2A65	MS2A65	CS2A65
680 MH	MJ2A66	CJ2A66	MR2A66	CR2A66	MS2A66	CS2A66
820 MH	MJ2A67	CJ2A67	MR2A67	CR2A67	MS2A67	CS2A67
1.0 HY	MJ2A68	CJ2A68	MR2A68	CR2A68	MS2A68	CS2A68
1.2 HY	MJ2A69	CJ2A69	MR2A69	CR2A69	MS2A69	CS2A69
1.5 HY	MJ2A70	CJ2A70	MR2A70	CR2A70	MS2A70	CS2A70
1.8 HY	MJ2A71	CJ2A71	MR2A71	CR2A71	MS2A71	CS2A71
2.2 HY	MJ2A72	CJ2A72	MR2A72	CR2A72	MS2A72	CS2A72
2.7 HY	MJ2A73	CJ2A73	MR2A73	CR2A73	MS2A73	CS2A73
3.3 HY	MJ2A74	CJ2A74	MR2A74	CR2A74	MS2A74	CS2A74
3.9 HY	—	—	MR2A75	CR2A75	MS2A75	CS2A75
4.7 HY	—	—	MR2A76	CR2A76	MS2A76	CS2A76
5.6 HY	—	—	MR2A77	CR2A77	MS2A77	CS2A77
6.8 HY	—	—	MR2A78	CR2A78	MS2A78	CS2A78
8.2 HY	—	—	—	—	MS2A79	CS2A79
10.0 HY					MS2A80	CS2A80
12.0 HY					MS2A81	CS2A81
15.0 HY					MS2A82	CS2A82

Above units also available in encapsulated construction with pin terminals arranged for printed circuit board applications. Write for information on 5101 - 5103 and 5105 series.

The above units represent only a small percentage of those available as standard from Hisonic, but represent those most commonly used. Thousands of additional standard inductors are available, one of which should meet your requirements. Special requirements get prompt and accurate development from Hisonic Custom Design Service.

Hisonic, with a background of 23 years experience in toroidal components, is headquarters for all your needs.

Write today for the Hisonic, Inc. catalog which contains full information on all Hisonic standard Toroidal Inductors and Hisonic Custom Design Service.

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249 N. Troost
Olathe, Kansas 66061
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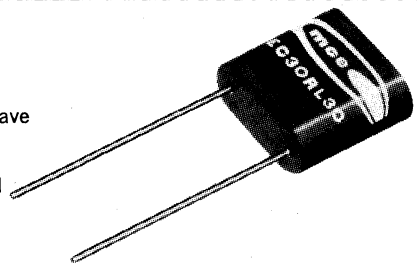
782-0012

MCE PRODUCT BULLETIN — SUB-MINIATURE LINE — EC30RL

TOROIDAL CHOKES

APPLICATION FEATURES

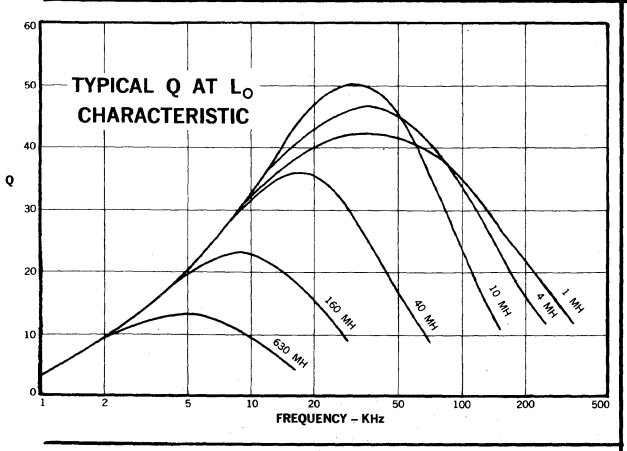
SELF SHIELDING—Toroidal configuration at low cost minimizes stray field effects. For use as noise suppressor in switching circuits and in high frequency or square wave power supplies. Also can be used as non-critical inductor in oscillator, filter, and wave shaping networks.
PACKAGING FOR P.C. BOARDS — Epoxy Encapsulated unit for plug-in on Standard 0.1 inch grid spacing. "Crystal" case requires small board area.

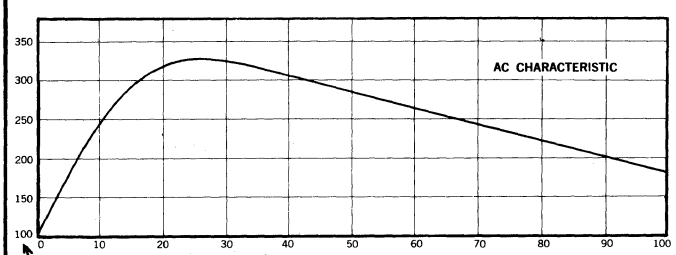


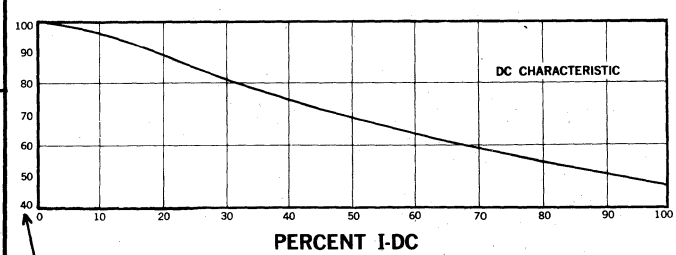
SPECIFICATIONS

1. Initial Inductance, Lo, is at corresponding test voltage and frequency as measured on ESI Impedance Bridge Model 250 or equivalent.
2. Self-Resonant Frequency is based upon a distributed capacitance of approx. 140 pf.
3. 100% I Milliamps is for a temperature rise of 50°C.
4. Max. temperature rating = 130°C.
5. Dielectric Withstanding Voltage = 1500V-RMS 60Hz & Insulation Resistance ≧ 1000 megohms at 500VDC from coil to mounting plate.
6. All electrical data at 20 ±5°C.

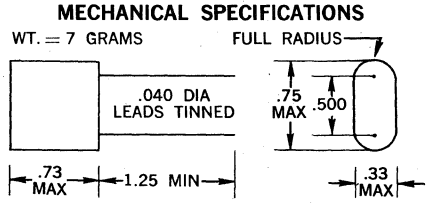
PART NUMBER	L_o ±15% MILLI-HENRIES	DCR ±20% OHMS	TYPICAL SELF-RES. FREQ. KHz	I-AC RMS or I-DC MA (100% I)	DC MA FOR 80% L_o	L_o TEST MILLIVOLTS AND FREQ.
EC30RL30	1.0	1.1	430	880	280	91 at 10 KHz
EC30RL31	1.6	1.7	340	700	220	120 at 10 KHz
EC30RL32	2.5	2.6	270	550	180	140 at 10 KHz
EC30RL33	4.0	4.2	210	440	140	180 at 10 KHz
EC30RL34	6.3	6.8	170	350	110	230 at 10 KHz
EC30RL35	10	11	130	280	89	290 at 10 KHz
EC30RL36	16	17	110	220	70	360 at 10 KHz
EC30RL37	25	27	85	180	56	460 at 10 KHz
EC30RL38	40	42	68	140	44	580 at 10 KHz
EC30RL39	63	70	54	110	35	72 at 1 KHz
EC30RL40	100	110	43	88	28	91 at 1 KHz
EC30RL41	160	170	34	70	22	120 at 1 KHz
EC30RL42	250	270	27	55	18	140 at 1 KHz
EC30RL43	400	440	21	44	14	180 at 1 KHz
EC30RL44	630	680	17	35	11	230 at 1 KHz







MECHANICAL SPECIFICATIONS



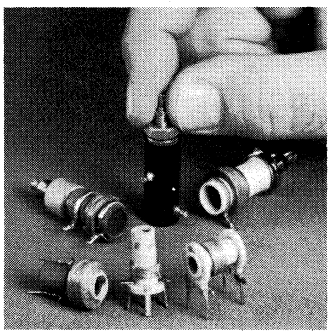
MAGNETIC CIRCUIT ELEMENTS INC 2455A GARDEN ROAD, MONTEREY, CALIFORNIA 93940
DEL MONTE RESEARCH PARK TELEPHONE (408) 373-0456

See J. W. MILLER CO. standard coil listings complete with prices in the 1970 RADIO MASTER

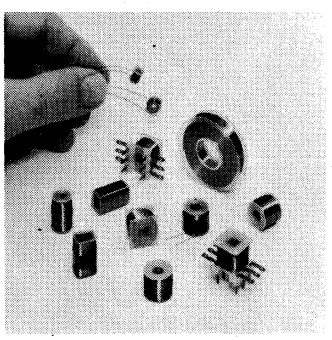
Special Coils



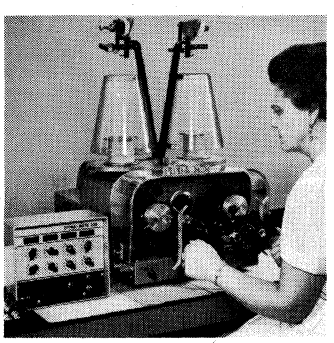
Special 16 Pi/30 KV windings for oil-filled high voltage transformers . . . special coil samples are shipped within 1 to 2 weeks after receipt of order.



Production shipments of special coils begin within 3 weeks after sample approval. Intensive specialization in coil design and manufacture assures excellent performance.



Where space limitations dictate one or more dimensions, Miller engineers will make recommendations to help you obtain optimum performance in your circuit.



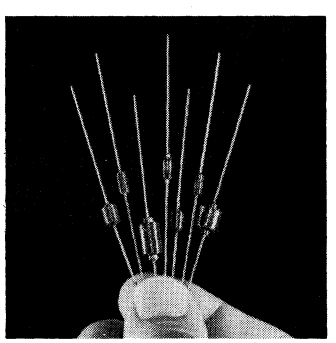
Custom wound bobbins are now available in an extensive range of inductance values and current ratings on many standard forms.

Custom Wound Bobbins

Standard Coils



Series 7830 heavy duty filter chokes provide up to 250 uh, carry up to 75 amps; widely used for RFI filters and reducing surge peaks; available from L.A. shelf stock.



RF and IF coils, chokes and filters are carried in stock, in depth, in extensive range of values and ratings, most are available from distributors' shelves at factory prices.

MILLER QUALITY PRODUCTS

J. W. MILLER COMPANY

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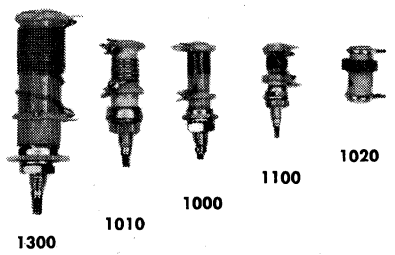
COILS

HIGH PERFORMANCE SERIES, ADJUSTABLE AND FIXED
To Cover All Frequency Ranges from Audio to 200 MHz

COILS ON CERAMIC FORMS PER MIL-I-10



Series No.	Dimensions (Inches) Dia.	Length	Mtg. Hole Dia. (Inches)
1000	.50	.88	.196
1020	.50	.63	.050, .500 Apart
1100	.33	.63	.166
1300	.70	1.80	.252
1010	.43	.88	.196

Miniature 1000 Series

Part No.	Range Microhenries	Average Q
1000-A	1.0- 1.6	70 @ 7.9 MHz
1000-B	1.6- 2.7	80 @ 7.9 MHz
1000-C	2.7- 4.5	85 @ 7.9 MHz
1000-D	4.5- 8.5	85 @ 7.9 MHz
1000-E	8.5-14.5	75 @ 2.5 MHz
1000-F	14.5-22	65 @ 2.5 MHz
1000-G	22-29	65 @ 2.5 MHz
1000-H	29-55	85 @ 2.5 MHz
1000-I	55-110	80 @ 2.5 MHz
1000-J	110-185	85 @ .79 MHz
1000-K	185-305	85 @ .79 MHz
1000-L	305-515	85 @ .79 MHz
1000-M	515-820	85 @ .79 MHz
1000-N	820-1100	75 @ .79 MHz

RF Printed Circuit Coils

1020-A	0.41- 0.53	75 @ 25 MHz
1020-B	0.85- 1.15	65 @ 7.9 MHz
1020-C	1.87- 2.50	65 @ 7.9 MHz
1020-D	4.0 - 5.4	70 @ 7.9 MHz
1020-E	7.5 -12.5	70 @ 2.5 MHz
1020-F	20 -29	80 @ 2.5 MHz
1020-G	33 -61	80 @ 2.5 MHz
1020-H	80 -120	60 @ 0.79 MHz
1020-I	170 -260	70 @ 0.79 MHz

Subminiature 1100 Series

1100-A	0.9- 1.4	60 @ 7.9 MHz
1100-B	1.4- 1.9	70 @ 7.9 MHz
1100-C	1.9- 2.6	65 @ 7.9 MHz
1100-D	2.6- 3.7	65 @ 7.9 MHz
1100-E	3.7- 5.5	65 @ 7.9 MHz
1100-F	5.5- 7.4	60 @ 7.9 MHz
1100-G	7.4-12.5	70 @ 7.9 MHz
1100-H	12.5-18.0	65 @ 2.5 MHz
1100-I	18.0-28.0	70 @ 2.5 MHz
1100-J	28.0-38.0	70 @ 2.5 MHz
1100-K	38.0-55.0	70 @ 2.5 MHz

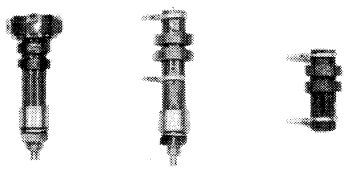
Transmitter 1300 Series

1300-A	For use from 90-200 MHz	
1300-B	For use from 40-90 MHz	
1300-C	For use from 20-40 MHz	
1300-D	0.7- 1.1	170 @ 25 MHz
1300-E	1.1- 1.7	130 @ 7.9 MHz
1300-F	1.7- 2.7	140 @ 7.9 MHz
1300-G	2.7- 4.5	140 @ 7.9 MHz
1300-H	4.5- 6.8	140 @ 7.9 MHz
1300-I	6.8-10.8	140 @ 7.9 MHz
1300-J	10.8-17.0	110 @ 2.5 MHz
1300-K	17.0-29.0	95 @ 2.5 MHz
1300-L	29.0-45.0	100 @ 2.5 MHz
1300-M	45.0-75.0	100 @ 2.5 MHz

HF Coils, Variable Approx. ±15%

1010-A	0.118	115 @ 50 MHz
1010-B	0.225	125 @ 25 MHz
1010-C	0.315	130 @ 25 MHz

WIDE ADJUSTMENT RANGE 120 SERIES



120 Series Mica-filled form .75" O.D. x 1.3" H. .196" dia. mtg. hole

PCS-120 Series Phenolic form

PC-120 Series Phenolic form .5" O.D. x 1.25" L. .05" Pins, .70" Apart

Part No.	Range Microhenries	Average Q
120-A	2-3	70 @ 7.9 MHz
120-B	3-5	80 @ 7.9 MHz
120-C	5-9	85 @ 7.9 MHz
120-D	9-18	65 @ 2.5 MHz
120-E	18-36	70 @ 2.5 MHz
120-F	36-64	65 @ 2.5 MHz
120-G	64-105	85 @ 2.5 MHz
120-H	105-200	80 @ .79 MHz
120-I	200-500	75 @ .79 MHz
120-J	500-1000	85 @ .79 MHz
120-K	1000-2000	50 @ .25 MHz



Subminiature 600 Series

- Variable ±10%
- Shielded
- 0.3" O.D. x 0.4" H
- .020" Leads .30" Apart

Part No.	Nominal Microhenries	Average Q
600U1X0	1.0	120 @ 7.9 MHz
600U1X5	1.5	120 @ 7.9 MHz
600U2X2	2.2	120 @ 7.9 MHz
600U3X3	3.3	130 @ 7.9 MHz
600U4X7	4.7	125 @ 7.9 MHz
600U6X8	6.8	140 @ 7.9 MHz
600U10X	10	135 @ 7.9 MHz
600U15X	15	130 @ 2.5 MHz
600U22X	22	135 @ 2.5 MHz
600U33X	33	130 @ 2.5 MHz
600U47X	47	130 @ 2.5 MHz
600U68X	68	120 @ 2.5 MHz
600MX10	100	100 @ 2.5 MHz
600MX15	150	125 @ .79 MHz
600MX22	220	130 @ .79 MHz
600MX33	330	125 @ .79 MHz
600MX47	470	120 @ .79 MHz
600MX68	680	100 @ .79 MHz
600M1X0	1000	100 @ .79 MHz

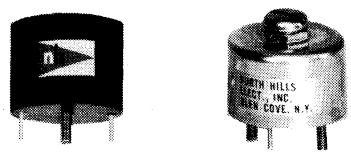


High Q RF Coils, Fixed

- .75" O.D. x .63" H
- Hermetically sealed
- Complete shielding
- For printed circuitry
- For standard circuitry

Part No.	Nominal Microhenries	Average Q
1219-A	0.47 ± 5%	170 @ 20 MHz
1219-B	1.0 ± 5%	170 @ 10 MHz
1219-C	2.2 ± 5%	170 @ 8 MHz
1219-D	4.7 ± 5%	170 @ 5 MHz
1219-E	10 ± 5%	170 @ 3 MHz
1219-F	22 ± 3%	170 @ 1.5 MHz
1219-G	47 ± 3%	170 @ 1 MHz
1219-H	100 ± 3%	170 @ 0.8 MHz
1219-I	220 ± 3%	170 @ 0.7 MHz
1219-J	470 ± 3%	170 @ 0.6 MHz
1219-K	1000 ± 3%	170 @ 0.5 MHz
1219-L	2200 ± 3%	150 @ 0.25 MHz

Hi Q 801, 802 Series, Adjustable ±10%

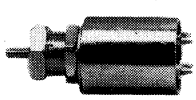


Industrial 801, 802 Series 1.13" O.D. x .88" H

Hermetically Sealed MS801, MS802 Series 1.25" O.D. x 1.25" H

Part No.	Nominal Millihenries	Peak Q
801M1X0	1.0	100 @ 10 kHz
801M1X5	1.5	100 @ 10 kHz
801M2X2	2.2	100 @ 10 kHz
801M3X3	3.3	100 @ 10 kHz
801M4X7	4.7	100 @ 10 kHz
801M6X8	6.8	100 @ 10 kHz
801M10X	10	200 @ 20 kHz
801M15X	15	200 @ 20 kHz
801M22X	22	200 @ 20 kHz
801M33X	33	200 @ 20 kHz
801M47X	47	200 @ 20 kHz
801M68X	68	200 @ 20 kHz
801HX10	100	300 @ 30 kHz
801HX15	150	300 @ 30 kHz
801HX22	220	300 @ 30 kHz
801HX33	330	250 @ 20 kHz
801HX47	470	250 @ 20 kHz
801HX68	680	250 @ 20 kHz
801H1X0	1000	150 @ 15 kHz
802M1X0	1.0	400 @ 100 kHz
802M1X5	1.5	400 @ 100 kHz
802M2X2	2.2	400 @ 100 kHz
802M3X3	3.3	400 @ 100 kHz
802M4X7	4.7	400 @ 100 kHz
802M6X8	6.8	400 @ 100 kHz
802M10X	10	400 @ 70 kHz
802M15X	15	400 @ 70 kHz
802M22X	22	400 @ 70 kHz
802M33X	33	400 @ 70 kHz
802M47X	47	400 @ 40 kHz

SHIELDED COILS



- Shielded
- Encapsulated

- .44" Diameter **900 Series**

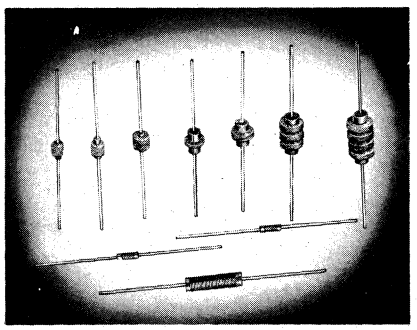
Part No.	Range Microhenries	Average Q
900-A	0.5- 0.8	80 @ 25 MHz
900-B	0.8- 1.3	70 @ 18 MHz
900-C	1.3- 2.0	60 @ 15 MHz
900-D	2.0- 4.0	70 @ 8 MHz
900-E	4.0- 7.0	70 @ 5 MHz
900-F	7.0-12.0	70 @ 4 MHz
900-G	12.0-20.0	70 @ 3 MHz
900-H	20.0-35.0	70 @ 2.5 MHz
900-I	35.0-60.0	70 @ 2.0 MHz
900-J	60.0-100.0	70 @ 1.0 MHz

- .63" Diameter **1500 Series**

Part No.	Range Millihenries	Average Q
1500-A	.100- .175	80 @ 790 kHz
1500-B	.175- .300	80 @ 790 kHz
1500-C	.300- .500	80 @ 790 kHz
1500-D	.500- .800	75 @ 790 kHz
1500-E	.800-1.15	55 @ 500 kHz
1500-F	1.15-1.50	55 @ 250 kHz
1500-G	1.50-2.30	55 @ 250 kHz
1500-H	2.30-3.50	50 @ 250 kHz
1500-I	3.50-7.50	40 @ 250 kHz

SEE SECTION 5600 FOR WIDEBAND TRANSFORMERS

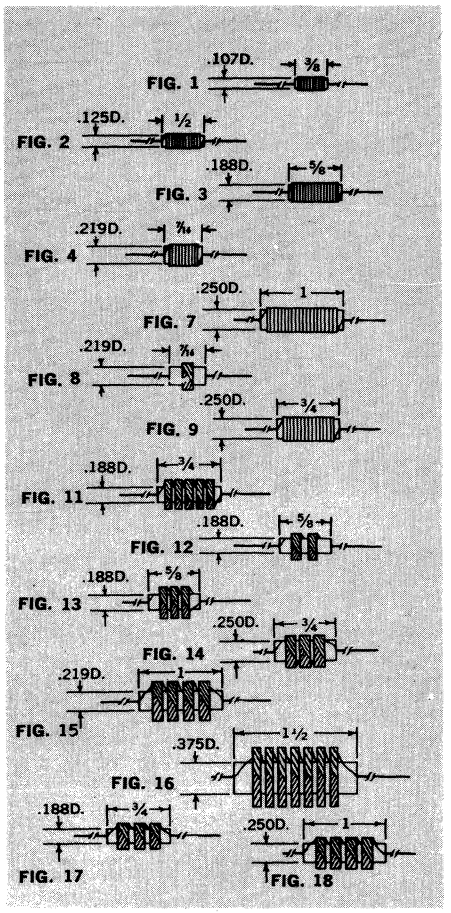
TYPICAL MILLEN INDUCTORS



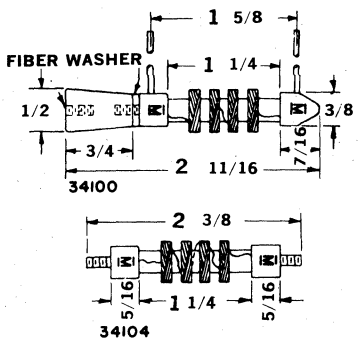
Part	Inductance Microhenries	Self Resonant Freq. Mc.	Fig. No.
34300-0.15	0.15 ± 10%	645 MC.	1
34300-0.22	0.22 ± 10%	510	1
34300-0.33	0.33 ± 10%	445	1
34300-0.47	0.47 ± 10%	375	2
34300-0.5	0.5 ± 10%	350	2
34300-0.68	0.68 ± 10%	300	2
34300-0.82	0.82 ± 10%	265	2
34300-1	1 ± 10%	175	4
34300-1.1	1.1 ± 10%	210	4
34300-1.2	1.2 ± 10%	210	3
34300-1.5	1.5 ± 5%	190	3
34300-1.8	1.8 ± 5%	171	3
34300-2.2	2.2 ± 5%	160	3
34300-2.5	2.5 ± 5%	140	3
34300-2.7	2.7 ± 5%	142	3
34300-3	3 ± 5%	132	3
34300-3.3	3.3 ± 5%	120	3
34300-3.9	3.9 ± 5%	118	3
34300-4.7	4.7 ± 5%	105	3
34300-5	5 ± 5%	85	3
34300-5.6	5.6 ± 5%	98	3
34300-6.2	6.2 ± 5%	90	7
34300-6.8	6.8 ± 5%	90	3
34300-8.2	8.2 ± 5%	81	3
34300-10	10 ± 5%	65	7

34300 SERIES INDUCTORS

Catalog Number	Inductance Microhenries	Self Resonant Freq. Mc.	Fig. No.
34300-12	12 ± 5%	65	3
34300-15	15 ± 5%	22	8
34300-18	18 ± 5%	22	8
34300-20	20 ± 5%	27	8
34300-22	22 ± 5%	46	9
34300-24	24 ± 5%	24	8
34300-25	25 ± 5%	26	8
34300-27	27 ± 5%	23	8
34300-30	30 ± 5%	15	8
34300-33	33 ± 5%	36	9
34300-36	36 ± 5%	35	9
34300-39	39 ± 5%	18	8
34300-47	47 ± 5%	18	8
34300-50	50 ± 5%	18	8
34300-56	56 ± 5%	28	9
34300-68	68 ± 5%	26	9
34300-75	75 ± 5%	12	8
34300-100	100 ± 5%	13	8
34300-120	120 ± 5%	12	8
34300-150	150 ± 5%	11	8
34300-180	180 ± 5%	9.8	8
34300-200	200 ± 5%	7.5	8
34300-220	220 ± 5%	12	11
34300-250	250 ± 5%	6.8	8
34300-270	270 ± 5%	11.9	11
34300-300	300 ± 5%	6	8
34300-330	330 ± 5%	8.5	17
34300-350	350 ± 5%	8	12
34300-470	470 ± 5%	7.6	13
34300-500	500 ± 5%	7.5	13
34300-750	750 ± 5%	5.8	14
34300-820	820 ± 5%	5.7	13
34300-1000	1000 ± 5%	4	12
34300-1200	1200 ± 5%	4.8	15
34300-1800	1800 ± 5%	2.6	16
34300-2200	2200 ± 5%	2.8	18
34300-2500	2500 ± 5%	2.7	18
34300-10000	10000 ± 5%	1.5	18

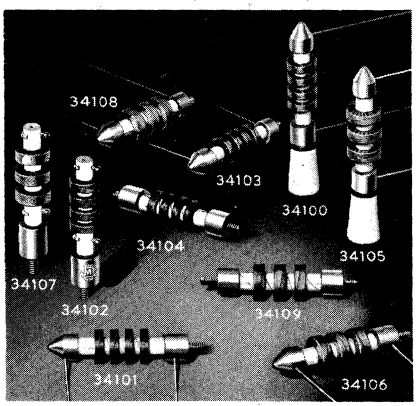


34100 SERIES R-F CHOKE COILS



Ceramic forms and insulators. Leads: #18 tinned solid wire, 2⅛" long. Mounting screws, 6-32 threaded x ¼" long.

Catalog Number	Inductance Millihenries	Maximum Current
34100	2.5	250 MA.
34101	2.5	250 MA.
34102	2.5	250 MA.
34103	2.5	250 MA.
34104	2.5	250 MA.
34105	1.0	300 MA.
34106	1.0	300 MA.
34107	1.0	300 MA.
34108	1.0	300 MA.
34109	1.0	300 MA.



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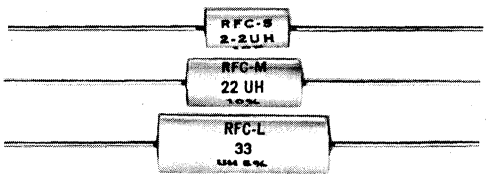
NYTRONICS, INC.
STANDARD COMPONENTS GROUP

INDUSTORS



S-M-L INDUCTORS — Non-shielded with inductance range 0.1 to 10,000uH. Designed to meet MIL-C-15305, Grade 1, Class B.
Molded Envelope: "S" Type — 0.188" diameter x 0.44" length
"M" Type — 0.25" diameter x 0.60" length
"L" Type — 0.31" diameter x 0.90" length.



DECI-DUCTOR — Subminiature with inductance range 0.1 to 1,000uH. Designed to MIL-C-15305, Grade 1, Class B.
Molded Envelope: 0.100" diameter x 0.250" length.



WEE-DUCTOR — Magnetically shielded with inductance range 0.1 to 180,000uH, designed to MIL-C-15305, Grade 1, Class B.
Encapsulated Envelope: 0.157" diameter x .450" length.



SUPER WEE-DUCTOR/90537 TYPE — Manufactured in accordance with MS90537, Molded Magnetically shielded with inductance range 0.1 to 100,000uH ±10% tolerance.
Molded Envelope: 0.163" diameter x 0.410" length.



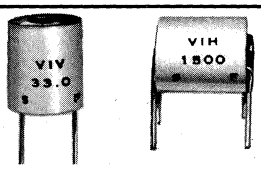
WEE WEE-DUCTOR — Magnetically shielded with inductance range 0.1 to 10,000uH. Designed to MIL-C-15305.
Encapsulated Envelope: 0.125" diameter x 0.335" length.



SUPER WEE-WEE-DUCTOR — Miniature shielded with inductance range 0.1uH to 10,000uH. Designed to MIL-C-15305, Grade 1, Class B.
Epoxy Molded Envelope: 0.125" diameter x 0.335" length.



WEE CHIP-INDUCTOR — Magnetically shielded wrap-around termination permitting contact to either face or ends. Designed to meet MIL-C-15305, Grade 2, Class B. .280" x .195" x .100". Presently available .15uH to 1,000uH.



VARIABLE INDUCTOR — Unshielded with adjustable range 0.1 to 4700uH. Designed to meet MIL-C-15305, Grade 1, Class B.
Encapsulated Envelope: 0.400" diameter x 0.500" length. Vertical or Horizontal mounting.



WEE V-L — Magnetically shielded adjustable range 0.1 to 100,000uH. Designed to MIL-C-15305, Grade 1, Class B.
Epoxy Molded 0.300" diameter x 0.400" length.



ADJUSTOROID — Adjustable toroid available in nominal values from 0.01Hy to 12Hy. This unit provides stepless adjustment in a completely hermetically sealed package.

FOR COMPLETE LINE OF THE ABOVE INDUCTORS—SEE CURRENT RADIO ELECTRONIC MASTER. ALSO CONTACT US FOR CERAMIC CAPACITORS; THIN FILM RESISTORS; AND DELAY LINES . . .

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NYTRONICS, INC.

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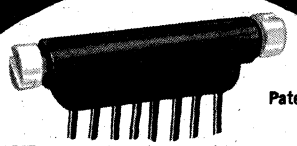
MICROELECTRONIC COILS

SPECIALISTS IN MICROELECTRONIC REACTIVE DEVICES



Patented

L AND I SERIES DEVICES—Types and electrical geometry dependent upon specific application. Frequency ranges from 100 kc to 200 mc. These devices are all custom designed to the specific circuit requirements. They are useful in standard f-m receivers, frequency deviating sensors, frequency locking circuits and related applications. They are also made in discriminator designs.



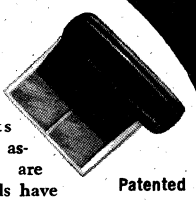


B SERIES INDUCTORS AND TRANSFORMERS—feature molded diallyl phthaldate case and high temperature delrin self locking screw. This is a well shielded, temperature stable device which has permitted 80% size reductions in conventional rf and if circuits and has better shielding and good temperature stability. Available electrical values from 7 nh - 7 mh.

Patented



P TYPE CHIP INDUCTORS—for use with hybrid circuits where automatic assembly techniques are employed. These coils have a gold-plated ceramic bonding pad for gap welding, soldering, hot chisel bonding, or ultrasonic welding. Both fixed and tunable designs available in values to 100 μh. Heights of .050 in. and .100 in. depending on electrical value.



Patented

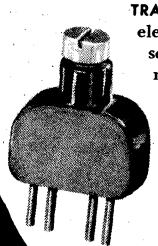


M SERIES CUSTOM DEVICES—These devices are made to the specific requirements of the customer. They may vary in size and shape from the stock items. Electrical parameters may be considerably different from standard items. Some applications of these items are: plasma physics experiments, absolute 0 applications and high temperature use.





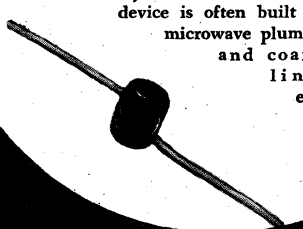
TT SERIES TUNABLE INDUCTORS AND TRANSFORMERS—offer the same electrical characteristics as the B series in a different mechanical geometry. It is designed for crowded printed circuit boards where top tuning is required. It meshes in between transistor cans for compact amplifier designs. This device is one-third the size of a TO-5 can.



Patented

ACTUAL SIZE

S SERIES MICROWAVE INDUCTOR—This device is used as a choke at frequencies in the 1 to 2 KMhz range. It is a low Q broadband choke with high current capability. It is only available in values of 25 nh and 35 nh. Special features are small size and very low insertion loss. The device is often built into microwave plumbing and coaxial lines, etc.





C AND G SERIES— ribbon leaded inductors are available in fixed and tunable versions with either silver plated copper ribbon or Kovar ribbon leads. These components are used in hybrid circuitry and subminiature modules. The tunable devices have a slide tuning mechanism that has reduced tuning time to ⅓ that of other approaches.



Patented

TYPICAL VALUES FOR B, C, P, and TT SERIES DEVICES

RANGE IN MICROHENRIES		Q MIN AT L MAX		DC res	I max	Fs	I (dc) for
L max	L min	Q	MCS	OHMS	MA.	MHz	5% Δ L max
0.1	0.05	45	25	0.1	100	700	No Change
0.22	0.11	40	25	0.22	100	480	No Change
0.47	0.24	40	25	0.5	70	320	No Change
1.0	0.5	35	7.9	1.2	50	150	No Change
2.2	1.1	30	7.9	3.6	50	75	No Change
4.7	2.4	30	7.9	4.7	50	50	No Change
10	5	25	7.9	6.0	50	24	No Change
22	10	25	2.5	9.5	50	10	40
47	22	20	2.5	14	50	7.5	34
100	47	20	2.5	20	30	5.5	27
220	100	20	.79	40	20	4.5	21
470	160	20	.79	70	15	4.0	15
1000	300	18	.79	150	9	1.8	13
2200	550	15	.25	330	7	1.2	9
4700	940	15	.25	600	6	.8	5
5800	1160	15	.25	800	5	.6	4

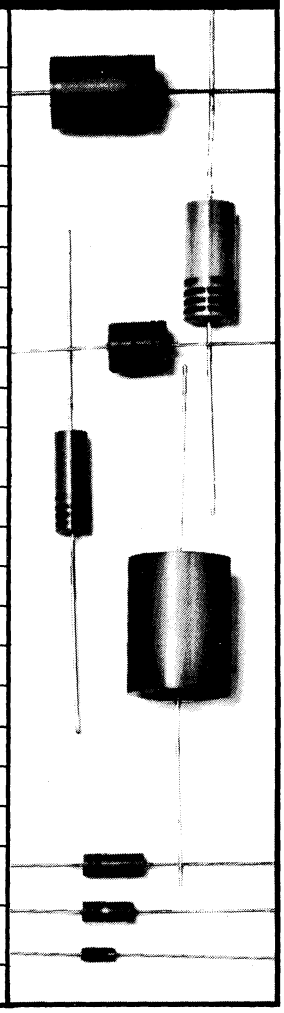
A new dimension in inductance is presented by a radically designed component with more features than the most reliable standard sized inductors available. These inductors have approximately one tenth the weight and size of other microelectronic inductors. The new design permits greater tuning range combined with smaller size in a more rugged construction. Advanced welding techniques permit welding the internal connections to provide extremely high reliability. Extremely large values of inductances which have not been obtainable in microminiature sizes are now available.

PICONICS Inc.
NO. BILLERICA, MASS. 01862
PHONE (617) 663-4862

STANWYCK

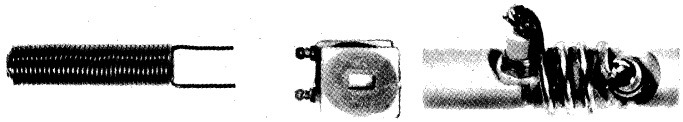
MOLDED INDUCTORS

STANWYCK SERIES	INDUCTANCE MICROHENRIES	NO. OF VALUES AVAILABLE	NOMINAL SIZE DIA. – LENGTH	NEW MS NUMBER	LT TYPE	OLD MS NUMBER	STYLE
1A1000M	0.15 to 1000	47	.095 x .240				AXIAL
20000M	0.15 to 1000	56	.156 x .375	MS-18130 MS-90538	LT4K074 to 099 LT10K001 to 021	MS-16225	AXIAL
30000M	0.10 to 10	37	.170 x .440				AXIAL
40000M	11. to 1000	48	.190 x .440	MS-90539	LT10K022 to 036		AXIAL
50000M	1000. to 10000	24	.240 x .740	MS-90541	LT10K050 to 060		AXIAL
60000M	1.1 to 12 1100. to 100000	13 15	.300 x .740 .300 x .740				AXIAL AXIAL
70000M	0.15 to 27	25	.170 x .440	MS-75008	LT4K027 to 051	MS-16224	AXIAL
80000M	1.2 to 120	25	.280 x .900	MS-91189	LT4K002 to 026	MS-16221	AXIAL
90000M	0.47 to 39 1100. to 3600	20 13	.215 x .560 .215 x .560	MS-90542 MS-90540	LT4K315 to 338 LT10K037 to 049	MS-16222	AXIAL AXIAL
A	47. to 150	7	.250 x .560	MS-75052	LT7K211 to 217	MS-16223	AXIAL
B	180. to 390	5	.310 x .560	MS-75053	LT7K218 to 222	MS-16223	AXIAL
C	470. to 1000	5	.375 x .625	MS-75054	LT7K223 to 227	MS-16223	AXIAL
D	1500. to 10000	5	.468 x .687	MS-75055	LT7K228 to 232	MS-16223	AXIAL
SWS	0.10 to 100	37	.170 x .440				AXIAL
SWM	1.0 to 1000	37	.240 x .590				AXIAL
SWL	1.0 to 10000	49	.280 x .900				AXIAL
DINK – Shielded	0.10 to 180000	76	.174 x .425				AXIAL
DKM – Shielded	0.10 to 1000	49	.125 x .335				AXIAL
SIV – Adjustable Vertical	0.10 to 4700	29	.400 x .500				PRINTED CIRCUIT
SIH – Adjustable Horizontal	0.10 to 4700	29	.400 x .500				PRINTED CIRCUIT
SSD – Shielded	0.10 to 100000	73	.157 x .395	MS-90537	LT4K242 to 314		AXIAL

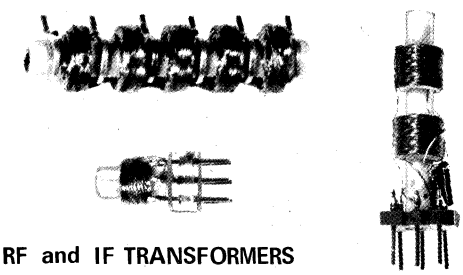


CUSTOM DESIGN

In addition to the comprehensive inductor line, Stanwyck offers the electronic design engineer a variety of special custom design electronic components. Illustrated in this section are examples of Stanwyck capabilities along these lines.



RELAY BOBBIN COILS, HASH CHOKES



RF and IF TRANSFORMERS

The engineering staff at Stanwyck is supported by one of the most modern and fully equipped environmental test laboratories in the industry. Extensive product life testing plus rigid quality control standards result in superior custom design electronic components.

SEND FOR FREE CATALOG

STANWYCK WINDING DIVISION
SAN FERNANDO ELECTRIC MANUFACTURING CO., INC.
137 WALSH AVE., NEWBURGH, NEW YORK 12550
Phone (914) 561-3360 New York City (212) 732-6282

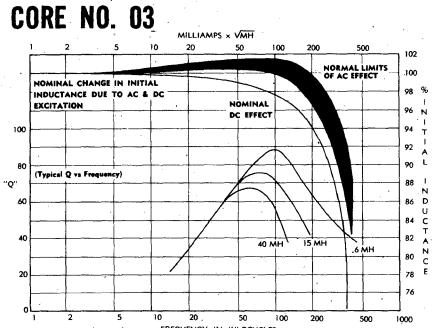
TOROTEL INC.

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030

PHONE: 816 SO 1-6314 TWX-910-777-7037

- OFFERING THE MOST COMPLETE LINE OF TOROIDAL INDUCTORS AVAILABLE FROM STOCK FOR 24 HOUR DELIVERY.
- PLASTIC MOLDED ("P" SERIES) INDUCTORS ARE MANUFACTURED TO MIL-T27B, GRADE 5, CLASS S, LIFE EXPECTANCY X.
- METAL ENCASED ("M" SERIES) ARE MANUFACTURED TO MIL-T-27B, GRADE 4, CLASS R, LIFE EXPECTANCY X.
- STANDARD INDUCTANCE TOLERANCE: ±1%.
- TEMPERATURE STABILITY: ±1% from −55°C to +100°C.

CORE NO. 03



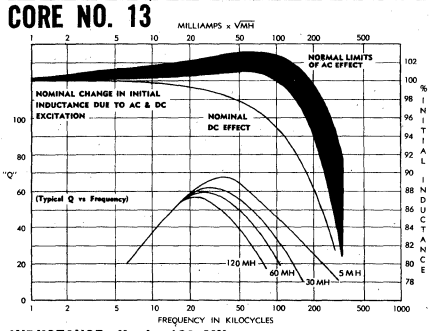
INDUCTANCE: Up to 250 MH.
FREQUENCIES: Up to 50 KHz.
TYPICAL DCR: 1.5 Ohms/MH.

DIMENSIONS

Type	Case	A	B	C	D
P03	Style 1	.285	.450	.300	.025
M03	Style 5	.385	.448	.200	.020

STANDARD INDUCTANCE VALUES (MH)	
1.0	15.0
1.25	17.5
1.5	20.0
1.75	24.0
2.0	30.0
2.4	36.0
2.5	43.0
3.0	50.0
3.6	60.0
4.3	72.0
5.0	75.0
6.0	86.0
7.2	100.0
7.5	120.0
8.0	150.0
8.6	175.0
10.0	178.0
12.0	200.0
12.5	250.0

CORE NO. 13



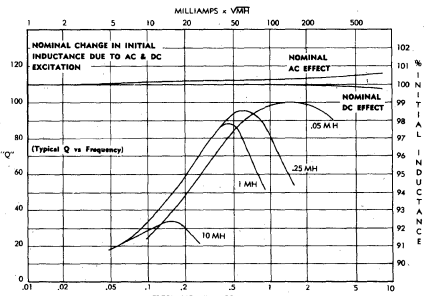
INDUCTANCE: Up to 100 MH.
FREQUENCIES: 10 to 200 KHz.
TYPICAL DCR: 3 Ohms/MH.

DIMENSIONS

Type	Case	A	B	C	D
P13	Style 1	.285	.450	.300	.025
M13	Style 5	.385	.448	.200	.020

STANDARD INDUCTANCE VALUES (MH)	
.50	8.6
.60	10.0
.72	12.0
.86	15.0
1.0	17.5
1.25	20.0
1.5	24.0
1.75	25.0
2.0	30.0
2.4	36.0
2.5	40.0
3.0	43.0
3.6	50.0
4.3	60.0
5.0	72.0
6.0	86.0
7.2	100.0

CORE NO. 29



INDUCTANCE: Up to 15 MH.
FREQUENCIES: 50 KHz-5 MHz.
TYPICAL DCR: 20 Ohms/MH.

DIMENSIONS

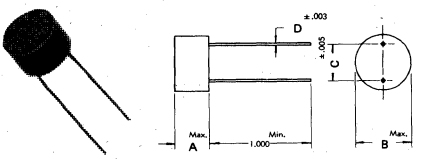
Type	Case	A	B	C	D
P29	Style 1	.285	.450	.300	.025
M29	Style 5	.385	.448	.200	.020

STANDARD INDUCTANCE VALUES (MH)			
.05	.200	.750	3.00
.06	.240	.860	3.60
.072	.250	1.00	4.00
.075	.300	1.20	4.30
.086	.360	1.25	5.00
.100	.400	1.50	6.00
.120	.430	1.75	7.20
.125	.500	2.00	7.50
.150	.600	2.40	8.60
.175	.720	2.50	10.0

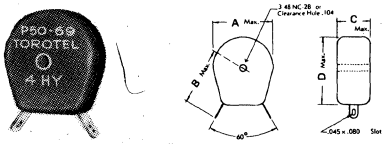
STANDARD CASE STYLES

SEE DIMENSION TABLES UNDER CORE TYPES

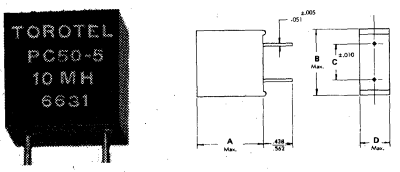
EPOXY ENCAPSULATED TYPES P03, P13, P29, PS50 & PS51



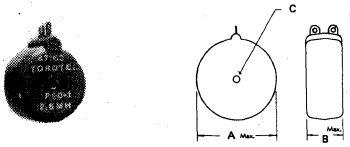
COMPRESSION MOLDED TYPES P50, P51



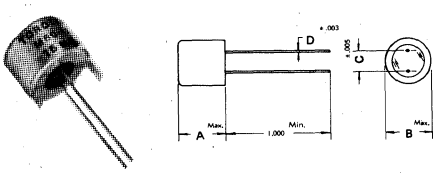
EPOXY ENCASED TYPES PC50, PC51, PC06, PC48



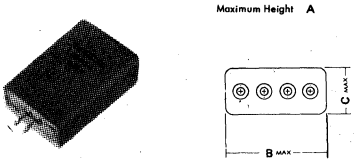
COMPRESSION MOLDED TYPES P90, P89, P06, P48, P30, & P84



HERMETIC SEALED TYPES M03, M13, M29, M50, M51, & M53



HERMETIC SEALED TYPES M90, M89, M06, M48, M30, & M84



STANDARD MOUNTING PROVISIONS VARY. SEE SPECIFICATIONS UNDER CORE NUMBERS.

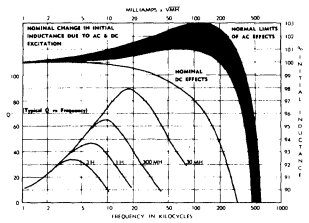
ALL CORE TYPES ALSO AVAILABLE IN "U SERIES" UNCASED UNITS.

TOROTEL INC

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030

PHONE: 816 SO 1-6314 TWX-910-777-7037

CORE NO. 50



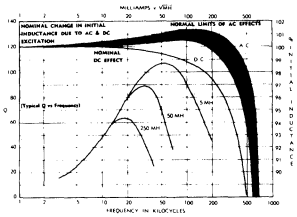
STANDARD INDUCTANCE VALUES		
1.0 MH	40. MH	430. MH
2.5 MH	43. MH	500. MH
5.0 MH	50. MH	600. MH
6.0 MH	60. MH	720. MH
7.2 MH	72. MH	750. MH
7.5 MH	75. MH	860. MH
8.6 MH	86. MH	1.0 HY
10.0 MH	100. MH	1.2 HY
12. MH	120. MH	1.25 HY
12.5 MH	125. MH	1.5 HY
15. MH	150. MH	1.75 HY
17.5 MH	175. MH	2.0 HY
20. MH	200. MH	2.4 HY
24. MH	240. MH	2.5 HY
25. MH	250. MH	3.0 HY
30. MH	300. MH	3.6 HY
36. MH	360. MH	4. HY
	400. MH	

MAXIMUM INDUCTANCE: 4.5 Hy.
FREQUENCY RANGE: Up to 20 KHz.
TYPICAL DCR: 500 Ohms/Hy.

DIMENSIONS

TYPE	CASE	A	B	C	D
P50	Style 2	.693	.640	.380	.743
PS50	Style 1	.438	.680	.150	.031
PC50	Style 3	.743	.743	.500	.350
M50	Style 5	.438	.680	.150	.031

CORE NO. 51



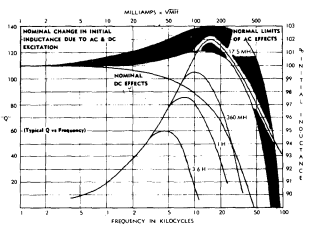
STANDARD INDUCTANCE VALUES		
1.0 MH	8.6 MH	72. MH
1.2 MH	10. MH	86. MH
1.5 MH	12. MH	100. MH
1.75 MH	15. MH	120. MH
2.0 MH	17.5 MH	150. MH
2.4 MH	20. MH	175. MH
3.0 MH	24. MH	200. MH
3.6 MH	30. MH	240. MH
4.3 MH	36. MH	300. MH
5.0 MH	43. MH	360. MH
6.0 MH	50. MH	430. MH
7.2 MH	60. MH	500. MH

MAXIMUM INDUCTANCE: 1 Hy.
FREQUENCY RANGE: 10 KHz to 100 KHz.
TYPICAL DCR: 1 Ohm/MH.

DIMENSIONS

TYPE	CASE	A	B	C	D
P51	Style 2	.693	.640	.380	.743
PS51	Style 1	.438	.680	.150	.031
PC51	Style 3	.743	.743	.500	.350
M51	Style 5	.438	.680	.150	.031

CORE NO. 90



STANDARD INDUCTANCE VALUES		
3.0 MH	40. MH	430. MH
3.6 MH	43. MH	500. MH
4.0 MH	50. MH	600. MH
4.3 MH	60. MH	720. MH
5.0 MH	75. MH	860. MH
7.2 MH	86. MH	1.0 HY
7.5 MH	100. MH	1.2 HY
8.6 MH	120. MH	1.25 HY
10.0 MH	125. MH	1.5 HY
12.0 MH	150. MH	1.75 HY
12.5 MH	175. MH	2.0 HY
15.0 MH	200. MH	2.4 HY
20. MH	250. MH	3.0 HY
24. MH	300. MH	3.6 HY
25. MH	360. MH	4.0 HY
30. MH	400. MH	5.0 HY
36. MH		6.0 HY

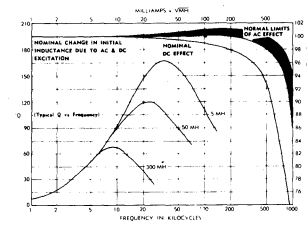
MAXIMUM INDUCTANCE: 9 Hy.
FREQUENCY RANGE: To 20 KHz.
TYPICAL DCR: 300 Ohms/Hy.

DIMENSIONS

TYPE	CASE	A	B	C
P90	Style 4	.875	.453	6-32 thd.
M90	Style 6	1.093	.938	.516

TYPE M90 MTG: 2 4-40 x .156 INSERTS

CORE NO. 89



STANDARD INDUCTANCE VALUES		
1.5 MH	12.0 MH	100. MH
1.75 MH	15.0 MH	120. MH
2.0 MH	17.5 MH	150. MH
2.4 MH	20. MH	175. MH
3.0 MH	24. MH	200. MH
3.6 MH	30. MH	240. MH
4.3 MH	36. MH	300. MH
5.0 MH	43. MH	360. MH
6.0 MH	50. MH	430. MH
7.2 MH	60. MH	500. MH
8.6 MH	72. MH	600. MH
10.0 MH	86. MH	

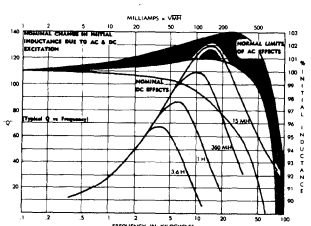
MAXIMUM INDUCTANCE: 1.5 Hy.
FREQUENCY RANGE: To 100 KHz.
TYPICAL DCR: 700 hms/Hy.

DIMENSIONS

TYPE	CASE	A	B	C
P89	Style 4	.875	.453	6-32 thd.
M89	Style 6	1.093	.938	.516

TYPE M89 MTG.: 2 4-40 x .156 INSERTS

CORE NO. 06



STANDARD INDUCTANCE VALUES		
5.0 MH	60. MH	720. MH
6.0 MH	72. MH	750. MH
7.2 MH	75. MH	860. MH
7.5 MH	86. MH	1.0 HY
8.6 MH	100. MH	1.2 HY
10. MH	120. MH	1.25 HY
12. MH	125. MH	1.5 HY
12.5 MH	150. MH	1.75 HY
15. MH	175. MH	2.0 HY
17.5 MH	200. MH	2.4 HY
20. MH	240. MH	2.5 HY
24. MH	250. MH	3.0 HY
25. MH	300. MH	3.6 HY
30. MH	360. MH	4.3 HY
36. MH	400. MH	5.0 HY
40. MH	430. MH	6.0 HY
43. MH	500. MH	7.2 HY
50. MH	600. MH	

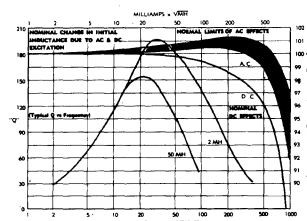
MAXIMUM INDUCTANCE: 7.2 Hy.
FREQUENCY RANGE: To 20 KHz.
TYPICAL DCR: 210 Ohms/Hy.

DIMENSIONS

TYPE	CASE	A	B	C
M06	Style 6	1.250	1.078	.516
P06	Style 4	1.068	.505	6-32 thd.

TYPE M06 MTG.: 2 4-40 x .188 INSERTS

CORE NO. 48



STANDARD INDUCTANCE VALUES		
2.0 MH	15. MH	100. MH
2.4 MH	17.5 MH	120. MH
3.0 MH	20. MH	150. MH
3.6 MH	24. MH	175. MH
4.3 MH	30. MH	200. MH
5.0 MH	36. MH	240. MH
6.0 MH	43. MH	300. MH
7.2 MH	50. MH	360. MH
8.6 MH	60. MH	430. MH
10. MH	72. MH	500. MH
12. MH	86. MH	600. MH

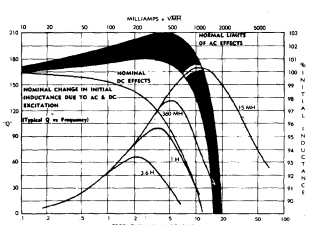
MAXIMUM INDUCTANCE: 1 Hy.
FREQUENCY RANGE: To 100 KHz.
TYPICAL DCR: 420 Ohms/Hy.

DIMENSIONS

TYPE	CASE	A	B	C
P48	Style 4	1.068	.505	6-32 thd.
M48	Style 6	1.250	1.078	.516

TYPE M48 MTG.: 2 4-40 x .188 INSERTS

CORE NO. 30



STANDARD INDUCTANCE VALUES		
5.0 MH	75. MH	1.25 HY
6.0 MH	86. MH	1.5 HY
7.2 MH	100. MH	1.75 HY
7.5 MH	120. MH	2.0 HY
8.6 MH	125. MH	2.4 HY
10. MH	150. MH	2.5 HY
12. MH	175. MH	3.0 HY
12.5 MH	200. MH	3.6 HY
15. MH	240. MH	4.0 HY
17.5 MH	250. MH	4.3 HY
20. MH	300. MH	5.0 HY
24. MH	360. MH	6.0 HY
25. MH	400. MH	7.2 HY
30. MH	430. MH	7.5 HY
36. MH	500. MH	8.6 HY
40. MH	600. MH	10.0 HY
43. MH	720. MH	12.0 HY
50. MH	750. MH	12.5 HY
60. MH	860. MH	15.0 HY
72. MH	1.0 HY	17.5 HY
	1.2 HY	

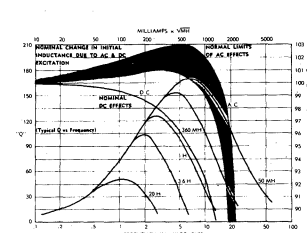
MAXIMUM INDUCTANCE: 17.5 Hy.
FREQUENCY RANGE: To 20 KHz.
TYPICAL DCR: 105 Ohms/Hy.

DIMENSIONS

TYPE	CASE	A	B	C
P30	Style 4	1.318	.724	6-32 thd.
M30	Style 6	1.750	1.297	.719

TYPE M30 MTG.: 2 4-40 x .188 INSERTS

CORE NO. 84



STANDARD INDUCTANCE VALUES		
5.0 MH	86. MH	1.25 HY
6.0 MH	100. MH	1.5 HY
7.2 MH	120. MH	1.75 HY
7.5 MH	125. MH	2.0 HY
8.5 MH	150. MH	2.4 HY
10. MH	175. MH	2.5 HY
12. MH	200. MH	3.0 HY
12.5 MH	240. MH	3.6 HY
15. MH	250. MH	4.0 HY
17.5 MH	300. MH	4.3 HY
20. MH	360. MH	5.0 HY
24. MH	400. MH	6.0 HY
25. MH	430. MH	7.2 HY
30. MH	500. MH	7.5 HY
36. MH	600. MH	8.6 HY
40. MH	720. MH	10.0 HY
43. MH	750. MH	12.0 HY
50. MH	860. MH	12.5 HY
60. MH	1.0 HY	15.0 HY
72. MH	1.2 HY	17.5 HY
75. MH		20.0 HY

MAXIMUM INDUCTANCE: 25 Hy.
FREQUENCY RANGE: To 12 KHz.
TYPICAL DCR: 75 Ohms/Hy.

DIMENSIONS

TYPE	CASE	A	B	C
P84	Style 4	1.730	.755	8-32 thd.
M84	Style 6	2.281	1.906	.563

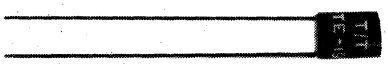
M84 MTG.: 4 6-32 x .375 STUDS

TOROTEL INC.

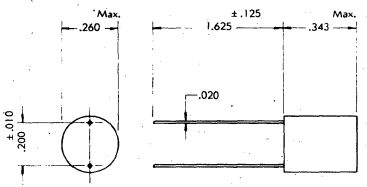
13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030

PHONE: 816 SO 1-6314 TWX-910-777-7037

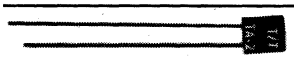
MINI-L ENCAPSULATED R.F. INDUCTORS — TE SERIES



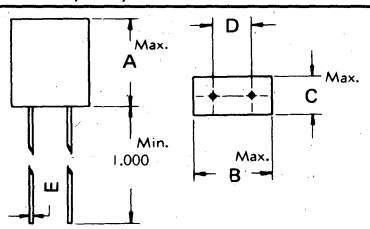
- DESIGNED TO MEET MIL-C-15305 C, GRADE 1 CLASS B (−55°C to +125°C).
- INDUCTANCE VALUES: 0.10 mh to 220.0 mh.
- FREQUENCY RANGE: 25 KHz to 2.5 MHz.
- DIELECTRIC WITHSTANDING VOLTAGE: 500 volts rms.
- RATED TEMPERATURE RISE: 35°C at an ambient temperature of 90°C.
- LEADS: Tinned Copper. Weldable leads available by special order.



MINI-L ENCAPSULATED R.F. INDUCTORS — TA, TB, TD & TF SERIES



- DESIGNED TO MEET THE REQUIREMENTS OF MIL-C-15305 C, GRADE 1, CLASS B (−55°C to +125°C).
- DIELECTRIC WITHSTANDING VOLTAGE: 700 volts rms.
- RATED TEMPERATURE RISE: 35°C at an ambient temperature of 90°C.
- LEADS: Tinned Copper. Weldable leads available by special order.



DIMENSIONS

Series	A	B	C	D	E	Max. Power
TA	.225	.210	.110	.100	.020	0.2 Watt
TB	.300	.280	.160	.200	.025	0.33 Watt
TD	.390	.390	.197	.200	.025	0.5 Watt
TF	.225	.210	.110	.100	.020	0.2 Watt

TA SERIES

- MIN. "Q": 60 to 70.
- INDUCTANCE RANGE: .1 to 10 uh.
- FREQUENCY RANGE: 1 to 50 mcs.
- INDUCTANCE TOLERANCES: Less than 1.0 uh, ±10%. Greater than or equal to 1.0 uh, ±5%. Closer tolerances available by special request.
- INDUCTANCE TC: +50 PPM/°C maximum.
- MAXIMUM POWER DISSIPATION: 0.2 watt.

TF SERIES

- MIN. "Q": 60 to 80.
- FREQUENCY RANGE: 20 to 300 mcs.
- INDUCTANCE RANGE: .01 to 1 uh.
- INDUCTANCE TOLERANCES: Less than 0.1 uh, ±20%. Greater than or equal to 0.1 uh, ±10%. Closer tolerances available by special request.
- INDUCTANCE TC: +200 PPM/°C maximum.
- MAXIMUM POWER DISSIPATION: 0.2 watt.

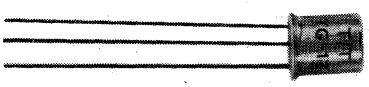
TD SERIES

- MIN. "Q": 40 to 30.
- INDUCTANCE RANGE: 100 to 10,000 uh.
- RECOMMENDED FREQUENCY RANGE: 50 kcs to 10 mcs.
- INDUCTANCE TOLERANCE: ±5%. Closer tolerances available by special request.
- INDUCTANCE TC: From +60 PPM/°C maximum to +300 PPM/°C, maximum, depending upon inductance value.
- MAXIMUM POWER DISSIPATION: .50 watt.

TB SERIES

- MIN. "Q": 50 to 80.
- RECOMMENDED FREQUENCY RANGE: 50 kcs to 35 mcs.
- INDUCTANCE RANGE: 10 to 1000 uh.
- INDUCTANCE TOLERANCE: ±5%. Closer tolerances available by special request.
- INDUCTANCE TC: From +60 PPM°/C maximum to +300 PPM/°C maximum, depending upon inductance value.
- MAXIMUM POWER DISSIPATION: .33 watt.

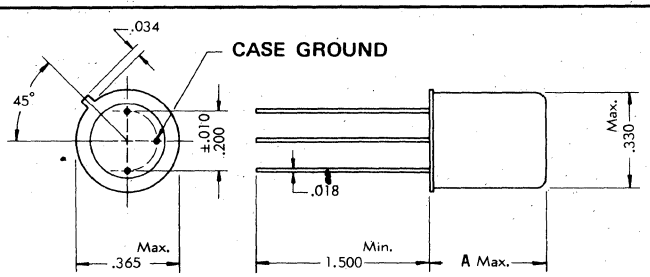
MINI-L HERMETICALLY SEALED R.F. INDUCTORS — TG & TH SERIES



- HERMETICALLY SEALED, HIGH "Q" INDUCTOR IN A T-05 TRANSISTOR CONFIGURATION.
- LOW EXTERNAL MAGNETIC AND ELECTROSTATIC FIELD.
- AMBIENT TEMPERATURE RANGE: −55°C to +85°C.
- DIELECTRIC WITHSTANDING VOLTAGE: 100 volts rms.
- INSULATION RESISTANCE: 10,000 meg. ohms Min.

TG SERIES

- DESIGNED TO MEET THE REQUIREMENTS OF MIL-T-27B, GRADE 4, CLASS R.
- FREQUENCY RANGE: 10 to 500 KHz.
- INDUCTANCE RANGE: 1 to 500 mh.
- INDUCTANCE TOLERANCES: ±5%.
- INDUCTANCE STABILITY: ±2% (−20°C to +85°C).



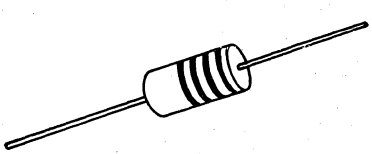
DIMENSIONS

Series	A
TG	.390
TH	.350

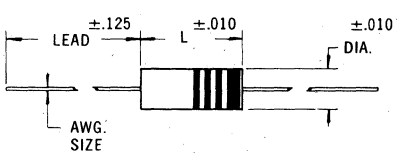
TH SERIES

- DESIGNED TO MEET THE REQUIREMENTS OF MIL-C-15305C, GRADE 1, CLASS 0.
- FREQUENCY RANGE: 100 KHz to 10 MHz.
- INDUCTANCE RANGE: 10 to 1000.
- INDUCTANCE TOLERANCES: 10 uh through 33 uh ±10%, 39 uh through 130 uh ±5%, greater than and including 150 uh ±3%.
- INDUCTANCE STABILITY: ±2% (−20°C to +85°C).

MOLDED R.F. CHOKES



- DESIGNED TO MEET MIL-C-15305C, GRADE 1, CLASS B.
- EPOXY MOLDED FOR HIGH RELIABILITY. EXCELLENT RESISTANCE TO IMMERSION, MOISTURE RESISTANCE, VIBRATION AND SHOCK TESTS.



- OPERATING TEMPERATURE EXTREMES FROM −55°C TO 125°C (35°C RISE AT 90°C AMBIENT.
- OPERATION TO ALTITUDES OF 70,000 FEET.
- COLOR CODED PER MIL-C-15305C.
- TINNED COPPER LEADS. WELDABLE LEADS AVAILABLE UPON REQUEST.

Series	Inductance Range (uh)	Power Rating (W)	D	L	AWG Size
RA	.15-1000	.17	.095	.250	24
RB	.15-240	.25	.155	.375	22
*SB	.10-100000	.25	.157	.395 ±.020	22
RC	270-1000	.25	.190	.440	22
RD	1100-3600	.40	.215	.560	22
RF	3900-10000	.45	.240	.740	20
RG	47-150	.30	.250	.560	22
RH	1.2-120	.33	.280	.900	21
RJ	180-390	.40	.310	.560	21
RK	470-1000	.45	.375	.625	21
RL	1500-10000	.55	.468	.687	21

*SHIELDED INDUCTOR

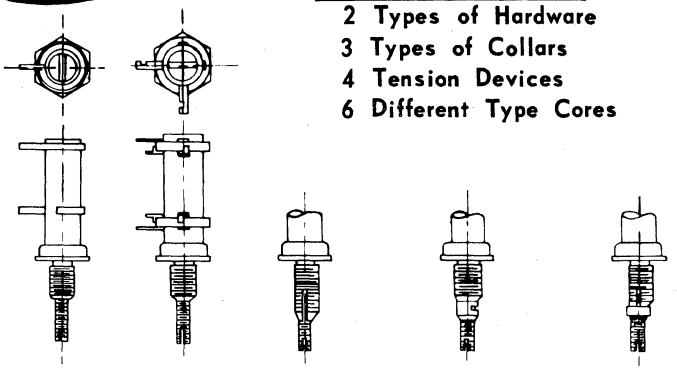
LEAD LENGTH: 1.44 inches on all series except RA. 1.50 inches on RA series.

ELECTRONIC ASSEMBLIES

unipco — UNITED PRODUCTS COMPANY

CERAMIC COIL FORMS

2 Types of Hardware
3 Types of Collars
4 Tension Devices
6 Different Type Cores



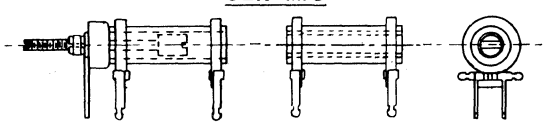
PB-TYPE (Jam Nut) CN-TYPE (Compression Nut) CS-TYPE (Compression Spring) CT-TYPE (Constant Tension)*

Basic Part No.	No. Collars	Lugs Per Collar	Total Lugs	A	B	C	D	E	F Dimension PB	F Dimension CN	F Dimension CS	F Dimension CT	Size of Hex
AY-4124	2	2	4	.205	19/32	23/64	1/64	9/32	1/4	21/64	1/4	1/4	1/4
" -4122	2	1	2	"	"	"	"	"	"	"	"	"	"
AY-3624	2	2	4	.260	27/32	9/16	1/32	15/32	5/16	13/32	9/32	5/16	3/8
" -3622	2	1	2	"	"	"	"	"	"	"	"	"	"
AY-2524	2	2	4	.375	1 1/16	23/32	1/32	5/8	5/16	27/64	9/32	5/16	1/2
" -2522	2	1	2	"	"	"	"	"	"	"	"	"	"
AY-1724	2	2	4	.500	11/16	1 1/8	1/32	11/32	5/16	29/64	5/16	5/16	5/8
" -1722	2	1	2	"	"	"	"	"	"	"	"	"	"

*Pat 2,899,220

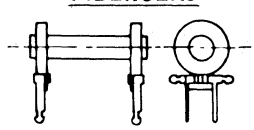
PRINTED CIRCUIT – HORIZONTAL MOUNT

CERAMIC



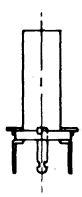
AY - 1112 AY - 1134

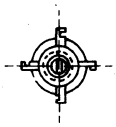
FIBERGLAS



AY - 1203

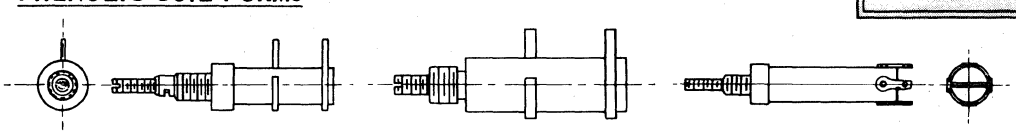
VERTICAL MOUNT





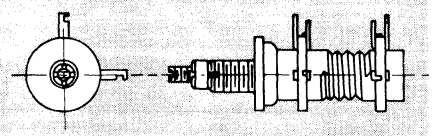
CERAMIC	FIBERGLAS	PHENOLIC
AY - 1140	AY - 1204	AY - 1142

PHENOLIC COIL FORMS



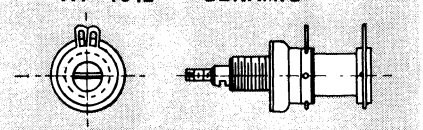
AY - 1065 AY - 1064 AY - 1066

THREADED COIL FORMS

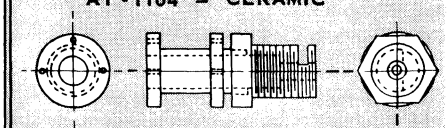


AY - 1071 - 3 – 3 turns at 12 T.P.I.
AY - 1071 - 5 – 5 turns at 16 T.P.I.
AY - 1071 - 7 – 7 turns at 18 T.P.I.

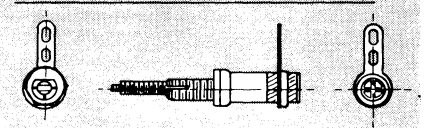
AY - 1042 – CERAMIC



AY - 1164 – CERAMIC

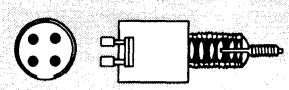


CAPACITORS, (Piston / Ceramic)



AY - 1041 - 1 0.5 – 4.5 uufd.
AY - 1041 - 2 1.5 – 12.5 uufd.
AY - 1036 - 1 1.0 – 8.0 uufd.
AY - 1036 - 2 3.0 – 25.0 uufd.

SHIELDED COIL FORMS



AY - 1070

UNIPCO SERVICES

1. Coil Forms – All types
2. Resistor Bobbins
3. Metallizing
4. Microwave Loads
5. Terminal Boards
6. Precision Machining ●

● Castings
● Hydraulics
● Microwave Hardware
● Plastics
● Servo Components

GASKETS

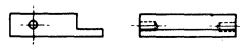


CONES & PYRAMIDS

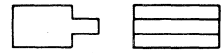


MICROWAVE ABSORBERS

L - TYPES



T - TYPE



unipco — UNITED PRODUCTS COMPANY

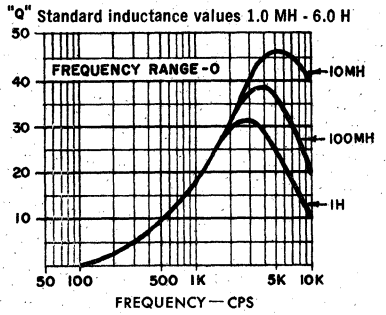
UNITED PRODUCTS COMPANY

451 S. JEFFERSON ST. • ORANGE, NEW JERSEY 07050

TORWICO ELECTRONICS TOROIDAL INDUCTORS

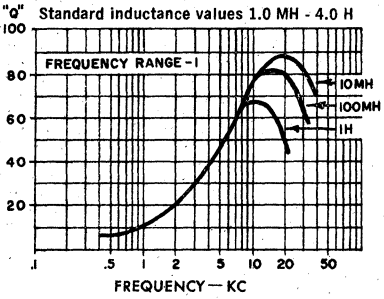
TWC Series

"Q" Standard inductance values 1.0 MH - 6.0 H



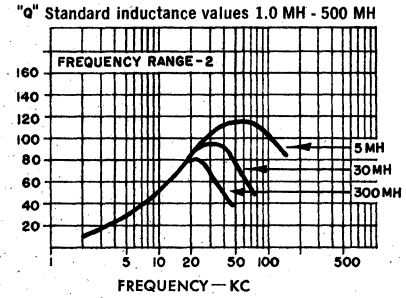
A. DC resistance (nominal) = 280 ohms/henry
B. DC current (ma) for 5% decrease in L = 135
C. Maximum AC current (ma) = 372 $\sqrt{mh}$ / $\sqrt{mh}$

"Q" Standard inductance values 1.0 MH - 4.0 H

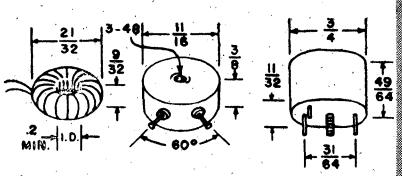


A. DC resistance (nominal) = 520 ohms/henry
B. DC current (ma) 5% decrease in L = 210
C. Maximum AC current (ma) = 424 $\sqrt{mh}$ / $\sqrt{mh}$

"Q" Standard inductance values 1.0 MH - 500 MH

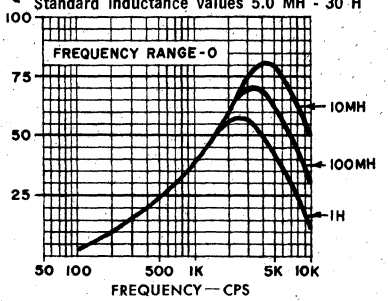


A. DC resistance (nominal) = 1100 ohms/henry
B. DC current (ma) for 5% decrease in L = 340
C. Maximum AC current (ma) = 453 $\sqrt{mh}$ / $\sqrt{mh}$



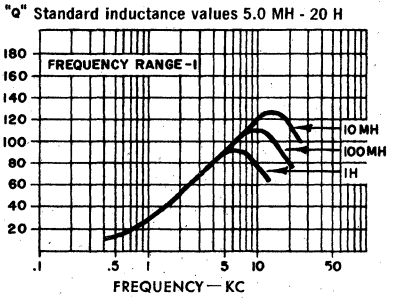
TWS Series

"Q" Standard inductance values 5.0 MH - 30 H



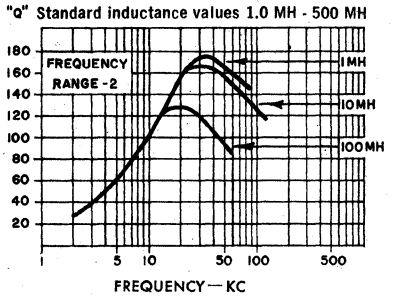
A. DC resistance (nominal) = 135 ohms/henry
B. DC current (ma) for 5% decrease in L = 320
C. Maximum AC current (ma) = 708 $\sqrt{mh}$ / $\sqrt{mh}$

"Q" Standard inductance values 5.0 MH - 20 H

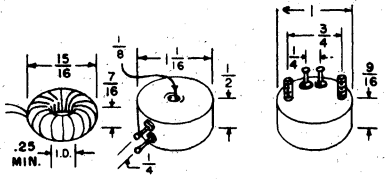


A. DC resistance (nominal) = 255 ohms/henry
B. DC current (ma) for 5% decrease in L = 380
C. Maximum AC current (ma) = 790 $\sqrt{mh}$ / $\sqrt{mh}$

"Q" Standard inductance values 1.0 MH - 500 MH

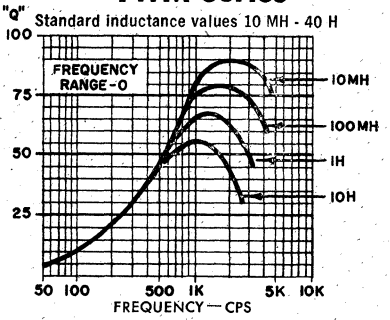


A. DC resistance (nominal) = 630 ohms/henry
B. DC current (ma) for 5% decrease in L = 420
C. Maximum AC current (ma) = 822 $\sqrt{mh}$ / $\sqrt{mh}$



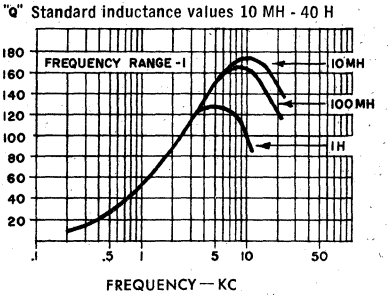
TWM Series

"Q" Standard inductance values 10 MH - 40 H



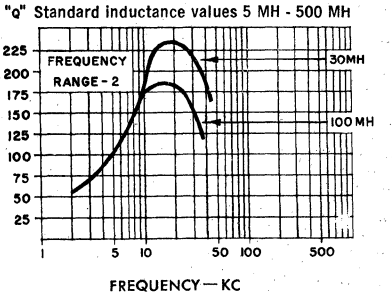
A. DC resistance (nominal) = 60 ohms/henry
B. DC current (ma) for 5% decrease in L = 500
C. Maximum AC current (ma) = 1300 $\sqrt{mh}$ / $\sqrt{mh}$

"Q" Standard inductance values 10 MH - 40 H

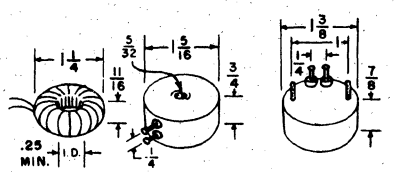


A. DC resistance (nominal) = 115 ohms/henry
B. DC current (ma) for 5% decrease in L = 550
C. Maximum AC current (ma) = 1415 $\sqrt{mh}$ / $\sqrt{mh}$

"Q" Standard inductance values 5 MH - 500 MH



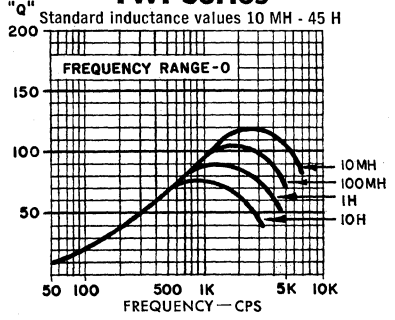
A. DC resistance (nominal) = 250 ohms/henry
B. DC current (ma) for 5% decrease in L = 880
C. Maximum AC current (ma) = 1548 $\sqrt{mh}$ / $\sqrt{mh}$



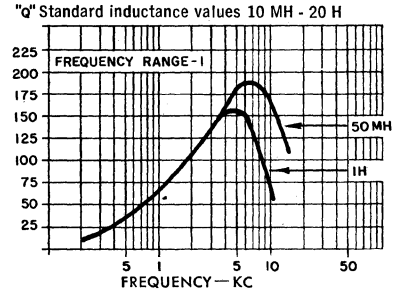
TORWICO ELECTRONICS INC. LAKEWOOD, N.J.

TORWICO ELECTRONICS — TOROIDAL INDUCTORS

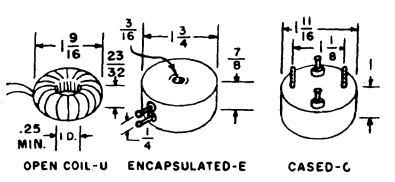
TWI Series



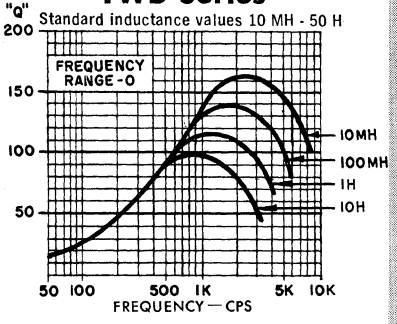
A. DC resistance (nominal) = 45 ohms/henry
B. DC current (ma) for 5% decrease in L = $\frac{715}{\sqrt{mh}}$
C. Maximum AC current (ma) = $\frac{1500}{\sqrt{mh}}$ $\sqrt{mh}$



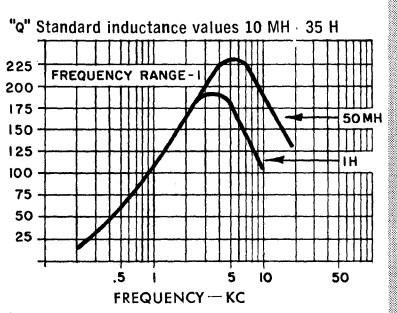
A. DC resistance (nominal) = 94 ohms/henry
B. DC current (ma) for 5% decrease in L = $\frac{900}{\sqrt{mh}}$
C. Maximum AC current (ma) = $\frac{1644}{\sqrt{mh}}$ $\sqrt{mh}$



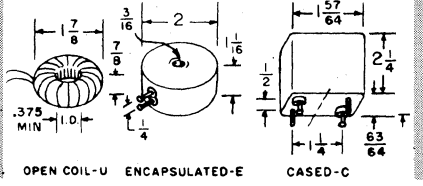
TWD Series



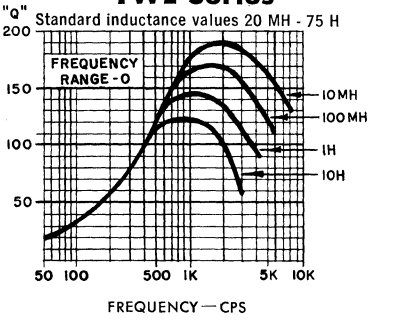
A. DC resistance (nominal) = 27 ohms/henry
B. DC current (ma) for 5% decrease in L = $\frac{1100}{\sqrt{mh}}$
C. Maximum AC current (ma) = $\frac{2000}{\sqrt{mh}}$ $\sqrt{mh}$



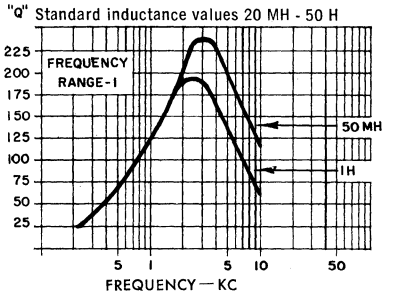
A. DC resistance (nominal) = 54 ohms/henry
B. DC current (ma) for 5% decrease in L = $\frac{1200}{\sqrt{mh}}$
C. Maximum AC current (ma) = $\frac{2264}{\sqrt{mh}}$ $\sqrt{mh}$



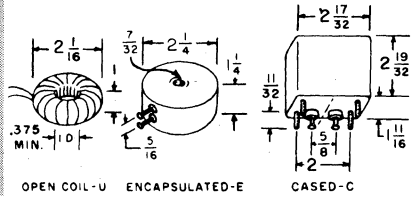
TWL Series



A. DC resistance (nominal) = 21 ohms/henry
B. DC current (ma) for 5% decrease in L = $\frac{1450}{\sqrt{mh}}$
C. Maximum AC current (ma) = $\frac{3100}{\sqrt{mh}}$ $\sqrt{mh}$



A. DC resistance (nominal) = 35 ohms/henry
B. DC current (ma) for 5% decrease in L = $\frac{1700}{\sqrt{mh}}$
C. Maximum AC current (ma) = $\frac{3290}{\sqrt{mh}}$ $\sqrt{mh}$



HOW TO ORDER

Order these standard inductors by their part number.
Example: **TWC100MHOE**

TWC	100MH	0	E
(1)	(2)	(3)	(4)

(1) Size: TWC, TWS, TWM, TWI, TWD, TWL

(2) Inductance:

Use MH—for millihenry designation below 1.0 henry
H—for henries above 1.0 henry

(3) Frequency Range: 0, 1, 2

(4) Packaging: U—Open Coil E—Encapsulated C—Steel Cased

GENERAL SPECIFICATIONS

Tolerance—The tolerance on standard inductors is ± 1%

Test Level—Standard inductors are adjusted at 1.0 volts, 1000 cps

Maximum Voltage—The maximum voltage across standard inductors shall be 115 VRMS

Insulation Resistance—10,000 megohms minimum, except for open coil versions which shall be 1,000 megohms minimum

Standard Torwico Inductors are designed to meet the following MIL-T-27 requirements:
Open Coil—Grade 6, Class S, Life Expectancy X
Military Designation: TF6SX04ZZ

Encapsulated—Grade 5, Class S, Life Expectancy X
Military Designation: TF5SX04ZZ

Steel Cased—Grade 4, Class S, Life Expectancy X
Military Designation: TF4SX04YY

Detailed information on request!

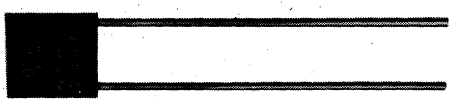
TORWICO ELECTRONICS INC. LAKEWOOD, N.J.

VANGUARD/WYLE

Vanguard's precision inductive components are known for high reliability throughout the aerospace/military and industrial electronics fields. Long-term experience, specialized manufacturing and full environmental test facilities are combined to assure economy, product dependability and delivery to schedule.

FIXED TOROIDAL INDUCTORS

Encapsulated Miniature and Subminiature



For use in printed circuits and modules in tuned circuit, filter and network applications.
Designed to meet MIL-C-15305, Grade 1, Class B (−55°C to +125°C).
Moisture and shock resistant, immersion proof.
Powdered iron toroidal core, low external magnetic field.
Developed for applications requiring high reliability and stability.
Standard leads are tinned copper wire. Also available with weldable gold-plated Dumet leads or weldable nickel.

RADIAL LEAD TOROIDS

SERIES 91
Inductance range: 0.01 μh to 1.0 μh
Frequency range: 25 MHz to 150 MHz
Inductance TC: +150 ppm/°C nominal
Dimensions: 0.20 (w) x 0.10 (thick) x 0.20 (h)

SERIES 92
Inductance range: 0.10 μh to 10 μh
Frequency range: 1 MHz to 50 MHz
Inductance TC: +20 ppm/°C nominal
Dimensions: 0.20 (w) x 0.10 (thick) x 0.20 (h)

SERIES 93
Inductance range: 10 μh to 1000 μh
Frequency range: 50 kHz to 50 MHz
Inductance TC: to 270 μh, +25 ppm/°C nominal; 330-1000 μh, +125 ppm/°C nominal
Dimensions: 0.27 (w) x 0.15 (thick) x 0.27 (h)

SERIES 94
Inductance range: 100μh to 10,000 μh
Frequency range: 50 kHz to 50 MHz
Inductance TC: to 1000 μh, +25 ppm/°C nominal; 1200-10,000 μh, +125 ppm/°C nominal
Dimensions: 0.375 (w) x 0.187 (thick) x 0.375 (h)

SERIES 95
Inductance range: 10 MH to 100 MH
Frequency range: 50 kHz to 5 MHz
Inductance TC: +125 ppm/°C nominal
Dimensions: 0.500 (w) x 0.300 (thick) x 0.562 (h)
Other series are available in high inductance ranges as well as high and lower frequency ranges.

SIDE LEAD TOROIDS

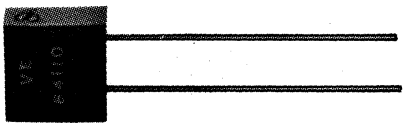


Same specifications as for toroidal inductors above.
Add suffix "S" to series number.
For applications where axial lead locations are more convenient.

NEW! VARIABLE TOROIDAL INDUCTORS

VAROIDS

(Adjustable) Encapsulated Miniature Toroids



Nominal inductance values in steps of 5% with adjustability from nominal value of ±5%.
Permit use of fixed capacitors for smaller printed circuit assemblies.
Inductance values from 0.1 to 1000 microhenries.

VARIABLE INDUCTORS

- Moisture and shock resistant, immersion proof
- Designed to meet MIL-C-15305, Grade 1, Class B (−55°C to +125°C)
- Inductance variation: ±20% or more from nominal

SEALED CORE INDUCTORS

Encapsulated



- Tuning core sealed off
- Torque device: preassembled compression spring that allows manual adjustment while preventing unintentional detuning
- Inductance TC: −50 to +100 ppm/°C

Series 3 (Miniature)
Inductance range: 0.1 μh to 15μh
Dimensions: 0.34 in. (dia) x 0.69 in. (max.)

Series 1
Inductance range: 0.1 μh to 22 μh
Dimensions: 0.40 in. (dia) x 0.94 in. (max.)

Series 2
Inductance range: 33 μh to 10 mh
Dimensions: 0.53 in. (dia) x 1.06 in. (max.)

Series 1BF (Bifilar Tunable RF Transformer)
Inductance range: 0.1 μh to 15 μh
Dimensions: 0.40 in. (dia) x 0.94 in. (max.)

OPEN CORE INDUCTORS

Encapsulated Miniature & Subminiature

- Applications: printed circuits and modules
- Low external field (magnetically shielded types)
- Tuning: unique torque device allows smooth, manual inductance adjustment while preventing unintentional detuning

Vanguard Electronics
Division of Wyle Laboratories / 930 West Hyde Park Blvd. / Inglewood, Calif. 90302 / (213) 678-7161 / TWX: 910 328-6126

VANGUARD/WYLE

Vanguard's precision inductive components are known for high reliability throughout the aerospace/military and industrial electronics fields. Long-term experience, specialized manufacturing and full environmental test facilities are combined to assure economy, product dependability and delivery to schedule.

VARIABLE INDUCTORS - CONT.



Series 51, 61 (Magnetically Shielded)
Inductance range: 0.1 μh to 1000 μh
Inductance TC: +30 ppm/°C nominal
Coupling coefficient between adjacent inductors: 1% max.
Dimensions
Series 51: 3/8 in. (dia) x 3/8 in.
Series 61: 3/8 in. (dia) x 1/2 in.

Series 71 (Magnetically & Electrostatically Shielded)
Magnetically and electrostatically shielded version of Series 61. Same specifications and electrical parameters.
Dimensions: 0.40 in. (dia) x 0.50 in.

Series 52 (Magnetically Shielded)
Inductance range: 1.0 μh to 22,000 μh
Inductance TC: to 470 μh, 25 ppm/°C nominal; over 470 μh, 75 ppm/°C nominal
Coupling coefficient between adjacent inductors: 1% max.
Dimensions: 1/2 in. (dia) x 1/2 in.



Series 53, 53A, 63 (Unshielded)
Inductance range: 0.1 μh to 10 μh
Inductance TC: +30 ppm/°C nominal
Dimensions
Series 53: 1/4 in. (dia) x 1/4 in.
Series 53A: 1/4 in. (dia) x 5/16 in.
Series 63: 1/4 in. (dia) x 3/8 in.

Series 54, 54A, 64 (Unshielded)
Inductance range: 15 μh to 1000 μh
Inductance TC: +75 ppm/°C nominal
Dimensions
Series 54, 54A: 5/16 in. (dia) x 5/16 in.
Series 64: 5/16 in. (dia) x 7/16 in.

RF CHOKES

Encapsulated



- Designed to meet MIL-C-15305, Grade 1, Class B (−55°C to +125°C)
- Moisture and shock resistant, immersion proof

Series 78/278: Magnetically Shielded
(Series 278 is MS 90537 equivalent)
Inductance range: 0.10 μh to 100,000 μh
Dimensions (max.)
Series 78: 0.190 in. (dia) x 0.415 in.
Series 278: 0.167 in. (dia) x 0.415 in.

Series SMS (MS 18130)
Inductance range: 0.15 μh to 33.0 μh
Dimensions (max.): 0.166 in. (dia) x 0.385 in.

Series MMS (MS 75008)
Inductance range: 0.15 μh to 27.0 μh
Dimensions (max.): 0.218 in. (dia) x 0.469 in.

Series LMS (MS 91189)
Inductance range: 1.2 μh to 120.0 μh
Dimensions (max.): 0.312 in. (dia) x 1.0 in.

Series 101, 102, 103
Inductance range and dimensions (max.)
Series 101:
0.10 μh to 15 μh; 3/16 in. (dia) x 15/32 in.
Series 102:
22 μh to 120 μh; 5/16 in. (dia) x 15/16 in.
Series 103:
150 μh to 10,000 μh; 9/16 in. (dia) x 1-1/16 in.

Series S, M, L
Inductance range and dimensions (max.)
Series S:
0.10 μh to 100 μh; 0.188 in. (dia) x 0.44 in.
Series M:
1.0 μh to 1000 μh; 0.25 in. (dia) x 0.60 in.
Series L:
10 μh to 10,000 μh; 0.31 in. (dia) x 0.90 in.

FILTERS

High Pass, Low Pass, Band Pass and Band Reject

Custom Filters

Designed to meet your specifications within the following parameters:
20 Hz to 100 MHz
Impedances up to 40 Kilohms
Controlled amplitude and phase characteristics
Temperature range: −55°C to +85°C operating; −65°C to + 125°C in storage
Designed to meet the requirements of MIL-F-18327

Standard Filters F-11 Series

Maximally flat amplitude response
Frequency range: 20 kHz to 100 MHz
Impedance: 50 ohms
Bandwidth (band pass only): 5% of center frequency min., 100% max.
Two to five sections in miniature sealed cases.
Printed circuit mounting.

TUNED CIRCUITS

Single & Double, Shielded
- Three Series: 10, 20, 30
- Frequency range: 50 kHz to 100 MHz
- Inductance range: 0.1 μh to 22,000 μh
- Dimensions: 3/4 in. x 3/4 in. x 2 in. (h); also available in smaller sizes

NETWORKS, FILTERS, DELAY LINES AND RLC CIRCUITS

Vanguard resistive-capacitive-inductive encapsulated networks eliminate the solder joints that occur when individual components are incorporated in a package, as well as greatly reducing the packaging density of finished equipment.

These modular units are produced in various combinations —RLC, RC, RL, LC—and in various configurations. Custom engineered to meet particular circuit requirements, also available in standard packages, eliminating engineering cost on prototype quantities.

All units are completely encapsulated in MIL-grade epoxy resin. The circuits are designed to meet or exceed existing environmental testing requirements. Available with tinned copper or gold-plated Dumet leads.

Vanguard Electronics
Division of Wyle Laboratories / 930 West Hyde Park Blvd. / Inglewood, Calif. 90302 / (213) 678-7161 / TWX: 910 328-6126

UTC® PIONEERS IN MINIATURIZATION

SPECIALS
(CUSTOM BUILT)
and STOCK
FOR EVERY APPLICATION

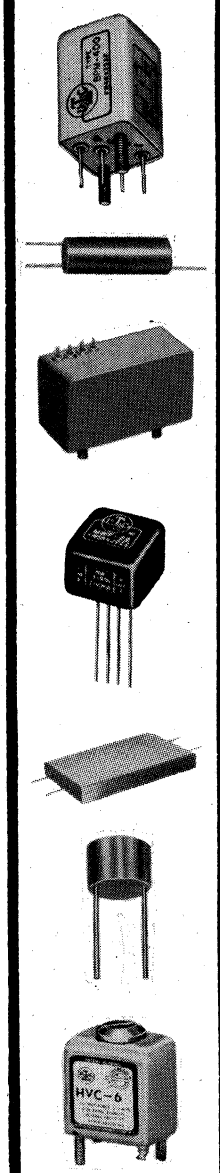
IMMEDIATE DELIVERY ON ALL STOCK ITEMS

ELECTRIC WAVE
FILTERS

Almost forty years of experience in the design and production of electric wave filters have resulted in UTC being a first source for top quality, reliability and advanced engineering . . . for both special and stock applications. Present designs incorporate a wide variety of core structures, winding methods, and capacitors to provide maximum performance. stability and reliability. Military (to MIL-F-18327C) and industrial types are available both metal cased and molded. Range of frequencies is from DC to 30 MHz.

AIRCRAFT
BAND PASS
BAND REJECT
DISCRIMINATORS
400 HERTZ LINE BP
400 HERTZ LINE LP
HIGH PASS
INTERSTAGE
LINEAR PHASE
LOW FREQUENCY
LOW PASS
TELEGRAPH
TELEMETERING
ULTRAMINIATURE

LUMPED CONSTANT DELAY LINES



HIGH Q
INDUCTORS

Almost four decades of specialization in high Q coils are reflected in the permalloy dust toroid, ferrite, and laminated structures produced by UTC today. The foremost engineering staff of its type is supported by the most modern, fully equipped materials and test laboratories. In addition, extensive life testing and rigid quality control standards create the top quality and highly reliable components associated with the UTC name. Metal cased and molded units are engineered to specifications or available from stock. Inductors ranging in applications from DC to 30 MHz, both military (to MIL-T-27C) and commercial types, are available, offering maximum Q for minimum size.

TOROIDS • TAPPED TOROIDS • LOW FREQUENCY • L DECADES • VARIBALE • TAPPED VARIABLE • VERNIER VARIABLE • MINIATURE

POWER
INDUCTORS

UTC's capabilities in range run from fractions of micro-henries to many thousands of henries, limited only by the physical size of the unit. Almost forty years of specialization in the design and production of iron core components have resulted in UTC being a first source of supply for difficult units. Military (to MIL-T-27C) and commercial types are available in all standard UTC case configurations, plus units to your specifications. Metal cased, molded, encapsulated, open, and potted units of the highest quality and reliability are available. The largest engineering staff of its kind is supported by the most modern, fully equipped materials and test laboratories. In addition, extensive life testing and rigid quality control measures assure the advanced designing and high reliability associated with UTC products.

FILTER-AUDIO • CHARGING

Write for catalog containing over 1,350 stock items with UTC top quality.
Short form catalog pages appear in The Radio-Electronic MASTER

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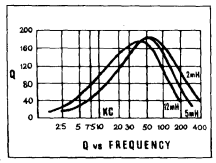
UNITED® TRANSFORMER CO. TRW®

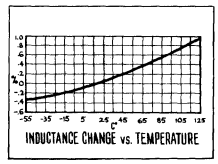
DIVISION OF TRW INC. • 150 VARICK STREET, NEW YORK, N. Y. 10013

Zaring Industries, Inc. • Carmel, Indiana • 46032
P.O. Box 477 • Tel: 317-846-2571

TOROIDAL INDUCTORS

CATALOG NO.	IND mH	DC mA MAX.	DC RES. OHMS
TF04026	1	820	0.75
TF04027	2	580	1.75
TF04028	3	450	2.5
TF04029	5	350	4.0
TF04030	7	300	5.5
TF04031	12	225	7
TF04032	20	175	12
TF04033	30	150	18

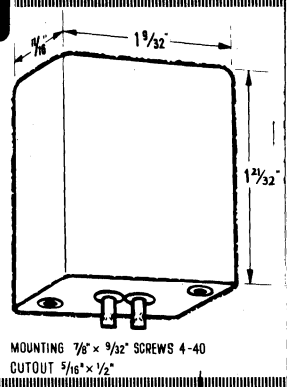




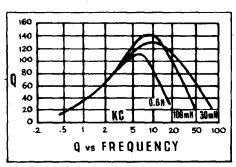
These hermetically sealed coils are used for high Q's up to 200 kcps. Temperature stability of the inductance and dependence of Q from frequency is shown here.

Constructed to meet MIL-T-27B-TF4RX20YY

All units have gray finish and are stamped with schematics legibly marked.



CATALOG NO.	IND mH	DC mA MAX.	DC RES. OHMS
TF04034	4	160	0.75
TF04035	7	135	1.5
TF04036	12	100	2.0
TF04037	20	80	3.5
TF04038	30	65	5.0
TF04039	50	50	8.0
TF04040	70	40	12
TF04041	100	35	17
TF04042	150	30	28
TF04043	250	22	45
TF04044	400	17	70
TF04045	600	14	105
TF04046	900	12	170
TF04047	1500	9	270
TF04048	2000	8	390
TF04049	2800	7	560
TF04050	4000	5	875

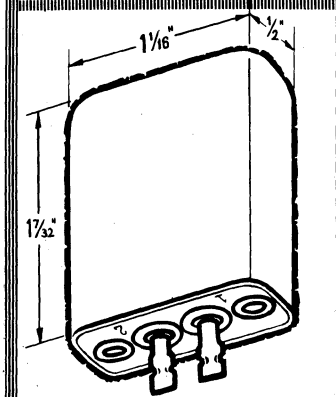


These hermetically sealed high Q inductors have high permeability steel enclosure for magnetic shielding.

Constructed to meet MIL-T-27B-TF4RX20YY. Inductances are shown with no DC mA in coils. Inductance is practically unchanged at the frequency range shown here.

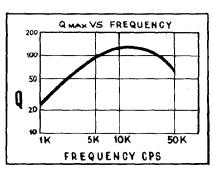
Units are legibly marked with schematics and come with gray finish.

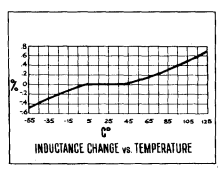
Typical Q curves are shown here.



CATALOG NO.	IND mH	DC RES. OHMS
TF20001	1	0.3
TF20002	2	0.7
TF20003	5	1.8
TF20004	8	2.2
TF20005	10	3.2
TF20006	20	7

CATALOG NO.	IND mH	DC RES. OHMS
TF20007	50	18
TF20008	80	30
TF20009	100	32
TF20010	200	71
TF20011	500	185
TF20012	800	300

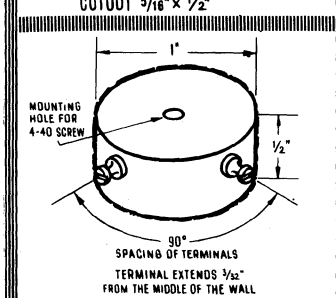




These inductors are encapsulated in glass fiber filled diallylphtalate cases approved under MIL-M-19833-GDI-30 "F". All inductors meet MIL-T-27B-TF5RX20ZZ. Cores are wound on high permeability cores of powdered molybdenum permalloy.

Temperature stability of inductance and dependence of Q from frequency are shown here.

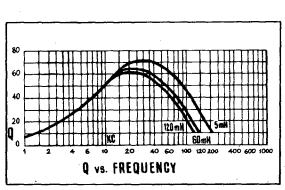
Furnished with green or black finish.

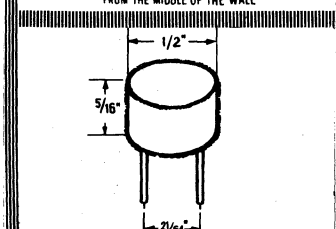


CATALOG NO.	IND mH	DC mA MAX.	DC RES. OHMS
TF04013	3	50	4
TF04014	5	40	7
TF04015	8	30	11
TF04016	12.5	25	16
TF04017	20	20	25
TF04018	30	16	40
TF04019	60	10	80
TF04020	120	7	160

These inductors are for transistor and printed circuit applications providing high Q and small size. Inductances shown are without DC current. With maximum DC mA applied inductances will drop 5%.

Furnished with green and black finish.

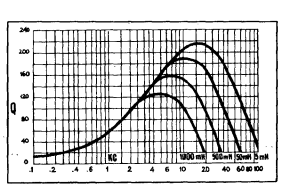


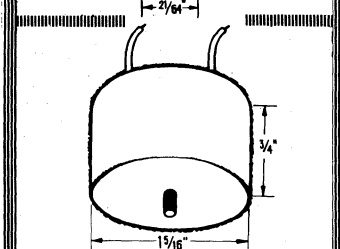


CATALOG NO.	IND mH	DC RES. OHMS
TF20021	5	1.1
TF20022	50	11
TF20023	100	25
TF20024	250	65
TF20025	500	115
TF20026	1000	250

These inductors have characteristics which permit high Q, power level, and stability with a reasonable size and weight.

Available with a 4-40 threaded rod of ¼ long for easy and fast mounting and two 12" long #24 teflon insulated leads.





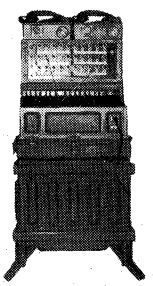
TELEPHONE EQUIPMENT

FOR MILITARY and COMMERCIAL APPLICATIONS

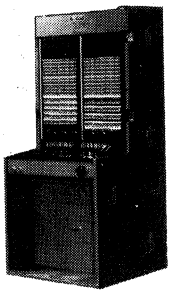
SWITCHBOARDS • CENTRAL OFFICE EQUIPMENT • HANDSETS • COMPONENTS • EARPHONE & MICROPHONE ELEMENTS • ACCESSORIES

TELEPHONE SWITCHBOARDS, CENTRAL OFFICE EQUIPMENT AND HANDSETS

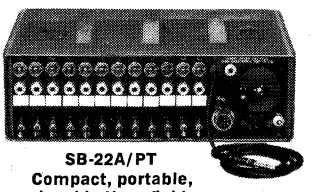
We are prime producers of manual and dial military switchboards, central office equipment and versatile handsets for many applications. Telephone facilities from 12 to 1,000 lines can be provided, for up to 160 manual or dial trunks, with our various equipments. Adaptations of standard equipment can be made to specifications.



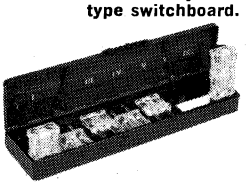
SB-86/P
Portable, local battery, field type manual switchboard.



AN/GTA-14V
Complete, transportable manual telephone central office.



SB-22A/PT
Compact, portable, local battery field type switchboard.



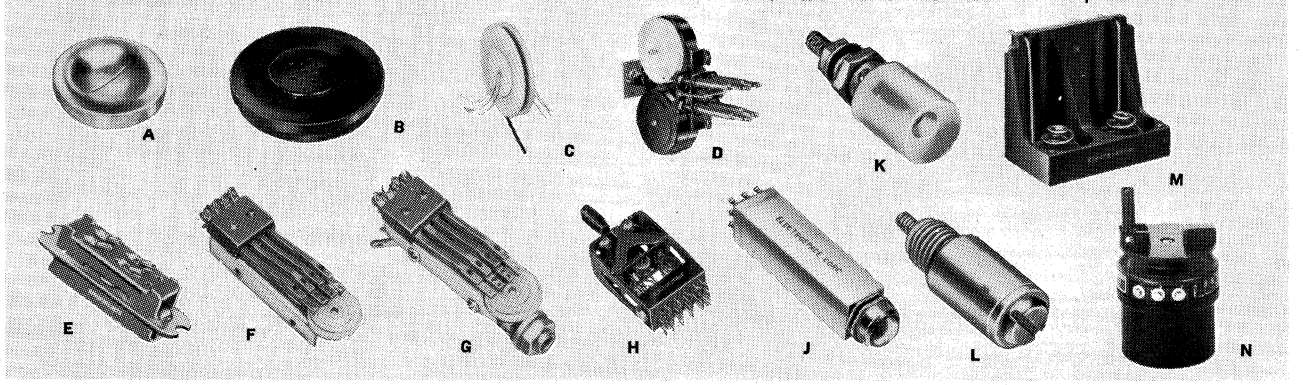
SB-993
Manual telephone switchboard for stacking conference calls.



H-33F/PT
Waterproof handset supplied with U-161/U connector.

TYPICAL TELEPHONE COMPONENTS

Widest Choice Available of Components, Elements and Accessories To Meet All Requirements.



(A) B3001P-1 MICROPHONE ELEMENT. Carbon capsule. Impedance: 40 ohms nominal. Frequency Response: 300-4000 Hz. Temperature Range: −40°F. to +150°F. Adaptable to standard WECO handsets. Made to MIL-M-11095A.

(B) C3001P-10 EARPHONE ELEMENT. Magnetic type. Impedance: 300 ohms nominal. Frequency Response: 300-4000 Hz. Temperature Range: −40°F. to +150°F. Reliable mechanical and acoustical stability. Adaptable to standard WECO handsets. Made to MIL-H-11134D.

(C) D3014-362 REEL & CABLE ASSEMBLY, RETRACTABLE. Accepts various cord types and sizes. Extends cord up to 4 ft. Provides neat, convenient cord storage. Readily applicable for use in telecommunication systems, test equipment, and others.

(D) D3014-318 TELEPHONE SWITCHBOARD MODULE. Shows typical application of Reel & Cable Assembly (−362) for field or stationary switchboards.

(E) B3001-18 BAR SWITCH. Double pole. 1 amp. 30V D.C. contact rating. Instantaneous actuation with nominal pressure at any point on bar. Operating life tested in excess of 500,000 cycles.

(F) C3014-105 THUMBWHEEL SWITCH. Flat, horizontal construction saves valuable panel space. One-finger operation. Permits multi-position, multi-circuit control. Heavy duty contacts mounted on leaf springs.

(G) D3014-76 THUMBWHEEL SWITCH & JACK ASSEMBLY. Shows typical application of switch (−105) with switchboard plug-in jack.

(H) D3014-320 LEVER SWITCH. Exceptionally rugged construction provides greatest operation dependability. Positive detent action. Return spring design reduces contact bounce and chatter. Three-position, multi-circuit contacts available.

(J) C3014-77 SIGNAL INDICATING RELAY. Requires only ¾" dia. panel space. Gives positive indication of relay operation. Combines signal-relay operation in one package. Operable from either of two individual coils.

(K) D3014-38 HOLE-IN-HEAD BINDING POST. Saves space. Provides easy, convenient, positive connection. Wire inserted at front of post instead of side. "PUSH-INSERT-RELEASE" — wire positively locked in place.

(L) B3014-39 CIRCUIT PROTECTOR. Reusable protective device for communication systems. Shorts the circuit to be protected against high voltage surges. Factory adjustable to break-down voltage required.

(M) B3014-54 BATTERY BLOCK. Provides convenient storage and method for connecting two "D" size cells into circuit.

(N) G-42A/PT HAND RINGING GENERATOR. Used for ringing field telephones. Centrifugally operated switch operates at a crank speed of about 140 rpm. The generator delivers 100 volts at 20 cycles at a crank speed of 200 rpm.

DETAILED SPECS AND MODIFICATIONS AVAILABLE. WRITE OR CALL FOR LITERATURE.

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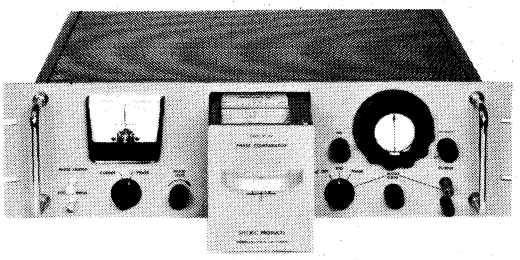
Tell them you found them in **eem**

STANDARD TIME & FREQUENCY RECEIVERS

TIME & FREQUENCY STANDARDIZATION TO THE NATIONAL BUREAU OF STANDARDS

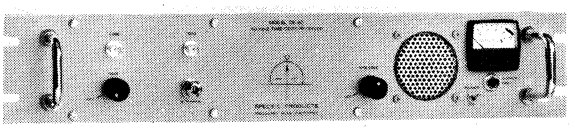


MODEL SR-60
60 KC PHASE COMPARATOR RECEIVER

Calibrates any local standard up to 5 - 10^{10} within a short period.

The Model SR-60 is the first low cost VLF Phase Comparison Receiver designed to permit phase comparison measurements between a local oscillator and the National Bureau of Standards transmitted 60 Kc/s from WWVB, Fort Collins, Colorado. The receiver is a straight-forward Tuned Radio Frequency receiver and can be used in any location in the United States with highly satisfactory results. Can be operated by any technician.

PRICE: $890.00



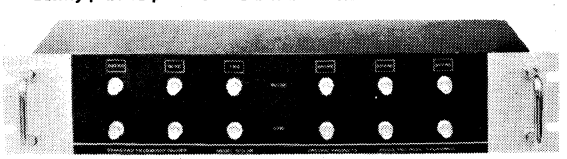
MODEL CS-60
60 KHZ TIME CODE RECEIVER

HIGH POWER • LOW CURRENT

A new, low current drain time code receiver, so sensitive that it will receive NBS signals from 2,000 or more miles away. Original and unique circuitry developed at the Seismological Laboratory in Pasadena, California. The unit will receive Radio Station WWVB signals, considered to be the most accurate time signals available. Intermediate frequency is 2kHz. It is designed for long term, remote, unattended operation as it requires power of only + 12 vdc ± 1 vdc at 1.5 ma without audio (35 ma with audio).

PRICE: MODEL CS-60A $580.00

Battery powered portable field unit available.

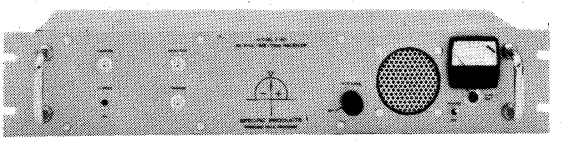


MODEL SFD-6R
STANDARD FREQUENCY DISTRIBUTION SYSTEM

- **COMPLETE STATION ISOLATION**
- **POWERED FROM INPUT LINE**
- **SOLID STATE**

The input is 100 kHz, and 18 vdc on distribution line from Model DAP-100 Distribution Amplifier. The outputs are 100, 10 and 1 kHz sine and square waves all available simultaneously. The modular construction allows for easy additions, deletions and inspection. Available in a rack—bench cabinet.

PRICE: Depends on modules selected. ($90.00 each)



MODEL T-60 60 KHZ TIME CODE RECEIVER

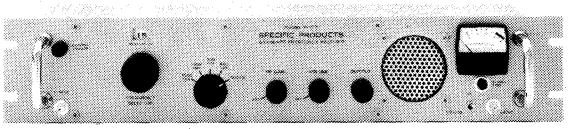
- **Round The Clock Binary Time Code Broadcasts from WWVB • Most Accurate Time Signal Available • Can Be Recorded Continuously**

Radio Station WWVB is broadcasting complete time information using a level shift carrier time code (10 db level changes). This code, which is binary coded decimal (BCD) is broadcast continuously and is synchronized with the 60 khz carrier signal. The Schmitt BCD output can be completely automated for continuous monitoring of extremely accurate real time and time interval information.

PRICE: MODEL T-60A $480.00

3½" x 19" rack panel with 5" depth behind panel. Includes 117v, 50 to 400 cps supply, or an external 12 to 16 volts may be used.

Battery powered portable field unit available.



MODEL WVTR WWV RECEIVERS MARK II
All Silicon Transistor

COMPLETE MODULAR CONSTRUCTION • CERAMIC FILTERS DOUBLE SHIFT SUPERHETERODYNE • 1 $_{u}$V SENSITIVITY

Crystal controlled front end receivers for 2.5, 5, 10, 15, 20 and 25 MHz frequencies. 2nd I.F. frequency for high selectivity. Has built-in filter for ticks and tones. Receiver has carrier level "S" meter, speaker and output jack on front panel. Audio output available on rear.

PRICE: $590.00 with AC Power Supply

Battery powered portable field unit available.



MODEL SR-7H STANDARD FREQUENCY RECEIVER

The Model SR-7 is a small crystal controlled front end receiver covering 2.5, 5, 10, 15, 20 and 25 MHz, with double conversion. 2 MHz first I.F. and 175 kHz second I.F. The receiver has a carrier level "S" meter, speaker and output jack on the front panel.

MODEL SR7-R Rack Model: $385.00; MODEL SR7-H Bench Model: $385.00

MODEL SR7-F — offers filtered outputs. Any two tones 1200, 1000, 600 or 440 may be selected by front panel switches. Rack mount: **$475.00**

MODEL AR-4 AUTOMATIC WWV RECEIVER

Automatic selection of strongest signal of any WWV frequency — or manual selection. Receives 5, 10, 15 and 20 MHz (other frequencies available). Unattended operation where around the clock signals are required without manual switching.

PRICE: MODEL AR-4 $1785.00

RACK MOUNT: 3½" x 19" x 7"

Send for complete specifications. Prices and specifications subject to change without notice. F.O.B. Woodland Hills, Calif. Net 30 Days.

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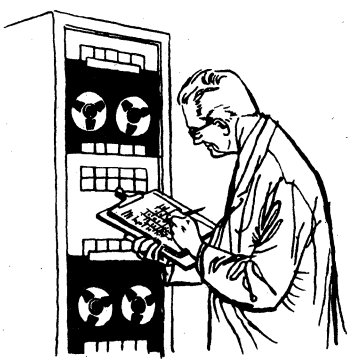

VFTG/VFCT DATA and TELEGRAPH modules, terminals and systems; TELEGRAPH POLLING, CONTROL and MONITORING systems and modules including Signal Regenerators, Speed and Code Converters; SWITCHING, PATCHING, MONITORING, ERROR PROTECTION equipment and systems; DATA INTERFACE, TIMING RECOVERY, SPEECH PRIVACY, TELEPHONE INTERFACE, and TELEPHONE, systems and ancillary equipment.

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A.D.D.S. specializes in low cost computer compatible data acquisition and switching systems. All systems are built up from our line of standard components. Integrated circuit design and modular construction assure reliability and ease of maintenance for the entire product line. Complete specifications on our standard products and information regarding special units is available from our representatives or from the factory.

DATALOGGERS

SIGNAL
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A/D CONVERTER
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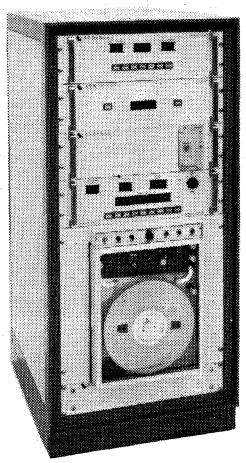
AMPLIFIER (OPTIONAL)
↓
SERIALIZER
↓
RECORDER
↓
TAPE



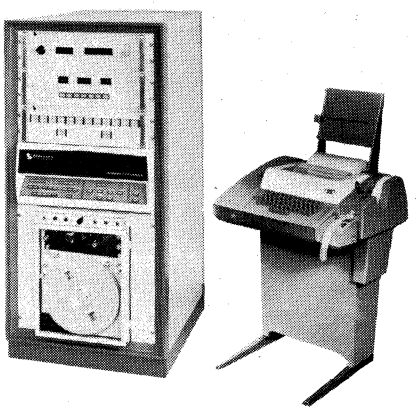
SERIES 100M

The Series 100M Datalogger accepts up to 100 channels of analog signals, digitizes the information, and records the data on computer compatible 7 or 9 track magnetic tape at 200, 556, or 800 BPI. The system is capable of recording up to 1200 characters/second (asynchronous) or up to 3,000 characters/second (synchronous).

Basic System Price: $13,200.00

The Series 10M Datalogger uses a combined scanner and A/D Converter to accept up to 10 channels of analog data for recording on computer-compatible 7 or 9 track magnetic tape. The same speeds and bit densities are available as for the 100M.

Basic System Price: $11,000.00

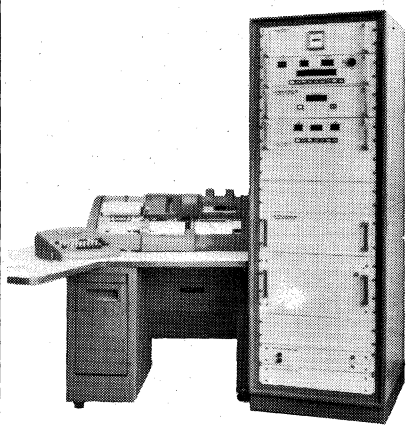


SERIES 100C

The Series 100C Datalogger is controlled by a computer with 4,096 words of core memory. Now discisions can be made for each channel instantaneously as data is being acquired. On line computations can be performed with results read out in engineering units.

Basic System Price: $22,500.00

Up to three extra 4,096 word memory modules are available for expandability allowing a wide range of applications. A.D.D.S. standard output devices, mag tape, paper tape printers, or card punch may be used with any of our dataloggers.



SERIES 100R

The Series 100R Datalogger is designed specifically for resistance measurement. Using A.D.D.S. unique "Automatic Bridge" principle, it automatically scans and accurately measure resistors in batches of up to 100.

Basic System Price: $14,000.00
(less card punch)

The Model 100 XR resistance tester accurately records readings as a percentage deviation from a standard value. Voltage deviation will be a positive or negative function of the ratio of the measured resistance to the standard resistance.

Basic System Price: $15,500.00
(less card punch)

Many options are available to complement A.D.D.S. product line. Scanners up to 1000 channel capacity and A/D Conveters are available in either binary or BCD format for full computer compatibility. Pin board programs are available for the A/D Converter to allow datalogging of signals from 10M volt full scale to 10 volt full scale. An instrumentation amplifier used when guarded measurements are required includes manual and relay switching of 7 gains — 1 to 1,000.

A/D CONVERTERS

Series 013 Converters operate at incremental tape recorder speeds. Operated manually or controlled by peripheral equipment, they include the features most sought after by designers of data acquisition systems and automatic checkout equipment.

SPECIFICATIONS

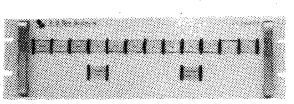
Range: 0 to ±10 volts
Input Impedance: 4K ohms
Conversion Time: 10 microseconds/bit including polarity decision

ACCESSORIES

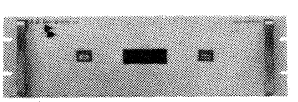
Buffer Amplifier — extends range of converter and increases input impedance to 10^5 megohms.
Price: $110.00

Sample & Hold Circuit — eliminates ambiguous readings when sampling rapidly changing inputs.
Price: $200.00

Autoranger — used with converter to allow switching of 7 gains from 1 to 1,000.
Price: $1,650.00



013-112 11-bit binary plus sign



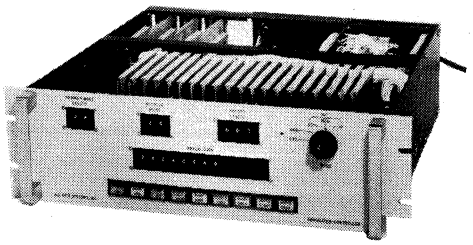
013-012 3-digit plus sign

A.D. Data Systems (eem) 3/4 DB....

MODELS/PRICES

MODEL NO.	TYPE	PRICE
013-022	3 digits plus sign (including 10 channel multiplexer)	$2,750.00
013-012	3 digits plus sign	1,650.00
013-011	5 digits plus sign	3,200.00
013-013	4 digits plus sign	2,750.00
013-112	11 bit binary plus sign	2,200.00
013-111	12 bit binary	2,200.00

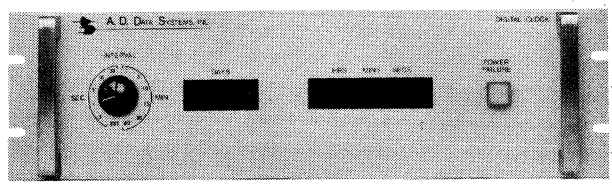
DIGITAL CONTROL COUPLERS



The Series 016 Digital Control Couplers are extremely flexible couplers and system controllers designed for use as an interface between digital outputs and recording media. The control section of the instrument provides for internal and external rate control, determination of word and record length, recycle point, and up to 12 characters of manual data. Series 016 couplers can operate a magnetic tape recorder, paper tape punch or card punch simultaneously by additions of a plug in driver card.

Price: $2,750.00

DIGITAL CLOCKS

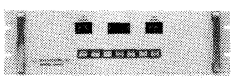


Series 015 Digital Clocks may be used with any standard A.D.D.S. instrument or independently for time display and control functions. Featuring I.C. design, the clocks are resettable, providing elapsed time indication, both visually and electrically. Nine decades of time data in BCD 1-2-4-8 code are available for recording.

Model 015-005 — Measures time in 23 hours, 59 minutes and 59 seconds. **Price: $1,320.00**

Model 015-010 — Measures time in 365 days, 23 hours, 59 minutes and 59 seconds. **Price: $1,650.00**

REED RELAY SCANNERS



Using a unique modular design, the switching sections of our scanners are built up from individual modules, providing a wide range of channel capacities and wiring options as well as ease of expansion.

MODEL 126 CONTROL

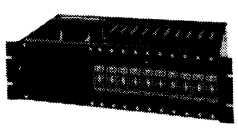
100 channel capacity for local or remote operation. Uses 2, 3, or 4 wire channel input cards (see listing at right).

Model 126
less modules $1,375.00

MODEL 127 CONTROL

Model 127 control may be used in conjunction with No. 162 module chassis to expand capacity to 1,000 channels.

Model 127
price less modules..$1,595.00



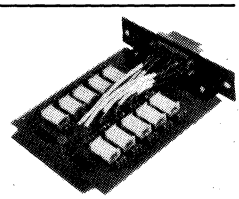
Reed Relay Module Chassis

These chassis are rack mountable and capable of holding 10 reed relay modules. Used with scanner control units, each chassis has up to 100 input channels pre-wired to connectors at the rear. Mating connectors are supplied.

Price less modules.....$250.00

REED RELAY MODULES

Reed Modules plug into the scanner unit or the module chassis. Two types of reed relays are available: Standard (for extremely low level signals). List shows configuration now available.



Used with 126 and 127 controls and Model 162 Chassis:

Module 485 — 10 2 pole switches. Standard Reed.....**Price: $ 65.00**

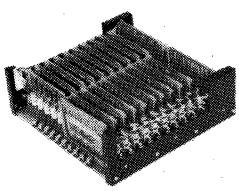
Module 483 — 10 3 pole switches. Standard Reed.....**Price: $ 95.00**

Module 484 — 10 4 pole switches. Standard Reed.....**Price: $125.00**

Module 476 — 10 3 pole switches (2 wires plus shield). Low Thermal.....**Price: $185.00**

Module 493 — Program Board for programming of special conditioning equipment on individual channels .....**Price: $ 95.00**

REED RELAY MATRICES



Reed Relay Matrices are high speed signal routing devices which by latching the appropriate crosspoints, will connect any or all of the inputs to any or all of the outputs. A fully equipped matrix with 20 crosspoint cards, yields a ten by ten array containing one hundred crosspoints. Ten signal paths are designated X0 through X9 and ten coordinate signal paths are designated Y0 through Y9. A unique "memory" is provided so that when a point is latched by a signal pulse, it remains latched until another pulse is issued. A plus 5 volt logic level can be brought out as a selected crosspoint indication. Two basic chassis are available depending on your requirement. Two coaxial connectors used in parallel allow multiplying matrices for large arrays.

MATRIX PRICING TABLE

Basic Chassis	Number of Coaxial Connectors (Y is provided on the chassis)		Price
10 x 10 x 1	1X	1Y	$350.00 less modules
	2X	2Y	$390.00

Modules Quantity	130560 - 0 No Connectors	130560 - 1 1 Connector	130560 - 2 2 Connectors
1 - 9	$33.00	$36.00	$40.00
10 & up	$30.00	$33.00	$36.00

With +5V Selected Crosspoint Indication.

Basic Chassis	Number of Coaxial Connectors (Y is provided on the chassis)		Price
10 x 10 x 1	1X	2Y	$470.00
	2X	2Y	$510.00

Modules Quantity	130569 - 0 No Connectors	130569 - 1 1 Connector	130569 - 2 2 Connectors
1 - 9	$40.00	$44.00	$48.00
10 & up	$36.00	$40.00	$44.00

TYPICAL PRICING

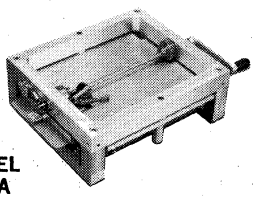
10 x 10 x 1 with (2) paralleled coaxial connectors and +5V selected crosspoint indication. **Price: $1,310.00**

A. D. DATA SYSTEMS, INC.

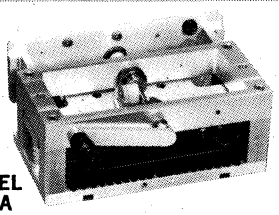
830 LINDEN AVENUE • ROCHESTER, NEW YORK 14625 • PHONE (716) 381-2370

AMP INTRODUCES A COMPLETE FAMILY OF CARD READERS

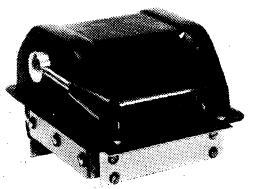
for process control, machine control, test programming, computer input, production control, status indication and access limitation



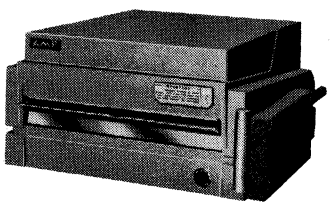
MODEL 2981A
- Industrial full IBM card reader
- Front panel space 3¾" x 8⅝"
- Gold plated contacts rated 0.25 amp
- Available bussed by column, by split column and by row
- 160 six bit word capability and complete alphanumeric coding with 160 diodes instead of 960



MODEL 2900A
- Low cost industrial Model
- IBM format up to 264 switches
- Gold plated double wiping contacts, contact rating 0.25 amp
- Supplied motor operated, manual model available
- Available bussed by row, by one-half column and full column



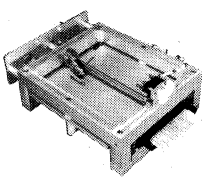
MODEL 2924
- Isolated switch industrial programmer
- Full IBM reader, 2 amp DC
- Remote switch operation
- Precious metal clad contacts
- Contacts tested to 1,000,000 cycles



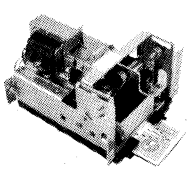
MODEL 1042 DESK
- Double wiping action
- IBM format to 960 switches
- Available in matrix or isolated outputs
- Tested to 100,000 cycles
- Contact rating 0.25 amp DC

OTHER MODELS AVAILABLE

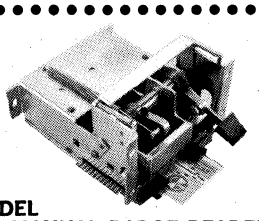
AMP has the largest line of card readers in the world. If you have special requirements, write for more information.



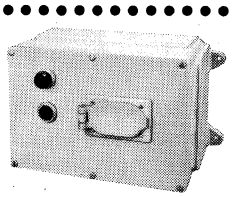
MODEL 2980A
- Motor operated full IBM card reader
- Semi-automatic card insertion and extraction
- Available bussed by column, by split column and by row
- Gold plated double wiping contacts
- Behind panel mounting



MODEL 360 SOLENOID BADGE READER
- Card operated reader similar to time clock or continuous duty
- Uses 15, 20, or 22 column badge
- Design life 500,000 cycles
- 115 Volt AC and 28 Volt DC solenoids available
- Maximum 264 switches



MODEL 361 MANUAL BADGE READER
- One handed automatic operation
- Uses 15, 20 or 22 column badge card
- Design life 1,000,000 cycles
- Cross matrix or individual outputs
- Maximum of 264 switches
- Nominal card thickness up to 0.030", maximum 0.040"



ALL-WEATHER READER
- Designed for outdoor or industrial environment
- Bifurcated contacts
- Up to 12 x 22 contacts, 264 cross points
- Indicator lamps and release switch available
- Air purge available

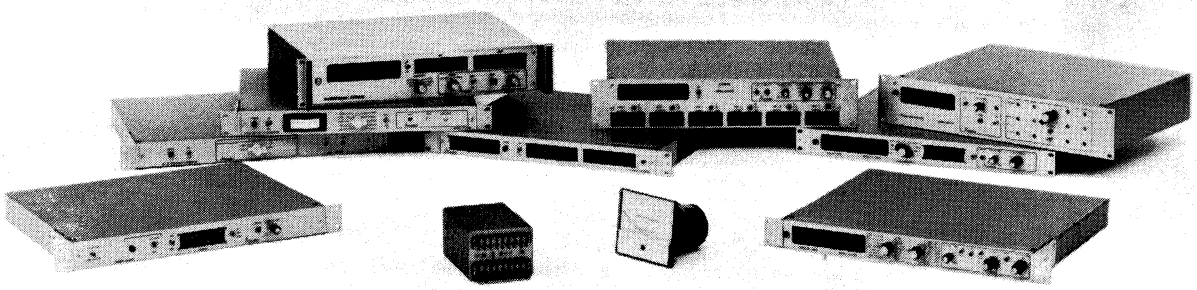
LET THIS DATA CARD . . . . **be your control board . . . it can switch 960 circuits simultaneously**



For further information write to Industrial Division, AMP Incorporated, Harrisburg, Pa. 17105

AMP INCORPORATED

ANADEX DIGITAL/ANALOG BUILDING BLOCKS



The next time you have a digital/analog application, call Anadex. Anadex Instruments not only puts together the finest digital/analog instruments at prices that make sense, but also has the capability of putting them together in a system. For immediate reply to your digital/analog system application, call (213) 873-6620.

ANALOG

DC to Frequency Converters	
DF-100	DC to Frequency Converter
DF-110R	DC to Frequency Converter
DF-115R	DC to Frequency Converter
Frequency to Frequency Converter	
FF-100	Frequency to Frequency Converter
Frequency to DC Converters	
PI-100	Pulse Rate Integrator
PI-200	Frequency to DC Converter
PI-300	Pulse Rate Integrator
PI-408	Frequency to DC Converter
PI-408R	Frequency to DC Converter Rack Mounted
PI-600	Industrial Frequency to DC Converter

SPECIAL

DR-100R	Strain Gage Digitizer
DT-600R	Digital Temperature Indicator
FD-250	Frequency Detecting Switch
CU-2	Multiple Frequency Standard
PD-600R	Preset Detector
CF-600N	Nuclear Instrument Module Packaging of Scalers, Timers, and Intercouplers. (NIM)
IC-600R	Intercoupler
DP-600R	Digital Printer

DIGITAL

Counters	
CF-600R	Counter-Timer
CF-601R	Variable Time Base Counter
CF-602R	Multichannel Variable Time Base Counter
CF-603R	Frequency Counter
CF-604R	Preset Scaler Timer
CF-611R	Frequency Divider/ Period & Delay Generator
CF-630R	Time Interval Counter
CF-635R	Universal Counter Timer
CB-600R	Bi-Directional Counter
Totalizer	
DC-600R	Totalizer

A Subsidiary of Electronic Memories

ANADEX INSTRUMENTS, INC

. . . THE NAME YOU CAN COUNT ON

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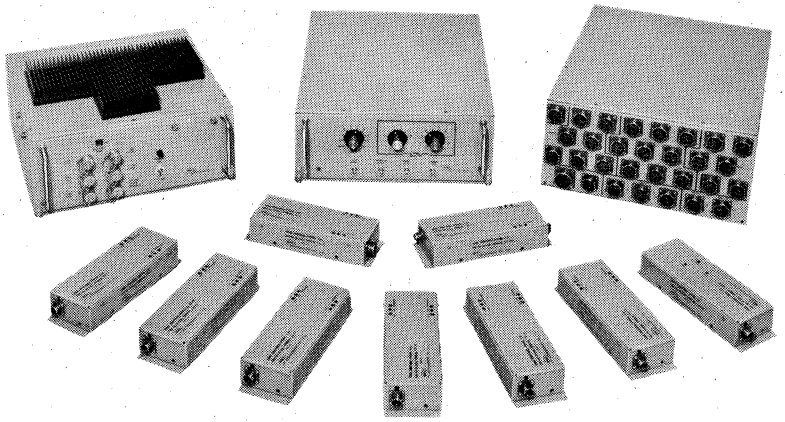
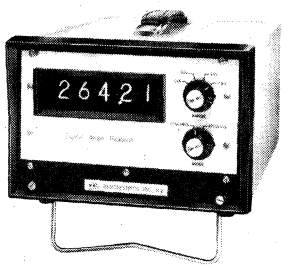
Analog to Digital Converters



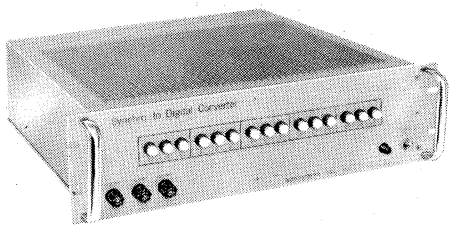
Multiplexed Analog to Digital PCM System

Astrosystems solid state Multiplexed PCM System is a 50 channel data acquisition system which converts synchro and linear AC inputs to a serial PCM output for data recording and/or telemetering. The basic unit provides a resolution and accuracy of 15 binary bits (.003%). Signal conditioning modules are provided for all inputs, with typical characteristics of 13 megohms input impedance and 80 db common mode rejection. The basic system includes power supplies, signal conditioners, multiplexer, converter and PCM code conversion. Write for Data File No. 109.

Digital Angle Readout



Astrosystems Digital Angle Readout is a simple, reliable and accurate device for converting synchro and resolver input angles to a direct in-line decimal display and electrical digital format. Guaranteed accuracy is 0.01° **peak** error from all causes. The standard model accepts either synchro or resolver inputs at 11.8, 26 or 90 volts line-to-line. Both the visual and electrical outputs continuously track the synchro input. Write for Data File No. 110.

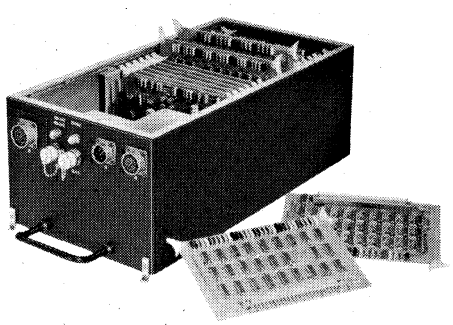


Synchro to Digital Converters

Astrosystems high accuracy Synchro to Digital Converters convert angle inputs from synchros to an equivalent binary or BCD output. Resolutions from 12 to 18 binary bits are available. Accuracy is ±1 bit total peak error including digitizing errors. Converter operation is ratiometric using toroidal transformers which make the units insensitive to transformation ratio and phase shift variations as well as harmonic distortion and noise. Write for Data File No. 101.

Mutiplexed Synchro to Digital Converter

Multiplexed Synchro to Digital Converters feature a high accuracy ultra-reliable method of converting multiple synchro and resolver inputs to parallel or serial digital outputs. The converters are completely solid state and have a basic accuracy of 16 binary bits (20 seconds of arc). The units are insensitive to wide variations in input voltage and frequency. Write for Data File No. 109.



See our line of Advanced Automatic Test Equipment listed under "Test Equipment"

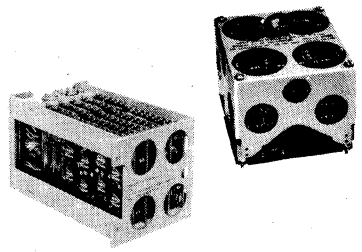
asi

Advanced Instrumentation

astrosystems, inc.

6 Nevada Drive ☐ New Hyde Park, New York 11040
PHONE: (516) 328-1600 ☐ TWX 510-223-0411

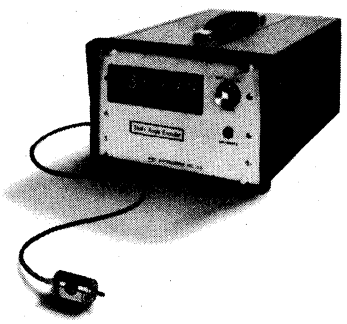
Digital to Analog Converters



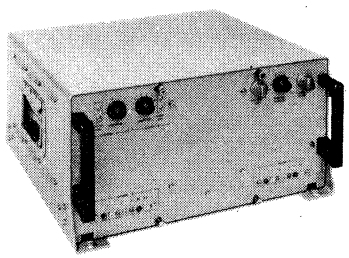
Airborne Digital to Analog Converters

Airborne solid state Digital to Analog Converters feature high reliability, high density packaging and low power consumption. Units are available to provide synchro, resolver or AC output signals to a resolution and accuracy of 16 binary bits. A full range of standard card and circuit designs are available to enable quick delivery of special units. Converters meet the requirements of MIL-E-5400 for airborne equipment. Write for Data File No. 103.

Shaft Angle Encoder



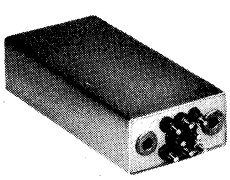
This unique solid state Shaft Angle Encoder is a completely self contained system for transforming shaft rotations into a direct decimal visual display and a digital output capable of feeding computers, printers and various types of off-line equipment. A magnetic transducer is used for long life and high reliability. Angle measurement is absolute, not incremental, to high resolution and accuracy. Data File No. 115.



Multichannel Digital to Analog Converter

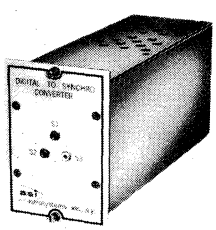
Multichannel solid state Digital to Analog Converters provide AC and/or DC voltage output signals proportional to a digital input. Units feature 15 bits resolution and accuracy. The DC as well as the AC outputs are floating and completely isolated from each other as well as from the digital inputs. Standard interfaces are available to match most computer and peripheral equipment interfaces. Write for Data File No. 102.

Synchro to DC Converters

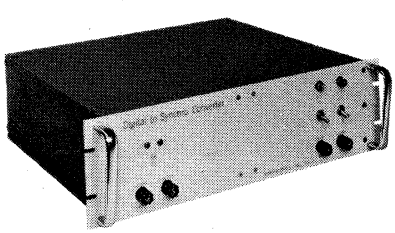


Synchro to DC Converters accept as an input 3-wire synchro or 4-wire resolver signals and provide a high accuracy DC output directly proportional to the input angle. The units are ideal for multiplexed systems which already have a DC to digital capability. A wide range of units are available covering the frequency range from 60Hz to 10K Hz at all standard synchro and resolver voltages. Write for Data File No. 116.

Low Cost Commercial Units



This solid state integrated circuit Digital to Synchro Converter is designed particularly for simulation and industrial control applications. Input is a 10 bit binary signal and output is a 3-wire 11.8 volt 400 Hz synchro signal capable of driving high power torque receivers. Logic levels are DTL or TTL compatible. Data File No. 112.



Digital to Synchro Converters

Digital to Synchro Converters accept and register digital angles in binary or BCD code and convert these inputs to an equivalent synchro or resolver output. Standard models are available to operate as synchro transmitters (CX) or synchro control transformers (CT). Accuracy and resolution to 18 bits is obtained through the use of tapped high precision toroidal transformers to derive the required output voltages. Write for Data File No. 102.

See our line of Advanced Automatic Test Equipment listed under "Test Equipment"

asi

Advanced Instrumentation

astrosystems, inc.

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PHONE: (516) 328-1600 ☐ TWX 510-223-0411

ASTRODATA

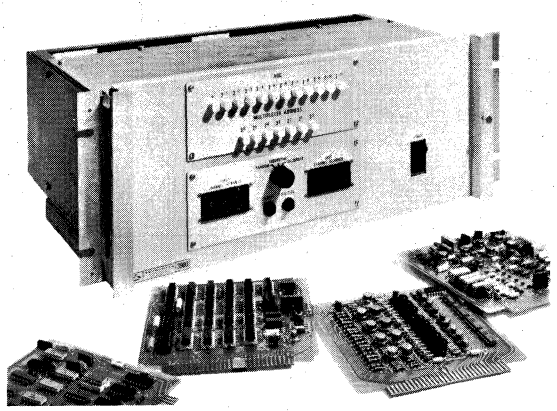
THE ASTROVERTER—
A New Concept in Data System Design

WHAT IS THE ASTROVERTER

The Astroverter is an entirely new concept in data system packaging.

It consists of a 7-inch high rack adapter, a built-in power supply, sixteen card slots and a whole family of interchangeable plug-in cards including:

- **High Speed Multiplexers**
- **High Speed Analog to Digital Converters**
- **Digital to Analog Converters**
- **Sample and Hold Amplifiers**
- **High Level Differential Buffer Amplifiers**



With these plug-in components virtually any type of data acquisition system can be designed.

Need an ADC? It takes only two cards. Add sample and hold with another card. Sixteen channels of multiplex fill up just two more slots. You still have room for a few channels of quick look with Astroverter DACs. Or up up to 128 channels of multiplexed input. Maybe you want sample and hold ahead of each multiplexed channel. No problem with the Astroverter. Or 14 channels of quick look . . . just fill up the 7-inch rack with DACs.

There has never been a system as flexible and as economical as the Astroverter, fast too, 100 KHz thruput rates.

FEATURES

IT'S FLEXIBLE . . .
An unlimited number of data acquisition system configurations are made easy using the large family of plug-in cards. Multiplexed ADC systems. Quick-look outputs. Sample and Hold. Computer Programmed Buffers. All on interchangeable 5″ x 5″ cards.

IT'S FAST . . .
Five microsecond digitizing. Less than 5 microseconds for multiplexer switching and settling. The time from addressing a channel to completion of digitizing is only 10 microseconds . . . A true thru-put rate of 100 KHz.

IT'S ECONOMICAL . . .
The Astroverter is surprisingly low priced. Like a 16 channel multiplexed ADC system with sample and hold for only $1,875. A 14 channel DAC package for $5,000. A 128 channel system for just $4,000. The Astroverter is hundreds of dollars less than slower competitive models.

IT'S SMALL . . .
A 128 channel multiplexed ADC system in only 7 inches of rack space. Or 16 Sample and Hold or Buffer Amplifiers. Or 14 Quick Look channels. You save valuable space and have configurations unlimited.

IT HAS APPLICATIONS GALORE . . .
The Astroverter offers the flexibility, speed, economy and reliability necessary in today's world of real time applications.

It can function as an interface between an analog and digital computer in hybrid computer systems.

It is ideal as a peripheral device for general purpose digital computers.

It fills a growing need in industrial process control systems.

The ability to mix multiplexers, ADC.

FRONT PANEL CONTROLS AND INDICATORS ARE OPTIONAL

For just a slight additional cost you can specify front panel controls and indicators.

Optional front panel controls include switches for first and last channel scan, a RANDOM / SEQUENTIAL / CALIBRATE switch, manual digitize and manual reset.

Optional indicators include a row of 12 indicator lamps to provide a binary readout of the 11 ADC bits plus sign, and a row of 7 lamps which gives a binary indication of channel address.

When optional controls and/or indicators are specified, a wiring control card is inserted in the extreme left hand card slot. This eliminates wiring to the front panel from other system cards.

ASTRODATA INC. P. O. BOX 3003 • 240 E. PALAIS ROAD, ANAHEIM, CALIF. • (714) 772-1000

Burroughs Computer System Components

Magnetic Tape Transports

Free-standing Units.

Several models are offered to meet various tape speed requirements. Bi-directional units operate up to 120 inches per second. All models feature gentle tape handling, end-of-tape sensing, fast start/stop, remote and local control, easy threading and dust-free operation. Packing densities up to 800 bits per inch; transfer rates up to 72 KC per second.

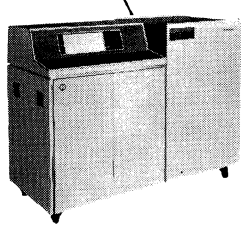
4-station "cluster" Units.

Unique Burroughs design permits four tape drives to share common electronics and cabinetry. Compact, economical, easy to use. Uses 7 or 9 channel tapes, or both. Packing densities up to 1600 bits per inch; transfer rates up to 36KC per second.



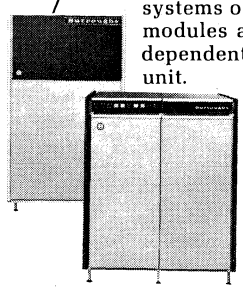
Line Printer

High speed drum printer offers 64 alphanumeric and special characters, prints 132 characters per line. Features a 132-character print buffer, plus immediate access print cycle. Handles multipart forms 5 to 20 inches wide. Available in 700 and 1040 line per minute models.



On-Line Disk File

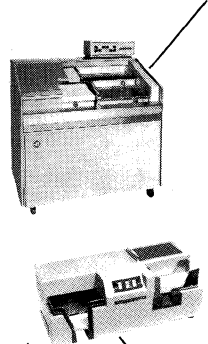
Full electronic switching via individual, fixed read/write heads provides very high speed access to every disk address regardless of total capacity. Fast, flexible, and fully proven. Individual modules available in 16-, 80- and 160-megabit capacities, with transfer rates up to 9 megabits per second. Expanded systems of up to 100 modules are possible dependent upon control unit.



Punched Card Reader

This reliable, high speed Burroughs reader handles short cards as well as standard 80-column cards. Features photoelectric reading and positive strobing of each card column. Unit shown reads 1400 cards per minute. 475 and 800 cpm models also available.

New Low-Cost Card Reader! Operates at 300 cpm flow mode, and 200 cpm demand mode. Same reliable photoelectric reading principle as higher speed units. Reads standard 80-column cards with strobe output for each card column.

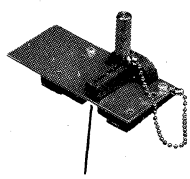




Decimal Keyboard

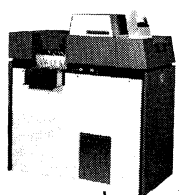
A modestly priced, versatile input device adaptable to a wide variety of data processing and communications systems.

A compact 13-key unit with a feather-light touch for high speed indexing.



Manual Tape Punch

A precision unit for adding information to an already prepared tape. Fast, easy, and accurate. No need to reinsert the tape in the main perforator. Accommodates standard Teletype and Commercial Control Flexowriter tapes. Corrects up to an 8-hole code. Tape slips in easily, and is held in perfect registration.



Card Punch

300 card per minute punch features magnetic core buffer, solid-state echo check punching verification, low maintenance. Unit may be loaded or unloaded while operating; can idle indefinitely without card damage. 3 program-selected stackers.

Burroughs

OEM Sales, 1649 Wilshire Blvd., Los Angeles 90017
Call (213) 483-4520, TWX: 910-321-2494

Integrated Circuit Logic Cards

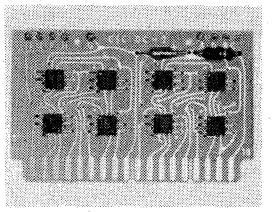
(PARTIAL LISTING)

BASIC BUILDING BLOCK ELEMENTS	
F1-4	4 Universal J-K Flip-Flops
F2-8	8 R-S Flip-Flops
2N-11	11 Two-Input NAND Gates
3N-8	8 Three-Input NAND Gates, One Inverter
4N-6	6 Four-Input Expandable NAND Gates
7-4	4 Seven-Input NAND Gates
4LDN-6	6 Four-Input Expandable NAND Buffers
MG-9	Mixed NAND Gates; 2, 3, 4 Input Gates
4GE-6	6 Four-Input Gates Extender

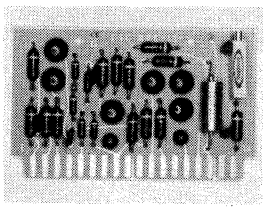
SYSTEM FUNCTIONAL BLOCKS	
4BC-1	4 Bit Binary Counter
4BC-2	Dual 4-bit Binary Counter
DC-1	BCD Decade Counter
DC-2	Dual Decade Counter
4SR-1	Four-Bit Shift Register
4SR-2	Dual Four-Bit Shift Register
4PBC-1	4-Bit Serial Carry Synchronous Binary Counter
6PBC-1	4-Bit Serial Carry Synchronous Binary Counter
4RBC-1	4-Bit Reversible Decade Counter
RDC-1	BCD Reversible Decade Counter
SR-84	MOS Shift Register; 4 21-Bit Registers; including DTL compatible interfaces
SR-126	126-Bit MOS Shift Register
BDD-IN	BCD Decade Decoder Driver for NIXIE tubes
BDD-IL	BCD Decade Decoder Driver for relays, lamps or DTL Logic
PSRG-1	Power Supply Reset Generators
BDC-1	Binary/Decimal Decoder

ANALOG SYSTEMS ELEMENTS	
OA-1	Wide Band Operational Amplifier, 86 db gain, 10 MHz bandwidth
LD (V)	Level Detector provides system output when preset level is crossed by either positive or negative crossings
LD (OD)	Differential zero Crossing Detector (comparator)
DAC-4	Four-Bit D/A Converter
RPS-15	Precision Reference Power Source (+15 volts) long term stability .005%
RPS-15	Precision Reference Power Source (−15 volts)

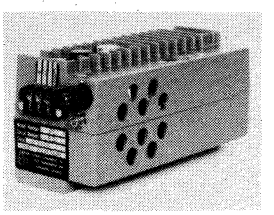
LOGIC INTERFACES — OUTPUT ELEMENTS	
I 1-4	Four Positive Output Interface
I 2-4	Four Positive Input Interface
I 3-4	Four Negative Output Interface
I 4-4	Four Negative Input Interface
I 5-4	Neon or NIXIE Indicator Drivers
I 6-4	4 Relay/Lamp/Logic Drivers
I 6-10	10 Relay/Lamp Drivers
I 7-4	4 High Speed Logic Drivers
I 8-4	4 Transmission Line Drivers
I 9-8	Eight Negative Input Interface
2RN-10	10 Two-Input RTL/NAND GATES
SD-3	3 Solenoid Drivers
ST-4	Four Schmitt Trigger circuits
CR-4	4 Form C contact relays with drivers
MLR-2	2 Form C contact magnetic latching relays with drivers
RRA-4	4 Form A reed relays with drivers
RRC-3	3 Form C reed relays with drivers



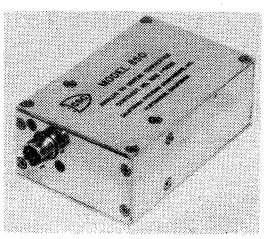
Functional Block



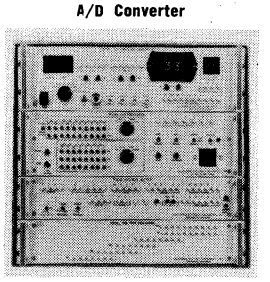
Analog Element



5 Amp Power Supply



10 Cubic Inch Spaceborne A/D Converter



System Design

OVER 300 Standard "Off-the-Shelf" products in the CSC DTuL line, including Power supplies & accessories . . . connectors, mtg. panels, chassis, bus bars, kluge cards, matrix, lamp cards, extractors, etc.

MOST PRODUCTS ARE OFFERED IN 0 TO 70°C COMMERCIAL AND FULL RANGE −55 TO 125°C TEMPERATURE RANGE.

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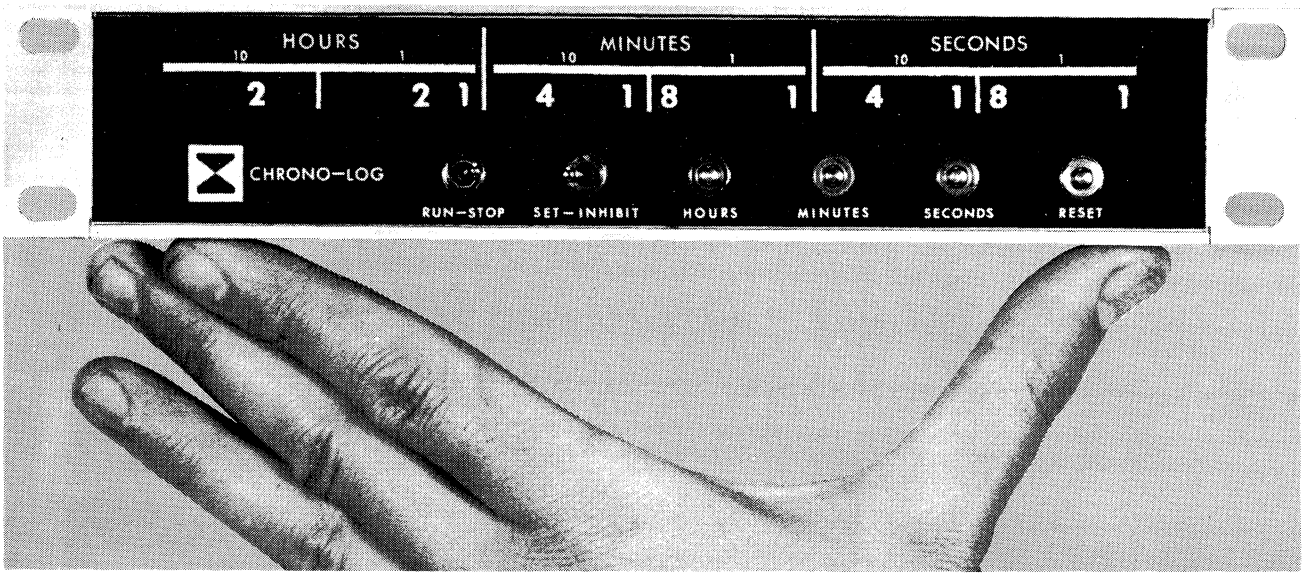
9176 INDEPENDENCE AVENUE CHATSWORTH, CALIFORNIA 91311
PHONE (213) 341-1050

ANALOG AND DIGITAL INTEGRATED CIRCUIT LOGIC CARDS

POWER SUPPLIES • MOUNTING HARDWARE SYSTEMS • A/D & D/A CONVERTERS • COMPUTERS

Whatever your requirements for TIME CODE EQUIPMENT...

Look to Chrono-log



Series 30,000

INTEGRATED CIRCUIT CLOCK/CALENDARS

Meet specific system needs at off-the-shelf prices

Applications
Wherever a digital output of real or elapsed time is required such as data logging, data transmission, data processing, time display, telemetry and digital printout systems.

Versatility, at low cost
Over 7,000 standard configurations available to meet specific system requirements at off-the-shelf prices which are less than the prices of electromechanical clocks. Use of common interface wiring and logic levels save you the costs of making engineering and documentation changes from one application to the next. Options include:

- BCD or NIXIE-type front panel displays
- Outputs of hours, minutes and seconds or other time ranges
- Day-of-the-year or month-and-day calendars
- Parallel and/or serial outputs
- Commercial or military temperature ranges
- A variety of internal or external time bases
- Various power supply inputs

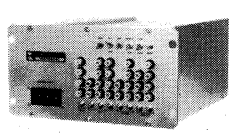
System compatibility
Use of TTL monolithic units, DTL and TTL circuits provide the optimum characteristics for clock applications, permitting simple interface with the most popular integrated circuit families. Chrono-log clock circuits are extremely reliable and provide excellent noise immunity.

Small size
Measures only 1¾ in. high, 9½ in. wide (half rack), and 8¾ in. deep.

For complete details request Bulletin 30,000.

OTHER CHRONO-LOG TIME CODE EQUIPMENT:

Time Code Generators — for recording, telemetry, range timing and other real time systems using IRIG, NASA, Vela or other time code formats. Both parallel outputs and serial modulated carrier outputs are provided for analog magnetic tape recording systems.



Low Power Time Code Generators — for field and airborne systems. Operate up to 60 hours from internal standby batteries. Internal oscillator has stability of 2 parts in 10^9 per day.

Time Code Readers — accept serial time code input in forward or reverse direction, fast or slow speed. Available for a variety of time codes or in universal multi-code models. Displays time reading and produces parallel and serial outputs of time for data processors, graphic recorders and other data devices.

Automatic Tape Search Control — controls tape drive to search for data at high speed and play back selected portions of recording. Provides front panel selection of start and stop times. Eliminates manual searching and playback.

Whatever your requirements for time code equipment, look to Chrono-log to fulfill them. For more information, contact your local Chrono-log field engineer or write us directly.

CHRONO-LOG CORPORATION

2583 West Chester Pike, Broomall, Pa. 19008. (215) 356-6771

Truth is stronger than fiction.



The truth about our A/D converters is stronger than the fiction you hear about others.

The truth about ours is that word lengths vary from 4 bits to 9 bits; word conversion rates vary from 1 MHz to 25 MHz; and aperture time is as low as 0.2 nanosecond!

Prices range from only $4,200 to $9,660 and include internal sample-and-hold, power supplies, and self-test features.



Not only that . . .
We also have D/A converters that match our A/D's in speed and accuracy. Honest!

COMPUTER LABS

for tomorrow's technology today

(919) 292-6427 • 1109 SOUTH CHAPMAN ST.
GREENSBORO, N. C. 27403

The D/A for stingy engineers



You want to convert from 4 bits at 25 MHz; or 9 bits at 10 MHz (or anywhere in between); and be ±2 millivolts accurate in less than 90 nanoseconds.

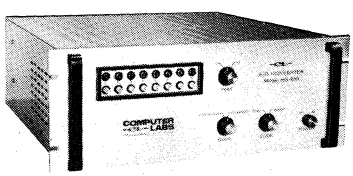
But you also want to vary external bias and reference from dc to 25 MHz.

That way, your converter can be used as a function generator, a modulator, or a programmable attenuator.

But you want to pay only $1480 to $1760 for any of six models.

You're not stingy. You're thrifty.

You want our HS-2000 Series D/A Converters.



Not only that . . .
As a thrifty engineer, you would also like our A/D converters that require no external test equipment.

Word conversion rates can vary from 1 MHz to 25 MHz; and aperture time is as low as 0.2 nanosecond!

COMPUTER LABS

for tomorrow's technology today

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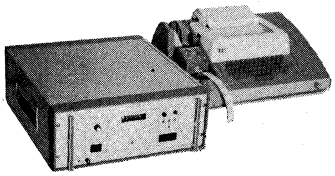
Data Loggers

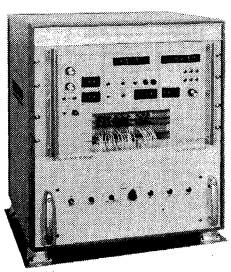
SERIES 110 LOW COST DATA LOGGERS



For scanning, digitizing, and recording analog voltages for computer entry. Two models available, one for recording low-level, low-frequency voltages on punched paper tape, the other for recording high-level, higher frequency voltages on magnetic tape. Each Data Logger contains a scanner, A/D converter with display, digital time base generator, output buffer, recording device, and desktop instrument cabinet.

CAPSULE SPECS: MODEL 112: 10 to 100 channels, 10 MV and 100 MV FS, 10 megohm differential inputs with 120 db CMR, 1 chan/sec scanning, 5-digit-plus-sign integrating ADC with Nixie display, Model 33 teleprinter with keyboard, page printer, tape punch, and reader. Basic Price: $4,950. MODEL 114: 10 to 100 channels, 10 volts FS, 10 megohm single-wire inputs, up to 2,000 chan/sec scanning, 11-bit plus sign ADC with binary display, 7-track, 556 bpi, or 9-track, 800 bpi, magnetic tape recorder with both incremental and slew writing capability. Basic Price: $8,750.

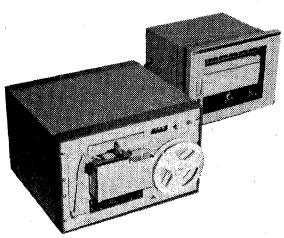
SERIES 120 DIGITAL DATA LOGGERS



For automatically measuring and recording both analog and digital signals from multiple installations of transducers for computer entry or manual study. Wide-range specifications with many options. Each Data Logger contains a scanner with display, A/D converter with display, time-of-day digital clock with display, digital data entry, output buffer, and recording device — mag tape recorder, paper tape punch, card punch, teleprinter or line printer.

CAPSULE SPECS: 10 to 1,000 channels, 10 MV to 10 volts FS with auto ranging, high-impedance differential inputs with high CMR, 0.02% system accuracy, 4-digit resolution, high-speed computer-compatible recording of time, digital data, channel and analog data. Price Range: $9,000 to $16,000.

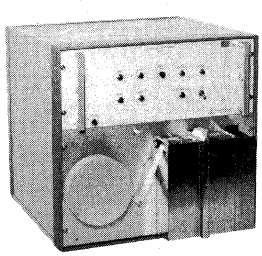
SERIES 140 MULTIPOINT RECORDER LOGGERS



Connect directly to standard multipoint recorders, digitize and record data for computer entry. Loggers are synchronized to recorders, log each data point on punched paper tape. Two models are available, one for use with single recorders, the other with 2 to 12 recorders. Simple installation, unrestricted recorder operation, automatic unattended operation.

CAPSULE SPECS: 4-digit record of each data point, punched paper tape output in 8-level ASCII or IBM code, 1,000-foot tape supply, all logging synchronized to recorders, no restrictions on multipoint recorder operation. Model 141 (single channel): $3,950. Model 142 (2-12 channels): $2,950 plus $950/channel.

SERIES 310 INTERFACE BUFFERS



For sequencing parallel digital data to magnetic tape and paper tape recorders and teleprinters. Use to record data from DVM's, counters, and other digital devices for later computer entry or manual study. Buffers control operation of recording device. Output format is programmed by user. Time-of-day digital clock and manual data entry available.

CAPSULE SPECS: 4-bit, 6-bit, or 8-bit character inputs, 0 and +5 volt logic levels, record command input and busy output. Recording rate determined by recording device. Data storage and logic level converters available. Price Range: $3,000 to $10,000, including recording device.

Control Equipment

CONTROL EQUIPMENT CORP. • 32 KEARNEY RD. • NEEDHAM HTS., MASS. 02194/(617) 444-7550

CONTROL LOGIC, INC.

SYSTEM PRODUCTS AND SERVICES

SERIES C MICRO LOGIC CARDS — A complete family of compatible micro logic cards for total capabilities in digital system design and construction. This series includes:

C110 DC to 1 MHz Logic Cards employing DTL-930 integrated circuit modules. This family offers economy with logical flexibility of collector ORing and input expansion. Including 4 flipflop cards, 8 gate cards, 10 timing and interface cards, 10 functional counters and registers, and 3 functional gating cards.

C150 DC to 5/10 MHz Logic Cards with SUHL I TTL logic in hermetically sealed ceramic modules. This high performance series operates at rated speed with up to 400 pf of load capacity. Including 5 flipflop cards, 8 gate cards, 10 timing and interface cards, 11 functional counters and registers, and 6 functional gating cards, plus 8 cards for A/D and D/A applications.

C150T DC to 5/10 MHz Logic Cards uses the 74N Series integrated circuits to provide the speed advantage of TTL with the cost advantage of epoxy packages and MSI functions. Includes 3 flipflop cards, 5 gate cards, 11 timing and interface cards, 7 functional counters and registers, and 3 functional gating cards.

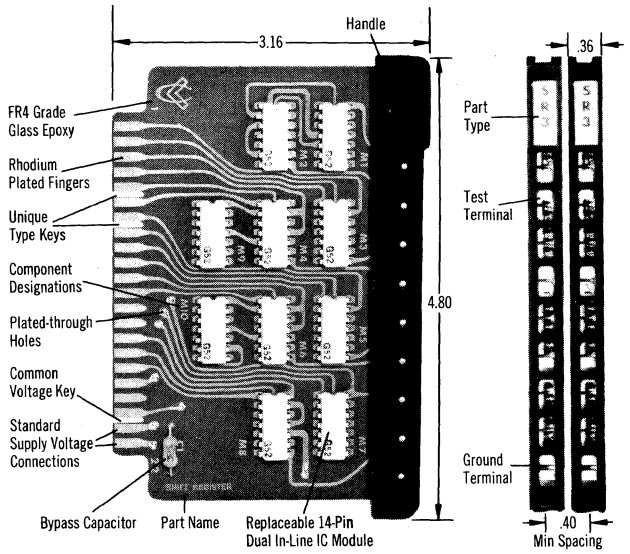
C120 DC to 20/30 MHz Logic Cards with SUHL II providing a high frequency extension to the C150 family. These cards are directly interchangeable with equivalent C150 types. Including 3 flipflop cards, 3 gate cards, 2 timing and interface cards, and 2 registers.

SERIES P PACKAGING PRODUCTS — This series provides a selection of over 100 packaging and accessory products for Series C micro logic cards. A unique modular design allows the packaging needs for any requirement to be solved with standard catalog components.

SERIES A COMPATIBLE ANALOG PRODUCTS — For analog to digital conversion, and analog measurement and test.

SERIES N SOLID STATE PRODUCTS — For industrial measurement and control. A family of system, accessory, and packaging components which supplement Series C and Series P products to provide one source of supply of components for industrial measurement and control systems. Series N provides complete electrical isolation between the logic unit and the outside world, to completely eliminate problems of electrical noise.

SERIES C CARD FEATURES



SERIES S DESIGN AND ASSEMBLY SERVICES — Control Logic offers computer aided design, automated wiring, and assembly services to assist you in your system design and construction. In addition, our Systems Department provides engineering design services to provide turnkey systems.

CONTROL LOGIC, INC. 3 Strathmore Road, Natick, Mass. 01760 — Tel: (617) 655-1170, (617) 235-1865; TWX: (710) 386-6677

REGIONAL OFFICE 30011 Euclid Ave., P.O. Box 226, Wickliffe, Ohio 44092 — Tel: (216) 943-0403

LOCAL REPRESENTATIVES

AL Huntsville 35801, Roy Attaway Company, 900 Bob Wallace Avenue, Tel: (205) 534-2811

CA Burlingame 94010, Compar, San Francisco, 1817 Bayshore Highway, Tel: (415) 347-8244

CA Downey 90241, Wieler and Company, 10842 S. Paramount Blvd., Tel: (213) 923-6611

CO Boulder 80302, Straube Associates, P.O. Box 1649, Tel: (303) 443-8600

CT Glastonbury 06033, Instrument Representatives, Inc., P.O. Box 165, Tel: (203) 633-0777

DC Washington 20014, Sonco, 4720 Montgomery Lane, Tel: (301) 654-5226

FL Orlando 32801, Roy Attaway Company, 57 East Robinson Street, Tel: (305) 424-9983

IL Chicago 60643, Brisky Associates, 11734 South Western Avenue, Tel: (312) 233-1339

IN Fort Wayne 46802, Robert O. Whitesell & Assoc., Inc., Central Building, Room 272, Tel: (219) 743-4411
Indianapolis 46219, Robert O. Whitesell & Assoc., Inc., 6620 E. Washington Street, Tel: (317) 359-5374

IA Cedar Rapids 52403, Engineering Services Company, 1026 Third Avenue, S.E., Tel: (319) 366-1591

KS Prairie Village 66208, Engineering Services Company, 7924-A State Line, Tel: (913) 649-4000

KY Louisville 40207, Robert O. Whitesell & Assoc., Inc., 3620 Lexington Road, Room 223, Tel: (502) 893-7303

MA Arlington 02174, Instrument Representatives, Inc., 1046 Massachusetts Avenue, Tel: (617) 646-1034

MI Southfield 48075, Robert O. Whitesell & Assoc., Inc., 25100 Evergreen Road, Tel: (313) 358-2020
Benton Harbor 49022, Robert O. Whitesell & Assoc., Inc., 303 Fidelity Building, Tel: (616) 927-2041

MO St. Louis 63130, Engineering Services Company, 6717 Vernon Avenue, Tel: (314) 726-2233

NJ Eatontown 07724, Sonco, 42 R Monmouth Road, Tel: (201) 542-1441

NY New Rochelle 10804, HAF Spectrum Associates, 35 Broadfield Road, Tel: (914) 632-3800

NC Winston-Salem 27101, Radco, 614 Nissen Building, Tel: (919) 722-9671

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PA Camp Hill 17011, Sonco, Park Place Office Building, Tel: (717) 761-0577
King of Prussia 19406, Sonco, 107 Town Center Road, Tel: (215) 265-3250
Pittsburgh 15235, Robert O. Whitesell & Assoc., Inc., 201 Penn Center Building, Tel: (412) 242-0100

TX Houston 77027, Arnold Barnes Co., 3230 Mercer Street, Tel: (713) 622-3620
Richardson 75080, Arnold Barnes Company, 740 South Sherman Street, Tel: (214) 235-4541
San Antonio 78209, Arnold Barnes Company, 104 East Petroleum Center, Tel: (512) 828-1323

UT Morgan 84050, Straube Associates, RFD 1 (Highland) P.O. Box 316, Tel: (801) 829-6448

VA Richmond 23219, Sonco, Ross Building, Tel: (703) 643-5226

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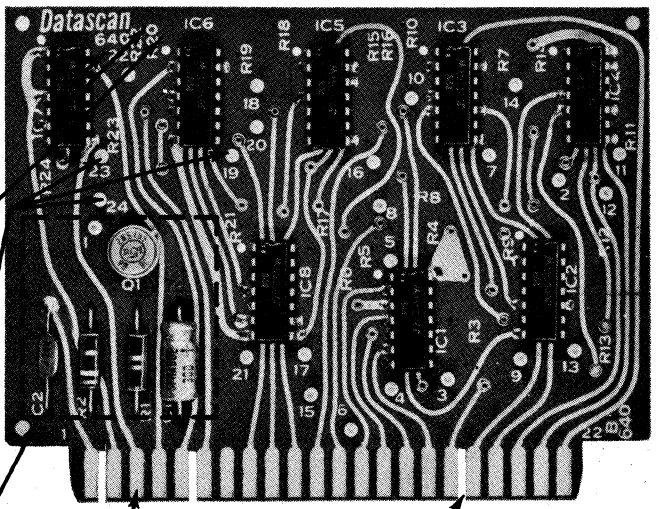
The Integrated Circuit Logic Card with *More Value* Built In

Datascan now offers you the most complete line of *function* IC cards — DTL 200 series, TTL 600 series and HTL (High Noise Immunity) 400 series, power supplies, hardware and accessories. All three card lines are pin for pin interchangeable.



Pull-Up Resistors
Provision for mounting resistors right on card — reduces number of interconnections, cards and cost.

Test Points
Optimum number with no added capacitance or sacrifice in function capacity.

Dynamic Decoupling™
Exclusive with Datascan — eliminates high and low frequency noise for extremely reliable system operation. The decoupling circuit is right on the card.

Edge Connections
44 pins for economy, availability, reliability—compatible for any type of termination.

Card Keying
Unique 3 slot interpin keying — prevents accidental interchanging or reversing—saves all 44 pins for active connections.

DESCRIPTION	CRTS/CARD	LOGIC MODULE #	PRICE
2 Input NAND Gate	12	201 401 601	$ 29.00 42.00 29.00
3 Input NAND Gate	9	202 402 602	29.00 41.00 29.00
4 Input NAND Gate	8	203 403 603	31.00 47.00 31.00
4 Input Power NAND Gate	8	203A	32.00
4 Input NAND, expandable	6	204 404	29.00 40.00
4 Input Power NAND, expandable	6	204A	30.00
Diode Expander	6	205 405* 605*	32.00 — —
Inverter	20	206 406 606	36.00 57.00 36.00
Inverter, Power	20	207	48.00
Inverter, Line Driver	20	208 408 608	48.00 98.00 48.00
4 Input Line Driver	8	209 409 609	32.00 51.00 32.00
4 Input Line Driver, expandable	6	210 410	30.00 43.00
Universal Flip-Flop	4	211 411 611	41.00 59.00 41.00
Toggle Flip-Flop	6	212 412 612	51.00 78.00 51.00
R-S Flip-Flop	10	213 413 613	36.00 58.00 36.00
One Shot Adjustable	5	214	84.00
One Shot, Fixed	5	214A	58.00
Input Level Converter	8	215 415 615	55.00 70.00 55.00
Output Level Converter (Neg.)	12	216 416 616	54.00 64.00 54.00
Astable Multivibrator & Gate	1	217 417 617	55.00 88.00 55.00

DESCRIPTION	CRTS/CARD	LOGIC MODULE #	PRICE
Power AND Gate	8	218 418 618	$ 45.00 50.00 45.00
Schmitt Trigger	4	219 419 619	54.00 59.00 54.00
Reed Relay Board	6	220 420 620	88.00 90.00 88.00
BCD Storage FF w. 7 Segment Decoding	1	221	56.00
BCD Storage FF w. Decimal Decoding	1	222	52.00
Level Converter, Neg.	6-in/6-out	223	52.00
Decimal to BCD Relay Board	1	224	82.00
Storage Flip-Flops	20	225 425 625	49.00 95.00 49.00
Gated Storage Flip-Flops	8	226	47.00
One Shot, Adjustable	4	427	78.00
One Shot, Fixed	4	427A	65.00
Count Down Counter, BCD	2	228 428 628	59.00 104.00 59.00
Count Down Counter, Binary	2	229 429 629	59.00 98.00 59.00
Decade Counter	2	230 430 630	59.00 98.00 59.00
4 Bit Counter	2	231 431 631	59.00 98.00 59.00
8 Bit Shift Register	1	232 432 632	60.00 98.00 60.00
Decade Counter w. Decimal Conv.	1	233 633	52.00 52.00
6 Bit Shift Register	2	234 434 634	78.00 134.00 78.00
Decade Ctr. w. 7 Seg. Conv.	1	235 635	73.00 73.00
4 Bit Binary Reversible Ctr.	1	236 436 636	52.00 89.00 60.00
4 Bit BCD Reversible Ctr.	1	237 437 637	56.00 109.00 70.00

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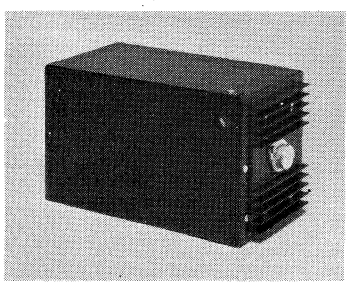
DESCRIPTION	CRTS/CARD	LOGIC MODULE #	PRICE
Synchronous Counter, 4 Bit Binary	2	238 438 638	$ 66.00 82.00 66.00
Synchronous Counter, BCD	2	239 439 639	66.00 82.00 66.00
Exclusive Or/Adder	6	240 440 640	40.00 74.00 56.00
BCD to Decimal Converter	2	241 441 641	43.00 78.00 43.00
BCD to Decimal Conv. w. Lamp Drivers	1	242 442 642	54.00 81.00 54.00
BCD to Decimal Conv. w. Nixie 1 Driver	1	242A 442A 642A	54.00 101.00 54.00
BCD to 7 Seg. Conv. & Lamp Drivers	1	243 443 643	55.00 80.00 67.00
Binary to Decimal Converter	1	244 444 644	42.00 75.00 42.00
Power Binary to Decimal Conv.	1	244A 444A 644A	43.00 84.00 43.00
8 Bit Parity Generator	1	245 445 645	43.00 80.00 43.00
Binary/Octal Converter	2	246 446 646	47.00 82.00 47.00
4 Bit Comparator, Parallel	2	247 447 647	36.00 60.00 44.00
12 Bit Shift Register	2	248	99.00
Operational Amplifier Board	1	256 456* 656*	58.00 — —
Crystal Oscillator	1	260 460 660 660B	63.00 76.00 63.00 67.00
Crystal Oscillator	1	260A 460A 660A	65.00 76.00 65.00
6 Decade Counter/Divider	1	261	106.00
Synchronous Clock Board	1	262 462 662	45.00 63.00 45.00
DC to Frequency Converter	1	263 463* 663*	135.00 — —
±15 V Power Converter @ 0.1A	1	264 664*	66.00 —
D/A Converter, 3 BCD Decades	1	265 665*	255.00 —
D/A Converter 12 Bit Binary	1	265 665A*	255.00 —
Pulse Coupled Flip-Flops	5	266	66.00
D/A Converter 6 Bit Binary	4	267 667*	203.00 —
A/D Converter Control Board	1	268 668*	102.00 —
One-Shot Adjustable	4	669	77.00
One-Shot Fixed	4	669A	65.00

DESCRIPTION	CRTS/CARD	LOGIC MODULE #	PRICE
Discrete Inverter	16	271 471* 671*	$37.50 — —
Time Delay	5	285 485 685	98.00 116.00 98.00
Transfer Gate	4	289 489 689	32.00 44.00 32.00
II ACCESSORIES			
Extender Board	—	249 449* 649*	22.00 — —
Test Board	—	250 450* 650*	74.00 — —
Kluge Board. I. C.	11	251 451 651*	15.00 15.00 —
Cable Board		253 453* 653*	13.00 — —
Universal Board	3	254 454* 654*	13.00 — —
Kluge Board, Discrete	—	258 458 658*	15.00 15.00 —
Card Extractor	—	270 470* 670*	11.50 — —
Diode Matrix, 12 x 18	1	272 472* 672*	15.00 — —
III POWER SUPPLIES			
Power Supply 7.0Vdc & 5.6Vdc	—	252 652*	161.00 —
Power Supply 17.0Vdc & 15.6Vdc	—	452	195.00
Power Supply 5.0Vdc		257,657*	160.00
IV FILES AND DRAWERS			
Card File (no connectors)	—	CF CF* CF*	$ 61.00 — —
Card Drawer, 2 Racks (no connectors)	—	CD CD* CD*	123.00 — —
Card Drawer, 3 Racks (no connectors)	—	CD CD* CD*	177.00 — —
V CONNECTORS			
Power Distribution Buss (installed)		PB	28.00
Chassis Slides (installed)		CT	18.00
CONNECTORS: (installed)			
Solder Tab	—	S	2.50
Wire Wrap	—	W	4.25
Termipoint	—	T	4.25
Taper Pin (0.6" centers only)	—	P	5.50
Taper Pin (0.5" centers only)	—	Q	5.00

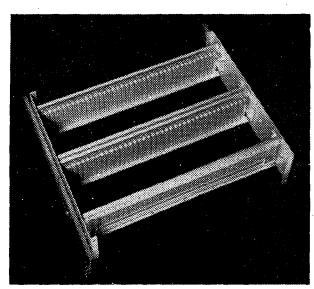
*No module exists in this series; 200 Series module is compatible.

POWER SUPPLIES



Solid state units, with current limiting and overvoltage protection. Available for use with or without dynamic decoupling in the logic system.

CARD DRAWERS



Datascan offers standard card drawers with 1 rack (40 slots), 2 racks (80 slots) or 3 racks (120 slots). All drawers are furnished with a finished 5¼" front panel, handles and holes for mounting chassis slides. Drawers can be furnished, at the customer's option, with solder, wire-wrap, Termi-Point or taper pin connectors; chassis slides; 4-layer power buss and rear connector panel.

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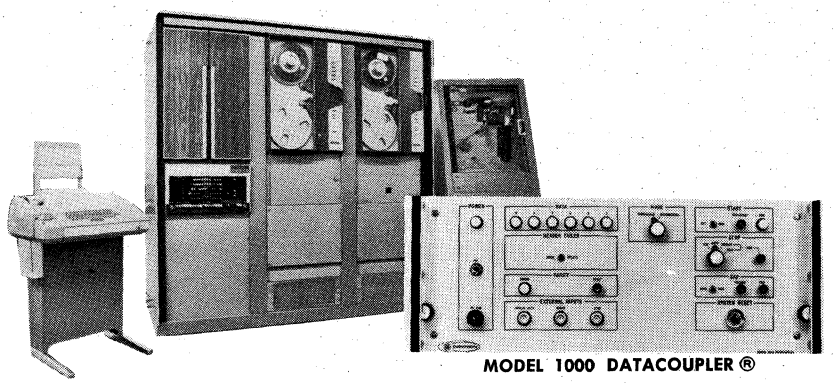
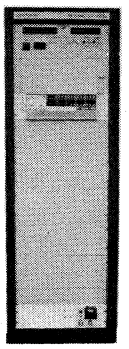
NEW IC Logic Card Handbook

Write for the new 200 page handbook—complete with application notes, schematics and module specifications.





MODEL 1000 DATACOUPLER ®



datatron's digital data products and systems...

IN THE FIELDS OF DATA ACQUISITION AND REDUCTION, DATATRON CAN PROVIDE THREE ALTERNATE APPROACHES TO SYSTEM IMPLEMENTATION.

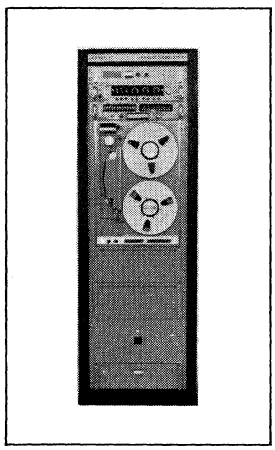
1. A broad range of high performance, low cost products which can be incorporated into user-designed systems.
2. The design and construction of complete, fully integrated systems.
3. An extensive line of linkage equipment for the interconnection of subsystems.

products

A key example of Datatron's design and productive capabilities is the MODEL 1000 DATACOUPLER®(as illustrated). Like all Datatron products and systems, this unit is entirely solid state making almost exclusive use of integrated circuits. In itself a complete multipurpose data system, the Model 1000 provides the capacity for both data acquisition and reduction. When used to acquire data, the unit accepts multichannel analog or digital inputs. All analog input data is digitized utilizing a self-contained analog-to-digital converter option. The resultant digital data is recorded on devices such as an incremental tape recorder, paper tape punch, or line printer. Other options including a digital clock, provisions for constant data insertion, and an intervalometer permit the tagging of the recorded data and the selection of the interval between data scans. When a digital recorder is used, the Model 1000 can assist in data reduction. Front panel rotary thumbwheel switches permit the operator to automatically search for a preselected file, record number, or time tag information. Once located, the entire record or selected channels of the record can be outputted to a line printer or converted back to analog form for "quick look" analysis.

systems

Datatron has purposely concentrated on the growing market for low through medium cost digital data systems. Examples include low or high level, low or high speed analog-to-digital conversion and recording systems; analog data reduction systems; and digital data reduction systems. These systems can be either the hard wire program type or stored program type making use of a central data processor. In each instance, Datatron will provide a fully compatible system including (as in the latter case) all necessary system software. Datatron has also achieved an impressive background of experience in the design of tape format converter systems (IBM to ASCII, etc.).



the datatron family of timing instrumentation



3000 Time Code Translator/Generator

The Model 3000 Time Code Translator/Generator provides a complete, highly flexible timing system for those facilities where both data acquisition and reduction will be performed. As a generator, the unit accumulates time from a precision internal frequency standard. Synchronization controls permit close correlation, if desired, to an external time standard. The Model 3000 generates up to five serial time codes simultaneously while also outputting pulse rates and parallel data. As a translator, the unit will accept different time codes simply by changing a printed circuit card. High or low speed, forward or reverse translation is provided. Such items as input carrier filters, and digital error bypass logic usually found only on much more expensive units are included as standard features in the Model 3000.



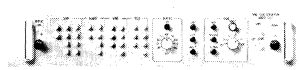
3100 Time Code Generator

Where timing is required for data acquisition at a site remote from the data reduction station, the Model 3100 Time Code Generator is an ideal solution. This generator accumulates time from an internal precision crystal oscillator, includes synchronization logic, and outputs up to five serial time codes along with pulse rate and parallel outputs.



3200 Time Code Translator

The Model 3200 Time Code Translator permits high or low speed, forward or reverse translation of a time code from magnetic tape or can be utilized as a terminal device to accept a time code over telephone line or RF link. The unit provides serial time code outputs for the redubbing on magnetic tape or "quick look" on strip chart recorders, parallel outputs for entry into digital data systems or time tagging of recorded digital data and pulse rates for system synchronization.



3110 Time Code Generator

The Model 3110 Time Code Generator is an extremely low power generator, designed primarily for portable and airborne applications. Depending upon the frequency standard utilized in the generator, the unit can generate five simultaneous time codes while consuming less than one watt of power. The Model 3110 is designed to mount in a standard nineteen inch rack and is 3-1/2 inches high. The unit is also available in a portable carrying case and can be configured to fit specific airborne or portable packaging requirements.



3400 Tape Search Unit

The Model 3400 Tape Search Unit complements the Model 3000 Time Code Translator/Generator and Model 3200 Time Code Translator. When used in conjunction with a translator, this unit provides automatic search for a data interval as programmed by front panel rotary thumbwheel switches or by a digital computer.



3350 Digital Clock

The Model 3350 Digital Clock accumulates time-of-day and day-of-year utilizing either an internal crystal oscillator or the 60-cycle power line as a frequency source. Digital outputs are available for time tagging data when the clock is used in data system applications. Accumulated time is displayed on the front panel. The unit is entirely solid state but is priced competitively with electro mechanical or mechanical units.

linkage equipment

Where a complete system is in existence but specialized equipment for the interconnection of subsystems is required, Datatron's capability for building a wide range of linkage equipment can be of great value. Typical linkage systems would connect a digital computer to a digital tape deck, telephone data set, xy plotter, timing system, or existing data system. Other linkage systems connect digital tape transports to telephone data sets, teletype, computer, punched paper tape, printer, xy plotter, etc.

DATATRON

Datatron manufactures an extensive line of digital data products and systems, timing instrumentation, and data transmission equipment and systems. Detailed information and literature can be obtained by writing Datatron or contacting one of our field representatives. Our staff is available at all times to offer additional assistance in any of these areas or for special projects.

Datatron Inc., 1562 Reynolds St., Santa Ana, California 92705 • (714) 540-9330 • TWX: (910) 595-1589

DATA CONVERSION MODULES

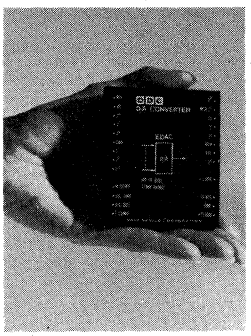
DDC
DATA DEVICE CORPORATION / DEPT. 18
100 TEC STREET, HICKSVILLE, N. Y. 11801
TWX: 510-221-1874 • PHONE: 516-433-5330

9-13 BIT DIGITAL/ANALOG CONVERTERS
UDAC Series Specifications — Electrical
at 25°C and rated supplies unless othewise noted

Digital/Analog Converter Model		UDAC-9	UDAC-11	UDAC-13
PARAMETER	UNIT		VALUE	
RESOLUTION	# of Bits(1)	9	11	13
ACCURACY	% of F.S.(2)	±0.1	±0.025	±0.0005
TEMP. COEF.(3)	% of F.S./°C(2)	±0.006	±0.002	±0.0005
SETTLING TIME(4)	μs	5 typ.; 10 max.(5)		
REFERENCE		±10 V (DC to 10 KHz)		
INPUT LOGIC		DTL or TTL, one line, one load per bit		
CODING(6)		Ones's complement, two's complement		
RATED OUTPUT				
Voltage	V		±10	
Current	mA		±5	
POWER SUPPLY REQUIREMENTS				
Voltage	V	+5	+15	−15
Current	mA	50	70	20
Accuracy(7)	%	2	1	1

NOTES: (1) Including sign; (2) F.S. = 20 V pp; (3) Lower T.C.'s available; (4) To within 1 LSB; (5) 5 μs max. available; (6) Other codes available; (7) Drift vs. power supply 1 mV/% for ±15V supplies.

Price (1-9) from $200



8-11 BIT DIGITAL/ANALOG CONVERTERS
EDAC Series Specifications — Electrical
at 25°C and rated supplies unless otherwise noted

Digital/Analog Converter Model		EDAC-8	EDAC-9	EDAC-10	EDAC-11
PARAMETER	UNIT		VALUE		
RESOLUTION	# of Bits(1)	11	11	11	11
ACCURACY	# of Bits(1)	8	9	10	11
	% of F.S.(2)	±0.2	±0.1	±0.05	±0.025
TEMP. COEF.(3)	% of F.S./°C(2)	±0.01	±0.0075	±0.005	±0.0025
SETTLING TIME(4)	μs	5 typ.; 10 max.(5)			
UPDATE RATE	MHz	10 max.			
REFERENCE		Internal			
INPUT LOGIC		DTL or TTL, one line, one load per bit			
CODING(6)		One's complement, two's complement			
RATED OUTPUT					
Voltage	V		±10		
Current	mA		±5		
POWER SUPPLY REQUIREMENTS					
Voltage	V	+5	+15	−15	
Current	mA	50	70	20	
Accuracy(7)	%	2	1	1	

NOTES: (1) Including sign; (2) F.S. = 20 V pp; (3) Lower T.C.'s available; (4) To within 1 LSB; (5) 5 μs max. available; (6) Other codes available; (7) Drift vs. power supply 1 mV/% for ±15V supplies.

Price (1-9) from $150

SAMPLE AND HOLD MODULES
Model MSSH Specifications — Electrical
at 25°C and rated supplies unless otherwise noted

PARAMETER	VALUE
ACQUISITION TIME	10μs max.
APERTURE TIME	100ns max.
ACCURACY (Sample)	±0.01% of F.S.(1)
DRIFT (Hold)	<1mV/100ms(2)
DIELECTRIC ABSORPTION (100 ms hold)	<0.01% of F.S.(1)
LOGIC LEVELS(3)	
HOLD = A•B•C (Logic 1)	+2V min.
SAMPLE = A•B•C (Logic 0)	+0.8V max.
INPUT VOLTAGE RANGE	
Comon Mode	±16V max.
Differential	±10V max.
INPUT IMPEDANCE	
Differential (balanced)	40KΩ min.
Single-ended	20KΩ min.
RATED OUTPUT	
Voltage	±10V min.
Current	±10ma min.
POWER SUPPLY VOLTAGES — RATED	±15V

(1) F.S. = 20 V p-p.
(2) <1mV/10ms at 85°C
(3) Sink current 1.5ma max.

Price (1-9) from $150

EIGHT CHANNEL MULTIPLEXER
Model MMUX Specifications — Electrical
at 25°C and rated supplies unless otherwise noted

PARAMETER	VALUE
ACCURACY	±0.01% of F.S.(1)
SETTLING TIME	10μs max.
DRIFT	25μv/°C max.
INPUT CAPACITANCE	
Switch Off	10 pfd. max.
Switch On	80 pfd. max.
INPUT CHANNELS (1 or 2 level)(2)	8/16/24/32/40/48/56/64
INPUT VOLTAGE RANGE	±10V max.
INPUT IMPEDANCE	10^9 Ω min.
ENTRY (Internal Address Register)	Serial/Parallel
INHIBIT	Parallel
RATED OUTPUT	
Voltage	±10V min.
Current	±10ma min.
POWER SUPPLY VOLTAGES —RATED	±15V

(1) F.S. = 20V p-p
(2) Unit Load = 1.6ma max.

Price (1-9) from $200

8-11 BIT ANALOG/DIGITAL CONVERTERS
MADC Series Specifications — Electrical
at 25°C and rated supplies unless otherwise noted

Analog/Digital Converter Model		MADC-8	MADC-9	MADC-10	MADC-11
PARAMETER	UNIT		VALUE		
RESOLUTION	# of Bits(1)	11	11	11	11
ACCURACY	# of Bits(1)	8	9	10	11
	% of F.S.(2)	±0.2	±0.1	±0.05	±0.025
TEMPERATURE COEFFICIENT(3)	% of F.S./°C(2)	±0.01	±0.0075	±0.005	±0.0025
CONVERSION TIME	μs	22			
BIT RATE	μs/Bit	2 max.			
OUTPUT LOGIC		DTL or TTL, positive logic			
CODING(4)		One's complement, two's complement			
INPUT					
Voltage	V	±10			
Impedance	KΩ	20			
POWER SUPPLY REQUIREMENTS					
Voltage	V	+5	+15	−15	
Current	mA	150	70	20	
Accuracy(5)	%	5	3	3	

NOTES: (1) Including sign. (2) F.S. = 20 V p-p. (3) Lower T.C.'s available. (4) Other codes available. (5) Drift vs. power supply 1 mV/% for ±15V supplies.

Price (1-9) from $300
MIL SPEC VERSION AVAILABLE

14 BIT MINIATURE DIGITAL/SYNCHRO CONVERTERS
EDSC Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY(1)	±4 minutes
RESOLUTION	14 Bits
CODING	natural binary 'angle'
LOGIC	parallel, positive logic, TTL levels
OUTPUT(2)(3)	3 wire synchro 11.8V rms L-L 400 Hz driving up to 300 ohms L-L balanced
REFERENCE INPUT(2)(3)	26V rms 400 Hz
POWER SUPPLY REQUIREMENTS	+15V at 100mA, −15V at 80mA, +5V at 50mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies, ±10% amplitude and frequency variation and up to 10% harmonic distortion of the reference and for any balanced load from no load to 300 ohms L-L.
(2) Other input and output voltages and frequencies available.
(3) Transformer isolated.

Price (1-9) from $495

13 BIT MINIATURE SYNCHRO/DIGITAL CONVERTERS
ESDC Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY(1)	±4 minutes ±0.5 LSB
RESOLUTION	13 Bits
CODING	natural binary 'angle'
DIGITAL OUTPUT	parallel, positive logic, TTL levels 13 angle data and 1 inhibit lines
SYNCHRO INPUT(2)(3)	11.8V rms L-L 400 Hz (ESDC-L), 90V rms L-L 400 Hz (ESDC-H)
REFERENCE INPUT(2)(3)	26V rms 400 Hz (ESDC-L), 115V rms 400 Hz (ESDC-H)
SYNCHRO INPUT RATES	0 to 360°/sec for full accuracy
POWER SUPPLY REQUIREMENTS	+15V at 40 mA, −15V at 20mA, +5V at 200mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortion of synchro and reference inputs.
(2) Other input voltages and frequencies available.
(3) Transformer isolated.

Price (1-9) from $645

14 BIT MINIATURE DIGITAL/RESOLVER CONVERTERS
MDRC Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY(1)	±4 minutes
RESOLUTION	14 Bits
CODING	natural binary 'angle'
LOGIC	parallel, positive logic, TTL levels
OUTPUTS	10 $\sin\theta \sin\omega t$ and 10 $\cos\theta \sin\omega t$ volts at 5mA. where θ = digitalinput angle and ω = reference input frequency
REFERENCE INPUT(2)	26V rms 400 Hz transformer isolated
POWER SUPPLY REQUIREMENTS	+15V at 30mA, −15V at 10mA +5V at 50mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortion of reference.
(2) Other input voltages and frequencies available.

Price (1-9) from $425

MINIATURE RESOLVER/SYNCHRO CONVERTERS
ERSC Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY(1)	±2 minutes
INPUTS(2)	resolver voltages, ±10V peak at 400 Hz
INPUT IMPEDANCE	10 megohms min.; 50 pF max.
OUTPUTS(2)	3-wire synchro voltages, 90V rms L-L no load 400 Hz transformer isolated
OUTPUT IMPEDANCE	100 ohms L-L max. balanced to 5%
LOAD	any balanced load from no load to 2500 ohms L-L
POWER SUPPLY REQUIREMENTS	±15V at 550mA peak at full load

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies, ±10% amplitude and frequency variation and up to 10% harmonic distortion of the inputs and for any balanced load from no load to 2500 ohms L-L.
(2) Other input and output voltages and frequencies available.

Price (1-9) from $295

14 BIT MINIATURE SOLID STATE CONTROL TRANSFORMER
SSCT Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY(1)	±4 minutes
RESOLUTION	14 Bits
CODING	natural binary 'angle'
DIGITAL INPUT	parallel, positive logic, TTL levels
SYNCHRO INPUT(2)(3)	11.8V rms L-L 400 Hz (SSCT)-L); 115V rms L-L 400 Hz (SSCT-H)
REFERENCE INPUT(2)(3)	26V rms 400 Hz (SSCT-L); 115V rms 400 Hz (SSCT-H)
OUTPUTS	AC(3) and DC(3), output gradient controllable by an external resistor
POWER SUPPLY REQUIREMENTS	+15V at 30mA, −15V at 10mA, +5V at 50mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortio nof synchro and reference inputs.
(2) Other input voltages and frequencies available.
(3) Transformer isolated.

Price (1-9) from $400

ELECTRONIC CONTROL DIFFERENTIAL TRANSMITTER
ECDX Series Specifications

PARAMETER	VALUE
ACCURACY(1)	±4.5 minutes
RESOLUTION	14 Bits
CODING	natural binary 'angle'
LOGIC	parallel, positive logic, TTL levels
OUTPUTS	10 $\sin\theta \sin\omega t$ and 10 $\cos\theta \sin\omega t$ volts at 5mA. where θ = digital input angle and ω = reference input frequency
SYNCHRO INPUT(2)	11.8V rms 400 Hz transformer isolated
POWER SUPPLY REQUIREMENTS	+15V at 30mA, −15V at 10 mA, +5V at 50mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortion of synchro input.
(2) Other input voltages and frequencies available.

Price (1-9) from $635

The Model VA-23 is our latest high speed data amplifier for fast conversions. Slew rate is 1000 V/μs; frequency for unity gain 150 MHz typically. See Section 1100.

PLEASE SEE SECTIONS 1100 AND 4900

All specifications subject to change without notice.

Oh, you'll put it together, all right, and after a while, it'll work, more or less.
Then you'll take the prototype to engineering for board design, get it back, attach the components, test it, make a few compromises, try it again. What you have then is an engineering model.
Then the manufacturing design. Back to engineering for debugging. More testing. Parts procurement. Incoming inspection. Telephone calls. Late deliveries. More testing. Heartache.
Final release and the module is ready for manufacture. Maybe.

All this time, an already designed, fully debugged, guaranteed, computer-tested, solid state module sits on Digital's shelf. Fifty engineers in offices around the country wait for your call to help. Application notes, installation drawings, catalogs sit in our mail room.
Power supplies, hardware, racks are piled high in the stock room.

M Series modules are the most complete, fully compatible, fast, all IC, TTL, inexpensive solid state logic available anywhere. With a few million modules in our recent history, and a few million dollars worth of test equipment, we really know how to put them out.
Read all about them in the new Logic Handbook. Free.

digital
COMPUTERS · MODULES

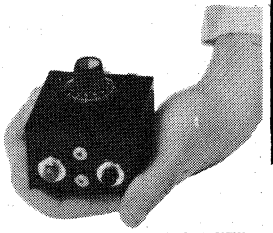
Hold it, right there.



DIGITAL EQUIPMENT CORPORATION, Maynard, Massachusetts 01754. Telephone: (617) 897-5111 / Cambridge, Mass. / New Haven / Washington, D.C. / Parsippany, Palisades Park, N.J. / Princeton, N.J. / Rochester, N.Y. / Long Island, N.Y. / Philadelphia / Pittsburgh / Cleveland / Dayton / Huntsville / Cocoa, Fla. / Chicago / Denver / Ann Arbor / Salt Lake City / Houston / Albuquerque / Los Angeles / Palo Alto / Seattle. INTERNATIONAL, Carleton Place and Toronto, Ont. / Montreal, Quebec / Edmonton, Alberta, Canada / Reading and Manchester, England / Paris, France / Munich and Cologne, Germany / Oslo, Norway / Stockholm, Sweden / Sydney and West Perth, Australia.

Solid State Instruments — DIGITAL INSTRUMENTS, INC. — Analog or Digital

13735 Victory Boulevard / Van Nuys, California 91401 213 988-3450

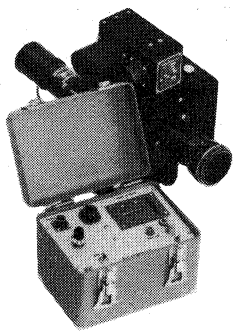


SOLID STATE TIMER WITH OUR NEW SOLID STATE RELAY SERIES 40

Replace your electro-mechanical timers with these Solid State, totally integrated Timers, and cut down on repair and maintenance costs. Trouble-free operational life extends to 500 million cycles!

GENERAL SPECIFICATIONS

INPUT POWER: 115 VAC 60 Hz, or 12 to 48 VDC.
TEMPERATURE: −10° to +170°F.
REPEAT ACCURACY: ±1% of dial setting with ±10% input voltage variation.
RESET TIME: 50 milliseconds.
RELIABILITY: timing unaffected by line voltage fluctuation or transients (up to 1000 volts).
LOAD CONTACT RATINGS: 2.0 AMPS at 25°C, 115 VAC inductive or resistive.



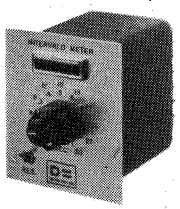
INTERVALOMETER SERIES 390

APPLICATIONS

- ☐ Time lapse photography including traffic control, construction progress, building security, school teaching methods etc.
- ☐ Life, product and stress-type testing.
- ☐ Photocopying Systems.
- ☐ Research in medical, laboratory, biological, botanical and small life studies.
- ☐ Weather, and Underwater Research.
- ☐ Dispensing of flares, etc.

GENERAL SPECIFICATIONS:

INPUT POWER: 115 VAC (±10%) 60 Hz or 400 Hz or 12 to 48 (±10%) VDC—120 MA.
DIMENSIONS: 5" high x 5" deep x 7" long.
OUTPUT CONTACT RATING: 10 Amps. at 12 to 48 VDC or 110 VAC.
POWER REQUIREMENT (excluding load): 120 MA DC models only.
REPEATABILITY: ±1%.
FRAME COUNTER: 9999 counts resettable to zero.
MANUAL OVERRIDE: Control for extra pictures.

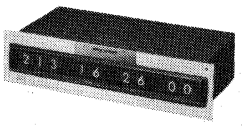


SERIES 500 REPEAT CYCLE OR SEQUENCE TIMER INTERVALOMETER

Upon application of operating power, the first timing interval is initiated. At the completion of the first timing interval the contacts transfer and the second timing interval is initiated. At the completion of the second interval timing contacts transfer and the cycle is repeated. This timing cycle is repeated for as long as operating power is applied.

GENERAL SPECIFICATIONS:

INPUT POWER: 115 V.A.C., 60 Hz. or 12-48 V.D.C.
TEMPERATURE: −10°C to +65°C.
REPEAT ACCURACY: ±2% of dial setting with ±10% input voltage variation.
RESET TIME: 50 milli.sec.
LOAD CONTACT RATINGS: 10 amps at 115 V.A.C. resistive One Form C.
LOAD SWITCH: External plug in relay (See options).
MOUNTING: Two 6/32 screws. Supplied.
MOUNTING DIMENSIONS:
A. For round casing, 3¾ diameter hole size.
B. For rectangular casing, 2.450W 3.300H hole size.
C. Overall size of timer 3.150W 3.650"H 3.500"D with external relay add 1.450" to depth.



CALENDAR CLOCKS SERIES 700

The Digital Instruments Series 700 Integrated Circuit Calendar-Clocks are a group of low cost date and time clocks, featuring easy-to-read visual displays and **digital electrical readout. The** electrical readout **can be used as direct computer input or to actuate a hard-copy printer.**

These units are successfully used in broadcast studios, process control systems, and for general purpose data logging and computer time-updating. An internal time base of either the 60 Hz power line or tuning fork type is available. Crystal control is an option.



BIDIRECTIONAL COUNTER SERIES 900 WITH ROTARY SHAFT ENCODER

GENERAL SPECIFICATIONS

BIDIRECTIONAL COUNTER
PULSE INPUT RATE: DC to 5 MHz.
MINIMUM PULSE "ON" TIME: 100 nanoseconds.
MINIMUM PULSE "OFF" TIME: 100 nanoseconds.
PULSE AMPLITUDE AND SHAPE: positive going +1 volt to +7 volt square wave.
INPUT IMPEDANCE: 10K ohms (diode input).
DISPLAY: backlighted projection of standard shape arabic numerals; 1 inch character height.
AMBIENT LIGHTING: visible under normal room lighting up to 100 feet (160°).
FRONT PANEL CONTROLS: reset and polarity reversal switches.
ELECTRICAL OUTPUT: 10-line or BCD, up to 48 VDC at 150 MA. Output rise time 30 nanoseconds minimum.
POWER REQUIRED: 115 VAC ±10% at 1.2 amps.
AMBIENT OPERATING TEMPERATURE: −5°C to +51°C.
DIMENSIONS: 3½" hgh x 9½" wide x 10" deep (half rack).



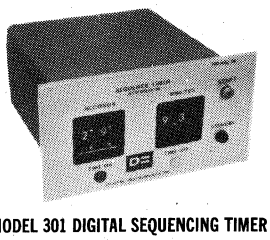
ELECTRONIC COUNTER SERIES 200

GENERAL SPECIFICATIONS:

COUNTING SPEED: 0 to 15,000 counts per minute.
INPUT PULSE SHAPE: Square waves or positive-going pulses with amplitudes of 1 volt minimum.
INPUT PULSE DURATION: 1 millisecond minimum pulse width, with 3 milliseconds minimum quiescent time.
RESET: Remote or manual.
OPERATING TEMPERATURE RANGE: −5°C to +65°C.
SUPPLY VOLTAGE: 115 VAC ±10%, 50/60 Herz, single phase.
SIZE: 3" high x 9" wide x 8" deep.
OPERATING LIFE: 500 million cycles minimum.
PRICE: $198.00.

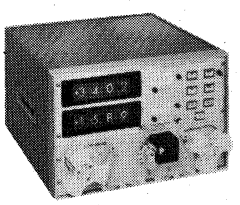
APPLICATIONS

- ☐ Automatic packaging systems
- ☐ Cut-to-length systems
- ☐ Process control systems
- ☐ Industrial counting systems
- ☐ Winding and turns counting systems, etc.



MODEL 301 DIGITAL SEQUENCING TIMER

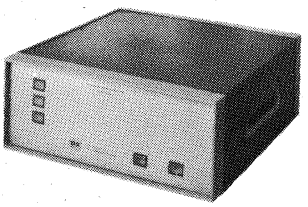
A solid-state counter is utilized to count clock pulses between outputs and therefore allows a programmed time to be selected. Thumbwheel switches are a boon to the operator for programming the desired sequence or time range. These positive-acting thumbwheel switches greatly reduce the possibility of operator error.



NUMERICAL POSITION CONTROL

Locates pre-programmed x-y positions with paper tape input.

Applications: Component insertion in PC boards, automatic drilling, automatic wire-wrapping, etc.

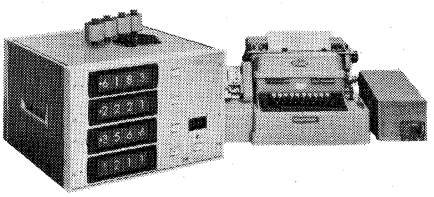


INTERFACE, CODE CONVERTER UNIT SERIES 300

The Digital Instruments Model 300 Interface Unit accepts counter inputs in binary, BCD, or 10-line form and converts them to **BCD, 10-line, ASCII** or any other form for transmission to the recording device.

The Model 300 Interface Unit times the successive serial characters. This unit also **formats, synchronizes** and **alarms** if something is wrong.

The versatile Model 300 is also capable of transferring data between **two recording media,** such as **card-to-punch, card-to-automatic typewriter, paper tape-to-magnetic tape,** and other combinations.



INTEGRATED DATA LOGGER SERIES 1800

APPLICATIONS

Analog

- ☐ Pressure
- ☐ Strain
- ☐ Voltage
- ☐ Current
- ☐ Flow rate
- ...and many others

Digital

- ☐ Assembly line counting and data logging
- ☐ X-Y-Z position display and recording (machine tools, drafting machines, coordinatographs, motion analyzer with fiducial inputs)
- ☐ Geophysical exploration data recording
- ☐ Continuous process data logging (metal rolling mills, chemical plants, furnaces)
- ☐ Preparation of numerical control tapes
- ☐ Precision microscope and optical comparator measurement recording
- ☐ Telemetry...and many others

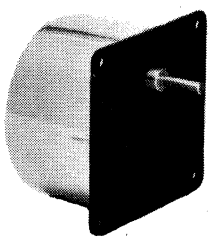
1. Teletype or other automatic typewriter.
2. Digital scanner input, DI Model 1297.
3. Analog-to-Digital (voltage-to- frequency) converter input, with or without multiplexer, DI Model 1296.

Digital Instruments' Product Line: TIMERS / HIGH-INTENSITY FLASHERS (Aircraft-Marine type) / INTERVALOMETERS / SOLID STATE RELAYS / NUMERCIAL POSITIONING CONTROLS / UNI-BIDIRECTIONAL COUNTERS WITH PRINTOUT / GRAPHIC & MOTION PICTURE DATA ACQUISITION AND PROCESSING SYSTEMS / COMPUTER INTERFACE / PUNCH CONTROLS (with Data Inverters) FOR AUTO-TYPEWRITERS, PRINTERS, TELETYPE, IBM (026, 029, 526 etc.), DATA-PHONES & MAGNETIC RECORDERS / DIGITAL CLOCKS & CALENDARS / HARD COPY COMPUTER INPUT SYSTEMS / OPTICAL SENSORS.

DIGITAL INSTRUMENTS, INC.

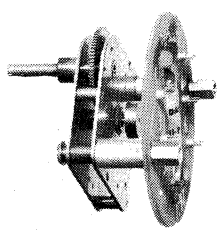
DISC ROTASWITCH® ENCODERS *(naked or cased)*

Here are shaft position encoders made to fit *any* application or design. The Disc ROTASWITCH Encoder line extends from an inexpensive, uncased Model 111 to the sophisticated Model 835, a photoelectric, bidirectional unit. In between you have an extensive choice of pulse rates, pulses per shaft revolution, and other parameters to meet your exact engineering requirements. The selection chart below will enable you to choose a ROTASWITCH Encoder as an off-the-shelf item, but if your problem needs a not-so-standard solution, please contact our Engineering Department.

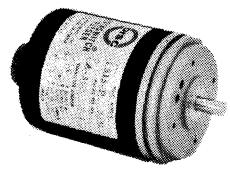


Model 111 ROTASWITCH Encoder

Mercury Wetted ROTASWITCH Encoder—Model 111. Why use switching devices with short life expectancy and innate design problems when the Model 111 ROTASWITCH incremental shaft encoder is available for *under* $50.00? With pulse rates up to 6000/min. it offers an inexpensive and reliable method of metering, measuring, controlling, and counting. Mercury wetted contacts prohibit contact bounce for long service life, and it's available without a case for direct incorporation into your design.



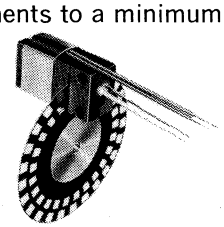
Model 111 ROTASWITCH Encoder (Naked)



Model 815 ROTASWITCH Encoder

Photoelectric ROTASWITCH Encoders—Series 800. Photoelectric encoders are available in 7 basic models to provide the designer with a wide range of operating parameters from which to select. Pulse rates go all the way to 30,000/sec., resolution up to 1000; both uni- and bi-directional versions, with square or sine wave outputs available.

The 800 series can also be specified without cases if the designer wishes to build in the encoder. The naked version consists basically of the rotating slotted disc and a photohead, cutting costs and space requirements to a minimum.



Typical 800 Series ROTASWITCH Encoder (Naked)

SPECIFICATIONS AND PRICES

MODEL	EXCITATION CURRENT (ma)	ACCURACY	RESOLUTION	WAVE SHAPE	PULSE RATE	AMPLITUDE (VOLTS)	TORQUE (IN./OUNCES)	LIFE	LENGTH OF UNIT X DIA. (IN.)	DIA. OF INPUT SHAFT (IN.)	WEIGHT (OZ.)	HOUSING	PRICE** (f.o.b. Santa Ana, Calif.)
111	—	±1.0%	360	Square	0 to 6000 p/min.	contact closure	0/01 x ppr	10^9	1.25 x 2.06	0.125	4	Flange	$ 49.00
810 (uni-directional)	70 (12 V dc)	±0.036 deg.	400	Sine	0 to 30,000 p/sec.	10	0.01	10^9	2.06 x 1.76	0.1247	9	Flange	140.00
811 (uni-directional)	70 (12 V dc)	±0.036 deg.	1000	Square	0 to 30,000 p/sec.	10	0.01	10^9	2.06 x 1.76	0.1247	9	Flange	190.00
814 (uni-directional)	70 (12 V dc)	±0.036 deg.	400	Sine	0 to 30,000 p/sec.	10	0.01	10^9	2.06 x 1.76	0.2497	9	Servo	160.00
815 (uni-directional)	70 (12 V dc)	±0.036 deg.	1000	Square	0 to 30,000 p/sec.	10	0.01	10^9	2.06 x 1.76	0.2497	9	Servo	210.00
830 (bi-directional)	70 (12 V dc)	±0.036 deg.	500	Sine	0 to 2500 p/sec.*	10	0.01	10^9	2.06 x 1.76	0.1247	9	Flange	225.00
834 (bi-directional)	70 (12 V dc)	±0.036 deg.	500	Sine	0 to 2500 p/sec.*	10	0.01	10^9	2.06 x 1.76	0.2497	9	Servo	245.00
835 (bi-directional)	70 (12 V dc)	±0.036 deg.	500	Square	0 to 2500 p/sec.*	10	0.01	10^9	2.06 x 1.76	0.2497	9	Servo	275.00

*Multiplication of pulse outputs by 2 or 4 times available w/ external circuitry **Up to 30% quantity discounts

Disc Instruments, Inc.
2701 S. Halladay Street, Santa Ana, California 92705
Tel: (714) 549-0343 • TWX 714-546-0434

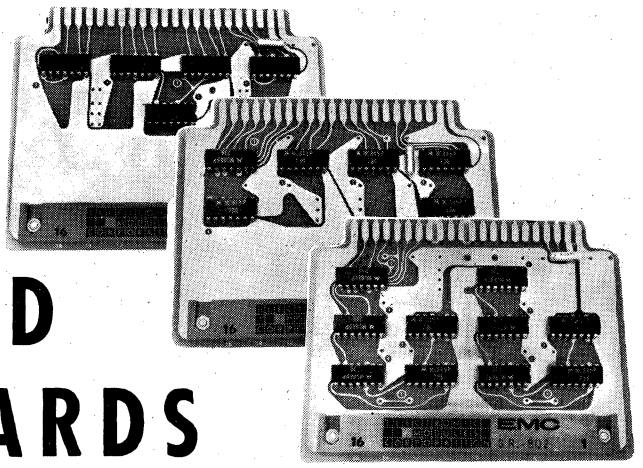
Disc Instruments, Ltd.
Ebberns Road, Hemel Hempstead
Hertfordshire, England • Tel: 57261-2

Disc Instruments GmbH
8000 München 50
Dachauerstr. 511, Germany • Tel: 54 22 91

ELECTRONIC MODULES CORPORATION

ELECTRONIC MODULES CORPORATION

SPECIFY EMC INTEGRATED LOGIC CARDS



EMC's 800 series 5 MHZ Integrated Circuit Logic Cards feature the popular DTL 930 family in the plastic dual-in-line package, already mounted on printed circuit cards ready for plug-in use. The 4.5-inch x 3.5-inch glass epoxy cards incorporate a standard edge connector with 44 rhodium plated tabs, and feature heavy power leads and large ground planes to reduce the effect of noise. A quality test point block accepts 16 standard 0.080-inch probes. Cards are keyed to prevent insertion in wrong connectors. Operating temperature range for commercial cards is 0°C to 75°C. Military versions offer broader temperature range. Card mounting racks, drawers, power supplies, etc. are available. For higher speed applications, the EMC 900 Logic Card family offers the 7400 series TTL integrated circuits on the same card configurations as the 800 series described above.

DESCRIPTION	Part	1-24	Part #	1-24
Two 4-Bit Shift Register	SR802	$62.10	SR902	$65.40
Two 4-Bit Binary Counters	BC803	62.22	BC903	57.65
Two BCD Decade Counters	DC804	62.42		
Two BCD/Decimal Decoders	DD805	48.26	DD905	54.90
Parallel Comparators	PC806	55.60	PC906	48.40
Transfer Gates	TG807	35.14	TG907	38.65
Reversible Decade Counter	RDC808	56.98		
Binary/16 Line Decoders	BD809	40.32	BD909	54.10
Two BCD Decade Counters	DC810	56.50	DC910	60.30
Universal Card	UB850	12.84	UB850	12.84
Eighteen Inverters	GG851	31.46		
Twelve 2-Input Gates	GG852	29.88	GG952	32.15
Nine 3-Input Gates	GG853	29.88	GG953	32.15
4 & 8 Input Gates	GG854	31.36		
Gate Expanders	GG855	30.40	GG955	29.95
12 Open Collector Gates			GG956	32.15
12 2-Input NOR Gates			GG957	33.10
Four 8-Input Gates			GG958	35.40
Eight 4-Input Gates	GG859	31.66	GG959	35.40

DESCRIPTION	Part	1-24	Part #	1-24
8 Expandable 4-Input Gates	GG860	$31.66		
AND/OR Inverter Gates			GG961	33.10
Five Monostable Multivibrators	MM865	56.74		
8 4-Input Power Drivers	DR871	31.66		
8 4-Input Buffer Gates	DR872	32.50	DR972	36.70
8 Expandable Buffer Gates	DR873	32.50		
Four Flip-Flops	FF881	40.90		
Six Flip-Flops	FF882	50.34		
Five J-K Flip-Flops			FF983	45.30
Six J-K Flip-Flops	FF883	50.34		
16-Bit Buffer Register			BR984	76.50
Amplifier/Comparator (Typical)	UAC1101	78.28		
Six Level Converters	LC1102A	47.08		
Six Relay Drivers	LRD1103	42.44		
Oscillator (plus crystal)	OB1104	50.76		
Extender Card	EC1201	49.02		
Display Card (count/decode/drive)	DB1202	48.81		

OTHER EMC PRODUCTS & SERVICES

- Data Acquisition Systems
- Temperature Scanners
- Data Loggers
- Doff Timers
- Custom System Design & Manufacture
- Data Amplifiers
- A-F Converters
- Temperature Controllers
- SCR Load Drivers
- Discrete Component Modules
- Contract Fabrication

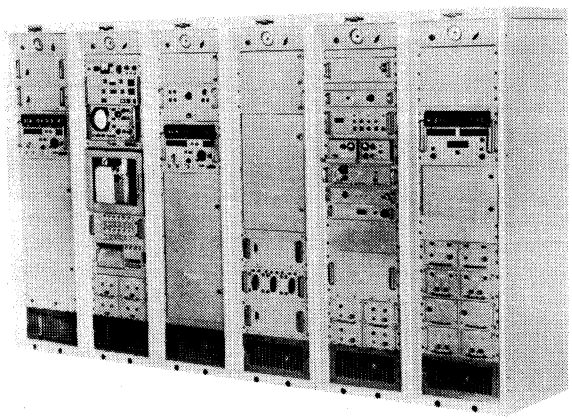
Electronic Modules Corporation invites your inquiries. For further information on any special requirements or applications you may have, write or call:

ELECTRONIC MODULES CORPORATION
COMPONENTS DIVISION
P.O. BOX 141 • TIMONIUM, MARYLAND 21093 • TWX 710-862-2638 • PHONE (301) 666-3300

GEO SPACE SYSTEMS, INC.

DIGITAL SYSTEMS AND TIMING EQUIPMENT

COMPLETE TIMING SYSTEMS



APOLLO TIMING SYSTEM

The most sophisticated central timing systems built by Geo Space Systems, Inc. were installed onboard the National Aeronautics and Space Administration's new Apollo instrumentation ships. The system generates time codes and a varety of standard and non-standard reference frequencies and distributes them to range instrumentation equipment located throughout the ships. It provides time signals that are synchronized within one ten thousandth of a second with the Naval Observatory.

Outputs, derived from precise rubidium and crystal frequency standards by redundant master time-of-year clocks and time signal generators, include standard NASA and IRIG time codes, serial binary time-of-year and time-of-day, serial binary-coded-group time-of-year and paralleled BCD time-of-day. Elapsed time clocks are incorporated for complete pre, or post event timing, and feature manual or automatic initiation. All frequencies and time codes are channelled through a system patch panel for programmable distribution. A time scaler produces time and event markers for use with event recorders and plotting boards.

The system's time comparison equipment includes a WWV receiver, a VLF receiver, chart recorders and an oscilloscope featuring a plug-in unit to make it readily available for use in synchronizing, timing procedures and troubleshooting. VLF doppler effect is corrected by a ships motion compensator.

The utmost in operational dependability has been incorporated into this system, exemplified by: The crystal frequency standard, phase-locked to the rubidium frequency standard to within ±0.2 degrees, is automatically switched in place of the rubidium standard if the rubidium standard output drops to half amplitude or if there is a dropout of a whole cycle. A monitoring circuit accomplishes similar switching between master time-of-year clocks. Synchronous, non-transient switching between time signal generator outputs is provided by the transfer switch unit.

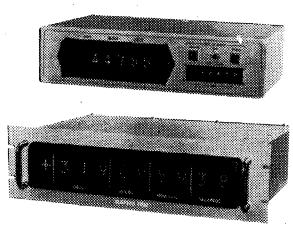
Redundancy also exists in the system master power supplies. An internal battery pack is also automatically selected in the event of main power failure. System battery chargers keep the stand-by pack ready at all times.

DIGITAL EQUIPMENTS AND SYSTEMS



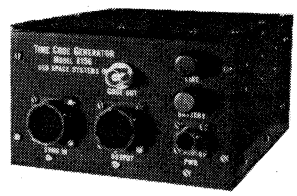
TIME CODE GENERATORS

This line of advance-design equipments begins with the GTG-1000, developed to meet the most stringent time correlated instrumentation requirements; and extends to the GTG-3000, designed for applications requiring a reliable, low-cost time signal source of ±1 second accuracy.



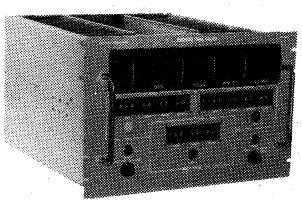
REMOTE DISPLAYS

Digital display indicators are available individually, or as companions to GSS time code generators. Simple time-of-year, time-of-day, and elapsed time indicators are featured, as well as models which incorporate selected time of event output. They are available in individual cabinets finished to customer specifications, or as rack mounted units.



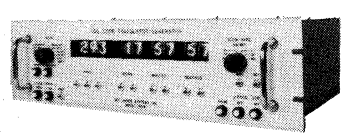
AIRBORNE TIME CODE GENERATOR

Model 8156, qualified for airborne use, is 5.6 x 6.6 x 3.5 inches and weighs only 3.2 pounds. It generates modified IRIG B time code with frequency stability of 1 x 10^{-6} and drift rate parts of 10^{8} per week provided by an internal temperature-compensated crystal oscillator. Time is preset by a 20-bit parallel BCD time-of-day input and an external switch or relay closure. An internal nickel-cadmium battery provides backup power during input power dropouts.



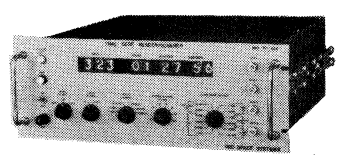
ELAPSED TIME CLOCKS & COUNT-DOWN GENERATORS

Capable of countdown and countup, with controls for hold count and count adjust, these units can be started automatically at a preset time-of-year, by an external start pulse, or manually by a front panel pushbutton. Preset time-of-year and preset initial elapsed time value (plus or minus) are set in by convenient front panel thumbwheel switches.



RANGE TIME CODE TRANSLATOR/GENERATOR

This RTC T/G is capable of functioning either as a subcentral timing system or an independent timing generator. Using dual-in-line integrated logic, the Model 8174 generates all the necessary timing signals and pulse rates for use in radar systems and computers. This includes NASA BCD and serial codes as well as binary time-of-year in tenths of seconds. Solid state components and technology are used throughout.



TIME CODE READER SCANNER

The GSS Time Code Reader/Scanner, Model 8108, provides reliable phase-coherent serial and parallel outputs when reading noisy time code signals with non-coherent carriers. An acquisition/lock feature assures coherent time outputs for up to 32 frames of signal dropout once sync is initially acquired. The standard unit handles the NASA 36-bit time code at the standard 1 kHz rate and four non-coherent carrier rates. Other codes and rates are optionally available.

Followng the introduction of silicon integrated circuit micrologic modules, Geo Space Systems, Inc. redesigned its line of standard building block module cards and incorporated them into a new family of timing system equipments. The company meets the needs of government and industry from a simple clock to a dual or triple-redundant, highly sophisticated digital system.

In the data display field, a team of engineering specialists is available to analyze customer needs and custom tailor our standard system configurations to their specific needs.

GEO SPACE SYSTEMS, INC.
6301 49TH STREET NORTH, P. O. BOX 13575
ST. PETERSBURG, FLORIDA 33733
Phone: 813 - 525-1161

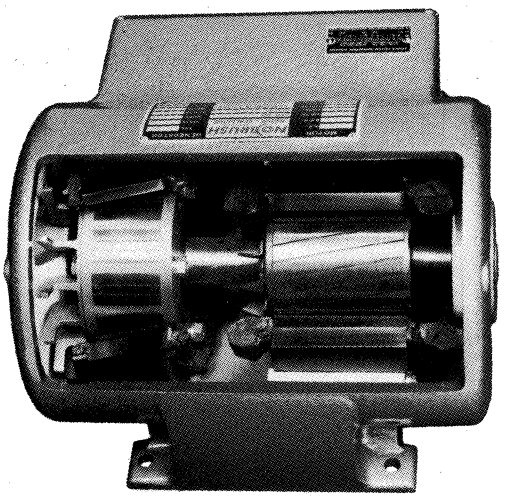
NOBRUSH® MOTOR GENERATOR SETS FOR COMPUTORS

Computer designers need a power supply that will give them highly stable output with freedom from noise. There are a number of ways to accomplish this, but in most cases the packages are too large and have too many parts that could fail. Motor generators have been proven to be the most efficient method for reasons of reliability, size, simplicity of design and over-all costs.

A Motor Generator set works on the simple principle of Mechanical Energy Storage. The essential component of a Motor Generator is a large rotating mass with high enough inertia to absorb power line transients. Its main function is to isolate the computer from the power line and provide stable output power. The rotating mechanism maintains the voltage output overriding input voltage changes. Even during short-term total power outage, a Motor Generator set will maintain usable output.

GEORATOR manufactures NoBrush®, an exclusive Permanent Magnet motor generator set designed for the highest efficiency and greater reliability.

Cutaway model of "NoBrush"® frequency converter shows simplicity of internal design.



FEATURES

MULTIPLE OUTPUTS
Up to 10 separate voltage outputs available at various current levels.

HIGH FREQUENCY OUTPUT
180 Hz to 840 Hz, usually three phase.

DC RECTIFICATION
Rectifier-filter package eliminates further circuitry.

IDEAL FOR INTEGRATED CIRCUIT SUPPLIES
NoBrush® sets provide low voltage, high current outputs.

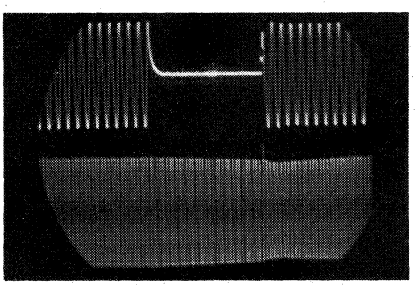
HIGH EFFICIENCY
Design quality minimizes windage, IR drop, excitation and other losses.

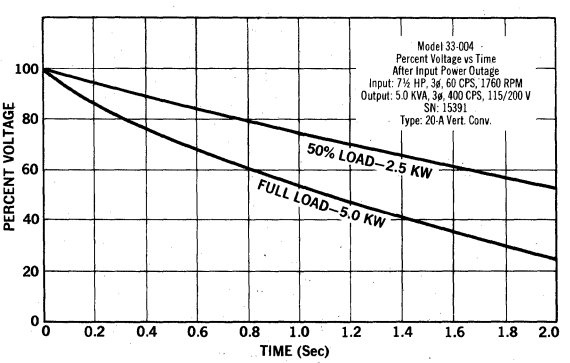
RFI
Reduced by brushless design . . . zero for most applications.

EMI
Complete electrical isolation between motor and generator keeps EMI at extremely low levels.

SHORT CIRCUIT PROOF
Permanent magnet design provides built-in protection.

Upper Trace-Input Voltage 60 Hz. Lower Trace-Output Voltage 180 Hz. Note that with complete power outage for several cycles, energy is still being delivered to the load. Typical curve illustrates percent output voltage available after total input power interruption. Note that even after outage of 100 milliseconds, output voltage is still within 93% of normal.





FOR MECHANICAL AND ELECTRICAL DETAILS, REFER TO SECTION 4000, PAGES 1952, 1953

GEORATOR CORPORATION • MANASSAS, VIRGINIA 22110 • TELEPHONE: (703) EMPIRE 8-2102

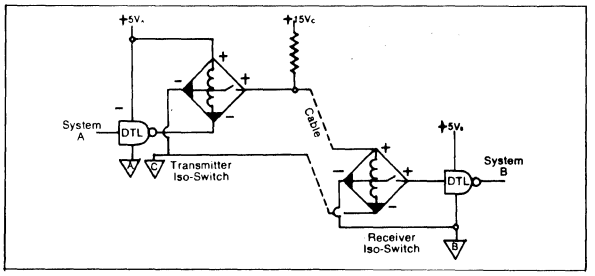
ISO-SWITCH® ISOLATED 1MC DIGITAL SWITCH*

Iso-Switches are isolating digital data couplers for computer-oriented electronic systems. They offer "universal interface" flexibility, DC-to-1 mc. switching rates, direct compatibility with IC logic elements, and many other advantages including low cost and small size:

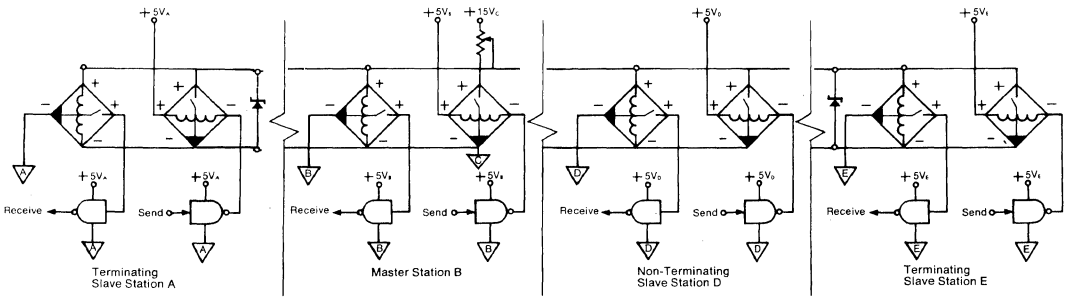
Features: no power supply — operate on signal power only, input isolated from output — no common connections — dual outputs available — isolated, floating packaged for p.c. card mounting — .100 grid packaged for dual-in-line 14-pin IC socket.

Isolating Digital Line Driver — $24.30 per line
200 feet twisted pair at 1 MC
4,000 feet twisted pair at 100 KC

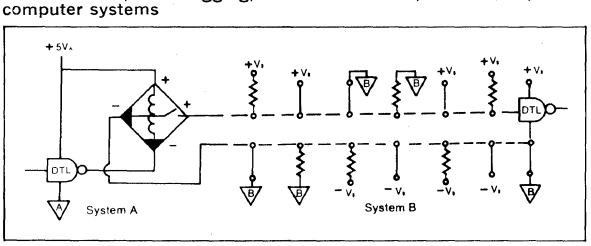
Isolating Digital Line Receiver — $24.30 per line
Eliminates ground loops. Avoids common mode noise problems. Allows DC offset up to 500 V.



Trunk Line Half-Duplex Send/Receive Network — $48.60 each station
Save wire cost. All stations isolated from each other.



Universal Level Shifter/Digital Coupler
Total isolation, Data Logging, data transmission, black boxes, computer systems



Abbreviated Specifications (for further information, contact factory)
Input: DTL compatible — draws 5 ma or approx. 3 DTL loads (singles), 10 ma or approx. 6 DTL loads (duals).
Output: Depending on model, will switch 0 to 60 V max, and 0 to 150 ma max.
Isolation: Input/Output 12pF paralleled with 10^{10} ohms.
Power Supply: None required to operate switch. Runs on signal power only.

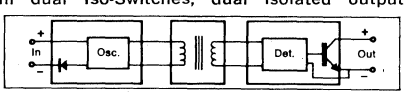
Packaging — Two basic Iso-Switch package styles are offered: one is similar to operational amplifier modules (uses .030 dia. pins arranged on a .100 layout grid) and the second is similar to the popular DIP I.C. logic elements — (uses flat pins arranged for direct "plug-in" to 14 or 16 pin I.C. sockets and printed circuit layouts). Signal pins in and out avoid power and ground bus assignments for DTL and TTL. The layout grids on both packages are symmetrical about the center-lines for length and width.

Available On Standard Logic Cards — Available from EECo as Long Line Isolating Driver/Receiver catalog module #D4047, D4048, D4049, D4050, D4051.

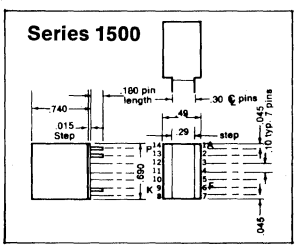
Available from Raytheon Computer as Universal Interface and Driver/Receiver catalog #MUI1, MUI2, MUI3, MUI4, MUI5, MUI6.

Available from Iso-Switch Corp. for Scanbe/Applied Development family and for other standard logic card families. Contact factory with your design requirements.

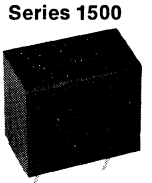
Operating Principles — The Iso-Switch is a solid-state circuit using a high-efficiency oscillator and detector to control the ON-OFF state of an NPN transistor switch (Oscillator ON = Switch ON; Oscillator OFF = Switch OFF). The "black box" function analogy is a single-pole-single throw relay with blocking diodes in the coil and contact circuits; that is, when polarized drive power is fed to the coil (oscillator), polarized load current will pass through the contacts (switch). In dual Iso-Switches, dual isolated output switches are provided, and the analogy of a double-pole - single - throw relay is applicable.



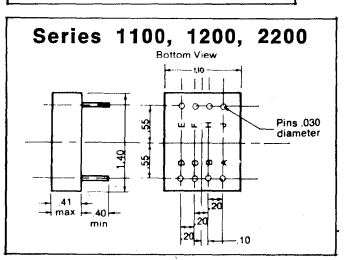
Series 1500



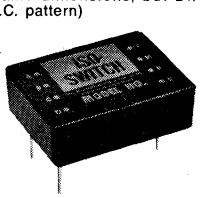
Packaging
Series 1500



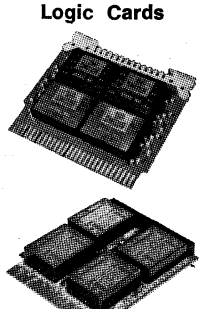
Series 1100, 1200, 2200



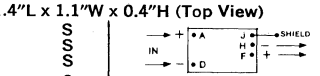
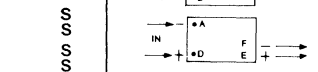
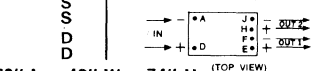
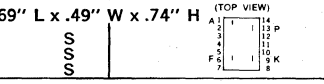
Series 1100, 1200, 2200
(Series 1300 and 2300 have same dimensions, but DIP I.C. pattern)



Logic Cards



ISO-SWITCH Ordering Information

Model Number	Single or Dual	Pin Location & Pin Assignments	Max. Switch Current	Max. Load Volts	Price 1-9	
Package = 1.4"L x 1.1"W x 0.4"H (Top View)						
1113	S		50	30	24.30	FOB Costa Mesa, Calif. Terms: ½ % 20 Net 30. Prices subject to change without prior notice.
1123	S		100	30	26.30	
1133	S		150	30	29.90	
51114	S		50	60	43.25	
51115	S		100	60	45.25	
1213	S		50	30	26.20	
1223	S		100	30	28.20	
1233	S		150	30	31.80	
2213	D		50 & 50	30	34.20	
2223	D		100 & 100	30	39.50	
Package = .69" L x .49" W x .74" H						
1513	S		50	30	24.30	
1523	S		100	30	26.30	
1533	S		150	30	29.90	

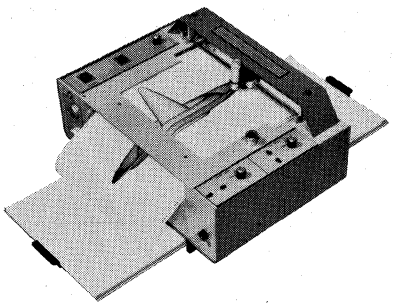
Data Terminals — Available for standard and custom interface applications. Contact factory for detailed information.

ISO-SWITCH Corp. 2955 Randolph Street, Costa Mesa, California 92626 (714) 540-3244 *Patent Applied For

CØMPLØT™: For Digital

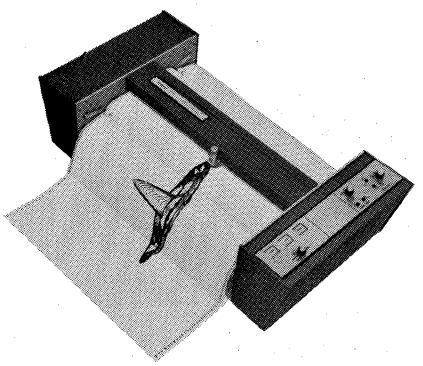
DP-1 Digital Incremental Plotter designed for use online, offline or with time sharing. Produces clean, clear graphic records annotated with alphanumerics at 300 increments/sec. Two step sizes: .01″ or .005″, Z-fold paper moves bi-directionally and is perforated for tear out to file size. Paper is 11″ wide x 144′. Accepts AC or DC coupled inputs. Free 5 year software update service. Request Bulletin #468 DP-1.

Price $3550



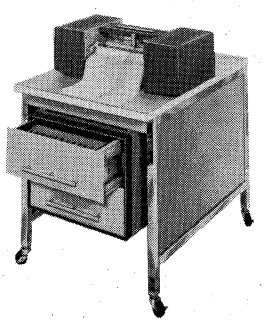
DP-3 Digital Incremental Plotter with 22″ wide plotting surface. Plots at 300 increments/sec. with .01″ or .005″ step size. Step size can be changed in minutes. Z-fold paper 22″ wide x 144′ is perforated for convenient tearout. DP-3 can be used online, offline or in time share mode. Accepts AC or DC coupled inputs. 5 year software plan included. Request Bulletin #868 DP-3.

Price $6400



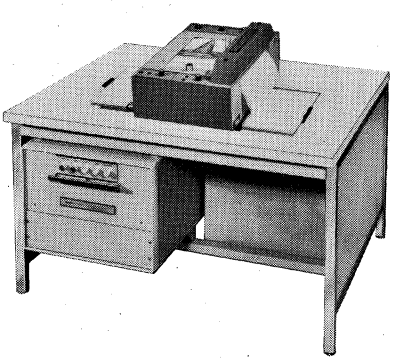
DP-5 Ultra High Speed Digital Incremental Plotter for computer graphics. Plots at a continuous speed of 1200 increments/sec. Conventional (300 increments/sec.) programs can be used at approximately 4 times normal speed. Step size is factory set at .005″ or .0025″. DP-5 features 11″ wide x 144′ long Z-fold paper for operational convenience. May be used online or offline, and accepts AC or DC coupled inputs. Housekeeping software for plotting for 5 years. Request Bulletin #269 DP-5.

Price $11,000



PTC-3 Plotter/Teletypewriter Controller allows graphic plotting at a remote time share terminal. PTC-3 acts as the interface between a 103A2 Data set, or equivalent, or an appropriate acoustical coupler and the teletypewriter and plotter. Incoming data can be accepted normally on the TTY or displayed graphically on the plotter. Controller is available in a desk or housed in a wrap-around case for bench or table mounting. May be used with DP-1 or DP-3. Request Bulletin #468 PTC-3.

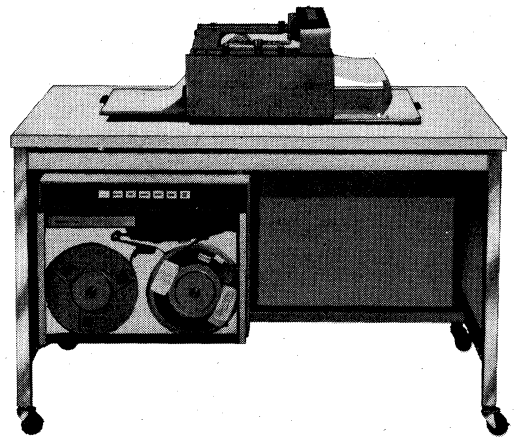
Price $5250



Graphics At Its Best

MTR-1 Magnetic Tape Reader operates with the DP-1, DP-3 or DP-5 to form a complete offline plotting system. MTR-1 is available for 200 BPI 7 track, 556 BPI 7 track or 800 BPI 9 track tape. Unit accepts 8½" reels. Drives 300 step/sec. plotters, DP-1 and DP-3, or 1200 step/sec. plotter, the DP-5. Rewind speed is 75 IPS. Single capstan drive and single edge tape guides minimize tape wear. Entire unit is supplied in a desk allowing convenient surface to set plotter. Request Bulletin #868 MTR-1.

Price 200 BPI, 7 Track
$12,500 (less plotter)



MTR-9 Offline Digital Plotting System offers fast computer plotting with *10 to 40 times less* computer time and tape usage. MTR-9 features Mohawk Data Recorder for I/O capability. Available for 7 or 9 track IBM format and operates DP-5 (DP-1 or DP-3) incremental plotters. New End-Step tm Mode software compresses computer time and tape length by a factor of 10 to 40. High speed search with block selection and many other features. Mohawk 700 or 900 owners need not purchase entire system and save $8000.00. Housekeeping software for plotting for 5 years included in price. Request Bulletin #369 MTR-9.

Price 200 BPI, 7 Track
$21,000 (less plotter)



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METRIC Systems Corporation

CUSTOM DIGITAL SYSTEMS FROM STANDARD SUBASSEMBLIES

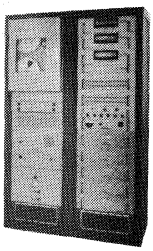
DATA TRANSMITTERS

HIGH DENSITY DATA TRANSMITTER

MODEL 8062

Model 8062 High Density Data Transmitter will accept serial Azimuth, Elevation and Range data words from a radar set. Timing pulses and a parallel time word are obtained from a time code generator.

The transmitter will accept 17 serial bits of Azimuth and Elevation data, a 20-bit Range word and two 36-bit auxiliary words which may be manually set in through the use of front panel switches.

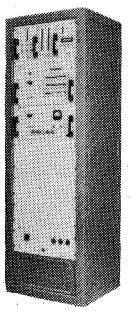


LOW DENSITY DATA TRANSMITTER

MODEL 8031

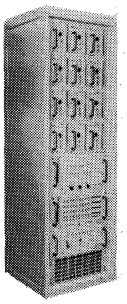
Model 8031 (CASY II) receives digital Radar Acquisition Data from a 7094 computer in the form of three 13-bit data words, 6 auxiliary bits and one sub-synch. The words are parallel dumped into a 45-bit input buffer register, transferred to a shift register and shifted out serially at 480-bits/10 frames per second rate.

The output bits modulate a 1920 CPS carrier to drive a standard 600 ohm telephone line. An internal test generator is provided which is capable of simulating computer commands.



MULTIPLE RADAR DATA TRANSMITTER

MODEL 8023



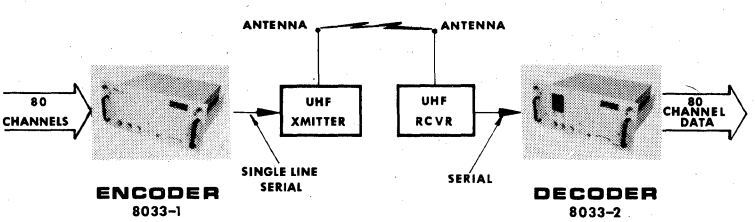
Model 8023

Real Time Data System, Model 8023, is the entire digital data link between 4 AN/FPS-16 radars and a Univac 1218 computer. Interrogate and Shift commands generated by the system are transmitted to the 4 radars. Incoming digital radar coordinate words are tagged with 9-bit identification and 23-bit time information, converted to Univac format, stored, and fed into the computer upon command.

DATA DISTRIBUTION SYSTEMS

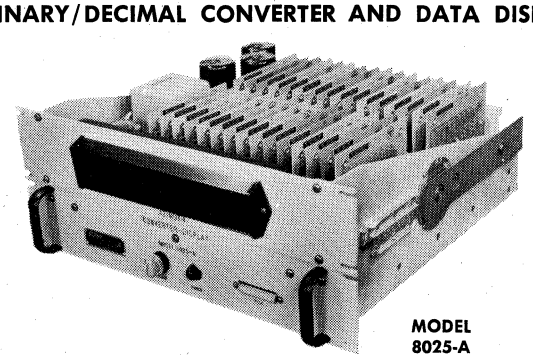
Model 8033 Data Distribution System transmits up to 80 channels of digital data from a centrally located transmitting station to any number of remotely located receiving stations. A complete Data Distribution System consists of a single 8033-1 Encoder unit located at the central transmitting station and a 8033-2 Decoder unit located at each receiving station. The Transmitting Encoder accepts up to 80 separate input data lines and converts to a single output line suitable for transmission by a radio link. The Decoder receives the single line serial information and reconstructs the original 80 channel input data. Each of the 80 data channels may be operated at bit rates as high as 1000 bits per second. The system contains a unique frame format and precision crystal clock to insure that the output data is an accurate reproduction of the input information. The system is all solid-state using Metric Systems' standard plug-in printed circuit cards.

DIGITAL DATA DISTRIBUTION BY RADIO LINK



BINARY/DECIMAL CONVERTERS

BINARY/DECIMAL CONVERTER AND DATA DISPLAY



MODEL 8025-A

The Model 8025-A Binary-to-Decimal Converter/Display is a device for the rapid conversion of straight binary coded words of up to 19 bits to their decimal equivalent and displaying the result.

The unit illustrated can complete the conversions and present a display of up to six digits in less than one millisecond.

The converter requires parallel input, one line for each bit. The input word is scanned from the most significant bit, in turn, to the least significant bit. If a "1" is present, pulses equal to the decimal equivalent of that particular bit are sent to the decimal counter. After all the bit lines have been scanned, the decimal counter will contain a count equivalent to the decimal value of the input binary word. The decimal counter output, which is a 1-2-4-8 code, is converted to straight decimal in a series of NIXIE DRIVERS which drive the indicator tubes.

It can be seen that since each decade is loaded with its decimal equivalent of a binary bit in a parallel fashion, most significant bit first, the time required for a complete conversion is far less than that required by simply counting up the bit equivalent one pulse at a time. Furthermore, since the display is loaded by pulses equal in number to a particular bit equivalent, the bit equivalent is a matter of choice or mathematical relationship making it possible to read the input binary word in any terms, i.e., bits, radians, degrees, minutes, seconds, miles per hour, pounds, ounces, feet per second, etc., in fact, any function that can be quantized.

Metric Systems Corporation produces an assortment of digital equipment ranging in scope from simple logic modules to complex digital instrumentation systems. Digital Systems designed and fabricated by Metric Systems are now in operation on both the Atlantic and Pacific Missile Ranges and most other Aerospace Instrumentation installations. Metric Systems invites your inquiries for solutions to problems involving special applications.

METRIC Systems Corporation
736 N. BEAL STREET
FORT WALTON BEACH, FLORIDA
Tel: (904) 242-2111

METRIC

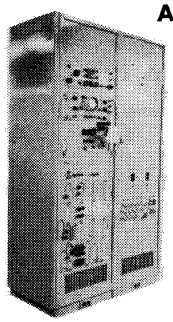
Systems Corporation

CUSTOM DIGITAL SYSTEMS FROM STANDARD SUBASSEMBLIES

TIMING EQUIPMENT

AMR TIMING SYSTEM

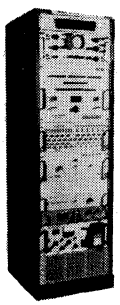
Model 8379



Timing System Model 8379 provides Atlantic Missile Range Time Codes B1, B2, C1, D1, and D5. The system features automatic or manual WWV synchronization, a WWV receiver, a synchronization oscilloscope, a waveform monitoring oscilloscope, a test point selector switch, and a versatile output patch panel. Models designed for ground station, airborne, or shipborne operation are available.

IRIG TIMING SYSTEM

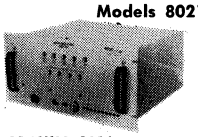
Model 8020



Timing System Model 8020 generates IRIG Codes A, B, C, and D. The system contains receivers for automatic or manual synchronization to WWV, VLF or LORAN "C". Other features are: a Decimal Time Display in Hours, Minutes, and Seconds, an oscillator stability of 1 part in 10^{10} per day, an oscilloscope for waveform monitoring and fine synchronization, and an output panel for patching time codes and pulse rates to any one of 10AC and 12DC line driver amplifiers.

CAMERA TIMING UNITS

Models 8021 & 8024

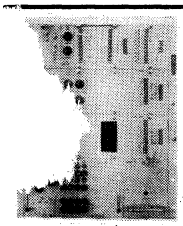


ASKANIA 8021 **BOWEN 8024**

The Askania and Bowen Camera Demodulators extract remote camera control and timing signals from the IRIG Time Code "B" signal. The units provide relay closures initiating shutter operation and high level neon outputs for film track timing. Three cameras may be started or stopped, remotely and independently, using three camera demodulators with channel selector switches set for three different IRIG "B" control function bit channels.

AMR TIME CODE GENERATOR

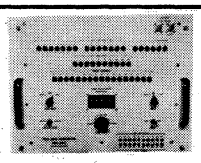
Model 8379-1



Time Code Generator Model 8379-1 is designed for mobile operation and is suitable for either airborne or shipborne use. Relay and neon output amplifiers are provided. The unit generates AMR Time Codes, Numbers B1, B2, C1, D1, and D5. Solid-state modularized construction permits expanding to additional codes by adding appropriate code generator modules.

IRIG TIME CODE GENERATOR

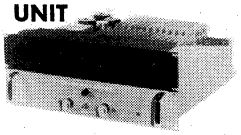
Model 8020-1



Model 8020-1 Time Code Generator simultaneously generates IRIG Codes A, B, C, and D synchronized to within 1 microsecond. Additional features include: Solid-state printed circuit card construction, taperpin wiring, propagation delay correction to better than 1 microsecond, digital time retard and advance, parallel binary coded decimal Time-of-Day, and parallel straight binary Time-of-Day in millisecond increments. Other output formats and pulse rates are available on special order.

TIME DISPLAY UNIT

Model 8729

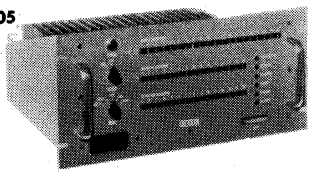


Time Display Unit Model 8729 is a digital code format translator and visual indicator, designed to accept one of several standard time codes and present a decimal time display in hours, minutes, and seconds. The unit is completely self-contained, including power supply and removable indicator section. Solid-state modular construction is employed throughout and provisions are incorporated for driving as many as 12 remote indicator units.

DIGITAL DATA PROCESSING EQUIPMENT

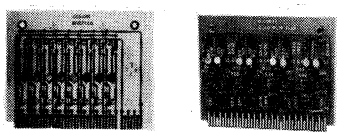
DATA FORMAT CONVERTER

Model 8005



Digital Data Format Converter (DECON), Model 8005, accepts 5 separate digital words in parallel reflected binary code and provides readout information in serial straight binary code. The unit is designed for standard 19-inch rack mounting and is entirely solid-state except for indicator lamps.

STANDARD PRINTED CIRCUIT CARDS

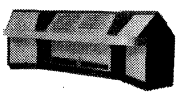


Metric Systems produces a large variety of Standard Printed Circuit modules. Most often used types are stocked for rapid delivery on custom data systems. Printed Circuit modules are fabricated on 41 pin 4½" x 5½" epoxy impregnated fiber glass boards. Each printed circuit logic module is individually inspected for quality of construction and tested for circuit performance.

MANUAL INTERVENTION & DISPLAY SYSTEM

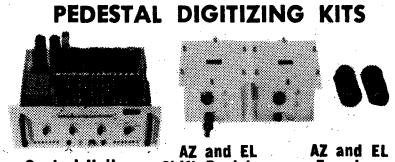
MAID

MODEL 8038



The Manual Intervention and Display System (MAID), Model 8038, was developed to provide a means for controlling the IBM 7094 Computer on a real time basis from a remote location. Real time control and intervention can, in many cases, eliminate the necessity of reprogramming the computer when unaccounted for developments arise. A more flexible control is obtained over the computer by having real time manual intervention.

PEDESTAL DIGITIZING KITS



Control Unit **AZ and EL Shift Registers** **AZ and EL Encoders**

Metric Systems manufactures a variety of digitizing kits for use on two-axis pedestals having accuracies ranging from 13-bits to 21-bits. The kits provide serial data suitable for recording on magnetic tape and a Decimal Display for operator use. Digitizing kits include the following items: Azimuth and Elevation Shaft Angle Encoders, Azimuth and Elevation Data Registers, Data Control Unit, and Azimuth and Elevation Decimal Display Units (optional).

DIGITAL MOVING TARGET SIMULATOR

Model 8007M



Simulator Model 8007M is designed for use with "multiple time around" tracking radars. Late model radars, such as the AN/FPS-16 (V) radiate a number of transmitter pulses before the first distant echo is received. To simulate a distant target, the simulator must be capable of receiving several input pulses before producing the first delayed echo pulse. Conventional simulators are not capable of responding to an input pulse before the delay interval is completed. In Metric's Model 8007M Simulator, as many as eighteen (18) pulses may be propagating through the delay section simultaneously.

AUTOMATIC DIGITAL DATA LOGGER

MODEL 8054



The Automatic Digital Data Logger, Model 8054, performs storage, conversion, parity generation, and logging of binary coded decimal (BCD) data generated by the AN/GJQ-9(V)2 Checkout Sequence Programming Set. The input data to this system is recorded on magnetic tape in an IBM compatible format.

The record length is variable and in the case of manual data, is controlled by manual operation of an "end of record" switch. Record length is limited only by the computer or the interface equipment.

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736 N. BEAL STREET

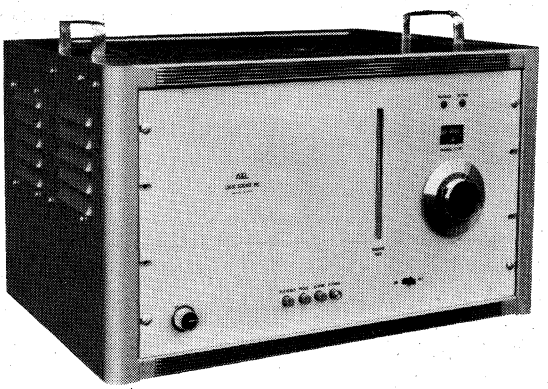
FORT WALTON BEACH, FLORIDA

Tel: (904) 242-2111

ΛΣI LOGIC SCIENCE, INC.

SERIES 93 multi-channel TAPE RECORDER

- SCHOOLS
- INDUSTRY
- OFFICES



FEATURES

- 30 hours uninterrupted stereo playback/automatic rewind
- Random selection from 81 22-minute programs
- Record capability from tuner, phono, or recorder
- Monitored lapsed-time indication on front panel
- Optional remote-control mode... other access
- Harmonic distortion less than 0.3%
- Signal-to-noise ratio greater than 40 DB
- Stereo separation greater than 30 DB
- Frequency response 50 Hz to 13 kHz

SERIES 70-3000 DIGITAL LOGIC CARDS

- FLEXIBLE—Fundamental I C family with flexibility to meet diverse and complex applications. Both DTL and TTL logic are employed to avoid design limitations.
- SYSTEM DESIGN—Full compatibility for diversity of application and high reliability to guarantee advantageous cost/performance index.
- RELIABLE—Rigid quality control and conservative component ratings to guarantee maximum performance

OCT21	Octal decoder, buffered inputs
SG21	Selector gate/2 sets of 8 2-input gates, 1 to each of 2 outputs
SG22	16 selector gates to a single output line
SRN21 -23	8-channel negative data receiver shaped, 5-, 10-, 20usec
SRP21 -23	8-channel plus data receiver shaped, 5-, 10-, 20usec
STP21	4-channel data xmtr shaped, 5-, 10- 20 usec
UG25	6, universal f/f
UF28	8, universal f/f
VFO22	Variable-frequency oscillator, voltage-tuned
XCG21	Crystal oscillator, with or without crystal
BR21	15-bit register/common clock & DC reset
CDA21	6, 4-input buffer/drivers
CDA31	6, 4-input hi-speed NAND gates
CR31	8-bit clocked counters
DRN21	8-channel data receiver/—signals
DRNS21	Same as above, shaped
DRP21	8-channel data receiver/+ signals
DRPS21	Same as above, shaped
EG21	8, 4-input expander gates
ND21	12, 2-input NAND gates
ND22	9, 3-input NAND gates
ND23	6, 4-input expandable NAND gates
ND24	Same as above, wired for OR
ND31	12, 2-input hi-speed NAND gates
ND32	9, 3-input hi-speed NAND gates
ND33	3, 4-input hi-speed NAND gates
ND35	5, 8-input hi-speed NAND gates

Add 200 to card model designation for full-ceramic integrated circuitry.

ΛΣI

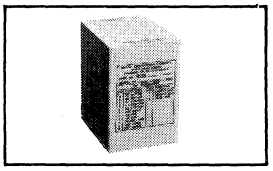
Prices and specifications available upon request

P.O. Box 10096, San Diego, California 92110 (714) 276-1464

NATEL

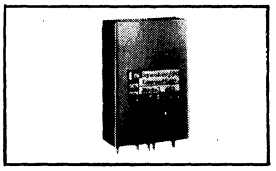
SPECIALISTS IN SIGNAL CONDITIONING AND SYNCHRO CONVERSION

NATEL SYNCHRO TO DC & DIGITAL CONVERTERS



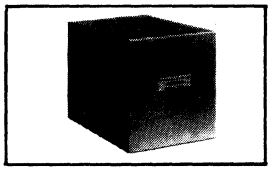
SYNCHRO TO DC CONVERTER MODEL 406

Provides one DC output voltage (either 0 to +5 or +10V) linearly proportional to rotor shaft angle (0 to 360°). Accuracy: ±6 min.



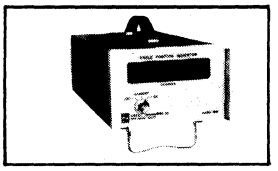
SYNCHRO TO SINE/COSINE CONVERTER MODEL 401*

Provides 2 DC output voltages: one proportional to sine of rotor shaft angle and the other proportional to cosine of rotor shaft angle. Accuracy: ± 3 min.



SYNCHRO TO DIGITAL CONVERTER MODEL 4060

Provides either a 12-bit parallel or a 4-character BCD output corresponding to rotor shaft angle. Accuracy: ± 6 min.



SYNCHRO TO DIGITAL CONVERTER WITH DISPLAY

(Angle Position Indicator)

MODEL 4061**

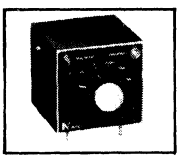
Provides a 4-digit display as well as same outputs as Model 4060. Accuracy: ±6 min.

GENERAL SPECIFICATIONS FOR ALL ABOVE MODELS: (1) All accept standard 3-wire synchro or 4-wire resolver inputs; 11.7, 57, or 90 VRMS, 400 or 60 CPS. (2) All are solid-state. (3) Tracking Speed: 7000° per sec. (4) Five to fourteen options available for each model resulting in maximum flexibility of models for your application.

*Also available Model 411, same as Model 401, but insensitive to reference voltage and frequency variations. **Model 4062 dual speed (1:36) also available.

NATEL DEMODULATORS & MODULATORS

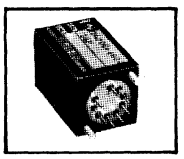
AMPLIFIER-DEMODULATOR (Phase Sensitive)



SERIES	LINEARITY & RIPPLE
D6006	.5%
D7006	.1%
D8006	.05%

INPUTS: From 0 — 1 mv to 0 — 25v (Multi-range units also available)
OUTPUTS: From 0 to ±1v to 0 to ±10vdc
REFERENCE: From 5 — 115v (fixed) @ 60, 400, 800, or 1000 Hz
NULL & GAIN STABILITY: To 20uv/°C
INPUT IMPEDANCE: 500K
FREQUENCY RESPONSE: To 20% of ref.

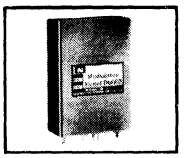
DEMODULATORS (Phase Sensitive)



SERIES	LINEARITY & RIPPLE
D500	.5%
D600	.1%

INPUTS: From 0 — 1v to 0 — 50v
OUTPUTS: From 0 to ±2.5v to 0 to ±10v
REFERENCE: From 5 — 115v (fixed) @ 60, 400, 800, or 1000 Hz @ 100 mw power max.
NULL OFFSET: ±.02%FS (D600); ±.1% (D500)
FREQUENCY RESPONSE: ±3 db to 20% of carrier (D500); to 10% of carrier (D600)
ISOLATION: Input, output & reference are isolated from each other by 50 megohms

MODULATORS (Phase Sensitive)



SERIES	LINEARITY
D6003	0.5%

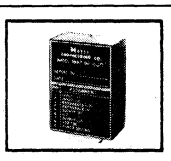
INPUTS: From 0 to ±10v to 0 to ±100vdc
OUTPUTS: From 3.5 to 30 vrms
OUTPUT WAVESHAPE: Sine
DISTORTION: 2% max.
MODULATION INTELLIGENCE: 20% of carrier
NULL: .1% of full scale output p-p
GAIN STABILITY: .005%/°C
OUTPUT POWER: Models up to 5 watts available

NATEL TRANSDUCER AMPLIFIERS

AC TO DC TRANSDUCER AMPLIFIERS

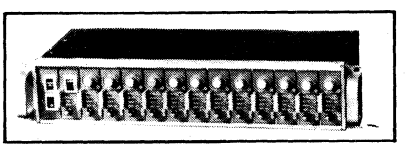
(Carrier Amps)

SERIES 800



INPUTS: From 0—2.5 to 0—100 mv rms.
OUTPUTS: From ±1v to ±10vdc or ±10 ma.
LINEARITY & RIPPLE: ±0.5%
GAIN ADJ.: 4:1 or 5 positions.
SHORT CIRCUIT PROOF.

CARRIER AMPLIFIER SYSTEM



For airborne strain gage or pressure measurements. Designed to accommodate half or full bridge and LVDT type transducers. Calibration and bridge completion networks are provided internally. Provides 5 vrms into ten 120 ohm strain gage bridges, plus powering the carrier amplifier demodulators. The amplifier demodulators provide four gain ranges, i.e., 1 mv to 100 mv input provide ±1 volt or ±1 madc full scale output.

This is typical of the many systems Natel has designed. Send us your specs for a thorough analysis of your requirements.

PROMPT DELIVERY AVAILABLE ON ALL MODELS

For new complete catalog or further data on your specific application, consult the factory (Attn: Phil Diamond, V.P. Marketing)

CUSTOM UNITS built to your precise specifications may be provided by NATEL based on past, successfully proven designs. SEND US your complete specifications for a prompt and thorough technical analysis and quotation.

NATEL ELECTRONIC INDUSTRIES INC.

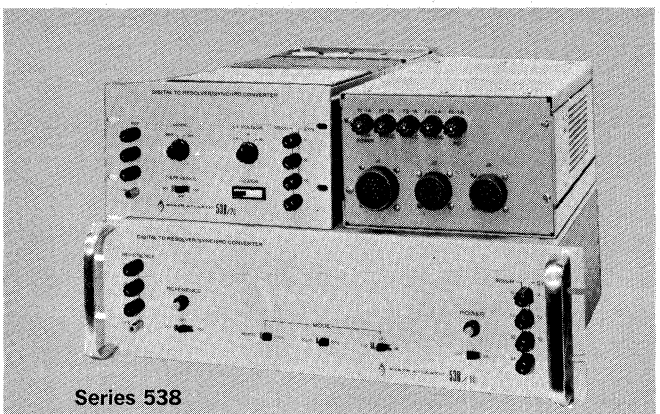
7129 Gerald Avenue, Van Nuys, California 91406 / (213) 782-4161 / TWX (910) 495-1765

PRECISION DIGITAL-TO-RESOLVER SYNCHRO AND RESOLVER/SYNCHRO-

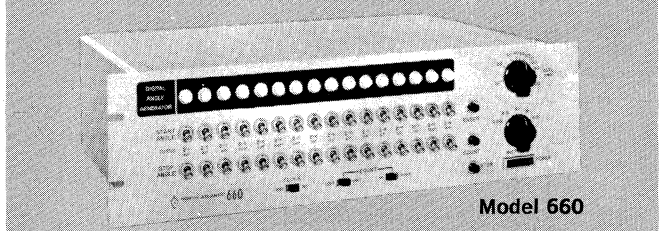
NORTH ATLANTIC *industries, inc.*

Digital To Resolver/Synchro Converters

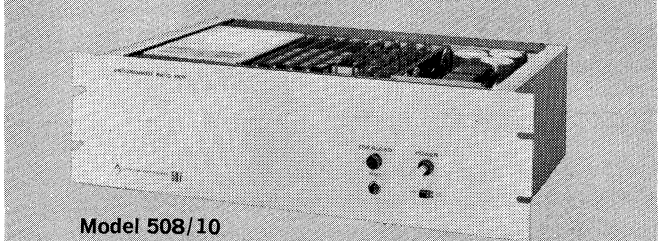
These units provide a complete high-speed interface from digital to analog systems, enabling precise simulation of resolver/synchro data. All converters feature semi-conductors, integrated circuits, and precision trigonometric transformers. Basic models use 400 Hz as the signal data frequency, with optional operation at other frequencies from 50 Hz to 10 KHz. A variety of system-oriented options are available in each model, and multi-speed or multi-channel systems can be provided.



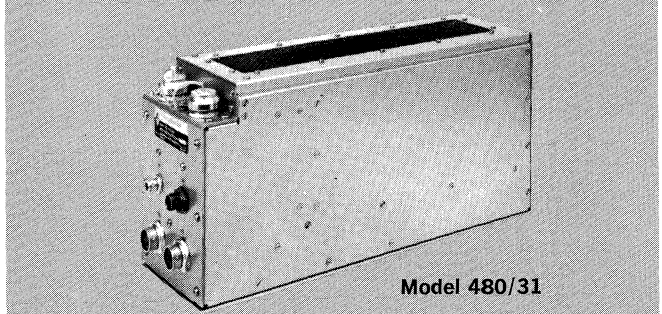
Series 538



Model 660



Model 508/10



Model 480/31

Series 538—Digital-To-Resolver/Synchro Converters

The Series 538 D/R-S Converters offer 9- to 17-bit single-speed resolution with digital input as binary angle. The input register is strobed and the digital data is then held until the next strobe. The internal logic selects the appropriate trigonometric transformer taps, thus simulating actual 4-wire resolver or 3-wire synchro data at the selected line-line voltage. Built-in protection circuits are provided for power-line voltage and frequency transients, overload and short-circuit. The Model 538/30 "shoebox" unit provides 9- to 13-bit resolution with 6-minute accuracy and the Models 538/10 (full-rack) and 538/20 (half-rack) converters provide 14- to 17-bit resolution with better than 1-minute accuracy. Options include 50 Hz to 10 KHz signal data frequencies, special input logic and multi-speed outputs. Series 536 D/R Converters and Series 537 D/S Converters are also available as single-mode units.

Model 660—Digital Angle Generator

The Model 660 Digital Angle Generator provides digital angle input data and data strobe signals to the Series 538 D/R-S Converters. Useful in semi-automatic test system applications, static data angles and angular data rates from 1 arc-minute/second to 2000°/second can be generated from an internal or an external clock. Typical optional features include 2-speed digital data output and start/stop angle.

Model 537/31—MIL-T-21200 D/S Converter

Designed and qualified to MIL-T-21200, the Model 537/31 Digital-To-Synchro Converter accepts binary inputs, provides solid-state-switched, precision trigonometric transformer conversion to 90 V and 11.8 V line-line synchro signals to an accuracy better than 50 arc-seconds with built-in short-circuit protection. Computer-related functions include "acknowledge" pulse, "busy" pulse, and 1 MHz clocked input serial data. Design MTBF of 13,000 hours.

Digital-To-AC-Converters

Model 508/10—Digital-To-AC Converter

In automatic test systems, this solid-state-switched, a-c ratiometric converter can be directly programmed from a punched card reader, a paper tape reader, or a digital computer. Featuring BCD digital data input with 10-microsecond data acceptance, the Model 508/10 400 Hz D/AC Converter has a ratio of zero to unity with 5-decade (BCD) resolution and is accurate to .005% (50 ppm). Also available is the Model 508/11, which accepts a pulse train input and provides an a-c ramp output. Higher accuracies, different resolution, and inversion mode are available as specific options.

A/D-D/A Converters

Model 480/31—A/D-D/A Converter

Designed and qualified to MIL-T-21200, the Model 480/31 A/D-D/A Converter is a state-of-art device incorporating 16 multiplexed A/D conversion channels and 11 D/A channels. The A/D Converter has bipolar ranges up to 32 vdc with measurement accuracy to 0.02% full scale. The D/A Converter provides non-inverted and inverted ratio conversion with 25 vdc output and a maximum conversion time of 600 msec, with accuracy to 0.01%. Computer-related functions include channel selection and read command. Featured are a self-test mode and module fault isolation. Design MTBF of 14,000 hours.

TO-DIGITAL COMPUTER-INTERFACE, AND ATE EQUIPMENT.

Resolver/Synchro To Digital Converters

These converters provide a complete high-speed interface from analog to digital systems through continuous conversion of analog resolver and synchro data into digital data at angular velocities up to 20,000°/sec. High-speed continuous tracking is achieved through use of a unique electronic servo technique which provides velocity constants to 200,000 sec^{-1} and eliminates any data staleness errors. These 400 Hz converters feature semiconductors, integrated circuits, and precision trigonometric transformers. A wide selection of application-oriented options including operation at other frequencies from 50 Hz to 10 KHz are available in specific models. Multi-speed and multi-channel systems are also available.

Model 545—Automatic Angle Position Indicator

This instrument is offered with .01° resolution and accuracy or with .001° resolution and 10-second accuracy for all line-to-line voltages from 11.8 to 90 V at 400 Hz. The digital angle is both displayed and available in BCD format at the rear connectors. Remote or front-panel selection of resolver or synchro input, line-line voltage range and operating mode. Operating modes selected as Track (the instrument continuously follows the input data), Update (the instrument tracks for 200 msec, then holds until receipt of another command), and Auto-Update (repetitive track/hold sequences) with a Variable Display Time of .5 to 3 seconds. Optional remote readout, analog d-c null output, data freeze command, signal frequencies 50 Hz to 4.8 KHz, multiplexed and multi-speed units.

Model 546/31—Synchro-To-Digital Converter

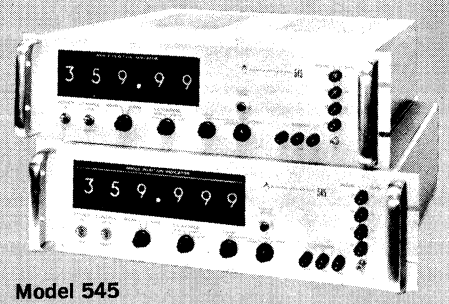
Designed and qualified to MIL-T-21200, this model converts 11.8 V line-line 400 Hz synchro signals to 16-bit binary angle data on 10-multiplexed channels. The accuracy is .01° with tracking speed to 20,000°/second and velocity constant of 200,000 sec^{-1} with input channels programmed by logic level address signals. System-related functions include self-test at 60° increments, and module fault isolation. Computer-related functions include "read command," 1 MHz clocked output serial data, "data ready" and "acknowledge" signals. Design MTBF of 10,000 hours.

Building Block 54

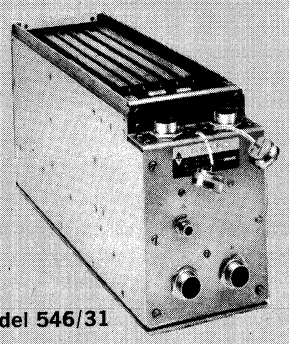
A special version of the Model 545 designed as a part of the GPATS (General Purpose Automatic Test System) system. It operates from 50 Hz to 5 KHz, includes module fault isolation, and provides digital output without display.

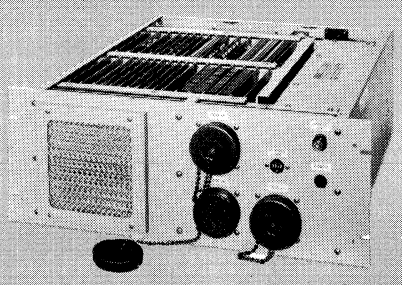
Angle Position Indicators

High-speed performance 400 Hz servos for field test and production test measurement of synchro and resolver transmitters. The half-rack API-8025 provides accuracy of 6 arc minutes, repeatability of 30 arc seconds, and slew speed of 25°/second with a digital readout display. Optional retransmit components, dual-mode, and two-speed operation. Also available for operational use, 2" and 3" diameter units.



Model 545


Model 546/31


Building Block 54


API-8025

NORTH ATLANTIC *industries, inc.*

TERMINAL DRIVE, PLAINVIEW, NEW YORK 11803 • 516—681-8600

New Headquarters for
MDS/OEM MARKETING
are at
P.O. BOX 630 • PALISADE ST., HERKIMER, N. Y. 13350
TEL. 315/866-6800

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Telephone 315/866-6800

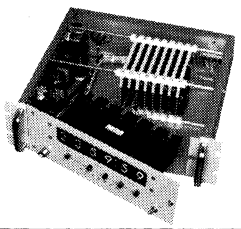
MDS®

PARABAM

DIGITAL CLOCKS

SOLID STATE—ELECTROMECHANICAL

For computers, data logging, missile launch count-down display and control. Multi-channel digital time programming for control of automatic processing and radio/TV broadcasts. Variety of logic outputs compatible with most data readout devices. Single or multiple remote glow-tube or projection-type time displays.



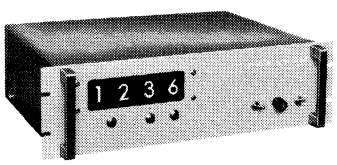
SOLID STATE CLOCKS

For countdown and/or elapsed time, time-of-day. Combined calendars provide day-of-year or month-day. Various time bases, time data output formats and displays available.

features:

- All silicon semiconductors.
- Plug-in circuit modules.
- Front panel access.
- Options: Automatic transfer to battery operation during line power failures. Strobed logic output. Special timing pulses. Sidereal time.

Write for Tech. Bulletin No. 465-22A



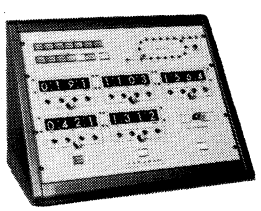
ELECTROMECHANICAL DIGITAL CLOCKS

Time resolution down to one second. Single or multiple isolated contact closure outputs in 10-line decimal, teletype code, and/or any BCD format. Wide choice of number and type of time displays.

features:

- Time Synchronized to line frequency or external pulse input.
- Countdown/elapsed time or real time.
- Outputs interface readily with digital systems.
- Special time-controlled pulse closures available.

Write for Tech. Bulletin No. 1066-27



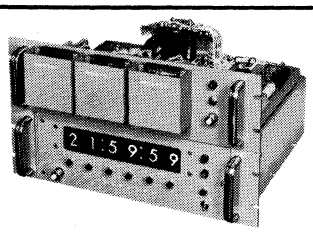
AUTOMATIC RACE TRACK TIMING SYSTEMS

Automatically measures and displays the precise quarter mile times and finish time for all types of races and for all race distances. Designed for operation by non-technical personnel.

features:

- All solid state electronics.
- For track, turf, and harness races.
- Output drives two tote board display units.
- Automatically programs photocells for selected race distances.

WRITE FOR DESCRIPTIVE LITERATURE



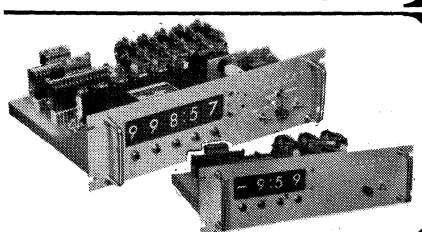
DIGITAL TIME PROGRAMMERS

Standard units accept time data inputs from solid state or electromechanical digital clocks and provide any number of precisely timed signal outputs as pre-selected by the wiring of one or more program plugs.

features:

- Programmed time interval accuracy well within the clock resolution.
- Display of output channel numbers and status available.
- Complete program changed in seconds by replacing program plugs.

Write for Tech Bulletin No. 566-24



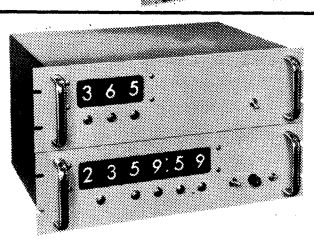
COUNT/DOWN, COUNT/UP DIGITAL CLOCKS

Used in missile launch, testing, radio-television — anywhere time is counted down, then afterward elapsed time is observed.

features:

- Available with digital logic output or for programming and recording.
- Plus/minus count in most time ranges and resolutions.
- Projection type or Nixie displays.
- Standard system operates up to 40 displays.

Write for Tech. Bulletin No. 162-16A



DIGITAL CALENDARS

Provide nonambiguous contact closures in parallel form corresponding to date in Month-Days (months from 01 to 12, days from 01 to 31) or Day-of-the-Year (from 001 to 365). Used in data logging, process control or other date of time oriented systems.

features:

- May be ordered in Month-Day or Day-of-Year Models.
- Outputs in decimal or various codes of binary coded decimal.
- Projection type or Nixie displays.
- Switch for leap year correction.

Write for Tech. Bulletin No. 1066-29

PARABAM, INC.

Special Design Charges eliminated through hundreds of off-the-shelf designs.

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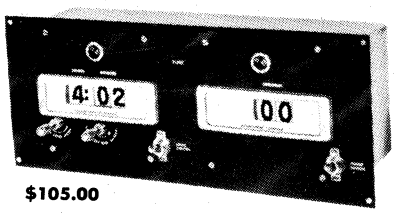
TYMETER GRADINETIC®

DIGITAL READ-OUT CLOCKS
ELAPSED TIME COMPUTERS
INTERVAL, COUNT DOWN, IMPULSE TIMERS

Featuring:
- *FRONT PANEL MOUNT*
- *DESK OR BENCH USE*
- *DIGITS RESETTABLE INDIVIDUALLY*

CSA and UL approved motor & cord



$105.00

DIGITAL CLOCK SECOND BY SECOND

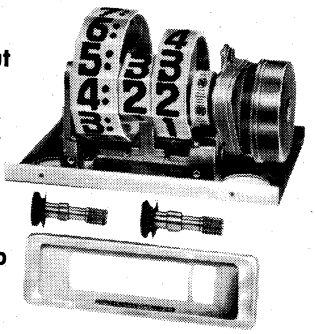
Time registered on 5 polygonal drums. One Hour drum, one 10-minute drum, one minute drum, two seconds drums. 4½"h, 12"w, 3¼"d. Wt. 6 lbs. Anodized metal dustproof case.

#110-12H ..... **12 Hour**
#110-24H ..... **24 Hour**

DIGITAL CLOCK MOVEMENT

6-Digit Read Out

3" high
5½" wide
3½" deep
Wt. 2 lbs.

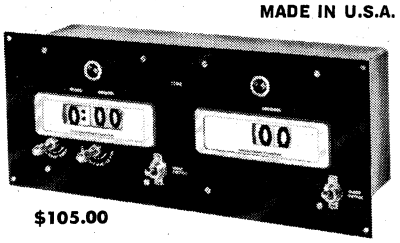


$16.50

Consists of Tymeter Digital Clock Movement, mounting bracket, window escutcheon assembly, 2 time reset assemblies

#130-12H ..... **12 Hour**
#131-24H ..... **24 Hour**

MADE IN U.S.A.



$105.00

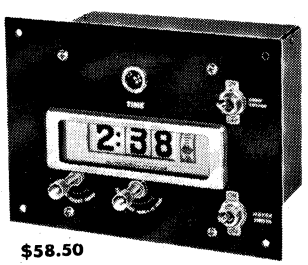
ELAPSED TIME DIGITAL COMPUTER

6 DIGIT READ OUT

Automatically calculates and registers elapsed time in hours, 10 minutes, minutes and seconds. Second by second. 4½' h, 12" w, 3½" d. Wt. 6 lbs. Stop and Hold Control. Count down and Count up.

#115

Available In:
30 Minute **12 Hour**
60 Minute **24 Hour**



$58.50

DIGITAL CLOCK

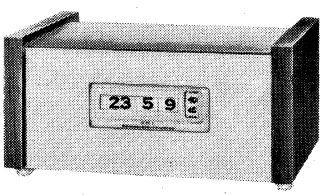
12 and 24 hour 6 digit read out . . . minutes, 10 minutes and hours. Rotating visual 1 RPM calibrated seconds drum. 4½"h, 6"w, 3¼"d. Wt. 3½ lbs. Anodized metal dustproof case.

#160-12H ..... **12 Hour**
#161-24H ..... **24 Hour**

24-HOUR DIGITAL READ OUT CLOCK

Calculates time automatically. Stainless steel case with walnut wood ends. 3⅞"h, 7¾"w, 3¾"d. Wt. 3 lbs. 110V 60 Cy. AC.

#920-24 Hour **$25.50**
#920-12 Hour **$24.50**

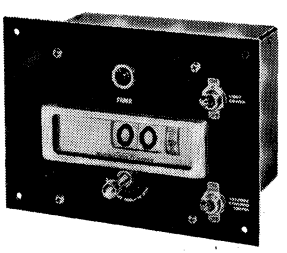


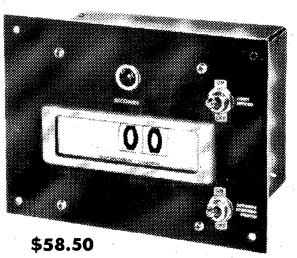
ELAPSED TIME DIGITAL COMPUTER

Stop and Hold control. Automatically computes and registers minutes, 10 minutes, hours. Rotating 1 RPM calibrated seconds wheel. Anodized metal dustproof case. 4½" h, 6" w, 3¼" d. Wt. 3½ lbs.

AVAILABLE
60 Minutes • 12 Hour • 24 hour

#162 .....**$58.50**



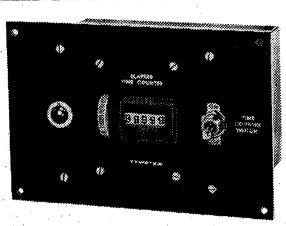


$58.50

ELAPSED TIME DIGITAL COMPUTER

Automatically calculates and registers elapsed time in seconds. Second by second 2 digit read out . . . 00-59. 4" h, 6" w, 3¼" d Wt. 3½ lbs. Anodized metal dustproof case. Stop and Hold Control. Count down and count up.

#10-60S.....**60 Seconds**



ELAPSED TIME COUNTER

Digits resettable individually. Stop and Hold Control. Time Control switch, Anodized metal dustproof case. 3½" h, 5½" w, 3¼" d. Wt. 3½ lbs.

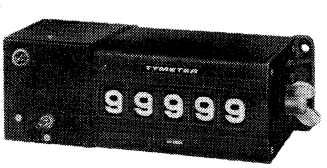
RANGES:
Hours .....99,999 hours
Hours, and tenths of hours .....9,999.9 hours
Minutes .....99,999 minutes
Minutes, and tenths of minutes .....9,999.9 minutes

#120 .....**$38.50**

#96—LARGE FIGURE COUNTER....$87.50

Digits ¾" high, 19/32" wide. Digits resettable. Stop and Hold Control. 10½" w, 3½" h, 4½" d. Wt. 5½ lbs.

RANGES:
Seconds .....99,999 seconds
Tenths of minutes 9,999.9 minutes
Minutes .....99,999 minutes
Tenths of Hours.....9,999.9
Hours .....99,999 hours

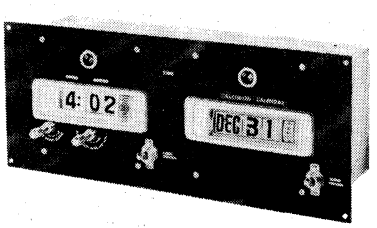


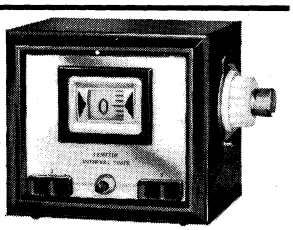
CALCHRON CALENDAR and *TYMETER DIGITAL CLOCK

Digits resettable individually. Anodized metal dustproof case, 4½" h, 12" w, 3½" d, Wt. 6 lbs.

* #125-12H — 12 Hour
* #125-24H — 24 Hour

#125 .....**$125.00**





DIGITAL TIMER
for All-Purpose Laboratory & Industrial
TEST TIMING

Adjustable reset stop to enable rapid repeat timing. Closes load circuit during OR after a preset interval. Buzzer sounds at end of interval. 120V 60 cy. AC. Ranges available: 57 seconds by seconds, 57 minutes by minutes, 11.5 hours by ¼ hours, 23 hours by ½ hours, 57 hours by hours. 5"h, 5½"w, 3½"d. Wt. 3½ lbs.

#90 .....**$25.00**

ALL TYMETERS AVAILABLE IN ALL VOLTAGES & CYCLES. CATALOG OF COMPLETE LINE ON REQUEST.

PENNWOOD NUMECHRON CO. - TYMETER ELECTRONICS
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pioneer magnetics incorporated

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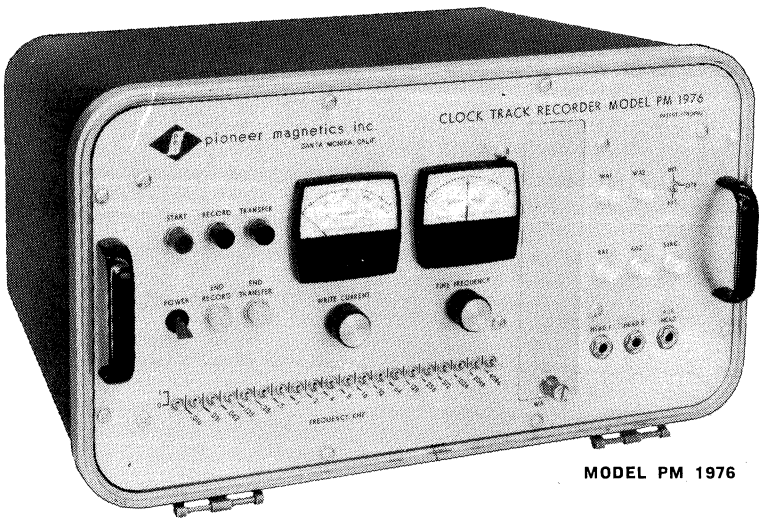
COMPUTER TEST EQUIPMENT AND POWER CONVERTERS

computer clock track recorder

A versatile, accurate instrument which places precision clock origin pulses and tracks on disc and drum computer memories.



MODEL PM 1976

FEATURES:

- Applies perfect track with **no** measurable closure error.
- Easy and quick. Save time in setup and production.
- No other equipment required.
- Automatic push-button operation.
- Portable instrument.

SPECIFICATIONS:

OUTPUT FREQUENCY: up to 5MHz.
NUMBER OF BITS: up to 524,287.
RECORDING: Ferranti or NRZ.
CLOSURE ERROR: not detectable.
JITTER: less than 10 nanoseconds, bit to bit.
DISC/DRUM SPEED: 600 rpm to 24,000 rpm.
INPUT LEVEL: down to 15MV p-p.
WRITE CURRENT: 10 to 200MA.
PROGRAMMING: front panel selection.
OPERATION: push buttons, illuminated.

APPLICATIONS:

- Computer discs and drums.
- Servo systems — Tachometers, constant speed drives.
- Laboratory — Frequency multiplexing and filtering of pulse trains.

computer power supplies

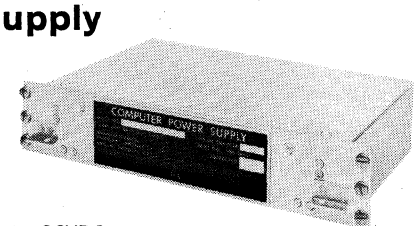
P.M.I. specializes in military and industrial power supplies for computer applications. A wide variety of inputs, AC or DC, are accommodated with standard designs. Multiple output regulators are modular and isolated. Full military specifications and quality control are provided.

FEATURES:

Minimum size and weight
Minimum cost
Maximum efficiency
Maximum reliability

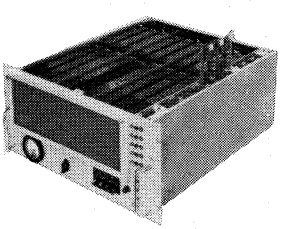
airborne computer power supply

MODEL PM 1854



INPUT: 21VDC to 36VDC.
DC OUTPUTS: 4 isolated outputs, 116 watts total.
MECHANICAL: Size: 64 cubic inches.
Weight: 3 pounds.
QUALITY: All components TX level.
APPLICABLE SPECIFICATIONS: MIL-E-5400, MIL-I-6181, MIL-STD-826, MIL-STD-810.
ENVIRONMENT: Manned aircraft, per MIL-T-5422.
Ambient Temperature: −55°C to +100°C.

9-channel computer power supply



MODEL PM 1779C

INPUT: 120VAC L-L, 3ϕ, 400Hz.
D.C. OUTPUTS: 9 isolated channels with remote sensing. 810 watts total.
QUALITY: Shipboard service.
CONSTRUCTION: Modular design for commonality of parts and rapid service.

RAYTHEON COMPUTER M-SERIES IC ANALOG & DIGITAL MODULES

M-Series Integrated Circuit Digital Modules... a module system, not just a line of circuits.

With Raytheon Computer's new M-Series Integrated Circuit Digital Modules, the digital designer has for the first time a true module system, not just a line of circuits. The modules themselves, the connectors, cases, power supplies, and power distribution scheme have been so thoroughly engineered that the designer can concentrate on his digital data problem, not the mechanical details of putting it together and making it work.

The M-Series logic system offers the user these specific advantages:

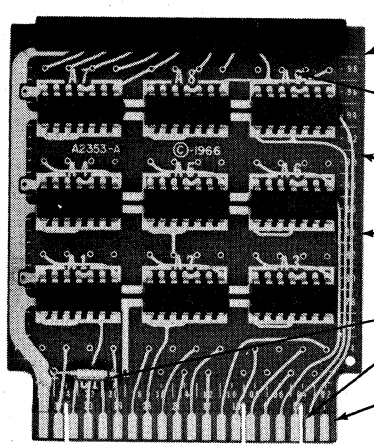
1. Complete complement of digital and analog modules, cases, power supplies and accessories. Over 80 types of cards available with DTL or TTL integrated circuits.
2. Module connectors unitized in groups of 10, 30 or 40 on aluminum plates; eliminates handling and mounting of separate connectors. Mounting plate is used as system ground plane to minimize noise.
3. Power and ground distribution in module cases simplified by use of laminated bus bars. Power wiring errors eliminated and assembly time reduced.
4. Point-to-point wiring minimizes capacitance.
5. Connector and hardware configurations designed for automatic wire wrapping—provide fast system delivery, high reliability, low cost and wiring consistency.
6. MINIVERTER, MINI-DAC, and other analog instruments.

In addition, Raytheon Computer offers complete technical documentation such as Application Notes which include useful "Hints and Kinks" for the systems designer, recommended tools and general information about the M-Series line.

In line with the M-Series system concept, Raytheon Computer offers complete backup and support in the following areas:

1. M-Series on-the-shelf stock of approximately $250,000.00.
2. Stock of wire wrap kits with all tools necessary.
3. Automatic wire wrap service available to all customers.
4. Assistance from field or factory application engineering staff.
5. Custom analog or digital modules for special requirements.

GENERAL SPECIFICATIONS *See catalog SP-230 for complete specifications.*



Compact optimum form factor (3 x 3.65 inches).

All components and connector pins identified by silk screen call-outs.

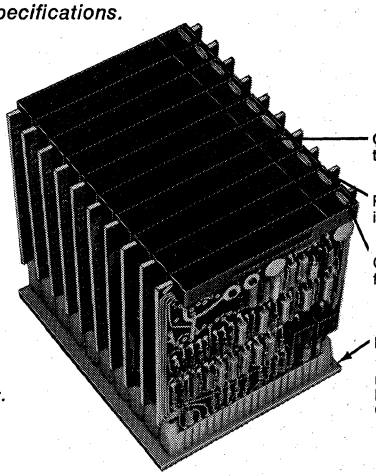
Coordinate system quickly identifies components for trouble shooting.

One-sixteenth inch thick glass epoxy, flame retardant FR 4 material exceeding MIL-P-13949.

Power supply decoupling on all modules.

Polarizing key slots prevent insertion into wrong connector.

Etched connector with 40 pins; Four reserved for power.



One ground and eight signal test points in module handle.

Plastic handle makes module insertion easy.

Color-coded module function.

MINIVERTER—
10-bit ADC, 16-channel multiplexer and sample and hold on 10-connector block. Other versions available.

ELECTRICAL AND ENVIRONMENTAL

Type of IC Logic:
DTL Dual-in-Line for medium speed applications.
TTL Dual-in-Line for high speed applications.

Input Logic Levels:
Logic "1": +2.0 to +5.0 Volts
Logic "0": 0 to +0.95 Volts

Output Logic Levels:
Logic "1": +2.5 to +5.0 Volts
Logic "0": 0 to +0.5 Volts

Noise Rejection: 1 Volt, typical

Power Supply Voltage:
+5V ±10%
−5V ±10% (used as bias for discrete component modules)

Temperature:
Operating: 0°C to +70°C
Storage: −55°C to +125°C

UNIT CIRCUIT LOADING

Input loading and drive capability for M-Series modules are specified in "unit loads" to simplify calculation of total loading on a driver circuit fanned out to several different circuit types.

A unit load is the current required to drive the input of a NAND Gate (approximately 1.3 ma.). Since NAND Gates require no input current when all inputs are at a logic "1" (+5 V), the unit load applies only to the logic "O" (Ov) condition at a gate input.

MECHANICAL

Physical Size
Width: 3.0 inches
Length: 3.65 inches (including handle)
Mounting: 0.375 inch centers

Connector: Etched-type 40 pin, gold-plated over nickel. Terminations spaced on 0.125 inch centers for insertion into Elco series 6303 Connector.

Board Material: 1/16 inch thick glass impregnated, flame retardant, blue epoxy Type FR 4 per MIL-P-13949.

Conducting Material: 2 ounce copper

Conducting Width: 0.020 inch nominal*

Conductor Spacing: 0.010 inch minimum

Test Points: 8 signal test points and 1 ground test point

*Ground and power conductors are a nominal ⅛ inch.

CONNECTORS

Mating connectors for the M-Series modules are Elco series 6303 mounted on a clear anodized aluminum plate. For easy pin identification on the reverse side, the plate is silk-screened with a unique checkerboard pattern. Connector assemblies come with 10, 20, 30, or 40 connectors each.

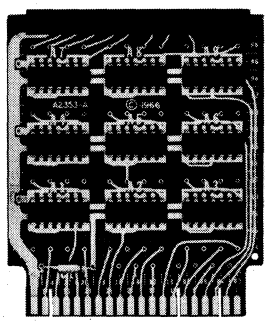
The Series 6303 connectors meet the applicable minimum performance requirements of MIL-C-21097. Copies of the Elco test report are available on request.

RAYTHEON COMPUTER ANALOG INSTRUMENTS

Raytheon Computer's analog and digital integrated circuit modules come in three packages to offer the systems engineer the most useful range of high performance data acquisition and conversion instruments at low cost. Typical is the MINIVERTER,™ which starts with 16 channels of multiplexing, a sample-and-hold amplifier and an analog-to-digital converter on a 10-module connector block. A/D and D/A converter resolution ranges from 10 to 12 bits binary/13 bits BCD, with speeds to 100KHz. Multiplexing, sample-and-hold and data distribution functions are available as individual modules.

1. M-Series IC Modules. You can order individual modules and put them together yourself. There are nearly 80 analog and digital modules, plus compatibly-engineered cases, hardware and accessories. All modules have important features like ground and signal test points in handles, color-coded function decal, 40-pin etched connector, etc.
2. MINIVERTER, ADC or DAC, assembled, wired, tested and mounted on 10, 30 or 40 connector block. You supply external DC power, mounting case. We call it an -04 configuration like the MINIVERTER shown here.
3. Complete analog instrument mounted in a 80 module case with options like channel selection controls, indicator lights, etc. We call this an -06 model, like the MINIVERTER system shown here.

The newest instruments available in this package are a series of high speed MINIVERTERs which combine up to 64 input channels, a sample-and hold-amplifier and either a 100KHz, 150KHz or 200KHz 12-bit analog-to-digital converter.



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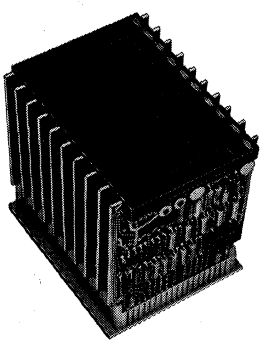

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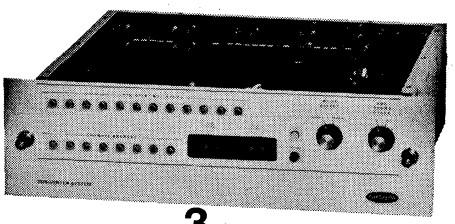


3

Analog Instrument Selection		
Instrument	**Model Designations** -04	-06
ADC's	10 Bit, 12 Bit,13 Bit (BCD)	
Miniverters	Channel Capacity	
10 Bit	64	128
12 Bit	64	128
13 Bit (BCD)	64	128
Multiverter III 15-bit	32 (see detailed specs at right)	128
DAC's		
10 Bit	16	48
12 Bit	16	48
13 Bit (BCD)	12	32
Multiplexer MMUX1	N/A	64
Sample & Hold System		
MSSH3	N/A	64
MSSH4	N/A	64

The Modular MULTIVERTER III®

Buy only what you need.

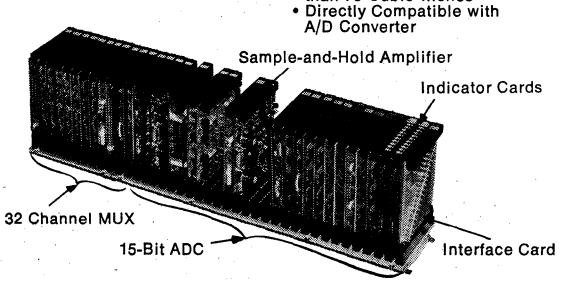
High Performance ADC
- Over 100KHz Conversion Rate
- 15-Bit Resolution
- 0.01% Accuracy

State-of-the-Art Sample-and-Hold Amplifier
- 2 Microsecond Settling Time
- 50 Nanosecond Aperture
- Unique Ground Isolation Network

Modular Construction
- Requires less than 200 Cubic Inches
- Mounts in Your Chassis or Ours
- Modular 32-Channel Multiplexer Option
- Built-in 16-Bit Indicators
- Uses M-Series Modules

Operates From DC Power Only
- Less Than 25 Watts Required
- Fast Warm-up—Less than 60 Seconds

State-of-the-Art Multiplexer Switch
- MOS Field Effect Switch
- High Speed—Less than 2 Microseconds to Switch and Settle
- 32 MUX Channels in Less than 70 Cubic Inches
- Directly Compatible with A/D Converter



RAYTHEON COMPUTER • 2700 SO. FAIRVIEW ST., SANTA ANA, CALIFORNIA 92704 (714) 546-7160 TWX 910-595-1570 RAYTHEON

RAYTHEON COMPUTER MULTIVERTER®

AN INTEGRATED CIRCUIT MULTIPLEXER, SAMPLE-AND-HOLD AMPLIFIER AND ANALOG-TO-DIGITAL CONVERTER IN A SINGLE CHASSIS.

Analog Input

Channel Capacity (16 channels/card)	96 channels w/o attenuators 48 channels w/attenuators
Crosstalk	80 db with 1K source at 400 cps①
Aperture Time	50 nanoseconds
Input Range	±10 volts full scale w/o attenuators ±100 volts full scale w/attenuators
Input Impedance (w/o attenuators)	100 meg. ohms min. for selected channel 1000 meg. ohms min. for unselected channel
(w/attenuators)	20K ohms (±0.02%) for either selected or unselected channels
Max. Source Impedance	1000 ohms for specified performance w/o attenuators
Max. Voltage Overload②	100% full scale w/o attenuators 25% of full scale w/attenuators

Performance

Throughput Rate	See ADC Table
Accuracy at DC	
Linearity	0.01 ± ½ LSB
Long Term Drift	0.01% Typical
Temp. Coefficient	10 ppm/°C max.
Crosstalk	80 db with 1K source at 400 cps①
Voltage Ref. Stability	0.001%

Typical Accuracy at 25°C will be within 0.02% (± ½ LSB) of full scale.

Digital Inputs

Logic Level (Input)	Binary "1" −6 volts to −12 volts Binary "0" 0 volts ±1 volt
Start Line (1 Line)③	Z_{in}=3K to −15 volts
Channel Address (7 Lines max)	Z_{in}=1.8K to −15 volts
Mode Selection (2 Lines)	Z_{in}=3.9K to −15 volts
Modes of Operation	Sequence, Digitize Only, Random Address, Manual

Digital Outputs

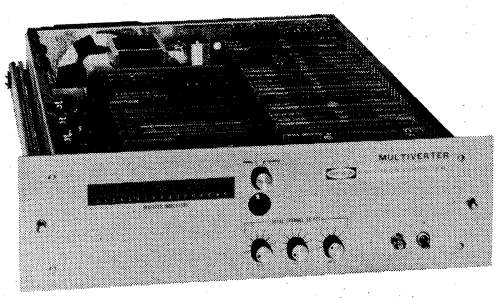
Parallel Data and "Busy"	Standard: Logic "1"	$\frac{V\ ext}{2}$
	Optional: Logic "0"	0 volts
	Logic "1"	0 volts
	Logic "0"	$\frac{V\ ext}{2}$
Frame Sync	3.9K to −15 volts	
Clock Output	Transformer coupled 8 volt pulse of 0.2 μsec. duration (Isolated Secondary) Z_o=10 ohms I_{max}=20 m.a.	
Serial Output	Same as clock output. A pulse is present every time that a Binary "zero" is generated during the conversion.	

Temperature

Temperature Range	0 to 50°C For extended Ranges See④
Warm up Time	10 min. to rated accuracy
Cooling	Internal-muffin fan
Temperature Coefficient	10 ppm/°C max.

Mechanical

Analog Inputs	Malco Connector Panel (wired for 64 channels).
Digital Inputs (mate)	Amphenol Type 17-20500-1 or Cannon Type DD-50P.
Display	Amperex Indicators for A/D Register
Size	19″ slide mounted drawer 22″ deep 5¼″ high
Weight	60 pounds (typ.)
Power	105 to 125 vac 60 to 400 cps (Fused at 3 Amp S.B.)



GENERAL NOTES ON MULTIVERTER SPECIFICATIONS

1 Crosstalk is measured as follows: A 400 cps full scale input voltage is applied through a 1000 ohm source impedance to all channels except the one being monitored. The 400 cps noise is measured on the selected channel which has 0 volts applied through a 1000 ohms source impedance.

2 No more than 2 channels can simultaneously be overloaded (by 100%) for the Multiverter to operate to rated specs.

3 The aperture time of the system is affected by the rise time of the "Start" pulse.

4 The Multiverter is capable of operating over a range of −20°C to +60°C at some reduction in performance. Contact factory for further information.

Analog-to-Digital Converters

Resolution	Model Number (Binary Instruments)	Bit Rate	Nominal A/D Conversion Rate	Nominal Multiverter **Throughput Rate
10 Bits*	ADC21-10B-B ADC23-10B-B	1.2 Microsec/bit 2.0 Microsec/bit	75KC 45KC	55KC 38KC
12 Bits*	ADC21-12B-B ADC23-12B-B ADC25-12B-B	1.2 Microsec/bit 2.0 Microsec/bit 3.5 Microsec/bit	64KC 38KC 22KC	50KC 33KC 21KC
14 Bits*	ADC22-14B-B ADC24-14B-B	2.0 Microsec/bit 3.5 Microsec/bit	33KC 19KC	30KC 18KC
15 Bits*	ADC21-15B-B ADC20-15B-B ADC24-15B-B	1.2 Microsec/bit 3.5 Microsec/bit 2.0 Microsec/bit	52KC 31KC 17KC	40KC 27KC 17KC
3 BCD Plus Sign (8-2-4-1 Code)	ADC22-13D-B ADC24-13D-B	2.0 Microsec/bit 3.5 Microsec/bit	35KC 20KC	31KC 19KC
4 BCD Plus Sign (8-4-2-1 Code)	ADC20-17D-B ADC24-17D-B	2.0 Microsec/bit 3.5 Microsec/bit	27KC 16KC	25KC 15KC

*Includes Sign **Throughput Rate for entire Multiverter when using the A/D Converter shown.

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REMEX Photocell Punched Tape Readers and Spoolers

"The Standard of the Industry"

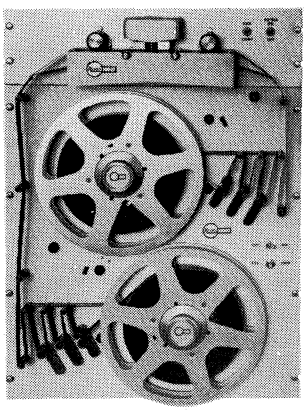
Complete range of speeds to 1000 char/sec. ■ Automatic adjustment for 5, 7, or 8-channel punched tapes ■ Complete with solid state output amplifiers and control circuits ■ Unidirectional or bidirectional ■ Rugged, precision mechanical construction ■ Regulated power supply ■ No contacts to wear out or cause errors due to bounce ■ Ultra soft take-up feature in all spoolers ■ No extra charge for rack mount units ■ Self-adjusting brakes on all reader models ■ Integrated circuit models available

Standard Readers

To **300** characters/sec. Unidirectional or bidirectional, combining ultra-high reliability with low cost. Ideal for applications such as automatic test equipment, numerical machine control, digital computer input, high speed data communications, process control, telemetry data analysis, etc.

To **1000** characters/sec. High speed, ultra-reliable reader featuring a rugged precision mechanical transport system and modular construction. Available in unidirectional and bidirectional models. Used in high performance systems where very fast reading and stopping rates are required.

Block-Stor. Expandable by two line increments up to 80 lines of storage.

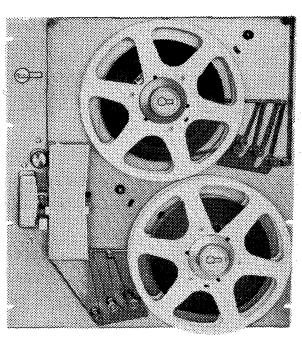


Standard Spoolers

Remex Tape Spoolers are high performance bidirectional units ideally suited to the corresponding Remex Photocell Readers. Or they can be used as modular units adaptable to the requirements of other systems. All models provide constant tape tension and self-adjusting electric brakes. The use of standard NAB reels on quick release hubs makes possible rapid and trouble-free changing of tapes. Other features include broken tape sensing and bidirectional rewind which can be controlled remotely and/or by a front panel switch. Long periods of maintenance-free service are assured by conservative engineering and the use of high quality components throughout. Available in models for 8" and 10½" diameter reels.

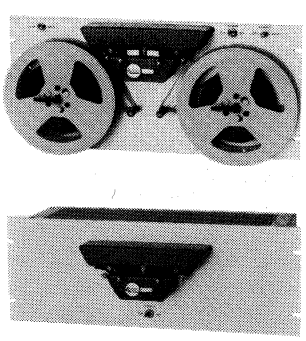
Combinations and Specials

In addition to the standard models of tape readers and spoolers above, available individually or in combination, units with custom packaging and circuitry are available to satisfy special requirements and suit new applications. Reader models are available with 15,000 hour lamp and fibre optics to read a wide range of tape transparencies.



New Models

Combination reader/spoolers with 7½ in. reels for speeds to 300 char/sec. and readers for speeds to 400 and 1,000 char/sec. are now available. These units feature quartz iodine lamps, fibre optics, automatic tape compensation, TTL integrated logic, pluggable options and rugged construction.



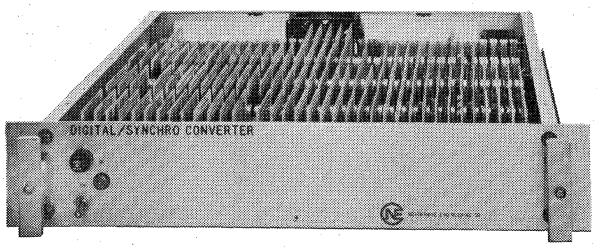
REMEX Electronics
A DIVISION OF EX-CELL-O CORPORATION XLO

5250 West El Segundo Boulevard
Hawthorne, California 90250
Telephone (213) 772-5321
TWX (910) 325-6219

REPUBLIC CORPORATION

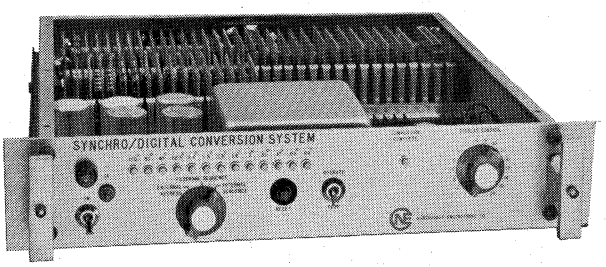
ADVANCED TECHNOLOGY SYSTEMS GROUP

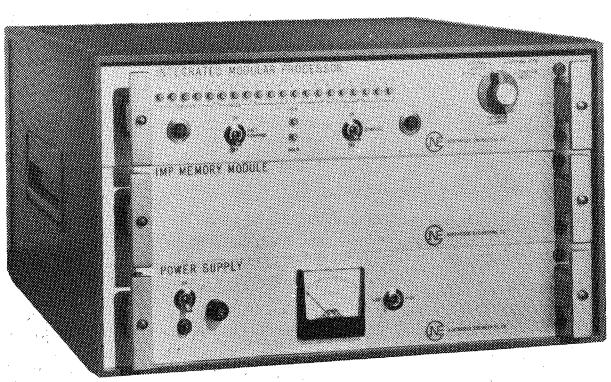
9754 DEERING AVENUE
CHATSWORTH, CALIF. 91311
(213) 341-9200



The Republic **Model 102 Digital-to-Synchro Converter** is a completely solid-state advancement over the Model 101. This unit has gained a wide ranging reputation for ruggedness and reliability in instrumentation systems. The Model 102 utilizes the latest advances in integrated circuitry completely eliminating the heavy bulky transformers of conventional D to S Converters. Resulting package size is strikingly reduced to 25 cubic inches per digital-to-synchro data channel. Speed is greatly increased to a rate in excess of 50 microseconds per conversion. As with all other Republic data instruments, the Model 102 Digital-to-Synchro Converter may be utilized with the Integrated Modular Processor (IMP) without need for added interfacing.

The companion to the Model 102 is the **Model 202 Synchro-to-Digital Converter.** This new unit eliminates the necessity for peak sampling or sample and hold techniques in conversion of the synchro type signals to 13 bit accuracy. The unit can be commanded externally or internally to sample the synchro signal at any time in the AC reference cycle. Except when the reference passes through zero, a new sample is available within 100 microseconds after a sample command. The use of completely solid-state circuitry allows for a 32 channel multiplexed converter to be packaged into one 3½" high chassis. Common mode rejection is ±50 volts. Input impedance is in excess of 100k ohms resistive line-to-line and line-to-common.



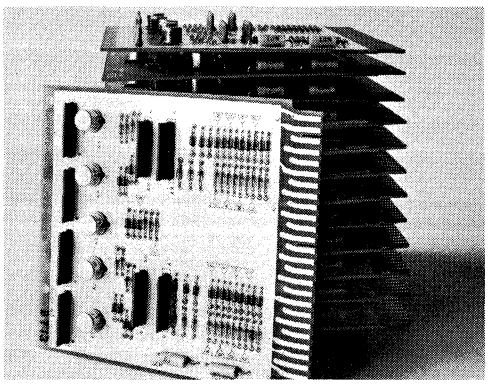


Republic's **Integrated Modular Processor (IMP)** is uniquely designed as an on-line, real-time data processor. IMP may be tailored to a wide variety of applications such as process control, radar data processing, weapon fire control, coordinate conversion, and data acquisition. In these applications IMP acts as the central computation and controlling element or as an adjunct to larger computers. Some of the IMP features include: a read only or core memory, versatile command structure, indexed and indirect addressing, relocatable programming, buffered input and output, and a wide line of peripheral equipment. The IMP is designed to interface directly with the Republic line of conversion equipment and uses the same family of logic modules—a feature that simplifies spares provisioning in complete systems.

Republic data instruments are easily integrated into complete data systems commanding the broadest capabilities. By incorporating the Integrated Modular Processor (IMP), Republic can offer a single function, any system subroutine, or complete data control. Entire closed loop systems are available to accept synchro data and convert it to digital format (either BAMS or BCD). Further, these systems can derive an action statement from the computer program and control the mechanism from which the original data were obtained. Republic has the experience, capabilities, products, and technical depth to provide an optimum system to solve your problem.

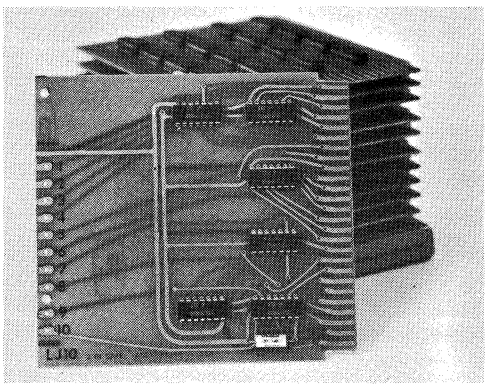
One stop source for digital systems components.

IC Logic Modules.



T SERIES: SDS T Series modules are the best logic modules available at commercial prices. They utilize integrated circuits for high-speed and economy, and discrete components to achieve superior noise rejection and high fan-out. We use them in Sigma computers. T Series modules feature:

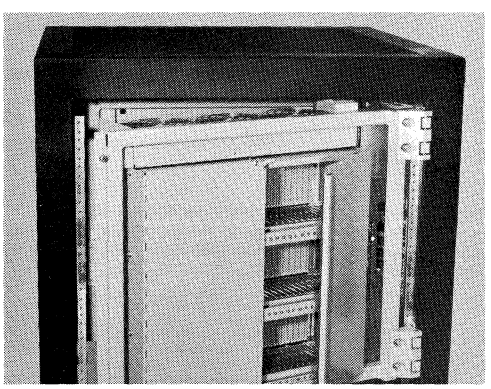
* DC to 10MHz, all modules, with plenty of margin.
* Guaranteed noise rejection 1.5 volts.
* 60ma per IC output for fan-out to 14 gates.
* Natural logic functions AND, OR, NAND, NOR, all at low cost, so you can minimize design and hardware.
* Simple wiring rules.
* Over 200 modules available.
* Design automation service is available to reduce your wire listing time.
* Wiring service is available to wire chassis from your wire list.



J SERIES: The J Series general purpose logic modules offer good performance and reliable operation at a budget price. J Series modules feature:

* DC to 5MHz operation.
* Ceramic dual inline packaged IC's for greater reliability.
* Many MSI circuits are used to reduce system cost and size.
* Ten front-edge test points for scope checks.
* Removable test lamp assembly mates with test points for convenient system troubleshooting.
* Wiring service is available to wire chassis from your wire list.
* 52 pin connector provides easy access to all circuits.
* Power and ground lines are bussed on mounting hardware to reduce wiring time.

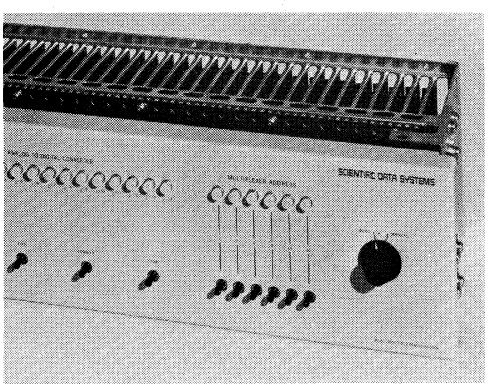
Systems Hardware.



We offer a complete line of mounting hardware for your convenience in implementing your system. Our hardware is of the same rugged construction as our own Sigma computers. All elements are mechanically compatible to simplify assembly and reduce assembly and checkout time. Here are some examples of the items we sell:

* Swing frames, for compact organization of large digital systems.
* Ribbon cable assemblies for intra-system wiring.
* Coax cable, mating connectors and cable trays to guide signals in and out of the system.
* Individual mounting cases, fixed mount or hinged.
* Power supplies for small or extremely large installations.
* System cabinets, with local power control panels, to enclose all other elements.
* Filtered blowers designed into mounting hardware for controlled air environment.

Analog/Digital Instruments.



We have a complete line of instruments to provide communication between digital equipment and a wide variety of analog devices. These include multichannel A to D and D to A converters, and single-channel digitizers.

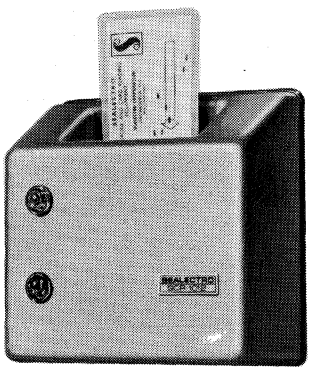
MODELS MD41 AND MD51: These are multiplexer-digitizer combinations designed for use as analog data gathering front ends for digital systems. The MD51 provides up to 64 multiplexed analog channels, a sample and hold amplifier, and a 15-bit analog to digital converter. The instrument needs only 10 microseconds to select and digitize each channel. This is equivalent to an overall throughput rate of 100KHz. The overall accuracy is ±0.01%, ±½ count, typical at constant temperature.

MODEL DA40: This is a digital-to-analog converter that controls up to 16 10-bit channels. The accuracy of each channel exceeds 0.1%. The instrument may be used with analog recording devices such as CRT displays, X-Y plotters and strip chart recorders.

SDS For further information contact local sales office or write Systems Products, Scientific Data Systems, 701 South Aviation Blvd., El Segundo, California 90245.

SEALECTRO

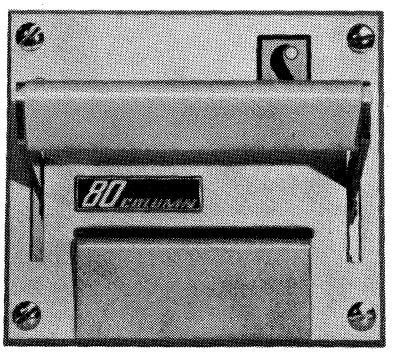
SEALECTROCARD™ CARD, BADGE AND TAB READERS



10x10-10x12 BADGE READERS

Completely automatic Badge Readers that accept standard IBM and Friden Type Badge cards in 10x10 or 10x12 formats. Ideal for personnel identification, production control and process control operations.

Go/no-go lights immediately indicate if the card is inserted correctly. No contacts actuate until the card is properly inserted. Remote solenoid-operated contacts sense hole patterns and read. Read function is automatically held until feedback from system releases contacts and card is automatically ejected. Flexible output wiring allows bussed or discrete contact interface connections.



12x80 CARD READER

The Sealectrocard card reader is designed to be completely compatible with all standard 12 x 80 TAB type punched-cards. This unit combines features which provide maximum reliability, convenience and economy in programming. The 12 x 80 Sealectrocard is ideally suited as peripheral equipment for a wide range of computers or as a programming device. Programs consisting of up to 960 bits of information can be read instantly from conventional punched-card formats. Features include:

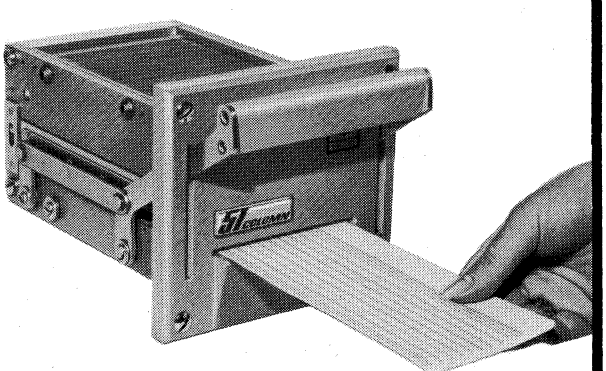
- Remote contacts with double contact wiping surfaces.
- Positive mechanical lockout if a card is mis-orientated.
- Wide choice of terminations.
- Simple, fast operation even by unskilled personnel.

12x51 TAB READER

Accepts and reads standard 80 column TAB card, but limits read area to 51 columns, providing 612 bits of information. Ideal for data acquisition in production control and other terminal operations of data processing systems not requiring full 960 point readout.

Completely foolproof. Correct orientation and positioning of card electrically interlocks operating handle eliminating faulty readouts. Card is inserted in insertion slot, handle pulled down to read position, and unit is in operation.

Utilizes same electrical contact assembly as 12 x 80 Reader. Can be bussed vertically or horizontally. It may be used with completely discrete circuitry for each of the 612 points.



PROGRAMMING DEVICES DIVISION
SEALECTRO CORPORATION
MAMARONECK, N. Y. 10543
PHONE: 914 698-5600 TWX: 710-566-1110
Sealectro Ltd. Portsmouth, Hants, England
Sealectro S.A. Villiers-le-Bel, Paris, France

TAURUS

World Leaders in Card Readers

FEATURING HIGH RELIABILITY

A Complete Line of Punched Card Readers for Static and Serial Programming

APPLICATIONS

MILITARY USES: Ground checkout equipment, programming, testing, component testing, simulators, etc.

COMMERCIAL USES: Batching of concrete, food, chemicals, etc.; automatic crane operation, automated manufacturing processes, data processing, process control, etc.

STANDARD SPECIFICATIONS

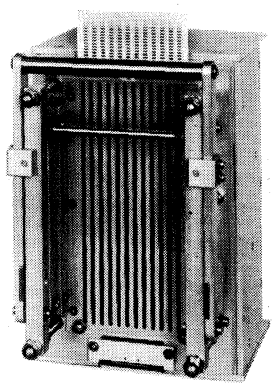
Cards—IBM, Rem. Rand or others.

No. of Switches—10 to 960—(Form A, B or C).

Electrical—Dry Circuit to 3 AMPS.

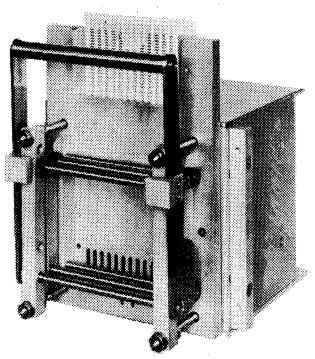
M-3
FULL IBM CARD STATIC READER

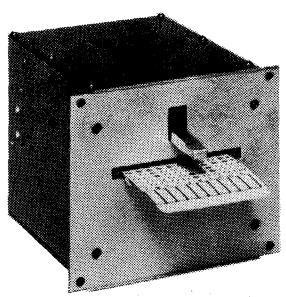
Reads up to 80 columns, or 960 switches, (complete IBM card). Most compact switching array available. Reads indirectly for maximum reliability. After insertion, punched hole has a closed switch, no hole an open switch. Switch reliability 100,000 cycles. Mechanical reliability 500,000 cycles.



JM-3
STATIC READER FOR ONE HALF OF AN IBM CARD

Reads up to 40 columns, or 480 switches, of an IBM card. After insertion, punched hole has a closed switch, no hole an open switch. Switch reliability 100,000 cycles. Mechanical reliability 500,000 cycles.



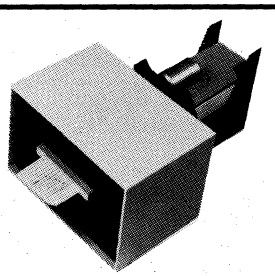


S SERIES
S-60, S-120, S-180

For simple functions. Practical. Economical. Reads an entire card or part of one. Choice of 60, 120, or 180 replaceable switches. Each switch can be removed or replaced separately. Cards can be hand punched.

MODEL 600
SERIAL READER

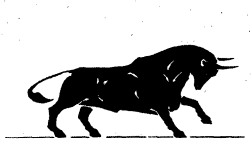
Relatively Slow But Inexpensive. Feed and Read . . . Less than $1,000.



Reads standard 80-column, 12-row cards, serially, column by column, 10 columns per second or less. Alpha-numeric or other symbols accepted. For on line computer, remote transmission, interfaced with other machines, numerical control, card duplication or correction. Sizes 6¼″ High x 9¾″ Wide x 6½″ Deep. Automatic card feed available for sequential feeding of up to 200 cards.

Also Teflon Terminals and Printed Circuit Board Guides

CUSTOM BUILT UNITS ARE OUR SPECIALTY. We will fill your requirements in spacing, switch action, number of switches and any other special needs, and will determine the most economical size and type for your operations. **Send for 1969 Catalog.**

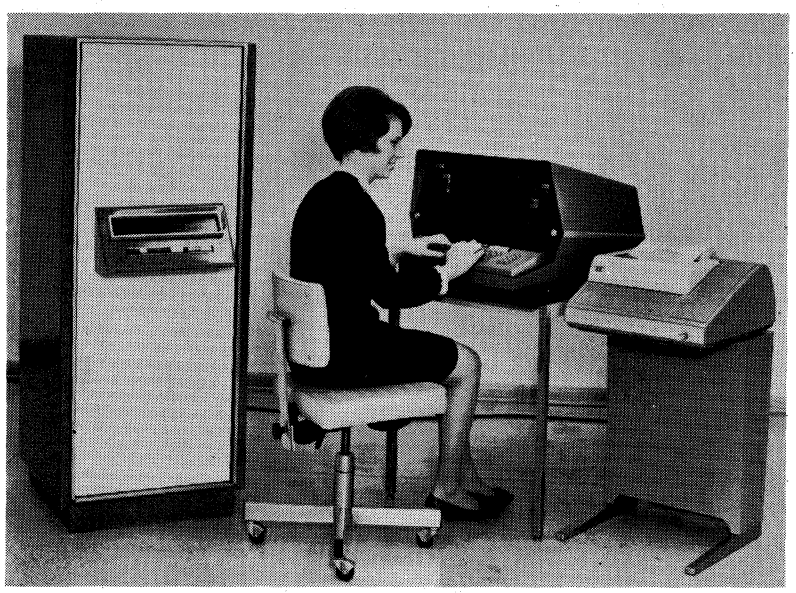


TAURUS CORPORATION
LAMBERTVILLE, NEW JERSEY 08530
AREA CODE (609) 397-2390

TEC LITE®

Transistor Electronics Corporation
TELEPHONE 612-941-5737 | BOX 6191 MINNEAPOLIS, MINN. 55424 | TELETYPE 910-576-2860

YOUR SINGLE SOURCE FOR
SYSTEMS...ASSEMBLIES...COMPONENTS



Complete data terminal system...display panel assembly...readout, indicator or switch component: They're all available from TEC...designed to fit your exact man-machine interface needs. Information display and control is TEC's only business and this single source capability allows TEC to meet your requirements most efficiently by integrating several product types into one display/control assembly. Complete engineering design, fabrication, assembly and quality control provides the capacity to produce orders of any complexity and volume.

Computer Peripheral Display Systems

Utilizing the various display and control systems and assemblies shown on these pages, TEC provides communication terminal systems for remote data display and data entry. TEC's Series 500 family of DATA-SCREEN terminals, controllers and related communication oriented display equipment provides versatile information display and control. These third generation terminal systems are unmatched in performance, reliability and design and are competitively priced.

Series 500 DATA-SCREEN™ Terminals

Displaying up to 1000 bright, easily readable stroke written alphanumeric characters, these CRT terminals include I/O logic, character generator, refresh core memory and separate keyboard. Page size CRT screen measures 8¾" x 6¾" and is combined with fixed message display areas. Editing module options provide a wide range of computer controllable functions and permit fast, accurate message composition by relatively inexperienced operators. Series 500 terminals offer versatile interface capability with most computer systems or they can be connected directly to data modems. Model 510 DATA-SCREEN Controller offers control logic and multiplexing features for up to 32 terminals to provide economical multi-station CRT display systems. TEC's family of CRT systems allows either stand-alone or multi-station terminal operation.

DATA-SCREEN Programmable Controller System

Offers new dimensions in peripheral processing and data communications capability. Data concentration, code conversion and data preprocessing are a few of the functions that can be performed with this system. The Model 520 has 16 high speed I/O channels, fully buffered operation, with one microsecond cycle time, core memory expandable to 16K words of 18 bits each. The I/O unit interfaces with CRT displays, line printers, card handling equipment, teletype terminals and other communications oriented peripheral equipment.

The Model 520 has a variety of communication interface options which include direct computer connection at rates up to 285KHz; asynchronous and synchronous serial data transmission rates from 300 to 4800 bits per second. Interface adapter is IBM compatible and other computer system interfaces are available on request.

DATA-PANEL®, DATA-SCREEN™. TRANSISTOR ELECTRONICS CORPORATION

TEC LITE®

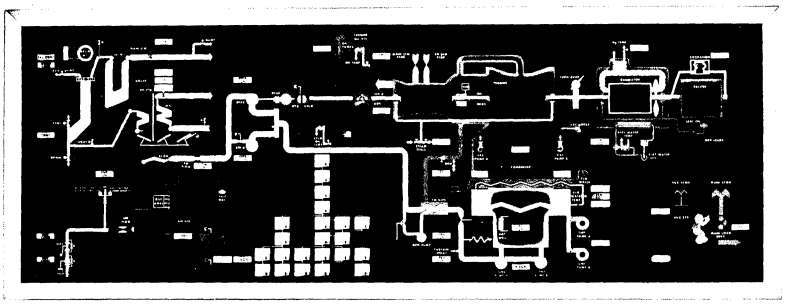
Transistor Electronics Corporation

TELEPHONE 612-941-5737 | BOX 6191 MINNEAPOLIS, MINN. 55424 | TELETYPE 910-576-2860

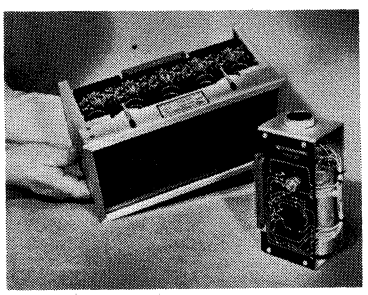
INFORMATION DISPLAY/CONTROL

DATA-PANEL® Display System

Conveys messages and symbols brilliantly and colorfully in a single viewing plane of any size. Only vital illuminated messages are seen. Permanently visible legends, lines and graphic symbols can be provided. Display costs are reduced because DATA-PANEL Display Systems are provided as complete, pre-wired assemblies, with lamp control and interface logic if desired, ready to mount and connect. Flexible displays may combine graphic, annunciator and readout displays in a single integrated assembly that is self-supporting when mounted in a panel cutout. Interface adaptability requires less computer or controlling logic in your system—cuts cabling costs too.



Large mimic/annunciator panel reports status of power generator system for Louisiana Power and Light Company.



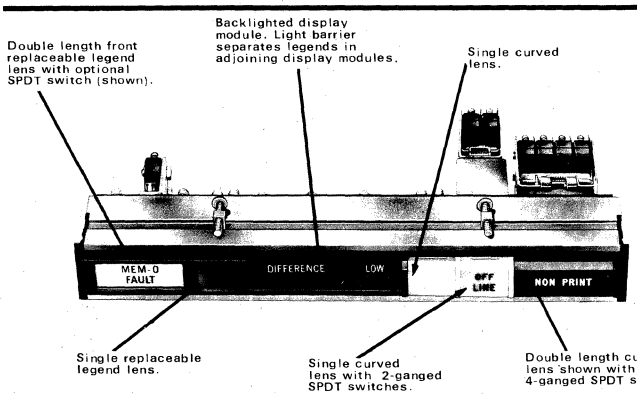
Solid State DATA-MONITOR Annunciator System

Provides reliable, compact, high density alarm displays at lower cost per point than similar competitive devices by integrating solid state annunciator logic into DATA-PANEL Display Systems. Flashing alarm indication is combined with audible alarm. Operator response to the problem turns off the audible alarm, but the indicator remains on steadily until the off-normal condition is corrected. Memory logic insures indication of passing alarms.



Electronic Keyboard System

Features a solid state, bounce eliminating interlock encoder actuated by TEC-LITE Keyboard Switches. Pulse and momentary action switches duplicate feel and travel of electric typewriter keys. Elimination of mechanical linkages insures greater reliability. TEC Electronic Keyboard Systems serve as input terminals for EDP and industrial control system and accomodate any code up to eight levels. Keyboards are custom built to meet specific key arrangements, enclosure colors and electrical connections.



DATA-LINE Display System

Modular in-line design permits intermixing of message display, neon or incandescent indicator/switch functions. Function options may be arranged in any sequence on .700" centers in an extruded aluminum frame. The frame, available in lengths to nearly four feet, forms the front bezel and provides panel mounting hardware. All lamps are replaceable. From every aspect, mechanical or electrical, TEC-LITE DATA-LINE Display System is as versatile as your requirements. Price of DATA-LINE Display's switch indicator function compares favorably with other multi-pole lighted pushbutton switches.

DATA-PANEL®, DATA-SCREEN™. TRANSISTOR ELECTRONICS CORPORATION

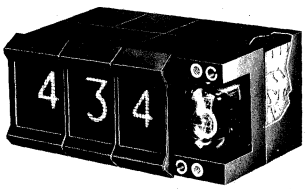
TEC LITE®

Transistor Electronics Corporation

TELEPHONE 612-941-5737 | BOX 6191 MINNEAPOLIS, MINN. 55424 | TELETYPE 910-576-2860

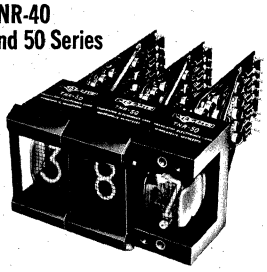
DIGITAL AND ALPHA READOUTS

TNR-10 and 30 Series



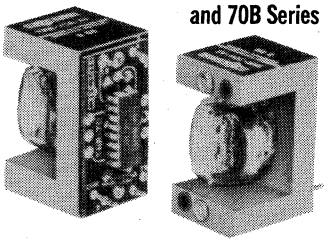
NIXIE tube with .610" high characters. Mounts on 1" centers. Military quality has dust cover and metal case transistors.

TNR-40 and 50 Series



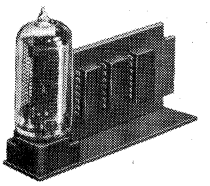
Rugged NIXIE tube in lower cost commercial quality package offers same functions as TNR-10 and 30 Series.

TNR-70A and 70B Series



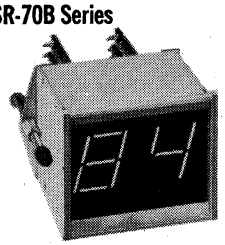
I-C logic provides NIXIE tube decoder/driver function plus buffer memory and decade counter options. Compact, highly reliable.

TNR-71A and 71B Series



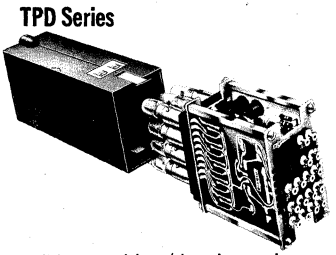
Functions same as TNR-70A and 70B Series but uses side viewing display tube for lower cost.

TSR-70B Series



I-C logic drives bright incandescent lamps of segmented readout. Also offers buffer memory and decade counter options.

TPD Series



Solid state driver/decoder package controls 6, 12 or 28 VDC incandescent lamps of IEE Series 10 and 120H projection readouts.

TEC offers the most complete line of readouts available from a single source: NIXIE® tube, segmented, projection, electro luminescent and is presently developing flap, dot matrix, disc and solid state (L.E.D.) type readouts. All models are designed to operate from decimal or 4-wire or 8-wire B.C.D. inputs and are controlled by low level outputs of discrete or RTL, DTL and TTL I-C logic modules. Readouts can be combined with TEC's DATA-PANEL® Display Systems to provide an integrated, ready-to-mount display.

NIXIE® Burroughs Corp.

TRANSISTOR CONTROLLED INDICATORS

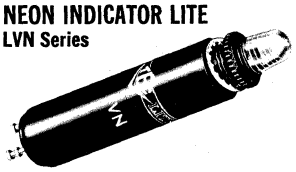
TRANSISTORIZED MINI-LITE INDICATOR
MTL Series



Long life, rugged neon lamp controlled by signals as low as 1.5V. Flat top or spherical lens shape offered.

TBL Series adds isolated momentary switch with SPST-NO-DB, SPST-NC-DB or SPDT-DB options.

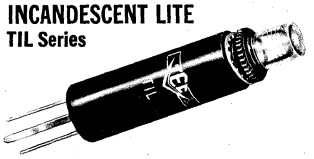
LOW VOLTAGE NEON INDICATOR LITE
LVN Series



Operates from supply as low as 2 VDC—internally generates high voltage AC to fire neon lamp. Can be controlled from signals as small as 2 volts.

LVB Series adds same switch-indicator function as TBL and TIB Series.

TRANSISTOR CONTROLLED INCANDESCENT LITE
TIL Series



Replaceable incandescent lamp controlled by signals as small as .3ma. Thirteen lens colors available.

TIB Series adds isolated momentary contact SPST-NO-DB, SPST-NC-DB or SPDT-DB switch function.

SUBMINIATURE TRANSISTOR CONTROLLED INDICATOR
STL Series

ACTUAL SIZE



Subminiature (.360" diameter x .600" long body) Transistor Controlled neon or incandescent lamp offers same functions as MTL or TIL Series, but in compact package.

TEC-LITE Indicators use self-contained transistorized circuitry to control incandescent and neon lamps from low level outputs of discrete and RTL, DTL and TTL I-C logic modules. Many models offer integral isolated switches actuated by the lens. Incandescent lamps are replaceable by unscrewing the lens, long life neon lamps are permanently wired. A variety of lens colors and styles are offered as well as taper pin receptacle, Wire-Wrap, turret lug or solder terminals. TEC's cataloged indicators can be custom designed to meet specific needs. Over 6000 special designs—electrical and mechanical —on file.

SOLID STATE MEMO-LITE® INDICATOR
TML-10 Series

MEMO-LITE® with replaceable lamp offers memory function—turns on lamp with 2μsec., .5ma pulse—remains on when signal is removed. Lamp is turned off by interrupting supply or by resetting. Switch option also available.



TRANSISTOR CONTROLLED L.E.D.
Solid State Indicator
MTLED Series

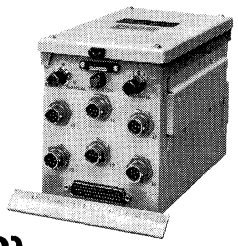
Integral, solid state logic controls gallium arsenide phosphide diode light source which offers almost infinite life and reliability, even under extremely adverse environmental conditions.

MEMO-LITE® TRANSISTOR ELECTRONICS CORPORATION

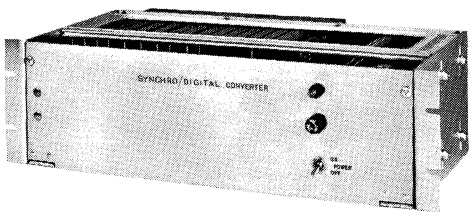
SYNCHRO/RESOLVER–DIGITAL CONVERTERS

ALL ELECTRONIC—*INTEGRATED CIRCUIT CONSTRUCTION*

AIRBORNE (Series SD 1000)



GROUND (Series SD 2000)



- Angular slew rates are unlimited
- Tolerates wide variations in signal voltage, frequency and waveform with full accuracy
- Simpler circuit techniques offer smaller size and weight, greater reliability, lower power consumption
- Multiple Synchro Inputs: 1-16 or more
- High Encoding Rates: 800 per second
- Single Speed System Accuracy: ±6′ over temperature range
- Binary Output Code: to 13 bits representing shaft angle
- Computer Compatible: Digital addressing and complete interface signals

OPTIONAL FEATURES

- Temperature Range 0°C to +71°C or −54°C to +71°C
- Serial and/or parallel outputs
- Binary address or discrete channel selection
- Simultaneous Sampling and/or Higher encoding Rates
- Isolation Transformers on signal inputs
- Power Supplies for 28v DC

CUSTOM FEATURES

- Digital Data Processors for dual speed synchros and binary — BCD conversion/scaling
- Digital — Synchro conversion with multiple synchro outputs
- A/D and Multiplexer for AC-DC Analog Inputs
- Power supplies for 400 Hz

ANALOG-DIGITAL CONVERTERS & MULTIPLEXERS

(CAPCODERS® AND CAPLEXERS®)

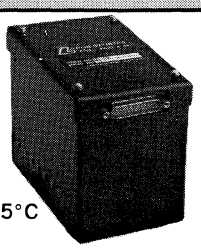
DIGITAL TELEMETERING & DATA SYSTEMS | **Simplified, highly reliable, solid state devices**

AIRBORNE



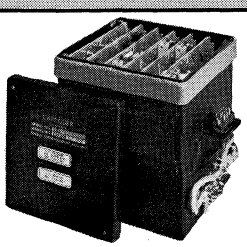
OC1001 A/D

±2.5v Input
10 bits, Serial
23,000/sec.
−54°C to +65°C



OC1501 A/D

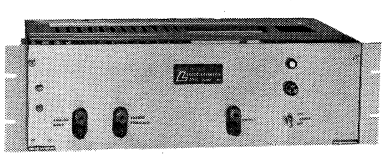
+5v Input
10 bits, Parallel
25,000/sec.
−20°C to 85°C



CM Series Converter — Multiplexer Systems

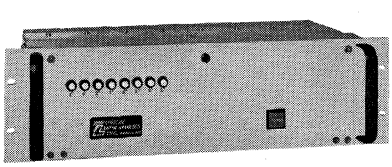
1-16, ±1v Inputs
10 bits, Ser/Par
50,000/sec. or
Synchro to Sine Cosine Codes

GROUND



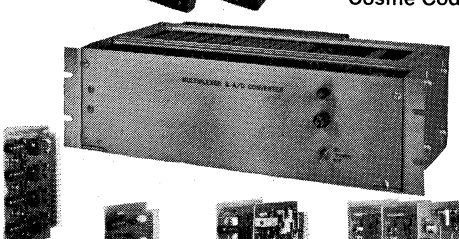
DT 102/103 Teletypewriter Converter

1v Input
3 Digit Printout
8 level ASCII
or Baudot



OC2010, A,B,C A/D

1v Input
8 bits, Parallel
185,000/sec.
0.6μ sec.
acquisition time



OM3101 Switches

PM3100 Programmers & Sampling Networks

OC3100 / 3101 A/D Converters

OC3200 Registers

Designers and manufacturers of CAPCODER and CAPLEXER Capacitive Charge Transfer Devices

TOWSON LABORATORIES, INC.

1400 TAYLOR AVENUE • BALTIMORE, MD. 21204 • AREA CODE 301 • 825-5200

TRANSMAGNETICS INC.



Digital Converters

Transmagnetics' Digital to SYNCHRO/RESOLVER and SYNCHRO/RESOLVER TO DIGITAL Converters find wide application in missile and aircraft navigation, control, fire control and guidance systems, in data processing, surface and subsurface craft, and in ground support, checkout and simulation equipment.

Multichannel, dual speed and angle indicator readouts are available.

Series 1602 SYNCHRO/RESOLVER TO DIGITAL

Model No.	Input	Freq. Hz	Signal Level	Reference
1602-26C	Synchro	400	11.8 L.L.	26V
1602-115C	Synchro	400	90 L.L.	115V
1602-60M	Synchro	60	90 L.L.	115V
1602-50M	Synchro	50	90 L.L.	115V
1602R-26C	Resolver	400	11.8 L.L.	26V

Other Specifications

SIZE: 4½ x 12 p.c. card. DIGITAL OUTPUT: 12 bit TTL levels. ACCURACY: 6 minutes. OPERATING TEMPERATURE: 0 to 70°C For −55 to +85°C replace "C" by "M" in Model No.

BCD Models:

3 Digit TTL Levels Out: Insert 3B after 1602 in Model Number.
4 Digit TTL Levels Out: Insert 4B after 1602 in Model Number.

Series 1616 ANGLE POSITION INDICATOR

Description:

These devices furnish 3 or 4 digit "NIXIE" Readout of synchro or resolver inputs.

Ordering information:

Replace 1602 by 1616 in description of converters above.

Series 1613 DIGITAL TO SYNCHRO/RESOLVER

Model No.	Output	Freq. Hz	Signal Level	Reference
1613-10C	Synchro	400	11.8 L.L.	26V
1613-90C	Synchro	400	90 V L.L.	115V
1613-60C	Synchro	60	90 V L.L.	115V
1613R-10C	Resolver	400	15 V	26V

Other Specifications

DIGITAL INPUT: 12 bit TTL levels. SIZE: 4½ x 12 p.c. card. ACCURACY: 6 minutes. OPERATING TEMPERATURE: 0 to 70°C For −55 to +85°C replace "C" by "M" in Model No.

Synchro models listed will drive torque receivers control or differential transformers. All models are short-circuit proof.

SEE EEM 4900 AND 2200 FOR SOLID STATE COMPUTING SERVOS, MULTIPLIERS, DIVIDERS AND OTHER TRANSMAGNETICS MODULES.



DESIGN MANUAL

Send for your free copy of Transmagnetics' Design Manual 868. It describes and illustrates more than 45 applications for trigonometric modules. The "building block" modules, around which the manual is based, allow designers to develop all solid state computing systems.

TRANSMAGNETICS INC. 134-25 NORTHERN BLVD / FLUSHING, N. Y. 11354
212-539-2750 • TWX. 710-582-2472

TRANSMAGNETICS INC.

Multipliers

Transconductance, quarter-square and pulse modulation type multipliers, Transmagnetics has them all in economy and computer grade, bandwidths from DC to 10 Megahertz, military operating temperature range to −55 to +85°C.

TRANSCONDUCTANCE MULTIPLIERS DC TO 10,000 KHZ MULTIPLIERS

The following transconductance DC four quadrant multipliers permit selection of the bandwidth required at lowest cost. Gain varies smoothly, without breakpoints, a desirable feature in PPI and other visual displays.

Freq. Resp. Full Output (KHz)	Model	Size - Inches	Transfer Function
40	375	.65 x 1.5 x 1.5	XY/10
300	382	.75 x 1.7 x 1.7	XY/10
1000	395CP5	.78 x 3.19 x 3.44	XY/10
4000 (3DB)	384CP5	.78 x 3.19 x 3.44	XY/100
10,000 (3DB	385	.78 x 3.19 x 3.44	XY/10

SPECIFICATIONS

INPUTS: −10 to +10V
OPERATING TEMPERATURE: 0 to 70°C
SUPPLY: + and − 15V DC
All units are available for −55 to +85°C operation

Multipliers — Pulse Modulation — Computer Grade*

Pulse modulation multipliers are accurate, stable and repeatable. They represent the best buy in servo and trigonometric computing requiring only limited bandwidth.

Multipliers — Quarter Square — Computer Grade**

Quarter square multipliers with diode-shaping networks are the most repeatable and stable wide-band multipliers.

Model		350RP2*	350MP4*	380MP4**	380CP5**
3 DB BW		100 Hz	100 Hz		
Size		.78 x 2.53 x 3.22	.58 x 2.03 x 2.28	.58 x 2.03 x 2.28	.78 x 3.19 x 3.44
Operating Temperature		−25 to +85°C	−55 to +85°C	−55 to +85°C	0 to 70°C
Input Impedance		100K, 50K	100K, 50K	10K ohms min.	10K ohms min.
Output	V	±10	±10	±10	±10
	MA	2	2	2	2
Accuracy % FSR		0.25	0.25	0.25	0.25
Supply DC		±15V	±15V	±15V	±15V
Full Output KHz				20	20

Analog Dividers

In addition to the quarter square and pulse modulation type dividers below, the wide-band transconductance multipliers shown above can be connected as dividers or square rooters using an operational amplifier. Most models below are off the shelf.

ANALOG DIVIDERS — COMPUTING GRADE

Model		450CP2	450MP4	480CP5	480MP4
Type		Pulse modulation	Pulse modulation	¼-square	¼-square
Bandwidth		100Hz (3dB)	100Hz (3dB)	20KHz (Full Power)	20KHz (Full Power)
Size		.78 x 2.53 x 3.22	.58 x 2.03 x 2.28	.78 x 3.19 x 3.44	.58 x 2.03 x 2.28
Oper. Temp.		0 to 70°C	−55 to +85°C	0 to 70°C	−55 to +85°C
Conformity % F.S. Range		½%	½%	.5 to 1.25%	.5 to 1.25%
Output	V	±10	±10	±10	±10
	MA	2	2	2	2
Supply DC		±15V	±15V	±15V	±15V

Analog Squarers — Wide Band

These compact diode type squarers with 20KHz full power bandwidth are available for one or two quadrant input operation. The output amplitude is proportional to the square of the input.

Model	751MP10	751CP10	752MP10	752CP10
Quadrant	TWO	TWO	ONE	ONE
Input	−10 to +10V	−10 to +10V	0 to +10V	0 to ±10V
Output	0 to ±10V	0 to ±10V	0 to −10V	0 to −10V
Size	.56 x 1.53 x 1.53	.56 x 1.53 x 1.53	.56 x 1.53 x 1.53	.56 x 1.53 x 1.53
Oper. Temp.	−55 to +85°C	0 to 70°C	−55 to +85°C	0 to 70°C
Conformity	0.5% FS	0.5% FS	0.5% FS	0.5% FS
Supply DC	±15V	±15V	±15V	±15V

SEE EEM SECTIONS 2200 AND 4900 FOR OTHER ANALOG AND TRIGONOMETRIC COMPUTING MODULES. SEE SECTION 2200 FOR ANALOG SQUARE-ROOTERS — WIDE BAND.

REQUEST DESIGN MANUAL 868, APPLICATIONS IN SOLID STATE TRIGONOMETRIC COMPUTING.

TRANSMAGNETICS INC. 134-25 NORTHERN BLVD / FLUSHING, N. Y. 11354
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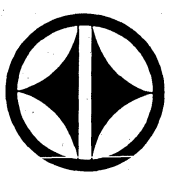
Look in the Yellow Section for Manufacturers' Sales Offices



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WORLD'S LARGEST VARIETY OF PRECISION COMPONENTS

- synchros
- resolvers
- servo motors
- motor generators
- tachometer generators
- damping devices
- gyro components
- stepper motors and logic
- dc torquers

*please see section 4900 for detailed catalog

VERNIDEX ®

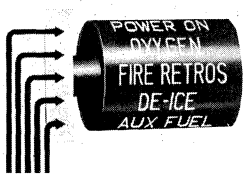


The tiny module that converts digital inputs to an electro-magnetic readout.

PART NO.	UNIT SIZE	VOLTS D.C.	NO. OF CHAR.	SIZE OF CHAR.	PULSE MODE	NO. OF LEADS OR TERM.
06VEA-0022	.390W. x .840H. x .875D.	10	10	.156x.156	1-1-1-1	11 L
06VBA-0048	.390W. x .840H. x 1.250D.	10	10	.156x.156	1-2-1-2	6 T
06VBD-1105 3 Position Flag	.390W. x .840H. x .875D.	10	3	.187x.187	Return to Flag with Power Off	3 L
12VBB-1002	.500W. x 1.500H. x 1.500D.	6	10	.250x.250	Polarity Reversal	6 P/C
12VAC-0015	.500W. x 1.500H. x 1.500D.	6	11	.250x.156	1-1-1-1	12 P/C

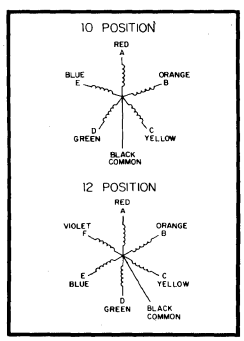
In addition to standard models above, Vernitron will manufacture to your specifications.

ENUNCIATOR ®



Visual readout device that converts from digital information and transmits readable, error-free messages *instantly*.

Enunciator spells out any type command message or series of coded letter messages according to specifications. Messages are held even under severe shock and vibration conditions when power is cut off. Available in magnetic and non-magnetic offset modes in wide variety of voltages (6-28 D.C.)



PLANE TO GROUND	BLOCKHOUSE TO ASTRONAUTS
SHIP TO SUB	TRAFFIC CONTROLLER TO HIGH SPEED TRAIN

The basic parameters shown are guidelines for Equipment Design Engineers only. Please consult us regarding your special requirements for operating voltages and drum lengths.

ELECTRICAL CHARACTERISTICS	10-Position ENUNCIATOR Model 08EBA-BBO	12-Position ENUNCIATOR Model 10EAA-BBO
VOLTAGE: Direct Current	12*	12*
RESISTANCE PHASE: Ohms	140	150
POWER PHASE: Watts	1.0	.96
CURRENT PHASE: Amps	.086	.080

*Voltage available—6 to 28 V.

MECHANICAL CHARACTERISTICS	10-Position	12-Position
Diameter "d"	.750	1.000
Weight (less mtg. bracket) (Oz.)	1	2
Accuracy	±1°	±1°
Position	Logic	Logic
1	A	A
2	A-B	A-B
3	B	B
4	B-C	B-C
5	C	C
6	C-D	C-D
7	D	D
8	D-E	D-E
9	E	E
10	E-A	E-F
11	—	F
12	—	F-A

STEPPER MOTORS

PERMANENT MAGNET TYPE (Step Angle — 90°) ← Variable Reluctance Type (Step Angle 15°)

TYPE NUMBER	UNITS	08MPA-AA2-A0	08MPA-AA4-A0	11MRA-AA2-B0	11MPA-AA4-B0	15MPA-AA2-A0	15MPA-AA4-A0	08MRC-AA3-A0	11MRA-AA3-B0	15MRA-AA3-A0
Figure Number	—	1	1	2	2	3	3	1	2	3
Weight	oz.	1.75	1.75	3.25	3.25	8.0	8.0	1.75	3.25	6
Resistance/Phase	Ohms	325	100	120	60	75	60	78	30	50
Power Input/Phase	Watts	2.5	8	7	13	10	13	10	29	15
Current Input/Phase	MA	105	370	250	700	250	600	205	480	480
Stall Torque	oz.-in.	.22	.45	1.5	1.5	2.5	5.0	.7	4.0	4.5
Max. Running Torque @ 10PPS	oz.-in.	.10	.22	.75	.74	1.0	2.5	.35	2.0	2.4
Max. Unloaded Stepping Rate	PPS	130	240	225	225	100	120	800	1000	725
Rotor Inertia	gm-cm²	.15	.15	1.0	1.0	3.75	5.0	.15	1.0	1.0
Length	in.	1.225	1.225	1.400	1.400	1.400	1.400	1.000	1.400	1.400

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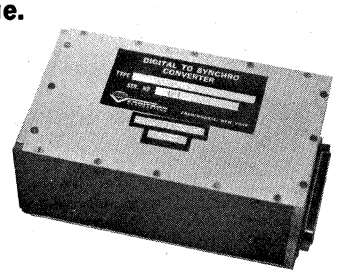
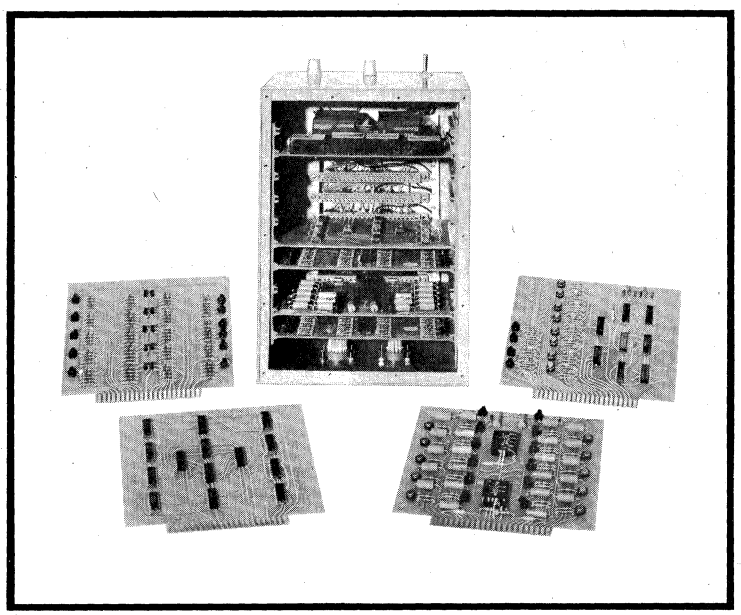
VERNITRON CATALOG DIGEST

ELECTRONIC (SOLID-STATE) SYNCHRO-TO-DIGITAL CONVERTERS

- **Direct digital control by direct computer interface.**
- **Either single-speed or multi-speed operation.**
- **Proven reliability.**
- **Simplest, lowest cost conversion technique.**





VERNITRON SERIES VDS (S) SPECIFICATIONS

Input Code	Input Ref	Output (L-L)	Simulates	Accuracy
11 through 13 bits or BCD 0-359.9	400Hz, 26V 400Hz, 115V 60Hz, 115V	400Hz, 11.8V 400Hz, 90V 60Hz, 90V	TX, CX	As TX: ±30′ with TR load As CX: ±10′
11 through 13 bits	L-L 400Hz, 11.8V 400Hz, 90V 60Hz, 90V	400Hz, 0.410 mv/deg 400Hz, 1V/deg 60Hz, 1V/deg	CT	±10′ ±3′ avail; 13 bits or higher
BCD 0-359.9 through 0-359.999	400Hz, 26V 400Hz, 115V 60Hz, 115V	400Hz, 0.410 mv/deg 400Hz, 1V/deg 60Hz, 1V/deg	CT	±10′ std ±3′ avail; 13 bits

DIGITAL-TO-RESOLVER

Input Code	Input Ref	Output (L-L)	Simulates	Accuracy
11 through 13 bits	400Hz, 26V 400Hz, 115V 60Hz, 90V	400Hz, 26V 400Hz, 115V 60Hz, 90V	RX	±6′ std ±3′ avail; 13 bits
BCD 0-359.9 through 0-359.999	L-L 400Hz, 26V 400Hz, 115V 60Hz, 115V	400Hz, 26V 400Hz, 115V 60Hz, 115V	RX, RT	±6′ std ±3′ avail; 13 bits
11 through 13 bits	L-L 400Hz, 26V 400Hz, 90V 60Hz, 90V	400Hz, 26V 400Hz, 90V 60Hz, 90V	RT	±6′ ±3′ avail; 13 bits

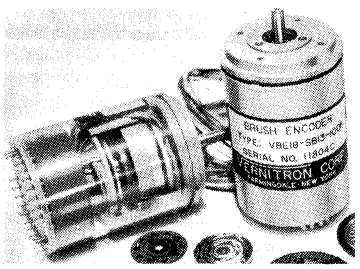
the quality name in precision components

VERNITRON CORPORATION

VERNITRON CATALOG DIGEST

VERNITRON ENCODER FEATURES

- Life: 5 x 10^6 to 60 x 10^6 Revolutions, Depending on Application
- Self Switching Circuits for Simplicity & Max Reliability
- Unique Disc and Brush Designs
- Outputs Available to Directly Operate with Standard Micro Logic
- Full performance at +125°(Optional)
- High Slewing Speeds—1500 RPM (Momentary)
- High Positional Accuracies



*BUORD STANDARD FRAME SIZE	CODE	AVAILABLE SCANS	CAPACITIES
11 & 18	BINARY	V SCAN	2^8 SINGLE DISC TO 2^{19} MULTI-DISC
11 & 18	GRAY	LINE & SELF SELECT	2^8 SINGLE DISC TO 2^{19} MULTI-DISC
11	GILHAM	LINE & SELF SELECT	128,000 FT—16 TURNS
18	BINARY	INTERNAL SELF SELECT	2^7 SINGLE DISC TO 2^{19} MULTI-DISC
23	BINARY	INTERNAL SELF SELECT	2^8 SINGLE DISC TO 2^{19} MULTI-DISC
23	B.C.D.	INTERNAL SELF SELECT	0-359 SINGLE DISC TO +99999 MULTI-DISC
23	B.C.D. EXCESS 3	INTERNAL SELF SELECT	0-359 SINGLE DISC TO +99999 MULTI-DISC
31	GRAY	LINE & SELF SELECT	2^{10} SINGLE TURN TO 2^{19} MULTI TURN

*Available with leads or connectors.

ELECTRONIC (SOLID-STATE) SYNCHRO-TO-DIGITAL CONVERTERS CONTINUOUS CONVERSION

Solid-State reliability—no moving parts • Integrated circuits—practical, compact • Conversion speeds of up to 2.5 milliseconds

VERNITRON SERIES VSD 100 (S) SPECIFICATIONS

INPUT

3 wire synchro, 11.8V or 90 VAC RMS line to line
26V or 115V reference
60 or 400 Hz
DC power: +15V @125 ma, −15V @125 ma, +5V @325 ma

OUTPUT

12-bit parallel, binary word representing input angle
Least significant bit = 5.27 minutes of arc
Most significant bit = 180°
Output Logic: Binary "0" = +0.2 ±0.2V
Binary "1" = +4 ±1.5V
Resolution: 5.27 minutes of arc
Accuracy: 6 minutes of arc
Tracking Rate: Up to 90°/second
Operating Temperature Range: 0 to +75°C
Storage Temperature Range: −55°C to +125°C
Size: 5 x 5 x 2

OPTIONS

13-bit output
Serial output
Other logic voltages up to 28V
Full temperature range of −55°C to +125°C (operating)
Output blanking
Faster tracking rates are available
4-wire resolver input
BCD output

VERNITRON SERIES VSD 200 (S) SPECIFICATIONS

INPUT

3-wire, 400 Hz synchro, 11.8V or 90 VAC RMS line to line
26V reference, 400 Hz
60 or 400 Hz
DC power: +15V @125 ma, −15V @125 ma, +5V @325 ma

OUTPUT

12-bit parallel, binary word representing input angle
Least significant bit = 5.27 minutes of arc
Most significant bit = 180°
Output Logic: Binary "0" = +0.2 ±0.2V
Binary "1" = +4 ±1V
Resolution: 5.27 minutes of arc
Accuracy: 6 minutes of arc
Operating Temperature Range: 0 to +75°C
Storage Temperature Range: −55°C to +125°C
Size: 5¼″ x 5¾″ x 2½″

OPTIONS

13-bit output
Serial output
Other logic voltages up to 28V
Full temperature range of −55°C to +125°C (operating)
Output blanking
4-wire resolver input
1.25 ms conversion time
Internal multiplexing
BCD ouput

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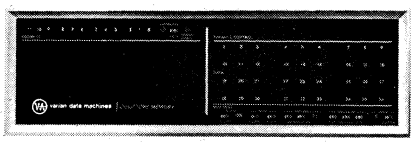
Name a memory-logic problem. Pick a varian data solution.

VersaSTORE III

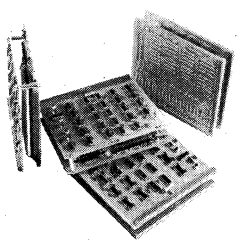


- 1.0 MICROSECOND FULL CYCLE OPERATION
- 4096 WORDS UP TO 36 BITS
- 8192 WORDS UP TO 18 BITS
- FIELD EXPANDABILITY
- AUTO ADDRESSING FOR EXPANSION UP TO 16K WORDS
- OPTIONAL "SELF-TEST"
- LOW COST
- HIGH RELIABILITY
- AUTO DATA GUARD

Small Store

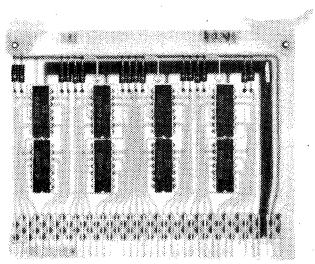
- 512–4096 WORDS BY 16 BITS/WORD
- 2.4 MICROSECOND
- LOW COST
- CARDS ONLY OR WITH 3½" x 19" RACK MOUNT CABINET
- APPLICATIONS
  - DATA STORAGE
  - FORMAT CONVERSION
  - CODE CONVERSION
  - TABLE LOOK-UP OPERATIONS

Read-Only-Memory (ROM)



- UP TO 2048 WORDS x 10 BITS (MAX)
- 500 OR 250 (AVAILABLE) NANOSECOND CYCLE TIME
- DTL/TTL LOGIC
- MODULAR CONSTRUCTION
- INTERCHANGEABLE BRAID MEMORY
- APPLICATIONS
  - CHARACTER GENERATION FOR CRT DISPLAYS
  - MACHINE TOOL CONTROL
  - CODE CONVERSION
  - LOOK-UP TABLE

Integrated Circuit Modules, Micro VersaLOGIC



Micro VersaLOGIC is a complete new line of 5 M.C. general purpose integrated circuit modules designed to provide the systems engineer with all the necessary building blocks for an integrated circuit digital system. Micro VersaLOGIC incorporates many of the features of the proven VersaLOGIC line, such as NAND, NOR logic with wired OR capability at the collector. Over twenty types of uVL modules are available including universal flip-flops, delay multi-vibrators, clock drivers, efficient 2, 3, and 4 input expandable gates, and pre-connected arrays such as dual binary counters, dual decade counters and dual shift registers. Interfacing modules for PNP to NPN conversion and power driving are also available.

GENERAL uVL I.C. MODULE SPECIFICATIONS

Logic Circuitry.....DTL Type
Logic Form .....NAND, NOR with wired OR at the collector
Frequency.....DC to 5 mc
Power Supply .....+5.0v + 10%

Input Logic:
True.....+2.5v to 5.5v
False.....−0.5v to +0.5v
Noise Rejection.....1.2v typical

Output Logic:
True.....+5v nominal
False.....+0.25v nominal
Fan Out.....Up to 20 unit loads
Unit Load.....1.6 ma, maximum

Temperature:
Operating.....0°C to +70°C
Storage.....−40°C to +125°C
Dimensions.....4.3 in. by 3.4 in.
Connector.....40-pin, ELCO Type 7009
Terminals.....Taper pin or wire-wrap

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a varian subsidiary
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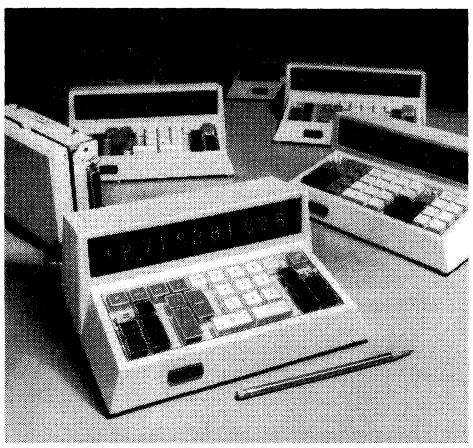
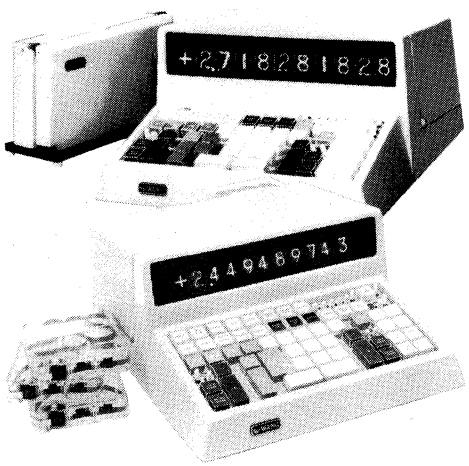
WANG ELECTRONIC CALCULATORS

...when you can't afford to wait



200/300 Series Electronic Calculators

Two unique and versatile families of calculators for all types of personal problem-solving from basic arithmetic computations to complex equations and programmed calculations. Simply choose the model that best suits your needs, whether it's figuring monthly mortgage payments, or rocket engine thrust coefficient. The 200 Series provides time-sharing economy for general business and statistical applications in four distinctly different models. You can choose from ten models in the 300 series: the 300 for high speed addition, subtraction, multiplication, division and reciprocals; the 310 for instantaneous $\sqrt{x}$ and x^2; the 320 for logarithmic and exponential operations; the 360 with four extra storage registers; the 362 with up to 26 storage registers; and a choice of six more keyboards for trig functions by single keystrokes. CP-1 and CP-2 Card Programmers plug into any of the above models and read 80-step program cards to automate repetitive calculator operations. Up to four keyboards can operate simultaneously from a briefcase-size electronic package.



370/380 Series Programmable Calculating Systems

With these compact, desk-top keyboards, smaller than a portable typewriter, you can have at your fingertips immediate answers to many complex calculations at less cost than with full-scale computers. Both the 370 and the 380 have the same simplicity of operation of basic 300 Series calculators. Data storage capacity is significantly increased, with random access from the keyboard or under program control. The 370 utilizes 80-step prescored tab cards for program control, with programs as long as 480 steps. Model 380 programs are "learned" directly from the keyboard, which features plug-in magnetic tape cartridges of 40 to 640 step capacity. Both systems will branch, loop, perform subroutines, make decisions and manipulate arrays. The ability to add other input, output, or storage devices or on-line electronic input increases versatility and avoids fixed-system obsolescence. The most comprehensive program library available is furnished free with each system.



MODEL 700 — The Ultimate Programmable Calculator

Exclusive integrated circuit design concentrates maximum power, sophistication and convenience in a fully self-contained, calculator. The 700 stores programs on tape cassettes for up to 960 core-stored program steps. It has 120 data registers, each of which can add, subtract, multiply and divide. Additional features include: dual Nixie-type display, special keys for trigonometric functions, commands for loops, branches and subroutines as well as basic arithmetic and exponential keys. Execution speeds are the fastest of any electronic calculator anywhere.

For application assistance or an immediate demonstration, call your nearest Wang office.

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Tel: 19-25-34

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WANG LABORATORIES (CANADA) LTD.
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Look in the Green Section for Products and their Manufacturers



Tell them you found them in **eem**

(ADC) Bantam Jack Panels

Bantam Jack Panels are designed to satisfy the increasing demand for more compact patchfields in modern electronic and communication equipment. Bantam Jack Panels, with miniaturized jacks, provide twice the number of jacks in a standard size panel. They require only ½ the rack space previously used by conventional panels. The new panel assemblies weigh 65% less when compared to an assembly using an equivalent number of jacks on a conventional jack panel. ■ Bantam Jack Panels are compact, lightweight, and yet provide the same dependable service as the long established telephone types. This new design offers 96 jacks (48 pairs) in a 1¾ inch x 19 inch standard sized panel. The jacks on this panel are spaced to prevent the cross patching of adjacent circuits when using double plugs.

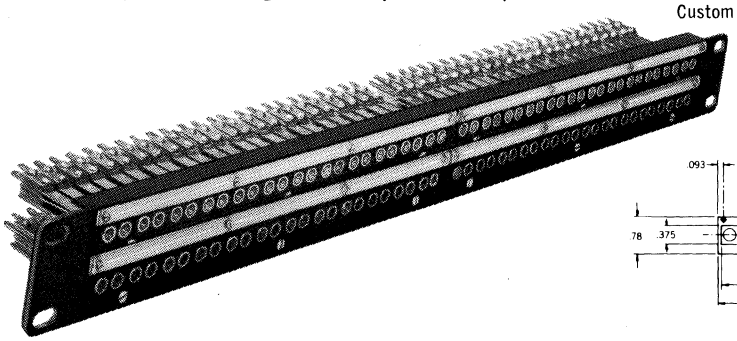
specifications

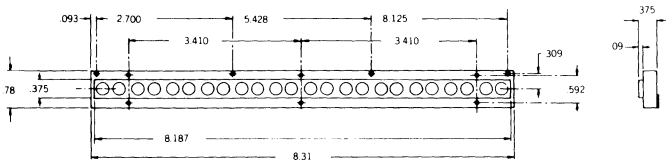
1. **Panel:** Aluminum alloy, extruded. Finished black anodized per Mil-A-8625A. Overall dimensions 1¾"x19"—Standard EIA mounting centers.
2. **Jack Mounting:** Four moulded plastic inserts, each provides for 24 jacks. Pairs of jacks on 5/16 inch centers. Double-row panel provides 96 jacks total. Blank inserts can be furnished where only single row of jacks is required.
3. **Designation Strip:** Extruded clear plastic.
4. Panel assemblies are available with a wide variety of two and three-conductor jacks. See listing of Bantam jacks for complete details.

PJ-731 Double row panel, assembly less jacks, holds 96 jacks.
PJ-737 Double row panel, with 48 pair (96 total) PJ-818 jacks.
PJ-739 Double row panel, with 48 pair (96 total) PJ-839 jacks.
PJ-724 Panel inserts, less jacks, 24 holes.
PJ-700 Panel inserts, blank (same as PJ-724 without holes).
PJ-736* Double row panel, with 104 PJ-818 jacks.
PJ-738* Double row panel, with 104 PJ-839 jacks.

*Panels with 104 jacks (26 per insert, jacks all on 5/16 inch centers) are available on special order.

Custom panel assemblies with up to 104 jacks are available on special order.

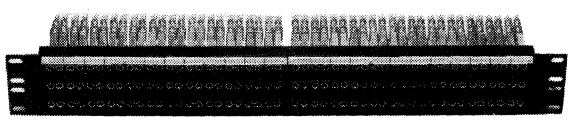




PJ-724 PANEL INSERT

Bantam Triple Row Jack Panel

Bantam Triple Row Jack Panels provides 144 jacks in a 2⅝ inch x 19 inch size panel. The specification and construction of this panel is the same as Bantam Double Row Panels except width of panel is one and one-half the standard panel size. Mounting centers conform to standard EIA rack spacing. Three rows of jacks with 48 jacks in each row. These three rows are particularly desirable for use in 2 wire and 4 wire VF Circuit applications where space can be saved by having three verticle jacks appear as a jack set. When needed number plates or labels to show row functions can be furnished on special order.



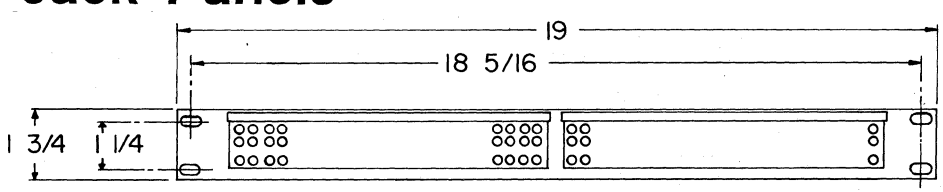
"BANTAM TRIPLE ROW JACK PANEL — 2⅝" WIDE"

BANTAM TRIPLE ROW JACK PANEL

PJ-732 Triple Row Panel Assembly, less jacks, holds 144 jacks
PJ-733 Triple Row Panel, with 144 PJ-818 Jacks
PJ-734 Triple Row Panel, with 144 PJ-839 Jacks
PJ-735 Triple Row Panel, with 96 PJ-839 Jacks (top and middle row) 48 PJ-838 Jacks (bottom row).

Bantam 2 + 1 Jack Panels

Bantam 2 + 1 Jack Panels are the newest development in the ADC line of Bantam components which offer the maximum in patching density. These unique three row panels feature three miniature jacks on a single frame, which effectively requires ⅓ less space than regular Bantam jacks. The Bantam 2+1 panels include 48 of these three conductor jacks, in a standard size 1¾ inch wide by 19 inch long panel. These panels were especially designed to provide vertically positioned jack sets such as the "Line", "Equipment" and "Monitor" jacks in a Voice Frequency Circuit. The Bantam 2 + 1 Jacks provided in these panels are available with solder type terminals and with wire wrap terminals. When required number plates or labels for identifying row functions can be provided on special order.



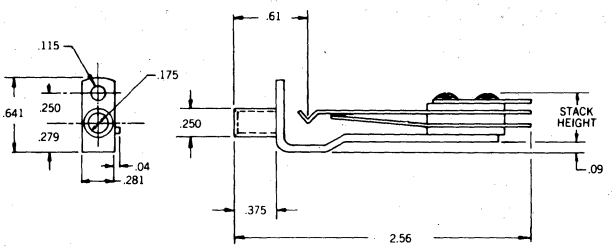
"BANTAM 2 + 1 JACK PANEL — 1¾" WIDE"

PJ-721 Panel Assembly, with 48 PJ-821 Jacks
PJ-721W Panel Assembly, with 48 PJ-821W Jacks

ADC PRODUCTS
6405 Cambridge St., Minneapolis, Minn. 55426

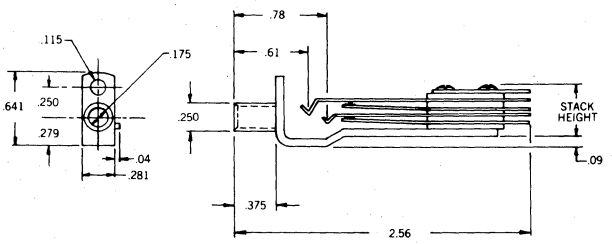
(ADC) Bantam Jacks

Bantam Jacks will meet the electrical, mechanical and environmental requirements of the military specification for long frame telephone jacks. Although reduced in size these jacks will provide the same reliable service equal to that expected from regular size telephone jacks. These jacks are available in a variety of two and three conductor types, with isolated circuit contacts as well as normalling contacts.



2 CONDUCTOR JACK

3 CONDUCTOR JACK



SCHEMATIC DIAGRAM	PART NO.	STACK HEIGHT (Inches)
	PJ-803	13/32
	PJ-808	43/64
	PJ-815	35/64
	PJ-816	35/64
	PJ-818	13/32
	PJ-823	27/64
	PJ-836	5/8
	PJ-805	43/64
	PJ-824	43/64
	PJ-838	35/64
	PJ-839	17/32
	PJ-841	43/64
	PJ-880	3/4

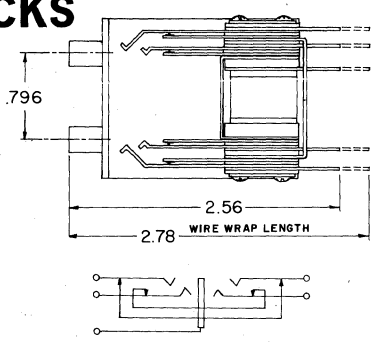
specifications

Frame: Steel, Cadmium plate with chromate conversion coating to withstand 50 hours of salt spray.
Springs: Nickel silver.
Contacts: W. E. #1 gold alloy, cross-bar contacts are welded to springs.
Insulation: Spacers, Phenolic Type PBE-P per MIL-P-3115B.
Bushing: Brass, silver soldered to frame. Finish same as frame.

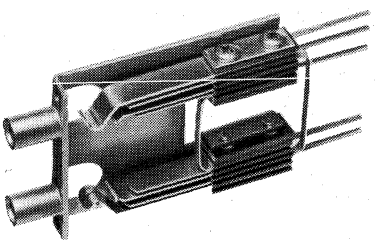
All of the above jacks are available on special order with Palladium cross-bar contacts.
If gold plating is required for all surfaces, jacks should be ordered as the PJ number with a "G" suffix. ADC uses .00005 gold per MIL-G-45204, TYPE II. The solder lugs are not tinned for gold plated jacks. Any requirements other than those described require special notation.

Bantam Twin Jacks

Bantam Twin Jacks are the miniature equivalent of the ADC PJ-482 or the WE 482A. These three conductor type jacks have normal contacts on both the tip and ring springs strapped, thereby reducing and simplifying wiring. The Bantam Twin Jacks are designed with sleeves on .796 inch centers and are made to mount in the ADC PJ-731 Double Row Panels and the PJ-732 Triple Row Panels. Bantam Twin Jacks are available with solder terminals and wire wrap terminals.



SCHEMATIC

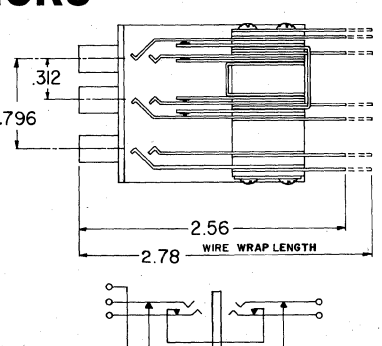


PJ-882 Bantam Twin Jack — Solder Terminals

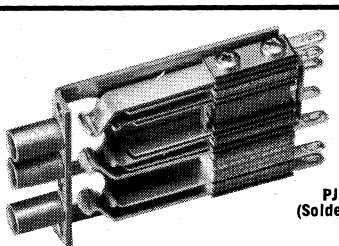
PJ-882W Bantam Twin Jack — Wire Wrap Terminals

Bantam 2 + 1 Jacks

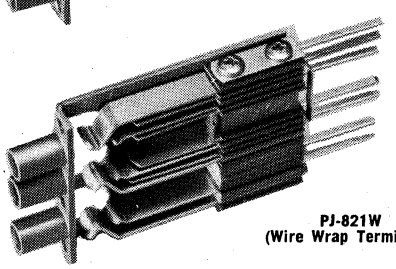
Bantam 2 + 1 Jacks offer almost unbelievable space saving advantages . . . Savings even greater than regular Bantam jacks. Bantam 2 + 1 Jacks literally permits tripling of the patching density of a 1¾ inch wide panel. This unique design features three jacks on a single frame. The jacks are three conductor types. Two of the jacks have normal contacts on both tip and ring springs. These normal contacts are strapped to simplify wiring. Ideally suited to VF Circuit applications where two of the jacks would function as "Line" and "Equipment" jacks and the third as a "Monitor" jack. Up to 48 Bantam 2 + 1 Jacks can be mounted on a 1¾ inch wide by 19 inch long panel. Bantam 2 + 1 Jacks are available with solder type terminals and with wire wrap terminals. These very remarkable miniature jacks are specifically designed to mount in the Bantam 2 + 1 Panel PJ-721.



SCHEMATIC



PJ-821 Jack (Solder Terminals)

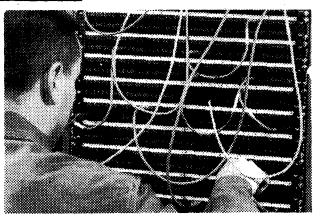


PJ-821W (Wire Wrap Terminals)

(ADC) Bantam Patch Cords

Bantam Patch Cords are plastic jacketed, shielded cords complete with molded-on plugs. The plugs are made with molded insulation between conductors. Bantam Patch Cords are available with single and double two and three conductor plugs. A cord strain relief feature is included in the plug construction.

Bantam plugs may be gold plated on special order per MIL-G-45204, Type II, .00005 inches thick.



specifications

Cord: Plastic jacketed, stranded copper conductors, braided shield. Jacket color — gray.

Plugs: Conductor parts are brass, finished to 32 microinch finish maximum.

Plug Insulation: Molded polystyrene.

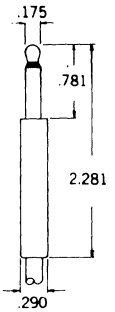
Internal Connections: Soldered.

Plug Shell: Plastic, black, rigid thermoplastic.

NOTE 1: Length is measured from the rear of the plug shell to rear of plug shell on opposite end.

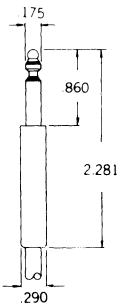
2 CONDUCTOR SINGLE PLUG

Length (see Note 1)	Single (2) Conductor Plug
6 inch	PJ-701
12 inch	PJ-702
18 inch	PJ-703
24 inch	PJ-704
30 inch	PJ-705
36 inch	PJ-706
48 inch	PJ-708
60 inch	PJ-710



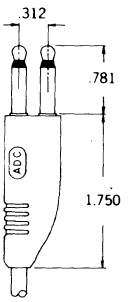
3 CONDUCTOR SINGLE PLUG

Length (see Note 1)	Single (3) Conductor Plug
6 inch	PJ-711
12 inch	PJ-712
18 inch	PJ-713
24 inch	PJ-714
30 inch	PJ-715
36 inch	PJ-716
48 inch	PJ-718
60 inch	PJ-720



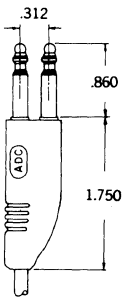
2 CONDUCTOR (DOUBLE)

Length	Double (2) Conductor Plug
6 inch	PJ-751
12 inch	PJ-752
18 inch	PJ-753
24 inch	PJ-754
30 inch	PJ-755
36 inch	PJ-756
48 inch	PJ-758
60 inch	PJ-760



3 CONDUCTOR (DOUBLE)

Length	Double (3) Conductor Plug
6 inch	PJ-761
12 inch	PJ-762
18 inch	PJ-763
24 inch	PJ-764
30 inch	PJ-765
36 inch	PJ-766
48 inch	PJ-768
60 inch	PJ-770



specifications

Cord: Plastic jacketed, stranded copper conductors, braided shield. Jacket color — gray.

Plugs: Conductor parts are brass, finished to 32 microinch finish maximum.

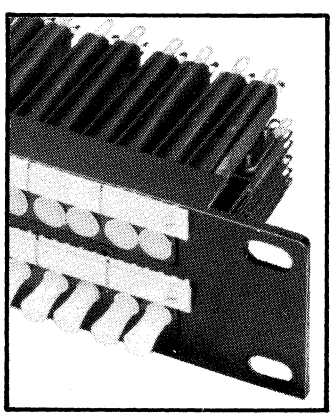
Plug Insulation: Molded polystyrene.

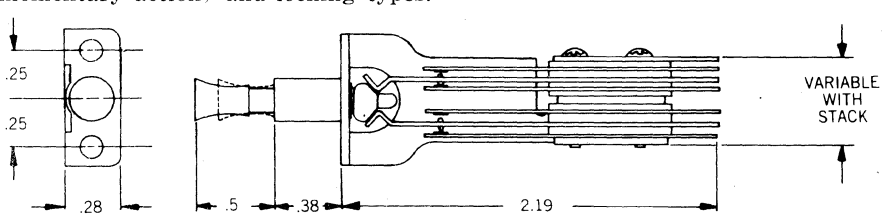
Internal Connections: Soldered.

Plug Shell: Plastic, gray, flexible thermoplastic.

Bantam Switches

Bantam Switches are specifically designed to be mounted in ADC Bantam panels. These switches may be mounted interchangably with Bantam jacks and Bantam lites. Unique from the standpoint of size, these switches are constructed of the same basic materials as used in Bantam jacks and will provide long life and dependable service. A variety of contact forms are available in both non-locking (momentary action) and locking types.





specifications

Plunger: White Nylon (color coded plungers may be obtained on special order.)

Frame: Steel, finished cadmium-chromate per Mil-F-14072 #M262, Type II.

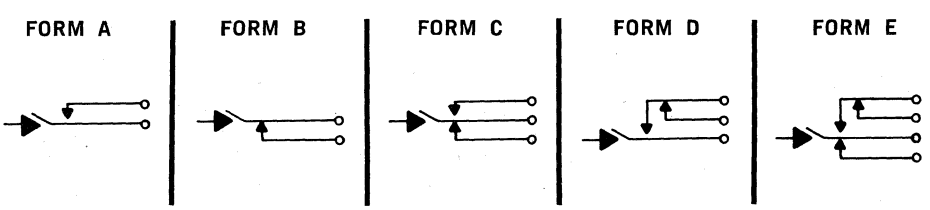
Springs: Nickel-Silver.

Contacts: WE #1 Gold Alloy.

Insulators: Phenolic type PBE-P per Mil-P-3115B.

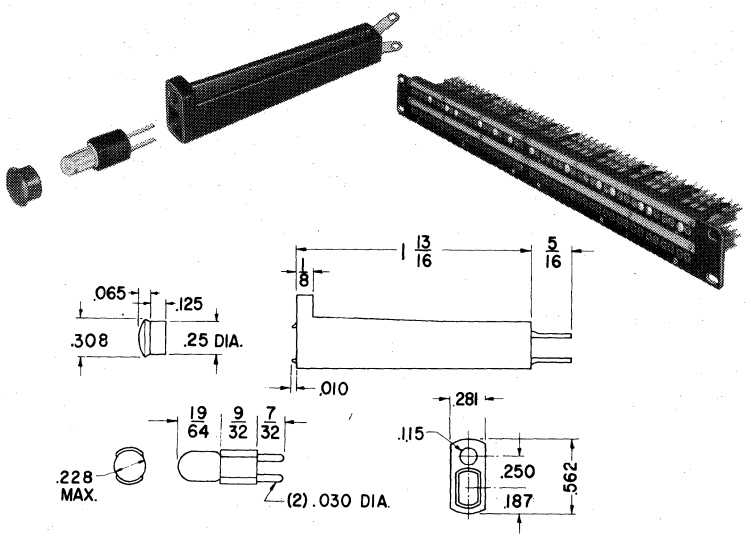
CATALOG NUMBER		CONTACT FORMS
Momentary Action	Locking Action	
SJ-863	LJ-863	One A
SJ-864	LJ-864	Two A's
SJ-865	LJ-865	Three A's
SJ-866	LJ-866	Four A's
SJ-867	LJ-867	One B
SJ-868	LJ-868	Two B's
SJ-869	LJ-869	One A, One B
SJ-870	LJ-870	Two A's, One B
SJ-871	LJ-871	Two A's, Two B's
SJ-872	LJ-872	One C
SJ-873	LJ-873	Two C's
SJ-874	LJ-874	Three C's
SJ-875	LJ-875	Four C's
SJ-876	LJ-876	One D
SJ-877	LJ-877	Two D's
SJ-878	LJ-878	One E
SJ-879	LJ-879	Two E's

contact forms



(ADC) Bantam Lites

Bantam Lites are miniature equivalents of the commonly used "telephone type" lamp sockets. ■ These half size lamp sockets feature miniature lamps and lamp caps which are removable from the front of the equipment panel. ■ Bantam Lites provide enough brilliance to be easily distinguished across a well-lighted room. ■ Bantam lamp caps are plastic and are readily visible from wide angles when illuminated. ■ There are no lens holders used on Bantam lamp caps to obscure the light when viewed from the side. ■ These lites have universal application but have been manufactured to fit Bantam Jack Panels and are interchangeable with Bantam Jacks. ■ Bantam Lites are designed for use in military and commercial telecommunication applications.



specifications

Lamp Socket: Made to mount in Bantam Jack Panels and are interchangeable with Bantam Jacks. Molded high heat resistant plastic — Diallyl-Phthalate (DAP). Conductor springs are die formed of nickel silver. Solder lug terminals are tin dipped.

Lamps: 24V miniature lamp draws 50 mils.* 1,000 hour minimum life rating. Base of molded plastic. Terminal pins, nickel silver.

Lamp Caps: Molded of translucent plastic in standard colors — red, green, white and amber.

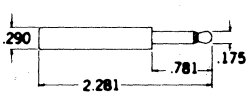
*6V and 12V lamps are available on special order.
NOTE: Lamp sockets, lamps and lamp caps are to be specified and ordered separately.

PJ-850	Lamp Sockets
PJ-729R	Lamp Caps (Red)
PJ-729G	Lamp Caps (Green)
PJ-729W	Lamp Caps (White)
PJ-729A	Lamp Caps (Amber)
PJ-862	Bantam Lamps (24V)
PJ-729B	Hole Plugs (Black)

Bantam Accessories

TERMINATING PLUGS

This plug is used to terminate a circuit with a specific load. Has a built-in ½ watt ±1% resistor. The plug handle is marked with the resistance value. Other resistance values available on special order.



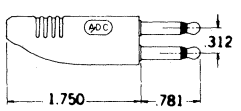
2 CONDUCTOR
PJ-741
600 Ohms
PJ-742
135 Ohms



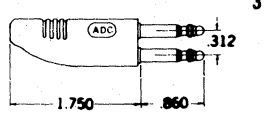
3 CONDUCTOR
PJ-743
600 Ohms
PJ-744
135 Ohms

LOOPING PLUGS

This plug is used to "loop" or patch adjacent jack circuits. The plug conductors are wired or strapped internally. The two-conductor plugs are wired tip to tip and sleeve to sleeve. The three-conductor types are wired tip to tip, ring to ring and sleeve to sleeve. Dual plugs with transposed wiring are available on special order.



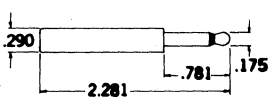
2 CONDUCTOR
PJ-745



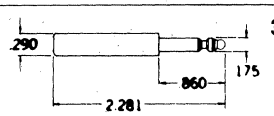
3 CONDUCTOR
PJ-746

DUMMY PLUGS

This plug is used to actuate Bantam Jacks. Constructed same as single plugs as provided on Bantam patch cords, except without cord and has no internal connections.

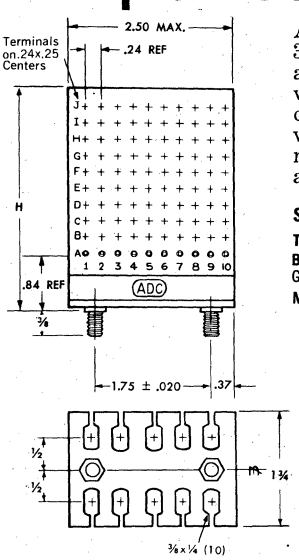


2 CONDUCTOR
PJ-747



3 CONDUCTOR
PJ-748

"Wrapid" Terminal Blocks FOR WRAPPED WIRE CONNECTIONS



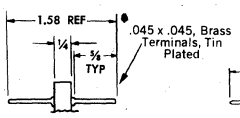


Fig. 1

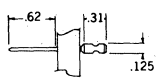


Fig. 2

ADC's Wrapid Terminal Blocks provide for up to 100 connections in a space of 2½" wide by 3⅜" high. ADC offers a variety of Wrapid Terminal Blocks designed for specific wiring applications. The Wrapid Terminal Blocks can be used for wrapped solderless connections, wrapped and soldered connections, or in applications requiring wrap to solder or solderless connectors. Wrapped wire terminations can be accomplished with any commercially available wrapping tool. Behind the development of these terminal blocks is 30 years of experience in meeting rigid commercial and military specifications on a wide variety of devices. This is your assurance of top performance and long dependable service life.

specifications

Terminals: Brass, Electro-Tin Plated.

Block and Fanning Strip: PJ-600 Series — Asbestos filled Polypropylene, molded — Blue. PJ-620 and 640 Series — Glass-filled NYLON (high temperature). Color — Natural (White). Heat Distortion — 442°F with 264 P.S.I.

Mounting Studs: (2) 8-32 Steel, Cadmium-Chromate Plating per MIL-F-14072 No. M262 II.

No. of Terminals	Wrapped Solderless Application Fig. 1 Terminal	Wrapped and Solder Application Fig. 1 Terminal	Wrapped to Solder or Solderless Application Fig. 2 Terminal	H. Dim.
40	PJ-604	PJ-624	PJ-644	1.75
60	PJ-606	PJ-626	PJ-646	2.25
80	PJ-608	PJ-628	PJ-648	2.75
100	PJ-610	PJ-630	PJ-650	3.25

(ADC) Jack Panels

ADC offers the most complete assortment of jack panels available today. ADC panels are used in television and broadcasting stations, recording studios, industrial paging systems, and communication equipment of all kinds where there is a need to efficiently switch and distribute audio signals. Molded of solid phenolic, reinforced with steel to provide maximum rigidity and strength. Jacks are spaced to permit use of any standard double plug with 5/8" spacing. Mounting brackets and designation strips* furnished with each panel. All panels designed to fit standard 19" relay rack. Consult ADC for your standard and special jack panel requirements.

*The jack panels as illustrated are equipped with ADC standard designation strips as shown. PJ-30, PJ-35, PJ-36 and PJ-37 type panels can be supplied with the reinforcement strips drilled and tapped to accommodate the Western Electric equivalent designation strips (PJ-899A, PJ-899B, PJ-903A and PJ-903B). The suffix "A" added to the part number denotes panels which are modified to accommodate these alternate type designation strips. Designation strips are to be ordered separately.

specifications

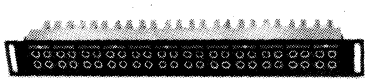
Panel: Molded, thermoset plastic per Mil-M-14F, Type CFG, black.

Mounting Brackets: PJ-31 and PJ-33: Die cast zinc, finished black lacquer.
PJ-30, PJ-35, PJ-36, PJ-37: Steel, finished cadmium + chromate per Mil-F-14072 #M262, Type II.

Reinforcing Strips: PJ-31 and PJ-33: Steel, finished nickel plated.
PJ-30, PJ-35, PJ-36, PJ-37: Steel, finished cadmium + chromate per Mil-F-14072 #M262, Type II.



PJ-30
Double Panel. Holds 52 jacks — requires 1¾" panel space. Double designation strip. Brackets for flush rack mounting. All jack mounting holes on 5/8" centers.

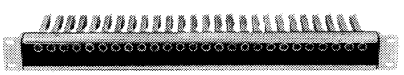


PJ-31
Double Panel. Holds 48 jacks. Holes are spaced to prevent patching adjacent circuits. Requires 2⅛" panel space.

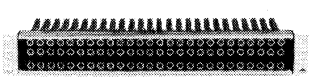


PJ-33
Single Panel. Holds 24 jacks. Holes are spaced to prevent patching adjacent circuits. Requires 1¾" panel space.

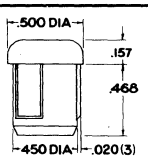
PJ-35 Same as PJ-30, except has 7" standoff mounting brackets.



PJ-36
Single Panel. Holds 26 jacks — requires 1¾" panel space. Brackets for flush rack mounting. All jack mounting holes on 5/8" centers.



PJ-37
Triple - Row Panel. Holds 78 jacks. Requires 2⅝" panel space (1½" standard rack spaces). Provided with brackets for flush rack mounting and PJ-901 designation strips top and bottom.



HOLE PLUG
Molded of black polyethylene plastic. Fits all ADC standard jack panels. Made to plug unused jack mounting holes in jack panels. **PJ-29**

PANELS LESS JACKS	PJ-30	PJ-30A	PJ-31	PJ-33	PJ-35	PJ-35A	PJ-36	PJ-36A	PJ-37	PJ-37A
PANEL WITH PJ-318	PJ-340	PJ-340A	PJ-341	PJ-343	PJ-350	PJ-350A	PJ-360	PJ-360A	PJ-370	PJ-370A
PANEL WITH PJ-339	PJ-390	PJ-390A	PJ-391	PJ-393	PJ-395	PJ-395A	PJ-396	PJ-396A	PJ-397	PJ-397A

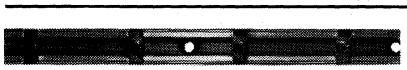
Designation Strips



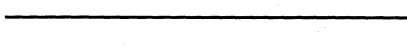
PJ-890 — Aluminum, black anodized strip with 12 transparent windows and a white card, perforated for easy typing, provided. Intended mounting is by #4 x ¼ flat head screws. Arranged to accommodate a card for each pair of jacks or lamps on .625 centers. Use with WE-185 Panel.



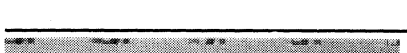
PJ-897 — Aluminum, black anodized strip with one transparent window and a white card provided. Intended mounting is by #4 flat head screws. Arranged to provide a continuous card. May be used as alternate on PJ-31 and PJ-33 Panels.



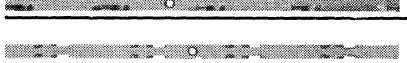
PJ-898 — Aluminum, black anodized strip with 12 transparent windows and a white card, perforated for easy typing, provided. Intended mounting is by #4 flat head screws. Arranged to accommodate a card for each pair of jacks or lamps on .625 centered pairs x .75 between adjacent pairs. Used on PJ-31 and PJ-33 Panels.



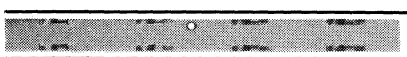
PJ-899A (WE-99A)* — Satin nickel plated strip 15/64" wide, with 13 transparent windows and a white card, perforated for easy typing, provided. Intended mounting by 2-56 flat head screws, special head available on request. Arranged to provide a card for each pair of jacks on .625 centers. Used on PJ-30A (WE-230A), PJ-36A (WE-230B) and PJ-37A Panels, will not overlap adjacent units.



PJ-899B (WE-99B)* — Same general description as PJ-899A except 15/32" wide and will overlap adjacent units by 15/64".



PJ-900A (WE-100A)* — Satin nickel plated strip 15/64" wide with 16 transparent windows and a white card, perforated for easy typing, provided. Intended mounting by 2-56 flat head screws, special head, available on for each pair of jacks on .625 centers. Used on 23" long Panels, WE-231A.



PJ-900B (WE-100B)* — Same general description as PJ-900A except 15/32" wide and will overlap adjacent units by 15/64".



PJ-903A (WE-103)* — Satin nickel plated strip 15/64" wide with 3 transparent windows and a continuous white card. Intended mounting by 2-56 flat head screws, a special head, available on request. Used on PJ-30A (WE-230A), PJ-36A (WE-230B) and PJ-37A Panels. Will not overlap adjacent units.



PJ-903B (WE-103B)* — Same general description as PJ-903A except 15/32" wide and will overlap adjacent units by 15/64".

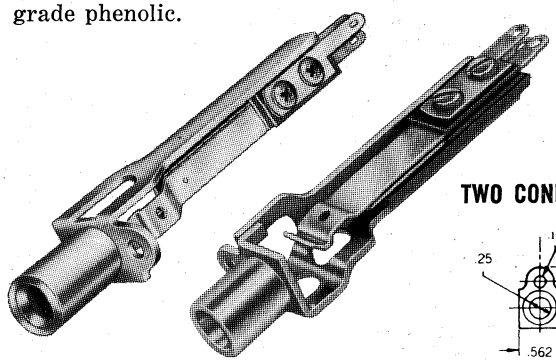


PJ-901 — Cadmium-chromated strip with one continuous window and 2-part card, perforated for typing ease. Spot welded to reinforcing strip. Used on PJ-30, PJ-35, PJ-36 and PJ-37.

(ADC) Jacks

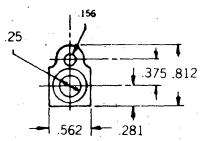
TELEPHONE TYPE

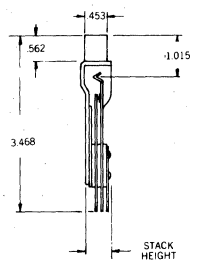
ADC is recognized as a leading supplier of long frame, telephone type jacks. As evidence of their outstanding quality, ADC jacks are used by the country's foremost manufacturers of communication equipment. The unique, ADC one-piece frame is strong, dimensionally stable and readily interchangeable both mechanically and electrically with commonly used jacks. Plating withstands 50-hour salt spray tests. Coin silver contacts are welded to nickel silver springs. Lugs are hot tin dipped. Insulation is high grade phenolic.



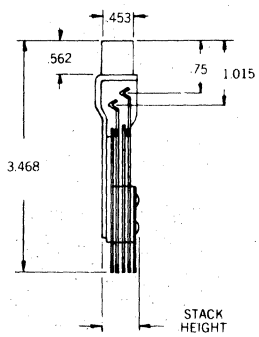
Schematic Diagram Jacks	WE Equiv.	Frame Style	Stack Height (Inches)
PJ-115	215-A	A	5/8
PJ-116	216-A	A	5/8
PJ-117	217-A	A	9/16
PJ-123	223-A	A	7/16
PJ-125	225-A	A	21/32
PJ-202	None	C	3/4
PJ-203	303-A	A	9/16
PJ-204**	None	A	3/4
PJ-205**	240-A	A	3/4
PJ-206**	242-A	A	3/4
PJ-207**	285-A	A	27/32
PJ-208**	284-A	A	63/64
PJ-209**	411-A	A	27/32
PJ-226	226-A	A	5/8
PJ-237	237-A	A	15/32
PJ-238	238-A	A	9/16
PJ-240	240-C	C	3/4
PJ-241**	241-A	A	3/4
PJ-242	242-C	C	3/4
PJ-280	280-C	C	23/32
PJ-318	218-A	A	1/2
PJ-336	236-C	C	19/32
PJ-338	438-C	C	13/16
PJ-339	239-A	A	9/16
PJ-418	218-C	C	1/2
PJ-246*	246-A	A	9/16
PJ-248*	248-A	A	9/16
PJ-249*	249-A	A	9/16

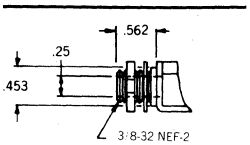
TWO CONDUCTOR





THREE CONDUCTOR





THREADED SLEEVE AVAILABLE ON SPECIAL ORDER



SPECIFICATIONS:

Frame: Steel, plated to withstand 50 hours salt spray per Mil-STD-202, Method.
Sleeve: Brass, nickle plated.
Springs: Nickle silver with tinned lugs.
Insulators: Phenolic, per Mil-P-3115 B type.

MILITARY JACKS

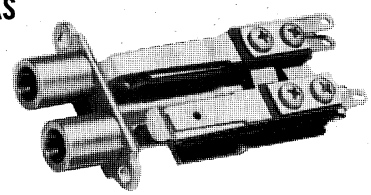
Designed to meet the rugged, exacting requirements of military applications. These ADC jacks are made in accordance with Mil-J-641B specifications. Highest quality materials and closely held tolerances on dimensions conform with military specifications.

Schematic Diagram	MIL Jacks	Frame Style	Stack Height (Inches)	Schematic Diagram	MIL Jacks	Frame Style	Stack Height (Inches)
	JJ-015	C	3/4		JJ-073*.*	A	3/4
	JJ-016	A	9/16		JJ-074	A	3/4
	JJ-017**	A	3/4		JJ-075**	A	3/4
	JJ-019	C	11/16		JJ-077	A	27/32
	JJ-022	A	9/16		JJ-078**	A	63/64
	JJ-024	A	1/2		JJ-084	A	5/8
	JJ-035	A	5/8		JJ-085	A	9/16
	JJ-042	A	9/16		JJ-086	A	7/16
	JJ-072	A	5/8		JJ-087**	A	27/32

*For use with PJ-309 or other similar type plugs having .207" diameter sleeves.

**Caution — Because of Stack Height these "A" frame jacks cannot be installed on 5/8" centers. "C" Frame version if not listed can be furnished on special order.

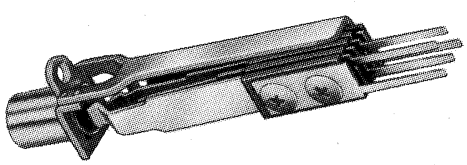
TWIN JACKS



ADC Twin Jacks are essentially two jacks with a common mounting frame. Jack sleeves are on 5/8" centers for vertical mounting in standard jack panels. Normal springs are cross-connected or strapped. Jack sleeves are brass, nickel plated. Die formed springs are nickel silver. Frame and hardware are steel, cadmium-chromate plated to withstand 50 hours salt spray.

Part No.	WE Equivalent	No. Conductors	Use With Plug
PJ-410	410A	2	PJ-047, PJ-1 and PJ-327
PJ-482	482A	3	PJ-051, PJ-7

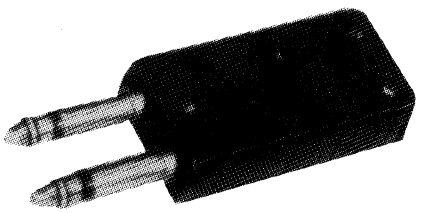
WRAPID JACKS (For Wrapped Solderless Connections)



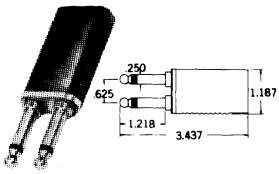
ADC offers a variety of Wrapid Jacks with .032" by .062" rectangular terminals for wrapped wire connections. These jacks feature cross-bar contacts. Overall length is 3.825" maximum, otherwise, dimensionally the same as telephone jacks.

Schematic Diagram	Wrapid Jack	Frame Style
	PJ-238W	A
	PJ-240W	C
	PJ-241W	A
	PJ-242W	C
	PJ-339W	A

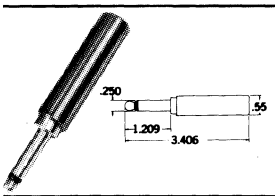
ADC Plugs



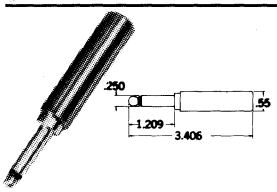
TWO CONDUCTOR



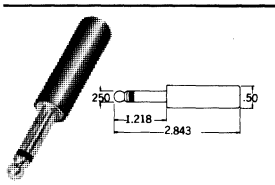
PJ-1 — Equivalent WE-241. Heavy duty die cast frame. Black phenolic shell. Has self-aligning plug sleeves on 5/8" centers for use with all standard jack panels. Two tip conductors, plus sleeve connection common to both sleeves.



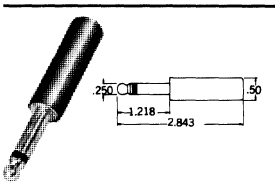
PJ-047R — Equivalent WE-347. Designed for use with tip and sleeve jacks. Molded insulation, red plastic handle, design and construction in accordance with MIL-P-642B specifications.



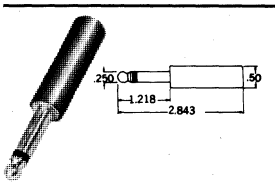
PJ-047B — Same as above except black plastic handle.



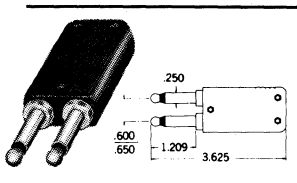
PJ-055B — Formerly ADC PJ-5, fits 1/4" phone jacks. Black plastic shell. Screw terminals, designed and manufactured in accordance with MIL-P-642B.



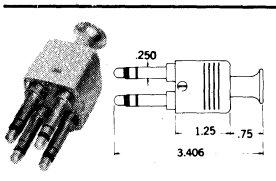
PJ-055M — Same as above except has metal handle, brass, nickel plated.



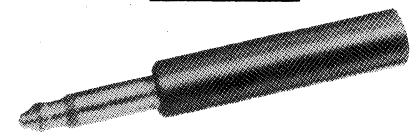
PJ-055R — Same as above except has red plastic handle.



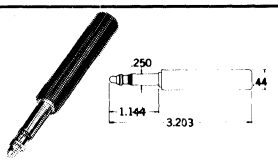
PJ-327 — Equivalent WE-327. Twin plug provides two electrically independent 2 conductor plugs in a black phenolic shell which is notched to indicate polarity. Self-aligning plug sleeves are on 5/8" centers. Designed and constructed in accordance with specification MIL-P-642B.



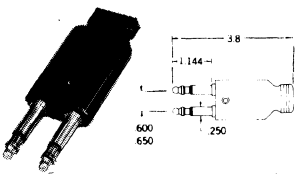
D7200 — Equivalent WE-315B. Four sleeves, self-aligning plug. Molded insulation. Brass shell notched for polarity is nickel plated and connected to plug sleeves to provide shielding for tip conductors. For use with four PJ-318 double jacks mounted on 5/8" centers. Five conductors total.



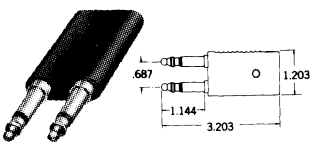
THREE CONDUCTOR



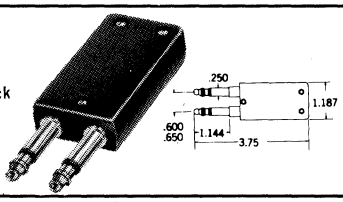
PJ-2 — Equivalent WE-291A. Designed for use with 1/4" diameter tip, ring and sleeve jacks. Especially designed cone-shaped tip to prevent momentary shorting of tip and ring conductors when used with ADC PJ-339, WE-239A or similar three circuit jacks.



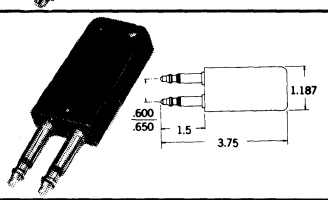
PJ-4 — Looping plug, dual three conductor type. Same conductor configuration as PJ-051 except has conductors wired internally, tip to tip, ring to ring and sleeve to sleeve. Black plastic shell.



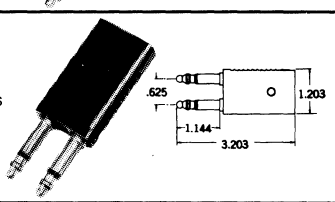
PJ-6 — Equivalent WE-213. Designed for applications requiring two separate 3 conductor circuits. Popularly used with operator's intercom/monitor headsets. Black shell notched for polarity identification. Self-aligning plug on 1 1/16" centers. (**Note:** Not intended for use with standard jack panels where jacks are mounted on 5/8" centers.)



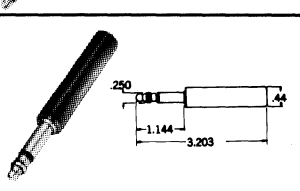
PJ-7 — Equivalent WE-425. Twin type plug with tip, ring and sleeve conductors on 5/8" centers for use with all standard jack panels. Designed to mate with three conductor jacks having 1/4" diameter sleeves. Molded insulation. Black phenolic shell is notched to indicate polarity.



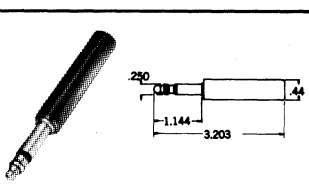
PJ-8 — Dual three conductor type with same conductor configuration as PJ-2, designed for non-shorting of tip and ring circuits when used with PJ-339, WE-239A or similar jacks. Black plastic handle notched to indicate polarity.



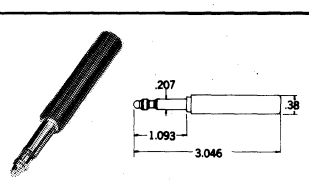
PJ-9 — Equivalent WE-338. Designed for applications requiring two separate 3 conductor circuits. Will mate with three-conductor jacks having 1/4" diameter sleeves. Molded insulation, black plastic handle notched to indicate polarity. Self-aligning plug sleeves on 5/8" centers. Has two separate cord entry holes and requires "Y" type cord or two separate cords.



PJ-051R — Equivalent WE-310. Formerly ADC PJ-3. Designed for use with 1/4" tip, ring and sleeve jacks. Molded insulation, red plastic shell, three conductor. Is in accordance with MIL-P-642B.

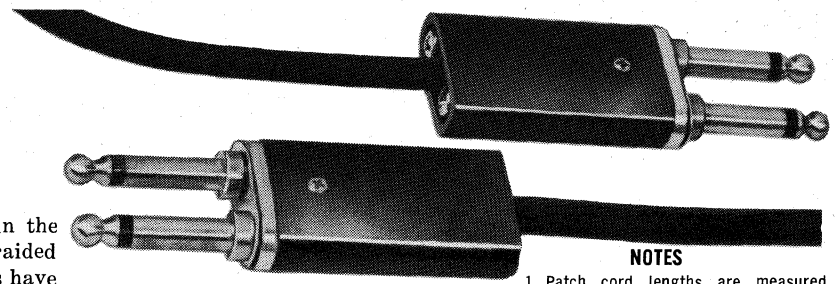


PJ-051B — Same as above except black plastic handle.



PJ-309 — Equivalent WE-309. Three conductor type. Has .207 diameter sleeve (small diameter). Intended for use with ADC PJ-246, PJ-249 and similar three circuit jacks which have .210 I.D. sleeves. Molded insulation — red plastic handle. Designed and constructed per MIL-P-642B.

ADC Patch Cords



ADC Patch Cords have become standards in the communications industry. The heavy Nylon braided jacket excels in abrasion resistance. All cords have been designed to give the ultimate combination of durability, flexibility and reliability. ADC has numerous combinations of special cord assemblies using virtually every plug combination required. You are invited to submit your requests or requirements for quotations.

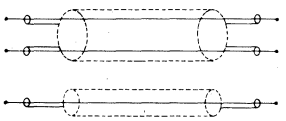
PATCH CORD LENGTH	TOLERANCE
6 inch	+ .375" —.00"
1 foot	+ .75 " —.00"
2 feet	+1.125" —.00"
3 feet	+1.375" —.00"
4 feet	+1.625" —.00"
5 feet	+2.0 " —.00"
6 feet	+2.25 " —.00"
10 feet	+2.625" —.00"

NOTES

1. Patch cord lengths are measured from backs of plug sheet.
2. When outer jacket colors other than noted are required add suffix:
   S — For Slate G — For Green
   R — For Red B — For Black
3. All cords and cord assemblies will withstand 500 V, 60 Hz PBT between all conductor. Cordage is designed to have minimum leakage resistance of 50 Megohms with 100 volts applied.

2 CONDUCTOR SHIELDED, CORD ASSEMBLIES

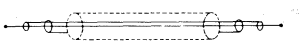
Length	Cord w/ PJ-1 Plugs	Cord w/ PJ-055B Plugs	Replacement Cords Only
6 inch	PJ-10½	PJ-50½	PJ-20½
1 foot	PJ-11	PJ-51	PJ-21
2 feet	PJ-12	PJ-52	PJ-22
3 feet	PJ-13	PJ-53	PJ-23
4 feet	PJ-14	PJ-54	PJ-24
5 feet	PJ-15	PJ-55	PJ-25
6 feet	PJ-16	PJ-56	PJ-26
10 feet	PJ-10	PJ-50	PJ-20



These cords provide two tinsel wire conductors plus a braided shield. The overall jacket is braided nylon. Black nylon is standard, also available in slate, green and red on special order, see Note 2.

3 CONDUCTOR SHIELDED, CORD ASSEMBLIES

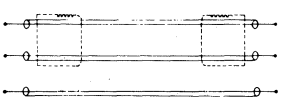
Length	Cord w/ PJ-2 Plugs	Cord w/ PJ-051R Plugs	Replacement Cords Only
1 foot	PJ-71	PJ-81	PJ-61
2 feet	PJ-72	PJ-82	PJ-62
3 feet	PJ-73	PJ-83	PJ-63
4 feet	PJ-74	PJ-84	PJ-64
5 feet	PJ-75	PJ-85	PJ-65
6 feet	PJ-76	PJ-86	PJ-66



These cords provide two tinsel wire conductors plus a braided shield. Overall jacket is braided nylon. Black nylon is standard with slate colored jacket also stocked. Green and red are available on special order. See Note 2.

2 CONDUCTOR UNSHIELDED, CORD ASSEMBLIES

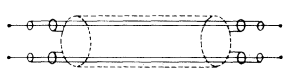
Patch Cords Length	Cord w/ PJ-327 Plugs	Cord w/ PJ-047R Plugs
1 foot	PJ-181	PJ-471
2 feet	PJ-182	PJ-472
3 feet	PJ-183	PJ-473
4 feet	PJ-184	PJ-474
5 feet	PJ-185	PJ-475
6 feet	PJ-186	PJ-476



The PJ-180 and PJ-470 series cords offer tinsel wire conductors, thermo plastic insulated. Standard color for PJ-180 series patch cords is slate. The standard color for the PJ-470 series cords is red. Other colors are available on special order, see Note 2.

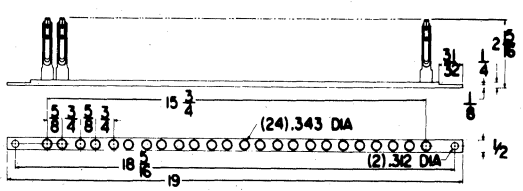
3 CONDUCTOR SHIELDED, CORD ASSEMBLIES

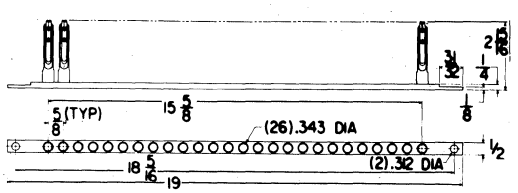
Length	Cord w/ PJ-7 Plugs	Cord w/ PJ-8 Plugs
1 foot	PJ-171	PJ-91
2 feet	PJ-172	PJ-92
3 feet	PJ-173	PJ-93
4 feet	PJ-174	PJ-94
5 feet	PJ-175	PJ-95
6 feet	PJ-176	PJ-96



The PJ-90 and PJ-170 series cords provide four tinsel wire conductors, plus a shield common to both sleeves on the plugs. Standard color for these cords is black. They are also available in slate, green or red on special order. See Note 2.

Lamp Strips (For Use with Standard Broadcast Jack Panels)

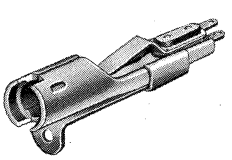




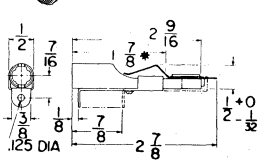
Designed to mount in standard 19" rack. These ½" wide lamp strips have individual lamp on ⅝" centers corresponding with the spacing on all broadcast jack panels. Same high quality materials and construction as used on switchboard lamp strip.

Type	No. Lamps	Use with Jack Panel
PJ-158	24	PJ-31 and PJ-33
PJ-159	26	PJ-30, PJ-35 and PJ-36

Lamp Sockets

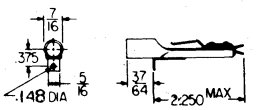


PJ-150—This new type lamp socket has the unique feature of an adjustable mounting tab which allows it to be used as a replacement for any standard lamp socket with a ⅛" diameter sleeve on panels from ⅛" to ⅞" thick. Designed to accommodate standard switchboard lamps such as WE #2 or equivalents supplied by General Electric or Sylvania. The PJ-150 lamp socket is interchangeable with WE Nos. 49 and 50.

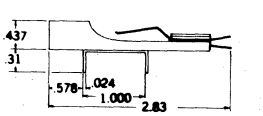


* LAMP INSERTION DEPTH

PJ-160—This lamp socket is dimensionally the same as the PJ-150 except without the adjustable mounting tab feature. Designed with a fixed ¼" wide mounting lug. This socket is used on ⅞" thick panels. Interchangeable with WE #49A. Use lamps and lamp caps as recommended for PJ-150.

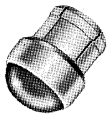


PJ-157 (Fits standard panels.) Designed to be used with any standard single or double row jack panel. Has fixed mounting tab for ⅝" thick panels. Interchangeable with WE #47A. Will accommodate standard switchboard lamps such as WE #2 or equivalent supplied by General Electric or Sylvania. Uses PJ-154, PJ-155, and PJ-156 lamp caps.



PJ-147—Designed for printed circuit board mounting, ¼" long mounting tabs and spring terminals are tinned for easy soldering. Will accommodate standard switchboard lamps such as WE-2 or equivalent supplied by General Electric or Sylvania. Uses PJ-154, PJ-155 and PJ-156 lamp caps.

ADC Lamp Caps



PJ-151, 152, 153—These series of lamp caps are made for use with ADC PJ-150 lamp sockets. Cap diameter 13/32". Shank diameter .343". Fits 11/32" hole. Interchangeable with standard lamp caps, such as Stromberg Carlson #31 and WE #2.

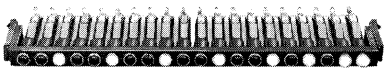
PJ-154, 155, 156—These lamp caps are for use with PJ-157 lamp sockets and PJ-148 and PJ-149 lamp strips. Cap diameter 3/4". Shank diameter .338". Fits 11/32" hole. Interchangeable with standard lamp caps, such as Stromberg Carlson #30.

Type	Color	Glass Surface
PJ-151	White	Glossy
PJ-152	Red	Frosted
PJ-153	Green	Frosted
PJ-154	White	Glossy
PJ-155	Red	Frosted
PJ-156	Green	Frosted

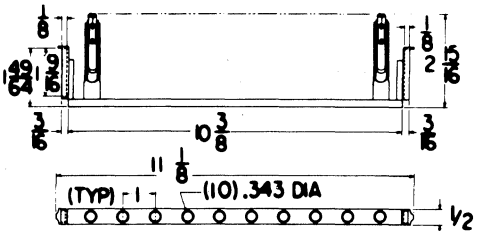
Lamp Strips

SWITCHBOARD TYPE LAMP STRIPS

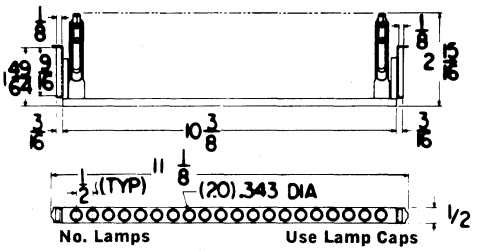
Available with 10 or 20 lamps per strip. Mounting provisions same as corresponding jack strips. Die formed lamp socket, welded construction. Mounting strip of alloyed steel with black satin vinyl finish. Nickel silver springs. Formed fiber sleeve insulates lamp from socket. Insulation of high grade phenolic. Lugs hot tin dipped. Sockets accommodate standard switchboard lamps, such as WE #2 or equivalents supplied by General Electric or Sylvania. Interchangeable with Stromberg Carlson type #121.



PJ-148



PJ-149



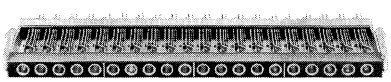
Type	No. Lamps	Use Lamp Caps
PJ-148	10	PJ-154, PJ-155 and PJ-156
PJ-149	20	

Jack Strips

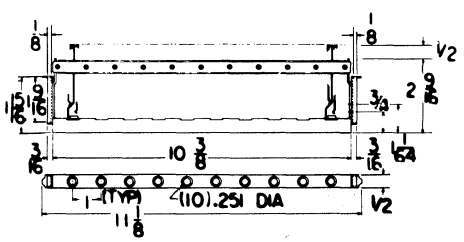
SWITCHBOARD TYPE JACK STRIPS

Type	No. Jacks	Use with Lamp Strip No.
PJ-126	10	PJ-148
PJ-127	20	PJ-149
PJ-128	10	PJ-148
PJ-129	20	PJ-149
PJ-130	10	PJ-148
PJ-131	20	PJ-149
PJ-132	10	PJ-148
PJ-133	10	PJ-148
PJ-134	20	PJ-149
PJ-135	10	PJ-148
PJ-136	10	PJ-148
PJ-137	10	PJ-148
PJ-138	20	PJ-149
PJ-139	10	PJ-148
PJ-140	20	PJ-149

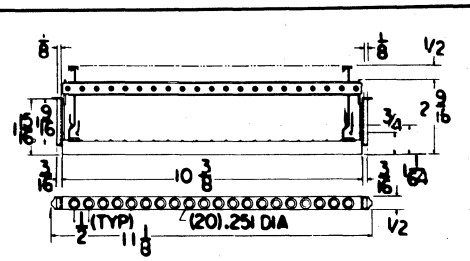
These jack strips with 10 or 20 jacks per strip provide circuits most commonly used in telephone switchboard applications. Jack mounting strips are molded black phenolic. Brass sleeves with bright dip finish can be removed individually for replacement. Contacts are coin silver, welded to nickel silver springs. Lugs are hot tin dipped. Insulation of high grade phenolic. Die formed mounting brackets designed to permit use of standard jack fasteners. Interchangeable with popular Stromberg Carlson types #99 and #100.

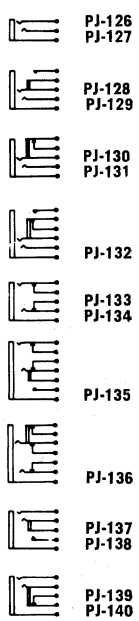


PJ-126
PJ-139



PJ-127
PJ-140





The ADC Jack and Lamp Strips shown here are designed with mounting brackets commonly used in telephone switchboards but can be supplied with other type mounting brackets to fit a variety of other applications. Ideally adaptable to rack mounting, these strips require much less space than broadcast type panels. Consult ADC for an alternate bracket to suit your needs.

ADC Coaxial Patch Panels

Modern day telemetry systems demand reliable performance of high frequency patching systems ■ COAX patch panels and accessories have been designed to insure the most dependable communication links available today ■ Mil Spec gold plating on all contact surfaces, precision tolerances and the finest available materials are standard on all units ■ The COAX label on jack panels and accessories is your assurance of the finest craftsmanship in the industry.

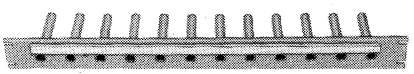
COAX PANEL SPECIFICATIONS

PANEL: Aluminum, 3/16 inches thick. Mounting centers to correspond with standard 19" rack mounting.

INSULATED PANELS: Sub-panel made of phenolic type PBG per Mil-P-3115B.

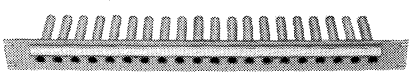
INSULATOR RING: Teflon (insulates sleeve of jack from aluminum panels — used on insulated panel assemblies only).

FINISH: Light Grey Enamel Color 111, Mil-E-15090. (Other finishes are available on special order.)



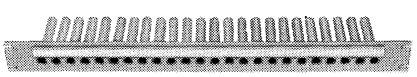
12 Jacks. Panel 1¾" wide.
Jacks Spaced on 1.43 Centers

SINGLE ROW		
Jack Type	Insulated	Non Insulated
CJ-1011	CM-1204	CM-1200
CJ-1000	CM-1205	CM-1201
CJ-1111	CM-1206	CM-1202
CJ-1100	CM-1207	CM-1203



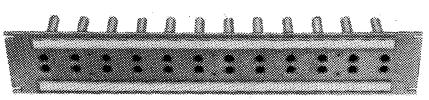
20 Jacks. Panel 1¾" wide.
Jacks Spaced on .830 Centers

SINGLE ROW		
Jack Type	Insulated	Non Insulated
CJ-1011	CM-1212	CM-1208
CJ-1000	CM-1213	CM-1209
CJ-1111	CM-1214	CM-1210
CJ-1100	CM-1215	CM-1211



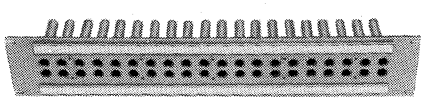
24 Jacks. Panel 1¾" wide.
Pairs of Jacks on 5/8" Centers with
¾" Between Adjacent Pairs

SINGLE ROW		
Jack Type	Insulated	Non Insulated
CJ-1011	CM-1220	CM-1216
CJ-1000	CM-1221	CM-1217
CJ-1111	CM-1222	CM-1218
CJ-1100	CM-1223	CM-1219



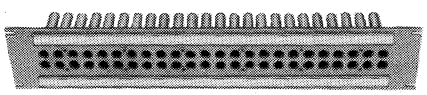
24 Jacks (12 per row). Panel 3½" wide.
Vertical Jacks Spaced on 5/8" Centers.
Horizontal Jacks Spaced on 1.43 Centers

DOUBLE ROW		
Jack Type	Insulated	Non Insulated
CJ-1011	CM-1228	CM-1224
CJ-1000	CM-1229	CM-1225
CJ-1111	CM-1230	CM-1226
CJ-1100	CM-1231	CM-1227



40 Jacks (20 per row). Panel 3½" wide.
Vertical Jacks Spaced on 5/8" Centers.
Horizontal Jacks Spaced on .830 Centers

DOUBLE ROW		
Jack Type	Insulated	Non Insulated
CJ-1011	CM-1236	CM-1232
CJ-1000	CM-1237	CM-1233
CJ-1111	CM-1238	CM-1234
CJ-1100	CM-1239	CM-1235



48 Jacks (24 per row). Panel 3½" wide.
Vertical Jacks Spaced on 5/8" Centers. Horizontal
Pairs of Jacks on 5/8" Centers with
¾" Between Adjacent Pairs

DOUBLE ROW		
Jack Type	Insulated	Non Insulated
CJ-1011	CM-1244	CM-1240
CJ-1000	CM-1245	CM-1241
CJ-1111	CM-1246	CM-1242
CJ-1100	CM-1247	CM-1243

These components were designed for patching (transferring or switching) high frequency signals. Generally these higher frequencies fall into an LF range (30-300KHz), MF range (300-3000KHz), HF range (3-30MHz), VHF range (30-300 MHz), and UHF range (300-3000MHz). ■ This new spectrum for higher frequency patching has found its principal application in the microwave, video, telemetry and data transmitting fields. ■ ADC coaxial components are available as catalog items from stock. Special requirements for engineered prototypes can be filled through the ADC engineering department. ■ All components are manufactured of the highest quality materials and built to pass stringent environmental requirements.

Fig. 1

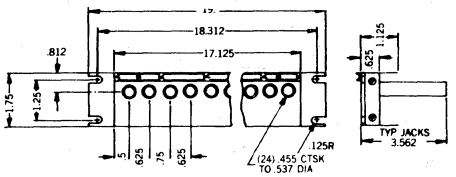


Fig. 2

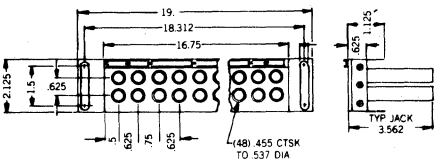


Fig. 3

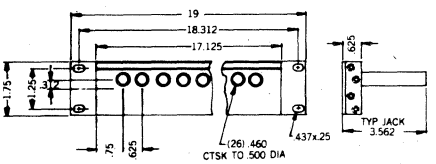
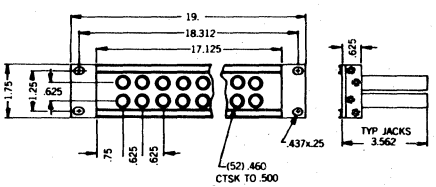
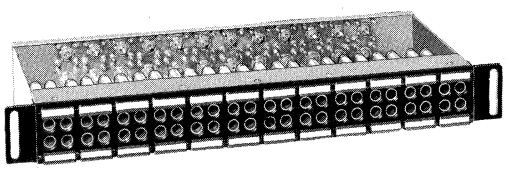


Fig. 4



Type of Coax. Jacks	Fig. 1 Panel Equipped with 24 Jacks	Fig. 2 Panel Equipped with 48 Jacks	Fig. 3 Panel Equipped with 26 Jacks	Fig. 4 Panel Equipped/w 52 Jacks
CJ-1000	CM-1020	CM-1025	CM-1028	CM-1031
CJ-1011	CM-1021	CM-1026	CM-1029	CM-1032
CJ-1100	CM-1120	CM-1125	CM-1128	CM-1131
CJ-1111	CM-1121	CM-1126	CM-1129	CM-1132



Panel and Subchassis with VHF Connectors

Type of Coax. Jacks	Single Row Panel Subchassis with 12 VHF Connectors	Double Row Panel Subchassis with 24 VHF Connectors
CJ-1000 Jacks	CM-1022	CM-1027
CJ-1100 Jacks	CM-1122	CM-1127

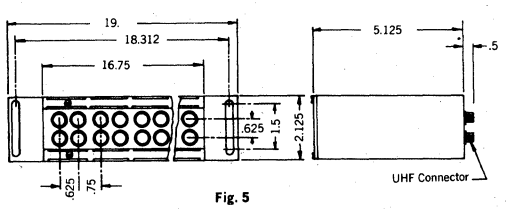


Fig. 5

(ADC) Coaxial Single Jacks

COAX jacks are available in both Western Electric compatible (CJ-1000 series) and RCA compatible (CJ-1100 series) types. These jacks are designed to be mechanically and electrically interchangeable with all commonly used coaxial jacks ■ Phosphor bronze spring fingers are preformed to provide large wiping and contact surfaces ■ The WE compatible jacks are made with a .090 inch diameter center conductor pin and the RCA compatible jacks are made with a .078 inch diameter center conductor pin ■ Both these types are made for 50 and 75 ohm systems applications.

SPECIFICATIONS

Jack Sleeve and Frame: Brass.

Center Conductor: Beryllium copper, condition HT (Gold plating*).

Outer Conductor Contacts: Phosphor bronze, spring tempered (Gold plating*).

Conductor Surfaces: Gold plating*.

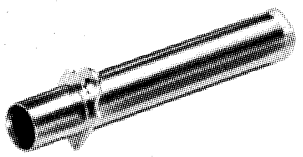
Insulation: Polytetrafluorethylene.

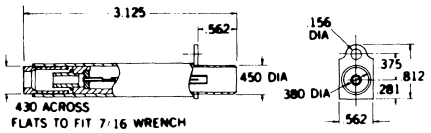
Shield Termination: Brass (Gold plating*). A sleeve is furnished for use when a crimp on solderless connection for the shield is desired.

*MIL-G-45204 Type II

COAX JACK ADC/WESTERN ELEC.
Cross Reference

ADC	WE
CJ-1000	477B
CJ-1005	465C
CJ-1008	498A
CJ-1009	491A
CJ-1010	470B

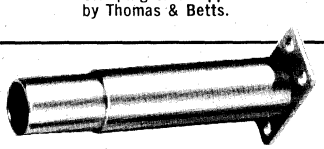




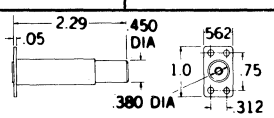
These ADC Coax Jacks feature cable entrances specifically matched to cable diameters. A crimping sleeve is furnished for a solderless shield connection. The retaining nut and internal assembly must be removed to make connections.

*Crimping tool supplied by Thomas & Betts.

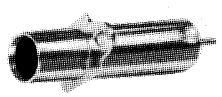
Part No. .090 Pin	Part No. .078 Pin	Use With Cable	Impedance	For Crimp Solderless Shield Termination — Use Tool Number*
CJ-1000	CJ-1100	RG-59	75 ohms	WT-412
CJ-1002	CJ-1102	RG-58	50 ohms	WT-412
CJ-1003	CJ-1103	RG-187	75 ohms	WT-402
CJ-1004	CJ-1104	RG-188	50 ohms	WT-402
CJ-1006	CJ-1106	RG-178	50 ohms	WT-402
CJ-1017	CJ-1117	WE-724 or Belden-8281	75 ohms	WT-415



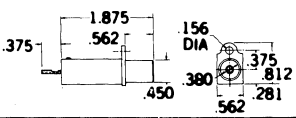
CJ-1008 CJ-1108



This jack is not intended for coaxial terminating. The jack is arranged to solder to the center conductor similar to the CJ-1000 series. No disassembly is necessary to make connections. Similar to WE-498A jack.



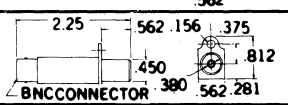
CJ-1010 CJ-1110



Singly mounted with the center conductor projecting beyond the body. The center conductor has a .062 hole x .34 deep and a .05 hole in the frame for solder connections. No disassembly is necessary to make connections. Similar to WE-470B jack.



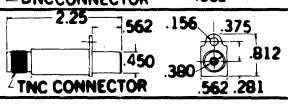
CJ-1011 CJ-1111



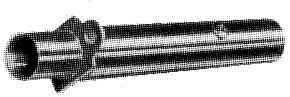
Short body, singly mounted jack with a BNC connector on the rear.



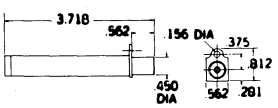
CJ-1012 CJ-1112



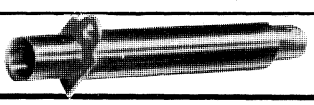
Short body, singly mounted jack with a TNC connector on the rear.



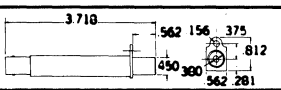
CJ-1013



Single terminating jack with a .156 I.D. cable entrance and shield crimping sleeve provided for solderless connection. Terminating resistor is 75 ohms ± 1%, ¼ watt. The resistor is removed from the circuit when a plug is inserted into the jack.

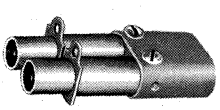


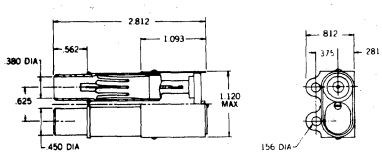
CJ-1015



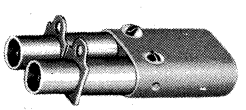
Single terminating jack with a BNC connector on the rear. Same function and usage as CJ-1013.

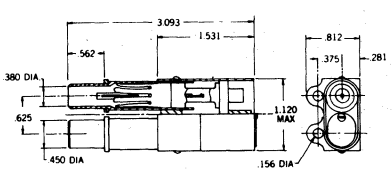
Coaxial Dual Jacks



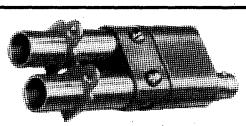


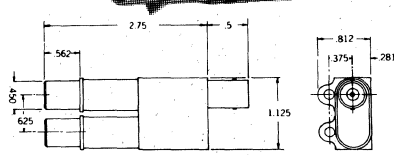
CJ-1005 — Dual Jack with two cable entrance holes (.312 dia.) permitting wiring to one or both of the center conductors. Accessibility is gained by removal of die cast zinc shell. This dual jack may be mounted on ⅝" horizontal centers with mounting lugs side by side or the mounting lugs may be rotated back to back for vertical mounting.



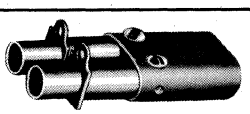


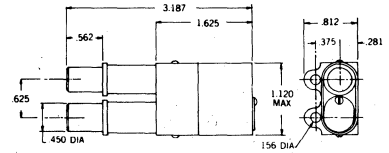
CJ-1009 — Dual jack with two cable entrances provided with crimping sleeves for solderless shield termination. Accessibility to solder center conductor is gained by removing rear half of zinc shell. Mounting lugs may be rotated similar to CJ-1005.





CJ-1014 — Dual paralleling jack with internal connections to facilitate one side to be used as a monitoring point. A BNC connector provides cable attachment to the rear. This jack is intended to be used at frequencies up to 400 MHz.





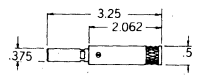
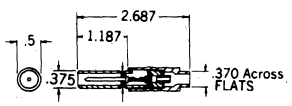
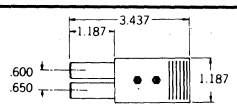
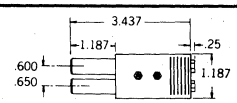
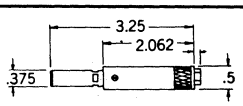
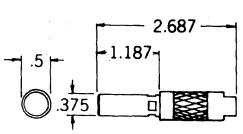
CJ-1016 — Dual paralleling jack designed to allow connections from WE-754E or equivalent, twin lead, shielded cable. Access is gained by removing rear metallic cover.

Coaxial Plugs

COAX plugs are compatible with both Western Electric and RCA types. Single plugs, termination plugs (with built-in resistor and capacitor), looping plugs and looping plugs with pin jacks for monitoring are available. COAX single plugs are made with standard wrench fittings for easy assembly and include a unique cable strain relief clamp. All COAX plugs are manufactured to precision tolerances of ±.002 to assure perfect fit with mating jacks. Chamfered edges on all plugs assure easy insertion.

COAXIAL PLUG SPECIFICATIONS
Outer Conductor: Brass
Finish (Conductor Surfaces): Gold Plating*
Center Conductor — Brass: Gold Plating*
Insulation: Polytetraflorethylene
Handle:
Single and Termination Plugs — Brass Nickel Plated
Looping Plugs — High Impact Resistant Plastic (Implex) Black
Dummy Plugs — Brass — Black Nickel
*MIL-G-45204 Type II

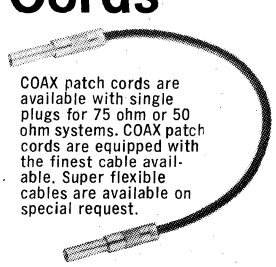


		Coax Plugs	WE Compatible Part Numbers (.090" Dia. Pin)	RCA Compatible Part Numbers (.078" Dia. Pin)	Use With Cable	For Crimp Solderless Shield Termination Use Tool No.*
CP-1040 **CP-1140**	 A terminating plug containing a 30 mmf capacitor and a 75 ohm resistor between the outer and center conductor. Gold contact surfaces and nickel plated handle similar to WE-340C.	Termination	CP-1040 (WE-340C)	CP1140		
CP-1041 **CP-1141**	 A plug cable jacket strain relief and crimped solderless connections, see tab for specific cable matching entrances. Nickel plated plug jacket has two flats for wrench fitting to attach to the outer conductor. Similar to WE-358A.	Single	CP-1041 (WE-358A)	CP-1141	RG58/ RG-59	WT-412
CP-1044 — Same as CP-1041 except made to accommodate RG-187 cable.		Single	CP-1044	CP-1144	RG-187	WT-402
CP-1045 — Same as CP-1041 except made to accommodate RG-188 cable.		Single	CP-1045	CP-1145	RG-188	WT-402
CP-1046 — Same as CP-1041 except made to accommodate RG-178 cable.		Single	CP-1046	CP-1146	RG-178	WT-402
CP-1048 — Same as CP-1041 except made to accommodate WE-724 or Belden 8281 cable.		Single	CP-1048	CP-1148	WE724 Belden 8281	WT415
CP-1042 **CP-1142**	 Looping plug with conductors on ⅝" centers. Internal shield connections feature crimped type solderless connections. The handle is of a high impact black plastic.	Looping	CP-1042 (WE-372A)[3]	CP-1142[3]		
CP-1043 **CP-1143**	 Looping plug with monitor points for the center and outer conductors on the rear of the handle.	Looping with Pin Jacks[1]	CP-1043	CP-1143[3]		
CP-1047 **CP-1147**	 Terminating plug containing a 75 ohm ±1%, ½ watt resistor between outer and center conductor. This plug also features a monitor pin bypassing the resistor to the center conductor.	Termination with Pin Jack	CP-1047	CP-1147		
CP-1049	 Dummy plug with a black nickel plug shell for immediate identification. The plug has the outer conductor only.	Dummy[2]	CP-1049 (WE-339A)	CP-1149		

[1]Same as CP-1042 with pin jacks.
[2]Same as single plug, except without center conductor or insulator.
[3]Both 50 and 75 ohm looping plugs are available. 75 ohm plug to be supplied unless order specifies 50 ohm version.

Coaxial Patch Cords

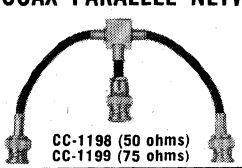
At ADC, workmanship is considered a very important factor since it contributes much to electrical performance of coaxial patching devices. For example, utmost care is taken when attaching the cables to the jacks and plugs since this has an effect on the electrical characteristics. The braided shield of the cable is positioned so as to be evenly distributed around the entire circumference of the shield termination on the jack or plug. The shield termination could be soldered but since heat tends to distort the dielectric in the cable, the use of a crimped on solderless connection for the shield conductor is recommended.



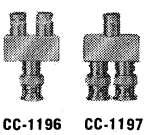
COAX patch cords are available with single plugs for 75 ohm or 50 ohm systems. COAX patch cords are equipped with the finest cable available. Super flexible cables are available on special request.

Length	WE Compatible Part Numbers 75 ohm cable (RG-58U) with CP-1041 plugs	RCA Compatible Part Numbers 50 ohm cable (RG-58U) with CP-1141 plugs	WE Compatible Part Numbers 75 ohm cable (RG-59U) with CP-1041 plugs	RCA Compatible Part Numbers 75 ohm cable (RG59U) with CP-1141 plugs	WE Compatible Part Numbers 75 ohm cable Belden 8281 (Equiv. to WE-724) with CP-1048 plugs
6"	CC-1051	CC-1151	CC-1071	CC-1171	CC-1281
12"	CC-1052	CC-1152	CC-1072	CC-1172	CC-1282
18"	CC-1053	CC-1153	CC-1073	CC-1173	CC-1283
24"	CC-1054	CC-1154	CC-1074	CC-1174	CC-1284
30"	CC-1055	CC-1155	CC-1075	CC-1175	CC-1285
36"	CC-1056	CC-1156	CC-1076	CC-1176	CC-1286

COAX PARALLEL NETWORKS



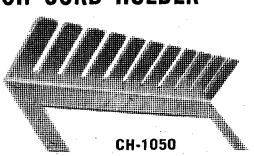
CC-1198 (50 ohms)
CC-1199 (75 ohms)



CC-1196 CC-1197

ADC Parallel Networks are designed for use with CJ-1011 and CJ-1111 or other similar jacks which are terminated in BNC connectors. These networks are used for dividing or paralleling circuits. The CC-1197 network is designed for use between adjacent jacks on ⅝ inch centers.

PATCH CORD HOLDER



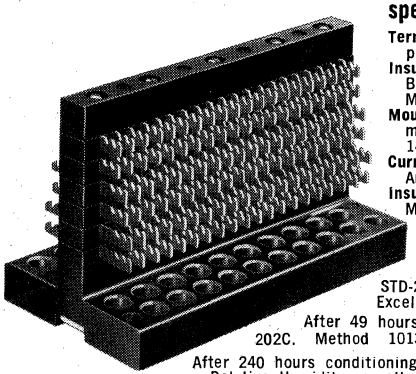
CH-1050

This convenient cord holder will hold up to 50 cords and is designed for wall or rack mounting. Will accommodate patch cords with cable diameters up to .300 inches and plug handles with a minimum diameter of .320 inches The CH-1050 is steel, finished with nickel plating.

Molded Terminal Blocks

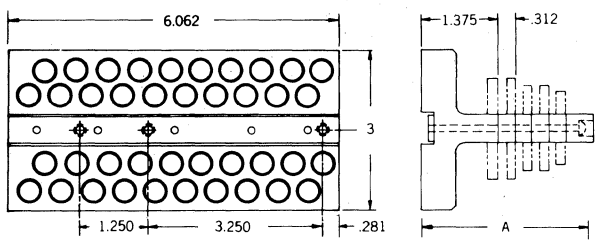
20 pin

Known for their ruggedness, ADC "Christmas Tree" Terminal Blocks have become standards in the Broadcast and Telecommunications Industries. The ADC 20-Pin Terminal Blocks are molded of durable, black, thermo-set plastic per Military specifications MIL-F-14F. Terminals are brass with a tin alloy plating for lasting solderability (see specifications below for details on solderability). The PJ-101 series blocks have terminals graduated in length for ease of wiring. The Figure 2 solderless terminals as furnished on the PJ-161 series blocks are designed to accommodate AMP No. 60197-1 Connectors as supplied by American Pamcor, Inc. or may be used as regular solder terminals. All Terminal Blocks are numbered along the top row for easy terminal identification.



specifications

Terminals: Brass, Tin alloy plated.
Insulating Strips and Base: Black Thermoset plastic per MIL-M-14F, Type CFG.
Mounting Strip: Steel, Cadmium-Chromate per MIL-F-14072, #M262, Type II.
Current Carrying Capacity: 5 Amperes.
Insulation Resistance: 1000 Megohms Min.
Dielectric Strength: 2500 V RMS 60 Hz. between terminals.
Solderability: Per MIL-STD-202C, Method 203A Initial: Excellent (over 95% coverage). After 49 hours salt spray per MIL-STD-202C. Method 1013: good (90% coverage). After 240 hours conditioning at +150 F and 95-98%. Relative Humidity: excellent. After 90 day storage at room temperature: excellent.



Catalog No.				
Terminal Fig. 1	Terminal Fig. 2	No. Rows	No. Terminals	Dim. A
PJ-101	PJ-161	1	20	1.906
PJ-102	PJ-162	2	40	2.250
PJ-103	PJ-163	3	60	2.593
PJ-104	PJ-164	4	80	2.937
PJ-105	PJ-165	5	100	3.281
PJ-106	PJ-166	6	120	3.625
PJ-107	PJ-167	7	140	3.968
PJ-108	PJ-168	8	160	4.312
PJ-109		9	180	4.656
PJ-110		10	200	4.968
PJ-111		11	220	5.281
PJ-112		12	240	5.593

This series of 20-Pin Terminal Blocks is identical to those illustrated above except for mounting details. The PJ-661 and PJ-664 series blocks are specifically intended to be mounted on distribution frames. Mounting brackets are provided for either vertical or horizontal mountings. Add "V" suffix for vertical mounting bracket or "H" suffix for Horizontal bracket. All hardware necessary to mount the blocks and bracket to the main frame are furnished. (Brackets and hardware are packed separately with the terminal blocks.) Both brackets and associated hardware are steel with cadmium-chromate finish per Mil-F-14072, #M262, Type II.

CATALOG NO.			
Fig. 1 Terminal	Fig. 2 Terminal	No. of Rows	Dim A
PJ-661-1	PJ-664-1	1	1.906
PJ-661-2	PJ-664-2	2	2.250
PJ-661-3	PJ-664-3	3	2.593
PJ-661-4	PJ-664-4	4	2.937
PJ-661-5	PJ-664-5	5	3.281
PJ-661-6	PJ-664-6	6	3.625
PJ-661-7	PJ-664-7	7	3.968
PJ-661-8	PJ-664-8	8	4.312
PJ-661-9	PJ-664-9	9	4.656
PJ-661-10	PJ-664-10	10	4.968
PJ-661-11	PJ-664-11	11	5.281
PJ-661-12	PJ-664-12	12	5.593

26 pin

The entire block, fanning strip and separator strips, is molded of durable thermoset plastic per MIL-M-14F specifications. Although primarily used as a "Line Terminal Block" in Central Office applications, these blocks are adaptable to many uses in the broadcast and telecommunications field. The PJ-660 series blocks are supplied with conventional solder terminals (see details regarding solderability). The PJ-665 series provides solderless terminals designed to accommodate AMP 60197-1 connectors (supplied by American Pamcor, Inc.) or may be used as conventional solder terminals if desired.

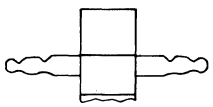


FIG. 1
Solder Type
Mat'l. .040 Thick

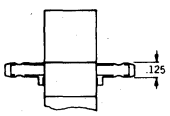
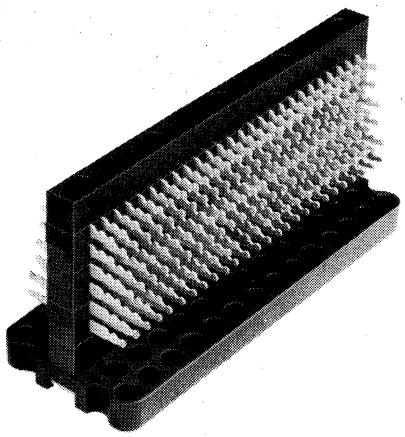
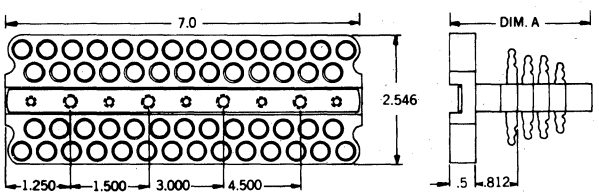


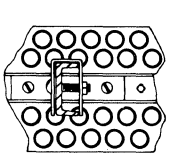
FIG. 2
Solderless or Solder
Mat'l. .032 Thick



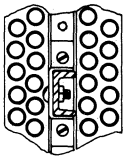


CATALOG NO.			
Fig. 1 Terminal	Fig. 2 Terminal	No. of Rows	Dim. A
PJ-660-1	PJ-665-1	1	1.812
PJ-660-2	PJ-665-2	2	2.125
PJ-660-3	PJ-665-3	3	2.437
PJ-660-4	PJ-665-4	4	2.750
PJ-660-5	PJ-665-5	5	3.062
PJ-660-6	PJ-665-6	6	3.375
PJ-660-7	PJ-665-7	7	3.687
PJ-660-8	PJ-665-8	8	4.000
PJ-660-9	PJ-665-9	9	4.312
PJ-660-10	PJ-665-10	10	4.625
PJ-660-11	PJ-665-11	11	4.937
PJ-660-12	PJ-665-12	12	5.250

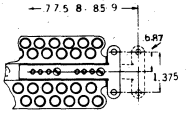
Unless otherwise specified the PJ-660 and PJ-665 Terminal Blocks will be supplied with the mounting strips as shown in the detailed drawings above. Mounting brackets, either horizontal type or vertical type, should be specified separately. All hardware necessary to mount the blocks and brackets to the main frame are furnished. The brackets and hardware are packed separately and included with the Terminal Blocks. Both brackets and associated hardware are steel with cadmium-chromate finish per Mil-F-14072, #M262, Type II.



PJ-660H Horizontal Mounting



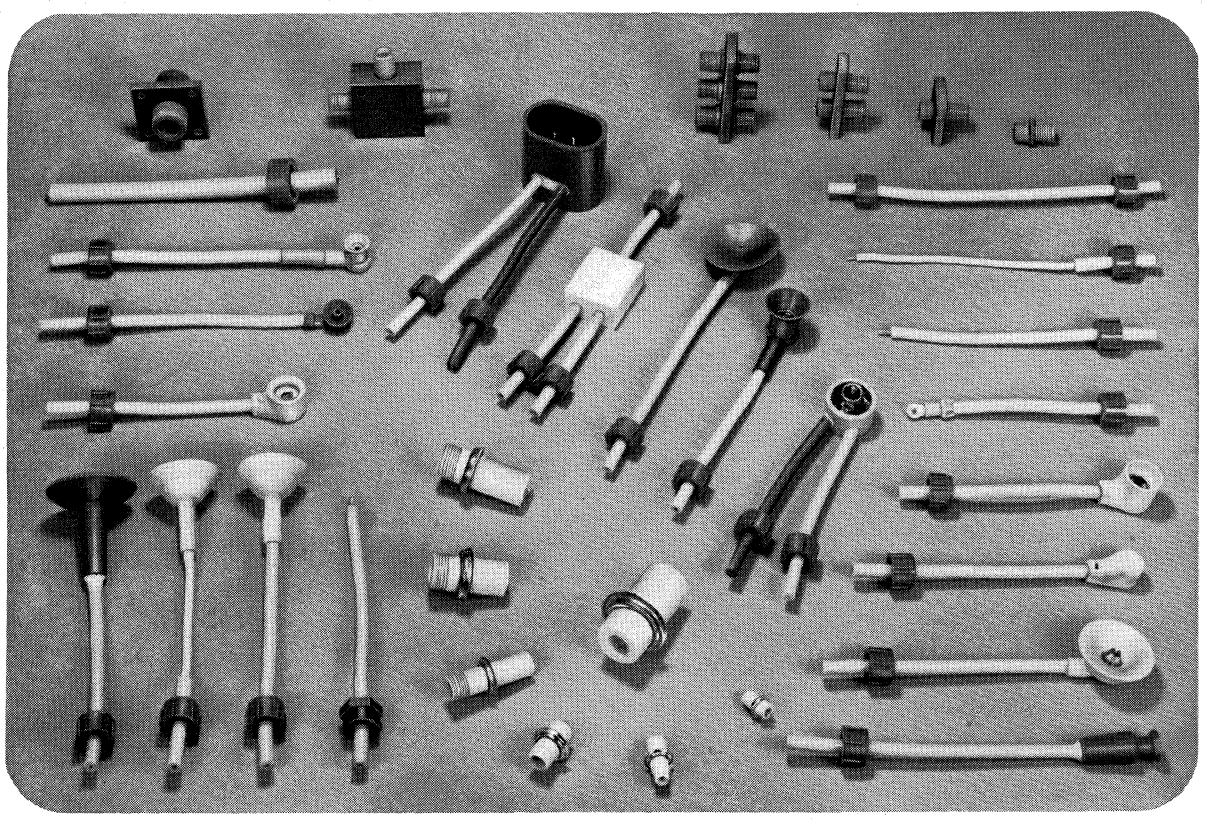
PJ-660V Vertical Mounting



PJ-660-A Adjustable Mounting Brackets

Intended for use with PJ-660 and PJ-665 terminal blocks, these adjustable mounting brackets allow for variable mounting centers of 7", 7½", 8", 8½" and 9". These mounting brackets are to be ordered separately. Both brackets and associated hardware are steel with cadmium-chromate finish per Mil-F-14072, #M262, Type II.

HIGH VOLTAGE LEAD ASSEMBLIES AND RECEPTACLES



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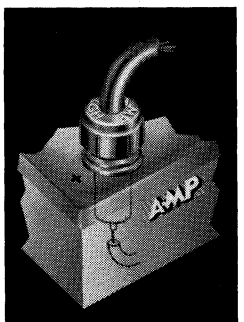
- Lightweight, space saving, safe
- Wide temperature range: −55° C to +125° C (−67° F to +257° F)*
- Voltage ratings: to 50,000 volts DC†
- Easy to install—no tools needed
- Insulation: extruded silicone rubber
- Receptacles: ceramic or glass epoxy
- Quick disconnect
- High dielectric and mechanical strength
- Hermetically sealed and corona-resistant
- High altitude operation: up to 70,000 ft. without derating
- Meet applicable mil. specs. for shock and vibration resistance
- RFI shielding optional

*Higher temperature components up to +200°C (+392°F) on request

†Special designs to 200,000 volts DC on request

NOTE: See other CAPITRON High Voltage products under Catalog Sections 2100 and 4000.



Sizes and Ratings Available

TYPE	DC VOLTAGE Rating**	CURRENT RATING**
LGH ½	6,000	10 amps DC
LGH ½ L	12,000	10 amps DC
LGH 1	12,000	10 amps DC
LGH 1 L	25,000	10 amps DC
LGH 2	25,000	10 amps DC
LGH 3	35,000	10 amps DC
LGH 4	50,000	10 amps DC

**Peak AC and peak pulse voltage ratings will be somewhat less than DC ratings. Current rating is limited to 7.5 amps AC rms, 60 cycles.

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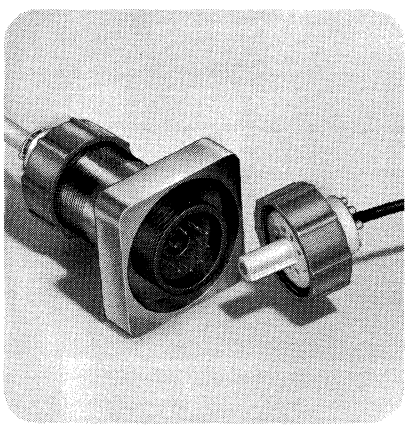
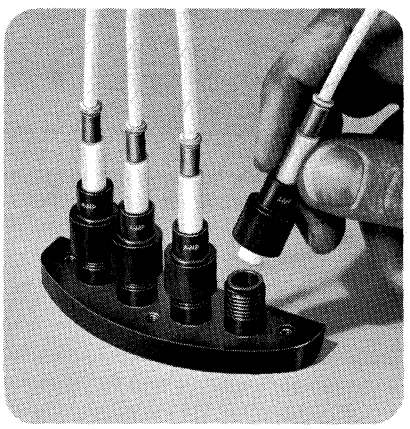
WJH* Connectors eliminate glass or ceramic insulators

10 PIN CONNECTOR

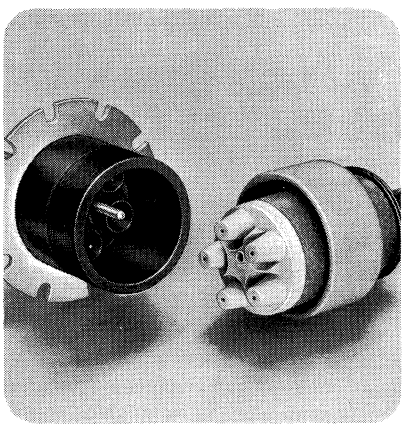


25,000 Volts D.C. center conductor and 9 low voltage pins



15,000 Volts D.C. Bulkhead Connector

5 PIN CONNECTOR



40,000 Volts D.C. Solder or "O" Ring Mounting

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- Fast connect and disconnect
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- Positive mating of lead into receptacle
- R F I shielding—optional
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- High altitude operation—up to 80,000 feet without voltage derating
- Excellent mechanical strength—resistant to vibration and shock
- High dielectric strength
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- Radiation resistant
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NOTE: See other CAPITRON High Voltage products under Catalog Sections 1500 and 4000.

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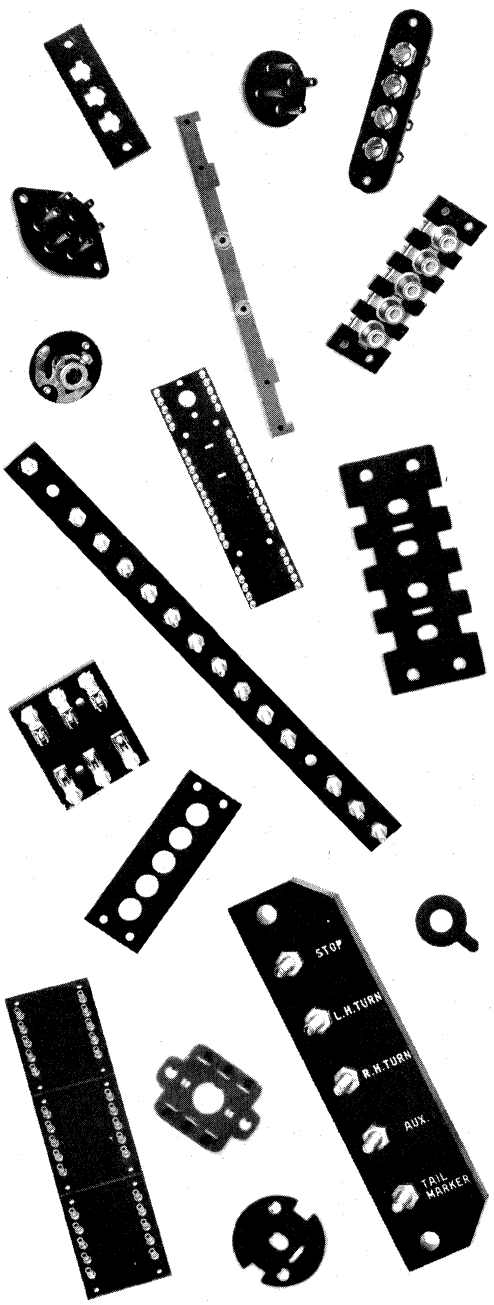

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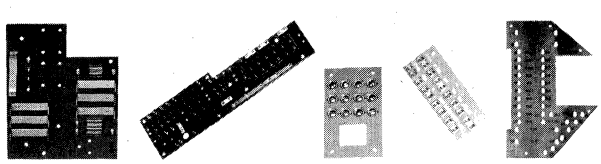

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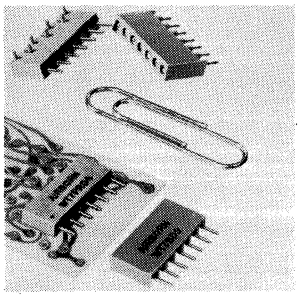
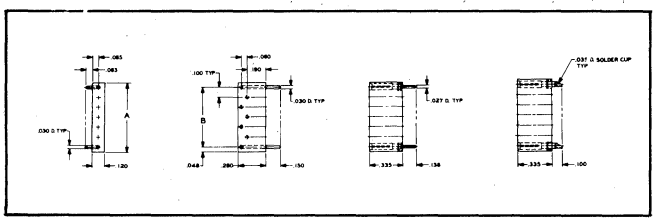
AirBorn Connectors

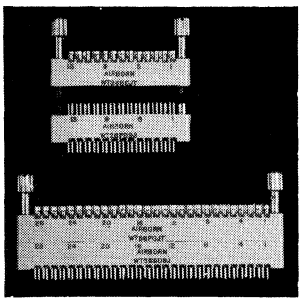


SERIES WT SUBMINIATURE, RIGHT ANGLE

plug, in-line receptacle with .100" centers, for PC card to mother board or cable, or cable to cable. Series features .030" dia. BeCu contacts.

Sizes: 7, 10, 12 (Check avail. 10, 12)

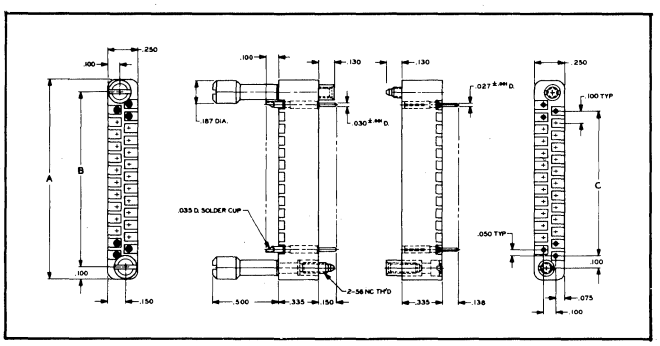


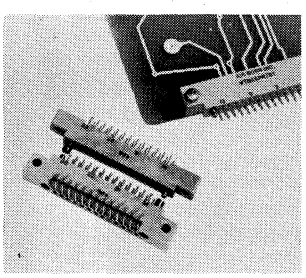


SERIES WTA SUBMINIATURE, RECTANGULAR

plug and receptacle, .100" centers, 2 rows, offset .050", for input/output connectors, cable to PC board, and cable to panel. BeCu contacts, .030" dia.

Sizes: 10, 14, 20, 24, 26, 30, 36, 40, 44, 50, 54, 56, 60, 66, 70.

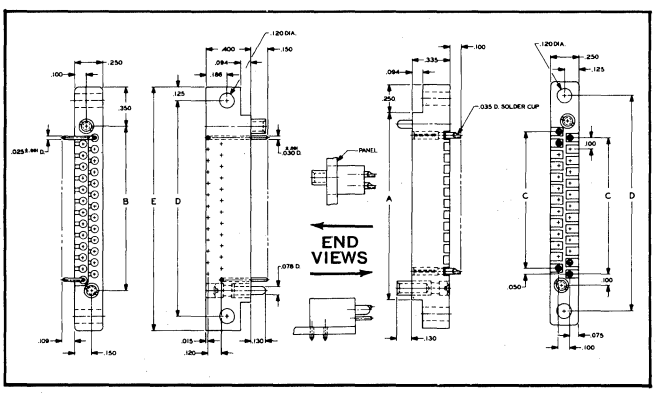


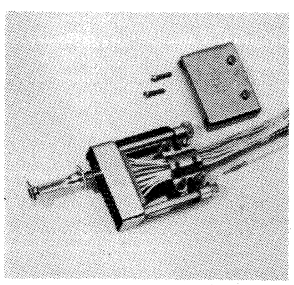


SERIES WTB SUBMINIATURE, RIGHT ANGLE

PC board connector for panel or mother board, with .100" centers, 2 rows, offset .050". Series features .030" dia. BeCU contacts.

Sizes: 10, 14, 20, 24, 26, 30, 36, 40, 44, 50, 54, 56, 60, 66, 70.

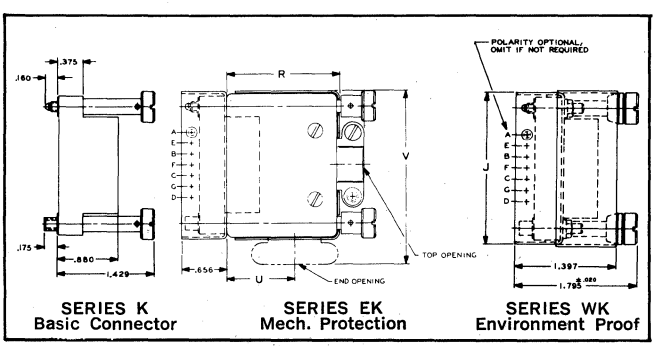


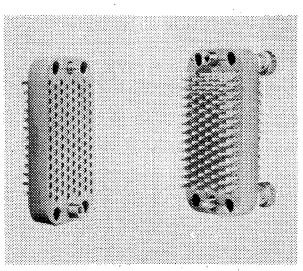


SERIES K, EK, WK CRIMP, REMOVABLE CONTACTS

50 lb. minimum resistance to push out. Stainless steel shells, mounting plates, and split hoods optional.

Sizes: 18, 34, 42, 50, 66, 75, 104.

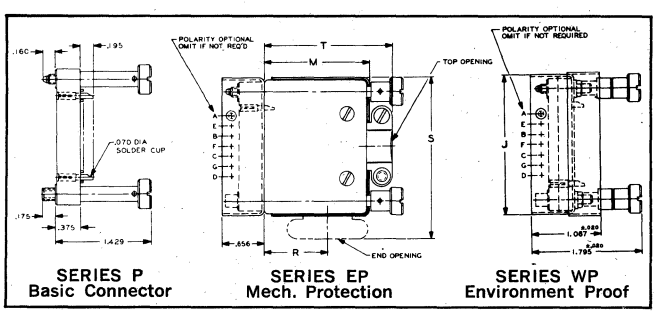




SERIES P, EP, WP SOLDERCUP CONTACTS

retained in molding. Rugged .0625 dia. pins. Stainless steel shells, mounting plates, and split hoods optional.

Sizes: 14, 20, 34, 42, 50, 50-8, 66, 75, 104.



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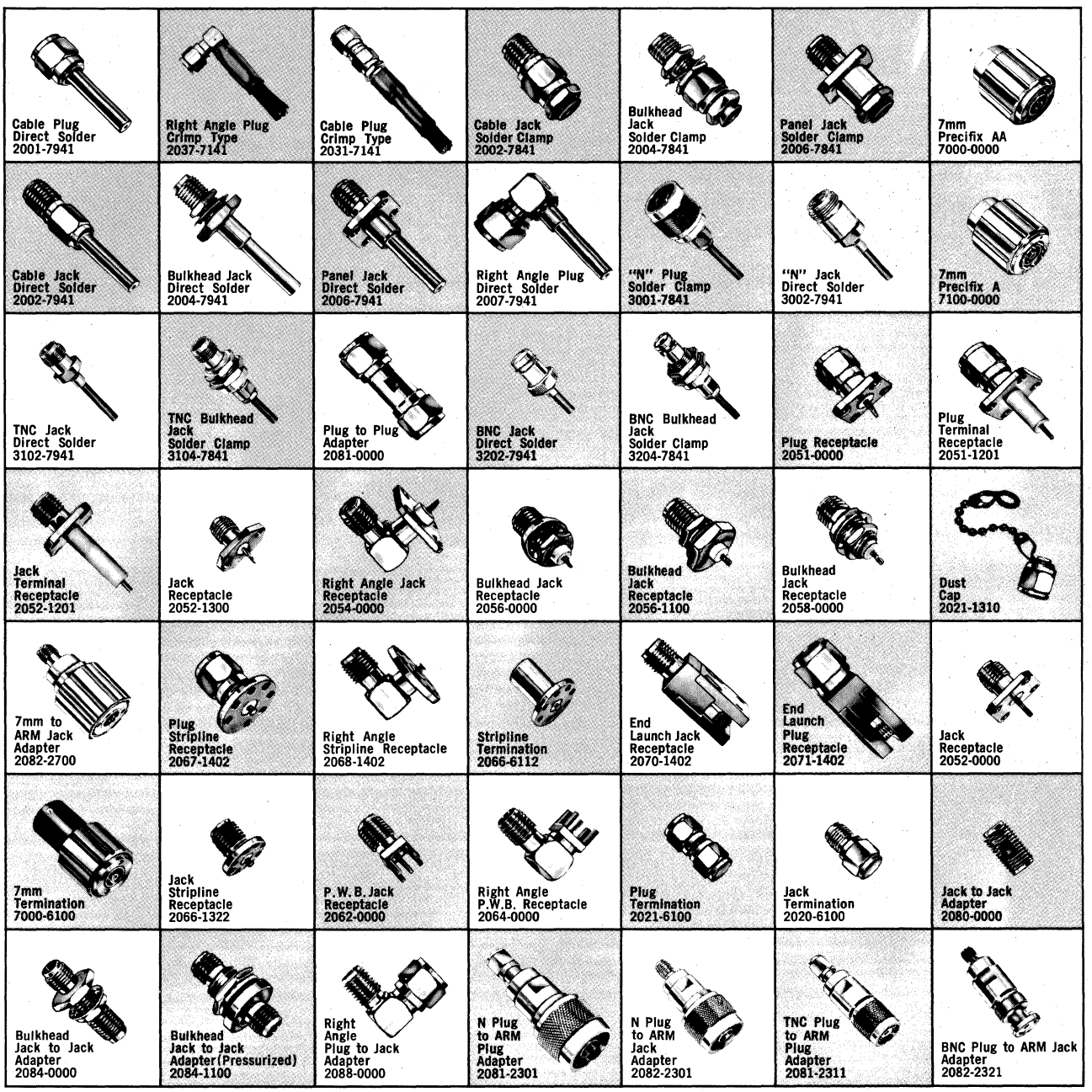

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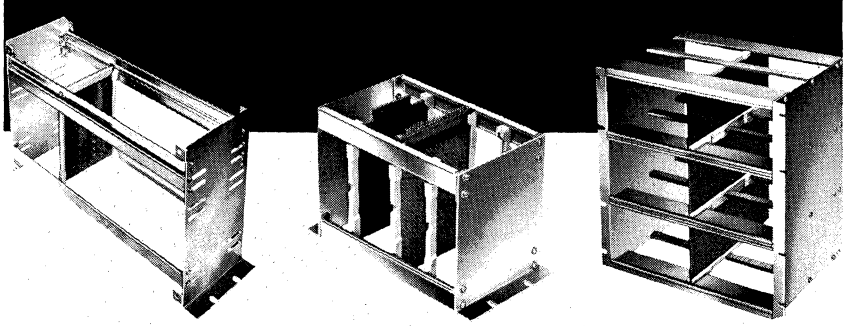

VERSA-RAK

Order this one when p.c. board size has not been finalized or varies from application to application. Choice of two sizes of side plates and p.c. board holders permits mounting up to 33 boards from 2" to 6¼" wide and from 4" to 9" long. Spacing is ½" on centers or any ⅛" increment over ½". Numbered "V" slots for accurate alignment. Very versatile, rapid assembly.

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Same board spacing as Versa-Rak . . . but YOU specify overall size to meet mounting needs (i.e. number of boards, board width, length). P.c. board holders available with and without connector mounting feet. Connectors can be mounted at flange end or opposite to flange end of Rak. Rapid assembly. Numbered "V" slots for accurate alignment. Center support rail for long boards.

STACK-RAK

Available in single, dual and multiple stack units to mount large numbers of boards in limited space. You specify overall dimensions for number and size of boards to be mounted. Each stack can mount different size boards. Board spacing is .4" on centers or any .1" increment over .4". Connectors can be mounted at either end of Rak. Rapid assembly . . . extra rugged construction.

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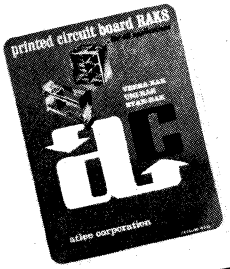

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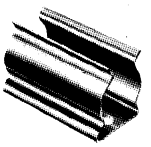
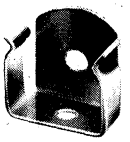


COMPONENT HOLDERS



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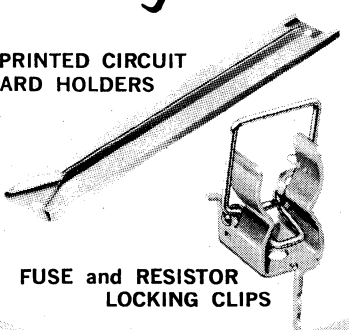

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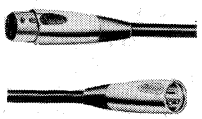
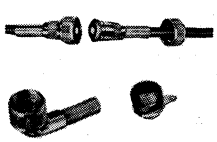


Description	3 Contacts	4 Contacts
Plug, Pin Contacts	91-853	91-857
Jack, Socket Contacts	91-854	91-858
Chassis Recept., Pin Contacts	91-855	91-859
Chassis Recept., Socket Contacts	91-856	91-860

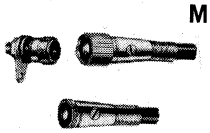
Series 75

Bright chrome finish. Threaded coupling and unique button contact permits plugs to be converted to jacks by removal of coupling ring. Receptacles mount in .385" holes when grounding. .500" holes for ungrounded two circuit operation.



Description	Part No.
Chassis Receptacle	75-PC1M
Chassis Receptacle, Closed Circuit	75-CL-PC1M
Straight Plug	75-MC1F
Cable Jack	75-MC1M
Angle Plug	75-MC1FA
Cap & Chain	75-CCC1
Phone Plug Adapter	75-MC1P
Microphone Switch	75-MC1S

Miniature 75 Series

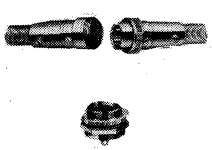


Miniature version of the above, receptacle mounts in 13/64" chassis hole.

Description	Part No.
Plug	75-1
Jack	75-2
Receptacle	75-3

Series 80

Single and Double Contact. Receptacles mount in 5/8" chassis hole with maximum panel thickness of 11/32".

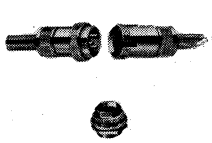


Description	1 Contact	2 Contacts
Plug, Pin Contacts	80-M	80-MC2M
Plug, Socket Contacts	80-F1	80-MC2F1
Jack, Socket Contacts	80-F	80-MC2F
Jack, Pin Contacts	80-M1	80-MC2M1
Recept., Socket Contacts	80-C	80-PC2F
Recept., Pin Contacts	80-C1	80-PC2M
Cap & Chain for Recept.	75-CCC1	75-CCC1

Series 91

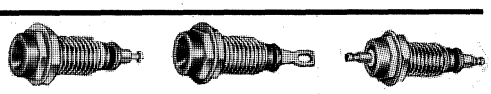
Panel 1/8" thick, maximum. Receptacles mount in 27/32" hole.

THREADED COUPLING—Pin Contacts. One to Six Contact Mike Connectors. Sturdy, reliable, attractive chrome finish.



Description	3 Contacts	4 Contacts	6 Contacts
Plug, Pin Contacts	91-MC3M	91-MC4M	91-MC6M
Plug, Socket Contacts	91-MC3F1	91-MC4F1	—
Jack, Socket Contacts	91-MC3F	91-MC4F	91-MC6F
Jack, Pin Contacts	91-MC3M1	91-MC4M1	—
Recept., Socket Contacts	91-PC3F	91-PC4F	91-PC6F
Recept., Pin Contacts	91-PC3M	91-PC4M	—
Cap & Chain for Recept.	91-CCC3	91-CCC3	91-CCC3

Tip Jacks



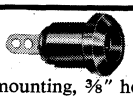
Nylon body with recessed silver plated contact. Tinned terminal. 1/4" mounting hole. Add suffix to catalog number to indicate color.

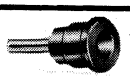
350-29175-* Turret Terminal
350-29200-* Spade Terminal
350-50200-* Feed-thru

**Suffix Color Numbers.*

-1 Red	-9 Pink
-2 Black	-10 Lt. Blue
-3 Brown	-11 Lt. Green
-4 Green	-12 Buff
-5 Orange	-13 Yellow
-6 White	-14 Natural
-7 Blue	-15 Violet
-8 Gray	

Test Jacks





Retainer ring mounting, 3/8" hole.

Test Jack Black	Test Jack Red	Contact Diameter	Mating Plug Black	Mating Plug Red
78-1S	78-1S-1000	3/32"	71-1S	71-1S-1000
78-1M	78-1M-1000	5/32"	71-1M	71-1M-1000
78-1L	78-1L-1000	1/8"	71-1L	71-1L-1000
78-1P	78-1P-1000	.080"	For .080" Phone Tip	

Miniature Cable Connectors

Black phenolic dielectric in cadmium plated brass shell. Polarized contact spacing. Plugs and receptacles take cables up to 1/4" diameter. Panel receptacle mounts in 7/8" hole with two 6-32 screw holes on 1 1/4" centers.

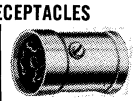
PLUGS





Contacts	Long	Short
3	91-MPM-3L	91-MPM-3S
4	91-MPM-4L	91-MPM-4S
5	91-MPM-5L	—
6	91-MPM-6L	—

CABLE RECEPTACLES



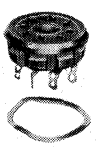


PANEL RECEPTACLE



Contacts	Long	Short	Mates With Long Plugs
3	91-MPF-3L	91-MPF-3S	78-PCG3
4	91-MPF-4L	91-MPF-4S	78-PCG4
5	—	—	78-PCG5
6	—	—	78-PCG6

Tube Sockets



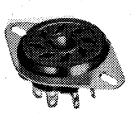
S TYPE

Retainer ring mounting. Black Phenolic and Mica Filled Phenolic. For 22 gauge (.031") to 18 gauge (.050") panel thickness. May be grooved on special order up to 13 gauge (.093"). Steatite fits .031" to .093" panels.

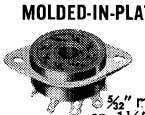
Contacts	Mtg. Hole Diameter	Black Phenolic	Mica Filled	Steatite
4	1 3/16"	78-S4	—	49-SS4
5	1 3/16"	78-S5	—	49-SS5
6	1 3/16"	78-S6	—	49-SS6
7	1 3/16"	78-S7S	—	49-SS7S
7 Large	1 9/32"	—	—	49-SS7L
8 Octal	1 3/16"	78-S8	78-S8T*	49-SS8
8 Loctal	1 3/16"	78-S8L	—	—
9	1 3/16"	78-S9	—	—
11	1 3/16"	78-S11	78-S11T*	—
12	1 3/16"	78-S12	—	—
16	1 3/32"	78-S16	—	—
20	1 5/16"	—	—	—

RS TYPE

Same as Type S, but with mounting plate assembled with retainer ring. Mounting plate slotted holes for 1 1/2" to 1 55/64" centers. Use 6-32 screw.



MOLDED-IN-PLATE TYPE



5/32" mtg. holes on 1 1/2" centers

Contacts	Black Phenolic	Mica Filled	Steatite #	Black Phenolic	Mica Filled
4	78-RS4*	—	49-RSS4	77-MIP-4	77-MIP-4T*
5	78-RS5*	—	49-RSS5	77-MIP-5	77-MIP-5T*
6	78-RS6	—	49-RSS6	77-MIP-6	77-MIP-6T*
7	78-RS7S	—	49-RSS7S	77-MIP-7S	77-MIP-7ST
7 Large	—	—	49-RSS7L	77-MIP-7L	—
8 Octal	78-RS8*	78-RS8T*	49-RSS8	77-MIP-8	77-MIP-8T*
8 Loctal	78-RS8L	—	—	—	—
9	78-RS9	—	—	77-MIP-9	77-MIP-9T
11	78-RS11	78-RS11T*	—	77-MIP-11	77-MIP-11T*
12	—	—	—	77-MIP-12	77-MIP-12T*
16	78-RS16	—	—	—	—
20	—	—	—	77-MIP-20	—

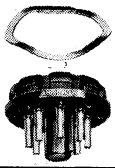
** Military version available with silver plated contacts and, where applicable, stainless steel mounting plate. Add suffix "M" to catalog number. Example: 77-MIP-8TM.*

 # Bottom mounted, requires 1 1/4" chassis holes; 7L requires 1 3/8".

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Plugs*



CP TYPE
Use with steel caps shown below, bottom right; or mount on panel with retainer ring. Same grooves as 78S tube sockets.



REPLACEMENT TYPE
Removable plate.



SPEAKER
For cable mounting only.

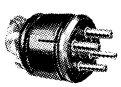
Contacts	Black Phenolic	Mica Filled	Black Phenolic	Black Phenolic
4	86-CP-4	—	86-RCP-4	71-4
5	86-CP-5	—	86-RCP-5	71-5
6	86-CP-6	—	86-RCP-6	71-6
7	86-CP-7S	—	86-RCP-7S	71-7
7 Large	86-CP-7L	—	86-RCP-7L	—
8 Octal	86-CP-8	86-CP-8T	86-RCP-8	70-8
9	86-CP-9	86-CP-9T	86-RCP-9	70-9
11	86-CP-11	86-CP-11T	86-RCP-11	—
12	86-CP-12	—	86-RCP-12	70-12
16	86-CP-16	—	—	—
20	—	—	—	70-20

**Mate with Tube Sockets on previous page.*

Light Duty Connectors**

Rubber Grommet





Cable Clamp

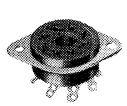
Contacts	Pin Contacts	Socket Contacts	Pin Contacts	Socket Contacts
4	86-PM4	78-PF4	86-PM4-11	78-PF4-11
5	86-PM5	78-PF5	86-PM5-11	78-PF5-11
6	86-PM6	78-PF6	86-PM6-11	78-PF6-11
7	86-PM7S	78-PF7S	86-PM7S-11	78-PF7S-11
—	—	—	—	—
8	86-PM8	78-PF8	86-PM8-11	78-PF8-11
9	86-PM9	78-PF9	86-PM9-11	78-PF9-11
11	86-PM11	78-PF11	86-PM11-11	78-PF11-11
12	86-PM12	—	86-PM12-11	—
—	—	—	—	—
20	86-PM20	—	—	—

*** For cable to cable application, mate with each other. For cable to panel applications, mate with type S, RS, and MIP tube sockets.*

Compact MIP

1⅛" mounting hole. Two .136" screw holes on 1-5/16" centers. 8 contacts only.

88-8	Octal, Black Phenolic
88-8T	Octal Mica Filled Phenolic
88-8TM	Octal Mica Filled Phenolic with silver plated contacts and stainless steel mounting plate
88-8X	Loctal. Black Phenolic



Saddle Sockets

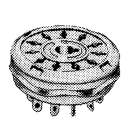
8 contact octal with 4 ground lugs.

168-001	Wrap around contacts
168-015	Tuning fork contacts



Steatite Magnal Socket

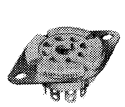
49-SS11L	11 contacts for TV or CRT. Retainer ring mounted in 1⅝" chassis hole. 1⅛" pin circle



Transmitting Tube Socket

Steatite, with mounting plate.

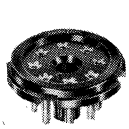
148-101	4 contacts, two small, two large



Tube and Relay Bases

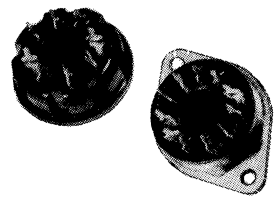
Black Phenolic.

50-801	Octal	.687 Pin Circle
50-820	11 contact	.750 Pin Circle



Printed Circuit Sockets

Standard socket series 77MIP and 78S of eight or more contacts for mounting directly to printed circuit boards. Contact tails are ⅛" long and mount through 1/16" diameter holes.

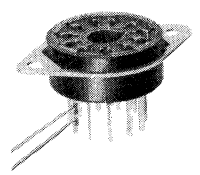


To Order:

Add suffix -WO125 to part number, i.e. 77MIP(X)-WO125 or 78S(X)-WO125.

Wire Wrap Sockets

Standard socket series 77MIP and 78S of eight contacts or more have ½" long contact tails for wire wrap termination.



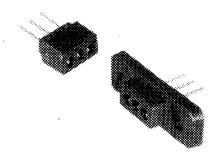
To Order:

Add suffix -WO500 to part number, i.e. 77MIP(X)-WO500 or 78S(X)-WO500.

SCR Sockets

Three contact receptacle designed to accept General Electric Company's C106 SCR (Silicone controlled rectifier). Nickel silver contacts. Black nylon insulator. Voltage rating: 500 volts RMS. Current rating: 5 amps. Contact spacing: .200" centers. Mating engagement depth: .160" min. Contact length: Approximately .323" x .020" square. Contact tails designed for wire wrap or printed circuit board mounting.

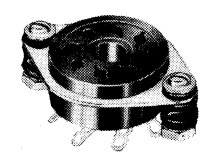
77-115	Press fit style without flange. To fit rectangular panel or chassis cut dimensions .340" x .164", .330" x .161".
77-116	Mounting flange style. Molded mounting flange has two .125" diameter mounting holes on .625" centers. Assembly fits rectangular panel or chassis cut-out .325" x .200".



Floating MIP Sockets

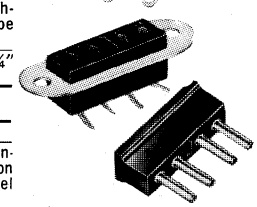
For vibration-free operation.

77-MIP-8FK	Octal. Complete with 4 rubber grommets, 2 mounting screws, nuts and washers
77-3K	Kit for making any "MIP" into floating socket. 4 grommets, 2 mounting screws, nuts and washers. MIP screw holes must be enlarged to ¼" diameter
77-MIP-8F	Same as 77-MIP-8, but with ¼" mounting holes



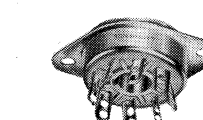
Rectangular Connector

70-26	4 contact cable plug
77-26	4 contact receptacle, molded-in-plate, two 5/32" screw holes on 1⅜" centers. 5/16" x 1 1/16" panel cutout



MIP, Cloverleaf Contacts

59-103	Octal. Same dimensions as standard MIP, stainless steel mounting plate, cloverleaf contacts hot tinned dipped



Grid Cap

63-1	For tube grid caps, ¼" to ⅜" diameter



Duodecal Socket

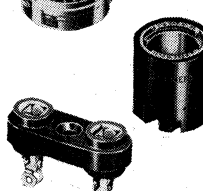
59-402	For CRT with maximum of 12 contacts equally spaced on 1.063" pin circle



Lamp Socket

For medium base pre-focused lamps. 1000 watts, 110/250 volts, UL approved.

98-8	Phenolic, to 450°F.
98-1	Steatite, to 1800°F.



Crystal Holder Sockets

Two contacts, ¾" centers for ⅛" prongs.

33-2	Black Phenolic
33-2T	Mica Filled Phenolic

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Miniature Sockets

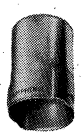


Mounting	Mounting Hole	Rivet Hole Centers With Tube
7 Pin Socket	5/8"	7/8"
9 Pin Socket	3/4"	1 1/8"

Contacts	Dielectric	Rivet Holes	Center Shield	Standard Bottom Mtd.	Shield Base Top Mtd.
7	Bakelite	.095	Large	147-500	147-905
7	Bakelite	.095	None	147-504	—
7	Mica Filled	.095	Small	147-505	147-913
7	Mica Filled	.125	Small	—	147-916
9	Bakelite	.095	Large	59-409	59-406
9	Mica	.095	Large	59-410	59-407
9	Mica	.125	Large	—	59-403

Tube Shields

Internal spring holds tube securely.



	Miniature Tube	Maximum Tube Length
5-401	7 Pin	1 3/16
5-402	7 Pin	1 3/4
5-405	9 Pin	1 1/2
5-408	9 Pin	1 15/16
5-409	9 Pin	2 3/8

Miniature Plugs

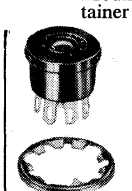


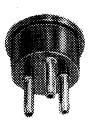
Mates with 7 and 9 pin miniature sockets. Diallyl Phthalate. Gold over silver plated contacts. Molded-in strain relief post. 1500 V RMS at 5 Amps.

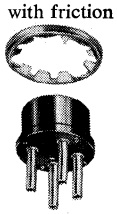
	7 Pin	9 Pin
Plug	86-896	86-893
Plug with rubber cap	86-895	86-897
Plug with rubber cap, side outlet	86-894	—

Miniature Speaker, Plugs & Receptacles

Mounts in 5/8" hole, round or D, with friction retainer ring.







Contacts		Mates With 78-SXS at Left	Mates With 78-SXS at Left
3	78-S3S	71-3S	86-CP-3S
4	78-S4S	71-4S	86-CP-4S
5	78-S5S	71-5S	86-CP-5S
6	78-S6S	71-6S	86-CP-6S
7	78-7P		

Caps



Rubber Grommet



Side Outlet Rubber Grommet

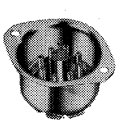


Cable Clamp

Makes inexpensive cable connectors of standard sockets, plugs and receptacles such as 78, 60, 61, 86 and 160 Series.

Finish: Black Japan	Finish: Clear Cadmium	Cable Outlet	Maximum Cable O.D.
3-10	—	None	Dust Cap
3-12	—	Metal	5/16"
3-13	3-857	Rubber	7/16"
3-17	—	Side, Rubber	7/16"
3-24	3-856	Cable Clamp	3/8"

Recessing Shells

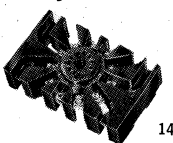


For use with 78S, 86CP, 60, 61 and 160 Series plugs and sockets.

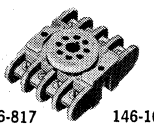
23-1S Aluminum. Raise or recess 13/16". 1 3/4" mounting hole, uses 3 No. 6 screws.

61-61 Cadmium plated steel. Recesses unit 13/16". Mounts in 1 7/16" hole. Two 5/32" mounting holes on 1 3/4" centers.

Relay Sockets/Industrial Tube Sockets



146-817



146-103



59-470



59-106

Heavy duty octal socket with barrier-protected screw type terminals. 1250 VRMS at 5 amps.

Top Mounting	8 Contact Octal: Two .156 mtg. holes on 1.688 centers	Bottom Mounting
146-103 146-104	No Tie Points With 4 Tie Points	146-203 146-204

11 Contacts Two .156 mtg. holes on 4.187 centers

146-817 With solderless reversible screw terminals. 600 VRMS at 10 Amps. May be gang mounted.

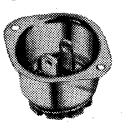
14 & 20 Contacts Relay Sockets

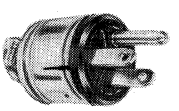
59-106 — 14 Contact

59-470 — 20 Contact

110/220 Volt Plugs and Receptacles

Black phenolic. UL Approved except for 160-10 & 160-11. Used with Series 3 steel caps, 23-1S & 61-61 mounting plates.





Mounting	2 Pole 15 Amp. 125 Volts Plug Polarized	2 Pole 15 Amp. 125 Volts Receptacle	2 Pole With Ground 15 Amp. 125 Volts Plug	2 Pole With Ground 15 Amp. 125 Volts Receptacle	3 Pole 15 Amp. 125 Volts Plug	3 Pole 15 Amp. 125 Volts Receptacle
Retainer Ring	61-M	61-MP	61-F	160-11	160-10	60-M	60-F
Mounting Plate and Retainer Ring	61-M1	61-MP1	61-F1	160-3	160-2	60-M1	60-F1
Molded-in-Plate	—	—	61-MIP-61F	—	—	—	—
Recessed Housing	61-M10	61-MP10	61-F10	160-5	160-4	—	—

With Steel Cap for Cable

Rubber Grommet	61-M4	61-MP4	61-F4	160-7	160-6	60-M4	60-F4
Cable Clamp	61-M11	61-MP11	61-F11	160-9	160-8	60-M11	60-F11

Heavy Duty Side Mount Socket



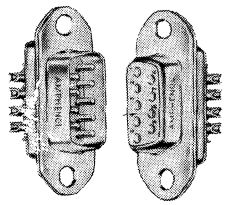
AMPHENOL Number	With Retaining Clip	With Terminal Block	With Bottom Cover	With Underwriter's Shield	For Super Jumbo 4-pin Tubes	For UX4-pin Tubes
146-105	X		X		X	
146-106	X				X	
146-107	X	X	X		X	
146-109						X
146-110				X		X

NOTE—Bottom Cover 146-910 may also be used with 146-109 and 146-110 sockets.

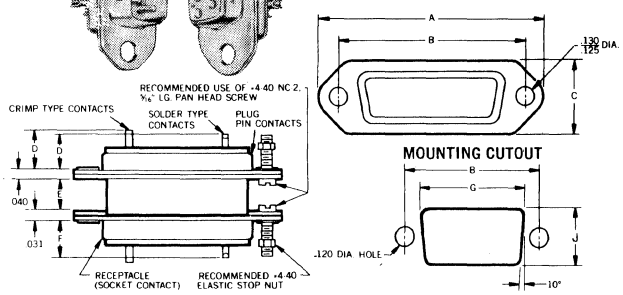
AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MinRac 17 Connectors 17 Series



MINIATURE RACK AND PANEL POKE-HOME CONTACTS CHOICE OF DIELECTRICS— DIALLYL PHTHALATE, ZYTEL, OR GLASS HERMETIC



A complete line of versatile lightweight rack and panel miniature connectors with 9 to 50 contacts. Trapezoidal shell polarizes the connector and insures proper mating with existing trapezoidal connectors. Poke-Home contacts permit soldering or crimping away from the connector (where there is room to work) and allows contacts to be recircuited at any time. Contacts are gold over silver plate and are rated 5 amperes.

Dimension Information

CONNECTOR DIMENSIONS

Contacts	A	B	C	D Crimp	D Solder
9	1 13/64	.984	31/64	21/64	17/64
15	1 17/32	1.312	31/64	21/64	17/64
25	2 5/64	1.852	31/64	21/64	17/64
37	2 23/32	2.500	31/64	21/64	17/64
50	2 5/8	2.406	39/64	21/64	17/64

CUTOUT DIMENSIONS

Contacts	E	F Crimp	F Solder	G	B	J
9	15/64	11/32	9/32	.787	.984	.458
15	15/64	11/32	9/32	1.115	1.312	.458
25	15/64	11/32	9/32	1.654	1.852	.458
37	15/64	11/32	9/32	2.302	2.500	.458
50	15/64	11/32	9/32	2.208	2.406	.564

Ordering Information

WITH CLEAR CHROMATE CONVERSION FINISH

	ZYTEL 101 DIELECTRIC Crimp Contacts	ZYTEL 101 DIELECTRIC Solder Cup Contacts	DIALLYL PHTHALATE Crimp Contacts	DIALLYL PHTHALATE Solder Cup Contacts
Plugs	17-20XX0-1	17-20XX0	17-70XX0-1	17-70XX0
Receptacles	17-10XX0-1	17-10XX0	17-60XX0-1	17-60XX0
Receptacles, With .030 Float Bushings	17-10XX0-6	17-10XX0-5	17-60XX0-6	17-60XX0-5
WITH GOLD IRIDITE FINISH				
Plugs	17-21XX0-1	17-21XX0	17-71XX0-1	17-71XX0
Receptacles	17-11XX0-1	17-11XX0	17-61XX0-1	17-61XX0
Receptacles, With .030 Float Bushings	17-11XX0-6	17-11XX0-5	17-61XX0-6	17-61XX0-5
	↑	↑	↑	↑

NUMBER OF CONTACTS

Replace XX with 09, 15, 25, 37 or 50 to indicate the number of contacts.

Hermetically Sealed Plugs

Contacts are fused within a single piece glass preform. Identoseal contact marking. Leakage rate is less than 0.1 micron cubic foot of helium per hour with one atmosphere differential. Tin over cadmium plated shell. Available in all pin contact configurations.
Flattened and Pierced Contacts 17-52XX0-3
Solder Cup Contacts 17-52XX0-4

Cable Application Accessories

Cable Clamps—For use with plugs and receptacles in cable-to-panel and cable-to-cable applications. Eliminates strain on wire terminations.
Locking Devices—Eliminates possibility of accidental disconnection. Spring latch is a swivel spring that is used with the cable clamps above. Screw latch is used with or without a cable clamp in a semi-permanent termination.

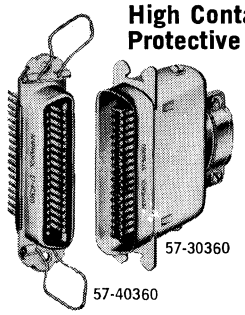
Contact Size	Cable Clamp Clear Chromate	Cable Clamp Gold Iridite	Spring Latch Locking Device Clear Chromate	Screw Latch Locking Device Clear Chromate
9	17-310-01	17-310-02	17-529	17-768
15	17-311-01	17-311-02	17-529	17-768
25	17-312-01	17-312-02	17-529	17-768
37	17-313-01	17-313-02	17-529	17-768
50	17-314-01	17-314-02	17-770	17-768

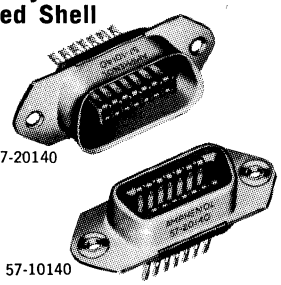
Tools

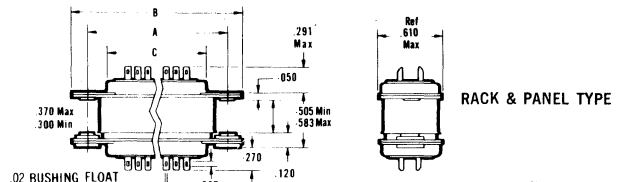
Contact Crimping Tool	294-136
Insertion and Removal Tool	294-155

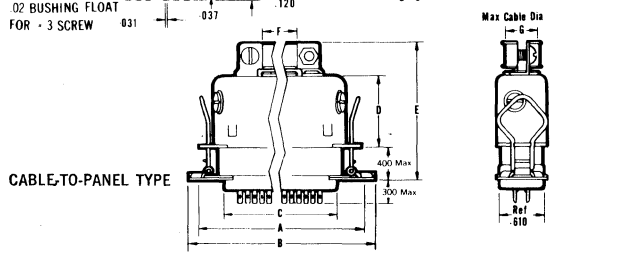
Micro Ribbon Connectors 57 Series

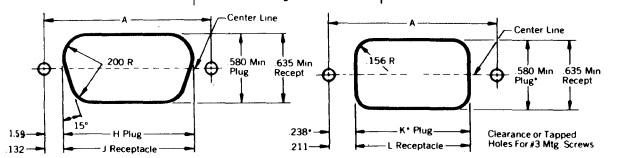
High Contact Density—14 to 50 Contacts Protective Polarized Shell











CUTOUT—BOTTOM MOUNTING for rack and panel type only

CUTOUT—TOP MOUNTING for both types

All of the advantages of ribbon contacts apply to Micro Ribbon Connectors. This includes the self-cleaning, self-wiping action of the contacts and extremely low insertion and withdrawal forces. Dielectric is improved diallyl phthalate with high impact strength and low moisture absorbency characteristics. Trapezoidal shells provide polarization. and are made of zinc plated brass with a clear chromate conversion seal. Small size makes the Amphenol Micro Ribbon Connector ideal for high density miniature modules as well as rack and panel applications. Connectors may be top or bottom mounted. Rated 700V DC at sea level; 200V DC at 70,000 feet.
Rack and Panel and Module Applications. Receptacle mounting plate includes float bushings to allow a float of .020 in each direction. This facilitates blind mating and minimizes the need for critical mounting dimensions.
Cable-To-Panel Applications. Panel receptacles are equipped with sturdy spring latches which are guided and retained by cutouts in the plug's flanges. Receptacle must be top mounted.

DIMENSIONS

		14 Contacts	24 Contacts	36 Contacts	50 Contacts
BOTH TYPES	A	1.417	1.842	2.352	2.947
	B	1.750	2.175	2.685	3.270
	C	.910	1.335	1.845	2.440
CABLE TO CHASSIS TYPE ONLY	D	.843	.843	.905	1.000
	E	1.668	1.668	1.730	1.825
	F	.306	.473	.640	.766
	G	.422	.473	.473	.473
BOTTOM MOUNTING FOR RACK & PANEL TYPE ONLY	H	1.098	1.523	2.033	2.628
	J	1.153	1.578	2.088	2.683
TOP MOUNTING FOR BOTH TYPES	K	.940	1.365	1.875	2.472
	L	.995	1.420	1.930	2.525

NOTE: All dimensions are reference.

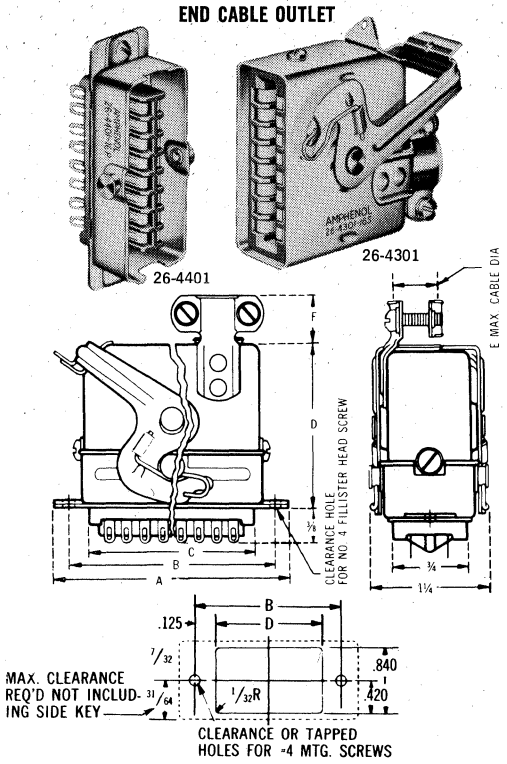
RACK AND PANEL MODULE APPLICATIONS Plugs	Receptacles	Contacts	CABLE-TO-PANEL APPLICATION Cable Plugs	Receptacles
57-10140	57-20140	14	57-30140	57-40140
57-10240	57-20240	24	57-30240	57-40240
57-10360	57-20360	36	57-30360	57-40360
57-10500	57-20500	50	57-30500	57-40500

AMPHENOL CONNECTORS

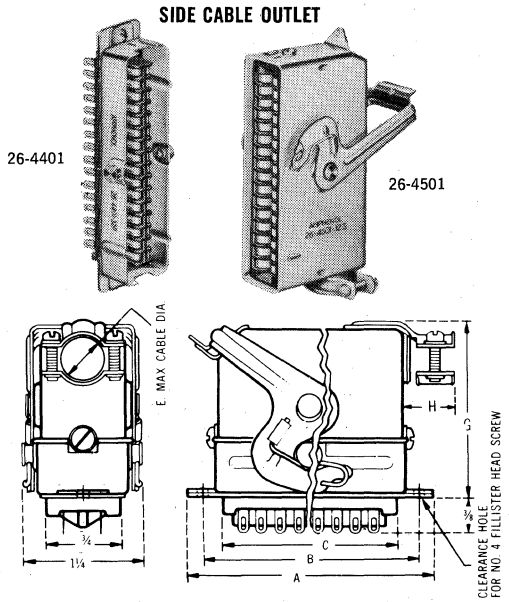
AMPHENOL
THE BUNKER-RAMO CORPORATION

Cable to Panel Blue Ribbon Connectors - 26 Series

END CABLE OUTLET



SIDE CABLE OUTLET



- Low Withdrawal Force
- Low Insertion Force
- Secure Spring Latch
- Alternate Positions
- Provision for Safety Wiring

Cable-to-Panel Blue Ribbon Connectors include a straight plug, right angle plug, and panel receptacle. The plug is equipped with a spring tension swivel latch to insure mating, even in vibration applications. Provision for safety wiring provides additional reliability.

The nickel plated brass shells are notched to provide keying for alternate positions. The large number of alternate positions available is effectively doubled since the plug and receptacles are available with either a male or a female insert. Add P to the catalog number for a male insert; S for a female insert.

Contacts	Straight Plugs	Angle Plugs	Mating Receptacles	Position No.	Shell Keys Letters	Shell Keys Numbers
8	26-4301-8 S or P	26-4501-8 S or P	26-4401-8 P or S	1	A	1
	26-4302-8 S or P	26-4502-8 S or P	26-4402-8 P or S	2	A	2
	26-4303-8 S or P	26-4503-8 S or P	26-4403-8 P or S	3	B	1
	26-4304-8 S or P	26-4504-8 S or P	26-4404-8 P or S	4	B	2
16	26-4301-16 S or P	26-4501-16 S or P	26-4401-16 P or S	1	A-C	3-6
	26-4302-16 S or P	26-4502-16 S or P	26-4402-16 P or S	2	A-D	2-5
	26-4303-16 S or P	26-4503-16 S or P	26-4403-16 P or S	3	A-E	5-6
	26-4304-16 S or P	26-4504-16 S or P	26-4404-16 P or S	4	A-F	4-5
	26-4305-16 S or P	26-4505-16 S or P	26-4405-16 P or S	5	B-C	1-6
	26-4306-16 S or P	26-4506-16 S or P	26-4406-16 P or S	6	B-D	1-2
	26-4307-16 S or P	26-4507-16 S or P	26-4407-16 P or S	7	B-E	1-4
	26-4308-16 S or P	26-4508-16 S or P	26-4408-16 P or S	8	B-F	2-3
24	26-4301-24 S or P	26-4501-24 S or P	26-4401-24 P or S	1	A-C	3-6
	26-4302-24 S or P	26-4502-24 S or P	26-4402-24 P or S	2	A-D	4-7
	26-4303-24 S or P	26-4503-24 S or P	26-4403-24 P or S	3	A-E	5-6
	26-4304-24 S or P	26-4504-24 S or P	26-4404-24 P or S	4	A-F	4-5
	26-4305-24 S or P	26-4505-24 S or P	26-4405-24 P or S	5	A-G	6-7
	26-4306-24 S or P	26-4506-24 S or P	26-4406-24 P or S	6	A-H	1-6
	26-4307-24 S or P	26-4507 24 S or P	26-4407-24 P or S	7	B-C	2-7
	26-4308-24 S or P	26-4508-24 S or P	26-4408-24 P or S	8	B-D	1-2
	26-4309-24 S or P	26-4509-24 S or P	26-4409-24 P or S	9	B-E	1-4
	26-4310-24 S or P	26-4510-24 S or P	26-4410-24 P or S	10	B-F	2-3
	26-4311-24 S or P	26-4511-24 S or P	26-4411-24 P or S	11	B-G	3-4
	26-4312-24 S or P	26-4512-24 S or P	26-4412-24 P or S	12	B-H	2-5
32	26-4301-32 S or P	26-4501-32 S or P	26-4401-32 P or S	1	A-C	3-6
	26-4302-32 S or P	26-4502-32 S or P	26-4402-32 P or S	2	A-D	4-7
	26-4303-32 S or P	26-4503-32 S or P	26-4403-32 P or S	3	A-E	5-6
	26-4304-32 S or P	26-4504-32 S or P	26-4404-32 P or S	4	A-F	4-5
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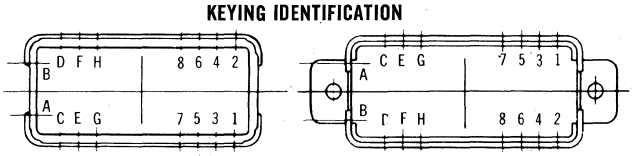
	26-4306-32 S or P	26-4506 32 S or P	26-4406-32 P or S	6	A-H	1-6
	26-4307-32 S or P	26-4507-32 S or P	26-4407-32 P or S	7	B-C	2-7
	26-4308-32 S or P	26-4508-32 S or P	26-4408-32 P or S	8	B-D	1-2
	26-4309-32 S or P	26-4509-32 S or P	26-4409-32 P or S	9	B-E	1-4
	26-4310-32 S or P	26-4510-32 S or P	26-4410-32 P or S	10	B-F	2-3
	26-4311-32 S or P	26-4511-32 S or P	26-4411-32 P or S	11	B-G	3-4
	26-4312-32 S or P	26-4512-32 P or S	26-4412-32 P or S	12	B-H	2-5

INSERTS: The plug and receptacle are available with either male or female inserts. Add the Suffix P for male inserts; S for female inserts.

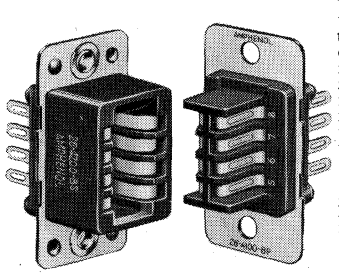
KEYING IDENTIFICATION



DIMENSIONS:

	A	B	C	D	E	F	G	H	J
8 contact plug and receptacle mated	1.719	1.375	1.036	1.593	.312	.438	1.593	.455	1.120
16 contact plug and receptacle mated	2.469	2.125	1.784	1.719	.625	.517	1.797	.517	1.868
24 contact plug and receptacle mated	3.219	2.875	2.536	1.844	.625	.517	1.922	.517	2.620
32 contact plug and receptacle mated	3.969	3.625	3.286	1.906	.625	.517	1.984	.517	3.370

Blue Ribbon 26 Series
Barrier Polarization



This is the most popular of all Blue Ribbon Connector Series. Tapered design of plug body provides pre-alignment of mating contacts. Dielectric barriers between contacts vary in thickness by minute dimensions to provide polarization. Float bushings allow a float of up to .02 in each direction, facilitating the blind mating common in rack and panel applications. Requires simple rectangular panel cutout.

The eight contact size is also available with a molded key and keyway for polarization. Catalog numbers, 26-182 plug and 26-183 receptacle.

Rated 5 amperes, 800V DC at sea level; 300V DC at 70,000 feet.

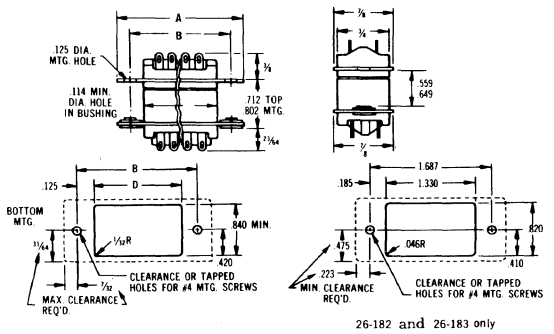
(CONTINUED ON NEXT PAGE)

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER RAMO CORPORATION

BARRIER POLARIZATION (CONTINUED)

Blue Ribbon 26 Series Dimensions

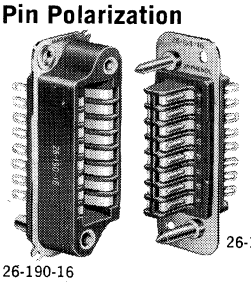


26-182 and 26-183 only

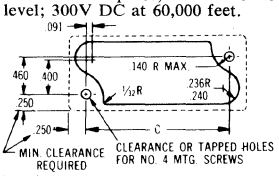
Contacts	Plugs	Mating Receptacles	DIMENSIONS A	B	C	D
8	26-4100-8P	26-4200-8S	1.719	1.375	1.036	1.120
16	26-4100-16P	26-4200-16S	2.469	2.125	1.784	1.868
24	26-4100-24P	26-4200-24S	3.219	2.875	2.536	2.620
32	26-4100-32P	26-4200-32S	3.969	3.625	3.286	3.370
8	26-182	26-183	—	—	—	—

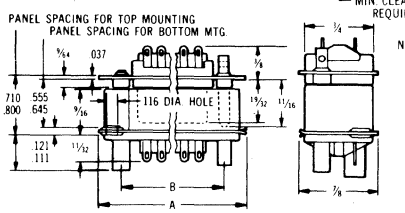
Pin Polarization

Sturdy guide pins pre-align connectors before contact engagement Pins are of dissimilar size to avoid reverse mating. Float bushings on receptacle allow a float in all directions of .02" to minimize the need for close mounting dimensions and to assist in blind matings. Rated 5 amperes, 750V DC at sea level; 300V DC at 60,000 feet.



26-190-16 26-159-16

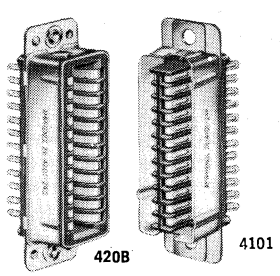




NOTE: THIS MOUNTING LAYOUT SHOWS HOLES AS VIEWED FROM FRONT OF RECEPTACLE OR REAR OF PLUG

Contacts	Plug	Receptacle	DIMENSIONS A	B	C
16	26-159-16	26-190-16	2.442	1.842	2.024
24	26-159-24	26-190-24	3.118	2.522	2.704
32	26-159-32	26-190-32	3.789	3.202	3.384

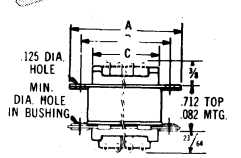
Keyed Shells

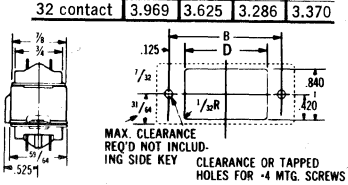


420B 4101

Similar to barrier polarization type, but with keyed aluminum shells to provide a large assortment of alternate positions. Mounting plates are stainless steel and receptacle includes float bushings which allow a float of .02 in all directions. Key location same as Cable to Panel Blue Ribbon Connector series listed on page 4. Rated 5 amperes, 800 V DC at sea level; 300 V DC at 70,000 Feet.

	DIMENSIONS A	B	C	D
8 contact	1.719	1.375	1.036	1.120
16 contact	2.469	2.125	1.784	1.868
24 contact	3.219	2.875	2.536	2.620
32 contact	3.969	3.625	3.286	3.370

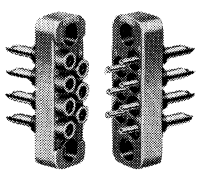




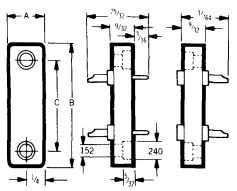
Keyed Shells Ordering Information

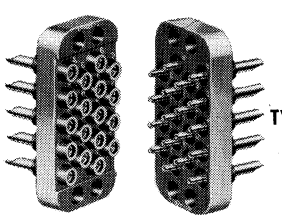
Contacts	Plug	Receptacle	Position	Shell Keys Letters	Numbers
8	26-4101-8P	26-4201-8S	1	A	1
	26-4102-8P	26-4202-8S	2	A	2
	26-4103-8P	26-4203-8S	3	B	1
	26-4104-8P	26-4204-8S	4	B	2
16	26-4101-16P	26-4201-16S	1	A-C	3-6
	26-4102-16P	26-4202-16S	2	A-D	2-5
	26-4103-16P	26-4203-16S	3	A-E	5-6
	26-4104-16P	26-4204-16S	4	A-F	4-5
	26-4105-16P	26-4205-16S	5	B-C	1-6
	26-4106-16P	26-4206-16S	6	B-D	1-2
	26-4107-16P	26-4207-16S	7	B-E	1-4
	26-4108-16P	26-4208-16S	8	B-F	2-3
24	26-4101-24P	26-4201-24S	1	A-C	3-6
	26-4102-24P	26-4202-24S	2	A-D	4-7
	26-4103-24P	26-4203-24S	3	A-E	5-6
	26-4104-24P	26-4204-24S	4	A-F	4-5
	26-4105-24P	26-4205-24S	5	A-G	6-7
	26-4106-24P	26-4206-24S	6	A-H	1-6
	26-4107-24P	26-4207-24S	7	B-C	2-7
	26-4108-24P	26-4208-24S	8	B-D	1-2
	26-4109-24P	26-4209-24S	9	B-E	1-4
	26-4110-24P	26-4210-24S	10	B-F	2-3
	26-4111-24P	26-4211-24S	11	B-G	3-4
	26-4112-24P	26-4212-24S	12	B-H	2-5
32	26-4101-32P	26-4201-32S	1	A-C	3-6
	26-4102-32P	26-4202-32S	2	A-D	4-7
	26-4103-32P	26-4203-32S	3	A-E	5-6
	26-4104-32P	26-4204-32S	4	A-F	4-5
	26-4105-32P	26-4205-32S	5	A-G	6-7
	26-4106-32P	26-4206-32S	6	A-H	1-6
	26-4107-32P	26-4207-32S	7	B-C	2-7
	26-4108-32P	26-4208-32S	8	B-D	1-2
	26-4109-32P	26-4209-32S	9	B-E	1-4
	26-4110-32P	26-4210-32S	10	B-F	2-3
	26-4111-32P	26-4211-32S	11	B-G	3-4
	26-4112-32P	26-4212-32S	12	B-H	2-5

Rectangular, Miniature Rack and Panel Connectors 126 Series

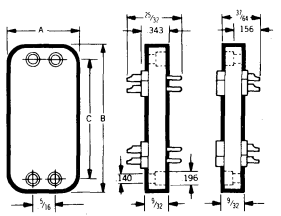


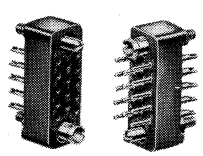
TYPE A



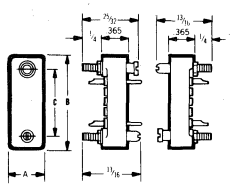


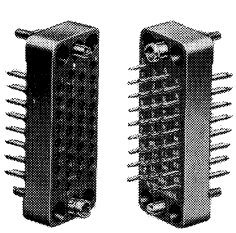
TYPE B



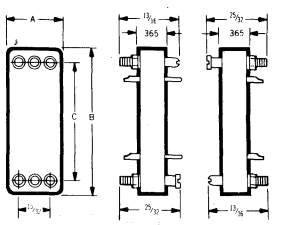


TYPE C





TYPE D



(CONTINUED ON NEXT PAGE)

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Rectangular, Miniature Rack and Panel Connectors - 126 Series (CONTINUED)

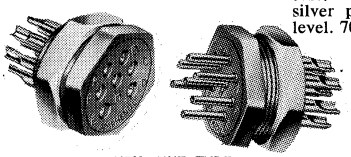
Heavy duty, reliable, time proven connectors. Dielectric is of melamine. Contacts are gold over silver plated. Voltage rating of types A and B is 700V RMS between contacts and 600V RMS between contacts and ground with a current rating of 17 amperes. Voltage rating of types C and D is 600V RMS with a current rating of 7½ amperes.

Connectors Type			No. of Contacts	Amps	Width A	Length B	Mounting Centers C
A	126-016	126-017	7	17	.5	1.63	1.25
	126-204	126-205	15	17	.5	2.59	2.22
B	126-206	126-207	18	17	1.0	2.00	1.69
	126-173	126-174	14	7½	.438	1.25	.938
C	126-199	126-189	18	7½	.563	1.31	1
	126-171	126-172	21	7½	.375	2.25	1.688
D	126-188	126-187	34	7½	.75	2	1.938

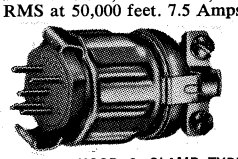
Hex Connectors 126 Series

4 to 9 Contacts

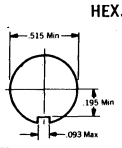
Popular hexagon rack and panel connectors. Diallyl Phthalate dielectric, gold over silver plated contacts. 2,000V RMS, sea level. 700V RMS at 50,000 feet. 7.5 Amps.



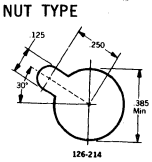
HEX. NUT TYPE

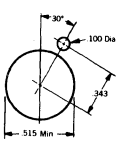


HOOD & CLAMP TYPE

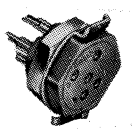


Hex Nut Type Mounting Holes





All Others

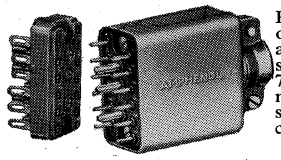


LOCKING CLIP TYPE

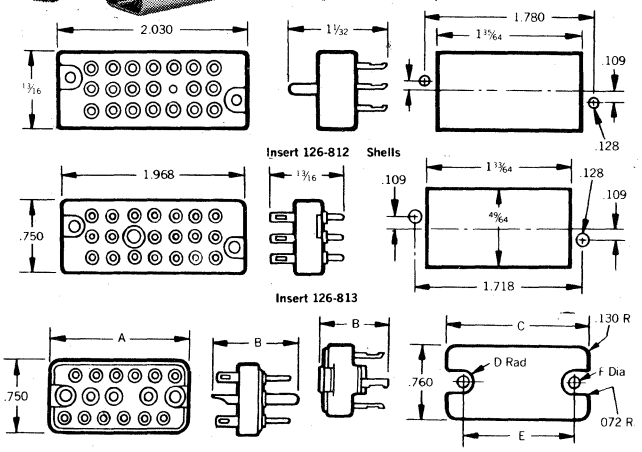
Contacts	Hex Nut Panel Mount	Mount With Locking Clip	With Hood and Cable Clamp
4 Pin	—	126-214	—
4 Socket	—	—	126-215 (Hood Only)
5 Pin	126-010	126-216	126-217
5 Socket	126-011	126-218	126-223
7 Pin	126-191	126-197	126-195
7 Socket	126-192	126-198	126-196
9 Pin	126-012	126-219	126-220
9 Socket	126-013	126-221	126-222

Rectangular Rack and Panel Connectors

126 Series Available With Shells and Cable Clamps



Rated a full 900V RMS, contacts are gold over silver. Four contact configurations are available with two contact sizes. Contact size No. 16 is rated 17 amperes; size 20 is 7½ amperes. Dielectric is mica filled phenolic. Aluminum housing with mechanical strain relief is available for cable applications. Gold over silver plated contacts.

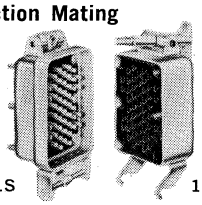


No. of Contacts		Pin Contacts		Socket Contacts		Mounting Screw Size No.	Shell Height
Size 16	Size 20	Insert Only	With Housing	Insert Only	With Housing		
2	9	126-804	126-809	126-805	126-808	4	1.75
3	12	126-151	126-152	126-150	126-153	6	2.06
4	16	126-806	126-811	126-807	126-810	4	2.06
20	—	126-813	—	126-812	—	4	—

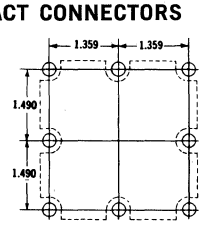
INSERTS	A	B	C	D	E	F
126-805	1.171	4 9/64	1.181	.120	.864	.120
126-151	1.500	.937	1.510	.115	1.188	.145
126-150	1.500	4 9/64	1.510	.115	1.188	.145
126-806	1.937	.937	1.947	.120	1.620	.120
126-807	1.937	4 9/64	1.947	.120	1.620	.120

115 Series 50 & 100 CONTACT CONNECTORS

Hinge Action Mating



115-31S



115-30P

Amphenol 115 Series connectors accommodate 50 or 100 No. 16 wires and are nominally rated at 750 volts RMS 60CPS at sea level

The vise action of the screw lock provides the leverage for easy attaching and disengaging of the plug. The two-piece inserts have molded-in numbers to facilitate wiring and checking of circuits. Contacts and inserts are so designed that when assembled the contacts are free floating for alignment in mating but cannot rotate.

Amphenol 115 Series connectors are available in a choice of three types of contacts — crimped-on, extended solder cup or a special socket type for use with taper pin terminals for making solderless connections. When using the crimp-on contacts, note the correct location to make the crimp so that the blade or tines of the contacts will not be distorted. Thomas and Betts tool No. WT-111 M is recommended for crimping the crimp contact. The crimp type can also be used as a buried solder type.

The approximate dimensions of the shells exclusive of attaching mechanisms is 3½" high, 3½" wide and 1 11/32" deep for the 100 contact connectors and 2 31/32" high, 2¼" wide and 1 11/32" deep for the 50 contact connectors. Receptacle Mounting — the 8-32 assembly screws are located as shown. Panel must be cut out for wire lead-in at the back of the receptacle (indicated approximately by dotted lines).

100 CONTACT CONNECTORS

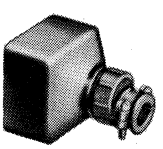
	With Crimp-On Contacts	With Taper Pin Contacts	With Solder Cup Contacts
Male Plug	115-30P	115-30P(432)	115-30P-1000
Female Receptacle	115-31S	115-31S(432)	115-31C-1000
Female Plug	115-30S	115-30S(432)	115-32S
Male Receptacle	115-31P	115-31P(432)	115-32P

50 CONNECTORS

	With Taper Pin Contacts	With Solder Cup Contacts
Male Plug	115-114P(432)	115-114P
Female Receptacle	115-115S(432)	115-115S
Female Plug	115-114S(432)	115-114S
Male Receptacle	115-115P(432)	115-115P

CABLE CLAMP

The 115-949 Cable Clamp fits the 115-30 and 115-31, P & S, as listed in the first column of the table above. The 115-1391 Cable Clamp fits 115-114 and 115-115, P & S. Housing is aluminum with an AN-type clamp. They mount to the back of the connector by means of six screws.



AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

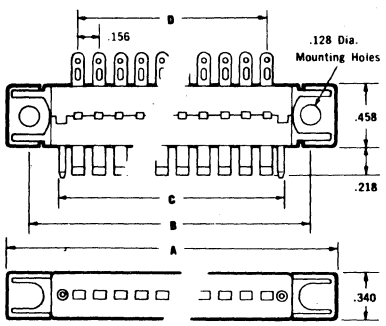
Prin-Cir Plugs - 133 Series

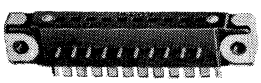
PRIN-CIR PLUGS flush mount directly to printed circuit boards and eliminate any possibility of wear on board circuitry. Used where frequent mating and disengagement is necessary, or where an unusually low milivolt drop is required. Ideal mating solution for boards of non-standard thickness. Gold over copper plated contacts are on .156 centers and mate with 143 Series PRIN-CIR RECEPTACLES.

The PRIN-CIR PLUG, when used with the 143 Series PRIN-CIR RECEPTACLE, is polarized by removing a contact. Contact removal and the marking of the connector is performed by your AiD, or at the Ampenhol factory.

DIMENSIONS

Part No.	No. of Contacts	A	B	C	D	E
133-006	6	1.820	1.531	1.091	1.239	.781
133-010	10	2.445	2.156	1.716	1.864	1.406
133-012	12	2.757	2.468	2.028	2.176	1.718
133-015	15	3.226	2.937	2.497	2.645	2.187
133-018	18	3.695	3.406	2.966	3.114	2.656
133-022	22	4.320	4.031	3.591	3.739	3.281





133-010-43
mates with 143 Series Receptacle

CONTACT OMISSION TABLE

Loc.	Suffix	Loc.	Suffix
A	1001	N	1012
B	1002	P	1013
C	1003	R	1014
D	1004	S	1015
E	1005	T	1016
F	1006	U	1017
H	1007	V	1018
J	1008	W	1019
K	1009	X	1020
L	1010	Y	1021
M	1011	Z	1022

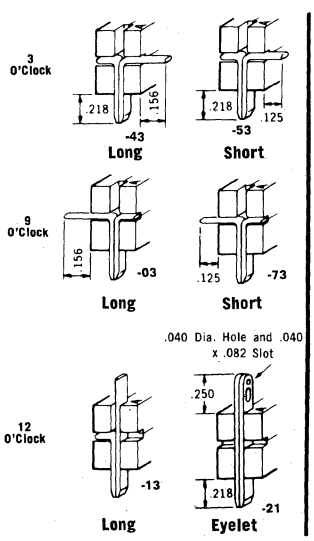
AVERAGE VOLTAGE BREAKDOWN Between Contacts: 3,250 VOLTS D.C. at Sea Level.
OPERATING VOLTAGE RATING: 600V RMS at Sea Level.
CURRENT RATING: 5 AMPS

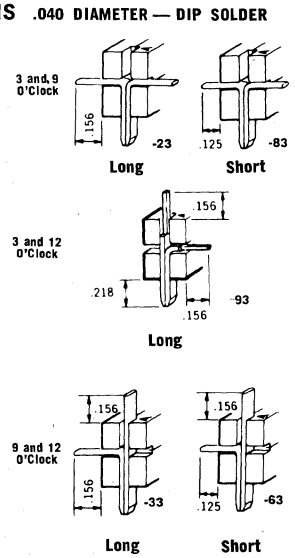
ORDERING INFORMATION

133 - 015 - 03
133 - 006 - 23 - 1002

133 Series PRIN-CIR PLUG
No. of Contacts 006, 010, 012, 015, 018, 022
Contact Tail Style
Positioning: Contact Omission

CONTACT TAIL POSITIONS .040 DIAMETER — DIP SOLDER





Contacts are viewed from front of connector. Contact position A is shown.

Prin-Cir Receptacle - 143 Series

TUNING FORK CONTACT CANNOT BE OVERSTRESSED .156 CONTACT CENTERS

MATES WITH .054 - .070 PC BOARDS OR 133 SERIES PRIN-CIR PLUGS

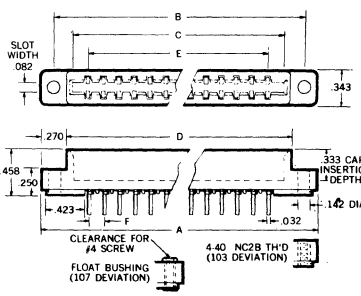
Tuning fork contact design assures uniform and firm contact action, even with PC boards at extremes of thicknesses.

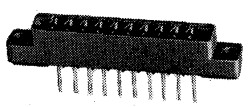
Gold plated over copper, tuning fork contacts glide over the delicate foil surface of the printed circuitry.

For boards of non-standard thickness, or where frequency of insertion and withdrawal will exceed 500 cycles, it is recommended that the 143 Series PRIN-CIR RECEPTACLE be used with the 133 Series PRIN-CIR PLUG. Contacts are on .156" centers. All sizes are available with a choice of contact tails.

DIMENSIONS

Part No.	No. of Contact Positions	A	B	C	D	E	Contact Centers
143-006	6	1.779	1.531	1.097	1.239	.781	.156
143-010	10	2.404	2.156	1.723	1.864	1.406	.156
143-012	12	2.716	2.468	2.035	2.176	1.718	.156
143-015	15	3.185	2.937	2.504	2.645	2.187	.156
143-018	18	3.654	3.406	2.972	3.114	2.656	.156
143-022	22	4.279	4.031	3.597	3.739	3.281	.156
143-028	28	4.279	4.031	3.597	3.739	3.375	.156
143-036	36	6.464	6.210	5.776	5.918	5.460	.156





143-010-03
mates directly to a printed circuit board or with a Series 133 Plug

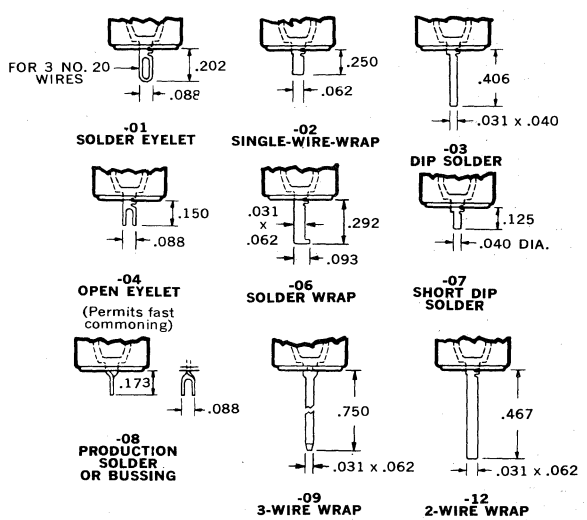
Loc.	Suffix	Loc.	Suffix
A	1001	N	1012
B	1002	P	1013
C	1003	R	1014
D	1004	S	1015
E	1005	T	1016
F	1006	U	1017
H	1007	V	1018
J	1008	W	1019
K	1009	X	1020
L	1010	Y	1021
M	1011	Z	1022

ORDERING INFORMATION

143 - 006 - 01
143 - 018 - 07 - 1010

PRIN-CIR RECEPTACLE
No. of Contacts 006, 010, 012, 015, 018, 022, 036
Contact Tail Style
Positioning Key Location
Polarizing Key is Available In Any Location

TAIL STYLES



AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Printed Circuit Receptacles - 225 Series

BLUE RIBBON PRINTED CIRCUIT CONNECTORS DESIGNED TO MIL-C-21097B
LOW MILLIVOLT DROP • NEGLIGIBLE PC CIRCUITRY WEAR

Amphenol gold-plated RIBBON contacts — with their smooth glide mating action — incur practically no wear on fragile printed circuitry. Ribbon contacts are bifurcated (slit), to guarantee at least two points of electrical contact, even with an irregular shaped printed circuit board. The double spring tension of the ribbon contact, and large mating surface, provides consistent low contact resistance, with corresponding low millivolt drop.

.156" CENTERS

Bifurcated ribbon contacts are on .156" centers and will accept PC boards of .054" to .071" thickness.

DIALLYL PHTHALATE

One piece, flame resistant, glass filled diallyl phthalate. Chamfered throat opening assists in guiding PC boards to a perfect engagement.

MIL-C-21097B

Amphenol Blue Ribbon PC Connectors represent the most comprehensive connector line designed in accordance to MIL-C-21097B.

POLARIZATION

Molded keying slots between contact accept polarizing key without loss of contact positioning. One nylon key is supplied with each commercial connector.

CONTACT ROWS

Blue Ribbon PC Connectors are available with two rows of separate independent contacts, or one row of contacts with back-up springs provided for proper mating tension. The 43 position size connector is therefore available with either 43 or 86 contacts. Double sided contacts with single tails are also available in 6 through 36 sizes.

TERMINATION

A wide variety of contact tails permit Blue Ribbon Printed Circuit Connectors to be terminated by soldering, or by crimping, of either Poke-Home or taper pin contacts.

SPECIFICATIONS

Operating voltage: 600 VAC (RMS) at sea level — 150 VAC (RMS) at 70,000 feet
Current rating: 5 amperes continuous
Test Voltage Between Adjacent Contacts: 1800 VAC (RMS) at sea level — 450 VAC (RMS) at 70,000 feet
Insulation Resistance: 5,000 megohms minimum

Contact Resistance
- Crimp and taper pin terminated — 35 millivolts max. at rated current
- Solder terminated — 25 millivolts max. at rated current

Contact Retention
- Solder terminated — 15 pounds axial load min.
- Crimp terminated — 10 pounds axial load min.
- Taper pin — 15 pounds axial load min.

Dielectric material: Glass fiber reinforced diallyl phthalate — Type SGDF per MIL-M-14
Contact material: Beryllium copper, or phosphor bronze (see below)
Contact plating — .00003" min. gold over copper, or .00005" min. gold over copper.

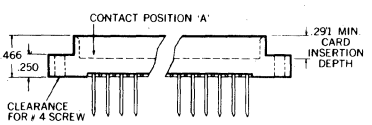
Number of Contact Positions	A	B	C	D	E	F	G
6	1.832	1.532	1.100	1.220	.780	.343	1.844
10	2.456	2.156	1.723	1.844	1.404	.343	2.468
15	3.236	2.936	2.502	2.624	2.184	.343	3.248
18	3.704	3.404	2.970	3.105	2.652	.343	3.716
22	4.328	4.031	3.597	3.730	3.276	.343	4.340
28	5.264	4.964	4.530	4.652	4.212	.500	5.264
36	6.512	6.219	5.778	5.900	5.460	.500	6.512
43	7.600	7.302	6.871	7.000	6.552	.500	7.600

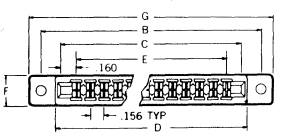
* TM Gardner-Denver Co.

SOLDER CONTACTS 225-2

Preset fixed contacts, used primarily for soldering.



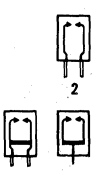




225 - 2 06 3 1 1 03

- Series No., Solder Contacts
- No. of Contact Positions **06, 10, 15, 18, 22, 28, 36, 43**
- Contact Configuration
- Polarization — Factory will insert key to right of contact position specified by suffix 01 thru 42.

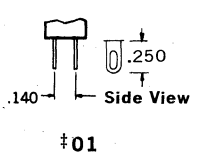
2 Two rows of independent contacts.
3 Two rows of contacts, each contact pair bridged**.
5 Single contact tail down center.*



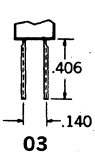
Mounting
Mounting Ear Depth .250
1 .128 Clearance Hole.
2 Float Bushing for #4 Screw.
3 Threaded, for #4-40 Screw.
4 .142 Clearance Hole.

Tail Styles

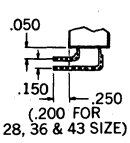
Available in Beryllium Copper



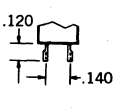
‡01 Solder Eyelet



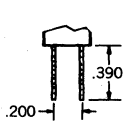
03 Long Dip Solder



05 Right Angle Dip Solder



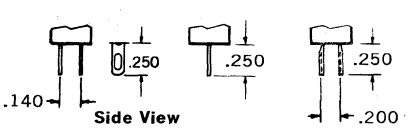
10 Short Dip Solder



*11 Medium Dip Solder

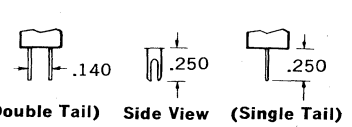
‡ Meets MIL-C-21097

Available in Phosphor Bronze (115)



‡01(115) Solder Eyelet

‡11(115) Dip Solder



12(115) Open Solder Eyelet

Contact Plating
1 .00003" min. gold over copper.
2 .00005" min. gold over copper, conforms to MIL-C-21097B.

* Phosphor bronze contacts only.
** Beryllium copper contacts only.

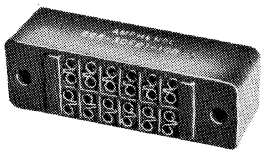
AMPHENOL CONNECTORS

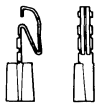
AMPHENOL
THE BUNKER-RAMO CORPORATION

Blue Ribbon Receptacles, Connectors - 225 Series

DOUBLE TAPER PIN 225-3 (Continued)

Each contact will accept up to two No. 53 taper pins.

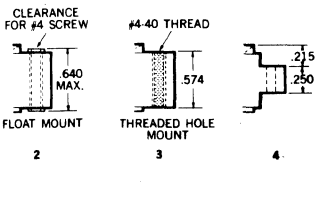




Each contact will accept two taper pins.



No. 53 Taper Pin.



225 - 3 06 2 1 - 100

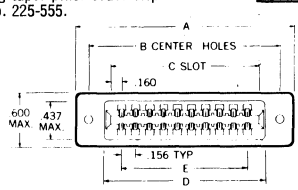
Series No., Taper Pin Contacts

No. of Contacts Positions
06, 10, 15, 18, 22, 28, 36, 43

Contact Configuration
1 One row of contacts and one row of back-up springs.
2 Two rows of independent contacts.

SELECTIVE BRIDGING

Horseshoe clip with tapered ends is inserted with same crimping taper pins. Order clip No. 225-555.



Polarization

Key inserted to right of contacts. Add suffix (contact no.) 01 thru 42.

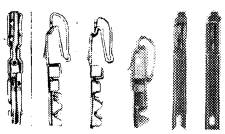
Contact Plating

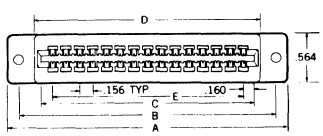
100 .00003″ min. gold over copper.
200 .00005″ min. gold over copper, conforms to MIL-C-21097B.

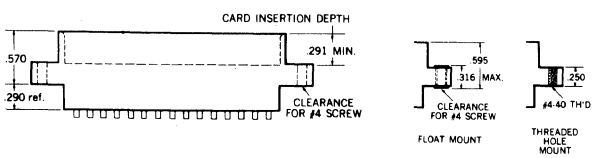
Mounting

Mounting Ear Depth .574
1 .128 Clearance Hole.
2 Float bushing for #4 Screw.
3 Threaded Bushing, for #4-40 Screw.
Mounting Ear Depth .250
4 .142″ Clearance Hole.

POKE-HOME CRIMP CONTACTS 225-4







Use with stripped wire. Wire size 18 to 24. Contacts are readily inserted by hand and may be recirculated at any time. Crimp tool No. 357-550 Full cycle, Removal tool No. 356-201. Solder Poke Home Contacts also available for this Series.

225-4 28 2 1 - 100

Series No., Poke-Home Crimp Contacts

No. of Contact Positions
06, 10, 15, 18, 22, 28, 36, 43

Contacts Furnished
0 No Contacts Supplied.
1 Loose Contacts Supplied for one row and back-up springs **inserted** in second row.
2 Loose Contacts Supplied for two rows.

Mounting

Mounting Ear Depth .250.
1 .128 Clearance Hole.
2 Float Bushing for #4 Screw.
3 Threaded, for #4-40 Screw.

Polarization

Key will be inserted at factory to right of contact by adding Suffix (contact No.) 01 thru 42.

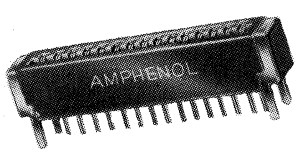
Contact Plating

000 Use when ordering less contacts.

100 .00003″ min. gold over copper.

200 .00005″ min. gold over copper, conforms to MIL-C-21097B.

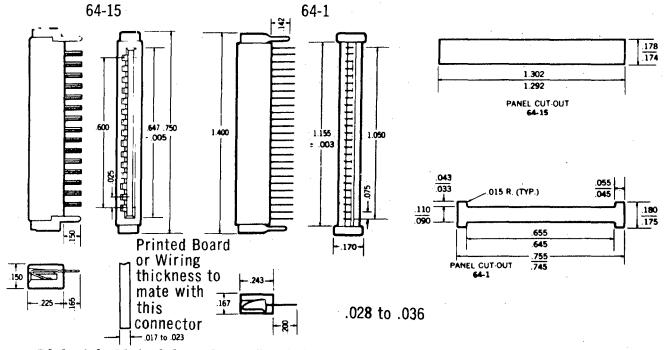
Micro-Edge - 64 Series SMALLEST STANDARD PC RECEPTACLE 9 to 25 CONTACTS FOR 1/32″ or 1/50″ PC BOARDS



Micro-Edge contacts will not set. The Micro-Edge will accept even warped boards with firm contact action. Contacts are rounded and will not scrape or injure delicate circuits.

	64-1	64-15	Economy Units 64-17	64-18
No. of Contacts	25	15	9	15
Overall Length	.75	1.40	.950	1.40
Contact Centers	.025″	.075″	.075″	.075″
Contact Diameter	.008″	.010″		
Contact Resistance, Ohms	.020-.030	.010-.020	.010	.010
P.C. Board Width	.647	1.155	.712	1.162
P.C. Board Thickness	.020 ±.003	.032 ±.004	1/32	1/32
Current Rating, Amperes	.5	.5	1	1

64-15 64-1



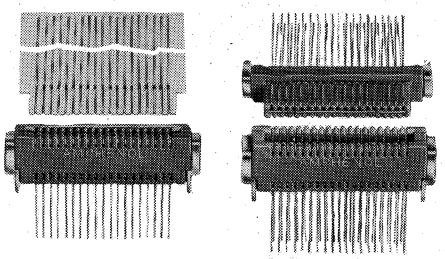
Dielectric Materials—Glass filled diallyl phthalate type GDI-30 per MIL-M-19833.
Contacts — Gold plated copper alloy.
600 V.A.C. RMS at Sea Level.
Temperature Range: −60°C. to +125°C.

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Micro Min Connectors - 74 Series

.050" CONTACT CENTERS



19 Contacts Single Side | 38 Contacts Double Side

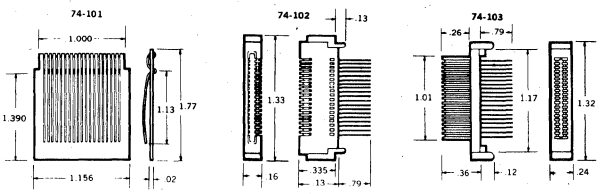
Two mating pairs, 19 and 38 contact, for contrasting applications. Both are only 1 5/16" long, and utilize 500 ma contacts on .050" centers.

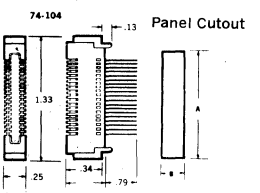
19 Contact — For miniature component board or P.C. board applications. The plug body serves as a component mounting board; usable space for mounting components is 1" x 1¼". The .020" thick glass filled resin board is easily drilled, cut, and is sufficiently sturdy to handle several components on both sides of the board. Contact tails are 1⅛" long and may be terminated directly to components.

Printed Circuit Board Applications

The 74-101 plug may be mounted to any printed circuit board by the use of epoxy or screws.

38 Contact — Two rows of 19 contacts each on .050" centers provide unusually high contact density for modular or rack and panel applications.





Panel Cutout

Description	A	B
19 Contact		
74-101 Component Board	—	—
74-102 Receptacle	1.187	.166
38 Contact		
74-103 Plug	1.325	.194
74-104 Receptacle	1.187	.254

Micro-Mod Connectors - 96 Series

Only ⅜" square (.380), the Micro-Mod is ideally suited to cordwood, stick, and even plainer circuitry for termination of up to 12 conductors. Green dielectric is glass filled diallyl phthalate. Mount with epoxy or hot bonding process. Catalog number 96-2 may be mounted with a No. 2-56 screw. Available in two distinctive styles.

POLARIZED STYLE — Keyed post provides positive contact alignment and connector polarization. Mated connectors are less than ¾" high.

COMPACT (No Contacts) STYLE — Actually no contacts on the receptacle. By using the conductors of the circuit (size 28), which easily snap into the receptacle — the usual conductor to contact soldering is eliminated. Mated pair is only .167" in height, making it ideal for plainer modules.

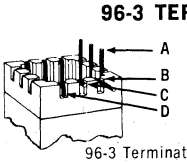
Specifications

Current Rating — 0.5 amp.
Contact Resistance — 0.015 ohm
Contact Spacing — .075" on centers
Contact Material — .010" gold plated copper alloy wire
Dielectric Material — Glass-filled diallyl phthalate Type GDI-30 per MIL-M-19833

Ordering Information

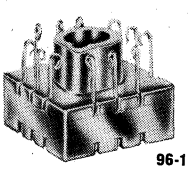
96-1 12-Contact Polarized Receptacle
96-2 12-Contact Polarized Plug
96-3 12-Contact Receptacle (less contacts)
96-4 12-Contact Plug

96-3 TERMINATION INSTRUCTIONS

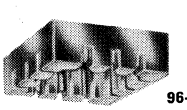


96-3 Termination

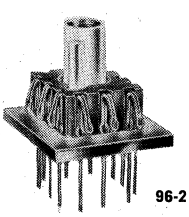
A—Epoxy to module and pull size 28 leads thru receptacle.
B—Bend leads 90°.
C—Cut off leads flush.
D—Complete forming of leads.



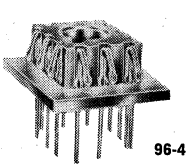
96-1



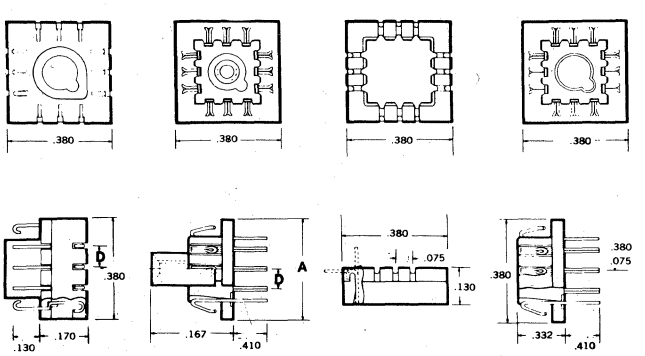
96-3



96-2



96-4

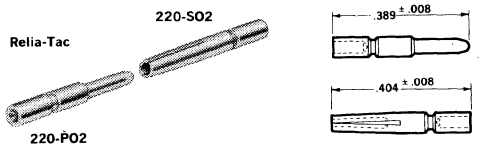


96-1 96-2 96-3 96-4

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Micro-Miniature Poke-Home Contacts



RELIA-TAC CONTACTS

These rugged, tried and proven contacts fit all 220, 221, 222, and 223 series Micro-Miniature connectors. They may also be used for module headers, motherboard assemblies, and microelectronic interconnections.

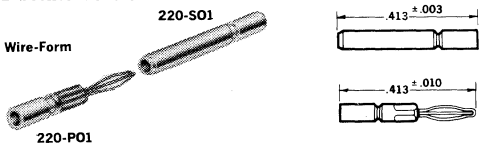
Relia-Tac contacts are usually crimp terminated, but are available for welded, solder, and wire-wrap termination.

Specifications

Current Rating — 3 amps
Resistance — .0060 ohm maximum constant to 1,000 cycles of insertion and withdrawal.
Wire Range — Solid: 22, 24, 26 and 28 gauge.
Stranded: 24, 26 and 28 gauge.
Contact Finish — Gold-over-nickel plate on copper-alloy bodies.

Ordering Information

(Minimum order quantity is 100 pieces.)
220-P02 Pin Contact
220-S02 Socket Contact



WIRE FORM CONTACTS

The unique 4-member spring design of the pin exerts self-equalizing force on 4 separate contact areas of the socket wall, reducing contact resistance and raising reliability to a very high level.

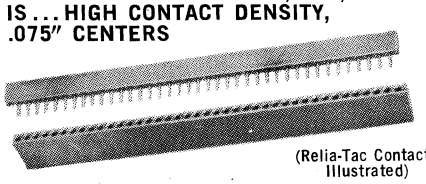
Wire Form contacts fit all 220, 221 and 223 series Micro-Miniature connectors. They are usually crimp terminated but are available also for welded, solder and wire-wrap termination. Eyelet type female contacts are available for specialized interboard connection and for potted component use.

Specifications

Current Rating — 3 amps.
Contact Resistance — .0050 to .0060 ohm constant to 1000 cycles of insertion and withdrawal.
Temperature Rise — 9° to 12°F at 3 amps.
Less than 1°F at 1 amp.

Strip Connectors - 221 Series

ADAPTABLE TO ANY SHAPE: STACK, CUT, CUT AND STACK, USE AS IS... HIGH CONTACT DENSITY, .100" or .075" CENTERS



(Relia-Tac Contacts Illustrated)

AMPHENOL Strip Connectors are highly reliable, low cost micro-miniatures with great application versatility. They are furnished in 4" and 6" lengths, but you can cut and stack them to whatever configuration you need to satisfy your various application requirements.

If you want, AMPHENOL can do it all for you promptly and economically — cut the connectors to the length you want, make mounting holes, cut leads to length, and crimp, weld, or solder them to the contacts.

Strip connectors use Poke-Home contacts and perform superbly. Where keying is desired, guide pins are inserted in two or more plug strip contact holes.

Because Strip connectors are injection molded, special configurations can be produced quickly and inexpensively.

ORDERING INFORMATION

221- 1 1 60

Series Designation 221
Contact Centers 1—.100 in. 2—.075 in.
Insert Style 1—Plug (Lexan) 2—Receptacle (Lexan)
Number of Contacts 53 (.075" centers) 60 (.100" centers)

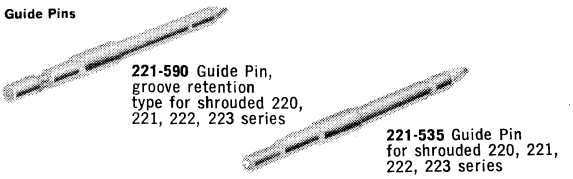
NOTE: Order Contacts Separately

Use Wire-Form pin contacts for plugs, socket contacts for receptacles.
Use Relia-Tac pin contacts for receptacles, socket contacts for plugs.
Guide Pin — Shrouded, 221-535
Guide Pin, Grooved Retention — Shrouded, 221-590

Standard crimp type contacts incorporate gold clad copper alloy wire members in copper sleeves; gold plate finish.
Wire Range — Solid: 22, 24, 26 and 28 gauge.
Stranded: 24, 26 and 28 gauge.

Ordering Information

(Minimum order quantity is 100 pieces.)
220-P01 Pin (Formerly 220-692)
220-S01 Socket (Formerly 220-679)

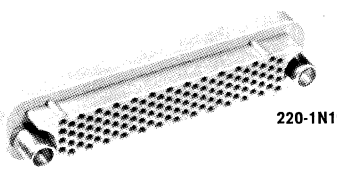


GUIDE PINS

These Poke-Home guide pins are for polarizing, keying, or connector alignment. They supplement the keyed slots and can be used in conjunction with either Relia-Tac or Wire Form contacts. They are inserted in plug inserts.

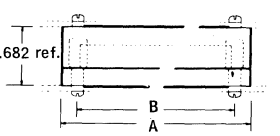
Micro-Rac - 220 Series

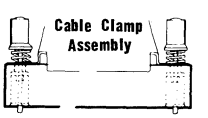
RACK AND PANEL APPLICATIONS: 52 AND 104 CONTACTS FLOAT MOUNTED: LOW COST HIGH CONTACT DENSITY

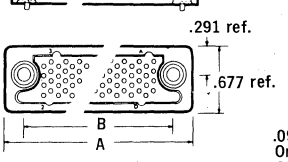


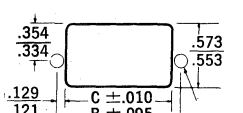
Mono-block construction. Contact identification numbers are molded in. Polarization is achieved by a trapazoidal mating area and keying with the use of guide pins or keying by molded-in slot-and-key arrangements.

Cable clamp assemblies are available for both sizes. Special size connectors can be supplied if needed. Environmental resistance can be added by potting the leads with an approved potting compound and sealing the connector faces with a molded neoprene gasket.









.094 Dia. (2 Holes) for Float Mounting Only. .172 Dia. (2 Holes) for Mountings Other Than Float.

ORDERING INFORMATION

	No. of Contacts 52	104
Plug	220-706	220-706
Receptacle	220-546	220-546
Environmental Plug	220-42-01	220-42-01
Potting Mold	220-635	220-634
Cable Clamp	220-5	220-6
Max. Length A	1.888	3.017
Mtg. Centers B	1.492	2.611
Cutout C	1.250	2.359

ORDERING INFORMATION

220- 1 N 104

Series Designation 220
Insert Style 1—Plug (Lexan) 2—Receptacle (Lexan) (Includes Hardware)
Connector Class N—Non-environmental P—Environmental, Potted
Number of Contacts 052, 104

NOTE: Order Contacts Separately

Use Wire-Form pin contacts for plugs, socket contacts for receptacles.
Use Relia-Tac pin contacts for receptacles, socket contacts for plugs.

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Wire-Form Mighty-Mite - 222 Series

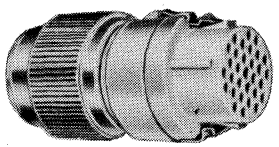
7 to 61 Contacts - .085 Contact Centers

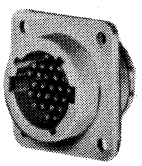
CABLE APPLICATIONS
ENVIRONMENTAL VERSION
MEETS/EXCEEDS MIL-C-26482

222-11N31

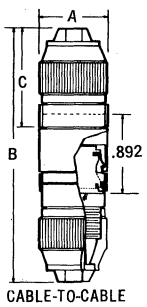
222-22N31

222-519

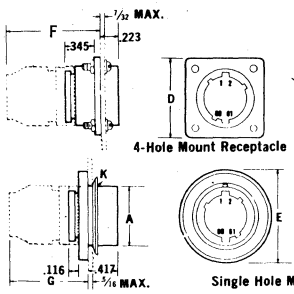




Circular in shape, the MIGHTY-MITE was designed specifically for cable to chassis and cable to cable applications. Five molded in keys and slots are molded in to assure positive alignment. Positioning is by guide pin. Contact identification numbers are molded into the polycarbonate resin dielectric. Strain relief serves also as potting form.



CABLE-TO-CABLE



		No. of Contacts		
	7	19	31	61
DIMENSIONS				
A ref. diameter	.496	.621	.746	.996
B ref. length	2.402	2.618	2.948	3.530
C ref. length	.854	.962	1.134	1.418
D ref. square	.750	.875	1.000	1.250
E ref. diameter	.940	1.065	1.189	1.444
F ref. length	1.170	1.278	1.450	1.734
G ref. length	.976	1.084	1.256	1.540
H length	.250	.312	.375	.500
J diameter	.511	.636	.761	1.011
Strain Relief Assembly	222-517	222-518	222-519	222-520
Retaining Ring	2-310	2-311	2-312	2-313

ORDERING INFORMATION

222- 1 1 N 61

- Series Designation 222
- Method of Mounting: 1—Flangeless; 2—4 hole mount recept.; 3—Single hole mount Receptacle
- Insert Style: 1—Plug (Lexan); 2—Receptacle (Lexan)
- Connector Class: N—Non-environmental; P — Potted*
- Number of Contacts: 07, 19, 31, 61

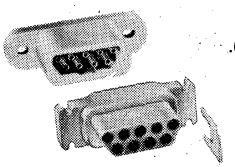
*The "N" Plug is used with "P" receptacles for potted connectors.

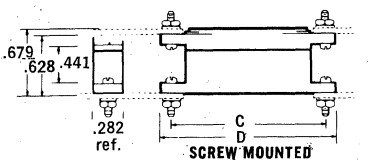
NOTE: Order Contacts Separately

Use Wire-Form pin contacts for plugs, socket contacts for receptacles.
Use Relia-Tac pin contacts for receptacles, socket contacts for plugs.

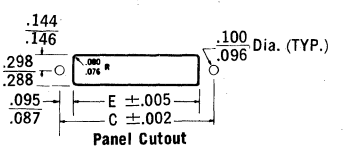
Tiny Tim - 223 Series

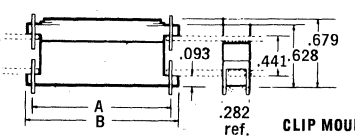
MODULE, RACK AND PANEL...
5 to 33 Contacts... Two Mounting Types

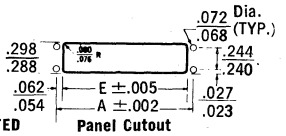




Tiny-Tim is available with a screw-on or clip type mounting. The clip mount is 10% shorter than the screw-on. Mounts with a small clip that is turned down by pliers after insertion. Punch and die sets are available for both.







No. of Contacts and Connector	CLIP MOUNTED A - Mounting Centers Length	CLIP MOUNTED B ref. Overall Length	E Length of Cutout	SCREW MOUNTED C Mounting Centers	SCREW MOUNTED D ref. Overall Length	Cable Clamp Assembly
5/c Plug	.526	.650	.410	.593	.843	223-21-01
5/c Receptacle	.526	.650	.410	.593	.843	
9/c Plug	.726	.850	.610	.793	1.043	223-21-02
9/c Receptacle	.726	.850	.610	.793	1.043	
17/c Plug	1.126	1.250	1.015	1.193	1.443	223-21-03
17/c Receptacle	1.126	1.250	1.015	1.193	1.443	
25/c Plug	1.526	1.650	1.410	1.593	1.843	223-21-03
25/c Receptacle	1.526	1.650	1.410	1.593	1.843	
33/c Plug	1.926	2.050	1.810	1.993	2.243	223-21-05
33/c Receptacle	1.926	2.050	1.810	1.993	2.243	

ORDERING INFORMATION

223- 1 1 17

- Series Designation 223
- Method of Mounting: 1—Screw Mount; 2—Clip Mount
- Insert Style: 1—Plug (Lexan); 2—Receptacle (Lexan)
- Number of Contacts: 05, 09, 17, 25, 33

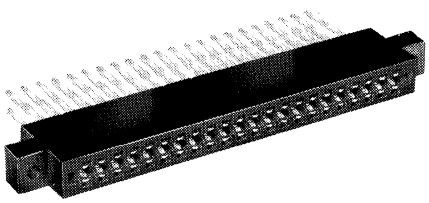
NOTE: Order Contacts Separately

Use Wire-Form pin contacts for plugs, socket contacts for receptacles.
Use Relia-Tac pin contacts for receptacles, socket contacts for plugs.

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Low Cost Edgeboard Connectors — 261 Series with Pre-Loaded Cantilever Contacts



True Positioned for Solderless Wrap Termination on Automatic Wrapping Machines

Electrical Characteristics

Contact Spacing	Current Rating (Max.) Amps	Contact Resistance (Max.) Milliohms	Voltage Rating (Sea Level)	Voltage Breakdown (Min.)
.100″ on Center	5.0	6.0	300 V RMS	1800 V RMS
.125″ on Center	5.0	6.0	350 V RMS	2000 V RMS
.150″ on Center	6.0	5.5	400 V RMS	2500 V RMS
.156″ on Center	7.5	5.0	400 V RMS	2500 V RMS
.200″ on Center	7.5	4.5	500 V RMS	4500 V RMS

Specifications

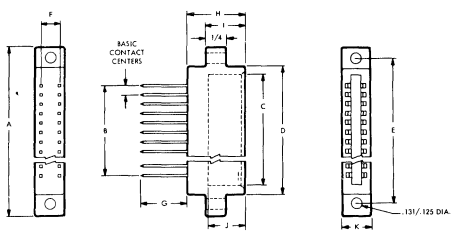
Block Material: Medium impact, electrical grade phenolic.

Contact Material: Grade A Phosphor Bronze with 50 micro-inches minimum thickness of gold on contacting surfaces.

Keying: Available on .200, .156 and .150 centers. On .125 and .100 centers key replaces one pair of contacts.

Tail length: Sufficient for three wire wraps plus space for bussing or PC board next to block. (See dimension G.)

Dimensions (Inches)



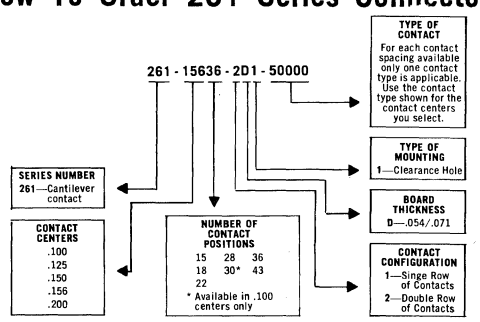
High Performance at Reasonable Cost

These high-performance edgeboard connectors provide dual readout of double-sided printed circuit boards. The pre-loaded cantilever type contacts are assembled into the dielectric with precise spacing to permit automatic solderless wrap termination. The phosphor bronze contacts have a minimum of 50 micro-inches of gold at the contacting surface. This results in extremely low contact resistance and permits over 500 insertion and withdrawal cycles without loss of continuity or significant increase in resistance.

An Extensive Line

- 15 to 43 positions providing up to 86 contacts
- Choice of .100″, .125″, .150″, .156″ or .200″ spacing
- Choice of tail sizes: .025″ sq., .035″ sq., or .035″ x .050″.

How To Order 261 Series Connectors



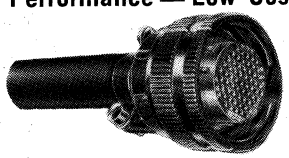
Contact Centers	Tail Dimensions	Type of Contact	No. Contact Positions	A	B	C	D	E	F	G	H (Max.)	I (Max.)	J	K
.100	.025 square	50001	15	2.474	1.400	1.720	1.874	2.156	.200	.627	.735	.494	.465	.343
			18	2.774	1.700	2.020	2.174	2.456						
			22	3.174	2.100	2.420	2.574	2.856						
			30	3.974	2.900	3.220	3.374	3.656						
			36	4.574	3.500	3.820	3.974	4.256						
			43	5.274	4.200	4.520	4.674	4.956						
.125	.025 square	50002	15	2.824	1.750	2.070	2.224	2.506	.250	.627	.735	.494	.465	.365
			18	3.199	2.125	2.445	2.599	2.881						
			22	3.699	2.625	2.945	3.099	3.381						
			28	4.449	3.375	3.695	3.849	4.131						
			36	5.449	4.375	4.695	4.849	5.131						
			43	6.324	5.250	5.570	5.724	6.006						
.150	.035 square	50003	18	3.624	2.550	2.870	3.024	3.306	.300	.765	.770	.515	.500	.443
			28	5.124	4.050	4.370	4.524	4.806						
			43	7.374	6.300	6.620	6.774	7.056						
.156	.035 x .050	50000	15	3.258	2.184	2.504	2.658	2.940	.200	.765	.770	.515	.500	.343
			18	3.726	2.652	2.972	3.126	3.408						
			22	4.350	3.276	3.596	3.750	4.032						
			28	5.286	4.212	4.532	4.686	4.968						
			36	6.534	5.460	5.780	5.934	6.216						
			43	7.626	6.552	6.872	7.026	7.308						
.200	.035 x .050	50000	22	5.274	4.200	4.520	4.674	4.956	.200	.765	.770	.515	.500	.343
			36	8.074	7.000	7.320	7.474	7.756						

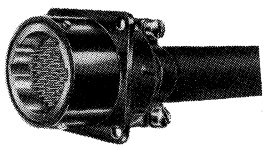
AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Ultra-Mite Connectors - 224 Series

Potted Connectors Provide MIL-C-26482 Performance — Low Cost





Amphenol 224 Series Ultra-Mite High-Density Miniature circular connectors are designed for all applications which require high performance and high density contact spacings — without a price premium. Potted connectors provide MIL-C-26482 performance at a quantity price of under $13.00 per pair.

- **Lowest cost** complete High-Density Miniature connector family available.
- High performance-potted constructions meet and exceed MIL-C-26482.
- Completely subminiaturized connectors with high contact density — 61 contacts in a size 18 shell.
- Size 22 Poke-Home contacts — Ultra-Tac hooded female contacts resist test prod damage.
- Full connector line — 2 connector classes "N" and "P" with 2 contact classes: Relia-Tac and Ultra-Tac.
- Constructions — Straight Plug, Square Flange, Single Hole Mounting and Cable Receptacles.
- Lightweight — about 25% that of standard connectors with the same number of contacts.
- All Class "P" receptacles have dynamic O-Ring shell seal.
- Bayonet-lock — 3 pin spring loaded coupling ring for quick disconnect.
- Crimp contact terminations.
- 5 key polarization.
- Cable clamps for strain relief.
- Connector identification molded in front and back.
- Natural recess in rear of connector for potting.

CONNECTOR CLASSES

Two 224 Series Ultra-Mite classes are available

"N" Non-Environmental

"P" Potted to meet and exceed the performance requirements of MIL-C-26482.

CONTACT CLASSES

Two contact classes are available:

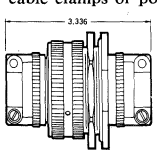
Relia-Tac Crimp Poke-Home pin and socket contacts with slit, preset tines on female members.

Ultra-Tac Crimp Poke-Home pin and socket contacts with female members hooded to resist test prod damage.

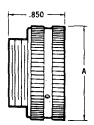
SHELL STYLES AND DIMENSIONS

CONNECTORS

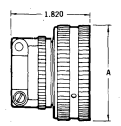
Ultra-Mite connector classes "N", "P" are available in four shell styles — Straight Plug, Square Flange Receptacle, Single Hole Mounting Receptacle, and Cable-to-Cable Receptacle. The standard Ultra-Mite coupling is bayonet lock for quick disconnect. All plugs have threaded back ends to accept cable clamps or potting forms.



Class "N" Mated



Standard Bayonet Plug

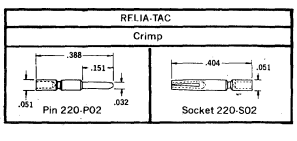


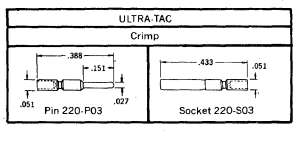
Plug with Cable Clamp

DIMENSIONS	
Shell Size	"A" Dia. Max.
10	.906
12	1.078
14	1.141
18	1.375

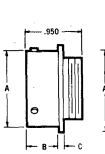
CONTACTS

Size 22 Relia-Tac and Ultra-Tac are Poke-Home contacts with crimp terminations. Please note that pin contacts insert in receptacle connectors only. Socket contacts insert in plug connectors only.

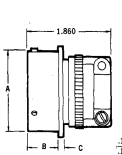




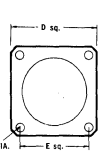
RECEPTACLES



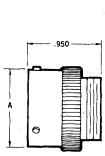
Square Flange Receptacle



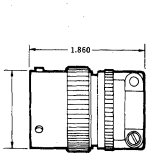
Square Flange Cable Clamp



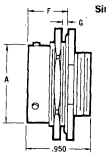
Square Flange



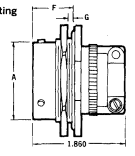
Cable-to-Cable Receptacle



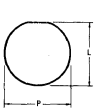
Cable-to-Cable Cable Clamp



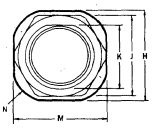
Single Hole Mounting Receptacle



Single Hole Mounting, Cable Clamp



Single Hole Mounting Panel Cutout



Single Hole Mounting Flange and Nut

RECEPTACLE DIMENSIONS

Shell Size	A Dia.	B Max.	C Max.	D ±.015	E ±.015	F Max	G Panel Thickness	H Max.	J Max.	K ±.003	L ±.005	M Panel Nut Max.	N Max.	P ±.005
10	.659	.620	.067	.938	.719	.650	.109	1.109	.953	.718	.730	1.075	1.192	.760
12	.829	.620	.067	1.031	.812	.650	.109	1.296	1.140	.905	.917	1.292	1.380	.947
14	.898	.620	.067	1.125	.906	.650	.109	1.396	1.205	.968	.980	1.396	1.505	1.010
18	1.131	.620	.067	1.312	1.062	.650	.109	1.646	1.455	1.217	1.225	1.646	1.740	1.260

CONTACT SPECIFICATIONS

Contact Rating—5 Amps

Resistance—.0060 Ohm maximum constant to 500 cycles of insertion and withdrawal.

Wire Range—Relia-Tac: 24, 26, 28. Ultra-Tac: 22, 24, 26.

Contact Finish—Gold-over-nickel on copper-alloy bodies.

ARRANGEMENTS

INSERTS AVAILABLE (Showing front face of plug insert)

Shell Size	10	12	14	18
Size 22 contacts rated 5 amperes for wire sizes 22-24-26-28 solid and 24-26-28 stranded	7 contacts 10-7	19 contacts 12-19	31 contacts 14-31	61 contacts 18-61

HARDWARE ACCESSORIES — CABLE CLAMPS

Cable clamps support conductors extending from plugs and receptacles and prevent twisting or pulling of the contact terminations. To order cable clamps, specify the part number of the cable clamp which corresponds to the connector shell size. For example, the correct cable clamp for a 224-16N18-61S02 plug is 224-552-18.



POTTING

On "P" connectors, to seal the back of the connectors, potting compound is injected into the back of the shell and allowed to cure. It forms a chemical bond to the inner and outer walls of the connector, to the back of the insert, around the contact terminations and well out along the leads.

Not only is a back shell eliminated, but also the cable clamp. The contact terminations are completely and individually protected by the resilient mass which surrounds them and resists transmittal of vibration to the terminations. The potted assembly is moistureproof and resistant to contaminants.

ORDERING INFORMATION

CONNECTOR PART NUMBER

The Ultra-Mite part numbering system has been set up to provide a complete and exact description of the connector assemblies. To order the 224 Series Ultra-Mite connectors you want, put together the part numbers as illustrated in the following example. All connector part numbers are without cable clamps and potting forms. Order hardware accessories separately.

Plug connectors accept socket contacts only. Receptacle connectors accept pin contacts only. Relia-Tac and Ultra-Tac contacts are not intermateable.

224-16N18-61S02(100)

Series Designation 224

Coupling Type
1—Bayonet

Shell Styles
0—Square Flange Receptacle
3—Single Hole Mounting Receptacle
6—Straight Plug
9—Cable-to-Cable

Connector Classes
N—Non-Environmental
P—Potted (Receptacles only).***

Shell Sizes
10, 12, 14, 18

Number of Contacts
7, 19, 31, 61

Contact Type
P—Pin (for receptacles only). P02 or P03, see below**
S—Socket (for plugs only). S02 or S03, see below**

(Deviations)
100-less Contacts*

*Most economical way to order. Order contacts in bulk (see below).

CONTACT PART NUMBERS

Order contacts by the part numbers below. A minimum order quantity of 100 contacts are bulk packaged in protective polycel bags. Contacts may also be ordered in reels for use with automatic crimping tools.

**RELIA-TAC			**ULTRA-TAC		
	Pin	Socket		Pin	Socket
Crimp	220-P02	220-S02	Crimp	220-P03	220-S03

***The "N" Plug is used with the "P" receptacles for potted connectors.

AMPHENOL POWER CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

POWER CONNECTOR SELECTOR GUIDE

Series	Meets/Exceeds MIL-Spec	Description	Contacts	Pressure-Proof	Max. Temp.	Mates With
MS-A	MIL-C-5015	Solid back shell formerly AN Threaded coupling, O.D. finish Diallyl Phthalate dielectric	1 to 52 Solder cup	No	257°F	All MS, 69, 89, 172 Series
MS-B	MIL-C-5015	Solid back shell formerly AN Threaded coupling, O.D. finish Diallyl Phthalate dielectric	1 to 52 Solder cup	No	257°F	All MS, 69, 89, 172 Series
MS-C	MIL-C-5015	Pressurized formerly AN Threaded coupling, O.D. finish Diallyl Phthalate dielectric	1 to 48 Solder cup	Yes	257°F	All MS, 69, 89 Series
MS-E	MIL-C-5015	Environmental Threaded coupling, O.D. finish Neoprene rubber dielectric	1 to 48 Solder cup	Yes	257°F	All MS, 69, 89, 172 Series
MS-R	MIL-C-5015	Environmental, light weight Threaded coupling, O.D. finish Neoprene rubber dielectric	1 to 48 Solder cup	Yes	257°F	All MS, 69, 89, 172 Series
48	MIL-C-26500 (USAF)	Miniature, highly environmental Threaded and bayonet coupling Black anodized finish Silicone rubber dielectric	3 to 55 Crimp/Poke-Home	Yes	392°F	48 Series only
67 MinniE	Proprietary	Miniature environmental Bayonet, gray anodized finish Diallyl Phthalate dielectric	3 to 48 Solder cup	Yes	257°F	67 Series only
69 PokeR	MIL-C-5015	Environmental Threaded coupling, O.D. finish Neoprene dielectric	2 to 37 Crimp/Poke-Home	Yes	257°F	All MS, 69, 89, 172 Series
89 GSE	MIL-C-5015	Submersible, threaded coupling Clear, or O.D. cadmium finish Diallyl Phthalate dielectric	2 to 52 Solder cup	Yes	257°F	All MS, 69, 89, 172 Series
115	MIL-C-5015	Hinge, screw-latch coupling Clear finish, brown phenolic dielectric	50, 100 Solder cup, Taper pin, or Crimp-on	No	185°F	115 Series only
165 Miniature AN/MS	MIL-C-19572	Pressure, waterproof, bayonet Diallyl Phthalate dielectric	5 to 24 Solder cup	Yes	257°F	165, 182 Series

MinniE - 67 Series

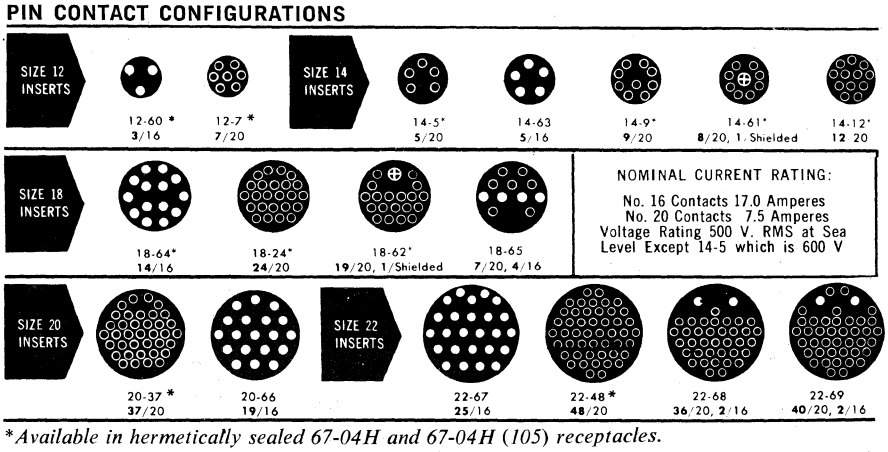
MINIATURE CONNECTORS

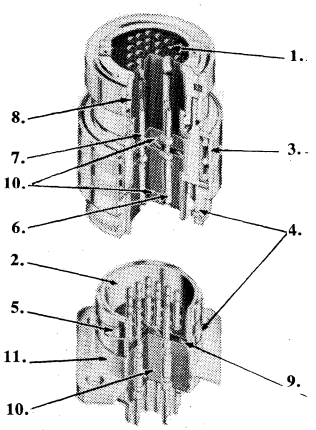
67 Series connectors are quick-disconnect, multi-contact, miniature bayonet lock types. Connectors are available as Plugs, Cable and Panel Receptacles and Single Hole Mounting Receptacles in five constructions, five shell sizes and 17 insert arrangements.

The first miniature connectors to fully meet the "E" requirements of MIL-C-5015C, the current specification governing A-N (now MS) type connectors.

Shell type numbers correspond to the "MS" nomenclature. Insert sizes and contact arrangements are shown below. "P" or "S" in insert style identify pin or socket contacts. Available in alternate insert positions "W" and "X".

PIN CONTACT CONFIGURATIONS





**Available in hermetically sealed 67-04H and 67-04H (105) receptacles.*

FEATURES (Numbers refer to illustration above, right)

1. Environmentally sealed with unitized back end grommet or with provision for potting. Either grommet seal or potted seal meets moisture resistance requirement of MIL--5015 specification.
2. Shells are polarized for easy mating alignment. Sizes 12, 14 & 18 have a single polarizing key. Sizes 20 & 22 have five polarizing keys for precision alignment of the many contacts.
3. Spring-loaded coupling ring provides a positive locking action in the bayonet slot, and a constant compensating force which eliminates the effects of a resilient face seal compression set.
4. Stainless steel bayonet slots and pins. The three pin bayonet coupling minimizes the rocking action of the mated plug and receptacle.
5. Flattened incline angle of bayonet slots reduces mating force requirement.
6. Hooded contacts resist test prod damage as defined in Paragraph 4.5.14 of Amphenol Specification 340-43-2108.
7. Contact plating is gold over silver.
8. Unitized grommet seal; clamp and grommet form a single unit for ease of assembly and maintenance.
9. Face seal gasket with individual barriers to isolate each contact.
10. Hard insert dielectric (plus resilient face seal) positively retains contacts with no possibility of contacts being pushed out of the insert.
11. A visual full engagement indicator is included in the design to insure the user that he has fully engaged the connectors. The indicator is an orange line around the receptacle shell.

- Insulation resistance of "E" type following altitude-moisture resistance test is a minimum 1000 megohms. MIL-C-5015 minimum following type "E" test is 100 megohms.
- When using mated sealed connectors, no derating for altitude is necessary at 70,000 feet.
- Test voltage 1,500 volts RMS 70,000 feet on sealed connectors.
- Vibration per Method 204 of MIL-Std-202A. 10 to 2,000 cps at 20 g's.
- Temperature cycling range per MIL-C-5015, Paragraph 4.5.3 increased to 257°F. maximum and —67°F. minimum.
- Receptacle fully meets Environmental requirements of MIL-C-5015.

Continued on next page

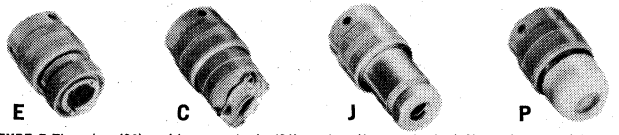
AMPHENOL POWER CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MinniE - 67 Series (CONTINUED)

DIALLYL PHTHALATE DIELECTRIC

Available in five shell styles and five rear end constructions in a total of 17 insert configurations with from 3 to 48 contacts.



TYPE E The plug (06), cable receptacle (01), and wall receptacle (00) employ a unitized grommet for individual wire seal providing complete connector environmental characteristics.
The panel receptacle (02) and round flange receptacle (03) utilize a compression o-ring seal to provide environmental capability.

TYPE C The rear end of the Type C **MinniE** Connectors are equipped with vise action two screw strain relief. Recommended for wire bundles in non-environmental applications.

TYPE J Compression gland provides strain relief for jacketed cables. Weatherproof.

TYPE P Includes potting mold.

TYPE H Hermetically sealed. Single glass preform for ultimate in sealing.

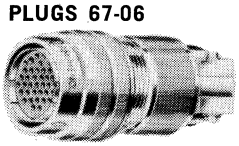
GLASS DIELECTRIC

Hermetically sealed, available in two receptacle styles in ten insert configurations, with up to 48 contacts.

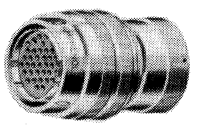
H



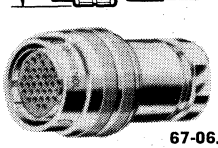
PLUGS 67-06

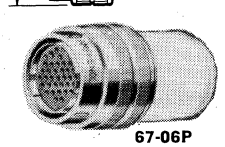


67-06C



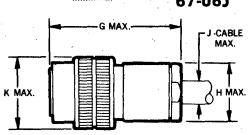
67-06E

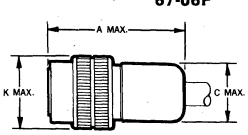




67-06J

67-06P



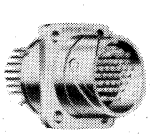


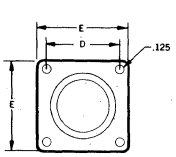
DIMENSIONS

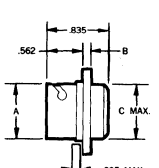
Connector Size	A	C	D	E	F	G	H	J	K
12	1.687	.795	.895	1.870	.817	1.937	.706	.250	.957
14	1.687	.920	1.000	1.870	.967	1.937	.812	.375	1.082
18	1.687	1.170	1.250	1.870	1.185	1.937	1.062	.656	1.375
20	1.734	1.223	1.375	1.970	1.312	2.312	1.187	.750	1.500
22	1.734	1.352	1.468	1.970	1.440	2.312	1.317	.875	1.625

PANEL RECEPTACLE 67-02E

Environmental Construction. No cable clamping.







DIMENSIONS

Connector Size	A	B	C	D*	E*
12	.662	.062	.690	.812	1.031
14	.781	.062	.812	.906	1.125
18	1.032	.093	1.062	1.062	1.312
20	1.156	.093	1.187	1.156	1.437
22	1.281	.093	1.281	1.250	1.562

* for all 67 series square flange connectors

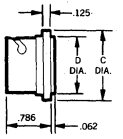
ROUND FLANGE RECEPTACLES

67-03E Diallyl Phthalate dielectric with o-ring compression seal. Rear mount only.

67-04H HERMETICALLY SEALED Receptacles, with single glass preform. Front mount only. Use suffix (105) after catalog number to order stake-on flange.

67-04H (105)

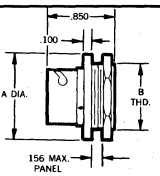




Round flange receptacle, hermetically sealed — stake-on solder flange — front mount

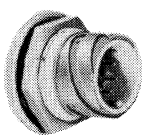
67-04H

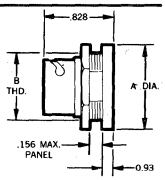




Round flange receptacle—rear mount

67-03E



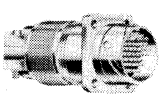


Round flange receptacle — hermetically sealed — front mount

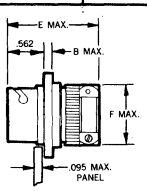
DIMENSIONS

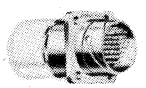
Connector Size	A	B	C	D
12	1.031	.750	.868	.743
14	1.156	1.125	1.203	1.083
18	1.406	1.125	1.203	1.083
20	1.531	1.250	1.363	1.243
22	1.656	1.375	1.493	1.363

WALL RECEPTACLE 67-00

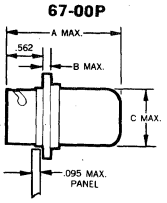


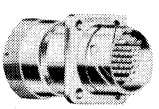
67-00C



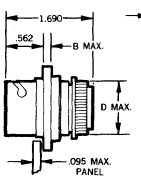


67-00P





67-00E



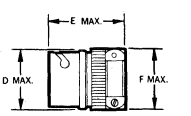
DIMENSIONS

Connector Size	A	B	C	D	E	F
12	1.687	.062	.795	.895	1.870	.817
14	1.687	.093	.920	1.000	1.870	.967
18	1.687	.093	1.170	1.250	1.870	1.185
20	1.734	.093	1.223	1.375	1.970	1.312
22	1.734	.093	1.352	1.468	1.970	1.440

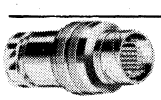
Mounting dimensions same as for 67-02E.

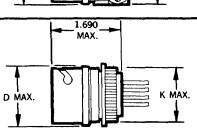
CABLE RECEPTACLE 67-01

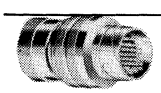


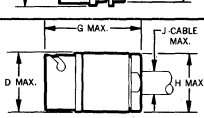


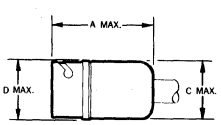












DIMENSIONS

Connector Size	A	C	D	E	F	G	H	J	K
12	1.687	.795	.895	1.870	.817	1.937	.706	.250	.957
14	1.687	.920	1.000	1.870	.967	1.937	.812	.375	1.082
18	1.687	1.170	1.250	1.870	1.185	1.937	1.062	.656	1.375
20	1.734	1.223	1.375	1.970	1.312	2.312	1.187	.750	1.500
22	1.734	1.352	1.468	1.970	1.440	2.312	1.317	.875	1.625

AMPHENOL POWER CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MinniE - 67 Series (CONTINUED)

GROMMET SEALS

Sealing plugs for sealing unused grommet holes in type E construction.

Contact Hole	Catalog No.
20	67-1472
16	67-1471

CAP & CHAIN for receptacles

Size	Catalog No.
12	67-1467
14	67-1464
18	67-1468
20	67-1469
22	67-1462

CATALOG NUMBER EXPLANATION

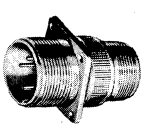
67 - 06 E 22 - 48 S X

- Series No.
- Shell Style
- Rear End Construction
- Connector Size
- Insert Configuration
- Pin or Socket Contacts
- W or X Alternate Positions

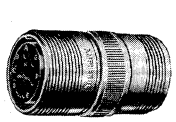
AVAILABILITY

Rear end Construction		00 Wall Receptacle	01 Cable Receptacle	02 Panel Receptacle	03 Round Receptacle Rear Mount	04 Round Receptacle Front Mount	06 Plug
C	Mechanical Clamp Cable	X	X				X
E	Grommet Seal	X	X				X
	Compression O-Ring Seal			X	X		
J	Compression Gland		X				X
H	Hermetically Sealed					X	
P	Potting	X	X				X

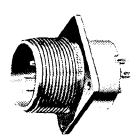
MS/AN - 97 Series NON-ROTATING CONTACTS, MACHINED COUPLING RINGS CONFORMS MIL-C-5015



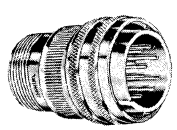
MS3100A
Wall Mounting Receptacle



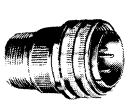
MS3101A
Cable Receptacle



MS3102A
Box Mounting Receptacle



MS3107A
Quick Disconnect, Solid Back Shell



MS3106A
Straight Plug, Solid Back Shell



MS3106B
Straight Plug, Split Back Shell



MS3108A
Angle Plug, Solid Back Shell



MS3108B
Angle Plug, Split Back Shell

PLUGS ◄——► RECEPTACLES

DIELECTRIC MATERIAL

MS Connectors are available with hard or resilient dielectric. Resilient dielectric is MIL-R-3065 neoprene rubber.

All hard dielectric inserts are molded of AMPHENOL Blue (diallyl phthalate,) famous for its dimensional stability, high insulation resistance, and high arc resistance.

SHELLS

MS shells are made of cadmium plated aluminum with an olive drab chromate conversion. The surface of the shell is conductive.

COUPLING RINGS

Machined from solid aluminum bar stock for greater strength.

CONTACTS

Non-rotating heavily silver plated contacts with pre-tinned solder pockets. Closed entry socket contacts prevent damage by oversize test prods.

With the exception of sizes 10SL and 12SL, all MS Connectors are available with either pin or socket contacts. Since socket contacts are insulated by the surrounding dielectric, they are normally used on the hot side of the line.

ORDERING INFORMATION

Select the specific contact configuration required from pages 856 and 857 and the appropriate shell style from the shells illustrated above.

Complete insert specifications, including voltage and current ratings, are shown on pages 857 and 858.

After the proper shell and insert have been selected, check their availability in the availability chart below, and then combine the shell and insert numbers into one catalog number; for example, a 22-21P insert and MS3106A shell should be ordered as an MS3106A-22-21P.

ALTERNATE POSITIONS

To avoid cross mating when two or more identical connectors are used, most MS Connectors are available with alternate positions, W, X, Y or Z. Positioned connectors are identical to non-positioned connectors except that the inserts within the connectors have been rotated a specific number of degrees. Alternate position availability and the degree of insert rotation are shown on the insert specifications chart, pages 859 and 860.

HERMETICALLY SEALED RECEPTACLES

For the finest in glass hermetically sealed receptacles, the 172 Series described on page 856 will mate with standard MS plugs.

MS CONNECTOR AVAILABILITY

The following indicates the availability of each connector style by size. For example, the MS3107A is available in a size 28, but not in a size 32.

EXPLANATION OF PART NUMBER

MS .....Indicates military standard. Replaces former designation on "AN". The number 97 is used with MS type connectors incorporating modifications not written into the military specifications.

3102.....Shell style or shape.

A.....Shell construction. A or B refers to rear end construction, solid or split back shell. C, E, and R refer to insert capability: C — pressurized, E and R, resilient dielectric, see page 8.

20.....Size refers to diameter of receptacle's threads in 10th of an inch. The letter S (sizes Ss, 10S, 12S) indicates a shortened design. The letters SL (sizes 10SL, 12SL) indicate a spun-in insert.

7.....Completes insert identification.

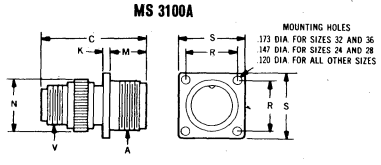
P.....P for pin contacts, S for socket contacts.

X.....Alternate positions.

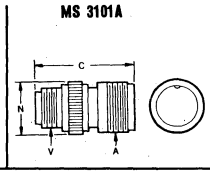
Connector Size	3100A	3100C	3101A	3102A	3102C	3106A	3106B	3107A	3107B	3108A	3108B
8S	X	X	X	X	X	X				X	X
10S	X	X	X	X	X	X		X		X	X
10SL-P	X	X	X	X	X						
10SL-S						X		X		X	X
12, 12S	X	X	X	X	X	X		X		X	X
12SL-844P				X							
12SL-844S						X		X		X	
14	X		X	X		X		X		X	X
14S	X	X	X	X	X	X	X	X	X	X	X
16	X	X	X	X	X	X		X		X	X
16S	X	X	X	X	X	X	X	X	X	X	X
18 thru 28	X	X	X	X	X	X	X	X	X	X	X
32, 36	X	X	X	X	X	X	X			X	X
40	X	X	X	X	X	X					X

MS-A, B, C Hard Dielectric Dimensions

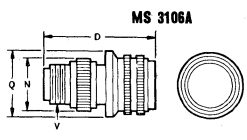
MS 3100A



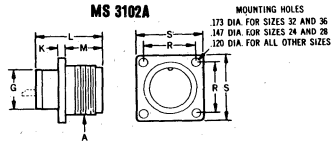
MS 3101A



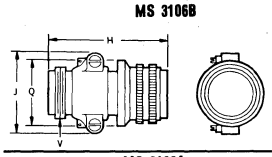
MS 3106A



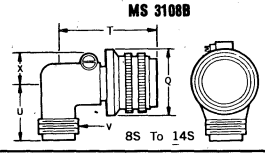
MS 3102A



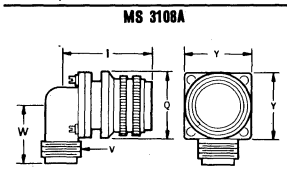
MS 3106B

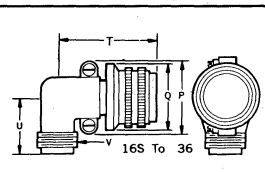


MS 3108B



MS 3108A





(CONTINUED)

AMPHENOL POWER CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MS-A, B, C Dimensions (See Dimension Drawings on Page 853

Connector Size	Mating Threads A	C	D	G	H	I	J	K	L	M	N
8S	1/2-28	1 1/4	1 1/4	7/16	—	1 1/4	—	5/64	27/32	9/16	17/32
10S	5/8-24	1 5/16	1 5/16	1/2	—	1 1/4	—	5/64	27/32	9/16	5/8
10SL	5/8-24	1 9/32	1 3/8	5/8	—	1 5/16	—	5/64	27/32	9/16	5/8
12S	3/4-20	1 15/32	1 7/16	11/16	—	1 3/8	—	5/64	61/64	9/16	25/32
12	3/4-20	1 27/32	1 7/8	11/16	—	1 13/64	—	5/64	1 5/16	3/4	25/32
12SL	3/4-20	—	1 31/64	11/16	—	1 3/8	—	5/64	27/32	35/64	7/8
14S	7/8-20	1 7/16	1 7/16	3/4	1 11/16	1 3/8	1 5/32	5/64	15/16	9/16	7/8
14	7/8-20	1 27/32	1 7/8	3/4	—	1 13/16	—	5/64	1 5/16	3/4	7/8
16S	1-20	1 31/64	1 29/64	7/8	1 11/16	1 1/2	1 1/4	5/64	15/16	9/16	1
16	1-20	1 57/64	1 57/64	7/8	—	1 15/16	—	1/8	1 11/16	3/4	1
18	1 1/8-18	2	2	1	2 1/16	1 15/16	1 41/64	1/8	1 11/32	3/4	1 1/8
20	1 1/4-18	2 1/8	2 1/8	1 1/8	2 1/8	2 1/16	1 13/16	1/8	1 11/32	3/4	1 1/4
22	1 3/8-18	2 1/8	2 1/8	1 1/4	2 1/8	2 1/16	1 15/16	1/8	1 11/32	3/4	1 3/8
24	1 1/2-18	2 1/4	2 1/4	1 3/8	2 9/32	2 15/32	2 1/16	1/8	1 11/32	13/16	1 1/2
28	1 3/4-18	2 1/4	2 1/4	1 5/8	2 9/32	2 15/32	2 5/16	1/8	1 11/32	13/16	1 3/4
32	2-18	2 3/8	2 3/8	1 29/32	2 5/16	2 11/16	2 19/32	1/8	1 7/16	7/8	2 1/32
36	2 1/4-16	2 3/8	2 3/8	2 1/8	2 11/32	2 11/16	2 27/32	1/8	1 7/16	7/8	2 1/4

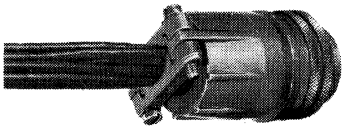
MS-A, B, C Dimensions (See Dimension Drawings on Page 853

Connector Size	Mating Threads A	P	Q	R	S	T	U	W	X	Y	Fitting Threads V
8S	1/2-28	—	3/4	19/32	7/8	1 7/16	7/8	7/8	—	25/32	1/2-28
10S	5/8-24	—	7/8	23/32	1	1 3/8	7/8	7/8	—	25/32	1/2-28
10SL	5/8-24	—	7/8	23/32	1	1 1/2	1	1	—	1 1/16	5/8-24
12S	3/4-20	—	1	13/16	1 3/32	1 9/16	1	1	1/2	1 1/16	5/8-24
12	3/4-20	—	1	13/16	1 3/32	1 7/8	1	1	1/2	1 1/16	5/8-24
12SL	3/4-20	—	1	13/16	1 3/32	—	—	1	—	1 1/16	3/4-20
14S	7/8-20	—	1 1/8	29/32	1 3/16	1 23/32	1 1/16	1	21/32	1 1/16	3/4-20
14	7/8-20	—	1 1/8	29/32	1 3/16	1 15/16	1 1/16	1	21/32	1 1/16	3/4-20
16S	1-20	1 1/2	1 1/4	31/32	1 9/32	1 3/4	1 1/8	1 1/8	—	1 5/16	7/8-20
16	1-20	1 1/2	1 1/4	31/32	1 9/32	2 1/8	1 1/8	1 1/8	—	1 5/16	7/8-20
18	1 1/8-18	1 41/64	1 11/32	1 1/16	1 3/8	2 5/32	1 3/16	1 1/8	—	1 5/16	1-20
20	1 1/4-18	1 13/16	1 15/32	1 5/32	1 1/2	2 3/8	1 5/16	1 5/16	—	1 5/8	1 3/16-18
22	1 3/8-18	1 15/16	1 19/32	1 1/4	1 5/8	2 13/32	1 5/16	1 5/16	—	1 5/8	1 3/16-18
24	1 1/2-18	2 1/16	1 23/32	1 3/8	1 3/4	2 5/8	1 7/16	1 1/2	—	2	1 7/16-18
28	1 3/4-18	2 5/16	1 31/32	1 9/16	2	2 5/8	1 7/16	1 1/2	—	2	1 7/16-18
32	2-18	2 19/32	2 7/32	1 3/4	2 1/4	2 13/16	1 3/4	1 25/32	—	2 1/2	1 3/4-18
36	2 1/4-16	2 27/32	2 15/32	1 15/16	2 1/2	2 27/32	1 15/16	1 25/32	—	2 1/2	2-18

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MS-E Connectors 69 Series



RESILIENT DIELECTRIC • ENVIRONMENTAL • NEW SELF-CENTERING CLAMP • NEW LOW COMPETITIVE PRICING • MORE THAN 1200 CONNECTORS • EASY DELIVERY

MS-E — New self-centering cable clamp provides still additional mechanical reliability above and beyond the mechanical strain relief provided by the neoprene grommet which securely gaskets each individual conductor.

Amphenol MS-E connectors are custom assembled to your order.

Environmental — Amphenol MS-E connectors meet all of the MS-E specifications of Mil-C-5015. In accordance with Mil-C-5015, Amphenol MS-E connectors must surpass stringent environmental tests including a twenty day temperature mated connector cycling test, under full load conditions, in a sealed high humidity chamber which, as the temperature is cycled above boiling and below freezing, will produce layers of moisture and frost. Before, during, and after the test, the insulation resistance between each contact and the connector shell must exceed 100 megohms.

Other stringent requirements include tests for thermal shock, air leakage, vibration, physical shock, durability, corrosion, and fluid immersion.

Construction — Shells are aluminum, cadmium plated with an olive drab chromate conversion seal. Coupling rings are machined from solid aluminum bar stock for maximum strength.

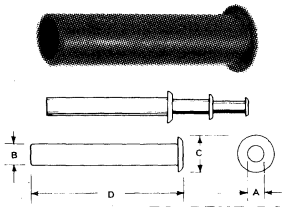
Non-rotating contacts are silver plated with completely tinned solder cups for ease in soldering. Female contacts are shrouded for additional damage protection.

Resilient dielectric is of Mil-R-3065 Polychloroprene rubber.

Availability — Insert configurations are identical to hard dielectric MS connectors.

All available inserts may be used with shell style illustrated above. Pin or socket contacts are available with the above shell style except in size 10SL, which is available only as a female plug and male receptacle.

For MS-E & Poke "R" Connectors



Neoprene boot gives a complete waterproof, oil proof and dust proof cable clamp for the new MS-E connector. Telescoping of boots reduces the clamp diameter for positive grip and strain relief.

For example, to use a cable with a 0.6 OD with an MS 3106E-20-18S (Size 20) plug, use boot No. AN-3420-12. To use the same connector with a 0.5 OD cable, use boot Nos. AN3420-12 and AN3420-10.

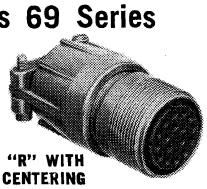
NEOPRENE BOOT DIMENSIONS

AMPHENOL PART NO.	CONNECTOR SIZE	A DIA.	B DIA.	C DIA.	D DIA.
AN3420-3	8S, 10S	.132	.212	.379	2.890
AN3420-4	10SL, 12, 12S	.222	.304	.505	2.765
AN3420-6	12SL, 14, 14S	.314	.429	.619	2.640
AN3420-8	16, 16S	.439	.554	.744	2.515
AN3420-10	18	.564	.617	.869	2.390
AN3420-12	20, 22	.627	.742	1.064	2.265
AN3420-16	24, 28	.752	.929	1.314	2.140
AN3420-20	32	.939	1.242	1.596	2.015
AN3420-24	36	1.252	1.367	1.847	1.890

MS-R & Poke "R" Connectors 69 Series



MS3106R AND 69-6R



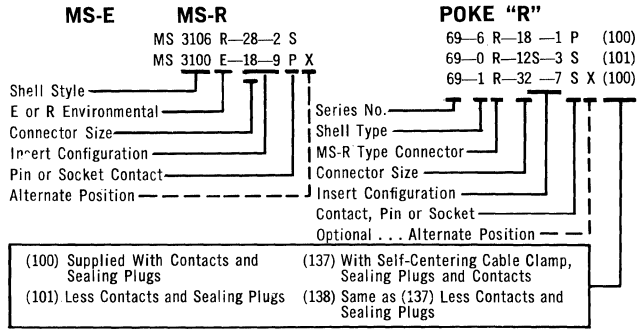
POKE "R" WITH SELF CENTERING CABLE CLAMP

MS-R — Resilient dielectric of Mil-R-3065 Polychloroprene rubber. All except MS 3102R receptacle have an individual wire grommet seal for complete environmental performance. O ring seal in MS 3106 plug provides additional environmental capability. The added features offered in the new MS-E wire risers, pressurized up to 1 atmosphere, 1200 styles.

POKE "R" — Similar to MS-R connectors, plus:

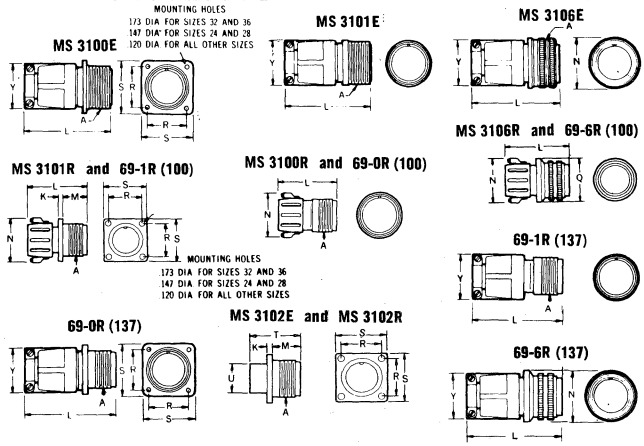
1. POKE-HOME Crimp Type Contacts — Crimp contacts provide a swift means of reliably terminating conductors without the inherent reliability problem of cold solder joints.
   The POKE-HOME feature permits the contact to be crimped away from the connector where there is room to work. POKE-HOME contacts are easily inserted and removed so that the connector can be recircuited or completely rewired at any time.
2. Altitude Immersion — Poke "R" Connectors must pass all of the stringent tests prescribed for the MS-R, plus an altitude immersion test as follows: Connectors entirely immersed in water are altitude cycled to 70,000 feet for 30 minutes. After cycling, and while still in water, connectors maintain a minimum insulation resistance of 100 megohms.
3. Gold over silver plated contact eliminate all possibility of contact tarnish.

The neoprene grommet provides complete sealing of each individual conductor. When all contacts are not used, a plastic sealing plug is inserted within the contact cavity of the grommet to preserve all environmental capabilities. A small quantity of sealing plugs for unused contact holes is supplied with Poke "R" connectors.



DIMENSIONS

Connector Size	Coupling Threads		MSE 69 (137)	MSR	69 (100)		MSE	MSR 69 (100)						MSE 69 (137)
	A	K	L	L	L	M	N ±.031	N	Q	R	S	T	U	Y
8S	1/2—28	5/64		1.635		5/16		1.036	3/4	19/32	7/8	1.003	7/16	
10S	5/8—24	5/64		1.635		5/16		1.036	7/8	23/32	1	1.003	1/2	
10SL	5/8—24	3/64	2.129	1.635	1.760	5/16	.865	1.125	7/8	23/32	1	1.003	5/8	.865
12S	3/4—20	5/64	2.129	1.635	1.760	5/16	.865	1.125	1	13/16	13/32	1.003	11/16	.865
14S	7/8—20	5/64	2.201	1.635	1.760	5/16	.990	1.343	1 1/8	29/32	1 3/16	1.003	3/4	.990
16S	1 —20	3/64	2.201	1.635	1.760	5/16	1.120	1.484	1 1/4	31/32	1 3/32	1.003	7/8	1.120
16	1 —70	5/64	2.524	1.960	2.085	3/4	1.120	1.484	1 1/4	31/32	1 3/32	1.328	7/8	1.120
18	1 1/8—18	1/8	2.596	1.960	2.085	3/4	1.211	1.609	1 11/32	1 1/16	1 3/8	1.328	1	1.211
20	1 1/4—18	1/8	2.654	1.960	2.085	3/4	1.468	1.890	1 15/32	1 5/32	1 1/2	1.328	1 1/8	1.468
22	1 3/8—18	1/8	2.654	1.960	2.085	3/4	1.468	1.890	1 19/32	1 1/4	1 5/8	1.328	1 1/4	1.468
24	1 1/2—18	1/8	2.885	1.960	2.085	13/16	1.750	2.170	1 23/32	1 3/8	1 3/4	1.328	1 3/8	1.750
28	1 3/4—18	1/8	3.885	1.960	2.085	13/16	1.750	2.170	1 31/32	1 5/16	2	1.328	1 5/8	1.750
32	2 —18	1/8	2.943	1.960	2.085	7/8	2.056	2.532	2 1/32	1 3/4	2 1/4	1.328	1 29/32	2.056
36	2 1/4—16	1/8	2.943	1.960	2.085	7/8	2.250	2.765	2 15/32	1 15/16	2 1/2	1.328	2 1/16	2.250



POKE "R" CONTACTS

Size	For 10SL, 12S, 14S & 16S Size Connectors	For All Other	Sealing Plugs
12 Pin Contact		69-1115-03	69-1130
12 Socket Contact		69-1100-03	69-1130
16 Pin Contact	69-1125-03	69-1120-03	69-1131
16 Socket Contact	69-1110-03	69-1105-03	69-1131

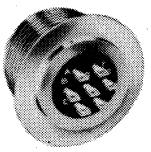
POKE "R" ACCESSORY TOOLS

294-126	MS 3191-1 Universal Crimping Tool
294-57	Universal Crimping Tool
294-85	#16 Contact Crimping Tool
294-86	#12 Contact Crimping Tool
294-39	#16 Contact Insertion & Removal Tool
294-40	#12 Contact Insertion & Removal Tool

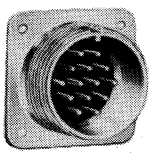
AMPHENOL
THE BUNKER-RAMO CORPORATION

MS Type Hermetic Seal Receptacles - 172 Series

MATE WITH MS PLUGS — SINGLE GLASS CONSTRUCTION
IDENTOSEAL CONTACT IDENTIFICATION
THREE BODY STYLES — ULTIMATE IN SEALING



Shell Style 2
Round Flange



Shell Style 3
Square Flange



Shell Style 6
Flange-Less

CONTACTS

Type 2

The 172 Series is a complete line of hermetically sealed receptacles which mate with MS/AN plug connectors. Three shell styles and 32 insert configurations are available from your local AID. By utilizing a single fused glass insulator for the entire connector, the fusing surface between the glass and the steel shell is considerably less than in other types of construction, making the leakage rate minimal. Amphenol's exclusive Identoseal contact marking, white on dark brown, is the clearest in the hermetic field. The numbers are as impervious as glass to solvents and acids.
To avoid mismating, most 172 Series receptacles are available with alternate positions.

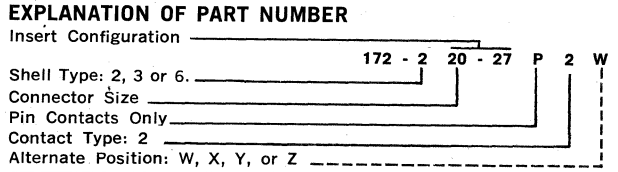
Specifications: Suitable for continuous operation at −200°F through +350°F. Voltage ratings, salt spray, shock, vibration resistance and mating dimension specifications conform to or exceed MIL-C-5015. Leakage rate is less than 0.1 micron cubic foot of helium per hour with one atmosphere differential.

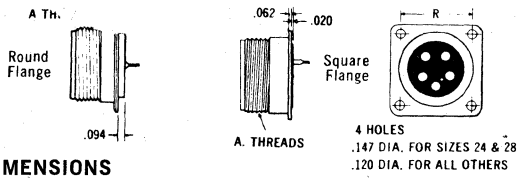
Contacts: Type 2— Flattened and Pierced. Pin contacts only, socket contacts are not available.

Insert Number	Contacts 16	12	8		Available Alternate Positions		
10S-2P	1						
10SL-3P	3						
10SL-4P	2						
12S-3P	2			W			
14S-1P	3						
14S-2P	4				X	Y	
14S-5P	5						
14S-6P	6						
14S-7P	3			W	X	Y	
14S-9P	2			W	X	Y	Z
16S-1P	7						
16S-4P	2						
16S-8P	5						
18-1P	10						
18-4P	4						
18-12P	6						
20-7P	8						
20-15P		7					
20-27P	14			W	X	Y	Z
20-29P	17						
20-33P	11						
22-2P			3				
22-14P	19			W			Z
22-19P	14			W	X	Y	Z
24-5P	16			W	X	Y	Z
20-10P			7				
24-28P	24			W	X	Y	Z
28-2P	12	2					
28-11P	18	4					
28-12P	26						
28-15P	35						
28-17P	15						
28-21P	37			W	X		

Contact Current Rating: No. 16—10 Amps., No. 12—20 Amps., No. 8—50 Amps.
Voltage Rating: Limited only by mating plug.

EXPLANATION OF PART NUMBER





DIMENSIONS

Connector Size	CUTOUT DIAMETER Round Flange Type 2	Square Flange Type 3	R Square Flange Type 3	CUTOUT DIAMETER Flange-Less Type 6
10S	.490	.499	.718	.499
10SL	.625	.499	.718	.499
12	.682	.655	.812	.655
14S	.745	.717	.906	.717
16S	.870	.843	.968	.843
18	.990	.967	1.062	.967
20	1.120	1.155	1.156	1.155
22	1.250	1.250	1.250	1.250
24	1.370	1.374	1.375	1.374
28	1.620	1.624	1.562	1.624

Submersible Connectors G S E - 89 Series

1 TO 52 CONTACTS — USES MS INSERTS



89-528-1S (09)
Cable Receptacle,
Anodized Finish

89-6232-12P
Open Wiring Receptacle,
O.D. Cad.-plate Finish

89-128-16S (13)
Plug,
Anodized Finish

Amphenol 89 series connectors are designed for stringent field service. Rugged and completely waterproof, these connectors provide efficient and dependable service even when entirely submerged in mud, ice, water or mire. They are used extensively in missile ground system and support equipment, radar antenna installations, oil well and digging equipment, and other hard-service applications.

Weather-proofing at the cable end is accomplished by an internal rubber gasket in the cable clamp which expands as the gland nut is tightened.

To facilitate handling in rough weather, the coupling rings are extra long and heavily grooved.

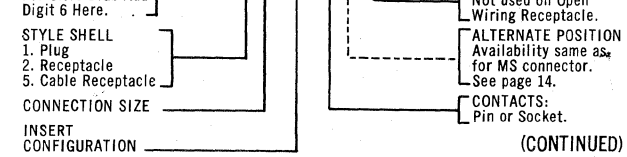
Connectors may be ordered with either clear anodized or olive drab cadmium-plate finish. Shells and cable clamps are machined from aluminum bar stock. Contacts are silver-plated. Insert material and contact arrangements are standard MS-type to MIL-C-5015.

CABLE CLAMPS

No.	Cable O.D.	For Shell Size 22	28	32	No.	Cable O.D.	For Shell Size 22	28	32
(04)	.188 to .250	X	X	X	(14)	.813 to .875		X	X
(05)	.250 to .312	X	X	X	(15)	.875 to .937		X	X
(06)	.313 to .375	X	X	X	(16)	.938 to 1.000		X	X
(07)	.375 to .437	X	X	X	(17)	1.000 to 1.062		X	X
(08)	.438 to .500	X	X	X	(18)	1.063 to 1.125		X	X
(09)	.500 to .562	X	X	X	(19)	1.125 to 1.187			X
(10)	.563 to .625	X	X	X	(20)	1.188 to 1.250			X
(11)	.625 to .687	X	X	X	(21)	1.250 to 1.312			X
(12)	.688 to .750	X	X	X	(22)	1.313 to 1.375			X
(13)	.750 to .812		X	X					

EXPLANATION OF PART NUMBERS

89— 228— 7 S
89—6522—13 PX (04)
89— 132—17 S (21) (105)



(CONTINUED)

AMPHENOL
THE BUNKER-RAMO CORPORATION

SUBMERSIBLE CONNECTORS GSE - 89 SERIES (Continued)

SERVICE RATING

Oper. Volt.	INST.	A	D	E	B	C
DC	250	700	1250	1750	2450	4200
AC (rms)	200	500	900	1250	1750	3000

DIMENSIONS

	89-1		89-2		89-5		Min. Chassis Hole Dia	Max. Chassis Thickness
Size	Length*	Dia.	Length	Dia.	Length*	Dia.		
22	5 1/16	1 21/32	1 13/32	1 7/8	5	1 3/4	1 25/64	5/16
28	5 1/16	2 1/32	1 13/32	2 1/4	5	2 1/8	1 49/64	5/16
32	5 3/16	2 11/32	1 13/32	2 1/2	5 1/8	2 3/8	2 1/64	5/16

* Includes cable clamp.

INSERT SPECIFICATIONS — Any size 22, 28 and 32 MS insert may be used with any of the 89 Series shells.

Insert Number	Total Contacts	Mech'l. Spacing	Serv. Rating	Contact Size #0	#4	#8	#12	#16
22-1	2	1/8	D			2		
22-2	3	1/8	D			2		
22-3	2	1/8	D		1			1
22-4	4	1/16	A			2	2	
22-5	6	1/8	D				2	4
22-6	3	1/8	D			2		1
22-7	1	3/16	E	1				
22-8	2	3/16	E				2	
22-9	3	3/16	E				3	
22-10	4	3/16	E					4
22-11	2	1/4	B					2
22-12	5	1/8	D			2		3
22-13	5	1/8	D					1
		1/16	A				4	
22-14	19	1/16	A					19
22-15	6	3/16	E					1
		1/16	A				5	
22-16	9	1/16	A				3	6
22-17	9	1/8	D					1
		1/16	A				1	7
22-18	8	1/8	D					5
		1/16	A					3
22-19	14	1/16	A					14
22-20	9	1/16	A					9
22-21	3	1/16	A	1				2
22-22	4	1/16	A			4		
22-23	8	1/8	D				1	
		1/16	A				7	
22-24	6	1/8	D					3
		1/16	A				2	1
22-25	3	1/16	A	1				2
22-26	7	1/8					2	5
22-27	9	1/8	D			1		
		1/16	A					8
22-28	7	1/16	A				7	
22-29	7	1/16	A		1			6
22-33	7	1/8	D					4
		1/16	A					3

Insert Number	Total Contacts	Mech'l. Spacing	Serv. Rating	Contact Size #0	#4	#8	#12	#16
22-34	5	1/8	D				3	2
22-35	3	1/8	D			3		
22-36	8	1/8	D	THERMO-			1	
		1/16	A	COUPLE			7	
22-404	8	1/16		THERMO-			8	
28-1	9	1/8	D			1	2	
		1/16	A			2	4	
28-2	14	1/8	D				2	12
28-3	3	3/16	E			3		
28-4	9	1/8	D				2	4
		3/16	E					3
28-5	5	1/8	D		2		1	2
28-6	3	1/8	D		3			
28-7	2	1/8	D		2			
28-8	12	1/16	A					9
		1/8	D					1
		3/16	E				2	
28-9	12	1/8	D				6	6
28-10	7	1/8	D				1	
		1/16	A		2	2	2	
28-11	22	1/16	A				4	18
28-12	26	1/16	A					26
28-14	11	1/8	D				11	
28-15	35	1/16	A				35	
28-16	20	1/16	A					20
28-17	15	1/4	B					1
		1/8	D					3
		1/16	A					11
28-18	12	5/16	C					1
		1/8	D					5
		1/16	A					2
			INST.					4
28-19	10	1/4	B					2
		1/8	D					2
		1/16	A				4	2
28-20	14	1/16	A				10	4
28-21	37	1/16	A					37

Insert Number	Total Contacts	Mech'l. Spacing	Serv. Rating	Contact Size #0	#4	#8	#12	#16
28-22	6	1/8	D		3			3
28-410	4	3/32						3
		1/2					1	
28-766	10	1/8				2	6	2
28-833	7	1/8				2		5
28-840	4	5/32			2	2		
28-880	3	1/8		COAX CONTACTS				
32-1	5	3/16	E				1	
		1/8	D	2			2	
32-2	5	3/16	E		3			2
32-3	9	1/8	D	1	2		2	4
32-4	14	1/16	A					4
		1/8	D				2	8
32-5	2	1/8	D	2				
32-6	23	1/16	A		2	3	2	16
32-7	35	1/16	A				7	24
			INST.					4
32-8	30	1/16	A				6	24
32-9	14	1/8	D		2			12
32-10	7	1/4	B					1
		1/8	D			2		
		1/16	A		2			
		3/16	E					2
32-12	15	1/16	A				1	4
		1/8	D				4	6
32-13	23	1/8	D				5	18
32-15	8	1/8	D	2			6	
32-17	4	1/8	D		4			
32-101	12			TWO COAX CONTACTS				
		5/16	C					2
		1/8	D					8
32-102	14			ONE COAX CONTACT				
		5/16	C					1
		1/8	D					6
		1/16	A					6
32-414	52	1/16	A					52

MS/AN Insert Contact Arrangement — As viewed from the front of the pin insert

1 CONTACT
8S-1
10S-2
12S-4
12-5
14-3
14S-4
16-2
16S-3
16-12
18-6

1 CONTACT
18-7
18-16
18-420*
20-2
22-7
24-835*

2 CONTACT
10SL-4
12S-3
12S-6*

2 CONTACT
14S-9
16S-4
16-11
16-13
18-3
18-14
18-404*
20-5
20-12

2 CONTACT
20-23
22-1
22-3
22-8
22-11
24-1
24-9

2 CONTACT
28-7
32-5

3 CONTACT
10SL-3
14S-1
14S-7
16S-5
16S-6
16-7

3 CONTACT
16-10
18-5
18-22
20-3
20-6
20-19
20-26
22-2

3 CONTACT
22-6
22-9
22-21
22-25
24-14
28-3
28-6

3 CONTACT
28-880*
36-4

4 CONTACT
12SL-844*
14S-2
16-9
18-4
18-10
18-13

4 CONTACT
18-15
20-4
20-20
20-24
22-4
22-10
22-22

4 CONTACT
24-4
24-18
24-22
28-410
28-840
32-17

4 CONTACT
36-5

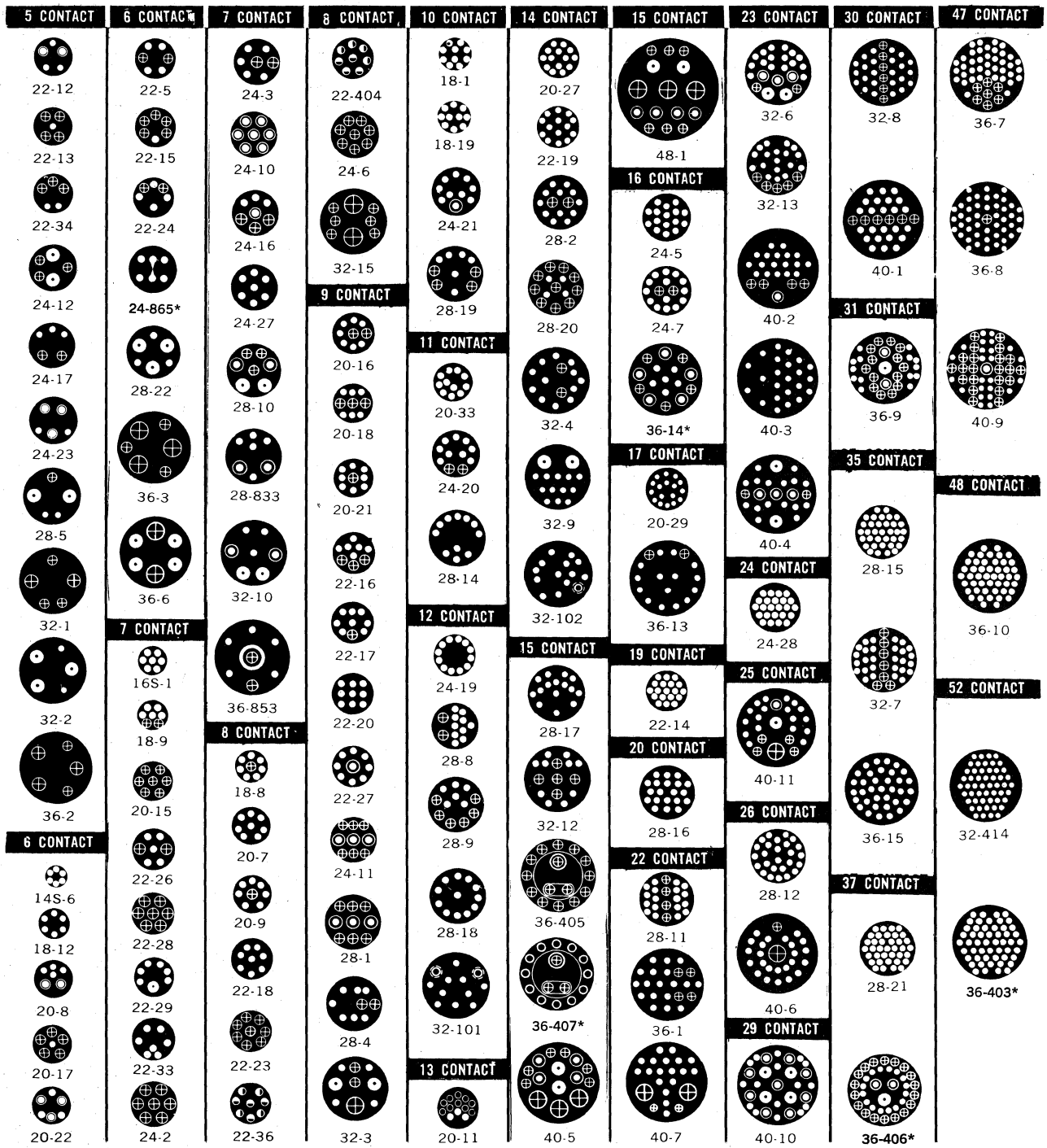
5 CONTACT
14S-5
18-11
18-20
18-29
20-14

(Continued)

* MS number not assigned as yet. Use 97 prefix in place of MS.

AMPHENOL
THE BUNKER-RAMO CORPORATION

MS/AN Insert Contact Arrangement (CONTINUED)



* MS number not assigned as yet. Use **97** prefix in place of **MS.**

CODE OF WIRE SIZES





CURRENT RATING

Contact Size	20	16	12	8	4	0
Amperes	10	22	41	73	135	245

Each insert is available with all male or female contacts. Contacts are non-rotating with all solder cups aligned for maximum wiring speed. Contact sizes correspond in number coding to wire sizes.

AMPHENOL POWER CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MS Quick Reference Insert Specifications

Insert No.	Total Contacts	Ampere Rating 245 135 73 41 22 — CONTACT SIZE 0	4	8	12	16	VOLTS DC	VOLTS AC	MS-E/R	PokeR	ALTERNATE POSITIONS Degrees to Right Front Pin Insert W	X	Y	Z
8S-1	1					1	700	500	X					
10S-2	1					1	700	500	X					
10SL-3	3					2	700	500	X	X				
10SL-4	2					2	700	500	X	X				
12ST-844	4					4								
12S-2	Like 12S-3 Rotated 250° R													
12S-1	Like 12S-3 Rotated 100° R													
12S-3	2					2	700	500	X	X	70	145	215	290
12S-4	1					1	1250	900						
12-5	1				1		1250	900						
12S-6	2					2	THERMO.							
14S-1	3					3	700	500						
14S-2	4					4	250	200	X	X		120	240	
14-3	1				1		700	500						
14S-4	1					1	1250	900						
14S-5	5					5	250	200	X	X		110		
14S-6	6					6	250	200	X					
14S-7	3					3	700	500			90	180	270	
14S-9	2					2	700	500			70	145	215	290
14S-10	Like 14S-2 Rot'd 100° R						700	500						
14S-11	Like 14S-2 Rotated 250° R													
14S-12	Like 14S-7 Rotated 100° R													
14S-13	Like 14S-7 Rotated 260° R													
16S-1	7					7	700	500	X	X	80			280
16-2	1				1		1750	1250						
16S-3	1					1	2450	1750						
16S-4	2					2	1250	900	X	X	35	110	250	325
16S-5	3					3	700	500	X		70	145	215	290
16S-6	3					3	700	500			90	180	270	
16-7	3			1		2	700	500			80	110	250	280
16-9	4				2	2	700	500			35	110	250	325
16-10	3				3		700	500	X	X	90	180	270	
16-11	2				2		700	500	X		35	110	250	325
16-12	1		1				700	500						
16-13	2				2	THE.	700	500			35	110	250	325
16S-14	3					3	700	500						
16S-15	Like 16S-4 Rotated 100° R													
16S-16	Like 16S-4 Rotated 250° R													
16S-17	Like 16S-5													
18-1	10					4	700	500	X	X	70	145	215	290
						6	250	200						
18-3	2				2		1250	900	X		35	110	250	325
18-4	4					4	1250	900	X	X	35	110	250	325
18-5	3				2	1	1250	900			80	110	250	280
18-6	1		1				1250	900						
18-8	8				1	7	700	500	X	X	70			290
18-9	7				2	5	250	200			80	110	250	280
18-10	4				4		700	500				120	240	
18-11	5				5		700	500	X	X		170	265	
18-12	6					6	700	500	X		80			280
18-13	4			1	3		700	500			80	110	250	280
18-14	2		1			1	700	500			80	110	250	280
18-15	4				4	THE.	700	500				120	240	
18-16	1				1		4200	3000						
18-17	Like 18-9 Rotated 100°R													
18-18	Like 18-9 Rotated 250° R													
18-19	10					10	700	500				120	240	
18-20	5					5	700	500			90	180	270	
18-22	3					3	1250	900			70	145	215	290
18-23	Like 18-1 Rotated 100° R													
18-24	Like 18-1 Rotated 250° R													
18-25	Like 18-3 Rotated 100° R													
18-26	Like 18-3 Rotated 250° R													
18-27	Like 18-5 Rotated 100° R													
18-28	Like 18-5 Rotated 250° R													
18-29	5					5	700	500			90	180	270	
18-30	Like 18-20 Rotated 110° R													
18-31	Like 18-20 Rotated 260°R													
18-404	Like 18-3 Except Thermocouple													
18-420	1 High Voltage Contact													
20-1	Replaced By 20-27													

Insert No.	Total Contacts	Ampere Rating 245 135 73 41 22 — CONTACT SIZE 0	4	8	12	16	VOLTS DC	VOLTS AC	MS-E/R	PokeR	ALTERNATE POSITIONS Degrees to Right Front Pin Insert W	X	Y	Z
20-2	1	1					1250	900						
20-3	3				3		1250	900			70	145	215	290
20-4	4				4		1250	900	X		45	110	250	
20-5	2					2	1750	1250			35	110	250	325
20-6	3					3	1250	900			70	145	215	290
20-7	8					4	1250	900	X	X	80	110	250	280
						4	700	500						
20-8	6			2		4	250	200			80	110	250	280
20-9	8				1		1250	900			80	110	250	280
						7	700	500						
20-11	13					13	250	200						
20-12	2		1			1	700	500			80	110	250	280
20-14	4			2	3		700	500			80	110	250	280
20-15	7				7		700	500	X	X	80			280
20-16	9				2	7	700	500	X	X	80	110	250	280
20-17	6				5	1	700	500			90	180	270	
20-18	9				3	6	700	500	X	X	35	110	250	325
20-19	3			3			700	500			90	180	270	
20-20	4		1		3		700	500			80	110	250	280
20-21	9				1	8	700	500			35	110	250	325
20-22	6			3		3	700	500			80	110	250	280
20-23	2			2			700	500			35	110	250	325
20-24	4			2		2	700	500			35	110	250	325
20-25	Like 20-11 Rotated 100°R													
20-27	14					6	700	500						
						8	250	200	X	X	35	110	250	325
20-29	17					17	700	500	X	X	80			280
20-33	11					11	700	500						
22-1	21			2			1250	900			35	110	250	325
22-2	3			3			1250	900			70	145	215	290
22-3	2		1			1	1250	900			80	110	250	280
22-4	4			2	2		700	500			35	110	250	325
22-5	6				2	4	1250	900			35	110	250	325
22-6	3			2		1	1250	900			80	110	250	280
22-7	1	1					1750	1250						
22-8	2				2		1750	1250			35	110	250	325
22-9	3				3		1750	1250			70	145	215	290
22-10	4					4	1750	1250			35	110	250	325
22-11	2					2	2450	1750			35	110	250	325
22-12	5			2		3	1250	900			80	110	250	280
22-13	5					1	1250	900						
					4		700	500			35	110	250	325
22-14	19					19	700	500	X	X	80	110	250	280
22-15	6					1	1750	1250						
					5		700	500			80	110	250	280
22-16	9				3	6	700	500			80	110	250	280
22-17	9				1	7	700	500						
						1	1250	900			80	110	250	280
22-18	8					5	1250	900						
						3	700	500			80	110	250	280
22-19	14					14	700	500	X		80	110	250	280
22-20	9					9	700	500			35	110	250	325
22-21	3	1				2	700	500			80	110	250	280
22-22	4			4			700	500				110	250	
22-23	8				1		1250	900			35		250	
					7		700	500						
22-24	6					3	1250	900						
					2	1	700	500			80	110	250	280
22-25	3	1				2	700	500			80	110	250	280
22-26	7				2	5								
22-27	9			1			1250	900			80		250	280
						8	700	500						
22-28	7				7		700	500			80			280
22-29	7		1			6	700	500			80	110	250	280
22-30	Like 22-14 Rotated 260° R													
22-32	Like 22-5 Rotated 260° R													
22-23	7					4	1250	900						
						3	700	500			80	110	250	280
22-34	5				3	2	1250	900			80	110	250	280
22-36	8	THERMO.			1		1250	900			90		270	
					7		700	500						

Insert No.	Total Contacts	Ampere Rating 245 135 73 41 22 — CONTACT SIZE 0	4	8	12	16	VOLTS DC	VOLTS AC	MS-E/R	PokeR	ALTERNATE POSITIONS Degrees to Right Front Pin Insert W	X	Y	Z
22-404	8	THERMO			8									
24-1	2	1			1		1250	900			80	110	250	280
24-2	7				7		1250	900			80			280
24-3	7				2	5	1250	900			80	110	250	280
24-4	4	1				3	1250	900			80	110	250	280
24-5	16					16	700	500	X		80	110	250	280
24-6	8				3		1250	900			80	110	250	280
					5		700	500						
24-7	16				2	14	700	500			80	110	250	280
24-9	2		2				700	500			35	110	250	325
24-10	7			7			700	500			80			280
24-11	9			3	6		700	500			35	110	250	325
24-12	5		2		3		700	500			80	110	250	280
24-14	3	1			2		700	500			80	110	250	280
24-15	Like 24-5 Rotated 100° R													
24-16	7		1			3	1250	900						
					3		700	500			80	110	250	280
24-17	5				2	3	1250	900			80	110	250	280
24-18	4					4					(Short Circuit Con.)			
24-19	12					12								
24-20	11				2	9	1250	900	X	X	80	110	250	280
24-21	10			1		9	1250	900			80	110	250	280
24-22	4			4			1250	900			45	110	250	
24-23	5			3		2	1250	900			80	110	250	280
24-24	Like 24-5 Rotated 250° R													
24-25	Like 24-6 Rotated 100° R													
24-26	Like 24-6 Rotated 250° R													
24-27	7					7	1750	1250			80			280
24-28	24					24	250	200	X	X	80	110	250	280
24-768	5			1	4		700	500						
24-835	1	High Voltage					*10000							
28-1	9			1	2		1250	900						
				2	4		700	500			80	110	250	280
28-2	14				2	12	1250	900	X		35	110	250	325
28-3	3			3			1750	1250			70	145	215	290
28-4	9				2	4	1250	900						
						3	1750	1250			80	110	250	280
28-5	5	2		1	2		1250	900			35	110	250	325
28-6	3	3					1250	900			70	145	215	290
28-7	2	2					1250	900			35	110	250	325
28-8	12					9	700	500						
						1	1250	900			80	110	250	280
					2		1750	1250						
28-9	12				6	6	1250	900			80	110	250	280
28-10	7				2		1200	900						
		2	2	1			700	500			80	110	250	280
28-11	22			4	18		700	500	X	X	80	110	250	280
28-12	26				26		700	500	X	X	90	180	270	
28-13	Like 28-12 Rotated 100° R													
28-14	11				11		1250	900			80	110	250	280
28-15	35				35		700	500	X		80	110	250	280
28-16	20				20		700	500	X		80	110	250	280
28-17	15				1		2450	1750						
					3		1250	900			80	110	250	280
					11		700	500						
28-18	12				1		4200	3000						
					5		1250	900						
					2		700	500			70	145	215	290
					4		250	200						
					2		2450	1750						
28-19	10				2		1250	900			80	110	250	280
				4	2		700	500						
28-20	14			10	4		700	500	X	X	80	110	250	280
28-21	37				37		700	500	X	X	80	110	250	280
28-22	6	3			3		1250	900			70	145	215	299
28-410	4				1		High Voltage Cont.							
					3									
28-766	10		2	6	2									
28-833	7			2		5								
28-840	4	2	2											
28-880	3	Coax. Contacts												

AMPHENOL POWER CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MS Quick Reference Insert Specifications (CONTINUED)

Insert No.	Total Contacts	Ampere Rating 245	135	73	41	22	VOLTS■ DC	VOLTS■ AC	MS-E/R	PokeR	ALTERNATE POSITIONS Degrees to Right Front Pin Insert W	X	Y	Z
		CONTACT SIZE 0	4	8	12	16								
32-1	5				1		1750	1250			80	110	250	280
		2			2		1250	900						
32-2	5		3			2	1750	1250			70	145	215	290
32-3	9	1	2		2	4	1250	900			80	110	250	280
32-4	14					4	700	500						
					2	8	1250	900			80	110	250	280
32-5	2	2					1250	900			35	110	250	325
32-6	23		2	3	2	16	700	500			80	110	250	280
32-7	35				7	24	700	500	X	X	80	125	235	280
						4	250	200						
32-8	30				6	24	700	500			80	125	235	280
32-9	14		2			12	1250	900			80	110	250	280
32-10	7					1	2450	1750						
				2			1250	900			80	110	250	280
		2					700	500						
						2	1750	1250						
32-12	15				1	4	700	500			80	110	250	280
					4	6	1250	900						
32-13	23				5	18	1250	900			80	110	250	280
32-15	8	2			6		1250	900			35	110	250	280
32-16	Like 32-6 Rotated 100° R													
32-17	4		4				1250	900			45	110	250	
32-18	Like 32-4 Rotated 100° R													
32-19	Like 32-1Rotated 100° L													
32-20	Like 32-6 Rotated 100° L													
						2	4200	3000						
32-101	12	Two Coax.Cont.			8		1250	900			65	125	225	310
		Two Coax. Cont.												

Insert No.	Total Contacts	Ampere Rating 245	135	73	41	22	VOLTS■ DC	VOLTS■ AC	MS-E/R	PokeR	ALTERNATE POSITIONS Degrees to Right Front Pin Insert W	X	Y	Z
		CONTACT SIZE 0	4	8	12	16								
32-102	14	One Coax. Cont.*				1	4200	3000						
						6	1250	900			65	125	225	310
						6	700	500						
32-414	52	One Coax. Cont.				52	700	500						
36-1	22				4	18	1250	900			80	110	250	280
36-2	5	3			2		1250	900						
36-3	6	3			3		1250	900			70	145	215	290
36-4	3	1					1250	900						
		2					700	500			70	145	215	290
36-5	4	4					700	500				120	240	
36-6	6	2	4				700	500			35	110	250	325
36-7	47				7	40	700	500			80	110	250	280
36-8	47				1	46	700	500			80	110	250	280
36-9	31		1	2	14	14	700	500			80	125	235	280
36-10	48					48	700	500	X	X	80	125	235	280
36-11	Like 36-10 Rotated 100° R													
36-12	Like 36-10 Rotated 110° L													
36-13	17					3	1750	1250						
					2	12	700	500			80	110	250	280
36-14	16			5	5	6	1250	900			90	180	270	
36-15	35					34	700	500						
						1	1250	900			60	125	245	305
36-16	Like 36-7 Rotated 100° R													
36-17	Like 36-7 Rotated 110° L													
36-18	Like 36-9 Rotated 100° R													
36-21	Like 36-9 Rotated 100° L													

Insert No.	Total Contacts	Ampere Rating 245	135	73	41	22	VOLTS■ DC	VOLTS■ AC	MS-E/R	PokeR	ALTERNATE POSITIONS Degrees to Right Front Pin Insert W	X	Y	Z
		CONTACT SIZE 0	4	8	12	16								
36-403	52					52	700	500						
					12			5000						
36-405	15				2			*9000						
					1			15000						
36-406	37		1	2	18	16	700	500						
						12		5000						
36-407	15				2			†9000						
					1			15000						
36-853	7				2	5								
40-1	30				6	24	1250	900			65	130	235	300
40-2	23					5	2450	1750						
						18	1250	900			80	110	250	280
40-3	23		1		4	18	1250	900			80	110	250	280
40-4	23		2	3	2	16	1250	900			80	110	250	280
40-5	15	3	2	4	6		700	500			80	110	250	280
40-6	26	1			1	24	1250	900			80	110	250	280
40-9	47			1	22	24	700	500			65	125	225	310
40-10	29		4	9		16	700	500			65	125	225	310
40-11	25	1	1	1	4	18	1250	900			80	110	250	280
40-13	Like 40-2 Rotated 100° R													

**For 7MM High Tension Cable. 20 Amps. Max.*
■Limiting operating voltage at 50,000 feet altitude are approximately 25% of the sea level values.
*†VOLTAGE BREAKDOWNS: 15,000 V. RMS between "A" and nearest Contacts; 9,000 V. RMS between High Voltage Contacts; 5,000 V. RMS to ground; 5,000 V. RMS between small Contacts. * 5,000 V. to ground. • Insert 20-11 contains 13 size No. 16 contacts, 10 of which have size No. 20 solder cups.*

CAPS - 97 Series





Two types of protective caps are available for use with MS Connectors:

CAP & CHAIN — For use when MS Connectors are not in use. The 9760 is made of aluminum with an olive drab chromate conversion seal and is available for either receptacles or plugs. To order the cap less chain, add the suffix G to the catalog number.

DISPOSABLE DUST CAPS — Expendable polyethylene dust caps provide added protection to precision built MS Connectors during storage or shipment or completed apparatus.

AUTOMATIC ORDERING — A disposable cap may be ordered with any MS Connector by adding the suffix (288) to the catalog number of the connector.

ORDERING INFORMATION

MS Connector Size	CAP & CHAIN For Engagement On Receptacles 9760-	CAP & CHAIN For Engagement On Plugs 9760-	DISPOSABLE DUST CAP For Mating End Receptacles 97121-	DISPOSABLE DUST CAP For Mating End Plug 97121-
8S	-8	-8P	-208	-308
10S	-10	-10P	-210	-310
10SL	-10	-10P	-210	-310
12, 12S	-12	-12P	-212	-312
12SL	-12	-12P	-212	-312
14, 14S	-14	-14P	-214	-314
16, 16S	-16	-16P	-216	-316
18	-18	-18P	-218	-318
20	-20	-20P	-220	-320
22	-22	-22P	-222	-322
24	-24	-24P	-224	-324
28	-28	-28P	-228	-328
32	-32	-32P	-232	-332

Thermocouples - 97 Series FOR MS CONNECTORS

Designed to provide a disconnect in thermocouple circuits without the introduction of dissimilar metals.

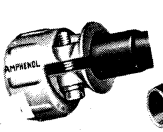
There are six insert configurations listed on page 19 as thermocouples. Each of these utilizes an equal number of iron and constantan contacts. However, any MS Connector with size 16 contacts may be ordered with any of the below listed contacts. For ease in wiring, each thermocouple contact is color coded on the solder cup end of the contact.

Contacts	Description	Color Code
Alumel	94% Nickel, 2.5% Manganese, 2% Aluminum, 1% Silicone, .5% Iron	Orange
Constantan	45% to 60% Copper, 40% to 55% Nickel, 0 to 1.4% Manganese, .1% Iron	Red
Copper	87.5% to 90% Copper, 1.8% to 2.2% Lead, .1% Iron, .5% Nickel, .5% Normal Impurities and balance Zinc	Yellow
Iron	84.4% Iron, 2% Sulphur, .4% Silicone, 2% Carbon, 3.6% Managenese, .6% Phosphor, .1% Copper, .9% Tin	White
Chromel	90% Nickel, 10% Chromium	Green

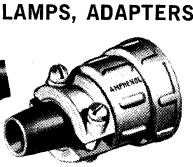
MS Fittings CABLE CLAMPS, ADAPTERS



AN3057



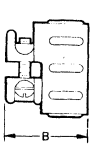
Basic 9767



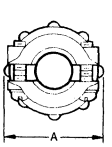
Weatherproof 9767



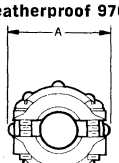
AN3055



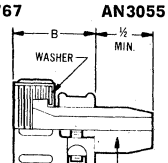
AN3057



AN3057 CABLE CLAMP



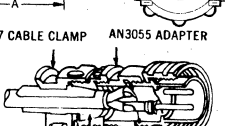
AN3055 ADAPTER



Basic 9767



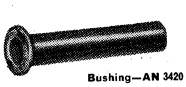
Cable Clamp—MS 3057A



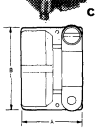
WASHER RUBBER BUSHING

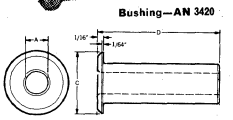
TYPE W WASHER

Weatherproof 9767



Bushing—AN 3420





(CONTINUED)

AMPHENOL POWER CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MS Fittings CABLE CLAMPS, ADAPTERS (Cont.)

AN3057 Cable Clamp — Standard cable clamp, threads onto all MS Connectors with threaded back shell. Provides reliable sturdy support. Illustration does not shown one rubber and two fiber washers which seats clamp to connector.

AUTOMATIC ORDERING — By adding deviation number (559) to the MS catalog number, the correct AN3057 cable clamp will be shipped with the MS Connector.

Basic 9767-X — Identical to AN3057 cable clamp, but the rubber washer and one of the two fiber washers are replaced with a rubber boot. Recommended for applications in which cable is subject to considerable flexing.

9767-X-X Weatherproof Cable Clamp — Same as BASIC 9767-X above with addition of AN3055 reducing adapter. The inside of the AN3055 is tapered to the same dimensions of the front end of the rubber boot — thus providing a weatherproof seal.

AN3055 Reducing Adapter — Permits smaller cable clamps to be used with MS Connectors.

AN3420 Bushing — Rubber bushing designed specifically for MS3057A Cable Clamp. Protects wire bundle and unjacketed cable from possible damage by cable clamp. Can also be used for a reducing bushing.

MS3057A Cable Clamp — For rubber covered cable or wires protected by tubing. Both clamping halves float so cable is always centered, affording maximum strain relief. With unjacketed cable or wire bundles without tubing, use corresponding AN3420 Bushing.

	CABLE CLAMP				CABLE CLAMP WITH RUBBER BOOT		REDUCING ADAPTER Use With AN3057 or Basic 9767 at Left		WATERPROOF CABLE CLAMP		DIMENSIONS					
Connector Size	Max. Cable O.D.	MS3057A	AN3057	Bushing for MS3057A	Max. Cable O.D.	BASIC 9767	AN3055	Fitting Size	Max. Cable O.D.	9767	3055, AN3057, 9767 A	3055, AN3057, 9767 B	MS3057A A	MS3057A B	AN3420 A	AN3420 D
8S, 10S	.25		AN3057-3		.156	9767-3	AN3055-8-3	3	.156 .219	9767-10-3 9767-10-4	.656	1				
10SL, 12, 12S	.313	MS3057A-4	AN3057-4	AN3420-3	.219	9767-4	AN3055-12-3 AN3055-12-4	3 4	.156 .219	9767-12-3 9767-12-4	.781	1	.795	.842	.130	2.875
12SL, 14, 14S	.438	MS3057A-6	AN3057-6	AN3420-4	.344	9767-6	AN3055-14-4 AN3055-14-6	4 6	.219 .344	9767-14-4 9767-14-6	9.06	1.078	.850	.995	.220	2.750
16, 16S	.563	MS3057A-8	AN3057-8	AN3420-6	.438	9767-8	AN3055-16-4 AN3055-16-6 AN3055-16-8	4 6 8	.219 .344 .438	9767-16-4 9767-16-6 9767-16-8	1.063	1.125	.920	1.120	.312	2.625
18	.625	MS3057A-10	AN3057-10	AN3420-8	.563	9767-10	AN3055-18-6 AN3055-18-8 AN3055-18-10	6 8 10	.344 .438 .563	9767-18-6 9767-18-8 9767-18-10	1.188	1.125	.920	1.216	.437	2.500
20, 22	.75	MS3057A-12	AN3057-12	AN3420-10	.688	9767-12	AN3055-22-8 AN3055-22-10 AN3055-22-12	8 10 12	.438 .563 .688	9767-22-8 9767-22-10 9767-22-12	1.375	1.188	.927	1.403	.562	2.375
24, 28	.938	MS3057A-16	AN3057-16	AN3420-12	.844	9767-16	AN3055-28-10 AN3055-28-12 AN3055-28-16	10 12 16	.563 .688 .844	9767-28-10 9767-28-12 9767-28-16	1.625	1.313	1.015	1.683	.625	2.250
32	1.25	MS3057A-20	AN3057-20	AN3420-16	1.031	9767-20	AN3055-32-12 AN3055-32-16 AN3055-32-20	12 16 20	.688 .844 1.031	9767-32-12 9767-32-16 9767-32-20	1.938	1.5	1.095	2.050	.750	2.125
36	1.375	MS3057A-24	AN3057-24	AN3420-20	1.188	9767-24	AN3055-36-16 AN3055-36-20 AN3055-36-24	16 20 24	.844 1.031 1.188	9767-36-16 9767-36-20 9767-36-24	2.188	1.563	1.156	2.245	.937	2.000
40	1.625		AN3057-28	AN3420-24			AN3055-40-20 AN3055-40-24 AN3055-40-28	20 24 28	1.031 1.188	9767-40-20 9767-40-24	2.438	1.563			1.250	1.875

MS Deviations

COMMON MS DEVIATIONS

MS Connectors are available with minor deviations from standard. Deviations are ordered by adding the deviation suffix to the MS part number. Deviation numbers always appear in parenthesis.

(288) Includes 97-121 dust cap for mating end.

(417) Plugs only, type W washer cemented.

(426) Minimum of .00002" gold over .0002/.0003" silver on contacts. Use 97 prefix instead of MS.

(432) No. 16 contact. For use with AMP No. 53 taper pin. Use 97 prefix instead of MS.

(559) AN3057 cable clamp included with connector.

(639) Cadmium plate finish with clear chromate conversion seal. Use 97 prefix instead of MS.

(866) Contacts with minimum of .00002 gold over .0002/.0003" silver with tinned solder cups.

..... Coax contacts for use with RG58 or RG55 cable may be substituted for size 0 contacts. Order 3-116 male or 31-117 female 50 ohm impedance coax insulated contacts.

MS Potting

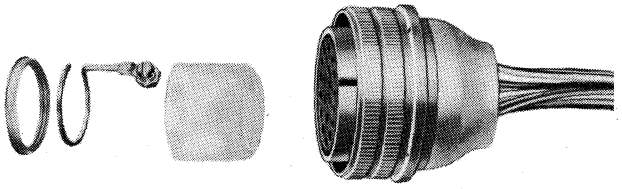
MS Connectors for potting are available in all connector styles except the MS3102. The back shell of the connector is removed and replaced with a potting mold retainer ring No. 9755-270-XX. (XX indicates connector size.) This describes the basic (438) construction. Other variations are listed on page 25.

ORDERING INFORMATION

Since the solid or split back shell is removed from the connector shell prior to potting, the A and the B is dropped from the part number of an MS potted connector.

For example: 97-3106-18-11P (596)
or 97-3101-14S-4P (438)

Since the potting construction does not fall under Miltary Specifications unless so indicated under the special marking column, the prefix 97 is used.



AMPHENOL POWER CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

POTTING DEVIATIONS

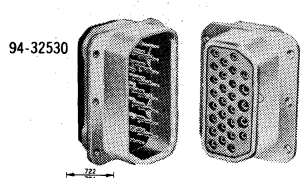
Potting Dev. No.	Applies to Shell Style (Never 3102)	Retainer Ring 9755-270-XX	Ground Lug 9755-255-XX	Potting Form: Polyethylene 9755-255-XX	Potting Form: Nylon 9755-271-XX	Dust Cap Front End 97-121	Type W Washer Plug Only	Taper Pin Contacts	Bagged & Tagged	Connector Marking
(438)	All	X					X			97 Prefix
(469)	All	X					X			BUA3A-225-XX-XX
(479	All	X					X	X		97 Prefix
(517)	All	X	X				X			97 Prefix
(521)	All	X				X	X			97 Prefix
(538)	All	X	X				X			BuAer-54A3A-225-XX-XX
(541)	All	X		X			X			97 Prefix
(542)	All	X	X	X			X			97 Prefix
(546)	All	X				X	X			BuAer-54A3A-225-XX-XX
(568)	All	X	X	X			X			BuAer-54A3A-225-XX-XX
(576)	All	X		X		X	X			BuAer-54A3A-225-XX-XX
(581)	All	X		X			X			BuAer-54A3A-225-XX-XX
(585)	3106	X			X		X			BuAer-54A3A-225-XX-XX
(596)	3106	X			X		X			97 Prefix
(816)	3106	X					X			MS-25183-XX-XX
(822)	3106	X			X	X	X			BuAer-54A3A-225-XX-XX
(824)	All	X			X		X		X	MS-25183-XX-XX
(826)	3106	X	X		X		X			MS-25183A-XX-XX
(835)	All	X			X		X			MS-25183-XX-XX
(836)	All	X					X		X	MS-25183-XX-XX
(838)	All	X			X	X	X			BuAer-54A3A-225-XX-XX
(840)	All	X	X				X			MS-25183A-XX-XX
(842)	All	X			X	X	X		X	MS-25183-XX-XX
(854)	3101	X					X			BU-57A5A234-XX-XX
(856)	3106	X			X	X	X		X	CVC-2530A-XX-XX
(857)	3100	X			X	X	X			CVC-2531A-XX-XX
(863)	3106	X					X		X	97 Prefix
(871)	All	X			X		X		X	97 Prefix
(872)	All	X		X			X		X	97 Prefix
(877)	All	X			X		X			97 Prefix

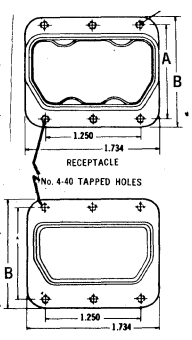
POKE-HOME CONTACTS—CRIMP or SOLDER CONTACTS—RUGGED, RELIABLE - 94 SERIES

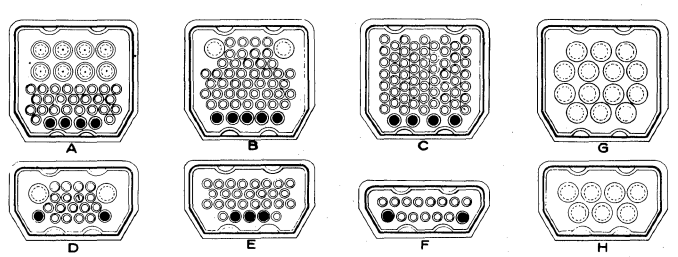
Poke-Home contacts permit the termination to be made away from the connector. No tool is required.

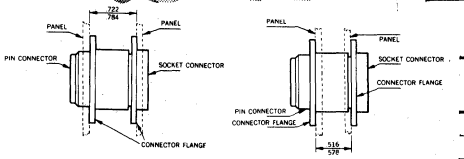
Coax contacts are designed for cables of the approximate size of RG-58/U or RG-180/U, and are terminated by soldering. Size 16 and 20 contacts are available for either crimping or soldering. Contacts are gold over silver plated. All socket contacts are hooded.

The dielectric material is Amphenol Blue — diallyl phthalate.









TOOLS

Universal Crimping Kit	294-57
#20 Crimping Tool	294-90
#16 Contact Crimping Tool	294-85
#20 Contact Removal Tool	294-58
#16 Contact Removal Tool	294-48

Note: No insertion tool required. Insert Manually.

ORDERING INFORMATION

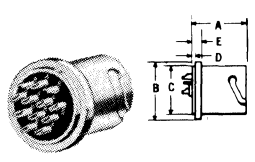
CRIMP CONTACTS Plug	CRIMP CONTACTS Receptacle	SOLDER CONTACTS Plug	SOLDER CONTACTS Receptacle	Insert	Cable Clamp Only	Cable Clamp & Hood	CONTACTS Size 16 20 Amps	CONTACTS Size 20 7.5 Amps	CONTACTS Coax	DIMENSIONS A	DIMENSIONS B
94-52548-1	94-62548-1	94-52548	94-62548	A	94-520	94-547	4	25	8	1.921	2.109
94-54352-1	94-64352-1	94-54352	94-64352	B	94-520	94-547	5	43	2	1.921	2.109
94-55940-1	94-65940-1	94-55940	94-65940	C	94-520	94-547	4	59	—	1.921	2.109
94-31722-1	94-41722-1	94-31722	94-41722	D	94-520	94-548	2	17	2	1.281	1.468
94-32530-1	94-42530-1	94-32530	94-42530	E	94-520	94-548	3	25	—	1.281	1.468
94-11320-1	94-21320-1	94-11320	94-21320	F	94-520	94-549	2	13	—	1.000	1.187
———	———	94-50014-5	94-60014	G	94-520	94-547	—	—	14	1.921	2.109
———	———	94-30007-2	94-40007-2	H	94-520	94-548	—	—	7	1.281	1.468

AMPHENOL POWER CONNECTORS

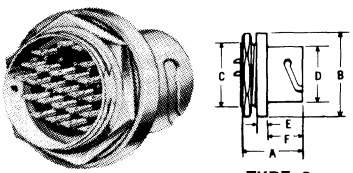
AMPHENOL
THE BUNKER-RAMO CORPORATION

Miniature AN - 182 Series

Hermetically Sealed Receptacles. Mates With 165 Series



TYPE 1



TYPE 2

Available in two shell styles; solder flange Type 1, and threaded back shell with hex nut Type 2; and two types of contacts; flattened and pierced and solder cup.

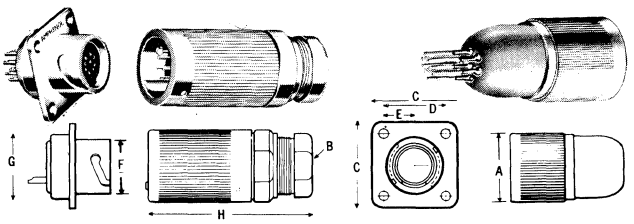
Available in all 165 Series contact insert configurations.

DIMENSIONS

	TYPE 1		TYPE 2			
	Small	Large	Small			Large
Dimension			182-15-1002 182-1-1008	182-1-1001	All Others	
A ±.016	.639	.639	.781	.781	.781	.813
B ±.005	.841	1.082	1.064	1.064	.875	1.438
C ±.003	.685	.926	.812	.750	.750	1.062
D ±.003	.042	.042	.684	.684	.684	.925
E ±.005	.107	.204	.126	.126	.063	.126
F ±.005	—	—	.437	.437	.532	.437

Miniature AN - 165 Series

Weather Proof, Bayonet Coupling, Internal Clamping, Pressure Proof, Lightweight, Inexpensive



The 165 Series is the first of the miniature quality connectors. Only ⅓ the size and weight of standard MS Connectors, it is a bayonet type available in eight insert configurations and five shell styles; "large" and "small" sizes.

Water proof and pressure proof, the 165 Series meet the same exacting government specified salt-spray tests by many hours. The socket contacts connectors feature a sandwich construction with the insert spun into the cartridge sealed and tested at the factory for any possible leakage. O-ring seals are used in both the plug and receptacle.

All connectors are available in W and X alternate positions.

Plugs and cable receptacles are available with a built-in compression type clamp or with potting mold.

Shells are made of aluminum. Plugs have a grey anodized finish. Receptacles, for ease of mating, are chrome plated.

HERMETICALLY SEALED RECEPTACLES

The ultimate in sealing, the 182 Series receptacle mates with 165 Series plugs.

DIMENSIONS

	A	B	C	D	E	F	G	H
Small	57/64	3/8	1 1/16	25/32	25/64	7/8	13/16	1 29/32
Large	1 9/64	21/32	1 5/16	31/32	31/64	1 1/8	1 1/16	1 15/16

EXPENDABLE DUST CAPS

165-636 Large Plug Dust Cap
165-655 Small Plug Dust Cap
165-634 Large Receptacle Dust Cap
165-656 Small Receptacle Dust Cap

165 & 182 SERIES AVAILABILITY

		INSERT ARRANGEMENTS (Approx. ½ actual size)	Contact Style	Plug	Receptacle Sq. Flange	Cable Receptacle	Hermetic Seal Receptacles: Type 1 — Solder Flange Shell: Flat and Pierced Contacts	Type 1 — Solder Flange Shell: Solder Pocket Contacts	Type 2 — Threaded Back Shell: Flat and Pierced Contacts	Type 2 — Threaded Back Shell: Solder Pocket Contacts	Potting Constructions: Plug	Potting Constructions: Cable Receptacles
SMALL		5 #20 contacts 7.5 Amps	Pin	165-33	165-35	165-35-1002	182-35-1000	182-35-1001	182-35	182-35-1002	165-33-1000	165-35-1000
		600 VRMS	Socket	165-34	165-36	165-36-1003	—	—	—	—	165-34-1000	165-36-1000
		9 #20 contacts 7.5 Amps	Pin	165-13	165-15	165-15-1002	182-15	182-15-1000	182-15-1001	182-15-1002*	165-13-1000	165-15-1000
		500 VRMS	Socket	165-14	165-16	165-16-1003	—	—	—	—	165-14-1000	165-16-1000
		8 #20 contacts, 1 coax 10 Amps	Pin	165-82	165-73	165-73-1001	182-1-1007	182-1-1000	182-1-1008*	182-1-1001*	165-82-1000	165-73-1000
		500 VRMS	Socket	165-61-1008	165-83	165-83-1001	—	—	—	—	165-61	165-83-1000
		12 #20 contacts 7.5 Amps	Pin	165-9	165-11	165-11-1002	182-11-1001	182-11	182-11-1005	182-11-1002	165-9-1000	165-11-1000
		500 VRMS	Socket	165-10	165-12	165-12-1002	—	—	—	—	165-10-1000	165-12-1000
LARGE		7 #20 contacts, 7.5 Amps 4 #16 contacts 17 Amps	Pin	165-17	165-19	165-19-1002	—	—	—	—	165-17-1000	165-19-1000
		500 VRMS	Socket	165-18	165-20	165-20-1003	—	—	—	—	165-18-1000	165-20-1000
		14 #16 contacts 17 Amps	Pin	165-29	165-31	165-31-1003	182-31	182-31-1002	182-31-1003*	182-31-1001*	165-29-1000	165-31-1000
		500 VRMS	Socket	165-30	165-32	165-32-1006	—	—	—	—	165-30-1000	165-32-1000
		19 #20 contacts, 1 coax 10 Amps	Pin	165-86	165-84	165-84-1001	182-2-1004	182-2-1000	182-2-1005*	182-2-1001*	165-86-1000	165-84-1000
		500 VRMS	Socket	165-62-1007	165-85	165-85-1001	—	—	—	—	165-62	165-85-1000
		24 #20 contacts 7.5 Amps	Pin	165-25	165-27	165-27-1005	182-27-1000	182-27-1006	182-27*	182-27-1005*	165-25-1000	165-27-1000
		500 VRMS	Socket	165-26	165-28	165-28-1003	—	—	—	—	165-26-1000	165-28-1000

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

48 Series MIL-C-26500 (USAF)

Highly Environmental Miniature Connector with POKE-HOME Crimp Contacts



MS24264
FLANGED MOUNTED
RECEPTACLE
Bayonet Coupling
AMPHENOL-type 48-10R



MS24265
SINGLE HOLE
RECEPTACLE
Threaded Coupling
AMPHENOL-type 48-03R



MS24266
STRAIGHT
PLUG
Bayonet Coupling
AMPHENOL-type 48-06R

Available with either bayonet and threaded coupling, in three shell styles and 29 insert configurations with 3 to 55 contacts. Crimp type contacts conform to MIL-C-26636 and are available in sizes 12, 16, 20, No. 1 and No. 2 shielded.

PERFORMANCE

MIL-C-26500 connectors perfom with utmost reliability at extremely high altitudes and in widely varying temperature extremes.

- Connectors are not affected by continuous exposure to 200°C (392°F) temperature for 1000 hours, while simultaneously conducting current through all contacts with an interior temperature of 238°C (460°F).
  Connectors withstand thermal shock cycling from −55°C (−67°F) to +260°C (500°F).
- Mated connectors support 1500 volts RMS from sea level to 350,000 feet.
- Even after insertion and removal of contacts, mated connectors are altitude-moisture resistant. After 3 immersion-altitude cycles, connectors have a minimum insulation resistance of 5000 megohms.
- Environmental and electrical integrity is maintained during and after vibration, 0 to 2000 CPS, 15 G's during exposure to 200°C (392°F) and −55°C (−67°F).
- Insulation resistance at 260°C (500°F) for 30 minutes is 2000 megohms minimum.
- Moisture resistant maintaining minimum insulation resistance of 1000 megohms.

DESIGN FEATURES

To achieve these outstanding performance parameters, MIL-C-26500 connectors utilize newly-developed materials and incorporate highly advanced design techniques.

- MIL-C-26636 (USAF) crimp Poke Home Contacts
- Amphenol-developed reversion-resistant silicone rubber inserts.
- Spiral marked inserts, front and rear to simplify contact insertion.
- Impact extruded aluminum shells.
- Metal-to-metal bottoming of mated shells.
- Stress-limited resilient displacement of inserts.
- Face seal, insert rim seal and shell peripheral seal ("O" Ring).
- Integral insert and grommet construction.
- Anti-deflection disk.
- Grommet triple sealing risers for wire.
- Visual full engagement indicators.

CATALOG NUMBERING

The Amphenol 48 Series may be ordered by either an Amphenol Catalog Number or the corresponding military number. Since the Amphenol number is less complex, many manufacturers prefer its use.

Shell Style	Contacts	BAYONET COUPLING	
		Amphenol 48 Series No.	Military MS2426 Number
Plug	Pin	48-16RXX-XXP	MS24266RXXBXXP
	Socket	48-16RXX-XXS	MS24266RXXBXXS
Receptacle with Square Mounting Flange	Pin	48-10RXX-XXP	MS24264RXXBXXP
	Socket	48-10RXX-XXS	MS24264RXXBXXS
Single Hole Receptacle	Pin	48-13RXX-XXP	MS24265RXXBXXP
	Socket	48-13RXX-XXS	MS24265RXXBXXS

Shell Style	Contacts	THREADED COUPLING	
		Amphenol 48 Series No.	Military MS2426 Number
Plug	Pin	48-06RXX-XXP	MS24266RXXTXXP
	Socket	48-06RXX-XXS	MS24266RXXTXXS
Receptacle with Square Mounting Flange	Pin	48-00RXX-XXP	MS24264RXXTXXP
	Socket	48-00RXX-XXS	MS24264RXXTXXS
Single Hole Receptacle	Pin	48-03RXX-XXP	MS24265RXXTXXP
	Socket	48-03RXX-XXS	MS24265RXXTXXS

ORDERING INFORMATION

Select shell style and proper insert configuration. Substitute the insert configuration number for XX-XX in the above. For example, a plug with bayonet coupling, containing 55 No. 20 socket contacts should be ordered by Amphenol No. 48-16R22-55S; or by Military No. MS24266R22B55S.

ALTERNATE POSITIONS

Precision alignment of mating contacts is achieved with the use of five keys and keyways which form an integral part of the shells of the 48 Series connectors. Alternate positions 6 through 10 are available for all 48 Series connectors. Alternate positions are obtained by using shells in which different positions have been assigned to all five keys and keyways. To order alternate positions add suffix 6, 7, 8, 9, or 10 to Amphenol or Military number. For example, 48-16R22-55S6 mates with 48-10R22-55P6.

DEVIATIONS

(100) Modified For Potting (105) Less Contacts
(102) Less Cable Clamp (106) Less Cable Clamp & Contacts
(100), (102), (105) and (106) suffix's are to be added to Amphenol number only. To order by Military number MIL-C-26500 connector less cable clamp, add suffix "X" to Military number. No other Military deviations have been assigned.

ULTRAMATE

Designed in accordance to MIL-C-38300. Similar to MIL-C-26500 connectors, except that all socket contact inserts are equipped with a hard face seal. Contacts are identical to standard 48 Series Connectors. Tools are the same except for removal of contacts; use removal tool No. 294-203 for size 20 contacts and 294-180 for size 16 contacts. To order, use Amphenol 48 Series catalog numbers with the letter "R" replaced by the letter "C". Available in bayonet or threaded coupling in the following socket inserts: 10-5, 12-12, 14-7, 14-15, 16-24, 18-31, 20-41, 22-19, 22-55, 24-61.

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

48 Series MIL-C-26500 (USAF) (Continued)

Inserts Available

(Showing front face of socket insert)

SHELL SIZE — 8



2 #20 contacts
Insert 8-2*

SHELL SIZE — 10
MS-24260



5 #20 contacts
Insert 10-5‡



2 #20 contacts
Insert 10-2*



2 #16 contacts
Insert 10-20*

SHELL SIZE — 12
MS-24260



12 #20 contacts
Insert 12-12‡



3 #16 contacts
Insert 12-3

SHELL SIZE — 14
MS-24260



15 #20 contacts
Insert 14-15‡



9 #20 contacts
3 #16 contacts
Insert 14-12*



7 #16 contacts
Insert 14-7‡



4 #12 contacts
Insert 14-4†

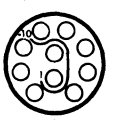


2 #16 contacts
1 #2 shielded contact
Insert 14-3

SHELL SIZE — 16
MS-24261

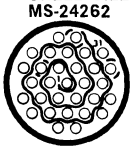


24 #20 contacts
Insert 16-24‡

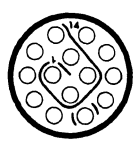


10 #16 contacts
Insert 16-10*

SHELL SIZE — 18
MS-24262



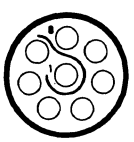
31 #20 contacts
Insert 18-31‡



14 #16 contacts
Insert 18-14

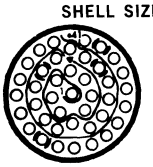


10 #16 contacts
1 #2 shielded contact
Insert 18-11

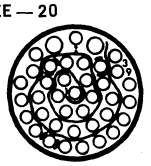


8 #12 contacts
Insert 18-8†

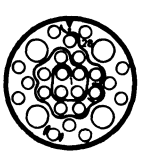
SHELL SIZE — 20



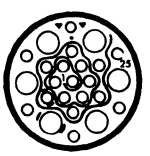
41 #20 contacts
Insert 20-41‡*



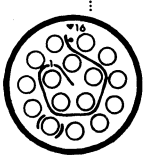
37 #20 contacts
2 #16 contacts
Insert 20-39*



24 #20 contacts
4 #12 contacts
Insert 20-28*†

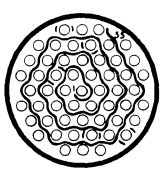


19 #20 contacts
6 #12 contacts
Insert 20-25*†

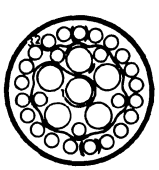


16 #16 contacts
Insert 20-16*

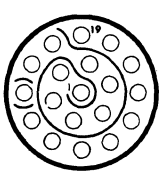
SHELL SIZE — 22
MS-24263



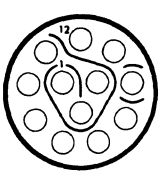
55 #20 contacts
Insert 22-55‡



26 #20 contacts
6 #12 contacts
Insert 22-32*†

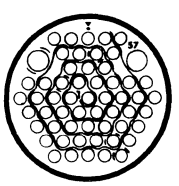


19 #16 contacts
Insert 22-19‡

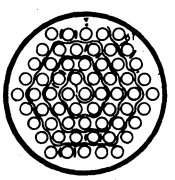


12 #12 contacts
Insert 22-12†

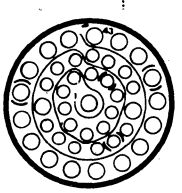
SHELL SIZE — 24



2 #12 contacts
55 #20 contacts
Insert 24-57*†



61- #20 contacts
Insert 24-61‡*



23 #20 contacts
20 #16 contacts
Insert 24-43*

‡ Available with hard-dielectric face socket inserts for Ultra-Mate (MIL-C-38300) connectors. Pin inserts for MIL-C-38300 connectors have a resilient face and, except for marking, are identical to MIL-C-26500 pin inserts.
* Not included MS-2426X at time of printing.
† #1 shielded contact is interchangeable with #12 power contact

SPECIFICATIONS

Contact	Wire Size	Wire Range Accommodations OD (Inches) Min.	Wire Range Accommodations OD (Inches) Max.	Current Rating Amps
20	24	0.040	0.090	3.0
20	22	0.040	0.090	5.0
20	20	0.040	0.090	7.5
16	18	0.068	0.130	16.0
16	16	0.068	0.130	22.0
12	14	0.106	0.170	32.0
12	12	0.106	0.170	41.0
#1 Shielded	22 Shielded Cable			3.0
#2 Shielded	20 Shielded Cable			7.5

DERATED CURRENT RATINGS AT CONTINUOUS OPERATION FOR CONTACTS OF #52 ALLOY FOR HERMETICS ONLY.

Contact Size	Amps
#12	20
#16	10
#20	5

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Environmental Connectors 48 Series (Cont'd)

POKE HOME® CONTACT INSERTION AND REMOVAL TOOLS

INSERTION TOOL MS No.	INSERTION TOOL Amphenol No.	Contact Size	REMOVAL TOOL MS No.	REMOVAL TOOL Amphenol No.
MS24256A12	294-72	12	MS24256R12	294-73
MS24256A16	294-96	16	MS24256R16	294-97
MS24256A20	294-88	20	MS24256R20	294-89

	Amphenol No.	Contact Size	MS No.
CRIMPING TOOLS	294-126	12, 16 and 20	MS3191-1 (Mil Spec.)
	294-243	12, 16 and 20	MS3191-4 Turret Head

CONTACTS AND SEALING PLUGS

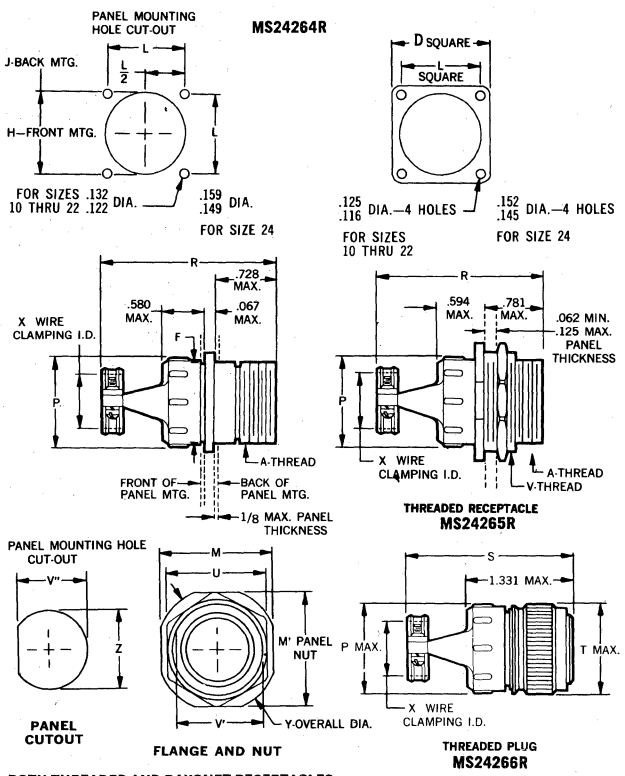
When 48 Series connectors are ordered with contacts the contact package contains the necessary number of contacts to fill the insert plus 2 spares or 3 contacts minimum, whichever is greater. A quantity of sealing plugs are also included in the contact package equal in quantity to 15% of the total number of contacts or a minimum of 3. When ordering contacts and sealing plugs separately, the part numbers are as follows:

CONTACTS

Size	AMPHENOL Part No. Pin	AMPHENOL Part No. Socket	MS Part No. Pin	MS Part No. Socket
20	48-1595-02	48-100-2000S-02	MS24254-20P	MS24255-20S
16	48-1825-02	48-100-1600S-02	MS24254-16P	MS24255-16S
12	48-1827-02	48-1215-02	MS24254-12P	MS24254-12S
#1 Shielded	48-1226-02	48-1227-50	MS27184-22P	MS27185-22S
#2 Shielded	48-2187-02	48-2188-02	MS27184-20P	MS27185-20S

GROMMET SEALING PLUGS

Color Code	Size	AMPHENOL Part No.	MS Part No.
Yellow	12	48-2221-12	MS27187-2
Blue	16	48-2221-16	MS27187-1
Red	20	48-2221-20	MS27186-1
White	#2 Shielded	48-1458-01	MS25251-8



48 Series Dimensions (Cont'd)

Dimensions (Inches)

Shell Size	A Th'd	A +.000 −.003 Bay.	D ±.005	F Max.	H Min.	J Min.	L ±.005	M Max.	M' Max.	P Max.	R Max.
10	1 1/16-24	.659	.937	.562	.572	.748	.719	1.109	1.075	.914	1.890
12	7/8-20	.829	1.031	.750	.760	.913	.812	1.296	1.292	1.026	1.890
14	15/16-20	.898	1.125	.812	.822	.980	.906	1.396	1.396	1.090	2.125
16	1 1/16-18	1.025	1.250	.938	.948	1.107	.969	1.521	1.521	1.250	2.125
18	1 3/16-18	1.131	1.343	1.062	1.072	1.209	1.062	1.646	1.646	1.358	2.125
22	1 7/16-18	1.381	1.562	1.312	1.322	1.452	1.250	1.959	1.959	1.604	2.125

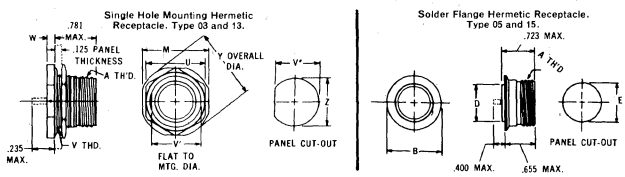
Shell Size	S	T Max. Thrd.	T Max. Bay.	U Max.	V Th'd	V' ±.003	V" ±.005	X ±.015	Y Max.	Z ±.005
10	1.832	.836	.906	.953	3/4-20	.718	.730	.270	1.192	.760
12	1.832	1.025	1.078	1.140	15/16-20	.905	.917	.400	1.380	.947
14	2.067	1.125	1.141	1.205	1-20	.968	.980	.460	1.505	1.010
16	2.067	1.250	1.265	1.329	1 1/8-20	1.093	1.105	.610	1.630	1.135
18	2.067	1.375	1.375	1.455	1 1/4-20	1.217	1.225	.690	1.740	1.260
22	2.067	1.625	1.625	1.705	1 1/2-20	1.467	1.475	.940	2.040	1.510

ORDERING INFORMATION

BAYONET COUPLING		THREADED COUPLING	
Amphenol No.	Military No.	Amphenol No.	Military No.
SINGLE HOLE, NEX NUT MOUNT			
48-13HXX-XXP	MS24265HXXBXXP	48-03HXX-XXP	MS24265HXXTXXP
SOLDER FLANGE			
48-15HXX-XXP(108)	MS27034HXXBXXP	48-05HXX-XXP(108)	MS27034HXXTXXP



HERMETICALLY SEALED RECEPTACLES To MIL-C-26500 (USAF)



The Amphenol 48 Series is available with a solder-flange or hex-nut single hole mounting hermetically sealed receptacle with either threaded or bayonet coupling.

Leakage rate is less than 0.1 micron cubic foot of helium per hour with one atmosphere differential. Additional sealing is provided by a shell peripheral "O" Ring and a chemically bonded insert face seal of high temperature silicone rubber. Contact spiral marking is marked on the face seal and by means of Amphenol's exclusive Identoseal marking, on the glass dielectric as well. Shells are non-magnetic stainless steel and are available in two shell styles, solder flange and hex nut single hole mounting. Contacts are rhodium plated, flattened and pierced. If solder cups are required, add the suffix (108) to the catalog number.

Dimensions (Inches)

Shell Size	A Threaded	Y Max.	M Max.	U Max.	V	V' ± .003	V" ± .005	W Max	Z ± .005	B Max	D Max	E +.010 −.000
10	1 1/16-24	1.192	1.109	.953	3/4-20	.718	.730	.107	.760	.860	.562	.567
12	7/8-20	1.380	1.296	1.140	15/16-20	.905	.917	.107	.947	1.050	.750	.755
14	15/16-20	1.505	1.396	1.205	1-20	.968	.980	.107	1.010	1.110	.812	.817
16	1 1/16-18	1.630	1.521	1.329	1 1/8-20	1.093	1.105	.107	1.135	1.230	.938	.942
18	1 3/16-18	1.740	1.646	1.455	1 1/4-20	1.217	1.225	.107	1.260	1.360	1.062	1.067
22	1 7/16-18	2.040	1.959	1.705	1 1/2-20	1.467	1.475	.138	1.510	1.610	1.312	1.317

CONTACT DEVIATIONS

Order by adding deviation suffix to Amphenol catalog number. Deviations do not apply to military catalog number.

(108) Rhodium plated, solder cup contact.
(115) Gold plated, flattened and pierced contact.
(116) Gold plated, solder cup contact.

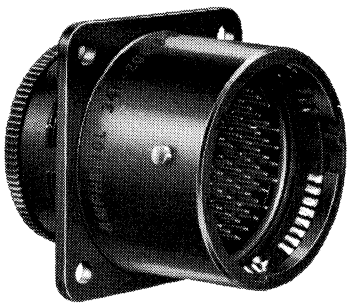
AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Astro/348™

High Density Miniature Connectors

THE NEW MIL-C-81511 CONNECTOR LINE





Astro/348 connectors meet all the requirements of MIL-C-81511, the definitive new military specification for high density miniature connectors. They offer .085" contact spacing for #23-22 contacts, full performance under extreme environmental conditions, a new, removable, crimp contact system, grounded shells and many other design benefits.

.085" Contact Spacing — High density configurations save space without sacrificing performance. With Astro/348 connectors you can use smaller shells, for example, a size 16 shell (instead of the usual size 22) for 55 contacts.

Locked-In Removable Contacts — Contact retention disc, actuated by rear locking nut, holds the contacts as tightly as molded-in construction. A twist of the nut makes them readily removable for wiring changes or servicing. They can then be easily reinserted and securely locked again by a twist of the nut.

Grounded Shells — Spring fingers inside the receptacle make contact with the mating plug and ground both shells before the contacts engage. As the connectors are unmated, the spring fingers keep the shells grounded until after the contacts disengage.

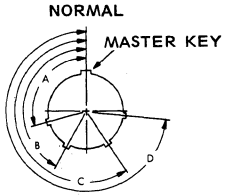
Contact Protection — Recessed pin contacts in receptacles, plus closed entry socket inserts and hooded contacts make them scoop proof and prevent damage to contacts under poor mating conditions.

DESIGN FEATURES

- Molded One-Piece Contact Retention Disc
- Captivated Rear-Locking Risers
- Individual Contact Risers
- Anti-Scoop Recessed Pin Contacts
- Closed Entry Socket Insert and Contacts
- Captivated Triple Bayonet Coupling System
- 5-Key Polarization
- Interfacial Mating Seal
- Dynamic "O" Ring Peripheral Shell Seal
- Monoblock Construction — Inserts Bonded to Shells
- Self-Sealing Rear Grommets
- Visual Mating Indicator
- Shell to Shell Grounding Fingers
- Contacts conform to MIL-C-23216
- Four-indent crimp form with MS3198-1 type tool
- Contacts accept sizes #22, #24, #26 and #28 solid or stranded wires
- Front release, rear serviceable contact system
- Contact retention in serviceable position: 3 pounds minimum
- Contact retention in locked condition: 10 pounds minimum after 10 cycles of maintenance aging
- Dielectric separation: Contact to contact minimum wall section 0.021 inches
- Minimum creepage in unmated condition: 0.063 inches
- Wire sealing range: 0.030 inches diameter minimum to 0.054 inches diameter maximum over insulation
- Five alternate positions for connector polarity are provided by rearranging secondary shell key and keyways. Master key remains in normal position

5 ALTERNATE SHELL POSITIONS

Illustration of Alternate Shell Positions for Receptacle

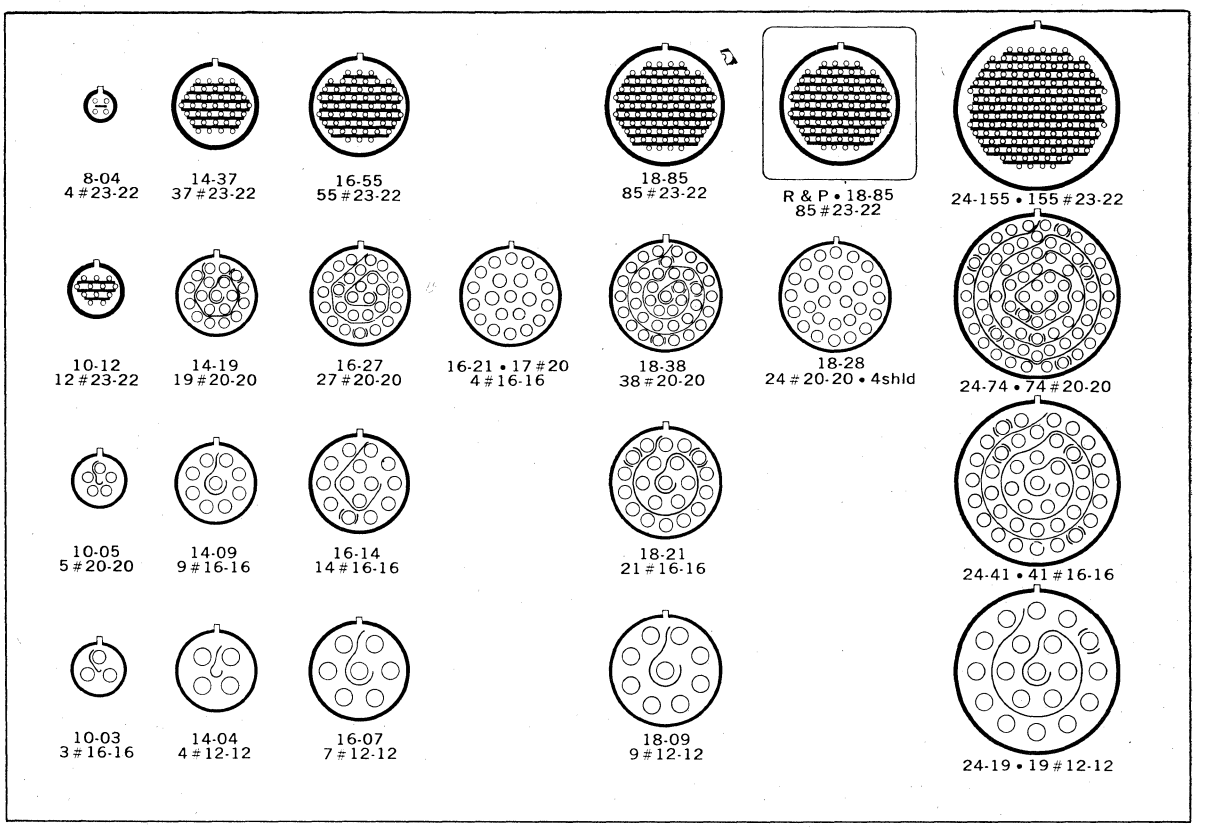


Key and Keyway Arrangement MIL-C-81511 Designation	Shell Size 8 A	Angular Location							
		Shell Sizes 10 and 14				Shell Sizes 16 and 18			
		A	B	C	D	A	B	C	D
1	128°	105°	140°	215°	265°	105°	140°	215°	265°
2	190°	102°	132°	248°	320°	18°	149°	192°	259°
3	205°	80°	118°	230°	312°	92°	152°	222°	342°
4	220°	35°	140°	205°	275°	84°	152°	204°	334°
5	235°	64°	155°	235°	304°	24°	135°	199°	240°
6	250°	35°	115°	220°	270°	98°	152°	268°	338°

AMPHENOL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

ASTRO/348 (Continued)
23 INSERT CONFIGURATION



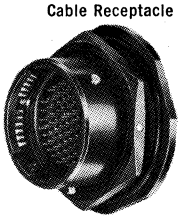

Plug


Single Hole Mtg. Receptacle


Square Flange Receptacle


Cable Receptacle

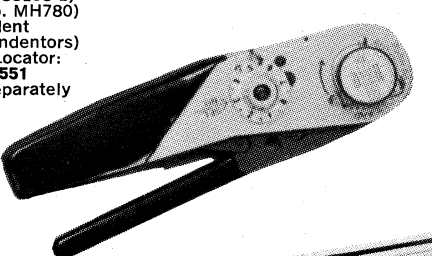

Hermetic Seal —
Solder Flange Receptacle

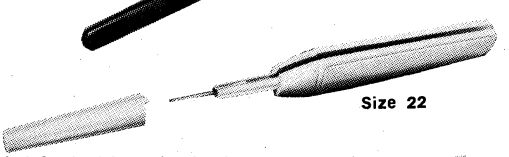

Hermetic Seal — Receptacle Single Hole Mtg.

50% No-Scoop connectors are illustrated.

ACCESSORY TOOLS

Contact Crimping Tool:
294-268 (MS3198-1)
(Daniels No. MH780)
(4 Indent
[Notched] indentors)
Contact Locator:
294-1551
ordered separately

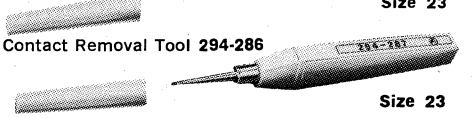



Size 22

Pin & Socket Contact Insertion Tool **294-278**


Size 23

Socket Contact Removal Tool **294-286**


Size 23

Pin Contact Removal Tool **294-287**

Full Details covered in new catalog available from factory on request.

AMPHENOL RF COAXIAL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

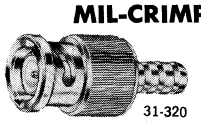
BNC & TNC

CHARACTERISTICS (Typical)

ELECTRICAL	
impedance	unimproved BNC: non-constant; all others: 50 ohms
frequency range	0-10 GHz
voltage rating	500 volts peak
dielectric withstanding voltage	1500 volts rms
SWR	improved: 1.3; MIL-Crimps: 1.2 (solder), 1.3 per spec
Other	contact resistance: 2.1 mv; RF leakage: −55 db; insertion loss: .04 db; insulation resistance: 5000 megohms
ENVIRONMENTAL	
thermal limits	Teflon insulators: −67° to 390°F (−55° to 199°C); Rexolite insulators: −67° to 185°F (−55° to 85°C)
weatherproof	standards with clamp gaskets; MIL-Crimps with heat-shrink tubing
hermetic seals	pass helium leak test of 2×10^{-8} cc/sec.
shock	MIL-Std-202 method 202
vibration	MIL-Std-202 method 204 (test cond. D)
moisture resistance	MIL-Std-202 method 106
corrosion	MIL-Std-202 method 101 (test cond. B)
temperature cycling	MIL-Std-202 method 102 (test cond. D)
altitude	MIL-Std-202 method 105 (test cond. C)
MECHANICAL	
mating	BNC: 2-stud bayonet lock; TNC: 7/16-28 thread cplg.
cable affixment (braid or jacket)	standards: screw-thread nut and braid clamp; MIL-crimps: hex braid crimp
cable affixment (center conductor) captivated contact	MIL-Crimps: 4 indent crimp or solder; others: solder only all MIL-Crimps; others: where specified
cable retention	standards: 20 to 50 lbs; crimps: 80 to 100 lbs.
MATERIAL	
contacts (center)	male: brass; female: beryllium copper or phopshor bronze (all MIL-Crimps)
contacts (outer)	MIL-Crimps: phosphor bronze; others: brass or beryllium copper where specified
other metal parts plating	brass center contacts, MIL-Crimps: .0001″ gold over .0001″ copper; all others: .0002″ silver
insulators	Teflon (all crimps); Rexolite; glass-Teflon (hermetically sealed)
clamp gaskets heat-shrink tubing crimp ferrule	synthetic rubber; silicone rubber MIL-Crimps: Thermofit plastic copper

MILITARY SPECIFICATIONS
MIL-Crimps: MIL-C-23329A; Standard BNC: MIL-C-3608
MIL-C-39012 where noted

MIL-CRIMP BNC


31-320


31-334

PLUGS

male contacts • captivated center contact weatherproof

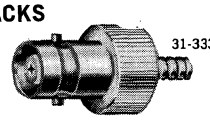
STRAIGHT

For RG-/U Cable	MIL. No. M23329/	No.	Ins.	Notes	Lgth.
55, 142, 223	3-02-04	31-326	T	GC	1 13/64
58, 141	3-01-03	31-320	T	GC	1 13/64
59, 62, 140, 210	3-05	31-321	T	GC	1 13/64
71	—	31-322	T	GC	1 13/64
122	3-06	31-324	T	GC	1 13/64
174, 188	—	31-315	T	GC	1 13/64
179, 187	—	31-242	T	GC	1 13/64
180, 195	3-07	31-323	T	GC	1 13/64
21-597	—	31-325	T	GC	1 13/64

ANGLE

55, 142, 223	—	31-334	T	GC	1 3/16
58, 141,	—	31-335	T	GC	1 3/16
59, 62, 140, 210	—	31-336	T	GC	1 3/16
71	—	31-337	T	GC	1 3/16
122	—	31-339	T	GC	1 3/16
179, 187	—	31-243	T	GC	1 3/16
174, 188	—	31-316	T	GC	1 3/16
180, 195	—	31-338	T	GC	1 3/16
Amphenol 21-597	—	31-340	T	GC	1 3/16

JACKS


31-333

female contacts
captivated center contact
weatherproof

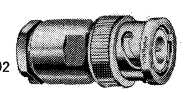
STRAIGHT

For RG-/U Cable	MIL. No. M23329/	No.	Ins.	Notes	Lgth.
55, 142, 223	3-09	31-333	T	GC	1 3/8
58, 141	3-08	31-327	T	GC	1 3/8
59, 62, 140, 210	3-12	31-328	T	GC	1 3/8
71	—	31-329	T	GC	1 3/8
122	3-13	31-331	T	GC	1 3/8
179, 187	—	31-244	T	GC	1 3/8
174, 188	—	31-317	T	GC	1 3/8
180, 195	3-14	31-330	T	GC	1 3/8
Amphenol 21-597	—	31-332	T	GC	1 3/8

BULKHEAD

55, 142, 223	3-16	31-341	T	GC	1 3/8
58, 141	3-15	31-342	T	GC	1 3/8
59, 62, 140, 210	3-19	31-343	T	GC	1 3/8
71	—	31-344	T	GC	1 3/8
122	3-20	31-346	T	GC	1 3/8
179, 187	—	31-245	T	GC	1 3/8
174, 188	—	31-318	T	GC	1 3/8
180, 195	3-21	31-345	T	GC	1 3/8
Aphenol 21-597	—	31-347	T	GC	1 3/8

STANDARD TYPE BNC


31-002


33275

PLUGS

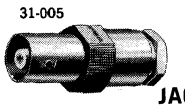
50 ohm impedance • male contacts • weatherproof

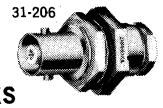
STRAIGHT *MIL NO. M39012/16-

For RG-/U Cable	UG-/U No.	No.	Ins.	Notes	Lgth.
6	—	9350	R		1 1/4
8, 9	959	6775	T		1 21/32
55, 58, 141, 142	88	31-002	T		3 1/32
	—	14625	T	PF	1
	88A	14525	T		1
	88B	31-018	T	NW	3 1/32
55, 58, 141, 142, 223	88C	31-202	T	I	1 1/16
	88D	31-2202	T	I, BOC	1 3/32
	88E	31-2202	T	I, BOC	1 3/32
	88G	31-3301	T	*0001	1 1/16
	—	14625	T	PF	1
	—	31-301	T	I, CC	1 5/32
	—	84800	T	I, CC	1 1/16
59, 62, 71, 140, 210	260	31-012	R		3 1/32
	260A	31-021	R	NW	1
	260B	31-212	T	I	1 1/16
	260C	31-2212	T	I, BOC	1 3/32
	260D	31-2212	T	I, BOC	1 3/32
	260F	31-3302	T	*0002	1 1/16
	—	70000	T	PF	1
	—	86475	T	I, 75	1 1/16
	—	31-304	T	I, CC	1 5/32
114A	—	17400	T		1 21/32
122, 195, 21-597	1033	84975	T	I	1 1/16
	1033C	31-3303	T	*0003	1 1/16
	—	12000	T		1
178, 196	—	15875	T		1
180	—	16300	T		1
174, 179, 187, 188	—	69475	T	I	1 1/16
#18, 20, 22 H. V. Wire	—	13925	T		1

ANGLE *MIL NO. M39012/20-

55, 58, 141, 142, 223	913	31-204	T		1 3/32
	913A	31-2204	T	I, BOC	1 1/16
	913B	31-3361	T	*0001	1 5/8
55, 58, 141, 142	—	38250	T		29/32
	—	8525	T		1 1/4
59, 62, 71, 140, 210,	—	31-850	R		1 1/4
	—	33750	T		29/32
	—	86225	T		1 1/16
	—	8575	T		1 1/4
122, 195, 21-597	—	33775	T		1 1/4
178, 196	—	21975	T		1 1/4
174, 179, 187, 188	—	33275	T		1 1/4
180	—	16975	T		1 1/4


31-005


31-206

JACKS

50 ohm impedance • female contacts • weatherproof

STRAIGHT

For RG-/U Cable	UG-/U No.	No.	Ins.	Notes	Lgth.
55, 58, 141, 142	89	31-005	T		1 1/8
	89A	31-019	T	NW	1 5/64
55, 58, 141, 142, 223	89B	31-205	T	I	1 7/64
	89C	31-2205	T	I	1 5/64
	—	31-302	T	I, CC	1 5/64
59, 62, 71,140, 210	261	31-015	R	70	1 1/8
	261A	31-022	R	NW, 70	1 5/64
	261B	31-215	T	I	1 7/64
	261C	31-2215	T	I	1 7/64
	—	31-305	T	I, CC	1 5/64
122, 195, 21-597	1056	84650	T	I	1 7/64
180	—	16925	T		1 5/64

ANGLE

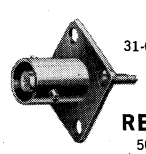
55, 58, 141, 142, 223		14325	T	AN	1 5/32
59, 62, 71, 140, 210		14225	T	AN	1 11/32

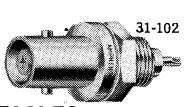
PANEL

8	—	6750	T		1 15/32
55, 58, 141, 142	90	1300	T		1 5/64
	291	31-001	T		1 1/8
	291A	31-020	T	NW	1 5/64
	291B	31-201	T	I	1 7/64
55, 58, 141, 142, 223	291C	31-2201	T	I	1 7/64
	—	31-300	T	I, CC	1 5/64
59, 62,71, 140, 210	262	31-011	R		1 1/8
	262A	31-023	R	NW	1 5/64
	262B	31-211	T	I	1 7/64
	262C	31-2211	T	I	1 7/64
	—	31-303	T	I, CC	1 5/64
	—	71000	T	PM	1 5/64
122, 180, 195, A21-597	—	16475	R		1 5/64
	—	86400	T	I	1 7/64
174, 179, 187, 188	—	86425	T	I	1 7/64

BULKHEAD

55, 58, 141, 142	909	31-206	T	I	1 1/8
	—	2475	T	FM	1 1/16
	—	2575	T		1 5/64
55, 58, 141, 142, 223	909A	31-2206	T	I	1 7/64
	909B	31-3206	T	I	1 7/64
	—	17725	T	I	1 9/64
59, 62, 71, 140, 210	910	31-207	T	I	1 1/8
	910A	31-2207	T	I	1 7/64
	910B	31-3207	T	I	1 7/64
	624	2075	R	FM	1 1/16
	—	2675	R		1 5/64
122, 180, 195, 21-597	—	84725	T	I	1 7/64
178, 196	—	86850	T	I	1 7/64
179	—	17825	T	FM	1 7/64


31-003


31-102

RECEPTACLES

50 ohm impedance
female contacts • weatherproof

PANEL *MIL NO. M39012/22-

UG-/U No.	No.	Ins.	Notes	Lgth.
185	4500	R	TT	1 3/64
290	31-003	R		1 1/32
290A	31-203	T	I	1 1/16
290B	31-3377	T	*0001	1 1/16
447	31-817	R		1 1/32
928	1100	R		27/32
—	31-105	R		1 1/32
—	31-842	T		1 1/32
—	2775	T	TT	1 1/16
—	3150	T	PM	1 1/4
—	14275	R		1 1/32
—	14375	R		1 1/32
—	18225	T	PC	25/32
—	13550	T	TT	1 5/64
—	31-104	PST		1 5/32

NOTES: AC—Armor Clamp, AK—Adapter Kit, AN—Angle Body, BOC—Beryl. Outer Contact, CC—Captivated Contact, FM—Front Mounting, FS—Field Serviceable, GC—Gold-plated Contact, H—Hermetically Sealed, HOC—Hooded Outer Contact, I—Improved Const., LB—Large Body, MLC—Male Contact, NW—Non-weatherproof, P—Pressurized, PC—For Printed Circuit Bds., PF—Polarized Female Contact, PI—Plug-in, PM—Polarized Male Contact, QC—Quick Crimp, RC—Radial Crimp, RM—Rear Mounting, SBC—Solderless Braid Clamp, SC—Solderless Contact, SFC—Shorting Female Contact, SL—Solder Lug, SMC—Shorting Male Contact, SW—Holes for Safety Wiring, TT—Turret Terminal, W—Weatherproof, 75—75 ohm impedance, 4000—4000 volts peak. **INSULATION:** B—Bakelite, C—Ceramic, FB—Filled Bakelite, G—Glass, K—Kel-F, PST—Polystyrene, R—Rexolite, T—Teflon. **ADAPTER ENDS:** C—Cable, J—Jack, P—Plug. **For additional specifications request Amphenol Coaxial Connectors Catalog CC-6.**

AMPHENOL RF COAXIAL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

STANDARD TYPE BNC (Cont'd.)

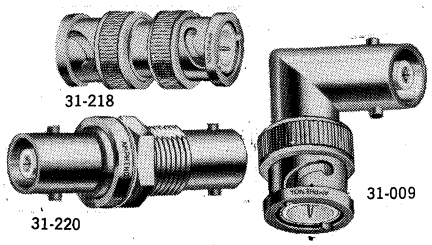
ANGLE

UG-/U No.	No.	Ins.	Notes	Lgth.
535	5675	T		1 1/32
1098	31-222	T		29/32
1098A	31-2222	T	I	29/32
—	5075	T		1 1/16

BULKHEAD

*MIL NO. M39012/21-

254A	31-016	R	P, RM	1 15/32
625	5575	R	FM	1 1/32
625B	31-236	T	I, FM	1 1/16
625C	31-3375	T	*0001	1 1/16
657	31-102	R	P, FM	1 9/64
657A	31-239	T	P, FM	1 9/64
911A	31-237	GT	I, H, RM	1 13/64
912	31-238	GT	I, H, FM	1 13/64
912A	31-2238	GT	I, H, FM	1 13/64
1094	31-221	T	I, FM	1 1/16
1094A	31-2221	T	I, FM	1 3/16
1094B	31-3376	T	*0002	1 1/16
—	11300	T	FM	1 1/32
—	11325	T	PM, FM	1 1/32
—	78725	GT	I, H, FM	1 1/32
—	86250	GT	H, FM	1 1/32
—	87225	GT	H, FM	1 1/32



ADAPTERS

50 ohm impedance • weatherproof

STRAIGHT

UG-/U No.	No.	Ins.	Notes	Adapter Ends	Lgth.
491	8425	T		PP	1 1/4
491A	31-218	T		PP	1 1/4
491B	31-2218	T	BOC	PP	1 1/4
914	31-219	T		JJ	1 9/32
—	21925	T		PJ	1 17/32
—	75000	T		JJ	1 9/32

ANGLE

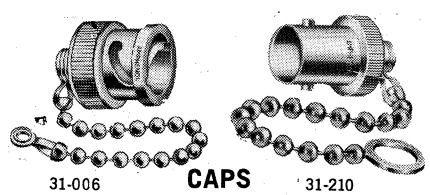
306	31-009	T		JP	1
306A	31-209	T	BOC	JP	1 1/16
306B	31-2209	T	BOC	JP	1 1/16

TEE

274	31-008	R		JPJ	1 9/32
274A	31-208	T	BOC	JPJ	1 9/32
274B	31-2208	T	BOC	JPJ	1 9/32
—	4725	T		PPP	1 13/16
—	17450	R		JJJ	1 9/32
—	21900	T		PJJ	1 17/32
—	27750	T		PJP	1 13/16
—	33725	T	RG-58/U	CPC	1 3/4

BULKHEAD

414	4700	T		JJ	1 9/32
414A	47025	T	I	JJ	1 9/32
492A	31-220	GT	H	JJ	1 13/32
492B	31-2220	GT	H	JJ	1 25/64
492D	31-3220	GT	H	JJ	1 17/32
—	4525	GT		JJ	1 13/32
—	75500	T	H	PP	1 1/16



CAPS

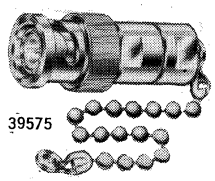
weatherproof

MALE

CW No.	No.	Ins.	Notes	Lgth.
123	31-006			1 1/16
123A	31-026		I	45/64
155	31-007			37/64
155A	31-027		I	37/64
159	31-017	T	SMC	1 1/16
—	900			23/32
—	5275	T	SMC	1 9/32
—	87300		SL	23/32

FEMALE

CW No.	No.	Ins.	Notes	Lgth.
282	31-210			1 1/16
—	1550	T	SFC	5/8
—	1750			25/32
—	2025			25/32
—	15300	T	SFC	25/32



RESISTOR TERMINATED CAPS

male contacts • weatherproof

MX No.	No.	Ins.	Notes	Lgth.
554	4700	R	100 ohm	1 1/4
554A	39575	T	100 ohm	1 1/4
—	35650	T	*	1 1/4
—	4750	R	*	1 9/64
—	35725	T	*	1 1/2
—	46650	T	*	1 1/2

*Add resistor value (ohms) to part no. when ordering: 47, 51, 68, 75, 82, 91, 100, 120, 130, 150, 180, 240, 270, 300, 470, 510, 560, 680, 750, 820, 1000, 1500, 3900, 4700, 10000, 100000, 150000.



HOODS

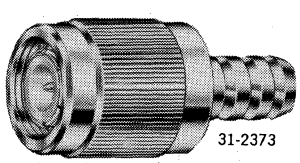
non-weatherproof

For RG-/U Cable	MX No.	No.	Notes	Lgth.
58	195	10900		7/8
58, 59, 62	195A	87175	PI	1 3/16
58	367	10925		7/8

NUT STRAP

No.	MX No.	Notes	Lgth.
1600	MT-412	4 Holes with No. 4-40 NC-2B Thds.	3/4 sq.

MIL-CRIMP TNC



PLUGS

weatherproof • captivated center contact
add-1000 suffix to part number for safety wiring holes
50 ohm impedance • male contacts

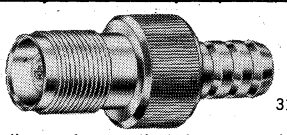
STRAIGHT

For RG-/U Cable	No.	MIL. No. M23329/	Ins.	Notes	Lgth.
55, 142, 223	31-2373	4-02-04	T	GC	1 7/32
58, 141	31-2367	4-01-03	T	GC	1 7/32
59, 62, 140, 210	31-2368	4-05	T	GC	1 7/32
71	31-2369	—	T	GC	1 7/32
122	31-2371	—	T	GC	1 7/32
174, 188	31-2315	—	T	GC	1 7/32
179, 187	31-2242	—	T	GC	1 7/32
180, 195	31-2370	4-06	T	GC	1 7/32
A 21-597	31-2372	—	T	GC	1 7/32

ANGLE

For RG-/U Cable	No.	MIL. No. M23329/	Ins.	Notes	Lgth.
55, 142, 223	31-2381	—	T	GC	1 3/16
58, 141	31-2382	—	T	GC	1 3/16
59, 62, 140, 210	31-2383	—	T	GC	1 3/16
71	31-2384	—	T	GC	1 3/16
122	31-2386	—	T	GC	1 3/16
179, 187	31-2243	—	T	GC	1 3/16
174, 188	31-2316	—	T	GC	1 3/16
180, 195	31-2385	—	T	GC	1 3/16
A 21-597	31-2387	—	T	GC	1 3/16

JACKS



non-weatherproof • captivated center contact
50 ohm impedance • female contacts

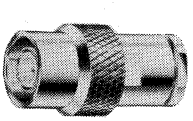
STRAIGHT

For RG-/U Cable	No.	MIL. No. M23329/	Ins.	Notes	Lgth.
55, 142, 223	31-2380	4-08-10	T	GC	1 3/8
58, 141	31-2374	4-07	T	GC	1 3/8
59, 62, 140, 210	31-2375	4-11	T	GC	1 3/8
71	31-2376	—	T	GC	1 3/8
122	31-2378	—	T	GC	1 3/8
179, 187	31-2244	—	T	GC	1 3/8
174, 188	31-2317	—	T	GC	1 3/8
180, 195	31-2377	4-12	T	GC	1 3/8
A 21-597	31-2379	—	T	GC	1 3/8

BULKHEAD

55, 142, 223	31-2388	4-14	T	GC	1 5/16
58, 141	31-2389	4-13	T	GC	1 5/16
59, 62, 140, 210	31-2390	4-17	T	GC	1 5/16
71	31-2391	—	T	GC	1 5/16
122	31-2393	—	T	GC	1 5/16
179, 187	31-2245	—	T	GC	1 5/16
174, 188	31-2318	—	T	GC	1 5/16
180, 195	31-2392	4-18	T	GC	1 5/16
A 21-597	31-2394	—	T	GC	1 5/16

STANDARD TYPE TNC



PLUGS

50 ohm impedance • male contacts • weatherproof

STRAIGHT

For RG-/U Cable	No.*	Ins.	Notes	Lgth.
55, 58, 141, 142, 223	77175	T	BOC	1 1/8
	79050	T	PF, BOC	1 1/8
	79875	T		1 1/16
	76175	T	GC, SW, BOC	1 1/8
59, 62, 71, 140, 210	79475	T	PF, BOC	1 1/8
	79525	T		1 1/8
122, 180, 195, 21-597	79725	T	BOC	1 1/8
180	78625	T		1
	79375	T	BOC	1 1/8
174, 179, 187, 188	73475	T		1 1/16

ANGLE

55, 58, 141, 142, 223	79075	T	BOC	1 1/8
	79550	T	BOC	1 3/16
59, 62, 71, 140, 210	79400	T	BOC	1 3/32

*Add—1000 to part number to order connectors with safety wiring holes.

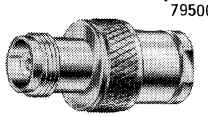
AMPHENOL RF COAXIAL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

STANDARD TYPE TNC (Cont'd.)

JACKS

79500



- 50 ohm impedance
- female contacts
- non-weatherproof

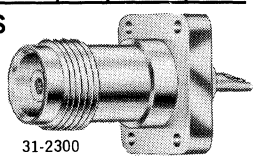
STRAIGHT

For RG-/U Cable	No.	Ins.	Notes	Lgth.
55, 58, 141, 142, 223	79600	T	GC	1 1/4
59, 62, 71, 140, 210	79450	T	PM	1 9/64
180, 195	7705C	T		1 9/64

BULKHEAD

55, 58, 141, 142, 223	77425	T	GC	1 9/64
59, 62, 71, 140, 210	77350	GT	H	1 27/32
180	77100	T		1 27/32

RECEPTACLES



31-2300

- 50 ohm impedance
- female contacts
- non-weatherproof

PANEL

No.	Ins.	Notes	Lgth.
31-2300	T	GC	1 1/16
78200	T	GC, PM	1 1/16
79650	T	GC	1 5/32
79750	GT	GC, H	3/4

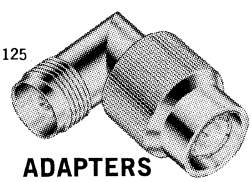
BULKHEAD

31-2301	T	GC, FM	1 1/16
77300	T	GC, *FM	1 1/16
79775	T	GC, FM	1 1/16
79800	GT	H, FM	1 1/16

* Gold Plated

ADAPTERS

79125



50 ohm impedance non-weatherproof

ANGLE

No.	Ins.	Adapter Ends	Lgth.
79125	T	PJ	1 1/32

BULKHEAD (Hermetically Sealed)

79100	GT	JJ	1 13/32

TEE

79700	T	JPJ	1 9/32

CAPS non-weatherproof

MALE

No.	Lgth.
78750	3/8

FEMALE

78400	37/64

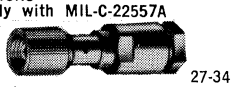
SUBMINAX® Series 27

CHARACTERISTICS (Typical)

ELECTRICAL	
impedance	50 ohm, 75 ohm
frequency range	0-10 GHz
voltage rating	500 volts peak
dielectric withstanding voltage	1,500 volts rms
SWR (50 ohm)	1.2 (0-4 GHz) 1.5 (4-10 GHz) 1.3 (UG's) (0-6 GHz) 1.5 (UG's) (6-10 GHz)
other	multivolt drop 6 MV. insulation resistance 1,000 megohms
ENVIRONMETAL	
thermal limits	−67° to 390°F (−55° to 199°C)
weatherproof	all 27 series are non-weatherproof, radial crimp have plastic boot or optional heat shrink tubing.
hermetic seals	pass helium leakage test of 2 x 10-8 cc/sec
thermal shock	Mil. Std. 202 Method 107
shock	Mil. Std. 202 Method 202
vibration	Mil. Std. 202 Method 204 (test cond. D)
moisture resistance	Mil. Std. 202 Method 106A
corrosion	Mil. Std. 202 Method 101 (test cond. B)
MECHANICAL	
contacts	radial crimp, not captivated; quick crimp, full captivated; field serviceable, semi-captivated
mating	push-on (snap-on) and screw-on, (50 ohm have 10-32 threaded coupling; 75 ohms, 3/16-32).
cable affixment	radial crimp: Quick-Crimp (hex crimp); field serviceable clamp mechanism
braid/jacket	
cable affixment-center conductor	solder only
coupling nut	recommended torque (hex nuts); 50 inch-ounces. Axial pull-off force: withstand up to 50 lbs.
MATERIAL	
contacts	male and outer (push-on): brass female: beryllium copper
other metal parts	brass
plating (all metal parts)	.000050 gold over copper, (UG's .0001" gold over copper)
insulators	Teflon, Kel-F-Teflon, glass Teflon (hermetically sealed)

MILITARY SPECIFICATIONS
UG items fully comply with MIL-C-22557A

27-1



27-34

STRAIGHT PLUGS

female contacts • Teflon Ins. • non-weatherproof

PUSH-ON

For RG-/U Cable	No.	Imp. Ohms	Notes	Lgth.
174, 179, 187, 188	27-841	50	QC, CC	1
	27-1	50	RC	19/32
180, 195, A 21-597	27-828	75	QC, CC	1 5/64
	27-13	75	RC	5/8
178, 196	27-30	50	FS, CC	25/32

SCREW-ON

For RG-/U Cable	No.	Imp. Ohms	Notes	Lgth.
174, 179, 187, 188	27-844	50	QC, CC	1 1/32
	27-7	50	RC	19/32
	†27-106	50	FS, CC	27/32
180, 195, A 21-597	27-835	75	QC, CC	1 5/64
	27-19	75	RC	19/32
178, 196	27-34	50	FS, CC	25/32
	*27-104	50	FS, CC	27/32

* UG-1460
† UG-1465

27-26



ANGLE PLUGS

female contacts • Teflon-Kel-F Ins. non-weatherproof

PUSH-ON

For RG-/U Cable	No.	Imp. Ohms	Notes	Lgth.
174, 179, 187, 188	27-843	50	QC, CC	41/64
	27-6	50	RC	9/16
180, 195, 21-597	27-834	75	QC, CC	41/64
	27-18	75	RC	39/64
178, 196	27-33	50	FS, CC	9/16
	27-823	50	FS, CC, HOC	19/32

SCREW-ON

174, 179, 187, 188	27-846	50	QC, CC	19/32
	27-26	50	RC	39/64
180, 195, 21-597	27-836	75	QC, CC	41/64
	27-25	75	RC	5/8
178, 196	27-37	50	FS, CC	39/64

27-31



27-8

STRAIGHT JACKS

male contacts • Teflon Ins. • non-weatherproof

PUSH-ON

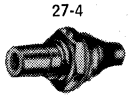
For RG-/U Cable	No.	Imp. Ohms	Notes	Lgth.
174, 179, 187, 188	27-849	50	QC, CC	1
	27-2	50	RC	35/64
180, 195, 21-597	27-837	75	QC, CC	1
	27-14	75	RC	9/16
178, 196	27-31	50	FS, CC	47/64

SCREW-ON

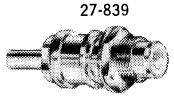
174, 179, 187, 188	27-8	50	RC	19/32
	*27-105	50	FS, CC	3/4
178, 196	27-35	50	FS, CC	3/4
	†27-107	50	FS, CC	3/4
180, 195, 21-597	27-20	75	RC	19/32

* UG-1467 † UG-1462

27-4



27-839



BULKHEAD JACKS

male contacts • Teflon Ins. • non-weatherproof

PUSH-ON

For RG-/U Cable	No.	Imp. Ohms	Notes	Lgth.
174, 179, 187, 188	27-842	50	QC, CC	1 1/16
	27-4	50	RC	41/64
180, 195, 21-597	27-838	75	QC, CC	1 7/64
	27-16	75	RC	41/64
178, 196	27-32	50	FS, CC	13/16

SCREW-ON

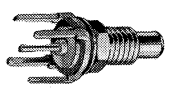
174, 179, 187, 188	27-845	50	QC, CC	1 1/16
	27-10	50	RC	21/32
	†27-103	50	FS, CC	7/8
180, 195, 21-597	27-839	75	QC, CC	1 1/8
	27-22	75	RC	21/32
178, 196	27-36	50	FS, CC	53/64
	*27-102	50	FS, CC	7/8

* UG-1463 † UG-1468

27-3



27-800



BULKHEAD RECEPTACLES

male contacts • non-weatherproof

PUSH-ON

UG-/U No.	No.	Imp. Ohms	Ins.	Notes	Lgth.
—	27-3	50	T	—	37/64
—	27-15	75	T	—	37/64
—	27-27	50	GT	H	45/64
—	27-45	75	GT	H	23/32
—	27-72	50	T	GC	31/64

SCREW-ON

—	27-9	50	T	—	19/32
—	27-12	50	GT	H	41/64
—	27-21	75	T	—	19/32
—	27-24	75	GT	H	11/16
—	27-800	50	T	PC	43/64
1619	27-101	50	T	RM, FS, CC	5/8
1464	27-108	50	T	FM, FS, CC	41/64

27-5



27-11



BULKHEAD ADAPTERS

Teflon Ins. • non-weatherproof

PUSH-ON

No.	Imp. Ohms	Adapter Ends	Lgth.
27-5	50	JJ	5/8
27-17	75	JJ	5/8

AMPHENOL RF COAXIAL CONNECTORS

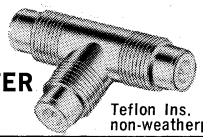
AMPHENOL
THE BUNKER-RAMO CORPORATION

SUBMINAX® SERIES 27 (Cont'd.)

SCREW-ON

No.	Imp. Ohms	Adapter Ends	Lgth.
27-11	50	JJ	21/32
27-23	75	JJ	21/32

27-70



TEE ADAPTER

Teflon Ins.
non-weatherproof

SCREW-ON

No.	Imp. Ohms	Adapter Ends	Lgth.
27-70	75	JJJ	1.050

SERIES C

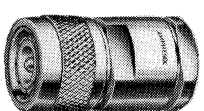
CHARACTERISTICS (Typical)

ELECTRICAL	
impedance	50 ohm constant
frequency range	0-10 GHz, 1,500 volt type 0-2 GHz, 4,000 volt type
voltage rating	1,500 volts peak — standard; 4,000 volts peak as noted
dielectric withstanding voltage	3,000 volts RMS, 1,500 volt type; 6,000 volts RMS, 4,000 volt type
SWR	1.25
ENVIRNMENTAL	
thermal limits	−67° to 390°F (−55° to 199°C)
weatherproof	except as noted, all C Series connectors are weatherproof
hermetic seals	pass Helium leak test of 2 x 10^{-8} cc/sec
pressurized	compression seal
MECHANICAL	
mating	2-stud bayonet lock
cable affixment	improved: screw-thread nut and braid clamp
MATERIAL	
contacts	male: brass; female and outer: beryllium copper
other metal parts	brass
plating	.0002" silver min
insulators	Teflon, glass-Teflon (herm. sealed)
weatherproof gaskets	silicone rubber

MILITARY SPECIFICATIONS
Meet applicable sections of MIL-C-3989.

PLUGS

82-530



50 ohm impedance • male contacts
weatherproof

STRAIGHT

For RG-/U Cable	UG-/U No.	No.	Ins.	Notes	Lght.
5, 21, 143, 212, 222	626A	80025	T		1 31/64
8, 9, 87, 213, 214, 225	573A	82-530	T	AK	1 31/64
	573B	28650	T	AK	1 31/64
	628A	82-532	T	4000, AK	1 3/4
	—	79150	T	4000, PF	1 3/4
10, 12, 116, 215, 227	943A	82-538	T	AC, AK	2 1/8
14, 217	707A	82-533	T		1 5/16
17, 218	708A	80075	T		2 5/32
55, 58, 141, 142, 223	709A	82-534	T		1 3/8
59, 62, 71, 140, 210	—	81650	T	4000	1 5/16
	—	80375	T	4000	1 5/16
	627A	82-548	T		1 11/32
63, 114	—	80300	T		1 31/64
117, 118	711A	80200	T		2 5/32

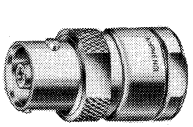
ANGLE

8, 9, 87, 213, 214, 225	710A	82-531	T		1 3/8
55, 58, 141 142, 223	—	80775	T		1 5/16

JACKS

50 ohm impedance
female contacts
weatherproof

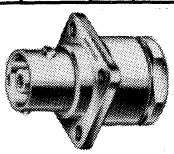
82-503



STRAIGHT

For RG-/U Cable	UG-/U No.	No.	Ins.	Notes	Lght.
8, 9, 87, 213, 214, 225	572	82-503	T		1 13/32
55, 58, 141, 142, 223	—	81575	T		1 1/4
59, 62, 71, 140,210	—	81550	T		1 1/4

82-501



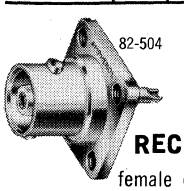
PANEL

8, 9, 87, 213, 214, 225	571	82-501	T	AK	1 13/32
10, 12, 116, 215, 227	938	82-523	T	AC, AK	2
14,217	—	81275	T		2
55, 58, 141, 142	—	74675	T	FM	1 1/4
	—	81150	T		1 1/4
59, 62, 71, 140, 210	—	81100	T	FM	1 1/4

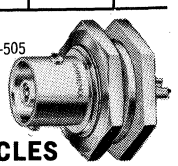
BULKHEAD

8, 9, 87, 213, 214, 225	570	82-502	T	AK	1 19/32
	570A	82-614	T		1 19/32
	632	82-521	T	4000, AK	1 11/16
10, 12, 116, 215, 227	937	82-522	T		2
55, 58, 141, 142	704	81175	T		1 1/4
	704A	74475	T	FM	1 1/4
	—	81425	gT	H	1 3/8
	—	81400	T		1 1/4
59,62,71, 140, 210	—	81600	T	FM, 4000	1 15/32

82-504



82-505



RECEPTACLES

female contacts

PANEL

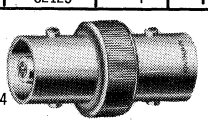
50 ohm impedance • weatherproof

UG-/U No.	No.	Ins.	Notes	Lgth.
568	82-504	T		1 3/32
—	82275	T		1 5/16

BULKHEAD

569	82-505	T		1 3/32
634	82-515	T	4000	1 5/16
705	82-511	GT	H	1 7/16
706	82125	T	FM	1 5/32

82-514



ADAPTERS

50 ohm impedance • weatherproof

STRAIGHT

UG-/U No.	No.	Ins.	Adapter Ends	Notes	Lgth.
642A	83150	T	PP		1 29/64
643	82-514	T	JJ	NW	1 9/32

ANGLE

567A	82-535	T	JP	NW	1 1/4

TEE

566A	82-536	T	JPJ		1 33/64
—	83525	T	CJC	RG-13/U	2 3/4

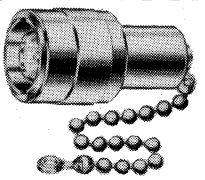
BULKHEAD

701	83050	GT	JJ	H	1 5/16
—	82250	GT	JJ	H, 4000	2 1/32

RESISTOR TERMINATED CAP

male contact
weatherproof

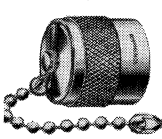
83925



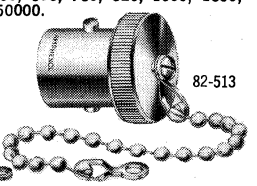
No.	Notes	Lgth.
83925	*	1 5/16

*Add resistor value (ohms) to part no. when ordering: 47, 51, 75, 82, 91, 100, 120, 130, 150, 180, 240, 270, 300, 470, 510, 560, 680, 750, 820, 1000, 1500, 3900, 4700, 10000, 150000.

82-512



82-513



CAPS weatherproof

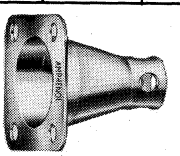
MALE

MX No.	No.	Notes	Lgth.
1142	82-512		51/64
—	83675	SMC	7/8

FEMALE

1143	82-513		27/32
—	83700	SFC	13/16

82-510

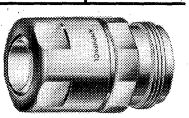


HOODS

non-weatherproof

—	82-510	—	3/4

82-517



ARMOR CLAMPS

weatherproof • improved N type

For RG-/U Cable	MX No.	No.	Lgth.
10, 12, 79, 116, 215, 227	1286	82-517	1 1/8
18,219	1441	92100	1 3/8
74, 224	1462	16850	1 3/16

SERIES N

CHARACTERISTICS (Typical)

ELECTRICAL	
impedance	as noted, 50 or 70 ohms
frequency range	0-10 GHz
voltage rating	1,500 volts peak (1,000 v ■)
dielectric withstanding voltage	3,500 volts rms (2,500 and 1500 vrms at 50 MHz■)
SWR	MIL-Crimp/MIL-Clamp: 1-15 (solder) 1.35 per spec; others: 1.25
other	contact resistance 1.0 mv, RF leakage −90 db, insertion loss .15 db, insulation resistance 5,000 megohms
ENVIRNMENTAL	
thermal limits	Teflon: −67°F to 390°F (−55° to 199°C) Rexolite: −67°F to 185°F (−55° to 85°C)
weatherproof	all Series N with gaskets are weatherproof
hermetic seals	pass Helium leak test of 2 x 10^{-8} cc/sec
pressurized	compression seal
shock	MIL-Std. 202 method 202
vibration	MIL-Std. 202 method 204 (test cond. B)
moisture resistance	MIL-Std. 202 method 106
corrosion	MIL-Std. 202 method 101 (test cond. B)
temperature	MIL-Std. 202 method 102 (test cond. C)
altitude	MIL-Std. 202 method 105 (test cond. C)

AMPHENOL RF COAXIAL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

SERIES N (Cont'd.)

MECHANICAL

mating	5/8-24 threaded coupling
cable affixment (braid/jacket)	MIL-Crimp: hex crimp; all others: screw-thread nut and braid clamp
cable affixment (center conductor)	MIL-Crimp/MIL-Clamp: 4 indent crimp, hex crimp or solder. All others: solder
captivated contact	all MIL-Crimp/MIL-Clamp Others, where specified
cable retention	MIL-Crimp/MIL-Clamp 90-120 lbs. (70 lb. per MIL-Spec). All others 30-70 lbs.

MATERIAL

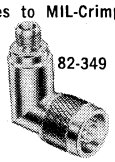
contacts	Male:brass; Female: MIL-Crimp/MIL-Clamp-Phosphor Bronze, all others-Beryllium Copper; Outer: MIL-Crimp/MIL-Clamp. Improved Phosphor Bronze, all others: brass or phosphor bronze.
other metal parts	brass
plating	center contacts, MIL-Crimp/MIL-Clamp: .0001" gold over .0001" copper. all other: .0002" silver
insulators	Teflon (all MIL-Crimp/MIL-Clamp) Rexolite, glass-Teflon (herm. seal)
weatherproof gaskets	silicone rubber (all MIL-Clamp)
crimp ferrule	synthetic rubber copper

MILITARY SPECIFICATIONS
MIL-Crimp/MIL-Clamp MIL-C-39012;
Standards: MIL-C-71B

■ Per MIL-C-39012 Spec. (applies to MIL-Crimp/MIL-Clamp connectors).

MIL-CRIMP N


82-340


82-349

PLUGS

weatherproof • captivated center contact
50 ohm impedance • male contacts

STRAIGHT

For RG-/U Cable	No.	MIL. No. M39012/	UG-/U No.	Ins.	Lgth.
5, 21, 143, 212, 222	82-341	01-0006	1680	T	1 3/64
8, 213	82-340	01-0007	1681	T	1 3/64
9, 214	82-332	01-0008	1682	T	1 3/64
11, 149	82-342	01-0013	1695	T	1 3/64
55, 142, 223	82-5370	—	—	T	1 3/64
58, 141	82-5375	—	—	T	1 3/64
59, 62, 71, 140, 210	82-5380	—	—	T	—

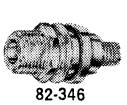
ANGLE

5, 21, 143, 212, 222	82-5350	—	—	T	1 3/16
8, 213	82-349	05-0002	1707	T	1 3/16
9, 214	82-336	05-0003	1708	T	1 3/16
11, 149	82-5351	—	—	T	1 3/16
55, 142, 223	82-5374	—	—	T	1 3/16
58, 141	82-5379	—	—	T	1 3/16

JACKS


82-343


82-337


82-346

weatherproof • captivated center contact
50 ohm impedance • female contacts

STRAIGHT

For RG-/U Cable	No.	MIL. No. M39012/	UG-/U No.	Ins.	Lgth.
5, 21, 143, 212, 222	82-338	02-0007	1687	T	1 3/16
8, 213	82-337	02-0008	1688	T	1 3/16
9, 214	82-333	02-0009	1689	T	1 3/16
11, 149	82-339	02-0014	1694	T	1 3/16
55, 142, 223	82-5371	—	—	T	1 3/16
58, 141	82-5376	—	—	T	1 3/16

PANEL

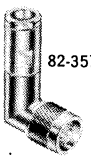
5, 21, 143, 212, 222	82-344	02-0015	1696	T	1 3/16
8, 213	82-343	02-0016	1697	T	1 3/16
9, 214	82-334	02-0017	1698	T	1 3/16
11, 149	82-5345	—	—	T	1 3/16
55, 142, 223	82-5372	—	—	T	1 3/16
58, 141	82-5377	—	—	T	1 3/16

BULKHEAD

5, 21, 143, 212, 222	82-347	03-0003	1699	T	1 27/32
8, 213	82-346	03-0004	1700	T	1 27/32
9, 214	82-335	03-0005	1701	T	1 27/32
11, 149	82-348	03-0010	1706	T	1 27/32
55, 142, 223	82-5373	—	—	T	1 27/32
58, 141	82-5378	—	—	T	1 27/32

MIL-CLAMP N


82-352


82-357

PLUGS

weatherproof • captivated center contact
50 ohm impedance • male contacts

STRAIGHT

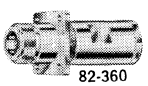
For RG-/U Cable	No.	MIL. No. M39012/	UG-/U No.	Ins.	Lgth.
5, 21, 143, 212, 222	82-354	01-0001	18F	T	1 25/32
8, 9, 213, 214	82-352	01-0005	1185B	T	1 25/32
	82-352-1	01-0002	21H	T	1 25/32
11, 13, 149, 216	82-5355	—	—	T	1 25/32
55, 58, 141, 142, 223	82-5381	—	—	T	1 25/32
59, 62, 71, 140, 210	82-5386	—	—	T	1 25/32

ANGLE

5, 21, 143, 212, 222	82-5361	—	—	T	1 1/2
8, 9, 213, 214	82-357	05-0001	594C	T	1 1/2
11, 13, 149, 216	82-5353	—	—	T	1 1/2
55, 58, 141, 142, 223	82-5385	—	—	T	1 1/2

JACKS


82-356


82-360


32-364

weatherproof • captivated center contact
50 ohm impedance • female contacts

STRAIGHT

For RG-/U Cable	No.	MIL. No. M39012/	UG-/U No.	Ins.	Lgth.
5, 21, 143, 212, 222	82-358	02-0001	20F	T	1 7/8
8, 9, 213, 214	82-356	02-0003	1186B	T	1 7/8
	82-356-1	02-0002	23G	T	1 7/8
11, 13, 149, 216	82-5359	—	—	T	1 7/8
55, 58, 141, 142, 223	82-5382	—	—	T	1 7/8

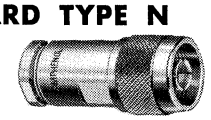
PANEL

5, 21, 143, 212, 222	82-362	02-0004	19F	T	1 17/32
8, 9, 213, 214	82-360	02-0006	1187B	T	1 17/32
	82-360-1	02-0005	22G	T	1 17/32
11, 13, 149, 216	82-5363	—	—	T	1 17/32
55, 58, 141, 142, 223	82-5383	—	—	T	1 17/32

BULKHEAD

5, 21, 143, 212, 222	82-366	03-0001	159D	T	1 51/64
8, 9, 213, 214	82-364	03-0002	160E	T	1 51/64
11, 13, 149, 216	82-5365	—	—	T	1 51/64
55, 58, 141, 142, 223	82-5384	—	—	T	1 51/64

STANDARD TYPE N


82-86

PLUGS

male contacts • weatherproof

STRAIGHT

For RG-/U Cable		No.	Imp. Ohms		Notes	Lgth.
5, 21, 143 212, 222	18	3400	50	R	NW	2
	18B	82-86	50	T		1 7/8
	18C	82-203	50	T	I	1 1/2
	18D	82-3203	50	T	I, SW	1 1/2
6	91A	7200	70	T		1 3/4
8, 9, 213, 214	21	3900	50	R		2
8, 9, 87, 213, 214, 225	21B	82-61	50	T	AK	1 7/8
	21C	82-96	50	T	AK	1 7/8
	21D	82-202	50	T	I, SW, AK	1 1/2
	21E	82-3202	50	T	I, SW, AK	1 1/2
	1185	82-312	50	T	I, CC, AK	1 1/2
	1185A	82-3312	50	T	I, CC, AK	1 1/2
10, 12, 116, 215, 227	941A	82-204	50	T	I, AC, AK	2 1/8
	941B	82-3204	50	T	I, AC, AK	2 1/8
11, 13, 149, 216	94A	82-84	70	T	AK	1 7/8
	—	91150	75	T	I	1 1/2
14, 217	204A	82-105	50	R		2
	204C	82-214	50	T	I	1 21/32
17, 218	167A	82-104	50	T		2 3/8
	167D	82-215	50	T	I, SW	2 1/8
	167F	82-3215	50	T	I, SW	2 1/8
18, 219	982	92125	50	T	I, SW	3
55, 58, 141, 142	188	23250	50	R	NW	1 3/4
	536	34000	50	R		2 1/8
	536B	34025	50	T	I	1 3/8
35	—	82-113	70	T		2 3/8
59, 62, 71, 140, 210	603	34500	50	R		1 25/32
	603A	34525	50	T	I	1 3/8
	—	34750	70	T		1 5/8
	—	91300	70	T	I	1 3/8
63, 114	1003	12400	50	T		1 3/4

ANGLE

5, 21, 143, 212, 222	—	15950	50	T	I	1 3/8
8, 9, 87, 213, 214, 225	594A	15425	50	T		1 7/16
	—	82-326	50	T	I, CC	1 13/64
	—	82-835	50	T		1 7/16
	—	6875	50	T		1 5/8
	—	15975	50	T	I	1 3/32
11, 13, 149, 216	—	17025	70	T		1 5/8
55, 58, 141, 142	—	18750	50	T		1 5/8
59, 62, 71, 140, 210	—	19250	50	T		1 5/8

JACKS female contacts • weatherproof

STRAIGHT

For RG-/U Cable	UG-/U No.	No.	Imp. Ohms	Ins.	Notes	Lgth.
5, 21, 143, 212, 222	20	42000	50	R		2
	20B	82-88	50	T		1 15/16
	20C	82-210	50	T	I	1 7/16
	20D	82-3210	50	T	I	1 7/16
6	92A	7700	70	T		1 7/8
	—	91225	75	T	I	1 7/16
8, 9, 213, 214	23	48000	50	R	NW	2
8, 9, 87, 213, 214, 225	23A	7600	50	R		1 7/8
	23B	82-63	50	T		1 15/16
	23C	82-94	50	T	I	1 13/16
	23D	82-209	50	T	I	1 7/16
	23E	82-3209	50	T	I	1 7/16
	1186	82-313	50	T	I, CC	1 7/16
10, 12, 116, 215, 227	940A	82-212	50	T	I, AC	2 1/4
	940B	82-3212	50	T	I, AC	2 1/4
11, 13, 149, 216	95A	82-89	70	T		1 15/16
17	—	14850	50	T		2 3/16
55, 58, 141 142	—	35000	50	R		1 13/16
	—	35025	50	T	I	1 1/2
59, 62, 71, 140, 210	602	36500	50	R		1 5/8

PANEL

5, 21, 143, 212, 222	19	3500	50	R		2
	19B	82-87	50	T		1 13/16
	19C	82-207	50	T		1 7/16
	19D	82-3207	50	T	I	1 7/16
6	93A	7800	70	T		1 7/8
8, 9, 87, 213, 214, 225	22B	82-62	50	T		1 13/16
	22C	82-95	50	T		1 13/16
	22D	82-208	50	T		1 7/16
	22E		50	T	I	1 7/16
	1187	82-314	50	T	I, CC	1 7/16

AMPHENOL RF COAXIAL CONNECTORS

AMPHENOL
THE BUNKER-RAMO CORPORATION

STANDARD TYPE N (Cont'd.)

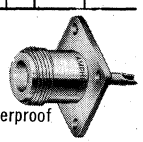
PANEL

For RG-/U Cable	UG-/U No.	No.	Imp. Ohms	Ins.	Notes	Lgth.
10, 12, 116, 215, 227	935A	82-211	50	T	I	2¼
	935B	82-321	50	T	I	2¼
11, 13, 149, 216	96A	82-90	70	T		1 13/16
55, 58, 141, 142	1052	36000	50	R		1 13/16
55, 58,, 141, 142, 223	1095A	36250	50	T	I	1½
59, 62, 71, 140, 210	593	35500	50	R		1 13/16
	—	35550	70	T		1 13/16
	—	91250	70	T	I	1½

BULKHEAD

5, 21, 143, 212. 222	159B	15550	50	T	I	1¾
8, 9, 87, 213, 214, 225	160A	82-67	50	T		1 13/16
	160B	82-93	50	T		1 13/16
	160D	91025	50	T	I	1¾
8, 9, 213, 214	—	23025	50	gT	H	2 5/32
55, 58, 141, 142	556	35250	50	T		1 13/16
55, 58, 141, 142, 223	556B	35275	50	T	I	1 43/64
59, 62,,71, 140, 210	—	18250	50	R		1 27/32

82-97



RECEPTACLES

male • male contact • weatherproof

PANEL

UG-/U No.	No.	Imp. Ohms	Ins.	Notes	Lgth.
—	49000	50	R	FM	1 3/32

female • female contacts • weatherproof

58	82-24	50	T		1 7/64
58A	82-97	50	T		1 7/64
58C	82-368	50	T	M39012/ 04-0002	1 7/64
231	2750	50	R	RG-58/U	1¾
—	82-112	70	T		1 7/64
—	9575	50	T		1 7/64

BULKHEAD

male • male contact

—	19550	50	GT	H, FM	1 7/16

female • female contacts

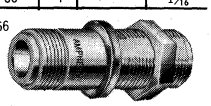
680	82-811	50	GT	H. FM	1 37/64
680B	82-369	**50**	G	M39012/ 04-0001	1 37/64
—	13275	50	gT	H, FM	1⅜
—	31150	50	T	W, FM	1 15/32

ANGLE

female • female contacts

997A	8975	50	T		1 7/16
—	23775	50	T		1 7/16

82-66



ADAPTERS

weatherproof

STRAIGHT

UG-/U No.	-No.	Imp. Ohms	Ins.	Notes	Adapter Ends	Lgth.
29	15000	50	R		JJ	1¾
29A	82-65	50	T		JJ	1¾
29B	82-101	50	T		JJ	1¾
57A	45250	50	T		PP	1 9/32
57B	82-100	50	T		PP	1 9/32
—	17075	70	T		PP	1 9/32
—	21650	70	T		JJ	1¾

ANGLE

27A	82-64	50	T		JP	1 7/16
27B	82-98	50	T		JP	1 13/32
27C	82-213	50	T		JP	1 5/16

BULKHEAD

30	82-66	50	R	P	JJ	1 5/8
30C	82-201	50	G	H	JJ	1¾
30D	91100	50	G	H	JJ	1 17/32
—	82-849	50	T	P	JJ	1 5/8
—	**90950**	**50**	**G**	**H**	JJ	1 15/16

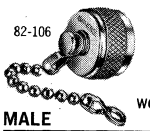
TEE

UG-/U No.	No.	Imp. Ohms	Ins.	Notes	Adapter Ends	Lgth.
28A	82-99	50	T		JJJ	1¾
107	4800	50	R		JPJ	3
107A	82-36	50	T		JPJ	2
107B	82-102	50	T		JPJ	1¾
—	4850	50	R		PPP	3 1/32

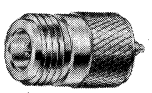
CROSS

—	17125	50	T		JJJJ	2¼

82-106



13675



CAPS

weatherproof

MALE

MX No.	No.	Notes	Length
913	82-106		5/16
—	9225		7/16
—	13700	SMC	27/32
—	18575		9/16

FEMALE

—	6950		31/32
—	13675	SFC	1

ARMOR CLAMPS

non-weatherproof

For RG-/U Cable	MX No.	No.	Notes	Lgth.
10, 12, 79,	564	82-48	N or HN	7/8
116, 215, 227	564A	82-109	N or HN	1 1/16
	1286	82-517	I	1 1/8
18, 219	1441	92100	I	1 3/8
74, 224	1462	16850	I, W	1 3/16

SERIES UHF

CHARACTERISTICS (Typical)

ELECTRICAL	
impedance	non-constant
frequency range	0-300 MHz
voltage rating	500 v. peak
ENVIRONMENTAL	
thermal limits	Teflon: —67°F to 390°F Rexolite: —67°F to 185°F polystyrene: —67°F to 185°F mica-filled Bakelite: —67°F to 300°F
weatherproof	no, except as noted
MECHANICAL	
mating	5/8-24 thrd. coupling (small body) 1-20 thrd. coupling (large body)
cable affixment	braid solder, Quick Crimp or Solderless
MATERIAL	
contacts	male: brass female: beryllium copper
bodies	die-cast zinc or brass
plating	.0002" silver min.
insulators	Teflon, Rexolite, polystyrene or mica-filled Bakelite
OTHER DATA	small and large body types do not intermate

83-1SP



PLUGS

non-constant impedance • male contacts
non-weatherproof

STRAIGHT small body, except as noted

For RG-/U Cable	MIL No.	No.	Ins.	Notes	Lgth.
8, 9, 11, 13, 63, 87, 149, 213, 214, 216, 225	PL-259	83-822	T		1½
	PL-259	83-ISP	FB		1½
	PL-259A	83-756	T		1 3/16
	PL-259A	83-ISPN	FB		1 9/16
	—	83-ISP-1002	FB		1½
	—	83-851	FB	SBC	1 43/64
8, 11, 149, 213	—	83-87	B	QC	1 23/32
11, 149	—	83-850	FB	SC, SBC	1 43/64
17. 218	—	83-86	T		2 1/8
	—	10450	R		2 1/8
34	UG-358/U	83-21SP	FB	LB, W	1 13/16
55, 142, 223	—	83-90	B	QC	1 23/32
58, 141	UG-203/U	83-776	FB		1 9/16
	—	83-89	B	QC	1 23/32
59, 62, 71, 140, 210	UG-111/U	83-750	FB		1 11/16
	—	83-88	B	QC	1 23/32

ANGLE small body

For RG-/U Cable	MIL. No.	No.	Ins.	Notes	Lgth.
8, 9, 11, 13, 63	—	83-67	T		1 3/8
87, 149, 213, 214, 216, 225	—	83-59	PST		1 3/8

RECEPTACLES non-constant impedance female contacts • non-weatherproof

PANEL small body, except as noted

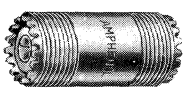
MIL No.	No.	Ins.	Notes	Lgth.
SO-239	83-1R	FB		1 1/16
SO-239A	83-798	T		1 1/16
UG-357/U	83-21R	FB	LB	1 5/64
—	83-716	C	P	1 3/64
SO-2392H	83-876	B	—	1 1/16

BULKHEAD small body

UG-266/U	4575	R	P	1 3/32
—	83-875	R, T	FM	1 3/32
—	74525	GT	H, RM	1 3/32
—	83-875-1002	B	FM	1 3/32
SO-2395H	83-878	FB	FM	1 1/16

ADAPTERS

83-1J



non-constant impedance
non-weatherproof

STRAIGHT small body, except as noted

adapter ends are Jack-Jack.

MIL No.	No.	Ins.	Notes	Lgth.
UG-224	29500	R		1 3/8
PL-258	83-1J	PST		1 1/8
UG-360	83-21J	PST	LB	1 1/8
363, PL-274	83-1F	PST		2
—	11850	T		1 1/8
—	13725	T		1 3/8
PL-258MM	83-877	PST	P-P	1 5/16

ANGLE small body

MIL No.	No.	Ins.	Adapter Ends	Lgth.
M-359A	83-58	PST	JP	1¼
M359,UG-646/U	83-1AP	PST	PJ	1¼

TEE small body

M-358	83-1T	PST	JPJ	1 5/8

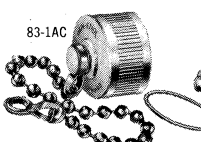
REDUCING small body

For RG-/U Cable	UG-/U No.	No.	Length
55, 58, 141, 142	175	83-185	1
59, 62, 71, 140, 210	176	83-168	1

HOODS non-weatherproof • small body

For RG-/U Cable	MIL No.	No.	Lgth.
8, 9, 10, 11, 12, 63, 79, 87, 115, 149, 213, 215	MX-543	5475	1
	UG-106/U	83-1H	¾
	UG-372/U	83-1HP	⅞
58, 141	UG-177/U	83-765	¾
55, 59, 140, 142, 223	MX-539	5375	1

83-1AC



83-1BC



CAPS

weatherproof • small body

MALE

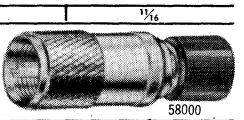
No.	Length
83-1AC	15/32

FEMALE

83-1BC	11/16

BINDING POST

non-weatherproof
male contact



58000

UG-/U No.	No.	Ins.	Length
332	58000	R	1 7/8

AMPHENOL RF COAXIAL CONNECTORS

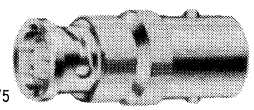
AMPHENOL
THE BUNKER-RAMO CORPORATION

BETWEEN SERIES ADAPTERS

CHARACTERISTICS (Typical)

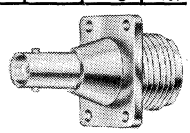
ELECTRICAL	
impedance	non-constant
frequency	per cable used
voltage	per cable used
ENVIRONMENTAL	
thermal limits	Teflon: —67°F to 390°F Rexolite: —67°F to 185°F Kel-F: —67°F to 390°F mica-filled Bakelite: —67°F to 300°F polyethylene: —67°F to 185°F
weatherproof	except as noted
hermetic seals	pass helium leakage test of 2×10^{-8} cc/sec.
MECHANICAL	
mating	per series
MATERIAL	
contacts	male: brass female: beryllium copper
other metal parts	brass
plating	.0002" silver min.
insulators	Teflon, Rexolite, Kel-F, mica-filled Bakelite, polyethylene or glass-Teflon

BNC to C
weatherproof


83175

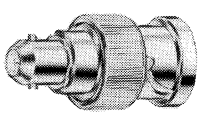
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	BNC	C	Lgth.
635	83175	T	50	Plug	Jack	1 9/32
636A	83200	T	50	Jack	Plug	1 15/64

BNC to HN
weatherproof



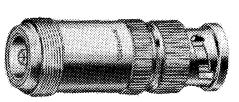
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	BNC	HN	Lgth.
309	8900	T	50	Jack	Plug	1 1/2
559	17750	R	50/AN	Plug	Jack	1 1/2
—	32750	T-R	—	Plug	Jack	1 3/8
—	35050	T	50	Jack	Jack	1 3/8

BNC to MB
weatherproof


47275

UG-/U No.	No.	Ins.	Imp. Ohms/Notes	BNC	MB	Lgth.
—	33200	T-K	50	Jack	Jack	1 5/32
—	47200	GT	50/H	Jack	Jack	1 1/8
—	47250	T-K	50	Jack	Plug	15/16
—	47275	T-K	50	Plug	Jack	1

BNC to N
weatherproof

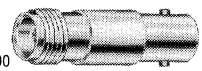

31-217

UG-/U No.	No.	Ins.	Imp. Ohms/Notes	BNC	N	Lgth.
201	31-830	T	—	Jack	Plug	1 15/32
201A	31-216	T	—/I	Jack	Plug	1 5/16
335	3025	T-R	50	Plug	Jack	1 3/4
349	2975	T-R	50	Plug	Jack	1 3/4
349A	31-217	T	—/I	Plug	Jack	1 7/16
1034	5225	T	50	Plug	Plug	1 1/2
—	2800	T	50/AN	Jack	Jack	1 7/16
—	4250	T	70	Jack	Plug	1 5/16
—	4900	T	50	Plug	Plug	1 1/2
—	5850	T-R	50/P	Jack	Jack	1 27/32
—	21850	T	50	Jack	Jack	1 1/2
—	93075	GT	—/H	Jack	Jack	1 11/16

BNC to SM
non-weatherproof

UG-/U No.	No.	Ins.	Imp. Ohms/Notes	BNC	SM	Lgth.
691	89250	GT	—/H	Jack	Jack	1 1/8

BNC to TNC
non-weatherproof

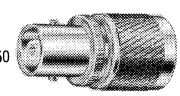

76400

UG-/U No.	No.	Ins.	Imp. Ohms/Notes	BNC	TNC	Lgth.
—	76400	T	50	Jack	Jack	1 3/32
—	79025	T	50	Plug	Jack	1 1/4
—	79675	T	50	Jack	Plug	1 1/4

BNC to UHF
non-weatherproof

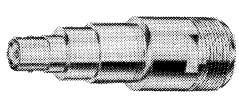
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	BNC	UHF	Lgth.
255	2900	R	50	Plug	Jack	1 5/16
273	31-028	R	—	Jack	Plug	1 3/16
—	2925	T	50	Plug	Jack	1 5/16
—	12025	T	50	Jack	Plug	1 9/32

C to HN
non-weatherproof


83350

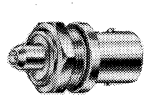
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	C	HN	Lgth.
702	83350	T	—	Jack	Plug	1 1/2
703A	83400	T	—	Plug	Jack	1 1/2

C to LC
weatherproof


82350

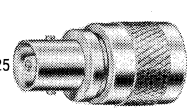
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	C	LC	Lgth.
—	82350	T	—	Jack	Jack	3 29/64

C to MB
weatherproof


83950

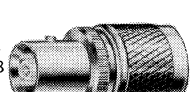
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	C	MB	Lgth.
—	83950	gT	—/H	Jack	Jack	1 7/32

C to UHF
non-weatherproof


83225

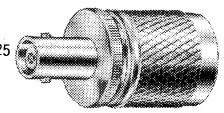
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	C	UHF	Lgth.
637	83225	T	—	Jack	Plug	1 3/8

C to N
weatherproof


82-508

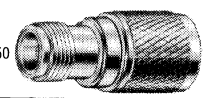
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	C	N	Lgth.
564	82-508	T	50	Jack	Plug	1 3/8
565A	82-540	T	50	Plug	Jack	1 17/32
—	83875	T	50/AN	Jack	Plug	1 9/32

HN to MHV
weatherproof


20625

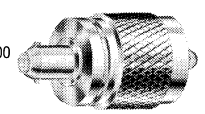
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	HN	MHV	Lgth.
—	20625	T	50	Plug	Jack	1 1/2

HN to N
weatherproof


16050

UG-/U No.	No.	Ins.	Imp. Ohms/Notes	HN	N	Lgth.
—	16050	T	50	Plug	Jack	1 5/16
—	16075	T	50	Jack	Plug	1 5/16
—	16100	T-R	50	Jack	Jack	1 49/64

MB to UHF
non-weatherproof

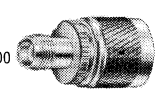

47400

UG-/U No.	No.	Ins.	Imp. Ohms/Notes	MB	UHF	Lgth.
—	47400	T	—	Jack	Plug	1 11/32

MHV to UHF
weatherproof

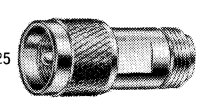
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	MHV	UHF	Lgth.
—	28050	T	—	Jack	Plug	1 9/32
—	28075	T	—	Plug	Jack	1 3/8

N to TNC
non-weatherproof


78800

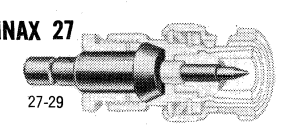
UG-/U No.	No.	Ins.	Imp. Ohms/Notes	N	TNC	Lgth.
—	78800	T	50	Plug	Jack	1 5/16
—	78825	T	50	Jack	Jack	1 25/64
—	78875	T	50/W	Plug	Plug	1 9/32
—	79825	T	50	Jack	Plug	1 21/32
—	79850	T	50/W	Plug	Plug	1 9/32

N to UHF
weatherproof


34125

UG-/U No.	No.	Ins.	Imp. Ohms/Notes	N	UHF	Lgth.
83	14000	T-R	—	Jack	Plug	1 5/16
83B	34125	T	—	Jack	Plug	1 13/16
146	4400	R	—/NW	Plug	Jack	1 13/32
318	26700	R	—	Plug	Plug	1 47/64
—	14650	T	—/NW	Plug	Jack	1 13/32

BNC to SUBMINAX 27
non-weatherproof


27-29

No.	Ins.	Imp. Ohms/ Notes	Mates With Sub. 27 Plug	Used In BNC UG-/U	Lgth.
27-28	T	50	50 ohm, Screw-On	88	1 5/16
27-29	T	50	50 ohm, Push-On	88	1 5/16
27-40	T	50/GC	50 ohm, Screw-on	89, 291	1 5/16
27-41	T	75	75 ohm, Push-On	260B	1 1/4
27-42	T	75	75 ohm, Screw-On	261B, 262B	1.355
27-805	T	75	75 ohm, Screw-On	260B	1 17/64

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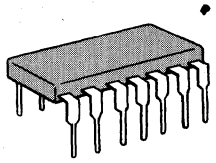
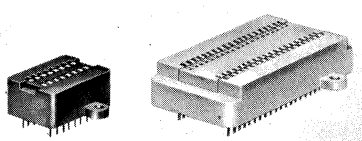
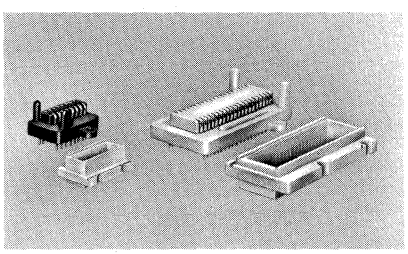
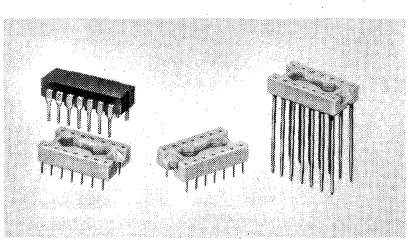




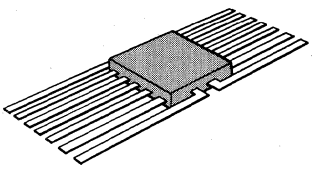
DIP SOCKETS...
For testing, aging, burn-in and breadboarding. Features easy loading, long, reliable life with no lead deformation.

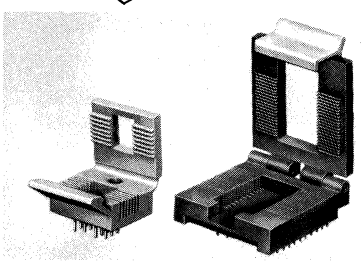


DIP CARRIERS/CONTACTORS...
For device protection during shipment, testing and manual or automatic handling. Provides uniform geometry and polarization protection for all package sizes and types.

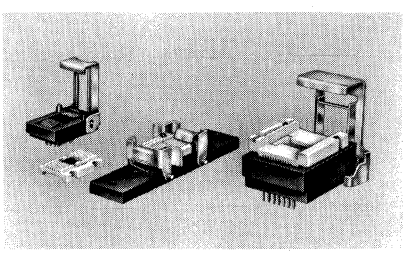


DIP PRODUCTION SOCKETS...
For high density production mounting of I.C.'s. Features low body profile, available in wire-wrap or solder tab terminals, temperatures to 150°C.

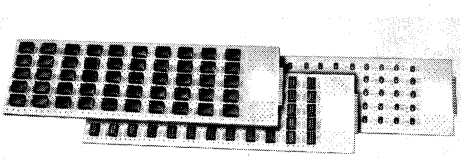




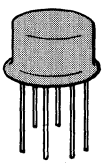
FLAT PACK SOCKETS...
For testing, aging, burn-in, breadboarding and production mounting. Features fast, one-hand loading and unloading, and positive lead separation with no deformation.

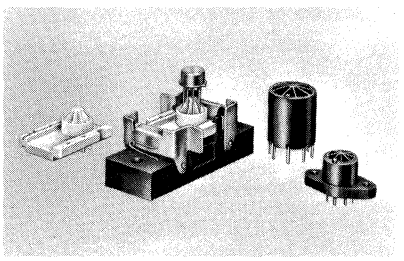


FLAT PACK CARRIERS/CONTACTORS...
For device protection during shipment, testing and manual or automatic handling. Provides uniform geometry and polarization protection for all package sizes and types.

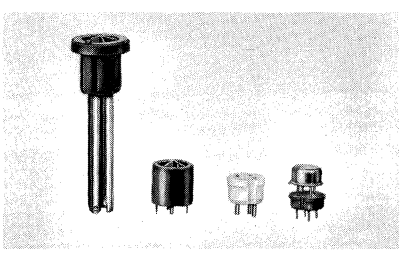


BREADBOARDS...
For high temperature circuit design, environmental testing, aging and burn-in for Dual-in-Line, Flat Pack and TO style I.C. packages. Available with 5 to 75 device positions per board with card receptacle edge connector.





TO SOCKETS, CARRIERS/CONTACTORS...
For testing, aging, burn-in and breadboarding ... and for device protection during shipment, testing and handling for all sizes and pin configurations.



TRANSISTOR SOCKETS...
For testing, aging, burn-in, breadboarding and production mounting. Features easy insertion, excellent electrical characteristics and low profile for high density production mounting, as well as wide temperature range capability.

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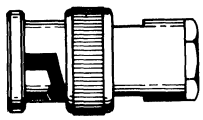
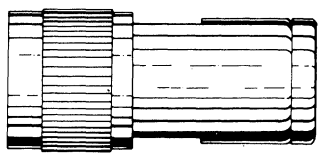
Broadest line of RF CONNECTORS on the market



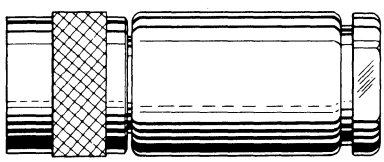
BNC Square Cut: 60 second cable assembly; weatherproof; small and lightweight with quick disconnect bayonet-lock coupling. BNC uses small cables, operates to peak load of 500 volts. Manufactured in accordance with MIL-C-3608A.

Cable	RG55B, 223	RG58	RG59, 62, 71	RG122	RG174
Plug	30220-9	30220-2	30220-4	30220-11	30220-13
Cable Jack	30516-5	30516-1	30516-3	30516-7	30516-9
S.H.Mt.Jack	30517-5	30517-1	30517-3	30517-7	30517-9



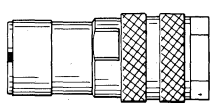
N Square Cut: A line of low voltage, constant impedence connectors (50 ohms) designed for quick cable assembly on small and medium size RF cable. They have a peak rating of 1,000 volts and are weatherproof.

Cable	RG55B, 233	RG58	RG59, 62, 71	RG8, 213	RG9, 214
Plug	33072-5	33072-1	33072-3	30533-1	30533-3
Cable Jack	33073-5	33073-1	33073-3	30534-1	30534-3
S.H.Mt.Jack	33086-5	33086-1	33086-3	30535-1	30535-3



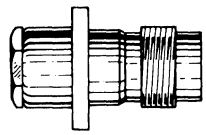
TRIAX Group A: Incorporates the normal coaxial design with center contact and outer contact, but with a third contact made through the body shell to accommodate the triaxial cable ground. Group A is of the same diameter as the Type C (UG-Series) connector line.

Cable	RG8	RG11	RG59	RG58
Plug	3875-1	3881-1	3880-1	—
Cable Jack	3874-1	3906-1	3902-1	—
S.H.Mt.Jack	3945-1	—	3974-1	3973-1



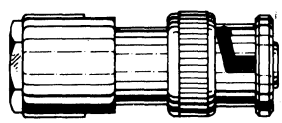
ADM: Miniature coaxial cable connectors featuring small bayonet-locking, superior cable gripping mechanism; waterproof construction and easy assembly with only 3 basic parts. Intermateable with DM Series; multiple polarization available. Fully tested to MIL-C-25516—B and C. Floating ground, ungrounded and unshielded versions available.

	Cable	Pol. E	Pol. F	Pol. J	Pol. K
Plug	RG179	43016-3	43003-2	43016-1	43003-3
Cable Jack	RG179	43005-1	43004-1	43005-2	43004-2
S.H.Mt.Jack	RG179	43006-1	43007-1	43006-2	43007-2



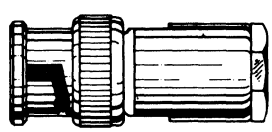
TNC Square Cut: A screw thread adaptation of BNC Square Cut. Assembly electrical and mechanical features are identical to the improved BNC Square Cut series and, except for threaded sleeve, are manufactured in accordance with MIL-C-3608A.

Cable	RG55B, 223	RG58	RG59, 62, 71	RG122	RG174
Plug	8280-5	8280-1	8280-3	8280-7	8280-9
Cable Jack	8281-5	8281-1	8281-3	8281-7	8281-9
S.H.Mt.Jack	8282-5	8282-1	8282-3	8282-7	8282-9



BNC High Voltage: A high voltage adaptation of the standard BNC. This series is of weatherproof construction rated at 4,000 V. at sea level.

Cable	RG55	RG58	RG59	RG195
Plug	2085-1	3621-2	UG932 A/U	3652-1
Cable Jack	3066-1	3066-1	UG1016 A/U	3954-1
S.H.Mt.Jack	3650-1	3650-1	3650-2	3655-1



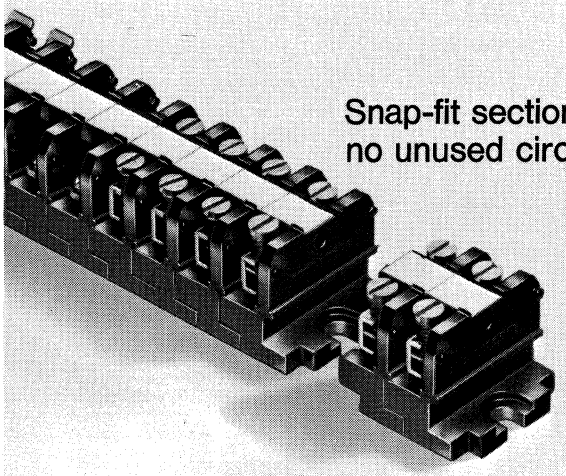
TRIAX Group B: Group B TRIAX is of the same diameter as the BNC series. It is available also in a polarized version.

Cable	21-738	50-3822	21-204	93-3930
Plug	2743-1	30088-1	4774-1	30061-1
Cable Jack	2741-1	30571-1	—	—
S.H.Mt.Jack	3107-1	—	30230-2	30062-1

Part numbers shown above (partial listing only) are suitable for most connector applications. All are available for fast delivery from Bendix stock. Bendix provides *one source* for all your RF connector requirements, including custom engineering and special finishes. Call or write for complete Catalog: Microwave Devices Division, The Bendix Corporation, Hurricane Road, Franklin, Indiana 46131. Phone (317) 736-6136.

Bendix Electronics

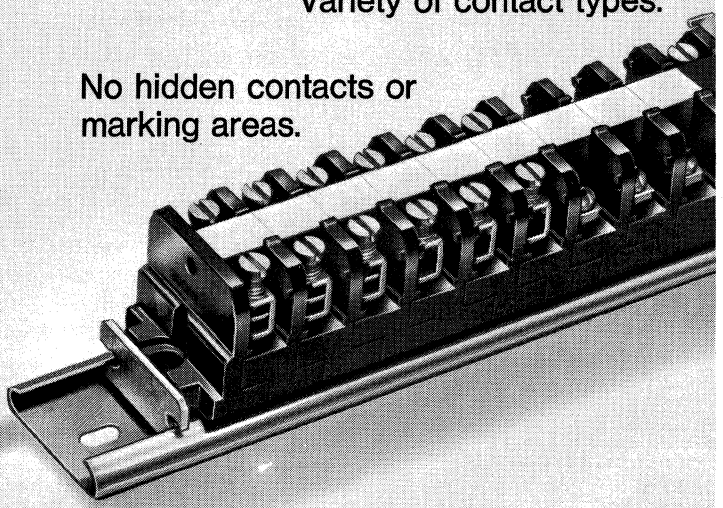
4 most sought-after terminal block features:



Snap-fit sections...
no unused circuits.

Variety of contact types.

No hidden contacts or
marking areas.



Direct or Channel
mounting.

Only BUCHANAN has them all!

Only Buchanan gives you the 4 most sought-after features in its terminal blocks—features that put more profit in your designs.

Assembly is fast because blocks are packaged in preassembled snap-fit sections. Clearly visible marking areas and contacts make wiring and marking fast and simple. Four different contact types meet the requirements of any application. You even have a choice of flat base or dovetail base. Bonus: New Buchanan® nylon blocks are designed to allow more circuits per foot than comparable competitive blocks.

To get all the profit-building facts, write today for catalog G-107: 1065 Floral Avenue, Union, New Jersey 07083 • (201) 289-8200 Telex 13-8214

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ELECTRICAL PRODUCTS CORPORATION
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Write for UL, CSA listings and NEC tables.

Extra-Heavy Duty Phenolic— #4 thru 250 MCM, 600V NEMA, 10 circuits per foot.

Switch Fuse Blocks— for wire sizes #18 thru #8-15 amps. 16 circuits per foot.

NEW 1/0 Nylon— special base for direct or channel mounting, #10 thru #1/0 AWG, 600V, 16 circuits per foot.

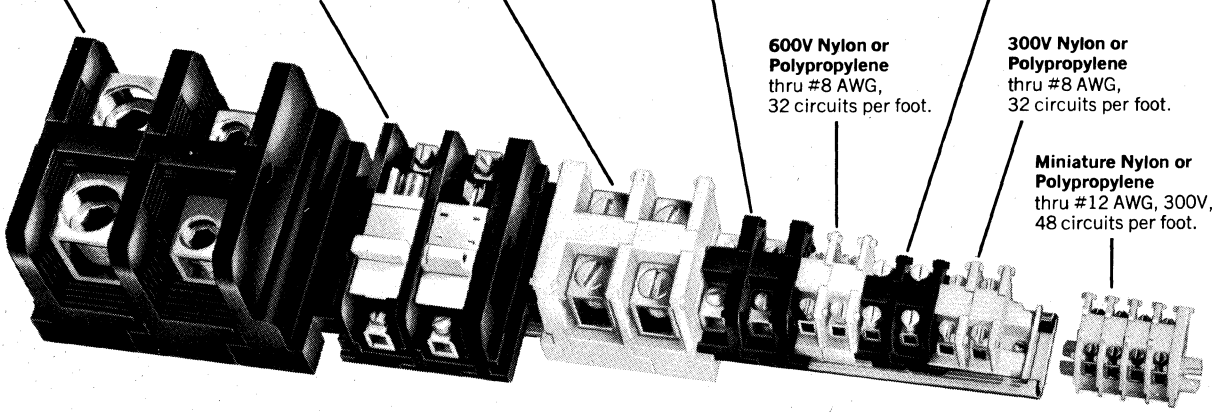
Heavy Duty Phenolic— #18 thru #4 600V NEMA, 750V IEEE, 21 circuits per foot.

Medium Duty Phenolic— #22 thru #8 AWG, 750V IEEE, 28 circuits per foot.

600V Nylon or Polypropylene thru #8 AWG, 32 circuits per foot.

300V Nylon or Polypropylene thru #8 AWG, 32 circuits per foot.

Miniature Nylon or Polypropylene thru #12 AWG, 300V, 48 circuits per foot.

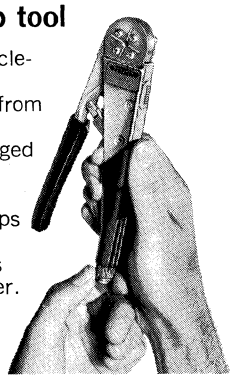


352A

BUCHANAN®

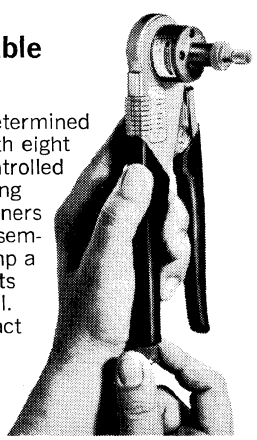
Headquarters for universal crimping tools

Infinitely adjustable microcrimp tool



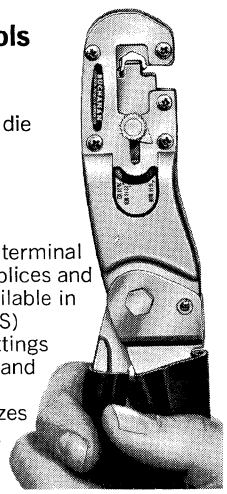
Eight indent cycle-controlled tool crimps depths from .025" to .075". Settings pin gaged to within .001". Direct-reading indicator. Crimps most pin and socket contacts #12 and smaller. Adaptable to accommodate MS turret head assemblies. Can be operator adjusted or preset and locked by toolroom or quality control personnel. Miniature tool available for contacts #20 and smaller to crimp depth values varying from .015" through .043". Meets performance requirements of MIL-T-22520.

Step adjustable crimp tool



Dial seven pre-determined crimp depths with eight indent, cycle-controlled tool. Direct reading indicator. Positioners in turret head assemblies let you crimp a variety of contacts with just one tool. Crimps MS contact sizes 12, 16, 20 and 22 to wire sizes #12 thru #26 AWG with or without turret head assemblies. Can be operator adjusted or preset and locked. Accommodates all MS turret head assemblies as shown on MS3191. Miniature tool available for contacts #20 and smaller to crimp depth values varying from .015" thru .043". MS3191-4 (MIL-T-22520 Class I).

"C" Frame Tools



Lighter, easier to operate, compact yet strong. In-line die system; cycle controlled.

CT tools

Crimp MS 25036 terminal lugs, MS 25181 splices and other fittings. Available in standard size (CTS) cat #11545 for fittings 12-10 thru 26-24 and miniature (CTM) cat #11707 for sizes 16-14 thru 26-24. Dial-for-size selector knob.

MIL-T-22910 Class I MS 90413 (AS)

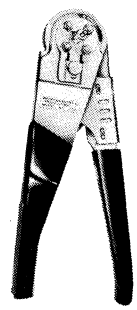
CH tools

Hex dies for use on various series of RF connectors and shielded terminating ferrules. Available standard size (CHS) and miniature (CHM).

CD tools

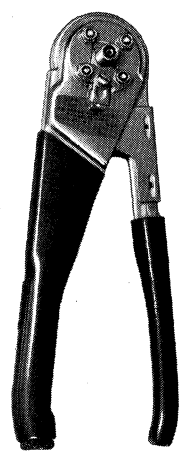
These have special dies for special custom applications. Available in standard size (CDS) and miniature size (CDM).

Miniature positioner controlled



Inexpensive positioners program cycle-controlled tool for crimp depth, rachet release and crimp location. Crimps most contacts #20 and smaller. Ideal for confined areas. 6¾" long; 10 ounces.

Standard size positioner controlled

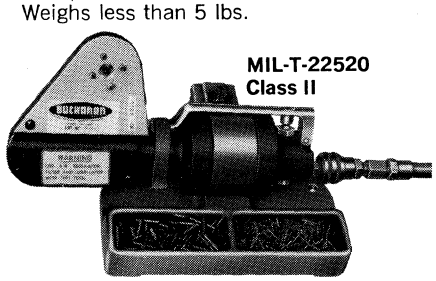


This MIL standard 4-indent, cycle-controlled tool crimps most proprietary and mil spec contacts #12 thru #22. Uses inexpensive positioners to control crimp depth, rachet release and crimp location.

MIL-T-22520 Class I

Manual Feed Tool

For moderate volume production. Pneumatic; cycle-controlled; portable or bench mounted with foot pedal. Crimps contacts #8 thru #22. Weighs less than 5 lbs.



MIL-T-22520 Class II

Automatic Feed Tool

For high-volume production. Four-indent tool automatically feeds contacts from disposable carriers (protects contacts from damage). Crimps as fast as operator inserts wires. Crimp depth automatically controlled. Bench unit holds 2,000 or more contacts. For portable application, carriers in self-positioning, "see-thru" magazines hold up to 102 contacts. Crimps contacts #12 thru #22.



MIL-T-22520 Class II

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351A

BURNDY PRINTED CIRCUIT CONNECTORS

Printed circuit boards are the most common and convenient way of assembling electronic components into systems. Printed circuit connectors are used to (1) interconnect various boards; (2) bring power, signal, and ground leads to the boards; and (3) permit ready replacement of a faulty board. The two connection methods used for printed circuit boards are contact spring to board (card receptacle) and pin to board (pin and socket).

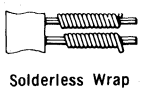
Design: Card Receptacle Method

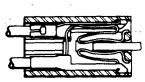
Burndy **EDGE-ON®** connectors (card receptacles) contain spring members which contact "lands" on the inserted board. These spring members may have pin or tab terminations for solder-dipping to "mother" boards; solder cups or solder eyes for soldering to individual wires; square or rectangular pins for solderless wrapping, or may accept crimped, removable contacts (**HYFEN®** principle).

Solder terminations provide the lowest cost connectors. Soldering individual wires to these terminations, however, is time consuming, requires considerable operator skill, and runs the risk of soldering across contacts on close centers. Solderless wrapping is economical, reliable, and can be programmed; it is especially useful in back-plane wiring. With crimp-removable contacts, solder is unnecessary and burnt wire insulation is avoided. Tooling has been designed for the contact, thereby ensuring a highly reliable termination. Changes and corrections can be made with ease. These contacts have no external spring members but snap into a block and make contact with a spring which is an integral part of the connector.

Card receptacle connectors use either accordion-type springs, wire-formed springs, or cantilever springs for low-cost reliable connections.




Solderless Wrap

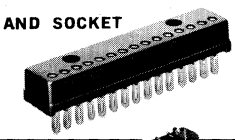
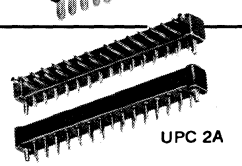
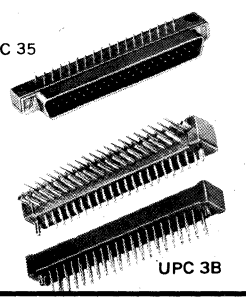
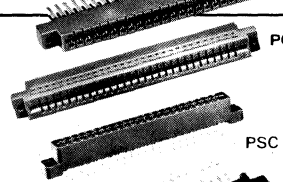
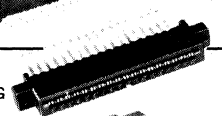
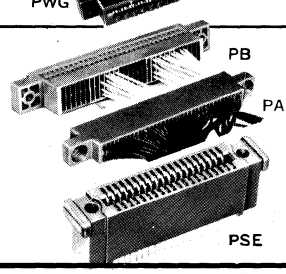
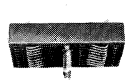

Edge-On

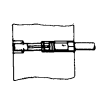

Accordion Spring

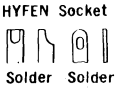

Cantilever Spring

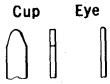
Design: Pin and Socket Method

In two-piece connectors (pin and socket), a plug is generally solder-dipped to the board. The plug will have pin or blade contacts which engage appropriate contacts in the receptacle. These contacts may have terminations of the solder-dip, solderless-wrap, or crimp-removable type. Solder-dip is a fast economical method of making multiple connections; however, it requires considerable operator skill. Crimped, removable terminations are of the machined cylindrical type and are suitable for stranded as well as solid wires. In addition to ease of circuit change, they provide rugged wiring arrays capable of withstanding high shock and vibration.

Spacing	TYPE		No. of Contacts
.156	PIN AND SOCKET 	Crimp Type Removable Terminations	23
		Solder Dip Solder Eye	10, 15, 18, 22
.150	 UPC 2A	Crimp Type Removable Terminations	31
		Solder Dip	17, 23, 28, 41
.100	MC 35  UPC 3B	Crimp Type Removable Terminations	35, 45, 21, (8 matched impedance min. coax. and 13 standard
		Solder Dip	17, 25, 33, 41
		Solder Dip	13, 49, 61, 92
		Solder Wrap	92
.200	CARD RECEPTACLE PWH 	Solderless Wrap	23
.156	 PC PSC	Crimp Type Removable Terminations	8, 15, 18, 22, 25, 30, 36, 43
		Solder Eye	10, 15, 18, 22
		Solder Dip	10, 15, 18, 22
		Solderless Wrap	15, 22, 30, 36, 43
.150	PWG 	Solderless Wrap	18
.100	 PB PA PSE	Crimp Type Removable Terminations	15, 22, 29, 30, 43, 50
.078		Crimp Type Removable Terminations	37
.050		Solder/Weld	10, 15, 18, 20, 22, 25
.100	MODULE HEADER HSSB 	Solder/Weld Components Header Bolted to Board	14, 16, 18, 20


HYFEN Socket


Solder Cup Solder Eye


Solder Dip Tab Solder Dip Pin

Tooling

A variety of installation tooling is available to the user to suit his particular manufacturing application. Burndy has designed specific tools for its **HYFEN** contacts including hand, pneumatic, or hydraulic-powered tools that accomplish a perfect crimp irrespective of the operator's skill. Refer to Installation Tooling section for description of specific tool or tools desired. Burndy sales engineers may be consulted concerning the optimum installation technique for a particular application.

For more detailed information refer to Burndy catalog PC (Printed Circuit Connectors). **BURNDY, NORWALK, CONN.**

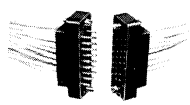
RACK AND PANEL CONNECTORS

BURNDY

Burndy's rack and panel connectors utilize various terminating techniques: solder, tapered pin receptacle, **HYFEN** crimped connection. Burndy's **HYFEN** connectors permit contact installation at any point in the assembly procedure. Because of the crimp, snap-lock feature, the connector block can be premounted, thereby permitting complete panel construction prior to wiring. In addition, circuit changes and replacement of individual contacts are quickly and easily accomplished.


Crimp

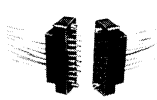

Snap-Lock


Connect

Design

The basic rack and panel connector consists of mating plug and receptacle blocks molded of a high-strength dielectric material. These connectors are designed so that each contact has a small degree of lateral freedom (float), to permit gang mating with reasonable engaging force, and a very limited degree of angular freedom to prevent mismatching of contacts. The blocks accept contacts that are made of a high-conductivity copper alloy. The copper contacts generally are gold-plated; they have varying underplates dependent upon the requirements of the application. Hardware is corrosion resistant.


ME heavy duty connector


MS miniature rectangular connector


DTD heavy duty connector

Most sockets are equipped with a beryllium copper contact spring which supplies high-contact pressure to ensure low-resistance contact between the pin and socket. In addition, beryllium copper locking springs are provided on both the pin and socket to retain the contacts within the connector.

Each connector family is provided with a variety of external hardware, including cable clamps, hoods and mating devices.

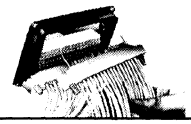
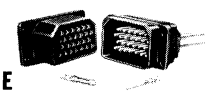
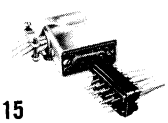
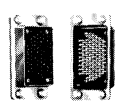
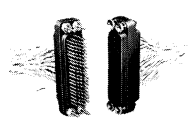
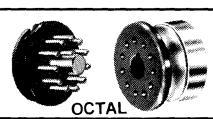
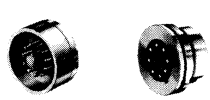
Burndy rack and panel connectors are designed and tested in accordance with applicable military specifications.

Tooling

The Burndy tooling family, which provides full-cycling control, ensures a reliable connection independent of the operator's skill and, therefore, at low cost. In addition, a Burndy extraction tool extracts the contacts quickly and easily. Refer to Installation Tooling section for a detailed description of the various Burndy tools. Burndy's experienced sales engineers may be consulted concerning the optimum installation technique for a particular application.

For more detailed information refer to the following Burndy catalogs: HMT63 (Plug-in HYFEN Sockets); MS67-1 (Miniature Rectangular HYFEN Connectors).

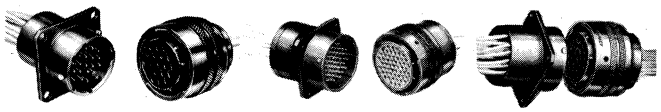
BURNDY, NORWALK, CONN.

TYPE		No. of Contacts	Contact Size
 MS	miniature rectangular	14, 20, 26, 34 42, 50, 75, 104 152	#20 and #16
 PD	modular for standard cable	35	#20
 ME	rack and panel for standard cable	8	#12
		13	10-#16 3-#12
		13	#16
		26	#16
		43	#20
 PD15	general purpose PD15 (crimp type) DTGS (solder type)	15	3-#12 12-#20
 DTD	rack and panel	40	#16
		45	43-#16 2-#10
		50	#16
		78	#16
		or double each of above arrangements	
		90	#16
 MP	rack and panel	99	#16
 MT-R	plug-in relay socket	8	#20
		9	.030 dia.
		10	.030 dia.
		14	#16
		14	#20
		16	.030 dia.
		20	#20
		21	#20
		22	#20
 OCTAL	plug, receptacle	8, 9, 11	#12
 OCTAL	metal-shelled plug, receptacle	8, 9, 11	#12
 CA	high voltage cable assemblies	1	coax

BURNDY

BANTAM CONNECTORS

Burndy's **BANTAM™** connectors conform to the requirements of MIL-C-26482 and are available in either solder or smooth (crimp) types. The connectors have a positive bayonet coupling lock which can be quickly connected and disconnected. They are vibration resistant and moisture proof within the required temperature range of −67° to +257°F. **BANTAM** connectors mate with, or replace, all connectors which conform to **MIL-C-26482.**



HYFEN BANTAM **Smooth BANTAM** **Solder BANTAM**

Polarization

Different polarizations are available in **BANTAM** connectors. These prevent mismatching when similar plugs and receptacles are used. Connectors can be ordered polarized in accordance with applicable military standards.

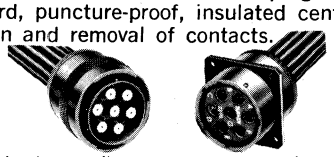
Design and Materials

Solder BANTAM Connectors — Pin contacts and closed-entry, probe-proof socket contacts are machined from a high-conductivity copper alloy and are plated with heavy gold over silver. The shells are a high-strength aluminum alloy and are plated with cadmium, olive-drab chromate, or other finishes as desired. The solder wells are designed so that insertion of the wire and completion of the termination can be accomplished with speed and accuracy.

Smooth BANTAM Connectors — Both pin and socket contacts are machined from a high-conductivity copper alloy and are plated with heavy gold over silver. The socket contact has a closed-entry design with an internal beryllium-copper contact spring to guarantee constant electrical contact pressure. The shell material and finishes are the same as on solder **BANTAM** connectors. Pin and socket contacts are crimped to the wires by any of several hand or power tools, including **MS3191.** Pins and sockets are installed with or can be removed by any insertion and extraction tools which meet the requirements of **MS24256.**

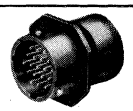
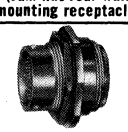
Smooth BANTAM Coaxial Contacts — These contacts will accept a variety of cables and are available in certain insert arrangements. They meet or exceed the environmental requirements of **MIL-C-26482.**

HYFEN BANTAM Connectors — Both plug and receptacle contain a hard, puncture-proof, insulated center that facilitates insertion and removal of contacts.



The pin contacts and closed-entry socket contacts are machined from a high-conductivity copper alloy that is plated with gold over silver. A locking spring is designed on each individual contact rather than in the connector itself. The shell material and finish are the same as on the solder and smooth **BANTAM** connectors.

HYFEN BANTAM Coaxial Connectors — These connectors accept a variety of miniature coaxial contacts as well as #16 or #12 standard wire contacts. (Refer to Coaxial and Shielded Cable Connectors).

Shell Style: Smooth	Smooth	Solder	HYFEN	TYPE	Shell Size	Solder BANTAM Contacts	Smooth BANTAM Contacts	HYFEN BANTAM Contacts
0	0	0		 (Wall mounting receptacle)		2 #20 3 #20 4 #20	3 #20	—
						6 #20	**6 #20**	**6 #20**
1	1	1		 (Cable connecting receptacle)		3 #16 8 #20 10 #20 14 #20	3 #16 10 #20	—
						5 #16 **8 #20 &** **4 #16** **14 #20. &** **1 #16** **18 #20** **19 #20**	**5 #16** **8 #20 &** **4 #16** **14 #20 &** **1 #16** **19 #20**	**3 #20** **4 #12 &** **1 #20** **19 #20**
2	2	2		 (Box mounting receptacle)		8 #16 22 #20 & 1 #16 26 #20	8 #16 26 #20 6 #20 & 2 #8 coax.	—
6	6	6		 (Straight plug)		**11 #16** **1 #16 &** **29 #20** **32 #20**	**11 #16** **32 #20**	**2 #16 &** **4 #12** **6 #20** **5 #16 &** **3 Min. coax.** **11 #16** **32 #20**
3	7A	4		 (Jam nut rear box mounting receptacle)		16 #16 24 #20 25 #20 27 #20 2 #16 & 37 #20 41 #20	16 #16 2 #16 & 37 #20 41 #20	41 #20
4	7P	—		 (Jam nut rear wall mounting receptacle)		**21 #16** **32 #20** **34 #20** **36 #20** **55 #20**	**21 #16** **19 #12** **or coax.** **55 #20** **6 #16 &** **31 #20** **26 #20 &** **6 #12** **or coax.**	**1 #12 &** **9 Min. coax.** **10 Min. coax.** **21 #16** **55 #20**
4	7E	—		 (Jam nut rear wall mounting receptacle wire sealing grommet)		61 #20	61 #20	—

Tooling

A variety of installation tooling is available to the user to suit his particular manufacturing application. Hand, pneumatic, or hydraulic-powered tools accomplish a perfect contact crimp irrespective of the operator's skill. The Burndy M10S-1 is a manually-operated, four-indent tool that exceeds the requirements of **MIL-T-22520A** and **MS3191.** Refer to Installation Tooling section for description of the tool or tools desired. Burndy's experienced sales engineers may be consulted concerning the optimum installation technique for a particular application.

For more detailed information refer to Burndy catalogs BSB67 (Solder BANTAM Connectors) and SCB67 (Smooth BANTAM Connectors).

BURNDY, NORWALK, CONN.

COAXIAL AND SHIELDED CABLE CONNECTORS

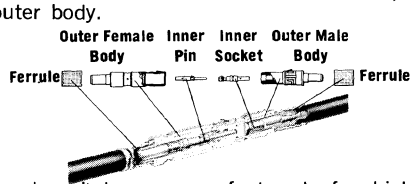
BURNDY

Burndy's **HYFEN** line of coaxial connectors combines the reliability of crimping with the versatility of removable contacts. **HYFEN** connectors enable a user to make installations at the most convenient point in his production cycle. The snap-lock feature permits quick circuit changes and replacement of individual contacts.

Design

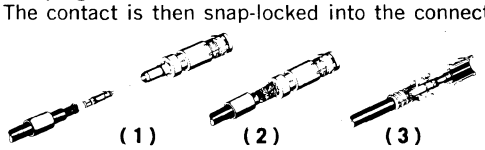
To eliminate the possibility of mismating, multiple contact connectors are aligned or polarized by the shell or guide pins before contact engagement. One-piece shell and one-piece insert design reduces the possibility of lost parts or moisture entrapment.

Contacts for coaxial or shielded cable consist of three components: an inner contact, an outer body, and a ferrule. Inner pin contacts are assembled within outer female bodies; inner socket contacts, within outer male bodies. An insulating bushing selected for its low dielectric constant is part of the outer body.



Pins and sockets are manufactured of a high-conductivity copper alloy and are gold-plated to resist corrosion and provide low-contact resistance.

Coaxial cable is terminated by (1) crimping the inner contact to the inner conductor; (2) snapping the inner contact into the outer coaxial contact body; (3) slipping a ferrule over the exposed braid and crimping it on the rear of the outer contact body. The contact is then snap-locked into the connector.

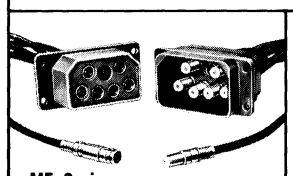
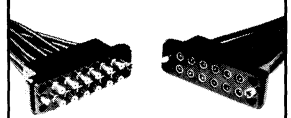
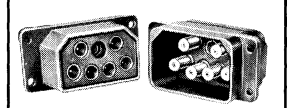
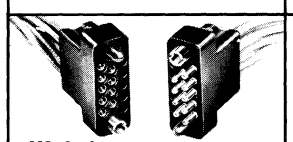
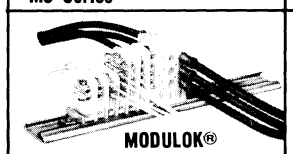
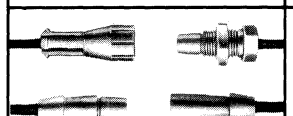
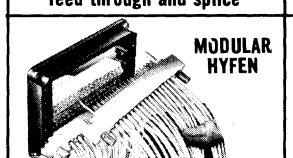
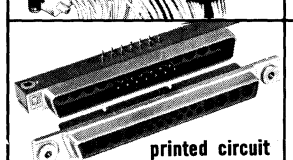
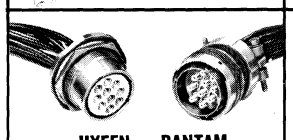
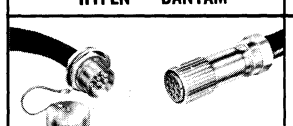


TRIM TRIO

In the **TRIM TRIO,** Burndy offers a unique approach in contact design. Any of the trio of subminiature coax, machined, and formed contacts can be combined at will and as desired in the insulating blocks. The MS-M connector series and the PD57 connector are designed specifically for the trio and will accept any combination of #16 standard and subminiature coaxial contacts. The MB152 and **HYFEN AQUALOK®** connectors will also accept members of **TRIM TRIO.**

Tooling

Burndy provides hand, pneumatic, or hydraulic-powered tools to crimp coaxial and shielded cable contacts. These full-cycling tools provide a reliable connection independent of the operator's skill. Refer to Installation Tooling section for a description of the specific tool or tools desired. Burndy's experienced sales engineers may be consulted concerning the optimum installation technique for a particular application.

TYPE		No. of Contacts	Contact Size
 ME Series	ME	7 coax. 4 coax. 13 6 coax. 13 12 coax. 23 coax. 25 coax. 33 coax.	std. std. #16 min. #16 min. std. std. std.
	MD12MX	12 coax.	min.
	MB7X	7 coax. (commoned)	std.
 MS Series	MS-M (TRIM TRIO)	14, 20, 26, 34, 42, 50, 75, 104, 152	#16 and submin. coax. (any combination)
 MODULOK®	TERMINAL BLOCK	various	std.
 feed through and splice	RS-M	1 coax.	min.
 MODULAR HYFEN	PD-X PD-MX PD57	10 coax. 21 coax. 57	std. min. #16 or submin. coax.
 printed circuit	MC8MX13	8 coax. 13	min. #20
 HYFEN BANTAM	M-T	3 coax. 5 10 coax. 9 coax. 1	min. #16 min. min. #12
 moisture resistant AQUALOK	MA	3 coax. 5 9 coax. 1 18 coax. 1 10 coax. 1	min. #16 min. #12 min. #12 min. #12

For more detailed information refer to Burndy catalogs MX-62-1 (Coaxial and Shielded Cable Connectors) and MS67 (Miniature Rectangular HYFEN Connectors).

BURNDY, NORWALK, CONN.

BURNDY

TERMINAL BLOCKS

Burndy offers industry a useful line of terminal blocks for electrical connection applications in a variety of environments. Included in the line are **MINILOK®**, **MODULOK®**, **SEALOK™**, and **YHLZ** terminal blocks. (Refer to accompanying table.)

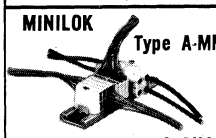
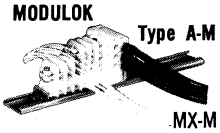
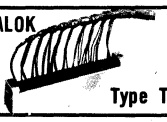
Design

The **MINILOK** terminal block, as its name implies, is a lightweight, miniature block that terminates #24-#18 wire and miniature coaxial cable. It is one-fifth the weight and occupies one-fourth the space required for a standard terminal block but is capable of terminating the same number of wires. Wires can be fed into **MINILOK** bodies through both side and top.

The **MODULOK** block terminates standard wire sizes #22-#8 and standard coaxial cable. The blocks, which are offered in two or four horizontal tiers, can be snapped together and mounted in tracks up to 32 inches in length.

SEALOK is an environmentally sealed modular interconnection system for shipboard, aircraft, aerospace and many industrial-commercial applications where protection against environment is required. The system functions over a wide range of temperature, vibration and shock without variations in contact resistance; it protects electrical junctions from humidity and corrosive attack, and it is readily installed and serviced by tools common in industry. The **SEALOK** modules are available in a wide variety of bussing arrangements and wire sizes.

The **YHLZ** is a lightweight, nonsealed modular terminal block for the distribution of electrical and electronic circuits. High-contact spring forces make this module suitable for both dry circuits and heavy-power circuits. It is available with 2-common, 4-common and 8-common bussing. Track

Terminal Block	Wire Type	Feed	Wire Size
MINILOK Type A-MM  A2DMM-1	std.	top/side	#24 - #18
	min. coax.	side	Most miniature coaxial cable
MODULOK Type A-M  MX-M	std.	side	#22 - #8
	std. coax.	side	Most miniature coaxial cable
SEALOK  Type TBS	std.	top	#24 - #12
YHLZ 	std.	top	#24 - #16

for both the **SEALOK** and **YHLZ** systems can be ordered in lengths to provide for the number of modules in your assembly. The modules are held in the track with end clamps and can be easily removed or added.

Tooling

Burndy's terminal blocks can be installed with a variety of installation tooling. Contacts can be crimped with hand, pneumatic, or hydraulic-powered tools depending upon the needs of the application. Refer to Installation Tooling section for a detailed description of the various Burndy tools.

For more detailed information refer to Burndy catalogs MMC (Terminal Blocks) and TBS68 (SEALOK) or your local Burndy representative (YHLZ).

COAXIAL AND SHIELDED CABLE TERMINATIONS

Burndy's one-piece **UNIRING®** ferrule and two-piece **HYRING®** ferrules are fast, reliable compression methods for terminating, grounding, or tapping coaxial or shielded cable. The reliability of these compact, crimped ferrules makes slow, unsure solder connections a thing of the past.

Design

HYRING ferrules consist of a hard brass inner ferrule and a slightly shorter and softer outer ferrule. When circumferentially crimped, these ferrules supply even pressure on all sections of the braid and tap wires and provide maximum protection of the cable. **UNIRING** one-piece construction combines the inner and outer ferrules in one unit; **UNIRING** ferrules are available insulated or uninsulated.

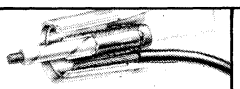
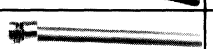
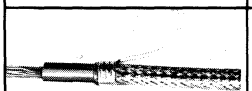
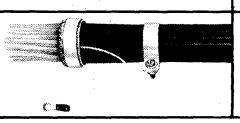




Since no heat is needed for a crimped termination, there is no danger of damage to the immediate or adjacent cables. Tin-plating eliminates any corrosion. **HYRING** and **UNIRING** ferrules are color-coded for easy size selection.

Tooling

Hand, pneumatic, or hydraulic-powered tooling with controlled depth-of-indent ensures optimum termination even by unskilled personnel. Refer to Installation Tooling section for a detailed description of the various Burndy tools. Burndy's sales engineers may be consulted concerning the optimum installation techniques for a particular application.

TYPE		Insulation	I.D. Range Inner	I.D. Range Outer
	**UNIRING** Type **YEC**	Insulated	.058 to .210	—
	**UNIRING** Type **YNC**	Uninsulated	.058 to .210	—
	**HYRING** Type **YOE**	Insulated outer	.046 to .297	.149 to .312
	**HYRING** Types **YIC & YOC**	Uninsulated	.046 to 1.602	.101 to 1.875
	**HYRING** (large), Types **YIK & YOK**	Uninsulated	.430 to 2.905	.590 to 3.170

Military Specifications

The superiority of crimping for grounding, tapping, or terminating coaxial or shielded cable is recognized by the military and is referred to in **MIL-E-16400** and **MIL-I-983. HYRING** terminations for frequencies to 100 megacycles conform to Signal Corps, Bureau of Ships, and U. S. Air Force requirements and are in accordance with Military Specifications. **UNIRING** terminations also meet applicable military requirements.

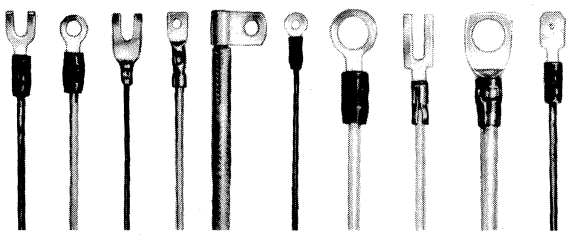
For more detailed information refer to Burndy catalogs YEC-66-4 (UNIRING-HYRING) and YK67 (Large HYRING).

BURNDY, NORWALK, CONN.

BURNDY

HYDENT TERMINALS AND SPLICES

Millions of miles of wire have depended upon Burndy's **HYDENT®** terminals and splices for reliable assemblies. These terminals and splices are available in a wide selection of types and sizes and are crimped with Burndy installation tools of proven convenience and reliability. They meet all applicable military and industry specifications.



Design

HYDENT terminals are available insulated or uninsulated; with or without insulation grips; with ring, forked or rectangular tongue; with straight, right-angle, or flag tongue. Splices are available either separable or permanent, insulated or uninsulated and provide joints that are better electrically than the wire itself. Both terminals and splices are made of electrolytic copper and are tin-plated to resist corrosion. Insulating sleeves are permanently locked in position. **HYDENT** terminals can be purchased loose-piece or in strip form for high-volume use.

Tooling

With Burndy tools, a completed connection has a neat, smooth appearance with no sharp edges, corners, or flash. Burndy has a complete line of hand and power tools to meet the needs of both occasional and high-volume users. Trained **HYTOOL®** specialists are available for operator instruction and tool repair. Refer to Installation Tooling section for a complete description of the Burndy tools available.

For more detailed information refer to Burndy catalogs HY59 and BA67-1.

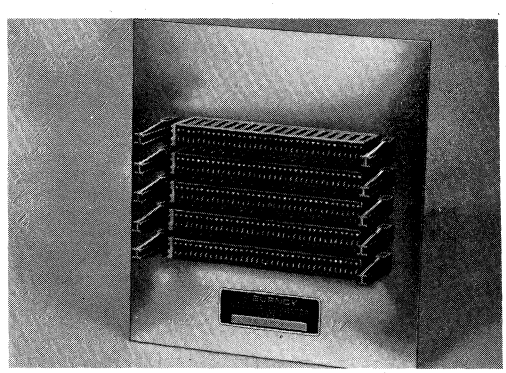
	TYPE	Tongue Type	Wire Range	Insulation Range
YAE YAES YAEV YSE PS PS-G2 YSES	**NYLON-INSULATED HYDENT**			
	Commercial and Military Terminals			
	YAE	ring	26-10	.090-.265
	YAE-Z, YAE-N-F	flanged-fork, fork	22-12	.125-.180
	YAEV-RS	right-angle ring	8-2/0	—
	YAES (MS25036)	ring	22-10	.120-.206
	YAES-L (MS17143)	rectangular	22-10	.120-.206
	YAEV (MS25036)	ring	12-2/0	.209-.628
	Commercial and Military Splices			
	YSE	—	22-10	.120-.209
	SEALINK PS, PSM	—	26-10	.080-.210
	BURLINK PS-G2, PSM-G2	—	26-10	.080-.210
	YSE-HN (NAS 1388, MS25181 Class 2)	—	22-10	.115-.200
	YSES-1, 2, 3 (MS25181 Class 1)	—	22-10	.116-.203
BA BA-F BS	**VINYL-INSULATED HYDENT**			
	Terminals			
	BA	ring	22-10	.050-.260
	BA-F	fork	22-10	.050-.260
	BA-Z	flanged-fork	22-10	.050-.260
	BA-S	rectangular	22-10	.050-.260
	Splices			
	BS	—	22-10	.050-.260
YAV YAV-R YAD-N-F YBV YSV	**UNINSULATED HYDENT**			
	Commercial and Miltary Terminals			
	YAV (MS20659)	ring	22-9	—
	YAV-L (MS20659)	ring	8-4/0	—
	YAV-H (MS20659)	ring	22-10	.120-.192
	YAD-H (MS20659)	ring	22-14	.120-.150
	YAV-H-F	fork	22-10	.120-.192
	YAV-Z	flanged-fork	20-14	.150
	YAD-N-F	long fork	22-6	.125-.265
	YAV-R, -RS	right-angle ring	22-4/0	—
	YBV	flag	22-2/0	—
	YAG-LH	HYSEALUG	16-1/0	.140-.682
	YE	solder cup adapter	18-8	.097-.275
	YZ	disconnect	22-10	.120-.150
	Splices			
	YSV	—	22-4/0	.120-.192
	YSM	—	300 to 300,000 CMA	
	YSM-G2	—	28-20	—
HP-N CYW YQE	**MISCELLANEOU**			
	NYLOCLIP HP-N	nylon cable hangers		
	TIPIT CYW	end cap	26-10	.060-.216
	BURCAP YQE	pigtail splice	Combination of 18-12 wire	

PLATE MODULE CONNECTORS

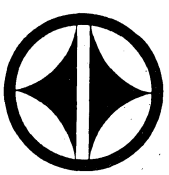
The Burndy modular connector system is designed for use with automatic solderless-wrap equipment. This connector system is composed of an .080″ thick aluminum plate, of any length and width up to a maximum of 22″ x 42″. Modules are pre-assembled in customer-specified patterns to provide card receptacles of any length that the plate can accommodate for cards with pad spacing of .1Q0″ and .062″ nominal thickness. The other side of the plate contains a field of solderless-wrap posts on a .100″ x .200″ grid.

For more detailed information refer to Burndy.

BURNDY, NORWALK, CONN.



Look in the Yellow Section for Manufacturers' Sales Offices

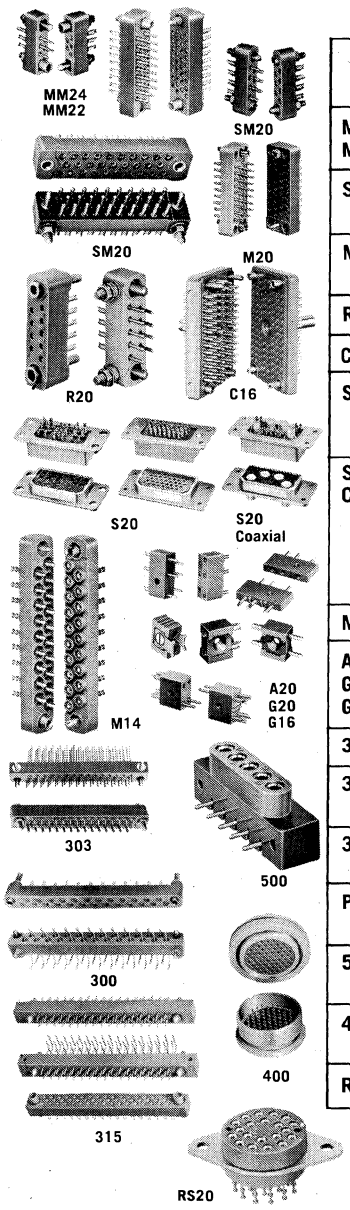


Tell them you found them in **eem**

DALE® for Optimum Value in Connectors

CONNECTORS

- **Rack and Panel**
- **Microminiature**
- **Subminiature**
- **Miniature**
- **Print Circuit**
- **Edgeboard**
- **Dip Solder**
- **Test Points**



SERIES	APPLICABLE MIL. SPEC.	AMP RATING	BREAKDOWN VOLTAGE AT SEA LEVEL — VRMS	NO. OF CONTACTS	WIRE GAUGE	SIZE O.D.
MM24 MM22	MIL-C-8384 MIL-C-5015	3 & 5	2000	5,7,9,11,14, 20,26,29,34 & 44	AWG #24 & AWG #22	3/16 x 11/16 to 3/8 x 1-1/2
SM20	"	7.5	2000	5,7,11,14,20,26, 34,42,50, & 75	AWG #20	1-5/64 x 25/32 to 23/32 x 2-1/16
M20	"	7.5	3000	18,20,26,41, & 50	AWG #20	9/16 x 1-5/16 to 7/8 x 2-23/32
R20	"	7.5	3000	9	AWG #20	3/8 x 1-5/16
C16	"	7.5	1800	104	AWG #16	1-23/32 x 2-11/16
S20	BuOrd Missile	10 & 13	AWG #16 3250 AWG #18 2500	41 AWG #20 & 20 AWG #18 & 8 AWG #16	AWG #16 & AWG #18	1-3/32 x 1-15/16
S20 Coaxial	"	10	Contact to Contact 2500, Contact to Coaxial S20-21-2R 4500, Contact to Coaxial S20-13-4R-3000	21 Pins and 2 Coaxial Contacts 13 Pins and 4 Coaxial Contacts	AWG #18	1-3/32 x 1-15/16
M14	MIL-C-8384	13	4900	19	AWG #14	1/2 x 3-1/8
A20	"	7.5(A20)	2000 (A20)	2,3,4 & 6	AWG #20	9/32 x 7/16 (A20)
G20	"	7.5(G20)	6100 & 3300 (G20)		&	1/8 x 3/4 (G20)
G16	"	13(G16)	4900 (G16)		AWG #16	1/4 x 7/16 (G16)
303	MIL-C-8384	3	1200	45	AWG #24	23/64 x 2-29/32
300	MIL-C-5015 & MIL-C-8384	7.5	3600	7,15,19 & 25	AWG #20	23/64 x 1-29/64 23/64 x 3-45/64
315	MIL-C-8384 & MIL-C-5015	7.5	2500	50	AWG #18	15/32 x 4-1/64
PJ	MIL-C-8384 & MIL-J-6751	7.5	— —	Single	— —	7/32 x 1/4 x 5/16 to 1-1/6 x 5/8 x 1/4
500	MIL-C-8384 & MIL-C-5015	5	3000	5	— —	23/64 x 1-3/32
400	"	7.5	2000	41,51 & 55	AWG #20	2.000 dia. 13/16 height
RS20	"	5	2000	20	AWG #20	1-1/16 x 1-25/32

Side Mounts available where applicable.

SPECIAL MODELS:

Dale can readily meet your non-standard connector requirements. Fully-equipped facilities for design, plating, molding and tooling enable prototypes to be supplied in minimum time.

For complete information, contact

CONNECTOR DIVISION, DALE ELECTRONICS, INC.
P. O. Box 609, Columbus, Nebr. 68601 Phone 402-564-3131

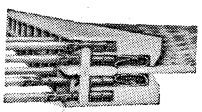
Let Cinch solve your interconnection problems

PC BOARD CONNECTORS

"Twin-Con"*

High reliability connectors. Meet MIL-C-21097 and combine the reliability of permanently assembled bifurcated contacts with the convenience and versatility of snap-in, crimp-on connectors. 8, 15, 22 and 43 position units available.

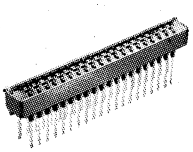
**Patent Pending.* CATALOG C-24.



.025 & .045 "Square Tail"

Wire wrap terminations available with selective gold plating on contact areas to substantially reduce cost. Contacts combine thin resilient flexing member with straight, rigid square tail. .025" on .125 centers and .045" on standard .156" centers. Wide range of types available.

**Patent Pending.* CATALOG C-24.

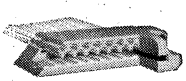


Hermaphroditic Types*

A broad line of .045" square tail, standard wire wrap, crimp-on, snap-in, taper pin and solder termination devices (interchangeable with ELCO's products sold under ELCO's trademark "VARICON"). 17 to 41 contacts

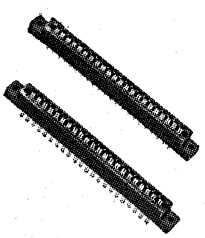
**Manufactured under license agreement with Elco Corporation.*

CATALOGS PBM-3, PBM-22 & PBM-47



Bifurcated Types*

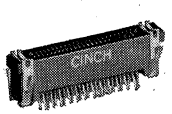
Designed especially for severe environmental conditions. Bifurcation provides two wiping contact surfaces, assuring positive contact even when board irregularities exist. Meet applicable requirements of MIL-C-21097A. 6-25 double contact positions on .156" centers. **Patent pending.* CATALOG C-24.



"Tykon" Subminiature*

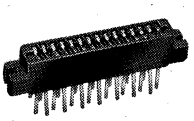
For double-sided .062" printed circuit boards. Ribbon type, flexing action contacts, spaced on .050" centers assure maximum contact. Ideal for memory planes and plug-in modules. 6 to 25 double-contact positions. Largest

**Patent pending.* CATALOG CM-24



Low Cost Cantilever Type

Unique pre-loaded cantilever contact construction combines minimum insertion force with maximum contact pressure. Simple mechanical design, plus adaptability to selective gold plating and high volume assembly techniques provide high quality connector at low cost. Currently available in 15 position size. Other sizes on .156" centers under development. CATALOG C-24.

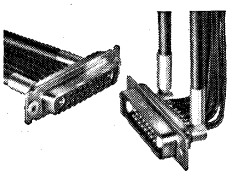


RACK AND PANEL CONNECTORS

"D-Subminiature" Series*

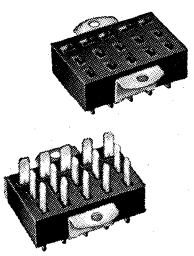
High contact density, high reliability units, available in a wide range of models, Mark I, Mark II, Mark III "Royal D" and Standard "D" as well as aerospace types can be supplied. 9,15,25,37 and 50 contact sizes, with solder pot, crimp type, snap-in or crimp type near-release contacts. Probe-proof, closed entry socket contacts on some models. Coaxial and/or high voltage contacts combinations provided on some series. Full line of hardware and accessories. Generally meet requirements of MIL-C-24308 Catalog CM-46.

**Manufactured under license agreement with ITT Cannon Electric Company.*



"Jones" Type

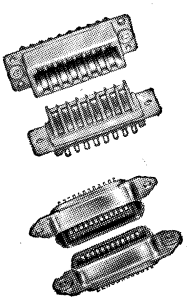
The most complete line of industry standard multi-contact units. Seven series covering 7.5, 10, 15 and 25 amps. 800-3000 V RMS, with 2 to 12 contacts. 7.5 amp. 1500 V series available to 33 contacts. Wide range of cap and cover variations. CATALOG CC-1



BLUE Ribbon* AND Micro RIBBON*

Industry standard types available in 8, 16, 24 and 32 contact sizes in the larger units (largest overall length of approximately 4 inches for 32 contacts). Micro Ribbon type available with 14, 24, 36 and 50 contacts (largest overall length approximately 2.7 inches for 36 contacts). Micro Ribbon also available with clamps and cable caps for cable-to-chassis and cable-to-cable applications. CATALOG CM-36

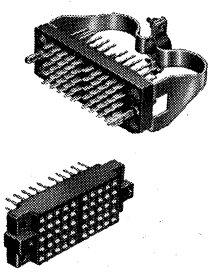
**Registered trademarks of Amphenol Corporation.*



"Gold Button"*

A gold button is welded in place, covering only the actual contact area of the female receptacle. Provides high dependability where frequent insertion and withdrawal are involved at no increase in cost over standard connectors. Available in 50 and 72 contact sizes for cable-to-chassis and cable-to-cable applications. Largest overall length for 72 contact size is approximately 3.70 inches. CATALOG PBM-73.

**Manufactured under license agreement with Western Electric Co.*



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with a broad line of interconnection devices . . . with extensive experience in special tooling for volume production . . . with large production facilities that ensure the availability of the product you need at competitive prices.

Information on these products can be obtained from your local Cinch Electronics sales office or you can write for more information to Cinch Manufacturing Company at 1501 Morse Avenue, Elk Grove Village, Illinois 60007

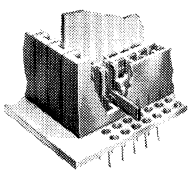
INTERCONNECTION SYSTEMS

Back Plane Assembly

Punched aluminum plate concept incorporates many innovations that reduce high labor content of conventional back plane systems and simultaneously provides increased design flexibility and more precise contact of terminal tip location.

The plane can be bussed from the board side or the terminal side. Individual contacts, including bussing contacts, can be replaced easily. Common voltage input can be provided to any position on the plane. Terminal tips are held to ± .010″ radius tolerance.

Assemblies with 24,640 contacts on .125″ centers are now being produced. CATALOG C-112.

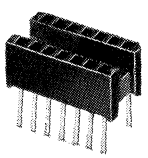


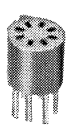
DIP and TO-5 Case IC Sockets

These devices combine low contact resistance and high contact force with exceptional environmental stability.

The DIP sockets are available for 14, 16, and 24 pin DIP's with standard 0.100″ spacing between pins. They will accept either round or flat leads and are available with diallyl phthalate or GP phenolic insulators and gold or electro-tin plated beryllium copper leads.

6, 8, and 10 pin TD-5 case sockets are supplied with deallyl phthalate and gold plated leads only. CATALOG C-113.

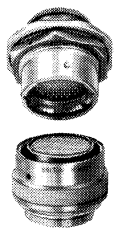




CYLINDRICAL CONNECTORS

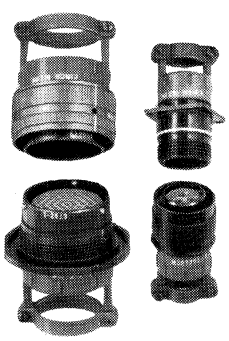
*MIL-C-81511—Astro/348**

These subminiature connectors have .085″ contact centers with dielectric separation of .021″. A one-piece retention system eliminates metal construction. Features include scoop-proof mating, grounding prior to electrical contact, removable crimp contacts and exceptional environmental stability. Five shell sizes; 8, 10, 14, 16 and 18 for 4, 12, 37, 55, and 85 contacts respectively are available in five receptacle styles with standardized accessories. CINCH-NULINE CATALOG CN-5



*MIL-C-26500 and MIL-C-38300—Omega**

A complete line of miniature connectors for any required shell style, contact size and insert configuration, including G-Type conductive shells of chrome plated aluminum. They operate continuously at 200°C and take short exposures to 800°C and are extremely resistant to shock, vibration, corrosion and small particles. The Omega series are generally available on short delivery cycles in large quantities. Small quantities can be obtained from authorized Cinch-NuLine distributors.
CINCH-NULINE CATALOG CN-3A



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FOR IMMEDIATE DELIVERY **Many of the Cinch products described here are stocked for off-the-shelf delivery through a nationwide network of Cinch Distributors.**

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The Cinch Electronics Group makes precision electronic components essential to every electronic product. Rely on Cinch quality, advanced engineering and superior manufacturing facilities. One telephone call to the Cinch Electronics Group sales office gives you quick service on this variety of products:

CINCH	connectors, contacts, sockets, terminal strips, interconnection systems
CINCH-GRAPHIK	multi-layer and printed circuit boards, thin film resistors
CINCH-MONADNOCK	heat sinks, stud bases, other electronic hardware
CINCH-NULINE	cylindrical and coaxial connectors
PLAXIAL	miniature low loss coaxial cable and cable harness

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MIL Spec. Platings Available: Silver: MIL-F-14072, QQ-S-365 • Electro-Tin: MIL-T-10727, Type 1 • Electro-Tin-Lead (Electro-Solder): MIL-F-14072 • Hot-Solder-Dip: MIL-F-14072, Type 221 • Hot-Tin-Dip: MIL-T-10727 • Gold: MIL-G-45204, Type II • Nickel: QQ-N-290, Type VI • Cadmium: QQ-P-416A, Type II, Class B, Clear Chromate • Bright Alloy: MIL Spec. • Copper: MIL Spec.

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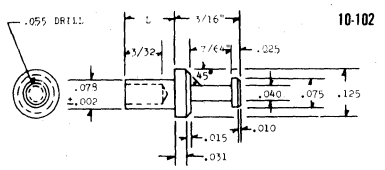
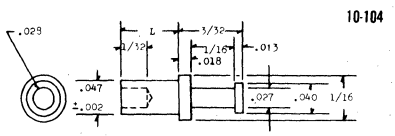
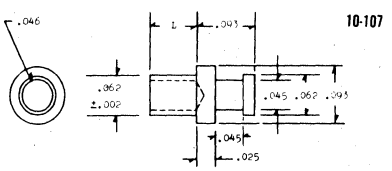
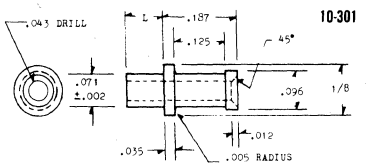
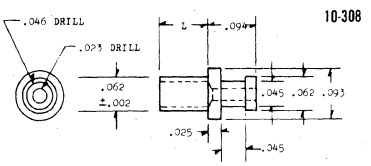


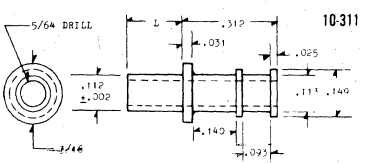


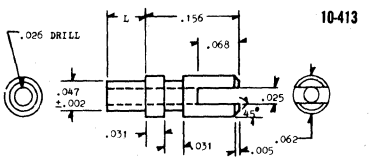


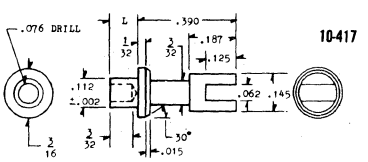
TUBULAR TERMINALS, SERIES 10-300

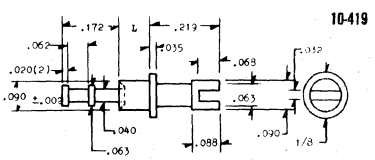












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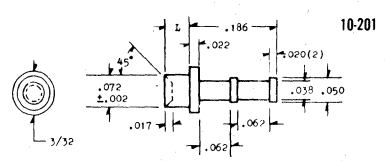

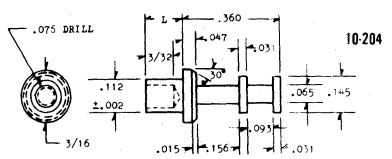

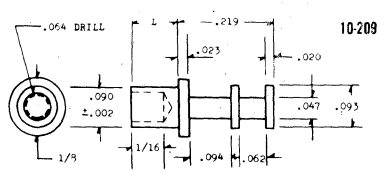

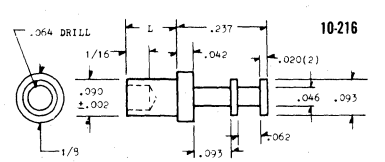

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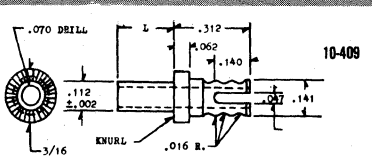
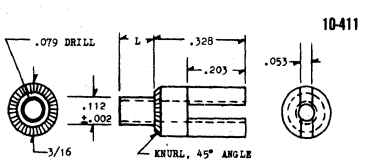
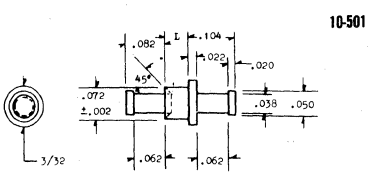
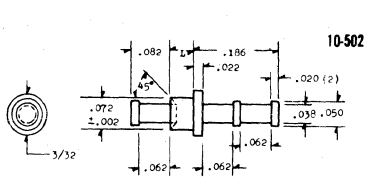
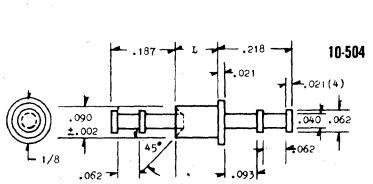




DOUBLE END TERMINALS, SERIES 10-500







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QUOTATIONS GIVEN ON CUSTOM DESIGNS

TERMINAL MATERIALS:

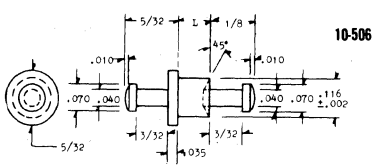
- **BRASS** QQ-B-626, Comp. 22, ½ hard. Brass tubing for hollow terminals is ASTM-B 135 grade.
- **BRONZE** to ASTM-B 140-58, Alloy B (leaded commercial bronze).

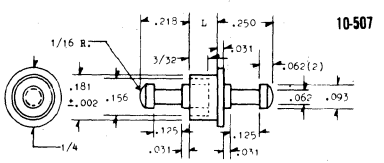
TERMINALS TO THE FOLLOWING SPECIFICATIONS:

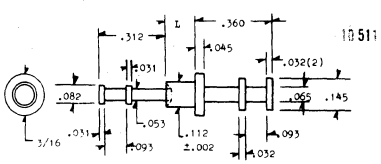
- NASA
- NATIONAL AEROSPACE
- MIL-T-55155
- FEDERAL SPEC. NUMBERS
- MS MILITARY STANDARDS

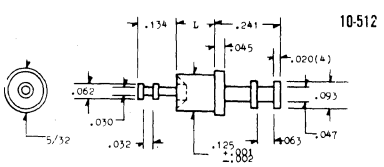
THESE ARE ONLY 36 OF THE HUNDREDS OF STYLES OF TERMINALS WE PRODUCE

DOUBLE END TERMINALS, SERIES 10-500

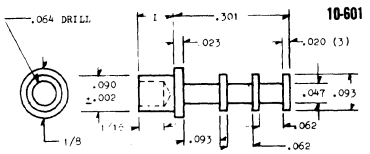


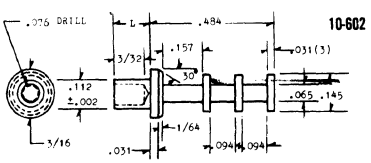




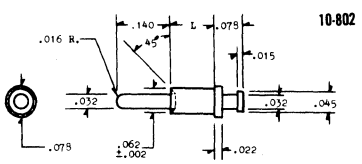


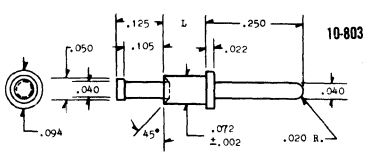
TRIPLE TURRET TERMINALS, SERIES 10-600

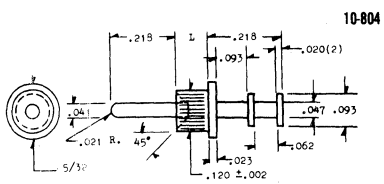


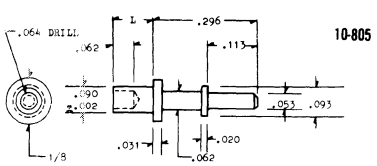


PIN TYPE TERMINALS, SERIES 10-800









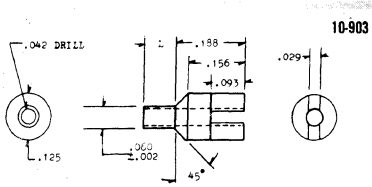
PRECISION-MADE

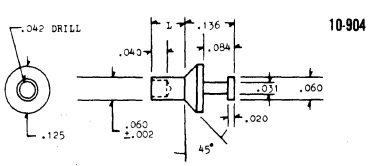
MODULE PINS
CONNECTOR PINS
PRINTED CIRCUIT PINS

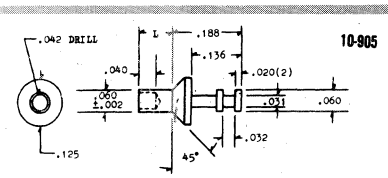
ANY & ALL SIZES TO YOUR SPECS

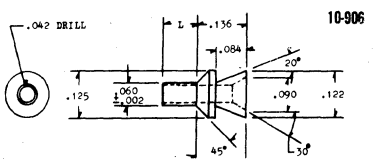
SEND DRAWINGS FOR PROMPT QUOTATION

PRINTED CIRCUIT TERMINALS SERIES 10-900









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CONCORD *ELECTRONICS CORPORATION*

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CONNECTOR CORPORATION

6025 N. KEYSTONE AVENUE • CHICAGO, ILLINOIS 60646 • TELEPHONE: 312, 539-3108

For many years the electronic industry has relied on the wide range of products, engineering services and consistent production quality of Connector Corporation.

A limited cross section of Connector Corporation's line is illustrated. Your specific requirement can be exactly met and mass produced with good delivery. Many items can be supplied with leads attached and color coded, offering production savings for your assembly. Special items can be designed or developed at relatively low cost. Just let us know what you need.

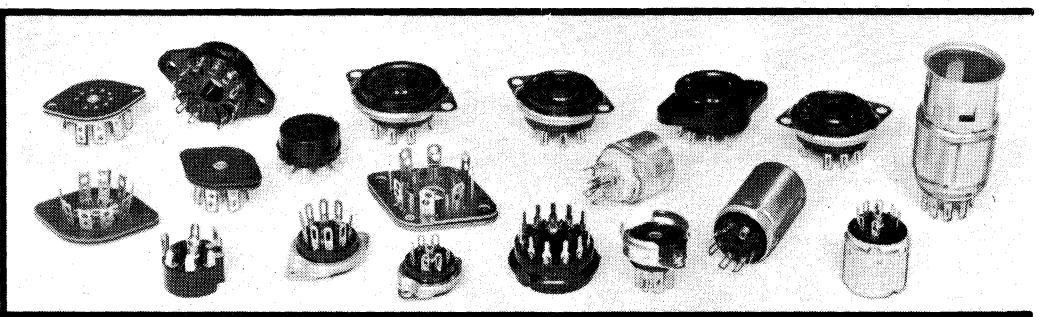
Products are available in a wide range of insulations and contact materials:

Insulations include: general purpose or mica-filled low loss Phenolic, glass filled alkyd, polypropolene, ceramic,etc., in molded versions. Laminated types include XP, XXP, XXXP Phenolics, X2B Hard Rubber, Glass Epoxy, Glass alkyd.

Contacts and Platings include: High tensile brass, phosphor bronze or beryllium copper with cadmium, electro tin, silver, hot tin dipped, silver-gold flash, gold plating, etc.

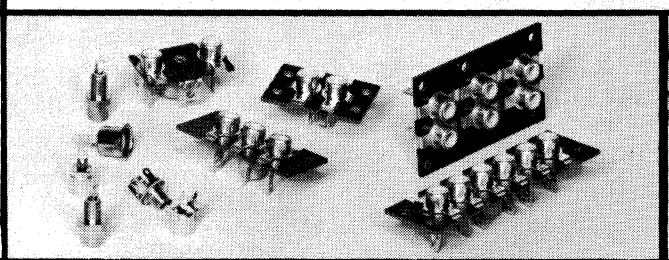
TUBE SOCKETS

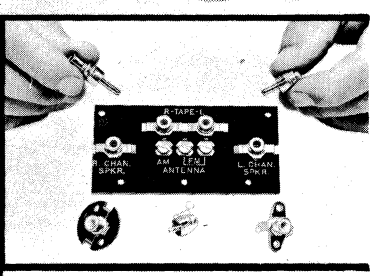
Most standard and many special molded & ceramic configurations available as well as laminated socket types. Fixed or collapsible types of shielding are available.



MULTI PURPOSE PHONO CONNECTORS

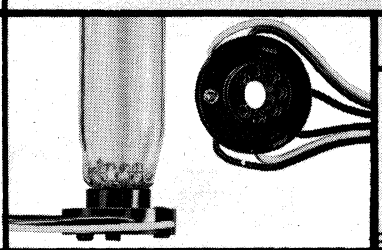
Sockets available in multiples up to 12 per section. Broad line of individual male and female types in a variety of mountings. Highly reliable for dependable repeated use.

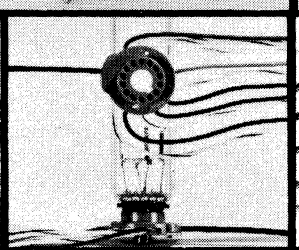


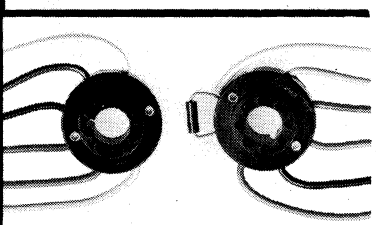


KINESCOPE SOCKET ASSEMBLIES

Include: Miniature Di Heptal Socket for 90° color tubes, 110° Eightar CRT sockets, miniature types for JEDEC E7-91, B7-247 basing (HEPTAL). Many special configurations and types may be furnished in quantity lots.

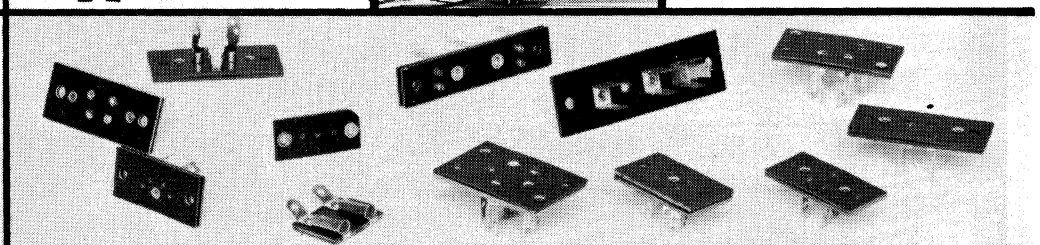






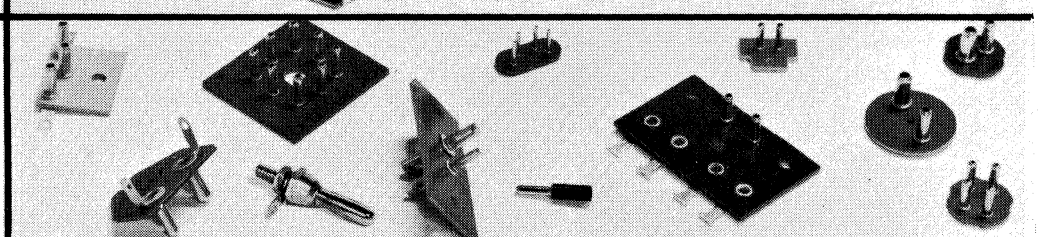
RECEPTACLES

Numerous varieties. Available in molded or laminated construction. Reliable contacts offer positive electrical and mechanical mating.



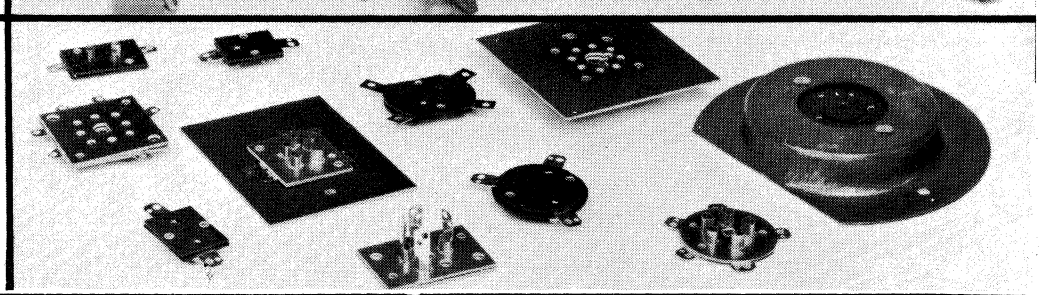
PLUGS

Numerous types available, with molded or laminated phenolic insulations. Leads may be supplied to specification.



BATTERY SOCKETS

Complete line for commercial & military batteries. Custom designed to your requirements.



CONNECTOR CORPORATION

6025 N. KEYSTONE AVENUE • CHICAGO, ILLINOIS 60646 • TELEPHONE: 312, 539-3108

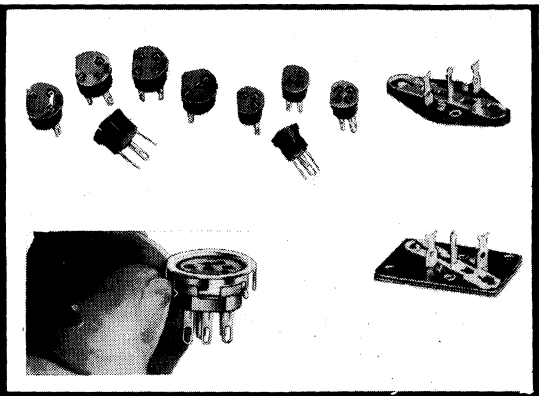
TRANSISTOR AND NUVISTOR SOCKETS

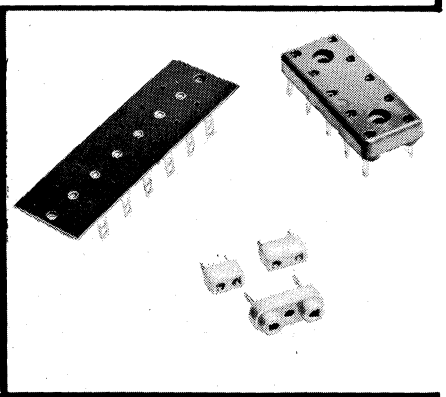
Available to mate with 3-pin, in-line transistors, and also with 3 and 4-pin transistors of any configuration on .200 or .100 dia. pin circle.

Miniature positive contact MIL quality nuvistor sockets for high quality military and commercial equipment.

CRYSTAL SOCKETS

Accommodate single & multiple crystals. Include both p.c. and conventional solder lug versions for crystals with .486, .273 and .192 pin centers and with .050 or .040 pin diameters. Also available to MIL Specs.



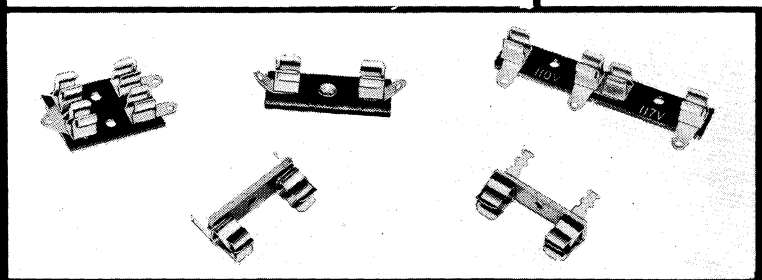


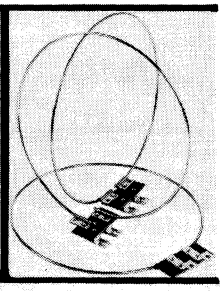
FUSE HOLDERS

Positive grip open type. Features: easy solderability, and versatility of construction which permit multiples or variations to your spec at reasonable cost.

UHF TV ANTENNAE

Attaches easily. Can be rotated in many different planes for optimum performance. Long life, trouble-free operation.



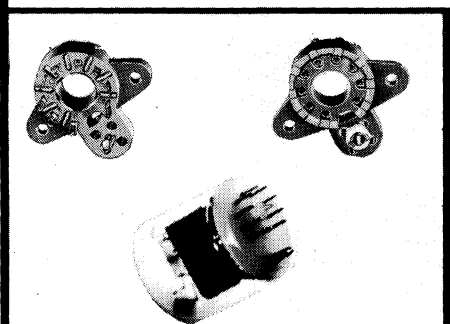


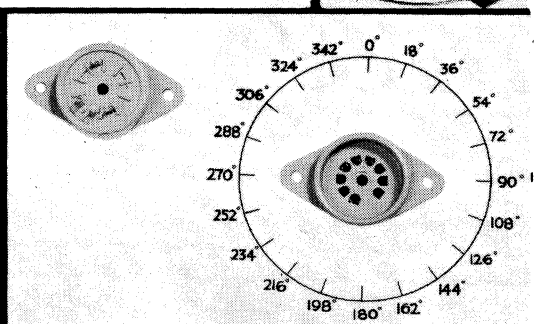
TRANSMITTER TUBE SOCKETS

Low loss at very high frequencies available. Vented to provide maximum cooling of tube base and anode contact area by convection. Voltage breakdown characteristics are enhanced by appropriate barriers between contact positions where indicated.

HIGH VOLTAGE TUBE SOCKETS

Designed for application with use of appropriate insulating materials and spacings.



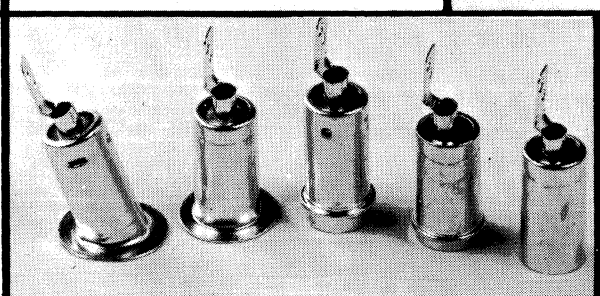


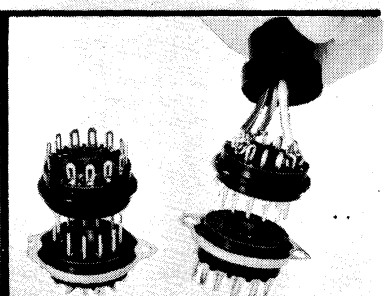
RF COAXIAL ANTENNA CONNECTORS

For auto receivers & similar applications. Rugged construction. Excellent contact resistance and retention.

MULTI-PIN MALE/FEMALE CONNECTORS

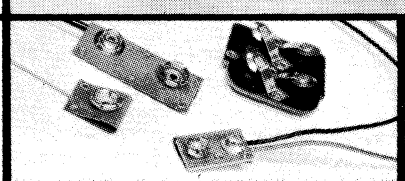
Provide quick reliable connect and disconnect for cable assemblies. Insert and extract easily, yet have reliable contact retention and resistance.

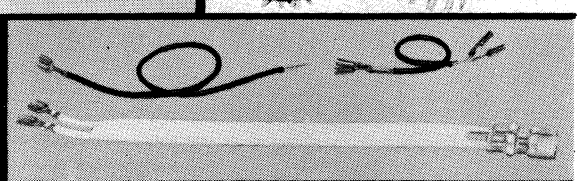




BATTERY CONNECTORS AND WIRE ASSEMBLIES

Snap-on and positive contact types available with wired leads if desired. Wire assemblies furnished to your specifications as to type of wire, length and termination attachments.

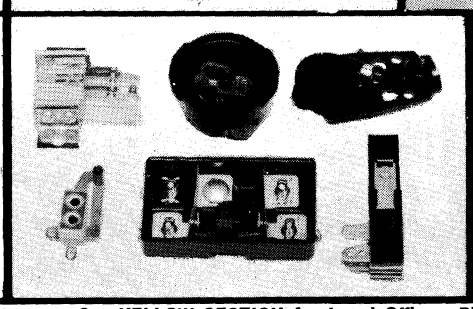


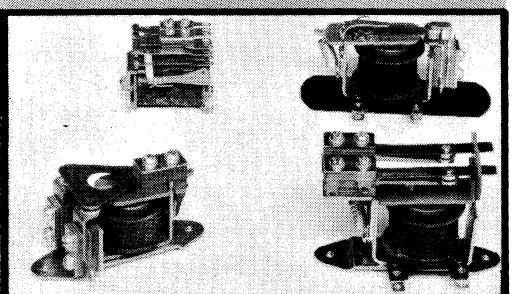


SEALECTRIC

SEALECTRIC SWITCHES AND RELAYS

For standard & special applications, send us your requirements.



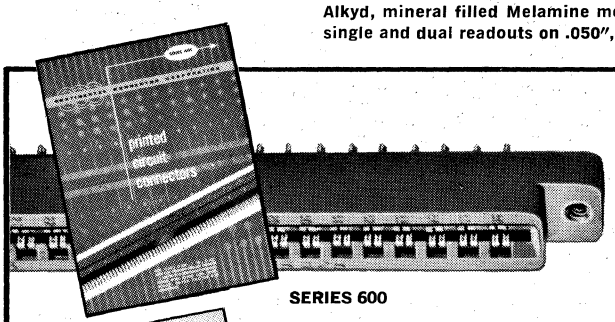


Precision Electronic Connectors

PRINTED CIRCUIT CONNECTORS*

Provide positive, space-saving connections between printed circuitry and conventional wiring through PC boards, tape cables or "plug" mounted subassemblies. Feature Continental's patented "Bellowform" contacts; glass-filled Diallyl Phthalate, Plaskon Alkyd, mineral filled Melamine moldings. Receptacles accommodate 1/32", 3/64", 1/16", 3/32" or 1/8" board thickness, single and dual readouts on .050", .075", .100", .125", .150", .156" and .200" centers.

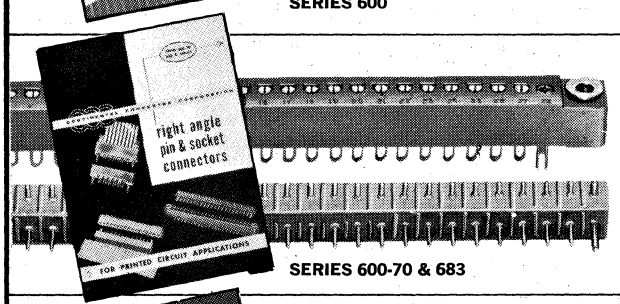
*Patent No. 2,875,425



SERIES 600

PC BOARD RECEPTACLE

Receptacle type printed circuit connectors for 1/32", 3/64", 1/16", 3/32" and 1/8" printed circuit boards. Available in wide range of sizes, single and dual readout contact construction... up to 210 terminals.

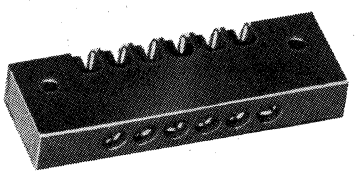


SERIES 600-70 & 683

PC RIGHT ANGLE PIN AND SOCKET

Provide additional flexibility in printed circuit system design. Mating parts have set of solder cups on socket and set of right angle pins on plug which mounts and dip solders to the printed circuit board. Wide variety of configurations, contact sizes, moldings and mounting styles are available.





SERIES 672

PC TEST POINT

Provide conveniently located test points to check printed circuitry. Available with 4, 5, 6, 8, 10, 11, 20, 21, 28, 30, 42 and 63 contacts which grip and hold securely a standard .080" test probe. Connectors have recessed and floating pin terminals mounted at right angle to the test socket. Pins dip solder to printed circuit board.

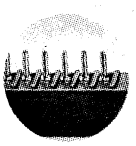
MOST PC CONNECTORS AVAILABLE IN THESE WIRING STYLES



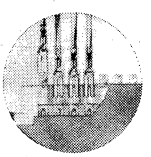
Wire-Wrapped



Eyelet Lug



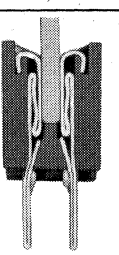
Dip Solder

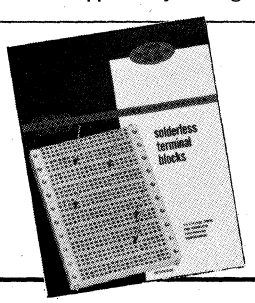


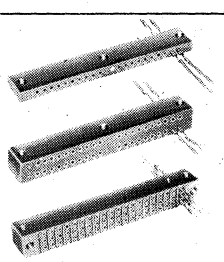
Taper Tab

EXCLUSIVE PATENTED "BELLOWFORM" CONTACT

Coil spring action grip clasps printed circuit board firmly over 100% of the contact area. Contact permits use of undersized or oversized board tolerances while maintaining low contact resistance. It "rides" with the printed circuit board under extreme vibration conditions or misalignment.







TERMINAL BLOCKS

SERIES 145-58, 145-50 AND 145-48. Precision reamed, solderless taper pin receptacles in single, dual and triple row construction, molded-in for highest durability. Available in any combination of feedthru individual or shorting terminals. Internal bus between any combination of terminals eliminates external wiring. Mounting holes for stacking, right angle and perpendicular mounting. Molding is glass filled Dially Phthalate (MIL-M-19833, Type GDI-30).

complete catalog data on request

CONTINENTAL

CONTINENTAL CONNECTOR CORPORATION • 34-63 56th STREET

for Commercial & Military Applications

PLUG & SOCKET CONNECTORS for every requirement.

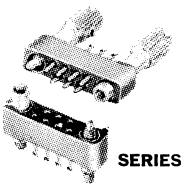
A complete line of high-reliability connectors for computer, missile, aircraft, communications and other critical applications. In addition to standard specifications, these connectors can be supplied with such optional accessories as aluminum hoods, protective shells, polarizing screwlocks*, and solder filled contacts. Various molding compounds are also available.

*Patent No. 2,746,022

MICRO-MINIATURE

5 TO 104 CONTACTS. Ruggedized to withstand shock and vibration extremes. Meet MIL-C-8384 specs. Available with guide pins and sockets, polarizing screwlocks, cable brackets, hoods and glass filled Diallyl Phthalate molding.

Breakdown Voltage (sea level), 2000V. RMS • Current Rating, 3A • Min. Creepage Bet. Contacts, .070″ • Min. Air Space Bet. Contacts, .040″ • Contacts, center-to-center 3/32″ • Pin Diameter, .030″ • Solder Cup, #22 AWG wire.



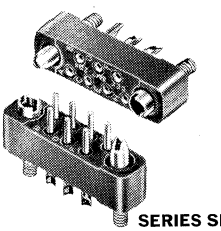


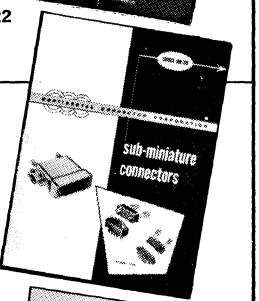
SERIES MM22

SUBMINIATURE

5 TO 104 CONTACTS. Meet or exceed applicable paragraphs of MIL-C-5015 and MIL-C-8384. Optional features include guide pins and sockets, polarizing screwlocks, protective shells and aluminum hoods. Glass-filled Diallyl Phthalate molding.

Breakdown Voltage (sea level), 2000V. RMS • Current, 5A. Cont., 7.5A max. • Min. Creepage Bet. Contacts, .078″ • Min. Air Space Bet. Contacts, .045″ • Contacts, center-to-center, 1/8″ • Pin Diameter, .040″ • Solder Cup, #20 AWG wire.



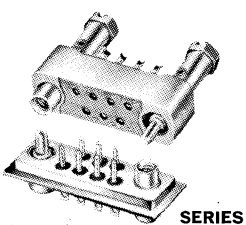


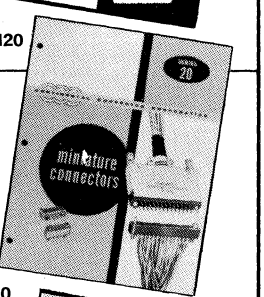
SERIES SM20

MINIATURE

4 TO 104 CONTACTS. A larger size, also available with guide pins and sockets, polarizing screwlocks, aluminum hoods, protective shells, and various molding compounds. Can be supplied with similar specifications in hexagonal types with 1, 4, 5, 7, 9 and 10 contacts.

Breakdown Voltage (sea level), 3000V. RMS • Current Rating, 5A. cont., 7.5A. max. • Min. Creepage Bet. Contacts, 1/8″ • Min. Air Space Bet. Contacts, .070″ • Contacts, center-to-center, .150″ • Pin Diameter, .040″ • Solder Cup, #20 AWG wire.



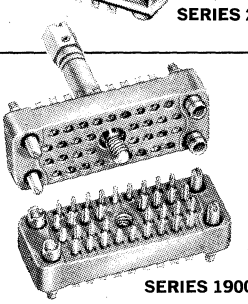


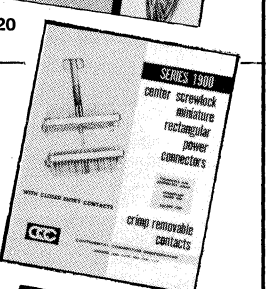
SERIES 20

CENTER SCREWLOCK

34, 50, 78, 104, 152 CONTACTS. Double lead thread action screwlock, stainless steel side channels and closed entry contacts for maximum reliability. 152 removable contacts Series 2500152 and 10-contact and 22-contact types, for #20 AWG wire also available.

Breakdown Voltage (sea level), 3000V. RMS • Current Rating, 10A. cont., 13A. max. • Pin Diameter, .062″ • Min. Creepage Bet. Contacts, .110″ • Min. Air Space Bet. Contacts, .050″ • Contacts, center-to-center, .150″ • Solder Cup (also solderless-wrap and taper pin), #16 AWG wire.

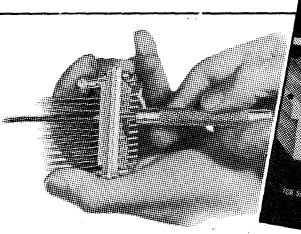




SERIES 1900

REMOVABLE CONTACTS

Miniature rectangular rack and panel connectors with removable crimp termination contacts. Available with 7, 9, 14, 18, 20, 26, 34, 50, 66, 75, and 104 contacts. For solderless wiring. Insertion, removal and crimping tools available. Conform to MIL-C-22857 specifications. Also in Microminiature Sizes: 50, 100, 200 Contacts. Series 25MM.





SERIES 25

complete catalog data on request

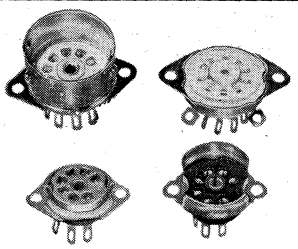
CONNECTORS

WOODSIDE, NEW YORK 11377 • PHONE SALES: (212) 899-4422

Eby™ SOCKETS, BINDING POSTS

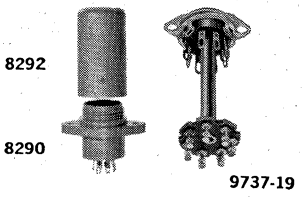
and related products . . .

SOCKETS



7 and 9-Pin Miniature Sockets. To MIL-S-12883A or commercial requirements. Contacts: brass, phosphor-bronze or beryllium-copper, with various finishes. Mica-filled or general purpose phenolic, ceramic or teflon bodies. Top mount, bottom mount, split-saddle or shield base versions. 4 ground lugs available in bottom mount version. Various mounting centers.

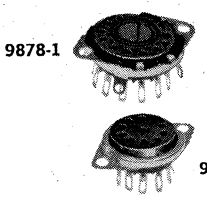
SOCKETS



High Voltage Socket, #8290. Prevents arcing at high temperatures and altitudes. Rated at 2000 volts DC, between contacts and threaded mounting insert at 40,000 ft. Mica-filled phenolic. Beryllium-copper contacts. Mica-filled shields, $1\frac{31}{32}$" high, #8292; $1\frac{9}{32}$" high, #8291.

Turret Socket, 7-Pin, #9737-19, 9-Pin, #9737-21. Variety of socket combinations available.

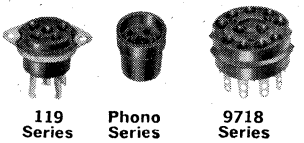
SOCKETS



Compactron Socket, #9878-1. Accommodates any Compactron tube. Top or bottom mount saddle. 4 ground lugs on bottom mount optional. $1\frac{5}{16}$" centers. Mica-filled or general purpose phenolic.

10-Pin Socket, #9713-282. Accepts new 10-Pin tube. Top or bottom mount. 4 ground lugs on bottom mount optional. Mica-filled or general purpose phenolic.

SOCKETS



119 Connector. 1 to 5 contacts. $\frac{7}{8}$" mounting centers.

Phono-Plug. Compact, self-enclosed. 2 to 4 contacts. $\frac{3}{4}$" max. dia. Contact is attached to wire, pushed into cavity and automatically locked.

9718 Series. Up to 12 contacts. $1\frac{5}{16}$" mounting centers. Many combinations available without tooling.

(Mating plugs available for all models)

UNIVERSAL BINDING POSTS



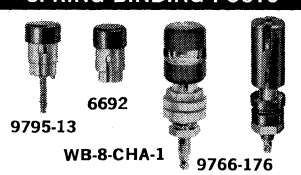
Multi-type. Accepts banana plug. "D" insulators for keyed mounting. Non-removable tops. Red or black phenolic.

#9738-19 — Rated 30 amps at 1000V. Nickel-plated brass.

#9766-150-1 — Miniature. Extends only $\frac{51}{64}$" from panel when closed. Max. dia., $\frac{17}{32}$". Gold flash on nickel-plated brass.

Twin Assemblies, #7186. Boss insulates posts from panel. $\frac{7}{8}$" mounting centers. 6-32 molded-in stud. $\frac{1}{2}$" dia. non-removable tops. Brass and phenolic.

SPRING BINDING POSTS



Quick connections. D-shaped hole for uniform tension across wire. Accepts phono-tip. Threaded stem and dowel optional. Nickel-plated brass. Red or black phenolic caps.

#9795-13 — with stem and dowel.

#6692 — without stem or dowel.

#WB-8-CHA-1 — To Signal Corps spec. U 106/U. Watertight. Can also be produced to MIL-P55149/8.

#9766-176 — Miniature, watertight. Meets MIL-P-55149/7A spec. Max. dia. 0.40". High impact strength nylon plastic body.

TUBE SHIELDS



JAN Shield. Nickel-plated brass shield with securing spring. To JAN-S28A. "J" slot locks on shield base socket. Also in cadmium-plated steel. Snap-on shield for split-saddle socket available.

JAN TS NO.	EBY NO.	HEAT SHIELD NO.
102U01	9700-14	9700-60
102U02	9701-20	9701-59
102U03	9702-11	9702-53
103U01	9703-14	9703-54
103U02	9704-14	9704-58
103U03	9710-10	9710-34

TRANSISTOR SOCKETS



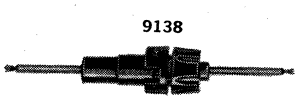
Designed for JEDEC series transistors. One-piece integral saddle design. Speedy assembly with rivets or #2 screws. Contacts are silver-plated beryllium copper with gold flash. Mica-filled phenolic sockets meet MIL-M-14 MFE specs.

POWER TRANSISTOR SOCKET



For to -3 power transistors. Special design permits **complete** electrical isolation of base connection. 1-piece molded construction of high impact Bakelite.

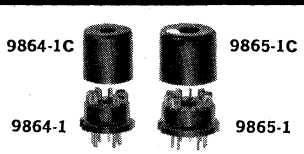
FUSE HOLDER



Heavy-duty Holder. Housing, #9138. Cap, #9137. Solder or crimp-type contacts. General purpose phenolic.

Springs according to type of fuse. Assembled or unassembled. Can also be supplied in thermoplastic nylon.

ADAPTORS



Converts any 7 or 9-Pin miniature socket into a connector. Brass cadmium contacts, mica-filled or general purpose phenolic.

7-Pin Socket, #9864-1
Cap, #9864-1C

9-Pin-Socket, #9865-1
Cap, #9865-1C

TIP JACKS

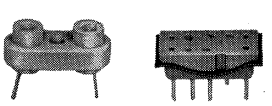


Metal Jack, #9768-17. Phosphor-bronze contacts. Nylon insulator in wide range of colors.

Molded Jack, #7115. Red or black general purpose.

Metal Jack, #9768-13. Brass body. Phosphor-bronze contacts. Cap in red or black phenolic. Locking nut and insulation washer available.

SOCKETS



Crystal Socket (TS0205C01), #9748-1. Glazed Steatite per JAN-1-10. Meets MIL-S-12883A. Contacts: phosphor-bronze or beryllium copper, silver-plated. Also available in black general purpose and mica-filled low loss.

8-Pin Subminiature Relay Socket, #9866-12.

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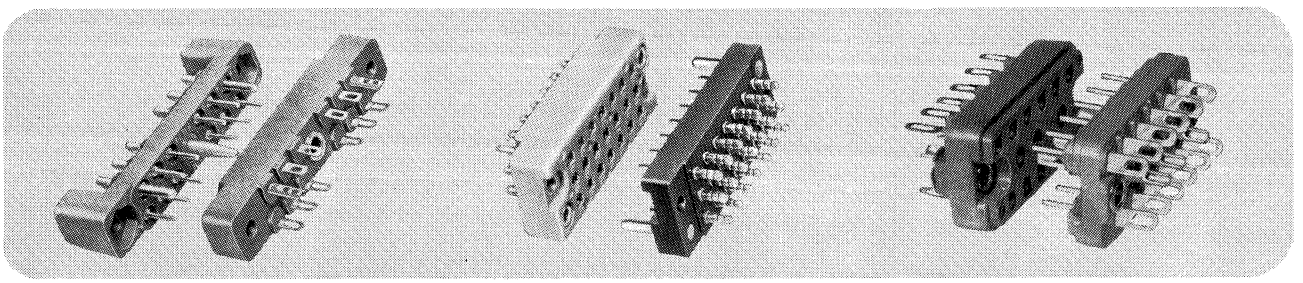
RACK & PANEL CONNECTORS

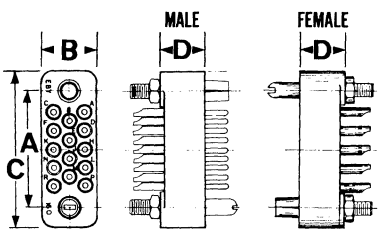
In addition to our off-the-shelf Rack & Panel Connectors, we also produce a variety of printed circuit male and female custom devices for the computer industry.



CONNECTOR MODELS AND SPECIFICATIONS

MODEL (F–female socket) (M–male plug)	NO. OF PINS	PIN SIZE (diam.)	FEMALE CONTACT MATERIAL	MALE PIN MATERIAL	WORKING VOLTAGE (VOLTS RMS AT SEA LEVEL)
9775-F3 M3	— 3	— .040″	Phos. Brz./Ag.; Au.	Brass/Ag.; Au.	800
9775-F7 M7	— 7	— .040″	Phos. Brz./Ag.; Au.	Brass/Ag.; Au.	800
9775-F11 M11	— 11	— .040″	Phos. Brz./Ag.; Au.	Brass/Ag.; Au.	800
9775-F14 M14	— 14	— .040″	Phos. Brz./Au./Ag.	Brass/Au./Ag.	925
9775-F15 M15	— 15	— .040″ (12) .093″ (3)	Be. Cu./Ag. Tin Dipped Tails	Brass/Ag. Tin Dipped Tails	1150
9775-F34 M34	— 34	— .040″	Phos. Brz./Au./Ag.	Brass/Au./Ag.	825
1000-F7 M7	— 7	— .064″	Phos. Brz./Au./Ag.	Brass/Au./Ag.	1500
1000-F12 M12	— 12	— contact pins .050″ polarizing pins .093″	Phos. Brz./Ag. Pl.	Brass/Ag. Pl.	—
1000-F15 M15	— 15	— .064″	Phos. Brz./Au./Ag.	Brass/Au./Ag.	1500
1000-F18 M18	— 18	— .062″	Phos. Brz./Au./Ag.	Brass/Au./Ag.	1500
1000-F21G F21G	— 21	— .040″	Phos. Brz./Ag. Pl., Au. Flash	Brass/Ag. Pl., Au. Flash	—

DIMENSIONS



Dimensions (inches)

MODEL	A	B	C	D
9775-F3 M3	.578 .578	3/8 3/8	57/64 57/64	23/64 5/16
9775-F7 M7	.858 .858	3/8 3/8	1 11/64 1 11/64	23/64 5/16
9775-F11 M11	1.140 1.140	3/8 3/8	1 29/64 1 29/64	23/64 5/16
9775-F14 M14	.937 .937	7/16 7/16	1 1/4 1 1/4	23/64 23/64
9775-F15 M15	1.188 1.188	.750 .750	1.500 1.500	.415 21/64
9775-F18 M18	1.700 1.700	1 1	2 2	9/32 5/16
9775-F34-1 M34	1.687 1.687	3/4 3/4	2 2	23/64 23/64
1000-F7 M7	1.250 1.250	1/2 1/2	1 5/8 1 5/8	5/16 9/32
1000-F12 M12	2.218 2.218	1/2 1/2	2 11/16 2 11/16	1/2 3/4
1000-F15 M15	2.218 2.218	1/2 1/2	2 19/32 2 19/32	5/16 9/32
1000-F21G M21G	1.937 1.937	3/8 3/8	2 1/4 2 1/4	23/64 23/64

Custom connectors are our specialty.
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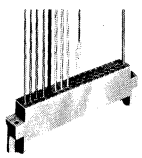
PRINTED CIRCUIT CARD CONNECTORS

Elco is the largest manufacturer of connectors for printed circuit cards. This fact enables us to offer the most versatile line on the market. We manufacture two basic types of connectors for printed circuit cards; the card-edge type of receptacle which mates directly with the printed circuit pad and the plug and receptacle combination. These two basic types are subdivided into many sizes and shapes too numerous to elaborate on within this representative product line brochure. However, through the use of photographs and brief descriptions below, we hope you will get a general idea of our immense product line.

FOR COMPLETE DATA, REQUEST OUR PRINTED CIRCUIT CONNECTOR CATALOG — PC967

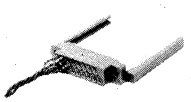
PLUG AND RECEPTACLE TYPES

Our plug and receptacle type utilizes the VARICON™ contact which is a hermaphroditic fork contact and is the prime reason for our leadership in the printed circuit connector field. We feel (and presumably others must be agreeing) that the VARICON™ method provides the most reliable pluggable connection. It excels in all of the prime considerations: contact resistance, ability to withstand excessive shock, is gas tight, and it isn't necessary to place critical tolerances on the p.c. card thickness.



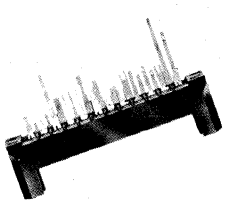
WIRE CRIMP RECEPTACLES

Through the use of hand pliers or high speed machines, wire is crimped to the contact which can then be inserted, by hand, into the insulators. Options include these types: with or without card guides, for p.c. circuit pads on .100″ or .200″ centers, for 1/16″ or 3/32″ thick p.c. card and numerous standard sizes.



SERIES #53 TAPER PIN RECEPTACLE

Each contact within the receptacle accepts two Series #53 taper pin tipped wires. There are various sizes available with or without card guides. P.C. card must be 1/16″ thick with circuit pads on .100″ centers.



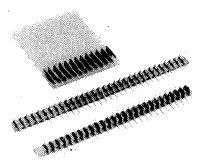
OTHER WIRE TERMINATIONS:

- WIRE WRAPPING POSTS
- SOLDER POSTS
- THREE WIRE SOLDER POST
- .078″ TAPER TAB
- .110″ MALE TAB
- WIRE HOLE
- SLOTTED POST FOR BUS

All of the above wire terminations are available in a versatile line of p.c. card receptacles. There are types with or without card guide; for .100″, .156″ or .200″ grid p.c. cards; for 1/16″ or 3/32″ thick p.c. cards and numerous standard sizes.

PLUGS

Two general types of plugs are available for the above receptacles. One type is where the contacts are fastened directly to the p.c. card. The contacts require no insulator and are supplied imbedded in plastic strips to facilitate handling and mounting. All equipment required to fasten the contacts and to remove the plastic strip is available from Elco.

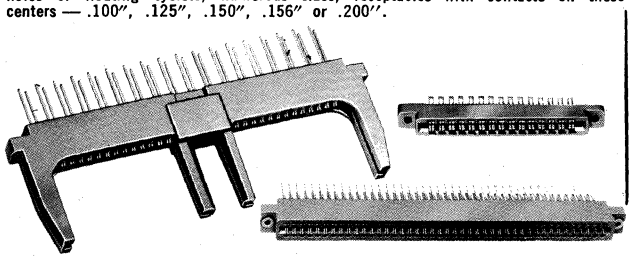


The second type of plug is a one piece molding with contacts bonded in place. The plug is fastened to the edge of the p.c. card. The options are: plugs for p.c. pads on .100″, .156″ or .200″ centers; plugs for 1/16″ or 3/32″ thick p.c. cards; plugs with or without guide pins; and plugs with or without end mounting holes.

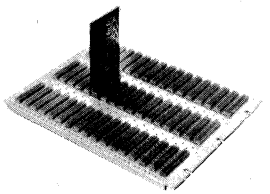


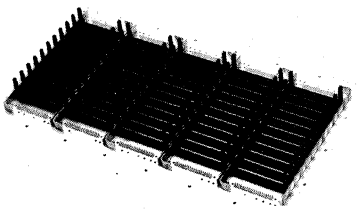
DIRECT CARD EDGE RECEPTACLES

A card edge type of receptacle mates directly with the p.c. card eliminating the need for a plug. Here again we can offer a wide variety of terminations including wire wrapping posts, wire hole, .078″ taper tab and solder post. Other options include: receptacles with or without card guides; receptacles with mounting holes or floating eyelets; numerous sizes; receptacles with contacts on these centers — .100″, .125″, .150″, .156″ or .200″.



METAL PLATE CONNECTION SYSTEMS





An outgrowth of the general p.c. card connector line is the metal plate interconnecting systems used in today's calculating equipment. A metal plate connection system consists of a sub-assembly of contacts housed within individual insulators which are interference fit into an aluminum plate. The birth of this line is due to the flexibility in arrangement, number and location of connector modules. Also, the size and shape of the plate can be varied to suit individual requirements; the plate can be terminated as a unit (using hand tools or programmed automatic equipment), completely checked out and then installed into the equipment. Elco has a wide selection of standard parts which we can custom assemble to your particular needs.

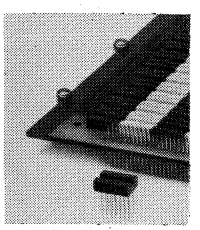
FOR COMPLETE DATA, REQUEST VARIPLATE CATALOG MP967

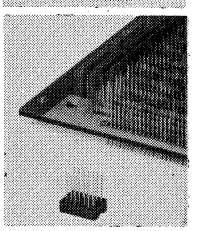
MICROELECTRONIC CONNECTORS

We manufacture a complete line of connectors suited for densely packaged microcircuits and we also have our own packaging systems.

DUAL IN-LINE PACKAGE (DIP) RECEPTACLES

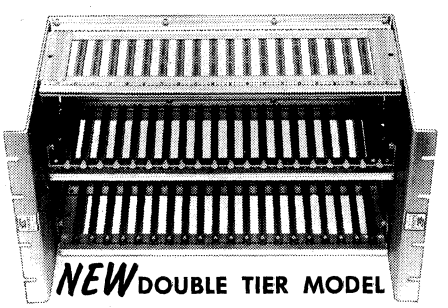
SERIES 8358 offers low profile, high density, low price, reliability, immediate delivery. Wire wrap/printed circuit contacts provide positive wiping action and redundant contact points with DIP leads for greater reliability and low resistance. Chamfered hole edges on the insulator facilitate DIP insertion; and the holes' closed entry configuration prevent contact damage. Receptacles are available individually for printed circuit card applications, or factory installed on plates whose size and shape you determine. Plates can also be equipped with wire wrap grounding terminals located under the receptacles. Offers universal application for all currently available 14 lead DIP's with flat or round leads in standard DIP grid. Wrappable or solderable. For small runs or large. Off-the-shelf delivery from our Distributors or factory.





FOR COMPLETE DATA, REQUEST ENGINEERING FLYER 61

PRINTED CIRCUIT CARD ENCLOSURES



Two models are available; a single tier model and a double tier model. Each model is made in 16 standard sizes, making it possible to package all average size p.c. cards. A maximum density of 41 p.c. cards on .400″ centers is possible within each tier. Other features include snap-in card guides and hinged front panels. Our p.c. card enclosures are made of heavy duty aluminum with a clear chromate finish. A gold chromate or clear anodize finish per MIL Spec. can be supplied.

FOR COMPLETE DATA, REQUEST CATALOG PC967

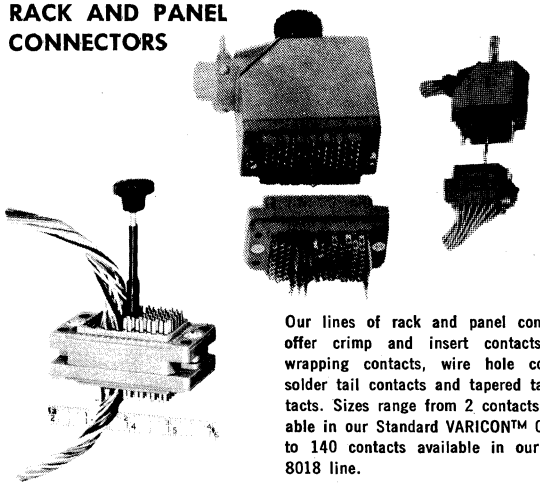
SPOT DELIVERY FROM YOUR NEAREST DISTRIBUTOR •

RELY ON THE RELIABLES BY RELYING ON . . .

ELCO™ CORPORATION

Main Plant and Offices: Willow Grove, Pa. 19090 • 215-659-7000; TWX 510-665-5573

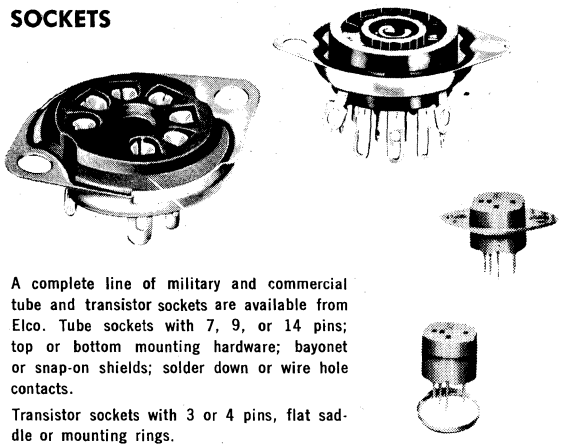
RACK AND PANEL CONNECTORS



Our lines of rack and panel connectors offer crimp and insert contacts, wire wrapping contacts, wire hole contacts, solder tail contacts and tapered tab contacts. Sizes range from 2 contacts, available in our Standard VARICON™ 01 line, to 140 contacts available in our Series 8018 line.

FOR COMPLETE DATA, REQUEST RACK AND PANEL CONNECTOR CATALOGS SV164 and RP167

TUBE AND TRANSISTOR SOCKETS

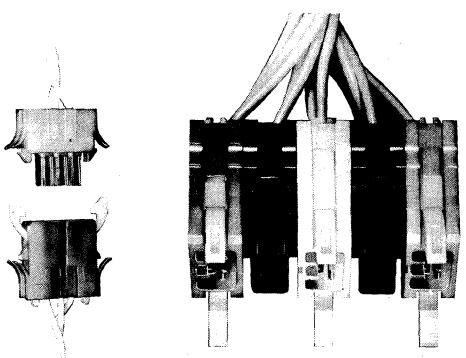


A complete line of military and commercial tube and transistor sockets are available from Elco. Tube sockets with 7, 9, or 14 pins; top or bottom mounting hardware; bayonet or snap-on shields; solder down or wire hole contacts.

Transistor sockets with 3 or 4 pins, flat saddle or mounting rings.

FOR COMPLETE DATA, REQUEST OUR TUBE AND TRANSISTOR SOCKET CATALOG — SC566

APPLIANCE CONNECTORS U.L. & C.S.A. APPROVED

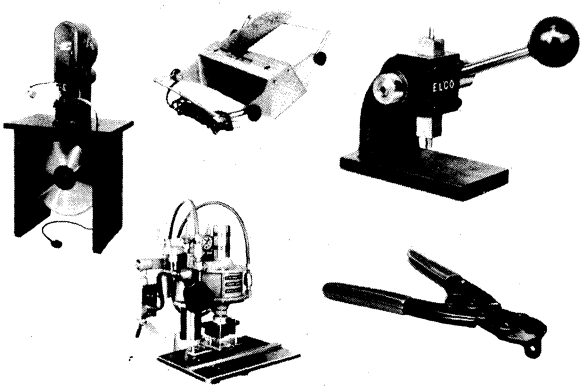


The APCON™ is a three contact connector designed for appliance type equipment having internal power connection requirements.

Features:
- Crimp and insert contacts.
- Will mount in panels without the need for hardware.
- Dove tail configuration on insulators permits modular buildup.
- Insulator's configuration eliminates the possibility of mis-mating.

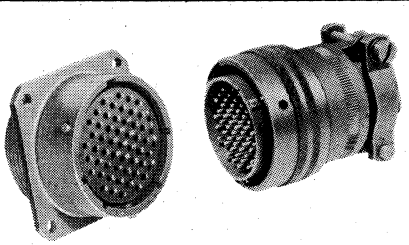
FOR COMPLETE DATA, REQUEST CATALOG RP167

INSTALLATION EQUIPMENT



We can supply all of the necessary equipment to install our connectors; from small bench stakers to large production staking machines; from the hand crimping pliers to crimping machines; contact inserters and extractors. Specially designed equipment for each product.

ELCO Cylindrical Connectors

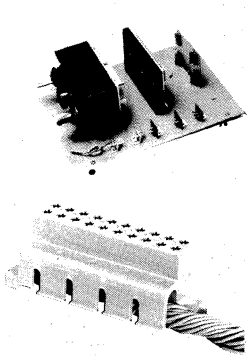


Now Available with Crimp Terminations

Precision cylindrical connectors for anyone who designs, specifies or purchases for the government or equally rigid commercial manufacturing. This line covers the entire spectrum of audio and power connectors, from 4 to 30 contacts, and includes connectors conforming to MIL-C-26482 and MIL-C-26500.

FOR COMPLETE DATA, REQUEST OUR CYLINDRICAL CONNECTOR CATALOGS

SPECIAL DESIGNS FOR SPECIAL APPLICATIONS



Elco has a large R & D and Engineering center in Ft. Washington, Pa., staffed with scientists, mathematicians, engineers and draftsmen. The staff's sole purpose is to direct their talents and experiences to your needs.

We have designed and produced all types of unusual connectors for special applications which includes ship-board fire control switches, memory planes, heart pacing devices, and logic modules.

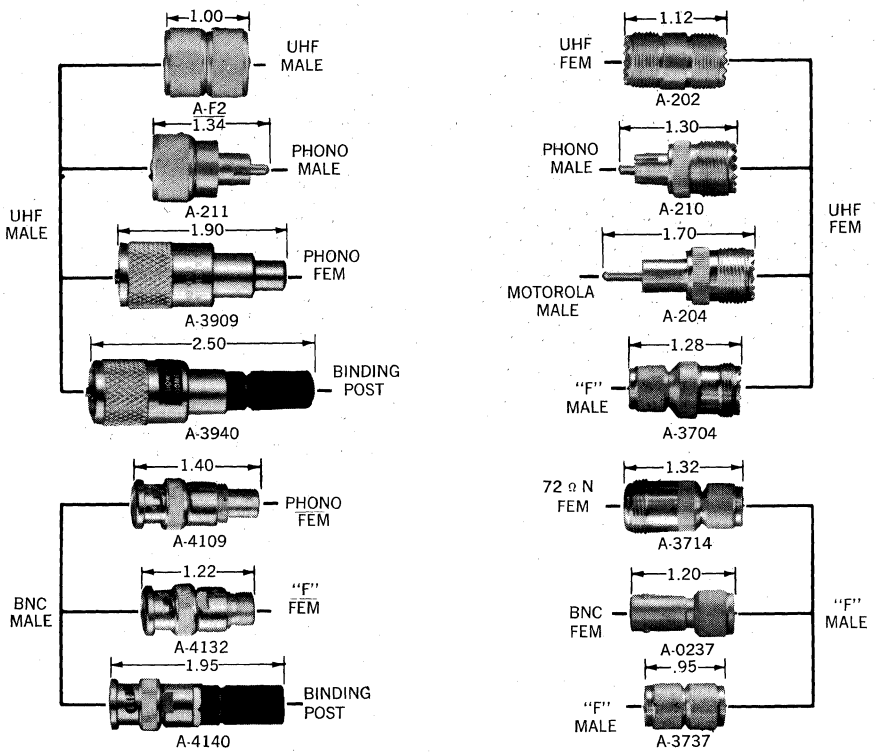
LET ELCO HELP SOLVE YOUR CONNECTION PROBLEM

SPOT DELIVERY FROM YOUR NEAREST DISTRIBUTOR •

RF ADAPTERS

Listed at right is a selection of unusual coaxial adapters that are frequently required in test setups. It includes phono type connectors, Motorola antenna connectors, CATV Type "F" connectors, etc. to standard UG and UHF type connectors. Also included is a listing of specialized receptacles, many of which are used on Dow-key coaxial switches.

ADAPTERS



RF CONNECTORS

NOTES:

(1) Mounts through a 5/8 hole, 1/8 max. panel thickness.

(2) Mounts into a 5/8-24 tapped hole or through a 5/8 hole, 1/8 max. panel thickness.

(3) Standard 1" square flange with four 4-40 tapped holes, polypropylene insulation.

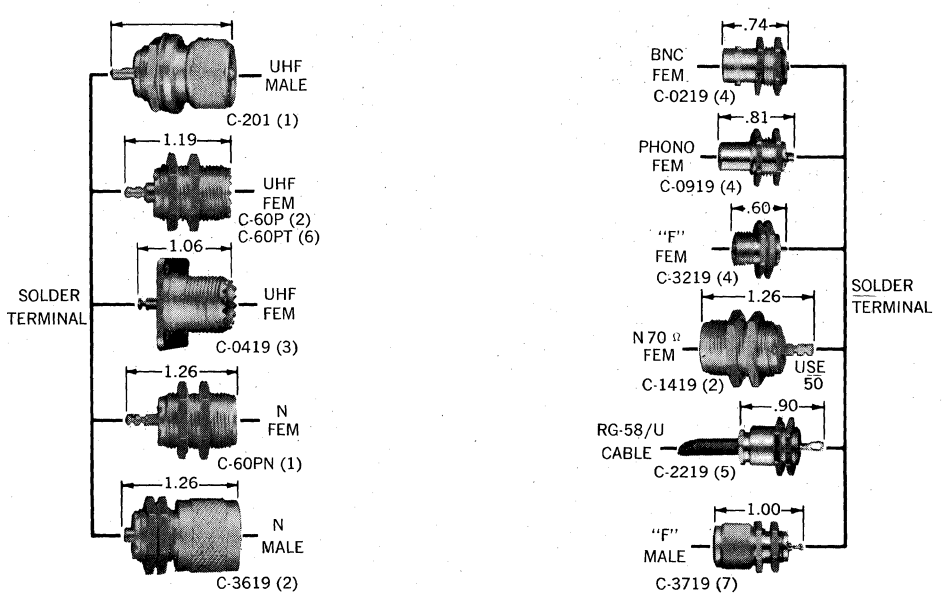
(4) Mounts into a 7/16-28 tapped hole or through a 7/16 hole with a 1/16 max. panel thickness.

(5) Mounts into a 7/16-28 tapped hole or through a 7/16 hole with a 1/16 max. panel thickness, and has clamp parts for RG-58/U or equivalent cables. It has a rigid solder terminal for fastening the cable center conductor to other components.

(6) Similar to C-60P except Teflon insulation and better impedance match.

(7) Mounts through a 3/8 hole, 1/8 max. panel thickness.

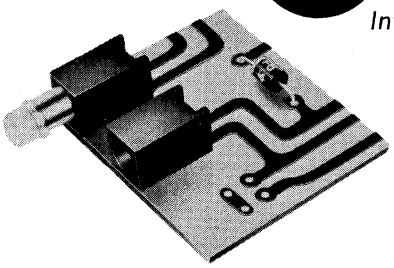
CONNECTORS (Receptacles)



DOW-KEY *2260 Industrial Lane, Broomfield, Colorado 80020, Tel: 303 466-7303 • TELEX No. 4-5890*

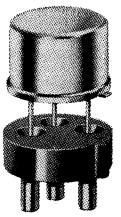
EMC
Interconnection Specialists

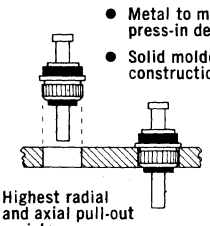

BINDING POSTS


LAMP SOCKETS


TEST JACKS

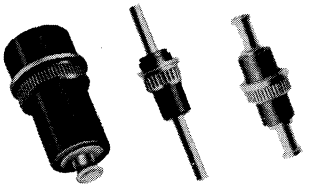

TERMINALS


TRANSISTOR AND IC SOCKETS



NURL-LOC DESIGN – TERMINALS AND TEST JACKS

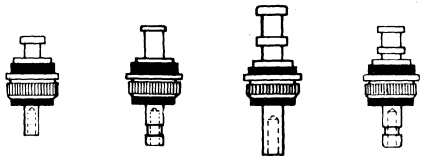
Electronic Molding offers the largest variety of molded insulated terminals and test jacks available anywhere. The metal inserts are molded into high-temperature Diallyl Phthalate, (500°F) forming a strong integral unit that will not crack while soldering. The metal to metal Nurl-Loc press-in feature (shown left) assures highest radial and axial pullout resistance of any terminal of this type. Ten colors are available, in a wide range of types for various applications, many designed to meet military specifications, plus mounting tools.



WRITE FOR COMPLETE CATALOG

TERMINALS

FEED-THRU END HOLE


8 50 6 4

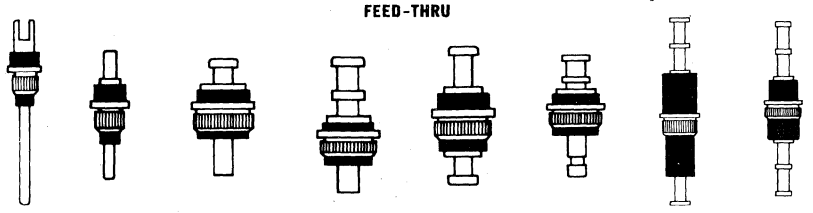
STANDOFF TERMINALS


11 1 12

FEED-THRU THRU HOLE


10 2 49

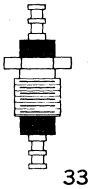
FEED-THRU


47 13 7 5 9 3 36 28

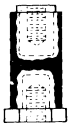
THREADED NURL-LOC FEED-THRU


37

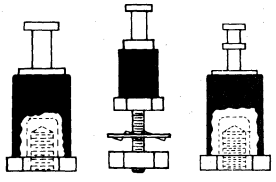
THREADED FEED-THRU


33

INSULATED SPACER

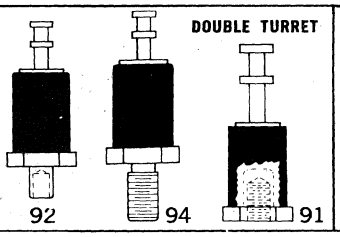

84

MIL-T-55155 TERMINALS

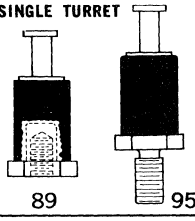

89M 90M 91M

STANDOFF TERMINALS

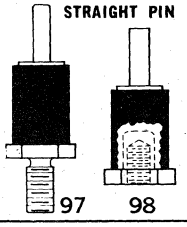
DOUBLE TURRET


92 94 91

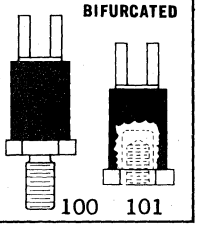
SINGLE TURRET


89 95

STRAIGHT PIN

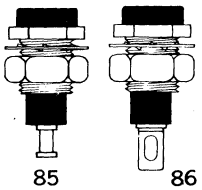

97 98

BIFURCATED

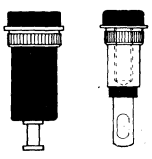

100 101

TEST JACKS

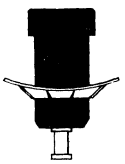
MS-16108 & MIL-C-39024 TEST JACKS


85 86

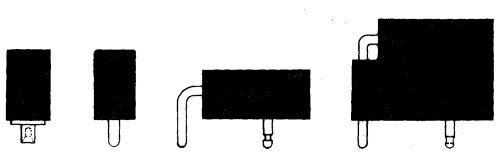
MIL-C-39024 NURL-LOC TEST JACKS


78 42

PUSH-ON TEST JACKS


65

MIL-C-39024 PRINTED CIRCUIT TEST JACKS


122 88 77 104

NURL-LOC PROBE


60

ELECTRONIC MOLDING CORPORATION

44 CHURCH STREET
PAWTUCKET, R. I. 02860
Phone (401) 726-2100

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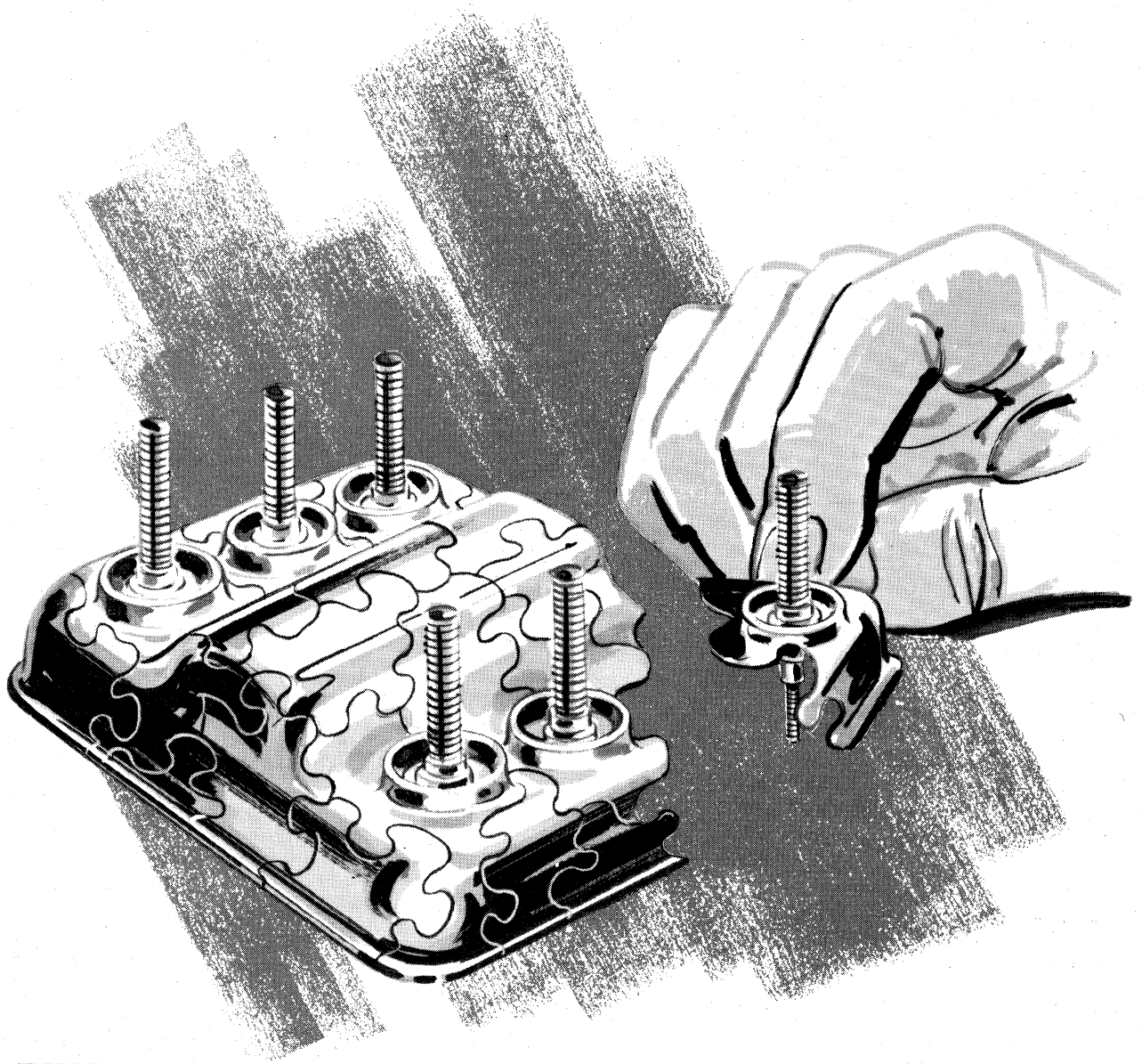
For over 25 years Fusite has been engineering customers out of trouble on highly complex hermetic terminal and header designs. Our more than 40 engineers and technicians have broad experience in sealing applications, including those of a highly unconventional nature. If your terminal design is *really* special, try us first. Call (513) 731-2020 or write Fusite Corporation, 6000 Fernview Ave., Cincinnati, Ohio 45212; overseas plants in Puerto Rico, Holland, West Germany, and Japan.

FUSITE

GLASS-TO-METAL HERMETIC TERMINALS
GLASS / GLASS-CERAMIC PREFORMS & SUBSTRATES



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33-012 BANANA PLUGS


33-072 BANANA PLUG ADAPTORS


33-106 TIP PLUGS

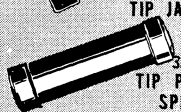

33-132 RIGHT ANGLE TIP PLUGS


33-142 SOLDERLESS PHONE TIPS


33-180 BANANA JACKS


33-194 BANANA TIP JACKS


33-208 TIP JACKS


33-232 TIP PLUG SPLICE

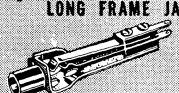

33-254 BINDING POSTS


33-300 SPADE LUGS


33-310 ALLIGATOR CLIPS


33-370 BATTERY CLIPS


708 LONG FRAME JACKS


912 TELEPHONE JACKS

GC ELECTROCRAFT COMPONENTS

QUALITY PRODUCTS

Designed, Engineered and Manufactured by our company with over 30 years of experience in the Electronics Industry, our Electrocraft Components meet the most exacting standards. Government approved quality control and inspection assure matching of the most rigid specifications.

RESEARCH and DEVELOPMENT

Our complete facilities and highly trained and skilled personnel enable us to develop and manufacture the ultimate in precision component parts. Our staff and equipment allows us to produce specifically designed or specially modified products. New products are developed and introduced regularly.

GOVERNMENT SPECIFICATIONS and FEDERAL STOCK NOS.

Quality and reliability of GC Electrocraft Products has given us the opportunity to serve the US Government. We regularly supply hundreds of items to Federal Stock Numbers. Scientific engineering allows us to meet the most exacting specifications regardless of material used, tolerances to be met, finish or plating to be applied.

MANUFACTURING FACILITIES

Three plants with over 400,000 square feet of floor space, the latest in manufacturing machinery, skillful and highly trained personnel with years of experience provide for you the finest in manufacturing capability. The combination of these features plus our abilities to save production and delivery time, yet provide economy, makes GC Electronics an industry leader.

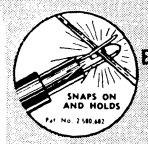
EXACT SPECIFICATIONS

NEARLY ALL ELECTROCRAFT COMPONENTS ARE MANUFACTURED TO GOVERNMENT MATERIAL PRODUCT SPECIFICATIONS.

Each and every item produced by GC Electrocraft must meet every criterion that results in a product manufactured exactly to specification. Quality control and inspection assure that you can depend on your Electrocraft components.

PRODUCT DIVERSIFICATION

In keeping with our physical size, our product line, too, is large and manifold. Over 10,000 electronic products are manufactured in our plant facilities. Electronic chemicals, hardware, tools, service aids, test equipment, antennas, phono drives, chassis punches, and audio accessories are only a few of the products numbered in our product line.



EXCLUSIVE KLIPZON FEATURE


33-076 KLIPZON ADAPTOR


33-138 KLIPZON MINI-PROD


33-342 MINI-GATOR CLIPS


33-380 TEST PRODS


33-450 TEST LEADS


33-486 CRYSTAL PROBES


33-606 PHONE PLUGS

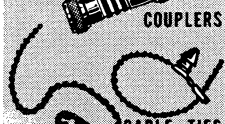

33-692 PHONE JACKS

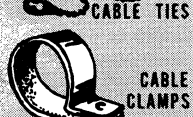

33-770 PHONO PIN PLUGS


33-792 PHONO JACKS


33-880 "Y" ADAPTORS

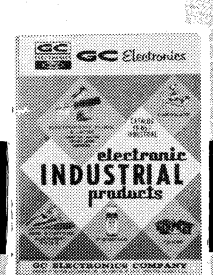

COUPLERS


CABLE TIES


CABLE CLAMPS

GC INDUSTRIAL PRODUCTS are available from select industrial distributors conveniently located throughout the nation; one is near you.

FREE NEW INDUSTRIAL CATALOG FR-70-I - write Dept. ID-7



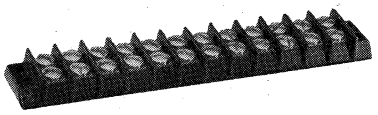
GC ELECTRONICS

GC ELECTRONICS DIVISION OF HYDROMETALS, INC.

Eastern Plant: Hicksville, L.I., N.Y.
Main Plant: Rockford, Illinois, U.S.A.
Western Plant: Los Angeles, Calif.

TERMINAL BOARDS

CR151 TYPE D ONE-PIECE BOARDS

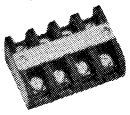


Eight terminal types.
Three board width — 7/8 in., 1 1/8 in., 1 5/16 in.

Boards rated 15, 20, and 30 amperes with breakdown voltages of 3600, 4800, and 7500 volts, respectively.
15-amp boards available in increments of 1 through 36 points; 20-amp boards in 1 through 30 points; 30-amp boards in 1-24 points.
Terminals on 15-amp boards accept through size #14 wire; 20-amp boards through size #12 wire; 30-amp boards through size #10 wire.
Choice of marked or unmarked boards or six types of marking strips.

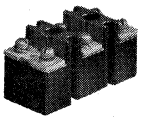
Write for Bulletin GEA-7317

CR151 TYPE B ONE-PIECE BOARDS



Rated 30-amperes, 600-volts for control circuits.
Available with 4-, 6-, and 12-points.
Screw, captive saddle-clamp, or screw terminals on one side, clamp terminals on the other.
Terminals accept wires through size #10.
Write-on marking strips, 15/32-in. wide, provided with boards.

CR2960 ONE-PIECE BOARDS



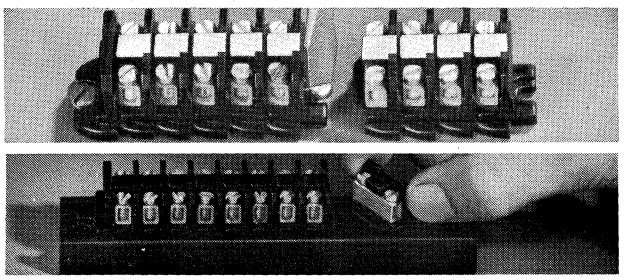
Control circuit boards rated 20-amperes at 600-volts; available with 4- and 6-points.

Power circuit boards rated 50-, 100-, and 150-amperes at 600-volts; available with 3 points per board.

All types have screw terminals.

Terminals accept wires through #8.

CR151 TYPE C SECTIONAL BOARDS

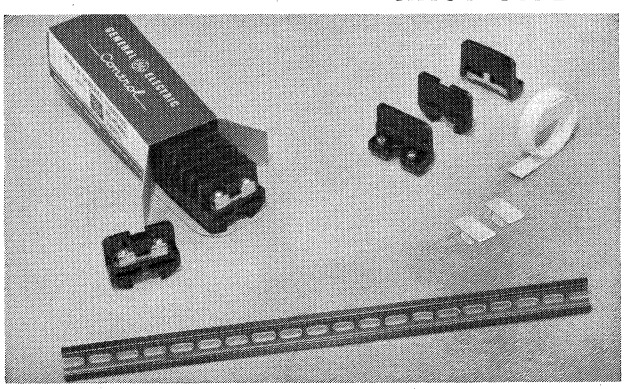


Can be mounted directly on panel (top) or in a channel (bottom) which is then mounted on panel.

Small CR151 Type C terminal boards provide two-way mounting and assembly flexibility. When the board has been assembled, you can mount it directly on a panel or you can assemble blocks in molded channels on applications where maximum flexibility is required. Blocks can be added after initial installation to meet increased requirements in control circuits.

These terminal boards can be ordered in three ways: 1) as individual blocks, 2) as factory-assembled blocks without channel, 3) as factory-assembled blocks in mounting channel based on specification.
Complete line of components for customer assembly.
Choice of three 25-amp terminal types and two 50-amp terminal types.
Both boards meet IEEE switchgear standards for 750 volts.
Screw terminals accept 5/16 in. ring or spade connectors, #22 - #12 wire.
25-amp box terminals accept #18 - #8 wire; 50-amp box terminals accept #10 - #4 wire.
25-amp box clamp terminals accept #22 - #10 wire; 50-amp clamp box terminals #14 - #4 wire.
Interlocking construction . . . blocks slide together.
25-amp blocks are 1 in. high, 1 1/8 in. wide; 50-amp blocks are 1 7/16 in. high, 1 1/2 in. wide.
Easy addition of blocks provides expansion flexibility.
Panel or channel mounting.
Factory-assembled forms for direct mounting in 2 through 12 point sections for 25-amp forms and 2 through 6 for 50-amp forms; for channel mounting, 2 through 99 points.
Choice of painted surface or separate marking strip.

CR151 TYPE A SECTIONAL BOARDS

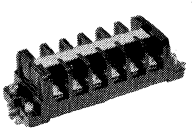


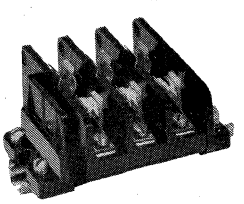
Components for customer assembly

From three basic components, you can build custom boards to meet most terminal board requirements:
- Mounting track — in lengths from 3 1/2 to 48 inches.
- Terminal blocks — ten types are available.
- Mounting assembly kit — contains two end blocks, one standard size barrier, two nylon guide inserts, and one 16-inch marking strip.

Additional blocks or blocks with different terminals can be added to existing boards.
Ten types of terminal blocks available.
Blocks rated 25-, 50-, 125-amperes.
30-amp fuse blocks, 15-amp isolating switch blocks offered.
25-amp forms accept #16 through #10 wire; 50-amp forms accept #14 through #4 wire; 125-amp forms accept #14 through #0 wire.
Adaptor kit available for installing overload relays.
Fanning strip accessory holds wires for fast, easy connection.
Marking strip can be marked with pencil or ink; can be cut to any length required.

Factory-assembled boards

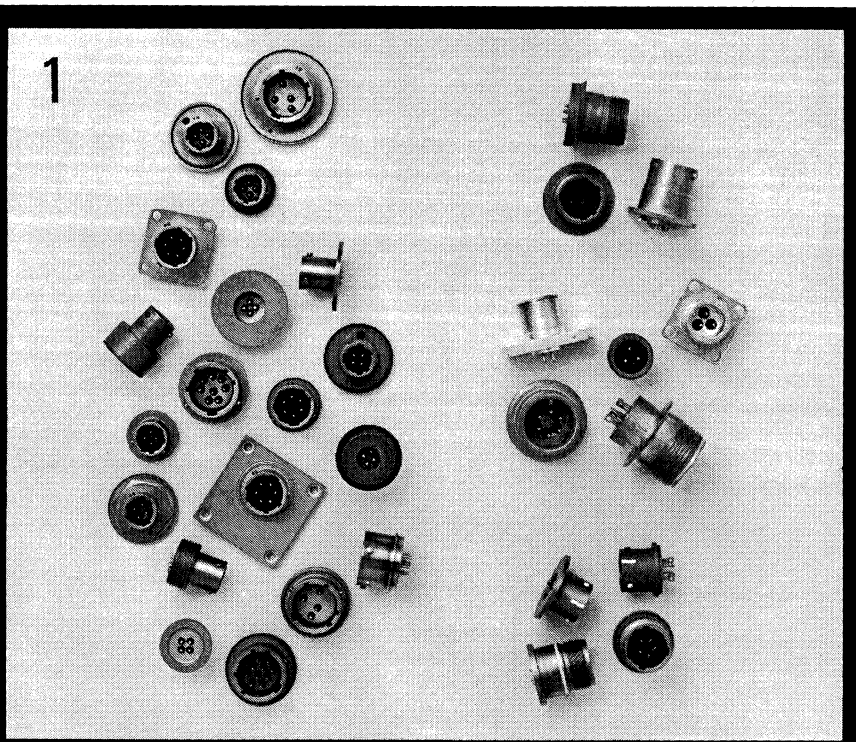




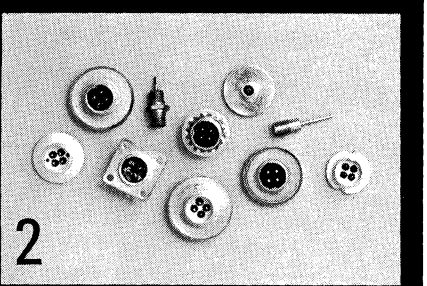
74 standard factory-assembled boards with two through 36 points are available to meet most applications. All terminals on any one board are of the same type, and all boards are complete with marking strip ready for panel mounting.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC



Glass to Metal Hermetically Sealed Connectors Headers and Feed-Thru terminals



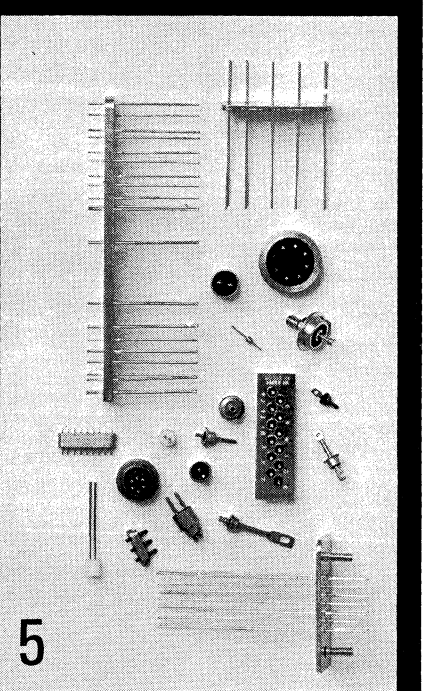
The Glass Technology division of GULTON INDUSTRIES offers a broad line of connectors, headers and feed-thru terminals for both commercial and aerospace applications. Geared for specials as well as standards, basic designs are available with stainless or cold rolled steel shells; weld, solder, box or flange mount styles; or in custom configurations to meet individual requirements.

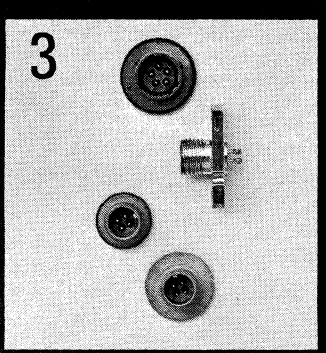
Typical Specifications:

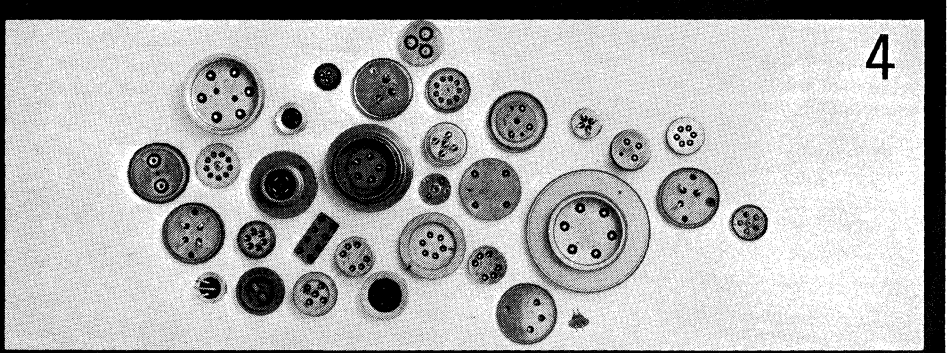
Leak rate: 1.2×10^{-10}cc Helium/sec.
Vibration: 0-2,000 cps @ 100 g's rms
Operating range: −420°F to +600°F
Pressure range: to 40,000 psi
Insulation resistance: 1×10^{12} ohms @ 300°F

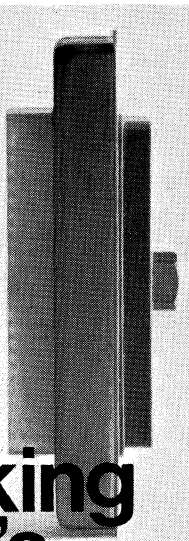
1. Hermetically sealed NAS and MIL type connectors
2. Sub-miniature hermetically sealed connectors
3. Low silhouette and double-start threaded hermetically sealed connectors
4. Hermetically sealed headers
5. Single and multi-pin feed-thru terminals

Gulton
GLASS TECHNOLOGY DIVISION
1644 Whittier Avenue, Costa Mesa, California 92627 (714) 642-0163









The thinking man's filter.

We make filter pin connectors in both rectangular and circular subminiatures. Nobody else does it our way. Nobody else guarantees a 100,000 to 1 reduction of RF energy. Think about that.

HUGHES
HUGHES AIRCRAFT COMPANY
CONNECTING DEVICES

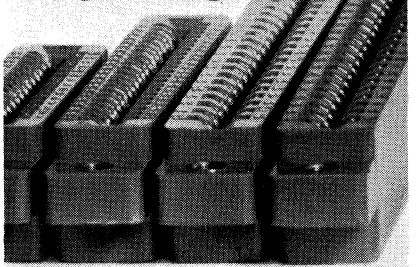


We're getting to be known as rounders.

We invented the BULLS-EYE Connector and created a reputation as circular subminiature specialists. Goes to show you what a little concentration can do. (Like 102 contacts in a #18 shell.)

HUGHES
HUGHES AIRCRAFT COMPANY
CONNECTING DEVICES

We've got your number.



Show us a spec, and we'll show you miniature and subminiature printed circuit connectors in 10 sizes with 10 to 96 contacts. We're good at the numbers game.

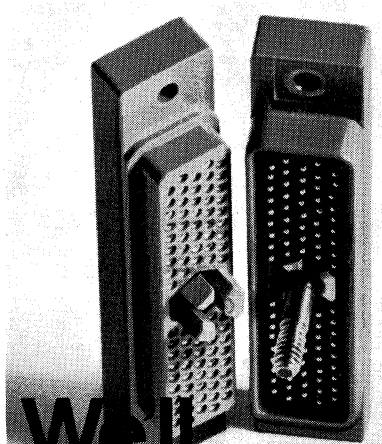
HUGHES
HUGHES AIRCRAFT COMPANY
CONNECTING DEVICES



We bend over backwards.

Contour Cable™ happened here first. Flexible etched flat cable. Flexible flat continuous cable. Custom cable/harness assemblies. Flexibility is a thing with us.

HUGHES
HUGHES AIRCRAFT COMPANY
CONNECTING DEVICES



We'll save your space.

The way we make subminiatures, they're more subminiature. More fully packed. Same contact size and spacing, only we get 110 contacts to the inch. Socket to 'em!

HUGHES
HUGHES AIRCRAFT COMPANY
CONNECTING DEVICES

The do-it-yourself connector kit.



With our Universal Connectors, you decide what goes where. The crimp removable contacts are interchangeable in either body. The big difference at Hughes is the positive way they get together. The PolarHex way.

HUGHES
HUGHES AIRCRAFT COMPANY
CONNECTING DEVICES

ITT Cannon Connector Guide

This Guide is designed to help you select the proper connector series and the appropriate catalog from which to specify your connector. Below is a suggested method of selection:

INSTRUCTIONS

1. Determine your basic application requirement:
   (a) Rectangular Rack/Panel
   (b) Circular
   (c) Microminiature
   (d) Special Application Connectors

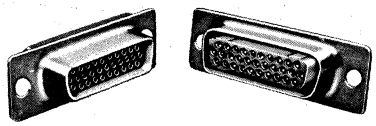
   Go to one of these four headings in the chart. Below each heading are several blocks listing the various connector series. (If a MIL Spec connector is required, turn to the back side of this Guide for the applicable catalog.)
2. Determine the required number of circuits, wire or contact size, and contact termination (solder, crimp, welded, etc.). Check these requirements with the data on the right side (dark shaded area) of each block.
3. Next, select the desired connector size, shell style or coupling method, on the left side (light shaded area) of each block.
4. Check the legend at the bottom of chart to see if environmental (symbols □ or ■) or hermetic (symbol •) requirements are satisfied.
5. Refer to the proper catalog for detailed product data and ordering information.

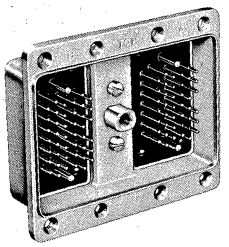
NOTE: For information on connectors not included in the chart, consult factory.



CANNON ITT

Rectangular Rack/Panel





BURGUN-D™ connector — economical D subminiature

General purpose economy version of popular D Subminiature; rear release of crimp snap-in contacts

1/8 scale

BD CATALOG

9-50 CONTACTS

Size 20 contact 20-24

Size 13-20 contacts one #18 or two #20

CRIMP TERMINATION

2D — double density D

D subminiature shell and hardware; 19, 31, 52, 79 or 100 crimp removable contacts

1/8 scale

2D CATALOG

19-100 CONTACTS

Wire Size 22 through 26

CRIMP TERMINATION

D Subminiature

D* —original D, solder contacts
D*M —monobloc insulator, solder contacts
D*MA—rear release of crimp snap-in contacts

● 1/8 scale

D CATALOG

9-50 CONTACTS

Contact/Wire Size
20

Coax. contacts avail.

SOLDER OR CRIMP TERMINATION

DRA — rugged, subminiature

Rugged, subminiature rectangular connector; rear release of crimp snap-in contacts

■ 1/8 scale

DRA CATALOG

9-50 CONTACTS

Contact/Wire Size
20

CRIMP TERMINATION

DPA — small, rugged general purpose

DPA —solid shell, solder contacts
DPAF —float mount DPA
DPAL —large flange DPA
DPAMA—rear release of crimp snap-in contacts

1/8 scale

● *DP CATALOG*

2-32 CONTACTS

Contact/Wire Size
4
8
12
14
16
20

Coax. contacts avail.

SOLDER OR CRIMP TERMINATION

DPG — small, extended shell

DPG —extended DPA type connector with peripheral seal
DPGM—crimp snap-in contacts in monobloc insulator

1/8 scale

DP CATALOG

2-32 CONTACTS

Contact/Wire Size
4
8
12
16
20

Coax. contacts avail.

SOLDER OR CRIMP TERMINATION

DPX — small, rugged, general purpose

DPX —split shell
DPXA —solid shell DPX
DPXAF —float mount DPXA
DPXB —ARINC shell DPX
DPXL —large flange DPX
DPXLF —float mount DPXL
DPXAMA—rear release of crimp snap-in contacts

1/8 scale

■ ● *DP CATALOG*

1-106 CONTACTS

Contact/Wire Size
4
8
12
16
20
22

Coax. contacts avail.

SOLDER OR CRIMP TERMINATION

DPX2 — two gang DPX

DPX2 —two gang shell
DPX2-F&M—screw coupling
DPX2-A —ARINC A shell
DPX2-B —ARINC B shell
DPX2MA —rear release of crimp snap-in contacts

1/8 scale

■ *DP CATALOG*

2-212 CONTACTS

Contact/Wire Size
4
8
12
16
20
22

Coax. contacts avail.

SOLDER OR CRIMP TERMINATION

DPSRC — rugged, general purpose

Rugged, non-environmental general purpose connectors used extensively on ground support equipment; rear release of crimp snap-in contacts

1/8 scale

DP CATALOG

4-42 CONTACTS

Contact/Wire Size
4
8
12
16
20

Coax. contacts avail.

CRIMP TERMINATION

DPK — high performance, environmental

Environmental sealing, thermal resistant connector with rear release of crimp snap-in contacts

■ ● 1/8 scale

DP CATALOG

18-161 CONTACTS

Contact/Wire Size
4
8
12
16
20
22

Coax. contacts avail.

CRIMP TERMINATION

DPJ — general purpose, extended shell

DPJ —extended connector with peripheral seal
DPJM —crimp snap-in contacts in monobloc insulator
DPJMB—rear release of crimp snap-in contacts

1/8 scale

■ *DP CATALOG*

3-98 CONTACTS

Contact/Wire Size
4
8
12
16
20

Coax. contacts avail.

SOLDER OR CRIMP TERMINATION

DPYC — square-shaped general purpose

Square-shaped, non-environmental general purpose connectors used extensively on ground support equipment; rear release of crimp snap-in contacts

1/8 scale

DP CATALOG

25-63 CONTACTS

Contact/Wire Size
4
8
12
16
20

Coax. contacts avail.

CRIMP TERMINATION

DPD — general purpose

DPD —standard rack/panel connector with widest range of contact arrangements
DPDL —large flange DPD
DPDB —back mounting DPD
DPDMA—rear release of crimp snap-in contacts
DPDR —DPD type with resilient insulator
DPDRM—DPD with crimp, snap-in contacts in DUAL-SHORE® insulator

1/8 scale

■ *DP CATALOG*

2-128 CONTACTS

Contact/Wire Size
0
2
4
6
8
10
14
16
20

Coax. contacts avail.

SOLDER OR CRIMP TERMINATION

DPD2 — two gang DPD

DPD2 —two gang DPD
DPD2MA—two gang DPD with rear release of crimp snap-in contacts
DPD2R —DPD2 with resilient insulator
DPD2RM—crimp, snap-in contacts in DUAL-SHORE® insulator

1/8 scale

■ *DP CATALOG*

4-224 CONTACTS

Contact/Wire Size
0
2
4
6
8
10
14
16
20

Coax. contacts avail.

SOLDER OR CRIMP TERMINATION

FLEX-WELD is a registered trademark of Digital Sensors, Inc.

Twist pin contacts are manufactured under license from the New Twist Connector Corporation.

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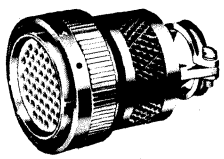
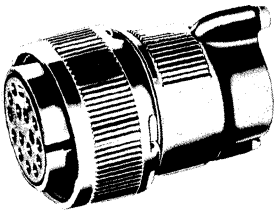
CANNON ITT

Circular





MINIATURE ½" to 1½" Coupling Thread Diameter

KV — high performance, NAS1599

Threaded Coupling

Mates with MIL-C-26500 types with threaded coupling and rear release of crimp snap-in contacts
KV-R—black anodic finish
KV-C—conductive chrome finish

KV/PV CATALOG

□●

3-61 CONTACTS
Contact/Wire Size
20
16
12
CRIMP TERMINATION

PV — high performance, NAS1599

Bayonet Coupling

Mates with MIL-C-26482 types with bayonet coupling and rear release of crimp snap-in contacts
PV-R—black anodic finish
PV-C—conductive chrome finish
PV-G—conductive electroless nickel finish

KV/PV CATALOG

□●

3-61 CONTACTS
Contact/Wire Size
20
16
12
CRIMP TERMINATION

KPT/KPSE — general purpose, MIL-C-26482

Bayonet Coupling

KPT —solder termination
KPTM—crimp contacts in DUAL-SHORE® insulator
KPSE—Crimp contacts in integrally molded insulator

Note: Receptacles with hard anodic, non-conductive finish and flanges positioned for rear panel mounting are available.

MCB CATALOG

□●

2-61 CONTACTS
Contact/Wire Size
20
16
SOLDER OR CRIMP TERMINATION

KM — environmental, MIL-C-25955

Acme Threads

KM —environmentally sealed with crimp, snap-in contacts
KM-MK2—improved KM with thru-grommet contact insertion

MC CATALOG

□●

3-54 CONTACTS
Contact/Wire Size
20
16
12
CRIMP TERMINATION

KO — rugged lightweight

Acme Threads

Miniature environmental version of standard K connector with special Acme threads

MC CATALOG

□●

3-50 CONTACTS
Contact/Wire Size
20
16
12
SOLDER TERMINATION

MC — subminiature, sealed connectors

Rugged

Designed to withstand severe handling and environmental conditions

MC CATALOG

□●

3-12 CONTACTS
Contact/Wire Size
20
SOLDER TERMINATION

KJ — high density, MIL-C-38999

Bayonet Coupling

High performance, high density, lightweight, compact, environment-resistant connectors; rear release of crimp snap-in contacts.

KJ CATALOG

□●

3-128 CONTACTS
Contact/Wire Size
22M
22
20
16
CRIMP TERMINATION

STANDARD ½" to 3" Coupling Thread Diameter

K — lightweight, rugged general purpose

Quick Coupling

K—with special Acme thread coupling nut
RK—same as K except has a reverse coupling nut

K CATALOG

Note: Catalog also includes connectors for firewall, bulkhead television and telephone recording applications.

●

1-110 CONTACTS
Contact/Wire Size
20
16
14
10
8
6
4
2
0
Coax. contacts avail.
SOLDER TERMINATION

MS — general purpose, MIL-C-5015

Threaded Coupling

MS-A—solid shell
MS-B—split shell
MS-C—receptacle, pressurized
MS-E—environmental, cable clamp
MS-R—environmental, endbell

MS CATALOG

Note: Catalog also includes connectors for potting, bulkhead, quick disconnect and weatherproof applications.

■●

1-102 CONTACTS
Contact/Wire Size
16
12
8
4
0
SOLDER TERMINATION
High Voltage Cartridges and Coax. Cartridges available.

CA-RX — MIL-C-5015 type, crimp contacts

Threaded Coupling

CA-RX—MIL-C-5015 type connector with crimp, snap-in contacts in DUAL-SHORE® insulator
BFRX —pressurized bulkhead type

RX CATALOG

□

1-54 CONTACTS
Contact/Wire Size
20
16
12
8
4
0
CRIMP TERMINATION

CV — standard circular connector

High performance connectors designed to MIL-C-5015; rear release crimp snap-in contacts.

CV CATALOG

□

1-48 CONTACTS
Contact/Wire Size
0-16
CRIMP TERMINATION

LR/MR — weatherproof, submersible

Submersible

Rugged environmental MIL-C-5015 type, designed to MIL-C-12520B
LR—hard insulator
MR—resilient insulator

LR/MR CATALOG

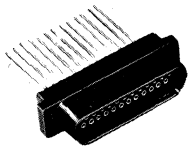
□

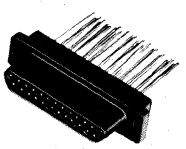
1-56 CONTACTS
Contact/Wire Size
16
12
8
4
0
SOLDER TERMINATION

LEGEND □ Environmental version only
■ Environmental versions available
● Hermetic versions available; For information refer to hermetic sections of respective catalogs

CANNON ITT

Microminiature





USING PROVEN TWIST PIN CONTACTS

MICRO-D™ connectors — rack/panel

MD —monobloc, glass-filled thermoset plastic insulator
MDN—thermoplastic insulator
MDA—thermoplastic insulator
MDB—same as MD connector with integral screw mounting holes
MDE—environmental type
MDM—Mark II metal shell

1/8 scale
.050" Centers

MMC CATALOG

9-51 CONTACTS
Amps
3
SOLID OR STRANDED LEADS

CENTI-K™ connectors — circular

A high density connector using MIL-C-26482 hardware with twisted pin contacts on .100" centers. Rear release. 20% smaller/50% lighter per contact than MIL-C-26482 types.

Bayonet Coupling
.100" Centers

MMC CATALOG

10-92 CONTACTS
Amps
5
CRIMP TERMINATION

MICRO-K™ connectors — circular

A high density connector using twisted pin contacts on .050" centers; 75% smaller/80% lighter per contact than MIL-C-26482 types.

Threaded Coupling
.050" Centers

MMC CATALOG

7-55 CONTACTS
Amps
3
SOLID OR STRANDED LEADS

50-MIL STRIP™ connectors

For edge mounting on PC boards and encapsulation in modules
MTA—polycarbonate insulator (up to 120 contacts)
MTB—diallyl phthalate (up to 81 contacts)

.050" Centers

MMC CATALOG

UP TO 120 CONTACTS
Amps
3
SOLID OR STRANDED LEADS

CENTI-LOC™ connectors — strip

Low cost, commercial strip connector available in "yardage" form for up to 53 crimp snap-in contacts on .075" centers and up to 60 contacts on 100" centers.

.075" or .100" Centers

1-60 CONTACTS
Contact/Wire Size
22 thru 26

CENTI-LOC connectors — rack/panel

CDL Series: Rectangular layouts are available with 139, 104 or 102 crimp, removable contacts on .075" centers.

.075" Centers

MMC CATALOG

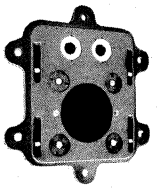
102-139 CONTACTS

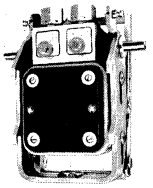
SOLDER OR CRIMP TERMINATION

OTHER SPECIAL CONNECTORS . . . consult factory

Battery connectors
Buffet connectors
Bussed contacts
CAM-RAC™ modules
CHICO™ pack modules
Cupronickel connectors
Custom harnessing
Environment-resistant connectors (see legend)
Hermetically sealed connectors (see legend)
High voltage contacts
Hydrospace connectors
Manometer air line connectors
Non-magnetic connectors
RFI shielding
Special finishes
Special insulator materials
Stainless steel connectors
Thermocouple contacts
Twinaxial cable connectors
Waterproof connectors
Weldable terminations

Special Applications





HIGH TEMPERATURE connectors

HRM —1300°F, nuclear radiation-resistant miniature circular connector
CA-HR—650° & 1000°F, radiation-resistant
CA-KE—350°F, moisture-resistant, for sealable wires, meets MIL-C-5015 fireproof test
CA-KR—350°F, moisture-resistant, for unsealable wires, meets MIL-C-5015 fireproof test
MS-K —350°F, meets MIL-C-5015 fireproof test, crimp contacts
FW —257° & 350°F, crimp or solder contacts

Threaded Coupling

HT CATALOG

1-73 CONTACTS
Contact/Wire Size
16
12
8
4
0
SOLDER, CRIMP OR WELD TERMINATIONS

FRF connectors

Firewall connector with front release of crimp snap-in MS90453 and MS90454 contacts; moisture sealed and exceeds MIL-C-5015 fireproof requirements of 400° F continuous use and 600° F shorter term

FRF CATALOG

2-47 CONTACTS
Contact/Wire Size
16
12
8
4
0
CRIMP TERMINATION

MISSILE & SPACE APPLICATIONS

Interstage and umbilical connectors, electro-mechanical devices, pyrotechnic devices and interconnection systems required in the missile and space field.

GM CATALOG

RFI FILTER CONTACT connectors

Rack/panel and circular connectors with π type filter elements on each contact. Maximum RFI suppression with great space and weight savings over separate filters.

FP CATALOG

Contact/Wire Size
20
SOLDER TERMINATION; consult factory for availability of CRIMP filter contacts.

AUDIO/ELECTRONIC connectors

Used on microphones, tape recorders, amplifiers, test instrumentation, computers and other low level circuit applications

AUD CATALOG

2-8 CONTACTS
Contact/Wire Size
10
14
16
Coax. contacts avail.
SOLDER TERMINATION

RF COAXIAL connectors

RF connectors for high performance and specialized applications; lightweight aluminum versions available

CONSULT FACTORY

FLEX-WELD® — flexible flat cable

Highly reliable, vibration-resistant cable assembly. Long flex life, effective shielding. Space & weight savings

FWA CATALOG

CANNON ITT

Popular Connector Specifications

MIL-C-26482 (Navy)

This specification covers general purpose, miniature circular connectors, with environmental and non-environmental types. These connectors feature bayonet coupling, five keyway polarization and both solder and crimp removable contacts.

See MCB Catalog

MS Number	ITT Cannon Number
MS3110	KPT00
MS3112	KPT02
MS3113	KPTH (hermetic)
MS3114	KPT07
MS3115	KPT
MS3116	KPT06
MS3119	KPTB
MS3120	KPSE00
MS3122	KPSE02
MS3124	KPSE07
MS3126	KPSE06
MS3180	KPT80
MS3181	KPT81

MIL-C-5015

This specification covers circular, general purpose connectors, both sealed and unsealed. These MS connectors were the original AN (Army-Navy) specification connectors and feature threaded coupling and solder termination of size 16 thru 0 contacts.

See MS Catalog

MS Number	ITT Cannon Number
MS3057	MS3057
MS3100	MS3100
MS3101	MS3101
MS3102	MS3102
MS3103	MS3103
MS3105	MS3105
MS3106	MS3106
MS3107	MS3107
MS3108	MS3108
MS25042	CA17530
MS25043	CA2209
MS25183	CA3106ER
MS25183A	CA06ER
MS39056	AN3420

MIL-C-25955

This specification covers miniature circular electrical connectors of an environment resisting class with snap-in contacts. The spec also covers receptacles of a hermetically sealed class with non-removable contacts.

See MC Catalog

MS Number	ITT Cannon Number
MS24234	KM0 and KM1-S
MS24235	KM1 and KM1-S
MS24236	KM6 and KM6-S
MS24237	KM8
MS24238	KM9
MS24239	KH02
MS24240	KH10
MS24241	KH30

MIL-C-38999 (Air Force)

This specification covers high density, high performance, miniature circular connectors. These connectors feature bayonet coupling to meet the environmental and electrical requirements of MIL-C-38999.

See KJ Catalog

MS Number	ITT Cannon Number
MS27472	KJO
MS27513	KJ2R
MS27476	KJ2Y (hermetic)
MS27497	KJ3
—	KJ5R
MS27473	KJ6
MS27474	KJ7
MS27477	KJ7Y (hermetic)
MS27478	KJIY

NAS1599

This industry (National Aerospace Standards) specification covers threaded and bayonet coupling type, miniature circular connectors. These high performance, environment-resistant connectors use crimp removable contacts inserted, released and extracted from the termination side. Threaded connectors (KV) mate with MIL-C-26500 types; bayonet connectors (PV) mate with MIL-C-26482 types. Both connectors use NAS1600 contacts and closed-entry socket insulators.

See KV/PV Catalog

NAS Number	ITT Cannon Number
NAS1641	KV41
NAS1642	KV42
NAS1643	KV43
NAS1650	PV50
NAS1651	PV51
NAS1652	PV52
NAS1653	PV53
NAS1662	pin contacts
NAS1663	socket contacts
NAS1664	tools
NAS1665	short endbells
NAS1666	straight endbells
NAS1667	90° endbells
NAS1668	wire hole fillers

MIL-C-21617 (Ships)

This specification covers small, rectangular polarized-shell connectors for cord mounting and equipment rack/panel use. They are non-environmental type (DPX) connectors with solder-terminated contacts, size 20 through 4. Contact arrangements with coax contacts are also covered.

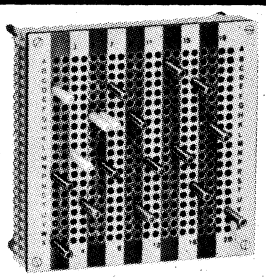
See DP Catalog

Specification Number	ITT Cannon Number
PF 013A	DPX-13-33S
PF 013A	DPXA-13-33S
PF 017A	DPX-17-33S
PF 017A	DPXA-17-33S
PF 023A	DPX-23-33S
PF 023A	DPXA-23-33S
PF 026A	DPX-26-33S
PF 026A	DPXA-26-33S
PF 032A	DPX-32-33S
PF 032A	DPXA-32-33S
PF 040A	DPX-40-33S
PF 040A	DPXA-40-33S
PF 007C	DPX-C7-33S
PF 007C	DPXA-C7-33S
PF 016C	DPX-16C3-33S
PF 016C	DPXA-16C3-33S
JM 013A	DPX-13-34P
JM 013A	DPXA-13-34P
JM 017A	DPX-17-34P
JM 017A	DPXA-17-34P
JM 023A	DPX-23-34P
JM 023A	DPXA-23-34P
JM 026A	DPX-26-34P
JM 026A	DPXA-26-34P
JM 032A	DPX-32-34P
JM 032A	DPXA-32-34P
JM 040A	DPX-40-34P
JM 040A	DPXA-40-34P
JM 007C	DPX-C7-34P
JM 007C	DPXA-C7-34P
JM 016C	DPX-16C3-34P
JM 016C	DPXA-16C3-34P

ITT CANNON ELECTRIC
3208 HUMBOLDT ST., LOS ANGELES, CALIF. 90031
A DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
CANNON® PLUGS

Program Boards • Data Modules • Custom Panels

MATRIX BOARDS

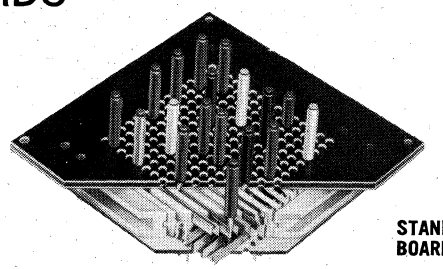


MINIATURE BOARD

Pin Spacing: .125" Nominal
Standard Configuration: 20 x 20

Accessories:
- Diode plugs
- Shorting pins
- Colored pins and plugs

Optional Features:
- Special marking and sizes
- Thumbwheel switches
- Data modules



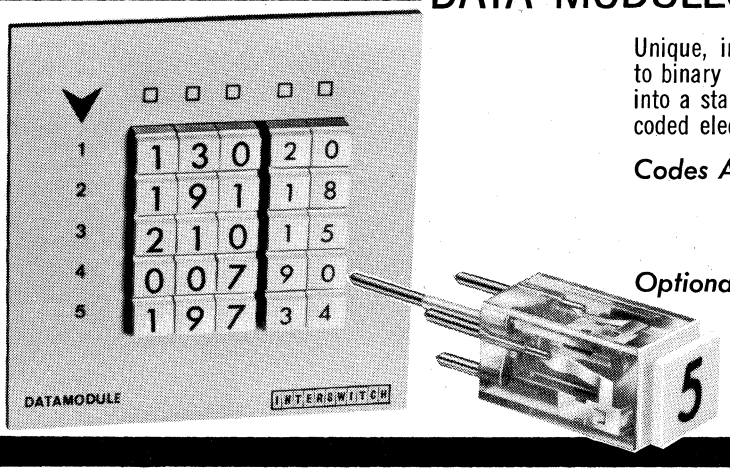
STANDARD BOARD

Pin Spacing: .250" Nominal
Standard Configuration: 10 x 10

Accessories:
- Diode pins • Dummy plugs
- Shorting pins • Lighted plugs
- Colored pins and plugs

Optional Features:
- Special marking and sizes
- Thumbwheel switches

DATA MODULES

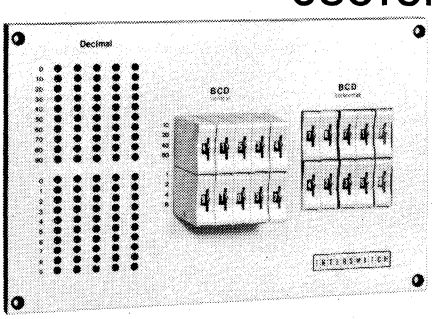


Unique, inexpensive programming plugs allow decimal to binary coding by simple insertion of the number keys into a standard base switch body which delivers binary coded electrical outputs.

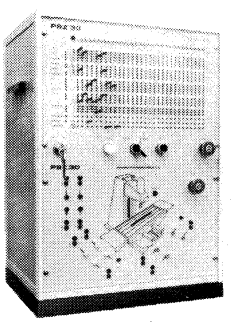
Codes Available:
- 1-2-4-8 (BCD)
- Excess Three
- 1-2-4-2 Aiken

Optional Features:
- Colored keys and characters
- Horizontal or vertical reading characters
- Modules adaptable for printed circuit boards or INTERSWITCH miniature matrix boards

CUSTOM PANELS



Combination matrix board and thumbwheel switch programming board.



Machine tool programming panel.

Custom Boards: INTERSWITCH can provide complete programming panels consisting of plug-in matrix boards in combination with data modules, thumbwheel switches, and miniature lamps completely imprinted to meet your specific requirements. Matrix boards integrated into the panel itself provide a smooth and neat appearance by eliminating mechanical attachment of the matrix board to the panel.

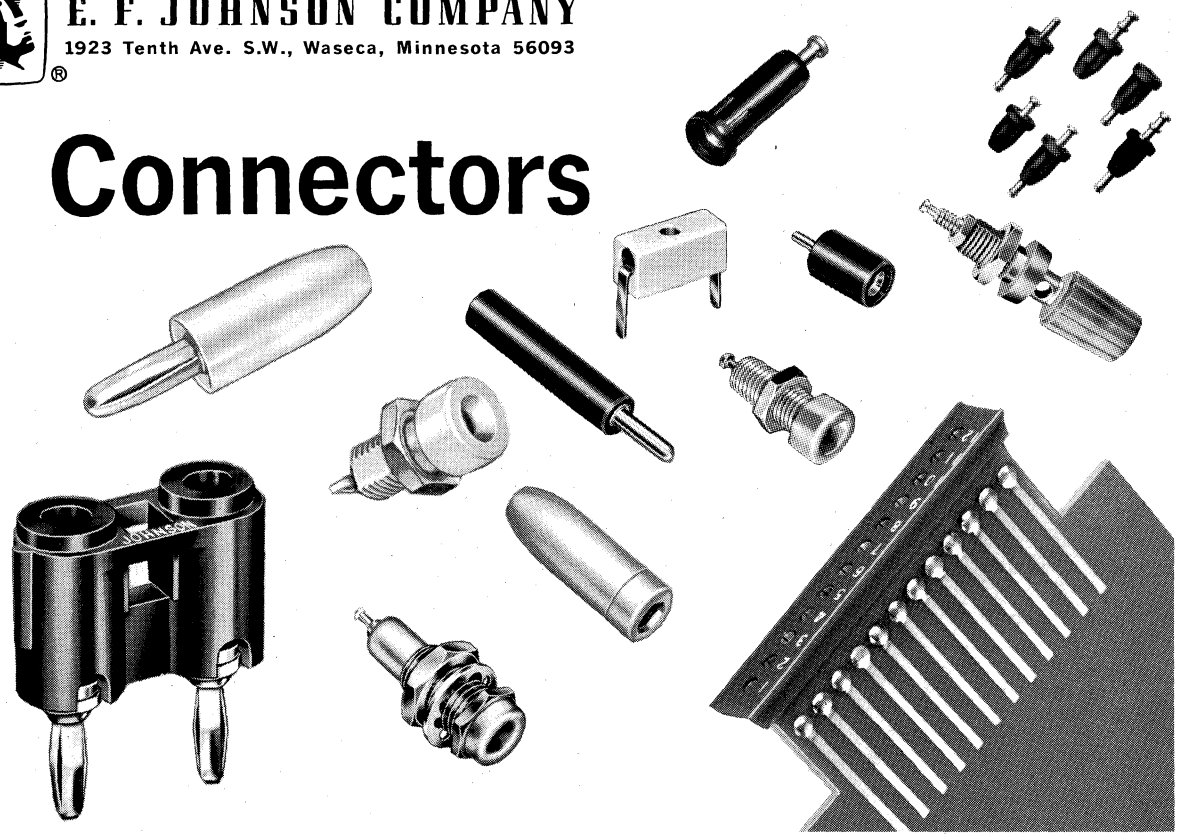
INTERSWITCH

For fast engineering application assistance, complete specifications, or ordering information, call (415) 347-8217 or TWX 910-374-2353 now. For more data and catalog information, write INTERSWITCH, 770 Airport Blvd., Burlingame, Calif. 94010.

2N-9103

E. F. JOHNSON COMPANY
1923 Tenth Ave. S.W., Waseca, Minnesota 56093

Connectors



Sub-miniature, standard types

Whatever the choice . . . sub-miniature connectors for printed circuit use—or Johnson's patented "Six-Way" Binding Posts . . . time and time again design and development engineers specify Johnson connectors!

A complete line of polyamide insulated connectors are readily available to meet most military and commercial applications—included are: sub-miniatures for printed circuit applications; insulated solderless tip and banana plugs; tip and banana jacks; tip jack and sleeve assemblies; metal-clad and "rapid-mount" tip jacks; dual banana plugs and "6-way" binding posts. Available in 6 colors for coded applications, designed to operate throughout an extremely wide temperature range and under conditions of high relative humidity—voltage breakdowns available up to 11,000 volts on some types! For detailed information on the complete Johnson connector line and other Johnsor electronic components—write today for our newest components catalog!

SUB-MINIATURE INSULATED CONNECTORS—Designed for printed circuit applications! Extremely compact, body is tough low-loss polyamide—resists extremes of shock, vibration, temperature and moisture. Operating voltages to 1500 volts RMS . . . 5 amperes current carrying capacity . . . contact resistance; less than 2 milliohms. Capacitance between two adjacent jacks: less than one pf. at 1 MC. 10 colors available. **Horizontal Jack**—Unique design accepts .080" diameter tip plug in either end or from top or bottom. **Vertical Jack**—Mounts through single .052" hole, requires minimum mounting area. **Sub-Miniature Tip Plug**—For use with miniature jack, .080" dia. with machined brass tip and solder lead connection. **"RIB-LOC" Terminal Design**—Single or double turret stand-offs and feed-thrus, tip jacks and tip plugs. Mount securely in .136" hole. MIL-P-20693 insulation. **New RIB-LOC tip jack**—Press-in installation. Accepts .080" tip plug in recessed, closed-entry type contact. Rated 10 amps with 8000 VDC breakdown. **Test-Point Strip/Handle**—Rapid-mounting polyamide body contains 12 test points each rated at 5 amps., maximum current capacity. Operating voltage 1500 volts RMS at seal level, 350 volts RMS at 50,000 feet. Contact resistance less than 2 milliohms.

STANDARD INSULATED CONNECTORS—A complete line of connectors molded of tough, low-loss, shock-proof polyamide in 10 colors meeting Fed. Std. 595—won't chip or crack with the hardest usage. **Tip, Banana and Dual Banana Plugs**—Metal parts nickel-plated—solderless connection up to 16 gauge wire. Current rating: 10 and 15 amps., respectively. **Tip and Banana Jacks**—molded bodies, current rating: 10 and 15 amps., respectively. Available in six types: **Standard Tip Jack**—Recessed cadmium-plated formed contact. Voltage breakdown: 9,000 volts DC; **Deluxe Tip Jack**—Recessed silver-plated machined contact. Voltage breakdown: 11,000 volts DC; **Rapid-Mount Tip Jack**—Low cost fast mounting. "Speed clip" snaps into hole, then jack is inserted. Voltage breakdown: 7,000 volts DC; **Standard Metal-clad Jack**—Nickel-plated jacket, formed silver-plated contact. Voltage breakdown: 7,000 volts DC; **Metal-Clad Tip Jack, Military**—Nickel-plated jacket, machined gold-plated beryllium copper contact. Voltage breakdown: 8,000 volts DC; **Banana Jack**—Recessed cadmium-plated insert for .175" plugs. Voltage breakdown: 12,500 volts DC. **Jack and Sleeve**—Ideal for patch cords, or insulated rear connection of panel-mounted tip jack. **Binding Posts**—Versatile "6-way" usage. Silver-plated shank, self-captivated thumb nut. Voltage breakdown: 7,000 volts DC. Current ratings: 15 and 40 amps., respectively.

Detailed components catalog free . . .
Write today on company letterhead

CAPACITORS • TUBE SOCKETS • CONNECTORS • PILOT LIGHTS • INSULATORS • TERMINALS • INDUCTORS

E. F. JOHNSON COMPANY
1923 Tenth Ave. S.W., Waseca, Minnesota 56093

KINGS

K-GRIP JR.™ CONNECTORS

Almost 50% smaller, 50% lighter, K-Grip Jr. is the design answer to better RF connectors. A three-piece configuration, it is a crimp-type version of Kings standard RF connector reduced to its simplest form.

FEATURES:

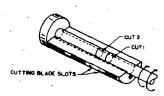
- Superior Strength . . . pull-out resistance unequalled by any other crimp-type connector in the industry.
- Uniform, Rapid Handling . . . connector-to-cable attachment reduced to a minimum — with exacting uniformity from unit to unit.
- Foolproof Assembly . . . Snug-fit design requires no highly skilled personnel.
- Broad Application Capability — Available in all standard connector types for RG-174 through RG-214.

Kings K-Grip Jr. Connectors are available in two tarnish-resistant finishes — a TR-4™, used over silver plating; or the TR-5™, a more durable, brilliant alloy finish.

CABLE RETENTION METHOD

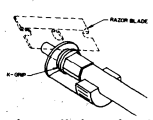
The K-Grip Jr. cabling procedure is as follows — After the braid has been trimmed, the K-Grip is inserted between the dielectric and braid. The K-Grip sleeve is slid over the braid and crimped in place. K-Grip, thus eliminates the time consuming braid combing operation and results in a stronger connection.
For precise easy cable trimming, the use of Kings jacket and dielectric trim jigs is recommended.

JACKET TRIM—JIG (KTJ) CP-200A & CP-400 (Patent Pending)



Used for making cuts 1 and 2 in the cabling procedure.

DIELECTRIC TRIM—JIG (KTD) CP-200A (Patent Pending)



Used for trimming dielectric in the cabling procedure.

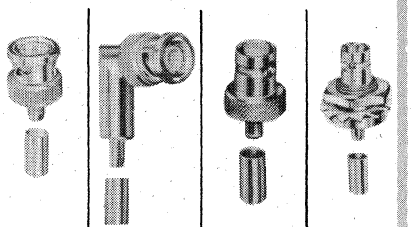
HAND CRIMP TOOL . . . KTH-1000

With removable dies — accommodates all die sizes.



Crimping of contacts and K-Grip Jr.™ may be easily and reliably accomplished by the use of Kings special crimping tools.

BNC SERIES



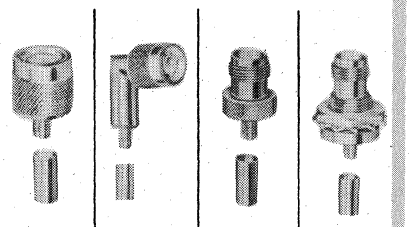
PLUG	ANGLE PLUG	JACK	BULKHEAD JACK
CABLE GROUP RG-174, 179A, 179B, 187, 187A, 188 and 188A/U			
KC-59-95	KC-59-109	KC-39-34	KC-19-68
*KC-59-152		*KC-39-50	*KC-19-93
CABLE GROUP RG-122, 180, 180A, 195 and 195A/U			
KC-59-107	KC-59-108	KC-39-36	KC-19-67
*KC-59-169	*KC-59-171	*KC-39-52	*KC-19-96
CABLE GROUP RG-58, 58A, 58C and 141/U			
KC-59-78	KC-59-101	KC-39-26	KC-19-61
*KC-59-123	*KC-59-153	*KC-39-38	*KC-19-83
CABLE GROUP RG-223, 55A, 142 and 142A/U			
KC-59-80	KC-59-103	KC-39-27	KC-19-64
*KC-59-162		*KC-39-51	*KC-19-140
CABLE GROUP RG-142B, 55 and 55B/U			
KC-59-104	KC-59-105	KC-39-35	KC-19-65
*KC-59-167	*KC-59-215	*KC-39-47	*KC-19-90
CABLE GROUP RG-59, 59A, 59B, 62, 62A, 62C and 210/U			
KC-59-79	KC-59-102	KC-39-28	KC-19-62
*KC-59-128	KC-59-222	*KC-39-45	*KC-19-89
CABLE GROUP RG-71, 71A and 71B/U			
KC-59-81	KC-59-106	KC-39-29	KC-19-66
*KC-59-135		*KC-39-60	*KC-19-91
CABLE GROUP WE-724 and Belden 8281			
KC-59-180		KC-39-65	KC-19-114
*KC-59-181		*KC-39-66	*KC-19-115

*TR-5 FINISH

CHARACTERISTICS

- Small, lightweight, bayonet coupling
- Used with small diameter RF cables
- Beryllium copper outer contacts
- Nominal 50 ohm impedance
- Excellent electrical performance from DC through X-Band
- Tested at 1500 volts RMS
- Teflon insulated

TNC SERIES



PLUG	ANGLE PLUG	JACK	BULKHEAD JACK
CABLE GROUP RG-174, 179A, 179B, 187, 187A, 188 and 188A/U			
KA-59-69	KA-59-70	KA-39-27	KA-19-42
*KA-59-120			*KA-19-60
CABLE GROUP RG-122, 180, 180A, 195 and 195A/U			
KA-59-58	KA-59-74	KA-39-28	KA-19-41
*KA-59-142		*KA-39-44	
CABLE GROUP RG-58, 58A, 58C and 141/U			
KA-59-44	KA-59-71	KA-39-17	KA-19-38
*KA-59-103	*KA-59-151	*KA-39-34	*KA-19-68
CABLE GROUP RG-223, 55A, 142 and 142A/U			
KA-59-45	KA-59-72	KA-39-18	KA-19-40
*KA-59-87		*KA-39-35	*KA-19-65
CABLE GROUP RG-142B, 55 and 55B/U			
KA-59-57	KA-59-73	KA-39-26	KA-19-39
*KA-59-86		*KA-39-36	
CABLE GROUP RG-59, 59A, 59B, 62, 62A, 62C and 210/U			
KA-59-46	KA-59-76	KA-39-19	KA-19-43
*KA-59-94			
CABLE GROUP RG-71, 71A and 71B/U			
KA-59-47	KA-59-75	KA-39-20	KA-19-44
CABLE GROUP WE-724 and Belden 8281			

*TR-5 FINISH

CHARACTERISTICS

- Positive locking thread-type coupling
- Withstands extreme vibration and shock
- Used with small diameter RF cables
- Beryllium copper outer contacts
- Nominal 50 ohm impedance
- Excellent electrical performance from DC through X-Band
- Tested at 1500 volts RMS
- Low noise level
- Teflon insulated

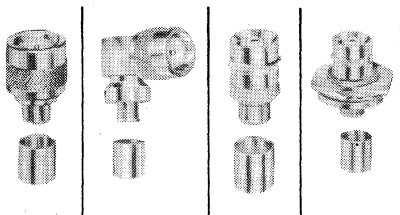
K-GRIP Jr. is a registered T.M. of Kings Electronics Co., Inc.

The types listed above are also available in a weatherproof version meeting mil spec. M39012.

KINGS
ELECTRONICS COMPANY, INC.
40 MARBLEDALE ROAD | TUCKAHOE, N.Y. 10707 | (914) SW 3-5000 | TWX 710-562-0110 | TELEX 1-37449

KINGS K-GRIP JR.™ CONNECTORS

C SERIES



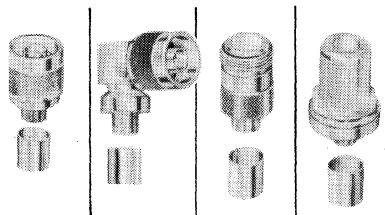
PLUG	ANGLE PLUG	JACK	BULKHEAD JACK
CABLE GROUP RG-58, 58A, 58C and 141/U			
KD-59-62	KD-59-67	KD-39-14	KD-19-43
*KD-59-96		*KD-39-25	
CABLE GROUP RG-223, 55A, 142 and 142A/U			
KD-59-63	KD-59-68	KD-39-17	KD-19-41
*KD-59-97			
CABLE GROUP RG-142B, 55 and 55B/U			
KD-59-64	KD-59-69	KD-39-18	KD-19-42
CABLE GROUP RG-59, 59A, 59B, 62, 62A, 62C and 210/U			
KD-59-65	KD-59-70	KD-39-15	KD-19-39
*KD-59-89			
CABLE GROUP RG-71, 71A and 71B/U			
KD-59-66	KD-59-71	KD-39-16	KD-19-40
CABLE GROUP RG-5, 5A, 5B, 6, 6A, 21, 21A, 143, 143A, 212 and 222/U			
KD-59-58	KD-59-59	KD-39-13	KD-19-38
CABLE GROUP RG-8, 8A, 11, 11A and 213/U			
KD-59-51	KD-59-60	KD-39-11	KD-19-36
*KD-59-98	*KD-59-107	*KD-39-23	
CABLE GROUP RG-9, 9A, 9B, and 214/U			
KD-59-52	KD-59-61	KD-39-12	KD-19-37
*KD-59-99		*KD-39-24	

*TR-5 FINISH

CHARACTERISTICS

- Bayonet coupling designed for use with medium sized RF cables
- Beryllium copper outer contacts
- Nominal 50 ohm impedance
- Excellent electrical performance from DC through X-Band
- Tested at 2500 volts RMS
- Teflon insulated

N SERIES



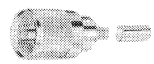
PLUG	ANGLE PLUG	JACK	BULKHEAD JACK
CABLE GROUP RG-58, 58A, 58C and 141/U			
KN-59-86	KN-59-91	KN-39-38	KN-19-53
*KN-59-118		*KN-39-46	
CABLE GROUP RG-223, 55A, 142 and 142A/U			
KN-59-87	KN-59-94	KN-39-39	KN-19-54
*KN-59-122			
CABLE GROUP RG-142B, 55 and 55B/U			
KN-59-88	KN-59-95	KN-39-40	KN-19-55
*KN-59-120			
CABLE GROUP RG-59, 59A, 59B, 62, 62A, 62C and 210/U			
KN-59-89	KN-59-92	KN-39-36	KN-19-56
CABLE GROUP RG-71, 71A and 71B/U			
KN-59-90	KN-59-93	KN-39-37	KN-19-57
CABLE GROUP RG-5, 5A, 5B, 6, 6A, 21, 21A, 143, 143A, 212 and 222/U			
KN-59-82	KN-59-85	KN-39-35	KN-19-52
CABLE GROUP RG-8, 8A, 11, 11A and 213/U			
KN-59-67	KN-59-83	KN-39-30	KN-19-50
*KN-59-132		*KN-39-52	*KN-19-88
CABLE GROUP RG-9, 9A, 9B, and 214/U			
KN-59-68	KN-59-84	KN-39-31	KN-19-51
*KN-59-104		*KN-39-47	*KN-19-87

*TR-5 FINISH

CHARACTERISTICS

- Positive locking thread type coupling
- Used with medium diameter RF cables
- Nominal 50 ohm impedance
- Excellent electrical performance from DC through X-Band
- Tested at 2500 volts RMS
- Teflon insulated throat

UHF SERIES

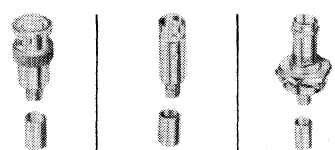


PLUG	
RG-58, 58A, 58C/U	
KU-59-46	*KU-59-53
RG-59, 59A, 59B, 62, 62A	
KU-59-44	*KU-59-54
RG-11, 11A	
KU-59-43	*KU-59-58
RG-8, 8A, 213	
KU-59-42	*KU-59-52
WE-724 Belden 8281	
KU-59-56	*KU-59-59

CHARACTERISTICS

- Positive locking, thread type coupling
- Used with small and medium diameter RF cables

MHV SERIES



PLUG	JACK	BULKHEAD JACK
RG-58, 58A, 58C and 141/U		
KV-59-17	KV-39-06	KV-19-16
	Polarized	
KV-59-18	KV-39-07	KV-19-17
RG-59, 59A, 59B, 62, 62A, 62C, and 210/U		
KV-59-15	KV-39-08	KV-19-15
*KV-59-23		*KV-19-19
	Polarized	
KV-59-16	KV-39-09	KV-19-18
*KV-59-20		*KV-19-22

*TR-5 Finish

CHARACTERISTICS

- Bayonet coupling
- Both standard and polarized versions available
- Nominal 50 ohm impedance
- Tested at 5000 volts RMS
- Teflon insulated

K-GRIP Jr. is a registered T.M. of Kings Electronics Co., Inc.

The types listed above are also available in a weatherproof version meeting mil spec. M3912.

KINGS
ELECTRONICS COMPANY, INC.
40 MARBLEDALE ROAD | TUCKAHOE, N.Y. 10707 | (914) SW 3-5000 | TWX 710-562-0110 | TELEX 1-37449

Look in the Green Section for Products and their Manufacturers



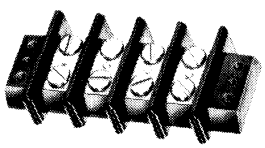
Tell them you found them in eem

Kulka TERMINAL BOARDS



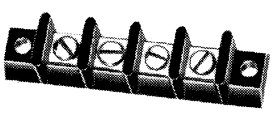
STANDARD

410, 600, 600A, 601, 602 Series. Current range 5 thru 30 Amps; Voltage Range 1000 thru; 600 RMS; Wire sizes 20-14 Ga.; 1 thru 26 Terminals.



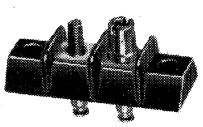
HEAVY DUTY

603, 604, 605 Series, Current range 50 thru 90 Amps, Voltage 1700 thru 2100 RMS; Wire Sizes #6 to 2 ga.; 1 thru 12 terminals.



SINGLE ROW

599, 699, 812 Series. Current range 15 thru 30 Amps; Voltage range 1100 thru 1600 RMS; Wire sizes: #22 to #12 ga.; 1 thru 23 terminals.

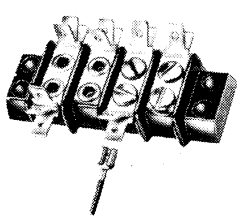


STUD and TURRET

For greater wiring convenience. Choice of terminals:

- Regular Screw Type
- Solder Turret • Feedthru
- Threaded Stud, etc.

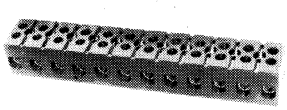
Also, choice of finishes: electro-tinned, silver-plated, even gold over silver. Our design facilities are available for your special requirements.



"KLIPTITE"

For fast connect and disconnect. Available on Kulka's full line of terminal boards.

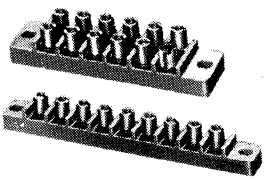
- Just clip on wire terminal fast for tight connection.
- Up to 6 connections per stage.
- Vari-angled tabs.
- Available rivetted to terminal hardware or with screw assembly.



PRESSURE CONTACT

9-85 SERIES

Ideal for power equipment. One-piece molded plastic for industrial or military use. Extra-safe, completely enclosed. 2 to 12 terminals. Rated at 85 Amps, 8000 Volts.

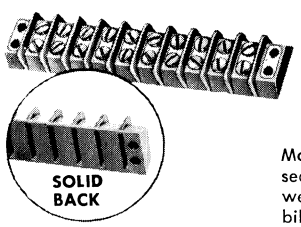


MILITARY BOARDS

Per MIL-T-16784B

Designed by the Bureau of Ships according to MIL-T-16784B, superseding MIL-T-16784A (Ships). They are made to BUSHIPS 9000-S6505-73214 drawings, with the latest revisions, and BUORD S64101.

MOLDED MATERIAL: MAI-60, in accordance with MIL-M-14F.



MILITARY BOARDS

SOLID BACK

MADE to MEET or EXCEED

MIL-T-55164

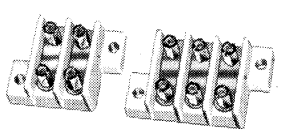
Molded-in Terminals. Equal molded sections. Kulka improved design, for weight saving, greater strength, flexibility. All sizes available, classes 37TB thru 42TB.



CLOSED BACK TERMINAL BOARDS



670, 670A, 671, 672 Series. Current range 15 to 30 Amps, Voltage range 2500 to 3300 Volts RMS. Wire sizes #22 thru #12 ga.; 1 thru 30 terminals.

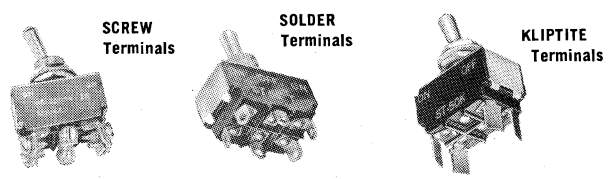


HIGH HEAT

1215 SERIES

For temperatures up to 850°. Made in two and three terminal units with incremental configuration. Stainless steel stud type terminals.

TOGGLE SWITCHES



Made to Military Specifications: JAN-S-23, MIL-S-21195, MIL-S-6745 and MIL-S-3950B. Available in SPST, SPDT, DPST and DPDT types. DA and AC up to 1600 cps. Your choice of terminals: Screw, solder or tab.

Also, MINIATURE, SUBMINIATURE, TAPER PIN, PRINTED CIRCUIT, WIRE-WRAP, SCREW CLAMP TERMINAL BOARDS AND ACCESSORIES. Available in a variety of Military and Commercial Grade materials.

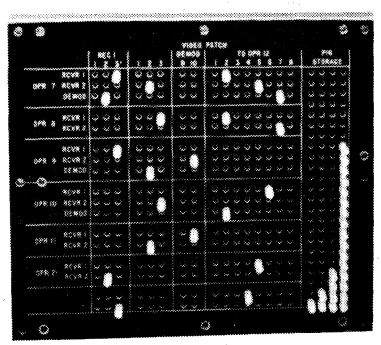
Manufacturers of Wiring Devices for more than a Quarter Century

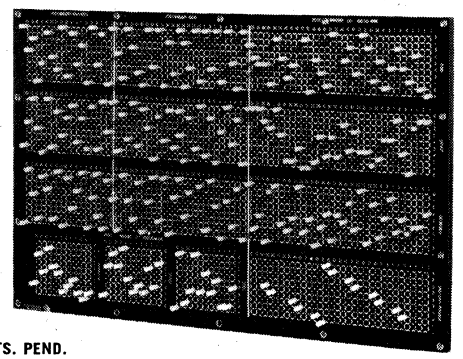
Kulka Electric Corporation
Dept. E. — P.O. Box 149, Mount Vernon, N. Y. 10551
TEL.: 914 664-4024 TWX: 710 562-0104 TELEX: 137413

KULKA COMPLETE TERMINAL BOARD CATALOG 17A ON REQUEST

CO-ORD SWITCH
A DIVISION OF LVC INDUSTRIES INC.
102-48 43rd AVE., CORONA, N. Y. 11368 • TEL: 212-899-5588

MATRIX PROGRAM BOARDS





U.S. & FOREIGN PATS. PEND.

CO-ORD Matrix Program Boards are composed of 2 to 6 decks of contacts that are bussed in parallel rows on .250 centers. The contact rows of one deck are usually oriented perpendicular to the rows of adjacent deck(s) so as to obtain switching crosspoints. Electrical connections of the bussed contact rows are effected by inserting shorting pins at the desired crosspoints; "CO-AX", phone plug type pins are available for networks which require component insertion (Diodes, resistors, etc.). Single board matricies of up to 11,000 crosspoints are available in standard or special arrangements. Bussed and isolated contacts can be had alone or in combination. Panels may be screened, engraved, or fitted with pre-punched templates for rapid program changing.

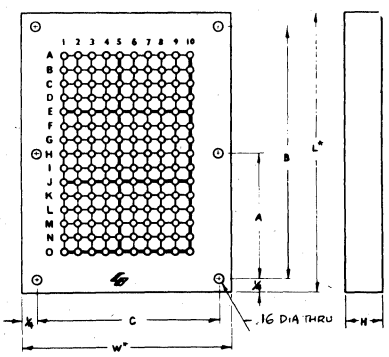
FEATURES

- Closed entry contacts
- High mechanical environment capacity for MIL applications
- Low interlead capacitance (cross-talk) for high frequency applications
- Attractive and uncluttered panel
- Compact package
- Standard sizes available off the shelf
- Permits insertion of components into network without soldering
- Wide variety of switching combinations available using standard hardware

APPLICATIONS

Computer memories
Cordless patch panels
Function generators (Analog/Digital)
Power distributors
Thermocouple signal selectors
Circuit/Component test programmers
Lighting systems (Special effects)
Variable sequence selectors
Variable diode matrices
Code generators
Traffic control panels
Decade switches
Vending machine control
Numeric controlled machinery
Data channeling & logging
Communications distributors

STANDARD MATRIX BOARDS — SERIES 63014



SPECIFICATIONS

1-Contact Resistance
a Total Pin Resistance: .004 OHM MAX.
b Volume Resistivity of Strip: .003 OHM/IN

2-Breakdown Voltage: 1000 VRMS MIN.

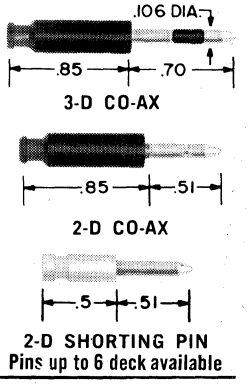
3-Current Capacity: 5 AMPS Continuous

4-Materials
a Plastic Parts: Black Phenolic XXX
b Flexible Contacts: Heat Treated Beryl. Copper
c Terminals: Brass
d Finishes: Gold, Silver or Nickel

DASH	MATRIX	L	W	A	B	C
-1	10 X 10	3¾	3¾	–	3.250	3.250
-2	10 X 15	5	3¾	–	4.500	3.250
-3	10 X 20	6¼	3¾	–	5.750	3.250
-4	10 X 25	7½	3¾	3.500	7.000	3.250
-5	15 X 20	6¼	5	–	5.750	4.500
-6	15 X 25	7½	5	3.500	7.000	4.500
-7	20 X 20	6¼	6¼	–	5.750	5.750
-8	50 X 10	13¾	3¾	6.500 / 7.250	13.250	3.250
-9	25 X 25	7½	7½	3.500	7.000	7.000

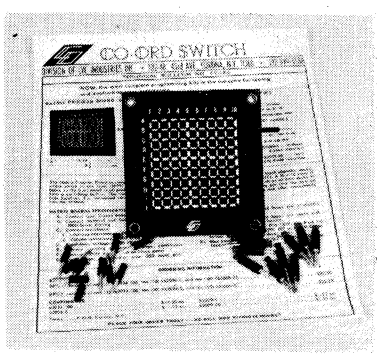
H	2-D	3-D	4-D	5-D	6-D
	9/16	¾	15/16	1⅛	1 5/16

PROGRAM PINS



Pins up to 6 deck available

PROGRAM BOARD KITS



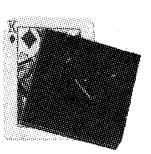
KIT BPS-1 consists of a 10 x 10 matrix board similar to #63014-1, above, 10 shorting pins and 10 "CO-AX" diode pins with 1N270's installed $27.00

KIT BPS-2 is the same as BPS-1 but without diodes $22.25

10 x 10 matrix board .....$17.00 ea.
Shorting pin ..... .12 ea.
Diode pin w/1N270 ..... .99 ea.
Diode pin w/o diode ..... .51 ea.

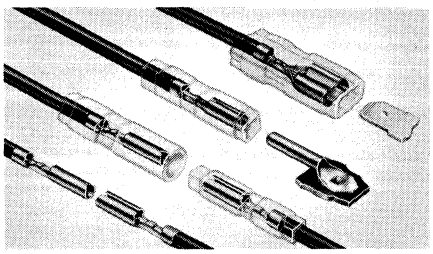
AVAILABLE FROM STOCK

1/10 INCH CENTERLINE MATRIX



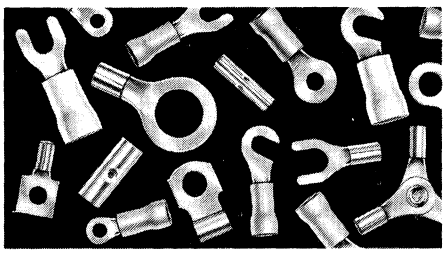
Offers a ½ reduction in both size and weight over standard matrices and can be made to meet any customer specifications. Ideal where space is critical.

ELECTRONIC TERMINALS AND CONNECTORS

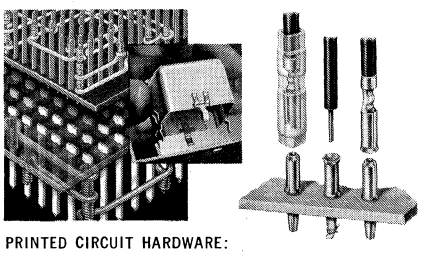


QUICK-CONNECT RECEPTACLES:
A large family of female receptacles for quick-connect male terminals supplied in chain style for automatic crimping. These terminals are available for round, square or rectangular male pins or blades. Terminals crimp to wires from 27-AWG to 16-AWG. REQUEST BULLETIN NO. 611.

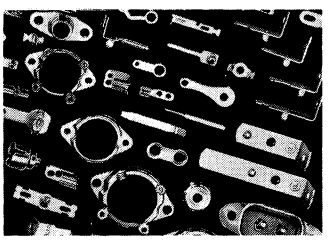
- **Terminals produced by high-speed production equipment insure highest quality at lowest prices.**
- **Chain style terminals may be applied by Malcomatic Machines for lowest possible assembly costs.**
- **Precision tooling and rigid quality control assure products that meet or exceed industry specifications—consistently.**
- **Most complete line of circuit hardware and small stampings available for Radio-TV, Electrical and Electronic, Communications, Automotive and Aviation Industries.**
- **Prompt delivery on over 2,000 different parts.**
- **Full staff of Malco engineers to solve customer application and design problems.**



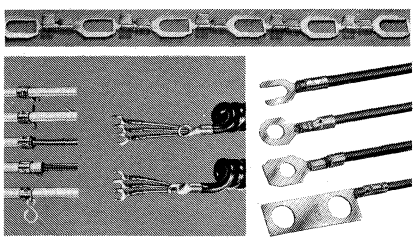
SOLDERLESS TERMINALS:
Broad range of sizes and types. Available insulated (straight or flared entry) or non-insulated. Made of pure soft copper with special internally serrated barrels for maximum crimp reliability. Full range from AWG 22 to AWG 10. REQUEST BULLETIN NO. 617.



PRINTED CIRCUIT HARDWARE:
Feed-Thru Terminals in chain style for automatic insertion in P. C. Cards. Available in a full range of sizes in "Wrap-A-Wire" or round pin styles. Interlock pin, "Wrap-A-Wire" and quick-connect tab lugs for edge-board or terminal strip applications. Spring clips for shielding cans. REQUEST BULLETIN No. 691.

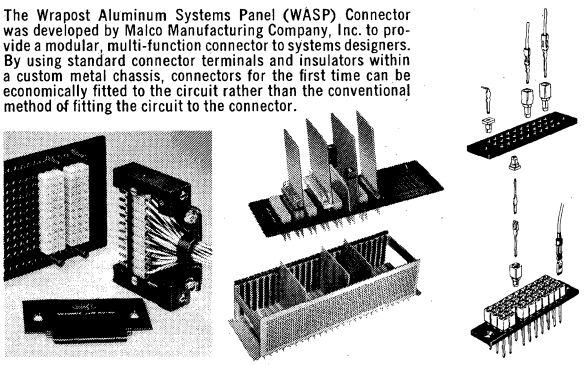


ELECTRONIC HARDWARE:
Socket and connector hardware, soldering and non-soldering terminals, quick-connect lugs. Phono plug and receptacle hardware, P. C. brackets and binding posts. REQUEST BULLETIN NO. 10.

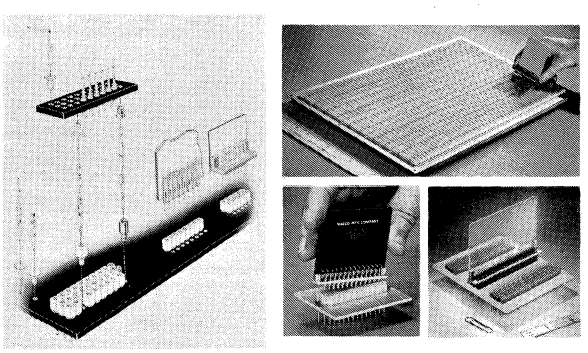


RING AND SPADE TERMINALS:
In chain style, applied by Malcomatic equipment. Available in a variety of sizes and types: hook, ring, spade, flag, either wire/insulation crimp or insulation-pierce crimp. Also, cord clamps for strain relief applications. REQUEST BULLETIN NO. 605.

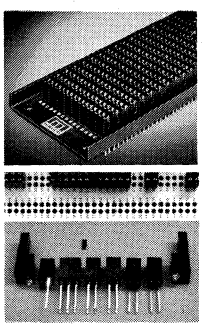
The Wrapost Aluminum Systems Panel (WASP) Connector was developed by Malco Manufacturing Company, Inc. to provide a modular, multi-function connector to systems designers. By using standard connector terminals and insulators within a custom metal chassis, connectors for the first time can be economically fitted to the circuit rather than the conventional method of fitting the circuit to the connector.

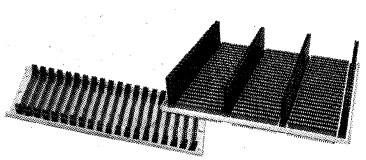


WASP—The "Wasp" Connector is a heavy duty blade/fork combination with .045" square wrap tails for automatic machine terminations. This line features the broadest range of connector terminal variations in the industry. Available in .125" thick aluminum plates up to 24"x 24" with terminals on .200" square or offset patterns. REQUEST BULLETIN NO. 631.

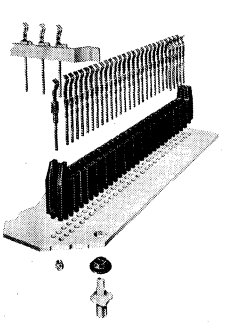


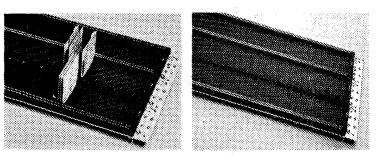
MINI-WASP—This line is a miniature version of the "Wasp" Connector. It is available in .080" aluminum plates on .100", .125" or .150" square or offset patterns. Terminals are high-reliability blade/fork type with .025" square wrap tails. The "Mini-Wasp" Connector Line features ground connectors as well as insulated connectors in the same manner as the "Wasp" line. Thus, the aluminum plate becomes a complete ground plane. REQUEST BULLETIN NO. 647.





CARDEC 200—The Cardec 200 Card Edge Plate Connector System is designed for direct entry P. C. card applications. The Cardec 200 version accepts 1/16" printed circuit cards with contacts on .200" centers with .045" square wrap tails. This connector system features the ground plane concept and modular construction of the "Wasp" Connector line while affording the economy of edge connector systems. REQUEST BULLETIN NO. 681.





CARDEC 125—Cardec 125 is a modular card edge connector system with contacts on .125" centers for maximum packaging density (.047" cards on solid .250" centers). In addition to the features of Cardec 200, this system offers printed circuit card voltage bus hardware for low resistance voltage distribution. As with all the Malco Plate Connector lines, Cardec 125 is supplied in your configuration completely assembled and ready for automatic wire-wrapping right out of the package. REQUEST BULLETIN NO. 681.

MALCO MANUFACTURING COMPANY INC
5150 W. ROOSEVELT RD. · CHICAGO, ILLINOIS 60650 · PHONE (312) 287-6700
MALCO PRECISION ELECTRONIC TERMINALS AND CONNECTORS

MAC
O.E.M. DIVISION

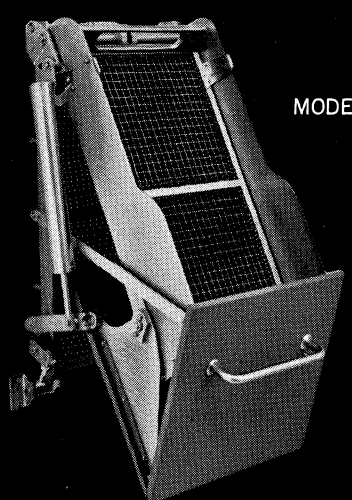
PLUGBOARD PROGRAMMING SYSTEMS

In addition to the specification detail which is included in our catalogs, you need only two pieces of information about MAC:

1. Our design engineers can suggest solutions to unique or unusual problems — solutions which are often variations on other solutions they've reached before.
2. We maintain a considerable inventory of our catalogued components, so most orders are shipped "off-the-shelf."

SERIES 157
PLUGBOARD PROGRAMMING SYSTEMS

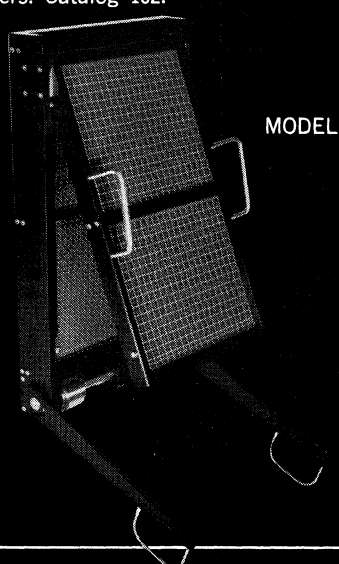
Reliable, economical program control. Taper pin terminations to external equipment. Removable plugboards patched with manual or fixed (semi-permanent) plugwires. 200 to 5120 gold or nickel plated contact positions mounted in phenolic or diallyl phthalate insulation. Catalog 101.



MODEL 908

SERIES 140
PLUGBOARD PROGRAMMING SYSTEMS

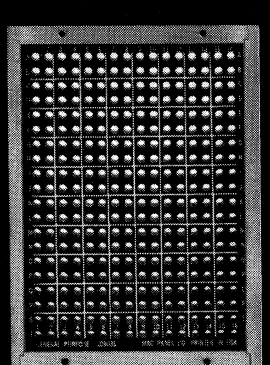
Extremely strong and compact removable plugboard programming systems. Termination choice of taper pin, Tab-D-Tent, or wrap terminals. Manual and fixed plugwires are available. 240 to 5120 gold or nickel plated contact positions mounted in phenolic or diallyl phthalate insulation on 0.250 x 0.250″ centers. Catalog 102.



MODEL 939

FIXED PLUGBOARD SYSTEMS

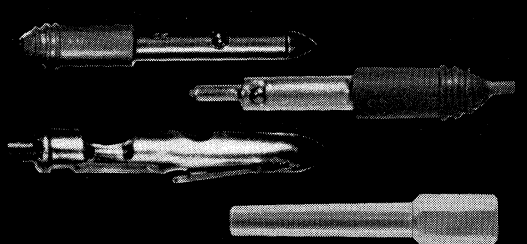
Used where program change requirements do not dictate the use of removable plugboard systems. 200 to 1280 contact positions with options as above. Catalog 101.



MODEL 803

All necessary plugwires, hardware, accessories and tooling are available for MAC Programming systems.

See your MAC representative or write for catalog data and specifications.



MAC O.E.M. DIVISION

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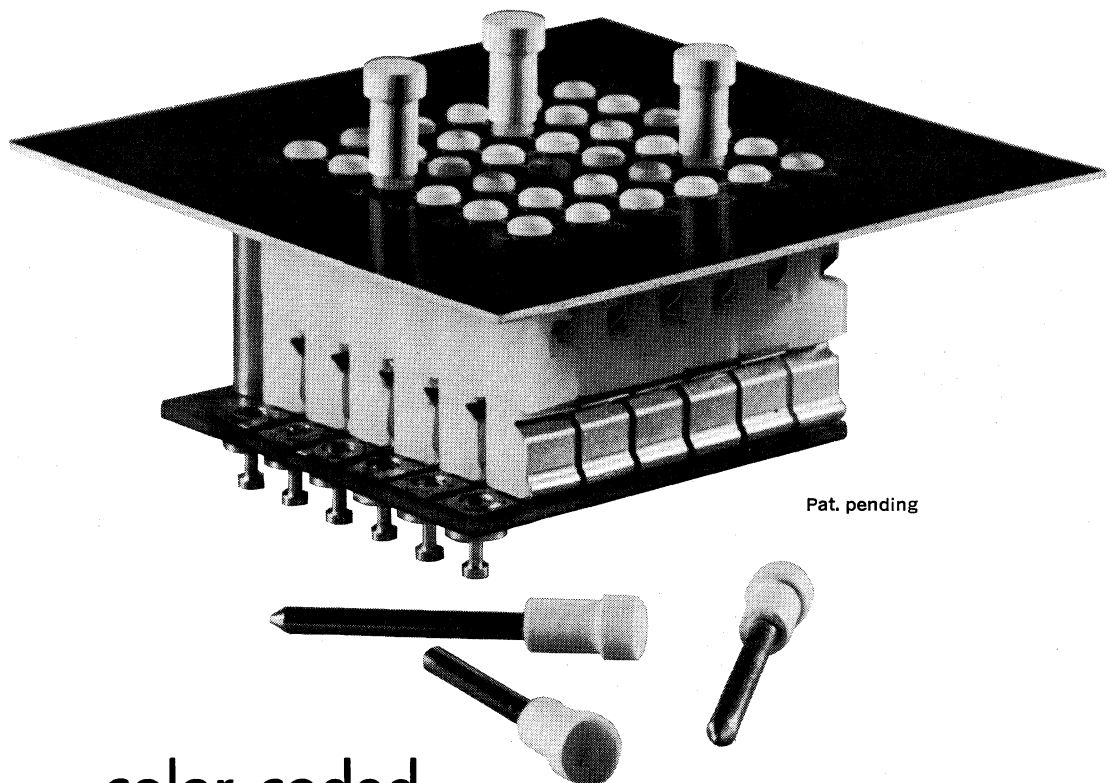
MAC goes Mod(ular)



Pat. pending

color coded

CROSSPOINT PROGRAMMING

Exclusive Features:

- Any size to 99 x 99 positions
- Modules color coded to your requirements
- 8 colors available
- Rigid, cordwood construction
- Two-layer crosspoint standard
- Three, four, five or more layers to your order

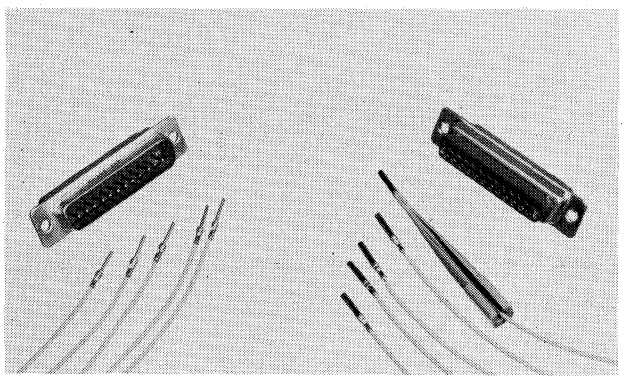
Additional Features:

- Fully guided, closed-entry contacts
- Shorting plug • Component plug
- Skip plug
- Tin-plated contacts standard
  Gold-plated contacts optional

For further information write or phone
Programming Products Division

MAC Panel Company
Box 5027 · 2060 Brentwood Street
High Point, North Carolina 27262
(919) 882-8138 · TWX (919) 883-4923

MATRIX D SUB-MINIATURE RACK & PANEL CONNECTORS TO MIL-C-24308



Matrix MD series general purpose connectors are used in applications where small size, light weight and reliability are demanded. They feature size 20 crimp contacts* that are inserted from the rear, released from the rear, and removed from the rear. They meet the specifications of MIL-C-24308.

The gold-plated Matrix MD contacts may be crimped to wire sizes 20, 22 or 24 with standard MS tools, and are quickly and easily inserted into correct position. They are held in position by high strength self-locking retainers, and are simply released from the rear with a non-conductive plastic tool which cannot damage the contact retainer.

The insulators in the Matrix MD series are of glass filled diallyl phthalate for highest mechanical and electrical strength. The socket contact apertures are chamfered at the interface to provide fail safe lead-in of pin contacts. Circuit identification is clearly printed in white on the face and rear of each dark green insulator. The yellow chromate finished cadmium plated steel shells incorporate mounting ears, and provide keystone polarization for each of the models.

**Matrix MD 308 crimp contacts conform to the dimensional and materials requirements of MS 18281, and may be used with other* MIL-C-24308 connectors. These contacts may be purchased separately from Matrix Science in production quantities.*

FEATURES OF THE MD 308

1. Crimp or Solder Contacts
2. Standard or Float Mounts
3. The Most Superior Solder Socket Design Available
4. Non-Magnetic Shells
5. Intermateable and Intermountable With Existing D Subminiature Connectors Per MIL-C-24308
6. Shell Sizes Of 9, 15, 25, 37, 50
7. Instant Delivery
8. A Nationwide Stocking Distributor Program

MD308 G F —25 P 1 ***NUMBER SYSTEM

Connector modification (Consult factory)

Type of contact.
1 designates solder.
2 designates crimp.

Mating half of connector.
P designates with pin contacts.
S designates with socket contacts.

Contact arrangement and model.
09 for 9 contact model.
15 for 15 contact model.
25 for 25 contact model.
37 for 37 contact model.
50 for 50 contact model.

"IF" (if specified) = Floating mount shells

Class designation.
G for general purpose connectors with steel shells.
N for non-magnetic connectors with gold plated brass shells and Beryllium Copper socket contact sleeves.

Series prefix.

PERFORMANCE SPECIFICATIONS:

VOLTAGE RATING
Sea Level: 1,000 VAC
At 70,000 Feet: 325 VAC

CURRENT RATING
Size 20 contacts: 7.5 amperes, max.

CONTACT RETENTION STRENGTH
Contact will not pull out upon application of 10 pounds force in the direction of mating forces.

CONTACT DURABILITY
No mechanical or electrical defects harmful to the operation of the connector after 500 cycles of engagement and disengagement, per MIL-C-24308, Para. 3.5.10.

CONTACT ENGAGEMENT & SEPARATION FORCE
Minimum: .50 ounces (with minimum dia. pin)
Maximum: 12.0 ounces (with minimum dia. pin)

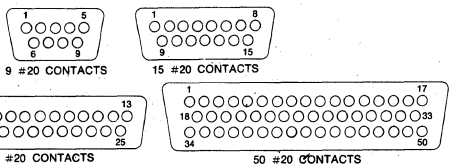
OPERATING TEMPERATURE RANGE
—67°F to 257°F

VIBRATION RESISTANCE
No interruption of electrical continuity longer than 1 microsecond. Per MIL-STD 202, method 204, condition D.

PHYSICAL SHOCK RESISTANCE
No damage or interruption of electrical conductivity longer than 1 microsecond. Per MIL-STD 202, method 213, condition G.

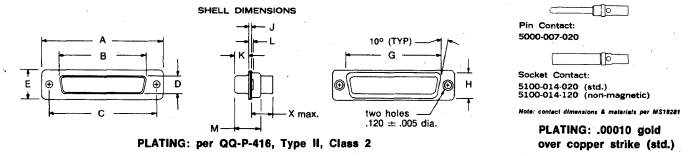
FACE VIEW OF PIN INSERTS (LAYOUTS)

MATERIALS: per MIL-P-19833, Type GDI — 30F



PART NUMBER	A ±.015	B ±.010	C ±.005	D ±.010	E ±.015	G ±.010	H ±.010	J ±.010	K ±.010	L ±.010	M ±.010	X MAX.
MD308-9P	1.213	.697	.984	.360	.494	.759	.422	.030	.236	.045	.422	.375
MD308-9S	1.213	.640	.984	.308	.494	.759	.422	.030	.243	.045	.429	.375
MD308-15P	1.541	1.025	1.312	.360	.494	1.083	.422	.030	.236	.045	.422	.375
MD308-15S	1.541	.968	1.312	.308	.494	1.083	.422	.030	.243	.045	.429	.375
MD308-25P	2.088	1.583	1.852	.378	.494	1.625	.422	.039	.231	.060	.426	.375
MD308-25S	2.088	1.508	1.852	.308	.494	1.625	.422	.030	.243	.045	.429	.375
MD308-37P	2.729	2.231	2.500	.378	.494	2.272	.422	.039	.231	.060	.426	.375
MD308-37S	2.729	2.156	2.500	.308	.494	2.272	.422	.030	.243	.045	.429	.375
MD308-50P	2.635	2.127	2.406	.484	.605	2.178	.534	.039	.231	.060	.426	.375
MD308-50S	2.635	2.062	2.406	.420	.605	2.178	.534	.030	.243	.045	.429	.375

SHELL DIMENSIONS



PLATING: per QQ-P-416, Type II, Class 2

PLATING: .00010 gold over copper strike (std.)

ASSEMBLY TOOLS

CRIMPING TOOLS:
Type MS 3198-1 with MS 3198-5P locator.
Buchanan Tool Number 612596 with 613533 locator.
Daniels Tool Number MH 780 with A 13 locator.

NON-CONDUCTIVE CONTACT REMOVAL TOOL
Use Size 20 NAS type plastic rear release removal tool, or Size 20 MS 18278 tool.
Matrix part number: 6500-017-20

MINI-MATE SUBMINIATURE ELECTRICAL CONNECTORS



MINI-MATE ASSEMBLY TOOLS
Contact insertion tool, model 90-0001-022
Contact removal tool, model 90-0002-022

FEATURES:

- ☐ Shortest and lightest subminiature connector available in today's market.
- ☐ Up to 85, low millivolt drop, removable crimp contacts on .080" centers in ⅓ the space and with ¼ the weight of miniature types.
- ☐ Simple, reliable assembly
  - Rear insertion of contacts
  - Front release
  - Rear removal
- ☐ Positive lock bayonet coupling.
- ☐ Low Engagement force.
- ☐ Electrical contact after only .020" penetration.
- ☐ Probe proof closed entry sockets.
- ☐ High performance silicone grommets and interfacial seals for environmental immunity.
- ☐ 5 key polarization.
- ☐ Hard chrome or black anodize finish.
- ☐ Uses standard crimp tool (MS-3191).
- ☐ Meets or exceeds applicable sections of MIL-C-26482, MIL-C-81511, MIL-C-38999 and NAS-1599.
- ☐ Receptacles available with glass dielectrics for hermetically sealed applications.

SHELL SIZE	NO. OF CONTACTS	Q MAX. DIA.	F MAX.	G MAX.
08	7	.750	1.050	1.323
10	19	.859	1.050	1.323
12	31	1.031	1.050	1.458
14	48	1.156	1.285	1.548
16	61	1.281	1.285	1.683
18	85	1.356	1.285	1.683

SHELL SIZE	CONTACTS NO. OF	A DIA.	R	S MAX.
08	7	.473	.594	.828
10	19	.590	.719	.954
12	31	.750	.812	1.047
14	48	.875	.906	1.141
16	61	1.000	.969	1.234
18	85	1.125	1.062	1.328

Shell Size	No. Of Contacts	A Dia.	G	H +.000 —.010	S	V Thread
08	7	.473	1.074	.539	.950	9/16-24
10	19	.590	1.199	.655	1.074	11/16-24
12	31	.750	1.387	.818	1.262	7/8-20
14	48	.875	1.512	.942	1.387	1-20
16	61	1.000	1.637	1.066	1.512	11/8-18
18	85	1.123	1.762	1.191	1.637	11/4-18

matrix SCIENCE CORPORATION
435 MAPLE AVENUE
TORRANCE, CALIF. 90503
(213) 775-2411
TWX 910-349-6953

MATRIX TERMINAL JUNCTION SYSTEMS DESIGNED TO MIL-T-81714

THE MATRIX MODULE

The Matrix Module is the basis of a new generation of interconnection system components introduced by Matrix Science Corporation in 1963. The device is the key element in a method of interconnecting an unlimited number of wires. The basic unit of a now large group of connection devices using the same concept is the MATRIX TERMINAL BLOCK. The Terminal Block was the first of these modular devices and its fundamental concepts have been used in most products now available. It is a female contact socket housed in a plastic body which incorporates a self locking retainer to hold the male member solidly in place. This device features "closed entry."

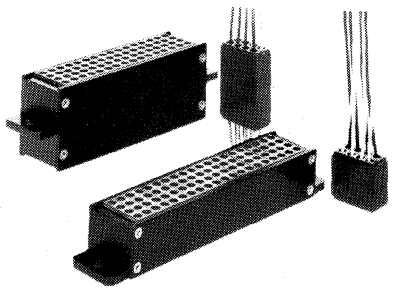
When the male contact is pushed into position with a non-conductive tool, this action produces the vitally important wiping action between male and female socket contact surfaces which improves connection integrity.

A further step to protect the environmental immunity of the connection is afforded by the addition of resilient sealing glands around all wire entries. This is an optional part of most Matrix Modules.

The first Terminal Block had eight female contacts which were all connected to a common bus plate. Split-bus units followed to provide a variety of common connection patterns within a single block.

A logical progression of product development provided means by which the Terminal Blocks became modules of multi-unit assemblies. Any number may be combined to provide connection and interconnection for an unlimited number of wires.

The apparent advantages of the Terminal Block method of making connections are in weight and space savings, plus connections that are inherently more reliable than open connections tied to terminal strips and similar devices. The most important improvement, though, is a marked increase in design and application flexibility early users found in their change to this simplified interconnection method. Because the wire termination employed requires tooling and procedures identical to those for connector pins and sockets, and because the termination can be attached to a broad range of wire sizes, the Matrix Module has been found to provide a fully compatible interconnection system.



GENERAL DESCRIPTION
TERMINAL BLOCKS, FEEDTHRU BLOCKS AND PROGRAMMING BLOCKS

Terminal Blocks — Matrix Terminal Blocks are used for general purpose interconnection and bussing. They are available in four sizes, the larger of which accommodates AWG 12 thru AWG 14 wires, and smaller sizes with which wires AWG 16 thru 26 may be used. Aluminum rails and end brackets with alpha coding for each connection point are used to mount the blocks and form multi-block assemblies.

Feedthru Blocks — Matrix Feedthru Blocks are for general purpose interconnection and bussing in applications where circuit wiring must be connected to two sides of a panel, bulkhead or patchboard. The same crimp-type male contacts used for wire termination and connection to Terminal Blocks are used for Feedthru Blocks as well as the Programming Blocks shown below. Aluminum rails and end brackets with alpha coding are used for mounting these modules, and for forming multi-block assemblies.

Programming Blocks — Matrix Programming Blocks are feedthru blocks whose connection points on one end do not include the self-locking retainers used in the other blocks. Male contacts may be plugged-in and removed from these points without tools while connections at opposing points on the blocks remain locked in place. These blocks are used in patch-boarding and similar applications (MTB Series only).



Track, Terminal Junction Module, Feedthru Type



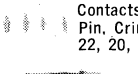
Track, Terminal Junction Module, Feedback Type



Splices, Wire, Removable Contact 22, 20, 16 and 12 Gauge



Module, Terminal Junction, Feedthru Type



Contacts, Electric, Pin, Crimp, Removable 22, 20, 16 and 12 Gauge

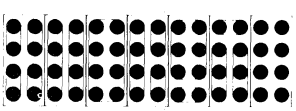


Module, Terminal Junction, Feedback Type



Insertion and Removal Tools

STANDARD BUSSING ARRANGEMENTS



02 03 04 05 06 07 01

MODULE LINE NOMENCLATURE
Multi-Block Assembly
MTB 20 E * - ***

- **NUMBER SYSTEM**
  - 3 digits indicates deviation number mixed blocks on bussing
  - 2 digits indicates buss arrangement all blocks identical
- Number of module blocks per row
- Number of module block rows wide
- "A" for Non-Environmental
  "E" for Environmental
- Size 20 for 20 AWG wire
  Size 16 for 16 AWG wire
- Style MTB std. terminal block
  Style MFB std. feed-thru block
  Style MPB program block
  Style MAP adapter block

Frame Assembly Kit
MTB20E***

Same as above, except less module blocks.

Individual Module Block Assembly
MTB 20 E **

- **Number System**
  2 digits indicates buss arrangement. Ref.: 01, 02, 03, 04, 05, 06 and 07.
- "A" for Non-Environmental
  "E" for Environmental
- Size 20 for 20 AWG wire
  Size 16 for 16 AWG wire
- Style MTB std. terminal block
  Style MFB std. feed-thru block
  Style MPB program block
  Style MAP adaptor block

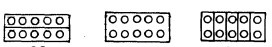
FOR MTB, MFB, MPB and MRTB, MRFB & WIRE SPLICES:
TERMINATION TOOLS and PIN CONTACTS

WIRE SPLICES: MATRIX WIRE SPLICE MWS**E

PART NO.	CONTACT SIZE
MWS22E	22
MWS20E	20
MWS16E	16
MWS12E	12

EXPLANATION OF PART NUMBER=
MWS ** E
- E — ENVIRONMENTAL SERIES WIRE SPLICE
- ** — WIRE SPLICE/CONTACT SIZE
- MWS — MATRIX WIRE SPLICE

MRTB SERIES: Module, Removable Feed-Back Type MRTB**E**
BUSSING ARRANGEMENTS - Size 20 & 22



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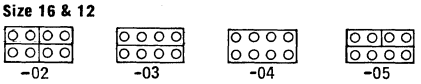
Size 16 & 12



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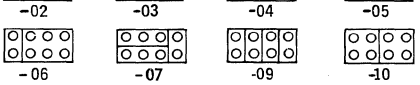

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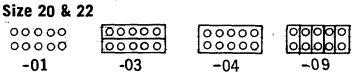
EXPLANATION OF PART NUMBER=
MRTB ** E **
- ** — Bussing Arrangement (See Tab Box)
- E — Environmental Series Module
- ** — Module/Contact Size
- MRTB — Matrix Removable Terminal Block

MRTB-10: Rail Assembly, Feed-Back Module

MRFB SERIES: Module, Removable Feed-Thru Type MRFB**E**
BUSSING ARRANGEMENTS

Size 20 & 22



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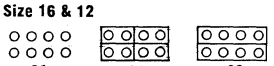
Size 16 & 12



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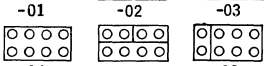

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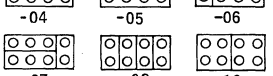


-07 -09 -10

EXPLANATION OF PART NUMBER=
MRFB ** E **
- ** — Bussing Arrangement (See Tab Box)
- E — Environmental Series Module
- ** — Module/Contact Size
- MRFB — Matrix Removable Feed-Thru Block

MRFB-10: Rail Assembly, Feed-Thru Module

TOOL INSERT/REMOVE	CONTACTS	CRIMP TOOL
SIZE 20 6500-001-20	5000-018-22 — 22-24-26 AWG WIRE	MS-3191 or MS-3198
SIZE 16 6500-001-16	5000-018-20 — 20-22-24 AWG WIRE	
SIZE 12 6500-001-12	5000-018-16 — 16-18-20 AWG WIRE	
	5000-018-12 — 12-14 AWG WIRE	

matrix science corporation

mueller clips

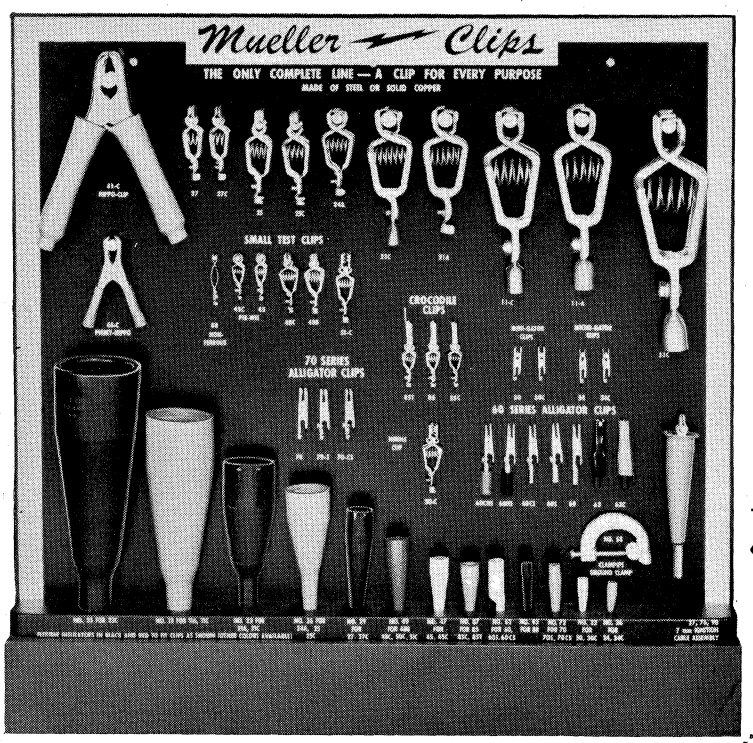
THE WORLD'S LARGEST AND ONLY COMPLETE LINE

MANUFACTURED FOR GENERAL SALE SINCE 1908

• AVAILABLE AT JOBBERS EVERYWHERE •

"WE BEGIN WHERE THE WIRE ENDS"

(For detailed information, refer to the Mueller Clip pages in the "Radio Electronic Master.")



IN UNIVERSAL USE FOR ALL KINDS OF QUICK, TEMPORARY ELECTRICAL CONNECTIONS. PLATED STEEL AND SOLID COPPER. INSULATORS IN STANDARD RED AND BLACK, AND IN SPECIAL COLORS — WHITE, BLUE, YELLOW AND GREEN.

"Mini-gator" and "Micro-gator" clips to fit the smallest crevices in tightly compacted equipment. Separate insulators for skin-tight, complete insulation.

Alligator Clips, including completely insulated model.

Crocodile Clips. (Nesting teeth.)

"Pee Wee" Clips, including completely non-ferrous type.

General purpose test clips with meshing teeth.

Needle Clips — Twin Clip — Geophone Clips.

Clips for Battery Booster Cables and Chargers.

Heavy duty Test and Battery Clips.

Large welding ground clamps.

Appliance ground clamps.

Separate flexible insulators.

NO. 123 DISPLAY-SELECTOR BOARD, a permanent, gloss-finish board of our entire line. Shipped complete, set up, with items in place over their printed code numbers. We absorb much of the cost, charging only $10.00 net postpaid in order to provide a unit which solves all quick-testing and clip-terminal problems for engineering and design departments, manufacturers and laboratories. Order direct from factory.

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Charlotte, North Carolina 28205 — Cartwright & Bean, 625 Harwyn Drive
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Columbus, Ohio 43227 — H. H. Seay Co., 1350 Crestwood Ave.
Denver, Colorado 80221 — L. B. Putnam Co, 7111 Larsh Drive
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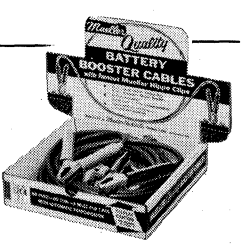
QUALITY BATTERY BOOSTER CABLES . . .



Heavy duty design for the commercial or industrial user who knows what he wants. Finely stranded pure copper cable with rubber insulation for maximum flexibility in coldest weather. 6 ga. 259 strands #30 wire, 4 ga. 413 strands #30. Mueller Hippo-Clips strongly clinched to cable and soldered for maximum current flow. Three models: 8' and 12' 6 ga. 100 amp.; 12' 4 ga. 200 amp.

Our Reader Service Department will answer your technical questions, and will honor your request for the latest catalog of our complete line.

FREE SAMPLE CLIPS AVAILABLE

Factory will supply free sample clips for your inspection. Refer to complete listing in "Radio Electronic Master."

AVAILABLE AT JOBBERS EVERYWHERE

Mueller Electric Co.

FACTORY

1589H East 31st St., Cleveland, Ohio 44114

Telephone: PRospect 1-5225 (Area Code 216)

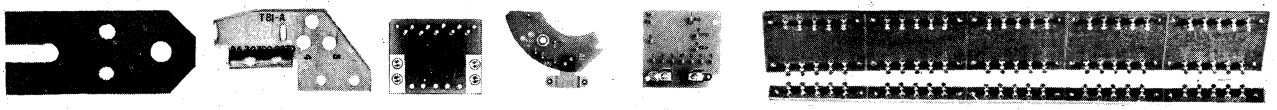

That's right. It's a commercial connector.
Our Molex Standard. Millions are finding their way into some of the most exciting circuitry man can imagine. For that's our business: creating connectors that simplify wiring. Speed production. Assembly. Installation. Servicing.
For the men who are looking for new ideas and ways to cut costs.
In the area of one circuit to sixty connections or more, Molex has the product. And the design and engineering capabilities to solve the most complex wiring and production problems . . . fast! We'd like to talk to you about it.
If you would like a free sample of our Molex connector, please write or phone (312) 969-4550. You can make connections at . . .
molex
M152
MOLEX PRODUCTS COMPANY
Downers Grove, Illinois 60615


They're new, Molex edge connectors.
For printed circuit boards. Terminals crimped
to wires automatically. We have straight-in and
right-angle types. With and without mounting ears.
It's another giant step by Molex in helping create
high-speed, low-cost devices that simplify circuitry.
Reliable? You bet. The connector has bifurcated
terminals that provide solid contacts. Yet you can
slip the connector on and off many times without
damaging printed circuits. And it's not
a preloaded unit. Carries only contacts
required. From nine to twenty-two.
If you want to save assembly time, steps and money,
take a close look at this new Molex edge connector.
For free samples, write or you can make connections
by calling (312) 969-4550.
molex
MOLEX PRODUCTS
COMPANY
Downers Grove, Ill. 60615
M155A

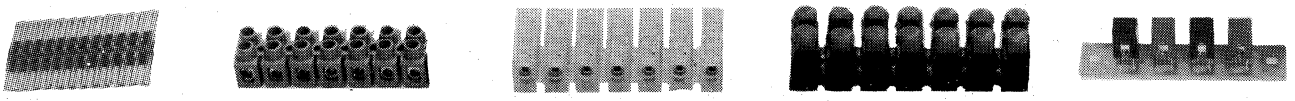

We call it INCONECT®. Our new Molex modular system that provides five ways of interconnecting electrical-electronic printed circuit assemblies: Two ways to connect circuit boards to chassis, three ways to interconnect printed circuit boards. It's a giant step forward in helping speed production and assembly techniques in the area of printed circuits. Unique flexibility enables you to tailor connector components to your specific product needs. Easily. Simplifies assembly, testing, servicing and model change requirements. It's another example of the Molex creative approach to circuitry problems. One that demonstrates just how reliable and economical printed circuit connections can really be. But see for yourself. Write for details. Or you can make connections by calling (312) 969-4550.
molex
M156
MOLEX PRODUCTS COMPANY
Downers Grove, Ill. 60615

ntt NATIONAL TEL-TRONICS CORP.

56 ST. CASIMIR AVE., YONKERS, N. Y.



FABRICATED PARTS — TERMINAL BOARDS — SCORED BOARDS

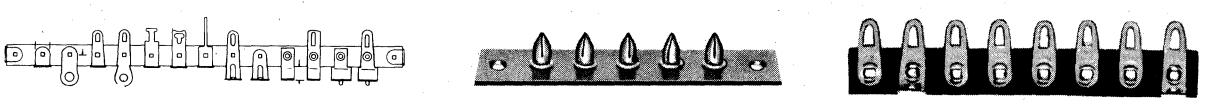


FLEXIBLE QUICK DISCONNECT — FLEXIBLE SCREW TYPE — QUICK CONNECT SLOT TYPE — PUSH BUTTON

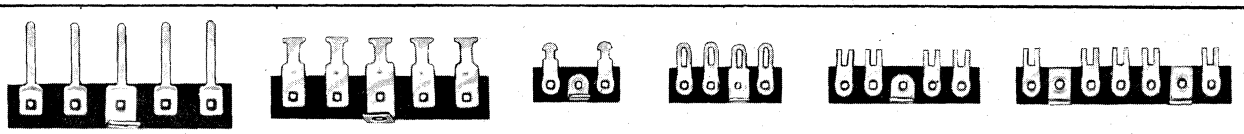
PUSH BUTTON TERMINAL BLOCKS — FLEXIBLE/TERMINAL BLOCKS



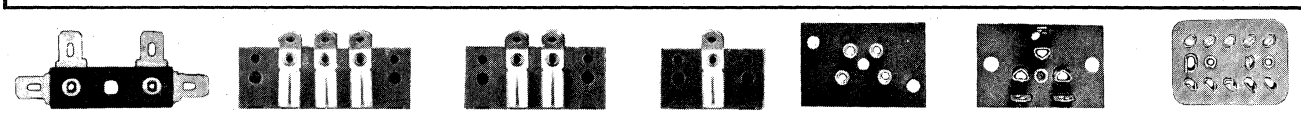
BINDING POST BOARDS — HEAVY DUTY BINDING POST BOARDS



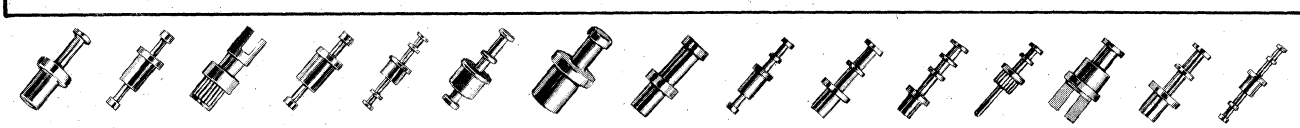
CONICAL TERMINAL STRIPS — STANDARD TERMINAL STRIPS



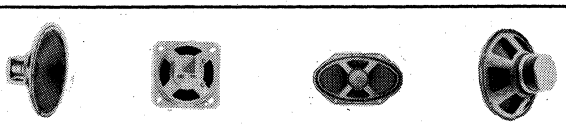
SPECIAL TERMINAL STRIPS — MINIATURE TERMINAL STRIPS



DISCONNECT STRIPS — CONTACT STRIPS — PIN PLUG AND SOCKET



TURRET TERMINALS IN MIL AND COMMERCIAL SPECS



STANDARD AND HIGH FIDELITY SPEAKERS

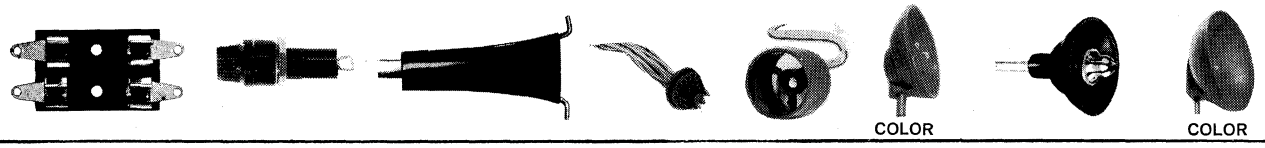
A full line. Send for complete catalog.

The National Tel-Tronics product line appears in full detail with complete specifications in THE RADIO MASTER 1969 EDITION.

NATIONAL TEL-TRONICS CORP.

56 ST. CASIMIR AVE., YONKERS, N. Y.

ntt



FUSE HOLDERS AND MOUNTING BASES

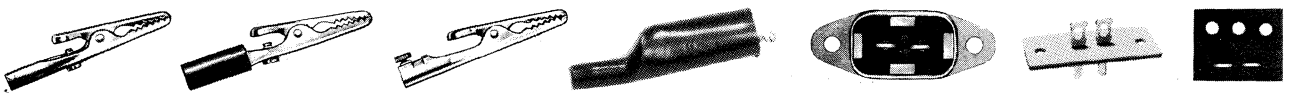
ANODE CONNECTORS



TIP AND BANANA PLUGS AND JACKS

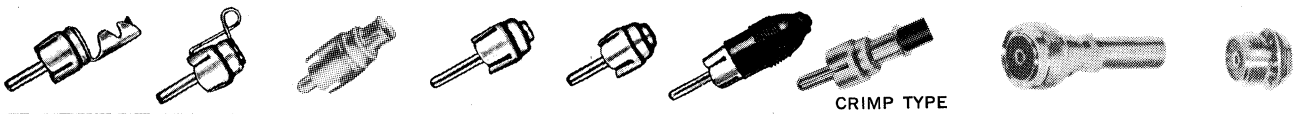


BINDING POSTS



ALLIGATOR CLIPS

INTERLOCK PLUGS

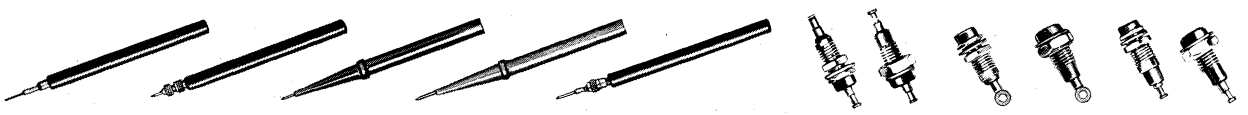


COMPLETE LINE OF PHONO PLUGS

MICROPHONE CONNECTORS

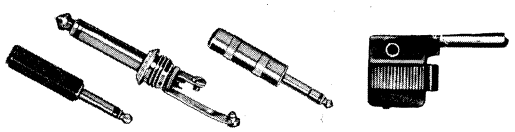


COMPLETE LINE OF PHONO CONNECTORS AND JACKS

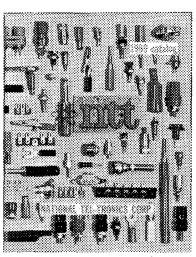


TEST PRODS AND SETS

NYLON TIP JACKS



TELEPHONE PLUGS





TELEPHONE JACKS

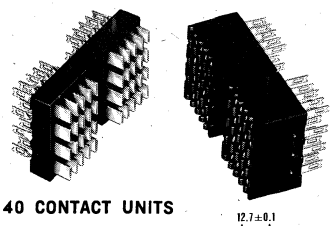
HARDWARE FOR COLOR T.V.

Terminal strips, interlocks, light shields, anode connectors, and specials to your specifications.

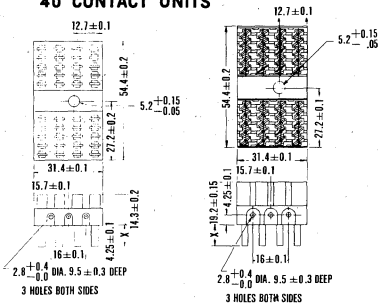
We have illustrated on these two pages the various categories of parts that National Tel-Tronics manufactures. For more detailed information send for our 54 page catalog.

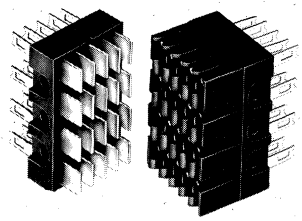
CONNECTORS — MULTI-CONTACT—MULTI-PURPOSE

BASIC CONNECTORS—MODULE UNITS

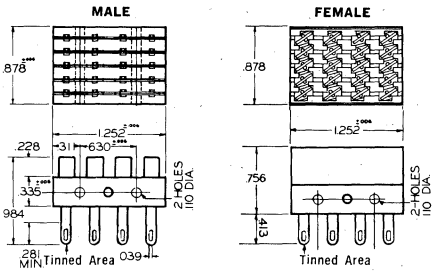


40 CONTACT UNITS





20 CONTACT UNITS



SPECIFICATIONS

Ambient Temperature Range — −55°C to +85°C.

Insulation Resistance — Greater than 5 x 10^5 megohms at 500 V.D.C. conductor to frame and between conductors with a 35% relative humidity at 25°C.

Dielectric Strength — Measured between conducting parts and frame, breakdown voltage is in excess of 2000 volts R.M.S. when measured for one minute at sea level.

Contact Resistance — Measured between soldering points, average resistance is 14 milliohms (silver) 7 milliohms (gold), measured with an open circuit voltage of .100 volts and a short circuit current of .100 Amperes D.C.

Contact Rating — Measured on a single contact basis with contact in rest position, the current rating is three (3) amperes. When several adjacent contacts are required to carry the same maximum load, current rating should be reduced to two amperes (2) per contact. Maximum permissible circuit breaking current on each contact is 500 millamperes at 48 V.D.C.

Mechanical Life — Standard connector unit withstands 4000 plug-in operations with negligible mechanical wear.

Finish — On all metal parts, where practical zinc plate, chromate to MIL-F-14072 is used, to ensure maximum resistance to corrosion.

Size — See specifications on next page. Weight 1 lb. (100 pin connector, plug and receptacle).

Capacitance — Measured between contacts and frame, 3.2 PF average at 1 kilocycle.

Contact Pressure — 250 grams (average).

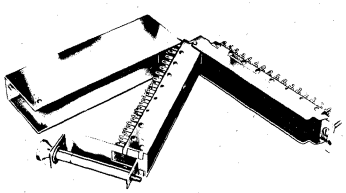
Initial Engagement Force — 70 grams per individual contact (approx.).

Retention Force — 50 grams per individual contact measured by straight pull test.

Terminals — Available with solder to taper tab terminals in mill-tinned Nickel Silver or Gold Plated Nickel Silver.

TYPE D & E CONNECTORS

These compact and highly efficient plug and receptacle type connectors are designed for electronic applications of cable-to-fixture to provide maximum connection concentration in minimum space. They are available in 40, 60, 80 and 100 contact assemblies with either solder or taper tab terminals. A permanent cable clamp is adjustable to accommodate varied cable sizes.

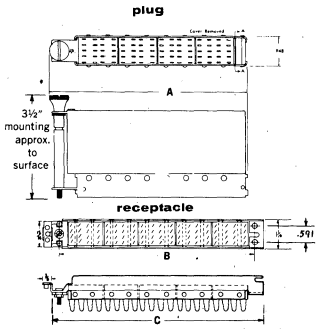




TYPE D CONNECTORS

This connector features a handy locking bolt for securing the plug to the receptacle and a removable cover with captive screw for rapid wiring or inspection.

dimensions type D

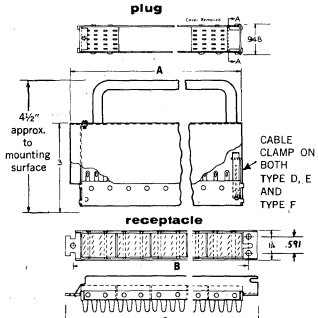


CONNECTOR	DIM A	DIM B	DIM C
40	3.949	3.042	3.514
60	5.209	4.302	4.774
80	6.469	5.562	6.004
100	7.729	6.822	7.294

TYPE E CONNECTORS

The handy drawer type handle on the plug of this connector unit permits instant plug-in and disconnect for rapid change of pre-programmed components or systems.

dimensions type E



CONNECTOR	DIM A	DIM B	DIM C
40	3.324	3.042	3.484
60	4.584	4.302	4.744
80	5.844	5.562	6.004
100	7.104	6.822	7.264

PRICES

20 TERMINAL CONNECTOR UNITS

Stock Number	Contact Material	Description	List Price
001411	Silver	Male Jack	$ .39 each
001412	Silver	Female Socket	.39 each
508939	Gold	Male Jack	1.00 each
508942	Gold	Female Socket	1.00 each

40 TERMINAL CONNECTOR UNITS

Stock Number	Contact Material	Description	List Price
526968	Silver	Female Socket	$ .75 each
526969	Silver	Male Jack	.75 each
557855	Gold	Female Socket	2.00 each
557856	Gold	Male Jack	2.00 each

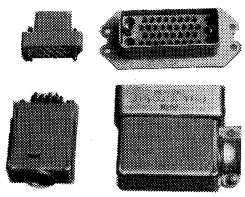
PRICES

CONNECTOR OPTIONS				TYPE D		TYPE E	
Number of Pins	Pin Type	Male or Female	Plug or Receptacle	Part Number	Price	Part Number	Price
040	S	F	P	513945	$5.40	521165	$6.05
040	S	M	R	513947	2.20	513948	1.45
040	T	F	P	517463	5.40	521166	6.05
040	T	M	R	517839	2.20	517818	1.45
040	S	M	P	517455	5.40	521167	6.05
040	S	F	R	517840	2.20	513975	1.45
040	T	M	P	517471	5.40	521168	6.05
040	T	F	R	517841	2.20	517820	1.45
060	S	F	P	513925	6.10	521169	6.70
060	S	M	R	513927	2.90	513928	2.10
060	T	F	P	517464	6.10	521170	6.70
060	T	M	R	517843	2.90	517822	2.10
060	S	M	P	517456	6.10	521171	6.70
060	S	F	R	517844	2.90	513976	2.10
060	T	M	P	517472	6.10	521172	6.70
060	T	F	R	517845	2.90	517824	2.10
080	S	F	P	512241	6.70	521173	7.30
080	S	M	R	512240	3.40	513934	2.75
080	T	F	P	512238	6.70	521174	7.30
080	T	M	R	512237	3.40	513935	2.75
080	S	M	P	517457	6.70	521175	7.30
080	S	F	R	517848	3.40	513977	2.75
080	T	M	P	517473	6.70	521176	7.30
080	T	F	R	517849	3.40	517827	2.75
100	S	F	P	513936	7.55	521177	8.10
100	S	M	R	513938	4.35	513939	3.50
100	T	F	P	517466	7.55	521178	8.10
100	T	M	R	517852	4.35	517829	3.50
100	S	M	P	517458	7.55	521179	8.10
100	S	F	R	517853	4.35	513978	3.50
100	T	M	P	517474	7.55	521180	8.10
100	T	F	R	517854	4.35	517831	3.50

NORTH ELECTRIC Electronetics Division/Galion, Ohio 44833/419-468-8100
A subsidiary of United Utilities, Incorporated

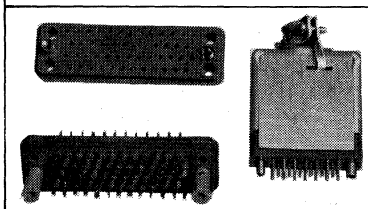
RACK and PANEL CONNECTORS

For QUICK REACTION to your connector needs, come to POSITRONIC INDUSTRIES. Military and Industrial quality Rack and Panel connectors readily available as standard catalog products. Any catalog listed connector may be promptly modified for our customer's special applications. Most cataloged connectors shipped within 10 days. Special connectors will be designed and shipped 21 to 90 days after design approval.



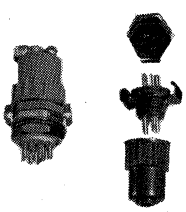
RECTANGULAR REMOVABLE CONTACTS

Mil-C-22857, 14, 18, 20, 26, 34, 50, 66, 75 and 104 contacts. Crimp and solder contacts for #16 through #24 AWG wire. Hoods, shells, guide pins, sockets and polarizing jackscrews available. DAP molded connector bodies.



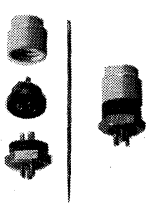
MINIATURE RECTANGULAR

Mil-C-8384, 7 to 50 contacts. Guide pilots, sockets, hoods, shells, and screw locks standard accessories. Solder pot #20 AWG wire contacts. MME and DAP moldings.



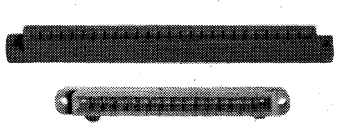
MINIATURE HEXAGONAL

Mil-C-8384, 4 to 9 solder pot contacts #20 AWG wire. Threaded bodies 3/8-24, 1/2-20 in MME and DAP. Mounting accessories and hoods available.



SUBMINIATURE HEXAGONAL

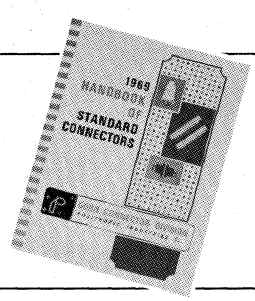
2 and 3 solder pot contacts #24 AWG wire. 1/4-20 threaded body in MME and DAP. Hood and mounting accessories available. 5/16 Hex dia. length mated connectors including hood 5/8 max.



PRINTED WIRING & TEST POINT

6, 8, 10, 12, 15, 18, 22, 25 contacts, tuning fork, .156 and .150 spacing. 1/16 thick boards. MME and DAP bodies.

Free 32 page Handbook of Standard Connectors containing complete electrical and physical data of our connectors is available upon request.



Write, telegraph or telephone us at

GORN CONNECTOR DIVISION
POSITRONIC INDUSTRIES, Inc.
1906 S. STEWART, SPRINGFIELD, MISSOURI 65804 • PHONE: 417-883-3434

POMONA ELECTRONICS

¾" SPACED MOLDED BANANA PLUGS

Pomona Banana Plug and stack-up accessories are of the highest quality — tough thermoplastic — molded directly on to the metal body of plugs and connectors for maximum strength, moisture resistance and insulative properties:

General Specifications listed below apply to items using banana plugs in this catalog.

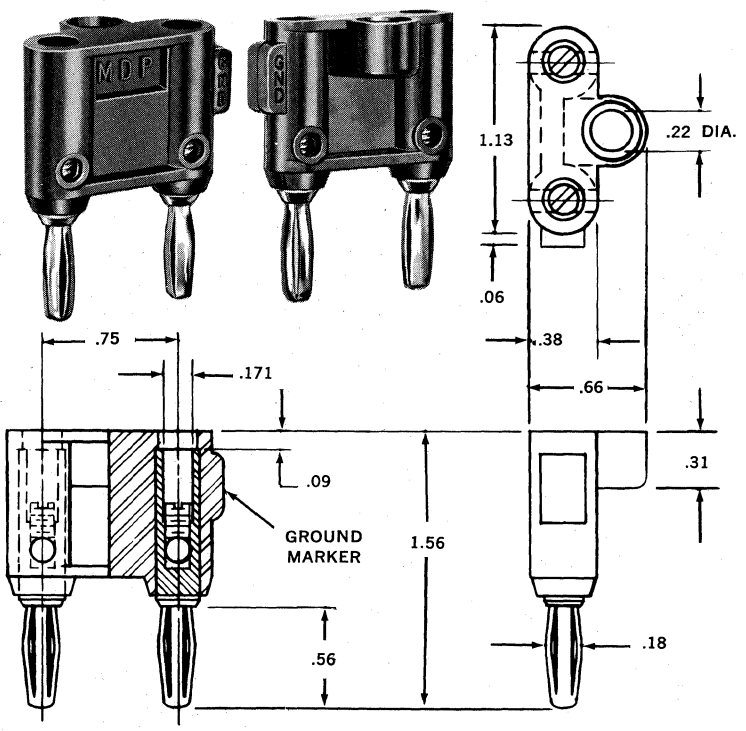
FEATURES . . .

- One piece beryllium copper heat treated spring for maximum long life.
- Rounded spring design results in maximum contact area.
- STACK-UP feature allows an unlimited number of connections at the same electrical point.

SPECIFICATIONS . . .

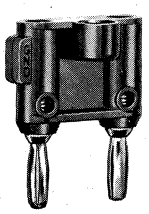
- Fits standard 0.166 dia. banana jacks.
- Spring, beryllium copper alloy 170 per QQ-C-533.
- Plug body, Brass per QQ-B-626. Comp. 22.
- Nickel plated per QQ-N-290, Class 2.
- Contact resistance less than 0.001 ohms per banana plug.

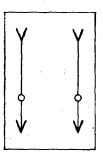
ACTUAL SIZE



RATINGS	Models: MDP; MDP-ST; 1330; 1330-ST; 2970
■ Capacity :	0.8 pf to 10 MC
■ Current :	15 Amps. Cont., 30 Amps. Int.
■ Voltage :	5000 W.V. D.C.
■ Temperature :	—25°C to +85°C, operating temp.

DOUBLE BANANA PLUG



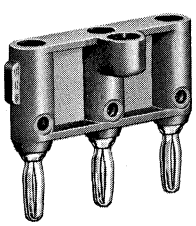


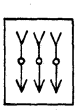
Double banana plug on ¾" centers; set screws secure leads; simplifies cable construction or component mounting; banana jacks permit top Stack-Up for multiple connections.

COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

MODEL MDP (Specify Color) QUANTITY DISC. CODE **A** **NET .75**

TRIPLE BANANA PLUG



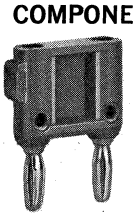


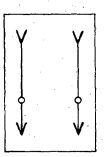
Triple banana plug on ¾" centers; set screws secure leads. Ideal for balanced line 2 conductor shielded cable assemblies. Banana jacks permit top Stack-up for multiple connections.

COLORS: Black, Red.

MODEL 2970 (Specify Color) QUANTITY DISC. CODE **A** **NET 1.25**

COMPONENT MOUNTING DOUBLE BANANA PLUG



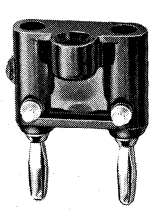


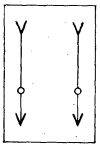
Double banana plug on ¾" centers; set screws secure leads; features recess for mounting small components; banana jacks permit top Stack-Up for multiple connections.

COLORS: Black, Red

MODEL 1330 (Specify Color) QUANTITY DISC. CODE **A** **NET .75**

DOUBLE BANANA PLUG WITH SOLDER TURRET TERMINALS



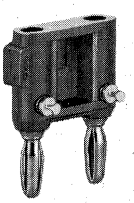


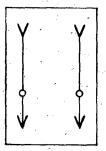
Similar to Model MDP, except has solder turret terminals for permanent noise-free connections of cables and components. Double banana plug on ¾" centers; banana jacks permit top Stack-Up for multiple connections.

COLOR: Black

MODEL MDP-ST QUANTITY DISC. CODE **A** **NET .85**

COMPONENT PLUG WITH SOLDER TURRET TERMINALS





Similar to Model 1330, except has solder turret terminals for permanent noise-free connections of components, etc. Double banana plug on ¾" centers: Banana jacks permit top Stack-Up for multiple connections.

COLORS: Black, Red.

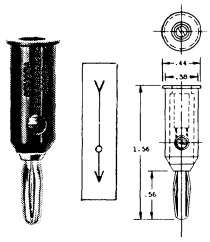
QUANTITY DISC. CODE **A**

MODEL 1330-ST (Specify Color) **NET .85**

POMONA ELECTRONICS

BANANA PLUG ACCESSORIES

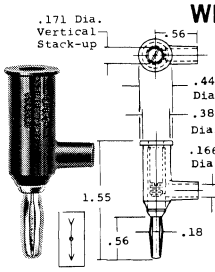
SOLDERLESS BANANA PLUG —STACK-UP



Wire firmly held in place with internal set screw, eliminating soldering. Assembly of test leads simplified.
UPPER: Banana jack, .166 dia.; Brass, nickel plated.
LOWER: Banana plug, one piece nickel plated beryllium copper spring for use with standard 0.166 dia. banana jack.
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

MODEL 1325 (Specify color) QUANTITY DISC. CODE **A** **NET .50**

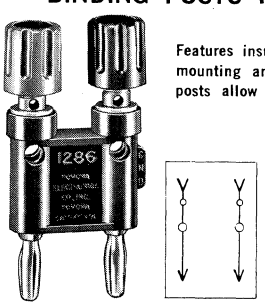
SOLDERLESS BANANA PLUG WITH SAFETY COLLAR —STACK-UP



Features: Integral safety collar insulates exposed wire leads. Wire firmly held in place with internal set screw, eliminating soldering. Assembly of test leads simplified.
UPPER: Banana jack, .166 dia.; Brass, nickel plated.
LOWER: Banana plug, one piece nickel plated beryllium copper spring for use with standard 0.166 dia. banana jack.
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

MODEL 1825 (Specify Color) QUANTITY DISC. CODE **A** **NET .50**

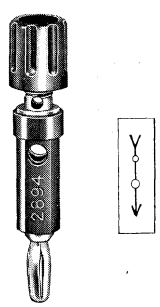
BINDING POSTS TO DOUBLE BANANA PLUG



Features insulated binding posts on ¾" centers for rapid mounting and interchangeability of components. Binding posts allow top Stack-Up for multiple connections. Side Stack-Up provided by thru-holes in plug body.
UPPER: Insulated double binding posts, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: Double banana plug, on ¾" centers.
COLORS: Body, Black. Binding Posts, Black/Red.

MODEL 1286 QUANTITY DISC. CODE **A** **NET 2.50**

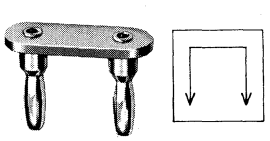
BINDING POST TO SINGLE BANANA PLUG



Features insulated binding post. Binding post allows top Stack-Up for multiple connections. Side Stack-Up provided by thru-hole in plug body.
UPPER: Insulated binding post. Cross hole (.166 dia.) in body provides side Stack-Up connections.
LOWER: Single banana plug, one piece nickel plated beryllium copper spring for use with standard 0.166 dia. banana jack.
COLORS: Black, Red.

MODEL 2894 (Specify color) QUANTITY DISC. CODE **A** **NET 1.50**

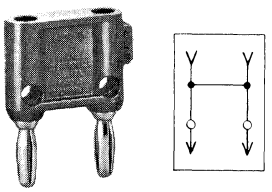
METAL SHORTING BAR



Low profile, nickel plated brass shorting bar. Double banana plugs on ¾" centers swaged to 3/32" thick brass bar. Resistance, less than 1.5 milliohms installed. Current rating: 15 Amps. Cont., 30 Amps. Int.

MODEL 1855 QUANTITY DISC. CODE **A** **NET .75**

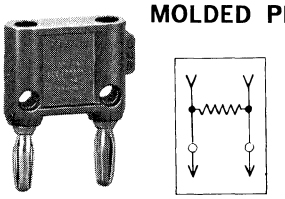
INSULATED SHORTING BAR



Ideal as a connecting link for use with ¾" spaced banana jacks. Banana plugs internally solder-bonded with #14 AWG wire. Banana jacks provide top Stack-Up. Cross holes (.166 dia.) in body provide side Stack-Up connections. Resistance less than 1.5 milliohms installed. Current rating 15 Amps. Cont., 30 Amps. Int. "Shorting Bar" marked on top of plug.
COLORS: Natural, Black, Red.

MODEL MDP-S (Specify Color) QUANTITY DISC. CODE **A** **NET 1.25**

MOLDED PRECISION RESISTOR

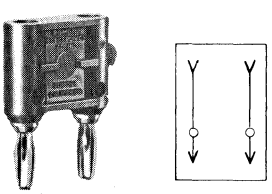


Ideal where rapid interchange of resistance values is required. Used in breadboarding, R & D labs., Standards, Terminations, etc. Deposited carbon 1% resistor, ½ watt, molded internally. Resistor soldered to double banana plug, on ¾" centers. Top Stack-Up provided for multiple connections. Cross holes (.166 dia.) in body provide side Stack-Up connections. Resistance value stamped on top of plug.

(OHMS)				
50	200	1K	100K	1 Meg.
75	250	5K	200K	2 Meg.
120	500	10K	250K	5 Meg.
130	600	20K	500K	10 Meg.
150	900	50K		

MODEL MDP-R (Specify Value) QUANTITY DISC. CODE **A** **NET 2.75**

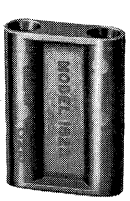
ADAPTER — .080 TIP JACKS TO DOUBLE BANANA PLUG



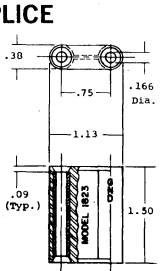
Permits .080 Tip plugs to be used with equipment having banana jacks.
UPPER: Tip jacks, beryllium copper, gold flashed; spaced on ¾" centers to accept .080 dia. pin tip plugs.
LOWER: Double banana plug, on ¾" centers, nickel plated. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLOR: Black.

MODEL 1845 QUANTITY DISC. CODE **A** **NET .85**

DOUBLE BANANA PLUG SPLICE

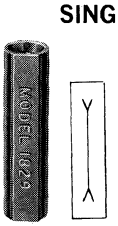


Provides rapid method for splicing cables. Reduces necessity of storing extra long cables. Molded thermo-plastic body eliminates shock hazard by completely enclosing banana plug contact. Brass, nickel plated banana jacks. .166 dia., on ¾" centers.
COLORS: Black, Red.

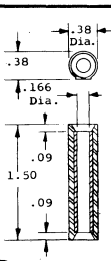


MODEL 1823 (Specify color) QUANTITY DISC. CODE **A** **NET .50**

SINGLE BANANA PLUG SPLICE



Provides rapid method for splicing single banana plug patch cords. Reduces the necessity of storing extra long patch cords. Molded thermo-plastic body eliminates shock hazard by completely enclosing banana plug contact. Brass, nickel plated banana jack, .166 dia.
COLORS: Black, Red.
Standard Package: 10 (per color)

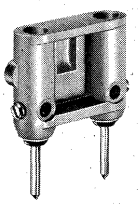


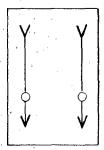
MODEL 1829 (Specify color) QUANTITY DISC. CODE **A** **NET .25 ea.**

POMONA ELECTRONICS

.080 PIN TIP PLUG ACCESSORIES

COMPONENT MOUNTING — TIP JACKS TO DOUBLE PIN TIP PLUG — SET SCREWS

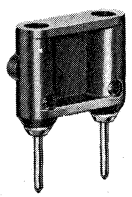


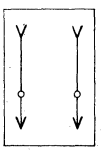


Features set screws on side of body to secure leads or components. Recess permits mounting of small component parts.
UPPER: Tip jacks, beryllium copper, gold flashed, spaced on ¾" centers, to accept .080 dia. pin tip plugs.
LOWER: Pin tips, .080 dia. on ¾" centers. Brass, nickel plated.
COLORS: Black, Red.

MODEL 2192 (Specify color) QUANTITY DISC. CODE **A** **NET 1.85**

COMPONENT MOUNTING PLUG— BANANA JACKS TO DOUBLE PIN TIP —SET SCREWS

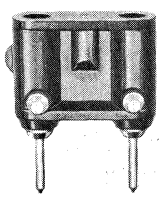


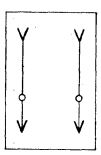


Permits single or double banana plugs to be used in equipment having tip jacks. Features recess for component mounting. Internal set screws firmly secure wire leads.
UPPER: Banana jacks, .166 dia., on ¾" centers. Brass, nickel plated.
LOWER: Pin tips .080 dia. on ¾" centers. Brass, nickel plated.
COLOR: Black.

MODEL 1858 QUANTITY DISC. CODE **A** **NET .75**

PLUG — COMPONENT MOUNTING — DOUBLE PIN TIP PLUG—SOLDER TURRETS

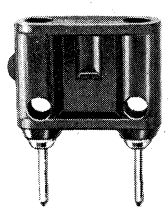


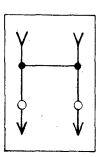


Features recess for mounting components. Gold flashed solder turrent terminals for permanent noise-free connections.
UPPER: Tip jacks, beryllium copper, gold flashed; spaced on ¾" centers to accept .080 dia. pin tip plugs.
LOWER: Pin tips, .080 dia. brass, nickel plated.
COLORS: Black, Red.

MODEL 1904 (Specify color) QUANTITY DISC. CODE **A** **NET .85**

INSULATED SHORTING BAR

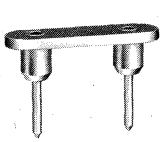


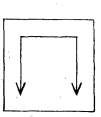


Used as a connecting link with equipment having tip jacks. Plugs internally solder bonded with 14 AWG wire. Top stack-up feature.
Current rating: 5 AMPS. cont., 10 AMPS. int. "Shorting Bar" marked on top of plug.
UPPER: Banana jacks, .166 dia. on ¾" centers. Brass, nickel plated.
LOWER: Pin tips, .080 dia. on ¾" centers. Brass, nickel plated. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLORS: Black, Red.

MODEL 1730 (Specify color) QUANTITY DISC. CODE **A** **NET .75**

METAL SHORTING BAR

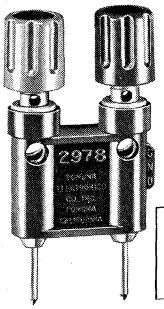


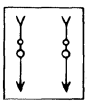


Used as a connecting link with equipment having tip jacks. Low profile, nickel plated brass shorting bar. Double pin tip plugs on ¾" centers swaged to 3/32" thick brass bar.
RESISTANCE: Less than 1.5 milliohms installed.
CURRENT RATING: 5 Amps Cont., 10 Amps Int.

MODEL 2072 QUANTITY DISC. CODE **A** **NET .75**

BINDING POSTS TO DOUBLE PIN TIP PLUG



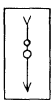


Features insulated binding posts on ¾" centers for rapid mounting and interchangeability of components. Binding posts allow top Stack-Up for multiple connections. Side Stack-Up provided by thru-holes in plug body.
UPPER: Insulated double binding posts on ¾" centers. Top and side stack-up connectors (.166 dia.). Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: Pin tips, .080 dia. on ¾" centers. Brass, nickel plated.
COLORS: Body, Black, Binding Posts, Black/Red.

MODEL 2978 QUANTITY DISC. CODE **A** **NET 2.25**

BINDING POST TO SINGLE PIN TIP PLUG





Features insulated binding post. Binding post allows top Stack-Up for multiple connections. Side Stack-Up provided by thru-holes in plug body.
UPPER: Insulated binding post. Top and side Stack-Up connectors (.166 dia.). Cross hole (.166 dia.) in body provide side Stack-Up connections.
LOWER: Pin tip, .080 dia. brass, nickel plated.
COLORS: Black, Red.

MODEL 2953 (Specify color) QUANTITY DISC. CODE **A** **NET 1.35**

SOLDERLESS PIN TIP PLUG—STACK-UP





Wire firmly held in place with internal set screw, eliminating soldering. Assembly of test leads simplified.
UPPER: Tip jack, beryllium copper, gold flashed; accepts .080 dia. pin.
LOWER: Pin tip, .080 dia., brass, nickel plated.
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

MODEL 1922 (Specify color) QUANTITY DISC. CODE **A** **NET .95**

ADAPTER — BANANA JACK TO PIN TIP





Permits standard single banana plug patch cords to be used with equipment having tip jacks.
UPPER: Banana jack, .166 dia. Brass, nickel plated.
LOWER: Pin tip, .080 dia. Brass, nickel plated. Cross hole (.166 dia.) in body provides side Stack-Up connection.
COLORS: Black, Red.
Standard Package: 10 (per color)

MODEL 1432 (Specify Color) QUANTITY DISC. CODE **A** **NET .15 ea.**

ADAPTER — .080 TIP JACK TO BANANA PLUG



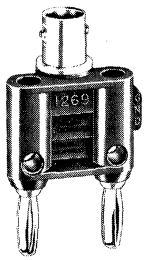


Permits .080 dia. pin tip patch cords to be used with equipment having banana jacks. Insulation molded to plug body.
UPPER: Tip jack, beryllium copper, gold flashed. Accepts .080 dia. pin.
LOWER: Banana plug, one piece nickel plated beryllium copper spring for use with standard 0.166 dia. banana jack. Cross hole (.166 dia.) in body provides side Stack-Up connection.
COLORS: Black, Red.

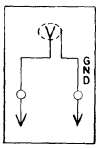
MODEL 1809 (Specify Color) QUANTITY DISC. CODE **A** **NET .75**

POMONA ELECTRONICS

BNC ADAPTERS

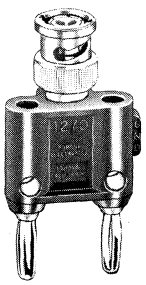


ADAPTER — BNC RECEPTACLE TO DOUBLE BANANA PLUG

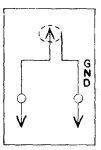


Permits BNC plug to be used with equipment having banana jacks. Excellent for adapting laboratory VTVM, oscilloscopes and signal generator inputs to readily available coaxial cables.
UPPER: BNC receptacle.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLOR: Black.

MODEL 1269 QUANTITY DISC. CODE **A** **NET 2.85**



ADAPTER — BNC PLUG TO DOUBLE BANANA PLUG



Permits BNC receptacle to be used with equipment having banana jacks. Minimizes number of coaxial connections for maximum efficiency.
UPPER: BNC plug.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLOR: Black.

MODEL 1270 QUANTITY DISC. CODE **A** **NET 3.85**

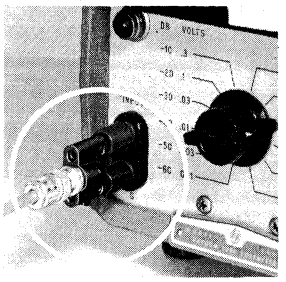
Now! Increase the flexibility of your laboratory with the use of POMONA molded test accessories.

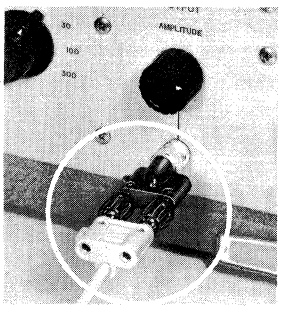
Minimize the necessity of stocking a large quantity and variety of coaxial cables by using POMONA molded adapters.

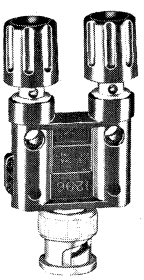
Tough thermo-plastic material molded to plug body or connectors insures maximum strength, moisture resistance and excellent insulative properties.

POMONA ELECTRONICS adapters are designed and engineered with you in mind, from the selection of the best in materials, incorporated with a quality control program that enables us to offer to you, products that are unequalled in reliability and quality.

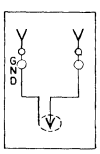
Complete engineering facilities are offered to our customers for special adapter problems that may arise.





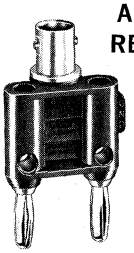


ADAPTER — BINDING POSTS TO BNC PLUG

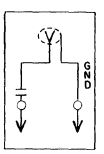


Permits single or double banana plugs to be used with equipment having BNC receptacle. Excellent for use with laboratory oscilloscopes.
UPPER: Insulated binding posts, on ¾" centers with .166 dia. banana jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: BNC plug.
COLOR: Body, Black. Binding Posts: Black/Red.

MODEL 1296 QUANTITY DISC. CODE **A** **NET 4.85**

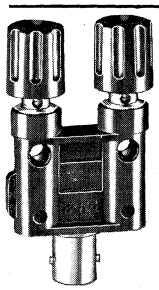


ADAPTER — SIGNAL ISOLATOR — BNC RECEPTACLE TO DOUBLE BANANA PLUG

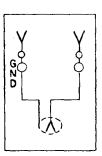


Permits BNC male connector to be used with equipment having banana jacks. General purpose ceramic capacitor molded internally. Rated @ .01 mfd ±20%, 200 WVDC. Insulation resistance 10,000 megohms min. Ideal for isolating DC signals from VTVM inputs and signal generator outputs.
UPPER: BNC receptacle.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLOR: Blue.

MODEL 1868 QUANTITY DISC. CODE **A** **NET 7.85**

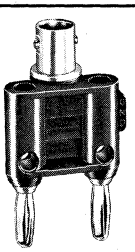


ADAPTER — BINDING POSTS TO BNC RECEPTACLE

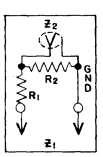


Permits single or double banana plugs to be used with equipment having BNC plug.
UPPER: Insulated binding posts, on ¾" centers with .166 dia. banana jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: BNC receptacle.
COLOR: Body, Black. Binding Posts: Black/Red.

MODEL 1452 QUANTITY DISC. CODE **A** **NET 4.85**

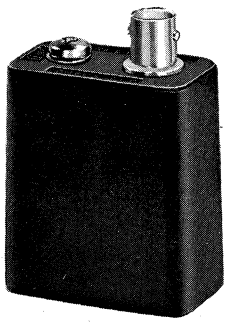


ADAPTER — BNC MATCHING PAD

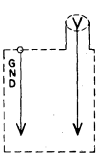


Adapts 600 OHM sources to 50, 75 or 93 OHM cables. Excellent for matching signal generators and VTVM's to standard coaxial cables. Ideal for receiver alignment. Molded in deposited carbon resistors 1%, ¼W.
UPPER: BNC receptacle.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.

MODEL	COLOR	RANGE — OHMS	NET	QUANTITY DISC. CODE
1656-1	Yellow	600 to 50	10.85	A
1656-2	Red	600 to 75	10.85	
1656-3	White	600 to 93	10.85	
1656-4	Blue	300 to 50	10.85	



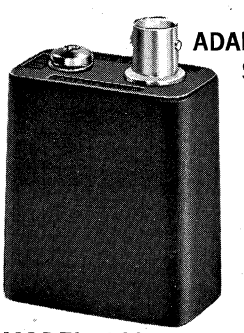
ADAPTER — BNC RECEPTACLE TO SHIELDED BANANA PLUGS



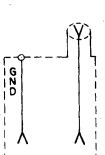
Permits BNC plug to be used with equipment having banana jack binding posts. Black anodized aluminum shield reduces noise Pick-up more than 70 DB. Ideal for low level inputs to oscilloscopes, wave analyzers, etc.
UPPER: BNC receptacle.
LOWER: Shielded double banana plug, on ¾" centers.

QUANTITY DISC. CODE **A**

MODEL 1645 **NET 3.45**



ADAPTER — BNC RECEPTACLE TO SHIELDED BANANA JACKS



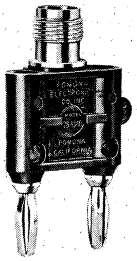
Permits BNC plug to be used with equipment having banana plugs. Black anodized aluminum shield reduces noise pick-up more than 70 DB. Ideal for low level inputs to oscilloscopes, wave analyzers, etc.
UPPER: BNC receptacle.
LOWER: Shielded double banana jacks, on ¾" centers.
COLOR: Black.

QUANTITY DISC. CODE **A** **NET 3.45**

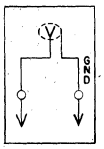
MODEL 1681

POMONA ELECTRONICS

TNC & "N" ADAPTERS



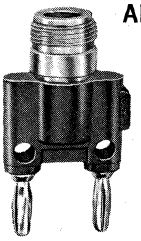
ADAPTER — TNC RECEPTACLE TO DOUBLE BANANA PLUG



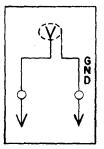
Permits TNC plug to be used with equipment having banana jacks. Perfect for connecting modern control systems to laboratory test equipment.
UPPER: TNC receptacle.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLOR: Black.

MODEL 1340

QUANTITY DISC. CODE **A** NET 5.85



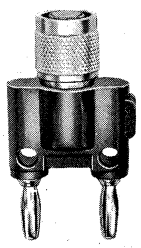
ADAPTER — TYPE "N" RECEPTACLE TO DOUBLE BANANA PLUG



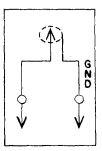
Permits Type "N" plug to be used with equipment having banana jacks. Ideal for connecting R.F. equipment to conventional test equipment.
UPPER: Type "N" receptacle.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLOR: Black.

MODEL 1740

QUANTITY DISC. CODE **A** NET 5.85



ADAPTER — TNC PLUG TO DOUBLE BANANA PLUG



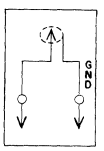
Permits TNC receptacle to be used with equipment having banana jacks. Minimizes your stock of coaxial cables.
UPPER: TNC plug.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLOR: Black.

MODEL 1981

QUANTITY DISC. CODE **A** NET 6.85



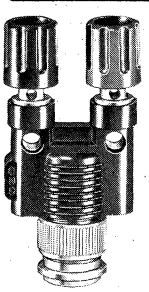
ADAPTER — TYPE "N" PLUG TO DOUBLE BANANA PLUG



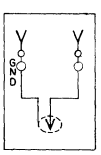
Permits type "N" receptacle to be used with equipment having banana jacks.
UPPER: Type "N" plug.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.
COLOR: Black.

MODEL 1770

QUANTITY DISC. CODE **A** NET 5.85



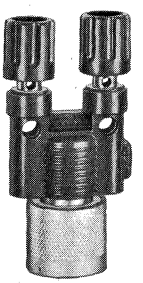
ADAPTER — BINDING POSTS TO TNC PLUG



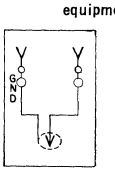
Permits single or double banana plugs to be used with equipment having a TNC receptacle. Exceptional for signal insertion with rapid interchangeability of terminations.
UPPER: Insulated binding posts, on ¾" centers with .166 dia. banana jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: TNC plug.
COLOR: Body, Black. Binding Posts: Black/Red.

MODEL 1982

QUANTITY DISC. CODE **A** NET 6.85



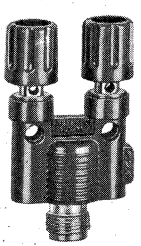
ADAPTER — BINDING POSTS TO TYPE "N" PLUG



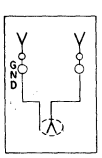
Permits single or double banana plugs to be used with equipment having Type "N" receptacle. Binding posts allow component insertion.
UPPER: Insulated binding posts, on ¾" centers with .166 dia. banana jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: Type "N" plug.
COLOR: Black. Binding Posts: Black/Red.

MODEL 1796

QUANTITY DISC. CODE **A** NET 5.85



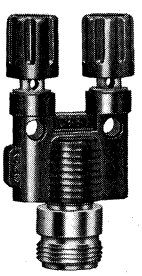
ADAPTER — BINDING POSTS TO TNC RECEPTACLE



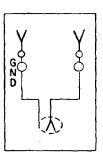
Permits single or double banana plugs to be used with equipment having TNC plug. Useful for rapid interconnection of systems and components.
UPPER: Insulated binding posts, on ¾" centers with .166 dia. banana jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: TNC receptacle.
COLOR: Body, Black. Binding Posts: Black/Red.

MODEL 1976

QUANTITY DISC. CODE **A** NET 5.85



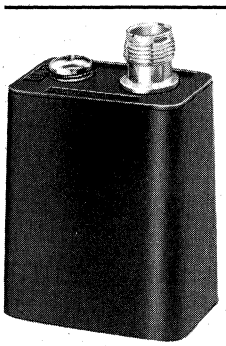
ADAPTER — BINDING POSTS TO TYPE "N" RECEPTACLE



Permits single or double banana plugs to be used with equipment having type "N" plug. Useful for rapid interconnection of systems and components.
UPPER: Insulated binding posts, on ¾" centers with .166 dia. banana jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: Type "N" receptacle.
COLOR: Body, Black. Binding Posts: Black/Red.

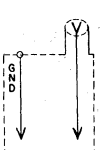
MODEL 1992

QUANTITY DISC. CODE **A** NET 5.85



ADAPTER — TNC RECEPTACLE TO SHIELDED BANANA PLUGS

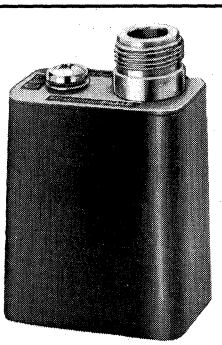
Permits TNC plug to be used with equipment having banana jack binding posts. Black anodized aluminum shield reduces noise pick-up more than 70 DB.



UPPER: TNC receptacle.
LOWER: Double banana plug, on ¾" centers.
COLOR: Black.

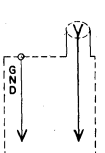
MODEL 1975

QUANTITY DISC. CODE **A** NET 4.85



ADAPTER — TYPE "N" RECEPTACLE TO SHIELDED BANANA PLUGS

Permits type "N" plug to be used with equipment having banana jack binding posts. Black Anodized aluminum shield reduces noise pick-up more than 70 DB.



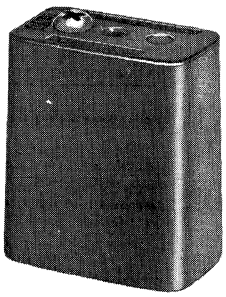
UPPER: Type "N" receptacle.
LOWER: Double banana plug, on ¾" centers.
COLOR: Black.

MODEL 1983

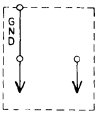
QUANTITY DISC. CODE **A** NET 4.85

POMONA ELECTRONICS

SHIELDED BANANA PLUGS UHF ADAPTERS

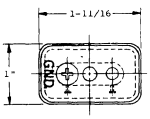


SHIELDED DOUBLE BANANA PLUG IN-LINE CABLE ENTRY

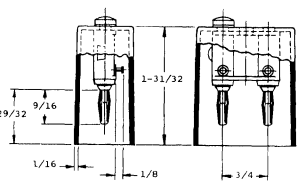


RATED: 15A CONTINUOUS
1200 WVDC
3400 VDC BREAKDOWN
2.5 PF @ 1 MC



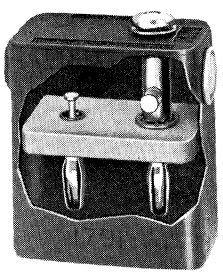


- Shielded double plug ¾" spaced
- Die cast aluminum shell, black anodized
- Noise pick-up reduced 70 DB
- Gold flashed solder turret terminals for positive reliable cable connections
- One piece nickel plated beryllium copper springs for use with standard 0.166 dia. banana jack binding posts.
- Rounded banana spring design results in maximum contact area and minimum contact resistance
- GND clearly molded in shell
- Cable opening, 7/32" diameter



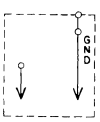
MODEL 1433

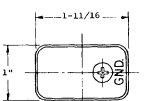
QUANTITY DISC. CODE **A** **NET 2.25**



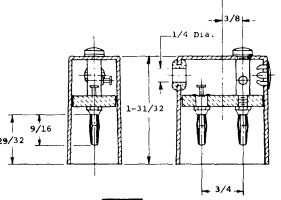
SHIELDED DOUBLE BANANA PLUG RIGHT ANGLE CABLE ENTRY

RATED: 15A CONTINUOUS
2800 PEAK WV
5000 VDC BREAKDOWN
2.0 PF @ 1 MC.





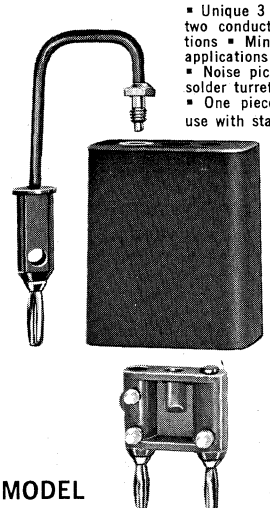
- Shielded double plug, ¾" spaced
- Ceramic insulating base
- Die cast aluminum shell, black anodized
- GND clearly molded in shell
- Noise pick-up reduced 70 DB
- One piece nickel plated beryllium copper springs for use with 0.166 diameter banana jack binding posts.
- Rounded banana spring design results in maximum contact area and minimum contact resistance
- Vinyl grommet and nickel plated snap button supplied



MODEL 1791

QUANTITY DISC. CODE **A** **NET 3.45**

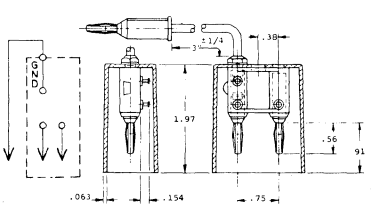
BALANCED LINE SHIELDED DOUBLE BANANA PLUG



- Unique 3 terminal design allows connection to shielded two conductor cable while maintaining balanced conditions
- Minimizes ground loop errors in low signal level applications
- Die cast aluminum shell, black anodized
- Noise pick-up reduced at least 70 DB
- Gold flashed solder turret terminals for reliable noise free connections
- One piece nickel plated beryllium copper springs for use with standard 0.166 dia. banana jack binding posts.

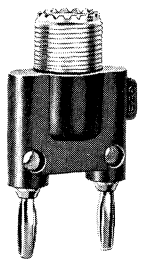
RATED:

15A Continuous	5000 V peak breakdown, line to line
1000 WV Peak; line to shield	2.0 pf @ 1 MC Capacity; line to line
2000 WV peak; line to line	3.0 pf @ 1 MC. capacity; both lines to shield.
2500 V peak breakdown; line to shield	

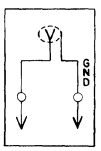


MODEL 1921

QUANTITY DISC. CODE **A** **NET 5.85**



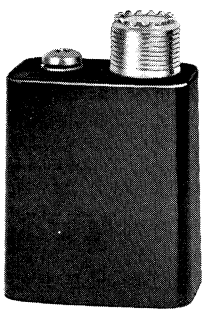
ADAPTER — UHF RECEPTACLE TO DOUBLE BANANA PLUG



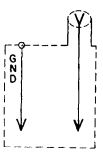
Permits UHF plug to be used with equipment having banana jacks.
UPPER: UHF receptacle, ⅝" dia.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up cannections.
COLOR: Black.

MODEL 1707

QUANTITY DISC. CODE **A** **NET 4.85**



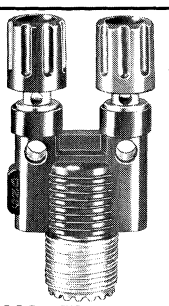
ADAPTER — UHF RECEPTACLE TO SHIELDED BANANA PLUGS



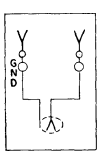
Permits UHF plug to be used with equipment having banana binding posts. Black anodized shield reduces noise pick-up at least 70 DB.
UPPER: UHF receptacle, ⅝" dia.
LOWER: Double banana plug on ¾" centers.
COLOR: Black.

MODEL 1708

QUANTITY DISC. CODE **A** **NET 4.85**



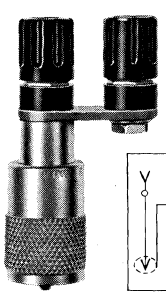
ADAPTER — BINDING POSTS TO UHF RECEPTACLE



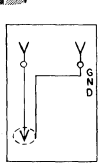
Permits single or double banana plugs to be used with equipment having UHF plug.
UPPER: Insulated binding posts, on ¾" centers with .166 dia. jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: UHF receptacle, ⅝" dia.
COLOR: Body, Black. Binding posts: Black/Red.

MODEL 1792

QUANTITY DISC. CODE **A** **NET 5.85**



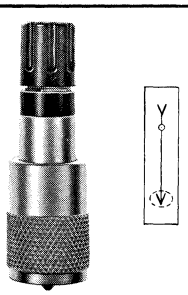
ADAPTER — BINDING POSTS TO UHF PLUG



Permits single or double banana plugs to be used with equipment having a UHF receptacle, ⅝" dia. Convenient for use with modern oscilloscopes. Center conductor binding post Red; Ground, Black.
UPPER: Insulated binding posts, on ¾" centers with .166 dia. jacks.
LOWER: UHF plug.

MODEL 1699

QUANTITY DISC. CODE **A** **NET 4.85**



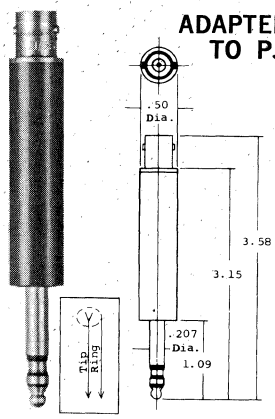
ADAPTER — BINDING POST TO UHF PLUG

Permits single banana plug to be used with equipment having a UHF receptacle, ⅝" dia. Adds flexibility to your oscilloscope.
UPPER: Insulated binding post with .166 dia. banana jack.
LOWER: UHF plug.

MODEL 1698

QUANTITY DISC. CODE **A** **NET 3.85**

ADAPTER — BNC RECEPTACLE TO PJ-068 PHONE PLUG

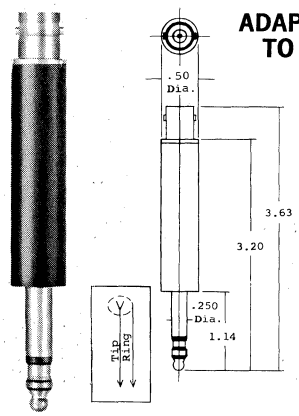


Permits BNC plug to be used with equipment having three circuit phone jacks for .206 dia. phone plugs. Readily adapts equipment to available BNC coaxial cables. Tip connected to inner contact of connector and Ring connected to shell. Sleeve, no connection.

UPPER: BNC receptacle, UG1094/U.
LOWER: Phone Plug, PJ-068.
COLOR: Black.

MODEL 1794 QUANTITY DISC. CODE **A** **NET 6.85**

ADAPTER — BNC RECEPTACLE TO PJ-051* PHONE PLUG

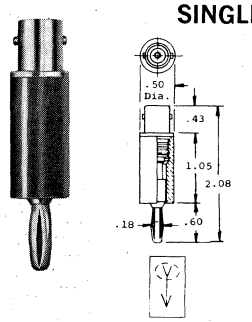


Permits BNC plug to be used with equipment having three circuit phone jacks for .250 dia. phone plugs. Readily adapts equipment to available BNC coaxial cables. Tip connected to inner contact of connector and Ring connected to shell. Sleeve, no connection.

UPPER: BNC receptacle, UG1094/U.
LOWER: Phone Plug, PJ-051*
*PJ-051 Interchangeable with WE 310

MODEL 2798 QUANTITY DISC. CODE **A** **NET 6.85**

ADAPTER — BNC RECEPTACLE TO SINGLE BANANA PLUG

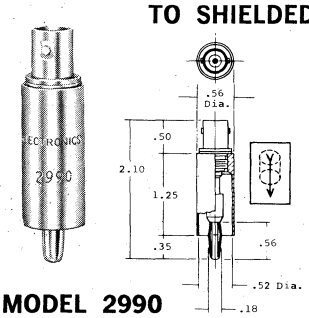


Permits BNC plug to be used with equipment having banana jacks. Inner conductor connected only. Excellent for adapting laboratory VTVM, oscilloscopes and signal generator inputs to readily available coaxial cables.

UPPER: BNC receptacle, UG1094/U.
LOWER: Single Banana Plug.
COLOR: Black.

MODEL 1894 QUANTITY DISC. CODE **A** **NET 2.50**

ADAPTER — BNC RECEPTACLE TO SHIELDED BANANA PLUG

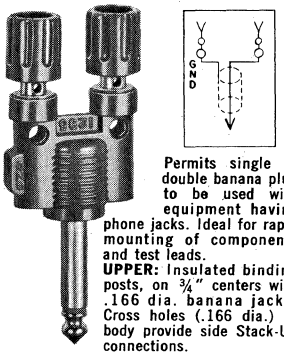


Permits BNC plug to be used with equipment having banana jacks or binding posts. Ideal for use when shielding of single banana jacks is needed. Nickel plated brass shield reduces pick-up more than 70 DB.

UPPER: BNC Receptacle, UG1094/U.
LOWER: Shielded single banana plug.

MODEL 2990 QUANTITY DISC. CODE **A** **NET 2.50**

ADAPTER — BINDING POSTS TO PHONE PLUG



Permits single or double banana plug to be used with equipment having phone jacks. Ideal for rapid mounting of components and test leads.

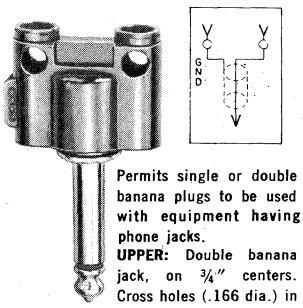
UPPER: Insulated binding posts, on ¾" centers with .166 dia. banana jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.

LOWER: ¼" dia. phone plug, 1-3/16" long.
COLOR: Body, Black. Binding Posts: Black/Red.

QUANTITY DISC. CODE **A**

MODEL 1285 NET 4.85

ADAPTER — BANANA JACKS TO PHONE PLUG



Permits single or double banana plugs to be used with equipment having phone jacks.

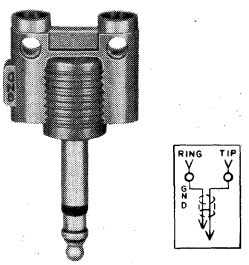
UPPER: Double banana jack, on ¾" centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.

LOWER: Standard ¼" dia. phone plug, 1-3/16" long.
COLOR: Black.

QUANTITY DISC. CODE **A**

MODEL 1980 NET 2.85

ADAPTER-BANANA JACKS TO PJ-051* PHONE PLUG

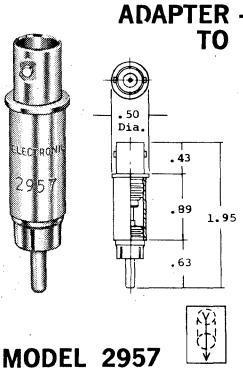


Permits single or double banana plugs to be used with equipment having three circuit phone jacks for .250 dia. phone plugs. Tip connected to hot side of adapter and Ring connected to ground side. Sleeve, no connection.

UPPER: Double banana jack, on ¾" centers. Crossholes (.166 dia.) in body provide side Stack-up connection.
LOWER: Phone Plug, PJ-051*
COLOR: Black
*PJ-051 Interchangeable with WE310

MODEL 2112 QUANTITY DISC. CODE **A** **NET 5.85**

ADAPTER — BNC RECEPTACLE TO PHONO PLUG

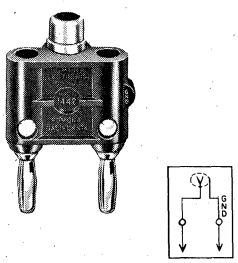


Permits BNC plug to be used with equipment having phono jacks. Readily adapts equipment to available BNC coaxial cables. All metal construction reduces pick-up more than 70 DB. to insure proper shielding.

UPPER: BNC receptacle UG1094/U.
LOWER: Phono plug.

MODEL 2957 QUANTITY DISC. CODE **A** **NET 2.50**

ADAPTER — PHONO JACK TO DOUBLE BANANA PLUG



Permits Phono plug to be used with equipment having banana jacks or binding posts. Quickly converts a cable with a phono plug to a double banana plug.

UPPER: Phono jack.
LOWER: Double Banana plug, on ¾" centers. Cross holes (.166 dia.) in body provide Side Stack-Up connections.
COLOR: Black.

MODEL 1442 QUANTITY DISC. CODE **A** **NET 2.85**

POMONA ELECTRONICS

ISOLATION PLUGS — COMPONENT MOUNTING

CREATE passive and active networks, voltage dividers, isolation networks or attenuators with the Split-Terminal isolation plugs described below.

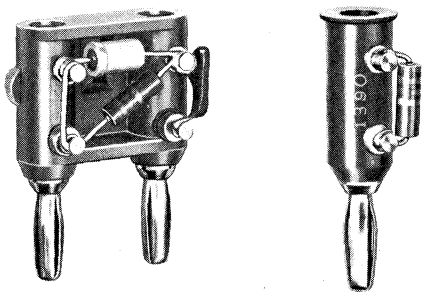
Gold flashed solder turret terminals provide permanent, reliable noise-free connections for component mounting.

Tough thermo-plastic material molded to plug body and connectors insures maximum strength, moisture resistance and excellent insulative properties.

Specifications for MDP-X, 1390, 1837, 1468:

- Fits standard 0.166 dia. banana jack.
- Spring, heat treated beryllium copper alloy 25 per QQ-C-533.
- Plug body, Brass per QQ-B-626 Comp. 22.
- Nickel plated per QQ-N-290, Class 2.
- Contact resistance less than 0.001 ohms per banana plug.

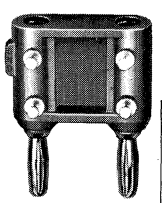
TYPICAL APPLICATION

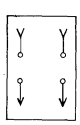


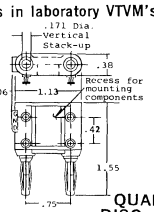
ACTUAL SIZE

MODEL MDP-X **MODEL 1390**

DOUBLE BANANA PLUG, FOUR TERMINAL ISOLATION







Provides four terminal isolation. Top Stack-Up receptacles isolated from lower plugs. Ideal for insertion of matching networks in laboratory VTVM's, signal generators, etc. Gold flashed solder turret terminals for permanent noise-free connections.

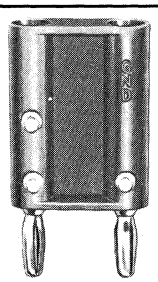
UPPER: Double banana jacks, .166 dia., on ¾" centers.

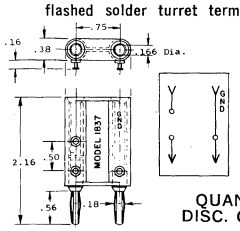
LOWER: Double banana plug on ¾" centers.

COLOR: Red.

MODEL MDP-X QUANTITY DISC. CODE **A** **NET 3.25**

DOUBLE BANANA PLUG, THREE TERMINAL ISOLATION





Provides three terminal isolation. Excellent for "L" and "Pi" networks. Plug and receptacle nickel plated. Gold flashed solder turret terminals for permanent noise-free connections. "Ground" is straight feed-thru. Hot side isolated.

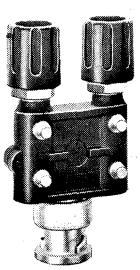
UPPER: Banana jacks, .166 dia. on ¾" centers.

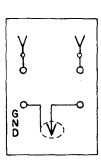
LOWER: Double banana plug on ¾" centers.

COLOR: Blue.

MODEL 1837 QUANTITY DISC. CODE **A** **NET 2.50**

ADAPTER — BINDING POSTS TO BNC PLUG, ISOLATION





Permits single or double banana plugs to be used with equipment having BNC receptacle. Provides isolation for a four terminal network. Binding posts facilitate connections of test leads or additional components. Gold flashed solder turret terminals provide permanent noise-free connections.

UPPER: Insulated binding posts, on ¾" centers with .166 dia. jacks.

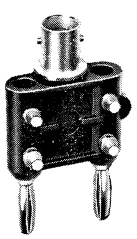
LOWER: BNC plug.

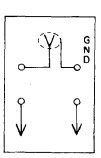
COLOR: Body, Black.

Binding Posts: Black/Red.

MODEL 1469 QUANTITY DISC. CODE **A** **NET 10.85**

ADAPTER — BNC RECEPTACLE TO DOUBLE BANANA PLUG, ISOLATION





Permits BNC plug to be used with equipment having banana jacks. Provides isolation for a four terminal network. Excellent for matching pad networks. Gold flashed solder turret terminals for permanent noise-free connnections.

UPPER: BNC receptacle.

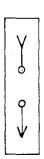
LOWER: Double banana plug, on ¾" centers.

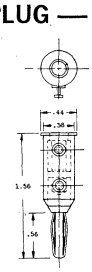
COLOR: Black.

MODEL 1468 QUANTITY DISC. CODE **A** **NET 9.85**

PLUG — SINGLE BANANA, ISOLATION







Provides two terminal isolation. Top Stack-Up receptacle is isolated from lower plug to permit addition of series resistors, diodes, etc. Ideal for computers, lab. circuit design and testing. Gold flashed solder turret terminals for permanent noise-free connections.

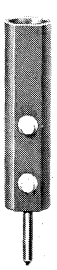
UPPER: Banana jack, .166 dia.

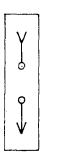
LOWER: Banana plug.

COLORS: Black, Red.

MODEL 1390 (Specify color) QUANTITY DISC. CODE **A** **NET .95**

PLUG — PIN TIP, ISOLATION



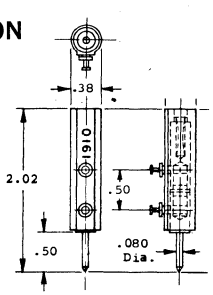


Pin tip jack is isolated from .080 pin tip plug. Provides for addition of series components. Ideal for use with computer boards, lab circuit designs, etc. Gold flashed solder turret terminals for permanent noise-free connections.

UPPER: Tip jack, beryllium copper, gold flashed; accepts .080 dia. pin.

LOWER: Pin tip, .080 dia. Brass, nickel plated.

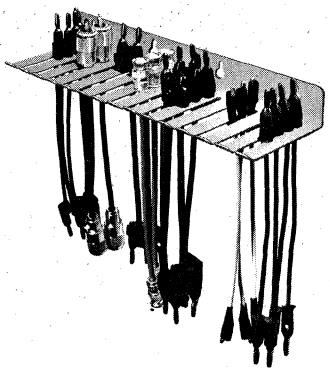
COLORS: Black Red.



MODEL 1910 (Specify color) QUANTITY DISC. CODE **A** **NET .95**

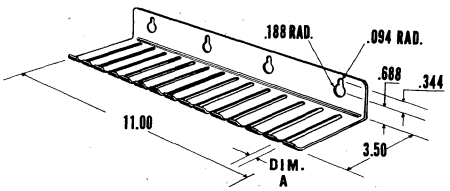
POMONA ELECTRONICS

MISCELLANEOUS ACCESSORIES



TEST LEAD HOLDER

No need to spend time searching for a particular test lead. With this new rack, all of your patch cords and cable assemblies can be conveniently filed for instant selection — within easy reach. Holder mounts quickly on any vertical surface. Test leads are easy to store, easy to remove. Two models to choose from for different size cables.



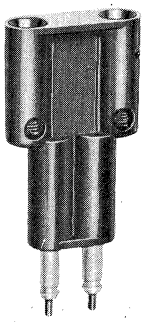
MATERIAL: Cold Rolled Steel.
FINISH: Baked Enamel.

	MAX. CABLE DIA. (DIM. A)	COLOR	NET
MODEL 1508	.210″	Orange	2.95
MODEL 2708	.450″	Blue	2.95

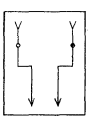
QUANTITY DISC. CODE **A**

SEE PAGE FOR TEST SOCKET ADAPTER HOLDER

ADAPTER — AMP PROGRAM BOARD



Permits single or double banana plugs to be used with AMP program boards having ¼″ or ⅜″ center to center spacing. Ideal for mounting components. Internal set screws secure leads. Useful in analog computer applications, etc.

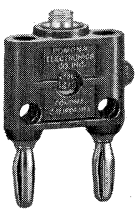


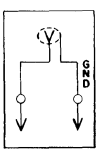
UPPER: Banana jacks, on ¾″ centers. Brass, nickel plated.
LOWER: Dual AMP pins, on ¼″ or ⅜″ centers.

QUANTITY DISC. CODE **A**

MODEL	PIN SPACING	COLOR	NET
1977	⅜″	Black	3.85
1991	¼″	Gray	3.85

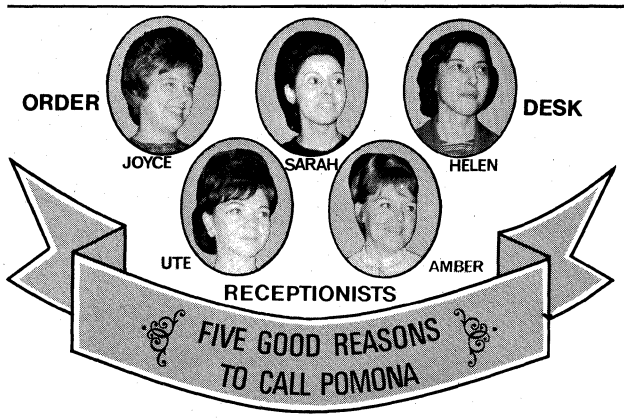
ADAPTER — MICRODOT RECEPTACLE TO DOUBLE BANANA PLUG



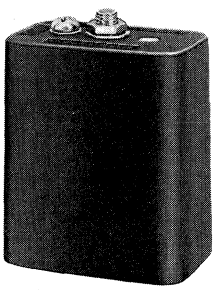


Permits Microdot miniature coaxial plug to be used with equipment having banana jacks. Cross holes in body provide side Stack-Up connections.
UPPER: Microdot receptacle, Screw-On Type.
LOWER: Double banana plug, on ¾″ centers. Cross holes (.166 dia.) in body provide side Stack-Up connections.

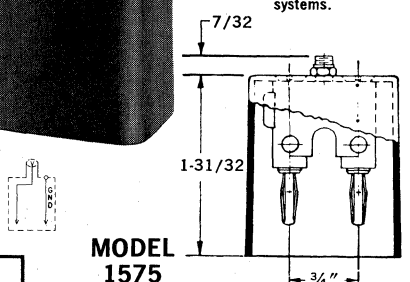
MODEL	TYPE (Ohms)	BODY COLOR	RECEPTACLE TYPE	NET	QUANTITY DISC. CODE
1275	50	Green	10-32 thread	6.85	A
1276	50	Black	Slide-on	9.85	
1277	70	Violet	12-32 thread	9.85	
1279	93	White	¼-32 thread	9.85	



ADAPTER—MICRODOT RECEPTACLE TO SHIELDED BANANA PLUGS



Permits Microdot miniature coaxial plug, 50 ohm, to be used with equipment having banana jack binding posts. Black anodized aluminum shield reduces noise pick-up more than 70 DB. Ideal for noise reduction in low level acceleration systems.



UPPER: Microdot Receptacle, Screw-On Type, Receptacle Thread 10-32.
LOWER: Shielded Double banana plug, on ¾″ centers.
COLOR: Black.

QUANTITY DISC. CODE **A**

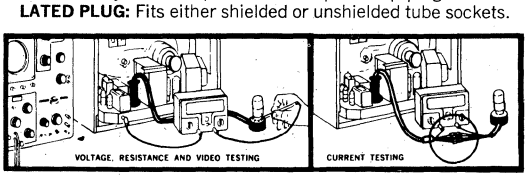
MODEL 1575 **NET 6.85**

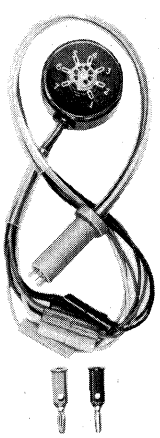
Universal Harness

TESTING ADAPTER

Takes the Trouble out of Trouble Shooting!

TEST SOCKET: Extended test tabs, phosphor bronze contacts, heavy duty molded phenolic base with easy-to-read socket connections. **CURRENT MEASUREMENT CONNECTIONS:** Fully insulated, molded .080 phone tip plugs. **INSULATED PLUG:** Fits either shielded or unshielded tube sockets.

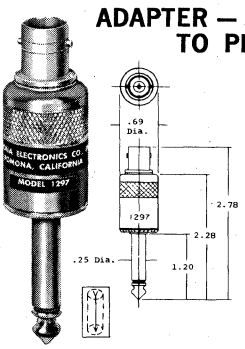




Model 1737 (7 Pin) Model 1738 (8 Pin) Model 1739 (9 Pin)

QUANTITY DISC. CODE **D** **NET 9.95**

ADAPTER — BNC RECEPTACLE TO PHONE PLUG



Permits BNC plug to be used with equipment having standard ¼″ dia. phone jacks. Readily adapts equipment to available BNC coaxial cables. All metal construction to insure proper shielding.
UPPER: BNC receptacle, UG1094/U.
LOWER: Standard ¼″ dia. phone plug, 1 3/16″ Long.

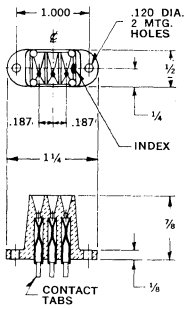
MODEL 1297 QUANTITY DISC. CODE **A** **NET 5.85**

★ Various lengths may be aggregated for best quantity price.

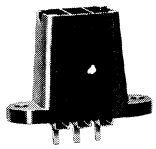
POMONA ELECTRONICS

TEST ACCESSORIES

TRANSISTOR SOCKET



For use in testing 3 lead transistors with .017 dia. leads. Beryllium copper springs for long life. Ideal for aging racks, incoming inspection, life testing, etc.

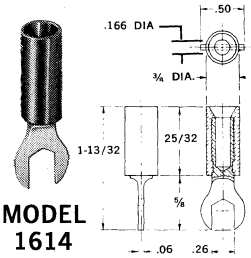


MODEL TS-187

QUANTITY DISC. CODE **A**

MODEL	TEMP. RANGE	INSULATION RESISTANCE	COLOR	NET
TS187	—100°C To +200°C.	1 x 10^5 Megohms Min. @ 500 V.D.C. @ 40% R.H., 24°C.	Black	1.75

INSULATED SPADE LUG ADAPTER



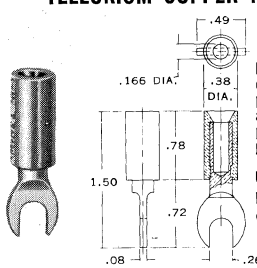
Permits single banana plug to be used with equipment having binding posts. Tough thermoplastic molded to body for maximum reliability and low shock hazard. Spade lug body, one piece machined brass, nickel plated.

UPPER: Banana jack, .166 dia.
LOWER: Spade lug, .26 opening.
COLORS: Black, Red.

QUANTITY DISC. CODE **A**

MODEL 1614 (Specify color) NET .35

TELLURIUM COPPER INSULATED SPADE LUG ADAPTER



Permits single banana plug to be used with equipment having binding posts. Tough thermoplastic molded to body for maximum reliability and low shock hazard. Spade lug body, one piece machined tellurium copper, gold plated per MIL-G-45204, Type 11, Class 1.

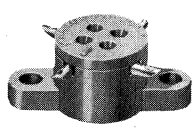
UPPER: Banana jack, .166 dia.
LOWER: Spade lug, .26 opening.
COLORS: Black, Red.

MODEL 2305 (Specify Color) QUANTITY DISC. CODE **A** NET .95

TRANSISTOR BREADBOARD SOCKET

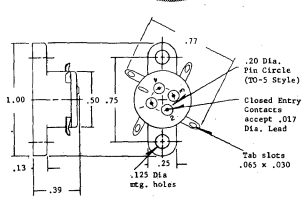
For Transistors with TO-5, and TO-12 Lead Arrangement

Excellent for breadboarding. All connections made on top of breadboard for quick accessible test points.



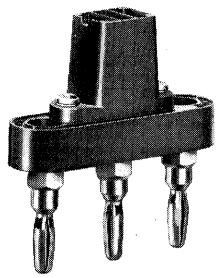
FEATURES:

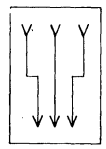
- Closed entry contacts accept .016—.019 dia. leads.
- Beryllium copper contacts silver plated.
- Contact numbers on top of socket.
- Socket molded of low loss mica filled phenolic.
- Easily mounted with two #2 screws.



MODEL XS-T4 QUANTITY DISC. CODE **C** NET .75

ADAPTER — TRANSISTOR TEST SOCKET





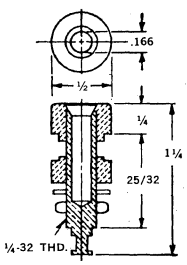
Permits the insertion of transistors with .017 dia. leads into equipment having banana jacks on ¾" centers. Ideal for incoming inspection. Transistor socket contact and banana spring made of beryllium copper. Heavy duty phenolic construction. Insulation resistance: 1 x 10^5 megohms min. @ 500 V.D.C., at 40% R.H., 24°C.

MODEL 1472 QUANTITY DISC. CODE **A** NET 5.85

INSULATED BANANA JACK ASSEMBLY

Used with standard banana plug. Body, one piece brass, silver plated. Heavy duty shouldered ceramic insulator. Nickel plated lockwasher and hex nut included.





FEATURES:

- Closed entry receptacle, .166 dia.
- Insulator head molded to body
- Mounts in ⅜" dia. hole, panels from .035" to .375" thick
- Solder turret terminal
- Rated: 2,500 WVDC

1581 — Black	**1581-5 — Green**
1581-1 — Brown	**1581-6 — Blue**
1581-2 — Red	**1581-7 — Violet**
1581-3 — Orange	**1581-8 — Gray**
1581-4 — Yellow	**1581-9 — White**

Standard Package: 10 (per color) Unassembled

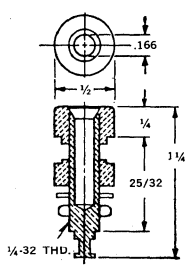
MODEL 1581 QUANTITY DISC. CODE **A** NET .25 ea.

INSULATED BANANA JACK ASSEMBLY GOLD PLATED

NEW

Used with standard banana plug. Body, one piece brass, gold plated. Head insulation and panel insulator are molded of tough Polycarbonate thermoplastic. Nickel plated lockwasher and hex nut included.





FEATURES:

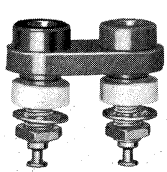
- Closed entry receptacle, .166 dia.
- Insulator head molded to body
- Mounts in ⅜" dia. hole, panels
- Solder turret terminal from .035" to .375" thick
- Rated: 2,500 WVDC

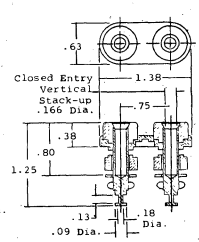
2854 Black	**2854-5 — Green**
2854-1 — Brown	**2854-6 — Blue**
2854-2 — Red	**2854-7 — Violet**
2854-3 — Orange	**2854-8 — Gray**
2854-4 — Yellow	**2854-9 — White**

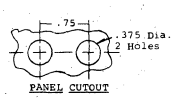
Standard Package: 10 (per color) Unassembled

MODEL 2854 QUANTITY DISC. CODE **A** NET .35 ea.

INSULATED DOUBLE BANANA JACK ASSEMBLY







Double banana jack silver plated on ¾" centers with one red and one black jack. Choice of Black or Red plate.

Mounts in panels from .035" to .275" thick.

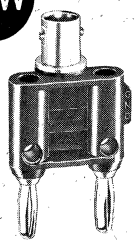
MODEL 2269 Black Plate
MODEL 2269-2 Red Plate

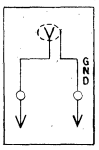
MODEL 2269 QUANTITY DISC. CODE **A** NET .75

POMONA ELECTRONICS — TEST ACCESSORIES

NEW

ADAPTER—MHV RECEPTACLE TO DOUBLE BANANA PLUG





This adapter allows an MHV Plug to be used with equipment having ¾" spaced banana jacks.

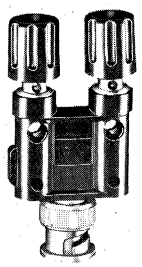
UPPER: MHV receptacle.
LOWER: Double banana plug, on ¾" centers. Cross holes (.166 Dia.) in body provide side Stack-Up connections.

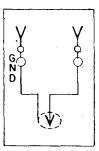
COLOR: Black.

MODEL 3290 QUANTITY DISC. CODE **A** **NET 5.85**

NEW

ADAPTER—BINDING POSTS TO MHV PLUG





This adapter converts a MHV Receptacle to standard ¾" 5 way binding posts.

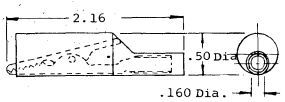
UPPER: Insulated binding posts on ¾" centers with (.166 dia.) banana jacks. Cross holes (.166 dia.) in body provide side Stack-Up connections.
LOWER: MHV plug.

COLOR: Black.

MODEL 3291 QUANTITY DISC. CODE **A** **NET 7.85**

INSULATED ALLIGATOR CLIP TO BANANA JACK





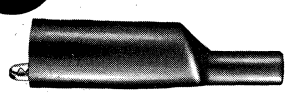
Clip, No. 60 Mueller, Steel, Cadmium Plated Vinyl insulators, No. 62 (5 Red, 5 Black). Unassembled.

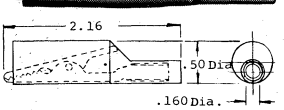
Standard Package of 10 clips and 10 insulators.

MODEL 2240 QUANTITY DISC. CODE **A** **NET .15 ea.**

NEW

GOLD PLATED—INSULATED ALLIGATOR CLIP TO BANANA JACK





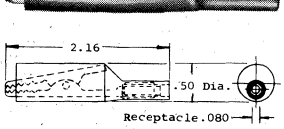
Alligator Clip, solid Copper, Gold plated. Vinyl insulators (5 Red, 5 Black). Unassembled.

Standard Package of 10 clips and 10 insulators.

MODEL 3289 QUANTITY DISC. CODE **A** **NET .50 ea.**

INSULATED ALLIGATOR CLIP TO PIN TIP JACK



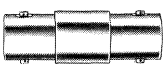


Alligator Clip, Steel, Cadmium Plated. Tip Jack, Beryllium Copper, Gold Flashed, except 0.80 dia. Pin tip plug. Vinyl insulators (5 Red, 5 Black). Unassembled.

Standard Package of 10 clips and 10 insulators.

MODEL 1437 QUANTITY DISC. CODE **A** **NET .50 ea.**

ADAPTER — BNC JACK TO JACK





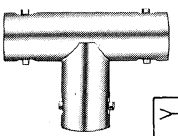
Allows the interconnection of two coaxial cables with BNC plugs.

FEATURES:
- Non-Tarnish finish.
- 50 Ohm impedance.
- Teflon insulation.
- Gold flashed beryllium copper contacts.

NEW

MODEL 3283 QUANTITY DISC. CODE **A** **NET 1.50**

ADAPTER — BNC "T" — 3 JACKS



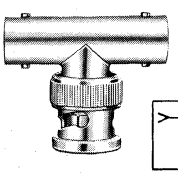
This adapter allows the interconnection of three coaxial cables with BNC Plugs.

FEATURES:
- Non-Tarnish finish.
- 50 Ohm impedance.
- Teflon insulation.
- Gold flashed beryllium copper contacts.

NEW

MODEL 3284 QUANTITY DISC. CODE **A** **NET 4.85**

ADAPTER — BNC "T" JACK — PLUG — JACK



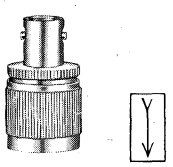
With this adapter, equipment or coaxial cables having a single BNC jack are changed to two BNC jacks.

FEATURES:
- Non-Tarnish finish.
- 50 Ohm impedance.
- Teflon insulation.
- Gold flashed beryllium copper female and outer male contact.

NEW

MODEL 3285 QUANTITY DISC. CODE **A** **NET 3.25**

ADAPTER — BNC JACK TO UHF PLUG



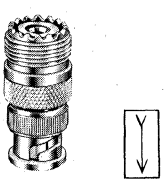
Allows the use of a BNC plug on equipment having a UHF Jack.

FEATURES:
- Non-Tarnish finish.
- Rexolite insulation.
- Gold flashed beryllium copper female contact.
- Gold flashed male contact.

NEW

MODEL 3286 QUANTITY DISC. CODE **A** **NET 1.50**

ADAPTER — UHF JACK TO BNC PLUG



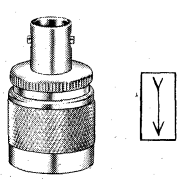
Allows the use of a UHF Plug on equipment having a BNC Jack.

FEATURES:
- Non-Tarnish finish.
- 50 Ohm impedance.
- Rexolite insulation.
- Gold flashed Phosphor Bronze female UHF and male BNC contacts.

NEW

MODEL 3287 QUANTITY DISC. CODE **A** **NET 2.50**

ADAPTER — BNC JACK TO TYPE "N" PLUG



Allows the use of a BNC Plug on equipment having a type "N" jack.

FEATURES:
- Non-Tarnish finish.
- Teflon insulation.
- Gold flashed contacts.

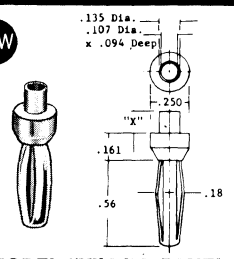
NEW

MODEL 3288 QUANTITY DISC. CODE **A** **NET 1.85**

POMONA ELECTRONICS

STANDARD AND MINIATURE BANANA PLUGS

NEW



RIVET TYPE BANANA PLUG

Excellent for riveting to panels or boards. Used with standard .166 dia. banana jacks.

- Spring, one piece heat treated beryllium copper, alloy 170 per QQ-C-533.
- Jack body, Brass Per QQ-B-626 comp. 22.
- Plating, Nickel per QQ-N-290, class 2.
- Rated, 15A. Cont., 30A. Int.

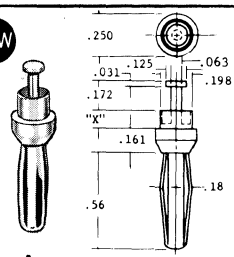
MODEL	"X" DIM.	PANEL
3257	.094	1/16"
3258	.125	3/32"
3259	.156	1/8"

Standard Package 10

QUANTITY DISC. CODE **A**

NET .22 ea.

NEW



RIVET TYPE BANANA PLUG WITH TURRET

Excellent for riveting to panels or boards. Solder turret for rapid attachment of wires. Used with standard .166 dia. banana jacks.

- Spring, one piece heat treated beryllium copper, alloy 170 per QQ-C-533.
- Jack body, Brass Per QQ-B-626 comp. 22.
- Plating, Nickel per QQ-N-290, class 2.
- Rated, 15A. Cont., 30A. Int.

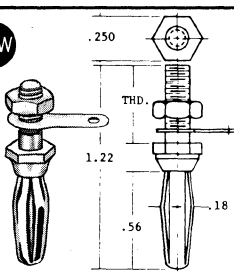
MODEL	"X" DIM.	PANEL
3260	.105	1/16"
3261	.135	3/32"
3262	.165	1/8"

Standard Package 10

QUANTITY DISC. CODE **A**

NET .25 ea.

NEW



BANANA PLUG WITH THREADED STUD

Threaded stud for rapid mounting. Used with standard .166 dia. banana jacks. Furnished with hex nut and solder lug.

- Spring, one piece heat treated beryllium copper, alloy 170 per QQ-C-533.
- Plug body, Hex brass per QQ-B-626 comp. 22.
- Plating, Nickel per QQ-N-290, class 2.
- Rated, 15A. Cont., 30A. Int.

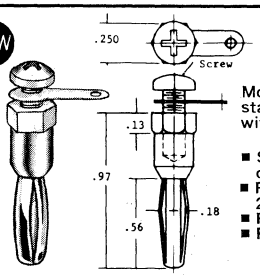
MODEL	THREAD
3263	6-32 x 1/2"
3264	8-32 x 1/2"

Standard Package 10
Unassembled

QUANTITY DISC. CODE **A**

NET .29 ea.

NEW



BANANA PLUG WITH SCREW

Mounts to various size panels. Used with standard .166 dia. banana jacks. Furnished with screw and solder lug.

- Spring, one piece heat treated beryllium copper, alloy 170 per QQ-C-533.
- Plug body, Hex brass per QQ-B-626 comp. 22.
- Plating, Nickel per QQ-N-290, class 2.
- Rated, 15A. Cont., 30A. Int.

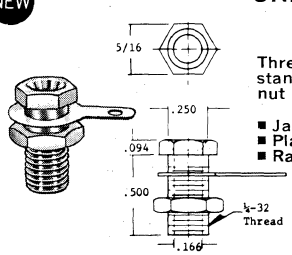
MODEL	SCREW
3265	6-32 x 1/4"
3266	8-32 x 1/4"

Standard Package 10
Unassembled

QUANTITY DISC. CODE **A**

NET .29 ea.

NEW



UNINSULATED—BANANA JACK

Threaded for rapid mounting. Used with standard banana plugs. Furnished with hex nut and solder lug.

- Jack body, Brass per QQ-B-626 comp. 22.
- Plating, Nickel per QQ-N-290, class 2.
- Rated, 15A. Cont., 30A. Int.

Standard Package 10
Unassembled

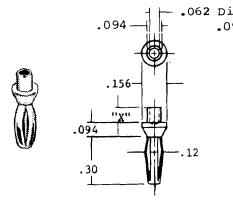
MODEL 3267

QUANTITY DISC. CODE **A**

NET .15 ea.

MINIATURE — RIVET TYPE BANANA PLUG

NEW



Excellent for riveting to panels or boards. Used with miniature .104 dia. banana jacks.

- Spring, one piece heat treated beryllium copper, alloy 170 per QQ-C-533.
- Plug body, Brass per QQ-B-626 comp. 22.
- Plating, Gold flashed per MIL-G-45204 Type II (.00002/.00003).
- Rated, 5A. Cont., 10A. Int.

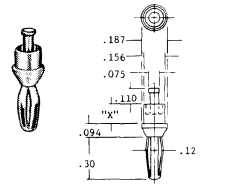
MODEL	"X" DIM.	PANEL
3268	.094	1/16"
3271	.125	3/32"
3272	.156	1/8"

Standard Package 10

QUANTITY DISC. CODE **A**

NET .22 ea.

NEW



MINIATURE — RIVET TYPE BANANA PLUG WITH TURRET

Excellent for riveting to panels or boards. Solder turret for rapid attachment of wires. Used with miniature .104 dia. banana jacks.

- Spring, one piece heat treated beryllium copper, alloy 170 per QQ-C-533.
- Plug body, Brass per QQ-B-626 comp. 22.
- Plating, Gold flashed per MIL-G-45204 Type II (.00002/.00003).
- Rated, 5A. Cont., 10A. Int.

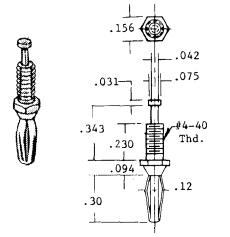
MODEL	"X" DIM.	PANEL
3273	.105	1/16"
3274	.135	3/32"
3275	.165	1/8"

Standard Package 10

QUANTITY DISC. CODE **A**

NET .25 ea.

NEW



MINIATURE — BANANA PLUG WITH THREADED STUD

Threaded stud for rapid mounting. Solder turret for attachment of wires. Used with .104 dia. miniature banana jacks.

- Spring, one piece heat treated beryllium copper, alloy 170 per QQ-C-533.
- Plug body, Brass per QQ-B-626 comp. 22.
- Plating, Gold flashed per MIL-G-45204 Type II (.00002/.00003).
- Rated, 5A. Cont., 10A. Int.

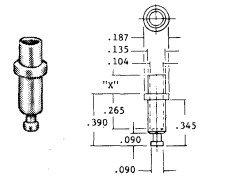
Standard Package 10

MODEL 3276

QUANTITY DISC. CODE **A**

NET .25 ea.

NEW



MINIATURE — RIVET TYPE BANANA JACK WITH TURRET

Excellent for riveting to panels or boards. Solder turret for rapid attachment of wires. .104 dia. jack accepts miniature banana plug.

- Jack body, Brass per QQ-B-626 comp. 22.
- Plating, Gold flashed per MIL-G-45204 Type II (.00002/.00003).
- Rated, 5A. Cont., 10A. Int.

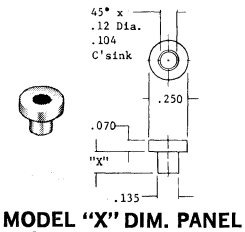
MODEL	"X" DIM.	PANEL
3277	.105	1/16"
3278	.135	3/32"
3279	.165	1/8"

Standard Package 10

QUANTITY DISC. CODE **A**

NET .15 ea.

NEW



MINIATURE — RIVET TYPE BANANA JACK

Excellent for riveting to panels or boards. .104 dia. jack accepts miniature banana plug.

- Jack body, Brass per QQ-B-626 comp. 22.
- Plating, Gold flashed per MIL-G-45204 Type II (.00002/.00003).
- Rated, 5A. Cont., 10A. Int.

MODEL	"X" DIM.	PANEL
3280	.105	1/16"
3281	.135	3/32"
3282	.165	1/8"

Standard Package 10

QUANTITY DISC. CODE **A**

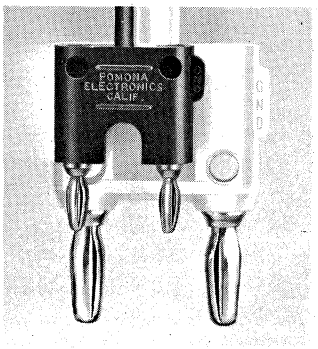
NET .10 ea.

POMONA ELECTRONICS

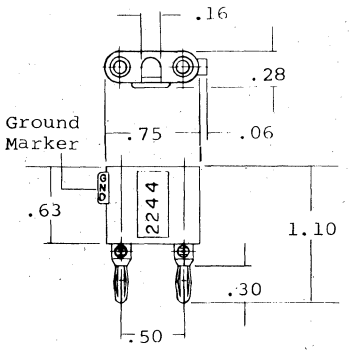
½" SPACED MINIATURE BANANA PLUGS AND ACCESSORIES

ONE-THIRD SMALLER Miniature Banana Plugs, a state-of-the-art development for the ever increasing demand for miniaturized test equipment.

Banana plug springs are precision formed of one-piece beryllium copper, heat treated for maximum life and low contact resistance. Tough thermoplastic molded to plug bodies.



ACTUAL SIZE

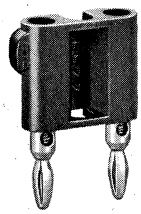


SPECIFICATIONS:

- Fits 0.104 dia. miniature banana jacks.
- Plug body brass, per QQ-B-626, Comp. #22.
- Gold flashed per MIL-G-45204 Type 11 (.00002/.00003).
- Spring, beryllium copper alloy 170 per QQ-C-533.

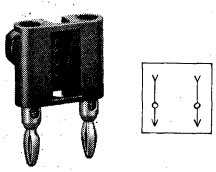
RATINGS:

- Operating temp.: —25°C to +85°C.
- Working voltage: 2500 VDC.
- Current: 5 amps cont., 10 amps. int.



ACTUAL SIZE

MINIATURE—DOUBLE BANANA PLUG WITH SET SCREWS



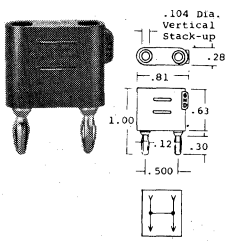
Miniature double banana plug on ½" centers. Internal set screws to secure cable or component leads. .104 dia. banana jacks on ½" centers permit top Stack-Up for multiple connections.

COLORS: Black, Red.

MODEL 2244 Black
MODEL 2244-2 Red

MODEL 2244 QUANTITY DISC. CODE **A** **NET .75**

MINIATURE—DOUBLE BANANA PLUG WITH SHORTING BAR



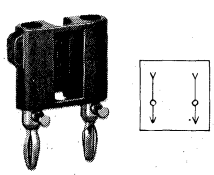
Ideal as a connecting link for use with ½" spaced banana jacks. .104 dia. banana jacks on ½" centers permit top Stack-Up for multiple connections. Banana plugs internally solder-bonded with #18 AWG wire. "Shorting Bar" stamped on plug.

COLORS: Black, Red.

MODEL 2035 Black
MODEL 2035-2 Red

MODEL 2035 QUANTITY DISC. CODE **A** **NET .95**

MINIATURE—DOUBLE BANANA PLUG WITH SOLDER TURRET TERMINALS



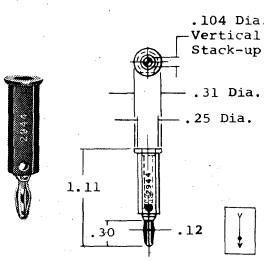
Miniature double banana plug on ½" centers. Solder turret terminals for permanent noise-free connections of cables or components. .104 dia. banana jacks on ½" centers permit top Stack-Up for multiple connections.

COLORS: Black, Red

MODEL 2245 Black
MODEL 2245-2 Red

MODEL 2245 QUANTITY DISC. CODE **A** **NET .85**

MINIATURE SOLDERLESS BANANA PLUG-STACK-UP



Miniature banana plug for rapid assembly of test leads. For use with miniature binding posts or banana jacks. Wire firmly held in place with internal set screw, eliminating soldering.

UPPER: Miniature banana jack .104 dia. Brass, gold flashed.

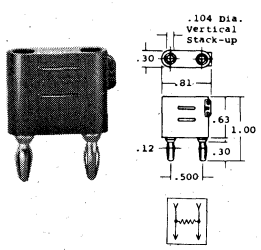
LOWER: Miniature banana plug, one piece gold flashed beryllium copper spring for use with .104 dia. miniature banana jacks.

COLORS: Black, Red.

MODEL 2944-0 Black
MODEL 2944-2 Red

MODEL 2944 QUANTITY DISC. CODE **A** **NET .50**

MINIATURE—DOUBLE BANANA PLUG WITH MOLDED PRECISION RESISTOR

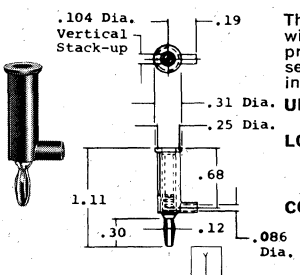


Ideal where rapid interchange of resistance values is required. Deposited carbon 1% ¼ watt, molded internally. .104 dia. banana jacks on ½" centers permit top Stack-Up for multiple connections. Resistance value stamped on plug.

COLOR: Blue (OHMS) 50 10K 600 50K 1K 100K

MODEL 2246 (Specify Value) QUANTITY DISC. CODE **A** **NET 2.75**

MINIATURE SOLDERLESS BANANA PLUG WITH SAFETY COLLAR-STACK-UP



This integral collar insulates exposed wire leads and acts as a strain relief by preventing the flexing of the lead at the set screw. Wire firmly held in place with internal set screw, eliminating soldering.

UPPER: Miniature banana jack. .104 dia. Brass, gold flashed.

LOWER: Miniature banana plug, one piece gold flashed beryllium copper spring for use with .104 dia. miniature banana jacks.

COLORS: Black, Red.

MODEL 2945-0 Black
MODEL 2945-2 Red

MODEL 2945 QUANTITY DISC. CODE **A** **NET .50**

POMONA ELECTRONICS

MINIATURE BINDING POSTS
MINIATURE BANANA JACKS

MINIATURE BINDING POSTS

A complete 5-way Binding Post in "Miniature." Captive Thumb Nut and Binding Post Body, machined brass; gold or nickel plated. Thumb Nut and Mounting Base molded of High Impact Polycarbonate Thermoplastic. Heavy Duty Shouldered Ceramic Insulator. Lockwasher and hex nut included, unassembled, nickel plated.

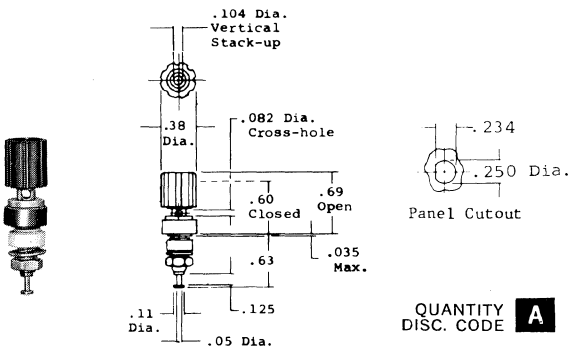
SPECIFICATIONS:

■ 5-way Binding Post ■ Mounts ¼" dia. "D" hole ■ Panels up to 3/16" thick ■ Captive Thumb Nut ■ .082 dia. Cross hole ■ Thumb Nut and Binding Post Body — Gold Flashed per MIL-G-45204 Type 2 OR Nickel Plated per QQ-N-290 Class 2.

RATINGS:

■ Operating Temp.: —65°C to +150°C.
■ Working Voltage: 1500 VDC.
■ Current: 5 Amps Cont., 10 Amps Int.

MINIATURE—INSULATED BINDING POST



QUANTITY DISC. CODE **A**

MODEL 2382-* *(Specify Color) Gold Flashed Assembly **NET .90**

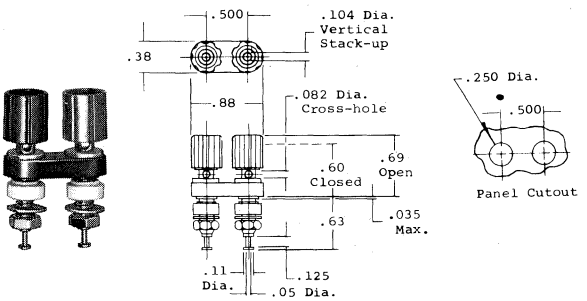
MODEL 2439-* *(Specify Color) Nickel Plated Assembly **NET .75**

(*) COLORS

-0 Black	-5 Green
-1 Brown	-6 Blue
-2 Red	-7 Violet
-3 Orange	-8 Gray
-4 Yellow	-9 White

MINIATURE—INSULATED DOUBLE BINDING POST

Double binding post body on ½" centers with one Red and one Black binding post. Choice of Black or Red plate.



MODEL 2383-* *(Specify Color) Gold Flashed Assembly **NET 1.80**

MODEL 2440-* *(Specify Color) Nickel Plated Assembly **NET 1.50**

QUANTITY DISC. CODE **A**

(*) COLORS
-0 Black Plate
-2 Red Plate

MINIATURE BANANA JACKS

Developed by the need for miniaturization of test equipment and test panels. The new generation of test jacks. Built to Pomona Electronics high standard of quality.

Wide selection of colors available.

Molded of High Impact Polycarbonate Thermoplastic Banana Jack body, one piece machined brass, gold flashed. Heavy duty shouldered ceramic insulator. Lockwasher and hex nut included, unassembled, nickel plated.

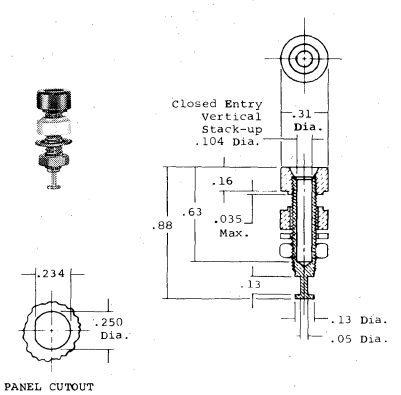
SPECIFICATIONS:

■ Closed entry jack .104 dia. ■ Insulator head molded to body. ■ Mounts in ¼" dia. hole. Model 2142, Panels up to ¼" thick. Model 2143, Panels up to 3/16" thick. ■ Solder turret terminal.

RATINGS:

■ Operating Temp.: —65°C to +150°C.
■ Working Voltage: 1500 VDC.
■ Current: 5 Amps Cont., 10 Amps Int.

MINIATURE—INSULATED BANANA JACK

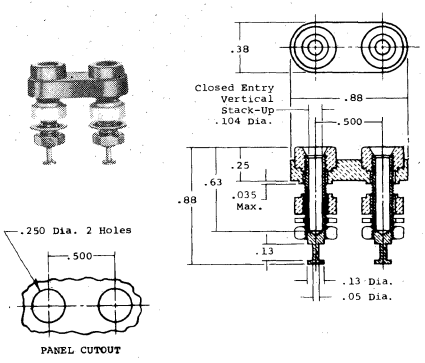


2142 —BLACK
2142-1—BROWN
2142-2—RED
2142-3—ORANGE
2142-4—YELLOW
2142-5—GREEN
2142-6—BLUE
2142-7—VIOLET
2142-8—GRAY
2142-9—WHITE

MODEL 2142 Standard Package: 10 (per color) QUANTITY DISC. CODE **A** **NET .25 ea.**

MINIATURE—INSULATED DOUBLE BANANA JACK

Double banana jack on ½" centers with one red and one black jack. Choice of Black or Red plate.



MODEL 2143 (Black Plate)

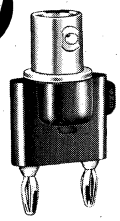
MODEL 2143-2 (Red Plate)

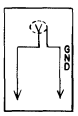
MODEL 2143 QUANTITY DISC. CODE **A** **NET .75**

POMONA ELECTRONICS

½" SPACED MINIATURE BANANA PLUG ADAPTERS AND ACCESSORIES

NEW ADAPTER — BNC RECEPTACLE TO MINIATURE DOUBLE BANANA PLUG





This adapter allows a BNC plug to be used with equipment having ½" spaced miniature .104 dia. banana jacks. Excellent for adapting test equipment to standard coaxial cables.

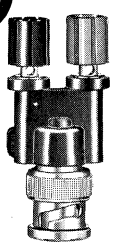
UPPER: BNC receptacle, UG 1094/U.

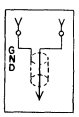
LOWER: Miniature double banana plug on ½" centers, for use with .104 dia. miniature jacks. Gold flashed one piece heat treated beryllium copper springs.

COLOR: Black.

MODEL 3269 QUANTITY DISC. CODE **A** **NET 3.25**

NEW ADAPTER — MINIATURE BINDING POSTS TO BNC PLUG





This adapter converts a BNC receptacle to miniature ½" spaced 5 way binding posts.

UPPER: Insulated, gold flashed miniature 5 way binding posts on ½" centers with .104 dia. miniature banana jacks.

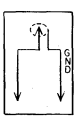
LOWER: BNC plug.

COLOR: Black.

MODEL 3296 QUANTITY DISC. CODE **A** **NET 4.85**

NEW ADAPTER — BNC PLUG TO MINIATURE DOUBLE BANANA PLUG





Allows a BNC cable jack to be used on equipment having ½" spaced .104 dia. banana jacks.

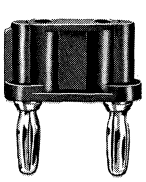
UPPER: BNC plug.

LOWER: Miniature double banana plug on ½" centers, for use with .104 dia. miniature jacks. Gold flashed one piece heat treated beryllium copper springs.

COLOR: Black.

MODEL 3270 QUANTITY DISC. CODE **A** **NET 4.25**

ADAPTER — STANDARD DOUBLE BANANA JACK TO MINIATURE DOUBLE BANANA PLUG





Permits standard double banana plug on ¾" centers to be used with equipment having miniature double banana jacks on ½" centers.

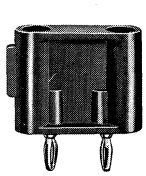
UPPER: Standard double banana jacks .166 dia. on ¾" centers. Brass, nickel plated.

LOWER: Miniature double banana plug on ½" centers. One piece nickel plated beryllium copper spring for use with .104 dia. miniature banana jacks.

COLOR: Black.

MODEL 2952 QUANTITY DISC. CODE **A** **NET .95**

ADAPTER — MINIATURE DOUBLE BANANA JACK TO STANDARD DOUBLE BANANA PLUG





Permits miniature double banana plug on ½" centers to be used with equipment having standard double banana jacks on ¾" centers.

UPPER: Miniature double banana jacks, .104 dia. on ½" centers. Brass, nickel plated.

LOWER: Standard double banana plug on ¾" centers. One piece nickel plated beryllium copper spring for use with .166 dia. standard banana jacks.

COLOR: Black.

MODEL 2943 QUANTITY DISC. CODE **A** **NET .95**

ADAPTER—STANDARD BANANA JACK TO MINIATURE BANANA PLUG





Permits standard banana plug to be used with equipment having miniature banana jacks.

UPPER: Banana jack, .166 dia.; Brass, nickel plated.

LOWER: Miniature banana plug, one piece nickel plated beryllium copper spring for use with .104 dia. miniature banana jacks.

COLORS: Black, Red.

MODEL 2138 2138-0 Black, 2138-2 Red **NET .50**

QUANTITY DISC. CODE **A**

ADAPTER—MINIATURE BANANA JACK TO STANDARD BANANA PLUG





Permits miniature banana plugs to be used with equipment having standard banana jacks.

UPPER: Miniature banana jack, .104 dia.; Brass, nickel plated.

LOWER: Standard banana plug, one piece nickel plated beryllium copper spring for use with .166 dia. banana jacks.

COLORS: Black, Red.

MODEL 2477 2477-0 Black, 2477-2 Red **NET .50**

QUANTITY DISC. CODE **A**

MINIATURE — METAL SHORTING BAR



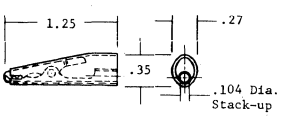


Low profile, gold flashed, brass shorting bar. Miniature banana plugs on ½" centers swaged to 1/16" thick brass bar. Center hole accepts #4-40 screw for easy removal. Current rating 5 Amps. cont., 10 Amps INT.

MODEL 3030 QUANTITY DISC. CODE **A** **NET .85**

NEW INSULATED MINIGATOR CLIP TO MINIATURE BANANA JACK



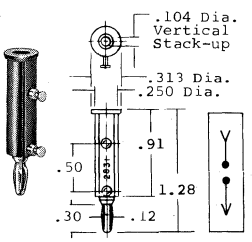


This Minigator clip accepts a miniature banana plug in the rear. Clip is steel, cadmium plated. Pinned hinge construction with full-meshing jaws for small wires. Vinyl insulators (5 red, 5 black). Unassembled.

Standard Package of 10 clips and 10 insulators.

MODEL 3217 QUANTITY DISC. CODE **A** **NET .20 ea.**

MINIATURE — SINGLE BANANA PLUG ISOLATION



Provides two terminal isolation. Allows for addition of series components. Excellent for circuit design and testing. Gold flashed solder turret terminals for permanent noise-free connections.

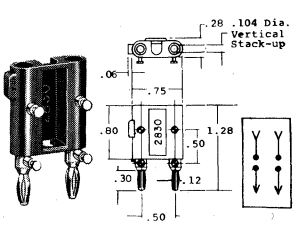
UPPER: Miniature banana jack, .104 dia. Brass, gold flashed.

LOWER: Miniature banana plug, one piece gold flashed beryllium copper spring.
Colvinimed

COLOR: Black, Red.

MODEL 2831 (specify color) QUANTITY DISC. CODE **A** **NET 1.25**

MINIATURE — DOUBLE BANANA PLUG — 4 TERMINAL ISOLATION



Provides four terminal isolation. Top Stack-up receptacles isolated from lower plugs. Ideal for insertion of matching networks in computer boards, circuit design and testing. Gold flashed solder turret terminals for permanent noise-free connections.

UPPER: Miniature double banana jack, .104 dia. Brass, gold flashed.

LOWER: Miniature double banana plug on ½" centers. Gold flashed one piece beryllium copper spring.

COLOR: Red.

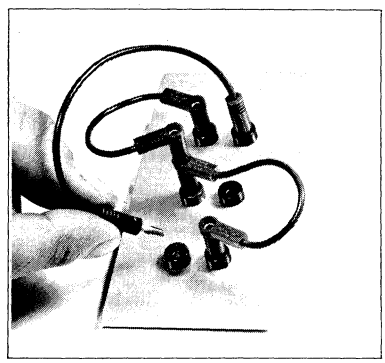
MODEL 2830 QUANTITY DISC. CODE **A** **NET 3.85**

POMONA ELECTRONICS

MINIATURE PATCH CORDS

Miniature patch cords for use with .104 dia. miniature banana jacks. Excellent for miniaturization of test equipment and high density packaging for patch systems.

Banana plug springs precision formed of one piece beryllium copper, heat treated for maximum life and low contact resistance. Tough thermoplastic molded to plug body and wire.



FEATURES:

■ Fits .104 dia. miniature banana jacks ■ Plug body brass, per QQ-B-626, Comp. #22 ■ Gold flashed per MIL-G-45204 Type II (.00002/.00003) ■ Spring, one piece heat treated beryllium copper, alloy 170 per QQ-C-533.

SPECIFICATIONS:

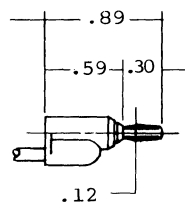
■ WIRE: 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation .087" O.D. ■ RATED: 5 A. Cont., 10 A. Int., 5,000 V.D.C. ■ OPERATING TEMP.: —0°C to +105 C°

MINIATURE—BANANA PLUG STACK-UP PATCH CORD

MODEL	LENGTH	NET
1081-4	4"	1.50
1081-8	8"	1.50
1081-12	12"	1.50
1081-18	18"	1.50
1081-24	24"	1.50
1081-36	36"	1.50
1081-48	48"	1.55
1081-60	60"	1.60





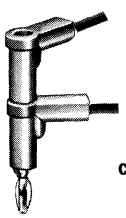


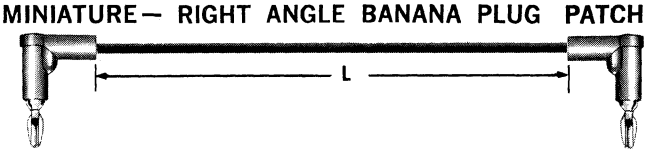
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

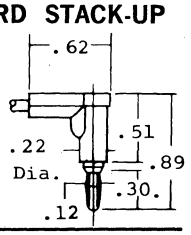
MODEL 1081 (Specify Color) ★QUANTITY DISC. CODE **A**

MINIATURE— RIGHT ANGLE BANANA PLUG PATCH CORD STACK-UP

MODEL	LENGTH	NET
2860-4	4"	1.50
2860-8	8"	1.50
2860-12	12"	1.50
2860-18	18"	1.50
2860-24	24"	1.50
2860-36	36"	1.50
2860-48	48"	1.55
2860-60	60"	1.60





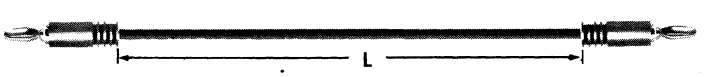


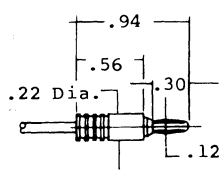
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

MODEL 2860 (Specify Color) ★QUANTITY DISC. CODE **A**

MINIATURE—BANANA PLUG PATCH CORD

MODEL	LENGTH	NET
2842-4	4"	1.00
2842-8	8"	1.00
2842-12	12"	1.00
2842-18	18"	1.00
2842-24	24"	1.00
2842-36	36"	1.00
2842-48	48"	1.05
2842-60	60"	1.10





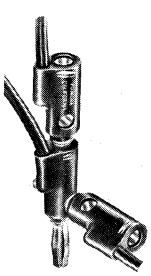
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

MODEL 2842 (Specify Color) ★QUANTITY DISC. CODE **A**

NEW

STANDARD BANANA PLUG TO MINIATURE BANANA PLUG PATCH CORD

MODEL	LENGTH	NET
3014-4	4"	1.50
3014-8	8"	1.50
3014-12	12"	1.50
3014-18	18"	1.50
3014-24	24"	1.50
3014-36	36"	1.50
3014-48	48"	1.55
3014-60	60"	1.60





A patch cord for rapid interconnection of equipment having standard and miniature banana jacks. Both plugs have a stack-up feature.
STANDARD BANANA PLUG: Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermoplastic molded to plug body and wire.
WIRE: 20 AWG, Strand. 41 x 36 T.C. extra flexible polyvinyl insulation .087" O.D.

MINIATURE BANANA PLUG: Spring, one piece beryllium copper, heat treated, gold flashed. Tough thermoplastic molded to plug body and wire.
RATED: 5 A. Cont., 10 A Int. 5,000 W.V.D.C.
OPERATING TEMP.: —25° C to +105° C.
COLORS: Black, Red.

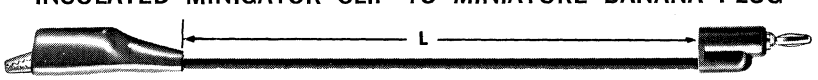


MODEL 3014 (Specify Color) ★QUANTITY DISC. CODE **A**

NEW

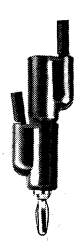
INSULATED MINIGATOR CLIP TO MINIATURE BANANA PLUG

MODEL	LENGTH	NET
3222-4	4"	1.00
3222-8	8"	1.00
3222-12	12"	1.00
3222-18	18"	1.00
3222-24	24"	1.00
3222-36	36"	1.00
3222-48	48"	1.05
3222-60	60"	1.10



Adapts to equipment using miniature banana jacks.
CLIP: Minigator, Steel, cadmium plated.
MINIATURE BANANA PLUG: Spring, one piece beryllium copper, heat treated, gold flashed. Tough thermoplastic molded to plug body and wire.

INSULATOR: Red vinyl with red wire. Black on black wire.
WIRE: 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation, .087" O.D.
OPERATING TEMP.: —25° C to +105° C.
COLORS: Black, Red



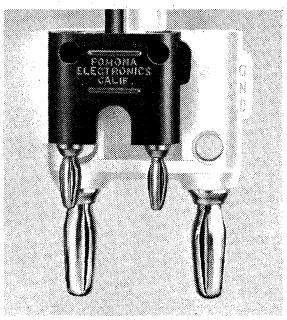
MODEL 3222 (Specify Color) ★QUANTITY DISC. CODE **A**

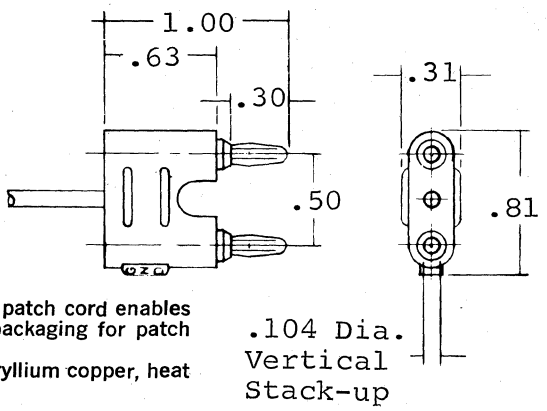
POMONA ELECTRONICS

½" SPACED MINIATURE DOUBLE BANANA PLUG PATCH CORDS

MOLDED MINIATURE DOUBLE BANANA PLUG PATCH CORDS

ACTUAL SIZE





STACK-UP

⅓ smaller...

A miniature double banana plug on ½" centers. This patch cord enables miniaturization of test equipment and high density packaging for patch systems.
Banana plug springs precision formed of one piece beryllium copper, heat treated for maximum life and low contact resistance.

FEATURES...

- One piece beryllium copper heat treated spring for long life.
- Rounded spring design results in maximum contact area.
- GND., clearly molded on plug body and shell.
- Solder-bonded noise-free connections.

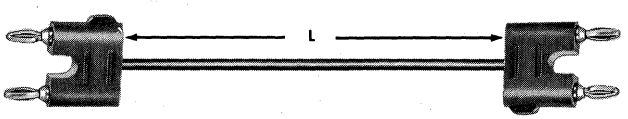
SPECIFICATIONS . . .

- Fits standard 0.104 dia. banana jacks, on ½" centers.
- Spring beryllium copper alloy 170 per QQ-C-533.
- Plug body brass per QQ-B-626, Comp. 22.
- Gold flashed per MIL-G-45204, type II.

CABLE DESCRIPTION:
Shielded coax., RG174/U. Polyethylene insulation, Vinyl jacket. Nom. cap. 29.5 pf/ft. Nom. Imp. 50 Ohms. Nom. O.D. .100". **Color: Black.**

NOTE: Molded double plug matches color of cable.

MINIATURE — DOUBLE BANANA PLUG BOTH ENDS

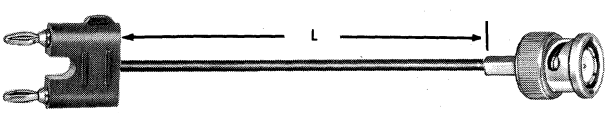


CONN: 1st END { Miniature Double Banana plug on ½" centers. **CABLE:** Shielded Coax., RG174/U. **CONN: 2nd END** { Miniature double banana plug on ½" centers.

MODEL	LENGTH
2247-K-12	12"
2247-K-24	24"
2247-K-36	36"
2247-K-48	48"
2247-K-60	60"

MODEL 2247 ★ QUANTITY DISC. CODE **B** **NET 4.95**

MINIATURE–DOUBLE BANANA PLUG TO BNC MALE

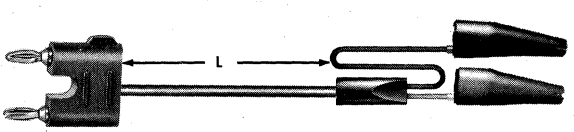


CONN: 1st END { Miniature Double Banana Plug on ½" centers **CABLE:** Shielded Coax., RG174/U **CONN: 2nd END** { Male BNC

MODEL	LENGTH
2248-K-12	12"
2248-K-24	24"
2248-K-36	36"
2248-K-48	48"
2248-K-60	60"

MODEL 2248 ★ QUANTITY DISC. CODE **B** **NET 5.95**

MINIATURE — DOUBLE BANANA PLUG TO MINIGATOR CLIPS

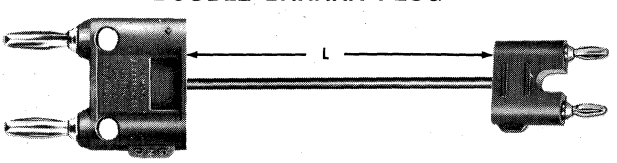


CONN: 1st END { Miniature Double Banana plug on ½" centers. **CABLE:** Shielded Coax., RG174/U. **CONN: 2nd END** { Minigator Clips, Steel, cad plated Insulators, Vinyl: Black/Red.

MODEL	LENGTH
3027-K-12	12"
3027-K-24	24"
3027-K-36	36"
3027-K-48	48"
3027-K-60	60"

MODEL 3027 ★ QUANTITY DISC. CODE **B** **NET 5.95**

DOUBLE BANANA PLUG TO MINIATURE DOUBLE BANANA PLUG



CONN: 1st END { Double Banana Plug, on ¾" Centers. **CABLE:** Shielded Coax., RG174/U. **CONN: 2nd END** { Miniature double banana plug on ½" Centers.

MODEL	LENGTH
2443-K-12	12"
2443-K-24	24"
2443-K-36	36"
2443-K-48	48"
2443-K-60	60"

MODEL 2443 ★ QUANTITY DISC. CODE **B** **NET 4.95**

POMONA ELECTRONICS "BLACK BOXES"

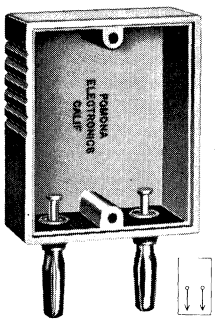
CREATE passive and active networks, voltage dividers, isolation networks or attenuators with these units. Solder turret terminals for permanent noise-free connection of components, etc. Entire unit may be potted or encapsulated.

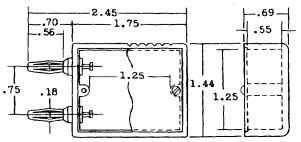
Housing molded of thermosetting electrical grade phenolic. Cover, punched XXP laminated paper base phenolic. Color, housing and cover, BLACK. Cover plate and 2 each #2-56 cover screws included.

APPLICABLE SPECIFICATIONS:

Operating Temp: —25°C to +125°C. Working Voltage: 5000 VDC. Current: 15 Amps Cont., 30 Amps Int.

COMPONENT MOUNTING—ACROSS BANANA PLUGS



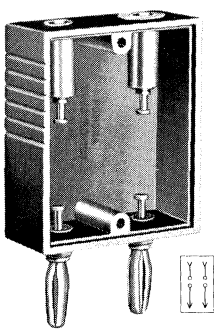


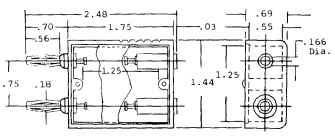
UPPER: No Connection.

LOWER: Banana plugs on ¾" centers. One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

MODEL 2096 QUANTITY DISC. CODE **A** **NET 1.95**

COMPONENT MOUNTING—BANANA JACKS TO DOUBLE BANANA PLUG—JUNIOR SIZE



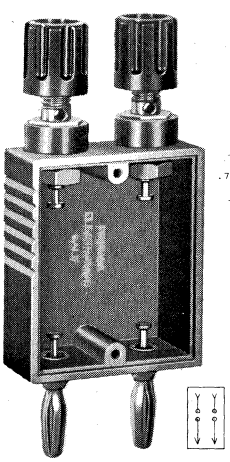


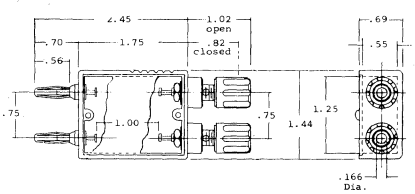
UPPER: Banana jacks, .166" dia. and solder turret terminals on ¾" centers. Brass, nickel plated. Polarity indicator on top, color, RED.

LOWER: Banana plugs on ¾" centers. One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

MODEL 2098 QUANTITY DISC. CODE **A** **NET 3.45**

COMPONENT MOUNTING—BINDING POSTS TO DOUBLE BANANA PLUG—JUNIOR SIZE

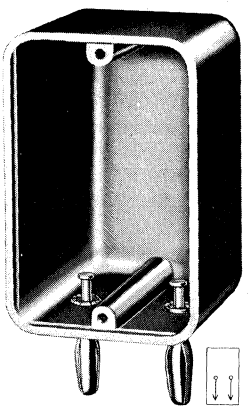




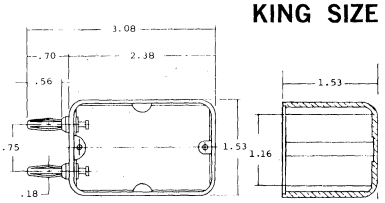
UPPER: Banana jack binding posts with solder turret terminals, on ¾" centers. Red and Black.

LOWER: Banana plugs on ¾" centers. One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

MODEL 2259 QUANTITY DISC. CODE **A** **NET 4.85**



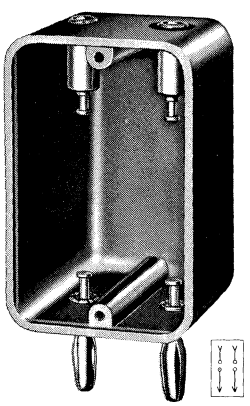
COMPONENT MOUNTING—ACROSS BANANA PLUGS—KING SIZE



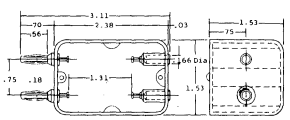
UPPER: No Connection.

LOWER: Banana plugs on ¾" centers. One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

MODEL 1177 QUANTITY DISC. CODE **A** **NET 1.95**



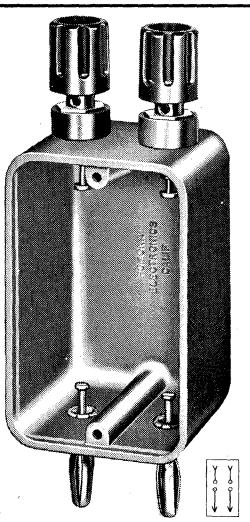
COMPONENT MOUNTING—BANANA JACKS TO DOUBLE BANANA PLUG—KING SIZE



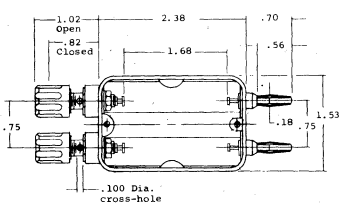
UPPER: Banana jacks, .166" dia. and solder turret terminals on ¾" centers. Brass, nickel plated. Polarity indicator on top, color, RED.

LOWER: Banana plugs on ¾" centers. One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

MODEL 2224 QUANTITY DISC. CODE **A** **NET 3.45**



COMPONENT MOUNTING—BINDING POSTS TO DOUBLE BANANA PLUG—KING SIZE



UPPER: Banana jack binding posts with solder turret terminals, on ¾" centers. Red and Black.

LOWER: Banana plugs on ¾" centers. One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

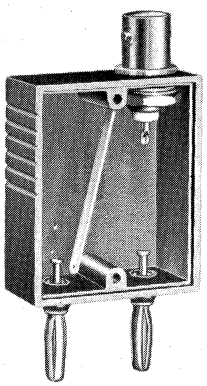
MODEL 2262 QUANTITY DISC. CODE **A** **NET 4.85**

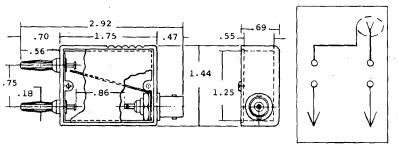
POMONA ELECTRONICS "BLACK BOXES"

CREATE passive and active networks, voltage dividers, isolation networks or attenuators with these units. Solder turret terminals for permanent noise-free connection of components, etc. Entire unit may be potted or encapsulated.

Housing molded of thermosetting electrical grade phenolic. Cover, punched XXP laminated paper base phenolic. Color, housing and cover, BLACK. Cover plate and 2 each #2-56 cover screws included.

COMPONENT MOUNTING—BNC RECEPTACLE TO DOUBLE BANANA PLUG





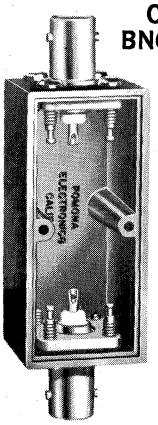
UPPER: BNC Receptacle UG1094/U

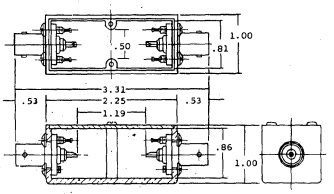
LOWER: Banana plugs on ¾" centers. One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

APPLICABLE SPECIFICATIONS:
Operating Temp: −25°C to +125°C.
Working Voltage: 500 V Peak.

MODEL 2097 QUANTITY DISC. CODE A **NET 3.85**

COMPONENT MOUNTING—BNC RECEPTACLE BOTH ENDS





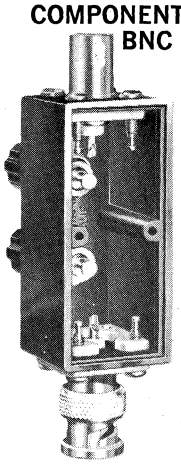
UPPER: BNC Receptacle UG290A/U

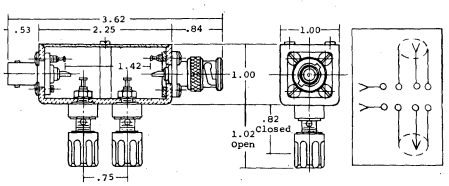
LOWER: BNC Receptacle UG290A/U

APPLICABLE SPECIFICATIONS:
Operating Temp: −25°C to +125°C.
Working Voltage: 500 V Peak.

MODEL 2101 QUANTITY DISC. CODE A **NET 4.85**

COMPONENT MOUNTING—BNC RECEPTACLE TO BNC PLUG WITH BINDING POSTS





UPPER: BNC Receptacle UG290A/U

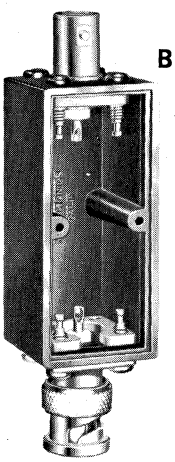
CENTER: Banana jack binding posts with solder turret terminals. Red and Black.

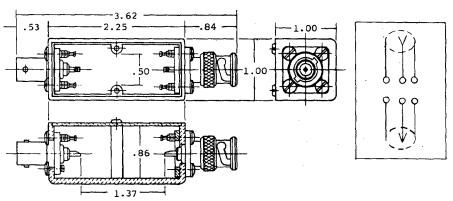
LOWER: BNC Plug. UG1104A/U.

APPLICABLE SPECIFICATIONS:
Operating Temp: −25°C to +125°C.
Working Voltage: 500 V Peak.

MODEL 2100 QUANTITY DISC. CODE A **NET 8.95**

COMPONENT MOUNTING—BNC RECEPTACLE TO BNC PLUG





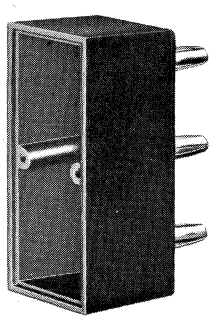
UPPER: BNC Receptacle UG290A/U

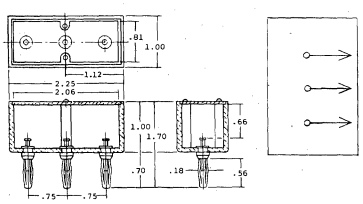
LOWER: BNC Plug UG1104A/U

APPLICABLE SPECIFICATIONS:
Operating Temp: −25°C to +125°C.
Working Voltage: 500 V Peak.

MODEL 2099 QUANTITY DISC. CODE A **NET 6.85**

COMPONENT MOUNTING—(3) ¾" SPACED BANANA PLUGS



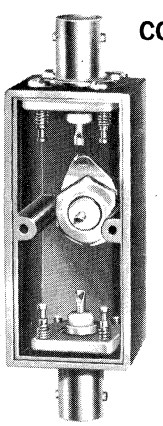


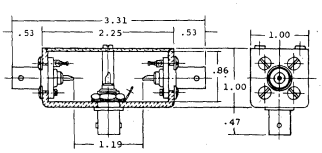
Three-in-line ¾" Spaced Banana Plugs.
One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

APPLICABLE SPECIFICATIONS:
Operating Temp: −25°C to +125°C.
Working Voltage: 5000 VDC.
Current: 15 Amps Cont., 30 Amps Int.

MODEL 2095 QUANTITY DISC. CODE A **NET 2.75**

COMPONENT MOUNTING—BNC RECEPTACLE "T"





UPPER: BNC Receptacle UG290A/U

CENTER: BNC Receptacle UG1094/U

LOWER: BNC Receptacle UG290A/U

APPLICABLE SPECIFICATIONS:
Operating Temp: −25°C to +125°C.
Working Voltage: 500 V Peak.

MODEL 2102 QUANTITY DISC. CODE A **NET 7.85**

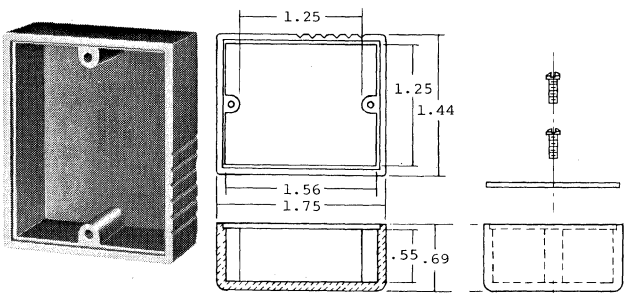
POMONA ELECTRONICS

"BLACK BOXES"

Boxes of unlimited uses for packaging of components and circuitry. Also ideal for potting and encapsulating. Available in three sizes as shown below. Housing molded of thermosetting electrical grade phenolic. Cover, punched XXP laminated paper base phenolic. Color, Housing and cover, Black. Cover plate and 2 each #2-56 cover screws included.

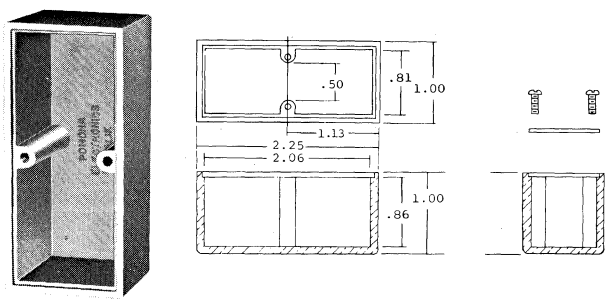
Operating Temperature: —25°C to +125°C.

BLACK BOX—JUNIOR SIZE



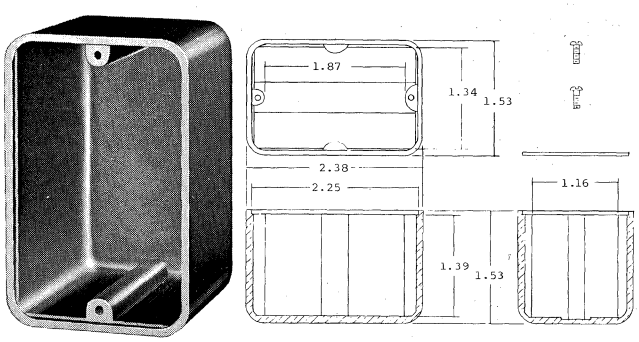
MODEL 2105 QUANTITY DISC. CODE **A** **NET .75**

BLACK BOX—QUEEN SIZE



MODEL 2103 QUANTITY DISC. CODE **A** **NET .75**

BLACK BOX—KING SIZE

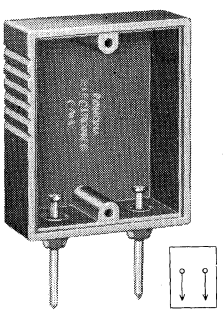


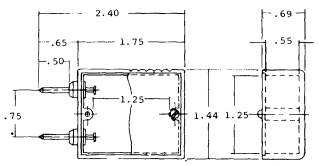
MODEL 2104 QUANTITY DISC. CODE **A** **NET .75**

CREATE passive and active networks, voltage dividers, isolation networks or attenuators with these units. Solder turret terminals for permanent noise-free connection of components, etc. Entire unit may be potted or encapsulated.

Housing molded of thermosetting electrical grade phenolic. Cover, punched XXP laminated paper base phenolic. Color, housing and cover, BLACK. Cover plate and 2 each #2-56 cover screws included.

COMPONENT MOUNTING—ACROSS PIN TIP PLUGS





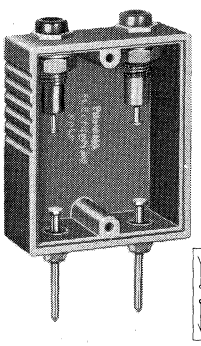
UPPER: No Connection.

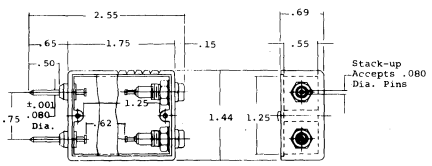
LOWER: Pin tip plugs, .080 dia. on ¾" centers. Plug bodies and solder turret terminals, brass, nickel plated.

APPLICABLE SPECIFICATIONS:
Operating Temp.: —25°C to +125°C
Working Voltage: 5000 VDC.
Current: 5 Amps Cont., 10 Amps Int.

MODEL 2268 QUANTITY DISC. CODE **A** **NET 1.95**

COMPONENT MOUNTING—PIN TIP JACKS TO DOUBLE PIN TIP PLUG—JUNIOR SIZE





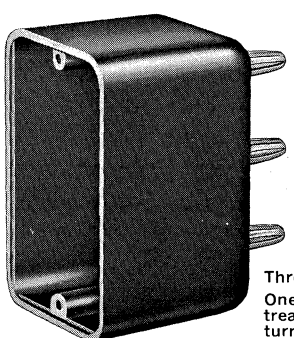
UPPER: Tip jacks, on ¾" centers, per MS-16108. One Red, one Black.

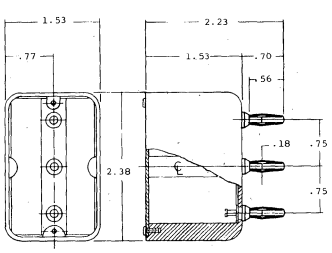
LOWER: Pin tip plugs, .080 dia. on ¾" centers. Plug bodies and solder turret terminals, brass, nickel plated.

APPLICABLE SPECIFICATIONS:
Operating Temp.: —25°C to +125°C.
Working Voltage: 5000 VDC.
Current: 5 Amps Cont., 10 Amps Int.

MODEL 2260 QUANTITY DISC. CODE **A** **NET 4.85**

COMPONENT MOUNTING — (3) ¾" SPACED BANANA PLUGS — KING SIZE





Three-in-line ¾" Spaced Banana Plugs.

One piece beryllium copper spring, heat treated, nickel plated. Plug body and solder turret terminals, brass, nickel plated. For use with standard .166" dia. banana jacks.

APPLICABLE SPECIFICATIONS:
Operating Temp: —25°C to +125°C.
Working Voltage: 5000 VDC.
Current: 15 Amps Cont., 30 Amps In.

MODEL 1943 QUANTITY DISC. CODE **A** **NET 2.75**

POMONA ELECTRONICS

SHIELDED "BLACK BOXES" SIZE "A"

NOW AVAILABLE, *SHIELDED* "BLACK BOXES." Boxes that fulfill the requirement for RF applications.

Ideal for compact packaging, eg., voltage dividers, isolation networks, impedance matching networks, and other varied uses.

Cover and self-tapping screws included.

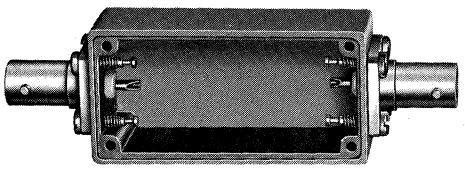
APPLICABLE SPECIFICATIONS: (ALL MODELS)

Operating Temp.: −55°C to +150°C.
Working Voltage: 500 V Peak (Model 2415, 1500 V Peak).
Noise Rejection: Greater than 70DB.

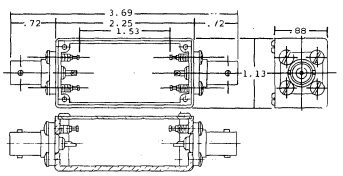
FEATURES:

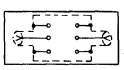
- SHIELDED HOUSING; Die Cast Aluminum. FINISH: BLUE baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.
- COVER; .040 Thick Aluminum #6061-T6 with clear anodized finish per MIL-A-8625A.
- Four screws secure cover for proper shielding.
- Solder turret terminals for permanent noise free connection of components.

COMPONENT MOUNTING— BNC RECEPTACLE BOTH ENDS



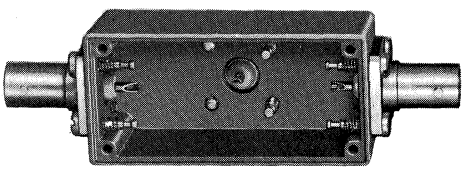
CONN: 1st END } BNC Receptacle Jack, UG290A/U.
CONN: 2nd END } BNC Receptacle Jack, UG290A/U.



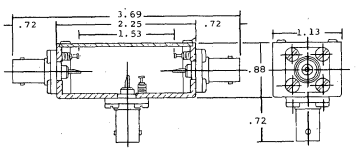


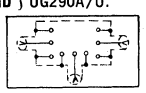
MODEL 2390 QUANTITY DISC. CODE **A** **NET 6.85**

COMPONENT MOUNTING— BNC RECEPTACLE "T"



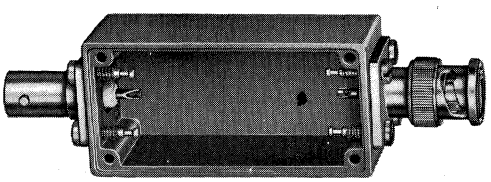
CONN: 1st END } BNC Receptacle Jack, UG290A/U.
CENTER: BNC Receptacle Jack, UG290A/U.
CONN: 2nd END } BNC Receptacle Jack, UG290A/U.



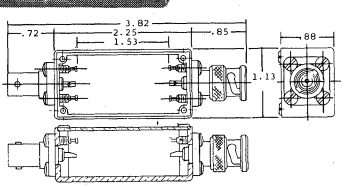


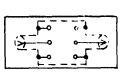
MODEL 2392 QUANTITY DISC. CODE **A** **NET 9.50**

COMPONENT MOUNTING— BNC RECEPTACLE TO BNC PLUG



CONN: 1st END } BNC Receptacle Jack, UG290A/U.
CONN: 2nd END } BNC Receptacle Plug, UG1104A/U.

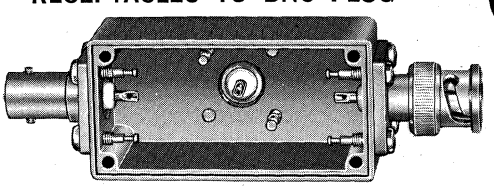




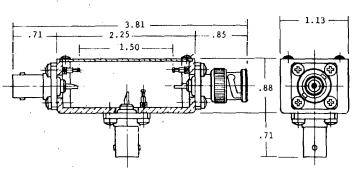
MODEL 2391 QUANTITY DISC. CODE **A** **NET 7.85**

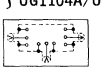
COMPONENT MOUNTING — "T" TWO BNC RECEPTACLES TO BNC PLUG

NEW



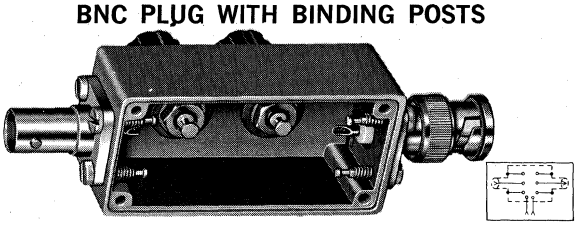
CONN: 1st. END } BNC Receptacle Jack, UG290A/U.
CENTER: BNC Receptacle Jack, UG290A/U.
CONN: 2nd END } BNC Receptacle Plug, UG1104A/U.



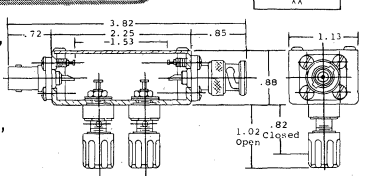


MODEL 2401 QUANTITY DISC. CODE **A** **NET 10.85**

COMPONENT MOUNTING—BNC RECEPTACLE TO BNC PLUG WITH BINDING POSTS

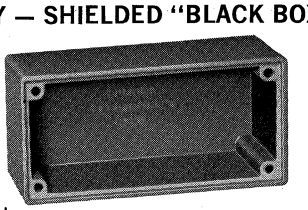


CONN: 1st END } BNC Receptacle Jack, UG290A/U.
CENTER: Banana jack binding posts with solder turret terminals. Red and Black.
CONN: 2nd END } BNC Receptacle Plug, UG1104A/U.



MODEL 2393 QUANTITY DISC. CODE **A** **NET 10.85**

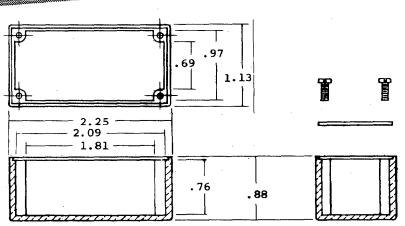
EMPTY — SHIELDED "BLACK BOX"



SIZE "A"

MODEL 2397
FINISH: Blue Baked Enamel.
Includes cover with part number on cover and four cover screws.

MODEL 2400
FINISH: None
Includes unmarked cover and four cover screws.



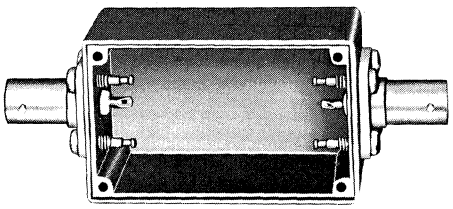
MODEL 2397
MODEL 2400
QUANTITY DISC. CODE **A** **NET 1.50**

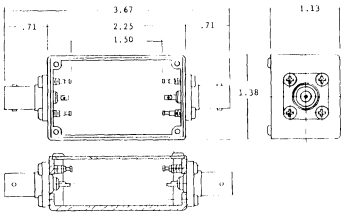
POMONA ELECTRONICS

SHIELDED "BLACK BOXES" SIZE "B"

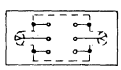
NEW

COMPONENT MOUNTING — BNC RECEPTACLE BOTH ENDS





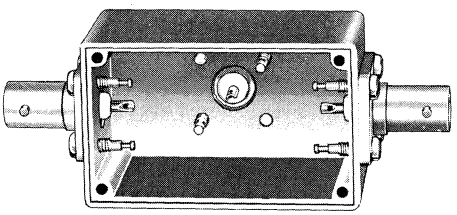
CONN: } BNC Receptacle Jack,
1st END { UG290A/U.
CONN: } BNC Receptacle Jack,
2nd END { UG290A/U.



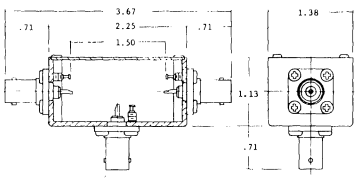
MODEL 3230 QUANTITY DISC. CODE **A** **NET 6.85**

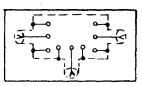
NEW

COMPONENT MOUNTING — BNC RECEPTACLE "T"



CONN: } BNC Receptacle Jack,
1st. END { UG290A/U.
CENTER: BNC Receptacle Jack, UG290A/U.
CONN: } BNC Receptacle Jack,
2nd END { UG290A/U.

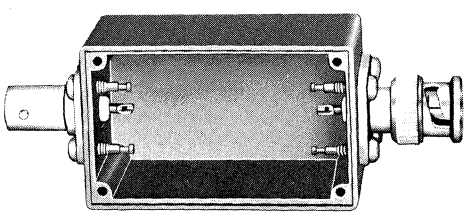




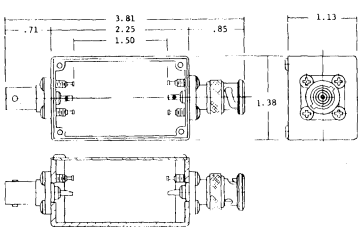
MODEL 3232 QUANTITY DISC. CODE **A** **NET 9.50**

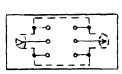
NEW

COMPONENT MOUNTING — BNC RECEPTACLE TO BNC PLUG



CONN: } BNC Receptacle Jack,
1st END { UG290A/U.
CONN: } BNC Receptacle Plug,
2nd END { UG1104A/U.

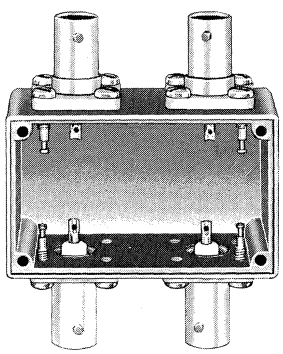


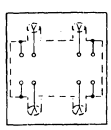


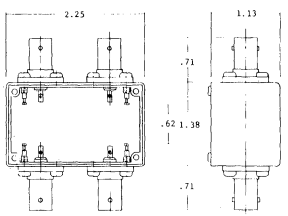
MODEL 3231 QUANTITY DISC. CODE **A** **NET 7.85**

COMPONENT MOUNTING — CROSS CONNECTIONS

NEW





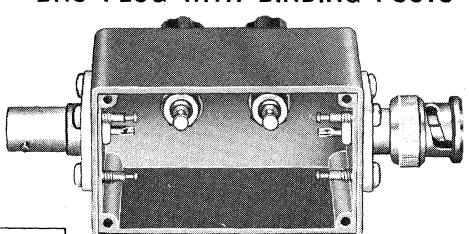


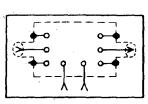
CONN: 4 each BNC Receptacle Jacks, UG290A/U.

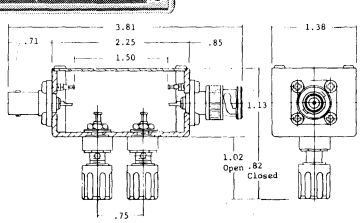
MODEL 3234 QUANTITY DISC. CODE **A** **NET 11.75**

NEW

COMPONENT MOUNTING — BNC RECEPTACLE TO BNC PLUG WITH BINDING POSTS



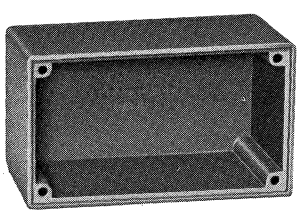




CONN. } BNC Receptacle Jack,
1st. END { UG290A/U.
CENTER: Banana jack binding posts with solder turret terminals. Red and Black.
CONN: } BNC Receptacle Plug,
2nd END { UG1104A/U.

MODEL 3233 QUANTITY DISC. CODE **A** **NET 10.85**

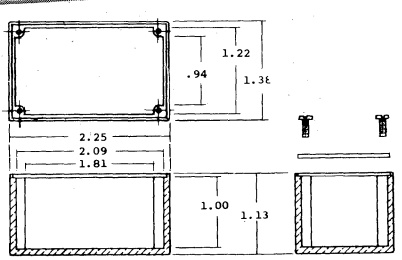
EMPTY — SHIELDED "BLACK BOX"



SIZE "B"

MODEL 2417
FINISH: Blue Baked Enamel.
Includes cover with part number on cover and four cover screws.

MODEL 2428
FINISH: None
Includes unmarked cover and four cover screws.

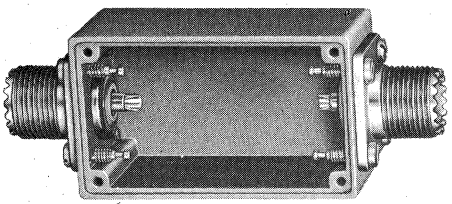


MODEL 2417
MODEL 2428 QUANTITY DISC. CODE **A** **NET 1.50**

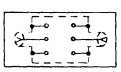
POMONA ELECTRONICS

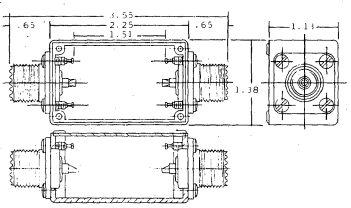
SHIELDED "BLACK BOXES" SIZE "B"

COMPONENT MOUNTING— UHF RECEPTACLE BOTH ENDS



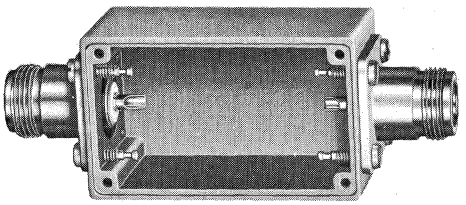
CONN: 1st END } UHF Receptacle Jack.
CONN: 2nd END } UHF Receptacle Jack.



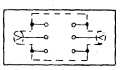


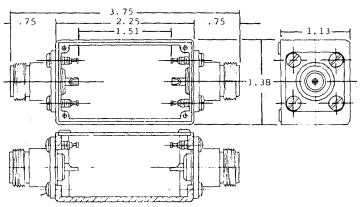
MODEL 2412 QUANTITY DISC. CODE A NET 7.85

COMPONENT MOUNTING— TYPE "N" RECEPTACLE BOTH ENDS



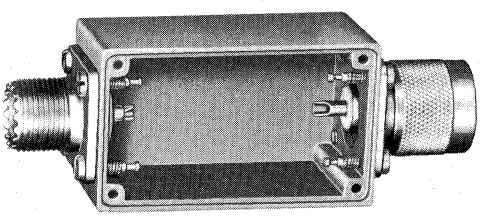
CONN: 1st END } Type "N" Receptacle Jack, UG58A/U.
CONN: 2nd END } Type "N" Receptacle Jack, UG58A/U.



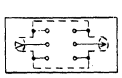


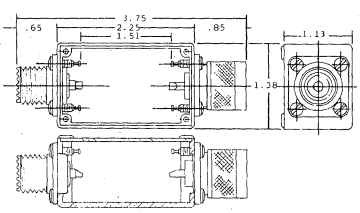
MODEL 2410 QUANTITY DISC. CODE A NET 6.85

COMPONENT MOUNTING— UHF RECEPTACLE TO UHF PLUG



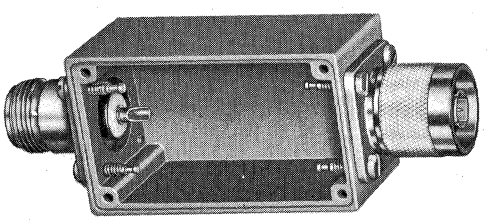
CONN: 1st END } UHF Receptacle Jack.
CONN: 2nd END } UHF Receptacle Plug.



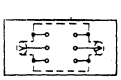


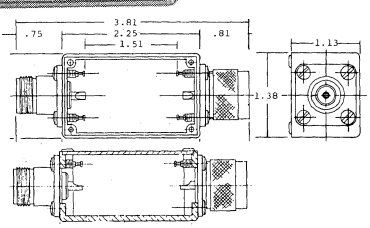
MODEL 2413 QUANTITY DISC. CODE A NET 10.85

COMPONENT MOUNTING— TYPE "N" RECEPTACLE TO TYPE "N" PLUG



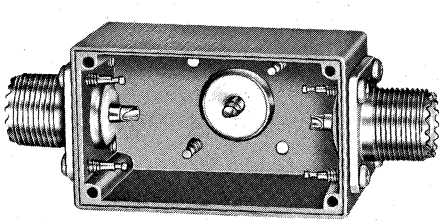
CONN: 1st END } Type "N" Receptacle Jack, UG58A/U.
CONN: 2nd END } Type "N" Receptacle Plug.



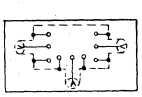


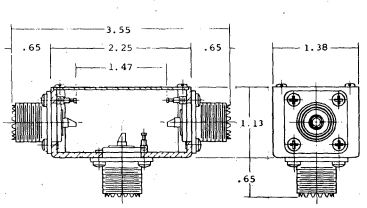
MODEL 2411 QUANTITY DISC. CODE A NET 9.85

COMPONENT MOUNTING— UHF RECEPTACLE "T"



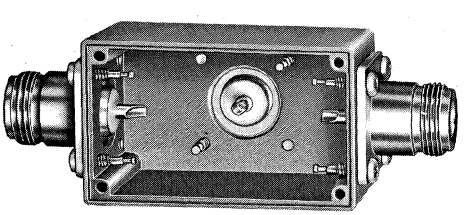
CONN: 1st END } UHF Receptacle Jack.
CENTER: UHF Receptacle Jack.
CONN: 2nd END } UHF Receptacle Jack.



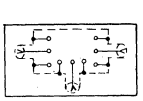


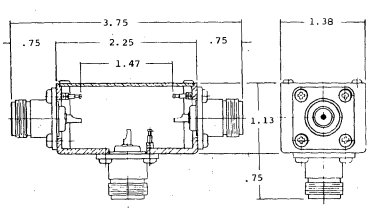
MODEL 2418 QUANTITY DISC. CODE A NET 10.85

COMPONENT MOUNTING— TYPE "N" RECEPTACLE "T"



CONN: 1st END } Type "N" Receptacle Jack, UG58A/U.
CENTER: Type "N" Receptacle Jack, UG58A/U.
CONN: 2nd END } Type "N" Receptacle Jack, UG58A/U.

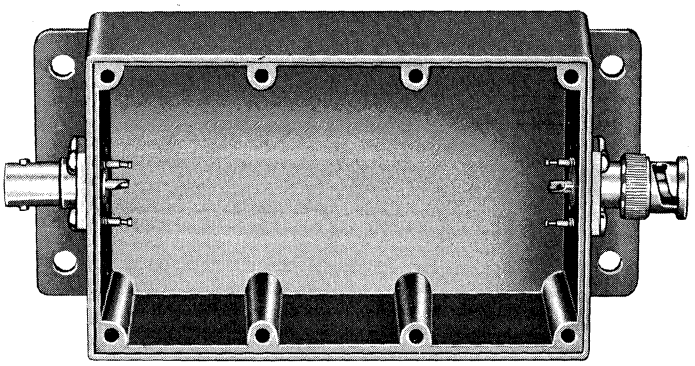




MODEL 2419 QUANTITY DISC. CODE A NET 9.50

POMONA ELECTRONICS

LARGER SHIELDED "BLACK BOXES" SIZE "C"



MODEL 2903

(Shown 2/3 actual size)

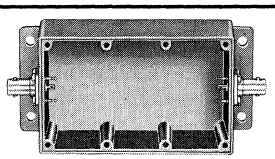
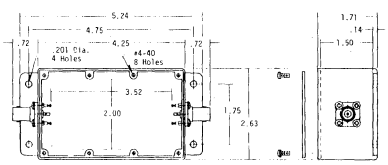
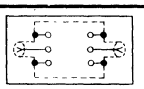
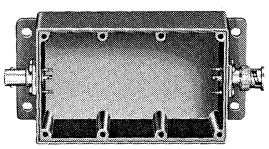
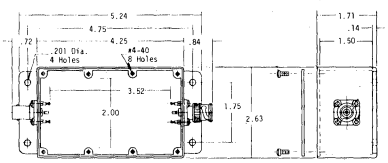
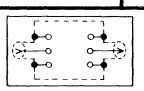
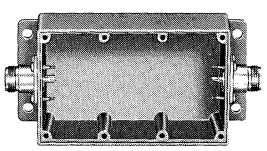
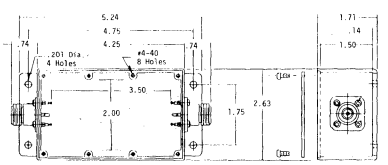
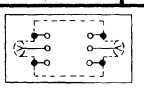
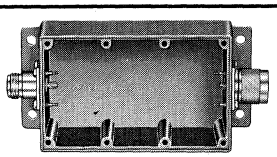
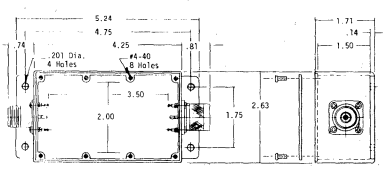
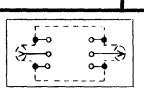
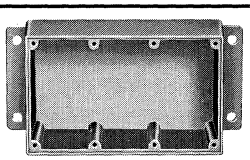
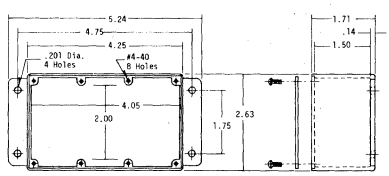
A **NEW** Series of **LARGER** shielded "BLACK BOXES."

These larger boxes are excellent for compact packaging of voltage dividers, isolation networks and many other applications.

APPLICABLE SPECIFICATIONS: (All Models)
Operating Temp.: —55°C to +150°C.
Working Voltage: 500 Peak.
Noise Rejection: Greater than 70DB

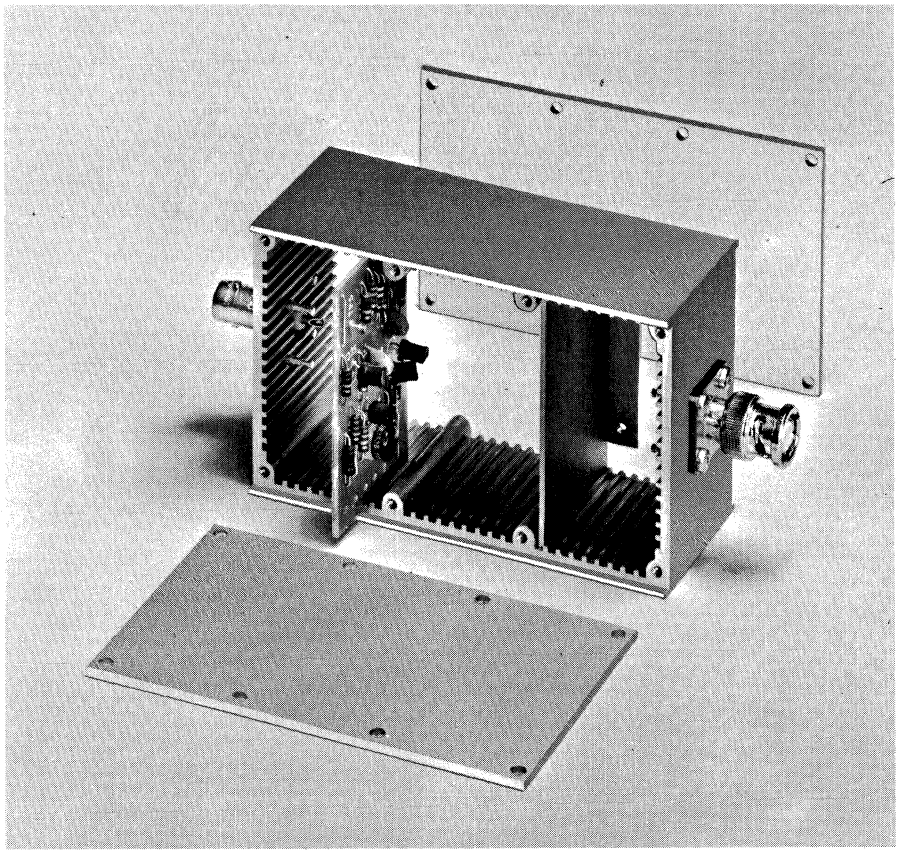
FEATURES:

- SHIELDED HOUSING; Die Cast Aluminum, Alloy #A380, FINISH: BLUE baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.
- COVER: .080 Thick Aluminum #6061-T6 with clear anodized finish per MIL-A-8625A.
- 8 ea. #4-40 x 1/4" screws secure cover for proper shielding.
- Solder turret terminals for permanent noise free connection of components.
- 2 flanges for easy mounting of box.

MODEL	CONN. 1st END	CONN. 2nd END			
 **MODEL 2902**	BNC Receptacle Jack UG290A/U	BNC Receptacle Jack UG290A/U		 QUANTITY DISC. CODE **A**	NET 9.85
 **MODEL 2903**	BNC Receptacle Jack UG290A/U	BNC Receptacle Plug UG1104A/U		 QUANTITY DISC. CODE **A**	NET 10.85
 **MODEL 2904**	TYPE "N" Receptacle Jack UG58A/U	TYPE "N" Receptacle Jack UG58A/U		 QUANTITY DISC. CODE **A**	NET 9.85
 **MODEL 2905**	TYPE "N" Receptacle Jack UG58A/U	TYPE "N" Receptacle Plug		 QUANTITY DISC. CODE **A**	NET 12.85
 **MODEL 2901**	NONE	NONE		QUANTITY DISC. CODE **A**	NET 5.85
MODEL 2906 **SEE 2901**	NONE	NONE	Same as Model 2901 except box is unpainted and cover is unmarked.	QUANTITY DISC. CODE **A**	NET 5.85

POMONA ELECTRONICS

SHIELDED "BLACK BOXES" WITH CARD GUIDES



SHIELDED "BLACK BOXES" WITH CARD GUIDES

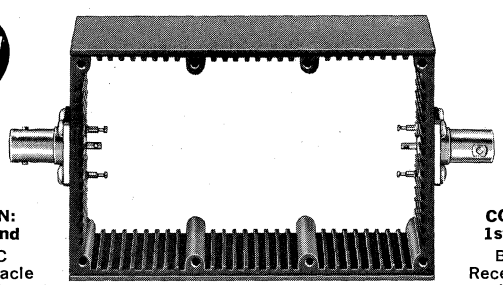
Aluminum boxes, slotted to accept 1/16" circuit boards and shielding dividers. Excellent for packaging electronic circuitry. Boxes have removable top and bottom covers. Useable inside space: 4"x2"x1½".

APPLICABLE SPECIFICATIONS:
(All Models)
Operating Temp.: —55°C to +150°C.
Working Voltage: 500 Peak.
Noise Rejection: Greater than 70DB

FEATURES:

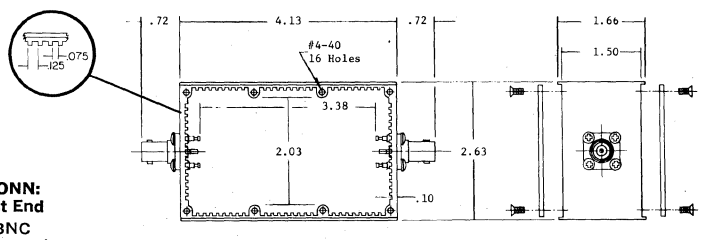
- **SHIELDED HOUSING:** Extruded Aluminum, Alloy #6061-T6. FINISH: BLUE baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.
- **COVERS:** Top and bottom, .080 thick Aluminum #6061-T6 with clear anodized Finish per MIL-A-8625A.
- **COVER SCREWS:** 16 EA #4-40x1/4" screws secure top and bottom cover for proper shielding.
- Solder turret terminals for permanent noise free connection of components.

NEW



CONN: 1st End BNC Receptacle Jack UG290A/U

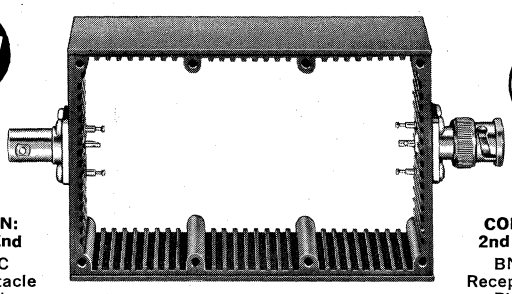
CONN: 1st End BNC Receptacle Jack UG290A/U



MODEL 3302

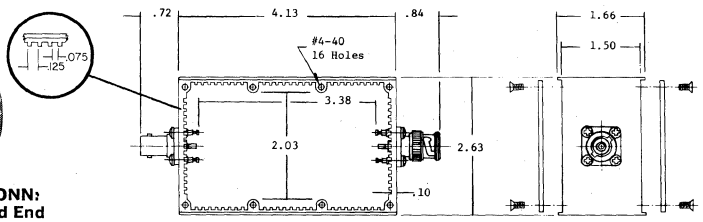
QUANTITY DISC. CODE A **NET 9.85**

NEW



CONN: 1st End BNC Receptacle Jack UG290A/U

CONN: 2nd End BNC Receptacle Plug UG1104A/U



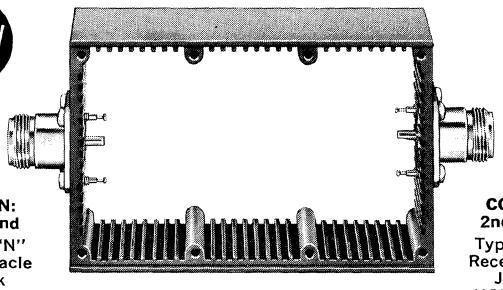
MODEL 3303

QUANTITY DISC. CODE A **NET 10.85**

POMONA ELECTRONICS

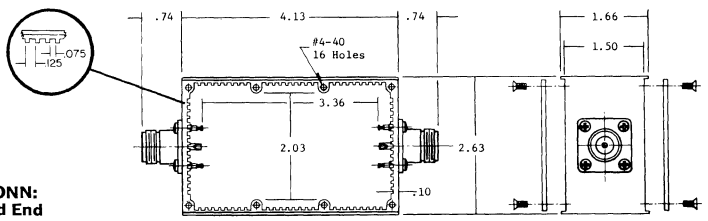
SHIELDED "BLACK BOXES" WITH CARD GUIDES

NEW



CONN: 1st End Type "N" Receptacle Jack UG58A/U

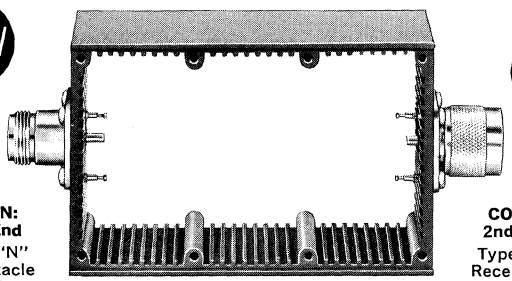
CONN: 2nd End Type "N" Receptacle Jack UG58A/U



MODEL 3304

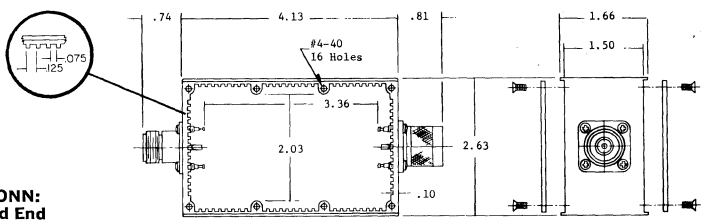
QUANTITY DISC. CODE **A** **NET 9.85**

NEW



CONN: 1st End Type "N" Receptacle Jack UG58A/U

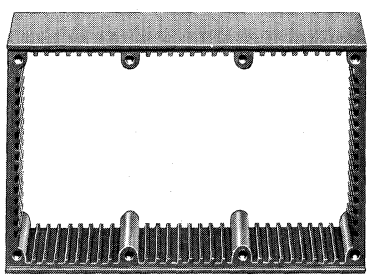
CONN: 2nd End Type "N" Receptacle Plug



MODEL 3305

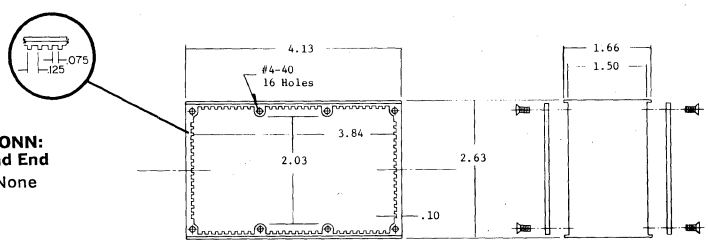
QUANTITY DISC. CODE **A** **NET 12.85**

NEW



CONN: 1st End None

CONN: 2nd End None



MODEL 3301

FINISH: Blue Baked Enamel. Includes top and bottom covers with part number on one and 16 cover screws.

MODEL 3306

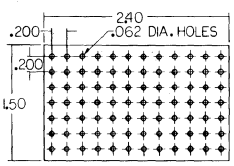
FINISH: None. Includes unmarked top and bottom covers with 16 cover screws.

QUANTITY DISC. CODE **A** **NET 6.85**

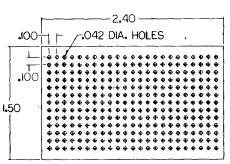
CIRCUIT MOUNTING BOARDS

Various Types of punched and blank Circuit boards for rapid assembly of components. Pre-cut to the proper size. Boards slide easily into the box card guides. All boards are 1/16" thick.

NEW



BOARD A



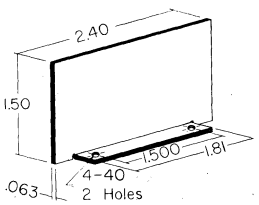
BOARD B

BOARD	MODEL	NO. OF HOLES	MATERIAL	NET EA.
A	3321	12 x 7	Paper-Epoxy (PEE)	.50
A	3322	NONE	Paper-Epoxy (PEE)	.35
A	3323	12 x 7	Glass-Epoxy (GEE)	.65
A	3324	NONE	Glass-Epoxy (GEE)	.45
A	3325	12 x 7	Glass-Epoxy (GEE) COP. CLAD 1 Side	.75
B	3326	23 x 13	Glass-Epoxy (GEE)	.85

QUANTITY DISC. CODE **A**

SHIELDING DIVIDER

NEW

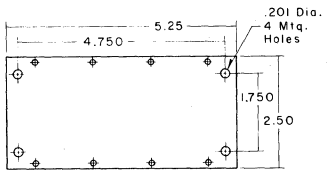


This Aluminum divider is excellent for dividing the box into shielded compartments. MATERIAL: .063 Aluminum, clear anodized per MIL-A-8625A.

MODEL 3327 QUANTITY DISC. CODE **A** **NET .75**

LARGER BOTTOM PLATE FOR MOUNTING

NEW



This larger plate, when attached to the box, provides flanges for mounting.

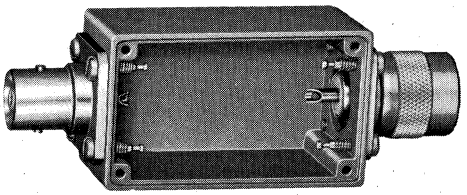
MATERIAL: .080 Aluminum #6061-T6, clear anodized per MIL-A-8625A.

MODEL 3328 (Plate only) QUANTITY DISC. CODE **A** **NET 1.25**

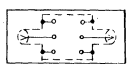
POMONA ELECTRONICS

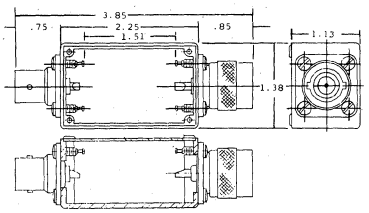
SHIELDED "BLACK BOXES"

COMPONENT MOUNTING— TYPE "C" RECEPTACLE TO TYPE "C" PLUG



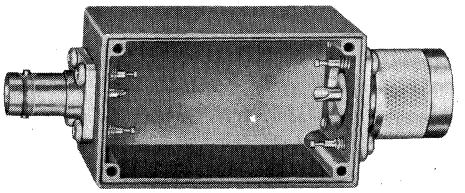
CONN: 1st END } Type "C" Receptacle Jack, UG568/U.
CONN: 2nd END } Type "C" Receptacle Plug.



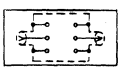


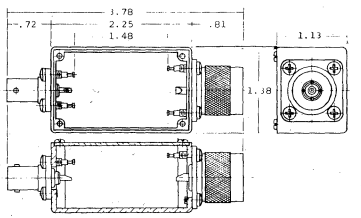
MODEL 2415 QUANTITY DISC. CODE **A** **NET 11.75**

COMPONENT MOUNTING— BNC RECEPTACLE TO TYPE "N" PLUG



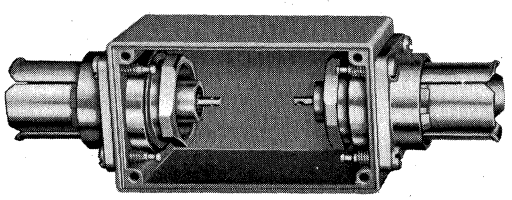
CONN: 1st END } BNC Receptacle Jack, UG290A/U.
CONN: 2nd END } Type "N" Receptacle Plug.



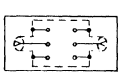


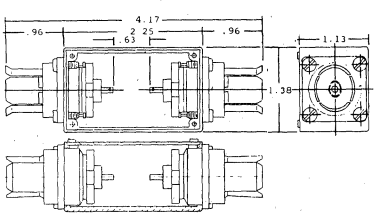
MODEL 2420 QUANTITY DISC. CODE **A** **NET 9.85**

COMPONENT MOUNTING— GR-874 CONNECTOR BOTH ENDS



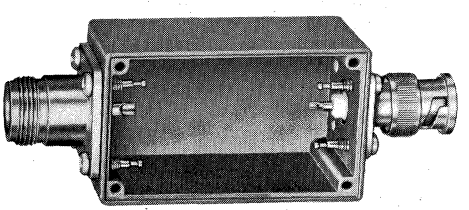
CONN: 1st END } Type GR-874 Connector.
CONN: 2nd END } Type GR-874 Connector.



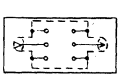


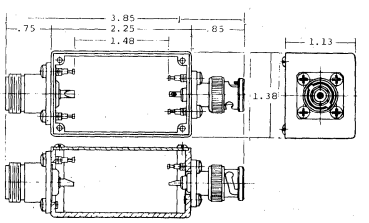
MODEL 2416 QUANTITY DISC. CODE **A** **NET 24.75**

COMPONENT MOUNTING— TYPE "N" RECEPTACLE TO BNC PLUG



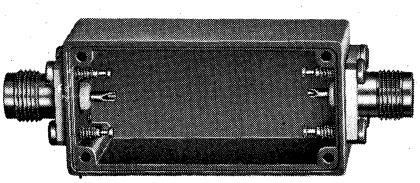
CONN: 1st END } Type "N" Receptacle Jack, UG58A/U.
CONN: 2nd END } BNC Receptacle Plug, UG1104A/U.



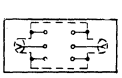


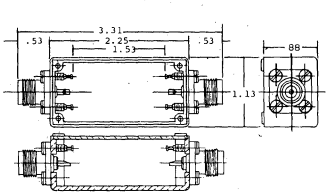
MODEL 2421 QUANTITY DISC. CODE **A** **NET 7.85**

COMPONENT MOUNTING— TNC RECEPTACLE BOTH ENDS



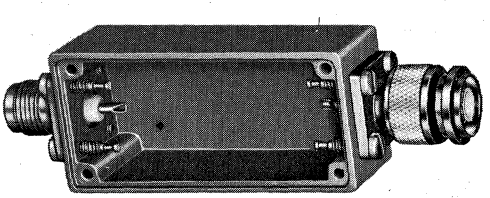
CONN: 1st END } TNC Receptacle Jack.
CONN: 2nd END } TNC Receptacle Jack.



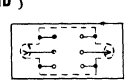


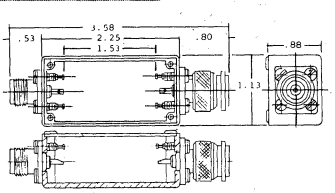
MODEL 2396 QUANTITY DISC. CODE **A** **NET 7.85**

COMPONENT MOUNTING— TNC RECEPTACLE TO TNC PLUG



CONN: 1st END } TNC Receptacle Jack.
CONN: 2nd END } TNC Receptacle Plug.



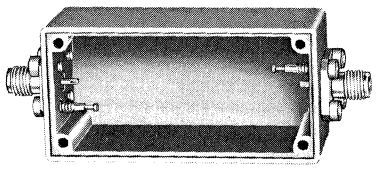


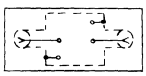
MODEL 2395 QUANTITY DISC. CODE **A** **NET 9.50**

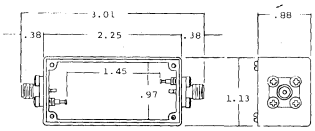
POMONA ELECTRONICS

SHIELDED "BLACK BOXES"

COMPONENT MOUNTING — OSM* RECEPTACLE BOTH ENDS



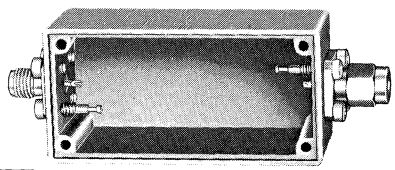


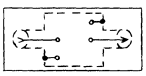


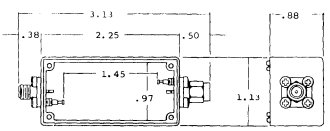
CONN: 1st END } OSM Receptacle Jack.
CONN: 2nd END } OSM Receptacle Jack.

MODEL 2399 QUANTITY DISC. CODE **A** **NET 17.95**

COMPONENT MOUNTING — OSM* RECEPTACLE TO OSM* PLUG



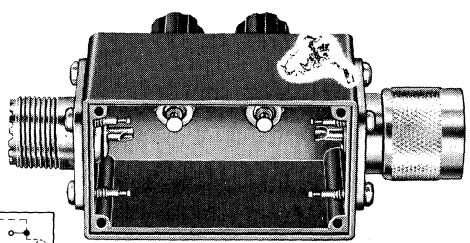


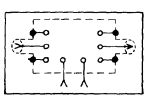


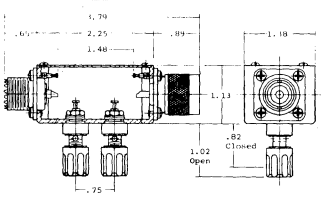
CONN: 1st END } OSM Receptacle Jack.
CONN: 2nd END } OSM Receptacle Plug.

MODEL 2398 QUANTITY DISC. CODE **A** **NET 22.95**

COMPONENT MOUNTING — UHF RECEPTACLE TO UHF PLUG WITH BINDING POSTS



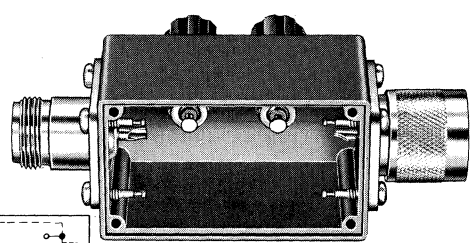


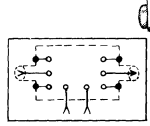


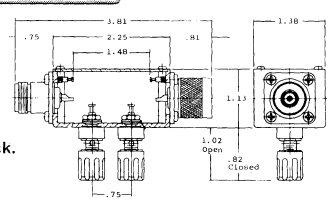
CONN: 1st END } UHF Receptacle Jack.
CENTER: Banana jack binding posts with solder turret terminals. Red and Black.
CONN: 2nd END } UHF Receptacle Plug.

MODEL 2422 QUANTITY DISC. CODE **A** **NET 13.85**

COMPONENT MOUNTING TYPE "N" RECEPTACLE TO TYPE "N" PLUG WITH BINDING POSTS



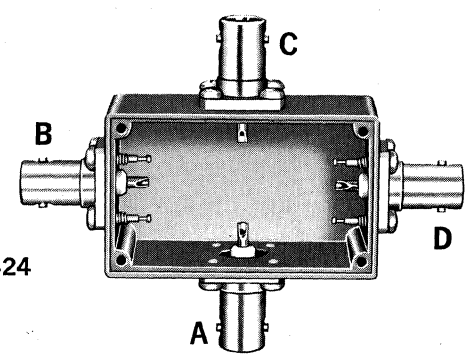




CONN: 1st END } Type "N" Receptacle Jack, UG58A/U.
CENTER: Banana jack binding posts with solder turret terminals. Red and Black.
CONN: 2nd END } Type "N" Receptacle Plug.

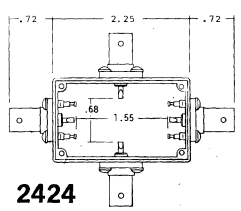
MODEL 2423 QUANTITY DISC. CODE **A** **NET 12.85**

COMPONENT MOUNTING — CROSS CONNECTIONS

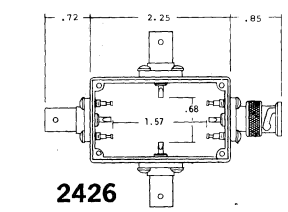


MODEL 2424

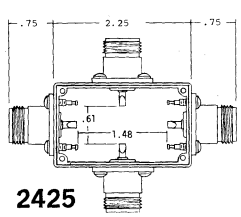
MODEL	CONNECTION A, B AND C	CONNECTION D	Quantity Disc. Code	NET
2424	BNC Receptacle Jack, UG290A/U.	BNC Receptacle Jack, UG290A/U.	A	11.75
2425	Type "N" Receptacle Jack, UG58A/U.	Type "N" Receptacle Jack, UG58A/U.	A	11.75
2426	BNC Receptacle Jack, UG290A/U.	BNC Receptacle Plug, UG1104A/U.	A	12.85
2427	Type "N" Receptacle Jack, UG58A/U.	Type "N" Receptacle Plug.	A	12.85



2424



2426



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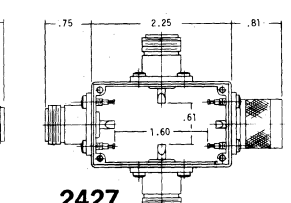
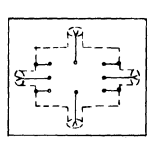
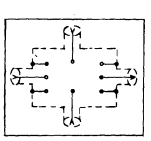


2427



2424, 2425



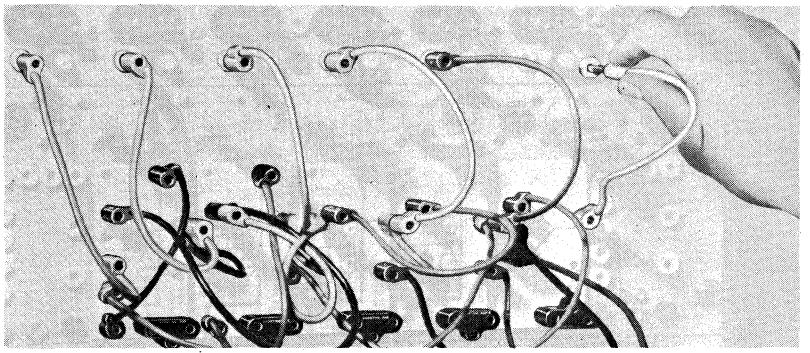
2426, 2427

POMONA ELECTRONICS

PATCH CORDS BANANA PLUGS

POMONA BANANA PLUG PATCH CORDS

Tough thermoplastic insulation molds the plug and leads into a strong moisture resistant integral unit. Excellent for computer board and test equipment applications. Used by leading industries in applications where extreme reliability is of prime importance.



FEATURES

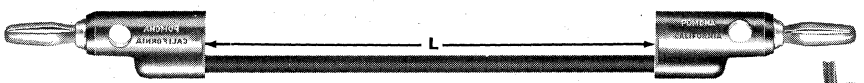
- One piece beryllium copper heat treated spring for maximum long life.
- Rounded spring design results in maximum contact area.
- Extra flexible polyvinyl insulation used on all leads.

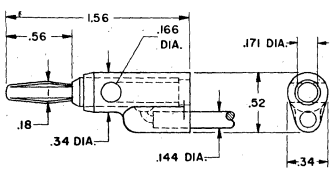
SPECIFICATIONS

- Fits standard 0.166 dia. banana jacks.
- Spring, beryllium copper alloy 170 per QQ-C-533.
- Plug body, brass per QQ-B-626, Comp. 22.
- Nickel plated per QQ-N-290, Class 2.
- Contact resistance less than 0.001 ohms per banana plug.
- Operating Temp.: −0°C to +105°C.
- Wire, 18 AWG, stranding 65 x 36 T.C.
- Insulation, polyvinyl .144" O.D.
- Ratings: 15 A. Cont., 30 A. Int. 10,000 W.V.D.C.

STACK-UP BANANA PLUG PATCH CORD

MODEL	LENGTH	NET
B-4	4"	1.50
B-8	8"	1.50
B-12	12"	1.50
B-18	18"	1.50
B-24	24"	1.50
B-36	36"	1.50
B-48	48"	1.55
B-60	60"	1.60

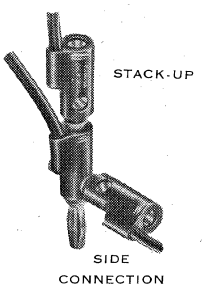




Multiple stacking feature accommodates the most complex stacking; keeps circuitry neater. Greatly simplifies circuit connections and changes. Reliable solder-bonded connections withstand pull test in excess of 50 lbs. Banana plugs both ends.

COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

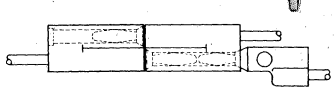
MODEL B (Specify Color) QUANTITY DISC. CODE **A** ★

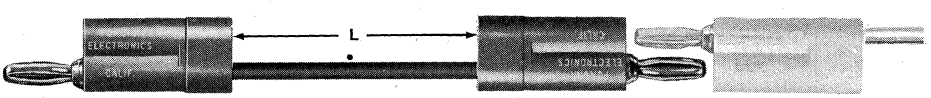


EXTENSION STACKING BANANA PLUG PATCH CORD

MODEL	LENGTH	NET
HB-4	4"	1.75
HB-8	8"	1.75
HB-12	12"	1.75
HB-18	18"	1.75
HB-24	24"	1.75
HB-36	36"	1.75
HB-48	48"	1.80
HB-60	60"	1.85



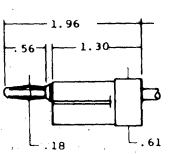




Dual purpose. Insulates all hot leads when used as an extension cord. Endless extension couplings possible with any banana plug patch cord. Provides vertical stacking from any jack. Reliable solder-bonded connections withstand pull test in excess of 50 lbs. Banana plugs both ends.

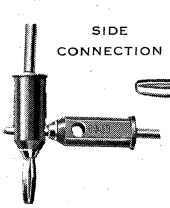
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

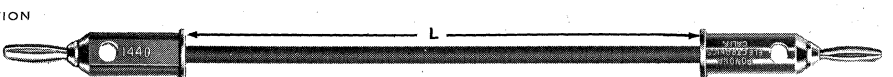
MODEL HB (Specify Color) QUANTITY DISC. CODE **A** ★



HORIZONTAL STACKING BANANA PLUG PATCH CORD

MODEL	LENGTH	NET
1440-4	4"	1.00
1440-8	8"	1.00
1440-12	12"	1.00
1440-18	18"	1.00
1440-24	24"	1.00
1440-36	36"	1.00
1440-48	48"	1.05
1440-60	60"	1.10

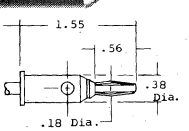




Ideal as an interconnecting lead between power supplies, test equipment, etc. Horizontal stacking feature. Banana plugs on both ends.

COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

MODEL 1440 (Specify Color) QUANTITY DISC. CODE **A** ★



★ Various lengths may be aggregated for best quantity price.

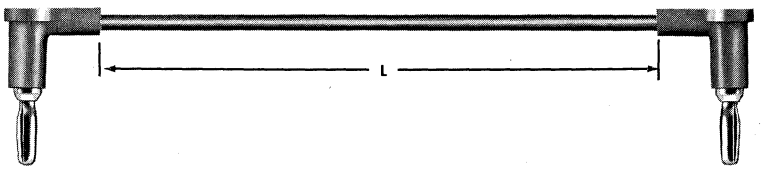
OTHER LENGTHS AVAILABLE TO ORDER

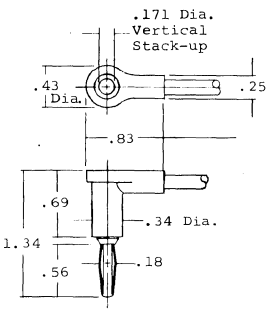
POMONA ELECTRONICS

PATCH CORDS BANANA PLUGS

STACK-UP RIGHT ANGLE BANANA PLUG PATCH CORD

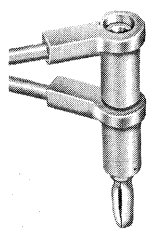
MODEL	LENGTH	NET
2864-4	4″	1.50
2864-8	8″	1.50
2864-12	12″	1.50
2864-18	18″	1.50
2864-24	24″	1.50
2864-36	36″	1.50
2864-48	48″	1.55
2864-60	60″	1.60





Vertical Stacking feature allows endless circuit connections and the right angle design keeps wires close to the chassis. An oversize shoulder allows easy connect and disconnect.

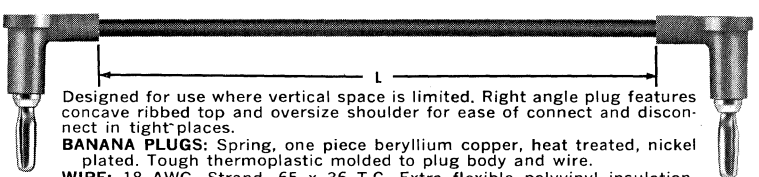
BANANA PLUGS: Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermoplastic molded to plug body and wire.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation, .144″ O.D.
OPERATING TEMP.: —0°C to +105°C.
RATED: 15 A. Cont., 30 A. Int. 10,000 W.V.D.C.
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.



MODEL 2864 (Specify Color) QUANTITY DISC. CODE **A** ★

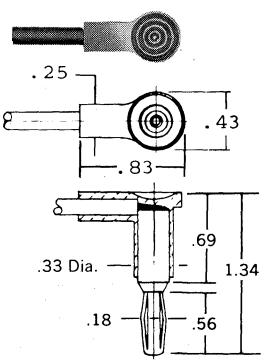
RIGHT ANGLE BANANA PLUG PATCH CORD

MODEL	LENGTH	NET
2700-4	4″	1.00
2700-8	8″	1.00
2700-12	12″	1.00
2700-18	18″	1.00
2700-24	24″	1.00
2700-36	36″	1.00
2700-48	48″	1.05
2700-60	60″	1.10



Designed for use where vertical space is limited. Right angle plug features concave ribbed top and oversize shoulder for ease of connect and disconnect in tight places.

BANANA PLUGS: Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermoplastic molded to plug body and wire.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation, .144″ O.D.
OPERATING TEMP.: —0°C to +105°C.
RATED: 15 A. Cont., 30 A. Int. 10,000 W.V.D.C.
COLORS: Black, Red



MODEL 2700 (Specify Color) QUANTITY DISC. CODE **A** ★

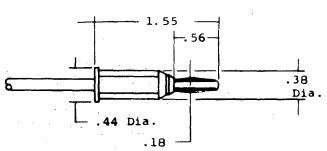
BANANA PLUG PATCH CORD

MODEL	LENGTH	NET
1985-4	4″	.95
1985-8	8″	.95
1985-12	12″	.95
1985-18	18″	.95
1985-24	24″	.95
1985-36	36″	.95
1985-48	48″	1.00
1985-60	60″	1.05



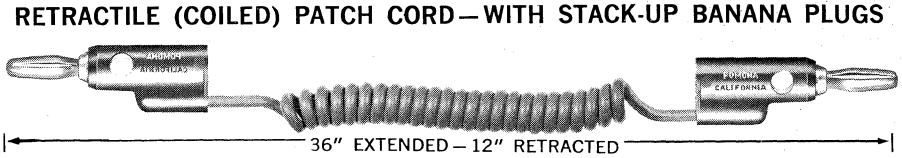
Excellent for general lab work. Permits interconnection between test instruments, etc. Banana plugs both ends.

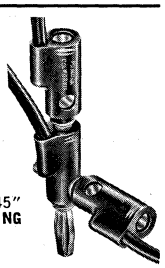
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.



MODEL 1985 (Specify Color) QUANTITY DISC. CODE ★

RETRACTILE (COILED) PATCH CORD—WITH STACK-UP BANANA PLUGS





Permits the use of one size patch cord in place of many various lengths. **BANANA PLUGS:** Spring, one piece beryllium copper heat treated, nickel plated. Tough thermoplastic molded to body and wire. **WIRE:** 20 AWG; Stranding 41 x 36 tinned copper; rubber insulation .145″ O.D. **RATED:** 4 A. Cont., 10 A Int./5000 WVDC. **OPERATING TEMP.:** —20°C to +60°C. **COLOR:** Black, Red.

MODEL 2484-36 (Specify Color) QUANTITY DISC. CODE **A** **NET 2.50**

POMONA ELECTRONICS

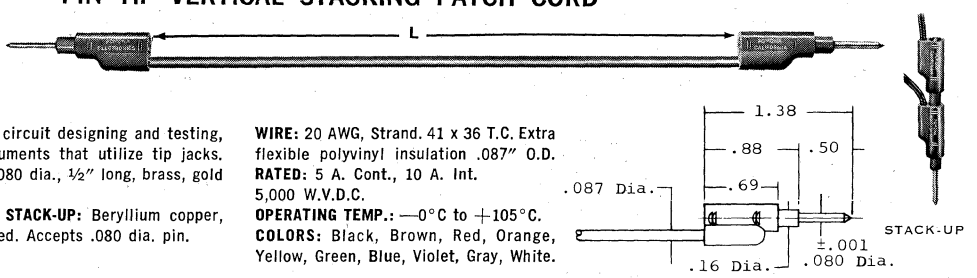
PATCH CORDS .080 TIP

PIN TIP VERTICAL STACKING PATCH CORD

MODEL	LENGTH	NET
P-4	4″	1.75
P-8	8″	1.75
P-12	12″	1.75
P-18	18″	1.75
P-24	24″	1.75
P-36	36″	1.75
P-48	48″	1.80
P-60	60″	1.85

MODEL P
(Specify Color)

★ QUANTITY DISC. CODE **A**



A must in circuit designing and testing, with instruments that utilize tip jacks.
PIN TIP: .080 dia., ½″ long, brass, gold flashed.
TIP JACK, STACK-UP: Beryllium copper, gold flashed. Accepts .080 dia. pin.

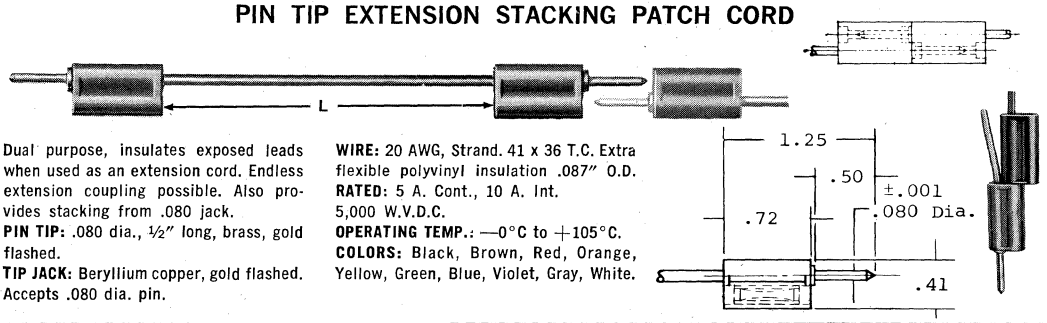
WIRE: 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation .087″ O.D.
RATED: 5 A. Cont., 10 A. Int. 5,000 W.V.D.C.
OPERATING TEMP.: —0°C to +105°C.
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

PIN TIP EXTENSION STACKING PATCH CORD

MODEL	LENGTH	NET
1727-4	4″	1.85
1727-8	8″	1.85
1727-12	12″	1.85
1727-18	18″	1.85
1727-24	24″	1.85
1727-36	36″	1.85
1727-48	48″	1.90
1727-60	60″	1.95

MODEL 1727
(Specify Color)

★ QUANTITY DISC. CODE **A**



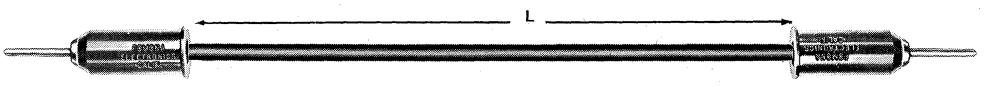
Dual purpose, insulates exposed leads when used as an extension cord. Endless extension coupling possible. Also provides stacking from .080 jack.
PIN TIP: .080 dia., ½″ long, brass, gold flashed.
TIP JACK: Beryllium copper, gold flashed. Accepts .080 dia. pin.

WIRE: 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation .087″ O.D.
RATED: 5 A. Cont., 10 A. Int. 5,000 W.V.D.C.
OPERATING TEMP.: —0°C to +105°C.
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

PIN TIP PATCH CORD

MODEL	LENGTH	NET
1990-4	4″	.95
1990-8	8″	.95
1990-12	12″	.95
1990-18	18″	.95
1990-24	24″	.95
1990-36	36″	.95
1990-48	48″	1.00
1990-60	60″	1.05

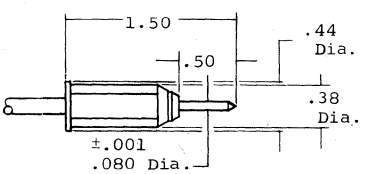
MODEL 1990
(Specify Color)



Heavy Duty patch cord. Excellent for general lab work. Permits interconnection between test instruments that utilize tip jacks.
PIN TIP: .080 dia., ½″ long, brass, nickel plated.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.

RATED: 5 A. Cont., 10 A. Int. 10,000 W.V.D.C.
OPERATING TEMP.: —0°C to +105°C.
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

★ QUANTITY DISC. CODE **A**



PIN TIP PATCH CORD

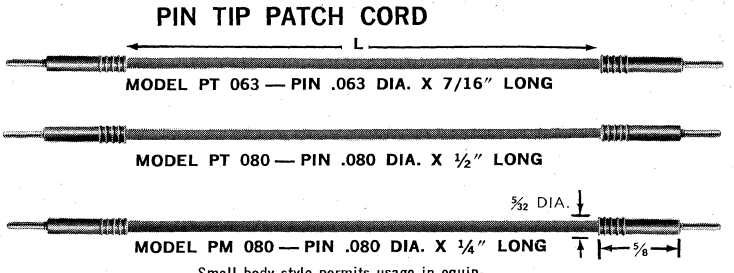
MODEL			LENGTH	NET
PT063-4	PT080-4	PM080-4	4″	.85
PT063-8	PT080-8	PM080-8	8″	.85
PT063-12	PT080-12	PM080-12	12″	.85
PT063-18	P8080-18	PM080-18	18″	.85
PT063-24	PT080-24	PM080-24	24″	.85
PT063-36	PT080-36	PM080-36	36″	.85
PT063-48	PT080-48	PM080-48	48″	.90
PT063-60	PT080-60	PM080-60	60″	.95

COLORS: PT063 and PM080—Red and Black only.
PT080 — Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.

MODEL PT & PM
(Specify Color)

PIN TIP: Brass, gold flashed.
WIRE: 22 AWG, Strand. 19 x 34 T.C. Insulation, polyvinyl .064″ O.D.
RATED: .3 A. Cont., 7.5 A. Int. 1,000 W.V.D.C.
OPERATING TEMP.: —0°C to +105°C.

★ QUANTITY DISC. CODE **A**



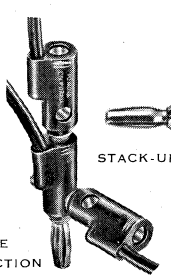
Small body style permits usage in equipment having receptacles spaced closely together. Three models shown.

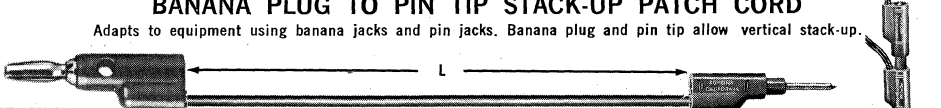
BANANA PLUG TO PIN TIP STACK-UP PATCH CORD

Adapts to equipment using banana jacks and pin jacks. Banana plug and pin tip allow vertical stack-up.

MODEL	LENGTH	NET
1126-4	4″	1.75
1126-8	8″	1.75
1126-12	12″	1.75
1126-18	18″	1.75
1126-24	24″	1.75
1126-36	36″	1.75
1126-48	48″	1.80
1126-60	60″	1.85

MODEL 1126 (Specify Color)





BANANA PLUG: Spring, one piece beryllium copper, heat treated, nickel plated.
PIN TIP: .080 dia. ½″ long, brass, gold flashed.

TIP JACK, STACK-UP: Beryllium copper, gold flashed. Accepts .080 Dia. pin.
WIRE: 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation .087″ O.D.
RATED: 5 A. Cont., 10 A. Int. 5,000 W.V.D.C.
OPERATING TEMP.: —0°C to +105°C.
COLORS: Black, Red.

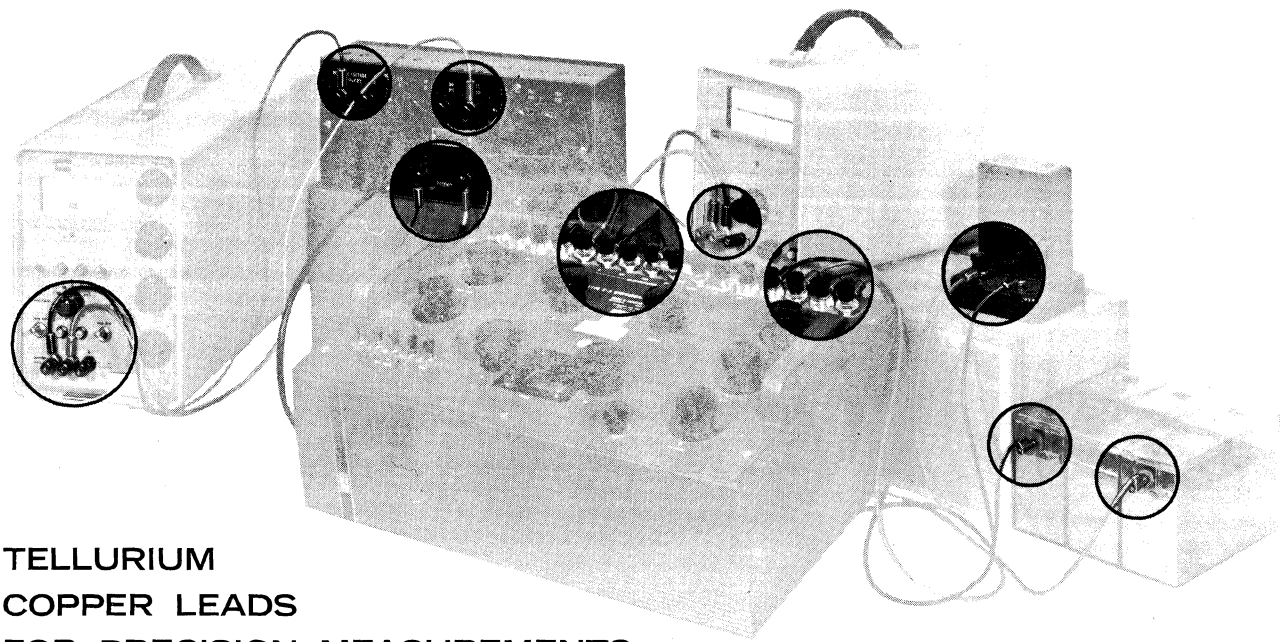
★ QUANTITY DISC. CODE **A**

★ Various lengths may be aggregated for best quantity price.

OTHER LENGTHS AVAILABLE TO ORDER

POMONA ELECTRONICS

JUMPERS – LOW THERMAL E.M.F.



TELLURIUM COPPER LEADS FOR PRECISION MEASUREMENTS

POMONA ELECTRONICS has advanced the state of the art in measurements where Thermoelectric Effects are significant sources of error. Comparators designed for use with the Kelvin-Varley voltage divider and microvolt leads were tested with Primary Standards Laboratory equipment.
Thermoelectric voltages were not detected until the most sensitive galvanometer range was used.

THERMOELECTRIC PROPERTIES—Tellurium copper gold plated spade lugs cold-staked to multi-stranded 12 gauge COPPER wire minimize thermoelectric effects—an absolute necessity for low voltage, high precision measurements.

LOW RESISTANCE—12 gauge multi-stranded COPPER wire results in extremely low cable resistance. Spade lugs plated with 50 micro inches gold for minimum contact resistance and minimum thermal EMF when using copper binding posts. (Less than 0.01 μv/c°).

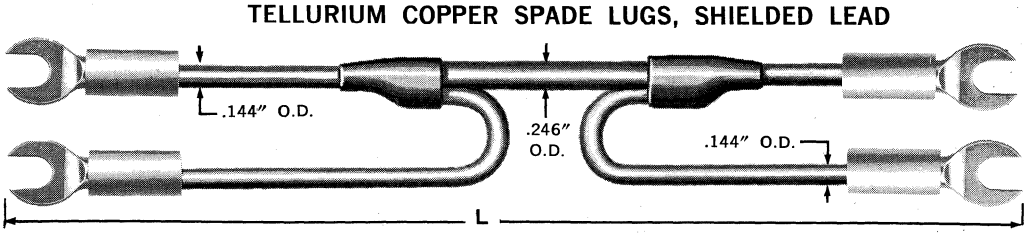
TELLURIUM COPPER SPADE LUGS, SHIELDED LEAD

MODEL	LENGTH
1756-24	24″
1756-48	48″

MODEL 1756
(Specify Length)

★ QUANTITY DISC. CODE **A**

NET 9.85

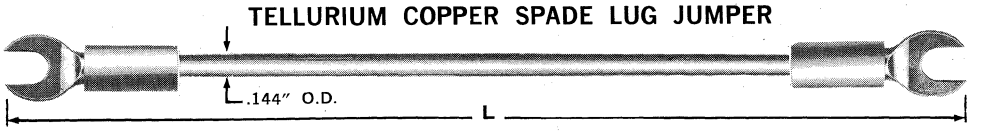


Designed for use with Kelvin Varley voltage dividers where extreme precision is required for low voltage measurements. Features guard shield to effectively reduce shunt resistance. Tough thermo-plastic molded to spade lug body, color; center conductor lug red, shield lug black. Tellurium copper heavy duty one piece machined spade lug gold plated per MIL-G-45204, Type II, Class I. Center conductor 12 AWG multi-stranded bare copper, shield lead wire, 18 AWG, stranded. Polyethylene primary insulation. Braided shield bare copper. Polyvinyl jacket, color black, per MIL-C-17C Type IIA.

TELLURIUM COPPER SPADE LUG JUMPER

MODEL	LENGTH	NET
1693-12	12″	2.75
1693-18	18″	2.75
1693-24	24″	2.75
1693-36	36″	2.75
1693-48	48″	2.75
1693-60	60″	2.75

MODEL 1693 (Specify Color) ★ QUANTITY DISC. CODE **A**



Single conductor tellurium copper spade lug jumper used in applications where guard shield is not required. Tough thermo-plastic molded to spade lug body. Color matches wire. Tellurium Copper heavy duty one piece machined spade lug gold plated per MIL-G-45204. Type II, Class I. Conductor, 12 AWG multi-stranded bare copper. Insulation polyvinyl, 105°C, .144″ O.D.
COLORS: Black, Red, Green.

★ Various lengths may be aggregated for best quantity price.

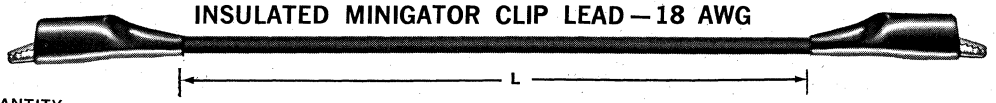
POMONA ELECTRONICS

JUMPERS – CLIP LEADS

INSULATED MINIGATOR CLIP LEAD – 18 AWG

MODEL	LENGTH	NET
MG-B-4	4″	.95
MG-B-8	8″	.95
MG-B-12	12″	.95
MG-B-24	24″	.95
MG-B-36	36″	.95
MG-B-48	48″	1.00
MG-B-60	60″	1.05

(Specify Color)



QUANTITY DISC. CODE **A** ★

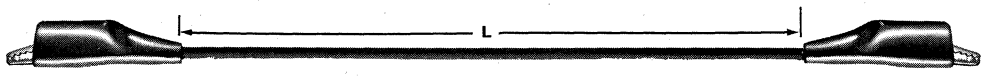
CLIP: Minigator, steel, cad plated.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.

INSULATOR: Red vinyl with red wire. Black on all other colors.
OPERATING TEMP.: —25°C to +105°C.
COLORS: Black, Red.

INSULATED MINIGATOR CLIP LEAD – 20 AWG

MODEL	LENGTH	NET
1236-4	4″	.95
1236-8	8″	.95
1236-12	12″	.95
1236-24	24″	.95
1236-36	36″	.95
1236-48	48″	1.00
1236-60	60″	1.05

(Specify Color)



QUANTITY DISC. CODE **A** ★

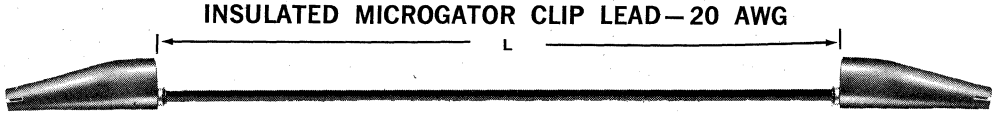
CLIP: Minigator, steel, cad. plated.
WIRE: 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation, .087″ O.D.

INSULATOR: Red Vinyl with Red Wire. Black on all other colors.
OPERATING TEMP.: —25°C to +105°C.
COLORS: Black, Red.

INSULATED MICROGATOR CLIP LEAD – 20 AWG

MODEL	LENGTH	NET
1613-4	4″	.95
1613-8	8″	.95
1613-12	12″	.95
1613-24	24″	.95
1613-36	36″	.95
1613-48	48″	1.00
1613-60	60″	1.05

(Specify Color)



QUANTITY DISC. CODE **A** ★

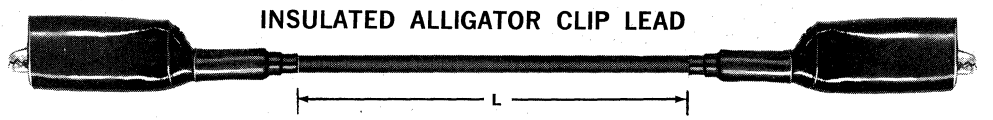
CLIP: Microgator, solid copper.
WIRE: 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation, .087″ O.D.

INSULATOR: Red Vinyl with Red Wire. Black on all other colors.
OPERATING TEMP.: —25°C to +105°C.
COLORS: Black, Red.

INSULATED ALLIGATOR CLIP LEAD

MODEL	LENGTH	NET
AL-B-4	4″	.95
AL-B-8	8″	.95
AL-B-12	12″	.95
AL-B-24	24″	.95
AL-B-36	36″	.95
AL-B-48	48″	1.00
AL-B-60	60″	1.05

(Specify Color)



QUANTITY DISC. CODE **A** ★

CLIP: Alligator, steel, cad plated.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.

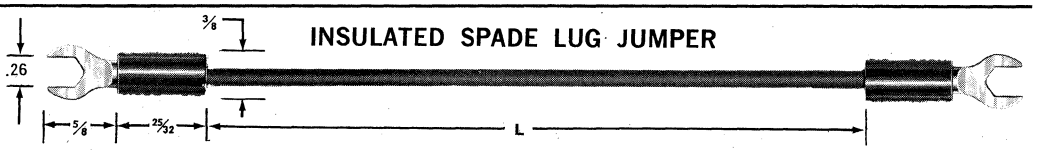
INSULATOR: Red vinyl with red wire. Black on all other colors.
OPERATING TEMP.: —25°C to +105°C.
COLORS: Black, Red.

INSULATED SPADE LUG JUMPER

MODEL	LENGTH	NET
1743-12	12″	.95
1743-24	24″	.95
1743-36	36″	.95
1743-48	48″	1.00
1743-60	60″	1.05

(Typical Dimensions spade lug)

(Specify Color)



QUANTITY DISC. CODE **A** ★

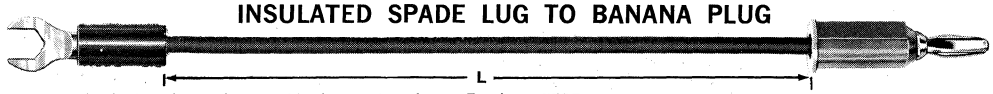
Spade lug heavy duty machined one piece brass. Tough thermo-plastic molded to spade lug body.
SPADE LUGS: Brass 1/16″ thick, nickel plated.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.

RATED: 15 A. Cont., 30 A Int. 10,000 W.V.D.C.
OPERATING TEMP.: —25°C to +105°C.
COLORS: Black, Red, Green, White.

INSULATED SPADE LUG TO BANANA PLUG

MODEL	LENGTH	NET
1987-12	12″	1.00
1987-24	24″	1.00
1987-36	36″	1.00
1987-48	48″	1.05
1987-60	60″	1.10

(Specify Color)



QUANTITY DISC. CODE **A** ★

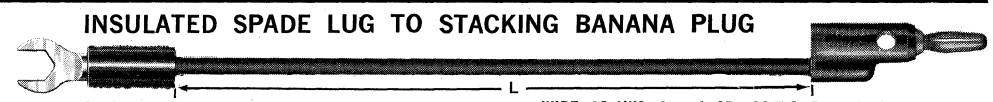
Spade lug, heavy duty machined one piece brass. Tough thermo-plastic molded to spade lug and banana plug body.
SPADE LUG: Brass 1/16″ thick, nickel plated.
BANANA PLUG: Spring one piece beryllium copper heat treated, nickel plated.

WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.
RATED: 15 A. Cont., 30 A. Int. 10,000 W.V.D.C.
OPERATING TEMP.: —25°C to +105°C.
COLORS: Black, Red

INSULATED SPADE LUG TO STACKING BANANA PLUG

MODEL	LENGTH	NET
1370-12	12″	1.00
1370-24	24″	1.00
1370-36	36″	1.00
1370-48	48″	1.05
1370-60	60″	1.10

(Specify Color)



QUANTITY DISC. CODE **A** ★

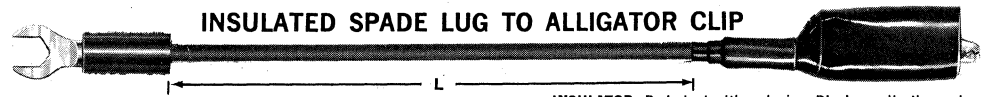
Spade lug, heavy duty machined one piece brass. Tough thermo-plastic molded to spade lug and banana plug body.
SPADE LUG: Brass 1/16″ thick, nickel plated.
BANANA PLUG: Spring one piece beryllium copper heat treated, nickel plated.

WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.
RATED: 15 A. Cont., 30 A. Int. 10,000 W.V.D.C.
OPERATING TEMP.: —25°C to +105°C.
COLORS: Black, Red, Green, White.

INSULATED SPADE LUG TO ALLIGATOR CLIP

MODEL	LENGTH	NET
1960-12	12″	.95
1960-24	24″	.95
1960-36	36″	.95
1960-48	48″	1.00
1960-60	60″	1.05

(Specify Color)



QUANTITY DISC. CODE **A** ★

Spade lug, heavy duty machined one piece brass. Tough thermo-plastic molded to spade lug body.
SPADE LUG: Brass 1/16″ thick, nickel plated.
CLIP: Alligator, steel, cad plated.

INSULATOR: Red vinyl with red wire. Black on all other colors.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.
OPERATING TEMP.: —25°C to +105°C.
COLORS: Black, Red

★ Various lengths may be aggregated for best quantity price.

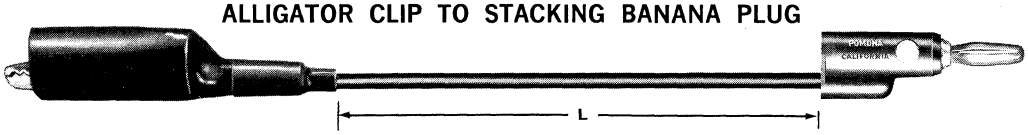
OTHER LENGTHS AVAILABLE TO ORDER

POMONA ELECTRONICS

CLIP LEADS TEST PROBES

ALLIGATOR CLIP TO STACKING BANANA PLUG

MODEL	LENGTH	NET
1166-4	4″	1.00
1166-8	8″	1.00
1166-12	12″	1.00
1166-24	24″	1.00
1166-36	36″	1.00
1166-48	48″	1.05
1166-60	60″	1.10



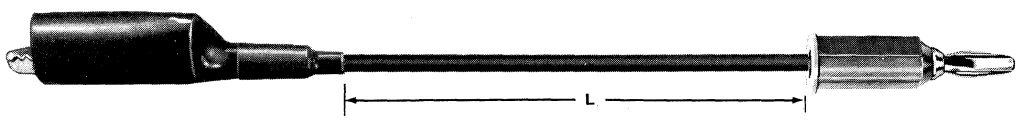
Adapts to equipment using standard banana jacks.
CLIP: Alligator, Steel, cadmium plated
BANANA PLUG: Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermoplastic molded to plug body and wire.

INSULATOR: Red vinyl with red wire. Black on all other colors.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.
OPERATING TEMP.: −25°C to +105°C.
COLORS: Black, Red.

MODEL 1166 (Specify Color) QUANTITY DISC. CODE **A** ★

ALLIGATOR CLIP LEAD TO BANANA PLUG

MODEL	LENGTH	NET
1959-4	4″	1.00
1959-8	8″	1.00
1959-12	12″	1.00
1959-24	24″	1.00
1959-36	36″	1.00
1959-48	48″	1.05
1959-60	60″	1.10



Adapts to equipment using standard banana jacks.
CLIP: Alligator, Steel, cadmium plated
BANANA PLUG: Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermoplastic molded to plug body.

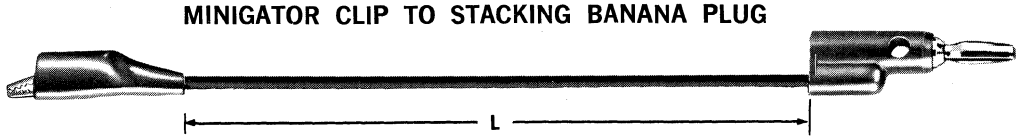
INSULATOR: Red vinyl with red wire. Black on all other colors.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation .144″ O.D.
OPERATING TEMP.: −25°C to +105°C.
COLORS: Black, Red.

MODEL 1959 (Specify Color) QUANTITY DISC. CODE **A** ★

NEW

MINIGATOR CLIP TO STACKING BANANA PLUG

MODEL	LENGTH	NET
3220-4	4″	1.00
3220-8	8″	1.00
3220-12	12″	1.00
3220-24	24″	1.00
3220-36	36″	1.00
3220-48	48″	1.05
3220-60	60″	1.10

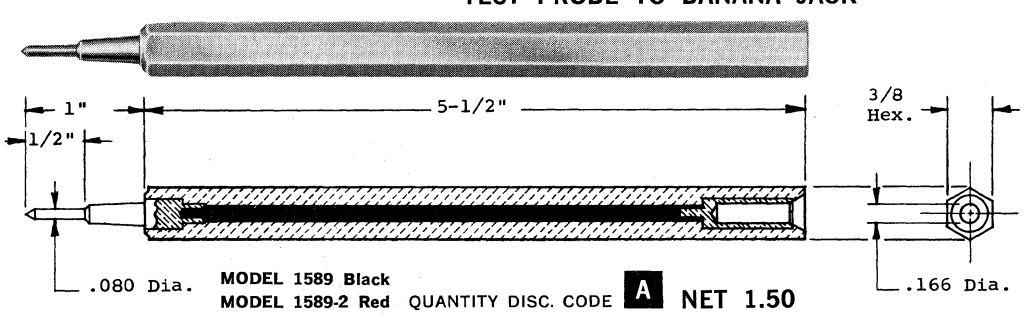


Adapts to equipment using standard banana jacks.
CLIP: Minigator, Steel, cadmium plated.
BANANA PLUG: Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermoplastic molded to plug body and wire.

INSULATOR: Red vinyl with red wire. Black on all other colors.
WIRE: 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation .087″ O.D.
OPERATING TEMP.: −25°C to +105°C.
COLORS: Black, Red.

MODEL 3220 (Specify Color) QUANTITY DISC. CODE **A** ★

TEST PROBE TO BANANA JACK



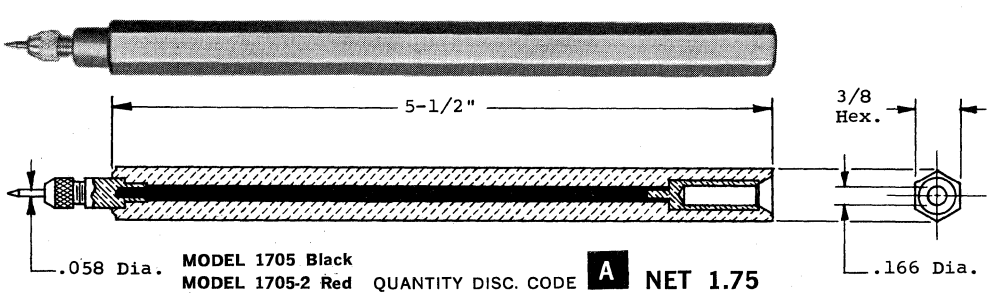
MODEL 1589 Black
MODEL 1589-2 Red QUANTITY DISC. CODE **A** **NET 1.50**

Banana jack in handle connected to tip. Permits use of standard banana plugs for circuit testing as a test prod. Heavy duty insulated handle molded to banana jack and tip.

PIN TIP: .080 dia. x ½″ long, brass nickel plated.

BANANA JACK: .166 dia. Brass nickel plated. Accepts standard banana plug.

NEEDLE TIP PROBE TO BANANA JACK



MODEL 1705 Black
MODEL 1705-2 Red QUANTITY DISC. CODE **A** **NET 1.75**

Sharp replaceable needle tip allows testing of encapsulated circuits. Banana jack in handle connected to tip. Permits use of standard banana plugs for circuit testing as a test prod. Heavy duty insulated handle molded to banana jack and tip.

PIN TIP: Replaceable needle tip, steel nickel plated.

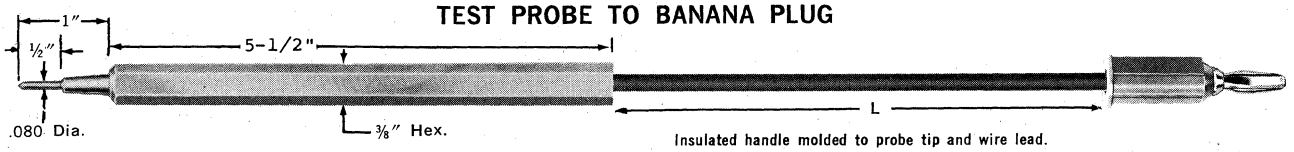
BANANA JACK: .166 dia. Brass nickel plated. Accepts standard banana plug.

★ Various lengths may be aggregated for best quantity price.

OTHER LENGTHS AVAILABLE TO ORDER

POMONA ELECTRONICS — TEST PROBES

TEST PROBE TO BANANA PLUG

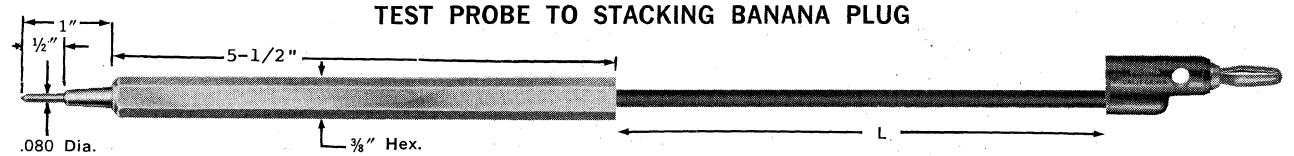


MODEL 1986-48-B	**48" Long**	**Black**	**NET 1.75**
MODEL 1986-48-R	**48" Long**	**Red**	**NET 1.75**

QUANTITY DISC. CODE **A**

Insulated handle molded to probe tip and wire lead.
PROBE PIN TIP: .080 dia. x ½" long. Brass nickel plated.
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation, .144" O.D.
BANANA PLUG: Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermo-plastic molded to body.
COLORS: Black, Red.

TEST PROBE TO STACKING BANANA PLUG

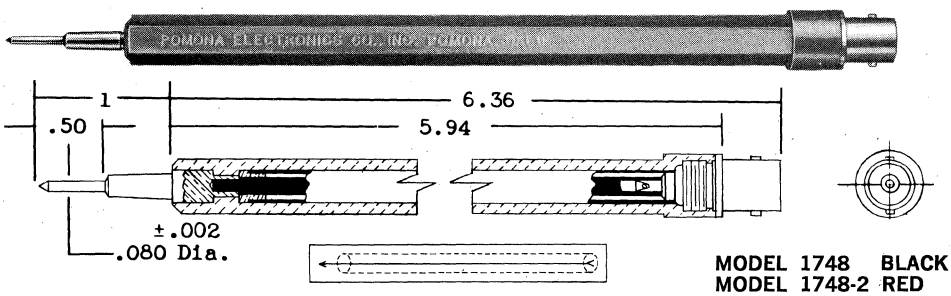


MODEL 1382-48B	**48" Long**	**Black**	**NET 1.95**
MODEL 1382-48R	**48" Long**	**Red**	**NET 1.95**

QUANTITY DISC. CODE **A**

Insulated handle molded to probe tip and wire lead.
PROBE PIN TIP: .080 dia. x ½" long. Brass nickel plated
WIRE: 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation, .144" O.D.
BANANA PLUG: Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermo-plastic molded to plug body and wire.
COLORS: Black, Red.

TEST PROBE TO BNC RECEPTACLE

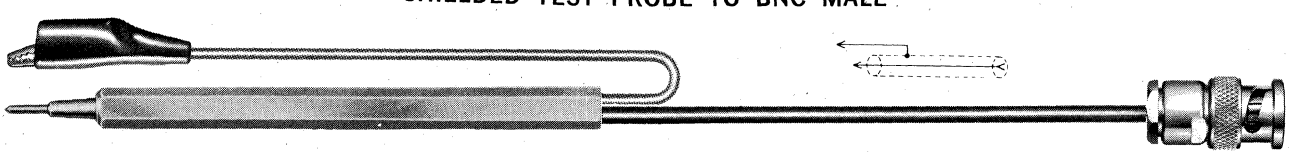


BNC receptacle in handle connected to tip. Permits the use of coaxial cables with BNC plug for circuit testing as a test prod. Tough thermoplastic molded to BNC receptable and tip. Shield extends to within 1½" of the probe tip end.
PIN TIP: .080" dia. x ½" long, brass, nickel plated.
RECEPTACLE: BNC, UG1094/U.

MODEL 1748 BLACK
MODEL 1748-2 RED

QUANTITY DISC. CODE **A** **NET 5.85**

SHIELDED TEST PROBE TO BNC MALE



A shielded test probe with the shield extending to within 1½" of the probe tip end. One piece molded construction. Insulated handle molded to probe tip and cable. Insulated minigator clip connected to shield lead.
PROBE PIN TIP: .080 dia. x ½" long. Brass, nickel plated.
CONNECTOR: BNC Male, UG88E/U.

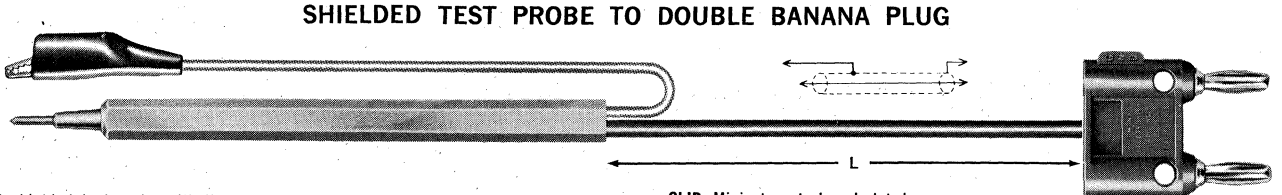
CLIP: Minigator, steel, cad. plated.
INSULATOR, VINYL: Color, Black.
CABLE: Shielded coax., RG58C/U, Polyethylene insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.
HANDLE: Color, red, molded of tough thermo-plastic.

MODEL 2739-C-48 . . . . . .48" long

QUANTITY DISC. CODE **B**

NET 6.85

SHIELDED TEST PROBE TO DOUBLE BANANA PLUG



A shielded test probe with the shield extending to within 1½" of the probe tip end. One piece molded construction. Insulated handle molded to probe tip and cable. Insulated minigator clip connected to shield lead.

PROBE PIN TIP: .080 dia. x ½" long. Brass nickel plated.

DOUBLE BANANA PLUG: On ¾" centers. Spring, one piece beryllium copper, heat treated, nickel plated. Tough thermo-plastic molded to double plug body. Color, Gray.

CLIP: Minigator, steel, cad plated.
INSULATOR, VINYL: Color, Black.
CABLE: Shielded microphone cable: Polyethylene insulation. Vinyl jacket. Nom. capacity 25 pf./ft. .205" O.D. Color, Gray.
HANDLE: Color, red, molded of tough thermo-plastic.

MODEL 1569-B-48 .....48" Long

QUANTITY DISC. CODE **B**

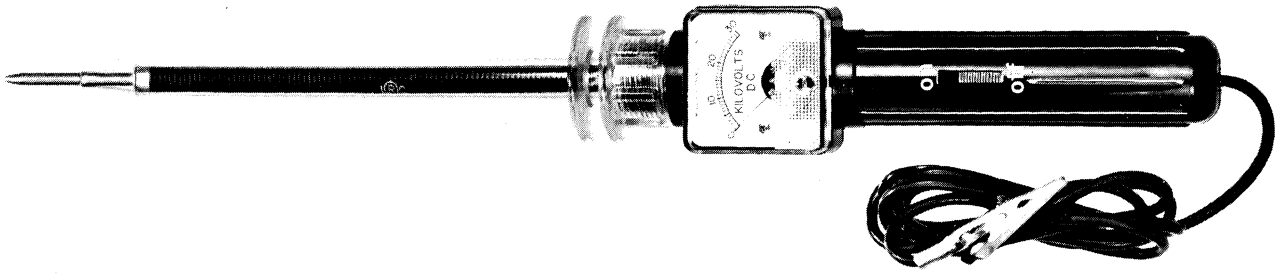
NET 6.85

OTHER LENGTHS AVAILABLE TO ORDER

POMONA ELECTRONICS

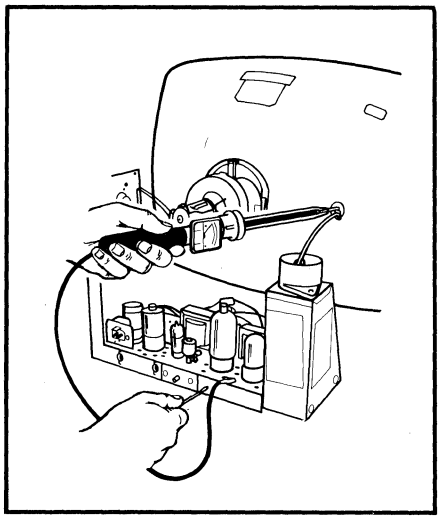
HIGH VOLTAGE TEST PROBES

DC HIGH VOLTAGE TEST PROBES WITH BUILT-IN METER



These High Voltage Test Probes built by Pomona Electronics are the most advanced instruments of their kind on the market; the only test probes featuring a built-in voltmeter. The Test Probes are self-contained, portable test instruments for rapid measurements of high voltages.

Easy to operate! Just ground the test probe instrument by attaching alligator clip to chassis, contact test probe tip to high voltage being measured and read voltage from the built-in meter. No warm-up time. No batteries.



PATENT PENDING

SPECIFICATIONS:

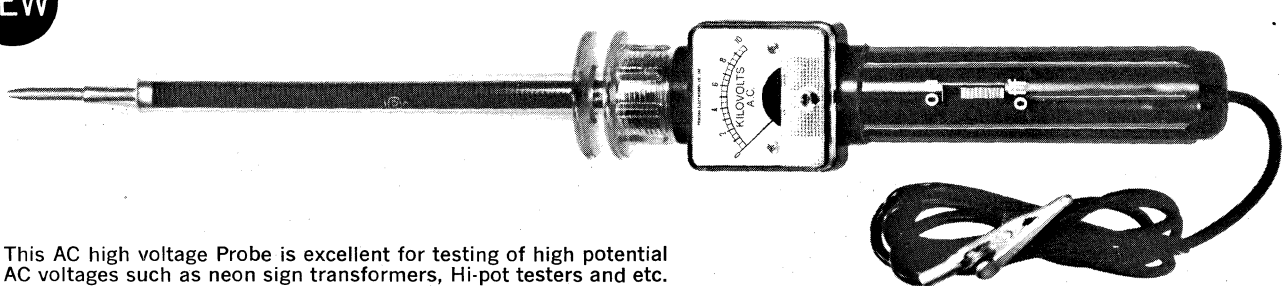
RANGE: See below. **SENSITIVITY:** 20,000 ohms/volt (50 ua) movement. **ACCURACY:** ± 3% full scale. **MULTIPLIER RESISTANCE:** See below. **MATERIAL:** Handle—high impact thermoplastic. Probe—high impact polystyrene. **LENGTH:** 14¾" overall. **WEIGHT:** 8 ounces.

MODEL	VOLTS Full Scale	MULTIPLIER RESISTANCE	NET
2900	30,000	600 Megohm	19.95
NEW 3157(*)	15,000	300 Megohm	29.95
NEW 3163(*)	6,000	120 Megohm	29.95

*Models 3157 and 3163 are supplied with Model 3295 carrying case.

QUANTITY DISC. CODE **C**

NEW 10 KV AC HIGH VOLTAGE TEST PROBE WITH BUILT-IN METER



This AC high voltage Probe is excellent for testing of high potential AC voltages such as neon sign transformers, Hi-pot testers and etc. Shielded meter movement for protection from stray magnetic fields. PROBE IS SUPPLIED WITH MODEL 3295 CARRYING CASE.

Easy to operate! Just ground the test probe instrument by attaching alligator clip to chassis, contact test probe tip to high voltage being measured and read voltage from the built-in meter. No warm-up time. No batteries.

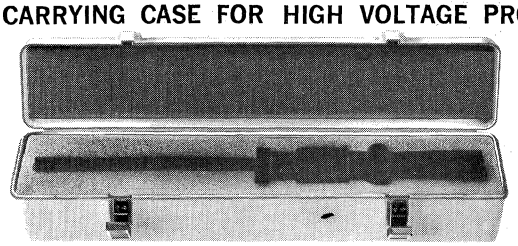
SPECIFICATIONS:

RANGE: 10,000 Volts AC. **SENSITIVITY:** 2,000 Ohms/Volt (500 UA) movement. **ACCURACY:** ± 3% 30 cps to 1000 cps. **MULTIPLIER RESISTANCE:** 20 Megohm ± 2%. **MATERIAL:** Handle—high impact thermoplastic. Probe — high impact polystyrene. **LENGTH:** 14¾" overall. **WEIGHT:** 8 ounces.

MODEL 3200 QUANTITY DISC. CODE **C** **NET 29.95**

CARRYING CASE FOR HIGH VOLTAGE PROBES

NEW



A quality built carrying case for protection of your high voltage probe. The case is made of tough thermoplastic. The inside is lined with soft, shock absorbing material.

MODEL 3295 QUANTITY DISC. CODE **D** **NET 5.95**

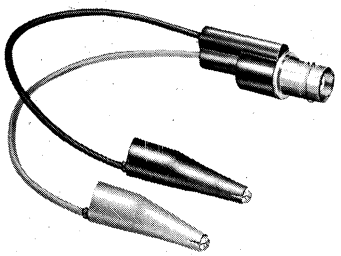
POMONA ELECTRONICS

MOLDED BREAKOUTS

A new series of "Breakouts", designed to convert standard coaxial cables to test cables.
By connecting proper Breakout receptacle or plug to corresponding cable plug or receptacle, any standard coaxial cable becomes a test cable equipped with clip leads.
All connections feature a non-tarnish finish, and tough molded thermoplastic insulation molded to connector and wire.

APPLICABLE SPECIFICATIONS:
Wire: (With Alligator Clips) 18 AWG, Strand. 65 x 36 T.C. Extra flexible polyvinyl insulation, .144" O.D.
Wire: (With Minigator Clips) 20 AWG, Strand. 41 x 36 T.C. Extra flexible polyvinyl insulation, .087" O.D.
Operating Temp.: —25°C to +85°C.
Working Voltage: 500 V Peak.

BNC RECEPTACLE TO TEST CLIPS

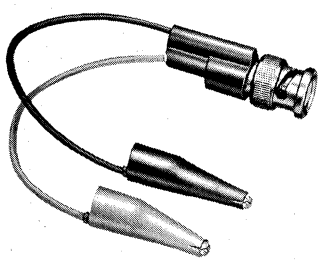


CONNECTOR: BNC Receptacle, UG1094/U.
INSULATION: Tough thermoplastic molded to connector and wire.
WIRE: See above.
TEST CLIPS: Minigator or Alligator, Steel, cad. plated. Insulators, Vinyl: 1 Black, 1 Red.

OVERALL LENGTH 7"

MODEL 2630 (ALLIGATOR CLIPS)
MODEL 2631 (MINIGATOR CLIPS) QUANTITY DISC. CODE **A** **NET 3.45**

BNC PLUG TO TEST CLIPS



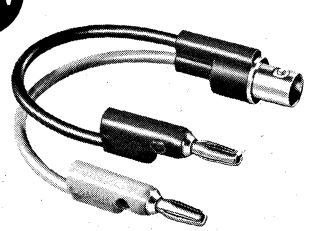
CONNECTOR: BNC Plug.
INSULATION: Tough thermoplastic molded to connector and wire.
WIRE: See above.
TEST CLIPS: Minigator or Alligator, Steel, cad. plated. Insulators, Vinyl: 1 Black, 1 Red.

OVERALL LENGTH 7"

MODEL 2885 (ALLIGATOR CLIPS)
MODEL 2886 (MINIGATOR CLIPS) QUANTITY DISC. CODE **A** **NET 4.50**

BNC RECEPTACLE TO STACKING BANANA PLUGS

NEW

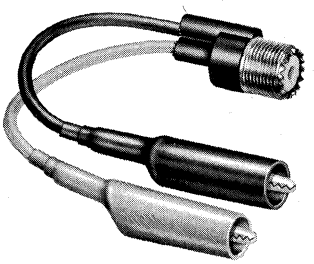


CONNECTOR: BNC Receptacle, UG1094/U.
INSULATION: Tough thermoplastic molded to connector and wire.
WIRE: See above, 18 AWG.
STACKING BANANA PLUGS: Spring, one piece heat-treated beryllium copper, nickel plated: 1 Black, 1 Red.

OVERALL LENGTH 7"

MODEL 3073 QUANTITY DISC. CODE **A** **NET 3.85**

UHF RECEPTACLE TO TEST CLIPS

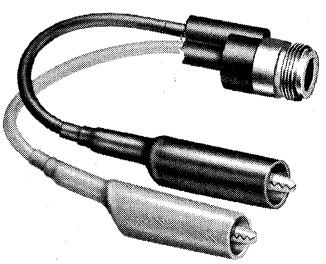


CONNECTOR: UHF Receptacle Jack.
INSULATION: Tough thermoplastic molded to connector and wire.
WIRE: See above.
TEST CLIPS: Minigator or Alligator, Steel, cad. plated. Insulators, Vinyl: 1 Black, 1 Red.

OVERALL LENGTH 7"

MODEL 2632 (ALLIGATOR CLIPS)
MODEL 2633 (MINIGATOR CLIPS) QUANTITY DISC. CODE **A** **NET 3.45**

TYPE "N" RECEPTACLE TO TEST CLIPS



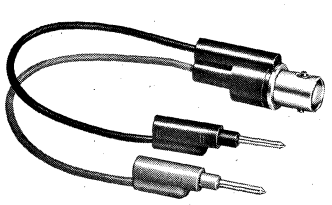
CONNECTOR: Type "N" Receptacle, UG58A/U.
INSULATION: Tough thermoplastic molded to connector and wire.
WIRE: See above.
TEST CLIPS: Minigator or Alligator, Steel, cad. plated. Insulators, Vinyl: 1 Black, 1 Red.

OVERALL LENGTH 7"

MODEL 2636 (ALLIGATOR CLIPS)
MODEL 2637 (MINIGATOR CLIPS) QUANTITY DISC. CODE **A** **NET 3.85**

BNC RECEPTACLE TO STACKING PIN TIP PLUGS

NEW

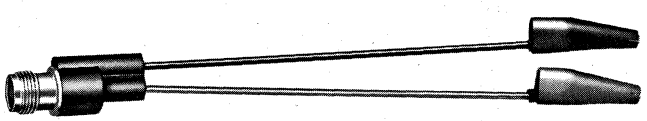


CONNECTOR: BNC Receptacle, UG1094/U.
INSULATION: Tough thermoplastic molded to connector and wire.
WIRE: See above, 20 AWG
STACKING PIN TIP PLUGS: 2 single plugs, .080 dia.: 1 Black, 1 Red.

OVERALL LENGTH 7"

MODEL 3221 QUANTITY DISC. CODE **A** **NET 3.85**

TNC RECEPTACLE TO TEST CLIPS



OVERALL LENGTH 7"

CONNECTOR: TNC Receptacle Jack.
INSULATION: Tough thermoplastic molded to connector and wire.
WIRE: See above.
TEST CLIPS: Minigator or Alligator, Steel, cad. plated. Insulators, Vinyl: 1 Black, 1 Red.

MODEL 2634 (ALLIGATOR CLIPS)
MODEL 2635 (MINIGATOR CLIPS) QUANTITY DISC. CODE **A** **NET 3.45**

POMONA ELECTRONICS

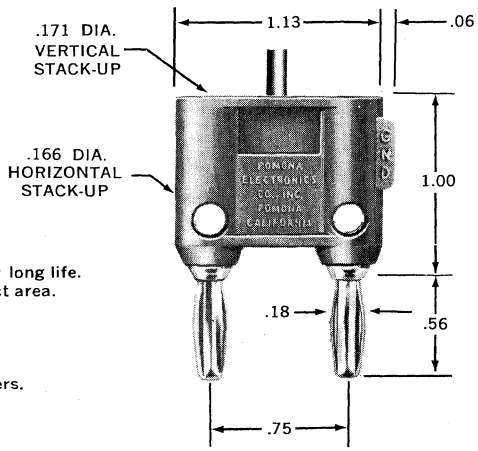
PATCH CORDS DOUBLE BANANA PLUGS

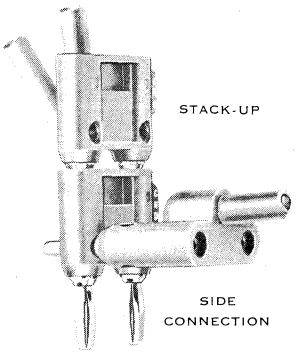
POMONA MOLDED DOUBLE BANANA PLUG PATCH CORDS AND TEST LEADS

. . . indispensable for bridge transformer connections, three terminal capacitor measurements and general hook-up for two wire systems. They are horizontally and vertically stackable in parallel.

Tough thermo-plastic material molded to plug body and cable insures maximum strength, moisture resistance and excellent insulative properties.

Used by leading industries in applications where extreme reliability is of prime importance.





FEATURES . . .

- One piece beryllium copper heat treated spring for long life.
- Rounded spring design results in maximum contact area.
- GND., clearly molded on plug body and shell.
- Solder-bonded noise-free connections.

SPECIFICATIONS . . .

- Fits standard 0.166 dia. banana jacks, on ¾" centers.
- Contact resistance less than 0.001 ohms per plug.
- Spring beryllium copper alloy 170 per QQ-C-533.
- Plug body brass per QQ-B-625, Comp. 22.
- Nickel plated per QQ-N-290, Class 2.

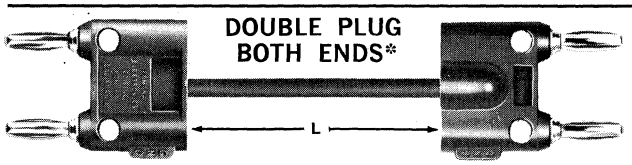
CABLE TYPE DESCRIPTION

TWO COND. TWISTED PAIR
18 AWG, Strand. 65 x 36 T.C. Vinyl insulation. Vinyl jacket, .250" O.D. Nom. Cap. 30 pf/ft.
COLOR: Gray.

SHIELDED MICROPHONE CABLE
Polyethylene insulation. Vinyl jacket, .205" O.D. Nom. Cap. 25 pf/ft.
COLOR: Gray.

SHIELDED COAXIAL CABLE
RG58C/U Polyethylene insulation. Vinyl jacket, .195" O.D. Nom. Cap. 28.5 pf/ft. **COLOR:** Black.

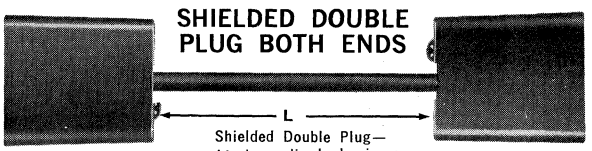
DOUBLE PLUG BOTH ENDS*



TWO COND. TWISTED PR.	SHIELDED MIC. CABLE	RG58C/U	RG59B/U	LENGTH	NET
2BA-18	2BB-18	2BC-18	2BE-18	18"	4.95
2BA-24	2BB-24	2BC-24	2BE-24	24"	4.95
2BA-30	2BB-30	2BC-30	2BE-30	30"	4.95
2BA-36	2BB-36	2BC-36	2BE-36	36"	4.95
2BA-48	2BB-48	2BC-48	2BE-48	48"	4.95
2BA-60	2BB-60	2BC-60	2BE-60	60"	4.95

★ QUANTITY DISC. CODE **B**

SHIELDED DOUBLE PLUG BOTH ENDS

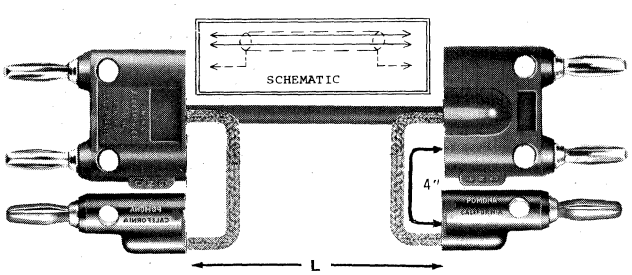


Shielded Double Plug—black anodized aluminum

SHIELDED COAX. CABLE	LENGTH	NET
1550-C-18	18"	5.95
1550-C-24	24"	5.95
1550-C-30	30"	5.95
1550-C-36	36"	5.95
1550-C-48	48"	5.95
1550-C-60	60"	5.95

★ QUANTITY DISC. CODE **B**

TWO COND. SHIELDED BALANCED LINE



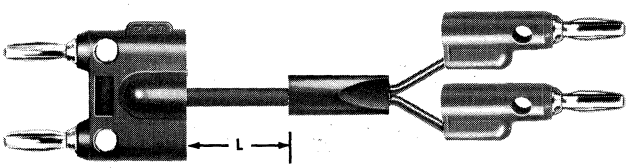
CABLE DESCRIPTION

2-Cond. shielded mic. cable. Polyethylene insulation. Vinyl jacket, .231" O.D. Nom. Cap. between cond. 18 pf./ft. Nom. Cap. between one cond. and remaining cond. connected to shield, 32 pf./ft. COLOR: Cable and double plug, Gray. Single ground plug, Green.

MODEL	LENGTH	NET
1167-18	18"	7.95
1167-24	24"	7.95
1167-30	30"	7.95
1167-36	36"	7.95
1167-48	48"	7.95
1167-60	60"	7.95

★ QUANTITY DISC. CODE **B**

DOUBLE PLUG TO SINGLE BANANA PLUGS



CABLE DESCRIPTION

TWO COND. TWISTED PAIR — 18 AWG, Strand. 65 x 36 T.C. Vinyl insulation. Vinyl jacket, .250" O.D. Nom. Cap. 30 pf/ft.
COLOR: Double Plug: Gray
Single Plugs: Red, Black

MODEL	LENGTH	NET
1368-A-18	18"	5.95
1368-A-24	24"	5.95
1368-A-30	30"	5.95
1368-A-36	36"	5.95
1368-A-48	48"	5.95
1368-A-60	60"	5.95

★ QUANTITY DISC. CODE **B**

***NOTE:** Molded double plug matches color of cable.
Two cond. Twisted pair, GRAY. Shielded mic. cable, GRAY.
Coaxial RG58C/U Cable, BLACK.

★ Various lengths may be aggregated for best quantity price.

1. Other cable colors available to order on the Two Cond. Twisted Pair and Shielded Mic. cable models with plug to match.
COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.
2. Other lengths and cable types available to order.

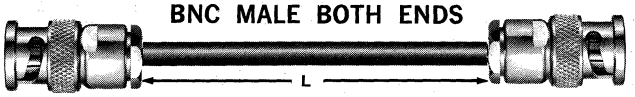
POMONA ELECTRONICS

PATCH CORDS BNC CONNECTING LEADS

CABLE TYPES

SHIELDED MICROPHONE CABLE	Polyethylene insulation, Vinyl jacket, .205" O.D. Nom. Cap. 25 pf.ft. COLOR: Gray.	SHIELDED COAXIAL CABLE	RG58C/U RG59B/U RG62A/U

BNC MALE BOTH ENDS



CONN: 1st END } UG88E/U Male BNC — CABLE: Shielded Coax., RG58C/U — CONN: 2nd END } UG88E/U Male BNC

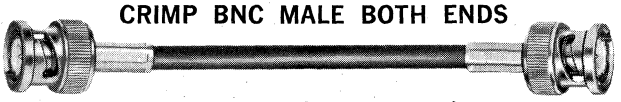
CONN: 1st END } UG260B/U Male BNC — CABLE: Shielded Coax., RG59B/U or RG62A/U — CONN: 2nd END } UG260B/U Male BNC

CABLE TYPES

SHIELDED MIC. CABLE	RG58C/U	RG59B/U	NET	RG62A/U	NET	LENGTH
BNC-B-18	BNC-C-18	BNC-E-18	5.95	BNC-M-18	6.95	18"
BNC-B-24	BNC-C-24	BNC-E-24	5.95	BNC-M-24	6.95	24"
BNC-B-30	BNC-C-30	BNC-E-30	5.95	BNC-M-30	6.95	30"
BNC-B-36	BNC-C-36	BNC-E-36	5.95	BNC-M-36	6.95	36"
BNC-B-48	BNC-C-48	BNC-E-48	5.95	BNC-M-48	6.95	48"
BNC-B-60	BNC-C-60	BNC-E-60	5.95	BNC-M-60	6.95	60"

★QUANTITY DISC. CODE **B**

CRIMP BNC MALE BOTH ENDS



CONN: 1st END } Crimp Male BNC (Comparable to UG88E/U) — CABLE: Shielded Coax., RG58C/U. — CONN: 2nd END } Crimp Male BNC (Comparable to UG88E/U)

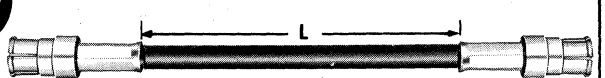
CONN: 1st END } Crimp Male BNC (Comparable to UG260B/U) — Cable: Shielded Coax., RG59B/U or RG62A/U — CONN: 2nd END } Crimp Male BNC (Comparable to UG260B/U)

CABLE TYPES

RG58C/U	RG59B/U	NET	RG62A/U	NET	LENGTH
2249-C-12	2249-E-12	4.60	2249-M-12	5.95	12"
2249-C-24	2249-E-24	4.60	2249-M-24	5.95	24"
2249-C-36	2249-E-36	4.60	2249-M-36	5.95	36"
2249-C-48	2249-E-48	4.60	2249-M-48	5.95	48"
2249-C-60	2249-E-60	4.60	2249-M-60	5.95	60"

★ QUANTITY DISC. CODE **B**

NEW "PUSH ON" BNC MALE BOTH ENDS



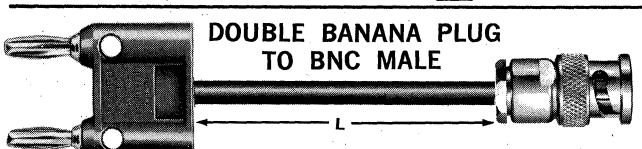
CONN: 1st END } Crimp "Push on" BNC, Male. — CABLE: Shielded Coax., RG58C/U. — CONN: 2nd END } Crimp "Push on" BNC, Male.

A test cable for rapid interconnection of equipment. Connector is pushed on and requires no twisting. Beryllium copper outer fingers maintain continuity of shield. Excellent for those hard to get at places.

MODEL	LENGTH
3199-C-12	12"
3199-C-24	24"
3199-C-36	36"
3199-C-48	48"
3199-C-60	60"

MODEL 3199 ★ QUANTITY DISC. CODE **B** **NET 4.60**

DOUBLE BANANA PLUG TO BNC MALE



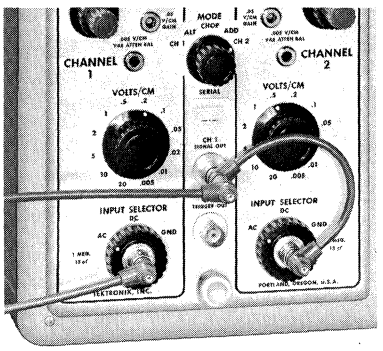
CONN.: 1ST END } Double Banana Plug, on ¾" Centers. — CABLE: Shielded coax., RG58C/U — CONN.: 2ND END } UG88E/U, Male BNC

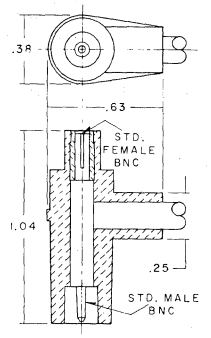
SHIELDED MIC. CABLE	SHIELDED COAX. CABLE	LENGTH	NET
2BB-BNC-18	2BC-BNC-18	18"	5.95
2BB-BNC-24	2BC-BNC-24	24"	5.95
2BB-BNC-30	2BC-BNC-30	30"	5.95
2BB-BNC-36	2BC-BNC-36	36"	5.95
2BB-BNC-48	2BC-BNC-48	48"	5.95
2BB-BNC-60	2BC-BNC-60	60"	5.95

★QUANTITY DISC. CODE **B**

"PUSH ON" STACKING BNC PATCH CORDS

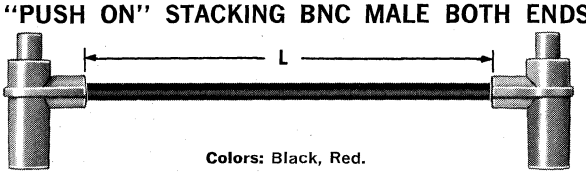
These multiple stacking patch cords connect the center conductors of BNC jacks having a common chassis. Excellent for use with instruments such as oscilloscopes. Stacking feature enables an endless number of connections to the same point.





FEATURES:
- **CONTACT:** Male and Female, one piece heat treated beryllium copper, gold flashed.
- **WIRE:** 18 AWG., stranded 65 x 36 T.C., polyvinyl insulation.
- **INSULATION:** Tough thermoplastic, polypropylene, molded around contact and wire.
- **OPERATING TEMP.:** —25° C to + 125° C.

NEW "PUSH ON" STACKING BNC MALE BOTH ENDS



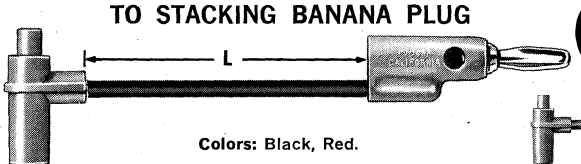
Colors: Black, Red.

MODEL	LENGTH	MODEL	LENGTH
3201-4	4"	3201-24	24"
3201-8	8"	3201-36	36"
3201-12	12"	3201-48	48"
3201-18	18"	3201-60	60"

★ QUANTITY DISC. CODE **B**

MODEL 3201 (Specify Color) **NET 1.75**

NEW "PUSH ON" STACKING BNC MALE TO STACKING BANANA PLUG

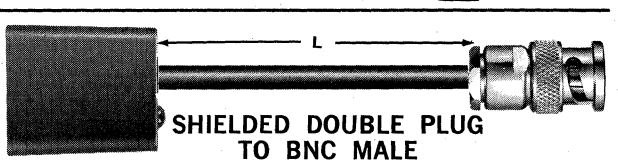


Colors: Black, Red.

MODEL	LENGTH	MODEL	LENGTH
3202-4	4"	3202-24	24"
3202-8	8"	3202-36	36"
3202-12	12"	3202-48	48"
3202-18	18"	3202-60	60"

MODEL 3202 (Specify Color) ★QUANTITY DISC. CODE **B** **NET 1.75**

SHIELDED DOUBLE PLUG TO BNC MALE



CONN.: 1ST END } Shielded Double plug, on ¾" centers. Black anodized aluminum. — CABLE: Shielded coax., RG58C/U — CONN.: 2ND END } UG88E/U, Male BNC

SHIELDED COAX. CABLE	LENGTH	NET
1555-C-18	18"	6.95
1555-C-24	24"	6.95
1555-C-30	30"	6.95
1555-C-36	36"	6.95
1555-C-48	48"	6.95
1555-C-60	60"	6.95

★QUANTITY DISC. CODE **B**

★ Various lengths may be aggregated for best quantity price.

OTHER LENGTHS AND CABLE TYPES AVAILABLE TO ORDER

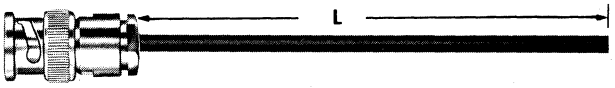
POMONA ELECTRONICS

PATCH CORDS BNC CONNECTING LEADS

Pomona Electronics cable assemblies and patch cords are used in applications where extreme reliability is of prime importance.

BNC MALE ONE END ONLY

NEW



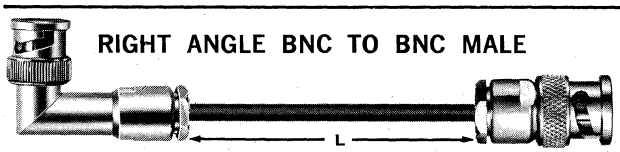
CONN: 1st END } UG88E/U Male BNC — CABLE: Shielded Coax., RG58C/U — CONN: 2nd END } None

CONN: 1st END } UG260B/U Male BNC — Cable: Shielded Coax., RG59B/U or RG62A/U — CONN: 2nd END } None

RG58C/U	RG59B/U	NET	RG62A/U	NET	LENGTH
1661-C-12	1661-E-12	3.95	1661-M-12	4.60	12″
1661-C-24	1661-E-24	3.95	1661-M-24	4.60	24″
1661-C-36	1661-E-36	3.95	1661-M-36	4.60	36″
1661-C-48	1661-E-48	3.95	1661-M-48	4.60	48″
1661-C-60	1661-E-60	3.95	1661-M-60	4.60	60″

★QUANTITY DISC. CODE B

RIGHT ANGLE BNC TO BNC MALE

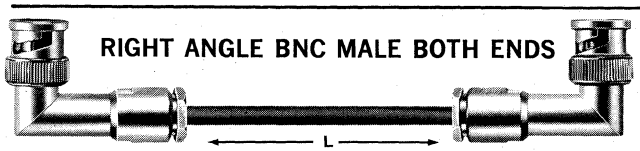


CONN.: 1ST END } UG913A/U, Angle Male BNC — CABLE: Shielded Coax., RG58C/U — CONN.: 2ND END } UG88E/U, Male BNC

SHIELDED COAX. CABLE	LENGTH	NET
1383-C-18	18″	7.95
1383-C-24	24″	7.95
1383-C-30	30″	7.95
1383-C-36	36″	7.95
1383-C-48	48″	7.95
1383-C-60	60″	7.95

★QUANTITY DISC. CODE B

RIGHT ANGLE BNC MALE BOTH ENDS

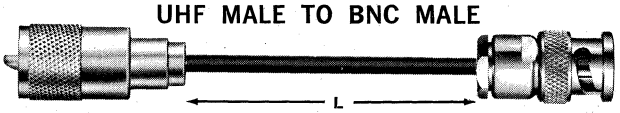


CONN.: 1ST END } UG913A/U, Angle Male BNC — CABLE: Shielded Coax., RG58C/U — CONN.: 2ND END } UG913A/U, Angle Male BNC

SHIELDED COAX. CABLE	LENGTH	NET
1155-C-18	18″	10.95
1155-C-24	24″	10.95
1155-C-30	30″	10.95
1155-C-36	36″	10.95
1155-C-48	48″	10.95
1155-C-60	60″	10.95

★QUANTITY DISC. CODE B

UHF MALE TO BNC MALE

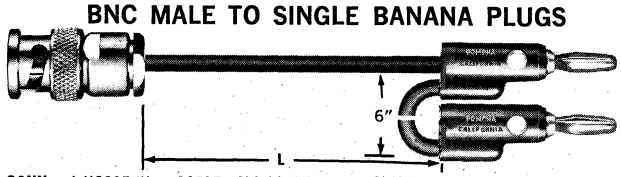


CONN.: 1ST END } PL259, UHF Male — CABLE: Shielded Coax., RG58C/U. — CONN.: 2ND END } UG88E/U, Male BNC

SHIELDED COAX. CABLE	LENGTH	NET
1367-C-18	18″	5.95
1367-C-24	24″	5.95
1367-C-30	30″	5.95
1367-C-36	36″	5.95
1367-C-48	48″	5.95
1367-C-60	60″	5.95

★QUANTITY DISC. CODE B

BNC MALE TO SINGLE BANANA PLUGS



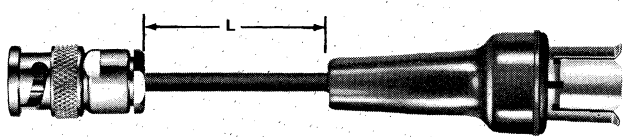
CONN: 1st END } UG88E/U Male BNC — CABLE: Shielded Coax., RG58C/U — CONN: 2nd END } Single Banana Plugs Color: 1 Black, 1 Red.

CABLE DESCRIPTION:
Shielded coax., RG58C/U, Polyethylene insulation. Vinyl jacket, .195" O.D. Nom. Cap. 28.5 pf/ft.

★QUANTITY DISC. CODE B

MODEL	LENGTH	NET
2241-C-18	18″	5.95
2241-C-24	24″	5.95
2241-C-36	36″	5.95
2241-C-48	48″	5.95

BNC MALE TO GR-874



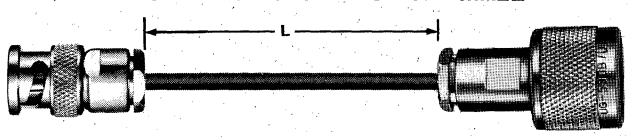
CONN: 1st END } UG88E/U Male BNC — CABLE: Shielded Coax., RG58C/U — CONN: 2nd END } GR-874

CABLE DESCRIPTION:
Shielded coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.

★QUANTITY DISC. CODE B

MODEL	LENGTH	NET
1703-C-24	24″	9.95
1703-C-36	36″	9.95
1703-C-48	48″	9.95

BNC MALE TO SERIES "N" MALE



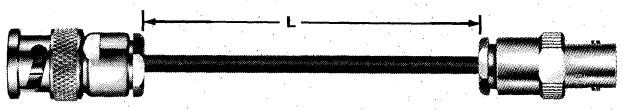
CONN: 1st END } UG88E/U Male BNC — CABLE: Shielded coax., RG58C/U — CONN: 2nd END } UG536B/U "N" Male

CABLE DESCRIPTION:
Shielded coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.

★QUANTITY DISC. CODE B

MODEL	LENGTH	NET
1366-C-24	24″	6.95
1366-C-36	36″	6.95
1366-C-48	48″	6.95

BNC MALE TO BNC FEMALE



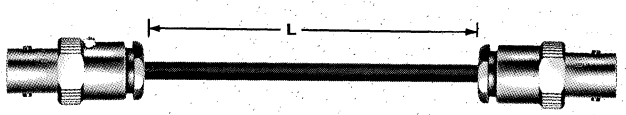
CONN: 1st END } UG88E/U Male BNC — CABLE: Shielded coax., RG58C/U — CONN: 2nd END } UG89C/U Female BNC

CABLE DESCRIPTION:
Shielded Coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.

★QUANTITY DISC. CODE B

MODEL	LENGTH	NET
2223-C-12	12″	6.95
2223-C-24	24″	6.95
2223-C-36	36″	6.95
2223-C-48	48″	6.95
2223-C-60	60″	6.95

BNC FEMALE BOTH ENDS



CONN: 1st END } UG89C/U Female BNC — CABLE: Shielded Coax., RG58C/U — CONN: 2nd END } UG89C/U Female BNC

CABLE DESCRIPTION:
Shielded coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.

★QUANTITY DISC. CODE B

MODEL	LENGTH	NET
1808-C-12	12″	6.95
1808-C-24	24″	6.95
1808-C-36	36″	6.95
1808-C-48	48″	6.95
1808-C-60	60″	6.95

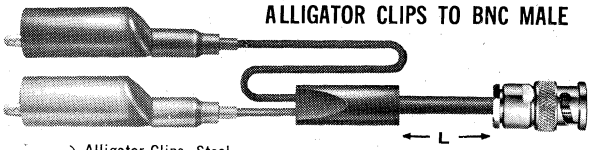
★ Various lengths may be aggregated for best quantity price.

OTHER LENGTHS AVAILABLE TO ORDER

POMONA ELECTRONICS

PATCH CORDS CONNECTING LEADS

ALLIGATOR CLIPS TO BNC MALE



CONN.: 1ST END } Alligator Clips, Steel, cad plated. Insulators, Vinyl: Black/Red.
CABLE: Shielded Mic. or Shielded Coax, RG58C/U.
CONN.: 2ND END } UG88E/U, BNC, Male.

SHIELDED MIC. CABLE	SHIELDED COAX. CABLE	LENGTH	NET
AL-B-BNC-18	AL-C-BNC-18	18″	5.95
AL-B-BNC-24	AL-C-BNC-24	24″	5.95
AL-B-BNC-30	AL-C-BNC-30	30″	5.95
AL-B-BNC-36	AL-C-BNC-36	36″	5.95
AL-B-BNC-48	AL-C-BNC-48	48″	5.95
AL-B-BNC-60	AL-C-BNC-60	60″	5.95

★ QUANTITY DISC. CODE **B**

MINIGATOR CLIPS TO BNC MALE

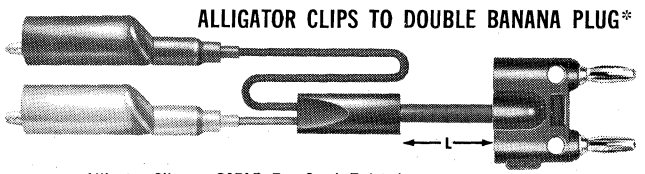


CONN.: 1ST END } Minigator Clips, Steel, cad plated Insulators, Vinyl: Black/Red.
CABLE: Shielded Mic. or Shielded Coax, RG58C/U.
CONN.: 2ND END } UG88E/U, BNC, Male

SHIELDED MIC. CABLE	SHIELDED COAX. CABLE	LENGTH	NET
MG-B-BNC-18	MG-C-BNC-18	18″	5.95
MG-B-BNC-24	MG-C-BNC-24	24″	5.95
MG-B-BNC-30	MG-C-BNC-30	30″	5.95
MG-B-BNC-36	MG-C-BNC-36	36″	5.95
MG-B-BNC-48	MG-C-BNC-48	48″	5.95
MG-B-BNC-60	MG-C-BNC-60	60″	5.95

★ QUANTITY DISC. CODE **B**

ALLIGATOR CLIPS TO DOUBLE BANANA PLUG*

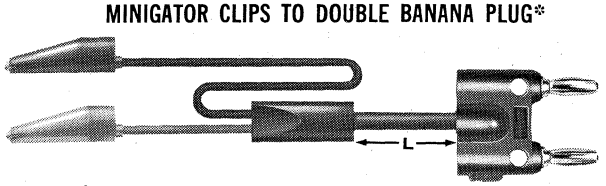


CONN.: 1ST END } Alligator Clips, Steel, cad plated Insulators, Vinyl: Black/Red.
CABLE: Two Cond. Twisted Pair, Shielded Mic. or Shielded Coax, RG58C/U.
CONN.: 2ND END } Double Banana Plug, on ¾″ centers.

TWO COND. TWISTED PAIR	SHIELDED MIC. CABLE	SHIELDED COAX. CABLE	LENGTH	NET
2BA-AL-18	2BB-AL-18	2BC-AL-18	18″	5.95
2BA-AL-24	2BB-AL-24	2BC-AL-24	24″	5.95
2BA-AL-30	2BB-AL-30	2BC-AL-30	30″	5.95
2BA-AL-36	2BB-AL-36	2BC-AL-36	36″	5.95
2BA-AL-48	2BB-AL-48	2BC-AL-48	48″	5.95
2BA-AL-60	2BB-AL-60	2BC-AL-60	60″	5.95

★ QUANTITY DISC. CODE **B**

MINIGATOR CLIPS TO DOUBLE BANANA PLUG*

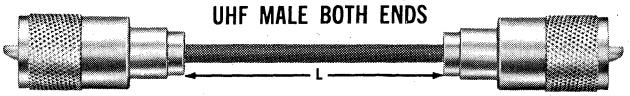


CONN.: 1ST END } Minigator Clips, Steel, cad plated Insulators, Vinyl: Black/Red.
CABLE: Two Cond. Twisted pair, Shielded Mic. or Shielded Coax, RG58C/U.
CONN.: 2ND END } Double Banana Plug, on ¾″ centers.

TWO COND. TWISTED PAIR	SHIELDED MIC. CABLE	SHIELDED COAX. CABLE	LENGTH	NET
2BA-MG-18	2BB-MG-18	2BC-MG-18	18″	5.95
2BA-MG-24	2BB-MG-24	2BC-MG-24	24″	5.95
2BA-MG-30	2BB-MG-30	2BC-MG-30	30″	5.95
2BA-MG-36	2BB-MG-36	2BC-MG-36	36″	5.95
2BA-MG-48	2BB-MG-48	2BC-MG-48	48″	5.95
2BA-MG-60	2BB-MG-60	2BC-MG-60	60″	5.95

★ QUANTITY DISC. CODE **B**

UHF MALE BOTH ENDS

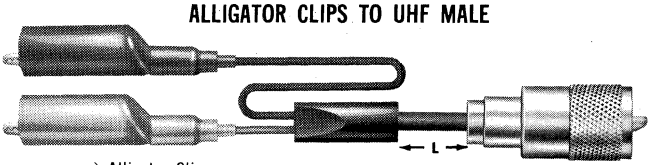


CONN.: 1ST END } PL259, UHF, Male
CABLE: Shielded coax., RG58C/U
CONN.: 2ND END } PL259, UHF, Male

SHIELDED COAX. CABLE	LENGTH	NET
UHF-C-18	18″	5.95
UHF-C-24	24″	5.95
UHF-C-30	30″	5.95
UHF-C-36	36″	5.95
UHF-C-48	48″	5.95
UHF-C-60	60″	5.95

★ QUANTITY DISC. CODE **B**

ALLIGATOR CLIPS TO UHF MALE

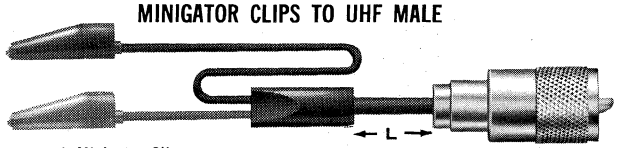


CONN.: 1ST END } Alligator Clips, Steel, cad plated Insulators, Vinyl: Black/Red.
CABLE: Shielded coax., RG58C/U
CONN.: 2ND END } PL259, UHF, Male

SHIELDED COAX. CABLE	LENGTH	NET
AL-C-UHF-18	18″	5.95
AL-C-UHF-24	24″	5.95
AL-C-UHF-30	30″	5.95
AL-C-UHF-36	36″	5.95
AL-C-UHF-48	48″	5.95
AL-C-UHF-60	60″	5.95

★ QUANTITY DISC. CODE **B**

MINIGATOR CLIPS TO UHF MALE

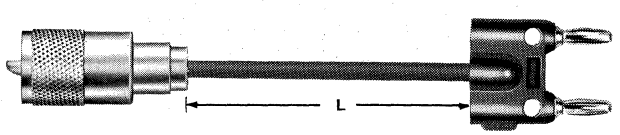


CONN.: 1ST END } Minigator Clips, Steel, cad plated Insulators, Vinyl: Black/Red.
CABLE: Shielded Coax., RG58C/U
CONN.: 2ND END } PL259 UHF, Male

SHIELDED COAX. CABLE	LENGTH	NET
MG-C-UHF-18	18″	5.95
MG-C-UHF-24	24″	5.95
MG-C-UHF-30	30″	5.95
MG-C-UHF-36	36″	5.95
MG-C-UHF-48	48″	5.95
MG-C-UHF-60	60″	5.95

★ QUANTITY DISC. CODE **B**

UHF MALE TO DOUBLE BANANA PLUG*



CONN.: 1ST END } PL259 UHF, Male
CABLE: Shielded Coax., RG58C/U
CONN.: 2ND END } Double Banana Plug, on ¾″ centers.

SHIELDED COAX. CABLE	LENGTH	NET
2BC-UHF-18	18″	5.95
2BC-UHF-24	24″	5.95
2BC-UHF-30	30″	5.95
2BC-UHF-36	36″	5.95
2BC-UHF-48	48″	5.95
2BC-UHF-60	60″	5.95

★ QUANTITY DISC. CODE **B**

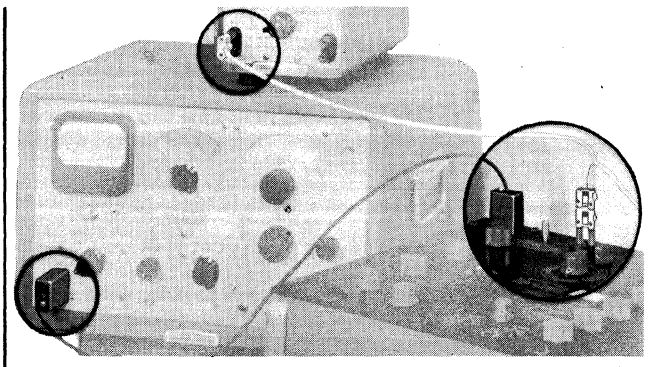
*NOTE: Molded double plug matches color of cable. Two cond. Twisted pair, GRAY. Shielded mic. cable, GRAY. Coaxial RG58C/U cable, BLACK.

1. Other CABLE COLORS available to order on the Two Cond. Twisted Pair and Shielded Mic. cable models, with plug to match. COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.
2. Other lengths and cable types available to order.

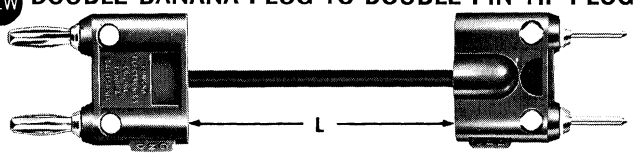
★ Various lengths may be aggregated for best quantity price.

POMONA ELECTRONICS

PATCH CORDS CONNECTING LEADS



NEW DOUBLE BANANA PLUG TO DOUBLE PIN TIP PLUG



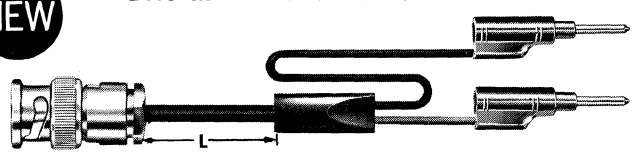
CONN: 1st END } Double Banana Plug, on ¾" Centers **CABLE:** Shielded Coax., RG58C/U **CONN: 2nd END** } Double Pin Tip Plug, .080 Dia. on ¾" Centers

CABLE DESCRIPTION:
Shielded coax., RG58C/U, Polyethylene insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.

MODEL	LENGTH
2288-C-18	18"
2288-C-24	24"
2288-C-36	36"
2288-C-48	48"
2288-C-60	60"

MODEL 2288 ★QUANTITY DISC. CODE **B** **NET 4.95**

NEW BNC MALE TO STACK-UP PIN TIPS



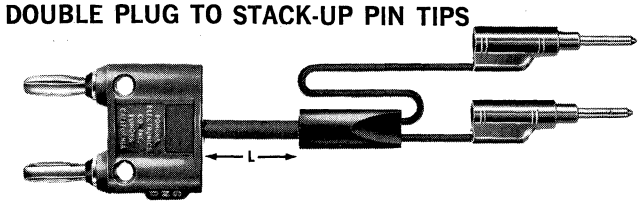
CONN: 1st END } UG88E/U Male BNC **CABLE:** Shielded Coax., RG58C/U **CONN: 2nd END** } Single Stack-Up Pin Tip Plugs, .080 Dia.; Color: 1 Black, 1 Red.

CABLE DESCRIPTION:
Shielded coax., RG58C/U, Polyethylene insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.

MODEL	LENGTH
2882-C-18	18"
2882-C-24	24"
2882-C-36	36"
2882-C-48	48"
2882-C-60	60"

MODEL 2882 ★QUANTITY DISC. CODE **B** **NET 7.50**

DOUBLE PLUG TO STACK-UP PIN TIPS



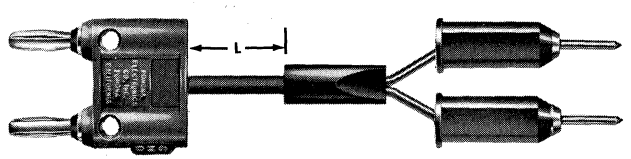
CONN: 1st END } Double Banana Plug, on ¾" Centers. **CABLE:** Shielded Coax., RG58C/U **CONN: 2nd END** } Single Stack-Up Pin Tip Plugs, .080 Dia. Color: 1 Black, 1 Red.

CABLE DESCRIPTION	MODEL	LENGTH	NET
Shielded coax., RG58C/U, Polyethylene insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.	2BC-PP-18	18"	7.50
	2BC-PP-24	24"	7.50
	2BC-PP-36	36"	7.50
	2BC-PP-48	48"	7.50
	2BC-PP-60	60"	7.50

COLOR: Cable and Double Plug, Black.

★QUANTITY DISC. CODE **B**

DOUBLE PLUG TO SINGLE PIN TIPS



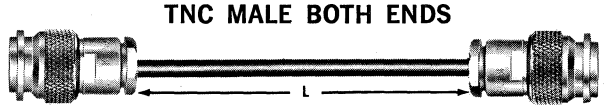
CONN: 1st END } Double Banana Plug, on ¾" Centers. **CABLE:** Two Cond. Twisted Pair **CONN: 2nd END** } Single Pin Tip Plugs, .080 Dia. Color: 1 Black, 1 Red

CABLE DESCRIPTION	MODEL	LENGTH	NET
Two Cond. Twisted pair. 18 AWG, Strand. 65 x 36 T.C. Vinyl insulation, vinyl jacket, .250" O.D. Nom. Cap. 30 pf/ft.	2184-A-24	24"	5.95
	2184-A-36	36"	5.95
	2184-A-48	48"	5.95
	2184-A-60	60"	5.95

COLOR: Cable and Double plug, Gray.

★QUANTITY DISC. CODE **B**

TNC MALE BOTH ENDS

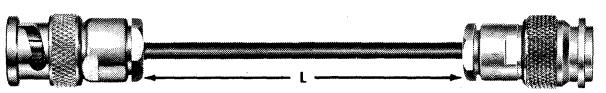


CONN: 1st END } Male TNC **CABLE:** Shielded coax., RG58C/U **CONN: 2nd END** } Male TNC

CABLE DESCRIPTION	MODEL	LENGTH	NET
Shielded coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.	1944-C-12	12"	7.95
	1944-C-24	24"	7.95
	1944-C-36	36"	7.95
	1944-C-48	48"	7.95
	1944-C-60	60"	7.95

★QUANTITY DISC. CODE **B**

BNC MALE TO TNC MALE

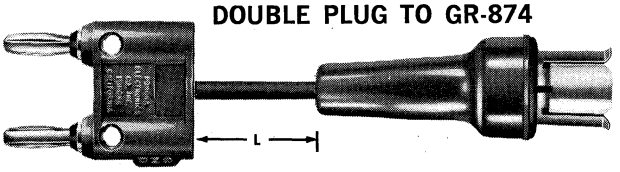


CONN: 1st END } UG88E/U Male BNC **CABLE:** Shielded coax., RG58C/U **CONN: 2nd END** } Male TNC

CABLE DESCRIPTION:	MODEL	LENGTH	NET
Shielded Coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.	1948-C-12	12"	6.95
	1948-C-24	24"	6.95
	1948-C-36	36"	6.95
	1948-C-48	48"	6.95
	1948-C-60	60"	6.95

★QUANTITY DISC. CODE **B**

DOUBLE PLUG TO GR-874



CONN: 1st END } Double Banana Plug, on ¾" Centers. **CABLE:** Shielded Coax., RG58C/U **CONN: 2nd END** } GR-874

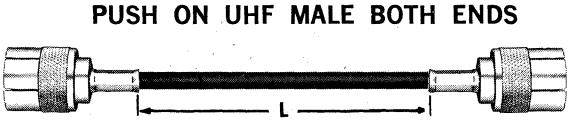
CABLE DESCRIPTION	MODEL	LENGTH	NET
Shielded coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.	2243-C-24	24"	9.50
	2243-C-36	36"	9.50
	2243-C-48	48"	9.50

COLOR: Cable and double plug, Black.

★QUANTITY DISC. CODE **B**

PUSH ON UHF MALE BOTH ENDS

NEW



CONN: 1st END } Crimp Push on UHF, Male. **CABLE:** Shielded Coax., RG58C/U **CONN: 2nd END** } Crimp Push on UHF, Male.

A test cable for rapid interconnection of equipment. Connector is pushed on and requires no screwing on of shell. Continuity of shield is maintained. Excellent for those hard to get at places.

MODEL	LENGTH
3137-C-12	12"
3137-C-24	24"
3137-C-36	36"
3137-C-48	48"
3137-C-60	60"

MODEL 3137 ★QUANTITY DISC. CODE **B** **NET 5.95**

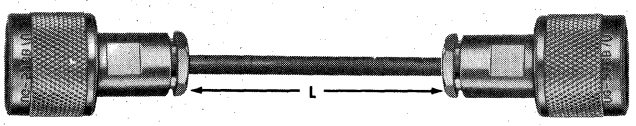
★ Various lengths may be aggregated for best quantity price.

OTHER LENGTHS AVAILABLE TO ORDER

POMONA ELECTRONICS

PATCH CORDS CONNECTING LEADS

SERIES "N" MALE BOTH ENDS

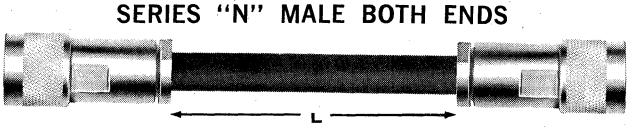


CONN: 1st END: UG536B/U "N" Male — **CABLE:** Shielded Coax., RG58C/U. — **CONN:** 2nd END: UG536B/U "N" Male

CABLE DESCRIPTION:	MODEL	LENGTH
Sheilded coax., RG58C/U, Polyethylene insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.	2256-C-24	24"
	2256-C-36	36"
	2256-C-48	48"
	2256-C-60	60"

MODEL 2256 ★ QUANTITY DISC. CODE **B** **NET 7.95**

SERIES "N" MALE BOTH ENDS



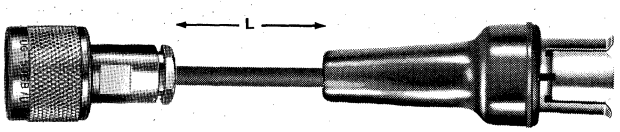
CONN: 1st END: UG21E/U "N" Male — **CABLE:** Coax., RG213/U or RG214/U — **CONN:** 2nd END: UG21E/U "N" Male

CABLE TYPES

RG213/U	NET	LENGTH	RG214/U	NET
1658-S-18	10.85	18"	1658-T-18	12.85
1658-S-24	10.85	24"	1658-T-24	12.85
1658-S-36	10.85	36"	1658-T-36	12.85
1658-S-48	11.35	48"	1658-T-48	13.60
1658-S-60	11.85	60"	1658-T-60	14.35

MODEL 1658 ★ QUANTITY DISC. CODE **B**

SERIES "N" MALE TO GR-874

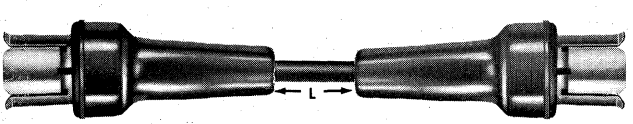


CONN: 1st END: UG536B/U "N" Male — **CABLE:** Shielded Coax., RG58C/U — **CONN:** 2nd END: GR-874

CABLE DESCRIPTION:	MODEL	LENGTH
Shielded coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.	2438-C-24	24"
	2438-C-36	36"
	2438-C-48	48"
	2438-C-60	60"

MODEL 2438 ★ QUANTITY DISC. CODE **B** **NET 10.95**

GR-874 TO GR-874

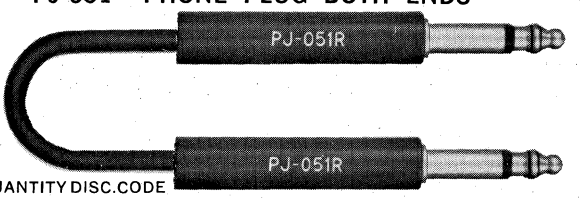


CONN: 1st END: GR-874 — **CABLE:** Shielded coax., RG58C/U — **CONN:** 2nd END: GR-874

CABLE DESCRIPTION:	MODEL	LENGTH
Shielded coax., RG58C/U, Polyethylene Insulation. Vinyl jacket, .195" O.D., Nom. Cap. 28.5 pf/ft.	2316-C-24	24"
	2316-C-36	36"
	2316-C-48	48"
	2316-C-60	60"

MODEL 2316 ★ QUANTITY DISC. CODE **B** **NET 16.95**

PJ-051* PHONE PLUG BOTH ENDS



★ **B** QUANTITY DISC.CODE

CONN.: 1ST END: PJ-051* — **CABLE: TWO COND. TWISTED PAIR** — **CONN.:** 2ND END: PJ-051*

*PJ-051 Interchangeable with WE310.

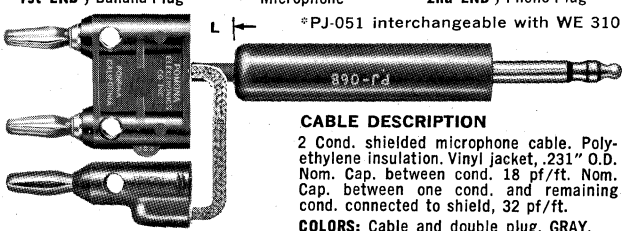
Patch Cord is wired tip to tip, and ring to ring. No sleeve connection.

CABLE DESCRIPTION	MODEL	LENGTH	NET
Two Cond. Twisted pair, 18 AWG, Strand. 65 x 36 T.C. Vinyl Insulation, Vinyl jacket .250" O.D., Nom. Cap. 30 pf/ft.	2524-A-18	18"	7.95
	2524-A-24	24"	7.95
	2524-A-36	36"	7.95
	2524-A-48	48"	7.95
COLOR: Cable, Gray. Phone Plug Handle, Red.	2524-A-60	60"	7.95

DOUBLE PLUG BALANCED LINE TO PJ-068 OR PJ-051*

CONN: 1st END: Double and Single Banana Plug — **CABLE:** 2 Cond. Shielded Microphone — **CONN:** 2nd END: PJ-068 or PJ-051 Phone Plug

*PJ-051 interchangeable with WE 310



CABLE DESCRIPTION

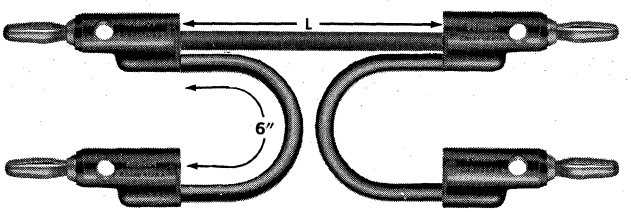
2 Cond. shielded microphone cable. Polyethylene insulation. Vinyl jacket, .231" O.D. Nom. Cap. between cond. 18 pf/ft. Nom. Cap. between one cond. and remaining cond. connected to shield, 32 pf/ft.

COLORS: Cable and double plug, GRAY. Single ground plug, GREEN.

MODEL	LENGTH	NET
2174-36	36"	9.85 (PJ-068)
2977-J-36	36"	9.85 (PJ-051)

★ QUANTITY DISC. CODE **B**

SINGLE BANANA PLUGS BOTH ENDS

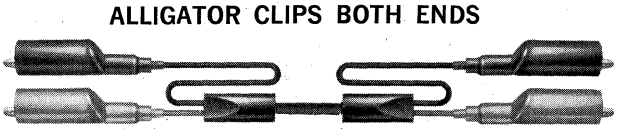


CONN: 1st END: Single Banana Plugs. Colors: Inner Conductor plug, Red. Ground Plug, Black. — **CABLE:** Shielded Coax., RG122/U — **CONN:** 2nd END: Single Banana Plugs. Colors: Inner Conductor Plug, Red. Ground Plug, Black.

CABLE DESCRIPTION:	MODEL	LENGTH
Shielded coax., RG122/U polyethylene insulation. Vinyl jacket, .160" O.D., Nom. Cap. 29.5 pf/ft.	2239-R-24	24"
	2239-R-36	36"
	2239-R-48	48"
	2239-R-60	60"

MODEL 2239 ★ QUANTITY DISC. CODE **B** **NET 4.95**

ALLIGATOR CLIPS BOTH ENDS



CONN: 1st END: Alligator Clips, Steel, cad plated Insulators, Vinyl: Black/Red. — **CABLE:** Shielded Coax., RG58C/U — **CONN:** 2nd END: Alligator Clips, Steel, cad plated Insulators, Vinyl: Black/Red.

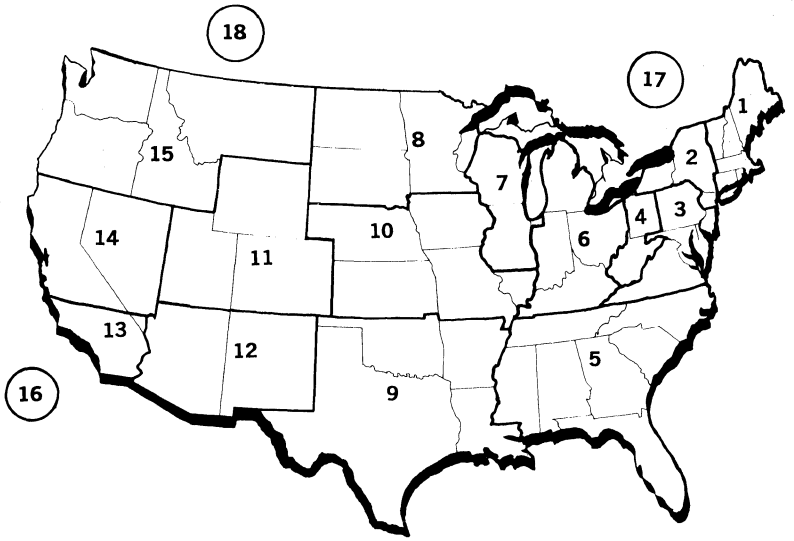
CABLE DESCRIPTION:	MODEL	LENGTH
Shielded coax., RG58C/U, Polyethylene Insulation Vinyl jacket, .195" O.D. Nom. Cap. 28.5 pf/ft.	1152-C-12	12"
	1152-C-24	24"
	1152-C-36	36"
	1152-C-48	48"
	1152-C-60	60"

MODEL 1152 ★ QUANTITY DISC. CODE **B** **NET 5.95**

***NOTE:** Molded double plug matches color of cable. Two cond. Twisted pair, GRAY. Shielded mic. cable, GRAY. Coaxial RG58C/U cable, BLACK.

1. Other CABLE COLORS available to order on the Two Cond. Twisted Pair and Shielded Mic. cable models, with plug to match. COLORS: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White.
2. Other lengths and cable types available to order.

★Various lengths may be aggregated for best quantity price.



SALES REPRESENTATIVES

Listed below are the names of our Factory Representatives who have contributed greatly to the growth of our organization. The men in your area are always ready to confer with you and assist you regarding Pomona Electronics products.

(1) Robert S. Reiss Associates
70 Jessie Drive
West Haven, Connecticut 06516
(203) 933-8542
Territory: Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island

Robert S. Reiss Associates
(Branch Office)
Al Appell
199 East Foxboro Street
Sharon, Massachusetts 02067
(617) 784-3439

(2) Jack Weber
2700 Henry Hudson Pkwy.
Bronx, New York 10463
(212) 546-8306
Territory: New York State, & Northern New Jersey

(3) David S. Linz
238 Shelmire Street
Philadelphia, Penna. 19111
(215) 379-0734
Territory: So. New Jersey, E. Pennsylvania, Delaware, Maryland, Washington, D.C.

(4) Perry Lohse & Company
537 Richmond Road
Cleveland, Ohio 44143
(216) 381-7788
Territory: West Virginia, West Pennsylvania

(5) V. Avis McCorvey Company
2187 Briarcliff Road NE
Atlanta, Georgia 30329
(404) 636-2502
Territory: Alabama, Florida, Georgia, N. Carolina, S. Carolina, Tennessee, Mississippi

V. Avis McCorvey Company
(Branch Office)
Hal C. Norman
P.O. Box 5185, Station B
Greenville, South Carolina 29606
(803) 244-6254

(6) Perry Lohse & Company
537 Richmond Road
Cleveland, Ohio 44143
(216) 381-7788
Territory: North Ohio, West Pennsylvania

Perry Lohse & Company
(Branch Office)
Keith H. Fannon
5090 Mengel Lane
Hilliard, Ohio 43026
(614) 876-4394
Territory: South Ohio, West Virginia

Perry Lohse & Company
(Branch Office)
Blind & Assoc., Inc.
1635 No. Gent Avenue
Indianapolis, Indiana 46202
(317) 635-6291
Territory: Indiana and Kentucky

Perry Lohse & Company
(Branch Office)
The C. A. Geer Company
221 Graceland Street, NE
Grand Rapids, Michigan 49505
(616) 361-9252
Territory: Michigan

(7) William M. Linz Associates, Inc.
4001 West Devon Ave., Room 302
Chicago, Illinois 60646
(312) 685-6060
Territory: Illinois (South to and including Jacksonville, Springfield, Decatur, Moline and Rock Island) Wisconsin (North to Green Bay and Marinette). Counties of Lake, La Porte and Porter in Indiana

(8) Northern States Sales Co.
1109 West 78½ Street
Minneapolis, Minnesota 55420
(612) 866-3468
Territory: Minnesota, N. Dakota, S. Dakota and Western Wisconsin

(9) Techno Associates
P.O. Box 20544
Dallas, Texas 75220
(214) 357-9213
Territory: Texas, Arkansas, Louisiana, Oklahoma

(10) Clemenson-Larrabee Company
3709-A Summit St.
Kansas City, Missouri 64111
(816) 931-0657
Territory: Kansas, Nebraska, Western Iowa, Western Missouri

Clemenson-Larrabee Company
(Branch Office)
2725 Beloit Drive
Bridgeton, Missouri 63042
(312) 539-7171
Territory: Eastern Iowa, Eastern Missouri, So. Illinois

(11) AES, Incorporated
12891 E. Nevada Circle
Aurora, Colorado 80010
(303) 366-0208
Territory: Colorado, Utah, Wyoming

(12) Harry A. Moore Sales Company
P.O. Box 7245
Phoenix, Arizona 85011
(602) 274-0060
Territory: Arizona, New Mexico and El Paso, Texas

(13) Paul Nurches—Indus. OEM Sales
2396 E. Foothill Blvd.
Pasadena, California 91107
(213) 681-8957
Territory: Southern California, Southern Nevada and City of Las Vegas

Al J. Rissi Sales Company
(Distributor Sales)
1817 San Gabriel Blvd.
San Gabriel, California 91776
(213) 283-7614 or (213) 288-3883
Territory: Southern California, Southern Nevada and City of Las Vegas

(14) Paul Nurches—Indus. OEM Sales
(Branch Office)
Chuck Boyenga, Branch Mgr.
999 Commercial St., Room 206
Palo Alto, California 94303
(415) 326-7842
Territory: No. Calif., No. Nevada, except for City of Las Vegas, and Southern Tip

Belchamber & French Company
(Distributor Sales)
308 Playa Blvd.
La Selva Beach, California 95076
(408) 688-3281
Territory: Northern California and No. Nevada except City of Las Vegas

(15) R. K. Squibb, Inc.
655 NE Northlake Place
Seattle, Washington 98105
(206) 632-2450
Territory: Washington, Oregon, Montana, Idaho, Alaska

(16) Intercontinental Aviation Services, Inc.
P.O. Box 1705
Beverly Hills, California 90213
(213) 274-7578 (213) 272-5054
Territory: Export

(17) Electronetic Systems Ltd.
62 Alness Street
Downsview, Ontario, Canada
(416) 636-3673 (416) 636-3676
Territory: Provinces of Ontario, Saskatchewan, Newfoundland, New Brunswick, Prince Edward Island

Electronetic Systems Ltd.
(Branch Office)
Ben L. Reitelman
6420 Victoria Ave., Suite 17
Montreal 26, Quebec, Canada
(514) 737-2744
Territory: Quebec, Ottawa, Manitoba

(18) Al Deskin Sales Corporation
1641 Venables Street
Vancouver 6, B.C., Canada
(604) 253-6396
Territory: British Columbia, Alberta

POMONA ELECTRONICS CO. INC. 1500 E. NINTH ST. • POMONA, CALIF. 91766
PHONE: (714) 623-3463 • TWX: 910-581-3822

EIA MEMBER
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PRECISION METAL PRODUCTS

TURRET TERMINALS • TERMINAL BOARDS • ELECTRONIC HARDWARE

PRECISION METAL PRODUCTS CO.
41 ELM STREET, STONEHAM, MASSACHUSETTS 02180 Tel. (617) 438-3650

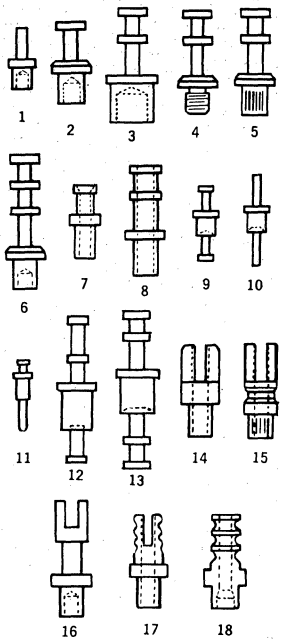
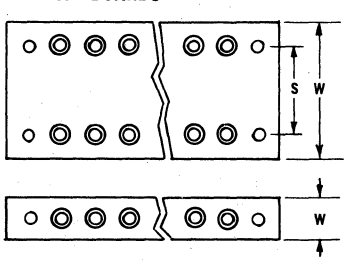


Fig. No.	Part No.	Shank (Thread)	Turret	Shoulder	Above	Below	Thick-ness	Notes	1-999	1M-4999	5M & Up
1	1P4-26	.090	—	.125	.173	—	1/32-1/8	Pin Dia. .040	$12.50	$10.00	$ 9.50
2	1S2-25	.047	.040	.062	.093	—	1/64-1/8		9.15	8.10	7.00
2	1S4-19	.090	.070	.125	.181	—	1/32-1/8		9.30	7.90	6.70
2	1S6-17	.112	.145	.187	.234	—	1/32-3/16		12.50	11.00	10.10
3	1D3-8	.061	.062	.093	.156	—	1/64-1/8		11.50	9.90	8.10
3	1D3-11	.072	.050	.093	.186	—	1/64-1/8	C-Sink 45° x .020 in Shank	9.90	8.10	7.50
3	1D4-6	.090	.093	.125	.237	—	1/32-1/8		9.00	7.70	7.00
3	1D5-5	.090	.109	.156	.281	—	1/32-1/8		13.20	11.00	10.10
3	1D6-1	.112	.145	.187	.360	—	1/32-1/4		12.50	11.00	10.10
4	1D6-15	4-40	.145	.187	.360	—	1/8 & 3/16	4-40 Thd.	17.05	16.50	15.40
4	1D6-16	4-40	.145	.187 Hex	.360	—	1/8 & 3/16	4-40 Thd.	17.05	16.50	15.40
5	1KD3-9	.061	.062	.093	.156	—	1/64-1/8	Knurled Shank	14.50	12.10	11.10
5	1KD6-2	.112	.145	.187	.360	—	1/32-3/16	Knurled Shank	15.95	14.15	12.40
6	1T4-13	.090	.093	.125	.316	—	1/32-1/8		11.00	9.90	9.10
6	1T6-12	.112	.145	.187	.484	—	1/32-3/16		19.50	18.20	17.40
7	2S4-38	.061	.093	.125	.156	—	1/64-1/8	.043 Dia. Thru Hole	11.00	10.45	8.80
7	2S4-39	.071	.096	.125	.187	—	1/64-1/8	.043 Dia. Thru Hole	11.00	10.45	8.80
7	2S6-35 (.067)	.110	.141	.187	.187	—	1/32-3/16	.067 Thru Hole	14.00	12.50	10.40
8	2D5-33	.078	.109	.156	.328	—	1/32-1/8	.043 Dia. Thru Hole	22.00	19.75	16.40
8	2D6-29	.112	.145	.187	.328	—	1/32-1/4	.078 Dia. Thru Hole	12.00	10.50	9.90
9	3SS3-67	.078	.050	.093	.104	.082	1/64-1/8		8.50	7.35	7.00
9	3SS4-65	.090	.062	.125	.133	.113	1/32-1/8		11.00	9.40	9.00
9	3SS5-63	.116	.070	.156	.156	.125	1/32-1/8		11.00	9.40	9.00
10	3PP4-66	.090	—	.125	.177	.156	1/32-1/8	Pin Dia. .040	18.50	15.90	14.75
11	3SP2-60	.062	.045	.078	.078	.140	1/64-1/8		12.50	11.20	9.35
11	3SP3-59	.072	.050	.093	.078	.250	1/64-1/8		12.50	11.20	9.35
12	3DS3-58	.072	.050	.093	.186	.082	1/64-1/8		9.75	8.50	7.90
12	3DS4-57	.090	.062	.125	.219	.103	1/32-1/8		12.10	10.35	9.90
12	3DS8-54	.202	.144	.250	.344	.109	1/32-3/16		25.30	22.00	20.05
13	3DD3-49	.072	.050	.093	.186	.164	1/64-1/8		10.25	8.80	8.40
13	3DD4-48	.090	.062	.125	.219	.187	1/32-1/8		12.75	10.90	10.40
13	3DD6-45	.156	.093	.187	.250	.218	1/32-3/16		28.00	25.00	21.00
13	3DD8-43	202	.144	.250	.357	.312	1/32-1/4		28.00	26.00	24.75
14	4S3-78	.061	—	.093	.156	—	1/64-1/8	Thru Hole .043	11.00	9.40	9.00
14	4S5-77	.112	—	.156			1/32-3/16	Thru Hole .078 Dia.	15.90	14.40	13.75
14	4S6-74	.112	—	.187	.345	—	1/32-3/16	Thru Hole .078 Dia.	19.95	17.60	15.70
15	4S5-76	.125	—	.156	.344	—	1/32-3/16	Thru Hole .070	19.00	17.00	16.10
16	5S4-86	.090	.090	.125	.219	—	1/32-1/8	Slot .032 Wide	17.60	15.95	14.30
16	5S6-82	.112	.145	.187	.390	—	1/32-3/16	Slot .063 Wide	17.60	15.95	14.30
17	52S6-83	.113	.140	.187	.328	—	1/32-3/16	Thru Hole .070 Dia. Slot .046 Wide	22.50	18.00	15.90
18	52S6-84	.112	.130	.187	.315	—	1/32-3/16	Thru Hole .060 Dia.	21.00	19.50	17.10

SEE ORDERING CHART BELOW.

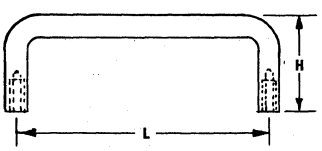
TERMINAL BOARDS



Part No.	W	S	Material	NEMA	1-49	50-249	250-500
2600A *	5/16	—	Phenolic (PBE)	(XXX)	$ .83 ea.	$ .72 ea.	$ .66 ea.
2600B *	3/4	1/2	Phenolic (PBE)	(XXX)	1.80	1.60	1.49
2600C *	1	3/4	Phenolic (PBE)	(XXX)	1.87	1.65	1.54
2601	1/2	—	Paper Phenolic	(XXX)	.83	.72	.66
2602	2	1 1/2	Paper Phenolic	(XXX)	1.80	1.60	1.49
2603	2 1/2	2	Paper Phenolic	(XXX)	1.87	1.65	1.54
2604	3	2 1/2	Paper Phenolic	(XXX)	1.98	1.71	1.60
2611	1/2	—	Linen Phenolic	(LE)	.88	.77	.72
2612	2	1 1/2	Linen Phenolic	(LE)	1.92	1.71	1.60
2613	2 1/2	2	Linen Phenolic	(LE)	2.04	1.76	1.65
2614	3	2 1/2	Linen Phenolic	(LE)	2.09	1.80	1.71
2621	1/2	—	Glass Epoxy	(GEE)	.99	.88	.83
2622	2	1 1/2	Glass Epoxy	(GEE)	2.26	2.04	1.93
2623	2 1/2	2	Glass Epoxy	(GEE)	2.42	2.20	2.08
2624	3	2 1/2	Glass Epoxy	(GEE)	2.53	2.31	2.20

* Board Thickness 1/16" - Terminal is No. 2S4-38B. Board Thickness is 3/32 Terminal is No. 1D6-1C

HANDLES & FERRULES



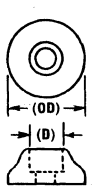
Part No.	Fig.	L (D)	H (OD)	Material	Finish	1-49	50-249	250-500
2101	1A	3	1 5/16	Brass	Nickel Plate	$ .95 ea.	$ .80 ea.	$ .69 ea.
2102	1A	4 1/2	1 1/2	Brass	Nickel Plate	1.00	.85	.74
2103	1A	6 1/2	1 3/4	Brass	Nickel Plate	1.15	.95	.84
2105	1B	(.320)	(3/4)	Brass	Nickel Plate	.13	.12	.11
2107	1B	(.320)	(.562)	Brass	Nickel Plate	.12	.11	.10
2121	1A	3	1 5/16	Stainless Steel		.95	.80	.70
2122	1A	4 1/2	1 1/2	Stainless Steel		1.00	.85	.75
2123	1A	6 1/2	1 3/4	Stainless Steel		1.10	.90	.80
2126	1B	(.320)	(3/4)	Stainless Steel		.16	.15	.14
2127	1B	(.320)	(.562)	Stainless Steel		.13	.12	.11
2130	1A	4	1 7/8	Aluminum	Black Anodize	1.15	.94	.82
2130F	1B	(3/8)	(3/4)	Aluminum	Black Anodize	.13	.12	.11
2141	1A	3	1 5/16	Brass	Nickel Plate	.95	.80	.69
2142	1A	4 9/16	1 1/2	Brass	Nickel Plate	1.00	.85	.74
2143	1A	6 7/16	1 3/4	Brass	Nickel Plate	1.15	.95	.84
2160	1A	4 1/4	2 1/8	Brass	Nickel Plate	1.20	1.00	.95
2171	1A	3	1 9/32	Brass	Nickel Plate	1.70	1.25	1.18
2172	1A	4 9/16	1 1/2	Brass	Nickel Plate	1.90	1.45	1.35
2173	1A	6 7/16	1 3/4	Brass	Nickel Plate	2.15	1.60	1.50
2174	1A	9	1 3/4	Brass	Nickel Plate	2.40	1.75	1.65
2181	1A	3	1 9/32	Aluminum	Black Anodize	1.25	.95	.85
2182	1A	4 9/16	1 1/2	Aluminum	Black Anodize	1.35	1.00	.90
2183	1A	6 7/16	1 3/4	Aluminum	Black Anodize	1.45	1.05	.95
2184	1A	9	1 3/4	Aluminum	Black Anodize	1.60	1.15	1.05

SEE ORDERING CHART AT LEFT.

ORDERING CHART

Add Suffix to Indicate Board Thickness

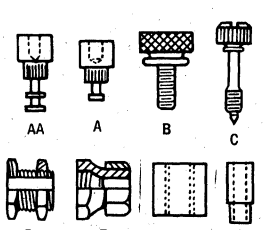
Suffix	Bd. Thickness
AA	1/64
A	1/32
B	1/16
C	3/32
D	1/8
E	5/32
F	3/16
G	1/4



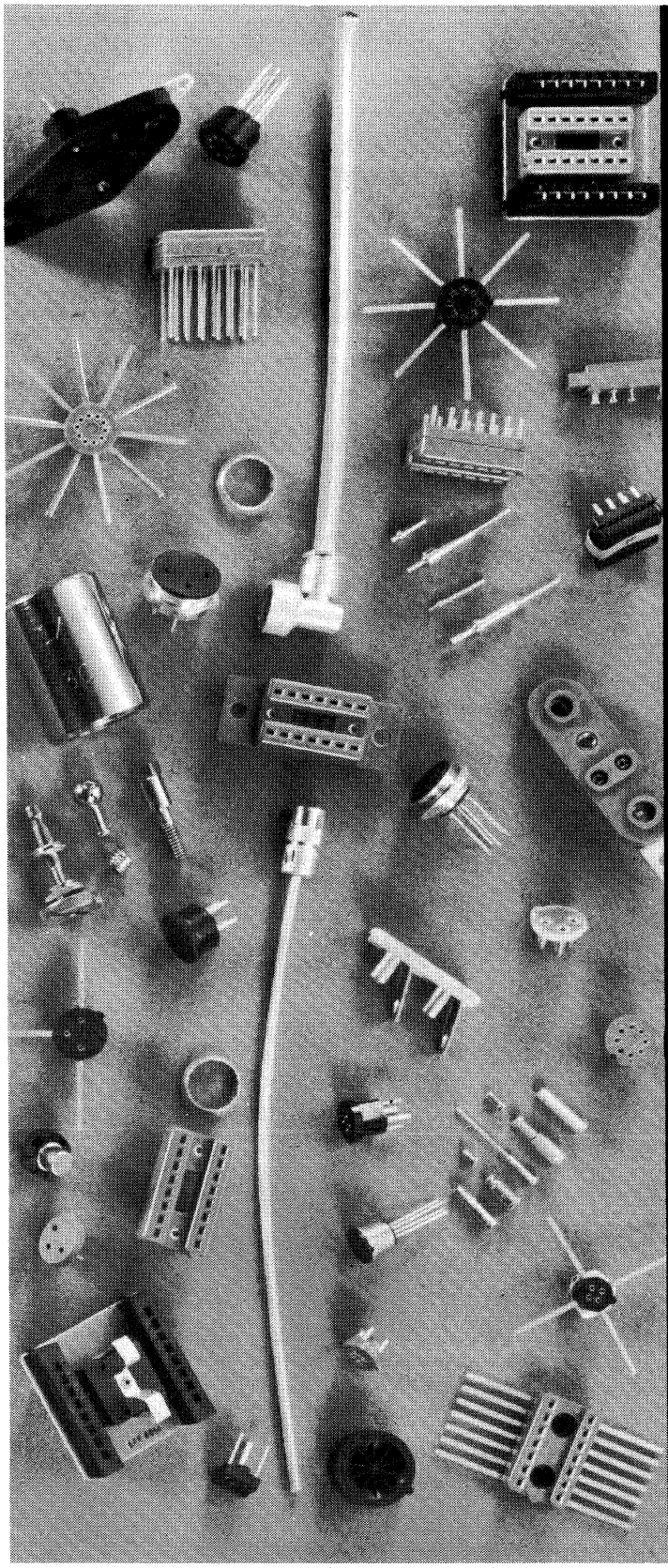
All Terminals Brass, Silver Plated.
Specify other finishes when ordering.

Part No.	Fig.	Diameter in Inches: Shank (Thread)	Diameter in Inches: Turret	Shoulder	Height (In.): Above	Height (In.): Below	Board Thickness	Notes	1-49	50-249	250-500
1700	AA	.202	.141	.312	.250	.312	1/32 - 3/16		$.09	$.07	$.06
1710	A	.220	.125	.312	.250	.170	1/32 - 3/16		.09	.07	.06

HARDWARE



		Length	Thds./in.	Dia.	Material	Finish				
2000	B	23/32	6-32	7/16 on 1/2 dia. head	Brass	Nickel Plate		.18	.15	.13
			8-32	3/8 on 7/16 dia. head	Brass	Nickel Plate				
			10-32	5/16 on 3/8 dia. head	Brass	Nickel Plate				
2010	C	15/16	6-32	5/16	Half hard Brass	Nickel Plate		.22	.19	.16
14	D	5/16	3/8 -32 nef 2	1/2 hex	Brass	Bright Alloy	7/64, & 1/32	.20	.17	.15
77	E	1/16	1/4 -32	3/8 hex	Brass	Bright Alloy		.20	.18	.16
77A	E	5/8	3/8 -32	5/8 hex	Brass	Bright Alloy		.22	.20	.18
79	E	3/16	1/4 -32 nef 2	3/8 hex	Brass	Bright Alloy		.20	.18	.16
79A	E	17/32	1/4 -32 nef 2	3/8 hex	Brass	Bright Alloy		.22	.20	.18
2301	F	1/4	4-40	3/16	Brass	Cadmium or Nickel Plate		.07	.06	.05
2302-6	F	1/4-3/4	6-32	1/4	Brass	Cadmium or Nickel Plate	1/8" Incr.	.10	.08	.06
2307-10	F	3/8-3/4	8-32	3/8	Brass	Cadmium or Nickel Plate	Specified	.12	.10	.08
2500	G	1/8-1/2	6-32 top	1/4	Brass	Cadmium Plate	1/32 - 3/16	.10	.08	.06
2510	G	1/8-1/2	6-32 top	1/4	Brass	Cadmium Plate	1/32 - 3/16	.10	.08	.06
2520	G	1/8-12	2-56 top	.156	Brass	Cadmium Plate	1/32 - 1/8	.10	.08	.06



Robinson NUGENT INCORPORATED

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IC SOCKETS — SYSTEMS — ACCESSORIES for TO-5, Flat Pak and DIP — TEST, BREADBOARDING and PACKAGING.

TRANSISTOR SOCKETS Molded and fabricated — For test and packaging — TO-5, TO-18, TO-3 and TO-66.

PIN SOCKETS For leads .010″-.100″ Dia. Over 200 standard styles. Ideal for making module or custom sockets, for relays, or any component. MINIATURE TERMINALS — mate with pin sockets. Over 100 standard styles. SPRING-LOADED CONTACTS for data cards, PCB and component test, lab and prototype.

COAX CONNECTORS AND SPLICES 1-4 conductors; high reliability.

PIPE COUPLINGS STAINLESS STEEL ⅛ thru 2″ NPT.

SCREW MACHINE PRODUCTS — 0″-3″ capacity. Sample lots to high volume. PLASTIC MOLDING — THERMOSETS AND THERMOPLASTICS — Insert molding and encapsulating to very close tolerances.

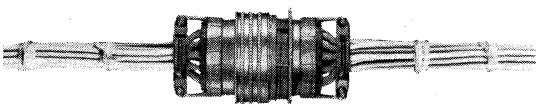
Also Specials, Customs, Modifications, and Prototype Development.

Pyle-Star-Line® Connectors

Pyle miniature connectors for electronic power and control

Miniature connectors exceeding MIL-C-26500B specifications. Pyle-Star-Line **Mercury Series** connectors are available in stainless steel and aluminum hardware. Stainless steel inhibits corrosion possibilities, extends wear-life, needs no conductive finishes for grounding. Insulator components resist most corrosive fluids and oils, offer complete sealing against moisture, and operate in temperatures up to 392° F.

Available with bayonet or threaded coupling in four shell styles: flange mounted receptacles; D-hole mounted receptacles; straight plug, and hermetic solder-mount receptacles. Stainless steel accessories offered for RFI and radiation resistance.

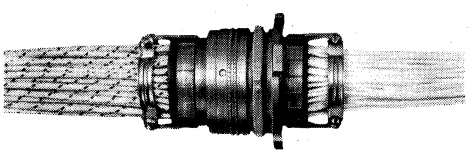


	Stainless Steel	Aluminum
SHELL SIZES:	**14, 16, 18, 22**	**10, 12, 14, 16, 18, 22**
CONTACTS (AWG):	**20, 16, 12**	**20, 16, 12**
NO. OF INSERT CONFIGURATIONS:	**14**	**14**

Miniature Environmental Firewall Connectors. Pyle-Star-Line **Phoenix Series** firewall connectors meet the environmental requirements of Military Specification MIL-C-26500B while exceeding Class K requirements of Military Specification MIL-C-5015D.

Reliable, ruggedly constructed, impervious to moisture and aircraft fluids, and capable of continuing operation at adverse temperatures. Standard installation tools or procedures.

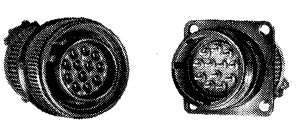
The Phoenix connector has investment-cast stainless steel shells. Threaded or bayonet couplings are available for either square flange or single hole mounting receptacles. Collet retained rhodium plated contacts. Thermocouple contacts are available in sizes 16 and 20.



SHELL SIZES: 14, 16, 18, 22
CONTACTS (AWG): 20, 16, 12
NO. OF INSERT CONFIGURATIONS: 7

Miniature connectors to NAS 1599 specifications. Pyle-Star-Line **Venus Series** connectors feature unique environmental sealing of individual contacts, combined with interfacial cork-in-bottle seal and multi-riser seal. Rear release of simple collet retained contacts with plastic tool.

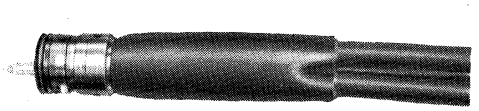
Bayonet coupling types (EB) mate with MIL-26482 connectors and threaded coupling types (ET) mate with MIL-C-26500B connectors.



	EB Series	ET Series
SHELL SIZES:	**10 through 24**	**10 through 22**
CONTACTS (AWG):	**20, 16, 12**	**20, 16, 12**
NO. OF INSERT CONFIGURATIONS:	**13**	**13**

CABLE HARNESSES

Cable Harnesses utilize Pyle-National "know-how" with connector terminating, potting and molding to cables. Eminently qualified by special equipment and experience to work with connectors and cable assemblies of varying sizes, insulations, jackets and connector configurations. Single source responsibility for dependable performance.

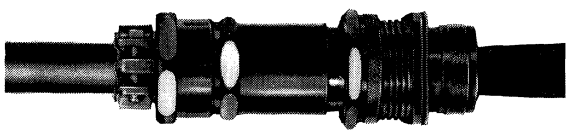


Pyle-National

Connector Division The Pyle-National Company
Chicago, Illinois 60651 (A.C. 312) DI 2-6300

To Meet Critical Application Requirements

Pyle Heavy-duty connectors for electric power and control



General duty connectors. Pyle-Star-Line **Neptune Series** connectors resist moisture, shock, vibration, chemicals, corrosion, pressure, temperature extremes. Rugged hard-coated aluminum shells. Insert configurations ranging from 3 to 143 contacts are available for any application with either captive solder contacts, or push-in crimp (or solder) removable contacts. The collet retained crimp contacts are designed for low insertion and high retention force, and may be easily removed from the rear of the insert with an expendable plastic tool, supplied with each connector.

Circuit breaking plugs and receptacles are UL listed. A wide choice of accessory hardware, including RFI shielding capability, is available for your requirements.

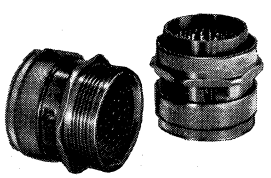
SHELL SIZES: 12, 16, 20, 24, 28
CONTACTS (AWG): 18 to 350 MCM
NO. OF INSERT CONFIGURATIONS: 150



Quick connect and disconnect connectors. Pyle-Star-Line **Class Q Series** operates with an axial "push" visibly and audibly engaging, locking and environmentally sealing the connector. An axial "pull" instantly disengages the plug and receptacle.

The simplified design of the connectors permit quick make-and-break without complicated mechanisms. For high reliability and durability in performance, rugged hardware and environmentally sealed inserts have been proven under arctic and tropic conditions. Crimp or solder contacts may be specified.

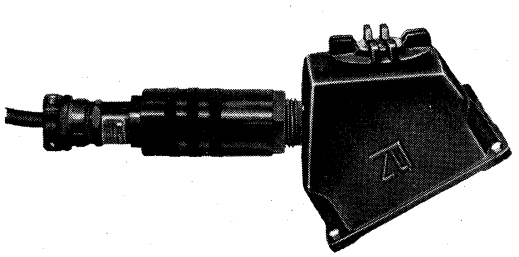
SHELL SIZES: 12, 16, 20
CONTACTS (AWG): 18 to 350 MCM
NO. OF INSERT CONFIGURATIONS: 75



Indexable test connectors. Pyle-Star-Line test connectors prevent physical and electrical damage and facilitate monitoring voltages or signals in circuits. Pyle-Star-Line Test Probe connectors couple to connector under test to enable a test probe to be used at exposed end of insert.

Easy multiple indexing accomplished without tools. Contacts are push-in, removable crimp type. Protective caps available for plugs and receptacles.

SHELL SIZES: 12, 16, 20, 24, 28
CONTACTS (AWG): 18 through 1/0
NO. OF INSERT CONFIGURATIONS: 36



Explosion-proof electrical connectors. Pyle-Star-Line explosion-proof connectors are suitable for use in all Class I, II and III hazardous areas. This includes Groups A, B, C, D, E, F, and G. They have been certified by Underwriters' Laboratories, Bureau of Mines, Canadian Standards Association, and Factory Mutual.

Available for 30, 60, 100 and 200 ampere circuitry.

SHELL SIZES: 16, 20, 24, 28
CONTACTS (AWG): 4, 1/0, 4/0, 350 MCM
NO. OF INSERT CONFIGURATIONS: 11

REYNOLDS INDUSTRIES, INC.

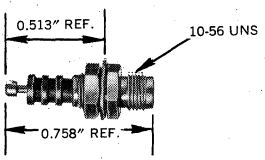
High Voltage Coaxial Connectors

P.O. Box P-850, Marina Del Rey, Calif. 90291 · (213) 823-5491/870-5671 TELEX: 65-2424

SERIES 600 S HIGH ALTITUDE, HIGH VOLTAGE COAXIAL CONNECTORS AND CABLE ASSEMBLIES

VOLTAGE RATING: 10,000 VDC PANEL CONNECTORS, CABLE CONNECTORS AND CABLE ASSEMBLIES (ADAPTERS 5000 VDC.)

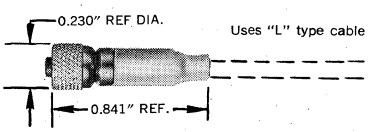
PANEL CONNECTOR: P/N 167-3771



Rated at 10KVDC at any altitude for limited pulse applications, such as EBW firing circuits, providing the rear portion of the connector is suitably encapsulated and it is mated to P/N 167-3770. Threaded sleeve couplings. Gold plated.

Production Test: 100% tested @ 15KVDC for 10 sec. 2% lot tested at altitude to 21KVDC, 3 minutes min.

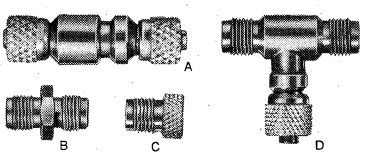
CABLE CONNECTOR: P/N 167-3770



Rated at 10KVDC at any altitude for limited pulse applications, provided it is mated to a suitably encapsulated P/N 167-3771. Threaded sleeve coupling. Soldered center contact and braid assembly. Uses "L" type cable, Reynolds P/N 167-2896. Gold Plated.

Production Test: All insulators are tested to withstand 15KVDC for 10 sec. 2% of each lot are cabled and tested at altitude to 21KVDC, 3 minutes min.

COAXIAL ADAPTERS: RATED 5000 VDC



Rated at 5KVDC for limited service under steady state DC condition. Coupling: Threaded Sleeve. *A:* Double End, Female. P/N 167-3887. *B:* Double End, Male. P/N 167-3318. *C:* Shorting Plug, Male. P/N 167-3833. *D:* "T" Adapter. P/N 167-3888.

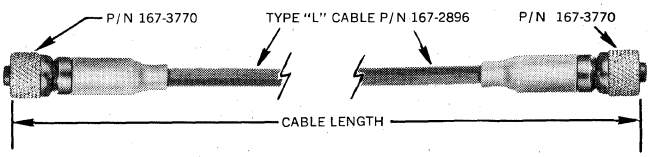
Production Test. 100% tested at 7.5KVDC, 10 sec. Max. permissible leakage: 10 microamperes (mated).

COAXIAL CABLE ASSEMBLIES: P/N 167-3306

Rated to 10KVDC for limited pulse applications at any altitude. Uses P/N 167-3770 connectors, Reynolds "L" cable. Soldered per MIL-S-6872.

Production Test: 100% test @ 21KVDC for 15 sec. Max. Leakage: 10 microamperes. Inspected for pin-to-pin or point-to-point continuity of center conductor and shield after assembly.

To Order: Add length desired to basic part number using a dash and "__F" for feet, "__N" for inches. Example: 167-3306-10F-8N is 10 feet 8 inches long.

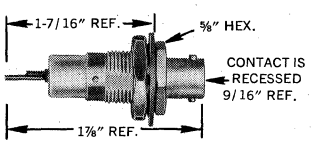


SERIES 500 HIGH VOLTAGE COAXIAL CABLE CONNECTORS AND CABLE ASSEMBLIES

VOLTAGE RATING: 10,000 VDC*

*The voltage ratings shown are for limited service under steady-state DC conditions at sea level. Under these conditions, the connectors operate in the corona region, and therefore have a limited service capability.

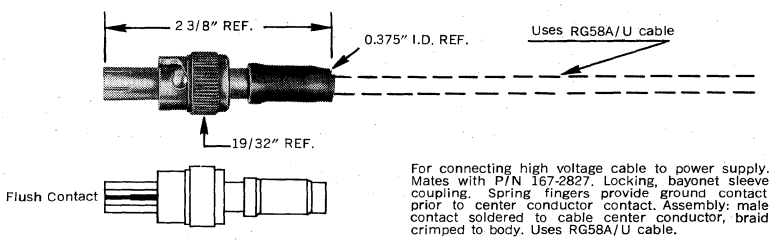
RECESSED CONTACT PANEL CONNECTOR P/N 167-2827



Recessed contact for use on the "hot" side of a HV circuit to minimize personnel hazard. Leakage (unmated): less than 1 microamp. at rated voltage. Spring fingers on mating connector 167-2826 provide ground before center conductor makes contact. Coupling: bayonet sleeve.

Production Test: 100% tested @ 13KVDC, 15 sec.

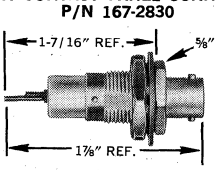
FLUSH CONTACT CABLE CONNECTOR P/N 167-2826. (MATES P/N 167-2827)



For connecting high voltage cable to power supply. Mates with P/N 167-2827. Locking, bayonet sleeve coupling. Spring fingers provide ground contact prior to center conductor contact. Assembly: male contact soldered to cable center conductor, braid crimped to body. Uses RG58A/U cable.

Production Test: 100% tested at 13KVDC for 15 sec.

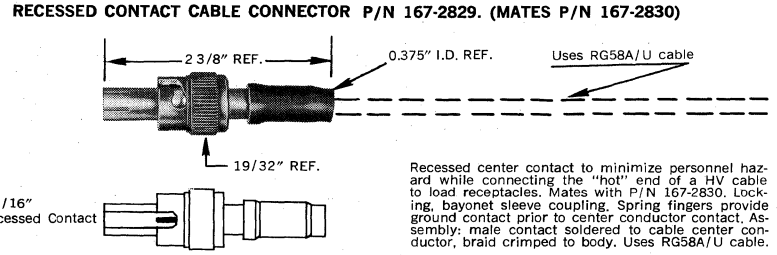
FLUSH CONTACT PANEL CONNECTOR P/N 167-2830



For use on the load or "cold" side of a high voltage circuit. Mates with P/N 167-2829. Coupling: bayonet sleeve. Spring fingers on mating connector provide ground contact before center conductor contact.

Production Test: 100% tested at 13KVDC for 15 sec.

RECESSED CONTACT CABLE CONNECTOR P/N 167-2829. (MATES P/N 167-2830)



Recessed center contact to minimize personnel hazard while connecting the "hot" end of a HV cable to load receptacles. Mates with P/N 167-2830. Locking, bayonet sleeve coupling. Spring fingers provide ground contact prior to center conductor contact. Assembly: male contact soldered to cable center conductor, braid crimped to body. Uses RG58A/U cable.

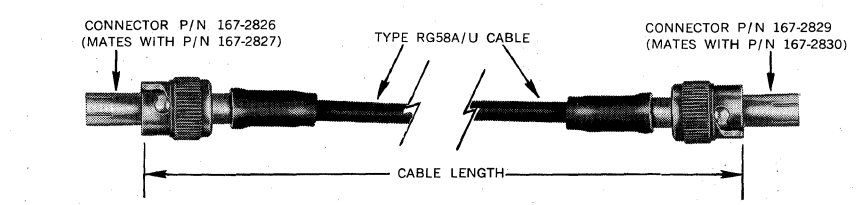
Production Test: 100% tested at 13 KVDC for 15 sec.

COAXIAL CABLE ASSEMBLIES: P/N 167-2969

Rated at 10KVDC with both ends mated. Comprised of P/N 167-2829 (recessed contact) for "hot" end of cable, and P/N 167-2826 (Flush contact) for connection to power source. Uses RG58A/U cable.

Production Test: 13 KVDC potential between center conductor and shell: 15 seconds minimum.

To Order: Add length desired to basic part number using a dash and "__F" for feet, "__N" for inches. Example: 167-2969-10F-8N is 10 feet 8 inches long.

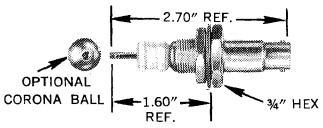


SERIES 531 SAFE HIGH VOLTAGE COAXIAL CABLE CONNECTORS AND ASSEMBLIES. Center Contact on Panel and Cable Connectors is Recessed 0.556"

VOLTAGE RATING: 10,000 VDC*

*The voltage ratings shown are for limited service under steady-state DC conditions at sea level. Under these conditions, the connectors operate in the corona region, and therefore have a limited service capability.

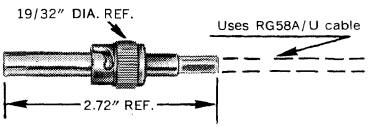
"SAFE" PANEL CONNECTOR: P/N 167-3555 RECESSED CONTACT



Provides rated voltage standoff, mated or unmated. Recessed contact for minimum personnel hazard. Less than 1 microamp. leakage at rated voltage (unmated, with corona ball). Mates with P/N 167-3554. Coupling bayonet sleeve. Mating connector provides ground contact before center conductor makes contact. To order corona ball, add "B" to part number.

Production Test: 100% tested at 15KVDC for 15 sec.

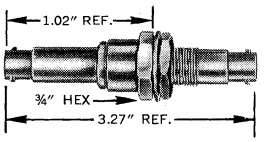
CABLE CONNECTOR: P/N 167-3554



Provides rated voltage standoff, mated or unmated. Recessed contact for minimum personnel hazard. Leakage (unmated) at rated voltage: less than 1 microamp. Mates P/N 167-3555 and 167-3646. Coupling: bayonet sleeve. Provides a ground contact prior to center conductor establishing contact. Assembly: soldered center contact, crimped sleeve braid. Uses RG58A/U cable.

Production Test: 100% tested at 15KVDC for 15 sec.

DOUBLE ENDED PANEL CONNECTOR/ADAPTER: P/N 167-3646



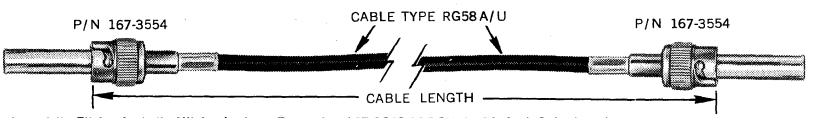
Panel mounted coupler for connecting to two cables. Recessed contact for min. personnel hazard. Leakage (mated or unmated) at rated voltage: less than 1 microamp. Mates P/N 167-3554, both ends. Mating connector provides ground before center conductor makes contact. Coupling: bayonet sleeve locking.

Production Test: 15KVDC for 1 minute.

COAXIAL CABLE ASSEMBLY: P/N 167-3648

Comprised of P/N 167-3554 connectors (recessed contacts) at both ends for minimum personnel hazard, Mates P/N 167-3555 and P/N 167-3646 Leakage at rated voltage less than 1 μa. Uses RG58A/U cable. Soldered per MIL-S-6872.

Production Test: 100% tested at 15KVDC for 1 min.



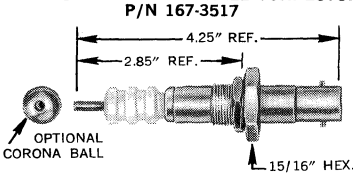
To Order: Add length desired to basic part number using a dash and "__F" for feet, "__N" for inches. Example: 167-3648-10F-8N is 10 feet 8 inches long.

SERIES 521 SAFE HIGH VOLTAGE COAXIAL CABLE CONNECTORS AND ASSEMBLIES. Center Contact on Panel and Cable Connectors is Recessed 0.896"

VOLTAGE RATING: 20,000 VDC*

*The voltage ratings shown are for limited service under steady-state DC conditions at sea level. Under these conditions, the connectors operate in the corona region, and therefore have a limited service capability.

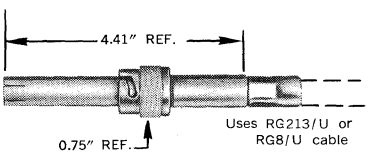
RECESSED CONTACT PANEL CONNECTOR P/N 167-3517



Provides rated voltage standoff, mated or unmated. Recessed contact for minimum personnel hazard. Less than 1 microamp. leakage at rated voltage (unmated, with corona ball). Mates P/N 167-3516. Coupling: bayonet sleeve. Mating connector grounds before center conductor makes contact. To order optional corona ball, add "B" to part number.

Production Test: 100% tested at 28KVDC, 15 seconds.

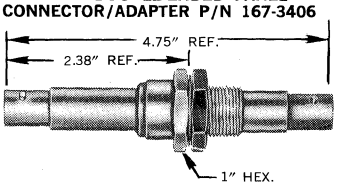
COAXIAL CABLE CONNECTOR: P/N 167-3516



Provides rated voltage standoff, mated or unmated. Recessed contact for minimum personnel hazard. Less than 1 microamp. leakage at rated voltage (unmated). Mates with P/N 167-3517 and P/N 167-3406. Grounds before center conductor makes contact. Coupling: bayonet sleeve. Uses RG213/U or RG8/U cable. Assembly: Soldered center contact, crimped braid.

Production Test: 100% tested at 28KVDC for 15 sec.

COAXIAL DOUBLE-ENDED PANEL CONNECTOR/ADAPTER P/N 167-3406



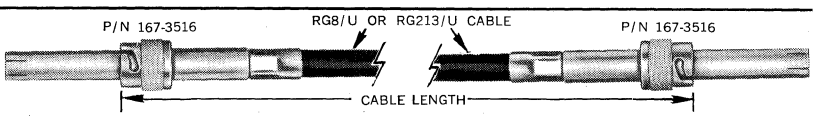
Panel mount coupler/adapter for connecting 2 cables. Recessed center contact for minimum personnel hazard. Leakage (mated or unmated) at rated voltage: less than 1 microamp. Mates P/N 167-3516 on both ends. Coupling: bayonet sleeve. Mating connector grounds before center conductor establishes contact.

Production Test: 100% tested at 28KVDC, 1 minute.

COAXIAL CABLE ASSEMBLY: P/N 167-3638

Comprised of P/N 167-3516 connectors (recessed contacts) at both ends for minimum personnel hazard. Mates P/N 167-3517 and P/N 167-3406. Leakage at rated voltage is less than 1 microampere. Uses RG8/U cable. Soldered per MIL-S-6872.

Production Test: 100% tested at 28KVDC for 15 sec.



To Order: Add length desired to basic part number using a dash and "__F" for feet, "__N" for inches.

Example: 167-3638-10F-8N is 10 feet 8 inches long. For RG213/U cable, add RG213 at end of part no.

SERIES 310 SAFE HIGH VOLTAGE, HIGH ALTITUDE, MOISTURE PROOF COAXIAL CONNECTORS AND ASSEMBLIES

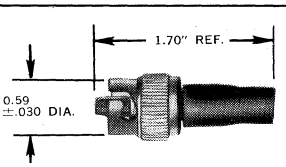
VOLTAGE RATING: 15,000 VDC*

*The voltage rating shown is for limited service under steady-state DC conditions. Under these conditions, the connectors operate in the corona region, and therefore have a limited service capability.

COAXIAL CABLE CONNECTOR: P/N 167-4356

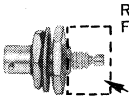
Rated at 15 KVDC at any pressure altitude for limited pulse applications, provided it is mated to a suitably encapsulated panel connector. Locking bayonet sleeve coupling. Assembly: female contact soldered to cable center conductor, braid crimped to body. Use type "C" cable (P/N 167-2669).

Production Test: 100% tested at 15 KVDC for 10 seconds max. 2% lot tested at pressures from sea level to a vacuum at 21 KVDC.



MATING CONNECTOR

Rear Mount P/N 167-3295 (shown)
Front Mount P/N 167-2370

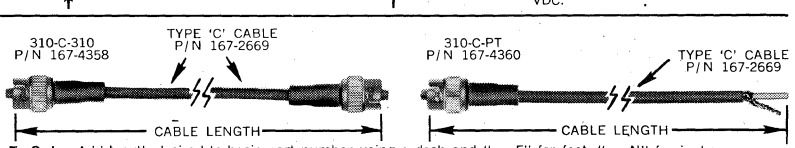


This area must be encapsulated or otherwise insulated when connector is subjected to reduced pressure, moisture or voltages above 5000 VDC.

COAXIAL CABLE ASSEMBLY: P/N 167-4358 and 167-4360

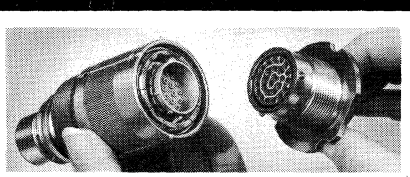
Type 310-C-310 (P/N 167-4358) cable assemblies are comprised of P/N 167-4356 connectors at both ends. Type 310-C-PT (P/N 167-4360) cable assemblies are comprised of a P/N 167-4356 connector at one end and pigtail leads at the other. Leakage at rated voltage is less than 1 microampere. Uses type "C" cable (P/N 167-2669). Soldered per MIL-S-6872.

Production Test: 100% tested at 21 KVDC for 15 seconds at a pressure altitude of 130,000 feet.



To Order: Add length desired to basic part number using a dash and "__F" for feet, "__N" for inches.
Example A: A type 310-C-310 cable 10-feet 8-inches long would be ordered as 167-4358-10F-8N.
Example B: A type 310-C-PT cable 10-feet 8-inches long would be ordered 167-4360-10F-8N.

SPECIAL CONNECTORS AND CABLE ASSEMBLIES



The connector assembly pictured at left is typical of many custom designed and produced connectors and cable assemblies produced by Reynolds Industries for critical and exacting programs for the military and space programs. If you require a special design for umbilical disconnects, interstage separation connectors or exploding bridge wire ordnance applications, we invite you to avail yourself of our twenty years of experience in this specialized field. Your inquiry is invited. □ The example shown is a stage separation connector produced by Reynolds Industries for a major aerospace contractor.

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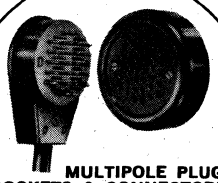
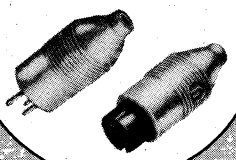
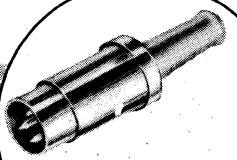


MULTIPOLE PLUGS SOCKETS & CONNECTORS UP TO 36 POLES

MULTIPOLE CONNECTORS UNSHIELDED

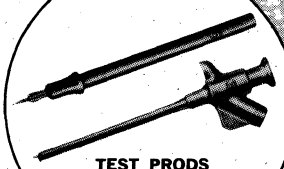




MULTIPOLE CONNECTORS DOUBLE-SHIELDED SHIELDED, UNSHIELDED



MINIATURE SOCKETS SHIELDED AND UNSHIELDED



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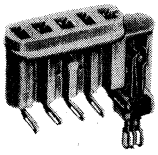
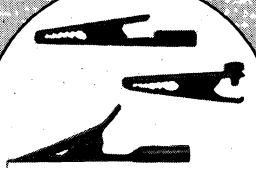


I.E.C. CONNECTORS



MULTI-WAY BINDING POSTS AND TERMINALS



ALLIGATOR CLIPS STAINLESS OR PLATED



ULTRA-MINIATURE AND MICRO-MESH ALLIGATOR CLIPS

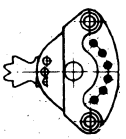




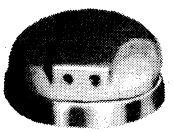
ALLIGATOR CLIPS INSULATED, QUICK-ACTING



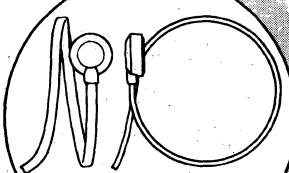
UNDER THE CHIN HEADSETS



MINIATURE SWITCHES
Ball bearing detent.

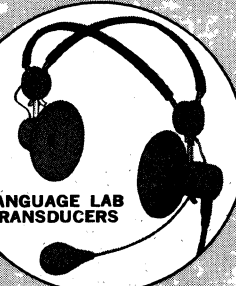


HIGH PERFORMANCE MINIATURE EARPHONES



THROAT AND HEARTBEAT MICROPHONES

rye INDUSTRIES



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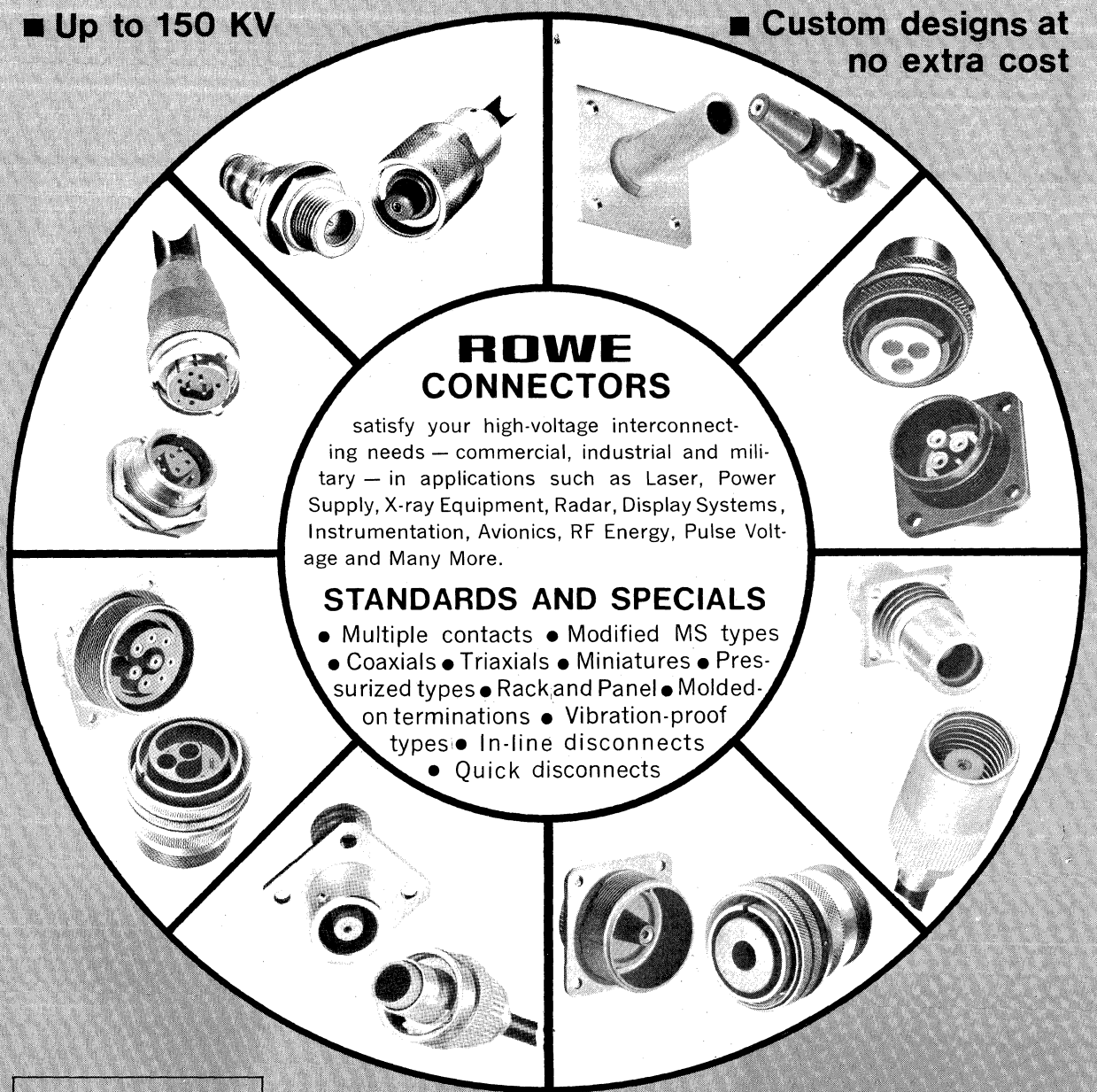
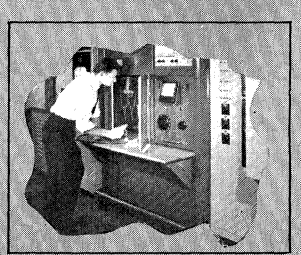


ROWE CONNECTORS

satisfy your high-voltage interconnecting needs — commercial, industrial and military — in applications such as Laser, Power Supply, X-ray Equipment, Radar, Display Systems, Instrumentation, Avionics, RF Energy, Pulse Voltage and Many More.

STANDARDS AND SPECIALS

• Multiple contacts • Modified MS types • Coaxials • Triaxials • Miniatures • Pressurized types • Rack and Panel • Molded-on terminations • Vibration-proof types • In-line disconnects • Quick disconnects



SPECIALIZED TEST FACILITIES

To insure that connectors and cable assemblies meet rigid specifications — dielectric strength, corona inception and extinction, altitude, leakage, temperature, humidity, shock, vibration.

FOREMOST IN HIGH VOLTAGE CONNECTORS

ROWE INDUSTRIES INCORPORATED

1702 AIRPORT HIGHWAY, TOLEDO, OHIO 43609
PHONE 419 — 729-3951, TWX 810 — 442-1734,
TELEX 286014 or contact rep in your area.
(Listed under "Sales Offices")

CONNECTOR-CABLE ASSEMBLIES

MOLDED PLUGS AND JACKS

Lab-Tronics molded assemblies are available in many variations both standard and special. Molded connectors are waterproof and provide strain relief. Standard cable jackets are smooth silver-gray non-contaminating high temp. P.V.C. Lab-Tronics can supply any type of cable assembly, lead assembly or wiring harness with molded, crimped or soldered terminations. Check with us first; we may have standard tooling for your special items.

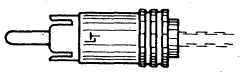
MIX and MATCH, CUSTOMS or STANDARDS

L-T Connectors will accept almost any cable. Designs other than those listed are available. Contact us for information to meet your application. Here are a few of the many markets which are now served by LAB-TRONICS Division of Rowe Industries: **• Communications Systems & Equipment • TV-Radio-Phonographs-Stereo • Data Processing Equipment • Business Machines • Computers • Transportation • Vending Machines • Musical Instruments • Appliances.**

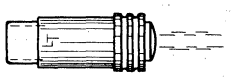
ORDERING INFORMATION

1. Specify Plug or Jack by part number for first end of assembly.
2. Specify wire or cable type.
3. Specify plug, jack, lug, terminal, or type of preparation (strip, split, and tin, etc.) for second end of assembly.
4. Specify overall assembly length.

MOLDED PHONO PLUGS AND JACKS



P-100 Available as right angle PR-100



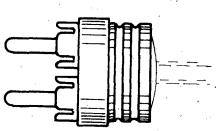
J-200 Available as right angle JR-200



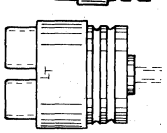
P-101 EXTRA-LONG FOR DEEP WELL APPLICATIONS

Available as jack J-201

MOLDED DUAL PHONO PLUGS AND JACKS FOR STEREO APPLICATIONS



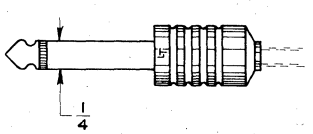
P-102 Available as right angle PR-102



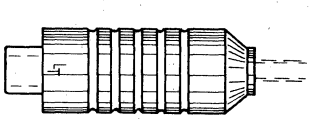
J-202 Available as right angle JR-202

MOLDED PHONE PLUGS AND JACKS

STANDARD SIZE

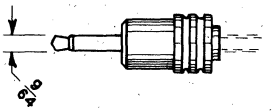


P-103 Available as right angle PR-103



J-203

MINIATURE MOLDED PHONE PLUGS AND JACKS

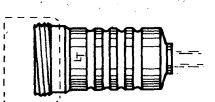


P-104 Available as right angle PR-104

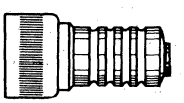


J-204

MOLDED MICROPHONE CONNECTORS



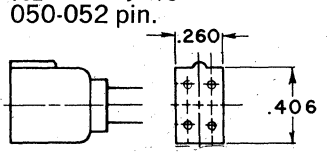
P-105



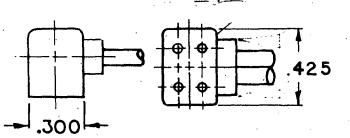
J-205

MOLDED TAPE HEAD CONNECTORS

7/32-inch by 1/8-inch contact spacing; contacts to fit 050-052 pin.



J-206



JR-206 (Right angle)

SPECIALS

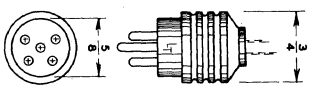
Modifications of standard items are available upon request.

LAB-TRONICS
DIVISION OF ROWE INDUSTRIES INCORPORATED
6225 Benore Road Toledo, Ohio 43612
Phone: 419/729-3951
TELEX 286014 TWX 810-442-1734

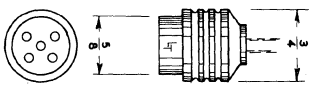
CONNECTOR-CABLE ASSEMBLIES

MOLDED PLUGS AND JACKS

MOLDED MULTI-PIN CONNECTORS MATE WITH A VARIETY OF UNIVERSAL PLUGS AND JACKS

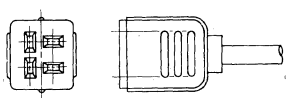


P-107



J-207

MOLDED LAB-TRONICS EQUIVALENTS ...TO INDUSTRY-STANDARD 4-CONTACT CONNECTORS

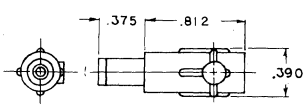


J-208

Male plug also available as P-108

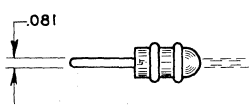
BATTERY CHARGER CONNECTORS

Commonly used with battery operated radio, TV, tape players, and similar equipment.



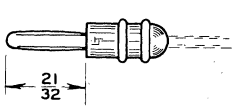
P-106 (6-volt)
P-109 (9-volt)
P-112 (12-volt)

TIP AND BANANA PLUGS



P-114

Also available with .125" diameter contact

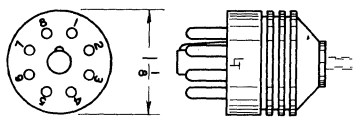


P-115

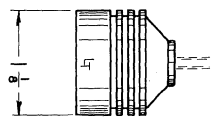
LAB-TRONICS PLUGS AND JACKS...
are molded in colors from PVC or TENITE® or material of your choice.

WIRE AND CABLE...
in a wide variety of gauge-sizes, constructions and colors are in stock at all times.

MOLDED TUBE-BASE PLUGS AND JACKS: 8-PIN OCTALS

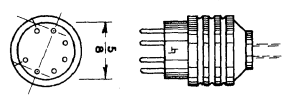


P-110

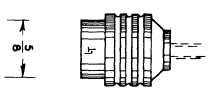


J-210

7-PIN MINIATURES

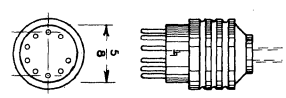


P-111 Available as right angle PR-111



J-211 Available as right angle JR-211

9-PIN MINIATURES



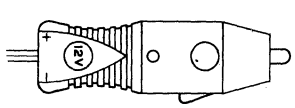
P-113 Available as right angle PR-113



J-213 Available as right angle JR-213

CIGARETTE LIGHTER ADAPTER PLUGS

UNIVERSAL SIZE

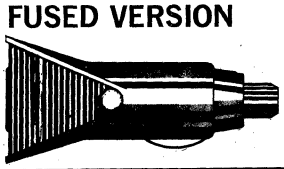


P-116

FUSED VERSION

SPECIFY FUSE SIZE

P-117

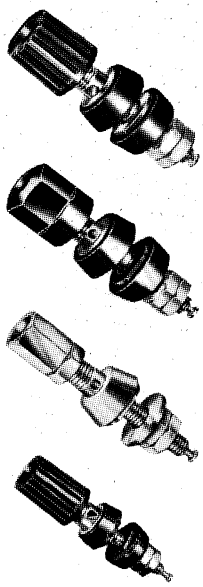


SPECIALS
Modifications of standard items are available upon request.

LAB-TRONICS
DIVISION OF ROWE INDUSTRIES INCORPORATED
6225 Benore Road Toledo, Ohio 43612
Phone: 419/729-3951
TELEX 286014 TWX 810-442-1734

5-way® BINDING POSTS

5 WAYS TO CONNECT • GOLD-PLATED BRASS PARTS • RANGE OF COLORS

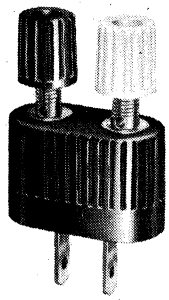


FLUTED NUT TYPES
Plastic parts of standard (not miniature) size types molded of Lexan polycarbonate resin; brass parts are gold-plated. Rated for 30 amperes, 1000 volts working. Nickel-plated brass types available on special order.

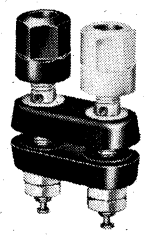
HEX NUT TYPES
Rated for 30 amperes, 1000 volts working. Brass parts are gold-plated; plastic parts are of nylon compounded to meet military specifications MIL-M-20693A, Type IV. Nickel-plated brass types available on order.

GROUNDING TYPE
For making rapid connections to ground. Made of finely machined brass nickel-plated and polished. Panel grounding collar frozen to shaft has "D" type shoulder for locking in keyed panel hole.

MINIATURE TYPES
Fluted nut design only. Rated for 15 amperes, 1000 volts working. Gold-plated brass parts; nylon plastic parts compounded to meet military specification MIL-P-20693A, Type IV. Types with nickel-plated brass available also.



DUAL ADAPTER TYPE
Designed to facilitate line voltage connections from output receptacles to binding posts. Has integral parallel-blade plug. Rating is 15 amperes, 125 volts. Body is black; captive black and white thumbnuts are mounted on ¾" centers. Brass parts are gold-plated. Ideal for safe, rigid connections to equipment lacking a parallel-blade plug and cord assembly.



DOUBLE ASSEMBLY TYPES
For instrument and equipment panels requiring binding posts mounted on ¾" centers. Rated for a current capacity of 30 amperes and a working voltage of 1000 volts. Brass parts are gold-plated; panel insulators in black only. Rugged, self-contained assembly makes mounting more accurate, faster and easier than two individual binding posts and gives maximum strength where connections are frequently made.

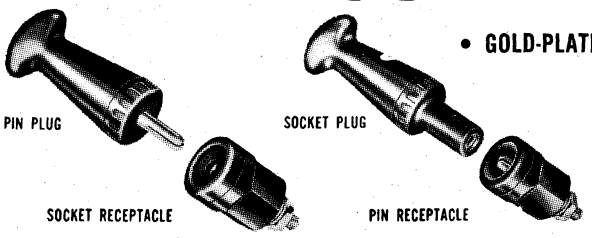
STYLE	TYPE
BINDING POSTS	
FLUTED NUT — STANDARD	DF31*
HEX NUT — STANDARD	DF30*
GROUNDING — ALL METAL	GP30NC
FLUTED NUT — MINIATURE	DF21*

STYLE	TYPE
DUAL ADAPTER TYPE	
BLACK & WHITE FLUTED NUTS	DAP15BWC
DOUBLE ASSEMBLY TYPES	
BLACK & WHITE HEX NUTS	DF30-2-BWTC
TWO BLACK HEX NUTS	DF30-2-BBC
BLACK & RED HEX NUTS	DF30-2-BRC

*Add desired color suffix to series designation number: BC (black), BLC (blue), RC (red), WTC (white), YC (yellow), GNC (green). For example: DF21BLC.

SUPERCON® ELECTRICAL CONNECTORS

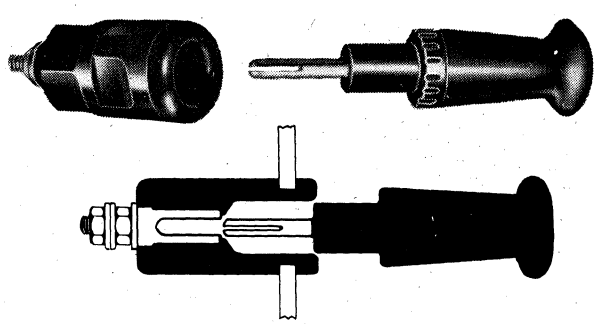
• GOLD-PLATED CURRENT CARRYING PARTS • SIMPLIFIED, QUICK ASSEMBLY



Nylon plastic parts, gold-plated brass current-carrying parts. Plugs accomodate either soldered or solderless connections to a wide range of cable sizes. Plug grips are of a simple, two-piece threaded construction for quick assembly. Receptacles have color-matched nylon caps and bodies. 25, 50 and 100 ampere types are rated 125-250 volts a-c ord-c current rupturing, 600 volts disconnect use only. 250 ampere types are rated 600 volts disconnect use only.

AMPERES	PIN PLUGS TYPE†	SOCKET RECEPTACLES TYPE†	SOCKET PLUGS TYPE†	PIN RECEPTACLES TYPE†
25	PP25G	RS25G	PS25G	RP25G
50	PP50G	RS50G	PS50G	RP50G
100	PP100G	RS100G	PS100G	RP100G
250	PP250G	RS250G	PS250G	RP250G

†Add desired color suffix to series designation number: B (black), BL (blue), R (red), WT (white), Y (yellow), GN (green). For example: PS25GWT.



EXTRA-SAFE "L" TYPE
"L" types have all current-carrying parts insulated to remove any possibility of physical contact when making connections. Rated same as 50 ampere conventional types. When ordering, add available color suffix to type number: B (black), R (red), WT (white).

SOCKET RECEPTACLES	PIN PLUGS
LSR50G	LPP50G

THE SUPERIOR ELECTRIC COMPANY
1000 MIDDLE STREET, BRISTOL, CONNECTICUT 06010

SEE OTHER SUPERIOR ELECTRIC PRODUCT PAGES IN SECTIONS 3500, 4000, AND 5600

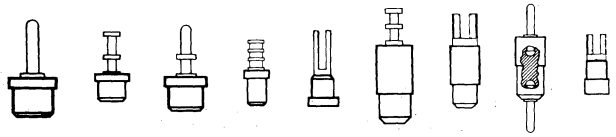
SEALECTRO CIRCUIT HARDWARE

PRESS-FIT® TEFLON* INSULATED TERMINALS

Simply punch or drill the correct hole in a chassis or panel and insert the "Press-Fit" terminal... it's in for good and with all of the outstanding insulating properties of Teflon. "Press-Fit" terminals are available in the most complete across-the-board selection of types in the industry—from micro-miniature units designed, developed and available only from Sealectro to heavy duty types especially designed for high current capacities.

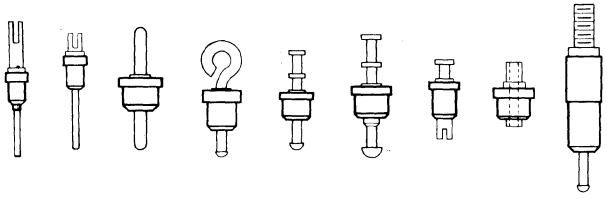
STAND-OFFS

Extremely wide selection of bushings, lugs, platings and finishes in micro-miniature, sub-miniature, and miniature sizes. One piece assembly—no additional hardware involved. From .073" to .215" diameter bushings with a variety of lug and body configurations. 10 E.I.A. colors available.



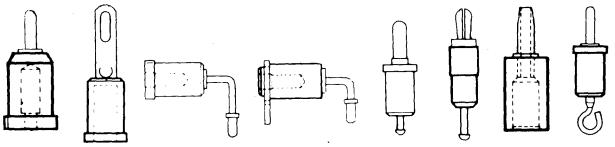
FEED-THRUS

Machined from virgin Teflon to extremely close tolerances for fast, easy and sure installation. Bushing diameters from .075" to .218" in over 350 micro-miniature, sub-miniature, miniature, and tubular units. Available in 10 standard E.I.A. colors and dozens of terminal styles.



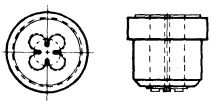
JACKS AND PROBES

Ideal for test points, instrument probes, jumper plugs and multiple connectors while many units are designed for printed circuit applications. Body and mating jack and probe configurations are available to fill virtually every requirement. Offered in 10 standard E.I.A. colors for ease of circuit coding.



CLOVERLEAF RECEPTACLES

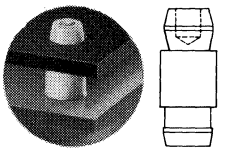
Designed to allow dip-soldering of metal chassis. Unique design for three, four or more thru-leads provides multi-wire connections with each wire in a perfect capillary flow configuration for positive, uniform solder connections. "Press-Fit" chassis installation.



U.S. Pat. No. 3,193,617

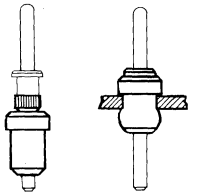
SPACER/BUSHINGS

Completely eliminate the need for metal stand-offs, spacers, and insulators. Install in seconds. Specifically designed for mounting printed circuit boards on metal chassis or panels. "Press-Fit" chassis installation with "snap-on" P. C. board mounting.



NEW *Riv-Loc* TERMINALS (Pat. Pending)

Riv-Loc terminals are a new type terminal designed for insertion in either chamfered or unchamfered holes. They overcome the inherent shortcomings of older semi-assembled terminal types while providing uniform above chassis height. After bushing insertion in the chassis, the lug is inserted from the major diameter side expanding the bushing and securely locking the terminal in the chassis.

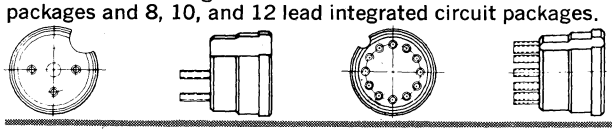


BEFORE INSTALLATION AFTER INSTALLATION

PRESS-FIT® TRANSISTOR & I. C. SOCKETS & HARDWARE

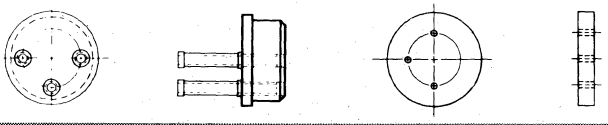
SOCKETS

Low cost, high precision sockets for transistors and integrated circuit packages offering "Press-Fit" installation combined with virgin Teflon bodies and precise contact design for maximum electrical and mechanical performance. Eight standard units designed for 3 and 4 lead TO-18 and TO-5 packages and 8, 10, and 12 lead integrated circuit packages.



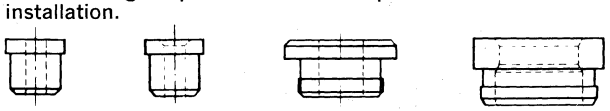
HOLDERS AND PADS

The widest line of Teflon transistor and I.C. holders and pads in the industry. Available in numerous JEDEC packages with from 3 to 12 leads. Color coded and precision machined from virgin Teflon.



"PRESS-FIT" BUSHINGS

A complete line of over 500 standard bushing configurations designed for lead feed-thrus, insulators, bearings, stand-offs, component mounting devices and hundreds of other applications. All machined from virgin Teflon, offered in E.I.A. colors, and featuring simple economical and permanent "Press-Fit" installation.



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SEALECTRO CORPORATION
MAMARONECK • NEW YORK 10543
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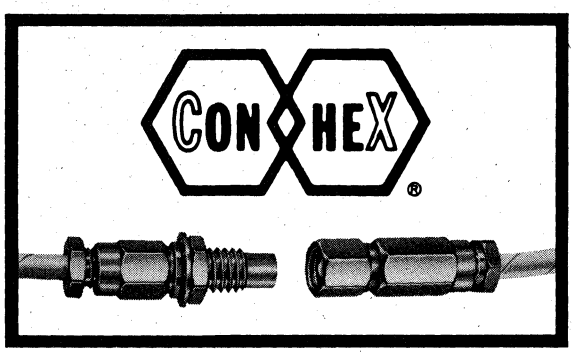
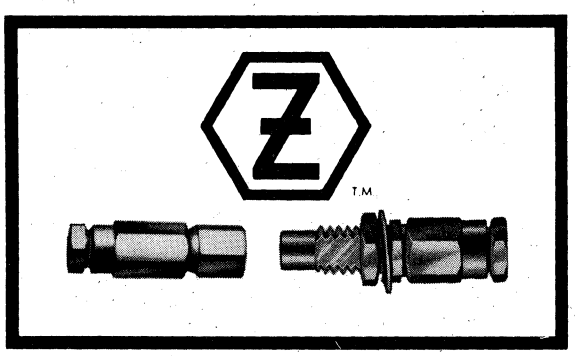
Sealectro Ltd., Portsmouth, Hants, England
Sealectro S.A. Villiers-le-Bel, Paris, France

CONHEX® R. F. CONNECTORS



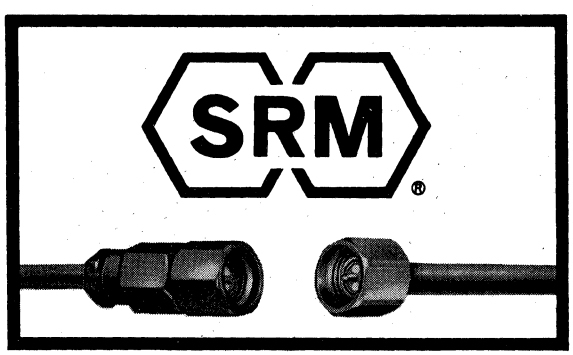
PERFORMANCE, PRICE, DELIVERY FOR RG-188/U AND SIMILAR CABLES UP TO 12.4 GHz

Conhex subminiature R. F. connectors are designed to meet or exceed the requirements of MIL-C-22557. Over 300 standard units — straight, right angle, bulkhead, strip-line, screw-on, snap-on and slide-on — are standard items.



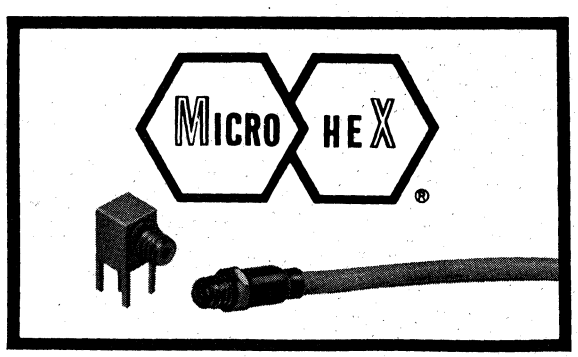
RELIABILITY AND HIGH PERFORMANCE IN AN ECONOMICAL CONNECTOR PACKAGE

Designed for complete compatibility with miniature coaxial cables, such as .141" diameter semirigid types, the Ƶ Series offers the optimum in performance, reliability and cost. More and major manufacturers are discovering that Sealectro Ƶ connectors not only meet their VSWR and power handling requirements but are many times more reliable than similar size connectors especially when subjected to adverse environmental conditions.



FOR STANDARD MATING ENGAGEMENTS AT REDUCED COSTS.

SRM connectors are designed to mate with standard OSM-type mating engagements at reduced cost. SRM connectors are designed for use with RG-141/U, RG-142/U, RG-188/U and similar subminiature coaxial cables, and provide maximum performance and minimum VSWR all the way to 18 GHz



MAXIMUM SPACE AND PAYLOAD SAVINGS WITH PERFORMANCE TO 5GHz

Specifically designed for microminiature RG-196/U and RG-178/U, Microhex connectors are the smallest commercially available. They combine extremely small size and light weight with exceptional performance and reliability. Over 50 standard types including straight, right angle, printed circuit, and bulkhead mounted units in screw-on, slide-on and snap-on are featured in the complete line.

® R. F. COMPONENTS DIVISION
SEALECTRO
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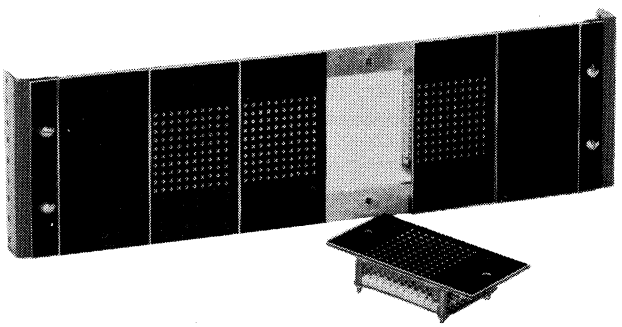
Write for the complete SEALECTRO R. F. CONNECTOR CATALOG

SEALECTRO

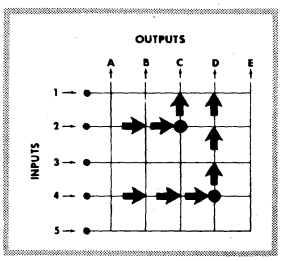
SEALECTROBOARD®

CORDLESS PROGRAMMING BOARDS



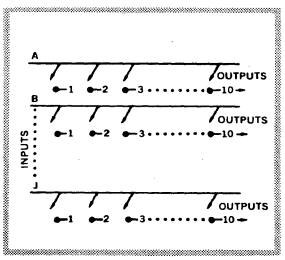
"Sealectroboard" programming and switching provides complete ease and simplicity of operation with drastic reductions in hardware and space. A single pin is used to complete the program circuit or insertion of a component . . . move the pin to a new location and you have a new program function. "Sealectroboards" are made in 2 to 5 deck versions and with a variety of pin styles such as shorting pins, diode holders and skip pins as well as with engraved or silk-screened panel marking and color coded program areas.

Modular "Sealectroboard" are designed to facilitate program board expansion in prototype and design applications and are offered off-the-shelf from Sealectro Distributors. Each modular board is a 10 x 10 matrix with two contact decks in bussed upper and lower or bussed upper, individual lower contact configurations. Companion mounting and panel pieces are designed for 19″ relay rack mounting and allow expansion from a single board up to 6 boards in just 5½″ of rack space. Write for our complete catalog and technical specifications.....



Bussed Upper and Lower Contacts

The Modular Sealectroboard is available with bussed upper and lower contacts and provides an ideal means for input/output switching. The standard 10 x 10 hole Modular Sealectroboard may be considered 10 Single Pole, Single Throw, Normally Open switches with 10 inputs each.



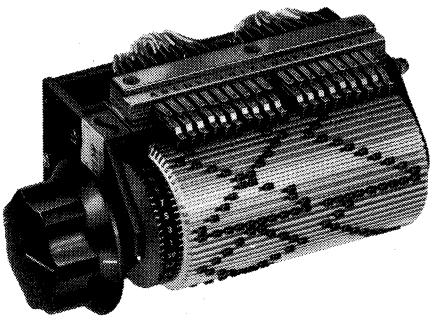
Bussed Upper and Individual Lower Contacts

The Modular Sealectroboard is also available with bussed upper and individual lower contacts which provide individual electrical access to each program hole and a path between many terminals and a lesser number of bussed terminals. The standard 10 x 10 hole Modular Sealectroboard with this contact configuration may be considered a 10 Pole, Single Throw, Normally Open switch with 10 positions per pole.

U.S. Pat. No. 3,027,534

PROGRAM SWITCHING SEALECTROSWITCH®

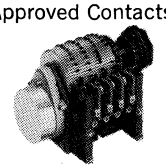
PROGRAMMING SWITCHES



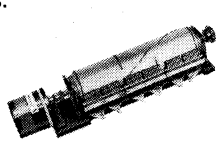
Programs may be changed in seconds without special tools and with 100% reproducibility. The Sealectroswitch programming switch provides a degree of versatility that can't be met by comparable devices . . . and in half the space and half the cost. Extremely high "built in accuracies" are provided through precision machined drums while flexibility is obtained through unique, field-adjustable, sliding contact actuators. Check these features • Field Adjustable Cams With Multiple ON/OFF Functions or Point-to-Point Switches • Manual or Remote Operation With Timing Motor or Solenoid Drive • Transfer Speeds to 50 Milliseconds Without Appreciable Contact Bounce • Removable Drums • Form A, B, and C Contacts in a Single Unit • Up to 57 Circuit Controls in a Single Unit. • Contacts Rated for Dry Circuit to 2 Amps, 24 VDC or 115 VAC. • Optional 10 Amp or 20 Amp, 115 VAC U. L. Approved Contacts.



Recycling timer with point-to-point or cam action, single snap-action contact.



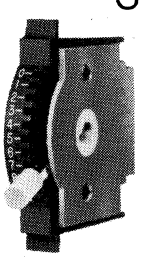
Enclosed, snap-action contacts and timing motor drive.



90 program positions, 57 contacts and timing motor drive.

U.S. Pat. No. 3,330,917 Also protected by foreign patents

SEALECTRO SLIDE 'N SWITCH™



The Sealectro Slide 'n Switch circuit selector is designed to provide a highly reliable random access switching device for the programming of all types of automated equipment. Standard units are 11 position, single pole with a built-in "skip" function. If it is desired to switch from position 1 to position 5, the Slide 'n Switch handle is pulled out and the switch handle moved from 1 to 5. No electrical contact is made with any of the intermediate switch contacts.

Multiple units may be stacked side-by-side to provide any number of decade switches while the unique printed circuit board construction of the switch permits any special electrical coding to be supplied at minimum cost. Slide 'n Switch output terminations mate with standard edge-mount pc card connectors.

Write today for our complete catalog . . .

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SEALECTRO CORPORATION
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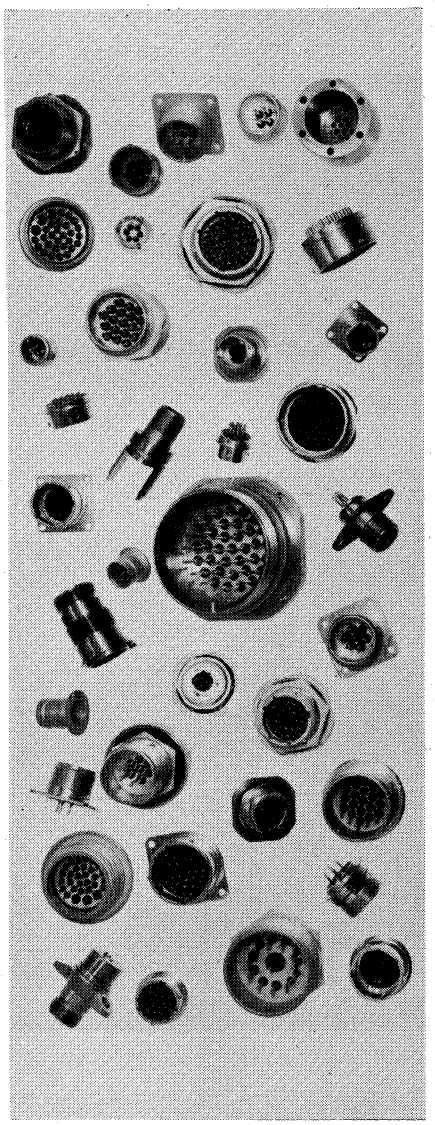
SEALTRON HERMETICALLY



STANDARDS

The table shows Sealtron's standard line of hermetically sealed receptacles. Materials and finishes are in accordance with the respective Military Specifications.

These receptacles can be furnished to customer requirements with modified finishes, basic material changes (i.e. stainless steel shells), thermocouple configurations such as Chromel - Alumel, Iron - Constantan, Platinum - Platinum Rhodium and others.

SEALTRON SERIES	SPECIFICATION	TYPE AND MATING PLUG	CONTACT SIZES	SHELL SIZES	CONTACT ARRANGEMENTS
8000	**MIL-C-5015** (SEE NOTE 1)	"AN" TYPE THREAD COUPLING **MATING PLUG MS3106**	16, 12, 8, 4, 0	8S, 10SL 12S, 14S, 16S, 16 18, 20, 22 24, 28	MS33680 THRU MS33688 (SEE NOTE 2)
8100	**MIL-C-26482** CLASS H	QUICK DISCONNECT BAYONET COUPLING **MATING PLUG MS3116**	20, 16	8, 10, 12, 14, 16, 18, 20, 22, 24	MS33708 THRU MS33716
8200	**MIL-C-25955** CLASS H	MINIATURE MODIFIED ACME THREAD COUPLING **MATING PLUG MS24243S**	20, 16	16, 19, 21	MS24242
8400	**MIL-C-26482** CLASS H	QUICK DISCONNECT PUSH-PULL COUPLING **MATING PLUG MS3137, MS3138**	20	3, 7, 12, 19, 27, 37	MS33698 THRU MS33703 (SEE NOTE)
8500	**MIL-C-26500** CLASS H TYPE T	MINIATURE THREAD COUPLING **MATING PLUG MS24266,** TYPE T	20, 16. 12	10, 12, 14, 16, 18, 22	MS24260 THRU MS24263
8600	**MIL-C-26500** CLASS H TYPE B	MINIATURE BAYONET COUPLING **MATING PLUG MS24266,** TYPE B	20, 16, 12	10 12, 14, 16, 18, 22	MS24260 THRU MS24263
9700	**MIL-C-38999** CLASS H LJT SERIES	QUICK DISCONNECT BAYONET COUPLING LONG JUNIOR TRILOCK **MATING PLUG MS27467**	22, 20, 16	9, 11, 13, 15, 17, 19, 21, 23, 25	MS20049 THRU MS20057 (SEE NOTE)
9800	**MIL-C-38999** CLASS H JT SERIES	QUICK DISCONNECT BAYONET COUPLING JUNIOR TRILOCK **MATING PLUG MS27473**	22, 20, 16	8, 10, 12, 14, 16, 18, 20, 22, 24	MS27343 THRU MS27351 (SEE NOTE)

SEALED CONNECTORS

MOUNTING (FOR SPECIAL MOUNTING CONFIGURATION CONSULT FACTORY.)			NOTES
SOLDER MOUNTING	BOX MOUNTING	JAM NUT MOUNTING	
8001 SERIES (FLANGELESS)	**8003 SERIES**	**8004 SERIES** (FRONT MOUNTING)	1.—RECEPTACLES MEET APPLICABLE PARAGRAPHS OF MIL-C-5015 2.—CONSULT FACTORY FOR AVAILABILITY
8002 SERIES (ROUND FLANGE)		**8005 SERIES** (REAR MOUNTING)	
8112 SERIES IN ACCORDANCE WITH **MS3113**	**8113 SERIES** IN ACCORDANCE WITH **MS3112**	**8115 SERIES** IN ACCORDANCE WITH **MS3114**	
8212 SERIES IN ACCORDANCE WITH **MS24239**		**8214 SERIES** FRONT MTG. IN ACCORDANCE WITH **MS24241**	
		8215 SERIES REAR MTG. IN ACCORDANCE WITH **MS24240**	
8402 SERIES IN ACCORDANCE WITH **MS3134**	**8403 SERIES** IN ACCORDANCE WITH **MS3132**		NOT ALL ARRANGEMENTS TOOLED TO DATE. CONSULT FACTORY FOR AVAILABILITY
8502 SERIES IN ACCORDANCE WITH **MS27034** TYPE T	**8503 SERIES**	**8505 SERIES** IN ACCORDANCE WITH **MS24265** TYPE T	
8602 SERIES IN ACCORDANCE WITH **MS27034** TYPE B	**8603 SERIES**	**8605 SERIES** IN ACCORDANCE WITH **MS24265** TYPE B	
9702 SERIES IN ACCORDANCE WITH **MS27471**	**9703 SERIES** IN ACCORDANCE WITH **MS27469**	**9705 SERIES** IN ACCORDANCE WITH **MS27470**	NOT ALL ARRANGEMENTS TOOLED TO DATE. CONSULT FACTORY FOR AVAILABILITY
9802 SERIES IN ACCORDANCE WITH **MS27478**	**9803 SERIES** IN ACCORDANCE WITH **MS27475**	**9805 SERIES** IN ACCORDANCE WITH **MS27477**	NOT ALL ARRANGEMENTS TOOLED TO DATE. CONSULT FACTORY FOR AVAILABILITY
	9813 SERIES IN ACCORDANCE WITH **MS27476**		

SPECIALS (CUSTOM DESIGN)

Sealtron will design special connectors or modify standard connectors for manufacturers who, by reason of assembly, design, or economy, require these services and modifications. Unit designs and multi-piece copper-brazed construction can eliminate many production problems by minimizing joints where leakage could occur, reducing rejection rate by minimizing secondary operations, and rendering an economical end product.

SEALTRON REPRESENTATIVES

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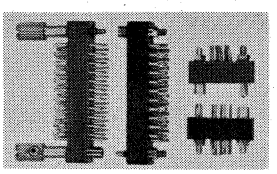
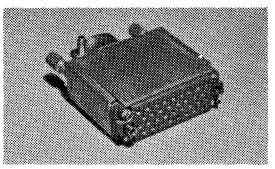
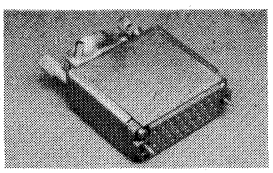
RACK AND PANEL

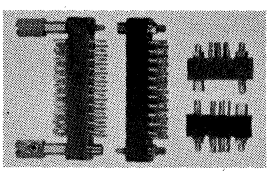
MICROMINIATURE (SOLDER)



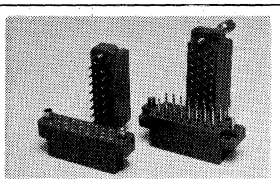


SUBMINIATURE (SOLDER)



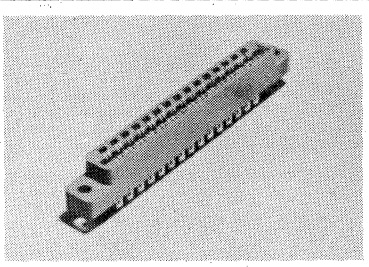


SUBMINIATURE (CRIMP)

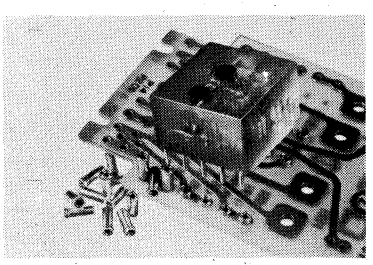


PRINTED CIRCUITS

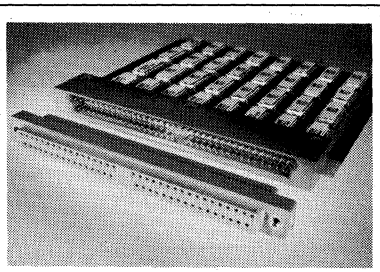
EDGEBOARD



CAGE SPRING CONTACTS



TWO PIECE



RELAY RECEPTACLES

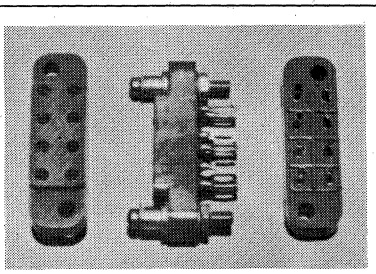
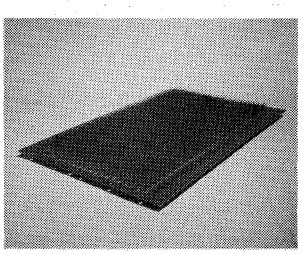
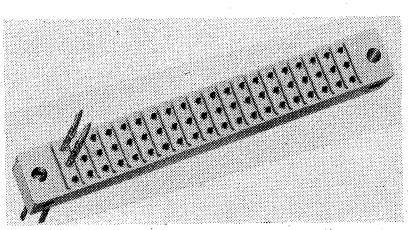


PLATE ARRAY (WIREWRAP)



TAPER PIN RECEPTACLE BLOCKS



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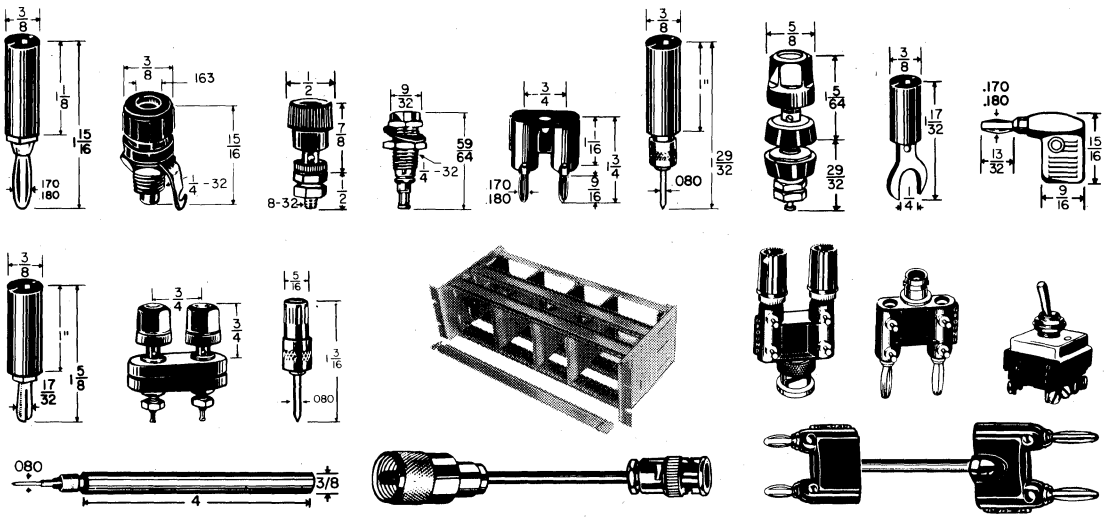
For Whatever You Need in

Electronic Components



MORE THAN TEN THOUSAND ITEMS MANUFACTURED UNDER ONE ROOF

- BINDING POSTS
- BANANA PLUGS & JACKS Insulated & Non-Insulated
- PHONE TIP PLUGS & JACKS Insulated & Non-Insulated
- Telephone Type Plugs & Jacks
- ALLIGATOR CLIPS
- TEST PRODS & TEST LEADS
- JUMPERS & PATCH CORDS
- SWITCHES Arrow, H-H, Kulka Cutler-Hammer, Micro, Continental-Wirt
- TEFLON & TURRET TERMINALS
- SHAFT ACCESSORIES
- ELECTRONIC HARDWARE Terminal Strips, Boards, Grommets, Bumpers, Bushings, Washers, Lugs
- KNOBS

You'll find these SMITH products on the shelves of leading industrial Electronic Distributors, throughout U.S.A. For your production runs, draw directly on our large plant inventories of standard components.

NATIONWIDE REPRESENTATIVES

The SMITH network of Qualified Sales Engineers is at your service! These men and their organizations are technically qualified and eager to help you with your requirements for standard or special components that we manufacture.

MODERN FACILITIES

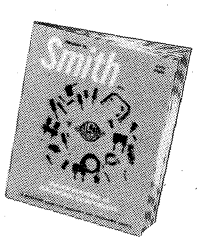
We invite you to utilize our modern manufacturing facilities and methods for your molding, screw-machine, stamping or sub-assemblies. We are equipped for both long and short runs. From raw material to finished part, SMITH detailed workmanship and production efficiency assure a quality product, speedily and economically made.

SPECIAL REQUIREMENTS?

Use our Engineering and Production Facilities to design and develop new products or modify existing components to meet your specific needs. "Specials are Standard with SMITH!"

FOR ENGINEERS & PURCHASING AGENTS!

New Smith Catalog is an important Reference Work on electronic component parts, containing:
Detailed specifications! Data; Dimensional Drawings.
SEND FOR YOUR FREE COPY #69-70



HERMAN H. SMITH, INC.

A NORTH AMERICAN PHILIPS COMPANY

812 Snediker Avenue, Brooklyn, N. Y. 11207

Telephone: 212 272-9400 • TWX: 212-763-8070

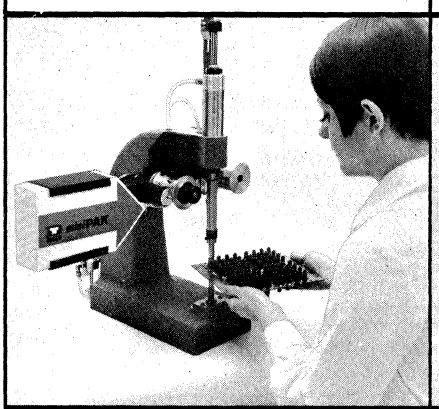
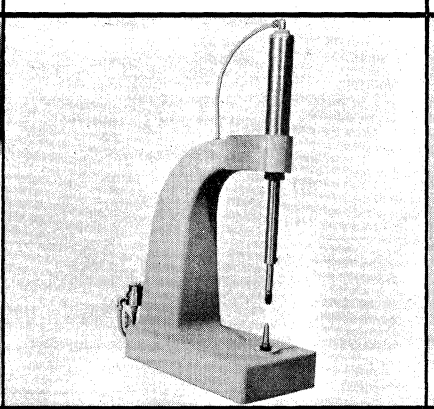
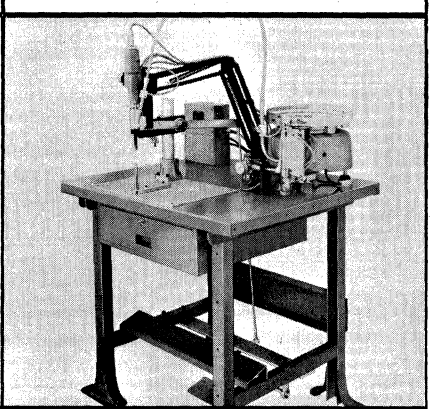
MANUFACTURERS OF ELECTRONIC COMPONENTS

Herman H. SMITH, inc.

Tooling for Teflon* Terminal Installation

Because proper tooling is an important consideration and in order to fully benefit from the application of H. H. Smith Terminals, special tools and equipment have been designed to accomplish installation to the optimum degree.

Depending on requirements, a customer may order any of the listed equipment. Smith installation tooling is designed for utmost versatility. Removable multi-usage inserting tools permit flexibility with a minimum of down time required for changeover.

MINISERT AUTOMATIC	MINISERT MK I	UNISERT
		
The MINISERT Automatic **feeds** and **inserts** teflon terminals **automatically**. This **low cost** air operated device **is fast** and **simple to set up** and **operate** and will install terminals pre-packaged in the unique Mini-Pak cartridge.	The MINISERT MK I semi-automatic eliminates the high cost of installing teflon terminals. **Practical** for Lab, model shop, or production application, the full range of terminals can be installed with a maximum of five tool sets.	***ATTENTION: HIGH VOLUME USERS!*** The UNISERT Universal teflon terminal inserting system meets the specific demands of high volume teflon terminal users. The **Unisert** may be operated utilizing its pantograph frame or with its uniquely designed anvil system. The **Unisert** has proven to be a reliable production tool, operating continuously on a multi-shift basis.

*Reg. Trademark E. I. DuPont Co.

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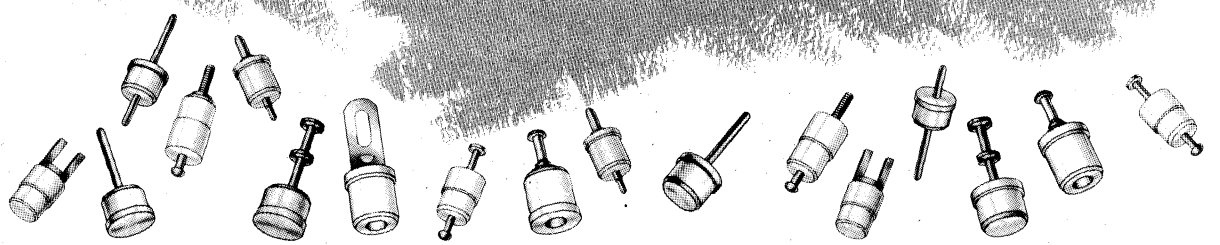
SMITH
Terminal Division

Herman H. SMITH, inc.

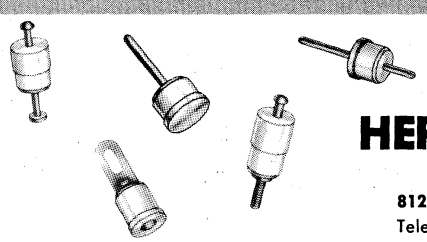
TEFLON TERMINALS



QUALITY	INVENTORY	SERVICE
Herman H. Smith manufactures its teflon terminals from virgin teflon that meets or exceeds the specifications of MIL-P-19468; and the requirements of MIL-T-55155 and MIL-C-39024. All phases of the manufacturing cycle are rigidly supervised by our Quality Control Department. The end product represents the ultimate in quality and reliability.	Herman H. Smith manufactures and stocks a complete line of teflon terminals, test jacks and transistor sockets . . . all colors . . . all sizes . . . all types. GUARANTEED STOCK AVAILABLE — contact your local rep or distributor for further information on our G S A program.	Herman H. Smith's design service offers a competent engineering, development and testing facility to resolve your application and product development problems. Smith's field engineering service is nationwide. These men are thoroughly experienced and can solve your design and production problems. They are at your service — CALL THEM.



THE MINIPAK CARTRIDGE is designed to work in conjunction with the **Minisert Automatic.** It contains a precision, hermetically sealed "carrier band" which protects the terminals from atmospheric contaminants, eliminating the problems of solderability and shelflife.



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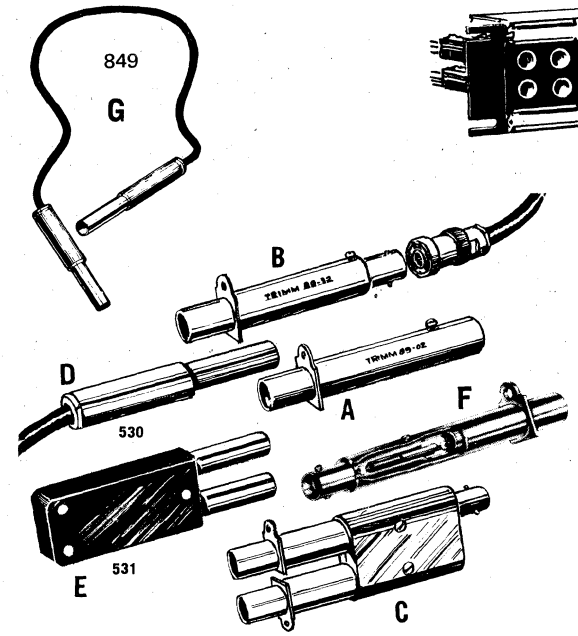
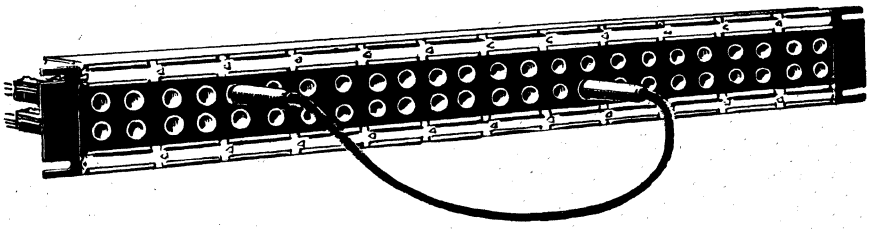
SMITH
Terminal Division

TRIMM INC.

- COAX PRODUCTS
- JACK PANELS
- TERMINAL BLOCKS





JACK PANELS—PATCH CORDS

TRIMM standard jack panels are available in several basic forms — all phenolic, all metal sandwich construction; and hybrid phenolic rear, metal front types. Also for use with either standard or miniature telephone jacks. See TRIMM bulletins.

SERIES SST — Standard sized telephone jacks, keys, lamp sockets, jack mounting strips, patch cords, plugs; coax jacks, plugs etc.

SERIES IST — Intermediate sized coax jacks, plugs, jack mounting strips (correspond with W.E. miniature coax items).

SERIES MST — Miniature telephone jacks, patch cords, plugs, jack mounting strips and other related items.

COAXIAL PLUGS & JACKS

A condensed listing of TRIMM's coaxial plugs, jacks and jack mounting strips used for monitoring and patching high frequencies or pulse circuitry is given below. Request Section 60 of our bulletins for additional data on TRIMM Coaxial Components.

SINGLE TYPE COAX JACKS

	W.E. Compatible	RCA Compatible	Cable
	64-88-02		RG-59 (Equiv. W.E. 560A)
	64-88-15		(Equiv. W.E. 558A)
	89-01	89-701	RG-58
	89-02	89-702	RG-59
A	89-05		RG-11
	89-06		RG-8, 9
	89-07	89-707	RG-54, W.E. 724 and Belden 8281; jack similar to W.E. 477B
	89-11		RG-187
	89-14		Amphenol 21-597 and RG-122U
B	89-15*	89-715	(*Similar to W.E.470B)
	89-32	89-732	Female BNC
	89-34	89-734	Female TNC

TWIN TYPES — NON-SWITCHING

	89-51	89-751	RG-58
C	89-52	89-752	RG-59
	89-57		W.E. 724 or Belden 8281
	89-82S	89-782S	Single BNC at rear

NORMAL THRU TWIN JACKS

	89-102	89-802	RG-59
	89-132	89-832	BNC at rear

COAX PLUGS

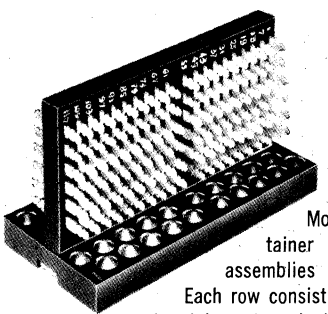
	64-530-6		RG-59 (Equiv. W.E. 440A)
	530-1	530-701	RG-58
	530-2	530-702	RG-59
D	530-6 (**)	530-706	RG-54, Belden 8281 or W.E. 724
	530-15	530-715	RG-58
	530-16	530-716	RG-59

(**) Similar to W.E. 358A

"531" SERIES BRIDGING PLUGS (E)
A twin coaxial plug (sometimes called a looping plug) internally wired and having no external cord connection.

TERMINATING JACKS (F)
These jacks are used in circuitry in which there is a need to maintain a known load in the circuit. When plug is fully inserted, load is automatically disconnected and circuit transferred to plug. Terminating resistor — ¼ watt 1% metallized film type in either 50 or 75 ohm.

"849" SERIES PATCH CORDS (G)
Use two "530" series plugs. They are available in length from six inches to 6 feet (or longer on special order).



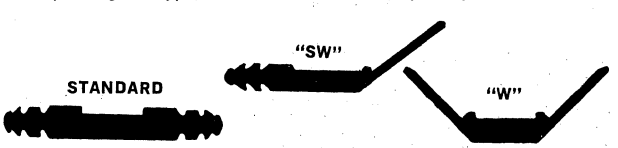
TERMINAL BLOCKS

Molded phenolic base and retainer strips used on all standard assemblies (dially!'s available to order). Each row consists of retainer strip with tintillate plated brass terminal lugs inserted into slots. Available in 20 and 26 terminals per row up to 14 rows high. Held together with machine screws passing through strips to base. Standard and alternate lugs shown below.

421A (No. of rows) 20 terminals per row } Have different
421C (No. of rows) 20 terminals per row } mounting means

427B (No. of rows) 26 terminals per row } "B" series most common; "D" series used on extra high assembly
427D (No. of rows) 26 terminals per row }

See TRIMM section bulletin 35 for more data. Pricing from $4 to $16 depending on type, number of terminals, quantity etc.



(NOTE: See SECTION 1300 on page 573 for TRIMM headsets, acoustical items and related products.)

Manufacturers of Precision Electronic Instruments and Components Since 1922

TRIMM INC.
400 WEST LAKE STREET
LIBERTYVILLE, ILLINOIS 60048
Phone (312) 362-3700

Southern California Factory Sales Office
1226 S. ATLANTIC BLVD.
LOS ANGELES, CALIFORNIA 90022
Phone (213) 261-9176

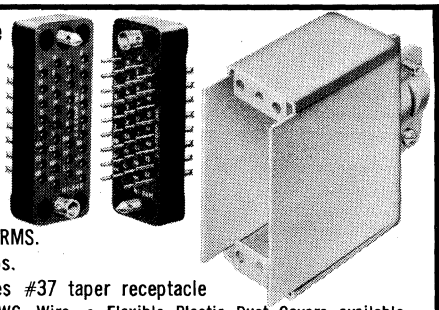
U.S. COMPONENTS INC.

1320 Zerega Ave., Bronx, N. Y. 10462 • Tel. 212-824-1600 • Telex: 1-2411 • TWX: 710-593-2141 • Cable Address: COMPONENTS NYK.

1.) Established Reliability Connectors and Contacts.
2.) Qualified Products — Connectors, Contacts, Crimping Tools and Hardware.
3.) Largest Variety Standard Shelf Items — Rapid Delivery.
4.) Custom-Built Connectors to Customer Specifications.
5.) Quality Assurance Built Into Our Products.
6.) Major Electronic Company Q.A. Approvals.
7.) Government QPLs and Underwriters Lab. Approvals.
8.) Research and Development Facilities.

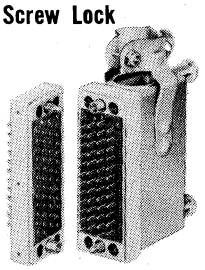
Rack and Panel Connectors

MI-SERIES - Miniature



Number of contacts: 7, 12 (8-4), 14, 18, 20, 21, 26, 34, 41, 50, 75
Maximum wire size: #20 AWG wire
Voltage breakdown between contacts — sea level: 3000V. A.C. RMS.
Current rating: 7.5 amps.
MI-SDL (solderless): uses #37 taper receptacle
Also available for #18 AWG. Wire. • Flexible Plastic Dust Covers available.

MI-BSL "FBI" SERIES - Miniature Bracket Screw Lock

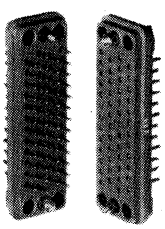


Floating Body Isolation

Number of contacts: 34, 41, 50, 75.
Maximum wire size: #20 AWG wire.
Voltage breakdown between contacts — sea level: 3000V. A.C. RMS.
Current rating: 7.5 amps.
Hoods: aluminum anodized.
Brackets: die-cast aluminum.
MI-BSL-SDL (solderless): uses #37 taper receptacle.
Patent Nos. 2,761,108, 2,845,603, 2,845,604.
Additional Patents Pending. Also available for #18 AWG. Wire.

IMI SERIES - Miniature

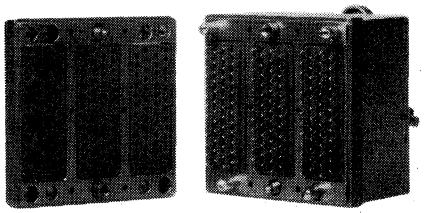
IMI-SL SERIES - Miniature Screwlock



(Similar to MI & MI-SL Series except: End Holes of 7 thru 26, & 41, and Center Holes of 34 thru 104 have Square Shape, for MS Hardware).
Number of contacts: 7, 9, 8-4, 14, 18, 20, 21, 26, 34, 41, 42, 50, 75 & 104.
Wire sizes accommodated: No. 20 A.W.G. (No. 18 on special order).
Pin diameter: .040
Current rating: 7.5 amps., max.
Test voltage, between contacts, sea level: Meets MIL-C-008384C requirements.
Contact options: Closed-entry, dip solder (.038 or .025 dia), turret.
Hardware: MS18194, MS18195, MS18196, MS18197 and MS Hoods (shields), all per MIL-C-008384C or its successor.
Guide pins and guide sockets: Many alternates.
Connectors and hardware qualified to MIL-C-008384C.
IMIs interchangeable with their counterparts in MI, REMI, and URC (size 20 contact) SERIES.
Patent No. 2,761,108. • Request Catalog IMI.

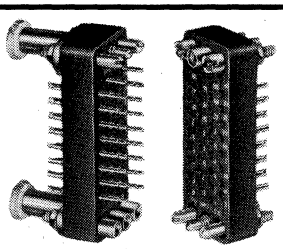
Floating Body Isolation

MI-BMSL SERIES Miniature Bracket Modular Screw Lock



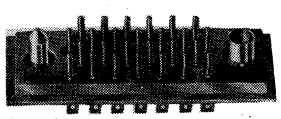
Number of contacts: 123, 150, 225.
Maximum wire size: #20 AWG wire.
Voltage breakdown between contacts — sea level: 3000V. A.C. RMS.
Current rating: 7.5 amps.
Hoods: aluminum anodized.
Brackets: die-cast aluminum.
MI-BMSL-SDL (solderless): uses #37 taper receptacle.
Patent Nos. 2,761,108, 2,845,603, 2,845,604. Also available for #18 AWG. Wire.
Additional Patents Pending

MI-KSL SERIES Miniature Hoodless Knob Type Screw Lock



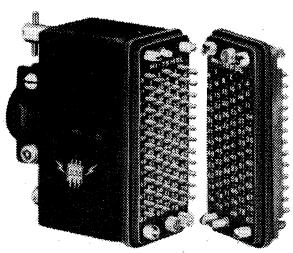
Number of contacts: 7, 12 (8-4) 14, 18, 20, 21, 26, 34, 41, 50, 75.
Maximum wire size: #20 AWG wire.
Voltage breakdown between contacts — sea level: 3000V. A.C. RMS.
Current rating: 7.5 amps.
MI-KSL-SDL (solderless): uses #37 taper receptacle.
Patent No. 2,761,108. • Also available for #18 AWG. Wire.

HMI-SL SERIES Hermetic Seal Miniature Screwlock



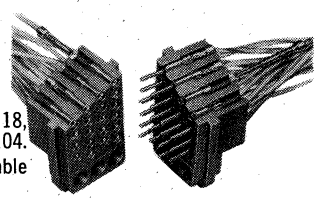
Number of contacts: 7, 12 (8-4), 14, 18, 20, 21, 26, 34, 41, 50, 75.
Voltage breakdown between contacts — sea level: 2200V. A.C. RMS, MIN.
Current rating: 7.5 amps.
Mates with corresponding MI-FSL (female) series connectors.
Also available in Draw-Pull Type. Mates with MI-F (female) Series Connectors.

MI-SL SERIES Miniature Screw Lock



Number of contacts: 7, 12 (8-4), 14, 18, 20, 21, 26, 34, 41, 50, 75.
Maximum wire size: #20 AWG. wire.
Voltage breakdown between contacts — sea level: 3000V. A.C RMS.
Current rating: 7.5 amps.
MI-SL-SDL solderless): uses #37 taper receptacle.
Patent No. 2,761,108. • Also available for #18 AWG Wire.

REMI® SERIES Standard and Screwlock

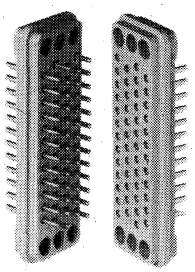


Number of contacts: 7, 12 (8-4), 14, 18, 20, 21, 26, 34, 41, 42, 50, 75, 104.
Type of contact: crimp style, removable with "snap-in, snap-out" feature.
Wire sizes accommodated: #14, #16, #18, #20, #22, #24, #26, #30 AWG and sizes #16 down to #32 per MIL-W-16878,
Snap-In . . . Snap-Out Contacts REMI Hand-Operated,* Pneumatic and Semi-Automatic Crimping Tools Available.
Patent No. 2,979,689 & 6 International Patents.
Contacts available meeting MS18134, MS18136, per MIL-C-23216, latest.
All sleeves meet MS18135. Insertion and Removal Tool Meets MS18137.
Request Catalog REMI. * MIL-T-22520 latest rev.

MIW SERIES

Miniature Rectangular Power Connectors

(Similar to MI Series except .062 dia. contact)



Number of contacts: 7, 9, 11, 14, 18, 20, 21, 26, 34, 41, 42, 50, 75, 104.

Pin diameter: .062

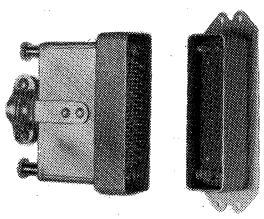
Wire sizes accommodated: up to #16 AWG.

Current rating: 13 amps., max.

Breakdown voltage between contacts — sea level: 2000V. A.C., RMS.

Connectors meet applicable provisions of MIL-C-8384, latest revision.

XMI Protective Shells for MI SERIES
XIMI Protective Shells for IMI SERIES
XREMI Protective Shells for REMI SERIES
XURC Protective Shells for URC SERIES



Number of contacts: 7, 14, 18, 20, 26, 34, 42, 50, 75, 104.

Material: Top quality aluminum, per Fed. spec.

Meet latest revision MS17775 unless otherwise specified.

Anodized per latest revision MIL-A-8625, or special conductive finishes on request.

Used on plugs and receptacles, all draw-pull or screwlock types.

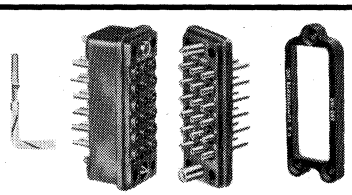
Polarization optional, at specified position.

For 9 & 66 contact shells, write factory.

Request Catalog IMI, REMI, or URC.

980 SERIES

Power Guide Pin Spring Release



Number of contacts: 12, 18, 24, 34.

Maximum wire size: #16 AWG. wire.

Voltage breakdown between contacts — sea level: 4600V. A.C. RMS.

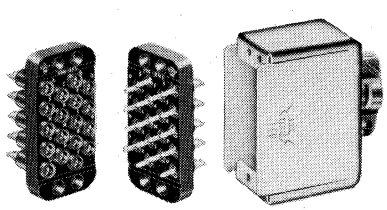
Current rating: 13 amps.

980-SDL (solderless): uses #53 taper pin.

Patent No. 2,658,182.

Request Catalog 980-990.

990 and 990-S (Short Contacts) SERIES - Power



Number of contacts: 7, 10, 15, 18.

Maximum wire size: #16 AWG. wire.

Voltage breakdown between contacts — sea level: 4000V. A.C. RMS.

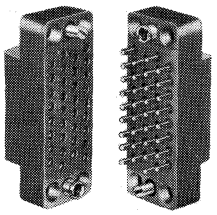
Current rating: 13 amps.

990-TU (Turret type).

Request Catalog 980-990.

ANYCON* Connectors

URC and URC-SL SERIES



Number of contacts: 9, 14, 18, 20, 26, 34, 42, 50, 66, 75, and 104.

Maximum wire size: #16 AWG.

Voltage breakdown between contacts — sea level: 2950V. A.C. RMS.

Current rating: 13 amps.

Contac size (standard): 20 & 16.

Shielded coax contacts: See list below.

Contacts — Removable, crimp-type. Socket closed entry type: See list below.

Order contacts separately.

Connectors meet MIL-C-22857, latest revision. Also commercial.

Both draw-pull and twin screwlock types available, with or without hoods or shells.

Crimping tools, insertion and removal tools available.

Patent No. 2,761,108. UNDERWRITERS' LABORATORIES APPROVED.

* ANY CONtact, std. size 16 or 20, or shielded coax in ANY CONtact position.

Request Catalog URC.

URC ANYCON CONTACTS

STANDARD, CONTACT SIZE 16 † ‡

MS17803-16-16 Pins for wire sizes 16, 18, 20 AWG.

MS17803-16-20 Pins for wire sizes 20, 22, 24 AWG.

MS17804-16-16 Sockets for wire sizes 16, 18, 20 AWG.

MS17804-16-20 Sockets for wire sizes 20, 22, 24 AWG.

† Qualified against MIL-C-23216.

‡ Available also in contact size 20 for wire sizes 16 thru 30 AWG.

SHIELDED 'COAX',* CONTACT SIZE 16

MS18232-1 Pins for RG-178B/U & RG-196A/U cable.

MS18233-1 Sockets for RG-178B/U & RG-196A/U cable.

MS18265-1 Sockets for RG-161/U, RG-179B/U, & RG-187A/U cable.

MS18265-2 Sockets for RG-174/U, RG-188A/U, & RG-316/U cable.

MS18266-1 Pins for RG-161/U, RG-179B/U, & RG-187A/U cable.

MS18266-2 Pins for RG-174/U, RG-188A/U, & RG-316/U cable.

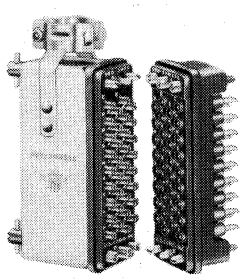
* For government end use.

Crimping tools per MIL-T-22520 (latest) and/or MS drawing requirements. Hand, semi-automatic, and automatic.

Request Catalog URC.

980-SL SERIES

Power Screw Lock



Number of contacts: 12, 18, 24, 30.

Maximum wire size: #16 AWG. wire.

Voltage breakdown between contacts — sea level: 4600V. A.C. RMS.

Current rating: 13 amps.

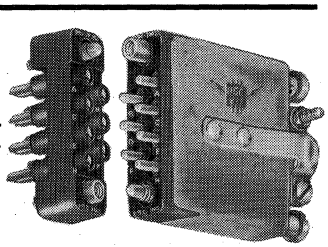
980-SL-SDL (solderless): uses #53 taper pin.

Patent Nos. 2,658,182, 2,761,108.

Request Catalog 980-990.

990-SL SERIES

Power Screw Lock



Number of contacts: 7, 10, 15, 18.

Maximum wire size: #16 AWG. wire.

Voltage breakdown between contacts — sea level: 4000V. A.C. RMS.

Current rating: 13 amps.

990-TU (Turret type).

Double Lead threads, "Twice the speed with Double Lead."

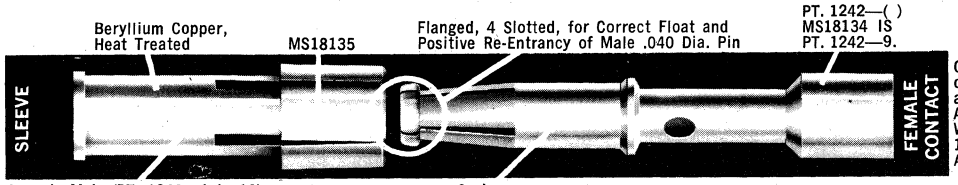
Patent No. 2,761,108.

Request Catalog 980-990.

THE REMI CONCEPT

Removable • Closed Entry • Crimp Type Contacts — Mechanical Stresses Confined between METALLIC Elements.

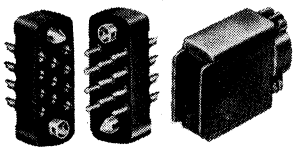
REMI Connectors Mate with REMI, MI, or URC (with .040 Dia. Contact) Series.



Crimp Barrels of Both Male and Female Accommodate Wire Sizes 14 thru 30 AWG.

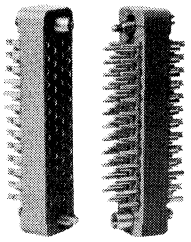
Rack and Panel Connectors & Edgeboard P.C. Connectors

SMI SERIES - Subminiature



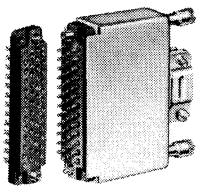
Number of contacts: 5, 7, 11, 14, 20, 26, 29, 34, 42, 50, 75, 104.
Maximum wire size: #20 AWG. wire.
Voltage breakdown between contacts — sea level: 1950V. A.C. RMS.
Current rating: 7.5 amps.
Also available with closed entry contacts — CSMI Series.
XSMI Protective Shells available for all types. Request Catalog SMI.

UMI SERIES - Ultraminiature
Draw-Pull & Screwlock



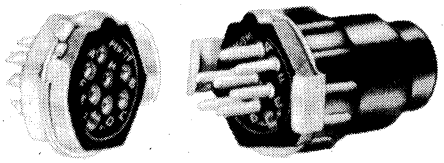
Number of contacts: 5, 7, 9, 11, 14, 20, 26, 29, 34, 44, 50.
Maximum wire size: #22 AWG. wire.
Voltage breakdown between contacts — sea level: 1800V. A.C. RMS.
Current rating: 3 amps.
Patent No. 2,761,108.
ALSO AVAILABLE WITH:
Closed Entry Contacts: CUMI Series.
Removable Crimp Contacts: RUMI Series.
.025 D. Pin and Socket: SSMI Series.
Request Catalog UMI-RUMI.

SMI-HSL - Subminiature Hooded Screwlock
SMI-KSL - Subminiature Hoodless Screwlock (Not Shown)



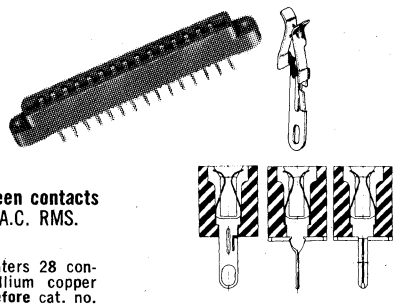
Number of contacts: 5, 7, 11, 14, 20, 26, 29, 34, 42, 50, 75, 104.
Maximum wire size: #20 AWG. wire.
Voltage breakdown between contacts — sea level: 1950V. A.C. RMS.
Current rating: 7.5 amps.
Also available with closed entry contacts — CSMI-SL Series.
Patent Nos. 2,761,108 & 3,030,602. Request Catalog SMI.
XSMI Protective Shells available for all types.

MH SERIES
Miniature Hex



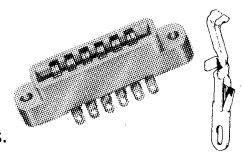
Number of contacts: 4, 5, 7, 9
Current rating: 7.5 amps.
Maximum wire size: #20 AWG. wire.
Voltage breakdown between contacts — sea level: 1215V. A.C. RMS.
Voltage breakdown contacts to ground: 1785V. A.C. RMS.
MH-SDL (solderless): uses #37 taper receptacle.
ALSO AVAILABLE FOR #18 AWG. WIRE
Patent No. 2,848,702.

UPCR SERIES
Single Row Printed Card Receptacle



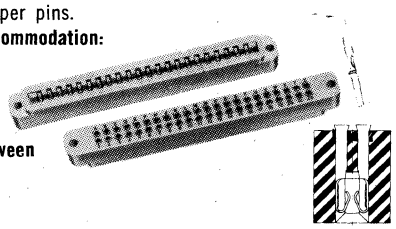
Number of contacts — (Phosphor Bronze): 6, 10, 15, 18, 22.
Solder wire hole size: .05 x .12.
Voltage breakdown between contacts — sea level: 2500V. A.C. RMS.
Current rating: 5 amps.
Also available on .125 centers 28 contacts UP4CR-28. For beryllium copper contacts add prefix "B" **before** cat. no.
Polarizing pins and contacts — snap-in or out design permitting easy interchangeability.
Patent No. 2,835,689. Request Catalog UPCR.
Connectors meet MIL-C-21097, latest revision.

UPCR-D - Double Row Printed Card Receptacle - Solder Type Terminals



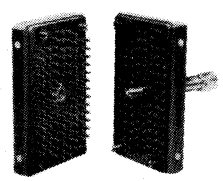
Card range thickness accommodation:
UPCR-D: .058 - .072 (nom. 1/16")
UPCR-93D: .080 - .104 (nom. 3/32")
Number of contacts (Phosphor Bronze*): 6, 7‡, 10, 15, 18, 22 per row, (2) rows.
Solder wire hole size: .05 x .12.
Voltage breakdown between contacts — sea level: 2500V. A.C. RMS.
Current rating: 5 amps.
Both bifurcated and non-bifurcated contacts available.
Polarizing pins and contacts — snap-in or out design permitting easy interchangeability.
* For beryllium copper contacts add prefix "B" **before** catalog number.
‡ Molded in polysulfone, one of the strongest, most heat-resistant, self-extinguishing thermoplastics available. Excellent electrical properties. For availability of other items in polysulfone, contact factory.
Patent No. 2,909,755. Request Catalog UPCR.
Connectors meet MIL-C-21097, latest revision.

UPCR-DTLP - Single Row Dual Linked Contact



UPCR-DLTP: Uses #53 taper pins.
Card Range thickness accommodation: .052 - .072 (nom. 1/16")
Number of contacts (Beryllium Copper): 18, 22.
Voltage breakdown between contacts — sea level: 2500V. A.C. RMS.
Current rating: 5 amps.
Tails locked in place with stainless steel retaining ring which controls retention force on the #53 taper pins accepted by contacts.
Request Catalog UPCR.

MIWC SERIES - 104 Contact Center Screwlock Plugs & Receptacles



Connector type: Rack and panel.
Contact types: 0.062 dia. pin and mating closed-entry socket.
Contact spacing: 0.150 center-to-center.
Current rating: 13 amps. max. 10 amps cont.
Voltage breakdown between contacts — sea level: 3000V. A.C. RMS.
Solder cup: 0.073 dia. for #16 AWG. max. wire.
Available versions: MIWC-104M2SL, MIWC-104F2K } (illustrated above) MIWC-104M2K, MIWC-104F2SL

CONNECTOR TYPES AVAILABLE:

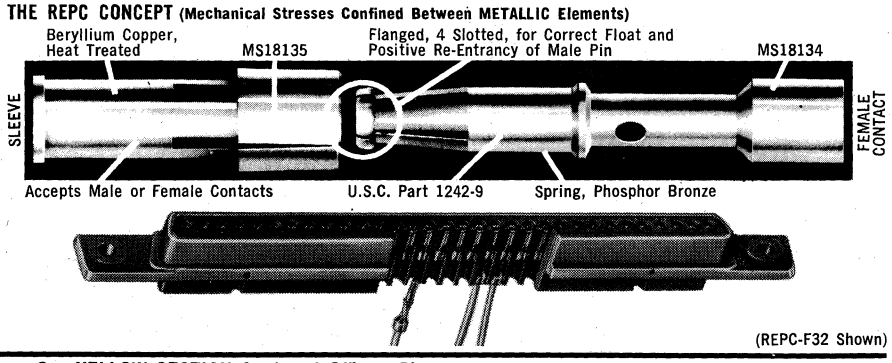
Rack and Panel	Test Point
Plug and Receptacle	Miniature Hexagonal
Edgeboard	Circular
Two-Piece Printed Circuit	Zero-Entry-Force P.C.
High Density	Hermetically Sealed

U.S.C. Manufacturers' Connectors and/or Contacts Meeting or Exceeding All Applicable Provisions of Latest Revision of:

MIL-C-8384	MIL-C-39029
MIL-C-21097	MIL-C-55302
MIL-C-22857	MS18134
MIL-C-23216	MS18136
MIL-C-23353	NAS713, NAS714,
MIL-C-25955	NAS715

Quality Control to Latest Revision of MIL-Q-9858, MIL-I-45208, NASA NPC200.
Calibration Per MIL-C-45662 Traceable to National Bureau of Standards.

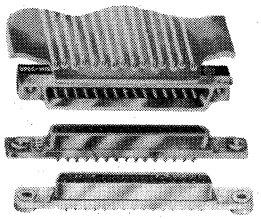
THE REPC CONCEPT (Mechanical Stresses Confined Between METALLIC Elements)



(REPC-F32 Shown)

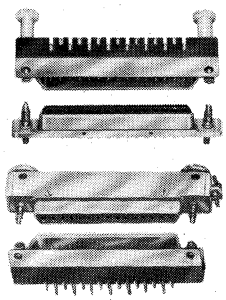
Two-Piece P.C. Connectors & Removable Crimp Contact Connectors

UPCC-M & F SERIES
Printed Circuit Connectors & Mates (Meet MIL-C-23353/1, 2, & 3 and NAS 713, 714, 715)



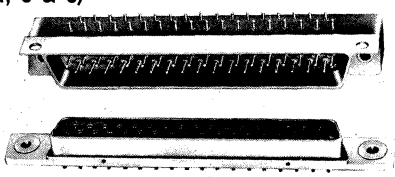
Contact spacing: 0.156.
Number of contacts: 7, 11, 15, 19, 23, 32.
Male dip solder. Card range thickness accommodation:
UPCC-M( ) A, B, or C: 1/16", 1/8", or 1/4".
Female UPCC-F( ): Max. #20 AWG. wire.
Female dip solder terminals. UPCC-FDN( ).
Current rating: 7.5 amps.
Voltage breakdown between contacts — sea level: 2500V. A.C. RMS.
REPC-F series also mates with UPCC-M series.
Request Catalog UPCC-REPC.

UPCC-SL SERIES - Printed Circuit Screwlock & Mate
UPCC-SLH SERIES Hooded Screwlock & Mate



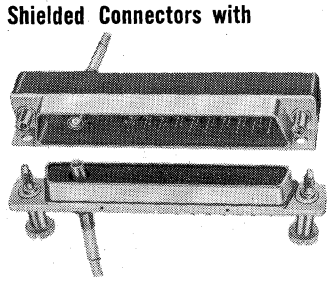
(Meet applicable provisions of MIL-C-23353 & NAS-713, 714, 715)
Contact spacing: 0.156.
Number of contacts: 7, 11, 15, 19, 23, 32.
Current rating: 7.5 amps.
Voltage breakdown between contacts—sea level: 2500V. A.C. RMS.
UPCC-SL
UPCC-M2K-( ) A, B, C for 1/16", 1/8", 1/4" P.C. or — E for solder eyelet.
UPCC-F2SL-( ) for #20 max. AWG. wire or — TU for turret terminals.
UPCC-SLH
UPCC-M2SL-( ) A, B, C for 1/16", 1/8", 1/4" P.C. or — E for solder eyelet.
UPCC-F2HSL-( ) for #20 max. AWG. wire or — TU for turret terminals.
Patent No. 2,953,767. Request Catalog UPOC-REPC.

UPCC-SGM & SGF SERIES - Printed Circuit Connector & Mates (Meet MIL-C-23353/4, 5 & 6)



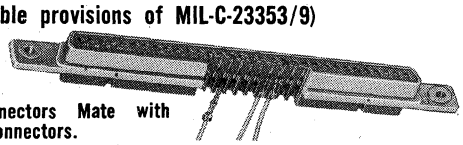
Contact spacing: 0.100
Number of contacts: 11, 17, 23, 29, 35.
Male dip solder. Card range thickness accommodation:
UPCC-SGM( ) A, B, or C: 1/16", 1/8", or 1/4".
Female dip solder terminals. UPCC-SGFDN( ).
Current rating: 7.5 amps.
Voltage breakdown between contacts — sea level: 2360V. A.C. RMS.
REPC-SGF series also mates with UPCC-SGM series.
Request Catalog UPCC-REPC.

TWO UNIT UPCC - 19 Pin Shielded Connectors with Coaxial Contacts



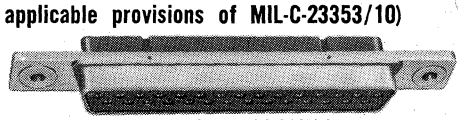
The male connectors meet all applicable provisions of the latest revisions of MIL-C-23353 and MIL-C-23353/6.
The female connectors meet all applicable provisions of the latest revisions of MIL-C-23353 and MIL-C-23353/4.
COAXIAL CONTACTS: High mating retention type plug with socket of top quality beryllium copper, gold over nickel plated. Receptacle with .031 nom. dia. pin of top quality beryllium copper, gold over nickel plated. Plug and receptacle are of snap-lock mounting type and are for use with RG180/U or RG195/U cable (Ref.).
Request Catalog UPCC-REPC.

REPC-F SERIES - Female Chassis Connector (Meet applicable provisions of MIL-C-23353/9)



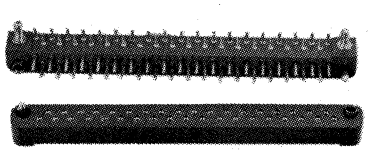
REPC-F( ) Connectors Mate with UPCC-M( ) Connectors.
Type of Contact: Removable ("snap-in, snap-out") crimp type, closed-entry.*
Contact spacing: 0.156.
Number of contacts: 7, 11, 15, 19, 23, 32.
Wire sizes accommodated: #14, #16, #18, #20, #22, #24, #26, #30 AWG. wire and sizes #16 down to #32 per MIL-W-16878.
Crimping tools: Hand-operated MIL-T-22520C and MS, also pneumatic and semi-automatic types.
Current rating: 7.5 amps.
Voltage breakdown between contacts — sea level: 2500V. A.C. RMS.
Patent No. 2,979,689 & 6 International Patents.
* Contacts meet MS18134 } per MIL-C-23216
* Sleeves meet MS18135 }
Request Catalog UPCC-REPC.

REPC-SGF SERIES - Female Chassis Connector (Meet applicable provisions of MIL-C-23353/10)



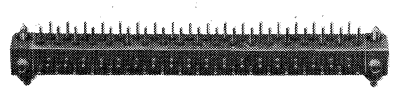
REP-SGF( ) connectors mate with UPCC-SGM( ) connectors.
Type of contact: Removable ("snap-in, snap-out") crimp type, closed-entry.*
Contact spacing: 0.100.
Number of contacts: 11, 17, 23, 29, 35.
Wire sizes accommodated: #14, #16, #18, #20, #22, #24, #26, #30 AWG. and sizes #16 down to #32 per MIL-W-16878.
Crimping tools: Hand-operated MIL-T-22520C and MS, also pneumatic and semi-automatic types.
Current rating: 7.5 amps.
Voltage breakdown between contacts — sea level: 2360V. A.C. RMS.
Patent No. 2,979,689 & 6 International Patents.
* Contacts meet MS18134 } Per MIL-C-23216, latest revision.
* Sleeves meet MS18135 }
Request Catalog UPCC-REPC.

MIG SERIES
Right Angle Plug & Receptacle Connectors



Contact spacing: 0.100.
Number of contacts: 11, 15, 23, 37.
Male dip solder. Card range thickness accommodation.
MIG-M: from 1/32" to 1/4".
Female. MIG-F: Max. #20 AWG. wire.
Current rating: 7.5 amps.
Voltage breakdown between contacts — sea level: 1060V. A.C. RMS.
Request Catalog MIG-WG-RWG.

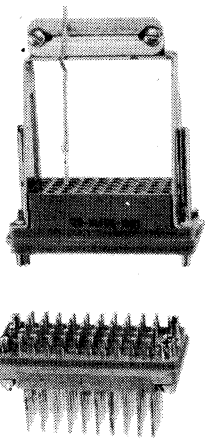
WG-37M - Connector Plug, Right Angle .100 Grid P.C.
RWG-37F - Mating Receptacle, Crimp Removable Contacts



Number of contacts: 37.
Wire sizes accommodated: #14 to #30 AWG.
Dielectric withstanding voltage between contacts: 1500V. D.C. at sea level.
Current rating: 7.5 amps., max.
WG-37M: is screw mounted. **WG-37MR:** is rivet mounted.
RWG-37F: uses MS18134 contact & MS18135 sleeve of MIL-C-23216 latest rev., and other REMI contacts.
Crimping tools: per MIL-T-22520 latest, and commercial. Hand, semi-automatic and automatic.
Patent No. 2,979,689 & 6 International Patents. Request Catalog MIG-WG-RWG.

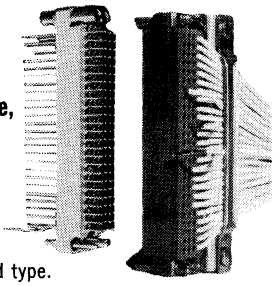
Miscellaneous Connectors

URG-50M1SL-WW - Connector Plug, Wire-Wrapped Terminals
URG-50FIK-BC - Mating Receptacle, Crimp Removable Contacts
.200 x .200 contact grid spacing



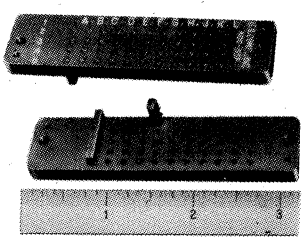
Number of contacts: 50.
Pin diameter: .062.
Male terminals: .045 square, wire wrapped type.
Female contacts (ordered separately): Meet MS17804-16-16 of MIL-C-23216 latest.
Wire accommodation: #16, #18, #20 AWG.
Crimping Tools: per MIL-T-22520 latest, and commercial. Hand, semi-automatic and automatic.
Current rating: 13 amps., max.
Dielectric withstanding voltage, between contacts — sea level: Depends upon wire sizes used on males.
Connectors meet all applicable provisions of MIL-C-22857, latest revision

GR-100MISL-WW Connector Plug, Wire-Wrapped Terminals
RGR-100FIKL-CC - Mating Receptacle, Crimp Removable Contacts
.100 x .100 contact grid spacing



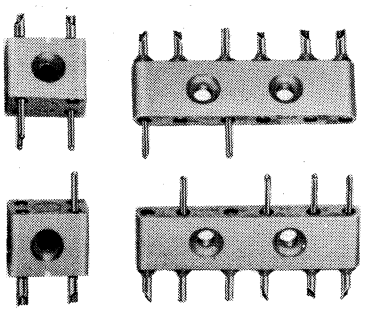
Number of contacts: 100.
Pin diameter: .031.
Male terminals: .025 square, wire wrapped type.
Female contacts (ordered separately) wire accommodation: #22 thru #26 AWG.
Crimping tool: MS3198-1 per MIL-T-22520, latest revision.
Current rating: 5 amps., max.
Dielectric withstanding voltage, between contacts — sea level: Depends upon wire sizes used on males.
Contacts meet applicable provisions of MIL-C-23216, latest revision.
Connectors meet applicable provisions of MIL-C-8384, latest revision.

NOG SERIES



Number of contacts NOG-( )F: 5, 10, 20, 55.
Number of contacts NOG-( )M: 1, 2, 3, 4, or 5.
Contact size 20: .040 dia.
P.C. dip solder terminals: .020 dia.
Current rating: 5 amps, continuous.
Voltage breakdown between nearest contacts sea level, normal humidity: 3000V. A.C. RMS.

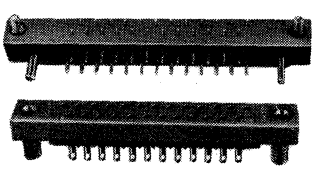
Side Mounting Miniature Connectors



Number of contacts: 4 or 6.
Pin diameter: .040.
Wire sizes accommodated: #20 to #22 AWG.
Current rating: 7.5 amps., max.
Voltage breakdown, between contacts — sea level: 2000V. A.C., RMS.
Many polarizations available (males and females in same connector body).

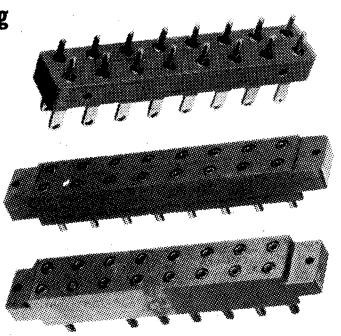
MG-4M & F **MG-6M & F**

901-25M - Connector Plug Right Angle .100 Grid P.C.
901-25F - Mating Receptacle, Solder Eyelet Terminals



Number of contacts: 25.
P.C. thicknesses accommodated: 1/16", 1/32", 5/32".
Pin diameter: .040.
Current rating: 5 amps. continuous.
Operating voltage — sea level: 900V. A.C. RMS.
Female contacts: Solder eyelet accepts 2 #20 AWG. wires.
Polarized foolproof assembly. Blind alignment.

960-16M - Power Connector Plug
960-16F - Mating Receptacle
960-16FT - Mating Receptacle (Anti-Rotation Contacts)



Number of contacts: 16.
Pin diameter: .094.
Male contacts, removable, dual wiring holes.
Female contacts, removable crimp type.
Wire sizes accommodated: #12 thru #20 AWG.
Current rating: 23 amps.
Polarization contacts available.
Breakdown voltage, between contacts — sea level: 6000V. A.C. RMS.

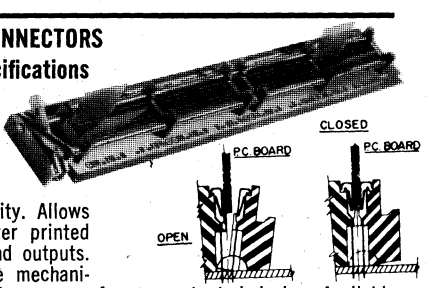
UTP-16 and UTP-S5 - Test Point Connectors



UTP-16
Number of contacts: 16.
Socket contact: accepts standard .080 dia. test probe and retains probe with spring pressure. Pin end of contact is .030 dia.
Current rating: 5 amps., max.
Breakdown voltage, between contacts — sea level: 3500V. A.C. RMS.

UTP-S5
Number of contacts: 5, button type.
Pin end of contact: .030 dia.
P.C. board accommodated: 3/32".
Current rating: 5 amps., max.
Voltage rating: 600V. A.C. RMS.
Test voltage — sea level: 1800V. A.C. RMS.

ZERO-ENTRY-FORCE CONNECTORS
Built to Customer Specifications



TYPICAL:

1.) (Illustrated). Z-E-F connector used in advanced computer applications involving maximum packaging density. Allows use of 3 edges of master printed circuit card for inputs and outputs. All connections are made mechanically and simultaneously by means of a cam-actuated device. Available in many configurations of connectors with from 56 to 520 contacts.

2.) (Not Illustrated). Z-E-F connector used in test set-up for special electronic modular components. Manual control levers are snapped closed, gently pressing the contacts against the module's pins for the test. Connectors come in 4 sizes (52 or 62 contacts), 3.6 in. long by 2 to 2.5 in. wide.

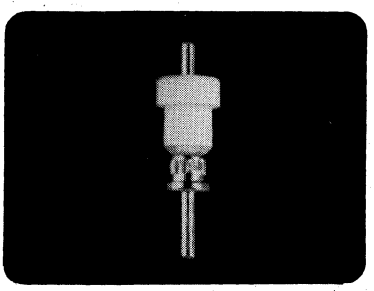
Write us about your requirements.

Rapid-Installing Teflon® Terminals

U. S. Terminals Inc. is staffed to meet your production needs for standard and special terminals quickly, and is tooled up for high production volume. We manufacture to applicable MIL-specs and design to satisfy special customer requirements.

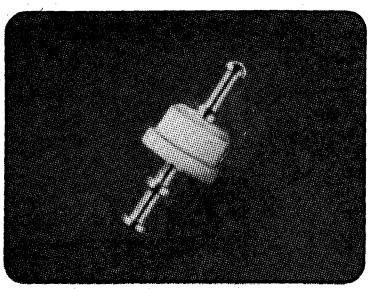
SLIP LOCK® terminals

No hole chamfering is ever required. Patented single-piece terminals can be inserted from either side of your chassis or card and lock in place under simple pressure. Reliability is unparalleled.



PRESS TYPE terminals

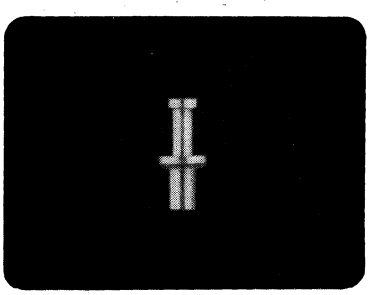
Press type terminals also are immune to mechanical shocks and vibrations and are suitable for all metal chassis applications. Electrode pins meet the latest exacting military specifications.



PRINTED CIRCUIT terminals

Bulletin 6802

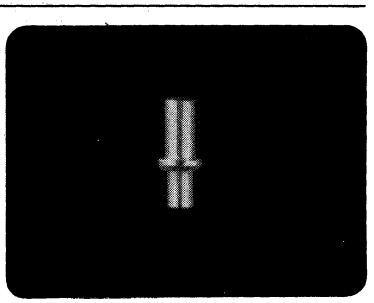
Available in brass or high-conductivity copper to meet the most exacting requirements. Precision machining assures trouble-free installation and service. Controlled heat treating and plating guarantee excellent solderability. Special designs are available.



PRINTED CIRCUIT sockets and test jacks

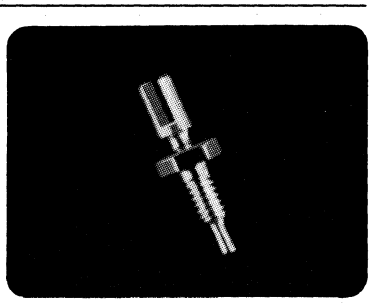
Bulletin 6802

Printed Circuit Sockets/Test Jacks offer new flexibility and compactness in printed circuit design. Suitable for test point jacks, min. tube sockets, module sockets, diode and transistor sockets and stacking P.C. boards.



GROUNDING terminals

Made to the same high standards as the above designs, grounding terminals are one-piece brass units, knurled or threaded for inserting or bolting to the metal chassis. Available in straight wire or slotted pin designs for soldering leads.



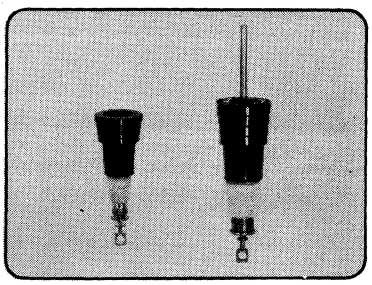
U.S. TERMINALS INC.

7502 Camargo Road, Cincinnati, Ohio 45243, Phone 513 561-8145 TWX 810-461-2290

Binding posts

Bulletin 6805

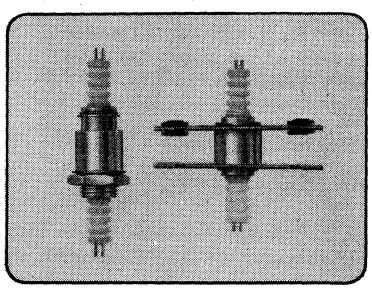
Binding posts incorporate Slip-Lock® design features for fastest production installation. One piece, no nuts or fasteners. They can be inserted blind from the front side of the chassis. Accept standard probes in integral jack.



High Voltage connectors

Bulletin 6804

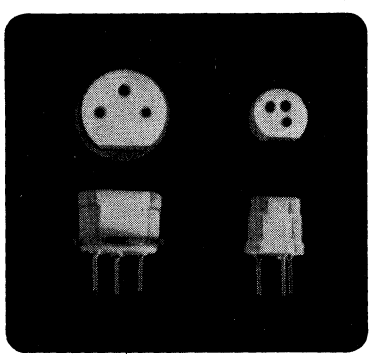
HV Miniature Connectors offer precise contact design, precious metal plating and Teflon insulation. Optimum creepage path for high-voltage use is engineered to meet MIL-C-8384. Breakdown voltages to 18,000 vdc.



BELTLINE transistor sockets

Bulletin 6901

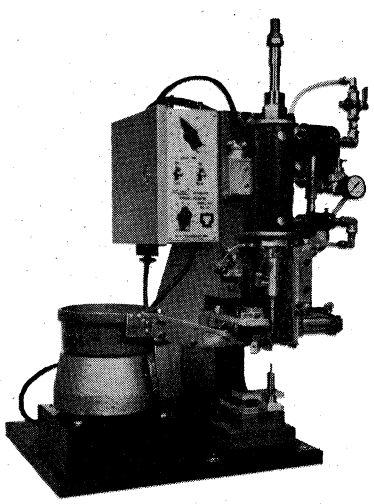
Easy installation sockets have beryllium copper age hardened receptacles; fit standard/existing mounting hole sizes. No chamfer necessary! Shoulder on pin at insulation prevents cold solder joints, pin extensions can be bent without cracking. "D" cross section prevents rotation. Teflon insulation is used. Lowest cost, highest quality sockets available. Special designs available, also Press Type Sockets.



Automatic insertion

For high production requirements, automated installation equipment is available on loan to U. S. Terminals' customers. The Model 415 Hopper-Fed Inserter shown here can save you time and money, speed your production 100 per cent to 500 per cent.

Send for comprehensive catalog.



U.S. TERMINALS

U.S. Terminals products are manufactured under one or more of the following patents: U.S.—3349365, 3095470, 3267205, 3244801; British—972756; Canadian—729317. Other patents applied for.

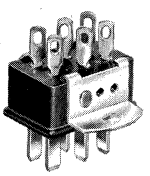
BEAUPLUG® Connectors / Plugs and Sockets

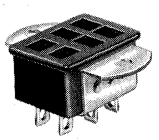
BEAUPLUG Series 3300

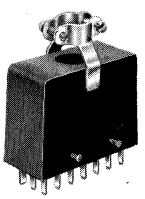
BEAUPLUG Series 3300 is interchangeable with Cinch-Jones 300 Series. Molded bakelite bases; cadmium plated contacts (gold, silver and rhodium available); polypropylene backshells (metal available); and bright plated hardware. UL rated at 250v at 10 amp.

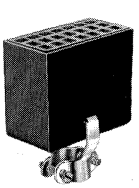
Series 3300 Plugs and Sockets are available as: DB Deep Bracket Mounted; EB End Bracket; FHT Flared Hole Top; FHT-L Flared Hole Top Latch; FHT-K Flared Hole Top Keeper; CCE Cable Clamp End; CCT-L Cable Clamp Top Latch; CCT-K Cable Clamp Top Keeper.

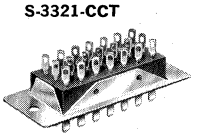
Beauchaine Number	Contacts	List	Each 1-49	Each 50-99	Each 100-249	Each 250-499
PLUGS — ANGLE BRACKETS MOUNTED (-AB)						
P-3303-AB	3	$.38	$.228	$.19	$.152	$.144
P-3304-AB	4	.42	.252	.21	.168	.16
P-3306-AB	6	.51	.306	.255	.204	.194
P-3308-AB	8	.61	.366	.305	.244	.232
P-3310-AB	10	.69	.414	.345	.276	.262
P-3312-AB	12	.77	.462	.385	.308	.293
P-3315-AB	15	1.05	.63	.525	.42	.399
P-3318-AB	18	1.30	.78	.65	.52	.494
P-3321-AB	21	1.65	.99	.825	.66	.627
P-3324-AB	24	2.00	1.20	1.00	.80	.76
P-3327-AB	27	2.35	1.41	1.175	.94	.893
P-3330-AB	30	2.70	1.62	1.35	1.08	1.026
P-3333-AB	33	3.05	1.83	1.525	1.22	1.159
SOCKETS — ANGLE BRACKETS MOUNTED (-AB)						
S-3303-AB	3	$.40	$.24	$.20	$.16	$.152
S-3304-AB	4	.44	.264	.22	.176	.167
S-3306-AB	6	.55	.33	.275	.22	.209
S-3308-AB	8	.69	.414	.345	.276	.262
S-3310-AB	10	.82	.492	.41	.328	.312
S-3312-AB	12	.95	.57	.475	.38	.361
S-3315-AB	15	1.20	.72	.60	.48	.456
S-3318-AB	18	1.45	.87	.725	.58	.551
S-3321-AB	21	1.80	1.08	.90	.72	.684
S-3324-AB	24	2.15	1.29	1.075	.86	.817
S-3327-AB	27	2.50	1.50	1.25	1.00	.95
S-3330-AB	30	2.90	1.74	1.45	1.16	1.102
S-3333-AB	33	3.20	1.92	1.60	1.28	1.216
PLUGS — CABLE CLAMP TOP (-CCT)						
P-3303-CCT	3	$.75	$.45	$.375	$.30	$.285
P-3304-CCT	4	.83	.498	.415	.332	.315
P-3306-CCT	6	.92	.552	.46	.368	.35
P-3308-CCT	8	.99	.594	.495	.396	.376
P-3310-CCT	10	1.11	.666	.555	.444	.422
P-3312-CCT	12	1.22	.732	.61	.488	.464
P-3315-CCT	15	1.56	.936	.78	.624	.593
P-3318-CCT	18	1.83	1.098	.915	.732	.695
P-3321-CCT	21	2.20	1.32	1.10	.88	.836
P-3324-CCT	24	2.56	1.536	1.28	1.024	.973
P-3327-CCT	27	2.92	1.752	1.46	1.168	1.11
P-3330-CCT	30	3.36	2.016	1.68	1.344	1.277
P-3333-CCT	33	3.75	2.25	1.875	1.50	1.425
SOCKETS — CABLE CLAMP TOP (-CCT)						
S-3303-CCT	3	$.77	$.462	$.385	$.308	$.293
S-3304-CCT	4	.84	.504	.42	.336	.319
S-3306-CCT	6	.95	.57	.475	.38	.361
S-3308-CCT	8	1.11	.666	.555	.444	.422
S-3310-CCT	10	1.23	.738	.615	.492	.467
S-3312-CCT	12	1.42	.852	.71	.568	.54
S-3315-CCT	15	1.72	1.032	.86	.688	.654
S-3318-CCT	18	2.00	1.20	1.00	.80	.76
S-3321-CCT	21	2.30	1.38	1.15	.92	.874
S-3324-CCT	24	2.72	1.632	1.36	1.088	1.034
S-3327-CCT	27	3.06	1.836	1.53	1.224	1.163
S-3330-CCT	30	3.56	2.136	1.78	1.424	1.353
S-3333-CCT	33	3.83	2.298	1.915	1.532	1.455
PLUGS — SHALLOW BRACKETS MOUNTED (-SB)						
P-3315-SB	15	$1.38	$.828	$.69	$.552	$.524
P-3318-SB	18	1.70	1.02	.85	.68	.646
P-3321-SB	21	2.07	1.242	1.035	.828	.787
P-3324-SB	24	2.50	1.50	1.25	1.00	.95
P-3327-SB	27	2.80	1.68	1.40	1.12	1.064
P-3330-SB	30	3.20	1.92	1.60	1.28	1.216
P-3333-SB	33	3.55	2.13	1.775	1.42	1.349
SOCKETS — SHALLOW BRACKETS MOUNTED (-SB)						
S-3315-SB	15	$1.58	$.948	$.79	$.632	$.60
S-3318-SB	18	1.90	1.14	.95	.76	.722
S-3321-SB	21	2.25	1.35	1.125	.90	.855
S-3324-SB	24	2.67	1.602	1.335	1.068	1.015
S-3327-SB	27	3.00	1.80	1.50	1.20	1.14
S-3330-SB	30	3.40	2.04	1.70	1.36	1.292
S-3333-SB	33	3.75	2.25	1.875	1.50	1.425


P-3306-AB


P-3306-AB


P-3321-CCT


S-3321-CCT

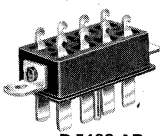

P-3321-SB


S-3321-SB

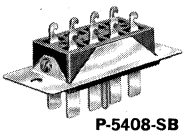
BEAUPLUG Series 5400

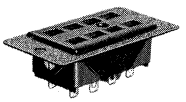
BEAUPLUG Series 5400 is interchangeable with Cinch-Jones 2400 Series. Rated at 250v at 15 amps. Molded bakelite bases; cadmium plated contacts (gold, silver and rhodium available); polypropylene backshells (metal available); and bright plated hardware.

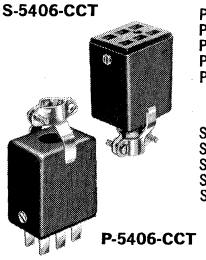
Series 5400 Plugs and Sockets are also made as: DB Deep Bracket Mounted; LAB Less Angle Bracket; FHE Flared Hole End; CCE Cable Clamp End. UL and CSA listed.


P-5408-AB

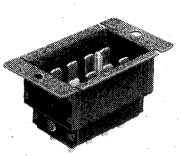

S-5408-AB


P-5408-SB


S-5408-SB


S-5406-CCT
P-5406-CCT

Beauchaine Number	Contacts	List	Each 1-49	Each 50-99	Each 100-249	Each 250-499
PLUGS — ANGLE BRACKETS MOUNTED (-AB)						
P-5404-AB	4	$1.12	$.672	$.56	$.448	$.426
P-5406-AB	6	1.27	.762	.635	.508	.483
P-5408-AB	8	1.45	.87	.725	.58	.551
P-5410-AB	10	1.76	1.056	.88	.704	.669
P-5412-AB	12	1.98	1.188	.99	.792	.752
SOCKETS — ANGLE BRACKETS MOUNTED (-AB)						
S-5404-AB	4	$1.27	$.762	$.635	$.508	$.483
S-5406-AB	6	1.46	.876	.73	.584	.555
S-5408-AB	8	1.70	1.02	.85	.68	.646
S-5410-AB	10	1.90	1.14	.95	.76	.722
S-5412-AB	12	2.12	1.272	1.06	.848	.806
PLUGS — SHALLOW BRACKETS MOUNTED (-SB)						
P-5404-SB	4	$1.26	$.756	$.63	$.504	$.479
P-5406-SB	6	1.47	.882	.735	.588	.559
P-5408-SB	8	1.60	.96	.80	.64	.608
P-5410-SB	10	1.93	1.158	.965	.772	.733
P-5412-SB	12	2.11	1.266	1.055	.844	.802
SOCKETS — SHALLOW BRACKETS MOUNTED (-SB)						
S-5404-SB	4	$1.38	$.828	$.69	$.552	$.524
S-5406-SB	6	1.61	.966	.805	.644	.612
S-5408-SB	8	1.87	1.122	.935	.748	.711
S-5410-SB	10	2.08	1.248	1.04	.832	.79
S-5412-SB	12	2.30	1.38	1.15	.92	.874
PLUGS — CABLE CLAMP TOP (-CCT)						
P-5404-CCT	4	$1.70	$1.02	$.85	$.68	$.646
P-5406-CCT	6	1.93	1.158	.965	.772	.733
P-5408-CCT	8	2.04	1.224	1.02	.816	.775
P-5410-CCT	10	2.35	1.41	1.175	.94	.893
P-5412-CCT	12	2.59	1.554	1.295	1.036	.984
SOCKETS — CABLE CLAMP TOP (-CCT)						
S-5404-CCT	4	$1.87	$1.122	$.935	$.748	$.711
S-5406-CCT	6	2.02	1.212	1.01	.808	.768
S-5408-CCT	8	2.28	1.368	1.14	.912	.866
S-5410-CCT	10	2.51	1.506	1.255	1.004	.954
S-5412-CCT	12	2.75	1.65	1.375	1.10	1.045


P-5408-DB


S-5408-DB

BEAUCAP Octal Plug Caps


2001

Series 2001 octal type plug and socket caps replace the metal caps with rubber grommets and fishpaper insulation. (Beau Products Division does not make the octal plugs and sockets.) Type 2001-1 caps have no hole for cable; Type 2001-2 have cable hole in top; Type 2001-3 have cable hole on side; Type 2001-4 have cable hole top with cable clamp. 4 NEMA colors: black, blue, red, and green.

SEE YOUR LOCAL REPRESENTATIVE LISTED IN E. E. M. YELLOW PAGES!

A VERNITRON COMPANY

Request 1969 Catalog for complete technical specifications

Vernitron Electrical Components
Beau Products Division
117 Union Avenue, Laconia, N.H. 03246
Tel: (603) 524-5101 TWX: 710-364-1843

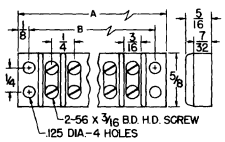
BEAU® Barrier Terminal Strips and Terminal Blocks



Open Back Barrier Terminal Strips

SERIES 10000 — 10 AMP

Wire size #26 to #22. Stand screw 2-56 x 3/16" brass, nickel-plated.

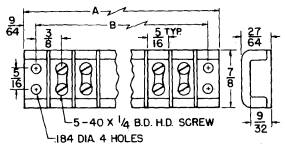


No. Circuits	A	B	No. Circuits	A	B
10001	3/4	1/2	10011	3 1/4	3
10002	1	3/4	10012	3 1/2	3 1/4
10003	1 1/4	1	10013	3 3/4	3 1/2
10004	1 1/2	1 1/4	10014	4	3 3/4
10005	1 3/4	1 1/2	10015	4 1/4	4
10006	2	1 3/4	10016	4 1/2	4 1/4
10007	2 1/4	2	10017	4 3/4	4 1/2
10008	2 1/2	2 1/4	10018	5	4 3/4
10009	2 3/4	2 1/2	10019	5 1/4	5
10010	3	2 3/4	10020	5 1/2	5 1/4

Closed Back Barrier Terminal Strips

SERIES 15000 — 15 AMP

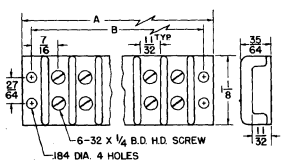
Wire size #22 to #16. Stand screw 5-40 x 1/4" brass, nickel-plated.



No. Circuits	A	B	No. Circuits	A	B
15001	1 1/32	3/4	15014	5 29/32	5 5/8
15002	1 13/32	1 1/8	15015	6 9/32	6
15003	1 25/32	1 1/2	15016	6 21/32	6 3/8
15004	2 5/32	1 7/8	15017	7 1/32	6 3/4
15005	2 17/32	2 1/4	15018	7 13/32	7 1/8
15006	2 29/32	2 5/8	15019	7 25/32	7 1/2
15007	3 9/32	3	15020	8 5/32	7 7/8
15008	3 21/32	3 3/8	15021	8 17/32	8 1/4
15009	4 1/32	3 3/4	15022	8 29/32	8 5/8
15010	4 13/32	4 1/8	15023	9 5/32	9
15011	4 25/32	4 1/2	15024	9 21/32	9 3/8
15012	5 5/32	4 7/8	15025	10 1/32	9 3/4
15013	5 17/32	5 1/4	15026	10 13/32	10 1/8

SERIES 19000 — 20 AMP

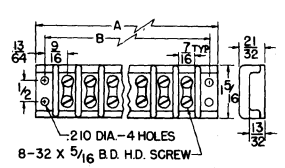
Wire size #16 to #14. Stand screw 6-32 x 1/4" brass, nickel-plated.



No. Circuits	A	B	No. Circuits	A	B
19001	1 3/16	7/8	19014	6 7/16	6 5/16
19002	1 5/8	1 5/16	19015	7 5/16	7
19003	2 1/16	1 3/4	19016	7 3/4	7 1/16
19004	2 1/2	2 3/16	19017	8 3/16	7 7/8
19005	2 15/16	2 5/8	19018	8 5/8	8 5/16
19006	3 3/8	3 1/16	19019	9 1/16	8 3/4
19007	3 13/16	3 1/2	19020	9 1/2	9 3/16
19008	4 1/4	3 15/16	19021	9 15/16	9 5/8
19009	4 11/16	4 3/8	19022	10 3/8	10 1/16
19010	5 1/8	4 13/16	19023	10 13/16	10 1/2
19011	5 5/16	5 1/4	19024	11 1/4	10 15/16
19012	6	5 11/16	19025	11 11/16	11 3/8
19013	6 7/16	6 1/8	19026	12 1/16	11 13/16

SERIES 22000 — 30 AMP

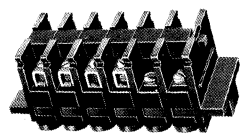
Wire size #14 to #12. Stand screw 8-32 x 5/16" brass, nickel-plated.



No. Circuits	A	B	No. Circuits	A	B
22001	1 17/32	1 1/8	22014	8 27/32	8 1/16
22002	2 3/32	1 11/16	22015	9 13/32	9
22003	2 21/32	2 1/4	22016	9 31/32	9 5/16
22004	3 5/32	2 13/16	22017	10 17/32	10 1/16
22005	3 25/32	3 3/8	22018	11 3/32	10 11/16
22006	4 11/32	3 15/16	22019	11 21/32	11 1/4
22007	4 25/32	4 1/2	22020	12 7/32	11 13/16
22008	5 5/32	5 1/16	22021	12 25/32	12 3/8
22009	6 1/32	5 5/8	22022	13 11/32	12 15/16
22010	6 13/32	6 3/16	22023	13 29/32	13 1/2
22011	7 5/32	6 3/4	22024	14 15/32	14 1/16
22012	7 23/32	7 5/16	22025	15 1/32	14 5/8
22013	8 5/32	7 7/8			

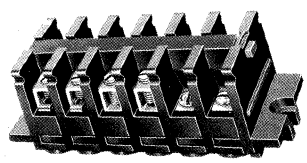
ADD-A-POINT Terminal Blocks

Medium Duty 600v, 5000 Series — Insulated moldings are of thermosetting phenolic material, Type CFG. Brass screw type connectors can be supplied with choice of box, pressure or screw type contacts. Pressure type features exclusive "Sure Grip" pressure pad design to insure against damage to the wire. **Series may be direct or channel mounted.**



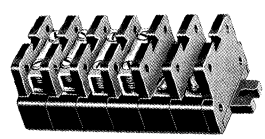
Model 5200

Heavy Duty 600v, 6000 Series — Material specification same as 5000 Series. Electrical specifications allow use of up to #4 wire with box type contacts. Available with either painted or plain marking surfaces.



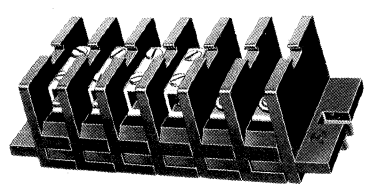
Model 6200

Miniature Medium Duty 600v, SM Series — Moldings are of thermosetting phenolic CFG material. Offering a low silhouette, these miniature blocks require less clearance than the conventional blocks. Available in box type, with or without pressure pad, or conventional screw contact. For service up to 40 amp.



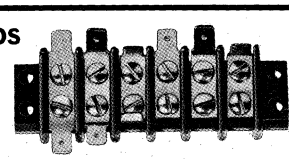
Model SM

Heavy Duty 600v, P Series — Molded with the same material as above models, this larger series is rated up to 60 amp service. Available with box, pressure type or screw contacts of pure electrolytic copper. Like other models, the P Series is available for channel or direct mounting.



Model P

FAST-TAB Barrier Terminal Strips



DIMENSIONS	DESCRIPTION	PART NO.	A	B	C	D	E	F	G
	TWO SIDED TAB FLAT	1410	1 3/8	.187	3/32	1/4	5/16	.136	—
		1810	1 5/8	.250	5/16	5/16	27/64	.144	—
		2110	1 53/64	.250	13/32	5/16	1/2	.171	—
	TWO SIDED TAB 45° ANGLE	1411	1 3/16	.187	3/32	1/4	5/16	.136	1 1/16
		1811	1 27/64	.250	5/16	5/16	27/64	.144	53/64
		2111	1 19/64	.250	13/32	5/16	1/2	.171	1 1/32
	TWO SIDED TAB 90° ANGLE	1412	—	.187	3/32	1/4	5/16	.136	1 1/16
		1812	—	.250	5/16	5/16	27/64	.144	53/64
		2112	—	.250	13/32	5/16	1/2	.171	1 1/32
Hole Dia.	ONE SIDED TAB FLAT	1413	1 3/16	.187	3/32	1/4	5/16	.136	—
		1813	1 5/32	.250	5/16	5/16	27/64	.144	—
		2113	1 3/8	.250	13/32	5/16	1/2	.171	—
	ONE SIDED TAB 45° ANGLE	1414	—	.187	3/32	1/4	5/16	.136	1 5/32
		1814	—	.250	5/16	5/16	27/64	.144	3/4
		2114	—	.250	13/32	5/16	1/2	.171	31/32
	ONE SIDED TAB 90° ANGLE	1415	—	.187	13/32	1/4	5/16	.136	1 5/32
		1815	—	.250	5/16	5/16	27/64	.144	3/4
		2115	—	.250	13/32	5/16	1/2	.171	31/32

Modified versions of standard Barrier Terminal Strips designed to save time and labor. 6 different terminal variations. Fastening can be made by riveting, eyeletting or with standard screws. All parts are of 1/32 brass, cadmium plated.

Vernitron Electrical Components
Beau Products Division
117 Union Avenue, Laconia, N.H. 03246
Tel: (603) 524-5101 TWX: 710-364-1843

VECTOR PATCHBOARDS

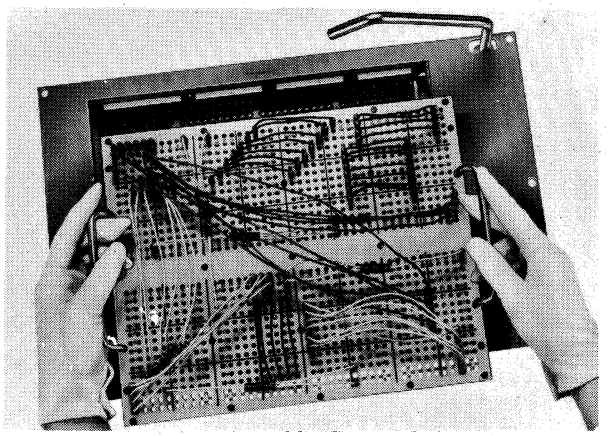
REMOVABLE PANEL PRE-PROGRAMING TYPE

- **Guaranteed Post Patching Capability Without Contact Damage**
- **All connections make and break simultaneously**
- **Mount In any position for space conservation**

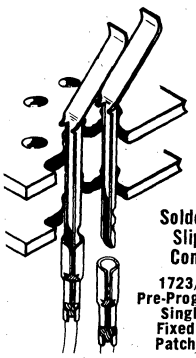
Reliable, low cost, Vector Pre-Programing Patchboard units function like a multiple contact switch to engage and disengage up to 1200 contacts simultaneously with a single lever action. The units are most useful where: 1. Maximum flexibility of connection arrangements is required. 2. A variety of connection setups must be changed quickly and without error. 3. Quick retrieval and reuse of a previous connection arrangement is desirable.

Vector Pre-Program Patchboards are easy to use. Depressing the hand lever (see picture) causes the patch cord tips, previously arranged in a removable panel, to make a wiping contact with fixed receptacle frame contacts connected to associated equipment. Wiring tabs are supplied standard for solder or solderless slip-on contact, or for wire wrap. Contact springs are beryllium copper heat treated for long life, nickel plated or gold flashed. Receptacle frame is gray steel, heat treated on wear points.

Predrilled Rack Panel Adapter Plates available.

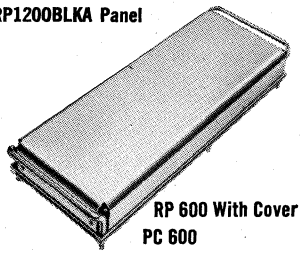


PPB 1200 with RP1200BLKA Panel

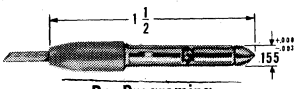


Solderless Slip-On Contact

1723/1 fits Pre-Programming Single and Fixed Panel Patchboards



RP 600 With Cover PC 600



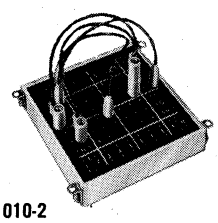
Pre-Programing Patch Cord Plug

ORDERING INFORMATION

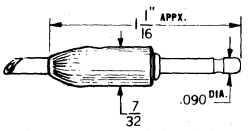
Recept. Frame Cat. No.	Outside Dimen. W.	Outside Dimen. H.	No. of Contacts	Mating Remov. Panels Unmarked Cat. No.	Mating Remov. Panels Std. marked Cat. No.
PPB204	10⅜″	6″	204	RP204BLK	RP204BLKA
PPB300	10⅜″	6″	300	RP300BLK	RP300BLKA
PPB450	16″	6″	450	RP450BLK	RP450BLKA
PPB600	16″	6″	600	RP600BLK	RP600BLKA
PPB1200	17″	10¾″	1200	RP1200BLK	RP1200BLKA

Depth beyond panel is 2⅝″.

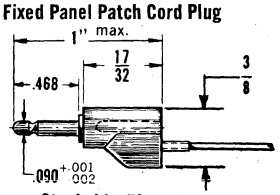
Single Patch cords available 6″, 9″, 15″, 24″. Order as K-3.06, K3.09, K3.15, K3.24. Jumper specify Cat. No. KP-1. Doubles and triples for shielding, "Splits" and cords with molded integral diodes available.



PB-1010-2



Fixed Panel Patch Cord Plug



Stackable Piggy Back

Fixed Patchboards

Cat. No.	Contacts	Outside Dimensions W.	Outside Dimensions H.
PB33-2	9	1.130″	1.130″
PB110-2	10	2.985″	.600″
PB210-2	20	2.985″	.865″
PB510-2	50	2.985″	1.660″
PB1010-1	100	3.250″	3.250″
PB1010-2	100	2.985″	2.985″
PB1020-2	200	5.635″	2.985″
PB1520-2	300	5.635″	4.310″

Fixed Panel Patchboard Cords

Standard	Piggyback	Lgth.
K2.06	K9.06	6″
K2.09	K9.09	9″
K2.15	K9.15	15″
K2.02-1	—	Jumper

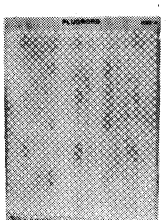
FIXED PANEL TYPE

Fixed Panel style Patchboards provide reliable low cost single conductor patching on control and test panels where pre-programing is not required. Low resistance beryllium copper, gold flashed contacts are independent wrap-around type and located on .265″ centers.

Single wire, piggy-back, splits, and jumper type programming patch cords are available. Permanent connections are made by soldering wires or using solderless slip-in contacts, crimped to wires (see above) on the rear of the boards. Boards listed have standard white alpha-numeric markings front and back and brackets are furnished as standard.

Special Sizes

Larger contact systems can be made by mounting standard panels adjacent. Special sizes up to 2200 contacts are readily made to order at minimum cost. Special marking and screening in colors are also available. Insulation material is black Epoxy .093″ thick. Terminals are beryllium copper, heat treated, nickel plated gold flashed per QQS-365. Plug tips are nickel plated brass and if so specified, gold flashed.

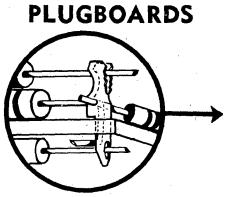


838A



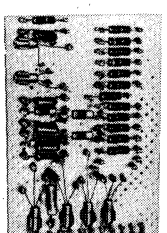
R644

PLUGBOARDS

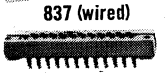


MINI-KLIP T28

Similar Type Plugboards with .042″ diameter holes spaced .1″ x .1″ available for D.I.P.'s



837 (wired)



R612-1

Receptacles listed are glass filled diallyl phthalate.

Use Plugboards with attached contacts for test circuits. P.C. prototypes and short runs. Precision pre-punched 1/16″ diameter holes on alternate 0.1″ centers permit maximum flexibility of component location. Vector T28 MINI-KLIPS, eyelets, or standard turned terminals may be located wherever desired. For maximum economy use epoxy paper boards; for military specification requirements or additional strength use epoxy glass. All Plugboards are 1/16″ thick and are available with Elco Varicon or 2 oz. copper etched contacts. Epoxy paper boards meet requirements MIL-P-22323 type PEE; Epoxy glass is G-10 grade per MIL-P-18177. Copper clad Epoxy paper meets MIL-P-13949 type PX, and copper-clad Epoxy glass meets MIL-P-13949B type FLGE-91.

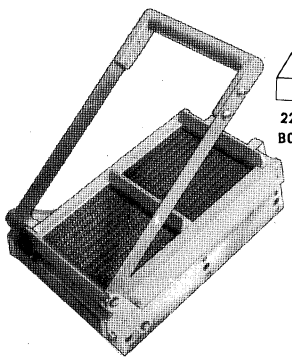
Catalog No.	Description	Matching Receptacle
812	4½″x6½″ Epoxy Paper, 16 Varicon contacts	R616-1
812WE	4½″x6½″ Epoxy Glass, 16 Varicon contacts	R616-1
837	3″x4½″ Epoxy Paper, 12 Varicon contacts	R612-1
837WE	3″x4½″ Epoxy Glass, 12 Varicon contacts	R612-1
838	4½″x6½″ Epoxy Paper, 43 Etched Contacts, 2 sides	R644
838A	4½″x6½″ Epoxy Paper, 22 Etched Contacts, 1 side	R644
838AWE	4½″x6½″ Epoxy Glass, 22 Etched Contacts, 1 side	R644
838WE	4½″x6½″ Epoxy Glass, 43 Etched Contacts, 2 sides	R644
848WE	4½″x6½″ Epoxy Glass, 35 Varicon Contacts	R635
T28	Miniature push-in terminal, beryllium copper, fused tin. Bags of 100 & 1000	—
838WE-1GN	4½″x6½″ Epoxy Glass, 43 etched contacts	R644
838AWE-1GN	4½″x6½″ Epoxy Glass, 22 Etched Contacts	R644

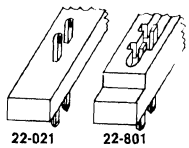
Plugboards listed with GN suffix have nickle plated gold flashed contacts

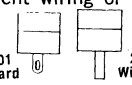
VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Sylmar, Calif. 91342 Area 213 Phone 365-9661

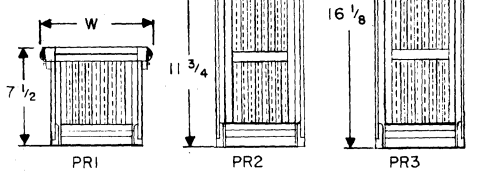
VELCO CIRCUIT PROGRAMMING SYSTEMS

The VELCO Circuit Programming System offers unique, patented features which contribute to its superior flexibility and reliability. With VELCO circuit programming, interconnection patterns can be changed easily and quickly. The basic mating configuration is a knife switch which makes positive contact. When contacts mate, there is full wiping action with a contact pressure of approximately two pounds (as compared to ounces in other competitive arrangements). A wide variety of contact assemblies (from 110 to over 3000) is possible because of the modular arrangement of VELCO standard stock, 22-pin, module contact strips. The VELCO Circuit Programming System is available for either permanent wiring or patching.









PR1 No. of Contacts	PR1 W Width	PR2 No. of Contacts	PR2 W Width	PR3 No. of Contacts	PR3 W Width
110	3 25/32	220	4 3/32	330	4 3/32
132	4 3/16	264	4 7/16	396	4 7/16
154	4 17/32	308	4 25/32	462	4 25/32
176	4 7/8	352	5 1/8	528	5 1/8
198	5 1/32	396	5 15/32	594	5 15/32
220	5 1/16	440	5 13/16	660	5 13/16
242	5 9/32	484	6 5/32	726	6 5/32
264	6 1/4	528	6 1/2	792	6 1/2
286	6 1/32	572	6 27/32	858	6 27/32
308	6 13/16	616	7 3/16	924	7 3/16
330	7 5/32	660	7 17/32	990	7 17/32
352	7 5/8	704	7 7/8	1056	7 7/8
374	7 31/32	748	8 1/32	1122	8 1/32
396	8 3/16	792	8 5/16	1188	8 5/16
418	8 21/32	836	8 29/32	1254	8 29/32
440	9	880	9 1/4	1320	9 1/4
462	9 1/32	924	9 9/32	1386	9 9/32
484	9 1/16	968	9 13/16	1452	9 13/16
506	10 1/32	1012	10 5/32	1518	10 5/32
528	10 3/8	1056	10 5/8	1584	10 5/8
550	10 23/32	1100	10 31/32	1650	10 31/32
572	11 1/16	1144	11 5/16	1716	11 5/16
594	11 5/32	1188	11 21/32	1782	11 21/32
616	11 3/4	1232	12	1848	12
638	12 3/32	1276	12 11/32	1914	12 11/32
660	12 7/16	1320	12 11/16	1980	12 11/16

VELCO FIXED PATCHBOARDS

Description	Part No.	Height
Single Deck	FB1-XXX	6 5/16"
Double Deck	FB2-XXX	11"
Triple Deck	FB3-XXX	15 7/16"

NOTE: "W" denotes width of board.
XXX denotes No. of contacts.

OVER 2500 CONTACTS IN 14" OF RACK SPACE ON A STANDARD 19" RACK PANEL

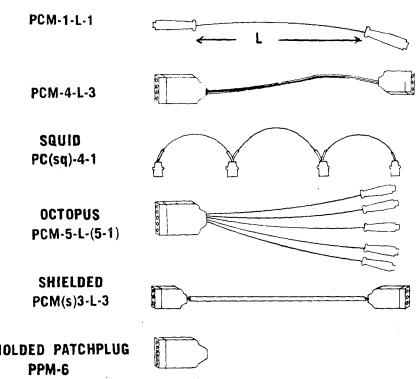
FEATURING:

- **FLEXIBILITY AND RELIABILITY.**
- **MORE EFFICIENT UTILIZATION OF PANEL SPACE.**
- **RACK PANEL MOUNTED, *(Optional to customer's instructions).**
- **MARKING: Engraved or etched blanking strips available, mounted where customer specifies.**

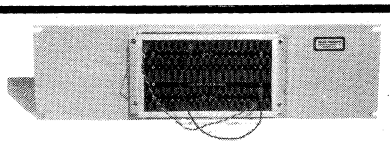
SPECIFICATIONS	Patchboard	Patchcord
A. MATERIALS AND FINISHES:		
All materials and finishes meet requirements of MIL-E-16400.	x	x
MATERIAL — FINISH		
Aluminum — Alkali etch, Iridite	x	
Stainless — Passivate	x	
Painted finishes optional		
B. DIELECTRIC MATERIALS:		
Molded Diallyl Phthalate	x	x
Molded Silicone Rubber		x
Polyethylene		x
C. CONTACTS:		
Brass, gold plate over albaloy	x	
Beryllium copper, gold plated		x
D. ELECTRICAL RATINGS		
Current: 5 amps		
Voltage: 600 volts rms at sea level		
Breakdown: 3200 volts d.c. between contacts		
Voltage drop: 5 millivolts at 2 amperes (max.)		

MULTICIRCUIT PATCHCORDS (from 1 to 22 contacts)

Available in many types and combinations. Molded in polyethylene or silicone rubber.



"L" DENOTES OVERALL LENGTH OF WIRE

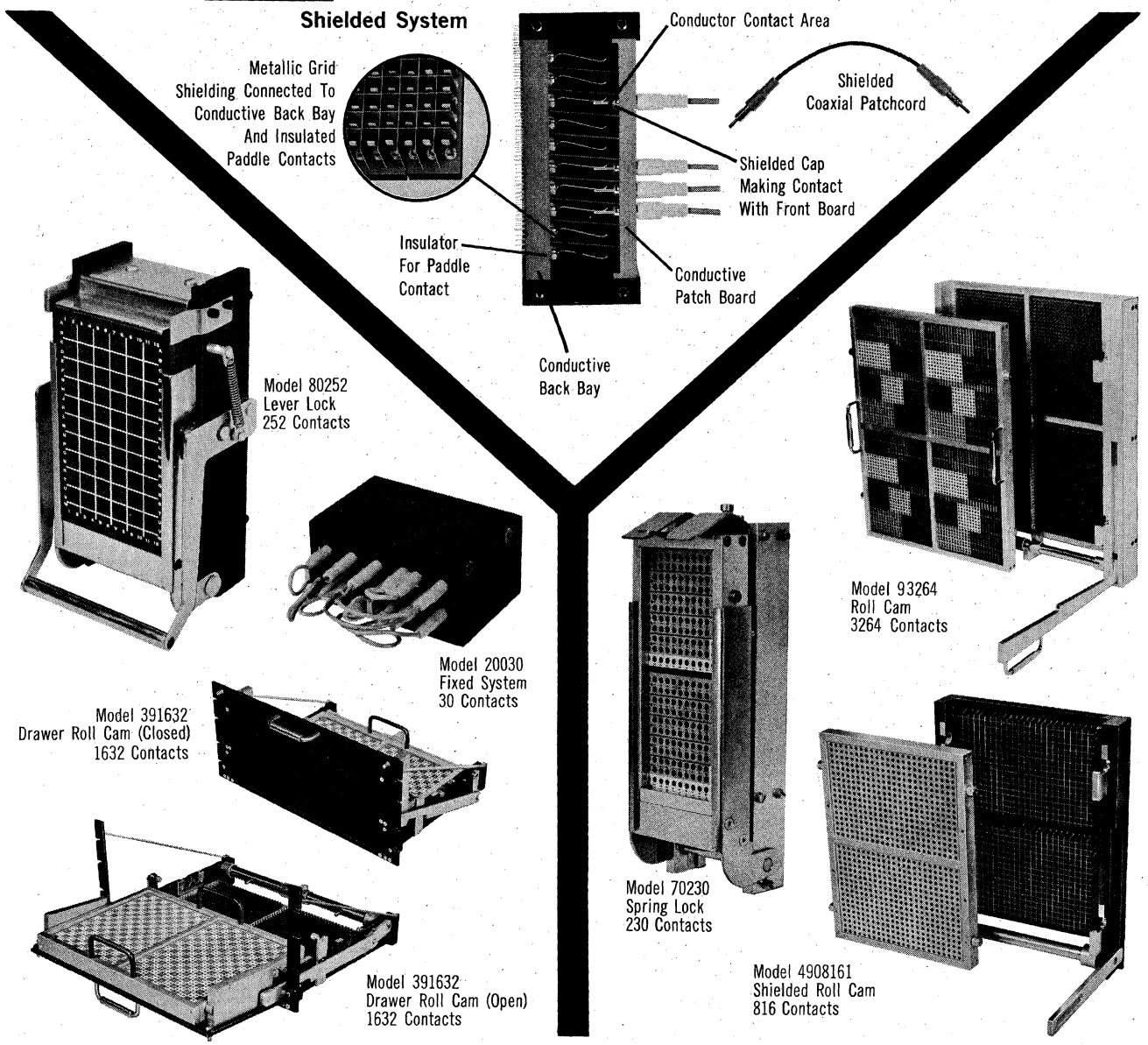


***RACK MOUNTING** (Optional)
All sizes of boards can be supplied on a standard 19" rack panel thus:
(A) Modules Vertical: (Max. 50 modules)
Type FB1 on 7" panel (as illustrated)
Type FB2 on 12¼" panel
Type FB3 on 15¾" panel, etc.
(B) Modules Horizontal:

Panel Size No. of Modules	3½ 9	5¼ 14	7 19	8¾ 24	10½ 29	12¼ 34	14 39
(CONTACTS):							
FB1 Single Deck	198	308	418	528	638	748	858
FB2 Double Deck	396	616	836	1056	1276	1496	1716
FB3 Triple Deck	594	924	1254	1584	1914	2244	2574

FB1 Single Deck (Contacts)	FB2 Double Deck (Contacts)	No. of Modules	FB1 W	FB2 W
110		5	1.965	
132		6	2.308	
154		7	2.651	
176		8	2.994	
198		9	3.337	
220	220	10	3.680	1.965
242		11	4.023	
264	264	12	4.366	2.308
286		13	4.709	
308	308	14	5.052	2.651
330		15	5.395	
352	352	16	5.738	2.994
374		17	6.081	
396	396	18	6.424	3.337
418		19	6.767	
440	440	20	7.110	3.680
462		21	7.453	
484	484	22	7.796	4.023
506		23	8.139	
528	528	24	8.482	4.366
550		25	8.825	
572	572	26	9.168	4.709
594		27	9.511	
616	616	28	9.854	5.052
638		29	10.197	
660	660	30	10.540	5.395
682		31	10.883	
704	704	32	11.226	5.738
726		33	11.569	
748	748	34	11.912	6.081
770		35	12.255	
792	792	36	12.598	6.424
814		37	12.941	
836	836	38	13.284	6.767
858		39	13.627	
880	880	40	13.970	7.110
902		41	14.313	
924	924	42	14.656	7.453
946		43	14.999	
968	968	44	15.342	7.796
990		45	15.685	
1012	1012	46	16.028	8.139
1034		47	16.371	
1056	1056	48	16.714	8.482
1078		49	17.057	
1100	1100	50	17.400	8.825

VIRGINIA ELECTRONICS CO., INC. • 2908 TELESTAR CT., FALLS CHURCH, VA. 22042 • PHONE: (703) 560-6500
SPECIALISTS IN COMMUICATION CONTROL AND AMPLIFIER SYSTEMS



VPC'S VERSATILITY INCREASES EFFICIENCY AND PROGRAMMING ABILITY

Virginia Panel Corporation offers a complete selection of programming systems ranging from 30 to 5,120 connections in three basic designs, **plus** custom designs to individual specifications.

In addition VPC now offers a new concept in shielded patchcord programming systems* . . . lower cost by using locking patchcords, molded conductive shielded type board. Module design offers great flexibility. Metallic-shielded paddle contacts reduce crosstalk, restrict outside interference. Drawer type systems permit lateral use of console space . . . release up to 50% more front panel area.

VPC systems permit quick changing for any use . . . test equipment, communication equipment, computers, automation controls. Design and construction permit either preprogramming of control panels or post patching while panel is engaged in receiver. Because of the interchangeability of many control panels with one receiver, previously programmed controls for established wiring combinations can be stored.

Camming action, spring contact and double wiping action, assure positive contact of mating connections. Both manual and permanent patchcords are available.

No. 20 AWG wire, covered with flexible (PVC) polyvinylchloride, is used in making patchcords. Durable materials and precise craftsmanship make possible the **unconditional guarantee** of VPC Patchcord Programming systems.

Contact Virginia Panel Corporation or your VPC Representative for additional information.

*Patents Applied

VPC

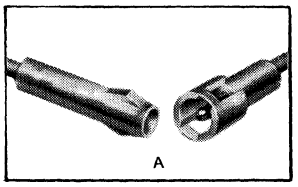
VIRGINIA PANEL CORPORATION

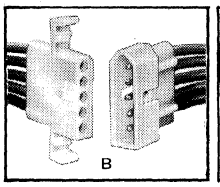
QUALITY • SERVICE • INTEGRITY

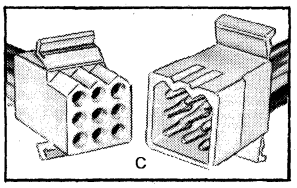
P.O. Box 1106 • Waynesboro, Virginia 22980 • Call Area Code 703 942-8376

waldom/molex nylon connectors

250 VOLTS PER CIRCUIT







Waldom/Molex Connectors offer incomparable reliability, versatility and economy. Save time and labor. Nylon Miniature Connectors are available in 1 to 36 circuits and standard connectors from 1 to 15 circuits. Most types have integrally molded mounting ears for ease of panel mounting. All connectors, with the exception of single circuit types, are polarized. Both male and female pin terminals of the same mating diameters can be intermixed in the same housing. Waldom/Molex provides a complete range of manual production and prototype hand tools. Both male and female terminals may be extracted and easily replaced using ejector tools.

	Catalog Number	Configuration	No. of Circuits	Fig.	W/Mounting Ears Plug	W/Holding Tabs Receptacle	W/Mounting Ears Receptacle	Amps. per Circuit	Std. Pkg.	Per Pkg.	100-499 Per C	500-Over Per C
Miniature Nylon Connector Housings	1625-1P	Plug	1	A				5	10	$ .70	$ 4.80	$ 4.00
	1625-1R	Receptacle	1	A		X		5	10	.60	4.15	3.50
	1625-3P	Plug	3	B	X			5	10	1.20	9.00	7.40
	1625-3R	Receptacle	3	B		X	X	5	10	1.40	10.15	8.35
	1625-4P	Plug	4	B				5	10	2.45	17.75	14.65
	1625-4R	Receptacle	4	B		X		5	10	2.55	17.90	14.70
	1625-5P	Plug	5	B				5	5	.95	13.30	10.95
	1625-5R	Receptacle	5	B		X	X	5	5	1.15	16.80	13.85
	1625-6P	Plug	6	C				5	5	.90	12.50	10.30
	1625-6R	Receptacle	6	C		X	X	5	5	1.05	14.10	11.60
	1649-8P	Plug	8	B				5	5	1.15	15.35	12.65
	1649-8R	Receptacle	8	B		X	X	5	5	1.30	18.55	14.80
	1625-9P	Plug	9	C	X			5	5	.95	13.30	10.95
	1625-9R	Receptacle	9	C		X	X	5	5	1.05	15.05	12.40
	1625-12P	Plug	12	C	X			5	5	1.15	15.70	12.90
	1625-12R	Receptacle	12	C		X	X	5	5	1.15	15.90	13.15
	1625-15P	Plug	15	C	X			5	5	1.50	21.90	18.05
	1625-15R	Receptacle	15	C		X	X	5	5	1.65	24.70	20.40
	1772-36P	Plug	36	C	X			4	5	5.75	84.00	68.15
	1772-36R	Receptacle	36	C			X	4	5	5.95	87.50	71.35
Standard Connector Housings	1619P	Plug	1	A				12	10	.72	5.20	4.05
	1619R	Receptacle	1	A		X		12	10	.61	4.55	3.55
	1545P	Plug	2	B	X			12	10	1.16	8.50	6.55
	1545R	Receptacle	2	B		X	X	12	10	1.20	8.80	6.70
	1396P	Plug	3	B	X			12	10	1.14	8.30	6.40
	1396R	Receptacle	3	B		X	X	12	10	1.26	9.40	7.25
	1490P	Plug	4	B	X			9	10	1.30	9.45	7.35
	1490R	Receptacle	4	B		X	X	9	10	1.47	10.70	8.25
	1653P	Plug	5	B				9	5	.80	12.70	9.85
	1653R	Receptacle	5	B		X		9	5	1.12	16.30	12.60
	1261P	Plug	6	C	X			9	5	.88	12.80	10.15
	1261R	Receptacle	6	C		X	X	9	5	.98	14.55	11.45
	1292P	Plug	9	C	X			9	5	1.00	15.10	11.90
	1292R	Receptacle	9	C		X	X	9	5	1.14	16.40	12.90
	1360P	Plug	12	C	X			7.5	5	1.17	17.00	13.35
	1360R	Receptacle	12	C			X	7.5	5	1.23	17.60	13.85
	1375P	Plug	15	C	X			7.5	5	1.40	19.90	15.65
	1375R	Receptacle	15	C			X	7.5	5	1.58	22.40	17.60

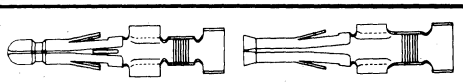
Housings are less pin terminals — order from chart below.

	Catalog Number	Configuration	Mating Diameter	Wire Size 16	18	20	22	24	26	28	30	Std. Pkg.	100-999 Per C	1,000-4999 Per M	5,000-Over Per M
Pin Terminals for above housings	1189	Female	.093"	X	X	X						100	$3.05	$20.75	$15.25
	1190	Male	.093"	X	X	X						100	3.05	20.75	15.25
	1380	Male	.093"		X	X	X	X	X	X		100	3.05	20.75	15.25
	1381	Female	.093"		X	X	X	X	X	X		100	3.05	20.75	15.25
	1433	Female	.093"				X	X	X	X	X	100	3.05	20.75	15.25
	1434	Male	.093"				X	X	X	X	X	100	3.05	20.75	15.25
	1560	Male	.062"		X	X	X					100	3.70	25.10	18.50
	1561	Female	.062"		X	X	X					100	3.70	25.10	18.50
	1854	Male	.062"					X	X	X	X	100	3.70	25.10	18.50
	1855	Female	.062"					X	X	X	X	100	3.70	25.10	18.50

NOTE: .093" Pin Terminals are used with Standard Connectors.
.062" Pin Terminals are used with Miniture Connectors.

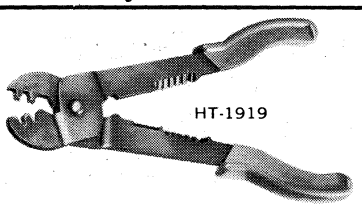
Material: Spring tempered tin-plated brass.
Also available with soldering tails. Write for details.

Waldom/Molex Tooling



Use with Pin Types	Prototype Hand Tool	Each	Manual Production Tool	Each
1189-1190	HT-1919	$4.35	HT-1031-C	$25.00
1380-1381	HT-1919	4.35	HT-1031-C	25.00
1433-1434	HT-1921	4.35	HT-1708	50.00
1560-1561	HT-1921	4.35	HT-1719-C	40.00
1854-1855	HT-1921	4.35	HT-1885	45.00

An ejector tool is included with each crimping tool at no extra cost for easy removal of pins for changes in circuitry. Will not damage pins.



Available at your Waldom Distributor. Write for Waldom/Molex Catalog.

These products are manufactured by Molex Products Co. and are available from Electronic/Electrical Distributors through Waldom Electronics, Inc.

waldom ELECTRONICS, INC. 4633 W. 53rd Street, Chicago, Illinois 60632

PLUGMOLD® MULTIOUTLET SYSTEMS FOR ELECTRONIC APPLICATIONS

Plugmold systems: the versatile, efficient way to organize electrical wiring and devices

To contain power wiring — along with a variety of outlets, switches, jacks, circuit breakers and other devices — use versatile Plugmold systems. Rugged, attractive Plugmold systems accommodate 14 to 2/0 AWG wire and accept a variety of electrical devices up to 60A, circuit breakers to 100A.

- With outlets and other devices placed where you need them, Plugmold adds efficiency and convenience wherever it is used.
- Made of steel, Plugmold protects wiring and keeps it accessible.
- A complete line of fittings makes it easy to apply Plugmold to almost any wiring situation.
- All Plugmold multioutlet assemblies and fittings are listed by Underwriters' Laboratories, Inc., and Canadian Standards Association.
- For engineering assistance, contact your nearest Wiremold representative — listed in the EEM yellow section.

Plugmold with prewired outlets

PLUGMOLD 2000 and 2200: Furnished completely prewired (No. 12 Type TW). Grounding outlets (15A, 125V) are spaced at regular intervals.

Outlet Spacing: 6, 9, 12, 18, 30, 60″ on centers.

Lengths: 1, 3, 5, 6′, and in Snapicoil® prewired harness up to 500′.

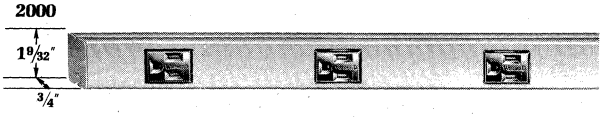
Circuit arrangements . . .

G Series: 2-wire, 1-circuit; Plugmold base serves as grounding conductor.

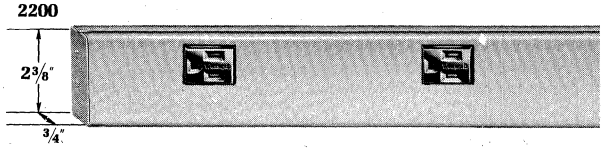
GA Series: 3-wire, 2-circuit; outlets wired alternately; Plugmold base serves as grounding conductor.

GB Series: 2-wire, 1-circuit; has insulated grounding conductor. (On special order, GB series available with insulated, isolated grounding conductor.)

2000



2200



Other Plugmold systems

Four types are furnished unwired. Outlets and other devices may be spaced as desired.

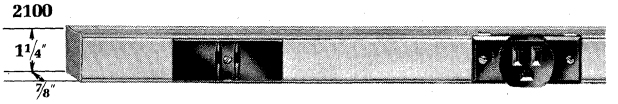
PLUGMOLD 2100: For use with various receptacles made by Wiremold (15A, 125V; 15A, 250V; 15A, 277V; and 20A, 125V). Devices include 2- and 3-wire receptacles, Lumiline single receptacle, single-pole switch, and keyless socket. Accepts wiring from 14 to 6 AWG. Devices can also be installed in 1-, 2-, and 3-gang Wiremold boxes as desired.

PLUGMOLD 3000: For use with most outlets (up to 50A) and devices designed for a 1-gang box. Accepts wiring from 14 to 2 AWG.

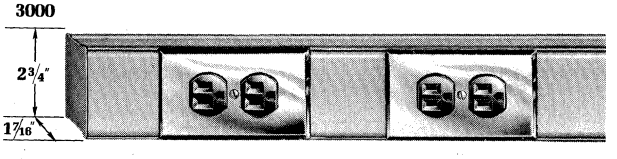
PLUGMOLD G-4000: Used with or without channel divider strip. With divider, one compartment holds power wiring (devices to 20A), the other carries low potential (communications, etc.) circuits. Without divider, the full channel accepts devices to 50A. Max. depth of devices, 1 5/8″. Accepts wiring from 14 to 2 AWG.

PLUGMOLD G-6000: For use with most outlets (up to 60A) and devices designed for a 1- or 2-gang box. Holds circuit breakers (to 100A). Accepts wiring from 14 to 2/0 AWG.

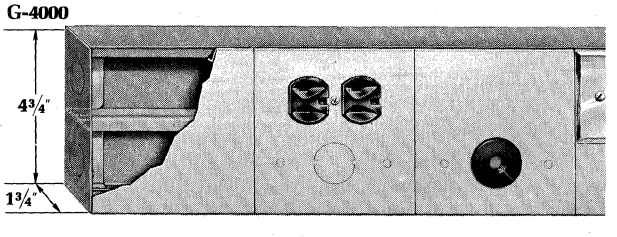
2100



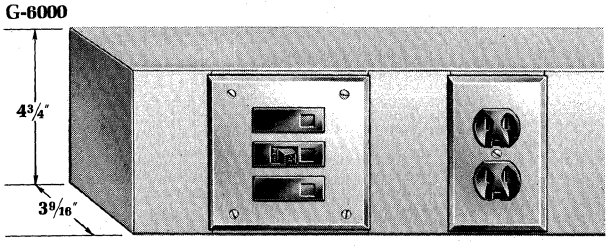
3000



G-4000



G-6000



SEND FOR WIREMOLD "ELECTRICAL PRODUCTS" CATALOG 685 AND SELECTION GUIDE

THE WIREMOLD COMPANY • HARTFORD, CONNECTICUT 06110

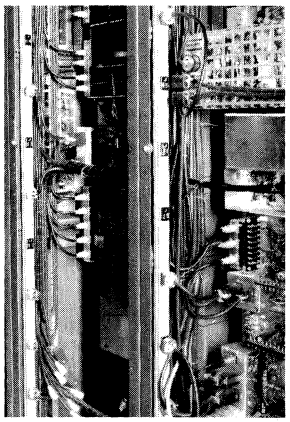
WIREMOLD®

PLUGMOLD® MULTIOUTLET SYSTEMS FOR ELECTRONIC APPLICATIONS

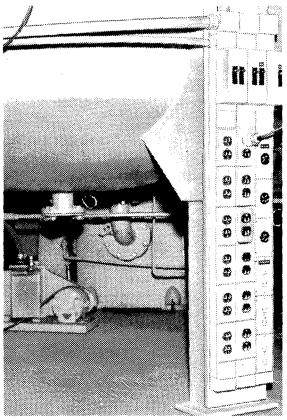
Typical uses of Plugmold

On original equipment: Plugmold adds value, convenience and efficiency to control consoles, cabinets, racks, benches, chassis, modular equipment, data processing equipment, trailers, shelters, etc.

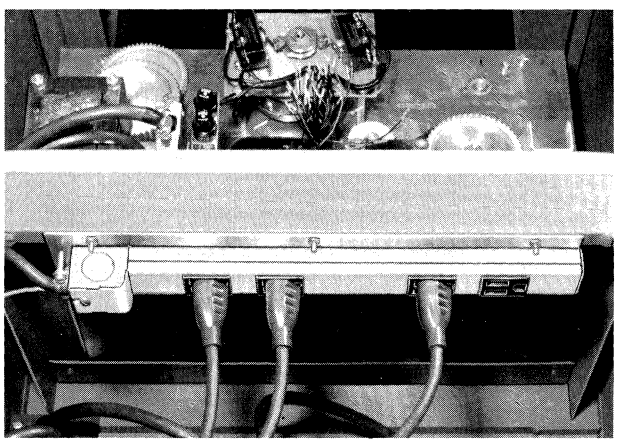
In laboratory and production areas: Use Plugmold on benches, over benches, on walls and partitions — wherever you need to put electricity to work.



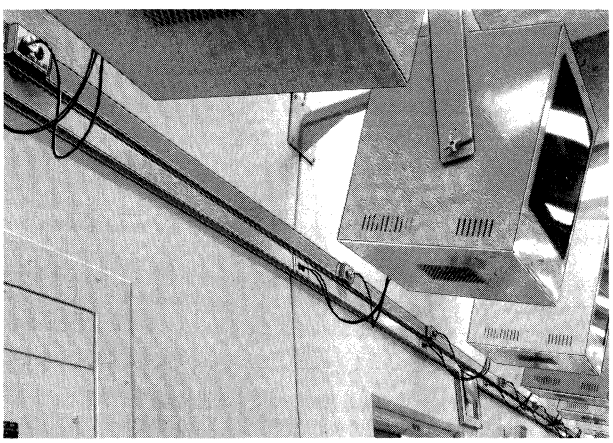
Strips of Plugmold in cabinets feed radio/TV transmitting equipment. *WTIC Broadcast House, Hartford, Conn.*



Rotary accelerator has Plugmold on leg to handle a variety of services. *G.E. Space Center, Valley Forge, Pennsylvania.*



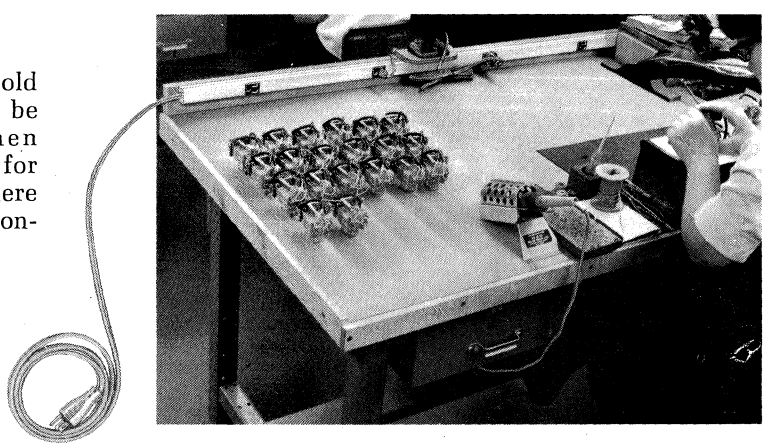
Central time transmitter in computer uses Plugmold to feed power to fan, clocks, etc. *Friden, Inc., Rochester, N.Y.*



Plugmold brings power wiring and antennae leads to closed-circuit TV monitors. *J. F. Kennedy Space Center.*

20CSK Cord Set Kit

The Cord Set Kit converts runs of Plugmold 2000 into portable power units that can be easily moved with work benches, then plugged in again at a new location. Ideal for laboratory and production situations where changing needs require frequent repositioning of benches.



WIREMOLD®

SOLD BY ELECTRICAL DISTRIBUTORS EVERYWHERE

AAC AMERICAN AEROSPACE CONTROLS, INC.

INSTRUMENTATION AND CONTROL DEVICES

• CURRENT, POWER AND PHASE SENSORS • ANALOG FUNCTION MODULES • MAGNETIC FLUX SENSITIVE ELEMENTS

SENSORS • CURRENT • POWER • PHASE

CURRENT • AC OR DC

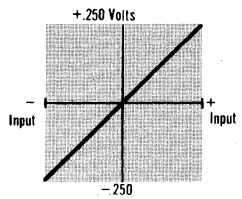
Current sensors for measurement and control of AC or DC current featuring linear output electrically isolated from current carrying line. Fast response is available from most models with low power consumption and faithful reproduction of input waveform. Applications include high potential line measurements.

2006



FAST RESPONSE, MINIATURE SIZE

Current Ranges Available AC or DC Amps
250
200
150
100
50
25



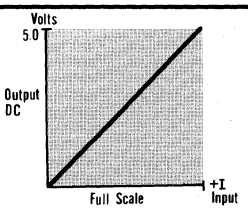
Output Volts	250 mv
Response	1μs
Linearity	±2.0%
Temp. Stability	0.1%/°C
Excitation DC or AC	7-15 VDC
Weight	1.0 oz.
Size	1 x 1 x 1

3009A



HIGH ACCURACY, HIGH OUTPUT

Current Ranges Available DC Only Amps	
100	0.2
50	0.1
20	0.05
10	0.02
5	0.01
2	0.005
1	0.002
0.5	0.001



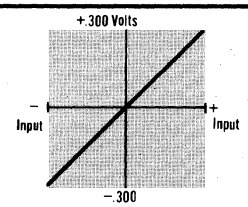
Output Volts	5.0 V
Response	10 ms
Accuracy	±1%
Temp. Stability	.04%/°C
Excitation DC	24-32 VDC
Weight	7.0 oz.
Size	1⅝ x 1⅝ x 2⅜

3011



FAST RESPONSE, ECONOMY

Current Ranges Available AC or DC Amps	
300	5
200	2
150	1
100	0.5
50	0.2
10	0.1



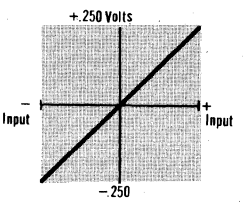
Output Volts	250 mv
Response	5μs
Linearity	±2.0%
Temp. Stability	0.1%/°C
Excitation DC or AC	10-20 V
Weight	5.0 oz.
Size	1 x 2 1/16 x 1¾

4008



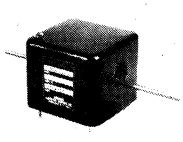
HIGH CURRENT, REMOVABLE YOKE

Current Ranges Available AC or DC Amps
5000
2500
1500
1000
750
500
250
150



Output Volts	250 mv
Response	200μs
Linearity	±2.0%
Temp. Stability	0.15%/°C
Excitation DC or AC	24-32 VDC
Weight	1.5 lbs.
Size	1 1/16 x 3¼ x 4⅝

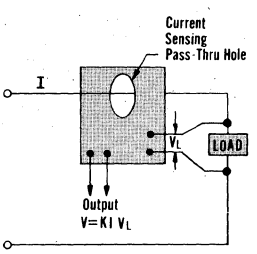
POWER • AC • DC



SERIES 4004

Instantaneous watt transducers suitable for measurement and control of AC or DC power. Models with current ranges of 50 amps and greater available with "THRU HOLE" permitting power measurements to be made without breaking into power line. The linear voltage output is the true product of current and voltage. Most models feature fast response.

Series Ranging	Range (watts)	Range (amps)	Output Voltage	Response
From WT3011	10 to 6000	0.5 to 300	0-300mv	5μs
To WT4007	3000 to 100K	150 to 5000	0-250mv	200μs

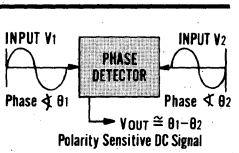


PHASE • VARS



Series 2000

Units similar in size and configuration to the Current Series available for use as phase detectors. Output is DC offset signal proportional to cosine of the phase angle between the two inputs. Output is zero DC at 90° and 270° phase angle; maximum of ±125 millivolts at 0° and —125 millivolts at 180° phase angle. Excellent for null detection.



Characteristics in above specifications are typical and indicate general area of operations. We welcome your inquiry for models with other inputs/outputs; operating capabilities; configurations, etc. Standard units are extremely flexible and readily adapted to special requirements. Our application staff is available to help with solutions to your specific problems. Contact factory or engineering representatives for further information.

ANALOG FUNCTION MODULES

MULTIPLIERS • SQUARING, SQUARE ROOT, DIVIDERS

Solid state flux controlled magnetoresistance bridges designed to meet exacting requirements for analog multiplication, modulation, signal mixing, division, squaring, square root extraction etc. Component features electrical isolation between inputs, low noise and null, low distortion and phase shift.

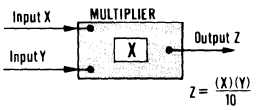
AM700



PLUG IN MULTIPLIER
FULL FUNCTION

TYPICAL MULTIPLIER SPECIFICATIONS	
Input X	±10V
Input Y	±10V
Output	±10V 5ma
Accuracy	±1% single quadrant ±1.5% four quadrant
Temp. Range (op)	0-70°C
Size	1.125 x 2 x .625

ELECTRICAL SCHEMATIC

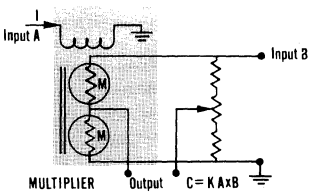


3000



ECONOMY MULTIPLIER
SINGLE BRIDGE

Input A	0-6ma; 0-10V to 0-250ma; 0-.225V
Input B	0-18V
Output C	0-700mv
Linearity	±2%
Null	−90db at 400Hz
Temp. Range	−55°C to +85°C
Size	1⅝ x 1⅝ x 1 1/16

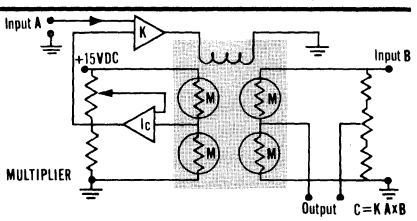


3050



HIGH ACCURACY
MULTIPLIER

Input A	0-9ma; 0-16V to 0-360ma; 0-.324V
Input B	0-18V
Output C	0-700mv
Linearity	±0.25%
Null	−90db at 400Hz
Temp. Range	−55°C to +85°C
Size	1⅝ x 1⅝ x 1 1/16



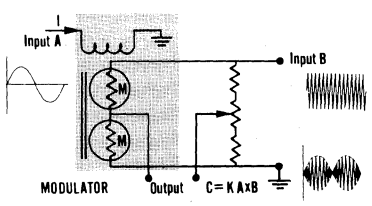
MODULATORS



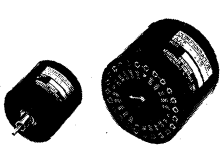
Series 2000

Ideal for controlling an AC carrier with a DC or low frequency input. Carrier frequencies of up to 1MHz can be modulated from DC to 400Hz with very low phase shift.

Units feature linear characteristics and distortion-free performance. These versatile modules can also be used for a wide range of demodulator applications.



FUNCTION GENERATORS • ANGULAR ERROR COMPENSATORS

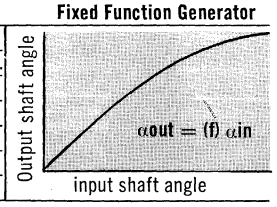


Size 11 Size 18

For correction of repeatable errors in servo systems. Can be used to create master synchro, potentiometer or as a limited range function generator. Available in adjustable or fixed models. Concentric output and input shafts.

	Adjustable
Range	±40 min. to ±11°
Repeatability	±1 min. to ±20 min.
Adjustability	10 min. to 22°
Ripple	2 min. to 55 min.
Drive Torque	2 oz.-in.
Load Torque	0.5 oz.-in.
Rotation Speed	300 rpm.

Fixed Function Generator

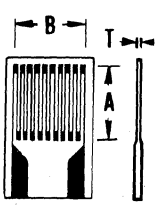


MAGNETIC FLUX SENSITIVE ELEMENTS

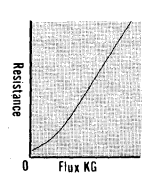
MAGNETORESISTORS

TYPE MRA: T = .004. Available in resistance values from 1 to 10K ohms. Suitable for cryogenic and high field applications.

TYPE MRI: T = .010. High sensitivity. Suitable for flux measurements, current sensing etc.



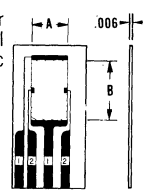
MODEL	DIMENSIONS A	B
MRA-11	1/16	1/16
MRA-12	1/8	1/8
MRA-13	1/4	1/4
MRA-14	1/2	1/2
MRI-100	1/8	1/8
MRI-500	1/16	3/16



HALL GENERATORS

Thin film elements useful for flux measurements in small air gaps and for cryogenic applications.

TYPE	A	B
HA-11	1/16	1/8
HA-12	1/8	1/4
HA-13	1/4	1/2
HA-14	1/2	1

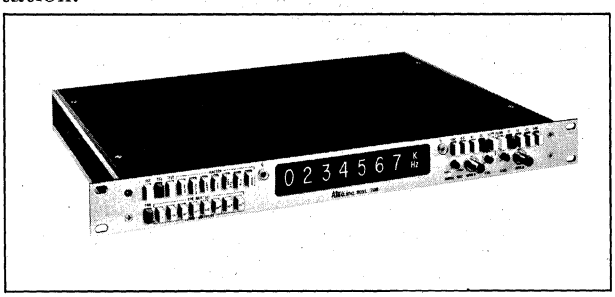


AMERICAN AEROSPACE CONTROLS, INC.
129 Verdi Street • Farmingdale, N. Y. 11735 • (516) MY 4-5100

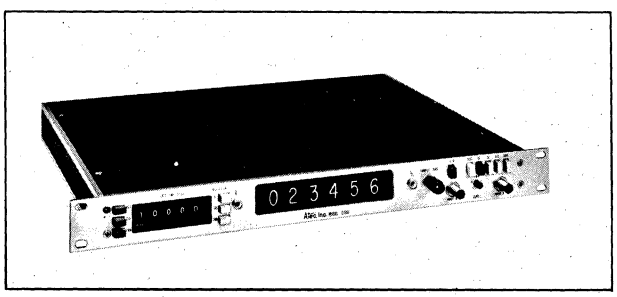
Atec sets the standard for Digital Counting Instruments...

Counters, Timers, Clocks, Totalizers, Comparators

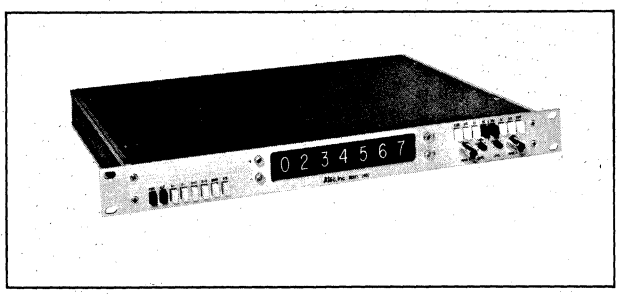
Precision and reliability in digital instrumentation at economical prices—that's Atec. *Versatility:* each instrument performs many functions. *Flexibility:* such features as extra digits, display storage, and high stability frequency standard may be added at any time. *Modern Design:* extensive use of IC's; standard plug-in modules; motherboard PC construction to minimize wiring. *Compact:* 1¾" high panels mount in standard 19" RETMA racks. *Extra Features:* remote programming, BCD output at TTL levels, inline readout, and self-testing are user benefits from Atec digital counting / timing / totalizing / sampling / comparing instrumentation.



Universal Counter Model 2000 provides six measurement functions: frequency, period, multiple period, time interval, ratio, scale (totalize) at frequencies up to 12.5 MHz. Registers and displays five decimal digits (up to seven optional). Inputs from 0.01 V RMS to 125 V RMS, AC or DC coupling. Crystal-controlled 1 MHz oscillator as frequency standard with excellent time, voltage and temperature stability. Price: $850.

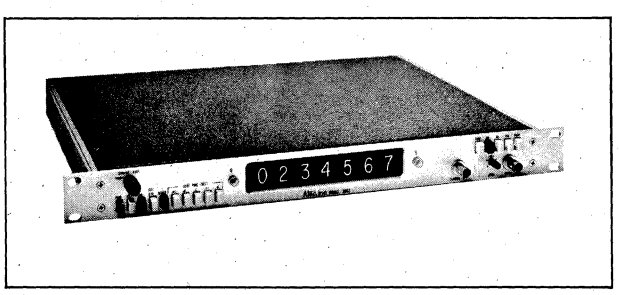


Variable Time Base or Rate Counter Model 2300 measures rate data over a wide range of counting intervals, 100 seconds down to 10 microseconds. Registers and displays four decimal digits (up to six optional). Rates to 12.5 MHz. Inputs from 0.01 V RMS to 125 V RMS. Frequency standard is 100 kHz crystal-controlled oscillator. Manual or remotely programmed control of gate time, multiplier, reset and storage. Price: $940.

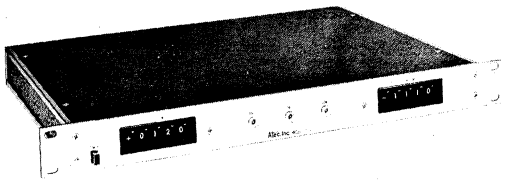


Bi-Directional Totalizer Model 2400 offers manual or remote selection of six operating modes: A+ adds pulses to register total at rates up to 10 MHz; A− subtracts pulses from register, 10 MHz maximum rate; other modes, 3 MHz maximum rate: A + B sums pulses at Inputs A and B and adds them to register; A−B adds pulses at Input A, subtracts at Input B; A quad B adds or subtracts pulses, depending on phase relationship; A as a function of B, pulses added or subtracted based on levels compared to threshold. Price: $895.

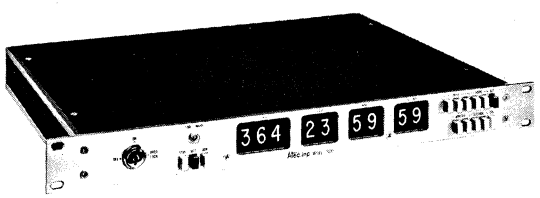
Time Interval Meter Model 2503 provides ultra-precise resolution from 0.1 microseconds to 10^8 seconds and can be used for such measurements as ballistic velocities, acceleration rates, nuclear phenomena, relay response times and many other transients. Inputs are adjustable for level, slope, polarity and coupling to trigger exactly at desired point on input waveform. Readout in milliseconds. Manual or remote programming. Price: $595.



Electronic Counter/Timer Model 2802 measures frequencies from DC to 12.5 MHz, time intervals to 1μsec (0.1 μsec with external clock), and also provides totalizing and ratio functions. Easily upgraded with options: registration and display of up to seven digits; 1 MHz crystal-controlled time base. Input: 10 mV, DC to 5 MHz; 30 mV, DC to 12.5 MHz. Overloads to 125 V. BCD output drives digital printers, tape punch units. Price: $455.



Digital Comparator Model 3200 is one of four models which generate output control signals, "Go-No-Go," "High/Low/In Limits", based on input data and pre-set limit values. Measurement comparisons are made by parallel computation as opposed to coincidence logic, permitting either moving or static BCD inputs to be compared to pre-established limits. These Comparators are specifically designed for local or remote limit programming and will accept BCD data from instrumentation inputs, including all Atec 2000 and 3000 series equipment. Models 3200 (dual limit) and 3201 (single limit) Comparators check unsigned "amplitude-only" data from rate and time interval meters. Models 3202 (dual limit) and 3203 (single limit) provide algebraic comparisons and interface with bi-directional totalizers and digital voltmeters. Prices: Model 3200. $625; Model 3201, $425; Model 3202, $825; Model 3203, $525.



Digital Clock Model 3000 provides both visual display and BCD output of elapsed or real time in days, hours, minutes and seconds. Time reference is either by an internal crystal-controlled oscillator, or optionally from a 1 Hz external signal. Operator controls permit any digit to be set to a desired number, to advance or retard time for updating, and for 24-hour (standard) or 12-hour (optional) cycles. Key-operated interlock switch prevents accidental destruction of time data. Outputs are four-line BCD signals to computers, printers, teletype couplers. Price: $1425.

Remote Programming Unit Model 2607 is useful for calibrating flow meters, monitoring RPM, measuring rate of consumption and similar applications. Operator manually selects a signal from one of two sources, and the unit then automatically applies suitable controls ("Gate Time" and "Multiplier") so that the output, which goes to an external electronic counter such as the Atec Model 2300, represents the desired engineering units. Price: $350. Other models with more channels available.

Frequency Deviation Meter Model 2910 measures frequency deviation in parts per 10^6 of an input signal from its set frequency. Increased resolution, deviation in parts per 10^7, is optional. Frequency standard is 10 MHz from internal crystal-controlled oscillator and harmonic multiplier. Three decimal digits and sign, with four-line BCD outputs are displayed. Maximum rate is 12.5 MHz. Typical application is monitoring quartz crystals during manufacture, measuring deviation from from desired exact frequency and then tuning crystals. Process is automated when 2910 is used with Atec Model 3200 Digital Comparator. Price (Model 2910): $1975.

Timer Model 1080A generates precise time delays to control external equipment. After manual "Start", a relay contact switches, holds for a pre-set period, then restores. Timing accuracy over the range 0.1 to 100.0 seconds is 0.025% exclusive of relay transfer. Applications: count gating to mechanical registers; photographic exposure control; turning equipment on or off after precise time delay. Panel height is 3½" (half-rack wide). Price: $725.

Strain Gage Digitizer Model 1086A performs two useful functions: (1) provides regulated 10 V DC output to excite transducer bridges; (2) offers choice of instantaneous or peak reading of digitized value of analog signals from strain gages used to measure torque, pressure, load or acceleration. Four decimal digit display; four-line BCD output drives digital recorders, computers, printers. Panel height is 3½". Price: $1495.

Storage Register Model 2911 furnishes memory on command for input data in signed digital form; also generates output signals to insert a starting count in an external register. Four decimal digits and sign are standard capacity .Storage time: 1 μsec or less. Useful with Atec Model 2400 Bi-Directional Totalizer. Price: $675.

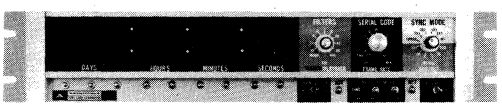
Standby Power Supply Model 2906 is an accessory battery pack containing circuits which automatically charge the internal batteries when primary 115 V AC power is available. Exhausted batteries are recharged in 24 hours. Model 2906 is designed to prevent data loss in event of primary power failure. Instruments such as Atec Model 3000 Digital Clock will run up to two hours when 2906's batteries are fully charged. Price: $375.

Atec, Inc.

1125 Lumpkin St., Houston, Texas • Phone (713) 468-7971
Mailing Address: P. O. Box 19426, Houston, Texas 77024

SERIES 7000
A Complete Family of Timing Instruments

Time Code Translator/Generator



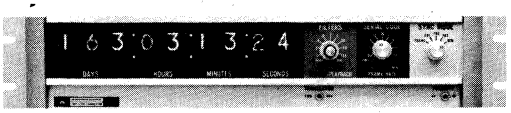
Model 7400

Model 7400 . . . The Model 7400 Time Code Translator/Generator is a two-in-one instrument, ideally suited for use in small data handling systems, data logging systems, laboratories, etc., wherever the requirement exists for both data recording and data playback operations.

This instrument performs both the time data translation and generation functions, utlizing only one set of "time-shared" logic circuitry, thus providing the versatility of two special purpose instruments with the economy of a single unit.

A few of the features that make the Model 7400 an outstanding instrument are: complete versatility through the use of optionalized function-circuit groups; single-cycle noise rejection and error frame bypass during time data translation; precision synchronization and external start during time data generation; and many others.

Time Code Translator

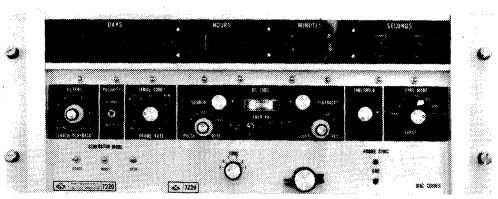


Model 7200

Model 7200 . . . The Model 7200 Time Code Translator is used in telemetry and data reduction systems, or wherever the need exists for translation of time data prerecorded onto magnetic tape.

The Model 7200 can, with appropriate optional circuits, reliably translate the IRIG and/or NASA standard time code formats in either the forward or reverse modes, at normal or accelerated speeds, while assuring complete AGC action over a wide range of tape speeds and input signal amplitudes. This capability makes the Model 7200 a valuable instrument for either manual or automatic tape search applications.

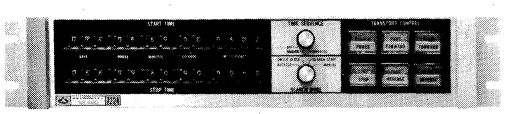
Universal Time Code Translator



Model 7220

Model 7220 . . . The Model 7220 Universal Time Code Translator is capable of translating virtually all standard time code formats in use today, (either dc level shift or amplitude-modulated sine wave carrier through the use of unique plug-in modules). This instrument may be used strictly as a time code translator, or as a tape search system when properly interfaced with an appropriate tape search, control unit (Astrodata Model 7224 Tape Search and Control Unit).

Tape Search and Control Unit



Model 7224

Model 7224 . . . The Model 7224 Tape Search Control Unit is utilized in conjunction with Astrodata time code translators to provide completely automatic or manual control of magnetic tape transport units during tape search and playback operations in both the forward and reverse modes.

This instrument features multiple control modes (search-to-start, single cycle, recycle, and manual) with a time resolution to 100 microseconds. Tape transport control functions are accomplished with momentary (or latching) contact closures/openings. Auxiliary contact closures are provided to aid in controlling the data reduction process.

ASTRODATA

SERIES 7000
A Complete Family of Timing Instruments

ASTRODATA has added a complete new line of compact timing units to an already substantial selection of precision timing instruments. This new line of timing units makes extensive use of proven dual in-line silicon integrated circuits mounted on function-oriented plug-in circuit boards.

The new line of timing units is designated as the 7000 Series, and comprises Time Code Generators, Time Code Translator /Generators, Tape Search and Control Units, and Remote Display units.

With the development of the 7000 Series timing units, Astrodata can provide instruments and systems to satisfy virtually all timing requirements, both simple and complex, including those that involve the stringent specifications of sophisticated data reduction and central timing systems.

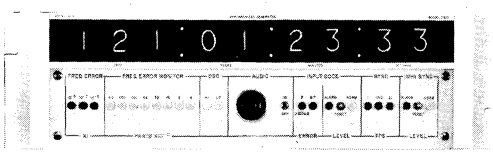
Versatility . . .The utmost in versatility of the 7000 Series timing units is achieved through utilization of optionalized function-circuits and/or plug-in modules in conjunction with predefined basic instruments.

The basic instruments contain all logic elements and controls required to perform the specific functions for which they were designed (i.e., time data translation, time data generation, etc.).

Reliability . . . All 7000 Series timing units combine compactness with minimum power consumption and maintenance time yet provide the maximum in performance and reliability through extensive use of TTL and DTL type integrated circuits and state-of-the-art design techniques. Dual in-line silicon integrated circuits are used throughout the 7000 Series timing units, except in some analog applications, and when output loading requirements necessitate the use of discrete components.

Maintainability . . . Small function-oriented plug-in type printed circuit boards are used in most 7000 Series timing units. These small circuit boards have card-edge test points which make circuit testing and trouble shooting fast and simple; their small size permits removal and replacement without disturbing adjacent boards or components; replacement cost is relatively inexpensive.

Synchronzed Time Code Generator

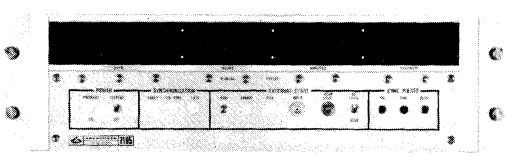


Model 7425

Model 7425 . . . The Model 7425 Synchronized Time Code Generator is an extremely sophisticated instrument that is unmatched in precision, quality, and reliability.

The Model can provide up to six serial time data outputs simultaneously (both dc level shift and modulated sine wave carrier), all precisely synchronized to IRIG A or IRIG B time data inputs from Central Timing Station. Precise synchronization is achieved with a unique digital resolver and servo system called ASTROLOCK. The ASTROLOCK system automatically compensates for frequency offset, drift rate and phase error of the internal 1 MHz oscillator and maintains a time error as small as ±5 microseconds/day with respect to an externally supplied reference, even if the reference signal is momentarily interrupted. The accuracy of this instrument makes it an excellent timing terminal.

Precision Universal Time Code Generator



Model 7195

Model 7195 . . . The Model 7195 Time Code Generator is the finest, most versatile generator ever designed. This instrument is accurate and stable enough for the most exacting standards-lab applications, yet versatile enough to accommodate complex range timing requirements.

The accuracy and stability of this instrument are made possible through the use of an extremely accurate 1 MHz crystal-controlled oscillator mounted in a temperature-controlled oven.

Accuracy is further enhanced through the use of precision control logic that allows synchronization to a time standard broadcast station such as WWV. Synchronization features include direct generator initiation from the output of a time standard broadcast receiver without intermediate buffering; propagation delay compensation with 10 microsecond resolution; synchronization resolution to within 30 nanoseconds.

Complete versatility of the Model 7195 is made possible through the use of optional functional-circuit groups. There are more than 30 such circuit groups available as standard options, and many more that are available as non-standard options. Some of the standard optional circuit groups include serial time data outputs (both dc level shift and modulated sine wave carrier) in the IRIG,NASA and AMR standard formats, plus many other standard and special formats (the Model 7195 may provide as many as 20 serial time data outputs simultaneously).

BASLER Electric Company
HIGHLAND, ILLINOIS
Box 269 Zip 62249—Phone 618-654-2341

Manufacturers of Magnetic Components, Power Control Equipment and Systems.

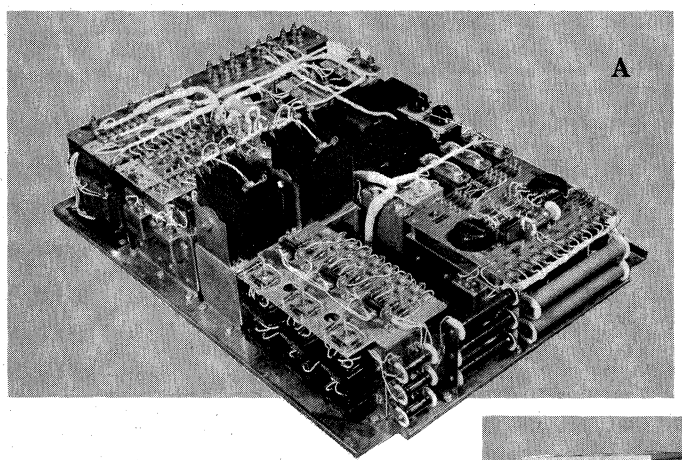
A. Motor Speed Controller—Standard and custom designs for machine-operator controlled industrial applications. Constant and variable speed . . . AC and DC motors . . . range of frequency and duty cycles . . . 50HP through 300HP.

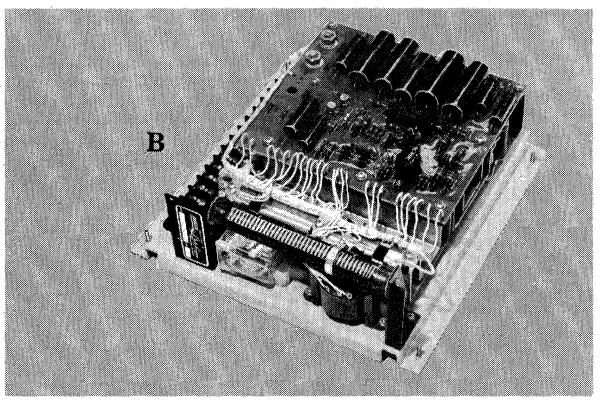
B. SR-Static Voltage Regulator—Solid state regulator responds in 16 milliseconds . . . Regulation better than ± ½ % . . . withstands 5 Gs from 20 to 500 Hz.

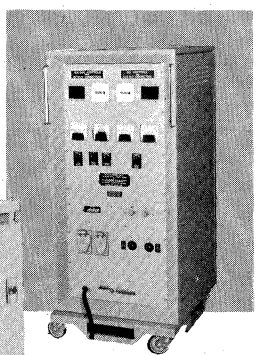
C. Static Power Unit—Does your 400-cycle and D.C. power source have portability, power isolation, power quality, electrical ruggedness and low noise level? Basler's does.

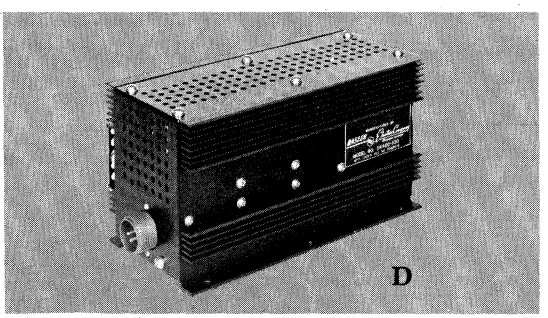
D. Static Inverter—Airborne Inverter. Built-to-drawings or Standard Designs.

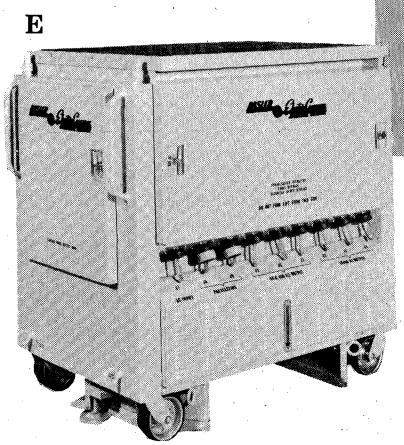
E. Static Power Cart—Mobile power unit designed for aircraft trainer/simulator use and suited for laboratory, classroom and "on line" power requirements where combinations of DC, 60 and 400 Hz power, with kilowatt capability, are required.











At Basler Electric, product capabilities are more than a mere possibility . . . they're a reality.

Quality "input" from engineering, design and manufacturing experience make Basler your obvious supplier of Magnetic Components, Power Control Equipment and Electronic Systems.

The units illustrated here are only representative of the broad range of electric and electronic products "on line" at Basler Electric.

For detailed information on these and other products by Basler, write for bulletins.

BASLER CONTROL EQUIPMENTS

BISSETT BERMAN E-CELL (TM)

Timing & Integrating Components

- *μWatt Power Drain*
- *One-Shot or Reusable*
- *Military or Commercial Specs*
- *Timing Range: Seconds to Months*
- *Integrating Range: 1 to near ∞ Events*

Something New Under the Sun!

1. WHAT IS AN E-CELL DEVICE?

An E-CELL device is a new kind of circuit element that looks like a discrete electronic component but does the work of a complex assembly. Its main functional part is a center electrode, which is surrounded by an electrolyte; the metallic container also serves as the second electrode. In terms of its physical operation, an E-CELL unit is a reversible micro-coulometer, i.e. it converts the current-time integral of an electrical function into an equivalent mass integral (or the converse operation) up to a maximum of several thousand microampere-hours. Exactly one atom is transferred for each electron impressed on the E-CELL unit. Power drain is normally in the microwatt region. The mass integral can be read out at a known current, the time to read it out being proportional to the original integral. When a mass is given as part of the initial condition, this same process generates a precise time interval.

2. WHAT DOES AN E-CELL DEVICE DO?

For *timing* applications a constant current is applied to a *pre-charged* E-CELL unit. The selected time delay is determined by a combination of the E-CELL type and the specific constant current being used. The range of timing is from seconds to months. The output voltage swing that occurs when the mass has been completely transferred is normally used as a bias transition with semiconductor devices. For *integration* applications an *uncharged* E-CELL unit accepts d-c, periodic, or random inputs in any waveshape and stores these as the mass equivalent of a current-time integral. Readout is handled in essentially the same manner that the timing function is handled for a pre-charged E-CELL unit, i.e. the measured time required to reach the point of the abrupt voltage swing, multiplied by the readout current, will be the accumulated charge integral. This could represent the total "count" of a series of events analogous to the input pulses.

3. APPLICATIONS

The scope of applications is as broad as timing and counting functions themselves. New uses are continually being devised. Here are two prime applications areas:

Control: You can use E-CELL devices in circuits for timing, gating, starting, stopping, delaying, relaying, monitoring, actuating, sequencing, measuring — wherever the control condition can be represented by an electrical signal.

Information Handling: You can use E-CELL devices in circuits for data capture, totaling and subtotaling time periods or discrete events, elapsed time logging, running time monitoring, out-of-limits logging, maintenance status reporting, real-time analog computing — wherever the input data can be represented by an electrical signal. Readout can be formatted as either analog or digital data.

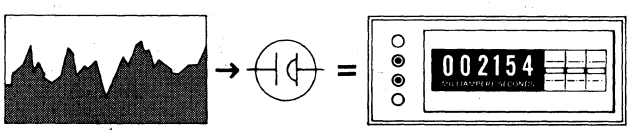
PART NUMBER	PHYSICAL CHARACTERISTICS
400 SERIES 	Single anode cell with leads; mil specs; ±4% charge accuracy for precharged types; −55°C to +71°C.
410† SERIES 	Dual anode cell, with leads; mil specs; ±5% anode 2 charge accuracy; −23°C to +55°C.

Actual size shown.

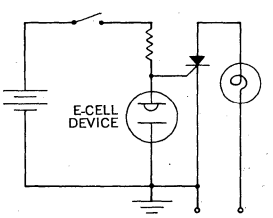
†No. 410 Dual cells are available on special order with anode 1 charges from 0 to 40 μamp-hr and anode 2 charges from 0 to 3000 μamp-hr. 

E-CELL TIMING COMPONENTS		
TYPE	NOMINAL CHARGE	NOMINAL RANGE
400-0400	40 μamp-hr	0.4-20 hr
400-2400	240 μamp-hr	2.4-80 hr
400-1441	1440 μamp-hr	14-480 hr
400-3001	3000 μamp-hr	30-1000 hr

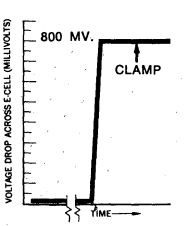
E-CELL Timing Components with other pre-charges are available on special order.



Typical Analog Input Signal — *E-CELL Integrator* — *Model 300 EDR E-CELL Digital Readout Instrument*



Typical circuit using E-CELL component.



Typical E-CELL device voltage rise.

E-CELL INTEGRATING COMPONENTS		
TYPE	CHARGE	NOMINAL INTEGRATING RANGE
400-0001	None	to 200 μamp-hrs.
400-0002	None	to 1000 μamp-hrs.

E-CELL components are protected by one or more of the following U.S. patents: 2,744,217; 3,423,642; 3,423,643; 3,423,644; and 3,423,648. Other U.S. and foreign patents pending.

Specifications subject to change without notice.

For additional technical information and applications notes, contact: Components Division, The Bissett-Berman Corporation, 3860 Centinela Avenue, Los Angeles, California 90066; Telephone (213) 394-3270; TWX: 910-343-6583.

A69

BISSETT BERMAN
A subsidiary of Alloys Unlimited, Inc.

Bissett-Berman Corp.
2001 Jefferson Davis Hwy.
Arlington, Va. 22202
Telephone: (703) 521-8202
Telex 89-9420

Bissett-Berman Corp.
4930 W. 77th Street
Minneapolis, Minn. 55435
Telephone: (612) 920-2541

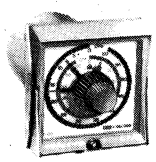
Bissett-Berman Corp.
3860 Centinela Ave.
Los Angeles, Calif. 90066
Telephone: (213) 394-3270
TWX 910-343-6583
Telex 65-2432

Bissett-Berman Europe
7-9 Rue Neuve
Eupen, Belgium
Telephone: (087) 524-62
Telex (846) 41645

Industrial and Commercial Time/Count Controls

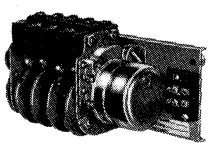
The broad line of Eagle Time/Count Controls includes electronic, electro-mechanical and pneumatic types in commercial, industrial, and military grades. Besides standard, catalog items, Eagle Signal designs and produces many custom time/count devices and systems for special applications. Write to the home office for complete catalog data or Bulletins mentioned. Application engineering consultation without obligation.

REPEAT CYCLE TIMERS



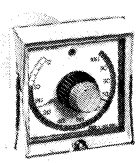
HG100 FLEXOPULSE TIMER—BULLETIN 321

A dual-function timer with a single, easy-to-set dial providing adjustable "on" and "off" time periods for cycles ranging from 30 seconds to 60 hours. Can be adjusted without setting cams or changing gears.



MULTIPULSE CAM TIMER—BULLETIN 340

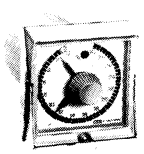
2 to 12 SPDT switches are actuated by adjustable cams. A complete selection of change gears and motors provides cycles from 6 sec. to 36 hours. Contact rating, 10 Amps. @ 120 VAC.



SOLID STATE REPEAT CYCLE TIMER—BULLETIN 322

Provides continuous on-off cycles from 3 to 1000 times a minute. The on and off cycles are individually adjustable on the dial. Load handling capacity 1 Amp. @ 120 VAC.

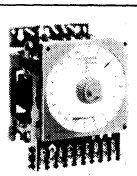
TIME DELAY OR SINGLE CYCLE TIMERS



CYCL-FLEX PLUG-IN TIMER—BULLETIN 125

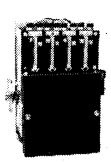
Plug in feature provides easy installation and reduces down time. Dial ranges from 5 sec. to 60 hours.

The Cycl-Flex series also includes a transistorized reset timer, an 80 count counter, pulse timer and percentage timer.



MICROFLEX TIMER—BULLETIN 110

Precision timing of 1/10 percent of full scale is provided by the 20 turn micrometer dial. Dial ranges from 20 sec. to 120 hours. Three load contacts are adjustable to hundreds of contact combinations—eliminate relays.



MULTIFLEX MULTIPLE CIRCUIT TIMER—BULLETIN 130

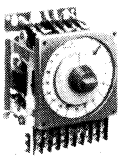
1 to 6 circuits are tripped open or closed according to settings on the linear scales. A repeat cycle model is available for continuous sequencing or programming.



SOLID STATE—CG SERIES—BULLETIN 158

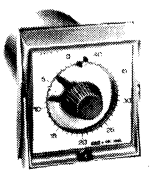
A solid state time delay relay that is reliable, accurate, and economical for applications requiring a delay up to 60 seconds. This knob-adjustable timer plugs into an octal relay socket and is a perfect replacement for pneumatic timers.

COUNTERS



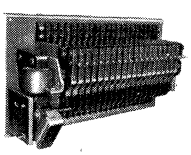
MICROFLEX RESET COUNTER—BULLETIN 720

Trips 3 SPST contacts at end of preset count. (19), (400), and (1000) count dials. Automatic reset. Available in impulse and shaft driven types. Contact rating 15 Amps. @ 120 VAC.



HZ 170 CYCL-FLEX COUNTER—BULLETIN 726

An impulse counter housed in the famous Cycl-Flex plug-in case. It has a single-turn dial with count ranges of 40 and 100. One switch operates simultaneously with the clutch coil as a hold-in circuit. Two other switches actuate at end of count.



STEP SWITCH—BULLETIN 780

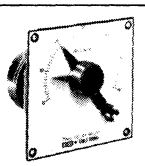
Up to 19 circuits turned ON and OFF in steps according to sequence established by break out cams. Use for programming machines and processes.

COMMERCIAL TIME/COUNT CONTROLS FOR CUSTOM APPLICATION



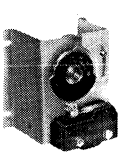
RESET TIMER—MODEL 88

A versatile little timer that can be used either as a delay timer, an interval timer, or a combination of the two. Precision adjustment, 10 amp contacts at 120/240 VAC, 6 seconds – 48 hour time ranges, and a cycle progress pointer are features.



MOTOR RESET TIMER—MODEL 84

Actuates a 5 Amp. SPDT switch at the end of a preset interval. Time ranges from 4 sec. to 5 minutes. A red cycle progress pointer indicates the progress of the timed interval.



REPEAT CYCLE TIMER—MODEL 220

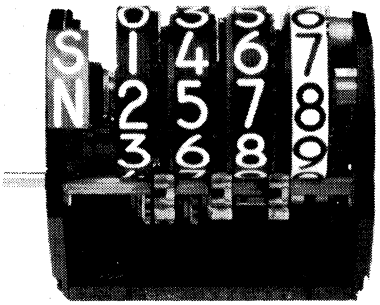
This compact and easily adjustable timer with up to 25 amp contact rating has 286 standard time ranges and can be operated in any position. It is ideal for those applications in which an electrical circuit is to be interrupted in accordance with a prearranged time setting.

For complete description and specifications, write to Eagle Signal Division, E. W. Bliss Company, Federal Street, Davenport, Iowa.

GW Eagle Signal Division
E.W. Bliss Company
A GULF+WESTERN COMPANY

BOWMAR Precision

COUNTERS



BOWMAR REVERSING NAVIGATIONAL COUNTER

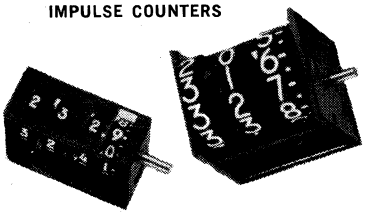
The Ultimate In:

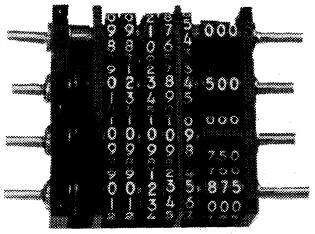
HIGH-SPEED
LOW-TORQUE
LIGHT-WEIGHT
MINIATURIZED RELIABILITY

Single-Bank display of latitude or longitude, and other navigational or decimal information is provided in Bowmar reversing counters; which reverse automatically with same direction of shaft rotation at zero or high points. Two to six drums.

Bowmar has unsurpassed capabilities in the design, manufacturing, and testing of:

REVERSING COUNTERS
ELAPSED TIME INDICATORS
EXTERNAL PINION COUNTERS
INTERNAL PINION COUNTERS
VARIATION COUNTERS
IMPULSE COUNTERS





Bowmar offers counters which satisfy every type equipment and application conceivable in electro-mechanical counting instrumentation. Bowmar's position of excellence has been earned through proven engineering competence, highly refined manufacturing and quality assurance programs. We also have the techniques and physical facilities to respond to critical needs, environmental testing and delivery requirements.

Additional Data Available From

BOWMAR INSTRUMENT CORPORATION
8000 Bluffton Road
Fort Wayne, Indiana 46809

BOWMAR PRECISION ROTARY COMPONENTS



Offering maximum **reliability** for use in **Guidance, Navigation, Communications, Systems.**

Bowmar stocks "off the shelf" models and has **complete design and manufacturing facilities** for special applications in:

Servo Motors
Sizes 8 – 10 – 11

Motor Tachometers
Sizes 8 – 10 – 11

Stepper Motors
Sizes 8 – 10

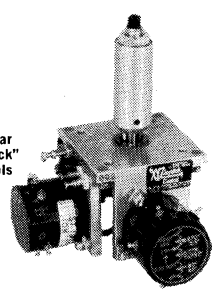
Synchros
All sizes, 8 thru 31

Gearheads, Speed Reducers
Sizes 8 – 10 – 11 – 15 – 18

Electro-Shift 2-Speed Gearchangers
Sizes 10 – 11 – 15 – 18 – 20 – 23

All components are available matched, preassembled, and pre-checked combinations meeting all military, industrial, and commercial standards. Bowmar is also a prime producer of many special geared devices including speed reducers, multi-shaft units, offset shaft gearheads, square gearheads, tandem gearheads for very high ratios, and all types of shafts, pinions, lengths, and other features.

Bowmar "Joystick" Controls



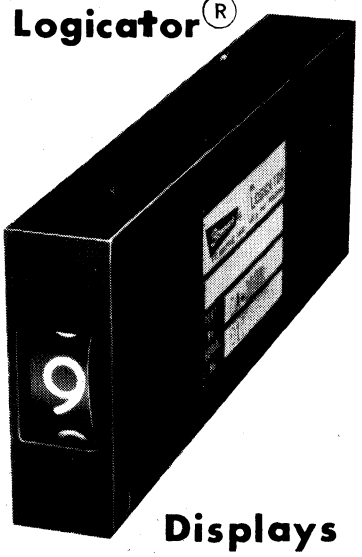
Handgrip movement in any direction produces corresponding rotation of potentiometers or other control components in the X and Y coordinates depending on stick position. Optional Z coordinate control is provided by clockwise or counter-clockwise stick rotation. Self-centering stick and other features available. Thumb operated safety interlock switch provided.

For more information about complete capability in custom components, assemblies, packages, and actuators, call or write

BOWMAR INSTRUMENT CORPORATION
8000 BLUFFTON ROAD • FORT WAYNE, INDIANA

BOWMAR

Logicator®



Displays

For Direct Readout of Digital Computer Signals

IDEAL FOR AIRBORNE INSTRUMENTATION DISPLAY

"BACK-LIGHTED" for both bright daylight and dark night readability

LOW POWER consumption, (1 Watt) *INHERENT MAGNETIC MEMORY*

BCD, 5 or 6 wire input standards.

RELIABLE self-contained *ELECTRO-MAGNETIC* drive

MINIATURE size, lightweight, high stability

BOWMAR'S LOGICATOR® provides direct readout of digital computer signals with back-lighting for optimum day and night readability. Units may be adapted to special applications such as use of any computer code, message displays, and custom assemblies. Designed for reliability and stability under conditions of high vibration, shock and extreme temperature variations; the BOWMAR LOGICATOR® is built in accordance with Aircraft Equipment Specification Mil-E-5400.

Single-digit unit: 1.25″ x .45″ x 2.5″ (slightly larger in some applications depending upon mounting and input code required); ¼″ numerals; continuous duty.

Additional Data Available From

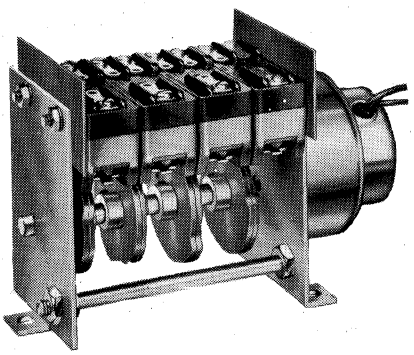
BOWMAR INSTRUMENT CORPORATION
8000 BLUFFTON ROAD • FORT WAYNE, INDIANA

BRISTOL MOTORS / DIVISION OF VOCALINE

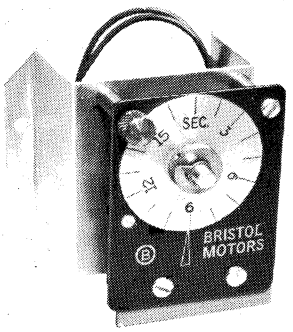
SYNCHRONOUS MOTORS AND TIMERS

Versatility is the characteristic which design engineers need — and find — in Bristol Synchronous Motors and Timing Devices. Bristol's unusually broad experience and range of design and manufacturing skills are particularly valuable where special requirements must be met.

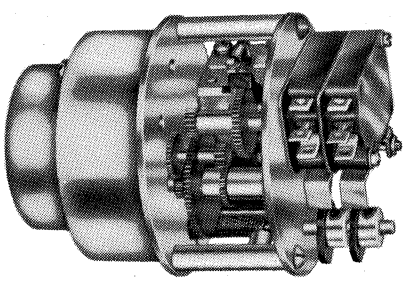
The devices shown are among the most widely used. All can be mounted in any position, and take a minimum of space. Materials are selected on the basis of their suitability to provide long service, and perform well under a variety of conditions. Bristol engineering service is available for applications that require custom design and manufacture.



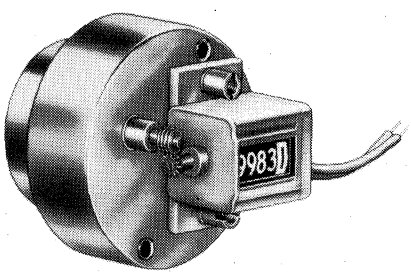
SERIES 31 REPEAT CYCLE TIMER. Low-cost multi-contact timer with high repeat accuracy. For vending machines, home appliances, industrial program controls. Speed Ranges: 1 Revolution Per Second to 1 Revolution Per Month. Motors standard, or high torque reversible. Switch Rating: 20 amp. at 115-230 V AC (also in ½ hp. at 125 V AC). Switches: enclosed snap action SPDT type. Cams: dual cams with set screws for field adjustment. Cut cams available on special order. Bulletin B-22.
One Switch Model $8.25 approx.
Four Switch Model $16.75 approx.



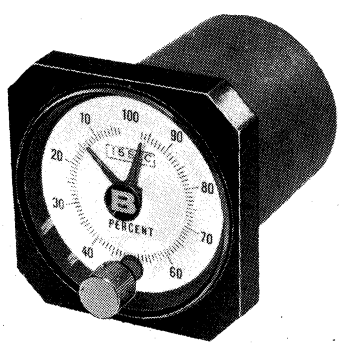
BRISTOL SERIES 55 DELAY TIMER, the low cost timer with the adjustable dial. For use when short time-delays are called for. This Delay Timer has a progress pointer which indicates the progress of a cycle, automatically resets when power to the duty-matched synchronous motor is interrupted and is manually adjusted by a selective dial which can be reset at will. The standard motor is for 115v/60 cycle, other voltages are available at small extra cost. Switch is SPDT rated 20 Amps resistive load at 115-230 VAC. Delay Timers are available in 15, 30, 60 and 120 second time delays. Bulletin B-32.
$14.00 approx.



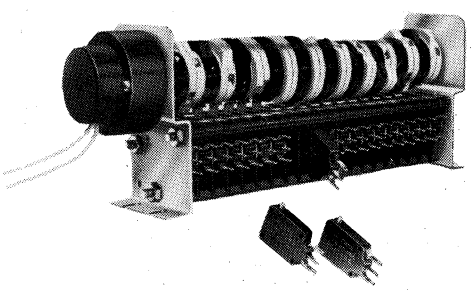
SERIES 21 TIME DELAY RELAY. General timer for instantaneous reset-type action, such as timers for photography, electronic safety, alarms, signals, etc. (Life expectancy over 1 million cycles.) Compact. Quick reset time (well under 1/5 second). Repeat accuracy better than 1% full scale. Time setting: 15 seconds to 3 months full scale. Rating: 10 amp (non-inductive load), Voltage: 115 V AC, 60 cycles standard. Optional adjustment feature available. Bulletin B-21.
One Switch Model $19.00 approx.
Two Switch Model $22.50 approx.



SERIES 41 ELAPSED TIME INDICATOR. Adaptable for panel or unit mounting, this low-cost series features simple installation, and a choice of four models with non-reset or reset counters. Maximum readings on both units from 9,999.9 minutes to 99,999 hours. 115 V AC, 60 Cycle standard. 50 Cycle and other voltages available. For further information on the three models above request Bulletin B-23.
Non-reset $14.00 approx.
Reset $20.00 approx.



SERIES 63 PERCENTAGE TIMER has a progress indicator which always shows the present position of the timer. This is an easily adjustable repeat cycle timer which makes or breaks an electrical circuit for an adjustable percentage of the full time cycle. Available in 7.5 second to 31 day time ranges, they are ideal for control of blowers, ovens, dryers, heaters, pumps, etc. Have repeat accuracy within ¼%. Panel mount. Automatic re-cycle. For complete information, request Bulletin B-30.
$27.00 approx.



SERIES 47 REPLACEABLE SWITCH REPEAT CYCLE TIMER is a multi-contact program timer which permits easy switch replacement without the necessity of disassembling. In addition one turn of the calibrated adjusting screw provides a 2% variation of cam time sequence. Switches are rated at 6 amps-115 volts. Available in a wide range of switches and speed combinations. Request Bulletin B-20
Two Switch Model $14.00 approx.
Six Switch Model $24.00 approx.

SEND FOR COMPLETE MOTOR AND TIMER CATALOG *

VOCALINE COMPANY OF AMERICA, INC., BRISTOL MOTOR/TIMER DIVISION

Timers and Motors to meet special applications are available from distributors. See Vocaline Bristol Motors Catalog for complete line of motors and timers.

IMMEDIATE DELIVERY FROM FRANCHISED VOCALINE\BRISTOL MOTORS DISTRIBUTORS

MAGSENSE®

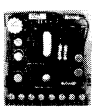
CONTROLLERS, RELAYS, COMPARATORS, ALARMS

MAGSENSE Instrumentation-Current and Voltage sensing devices that will compare electrical signals of 10^{-10} watts with a known variable reference. This enables you to connect directly to such transducers as thermocouples, strain gauges, and DC tach generators. **No pre-amplifiers required.** Power gain of **100 BILLION** makes it possible to accomplish a variety of control/alarm tasks with these products.

FEATURES

- ☐ Input versatility—AC or DC isolated input
- ☐ Proven in service
- ☐ Zener stabilized set point
- ☐ Adjustable hysteresis—0 to 200%
- ☐ Solid-state reliability

BRIEF SPECIFICATIONS

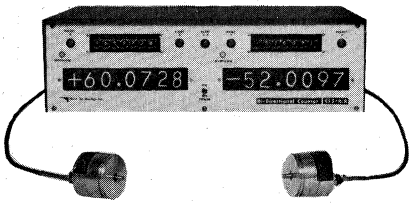
MODEL	TYPICAL APPLICATIONS	INPUT RANGES	INPUT RESISTANCE	RESPONSE TIME	POWER REQUIRED	OUTPUT LOAD	PRICE*
 MODEL 30	Voltage sensitive relay, battery voltage monitor, pressure, force, strain, speed monitor	1 to 3 VDC, expandable	>100K ohms	<1 ms	12 or 28 VDC	Nonlatching—100 ma max. Latching—500 ma max.	$ 50
 MODEL 70	Comparator, control relay, alarm, gap or band controller	0-100 μa 0-1 ma 0-10 ma 0-100 ma	100 ohms to 0.1 ohm	100 ms max. (10 ms available)	12 or 28 VDC	Nonlatching—.1 amp, .5 amp, DC; pulse output Latching—.5 amp max., DC	$ 60
 MODEL 71	Time-proportional temperature controller	0 to 1000°F	For use with 15 ohm thermocouple	500 ms	28 VDC at 40 ma	Pulses at 2 KC rate—3 volts, open circuit voltage for 5 μs	$ 90
 MODEL 73	Thermocouple relay for temperature alarm, control relay, proportional controller	0 to 50 mv	105 ± 10 ohms	500 ms	12 or 28 VDC	Nonlatching/latching—.1 amp, .5 amp, DC; pulse output	From $ 76
 MODEL 77	Dual set point version of Model 70	0-100 μa 0-1 ma 0-10 ma 0-100 ma	210 ohms to less than 1 ohm	100 ms max.	12 or 28 VDC	Nonlatching—up to 100 ma	$ 99
 MODEL 80	Comparator meets MIL-E-5272, temperature alarms, go/no-go logic, control relay, controller	0 to 500 μa	100 ohms ±10%	100 ms max. (10 ms available)	22 to 32 VDC	Nonlatching—50 ma max. Latching—1 amp max.	$ 90
MODEL 82	Comparator meets MIL-E-5272, internal set point, output equivalent of SPDT	DC, AC and bipolar DC volts, current	100 ohms ±10%	100 ms max. (10 ms available)	22 to 32 VDC	Nonlatching—500 ma max. Latching—1 amp	$170
 MODEL 90	Thermocouple amplifier, thermocouple transmitter with cold junction compensation and excellent C.M.R.	0 to 50 mv	For use with 10 ohm thermocouple	1 cps	24 to 30 VDC	Proportional output, 4 to 20 ma DC	$110
MODEL 101 	Single channel alarm/controller for temperature, pressure, speed, strain systems. Differential or time proportioning control action through use of Series 30,70 MAGSENSE BD.	micro-amp and millivolt signals from referenced transducers	100 ohms to 0.1 ohm	1 ms up	120 VAC, 60 to 400 Hz	Isolated DPDT 5A resistive or solid-state SCR output—1 KW	$136
MODEL 102	Dual channel alarm/controller for temperature, pressure, speed, strain systems. Differential or time proportioning control action through use of Model 77 MAGSENSE Board.	micro-amp and millivolt signals from referenced transducers	200 ohms to 0.1 ohm	100 ms up	120 VAC, 60 to 400 Hz	2 isolated DPDT 5A resistive	$188

*Single unit prices quoted. Reduced prices for quantity orders. Prices and specifications subject to change without notice.

Characteristics quoted in these specifications indicate the general area of operation for each model. Models with a variety of other input/output and operating capabilities are also available.

FOR THE DISTRIBUTOR NEAREST YOU, check the listing in this catalog or contact Control Data Corporation, MAGNETIC PRODUCTS OPERATION — Phone: 612/544-8851.

CONTROL DATA CORPORATION
MAGNETIC PRODUCTS OPERATION
775 COLORADO AVENUE SOUTH
MINNEAPOLIS, MINNESOTA 55416



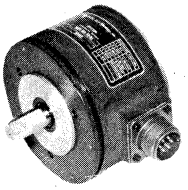
DIGITAL POSITION READOUTS

Digital measurement or control of rotational or linear position for machine-tool, process control, tracking, servo system and digital instrumentation applications.

Features

ECONOMY — Greatest Value per dollar . . . FULLY INTEGRAL SYSTEM — self-contained power supply for encoder as well as counter . . . MAXIMUM NOISE IMMUNITY — high-level encoder output coupled with line-receiver counter input . . . MATCHED ENCODERS and COUNTERS for best performance, reliability and accuracy . . . TTL INTEGRATED CIRCUITS used throughout . . . MULTI-FEATURE FLEXIBILITY satisfies a wide range of application requirements.



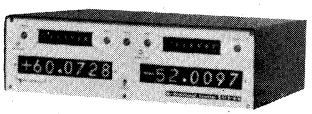


SHAFT-ENCODERS

Optical-OPTECON Incremental . . . economy price basis . . . fully integral circuitry (full voltage square-wave, pulse and/or zero outputs) . . . 150,000 hr. lamp . . . rugged . . . sizes 25 or 35 — commercial, industrial or military . . . hysteresis feedback for jitter-free operation . . . standard resolutions: 250, 360, 500, 512, 635, etc. cpt-up to 2540 on special order . . . ideal for digitizing rotational travel, position, or speed for measurement and control. PHOTOSYN Incremental Encoder . . . resolutions to 16,384 cpt at accuracies up to 10 arc-secs . . . fully integral circuitry . . . matched complementary push-pull photo transistors for highest noise immunity . . . 200,000 hr. lamp . . . hysteresis feedback . . . rugged . . . size 35 . . . Standard resolutions: 2048, 2500, 2540, 3600, 4069, 5000, 5400, 6350, 7854, 8192, and 10,000 — up to 16,384 on special order . . . Pulse rate to 1 MHz ...ABSOLUTE units to 16 bits non-ambiguous binary . . . sin-cos to 13 bits per quadrant.

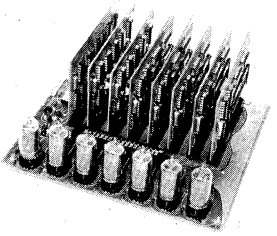
Magnetic — VERNISYN non-contact encoder . . . full-scale vernier and full-perimeter averaging . . . resolutions to 2^{21} . . . absolute serial pulse-train output. INCRESYN, incremental encoder for digital control and readout . . . high-signal magnetic pickoff, integral silicon circuits guarantee low noise susceptibility . . . ROTOSYN — compact absolute encoder . . . serial pulse-train output: each pulse represents 1/nth of circle . . . ideal signal recording or transmission to gated counter . . . resolution to 2^{11}.

READOUT COMPONENTS

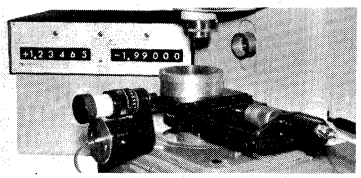


Bi-Directional Counters. All-TTL circuitry on plug-in PC cards . . . count and reverse to rates >5 MHz . . . single and multi-axis with ±4 to 7 decades, in line (Nixie) Numerical Display, BCD output, manual and pulse reset, overflow indication, remote display and thumbwheel preset options . . . Table or Rackmounted Cabinet . . . self-contained 110-117 VAC, 60-Hz supply.

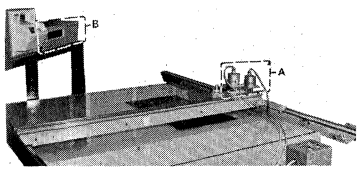
Bi-Directional Counter Module. Full single axis plug-in for direct installation in digital system cabinet . . . High reliability, compact, lightweight, all TTL integrated circuitry . . . 5 MHz count rate (incl. reversing) . . . economical base price includes: ±4 to 7 decades, buffered BCD output, five standard input modes for maximum flexibility, inputs for remote reset and presets, in-line display . . . optional-mounting container with connectors and terminals, power supply also available.



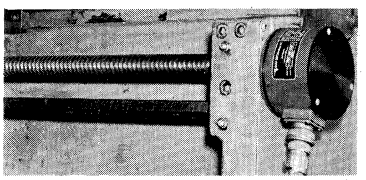
READOUT APPLICATIONS



Digitized Micrometer Assembly and Readout: interchangeable with existing micrometers to provide display or readout . . . advantageous for comparator or Microscope stage . . . produces 20,000 pulses per inch of travel fed to bi-directional counter with display and readout to 0.00005″.



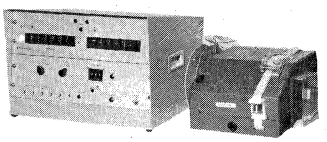
Coordinatograph Digital Readout Adaptor Kit provides numerical displays for greater accuracy and ease of use . . . replaces conventional x-y dials and verniers . . . for increased utility, reduced operator fatigue; reading errors eliminated . . . higher resolution (.0005″), 1:1, 2:1, 4:1 scaling, floating-zero reset (or preset) . . . also BCD output provided for printout, punchout or in-line computer interface.



English to Metric Conversion for Machine Tools: encoder converts inch-pitch lead screw travel into decimal fractions of a centimeter . . . enables machining to metric dimensions directly . . . two models available to accommodate 4-pitch, 5-pitch and 10-pitch machine tool leadscrews as well as 40 pitch micrometer lead screws.

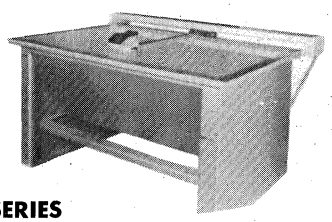
COORDINATE DIGITIZERS

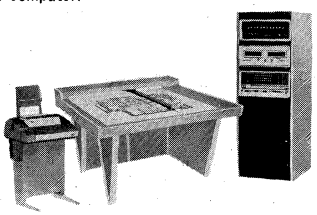
DATA TECH offers a full line of Coordinate Digitizers for N/C Tape Preparation and Graphical Codification in complete systems . . . great flexibility and advantages in: tape preparation for numerical control; image plane digitizing of projections; pattern, chart and photographic digitizing; precision drawing of templates and reticles; verification, precision plotting, cutting or positioning; and numerous others.



IPD SERIES

Image Plane Digitizer: coordinate digitizer specifically for work with film projections (such as bubble chamber tracks) . . . user oriented, consists of a rugged, stable, formica covered 1″ cast aluminum digitizing table with Readout/Buffer Control Electronics . . . resolution is 0.001″, accuracy to 0.002″ . . . compatible outputs provided for data compilation on punched cards, paper tape, magnetic tape or direct feed to computer.





APD SERIES

Adoptable Program Digitizer: hard-wired coordinate digitizer tailored to specific format requirements of NC tools . . . prepares final control tapes directly from artwork, non-dimensioned drawing or negatives . . . reduces operating costs, increases productivity. Rugged, fixed-position or tilt-top light tables in popular sizes . . . complete selection of **must** features and useful accessories . . . economical solution for NC tape preparation requiring extensive dimensioning; accuracy to 0.002″, resolution and repeatability to 0.001″.

UPD SERIES

Universally Programmable Digitizer: integrated coordinate digitizing system to handle a wide variety of NC format requirements . . . PDP-8L computer along with GRAFTRAN software provide complete program and functional flexibility (self monitoring, repeat patterns, editing, code conversion, etc.) . . . wide variety of operating features and accessory options . . . along with selection of fixed-position or tilt-top light table; accuracy to 0.002″, resolution and repeatability to 0.001″.

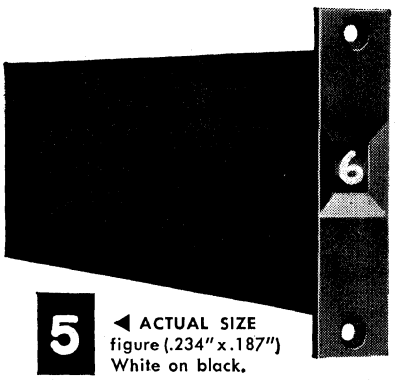
DIGITAL DRAFTING TABLE

For rough digitizing or precision layout and drafting . . . templates, reticles, scales, etc. . . . employs incremental encoders and dual-axis bi-directional counter with numerical display to indicate position of drafting head with resolution and accuracy of 0.001″ . . . Standard Table — 38″ x 60″ working area . . . height and tilt adjustments . . . features solid state circuitry, push-button control, economical modular design, selectable scale factors, position lock in and out, floating zero-reference, etc.

DATA TECHNOLOGY, INC

65 GROVE ST., WATERTOWN, MASSACHUSETTS 02172 / 617 • 924-1773 TWX: 710 • 329-0607

DURANT®
INSTRUMENT COUNTERS

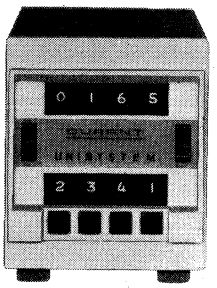


5 ◀ ACTUAL SIZE figure (.234" x .187") White on black.

UNIPULSER®
HI-SPEED DECADE COUNTER
with both VISUAL and ELECTRIC READOUT

An important, off-the-shelf component providing Extreme VERSATILITY, Space-saving COMPACTNESS, 100 Million COUNT LIFE, plus Attractive LOW COST.

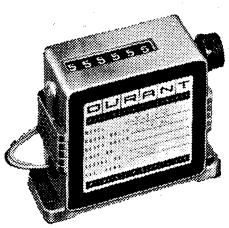
This unique decade counter of modular design, with speed of 40 pulses/sec. combines visual readout on a printed number wheel and electrical readout by means of an internal etched circuit switch. Each unit incorporates circuitry for resetting to zero and transferring the pulse from decade to decade in sequential counting. A Unipulser system can be adapted to Predetermined Counting (including automatic recycle), or for many other digital control requirements. Send for Catalog 90.



Durant 49600 and 49800 Unisystems are available as complete systems for desk, panel or relay rack mounting. 49600 model is additive with a variable predetermined number; 49800 is subtractive, with a factory-wired prewarn value.

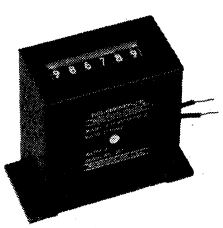
STANDARD ELECTRIC COUNTERS for INSTRUMENTATION

Durant Electrics, combining dependability, fast speed, legibility and long life with the advantages of remote counting of impulses, make them particularly adaptable for certain instrumentation applications. Most models available from stock — ready to be installed with other instrumentation in control panels, or as an integral part of a machine, instrument or system. Coils completely within frame — will not burn out if left on closed circuit. UL approval on 115 V. AC models.



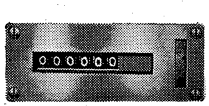
"Y" SERIES

Available with 4-6-7 figures (also dozens unit wheel). Built-in rectifier operates coil on dependable DC current. Speeds up to 1500 CPM. Knob, lock, or non-reset. Operates under severe shock and vibrations. *Models also available without rectifiers.*



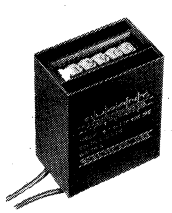
"YE" SERIES

A six figure model with instant push-button or electric reset. Can be reset under power or when coil is energized. High speed, up to 2400 CPM.



PANEL MOUNT

"Y" and "YE" Series can be mounted singly or in batteries with reading line flush with front of panel.



NEW "ME" SERIES

A small, precise electric counter. Available as six-figure non-reset and four-figure reset models, with base or panel mounting. DC and 115 VAC voltages available. Speeds to 1000 cpm. Request "ME" Bulletin.

SPECIAL ELECTRICS: If standard models cannot do your job, variations or specially developed counters can be engineered upon application.

STANDARD DIGITAL READOUT COUNTERS for SYSTEMS and INSTRUMENTATION

Durant pioneered the development of the first standardized line of stocked instrument counters for high speed, easy-to-read digital presentations. In just a few years this "first family" has grown from 96 model variations to over 200. This extensive selection of precision counters provides you with a wide choice of wheel sizes, number of figures, types of unit wheels, rotation and side of drive. In quickly satisfying virtually all of your design requirements, Durant will save you time and engineering costs. All models available Right or Left Drive, Clockwise or Anti-clockwise Rotation.

"Y" SERIES

Series Y — 11285 (24 models)
Hi-Speed Index, 2 to 7 figures

Series Y-8822 (24 models)
Single width unit wheel, 2 to 7 figures

Series Y-8823 (24 models)
1½ width unit wheel, 2 to 7 figures

Series Y-8829 (20 models)
Double width unit wheel, 2 to 6 figures

Series Y-8831 (16 models)
Dual Bank, in line. 2 to 5 figures/bank

Series Y-8831-1 (12 models)
Dual Bank, in line. Double width unit wheel. 2 to 4 figures/bank

Series Y-9425 (12 models)
Dual Bank, stacked. Single width unit wheel. 3 to 5 figures/bank

Series Y-9448 (12 models)
Dual Bank, stacked. 1½ width unit wheel

BEARING DEGREE COUNTERS

Series Y-9994 (4 models)
Double width unit wheel. Hi-speed Geneva Index. 4 figures only

Series Y-9992 (4 models)
Single width unit wheel. Hi-speed Geneva Index. 3 figures only

"D" SERIES

Series D-8856 (16 models)
Single width unit wheel, 3 to 6 figures

Series D-8861 (12 models)
1½ width unit wheel, 3 to 5 figures

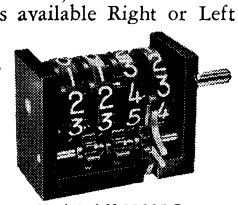
Series D-11256 (12 models)
Hi-speed Geneva Index, 3 to 6 figures

"S" SERIES

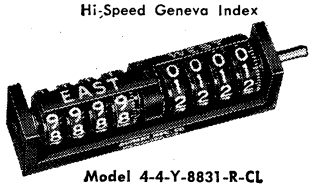
Series S-9679 (12 models)
Sub-miniature, single width unit wheel. 3 to 5 figures

SPECIAL REVOLUTION COUNTERS — In addition to the above listed standard models, many other minor variations can be made on request for specific requirements.

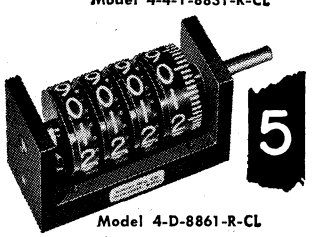
ACTUAL FIGURE SIZE 5



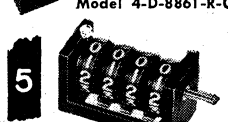
Model 4-Y-11285-R
Hi-Speed Geneva Index



Model 4-4-Y-8831-R-CL



Model 4-D-8861-R-CL



Model 4-S-9679-R-CL



NUMBER WHEELS and pinions available in all three sizes.

CONTROL

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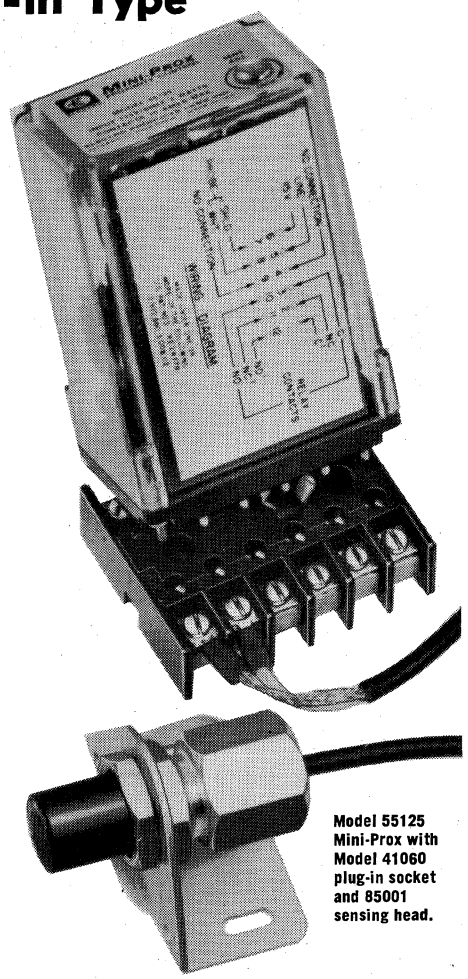
ELECTRO MINI-PROX

Low Cost — Plug-in Type



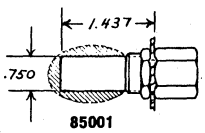
Model 55125 Mini-Prox with Model 41060 plug-in socket and 85001 sensing head.

Compact Proximity Sensing System for Non-contact, Detection and Control of Ferrous and Nonferrous Metals

Accuracy of sensing distance is often a critical factor in sensing and control applications. Mini-Prox accuracy can be depended upon in any environment; heat to +160°F or cold to −30°F at either probe or control. Line voltage variations from 105 to 130 volts — dust — moisture — vibration, none of these affect its accuracy. You can set it and forget it.

Plug-in design provides for easy wiring. Unitized construction eliminates soldering or wiring of sensitivity controls. Connections for power, sensing head and relays are made to screw-type socket terminals. Operations up to 600 per minute may be controlled or monitored by the Model 55125 illustrated. Electronic output models for higher speeds are also available.

5 STANDARD TEMPERATURE-STABLE SENSING HEADS



85001

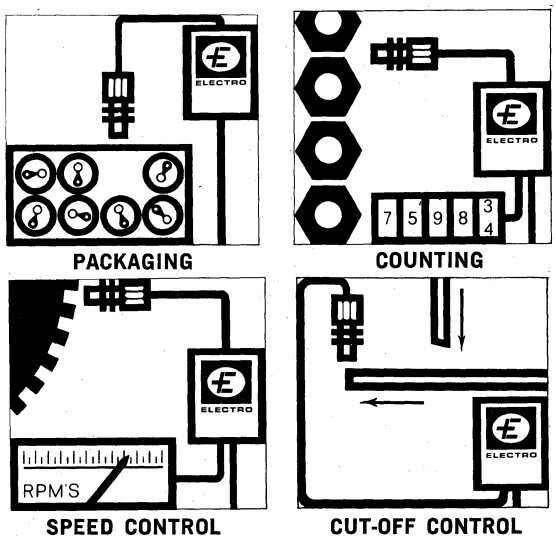
Model No.	Sensing Face Dia.	Sensing Range	Overall Length	Mounting	Cable
4943	.312″	.050″ to .250″	1⅝″	⅜″ - 24	10′
4944	.375″	.050″ to .250″	1¼″	clamp	10′
85.001	.655″	.050″ to .250″	2⅛″	bracket	10′
85.002	.655″	.100″ to .500″	2⅝″	bracket	10′
85.003	.750″	.300″ to 1.000″	3¾″	bracket	10′

MINI-PROX MODELS FOR A VARIETY OF FUNCTIONS

Model No.	Output	Additional Data
55125	10A DPDT Relay output	115V Power
55126	10A DPDT Relay output	230V Power
55141	Electronic output +12V metal near; −0.5V metal away	115V Power
55145	Electronic output +12V metal near; −0.5V metal away	230V Power
55132	Delayed-make relay unit	.05 - 1 sec. delay
55133	Delayed-make relay unit	.5 - 10 sec. delay
55136	Delayed-break relay unit	.05 - 1 sec. delay
55137	Delayed-break relay unit	.5 - 10 sec. delay
55148	Solid State AC output	3 Amp 200 Vp
55147	Solid State DC output	1 Amp 150 V max.
MINI-PROX OR MAGNETIC PICKUP SPEED CONTROLS		
55149	These 5 models cover 5 ranges from 0.1 Hz min. to 15,000 Hz max. Each have optional under or over-speed control and optional latching feature.	Freq. .1 to 1.5 Hz
55150		Freq. 1 to 15 Hz
55151		Freq. 10 to 150 Hz
55152		Freq. 100 to 1500 Hz
55153		Freq. 1000 to 15,000 Hz

CONTROL AND SENSING HEAD TEMPERATURE STABLE −30°F TO +160°F

MANY MONEY SAVING APPLICATIONS



PACKAGING — COUNTING — SPEED CONTROL — CUT-OFF CONTROL

Conveyor Control • Measurement • Missing Parts Detection • and many others.

ELECTRO PRODUCTS LABORATORIES, INC.
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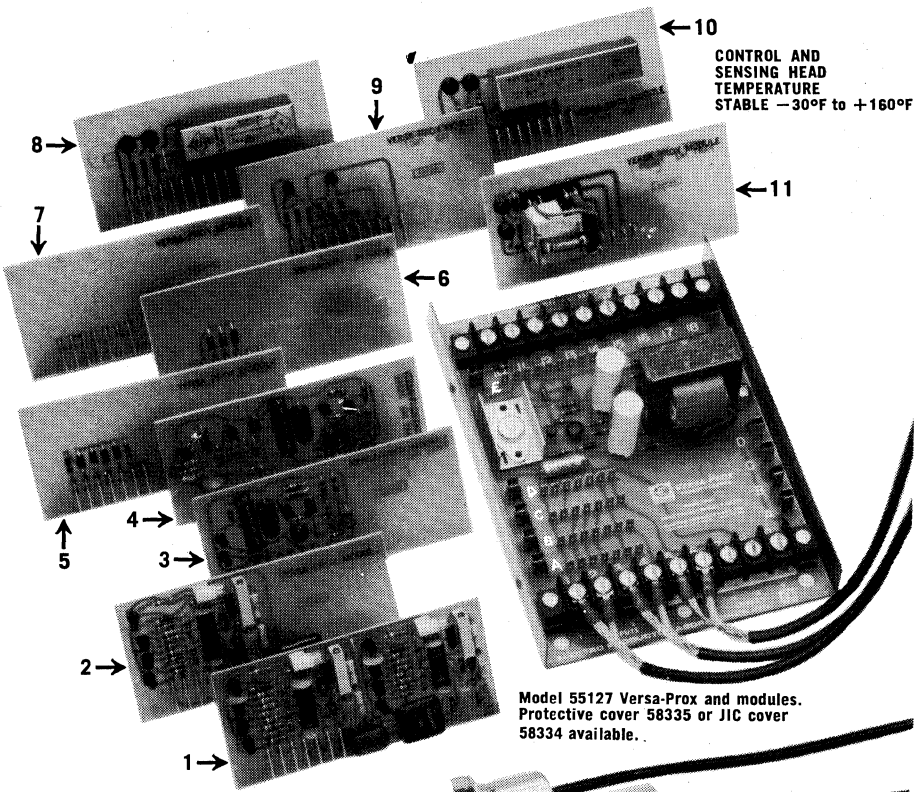
ELECTRO VERSA-PROX

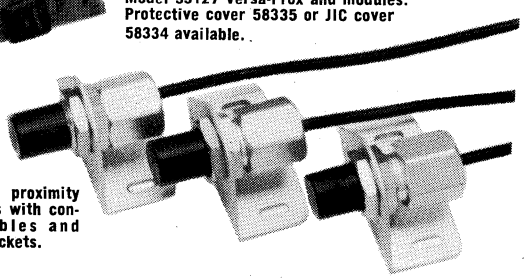
Modular Plug-in Proximity System enables you to tailor signal output to YOUR requirements

Versa-Prox is a new concept in proximity switch versatility. By means of plug-in modules in a five position "mother board", you can tailor detection or control to your exact needs — and change it in a matter of seconds, whenever your need changes.

The outputs of one, two or three transducers may be combined by means of digital logic to form a single output. This output may then be delayed until the output module is required to be energized for the selected control signal.



Model 55127 Versa-Prox and modules. Protective cover 58335 or JIC cover 58334 available.

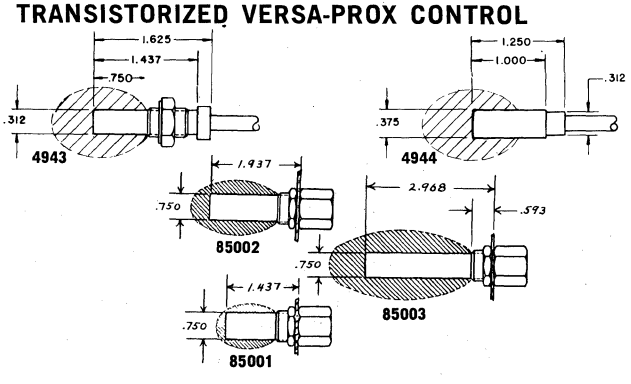


Models 85001 proximity sensing heads with connecting cables and mounting brackets.

VERSA-PROX MODULES FOR MANY FUNCTIONS

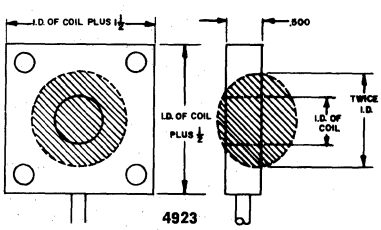
Socket Insert	Module Model	Function	Key to Photo
A and B	76030	Single oscillator	2
	76031	Dual oscillator	1
	76049	Single photo electric amplifier	
	76056	Magnetic pickup signal conditioner	
C (only)	76033	OR	6
	76042	PASS	7
	76043	AND	5
	76048	3 - Input Comparator/Latch	
	76054	2 - Input Comparator/Latch	
C or D	76034	Delayed-make .05 - 1 sec.	
	76040	Delayed-make .5 - 10 sec.	3
	76035	Delayed-break .05 - 1 sec.	
	76041	Delayed-break .5 - 10 sec.	4
	76052	Pulse Width Control .05 - 1 sec.	
	76053	Pulse Width Control .5 - 10 sec.	
	76047	No - No Latch	
E	76036	Relay output 10-A DPDT	11
	76037	Electronic output +12V metal near −0.5V metal away	9
	76038	Reed Relay	10
	76039	Mercury Relay	8
	76050	Solid State AC output 3A 200Vp	
	76051	Solid State DC output 1A 150V Max.	

PROXIMITY SENSING HEADS FOR USE WITH TRANSISTORIZED VERSA-PROX CONTROL



Model 4943 — typical of a selection of standard sensing heads available from stock for quick delivery.

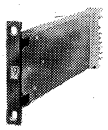




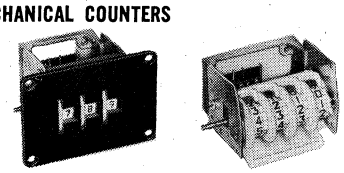
ELECTRICAL AND MECHANICAL COUNTERS AND NUMBERING DEVICES

INDICATING MODULE

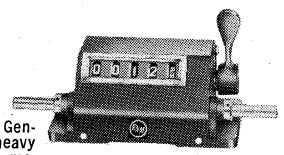
Stock U44 — Panel mount, indicating, up to 40 pulses per second, resettable by external switch using half wave rectified A.C. source with fixed plug and removable socket.
Dimensions: Front panel 1.680″ high x ¼″ wide; Overall length 4.216″; Body height 1.125″.
Price each: $12.00
Also available with electrical readout, print wheels, high speed operation 80 pulses/second.



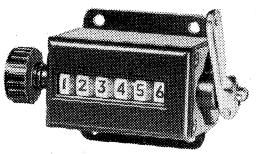
MECHANICAL COUNTERS



Stock M36 — Predetermining mechanical counter, 3 digit, 200 strokes per min. Predetermined contact is a single pole double throw switch, capacity 5 A., 250 V. A.C. Terminals on switch, panel mount, preset by 3 setting knobs.
Dimensions: 2.155″ long x 3.062″ wide x 2.312″ high
Price each: $14.30

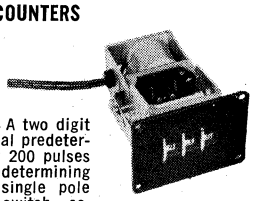


Stock M28 — General purpose heavy duty, 6 digit, mechanical double shaft counter, revolution drive, adds or subtracts one count for each complete revolution of input shaft, 10,000 CPM, base mount with resettable lever.
Dimensions: 3.094″ long x 2.250″ wide x 1.781″ high
Price each: $42.00

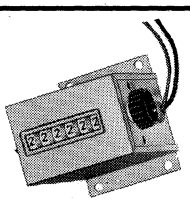


Stock M26 — Small medium duty 6 digit mechanical stroke counter with resettable knob and operating lever, 1000 CPM, base mount.
Dimensions: 1.63″ long x 1.00″ wide x 1.045″ high
Price each: $7.22

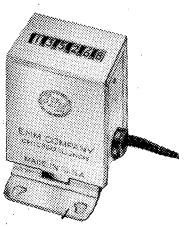
ELECTRICAL COUNTERS



Stock PE 35 — A two digit 115 W. electrical predetermining counter 200 pulses per min. Predetermining contact is a single pole double throw switch, capacity 5A, 250 V. A.C. panel mount. Preset by two setting knobs. U.L. Recognized.
Dimensions: 3.580″ long x 3.062″ wide x 2.312″ high
Price each: $19.90, 2 figures; $21.20, 3 figures

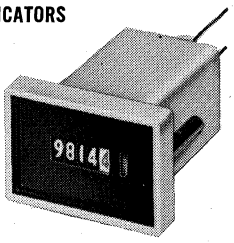


Stock E3A — Mount electrical impulse counter, standard speed (500 counts per min.), knob resettable 6 digits, 115 V 60 hz. U.L. Recognized.
Dimensions: 2.63″ long x 2.75″ wide x 1.87″ high
Price each: $12.50

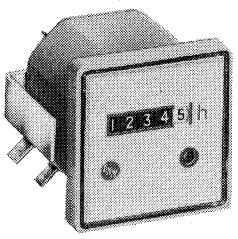


Stock E2B — Economy electric counter, 6 digit, 110 V. 60 hz. 600 CPM, 12″ leads, non-resettable, base mount, "L" shaped mounting holes. U.L. Recognized.
Dimensions: 2.340″ long x 1.718″ wide x 1.187″ high
Price each: $5.25

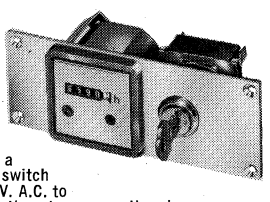
ELAPSED TIME INDICATORS



Stock T4B — Miniature elapsed time indicator, 5 digit, non-reset, 115 V. 60 hz., scale 9999.9 hours, with tenths in red, panel mount.
Dimensions: 1.72″ long x 1.59″ wide x 1.03″ high
Price each: $15.50

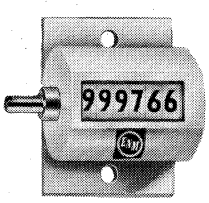


Stock T5B — Economy elapsed time indicator, 5 digit, non-reset, 110 V. 60 hz., scale 9999.9 hours, with tenths in red, mounting in 1.968 dia. hole or 1.781 square panel cutout.
Dimensions: 2.078″ long x 1.891″ wide x 1.891″ high
Price each: $15.00

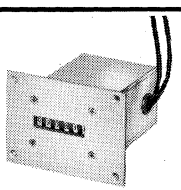


Stock P8C — Economy elapsed time indicator with security lock and key. Key actuates a standard D.P.S.T. switch 25 AMP, 120-250 V. A.C. to start equipment; thus true operating hours are recorded. 5 digit, non-reset, 110 V. 60 hz., scale 9999.9 hours with tenths in red, panel mount.
Dimensions: 1.828″ long x 5.505″ wide x 1.891″ high
Price each: $17.90

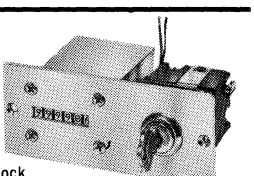
NON-RESET COUNTERS



Stock M21 — Small medium duty 5 digit mechanical revolution counter, 3000 CPM, non-resettable, base mount.
Dimensions: 0.876″ long x 0.938″ wide x 0.432″ high
Price each: $3.64

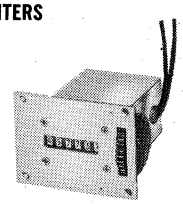


Stock P2A — Panel mount electric counter, 6 digits, 115 V. 60 hz., (U.L. Recognized) 500 CPM, non-resettable.
Dimensions: 2.63″ long.
Price each: $9.45

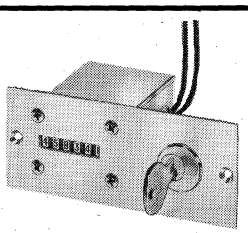


Stock P6A — Panel mount electric counter non-reset with key lock, controlling two electrical circuits, one operating the counter, the other operating the equipment, 6 digit, 500 CPM, 115 V. 60 hz., key switch; D.P.S.T. standard 25 AMP, 120-250 V. A.C.
Dimensions: 2.63″ long x 4.5″ wide x 1.87″ high
Price each: $15.10

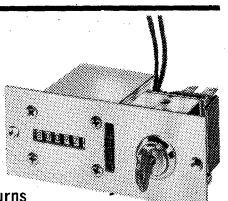
RESET COUNTERS



Stock P3A — Panel mount electric counter, 6 digit, knob reset, 500 CPM, 115 V. 60 hz. (U.L. Recognized)
Dimensions: 2.63″ long x 2.25″ wide x 1.87″ high
Price each: $12.50



Stock P4A — Panel mount electric counter, 6 digit, key reset, 500 CPM, 115 V. 60 hz. (U.L. Recognized)
Dimensions: 2.63″ long x 4.50″ wide x 1.88″ high
Price each: $28.15

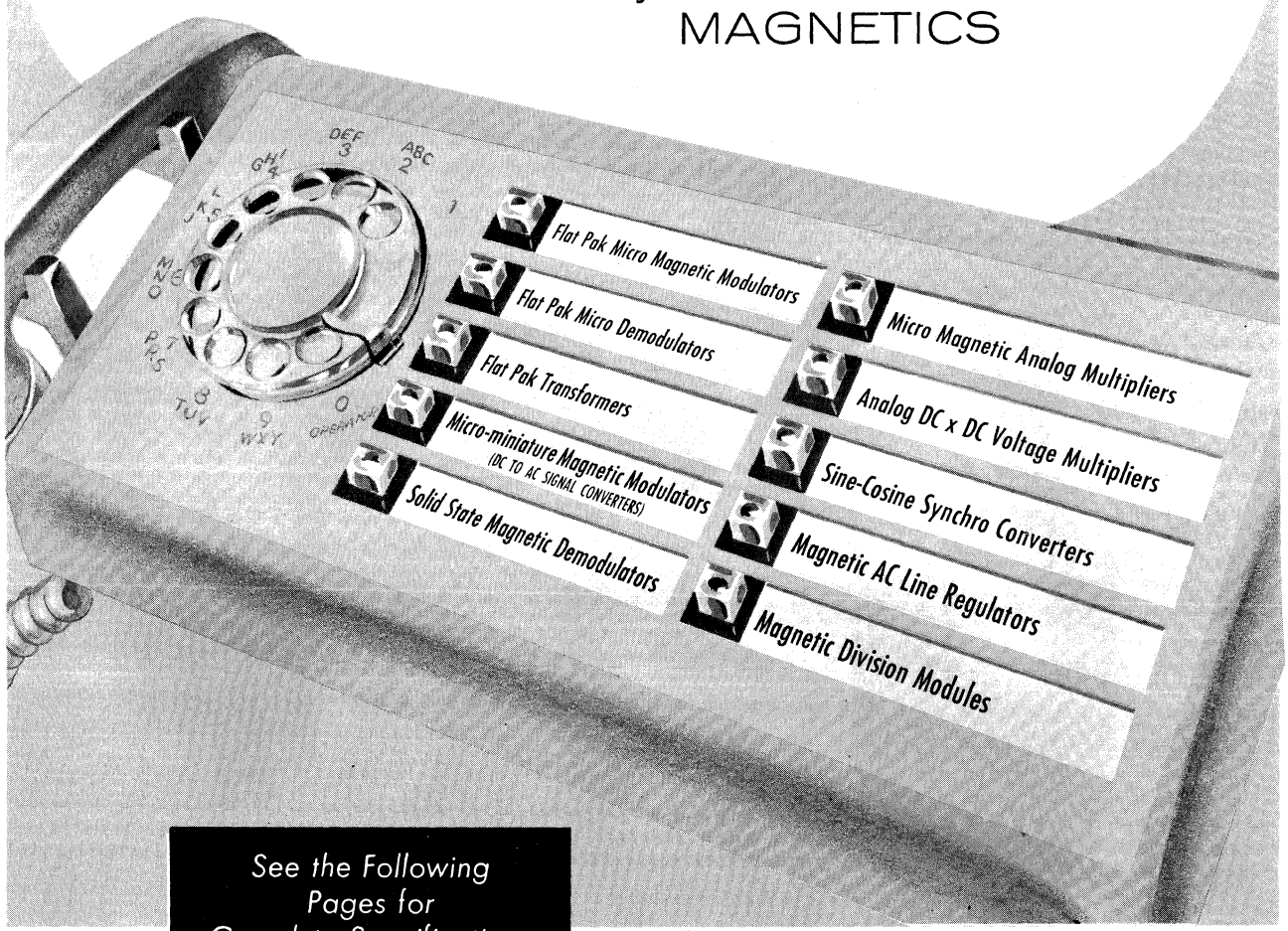


Stock P7A — Panel mount electric resettable counter with an exclusive key switch which turns the equipment on or off. Key necessary for manually resetting to zero, 6 digit, 500 CPM, 115 V. 60 hz., switch D.P.S.T. standard 25 AMP, 120-250 V. A.C. (U.L. Recognized)
Dimensions: 2.63″ long x 4.5″ wide x 1.88″ high
Price each: $29.15

FOR UNLIMITED LIFE AND
SUPERIOR PERFORMANCE

Design Analog Computers with Magnetic Microblocks

by GENERAL
MAGNETICS



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Complete Specifications
and Data . . .

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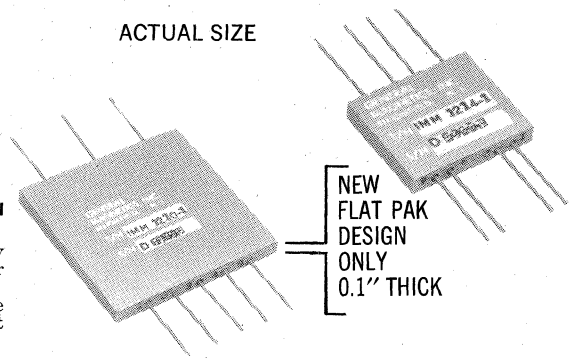
GENERAL MAGNETICS • INC

135 Bloomfield Ave., Bloomfield, New Jersey 07003—Tel. (201) 743-2700

Flat Pak 'Mag Mod' Magnetic Modulators

ACTUAL SIZE

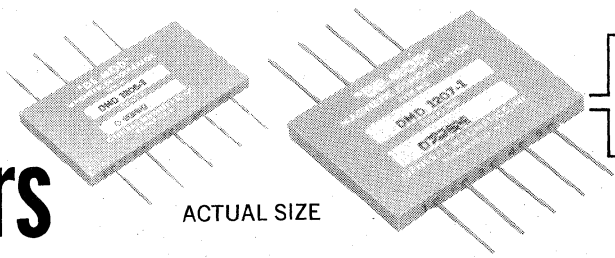


SPACE-SAVING MODULES THAT MEET TODAY'S MINIATURIZATION REQUIREMENTS

The Flat Pak Micro Magnetic Modulators feature an essentially drift free circuit with superior phase and gain slope stability over very wide temperature ranges.
Transformer-like ruggedness and reliability features characterize the dependability of these devices over wide dynamic ranges. Flat Pak Micro "Mag Mods" are shock and vibration proof.
Typical specifications:

TYPE NUMBER	IMM 1199-1	IMM 1210-1	IMM 1211-1	IMM 1212-1	IMM-1213-1	IMM 1214-1	IMM 1216-1
Reference Carrier Voltage and Frequency	10 V RMS @ 1800 Hz	10 V RMS @ 400 Hz	5 V RMS @ 10 KHz	5 V RMS @ 25 KHz	5 V RMS @ 50 KHz	5 V RMS @ 100 KHz	5 V RMS @ 1 MHz
Input Control Signal Range	0 to ±1.5 ma DC	0 to ±300 ma DC	0 to ±5 V DC	0 to ±5 V DC	0 to +10 V DC	0 to ±10 V DC	0 to ±10 V DC
DC Resistance of Input DC Signal Winding	8 K ohms	30 K ohms	10 K ohms min	10 K ohms min	> 5 K ohms	> 5 K	> 5 K
AM Phase Reversing AC Output Range	0 to 5 V RMS @ 1800 Hz	0 to 5 V RMS @ 400 Hz	0 to 5 V RMS @ 10 KHz	0 to 5 V RMS @ 25 KHz	0 to 5 V RMS @ 50 KHz	0 to 5 V RMS @ 100 KHz	0 to 5 V RMS @ 1 MHz
Differential Gain RMS mv. AC Output/ ua DC Sig. Input	4 mv RMS/μ a DC	16.5 mv RMS/μ a DC	1 V RMS/1 V DC	1 V RMS/1 V DC	0.5 V RMS/ 1 V DC	0.5 V RMS/ 1 V DC	0.5 V RMS/ 1 V DC
AC Output Null (Noise Level) RMS	½% f.s.	½% f.s.	0.5% f.s.	0.5% f.s.	0 to 5 V RMS @ 50 KHz	0 to 5 V RMS @ 100 KHz	0 to 5 V RMS @ 1 MHz
Output Impedance	< 50 ohms	< 50 ohms	< 50 ohms	< 50 ohms	< 50 ohms	< 50 ohms	< 50 ohms
External Load	10 K to 100 K ohms	10 K to 100 K ohms	10 K to 100 K ohms	10 K to 100 K ohms	10 K to 100 K ohms	10 K to 100 K	10 K to 100 K
Excitation (Carrier Winding) Impedance	4 K ohms	25 K ohms	10 K ohms	10 K ohms	5 K ohms	1 K ohms	1 K ohms
Zero Point Drift over Temp. Range Referred to DC Input Terminals	0.25% f.s.	0.5% f.s.	0.5% f.s.	0.5% f.s.	1% max	1% max	1% max
Hysteresis in Percent of Max. Input DC Signal	0.2% f.s.	0.5% f.s.	0.5% f.s.	0.5% f.s.	0.5% f.s.	0.5% f.s.	0.5% f.s.
% Harmonic Distortion in Output Wave	5%	10%	< 5%	< 5%	< 5%	< 5%	< 5%
Temperature Range	—55°C to +125°C	—55°C to +125°C	—55°C to +125°C	—55°C to +125°C	—55°C to +100°C	—55° to +100°C	—55° to +100°C
Frequency Response	DC to 200 HZ	DC to 100 Hz	DC to 1 KHz	DC to 2.5 KHz	DC to 5 KHz	DC to 10 KHz	DC to 10 KHz
Overall Dimensions (in inches)	0.1 x 1.25 x 1.25	0.1 x 1.25 x 1.25	0.1 x 1.25 x 1.25	0.1 x .75 x .625	0.1 x .75 x .625	0.1 x .75 x .625	0.1 x .75 x .625
Type of Mounting	Flat Pak Terminals	Flat Pak Terminals	Printed Circuit Flat Pak	Printed Circuit Flat Pak	Printed Circuit Flat Pak	Printed Circuit Flat Pak	Printed Circuit Flat Pak

Flat Pak Demodulators



ACTUAL SIZE

TYPE NUMBER	DMD 1206-1	DMD 1207-1
REFERENCE		
A. Voltage	26 V	26 V
B. Frequency	400 Hz	2 KHz
C. Impedance	> 50 K	> 50 K
SIGNAL		
A. Voltage Range	0-1 V	0-1 V
B. Frequency	400 Hz	2 KHz
C. Impedance	> 15 K	> 15 K

TYPE NUMBER	DMD 1206-1	DMD 1207-1
OUTPUT		
A. Maximum Output	1.0 V	1.0 V
B. Load	30 K	30 K
C. Linearity	0.5% fs	0.5% fs
D. Frequency Response	30 Hz	30 Hz
E. Ripple	> 30 mv	> 10 mv
F. Null	1 mv	1 mv

TYPE NUMBER	DMD 1206-1	DMD 1207-1
AMBIENT TEMP. RANGE	—55°C to +125°C	—55°C to +125°C
PHYSICAL SIZE	0.95 X 1.65 X 0.1	0.95 X 1.3 X 0.1
D.C. POWER	±15 V	±15 V

There is No Substitute for Reliability

GM INC.

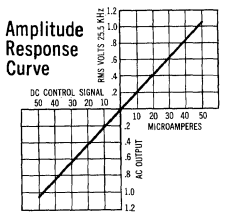
A typical unit gives 1 v. DC per 1 v. AC and provides 10K impedances on both signal and reference windings. This demodulator provides less than 2% absolute linearity from 0.1 v. to 10.0 v. output. Operation is over an ambient range of —55°C to +125°C. Output impedance less than 500 ohms DC; offset null less than 8 mv over the entire ambient range.

GENERAL MAGNETICS • INC
135 Bloomfield Ave., Bloomfield, New Jersey 07003—Tel. (201) 743-2700

'Mag Mod' Micro-miniature Magnetic Modulators

... Design Analog Computers with Micro Magnetics

General Magnetics



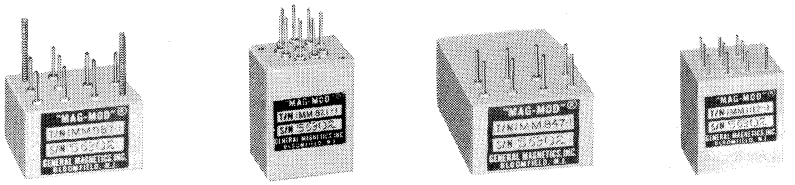
Typical Performance Data — Model 748-3

- **Output distortion as low as 1%**
- **Electrical zero point and gain, repeatability and stability over the entire service life**
- **Extremely broad bandwidth**
- **Carrier frequencies as high as 5 MHz**
- **Input signal current resolution better than 0.001 μa**
- **Low milliwatt power consumption**

Circuit Isolation — DC to AC Sinusoidal Conversion and Amplification

"MAG MODS" PROVIDE FOUR QUADRANT OPERATION, extreme stability with negligible change of phase, gain and zero position over a wide temperature range. Design is simple, featherweight and rugged — with no vacuum tubes, semiconductors or moving parts to limit life.

MICRO MAGNETIC MODULATORS FEATURE an essentially drift-free circuit with superior phase and gain stability over wide environmental ranges. All the ruggedness, dependability, wide dynamic range and stability that are characteristic of the larger magnetic modulators are engineered into this new magnetic circuit. MICRO "MAG MODS" are shock and vibration proof, provide infinite standby and service life. The micro modulators below are typical; for specifications on other models request literature.



TYPE NUMBER	IMM 987-1	IMM 821-1	IMM 847-1	IMM 1112-1
Reference Carrier Voltage and Frequency	115 V 400 Hz	3 V RMS @ 96 KHz	5 V @ 800 Hz	3.5 V RMS @ 1 MHz
Input Control Signal Range	0 to ±150 μa DC	0 to ±100 μa (DC to 1000 Hz)	0 to ±200 μa DC	0 to ±3 ma DC (DC to 200 KHz)
DC Resistance of Input DC Signal Winding	3 Inputs — 4.5 K each	150 ohms	12.5 K ohms	1000 ohms
AM Phase Reversing AC Output Range	0 to 5 V RMS @ 400 Hz	0 to 0.6 V RMS @ 96 KHz	0 to 1 V RMS @ 800 Hz	0 to 3 V RMS @ 1 MHz
Differential Gain RMS mv. AC Output/ua DC Sig. Input	33 mv RMS/μa DC	6 mv RMS/μa	5 mv RMS/μa DC	1 V RMS/ma DC
AC Output Null (Noise Level) RMS	25 mv RMS	20 mv RMS Max.	5 mv RMS	30 mv RMS
Output Impedance	1.2 K ohms	7.5 K ohms	10 K ohms	3 K ohms
External Load	25 K ohms	100 K ohms	50 K ohms	50 K ohms
Excitation (Carrier Winding) Impedance	200 K ohms	115 ohms	12 K ohms	800 ohms
Zero Point Drift over Temp. Range Referred to DC Input Terminals	±0.2 μa DC	±0.2%	±0.5 μa DC	±0.5%
Hysteresis in Percent of Max. Input DC Signal	±0.2%	±0.2%	±0.4%	±0.5%
% Harmonic Distortion in Output Wave	10%	5%	10%	3%
Temperature Range	−55°C to +80°C	0°C to +100°C	−55°C to +100°C	−55°C to +85°C
Frequency Response	DC to 100 Hz	DC to 1000 Hz	DC to 200 Hz	DC to 200 KHz
Overall Dimensions (in inches)	.550 X .750 X .550	0.562 X 0.40 X .750	1 3/16 X 1 3/16 X ½	0.4 X 0.5 X 0.6
Type of Mounting	2-56 Studs	Printed Circuit Board	Printed Circuit Board	Printed Circuit Board 1/10" Grid
Approximate Weight (in ounces)	0.3 ounce	0.12 ounce	0.2 ounce	0.1 ounce

"MAG MODS" conform to MIL-T-27A and MIL-E-5400 Specifications

Prime Components in Solid State Design—The "MAG MOD" family of Magnetic Modulators has proven to be the most reliable module circuit block in aircraft and space vehicle flight control systems developed to date. They are universally accepted and in use in many military and commercial products where reliability is a price factor. Request literature.

There is No Substitute for Reliability

GM INC.

GENERAL MAGNETICS • INC

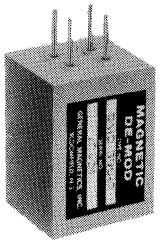
135 Bloomfield Ave., Bloomfield, New Jersey 07003 —Tel. (201) 743-2700

Design Analog Computers with Micro Magnetics..

G/M Solid State Magnetic Demodulators

FREQ. RANGE 60 Hz to 10 KHz

General Magnetics



G/M MAGNETIC DEMODULATORS are solid state circuits for converting phase reversing AC signal voltages into phase detected polarity reversing DC voltages; the amplitude and polarity of the DC output are directly proportional to the phase and amplitude of the AC signal.

- **High reference impedance resulting in very small reference power requirements**
- **Output as high as ±10 v. DC in present units**
- **Unit operation frequencies; 60 Hz to 10 KHz**
- **Operation over wide environmental range**
- **Very low DC offset null voltages (as low as 0.1% of full scale)**
- **Signal and reference terminals may be isolated**
- **Low output impedance**
- **Small physical size**

TYPE NUMBER	DMD 1012-1	DMD 1013-1	DMD 1017-1	DMD 1023-1	DMD 1024-1	DMD 1028-1
REFERENCE						
A. Voltage	115 V	115 V	115 V	30 V-P-P	30 V	15 V
B. Frequency	60 Hz	400 Hz	400 Hz	55 Hz	900 Hz	50 to 60 Hz
C. Impedance	> 50 K	> 50 K	> 5 K	≈ 2.7 K	≈ 31 K	≈ 5.1 K
SIGNAL						
A. Voltage Range	0-1 V	0-10 V	0-10 V	0-5 V	0-3 V	0-10 V
B. Frequency	60 Hz	400 Hz	400 Hz	55 Hz	900 Hz	50 to 60 Hz
C. Impedance	10 K ±10%	10 K +10%	> 10 K	> 10 K	> 3 K	≈ 3 K
OUTPUT						
A. Maximum Output	±0.5 V ±5%	±5 V ±5%	±3 V ±5%	±4 V ±5%	±100 mv ±10%	±10 V ±5%
B. Load	25 K ohms	5 K ohms	2 K ohms	10 K ohms	250 ohms	10 K ohms
C. Linearity	±1% fs	±1% fs	±1% fs	±1% fs	±1% fs	±1% fs
D. Frequency Response	—	—	40 Hz	0.5 Hz	0.5 Hz	—
E. Ripple	No Filter	No Filter	< 150 mv	< 200 mv	< 0.5 mv	< 400 mv
F. Null	< 10 mv	< 10 mv	< 10 mv	< 10 mv	< 60 μv	< 15 mv
AMBIENT TEMP. RANGE	—30°C to +85°C	—30°C to +85°C	—30°C to +71°C	0°C to +50°C	0°C to +50°C	—10°C to +55°C
PHYSICAL SIZE	1 X 1 X 2.5	1 X 1 X 2.5	1 X 1 X 2.5	0.95 X 1 X 2.5	1 X 1.7 X 0.75	1.9 X 1.25 X 2.9
D.C. POWER	+15 V	+15 V	+28 V	±15 V	±15 V	+15 V

TYPE NUMBER	DMD 1034-1	DMD 1040-1	DMD 1053-1	DMD 1074-1	DMD 1066-1	DMD 1133-1
REFERENCE						
A. Voltage	26 V	115 V	115 V	115 V ±5%	115 V ±10%	115 V
B. Frequency	400 Hz	400 Hz	400 Hz	400 ≈ ±5%	400 Hz	400 Hz
C. Impedance	> 8 K	> 100 K	> 100 K	> 100 K	> 40 K	> 100 K
SIGNAL						
A. Voltage Range	0-5 V	0-3.2 V	0-0.5 V	0-50 V	0-10 V	0-2.5 V
B. Frequency	400 Hz	400 Hz	400 Hz	400 ≈	400 Hz	400 Hz
C. Impedance	> 10 K	> 3 K	> 200 K	> 1 meg	> 15 K	> 200 K
OUTPUT						
A. Maximum Output	±5 V ±5%	±5 V ±5%	±2.5 V ±5%	±50 V ±5%	±1.0 V ±5%	±1.0 V ±5%
B. Load	10 K ohms	50 K ohms	10 K ohms	100 K	1 K	10 K
C. Linearity	±1% fs	±1% fs	±1% fs	±1% fs	± 1% fs	±1% fs
D. Frequency Response	≈ 100 Hz	—	30 Hz	80 ≈	N.S.	> 30 Hz
E. Ripple	< 450 mv	No Filter	< 125 mv	< 50 mv	< 40 mv	< 30 mv
F. Null	< 15 mv	< 10 mv	< 4 mv	< 100 mv	< 4 mv	< 4 mv
AMBIENT TEMP. RANGE	0°C to +85°C	—30°C to +85°C	—20°C to +50°C	0°C to +65°C	—55°C to +90°C	—40°C to +68°C
PHYSICAL SIZE	0.6 X 0.9 X 1.8	1 X 1 X 2.5	1 X 1 X 2.5	2.6 X 1.95 X 2	1.6 X 0.8 X 0.6	1 X 1 X 2.5
D.C. POWER	±15 V	No	+24-32 V	±15 V ±60 V	±10 V	+24 —32 V

All units available in wider temperature ranges. See Bulletin 108B for other stock types.

There is No Substitute for Reliability

GM INC.

A typical unit gives 1 v. DC per 1 v. AC and provides 10K impedances on both signal and reference windings. This demodulator provides less than 2% absolute linearity from 0.1 v. to 10.0 v. output. Operation is over an ambient range of −55°C to +125°C. Output impedance less than 500 ohms DC; offset null less than 8 mv over the entire ambient range.

GENERAL MAGNETICS • INC

135 Bloomfield Ave., Bloomfield, New Jersey 07003—Tel. (201) 743-2700

Micro Magnetic Multipliers

AC x DC MONOLITHIC ANALOG COMPUTING MODULES

..For Unlimited Life and Superior Performance!

General Magnetics

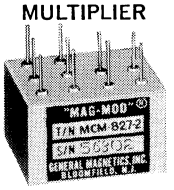
MONOLITHIC MICRO CIRCUIT BLOCK for analog voltage multiplying of DC x AC voltages.

ADDITION, SUBTRACTION, MULTIPLICATION, AND SQUARING of many voltage variables may be handled by one G/M Magnetic Microblock.

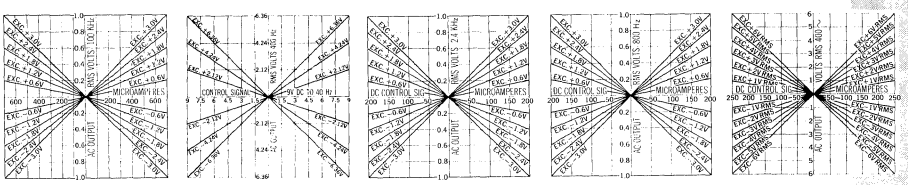
PRODUCT ACCURACY of up to 0.2% of full scale, with very slight derating over a wide temperature range.

Proven reliability—unlimited life
Extreme stability with negligible change of product accuracy over a wide temperature range
High shock and vibration proof
Bandwidth may be extended into the kilocycle
Low milliwatt power consumption
Four quadrant operation
Repeatable data over years of continuous unattended operation
Simple, lightweight, rugged
May be mounted directly on printed circuit cards

World's Smallest and Most Reliable G/M ANALOG VOLTAGE MULTIPLIER



New micro-miniature G/M Analog Voltage Multiplier as small as 0.1 cubic inch, weighing as little as 0.1 ounce.



TYPE NUMBER	MCM 827-2	MCM 1079-2	MCM 845-1	MCM 847-1	MCM 893-2
Product Accuracy	1% Maximum	1% f.s.	Less than 1%	1% f.s.	1% f.s.
Input Control Signal Range	0 to ±800 μa (DC to 5,000 Hz	0 to ±9 V DC (DC to 50 Hz	0 to ±200 μa (DC to 100 Hz	0 to ±200 μa (0 to 50 Hz	0 to ±250 μa DC
DC Resistance of Input Signal Range	500 ohms	50 K ohms	12.5 K ohms	12.5 K ohms	2,500 ohms
Input AC Sig. Range Amplitude, Frequency	0.6 V to 3 V RMS 100 KHz	0 to 6 V RMS 400 Hz	0 to 3 V RMS 2400 Hz	0 to 3 V RMS 800 Hz	0 to 6 V RMS 400 Hz
AC Output Product Range	0 to 1 V RMS @ 100 KHz	0 to 6 V RMS @ 400 Hz	0 to 1 V RMS @ 2.4 KHz	0 to 1 V RMS @ 800 Hz	0 to 6 V RMS @ 400 Hz
Null at Max. AC Signal, Zero DC Signal	15 mv RMS	50 mv RMS	10 mv RMS Max.	10 mv RMS Max.	30 mv RMS
Output Impedance	650 ohms	50 ohms	12 K ohms	8 to 10 K ohms	600 ohms
External Load	10 K to 100 K ohms	5 K to 50 K ohms	50 K ohms	50 K ohms	25 K or greater
Temperature Range	−55°C to +85°C	−55°C to +71°C	−55°C to +100°C	−55°C to +100°C	−55°C to +85°C
Null Drift over Temp. Range	±0.2% of f.s.	±0.2% f.s.	±0.2%	±0.2%	±1 μa RC ±μa DC*
Accuracy Variation over Temp. Range	±0.5%	±0.5%	±0.2%	±0.2%	±0.5%
Hysteresis in % of Max. Input DC Signal	±0.1%	±0.4%	±0.2%	±0.2%	±0.5%
% Harmonic Dist. in Output Prod. Wave	Less than 5%	5%	3% to 5%	5% maximum	5% maximum
Overall Dimensions (in Inches)	5/8 X 25/32 X 1/2	0.6 X 0.7 X 1.0*	37/64 X 25/32 X 1/2	37/64 X 25/32 X 1/2	1.7 X 1.560 X 0.60
Approximate Weight (in Ounces)	0.26 ounce	0.5 ounce	0.26 ounce	0.26 ounce	3 ounces

*Reference to input

For proven reliability in solid state magnetic module applications, these high reliability devices are widely employed in flight systems, fire control, analog computers, guided missiles, nuclear equipment, antennas and thousands of control systems; request literature. Customized engineering, when required, is performed on a no-charge basis. Delivery as required.

There is No Substitute for Reliability

GM INC.

GENERAL MAGNETICS • INC
135 Bloomfield Ave., Bloomfield, New Jersey 07003—Tel. (201) 743-2700

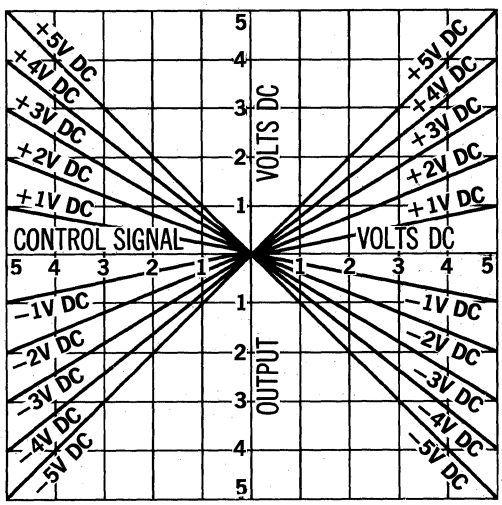
For Unlimited Life and Superior Performance..

G/M Analog DC x DC Voltage Multiplier

General Magnetics

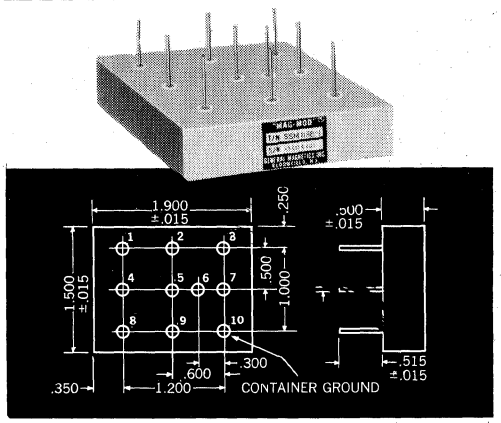
General Magnetics proven-reliable four quadrant multiplying module is particularly applicable for flight systems, analog computers, guided missiles, nuclear equipment, weapon control, etc. It features a product accuracy of at least 0.5% of full scale output amplitude.

Small in size — only 1.5 x 1.9 x .5 inches, Type SSM 1179-1 will provide repeatable data for years of continuous, maintenance-free service life. Simple, lightweight and rugged, this DC voltage multiplier may be mounted directly on printed circuit cards.



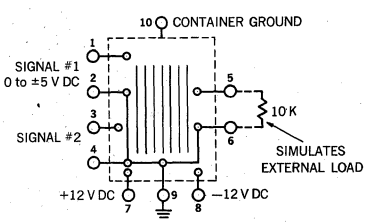
FEATURES:

20 K ohms input resistance, each signal
Four quadrant DC operation
Frequency response 0 to 100 cps
Product accuracy 0.5% or better, of full scale
Operation over a temperature range of −55°C to +100°C
High shock and vibration resistance



TYPICAL SPECIFICATIONS — TYPE SSM 1138-2	
Product Accuracy	*0.5% of full scale
Input Signal #1	0 to ±10 V DC to 100 cps
Input Signal #2	0 to ±10 V DC to 100 cps
Input Resistance	20 K ohms, both signals
Output	0 to 10 V DC ±5% to 10 K ohm load
DC Power Requirements	±15 V DC
Ambient Temperature Range	−55°C to +100°C

*INCLUDES TEMPERATURE DRIFT OVER SPECIFIED RANGE



TERMINALS:

7-9	+15 V DC, 30 MA DC (max.)
8-9	−15 V DC, 30 MA DC (max.)
5-6	OUTPUT, 0 to ±10 V DC ±5%, ACROSS 10 K
1-2	SIGNAL #1: 0 to ±10 V DC RIN = 20 K
3-4	SIGNAL #2: 0 to ±10 V DC RIN = 20 K
10	CONTAINER GROUND ONLY

Notes: Terminals 2, 4, 6 and 9 are common internally

There is No Substitute for Reliability

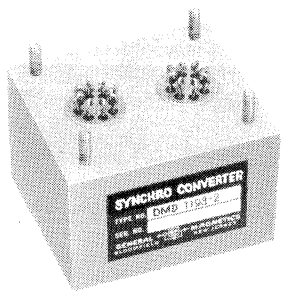
GM INC.

G/M BULLETINS AVAILABLE — Micro Magnetic Demodulators (MM101X), Miniaturized Magnetic Modulators (MM103), Miniaturized Multiplying Modulators (MM104), Miniaturized High-Stability Oscillators (MM105), Micro Magnetic Multiplying Modulators (MM106), Magnetic Relays (MM107), Magnetic Demodulators (MM108), Micro Magnetic Multiplying and Dividing Modulators (MM109), Micro Miniature Magnetic Division Modules (MM110), Magnetic AC Line Regulator (MM111) and Analog DC x DC Voltage Multiplier (MM112).

GENERAL MAGNETICS • INC
135 Bloomfield Ave., Bloomfield, New Jersey 07003 —Tel. (201) 743-2700

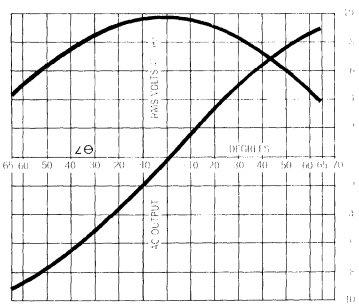
Solid State Sine-Cosine Synchro Converter

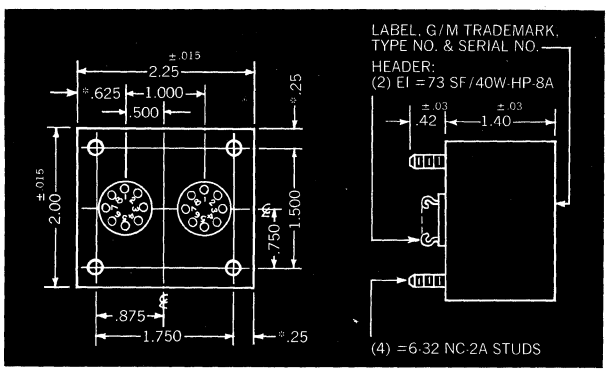
General Magnetics



This new encapsulated circuit converts a 3-wire synchro input to a pair of d-c outputs proportional to the sine and cosine of the synchro angle.

- Complete solid state construction.
- Occupies a volume of only 3.2 cu. in. (Single Channel)
- Operates over a wide temperature range.





	TERMINAL	FUNCTION	
HEADER A	1	S1	SYNCHRO INPUT =1
	2	S3	11.8 V RMS ±10% L-L 400 Hz ±5% REFERENCE
	3	S2	
	4	R2	115 V RMS ±5% @
	5	R1	400 Hz ±5%
	6	+15 V DC	
	7	DC GROUND	
	8	−15 V DC	
HEADER B	1	S1	SYNCHRO INPUT =2
	2	S3	11.8 U RMS ±10% L-L 400 Hz ±5%
	3	S2	
	4	SINE	OUTPUT =1
	5	COSINE	10 V DC FULL SCALE OUTPUT
	6	SINE	OUTPUT =2 10 V DC FULL SCALE OUTPUT
	7	DC GROUND	
	8	COSINE	OUTPUT =2 10 V DC FULL SCALE OUTPUT

Typical Specifications
Type DMD 1193-2
Dual Channel Synchro Converter

ACCURACY—Overall conversion accuracy 6 minutes
AMBIENT TEMPERATURE RANGE — Operating, −40°C to +100°C
Storage, −62°C to −125°C
APPLICATIONS — Analog computers
Flight systems
Fire control
Guided missiles

DUAL CHANNEL SYNCHRO CONVERTER
General Magnetics Model DMD 1193-2 provides two (2) completely independent sine-cosine synchro converter circuits in one package. Overall conversion accuracy is six (6) minutes. Temperature range is −40°C to +100°C.

This new General Magnetics circuit converts a 3 wire synchro input to a pair of d-c outputs proportional to the sine and cosine of the synchro angle. The circuit features complete solid state construction, occupies a volume of only 3.2 cubic inches and operates over a wide temperature range. Overall conversion accuracy defined by the tangent of the angle whose sine and cosine are generated is six (6) minutes. Models are available with both single and dual channel outputs.

There is No Substitute for Reliability

GM INC.

GENERAL MAGNETICS • INC
135 Bloomfield Ave., Bloomfield, New Jersey 07003—Tel. (201) 743-2700

G/M Solid State Magnetic AC Line Regulators 0.1 REGULATION

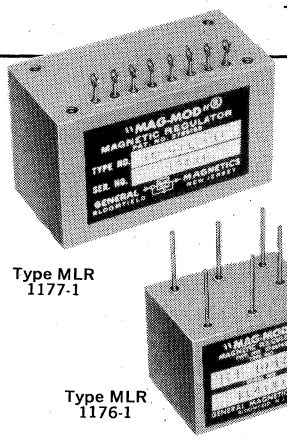
..For Unlimited Life and Superior Performance!

General Magnetics

- 0.1% total line load regulation
- Capable of handling ±10% line frequency variations without loss of regulation
- Output is a low distortion amplitude sinusoidal wave
- Efficient circuit design permits low power consumption
- Small size — lightweight — rugged
- Capability of operating at any center frequency to 50 KHz

AN ENTIRELY NEW TECHNOLOGY is utilized, which completely eliminates resonant tuned AC circuits, no bulky inductors, capacitors or buck-boost transformers are needed to obtain a total AC line load and frequency regulation of 0.1%. The output is a clean sinusoidal wave form containing low harmonic distortion. These G/M line regulators are particularly applicable to flight instruments, and analog and digital computers where an accurate and stable AC reference source is required.

TYPE UNITS



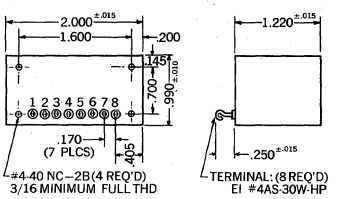
Type MLR 1177-1

Type MLR 1176-1

TYPICAL APPLICATIONS:

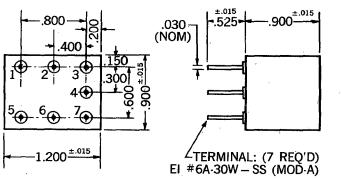
Specifications — Type MLR 1177-1

LINE VOLTAGE:	115 V ±20% 400 Hz ±10%
OUTPUT:	115 V ±1% 400 Hz (includes initial setting accuracy)
LOAD:	5 watts
DISTORTION:	Less than 2%
REGULATION:	±0.2%
D.C. POWER:	±28 V DC



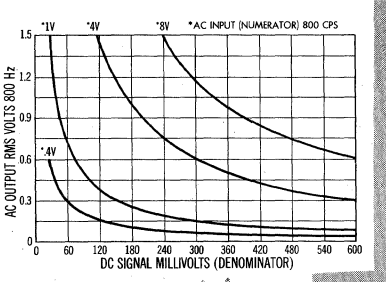
Specifications — Type MLR 1176-1

LINE VOLTAGE:	26 V ±20% 400 Hz ±10%
OUTPUT:	26 V ±1% 400 Hz (includes initial setting accuracy)
LOAD:	1 watt
DISTORTION:	Less than 2%
REGULATION:	±0.1%
D.C. POWER:	±15 V DC



Magnetic Division Modules

These modules can be engineered to meet the most exacting requirements. They employ a new concept which eliminates high gain operational amplifiers and logarithmic circuitry previously used in electronic dividers. This means fewer components resulting in high reliability, excellent stability, micro-miniature size and lower cost. The combination of magnetic and semiconductor circuitry results in analog division with accuracies of 1% or better over wide environmental ranges. The output is an AC sinusoidal signal which is the quotient of an AC numerator and a DC denominator.

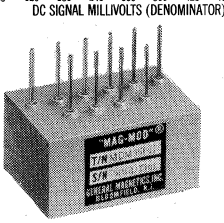


Specifications — Type MDM 889-1*

EXCITATION (NUMERATOR):	0.4 V to 8 V : 800 Hz
BIAS:	+30 V DC
OUTPUT LOAD:	5 K
SIGNAL (DENOMINATOR):	30 MV to 600 MV
AMBIENT TEMPERATURE RANGE:	0°C to +70°C

*Above specifications apply only to MDM 889-1 and may be changed to fit exact requirements

- Micro-miniature Size
- Completely Solid State
- Low Power Consumption
- Wide Numerator and Denominator Ranges
- Isolated Inputs
- Low Output Impedance



These dependable analog computing modules are widely employed in flight systems, fire control, analog computers, guided missiles, nuclear equipment, antennas and thousands of control systems. Micro-circuit, miniature, subminiature, standard and specials are available for proven reliability in linear division, trig function conversion, automatic gain control, etc., applications.

There is No Substitute for Reliability

GM INC.

GENERAL MAGNETICS • INC

135 Bloomfield Ave., Bloomfield, New Jersey 07003—Tel. (201) 743-2700

Full line of high quality industrial time count, control devices

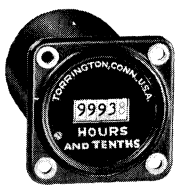
ELAPSED TIME INDICATORS



EF **BULLETIN HD-12**
Synchronous motor-driven, panel mounted non-resettable unit registers minutes and tenths, or hours and tenths. 6 digits. 120 or 240 VAC, 50 or 60 Hz. Round bezel 2⅞ diameter, unit depth 1.790" and barrel diameter 2.110".

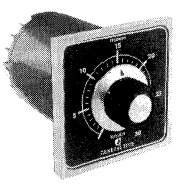


EN & ER **BULLETIN HD-12**
Dust cover enclosed unit with round or square bezel. These meters read in minutes and tenths or hours and tenths. Can be resettable or non-resettable. Units operate on 120 or 240 VAC, 50 or 60 Hz. Bezel diameter 3½", Rd; 3.0", Sq. Unit depth 3¾", barrel 2²³⁄₃₂" dia.



7010-004 HERMETICALLY SEALED MILITARY TYPE INDICATOR **BULLETIN HD-12**
A very small, lightweight running time meter, hermetically sealed. Meets Mil specification requirements per Mil-M-7793C and Mil-E-5272C. Life tested over 78,000 hours. Readout four digits plus tenths. Temperature range −55°C to +85°C. Round case 1¾" square bezel, 2³⁷⁄₆₄" deep, barrel diameter 1½". 115 volts 400 Hz. Solder terminals. Shipping weight: ¾ lb. Also available as ED 71 Commercial version 60 Hz.

ELECTRONIC



SERIES QT11 SOLID STATE PANEL-MOUNT TIMERS **BULLETIN QT-11**
Rugged, highly accurate. Adjustable time range. Internal load relay. Repeat accuracy ±1% of set value above 1 sec, even with voltage variations of ±10%, temperature variations 0° to 60°C. Maximum reset time .050 seconds. Life expectancy up to 10,000,000 operations, depending on load (1,000,000 operations at rated load). 117 VAC 60 Hz. Screw terminal block. Size: 3⅝" sq. x 4⅛" D, behind panel. Requires 3¼" dia. mounting hole. Shipping weight: 2 lbs.

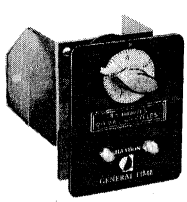


HAYDON QT21 SOLID STATE REAR MOUNTING TIMERS **BULLETIN QT-21**
Moisture-resistant coated PC board. Knob-adjustable time periods. Rear mounting. SPDT relay 10 amps, 125 VAC resistive. Power input 117 volts, 60 Hz. Repeat accuracy ±2% of set value under constant conditions of temperature and voltage. Power standing on this timer has no damaging effect. Maximum reset time 130 milliseconds. Dial accuracy 10% of full scale. ¼" male spade terminals. Size: 3⅜" x 2⁵⁵⁄₆₄" x 3⅝". Two ³⁄₁₆" x ⅝" slotted mounting holes on 2⅞" centers. Average weight, 1 lb.



HAYDON QT52 SOLID STATE OCTAL PLUG TIMERS **BULLETIN QT-52**
Basically same specifications as QT21, except has octal plug mounting and DPDT relay. Size: 4⅜" x 3⁹⁄₁₆" x 2⅛".

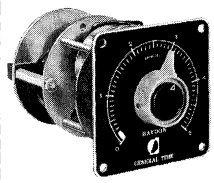
ELECTRICAL RESET TIMERS



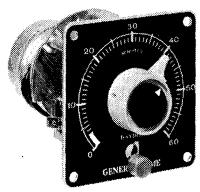
SERIES DA TIME DELAY TIMERS, REAR MOUNTING **BULLETIN HD-12**
Type DA11. Manually adjustable by knob. Apply wherever delay, interval or repeat cycle timing functions are required (repeat cycle requires two units). Resets to start position when power is removed. SPDT switch rated 20 amps. 125 or 250 VAC, resistive; solder lug terminals. Min. setting 0 sec. Repeat accuracy ±¾% of total time range. 5 watt motor. 120 VAC 60 Hz. U/L listed. Size: 3⅜" W x 2¹³⁄₁₆" D x 3⅛" H. Weight: 1½ lbs.
Type DA21. Same as DA11 but with locknut adjustment to eliminate tampering.



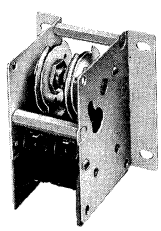
SERIES DP11 PANEL MOUNTING RESET TIMER **BULLETIN HD-12**
Adjustable time range by simple pointer knob. Apply wherever delay, interval or repeat cycle timing are needed. Readout of elapsed time by pointer in center of knob. Unit resets to start position when power is removed. 125 or 250 VAC resistive. Timing motor rated 5 watts max. 120 VAC 60 Hz. Repeat accuracy ±1% of total time range. Screw terminals. Size 3⁵⁄₁₆" sq. x 3³⁄₃₂" D., behind panel; requires 3³⁄₁₆" dia. mounting hole cut.

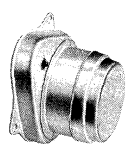


BN41 (INTERVAL) AND BN42 (DELAY) PANEL MOUNT **BULLETIN HD-12**
Dial and setting knob with readout of elapsed time by pointer in center of knob. SPDT relay rated 10 amps at 125 or 250 VAC. Timing motor rated 5 watts max. 120 VAC 60 Hz. Repeat accuracy ±¾ of 1% of total time range. Screw terminal block. Size: 3⅝" sq. x 4⅜" D.; behind panel. Requires 3³⁄₁₆" dia. mounting hole.



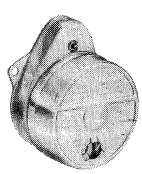
SERIES BJ-12 PUSH-BUTTON INTERVAL TIMER **BULLETIN BJ**
Panel-mount timer. Timing interval is initiated by manually setting knob to selected position and manually depressing the push button. Readout of elapsed time by pointer in center of setting knob. Instant reset to start position automatically. SPDT switch rated 15 amps, 125 or 250 VAC resistive. 120 VAC 60 Hz. Repeat accuracy ±½% of full scale. Combination spade and solder lugs size: 3⅝" Sq x 2²³⁄₃₂" D, behind panel; requires 3³⁄₁₆" dia. mounting hole. Weight: 1½ lbs.



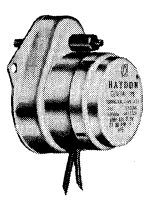


SERIES RE62 REPEAT CYCLE MULTI-CAM TIMERS BULLETIN HD-12
Run continuously, repeating set cycles of multiple switching operations as long as motor is energized. Complete unit requires one motor and one or more switch stacks. Two-switch unit size 2⅝" H x 3³⁄₃₂" W x 3⁹⁄₁₆" D; add 1¹⁄₁₆" to depth for each additional switch.

TIMING MOTORS



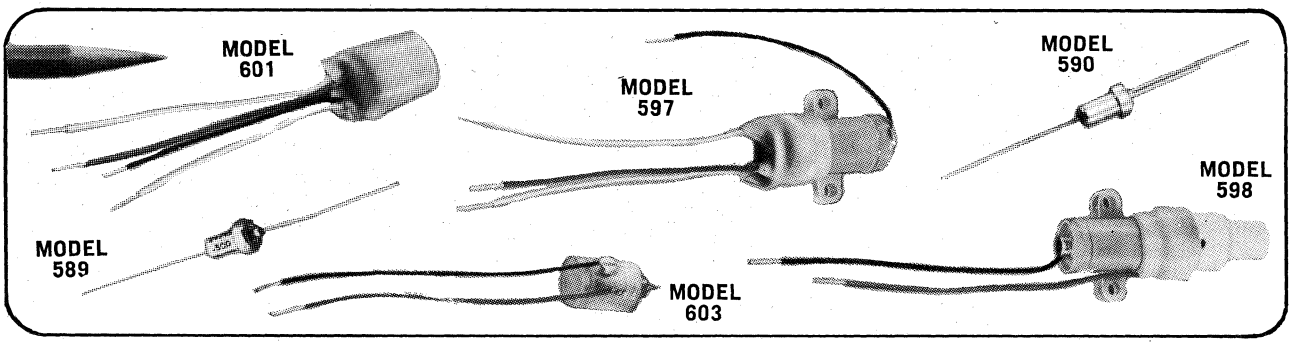
MA26 **BULLETIN MA**
The MP26 is a hysteresis type motor designed for timing operations. Power output is 6 oz./in. at 1 RPM 60 Hz. Output shaft speeds are available from 1 rev per month to 60 RPM. 450 RPM without gear-train @ 60 Hz. Output shafts are available in four standard, plus many special configurations in round, flatted, knurled, and with cross-drilled hole. Operating voltage ranges are 24, 120 and 240 VAC. Frictions are available for manual turning of shaft below 15 RPM. MP26 has standard pear shape gear housing and mounting flange. Mounting holes are on 1.875" centers.



MP20 POWER MOTOR **BULLETIN MP-20**
This timing size synchronous AC motor has an output rating of 200 oz./in. @ 1 RPM over the range of 103 to 132 VAC or 206 to 264 VAC at 60 Hz. Guaranteed minimum running life 10,000 hours. Output shaft speeds 1, 2, 3, 4, 5, 6, 10, 15, 20, 30 and 60 RPM. Output shaft available in 2 standard types, long round and long with flat, for other configurations consult factory. Mounting standard pear shape holes on 1⅞" centers. Rotation can be CW or CCW.

GENERAL TIME
Progress in the World of Time
INDUSTRIAL CONTROLS DIVISION
Torrington, Connecticut 06790 (203) 482-4481

GIBBS TIMING ELECTROLYTIC CELLS



A MAJOR BREAKTHROUGH IN TIMING

Now available from GIBBS — two unique types of Timing Devices called Electrolytic CELLS or COULOMETERS. The timing capability of these units range from thirty seconds to many months. For the first time, the Design Engineer can specify just one type of timing device that is **infinitely variable** to accommodate a truly wide range of timing intervals, and meets all military environmental requirements.

GIBBS Electrolytic CELLS are available in two classifications; **mechanical switching** and **impedance-change switching.** Both classifications are dependent on a simple current/time relationship for their operation, and are specified in terms of "ampere-hour" capacity. The mechanical switching devices mechanically close (or open) switch contacts at the end of the timing period. The impedance change cells exhibit approximately a 10 to 1 change in impedance at the end of the timing period, sufficient to trigger an SCR or Transistor. Input currents range from 5 μA to 2.7 Ma.

GIBBS Electrolytic Cells are ideal for use where a predetermined time action is required. **Applications include:** Signal when maintenance is due; Indicate conclusion of warranty; End-of-life Indicator; Sonobuoy scuttling; Airframe Inspections, Ordnance Safety and Arming; or any timing function ranging from 30 seconds to many months where small size, low cost, ruggedness, accuracy and low current consumption are desirable.

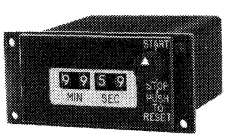
GIBBS Electrolytic CELLS are almost perfect current/time integrators and respond accurately to any input — steady state, pulse, square wave, triangular, etc. Because of this unique integration capability, the designer can successfully work with almost any number of inputs to accurately monitor system operating conditions. SEND FOR FREE DATA AND ENGINEERING APPLICATION NOTES.

SPECIFICATIONS — GIBBS ELECTROLYTIC CELLS

	Model Number	Capacity Microamp. Hours	Time Hours	Accuracy	Size, Inches (body)	Operating Temperature	Application — Operation
IMPEDANCE CHANGE	589-50	50	1-10	±5%	0.310″ dia. x 0.550″	−55°C to +76°C	Cell voltage triggers semiconductor circuit at end of timing period. Impedance-change type. Characteristic Z = 100 ohms before time-out, 50K after.
	589-100	100	2-20	±5%	0.310″ dia. x 0.550″	−55°C to +76°C	
	589-500	500	4-50	±5%	0.310″ dia. x 0.550″	−55°C to +76°C	
	589-1000	1000	8-100	±5%	0.310″ dia. x 0.550″	−55°C to +76°C	
	589-1500	1500	12-150	±5%	0.310″ dia. x 0.550″	−55°C to +76°C	
	589-2500	2500	20-250	±5%	0.310″ dia. x 0.550″	−55°C to +76°C	
	589-2650	2650	100-720	±5%	0.310″ dia. x 0.550″	−23°C to +76°C	
	589-3200	3200	100-800	±5%	0.310″ dia. x 0.550″	−23°C to +76°C	
	590-75-2650	75-Anode #1 2650-Anode #2	1.5-15.0 100-720	±5% ±5%	0.310″ dia. x 0.550″	−23°C to +76°C	Dual anode cell—combines long, short times same unit.
MECHANICAL SWITCHING	597	5350	30 sec.-10 days	±15%	.625″ dia. x 1.50″	−20°C to +38°C	Operates mechanical switch — Close circuit at end of time period.
	598	5350	1-240	±15%	.625″ dia. x 2.25″	−20°C to +38°C	Operates air valve — opens passage at end of time period.
	601	5350	1-240	±10%	.812″ dia. x 1.125″	−40°C to +76°C	Operates mechanical switch — Close circuit at end of time period.
	603	5350	1-240	±10%	.812″ dia. x .812″	−40°C to +76°C	Operates stab detonator.

GIBBS ULTRA-HIGH RELIABILITY DIGITAL COUNTERS

- TESTED BEYOND 100 MILLION OPERATIONS
- DIGITAL READOUT
- INSTANTANEOUS RESET
- HIGH SPEED INPUT
- ULTRA-HIGH RELIABILITY



This counter has been tested to over 100 million operations: Operating from pulse rates to 10 pps or more, its unique design features insure extremely long life, and guarantee rapid, ultra reliable reset operation. It may be preset to any given digit and reset by front panel actuation or remote electrical control. Easily adaptable to other numbering systems as well as base ten, time-of-day readout such as 23:59 is readily provided. Four and six digit models are standard — others are available on special order. Write for additional information.

GIBBS

GIBBS MANUFACTURING & RESEARCH CORPORATION

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TELEPHONE: (213) 870-4642
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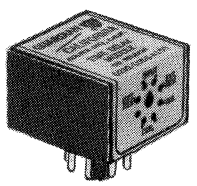
UNIVERSAL TIMING MODULES

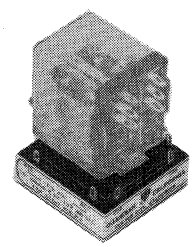


SERIES TMP

Series TMP Time Delay Modules are available in "on-operate" and "on-release" configurations with two time delay and three standard input voltage ranges. The time is externally adjustable within the two ranges from ½ to 100 seconds and 100 to 300 seconds. Repeatability is ±1 percent under normal conditions. Life expectancy is in excess of one-million cycles. Standard input voltages are 24VAC, 115VAC and 24VDC. Other ranges are available as options. The unit is terminated in an octal plug for quick mounting and remote control of relays.

SERIES TMT

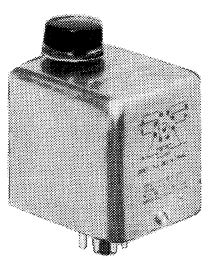
Series TMT Time Delay Modules are designed to permit a relay to be mounted directly onto the module or to permit stacking of TD modules for extended time delay periods. The unit can also be soldered directly to a printed circuit board if desired. Modules provides "on-operate" or "on-release" operation at input voltages of 24VAC, 115VAC and 24VDC. Other input voltages are available as an option. The time delay is externally adjustable within ranges of ½ to 100 seconds and 100 to 300 seconds. Repeatability is ±1 percent under normal conditions. Life expectancy is in excess of one million cycles.

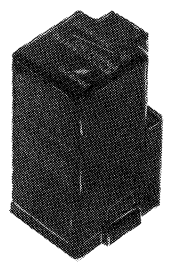


TIME DELAY RELAYS

SERIES TDO

Although it incorporates many features of more expensive units, California Guardian's Series TDO is the most economical 115VRMS solid-state time-delay on the market. Time delay is adjustable from 0.5 to 30 seconds and is controlled by a ten-turn potentiometer. The multi-turn potentiometer provides high resolution, easy reset and accuracy. Series TDO time delays are built to U/L standards. The unit terminates in a standard octal plug for easy mounting. It is accurate within 10 percent of a nominal setting over it's entire temperature range.

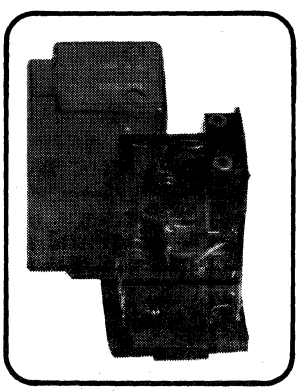




SERIES TD

Similar to high-priced military units, the lower-cost series TD is the most accurate and compact time-delay relay available from stock. Six models for 24VDC to 115VRMS provide delays from 0.5 to 180 seconds. Silicon semi-conductors and tantalum capacitors are utilized for reliability. A 15-turn screw-type potentiometer provides high resolution and accuracy. Recessed screw prevents inadvertent changing of time delay setting. Accuracy is 5 percent of nominal setting over it's complete temperature and voltage range. Repeatability is 2 percent after a line interruption of 50 milliseconds. DC units are polarity protected.

CONTROLLED SENSORS

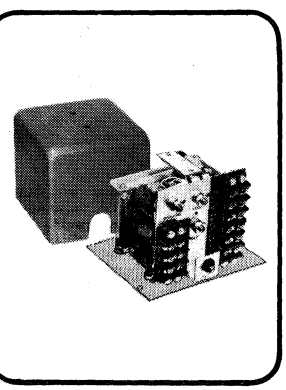


California Guardian's line of solid state controlled sensors and protective devices is the broadest available. Designed for the instrumentation and power equipment industries, sensors are available for 3-phase average sensing; over-voltage sensing; close differential voltage sensing; phase rotation sensing; and over-frequency and under-frequency sensing. Sensors are non-latching, may be interwired with a latching relay, or wired for self latching and pushbutton start and reset. The unit can be socket mounted or chassis mounted and wired with quick disconnect or soldered connections. Voltage and frequency sensors are transient protected.

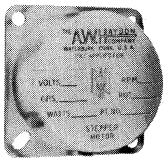
SPECIAL ASSEMBLIES

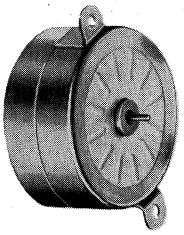
California Guardian will design any type of special sensor or control assembly. In most cases, circuitry has already been designed which eliminates engineering costs. For your special circuits, contact California Guardian. Our engineering department will give your requirements immediate attention.

The unit shown is an undervoltage sensing relay alarm designed for power utility use.



THE AWH AYDON COMPANY TIMING & CONTROL DEVICES



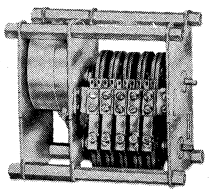


STEPPER MOTORS

A wide range of stepper motors, operating from simple pulse control circuits or electronic logic circuits. Miniature, high-torque, general duty, MIL-SPEC, industrial and commercial models -- unidirectional or bi-directional. Over 150 gear reductions available.

These steppers respond in discrete shaft angle increments to pulsed inputs. Some of their uses are driving counters, positioning synchros, pots, or rotary devices; driving cams, actuators, drums, or charts. They can be used for integrating, timing, data transfer, count or position memory, and for digital/analog conversion.

Low-cost, efficient units are available from The A. W. Haydon Co. to fit your application.

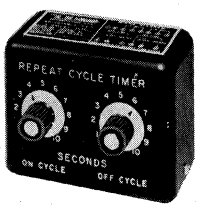


REPEAT CYCLE TIMERS

Both electromechanical and electronic low-cost industrial types handle up to 25 amp load. Standard motor-driven timers have up to 12 switches, cycle times from one second to five days. Sub-miniature units afford small size and lightweight plus ability to meet MIL spec environmentals.

Electronic timers feature versatility and fast timing capabilities for both industrial and military use. Typical industrial unit shown has solid state circuitry and has adjustable "on-off" times, which can be varied from 0.5 to 100 seconds independently. Fixed cycle time units capable of handling 100 amp loads can be supplied.

All repeat cycle timers available in AC and DC. The A. W. Haydon Co. welcomes special problems.



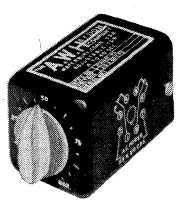


ELAPSED TIME INDICATORS

The A. W. Haydon Co. offers a complete line of elapsed time indicators for both industrial and military applications. These units dependably record the operating time of any mechanism. The industrial indicator shown measures only 37/64" square X 1 1/4" long and is available with a front or side readout.

Also — miniature, subminiature, and microminiature military type units. Hermetically sealed, reset and non-reset types, available in 50, 60, or 400 Hz AC models and governed or ungoverned DC versions.

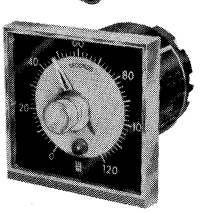




TIME DELAY RELAYS

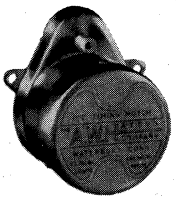
A broad line of electromechanical and electronic timers for industrial and military applications. Available in AC and DC, fixed or adjustable delay times. Motor-driven units are ideally suited for multi-switch requirements where fixed delay times between a number of circuits are required. Progress-indicating type (shown) has convenient knob adjustment, time remaining indicator, and easily read dial.

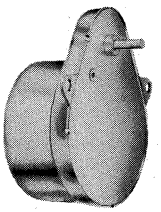
Solid state timing assemblies consist of an RC delay with a bridge-type pick-off network built into a high density welded module. Where size, weight, extreme environmental conditions, or very short delay times are required, these electronic units are particularly appropriate.



TIMING AND DRIVE MOTORS

The A. W. Haydon Co. offers fifty three series of standard and special motors with a wide range of gear reductions. Quiet, self-starting, reversible, synchronous AC motors; all standard frequencies from 25 to 400 Hz. DC motors offer high starting torque, speed adjustable with voltage, easy reversibility, low power consumption. Hollow rotor design eliminates iron and prevents cogging, providing smooth, low-voltage starts and more constant speed under load variations. Chronometrically governed DC motors maintain constant speed from no load to full load, with voltage variations as great as ± 20%.

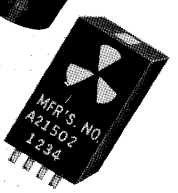




"BITE" INDICATORS

Microminiature BITE (Built-In-Test Equipment) indicators continuously monitor electrical or electronic circuits and give a visual warning of faulty performance. Even transient failures are indicated and are retained by means of magnetic latching until a reset signal is applied. These indicators elminate the need for special test instruments, trouble-shooting time, and highly trained personnel. They respond to a pulse width of 15 milliseconds and use power only to transfer the visual signal from "normal" to "malfunction". Round or rectangular models. All meet MIL-E-5400H (ASG) Class 1-A Equipment.

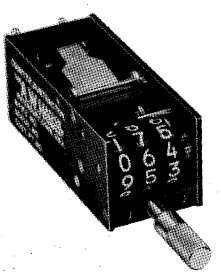




COUNTERS

Mechanical and electrical counters for OEM and military applications. Mechanical counters are available in various sizes and with any number of drums required. They are all of external pinion design, allowing high speed operation. They are highly accurate and have a long service life without maintenance or lubrication.

All mechanical counters can be furnished with suitable engines for electrically powered applications. Solenoids, timing motors, and stepper motors can be used, either unidirectional or bi-directional. Options: electric or manual preset or reset; internal switching; type of enclosure, including hermetically sealed; various mounting configurations; operating voltage and frequency. Also available are microminiature counters for military/aerospace applications.

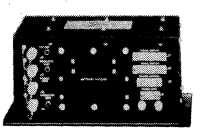


TIME CODE GENERATORS

Electronic and electromechanical time code generators for aircraft, missile, ground support, and industrial applications. Typical electronic system shown provides illuminated visual readout plus modified IRIG, PARSET, and HUACHUCA codes. Other units manufactured by The A. W. Haydon Co. include Time of Year Generator, Elapsed Time Generator, etc. Accuracies up to 1 part in 10^8 are possible.

Electromechanical units use a synchronous motor-driven switch for a time base, and supply straight decimal or binary coded decimal switch patterns, rapidly stepped to provide digital time inputs to data handling equipment. Visual readout counter display. Readings from seconds to 369 days.

Other Time Code Generators to your specifications.





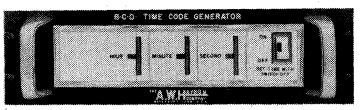


A NORTH AMERICAN PHILIPS COMPANY

THE AWH AYDON COMPANY

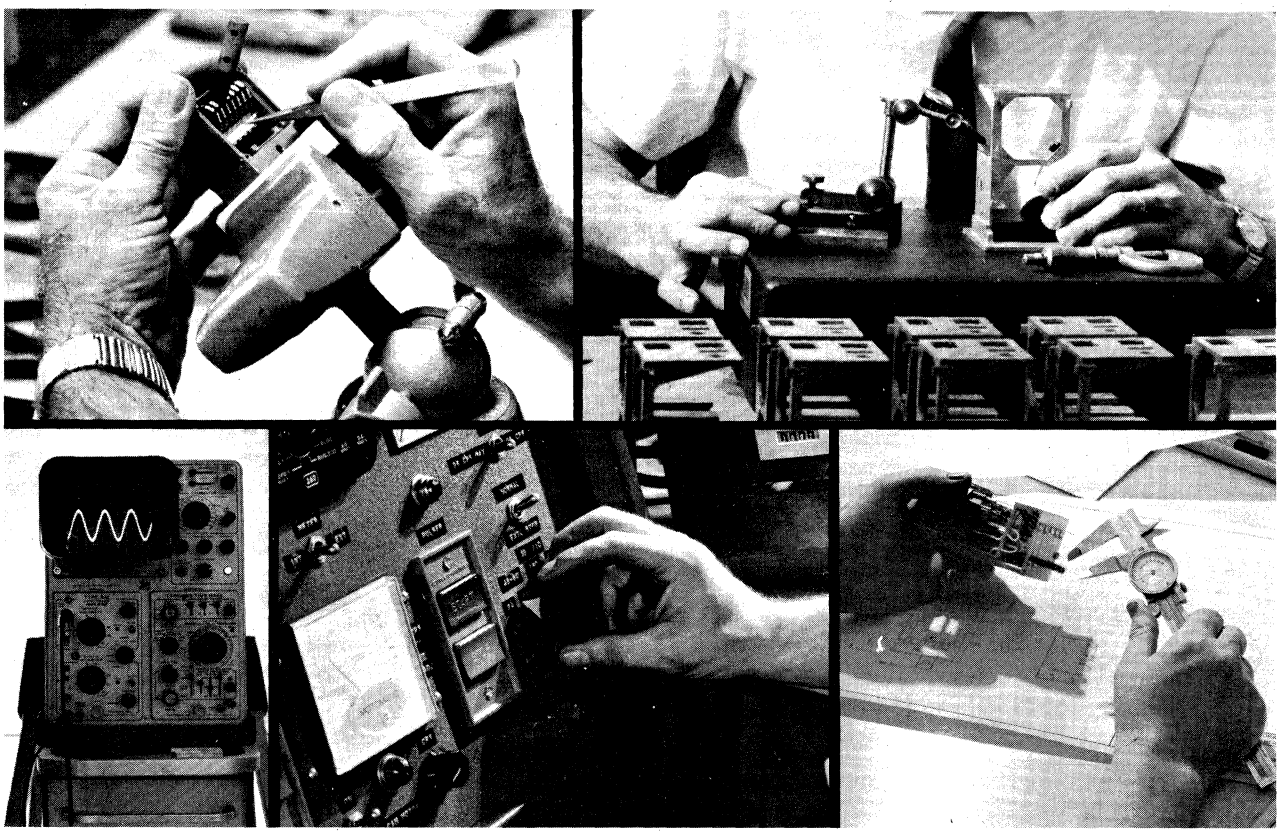
232 North Elm Street
Waterbury, Conn. 06720

See EEM for local Representatives in U. S.



In Europe: s.a. Polymotor • 29 Av. Paul Henri Spaak • Brussels 7 • Tel. 23.40.83

Timing & Stepper Motors • Electromechanical & Electronic Timing Devices & Systems



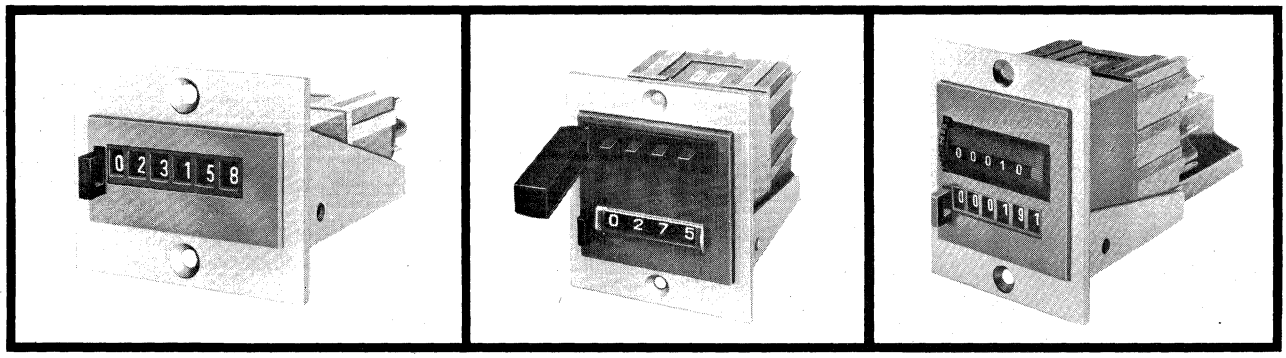
HECON QUALITY COUNTS

A Complete Line of High Performance Electro-Magnetic Counters

Hecon counters do more than count. They are highly reliable control devices that exercise control by counting.

Our exclusive building block design permits many system variations and applications. Used as an individual control instrument, or as part of a control system, Hecon counters can solve your control problems.

For reliable, low cost digital control systems, only Hecon offers a complete line of high performance electro-magnetic counters featuring closed loop design.



F 043 TOTALIZING COUNTER

Modular 6 digit plug-in unit, with either manual or electrical reset—speeds up to 60 counts per second—life in excess of 200 million operations.

FE 043 SUBTRACTING PREDETERMINING COUNTER

Modular 4 digit plug-in counter features easy push button preset and optional presignal. Available with manual/electric reset and automatic recycling. Speeds up to 40 CPS—life in excess of 200 million operations.

FA 043 PREDETERMINING COUNTER

Modular 6 digit plug-in unit, with manual, electrical or automatic reset, for speeds up to 35 counts per second—life in excess of 200 million operations.

HECON

Better by Design

Hecon engineers can help you solve your counting and control problems with Hecon high performance counters—reliably and economically. Write or call today for full information on these and other Hecon counters.

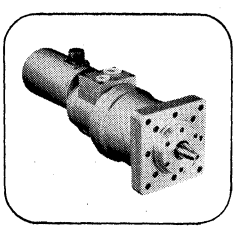
HECON CORPORATION 31 Park Road, New Shrewsbury, New Jersey, (201) 542-9200 TELEX 13-223

Automatic motion control in manufacturing, assembly & packaging? in production machinery & machine tools? in electronics & data processing? in research and development? welding? graphic arts & printing? or instrumentation?

ICON: your complete, ready source for direct digital positioning!

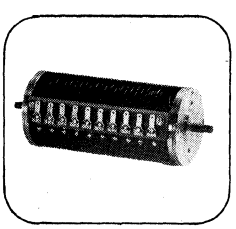
ICON automatic systems, subsystems and modules and know-how in stepping motor technology can help you automate your plant and products simply and economically!

ICON AUTOMATIC MOTION CONTROL SYSTEMS INCLUDE



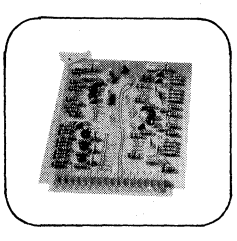
ELECTROHYDRAULIC PULSE MOTORS

. . . a complete line of high power motors built by Fujitsu, Ltd., for direct digital positioning in heavy applications such as machine tools, textile and printing machinery, welders, typesetters, automated production machinery, etc. Torque output exceeds 500 in-lbs. at 2000 steps per second. Power ranges from .8 to 6 HP at 8000 steps per second.



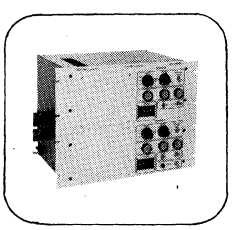
HIGH SPEED ELECTRIC STEPPER MOTORS

. . . variable reluctance steppers that are the fastest, most advanced digital actuators in America, today. Available in a wide range of torques with error-free response rates of 2000 pps, and running speeds in excess of 10,000 pps.



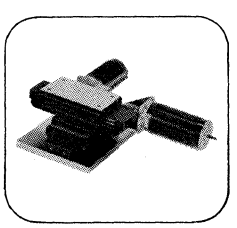
DIGITAL SYSTEM POSITIONING MODULES

. . . for the engineer who wants to design and package his own positioning control system. A full line of solid-state driver modules for most stepping motors, plus general purpose system logic modules using NAND logic.



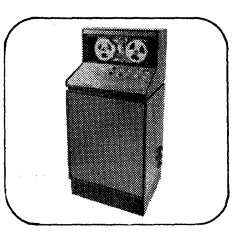
MULTI-AXIS STEPPER PROGRAMMERS & DRIVE UNITS

. . . Icon Series 400 positioning systems emphasize high motor performance and input flexibility. Able to drive up to 6 independent steppers of any type. Accept inputs ranging from switch closure to computer. Readily interface with other system elements.



NUMERICALLY-CONTROLLED X-Y TABLES

. . . two complete lines of X-Y tables covering the motion range from 2" x 2" through 12" x 12". Speeds in excess of 2 ips, resolution of .001 inch. Ideal for automation of production, assembly and test. Many control options available.



HIGH SPEED NUMERICAL CONTROL SYSTEMS

. . . with extremely reliable I.C. logic, very flexible program structure. Advanced, low-cost control for a wide range of automatic 2 or 3 axis point-to-point positioning applications. Open-loop, all-digital design for simple application, operation, service.

LEADERS IN DIGITAL MOTION

icon CORPORATION

FOR THE ANSWERS AND ACTION IN POSITIONING CONTROLS . . . ASK ICON!

156 Sixth Street, Cambridge, Massacnusetts 02142 Telephone: 617 / 868-5400

COUNTER—TIMERS

itron

ITRON COUNTER-TIMERS provide maximum performance and versatility for general-purpose time or frequency measurements up to 20 MHz. Their low costs are the result of large-scale production economies and the use of medium-scale integrated circuits rather than performance limitations. All of the performance and functions you expect from a general-purpose counter-timer are included. The Series 600 Counter-Timers each contain an operating/specifications brochure in a pocket built into the instrument to insure maximum benefit of the versatile design. Performance advancements include automatic sensitivity, syncrostart, extended range and an isolated input option. ITRON instruments are designed to be reliable through the use of quality components and maintainable through quick-access cases. A calibration record is kept within the instrument for immediate referral.

SERIES 600

COUNTER TIMERS—GENERAL PURPOSE, VERSATILE, LOW COST

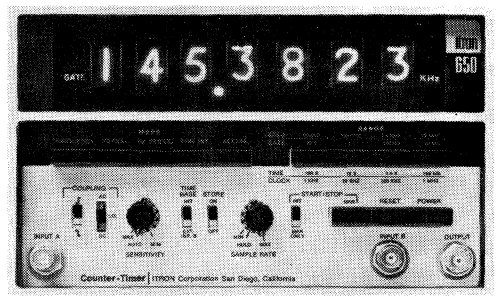
Functions: Frequency, Period, Multiple Periods, Time Interval, Cumulative Time Interval, Ratio, Multiple Ratio, Scale, Totalize, Cumulative Totalize, Generate, Stopwatch.
Range: DC to 20 MHz.
Digits: 5 and 6, + Extended Range.
Sensitivity: To 50 mVrms. Some are automatic.
Input Channels: Dual and single channels available.
Time Base: Crystal reference, 3 x 10^{-5} to 3 x 10^{-7}.
Size: Half rack.
Configuration: Portable or rack mount.
Options: Isolated inputs, BCD outputs, programming.

SPECIAL

COUNTERS AND TIMERS — SPECIAL PURPOSE, OEM

Functions: Frequency, Deviation, Bi-Directional, Multi-Channel, Variable Time Base, Preset.
Range: DC to 40 MHz.
Packaging: Custom.

COUNTER—TIMERS



From $500.

ITRON DIGITAL FREQUENCY METERS are specifically designed to measure low frequencies direct, with no calculations. A signal frequency such as 60 Hz is displayed as 60.000 with continuous resolution. Tracking logic is employed to eliminate long gate times and reset-recount interruptions. An analog output proportionate to segments of the signal frequency is available for continuous recording. Other performance advancements include automatic sensitivity and automatic ranging.

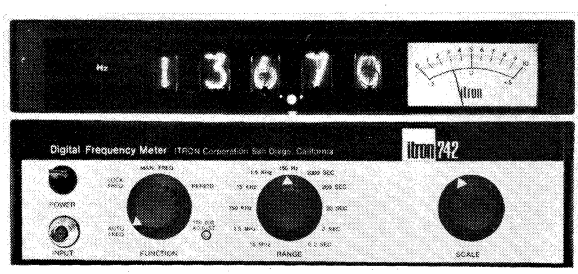
SERIES 740

DIGITAL

FREQUENCY METERS—HIGH RESOLUTION, LOW FREQUENCY

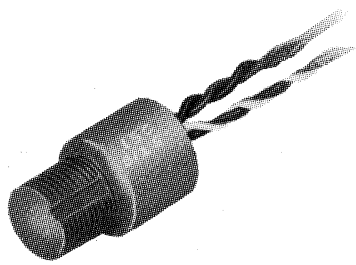
Functions: Frequency, Period, RPM.
Resolution: 0.001% Full Scale (1 x 10^{-3} Hz basic).
Range: 5 Hz to 15 MHz.
Ranges Full Scale: 150.000 Hz, 1500.00 Hz, 15.0000 kHz, 150.000 kHz, 1.50000 MHz, 15.0000 MHz.
Ranging: Automatic.
Accuracy: ±0.003% Full Scale.
Sensitivity: 50 mVrms automatic.
Logic: Continuous tracking.
Analog Output: Buffered 0-100 mV proportionate.
Size: Three-quarter rack.
Configuration: Portable or rack mount.
Options: BCD outputs.

DIGITAL FREQUENCY METERS



From $1,500.

itron ITRON CORPORATION • 11675 Sorrento Valley Road • San Diego, California 92121 • Tel. (714) 453-5300



SPEED-INDEPENDENT MAGNETIC PICK-UP

The B-12S Magnetic Pick-up is the first of a family of devices from ISC/Magnetics with output voltage amplitudes that are independent of the rate of change to the external magnetic field. This characteristic and its relatively low output impedance result in a device ideally suited for use with transistor circuitry of the type often found in flow control and computer peripheral equipments for *Static* as well as Dynamic sensing.

Typical output using a 20 pitch ferrous gear at a sensing distance of 0.020 inches is 1V peak to peak at an ouput impedance of 500 ohms.

MAGNETICS ISC DIVISION

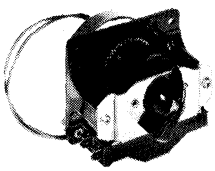
instrument systems corporation

770 Park Avenue, Huntington, N. Y. 11743

(516) 423-6200 TWX 510-226-6983 Cable INSSYSTHTGH

MALLORY INDUSTRIAL TIMERS

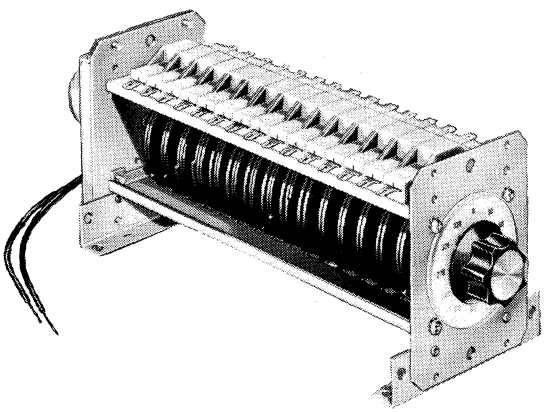
Series MIT



Miniature Industrial Sequence Programmers

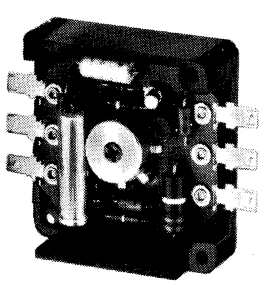
This small-size timer does big-size jobs. Measures only 2⅜" x 2⅞" x 2¾" including the motor. Comes with one or two cams, either adjustable or fixed. Select a cycle, from seconds to hours, change it with a simple manual adjustment. Designed for industrial service as interval or cycle timer.

Series IT



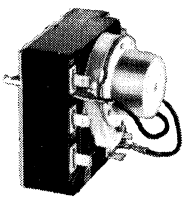
Multi-cam Industrial Sequence Programmer

Simple, quick, convenient. That's what it's like to change the cycle of this Mallory adjustable cam industrial timer. All you do is pull the spring-loaded cams apart, reposition to the cycle you want, let go... and you new cycle is locked in place. Changes as small as two degrees give flexibility to any automated product. The basic timer design comes in units of 5, 10 or 15 cams with virtually any time cycle and circuitry you need. Enclosed snap-action switches, tested for 1 million cycles, are rated 15 amps, 125 VAC.



Electronic assemblies— complete engineering and production facilities for design and manufacturing of special components.

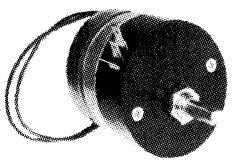
Series SD



Compact - Heavy Duty Timers

Switches four 25-amp circuits and a 10-amp circuit. The 3" x 3" x 1" size lets it fit behind a panel or inside a console. Designed for long-life, heavy-current applications such as dryers, furnaces, copying machines, battery chargers. Comes in a wide variety of time cycles and physical configurations.

Series LRT



Interval Timer

A compact, versatile hand-set electric timer. Heavy duty, 15 amp, rated switches provide a wide variety of switching functions. A neutral, or "center-off" switch position is available, as is a double upper ("make-make") configuration.

Setting the desired interval may be done by turning the shaft in either direction... even during a timing cycle. Many standard cams along with the wide range selection allow the LRT to meet most OEM dial layout specifications easily, without tooling.

"Hold" feature is available, allowing a non-timed setting during which the load under control is "on".

Applications include: hair dryers, heat lamps, blenders, battery chargers, food warmers, conveyor feeds, barn heaters, therapy machines, sterilizers and many others.

SPECIFICATIONS

OVERALL DIMENSIONS
2" dia. x 1¾"

AVAILABLE SWITCHING
SPST, SPDT, SPDT with neutral or double make positions (see other side)

SWITCH RATING
15 amp, 125/250 VAC
½ HP, 125/250 VAC

MOUNTING
Threaded bushing

TIMING MOTOR
Permanent magnet, 120 VAC, 60 Hz (standard)
24 to 240 VAC available — also 50 Hz

SHAFT ROTATION
Counter clockwise (standard), clockwise on request

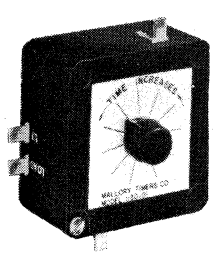
TERMINALS
¾" flag on one lead, other stripped (standard)

TIME CYCLES AVAILABLE

SECONDS	30	40	48	60	72	90	96						
MINUTES	2	2.5	3	4	5	6	8	20	30	40	45	50	60
HOURS	2	2.5	3	4	5	6	8						

More than 100 other speeds, not listed above, are available.

Series BST



Solid State Timer

All solid state reset interval timer. No moving parts. High repeat accuracy over a wide range of temperature and voltage. Rugged housing permits easy mounting and connections. Timer and power output circuits protected against transient surges, noise. Ranges to five minutes.

Standard Mallory components are available from authorized Mallory distributors throughout the United States.

MALLORY TIMERS COMPANY
a division of P. R. MALLORY & CO. INC.
3029 E. Washington St., Indianapolis, Indiana 46206; Telephone: 317-636-5353

Alarm, Control, Measurement Modules

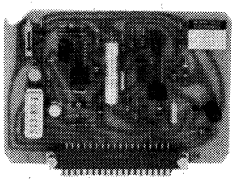


Fig. 1

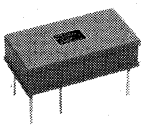


Fig. 2

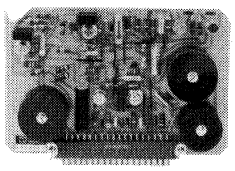


Fig. 3

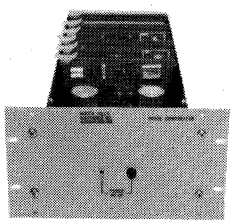


Fig. 4

ALARM DEVICES

LK-1 Ac Amplitude Alarm — Provides relay closure when input signal level exceeds preset value. Threshold level 20 - 100mV., 2 to 5000 Hz. Figure 1, 4″ x 6″ p.c. card.

PK-1 Phase Sequence Alarm — Furnishes energizing signal for external relay when phase relationship is correct in 2-phase 90° systems. 800 to 1200 Hz range. Other frequency ranges to order. Figure 2.

SK-1 Frequency Alarm and Relay — Provides relay closure when signal frequency corresponds to preset value anywhere in 10 Hz to 10 kHz range. 4″ x 6″ p.c. card.

TK-1 Temperature Alarm — Furnishes energizing signal for external relay when temperature is between two preset limits.

CONTROL DEVICES

DS Phase Shifter — Dc signal or resistance value determines phase shift at fixed frequency.

MF Ac Modulator-Filter — Furnishes low distortion signal at amplitude determined by dc control voltage. Fixed frequency in 60 Hz to 10 kHz range.

TC Temperature Controller — Close tolerance control with digitally set or fixed control temperature.

CONVERTERS – DC TO PARAMETER

DF 3101 Voltage to Frequency Converter — Furnishes output pulses at a repetition rate proportional to dc input level. Scale factor is 1 kHz/V from 0 - 10 V dc. Linearity better than ±2 Hz. Figure 2.

DS Dc to Phase — See DS under Control Devices.

MF Dc to Ac Amplitude — See MF under Control Devices.

SIGNAL SOURCES DC
High stability, line isolated

RS-10 Dc Voltage Reference Source — Output 10 V dc, 0 - 10 mA, 0.01% stability for input of 105 - 125 V rms, 55 - 500 Hz. 4″ x 6″ p.c. card.

VS-510 Programmable Dc Voltage Source — Output 0 - 35 V dc, 0 - 100 mA programmed by external resistor. Four-terminal sensing, short-circuit protected. 4″ x 6″ p.c. card.

SIGNAL SOURCES AC

VS-410 In-Phase Reference Source — Output 10 V rms ±0.1% at 0° or 180° with respect to input 26 V rms ±20%, 350 - 5000 Hz. Figure 3.

VS-420 Quadrature Reference Source — Same as VS-410 except + or −90°. Figure 3.

VS-430 Ac Voltage Programmable Source — Multiple preset, relay-selected, programmable output levels at 0° to 180° with respect to 10 V ±0.1% input, 350 - 5000 Hz.

VS-440 Ac Voltage and Phase Programmable Source — Multiple outputs preset, relay-selected programmable levels and phase angles between 0° and 360° with respect to 10 V ±0.1% input, 350 - 5000 Hz.

VS-450 Ac Continuously Programmable Voltage Source — Output adjustable 0 - 32 V rms by means of external potentiometer at 0° or 180° with respect to input of 26 V rms ±20%, 350 - 2000 Hz.

CONVERTERS – PARAMETER TO DC

FD-1 Frequency to Dc Converter — Has dc output proportional to frequency input over 0-10 kHz range. Linearity 0.1%.

PM-2 Phase Computer — Supplies dc output proportional to phase difference. Consists of 2 zero-crossing detectors and 1 phase comparator (described below), power supply and interconnctions. 5 cards with mounting. Figure 4.

PR-7 Ac to Dc Converter — Precision operational rectifier accepts inputs from 60 Hz to 10 kHz and furnishes dc output proportional to input. Linearity 0.1% Figure 2.

TV-2 Pulse Phase Comparator — Supplies dc voltage proportional to phase difference between 2 square waves. Scale factor to 0.1 V/° over 0° - 360° range. 4″ x 6″ p.c. card.

XD-3 Zero Crossing Detector — Supplies positive-going pulses at positive-going zero crossings of input waveform. For wide-band applications over input range from 1 - 125 V rms. 4″ x 6″ p.c. card.

XD-4 — Same as XD-3 but works down to 100 μV input level. 4″ x 6″ p.c. card.

If standard units do not meet your requirements, please send us your specifications indicating quantity for quotation.

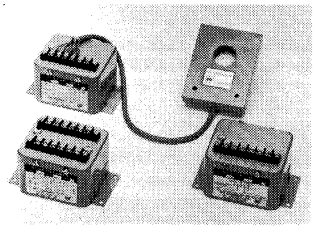
SEE SECTION 4000 FOR PRECISION POWER SOURCES

nh
NORTH HILLS ELECTRONICS, INC.
GLEN COVE, L.I., N.Y. 11542 • PHONE (516) 671-5700

OSI

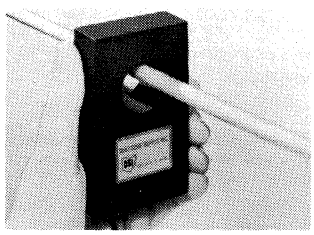
Precision Devices and Equipment for Current and Power Measurement

HALLTRON POWER COMPUTER



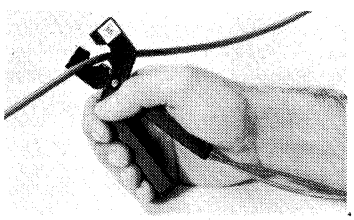
HALLTRON POWER COMPUTERS OR WATT TRANSDUCERS

The Halltron Power Computer provides a d.c. output signal proportional to the true power consumed by the load. Single and three phase units have fast response needed for sinusoidal or chopped waveforms and have an output which is electrically isolated from supply lines.



HALLTRON D.C. TO KILOHERTZ CURRENT TRANSDUCERS

Units with 100, 200, 400, 600, 1000 and 2000 ampere ratings, having d.c. to 5 Kilohertz response, an output of 50 millivolts, 1% linearity, and temperature effects less than 1% are stock items.
Other units can be supplied for special requirements such as 8000 ampere split-core units with associated power supply-amplifier to provide 0 to 10 Volt output.

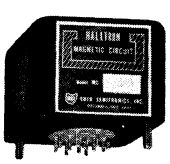


WIDEBAND HALLTRON CLAMP-ON CURRENT TRANSDUCERS

These new unique wide-band clamp-on current transducers provide an output signal proportional to enclosed current in the d.c. to megahertz range. The less than 1 microsecond rise time makes these units ideally suited for motor testing, inverter testing, power supply monitoring, automotive applications or other areas where interruption of high current lines is undesirable.

HALLTRON TRUE PRODUCT MULTIPLIER

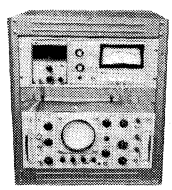
O.S.I.'s Halltron, true-product multipliers provide an electrical output which is the product of two input currents which may be ± d.c. or time-dependent. High linearity and low-noise properties insure optimum performance in critical circuit applications. All units are supplied in hermetically sealed packages with, in most cases, dual magnetic inputs so that series or parallel operation can be obtained to satisfy various input requirements.



MODEL	INPUT 1	INPUT 2	OUTPUT MILLIVOLTS
MC-101	25/50 ma.	250 ma.	250
MC-103	250/500 ma.	250 ma.	250
MC-105	1.25/2.5 A.	250 ma.	250
MC-107	7.0 A.	250 ma.	250

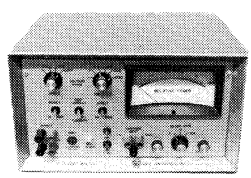
MODEL	APPLICATION	(Volts) VOLTAGE	(Ampere) CURRENT	(Millivolts) OUTPUT
PC 51	1ϕ 2 Wire	120	5	50 @ .5KW
PC 52	1ϕ 2 Wire	240	5	50 @ 1KW
PC 101	1ϕ 2 Wire	120	10	50 @ 1KW
PC 102	1ϕ 2 Wire	240	10	50 @ 2KW
PC 51-3	3ϕ 3 Wire	120	5	100 @ 1KW
PC 52-3	3ϕ 3 Wire	240	5	100 @ 2KW
PC 11-3	3ϕ 3 Wire	120	10	100 @ 3KW
PC 12-3	3ϕ 3 Wire	240	10	100 @ 4KW
PC 51-4	3ϕ 4 Wire	120	5	150 @ 1.5KW
PC 52-4	3ϕ 4 Wire	240	5	150 @ 3KW
PC 11-4	3ϕ 4 Wire	120	10	150 @ 3KW
PC 12-4	3ϕ 4 Wire	240	10	150 @ 6KW
PC-C2	1ϕ 2 Wire	240	100	50 @ 20KW
PC-2C2	1ϕ 2 Wire	240	200	50 @ 40KW
PC-4C2	1ϕ 2 Wire	240	400	50 @ 80KW
PC-6C2	1ϕ 2 Wire	240	600	50 @ 120KW
PC-K2	1ϕ 2 Wire	240	1000	50 @ 200KW
PC-2K2	1ϕ 2 Wire	240	2000	50 @ 400KW

Special units, for higher currents or higher voltages than listed in stock models, can be supplied for control applications.



WIDEBAND POWER MONITORING EQUIPMENT

The 4000 Series Power Monitoring Equipment is designed for industrial power monitoring applications in resistance welding, electrical discharge machines and other areas where high energy short duration pulses are used.



WIDE-BAND PULSE WATT METER

The 5000 Series wideband wattmeters provide the unique capability of measuring sub-microsecond pulse energies involved in switching transistors, silicon-controlled rectifiers, triacs, etc. Typical 30 nanoseconds rise-time and d.c. response permit detailed study of turn-on and turn-off and storage properties of solid state devices.

AMPERE-HOUR MONITORING EQUIPMENT

The A-H Series units provide bidirectional registration of charge and discharge in d.c. applications, thereby accurately indicating electrical energy consumed. 1% accuracy is maintained to current levels of 10,000 amperes.

TRUE PRODUCT WIDEBAND MODULATOR

The MC-500 true product modulators exhibit high linearity as indicated by over 60 db suppression of higher order product terms in double sideband suppressed-carrier operation without filtering. Carrier suppression in excess of 60 db is maintained to frequencies in excess of 200 Kilohertz.

ELECTROCHEMICAL PLATING CURRENT DENSITY METER

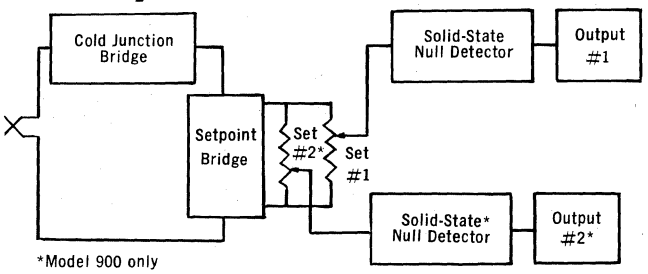
The CT-306 Plating Current density meter is designed to measure plating current in an electrochemical bath. This instrument is especially useful in starting up a plating bath and in quality control measurements to insure uniform plating of products. The CT-306 features a toroidal probe which can be placed in the plating bath to measure full scale current densities of 0.3 or 1.0 ampere per square inch. An accuracy of 3% of full scale or better is provided.

OSI

OHIO SEMITRONICS, INC.
1205 CHESAPEAKE AVENUE • COLUMBUS, OHIO 43212 • PHONE: 614-486-9561
PIONEER IN SOLID STATE ENERGY CONVERSION MATERIALS, DEVICES and SYSTEMS

TEMPERATURE ALARMS and CONTROLLERS

ultraLARM™



*Model 900 only

SPECIFICATIONS

THERMOCOUPLE INPUTS AND RANGES (Standard):

Type J—Iron/Constantan
0 to 300°F, 0 to 900°F, 0 to 1200°F, 0 to 1600°F

Type K—Chromel/Alumel
0 to 1000°F, 0 to 2000°F

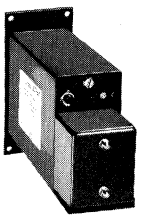
Type T—Copper/Constantan
0 to 300°F, 0 to 600°F

Other ranges and TC types available as options, also range cards for field changes.

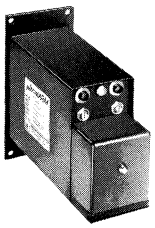
SENSITIVITY:	Less than 30 microvolts (approx. 1°F with iron-constantan T/C)
MV RANGES:	0 to +5 or 0 to +10 millivolts
REPEATABILITY:	To ±2F°
INPUT IMPEDANCE:	250,000 ohms min. at null; 100,000 ohms min. off null
FAILSAFE:	Upscale and also loss of power, standard; Downscale failsafe optional
OUTPUT:	SPDT rated 10 A, 120 VAC resistive load. Pushbutton reset with latching alarm optional

OVER-TEMPERATURE ALARMS

Solid-state, reliable protection against over-temperature/power failure



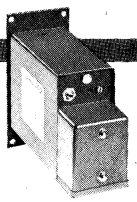
Model 500
Single-Setpoint Over-Temperature Alarm



Model 900
Dual-Setpoint Over/ Under-Temperature Alarm

DEADBAND:	1% nominal of full scale (900°F) factory preset; field-modifiable
OPERATIONAL AMBIENT:	0-150°F
AMBIENT TEMPERATURE EFFECT:	Less than ±0.02%/°F when used within ambient temperature extremes
OPERATE VOLTAGE AND POWER:	100-130 VAC; 50/60 Hz; less than 4 watts 240 VAC, 50/60 Hz operation optional
LINE VOLTAGE EFFECTS:	Less than 0.2% when Alarm operates within 100 to 130 VAC
SETPOINT ADJUSTMENT:	Infinite-resolution single-turn potentiometer standard; ten-turn potentiometer optional
ENCLOSURE:	Heavy-gauge steel with conduit mount provides two holes for ½-inch thinwall conduit. Designed for class 1, group D, division 2 installation. Hermetically sealed relay optional.
DIMENSIONS:	
BODY:	6.56″ H x 3.00″ W x 8.25″ D
PANEL CUTOUT:	5.00″ H x 2.75″ W
MOUNTING:	Rack, panel, or surface

ultraLARM™



PROPORTIONAL CONTROLLER

Solid-state, ultra-sensitive, time-proportioning temperature controller

MODEL 600

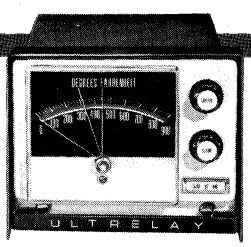
The ultraLARM proportional controller is extremely sensitive (to ¼°F) and maintains process temperatures accurately. The Model 600 switches power to the load and within a proportional band automatically regulates the ratio of ON to OFF as required.
A cycle rate adjustment is provided to permit matching the ultraLARM proportional controller to the thermal requirements of the process. Thermocouple cold-junction compensation is provided.

SPECIFICATIONS

All specifications and options for Model 600 are same as Model 500 above except:

SENSITIVITY:	Less than 7 microvolts (approx. ¼°F with Type J thermocouple)
REPEATABILITY:	Substitute **Control Capability:** To ±0.5°F
CYCLE RATE:	Adjustable from 90 to 360 cycles per hour nominal
PROPORTIONAL BAND:	3 to 30°F, dependent on cycle-rate setting. Proportional band decreases with increasing cycle rate
SETPOINT ADJUSTMENT:	Infinite resolution 10-turn potentiometer
DEADBAND:	Does not apply (automatic cycling)

ultRelay®



MONITOR/CONTROLLER

Solid-state, ultra-sensitive, versatile, indicating control

M/C 330

Temperature, pressure, flow, and virtually any physical force that can be translated into a-c or d-c millivolts (or changing resistance) can be monitored, indicated, and made to cause control action with the versatile M/C 330 ultRelay. Indication can be absolute or deviation.

Available in four basic models:

M/C 330-1 Single setpoint, non-indicating

M/C 330-2 Single setpoint, indicating

M/C 330-3 Single setpoint, proportional control, indicating

M/C 330-4 Dual setpoint, proportional and alarm control, indicating

SPECIFICATIONS

Specifications and options similar to ultraLARM instruments described above except:

DIMENSIONS: 5.75″ H x 7.20″ W x 8.90″ D. Panel cutout 5.10″ H x 6.36″ W

Descriptive literature on request.

PLESSEY AIRBORNE CORPORATION
1414 Chestnut Ave., Hillside, N.J. 07205 Tel. (201) 688-0250 TWX 710-985-4667
AVAILABLE IN CANADA

See Plessey Airborne ad in Section 4500, page 2310

READOUTS, SCANNERS, CONVERTERS

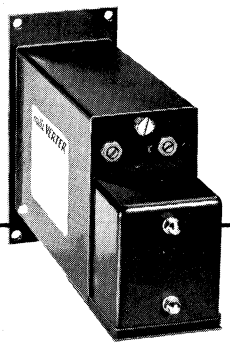
ultraMONITOR™

MODEL 800 SEVEN-POINT TEMPERATURE OR MV INDICATOR



milliVERTER™

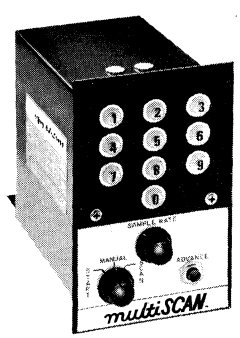
MODEL 1000 MILLIVOLT-TO-MILLIAMP CONVERTER-TRANSMITTER



SPECIFICATIONS

Thermocouple Inputs and Ranges, Standard:	TYPE J—Iron/Constantan 0 to 300°F, 0 to 900°F, 0 to 1600°F TYPE K—Chromel/Alumel 0 to 1000°F, 0 to 2000°F TYPE T—Copper/Constantan 0 to 300°F, 0 to 600°F Other ranges and T/C types available as options.	
ACCURACY:	±1.75% of full-scale reading	± 0.20% full scale
INPUT IMPEDANCE:	1,250,000 ohms min.	125,000 ohms min.
OPERATIONAL AMBIENT:	32° to 120°F	0° to 150°F
POWER REQUIREMENT:	117 VAC, 50/60 Hz, 3W (240 VAC optional)	117 VAC, 50/60 Hz, 3W (240 VAC optional)
SCALE LENGTH:	5.6"	not applicable
FAILSAFE:	not applicable	Upscale standard
OUTPUT:	not applicable	1-5ma into 0-4000 ohms 4-20ma into 0-1000 ohms 10-50ma into 0-400 ohms
OPTIONS:	Recorder connection and calibration adjustment, 0-1.5 VDC into 1000 ohms	Special output spans Current decrease with rising temperature Range change cards

MODEL 1100



multiSCAN™

Reliable automatic/manual multiplexing of 1 to 10 inputs to a common output

The Model 1100 Scanner utilizes reed-relay switching for high isolation between inputs (greater than 200 megohms) and solid-state "soft-make soft-break" circuits to restrict generation of transients.

Selected Specifications

CYCLE RATE:	Scans 10 points per second maximum, adjustable to 1 point per second or manually positioned (other rates available)
OPERATIONAL AMBIENT:	32° to 120°F
OPERATE POWER:	117 ± 10% VAC, 50/60 Hz, 3 watts 220 VAC, 50/60 Hz optional
SWITCHING MATRIX:	10-channel; SPST N.O./channel to common two-wire output (other switching modes available)
CONTACT RATING:	25 volt-amperes max.

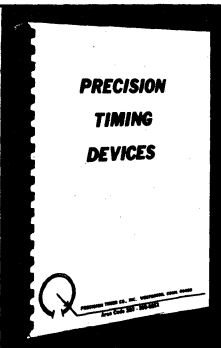
Descriptive literature on request.

PLESSEY AIRBORNE CORPORATION
1414 Chestnut Ave., Hillside, N.J. 07205 Tel. (201) 688-0250 TWX 710-985-4667
AVAILABLE IN CANADA

See Plessey Airborne ad in Section 4500, page 2310

HUGE INVENTORY OF SHELF STOCK ITEMS

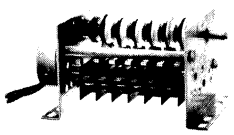
Precision Timer Co., Inc.
400 Wesley Ave. Westbrook, Conn. 06498



Send For This Special Edition Or If You Are In A Hurry – Call Us At Area Code 203 399-6253

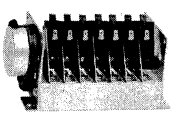
PROGRAM

Economy Program Timer



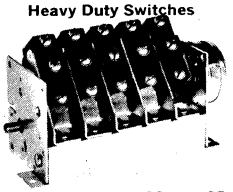
Choice of — 3 to 8 Poles, 239 Stock Speeds, 7 Switch Capacities.

Program Timer



Standard Stocked Units used in Vending Machines and 100s of other products. Tab Terminals — Field Replaceable Switches — Up to 20 Load Circuits.

H. D. Program Timer Heavy Duty Switches



Choice includes: 22 or 25 Amps (1 h.p.) Many, Many Types Shelf-Stocked, Plus Specials.

Low Cost Programmer



Standard or Special Models Ideal for Continuous or Intermittent Operations.

Panel Mount Programmer



Manually Settable While Running or De-energized, Plus Completely Versatile Design.

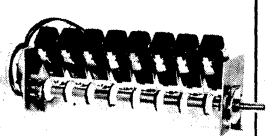
DELAY AND INTERVAL

Pushbutton Delay Relay



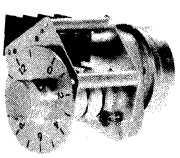
Your Choice of 100s, Standard Stock, Time Delays Plus Specials.

Multi-Pole Chassis Mount



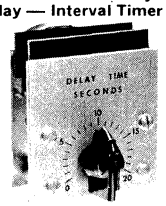
Reset Ganged Delay Relays 2 to 20 Poles.

Panel Mount Adjustable Delay Relay



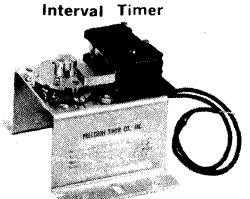
10 thru 25 Amps 1, 2 or 3 Pole 8 Time Ranges.

Precision Time Delay Relay — Interval Timer



Standard or Special — Times Down to Zero Exactly, Then Holds to Your Special Program.

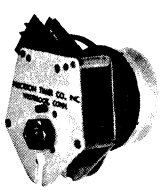
Time Delay Relay Interval Timer



Fully Adjustable — Employed to Delay Transfer of a Heavy Duty Action Switch.

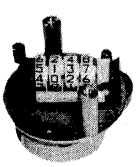
TOTALIZE

Pulse Accumulator



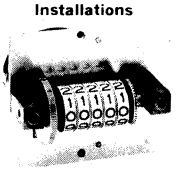
Produces Signal at End of Predetermined Pulse Countdown.

Hours Meter



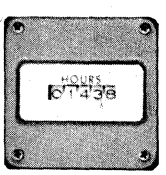
Standard Shelf Stock with Instant Pushbutton Reset and Convenient Behind Panel, Easy Installation.

Running Time Meter For Behind-Panel Installations



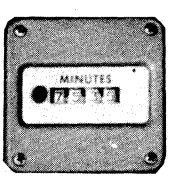
Resettable with Thumb-Wheel or Non-Resettable.

Running Time Meter



Low-Low Cost, Yet Accurate and Reliable. Standard Stock Shelf Units Very Popular.

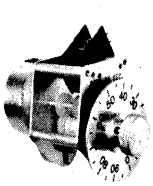
Pushbutton Reset



Fully Synchronous. Choose from: Square or Round Bezels — Instant Reset with Pushbutton for Extremely Fast Data Readings.

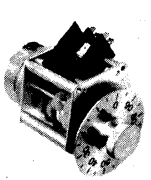
SPECIAL PURPOSE

Percentage Timer



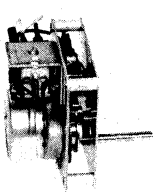
Produces Manually Selectable Output Pulse During Each Fixed Cycle.

Variable Pulse Generator



A Percentage Timer with One or Two Pair of Independent Programming Cams. An Ideal Photocopier Control.

Delay With Pulse Output



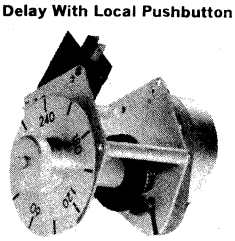
Special Purpose — 2 Pole Delay Relay, Yields Delay Plus Pulse.

Ultra-Reliable Starter Timer



Specially Built Starter Timer for Diesel-Electric Emergency Generators for Hospitals, Schools, Public Buildings.

Delay With Local Pushbutton



Manually Adjustable Delay Relay/Interval Timer for Local Pushbutton Operation.

COUNTERS / PRINTING COUNTERS / DATA PRINTERS / DIGITAL DISPLAYS

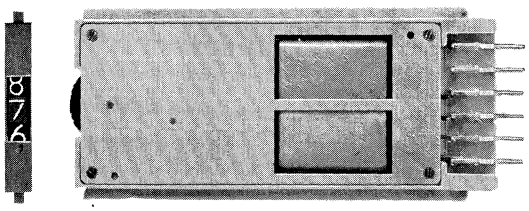
HOLD THE PRESSES!

$500.00

WILL NOW BUY YOU

A PRINTING DVM

MEASURING ONLY 8" X 3½" (HALF-RACK)
• DUAL SLOPE INTEGRATING • NIXIE READOUT
• 6 DIGIT PRINTING • 3 LINES PER SECOND



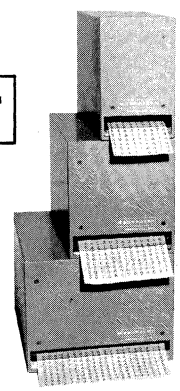
THE COUNT MODULE

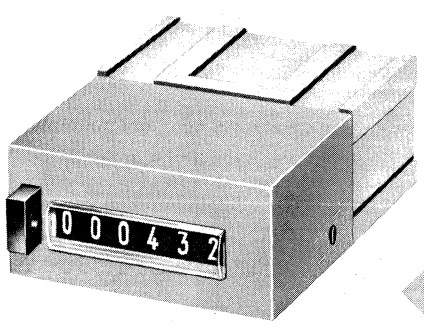
a basic tool for counting, controlling, displaying and printing

Pencil-thin, these single digit electromagnetic displays build into any kind of counting, registering or printing system . . . with any number of digits. The modular concept extends both to the mountings in the front and the circuitry in the rear. Two types: with 10 or 12 line readout or switch controls with zero and cascade capability.

MODUPRINT

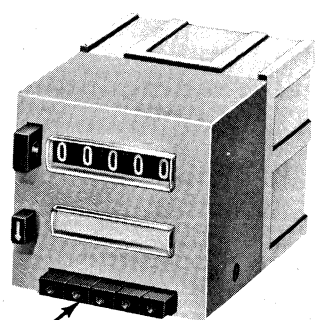
Four basic frames adaptable to your specific printer requirements. 6, 9, 14 or 20 digits. Maximum flexibility at minimum cost to print count, time, date, or data in any combination.





F104—TOTALIZING COUNTERS

Looking For Better Ones?



Pushbutton Preset

FE104—PREDETERMINING COUNTERS

These new counters are to the 25 x 50 mm. international standard and interchangeable with others without customer panel modification — but far more ruggedly constructed. And the preset versions are pushbutton preset — protecting against external damage and fool proofed. Of course, for all means of resetting and with a variety of diecast (not plastic) panels, or dovetail interlocking. To 60cps, to 6 digits AC or DC. Predetermining with manual, electrical or automatic reset. Other electrical impulse counters, 3-7 digits, AC or DC, push-button, key, knob, electrical or non reset, panel, base or stud mounting. **Write for Bulletins 139 and 140.**

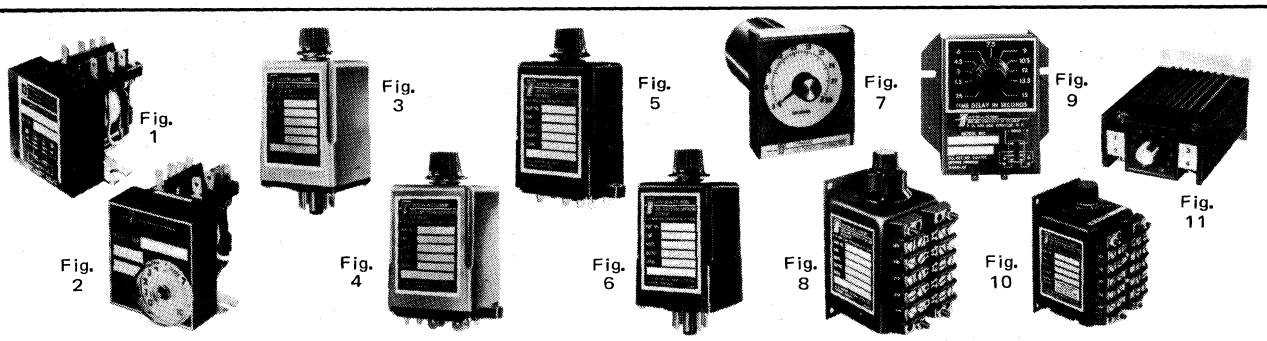
PRESIN CO., INC.

TRAP FALLS ROAD
SHELTON, CONN. 06484 — U.S.A.
PHONE 203 929-1495 • TELEX: 96-4217

the broadest line of solid state timing devices

Syracuse Electronics transistorized series of timers (time delay relays) are of the fixed or adjustable type, designed for use in light or heavy industrial and commercial applications. Timers consist of solid state circuitry driving a self-contained relay, (except MTS – fully solid state).

Since the timer circuit eliminates cams, clutches and motors, there can be no mechanical wear, thus affording long dependable life and highly reliable operation. Many models are interchangeable with mechanical, pneumatic, thermal and other electronic timers.



MODEL	ENCLOSURE FIG. #	MODE OF OPERATION	MIN.-MAX. TIME DELAY RANGES (SECONDS)	REPEAT ACCURACY ±, %	OUTPUT RATING (AMPS)	CONTACT FORM	TYPE TERMINATION	APPROX. SIZE L" x W" x H"	BASIC UNIT PRICE
TIR U.L.	1	ON DELAY (FIXED)	.1 TO 180	±7%	10	DPDT (RELAY)	QUICK CON SOLDER	2 x 1 7/8 x 2	$9
TAR	2	ON DELAY	.1 TO 180	7	10	DPDT (RELAY)	QUICK CON SOLDER	2 x 1 7/8 x 2 3/16	$12
TLR	3-4	ON DELAY	.1 TO 480	5	10	DPDT (RELAY)	QUICK CON OCTAL PLUG-IN	2 x 1 1/2 x 4	$19
TER U.L.	5-6	ON DELAY	.1 TO 480	2	10	DPDT (RELAY)	QUICK CON OCTAL PLUG-IN	2 x 1 1/2 x 4	$24
THR	5-6	ON DELAY	.1 TO 480	1	10	DPDT (RELAY)	QUICK CON OCTAL PLUG-IN	2 x 1 1/2 x 4	$29
PTR	7	ON DELAY	.25 TO 480	1	10	DPDT (RELAY)	SCREW PANEL MOUNT	5 9/16 x 3 3/4 x 4 3/8	$68
PLR	7	ON DELAY	.25 TO 480	5	10	DPDT (RELAY)	SCREW PANEL MOUNT	5 9/16 x 3 3/4 x 4 3/8	$48
PIR	7	ON DELAY INST.	.25 TO 480	2	10	2-DPDT (RELAY)	SCREW PANEL MOUNT	5 9/16 x 3 3/4 x 4 3/8	$52
TTR	10	ON DELAY	.1 TO 480	2	10	DPDT (RELAY)	TERMINAL BLOCK	3 1/2 x 2 x 2 1/2	$27
STR	9	ON DELAY	.1 TO 480	5	10	DPDT (RELAY)	QUICK CON SOLDER	3 3/4 x 3 3/8 x 2 5/8	$17
DDR	5-6	OFF DELAY	.1 TO 480	2	10	SPDT (RELAY)	QUICK CON OCTAL PLUG-IN	2 x 1 1/2 x 4	$24
DLR	3-4	OFF DELAY	.1 TO 480	5	10	SPDT (RELAY)	QUICK CON OCTAL PLUG-IN	2 x 1 1/2 x 4	$19
TSR	5-6	SINGLE SHOT	.1 TO 480	2	10	SPDT (RELAY)	QUICK CON OCTAL PLUG-IN	2 x 1 1/2 x 4	$29
TFR	8	ON-OFF RECYCLE	.25 TO 360	2	10	DPDT (RELAY)	TERMINAL BLOCK	3 1/2 x 2 x 2 1/2	$37
MTS	11	ON DELAY	.1 TO 360	3	1	SPST N.O. (SOLID STATE)	SCREW	2 3/8 x 2 3/8 x 3 1/4	$44

NOTES:

1. AVAILABLE INPUT VOLTAGE: 24V AC, 48V AC, 115V AC, 230V AC, 12V DC, 24V DC, 28V DC, 48V DC, 115V DC.
2. CUSTOM DESIGNS ALSO AVAILABLE UPON REQUEST.
3. SPECIFICATIONS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

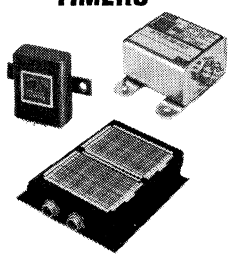
In addition to the timing products shown, Syracuse Electronics Corporation manufactures Temperature, Photo, Power, Liquid Level, and a host of other solid state controls for the Industrial, Commercial and Military consumers.

SYRACUSE ELECTRONICS CORPORATION

P. O. Box 566 Syracuse, New York 13201 Phone: 315 488-4911

MIL-TYPE DEVICES FOR TIMING, SENSING, CONTROLLING

TIMERS



MILITARY TIMERS, MIL-R-5757/22

TRANSISTORIZED TIME DELAY RELAYS

MICRO-MINIATURE TIMERS

REPEAT CYCLE TIMERS

SOLID STATE SEQUENTIAL PROGRAMMERS

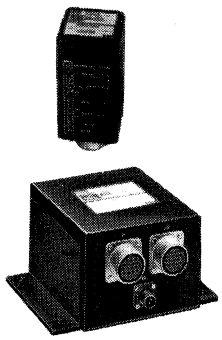
TRANSISTORIZED SIGNAL FLASHERS

SOLID STATE INTERVALOMETERS

AIRCRAFT LAVATORY TIMERS

COMPUTER TIMERS

SENSORS



FREQUENCY DETECTORS

SPEED SENSORS

RPM WARNING DETECTORS

VOLTAGE SENSORS

3-PHASE FAULT DETECTORS

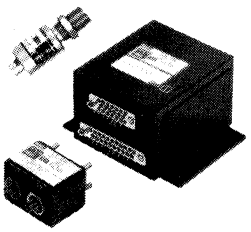
CURRENT SENSORS

PULSE DETECTORS

TEMPERATURE SENSORS

SOLID STATE SWITCHES & CIRCUIT BREAKERS

CONTROLS



SOLID STATE LAMP DIMMERS

ORDNANCE/WEAPON CONTROLS

ELECTRONIC DYNAMIC BRAKES

AIRBORNE TELEMETRY CALIBRATORS

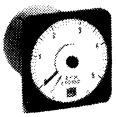
WARNING TONE GENERATORS

SOLID STATE SPEED SWITCHES

HEATER CONTROLS

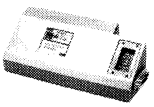
MOTOR SPEED CONTROLLER/REGULATOR

METERS/INSTRUMENTS



RPM INDICATORS
FREQUENCY METERS

SPECIAL PRODUCTS



RADIATION-HARDENED DEVICES

EXTREME ENVIRONMENT DESIGNS

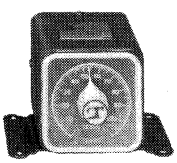
HIGH-RELIABILITY PROGRAMS

Tempo offers facilities and personnel for high reliability programs requiring special documentation, component identification and traceability, NASA-qualified personnel, etc.

INDUSTRIAL SOLID STATE TIMERS

The Most Complete Choice Available

SERIES 888



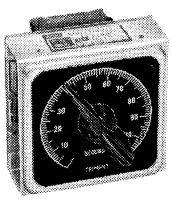
Highest quality solid state timers for industrial applications requiring the ultimate in reliability, quality and versatility. Repeat timing accuracy ±2%. Adjustable timing from 0.15 sec. to 15 min. Complete choice of timing logics, mounting styles, and input voltages.

SERIES 666



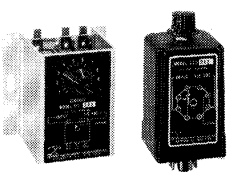
Moderately priced solid state timers in plug-in package. Timing logic is Delay-On-Pull-In, delay between power application and relay energizing. Repeat timing accuracy ±2%. Adjustable timing from 0.15 to 300 sec. Input voltage 115 VAC.

SERIES 444



Low cost solid state timers for wall or panel mounting. Repeat timing accuracy ±5%. Timing logic is Delay-On-Pull-In. Adjustable timing from 0.15 to 300 sec. Plug-in output relay. Input voltage 115 VAC, 28 VDC, or other.

SERIES 111 & 333



NEW! The only low cost solid state timers with positive electronic latching plus choice of mounting (plug-in or rear-chassis) and three different timing logics. Repeat timing accuracy ±3%. Adjustable timing from 0.5 to 180 sec. Input 115 VAC.

Talk to Tempo When You Want to Time, Switch, Sense or Control

TEMPO INSTRUMENT INCORPORATED

Plainview, L.I., New York • 516-694-4400 • TWX 510-224-6421

TRANSMAGNETICS INC.

Var. Gain Amplifier— Multiplying Modulator

Model 365, a miniature solid state multiplying modulator without hysteresis produces an ac gain proportional to a dc input. The device finds applications in flight control systems in varying loop gain or as a sine wave modulator:

Model 365 Specifications:

DC Input: 0 to ±10V into 50K ohms min.

AC Input: 0 to 7V RMS into 50K ohms min.

AC Output: Proportional to product of inputs.

Output is 2V RMS when inputs are at maximum above.

Phase: Constant to ±1° over 380 to 420Hz.

3 DB Bandwidth: 200 Hz to 100KHz

AC Linearity: 1% FS

DC Linearity: 1% FS

Null: 10MV RMS, 200 Hz to 10KHz

DC Power: ±15V

Size: .4H x 1.27 x 1.77

Operating Temperature: 0 to 70°C (available for −55 to +85°C)

Root Mean Squarer Wide Band

Series 742 provides a true r.m.s. output for signals from plus or minus dc to 20K Hz. The output voltage is linearly proportional to true r.m.s. and can be displayed on linear or Digital voltmeters.

Specifications Series 742:

Input: −10 to +10V peak into 10K ohms min.

Output: 0 to +10V, from 50 ohms max into 10K ohms min.

Conformity: 0.5% FSR

DC Power: ±15V

Size: .78H x 3.19 x 3.44

Models Available: 742CP5 for 0 to 70°C operating — 742MP5 for −55 to +85°C operating

AC to DC Converter Series A1200

Series A1200 convert a varying 400Hz signal to a proportional DC for applications in signal conditioning and compensation for line voltage variation. Models with full scale from 6 to 115 V RMS and wide bandwidth of 60 to 5K Hz are available.

Specifications Series A1200:

AC Input: 23 to 29 V RMS, 380 to 420 Hz into 100K ohms min.

Gain: 10V DC/28.6V RMS

Linearity: ½% FS

Ripple: 50MV RMS max.

DC Power: ±15V

Size: .78 x 2.53 x 3.19

Models Available: A1200CP2 for 0 to 70°C operating — A1200MP2 for −55 to +85°C operating

Frequency to DC Converter Series 567

These devices generate a dc voltage linearly proportional to the frequency of an ac signal for applications in signal conditioning, monitoring, and control systems for tachometers, alternators and other variable frequency sources. Models are available for full scale frequencies from 50 to 5KHz.

Specifications Series 567:

AC Input: Approximate sine wave of frequency 10 to 3000 Hz, voltage from .07 to 21V RMS into 10K ohms min.

DC Output: 0 to 5V proportional to frequency from 50 ohms max output impedance

Linearity: ¼% FS

Ripple: 25MV RMS max.

DC Power: ±15V

Size: .58H x 2.03 x 2.28

Models Available: 567CP4 for 0 to 70°C operating — 567MP4 for −55 to +85°C operating

Analog Square-Rooters— Wide Band

These compact diode type square rooters with 20KHz full power bandwidth are available for one or two quadrant inputs. The output amplitude is proportional to the square root of the input.

Model	748CP10	748MP10	747CP5	747MP5
Quadrant	ONE	ONE	TWO	TWO
Input	0 to +10V	0 to +10V	−10 to +10V	−10 to +10V
Output	0 to −10V	0 to −10V	0 to +10V	0 to +10V
Size	.56 x 1.53 x 1.53	.56 x 1.53 x 1.53	.78 x 3.19 x 3.44	.78 x 3.19 x 3.44
Oper. Temp.	0 to 70°C	−55 to +85°C	0 to 70°C	−55 to +85°C
Conformity	0.5% FS	0.5% FS	0.5% FS	0.5% FS
Supply DC	±15V	±15V	±15V	±15V

DESIGN MANUAL

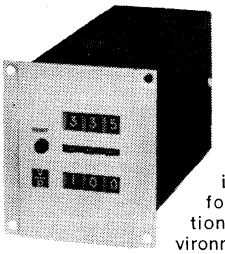
Send for your free copy of Transmagnetics' Design Manual 868. It describes and illustrates more than 45 applications for trigonometric modules. The "building block" modules, around which the manual is based, allow designers to develop all solid state computing systems.

SEE EEM SECTION 2000 AND 4900 FOR SYNCHRO/DIGITAL CONVERTERS, MULTIPLIERS AND ANALOG AND TRIGONOMETRIC COMPUTING MODELS.

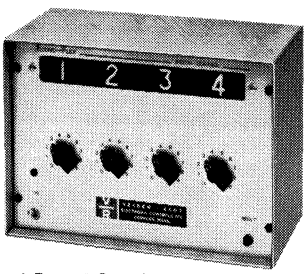
REQUEST DESIGN MANUAL 868, APPLICATIONS IN SOLID STATE TRIGONOMETRIC COMPUTING.

TRANSMAGNETICS INC. 134-25 NORTHERN BLVD / FLUSHING, N. Y. 11354
212-539-2750 • TWX 710-582-2472

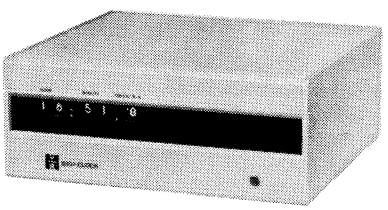
When it comes to counting, recording or controlling, come to Veeder-Root



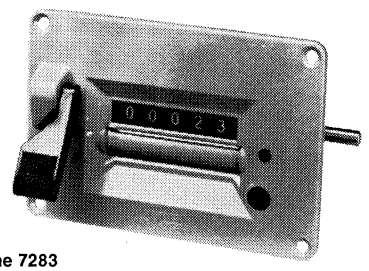
The 7102 Digi-Flex* Predetermining Counter: Electrically driven. Off-the-shelf. Both versatile and economical. Ideally suited for control applications in industrial environments.



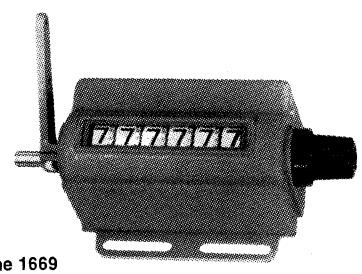
The 7122
Econo-Flex* Preset Counter:
One or two rows of presets. Reliable integrated circuitry. Operates from a selection of inputs. For critical control problem areas: coil winding, weighing, blending.



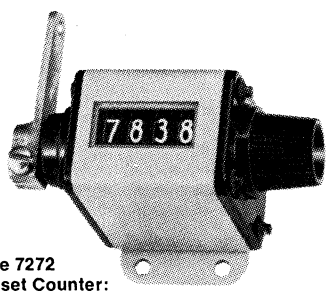
The 7108
Digi-Clock Time Display:
Offers a wide range of features for computer input. Self-contained desk unit or component of larger systems. Readout code: decimal or BCD.



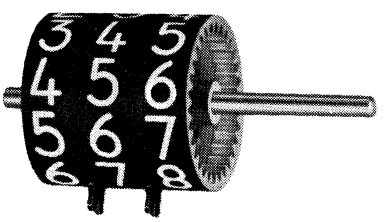
The 7283
Predetermining Counter:
Rapid reset counter with positive electrical knock-off. Features a positive interlock and base or panel mount. Recommended for industrial precision control.



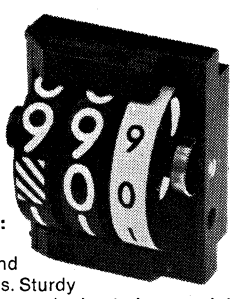
The 1669
Visicounter* Totalizer:
Ruggedly-built counter with distinct figures. Ideal for use on heavy equipment like power presses and industrial machines.



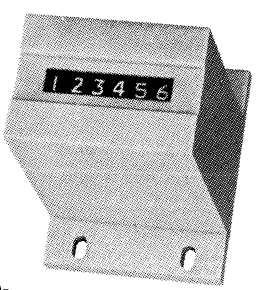
The 7272
Reset Counter:
For indoor and outdoor use where small size, accuracy, and legible figures are essential. Features acetal resin components and a corrosion-resistant case.



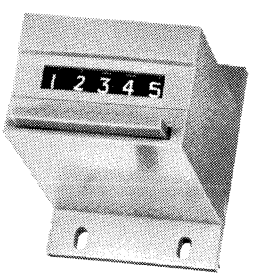
The 7170
Precision Instrument Odometer:
Light yet durable counter with modular wheel construction, providing flexible design opportunities. High speed 500 rpm. Meets applicable Mil Specs.



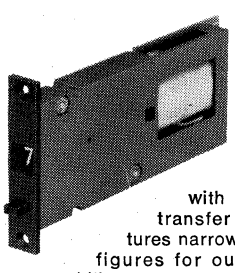
The 7162
Jewel Bearing:
Features individual wheel and pinion supports. Sturdy aluminum frame and wheels keep weight low. For use in servopneumatic altimeters. Exceptionally low torque 0.0002 oz-in.



The 7437
Electric Counter:
A low cost electric counter featuring a one piece frame construction for greater reliability and simplicity of design. Ideal for office machines or coin-operated equipment. Available with 5 or 6 figures and a variety of mounting configurations. AC or DC.



The 7438
Reset Electric Counter:
Offers the convenience of push-bar reset with the economy of rotary reset. Simple, one piece frame construction assures reliability. Ideal for test equipment, control equipment and office machines. Available with 5 figures and a variety of mountings. AC or DC.



The 1969
Veeder Decade* Totalizer:
Single wheel, electric counter with electric readout, transfer and reset. Features narrow width with large figures for outstanding readability.

*Trademark of Veeder-Root

Veeder-Root always comes through with the finest equipment you can buy.

In fact, our line of counters is so complete, it'll solve any application problems you may have.

For further information on our full line of mechanical, electrical and electronic totalizers and controls, write to: Veeder-Root, Hartford, Connecticut 06102.

V E E D E R - R O O T

INNOVATORS IN NUMERICS: COUNTING/RECORDING/CONTROLLING

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MANUFACTURER OF COMPONENTS THAT INTERFACE BETWEEN COMPUTER LEVEL SIGNALS AND MECHANICAL OR ELECTRICAL FUNCTIONS



Size: 3.1″ x 1.4″ x 1.3″ ht.
2 #6 through holes 2.625″ c-c

SOLID STATE CONTROL RELAY

Designed for computer signal control of electrical equipment, power supplies, motors and similar high power devices in military and industrial systems demanding maximum reliability, these relays contain no moving parts and elminate the problems of shock and vibration effects, contact deterioration and slow response time of electromechanical devices. Operating on line frequencies of 2 cps to 10K cps turn-on time is typically 2 to 5 μsec with turn off at zero load current. One cycle surge current is 80 amps (60 cps) for the 6 and 7½ amp models or 240 amps for the 20 amp versions over an operating temperature range of −40 to 190°F.

featuring . . .

NO CONTACTS TO WEAR OUT
ALL SILICON SOLID STATE
BARRIER STRIP TERMINALS
RUGGED ALUMINUM CASE
ENCAPSULATED IN EPOXY
ISOLATED CONTROL SIGNAL
INPUT 3-32 volt 5K ohms

MODEL	VOLTS rms	VOLTS pk	AMPS rms	MODE	PRICE 1-24	PRICE 25-99
CR211	115	200	7½	SPST	$30.00	$27.50
CR411	230	400	7½	SPST	35.00	32.00
CR611	400	600	7½	SPST	42.50	38.75
CR212	115	200	6	DSPT	35.00	32.00
CR412	230	400	6	DPST	42.50	38.75
CR612	400	600	6	DPST	57.00	51.75
CR221	115	200	20	SPST	50.00	45.50
CR421	230	400	20	SPST	55.00	50.00
CR621	400	600	20	SPST	70.00	63.50

Size: 3.1″ x 1.4″ x 1.4″ ht.
4 #6 holes on .42″ x 2.625″ sq.



Prices, specifications may change without notice. Write for complete data and quantity quotations.

DIGITAL STEPPING MOTOR

These motors are used for incremental controls, indexing and precise servo systems designed with simplified logic.

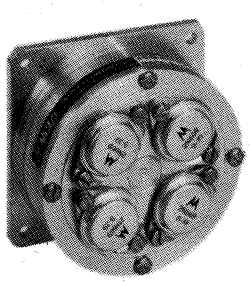
MODEL	VOLTS	TORQUE gm-cm	INERTIA gm/cm²	LENGTH in.	PRICES 1-9	PRICES 10-24
SM118	5	300	0.25	0.97	$ 95.00	$ 86.50
SM128	5	600	0.50	1.36	125.50	113.50
SM138	5	900	0.74	1.75	145.00	131.50
SM418	28	450	0.25	0.97	100.00	91.00
SM428	28	900	0.50	1.36	130.50	118.50
SM448	28	1800	0.99	2.15	170.00	138.50

featuring . . .

FLAT PROFILE
FLANGE MOUNTING
SMALL STEP ANGLE
VERY FAST RESPONSE
SEALED BALL BEARINGS



Size: 3.25″ diam.
Shaft: .25″ diam.
by ½″ long both ends



Shown mounted on an SM118
Size: 3.25″ diam. x .97″ o.a.

DIGITAL MOTOR CONTROLLER

16 (22½°) OR 32 (11¼°) REVERSIBLE POSITIONS FROM I.C. LEVEL INPUTS

MODEL MC124 4 CYCLE REVERSIBLE.....**$85.50** (1-9) **$75.00** (10-24)

MODEL MC128 8 CYCLE REVERSIBLE.....**$95.00** (1-9) **$85.00** (10-24)

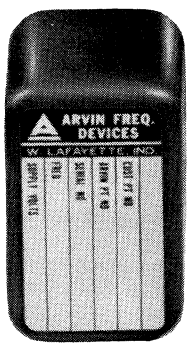
Will drive any 4 phase (2 split) stepper motor from 5 to 32 volts at 3 amps max. When used with the above motors, 16 or 32 positions can be obtained, eliminating the need for gear boxes and dynamic feedback loops in many servomechanism designs.

ZENRAD CONTROLS COMPANY (805) SANTA BARBARA, CALIF. 965-4996

ARVIN FREQUENCY DEVICES

ARVIN TCXO

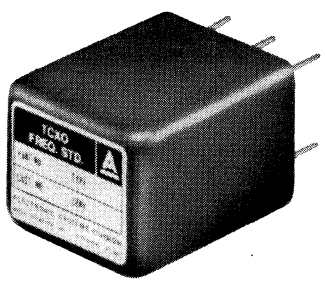
Arvin temperature compensated crystal oscillators provide precise frequency management without the use of ovens, permitting small size, light weight, instant warm-up, and low power drain. Sine, square, or pulse outputs are available. Units generating more than one frequency can be provided. All circuit values are computer optimized. Following are typical specifications. Let us know your exact requirements.



Frequency Range.....to 200 MHz
Frequency Stability.....±5 PP 10^8 depending upon freq. and temp.
Short Term Stability..less than 2 PP 10^9/sec., 2 PP 10^8/hr. and/24 hr.
Input Voltage.....±12 VDC ±5% is standard, others available
Power Output..1 MW RMS across 50 ohms output impedance
Power Input.....50 MW
Packaging.....MIL, NASA, or commercial

ARVIN TC/VCXO

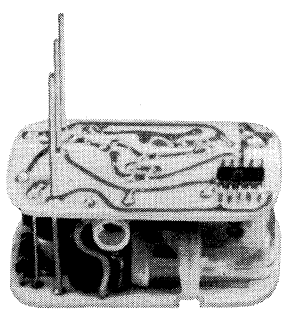
Arvin TC/VCXO's have all the advantages of Arvin TCXO's combined with a unique voltage control capability. This gives Arvin TC/VCXO's even greater flexibility without the need for external compensating circuitry or added power. Units generating one or more frequencies can be provided with sine, sawtooth, or pulse outputs. Following are typical specifications for Arvin TC/VCXO's. Send us your exact requirements.



Frequency Range.....to 50 MHz
Frequency Deviation...to ±200 PPM depending upon freq. and temp.
Deviation Sensitivity..to ± 20 PPM/volt
Deviation Rate.....to 10% of nominal oscillator frequency
Linearity.....to ± 1% of best straight line
Input Voltage....± 10 to ± 50 VDC
Packaging.....MIL, NASA, or commercial

OSCILLATOR R&D

Arvin Frequency Devices is equipped to design, develop, and manufacture in quantity a variety of oscillators and frequency control equipment. Our specialty is high reliability TCXO, VCXO, and TC/VCXO devices for miniaturized communications applications. We have built TCXOs for satellite, missile, airborne, and portable ground equipment applications. Arvin



Frequency Devices provide precise frequency management in the smallest possible package, some as small as one cubic inch, with low power drain and stabilities as high as 1 PP 10^7 in a range to 200 MHz. Let us help solve your frequency management problems. We welcome research and development contracts. Call us early in the design stage.

FOR ADDITIONAL INFORMATION WRITE:

ARVIN FREQUENCY DEVICES
ELECTRONIC SYSTEMS DIV., ARVIN INDUSTRIES, INC.

2505 N. SALISBURY STREET • WEST LAFAYETTE, INDIANA 47906 • PHONE 317-743-9639

SYSTEM CLOCK
Series 100

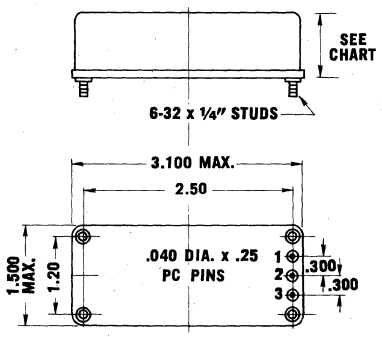
1Hz to 1MHz

FREQUENCY STABILITY

PARAMETER	ORDERING GUIDE			
	CD	JJ	KK	
Temperature Range	−55°C to +75°C	0°C to +60°C	+15°C to +35°C	
Frequency Stability	±0.025%	±0.005%	±0.002%	

BASE DIMENSIONS

ORDERING GUIDE
8



FREQUENCY, WAVEFORM & HEIGHT

PARAMETER	ORDERING GUIDE			
	5	2	7	5
Frequency	1 Hz to 15KHz	15KHz to 1MHz	60Hz to 15KHz	15 KHz to 1MHz
Waveform	Square	Square	Sine	Sine
Case Height	1.00"	0.50"	1.50"	1.00"

OUTPUT SPECIFICATIONS

PARAMETER	ORDERING GUIDE		
	28	27	12
Frequency Range	1Hz to 1MHz	1Hz to 1MHz	60Hz to 1MHz
*Supply Voltage	+5VDC ±5%	+12VDC ±5%	+12VDC ±5%
Waveform	Square	Square	Sine
Rise Time	<50 NS 10pfd load	<100 NS 10pfd load	———
Fall Time	<25 NS 10pfd load	<50 NS 10pfd load	———
Distortion	———	———	<5%
Source Voltage	5V peak ±5% from 680Ω	12V peak ±5% from 1KΩ	———
Sink Voltage	0.0V ±0.3V @ 10MA	0.0V ±0.3V @ 10MA	———
Output Voltage	———	10V P/P nominal	1V rms ±30%
Load Resistance	IC Logic	10KΩ resistive	10KΩ resistive
Source Impedance	680Ω	1KΩ	8KΩ Max.
Output Stage	NPN Common Emitter	NPN Common Emitter	———

TERMINATION

ORDERING GUIDE
P
PRINTED CIRCUIT PINS Pin #1 — Plus Supply #2 — Output #3 — Common

GENERAL SPECIFICATIONS

PARAMETER	FREQUENCY RANGE				
	1Hz to 4Hz	4Hz to 60Hz	60 Hz to 960 Hz	960Hz to 15 KHz	15KHz to 1MHz
Current Drain	<175MA	<140MA	<65MA	<45MA	<20MA
Symmetry	50/50 ±1%	50/50 ±1%	50/50 ±1%	50/50 ±1%	50/50 ±20%

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

FILL IN BLANKS BELOW TO CONSTRUCT YOUR PART NO. Typical No. is KK 8 7 28 P

Frequency Stability CD, JJ or KK	8 Base Dimensions 8	Frequency Waveform Height 5, 2, 7 or 5	Output Specifications 28, 27 or 12	P Terminations P

accutronics, inc.
628 NORTH STREET • GENEVA, ILL. 60134 • 312-232-2600

MINIATURE OSCILLATOR
Series 110

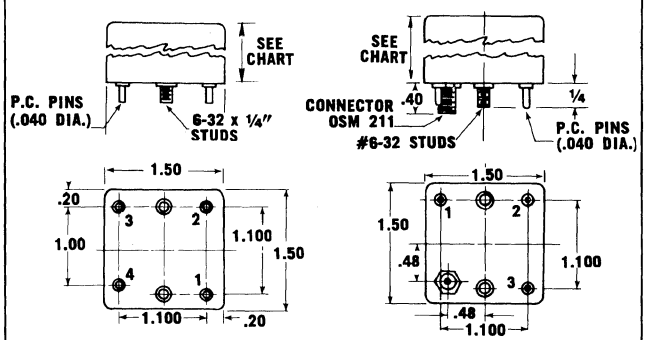
1MHz to 250MHz

FREQUENCY STABILITY

PARAMETER	ORDERING GUIDE			
	CJ	JL	KM	
Temperature Range	−55°C to +75°C	0°C to +60°C	+15°C to +35°C	
Frequency Stability	±0.005%	±0.001%	±0.0005%	

BASE DIMENSIONS

ORDERING GUIDE
1



Printed Circuit Pins — OSM Connector

FREQUENCY, WAVEFORM & HEIGHT

PARAMETER	ORDERING GUIDE			
	3	2	5	7
Frequency	1MHz to 10MHz	10MHz to 60MHz	1MHz to 100MHz	10MHz to 250MHz
Waveform	Square	Square	Sine	Sine
Case Height	0.62" PC pins	0.50" PC pins	1.00" PC pins	1.50" - OSM connector

OUTPUT SPECIFICATIONS

PARAMETER	ORDERING GUIDE		
	28	12	11
Frequency Range	1MHz to 60MHz	1MHz to 10 MHz	10MHz to 250MHz
*Supply Voltage	+5VDC ±5%	+12VDC ±5%	+12VDC ±5%
Waveform	Square	Sine	Sine
Rise Time	<25 NS	———	———
Fall Time	<15 NS	———	———
Distortion	———	<5%	<10%
Source Voltage	5V peak ±5% from 680Ω 5V peak ±5% from 330Ω >10MHz	——— ———	——— ———
Sink Voltage	0.0V ±0.3V @ 5MA	———	———
Output Voltage	———	1V rms ±30%	+10 dbm ±3 db
Load Resistance	IC Logic	1KΩ resistive	50Ω resistive
Output Stage	NPN Common Emitter	———	———

TERMINATION

ORDERING GUIDE	
P	L
PRINTED CIRCUIT PINS	OSM CONNECTOR
Pin #1 Plus Supply	Pin #1 Plus Supply
#2 Common	#2 Common
#3 Common	#3 Common
#4 Output	#4 OSM Output

GENERAL SPECIFICATIONS

PARAMETER	FREQUENCY RANGE			
	1MHz to 10MHz	10MHz to 20MHz	20MHz to 60MHz	60MHz to 250MHz
Current Drain	< 10MA	< 10MA	< 20MA	< 35MA
Symmetry	50/50 ±20%	50/50 ±20%	50/50 ±20%	———

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

FILL IN BLANKS BELOW TO CONSTRUCT YOUR PART NO. Typical No. is CJ 1 1 28 P

	1			
Frequency Stability CJ, JL or KM	Base Dimensions 1	Frequency Waveform Height 3, 2, 5 or 7	Output Specifications 28, 12 or 11	Terminations P or L

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ULTRAMINIATURE OSCILLATOR
Series 130

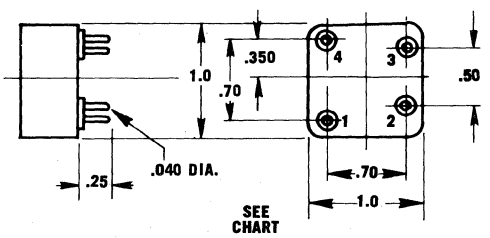
100Hz to 150MHz

FREQUENCY STABILITY

PARAMETER	ORDERING GUIDE			
	CJ	JK	KL	
Temperature Range	−55°C to +75°C	0°C to +60°C	+15°C to +35°C	
Frequency Stability	±0.005%	±0.002%	±0.001%	

BASE DIMENSIONS

ORDERING GUIDE
3



FREQUENCY, WAVEFORM & HEIGHT

PARAMETER	ORDERING GUIDE			
	3	2	1	4
Frequency	100Hz to 23KHz	23KHz to 6MHz	6MHz to 60MHz	6MHz to 150MHz
Waveform	Square	Square	Square	Sine
Case Height	0.62″	0.50″	0.40″	0.75″

OUTPUT SPECIFICATIONS

PARAMETER	ORDERING GUIDE		
	29	12	11
Frequency Range	100Hz to 60MHz	6MHz to 20MHz	20MHz to 150MHz
*Supply Voltage	+5VDC ±2%	+12VDC ±1%	+12VDC ±1%
Waveform	Square	Sine	Sine
Rise Time	<20 NS	———	———
Fall Time	<10 NS	———	———
Distortion	———	<5%	<10%
Source Voltage	>2.5V peak @ 2MA	———	———
Sink Voltage	<0.4V @ 5MA	———	———
Output Voltage	———	1V rms ±30%	0 dbm ±3 db
Load Resistance	IC Logic	1KΩ resistive	50Ω resistive

TERMINATION

ORDERING GUIDE
P

PRINTED CIRCUIT PINS

Pin #1 — Plus Supply
#2 — Common
#3 — Common
#4 — Output

GENERAL SPECIFICATIONS

PARAMETER	FREQUENCY RANGE					
	100Hz to 2KHz	2KHz to 24KHz	24KHz to 375KHz	375KHz to 1.5 MHz	1.5MHz to 6MHz	6MHz to 150MHz
Current Drain	<230MA	<180MA	<130MA	<60MA	<50MA	<40MA
Symmetry	50/50 ±1%	50/50 ±1%	50/50 ±1%	50/50 ±5%	50/50 ±7%	———

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

FILL IN BLANKS BELOW TO CONSTRUCT YOUR PART NO. Typical No. is CJ 3 3 29 P

Frequency Stability CJ, JK or KL	3 Base Dimensions 3	Frequency Waveform Height 3,2, 1 or 4	Output Specifications 29, 12 or 11	P Terminations P

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CHASSIS MOUNTED OSCILLATOR
Series 140

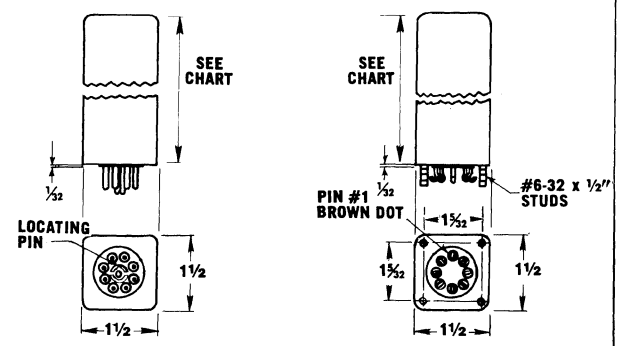
1Hz to 1MHz

FREQUENCY STABILITY

PARAMETER	ORDERING GUIDE			
	CD	JJ	KK	
Temperature Range	−55°C to +75°C	0°C to +60°C	+15°C to +35°C	
Frequency Stability	±0.025%	±0.005%	±0.002%	

BASE DIMENSIONS

ORDERING GUIDE
1



FREQUENCY, WAVEFORM & HEIGHT

PARAMETER	ORDERING GUIDE		
	9		
Frequency	1Hz to 1MHz		
Waveform	Square or Sine		
Case Height	3.00"		

OUTPUT SPECIFICATIONS

PARAMETER	ORDERING GUIDE		
	28	27	12
Frequency Range	1Hz to 1MHz	1Hz to 1MHz	60Hz to 1 MHz
*Supply Voltage	+5VDC ±5%	+12VDC ±5%	+12VDC ±5%
Waveform	Square	Square	Sine
Rise Time	<50 NS 10pfd load	<100 NS 10pfd load	———
Fall Time	<25 NS 10pfd load	<50 NS 10pfd load	———
Distortion	———	———	<5%
Source Voltage	5V peak ±5% from 680Ω	12V peak ±5% from 1KΩ	———
Sink Voltage	0.0V ±0.3V @ 10MA	0.0V ±0.3V @ 10MA	———
Output Voltage	———	10V P/P nominal	1V rms ±30%
Load Resistance	IC Logic	10KΩ resistive	10KΩ resistive
Source Impedance	680Ω	1KΩ	10KΩ Max.
Output Stage	NPN Common Emitter	NPN Common Emitter	———

TERMINATION

ORDERING GUIDE	
Z	Q
OCTAL PLUG	**SOLDER TERMINALS**
Pin #1—Common	Pin #1—Common
#2—Plus Supply	#2—Plus Supply
#8—Output	#8—Output

GENERAL SPECIFICATIONS

PARAMETER	FREQUENCY RANGE				
	1Hz to 4Hz	4Hz to 60Hz	60Hz to 960 Hz	960Hz to 15KHz	15KHz to 1MHz
Current Drain	<175MA	<140MA	<65MA	<45MA	<20MA
Symmetry	50/50 ±1%	50/50 ±1%	50/50 ±1%	50/50 ±1%	50/50 ±20%

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

FILL IN BLANKS BELOW TO CONSTRUCT YOUR PART NO. Typical No. is CD 1 9 28 Z

	1	9		
Frequency Stability CD, JJ or KK	Base Dimensions 1	Frequency Waveform Height 9	Output Specifications 28, 27 or 12	Terminations Z or Q

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CHASSIS MOUNTED OSCILLATOR
Series 150

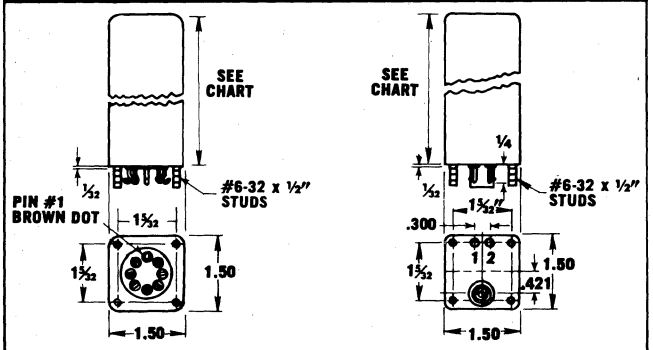
1MHz to 250MHz

FREQUENCY STABILITY

PARAMETER	ORDERING GUIDE				
	CJ	JL	KL		
Temperature Range	−55°C to +75°C	0°C to +60°C	+15°C to +35°C		
Frequency Stability	±0.005%	±0.0015%	±0.001%		

BASE DIMENSIONS

ORDERING GUIDE
1



FREQUENCY, WAVEFORM & HEIGHT

PARAMETER	ORDERING GUIDE			
	9	0		
Frequency	1MHz to 250MHz	1MHz to 250MHz		
Waveform	Square & Sine	Sine		
Case Height	3.00" Solder Pins	3.50" BNC Connector		

OUTPUT SPECIFICATIONS

PARAMETER	ORDERING GUIDE		
	28	12	11
Frequency Range	1MHz to 60MHz	1MHz to 10MHz	10MHz to 250MHz
*Supply Voltage	+5VDC ±5%	+12VDC ±5%	+12VDC ±5%
Waveform	Square	Sine	Sine
Rise Time	<30 NS	———	———
Fall Time	<20 NS	———	———
Distortion	———	<5%	<10%
Source Voltage	5V peak ±5% from 680Ω	———	———
Sink Voltage	0.0V ±0.3V @ 5MA	———	———
Output Voltage	———	1V rms ±30%	+10 dbm ±3 db
Load Resistance	IC Logic	1KΩ resistive	50Ω resistive
Output Stage	NPN Common Emitter	———	———
Spurious Response	———	———	−60db

TERMINATION

ORDERING GUIDE	
Q	M
SOLDER TERMINALS Pin #1—Common #2—Plus Supply #3—Output	BNC CONNECTOR Pin #1—Common #2—Plus Supply BNC-Output

GENERAL SPECIFICATIONS

PARAMETER	FREQUENCY RANGE				
	1MHz to 10MHz	10MHz to 20MHz	20MHz to 60MHz	1MHz to 10MHz	10MHz to 250MHz
Current Drain	<10MA	<10MA	<20MA	<25MA	<35MA
Symmetry	50/50 ±20%	50/50 ±20%	50/50 ±20%	———	———

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

FILL IN BLANKS BELOW TO CONSTRUCT YOUR PART NO. Typical No. is CJ 1 9 28 Q

Frequency Stability CJ, JL or KL	Base Dimensions 1	FrequencyWaveformHeight 9 or 0	Output Specifications 28, 12 or 11	Terminations Q or M

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POWER SERIES
Series 200

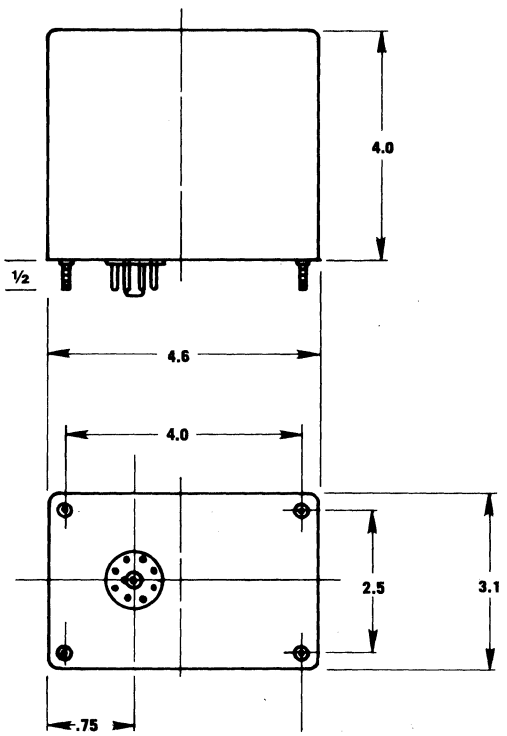
60Hz to 10KHz

FEATURES
- Crystal Control
- Digital Dividers
- Worst Case Design
- Wide Frequency Coverage
- 5 Watt Capability
- Amplitude Adjustment
- Small Size

APPLICATIONS
- Synchronous Motor Drive
- LVDT Drive
- Acoustic Measurement
- Audio Reference Generator
- Tone Signalling
- Resonant Reed Communications
- Low Impedance Audio Bridges

Pin Connections:

Pin #1 — Common
#2 — Plus Supply
#4 — Case Grounded
#7 — Output
#8 — Output



SPECIFICATIONS

PARAMETER	MODEL	
	WG117	WG118
Frequency Range	60Hz to 960 Hz	960Hz to 10kHz
Frequency Tolerance	±0.01%	±0.01%
Temperature Range	0°C to +60°C	0°C to +60°C
*Supply Voltage	26VDC ±2VDC	26VDC ±2VDC
Current Drain	400MA Max.	400MA Max.
Output Stability	±8%	±8%
Waveform	Sine	Sine
Distortion	<5%	<5%
Power Output	5 Watts per Voltage Level	5 Watts per Voltage Level
Voltage Levels (Level desired to be specified)	30 VRMS ±10% (180Ω Load) 60 VRMS ±10% (720Ω Load) 90 VRMS ±10% (1620Ω Load) 120 VRMS ±10% (2900Ω Load)	30 VRMS ±10% (180Ω Load) 60 VRMS ±10% (720Ω Load) 90 VRMS ±10% (1620Ω Load) 120 VRMS ±10% (2900Ω Load)
Size	3.1" x 4.6" Max.	3.1" x 4.6" Max.
Header	Octal Plug	Octal Plug
Note: Unit can be operated without load		

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

ORDERING INFORMATION:

To Order, Specify Model No. (Example WG117) and Frequency.

accutronics, inc.
628 NORTH STREET • GENEVA, ILL. 60134 • 312-232-2600

SECTION 2300 eem File System

HIGH STABILITY OSCILLATOR
Series 165

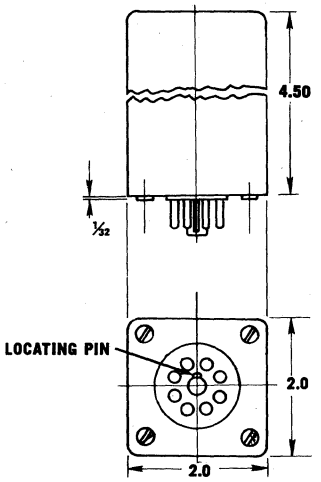
1MHz to 150MHz

FEATURES

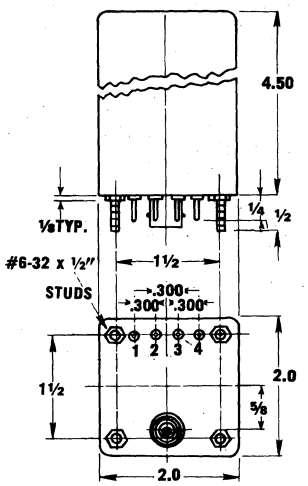
- All Units Operate On Frequency Without Multiplication
- Low Spurious Content
- Excellent Short Term Stability
- Low Harmonic Content
- Logic Compatibility

APPLICATIONS

- Frequency Source For Multiplier Chain
- Telemetry Main Carrier Source
- Integrated Circuit Clock
- Digital Scanning Clock
- Computer Time Base
- Reference Oscillator



Pin #1 — Common OSC
#2 —Plus Supply OSC
#5 — Oven Plus
#6 — Oven Common
#8 — Output



Pin #1 — Plus Supply OSC
#2 — Common OSC
#3 — Common Oven
#4 — Plus Supply Oven
— BNC - Output

SPECIFICATIONS

PARAMETER		MODEL			
		ZT119	ZT120	ZT121	ZT122
Frequency Range		1MHz to 20MHz	20MHz to 60MHz	60MHz to 100MHz	100MHz to 150MHz
Frequency Adjust		±5 PPM Min.			
Temperature Range		0°C to +60°C			
*Supply Voltage (OSC)		+12VDC ±2%			
*Supply Voltage (Oven)		+24VDC ±5% or 28VDC ±5% (Specify)			
Waveform		Sine			
Load		50 Ohms Resistive			
Oven Power		15 Watts at turn-on: 6 Watts at 25°C Following 1 Hr. Warmup			
Power Output		0DBM ±1.5DBM	0DBM ±1.5DBM	+10DBM ±2DBM	+10DBM ±2BDM
Harmonic Content		−30DB	−30DB	−20DB	−20DB
Spurious Response		−70DB	−60DB	−60DB	−60DB
Current (OSC)		35 Ma	50 Ma	50 Ma	50 Ma
Short Term Stability		$<5x10^{-10}$ Per Sec.	$<1x10^{-9}$ Per Sec.	$<1x10^{-9}$ Per Sec.	$<1x10^{-9}$ Per Sec.
Tolerance		$\pm5x10^{-8}$	$\pm1x10^{-7}$	$\pm5x10^{-7}$	$\pm5x10^{-7}$
Unit Shipped at		$\pm5x10^{-8}$ Per 24 Hrs.	$\pm5x10^{-7}$ Per 24 Hrs.	$\pm1x10^{-7}$ Per 24 Hrs.	$\pm1x10^{-7}$ Per 24 Hrs.
Drift after 200 Hrs. (Typical)		$\pm2x10^{-8}$ Per 24 Hrs.	$\pm5x10^{-8}$ Per 24 Hrs.	$\pm1x10^{-7}$ Per 24 Hrs.	$\pm1x10^{-7}$ Per 24 Hrs.
Stabilization to $\pm5x10^{-7}$ of nom. freq.		35 Min.	45 Min.	45 Min.	45 Min.
Size		2" x 2" x 4½"			
Header	add -1	Octal Plug	Octal Plug	N/A	N/A
	add -2	BNC & Solder Pins			

PARAMETER		MODEL	
		ZT123	ZT124
Frequency Range		1MHz to 20MHz	20MHz to 60MHz
Frequency Adjust		±5 PPM Min.	
Temperature Range		0°C to +60°C	
Supply Voltage (OSC)		+12VDC ±2%	
Supply Voltage (Oven)		+24VDC ±5% or 28VDC ±5% (Specify)	
Waveform		Square	
Output Voltage ("1")		Minimum of 3.5V peak from 100Ω Source	
Output Voltage ("0")		0.0V ±0.4V at 5 Ma Sink Current	
Oven Power		15 Watts at turn-on: 6 Watts at 25°C Following 1 Hr. Warmup	
Short Term Stability		$<\pm5x10^{-10}$/Sec.	$<\pm1x10^{-9}$/Sec.
Tolerance		$\pm5x10^{-8}$	$\pm1x10^{-7}$
Unit Shipped at		$\pm5x10^{-8}$/24 Hrs.	$\pm5x10^{-7}$/24 Hrs.
Drift after 200 Hrs. (Typical)		$\pm2x10^{-8}$/24 Hrs.	$\pm5x10^{-8}$/24 Hrs.
Stabilization to $\pm5x10^{-7}$ of nom. freq.		35 Min.	45 Min.
Rise Time		<20 NS	<10 NS
Fall Time		<20 NS	<10 NS
Size		2" x 2" x 4½"	
Header	add -1	Octal Plug	
	add -2	BNC & Solder Pins	

Note: Unit must be loaded with 200 ohm load to preserve waveform fidelity

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

ORDERING INFORMATION:

To Order, Specify Model No. (Example ZT119), Header (-1 or -2) and Frequency.

accutronics, inc.
628 NORTH STREET • GENEVA, ILL. 60134 • 312-232-2600

RC VOLTAGE CONTROLLED OSCILLATOR Series 180

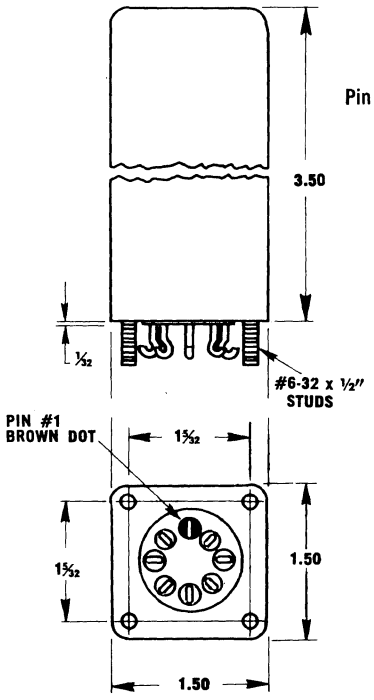
100Hz to 40KHz

FEATURES

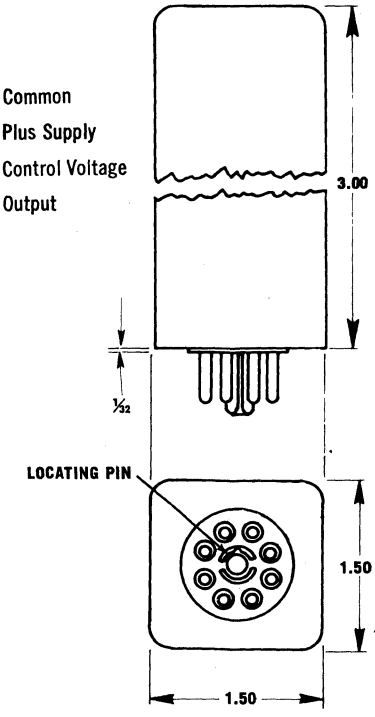
- Excellent Stability
- Small Size
- Low Current Drain
- Choice of FM Deviation
- Wide Frequency Coverage
- IRIG Compatibility
- Logic Compatibility

APPLICATIONS

- IRIG Channels 1-16
- Low Frequency Telemetry
- Transducer to Frequency Conversion
- Sub Carrier Generation
- Phase Locking
- Pulse Modulation
- Signal Averaging



Pin #1 — Common
#2 — Plus Supply
#4 — Control Voltage
#8 — Output



SPECIFICATIONS

PARAMETER	MODEL		PARAMETER	MODEL	
	RC178	RC179		RC180	RC181
Frequency Range	100Hz to 40kHz		Frequency Range	400Hz to 40kHz	
Frequency Adjust	±10% Minimum		Frequency Adjust	±3% Minimum	
Frequency Tolerance	±0.1%		Frequency Tolerance	±0.1%	
Temperature Range	0°C to +60°C		Temperature Range	0°C to +60°C	
*Supply Voltage	+24 VDC ±5%		Supply Voltage	+24 VDC ±5%	
Supply Current	250 Ma at Turn-on: 100 Ma at +25°C		Supply Current	250 Ma at Turn-on: 100 Ma at +25°C	
Waveform	Square		Waveform	Sine	
Symmetry	50/50 ±2%		Output Voltage	2 VRMS ±10% at center frequency	
Output Voltage ("1")	5.1 V ±5% from 1kΩ Source		Distortion	<5%	
Output Voltage ("0")	0.0 V ±0.3 V at 5 Ma		Load	10KΩ	
Output Stage	NPN Common Emitter		AM Ripple	±10% Maximum	
Deviation	±10%	±50%	Deviation	±7.5%	±15%
Linearity	±0.2%	±0.5%	Linearity	±0.2%	±0.5%
Control Voltage	0 V to +10 VDC or ±5 VDC (Specify)		Control Voltage	0 V to +10VDC or ±5 VDC (Specify)	
Input Impedance	20kΩ Minimum		Input Impedance	20kΩ Maximum	
Size	1.5" x 1.5" x 3.5"		Size	1.5" x 1.5" x 3.5"	
Header add -1	8 Pin Hook Terminals		Header add -1	8 Pin Hook Terminals	
Header add -2	Octal Plug		Header add -2	Octal Plug	
Note: Unit may be shorted to ground without damage					

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

ORDERING INFORMATION:

To Order, Specify Model No. (Example RC178), Header (-1 or -2) and Frequency.

accutronics, inc.
628 NORTH STREET • GENEVA, ILL. 60134 • 312-232-2600

LC VOLTAGE CONTROLLED OSCILLATOR Series 170

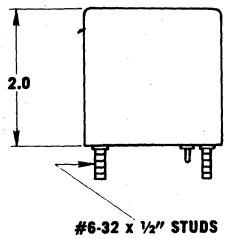
1MHz to 100MHz

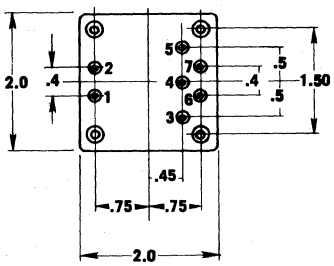
FEATURES

- Wide Deviation
- Low Jitter
- Logic Compatibility
- Excellent Stability
- Ovenized & Non-ovenized
- Low Power
- Small Size

APPLICATIONS

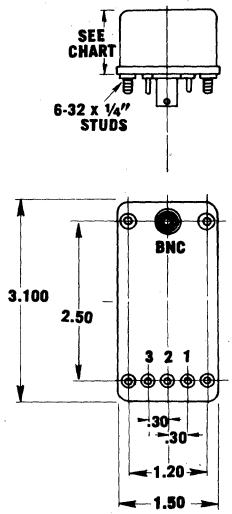
- Phase Locking System
- Telemetry
- Pulse Frequency Modulation
- Analog to Frequency Converters
- Transducer to Frequency Conversion
- Digital Phase Locking





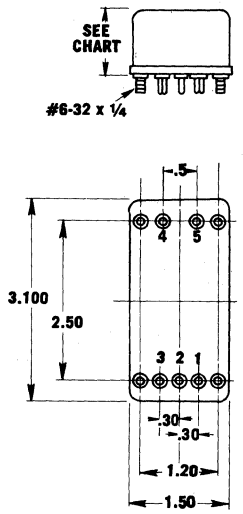
Models LC176 & LC177

Pin #1 — Oven Plus
#2 — Oven Common
#3 — Plus Volts OSC
#4 — Control Voltage
#5 — Common OSC
#6 — Signal Output
#7 — Signal Ground



Models LC170 & LC173

Pin #1 — Plus Supply
#2 — Control Voltage
#3 — Common
— Output OSM
— BNC-Output



Models LC168, LC169, LC171, LC172 & LC174, LC175

Pin #1 — Plus Supply
#2 — Control Voltage
#3 — Common
#4 — Signal Output (Hi)
#5 — Signal Output (Lo)

SPECIFICATIONS

PARAMETER	MODEL					
	LC168	LC169	LC170	LC171	LC172	LC173
Frequency Range	1MHz to 10MHz	10MHz to 60MHz	60MHz to 100MHz	1MHz to 10MHz	10MHz to 60MHz	60MHz to 100MHz
Frequency Tolerance	±1%	±1%	±2%	±2%	±3%	±4%
Temperature Range	0°C to +60°C					
*Supply Voltage	+24VDC ±1%					
Control Voltage	0 to +10V or ±5V (Specify)					
Waveform	Sine					
Output Voltage	>+5DBM					
Load	50Ω					
Current Drain	<50 Ma					
Deviation	±10%	±10%	±10%	±30%	±20%	±20%
Linearity	±3%	±5%	±5%	±5%	±10%	±10%
Height	.75"	1"	1"	.75"	1"	1"
Size	1.5" x 3.1"					
Header	5 PC Pins	5 PC Pins	3 PC Pins and BNC Conn.	5 PC Pins	5 PC Pins	3 PC Pins and BNC Conn.

PARAMETER	MODEL			
	LC174	LC175	LC176	LC177
Frequency Range	1MHz to 10MHz	10MHz to 60MHz	1MHz to 10MHz	10MHz to 60MHz
Frequency Tolerance	±2%	±3%	±0.1%	±0.1%
Temperature Range	0°C to +60°C			
Supply Voltage	+24VDC ±1%			
Control Voltage	0 to +10V or ±5V (Specify)			
Waveform	Square			
Output Voltage ("1")	5.1V ±5% from 470Ω Source			
Output Voltage ("0")	0.0 ±0.3V at 5 Ma			
Rise & Fall Times	<10 NS			
Current Drain	<60 Ma		<350 Ma at Turn-on 150 Ma at +25°C	
Deviation	±30%	±20%	±30%	±20%
Linearity	±5%	±10%	±5%	±10%
Height	.75"	1"	2"	2"
Size	1.5" x 3.1"		2" x 2"	
Header	5 Printed Circuit Pins	5 Printed Circuit Pins	7 Printed Circuit Pins	7 Printed Circuit Pins

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

ORDERING INFORMATION:

To Order, Specify Model No. (Example LC168) and Frequency.

accutronics, inc.
628 NORTH STREET • GENEVA, ILL. 60134 • 312-232-2600

VOLTAGE CONTROLLED CRYSTAL OSCILLATOR Series 190

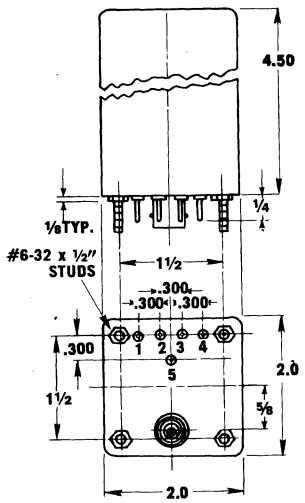
3MHz to 200MHz

FEATURES

- Wide Modulation Deviation
- Low Harmonic Content
- Low Spurious
- Good Short Term Stability
- Compatible With IC Logic

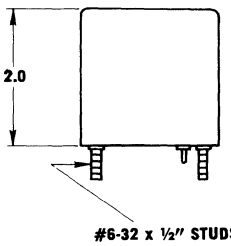
APPLICATIONS

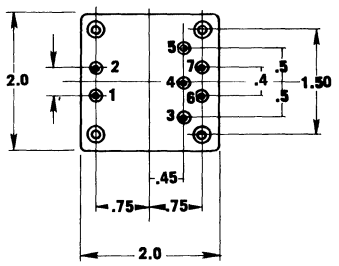
- Frequency Modulation System
- Sub Carrier Generation
- Transducer Encoding System
- Transmitter Sources
- Phase Locking System



Models VN163 & VN164

Pin #1 — Plug Supply OSC
#2 — Common OSC
#3 — Common Oven
#4 — Plus Supply Oven
BNC - Output
#5 — Sync





Model VN162

Pin #1 — Oven Plus
#2 — Oven Common
#3 — Plus Volts OSC
#4 — Control Voltage
#5 — Common OSC
#6 — Signal Output
#7 — Signal Ground

SPECIFICATIONS

PARAMETER	MODEL VN162	PARAMETER	MODEL VN163	MODEL VN164
Frequency Range	100MHz to 200MHz	Frequency Range	3MHz to 20MHz	
Frequency Adjust	±5 PPM Minimum	Frequency Adjust	±5 PPM Minimum	
Frequency Tolerance	±0.0001%	Frequency Tolerance	±0.0001%	
Temperature Range	0°C to +60°C	Temperature Range	0°C to +60°C	
*Supply Voltage	Oven +24 VDC ±2%: Oscillator & Multiplier +12 VDC ±1%	Supply Voltage	Oven +24 VDC ±5%: Oscillator +12 VDC ±5%	
Supply Current	Oven 500 Ma Max. at Turn-on: 250 Ma at 25°C Oscillator & Multiplier 100 Ma Max.	Supply Current	Oven 300 Ma Max. at Turn-on: 150 Ma at 25°C Oscillator 50 Ma Max.	
Waveform	Sine	Waveform	Square	
Waveform Purity	All harmonics down −20db	Output Voltage ("1")	+5.1 V ±5% from 470Ω Source	
Output Level	+5DBM Minimum	Output Voltage ("0")	0.0 ±0.3 V at 5 Ma	
Load	50Ω Resistive	Rise Time	<30 NS	
Deviation	±0.02%	Fall Time	<20 NS	
Linearity	<20% from Straight Line Between End Points	Deviation	±0.01%	±0.025%
Control Voltage	0 to +10 V or ±5 VDC (Specify)	Linearity	<20% from Straight Line Between End Points	
Size	2" x 2" x 4½"	Control Voltage	0 to +10 VDC or ±5 VDC (Specify)	
Header	BNC & 5 Wire Terminals	Input Impedance	>10kΩ	
		Size	2" x 2" x 2"	
		Header	7 Wire Terminals	

* These are standard operating supply voltages and output voltages. Other voltages are available upon request.

ORDERING INFORMATION:

To Order, Specify Model No. (Example VN162) and Frequency.

accutronics, inc.
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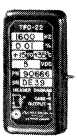
SPECIFY AUSTRON

Tuning-fork oscillators, tuning-fork filters and Sulzer crystal oscillators

TUNING FORK OSCILLATORS



TFO-1
(1⅝ x 1⅝ x 2⅜")



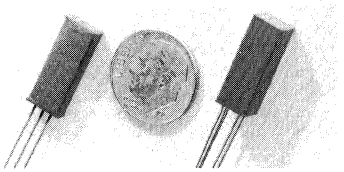
TFO-22
(1 x 2 x 0.5")

AUSTRON, INC. continues to supply a complete selection of tuning fork oscillators for industrial, military, inner and outer space, frequency control applications.

- Frequency Range — <1Hz to >50KHz
- Temperature Range — <−65°C to >+125°C.
- Frequency Tolerances — <±0.001% to >±1%.
- Outputs — Direct DTL or TTL compatibility. Sine, square, or pulse.

TFO-1 <1Hz to 50KHz
Multi-frequency-1,2,or 3Φ outputs.
TFO-22 <50Hz to 50KHz. Low cost. Printed circuit board mounting.

TUNING FORK FILTERS



TFF-38 Single Filter
.290 x .700 x .140"
<3 grams

TFF-42 Double Filter
.290 x .725 x .290"
<5 grams

AUSTRON tuning-fork filters are solving the need for small, hi-Q filters in the frequency range of 10 KHz to 50 KHz. Units are mechanically rugged and temperature stable.

- Frequency Range — <10 KHz to >50 KHz
- Frequency Tolerance — ±0.05%
- Insertion Loss — <−3dB
- Bandwidth — 6 dB — <0.005% to 0.2%
  40 dB — 6% nominal
- Frequency vs Temperature — <60% of bandwidth
- Maximum Spurious Response — >−25 dB
- Input Level — <10 μv to 5 v rms

SULZER CRYSTAL OSCILLATORS



MODEL 1120
(2¼ x 2⅛ x 4")



MODEL 1100
(1¼ x 1¾ x 3¼")



ACO-22
1 x 2 x 0.5"
Low Cost



TCXO-50
Temperature-Compensated
Crystal Oscillator 2 x 2 x 1"

The Sulzer Crystal Oscillators are manufactured in AUSTRON's Washington Division. They emphasize the best performance in low power consumption, long and short term stability, and minimum size.

Oven-controlled Crystal Oscillators

1000 — Long term stability to 1 x 10^{-8}/24 hours, −10°C to +55°C, 1 MHz output.

1100 — Long term stability to 1 x 10^{-9}/24 hours, −20°C to +65°C, 5 x 10^{-9} retrace after one hour, 5 MHz output, 4 watts maximum 2 watts average power input, 1¼ x 1¾ x 3¼ inches, 7 ounces.

1120 — Long term stability to 1 x 10^{-9}/24 hours, −20°C to +55°C, 5 x 10^{-9} retrace after one hour, 1 MHz output (special frequencies available), 4 watts maximum 2 watts average power input, 2.14 x 2.27 x 4 inches, 9 ounces. Electrical and mechanical replacement for older Sulzer Model 1 KLM series.

1140 — Long term stability to 1 x 10^{-9}/24 hours, −10°C to +65°C, 5 x 10^{-9} retrace after one hour, 1 MHz or 5 MHz output (special frequencies to 100 KHz available), 1⅞ x 1⅞ x 3½ inches.

1150 — 2 x 10^{-10}/day long term stability, 2 x 10^{-11}/°C average for −55°C to +60°C, 5 MHz, 4.5 watts maximum 2.5 watts average power input, 2½ x 3¼ x 5 inches.

1160 — 2 x 10^{-10}/day long term stability, 2 x 10^{-11}/°C average for −55°C to +60°C, 5 MHz, 3.5 watts maximum 1.5 watts average power input, 2 x 2 x 5⅜ inches.

Temperature-compensated Crystal Oscillators

ACO-22
Frequency Range — 100 KHz to 50 MHz
Accuracy — ±1 x 10^{-6}
Frequency vs Temperature 5 x 10^{-6}
Temperature Range — −5°C to +55°C
Input 5 v dc ±1%
Output — 1-4 v pk-pk into 10 K ohms

TCXO-50
Frequency Range — 1 MHz to 10 MHz
Frequency Tolerance — ±1 x 10^{-6}
Temperature Range 5°C to +55°C
Frequency vs Temperature — ±1 x 10^{-6}
Input 24 v dc ±10%
Output — 1-4 v pk-pk into 10 K ohms
Stabilization — <3 seconds

AUSTRON INC. 10214 NORTH INTERREGIONAL HIGHWAY, AUSTIN, TEXAS 78753 TELEPHONE (512) 454-2581

BLACKHAWK NETWORKS CRYSTAL BANDPASS FILTERS

SINGLE SIDEBAND CRYSTAL FILTERS

MODEL	SIDEBAND	3 db PASSBAND (cps)	60 db BANDWIDTH (cps)	ULTIMATE ATTENUATION	IMPEDANCE (ohms)	CARRIER SUPPRESSION (db)
1650-2800-6CL	Lower	−350 to −3100	4400 @ 50	50	600	25
1650-2800-6CU	Upper	+350 to +3100	4400 @ 50	50	600	25
1650-2400-8AL	Lower	−300 to −2700	3600	60	4000	30
1650-2400-8AU	Upper	+300 to +2700	3600	60	4000	30
1750-2700-6AL	Lower	−300 to −3000	5400	60	1000	20
1750-2700-6AU	Upper	+300 to +3000	5400	60	1000	20
3000-2700-8AL	Lower	−300 to −3000	4200	60	50	30
3000-2700-8AU	Upper	+300 to +3000	4200	60	50	30

SYMMETRICAL CRYSTAL FILTERS

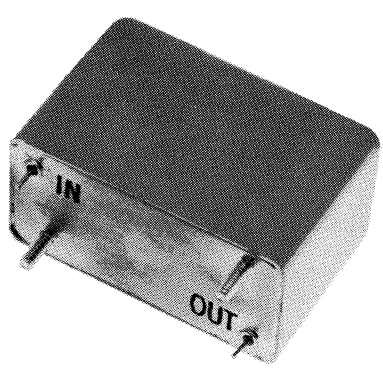
MODEL	CENTER FREQUENCY (kcs)	3 db BANDWIDTH (cps)	60 db BANDWIDTH (cps)	IMPEDANCE (ohms)	ULTIMATE ATTENUATION (db)
30-3-4A	30	3	15	10000	60
130-100-2A	130	80 @ 6 db	500 @ 40	10000	30
250-600-4D	250	600 @ 6 db	2500	4000	60
1000-2800-4A	1000	2800	16000	10000	50
1650-6000-4D	1650	6000 @ 6 db	20000	1000	60
2215-250-4A	2215	250	1100	4000	60
2215-1000-4A	2215	1000	4000	5600	60
2215-2000-4A	2215	2000	8000	5600	60
2215-2500-4A	2215	2500	10000	4000	60
2215-3100-6A	2215	3100	7500	4000	60
2215-4000-4A	2215	4000	16000	5600	60
2215-6000-4A	2215	6000	24000	5600	60
2215-800-4A	2215	8000	32000	5600	60
3000-500-4D	3000	500 @ 6 db	25000	2000	60
3000-1000-4A	3000	1000	5000	4700	60
3000-1500-6C	3000	1500 @ 6 db	5000	2000	60
3000-3000-6A	3000	3000 @ 6 db	7000	2000	60
3000-7000-6A	3000	7000	12000	8200	60
3395-2100-6B	3395	2100 @ 6 db	5000	2000	60

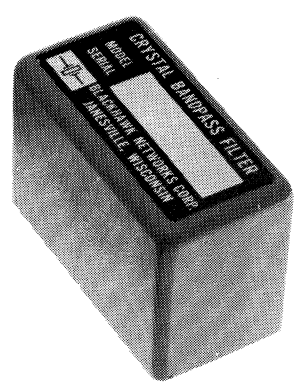
CUSTOM DESIGNS

Send us your specifications for prompt quotation service on special requirements. We will be glad to help you with our application engineering experience, too.



SEE OUR SPECIFICATIONS IN VSMF MICROFILM CATALOG FILE





BLACKHAWK

BLACKHAWK NETWORKS CORP.
14 NORTH PARKER DRIVE
JANESVILLE, WISCONSIN 53545
DIAL (608) 752-8701

Bliley
if you buy quality

CRYSTAL OSCILLATORS INCORPORATING TEMPERATURE CONTROL



CCO-23

CCO-23 Series TYPE	FREQUENCY RANGE	STABILITY (After One Hour)			AGING CHARACTERISTICS		OUTPUT WAVE SHAPE	OUTPUT (rms) WITH LOAD (ohms)	OSCILLATOR VOLTAGE	OVEN VOLTAGE
		Short Term (10 sec)	Fixed Ambient (25°C ± 5°C)	Ambient Range (0° - 50°C)	24-hour Period (After 72 hours)	One Week (After 72 hours)				
CCO-23MD-7	1 MHz	5×10^{-10}	5×10^{-9}	2×10^{-8}	5×10^{-9}	2×10^{-8}	Sine	1 volt-1500	27 VDC	27 VDC
CCO-23MD-6H	1 MHz	3×10^{-10}	3×10^{-9}	$\pm 1 \times 10^{-8}$	3×10^{-9}	2×10^{-8}	Sine	1 volt-500	27 VDC	27 VDC
CCO-23LD-H	5 MHz	3×10^{-10}	3×10^{-9}	$\pm 1 \times 10^{-8}$	3×10^{-9}	2×10^{-8}	Sine	1 volt-1500	27 VDC	27 VDC

The CCO-23 series offers a choice of 3 ultra stable time base oscillators for premium performance. Special glass sealed quartz crystals are designed for high Q characteristics and are processed to assure low aging needed in sophisticated applications. All models incorporate full proportional temperature control ovens and solid state circuitry.



CCO-7

CCO-7 Series MODEL	FREQUENCY RANGE	STABILITY — AMBIENT		OUTPUT VOLTS rms
		25°C	0-60°C	
CCO-7R	10-14 kHz	5×10^{-7}	$\pm 2 \times 10^{-6}$	1.5
CCO-7R	14-35 kHz	3×10^{-7}	$\pm 5 \times 10^{-7}$	1.5
CCO-7R	35-198 kHz	2×10^{-7}	$\pm 4 \times 10^{-7}$	1.5
CCO-7R	198-300 kHz	1×10^{-7}	$\pm 1.5 \times 10^{-7}$	1.0
CCO-7M	.95-3.0 MHz	1×10^{-8}	$\pm 3 \times 10^{-8}$	1.0
CCO-7L	3-8 MHz	1×10^{-8}	$\pm 3 \times 10^{-8}$	0.5
CCO-7N	8-15 MHz	1×10^{-7}	$\pm 3 \times 10^{-7}$	1.5
CCO-7V	15-50 MHz	2×10^{-7}	$\pm 5 \times 10^{-7}$	0.5
CCO-7U	50-100 MHz	2×10^{-7}	$\pm 5 \times 10^{-7}$	0.5

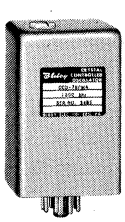
Standard models in this series are supplied with glass sealed crystals for low long term aging. All models have solid state oscillators designed for operation on 27 VDC. Mercury thermostat ovens may be specified for 115 VAC or 27 VDC operation. Standard output is clipped sine wave with ratings as shown above based on 1500 ohm load conditions.



CCO-25

CCO-25 Series TYPE	FREQUENCY RANGE	STABILITY — AMBIENT		OUTPUT INTO 1500 OHMS	AGING/WK AFTER 72 HRS. Specify Aging Option	
		25°C	0-60°C		Standard	Special
CCO-25MD	1-3 MHz	5×10^{-8}	$\pm 5 \times 10^{-7}$	1v	1×10^{-7}	3×10^{-8}
CCO-25LD	3-8 MHz	5×10^{-8}	$\pm 5 \times 10^{-7}$	1v	1×10^{-7}	3×10^{-8}
CCO-25ND	8-15 MHz	1×10^{-7}	$\pm 5 \times 10^{-7}$	1v	2×10^{-7}	5×10^{-8}
CCO-25VD	15-50 MHz	2×10^{-7}	$\pm 5 \times 10^{-7}$	.5v	3×10^{-7}	1×10^{-7}
CCO-25UD	50-100 MHz	2×10^{-7}	$\pm 5 \times 10^{-7}$	.5v	4×10^{-7}	1×10^{-7}

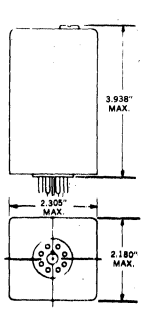
This series is designed with proportional temperature control to meet high stability performance requirements in a minimum size package for PC board mounting. Standard models have sine wave output and operate with 12 VDC (oscillator) and 24 VDC (oven) supply.



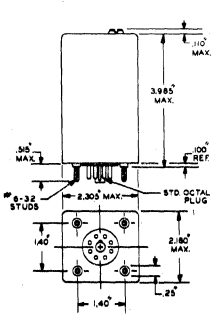
CCO-78

CCO-78 Series MODEL	FREQUENCY RANGE	STABILITY — AMBIENT		OUTPUT VOLTS rms
		25°C	0-60°C	
CCO-78R	10-14 kHz	5×10^{-7}	$\pm 2 \times 10^{-6}$	1.5
CCO-78R	14-35 kHz	3×10^{-7}	$\pm 5 \times 10^{-7}$	1.5
CCO-78R	35-60 kHz	2×10^{-7}	$\pm 4 \times 10^{-7}$	1.5
CCO-78R	60-198 kHz	2×10^{-7}	$\pm 4 \times 10^{-7}$	1.5
CCO-78R-2	198-500 kHz	1×10^{-7}	$\pm 1.5 \times 10^{-7}$	1.0
CCO-78M	.80-3.0 MHz	1×10^{-8}	$\pm 3 \times 10^{-8}$	1.0
CCO-78L	3.0-8.0 MHz	1×10^{-8}	$\pm 3 \times 10^{-8}$	.75
CCO-78N	8.0-15.0 MHz	5×10^{-8}	$\pm 8 \times 10^{-8}$	1.0
CCO-78V	15.0-50 MHz	1×10^{-7}	$\pm 2 \times 10^{-7}$	1.0
CCO-78U	50-100 MHz	2×10^{-7}	$\pm 4 \times 10^{-7}$	.75

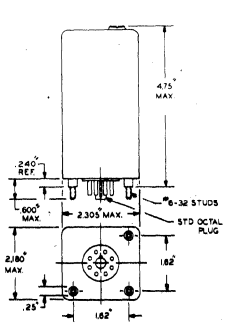
Standard models in this series incorporate solid state proportional temperature control which may be specified for 115 VAC or 27 VDC operation with 5% regulation. Solid state oscillator circuitry is designed to operate on 27 VDC (1% regulation) supply with sine wave output ratings shown for 1500 ohm load conditions.



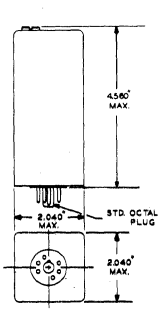
CCO-23MD-7



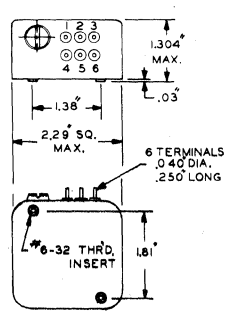
CCO-23MD-6H



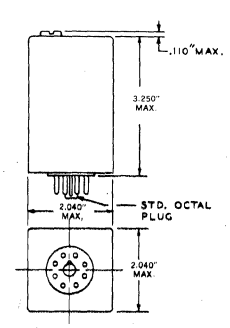
CCO-23LD-H



CCO-7



CCO-25



CCO-78

Bliley

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CRYSTAL OSCILLATORS WITHOUT TEMPERATURE CONTROL

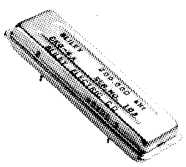


TCCO Series

TCCO-26 Series RANGE 1-20 MHz	FREQUENCY STABILITY WITH TEMPERATURE DEVIATION	
TCCO-26	$\pm 1 \times 10^{-6}$	0-50°C
TCCO-26-1	$\pm 3 \times 10^{-7}$	0-50°C
TCCO-26-2	$\pm 2 \times 10^{-6}$	−20 to +70°C
TCCO-26-3	$\pm 4 \times 10^{-7}$	−20 to +70°C
TCCO-26-4	$\pm 1 \times 10^{-6}$	−40 to +70°C

FREQUENCY STABILITY WITH TIME		
24 Hour Period	5×10^{-8} Max. with Ambient Temp. 25°C	
After 72 Hours Continuous Operation	1×10^{-7}/wk.	1-10 MHz
	2×10^{-7}/wk.	10-20 MHz

TCCO is the Bliley acronym for TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS designed to integrate the characteristics of high quality crystals with temperature compensated circuitry for improved frequency stability without temperature control. Typical performance characteristics are shown for the TCCO-26 series. Standard models operate on 12 VDC (2% regulation) at 15 mils maximum. Sine wave output is 1 volt rms into 1000 ohms or 2 volts peak to peak square wave on special order.

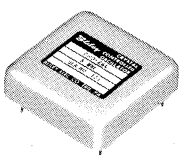


CKO Series

CKO Series — FREQUENCY TOLERANCE		
SPECIFY	DEVIATION	AMBIENT RANGE
A or B	±10 ppm	0° to 50°C
	±20 ppm	−40° to +70°C
STANDARD MODELS		
SPECIFY TYPE	FREQUENCY kHz	OUTPUT WAVEFORM
CKO-4A	200-5000	Logic
CKO-4B	200-5000	Square Wave
CKO-3	3000-15000	Sine Wave

OUTPUT RATING			
FREQUENCY RANGE kHz	OUTPUT VOLTAGES AND LOAD		
	Square Wave	Logic	Sine Wave
	1k ohm load	Output will drive most TTL and DTL integrated circuitry	1k ohm load
200 to 1000	3v p-p		—
1000 (+) to 5000	3.2v p-p		—
3000 to 6000	—	—	1.7v p-p
6000 (+) to 15000	—	—	1.4v p-p

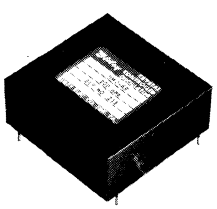
This low profile solid state crystal oscillator is designed to provide choice of LOGIC output for IC applications where space is limited. The koldweld sealed package operates on 5 VDC with output ratings as shown above. When specified, electrical trim adjustment is available to offset long term aging.



CMO-26 Series

CMO Series FREQUENCY RANGE	STABILITY (A) Specify (B)		OUTPUT RATINGS		
	0° to 50°C	−40° to +70°C	Logic	Square Wave	Sine Wave
				1k ohm load	1k ohm load
60 Hz - 4000 Hz	±.004%	±.01%	Output will drive most TTL and DTL integrated circuitry	2 volts p-p	
1 kHz - 50 kHz	±.003%	±.007%		2.4 volts p-p	
50 kHz - 5 MHz	±.001%	±.002%		3 volts p-p	
800 kHz - 20 MHz	±.001%	±.002%		3 volts p-p	1.5 volts p-p

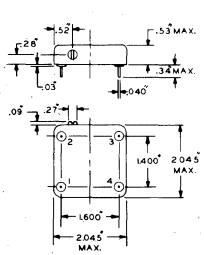
The CMO series crystal oscillator offers choice of LOGIC output in a compact sealed module for PC board mounting. Standard units are designed for operation on 5 VDC (2% regulation) input with optional mechanical or electrical trim adjustment to offset long term aging.



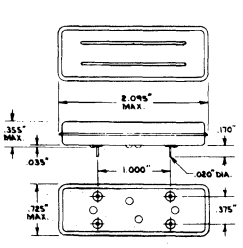
BMO Series

BMO Series TYPE	FREQUENCY RANGE	TOLERANCE (A) 0° to 50°C	TOLERANCE (B) −40° to +70°C	OUTPUT VOLTS rms
BMO-6R-1	15-120 kHz	±.004%	±.01%	0.7
BMO-6R-1	90-150 kHz	±.008%	±.018%	0.7
BMO-6R-1	150-500 kHz	±.003%	±.007%	0.7
BMO-6R-1	400-800 kHz	±.008%	±.016%	0.7
BMO-6M	800-3000 kHz	±.001%	±.002%	0.7
BMO-5L-1	3-10 MHz	±.001%	±.002%	0.7
BMO-5N	10-15 MHz	±.001%	±.002%	0.5
BMO-5V-2	15-60 MHz	±.001%	±.002%	0.3
BMO-5U	60-100 MHz	±.0015%	±.003%	0.25

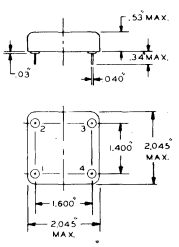
The BMO series oscillator combines a precision quartz crystal and solid state circuitry in an encapsulated module designed for mounting on PC boards. Output is approximately sine wave at voltages shown above for 1000 ohm load conditions. Input requirements are 12 VDC - 10 ma.



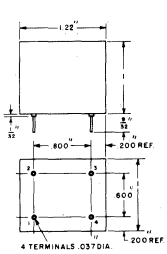
TCCO-26



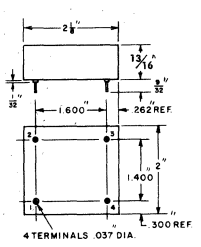
CKO-4



CMO-26



BMO-5



BMO-6

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BLILEY CUSTOM ENGINEERED CRYSTAL FILTERS

Design Considerations

BANDWIDTH RANGES. Quartz crystal filters can be designed with a wide variety of characteristics and bandwidths depending on the frequency range. In narrow band filters the maximum bandwidth obtainable is controlled by the ratio of capacities of the particular crystal cut, and the mode of operation, which in turn is dictated by the frequency range of interest. The minimum bandwidth obtainable is controlled by the Q of the crystals used. Wide band filters make use of inductors to effectively spread the poles of the crystals, resulting in greatly increased bandwidths.

In the range from 100 kHz to 600 kHz crystal filters can be designed with bandwidths from .035% to 8% of center frequency as shown in Table 1. Bandwidths from .01% to 3% of center frequency are available with center frequencies in the 1700 kHz - 30 MHz range as indicated in Table 2.

TABLE 1 Range kHz	NARROW BAND FILTERS			WIDE BAND FILTERS		
	Bandwidth—6 db		Shape Factor	Bandwidth—6 db		Shape Factor
	Min. (%)	Max.	Min. (60/6 db)	Min. (%)	Max.	Min. (60/6 db)
100-250	.05	.5	1.5	1	8	2
200-400	.04	.4	1.5	1	7	2
300-600	.035	.35	1.5	1	6	2

TABLE 2 Range kHz	BANDWIDTH % at 6 db		SHAPE FACTOR 60/6 db
	Min.	Max.	Min.
1700-5000	.01	3.0	1.8
5000-10000	.02	2.0	1.8
10000-15000	.03	1.0	2.0
15000-30000	.05	0.5	2.0
20000-30000	.05	0.3	2.0

Table 3 lists the characteristics of typical symmetrical Bliley filters of proven design. Many other designs with special characteristics are available. However, their great variety does not lend to simple listing.

SHAPE FACTOR limitations (ratio of 60 db to 6 db points on symmetrical types) are primarily dictated by economics. Pass band ripple and phase linearity are also important in determining shape factor possibilities. If linear phase within the pass band is a major requirement, the Gaussian design must be used, and this greatly limits the selectivity shape factor.

PASS BAND RIPPLE requirements, when extremely small, dictate the use of the Butterworth design, and again selectivity for a given number of crystals is sacrificed. Shape factors as low as 1.5 to 1 at 6 db points are common if 1 db ripple can be tolerated.

CENTER FREQUENCY STABILITY of a crystal filter with temperature is essentially that of the crystals themselves. If, for example, AT cut crystals of the correct angle for a specific frequency range are used, center frequency tolerances of ±.004% over a temperature range of −55 to +105°C can be expected of the filter. The pass band width itself is not greatly affected with temperature if all crystals in a filter are held within tight angular tolerances of each other, because the crystals will drift in unison with temperature.

SINGLE SIDEBAND filters are available with a wide range of skirt selectivity, and carrier suppression of 30 db or more can readily be obtained over most of the frequency range.

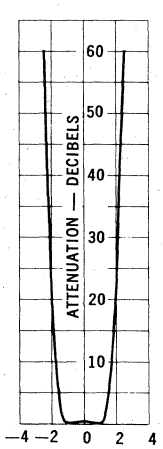
COMB SET filters, either "spaced" or "contiguous" types, are available. A contiguous comb set is one in which the adjacent channel skirts cross at the 3 db points. Such sets usually require individual terminations when operated in parallel to prevent interchannel distortion, unless the Butterworth "Maximally flat passband" design approach is used. Such designs, however, do not always provide the greatest economy for a given shape factor. For the most economical filter design, the termination problem can be resolved by staggering the channels so that no adjacent channel shares the same termination; in other words, alternate or every third channel can be combined in parallel, and in this manner any number of such combinations can share the same termination.

Application Considerations

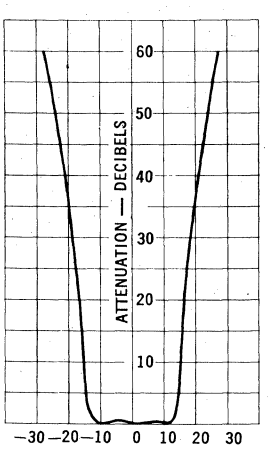
To obtain optimum performance from a crystal filter it is necessary to provide for matching impedances at the input and output terminals. An impedance mismatch will usually sacrifice loss, skirt selectivity, bandwidth or cutoff characteristics.

In the low frequency group extraneous circuit capacities usually have minor significance in their effect on a filter. In the high frequency group, external circuit capacities of 10 or 15 mmf can represent an appreciable part of the total tuning capacity inside the filter. For this reason crystal filters in the high frequency group are usually designed to work with an external capacity of 15 to 25 mmf which can be adjusted to compensate for stray capacities and tuned for minimum loss through the filter at mid-band frequency.

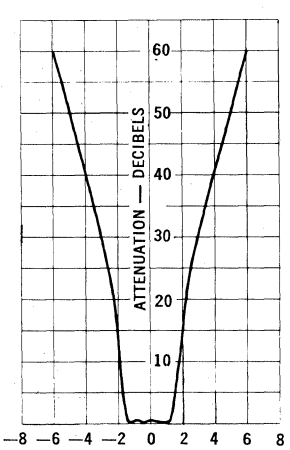
The ideal approach to crystal filter design and application presumes that the external impedances, seen by the filter, are known. The filter can then be designed for these values. By the use of special high Q transformers impedance transformations can be made to almost any desired external circuit level. This can be accomplished without imparing bandwidth, loss, skirt selectivity or sharp cutoff. While this method may result in slightly increased cost it is preferable to the use of external capacitor dividers or tapped coils which may reduce gain and, due to reflections, distort the true filter characteristic.



Frequency — kHz
106 kHz Filter
Type BFN-0106B38

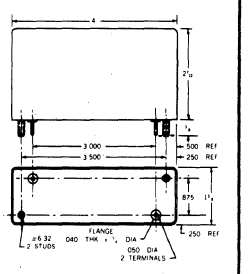


Frequency — kHz
10.7 MHz Filter
Type BFN-11B10



Frequency — kHz
5 MHz Filter
Type BFN-5000B16

STYLE 1



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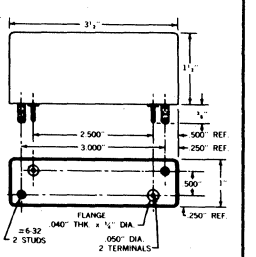
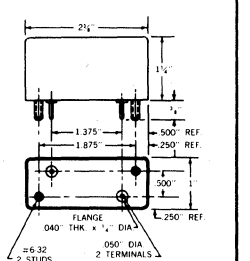


STYLE 3



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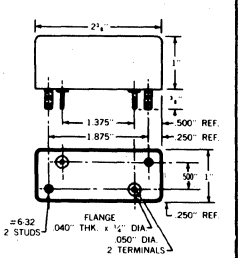

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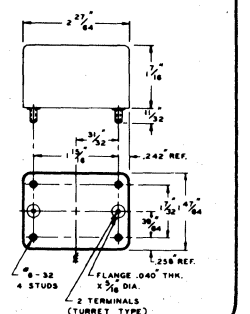

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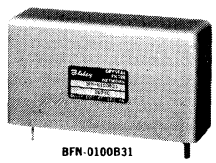
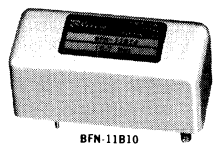

BFN-0100B31

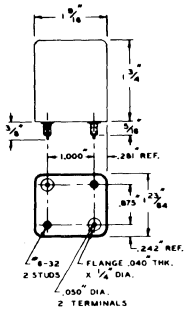

BFN-11B10


BFN-0330B33

Typical Bliley Filters with Symmetrical Characteristics

TABLE 3 Type No.	Center Frequency	Bandwidth (6 db)	Bandwidth (60 db)	Maximum Insertion Loss	Nominal Impedance (ohms)	Case Style
BFN-0100B31	100 kHz	500 Hz	1.5 kHz	6 db	27 k	1
BFN-0100B23	100 kHz	3 kHz	7 kHz	3 db	680	1
BFN-0200B32	200 kHz	100 Hz	400 Hz	3 db	8.2 k	5
BFN-0330B33	330 kHz	250 Hz	1 kHz	3 db	6 k	6
BFN-0500B41	500 kHz	300 Hz	1.2 kHz	3 db	4 k	3
BFN-2000B21	2000 kHz	100 Hz	1000 Hz	3 db	1.5 k	3
BFN-2000B22	2000 kHz	4 kHz	16 kHz	3 db	50	3
BFN-2215B3	2215 kHz	300 Hz	1.1 kHz	3 db	4 k	3
BFN-2215B4	2215 kHz	3 kHz	12 kHz	3 db	4 k	3
BFN-2215B27	2215 kHz	2.5 kHz (3 db)	10 kHz	3 db	4 k	7
BFN-2215B28	2215 kHz	250 Hz (3 db)	1 kHz	3 db	4 k	7
BFN-2400B42	2400 kHz	4.4 kHz (3 db)	18 kHz	3 db	2 k	3
BFN-2500B36	2500 kHz	5 kHz (3 db)	20 kHz	3 db	2 k	8
BFN-3000B14	3000 kHz	3 kHz	12 kHz	3 db	4.7 k	3
BFN-3000B47	3000 kHz	3 kHz (3 db)	6 kHz	6 db	2 k	9
BFN-4000B21	4000 kHz	5 kHz (3 db)	20 kHz	3 db	50	3
BFN-5000B16	5000 kHz	3.5 kHz	12 kHz	3 db	1.6 k	3
BFN-5000B22	5000 kHz	10 kHz	40 kHz	3 db	1.6 k	10
BFN-5000B23	5000 kHz	5 kHz (3 db)	20 kHz	4 db	50	3
BFN-5000B24	5000 kHz	3.5 kHz	12 kHz	6 db	50	11
BFN-5000B30	5000 kHz	3 kHz	12 kHz	3 db	1.6 k	3
BFN-5000B37	5000 kHz	3.5 kHz	18 kHz (80 db)	6 db	50	12
BFN-5000B50	5000 kHz	500 Hz	2500 Hz (40 db)	3 db	1.6 k	5
BFN-7000B22	7000 kHz	8 kHz	50 kHz	6 db	500	3
BFN-9000B13	9000 kHz	3 kHz	12 kHz	3 db	600	4
BFN-9000B22	9000 kHz	1 kHz	10 kHz	3 db	1 k	4
BFN-11B53	10.00 MHz	1 kHz	2 kHz	3 db	220	4
BFN-11B36	10.01 MHz	8 kHz	20 kHz	3 db	50	4
BFN-11B8	10.7 MHz	4.2 kHz	10 kHz	3 db	400	4
BFN-11B9	10.7 MHz	15 kHz	30 kHz	3 db	1 k	4
BFN-11B10	10.7 MHz	30 kHz	60 kHz	3 db	1 k	4
BFN-11B21	10.7 MHz	15 kHz	32 kHz	3 db	1 k	13
BFN-11B22	10.7 MHz	30 kHz	60 kHz	3 db	2 k	13
BFN-11B23	10.7 MHz	13 kHz	30 kHz (80 db)	3 db	1 k	13
BFN-11B41	10.7 MHz	40 kHz	80 kHz	5 db	1 k	4
BFN-11B51	11.00 MHz	3 kHz	10 kHz	3 db	180	4
BFN-11B34	11.5 MHz	37.5 kHz	85 kHz	3 db	50	4
BFN-11B35	11.5 MHz	37.5 kHz	200 kHz (40 db)	3 db	50	4
BFN-12B21	12.00 MHz	41 kHz	82 kHz	3 db	1.8 k	4
BFN-13B1	13 MHz	15 kHz	30 kHz	3 db	680	4
BFN-13B2	13 MHz	30 kHz	60 kHz	3 db	1.5 k	4
BFN-15B21	15.00 MHz	1.1 kHz	10 kHz	3 db	50	4
BFN-18B21	18.00 MHz	20 kHz	50 kHz	3 db	50	4
BFN-20B21	20 MHz	60 kHz	200 kHz	3 db	1 k	13

STYLE 6



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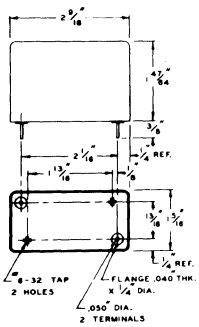

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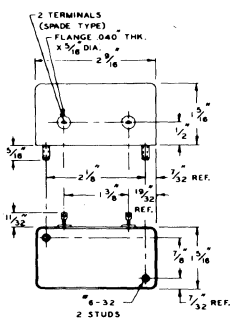

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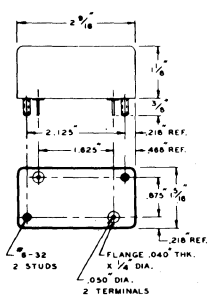

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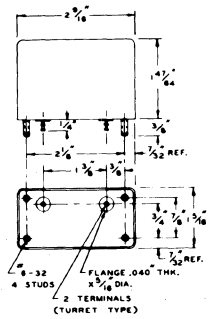

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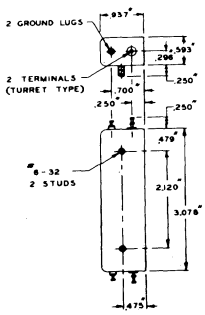

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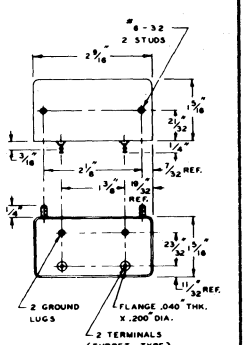

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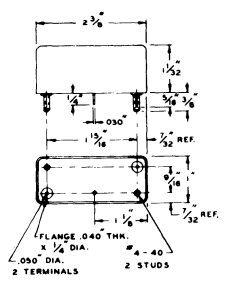

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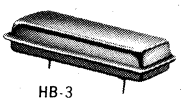
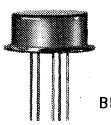
CRYSTALS

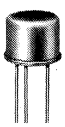
Koldweld Sealed Crystal Holders for High Reliability

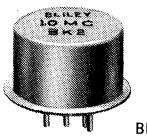
This group of crystal holders is hermetically sealed by a koldweld process, without heat or flux, to minimize contamination. Crystal units supplied in these enclosures have improved aging and reliability. All units are custom built to your specifications. Data sheets for each type are available on request.


HB-2


HB-3


BK-5


BK-3



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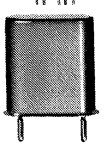
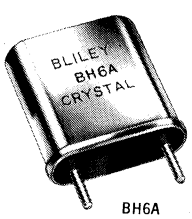

BA-6

KOLDWELD SERIES

BLILEY HOLDER	HB2	HB3	BK2	BK3	BK5	BA2	BA4	BA6	BA9
FREQUENCY RANGE	0.2-100 MHz	2.5-250 kHz	1-15 MHz	10-150 MHz	2-30 MHz	3-150 MHz	2-150 MHz	0.2-150 MHz	2-250 kHz
DIMENSIONAL DRAWING	8	9	10	11	12	13	14	15	16

General Communication and Mil-Type Crystal Holders

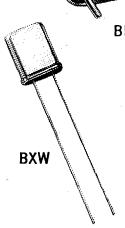
Bliley offers a complete selection of solder sealed Mil-type crystal holders and commercial variations such as wire leads, mounting brackets and ruggedized models. For quotation, choose the basic holder style required, indicate any special variations and advise performance characteristics for complete crystal unit.



BH6A

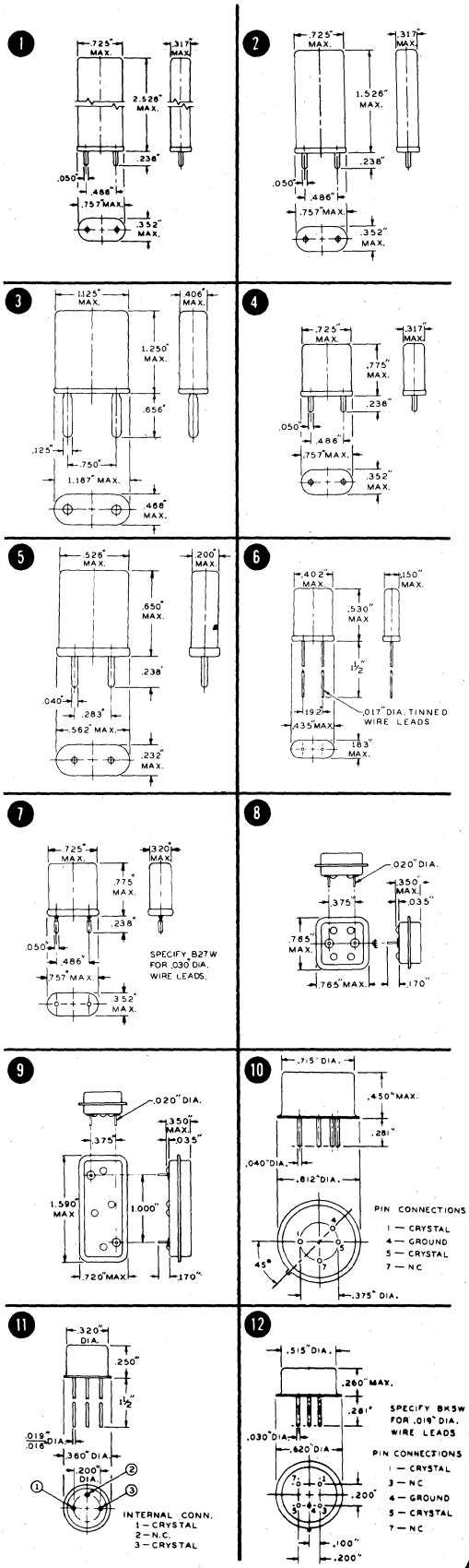


BH9A


BXW

GENERAL COMMUNICATION AND MIL-TYPE CRYSTAL HOLDERS

BLILEY HOLDER	MIL HOLDER	FREQUENCY RANGE	DIMENSIONAL DRAWING
BH9T	—	1-2 kHz	1
BH9A	HC-13/U	2-250 kHz	2
BH91A	—	2-250 kHz	2
BH9W	—	2-250 kHz	2
BH120	—	100-250 kHz	3
BH120W	—	100-250 kHz	3
BH6A	HC-6/U	0.2-150 MHz	4
BH61A	HC-17/U	0.2-150 MHz	4
BH6W	—	0.2-150 MHz	4
BH4	HC-32/U	2-150 MHz	5
BH4W	—	2-150 MHz	5
BXW	HC-18/U	3-150 MHz	6
BXP	HC-25/U	3-150 MHz	6
B27	HC-27/U	1-30 MHz	7



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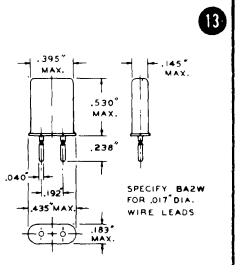
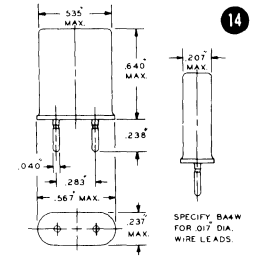
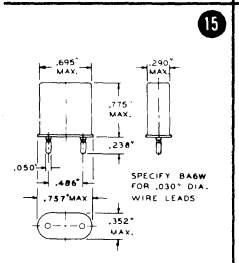
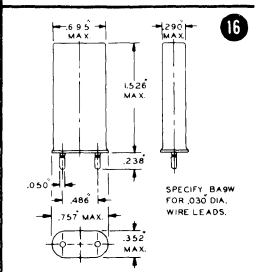
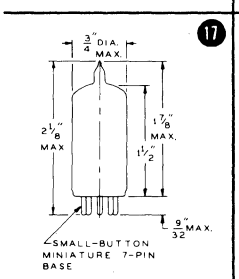
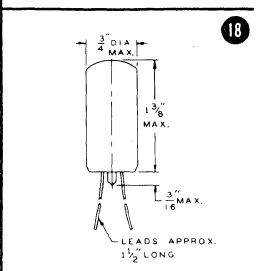


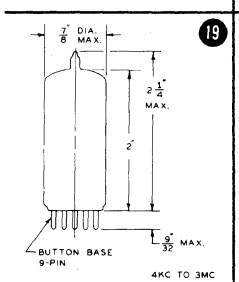


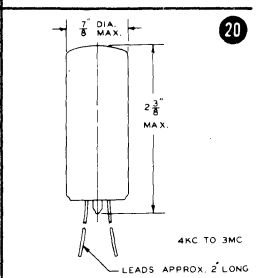


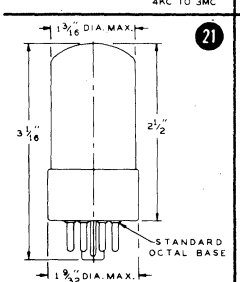


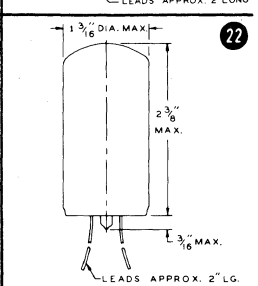


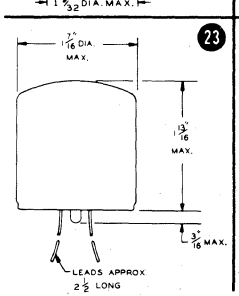


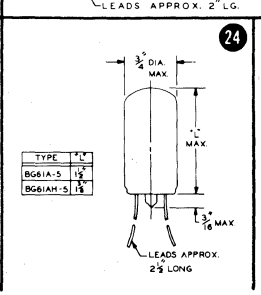


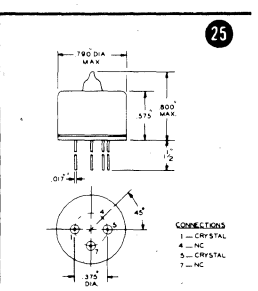






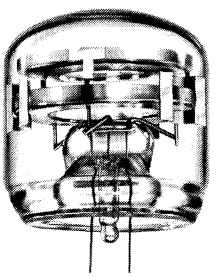


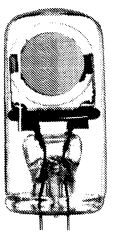


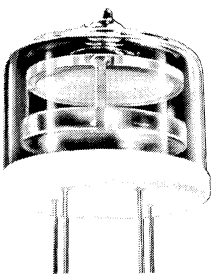


CRYSTALS

Ultra High Stability Glass Units


BG11AH-5


BG61A-5

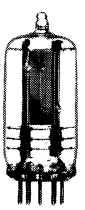

BG61AH-5S

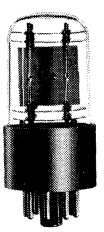
This is an outstanding group of crystal units incorporating the advanced technology and craftsmanship that has made Bliley famous for quality without compromise. Exceptionally low aging and high Q characteristics provide precision reference for synthesizers and systems clocks. Complete data available in special bulletins supplied on request.

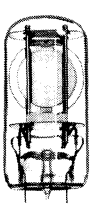
ULTRA HIGH STABILITY GLASS SEALED CRYSTAL UNITS

BLILEY TYPE	FREQUENCY RANGE	MODE	Q	AGING	DIMENSIONAL DRAWING
BG61A-5	5 MHz	Fifth	2.5×10^6	2×10^{-9}/wk.	24
BG61AH-5	5 MHz	Fifth	2.5×10^6	2×10^{-9}/wk.	24
BG61AH-5S	5 MHz	Fifth	2.5×10^6	7×10^{-10}/wk.	25
BG11AH-5	2.5 MHz	Fifth	4.5×10^6	5×10^{-10}/wk.	23
B27	5 MHz	Third	1.8×10^6	2×10^{-8}/wk.	7
B27	10 MHz	Third	1.5×10^6	2×10^{-8}/wk.	7
BG93A	1 MHz	Fund.	1.5×10^6	1×10^{-8}/wk.	22

Glass Sealed Crystal Holders


BG7N


BG9D


BG93A


B27

Vacuum sealed crystals in this group of holders exhibit superior aging characteristics and long term reliability. Ideal for use in high stability crystal and oven combinations as indicated in separate listing of crystal ovens.

GLASS SEALED CRYSTAL HOLDERS

BLILEY HOLDER	FREQUENCY RANGE	DIMENSIONAL DRAWING
B27	2-30 MHz	7
BG6A	3-100 MHz	17
BG61A	3-100 MHz	18
BG7	4-3000 MHz	19
BG7A	4-3000 MHz	20
BG9A	90-160 kHz	21
BG9A	1-5 MHz	21
BG93A	90-160 kHz	22
BG93A	1-5 MHz	22

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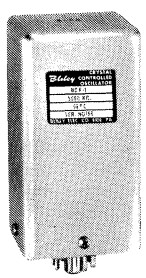
COMPONENT AND CRYSTAL OVENS

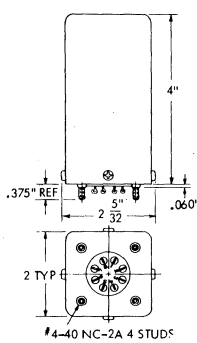
Standard oven designs in this group utilize all silicon transistors in the control circuitry. Oven types with the prefix BP are for proportional temperature control. Oven types with the prefix BC or BS utilize mercury thermostats. Detail specifications available on separate data sheets supplied on request.

COMPONENT OVENS

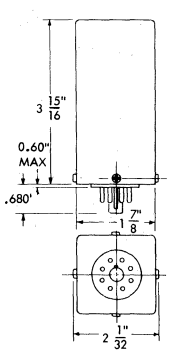
TYPE	BPO-12	BPO-13	BPOC	BPOC-1	BCR-4	BST-4	BPCO-30-1	BPCO-40-1	BPCO-31-1	BPCO-41-1
AMBIENT CONDITION	0°C to +60°C	0°C to +60°C	0°C to +60°C	0°C to +60°C	0°C to +65°C	0°C to +65°C	0°C to +65°C		0°C to +65°C	
STABILITY	±0.2°C	±0.2°C	±0.25°C	±0.25°C	±1°C	±1°C	±1°C		±1°C	
OVEN TEMPERATURE	70°C	70°C	70°C	70°C	75°C	75°C	75°C		75°C	
OVEN VOLTAGE	12 VDC	27 VDC	12 VDC	27 VDC	115VAC	27 VDC	27 VDC		12 VDC	
CAVITY SIZE	.960" diam. 2.375" long	.960" diameter 2.375" long	1 7/16" wide 3/4" high 2 1/2" long	1 7/16" wide 3/4" high 2 1/2" long	1.450" diam. 3" height	1.450" diam. 3" height	.25 cubic inches	.46 cubic inches	.25 cubic inches	.46 cubic inches

BCR-1



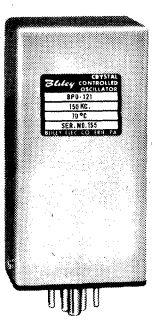


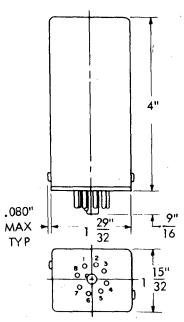
BCR-4 and BST-4



BCR-1 and BST-1 Series

BPO-121

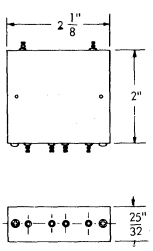




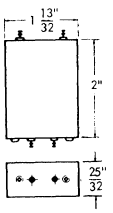
BPO Series

BPCO-3



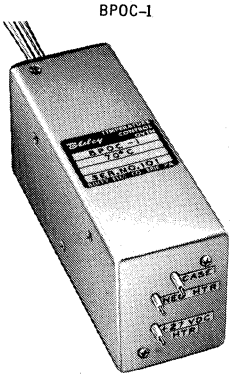


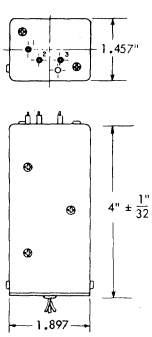
BPCO-2



BPCO-3

BPOC-1

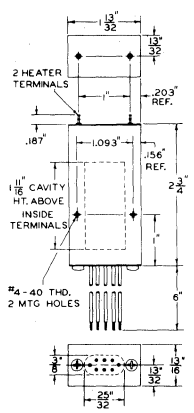




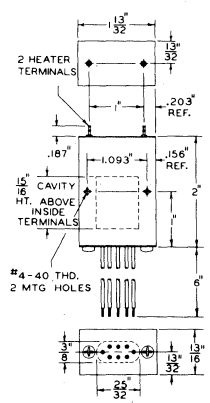
BPOC Series

BPCO-41-1





BPCO-41-1



BPCO-31-1

CRYSTAL OVENS

TYPE	FOR CRYSTAL TYPE	TEMPERATURE STABILITY		OVEN TEMP.	OVEN VOLTAGE
		Fixed Ambient	Range 0°C to 60°C		
BPO-121	BG7	±.01°C	±0.1°C	70°C	12VDC
BPO-131	BG7	±.01°C	±0.1°C	70°C	27VDC
BPCO-21	BH4 (2 units)	±.05°C	±0.5°C	75°C	12VDC
BPCO-2	BH4 (2 units)	±.05°C	±0.5°C	75°C	27VDC
BPCO-31	BH6 or B27	±.05°C	±0.5°C	75°C	12VDC
BPCO-3	BH6 or B27	±.05°C	±0.5°C	75°C	27VDC
BCR-1	BG61	±.02°C	±0.2°C	68°C	115VAC
BST-1	BG61	±.02°C	±0.2°C	68°C	27VDC

CTS Knights, Inc., Sandwich, Illinois
Subsidiary of CTS Corporation, Elkhart, Indiana

JK PRODUCTS

Frequency Control Devices

CRYSTALS, CRYSTAL FILTERS, PACKAGED TRANSISTOR OSCILLATORS, CRYSTAL AND COMPONENT OVENS, AND CRYSTAL-OVEN COMBINATIONS

JK offers a complete line of crystals with frequencies ranging from 1000 cycles to 200 MC. Precision crystals, providing changes as little as 1 x 10^{-10}, are regularly manufactured for use in frequency standards and similar ultra-stable devices. Low frequency crystals are available in evacuated glass envelopes, conventional metal holders and the new KOLDWELD metal enclosures. High frequency crystals, in both metal and glass holders, are manufactured at high volume rates for Government and commercial users. Military standard crystals offer the assurance of maximum quality by adherence to MIL SPECS and close supervision by a resident Government Inspector.

JK crystal filters are compact, rugged, hermetically sealed and stable. Frequency ranges from 1 kc to 40 MC are available to 150 MC.

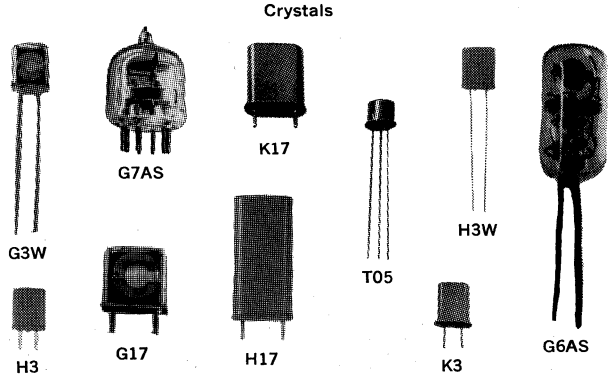
Packaged transistor oscillators are offered in a wide line of precision, plug-in, crystal controlled signal sources from 10 cps to 75 MC. These oscillators are available with sine or square wave outputs. Stabilities range from 1 x 10^{-6} to 1 x 10^{-9} and better per day. Designs can be made to specifications for laboratory, vehicular and full military environmental performance. Each oscillator is aged in and its performance certified before being shipped.

Crystals and component ovens are compact, high temperature stability types carefully made to accommodate crystals and other precision devices. Single crystal, dual crystal and multiple crystal types are available. Many sizes and types are available including snap-action thermostats and proportionately controlled ovens giving the ultimate in quiet, precise operation with stabilities to ±.0025°C.

JK crystal-oven combinations, "THERMYSTALS," cover a wide range of packages for use where close temperature control of crystals is required. Frequency ranges for these crystal-oven combinations are 1 kc to 200 MC. Proportional control and snap-action thermostat control ovens are available in combination with precision, glass-enclosed, and metal-cased crystals with frequency stabilities from .0001% to .0000001%.

CTS Knights TCXO, always on frequency regardless of environment. From −40°C to +70°C, in outer space or down on earth, CTS Knights **Temperature Compensated Crystal Oscillators** are right on frequency with excellent stability (0.5ppm) over wide temperature ranges. With no warm up delay and minimal power requirements (50 Milliwatts) in a compact design CTS Knights TCXO's supply the stable signal source to fit your design requirements.

Crystals

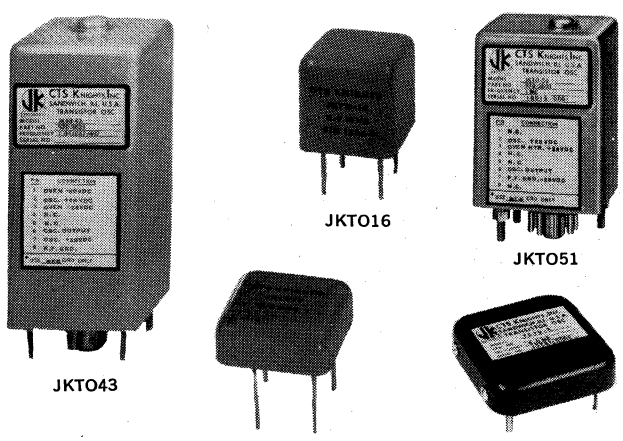


Filters



BAND PASS FM

Oscillators

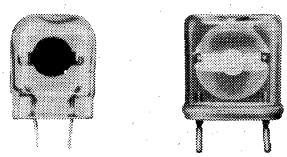


ORDERING INFORMATION: Place orders using the following address:

CTS Knights, Inc., 400 Reimana Street, Sandwich, Illinois 60548 • Telephone 815-786-8411 • TWX 910-642-0860

BULOVA QUARTZ CRYSTALS

- AT ● CT ● DT ● +5° (E and H Elements) GT ● MT ● NT ● PT ● SL
- Military Types ● General Communications ● Precision SSB
- Coldweld ● Glass Sealed ● Glass Bulb ● Metal Holders
- Military crystals meet latest MIL-C-3098 specifications
- Special shock and vibration mounts available



HIGH PRECISION GLASS-ENCAPSULATED CRYSTALS

Covering a frequency range of 5,000 Hz thru 150 MHz, Bulova has available in glass holders the Mil types HC-26/U and HC-27/U, as well as the standard vacuum tube types. A 3rd overtone 5 MHz crystal is available in the HC-27/U holder with Q's in excess of 1 million and stability of 1 pp 10^{10} for 24 hours.

FILTER AND OSCILLATOR CRYSTAL

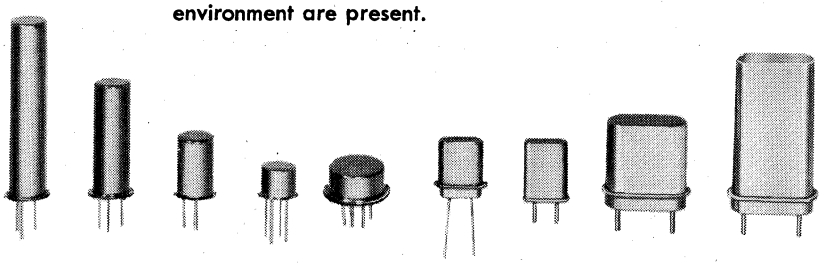
Bulova has designed a line of quartz crystals ranging in fundamental frequencies of 2,000 Hz thru 30 MHz—overtone frequencies to 150 MHz. Custom capability enables us to design to fit your most exacting requirements.

- Spurious attenuation as low as 80 db.
- Motional parameters of L, and C, held to within ±2%.

A COMPLETE LINE FOR ALL APPLICATIONS IN A FREQUENCY RANGE OF 2,000 Hz THRU 150 MHz

Commercial: Crystals for Aviation, Marine and CB communications equipment. Manufactured to the highest quality in standard type holders or modified to suit special designs.

Military: Bulova produces all the standard military "CR" types and is Q.P.L. on most of the current "CR" types. Designs crystals for new military applications where low power and extreme environment are present.



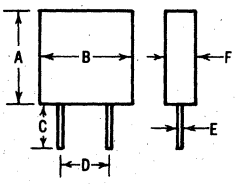
Coldweld Sealed Crystals—

Bulova has extended the developmental perimeter of coldweld types to provide a more miniaturized package with a broader frequency output. A support facility has been built capable of handling volume production. Series 100 coldweld holders consists of nine (9) configurations which include the four (4) main military types. The military crystals fit within the dimensional requirements of the military drawing.

Features:

- High Quality-High Reliability
- Tolerances as close as 3 ppm of nominal can be held on initial adjustment.
- Aging rates of 3 pp 10^8 per week are standard.
- Small package/broad frequency capability.

CRYSTAL HOLDERS



MIL TYPE	BULOVA TYPE	DIMENSIONS IN INCHES					
		A	B	C	D	E	F
HC-6/U	70	.765	.750	.238	.486	.050	.345
HC-13/U	73	1.500	.750	.238	.486	.050	.345
HC-18/U	80	.515	.418	1.500	.192	.017	.166
HC-25/U	83	.515	.418	.238	.192	.040	.156
HC-27/U	77	.775	.757	.238	.486	.050	.352
HC-26/U	76	.530	.435	1.500	.192	.017	.185

Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

BULOVA fcp

BULOVA FREQUENCY CONTROL PRODUCTS

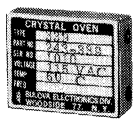
ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.

61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

BULOVA TEMPERATURE CONTROLLERS/OVENS

A wiae selection of temperature control devices and enclosures . . . compact—highly versatile

Solid State Controllers:



339 Transistat



184 Transistat



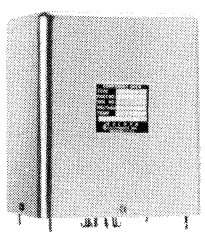
320 Conax

Available as AC Switches, DC Switches or Proportional Controllers, they are designed to handle power requirements of as little as .4 watt to 3KW. Package sizes of as small as .5 cubic inches are available; temperature control as close as .01°C, dependent on application.

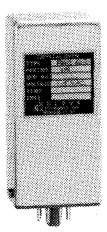
	Type 184-115 184-26	Type 339	Type 320-115* 320-26
Voltage	20VAC to 125VAC 60 to 400 cps	115VAC 400 cps	20VAC to 125VAC 60 to 400 cps
Peak Heater Current	1.5 amp. (Half Wave)	1 amp. cont. 1.5 amp. 50% Duty Cycle	1.5 amp. (Half Wave)
Set Temperature Range	Any Temperature, 5° intervals, −55°C to +125°C		
Temperature Stability Over Ambient	.1°C	.1°C	.75°C
R.F.I.	none	Mil I 26-600	none
Ambient Operating	−55°C to +125°C		
Vibration	Mil Std. 202 Method 204D		none
Shock	Mil Std. 202 Method 202		none
Size	.625 Dia. .437 Hgt.	1.390 x 1.075 .380 Hgt.	1.250 Sq. .380 Hgt.

*Commercial

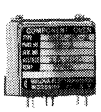
Crystal and Component Ovens:



341



613



BHC-18-2

Crystal ovens are available to hold from a single crystal to 15 crystals; component ovens are available up to 50 cubic inches. Many ovens are available with either bi-metal thermostats or solid state control.

	BHC-18 Series	BHC-613 Series	COM-341 Typical Large Cavity Oven
Accomod.:	1-15, HC-18 or HC-25 crystal holders	Single HC-6 crystal holder to small printed circuit board	Up to 50 cubic inches
Oper. Volt:	To 28 VDC or 115 VAC dependent on controller		
Temp. Set:	5° intervals +55°C to +100°C		
Controls Available:	Bi metal or solid state	Bi metal, solid state or mercury	
Stability:	Up to ±.5°C	Up to ±.01°C	Up to ±.1°C
Mounting:	Flange, bracket or stud	Flange, octal plug or stud	
Termination:	N/A	To 15 pins	To 20 pins

Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

BULOVA fcp

BULOVA FREQUENCY CONTROL PRODUCTS

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.

61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

BULOVA CRYSTAL FILTERS

Computer Designed for Reliable Performance
Accurate — Narrow Band — 4KHz to 30MHz



The business of Crystal Filter design and production has been Bulova's business since 1955. It is another reason for our leadership in the broad area of frequency control and related precision products.

We are a design/production center to fulfill the most exacting system specifications. Combining many years of experience, an engineering team of many design disciplines and advanced computer techniques, we can produce 'state-of-the-art' filters in cost-controlled packages to military and commercial specifications.

COMPUTER OPTIMIZED FILTER DESIGNS

To provide optimized designs for individual system requirements, Bulova has a co-related library of computer programs. From pre-packaging tolerance analysis of individual components to the finished product spec'd to the customer's parameters, we can determine design "trade-off" quickly and economically.

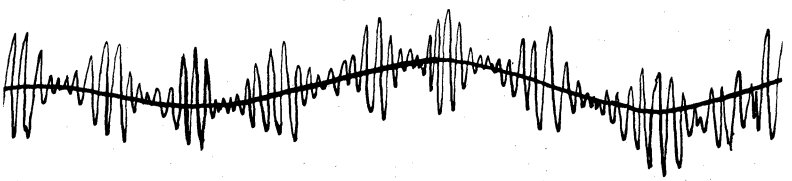
The prime parameters have been programmed to make available the following crystal filter types

1. **Butterworth Designs**
2. **Butterworth-Thompson Designs**
3. **Chebyshev Designs**
4. **Bessel Designs**
5. **Elyptic Designs**
6. **Lerner Designs**
7. **Gaussian (Transitional)**
8. **Image Parameter**

FULL PRODUCTION CAPABILITY

From crystal configuration to finished product, each segment of manufacture utilizes the most advanced and controlled production techniques. Geared to large volume requirements, Bulova's modern automated test facilities allows for a mass production output with no loss in quality—fully equipped environmental laboratory available for most testing. Short runs and engineering prototypes are handled in our pre-production shop.

TYPICAL FILTER APPLICATIONS FROM



4KHz — * — **30 MHz**

Band Pass	**Notch**
Band Elimination	**Time Delay**
Single Side Band	**Equalizer**
Narrow Band	**Lerner**
Wide Band	**Time Domain**
Linear Phase	
RF & IF	**Discriminators**

*For areas not specified above, consult our application engineering department.

CUSTOM DESIGNED TO THESE POSSIBLE PARAMETERS:

Band Widths	from 0.01% to 8% of Center frequency
Shape Factor:	1.08 Ratio for 60 db BW to 3 db BW
Ripple Factor	<0.5 db
Phase Linearity	<5%
Carrier Rejection	>70 db
Ringing	>40 db
Insertion Loss	<3 db
Attenuation	>100 db
Phase Matching	closer than 3° (Filter to Filter) over environmental requ.
Temperature Tolerances	<0.005% (depending upon frequency)
Max. Operating Temperature Range	−55°C to +125°C
Shock & Vibration	All applicable MIL specifications

Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

BULOVA fcp

BULOVA FREQUENCY CONTROL PRODUCTS

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.

61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

BULOVA LC FILTERS

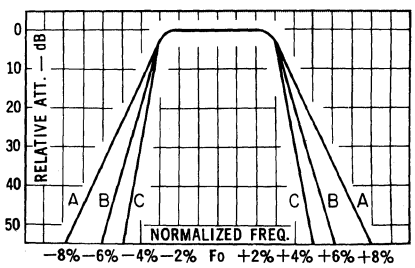
Computer Designed for Maximum Performance — DC to 50MHz

Pioneers in Time/frequency product design, Bulova has developed a diversified L C Filter product line that features ● Computer programmed performance characteristics ● Competitive pricing ● Custom product sophistication ● High-use, long-life reliability

A continuing effort in L C filter design for the selection and shaping of frequencies has culminated in the development of a unique series of filters, particularly engineered for spectrum analysers.

Filters With Excellent Shape Factor

High frequency filters with 45db/3db shape factors between 1.5/1 and 2.3/1. They are designed to operate between 100 ohm impedances and exhibit excellent temperature stability.



Comb Filters

Useful for such applications as spectrum analysis and available as standard items in contiguous banks from 10 Hz to 10 MHz.

IRIG BANDPASS FILTERS—Available from 400 Hz to 165 kHz with attenuation at ±7.5% of center frequency within 3 db in 21 channels. Eight other standard channels are available in frequency from 22 kHz to 165 kHz at ±15% 3 db points.

IRIG LOW PASS FILTERS—Low Pass and Linear Phase Low Pass filters are available in IRIG frequencies. The low pass are intended to attenuate the 2nd and higher harmonics of the incoming signal. Bulova's linear phase low pass filters attenuate the higher harmonics and provide minimum phase distortion and therefore low transient response. These filters are for 10k ohms terminating impedances.

TONE CHANNEL FILTERS—Bulova offers 18 standard tone filters ranging in channel frequencies from 424 Hz to 3315 Hz. They are available in both the narrower bandwidth receive and wider transmit telegraph tone channels.

DISCRIMINATOR TRANSFORMERS—Employing stable, high-Q components, Bulova Discriminator Transformers perform with an excellent stability and exceptional amplification and linearity.

BAND REJECT FILTERS—Some of the outstanding features of Bulova LC Band Reject Filters are their high discrimination and stability. This type of filter is available in a wide range of frequencies and shape factors . . . Bulova also specializes in LC and RC Notch Filters.

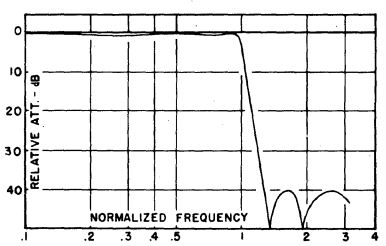
LUMPED CONSTANT DELAY LINES—Bulova custom designs Delay Lines to cover any practical impedance range. Keeping physical dimensions at a minimum, these networks feature low signal attenuation, excellent thermal stability, low pulse distortion and extended band width, achieving high delay-to-rise-time ratio.

MODULATORS—Modulators, covering a wide frequency range are also designed and manufactured to achieve maximum audio output features and high attenuation of undesired frequencies.

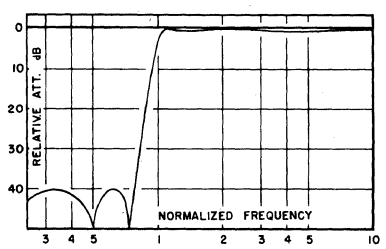
EQUALIZERS—Maintaining narrow tolerances, a wide selection of custom designed Amplitude and Phase (Delay) Equalizers have been developed to be used with transmission lines, amplifier networks etc. Bulova's engineering staff is always available to consult with you on design problems. Additional information on all networks is available upon request.

INTERSTAGE FILTERS—60 Hz to 20 kHz

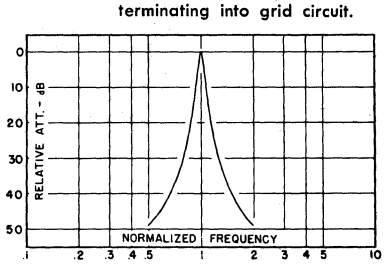
Low Pass
Available up to 30 MHz



High Pass
Available in impedance from 50 ohms to 10 K ohms



Band Pass
Standard filters available with 600 ohm and 10 K ohm terminations. All have provision for terminating into grid circuit.



Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

BULOVA fcp

BULOVA FREQUENCY CONTROL PRODUCTS

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.

61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

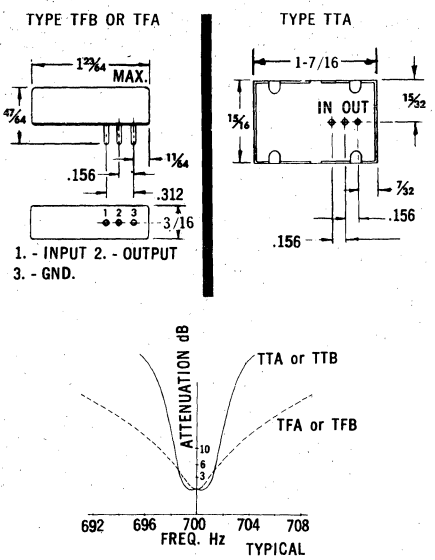
BULOVA INDUCOM

FORKS/OSCILLATORS/RESONATORS

A New, Low Cost Line Of Industrial/Commercial Tuning Fork Products

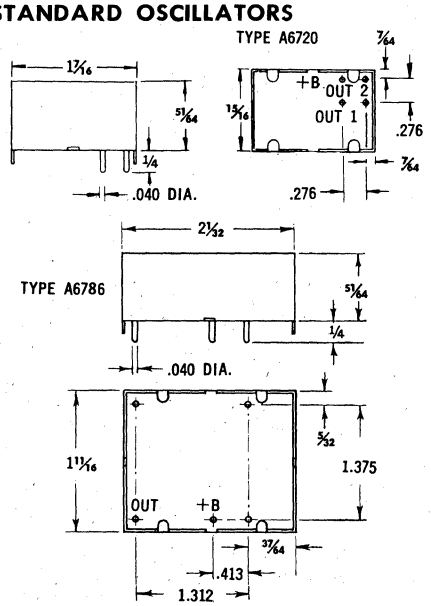
- Lightweight—Small Size
- Based upon 30 years of ATP Experience in Fork Design Capability
- For Industrial/Commercial Applications Where Price Is Critical

FORK RESONATORS AND FILTERS (encoders or decoders)



	TFB or TFA (Single Fork)	TTA (Dual Fork)
Center Frequency:	300 to 3000Hz	700 to 1500Hz
Frequency Stability:	±0.2% max.	±0.20% max.*
Operating Temperature:	−40°C to +60°C	−40°C to +60°C
Bandwidth: 3dB 6dB	0.3% 0.5%	0.35% 0.45%
Insertion Loss:	8dB max.	8dB max.
Ripple:	—	2dB max.
Impedance-In and Out:	50k to 200k ohms	50k to 200k ohms
In Moderate Quantities, priced as low as:	$5.00	$12.50 (considerably lower in large quantities)

STANDARD OSCILLATORS



	Type A6720	Type A6786
Frequency Range:	300 to 3000Hz	60 to 1500Hz
Frequency Accuracy:	±0.2% max.*	±0.2% max.*
Input Voltage:	10 to 16V DC	10 to 16V DC
Input Current:	1.0mA max.	12mA max.
Operating Temperature:	−40°C to +60°C	−40°C to +60°C
Output Voltage:	1.0V P-P into 5k ohms	1.0V P-P into 5k ohms
Wave Form:	Limited Sine	Square
In Moderate Quantities priced as low as:	$15.00	$30.00 (considerably lower in large quantities)

*.1% for narrow temperature ranges.
Countdown circuit, Type 6766, is available for dividing by 8.
Better frequency accuracies available.
Many other low cost versions available.

Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

BULOVA AMERICAN TIME PRODUCTS
ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

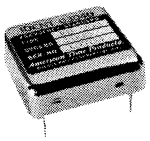
BULOVA FORK OSCILLATORS/RESONATORS

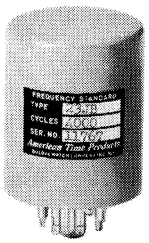
- From 1 Cps to 20 kHz (or lower)
- Accuracies up to ±.001%
- Unique capability to meet special custom requirements

Whatever your requirements for tuning forks and oscillators, Bulova has either the product available or the inherent capability to meet your need. Reliability, accuracy and size criteria can be quickly met, with appreciable savings in engineering time and production costs. Each product is founded on the same design experience that has made the ACCUTRON a by-word of precision and accuracy.

PRECISION OSCILLATORS

(Complete Standards)



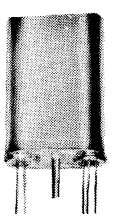
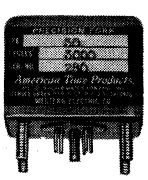




Type	FS 200	FS 11	FS 27	FS 23 JB	FS 32
Frequency	360 to 1000 Hz	400 to 15 kHz	360 to 1300 Hz	240 to 15 kHz	240 to 20 kHz
Frequency Accuracy	up to ±.01%	up to ±.02%	up to ±.002%	up to ±.02%	up to ±.002%
Temperature Range	FOR SOME ACCURACIES AS MUCH AS −65°C to + 125°C				
Input	1.5 V DC at 6 to 20 microamps	STANDARD 28 V DC (AVAILABLE 5 to 40 V DC)			
Output	0.1 volt	APPROXIMATELY 5 V RMS			
Load	500 K ohms	30 K ohms	70 K ohms	30 K ohms	20 K ohms
Size	1-5/16" x 1-5/16" x 3/8"	1-1/2" x 1-1/2" x 3/8"	23/32" x 3"	1-1/2" x 1-7/8"	1-1/2" x 1-1/2" x 1-1/8"
Weight	1 ounce	2-1/2 ounces	2 ounces	3-1/2 ounces	2-1/2 ounces

PRECISION FORK RESONATORS

(External Drive Circuit Required)



Type	TF 600	TF 34	TF 25	TF 500	TF 30
Frequency	400 to 2400 Hz	240 to 4000 Hz	200 to 1400 Hz	240 to 2400 Hz	240 to 20 kHz
Frequency Accuracy	up to ±.02%	up to ±.02%	up to ±.002%	up to ±.02%	up to ±.002%
Temperature Range	FOR SOME ACCURACIES AS MUCH AS −65°C TO +125°C				
Output, Input and Load	DEPENDENT ON EXTERNAL CIRCUITRY USED. RECOMMEND CIRCUITS SUPPLIED TO CUSTOMERS				
Size	1.2 x .9 x .24"	1-1/2 x 1-1/2 x 3/8"	23/32 x 3"	3/8" x 1-1/2"	1-1/2 x 1-1/2 x 1-1/8
Weight	1/2 ounce	1/2 ounce	2 ounces	1/2 ounce	2-1/2 ounces

Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

BULOVA atp

BULOVA AMERICAN TIME PRODUCTS

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.

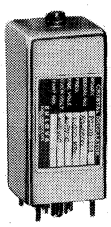
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

BULOVA CRYSTAL OSCILLATORS

Bulova offers a full line of crystal oscillators manufactured completely in-house from quartz to finished unit. Bulova provides a total capability from custom engineering to volume production, using the latest automatic test equipment and labor-saving production equipment.
Bulova's full line of crystal oscillators includes • miniature clock oscillators • high stability oscillators • temperature-compensated crystal oscillators (TCXO) • voltage-controlled crystal oscillators (VCXO) . . . using a full range of crystal cuts engineered and produced at Bulova. Units built to meet material, parts and environmental specifications of MIL-E-5400, MIL-E-4970 and MIL-E-16400 as required.

If one of Bulova's full line of crystal oscillators does not meet your requirements, we will modify one of our present models or design a unit to your specifications.

HIGH STABILITY CRYSTAL OSCILLATOR



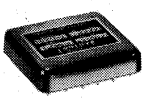
PCOXO-101

The high frequency stability of these oscillators results from housing a high precision crystal and an oscillator circuit with AGC to maintain low constant crystal drive in a stable DC proportional control oven.

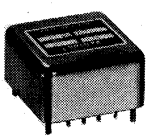
Features: Plug-in oscillator with stud mounting • Frequency trimming provided by a screwdriver adjustment.

MODEL	PCOXO-101	PCOXO-102	PCOXO-103	PCOXO-104
Frequency Range	1.0 or 5.0 MHz	1.0 or 5.0MHz	1.0, 3.0 or 5.0MHz	1.0, 3.0 or 5.0MHz
Ambient Range	−55°C to +70°C	−55°C to +70°C	−55°C to +70°C	−55°C to +70°C
Stability				
Ambient	$\pm 1PP10^8$	$\pm 1PP10^8$	$\pm 2.5PP10^8$	$\pm 2.5PP10^8$
Aging per day	$1PP10^9$	$3PP10^9$	$5PP10^9$	$10PP10^9$
Line Voltage ±10%	$\pm 5PP10^9$	$\pm 5PP10^9$	$\pm 5PP10^9$	$\pm 5PP10^9$
Load ±10%	$\pm 1PP10^9$	$\pm 1PP10^9$	$\pm 1PP10^9$	$\pm 1PP10^9$
Warm-up at +25°C after 1 hr.	$\pm 3PP10^8$	$\pm 3PP10^8$	$\pm 3PP10^8$	$\pm 3PP10^8$
Output	.5VRMS (min)	.5VRMS (min)	.5VRMS (min)	.5VRMS (min)
Load	50 ohms	50 ohms	50 ohms	50 ohms
Input Voltage	+28VDC	+28VDC	+28VDC	+28VDC
Turn on Power	18W	18W	18W	18W
Power at 25°C	4.5W (Typ)	4.5W (Typ)	4.5W (Typ)	4.5W (Typ)
Size	2″ x 2″ x 4″	2″ x 2″ x 4″	2″ x 2″ x 4″	2″ x 2″ x 4″

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS



TCXO-1



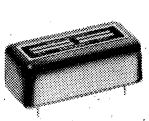
TCXO-5 & 30

Bulova temperature compensated crystal oscillators employ a computer selected and optimized variable capacitance diode and thermistor compensation network to maintain frequency stability over wide temperature ranges, without the use of an oven. They are designed for use in aerospace, military, and industrial applications where power, space and weight restrictions preclude the use of an oven for temperature stabilization.

Features: • No warmup time, due to elimination of oven • Low power consumption • Glass sealed crystal holder to minimize aging and ensure long life • Self-contained voltage regulator • All components derated for long life and high reliability • Hermetically sealed

MODEL	TCXO-1	TCXO-5	TCXO-30
Frequency Range	3MHz to 5MHz	3MHz to 5MHz	3MHz to 5MHz
Frequency Adjustment Range	±3PPM	±3PPM	±3PPM
Frequency Stability	±1PPM over Temp. Range of −40°C to +70°C	±0.5PPM over Temp. Range of −40°C to +75°C	±0.5PPM over Temp. Range of −55°C to +85°C
Aging Rate per week	$\pm 1PP10^8$	$\pm 1PP10^8$	$\pm 1PP10^8$
Power Input	18VDC ±2% at 150mw	12VDC ±10% at 50mw	12VDC ±10% at 50 mw
Output	1 VP-P into 1K ohm	1 VP-P into 1K ohm	1 VP-P into 1K ohm
Size	2″ x 2″ x 0.5″	2″ x 2″ x 1″	2″ x 2″ x 1″
Weight	3 oz.	5 oz.	5 oz.

MINIATURE CLOCK OSCILLATORS



XO-140

These miniature clock oscillators feature, crystal stability, printed circuit board mounting and outputs directly compatable with DTL or TTL loads.

MODEL	XO-140	XO-150	XO-160
Frequency Range	8KHz to 1MHz	1MHz to 4MHz	4MHz to 25MHz
Operating Temperature	−40°C to +70°C	−55°C to +85°C	−55°C to +85°C
Frequency Stability over Ambient	±120PPM	±50PPM	±50PPM
Input Voltage	+5VDC	+5VDC	+5VDC
Output	Logic Zero: 0 to .4V Logic One: 2.6 to 5V	Logic Zero: 0 to .4V Logic One: 2.6 to 5V	Logic Zero: 0 to .4V Logic One: 2.6 to 5V
Size	1″ x 2″ x .5″	1″ x 2″ x .5″	1″ x 2″ x .5″

Manufacturer of the widest range of Frequency Control Components: Crystals • Crystal Oscillators • Crystal Filters • LC Filters • Tuning Forks • Fork Oscillators • Ovens • Coils • Servo Amplifiers

BULOVA fcp

BULOVA FREQUENCY CONTROL PRODUCTS

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.

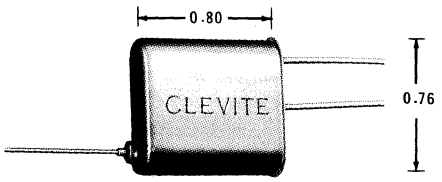
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

Clevite Quartz Filters

for the man with designs on something better.

Small, lightweight and rugged. Ideal for matching IC circuitry in communications receivers operating in the VHF and UHF frequency ranges as well as in telemetry, radar and aerospace systems.

Independent Mode Quartz Uni-Wafer Filter



Four-pole crystal filters with center frequencies of 10.7MHz, 15MHz 20MHz, and 30MHz. Except for termination, each filter is contained complete in a standard HC-6/U crystal can. Typical characteristics are: ripple 1db peak to valley and temperature stability ±.005 percent maximum from —40° to +85°C. Outstanding advantage is its small size (¾" x ¾" x ⅜"), light weight and good electrical isolation.

In addition, an independent mode filter gives higher spurious mode supression than a coupled mode filter. Special independent mode filters are also inexpensive to tool.

Independent Mode Uni-Wafer filters are smaller than standard quartz filters by a factor of at least three to one. They are characterized by fewer interconnections and higher selectivity per unit volume.

Specials are available as follows: 10.7MHz to 60MHz—bandwidths .02% to .3% of center frequency.

Independent Mode Quartz UW Filter

Model Number	Center Frequency (MHz)	Bandwidth 3dB (Min.) (kHz)	Bandwidth 40dB (Max.) (kHz)	Ultimate Attenuation (dB)	Impedance In & Out (ohms)
UW-2C10-10.7	10.7±1kHz[3]	2	10	55	470
UW-6C22-10.7	10.7±1kHz[3]	6	22	55	1200
UW-12C42-10.7	10.7±1kHz[3]	12	42	55[1]	2700
UW-20C65-10.7	10.7±1kHz[3]	20	65	50[2]	3900
UW-3C15-15.0	15.0±1kHz[3]	3	15	55	560
UW-6C22-15.0	15.0±1kHz[3]	6	22	55	1200
UW-12C42-15.0	15.0±1kHz[3]	12	42	55[1]	2200
UW-20C65-15.0	15.0±1kHz[3]	20	65	50[2]	3900
UW-30C100-15.0	15.0±1kHz[3]	30	100	50[2]	5600
UW-4C20-20.0	20.0±1kHz[4]	4	20	55	680
UW-12C44-20.0	20.0±1kHz[4]	12	44	55	1800
UW-24C84-20.0	20.0±1kHz[4]	24	84	55[1]	4700
UW-40C130-20.0	20.0±1kHz[4]	40	130	50[2]	5600
UW-6C30-30.0	30.0±2kHz[4]	6	30	55	330
UW-12C44-30.0	30.0±2kHz[4]	12	44	55	560
UW-24C84-30.0	30.0±2kHz[4]	24	84	55	820
UW-30C100-30.0	30.0±2kHz[4]	30	100	55[1]	1800
UW-40C130-30.0	30.0±2kHz[4]	40	130	50[2]	2200

Stability:
TIME ±.0007%/year
TEMP ±.005%

Operating Temp. Range:
—45°C +85°C

(1) There is the possibility of one spurious response down to 50db in the upper stopband between the upper 40db point and f. +300Khz

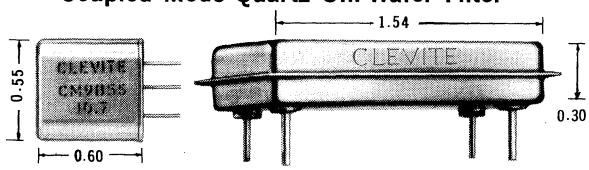
(2) There is the possibility of one spurious response down to 45db in the upper stopband between the upper 40db point and f. +300 khz. Beyond f. +300kHz the upper stopband will be 55db. The lower stopband will support 55db continuously.

(3) Insertion Loss 4dB max.

(4) Insertion Loss 5dB max.

For more information, write for Bulletin 94027. Clevite Corporation, Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146.

Coupled Mode Quartz Uni-Wafer Filter



Available in two-, four- and six-pole models with center frequencies ranging from 10.7MHz to 30MHz. These monolithic filters offer IC compatibility, low insertion loss and high stopband rejection. Standard two-pole models are provided in solderseal packages. Four- and six-pole filters are provided in coldweld packages.

They were developed using Clevite's original thin film approach to quartz filters. Arrays of resonators are achieved on a single quartz wafer. Spurious suppression is controlled by the trapped energy principle.

Performance of these computer designed filters is achieved by carefully controlled elastic coupling between metal plated regions.

Two-Pole Coupled Mode Quartz UW Filter

Model Number	Center Frequency (MHz)	Bandwidth 3dB(Min.) (kHz)	Bandwidth 30dB(Max.) (kHz)	Spurious Mode Rej. (dB)	Ripple Max. (dB)
CM9B55-10.7	10.7±1kHz	9	55	25	1.0
CM14B85-10.7	10.7±1kHz	14	85	25	1.0
CM30B180-10.7	10.7±1kHz	30	180	20	1.5
CM9B55-20.5	20.5±1kHz	9	55	25	1.0
CM14B85-20.5	20.5±1kHz	14	85	25	1.0
CM30B180-20.5	20.5±1kHz	30	180	20	1.5
CM9B55-30.0	30.0±2kHz	9	55	25	1.0
CM14B85-30.0	30.0±2kHz	14	85	25	1.0
CM30B180-30.0	30.0±2kHz	30	180	20	1.5

Four-Pole Coupled Mode Quartz UW Filter

Model Number	Center Frequency (MHz)	Bandwidth 3dB(Min.) (kHz)	Bandwidth 60dB(Max.) (kHz)	Spurious Mode Rej. (dB)	Ripple Max. (dB)
CM9D45-10.7	10.7±1kHz	9	45	70	1.0
CM14D70-10.7	10.7±1kHz	14	70	70	1.0
CM30D150-10.7	10.7±1kHz	30	150	60	1.5
CM9D45-20.5	20.5±1kHz	9	45	70	1.0
CM14D70-20.5	20.5±1kHz	14	70	70	1.0
CM30D150-20.5	20.5±1kHz	30	150	60	1.5
CM9D45-30.0	30.0±2kHz	9	45	70	1.0
CM14D70-30.0	30.0±2kHz	14	70	70	1.0
CM30D150-30.0	30.0±2kHz	30	150	60	1.5

Six-Pole Coupled Mode Quartz UW Filter

Model Number	Center Frequency (MHz)	Bandwidth 3dB(Min.) (kHz)	Bandwidth 60dB(Max.) (kHz)	Spurious Mode Rej. (dB)	Ripple Max. (dB)
CM9D25-10.7	10.7±1kHz	9	25	90	1.0
CM14D35-10.7	10.7±1kHz	14	35	90	1.0
CM30D75-10.7	10.7±1kHz	30	75	80	1.5
CM9D25-20.5	20.5±1kHz	9	25	90	1.0
CM14D35-20.5	20.5±1kHz	14	35	90	1.0
CM30D75-20.5	20.5±1kHz	30	75	80	1.5
CM9D25-30.0	30.0±2kHz	9	25	90	1.0
CM14D35-30.0	30.0±2kHz	14	35	90	1.0
CM30D75-30.0	30.0±2kHz	30	75	80	1.5

Stability:
TIME ±.0007%/year
TEMP ±.005%

Operating Temp. Range:
—45°C to +85°C

	2-Pole Models	4-Pole Models	6-Pole Models
Insertion Loss	2dB	3dB	4dB
Ultimate Attenuation	50dB	80dB	100dB

IMPEDANCES: Terminating impedances will run between 500 ohms and 6000 ohms depending upon frequency and bandwidth. The 30kHz at 10.7MHz will be in the 6000 ohm range and the 9kHz at 30MHz will be in the 500 ohm range with all others in-between. Specific impedances will be determined at the time a design is finalized.

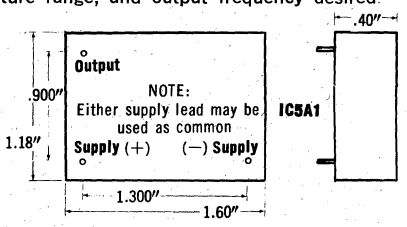
For more information, write for Bulletin 94028. Clevite Corporation, Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146.

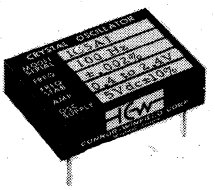
CLEVITE

CRYSTAL OSCILLATORS

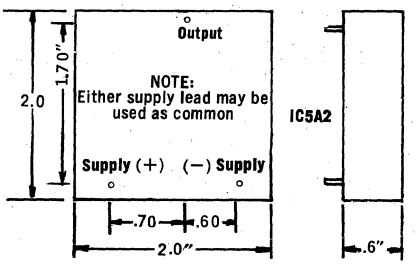
CRYSTAL CONTROLLED OSCILLATORS FOR IC SYSTEMS

These crystal oscillators are designed primarily for use with I.C. systems and are completely compatible with Series "930" as well as other I.C. devices. Priced equal to or lower than their larger equivalents, they provide low output frequencies with true crystal accuracy. Their operation is silent and the output frequency is not affected by mounting position or variation in "G" forces. A total of eight different Models provide five frequency accuracies and five temperature ranges as shown in the table below. The cost of a unit is determined by the frequency accuracy, temperature range, and output frequency desired.





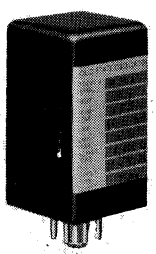
MODEL IC5A1



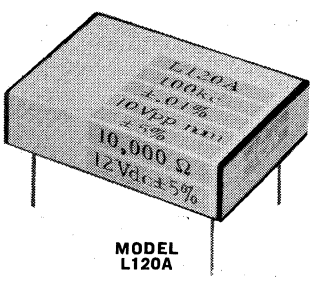
Square Wave Model	Sine Wave Model	Frequency Accuracy	Temperature Range	
			Degrees C	Degrees F
IC5A1	IC5A2	±.002%	+20 to +40	+68 to +104
IC5B1	IC5B2	±.005%	0 to +50	+32 to +122
IC5C1	IC5C2	±.005%	0 to +65	+32 to +149
IC5D1	IC5D2	±.01%	0 to +65	+32 to +149
IC5E1	IC5E2	±.01%	−25 to +70	−13 to +158
IC5F1	IC5F2	±.02%	−25 to +70	−13 to +158
IC5G1	IC5G2	±.02%	−55 to +70	−67 to +158
IC5H1	IC5H2	±.05%	−55 to +70	−67 to +158

Output Waveform:	Square Wave Duty Cycle 50% Rise Time <50ns	Sine Wave Distortion <5%
Frequencies Available:	1.0Hz to 500kHz	50Hz to 500kHz
Output Amplitude:	Logic Zero, <0.4V Logic One, >2.4V	3Vrms nominal into 10kΩ load
Supply Voltage:	5Vdc ±10%, 20ma to 100ma depending on frequency	
Termination:	Gold plated solder pins	

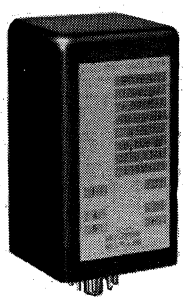
CRYSTAL CONTROLLED OSCILLATORS



MODEL P150A



MODEL L120A



MODEL P210A

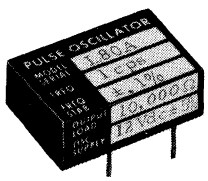
Termination is indicated by Part No. prefix: P, Octal Plug; S, Solder Hooks; L, Gold Plated Pins.
Output signal 5Vrms nominal to 10,000 Ω load. Accessory power amplifiers are available up to 5 watts output. Typical supply voltage is 12VDC, but other voltages can be accommodated.

Model	Frequencies Available	Frequency Tol. over Temp. Range	Amplitude Stab. over Temp. Range	Temperature Range	Output Waveform	Size	Price Single Unit
P210N S210N	1Hz to 100kHz	±.001%	±2%	−55°C to +50°C oven stabilized	Square or Sine (specify)	2" x 2" x 3½"H	$128.00 to $283.00
P150T S150T	1Hz to 100kHz	±.002%	±2%	+20°C to +40°C	Square or Sine (specify)	1½" x 1½" x 2½"H	$113.00 to $233.00
P150N S150N	1Hz to 100kHz	±.005%	±5%	0°C to +50°C	Square or Sine (specify)	1½" x 1½" x 2½"H	$ 98.00 to $208.00
P150A S150A	1Hz to 100kHz	±.02%	±5%	−25°C to +85°C	Square or Sine (specify)	1½" x 1½" x 2½"H	$ 73.00 to $193.00
L120A	15kHz to 1MHz	±.005%	±5%	0°C to +50°C	Square, duty cycle 50%	1.6" x 1.2" x 0.4"	$ 58.00 to $ 73.00
L220B	200Hz to 500kHz	±.005%	±5%	0°C to +50°C	Sine, <5% distortion	2" x 2" x 0.6"	$98.00 to $183.00

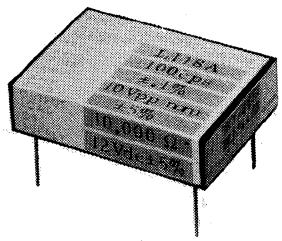
CONNOR-WINFIELD CORPORATION
PHONE (312) 231-5270 WINFIELD, ILLINOIS 60190

RC OSCILLATORS AND AC VOLTAGE STANDARDS

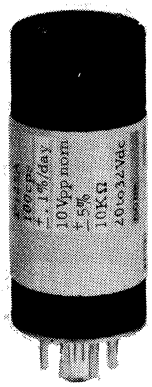
RC OSCILLATORS



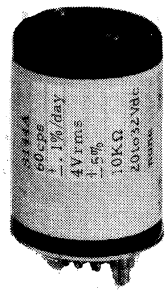
MODEL L80A



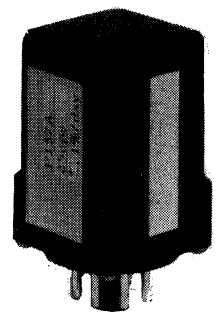
MODEL L118A



MODEL P125A



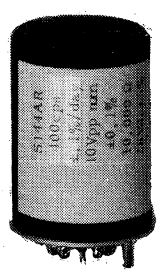
MODEL S144A



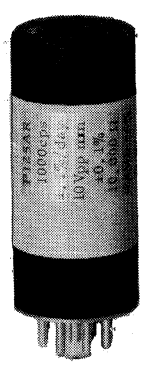
MODEL P137A

Model	Frequencies Available	Frequency Tol. over Temp. Range	Amplitude Stab. over Temp. Range	Temperature Range	Output Waveform	Size	Price Single Unit
L80A	1Hz to 50kHz	±.1%	±5%	0°C to +50°C	Neg. Pulse	1.2″ x 0.8″ x .48″	$43.00
L118A	1Hz to 20kHz	±.1%	±5%	0°C to +50°C	Square, <1μs rise time	1.6″ x 1.2″ x .40″	$58.00
L200B	50Hz to 20kHz	±.1%	±5%	0°C to +50°C	Sine, <5% distortion	2″ x 2″ x 0.6″	$78.00
P125A	1Hz to 20kHz	±.1%	±5%	0°C to +50°C	Square, <500ns rise time	1¼″D x 2¾″H	$43.00
P125B	20Hz to 20kHz	±.1%	±5%	0°C to +50°C	Sine, 5% distortion	1¼″D x 3¾″H	$58.00
S144A	1Hz to 20kHz	±.1%	±5%	0°C to +50°C	Square, <500ns rise time	1 7/16″D x 2″H	$43.00
S144B	20Hz to 20kHz	±.1%	±5%	0°C to +50°C	Sine, 5% distortion	1 7/16″D x 2¾″H	$58.00
P137A	10Hz to 3kHz	±1%	±5%	0°C to +60°C	Square, <1μs rise time	1⅜″ x 1⅜″ x 2⅛″	$23.00

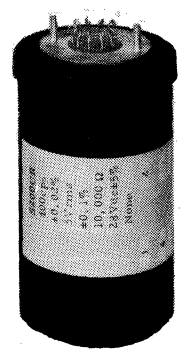
AC VOLTAGE STANDARDS



MODEL S144AR



MODEL P125AR



MODEL S200CR

Model	Frequencies Available	Frequency Tol. over Temp. Range	Amplitude Stab. over Temp. Range	Temperature Range	Output Waveform	Size	Price Single Unit
P200CR S200CR	100Hz to 20kHz	±.01%	±.25%	0°C to +50°C	Sine, <1% distortion	2⅛″D x 3⅝″H	$123.00 to $193.00
P125AR	10Hz to 6kHz	±.1%	±.25%	0°C to +50°C	Square, <500ns rise time	1¼″D x 2¾″H	$73.00
P125BR	100Hz to 6kHz	±.1%	±.25%	0°C to +50°C	Sine, <1% distortion	1¼″D x 3¾″H	$98.00
S144AR	10Hz to 6kHz	±.1%	±.25%	0°C to +50°C	Square, <500ns rise time	1 7/16″D x 2″H	$73.00
S144BR	100Hz to 6kHz	±.1%	±.25%	0°C to +50°C	Sine, <1% distortion	1 7/16″D x 2¾″H	$98.00

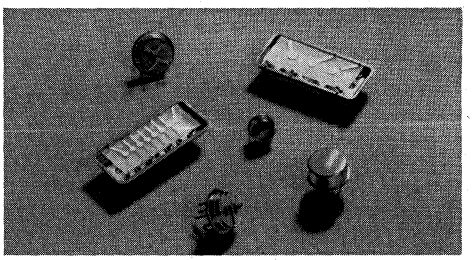
CONNOR-WINFIELD CORPORATION
PHONE (312) 231-5270 WINFIELD, ILLINOIS 60190

Damon... the form-factor specialists in crystal filters, oscillators, monolithics.

Whatever your signal-shaping needs . . . from a narrow band-reject "spike" to a broad band-pass . . . you can rely on the form-factor specialists at Damon. Computer assisted custom designs. Production quantities. Frequency selection from 10 KHz to 75 MHz. Bandwidths from 10 Hz to 400 KHz. Competitive pricing. You name it. Damon will deliver it — on schedule. Here are five examples typical of Damon's broad capability in frequency control devices:

Monolithic Crystal Filters

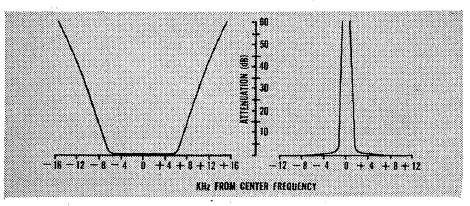
Damon Monolithic Filters utilize a single quartz plate for multiple resonators and the coupling medium between them. Advantages over conventional crystal filters include smaller size, superior stability, and lower cost. Available in a wide variety of computer-assisted designs from Chebyshev to Gaussian characteristics and from 2 to 8 poles.



Center Frequency .....3 - 30 MHz
3 dB Bandwidth .....0.3 - 30 KHz
No. of Coupled Resonators .....2 - 8
Insertion Loss .....1 - 6 dB
Ripple .....0.5 dB max
Terminations .....50 ohms to 20 kilohms
Size .....TO-5, TO-8, or Flat-Pack

Band-Pass/Reject Crystal Filters

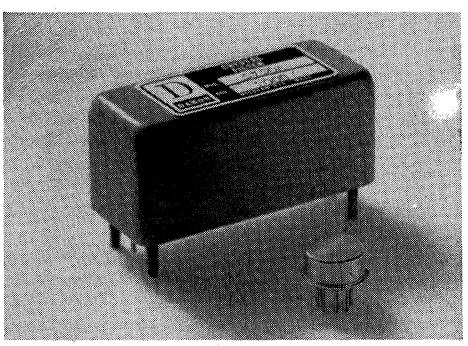
A wide variety of conventional crystal filters are produced at Damon Engineering. Standards designs such as Butterworth, Chebyshev, Gaussian, Bessel, and Legendre, as well as custom tailored designs are available.



RANGE OF PARAMETERS:
Center Frequency .....10 KHz - 75 MHz
Bandwidth ..... .01% - 3% of C. F.
Phase Linearity .....± 5%
Transient Overshoot .....40 dB down
Shape Factor .....down to 1.4:1
Differential Phase Shift .....±2°
Group Delay Uniformity .....±5%

Gaussian Crystal Filters

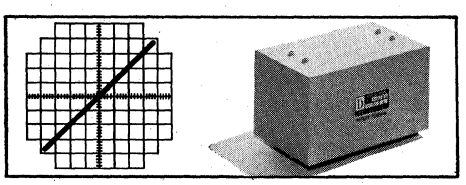
Gaussian Crystal Filters of either conventional or monolithic design. Useful in FM communications or radar systems where flat time delay is required. In a coherent pulsed radar, it can minimize return-pulse overshoot. Eliminates ringing problems in swept spectrum analysis. Available in 2 to 6 pole designs.



Center Frequency
Conventional .....100 KHz - 35 MHz
Monolithic .....3 - 30 MHz
3 dB Bandwidth .....100 Hz - 30 KHz
Shape Factor,
30 dB to 3 dB .....3:1 to 7:1
Ringing, Pulse or
Impulse .....25 - 40 dB down
No. of Poles
Conventional .....2 - 6
Monolithic .....2 - 4
Volume
Conventional .....1 - 6 cu. in.
Monolithic .....0.016 - 0.4 cu. in.

VCXO's — 50 KHz to 100 MHz

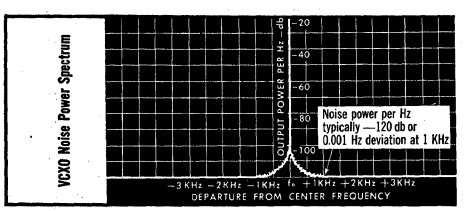
Damon VCXO's provide high stability over a broad range of center frequencies. An optional square wave or pulse output signal compatible with I. C. Logic Circuits is available.



Center Frequency .....50 KHz to 100 MHz
Deviation ..... .01% to 0.2% of Center Frequency
Linearity .....1% to 2% of Peak Deviation
Frequency Stability ....1% of Peak Deviation over 0° to 50°C temp. range

Low Noise VCXO's

Damon low noise miniaturized VCXO's are all solid state quartz crystal stable oscillators whose frequencies can be varied linearly by an external DC or AC modulating signal. Only a source of power and control signal are required . . . no auxiliary compensating circuitry.



TYPICAL CHARACTERISTICS:
Center Frequency .....10.000 MHz ±1 KHz
Deviation .....±10 KHz
Linearity .....±1%
Modulation Rate .....Flat to 4 KHz
Output Power .....>1 MW

Write for technical bulletins.
Electronics Division, Damon Engineering, Inc.
115 Fourth Avenue, Needham, Mass. 02194
(617) 449-0800

DAMON

W H FERWALT, INC.

LAPWAI, IDAHO 83540
PHONE: (208) 843-2463

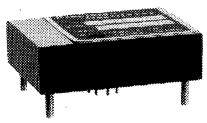
PRECISION OSCILLATORS

.0005 Hz TO 75 MHz

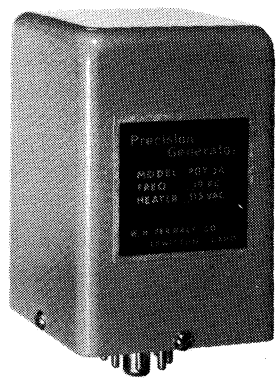
USES INTEGRATED CKTS • DRIVES INTEGRATED CKTS
CRYSTAL CONTROLLED • LC & RC • PHASE LOCK
TEMPERATURE COMPENSATED • VOLTAGE CONTROLLED

GENERAL CHARACTERISTICS AVAILABLE—

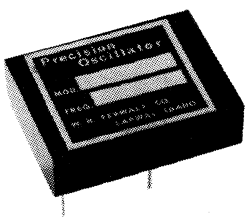
- Square-wave or Sine-wave output
- Manual trim or preset to ±.001% or better
- Supply voltages to suit customer requirements
- Internal dividing and gate control
- Special logic gating or memory
- Shock and vibration specifications



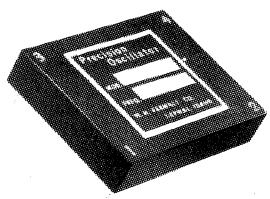
PKG STYLE C
7-pin plug-in
Encapsulated
1.5″ x 2.0″ x .56″



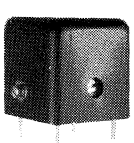
PKG STYLE D
Octal plug-in
Removable cover
2.0″ x 2¼″ x 3⁵⁄₁₆″



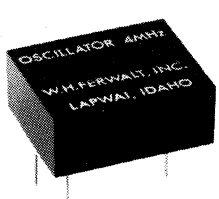
PKG STYLE A
Printed ckt mount
Encapsulated
1.5″ x 2.0″ x .56″
(**AX:** Without mtg. hole)



PKG STYLE B
Printed ckt mount
Encapsulated
1.9″ x 2.5″ x 5″
(**BX:** 2.12″ x 5.0″ x .5″)



PKG STYLE E
4-pin plug-in or
solder-in
Removable cover
1.0″ x 1.0″ x 1.0″



PKG STYLE F
Printed ckt mount
Encapsulated
1.0″ x 1.25″ x .5″

MODEL SERIES	FREQUENCY RANGE	STABILITY	TEMPERATURE RANGE	PK-TO-PK OUTPUT	LOAD	SUPPLY VOLTAGE	PKG. STYLE	1-9 PRICE RANGE
CRYSTAL OSCILLATORS, NON-OVEN TYPE								
X026	200KHz to 700KHz	±.005%	0°C to +70°C	2V Sine	500 ohms	+25V	E	$85.00
X032	200KHz to 5.99MHz	±.004 to ±.025%	0°C to +75°C	3V Square	25 DTL	+5V	A	$74 to $100
X032A	200KHz to 5.99MHz	±.01%	−55°C to +125°C	3V Square	25 DTL	+5V	A	$104 to $204
X032B	200KHz to 600KHz	±.02% to ±.04%	−55°C to +90°C	3V Square	25 DTL	+5V	A	$113 to $125
X032C	6MHz to 30MHz	±.004%	0°C to +75°C	3V Square	9 TTL	+5V	A	$94.50
X032CA	6MHz to 30MHz	±.01%	−55°C to +125°C	3V Square	9 TTL	+5V	A	$126.20
X033	1Hz to 30MHz	±.004%	0°C to +75°C	3V Square	9 DTL/TTL	+5V	B	$74 to $190
X033A	1Hz to 30MHz	±.01%	−55°C to +125°C	3V Square	9 DTL/TTL	+5V	B	$104 to $260
X033R	1Hz to 5MHz	±.001%	0°C to +50°C	1V Square	2 RTL	+5V	B	$94 to $210
X033L	.001Hz to 1Hz	±.004%	0°C to +75°C	3V Square	9 DTL/TTL	+5V	B	$190 to $272
X045	1MHz to 5MHz	±.001%	+10°C to +50°C	.63 V Sine	50 Ohms	+15V	C	$109.20
X082	250KHz to 16MHz	±.005%	0°C to +75°C	3 V Square	9 DTL/TTL	+5V	F	$58 to $78
PG049	800Hz to 1MHz	±.01%	0°C to +75°C	8V Square	3.9K ohms	−12V	D	$90 to $165
ULF55	7.5Hz to 30KHz	±.01%	0°C to +50°C	3V Sine	10K ohms	+12V	D	$120 to $187
CRYSTAL OSCILLATORS, OVEN-REGULATED (115VAC, 28VDC, or 6.3VAC)								
PGT	1KHz to 250KHz	±.0001% to ±.0008%	−54°C to +65°C	8V Square	3.9K ohms	+12V	D	$168 to $220
PGX50	65KHz to 17MHz	±.00001%	0°C to +50°C	3V Sine	1K ohms	+28V	D	$225 to $245
PGX63	1Hz to 17MHz	±.00001%	0°C to +50°C	3V Square	1.5K ohms	+12V	D	$208 to $330
CRYSTAL OSCILLATORS, TEMPERATURE-COMPENSATED (no oven)								
TCX034	30Hz to 30MHz	±.0001%	0°C to +50°C*	3V Square	9 DTL/TTL	+5V	B	$158 to $250
TCX034L	.0005Hz to 30Hz	±.0001%	0°C to +50°C*	3V Square	9 DTL/TTL	+5V	BX	$256 to $348
TCX056	100KHz to 30MHz	±.0001%	0°C to +50°C*	3V Square	9 DTL/TTL	+5V	A	$158 to $177
VOLTAGE-CONTROLLED OSCILLATORS (0V to +6V typical control range for ±20PPM to ±10%)								
VCX025	1Hz to 30MHz	±.004%	0°C to +75°C	3V Square	9 DTL/TTL	+12V	B	$99 to $215
VCX032	200KHz to 30MHz	±.004% to ±.025%	0°C to +75°C	3 V Square	25 DTL	+5V	A	$99 to $125
VC047	1Hz to 75MHz	±3%	0°C to +75°C	2V Square	270 Ohms	+5V	B	$82 to $198
ECONOMY OSCILLATORS (RC, LC & XTAL)								
LC035	75KHz to 5MHz	±½%	0°C to +85°C	2V Sine	10K ohms	+12V	A	$34.90
PS057	340Hz to 40KHz	±2%	−20°C to +70°C	8V Sine	10K ohms	+12V	A	$39.30
RC036	50Hz to 1MHz	±3%	0°C to +75°C	3V Square	8 DTL	+5V	A	$29 to $45
UJ039A	.1Hz to 100Hz	±2%	0°C to +50°C	3V Square	1.5K ohms	+12V	A	$25.50
X062	4KHz to 16MHz	±.01% to ±.025%	−20°C to +70°C	3V Square	1.5K ohms	+12V	AX	$44 to $69

*Stability at constant ambient: ±.000002% per day average over 30-day period.

We invite your specifications.

W. H. FERWALT, INC.

WEBB ROAD LAPWAI, IDAHO 83540 PHONE (208) 843-2463

CRYSTAL DISCRIMINATORS

Crystal discriminators offer high sensitivity and excellent linearity in addition to the same characteristic attributes of crystal filters: compact size, rugged construction, precise and stable performance.

ULTRA-STABLE CRYSTAL DISCRIMINATORS

Typical Specifications
Center Frequency: 10.0MC ± 50 Hz
−55°C to +70°C
Center frequency adjustable with external DC Bias.
Peak to peak bandwidth − 80 KHz
Linearity: ± 3% over ± 10KHz deviation
Sensitivity: 20 MV per 100 Hz deviation with 3.0V RMS open circuit input.
Source Impedance: 500 Ohms
Load Impedance: 100K Ohms
Oven Voltage: 28 VDC
Dimensions: 4″ x 2.5″ x 2″

AL-14 DISCRIMINATOR

Center Frequency: 11.5MC ± 1.5KC −40°C to 65°C
Peak to Peak BW: 50 KHz Minimum
Distortion (total harmonic): 3% max with 10 KHz deviation and 1 KHz modulation rate
Input: 350 MV across 390 Ohms
Output: 120 MV min across 100K Ohms

ZC-28U AND ZC-29L SYMMETRICAL SSB FILTERS

One filter gives upper and lower SSB operation by simply switching carrier crystal frequency.
Typical specifications
Center Frequency Range: 1 to 3 MHz
Passband: 3db min BW 2.75 KHz
Shape Factor: 60db/3db = 1.4 : 1 max
Carrier Suppression (either side): 25 db min +300 Hz or −300 Hz from 3db frequency
Unwanted sideband suppression: 60db min at +300 Hz or −300 Hz from carrier frequency
Passband Ripple: ± 1db max
Insertion Loss: 6db max
Nominal Impedance: 50 Ohms in and out
Dimensions: 3.13 x 1.44 x 1.77 inches

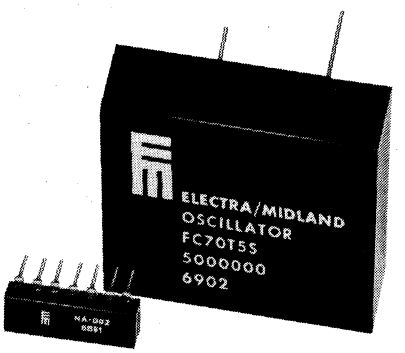
THICK FILM IF FM AMPLIFIER − NA005

This amplifier can be used with a crystal filter to provide complete "IF Strip" to include selectivity, amplification, limiting, and AGC for controlling RF Amplifier gain. It requires minimum power so is an excellent choice for mobile/portable FM communication application as 10.7 MHz. IF amplifier.

1. Voltage Gain:	**85 db**
2. Freq. Response:	**4 MHz. to 12 MHz.**
3. Input Power:	**4.2 VDC, 56 mw**
4. Output Impedance:	**500 ohms**
5. Input Impedance:	**500 ohms to 2k ohms**
6. AGC Out:	**.25 to 1.5 VDC**
7. Limiting:	**2V PP out for 75 μv input**
8. Package:	**Hermetic, .335″ D x 1″ L.**

TO ORDER, SPECIFY: NA005/Center Frequency/Input Impedance

CRYSTAL CONTROLLED CLOCK OSCILLATOR



This device is a crystal controlled fixed frequency Square Wave Oscillator for use as Master Clock in Digital Systems. It exhibits excellent rise/fall time characteristics, compatible with T^2L Logic. NOTE: It is available in Thick Film DIP, plastic or hermetically sealed, complete with crystal, or encapsulated P/C Mount.

TYPE	FAN OUT UNITS*	FREQUENCY RANGE	TEMPERATURE	TOLERANCE	INPUT POWER
FC70T2S	**2**	**.1 MHz to .5 MHz**	**−20°C to 70°C**	**±.02%**	**Operating voltage**
FC70T2S	**2**	**.5 MHz to 1 MHz**	**−20°C to 70°C**	**±.01%**	**3.5 to 5.5 VDC**
FC100T2S	**2**	**.5 MHz to 1 MHz**	**−55°C to 100°C**	**±.01%**	
HC100T2S	**2**	**.5 MHz to 1 MHz**	**−55°C to 100°C**	**±.05%**	**Tested at 5V ±10%**
PC70T2S	**2**	**.5 MHz to 1 MHz**	**−20°C to 70°C**	**±.05%**	
FC70T5P	**5**	**1 MHz to 15 MHz**	**−20°C to 70°C**	**±.005%**	**Special order for operating**
FC70T5S	**5**	**1 MHz to 15 MHz**	**−20°C to 70°C**	**±.01%**	**voltage to 12 VDC**
FC100T5S	**5**	**1 MHz to 15 MHz**	**−55°C to 100°C**	**±.01%**	
HC100T5S	**5**	**5 MHz to 15 MHz**	**−55°C to 100°C**	**±.01%**	**Power 30 mw**
PC70T5S	**5**	**5 MHz to 15 MHz**	**−20°C to 70°C**	**±.01%**	**typically**
FC70T10P	**10**	**1 MHz to 15 MHz**	**−20°C to 70°C**	**±.005%**	**5V ±10%, 300 mw**
FC70T10S	**10**	**.5 MHz to 15 MHz**	**−20°C to 70°C**	**±.01%**	**typically**

***1.6 ma max. per unit Logic "O" .4 V max. Logic "1" 2.4V min.**

PACKAGE: PC Types Fig. 8, FC Types Fig. 9, HC Types Fig. 10
TO ORDER, SPECIFY: Type and exact Frequency.

TYPE	FREQUENCY RANGE	TOLERANCE	POWER REQUIRED	PACKAGE SIZE
FC70T10P	**25 KHz to 100 KHz**	**±.02%**	**5V ±10%, 25 ma Typical**	**1.7″ x 1.7″ x .75″**
FC70T10S	**25 KHz to 100 KHz**	**±.05%**	**5V ±10%, 25 ma Typical**	**1.7″ x 1.7″ x .75″**
FC70T10P	**7 KHz to 25 KHz**	**±.02%**	**5V ±10%, 50 ma Typical**	**1.7″ x 1.7″ x .75″**
FC70T10S	**7 KHz to 25 KHz**	**±.05%**	**5V ±10%, 50 ma Typical**	**1.7″ x 1.7″ x .75″**
FC70T10P	**400 Hz to 7 KHz**	**±.02%**	**5V ±10%, 75 ma Typical**	**1.7″ x 1.7″ x .75″**
FC70T10S	**400 Hz to 7 KHz**	**±.05%**	**5V ±10%, 75 ma Typical**	**1.7″ x 1.7″ x .75″**
FC70T10P	**5 Hz to 400 Hz**	**±.02%**	**5V ±10%, 150 ma Typical**	**2.15″ x 2.15″ x .75″**
FC70T10S	**5 Hz to 400 Hz**	**±.05%**	**5V ±10%, 150 ma Typical**	**2.15″ x 2.15″ x .75″**

Logic "O" .4 V max. Logic "1" 2.4 V min.

Operating Temperature −20 to +70°C

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MILITARY QUARTZ CRYSTAL UNITS

Military Crystal Unit	Military Holder	Freq. Range Nominal KHz	Operating Temp. Range °C	Frequency Tolerance %	C_o PF	C_L PF	Mode	Test Set
CR-1A/AR	HC-11/U	3,600 to 10,000	−55° to +90°C	±0.02	–	35.0	F	TS-330
CR-1D	HC-11A/U	3,600 to 10,000	−55° to +90°C	±0.005	–	35.0	F	TS-330
CR-2/U	HC-17/U	200	−40° to +70°C	±0.009	–	125.0	F	AN/TSM-2
CR-3/U	HC-17/U	300 to 600	−40° to +70°C	±0.02	–	Series	F	AN/TSM-2
CR-4/U	HC-17/U	500 to 1,200	−40° to +70°C	±0.02	–	Series	F	AN/TSM-2
CR-5A/U	HC-17/U	2,000 to 10,000	−55° to +90°C	±0.005	–	25.0	F	TS-330
CR-6A/U	HC-17/U	2,000 to 10,000	−55° to +90°C	±0.005	–	13.0	F	TS-330
CR-7/U	HC-14/U	3,750 to 10,000	+75°	±0.004	7.0	28.0	F	TS-330
CR-8/U	HC-17/U	1,000 to 10,000	−40° to +70°C	±0.02	–	Series	F	TS-330
CR-10/U	HC-17/U	5,000	−40° to +70°C	±0.005	–	25.0	F	TS-330
CR-13/U	HC-17/U	455	−40° to +70°C	±0.02	14.0	Series	F	TS-537
CR-15B/U	HC-21/U	80 to 200	−40° to +70°C	±0.01	–	32.0	F	TS-537
CR-16B/U	HC-21/U	80 to 200	−40° to +70°C	±0.01	–	Series	F	TS-537
CR-18A/U	HC-6/U	800 to 20,000	−55° to +105°C	±0.005	7.0	32.0	F	TS-330/TS-683
CR-19A/U	HC-6/U	800 to 20,000	−55° to +105°C	±0.005	7.0	Series	F	TS-330/TS-683
CR-23/U	HC-6/U	10,000 to 75,000	−55° to +90°C	±0.005	7.0	Series	O	TS-683
CR-24/U	HC-10/U	15,000 to 50,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-25B/U	HC-6/U	200 to 500	−40° to +85°C	±0.01	–	Series	F	TS-537/TS-710
CR-26A/U	HC-6/U	200 to 500	75°C ±1°	±0.002	–	Series	F	TS-537/TS-710
CR-27A/U	HC-6/U	800 to 20,000	75°C ±1°	±0.002	7.0	32.0	F	TS-330/TS-683
CR-28A/U	HC-6/U	800 to 2,000	75°C ±1°	±0.002	7.0	Series	F	TS-330/TS-683
CR-29A/U	HC-21/U	80 to 200	75°C ±1°	±0.002	–	Series	F	TS-537/TS-710
CR-30A/U	HC-21/U	80 to 200	75°C ±1°	±0.002	–	Series	F	TS-537/TS-710
CR-31/U	HC-6/U	1,000 to 10,000	−55° to +90°C	±0.005	10.0	12.0	F	TS-330
CR-32A/U	HC-6/U	10,000 to 75,000	75°C ±1°	±0.002	7.0	Series	O	TS-683
CR-33A/U	HC-6/U	10,000 to 25,000	−55° to +105°C	±0.005	12.0	32.0	O	TS-683
CR-35A/U	HC-6/U	800 to 20,000	85°C ±1°	±0.002	7.0	32.0	F	TS-330/TS-683
CR-36A/U	HC-6/U	800 to 20,000	85°C ±1°	±0.002	7.0	Series	F	TS-330TS-683
CR-37A/U	HC-13/U	90 to 250	−40° to +70°C	±0.02	–	20.0	F	TS-537/TS-710
CR-38A/U	HC-13/U	16 to 100	−40° to +70°C	±0.012	–	20.0	F	TS-537/TS-710
CR-39/U	HC-15/U	160 to 330	−55° to +75°C	±0.003	–	Series	F	TS-710
CR-40/U	HC-15/U	160 to 330	−65° to +75°C	±0.003	–	Series	F	TS-710
CR-42A/U	HC-13/U	90 to 250	75°C ±1°	±0.003	–	32.0	F	TS-537/TS-710
CR-43/U	HC-16/U	80.860	−30° to +75°C	±0.001	45.0	45.0	F	TS-537/TS-710
CR-44/U	HC-6/U	15,000 to 20,000	85°C ±1°	±0.002	7.0	32.0	F	TS-683
CR-45/U	HC-6/U	455	−40° to +70°C	±0.02	5.0	Series	F	TS-537/TS-710
CR-46A/U	HC-6/U	200 to 550	−40° to +85°C	±0.01	–	20.0	F	TS-537/TS-710
CR-47A/U	HC-6/U	190 to 500	75°C ±1°	±0.002	–	20.0	F	TS-537/TS-710
CR-48/U	HC-6/U	800 to 3,000	−55° to +90°C	±0.0075	7.0	32.0	F	TS-330
CR-49/U	HC-6/U	800 to 3,000	−55° to +90°C	±0.0075	–	Series	F	TS-330
CR-50A/U	HC-13/U	16 to 100	−40° to +70°C	±0.012	–	Series	F	TS-710
CR-51A/U	HC-6/U	10,000 to 61,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-52A/U	HC-6/U	10,000 to 61,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-53A/U	HC-6/U	50,000 to 87,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-54A/U	HC-6/U	50,000 to 125,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-55A/U	HC-18/U	17,000 to 61,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-56A/U	HC-18/U	50,000 to 125,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-57/U	HC-6/U	500	85°C ±1°	±0.001	7.0	32.0	F	TS-710
CR-58A/U	HC-17/U	800 to 20,000	−55° to +105°C	±0.005	7.0	32.0	F	TS-330/TS-683
CR-59A/U	HC-18/U	50,000 to 125,000	85°C ±1°	±0.002	7.0	Series	O	TS-683
CR-60A/U	HC-18/U	5,000 to 20,000	−55° to +105°C	±0.005	7.0	Series	F	TS-330
CR-61/U	HC-18/U	17,000 to 61,000	85°C ±1°	±0.002	7.0	Series	O	TS-683
CR-62/U	HC-6/U	800 to 20,000	75°C ±1°	±0.001	7.0	32.0	F	TS-330/TS-683
CR-63B/U	HC-6/U	200 to 555	−40° to +70°C	±0.01	7.0	20.0	F	TS-710
CR-64/U	HC-18/U	2,900 to 20,000	−55° to +105°C	±0.005	7.0	30.0	F	TS-330/TS-683

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CR-65/U	HC-6/U	10,000 to 61,000	75°C ±1°	±0.001	7.0	Series	O	TS-683
CR-66/U	HC-6/U	3,000 to 20,000	−40° to +90°C	±0.002	7.0	30.0	F	TS-330/TS-683
CR-67A/U	HC-18/U	17,000 to 62,000	−55° to +105°C	±0.0025	7.0	Series	O	TS-683
CR-68/U	HC-6/U	3,000 to 20,000	75°C ±1°	±0.002	7.0	32.0	F	TS-330/TS-683
CR-69A/U	HC-18/U	2,900 to 25,000	−40° to +90°C	±0.002	7.0	30.0	F	TS-330/TS-683
CR-70/U	HC-13/U	4	−40° to +70°C	±0.01	–	Series	F	TS-537
CR-71/U	HC-30/U	4,500 to 5,500	+65° to +77°C	±0.00008	4.0	32.0	O	AN/TSM-17
CR-72/U	HC-25/U Mod	17,000 to 61,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-73/U	HC-29/U	17,000 to 61,000	−55°to +105°C	±0.003	4.0	Series	O	TS-683
CR-74/U	HC-26/U	45,000 to 125,000	85°C ±1°	±0.001	4.5	Series	O	TS-683/AN/TSM-15
CR-75/U	HC-6/U	50,000 to 125,000	75°C ±1°	±0.001	7.0	Series	O	TS-683/AN/TSM-15
CR-76/U	HC-18/U	17,000 to 61,000	−40° to +90°C	±0.002	3.5	Series	O	TS-683
CR-77/U	HC-25/U	17,000 to 62,000	−40° to +90°C	±0.002	7.0	Series	O	TS-683
CR-78/U	HC-25/U	2,900 to 20,000	−55° to +105°C	±0.005	7.0	30.0	F	TS-330/TS-683
CR-79/U	HC-25/U	2,900 to 20,000	−55° to +105°C	±0.005	7.0	Series	F	TS-330/TS-683
CR-80/U	HC-18/U	50,000 to 125,000	−40° to +90°C	±0.002	7.0	Series	O	TS-683
CR-81/U	HC-25/U	17,000 to 61,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-82/U	HC-25/U	50,000 to 125,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-83/U	HC-25/U	50,000 to 125,000	−40° to +90°C	±0.002	7.0	Series	O	TS-683
CR-84/U	HC-25/U	17,000 to 61,000	85°C ±1°	±0.002	7.0	Series	O	TS-683
CR-85/U	HC-6/U	800 to 20,000	−40° to +90°C	±0.002	7.0	Series	F	TS-330/TS-683
CR-86/U	HC-27/U	5,000 to 15,000	−55° to +180°C	±0.005	7.0	Series	F	TS-330/TS-683
CR-87/U	HC-27/U	15,000 to 45,000	−55° to +180°C	±0.005	7.0	Series	O	TS-683
CR-88A/U	HC-13 Mod	2.75 to 16 KHz	−40° to +70°C	±0.01	(8)15-30	Series	F	TS-710
CR-89/U	HC-32/U	2,120 to 6,200	−55° to +90°C	±0.005	7.0	30.0	F	TS-330
CR-90/U	HC-27/U	3,000 to 5,000	30°C	±0.0004	3.0	30.0	F	TS-330
CR-91/U	HC-11A/U	6,444 to 12,500	−55° to +90′	±0.001	–	55.0	F	TS-330
CR-94/U	Special	7,000 to 20,000	−55° to +105°C	±0.005	7.0	30.0	F	TS-330/TS-683
CR-95/U	HC-11A/U	2.0 to 9.25 MHz	−35° to +75°C	±0.005	–	91.0	F	TS-330
CR-96/U	HC-11A/U	2.0 to 9.25 MHz	−35° to +75°C	±0.005	–	35.0	F	TS-330
CR-97/U	HC-18	0.8 to 10 MHz	−40° to +85°C	±0.005	7.0	32.0	F	TS-330
CR-98/U	HC-25	50 to 134 MHz	−30° to +71°C	±0.0015	7.0	Series	O	TS-683/TSM-15
CR-99/U	HC-11A/U	44,000 to 69,000	−55° to +105°C	±0.005	7.0	Series	O	TS-683
CR-100/U	HC-6	1.75 to 3.5 MHz	−55° to +90°C	±0.005	7.0	32.0	F	TS-330
CR-103/U	HC-35/U	17 to 61 MHz	−55° to +105°C	±0.0025	7.0	Series	O	TS-683
CR-104/U	HC-33/U	200 to 580	75° C ±1°	±0.002	–	21.5	F	TS-710
CR-105/U	HC-18/U	48,000 to 70,000	25°C ±1°	±0.001	4.0	Series	O	TS-683
CR-106/U	HC-18/U	10,500 to 11,500	−55° to +105°C	±0.005	7.0	32.0	F	TS-330
CR-107/U	HC-18/U	70,000 to 125,000	−55° to +105°C	±0.005	6.0	Series	O	TS-683/AN/TSM-1
CR-108/U	HC-26/U	66,000 to 93,000	85°C ±1°	±0.001	5.5	Series	O	TS-683
CR-109/U	HC-25/U	10,000 to 11,500	85°C ±2°	±0.002	7.0	32.0	F	TS-330
CR-110/U	HC-18/U	63,000 to 75,000	−40° to +85°C	±0.003	4.0	Series	O	TS-683
CR-111/U	HC-18/U	17,000 to 27,000	−55° to +105°C	±0.005	4.0	Series	O	TS-683
CR-112/U	HC-18/U	5,000 to 20,000	−55° to +105°C	±0.0025	7.0	Series	F	TS-330
CR-113/U	HC-18/U	10,000 to 61,000	75°C ±1°	±0.001	7.0	Series	O	TS-683
CR-114/U	HC-25/U	2,900 to 3,850	−55° to +105°C	±0.005	7.0	32.0	F	TS-330
CR-115/U	HC-18/U	24,900 to 34,450	−55° to +105°C	±0.005	4.0	Sereis	O	TS-683
CR-116/U	HC-18/U	50,000 to 125,000	−55° to +105°C	±0.0025	4.5	Series	O	TS-683
CR-118/U	HC-25/U	10,775 to 11,250	−55° to +85°C	±0.003	7.0	32.0	F	TS-683
CR-119/U	HC-6/U	800 to 20,000	−55° to +105°C	±0.005	7.0	30.0	F	TS-330/TS-683
CR-120/U	HC-27/U	2,000 to 10,000	85° C ±.5°	±0.0005	–	100.0	F	TS-330 Mod
CR-121/U	HC-27/U	2,000 to 10,000	85° C ±.5°	±0.0005	–	50.0	F	TS-330 Mod
CR-122/U	HC-18	50 to 125 MHz	85° ±1°	±0.005	7.0	Series	O	TS-683/AN/TSM-15
CR-123/U	HC-18	50 to 125 MHz	85° ±1°	±0.00025	4.5	Series	O	TS-683/AN/TSM-15
CR-124/U	HC-18/U	2.9 to 3.8 MHz	−55° to +105°C	±0.005	7.0	32 ±0.5	F	TS-330
CR-125/U	HC-6	1.85 to 3.05 MHz	−55° to +105°C	±0.005	7.0	32.0	F	TS-330
CR-127/U	HC-6/U	10 to 61 MHz	−55° to +90°C	±0.0025	7.0	Series	O	TS-683
CR-130/U	HC-6	0.8 to 20 MHz	−40° to +90°C	±0.002	7.0	30.0	F	TS-330/TS-683

CRYSTAL BAND PASS FILTERS

Type #	Center Frequency (MHz)	Passband Minimum Bandwidth 6 db(KHz)	Stopband Maximum Bandwidth 60db(KHz)	Insertion Loss Maximum (db)	Ripple Maximum (db)	Ultimate Attenuation (db-Max)	Input & Output Impedance (OHMS)	Package Size LxWxH (Inches)
DA-21	.200	.540*	6**	5	±.5	40	5 K	$1\frac{15}{16}$" x 1 x 1½
LA-22	.200	3.6*	12**	10	±.5	40	5 K	$1\frac{15}{16}$" x 1 x 1½
EA-20	1	2.1	4.5	3	±.5	60	39000	3½ x 1⅜ x 1½
DC-20	1	.85	5.5	3	±.5	60	500	$2\frac{25}{32}$ x 1 x 1⅜
DE-5	3.3954	.4/.6	2.5	3	±.5	65	2000	$2\frac{15}{64}$ x ⅞ x $1\frac{25}{64}$
EE-13	3.395	2.1	5	3	±.5	60	2000	$2\frac{15}{64}$ x ⅞ x $1\frac{25}{64}$
NF-11	5.0	120	180	10	±1	60	3 K	2⅜ x 1 x $1\frac{1}{32}$
EK-47	10	55*	125**	3	±.5	60	2000	2¼ x 1½ x $\frac{5}{16}$
FK-48	10	.475*	2	8	±.5	70	50	$2\frac{9}{16}$ x $1\frac{5}{16}$ x 1½
FK-49	10	.95*	4	8	±.5	70	50	2⅜ x 1 x $1\frac{1}{32}$
FK-50	10	2*	5	4	±.5	70	50	2⅜ x 1 x $1\frac{1}{32}$
FK-51	10	4*	10	3	±.5	70	50	2⅜ x 1 x $1\frac{1}{32}$
FK-52	10	8.5*	19	3	±.5	70	50	2⅜ x 1 x $1\frac{1}{32}$
FK-53	10	16.5*	35	3	±.5	70	50	2⅜ x 1 x $1\frac{1}{32}$
FK-54	10	34*	68	3	±.5	70	50	2⅜ x 1 x $1\frac{1}{32}$
EB-21	10.7	3.5	8.7	3	±.5	80	200	2⅜ x 1 x $1\frac{1}{32}$
FB-6A	10.7	15	29	2	±.5	100	950	2⅜ x 1 x $1\frac{1}{32}$
FB-8A	10.7	20	39	2	±.5	90	1.3 K	2⅜ x 1 x $1\frac{1}{32}$
FB-10A	10.7	30	60	2	±.5	80	2.2 K	2⅜ x 1 x $1\frac{1}{32}$
FB-68	10.7	40	63	4	±.5	70	2.2 K	2⅜ x 1 x $1\frac{1}{32}$
ZB-60	10.7	90*	180**	3	±1	45	2.7 K 5000 In	$2\frac{9}{16}$ x $1\frac{5}{16}$ x 1
EB-1D	10.7	15*	40	6	±1	70	45 Out	$2\frac{21}{64}$ x $\frac{19}{32}$ x $\frac{21}{32}$
EB-86	10.7	7.5*	16	3	±.5	90	470	$1\frac{27}{64}$ x $1\frac{1}{64}$ x ¾
FB-5M	10.7	13	25	3	±.5	100	900	2⅜ x 1 x $1\frac{1}{32}$
GB-79	10.7	34	55	5	±.5	110	1000	2⅜ x 1 x $1\frac{1}{32}$
LB-83	10.7	250*	1100**	5	±1	50	1000	2¼ x ¾ x $\frac{15}{16}$
NB-89	10.7	200/250	500	10	±1	70	50	2⅜ x 1 x $1\frac{1}{32}$
FB-82	10.745	74*	100**	8	±1	60	100	2 x 1¼ x 1
BL-10	11.5	36*	100***	3	±.5	35	50	$2\frac{3}{16}$ x ¾ x ⅞
EL-3A	11.5	36	100	4	±.5	70	50	1¾ x 1¾ x ½
FO-9	16.9	34	65	3	±.5	90	1300	2⅜ x 1 x ¾
RP-12	17.5	500*	800	12	±.5	70	50	3 x 1¾ x 1¼
ZQ-18	20	200*	425**	4	±1	50	50	3⅛ x $1\frac{7}{16}$ x 1
ZQ-6	20	97*	218	3	±1	60	50	3⅛ x $1\frac{7}{16}$ x 1
EQ-2A	20.55	50	200	4	±.5	60	2 K	1⅞ x ½ x ⅞
GQ-20	20.6	36*	60	4	±.5	100	50	2⅜ x 1 x ¾
FR-27	21.4	75*	175	3	±.5	70	50	$1\frac{15}{16}$ x 1 x ¾
FS-11	24	36	70	4	±.5	80	50	2⅜ x 1 x $1\frac{1}{32}$
FV-25	30	50	125	4	±1	70	1000	2 x ¾ x 1¼
ZV-21	30	250	500**	10	±1	50	1000	2 x ¾ x 1¼
FV-4	30	30*	60	3	±.5	70	720	2⅜ x 1 x $1\frac{1}{32}$
FV-5	30	40*	80	4	±.5	70	960	2⅜ x 1 x $1\frac{1}{32}$
FV-6	30	80*	160	4	±.5	60	1.9 K	2⅜ x 1 x $1\frac{1}{32}$
FY-11	38	16*	40	6	±.5	60	50	2⅜ x 1 x $1\frac{1}{32}$
EY-12	45	10*	30**	5	±.5	50	50	2⅜ x 1 x $1\frac{1}{32}$
FY-8	68	12*	60	6	±.5	60	50	$2\frac{25}{32}$ x 1 x 1⅜
DY-4	75	20	800	5	±.5	60	1000	2⅜ x 1 x $1\frac{1}{32}$

These filters are representative
of standard production band pass types.
*3db Bandwidth—**45db Bandwidth—***15db Bandwidth

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ELECTRA/MIDLAND HAS A UNIQUE PROCESS FOR SEALING CRYSTALS SO THEY WILL LAST LONGER AND PERFORM BETTER FOR YOU.

Traditionally, crystals have been sealed by the old solder and flux method... a method with two major disadvantages. First, it is impossible to insure that no flux vapors enter the can and deposit on the crystal itself. This contamination contributes to high aging rates and poor frequency stability. Secondly, small balls of solder are often formed inside the solder-sealed enclosure in final processing. These can cause intermittent operation, or short-circuit the crystal unit to the can.

Recognizing this, Electra/Midland has developed an all new process using a resistance-welded seal.

We use a crystal can made of nickel and a crystal base with glass-to-metal seals. When the crystal has been mounted on the base and the base on the can, we connect one low resistance electrode to the can and a second one to the crystal base. In less than one second, electrically produced heat hermetically seals the crystal can.

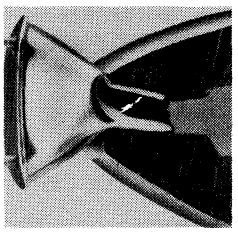
The weld is produced so quickly that virtually no heat reaches the quartz blank... thus allowing precision frequency settings with high consistency.

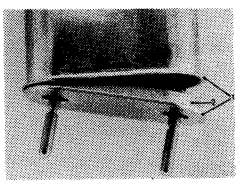
Crystals sealed by resistance-welding exhibit low aging rates because the seals are perfect to begin with, they are contaminant free, and because the weld will not deteriorate or fracture—thus air and moisture never reach the crystals to age them.

Some work has been done with cold-welds and glass fusing, but only Electra/Midland's resistance-weld process will produce crystals with a high reliability factor at solder seal prices.

This exclusive process is the result of extensive research by Electra/Midland engineers, designed to bring you the highest quality crystals at the lowest possible prices.

An hermetic seal that cannot be broken—even after extensive use—is formed.





Electra/Midland seals base to can with a single, continuous resistance weld.

The Type **HC-13** is a hermetically sealed, metal holder that accommodates crystals in the frequency range of 4 KC to 200 KC. Its size is determined by the very low frequency range in which it is used and its terminals are of the plug-in type.

The Type **HC-10** is a hermetically sealed, metal holder that is usually supplied for crystal Type CR-24, which operates in the frequency range of 15 MC to 50 MC. It is furnished with metal stud terminations which plug into a spring-clip holding device. This type of crystal holder is specified for crystal Type CR-24/U under the latest military specifications.

The Type **HC-27** is a glass holder in which the crystal is hermetically sealed under vacuum. Crystals in glass holders are utilized where higher reliability is required. Such crystals provide better aging stability and visual quality assurance. These crystals can be furnished in a frequency range from 1 to 150 MC. Also available with wire leads.

The Type **HC-26** is also a glass holder but in miniature size. It accommodates crystals in the frequency range of 5 to 150 MC. Also available with fixed pins.

The Type **HC-6** is a hermetically sealed, metal holder that accommodates crystals in the frequency range of 200 KC to 150 MC. It is used in most applications where adequate space is available and a plug-in unit is preferred. This type also available with wire leads.

The Type **ML-12** is a miniature, hermetically sealed, metal holder that accommodates crystals in the frequency range of 1 MC to 150 MC. It is intermediate in size between Type HC-18 and Type HC-6 and is used where a plug-in unit is preferred for ease in changing units. This type also available with wire leads.

The Type **HC-18** is a miniature, hermetically sealed, metal holder that accommodates crystals in the frequency range of 5 MC to 150 MC. Identical to the HC-25, it also is used where space is at a premium but is supplied with wire leads when soldered connections are preferred.

The Type **HC-25** is a miniature, hermetically sealed, metal holder that accommodates crystals in the frequency range of 5 MC to 150 MC. It is used where space is an important factor and a plug-in unit is preferred for ease in changing units.

ELECTRA/MIDLAND CORPORATION
MIDLAND DIVISION
3151 Fiberglas Road, Kansas City, Kansas 66115

erc

frequency control products

CRYSTALS • LC FILTERS
CRYSTAL FILTERS
OSCILLATORS • OVENS

electronic research co.
A TEXTRON COMPANY
(913) 631-6700
10,000 W. 75 • Overland Park, Kans. 66204

THERMOSTATS

Snap Action - ERT-S1

Long life, inexpensive thermostats for commercial or military applications.

- ★ Snap Action of bi-metal disk and wiping action of switch contacts insures long contact life and minimum radiation interference.
- ★ Temperature is pre set and not adjustable.
- ★ A dust shield insures reliability.
- ★ Switch contacts are electrically isolated from thermostat case.
- ★ All thermostats are precisely tested for open and close temperatures.
- ★ Thermostats are guaranteed for 100,000 cycles with 10 amp resistive load.
- ★ Crystal and component ovens.

TYPICAL APPLICATIONS

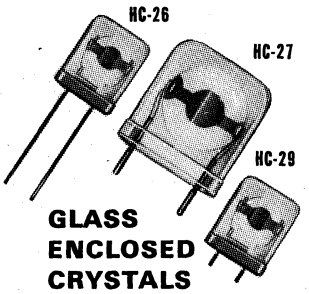
- ★ Temperature overload protectors for motors, relays, etc.
- ★ Household appliances such as electric blankets, heaters, dryers, freezers, refrigerators, etc.

TYPICAL TEMPERATURE SETTINGS		
Set Tolerance Norm Close	Set Tolerance Norm Open	Differential Range
± 5°F	± 10°F	10°F to 40°F

Temperature Range 140°F to 212°F

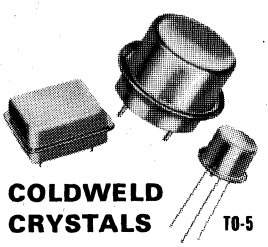
CRYSTALS

ERC produces crystals in all frequency ranges from 2 kHz to 180 mHz for telephone, computer, aircraft and radio communication industries. Our Quality Products List (QPL) currently includes low frequency, high frequency and glass enclosed crystals.



GLASS ENCLOSED CRYSTALS

supply the design engineer with the maximum in reliability and crystal Q. Minimum drive level requirements and reduction of contaminants due to improved sealing techniques, insures high stability and minimum aging. Besides improved reliability, glass provides better long term aging stability and visual quality analysis. As a high reliability replacement for the accepted HC-6/u, HC-18/u, HC-25/u holder, these units are directly interchangeable in existing equipment.



COLDWELD CRYSTALS

provide better long term aging stability with improved sealing techniques. These units are available in various sizes and configurations depending on frequency and mounting requirements. The coldweld technique eliminates possible contamination of the metal enclosure due to soldering fluxes and avoids adverse changes of high temperature effects due to heat transfer during sealing. Units will meet environmental conditions as specified by MIL-C-3098-E.

LC FILTERS

ERLC 1187 Low Pass

CENTER FREQUENCY: 80.0 mHz
.5 db PASS BAND: dc to 80.000 mHz
RIPPLE: .5 db peak to valley
STOP BAND: Attenuation 50 db min. at 111.455 mHz with a 60 db ultimate attenuation extending to 5 times the cut off frequency and a 30 db ultimate attenuation extending from 5 times the cut off frequency to 1 GHz
INPUT and OUTPUT IMPEDANCES: 50 ohms
INSERTION LOSS: .5 db
INPUT LEVEL: Up to 2 watts
TEMPERATURE RANGE: — 45° to +80°C
SIZE: 1 x 2¼ x 3

ERLC 1170 Bandpass

CENTER FREQUENCY: 37.5 kHz
LOWER 3 db BANDWIDTH: 30 kHz max.
UPPER 3 db BANDWIDTH: 45 kHz min.
30 db BANDWIDTH: 30 kHz max.
60 db BANDWIDTH: 60 kHz max.
INSERTION LOSS: Less than 3 db
RIPPLE: Less than 1 db
INPUT and OUTPUT IMPEDANCES: 10k ohms
INPUT VOLTAGE: 10 v
TEMPERATURE RANGE: — 20° to 65°C
(The rejection is at least 60 db from 0 to 200 kHz except on the skirts or in the passband and filter will not ring with 1 vrms, 1 kHz or sinewave)
SIZE: 1.490 x .590 x .790

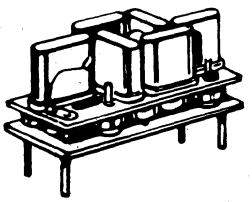
ERLC 1179 Band Suppression

CENTER FREQUENCY: 12.0 kHz
FREQUENCY RESPONSE: 1 kHz to 11 kHz within .5 db over the ambient range; 11.95 to 12.05 kHz down 50 db min. below response; 13 kHz to 2.5 mHz within .5 db @ +25°C within 1.0 db over the ambient range
INPUT and OUTPUT IMPEDANCES: 75 ohms
INSERTION LOSS: 3 db max. at the frequency of min. attenuation in the passband of 12.6 kHz to 2.5 mHz
POWER: 1 mw continuous
TEMPERTURE RANGE: 0° to +50°C
SIZE: 3¾ x 1⅛ x 7¾

ERLC 4000 Low Pass ACTIVE Filter

TYPICAL CUT OFF FREQUENCIES: 75, 300, 1280, 2400 Hz
MAXIMUM INPUT: 12v P to P
INPUT IMPEDANCE: 10k ohms min.
OUTPUT IMPEDANCE: 1.0 ohm
LOAD: 5k in parallel with 100 uuF
POWER SUPPLY: ± 15 vdc, ± 1.0 vdc, ± 6.0 ma max.
PASSBAND FLATNESS: ± .2 db from 0 to .7 Fc. +.2 db max. from .7 Fc to Fc — 1.0 db ± 5 db @ Fc
STOPBAND REJECTION: — 18.0 db min. @ 2.5 Fc — 36.0 db min. @ 5.0 Fc
PHASE SHIFT: @ +25°C, 248° ± 3° Fc from —30°C to +85°C, 248°, ± 4.5° @ Fc
GAIN: 1.0 ± 2% from 0 to .2 Fc
NOISE OUTPUT: 15 microvolts Rms max. from 10 Hz to 50 kHz
TEMPERATURE RANGE: — 30° to +85°C
SIZE: 1.12 x 1.12 x .60

CRYSTAL FILTERS



ERXF 17700 Linear Phase

CENTER FREQUENCY: 15 mHz
TEMPERATURE RANGE: — 40° to 70°C
LINEAR PHASE BANDWIDTH: 35 kHz min.
3 db BANDWIDTH: 80 kHz max.
40 db BANDWIDTH: 900 kHz max.
INSERTION LOSS: 3 db max.
PHASE SLOPE @ CENTER FREQUENCY: 5.6 msec.
SOURCE IMPEDANCE: 50 ohms
LOAD IMPEDANCE: 300 ohms
SIZE: 1.953 x .594 x .800

ERXF 18400 Spectral Purity

CENTER FREQUENCY: 60 kHz ± .6 Hz
3 db BANDWIDTH: 4 Hz ± 1 Hz
40 db BANDWIDTH: 1 kHz max.
ULTIMATE ATTENUATION: 40 db min.
INERTION LOSS: 4 db max.
INPUT and OUTPUT IMPEDANCE: 600 ohms
RIPPLE: .5 db max.
PROPORTIONAL CONTROL OVEN: 24 vdc, 12 watts max. 4 watts @ +25°C
TEMPERATURE RANGE: — 30°C to 60°C
SIZE: 4.5 x 2.5 x 1.75 max.

ERXF 11500 Airborn

CENTER FREQUENCY: 75.0 mHz
6 db BANDWIDTH: ± 12 kHz min.
40 db BANDWIDTH: ± 150 kHz max.
70 db BANDWIDTH: ± 400 kHz max.
RIPPLE: 3 db max.
ULTIMATE ATTENUATION: 70 db. min.
SPURIOUS ATTENUATION: 70 db min.
INSERTION LOSS: 6 db max.
SOURCE IMPEDANCE: 50 ohms
LOAD IMPEDANCE: 500 ohms
TEMPERATURE RANGE: — 55° to 90°C
SIZE: 1.0 x 2.187 x .750

ERXF 10800 Discriminator

CENTER FREQUENCY: 8.8 mHz
BANDWIDTH P to P: ± 20 kHz
LINEARITY: 9% over ± 20 kHz
SOURCE IMPEDANCE: 50 ohms
LOAD IMPEDANCE: 100k ohms
SENSITIVITY: ± 1 v at ± 20 kHz
TEMPERATURE: — 55°C to 110°C
SIZE: 1.75 x 1.25 x 0.50

OSCILLATORS..... TIME BASE OVENS....

TCXO

EROS 600—SL4

FREQUENCY: 5.0 mHz
STABILITY: ± 0.5 ppm, — 32° to 62°C
AGING: 1 ppm/year
ADJUSTMENT: Sufficient for 5 years aging
SHORT TERM STABILITY: Not more than 2 x 10^{-9} for a one second average aging period
VOLTAGE: +17 vdc ± .85v
POWER: Less than 100 mw
SPURIOUS: Non harmonics down 80 db harmonics down 30 db
OUTPUT: Sine wave, 1.5 v p to p into 470 ohms
SIZE: 3.635 x 1.938 x .750

EROS 600—SL23

FREQUENCY: 1.0 mHz
TEMPERATURE STABILITY: ± 2.5 x 10^{-6} over 0° to +50°C
AGING: 1 x 10^{-8} per day
SUPPLY VOLTAGE: +15 vdc ± 3% .5 watts max.
OUTPUT WAVEFORM: Sine wave, 20% max. distortion
OUTPUT VOLTAGE: TTL output
FREQUENCY ADJUSTMENT: Sufficient for 2 years aging
SIZE: 2 x 2 x .750

EROS 800—SL3

FREQUENCY: 12.8 mHz
FREQUENCY TOLERANCE:
± 1.5 x 10^{-6} over — 54° to — 29°C
± 0.5 x 10^{-6} over — 30° to +70°C
± 2 x 10^{-6} over +71° to +105°C
AGING: Less than 2 x 10^{-8} per week when measured @ +25°C
SHORT TERM DEVIATION: Less than 1 x 10^{-9} for 10 sec. average
WARM UP: 5 seconds to within 5 x 10^{-7}
INPUT: +12 vdc regulated or — 12 vdc and/or +5v with common ground .5 watts max.
OUTPUT: 1 vrms into 1k ohm ± 20% sine wave
HARMONIC DISTORTION: Does not exceed 3%
ADJUSTMENT: Sufficient for 10 years aging
ESTIMATED MTBF: 15,000 hours
WEIGHT: 6 oz. max.
HEADER: Miniature 7 pin solder
SIZE: 1.875 x 1.875 x 4.0

EROS 600—SL1

FREQUENCY: 40.755 mHz
SHORT TERM STABILITY: 10 Hz max. @ +25°C during any 10 sec. period
LONG TERM STABILITY: ± 125 Hz of nominal for min. operational period of 22.5 hrs.
POWER OUTPUT: 2 mw into 50 ohms, lv P to P min.
SPECTRAL PURITY:
Harmonics 20 db max.
Spurious 20 db max.
INPUT: 12 vdc ± lv, 20 ma max.
ADJUSTMENT: ± 125 Hz min. over 225 hrs min.
TEMPERATURE RANGE: — 54° to +90°C
WARM UP: 1 minute under std. conditions, 3 minutes under extreme conditions
WEIGHT: 3 oz. max.
SIZE: 2 x 1 x 1

VCXO

EROS 750—SL35

FREQUEICY: 12.0 mHz (settable to within ± 12 Hz)
DEVIATION : ± 10 kHz peak
SENSITIVITY: 10 kHz/v ± 10%
RATE: 300 to 4000 Hz ± 1db
LINEARITY: Within 1% of best straight line
MODULATION INPUT IMPEDANCE: 600 ohms ± 10% resistive
OUTPUT POWER: — 4 db adjustable ± 3db
LOAD IMPEDANCE: 50 ohms ± 5%
VOLTAGE: +19.5 ± 1%
HEATER POWER: 22-28v unregulated, 10 watts
WARM UP: ± 10 ppm of nom. freq. after 20 min. at 25°C
AGING:
3.5 ppm for the 1st 6 months
1.5 ppm for the 2nd 6 months
STABILITY: 10 ppm max. over — 32° to +80°C
SIZE: 2.5 x 2.0 x 1.75

EROS 400—SL38

FREQUENCY: 11.6 mHz
FREQUENCY DEVIATION RANGE: ± 5 kHz
FREQUENCY STABILITY: ± .005% 0° to 60°C
± .01% — 32°C to +80°C
AGING: ± .0025% per year
SHORT TERM STABILTY: 10^{-8} over 10 Msec.
DEVIATION RATE: dc to 3 kHz ± 1db
CONTROL VOLTAGE: +6 vdc
SENSITIVITY: — 1.5 kHz/v ± 10%
LINEARITY: Within 3% of best straight line from 0° to 60°C and within 5% — 32°C to +80°C
MODULATION INPUT IMPEDANCE: 50k ohm ± 10%
OUTPUT: +7 dbm ± 1 db
LOAD IMPEDANCE: 50 ohms
POWER REQUIREMENTS: +19.5 ± .5 vdc, 10 ma max.
ADJUSTMENT RANGE: ± .015%
SIZE: 2.25 x 2.25 x .75

EROS 400—SL3

CENTER FREQUENCY: 60 mHz
FREQUENCY DEVIATION: ± 100 kHz
ADJUSTMENT RANGE: ± 5 kHz
FREQUENCY STABLIITY:
± 1 ppm/day after 1 week warm up
± 10 ppm/day after 1 hour warm up
LINEARITY: ± 2%
DEVIATION RATE: dc — 100 kHz
CARRIER SECOND HARMONIC SUPPRESSION: 30 db
OUTPUT POWER: 0 dbm min. into 50 ohms ± 10%
OUTPUT LEVEL STABILITY: ± 1.5 db 0 to 65°C
MODULATION SENSITIVITY: Between 4 kHz/v and 20 kHz/v
SIZE: 2.5 x 3.5 x 1.5

EROS 700—SL20

FREQUENCY: 10.005 mHz ± .001% @ 27°C ± 1°
FREQUENCY DEVIATION: ± 10 kHz
VOLTAGE SENSITIVITY: 2.5 kHz/v from — 2.0 to +6.0 vdc
FM DISTORTION: Less than 2% of the level of any frequency between 300 Hz and 3 kHz deviated from a 7.5 kHz peak
INPUT IMPEDANCE: 10k ohms min.
STABILITY: Less than ± .002% from — 40° to +85°C
LONG TERM DRIFT: Less than .001% after 30 days
POWER SUPPLY: +18 v and 28 vdc
OUTPUT POWER: 7 mw ± 2 mw into 50 ohms
OUTPUT WAVEFORM: Sine, less than 15% distortion
WARM UP: 10 minutes max.
SIZE: 3.0 x 2.0 x 1.40

EROS 800—S5

FREQUENCY: 1 mHz or 5 mHz
FREQUENCY ADJUSTMENT: Sufficient for 5 years aging
AGING: 5 x 10^{-10}/day
CRYSTAL TYPE: High precision, glass enclosed
STABILITY: ± 2 x 10^{-10} per degree C from 20°C to 65°C
LINE VOLTAGE STABILITY: ± 1 x 10^{-9} for ± 5% change
OVEN SUPPLY: 28 vdc
WARM UP TIME: 1 x 10^{-8} after 1 hour
INPUT: 26 volt dc. 500 ma max.
OUTPUT VOLTAGE: 1 vrms into 500 ohms
OUTPUT WAVEFORM: Sine wave
OVEN: Proportional control
HEADER: Octal
SIZE: 2 x 2 x 4

EROS 800—S1

FREQUENCY: 1 MHz or 5 MHz
FREQUENCY ADJUSTMENT: Sufficient for 5 year aging
AGING: 1 x 10^{-9}/day
CRYSTAL TYPE: High precision, glass enclosed
STABILITY: ± 2 x 10^{-10} per degree C from 20°C to 65°C
LINE VOLTAGE STABILITY: ± 1 x 10^{-9} for ± 5% change
OVEN SUPPLY: 28 volt dc
WARM-UP TIME: 1 x 10^{-8} after 1 hr.
INPUT: 26 volt dc, 500 ma max.
OUTPUT VOLTAGE: 1 volt rms into 500 ohms
OUTPUT WAVEFORM: Sine Wave
OVEN: Proportional control
HEADER: Octal
SIZE: 2 x 2 x 4 h

EROS 800—S2

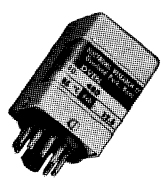
FREQUENCY: 1 MHz or 5 MHz
FREQUENCY ADJUSTMENT: Sufficient for 2 years aging
AGING: 3 x 10^{-9}/day
CRYSTAL TYPE: High precision, glass enclosed
STABILITY: ± 2 x 10^{-10} per degree C from 20°C to 65°C
LINE VOLTAGE STABILITY: ± 1 x 10^{-9} for ± 5% change
OVEN SUPPLY: 28 volt dc
WARM-UP TIME: 1 x 10^{-8} after 1 hr.
INPUT: 26 volt dc, 500 ma. max.
OUTPUT VOLTAGE: 1 volt rms into 500 ohms
OUTPUT WAVEFORM: Sine Wave
OVEN: Proportional control
HEADER: Octal
SIZE: 2 x 2 x 4 h

EROS 800—S3

FREQUENCY: 1 MHz, 3 MHz or or 5 MHz
FREQUENCY ADJUSTMENT: Sufficient for 5 years aging
AGING: 1 x 10^{-8}/day
CRYSTAL TYPE: High precision, glass enclosed
STABILITY: ± 5 x 10^{-10} per °C from — 20°C to 65°C
LINE VOLTAGE STABILITY: ± 5 x 10^{-9} for ± 5% change
OVEN SUPPLY: 28 volt dc
WARM-UP TIME: 1 x 10^{-8} after 1 hr.
INPUT: 28 volt dc 500 ma max.
OSCILLATOR VOLTAGE: 15 volt dc to 28 volt dc
OUTPUT VOLTAGE: 1 volt rms into 500 ohms
OUTPUT WAVEFORM: Sine wave
OVEN: Proportional control
HEADER: Octal
SIZE: 2 x 2 x 4 h

AC or DC—

ERC produces a complete line of component and crystal ovens with a history of over 3,000 designs and configurations that employ Solid State Temperature Control, Proportional Control, Snap-Action and Mercury Control. Proportional controlled units are available with external adjustments that set temperature to within 0.1°C over a possible 20°C temperature range for precision oscillator of solid state device application. All units are for either AC or DC applications.



ERO—710 Solid State Adjustable

CAVITY: One HC-6/u
HEADER: Octal
TEMPERATURE SETTING: 50°C to 95°C
SETTING TOLERANCE: ± 0.1°C
WARM-UP: 30 min. from — 30°C
VOLTAGE: 6 to 120 volt AC, 12 to 28 volt DC
POWER: 6 watts
SIZE: 1.437 x 1.875 x 3.437

ERO—480 Snap Action

CAVITY: Eight HC-25/u
HEADER: Octal
TEMPERATURE SETTING: 60°C, 75°C, 85°C are standard
SETTING TOLERANCE: ± 2.5°C at 25°C ambient
WARM-UP: 10 minutes at 25°C ambient
VOLTAGE: 6 thru 120 volts, AC or DC
POWER: 2.5 watts average
SIZE: 1.3125 x 1.3125 x 1.125

ERO—160 Solid State SCR

CAVITY: One HC-6/u
HEADER: Octal
TEMPERATURE SETTING: 60°C, 75°C, 85°C are standard
SETTING TOLERANCE: ± 2.5°C at 25°C ambient
WARM-UP: Within 0.1°C in 15 min. at 25°C ambient
VOLTAGE: 6 thru 120 volts AC
POWER: 2 watts average
SIZE: 1.5 OD x 2.75 seated

THOUSANDS OF FREQUENCIES

Precision Oscillators

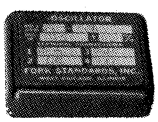
Fork Standards tuning fork and crystal oscillators provide high-accuracy outputs at frequencies from sub-audio through RF. Case sizes range from miniature PC board-mount types to plug-in, oven-stabilized frequency standards. Both square wave and sine wave outputs are available.

Tuning forks are limited to frequencies up to about 15 kHz, and are generally preferred for low-frequency applications because they require less frequency-division circuitry than an equivalent crystal unit. A low-frequency tuning fork oscillator is thus more compact, draws less current, and is usually less expensive and more reliable than a low frequency crystal unit. However, for highest accuracy or for higher frequencies, crystals are preferred.

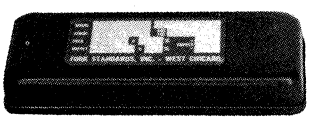
The Fork Standards oscillators which are specified most often are described below. The data in the table, along with the accuracy versus temperature range and output waveform information on the following page, enables you to specify the exact oscillator you require.



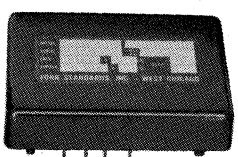
Model G, GQ
(base 1½" Sq.)



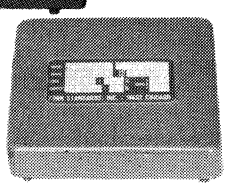
Model FO, FR
(base 1½" Sq.)



Model P, PQ
(base 1½" x 3½")



Model W, WQ
(base 2 7/16" x 2½")

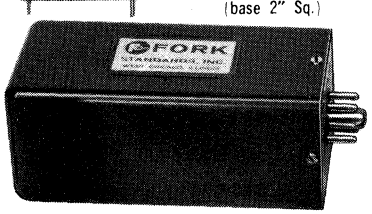


Model R, RQ
(base 3 7/16" Sq.)



Model UQ
(base 1½" Sq.)

Model DQ
(base 2" Sq.)



MODEL G: Plug-in general purpose unit with very-low-frequency capability. Also available with studs and solder hooks.

MODEL FO: Very compact, designed for printed circuit board applications. Use where space is at a premium.

MODEL P: Larger printed circuit board unit than Model FO. Increased capabilities and slightly lower unit cost. Can be chassis mounted.

MODEL W: Similar to Model P, except case proportions changed to adapt to different board layout requirements.

MODEL R: Largest PC board mount model, with lowest case profile at sub-audio frequencies.

MODEL FR: Tuning fork resonator in F case. For use where user provides oscillator circuitry, or as a highly selective audio filter element.

MODEL GQ: General-purpose plug-in crystal oscillator, with output frequencies down to .125 Hz. Can be supplied with studs and solder hooks.

MODEL UQ: Smallest crystal unit, designed for PC board mount. PC pins hold unit to board. Vernier frequency adjustment available.

MODEL PQ: General-purpose flat case unit for PC board or chassis mounting. Larger case volume than UQ.

MODEL WQ: Similar in volume to Model PQ, but base proportioned differently and designed for PC board use only.

MODEL RQ: Largest board-mounted crystal model, with lowest profile in sub-audio frequency range.

MODEL DQ: Available with either snap-action or proportional control oven, plug-in or stud-mounted base with solder hooks. Accuracy to .0005% or better over extreme temperatures.

TUNING FORK OSCILLATORS

Model	Frequency Range	Output	Height	Price
G	2 Hz to 15 kHz	Square	2½"	$ 59 up
	.017 Hz to 2 Hz	Square	3½"	134 up
	100 Hz to 15 kHz	Sine	2½"	74 up
	30 Hz to 100 Hz	Sine	3½"	119 up
FO	1 kHz to 15kHz	Square	3/8"	$ 65 up
	.25 Hz to 1 kHz	Square	.6"	80 up
	1 kHz to 15 kHz	Sine	½"	90 up
P	60 Hz to 15 kHz	Square	17/32"	$ 65 up
	.1 Hz to 60 Hz	Square	15/16"	103 up
	30 Hz to 15 kHz	Sine	15/16"	95 up
W	60 Hz to 15 kHz	Square	.6"	$ 65 up
	30 Hz to 15 kHz	Sine	.85"	95 up
R	.25 Hz to 15 kHz	Square	.6"	$ 65 up
	20 Hz to 15 kHz	Sine	.85"	95 up

TUNING FORK RESONATOR

FR	1000 Hz to 15 kHz	3/8"	$ 50 up

CRYSTAL OSCILLATORS

GQ	32 Hz to 10 MHz	Square	2½"	$ 59 up
	.12 Hz to 32 Hz	Square	3½"	171 up
	800 Hz to 10 MHz	Sine	2½"	74 up
	16 Hz to 800 Hz	Sine	3½"	141 up
UQ	12 Hz to 10 MHz	Square	½" or	$ 59 up
	50 kHz to 10 MHz	Sine	.6"	74 up
PQ	32 kHz to 10 MHz	Square	17/32"	$ 59 up
	100 Hz to 32 kHz	Square	15/16"	81 up
	800 Hz to 10 MHz	Sine	15/16"	74 up
WQ	32 kHz to 10 MHz	Square	.6"	$ 59 up
	100 Hz to 32 kHz	Square	.85"	81 up
	64 kHz to MHz	Sine	.6"	74 up
RQ	200 Hz to 10 MHz	Square	.6"	$ 59 up
	.125 Hz to 200 Hz	Square	.85"	148 up
	400 Hz to 10 MHz	Sine	.85"	74 up

OVEN-STABILIZED CRYSTAL OSCILLATOR

DQ	.125 Hz to 10 MHz	Either	4"	$134 up

CUSTOM OSCILLATORS

Fork Standards builds many oscillators to customer's specifications on special order. Non-standard output waveforms, multiple output frequencies, special cases and terminals are available with prompt delivery at competitive prices.

For an immediate quotation on your specific requirements call your local Fork Standards representative or the factory today.

Fork Standards, Inc. 213 Main Street, West Chicago, Illinois 60185 — (312) –231-3511

FROM FORK STANDARDS, INC.

Specifying a Fork Standards Oscillator:

A Fork Standards specification number completely describes the oscillator to which it refers. Conversely, a specification number may be determined whenever an oscillator requirement is completely defined. The parameters required are:

1. Frequency
2. Accuracy
3. Temperature Range
4. Output Waveform
5. Supply Voltage
6. Case Size
7. Mounting and Terminals

The first step is to determine the model that satisfies the output waveform requirement at the needed frequency from the table on the opposite page. Then select the proper accuracy/temperature code from the table at the right. For example:

G - 3C - 4K - BL - 12

- 12 = 12 VDC power supply
- BL = Square Wave Output for Micrologic drive
- 4K = 4 kHz Output Frequency
- 3C = .05% Accuracy, 0 - 65°C.
- G = Model G Case

Standard Output Waveforms

Most Fork Standards oscillators can be supplied with any of several output waveforms. The most popular of these (referenced to 12 VDC supply) are:

Square Wave:

B: 8 V p-p min. into 10 k ohm resistive load.

BN: Same as B except rise time under 1 μs and equal symmetry from binary divider.

BB: Same as BN except has two outputs, 180° out of phase.

BL: To drive micrologic. Specify manufacturer and type.

Sine Wave:

AA: 3 V rms into 10 k ohm resistive load. Harmonic distortion 1 to 10%, depending on frequency.

AT: Same as AA except transformer isolated output.

DT: 1 mW into 600 ohms, transformer isolated.

SPECIFICATION NUMBERS INDICATING OSCILLATOR ACCURACY VS OPERATING TEMPERATURE

Accuracy (%)	TEMPERATURE RANGE +15° to +35° C	0° to +65° C	— 25° to + 65° C	— 40° to + 65° C	— 55° to + 85° C
.2	2A	2C	2F	2N	2J
.1	2A	2C	3F	3N	4J
.05	2A	3C	4F	4N	5J
.01	4A	5C	6F	6N	7J
.005	5A	6C	6F	7N	7J
.0025	6A	7C	7F	8N	*
.001	7A	8C	8F	8N	*
.0005	8A	8C	8F	8N	*
.0001	9A	9C	9F	9N	*

☐ *Tuning fork, classes 2-5*

■ *Crystal without oven, classes 6-7*

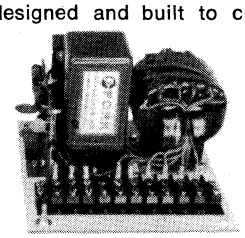
☐ *Special crystal without oven. Accuracy. 0005% from +10° to +60°C.*

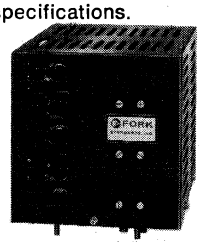
▨ *Crystal with oven, classes 8-9. Specify Model DQ.*

* *Special oven unit. Consult factory.*

PRECISION FREQUENCY POWER INVERTERS AND FREQUENCY CHANGERS

Fork Standards manufactures an extensive line of DC to AC power inverters and AC to AC frequency changers, with output frequency accurately controlled by a Fork Standards tuning fork or crystal oscillator. The line includes both standard models, described briefly below, and custom types designed and built to customer specifications.





General Specifications:

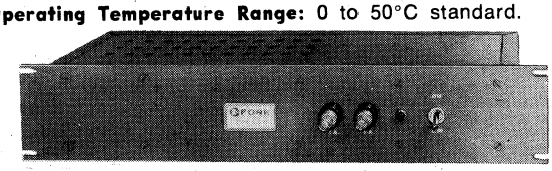
Power Output: 15, 50, 100, 250, or 500 VA.

Output Frequency: 50, 60, or 400 Hz standard; 25 to 10,000 Hz, square or sine wave, special.

Frequency Accuracy: to .01% (tuning fork); .0005% (crystal).

Input Voltage: 12 or 24 VDC (inverters); 115 or 230 VAC, 50 to 400 Hz (frequency changers).

Operating Temperature Range: 0 to 50°C standard.



OTHER PRODUCTS

Power Supply Modules

Plug-in or stud-mounted modular DC power supplies deliver regulated 5 or 12 VDC to power Fork Standards oscillators.

Synchronous Clock Motor Driver

Delivers 50, 60, 400 Hz or other required frequencies at accuracies to 1 ppm (30 seconds per year).

Frequency Dividers

Modular dividers provide one output cycle for a set number of input cycles. Standard models divide by 2, 3, 4, 5, 6, 8, 10, or 16; combination outputs are available. Special options include zero reset, gate control, and pulse output.

Solenoid/Totalizer Driver

Delivers one pulse per second (typical) to drive solenoid or totalizer. Output power to meet system requirements.

When precision is specified . . . Call Fork Standards

FORK STANDARDS, INC.

213 Main Street / West Chicago, Illinois 60185

Telephone: *AREA CODE 312*—231-3511

OSCILLATORS and FREQUENCY STANDARDS

OVER 120 STANDARD MODELS IN OUR GIANT CATALOG



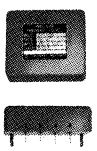
356100A

ULF Oscillators—Withstands extreme shock and vibration. Very flexible where a very low frequency is desired at a reasonable cost.



L-216

Audio and R.F. L-C Oscillators — shock proof, vibration proof and very stable.



L-217

L-C Oscillators for printed circuit board mounting. Ideal where an AUDIO TONE or an RF signal is required. Used widely in test equipment.



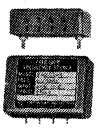
61000

Adjustable Frequency Oscillators — Slug-tuned over ±10% of specified center frequency.



313100A

General Purpose Oscillator—Crystal controlled. For very low frequency, high stability requirements.



Y283-3

Crystal Oscillators—designed to direct-drive all popular types of micrologic. 25 nanosecond maximum rise and fall time.



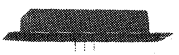
28100 and Y-312

Crystal Oscillators for general application with excellent stability. 800 Hz to 600 MHz.



Y-367

Crystal Oscillators for printed circuit mounting—3 kHz to 150 MHz.



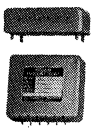
T-224

Temperature Compensated Crystal Oscillators—High stability over wide temperature range. No Oven used. Features instant warm-up.



78000 and YH-277

Frequency Standard Medium stability — 3200 Hz to 100 MHz.



YH-320

Frequency Standard—Low noise, for printed circuit board mounting.



138000A

Frequency Standard—Very stable. Uses proportional type oven.

±1 part in 10^8



356000C

Frequency Standard—Ultra stable. Uses proportional type oven.

±1 part in 10^9



228200C

Multiple Channel Crystal Oscillator—Up to 20 output frequencies in the 5 MHz - 50 MHz Range (Rotary Switch Selection).

Model No.	Frequency (Fixed)	Accuracy over Temp. Range	Temperature Range	Minimum Output	Input	Size	Price 1-3 (each)
356100A R-C	.01 Hz to 400 Hz	±2%	−40°C to 70°C	Sine 1V RMS	28V D.C.	2″ x 2″ x 4″ H	$94.50 to $190.00
L-216 L-C	100 Hz to 1 MHz	±.5%	−40°C to +70°C	Sine 1.5V RMS	28V D.C.	1½″ D x 2 9/16″ H	$87.50
L-217 L-C	100 Hz to 1 MHz	±.5%	−40°C to +70°C	Sine 1.5V RMS	28V D.C.	2 9/16″ x 2 15/16″ x ⅞″ (P-C Mount)	$89.50
61000 L-C	400 Hz to 10 MHz ± 10% Adj.	±.5%	−30°C to +60°C	Sine 2.5V RMS	28V D.C.	1½″ D x 3 11/16″ H	$114.50
313100A Crystal	1 Hz to 3000 Hz	±.015%	−40°C to +70°C	Square 6V P to P	28V D.C.	2″ x 2″ x 4″ H	$290.00 & up
Y-283-3 Crystal	70 kHz to 9 MHz	±.005% or ±.025%	−55°C to +90°C	Square 0 to 6V P to drive micrologic	+3V D.C. to +6V D.C.	1 5/8″ x 2¼″ x ¾″ H	$199.00 to $209.00
28100 & Y-312 Crystal	800 Hz to 600 MHz	±.012% or ±.005%	−40°C to +70°C	Sine 1V RMS or 1 milliwatt	28V D.C.	1¼″ D x 2 9/16″ or 1½″ D x 3 5/16″ H maximum	$119.00 to $169.00
Y-367 Crystal	3000 Hz to 150 MHz	±.015% or ±.005%	−40°C to +70°C	Sine 1V RMS or 1 milliwatt	28V D.C. or +12V D.C.	2″ x 2″ x ¾″ H (P-C Mount)	$139.00 to $195.00
T-224 (TCXO) Crystal	3 MHz to 6 MHz	Up to ±.0001%	−40°C to +70°C or −32°C to +100°C	Distorted Sine 1V P to P	No Oven 17.5V D.C. 20Ma maximum	Approx. 1¼″ x 3¾″ x ¾″ H.	$585.00 to $985.00
78000 & YH-277 Crystal	3200 Hz to 100 MHz	±.0002% to ±.00001%	0°C to +50°C	Sine 1V RMS	28V D.C. & 6V A.C. or 28V D.C.	1¾″ D x 3⅜″ H	$197.00 to $287.00
YH-320 Crystal	100 kHz to 90 MHz LOW NOISE	Up to ±.00005%	0°C to +50°C	Sine 1 Milliwatt	28V D.C. for oscillator and proportional oven	2 9/16″ x 2 15/16″ x ⅞″ H (P-C Mount)	$370.00 to $399.00
138000A Crystal	16 kHz to 70 MHz LOW NOISE	±.000001% or ±.00001%	0°C to +50°C	Sine 1V RMS	28V D.C. & 6.3V A.C. or 115V A.C. or 28V D.C.	2″ D x 3½″ H	$394.00
356000C Crystal	1 MHz to 10 MHz LOW NOISE	$\pm 1 \times 10^{-9}$	20°C to +55°C	Sine 1V RMS	28V D.C. for oscillator & proportional oven	2¾″ x 2¾″ x 4⅝″ H	$770.00
228200C 1 to 20 Crystals	5 MHz to 50 MHz	±.0001%	0°C to +55°C	Sine 1V RMS	28V D.C. for oscillator & oven	2 9/16″ x 2 15/16″ x 3 1/16″ deep	$490.00 for 10 channels

Greenray Industries, Inc.

840 West Church Road, Mechanicsburg, Pa.

Phone — (Area Code 717) 766-0223

VOLTAGE CONTROLLED OSCILLATORS

Through continuous research and specialization, Greenray Industries offers the most complete and advanced line of Frequency Standards and Oscillators in the industry.



Q-200

R-C Voltage Controlled Oscillator—Low frequency with ±20% frequency deviations. Less than 1 microsecond rise time.



P-200

L-C Voltage Controlled Oscillator—More stable than R-C types. Popular plug-in unit.



P-201

L-C Voltage Controlled Oscillator—Stabilities of ±.2%. Frequency deviations as great as ±10%.



P-202

L-C Voltage Controlled Oscillator—High frequency oscillator with ±20% frequency deviation.



PH-229 & PH-230

L-C Voltage Controlled Oscillator—Proportional oven units offer stabilities of ±.001% and frequency deviations to ±10%.

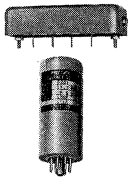
Model No. and Type	Center Frequency Range	Maximum Range of Frequency Swing	Stability over Temp. Range (at a fixed frequency)	Temperature Range	Output Wave Form and Minimum Voltage	Input	Size	Unit Price 1-3 (each)
Q-200 R-C VCO	20 Hz to 100 kHz	±10% or ±30%	±2% ±4%	0 to 50°C −40°C to +60°C	Pulse, Square or Sine	+28V D.C.	2" x 2" x 4" high	$275.00 to $375.00
P-200 L-C VCO	1 kHz to 99.99 kHz	±1% or ±4%	±.5% ±1%	0 to 50°C −40°C to +70°C	Sine 2V RMS	+28V D.C.	1¾" dia. x 3⅜" high	$489.00
P-201 L-C VCO	100 kHz to 19.99 MHz	±1%, ±5%, or ±10%	±.2% ±.5%	0 to 50°C −40°C to +70°C	Sine 2V RMS	+28V D.C.	1½" dia. x 3⅜" high	$389.00 to $485.00
P-202 L-C VCO	20 MHz to 200 MHz	±10% or ±20%	±.2% ±.5%	0 to 50°C −40°C to +70°C	Sine 1 Milliwatt into 50 ohms	+28V D.C.	2" x 2" x 4" high	$389.00
PH-229 L-C VCO	100 kHz to 20 MHz	±10%	±.01%/hr. ±.02%/day	0°C to +50°C	Sine 1 mw into 50 ohms	+28V D.C. for oscillator and proportional oven	2" x 2" x 4"	$525.00
PH-230 L-C VCO	100 kHz to 20 MHz	±2%	±.001%/hr. ±.01%/day	0°C to +50°C	Sine 1 mw into 50 ohms	+28V D.C. for oscillator and proportional oven	2" x 2" x 4"	$795.00
N-200 VCXO	4 kHz to 999.9 kHz	±.01%, ±.05% or ±.1%	±.015%	−20°C to +60°C	Sine 1V RMS	+28V D.C.	2" x 2" x 4" high	$525.00 to $675.00
N-201 VCXO	1 MHz to 60 MHz	±.01%, ±.05% ±.1%	±.005%	−20°C to +60°C	Sine 1V RMS	+28V D.C.	1½" dia. x 3⅜" high	$385.00 to $485.00
N-330 VCXO	50 kHz to 250 kHz	±.1%	±.01%/day	0 to +60°C	Square to drive T²L micrologic	+5V D.C.	2⅝" x 2 1⅝" x ⅞"	$425.00 to $475.00
N-331 VCXO	250.1 kHz to 5 MHz	±.1%	±.01%/day	0 to +60°C	Square to drive T²L micrologic	+5V D.C.	2⅝" x 2 1⅝" x ⅞"	$399.00 to $519.00
N-332 VCXO	5.1 MHz to 25 MHz	±.1%	±.01%/day	0 to +60°C	Square to drive T²L micrologic	+5V D.C.	2⅝" x 2 1⅝" x ⅞"	$385.00
NH-203A VCXO	1 MHz to 60 MHz LOW NOISE	±.01% or ±.05% or ±.1%	±.0001%	0 to 50°C	Sine 1 Milliwatt into 50 ohms	+28V D.C. for oscillator and proportional oven	2" x 2" x 4" high	$565.00 to $645.00
NH-314 VCXO	60.1 MHz to 300 MHz LOW NOISE	±.05%	±.0005%/day	0°C to +50°C	Sine 1 mw into 50 ohms	+28V D.C. for oscillator and proportional oven	2¾" x 2¾" x 4⅝"	$748.00 to $975.00
SH-219 Wide Band VCXO	500 kHz to 60 MHz LOW NOISE	±.25% or ±.5% or ±1%	±.001% ±.005%	0 to 50°C	Sine 1 Milliwatt into 50 ohms	+28V D.C. for oscillator and proportional oven	2¾" x 2¾" x 4⅝" high	$975.00 to $1450.00

Typical control voltage input: 2V RMS up to 15 kHz rate or ±3V D.C. for full modulation at 1000 ohm input impedance.—**Standard modifications available.**



N-200

Voltage Controlled Crystal Oscillator—Low frequency from 4 kHz to 999.9 kHz.



N-201

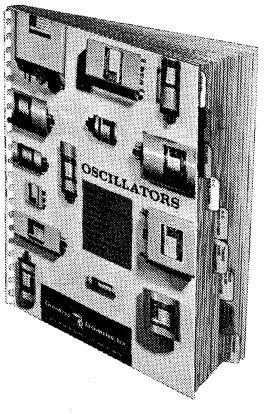
Voltage Controlled Crystal Oscillator—Nonoven unit available in flat pack or plug-in construction. Very popular.



NEW
N-330, N-331 & N-332

Voltage Controlled Crystal Oscillator—Designed to direct-drive all popular types of micrologic. 25 nanosecond maximum rise and fall time.

CALL OR WRITE FOR OUR COMPLETE CATALOG





NH-203A

Voltage Controlled Crystal Oscillator—Proportional oven unit for FM and phase locked loop applications.



NH-314

Voltage Controlled Crystal Oscillator—High frequency 60 MHz to 300 MHz.



SH-219

Wide Band Voltage Controlled Crystal Oscillator — Uses special techniques for ±1% frequency deviation.

Greenray Industries, Inc.
840 West Church Road, Mechanicsburg, Pa.
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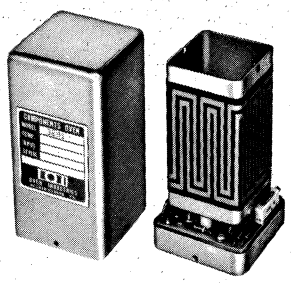
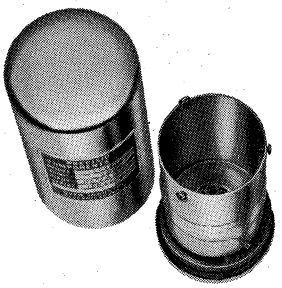
Leaders in temperature control for the electronics industry

24 HOUR QUOTE SERVICE
4 WEEK DELIVERY



SQUARE UNITS



ROUND UNITS

PROPORTIONAL CONTROL OVENS

Cavity Size (ID) A	Cavity Size (ID) B	Case Size (OD) C	Case Size (OD) D	Maximum Power	AC Proportional Model No.	AC Proportional Price 1-3	DC Proportional Model	DC Proportional Price 1-3
.960" sq.	1.187" deep	1.500" sq.	2.500" tall	8 watts	2250	$ 117.50 ea.	3250	$ 117.50 ea.
.960" sq.	1.687" deep	1.500" sq.	3.000" tall	10 watts	2260	117.50 ea.	3260	117.50 ea.
1.462" sq.	1.875" deep	2.000" sq.	3.000" tall	15 watts	2893	117.50 ea.	3893	117.50 ea.
1.462" sq.	2.187" deep	2.000" sq.	3.500" tall	15 watts	2892	117.50 ea.	3892	117.50 ea.
1.462" sq.	2.875" deep	2.000" sq.	4.000" tall	15 watts	2891	117.50 ea.	3891	117.50 ea.
1.950" sq.	2.250" deep	2.750" sq.	3.500" tall	18 watts	2251	125.00 ea.	3251	135.25 ea.
1.950" sq.	2.625" deep	2.750" sq.	4.000" tall	20 watts	2252	125.00 ea.	3252	135.25 ea.
1.950" sq.	3.250" deep	2.750" sq.	4.625" tall	25 watts	2253	125.00 ea.	3253	135.25 ea.
2.485" sq.	2.875" deep	3.062" sq.	4.000" tall	40 watts	2565	160.00 ea.	3565	165.00 ea.
2.485" sq.	3.375" deep	3.062" sq.	4.500" tall	40 watts	2566	160.00 ea.	3566	165.00 ea.
2.485" sq.	3.875" deep	3.062" sq.	5.000" tall	45 watts	2567	165.00 ea.	3567	170.00 ea.

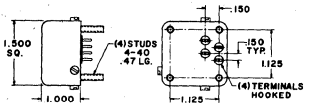
Cavity Size (ID) A	Cavity Size (ID) B	Case Size (OD) C	Case Size (OD) D	Maximum Power	AC Proportional Model No.	AC Proportional Price 1-3	DC Proportional Model	DC Proportional Price 1-3
1.462" dia.	1.875" deep	2.000" dia.	3.000" tall	15 watts	2992	117.50 ea.	3992	117.50 ea.
1.462" dia.	2.187" deep	2.000" dia.	3.500" tall	15 watts	2991	117.50 ea.	3991	117.50 ea.
1.462" dia.	2.875" deep	2.000" dia.	4.000" tall	15 watts	2990	117.50 ea.	3990	117.50 ea.

SPECIFICATIONS

Internal cavity temperature: 65°C ± 2°C setting tolerance.
Cavity temperature stability: ± .25°C over 0°C to + 50°C ambient range. ± .01°C at any fixed ambient (±.5°C).
Input voltage: AC Proportional, 117 VAC 50 to 60 Hz. DC Proportional, 28 VDC ± 5%.
Warm-up time: 15 minutes average from 0°C.
Header and mounting: 8 pin octal. Plug-in mounting. Cavity supplied with 7 pin miniature socket and mating plug. Unit available with solder lug headers and bolt down mounting. Input voltage cavity temperature modifications available—contact factory or area representative with your requirements.

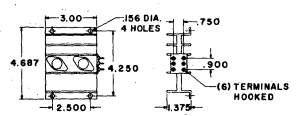
PROPORTIONAL TEMPERATURE CONTROLLERS

50 WATTS DC — **MODEL 3C2-50 LOW COST CONTROLLER**

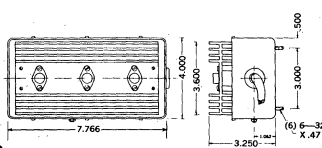


Input: 20 to 32 VDC. Will withstand overvoltage transient of 60 Volts peak for one second.
Output: 19 to 31 Volts pure DC into a 50 watt maximum resistive load.
Utilizes a thermistor sensor, which is supplied with the unit, that will control temperature to within ± .05°C.
Proportioning bandwidth: 3°C.
Set temperature (standard): Adjustable +40°C to +100°C with .5°C resolution.
Long term stability: < 1°C/6 months operation.
Price: 1 to 10 units, $65.00 each.

100 WATTS NOISLESS AC (No SCR's) — **MODEL 7C4-100**



Input: 100 to 130 VRMS, 47 Hz to 440 Hz. Will withstand overvoltage transient of 300 Volts peak for two seconds.
Output: 98 to 128 Volts pulsating DC (120 Hz ripple content) into a 100 watt maximum resistive load.
Utilizes a thermistor sensor, which is supplied with the unit, that will control temperature to within ± .05°C.
Proportioning bandwidth 3°C.
Set temperature (nominal): Adjustable +40°C to +90°C with .5°C resolution.
Long term stability: < .1°C/6 months operation.
This unit is available with three phase input (208 V).
Price: 1 to 10 units, $185.00 each.

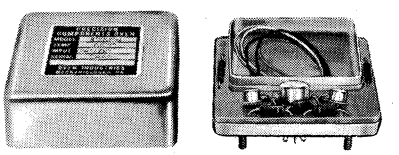


3KW 3 PHASE
MODEL 2ZC3—3000-3

Input: 100—130 VRMS, 3—Phase—WYE
Output: 95—125 VRMS, 3—Phase into a max. resistive load of 1 KW per phase
Type Of Control: Zero—voltage switching
Proportioning Bandwith: 1°C
Set Temperature: Adjustable +20°C to +60°C
Price: 1—3 units $210.00 each

PRINTED CIRCUIT MOUNT OVENS

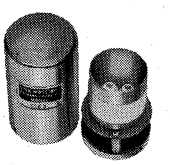
MODEL 3765-1



Cavity Size (ID)	Case Size (OD)	Model	Price 1-10 Units
1.900" sq. x .500" deep	2.562" x 2.937" x .875" thick	3765-1	$ 99.50 ea.
1.900" sq. x 1.000" deep	2.562" x 2.937" x 1.500" thick	3147-1	109.25 ea.
1.900" sq. x 2.000" deep	2.562" x 2.937" x 2.625" thick	3261	129.50 ea.

Cavity temperature: 65°C ± 2°C setting tolerance.
Cavity temperature stability: ± .008°C at any fixed ambient (±.5°C).
Input voltage: 28 VDC ± 1%.
Maximum Power: 10 watts, average power 3 watts.
Warm-up time: 30 minutes from — 20°C.
Cavity supplied with 6 #28 color coded teflon leads.
Header: 8 pin hooked.
Mounting: 4 studs.

AC PROPORTIONAL ZERO VOLTAGE SWITCH CRYSTAL OVEN



WILL ACCEPT 2 HC-6/U CRYSTALS

MODEL 5169

Cavity Size: (ID) .962 Dia. x 2.330
Case Size: (OD) 1.297 Dia. x 2.330
Cavity Temperature: Selectable from 55°C to 85°C ±2°C setting tolerance
Cavity Temperature Stability: .5°C over 0°C to within 15°C of Cavity set temperature. ±.15°C at any fixed ambient (±.5°C)
Input Voltage Range: 28—135 VAC ±10%
Max Power: 10 W
Warm-up Time: 15 mins. from 0°C
Header: 8 Pin Octal
Price: 1—3 units $105.00 each

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CLARK CRYSTALS FOR A VARIETY OF APPLICATIONS

CLARK CRYSTALS—MILITARY TYPE—MIL-C-3098 SERIES

Frequency Range (Specify exact frequency desired)	Maximum frequency change over temperature range. (See note 1)	Temperature Range	Load Capacity (See note 2)	Mode of Operation	Type of Cut	Military CR type	Crystal Holder	Clark Number	PRICE LIST Frequency Range	1-4 units
16 kHz to 100 kHz	±.012%	−40°C to +70°C	20pf	Fundamental	NT	CR-38A/U	HC-13/U	CL-38	16 kHz to 49.99 kHz	$24.00
16 kHz to 100 kHz	±.012%	−40°C to +70°C	Series	Fundamental	NT	CR-50A/U	HC-13/U	CL-50	50 kHz to 100.0 kHz	20.00
90 kHz to 250 kHz	±.02%	−40°C to +70°C	20pf	Fundamental	5°X	CR-37A/U	HC-13/U	CL-37	90 kHz to 114.9 kHz	$12.00
90 kHz to 250 kHz	±.002% (See note 3)	+70°C to +80°C (See note 7)	32pf	Fundamental	5°X	CR-42A/U	HC-13/U	CL-42	115 kHz to 250 kHz	11.50
200 kHz to 555 kHz	±.01%	−40°C to +85°C	Series	Fundamental	DT or SL	CR-25A/U	HC-6/U	CL-25		
200 kHz to 500 kHz	±.0005%	+70°C to +80°C (See note 5)	Series	Fundamental	DT or SL	CR-26A/U	HC-6/U	CL-26		
455 kHz	±.02%	−40°C to +70°C	Series	Fundamental	SL	CR-45/U	HC-6/U	CL-45	200 kHz to 499.9 kHz	$10.00
200 kHz to 550 kHz	±.01%	−40°C to +85°C	20pf	Fundamental	DT or SL	CR-46A/U	HC-6/U	CL-46	500 kHz to 555 kHz	12.00
190 kHz to 500 kHz	±.0005%	+70°C to +80°C (See note 5)	20pf	Fundamental	DT or SL	CR-47A/U	HC-6/U	CL-47		
200 kHz to 555 kHz	±.01%	−40°C to +70°C	20pf	Fundamental	DT or SL	CR-63A/U	HC-6/U	CL-63		
.8 MHz to 20 MHz	±.005%	−55°C to +105°C	32pf	Fundamental	AT	CR-18A/U	HC-6/U	CL-18		
.8 MHz to 20 MHz	±.005%	−55°C to +105°C	Series	Fundamental	AT	CR-19A/U	HC-6/U	CL-19		
.8 MHz to 20 MHz	±.0005%	+70°C to +80°C (See note 5)	32pf	Fundamental	AT	CR-27A/U	HC-6/U	CL-27	.800 MHz to .999 MHz	$18.00
									1.000 MHz to 1.49 MHz	12.00
.8 MHz to 20 MHz	±.0005%	+70°C to +80°C (See note 5)	Series	Fundamental	AT	CR-28A/U	HC-6/U	CL-28	1.500 MHz to 1.99 MHz	8.50
									2.000 MHz to 2.499 MHz	8.25
.8 MHz to 20 MHz	±.0005%	+80°C to +90°C (See note 5)	Series	Fundamental	AT	CR-35A/U	HC-6/U	CL-35	2.500 MHz to 2.999 MHz	7.25
									3.000 MHz to 5.999 MHz	6.80
.8 MHz to 20 MHz	±.0005%	+80°C to +90°C (See note 6)	32pf	Fundamental	AT	CR-36A/U	HC-6/U	CL-36	6.000 MHz to 9.999 MHz	6.60
									10.00 MHz to 14.99 MHz	6.25
.8 MHz to 20 MHz	±.005%	−55°C to +105°C	32pf	Fundamental	AT	CR-58A/U	HC-17/U	CL-58	15.00 MHz to 17.499 MHz	6.75
									17.50 MHz to 19.999 MHz	7.50
.8 MHz to 20 MHz	±.0005%	+70°C to +80°C (See note 5)	32pf	Fundamental	AT	CR-62/U	HC-6/U	CL-62	20.00 MHz to 22.999 MHz	8.75
									Add $6.00 to above prices for CL-85	
3 MHz to 20 MHz	±.0005%	+70°C to +80°C (See note 5)	32pf	Fundamental	AT	CR-68/U	HC-6/U	CL-68		
.8 MHz to 20 MHz	±.002%	−40°C to +90°C	Series	Fundamental	AT	CR-85/U	HC-6/U	CL-85		
	±.003%	−55°C to −40°C & +90°C to +105°C								
5 MHz to 20 MHz	±.005%	−55°C to +105°C	Series	Fundamental	AT	CR-60A/U	HC-18/U	CL-60	2.90 MHz to 3.299 MHz	$18.00
									3.30 MHz to 3.699 MHz	15.50
2.9 MHz to 20 MHz	±.005%	−55°C to +105°C	30pf	Fundamental	AT	CR-64/U	HC-18/U	CL-64	3.70 MHz to 3.999 MHz	13.75
									4.00 MHz to 4.499 MHz	12.00
2.9 MHz to 25 MHz	±.002%	−40°C to +90°C	30pf	Fundamental	AT	CR-69/U	HC-18/U	CL-69	4.50 MHz to 4.999 MHz	10.25
	±.003%	−55°C to −40°C & +90°C to +105°C							5.00 MHz to 5.999 MHz	9.90
									6.00 MHz to 7.499 MHz	9.00
									7.50 MHz to 9.999 MHz	8.50
2.9 MHz to 20 MHz	±.005%	−55°C to +105°C	30pf	Fundamental	AT	CR-78/U	HC-25/U	CL-78	10.00 MHz to 15.999 MHz	8.00
									16.00 MHz to 20.000 MHz	8.25
2.9 MHz to 20 MHz	±.005%	−55°C to +105°C	Series	Fundamental	AT	CR-79/U	HC-25/U	CL-79	Add $10.00 to prices above for CL-69	
10 MHz to 61 MHz	±.00025% (See note 4)	+70° to +80°C (See note 5)	Series	3rd	AT	CR-65/U	HC-6/U	CL-65	10.0 MHz to 61 MHz	$9.00
10 MHz to 25 MHz	±.005%	−55°C to +105°C	32pf	3rd	AT	CR-33/U	HC-6/U	CL-33	Add $2.00 to price above for CL-65	
10 MHz to 61 MHz	±.005%	−55°C to +105°C	Series	3rd	AT	CR-52A/U	HC-6/U	CL-52		
50 MHz to 125 MHz	±.005%	−55°C to +105°C	Series	5th	AT	CR-59A/U	HC-6/U	CL-54	50.0 MHz to 74.99 MHz	$ 9.50
									75.0 MHz to 99.99 MHz	10.50
50 MHz to 125 MHz	±.00025% (See note 4)	+70°C to +80°C (See note 5)	Series	5th	AT	CR-75/U	HC-6/U	CL-75	100.0 MHz to 125.00 MHz	13.50
									Add $2.00 to prices above for CL-75	
17 MHz to 61 MHz	±.005%	−55°C to +105°C	Series	3rd	AT	CR-55/U	HC-18/U	CL-55	17.0 MHz to 19.99 MHz	$10.00
17 MHz to 61 MHz	±.0005%	−55°C to +105°C	Series	3rd	AT	CR-61/U	HC-18/U	CL-61	20.0 MHz to 49.99 MHz	9.00
17 MHz to 61 MHz	±.0025%	−55°C to +105°C	Series	3rd	AT	CR-67/U	HC-18/U	CL-67	50.0 MHz to 61.00 MHz	10.00
17 MHz to 61 MHz	±.002%	−40°C to +90°C	Series	3rd	AT	CR-76/U	HC-18/U	CL-76	Add $3.00 to prices above for CL-67 and CL-76	
	±.003%	−55°C to −40°C & +90°C to +105°C								
50 MHz to 125 MHz	±.005%	−55°C to +105°C	Series	5th	AT	CR-56A/U	HC-18/U	CL-56	50.0 MHz to 74.99 MHz	$10.50
50 MHz to 125 MHz	±.0005%	+80°C to +90°C	Series	5th	AT	CR-59A/U	HC-18/U	CL-59	75.0 MHz to 99.99 MHz	12.50
									100.0 MHz to 125.00 MHz	16.00
50 MHz to 125 MHz	±.002%	−40°C to +90°C	Series	5th	AT	CR-80/U	HC-18/U	CL-80	Add $4.50 to above prices for CL-80	
	±.003%	−55°C to −40°C & +90°C to +105°C								
17 MHz to 62 MHz	±.002%	−40°C to +90°C	Series	3rd	AT	CR-77/U	HC-25/U	CL-77	17.0 MHz to 19.99 MHz	$10.00
	±.003%	−55°C to −40°C & +90°C to +105°C							20.0 MHz to 49.99 MHz	9.00
									50.0 MHz to 61.00 MHz	10.00
17 MHz to 61 MHz	±.005%	−55°C to +105°C	Series	3rd	AT	CR-81/U	HC-25/U	CL-81	Add $4.50 to above prices for CL-77	
17 MHz to 61 MHz	±.0005%	+80°C to +90°C	Series	3rd	AT	CR-84/U	HC-25/U	CL-84		
50 MHz to 125 MHz	±.005%	−55°C to +105°C	Series	5th	AT	CR-82/U	HC-25/U	CL-82	50.0 MHz to 74.99 MHz	$10.50
									75.0 MHz to 99.99 MHz	12.50
									100.0 MHz to 125.00 MHz	$16.00

Frequency Ranges given are per MIL-C-3098. CLARK numbers cover wider ranges in most types

Note 1: Setting tolerance ±.002% unless otherwise specified.

Note 2: Series indicates that crystal is operated in a series oscillator circuit without series capacitance (180° phase shift between crystal connections).

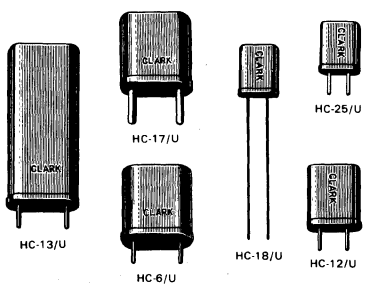
Note 3: ±.003% setting tolerance.

Note 4: ±.001% setting tolerance.

Note 5: Recommended for oven operation. Set at 75°C, ±2°C. (Clark oven type, CO-23.)

Note 6: Recommended for oven operation. Set at 85°C, ±2°C. (Clark oven type, CO-24.)

Note 7: Recommended for oven operation. Set at 75°C, ±2°C. (Clark oven type, CO-25.)



ORDERING INFORMATION

1. Select crystal desired from chart and order by Clark number and exact frequency desired. (or call Clark about special requirements).
2. Use prices shown. If money accompanies order, add 25¢ per crystal for postage, handling, and insurance.
3. Delivery: 2-3 weeks, ARO (for small quantities)

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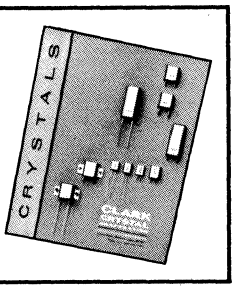

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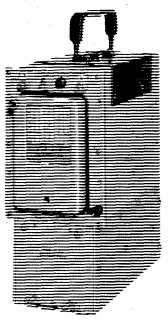
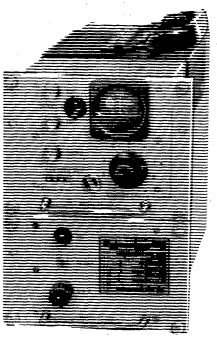
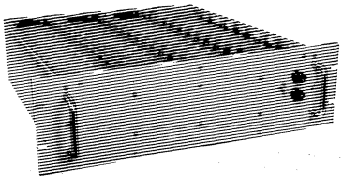
INSTRUMENTATION



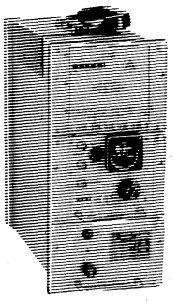
DIGITAL PHASE COMPARATORS



HIGH STABILITY FREQUENCY STANDARDS

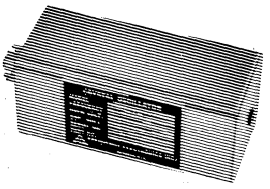


DISTRIBUTION AMPLIFIERS

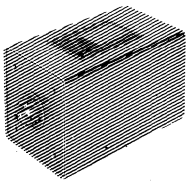


PORTABLE DIGITAL CLOCKS

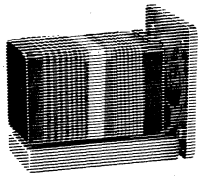
COMPONENTS



CRYSTAL OSCILLATORS

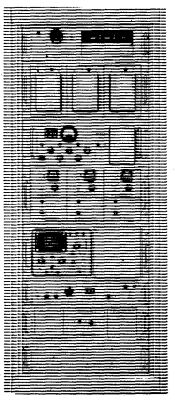


LINEAR DISCRIMINATORS



PROPORTIONAL OVENS

SYSTEMS



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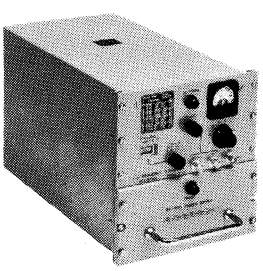
Gibbs' capabilities are by no means limited to the manufacture of stock items... All of these facilities are **available to you** for the development of equipment of highest reliability for the most specialized applications.

Whatever your particular application, it is likely that some combination of Gibbs stock modular designed oscillators will meet your requirements. Through this concept the oscillator is the frequency source and additional output circuits are simply plugged in to meet the specific requirements of the application. Such modular design makes high reliability oscillators available on short delivery at relatively modest cost. The models shown here are typical GIBBS Oscillators. We can tailor a unit to fit your requirements.

GIBBS ULTRA HIGH STABILITY FREQUENCY STANDARDS

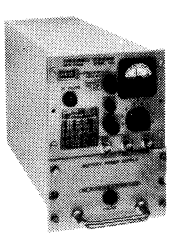
FOR LABORATORY STANDARDS, NAVIGATION SYSTEMS, TIME BASES

GIBBS MODEL 570



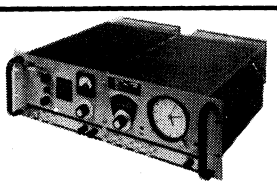
The ultimate in high stability Frequency Standards. **LONG TERM STABILITY:** 1 x 10^{-11} per day. **OUTPUT FREQ.:** 5 MHz, 1 MHz and 100 KHz. **POWER REQUIREMENTS:** 115 V ±10%, 60 Hz, 18 watts nominal. Automatically recharged internal battery maintains output frequency without interruption during transport or power failure. **DIMENSIONS:** 8¼" high; 8" wide; 16" deep.

GIBBS MODEL 568



A portable Frequency Standard of high stability manufactured to Mil-F-21584C (Ships) specs. Military designation AN/URQ-10. **FREQ. STABILITY:** 5 x 10^{-10} per day (long term); 5 x 10^{-12} rms average of 100 consecutive 1 second periods (short term). **OUTPUT FREQ.:** 5 MHz, 1 MHz and 100 KHz. **POWER REQUIREMENTS:** 115 V ±10%, 50 to 400 Hz; 12 watts, nominal. Automatically recharged battery maintains output frequency without interruption during transport or power failure. **DIMENSIONS:** 7 13/16" high, 5½" wide; 12½" deep.

GIBBS MODEL 572



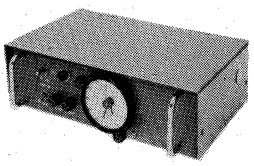
A rack mounted 5 MHz Frequency Standard combined with analog-type 24 hour clock with sweep second hand. **FREQ. STABILITY:** 5 x 10^{-10} per day. **OUTPUT FREQ.:** 5 MHz, 1 MHz, 100 KHz, 10 KHz, 1 KHz, 100 PPS and 1 PPS. **POWER REQUIREMENTS:** 115 V ±10%, 50 to 400 Hz; 28 watts, nominal. Automatically recharged battery maintains clock operation without interruption during power failures. **DIMENSIONS:** 5¼" panel, 19" rack; 15¼" deep behind panel; 16¾" overall depth.

MODEL 571

Same as MODEL 572 above except without clock but with redundant circuitry and outputs.

FREQUENCY STANDARD CLOCK

GIBBS MODEL 438



The Gibbs Model 438 Frequency Standard Clock is a completely transistorized, quartz crystal-controlled clock, timer, and frequency standard.

Some applications are: aircraft terminals and bases, air traffic control timing systems, time clock checks and updating, recorders laboratory standards, slave clocks, and seismographic use.

SUPPLY VOLTAGE:
110 VAC 60 Hz or 12 VDC battery @ 20 watts max.

FEATURES:

Time Indication: Front panel 24 hour clock with sweep second hand. All hands can be instantaneously reset to zero using a simple ¼ turn reset knob.

Mechanical Programmer: Cam operated contacts that close at 12 hours, 1 hour, and 1 minute intervals.

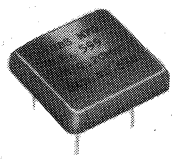
Accuracy: Better than 0.0001% with a drift rate of less than .0004% per year.

Auxiliary Power Output: 60 Hz square @ approx. 150 V PP into a 2K load.

GIBBS CRYSTAL OSCILLATORS

TYPICAL GIBBS CRYSTAL OSCILLATORS

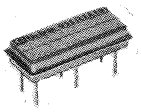
NEW FROM GIBBS

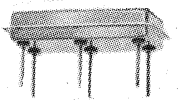


MODEL 599
L. 1½"
W. 1½"
H. .300" Max.

MODEL 599

Low Profile for Printed Circuit Board Mount. Temperature range from −55°C to 125°C. Choice of discrete frequencies from 2.5 MHz to 20 MHz. **SUPPLY VOLTAGE:** +5 VDC ±5% @ 30 MA. Max. **OUTPUT:** Any discrete frequency between 2.5 MHz and 30 MHz. ±0.1% Maximum frequency drift from −55 to 125°C. **WAVEFORM:** Logic (0) .5V Max., Logic (1) +2.7V Min., Rt and Ft = 5 Nanosec. Max., Load: TTL (Typical). **ENVIRONMENTAL:** Designed to withstand high impact shock and vibration. **TYPICAL USAGE:** Communications equipment or digital systems.



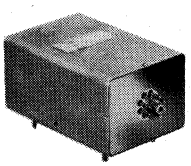


MODEL 606
Low Profile Coldweld Crystal Oscillator

MODEL 606
L. 1¾"
W. 1¼"
H. .370 Max.

Low cost, less than $40.00 in quantities of 10 to 24. Widest range frequencies available in miniature construction 2.5 to 30 MHz. Only .370 inches max. height for P. C. mount. Cold weld construction for positive hermetic seal and minimum contamination. **SUPPLY VOLTAGE:** +5 ±.5 VDC @ 75 mw max. **OUTPUT FREQUENCIES:** Any discrete frequency between 2.5 and 30 MHz aavilable. **FREQUENCY DRIFT TOLERANCE:** ±.005% maximum allowable deviation over the temperature range of −40 to +65°C, ±.01% from −55 to +125°C. **OUTPUT WAVEFORM:** Square wave, compatible with T²L integrated circuits. Unit designed for high shock, vibration, and humidity environment. **TYPICAL USAGE:** Communication equipment or digital systems.

MODEL 518



MODEL 518
L. 5¼",
W. 3¹³⁄₆₄",
H. 2³³⁄₆₄.

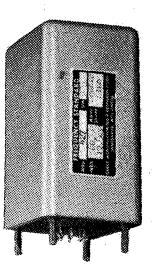
SUPPLY VOLTAGE: 115 VAC ±10% 50 to 400 Hz or DC input to customers' spec. **OUTPUT:** 30 Hz to high audio ±1 PPM calibration tolerance @ 25 ±5°C. Binarily related multiple outputs available. **STABILITY:** ±1 PPM/week after warmup. **TEMP. COEF. of FREQ.:** ±2 PPM 0 to 50°C. **FREQUENCY ADJ.:** ±25 PPM minimum. **WAVEFORM:** Sine, square or pulse to customers' spec. 5 VPP minimum squarewave into 5K load is standard. **APPLICATION:** Industrial, will withstand normal handling and limited shock and vibration unless ruggedized configuration is requested. Unit has been supplied to Mil-Std. 810 Application. **COMMENTS:** Very popular for lab use. Extensively used at 60 Hz output for facsimile equipment and inverter/converter power supplies.

MODEL 414: Superseded by Model 518. Same specifications as Model 518

BOTH MODELS AVAILABLE WITH PROPORTIONAL OR THERMOSTAT OVEN CONTROL.

MODEL 427

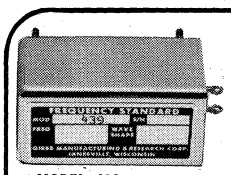
SUPPLY VOLTAGE: 28 ±2 VDC or 12 ±1 VDC. **OUTPUT:** 1 Hz to 100 KHz ±1 PPM calibration tolerance @ 25 ±5°C. *Binarily related multiple outputs available. **STABILITY:** ±1 PPM/day after warmup. **TEMP. COEF. of FREQ.:** ±5 PPM −20 to 75°C. **FREQ. ADJ.:** ±15 PPM minimum. **WAVEFORM:** Sine, square or pulse to customer spec., 5 VPP squarewave into 10K load is standard. **APPLICATION:** Industrial or Military. Very rugged, compact design for portable and mobile gear. **COMMENTS:** Extensively used @ 38.4 KHz and 1 Hz as accurate time base for mobile seismograph recording equipment. *Calibration, stability specs. apply for unit with oven control. Wider tolerances available at lower cost w/o oven.



MODEL 427
L. 4½",
W. 2",
H. 2".

THERMOSTAT OVEN CONTROL OR NO OVEN CONTROL.

MODEL 439



MODEL 439
L. 3",
W. 1⁵⁄₁₆",
H. 1⁵⁄₁₆".

SUPPLY VOLTAGE: 12 ±2 VDC or 27 ±3 VDC. **OUTPUT:** 1 KHz to 100 KHz ±20 PPM calibration tolerance @ 25 ±5°C. **STABILITY:** ±5 PPM/day under static ambient conditions. **TEMP. COEF. of FREQ.:** ±100 PPM −40 to +60°C. **FREQ. ADJ.:** None. **WAVEFORM:** Square, sine or pulse to customer spec. 8 VPP into 10K is standard. **APPLICATION:** Industrial or Military. **COMMENTS:** This unit has found wide industrial acceptance for replacement of unstable tuning forks at relatively low output frequencies. **NO OVEN CONTROL.**

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GIBBS CRYSTAL OSCILLATORS

TEMPERATURE COMPENSATED

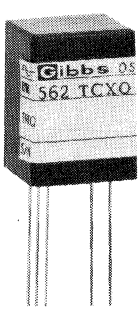
MODEL 520 TCXO



MODEL 520
L. 2″
W. 2″
H. .800″ Max.

SUPPLY VOLTAGE: Any discrete voltage between +20 and +30 VDC ±2% @ 650 mw typical. **OUTPUT FREQUENCIES:** Any discrete frequency between 1.0 and 10 MHz available. **FREQUENCY DRIFT TOLERANCE:** ±.0002% (2 PPM) maximum allowable frequency deviation over temperature range of −40 to 75°C, ±.0005% (5 PPM) over temperature range of −54 to 85°C. **LONG TERM AGING:** 2 PPM per year maximum. **FREQUENCY ADJUSTMENT:** Manual screwdrive adjust ±.0004% about the center frequency setable to resolutions of .05 PPM of desired frequency. **OUTPUT WAVEFORM:** Square wave, compatible with T²L integrated circuits. Other loads available upon request. **TERMINATIONS:** Glass to metal seal header or per customer request. **MOUNTING:** (4) 4-40 studs. Unit designed for high shock, vibration, and humidity environment. **TYPICAL USAGE:** Navigation or Communications Systems.

MODEL 562

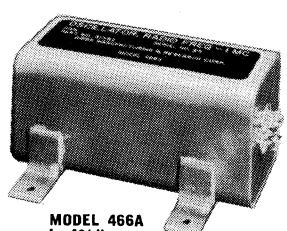


MODEL 562
L. 1⅛″ by
⅞″ square.
Typical

SUPPLY VOLTAGE: +5 VDC for Dividers, any discrete voltage between +12 and 35 VDC for T.C. networks. **OUTPUT:** 60 Hz to 4 MHz ±2 PPM calibration tolerance @ 25 ±5°C. **STABILITY:** ±.1 PPM/day under static ambient conditions. **TEMP. COEF. of FREQ.:** ±5 PPM from 0 to 50°C. **FREQ. ADJUST.:** ±5 PPM min. **WAVE FORM:** Logic squarewave, "1" state +4.5 min. "0" state ±5 V max. **APPLICATIONS:** Industrial — can be adapted for military use. **COMMENTS:** Unit can also be supplied without Temp. Compensation at reduced cost. Designed for use with IC's and mounts on PCB.

PROPORTIONAL OVEN CONTROLLED

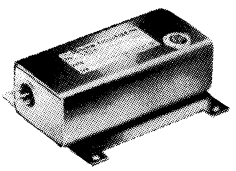
MODEL 466A



MODEL 466A
L. 4¾″,
2⅛″ square.

SUPPLY VOLTAGE: 28 ±3 VDC oven and oscillator. 3 watts average power after warmup. **OUTPUT:** 1 MHz precision ±.01 PPM calibration tolerance @ 25 ±5°C. **STABILITY:** ±.005 PPM/day under static ambient conditions. ±.05 PPM 0 to 50°C. **TEMP. COEF. of FREQ.:** ±.05 PPM from 0 to 50°C. **FREQ. ADJ.:** ±4 PPM minimum with external screwdriver. **WAVEFORM:** 1 VRMS Sinewave — 5K load. **APPLICATION:** Military, 100G shock, 20G vibration. **COMMENTS:** Originally designed for Minuteman Program. Unit has been adapted for less stringent commercial use.

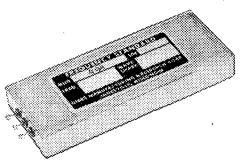
MODEL 537



MODEL 537
L. 3²⁹⁄₃₂″,
W. 3″,
H. 1¹⁷⁄₆₄″.

SUPPLY VOLTAGE: 12 ±1 VDC. **OUTPUT:** 3600 Hz to 250 KHz ±1 PPM calibration tolerance @ 25 ±5°C. **STABILITY:** ±0.5 PPM/day under static ambient conditions. **TEMP. COEF. of FREQ.:** ±5 or ±10 PPM from 0 to 50°C. **FREQ. ADJUST.:** ±10 PPM minimum. **WAVEFORM:** Square, 5 VPP minimum into 10K load. **APPLICATION:** Industrial or military. Meets requirements of Mil-E-16400. **COMMENTS:** Supplied @ 3600 Hz for Naval Facsimile Systems. Complete integrated circuitry.

MODEL 494

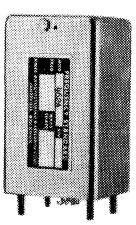


MODEL 494
L. 3⅝″,
W. 1¹³⁄₃₂″,
H. ½″.

SUPPLY VOLTAGE: 5 ±0.5 VDC or 12 ±0.1 VDC. **OUTPUT:** 500 KHz to 10 MHz ±.05 PPM calibration tolerance @ 25 ±5°C. **STABILITY:** .01 PPM/day under static ambient conditions. **TEMP. COEF. of FREQ.:** ±5 or ±10 PPM from −55 to +85°C. **FREQ. ADJ.:** 10 PPM minimum. **WAVEFORM:** 4 VPP minimum squarewave into 2.2K load. **APPLICATIONS:** Designed for Spaceborne use. **COMMENTS:** Originally designed as a "high rel" space unit. Now available for individual use. Incorporates stainless steel case with threaded inserts for PCB use. 5 VDC input and logic squarewave output. Unit is very popular for use with ICs.

VOLTAGE CONTROLLED

MODEL 462A



MODEL 462A
L. 3⁵⁄₁₆″,
W. 2″,
H. 1¹⁄₁₆″.

SUPPLY VOLTAGE: +20 VDC ±.05% @ 40 Ma. **FREQ. CONTROL VOLTAGE:** +1.5 to 3.5 VDC. **CONTROL VOLTAGE SENSITIVITY:** 1 CPS/Mv. **OUTPUT:** Frequency, Hi, 1101 KHz: C-1100 KHz: Lo-1099 KHz. **STABILITY & LINEARITY:** ±10 PPM/day ±2 PPM/hr. over any 5°C range between −40°C to +75°C. Voltage and waveforms-Sinewave, 0.25 VRMS into 2.2K load. Spurious frequencies outside the pass band — 55 db down. **APPLICATIONS:** Single side band radio receivers.

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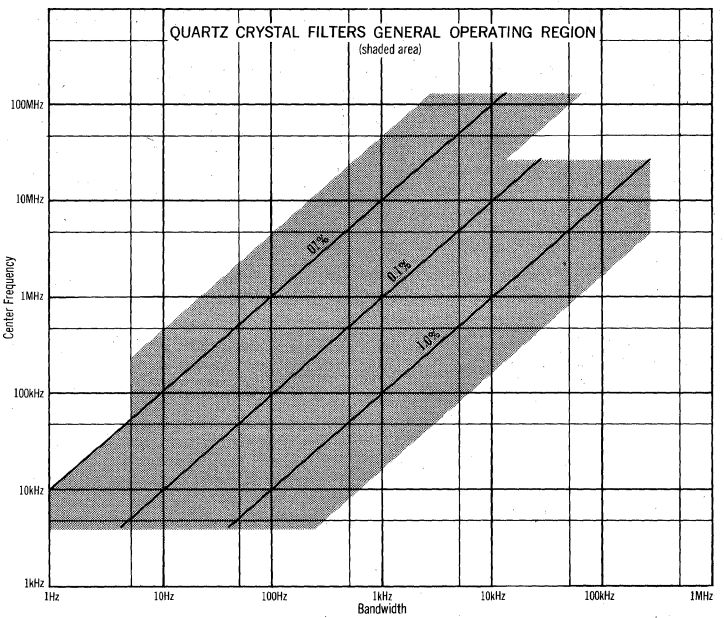
HUGHES

CRYSTAL FILTERS

As the nation's leading supplier of precision crystal filters, Hughes offers years of technical experience backed by the industry's most advanced production and test facilities. Thousands of Hughes crystal filters are currently in use in missiles, space vehicles, radar systems and communications equipment. Available in various frequencies, sizes and environmental standards, Hughes filter types include bandpass, single sideband, band rejection, contiguous comb doppler and thin-film monolithic.



Bandpass & Single Sideband Filters. Narrow passbands, steep shape factors and low insertion losses are characteristic of all Hughes bandpass and single sideband filters. General specifications include:

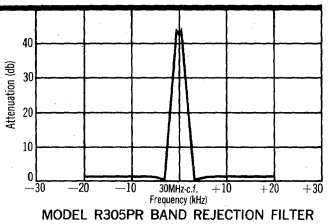
Center Frequency Range	10kHz to 100MHz
Fractional Bandwidth Range	0.002% to 6%
Shape Factor (60 db/3 db ratio)	As low as 1.15 to 1
Insertion Loss	Down to 0.1 db
Passband Ripple	Down to ±0.1 db

Note: Refer to the General Operating Regions Chart (right) to determine producible design combinations of bandwidth and center frequency.

Band Rejection Filters. For systems applications requiring rejection of discrete bands of incoming signals while passing certain other bands, Hughes band rejection filters display optimum selectivity and attenuation in the adjacent passbands. Rejection bandwidths up to 1.5% of center frequency can be supplied, with insertion losses under 1 db.

Model R 305 PR (typical)

Center Frequency	30MHz
Rejection Bandwidth (40 db)	1.1kHz min.
Rejection Bandwidth (1.5 db)	6kHz max.
Upper & Lower Pass Bandwidth	100kHz min.
Passband Insertion Loss	6 db max.
Passband Ripple	±0.5 db

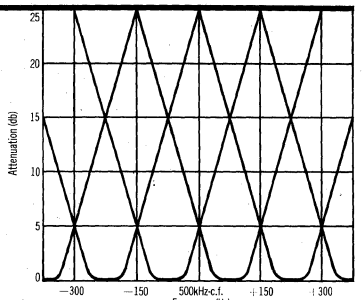


MODEL R305PR BAND REJECTION FILTER

Contiguous Comb Filters. Hughes crystal filter combs provide direct operation of large numbers of contiguous frequency channel filters from a single, low-power driver. Since no padding or isolation impedance is necessary, efficiency over non-contiguous types is greatly improved—up to 50% in many cases. Comb frequencies from 10kHz to 60MHz, or higher, can be made with bandwidths of several Hertz up to 100 Kilo Hertz. Where time domain response is important, Hughes filters can be used singly or in multiple banks without troublesome ringing or overshoot.

Model B503CS (typical)
64 Filters in Comb

Nominal Center Frequency of Comb	500kHz
2db Bandwidth ea. Channel	150Hz
30db Bandwidth ea. Channel	900Hz
Center-to-center Spacing of Channels	150Hz
Voltage Transfer Ratio of each Channel	1 nominal
Source Impedance	50 ohms
Load Impedance	20 K ohms
Nominal Output Voltage	2 volt rms
Ripple of the Filter Passband	0.5 db
Power Efficiency of Comb	33%
Noise Bandwidth each Channel	165Hz



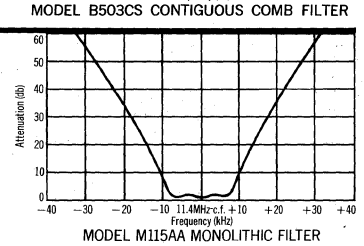
MODEL B503CS CONTIGUOUS COMB FILTER

Monolithic Filters. High reliability, excellent aging characteristics and reduced package size through the absence of discrete components are primary features of Hughes' thin-film, monolithic crystal filters. General specifications include:

Center Frequency Range	5 MHz to 25 MHz
Bandwidth Range	0.005 to 0.2% of C.F.
Shape Factor (60db/3db)	Down to 1.8 to 1

Model M115AA (typical)

Center Frequency	11.4 MHz
Bandwidth (3 db)	16kHz
Shape Factor (60db/3db)	4:1
Stop Band Attenuation	60 db
Ripple	1 db
Package (flat pack)	1.28″x.83″x.25″



MODEL M115AA MONOLITHIC FILTER

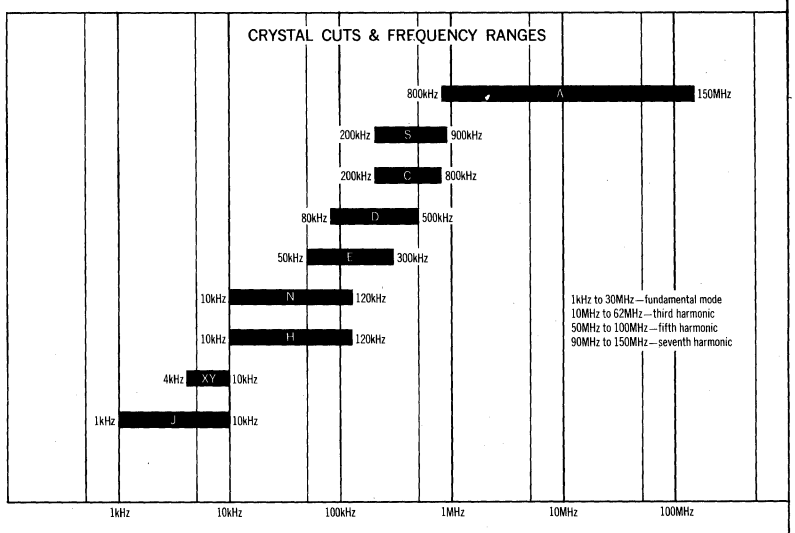
FREQUENCY CONTROL DEVICES

QUARTZ CRYSTALS

Hughes supplies a full range of low and high frequency quartz crystals from 1kHz to over 150MHz. Hughes utilizes nine different crystal cuts (see chart, right) to cover this broad frequency range and to assure minimum frequency drift. Both standard and custom units in prototype or production quantities can be supplied for a variety of precision, frequency control applications.

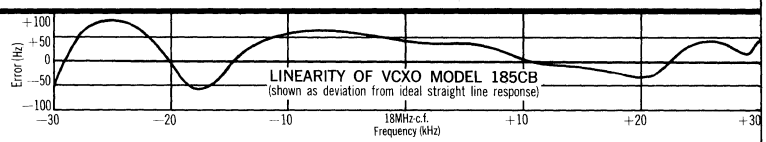
Military Standard Crystals. Manufactured to MIL-C-3098E, Hughes military standard quartz crystal units are offered in a full range of low and high frequencies.

Coldweld Sealed Crystals. For applications requiring exceptionally high reliability and long term frequency stability, Hughes employs the Coldweld process for hermetically sealing the crystal enclosure. Only pressure is used in welding the cover to the base, thereby eliminating all possibility of contamination from fluxes, sparking or heating. Hughes Coldweld quartz crystals are available in 200kHz to 150MHz frequencies and in TO-5, HC-6 or HC-18 Coldweld holders.



VOLTAGE CONTROLLED CRYSTAL OSCILLATORS

Hughes' VCXO's are noted for their exceptionally low frequency drift characteristics. Over a wide center frequency range, frequency deviation can be provided up to ±0.3% of center frequency. For most applications requiring high stability, temperature compensation can be added; for maximum stability, a proportionally controlled oven is used. Typical applications are FM generators, doppler radar systems, frequency synthesizers and AFC in communications systems.



General specifications include:

Center Freq. Range	15kHz to 150MHz
Frequency Deviation	up to ±0.3%
Jitter Stability	1Hz/sec. (typical)
Long Term Stability	±5 to ±20 ppm/wk.
Modulation Sensitivity	2kHz/V (typical)
Modulation Linearity	to ±0.2%
Modulation Rate	DC to 100kHz
Output Power	to 25 mw

Model 185CB (typical)

Center Frequency	18MHz
Frequency Deviation	±35kHz
Long Term Stability	±20 ppm/wk.
Jitter Stability	<2Hz/sec.
Temperature Range	−20° to +50°C
Modulation Sensitivity	2.3kHz/V
Modulation Linearity	±200Hz
Modulation Freq. Range	DC to 100kHz
Output Power	1mw

CRYSTAL OSCILLATORS

For stable generation of frequencies from very low audio to VHF, Hughes offers a series of transistorized oscillators utilizing Hughes high quality, precision crystals. Frequencies as low as 50 Hz with crystal stability are produced in TO-5, TO-8 and flat pack enclosures. A very high degree of stability at higher frequencies can be achieved with temperature compensation. Small volume and the absence of warm-up delay are characteristic of these TCXO's. For highest stability over a wide ambient range, a proportional temperature control with solid state circuitry provides oven stability. In combination with Hughes Coldweld crystals, extremely good short and long term stabilities can be realized. General specifications include:

Frequency Range
- 50Hz to 100kHz
- 10kHz to 30MHz (fundamental)
- 30MHz to 150MHz (overtones)

Frequency Stability
- ±1 pp 10^7/day (over temp. & volt. range)
- ±1 pp 10^8/day (const. amb. temp. & volt.)

Temperature Range	−55° to +80°C
Input Voltage (osc.)	12 VDC (typical)
Output Power	10 mw (typical)
Input Voltage (oven)	28 VDC, unreg. (standard)

Input Power (oven)
- 15 watts (warm-up)
- 2.5 watts (at 25°C, typical)
- 45 watts ("quick-heat")

Vibration	up to 30g, 10—2,000Hz
Shock	up to 50g, 11 ±1 m sec.

Hughes is the country's leading supplier of crystal filters and related frequency control devices. A partial list of major programs using these products includes BMEWS, LEM, Syncom, Surveyor, Mauler, Hawk, Minuteman, Talos, Phoenix and Standard missile. No frequency control problem is too difficult for Hughes. A staff of competent engineers backed by the industry's most advanced quality control and test facilities, stands ready to handle your toughest assignment. Call collect or contact your nearest Hughes representative for assistance.

Hughes Aircraft Company
Frequency Control Devices
500 Superior Avenue, Dept. E9
Newport Beach, California 92663
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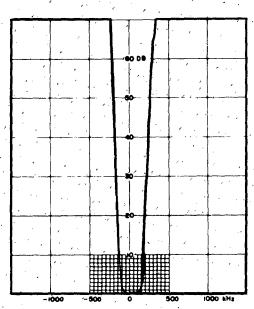
FREQUENCY CONTROL DEVICES
NEWPORT BEACH, CALIFORNIA

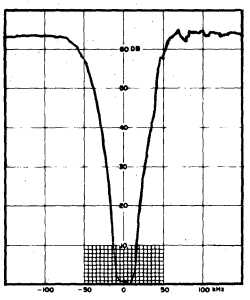
IXF® INTEGRATED CRYSTAL FILTERS

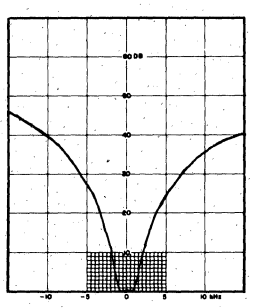
- We specialize in integrated crystal filters — both monolithics and tandem monolithics. From 2 MHz to 350 MHz.
- We pioneered the market — nationwide. Our IXF® integrated crystal filters have been available since February, 1966. We have more experience with monolithics and tandem monolithics than anyone else in the country.
- We pioneered the technology. We made the first VHF monolithic crystal filter. The first monolithics above 300 MHz. Developed high-performance tandem monolithics using modern filter design techniques.



f_{on} = 30 MHz
BW_3 = 240 kHz Min.
BW_{60} = 550 kHz Max.
Ultimate Attenuation = Greater than 90 db
Ripple = 2 db Max. 1 db Typical
Insertion Flat Loss = 10 db Max. 8 db Typical
Dimensions: 4.4 x 1 x 1
Termination Impedances: 50 Ohms

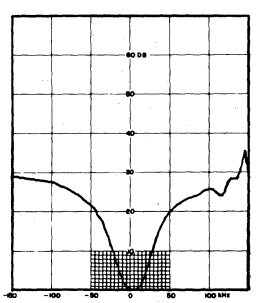
f_{on} = 125 MHz
BW_3 = 20 kHz Min.
BW_{50} = 120 kHz Max.
Ripple = 1 db Max.
Insertion Flat Loss = 6 db Max. 4.5 db Typical
Case Style: CSI (see below)
Termination Impedances: 50 Ohms





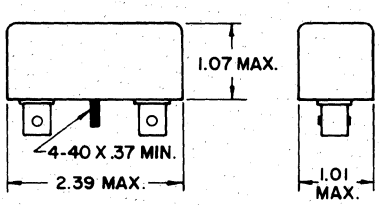
f_{on} = 6 MHz
BW_3 = 2 kHz Min.
BW_{40} = 30 kHz Max.
Ultimate Attenuation = Greater than 70 db
Insertion Flat Loss = 6 db Max.
Case Style: C (see below)
Termination Impedances: 1300 Ohms

f_{on} = 350 MHz
BW_3 = 25 kHz Min.
BW_{20} = 200 kHz Max.
Ripple = 1 db Max.
Insertion Flat Loss = 10 db Max. 7 db Typical
Case Style: VBA (See below)
Termination Impedances: 50 Ohms

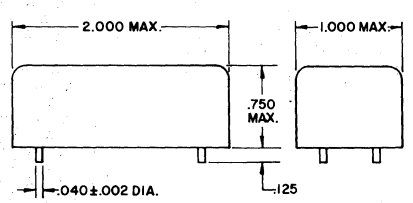


Specifications and response curves of typical custom model IXF integrated crystal filters are shown above.

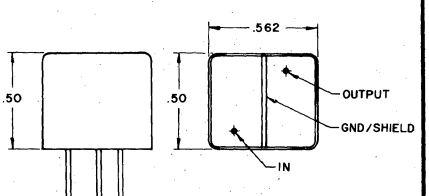
Shown below are some of the most popular standard packages. Types C and F are for monolithic units. Type SMA is for a monolithic unit including source and load matching circuitry. Type FPC is for tandem monolithic filters. Types VBA and CSI are for tandem monolithic filters, including source and load matching circuitry.



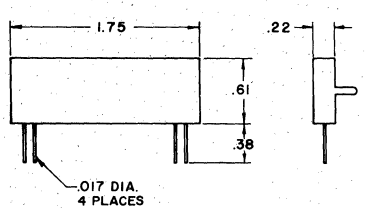
Case Style VBA



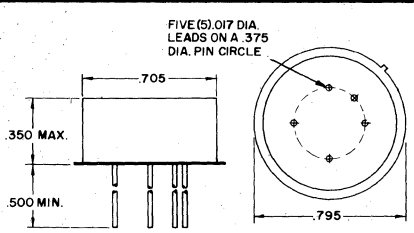
Case Style CSI



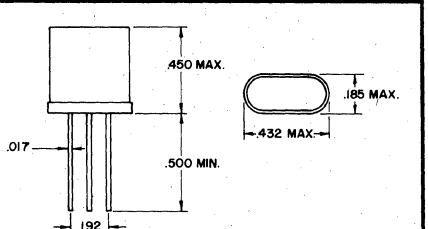
Case Style SMA



Case Style FPC



Case Style C



Case Style F

IXF® integrated crystal filters are ideally suited for receiver IF and front-end filtering. They are being widely used in new and unconventional applications requiring high performance, low cost filtering, such as spectrum cleanup in frequency synthesizers.

Custom models of IXF® Integrated Crystal Filters are available with a wide variety of performance characteristics and package configurations. Prototypes are available within 6 weeks. A number of standard models are available from stock.

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COMLINE® INTEGRATED CRYSTAL FILTERS

- The broadest line of standard model 10.7 and 21.4 MHz crystal filters on the market. Over 20 different models. Two-pole to twelve-pole response. Popular bandwidths.
- The only standard line of integrated 10.7 MHz and 21.4 MHz crystal filters on the market. These tandem monolithic integrated crystal filters use no inductors or transformers. Don't use an old-fashioned filter in your new equipment designs. Take advantage of the reduced cost, small size and improved performance available only with a tandem monolithic integrated crystal filter.
- The smallest standard model 10.7 and 21.4 MHz crystal filters on the market. Upright mount or flatpack. Our flatpack 10.7 MHz filters are only 0.20 inches high.

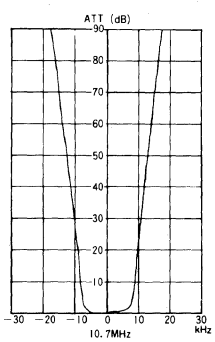
Guide to Standard Models 10.7 MHz

15 kHz Bandwidth	30 kHz Bandwidth	No. Poles (Resonators)	Case Styles
10M-1B	10M-1A	2	HC-18/U Style
10M-2B, -2BL	10M-2A, -2AL	4	H-3, L-2
10M-3B, -3BL	10M-3A, -3AL	6	H-3, L-3
10M-4B, -4BL	10M-4A, -4AL	8	H-4, L-4
10M-5B, -5BL	10M-5A, -5AL	10	H-5, L-5
10M-6B, -6BL	10M-6A, -6AL	12	H-6, L-6



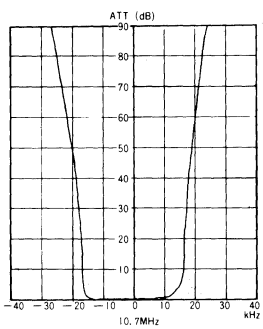
10M-4B
10M-4BL

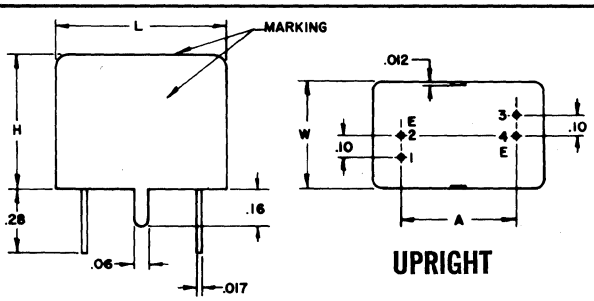
Nominal Center Frequency	10.7 MHz
6 db Bandwidth	±7.5 kHz min.
Ripple	2 db max.
60 db Bandwidth	±15 kHz max.
80 db Bandwidth	±20 kHz max.
Insertion Flat Loss	4 db max.
Ultimate Attenuation	more than 100 db
Nominal Impedances	3000 Ohms
Case Styles	H-4, L-4
Weight	.3 oz.



10M-6A
10M-6AL

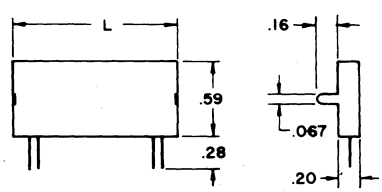
Nominal Center Frequency	10.7 MHz
6 db Bandwidth	±15 kHz min.
Ripple	2 db max.
75 db Bandwidth	±25 kHz max.
Insertion Flat Loss	4 db max.
Ultimate Attenuation	more than 100 db
Nominal Impedances	5000 Ohms
Case Styles	H-6, L-6
Weight	.4 oz.





UPRIGHT

Case Style	L	W	H
H-3	.59 in.	.47 in.	.59 in.
H-4	.73 in.	.47 in.	.59 in.
H-5	.90 in.	.47 in.	.59 in.
H-6	1.10 in.	.47 in.	.59 in.



FLAT PACK

Case Style	L
L-2	.87 in.
L-3	1.30 in.
L-4	1.73 in.
L-5	2.16 in.
L-6	2.60 in.

Piezo Technology Inc. and Toyocom — the two oldest names in integrated crystal filters — have combined forces to bring you COMLINE® tandem monolithic integrated crystal filters. COMLINE filters are manufactured to highest commercial standards by Toyocom, the leading Japanese manufacturer of quartz crystal products — distributed, tested and guaranteed by Piezo Technology Inc.

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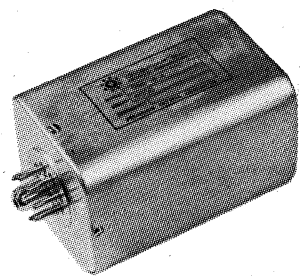
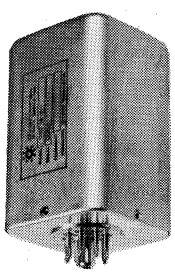
Ovenaire's Engineering and Manufacturing facilities offer a complete product line of precision crystal oscillators, crystal ovens and component ovens. The abbreviated specifications and illustrations below are typical of units in regular production at Ovenaire but do not reflect the limits to our capabilities. In addition to many standard designs, Ovenaire offers custom design and manufacturing services to provide an oscillator or oven to your exact specifications.

PRECISION CRYSTAL OSCILLATORS



PRECISION STANDARDS — DC PROPORTIONAL CONTROL

Frequency Range: 1 MHz to 20 MHz.
Output: Square or Sine Wave, Typically 2 to 10 mW.
Long Term Stability: From 5 x 10^{-8}/Day to 5 x 10^{-10}/Day.
Ambient Stability: From 5 x 10^{-9}/°C to 5 x 10^{-11}/°C.
Operating Temperature: Within the Range −55°C to +75°C.
Supply Voltage: +12 VDC to +28 VDC Range.

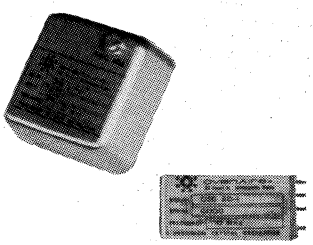


HIGH STABILITY OSCILLATORS — AC PROPORTIONAL CONTROL

Frequency Range: 1 MHz to 20 MHz.
Output: Square Wave or Sine Wave, Typically 2 to 10 mW.
Long Term Stability: From 1 x 10^{-7}/Day to 5 x 10^{-9}/Day.
Ambient Stability: From 1 x 10^{-8}/°C to 1 x 10^{-9}/°C.
Operating Temperature: Within the Range −30°C to +65°C.
Oven Supply: 115 VAC ±10% 50 Hz or 60 Hz.
Oscillator Supply: +9 VDC to 28 VDC Range.

TEMPERATURE COMPENSATED OSCILLATORS — TCXO

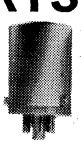
Frequency Range: 1 MHz to 15 MHz.
Output: Square Wave or Sine Wave, Typically 1 to 10 mW.
Long Term Stability: From 1 x 10^{-7}/Month to 5 x 10^{-7}/Month.
Ambient Stability: Up to ±2 x 10^{-7} depending on temperature range.
Operating Temperature: Within the Range −30°C to +75°C.
Supply Voltage: +9 VDC to +28 VDC Range.

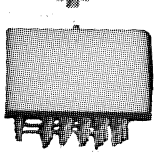


VOLTAGE CONTROLLED OSCILLATORS — VCXO

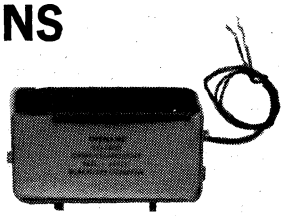
Ovenaire VCXO's are available for all classes of oscillators. From fine electrical trim on precision standards to wide swing VCXO. Available to customer requirements in 1 to 40 MHz with up to ±300 ppm swing.

CRYSTAL OVENS AND COMPONENT OVENS





Single crystal, dual crystal and multiple crystal ovens.
Component ovens for precise temperature control of electronic components.
Thermostat control, thermostat with circuitry control, solid state control and proportional control. Available in all standard voltages and temperatures.
A wide range of standard designs include many sizes, configurations, circuit options and mountings.



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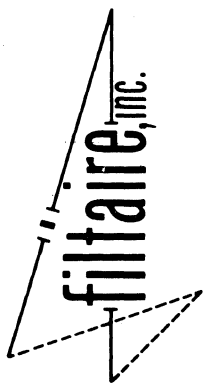



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Time domain a problem? We work in it.

- Sideband filters
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- Extreme environmental conditions
- Fast delivery
- High reliability
- Custom designs





QUARTZ CRYSTALS

- Frequency as low as 400 cycles per second
- High quality
- Glass enclosed
- Military standard including new Coldweld seal
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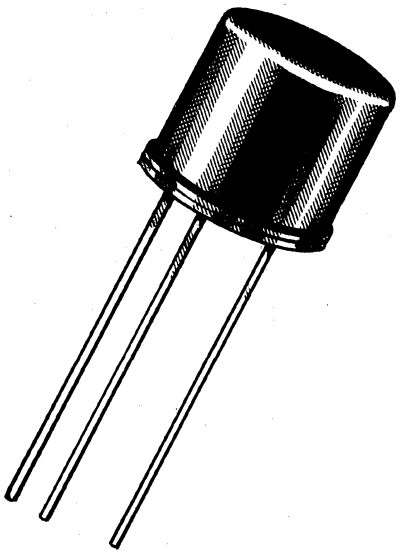
FREQUENCY CONTROL SPECIALISTS

Croven Limited is presently supplying major buyers across the United States. Our high quality craftsmanship in meeting the exacting requirements of today's electronic and aerospace industries have gained Croven considerable international recognition.
The exceptional reliability, frequency stability and low aging characteristics have made Croven a preferred manufacturer of a complete line of quartz crystals.
Our qualified staff will be pleased to assist your individual requirements, just call, we'll be there.



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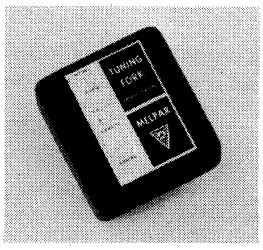
TO BE PRECISE
Specify Melpar Oscillators



TUNING FORKS

Frequency Range: 240Hz to 25000Hz

SERIES	ACCURACY	SIZE	TERMINALS
22	±0.05% (−55°C to 125°C) ±0.02% (15°C to 35°C)	11/32" x 3/4" x 1 17/32"	Wire Leads
23	±0.02% (−55°C to 125°C) ±0.01% (−55°C to 85°C) ±0.005% (20°C to 30°C)	1 5/16" x 1 5/16" x 3/8"	Solder Pin
24	±0.05% (−55°C to 125°C) ±0.03% (−55°C to 85°C) ±0.01% (0 to 65°C)	1 1/2" x 1 1/2" x 3/8"	Solder Pin
27	Low Cost — 1000 pcs — Price less than $10.00 each. ±.1% 25°C ±10°	1" x 1.5" x .6"	Solder Pin



TUNING FORK OSCILLATORS

Frequency Range: 1Hz to 25000Hz

SERIES	ACCURACY	INPUT	OUTPUT	SIZE	TERMINALS
10	±0.005% @ 25°C ±0.02% (0 to 60°C) ±0.1% to .05% (−55° to 125°)	3 to 32VDC	Sine or Square Wave	1 29/32" x 1 15/32" x .4"	Loop or Solder Pin
10H				1 29/32" x 1 15/32" x 15/16"	
10HD				1 29/32" x 1 15/32" x 1 21/32"	
30	±0.1% (−55°C to 125°C) ±0.05% (−55°C to 85°C) ±0.02% (15°C to 35°C)	12 to 32VDC		1 17/64" x 1 17/64" x 1 3/4"	Solder Loop
31				1 5/8" x 1 3/4" x 7/8"	Solder Pin
50	±0.1% (−55°C to 125°C) ±0.05% (−55°C to 125°C) ±0.01% (0 to 50°C) ±0.005% @ 25°C			1 1/2" x 1 1/2" x 3/8"	Solder Pin
50H				1 1/2" x 1 1/2" x 1 1/2"	Octal Plug
51 52				1 1/2" x 1 1/2" x 3/8"	Solder Pin
80				2" x 2" x .4"	Solder Pin

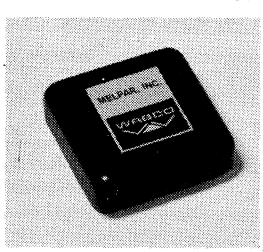


SOLID STATE OSCILLATORS

Frequency Range: 1Hz and up

SERIES 5

ACCURACY	INPUT	OUTPUT	SIZE	TERMINALS
±0.05% (25°C ±10°C) ±0.1% (−25°C to 85°C) ±0.5% (−40°C to 85°C)	6 to 28VDC	Square Wave	1" x 1" x 1" or 1.6" x 1.6" x 1.5"	Solder Pin



CRYSTAL CONTROLLED OSCILLATORS

Frequency Range: 25K Hz to 50M Hz

SERIES	ACCURACY	INPUT	OUTPUT	SIZE	TERMINALS
C65	±0.001% (−40°C to 85°C)	3 to 28VDC	Square Wave	1 13/32" x 1 13/32" x .4"	Solder Pins
C80	±0.005% (−55°C to 85°C)			2" x 2" x .4"	

Our units are ideally suited for use in ground, shipboard, airbirne, and satelite equipment.

We also have a versatile line of: • **TIME BASE GENERATORS** • **FREQUENCY DIVIDERS** • **TIMERS**

We have many models designed to meet your shock and vibration requirements of MILE-E-5400, MIL-E-5272, MIL-STD-67 and MIL-STD-202. Our application engineers would appreciate the opportunity of assisting you in selecting a model to meet your specific requirements.

FOR PRICE AND DELIVERY INFORMATION CONTACT
SPECIAL PRODUCTS DEPARTMENT

MELPAR, INC.
AN AMERICAN STANDARD CO.

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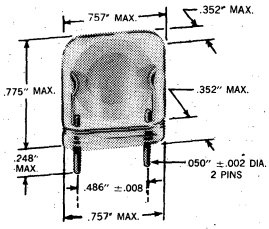
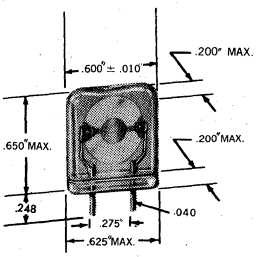


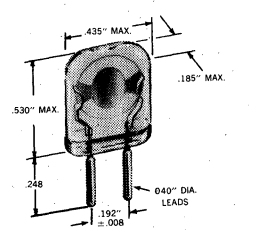
G-1

G-1 Holder (HC-27/U)
For wire leads, specify G-4
Metal equivalent is M-1 (HC-6/U)



G-31

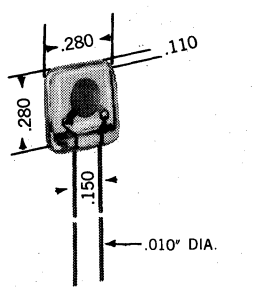
G-31 Holder
For wire leads, specify G-30



G-21

G-21 Holder
(HC-29/U)
For wire leads,
specify G-20 (HC-26/U)

Metal equivalents are HC-25/U (pins) and HC-18/U (wire leads)



MM

(Micro-Miniature)

High frequency crystals are offered at frequencies from 700 kc to 250 mc to customer specifications, in addition to the MIL-C-3098 specifications listed below.

HIGH FREQUENCY QUARTZ CRYSTAL SPECIFICATIONS

CRYSTAL UNITS LISTED IN ORDER OF LOW LIMIT OF FREQUENCY RANGE BY HOLDER SIZE

Frequency range	McCoy Holder	Military Holder	Military Crystal-unit type	Mode of oscillation	Frequency tolerance percent(±)	Operating temperature range, °C	Detail specification MIL-C-3098/	Load capacitance, pf[1]	Rated Drive level, mw
800 kc to 20 mc	M-1	HC-6/U	CR-18A/U	Fundamental	0.005	−55 to +105	3	32.0 ± 0.5	[5]10.0 ± 2.0 [6] 5.0 ± 1.0
		HC-6/U	CR-19A/U	Fundamental	0.005	−55 to +105	4	∞	[5]10.0 ± 2.0 [6] 5.0 ± 1.0
		HC-6/U	CR-27A/U	Fundamental	[3]0.002	+70 to +80	9	32.0 ± 0.5	[5] 5.0 ± 1.0 [6] 2.5 ± 0.5
		HC-6/U	CR-28A/U	Fundamental	[3]0.002	+70 to +80	10	∞	[5] 5.0 ± 1.0 [6] 2.5 ± 0.5
		HC-6/U	CR-35A/U	Fundamental	[3]0.002	+80 to +90	15	∞	[5] 5.0 ± 1.0 [6] 2.5 ± 0.5
		HC-6/U	CR-36A/U	Fundamental	[3]0.002	+80 to +90	16	32.0 ± 0.5	[5] 5.0 ± 1.0 [6] 2.5 ± 0.5
		HC-6/U	CR-62/U	Fundamental	[3]0.001	+70 to +80	40	32.0 ± 0.2	[5] 5.0 ± 1.0 [6] 2.5 ± 0.5
		HC-6/U	CR-85/U	Fundamental	0.002 0.003	−40 to +90 {−55 to −40 {+90 to +105	56	∞	[5]10.0 ± 2.0 [6] 5.0 ± 1.0
2.12 to 6.2 mc	M-25	HC-32/U	CR-89/U	Fundamental	0.005	−55 to +105	67	30.0 ± 0.5	10.0 ± 2.0
2.9 to 20 mc	M-20	HC-18/U	CR-64/U	Fundamental	0.005	−55 to +105	42	30.0 ± 0.5	5.0 ± 1.0
		HC-18/U	CR-69/U	Fundamental	0.002 0.003	−40 to +90 {−55 to −40 {+90 to +105	47	30.0 ± 0.5	5.0 ± 1.0
	M-21	HC-25/U	CR-78/U	Fundamental	0.005	−55 to +105	62	30.0 ± 0.5	5.0 ± 1.0
		HC-25/U	CR-79/U	Fundamental	0.005	−55 to +105	63	∞	5.0 ± 1.0
3 to 20 mc	M-1	HC-6/U	CR-66/U	Fundamental	0.002 0.003	−40 to +90 {−55 to −40 {+90 to +105	44	30.0 ± 0.5	[5]10.0 ± 2.0 [6] 5.0 ± 1.0
		HC-6/U	CR-68/U	Fundamental	[3]0.002	+70 to +80	46	32.0 ± 0.5	5.0 ± 1.0
4.5 to 5.5 mc		HC-30/U	CR-71/U	Fifth overtone	See detail spec		49	32.0 ± 0.5	See detail spec
5 to 15 mc	G-1	HC-27/U	CR-86/U	Fundamental	.005 .02	−55 to +180 +180 to +200	64	∞	5 — 10 mc 5.0 ± 1.0 10 — 15 mc 2.0 ± 0.5
5 to 20 mc	M-20	HC-18/U	CR-60A/U	Fundamental	0.005	−55 to +105	38	∞	5.0 ± 1.0
10 to 25 mc	*M-1	HC-6/U	CR-33A/U	Third overtone	0.005	−55 to +105	14	32.0 ± 0.5	2.5 ± 0.5
10 to 61 mc		HC-6/U	CR-51A/U	Third overtone	0.005	−55 to +105	29	∞	20.0 ± 4.0
10 to 61 mc	M-1	HC-6/U	CR-52A/U	Third overtone	0.005	−55 to +105	30	∞	[7] 4.0 ± 0.8 [8] 2.0 ± 0.4
		HC-6/U	CR-65/U	Third overtone	[9]0.001	+70 to +80	43	∞	[7] 2.0 ± 0.4 [8] 1.0 ± 0.2
15 to 45 mc	G-1	HC-27/U	CR-87/U	Third overtone	.005 .02	−55 to +180 +180 to +200	65	∞	2.0 ± 0.4
15 to 50 mc		HC-10/U	CR-24/U	15 to 25 mc Third overtone 25+ to 50 mc Fifth overtone	0.005	−55 to +105	6	∞	2.0 ± 0.4
17 to 61 mc	M-20	HC-18/U	CR-55/U	Third overtone	0.005	−55 to +105	33	∞	2.0 ± 0.4
		HC-18/U	CR-61/U	Third overtone	[3]0.002	+80 to +90	39	∞	[7] 2.0 ± 0.4 [8] 1.0 ± 0.2
		HC-18/U	CR-67/U	Third overtone	0.002 0.003	−40 to +90 {−55 to −40 {+90 to +105	45	∞	2.0 ± 0.4
	G-21	HC-29/U	CR-73/U	Third overtone	0.003	−55 to +105	54	∞	2.0 ± 0.4
	M-20	HC-18/U	CR-76/U	Third overtone	0.002 0.003	−40 to +90 {−55 to −40 {+90 to +105	53	∞	2.0 ± 0.4
	M-21	HC-25/U	CR-81/U	Third overtone	0.005	−55 to +105	58	∞	2.0 ± 0.4
		HC-25/U	CR-84/U	Third overtone	[3]0.002	+80 to +90	61	∞	[7] 2.0 ± 0.4 [8] 1.0 ± 0.2
17 to 62 mc	M-21	HC-25/U	CR-77/U	Third overtone	0.002 0.003	−40 to +90 {−55 to −40 {+90 to +105	55	∞	2.0 ± 0.4
45 to 125 mc	G-20	HC-26/U	CR-74/U	Fifth overtone	[9]0.001	+80 to +90	51	∞	1.0 ± 0.2
50 to 87 mc		HC-6/U	CR-53A/U	Fifth overtone	0.005	−55 to +105	31	∞	20.0 ± 4.0
50 to 125 mc	M-1	HC-6/U	CR-54A/U	Fifth overtone	0.005	−55 to +105	32	∞	2.0 ± 0.4
	M-20	HC-18/U	CR-56A/U	Fifth overtone	0.005	−55 to +105	34	∞	2.0 ± 0.4
		HC-18/U	CR-59A/U	Fifth overtone	[3]0.002	+80 to +90	37	∞	1.0 ± 0.2
	M-1	HC-6/U	CR-75/U	Fifth overtone	[9]0.001	+70 to +80	52	∞	1.0 ± 0.2
	M-20	HC-18/U	CR-80/U	Fifth overtone	0.002 0.003	−40 to +90 {−55 to −40 {+90 to +105	57	∞	2.0 ± 0.4
	M-21	HC-25/U	CR-82/U	Fifth overtone	0.005	−55 to +105	59	∞	2.0 ± 0.4
		HC-25/U	CR-83/U	Fifth overtone	0.002 0.003	−40 to +90 {−55 to −40 {+90 to +105	60	∞	2.0 ± 0.4

(For other special applications and requirements, contact McCoy Engineering)

*Color bars indicate crystals requiring government approval on new equipment design.

[1]When a load capacitance is given, the crystal unit is designed to resonate at rated frequency with an external capacitor of the value specified. Crystal units which have infinite load capacitance are designed to operate at series resonance.

[2]Stability with overall frequency tolerance: ±0.002 percent.

[3]Stability within overall frequency tolerance: ±0.0005 percent.

[4]Frequency tolerance over secondary operating temperature range (−55 to −40°C and +70 to +90°C): ±0.015 percent.

[5]For frequencies up to and including 10 mc/sec.

[6]For frequencies above 10 mc/sec.

[7]For frequencies up to and including 25 mc/sec.

[8]For frequencies above 25 mc/sec.

[9]Stability within overall frequency tolerance: ±0.00025 percent.

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a subsidiary of OAK ELECTRO/NETICS CORP

McCOY "The Real Name for QUALITY Crystal Components"

Low frequency crystals are offered over the frequency range of 700 cps to 800 kc, using a variety of angles to achieve the desired characteristics. Rigid manufacturing control assures the highest standard of quality, together with competitive pricing and on-time delivery.

LOW FREQUENCY QUARTZ CRYSTAL SPECIFICATIONS

Type Cut	Military Type	Mil Type Holder	McCoy Type Holder	Frequency Range	Frequency Tolerances Available over the Temperature Range Indicated. All Tolerances are ± %							Load Capacitance [4]pf	Drive Level mw Max.	Mil Specifications
					−55°C +105°C	−55°C +90°C	−40°C +70°C	0°C +50°C	+20°C +40°C	+55°C +65°C	+70°C +80°C			
JT			M-22A	700 CPS-1.5 KC	.025	.02	.01	.005	.002	.003	.005	∞	0.01	
			M-22B	1.5 KC-4 KC	.025	.02	.01	.005	.002	.003	.005	∞	0.01	
		HC-13/U	M-22	4 KC-15 KC	.025	.02	.01	.005	.002	.003	.005	∞	0.01	
NT	CR88A/U	HC-13/U MOD.	M-22A	2.75 KC-16 KC			.01			[6].005		∞	0.1	3098/66
			M-22A	4 KC-10 KC	.02	.015	.01	.005	.002	.002	.002	∞	0.1	
			M-22B	10 KC-15 KC	.02	.015	.01	.005	.002	.002	.002	∞	0.1	
		HC-13/U	M-22	15 KC-80 KC	.02	.015	.01	.005	.002	.002	.002	∞	0.1	
		HC-6/U	M-1	80 KC-150 KC	02	.015	.01	.005	.002	.002	.002	∞	0.1	
	CR38A/U	HC-13/U	M-22	16 KC-100 KC			.012					20.0 ± 0.5	0.1	3098/18
	CR50A/U	HC-13/U	M-22	16 KC-100 KC			.012					∞	0.1	3098/28
5°XF			M-22A	4 KC-12 KC	.06	.05	.025	.01	.004	.006	.008	∞	0.1	
			M-22B	12 KC-15 KC	.06	.05	.025	.01	.004	.006	.008	∞	0.1	
		HC-13/U	M-22	15 KC-80 KC	.06	.05	.025	.01	.004	.006	.008	∞	0.1	
		HC-6/U	M-1	80 KC-150 KC	.06	.05	.025	.01	.004	.006	.008	∞	0.1	
5°X			M-22A	50 KC-70 KC	.025	.02	.012	.003	.002	.003	.003	∞	2.0	
			M-22B	70 KC-80 KC	.025	.02	.012	.003	.002	.003	.003	∞	2.0	
		HC-13/U	M-22	80 KC-175 KC	.025	.02	.012	.003	.002	.003	.003	∞	2.0	
		HC-6/U	M-1	175 KC-250 KC	.025	.02	.012	.003	.002	.003	.003	∞	2.0	
	CR37A/U	HC-13/U	M-22	90 KC-250 KC			.02					20.0 ± 0.5	2.0 ± 0.4	3098/17
	CR42A/U	HC-13/U	M-22	90 KC-250 KC							[1].003	32.0 ± 0.5	2.0 ± 0.4	3098/21
MT			G-90	50 KC-100 KC	.012	.01	.008	.004	.002	.001	.001	∞	2.0	
			G-65	100 KC-150 KC	.012	.01	.008	.004	.002	.001	.001	∞	2.0	
		HC-13/U	M-22	150 KC-185 KC	.012	.01	.008	.004	.002	.001	.001	∞	2.0	
		HC-6/U	M-1	185 KC-250 KC	.012	.01	.008	.004	.002	.001	.001	∞	2.0	
GT			G-130	80 KC-150 KC			.002	.001	.00025	.00025	.0005	∞	0.1	
			G-90	150 KC-300 KC			.002	.001	.00025	.00025	.0005	∞	0.1	
		HC-6/U	M-1	250 KC-300 KC			.002	.001	.00025	.00025	.0005	∞	0.1	
BD			G-90	80 KC-100 KC	.012	.01	.006	.003	.002	.002	.003	∞	2.0	
			G-65	100 KC-150 KC	.012	.01	.006	.003	.002	.002	.003	∞	2.0	
		HC-13/U	M-22	150 KC-185 KC	.012	.01	.006	.003	.002	.002	.003	∞	2.0	
		HC-6/U	M-1	185 KC-300 KC	.012	.01	.006	.003	.002	.002	.003	∞	2.0	
DT			G-90	80 KC-175 KC	.012	.01	.008	.004	.002	.001	.001	∞	2.0	
		HC-6/U	M-1	175 KC-550 KC	.012	.01	.008	.004	.002	.001	.001	∞	2.0	
	CR25A/U	HC-6/U	M-1	200 KC-500 KC			.01					∞	2.0 ± 0.4	3098/7
	CR26A/U	HC-6/U	M-1	200 KC-500 KC							[2].002	∞	2.0 ± 0.4	3098/8
	CR47A/U	HC-6/U	M-1	190 KC-500 KC							[2].002	20.0 ± 0.5	2.0 ± 0.4	3098/26
	CR63A/U	HC-6/U	M-1	200 KC-500 KC			[3].01					20.0 ± 0.5	2.0 ± 0.4	3098/41
	CR15B/U	HC-21/U		80 KC-200 KC			.01					32.0 ± 0.5	2.0 ± 0.4	3098/1
	CR16B/U	HC-21/U		80 KC-200 KC			.01					∞	2.0 ± 0.4	3098/2
	CR29A/U	HC-21/U		80 KC-200 KC							[2].002	32.0 ± 0.5	2.0 ± 0.4	3098/11
	CR30A/U	HC-21/U		80 KC-200 KC							[2].002	∞	2.0 ± 0.4	3098/12
	CR46A/U	HC-6/U	M-1	200 KC-500 KC			.01					20.0 ± 0.5	2.0 ± 0.4	3098/25
CT			G-90	150 KC-250 KC	.018	.015	.012	.006	.002	.001	.001	∞	2.0 ± 0.4	
		HC-6/U	M-1	250 KC-700 KC	.018	.015	.012	.006	.002	.001	.001	∞	2.0 ± 0.4	
	CR45/U	HC-6/U	M-1	455 KC			.02					∞	2.0 ± 0.4	3098/24
SL		HC-13/U	M-22	200 KC-300 KC	.01	.008	.005	.003	.002	.001	.001	∞	2.0	
		HC-6/U	M-1	300 KC-500 KC	.01	.008	.005	.003	.002	.001	.001	∞	2.0	
		HC-18/U	M-21	500 KC-700 KC	.01	.008	.005	.003	.002	.001	.001	∞	2.0	
	CR57/U	HC-6/U	M-1	500 KC	[5].001 over +80°C to +90°C							32.0 ± 0.5	0.5	3098/35

(For other special applications and requirements, contact McCoy Engineering)

*Color bars indicate crystals requiring government approval on new equipment design.

[1]Stability within overall frequency tolerance: ±0.002 percent.

[2]Stability within overall frequency tolerance: ±0.0005 percent.

[3]Frequency tolerance over secondary operating temperature range (−55 to −40°C and +70 to +90°C): ±0.015 percent.

[4]When a load capacitance is given, the crystal unit is designed to resonate at rated frequency with an external capacitor of the specified value. Crystal units which have infinite load capacitance are designed to operate at series resonance.

[5]Frequency tolerance over secondary operating temperature range (+20 to +80°C): ±0.005 percent. Stability within overall frequency tolerance: ±0.0003 percent.

[6]Over 0°C to +65°C.

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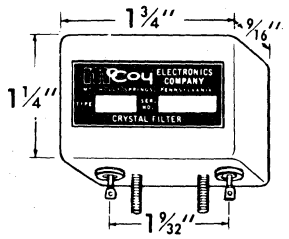
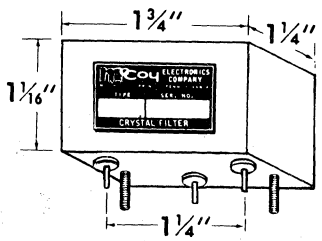
McCOY CRYSTAL FILTERS

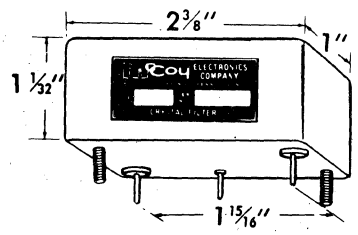
McCoy offers the most complete line of filters in the world!

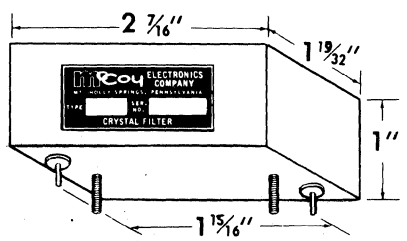
Filters are available from 5 kc to 125 mc

Typical Packages

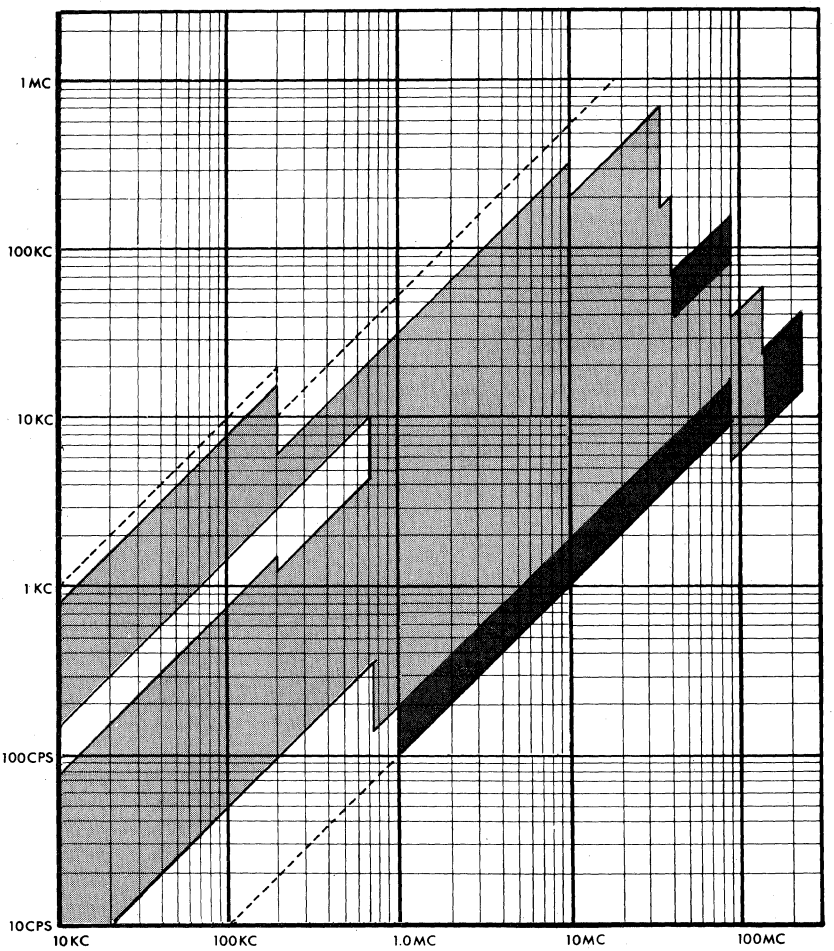








This logarithmic chart indicates the practical and theoretical possibilities in crystal filters. Read center frequency along X axis, bandwidth along Y axis. As a rule, filters selected near the middle of the "narrow and intermediate" band can be produced with the greatest variety of characteristics.



Crystal Discriminators

McCoy maintains a complete engineering staff for crystal discriminators, and offers units over the frequency range of 50 kc to 30 mc. Examples of the standard line are described below.

Center frequency: 10.7 mc adjustable ±300 cps (See Note 1)
Center frequency stability: ±.003% −10°C to +70°C
Peak to peak bandwidth: 30 kc (See Note 2)
Output sensitivity: 1 volt per kc with an input level 3.0 VRMS amplitude limited
Output linearity: 3% to ± 11 kc
Output symmetry: 5% ±11 kc to ±30 kc
Designed for high reliability applications
Package size: L. 1¾", W. 1¼", H. ½"

1. Available over frequency range of 8.5 mc to 30.0 mc. (Available with or without center frequency adjustment.) Size: L. 1¾", W. 1.0", H. ½".
2. Available in bandwidths up to 100 kc peak to peak and narrow to 5 kc peak to peak with corresponding sensitivity, linearity and stability variations.

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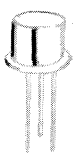
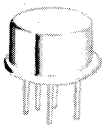
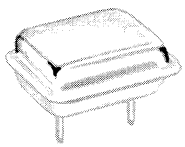
McCOY CLEANSEAL CRYSTALS



W-6



W-7



W-10

THE LATEST DEVELOPMENT FOR HIGH RELIABILITY PERFORMANCE

McCoy Cleanseal enclosures are now available in the low frequency range of 1 kc through 700 kc. Cleanseal techniques eliminate possible contamination of the metal enclosure due to soldering fluxes and also avoid the adverse effects of high heat imposed by the conventional soldering methods. Frequency stability and aging characteristics are improved by the Cleanseal method of encapsulation. Units listed will meet environmental conditions such as shock and vibration, as specified by MIL-C-3098D.

DESIGN AND TESTING...

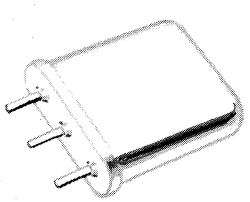
McCoy engineers and technicians have worked with other industry leaders in developing the Cleanseal technique for production requirements. Extensive research, together with in-the-field testing, has proven the McCoy Cleanseal enclosures can withstand the rigorous environmental conditions of the space age with a minimum change in crystal parameters. This new construction technique permits after-seal leak rates of less than 1×10^{-8} atm. cc per second.

Frequency Range MC	Type Holder			Mode of Operation	Max. Res. in Ω	Drive Level	
	W-6	W-7	W-10			Evacuated	Gas Fill
.800- 3.000			X	Fund.	*	4.0 MW max.	10.0 MW max.
3.000- 10.000		X	X	Fund.	*	2.0 MW max.	10.0 MW max.
10.000- 35.000	X	X	X	Fund.	*	1.0 MW max.	2.0 MW max.
16.000- 30.000		X	X	3rd	40	1.0 MW max.	2.0 MW max.
30.000- 90.000	X	X	X	3rd	40	1.0 MW max.	2.0 MW max.
60.000-125.000	X	X	X	5th	60	1.0 MW max.	2.0 MW max.
125.000-210.000	X	X	X	7th	100	1.0 MW max.	2.0 MW max.

CRYSTAL OSCILLATORS • TCXO's • OVEN OSCILLATORS CRYSTAL AND COMPONENT OVENS

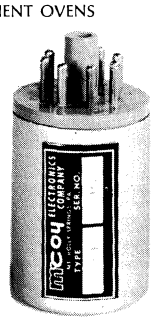
McCoy Electronics' standard line of crystal controlled oscillators covers the complete frequency range from 400 Hz to 150 MHz. The most advanced techniques in circuit design and packaging provide highly stable, miniature frequency standards.

McCoy's standard line of crystal controlled oscillators covers the frequency range from 400 Hz to 150 MHz. Crystal controlled frequencies below 10 KHz can be provided by utilizing integrated binary countdown techniques. For stability requirements more stringent than those provided by the crystal alone, McCoy offers oscillators with either temperature control or temperature compensation. The temperature control technique uses either snap-action thermostats or proportional ovens.



MINIATURE CRYSTAL OSCILLATOR

CRYSTAL AND COMPONENT OVENS



McCoy crystals and component ovens provide the temperature accuracy and frequency stability required for the majority of applications requiring control of temperature environment of crystals, small components and circuit assemblies.

McCoy Electronics has had wide experience in TCXO (Temperature Compensated Crystal Oscillator), Stabilities of ±0.5 PPM over −40°C to +70°C are achievable results without the use of an oven. The obvious advantage of drastically reduced power consumption, combined with immediate operation without warm-up, make the TCXO especially applicable to portable, airborne and space applications.



TCXO

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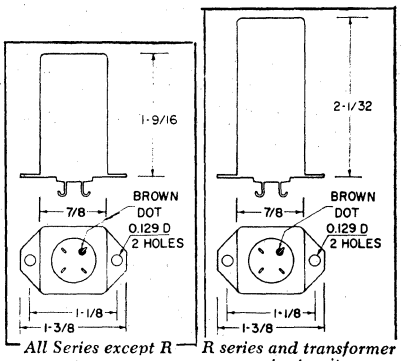
OSCILLATORS

FIXED OR SLIGHTLY VARIABLE FREQUENCY AND/OR AMPLITUDE

- Sine wave frequencies from 50 cps to 80 kc
- Temperature: —25 to +55°C
- Size: 7/8" sq. x 1-9/16" high
- For shock and vibration, specify R (2-1/32" high) or S (1-9/16" high)
- Each oscillator may be adjusted for your requirements of load, voltage output and input, etc.
- 600 ohm balanced output available
- Extremely low distortion units available



All Series except R — *R series and transformer output units*

ELECTRICAL SPECIFICATIONS

Series 101 and 102 are fixed frequency and amplitude units to be used as a signal source into a light load. These should be used where no field adjustments are required. Series 101 and 102 usually supplied with 4 pin solder hook terminals. If desired, specify NOVAL plug.

	Series 101	Series 101A	Series 102	Series 102A
Input Volts, DC	10.5-13.5	24-32	10.5-13.5	24-32
Input Current, ma.	10	10	10	10
Output Frequency	Fixed. Any frequency from 50 cycles to 80 KC			
Initial Frequency Accuracy per cent	± 2½	± 2½	± ½	± ½
Frequency Drift, maximum, per cent	± 2½	± 2½	± 1½	± 1½
Maximum Load, kilohms	10	20	10	20
Output Voltage, VRMS, minimum	1	2	1	2
Change in Amplitude, maximum db.	± 1	± ½	± 1	± ½
Distortion, maximum, per cent	1	1	1	1

Series 103 thru 105 are similar to Series 102 except adjustment of amplitude and frequency may be made with an external variable resistor. They may be used as signal source into a light load where exact voltage or frequency is required. Series 103 and 104 are supplied with 4 pin solder hook terminals and Series 105 oscillators are supplied with 7 pin solder hook terminals. If a plug-in unit is required, specify NOVAL plug.

	Series 103	Series 103A	Series 104	Series 104A	Series 105	Series 105A
Input Volts, DC	10.5-13.5	24-32	10.5-23.5	24-32	10.5-13.5	24-32
Input Current, ma.	10	10	10	10	10	10
Output Frequency	Variable ±3% around any specified frequency from 50 cy. to 80 KC		Fixed. Any frequency from 50 cy. to 80 KC.		Variable ±3% around any specified frequency from 50 cy. to 80 KC	
Initial Frequency Accuracy, per cent	0	0	± 1	± 1	0	0
Frequency Drift, maximum, per cent	± 1½	± 1½	± 1½	± 1½	± 1½	± 1½
Maximum Load, kilohms	10	20	10	20	10	20
Output Voltage, VRMS, Minimum	1	2	Variable, from 0.5 to 1 VRMS or greater	Variable, from 1 to 2 VRMS or greater	Variable, from 0.5 to 1 VRMS or greater	Variable, from 1 to 2 VRMS or greater
Change in Amplitude, maximum db.	± 1	± ½	± 1	± ½	± 1	± ½
Distortion, maximum, per cent	1	1	1	1	1	1

Series 106 through 110 are for use into a lower impedance load. All require a 600 ohm resistive termination except Series 110 which requires a 220 ohm termination. Since these units are capable of a small power output, they are recommended for ground support use in temperatures from — 25 to + 50°C. Series 106 oscillators are supplied with 4 pin solder hook terminal and Series 107 through 110 are supplied with 7 pin solder hook terminals. If a plug-in unit is required, specify NOVAL plug.

	Series 106	Series 106A	Series 107	Series 107A	Series 108	Series 108A	Series 109	Series 109A	Series 110
Input Volts, DC	10.5-13.5	24-32	10.5-23.5	24-32	10.5-13.5	24-32	10.5-13.5	24-32	10.5-13.5
Input Current, ma.	14	14	14	14	14	14	14	14	15
Output Frequency	Fixed. Any frequency from 50 cy. to 80 KC		Variable ± 3% around any specified frequency from 50 cy. to 80 KC		Fixed. Any frequency from 50 cy. to 80 KC		Variable ±3% around any specified frequency from 50 cy. to 80 KC		
Initial Frequency Accuracy, per cent	± 1	± 1	0	0	± 1	± 1	0	0	0
Frequency Drift, maximum, per cent	± 3	± 3	± 3	± 3	± 3	± 3	±3	± 3	±3½
Required Resistive load, ohms	600	600	600	600	600	600	600	600	220
Output Voltage, VRMS, minimum	1	1.5	1	1.5	Variable, from 0.5 to 1 VRMS or greater	Variable, from 1 to 2 VRMS or greater	Variable, from 0.5 to 1 VRMS or greater	Variable, from 1 to 2 VRMS or greater	Variable, from 0.5 to 1 VRMS or greater
Change in Amplitude, maximum db.	± 1	±¾	± 1	±¾	± 1	±¾	± 1	±¾	± 1
Distortion, maximum per cent	2	2	2	2	2	2	2	2	2

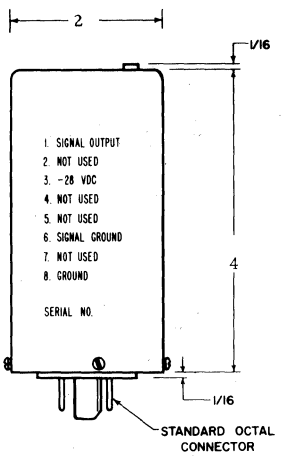
Note—UNITS EASILY MODIFIED TO MEET YOUR SPECIFICATIONS. WRITE FOR COMPLETE LITERATURE

M F Electronics Corp.
118 EAST 25TH STREET, NEW YORK, N.Y. 10010 / 212 OR 4-5360

CRYSTAL OSCILLATORS 3.5 KHZ to 10 MHZ

- Modular Construction — Easily repairable in the field
- MIL-E-16400E, Class 4, with temperature to 60°C
- High Reliability; high MTBF; parts from MIL-STD-242
- Output drives 500 ohms

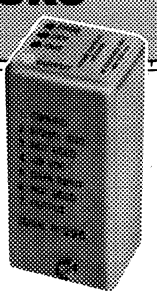
	Series 401	Series 401A	Series 402	Series 402A
Voltage Input	−28 ±2 volts	+28 ±2 volts	−28 ±2 volts	+28 ±2 volts
Current	25 ma., max.		25 ma., max.	
Frequency Stability	±.01%		±.01%	
Output Voltage	0 to 2.5 VRMS, adjustable		2.5 VRMS, min.	
Output Stability	1 db, total		1db, total	
Distortion	5%, max.		5%, max.	



SERIES 403A IS GATED CRYSTAL OSCILLATORS FOR COMMAND FUNCTIONS.

VOLTAGE CONTROLLED OSCILLATORS

SERIES 300



- Modular construction — easily repairable in the field
- MIL-E-16400E, Class 4, with temperature to 60°C
- High reliability; high MTBF; parts from MIL-STD-242
- Frequency stability 0.15% of frequency
- High deviation

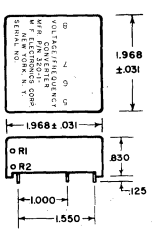
VOLTAGE TO FREQUENCY CONVERTERS

(WIDE BAND VCO)

Used to convert an analog voltage into digital form. May be applied to register to read digital output.

SERIES 320-1 full military unit meeting MIL-E-16400. Accuracy of conversion is (1% of reading +0.7% of full scale).

SERIES 320-2 for commercial application in the conversion from analog to digital. Range of frequencies is 0 to 50 kHz.



AC DATA VCO MODULATOR AND DEMODULATOR, SERIES 310 AND 410

The 310-1 and 410-1 comprise a modulator-demodulator pair which can be used for transmission of very low frequencies via standard voice channels. Frequency response is 1 Hz to 200 Hz. Carrier is nominal 2500 Hz. Quantity cost for the pair is $95.00. Useful in oceanagraphic, geodetic, seismographic applications, wherever transmission of low frequencies are involved. Detailed data sheets available.

UNITS PRODUCED TO MEET YOUR REQUIREMENTS . . .
WRITE OR TELEPHONE FOR INFORMATION

MF Electronics Corp.

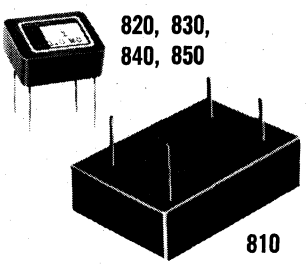
118 EAST 25TH STREET, NEW YORK, N.Y. 10010 / 212 OR 4-5360

OFF THE SHELF DELIVERY!

ECONOMY INTEGRATED CIRCUIT OSCILLATORS

as low as $32.90 each in 10 quantity

Monitor's new 800 Series Integrated Circuit Oscillators make it uneconomical to buy crystals (even ours) and design your own oscillator. Why are they so economical? They were designed specifically for the less stringent temperature and stability requirements found in commercial and industrial EDP and digital control applications. But don't think the low price means lower quality. They feature the same high quality, workmanship and reliability as the 700 Series IC Oscillators shown below.



Who pioneered the Koldwell Crystal . . . MONITOR! Who was first with a complete line of integrated Circuit-Subminiature Oscillators . . . MONITOR! NOW — who is going to be first to break the Availability Barrier . . . you know it . . . MONITOR is! We say it's "STOCK IT TO ME TIME!" That's right — off the shelf, directly to you for the first time, complete crystal oscillators. Not just one or two but 34 of the most commonly manufactured frequencies. Naturally, we are not going to have all the items you need, but beside the crystal oscillators, we have thousands of crystals ready to go — in all shapes and sizes — give us a chance to show we mean business. Call us — tell us what you need and just say "STOCK IT TO ME!" (We've got some OVENS in stock, too . . .)

TYPE	FREQUENCY RANGE	OUTPUT	OSC INPUT VDC	OSC CURRENT DRAIN MA	DIMENSIONS (INCHES)	TYPICAL STABILITY (0-60°C)	PRICE 1	PRICE 10	PRICE 50
810	16-80 KHZ	Logic 0:+.2V±.2V	5 ±10%	15	1.87 x 1.25 x .5	±80 ppm	98.50	49.85	39.90
820	80-900 KHZ	Logic 1:+2.8V min			1.00 x 1.25 x .5	±60 ppm	78.40	41.60	35.60
830	1 MHZ	TTL		25	1.00 x 1.25 x .5	±30 ppm	85.30	47.75	40.73
840	1.5-3 MHZ			15		±30 ppm	69.50	35.90	29.85
850	3-10 MHZ					±30 ppm	66.85	32.90	26.80

INTEGRATED CIRCUIT CLOCK STANDARDS

New Model 613 1 MHZ IC Oscillator with parts in 10^{-9} stability after 30 days of aging. Approximately $60 each in 100 quantity.

1 MHZ

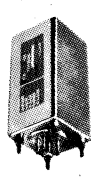
TYPE	FREQUENCY RANGE	OUTPUT	INPUT VDC OSC	INPUT VDC OVEN	CURRENT DRAIN MA OSC	CURRENT DRAIN MA OVEN	DIMENSIONS	TYPICAL STABILITY (0-50°C)	TYPICAL STABILITY (25°C ±2°C)	TYPICAL** AGING (PER/DAY)
613†	1 MHZ	Logic 0:+.2V ±.2V Logic 1:2.8V min. Square Wave TTL	+5 ±1% +12 ±1% +28 ±1%	115 VAC 28 VDC	30	350	1.5 x 1.5 x 2.75	.005 PPM/°C	±.003 PPM	.003 PPM
761†	1 MHZ				30	500	2 x 2 x 4.2	.002 PPM/°C	±.002 PPM	.005 PPM
3249†	1 MHZ				30	350	1.1 x 2.1 x 2.5	.005 PPM/°C	±.003 PPM	.003 PPM
762*	1 MHZ			28 VDC	30	350	2 x 2 x 4.2	.002 PPM/°C	±.001 PPM	.005 PPM
726*	1 MHZ			28 VDC	28	75	2 x 1.06 x .7	.01 PPM/°C	±.005 PPM	.08 PPM
748	1 MHZ		+5 ±5%	NA	25	NA	.8 x .4 x .8	.5 PPM/°C	±1 PPM	.08 PPM
751					25		1 x 1.25 x .5	.2 PPM/°C	±.5 PPM	.003 PPM

* Proportional control. † Solid state mercury. ** Aging after 45 days of dynamic usage.
Note: Standards at other frequencies are available in above packages with similar specifications.

100 MHZ

TYPE	FREQUENCY RANGE	OUTPUT	INPUT VDC OSC	INPUT VDC OVEN	CURRENT DRAIN MA OSC	CURRENT DRAIN MA OVEN	DIMENSIONS	TYPICAL STABILITY (0-50°C)	TYPICAL STABILITY (25°C ±2°C)	TYPICAL** AGING (PER/DAY)
624†	40-120 MHZ	2 VPP min. 50 ohm load	−20 ±1%	28 VDC	50	500	2 x 2 x 4.4	.5 PPM	±.05 PPM	.05 PPM
770	40-100 MHZ	Logic 0:−1.6V Logic 1:−.75V MECL	−5.2 ±5%	NA	40	NA	.8 x .4 x 1.5	60 PPM	NA	.5 PPM

† Solid state mercury. ** Aging after 45 days of dynamic usage.
"DUAL INLINE PACKAGING": Equivalent packages are available with .6" dual inline pin spacing for standard logic P.C. board. For further information, please consult factory.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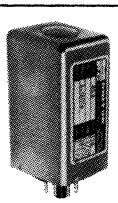
762
624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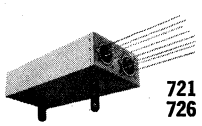
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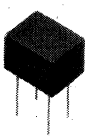
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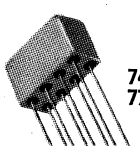
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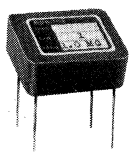

751

MONITOR PC

MONITOR PRODUCTS COMPANY, INC.

815 FREMONT AVE. / SOUTH PASADENA, CALIFORNIA 91030 / (213) 682-3761

see our data in VSMF VISUAL SEARCH MICROFILM FILE

CRYSTAL FILTERS

As one of the nation's leading suppliers of high reliability crystals and subminiature integrated circuit oscillators, Monitor Products recently expanded their product line to include quartz crystal filters in the 20-1000 KHz region.

With the utilization of the computer in the realization and most importantly in the analysis of filter networks, Monitor is now able to provide a suitable tool to produce crystal filters for our customers.

A broad list of catalog items is not available, but Monitor will quote directly to your filter requirements.

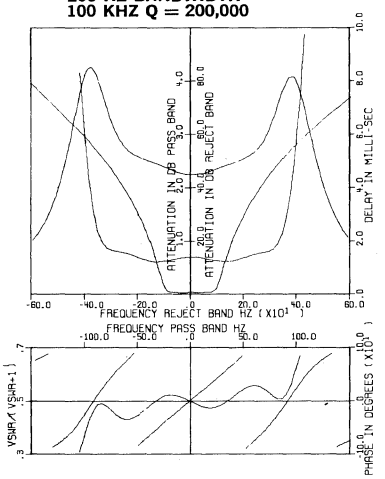
Monitor has developed several prototype networks based on computer-aided design. The computer-graphic analysis of these networks is shown below. The figures are in themselves somewhat unique in that all of the pertinent characteristics of the network are available to the customer with a single graphic presentation.

While these are theoretical curves, it can be noted that they are not the common textbook variety, and the physical losses of both crystals and coils are included in the analysis. In the majority of these cases where a computer-graphic analysis is presented, the characteristics far exceed the specifications. If the design in any way appears borderline, element perturbations are made and a sensitivity projection indicated to justify or eliminate the design.

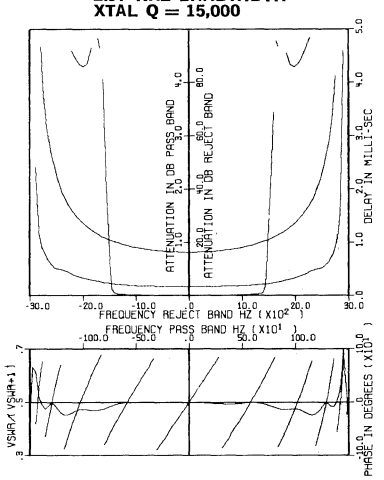
While Monitor is new in the filter field, we feel that the crystal is the heart of the device, and our capabilities in this area are well known. We cannot guarantee that we can produce every one of your requirements. However, we can guarantee that we will not lead you into production delays by a faulty and unrealistic design.

Please forward your production requirements to Monitor for our analysis and quotation.

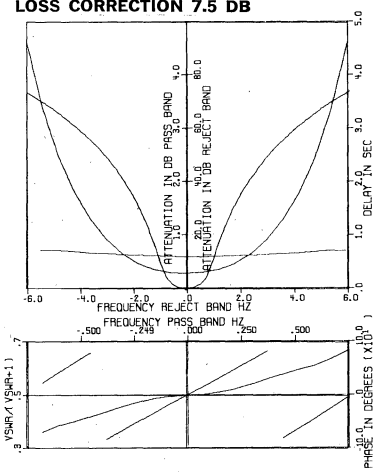
FOUR POLE — FOUR ZERO
200 HZ BANDWIDTH
100 KHZ Q = 200,000



100 KHZ SSB FLTR
2.97 KHZ BANDWIDTH
XTAL Q = 15,000



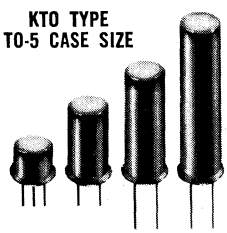
FOUR POLE — NO ZERO
1.5 HZ BANDWIDTH 100 KHZ Q = 200,000
LOSS CORRECTION 7.5 DB

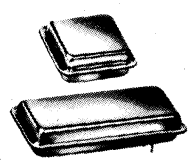


HIGH RELIABILITY "KOLDWELD" CRYSTALS 10KHZ TO 170MHZ

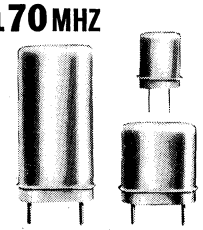
The KOLDWELD process is the first major advance in crystal reliability and packaging in 20 years. The process eliminates contaminating solder, flux and heat from the sealing process and improves aging and reliability. Each crystal is manufactured under decontaminant conditions, then leak tested to 10^{-8} cc of helium per second prior to final QC testing. There's a Monitor crystal for all your high reliability frequency control applications. Monitor also manufactures a complete line of crystals to MIL-C-3098D.

KTO TYPE
TO-5 CASE SIZE





KBM TYPE
CIRCUIT BOARD
MOUNTING



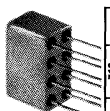
KX TYPE
HC CASE SIZE

SOLID STATE AND INTEGRATED CIRCUIT OSCILLATORS: 60 HZ TO 150 MHZ

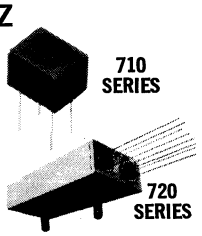
519
520
521
OVEN
619
620
621
OSC



740 SERIES



	OSCILLATOR MODEL NUMBER	FREQUENCY RANGE	OUTPUT	INPUT VDC		CURRENT DRAIN MA		DIMENSIONS INCHES	BASIC STABILITY OVER AMBIENT PPM
				OSC	OVEN	OSC	OVEN		
710 SERIES	710, 11	20-200 KHZ	Logic zero: +.2V ±.2V Logic one: +2.8V min.	5±10%	NA	15	NA	As small as .38 cu. in.	150
	712, 13	201-400 KHZ						As small as .22 cu. in.	100 to 400
	714, 15, 16	400-1000 KHZ						As small as .16 cu. in.	100 to 400
740 SERIES	740, 41	125-700 KHZ	Logic zero: +.2V ±.2V Logic one: +2.8V min.	5±10%	NA	15 & 25	NA	.8 X .4 X .8	100 to 250
	742, 43, 44	2-700 KHZ				15, 25 & 50		.8 X .4 X 1.44	100 to 250
	745	455-1000 KHZ				15		.8 X .4 X .5	120 to 400
	746, 47	500KHZ-40MHZ				25		.8 X .4 X 1.0 max.	40
750 SERIES		4KHZ-4 MHZ	Dual complimentary compatible TTL	5±10%	NA	15 (60 below 75 KC)	NA	1.0 X 1.25 X .5	40 to 350



710 SERIES

720 SERIES

	MODEL NUMBER	FREQUENCY RANGE	OUTPUT	INPUT4VDC OSC	INPUT4VDC OVEN	CURRENT DRAIN MA OSC	CURRENT DRAIN MA OVEN	DIMENSIONS	TYPICAL STABILITY 0-50°C	TYPICAL STABILITY 25°C ±2°C	TYP.** AGING PER DAY
720 SERIES	720, 21*	20-200 KHZ	Logic zero: +.2V ±.2V Logic one: +2.8V min.	5 ±10%	26 ±4	15	−55°C 150 0°C 75 +25°C 35 +55°C 20	As small as 1.48 cu. in.	.05 PPM/°C	±.2 PPM	.5 PPM
	722, 23*	201-400 KHZ				25		As small as 1.11 cu. in.			
	724, 5, 6, 7*	400 KHZ-10 MHZ				15			.01 PPM/°C	±.005 PPM	.08 PPM
	612†, 613	7 KHZ-20 MHZ	2V pp, 2K sine 4V pp, 4K sq. (2MV min. into 50 ohms above 15 MHZ)	12 or 26	28 or 115 VAC	15	500 to 130	1.875 x 1.437 x 4	.005 PPM/°C	±.003 PPM	.003 PPM
	619†, 761	75-250 KHZ				65		2 x 2 x 4.5	.02 PPM/°C	±.02 PPM	.02 PPM
	620†, 761	3 KHZ-70 MHZ				15 to 65			Stability varies with frequency. Consult factory.		
	621*, 762	75 KHZ-70 MHZ		26	28	15 to 65	500 max.				

* Proportional control. † Solid state mercury. ** Aging after 45 days of dynamic usage.

CRYSTAL AND COMPONENT OVENS

100 DIFFERENT DESIGNS

SOLID STATE MERCURY AND PROPORTIONAL CONTROLLED

Monitor solid state mercury and proportional control ovens are available in a variety of high reliability subminature packages and also in larger configurations. Each oven is designed for high stability, wide variety of temperature and environmental conditions.

MONITOR PC

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WRITE FOR A COPY OF OUR NEW 40 PAGE CATALOG

MOTOROLA FREQUENCY PRODUCTS

MOTOROLA COMMUNICATIONS AND ELECTRONICS INC.
A Subsidiary of Motorola Inc.
Dept: Component Products
4501 W. Augusta Blvd.
Chicago, Illinois 60651
Phone (312) 772-6500

CRYSTAL OSCILLATORS

PRECISION OVEN CONTROLLED OSCILLATORS

Motorola has pioneered the field in the design and manufacture of ultra-precision, oven controlled, crystal oscillators. Meeting both military and commercial standards, and designed for both mobile and laboratory use, they are ideally suited for the generation and control of precise frequency and time signals. Both standard and custom designs are offered.



HIGH STABILITIES: To parts in 10^{-10} vs: environmental factors.
WIDE FREQUENCY RANGE: From 60 KHz to 20 MHz normal. Extended ranges available on special order.
FAST WARMUP: The industry's fastest. Meets all military requirements.
WIDE TEMPERATURE RANGE: From —55°C to + 125°C. Extended ranges available on special order.
LOW AGING: Less than 5 x 10^{-10}/day.
OTHER FEATURES: All silicon solid state design. Proportionally controlled ovens. Excellent spectral purity designs with output filters available.

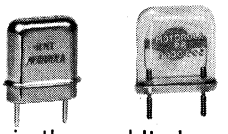
TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

A complete line of TCXO oscillators is available for applications where compactness, minimal power drain, and instant operation is needed. Established designs are supported by high production rate capabilities.



FREQUENCY RANGE: 4 MHz to 30 MHz normal. Extended ranges available to order.
STABILITIES: 1.0, 2.0, 3.5, 5.0 and 10.0 PPM standard designs over temperature ranges extending from —30°C to +85°C. Others on special order.
OUTPUTS: Sine, square, and logic drivers.
OTHER FEATURES: All silicon solid state construction. Cold weld low aging rate crystals. Compact, space saving packaging.

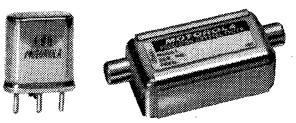
PRECISION CRYSTALS



Motorola is the world's largest manufacturer of precision grade high frequency crystals. High volume facilities at multiple plants.

FREQUENCY RANGE: 2.0 MHz to 60 MHz normal. Standard designs to 250 MHz available.
HOLDERS: Glass HC-27/U, HC-6/U, HC-25/U, and HC-18/U cold weld and solder seal.
LOW AGING: Rates as low as 1 x 10^{-6}/yr.
OTHER FEATURES: Gold plated electrodes exclusively. All manufacturing in Class 100 Clean Room facilities. Tight tolerance designs for TCXO and filter applications are standard.

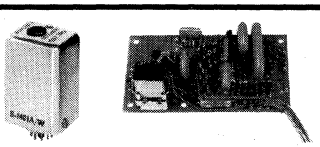
CRYSTAL FILTERS



Motorola has a wide range of designs employing both monolithic and discrete component techniques. Special designs readily produced on a production level basis.

DESIGNS: Band pass, band reject, symmetrical, asymmetrical, contiguous comb.
FREQUENCY RANGE: 1.0 MHz to 250 MHz.
SIZE: As small as ½" square.
TYPES: Monolithic and discrete designs.

TONE MODULES



Motorola offers a line of tone modules especially designed for selective switching, signalling and similar applications. Modules are operating devices based on Motorola's time proven contactless resonant reeds combined with solid state circuitry.

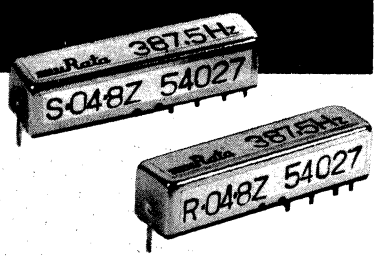
MOUNTING: Plug in custom circuit board modules.
CIRCUITRY: Solid state combined with contactless resonant reeds.
FREQUENCY RANGE: 67 Hz to 3000 Hz.
OTHER FEATURES: Highly selective, extremely stable, low operating power.

CUSTOM DESIGNS

Motorola now offers its extensive design and production facilities in the frequency components field to other OEM manufacturers in the electronics industry. Both standard designs and your custom designs are available, at multiple plant facilities, for production level deliveries. For further information address all inquiries to: Marketing Manager, at the above address.

LOW FREQUENCY FILTER ?

SPECIFY MURATA MICROFORK®
a unique piezoelectric tuning fork.



MICROFORK MODEL EFM

Microfork is a newly designed subminiaturized tuning fork.

This model is now widely used for bellboy system, selective calling, remote control and tone control of electronic music instruments, where compactness, ruggedness and economy are required.

Nickel plated brass case is mounted on a plastic base designed for printed circuit arrangement.

SPECIFICATION

Items	for Receiver EFM-R	for Sender EFM-S
Frequency	360~2900Hz	
Frequency Accuracy	360~ 999Hz ; ±0.5Hz 1000~2900Hz ; ±1.0Hz	
Input and output Impedance	300KΩ	
Insertion Loss*	10dB max.	
Temperature Coefficient of Frequency	3.5×10^{-5}/°C max.	
Allowable Temperature Range	−20~+60°C	

* Insertion Loss $=20\log\frac{E_1}{E_2}-6$(dB)

STANDARD FREQUENCY (Hz)

367.5	532.5	697.5	862.5	1000
382.5	547.5	712.5	877.5	1500
397.5	562.5	727.5	892.5	1700
412.5	577.5	742.5	907.5	1900
427.5	592.5	757.5	922.5	2100
442.5	607.5	772.5	937.5	2300
457.5	622.5	787.7	952.5	2500
472.5	637.5	802.5	967.5	2700
487.5	652.5	817.5	982.5	2900
502.5	667.5	832.5	997.5	
517.5	682.5	847.5		

DESIGN CONSIDERATION

1. Maximum voltage of input is 10Vrms.
2. Microfork is not effected by magnetic field and is not mutually coupled even in close lay-out.
3. Microfork may oscillate in higher harmonics. In this case, you should use high pass capacitor (0.001~0.005 μF) at the output of Microfork, as shown in Fig. 3.
4. EFM-R is adjusted by the test circuit of Fig 1.
   But oscillating frequency by the self-oscillator circuit of Fig. 3 is lower about 0.2% than the adjusted frequency.

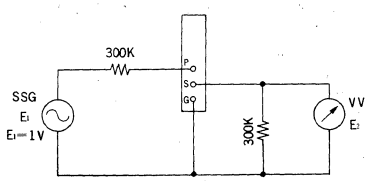


Fig. 1

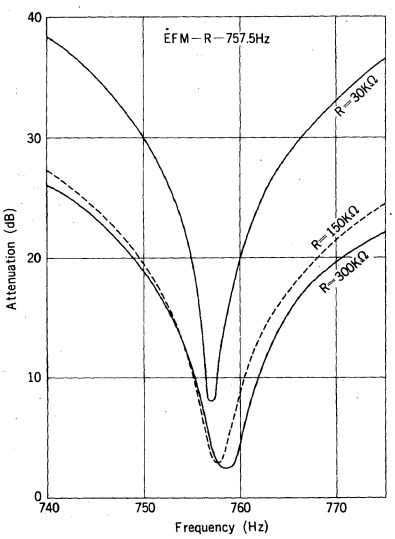


Fig. 2

So, EFM-S is adjusted by the test circuit of Fig. 3.

5. The input and output impedance of Microfork is 300 KΩ as shown in the specification.
   The band-width of Microfork is maximum when terminated by this valued resistance as shown in Fig. 1.
   When the resistance value is smaller, both band-width and resonant frequency decrease the more as shown in Fig. 2.

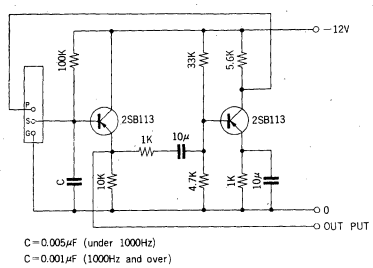


Fig. 3

VOLTAGE CHARACTERISTIC

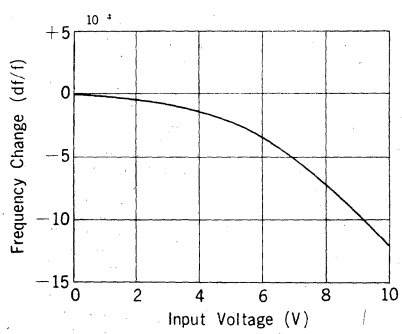


Fig. 4

muRata

Murata Manufacturing Co.
Nagaoka, Kyoto, Japan
Telex: 5422-317 KYO
Cable Address: MURATAKYOTO

Murata Corp. of America
2 Westchester Plaza, Elmsford,
New York 10523
Telex: MURATA EMFD 137332
Phone 914-592-9180

FREQUENCY CONTROL DEVICES

HERMETICALLY SEALED IN METAL

NE-6 Equivalent to Mil HC-6/U holder. Frequency range 185 Khz to 55 Mhz. Available with wire leads or large pins.

NE-12 Designed to fill size gap between HC-6/U and HC-18/U. Popular with filter manufacturers. Frequency range 3 Mhz to 55 Mhz.

NE-13 Equivalent to Mil HC-13/U holder. Frequency range 3.5 Khz to 250 Khz. Can be extended down to 2.0 Khz with taller versions. Available with wire leads.

NE-18 Equivalent to Mil HC-18/U holder. Available in frequency range 10 Mhz to 55 Mhz.

NE-25 Equivalent to Mil HC-25/U holder. Available in frequency range 10 Mhz to 55 Mhz.

VACUUM SEALED IN GLASS

T-3 Under .400" in diameter. Available in frequency range of 10 Khz to 200 Khz.

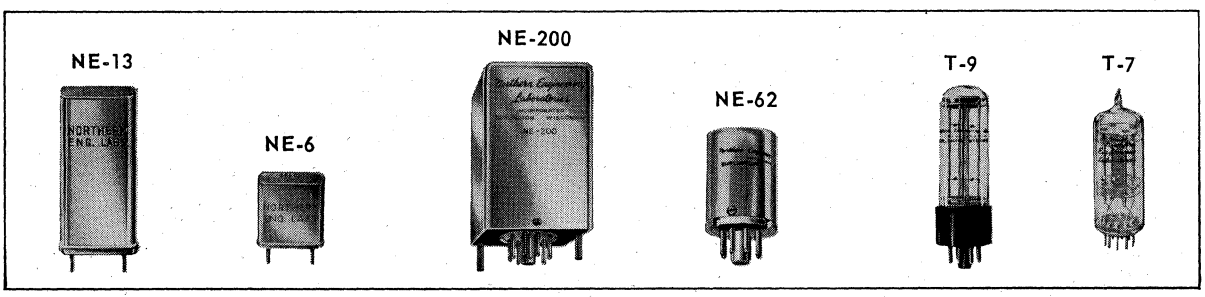
T-6 Equivalent to 6AU6 tube in size. Available in frequency range of 6 Khz to 400 Khz.

T-7 Equivalent to 12BH7 tube in size. Frequency range 2 Khz to 400 Khz. Especially popular at 100 KC for precision time base for frequency counters.

T-9 Equivalent in size to 6SN7 tube. Frequency range 800 hz to 200 Khz.

T-12 Equivalent to 6146 tube in size. Frequency range 75 Khz to 120 Khz, & 550 Khz to 1600 Khz.

Metal QUARTZ CRYSTALS Glass



Crystal OVENS Component

NE-62 Capable of holding two HC-6/U crystals, or other components of equivalent size. Popular for voltage reference diodes.

NE-71 For enclosing one T-7 crystal.

NE-132 Capable of holding two HC-13/U crystals, or other components of equivalent size. Popular for voltage reference diodes.

NE-200 With cavity size 2.75" high, 1.75" wide, by 1.375" deep, this oven is very popular for components. Can be adapted to accept plug in cards.

NE-461 Designed to hold one HC-6/U crystal where exceptional stability is required, without high cost of proportional control.

Many other types available as standard production models, or contact us with your special requirements.

Request Detailed 20 Page Catalog 367

Card OSCILLATORS Package

NE-100TO A stable unit capable of handling a wide variety of applications. Popular at 100 Khz, high or low impedance, sign wave output. Available with A.F.C. terminal. With or without temperature control.

NE-200TO A versatile package for one or two oscillators, or one oscillator and another board for other functions. With or without temperature control.

Hermetically sealed oscillator packages for severe environments. Can be provided with terminal for remote frequency trim. Card oscillators for either plug in or bolt - down mounting. Available with amplifiers and wave shaping circuits. Temperature compensated oscillators for improved performance without the power required for temperature control.

SEE OUR SPECIFICATIONS IN VSMF MICROFILM CATALOG FILE

Northern Engineering Laboratories Incorporated
357 Beloit Street, Burlington, Wisconsin 53105 Phone: Area Code 414 - 763-3591

CRYSTALS

"Makers of fine crystals since 1934"

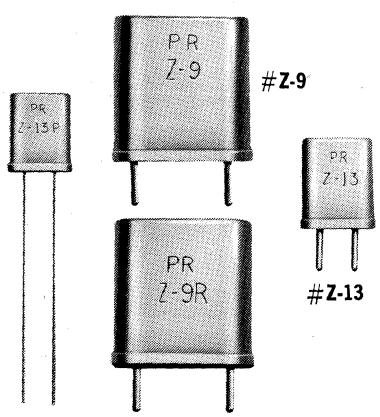
PETERSEN RADIO HI FREQUENCY MILITARY TYPE CRYSTALS FOR

- **VHF AIRCRAFT REQUIREMENTS**
- **VHF MARINE BAND REQUIREMENTS**
- **SPECIAL VHF APPLICATIONS**

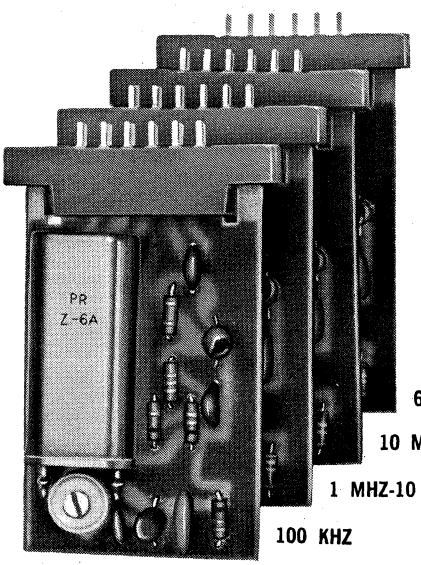
MILITARY QUARTZ CRYSTAL UNITS

Military Crystal Unit	PR Type	Military Holder	Frequency Range Nominal KHZ	Operating Temp. Range °C	Frequency Tolerance %	Co PF	Resonance
CR-54A/U	Z-9R	HC-6/U	50,000 to 125,000	−55° to +105° C	±0.005	7.0	Series
CR-56A/U	Z-13P	HC-18/U	50,000 to 125,000	−55° to +105° C	±0.005	7.0	Series
CR-59A/U	Z-13P	HC-18/U	50,000 to 125,000	85° C+1°	±0.002	7.0	Series
CR-75/U	Z-9R	HC-6/U	50,000 to 125,000	75° C+1°	±0.001	7.0	Series
CR-80/U	Z-13P	HC-18/U	50,000 to 125,000	−40° to +90° C	±0.002	7.0	Series
CR-82/U	Z-13	HC-25/U	50,000 to 125,000	−55° to +105° C	±0.005	7.0	Series
CR-83/U	Z-13	HC-25/U	50,000 to 125,000	−40° to +90° C	±0.002	7.0	Series
CR-107/U	Z-13P	HC-18/U	70,000 to 125,000	−55° to +105° C	±0.005	6.0	Series
CR-116/U	Z-13P	HC-18/U	50,000 to 125,000	−55° to +105° C	±0.005	4.5	Series

CR-18A/U Maximum drive level 10 Mw. from 800 KHZ to 1.00 MHZ. Drive level 5 Mw. from 1.00 MHZ to 25 MHZ. Correlated to 32 pf. unless otherwise specified.



#Z-13P #Z-9R #Z-9 #Z-13



60-125 MHZ
10 MHZ-60 MHZ
1 MHZ-10 MHZ
100 KHZ

FREQUENCY STANDARDS
+5° x cut. Correlated at 32 pf. load capacitance. Tolerance ±.005% .050" pins; .486" pin spacing; 1.526" height above pins; .757" width at base. 100 KHZ only.



#Z-6A

OSCILLATORS 1 MHZ-125 MHZ Output impedance 50 ohms. Minimum output 10 Mw. □ Frequency Dividers available below 1 MHZ.

Write for Petersen's complete military crystal type catalog.

PETERSEN RADIO CO., INC. 2800 WEST BROADWAY COUNCIL BLUFFS, IOWA 51501

Export Sales: Roburn Agencies, Inc., 431 Greenwich St., New York, New York 10013

REEVES-HOFFMAN

Described are typical units of commonly used types. Descriptive data, including measured capabilities, furnished on request. If your need concerns types and parameters not shown, please contact our plant.

Available with special C_0, C_1, and L_1 for filter applications • temperature coefficients to your specifications • pre-aging to guarantee stability of high precision units • special designs for high shock and vibration. All units meet mil-3098 requirements. Special high precision units, with aging characteristics up to 2×10^{-11} per day, are available in standard frequencies of 1, 2.5 and 5 MHz.

CRYSTALS

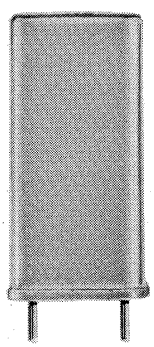
Frequency Range	Frequency Tolerance/Temperature Range			Holder Size (Military)*
	−55°C to +105°C	−40°C to +85°C	0°C to +50°C	
.85 to 50 kHz	±0.02%	±0.015%	±0.01%	HC-6, HC-13, HC-14
1 to 14 kHz	±0.02%	±0.015%	±0.01%	HC-13
14 to 150 kHz	±0.015%	±0.010%	±0.008%	HC-6, HC-13, HC-14, HC-17
90 to 300 kHz	±0.025%	±0.018%	±0.01%	HC-6, HC-13, HC-17
200 to 500 kHz	±0.012%	±0.008%	±0.003%	HC-6, HC-14, HC-17, HC-21(**)
200 to 800 kHz	±0.009%	±0.005%	±0.003%	HC-6, HC-13, HC-14, HC-17
250 to 800 kHz	±0.018%	±0.015%	±0.008%	HC-6, HC-14, HC-17
500 to 1,400 kHz	±0.005%	±0.004%	±0.0025%	HC-6, HC-14, HC-17
1.4 to 20 MHz	±0.004%	±0.004%	±0.002%	HC-6, HC-14, HC-17, 511, 512
10 to 200 MHz	±0.004%	±0.003%	±0.002%	HC-6, HC-13, HC-14, HC-17, HC-18

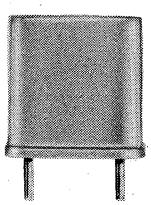
* All units listed are also available in T-5 ½ glass holder.

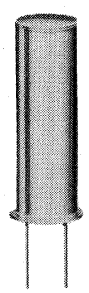
** Also available in T-9 glass bulb.

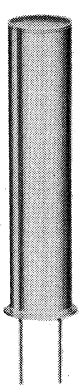
QUARTZ CRYSTAL HOLDERS

CW—Coldweld
SS—Solderseal

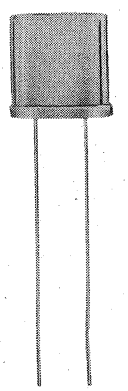

RH-13 (SS)

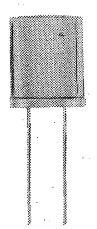

RH-6 (SS)

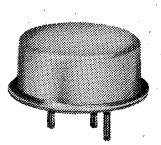

A-3 (CW)

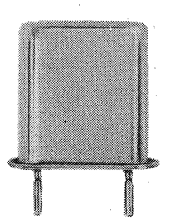

A-2 (CW)

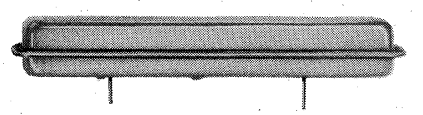

A-5 (CW)

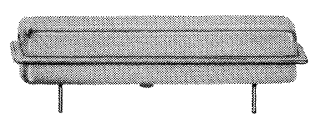

RH-512 (SS)

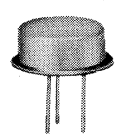

RH-18 (SS)

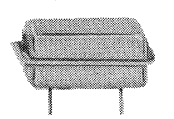

C (CW)


DA (CW)


E-1 (CW)


E-2 (CW)


B-5 (CW)


E-3 (CW)

Illustrations show actual sizes

REEVES-HOFFMAN

DIVISION OF DCA

400 WEST NORTH STREET, CARLISLE, PA. 17013

REEVES-HOFFMAN CRYSTAL FILTERS

Note: The frequencies and bandwidths indicated are not to be considered production limitations. Variations of these filters can be made over the frequency range of approximately 10 kHz to 30 MHz (or higher).

BAND PASS

Center Frequency	3 dB Bandwidth	Shape Factor	Impedance (Ohms)	Size (in.) (L x W x H)
8 kHz	4 Hz	50:1 @ 40 dB	600	1.82 x 1.5 x 5.0
100 kHz	2 Hz	4:1 @ 60 dB	3K	4.25 x 2.0 x 3.82
250 kHz	100 Hz	3:1 @ 60 dB	8K	2.0 x 2.0 x 3.5
455 kHz	200 Hz	10:1 @ 60 dB	2K	3.5 x 1.5 x 2.0
700 kHz	1000 Hz	10:1 @ 80 dB	2.5K	1.5 x 1.5 x 3.5
1.75 MHz	400 Hz	5:1 @ 60 dB	1K	1.0 x 1.5 x 1.5
1.75 MHz	110 Hz	2:1 @ 60 dB	200	3.75 x 1.75 x 1.25
3.0 MHz	400 Hz	6:1 @ 60 dB	5K	3.0 x 2.0 x 1.5
4.0 MHz	1200 Hz	10:1 @ 70 dB	50	3.5 x 1.5 x 1.5
* 9.0 MHz	5400 Hz	2:1 @ 60 dB	470	1.5 x .75 x .32
*10.7 MHz	2700 Hz	2:1 @ 60 dB	470	1.5 x .75 x .32
*10.7 MHz	13 kHz	2:1 @ 60 dB	470	1.5 x .75 x .32
10.7 MHz	800 Hz	1.5:1 @ 60 dB	600	2.0 x 2.0 x 1.0
11.5 MHz	120 kHz	4:1 @ 40 dB	2K	1.5 x 1.5 x 1.0
20.0 MHz	30 kHz	1.7:1 @ 60 dB	1K	1.5 x 1.5 x 1.0
*25.0 MHz	26 kHz	3:1 @ 50 dB	2K	1.75 x .70 x .50
30.0 MHz	25 kHz	3:1 @ 60 dB	2K	1.5 x 1.5 x 1.0

* "MINILITH," Reeves-Hoffman monolithic design.
† Reeves-Hoffman "Hi-Fidelity" SSB design.

SINGLE SIDE BAND

Center Frequency	3 dB Passband	Min. Attenuation	Insertion Loss	Passband Variation	Impedance (Ohms)
250 kHz	−230 to −7730 Hz	60 dB	6.0 dB	3 dB max.	3K
250 kHz	+240 to +7740 Hz	60 dB	6.0 dB	3 dB max.	3K
1750 kHz	−350 to −3040 Hz	70 dB	6.0 dB	1.5 dB	3K
1750 kHz	+350 to +3040 Hz	70 dB	6.0 dB	1.5 dB	3K
†1743.71 kHz	−3255 to −5935 Hz	70 dB	3.0 dB	.5 dB	220
†1750.00 kHz	−255 to −3035 Hz	70 dB	3.0 dB	.5 dB	220
†1750.00 kHz	+255 to +3035 Hz	70 dB	3.0 dB	.5 dB	220
†1756.29 kHz	+3255 to +5935 Hz	70 dB	3.0 dB	.5 dB	220
* 9.0 MHz	(6 dB) +500 to +3000 Hz	60 dB	3.0 dB	1.5 dB	470
* 9.0 MHz	(6 dB) −500 to −3000 Hz	60 dB	3.0 dB	1.5 dB	470
*10.7 MHz	+500 to +3200 Hz	60 dB	2.0 dB	2.0 dB	470
*10.7 MHz	−500 to −3200 Hz	60 dB	2.0 dB	2.0 dB	470

REEVES-HOFFMAN CRYSTAL OSCILLATORS

Note: Parameters shown are not production limitations. Custom designing is available from 1 Hz to 200 MHz. Stability, aging, output voltage, waveform, and environment to your specifications.

Frequency	Aging	Output	Supply Voltage	Temp. Range	Size in.) (L x W x H)
60 Hz	3×10^{-8}/day	1v, rms	12v, ac	10°C to 60°C	4 x 4.7 x 4.9
400 Hz	25×10^{-6}/yr.	sq. wave	24v, dc	−32°C to +52°C	1.75 x 1.75 x 4.33
100.000 kHz	3×10^{-8}/day	1v, rms	28v, dc	−40°C to +70°C	1.88 x 1.44 x 3
90-650 kHz	25×10^{-6}/yr.	1v, rms	30v, dc	−30°C to +55°C	1.290 dia. x 4.062
1000.000 kHz	1×10^{-9}/day	1v, rms	28v, dc	0°C to 65°C	2 x 2 x 4.75
2500.000 kHz	2×10^{-11}/day	100 kc 1.0 mc 5.0 mc 1v, rms	24v, dc	0°C to 40°C	Rack mount 5¼" panel
5000.000 kHz	1×10^{-8}/wk	55mv	12v, dc and 26v, dc	0°C to 60°C	8.5 x 5 x 5

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up to the minute
data
about the
latest

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Philamon® INCORPORATED

90 HOPPER STREET, WESTBURY, NEW YORK 11590

SHEROLD FREQUENCY CONTROLS

CRYSTALS

PRECISION EXCEEDING MIL SPECIFICATIONS

Advanced design crystals in all frequencies, for military and commercial users. Sherold's complete research, design and production facilities enable us to produce to the most exacting specifications in small quantities or high volume. Questions about selection, design, or special application are always welcome.

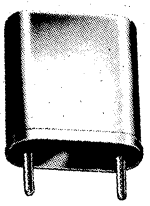
SC-100



Freq. Range } 4-125 MC

Subminiature hermetically-sealed plated unit. Smallest space requirements of any hermetic crystal available. Weight approximately 1/25 ounce. Shown actual size.

SC-6



Freq. Range } 190 KC-125 MC

Metal plated and hermetically sealed in military type HC-6/U holder. Very low resistance, low drift, rugged construction. Available in 25 military types. Shown here actual size.

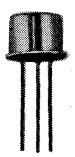
SC-106

Identical to SC-100 except designed for plug-in application with .040 diameter pin.

SC-8

Identical to SC-6 except for 2-inch tinned wire leads for soldered-in applications.

SC-15



SC-17



New popular TO-5 and "Flat Pack" Holders above give maximum feasibility for circuit board mounting.

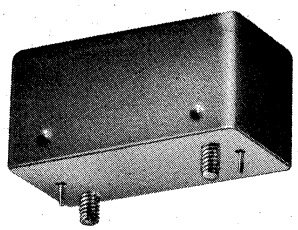
OTHER HOLDER STYLES ARE AVAILABLE

MILITARY TYPES: MIL C 3098
MOST CR TYPES, FREQUENCY RANGES AND HOLDER STYLES

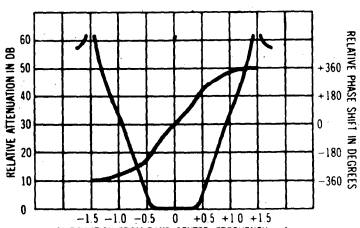
RESISTANCE WELD SEALS
COLD WELD SEALS

CRYSTAL FILTERS; LC FILTERS; CRYSTAL DISCRIMINATORS

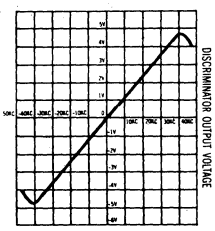
Miniaturized crystal filters designed for use where extreme selectivity and stability must be combined with minimum volume. Under one roof are facilities for designing and producing crystal filters as well as filter crystals. This assures fabrication of highly reliable crystal filters and discriminators. Sherold has also designed and is producing monolithic filters in volume.



BANDPASS FILTER



CRYSTAL DISCRIMINATOR



TYPICAL BANDPASS FILTERS

CENTER FREQUENCY	MINIMUM 6 DB BW	MAXIMUM 6 DB BW	CASE SIZE
1.75 MHZ	2.8 KHZ	6.0 KHZ	3¾ x 1¼ x 1¼
5.125 MHZ	84 KHZ	180 KHZ	2 3/16 x 1 x ¾
9.07 MHZ	3.5 KHZ	9 KHZ	1½ x ¾ x ¾
10.7 MHZ	13 KHZ	23 KHZ	1⅝ x ⅞ x ¾
10.7 MHZ	240 KHZ	700 KHZ	2 3/16 x 1 x ¾
11.5 MHZ	36 KHZ	100 KHZ	2 3/16 x 1 x ¾
11.5 MHZ	36 KHZ	64 KHZ	1⅝ x ⅞ x ¾
21.4 MHZ	18 KHZ	32 KHZ	1⅝ x ⅞ x ¾
29 MHZ	30 KHZ	60 KHZ	1 15/16 x 1 5/16 x ⅝
30 MHZ	100 KHZ	200 KHZ	4 3/16 x 1 x ¾
44 MHZ	40 KHZ	120 KHZ	2 3/16 x 1 x ¾
67.75 MHZ	65 KHZ	200 KHZ	3 x 1½ x ½
77.75 MHZ	65 KHZ	200 KHZ	3 x 1½ x ½

Miniaturized monolithic two pole filters in an HC-12 crystal case

CENTER FREQUENCY	3 DB	30 DB	CASE SIZE
10.7 MHZ	15 KHZ	150 KHZ	17/32 x 7/32 x ½
11.5 MHZ	20 KHZ	200 KHZ	17/32 x 7/32 x ½

CRYSTAL DISCRIMINATOR

CENTER FREQUENCY	PEAK TO PEAK BANDWIDTH	MAXIMUM HARMONIC DISTORTION	CASE SIZE
11.5 MHZ	± 40 KHZ	2%	1¾ x 1½ x ½
11.5 MHZ	±100 KHZ	3%	1¾ x 1½ x ½
30 MHZ	±100 KHZ	2%	1¾ x 1½ x ½

Have a need for UNUSUAL LC FILTERS? . . . Contact us for UNUSUAL DESIGNS

SHEROLD CRYSTAL PRODUCTS GROUP

TYCO LABORATORIES, INC.

1510 McGee Trafficway • Kansas City, Missouri 64108 • Phone: (816) 842-9792 • TWX: 910-771-2181

SPECIFY SHEROLD FOR HIGH QUALITY...PROMPT DELIVERY

IF YOU'RE LOOKING FOR CUSTOM CRYSTAL OR TUNING FORK OSCILLATORS,

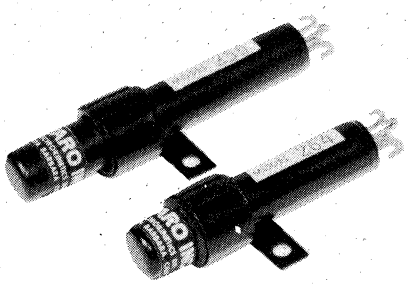
With us, "custom" is customary.

Sure, we have standard designs, but we start with these and adapt them to fit customer specifications exactly.

This kind of capability is nothing new to us. We're fortunate to have on our design-engineering staff people who helped originate ideas and concepts like Temperature Compensated Crystal Oscillators.

Today we make the broadest line of tuning fork oscillators in the industry, including Model 6205—the smallest, lightest unit on the market today.

In conventional crystal oscillators we offer sub-miniature units with wide temperature ranges, outputs compatible with integrated circuit loads, and frequency ranges of less than one Hertz to 100 MHz.

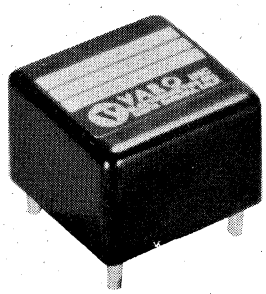


ELECTROMAGNETICALLY COUPLED TUNING FORK RESONATORS.

Designed for use in oscillator circuits where frequency stability requires use of a mechanical resonator. Will withstand severe mechanical shock without calibration change. Resilient mounting clips provide vibration isolation. Hermetically sealed in drawn, cold-rolled steel cans.

	Model 256		Model 264
Frequency:	360 Hz-800 Hz	800 Hz-2 KHz	1 KHz-4 KHz
Accuracy:	±.05%	Same	Same
Operating* Temperature:	−55°C-100°C	Same	Same
Size:	2 7/16" long 5/8" diameter	Same	1 15/16" long 9/16" diameter

*Closer tolerance over narrower temperature ranges available.



TUNING FORK OSCILLATOR FOR RUGGED ENVIRONMENT.

Produces stable output frequency where reliable low frequency signals, small size and low weight are essential. All solid state. For use in all military and aerospace environments. Performs function of frequency standard, time base generator, computer clock source, speed control reference source, program controller, or frequency coding.

Frequency: 800 Hz-4,000 Hz.

Output: 8 V minimum peak to peak at 12 vdc supply, to 10 K ohms, sine or square, with 10 microseconds maximum rise and fall time.

Physical Package: 1¼" x 1½" x 1½". Stud mounted. Hermetically sealed.



SUB-MINIATURE TUNING FORK OSCILLATOR.

Tiny eleven-gram package combines the advantages of ceramic transducers and modern integrated circuitry. Unit mounts by leads directly on printed circuit board. Tuning fork element is mounted in silicon-rubber which provides isolation from shock and vibration.

Frequency: 2 KHz to 40 KHz.

Output: Logic "0", < +0.5 volts
Logic "1", +4.0 ±0.5 volts

Waveshape: Square

Rise-Fall Time: Less than 5% of total period measured from 10% to 90% of maximum.

Physical Package: ⅞" square. Only 7/16" high when seated. Hermetically sealed.

Spectrum Technology Inc

BLDG. 240, SANTA BARBARA AIRPORT
P. O. BOX 368
GOLETA, CALIFORNIA 93017
(AREA CODE 805) 964-7791

YOU'RE LOOKING IN THE RIGHT PLACE.

Spectrum Technology, Inc. has acquired and is operating on a continuing basis the Varo Time and Frequency business. All Varo standard designs and models shown here and the Varo Time and Frequency custom design capability are now available from Spectrum Technology.

Our tuning fork resonators designed for space and missile environment have a MTBF of more than 400,000 operating hours.

If you have a systems application that requires custom tuning fork oscillators, crystal oscillators, mil spec oscillators, or tuning fork resonators, but you don't know who to talk to, now you do.

Us.

Spectrum Technology, Inc.



PRECISION OSCILLATOR.

Sub-miniature tuning fork oscillator. Combines advantages of ceramic transducers and modern integrated circuitry for high performance in a small package. Resonator element is mounted in silicon-rubber to provide isolation from shock and vibration.

Frequency: 1 KHz to 40 KHz without multipliers.

Output: 1 volt rms minimum to 10,000 ohm load, sine.

Physical Package: 2" x 2" x ½" seated height. Lead mounted directly to printed circuit board. Hermetically sealed.



TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS.

Designed for applications where no warm-up time or oven power is available, and minimal size and weight are important to the user. Termistor-varactor compensation networks and Silicon IC active devices provide optimum performance. Excellent long-term stability results from use of glass-enclosed or cold weld quartz crystal.

MODEL 7000

Frequency: 10 KHz to 20 MHz

Accuracy: $\pm 1 \times 10^{-6}$ at +25°C

Stability: To $\pm 3 \times 10^{-7}$ at 0°C to 50°C

Physical Package: 2" x 2" x .63" May be mounted by its terminals on a printed circuit board. Hermetically sealed.

MODEL 7001

Frequency: 100 KHz to 20 MHz

Accuracy: $\pm 1 \times 10^{-6}$ at 25°C

Stability: To $\pm 3 \times 10^{-7}$ at 0°C to 50°C

Physical Package: 2" x 2" x .75" Mounted by terminals on PCB. Hermetically sealed.

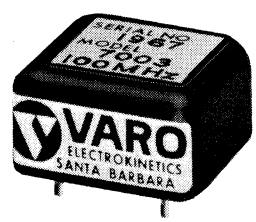
MODEL 7002

Frequency: 2.7 MHz to 20 MHz

Accuracy: $\pm 1 \times 10^{-6}$ at +25°C

Stability: To $\pm 3 \times 10^{-7}$ at 0°C to 50°C

Physical Package: 2" x 2" x ½" Can be mounted by terminals on PCB. Hermetically sealed.



SUB-MINIATURE CRYSTAL OSCILLATOR I.C. LOGIC CLOCK.

This tiny oscillator supplies a clocking signal for use in digital computer applications where space and power are limited. Simple design allows use of premium quality components to attain high reliability. Can be used in high shock, high vibration environments, including aircraft, shipboard, oceanographic, missile, or mobile.

Frequency: 3 MHz to 100 MHz

Accuracy: ±10 ppm at 25°C
±50 ppm, −55°C to +125°C

Stability: $\pm 1 \times 10^{-7}$/24 hours at 25°C

Physical Package: .88" x .88" x .45" Can be mounted on printed circuit board. Hermetically sealed.

Spectrum Technology Inc

BLDG. 240, SANTA BARBARA AIRPORT
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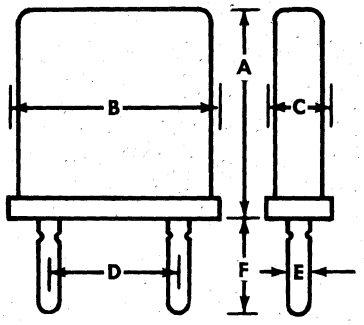
GOLETA, CALIFORNIA 93017
(AREA CODE 805) 964-7791

STANDARD CRYSTAL HOLDERS & AVAILABLE FREQUENCY RANGES



HOLDER		CASE DIMENSIONS* TERMINATIONS						FREQUENCY RANGE (MHz)
TEDFORD	MILITARY	A (MAX.)	B (MAX.)	C (MAX.)	D (±.008)	E (±.002)	F (MAX.)	
TL-10 TL-11	HC-13/U HC-34/U	1.526	.757	.352	.486	.050 .030[1]	.248 1.500[2]	0.09—0.25
TL-15 TL-16 TL-17	HC-6/U HC-17/U HC-33/U	.775	.757	.352	.486	.050 .093 .030[1]	.248 .447 1.500[2]	0.20—210.0
TL-20 TL-21 TL-22	— — —	.690	.757	.352	.486	.050 .093 .030[1]	.248 .447 1.500[2]	0.20—0.80 and 2.0—210.0
TL-25 TL-26 TL-27	HC-14/U — —	.583	.757	.352	.486	.050 .093 .030[1]	.248 .447 1.500[2]	0.20—0.80 and 2.0—210.0
TL-30 TL-31	—	.775	.757	.352	.486	.050 .030[1]	.248 1.500[2]	0.20—210.0
TL-40 TL-41	— —	.775	.757	.240	.486	.050 .030[1]	.248 1.500[2]	0.20—210.0
TL-45 TL-46	HC-32/U —	.640	.567	.237	.275	.040 .017[1]	.248 1.500[2]	1.50—210.0
TL-50 TL-51	— —	.570	.567	.237	.275	.040 .017[1]	.248 1.500[2]	1.50—210.0
TL-60 TL-61	HC-25/U HC-18/U	.530	.435	.183	.192	.040 .017[1]	.248 1.500[2]	2.90—210.0
TL-65 TL-66	— —	.450	.435	.183	.192	.040 .017[1]	.248 1.500[2]	2.90—210.0
TL-70 TL-71	— —	.425	.435	.183	.192	.040 .017[1]	.248 1.500[2]	5.0—210.0
TL-85	HC-35/U	.250	.390 Dia.		.200	.0185[1]	.600	5.0—210.0

[1]Flexible wire leads. [2]Minimum length. *Dimensions shown in inches.

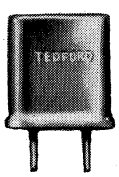
TEDFORD CRYSTAL LABS., Inc.

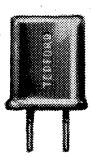
Since 1930, Tedford has been a steadily growing supplier of quartz crystals to the electronic industry. Now, with our new air conditioned facility, humidity-controlled areas and modern equipment, our capabilities are unsurpassed for the design and manufacture of high-reliability crystals for commercial and military applications.

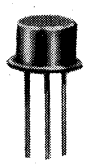
Tedford also supplies frequency control devices, filters and oscillators, shown in section 2700 of EEM.

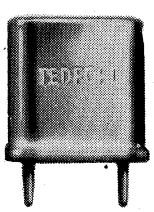
Tedford manufactures low and high frequency quartz crystals in a range from 90 KHz to 210 MHz. Both standard and custom units in small or large quantities can be supplied for a variety of applications.

Dimensions of the holders below and the frequency ranges they can accommodate are indicated in the table to the right.


TL-45


TL-60


TL-85


TL-15

Also available: CR-89/U, CR-97/U, CR-98/U, CR-100/U, CR-105/U, CR-106/U, CR-107/U, CR-110/U, CR-111/U, CR-114/U

[1]Maximum frequency deviation from nominal frequency over operating temperature range. [2]Maximum frequency deviation over operating temperature range with respect to measured frequency at reference temperature. [3]Requires government approval on new equipment design. [5]±.001% from 0.485—0.580 MHz.

MILITARY CRYSTAL TYPES—CONTROLLED TEMPERATURE CONDITIONS

MIL. TYPE	HOLDER	FREQ. RANGE (MHz)	MODE	RESONANCE	CAPACITANCE LOAD (pf)	REF. TEMP. °C	FREQ. TOL.[1] PERCENT (±)	OPR. RANGE °C	STABILITY[2] PERCENT (±)
CR-26A/U	HC-6/U	0.20 - 0.555	FUND.	SERIES	—	75±1	0.002	70 TO 80	0.0005
CR-27A/U	HC-6/U	0.80 - 20.0	FUND.	PARALLEL	32.0±0.5	75±1	0.002	70 TO 80	0.0005
CR-28A/U	HC-6/U	0.80 - 20.0	FUND.	SERIES	—	75±1	0.002	70 TO 80	0.0005
CR-32A/U	HC-6/U	10.0 - 75.0	3RD, 5TH	SERIES	—	75±1	0.002	70 TO 80	0.0005
CR-35A/U	HC-6/U	0.80 - 20.0	FUND.	SERIES	—	85±1	0.002	80 TO 90	0.0005
CR-36A/U	HC-6/U	0.80 - 20.0	FUND.	PARALLEL	32.0±0.5	85±1	0.002	80 TO 90	0.0005
CR-42A/U	HC-13/U	0.09 - 0.25	FUND.	PARALLEL	32.0±0.5	75±1	0.003	70 TO 80	0.002
CR-47A/U	HC-6/U	0.19 - 0.50	FUND.	PARALLEL	20.0±0.5	75±1	0.002	70 TO 80	0.0005
CR-59A/U	HC-18/U	50.0 - 125.0	5TH	SERIES	—	85±1	0.002	80 TO 90	0.0005
CR-61/U	HC-18/U	17.0 - 61.0	3RD	SERIES	—	85±1	0.002	80 TO 90	0.0005
CR-62/U	HC-6/U	0.80 - 20.0	FUND.	PARALLEL	32.0±0.2	75±1	0.001	70 TO 80	0.0005
CR-65/U	HC-6/U	10.0 - 61.0	3RD	SERIES	—	75±1	0.001	70 TO 80	0.00025
CR-68/U	HC-6/U	3.0 - 20.0	FUND.	PARALLEL	32.0±0.5	75±1	0.002	70 TO 80	0.0005
CR-75/U	HC-6/U	50.0 - 125.0	5TH	SERIES	—	75±1	0.001	70 TO 80	0.00025
CR-84/U	HC-25/U	17.0 - 61.0	3RD	SERIES		85±1	0.002	80 TO 90	0.0005
CR-104/U	HC-33/U	0.2 - 0.58	FUND.	PARALLEL	21.5±0.5	75±1	0.002[5]	70 TO 80	0.0005
CR-109/U	HC-25/U	10.0 - 11.5	FUND.	PARALLEL	32.0±0.5	85±2	0.002	80 TO 90	0.0005

MILITARY CRYSTAL TYPES—NON CONTROLLED TEMPERATURE CONDITIONS

CR-18A/U	HC-6/U	0.8 - 20.0	FUND.	PARALLEL	32.0±0.5	0.005	−55 TO +105
CR-19A/U	HC-6/U	0.8 - 20.0	FUND.	SERIES	—	0.005	−55 TO +105
CR-25B/U	HC-6/U	0.20 - 0.555	FUND.	SERIES	—	0.010	−40 TO +85
CR-33A/U[3]	HC-6/U	10.0 - 25.0	3RD	PARALLEL	32.0±0.5	0.005	−55 TO +105
CR-37A/U	HC-13/U	0.09 - 0.25	FUND.	PARALLEL	20.0±0.5	0.020	−40 TO +70
CR-45/U	HC-6/U	0.455	FUND.	SERIES	—	0.020	−40 TO +70
CR-46A/U[3]	HC-6/U	0.20 - 0.50	FUND.	PARALLEL	20.0±0.5	0.010	−40 TO +85
CR-52A/U	HC-6/U	10.0 - 61.0	3RD	SERIES	—	0.005	−55 TO +105
CR-54A/U	HC-6/U	50.0 - 125.0	5TH	SERIES	—	0.005	−55 TO +105
CR-55/U	HC-18/U	17.0 - 61.0	3RD	SERIES	—	0.005	−55 TO +105
CR-56A/U	HC-18/U	50.0 - 125.0	5TH	SERIES	—	0.005	−55 TO +105
CR-58A/U	HC-17/U	0.8 - 20.0	FUND.	PARALLEL	32.0±0.5	0.005	−55 TO +105
CR-60A/U	HC-18/U	5.0 - 20.0	FUND.	SERIES	—	0.005	−55 TO +105
						0.010	−40 TO +70
CR-63B/U	HC-6/U	0.20 - 0.555	FUND.	PARALLEL	20.0±0.5	0.015	−55 TO −40 +70 TO +90
CR-64/U	HC-18/U	2.9 - 20.0	FUND.	PARALLEL	30.0±0.5	0.005	−55 TO +105
						0.002	−40 TO +90
CR-66/U	HC-6/U	3.0 - 20.0	FUND.	PARALLEL	30.0±0.5	0.003	−55 TO −40 +90 TO +105
CR-67/U	HC-18/U	17.0 - 61.0	3RD	SERIES	—	0.0025	−55 TO +105
						0.002	−40 TO +90
CR-69A/U	HC-18/U	2.9 - 25.0	FUND.	PARALLEL	30.0±0.5	0.003	−55 TO −40 +90 TO +105
						0.002	−40 TO +90
CR-76/U	HC-18/U	17.0 - 61.0	3RD	SERIES	—	0.003	−55 TO −40 +90 TO +105
						0.002	−40 TO +90
CR-77/U	HC-25/U	17.0 - 62.0	3RD	SERIES	—	0.003	−55 TO −40 +90 TO +105
CR-78/U	HC-25/U	3.0 - 20.0	FUND.	PARALLEL	30.0±0.5	0.005	−55 TO +105
CR-79/U	HC-25/U	5.0 - 20.0	FUND.	SERIES	—	0.005	−55 TO +105
						0.002	−40 TO +90
CR-80/U	HC-18/U	50.0 - 125.0	5TH	SERIES	—	0.003	−55 TO −40 +90 TO +105
CR-81/U	HC-25/U	17.0 - 61.0	3RD	SERIES	—	0.005	−55 TO +105
CR-82/U	HC-25/U	50.0 - 125.0	5TH	SERIES	—	0.005	−55 TO +105
						0.002	−40 TO +90
CR-83/U	HC-25/U	50.0 - 125.0	5TH	SERIES	—	0.003	−55 TO −40 +90 TO +105
						0.002	−40 TO +90
CR-85/U	HC-6/U	0.8 - 20.0	FUND.	SERIES	—	0.003	−55 TO −40 +90 TO +105

TEDFORD CRYSTAL LABS, INC.
FREQUENCY CONTROL DEVICES

TEDFORD CRYSTAL LABORATORIES, INC.
4914 Gray Road, Cincinnati, Ohio 45232
Phone 513/542-5555

TOYOCOM FINEST PRODUCTS

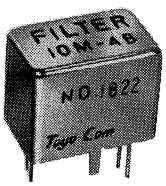
■ TOYO HCM FILTERS (high-frequency crystal mechanical filters)

The Toyo HCM Filter is a bandpass filter combining the fundamental and inharmonic thickness-shear vibration of the AT-cut crystal resonator. Miniaturized and feather-weight, this ultra compact high-frequency crystal mechanical filter can be applied to integrated circuit modules, and its excellent selectivity makes it ideal for use in miniaturized communications equipment.

FEATURES

● Sharp cut-off characteristic ● Wide temperature range (−20°C to +70°C or −60°C to +105°C) ● Excellent temperature characteristics ● Minimum insertion loss ● Durability ● Compactness and feather-weight ● Low cost

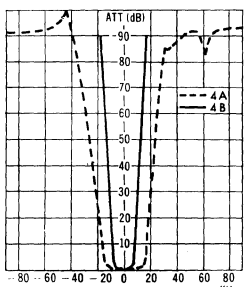
Model **Model**
10M-4A-1 · 10M-4B-1

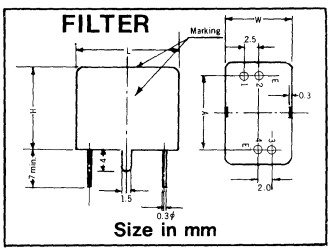


SPECIFICATIONS:

Center Frequency: 10.7MHz
Ripple: ....less than 2dB
Attenuation Guaranteed: ....more than 80dB

Pass Bandwidth:	(*10M-4A-1)
...more than ±7.5KHz (6dB)	* ±15KHz (6dB)
Stop Band Discrimination:	
...less than ±15KHz (60dB)	* ±30KHz (60dB)
±20KHz (80dB)	* ±40KHz (80dB)
Insertion Loss:	
...less than 4dB	* 3dB
Nominal Impedances	
...3KΩ	* 5KΩ



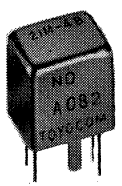


Size in mm

Table

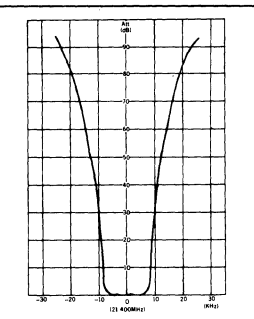
Case Code	L	W	H	A
H-3	15	12	15	9.0
H-4	18.5	12	15	13.4
H-5	23	12	15	17.8
H-6	28	12	15	22.2
H-1	11.0	8.5	11.5	3.7

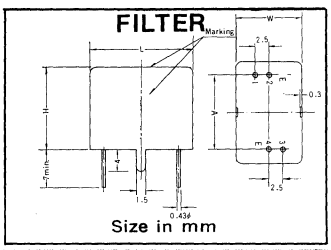
Model
21M-4B-1



SPECIFICATIONS:

Center Frequency: 21.4MHz
Ripple: ....less than 2dB
Attenuation Guaranteed: ....more than 80dB
Pass Bandwidth: ....more than ±7.5KHz (6dB)
Stop Band Discrimination:
....less than ±15KHz (60dB)
less than ±20KHz (80dB)
Insertion Loss: ....less than 4dB
Nominal Impedances: ....980Ω // 1pF



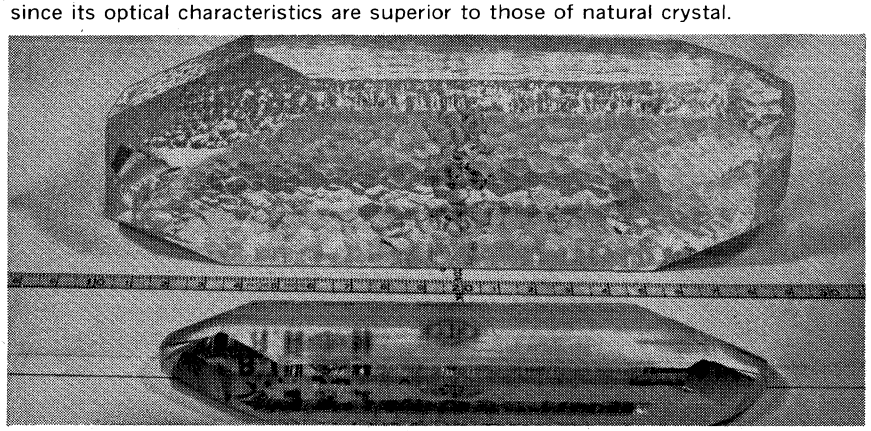


Size in mm

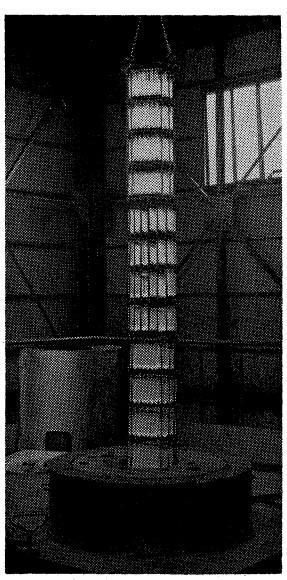
■ TOYO QUARTZ

Top in Quality, Low Cost and Ready Supply!

TOYO QUARTZ, the product of TOYO's many years of experience in quartz crystal manufacture, comes in various types and sizes for easy adaptation by the customer to fit his requirements. Although manufactured primarily for use in electronic communications equipments, especially in oscillators, TOYO QUARTZ is also suitable for optical applications particularly since its optical characteristics are superior to those of natural crystal.



Synthetic Quartz (Toyo Quartz)



TOYOCOM
TOYO COMMUNICATION EQUIPMENT CO., LTD.

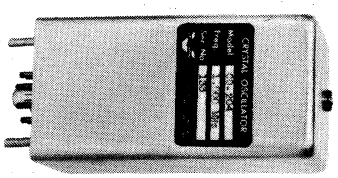
EXPORT DEPARTMENT:
TORANOMON BLDG.,
15, SHIBA-TORANOMON, MINATO-KU,
TOKYO, JAPAN.
CABLE: EXPORTOYOCOM TOKYO

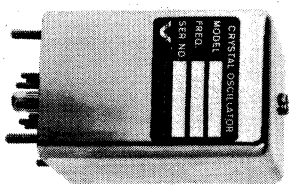
VECTRON

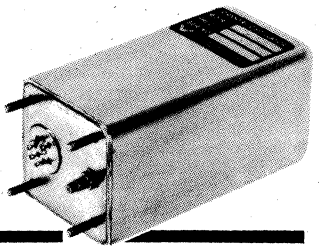
CRYSTAL OSCILLATORS Frequency Stds.

High Stability Crystal Oscillators (Oven Controlled)

MODEL	CO-204	CO-203	CO-202	CO-201	CO-214	CO-213	CO-212	CO-211	CO-223	CO-222	CO-221
AGING RATE	$1x10^{-9}$/day	$3x10^{-9}$/day	$5x10^{-9}$/day	$1x10^{-8}$/day	$1x10^{-8}$/day	$3x10^{-8}$/day	$5x10^{-8}$/day	$1x10^{-7}$/day	$2x10^{-8}$/day	$5x10^{-8}$/day	$1x10^{-7}$/day
TEMPERATURE	0°C to +50°C: $\pm5x10^{-9}$ −20°C to +70°C: $\pm1x10^{-8}$ −55°C to +80°C: Optional				0°C to +50°C: $\pm5x10^{-8}$ −55°C to +75°C: Optional				0°C to +50°C: $\pm1x10^{-7}$ −55°C to +80°C: Optional		
FREQUENCY	1-15 MHz (lower and higher frequencies with inclusion of dividers or multipliers; have delivered units with output as low as 1 KHz)				500 KHz to 50 MHz (lower frequencies with inclusion of dividers)				Up to 125 MHz		
INPUT VOLTAGE	Oscillator: 5-32 VDC Oven: 5-32 VDC or 115 VAC				Oscillator: 5-32 VDC Oven: 5-32 VDC or 115 VAC				Oscillator: 20-32 VDC Oven: 20-32 VDC		
OVEN CONTROL	Proportional (integrated circuit)				Proportional				Proportional (Integrated circuit)		
SIZE	2"x2"x4"; octal plug-in (Other configurations available)				2"x2"x3"; octal plug-in (Other configurations available)				2"x2"x4"; 7 pin header and rf connector		

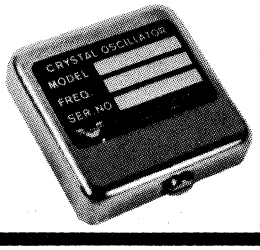






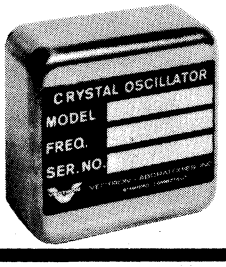
TCXOs

MODEL	CO-251	CO-252
FREQUENCY	250 KHz to 10 MHz	
TEMPERATURE	0°C to 50°C: $\pm1x10^{-6}$	−20°C to +70°C: $\pm1x10^{-6}$
AGING	$1x10^{-6}$/year	$1x10^{-6}$/year
OUTPUT	1 vrms into 1K (logic level optional)	
INPUT	5-32 VDC @<10 ma	12-32 VDC @<10 ma
SIZE	2"x2"x¾"	2"x2"x¾"



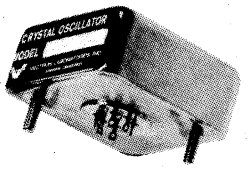
Clock Oscillators

MODEL	CO-231	CO-232	CO-233
FREQUENCY	0.1-25 MHz	3-25 MHz	25-125 MHz
TEMPERATURE	Standard: 0° to +70°C: ±.0025% −1 Option: −55°C to +85°C: ±.005% −2 Option: −55°C to +105°C: ±.005%		
OUTPUT	DTL/TTL	DTL/TTL	5mw into 50Ω
INPUT	5-32 VDC	5 VDC	15-30 VDC
SIZE	1½"x1½"x1½"	1"x1"x1½"	1½"x1½"x⅝"



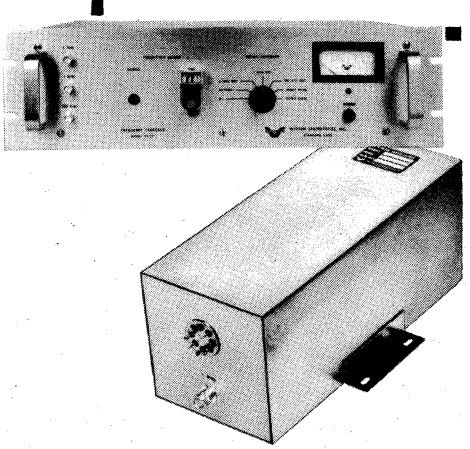
Typical VCXOs

MODEL	CO-273V	CO-221V
FREQUENCY	1 MHz	100 MHz
VCXO RANGE	±0.1%	$\pm1x10^{-5}$
LINEARITY	5%	5%
TEMPERATURE	0-50°C: ±.005%	−20°C to +65°C: $\pm5x10^{-7}$
SIZE	2"x2"x1"	2"x2"x4"



Frequency Standards

MODEL	FS-321A	CO-243
AGING RATE	$5x10^{-10}$/day at shipment; $1x10^{-10}$/day typical after six months	
FREQUENCY	5 MHz, 1 MHz & 100 KHz	5 MHz
LEVEL	1 vrms into 50 ohms	
TEMPERATURE	0°C to 50°C: $\pm3x10^{-10}$	
INPUT	115/230 VAC or 22-30 VDC; includes rechargeable battery for 40 hours of operation.	22-30 VDC
SIZE	5¼"h x 19"w x 14"d	4"x4"x10"



DELAY LINES

Andersen designs and develops many more different types of delay devices (including optical and microwave) than any other concern.

Andersen is the only firm producing delay devices for the entire range of frequencies. (DC through 5200 GHz.)

Andersen is the sole major manufacturer of delay devices specializing in signal processing systems.

Andersen supplies a substantially greater volume of delay equipment than any other source.

	TYPICAL APPLICATIONS	RANGE OF PARAMETER	NEWEST DEVELOPMENTS and UNIQUE CHARACTERISTICS
AUDIO	Sonar, voice equalization, ASW sensors.	1 msec to 1 sec delay, balance or unbal anced. Typical delay-bandwidth products up to 40. Impedances from 100 to 1000 ohms.	Delay-BW products up to 60 or more for fixed lines, and 15 or more for electrically variable lines. Extremely low attenuation for delay-BW of 40 max, e.g. 0.001 db per usec max. For higher delay-BW 0.01 db per usec max. Extremely low frequcy ripple, better than 1%. Phase response and group delay to better than 1% at 3 db response.
VIDEO	Radar-sonar signal processing, comb filters, correlation, cancelling, television broadcast, delay equalization, field storage, signal sycnchronization.	Lumped constant lines with delay-BW products of 40 to 60, delays from 1 nsec to milliseconds. Quartz lines with CF to 150 Mhz and delays to 4000 msec. Electrically variable delays of 0.1-100 usec with delay-BW product of 15.	High fidelity storage of one full field of TV signal. Variable delay of full 360° of chrominance. EVDL's with improved group delay and response characteristics meeting video color standards.
IF-RF	Non-dispersive: MTI, clutter cancellation, coherent integration, target simulation, range markers, codeds equence processing, transversal equalizers, receiver gain control versus time, time multiplexing correlation. Dispersive: Pulse expansion-compression systems, spectrum anal-y zers, panoramic receivers, doppler estimators.	CF to 150 Mhz, BW to 50% of CF. Delay 4000 usec in single unit, longer when used in cascade. Products always offered with unity. gain.	Short delays with low spurious, e.g., 1 usec delay, 48 db spurious at 60 Mhz. Wider BW, e.g., 65% at 60 Mhz CF. Flat amplitude response e.g., plus or minus 0.2 db 30% BW 60 Mhz CF. VSWR across BW e.g., 1.3 to 1 nom 50 ohms.
MICRO-WAVE	Non-dispersive: ECM, ECCM, radar processing and checkout systems, fusing, altimeters, transponders. Dispersive: High resolution pulse compression and similar wide band signal processing.	CF UHF through X-band, delay 200 nsec to 10 usec. BW to 500 Mhz. Pulse-compression ratios to 500 to 1.	10 db insertion loss at 500 Mhz, delays to 10 usec at X-band. Dispersive lines with 500 Mhz Bw, .5 usec dispersion. Transducer peak power capability to 50 watts, average power 2 watts.
DIGITAL	Deltics, delta modulators, spectrum analysis, matched filters, serial memories, scratch pad, refresh, buffer storage, A-D conversersion.	Wiresonic: CF to 2 Mhz, storage 20,000 bits per unit. Glass: CF to 20 Mhz, storage 4500 bits per unit. Quartz: CF to 40 Mhz, storage 30,000 bits per unit.	Dual channel, 35 Mhz memory in single small package. Low cost high capacity temperature compensated multi-line packages. Lowest cost per bit in comparison with ferrites and MOS. Highest bits per cubic inch. Lowest power dissipation per bit.
OPTICAL	Laser modulation, Q switches, mode lockers, beam deflectors, optical signal processing, cross and auto correlation, radar pulse compression-expansion matched filters, spectrum and Fourier analyzers, acousto optical continuously variable and multi-tapped delay lines.	CF 0.1 Mhz to 12 Ghz. BW octave or greater. Modulation to 4 Ghz. Time-BW products to 20,000 Mhz-useconds. Spectral ranges from UV to IR.	High efficiency, high power broad band transducers, IR modulation Stable, high rep rate Q switches, liquid cooling for high power, compact solid state designs.

ANDERSEN LABORATORIES, INC.

1280 BLUE HILLS AVENUE • BLOOMFIELD, CONN. 06002 • 203-242-0761

signal processing equipment

Andersen is also the leading producer of delay oriented signal processing systems for broadcast, computer and radar fields.

ALLEN AVIONICS, INC.
255 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • 516-747-5450

LUMPED CONSTANT DELAY LINES

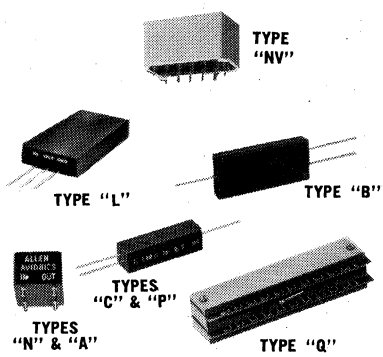
CUSTOM-BUILT

Allen Avionics, Inc. manufactures a wide variety of delay lines to customers' specifications. The following specifications encompass areas in which we normally work. If, however, your requirements fall outside of the following parameters, we would still be interested in hearing from you.

RANGE — Delay times from 3 nanoseconds through audio ranges are available.
TIME DELAY/RISE TIME RATIO — Time delay to rise time ratio to 300/1.
CONSTRUCTION — Units are hermetically sealed in metal cans with glass to metal terminals. Epoxy encapsulated units are also available.
SIZE — Sizes are available from ⅝ x ⅝ x .450 inches.
TOLERANCE — Normal tolerance on time delay is 5%. In most cases tolerances of 1% can be held.
TEMPERATURE — Most of our lines are manufactured to 50 parts/million/degree C from minus 55 degree C to 105 degree C.
SALT SPRAY & HUMIDITY — No problem is encountered here due to the complete seal and the utilization of special paints.
SHOCK & VIBRATION — Units are foamed in hermetically sealed cans which enables them to meet military specifications.
DELIVERY — Prototypes of special lines can often be delivered in a week or two.

Our engineering staff is always available to help with any delay line and application problems.

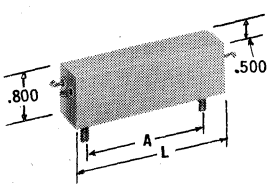
STOCKED DELAY LINES FROM 20 NANOSECONDS TO 1000 MICROSECONDS



TYPE	TIME DELAY	IMPED-ANCE	TIME DELAY TO RISE TIME RATIO	SIZE
N	20, 30, 40, 50, 60, 70, 80, 90, 100 ns.	100 Ω	3.5 to 1	⅝″ x ⅝″ x .450″
A	0.1, 0.2, 0.3, 0.4, 0.5 μs.	500 Ω	3.5 to 1	⅝″ x ⅝″ x .450″
	0.5, 0.6, 0.7, 0.8, 0.9, 1.0 μs.	1000 Ω		
C	.4, .5, .6, .7, .8, .9, 1.0, 1.1, 1.2 μs.	1000 Ω	5 to 1	6/10″ x ½″ x 2″
P	.2, .3, .4, .5, .6, .8, 1.0, 1.2, 1.6, 2.0 μs.	500 Ω	5 to 1	6/10″ x ½″ x 2″
Q*	.2, .3, .4, .5, .6, .8 μs.	100 Ω	5 to 1	1⁵⁄₁₆″ x 4.9″ x .550″
	.1, .2, .3, .4, .5, .6, .8, 1.2 μs.	500 Ω		
	.2, .3, .4, .5, .6, .8, 1 μs.	1000 Ω		
NV	10 to 100 ns. in 10 ns. steps	100 Ω	5 to 1	.675″ x 1.30″ x .735″
B	5, 10, 15 μs.	1000 Ω	5 to 1	½″ x 1⅜″ x 3⅛″
L	25, 75, 200, 250 μs.	250 Ω	5 to 1	2½″ x 4½″ x .8″
	50, 150, 400, 500 μs.	500 Ω		
	100, 300, 800, 1000 μs.	1000 Ω		

* Since the Quick Line is a tapped module consisting of 10 sections, the tap increment of any module can be determined by dividing the module time delay by 10. Modules of the same impedance can be put together in groups of 1, 2, 3 and 4 to achieve different time delay and rise time combinations.

STANDARD MINIATURE DELAY LINES



L Dim. Inches	A Dim. ±.005
1.5	1.140
2.0	1.640
2.5	2.140
3.0	2.640
3.5	3.140
4.0	3.640

All delay lines are 100% tested for delay time, rise time, attenuation, and impedance before and after potting, and again before shipment.

Construction: Hermetically sealed in metal case and potted in epoxy resin.
Mounting: 4/40 studs.
Terminals: 4 glass headers.
Finish: Military Gray.
D.C. working voltage: 300.
D.C test voltage: 600.
Temperature: from −55 to 105°C .005%/°C.
Impedance tolerance: ±10%

Td. (μs)	Td. Tol. %	Tr. (μs)	Att. %	Lgth. In.	Part No.
.1	10	.030	5	1.5	5XP1
.15	10	.045	5	1.5	5XP15
.16	10	.033	5	2	8XP16
.2	10	.059	5	1.5	5XP2
.2	10	.036	10	2.5	10XP2
.24	10	.049	5	2	8XP24
.24	10	.037	10	3	12XP24
.25	10	.074	5	1.5	5XP25
.3	5	.040	15	3.5	15XP3
.3	10	.053	10	2.5	10XP3
.3	10	.089	5	1.5	5XP3
.32	10	.066	5	2	8XP32
.35	10	.104	5	1.5	5XP35
.36	10	.056	10	3	12XP36
.36	5	.041	15	4	18XP36
.4	5	.043	15	4	20XP4
.4	10	.071	10	2.5	10XP4
.4	10	.082	5	2	8XP4
.4	10	.118	5	1.5	5XP4
.45	5	.059	15	3.5	15XP45
.48	10	.074	10	3	12XP48
.48	10	.098	5	2	8XP48
.5	10	.088	10	2.5	10XP5
.54	5	.061	15	4	18XP54

Td. (μs)	Td. Tol. %	Tr. (μs)	Att. %	Lgth. In.	Part No.
.56	10	.115	5	2	8XP56
.6	5	.064	15	4	20XP6
.6	5	.078	15	3.5	15XP6
.6	10	.093	10	3	12XP6
.6	10	.106	10	2.5	10XP6
.64	10	.131	5	2	8XP64
.7	10	.123	10	2.5	10XP7
.72	5	.081	15	4	18XP72
.72	10	.111	10	3	12XP72
.75	5	.098	15	3.5	15XP75
.80	5	.085	15	4	20XP8
.80	10	.141	10	2.5	10XP8
.84	10	.130	10	3	12XP84
.9	5	.117	15	3.5	15XP9
.9	5	.101	15	4	18XP9
.96	10	.148	10	3	12XP96
1.00	5	.106	15	4	20X1
1.05	5	.137	15	3.5	15X1P05
1.08	5	.121	15	4	18X1P08
1.2	5	.127	15	4	20X1P2
1.26	5	.141	15	4	18X1P26
1.4	5	.148	15	4	20X1P4
1.44	5	.161	15	4	18X1P44
1.6	5	.169	15	4	20X1P6

100, 500 & 1,000 ohm impedance.

ALLEN AVIONICS, INC.
255 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • 516-747-5450

SPIRADEL®* MINIATURE FIXED DELAY LINE

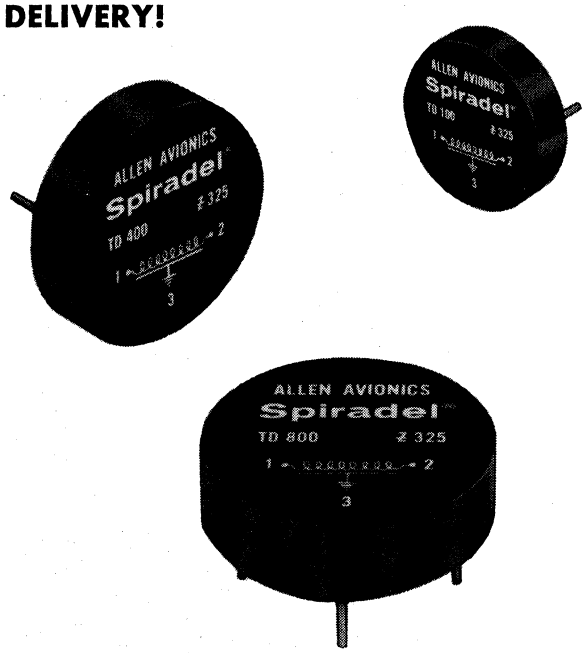
FOR IMMEDIATE DELIVERY!

SPIRADEL® is a small diameter, distributed constant fixed delay line, featuring higher delay to rise time ratio and excellent pulse fidelity. Its new shape offers greater package design versatility than most other delay lines available, and the entire unit is encapsulated for maximum environmental protection.

The SPIRADEL line covers a delay range of 100 to 1000 nanoseconds, and delays may be selected in 10 nanosecond increments within the range, although 50 nanosecond increments is standard. The standard impedance for all models is 325 ohms ±10%. Any impedance from 200 to 600 ohms is available on special order. Standard delay tolerance is 5%, although tighter tolerances can be held on special order.

SPIRADEL units are designed for operation from —55°C up to +105°C.

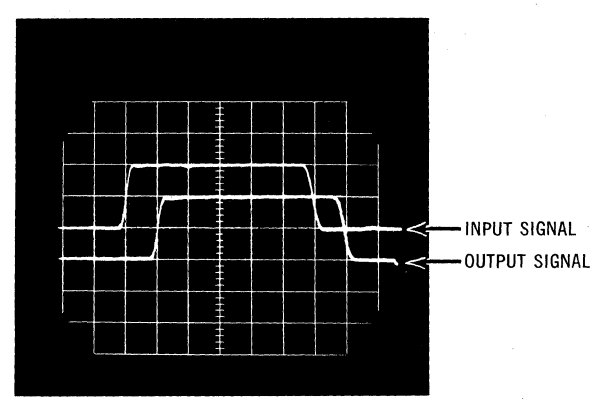
Bandwidth is from DC to the frequency f = .35/rise time.



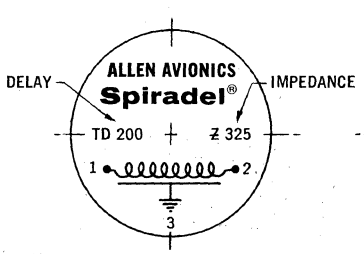
SPECIFICATIONS

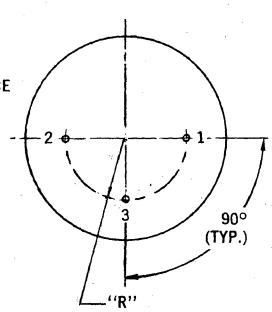
Time Delay (Nanoseconds)	Rise Time (Nanoseconds) Maximum	Delay to Rise Time Ratio, Min.	Bandwidth Min. (mc)	Attenuation Max. (%)
100	12	8.3/1	29.2	15
150	14	10.7/1	25.0	15
200	17	11.7/1	20.6	15
250	19	13.1/1	18.4	20
300	21	14.3/1	16.7	20
350	23	15.2/1	15.3	20
400	24	16.7/1	14.6	25
450	26	17.3/1	13.5	25
500	28	17.8/1	12.5	25
550	29	18.9/1	12.1	25
600	31	19.4/1	11.3	25
650	33	19.7/1	10.6	25
700	34	20.6/1	10.3	30
750	35	21.4/1	10.0	30
800	37	21.6/1	9.5	30
850	39	21.8/1	9.0	30
900	41	22.0/1	8.5	30
950	43	22.1/1	8.1	30
1000	45	22.2/1	7.8	30

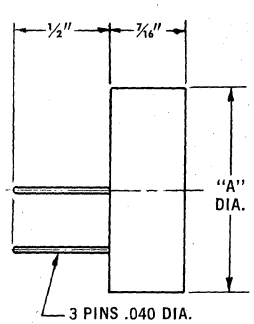
TO ORDER STANDARD UNIT SPECIFY SPIRADEL & TIME DELAY



Actual oscilloscope presentation photo of input and output pulses of 100 ns. Spiradel, illustrating excellent pulse fidelity.







Time Delay (Nanoseconds)	"A"	"R"
100-200	1.2"	.400"
205-420	1.6"	.600"
425-1.00	2.5"	1.050"

*Patented and patents applied for.

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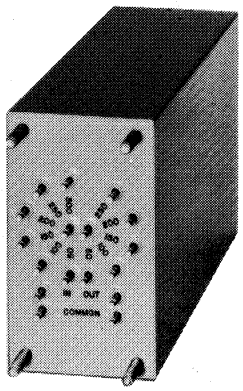
TV LINE EQUALIZER

TYPE AV-535



THE ALLEN AVIONIC'S AV-535 EQUALIZER IS DESIGNED TO COMPENSATE FOR LOSSES IN RG-11/U (75 OHM) CABLE AND ITS EQUIVALENTS. THE UNIT IS CAPABLE OF EQUALIZING 50 TO 300 FEET IN 50 FOOT INCREMENTS.

Terminals on mounting surface are so arranged to provide for simplified strapping for compensation of different cable lengths. All units are foamed and hermetically sealed in steel cans.

IMPEDANCE: 75 ohms ±2 ohms to 8 megs.

ATTENUATION OF CABLE PLUS EQUALIZER: 3 db.

Attenuation of equalizer alone is as shown in the following table:

Feet	0.1 mc	2 mc	4 mc	8 mc
50	2.97 db	2.86 db	2.79 db	2.67 db
100	2.93	2.68	2.53	2.27
150	2.90	2.51	2.28	1.88
200	2.86	2.35	2.03	1.52
250	2.82	2.19	1.82	1.21
300	2.78	2.02	1.58	0.86

TOLERANCE: ±.07 db.

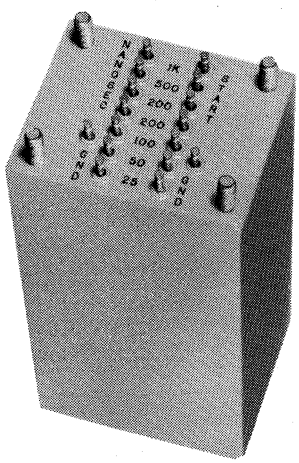
SIZE: 2 x 3½ x 5 inches (not including mounting stud length).

MOUNTING CENTERS: 1½ x 3 inches.

STUD SIZE: 8/32 x 1/2 inch long.

PULSE & VIDEO DELAY LINE

TYPE AV-397



These delay lines are designed to be used with any 75 ohm system for either pulse or video delay. Although intended primarily for equalizing the delays in various lengths of coaxial cable, the line can be used wherever any delay from .025 μs. to 2.075 μs. is needed. The delay is changed by adding individual lines of various delays to give the desired total delay.

Each type AV-397 delay line consists of seven individual delay lines each having its own input and output terminals. Each of these seven lines may be used individually or collectively. By connecting the output of one to the input of another, 83 different time delays are available in .025 μs. steps from .025 μs. to 2.075 μs. The delay of each individual line is marked between its input and output terminals. The total time delay is the sum of the delays of the individual lines that are connected.

Distortion with a normal TV type pulse is well under 2% and not normally visable. Using the full delay of 2.075 μs., the response to video is down by 3 db at 5 megacycles.

MAXIMUM DELAY: 2.075 microseconds ±3% variable in .025 microsecond steps from .025 microseconds to 2.075 microseconds.

TIME DELAY OF INDIVIDUAL LINES: 1, .5, .2, .2, .1, .05, .025 microseconds.

RISE TIME FOR ENTIRE LINE: .06 microseconds maximum.

FREQUENCY RESPONSE: 3 db down at 5 megacycles for 2.075 microseconds delay.

DISTORTION: 2% maximum with .2 microsecond input pulse.

IMPEDANCE: 75 ohms ±5%.

DC WORKING VOLTS: 300.

TEMPERATURE COEFFICIENT: 50 parts/million/C° from −55°C to 105°C.

ATTENUATION: 7% maximum for 2.075 microsecond delay.

MECHANICAL: Hermetically sealed in a steel can 2″ x 2½″ x 5½″, painted gray with black identification markings, and using 10/32 x 1/2 inch studs spaced on 1½″ x 2″ centers for mounting.

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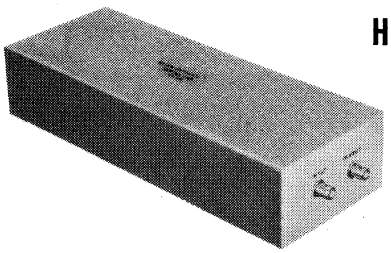
LUMPED CONSTANT DELAY LINES



HIGHEST $\frac{\text{TIME DELAY}}{\text{RISE TIME}}$ RATIO EVER BUILT!

These Delay Lines have the highest ratio of time delay to rise time that has ever been built in a Lumped Constant Line. Unlike other types of high ratio lines, the Lumped Constant Delay Line has a passband from D.C. to its cutoff frequency and maintains a constant delay over these frequencies. These lines are also unique in that they offer relatively low insertion loss.

This group of lines is characterized by tight time delay tolerances, low pulse distortion, excellent phase linearity and good temperature stability.

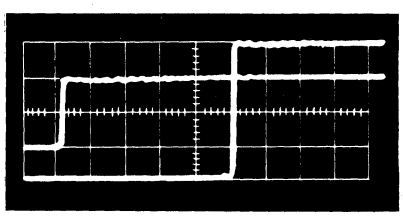
For laboratory use, any time delays from 10 microseconds to 100 microseconds can be built into variable decade instruments with ratios of over 100/1. These units could have a resolution of up to 1/5000 of the total delay.

Series "HF" HIGH FREQUENCY

The HF Series in most cases will serve as more than adequate electrical replacement for coaxial cable. The inconvenience of handling and storing cable will thus be eliminated. Standard impedances of 50 and 75 ohms are available. Units are normally supplied with BNC connectors. Tapped lines and time delays other than those shown below can be supplied.

Time Delay Microseconds	Rise Time Microseconds Maximum	Bandwidth (3 db) Megacycles
50/1 RATIO ATTENUATION 9 db MAXIMUM SIZE: 2½" x 4½" x 12"		
.5	.010	36.0
.6	.012	30.0
.7	.014	25.7
.8	.016	22.5
.9	.018	20.0
1.0	.020	18.0
1.25	.025	14.4
1.5	.030	12.0
1.75	.035	10.3
2.0	.040	9.0
2.5	.050	7.2
3.0	.060	6
3.5	.070	5.15
4.0	.080	4.5
4.5	.090	4.0
4.75	.095	3.8
75/1 RATIO ATTENUATION 12 db MAXIMUM SIZE: 3½" x 4½" x 12"		
1.5	.020	18
1.75	.023	15.4
2.0	.027	13.5
2.25	.030	12.0
2.50	.033	10.8
2.75	.037	9.8
3.0	.040	9.0
3.25	.043	8.3
3.50	.047	7.7
3.75	.050	7.2
4.0	.053	6.75
4.25	.057	6.35
4.50	.060	6.0
4.75	.063	5.7
100/1 RATIO ATTENUATION 15 db MAXIMUM SIZE: 3½" x 6½" x 16"		
2.0	.020	18
2.25	.023	16
2.5	.025	14.4
2.75	.028	13
3.0	.030	12
3.25	.033	11.1
3.5	.035	10.3
3.75	.038	9.6
4.0	.040	9
4.25	.043	8.48
4.5	.045	8
4.75	.048	7.58

Series "HR"



1 MICROSECOND PER DIVISION
(5 Microseconds Delay — .05 Microsecond Rise Time)

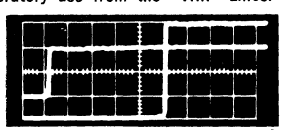
Time Delay Micro-seconds	Rise Time Micro-seconds	Bandwidth (3 db) Megacycles	Imped-ance Ohms
100/1 RATIO ATTENUATION 8 db MAXIMUM SIZE: 2½" x 4½" x 12"			
5	.05	7.2	50-100
6	.06	6.0	50-100
7	.07	5.15	50-100
8	.08	4.5	50-100
9	.09	4	50-100
10	.1	3.6	50-100
15	.15	2.4	50
20	.20	1.8	50
25	.25	1.44	50
30	.3	1.2	50
35	.35	1.03	50
40	.40	.9	50
45	.45	.8	50
50	.50	.72	50
130/1 RATIO ATTENUATION 9 db MAXIMUM SIZE: 3½" x 4½" x 12"			
5	.039	9.36	50
10	.077	4.68	50-100
15	.116	3.11	50-100
20	.154	2.34	50
25	.193	1.86	50
30	.232	1.55	50
35	.271	1.33	50
40	.308	1.17	50
45	.348	1.035	50
50	.387	.930	50
60	.462	.780	50
75	.580	.620	50
90	.693	.520	250
100	.770	.468	250

Series "VHR"

The "VHR" Series have a characteristic impedance of 50 ohms. While the units listed are standards, we can manufacture the "VHR" Lines to your exact delay specifications.

These units are hermetically sealed in a metal can 3½ x 6½ x 16 inches, with four ¼ x 20 studs on the 6½ x 16 inch surface.

Two BNC connectors are located on the 3½ x 6½ inch surface for input and output connections. Variable Decade Delay Units can be manufactured for laboratory use from the "VHR" Lines.



5 MICROSECONDS PER DIVISION
(25 Microseconds Delay—.1 Microsecond Rise Time)

Time Delay Microseconds	Rise Time Microseconds
150/1 RATIO ATTENUATION 16 db MAXIMUM SIZE: 3½" x 6½" x 16"	
10	.067
15	.100
20	.133
25	.167
30	.200
35	.233
40	.267
45	.300
50	.333
55	.367
60	.400
63	.420
65	.433
70	.467
200/1 RATIO ATTENUATION 18 db MAXIMUM	
10	.050
15	.075
20	.100
25	.125
30	.150
35	.175
40	.200
45	.225
50	.250
55	.275
60	.300
63	.315
65	.325
70	.350
75	.375
250/1 RATIO ATTENUATION 20 db MAXIMUM	
20	.080
25	.100
30	.120
35	.140
40	.160
45	.180
50	.200
60	.240
63	.252
65	.260
70	.280
80	.320
90	.360
100	.400

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DELAY LINE SYNTHESIZERS

A primary use is to experimentally determine the exact requirements of a delay line in order to avoid over-specifying. A safety factor of 50%, caused by not knowing the exact required rise time, results in approximately 280% increase in cost, size and weight. In addition, the added components reduce the reliability to ⅓ of the original.

Any delay output of the Synthesizer is the summation of individual lines. It is not the result of a tapped line. This feature is an important factor in eliminating undesirable reflections in the output pulse.

The rise time control filter (Fig. 1) is especially designed to give a flat response to a pulse input with the only effect being a change in rise time. The filter may be used alone in any other application where it is desired to slow the rise time of a pulse by a known amount while still maintaining symmetrical wave form without ringing.

When a line with almost no ripple or distortion is required, the rise time control may be used with only a slight decrease in rise time to obtain the pulse pictured in Fig. 2.

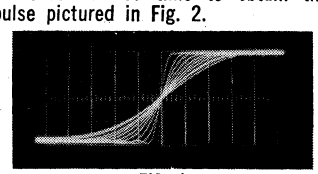


FIG. 1
Output of rise time control

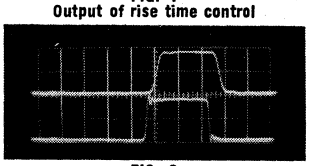


FIG. 2
Effect of rise time control on distortion

Model 73-11

The Model 73-11 Synthesizer can be used in any breadboard circuit where a time delay of up to 11 microseconds is required. The 50 ohm input allows for direct impedance match to the output of most pulse generators.

The basic delay line finds general use in the lab in such applications as delaying the sync on sampling scopes so that the output of delay lines may be observed, or in any application where the internal delay of the scope is not sufficient.

The filter may be used alone to control the rise time of pulse generators which are too fast for the application at hand.

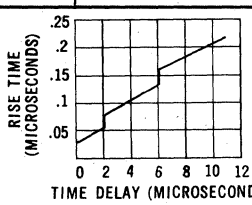


Model 500-63

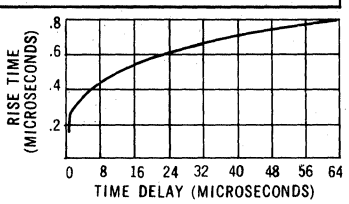
The Model 500-63 Synthesizer can be used in any breadboard circuit where a time delay up to 63.5 microseconds is required. The 500 ohm input allows for direct impedance match to transistor circuits.



	Model 73-11	Model 500-63
Time Delay:	From .025 microseconds to 11.075 microseconds in .025 microsecond increments.	From .5 microseconds to 63.5 microseconds in .5 microsecond increments.
Rise Time of Delay Lines:	@ maximum delay: .22 μs. See graph.	@ maximum delay: .8 μs. See graph.
Impedance:	50 or 73 ohm input or output — switch controlled.	500 ohms
Rise Time Control:	Rise time 0.01 microseconds to 1.1 microseconds in .01 microsecond increments.	Rise time .1 microseconds to 11 microseconds in .1 microsecond increments.
Rise Time Control Tolerance:	5%	10%



Rise time at different delays for basic delay line.



Independent control of time delay and rise time is available to experimentally determine required time delay and rise time for minimum size, weight, cost and for maximum reliability.

VARIABLE DELAY LINE — MODEL 500-31.5



Model 500-31.5 is a switch variable time delay unit consisting of 6 individual delay lines. The time delays of these individual lines are so arranged that by switching in one or more lines 63 different delays can be obtained. These delay times range from .5 microseconds to 31.5 microseconds in .5 microsecond steps. Since the delayed output pulse is always the addition of individual lines, it is free of distortions that are caused by reflections from tapped lines. At total delay, the unit has a time delay to rise time ratio of greater than 48 to 1. Because the unit has an input and output impedance of 500 ohms, it is well matched to the impedance of most transistor circuits. The wide range of time delays coupled with the high time delay to rise time ratio and the impedance make for an extremely useful test instrument.

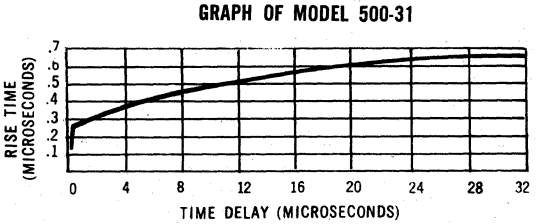
VARIABLE DELAY LINE — MODEL 75-2



Model 75-2 consists of seven delay lines each having its own switch. The time delay is changed by switching one or more individual lines in series. The delayed output is always the summation of individual delay lines and not the result of a tapped line. This feature is an important factor in eliminating undesirable reflections in the output pulse. The passive networks are capable of any of 83 different time delays ranging from .025 microseconds to 2.075 microseconds in .025 microsecond increments. The delay line finds general use in the laboratory in such applications as delaying the sync on sampling scopes so that the output of delay lines may be observed. Two RG11/U connectors serve as the input and output.

	MODEL 500-31.5	MODEL 75-2
Time Delay:	From .5 to 31.5 μs. in .5 μs increments.	From .025 to 2.075 μs. in .025 μs. increments.
Delay Tolerance @ Maximum Setting:	1%	3%
Time Delay of Individual Lines:	.5, 1, 2, 4, 8, 16 μs.	.025, .05, .1, .2, .2, .5, 1 μs.
Rise Time:	.65 μs. max. for max. delay. See graph.	.06 μs. max. @ max. delay.
Impedance:	500 ohms	75 ohms
Attenuation:	20% max.	7% max.
Distortion:	2% max. with .2 μs. input pulse.	2% max. with .2 μs. input pulse.
D.C.W.V.:	300	300
Size:	7" x 8" x 8"	7" x 8" x 8"

GRAPH OF MODEL 500-31



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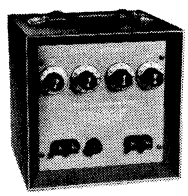
LUMPED CONSTANT DECADE DELAY LINES

TYPE "D"

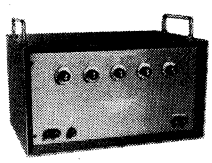
Type "D" Variable Decade Delay Units are engineered to provide variable time delays with absolute stability for accurate triggering and excellent reproduction of the input pulse. These lumped constant delay lines are completely passive. All models have a minimum of 1000 to 1 resolution and consist of three or more decade switches. Any delay output of Type "D" decade delay unit is the summation of individual lines. It is not the result of a tapped line. This feature is an important factor in eliminating undesirable reflections in the output pulse. Accuracy at any delay exceeding 1% of the unit's total delay is within 3%. These units have a characteristic impedance of 500 ohms in and out. While the units listed are standard, other delays and impedances can be manufactured to specifications.



Cabinet Size: 8" wide x 8" high x 7" deep



Cabinet Size: 14" wide x 8" high x 10" deep



Cabinet Size: 17" wide x 9½" high x 11½" deep

Part No.	Maximum Time Delay In Microseconds	Resolution In Microseconds	Rise Time @ Max. Delay In Microseconds	Attenuation in db
D11	11.1	.01	.45	3
D21	21.1	.01	.85	5
D41	41.1	.01	1.65	5
DD41	41.1	.01	.83	5
D61	61.1	.01	2.45	6
DD61	61.1	.01	1.23	6
D1C	111.1	.01	4.45	3
DD1C	111.1	.01	2.23	8
D2C	211.1	.01	8.45	3
DD2C	211.1	.01	4.23	3
D4C	411.1	.01	16.45	3
DD4C	411.1	.01	8.23	6
D6C	611.1	.01	24.45	3
DD6C	611.1	.01	12.23	6
D1K	1111.1	.01	40.45	3
DD1K	1111.1	.01	20.23	8
D2K	2111	.1	84.5	5
D4K	4111	.1	164.5	6
D6K	6111	.1	244.5	8
D11K	11,111	.1	444.5	11
D21K	21,111	1	844.5	11
DD2K	2111	.1	42.25	5
DD4K	4111	.1	82.25	6
DD6K	6111	.1	122.25	8
DD11K	11,111	.1	222.25	11
DD21K	21,111	1	422.25	11
DD41K	41,111	1	822.25	12
DD61K	61,111	1	1222.25	12

SERIES "S" & "LV"

SWITCH VARIABLE

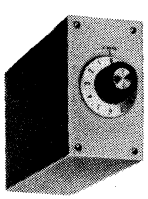
These units are composed of 4 individual delay lines having a common ground. The switch is so arranged that (except for position one which has no time delay) it connects one or more of the delay lines in series across the input and output terminals. Therefore, the delayed output is always the summation of individual delay lines and not the result of a tapped line. This feature is an important factor in eliminating undesirable reflections in the output pulse.

All units in this series can have their time delays varied to any multiple of 1/10 of the total delay.

Units are supplied in gray steel cans, 2 x 3½ x 5 inches. Four 8/32 inserts and four terminals (1 input, 1 output and 2 grounds) are on the 2 x 3½ inch surface. The switch knob is located on the opposite surface.

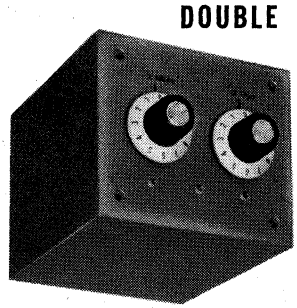
Distortion with .02 μsec. input: 10% maximum.

All units have variable time delays in any multiple of 1/10 of the total delay.



	Impedance	Time Delay @ Maximum Setting (microseconds)	Maximum Attenuation	Notes
S Series	75 ohms	.3, .6, .9, 1.2	5%	Time delay to rise time ratio at maximum delay: 10 to 1 minimum. D.C.W.V.: 300.
	500 ohms	.6, .9, 1.2, 1.8, 2.4, 3, 4.5, 6.0	10%	
LV Series	250 ohms	200	50%	Time delay to rise time ratio at maximum delay: 5 to 1 minimum. D.C.W.V.: 100
	500 ohms	400, 500		
	1000 ohms	100, 300, 1000		

DOUBLE SWITCH VARIABLE AUDIO DELAY LINES



"LDV"

Where increased resolution is desired over that of the "LV" Series, the "LDV" Series is recommended. These lines are composed of 8 individual delay units — four to a switch. They employ the same summation principle as that used in the "LV" Series. Units are supplied in gray steel cans, 4⅝" x 3 15/16" x 4⅞". Four 10/32 inserts and three terminals (1 input, 1 output and 1 ground) are on the 4⅝" x 3 15/16" surface. The switch knob is located on the same surface.

Time Delay Microseconds	Impedance Ohms	Resolution Microseconds	Bandwidth Kilocycles
LDV 0-550	500	5	3.2
LDV 0-1100	1000	10	1.6

ARTRONIC INSTRUMENT COMPANY

MILITARY GRADE

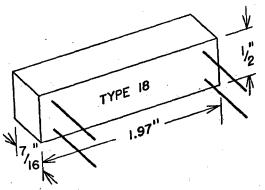
DELAY LINES

TYPE 18

Rise Time: 20% to 25% of delay time

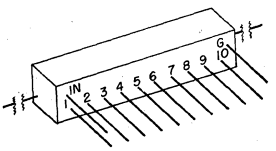
Leads: #22 AWG tinned copper, 1½" long

Delay (μsec)	Type 18H Impedance (ohms)	Type 18L Impedance (ohms)
0.05	125	62
0.1	250	62
0.2	500	50
0.25	625	62
0.3	750	75
0.4	1000	100
0.5	1250	125
0.6	1500	150
0.7	1750	175
0.75	1875	188
0.8	2000	200
0.9	2250	225
1.0	2500	250
1.5	1875	375
2.0	2500	500
2.5	3125	625
3	1875	750
4	2500	1000
5	3125	1250
6	1500	
7	1750	
8	2000	
9	2250	
10	2500	



TYPE 18 AND TYPE 22

Delay Tolerance: 2%
Thermal Coefficient of Delay: 0.003%/°C to 0.01%/°C
Test Voltage: 800 vDC
Working Voltage: 400 v, DC or pulse
Temperature Range: −65°C to 125°C
Ordering Information: Part numbers are given by designating first the type number and letter, and then the delay, e.g., 22L-0.75. Intermediate values of delay and impedance can also be furnished.



TYPE 22

10 Taps, equally spaced

Rise Time: 15% to 20% of total delay time

Dimensions: ½" x ½" x 2½"

Leads: #22 AWG tinned copper or brass, 1¼" long

Leads on end faces are spare ground leads to provide added mounting rigidity. They may be clipped off if not needed, since a third ground lead is provided on the long face.

Delay (μsec)	Type 22H Impedance (ohms)	Type 22L Impedance (ohms)
0.05	100	50
0.1	200	50
0.2	400	100
0.25	500	50
0.3	600	60
0.4	800	80
0.5	1000	100
0.6	1200	120
0.7	1400	140
0.75	1500	150
0.8	1600	160
0.9	1800	180
1.0	2000	200
1.5	3000	300
2.0	2000	400
2.5	2500	500
3	3000	600
4	2000	800
5	2500	1000
6	3000	1200
7	1400	
8	1600	
9	1800	
10	2000	
12	2400	
15	3000	

PRECISION, RUGGEDNESS, RELIABILITY

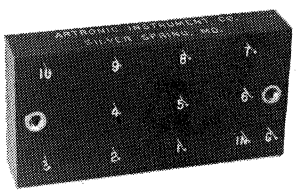
These four series of military grade delay lines are encapsulated in an epoxy casting resin, which is poured under vacuum and cured to a solid, void-free block of high-temperature plastic. All components and wires are solidly supported against shock and vibration and completely protected from moisture and salt spray. All four series meet the requirements of MIL-STD-202B..

The remarkable performance and stability of these very compact delay lines is due to the extraordinary care taken in the design and manufacturing processes. Phase characteristics are individually adjusted for optimum pulse performance, to give fast-rising, noise-free output pulses with minimum overshoot and distortion. A complete system of inspections and tests at every stage of construction and assembly assures the utmost in quality and reliability.

OTHER TYPES AND CUSTOM DESIGNS ALSO AVAILABLE

SERIES L — 10 Taps

Rise Time: 7% to 8% of Total Delay



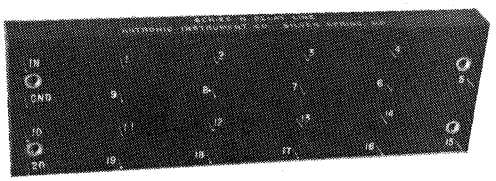
BANDWIDTHS IN MC

Delay (μsec)	Characteristic Impedance (Ohms) 50	200	500	1,000	2,000
0.1	110				
0.2	58	58			
0.3	39	39			
0.4	29	29			
0.5	23	23	23		
0.6	19	19	19		
0.7	16	16	16		
0.8		14	14		
0.9		13	13		
1.0		11	11	11	
2.0		5.8	5.8	5.8	5.8
3.0		3.9	3.9	3.9	3.9
4.0			2.9	2.9	2.9
5.0			2.3	2.3	2.3
6.0			1.9	1.9	1.9
7.0			1.6	1.6	1.6
8.0				1.4	1.4
10				1.1	1.1
15				0.7	0.7
20					0.6
25					0.5
30					0.4

Size: ½" x 1.5" x 2.9"
Mounting: Two 6-32 tapped inserts

SERIES N — 20 Taps

Rise Time: 3% to 4% of Total Delay



Size: ½" x 2" x 6.4" Mounting: Four 6-32 Tapped Inserts

BANDWIDTHS IN MC

Delay (μsec)	Characteristic Impedance (Ohms) 50	200	500	1,000	2,000
1	39	39			
1.5	26	26			
2	19	19			
2.5	15	15	15		
3		13	13		
4		9.7	9.7		
5		7.8	7.8	7.8	
6		6.5	6.5	6.5	
8		4.8	4.8	4.8	
10		3.9	3.9	3.9	3.9
12			3.2	3.2	3.2
15			2.6	2.6	2.6
20			1.9	1.9	1.9
25			1.5	1.5	1.5
30				1.3	1.3
40				0.9	0.9
50				0.7	0.7
75					0.5
100					0.4

SERIES L AND SERIES N

Delay Tolerance: 2%
Delay Temp. Coeff.: 0.003%/°C to 0.01%/°C
Test Voltage: 800 vDC
Working Voltage: 400 vDC max
Pulse Voltage: 400 v peak max
Temperature Range: −65°C to 125°C
Connections: 22 gauge pins, 3/16" long

Designed to plug into printed wiring boards for dip-soldering into place, these high-performance units are readily adaptable to other types of circuit construction, since the 22 gauge pins may be easily formed to fit lugs or terminal posts. The pins are laid out on the standard 0.1" printed circuit grid.

Careful control of the attenuation characteristic and the provision of special phase-compensating circuits result in superlative pulse performance. The tables give the cut-off frequencies of the delay lines which are available in each series. Part Numbers: Give series, impedance, and delay; e.g., N-1000-40.

THE ARTRONIC INSTRUMENT COMPANY

Phone: 949-1131 (Area Code 301) 11232 Triangle Lane, Silver Spring, Md.

Bliley

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BLILEY GLASS DELAY LINES FOR DIGITAL STORAGE

Digital glass memories have recently found wide application as an ultrasonic storage device in computers and associated digital processing equipment. Bliley ultrasonic digital delay lines meet this requirement with bit rates as high as 30M bits/sec and access times as low as one microsecond. Although digital lines operate at one-half the period of the center frequency, the recommended bit rate is approximately two-thirds of the center frequency.

Digital lines operate in the RZ or return to zero mode which is the least demanding on external circuitry. Additional circuitry is required for NRZ operation to obtain increased storage capacity or BIPOLAR operation for increased signal to noise ratio. Most digital lines utilize low temperature coefficient glass as the delay medium to obtain good delay time stability with temperature change as indicated in Figure 1.

Attenuation depends upon delay time, operating frequency, required signal to noise ratio, terminating impedance, input and output admittance conditions and pulse shape. The most efficient operation of a digital line is achieved at its point of minimum attenuation (center frequency) although it may operate satisfactorily at any point throughout its 3 db bank pass. To reduce loss level, ceramic transducers are used up to 20 MHz and quartz transducers from 20 MHz to 30 MHz.

Typical digital response characteristics are shown in Table I, and Table II indicates the present design range parameters for glass lines.

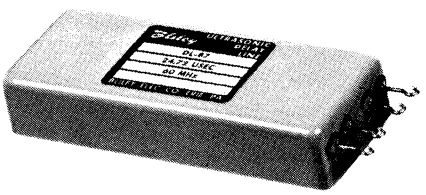
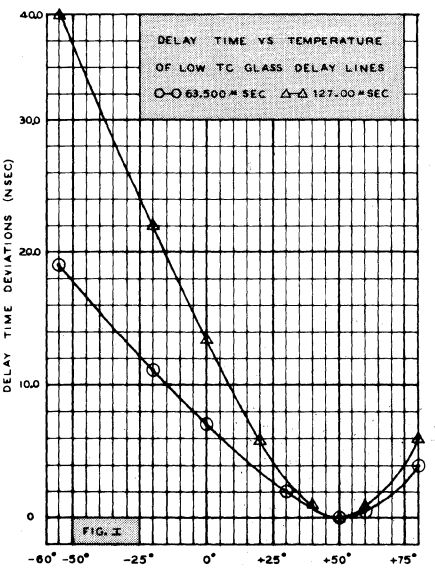


FIG. 1



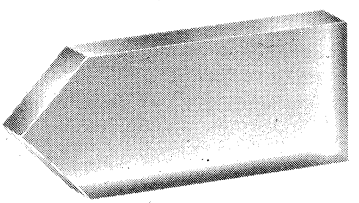


TABLE I. TYPICAL DIGITAL CHARACTERISTICS

Delay Time (μsec)	Pulse Width (nsec)	Atten. (max.) (db)	S/N (min.) (db)	Term. Imp. (ohms)	Max. Delay Change Temp. 10-80°C (nsec)
1.700	85	22	25	50	3.0
10.000	12	30	20	50	2.0
26.500	80	26	20	100	2.0
26.500	30	26	20	100	2.0
52.800	30	35	20	50	4.0
50.000	25	32	20	50	4.0
63.500	18	70	25	50	5.0
63.500	75	32	20	50	5.0
63.400	50	38	25	100	5.0
98.700	84	26	20	100	8.0
140.400	84	26	20	100	10.0
200.000	75	36	20	50	17.0
250.000	25	50	20	50	21.0

TABLE II. DIGITAL DESIGN RANGE

Center Frequency	3.0 MHz.	to	30.0 MHz
Input Pulse Width	167 nsec.	to	16.7 nsec.
Delay Time	1.0 μsec.	to	300 μsec.
Signal to Noise Ratio	15 db	to	25 db
Termination Impedance	1500 ohms	to	15 ohms
Attenuation: Ceramic Transducers	20 db	to	40 db
Quartz Transducers	30 db	to	80 db
Delay Time Tolerance at 25°C	±0.2% (1-20 μsec.)	to	±5 nsec. (10-300 μsec.)
Delay Time Stability 0 to +80°C	(0.2% @ 1 μsec. / 0.01% @ 10 μsec.)	to	0.01% (10-300 μsec.)

Bliley is equipped to manufacture a broad range of custom-designed delay lines. Our experienced staff will welcome an opportunity to analyze your specifications and prepare quotations for your requirement. Literature will be sent promptly upon request.

BLILEY ULTRASONIC DELAY LINES FOR RF APPLICATIONS

Ultrasonic delay lines are widely used in conventional RF systems such as video pulse integrators and moving target indicators in radar applications. This type of ultrasonic delay line is available over the range from 1 microsecond to 4500 microseconds.

In general, low TC glass is used for the short delay time range, with frequency temperature characteristics as shown in Figure 1. Long lines, which use fused quartz as the delay medium, have a temperature coefficient of minus 75 ppm per degree C.

Long delay lines may be specified with carrier frequencies in the range from 10 MHz to 40 MHz. Spurious signal attenuation shown in Table III applies only to frequency range 25-40 MHz. Best attenuation of spurious signals is achieved in medium delay time ranges and at higher carrier frequencies. Dependent upon loss level requirements, bandwidth may be estimated from 50% to 65% of carrier frequency. Loss and bandwidth characteristics are interdependent and are controlled by choice of terminations, carrier frequency and transducer capacity as shown in Table IV.

TABLE III. LONG DELAY LINES

Delay Time Range (μsec)	30-400	200-700	300-1400	500-1600	600-2000	1400-2700	600-3300	1300-4500
Spurious db Down	50	55	60	55	55	50	45	45
3rd Time Signal db Down	40	45	55	—	—	—	—	—

TABLE IV. SHORT DELAY LINES

Group	Freq. Range (MHz)	Delay Time Range (Microseconds) Ringing Single Ended	Delay Time Range (Microseconds) Absorber Double Ended	Max. Temp. Coeff. (ppm/°C)	Bandwidth as percent of carrier (with 93 ohm termination)	Loss level (db) with different termination 50 ohm	93 ohm	1000 ohm
A	5-60	.75-60	.75-30	—100	30		45	28
	60-100	.75-60	.75-30	—100	15		50	33
B	5-60	.75-40	.75-20	+85	35		43	27
	60-100	.75-40	.75-20	+85	15		48	31
C	5-60	.75-40	.75-20	+20	35		43	27
	60-100	.75-40	.75-20	+20	15		48	31
D	5-30	1.00-60	1.00-30	—100	40 (50 ohm) term.)	12		
E	5-30	1.00-40	1.00-20	+20	40 (50 ohm) term.)	12		

Bliley

For further information call (814) 838-3571 or wire TWX 510-696-6886

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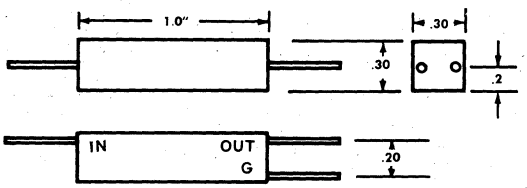
DELAY LINES

A



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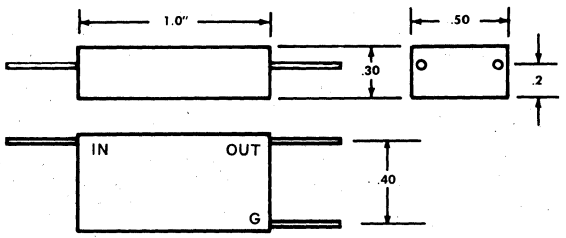

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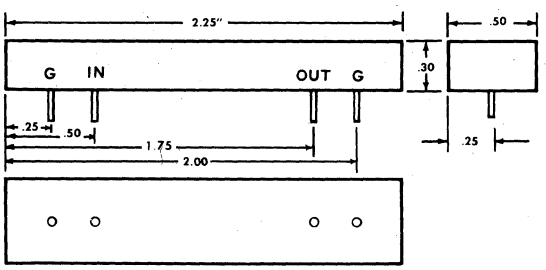

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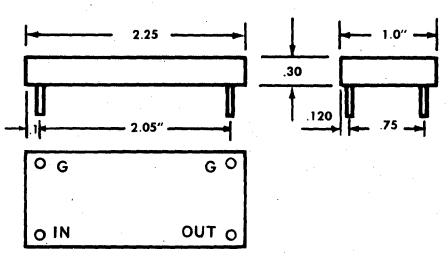

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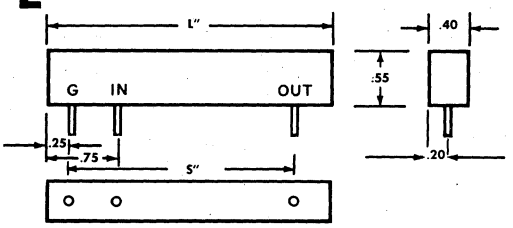

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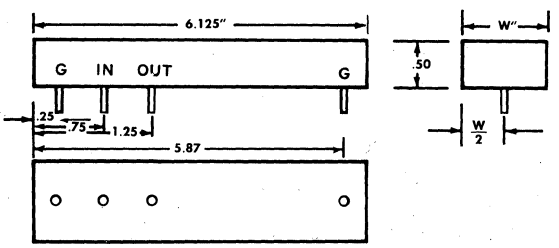

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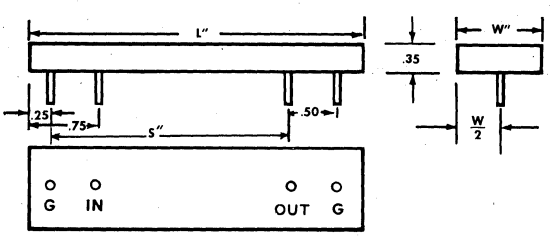

The condensed version of our catalog items are listed here showing the most widely used sizes and types available for prompt shipment. Space prohibits the full listing of the many specials and the variations available.

CAUTION: Before finalizing your design, it is highly recommended you contact our Engineering Staff for their expert guidance, founded on our vast experience and up-to-date technology — a phone call can save you valuable time and money.

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NANOSECONDS

PART NUMBER — IMPEDANCE ±10%				DELAY TIME ±5% nsec	RISE TIME nsec	CONFIGURATION	LEAD SPACING "S" INCHES	LENGTH "L" INCHES	WIDTH "W" INCHES
93Ω	200Ω	500Ω	1000Ω						
HN901	HN201	HN501	HN1001	1	2.0	A	—	1.0	.3
HN902	HN202	HN502	HN1002	2	2.0	A	—	1.0	.3
HN903	HN203	HN503	HN1003	3	2.0	A	—	1.0	.3
HN904	HN204	HN504	HN1004	4	2.0	A	—	1.0	.3
HN905	HN205	HN505	HN1005	5	2.0	A	—	1.0	.3
HN910	HN210	HN510	HN1010	10	2.0	A	—	1.0	.3
HN915	HN215	HN515	HN1015	15	2.5	B	—	1.0	.5
HN920	HN220	HN520	HN1020	20	2.5	B	—	1.0	.5
NL 925	NL 225	NL 525	NL 1025	25	2.8	C	—	2.25	.5
NL 930	NL 230	NL 530	NL 1030	30	3.0	C	—	2.25	.5
NL 935	NL 235	NL 535	NL 1035	35	3.5	C	—	2.25	.5
NL 940	NL 240	NL 540	NL 1040	40	4.0	C	—	2.25	.5
NL 945	NL 245	NL 545	NL 1045	45	4.5	C	—	2.25	.5
NL 950	NL 250	NL 550	NL 1050	50	5.0	C	—	2.25	.5
NL 955	NL 255	NL 555	NL 1055	55	5.4	D	—	2.25	1.0
NL 960	NL 260	NL 560	NL 1060	60	5.8	D	—	2.25	1.0
NL 965	NL 265	NL 565	NL 1065	65	6.2	D	—	2.25	1.0
NL 970	NL 270	NL 570	NL 1070	70	6.6	D	—	2.25	1.0
NL 975	NL 275	NL 575	NL 1075	75	7.0	D	—	2.25	1.0
NL 980	NL 280	NL 580	NL 1080	80	7.4	D	—	2.25	1.0
NL 985	NL 285	NL 585	NL 1085	85	7.8	D	—	2.25	1.0
NL 990	NL 290	NL 590	NL 1090	90	8.2	D	—	2.25	1.0
NL 995	NL 295	NL 595	NL 1095	95	8.5	D	—	2.25	1.0
NL 9100	NL 2100	NL 5100	NL 10100	100	8.5	D	—	2.25	1.0
NL 9125	—	—	—	125	12.5	G	2	3.00	.75
—	NL 2125	—	—	125	12.5	G	2.8	3.8	.625
—	—	NL 5125	NL 10125	125	12.5	E	1.20	1.8	.4
NL 9150	—	—	—	150	15.0	G	2	3.0	1.0
—	NL 2150	—	—	150	15.0	G	2.8	3.8	.625
—	—	NL 5150	NL 10150	150	15.0	E	1.20	1.8	.4
NL 9175	—	—	—	175	17.5	G	2	3.0	1.0
—	NL 2175	—	—	175	17.5	G	2.8	3.8	.625
—	—	NL 5175	NL 10175	175	17.5	E	1.20	1.8	.4
NL 9200	—	—	—	200	19.0	G	2	3.0	1.5
—	NL 2200	—	—	200	19.0	G	2.8	3.8	.625
—	—	NL 5200	NL 10200	200	19.0	E	1.20	1.8	.4
NL 9250	—	—	—	250	23.0	G	2	3.0	1.5
—	NL 2250	—	—	250	23.0	G	2.8	3.8	.625
—	—	NL 5250	NL 10250	250	23.0	E	1.20	1.8	.4
NL 9300	—	—	—	300	27.0	G	5.125	6.125	1.5
—	NL 2300	—	—	300	27.0	G	2.8	3.8	.9
—	—	NL 5300	NL 10300	300	27.0	E	2.20	3.0	.4
NL 9400	—	—	—	400	36.0	G	5.125	6.125	1.5
—	NL 2400	—	—	400	36.0	G	2.8	3.8	.9
—	—	NL 5400	NL 10400	400	36.0	E	2.20	3.0	.4
NL 9500	—	—	—	500	40.0	G	5.125	6.125	1.5
—	NL 2500	—	—	500	40.0	G	2.8	3.8	1.5
—	—	NL 5500	NL 10500	500	40.0	E	2.20	3.0	.4
—	NL 2600	—	—	600	50.0	G	2.8	3.8	1.5
—	—	NL 5600	NL 10600	600	50.0	E	2.20	3.9	.4
—	NL 2700	—	—	700	60.0	G	5.125	6.125	.8
—	—	NL 5700	NL 10700	700	60.0	E	2.20	3.9	.4
—	NL 2800	—	—	800	70.0	G	5.125	6.125	.8
—	—	NL 5800	NL 10800	800	70.0	E	3.40	4.25	.4
—	NL 2900	—	—	900	80.0	G	5.125	6.125	.8
—	—	NL 5900	NL 10900	900	80.0	E	4.40	5.25	.4
—	NL 21000	—	—	1000	90.0	G	5.125	6.125	.8
—	—	NL 51000	NL 101000	1000	90.0	E	4.40	5.25	.4
—	DC 21.5K	—	—	1500	150.0	F	—	6.125	2.0
—	—	DC 51.5K	DC 101.5K	1500	150.0	F	—	6.125	.8
—	DC 22K	—	—	2000	200.0	F	—	6.125	2.0
—	—	DC 52K	DC 102K	2000	200.0	F	—	6.125	.8
—	DC 22.5K	—	—	2500	250.0	F	—	6.125	2.0
—	—	DC 52.5K	DC 102.5K	2500	250.0	F	—	6.125	.8
—	DC 23K	—	—	3000	300.0	F	—	6.125	2.0
—	—	DC 53K	DC 103K	3000	300.0	F	—	6.125	1.2
—	DC 23.5K	—	—	3500	350.0	F	—	6.125	3.0
—	—	DC 53.5K	DC 103.5K	3500	350.0	F	—	6.125	1.2
—	DC 24K	—	—	4000	400.0	F	—	6.125	3.0
—	—	DC 54K	DC 104K	4000	400.0	F	—	6.125	2.0
—	DC 24.5K	—	—	4500	450.0	F	—	6.125	3.0
—	—	DC 54.5K	DC 104.5K	4500	450.0	F	—	6.125	2.0
—	DC 25K	—	—	5000	500.0	F	—	6.125	3.0
—	—	DC 55K	DC 105K	5000	500.0	F	—	6.125	2.0

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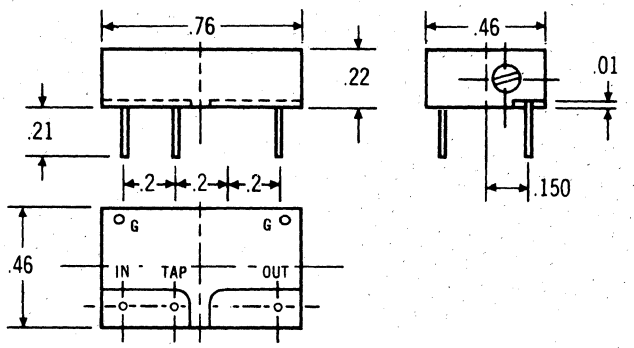
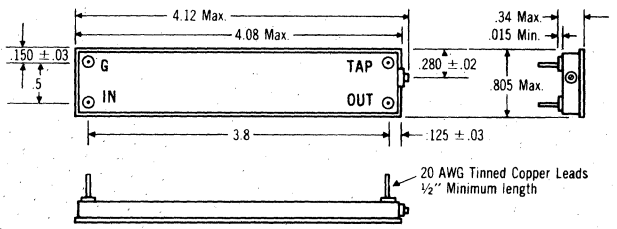
DUAL-IN-LINE VARIABLE DELAY LINES

DV Series



BEL introduces the first variable delay line compatible with IC Dual-In-Line packaging featuring: • Hermetic Seal-O-Ring construction • Precious metal contacts • Resolution — MIN 2% (for high reliability performance)

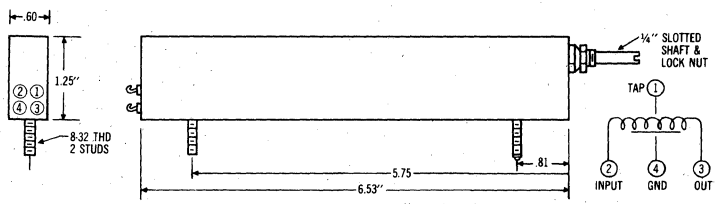
NV Series



VARIABLES

These precision hermetically sealed variables are available in a wide range of delays and impedances. Both may be provided with various mounting and terminal configurations to suit most applications.

CV Series
LV Series



VARIABLES

These precision hermetically sealed variables are available in a wide range of delays and impedances. Both may be provided with various mounting and terminal configurations to suit most applications.

Part Number	Td Range	Rise Time	Impedance ±10%	Style
NV540	0-40 nsec	15 nsec	500 ~	NV
NV250	0-50 nsec	12 nsec	200 ~	
NV10150	0-150 nsec	55 nsec	1000 ~	
NV5250	0-250 nsec	50 nsec	500 ~	
NV4250	0-250 nsec	32 nsec	400 ~	
CV10450	0-450 nsec	80 nsec	1000 ~	CV
CV5700	0-700 nsec	100 nsec	500 ~	
CV5750	0-750 nsec	100 nsec	500 ~	
CV51000	0-1000 nsec	120 nsec	500 ~	
DV105	0-5 nsec	5 nsec	100 ~	DV
DV220	0-20 nsec	15 nsec	200 ~	
DV330	0-30 nsec	20 nsec	350 ~	
DV540	0-40 nsec	25 nsec	500 ~	
LV9250	0-250 nsec	35 nsec	100 ~	LV
LV10500	0-500 nsec	50 nsec	1000 ~	
LV51000	0-1000 nsec	90 nsec	500 ~	

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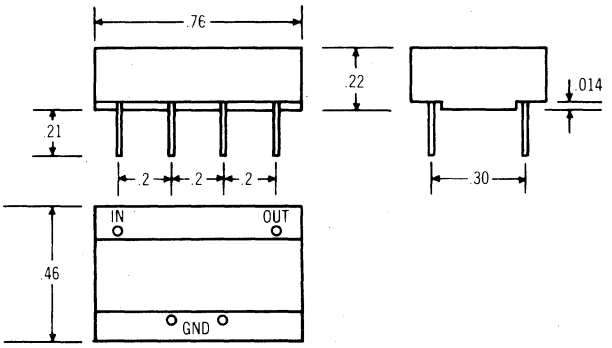
DUAL-IN-LINE DELAY LINES

- Delays from 1-1000 nanoseconds.
- Band Width to 60 mhz.
- Impedance 50 to 1000 ohms.
- Resistive Terminations if desired.
- Tapped Delay Lines available.
- Several separate lines in one case.
- Contact Bel Engineering for special applications.



Time Delay nsec ±5%*	Impedance ±10%					
	50 Ω	75 Ω	100 Ω	200 Ω	500 Ω	1000 Ω
5	D055 Tr = 5	D075 Tr = 5	D015 Tr = 3	D205 Tr = 4	D505 Tr = 4	D105 Tr = 4
10	D0510 Tr = 8	D0710 Tr = 8	D0110 Tr = 3.5	D2010 Tr = 4.5	D5010 Tr = 5.5	D1010 Tr = 5.5
15	D0515 Tr = 12	D0715 Tr = 12	D0115 Tr = 4	D2015 Tr = 5	D5015 Tr = 6	D1015 Tr = 6
20	D0520 Tr = 17	D0720 Tr = 17	D0120 Tr = 6	D2020 Tr = 6	D5020 Tr = 6	D1020 Tr = 6
30	D0530 Tr = 25	D0730 Tr = 20	D0130 Tr = 20	D2030 Tr = 8	D5030 Tr = 8	D1030 Tr = 8
40	D0540 Tr = 25	D0740 Tr = 20	D0140 Tr = 20	D2040 Tr = 20	D5040 Tr = 10	D1040 Tr = 10
50	D0550 Tr = 25	D0750 Tr = 20	D0150 Tr = 20	D2050 Tr = 17	D5050 Tr = 20	D1050 Tr = 20
60	D0560 Tr = 40	D0760 Tr = 20	D0160 Tr = 20	D2060 Tr = 17	D5060 Tr = 25	D1060 Tr = 25
70	D0570 Tr = 30	D0770 Tr = 22	D0170 Tr = 22	D2070 Tr = 18	D5070 Tr = 30	D1070 Tr = 30
80	D0580 Tr = 45	D0780 Tr = 22	D0180 Tr = 22	D2080 Tr = 20	D5080 Tr = 34	D1080 Tr = 34
90	D0590 Tr = 50	D0790 Tr = 23	D0190 Tr = 23	D2090 Tr = 23	D5090 Tr = 36	D1090 Tr = 36
100	D05100 Tr = 65	D07100 Tr = 23	D01100 Tr = 23	D20100 Tr = 23	D50100 Tr = 37	D10100 Tr = 55
125	D05125 Tr = 90	D07125 Tr = 40	D01125 Tr = 25	D20125 Tr = 30	D50125 Tr = 40	D10125 Tr = 62
150	D05150 Tr = 100	D07150 Tr = 35	D01150 Tr = 30	D20150 Tr = 30	D50150 Tr = 35	D10150 Tr = 65
200	D05200 Tr = 120	D07200 Tr = 50	D01200 Tr = 40	D20200 Tr = 40	D50200 Tr = 40	D10200 Tr = 75
300			D01300 Tr = 60	D20300 Tr = 60	D50300 Tr = 60	D10300 Tr = 70
400				D20400 Tr = 80	D50400 Tr = 70	D10400 Tr = 70
500				D20500 Tr = 110	D50500 Tr = 110	D10500 Tr = 110
600				D20600 Tr = 130	D50600 Tr = 130	D10600 Tr = 130
700				D20700 Tr = 150	D50700 Tr = 150	D10700 Tr = 155
800					D50800 Tr = 180	D10800 Tr = 180
900					D50900 Tr = 180	D10900 Tr = 180
1000					D501000 Tr = 180	D101000 Tr = 180

or 1 nsec (whichever is greater)

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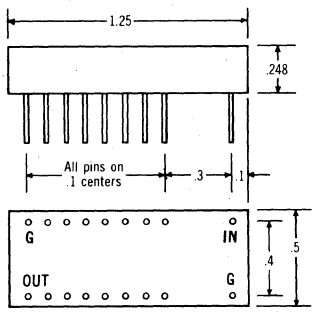
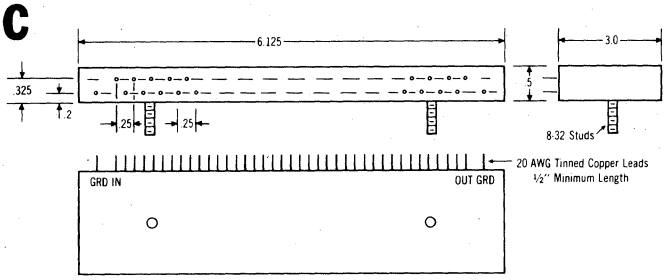
TAPPED DELAY LINES

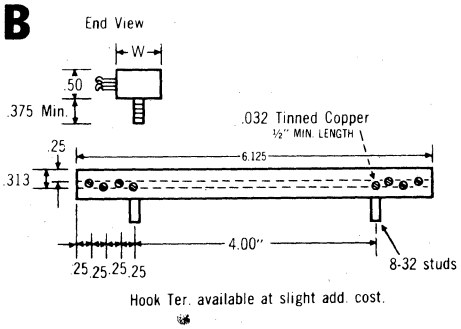
A



C

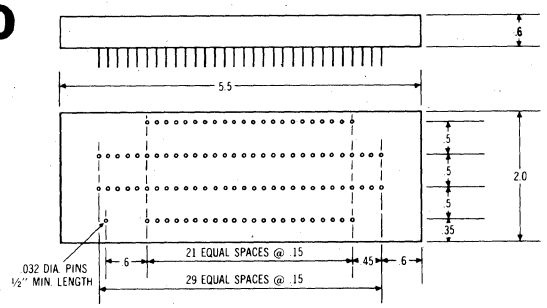


B



Hook Ter. available at slight add. cost.

D



Part No.	Delay nsec	Tr nsec	No. of Taps	Delay/Tap nsec	Impedance	Width "	Style
BF-14-155-1	15	5	15	1	100 ~	½	A
BF-14-155-2	15	5	15	1	200 ~	½	A
BF-14-155-3	15	5	15	1	500 ~	½	A
BF-14-131A	100	15	20	5	500 ~	¾	B
BF-14-447	200	25	20	10	500 ~	¾	B
BF-14-448	300	35	20	15	500 ~	¾	B
BF-14-449	400	45	20	20	500 ~	¾	B
BF-14-131B	500	55	20	25	500 ~	¾	B
BF-14-450	600	60	20	30	500 ~	¾	B
BF-14-451	700	70	20	35	500 ~	¾	B
BF-14-452	800	80	20	40	500 ~	¾	B
BF-14-453	900	90	20	45	500 ~	¾	B
BF-14-131C	1000	100	20	50	500 ~	¾	B
BF-14-454	1000	30	100	10	100 ~	2.0	D
BF-14-455	2000	200	20	100	500 ~	.8	B
BF-14-456	3000	300	20	150	500 ~	.8	B
BF-14-457	4000	400	20	200	500 ~	.8	B
BF-14-458	5000	500	20	250	500 ~	.8	B
BF-14-459	7500	750	20	375	500 ~	1.5	B
BF-14-460	10,000	1000	20	500	500 ~	1.5	B
BF-14-461	12,500	750	25	500	500 ~	3	C
BF-14-462	15,000	900	30	500	500 ~	3	C
BF-14-463	17,500	1100	35	500	500 ~	3	C
BF-14-464	20,000	1200	40	500	500 ~	3	C

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magnetostrictive delay lines

Model	Max. Delay	Max. (RZ) Storage	Min. Output	Max. Drift	Temp. Range	SIZE						
						A	A_1	A_2	B	B_1	B_2	C
VS	1024 μs	1536 bits	10 MV-P	100 ns	0 to 60°C	3.88	0.55	3.000	3.00	0.25	2.400	0.50
EX	1,500 μs	2,000 bits	10 MV-P	100 ns	0 to 60°C	5.00	0.531	3.250	4.25	0.50	3.250	0.50
SG	3,500 μs	4,500 bits	8 MV-P	200 ns	5 to 55°C	5.00	0.50	4.000	6.00	0.50	4.000	0.50
MD	5,000 μs	6,500 bits	8 MV-P	200 ns	0 to 50°C	7.50	0.50	5.50	6.50	1.00	4.50	0.50
IN	8,500 μs	11,000 bits	5 MV-P	200 ns	5 to 50°C	9.50	2.00	6.500	8.75	1.00	6.750	0.50
LR	10,000 μs	12,000 bits	4 MV-P	200 ns	10 to 50°C	9.00	2.00	6.000	8.00	1.00	6.000	0.75
EL	17,000 μs	17,000 bits	3 MV-P	±10 μs	0 to 60°C	11.00	1.50	8.50	11.00	1.50	9.00	0.75

The following conditions and specifications hold on all the units above:

input drive source:	50ma @ 12 volts
output termination:	3300 ohms
dynamic signal to noise:	3/1 min.
single pulse signal/noise:	10/1 min.
delay adj. (except EX and EL):	±2us min.

to order, specify: MD5000BP1

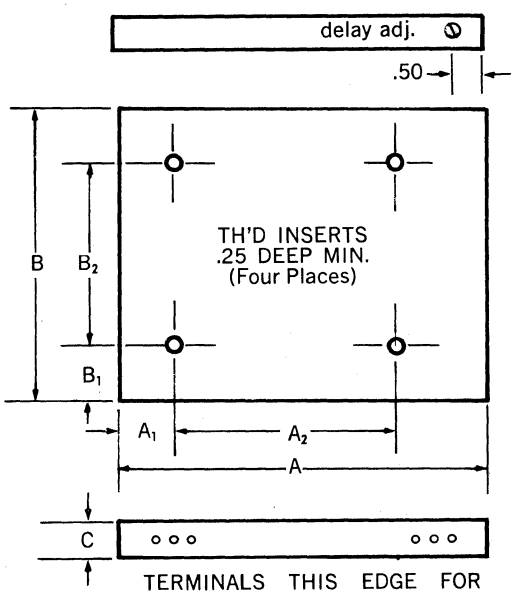
- MD — model: VS, EX, SG, MD, IN, LR or EL
- 5000 — delay in microseconds
- B — recording mode: RZ, NRZ, or Bi-Polar
- P1 — bit rate in mHz

Low Temp. Coeff. (Less than 1 ppm/°C 10 to 40°C) and Delay Adj. (±2 μs min.) available in Model EL. with reduced preformance. Lower cost, less attenuation and higher frequency response for ±20 ppm/°C max. temp. coeff. in other models.

Memories available for all models including low power versions operating from a single +5 VDC supply. Others employ Differential Preamplifiers having greater than 60DB common mode rejection. One TTL model for all lines, many DTL and RTL versions also available.

CUSTOMED PACKAGES FOR ANY REQUIREMENT

SYSTEMS APPLICATION & DESIGN ENGINEERING ALWAYS AVAILABLE.



TERMINALS THIS EDGE FOR ALL MODELS EXCEPT EX AND VS, WHICH HAVE TERMINALS ON MOUNTING SURFACE.

#4-40 THREAD FOR EX, VS AND SG MODELS, OTHERS EMPLOY #6-32 UNLESS REQUESTED OTHERWISE.

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COLUMBIA COMPONENTS

Q-LINES · VARILINES · MINILINES · MAGNETIC-CORE DELAY CABLE

Q-LINES® Lumped-Constant Delay Lines (LCDL) with High Figure of Merit

Unique design and latest packaging techniques make CCC's Q-Lines ideal for a wide range of applications. Specifications for standard units include:

"Q" Factor: Delay-to-rise-time ratios (Q) of up to 100:1.

Packing Factor: Delay lines used in industry today have packing factors ranging from 1 to 2. Columbia offers Q-Lines with packing factors as high as 10.

Attenuation: Extremely low signal attenuation is a built-in feature of all Q-Lines. Actual attenuation ranges from .01 to 0.2 db/μsec.

Thermal Stability: Nominal temperature coefficient of delay of 50 ppm/°C, with lower temperature coefficients available.

Spurious Response: Transients and noise average 5% of signal amplitude, with lower levels available.

Impedance Range: Standard Q-Lines cover the range of 100 to 200 ohms. Special designs are available with impedances from 50 to 10,000 ohms.

Delay Tolerance: Standard tolerance is +5%. Closer delay tolerances may be furnished on special order.

Temperature Range: Standard Q-Lines meet all military environmental tests from −55°C to +125°C.

Construction and Finish: All Q-Lines are potted in hermetically sealed cases. Cases are electro-tinned per MIL specifications and are finished with gray lacquer.

Mounting and Terminals: Standard Q-Lines are supplied with 2- or 4-stud mounting. Terminals are compression-seal, solder types.

Standard Q-Lines

TOTAL DELAY (μsec)	RISE TIME (μsec)	IMPEDANCE (ohms)
1	0.02	100
1	0.025	100, 500
1	0.03	100, 500
1	0.05	100, 500, 1000
1	0.1	100, 500, 1000
5	0.1 to 0.5	100, 500, 1000, 2000
10	0.2 to 1	100, 500, 1000, 2000
25	0.25 to 2.5	100, 500, 1000, 2000
50	0.5 to 5	100, 500, 1000, 2000

See CCC Data Sheet #DL-6-368.

VARILINES® Mechanically-Variable Delay Lines (MVDL)

For use in the laboratory or in military equipment, Columbia's Series VB and VC Varilines offer the designer a rugged component with no compromise in reliability. All units are produced with precision windings, precious metals and precise assembly techniques.

Features

Resolution: In excess of 0.001 μsec.

Attenuation: Less than 1.0 db.

Dielectric Strength: 300 VDC.

Temperature Coefficient: 200 ppm/°C.

Rotation: A minimum of ten turns provides continuous variation of delay from zero to maximum specified for the model.

Case Dimensions: 6 17/32" x 5/8" x 1 1/4" (Series VB)
7 1/4" x 1" x 1 5/8" (Series VC)

The Series VA Variline is a precision variable delay line trimmer specifically designed for printed circuit applications. Offered in a case 0.750" wide and 0.300" high, with lengths from 1.5" up to 4.0", the VA Series is available with delays from 0 to 15 nanoseconds up to 0 to 250 nanoseconds. Rise times of 5 nanoseconds to 42 nanoseconds are offered, together with impedances from 50 to 500 ohms.

See CCC Data Sheet #DL-1-368.

Series VB

MODEL NO.	MAX. DELAY (μsec)	MAX. RISE TIME (μsec)	IMPEDANCE (ohms)
VB201	0.10	0.03	100
VB202	0.20	0.04	200
VB203	0.70	0.095	500
VB204	0.50	0.09	750
VB205	0.40	0.075	1000
VB206	0.25	0.045	1300
VB207	0.20	0.04	1500

See CCC Data Sheet #DL-2-368.

Series VC

MODEL NO.	MAX. DELAY (μsec)	MAX. RISE TIME (μsec)	IMPEDANCE (ohms)
VC301	0.9	0.20	1000
VC302	2.0	0.40	470
VC303	4.0	0.80	220
VC304	9.0	1.80	100
VC305	15.0	3.00	56

See CCC Data Sheet #DL-3-368.

Series VA

MODEL NO.	MAX. DELAY (nanosec)	Z (Ω) ±10%	RISE TIME* (nanosec max.)
VA101	15	50	5
VA103	35	50	12
VA105	30	100	10
VA107	70	100	18
VA109	45	200	11

Series VA

MODEL NO.	MAX. DELAY (nanosec)	Z (Ω) ±10%	RISE TIME* (nanosec max.)
VA111	100	200	20
VA113	100	500	20
VA115	175	500	30
VA116	250	500	42

See CCC Data Sheet #DL-1-368.

*At maximum delay setting.

Write for complete CCC Delay Line Catalog.

State-of-the-art Delay Lines for every application

MINILINES® Miniature & Subminiature Distributed-Constant Delay Lines (DCDL)

Series MM Miniature Minilines and Series MS Subminiature Minilines are economically-priced distributed-constant delay lines featuring low-profile envelopes. They are ideal for printed circuit cards and other applications involving high packaging densities. Both Series are encapsulated in high-temperature epoxy and meet or exceed all applicable portions of MIL-D-23859A.

Features

Distortion: ±10%

Dielectric Strength: 100 VDC

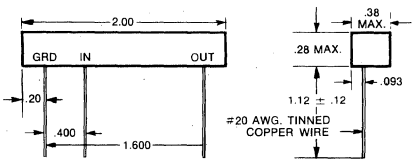
Attenuation: 0.5 db max.

Operating Temperature: —55°C to +125°C

Series MM

MODEL NO.	IMPEDANCE (ohms)	DELAY (nsec)	MAX. RISE TIME (nsec)
MM100B	200	10	3.0
MM200B	200	20	6.0
MM400B	200	40	10.0
MM800B	200	80	20.0
MM200D	400	20	6.0
MM400D	400	40	10.0
MM800D	400	80	20.0
MM161D	400	160	40.0

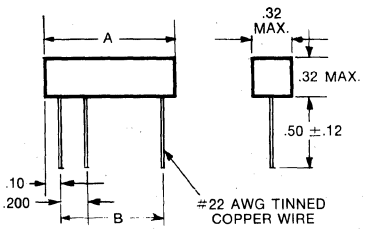
See CCC Data Sheet #DL-4-368.



Series MS

MODEL NO.	IMPEDANCE (ohms)	DELAY (nsec)	MAX. RISE TIME (nsec)
MS100A-1	100 or 200	10	2.5
MS200A-1	100 or 200	20	6.0
MS300A-1	100 or 200	30	8.5
MS400A-1	100 or 200	40	12.0
MS500A-1	100 or 200	50	15.0
MS600A-2	100 or 200	60	12.0
MS800A-2	100 or 200	80	16.0
MS101A-2	100 or 200	100	20.0
MS101E-1	500	100	30.0
MS151E-1	500	150	45.0
MS201E-1	500	200	60.0
MS301E-1	500	300	80.0
MS401E-2	500	400	55.0
MS501E-2	500	500	70.0
MS601E-2	500	600	80.0
MS122E-2	500	1200	250.0

See CCC Data Sheet #DL-5-368.



CASE	A	B
1	1.00	0.800
2	2.00	1.800

MAGNETIC-CORE DELAY CABLE

Columbia Magnetic-Core Delay Cables were developed to provide economical and versatile low-loss high-impedance delay elements. The outstanding feature of this patented design is the continuous, uniform, flexible, low-loss magnetic core which effectively increases the impedance and the unit delay of the cable. At the same time, its unique construction reduces transmission losses drastically so that in pulse work extremely fast rise times can be obtained.

All Magnetic-Core Delay Cables can be supplied in calibrated lengths with mechanical terminations, ready for installation. Standard delay accuracy is ±5%, but not less than ±0.025 μsec. Closer tolerances, particularly on types HH-1500A and HH-2000, can be maintained if desired. When required, one end of the delay line can be internally shorted or left open-circuited. Operating temperature for all Magnetic-Core Delay Cables is —40°C to +85°C.

TYPE	IMPEDANCE (ohms)	DELAY (μsec/ft.)	B-WIDTH (Mhz)*	INSERT. LOSS (db/μsec)	O.D.
HH-1500A RG-266/U	1500	0.08	15	0.2	0.40″
HH-1600	1700	1.0	6	0.4	0.28″
HH-2000 RG-176/U	2400	0.11	15	0.25	0.40″
HH-2500	3000	0.6	8	0.3	0.28″
HH-4000	3900	1.0	6	0.2	0.32″

* Bandwidth (3 db down) based on 1 μsec delay.

See CCC Data Sheet #DL-7-368.

For special applications, engineering quotations and delivery information, please call or write. Ask for complete catalog.

COLUMBIA COMPONENTS CORP.

A SUBSIDIARY OF COMPUTER INSTRUMENTS CORP.

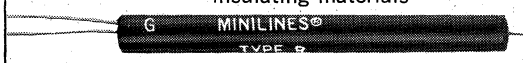
60 Madison Avenue, Hempstead, New York 11550

(516) 483-8200 / TWX 510-222-4189

TUBULAR MINILINES® SERIES MT

Designed to display unusual stability under severe environmental conditions.

• Totally encapsulated circuit elements • Silvered ceramic cores • High temperature resistant wires & insulating materials



For specs see Miniline data above or see CCC Data Sheet #DL-8-868.

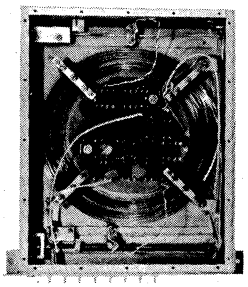
military & commercial

DELAY LINES

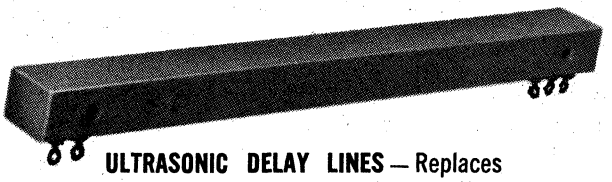
WITH OR WITHOUT CIRCUITRY

MAGNETOSTRICTIVE ★ LUMPED CONSTANT ★ ULTRASONIC ★ DISTRIBUTED CONSTANT ★ DISPERSIVE STRIP

MAGNETOSTRICTIVE DELAY LINES — Fixed and variable delays to 10,000 microseconds. Variable lines in either flat disc or thin cylinder types. Fixed — FMS Series; Variable — VM Series.

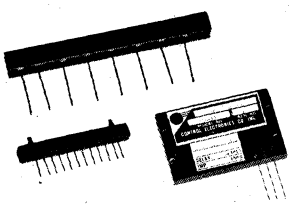


FIXED MAGNETOSTRICTIVE DELAY LINE — Up to 10,000 bits of data for memory storage. Circuitry compatible with all microcircuit logic. Choice of data format: RZ, NRZ or Bipolar.

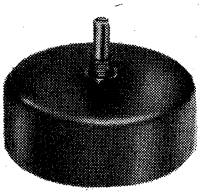


ULTRASONIC DELAY LINES — Replaces most quartz or glass lines. Offers superior performance, lower attenuation and smaller size at less cost. Frequencies to 30 MHz. Delays to 200 usec and greater.

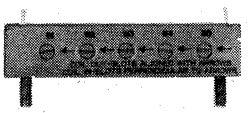
LUMPED CONSTANT DELAY LINES — Many shapes available including miniature types with pin connectors for PC Boards, connector fingers for plug-in units...multi-tapped units...terminal-ended units, etc. Delays from 0.05 usec to 500 usec for standard units. Delay to risetime ratios up to 100:1. Temperature stability to 50 ppm/C°.



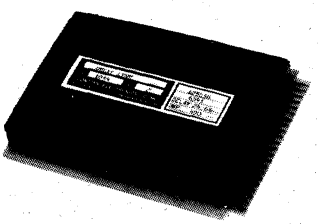
COMPACT FIXED DELAY LINES FOR PC BOARDS — Extremely high density packaging. Typical Unit: 25:1 delay-to-rise-time ratio in a volume of 2 cubic inches.



VARIABLE DELAY LINE Resolution of 1 part in 120. Delay up to 10 usec. 1" x 3½".

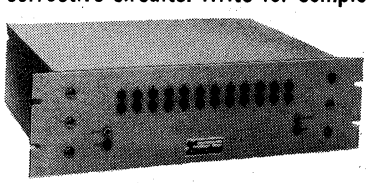


UNIQUE BINARY CODED SECTIONAL DELAY LINE — Uses miniature transfer switches. Also available with terminals for remote switching.



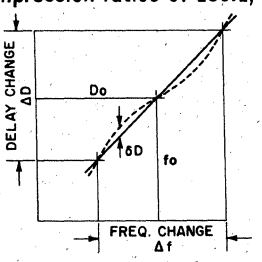
IFF MULTI-TAP DELAY LINES Standard IFF delay lines with taps every 1.45 usec. High density packaging available for airborne transponder use.

AUDIO, HIGH FREQUENCY & DISTRIBUTED CONSTANT DELAY LINES — With unusual circuits, extreme delays, high frequency application, rapid rise times, conforming waveform circuits and corrective circuits. Write for complete details.



AUDIO DELAY CABINET — Relay rack mounted cabinet houses 25 millisecond delay with taps at every ms. Units can be cascaded for longer delays.

DISPERSIVE STRIP DELAY LINES — Delay varies with frequency. A prime application is in Pulse Compression Radar Systems, eliminating large, expensive filter components. Compression ratios of 150:1, typical.



ΔD · Δf = COMPRESSION RATIO OR DISPERSION FACTOR

Δf / fo = BANDWIDTH %

fo = MIDBAND FREQUENCY

Do = MIDBAND DELAY

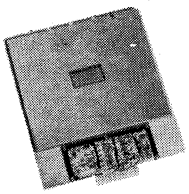
A subsidiary of Bell Electronic Corp.

For all your Delay Line requirements, contact:

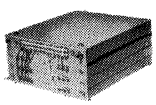
CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11725 · (516) 694-0125

DELAY LINE COMPUTER MEMORIES DELCOMS



THE DELAY LINE COMPUTER MEMORY (DELCOM) offers the **Lowest Price Per Bit** of any high speed memory device. Computer Devices Corp. offers convenient standard packages for all practical storage capacities from 10 bits to 20,000 bits in single delay line units as well as multi delay line units* with massive storage capacities. All Delcoms are compatible with DTL and T²L logic. Normal power requirements are +12 and −12 VDC and +5 VDC. However, Delcoms are tailored to your bit rate, delay, input-output logic and power requirements.



MODEL SERIES	MAXIMUM STORAGE (BITS)	MAXIMUM (Hz) BIT RATE	SIZE INCHES
MS 2219	1,300	2.6	3.25 x 4 x 1
MS 777	1,500	2.3	3.50 x 6.37 x .5
MS 772	4,000	2.2	4.50 x 6.25 x 1.12
MS 773	8,000	2.0	8 x 10.50 x .62
MS 2150	16,000	2.0	11 x 14 x .75
MS 775	20,000	2.0	12 x 15 x .75
*MA 2254	10,000	2.0	6.50 x 4 x 3.50
*MA 2255	24,000	2.0	8 x 5 x 2.75
*MA 2256	250,000	2.0	19 x 14 x 17

*Examples of multi delay line units.

ADDRESSABLE RANDOM ACCESS MEMORY

M4000 Series

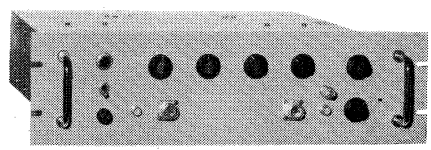
- Random Access
- Binary coded address
- Average access time 512 μsec
- Integrated circuits throughout
- Storage modularly expandable without limit
- Immune to primary power failure
- Visual display available

STORAGE

One basic unit stores either 1024 — 12 bit words expandable in 2 bit steps per module or 2048 — 6 bit words expandable in 1 bit steps per module.

Other models with capacity of up to 16,384 words of any length.

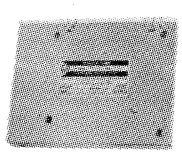
OTHER CUSTOM-MADE DELAY LINE PRODUCTS



- Digital Transmitter Line Simulator
- Word Generators
- Low Frequency Stable Oscillators
- Correlation Delay Lines
- Radar Range Calibrators and Simulators
- Teletype Buffers

DIGITAL DELAY LINES FOR DIGITAL AND CW APPLICATIONS

MAGNETOSTRICTIVE DELAY LINES are extremely stable with temperature, with stabilities of up to .5 PPM/°C achievable. Although primarily used in digital applications at bit rates of up to 1 MHz RZ or 2 MHz NRz, they also delay CW signals with center frequencies from 200 KHz to 1 MHz with a bandwidth of 20%. Insertion loss is about 60 db.



MODEL	DELAY (μsec)	SIZE (INCHES)
ML 545	up to 23 μsec	1 x 5 x .375
MT 767	1,000	3.5 x 4.0 x .46
MT 762	2,000	4.0 x 5.0 x .50
MT 763	4,000	6.0 x 7.0 x .50
MT 764	8,000	9.5 x 10.5 x .75
MT 765	16,000	10.5 x 11.5 x .56

MULTIPLE OUTPUT DELAY LINES

Multi-tap Delay Lines are supplied with as many tap points as desired and are useful as word generators and correlators.

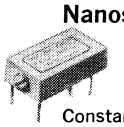
MODEL	TOTAL DELAY μsec	NO. OF TAPS	TAP SPACING μsec	SIZE
ML718	15	12	1.25	1.75 x 8 x .50
ML790	16	16	1.0	1.75 x 8 x .50
ML791	20.3	14	1.45	1.75 x 8 x .50
ML883	28	24	1.0	3 x 9.37 x .50

SEE VARIABLE DELAY LINE SECTION FOR VARIABLE MAGNETOSTRICTIVE DELAY LINES

COMPUTER DEVICES CORP.
63 AUSTIN BOULEVARD COMMACK, N. Y. 11725
516—543-4220

VARIABLE DELAY LINES

THIN LINE VARIABLE
Nanosecond Range



Compatible with Dual-In-Line packaging with .25" overall thickness. Sealed in plastic case. Lumped Constant parameters. Temperature coefficient less than 50 PPM/°C. .020" P.C. mounting pins.

MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
V1570-1	0 - 10 Nsec	2 Nsec	100	.25 x .75 x 1.5
V1570-2	0 - 20	4	100	.25 x .75 x 1.5
V1570-3	0 - 40	8	100	.25 x .75 x 1.5
V1570-4	0 - 80	16	100	.25 x .75 x 1.5
V1570-5	0 - 160	32	200	.25 x .75 x 1.5
V1570-6	0 - 320	64	200	.25 x .75 x 1.5

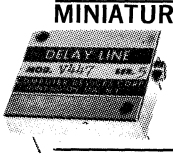
MINIATURE DISTRIBUTED VARIABLE Nanosecond Range

Hermetically sealed in a metal case. Distributed parameter with temperature coefficient of less than 150 PPM/°C. .030" P.C. mounting pins.



DV900-11	0 - 20 Nsec	7 Nsec	1000	.31 x .62 x 1.75
DV900-12	0 - 20	7	500	.31 x .62 x 1.75
DV900-13	0 - 50	17	1000	.31 x .62 x 1.75
DV900-14	0 - 50	17	500	.31 x .62 x 1.75
DV900-15	0 - 100	33	1000	.31 x .62 x 1.75
DV1446-1	0 - 50	18	2000	.31 x .62 x 1.75
DV900-21	0 - 20 Nsec	3.5 Nsec	1000	.3 x .62 x 3.50
DV900-22	0 - 20	3.5	500	.3 x .62 x 3.50
DV900-23	0 - 50	9	1000	.3 x .62 x 3.50
DV900-24	0 - 50	9	500	.3 x .62 x 3.50
DV900-25	0 - 100	17	1000	.3 x .62 x 3.50
DV900-26	0 - 100	17	500	.3 x .62 x 3.50
DV900-27	0 - 250	42	1000	.3 x .62 x 3.50
DV900-28	0 - 350	60	1000	.3 x .62 x 3.50
DV1446	0 - 100	20	2000	.3 x .62 x 3.50

MINIATURE LUMPED VARIABLE
Nanosecond Range



Hermetically sealed in a metal case. Lumped constant parameter. Temperature coefficient less than 50 PPM/°C. .030" P.C. mounting pins.

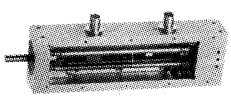
V447-1	0 - 55 Nsec	15 Nsec	150	.31 x 1 x 1.25
V447-2	0 - 100	20	50	.31 x 1 x 1.25
V447-3	0 - 150	25	150	.31 x 1 x 2.45
V447-4	0 - 250	30	50	.31 x 1 x 2.45
V447-5	0 - 300	30	150	.31 x 1 x 3.45
V447-6	0 - 500	60	50	.31 x 1 x 3.45

MICROSECOND RANGE VARIABLE

Hermetically sealed in a metal case. Lumped or distributed constant parameters for longer delays and special applications.

V172	0 - .55 μsec	.08 μsec	1000	.5 x 1.5 x 4.5
V703	0 - .95	.07	500	.75 x 1.87 x 7
DV219	0 - 1.0	.11	1000	.62 x 1.25 x 6.5
V443	0 - 3.0	.25	200	.62 x 2 x 4.5

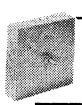
NOVEL INFINITE RESOLUTION



with input and output impedance of equal value. Voltage standing wave ratio less than ½ db to 45 MHz.

DV575-1	2 - 25 Nsec	70 MHz	200	1 x 1.25 x 5.37
DV575-2	2 - 50	70	100	1 x 1.25 x 5.37
DV575-3	2 - 50	70	200	1 x 1.25 x 5.37
DV575-4	2 - 50	70	93	1 x 1.25 x 5.37
DV575-5	2 - 25	70	50	1 x 1.25 x 5.37
DV575-6	2 - 50	70	93	1 x 1.25 x 5.37

ONE TURN VARIABLE



Lumped parameter multi position switch provides resolution of 100:1.

V168-1	0 - .2 μsec	.015 μsec	100	4 x 4 x 1.25
V168-2	0 - 1.5	.08	1000	4 x 4 x 1.25
V168-3	0 - 3.0	.15	1000	4 x 4 x 1.25

INFINITE RESOLUTION VARIABLE

provides absolutely stepless delay change to high frequency signals. Ideal phase shifter.

DV1556-1	2 - 33 Nsec	28 to 32 MHz	93	.5 x 1 x 3.5
DV1556-2	2 - 40 Nsec	26 to 30 MHz	93	.5 x 1 x 3.5

MAGNETOSTRICTIVE DIGITAL VARIABLE

For delay of radar pulses or digital data. These units utilize the magnetostrictive delay line and are supplied with electronics to faithfully reconstruct the delayed input data.

MV994	2 - 18 μsec	2 MHz	300/3000	1 x 5 x .5
MV781	2 - 30	2	300/3000	1 x 9 x .5
MV785-1	0 - 1 Msec	2	100	19 x 17 x 3.5
MV785-2	0 - 10 Msec	2	100	19 x 17 x 5.25
MV785-3	0 - 100 Msec	2	100	19 x 17 x 10.5

LOW FREQUENCY ANALOG VARIABLE DELAYS



Decade switched. Lumped parameter. Temperature stability less than 40 PPM/°C, VSWR less than ±½ db; phase linearity ±¼ %.

AV175	0 - .15 Msec	to 30 KHz	500	9 x 3 x 6
AV287	0 - .50	20	1000	19 x 3.5 x 12
AV206	0 - 1.0	20	600	19 x 3.5 x 12
AV731	0 - 5.0	5	1000	19 x 5.25 x 15
AV211	0 - 10.0	2.5	600	19 x 5.25 x 15

ANALOG DELAYS WITH DIGITAL TECHNIQUES

can provide delays in excess of 1 second to analog signals as high as 1 MHz.

AV1561-1	0 - 25 Msec	to 30 KHz	100	19 x 5.25 x 17
AV1561-2	0 - 50	30	100	19 x 7.0 x 17
AV1561-3	0 - 100	30	100	19 x 7.0 x 17

COMPUTER DEVICES CORP. specializes in the design and production of variable delay devices and will custom design units to meet your specific requirements. If the Delay Lines in this partial listing do not fill your need, please call.

This condensed catalogue information is only meant to serve as a guide. Before finalizing on a design it is most prudent to utilize the experience, ingenuity and up-to-date information of our Engineering Staff. Expert guidance, which can save you hours of searching, is as close to you as your telephone —

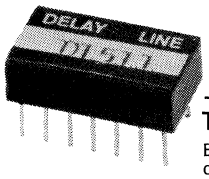
516-543-4220

COMPUTER DEVICES CORP.

FIXED AND TAPPED DELAY LINES

THINLINE—NANOSECOND SUB-MINIATURE LINES

.21 inch thickness and pin arrangement makes these lines compatible with dual-in-line packaging. Encapsulated in plastic.



MODEL	IMPEDANCE OHMS	DELAY	RISE TIME OR FREQ. RESP.	SIZE INCHES
D1521-1	Available in 50, 93 and 100 ohms	50 Nsec	20 Nsec	.21 x .39 x .7
D1521-4		25	10	
D1521-7		10	4	
D152-10		5	2	
D1551-1	200	100 Nsec	10 Nsec	.21 x 1.0 x 1.5
D1551-2		150	15	
D1551-3		200	20	
D1551-4		250	25	
D1551-5		300	30	

TAPPED DELAYS

Each line provides 10 tap delays spaced at equal intervals.

D1511-1	100	10 Nsec	3 Nsec	.21 x .39 x .7
D1511-2		20	6	
D1511-4		40	13	
D1511-6		60	20	
D1511-8		80	26	
D1511-10		100	33	

MANY TAPS PER LINE

50 taps	D1543	100	150 Nsec	13 Nsec	.25 x .8 x 5.2
50 taps	D1544	100	300	20	.25 x 1.0 x 5.3
30 taps	D1545	100	90	8	.25 x .8 x 3.2

MINIATURE LUMPED CONSTANT



Hermetically sealed in a metal container. Delay tolerance ±5%.

Temperature stability less than 50 PPM/°C. P.C. Mounting.

D647- — — 0	Available in 93, 330, 500 and 1000 ohms	.05 μsec
D647- — — 1		.10
D647- — — 2		.25
D647- — — 3		.50
D647- — — 4		.75
D647- — — 5		1.00
D647- — — 6		1.45
D647- — — 7		2.90
D647- — — 8		4.35

Available with 3 delay to rise time ratios in 3 case sizes
4:1 .30 x 1.0 x 1.25
8:1 .30 x 1.0 x 2.45
12:1 .30 x 1.0 x 3.45

INEXPENSIVE DISTRIBUTED CONSTANT DELAYS

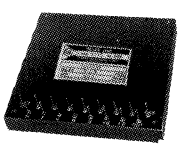
Plastic encapsulated units with a temperature coefficient of 150 PPM/°C. P.C. Mounting. Many other models available including the nanosecond range.



DD679- — — 1	Available in 330, 500 and 1000 ohms	.1 μsec
DD679- — — 2		.2
DD679- — — 3		.3
DD679- — — 4		.4
DD679- — — 5		.5
DD679- — — 6		.6
DD679- — — 7		.7
DD679- — — 8		.8
DD679- — — 9		.9
DD679- — — 10		1.00

Available with delay to rise time ratios of: In 2 case sizes
5:1 .37 x .5 x 4.5
10:1 .37 x 1.0 x 4.5

ATC TRANSPONDER AND BEACON CODING DELAY LINES



Standard 1.45 μsec tap spacings plus other special delay points are provided. Hermetically sealed steel cased, plastic encapsulated and PC mounted units are offered.

D1560	400	10.15 μsec	.33 μsec	.55 x 2.25 x 3.62
D1365	180	20.3	.5	.87 x 3.5 x 3.5
D1000	330	20.3	.5	.35 x 2 x 4
D120	180	25.0	.55	.75 x 5 x 4.37
D298A	500	25.3	.6	1.62 x 2.87 x 4.25
D637	180	20.3	.3	2.37 x 2.75 x 3.18
D1190	400	20.3	.4	.63 x 4 x 5
D1191	500	24.65	.5	.63 x 4 x 5
D1210	500	8.0	.5	.5 x 1 x 4

LONG DELAYS OF LOW FREQUENCY

Fixed and multi-tapped delays with high accuracy and flat response VSWR ±½ db; phase linearity ±¼%.

DA921	2000	420 μsec	100 KHz	14 x 2 x 1
DA563	1000	500	30	7 x 2.5 x 2
DA301	600	1,000	20	19 x 3.5 x 9
DA261	500	5,000	5	19 x 5.25 x 10
DA607	500	20,000	3.5	19 x 7 x 15
DA177	1000	100,000	.2	19 x 21 x 12

ANALOG DELAYS WITH DIGITAL TECHNIQUES can provide delays in excess of 1 second to analog signals as high as 1 MHz.

MDA2300-1	50	25,000 μsec	30 KHz	19 x 3.5 x 17
MDA2300-2	50	50,000	30	19 x 5.25 x 17
MDA2300-3	50	100,000	30	19 x 21 x 17

MANY OTHER MODELS AND SPECIALTY Delay Lines are available. If exactly what you want is not listed, please call.

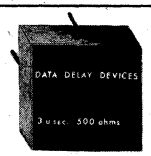
COMPUTER DEVICES CORP.
63 AUSTIN BOULEVARD COMMACK, N. Y. 11725
516-543-4220

SHORT FORM CATALOGUE

DATA DELAY DEVICES

253 CROOKS AVE., CLIFTON, N. J. 07011 Tel. (201) 772-1106

Delay Lines



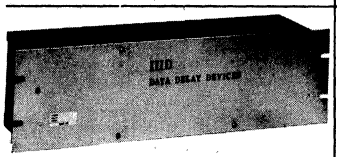
3D-100 SERIES

This miniature, completely potted unit is adaptable for printed circuit board applications. Time-Delay: 0-5 us. Rise-Time: 15%, 10%, 5%, & 3% of time-delay. Impedance: up to 4000 OHMS. Frequency Response: 10 MHz. Attenuation: less than 0.1 db/us. Temp. Coefficient: 0.1%/°c.



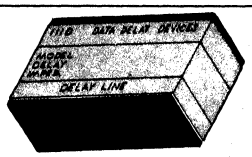
DISTRIBUTED TYPE

This delay line is ideally suitable for applications in digital computers, and other circuit applications requiring low attenuation, fast Rise-Time & Excellent pulse-form fidelity. Time Delay: 0-1 us. Rise-Time: 0.06 us. Impedance: 300 to 2000 OHMS. Attenuation: 1 db/us approx.



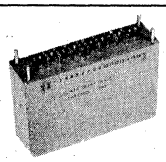
CABLE DELAY LINE

These units are extremely usefull for phase-shifting, phase-array, phase-comparison applications at very high frequencies. They are completely shielded against Radio Frequencies Interference. They feature: Time Delay 0-1 us; Delay Tolerance: ± 1%. Impedance: 50, 75, 90, OHMS. Attenuation: 16 db approx. at 10MHz. VSWR: 1.05. Frequency Range: greater than 100MHz. Mounting: flush or rack mounted panel.



ELECTRICALLY VARIABLE

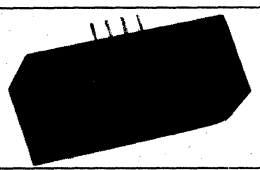
These Electrically variable delay lines can be made to be current or voltage variable. They exhibit a truely infinite resolution of time delay. They are ideally suitable for remote control applications. Time Delay variation: up to 50 us. Tracking accuracy: ± 5% or better. Impedance: 200 to 2000 OHMS. Operating Temperature: -65°c to +85°c. Frequency Range: 1MHz for current variable, 10MHz for voltage variable.



SPECIALS: SONAR, RADAR, TRANSPONDER

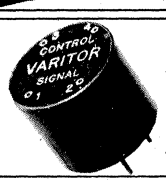
We specialize in custom design delay lines. These delay lines find usage in specific equipments and systems such as: SONAR, TRANSPONDER, RADAR, etc. These units meet in full or exceed all the military requirements and environmental conditions. Our Engineering know-how and our past experience in this field assures you the highest quality and reliability in our products. In addition we provide the shortest delivery time.

Filters-Inductors



LOW-PASS & HIGH-PASS

These filters are designed to meet or exceed the requirements of MIL-f-18327. The compactness, light weight and built-in reliability affords an added advantage to modern equipments design criteria. The units are housed in an hermetically sealed protective case with plug-in terminals adaptable to printed circuit board connections. It features: Insertion loss: .5 db. Attenuation: -0.5 db over the pass band, 60 db skirt for fo/ fl = 1.3. Frequency Range: 1 to 30 KHz. Impedance: 600 and 1000 OHMS unbalanced: Size: 3.187 X 0.565 X 1.250. (81 X 14 X 32mm)



VARITOR

This is a current variable inductor. It is an extremely simple, reliable, non-mechanical device used in Sweep Generators, Spectrum Analayzers, Telemetry equipments. It offers indunctance variation: 7/1 over its nominal value. Tracking accuracy: ± 3% or better. Inductance linearity ± 2%. Size: 3/4 O.D. X 5/8. (19mm O.D. X 16mm)



TOROIDS

These inductors provide the highest "Q" obtainable in the frequency range of 0.1 KHz to 1 MHz. They are completely potted, small in size, low in cost and extremely stable over temperature variation. Matched units for inductance are available. The specifications of these units are the following: Inductance range: 50UHY to 36HY. Accuracy: ± 1% (± .25% available). "Q" factor: greater than 250. Temperature Coefficient: ± 18 PPM/°c from -55°c to +85°c. Multiple taps are available upon request.

We are ready to give your requirements (large or small) our conscientious, personal, and scientific consideration, which is guaranteed to please all our customers.

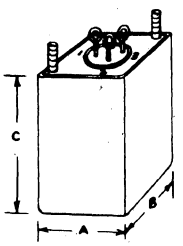
ESC ELECTRONICS CORP.

World's Leading Producer of Delay Lines

TO MIL-D-23859 USUALLY IN STOCK

STANDARD LUMPED CONSTANT DELAY LINES

- Delay Tolerance ± 5%
- Attenuation:
  1 μsec. or less — 1 db Max.
  2.5 and 5.0 μsec —3 db Max.
  10, 25 and 50 μsec. — 6 db Max.
- Temperature Stability — .00005 μsec/μsec/°C
- Operating Temperature Range —55°C to +125°C
- Output Pulse Distortion ± 10% Max.



Dim.	A	B	C
L	1 3/16	1 5/16	3 1/4
N	1 3/16	1 3/16	2
O	1 5/16	1 5/16	3
P	1 5/8	1 7/8	3
R	1 5/8	1 7/8	3 3/4
S	1 7/16	1 7/8	3 1/4
T	1 5/16	1 5/16	2 1/2
V	2 1/8	2 1/4	4 1/2
W	1 5/16	1 5/16	3 7/8
X	2 1/8	2 1/4	3 1/2
Y	2 13/16	3 5/16	4 1/2
Z	1	1	2

CHARACTERISTIC IMPEDANCE →		50Ω		100Ω		200Ω		500Ω		1000Ω		1200Ω		2000Ω	
Delay (μsec)	RISE TIME (μsec)	Size Letter	Model	Size Letter	Model	Size Letter	Model	Size Letter	Model	Size Letter	Model	Size Letter	Model	Size Letter	Model
0.25	.05	N	1G250	Z	1A250	Z	1B250	Z	1C250	Z	1D250	Z	1E250		
0.25	.025	L	2G250	T	2A250	T	2B250	T	2C250						
0.25	.015			O	3A250	O	3B250	O	3C250						
0.50	.1	N	1G500	Z	1A500	Z	1B500	Z	1C500	Z	1D500	Z	1E500	Z	1F500
0.50	.05	T	2G500	T	2A500	T	2B500	T	2C500	T	2D500				
0.50	.03	O	3G500	O	3A500	O	3B500	O	3C500						
1.0	.20	N	1G101	N	1A101	Z	1B101	Z	1C101	Z	1D101	Z	1E101	Z	1F101
1.0	.10	T	2G101	T	2A101	T	2B101	T	2C101	T	2D101	T	2E101	T	2F101
1.0	.06	O	3G101	O	3A101	O	3B101	O	3C101		3D101				
1.0	.03			R	4A101	R	4B101								
2.5	.50	L	1G251	L	1A251	N	1B251	Z	1C251	Z	1D251	Z	1E251	Z	1F251
2.5	.25	P	2G251	T	2A251	T	2B251	T	2C251	T	2D251	T	2E251	T	2F251
2.5	.15	S	3G251	O	3A251	O	3B251	O	3C251	O	3D251	O	3E251	O	3F251
2.5	.075	R	4G251	R	4A251	R	4B251	R	4C251	R	4D251	R	4E251		
5.0	1.0	W	1G501	L	1A501	L	1B501	N	1C501	Z	1D501	Z	1E501	N	1F501
5.0	.50	P	2G501	P	2A501	T	2B501	T	2C501	T	2D501	T	2E501	T	2F501
5.0	.30	S	3G501	S	3A501	O	3B501	O	3C501	O	3D501	O	3E501	O	3F501
5.0	.15	X	4G501	R	4A501	R	4B501	R	4C501	R	4D501	R	4E501		
10.0	2.0			W	1A102	L	1B102	N	1C102	N	1D102	N	1E102	N	1F102
10.0	1.0	R	2G102	P	2A102	P	2B102	T	2C102	T	2D102	T	2E102	T	2F102
10.0	.6	V	3G102	S	3A102	S	3B102	O	3C102	O	3D102	O	3E102	O	3F102
10.0	.3	X	4G102	X	4A102	R	4B102	R	4C102	R	4D102	R	4E102	R	4F102
25.0	5.0							L	1C252	O	1D252				
25.0	2.5					P	2B252	P	2C252	P	2D252	T	2E252	T	2F252
25.0	1.5	V	3G252	V	3A252	V	3B252	S	3C252	O	3D252	O	3E252	S	3F252
25.0	.75	Y	4G252	X	4A252	X	4B252	R	4C252	R	4D252	R	4E252	R	4F252
50.0	5.0							P	2C502						
50.0	3.0			V	3A502	V	3B502	S	3C502	S	3D502	S	3E502	S	3F502
50.0	1.5	Y	4G502	Y	4A502	X	4B502	X	4C502	R	4D502	R	4E502	R	4F502

TO MIL-D-23859 USUALLY IN STOCK

NANOSECOND DELAY LINES

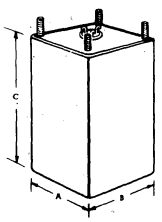
SERIES BM & HM

- Dimensions 2.00" long x 0.38" wide x 0.28" high
- Lead length 1.12" located on .38" x 2.00" surface
- Molded in epoxy resin
- Attenuation 5% maximum for all units

No.	Delay nsec ± 5%	Rise Time nsec Max.	Impedance Ohms ± 10%
BM 10	10	3	200
BM 20	20	6	200
BM 40	40	10	200
BM 80	80	20	200
HM 20	20	6	400
HM 40	40	10	400
HM 80	80	20	400
HM 160	160	40	400

TO MIL-D-23859

MILLISECOND DELAY NETWORKS



Dim.	A	B	C
D	2.25	3.75	4.25
E	2.12	2.25	4.50
F	2.12	2.25	3.00
G	3.41	6.81	4.89
H	3.00	3.50	5.06
J	3.00	3.50	3.81
K	4.44	5.44	6.69
M	4.25	5.00	5.44
Q	3.63	4.25	5.50

SPECIFICATIONS:

Delay Tolerance ..... ±5%

Attenuation:

10, 20, 25 μsec ..... 1.5 db

50, 100, 200 μsec ..... 2.0 db

250 μsec ..... 2.5 db

500 μsec and over ..... 4.0 db

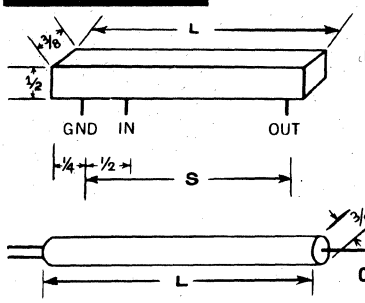
Characteristic Impedance		Size Letter	500Ω	1000Ω	2000Ω
Delay (ms)	Rise Time (μs)		Model	Model	Model
.1	2.0	G	7C103	7D103	7F103
.1	3.0	H	6C103	6D103	6F103
.1	4.0	J	5C103	5D103	5F103
.2	4.0	G	7C203	7D203	7F203
.2	6.0	H	6C203	6D203	6F203
.2	8.0	J	5C203	5D203	5F203
.25	5.0	G	7C253	7D253	7F253
.25	7.5	H	6C253	6D253	6F253
.25	10.0	J	5C253	5D253	5F253
.5	10.0	G	7C503	7D503	7F503
.5	15.0	H	6C503	6D503	6F503
.5	20.0	J	5C503	5D503	5F503
1.0	20.0	K	7C104	7D104	7F104
1.0	30.0	M	6C104	6D104	6F104
1.0	40.0	Q	5C104	5D104	5F104
2.0	40.0	K	7C204	7D204	7F204
2.0	60.0	M	6C204	6D204	6F204
2.0	80.0	Q	5C204	5D204	5F204
3.0	60.0	K	7C304	7D304	7F304
3.0	90.0	M	6C304	6D304	6F304
3.0	120.0	Q	5C304	5D304	5F304
5.0	100.0	K	7C504	7D504	7F504
5.0	150.0	M	6C504	6D504	6F504
5.0	200.0	Q	5C504	5D504	5F504

ESC ELECTRONICS CORP. 534 BERGEN BOULEVARD • PALISADES PARK, N. J. WINDSOR 7-0400

ESC ELECTROMAGNETIC DELAY LINES

TO MIL-D-23859 USUALLY IN STOCK

DISTRIBUTED CONSTANT DELAY LINES



PRINTED BOARD TYPE

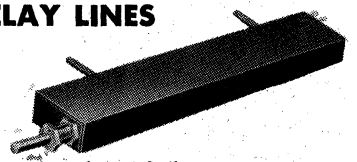
- —55°C to +125°C
- Temperature coefficient of delay approximately 200 PPM°C
- Encapsulation in resin

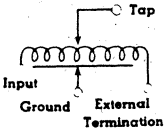
CYLINDRICAL TYPE

Delay μsec ± 5%	Impedance ± 10%	Rise Time (μsec) Max.	Attenuation db Max.	Cylindrical Type "L" Model	Printed Board Type "L" "S" Model
.02 .04 .06 .08 .10 .12	100Ω	.020 μsec Max. for .12 μsec delay	1 db/μsec or .25 db whichever is greater	1½" A02 2½" A04 3½" A06 4¼" A08 5¼" A10 6¼" A12	2" 1.2 AP02 2½" 1.8 AP04 3½" 2.8 AP06 4¼" 3.4 AP08 5¼" 4.4 AP10 6¼" 5.4 AP12
.05 .10 .15 .20 .25	200Ω	.025 .028 .030 .032 .035	1 db/μsec or .25 db whichever is greater	1¾" B05 2¾" B10 3¾" B15 5" B20 6" B25	2" 1.2 BP05 3" 2.2 BP10 3¾" 3.0 BP15 6" 4.2 BP20 6" 5.2 BP25
.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2	500Ω	.045 .055 .060 .065 .075 .080 .085 .090 .095 0.10 0.12 0.13	1.2 db/μsec or .25 db whichever is greater	1" C1 1½" C2 2" C3 2½" C4 3" C5 3½" C6 3¾" C7 4¼" C8 4¾" C9 5¼" C10 5½" C11 6" C12	2" 1.2 CP1 2" 1.2 CP2 2" 1.2 CP3 2½" 1.8 CP4 3" 2.2 CP5 3½" 2.8 CP6 3¾" 3.0 CP7 4¼" 3.4 CP8 4¾" 4.0 CP9 5¼" 4.4 CP10 5½" 4.8 CP11 6" 5.2 CP12
.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1	1000Ω	.040 .045 .055 .065 .070 .075 .080 .085 .090 .100 .110	1.6 db/μsec or .25 db whichever is greater	1" D1 1¾" D2 2¼" D3 2¾" D4 3¼" D5 3¾" D6 4¼" D7 4¾" D8 5¼" D9 5¾" D10 6¼" D11	2" 1.2 DP1 2" 1.2 DP2 2½" 1.8 DP3 3" 2.2 DP4 3½" 2.8 DP5 3¾" 3.0 DP6 4¼" 3.4 DP7 4¾" 4.0 DP8 5¼" 4.4 DP9 5¾" 5.0 DP10 6¼" 5.4 DP11
.1 .2 .3 .4 .5 .6 .7 .8 .9	1200Ω	.040 .045 .050 .055 .060 .065 .070 .075 .080	1.6 db/μsec or .25 db whichever is greater	1¼" E1 1¾" E2 2½" E3 3" E4 3¾" E5 4¼" E6 5" E7 5½" E8 6¼" E9	2" 1.2 EP1 2" 1.2 EP2 2½" 1.8 EP3 3" 2.2 EP4 3¾" 3.0 EP5 4¼" 3.4 EP6 5" 4.2 EP7 5½" 4.8 EP8 6¼" 5.4 EP9
.1 .2 .3 .4 .5 .6	1800Ω	.040 .045 .050 .055 .060 .070	1.5 db/μsec or .25 db whichever is greater	1½" F1 2½" F2 3¼" F3 4¼" F4 5¼" F5 6¼" F6	2" 1.2 FP1 2½" 1.8 FP2 3½" 2.8 FP3 4¼" 3.4 FP4 5¼" 4.4 FP5 6¼" 5.4 FP6

TO MIL-D-23859 USUALLY IN STOCK

CONTINUOUSLY VARIABLE DELAY LINES





SERIES 400

- Attenuation: less than 1.0 db
- Resolution: better than .001 μsec.
- External termination not supplied)
- Can be operated above ground potential
- Operating temperature: — 55°C to + 125°C
- O Ring shaft seal.
- Operation: continuously variable shaft rotation of 10 turns from zero to maximum delay
- High impedance tap (variable)
- Outside dimensions: $6\frac{17}{32}$ x ⅝ x 1¼

No.	Delay (Max.)	Rise Time* (Max.)	Impedance (Ohms)
401	.10 μsec	.03 μsec	100
402	.20 μsec	.04 μsec	200
403	.70 μsec	.095 μsec	500
404	.50 μsec	.09 μsec	750
405	.40 μsec	.075 μsec	1000
406	.25 μsec	.045 μsec	1300
407	.20 μsec	.04 μsec	1500

*As measured at termination.

SERIES 500*

- Resolution: better than $\frac{1}{1000}$ of maximum delay
- External termination (not supplied)
- Can be operated above ground potential
- O Ring shaft seal
- Operation: continuously variable shaft rotation of 10 turns from zero to maximum delay
- High impedance tap (variable)
- Outside dimensions: 7¼" x 1" x 1⅝"
- Operating temperature —55°C to +125°C

*Delay to rise time ratio of 10:1, also available upon special order.

No.	Delay (Max.)	Impedance (Ohms)	Rise Time* (Max.)	Attenuation
501	.9 μsec	1000	.2 μsec	.5 db
502	2.0 μsec	470	.40 μsec	1.2 db
503	4.0 μsec	220	.80 μsec	2.5 db
504	9.0 μsec	100	1.8 μsec	5.0 db
505	15.0 μsec	56	3.0 μsec	9.0 db

*As measured at termination

CUSTOM DESIGNS: In addition to the above listed models, ESC can supply you with custom-designed Continuously Variable Delay Lines for your special applications.

SUBMINIATURE NANOSECOND DELAY LINES

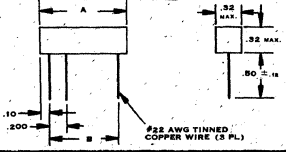


- **Operating Temperature:** —55°C to +125°C
- **Temperature Coefficient:** 100 ppm/°C
- **Attenuation:** 0.5 db max.
- **Distortion (typical):** ±10%; with an input rise time of 20% of specified rise time or 1 nsec. whichever is greater
- **Dielectric Strength:** 100 VDC

SERIES SM

TO MIL-D-23859 USUALLY IN STOCK

IMPEDANCE 100Ω ±10%				IMPEDANCE 200Ω ±10%				IMPEDANCE 500Ω ±10%			
Model No.	Delay nsec. ±5%	Rise Time nsec. Max.	Case	Model No.	Delay nsec. ±5%	Rise Time nsec. Max.	Case	Model No.	Delay nsec. ±5%	Rise Time nsec. Max.	Case
SMA10	10	2.5	1	SMB10	10	2.5	1	SCM100	100	30	1
SMA20	20	6.0	1	SMB20	20	6	1	SCM150	150	45	1
SMA30	30	8.5	1	SMB30	30	8.5	1	SCM200	200	60	1
SMA40	40	12	1	SMB40	40	12	1	SCM300	300	80	1
SMA50	50	15	1	SMB50	50	15	1	SCM400	400	55	2
SMA60	60	12	2	SMB60	60	12	2	SCM500	500	70	2
SMA80	80	16	2	SMB80	80	16	2	SCM600	600	80	2
SMA100	100	20	2	SMB100	100	20	2	SCM1200	1200	250	2



CASE	A	B
1	1.00	0.800
2	2.00	1.800

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ESC ELECTROMAGNETIC DELAY LINES

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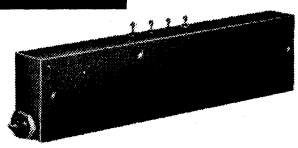
MINIATURE VARIABLE DELAY NETWORKS



The Series 700 of Miniature Variable Delay Networks has been designed and created by ESC to meet the increasing demand for variable delay lines suitable for printed board mounting.

- Operation: continuously variable shaft rotation of 4½ turns from zero to maximum delay.
- High impedance tap (variable)
- Outside dimensions: 4½" x 1½" x ½"
- Operating temperature —55°C to 125°C
- Resolution: better than 1/1000 of maximum delay
- External termination (not supplied)
- Can be operated above ground potential
- O Ring shaft seal.

MODEL NO.	TIME DELAY*	IMPEDANCE	PULSE RISE TIME**
701	.125 usec.	1500 ohms	.03 usec. (max.)
702	.25 usec.	1800 ohms	.06 usec. (max.)
703	.50 usec.	1000 ohms	.10 usec. (max.)
704	.75 usec.	680 ohms	.15 usec. (max.)
705	1.0 usec.	560 ohms	.20 usec. (max.)
706	1.25 usec.	470 ohms	.25 usec. (max.)
707	1.50 usec.	390 ohms	.30 usec. (max.)
708	.65 usec.	93 ohms	.10 usec. (max.)
Pulse Attenuation —1.0 db (max.) all units DC Working Volts — 500 volts (max.)			

*Minimum delay at max. position.
**Pulse rise time at termination of delay line.
Mechanical and electrical modifications available on special order.

COMPUTER LINES APPLICATIONS

A series of miniature delay lines featuring multiple taps and adjustability of delay. All at 93Ω, they are epoxy molded, designed for P.C. board mounting with a maximum height of .370". Overall delays of 100, 125, 250, and 500 nsec. Ask for specification RX1189.

GEOPHYSICAL APPLICATIONS

Part Number 81-27 Total time delay of 28 msec. tapped at 1.0 msec. intervals. Amplitude response flat within ±.25 db from 15 cps to 250 cps. Phase response linear with ±.075% over the same frequency range. Impedance is 5000Ω and attenuation less than 6.0 db. Size 6" x 10" x 14".

Part Number 81-43 Total time delay of 50 msec, impedance is 5000. Atten. vs. frequency: —3 db at 800 cps; within ±1 db from 100 to 600 cps. Insertion loss is 8 db.

SONAR APPLICATIONS

Part Number 81-41 Total time delay of 2.9 msec. tapped at 100 μsec intervals. Tap tolerance of 20 μsecs over temperature range of 0° to 65°C and dynamic range of 0.10 to 10 volts with $\cos^2$ input pulse. Impedance is 1000Ω and attenuation less than 6.0 db. Hermetically sealed metal case, 3.5" x 4.5" x 11.5".

USUALLY
IN STOCK

MINIATURE TRIMMER DELAY LINE



SERIES 800 "TRIMLINE"™

The Series 800 Trimmer delay line is designed for circuits requiring precision delay adjustments and is particularly suitable for printed board mounting. Sealed in an alkyd resin case, and with precious metal contacts, the "Trimline" will meet or exceed most equipment specifications.

- Attenuation: less than .5 db
- Resolution: less than 1 nsec.
- External termination (not supplied)
- Dielectric Strength: 300 VDC
- Operating temperature: —55°C to +125°C
- O Ring shaft seal
- High impedance tap (variable)
- Width: .75" max.
- Height: .35" max.

MODEL	DELAY* (nsec)	CHAR. IMPEDANCE (ohms)	APPROXIMATE TD/TR RATIO	"A" DIM	APPROX. # OF REVOLUTIONS
801	50	200	4:1	2.25	6
802	75	1000	4:1	2.25	6
803	100	200	7:1	4.00	12
804	125	500	4:1	2.25	6
805	150	1000	7:1	4.00	12
806	250	500	7:1	4.00	12
807	10	100	4:1	2.25	6
808	20	100	7:1	4.00	12

* Min. delay at max. position.

ATC TRANSPONDER AND BEACON DECODING NETWORKS

Although the pulse interval is standardized, other parameters such as impedance, rise time, tolerances, and size are subject to the system designer's discretion. Our long experience in this field can help you choose an economically satisfactory solution without compromising system performance. Some representatives lines are described below.

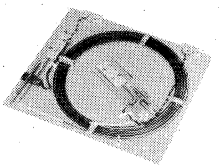
MODEL	TIME DELAY (μsec)	RISE TIME (μsecs)	IMPEDANCE (ohms)	ATTENUATION (db)	SIZE (Inches)	
37-97	1.45	.03	500	1.0	0.5x2.0x6.0	Single interval delay, low distortion, fast-rise-time.
52-77	24.65	.47	470	4.0	1x2x4.25	High density packaging. Hermetically sealed in metal case.
53-92	24.65	.47	470	2.5	.38x4.0x4.0	Molded in silicone rubber on printed card. Mates with edge connector.
53-42	27.0	.55	180	2.0	1.7x2.2x7.12	Precision tapped, low attenuation meets extreme environmental conditions.
53-84	24.65	.30	180	2.5	2.19x4x6	Low attenuation, fast rise time.
53-63	20.4	.2	470	2.0	3.88x5.12x6.6	Delay/Rise Time is 100/1; precision tapped, temperature coefficient < 20ppm/°C.

ESC ELECTRONICS CORP. 534 BERGEN BOULEVARD • PALISADES PARK, N. J. WINDSOR 7-0400

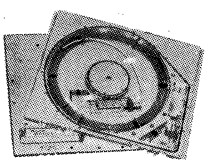
DELAY LINES... MEMORY SYSTEMS

...AVAILABLE AS COMPONENTS...

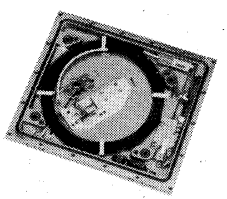
LOW COST COMMERCIAL delay lines offer the lowest price per bit of any high-speed fast-access memory device. Tailor made lines can be mounted on customer pc boards with input and output transducers matched to available circuits. Delays from a few microseconds to 15 milliseconds are available



HERMETICALLY SEALED lines are recommended for critical commercial and industrial applications requiring reliable operation in uncontrolled environments. Bit rates to 4 mc using NRZ techniques and 2 mc using RZ or bipolar recording are available.

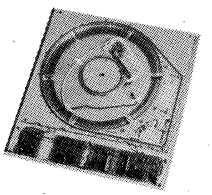


FULL MIL SPEC units are qualified to aircraft (MIL-E-5400), shipboard (MIL-E-16400) and aerospace specifications offering continuous operation under severe shock and vibration over wide temperature ranges (—55°C to +125°C). Tapped lines and wide adjustment lines are available

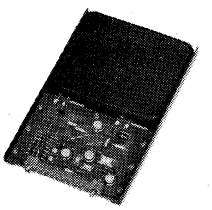


...WITH INTERFACE ELECTRONICS...

DISCRETE COMPONENT electronics can be mounted within delay line case or using conventional printed circuit board construction. Circuits include input gating, line drivers, linear read amplifiers, NRZ or bipolar detectors and re-timing flip flops



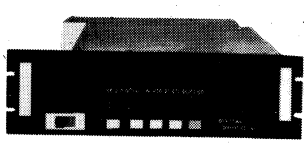
INTEGRATED CIRCUITS permit exceptional volumetric efficiency, (more than 150 bits per cubic inch) at low cost and with complete compatibility with various IC manufacturers. Lines can be synchronized to external clock or provided with internal crystal oscillator



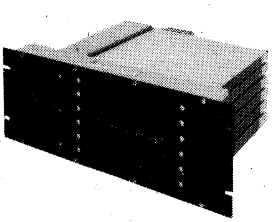
SPECIAL SUBSYSTEMS can be provided. Typical is 4-line 33-msec, 84,000-bit recirculating buffer for raster scan display applications. Special interface cards adjust logic levels to any NPN, PNP, or integrated circuit interface. Storage costs as low as ½¢ per bit.



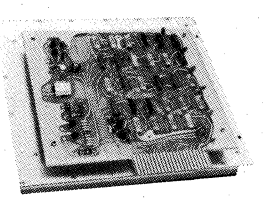
...OR IN COMPLETE MEMORY AND INFORMATION PROCESSING SYSTEMS...



KEYBOARD-COMMUNICATIONS BUFFERS are available to provide paper tape to magnetic tape buffering, keyboard buffering, or buffering to teletype or telephone data links. Basic system stores 4096 characters, can be expanded to 128,000 characters. I/o rates of up to 4800 baud can be provided.



SPECIAL DELAY SYSTEMS are available such as the illustrated Audio Delay Unit which delays audio or FM data up to 100 ms with excellent linearity and less than 5% distortion. A frequency response of ±1 db, 20 Hz to 20 kHz and a dynamic range of 40 db are other features.



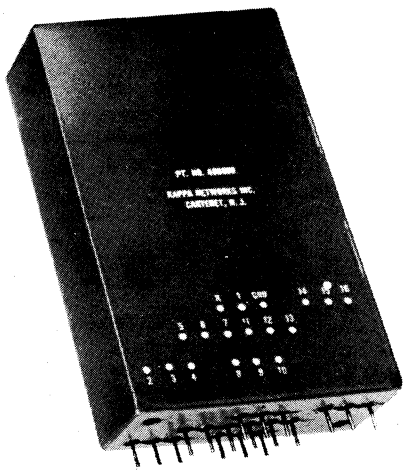
LIMITED MESSAGE BUFFER SYSTEMS are available for buffering small remote terminal devices. Storage is up to 4,000 characters, input/output rates are compatible with telephone or teletype lines. Options include floating battery power supplies, direct interfacing to communication lines, non-destructive readout, and selective edit.

Consult your Digital Devices representative for further information

TYCO DIGITAL DEVICES DIVISION

Phone 516 - 921-2400
TWX 510-221-2187
200 MICHAEL DRIVE
SYOSSET, N. Y. 11791

When you want high efficiency delay lines specify Kappa Super-η*



*SUPER-η LINES embody a new design principle providing the highest efficiency yet obtainable in lumped constant delay lines. Use of network synthesis techniques rather than conventional m-derived methods results in sharply improved delay line efficiency. Compared to ordinary lines of any given delay, KAPPA SUPER-η lines provide linear performance over a much greater band width. In addition these newly developed lines offer such outstanding advantages as: greater inherent reliability, smaller package size, and appreciable cost reduction.

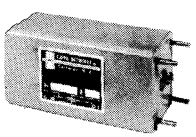
SUPER-η LINES FOR VIDEO SYSTEMS

Impedance:	75 ohms (unless otherwise specified)
Amplitude Response:	better than 0.1 db. flatness to 10 MHZ or higher
Ripple:	within ± .05 db to 10 MHZ or higher
Group Delay:	linear within ± 1% or ± 1 nsec, whichever is greater.
Group Delay Ripple:	within ± 2½% to 14 MHZ
K factor:	better than .25% for T or 2T sin² pulse for both American and European systems
Cross talk:	less than 46 db.

UPDATE YOUR VIDEO BROADCAST EQUIPMENT WITH KAPPA SUPER-η DELAY LINES!

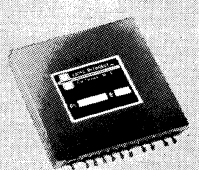
Specify KAPPA for the most complete line of electro-magnetic delay lines...

STANDARD LUMPED CONSTANT DELAY LINES
SERIES LC



Delay: 50 Nanoseconds to 1 second
Bandwidth: DC to 250 MHZ
Rise Time: As low as 2 Nanoseconds
Impedance: 25 ohms to 50 K ohms

TRANSPONDER LINES
SERIES C



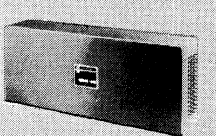
Tap Spacing: 1.45 μsec, or as required
Tap Tolerance: ± .05, or as required
Delay-to-Rise-Time Ratio: 100 max.
Temperature Stability: 50 ppm °C or less

LOW DISTORTION LINES
SERIES D



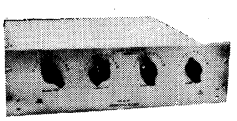
Distortion at Output: 2% max.
Distortion at Taps: Less than 5% at any tap
Distortion Limit: As low as 0.1% if required
Delay Range: up to 100 usec.

PRECISION AUDIO DELAY LINES
SERIES A



Delay Range: from 500 μsec to 1 sec.
Bandwidth: 70 KHZ (max.)
Delay Linearity: nominally within ± 0.25%; available to within ± 0.05%

PRECISION DECADE DELAY UNITS
SERIES DK



Variable delays available between input and output terminals in decade steps. Each decade has eleven (11) switch contacts and ten (10) delay increments so that the dial values overlap.

ULTRA MINIATURE DELAY LINES
SERIES T



Delay Range: to 200 nsec.
Delay/Rise Time: 10 max.
Attenuation: .2 db max.
Fully encapsulated

STANDARD DISTRIBUTED CONSTANT DELAY LINES
SERIES DC



Delay Range: to 3 μsec.
Standard Tolerance: ± 5% on Delay
Delay-to-Rise-Time Ratio: 11 max.
Distortion: ± 5% (typical), ± 10% max.

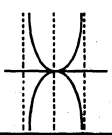
DELAY TRIMMERS: TINY TRIM® SERIES



Size: ¼ Cubic Inch

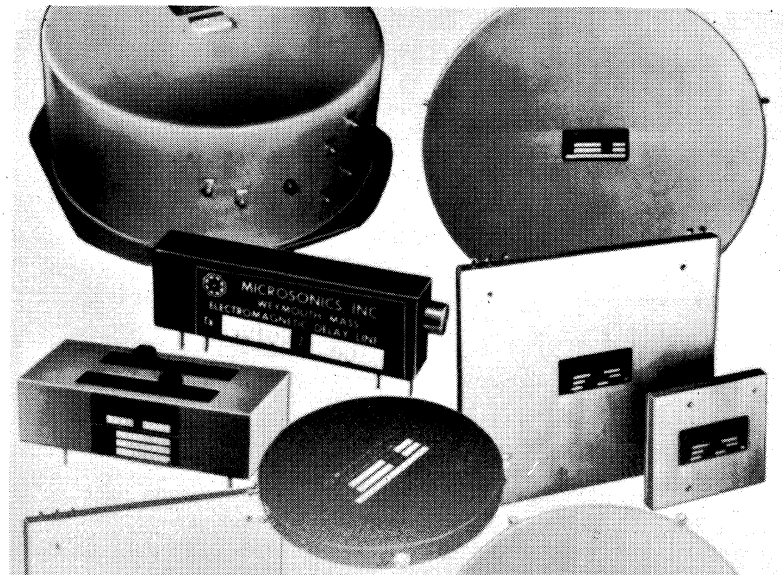
PART NUMBER	Ø SHIFT RANGE @ 3.58 MHZ DEG.	DELAY (Nano-sec.)	RISE TIME (Nano-sec.)	IMPEDANCE (ohms)
TT20D	25	20	5	500
TT30C	38	30	7.5	390
TT40D	50	40	10	500
TT50C	64	50	12.5	390
TT60C	75	60	15	330

Contact us for the name of your nearest representative or consult listing in this directory. Complete new catalog available.



KAPPA NETWORKS, INC.
Delay Line Specialists • Electric Wave Filters
Manufacturing Engineers
165 ROOSEVELT AVENUE · CARTERET, NEW JERSEY 07008 · TEL. (201) 541-4226

See Our Filter Ad on Page 1297



LC & DC • DISPERSIVE • DIGITAL
MAGNETOSTRICTIVE • QUARTZ
GLASS • VARIABLE • TAPPED
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MICROSONICS

for proven design, reliability & performance in

DELAY LINES

Serial Memories

Write for Bulletins today

MICROSONICS
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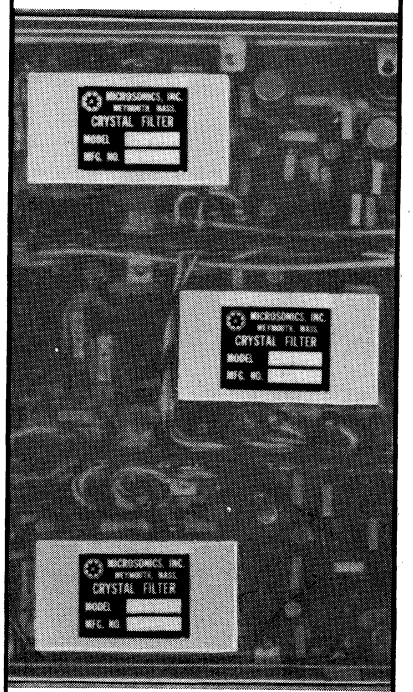
A division of the Sangamo Electric Company

CRYSTAL FILTERS



Microsonics, Inc. has designed and developed phase tracking crystal filters, in which the phase between filters will track within close tolerances, over wide temperature ranges, without temperature control. Any one of the standard multi-pole filters such as Butterworth, Tchebycheff, Bessel, etc. may be obtained with phase tracking requirements. In the event of tight tracking requirements, the filters are produced in matched sets according to the customer's requirements.

The set of 3 filters shown above have been produced in production quantities and the specifications are shown below.

SPECIFICATIONS

Center frequencies: .....5MC ±150 cps
Bandwidth 3db: ....1KC ±100 cps
Shape-factor 60/3db: 5:1
Ultimate rejection: .....70db min.
Initial phase off-set: .....1°
Phase tracking across the 3db bandwidth: .....5° max.
Operating temperature: −35°C to +75°C

Send for Microsonics' Brochure No. 4350

MICROSONICS, INC.
60 Winter Street
Weymouth, Mass. 02188
Tel: 617 337-4200
A subsidiary of the Sangamo Electric Company

NYTRONICS, INC.
STANDARD COMPONENTS GROUP

DELAY LINES
WEE LINE

Delay Lines

Epoxy-Encapsulated High-Reliability

Non-Flammable

Available for Base and Stacked Mounting, and Printed Circuits

A Complete Series Providing Greater Design Freedom and More Mechanical Versatility

Use Tap-Off Points for Lower Delays

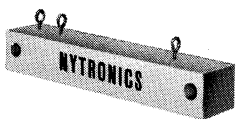
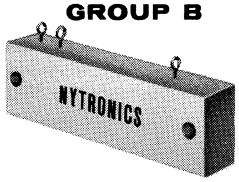
STANDARD SPECIFICATIONS

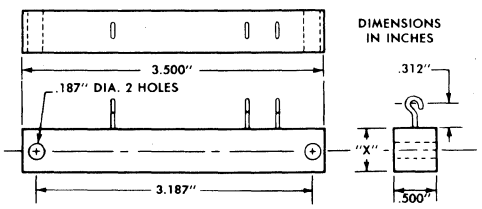
DELAY TOLERANCE AT 50% PTS.	±10%
RISE TIME: 10% TO 90%	.15 Td MAX.
IMPEDANCE	1000Ω±10%
ATTENUATION	$\sqrt{Td}$ db MAX.
SPURIOUS RESPONSE	15% MAX.
DC WORKING VOLTAGE	600 MAX.
TEMPERATURE RANGE (OPERATING)	—55°C TO 105°C

CONFORMS TO MIL-T-27A CLASS 2R

SPECIAL DELAY LINES The delay lines listed above are only a small sample of the large variety of both lumped and distributed constant delay lines manufactured by Nytronics.

Lines from a fraction of a microsecond delay to several hundred microseconds, at impedances from 50 ohms to several thousand ohms, and with bandwidths up to 25 MC are within the scope of Nytronics engineering and production facilities.

	DELAY IN μSEC	PART NO.
GROUP A 	0.05	DL05A
	0.10	DL10A
	0.25	DL25A
	0.50	DL50A
	1.00	DL100A
GROUP B 	1.25	DL125B
	1.50	DL150B
	2.00	DL200B
	3.00	DL300B
	4.00	DL400B
	5.00	DL500B



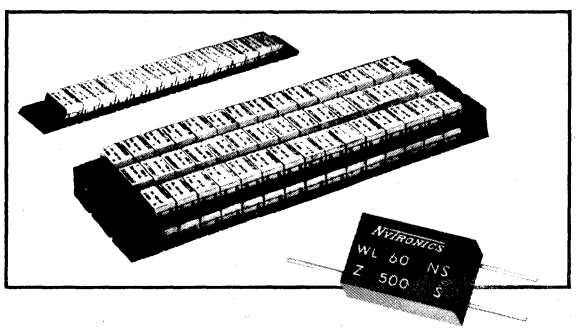
	GROUP A	GROUP B
DIMENSION "X"	.500	1.000

Wee Line

Unique sectional construction utilizing individual pre-designed Pulse Delay elements.

48 hour delivery not 8 weeks.

No tooling expenses.



The **WEE LINE** offers a unique sectionalized delay line that reduces delivery for prototype delay lines from weeks to days and eliminates expensive tooling and design efforts. Consisting of pre-designed LC sections called Wee Bits, a discrete value of delay time is offered. The aggregate number of Wee Bits determines the total delay time and is a function of delay to rise time ratio. The Wee Line assembly is made of selected Wee Bits mounted on printed circuit boards that conform to MIL-P-13949B, stacked or single layer and permits increment of delay to be tapped without disturbing uniform pulse shape. Wee Bit size 0.401" long by 0.625" wide by 0.230" height and are epoxy molded to meet environmental conditions of MIL-C-15305C. Temperature range —55°C to 125°C. 300 VDC working voltage. Delay time available per Wee Bit from 10 nanoseconds to 100 nanoseconds in 10 nanoseconds increments. Wee Bits also stocked with 200 nanoseconds delay. This unique Wee Line sectionalized delay line concept allows reducton of approximately 40% in number of sections ordinarily required*, flexibility of design, and line tapping. Individual Wee Bits only may be purchased for assembly on customer's circuits. Wee Lines also available in shielded case.

*Compared to constant K

LEADING ELECTRICAL PARTICULARS

Delay Tolerance:	±5%
Risetime Tolerance:	±20%
Noise:	1 to 10%, less than 3% for most types
Ripple:	1 to 10%, less than 3% for most types
Attenuation:	0.2 db/usec. to 1.0 db/usec. most types 0.2 db/usec.
Temp. Coefe.:	150 (10)^6 us/us —°C
Impedance:	500 ohms ±5%
Operating Voltage:	300 Volts D.C.

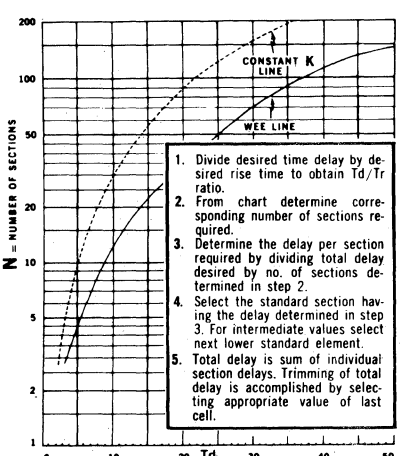
Tr MEASURED AT 10% & 90% and Td MEASURED AT 50% POINTS OF INPUT AND OUTPUT PULSES. Individual Sections furnished in ±5% Tolerance (or ±1NS, whichever is greater) and must be tested in accordance with Nytronics, Inc. DSI 394.

LEADING MECHANICAL PARTICULARS (for 15 section delay line)

Length of 15 cells	6.125"
Length of 15 cells plus P.C. mounting board	7.141"
Width of cells plus P.C. mounting board	0.750"
Height of cells plus P.C. mounting board	0.330"

Basic cell size: Length — 0.401"
Width — 0.625"
Height — 0.230"

Temperature range and operating environmental conditions are covered by MIL-C-15305B.



$$Tr\ eff. = \sqrt{Tr^2_{OUT} - Tr^2_{IN}}$$

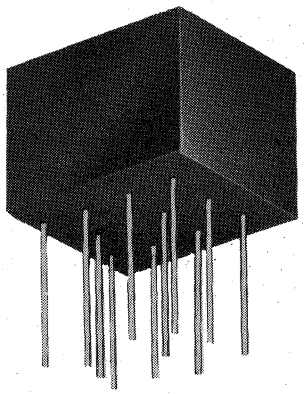
IF $Tr_{OUT} \geq 10x\ Tr_{IN}$, $Tr\ eff. = Tr_{OUT}$

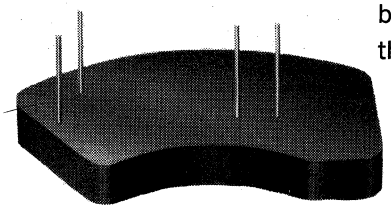
Essex Electronics Division
NYTRONICS, INC.

550 Springfield Ave., Berkeley Heights, N. J. 07922
Tel.: 201-464-9300 / TWX: 710-984-7977

RCL *electromagnetic delay lines*

. . . LUMPED CONSTANT
. . . DISTRIBUTED CONSTANT
. . . VARIABLE

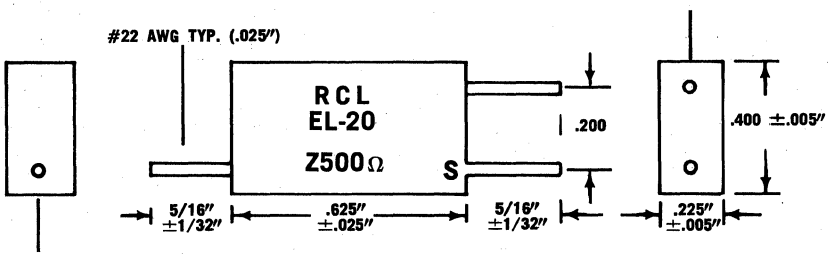




In the past delay lines have generally been custom designed units. For prototypes and research and development work, this is extremely complicated. RCL's Series DLM has created modules with fixed delay times. RCL has available 15 different values between 10 and 200 nano-seconds as standard stock items. Each module is one section. The number of sections depends on the ratio delay time/rise time. According to the requested ratio, delay time/rise time, the necessary number of modules is computed by a curve. By division of the total delay time by the number of modules, approximate value of the necessary modules are available. The single modules can be connected to each other on a printed circuit board. Taping is possible at the connecting points between the different modules.

DELIVERY FROM STOCK

Typical Series Designed for Commercial Computer Use:



STANDARD DELAY TIMES	
DELAY TIME	**TYPE**
10 Nanoseconds	EL 10
20 Nanoseconds	EL 20
25 Nanoseconds	EL 25
30 Nanoseconds	EL 30
40 Nanoseconds	EL 40
50 Nanoseconds	EL 50
55 Nanoseconds	EL 55
60 Nanoseconds	EL 60
70 Nanoseconds	EL 70
75 Nanoseconds	EL 75
80 Nanoseconds	EL 80
90 Nanoseconds	EL 90
100 Nanoseconds	EL 100
150 Nanoseconds	EL 150
200 Nanoseconds	EL 200

TECHNICAL DATA:

Delay time:	**10 NS — 200 NS**
Tolerance of delay time:	**±5%**
Tolerance of rise time:	**±10%**
Impedance:	**500 Ohms**
Ambient temperature range:	**−55°C to +125°C**
Operating voltage:	**300 Volt**
Temperature Coefficient:	**±100 ppm**
Noise:	**Average: 2%**
Ripple:	**Average: 2%**

RCL's staff and facilities are always available to help you. You can be assured of prompt, courteous and professional treatment whenever you call RCL.

WRITE FOR COMPLETE CATALOG

RCL **ELECTRONICS, INC.**
General Sales Office:
700 South 21st Street, Irvington, N. J. (Area Code 201) 374-3311 • TWX 710-999-5511

VIDCOR CO., Inc.

(213) 757-0110

1251 W. EL SEGUNDO BLVD. • GARDENA, CALIFORNIA 90247 • TEL. (213) 757-0119

SPECIAL FEATURES

- High density package without loss of bandwidth or rise time
- "M" Series provides 75% reduction over conventional unit size
- Temperature Range: −55°C to 125°C with low temperature coefficient
- Lead spacings designed for 0.1" circuit board grids
- Designed to allow low cost production
- Dimensions — .30 x .30 maximum cross-section, 2.5" maximum length

SPECIAL DELAY LINES

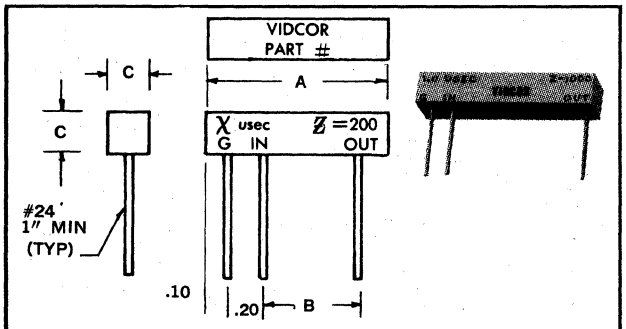
Vidcor Company offers at low cost, custom designed lines to your requirements in addition to the typical size shown. Custom delay lines have been made in various external configurations consistent with customer requirements.

MICROMINIATURE DELAY LINE -M

STANDARD MODEL SPECIFICATIONS

DELAY TIME (μ SEC)	0.1	0.3	0.5	0.7	1.0
RISE TIME (μ SEC)	0.03	0.08	0.10	0.12	0.18
DIMENSION "A"	1"	1"	1"	1¼"	1½"
DIMENSION "B"	0.6"	0.6"	0.6"	0.9"	1.1"

ATTENUATION	Less than 1 db
CHARACTERISTIC IMPEDANCE	Up to 1500 ohms
TOLERANCE	5% for delay time and 10% for characteristic impedance
OVERSHOOT	Less than 10 percent
TEST VOLTAGE	500 volts (DC)
TEMPERATURE COEFFICIENT	0.1 percent per degree centigrade
TERMINALS	#24 AWG, 1" minimum length, tinned copper leads
SIZE TOLERANCE	Decimal dimensions ±.02", fractional dimension ±1/32"



TOLERANCES: +.00 −.02 BODY DIMENSIONS
MATERIAL: THERMOSETTING RESIN
DIELECTRIC BREAKDOWN TEST: 300 VDC
MAXIMUM TEMPERATURE: +105°C
Standard size packaging for all delays.
Weldable "Dumet" leads are available at additional cost.

NANOSECOND DELAY LINES 200 OHMS

Tin-Coated Leads Part No.	T_d nanosec ±10%	T_r nanosec ±10%	Attenuation % max.	Attenuation % max.	Case Dimensions (inches) A	B	C
A1345	10	5	3	5	1.00	.60	.25
A1346	12	7	3	5			
A1347	14	8	3	5			
A1170	15	12	5	5	1.00	.60	.25
A1171	20	13	5	5			
A1148	25	14	5	5			
A1173	30	15	5	5	1.00	.60	.25
A1174	40	15	5	5			
A1142	50	16	5	5			
A1348	60	18	5	5	1.00	.60	.25
A1363	70	20	5	5	1.00	.60	.25
A1525	80	20	5	5			
A1532	90	20	5	5	1.00	.60	.25

500 OHMS

Miniature Delay Lines Impedance 500 ohms ±10%
Case: Diallylphathalate glass filled per Mil-M-14 SDG

VIDCOR Part No.	Time Delay T_d (nanosec)	Rise Time max. (nanosec)	Attenuation % max.	Case Dimensions (inches) A	B	C
A1458	45	12	5	1.25	.6	.3
A1459	95	20	5	1.25	.6	.3
A1471	100	30	5	1.00	.6	.3
A1479	150	45	5	1.25	.6	.3
A1448	175	50	5	2.50	.6	.3
A1087	200	87	5	.875	.6	.3
A1512	300	80	5	1.00	.6	.3
A1422	225	80	5	1.00	.6	.3
A1423	275	80	5	1.00	.6	.3
A1480	300	85	5	1.25	.6	.3
A1527	400	90	5	1.25	.6	.3
A1090	500	100	5	1.00	.6	.3
A1481	600	150	8	1.50	.6	.3
A1092	700	165	8	1.50	.6	.3
A1093	800	175	9	1.50	.6	.3
A1094	900	185	10	1.50	.6	.3
A1095	1000	215	10	1.50	.6	.3
A1482	1200	300	12	2.00	.6	.3

HIGH DENSITY DELAY LINES - 1000Ω

Tin Coated Leads Part No.	T_d μsec ±5%	T_r μsec max.	Attenuation % max.	Attenuation % max.	Case Dimensions (inches) A +.00 −.02	B ±.02	C ±.02
A1325	0.1	.04	10	10	1.00	.60	.30
A1326	.2	.07	10	10	1.00	.60	.30
A1057	.3	.085	10	10	1.00	.60	.30
A1058	.4	.10	10	10	1.00	.60	.30
A1053	.5	.12	10	10	1.00	.60	.30
A1329	.6	.14	10	10	1.25	.90	.30
A1060	.7	.16	10	10	1.25	.90	.30
A1331	.8	.17	10	10	1.50	1.10	.30
A1062	.9	.21	10	10	1.50	1.10	.30
A1063	1.0	.25	10	10	1.50	1.10	.30
A1139	1.1	.26	15	10	2.00	1.60	.30
A1140	1.2	.22	15	10	2.00	1.60	.30
A1141	1.3	.25	15	10	2.00	1.60	.30
A1333	1.4	.27	15	10	2.00	1.60	.30
A1055	1.5	.27	15	10	2.00	1.60	.30
A1064	2.0	.4	15	10	2.50	2.10	.30

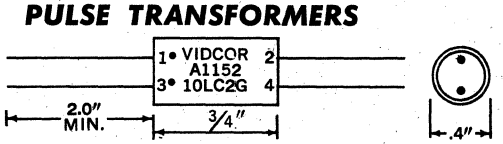
MINIATURE TAPPED DELAY LINES

CHARACTERISTIC IMPEDANCE 1000Ω. 5% TOL. MAINTAINED ON ALL DELAYS.

Part Number	Total Delay	Taps (μsec)	Case Dim. (inches) A	C
A1465	0.1 μsec	.02, .04, .06 & .08 μsec	1.5	.30
A1466	0.5 μsec	.1, .2, .3 & .4 μsec	1.5	.30
A1467	1.0 μsec	.3, .5, .7 & .9 μsec	2.00	.30
A1468	1.0 μsec	.2, .4, .6 & .8 μsec	2.00	.30
A1469	2.0 μsec	.6, 1.0, 1.4 & 1.8 μsec	2.50	.30
A1470	2.0 μsec	.4, .8, 1.2 & 1.6 μsec	2.50	.30

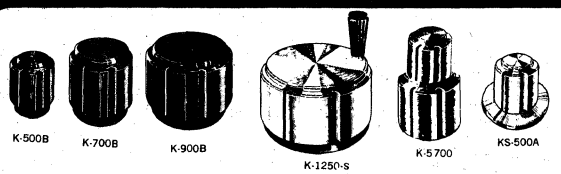
The delay lines above display a basic design that has been fully engineered and field tested. Other values of delay, impedance and tap delay are available on short notice and at low cost to vendor.

PULSE TRANSFORMERS



Part No.	A1150	A1152	A1155	A1156	A1158	A1160	A1164	A1166
Pulse Width (μsec)	2.0	5.0	6.0	6.0	16.0	10.0	10.0	16.5
Ratio	1:1	1:1	1:1:1	1:2	1:1	1:1:1	1:1:1	1:1:2
Rise Time (nsec)	40	30	60	60	60	90	100	100

ALUMINUM KNOBS • CERAMIC TERMINAL STRIPS



ALUMINUM INSTRUMENT KNOBS

STANDARD ANODIZED KNOBS FOR ¼" SHAFTS

Modern, decorative knobs of fabricated aluminum. Offers one-piece construction and superior styling at moderate price.

Model	O.D.	Finish*	One-99	100-249	250-499	500-999
K-500	.500"	A, B, G	.45	.41	.39	.36
K-700	.750"	A, B, G	.50	.45	.43	.40
K-900	.937"	A, B, G	.55	.50	.47	.44
K-1250	1.250"	A, B, G	.65	.59	.56	.52
K-1250-S	1.250"	A, B	1.55	1.40	1.32	1.24
K-5700	.500" & .750"	A, B	1.10	.99	.94	.88

SKIRTED ANODIZED KNOBS FOR ¼" SHAFTS

Decorative knobs with skirts of natural or black aluminum or acrylic plastic. KS types have aluminum skirt; KSP types, acrylic plastic skirt.

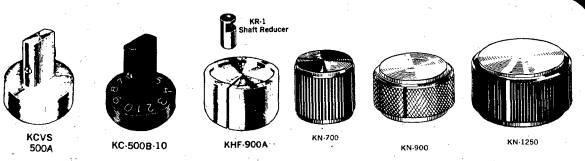
Model	O.D.	Skirt Dia.	Finish*	One-99	100-249	250-499	500-999
KS-500	.500"	.750"	A, B	.60	.54	.51	.48
KS-700	.750"	1.125"	A, B	.65	.59	.56	.52
KS-900	.937"	1.406"	A, B	.85	.77	.73	.68
KSP-700	.750"	1.125"	A, B	.60	.54	.51	.48
KSP-900	.937"	1.406"	A, B	.65	.59	.56	.52

DELUXE KNOBS WITH A CUSTOM LOOK

ALCOKNOBS with unique, notched pointers are designed for hi-fi/stereo, tape recorders, test equipment, lab and medical instruments. The emphasis is on style to enhance the overall appearance. For ¼" shafts.

Model	O.D.	Finish*	One-99	100-249	250-499	500-999
KHF-500	.500"	A, G	.45	.41	.39	.36
KHF-700	.750"	A, G	.50	.45	.43	.40
KHF-900	.937"	A, G	.55	.50	.47	.44
KHF-1250	1.250"	A, G	.65	.59	.56	.52

*Specify color: add suffix **A** for natural aluminum anodizing with black pointer; add **B** for black anodizing with white pointer; add **G** for gold anodizing with red pointer.



MINIATURE ANODIZED KNOBS FOR ⅛" SHAFTS

K-⅛ types are machined aluminum with anodized finish and hairline indicator. Usable with switches and controls having ⅛" shafts. KC types are skirted knobs for MRA Series Alcoswitches: machined aluminum anodized with hairline and two set screws.

Model	O.D.	Skirt	Finish*	One-99	100-249	250-499	500-999
K-500-⅛	.500"	No	A, B, G	.45	.41	.39	.36
KS-500-⅛	.500"	Yes	A, B	.60	.54	.51	.48
KC-500	.473"	Yes	A, B	.55	.50	.47	.44
KC-500-10†	.473"	Yes	A, B	.65	.59	.56	.52
KCVS-500°	.473"	Yes	A, B	1.10	.99	.94	.88
KR-1	Shaft Reducer ¼ to ⅛			.06	.045	.04	.036

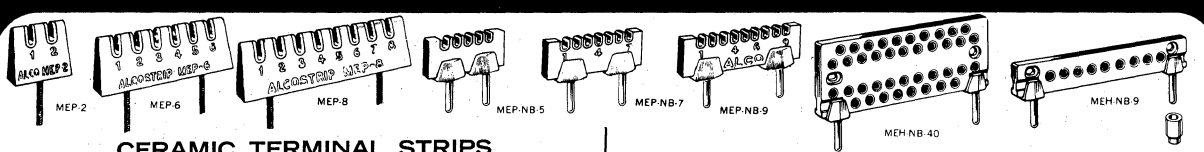
†Has engraved 0-9 numerals. °Special adjustable stop types.

KNURLED ALUMINUM KNOBS

Model	O.D.	Style Knurl	Finish*	One-99	100-249	250-499	500-999
KD-500	.500"	Diamond	A, B, G	.55	.50	.47	.44
KD-500-⅛°	.500"	Diamond	A, B, G	.55	.50	.47	.44
KD-700	.750"	Diamond	A, B, G	.60	.54	.51	.48
KD-900	.937"	Diamond	A, B, G	.70	.63	.60	.56
KD-1250	1.250"	Diamond	A, B, G	.85	.77	.73	.68
KN-500	.500"	Straight	A, B	.55	.50	.47	.44
KN-500-⅛°	.500"	Straight	A, B	.55	.50	.47	.44
KN-700	.750"	Straight	A, B	.60	.54	.51	.48
KN-900	.937"	Straight	A, B	.70	.63	.60	.56
KN-1250	1.250"	Straight	A, B	.85	.77	.73	.68
KN-500	.500"	Straight	AB, BA**	.75	.68	.64	.60
KN-500-⅛°	.500"	Straight	AB, BA**	.75	.68	.64	.60
KN-700	.750"	Straight	AB, BA**	.80	.72	.68	.64
KN-900	.937"	Straight	AB, BA**	.90	.81	.77	.72
KN-1250	1.250"	Straight	AB, BA**	1.10	.99	.94	.88
KPN-700	.750"	Pointer	A, B	1.40	1.26	1.20	1.12
KPN-700	.750"	Pointer	AB, BA**	1.60	1.44	1.36	1.28

*Specify color: add suffix **A** for natural aluminum anodizing; add **B** for black anodizing; add **G** for gold anodizing.

**Specify colors: Add suffix AB for Natural Aluminum body with Black top; Add BA for Black anodized body with Natural top. °For ⅛" Shafts.



CERAMIC TERMINAL STRIPS

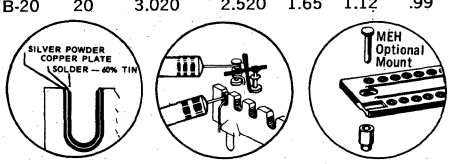
Ceramic-base terminal strips with fired silver, copperplated and tinned terminals to facilitate high-temperature soldering of components and leads. Features permanent bond between metal and ceramic. Standard 2-56 threaded studs are extra long for cutting to any required dimension. Board ht. 0.590" from base. Depth of slots, 0.197". Dielectric Strength: more than 10 seconds at 1500 VDC between terminals. Insulated Resistance: over 1000 megohms at 500 VDC megger. Dip Solder Test: no exfoliation at 250°C for 5 seconds.

STANDARD TYPES WITH THREAD MOUNTING

Model	No. of Terminal Slots	Size, Overall Width	Mtg. Ctrs.	One-24	25-99	100-499	500-999
MEP-2	2	0.650	.....	.36	.24	.21	.17
MEP-4	4	1.161	0.512	.45	.30	.25	.21
MEP-6	6	1.673	1.024	.60	.40	.34	.28
MEP-8	8	2.185	1.535	.75	.50	.42	.35
MEP-10	10	2.697	2.047	.87	.58	.49	.41
MEP-12	12	3.209	2.560	.99	.66	.56	.46

MINIATURE TYPES WITH SNAP MOUNTING

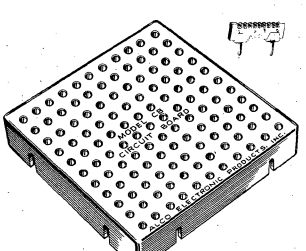
MEP-NB-3	3	0.600	.....	.48	.325	.29	.26
MEP-NB-5	5	0.885	0.490	.66	.45	.395	.355
MEP-NB-7	7	1.165	0.490	.81	.545	.48	.435
MEP-NB-9	9	1.445	0.750	.87	.59	.52	.47
MEP-NB-13	13	2.140	1.500	1.11	.755	.665	.60
MEP-NB-16	16	2.440	1.500	1.35	.92	.81	.73
MEP-NB-20	20	3.020	2.520	1.65	1.12	.99	.89



UNIVERSAL TYPES WITH SNAP MOUNTING

ALCO's new concept allows for horizontal or vertical mounting of terminal strips. Each strip is supplied with 2 types of mounting hardware. The selected positioning of the terminals permits the use of more components in a limited space (either singly or in pairs). Silverplated copper eyelets are swedged to the ceramic base.

Model	No. of Terminal Slots	Size Overall Width	Inches Mtg. Ctrs.	One-24	25-99	100-499	500-999
MEH-NB-9	9	3.000	2.500	.80	.53	.45	.38
MEH-NB-18	18	3.000	2.500	1.45	.97	.81	.67
MEH-NB-19	19	3.000	1.750	1.45	.97	.81	.67
MEH-NB-40	40	3.000	2.500	2.20	1.47	1.23	1.01



Simplify Circuitry With These
DESIGN BOARDS
and Plug-in Terminal Strips

Ceramic Alcostrips are ideal for breadboarding which may be quickly inserted or removed as desired to simplify circuit design. A mating circuit board measuring only 5" x 6" is provided to form a base for experimental design work. Complete ceramic kit includes 16 strips (8 sizes) and one board.

CB-2 Kit 10.95
CB-1 Board only .95

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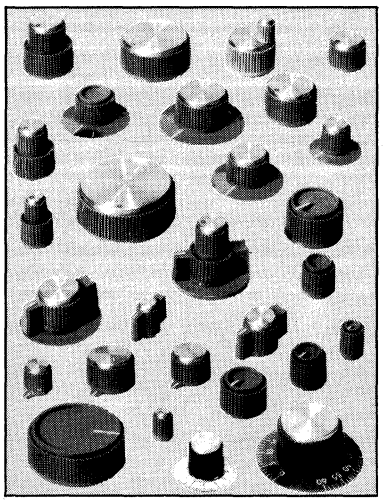
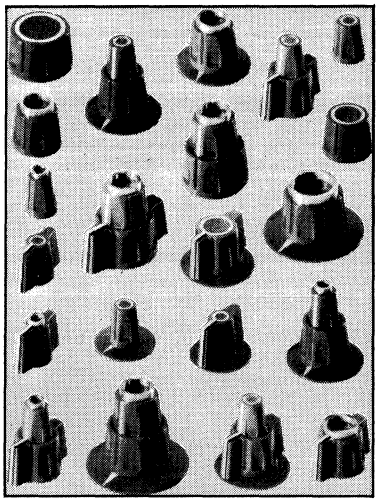
BUCKEYE



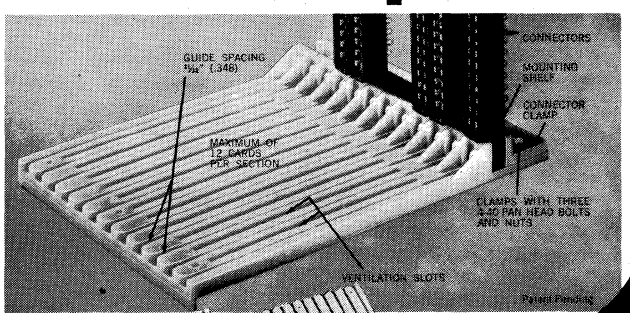
KNOBS

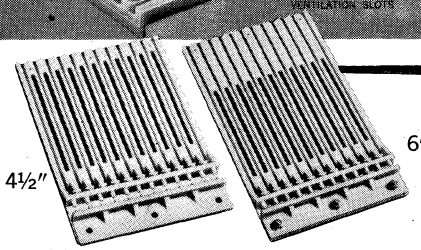


Your instrumentation can now be greatly enhanced by the use of a harmonizing style of the uniquely designed Buckeye Matching Instrument Knobs. They're available in six attractive styles in four stock colors, and in six basic sizes.

This "MATCHING INSTRUMENT LINE" features single-round, concentric, bar and half bar, spinners, pointers and skirted knobs with numerous variations. Molded of Cycolac, Buckeye knobs are noted for their toughness, rigidity, dimensional stability, high gloss and resistance of stain, weather and heat. They are fitted with metal bushings and 2 set screws. All caps are spun aluminum and are corrosion protected by anodizing.

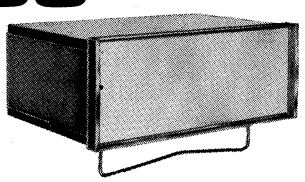
bord-pak®





CIRCUIT BOARD GUIDES are a time and labor saving innovation for packaging integrated modular circuitry. The Cycolac guide is molded into a single section with 12 tracks, spaced 11/32" apart with ventilation slots for safe maximum density circuit card packaging. The mounting shelf and clamp design assures quick and positive alignment of connectors with only three bolts. Guides are available to accept either 4½" or 6" length etched or printed circuit boards. Module spacing and design other than standard is available on quantity orders.

cases

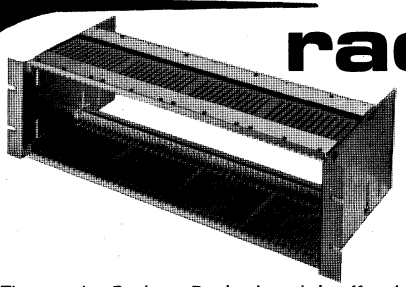


Bord-pak cases are designed in three popular functional sizes to facilitate economical assembly of standard 4½" circuit guides.

The recessed satin anodized front panel and polished aluminum frame trim harmonizes with the "over-tone" gray pebble grain finish to give extra attractiveness to any finished packaged assembly. Bottom is provided with safety snap elevating bail and nylon feet. Internally the cases are designed to incorporate two, four or six Bord-pak sets.

The overall sizes range from 5 5/16" wide x 5 5/16" high x 11 3/8" deep to 15 7/16" wide x 5 5/16" high x 11 3/8" deep.

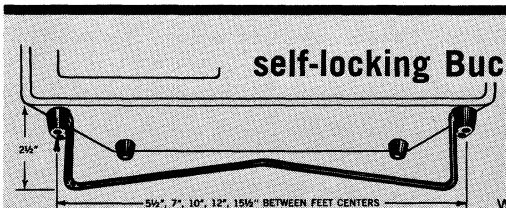
racks



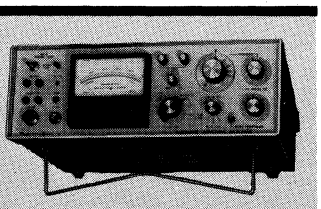
The popular Buckeye Bord-pak rack is offered in four functional sizes — for 1, 2, 3 or 4 Bord-pak circuit guide sets — and to accommodate circuit board modules of either the 4½" or 6" size. The racks are sturdily designed of rigid aluminum support bars and flanged end plates to either stack or facilitate an economical assembly of your own choice of stationary multiple-rack electronic systems.

The overall sizes range from 5⅞" high x 5" deep x 6" wide to 8⅝" high x 5¼" deep x 19" wide.

self-locking Buckeye Instrument bail



A safe, positive-locking bail to elevate — and that eliminates collapse — of your bench instruments. Offered in five standard sizes (custom sizes in quantity) in bright chrome finished 3/16" rod, nylon feet and necessary mounting screws. Folds away completely for level bench work.



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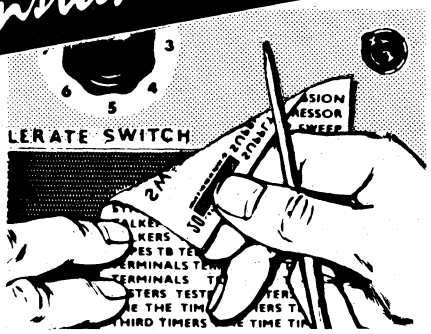

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All the necessary letters, letter combinations and numerals for marking chassis, printed circuit and terminal boards, rotating components, etc.

No. 966—Black **$4.95**
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Low cost dry transfer marking kits designed to provide useful preset words, symbols and alphabets for specific uses.

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K59B—Amateur Radio & CB (black) **$1.25**
K59W—Amateur Radio & CB (white) **$1.25**
K60B—Experimenter, Home & Intercom (black) **$1.25**
K60W—Experimenter, Home & Intercom (white) **$1.25**
K61B—Test & Industrial Equipment (black) **$1.25**
K61W—Test & Industrial Equipment (white) **$1.25**
K62—Marks & Switch Patterns **$1.25**
K63—Alphabets & Numerals (⅛") **$1.25**
K64—Alphabets & Numerals (¼") **$1.25**
K65—Alphabets & Numerals (½") **$1.25**



METER & DIAL MARKING KIT

Arcs, dial patterns, lines, wedges, graduation lines, switch symbols alphabets and numerals in black, white and red for marking standard and special rotary tap switches, potentiometers and prototype and specially calibrated meter dials. Colors provide contrast on scales and switches, simplifying usage of complex instruments.

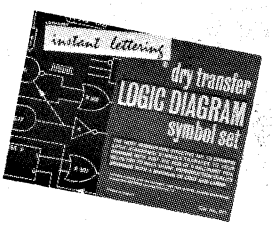
No. 968—Complete Set **$4.95**
REFILL SHEETS—set of four identical sheets
No. 968R—(specify sheet number) **$2.00**



ELECTRONIC SYMBOL DRAFTING SET

The quick way to more readable schematics. Contains 40 sheets of electronic symbols plus letters and numerals. Symbols designed to conform with MIL-STD-15-1A. Sheets have heat resistant adhesive for perfect reproduction in any blue- or white-printer. Also included is a complete guide to drawing with dry transfer symbols.

No. 970—Complete Set **$15.95**
REFILL SHEETS—set of four identical sheets
No. 970R—(specify sheet number) **$2.00**



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NEW! The most modern and effective aid to drawing logic diagrams. Symbols transfer to your drawing in seconds. All you need do is add the connecting leads. Heat resistant adhesive allows perfect reproduction even in diazo and other high speed printers. Symbols conform fully to MIL-STD-806B and ASA-Y32.14.

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Full 10" x 15" sheets of alphabets and numerals available in over 50 different typefaces in sizes ranging from 8 pt. to 3 in. display letters and in 6 colors. Also available are arrows, math symbols, chart symbols, line and dot rules, etc. Free sample and complete type chart available upon request.

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Heat resistant letters allow your drawings to be reproduced with perfect results every time. Letters will not flake, peel or fray in any blue- or white-printer. Razor sharp letters are printed with a highly opaque ink so you get perfect results every time. Write for complete details.

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Sheets made to your own specifications can include logos, drawings, symbols, preset words — anything that you use repeatedly. Hundreds of lettering and marking problems that were impossible or too expensive become practical with "Instant Lettering". Tell us your problem and let us suggest a "dry transfer" solution.

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Clear Protective Coating

Specially designed to protect "Instant Lettering" transfers from abrasion and weathering. Datakoat is water-clear and dries quickly.

Protective Coating Kit contains a 1 oz. bottle of Datakoat with applicator brush in cap and a 1 oz. bottle of thinner.

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Spray Coatings are the handy aerosol can form of Datakoat (16 oz. cans).

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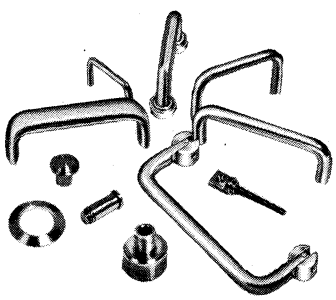
HARDWARE FOR THE ELECTRONICS INDUSTRY

METAL COMPONENTS



Handles, ferrules, stand-offs, terminals and metal screw machine parts for electronic instruments and equipment available in brass, aluminum and stainless steel in a wide variety of sizes, styles and finishes.

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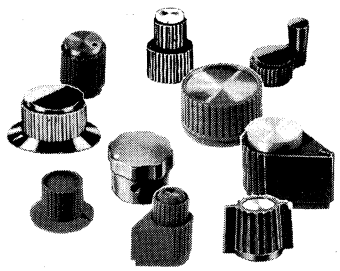

featuring MS 91528 and new "Design-A-Knob" series; includes hundreds of different commercial and Mil/Spec knobs.

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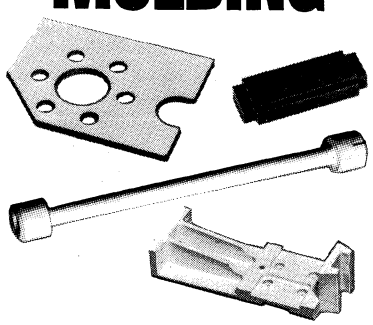

Custom molding for the electronics industry. Featuring the use of "State-of-the-art" plastic materials for an infinite variety of intricate components.

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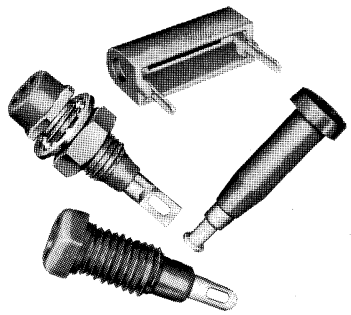
TEST JACKS



for standard 0.080 test probes for military, industrial and commercial applications; also custom jacks with special terminations, plating, colors, insulators and multi-contact connector applications.

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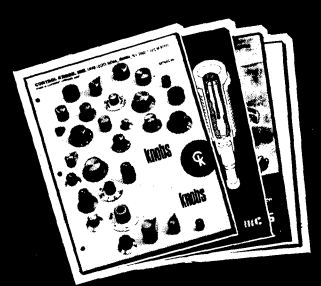

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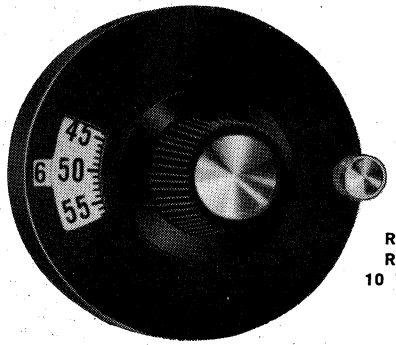
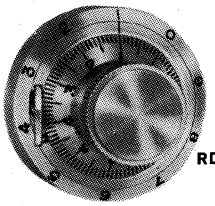
IRC® REVODEX® COUNTING DIALS

TRW INC.

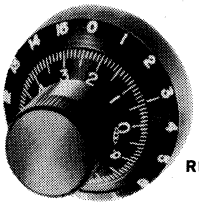


RD-1
RD-6
10 Turns

1" and 1⅞" REVODEX Dials Eliminate Reading Errors and are Available in Both Clear or Black Anodized.



RD-400 Series
10 Turns



RDK-400 Series
15 Turns

Accurate Reproducible Readings: To one part in a thousand. Settings can be estimated to fractions of a thousandth.

See exact settings quickly and clearly . . . significant digits are conveniently grouped at one spot. Reading errors are eliminated. REVODEX dials are particularly suited to IRC 3, 5, 10 and 15 turn precision potentiometers.

Locking Device: Standard on 1⅞", optional on 1" dials. Finger-tip action positively locks or unlocks the dial. Locks can be set without shifting the dial reading.

Easy Reading: Even when mounted above eye level. 1⅞" sizes give a direct reading with 3 numbers grouped for fool-proof reading. On the 1" size, an angular surface provides greater area to obtain maximum numeral size. For greatest ease of reading, numbers are rearranged to a primary and secondary scale presentation.

Full Range: 000 to 999 to indicate full ten turns. 000 to 1599 to indicate full fifteen turns.

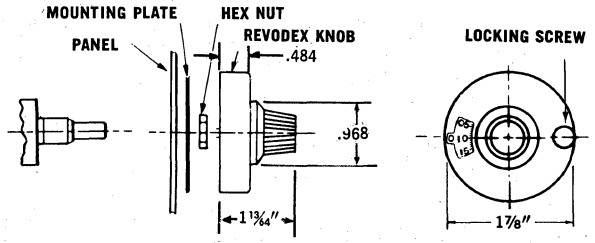
Zero Backlash: Knobs are set-screwed directly to potentiometer shaft and the non-rotating base is tight to the panel in the RD-400 series. This feature thereby eliminates dial backlash.

Sturdy Construction: Life tested for one quarter million cycles with no signs of appreciable wear.

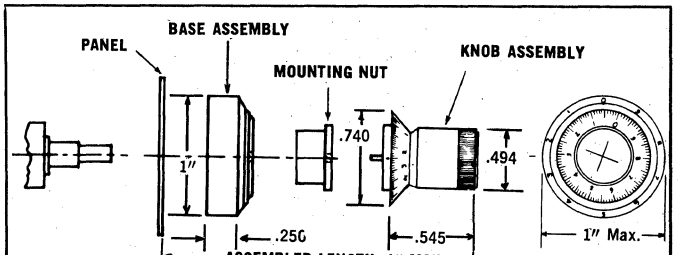
Easy Mounting: Mounting plate of 1⅞" dial fits under potentiometer mounting nut. Knob is secured to shaft with set screw. Body of 1" dial mounts directly on potentiometer bushing and knob attaches to shaft. No special panel holes required.

10 Turns*	RD-1	RD-6	RD-411	RD-412	RD-461	RD-462	RD-421	RD-422	RD-471	RD-472
15 Turns**	—	—	RDK-411	RDK-412	RDK-461	RDK-462	RDK-421	RDK-422	RDK-471	RDK-472
Locking Mechanism	Yes		No	Yes	No	Yes	No	Yes	No	Yes
Finish (Satin Anodized)	Black	Clear	Black		Clear		Black		Clear	
For Shaft Dia.	¼"		¼"				⅛"			
Bushing/Threads	⅜" Max. (Uses Pot Mounting Nut)		⅜" - 32 NEF2				¼" - 32 NEF2			
Shaft Ext. From Panel — Min.	0.60"		0.60" (.725" Optimum)							
Shaft Ext. From Panel — Max.	1.0"		0.80"							
Max. Bushing Extension from Panel	0.328"		0.296"							
Dial Body Dia.	1⅞"		1" Max.							

*Available from Distributor Stock. **Available on Special Order.



NOTE: Permissible shaft extension from front of panel, 0.60 to 1.0
Bushing extension beyond panel face, .328 max.

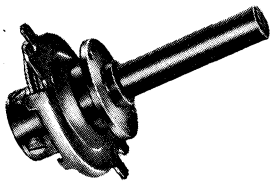


NOTE: Permissible shaft extension from front of panel, 0.60 to 0.80
Bushing extension beyond panel face, .296 max.

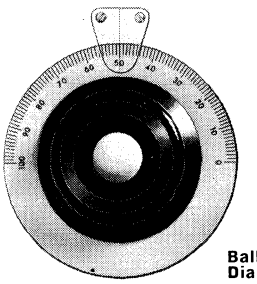
JACKSON BROS. (LONDON) LTD. TUNING CONTROLS/DRIVES/ TERMINALS MADE IN ENGLAND

TUNING CONTROLS

Ball Drive. 6-1 Ratio. Coaxial Spindle. Epicyclic Friction Drive.
Ball Drive Dial. 6-1 Ratio. 4" Dial. Mounts outside the Panel.



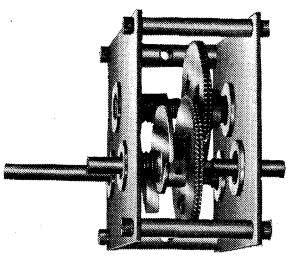
Ball Drive



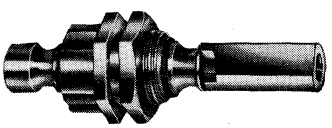
Ball Drive Dial

DRIVES

Gear Drive Unit. Precision Gearing. No Backlash. Precisely 56.25-1. All Ball Bearing.
Epicyclic Reduction Drive. 5-1 Ratio. One (⅜") Hole Fixing.



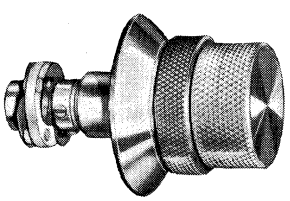
Gear Drive Unit



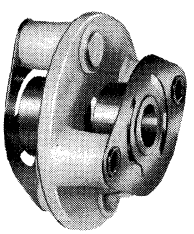
Epicyclic Reduction Drive

SHAFT COUPLINGS

D. Type 2 Speed Drive Unit. Superb quality continuous reduction drive with 4½" : 1 ratio.
Universal Shaft Coupling. Constant Velocity. Flexible. Robust. Allows for both Linear and Angular Misalignment.



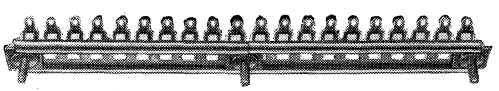
D Type 2 Speed Drive Unit



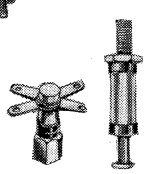
Universal Shaft Coupling

STAND OFF INSULATORS AND TERMINALS

Stand Off Insulators. Professional Quality. Working voltages up to 10kV. Stoved-on silicone treatment: Water repellent. Ceramic bodies. Silver-plated tags. No solder. No plastic. No adhesives.



Stand Off Insulators



Terminal Strips of the same high quality, ¼" spacing, two up to 12-way or ADUP (as illustrated) may be butted to form any number.

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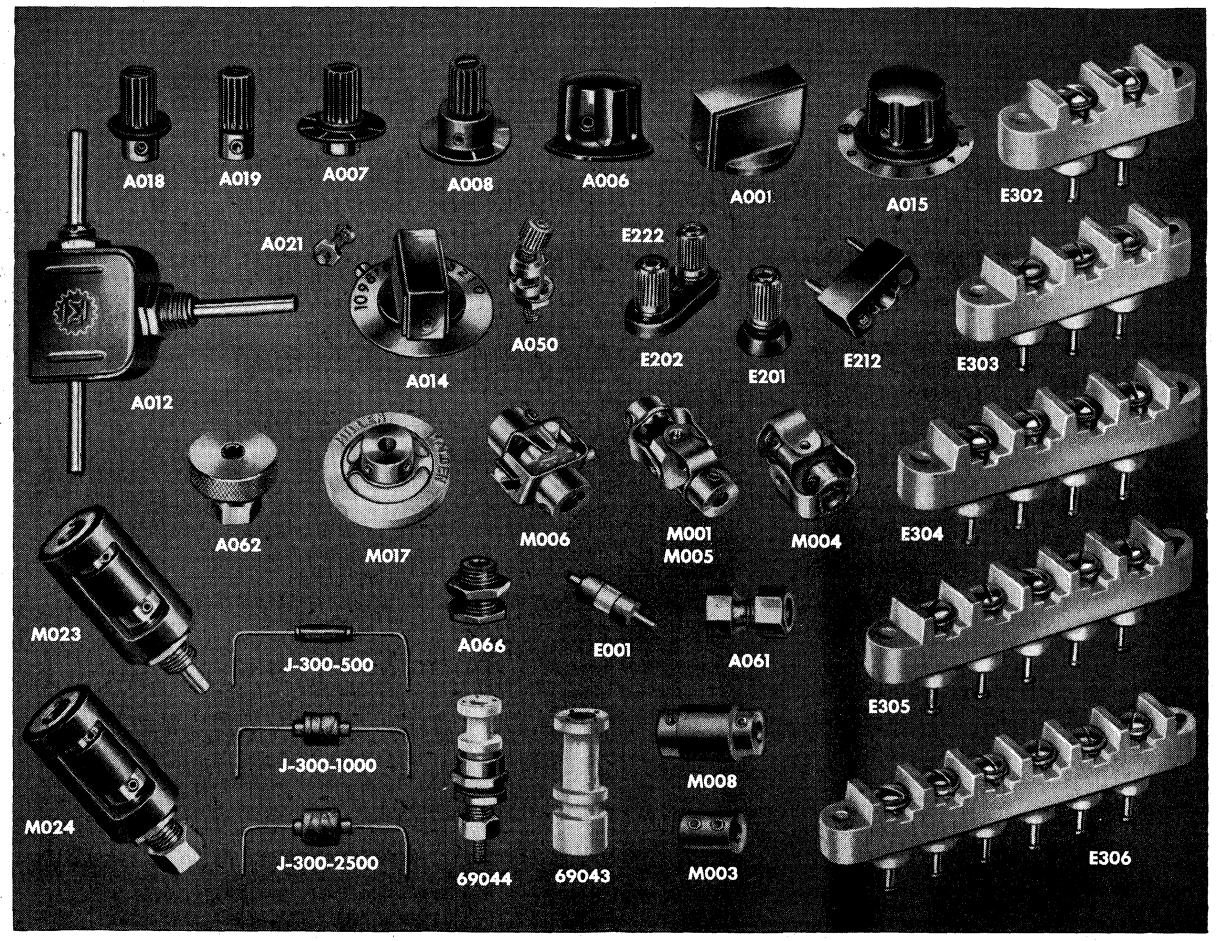

MINIATURIZED COMPONENTS

Typical of the MILLEN line of miniature components:

No. A001 Bar knob for 1/8" shaft. 1/2" high by 3/4" long.....
No. A006 Fluted black phenolic knob with brass insert for 1/8" shaft.....
No. A007 and A008 1/4" black plastic dial knobs; inserts for 1/8" shaft.
No. A012 Right angle drive for 1/8" shafts. Single hole mounting.....
No. A014 1" bar dial for 1/8" shaft. 1/2" high. 180° or 280° dials.....
No. A015 1" fluted knob dial for 1/8" shaft. 1/2" high. 180° or 280° dials.
No. A017 1 1/8" diameter fluted black phenolic knob for 1/8" shaft.....
No. A018 and A019 Knobs. .....
No. A050 Miniature dial lock.....
No. A061 and A062 Miniature shaft locks for 1/8" shaft.....
No. A066 Miniature shaft bearing for 1/8" shaft.....
No. E201, E202, E212, and E222 Miniature binding posts and plug.
No. E302A to E306A Miniature ceramic terminal strips.....
No. J300-3.3 to J300-2500 Miniature Inductors.....
No. M001 and M006 Miniature insulated universal joint style flexible coupling for 1/8" shafts.....
No. M004 and M005 Miniature non-insulated universal joint style flexible couplings for 1/8" dia. shafts.....
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No. M023 and M024 Miniature high voltage insulated shaft extensions for 1/8" dia. shaft.....

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Comprehensive Coverage of

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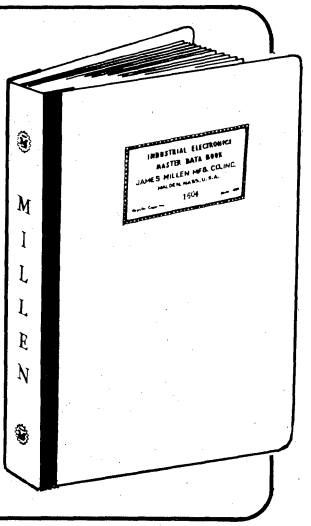

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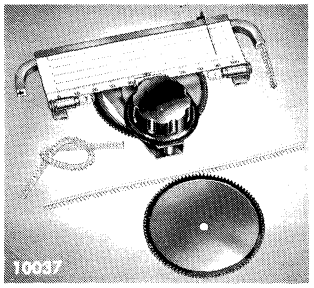
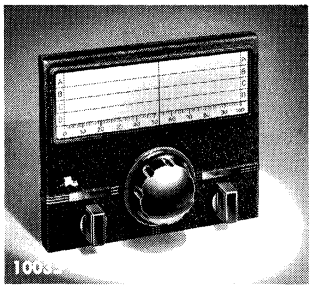
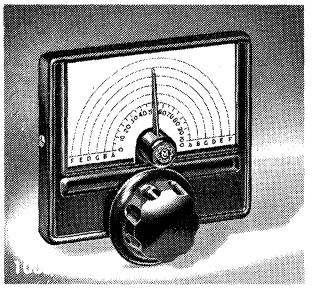
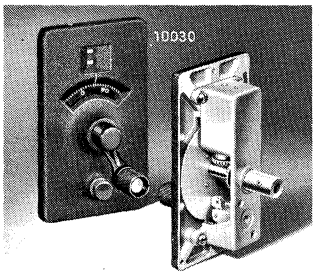
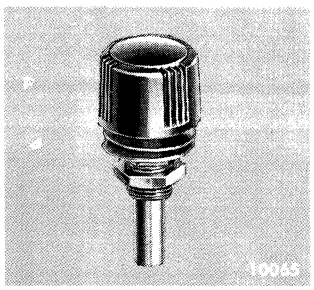
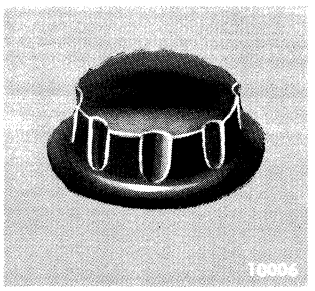
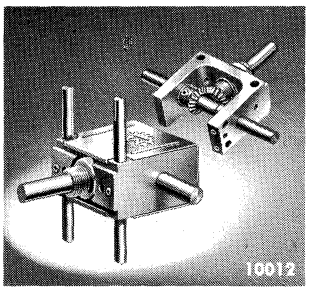
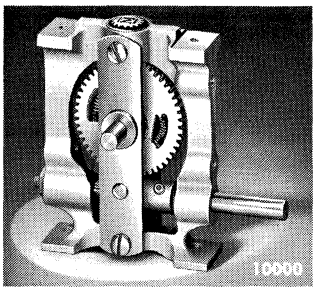
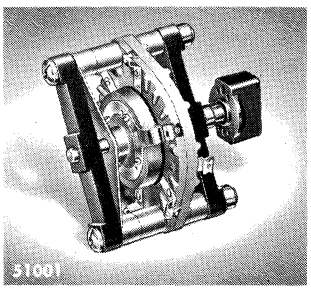


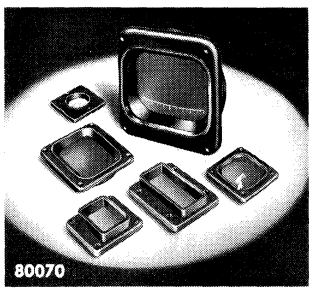




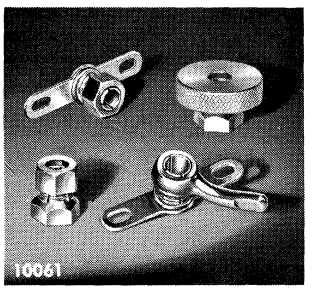


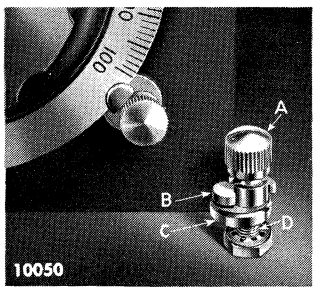













"Designed for Application"® DIALS AND COMPONENTS

NO-STRING DIAL

No. 10037 — No-string illuminated slide rule dial. The pointer is driven by a flexible but non-elastic molded gear driven rack which rides in a multi-slot extruded aluminum channel. This girder-like channel provides rigidity. Reduction 11:1. Scale length 6½ inches. Supplied with bezel.

FRONT OF PANEL DIALS

Compact mechanical design. Easy to mount. Self-contained mechanisms, thus eliminating back of panel interference. Flat black art metal.
No. 10035 — Illuminated panel dial has 12 to 1 ratio; size 8-3/16" x 6-17/32". Provision for mounting and marking auxiliary controls such as switches, potentiometers, etc. provided.
No. 10039 — Small panel dial has 8 to 1 ratio; size 4" x 3-9/32".
No. 10039-D — Small panel dial with positive loaded gear drive. 20 to 1 ratio; size 4" x 3-9/32". For ten turn devices.
No. 10039-E — Small panel dial with positive loaded gear drive. 10 to 1 ratio; size 4" x 3-9/32". For five turn devices.

COUNTER DIALS

No. 10030 — Extremely sturdy instrument type indication. Control shaft has 1 to 1 ratio. Veeder type counter is direct reading in 99 revolutions.
No. 10030-E — Same as No. 10030 except that the crank handle on the No. 10030 has been replaced by a fluted knob.

KNOBS

A006 — Fluted black phenolic knob with brass insert for ⅛" shaft.
10006 — 2¾" black phenolic knob with brass insert for ¼" shaft.
10016 — ¾" black phenolic knob with brass insert for ¼" shaft.
10016-A — ¾" fluted knob with nickel plated brass pointer.

BEZELS FOR CATHODE RAY TUBES

No. 80071 — Buterate bezel for 1 in. tube such as 1CP1. 2⅜" x 2⅜".
No. 80072 — Phenolic bezel for 2 in. tube such as 2BP1. 2⅝" x 2⅝".
No. 80073 — Phenolic bezel for 3 in. tube such as 3RP1. 3⅝" x 3⅝".
No. 80075 — Phenolic bezel for 5 in. tube such as 5UP1. 6⅛" x 6⅛".
No. 80173-B — Bezel for rectangular tube such as 3XP1. 2½" x 3¼".

HIGH VOLTAGE R-F SWITCH

No. 51001 — High voltage r-f switch designed for high frequency requirements. The No. 51001 features high voltage breakdown, and a non-arc tracking and arc resistant molded frame. Both collector and switched contacts break contact. Heavy duty silver contacts, and insulated mount.

DRIVES

RIGHT ANGLE DRIVES

No. A012 — Miniature right angle drive for ⅛" shafts. 1 to 1 ratio.
No. 10012 — Standard size right angle drive for ¼" shafts. 1 to 1 ratio.
No. 10012-T — Thru-sleeve right angle drive for ¼" shafts. 1 to 1 ratio.

WORM DRIVE UNITS

Cast aluminum frame may be panel or base mounted. Spring loaded split gears to minimize back lash.
No. 10000-A — 16 to 1 ratio.
No. 10000-B — 48 to 1 ratio.
No. 10000-C — 12 to 1 ratio.
No. 10000-D — 36 to 1 ratio.

GEAR DRIVE

No. 10000-12 — Spring loaded split gears to minimize back lash. 2 to 1.

FRICTION DRIVE

No. 10065 — Friction drive for 0.025" to 0.032" thick disc dials.

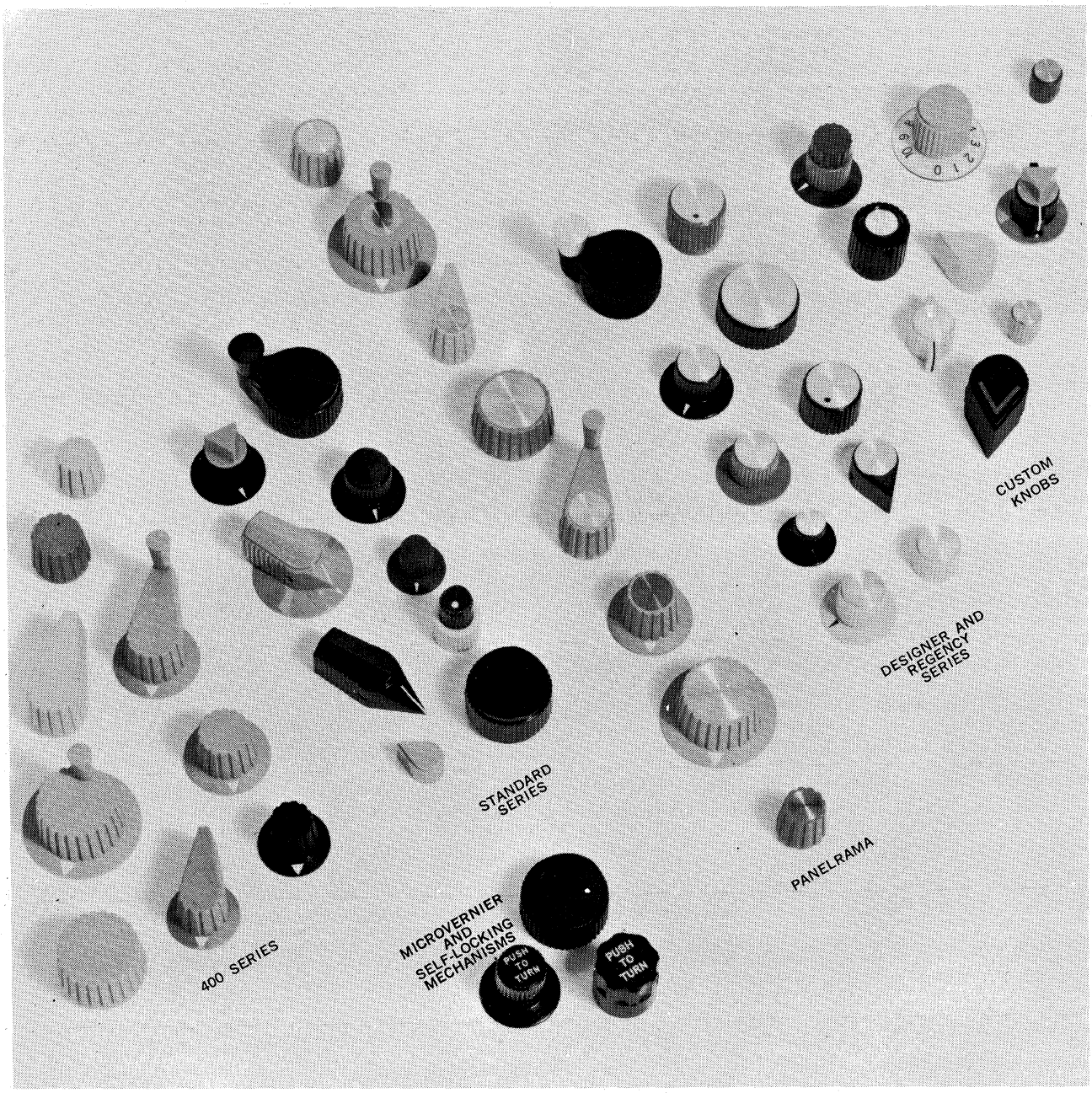
SHAFT LOCKS

No. 10060 — Shaft lock for ¼" shaft. ⅜"-32 bushing with 7/16" hex nut.
No. 10061 — Lock for conversion of "plain" ¼" shaft to "locking type."
No. 10062 — Thumb screw shaft lock for ¼" shaft. ⅜"-32 bushing.
No. 10063 — Lever operated shaft lock for ¼" shaft. ⅜"-32 bushing.

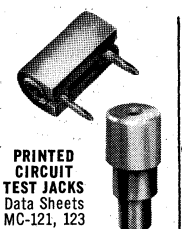
DIAL LOCKS

No. A050 — Miniature dial lock. Compact, easy to mount, positive in action.
No. 10050 — Rotation of knob A depresses finger B locking dial against C.
No. 10050-A — Lock with index mounting to prevent rotation of assembly.
No. 10053 — Sub panel dial lock. Nickel plated brass.

JAMES MILLEN MFG. CO., INC.
MAIN OFFICE AND FACTORY
MALDEN, MASSACHUSETTS, U.S.A.



Pick a knob... Any knob... Raytheon has it in stock



PRINTED CIRCUIT TEST JACKS
Data Sheets MC-121, 123

STANDARD TEST JACKS

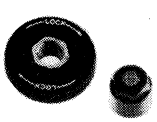


Per MIL-C-39024 /10 (Turret and Spade Terminal Types)
Data Sheet MC-125

SUBMINIATURE TEST JACKS



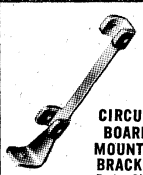
Fixed Snap-in
Data Sheet MC-122



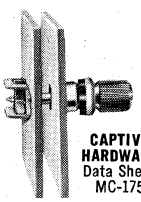
KNOB & CONTROL SHAFT LOCKS
Data Sheets MC-114, 115



BINDING POSTS
Data Sheet MC-130



CIRCUIT BOARD MOUNTING BRACKETS
Data Sheet MC-180



CAPTIVE HARDWARE
Data Sheet MC-175



FUSE & RESISTOR MOUNTING CLIPS
Data Sheet MC-160

Hundreds of standard types. More than 2,000 "specials" available from local distributors and large factory stocks.

Turn to color with new PANELRAMA knobs... mix and match caps and body colors. Specify DESIGNER SERIES knobs . . . or colorful 400 and REGENCY Series knobs. Raytheon Standard Series meet MS91528. Or, select MICRO-VERNIER CONTROLS and self-locking devices to meet your requirements. For a complete line catalog, call your Raytheon distributor or write: Raytheon Company, Industrial Components Operation, Quincy, Mass. 02169.

RAYTHEON

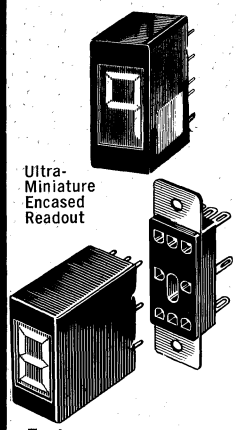
Look in the Yellow Section for Manufacturers' Sales Offices



Tell them you found them in **eem**

READOUT INDICATORS

NEW 5V. MINIATURE ENCASED READOUTS



Ultra-Miniature Encased Readout

New 7-segment incandescent readout has a bright display that is clearly read under all ambient lighting conditions. Contrast is further emphasized and glare is minimized because of its "built-in" red filter. The flat, single-plane display allows true wide-angle viewing without distortion. Large character size (.325" x .600") relative to case size (.552" x 1.18"). This compact unit permits multiple installation in a minimum of space. No moving parts. Makes use of high temperature materials housed in a one-piece metal case. Lamps are closely fitted into a compartmented block with short leads virtually eliminating vibration problems. Lamps are separately lit to form any numeral as desired by use of an external decoder/driver. High reliability is achieved through the use of long life #683 T-1 subminiature lamps with a life expectancy of 100,000 hours. Entire readout is easily removed by simply unplugging it from the 8-prong socket.

Features
- Long Life
- Miniature T-1 Lamps
- Metal Enclosure
- Popular 5V
- Plug-in
- Large Numerals
- Lowest Cost

Typical Applications
- Digital Voltmeters
- Frequency Meter
- Calculator
- Digital Clocks
- Computers
- Airborne Instruments
- Control Panels
- Test/Checkout Systems

SPECIFICATIONS

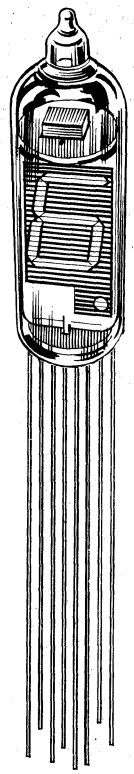
Characters:	0 to 9 and some alpha
Lamps:	#683, 5V @ 60 ma
Case:	Metal, Black Matte
Terminal Pins:	Nickel Plated Brass
Vibration Test:	2000 c/s per min.
Current Drain:	120 ma (min.)
Consumption	420 ma (max.)
Power:	0.6 watt (min.)
	2.1 watt (max.)
Weight:	15 Grams
Size:	.522" x 1.18" x 1.18"

Model	Description	One-99	100-999	1000 over
MS-4000B	Miniature Readout	6.45	4.80	3.85
SKT-4B	Socket (for above)	.48	.36	.29

QUANTITY PRICES UPON REQUEST

ELFIN® NEON INDICATORS

HAVE MANY ADVANTAGES



SINGLE PLANE . . . closely interlinked segments insure uniform clarity and easy readability.

BRIGHTER DISPLAY . . . the **ELFIN** design has a brighter neon glow, with no flashover from unlighted stacked filaments.

WIDER ANGLE VIEWING . . . ignited electrodes are all up front to provide widest viewing angle.

SMALLEST IN SIZE . . . only 0.453" in diameter resulting in a 4-digit display within a 2" space requirement. 1½" high.

NUMERIC AND OTHER CHARACTERS . . . same indicator used to display 0-9 numerals, + and − symbols, some alpha and a decimal point.

LONG OPERATION LIFE . . . **ELFIN** neon displays possess prolonged life span, thereby making them most reliable.

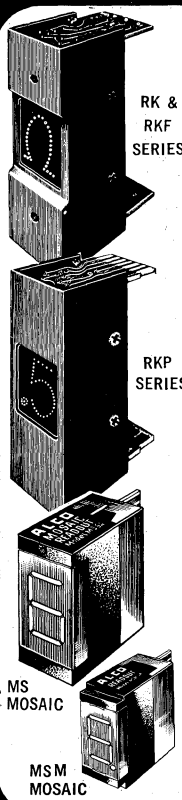
LOW POWER REQUIREMENT . . . exceptional low cathode current of 400 μa per segment makes it ideal for IC circuits.

ELFIN, the smallest of all neon readouts has been developed for equipment where space is a premium such as airplane displays, digital voltmeters, desk electronic calculators and other applications.

ELFIN consists of uniform cathode segments and a common anode mounted with a small glass envelope. Numeric and many other characters are formed by applying DC voltage to appropriate combination of cathode segments.

ELFIN characters appear as bright continuous neon glow easily read under high ambient light conditions.

Model	Description	One-99	100-999	1000 Over
MG-19	Subminiature Neon Indicator	4.95	3.75	2.99
		One-24	25-99	100 Over
MG-DL	ELFIN Mounted on P/C with Driver & Decoder	29.95	22.50	19.97



RK & RKF SERIES

RKP SERIES

MS MOSAIC

MSM MOSAIC

READOUT INDICATORS

RK Series — precision machined from 1-piece aluminum which also serves as a heat sink for the bulbs. Front and rear tapped holes for mounting on a panel or on RKA-2-8 brackets. The RK-FLV violet filter is available to reduce reflected lighting effects resulting in a better contrast.

Unique in-line design provides clear displays without focusing problems thereby allowing equally clear viewing from any angle. Compact size assures a neat fit in a limited space. Long life bulbs — 20,000 to 50,000 hrs. Engraved acrylic plates are of a non-yellowing quality are mounted in a tightly-packed stack and edge-lit.

RKP Series—plug-in readout indicators are designed for ease of use.

RKF Series—has a larger 1-piece aluminum body with 1" high numerals, along with 2 long-life bulbs per numeral for increased brightness.

SPECIFICATIONS

Numerals: 0 to 9 and a period
Numeral Size: .55" high (RK, RKP)
1.0" high (RKF)
Standard Voltages: 6, 14, 24 volts
Bulbs Used (T-1-¾): #2181 (6.3V), 2182 (14V), A-24 (24V)
Current Drain: 6.3V @ 200 ma., 14V @ 80 ma., 24V @ 50 ma. (RK, RKP)
6.3V @ 400 ma., 14V @ 160 ma., 24V @ 100 ma. (RKF)
Body Size: 2.56 x .78 x .83" (RK, RKP)
3.30 x 1.18 x 1.18" (RKF)
Bracket: Holds 2 to 8 readouts. (RK, RKP)

MS Series Mosaic — 0-9 and some alphabet is displayed through diode-matrix (not supplied). Decimal points used as colon. High illumination. Figures 25/32" high. 20,000 hr. bulb life. Body size: .827" w. x 1.73" h. x 1.69" d. Available 6 or 14V

MSM Series Mosaic (Miniature) — as above, except smaller. Lamps are 5v 60 ma. Body size: .433" w. x 1.15" h. x 1.18" d. Figures .472" high, 100,000 hr. bulb life.

Model	Volt	Description	One-99	100-999	1000 Over
RK-6	6.3	Edgelighted, Numeric	8.25	6.19	4.97
RK-14	14.0	Edgelighted, Numeric	8.25	6.19	4.97
RK-24	24.0	Edgelighted, Numeric	8.75	6.56	5.21
RK-6S	6.3	Edgelighted, Symbol	8.25	6.19	4.97
RK-14S	14.0	Edgelighted, Symbol	8.25	6.19	4.97
RK-24S	24.0	Edgelighted, Symbol	8.75	6.56	5.21
RKP-6	6.3	Edgelighted, Numeric	8.25	6.19	4.97
RKP-14	14.0	Edgelighted, Numeric	8.25	6.19	4.97
RKP-24	24.0	Edgelighted, Numeric	8.75	6.56	5.21
RKP-6S	6.3	Edgelighted, Symbol	8.25	6.19	4.97
RKP-14S	14.0	Edgelighted, Symbol	8.25	6.19	4.97
RKP-24S	24.0	Edgelighted, Symbol	8.75	6.56	5.21
RKF-6	6.3	Edgelighted, Numeric	15.75	11.80	9.48
RKF-14	14.0	Edgelighted, Numeric	15.75	11.80	9.48
RKF-24	24.0	Edgelighted, Numeric	16.60	12.45	9.97
RKF-6S	6.3	Edgelighted, Symbol	15.75	11.80	9.48
RKF-14S	14.0	Edgelighted, Symbol	15.75	11.80	9.48
RKF-24S	24.0	Edgelighted, Symbol	16.60	12.45	9.97
RKA-2-8	—	Bracket (RK, RKP)	1.65	1.24	.97
RK-FLV	—	Violet Filter (RK, RKP)	.40	.28	.20
RKF-FLV	—	Violet Filter (RKF)	.50	.35	.26
RK-SKT	—	Pr. Sockets (RKP, RKF)	1.65	1.24	.97
RK-SKT-C	—	Pr. Sockets w/cover (RKP, RKF)	2.45	1.85	1.48
MS-6A	6.3	Mosaic, Numeric	8.25	6.19	4.97
MS-6S	6.3	Mosaic, Plus — Minus	8.25	6.19	4.97
MS-14A	14.0	Mosaic, Numeric	8.25	6.19	4.97
MS-14S	14.0	Mosaic, Plus — Minus	8.25	6.19	4.97
MSM-5A	5.0	Mini Mosaic, Numeric	8.25	6.19	4.97
MSM-5S	5.0	Mini Mosaic, Plus — Minus	8.25	6.19	4.97
MS-MTX	—	49 Diode Matrix	12.45	9.35	7.47
MS-SK-R	—	Right Angle Socket (MS)	1.55	1.16	1.03
MS-SKT	—	Socket (MS)	1.15	.92	.82
MSM-SK	—	Socket (MSM)	.85	.68	.57
MS-FLV	—	Filter, violet	.40	.28	.20
MS-FLR	—	Filter, red	.40	.28	.20
MS-FLG	—	Filter, green	.40	.28	.20

Symbol indicators (+ − V Ω %) can be used with numeric readouts.

QUANTITY PRICES UPON REQUEST

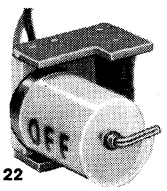
PROMPT SERVICE FROM LAWRENCE, MASS. — (617) 686-3887

ALCO®
ELECTRONIC PRODUCTS, INC.
MAILING ADDRESS: P.O. BOX 1348, LAWRENCE, MASSACHUSETTS 01842

ELECTROMAGNETIC INDICATORS

ALLARD INSTRUMENT CORP.

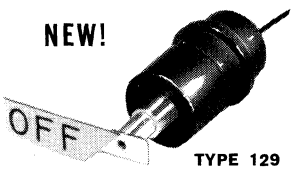
Designed for compact instrument and control panels, Allard miniature electromagnetic indicators provide positive visual signaling, are not subject to burnout, assure high readability in strong incident light. One-piece balanced rotor for dependable performance under shock and vibration. Models for momentary or latching operation, from DC or rectified AC. All models can be supplied to meet particular requirements for operating voltage, type of display and mounting, to commercial or MIL specifications.



Type 122

Tiny indicator with open structure. Mounting screw holes on bottom of block. 2 position only. May be illuminated through the translucent drum. Less than ½" along each axis.

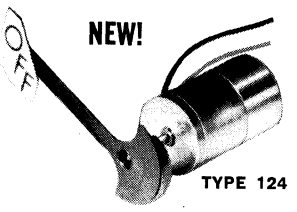
NEW!



TYPE 129

Shorter version of the Type 104 and just as powerful. For CW or CCW rotation using demountable flag arms. Rotational angles to 60°. Works in any position. 7/16" diam. x ¾" long.

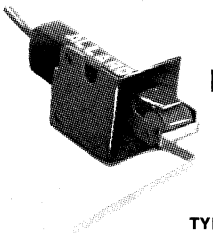
NEW!



TYPE 124

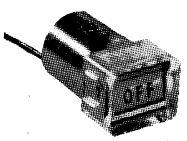
Miniaturized version of Type 104 with rotation up to 45°. Available with CW or CCW rotation. For use with plug-on (demountable) flags. Operates in any position. Case size — ⅜" O.D. x .575" long.

NEW!



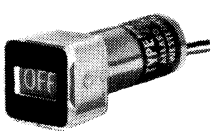
TYPE 219

Relatively inexpensive version of our old Type 101. Can display legends on the drum face or rotate a flag arm CW or CCW. Two position momentary or latching operation. Indicator drum is .300" wide x .300" diam. Total length is 1⅝".



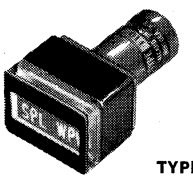
TYPE 120

Tiny broad faced indicator available in 2- or 3-position momentary or 2-position latching indication. Capped or sealed. Shows colors or legends. Head is 9/16" wide by 7/16" high. Body ½" dia. Overall length 15/16".



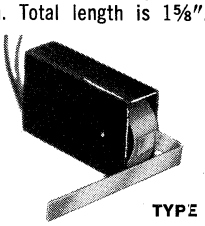
TYPE 108

Small indicator for 2- or 3-position momentary or 2 position latching (memory) indications. Plastic head can pipe external light to indicating face. Colors or legends as required. 1⅛" long, ⅜" dia., 7/16" square head.



TYPE 110

Extended face indicator, permits display of complete words or multiple symbols. For 2- or 3-position momentary, or 2-position latching indication. Plastic capped for dust and moisture protection, or hermetically sealed. Length 1¾", head 1" by ¾".



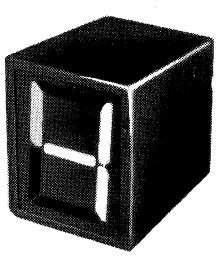
TYPE 109

Two or three position slim indicator for narrow locations. Can supply power to rotate a flag arm up to 60° or can display a legend directly on rotor face. CW or CCW for two position operation. .270" x .562" x 1".

Types	129	108	109	110	120	122	219	124
D.C. VOLTAGES	To 40	To 90	To 40	To 50	To 40	To 28	To 40	To 40
OPERATING POWER (WATTS)	0.9	1.0	1.0	0.5	0.5	0.5	0.9	1.0
NO. OF CONNECTIONS	2	2, 3	2, 3, 4	2, 3, 4	2, 3	2	2, 3, 4	2
WEIGHT (GRAMS)	10.5	10.6	9.	35	9.5	2.5	15	5

ELECTROMECHANICAL READOUTS

High Visibility!
Inherent Memory!



Other sizes available

Digital Type 202

Compact digital indicating modules for instrument, data presentation and other display systems. Seven electromagnetic indicating segments can be operated in any desired combination by low power DC signals. Momentary or latching types. Windings available from 1 to 30 V.. 1 15/16" h. by 1 7/16" w. by 2¼" d. Digit size 1½" h. by 1" w. Operating time less than 0.03 sec.

Type 1218

Complete readout display operating as remote repeater of cash register readings. Contains readouts, encoding matrices, pulsing and cycling circuitry and its own power supply. Use of latching (memory) type readouts makes average power consumption negligible. Packaged for all-weather, outdoor use. Uses 4 Type 218 readouts, 4" high.



Other sizes available

For literature or quotations on electromagnetic instruments and controls, call or write -

ALLARD INSTRUMENT CORP.

770 MAIN STREET, WESTBURY, L. I., N. Y. 11590 • (516) EDgewood 4-8742

Burroughs NIXIE® INDICATOR TUBES

Burroughs NIXIE® tubes remain industry's most popular display devices for every digital readout application because of their • high reliability (200,000 hrs. life) • high constant brightness (200 ft. lamberts) • best readability • lowest cost • compact size • rugged construction • availability of JAN types • special character tubes

MINIATURE SIZE

AIRBORNE AND MOBILE EQUIPMENT READOUTS
SMALL LIGHTWEIGHT INSTRUMENTS

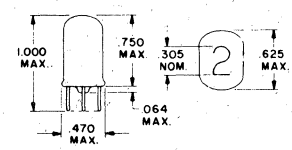


RECTANGULAR *

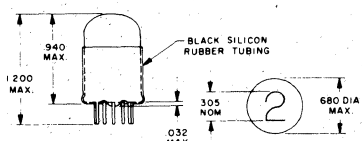


ROUND

Character Size ..... 0.3″
Viewing Distance ..... 14′



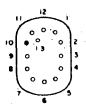
Type B4998



Type 7977

OUTLINE DRAWINGS

PIN CONNECTIONS

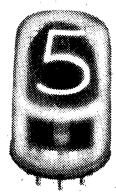


Bottom

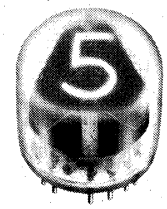
PIN NO.	NUMERAL RECT.	ROUND	PIN NO.	NUMERAL RECT.	ROUND
1—	2	1	8—	8	8
2—	3	2	9—	9	9
3—	4	3	10—	0	0
4—	5	4	11—	Anode	
5—	6	5	12—	1	
6—	IC	6	13—	IC	
7—	7	7			

STANDARD SIZE

DESK TOP DISPLAYS AND BENCH TEST EQUIPMENT

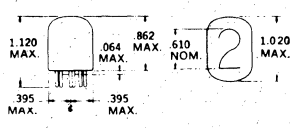


RECTANGULAR *

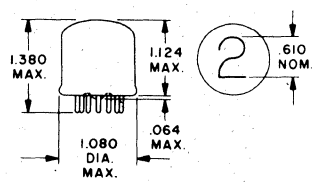


ROUND

Character Size ..... 0.6″
Viewing Distance ..... 30′



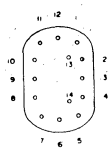
Type 8422



Type 8421

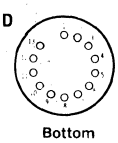
OUTLINE DRAWINGS

PIN CONNECTIONS



Bottom

PIN NO.	NUMERAL RECT.	ROUND	PIN NO.	NUMERAL RECT.	ROUND
1—	Anode	IC	8—	4	IC
2—	0	Anode	9—	3	5
3—	9	0	10—	2	4
4—	8	9	11—	1	3
5—	7	8	12—	IC	2
6—	6	7	13—	IC	1
7—	5	6	14—	IC	



Bottom

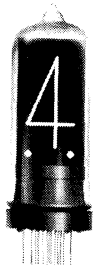
ELECTRICAL DATA (Note 1)	MINIATURE (Notes 2 & 3)		ELECTRICAL DATA (Note 1)	STANDARD (Notes 2 & 3)	
	B4998* Long Life Rectangular	7977 (B4032) Long Life		8422 (B5991)* Long Life Rectangular	8421 (B5092) Long Life Wide Angle
Absolute Ratings Ionization Voltage (Max)	170 Vdc	170 Vdc	**Absolute Ratings** Ionization Voltage (Max)	170 Vdc	170 Vdc
Supply Voltage (Min)	170 Vdc	170 Vdc	Supply Voltage (Min)	170 Vdc	170 Vdc
Cathode Current (Peak)	2.5 ma	2.0 ma	Cathode Current (Peak)	3.5 ma	3.5 ma
Test Conditions			**Test Conditions**		
Supply Voltage	170 Vdc	170 Vdc	Supply Voltage	170 Vdc	170 Vdc
Series Resistor	15K	15K	Series Resistor	8.2K	10K
Cathode Current: (Min) (Max)	1.0 ma 2.0 ma	0.7 ma 1.4 ma	Cathode Current: (Min) (Max)	1.5 ma 3.0 ma	1.5 ma 3.0 ma
Sockets: Standard Wiring Printed Circuit	SK176 SK178	SK116A SK118A	Sockets: Standard Wiring Printed Circuit	SK169 SK144	SK112 SK130

*Preferred type (for long life, readability and size).

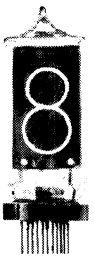
NOTES

1. The minimum supply voltage should be +170 Vdc, however, the use of the highest voltage available with an appropriate series resistor is recommended to provide: 1) greater tolerance of B+ & Rp; 2) more uniform brightness; 3) more constant current operation; 4) improved operation with temperature and 5) improved life.
2. Special NIXIE tubes such as regular life wide angle types and weldable or tin dipped flying lead types are also available.
3. Special character NIXIE tubes such as + and — tubes, tubes with alphabet characters, and symbols (μ, mV) are also available.

SIDE-VIEWING NIXIE TUBES



B-5750



B-5855

THE BWB SERIES BEZEL IS DESIGNED FOR USE WITH THE SIDE-VIEWING NIXIE TUBES



B-5441



B-5445



B-5441A

Character Size.....0.5"
Viewing Distance.....24'

Character Size.....0.6"
Viewing Distance.....30'

The B-5750 and B-5850 series NIXIE tubes are high quality, low cost, side viewing indicator tubes, which display the numerals 0-9 and either of two internal decimal points.

The B-5750 NIXIE tube draws less current than the B-5850 series and is designed for DC and strobed/Time sharing applications. Mounting centers of 0.540 center to center can be obtained with this tube.

The B-5855 NIXIE tube is designed specifically for strobed/time sharing applications. This tube features all glass construction, a lower seated height than the B-5750 series, and 0.520 center to center mounting.

The B-5859 NIXIE tube is the same as the B-5855 except it is designed for both DC and strobed/time sharing applications.

The B-5750 and B-5850 series NIXIE tubes are available in a short lead version for use with the SK-207 socket. To order the short lead tube suffix the tube designation number with an S (i.e.; B-5750S, B-5855S).

The B-5440 is a low cost, long life NIXIE tube which also features a narrow tube width for 0.80" center-to-center spacing and a short seated height for minimal instrument panel dimensions.

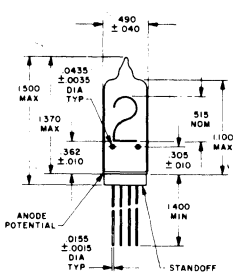
The B-5441 is identical to the B-5440 except it has two decimal points (right and left of the numeral) inside the tube which are independently operable.

A "+" "—" NIXIE tube is also available (B-5442).

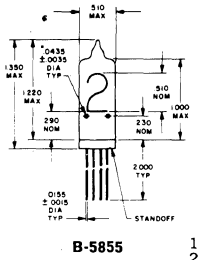
The B-5445 is identical to the B-5440 except it mounts upside down (stem up).

The B-5440A is identical to the B-5440 except it is stem tubulated and has a seated height of only 1.500" max. (tubulation is .064" max.). A "keep alive" is also available for consistently rapid ionization.

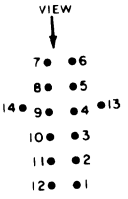
Bulletin 1104 & 1116 for details.



B-5750



B-5855

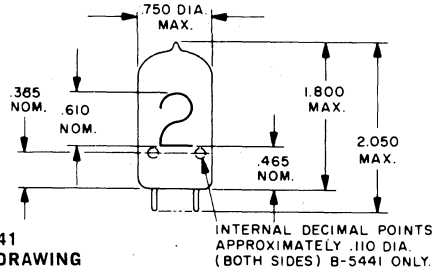


PIN CONNECTIONS

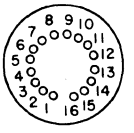
PIN NO.	ELEMENT	PIN NO.	ELEMENT
1	Numeral 1	8	Numeral 7
2	Numeral 2	9	Numeral 8
3	Numeral 3	10	Anode*
4	Numeral 4	11	Numeral 9
5	Numeral 5	12	Numeral 0
6	Numeral 6	13	Rt. Dec. Pt.
7	Anode	14	Lft. Dec. Pt.

*Pin 10 removed from B-5850 series.

OUTLINE DRAWING



B-5441
OUTLINE DRAWING



Bottom

PIN CONNECTIONS

PIN	ELEMENT
1	Anode
2	K1
3	K2
4	K9
5	K7
6	Left Dec. Pt.
7	K8
8	Int. Conn.
9	K3
10	K4
11	Right Dec. Pt.
12	K5
13	K6
14	K0
15	Int. Conn.
16	Int. Conn.

Absolute Ratings

	B-5750	B-5855	B-5859
Ionization Voltage	+170Vdc max	+170Vdc max.	+170Vdc max
Supply voltage	+170Vdc min	+180Vdc min.	+170Vdc min
Numeral Cathode Current	3.8ma max		
Peak Numeral Cathode Current	15ma max	17ma max	
Decimal Point Cathode Current	0.1ma to 0.3ma	note	0.1ma 0.5ma
Cathode Pre-bias	+60Vdc to +120Vdc		+6Vdc to +110Vdc
Anode Current			5.0ma max
Peak Anode Current			20ma max

Typical Operating Conditions

Supply voltage	+170Vdc	+200Vdc nom.	+170Vdc
Series Resistor	9.1K		10K
Anode Current	2.6ma typ		3.5ma typ
Decimal Point Current	0.2ma typ		0.35ma typ
Cathode Pre-bias Voltage	+60Vdc		+60Vdc
Peak Anode Current			14ma typ
Pulse Duration			100 sec
Duty Cycle			2msec

Test Conditions B-5855

Peak Anode Current	11ma peak
Pulse Duration	100 sec
Repetition Rate	600 cps

note: The decimal point must never be operated at a potential more negative than the one numeric cathode.

ELECTRICAL SPECIFICATIONS NOTE I

Absolute Ratings

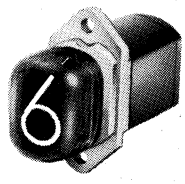
Ionization Voltage	170 Vdc max.
Supply Voltage	170 Vdc min.
Cathode Current	3.5 ma max.
Decimal Point Current (B-5441)	0.7 ma max.

Typical Operating Conditions

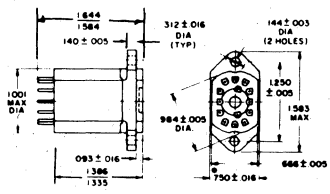
Supply Voltage	170 Vdc
Series Resistor	10 K ohm
Numeral Cathode Current (B-5440)	**2.5 ma (1.5 to 3.0 ma)**
Numeral Cathode Current (B-5441)	**2.5 ma (1.5 to 3.0 ma)**
Decimal Point Cathode Current (B-5441)	0.5 ma nom.

Burroughs

NIXIE TUBE DECODER/DRIVERS, DECADE COUNTING UNITS



BIP-8804 SERIES
FOLLOW APPLICATIONS
BIP-8806 SERIES
WITH MEMORY



* A DRAFT OF UP TO 0°30' PER SIDE INCREASING THE PACKAGE WIDTH AT THE PLUG END TO .775 MAX IS STANDARD

OUTLINE DRAWING

The BIP-8804 and BIP-8806 series integrated circuit decoder/drivers accept 4-line positive logic 8-4-2-1 BCD input from DTL and TTL circuitry, and provide decimal readout on integrally mounted NIXIE® tubes.

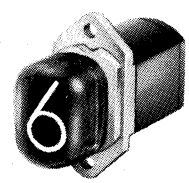
The BIP-8804 series modules are non-latching in that they require a continuously available BCD information input.

The BIP-8806 series modules have memory capability; they do not require a continuously available BCD information input.

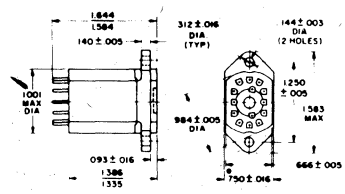
The BIP-8804-1 and BIP-8806-1 modules drive a standard rectangular "0-9" NIXIE tube type 8422 (B-5991). The BIP-8804-2 and BIP-8806-2 modules drive the B-59956 standard rectangular NIXIE tube "0-9 with a decimal point". The NIXIE tube is supplied as part of the module and prices include both the module and the tube.

ELECTRICAL SPECIFICATIONS

	BIP-8804	BIP-8806
Input Requirements	...4 line 8-4-2-1 BCD	...4 lines 8-4-2-1 BCD
Logic "0" (E_0)	.....—0.5V to +0.85V	.....—1.0V to +0.5V
Logic "1" (E_1)	.....2.0V to 6.0V	.....1.0V to 4.0V
Input Current		
Logic "0" present	.....1.5 mA max.	.....—20 A to +20 A
Logic "1" present	.....10 μA max.	..... 400 μA max.
Power Requirements		
Positive High Voltage	...+200 Vdc ±10V	.....200 Vdc ±10V
Positive Low Voltage	...5 Vdc ±0.25V	.....5Vdc ±0.25V
Current at 200V	.....2.3 mA typ. (BIP-8804-1)	.....2.3 mA typ. (BIP-8806-1)
	2.8 mA typ. (BIP-8804-2)	.....2.8 mA typ (BIP-8806-2)
Current at 5.0V	.....60 mA max.	.....90 mA typ.
Temperature		
Operating (free air)	.....0°C to +75°C	.....0°C to +75°C
Non-operating	.....—55°C to +125°C	....—55°C to +125°C



BIP-8820 UNIT
WITH BCD OUTPUT
BIP-8821 UNIT
WITH PRESET INPUT



* A DRAFT OF UP TO 0°30' PER SIDE INCREASING THE PACKAGE WIDTH AT THE PLUG END TO .775 MAX IS STANDARD

OUTLINE DRAWING

The BIP-8820 and BIP-8821 Modules are 20 MH_Z Decade Counters with NIXIE tube readout. A decimal point control line is provided for the decimal point located on the left side of the numerals in the B-59956 NIXIE tube when the decimal point model is required.

Memory and control circuits are not provided for the decimal point line.

Both decade counters are positive logic TTL compatible modules which change state during the negative going edge of the clock pulse. A master reset input is also available on the modules to reset the counter to zero.

The BIP-8820 provides 4 line, parallel BCD outputs of the count for use in external coincidence detection circuits and other logic. The BIP-8821 can be set to any predetermined number by 4-line parallel BCD inputs at the data input terminals when the strobe input goes to the low state. When the strobe is in the high state, the counter is unaffected by data on the input lines.

TABLE 1 GENERAL CHARACTERISTICS

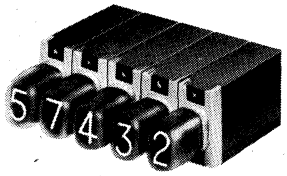
	Preset Input	BCD Output	Decimal Point
BIP-8820-1	.....No	.....Yes	.....No
BIP-8820-2	.....No	.....Yes	.....Yes
BIP-8821-1	.....Yes	.....No	.....No
BIP-8821-2	.....Yes	.....No	.....Yes

ABSOLUTE MAXIMUM RATINGS

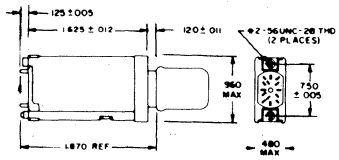
Rating	Value
High Voltage Supply	.....300V
V_{CCL} Low Voltage Supply	.....6V
Logic 1	.....6V
V_{IN} (Negative Logic 0	.....5.5V
I_{OFF} Decimal Output Current (off)	.....1.5mA
I_{ON} Decimal Output Current (on)	.....15mA
Output Current at Counter Output Terminals	.....±100mA
Operating Temperature Range	.....0 to 75°C
Storage Temperature Range	.....—20 to +125°C

POWER REQUIREMENTS

V_{CCH} High Voltage Supply .....190 to 210V (200V typ.)
V_{CCL} Low Voltage Supply .....4.75 to 5.25V (5V typ.)
I_{CCH} High Voltage Supply Current B-59956 ..2.8mA typ. (4.0mA Max.)
I_{CCH} High Voltage Supply Current B-5961 ..2.3mA typ. (3.5mA Max.)
I_{CCL} .....57mA Max.



BIP-9800 SERIES
DECODER/DRIVERS



OUTLINE DRAWING

The BIP-9800 series modules are miniature integrated circuit decoder/drivers intended for military mobile or airborne applications. They drive the B-4998 NIXIE tube which displays a 0.3" high number or character. The modules accept 4-line, positive logic 8-4-2-1 BCD input from DTL and TTL circuitry. The BIP-9801 modules are approximately .85 inches shorter than the BIP-9802 and BIP-9806 modules shown in the outline drawing.

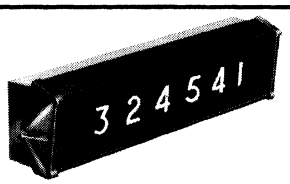
The modules feature the use of integrated circuits for decoding and driving, and are potted in anodized sheet aluminum enclosures which can be mounted on 0.5" centers. A tantalum decoupling capacitor is used to bypass 5V power supply transients while a 2% metal glaze anode resistor is used to optimize performance.

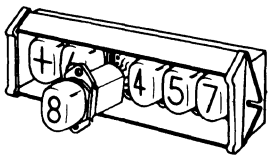
The individual characteristics of each module are described below. • BIP-9801-1 Miniature (4998) NIXIE tube decoder/driver • BIP-9801-2 Miniature +, — NIXIE tube decoder/driver • BIP-9802-1 Same electrically as BIP-9801-1 except features blanking, dimming and temperature range to +125°C • BIP-9806-1 Same as BIP-9802-1 except features memory.

ELECTRICAL SPECIFICATIONS

	BIP-9801-1 BIP-9801-2	BIP-9802-1	BIP-9806-1
Input Requirements	..4 line 8-4-2-1 BCD		
Logic "0" (Eo)	.....—0.5V to +0.8V	...—0.5V to +0.8V	...0 to +0.8V
Logic 1	.....+2.1V to +6.0V	....+2.1V to +6.0V	....+2.1V to +6.0V
Input Current			
Logic 0 present	..... —1.6mA max.	..—1.6mA @ .45V	—1.6mA @ .45V
Logic 1 present	..... 5 μA max.	....5 μA @ 4.0V	..5 μA @ 4.0V
Power Requirements			
Positive High Voltage.	+200Vdc ±10V		
Positive Low Voltage.	+5.0Vdv ±0.5V		
Current at +200Vdc	..1.5mA typ.	.....2.0mA typ.	....2.0mA typ.
Current at +5.0Vdc	.. 60mA max.	.....	.....135mA max.
Temperature			
Operating (Free Air)	.. —25°C to +100°C	.... —25°C to +100°C	
Non-operating	..... —55°C to +125°C	.... —55°C to +125°C	

NIXIE TUBE BEZELS, SPECIAL PURPOSE DISPLAY SYSTEMS, COMPLETE HYBRID CAPABILITY

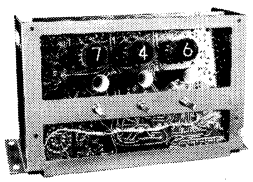




NIXIE tube bezel assemblies offer an efficient, attractive, and economical means of packaging NIXIE tubes, driver modules and sockets for multi-digit displays. The bezels enhance the appearance of equipment, provide optimum readability and save production labor as well as electrical and mechanical design time.

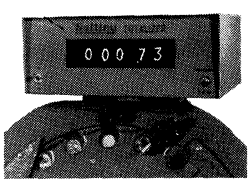
Assemblies are available for use with all size NIXIE tubes. They are available in various configurations which include complete packages with mounted driver modules, colons, decimal points and tubes, or partial assemblies with mounted sockets only. Amber Polaroid filters which provide maximum contrast and readability in high ambient light are standard with all assemblies. Special configurations can usually be supplied within several weeks at attractive prices. Request Bulletin 1137.

For the past ten years Burroughs has been building special purpose display systems to fulfill requirements of customers who wish to save design and development costs by using our highly-skilled experienced design group. Members of our engineering staff and a large production area are committed to the design, development and production of these systems. Listed below is a descriptive sampling of systems built for large equipment and systems manufacturers.



The electronic control and display unit shown is produced by Burroughs for Xerox Corporation for their 2400 copier/duplicator.

This compact Burroughs unit controls the number of copies being made and features a numerical display indicating both the number of copies made and the accumulated total. The unit stops the machine automatically when the proper number of copies has been made. Simultaneously, it computes the amount to be billed to the user on a sliding scale. The display portion of the unit incorporates Burroughs NIXIE indicator tubes, type B-5092.



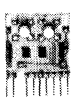
The Coin Totalizer System shown operates as an adjunct to the Sattley Coin Sorter/Counter to display total dollars and cents. The Sattley Coin Counter is an electromechanical device which separates any mix of change (pennies, nickels, dimes, quarters, and half dollars) and distributes them by denomination into separate bins. As the coins drop into these bins, a switch-closure pulse is generated on one of five input lines of the coin totalizer. The pulses are processed into an accumulator so that the total dollar value of the coins processed is continuously available. The time savings and reduction in errors provided by the totalizer are of obvious value to banks, toll collectors, vending machine operators and other groups who regularly handle large volumes of coins.



The Hexidecimal Display Unit, produced by Burroughs for the Foxboro Company, has the capability to display the numerals 0 through 9 and the letters A through F. This four place display utilizes B-5971 alphanumeric NIXIE tubes. The unit is used by the Foxboro Company on computer interface for a large scale process control system. The process is read out in four letter-number designations.

Each place in the display is supplied with five input logic lines: 8, 8, 4, 2, 1. This logic is decoded to drive the proper segments of the tube. The power supply is the only common connection between the four places of the display. A high voltage power supply for the NIXIE tube is incorporated in this self-contained unit. The Hexidecimal display unit is connected to the Foxboro system through a 36 contact receptacle and plug.

Burroughs maintains a modern, well equipped 5000 square foot engineering facility devoted exclusively to microcircuitry and staffed by engineers whose educational backgrounds include physics, electronic engineering, metallurgy, chemical engineering and mechanical engineering. These highly trained people represent more than 50 years of semiconductor and thick film experience. This facility is backed up by a 40,000 sq. ft. production facility and a 12,000 sq. ft. clean room. Circuits are available in both hermetic and non-hermetic package in all common configurations contain screened resistors and conductors, capacitors and discrete IC or MSI chips. They offer small size for maximum packaging density, low cost, IC compatibility, high power and high voltage capability.



HYBRID CAPABILITY

CONDUCTIVE INKS
Pd/Au, Pd/Ag, PT/Au

RESISTORS
Range of resistance .....5ohms to 5 megohms
Temperature Coefficient .....to ±50 ppm/°C
Tolerance .....to 0.5% trimmed, 15% as fired
Power Capability .....25W/in² (room temperature)
Temperature range .....−65° to +125°C

CAPACITORS
Attached chip ceramic capacitors are used, however capacitors can also be fabricated on the substrate to required specifications. Typical values range from 10 to 1000 pf.

ACTIVE DEVICES
Discrete Semiconductors, Transistors, Integrated Circuit Chips and MSI. Many active devices are stocked. Our semiconductor facility can produce custom devices when design requires it and design time is available.

SCREEN FABRICATION
In-House

SUBSTRATE SIZES
from .35 in. x .35 in. min. to 2 in. x 2 in. max.

SUBSTRATE MATERIAL
Alumina 96%

MOUNTING TECHNIQUES
Reflow solder machine attaches flat leads, round wire leads, chips, connectors, pins and special purpose formed leads.

ENCLOSURES
Polyurethane (conformed coating)
Flatpacks (hermetic)
Epoxy shells

ENVIRONMENTAL TEST CAPABILITY
Shock
Centrifuge
Temperature — High and Low
Altitude
Humidity — Steady state or programmed
Salt Spray

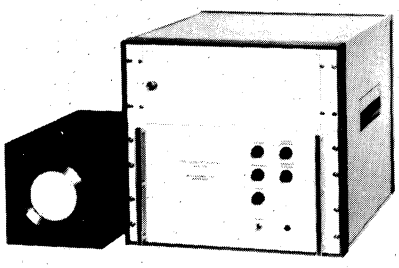
CIRCUIT PRODUCTION CAPABILITY
Prototype units in 4-6 weeks
Production units 6-9 weeks
Total production capability 100,000 circuits per week.

FURNACES
3 in., 5 in., and 12 in. furnaces available

BONDERS
Multiple thermocompression, ball bonders and ultrasonic bonders are used for wire attachment.

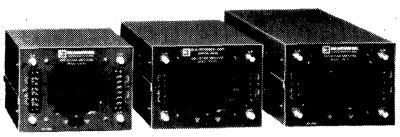
PRECISION CRT DISPLAYS and DISPLAY SYSTEM MODULES

PRECISION X-Y CRT DISPLAYS FOR FILM RECORDING AND FILM READING



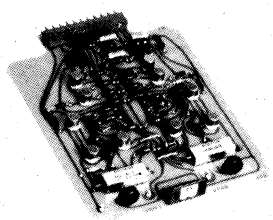
	PD900	PD1100	PD1200
CRT Diameter	5 inches	5 inches	5 inches
Resolvable Elements/Diameter	1700	2100	3400
Maximum Spot Size	0.0025	0.002	0.00125
Settling Time	10 usec	12 usec	20 usec
Small Signal Bandwidth	1 mhz	1 mhz	1 mhz

±35 VOLT DEFLECTION AMPLIFIERS



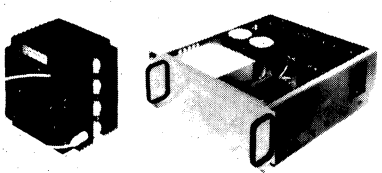
The models DA223, DA224 and DA225 are dc-coupled, all-silicon, solid-state modular packages capable of supplying up to ±2.0, ±4.0 and ±6.0 amperes of deflection current respectively to each axis of a directly-coupled deflection yoke. A unique method of damping optimizes the amplifier for the particular yoke being used by means of an adjustable potentiometer. The amplifiers also feature extremely fast settling time and high bandwidth. The user has the choice of operating the amplifiers Class A for achieving nonlinearities of ±0.02% maximum or Class AB for minimum power consumption.

MODULAR CRT BUILDING BLOCK COMPONENTS



Individual, compatible plug-in circuits such as: DF2050 Dynamic Focus Generator; DF347 Dynamic Focus Amplifier; LC1784/1785 Precision Linearity Correction Circuit; LC916/918 Linearity Correction Circuit; VA2076 Video Amplifier (10 mhz); VA2075 Gamma-Corrected Video Amplifier (10 mhz); VA2077 Video Amplifier (30 mhz); SG1190 Sawtooth Generator; PP529 Phosphor Protection Circuit; DA341 Deflection Amplifier (±200 ma); DA1340 Deflection Amplifier (±0.75 amperes); EDA800 Electrostatic Deflection Amplifier (350 volts plate-to-plate positive or negative); EDA1504 Electrostatic Deflection Amplifier (500 volts plate-to-plate positive or negative); FR1882 Static Focus Regulator; BA1714 Blanking Amplifier. All Beta circuitry features silicon semiconductors and temperature stable metal-film resistors throughout.

HIGH & LOW VOLTAGE CRT POWER SUPPLIES



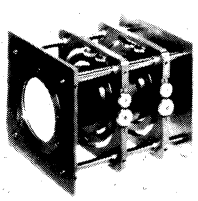
SERIES HV provides regulated high voltage outputs for CRT electrodes — anode, focus grid, G2 and filament.

Model No.	Anode Output Range
HV8	1-8 kv
HV20	5-20 kv
HV30	15-30 kv

SERIES PAK provides regulated low voltage outputs for Beta modules — ±35 volts, ± 20 volts, G1 and filament.

Model No.	±35 volt (deflection) Output
PAK7	7 amperes
PAK16	16 amperes

PRECISION TUBE AND COIL MOUNTS



Flexible combinations of standard assemblies for the precision mounting and alignment of CRT's, yokes and coils: CRTM Basic CRT Mount includes removable bezel, rods and neck end clamps; DSTM Dual Gun Recording Storage Tube Mount, includes rods and neck clamps both ends; MCM Micropositioner Coil Mount allows 6 independent motions and positive lock; FYM Fixed Yoke Mount for application where micropositioning is not required; FYMS Fixed Yoke Mount for servo-type mounted yokes; CCM Centering and/or Alignment Coil Mount; MS983 Magnetic Shield Enclosure.

Beta Instrument Corp. 377 ELLIOT ST., NEWTON UPPER FALLS MASSACHUSETTS / TEL. 617 • 969-6510

DiGiCATOR®

the wholly integrated, complete line of

Numeric Readouts and Decoder/Drivers

7 SEGMENT DISPLAY READOUTS

- Compact Design
- Incandescent Lighted
- Replaceable Lamps
- Wide-angle Viewing
- High Brightness
- High Contrast
- Low Voltage
- Low Current
- Long-life Lamps
- Light Weight
- Character Heights 5/16" to 1"
- Immediate Delivery

BCD TO 7 LINE DECODER DRIVERS

- Advanced Technology
- Drive Capacity up to 15 v / 80 ma per lamp
- High Reliability
- Compact Size
- Lamp Supply Separate From Logic Supply Circuit
- Lamp Voltage Adjustable Without Affecting Decoder Logic
- Wide Selection
- Compatible With All TTL, DTL, and RTL Integrated Logic Systems
- Special Units Available for Interfacing With Other Types of Logic
- Immediate Delivery

Including the new DiGiCATOR® "Save-Mates"

SAVE SPACE – SAVE TIME – SAVE COST

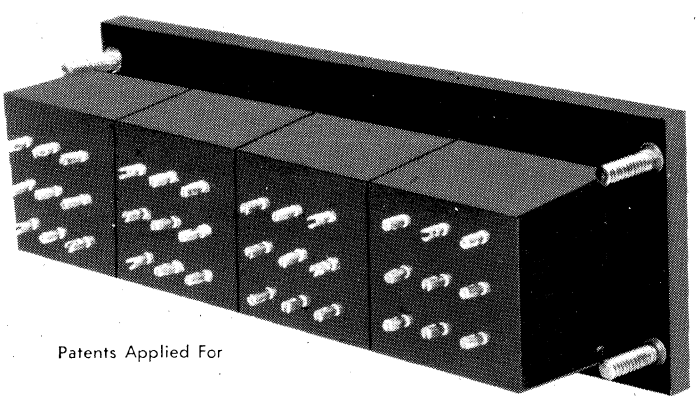


THINLINE READOUT SERIES 20
MOUNTS FROM THE FRONT—ONLY ¼" PROFILE

Character height 1 inch • Wide-angle readability to 35 feet • High brightness in combination with exceptional lamp life. 5 or 12 volt lamps • Delivered as a complete assembly to your specifications, including integral bezel, screen, mounting studs — and lamps!

AND THE ULTRA-COMPACT
MODEL 5720 DECODER/DRIVER

Plug-in package mates with the Series 20 Readout • Monolithic IC unit has integral high-current lamp drivers • Compatible with all TTL, DTL, and RTL logic systems • Lamp supply circuit separate from logic supply • Eliminates all but logic and power supply connections!



Patents Applied For

SIMPLE TO SPECIFY • SIMPLE TO PURCHASE • EASY TO DESIGN IN • EASY TO INSTALL • COMPETITIVELY PRICED

For the whole story on all available types, phone or write for our complete catalog.

DISCON CORPORATION

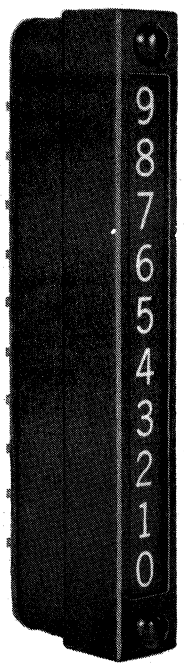
1150 NORTHWEST 70th STREET • FT. LAUDERDALE, FLORIDA 33309
PHONE: (AREA CODE 305) 933-4551

display devices

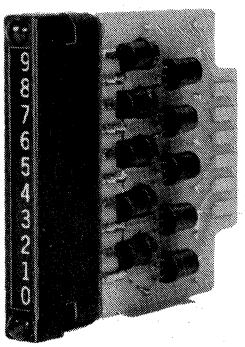
DIGISTRIP front relampable DIGITAL DISPLAYS

For a wide range of console and instrument display applications. Can be mounted horizontally or vertically, directly on p.c. boards, or ganged for high-density readout.

All Digistrip models are available with standard 0-9 legend, or with custom read-out information.



Digistrip II
3″ legend area.



Digistrip I with high-gain transistor drivers on integral printed circuit board.



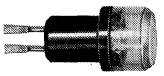
Digistrip I
1½″ legend area.

All illustrations are actual size

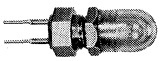
Write for detailed specification sheets

MINIATURE T-1 INDICATOR LIGHTS

Designed to provide the brightest light in the least space. Available off-the-shelf, or designed to your application.



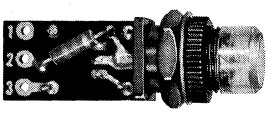
QUICK-LENS
Front-relampable miniature indicator light with built in light reflector for maximum brightness, even in high ambient light.



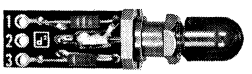
MINI-LENS
Front relampable, micro-miniature indicator light, featuring minimum panel spacing. Can be RFI shielded. Threaded body can mount directly to panel.



FLUSH-LENS
For panel mounting without protrusion. Available with RFI shield. Unit is relampable from rear of panel. No solder connections required.

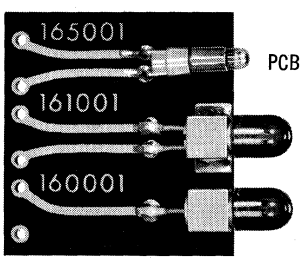


TRANS-LENS



TDML

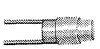
Each front relampable, with high-gain transistor driver on compact, integral p.c. board. Minimum depth behind panel. Both available in "bare board" configuration for customer to install own components. Trans-Lens is transistor-driven version of Quick-Lens; TDML is transistor-driven version of Mini-Lens.

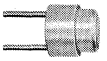


PCB LIGHT

P.C. BOARD INDICATORS

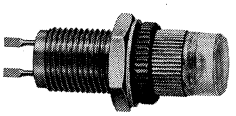
SINGLE-SIDED BOARDS
DOUBLE-SIDED BOARDS
} TEST LENS





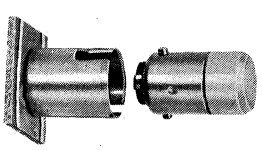
T-1 UNBASED | **T-1¾ BI-PIN**

Basic sockets for custom designed lamp holders or p.c. board mounting used as lighting chassis for back lighted display.



TWIST-LENS

Quick-change lens, available in clear or colors. Waterproof and RFI shielded units available. Uses T-1¾ Bi-Pin base lamp for high brightness.



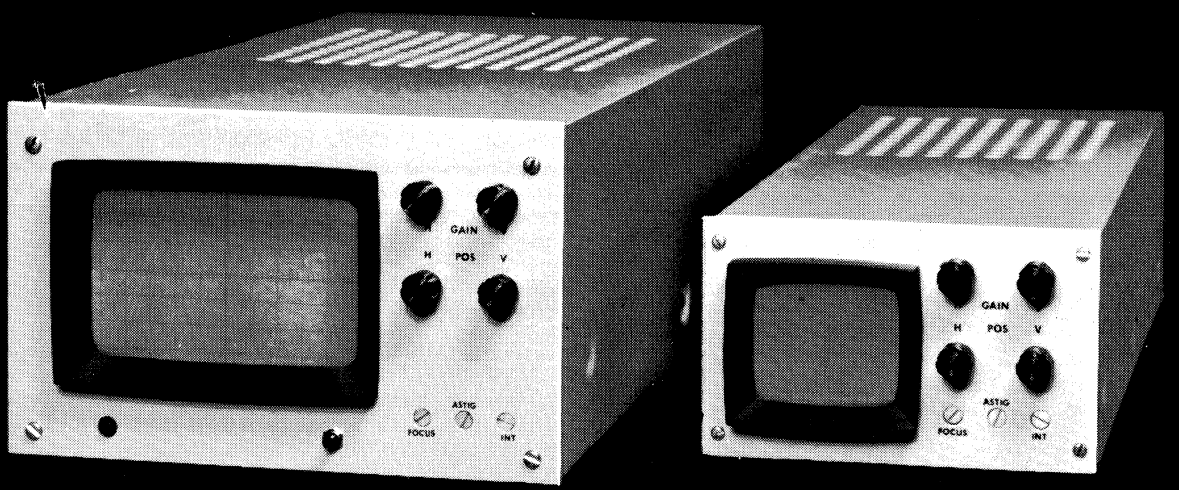
ADAPTER LENS AND SOCKET

Midget T-1¾ flanged base lamp adaptor used with T-3¼ printed circuit mounted socket. Furnished with or without integral color filter.

ALSO AVAILABLE: Custom back lighted panel assemblies and DF991 (Dead Front) legend screens.

d² display devices, inc
2928 nebraska avenue santa monica, california 90404
(213) 393-0385

CRT DISPLAY



Series 8620
Panel size: 5¼" x 8½"

Series 8600
Panel size: 3½" x 5¾"

- 66 standard models available.
- Design permits great latitude of special modifications.
- Front panel easily removable for custom installation.
- Available as X-Y indicator or with multi-range sweep.

OPTIONAL FEATURES

Screwdriver controls

DC-coupled Z axis

10 mv/div sensitivity

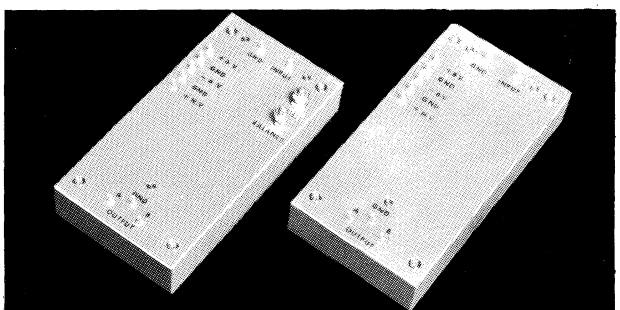
Multi-range sweeps — 11-position front panel selector switch (0.5 μs/div to 200 ms/div)

Multi-range input attenuators — front panel selector switch

Graticule illumination

SPECIFICATIONS

CRT	Type 8600 3" rectangular	Type 8620 5" rectangular
Screen size	4 x 5 cm	6 x 10 cm
Bandwidth, Y axis	1 MHz	2½ MHz
Bandwidth, X axis	1 MHz	1 MHz
Sensitivity	100 mv/div	100 mv/div



HYDRIVE AMPLIFIERS

High level, DC to 2.5 MHz
- **For CRT deflection**
- **For grey scale modulation**
- **For extending output capabilities of signal generators, IC's, etc.**

Size: 1" x 3" x 5¾". Four threaded inserts for mounting on your chassis.

Linear Hydrive Amplifiers

Model	Input (single ended)	Differential Output	Bandwidth	Operating Voltages Required
802	1 volt	60 volts p-p	2½ MHz	+6v, −6v, 40 to 60 vdc
803	1 volt	100 volts p-p	1½ MHz	+6v, −6v, 60 to 85 vdc
804	1 volt	150 volts p-p	1 MHz	+6v, −6v, 85 to 110 vdc
805	1 volt	200 volts p-p	½ MHz	+6v, −6v, 110 to 150 vdc

Switching Hydrive Amplifiers

Model	Input	Output	Tr & Tf	Operating Voltages Required
822	0/2 volt	0/30 volts	50 ns	+6v, −6v, 30 vdc
823	0/2 volt	0/60 volts	100 ns	+6v, −6v, 60 vdc

Price: $88 each.

Amplifiers can be built to meet special requirements. Inquiries invited.

INFODEX
INCORPORATED

7 Cherry Ave., Waterbury, Conn. 06702 Phone 203-754-4159

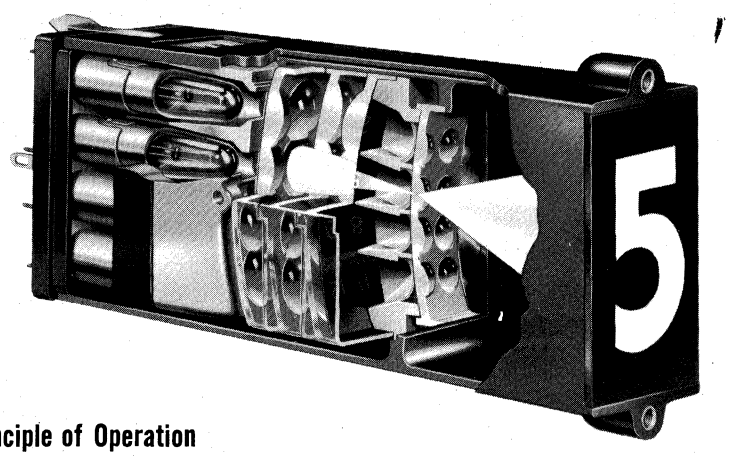
The world's broadest line of rear projection readouts

Industrial Electronic Engineers, Inc.

7720 Lemona Avenue, Van Nuys, Calif. 91405 • Phone (213) 787-0311 • TWX 910-495-1707

REAR PROJECTION READOUTS—MODELS TO MEET EVERY APPLICATION

- SINGLE-PLANE PRESENTATION for crispness, not visual "hash."
- BOLD, BRIGHT DISPLAYS for high readability at wide angles, long distances, in brightest light. (Character brightness up to 90 foot-lamberts.)
- FROM 11 TO 48 MESSAGE POSITIONS per readout. May be displayed individually or in combination.
- NO MOVING PARTS for unlimited unit life; easily replaceable lamps provide up to 100,000 hours of operation per lamp.
- LOW VOLTAGE OPERATION.



Principle of Operation

Cut-away of IEE Series 10 readout shows basic principles of IEE's patented rear-projection, single-plane operation. Photographic film containing individual messages is mounted in front of lamp assembly. As one or more of these lamps is lighted, the corresponding message is projected on the front viewing screen by a set of lenses. Because the presentation is entirely single-plane, only the message being displayed is visible; the other messages are totally invisible.

- INFINITE DISPLAY VERSATILITY. IEE readouts permit you to display anything that can be put on film:

NUMERALS AND LETTERS	POLARITY AND SYMBOLS	MODES AND WORDS	MULTIPLE WORDS AND NUMBERS	ANY SYMBOLS	COLORS WITH OR WITHOUT MESSAGES
A 3	+9.4	1 2 LOAD PRINT	VALVE PUMP 52 34 OPEN OFF	SINA Ω	STOP OK
		SERIES 345	SERIES 340	SERIES 120H	SERIES 220H	SERIES 880

Number of Message Areas	11		11		12			12			12	
Usable Projected Message Area	.38H x .34W		.38H x .34W		.62 Square			.62 Square			.62 Square	
Average Character Brightness at Rated Voltage	#C1 5 Volts	#C1 6 Volts	#1 5 Volts	#1 6 Volts	#328 6 Volts	#330 14 Volts	#327 28 Volts	#328 6 Volts	#330 14 Volts	#327 28 Volts	#718 5 Volts	#718 6 Volts
	30 F/L	60 F/L	30 F/L	60 F/L	100 F/L	35 F/L	25 F/L	100 F/L	35 F/L	25 F/L	30 F/L	60 F/L
IEE Rated Lamp Life	10,000 Hours	1,000 Hours	40,000 Hours	4,000 Hours	3,000 Hours	2,500 Hours	5,000 Hours	3,000 Hours	2,500 Hours	5,000 Hours	40,000 Hours	4,000 Hours
Rated Lamp Life at 30 Foot Lamberts	10,000 Hours	N/A	40,000 Hours	N/A	240,000 Hours	4,500 Hours	2,500 Hours	240,000 Hours	50,000 Hours	2,500 Hours	40,000 Hours	N/A
Standard Character Height Viewing Distance	.37 in. — 8 ft.		.37 in. — 8 ft.		.59 in. — 12 ft.			.59 in. — 12 ft.			.50 in. — 10 ft.	
Overall Dimensions	2.50 x .75 x .50		2.16 x .760 x .505		4.16 x 1.31 x .995			3.96 x 1.475 x 1.07			3.19 x 1.18 x .810	
Lamp Replacement Access	Front Panel		Front Panel		Rear Panel			Front Panel			Front Panel	
Method of Removing Unit from Panel	Pull Forward by Hand		Push In to Release Latch and Pull Forward		Rear Removable			Push In to Release Latch and Pull Forward			Release Positive Latch and Pull Forward	
Type of Lamp Recommended for Optimum Performance	Based T-⅞ #C1		Based T-⅞ #1		Based T-¾ #328			Based T-1¼ #328			Based T-1 #718	
Maximum Operating Ambient Temperature. 1 Lamp Cont.	85°C		85°C		85°C			85°C			85°C	
Method of Changing Film Reticle	Remove 2 Screws and Open Case		Remove 2 Screws and Open Case		Remove 2 Screws and Open Case			Remove 4 Screws and Open Case			Remove 2 Screws and Separator	
Unit Cost (1-9 Quantity) Consult Factory for Quantity Prices	$23.00		$39.50		$35.00			$36.00			$36.00	
IEE Lamp Replacement Costs	$.280 — .40 each		$.44 — .63 each		$.160 — .178 each			$.160 — .178 each			$.417 — .596 each	
Assembly Hardware Costs	1 Unit $3.00 each Over 2 — $1.50/Unit		$1.50 per unit		$1.50 per unit			$1.50 per unit			$6.00 Per Assembly*	

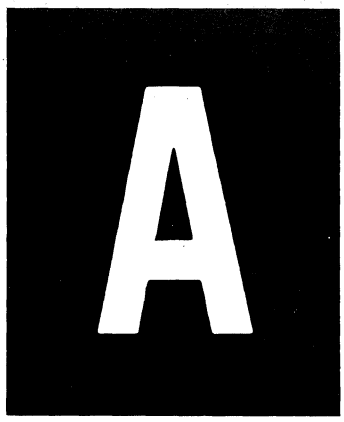
*Preliminary Pricing Subject to Change



SERIES 80



SERIES 360



BINA-VIEW®

ALL DRAWINGS SHOWN ACTUAL SIZE.



CUE-SWITCH®



SERIES 340



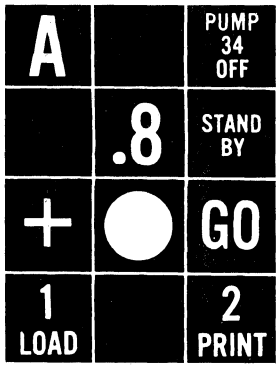
SERIES 120H



SERIES 220H

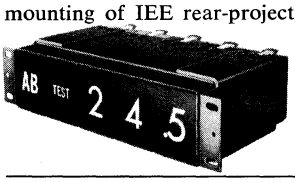


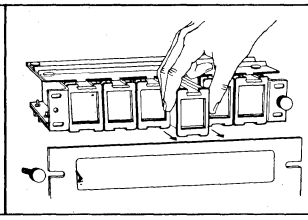
SERIES 10



STATUS INDICATOR

ASSEMBLIES — Various assemblies are available for in-line mounting of IEE rear-projection readouts. These are supplied with a continuous viewing screen and are stocked in widths to accept up to 8 readouts. Others available on order.





Front Panel Accessibility Most IEE Rear Projection Readouts are front panel plug-ins, providing easy accessibility. Most models have quick disconnect lamp assemblies which permit fast, easy lamp replacement.

IEE Subminiature Incandescent Lamps are available for all IEE Rear Projection Readouts. See page 1798.

*SERIES 865 *Option with Switch becomes 860		SERIES 10H			SERIES 160H		SERIES 360H			SERIES 80			Bina-View (see reverse side)			Status Indicator		
24		12			12		12			12			64 Maximum			12		
.62 Square		.94 Square			1.562H x 1.125W		2.0H x 1.5W			3.375H x 2.75W			1.38H x 1.25W			.43 Square		
#718 5 Volts	#718 6 Volts	#44 6.3 Volts	#1815 14 Volts	#1820 28 Volts	#238 Lamp 6.3 Volts	#44 Lamp 6.3 Volts	#238 6.3 Volts	#1815 14 Volts	#313 28 Volts	#1886 6.3 Volts	#1414 14 Volts	#1495 28 Volts	#1886 6.3 Volts	#1414 14 Volts	#1495 28 Volts	#47 6.3 Volts	#1815 14 Volts	#1820 28 Volts
20 F/L	38 F/L	75 F/L	60 F/L	32 F/L	45 F/L	24 F/L	60 F/L	20 F/L	25 F/L	45 F/L	35 F/L	19 F/L	85 F/L	80 F/L	40 F/L	200 F/L	220 F/L	140 F/L
40,000 Hours	4,000 Hours	3,000 Hours	3,000 Hours	1,000 Hours	2,000 Hours	3,000 Hours	2,000 Hours	3,000 Hours	5,000 Hours	3,000 Hours	500 Hours	500 Hours	3,000 Hours	500 Hours	500 Hours	3,000 Hours	3,000 Hours	1,000 Hours
N/A	9,200 Hours	90,000 Hours	45,000 Hours	N/A	8,000 Hours	N/A	24,000 Hours	N/A	N/A	12,000 Hours	900 Hours	N/A	135,000 Hours	17,500 Hours	15,000 Hours	30,000 Hours	30,000 Hours	10,000 Hours
.50 in. — 10 ft.		.94 in. — 20 ft.			1.50 in. — 30 ft.		2.00 in. — 40 ft.			3.37 in. — 70 ft.			1.37 in. — 38 ft.			.37 in. — 8 ft.		
3.095 x 1.39 x .900		5.50 x 2.625 x 1.562			7.00 x 2.69 x 1.56		7.80 x 3.935 x 2.00			12.12 x 5.30 x 3.29			6.25 x 3.30 x 3.22			2.62 x 2.415 x 1.935		
Front Panel		Rear Panel			Rear Panel		Rear Panel			Rear Panel			Rear Panel			Front Screen is Removable by Hand for Lamp Access		
Release Positive Latch and Pull Forward		Rear Removable			Rear Removable		Rear Removable			Rear Removable			Rear Removable			Front Removable by Hand		
Based T-1 #718		Bayonet Base T-3¼ #44			Bayonet Base T-3¼ #44		Bayonet Base T-3¼ #238			Bayonet Base T-4½ #1886			Based T-4¼ #1886			Bayonet Base T-3¼ #47		
85°C		70°C			70°C		70°C			70°C			70°C			85°C		
Remove 2 Screws and Open Case		Remove 4 Screws and Open Case			Not Changeable by Customer		Remove 4 Screws and Open Case			Remove 4 Screws and Open Case			No Film			Release Screen and Remove Display Grid		
$49.00		$20.00			$25.50		$38.50			$43.00			$130.50* *4 Bit 16 Character Model			$17.50 — $19.50		
$.596 each		$.10 — .16 each			#238 Lamp $.20 each	#44 Lamp $.10 each	$.20 each			$.20 each			$.20 — .26 each			Depending on Lamps		
$17.00 Per Assembly		$1.50 per unit			$1.50 per unit		$2.00 per unit			$2.50 per unit			No Charge for Maximum of 8 Units			$.10 — .30 each N/A		

The world's broadest line of rear projection readouts

Industrial Electronic Engineers, Inc.

7720 Lemona Avenue, Van Nuys, Calif. 91405 • Phone (213) 787-0311 • TWX 910-495-1707

Nimo™ Display Tubes

Discrete and 4-decade models available now.
6 decade model in development.

Single plane digital displays unsurpassed for brightness and clarity. Numbers, letters and words are projected onto a fluorescent screen from a 10-gun CRT. Sharp images easily viewed in direct sunlight. Exceptionally wide viewing angle. Extremely low power consumption. Small grid control swing. Available *now* in quantity in standard single decade and four decade models; a six decade Nimo™ is on the way.



Discrete



Four Decade



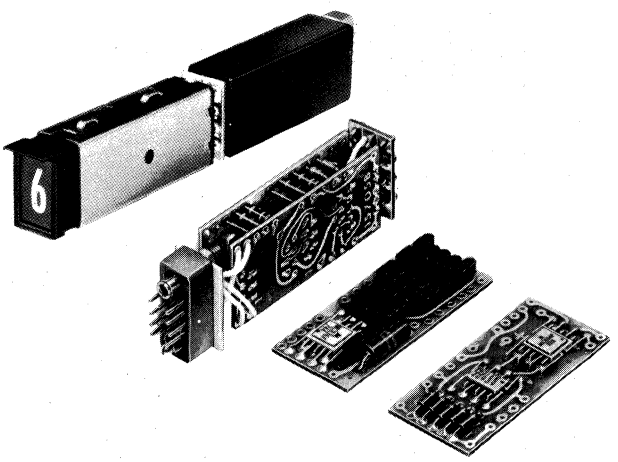
Six Decade

IC DRIVER/DECODERS

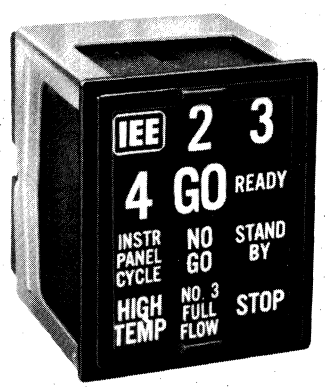
New, smaller IC models for converting binary to decimal

Small, compact units for driving incandescent lamps in rear projection readouts. Utilize the latest integrated circuit techniques. Fully compatible with modern integrated circuits. Can drive lamps up to 250 ma. and 28 volts DC. Require no reset function. Other features include internal data storage for pulsed operation, low power consumption (typically 600 mw), high noise immunity (1.0 volts), same logic voltage (Vee) as used with IC's, and high reliability.

All models incorporated forbidden code rejection which eliminates ambiguous displays. Standard 8-4-2-1 BCD code accepted, equivalent decimal output provided.

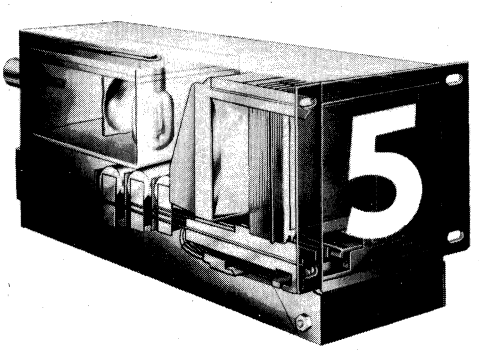


STATUS INDICATOR DISPLAY



Backlighted, simultaneous message indicator replaces 12 individual lights. Displays up to 12 messages in a single plane; individually, in any combination, or all 12 simultaneously. Installs vertically or horizontally; no external screws required. Operates with any T-3¼" bayonet-base lamp of 6 to 28 volts; straight decimal input; one lamp per message position.

BINA-VIEW®

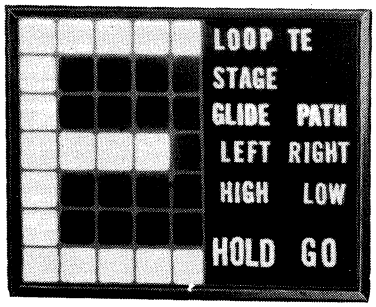


The Bina-View readout is a binary input (up to six bits), self-decoding readout. Decoding is entirely self-contained. Its 64-message capacity permits additional display of colors, symbols, words. Floating decimal points available. Provides automatic memory, retains the last message displayed after signal and set-pulse power have been removed. Contact closures can be provided.

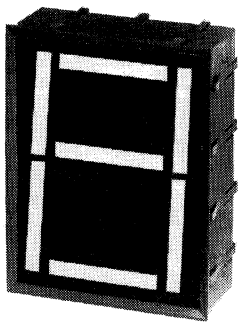
INFO-LITE

THE BUILDING BLOCK APPROACH TO

INFORMATION DISPLAYS • READOUTS • LIGHTED INDICATORS



NOW, a new modular approach to Lighted Information Displays that provides the design flexibility and attractive appearance usually associated with expensive custom units. INFO–LITE allows you to choose the Size, Shape, Color, Legend and Intensity combination that will meet your requirements · All INFO–LITE units are made from four basic light modules which have lighted area sizes of 3/8 x 3/8, 3/8 x 3/4, 3/8 x 1-1/8 and 3/8 x 1½ · Colored filters, special legends and masks are added as required · Light sources are standard, flange based T 1¾ lamps · INFO–LITE assemblies are easily panel mounted and may be removed from the front for rapid servicing. Solid state "Encode" & "Decode" driver modules can be supplied intergrally with INFO–LITE Displays.



FEATURES

- MODULAR CONSTRUCTION
- WIDE VARIETY OF STANDARD SERIES UNITS
- MANY COMBINATIONS AVAILABLE FOR SPECIAL DISPLAYS
- FREEDOM IN LEGEND, COLOR, SIZE, SHAPE AND INTENSITY SELECTION
- ATTRACTIVE CUSTOM BUILT APPEARANCE
- STANDARD LAMPS USED AND CAN BE SERVICED FROM FRONT
- SIMPLE, CLIP MOUNTING
- STANDARD 3/8" GRID CONSTRUCTION
- LOW COST







APPLICATIONS

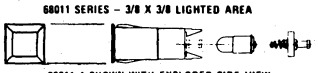
- ANNUNCIATOR PANELS
- NUMERIC & ALPHA/NUMERIC READOUTS
- SYSTEMS CONDITION INDICATORS
- DIGITAL INDICATORS (0-9 OR BCD)
- PATTERN/CODE DISPLAYS

Patent Pending

STANDARD INFO–LITE UNITS

INDICATOR LIGHTS

68011 SERIES – 3/8 X 3/8 LIGHTED AREA



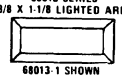
68011-1 SHOWN WITH EXPLODED SIDE VIEW

68012 SERIES
3/8 X 3/4 LIGHTED AREA



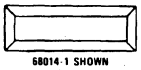
68012-1 SHOWN

68013 SERIES
3/8 X 1-1/8 LIGHTED AREA



68013-1 SHOWN

68014 SERIES
3/8 X 1½ LIGHTED AREA

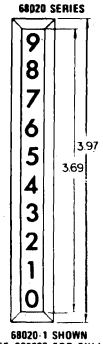


68014-1 SHOWN

SEE SHEET C68011 - 68014 FOR FULL SPECIFICATIONS

DIGITAL READOUTS

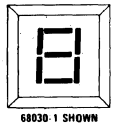
68020 SERIES



68020-1 SHOWN
SEE C68020 FOR FULL SPECIFICATIONS

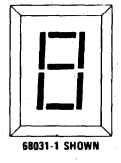
7-BAR NUMERIC READOUTS

68030 SERIES
.7" HIGH DIGITS



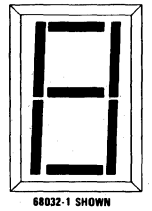
68030-1 SHOWN

68031 SERIES
1.0" HIGH DIGITS



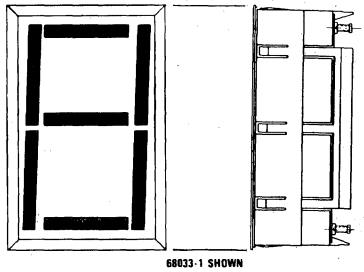
68031-1 SHOWN

68032 SERIES
2.0" HIGH DIGITS



68032-1 SHOWN

68033 SERIES - 2.7" HIGH DIGITS

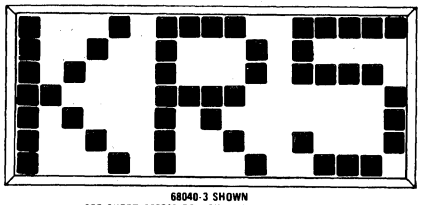


68033-1 SHOWN

SEE SHEET No. C68030 - 68033 FOR FULL SPECIFICATIONS

ALPHA/NUMERIC READOUTS

SERIES 68040 - 2.6" HIGH CHARACTERS



68040-3 SHOWN
SEE SHEET C68040 FOR FULL SPECIFICATIONS

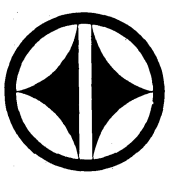
For more information on how INFO-LITE can meet your display requirements, call your area representative or contact:

INFO-LITE

THE INFORMATION DISPLAY DIVISION OF
CARTELLI TECHNOLOGY INC.
"LINKS BETWEEN MAN AND MACHINE"

45-12 108th Street, Corona, N.Y. 11368 · [212] 592-4700

Look in the Green Section for Products and their Manufacturers

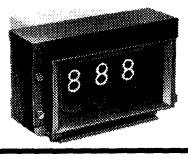


Tell them you found them in eem

INTEGRATED CIRCUIT ELECTRONICS, INC.

DECODE DISPLAY COUNT AND MEMORY MODULES AVAILABLE AS A COMPLETE ASSEMBLY FROM 2 - 10 DECADES INCLUDING DISPLAY TUBES, LOGIC MODULES, BEZEL, FILTER, HOUSING & INTERCONNECTING MOTHER BOARD.

NOW AVAILABLE FROM STOCK



$69.50* (100 Qty. Price)
*3 digit version shown units available from 2 - 10 decades

FEATURING: Plug in logic modules and tubes. BCD output from storage or counting stages. Decimal point standard in each decade. Dependable TTL Logic. Side view cold cathode display tube. All input/output on rear connector. Symbolic tube available with + − x y z ~ symbol. Optional high voltage one level logic. Compact attractive styling; no visible mounting screws.

Model C-103 Count/Display Assembly

INPUT REQUIREMENTS

Count Input (Count advances on transition from Logic 1 to Logic 0).
Width of input count Pulse ≥ 50NS

Rate 0 to 15 MHz

Logic 1 Requirements		Logic 0 Requirements	
Voltage (Maximum)	5.5 vdc	Voltage (Maximum)	0.8 vdc
(Minimum)	2.2 vdc		
(Recommended)	4.0 to 4.5 vdc	(Recommended)	0.4 vdc
Current (Nominal)	160 μa dc	Current (Nominal)	3.6 ma dc

Reset
Width of Input Pulse ≥ 50NS
Logic 0 applied allows counter to count. Logic 1 applied resets counter to 0.

Logic 1 Requirements		Logic 0 Requirements	
Voltage (Maximum)	5.5 vdc	Voltage (Maximum)	0.8 vdc
(Minimum)	2.2 vdc		
(Recommended)	4.0 to 4.5 vdc		
Current (Nominal)	80 μa dc	Current (Nominal)	1.8 ma dc

Carry
Common internal connection with the 8 weighted bit of the BCD output. Supply current is 200 μa at Logic 1. Sink current is 8 ma at Logic 0.
BCD Output

Logic 1		Logic 0	
Voltage (Maximum)	5.5 vdc	Voltage (Maximum)	0.6 vdc
(Minimum)	2.2 vdc		
Current: Supply	200 μa dc	Current: Sink	8.0 ma dc

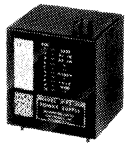
POWER REQUIREMENTS: Ebb, Ib, Vcc — Same as for D103
Icc — 49 ma (with Vcc = 5 v.d.c.)

Model CS-103 Count/Display with Memory Assembly

Same as C-103 except for the following terminal connections — 8 - key slot, 9 - hold* and ICC equals 79 ma.

- **Display Hold:** Logic "0" applied holds the count on the display readout tube while the input changes. Logic "1" updates the display.

DATECON MODEL PS-200



The DATECON Model PS-200 is specifically designed to power the Integrated Circuit line of Counter/Display and Decode/Display modules and assemblies. It provides an unregulated +200 volts DC at 50 milliamps for readout tubes and regulated +5.5 volts at 1 ampere for the circuit requirements. Sufficient current capability to drive 15 decades of decode/displays. This low cost compact unit measures only 3 9/16" x 3 1/16" x 4 3/8" and is protected against momentary short circuits and overload conditions. This unit is ideally suited when using DATECON displays as well as those of competitive manufacturers. $49.95. (Quantity — 1 to 9.)

Model D-103 Decode/Display Assembly

INPUT REQUIREMENTS

Logic "0" Voltage (Vcc = 4.75):
Maximum ..... .8 v.d.c.
Minimum ..... 0 v.d.c.
Recommended ..... .4 v.d.c.

Logic "0" Voltage (Vcc = 5.25):

BCD 1	3.2 ma (max.)
BCD 2	1.6 ma (max.)
BCD 4	1.6 ma (max.)
BCD 8	1.6 ma (max.)

Logic "1" Voltage (Vcc = 4.75):
Maximum ..... 5.5 v.d.c.
Minimum ..... 2.2 v.d.c.
Recommended ..... 4.4 to 5.5 v.d.c.

Logic "1" Currents (Vcc = 5.25):

	Vin = 2.4	Vin = 5.5
BCD 1	80 μa	1 ma
BCD 2	40 μa	1 ma
BCD 4	40 μa	1 ma
BCD 8	40 μa	1 ma

Decimal Point:
"Off" ..... 65 volts (nominal)
"On" ..... 0 volts (nominal)

Terminal Connections:

1—Ebb	6—Key Slot
2—No. Conn.	7—Vcc
3—Ground	8—BCD 8
4—BCD 4	9—BCD 1
5—BCD 2	10—Decimal point

MECHANICAL CHARACTERISTICS
Numeral height: .5 inches.
Connector: Amphenol 143-010-01 or equivalent.
Temperature:
Operating: 0° to 70°C.
Storage: −55° to +125°C.

POWER REQUIREMENTS
Ebb ..... 200 volts d.c.
Ib (nominal) ..... 2.25 ma
Vcc:
Maximum ..... 7.0 v.d.c.
Recommended ..... 5.0 v.d.c.
Icc ..... 19 ma (with Vcc = 5 v.d.c.)

Model DS-103 Display/Memory Assembly

INPUT REQUIREMENTS

Logic "0" Voltage (Vcc = 4.75):
Maximum ..... .8 v.d.c.
Minium ..... 0 v.d.c.

Logic "0" Currents (Vcc = 5.25):

BCD 1	3.2 ma (max.)
BCD 2	3.2 ma (max.)
BCD 4	3.2 ma (max.)
BCD 8	3.2 ma (max.)

Logic "1" Voltage (Vcc = 4.75):
Maximum ..... 5.5 v.d.c.
Minimum ..... 2.2 v.d.c.

Logic "1" Currents (Vcc = 5.25):

	Vin = 2.4	Vin = 5.5
BCD 1	80μa	1 ma
BCD 2	80 μa	1 ma
BCD 4	80 μa	1 ma
BCD 8	80 μa	1 ma

Decimal Point:
"Off" ..... 65 volts (nominal)
"On" ..... 0 volts (nominal)

Terminal Connections:

1—Ebb	6—BCD 1 output
2—BCD 8 output	7—Vcc
3—Ground	8—Key Slot
4—BCD 4 output	9—Display Hold
5—BCD 2 output	10—Decimal point when included
B—BCD 8 input	D—BCD 2 input
C—BCD 4 input	K—BCD 1 input

MECHANICAL CHARACTERISTICS
Connector: Amphenol 225-21021-101 or equivalent.
Weight: 75 grams.
Temperature: Same as for D-103.

POWER REQUIREMENTS
Ebb, Ib, Vcc, same as for D-103.
Icc .....49 ma (with Vcc = 5 v.d.c.)

Display Hold: Logic "0" applied holds the count on the display readout tube while the input changes. Logic "1" updates the display.

HOW TO ORDER BEZEL ASSEMBLIES

When modules are ordered for an assembly, the model number changes as follows: (A three in the last digit of the model number denotes an assembly.).

The number of decades desired is shown by a suffix after the model number, that is, for a 4-decade Decode/Display, the model number is D-103-4. If a special symbol is desired, its placement should be indicated.

To determine price—simply add the cost of modules with a 103 suffix to the cost of the Bezel Assembly. For example: To determine the price of 100 3 digit counters (CS-103's) with Bezel (300 decade total)—the price of each decade is $38.50 or $115.50 for the three decades, plus $12.00 for the Bezel Assembly—for a total price of $127.50.

Decade	1 - 24	25 - 49	50 - 99	100 - 499	500 - 999
2	$15.00	$13.50	$12.00	$10.50	$ 9.00
3	17.00	15.00	13.00	12.00	11.00
4	18.50	16.50	14.50	13.00	12.00
5	20.00	18.00	16.00	14.00	13.00
6	22.50	20.00	18.00	16.00	15.00
7	25.00	22.50	20.00	18.00	17.00
8	27.50	24.00	21.00	19.00	18.00
9	30.00	25.50	22.50	20.00	19.00
10	32.50	27.50	25.00	22.50	20.00

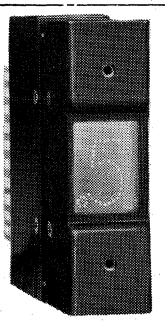
DISPLAY MODULE PRICES

DECODE/DISPLAY MODULES	QUANTITY 1-24	25-99	100-999
D-102 Decode/display module without tube	24.00	18.50	16.50
D-103 Decode/display module with tube (used for Assemblies)	27.50	21.50	19.50
COUNT/DISPLAY MODULES			
C-102 Count/display module without tube	37.00	31.50	30.50
C-103 Count/display module with tube (used for assemblies)	40.50	34.50	33.50
COUNTER/MEMORY MODULES			
CS-102 Counter/memory module without tube	47.00	41.50	35.50
CS-102 Counter/memory module with tube (used for Assemblies)	50.50	44.50	38.50
DISPLAY/MEMORY MODULES			
DS-102 Display/memory module without tube	36.50	29.50	25.50
DS-103 Display/memory module with tube (used for Assemblies)	40.00	32.50	28.50

NOTE: To these module prices add the cost of a bezel assembly shown at left.

INTEGRATED CIRCUIT ELECTRONICS, INC. • 237 RIVERVIEW AVE., NEWTON, MASS. 02154/(617) 891-4311

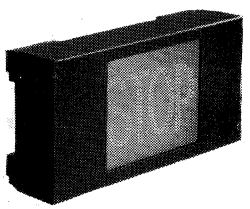
THE INTER-MARKET RANGE OF "KGM" READ-OUTS is available in many models with character height from ½" to 6". These readouts utilize incandescent lamps in voltages from 6 to 28 volts. Two types are available the first of which secures an image from engraved acrylic plates and the other is a 7-bar segmented type which permits the display of many letters in addition to all digits and a decimal point. **DECODER/DRIVES, BCD COUNTERS and DECODER/DRIVERS WITH MEMORY** are available which connect to the user's circuit using a standard connector.



FEATURES
- ...Maximum flexibility for special characters or symbols
- ...Easily mounted in multiple units
- ...May be mounted from front or rear
- ...Highly resistant to shock and vibration
- ...Low voltage operation
- ...Delivery from stock

PRICES: Readouts from $6.00 in 100 lots, Decoder/Drivers from $26.00 in 100 lots.

INTER-MARKET has a complete range of **KGM LEGEND DISPLAY INDICATORS** available for many applications such as elevator cabs, annunciators, vote recorders, drive-in check cashing units, television studio displays, visual recorders on scales, submarine and aeroplane status indicators, hymn indicators, mimic diagrams, etc. Each unit is tailored to the customers needs with no charge for special legends. Size varies in different models from 2⅞" x 1" to two large sizes 1½" x 12" and 4" x 6". Up to 48 messages can be secured from one **KGM LEGEND DISPLAY** in a variety of colors as required.



FEATURES
- ...Special messages can be supplied without engineering cost and changes can be made easily
- ...Operation on low voltage source
- ...Highly resistant to shock and vibration
- ...Front or rear mounting available
- ...Units available for dusty and explosive atmospheres
- ...Units available for high humidity and marine applications

PRICES: Prices depend on specification but range from $15.00 to $100.00 in 100 lots.

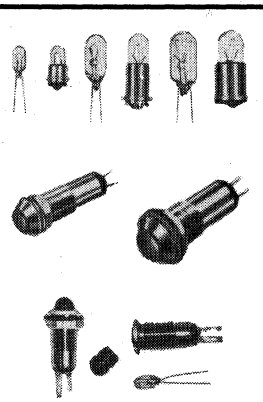
INTER-MARKET ● INCORPORATED

312 WAUKEGAN ROAD
GLENVIEW, ILLINOIS 60025
312/729-5330

- NUMERICAL READOUTS • THUMBWHEEL SWITCHES
- LEGEND DISPLAYS • SUBMINIATURE LAMPS
- INDICATOR LIGHTS

The **RODAN** series of **SUBMINIATURE LAMPS** includes a wide variety of T-1, T-1¼ and T-1¾ lamps with both flanged base and wire terminals to meet the requirements of many users such as manufacturers of instruments, indicators, office equipment, computers and aircraft equipment. In addition to standard subminiature lamps INTER-MARKET can work with you to design subminiature lamps for special purposes.

RODAN INDICATOR LIGHTS are available in three sizes with replaceable and non-replaceable plastic caps in white, yellow, green, blue and red colors.



FEATURES

Subminiature Lamps
...performance equal to or better than industry standards

Indicator Lights
- ...Quick delivery and low cost
- ...Durable machined metal housings
- ...Long life — 40,000 to 200,000 hours
- ...Solder terminals

PRICES

Subminiature Lamps				
T-1	Style (typical)	685	$45.50/100	10,000 lots
T-1¼	Style (typical)	628	29.50/100	10,000 lots
T-1¾	Style (typical)	327	17.40/100	10,000 lots
Indicator Lights				
BFA & BFK		40,000 hr	$34.00/100	10,000 lots
BFK		100,000 hr	48.00/100	10,000 lots

The **INTER-MARKET** range of **STOLEC PRINTED CIRCUIT THUMBWHEEL SWITCHES** are low cost units which have been specifically designed for applications where adverse environmental conditions are not usually met. They are available in 10, 12, 16, 20 and 24 position decimal outputs and 10 position BCD and BCD with complements versions. They are manufactured from high quality materials to insure long operational life. They extend the use of thumbwheel switches for many applications where MIL Spec switches are too expensive covering a wide variety of instrument and industrial control applications.



FEATURES

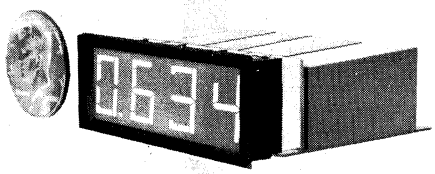
Standard and Miniature Sizes
Height: Standard 2.28 Width: 0.5" x no. of switches +0.5"
Miniature 1.125 0.50" x no. of switches +0.25"
See detailed specifications for tolerances
Life: 100,000 cycles minimum
Color: Black
Legend: White on black wheel
Current: 0.5 amp.
Voltage: 200 VDC or RMS
Insulation Resistance: 1000 megohms
Contact Resistance: 0.05 ohms
Stops: Stops to limit switch positions
Illumination: Available.

PRICES: (For lots of 100 Switches)

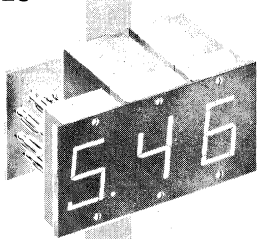
	Standard	Miniature
10 position decimal	$2.47 ea.	$3.60 ea.
10 position BCD	4.95 ea.	6.30 ea.
10 position BCD w/Comp.	5.94 ea.	9.00 ea.
End plates	1.00 pr.	1.00 pr.
Spacer	.75 ea.	.75 ea.
Assembly Hardware	.75 set	.75 set

THE MESA COMPANY, INC.

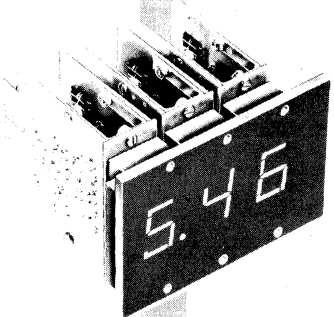
DIGITAL DISPLAY MODULES



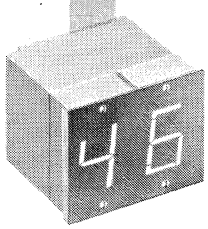
NQS SERIES



NQM SERIES



NQZ SERIES



NQT SERIES

- IN-PLANE, EASY-TO-READ NUMERALS
- 1″ AND .6″ HIGH CHARACTERS
- INPUT LEVELS COMPATIBLE WITH I.C. LOGIC
- NEON OR INCANDESCENT LAMPS
- BCD OR DECIMAL CODES

The NQ Series Digital Display modules employ numeric characters consisting of seven properly shaped segments which are illuminated by aged and selected high-brightness neon or incandescent lamps. The integral decoder-drivers translate 4 or 8 line BCD or 10 line decimal codes into the correct segment illumination.

The BCD decoders have a logical "one" level of 2.5v. and low signal current requirements, allowing them to be driven by I.C. or standard logic. All units are normally furnished mounted on a common panel in the exact configuration desired by the customer thus eliminating the need for bezels, brackets, filters, sockets, mounting hardware or additional assembly time. Decimal points, plus-minus signs, colons, etc. are optionally available.

Brief Specifications:
NQS . . . Available in three models; two 1″ high character and one .6″ high character. Employs I.C. decoder and discrete drivers for neon or incandescent lamps. Display faces, with or without lamps and decoder-drivers available. Economically priced at under $16.00 per decade in 1000 lots.

NQM . . . A miniature version available in 4 line, positive logic. 1.97″ high, 2″ deep and 1.06″ wide, 1″ high character. Sells for as little as $25. per decade in production quantities.

NQZ . . . 3″ High, 4″ deep, 1.25″ wide, 1″ high character. Available in positive or negative logic, special codes and fail-safe versions.

NQT . . . The "Two-fer" — A miniature version utilizing multiplexing techniques to achieve a two digit display driven by one decoder-driver. Priced as low as $19. per decade in production quantities, the NQTR measures 1.97″ high, 2″ deep and 2.250″ wide.

• SEE EEM YELLOW PAGES OR VSMF FOR LOCAL REPRESENTATIVES . . . 215-788-5521

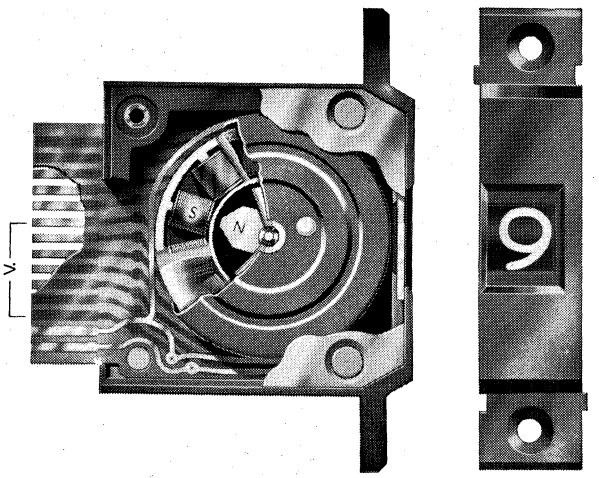
THE MESA COMPANY, INC. 216-220 MILL STREET BRISTOL, PENNA. 19007

Magneline® DIGITAL INDICATORS...

GENERAL PRINCIPLE:

MAGNELINE® Indicators operate by pulsed D.C. signals. A pulse through a coil creates a magnetic field and a permanent magnet, to which a numbered drum is attached, rotates to align itself with the field. The magnet and drum move silently, smoothly, and always by the most direct course. There is no stepping action or mechanical drive.

When the magnet is aligned with the field, it is held in position by attraction of the magnet to a pole piece in the coil. It will remain there, independent of any external light or power, until a different coil is pulsed. This is MAGNELINE's inherent memory; it means that data remains on display as long as needed without any use of external power.



All MAGNELINE® Indicators have inherent memory. They also have other extremely important features. They are easy to read in normal or brilliant ambient light, they may be mounted in a variety of ways to make best use of panel space, and they are very reliable. Of these, reliability is most important to the systems engineer. These indicators have no internal make or break contacts and the only moving part is the light weight magnet and drum assembly which rotates on a jewel bearing. MAGNELINE® test units have been run through 30 million cycles without failure or appreciable wear.

DIGIT SIZE:

MAGNELINE® digits or symbols are silk screened on a contrasting, dull finish background. They are as easy to read as the figures shown here.



16000 SERIES
9/16" high x 7/16" wide



15000 SERIES
9/32" high x 1/4" wide



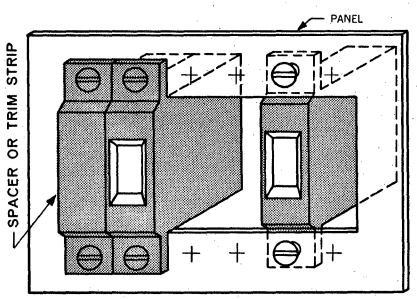
14000 SERIES
9/32" high x 1/4" wide



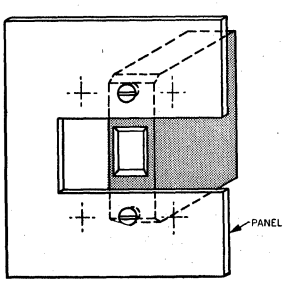
12000 SERIES
7/32" high x 11/64" wide

MOUNTING METHODS:

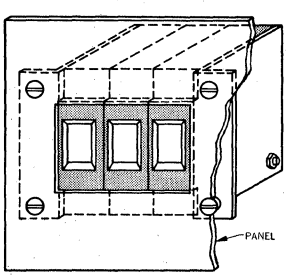
Front mount units form their own bezel. Rear or bracket mounts are used when vertical panel space is limited.



FRONT OR REAR MOUNT



REAR MOUNT



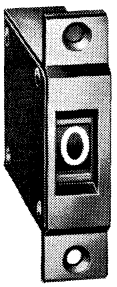
FOR FRONT OR REAR MOUNT

ORDERING INFORMATION:

For complete details and the name of our nearest representative, write to us at Waterbury. Better yet, call us at (203) 756-3636 or get in touch by TWX (710) 477-1219

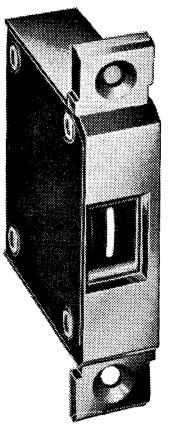
...THE INDICATORS WITH INHERENT MEMORY

Average physical and electrical characteristics:



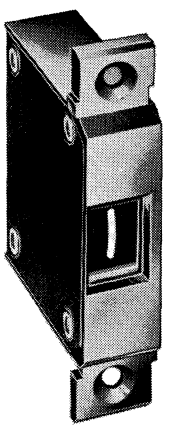
12000 SERIES

PANEL SPACE (per unit)	25/64" wide x 1 9/16" high (25/64" x 1" if bracket mounted)
NUMBER OF CHARACTERS	up to 10
NUMBER OF LEADS	5, plus a common and 2 light leads
WATTS	3
PULSE TIME	500 milliseconds (min.) 600 msec. (max.)
DUTY CYCLE	25% (pulsing same coil)



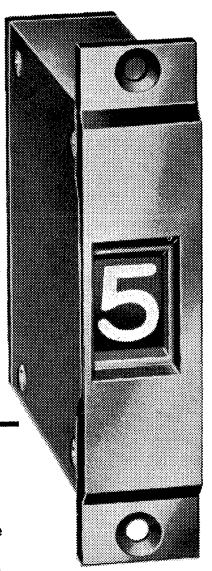
14000 SERIES

PANEL SPACE (per unit)	½" wide x 2¼" high (½" x 1½" without mounting ears)
NUMBER OF CHARACTERS	up to 11
NUMBER OF LEADS	11, plus a common and 2 light leads
WATTS	2 nominal, depending on voltage and duty cycle
PULSE TIME	500 milliseconds (min.) 600 msec. (max.)
DUTY CYCLE	50% (25% when pulsing same coil)



15000 SERIES

PANEL SPACE (per unit)	½" wide x 2¼" high (½" x 1½" without mounting ears)
NUMBER OF CHARACTERS	up to 10
NUMBER OF LEADS	5, plus a common and 2 light leads
WATTS	1.5 nominal, depending on voltage and duty cycle
PULSE TIME	500 milliseconds (min.) 600 msec. (max.)
DUTY CYCLE	50% (25% when pulsing same coil)



16000 SERIES

PANEL SPACE (per unit)	7/8" wide x 3¾" high (7/8" x 2 15/16" without mounting ears)
NUMBER OF CHARACTERS	up to 12
NUMBER OF LEADS	12, plus a common and 2 light leads
WATTS	4 nominal, depending on voltage and duty cycle
PULSE TIME	650 milliseconds (min.) 750 msec. (max.)
DUTY CYCLE	50% (25% if pulsing same coil)

Manufactured under one or more of the following U.S. Patents: 2,943,313, 3,009,140, 3,118,138, 3,201,785, 3,260,871. Other patents pending.

All MAGNELINE® Indicators are available in 6, 12, 24 or 28 volts (as specified) and the standard operating temperature range is from —20 deg. C to +71 deg. C., provision for wire leads. Options, at extra cost, include special voltage, special characters, trim-spacer strips, internal lighting, and dummy models with fixed digit or black window.

PATWIN®
DIVISION OF UNITED-CARR
UNITED-CARR INCORPORATED • A SUBSIDIARY OF TRW INC.
WATERBURY, CONNECTICUT 06720

Pinlite® / MINIATURE READOUT DEVICES AND ENCODERS

Pinlite® multi-filament lamps can be made in virtually any shape, making possible a very extensive range of applications. Acceptance for these lamps in various forms has rocketed forward since their development less than four years ago. Specific applications of these microminiature assemblies created the birth of the Midgi-Lite® and Alpha-Lite. Also, a line of drivers and encoders known as Midgi-Coder, compatible with Midgi-Lites, is now available. Models compatible with other Pinlite® multi-filament lamps are being developed.

MIDGI-LITE®. . . a microminiature, modular, multi-filament digital readout display. Each unit contains a complete digit . . . 4 models with height of characters from 3/16" to 1/2"

A 7-light-bar filament (each filament individually controlled within a single lamp), low voltage, direct reading lamp with terminations available as follows: standard microminiature connectors, or integral cabling.

FEATURES:

1. Excellent readability
   a) Light bars, (incandescent filament), are all on same plane, thus providing wide angle of viewing.
   b) Brightness, (up to 10,000 ft. lamberts), is adjustable to maintain proper brightness/contrast ratio under varying ambient conditions including sunlight.
   c) Proper stroke thickness maintained.
   d) The coiled tungsten helix of only a few thousandths of an inch diameter allows for sharpness of contrast for reading at both short and long distances, even under extreme variations of ambient light conditions.
2. Excellent volume/character height ratio
   a) The complete assembly is a 7-filament incandescent lamp — no waste space — no extra components or connections.
3. Small size
   a) 6 digits occupy as little as 7/32" x 1" of panel space.
4. Low Power
   a) Complete 7 bar segment from as low as 50 milliwatts.
   b) Larger sizes up to 1/2 Watt.
5. Reliability
   a) Life expectancy from 20,000 to 100,000 hours, depending on the model number.
6. Display speed
   a) Superior to all read-outs using incandescent lamps.
   b) As low as 10 milliseconds.

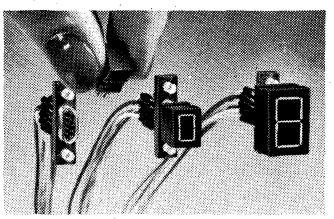


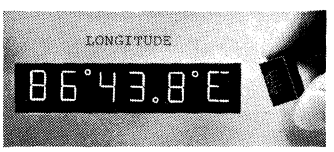
Photo shows 03-15 Midgi-Lite being plugged into a micro-miniature connector (our part No. CF-9H) and the comparative sizes of the 04-30 and 08-60 Midgi-Lites.

SPECIFICATIONS:

Model Numbers	03-15 03-15PM* 03-15DP**	04-30 04-30PM* 04-30DP**	06-40 06-40PM* 06-40DP**	08-60 08-60PM* 08-60DP**
Character Height (Inches)	3/16	1/4	3/8	1/2
Overall Dimensions (Inches)				
Height (a)	.280	.350	.460	.600
Width (b)‡	.200	.250	.300	.400
Depth (c)	.350	.350	.350	.350
Voltage	1.5	3.0	4.0	5.0
Current/Segment (Milliamps)	8	8	18	18
Life/Segment (Hours)	50,000	100,000	100,000	100,000
Availability	Stock	Stock	Stock	Stock

‡Widths for decimal points are as follows: .075" for models 03-15, 04-30; .100" for models 06-40 and 08-60. Height, depth, voltage and current remain the same as their digital counterparts.

*Plus/Minus
**Decimal Point



Model M6-30, new low cost, microminiature readout with character height of 5/16". Low power (8ma/segment at 3V) with long life of 100,000 hrs./segment. Can be plugged into connector or wired directly into printed circuit logic. Commercial unit, in large quantities, $12.95.

Prices from $40.00 each (quantities — 1 to 9, model 04-30). Write for our 1969 catalog for complete information and prices.

ALPHA-LITE . . . a microminiature, modular, multi-filament alpha-numeric readout display

Each unit is capable of displaying the entire alphabet and a complete digit in a space smaller than a 3/8" cube. Alpha-Lite is a direct reading, low voltage, 16-segment light-bar arrangement with shock and vibration characteristics that are ideal for aero-space applications.

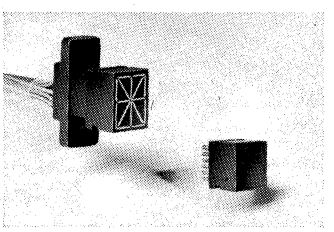
FEATURES

- Alpha-numeric (letters, digits, symbols)
- Miniature (world's smallest alpha-numeric)
- Long Life — in excess of 50,000 hours
- Wide Viewing Angle — light bars (incandescent filament) are all on same plane, thus providing wide viewing angle
- Modular — can be matched with Midgi-Lites of same height
- Contrast ratio excellent
- Brightness — variable, with high degree of readability even in sunshine
- Modular plug-in arrangement allows for mixed use with modular Midgi-Lites and plug-in Pinlites.

SPECIFICATIONS

	MODEL 43	MODEL 64
• Voltage	3.0	4.0
• Milliamps/seg.	8	16
• Character height	¼"	5/16"
• Overall dimensions		
height (a)	.375	.465
width (b)	.335	.375
depth (c)	.312	.312

Available from stock — new M series prices, from $64.00 (1-9 quantity).



The plug-in Model 64 Alpha-Lite shows all 16 segments lighted. Power is transmitted through the microminiature Alpha-Lite connector. The Model 43 Alpha-Lite with plug-in termination is shown at right.

MIDGI-CODER-LITE . . . 7 Segment Display with Integral Decoding

PINLITES INC., offers a major advancement in size reduction of digital readout systems. The basic MIDGI-LITE "M" Series is a seven segment, direct viewing incandescent tungsten filament (light bar) display. The use of tungsten filaments allows voltage control for brightness level. The light bars have a design life of 100,000 hours per segment, or 11 years of continuous data display.

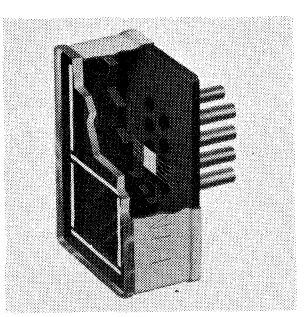
For decoding 8-4-2-1 BCD to seven segment presentation, a separate encoder package is normally required. With the introduction of the MIDGI-CODER-LITE, Model M6-1C, PINLITES INC. has eliminated the separate decoder package. All translation from 8-4-2-1 BCD code to seven segment display can now be done within the readout head; with a total combined depth of only 3/16".

UNIQUE DESIGN FEATURES:

1. The World's smallest decoder/display system.
2. Lowest power requirements: Combined decoder/display requires less than ½ watt.
3. Display head is a ceramic, metal, glass hermetic package designed for severe shock and vibration environments.
4. 250 Ft. Lambert brightness per segment.
5. 100,000 hour design ilfe on filaments.
6. Six of the Coder-Lites can be stacked in less than one square inch; digital character height is 3/16".
7. Military specification performance: MIL-E-5400 Class II.

Write or call Bruce A. Bundy, Sales Manager, for full details regarding input logic, function, coding, truth tables.

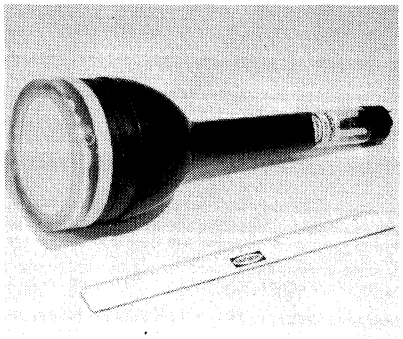
Price $51.00 in fifty quantities.



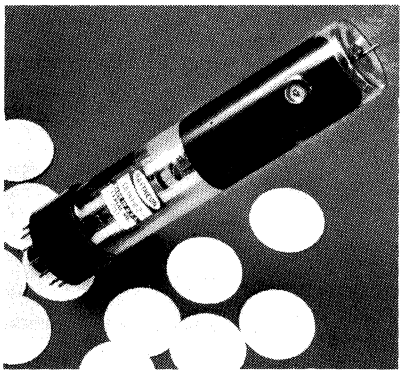
SEE OTHER LISTING FOR PINLITES' MICROMINIATURE INCANDESCENT LAMPS AND ASSEMBLIES

Pinlites Inc. 1275 BLOOMFIELD AVE., FAIRFIELD, N. J. 07006 • (201) 226-7724

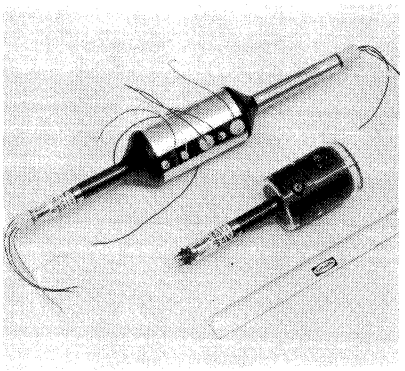
Data Display Devices from Raytheon



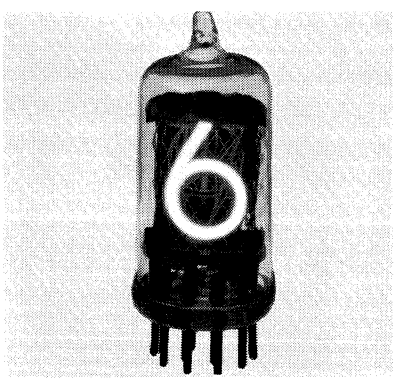
New Projectoray* CRT brings large-size displays with up to 1,000 line resolution, whether they're systems with TV type formats or any type of CRT display from radar to oscilloscope to alphanumerics. Projectoray offers high brightness, long life — lasting hundreds of hours — at 15 foot-lambert light on a 3′ x 4′ screen of unity gain. Projectoray uses a clear face-plate material that rapidly conducts heat **away** from the phosphor and an efficient heat exchanger. Refractive optical lens design allows variable throw distance for large or small theaters. **Write for Projectoray data sheets.**



Symbolray* Monoscope can generate almost any presentation you can think of — from ASCII to custom data displays and even hieroglyphics. We can meet your requirements with only an inexpensive change in target font design. A more economical method of generating displays than using circuit cards, Symbolray monoscopes cost less than $100 in quantities of 1,000. Only 2″ x 12″, Symbolray uses electrostatic deflection and focus. Full messages can be displayed when Symbolray method is used with buffer memory techniques. Monoscope is currently available with 64 and 96 character matrices. **Write for Bulletin SP-1178.**



Recording Storage Tubes. These two new designs utilize miniaturized guns and necks to provide high deflection and focus sensitivity, resulting in savings in coil and power supply weight and size. They provide Kiloline resolution, long storage, and fast erase capability. Raytheon's line of electrical-output storage tubes feature high resolution and nondestructive reading. Information can be written and stored by sequential techniques or by random-access writing. Complete, gradual, or selective erasure is possible. High output tubes using electron multiplier and completely packaged (magnetics and shielding cemented to tube) designs are available. **Write for Bulletin SP-1079B.**

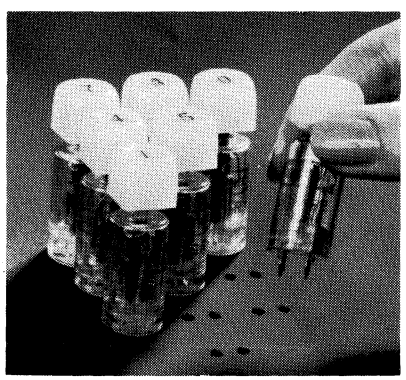


Datavue* Indicator Tubes — made in the U. S. A. — at lowest prices. For example: our CK 8754 costs less than $3.95 in 1,000 lot quantities.

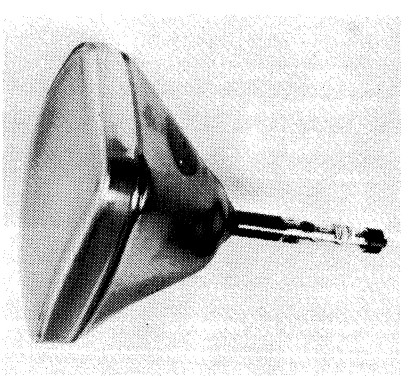
Raytheon offers a complete line of side- and end-view indicator tubes in a wide range of alphanumerics, decimals, and special characters. Turn-around service on all custom designs is fast and reliable.

All Datavue Indicator Tubes are EIA rated, produced for 200,000 hours of operation, highly dependable tubes with high brightness, in-line characters. **Write for Bulletin SP-1114.**

* Trademark of Raytheon Company



New Keyboard Switches — an original Raytheon design — are low cost yet extremely reliable. Just a feather-light (2½-oz.) touch activates the switch, which is designed for switching at logic levels. Life expectancy of the dry reed type is more than 10 million cycles. Bounce is less than 500 microseconds. Switches cost less than $1.00 in production quantities. **Write for data sheets.**



Dataray* Cathode Ray Tubes. Raytheon makes a wide range of CRTs — including special types — in screen sizes from 7″ to 24″. Electrostatic, magnetic, and combination deflection types are available for writing alphanumeric characters while raster scanning. All standard phosphors are available and specific design requirements can be met. **Write, describing your application, for data and assistance.**

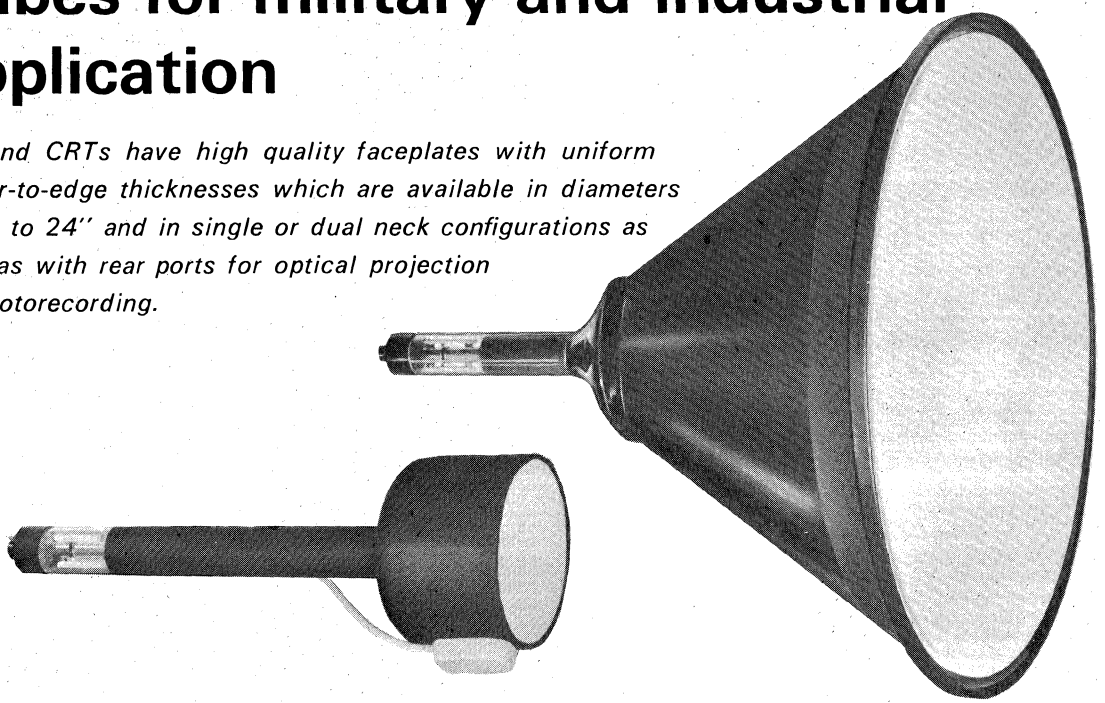
For data sheets, application notes, price information, call your Raytheon regional sales office. Or write: Raytheon Company, Industrial Components Operation, 465 Centre Street, Quincy, Massachusetts 02169.

RAYTHEON

Industrial Components Operation — A reliable source for Circuit Modules / Control Knobs / Display Devices / Filters / Hybrid Thick-Film Circuits / Industrial Tubes / Optoelectronic Devices / Panel Hardware

Rauland Precision Cathode Ray Tubes for military and industrial application

Rauland CRTs have high quality faceplates with uniform center-to-edge thicknesses which are available in diameters of 1" to 24" and in single or dual neck configurations as well as with rear ports for optical projection or photorecording.



REPRESENTATIVE RAULAND CRTs

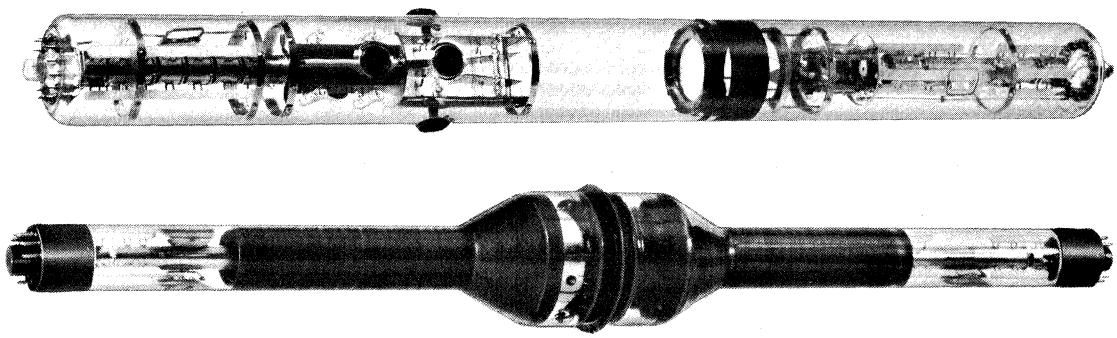
Applications include: Precision computer display for combined presentation of analog and alphanumeric information . . . light pen interactive displays . . . high definition monitors . . . bright avionic displays . . . flying spot scanner . . . photorecording . . . enroute air traffic control.

Other features include: deflection angles from 42° to 70° (other angles available on request) . . . electrostatic or magnetic character generation design variations . . . resolution up to 2500 TV lines . . . available in a wide variety of special phosphors . . . optional laminated safety panels for all designs . . . R.F.I. shielding, anti-reflective and other special coatings . . . ruggedized, low weight construction allows easy mounting.

Tube Description	Deflection Angle	Faceplate Diameter (Inches)	Overall Length (Inches)	Resolution (TV Lines)
7" Rear Projection R-6331	52°	7.000	13.635	545
16" Single Neck R-6308	52°	15.875	24.750	2500
16" Dual Neck R-6337	52°	15.875	25.687	1250
19" Single Neck R-6327	62°	18.625	23.375	945
22" Single Neck R-6301	53°	21.750	29.187	1250
22" Single Neck R-6310	62°	21.750	27.500	1500
22" Single Neck 22H	70°	21.750	23.875	945
24" Single Neck Rear Projection R-6323	55°	24.094	33.000	1000

ZENITH RADIO CORPORATION
the RAULAND division
5610 WEST JARVIS AVENUE • CHICAGO, ILLINOIS 60648
(312) 647-8000

Rauland Scan Converter Storage Tubes



Offering a variety of designs for industrial, scientific and military applications, Rauland Scan Converter Storage Tubes feature electron bombardment induced conductivity (EBIC) targets as well as both electrostatic and magnetic focusing/deflection. Resolutions to 1600 TV lines and frequency responses of some designs are in the nanosecond region.

Special features include:

Rauland R-6317 has storage time variable from seconds to minutes and is less than 17" long . . . Tube R-6297 is 13" long . . . Both R-6288 and R-6294A are ideal for demanding operational environments.

REPRESENTATIVE RAULAND SCAN CONVERTER STORAGE TUBES

Tube Description	Deflection	Application
R-6288	Write beam: distributed electrostatic element Read beam: electrostatic	Ultra fast single transient phenomena such as found in high speed chemistry and nuclear physics.
R-6294A	Write beam: electrostatic Read beam: electrostatic	Special applications requiring medium frequency range response.
R-6297	Write beam: magnetic Read beam: magnetic	Air borne and other space-limited environments.
R-6317	Write beam: magnetic Read beam: magnetic	Special purpose. High resolution.

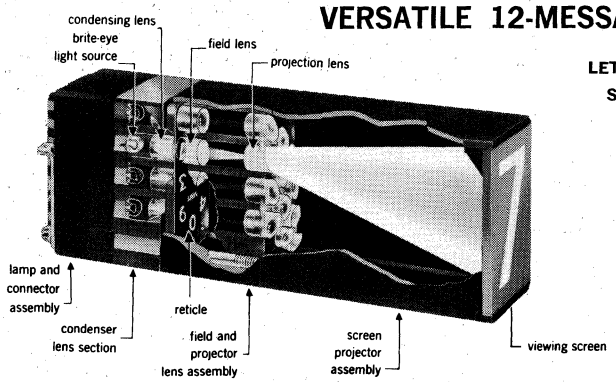
Rauland Image Intensifier Tubes

Rauland Image Intensifier Tubes are available with visible and near infrared spectral response. Other models are used for X-ray imaging in industrial and medical applications. Neutron and gamma-ray sensitive designs are also available.

For more information, contact:

ZENITH RADIO CORPORATION
the RAULAND division
5610 WEST JARVIS AVENUE • CHICAGO, ILLINOIS 60648
(312) 647-8000

shelly REAR PROJECTION READOUTS...



VERSATILE 12-MESSAGE READOUTS CONFORMING TO MIL-R-39027

(READOUTS: INCANDESCENT)

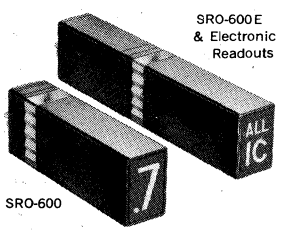
LETTERS, NUMERALS, SYMBOLS OR SIX-LINE MESSAGES TO IMAGE SIZE OF 0.700" HIGH. REMOVABLE FROM PANEL FRONT WITHOUT TOOLS.

Shelly projection-type readouts are precision, completely modular devices consisting of 12 parallel, miniature optical projectors which display 12 different filmed messages on a single-plane viewing screen. Any combination of characters or words can be projected from custom designed photographic film reticles. To create compound messages, up to six lamps may be energized simultaneously. Modular construction permits rapid "in field" change of lamps, color filters or film message reticles. To solve high density packaging problems, Shelly Readouts can include built-in solid-state lamp drivers, binary to visual decoders, or binary to visual decoders with memory. The simplicity of the Shelly Readout assures high reliability in environmental extremes. They meet all applicable requirements of MIL-R-39027.

EASY LAMP REPLACEMENT WITHOUT TOOLS!

MIX OR MATCH COMMON FEATURES

Front removable, plug-in modules * Electronic versions all Integrated Circuit (IC) * Image height 0.700" * 12 numeral, word or symbol messages * Lamp or reticle changes without tools * Intermix message colors * Vertical, horizontal or matrix mounting * Natural or blue Polacoat screens

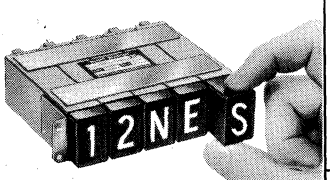


SRO-600E & Electronic Readouts

SRO-600

DECIMAL INPUT TO VISUAL DISPLAY — MODELS SRO-600 & SRO-600E

Advanced viewing screen and projector system design affords greater viewing area than conventional readouts . . . 10% larger images and 30% smaller housing. Both standard length SRO-600 and extra length SRO-600E, for use with electronic readouts, accept decimal input and provide 12 different visual displays . . . letters, numerals, symbols, characters or up to six line messages with excellent contrast. Standard based or unbased lamps are available from most sources, minimizing special stocking or procuring of lamps . . . available from 3 to 28 volts. RFI and weather-proof bezels, as well as finishing types, available from stock. Printed circuit connector mates with connector in housing for greater shock and vibration resistance than conventional types. Optional type available with "solder-on" terminals. Terminal arrangements: 24 common terminals or 12 lamp terminals and common or split common. Stainless steel individual housings are welded together providing wide mounting versatility and excellent rigidity. Aluminum housings available for applications where light weight is essential. Special tabs fabricated to customer requirements, as are spacing groups for clarification for message meanings. Lamp and film reticle replacement is easily accomplished without tools. Individual message colors available.

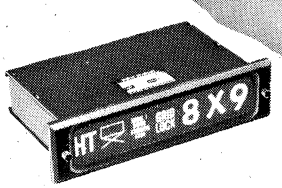


BINARY INPUT TO VISUAL DECIMAL DISPLAY — ALL IC — SERIES BDR-100 & BDR-100HV

Converts 8-4-2-1 binary input signals to visual decimal displays. All IC hex-inverter flat paks enable packaging entire module assembly into plug-in 1.12"H x 0.745"W x 5.17" long . . . only 1.67" longer than standard SRO-600 readout! Front panel removal feature offers fast, easy access to electronic circuitry, as well as lamps and reticles. Configurations accept and decode any one of the following: 10 binary signals to visual decimal display; 10 binary signals to visual decimal display, plus two additional direct wired displays; 12 binary signals to visual decimal display. Logic levels 0 to 0.8 volts "0" and greater than +2 volts for "1." BDR-100 uses 6-volt based type T-1 lamps; BDR-100HV accepts 10, 12, 18 or 28 volt T-1 based lamps. High performance and high reliability assured through all IC circuitry which incorporates all necessary drivers, gates and complementary function generators to decode 8-4-2-1 codes to visual decimal display. T^2L input logic compatible with DTL logic. Tolerance to wide temperature range . . . free air operation 0°C to +70°C; storage range −55°C to +85°C. Fully enclosed modular readouts provide excellent protection for lamps and electronic circuitry. Fast and easy access to module simplifies field inspection or lamp maintenance . . . without tools. Individual or multiple message colors.

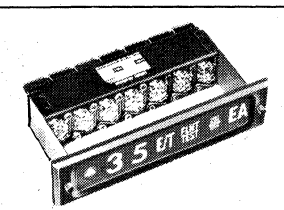
BINARY INPUT TO VISUAL DECIMAL DISPLAY WITH MEMORY — ALL IC — SERIES MBR-100 & MBR-100HV

Binary input to decimal display with memory for readout of binary input data normally too fast for high accuracy. Unit employs SRO-600 type precision 12 message readout projection system and lamp assembly module . . . also retains fast front removal feature. The all IC binary to decimal converter and compatible memory, contain all the drivers, gates and complementary function generators required to decode and store 10-digit or 12-digit binary input information. Unit accepts four line parallel binary coded decimal information and displays decimal messages upon application of an external +3 volt enable pulse of 2 μsec or more; this is due to DC coupling which responds to the whole pulse rather than the leading or trailing edge. Display will be held indefinitely, or until another enable pulse is applied. Display versatility increased through application of a constant 3 volt signal level which causes the readout to follow the input, similar to the BDR-100. Designed for use with 6 volt positive logic source, the "0" logic level requires 0 to +0.8 volts; "1" logic level greater than +2 volts. Floating commons permit using the decoder with negative logic. Configurations accept and decode any one of the following: 10 binary signals; 10 binary signals plus two additional direct wired displays; 12 binary signals



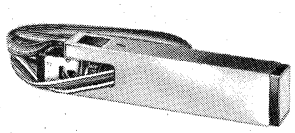
DRIVER AUGMENTED READOUT — SERIES DAR-100

Decimal inputs as low as 0.3 mA will produce crisp images up to 0.700" high with excellent contrast, when driven by 12 silicon planar epitaxial transistor lamp drivers. The readout is comprised of a precision 12 message readout of the SRO-600 type, plus individual lamp drivers for each optical system projector lamp. The DAR-100 is available in both standard 1.12"H x 0.745"W x 3.5" long modules, as well as the 5.17" long model, compatible with the electronic readouts contained in this "Mix or Match" group. The readout will project numerals, symbols or up to six line words . . . singly or in combination since each lamp is individually controlled. The entire display may be colored, or individual messages may be colored through use of color chips in the projection system. Lamps of the miniature long-life T-1- type are used, with ratings of 5 to 28 volts . . . based or unbased for simplified stocking or procuring. The readout incorporates a highly shock and vibration resistant printed circuit connector which is keyed for easy front panel installation or removal, as are the other plug-in modules in this grouping. Other similarities include high impact resistant housing and a choice of blue or white Polacoat screens . . . blue raises the white color display temperature approximately 800°K.



ECONOMY DECIMAL INPUT TO VISUAL DISPLAY — MODEL SRO-300

Economy rear projection readouts display images up to 0.700" high. Up to 12 readouts may be arranged in a single assembly employing a common viewing screen. This technique offers substantial cost savings over more costly individual modular housings and plug-in terminal/connector blocks. Readouts display 12 numerals, words or symbols . . . singly or in combination . . . black and white or in color. From one to twelve modules and common viewing screen are supplied completely assembled and ready for installation and operation. The common mounting bracket requires only four screws to secure the entire assembly into position, thus simplifying and speeding installation. Fast direct wiring to equipment harness is accomplished with well separated, plainly marked and pre-tinned integral terminals mounted on the rear of each module. Removal of two screws permits access to readout for quick lamp maintenance, as well as field inspection, changing of message reticles or film chips in each projector system. Long-life T-1 type miniature lamps, either standard based or unbased are used, thus minimizing special stocking or procuring of lamps; lamp voltages from 3 to 28 volts may be used in the SRO-300. A special bracket permits focusing two readouts on a single image area, for 24 message capability.



12 MESSAGE REAR PROJECTION READOUT/SWITCH — MODEL ROS-500

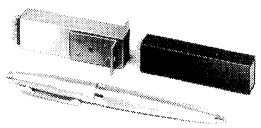
This decimal input to visual display readout/switch consists of 12 parallel miniature optical projectors, similar to the SRO-600. Up to six optical systems can be energized simultaneously to produce complex messages. Any message that can be put on film can be projected to an image height of 0.700" . . . black and white or in color . . . singly or in combination. This unit combines the advantages of the rear projection readout with a pushbutton switch assembly. Units can be fitted with 2DPT or 4PDT momentary or alternate action switch assemblies for full pushbutton switch operation. The switch assembly is actuated by pressing the face of the readout. Switches are available with silver or gold contacts, with resistive ratings of 125 or 250 vac at 5 amps. and 30 vdc at 1 amp. respectively. Total weight is less than 5 ounces, with measurements of 1"W x 1.25"H x 5.25" long, completely assembled. Modular design of this unit permits grouping in intimate contact in any horizontal or vertical arrangement, as well as matrix configurations comprised of any number of units. Housings are welded together for maximum strength. Mounting brackets may be provided at any position desired. The versatile readout/switch module uses long-life, miniature T-1 lamps, in either based or unbased types, offering simplified stocking.

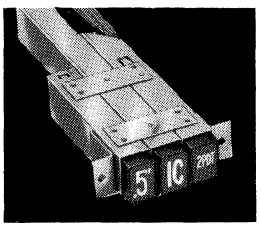
SHELLY ASSOCIATES, INC., 111 Eucalyptus Drive, El Segundo, California 90246 (213) 322-2374 — TWX 910-348-6683

shelly REAR PROJECTION READOUTS/INDICATOR LIGHTS

MIX OR MATCH COMMON FEATURES

Front removable, plug-in modules * Electronic versions all Integrated Circuit (IC) * Image height 0.450" * Natural or blue Polacoat screens * Field maintenance without tools * Message or background colors * Vertical, horizontal or matrix mounting.





ULTRA-MINIATURE DECIMAL INPUT TO 12 MESSAGE VISUAL DISPLAY — MODEL SRO-90

The smallest and most versatile 12 message rear projection readout ever developed. It displays intricate messages and diagrams no other rear projection miniature readout can produce . . . a design dictated by quality, rather than cost. The precision optical system will project anything that can be put on film . . . image size up to 0.450"H . . . 12 numeral, symbol or up to four line messages with excellent focus and corner-to-corner contrast . . . 20% more image area in 20% less space than any other readout available. Smaller than a roll of pennies, this readout offers all the features available in the larger readouts in a 0.650"H x 0.460"W x 2.68" long plug-in module . . . the smallest size possible, compatible with standard T-1/MS 24367; standard lamps minimize problems normally associated with stocking or procuring of special lamps. Field maintenance may be performed from the front panel, without tools. Lamp voltages from 3 to 28 volts. Individual or common grounding for greater message control or complex signalling. Total weight, including housing, only 1½ ounce. Options are drip-proof, RFI and conventional bezels. Modular construction permits mounting vertically, horizontally, or in matrix configurations; housings are welded together for maximum strength. Gold pin terminals mate with terminal blocks held captive in each housing. Message or background colors available. Extra length version compatible with electronic readouts.

ULTRA-MINIATURE BINARY INPUT TO 12 MESSAGE VISUAL DISPLAY — ALL IC — MODEL BDR-90

This plug-in module employs IC's, containing all drivers, gates and complementary function generators required to convert 8-4-2-1 codes, from 10-digit binary inputs, to visual decimal displays. The 12 message readout provides two supplemental wired positions, which may be turned on as needed for simultaneous display of background colors, + or −, left or right decimal, or other symbol, word or numeral messages . . . anything that can be put on film. Combined with the smallest precision optical system ever developed, this front removable module provides images up to 0.450" high. As the smallest completely self-contained readout and binary converter, the BDR-90 opens a new era in high density packaging. Over-all size is 0.450"W x 0.650"H x 5.500" long, from the front of the module to the end of the housing terminals. Modular design permits vertical, horizontal or matrix mounting, with either vertical or horizontal messages. Flat pak IC's use T²L input logic, which is compatible with DTL logic. Logic "0" input, 0 to +0.5 volts; logic "1" input, greater than +2 volts. High reliability, high performance IC's permit operation over a wide temperature range . . . 0°C to +70°C; storage range −55°C to +85°C. Long-life, standard T-1 lamps (MS 24367) are used for simplified stocking and procurement. Fully enclosed housing assures protection for electronic circuitry and projector systems.

12 MESSAGE REAR PROJECTION READOUT/SWITCH — MODEL ROS-90

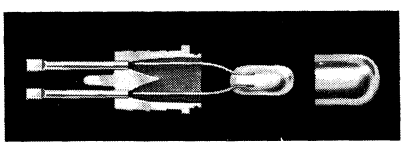
The ROS-90 combines the advantages of a standard SRO-90 rear projection readout with a switch. The standard 12 message readout is simply plugged into movable 2PDT switches for momentary or alternate operation. The switches are operated by pressing the screen of the readout. The switch can be programmed with related equipment for 1 to 12 count readout or to perform similar functions. The complete assembly is packaged in a stainless steel housing that is equipped with a wide variety of mounting tabs for quick and easy mounting. Switch assemblies may be mounted vertically, horizontally or in matrix configurations. The complete assembly measures 0.510"W x 0.710"H x 3.750" long, with total weight of less than 2 ounces each. ROS-90 assemblies are supplied with a 12 inch harness for easy wiring.

MICROMINIATURE INDICATOR LAMPS — Conform to MS 90308

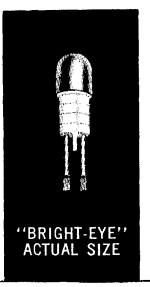
MIX OR MATCH COMMON FEATURES

Produce light intensity greater than lamps five times their size * Relampable from front panel without tools * Mount on 0.225" centers * Guide housing makes lamp replacement easy * Housings lock into position with snap-in action * Wide range of lamps and voltages.

NEW HOUSING GUIDES LAMP LEADS TO CONTACTS



Funnel-shaped passages guide lamp leads to electrical contacts . . . speeds installation . . . no chance for misalignment or bent leads!



"BRIGHT-EYE" ACTUAL SIZE

OPTIONAL CAP STYLES



Specify ball, lens or square caps from 30 combinations of color and type . . . or Digi-caps, square caps in 10 color/type combinations embossed to order with high contrast letters, numerals or symbols. Ideal for decimal or binary count.



Standard "Bright-Eye"

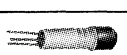


"Bright-Eye" with High Temperature, Epoxy Heat Barrier

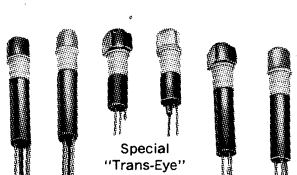
"BRIGHT-EYE" MICROMINIATURE INDICATOR LAMPS — Panel Mount

Smallest front relampable indicator light available.

The panel mounted "Bright-Eye" P series is specifically designed for installations that require excellent visual indications, combined with high density packaging, to monitor important operating functions. Lightweight, of less than ½ gram each, including lamp, makes the "Bright-Eye" ideal in applications where weight is a critical factor. The unique lamp and housing combination offers many advantages not available in any other microminiature indicator light . . . funnel-shaped passage guides permit use of axial lead lamps . . . axial lamps provide highest illumination intensity available in this class lamp . . . replacement lamps slip in or out without tools . . . small diameter housing body permits mounting indicators on 0.225" centers . . . indicator housings snap into position and lock without additional hardware . . . lens caps snap off or on for easy access to lamps from the front panel . . . indicators available with a choice of 14 lamp ratings from 1.5 to 28 volts and life expectancies from 10,000 to 60,000 hours. Easy access solder terminals are provided on the rear of each housing for simplified and fast installations. Terminals are gold plated for corrosion resistance and sure flow of solder. Special "Bright-Eye" configurations are now available with high temperature, epoxy heat barrier which prevents transmission of soldering iron or solder gun heat into the body of the housing, thereby making the housing virtually impervious to damage that could occur from heat.



Standard "Trans-Eye"



Special "Trans-Eye" "Configurations

"TRANS-EYE" MICROMINIATURE TRANSISTORIZED INDICATOR LAMPS

High intensity indications from signal levels too low to illuminate conventional indicators.

The "Trans-Eye" indicator is designed for compatible "Mix or Match," with panel mounted "Bright-Eye" indicators . . . units are physically identical, except the "Trans-Eye" is ⅛ to ¼" longer. Electrically, the "Trans-Eye" incorporates a transistor in the housing which will "turn-on" the indicator when a signal as low as 0.3 mA is applied. This capability is ideal for bright front panel indications when extremely low signal levels are being used. Long operating life and dependable indications are assured through the use of silicon NPN or PNP planar transistors . . . the "Trans-Eye" also has a high temperature characteristic which makes the unit reliable in a wide range of environmental applications. Configurations are also available incorporating a built-in resistor. Lamps are available in ratings from 5 to 28 volts with life expectancies from 10,000 to 60,000 hours.

SPECIALIZED "TRANS-EYE" CONFIGURATIONS

Specialized physical and electrical configurations have been developed to meet a wide range of customer specifications. Shelly's staff will be happy to consult or quote on "Trans-Eye" indicators for any specialized application. Consult the factory or your nearest field engineering representative.

"Brite-Eye"

"BRIGHT-EYE" MICROMINIATURE INDICATOR LAMPS — Circuit Board Mount

The "Bright-Eye" C series is designed for use with printed circuit boards, where it is important that the state or condition of the board, or operation, be monitored rapidly. The high intensity illumination and microminiature size of the C series make it an ideal indicator for use in multiple rows, or bays of cards, as well as any other application where space is limited beyond the mounting surface. The C series "Bright-Eye" incorporates standard "Bright-Eye" features . . . it may also use any of the optional cap styles.



"GLO-EYE" MICROMINIATURE NEON INDICATORS

The Glo-Eye microminiature neon indicator series provides bright indications in the presence of 115VAC power. The indicator consists of an "easy-lamp" housing, a wire terminal neon lamp type USASI A1K, and a snap-on cap in 12 type/style/colors. The housing also contains an integral resistor for varying life expectancies. The Glo-Eye housing fits a 0.191" hole for compatibility with the Brite-Eye and Trans-Eye. Over-all flange dimension of 0.225" permits mounting the units on 0.225" centers for high density packaging applications.

SHELLY ASSOCIATES, INC., 111 Eucalyptus Drive, El Segundo, California 90246 (213) 322-2374 — TWX 910-348-6683

AMPLIFIERS AVAILABLE FOR BENRUS CRT DISPLAYS

5" high frequency displays:
"A" channel:
5 to 25 MHz frequency response, sensitivity 50 to 1.2 mv/div.
"B" channel:
frequency response 5 to 15 MHz, sensitivity 125 to 1.7 mv/div.

3" high frequency displays:
"A" channel:
frequency response 5 to 20 MHz, sensitivity 75 to 2.5 mv/div.
"B" channel:
frequency response 5 to 20 MHz, sensitivity 90 to 3.0 mv/div.

5" low frequency displays:
"A" channel:
frequency response .25 to 5 MHz, sensitivity 40 to 1 mv/div.
"B" channel:
frequency response .25 to 5 MHz, sensitivity 140 to 1.8 mv/div.

3" low frequency displays:
"A" channel:
frequency response .25 to 5 MHz, sensitivity 120 to 1.5 mv/div.
"B" channel:
frequency response .25 to 5 MHz, sensitivity 140 to 2 mv/div.

Request Catalog #802 for complete data.

SWEEPS AVAILABLE FOR BENRUS CRT DISPLAYS

Either channel may be swept, in which case sweep circuitry is ordered in place of an amplifier for that channel. Sweeps can be provided in the following speed ranges:

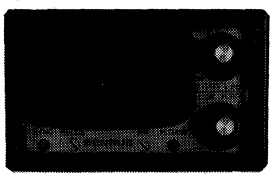
NORMAL RANGE speed/div	EXPANDED RANGE speed/div
50 ns - 250 ns	10 ns - 250 ns
100 ns - 500 ns	20 ns - 500 ns
200 ns - 1 μs	40 ns - 1 μs
500 ns - 2.5 μs	100 ns - 2.5 μs
1 μs - 5 μs	200 ns - 5 μs
2 μs - 10 μs	400 ns - 10 μs
5 μs - 25 μs	1 μs - 25 μs
10 μs - 50 μs	2 μs - 50 μs
20 μs - 100 μs	4 μs - 100 μs
50 μs - 250 μs	10 μs - 250 μs
100 μs - 500 μs	20 μs - 500 μs
200 μs - 1 ms	40 μs - 1 ms
500 μs - 2.5 ms	100 μs - 2.5 ms
1 ms - 5 ms	200 μs - 5 ms
2 ms - 10 ms	400 μs - 10 ms
5 ms - 25 ms	1 ms - 25 ms
10 ms - 50 ms	2 ms - 50 ms
20 ms - 100 ms	4 ms - 100 ms
50 ms - 250 ms	10 ms - 250 ms
100 ms - 500 ms	20 ms - 500 ms

Request Catalog #802 for complete data.

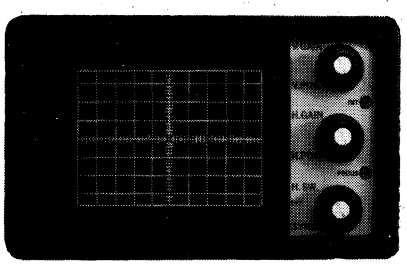
BENRUS SOLID STATE, PANEL MOUNTING

MONITOR OSCILLOSCOPES

DC to 500 KHz



3" Type RA840B



5" Type RA850

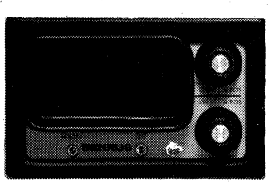
These instruments are ideal for applications where economical, stable, dependable monitors are needed. They are compact, light in weight, low in heat dissipation, require only AC line power. Units with on-off blanking and grey scale modulation are available. Up to three 3" models can be mounted on a standard 3½" panel; two 5" models on a standard 5¼" panel. **Conform with MIL SPEC environmental requirements.**

While designed primarily for panel mounting, the units are fully cased and may be safely operated on the bench.

Plug-in Flexibility — A full line of plug-in vertical and horizontal amplifiers, trigger and sweep circuits are available, and may be used interchangeably on either the Type RA840B or the Type RA850 scopes. The range includes X and Y amplifier channels from DC to 500 KHz with 10 mv/cm to 2 v/cm sensitivity, free-running sweep circuits with sweep frequency rates from 0.2 Hz to 10 KHz, and triggered sweeps with speeds from 1 sec/cm to 10 μsec/cm.

BENRUS SOLID STATE, LOW COST, COMPACT

X-Y INDICATOR



3" Type RA840C

- **Bandwidth: DC to 200 KHz (3 db).**
- **Sensitivity: 1 v/cm to 10 v/cm.**
- **Rise time: 1.5 μs.**
- **DC coupled blanking provided.**
- **Compact — behind panel depth less than 10½".**
- **Identical X and Y amplifier characteristics.**
- **Complete — ready to operate.**

spedcor Lavoie Analab Benrus INSTRUMENT DIVISION

spedcor electronics, inc.
Lavoie Analab Benrus Instrument Division
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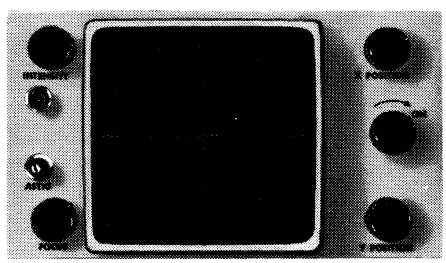
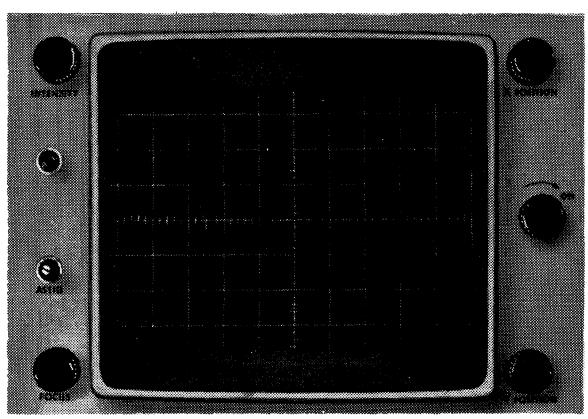
Better Readout for your System Design with Benrus

Bandwidths to 25 MHz
Sensitivities to 1 mv/div
Meet MIL SPEC Environmental Requirements

CRT DISPLAYS





1. You select panel height.

Units mount on standard 3½", 5¼", 7" rack panels.

2. You select amplifier characteristics.

Many bandwidths and sensitivities are available, for either or both channels, as noted on next page.

3. You select sweep, if desired.

Either "A" or "B" channel may be swept; choice of 40 speed ranges, as noted on next page.

To the combination of your choice you may now add, if desired, any of many optional features. The result is a standard, off-the-line instrument, custom-assembled to meet your exact requirements.

For optimum panel-mounting efficiency, the units have been designed to exact modular dimensions. Thus, 1 to 3 of the 3½" units mount horizontally in a 3½" rack; up to 5 of the same units may be mounted vertically in a 5¼" rack. Similarly, 2 of the 5¼" units mount horizontally in a 5¼" rack; 3 may be mounted vertically in a 7" rack. Hardware is available for fast and rigid assembly of any combination of units for custom rack mounting without hole cutting or drilling.

The CRT Displays have integral power supplies and are fully self contained. Complete description, specifications, and ordering information are given in Catalog #802. Ask your rep for a copy, or write direct.

spedcor Lavoie Analab Benrus INSTRUMENT DIVISION

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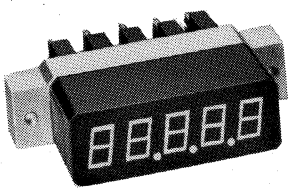
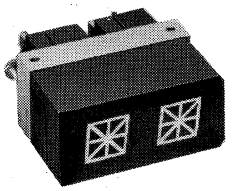
TUNG-SOL DIGITAL AND ALPHANUMERIC READOUTS

INCANDESCENT TYPES



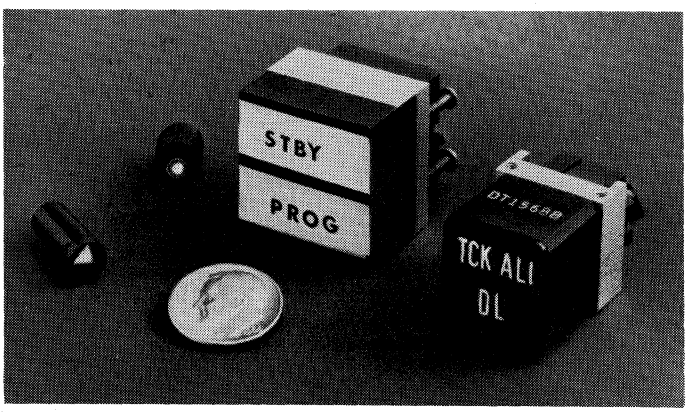
7 SEGMENTS—Display 0 through 9, plus 13 letters. Character size: .32" high, .19" wide, .05" slope. Spacing: Integrated—.3125" c. to c. Stacked—.500 c. to c.



16 SEGMENTS — Full alphanumeric display. Character size: .32" high, .33" wide, .05" slope. Spacing: Integrated—.625" c. to c. Stacked—.807" c. to c.

STACKED—Digits as well as lamp blocks are individually replaceable, for each digit. 70 ma and 20 ma lamp blocks are interchangeable.

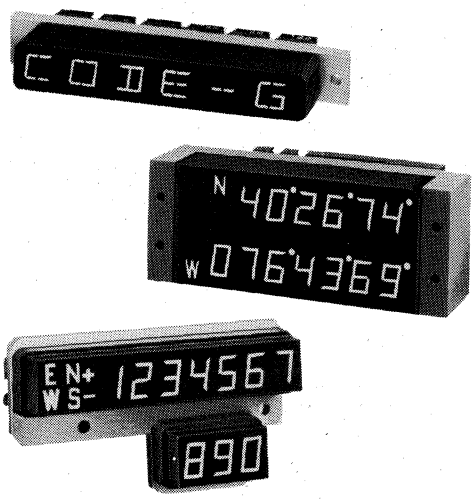
INTEGRATED—Monolithic construction requires less width per character. Permits precise alignment of digits in line and in plane. Individual lamp blocks are replaceable.



STATUS INDICATORS—Fixed messages, or symbols, to customers specifications. Supplied in types readable when off or completely blank. All have the clarity and high visibility characteristic of all Tung-Sol readouts.

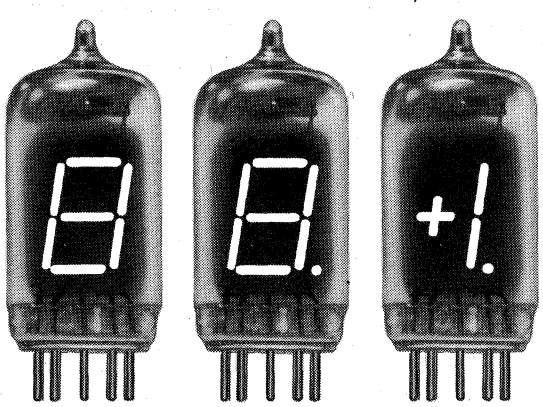
Tung-Sol incandescent readouts and status indicators provide optimum contrast under high ambient light conditions. Filtering attenuates the reflection from unlighted segments to assure maximum definition of the display. Light shades are not needed. Tung-Sol readouts are designed to function in extreme environmental conditions. They are available with seven segment characters or with sixteen segments which provide full alphanumeric display. Made in both stacked and integrated styles. Special fixed characters can be supplied. The 20 ma and 70 ma lamp banks are mechanically interchangeable.

TYPICAL CONFIGURATIONS



VACUUM TYPES

DIGIVAC S/G VACUUM FLUORESCENT READOUTS



DT1704A DT1705C DT1707A

This is a new concept in seven-bar segmented vacuum readouts designed for low signal level applications. Even the most advanced systems can employ this side-display readout without compromising performance or reliability. In less sophisticated equipment, it can improve the readout function while remaining cost-competitive.

1. Low cost
2. Single plane display
3. 150° viewing angle
4. Low cost socket
5. High brightness
6. Low power
7. Low voltage
8. Simplicity of design
9. I.C. compatibility
10. Optional decimal
11. Optional ± 1 decimal
12. 10 numerals; 13 letters
13. Variety of colors with appropriate filtering

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630 W. Mt. Pleasant Avenue, Livingston, N. J. 07039
TWX: 710-994-4865 Phone: (201) 992-1100; (212) 732-5426

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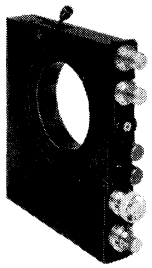
COMPLETE LINE for every Military and Industrial Purpose in PRODUCTION QUANTITIES or CUSTOM DESIGNED to your specific requirements

- Yokes for ALL types of ⅞", 1", 1⅛", 1½", and 2⅛" neck dia. CRT's—only representative types are shown.
- Special designs for all types of computer and high speed character displays.
- Wide variety of coil impedances in both push-pull and single-ended configurations.
- Most experienced yoke engineers in the industry, plus complete production and testing capability.



MODEL D4499

MICROMETER–CONTROLLED PRECISION COIL ALIGNER

For fast, convenient alignment of yokes and focus coils in (1) ultra precision displays and flying spot scanners, and (2) laboratory research and prototype evaluation. **Exclusive** independent micrometer adjustment of pitch, yaw, horizontal and vertical translation . . . with firm precision locking. **Exclusive** true precision control and exact repeatability, plus rugged construction. For full details request catalog page.



TYPE F20

PRECISION ELECTRO-MAGNETIC FOCUS COILS for ⅞", 1½", 2⅛" and other neck dia. CRT's.

All designed for ultimate focus. Negligible effect on spot size when properly aligned to beam. Static types (all sizes)—low power or high power. Dynamic-static combinations (1½" neck dia.) . . . compact single gap design . . . or double gap design to simplify circuitry by eliminating coupling between static and dynamic coils. Wide range of coil resistances available. For full technical details, request catalog pages. Please specify your CRT and beam accelerating voltage.



TYPE P7



TYPE P8

ANTI-PINCUSHION DEVICES, both PM and EM types

Eliminates CRT geometrical picture distortion. Type P7 permanent magnet anti-pincushion assembly requires no current . . . occupies small space . . . easily adjustable . . . mounts directly on standard yokes . . . available in wide choice of magnet strengths with tight tolerances. Type P8 electromagnetic coil anti-pincushion assembly has very high precision construction . . . allows convenient front panel adjustment. For full technical details request catalog page.

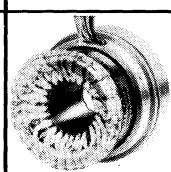


TYPE C4942

Request catalog page

SHIELDED DYNAMIC FOCUS COIL

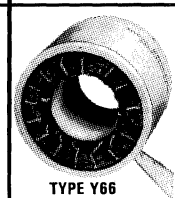
For sharp focus applications up to 25kv accelerating potential, such as scan converter storage tubes and flat faced high resolution CRT's. Static and dynamic coils combined into a single gap to ease alignment and position. Gap in forward position for superior focus and best image-to-object ratio.



TYPES Y58-Y60-Y62-Y64 for 42°, 52°, 70°, & 90° Deflection Angles

PRECISION STATOR YOKES for 1½" neck dia. CRT's.

High efficiency and accuracy achieved by stator type core which also provides exceptionally low astigmatism and residual magnetism. Push-pull or single-ended coils for time shared sweep displays, character displays and others. Request catalog sheet for full details.



TYPE Y66 Up to 60° Deflection Angle

LARGE I.D. YOKES for 2⅛" neck dia. CRT's.

Single-ended and push-pull designs especially for charactron CRT's to give minimum twisting or distortion of characters. Suitable also for precision displays with other types of 2⅛" neck dia. CRT's. Request catalog sheet for full details.



TYPES V21 & V22

VIDICON YOKES & FOCUS COILS for 1" Vidicons

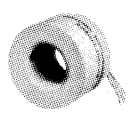
IN VOLUME PRODUCTION NOW. For both commercial and military applications. Engineering Service available. Special designs for all types of 1" vidicons including electrostatic focus magnetic deflection types. For full technical details request catalog page.



TYPE Y25-R Series Up to 52° and 70° Deflection Angles

COMPACT ROTATING COIL YOKES for 1½" neck dia. CRT's

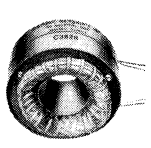
For Radar Plan Position Indicator and all other rotating coil applications. Versions available with dc off-centering coils. Complete in aluminum housing containing deflection coil, slip rings and brush assembly, drive gear and bearing for easy installation into any equipment design. Only 3¾" OD x 2 11/16" long. For technical details request catalog page.



TYPE Y65 Up to 70° Deflection Angle

ENCAPSULATED MINIATURE PRECISION YOKE for ⅞" or 1" neck dia. CRT's.

Push-pull and single-ended coils available in a wide range of inpedances for transistor drivers or vacuum tube circuits. Features electrically balanced windings with equal deflection sensitivities. Close angular tolerances of the display are achieved by precise construction. Epoxy encapsulated to withstand extreme environments. For full technical details, request catalog page.



TYPES C3287/C3528

MAGNETIC SCAN-CONVERTER DEFLECTION YOKES

Stator Design for standard 1½ inch neck diameter scan converter storage tubes. High resolution, geometrical accuracy and sensitivity are combined to offer power savings, plus ultimate performance. A desirable short precision magnetic field is achieved by combining short overall length and small ears with the proper distribution, insertion and extreme care in construction. Magnetically shielded designs also available. Request catalog sheet for full details.

For engineering assistance in solving your display problems, please contact our nearest representative:

Boston-New England:	617-762-3164
New York:	212-695-3727
Philadelphia Area:	215-789-2320
Washington-Baltimore Area:	202-628-1023
Minneapolis:	612-920-1046
Los Angeles:	213-283-1201
San Francisco:	415-322-8461

syntronic INSTRUMENTS, INC.

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Specialists in Components and Equipment used with Cathode Ray Tubes

Radiation Detectors

Proportional Counters

Tube Type	Thermal Neutron Sens. cps/nv	Max. Oper. Temp. °F
BF_3 Counters		
WL-6307	4.5	250
WL-6998	13	250
WL-7087A	40	175
WL-7243	13	175
WL-23055	35	310
WL-23056	45	175
WL-23064	35	300
WL-23153	20	250
B^{10} Counters		
WL-22791	10	400
WL-22792	3	400
WL-23068	3	500
He^3 Counters		
WL-23155	22	300
WL-23156	16	300

Fission Counters

Tube Type	Thermal Neutron Sens. cps/nv	Max. Oper. Temp. °F
WL-6376A	0.7	300
WL-6941A	0.2	300
WL-6971A	0.14	300
WL-7186	1.25×10^{-3}	300
WL-7188	0.07	300
WL-23033	0.7	700
WL-23071	0.5	850
WL-23072	0.25	700
WL-23073	5×10^{-3}	750
WL-23094	1×10^{-5}	250

Fission Chambers

Tube Type	Thermal Neutron Sens. A/nv	Max. Oper. Temp. °F
WL-6376A	1.4×10^{-13}	300
WL-6941A	2.6×10^{-14}	300
WL-7657	4.0×10^{-14}	575
WL-8073	1.4×10^{-13}	300

Ionization Chambers

Tube Type	Thermal Neutron Sens. A/nv	Max. Oper. Temp. °F
UNCOMPENSATED		
WL-6937A	4.4×10^{-14}	300
WL-7606	4.4×10^{-14}	575
WL-8075	4.4×10^{-14}	300
WL-8137	1.5×10^{-14}	175
WL-23078A	1.2×10^{-14}	175
WL-23079	3.0×10^{-13}	175
COMPENSATED		
WL-7741	4.4×10^{-14}	575
WL-8074	4.4×10^{-14}	175
WL-8105	1.5×10^{-14}	175
WL-23085	1.0×10^{-15}	660

Industrial & Military Cathode Ray Tubes

Electrostatic Focus & Deflection

Tube Type	Max. Bulb Face Dia. Inches	Line Width "A" Mils	@	Special Features
3JP	2.75 dia.	30	100μA	Post Defl. Accel.
3WP	3.06 dia.	26	7 Ft.-L	High Defl. Sens.
5UP	4.5 dia.	20	8 Ft.-L	High Brightness
WX-5006P-	5.25 dia.	20	4.5 Ft.-L	Post Defl. Accel. High Freq. Oper.
5DEP-	5.34 dia.	23	4 Ft.-L	High Defl. Sens.
7VP	7.12 dia.	40	300μA	High Defl. Sens.
WX-31101P-	7.12 dia.	30	50μA	Post Defl. Accel.
8CP	7.5 dia.	30	50 Ft.-L	Post Defl. Accel.
WX-31120P-	8.5 dia.	35	50μA	Post Defl. Accel. High Light Out.
WX-30764P-	4.5 x 5.5	15		Post Defl. Accel.—High Brightness
WX-30919P-	4 x 5	15	12 Ft.-L	Mon. Accel.

Magnetic Deflection — Round

Tube Type	Size	Max. Bulb Face Dia. Inches	Focus Type	Line Width "A" Mils	@	Special Features
WX-4527P-	1″	1.25	ES	0.75	1μA	High Resolution
WX-4497P-	1.5″	1.38	ES	0.75	2μA	High Resolution
WX-4827P-	3″	2.88	ES	0.8	1μA	Single Axis Aux. Defl., High Res.
WX-4912P-	4″	4.12	ES	1.5	4μA	High Resolution
WX-4965P-	4″	4.12	ES	1.5	4μA	Single Axis Aux. Defl., High Res.
WX-30038P-	4″	4.12	ES	0.65	1μA	Full Fiber Optic F.P., Very High Res.
5CEP-	5″	5.31	ES	1.5	4μA	High Resolution
5ZP-	5″	5.12	ES	4.5	30μA	—
WX-4129P-	5″	5.31	ES	1.5	2μA	Double Axis Aux. Defl., High Res.
WX-4877P-	5″	5.31	ES	2.5	4μA	Imp. Deft. Linearity, High Res.
WX-4903P-	5″	5.38	ES	.65	1μA	Very High Resolution
WX-31205P-	5″	5.38	ES	0.65	1μA	U V Trans. F.P., Very High Res.
WX-31227P-	5″	5.12	ES	12	200μA	High Brightness
WX-30566P-	5″	5.31	ES	4.0	50μA	High Res. at High Beam Current
WX-30566P-	5″	5.00	ES	4.0		Low Defl. Power, High Brightness
7ABP-A-	7″	6.00	ES	12	100μA	—
7AUP-	7″	7.06	ES	12	50μA	Small Neck for Low Defl. Power
WX-4541P-	7″	7.06	ES	12	50μA	Rugged, Small Neck for Low Defl. Power
WX-4595P-	7″	7.31	ES	2.75	4μA	Double Axis Aux. Defl., High Res.
WX-30027P-	7″	7.05	ES	12	20 Ft.-L	Integral Magnetic Shield, 2-Optical Rear Windows
WX-30315P-	7″	7.12	Mag	1.5	1μA	High Resolution
WX-30026P-	9″	9.31	ES	2.5	4μA	High Resolution
WX-30734P-	10″	10.25	Mag	2		High Resolution
10SP-	10″	10.56	ES	15	100μA	—
10WP-	10″	10.56	ES	17	100μA	—
10WP-A	10″	10.56	ES	17	100μA	—
WX-4924P-	10″	10.56	ES	15	50μA	Single Axis Aux. Defl.
WX-30176P-	10″	10.25	ES	2	4μA	Double Axis Aux. Defl., High Res.
WX-31114P-	10″	10.56	ES	17	100μA	Small Neck for Low Defl. Power
WX-31224P-	10″	10.25	ES	1.7	4μA	High Resolution
12ABP-A	12″	12.56	ES	19	100μA	—
WX-30838P-	12″	12.56	ES	15	—	Optically Flat Rear Window
WX-31060P-	12″	12.12	ES	10	—	2-Rear Windows
16AKP-	16″	16	ES	25	100μA	—
WX-5008P-	16″	16	ES	10	25μA	Double Axis Aux. Defl.

For further information on these and other Westinghouse tubes or for application assistance, contact the Westinghouse Electronic Components and Specialty Products Sales Representative nearest you. They are listed in the Yellow Pages at the back of this book.

Magnetic Deflection — Rectangular

Tube Type	Size	Max. Bulb Face H x W Inches	Line Width "A" Mils @
WX-30844-	6″	4.5 x 5.0	8 100μA
8NP-	8″	6.12 x 7.94	12 100μA
WX-30733P-	10″	8.60 x 0.25	1.5 —
WL-30886P-	12″	8.54 x 10.94	14 —
WL-31092P-	12″	8.54 x 10.94	10 25μA
WX-31250P-	12″	8.54 x 10.94	20 100μA
14WP	14″	10.56 x 13.06	15 100μA
WX-31364P-	14″	10.69 x 13.19	10 25μA
17DWP-	17″	12.41 x 15.5	20 100μA
21EWP-	21″	16.5 x 20.38	18 40 Ft.-L
WX-30789P-	23″	19.25 x 15.12	20 —
WX-31061P-	23″	16.62 x 20.62	22 150μA

Ruggedized Tube — Yoke — Shield Packages

Type Type	Package Max. Dia.	Package Max. Length	Elements Per Dia.
WX-5328P-B	4.65″	13.12″	3800
WX-30233	4.65″	13.12″	3530
WX-30005P-	6.56″	17.75″	6500
WX-30099P-	6.56″	17.75″	6400 x 360
WX-30914	6.56″	17.75″	6970

NOTES:

(1) The above list is representative of the variations of industrial and Military Cathode Ray Tube types available from Westinghouse. In general, any industry bulb can be combined with specific phosphor and electron gun types to meet individual display system requirements.

(2) Many of the above tubes can also be furnished with any of the following variations: Internal Graticules, Fiber Optic Faceplates or Strips, Yokes, Shields, Mounting Fixtures, Implosion Protection or Potted Leads.

Image Tubes

SEC Camera Tubes

High efficiency S-20 photocathodes are standard; other photosurfaces available on request. The tubes below use magnetically focused and deflected reading sections.

Tube Type	Photocathode Diameter	Resolution (TV lines/picture ht.) Typ.	Min.	Sensitivity μA/fc Typ.	Min.
WL-30691	25 mm (Fiber Optic)	550	500	50	35
WX-30654	40 mm (Fiber Optic)	800	700	120	90
WX-5419B	40 mm	900	800	120	90

Slow Scan Vidicons

RANGE GUN			High Resolution Magnetic	Hybrid (ES Focus, Magnetic Deflection)	All Electro-Static
	Environmental	Standard Magnetic			
Visual	Industrial	WL-7290	WX-5110	WX-4950	WX-4384
	Military	WX-5424	WX-5112	WX-5119	WX-4871
Ultra Violet	Industrial	WX-4887	WX-5114	WX-5120	WX-4890
	Military	WX-4885	WX-5116	WX-5121	WX-5118

Special Purpose Vidicons

Tube Type	Face Plate Dia.	Resolution	Special Feature
WX-5123	1″	900 TV lines/picture height.	Continuous non-destructive readout. Separate field mesh.
WX-5129	1″	500 mesh stainless steel wire.	Converts X-radiation directly into a video signal.
WX-5140	2″	1800 TV lines/picture height.	High resolution. Separate field mesh.

Image Intensifiers

Tube Type	Minimum[1] Sensitivity	Resolution (at photocathode)	Brightness Gain (Min.)
WL30677 Class II	175 μA/lumen	30 lp/mm	200
WL-30677 Class II	100 μA/lumen	30 lp/mm	150

[1] S-20 Photocathode

Display-Storage Tubes

Electrostatic Focus & Deflection

Tube Type	WX-5308	WX-7268B	WL-22662	WX-4951	WX-30154	Units
Min. Useful Screen Dia.	3	4	4	4	5.8	Inches
No. of Write Guns	1	2	1	1	1	—
Min. Storage Time	30	15	60	10	40	Seconds
Min. Writing Speed	1×10^4	4×10^4	4×10^5	1×10^5	5×10^4	Inches/Second
Min. Brightness	1200	2200	1000	1200	750	Foot-Lamberts
Min. Resolution	50	70	50	60	45	Lines/Inch

WESTINGHOUSE AIR BRAKE COMPANY
AEROSPACE DEPARTMENT
Swissvale Post Office, Pittsburgh, Pa. 15218

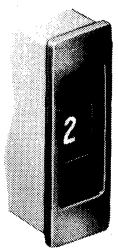
WABCO

READALL® READOUT INSTRUMENTS

READALL Readout Instruments are precision-built data readout devices for displaying characters in accordance with a pre-determined code. READALL Readout Instruments will translate, display, store and transfer data in digital form. The instruments are compact and self-contained and can be applied to the output of telemetering systems, digital computers, teletype receiving equipment, or wherever data must be displayed. Special characters can be provided on request.

An outstanding feature of READALL Readout Instruments is their ability to retain information indefinitely. They are so constructed that they store the positioned character electrically as well as visually. The stored code can be transmitted into other readout instruments, printers or transmitters. Once positioned, they consume no power while information is retained and displayed.

10-CHARACTER READALL READOUT INSTRUMENT INDUSTRIAL



10-Character READALL Readout Instruments will operate through one million random operations reliably and efficiently. These instruments utilize a four-bit binary code to position ten characters for visual display. The relation of the visable character to its code is the direct translation of binary notation to decimal indication. If desired, combinations other than those included in this particular instrument can be developed.

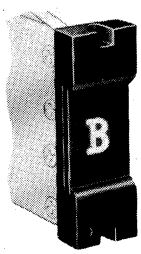
12-CHARACTER READALL READOUT INSTRUMENT MILITARY



The 12-Character Readall Readout instrument is designed to meet the severe environmental requirements specified in MIL-E-5422D. The digital display includes characters in numerical sequence from 0 to 9 and two blank spaces.

These readout instruments can be used individually in separate gasket-sealed cases, or as modules assembled in groups to display several characters in a single case. Greater flexibility of operation is provided through the separate code and motor circuits, which permit application in low level circuitry.

64-CHARACTER READALL READOUT INSTRUMENT INDUSTRIAL AND GROUND SUPPORT



The 64-character READALL Readout Instrument employs a six-bit code and a differential sprocket and belt arrangement to accomplish a digital readout. The character belt is back-lighted with diffused light by means of a miniature aircraft-type bulb. In order to make back-lighting possible, the belt is made with characters on one side only. And, in order to reduce its size, the belt is formed into a Mobius-like configuration.

These instruments meet many of the requirements of the existing military specifications. Specific information can be obtained upon request.

64-CHARACTER READALL READOUT INSTRUMENT SEALED CASE FOR MILITARY APPLICATION



This 64-character Readall Readout is designed to meet the severe environmental requirements of MIL-E-5422D and other specifications. It provides reliable operation under conditions of intense shock, vibration and extreme ranges of temperature. The sealed case protects the instrument in humidities of 100 per cent; it will operate at altitudes up to 50,000 feet. Salt spray, dust, sand and other foreign particles cannot penetrate the case.

The method of operation and internal arrangement are similar to that of the standard 64-Character READALL Readout Instrument.

READALL READOUT SPECIFICATIONS—All operating data at 60 to 80 deg. F.

	10-character Industrial	12-character Military	64-character Industrial	64-character Military
Character size				
height	3/8 in.	9/32 in.	9/32 in.	9/32 in.
width	1/4 in.	1/8 in.	13/64 in.	13/64 in.
stroke width	0.040 in.	0.030 in.	0.032 in.	0.032 in.
Voltage	24 to 28 vdc	24 to 28 vdc	24 to 28 vdc	24 to 28 vdc
Motor starting current @ 26 vdc	0.500 amp	0.500 amp	0.60 amp	0.500 amp
Motor running current @ 26 vdc	0.125 amp	0.150 amp	0.150 amp	0.150 amp
Power-running	3 watts, avg	3.9 watts, avg	7.5 watts, total	7.5 watts, total
Power, steady state	0.0 watts	0.0 watts	0.0 watts	0.0 watts
Running time	9 character spaces—0.8 sec	11 character spaces—1.0 sec	71 belt spaces—1.7 sec	71 belt spaces—1.5 sec
Life	10^6 random indications	10^6 random indications	$5x10^5$ random indications	$5x10^5$ random indications
Dimensions				
length	5 5/64 in. (including pins)	4 61/64 in. (excluding pins)	10 25/32 in. (including pins)	8 17/32 in.
height	1 41/64 in.	1 47/64 in.	front face 1 47/64 in.	1 27/32 in.
width	19/32 in.	39/64 in.	front face 39/64 in.	43/64 in.
Weight	Less than 7 oz	with individual sealed case—7 oz; without case—4½ oz	Less than 16 oz	14 oz

READALL READOUT ORDERING REFERENCES

READALL Readout Instrument	Characters 0 to 9 inc. UN 341783	Characters 0 to 9 and two blanks. White illumination with case. UN 375329-049	Characters 0 to 9 plus alphabet. UN 378593	Characters 0 to 9 plus alphabet plus special characters. UN 382750-009
Mating Receptacle (order separately)	UN 310097	UJ 706026	UN 310097	Note: Mates with mil stan connector MS24013.

For further details, contact the Representatives listed in this catalog or write direct for Bulletin 1057-B.

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Order any quantity from our standard stock of *five different thicknesses, ten different sizes* and get 5-DAY DELIVERY! And there are no art, negative or plate charges — no photostats and costly paper work. Compare our prices and the 5-day delivery against your present nameplate costs. You'll be amazed at the savings. No more costly inventory, no more obsolescence due to changes. Write, wire or phone today for generous supply of samples and complete catalog.

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Phone 305•621-3641

SPECIFY "ARNOLD" FOR YOUR PERMANENT MAGNET

ALNICO MAGNETS

Arnold permanent magnets are available in all types of Alnico material, in sizes ranging from large castings weighing over 80 pounds to very small sintered parts weighing less than one gram.

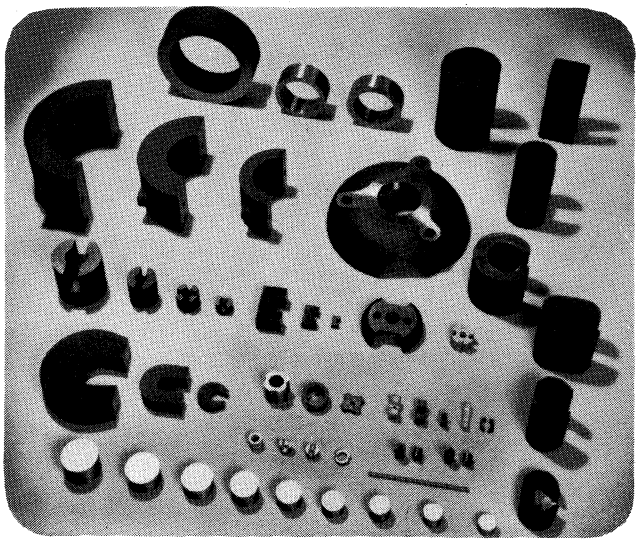
Alnico 5 can usually be depended upon to deliver the greatest energy product to the magnetic circuit per weight of magnet material. It is therefore generally the first choice for a magnetic material except where special physical considerations are paramount. Modified or premium grades are also available, such as Alnico 5-7, a crystal-oriented material used where size and weight must be reduced without loss of energy.

Special assemblies such as rotors, traveling wave tube magnets, magnetron magnets, etc. may be supplied in an aluminum jacket to facilitate mounting and supply an added protection to the magnet.

Large magnet assemblies may be supplied for focusing mass spectrometer and other measuring applications where a high degree of stability and uniformity of field is required.

Many sizes and types of Alnico magnets are carried in stock for immediate delivery.

ALNICO 8 Available from Arnold in production quantities, Alnico 8 possesses the highest coercive force of all Alnico grades, as well as a high energy product and a relatively low temperature coefficient. It is especially suited for traveling wave tube periodic focusing applications. Gap flux densities greater than 1000 gausses are attainable in tubular-type straight field focusing magnets. Alnico 8 is also recommended for applications which involve strong demagnetizing fields, or where space considerations dictate the use of a short magnet.



Typical group of Arnold permanent magnets, both cast and sintered types.

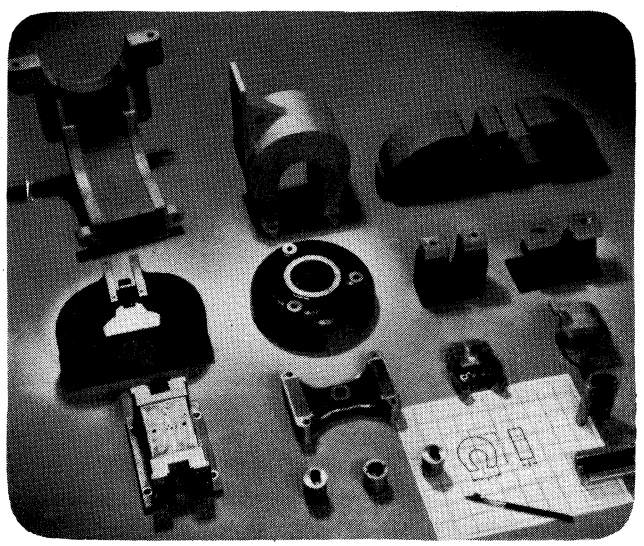
SPECIAL PERMANENT MAGNET MATERIALS

ARNOX 3 Arnox 3 is a molded-type magnet having high coercive force and moderately low residual induction and energy product. Principal uses are for magnetic requirements which are not stringent, and for a relatively short magnet of reasonable cross section. Accurate dimensions and close tolerances can be economically obtained. These magnets can be premagnetized before assembly, and have very high resistance to demagnetiziation. Slightly better magnetic properties are obtained in the pressing direction than in other directions.

ARNOX 5 Arnox 5 is a ceramic permanent magnet material composed of highly oriented barium ferrite. It has many times the energy product of Arnox 3 and is comparable in many applications to Alnico 5. Because of its high coercive force, its use is recommended in applications where a short magnetic length is desirable or where extremely high demagnetizing forces are encountered.

VICALLOY Vicalloy is a carbon-free permanent magnet alloy containing about 10% vanadium, 50% cobalt and the balance iron.

Vicalloy may be fabricated in the form of castings, hot rolled bars and forgings, or cold rolled strip, wire and tubing. After suitable heat treatment, the material is quite readily machinable. Vicalloy is available on special order in bar, strip and thin tape for recording purposes.



Typical group of permanent magnet assemblies.

SILECTRON C, E, O AND DISTRIBUTED GAP CORES Precision-rolled Silectron strip in 1, 2, 4 and 12 mil thicknesses. They are supplied in a wide variety of shapes, and in sizes from a fraction of an ounce to several hundred pounds. In addition to standard transformer applications, they may also be supplied for special applications such as saturable reactors, instrument transformers and pulse transformers.

Distributed Gap Cores reduce watt loss by 30%, exciting current by 70% and cost by 10% over conventional 12 mil C cores of the same size and weight. Made of the best commercial grades of .012 grain-oriented silicon steel, cores are available in 36 basic sizes for power transformer and reactor applications.

Over 1,000 stock cores are listed in the Arnold Silectron catalog. A wide selection of preferred sizes are stocked for immediate shipment.

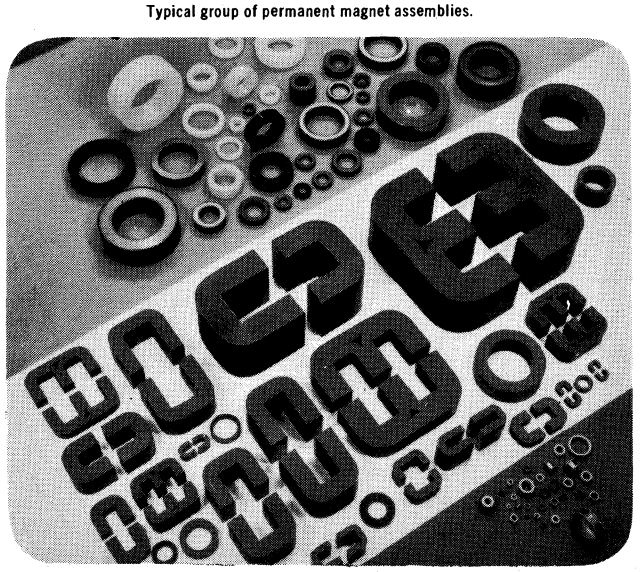
TAPE WOUND CORES OF HIGH PERMEABILITY MATERIALS Arnold tape wound cores are available made of Deltamax, 4-79 Mo-Permalloy, Supermalloy, Mumetal, 4750 Electrical Metal, Silectron, or the new rectangular-loop material, Supermendur. All except Supermendur cores are available in standard tape thicknesses of ½, 1, 2, 4 or 12-mils.

Toroidal cores are made in 30 standard sizes with protective nylon or aluminum cases. Special sizes produced to individual requirements. Wide selection of Deltamax, Square Permalloy and Supermalloy type 6T cores (aluminum cased, oil filled, hermetically sealed and epoxy coated) carried in stock for immediate shipment.

BOBBIN CORES Arnold bobbin cores are available in a wide range of sizes, tape thicknesses, widths and number of wraps to suit the ultimate use of the core in electronic computer assemblies. Magnetic materials usually employed are Deltamax and Square Permalloy in standard thicknesses of 1, ½, ¼ and ⅛ mil. Bobbins are supplied in ceramic or stainless steel.

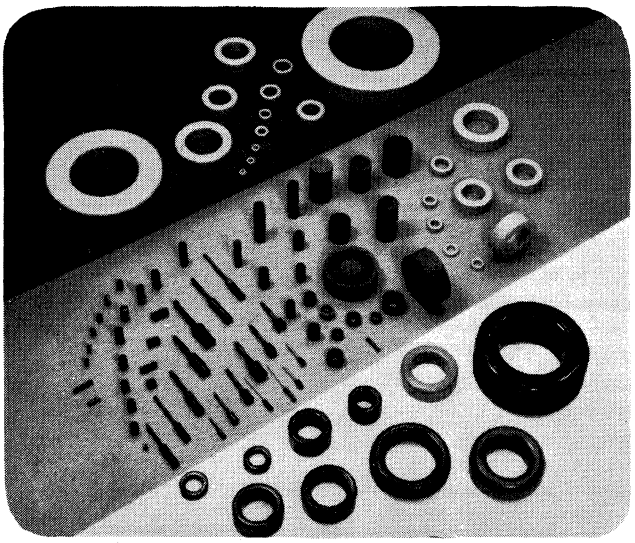
MO-PERMALLOY POWDER CORES Available in a wide range of sizes, from .183" OD to 5.218" OD. They are given various types of enamel and varnish finishes, some of which permit winding with heavy Formex insulated wire without supplementary insulation over the core.

These powder cores are supplied in standard permeabilities of 14, 26, 60 and 125 Mu; high-permeability cores of 147, 173 and 205 Mu are also available in all sizes. They provide constant permeability over a wide range of flux density, and in many cases may be furnished stabilized to provide essentially constant permeability over a specific temperature range. Preferred sizes carried in warehouse stock for immediate shipment.



Top to bottom: Tape wound cores, Silectron C, E and O cores, and bobbin cores.

AND OTHER **MAGNETIC MATERIAL** REQUIREMENTS . . .



Powder cores.

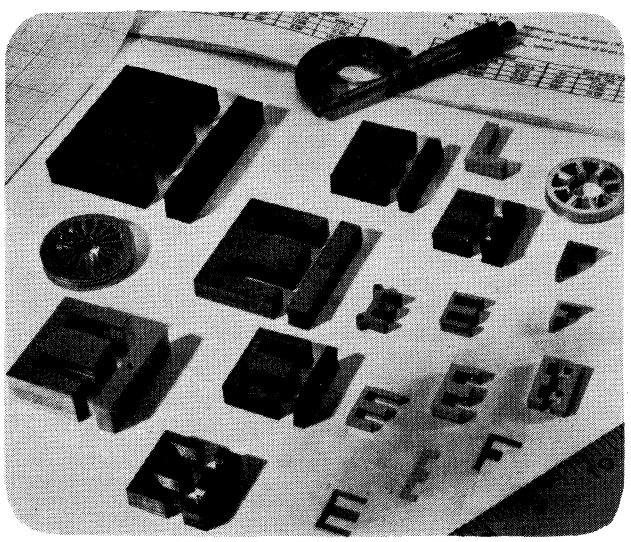
IRON POWDER CORES A wide selection of cores is available from simple cylinders to special cores of complicated design. The line includes all standard types of threaded cores, cup, sleeve, slug and cylindrical insert cores; for use in antenna and RF coils, oscillator coils, IF coils, perm tuning, FM coils, television coils, noise filter coils, induction heating and bombarder coils, and other low frequency applications. Preferred sizes are carried in warehouse stock for quick shipment. A standard series of iron powder toroids is also manufactured, conforming to the standard sizes adopted by the Metal Powder Industries.

MSS IRON POWDER CORES Lower magnetostrictive noise than other commercial iron powder even when cores are operated at saturation flux densities.

MSS powder cores are being used in interference filters, "gateless" SCR circuits for light dimming, etc. These cores have very high electrical resistivity, thus permitting utilization over a wide spectrum of frequencies ranging from 60 cycles through telephone carrier frequencies.

MSS cores are moderately priced and are available in a wide range of sizes.

LAMINATIONS AND FORMED PARTS Arnold produces a wide selection of silicon-steel, nickel-iron and cobalt-iron laminations for motors and transformers. Thin-gauge laminations (1, 2 and 4-mil thicknesses) of high-permeability materials are specialties. A complete line of transformer cans and hardware is available, including Mil-T specification. Many sizes and types of magnetic shields are available

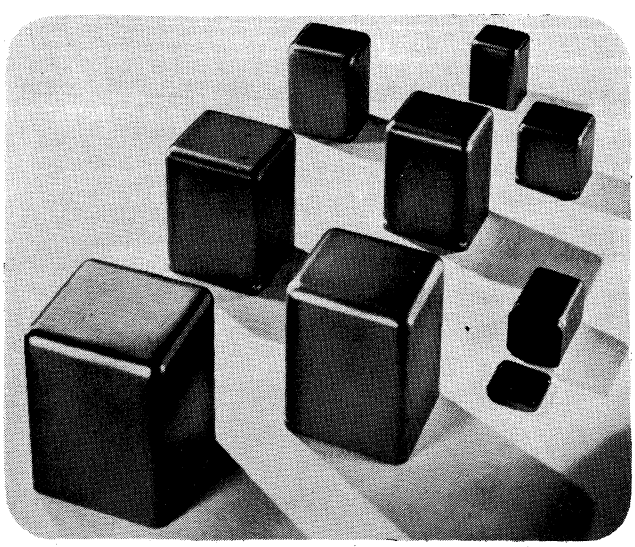


Laminations of silicon and nickel-iron.



Typical group of formed magnetic shields.

or can be fabricated to your exact requirements from Mu-Metal and other shielding materials. Shielding materials are also available in bulk form, without annealing.



Typical group of drawn transformer cans.

SPECIAL MATERIALS

2V PERMENDUR . . . a ferromagnetic alloy of cobalt, vanadium and iron that possesses high flux density saturation properties. Its magnetostrictive properties are useful in many transducer applications.

VIBRALLOY . . . a ferromagnetic alloy of nickel, molybdenum and iron whose temperature coefficient of elastic modulus is controllable over a wide range. It has high ferromagnetic permeability, and a rather high coefficient of magnetostriction. Used in applications where a zero or controlled thermo-elastic coefficient is desired.

ARNOLD®

SPECIALISTS IN MAGNETIC MATERIALS

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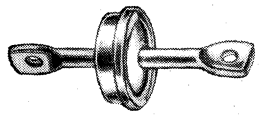
WRITE FOR COMPLETE TECHNICAL DATA

Glass-to-metal PRECISION HERMETIC SEALS

BENDIX glass-to-metal seals represent the highest standards of excellence in design, materials and workmanship. All assemblies meet or exceed MS requirements for shock, immersion, corrosion resistance, pressure and dimensional integrity. They are unsurpassed for dependable performance in any application for which they are designed. BENDIX hermetic seals are available in standard configurations and finishes for most applications. Custom designing to your individual requirements is our special skill.

SINGLE ELECTRODE TYPES

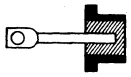


FLATTENED & PIERCED STRAIGHT WIRE (FP-SW) TYPE



Bendix No.	Eyelet Details		
	Length	Flange Dia.	Barrel O. D.
20079-1	.075	.135	.112
20079-2	.125	.375	.280
20079-3	.125	.375	.280
20079-4	.145	.500	.380
20079-5	.145	.500	.380

STAND OFF-FLATTENED & PIERCED (SO-FP) TYPE

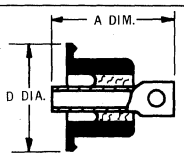


Bendix No.	Eyelet Details		
	Length	Flange Dia.	Barrel O. D.
20101-1	.125	.250	.200

HOLLOW TUBE (HT) TYPE



Bendix No.	Eyelet Details		
	Length	Flange Dia.	Barrel O. D.
20085-1	.125	.250	.200
20085-2	.125	.250	.200
20085-3	.125	.250	.200
20085-4	.125	.375	.280
20085-5	.060	.175	.125



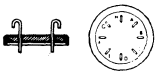
Bendix No.	Body	A Dim.	D Diam.
25073-1	21289-2	.458	.600
25073-2	21289-2	.618	.600

DOUBLE GLASS SEAL TYPE



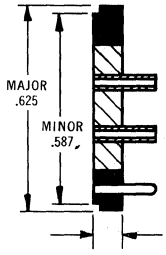
Bendix No.	Eyelet Details			
	Outer Eyelet		Inner Eyelet	
	Length	Barrel O. D.	Length	Barrel O. D.
20162-1	.093	.375	.407	.240
20162-2	.093	.375	.407	.240

5 PIN COMPRESSION SEAL HEADER CANE STRAIGHT WIRE (C-SW) TYPE

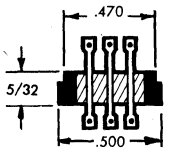


Bendix No.	Plate Detail		
	Major Dia.	Minor Dia.	Plate Thick.
20105-2	.800	.770	.145

MULTIPLE ELECTRODE TYPES

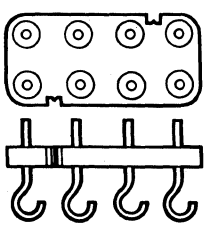


Bendix No. 25080-1

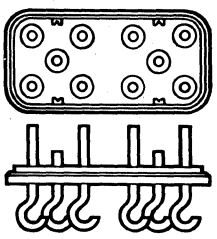


Bendix No. 20498-	1	2	3	4	5
No. of Contacts	2	3	4	5	7

HERMETICALLY SEALED MULTIPLE ELECTRODE HEADERS

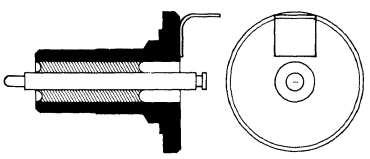


BENDIX NO. 20441

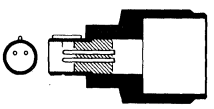


BENDIX NO. 20546

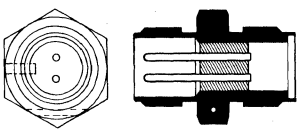
IGNITORS AND SPECIALS



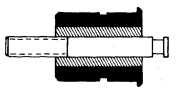
BENDIX NO. 20157



BENDIX NO. 20317



BENDIX NO. 20271



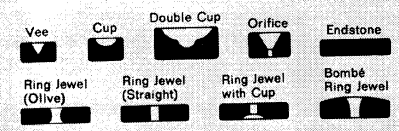
BENDIX NO. 20319

This is a partial listing only. For information and specifications on the BENDIX complete line of hermetic seals, call your representative or write direct to Microwave Devices Division, The Bendix Corporation, Hurricane Road, Franklin, Indiana 46131. Phone (317) 736-6136.

Bendix Electronics

They're on their mark. They're set. Or they're unset.

And they're ready to go to you with the highest standards of precision set for industrial jewel bearings, orifices, insulators, or assemblies. Produced under the most rigid quality control with advanced manufacturing and testing techniques, Bird precision jewels guarantee a low coefficient of friction, non-magnetic properties, and high performance over a long life expectancy. Available in either *glass* or *sapphire.* Set or unset. These jewels are ideal for meters, compasses, control units, gauges, or any electrical or mechanical device where critical parameters must be met uniformly and dependably.



BIRD PRECISION JEWELS

RICHARD H. BIRD & CO., INC. / 1 SPRUCE STREET / WALTHAM, MASS. 02154 / TELEPHONE: 617 894-0160

For a free copy of our latest literature, please call or write to:
Richard Cameron
Sales Manager

From the people who pioneered magnetic recording

Brush magnetic rubber.

non-wearing medium for magnetic recording

Molded bands of tough, highly stable rubber . . . densely impregnated with magnetic oxide . . . smooth-surfaced for minimum head wear . . . an ideal memory system for machine or process-control sequences, data processing, fault recording, repetitive message reporting (over 3,000,000 repeats without failure).

Recorded data is virtually permanent until erased . . . normal operating life well above 10,000 hours at 30 ips.
• Prolonged life • Minimum Head Wear • High Signal/noise ratio • High Fidelity • High Reliability • Low Operating Cost.

In either Hypalon® or extra-tough Adiprene® . . . bands ½" to 6" width, 2" to 18" diameters.

Whatever your problem involving magnetic media, give us your specifications. Clevite Corporation, Brush Instruments Division, 37th and Perkins, Cleveland, Ohio 44114.

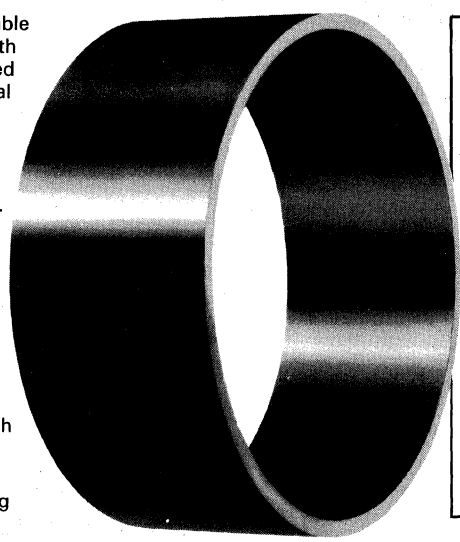
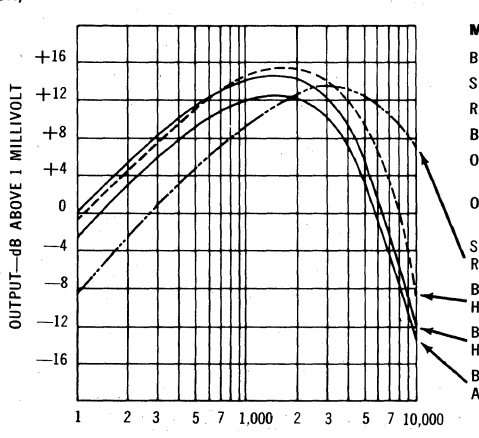


TABLE I
MATERIAL SPECIFICATION OF MAGNETIC BANDS

Magnetic Properties	Hypalon	Adiprene	Hypalon
Compound	98306	03866	98308
Coercive force *Hc-Oersteds	350	355	385
Remanence *Br - Gauss	720	510	690
Maximum Induction—Gauss	1130	800	1050
Physical Properties			
Tensile Strength, PSI Min. ASTM-D-412-51T-Die C	1500	1800	1500
Elongation Before Breakage, Min. ASTM-D-412-Die C	100%	200%	100%
Normal Elongation Recommended for Mounting	6%	6%	6%
Hardness, Shore "A" Durometer	85 ±5	80 ±5	85 ±5
Relaxation—Max. (Inches) ASTM-D-412-512-Die C.	.125"	.175"	.125"

*Magnetic properties are average values obtained from hysterisis loops and assumed magnetic cross sectional area. The loops were obtained using a 60 CPS magnetizing field of 4000 oersteds, peak to peak. Physical properties were determined from a random sampling of bands.



MAGNETIC BAND FREQUENCY RESPONSE

Brush BK-1090 Record—Reproduce Head.

Speed: 7½ in./Sec.

Record Current: 0.2 Milliamps/Winding (0.4 Milliamps Total)

Bias Current: 1.5 Milliamps/Winding (3.0 Milliamps Total) @ 50 KCPS

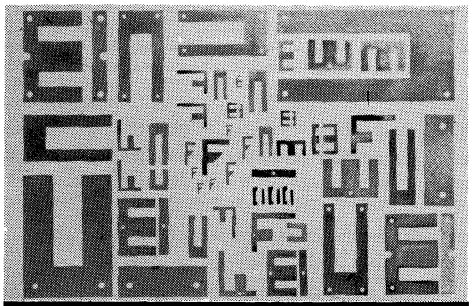
Optimum Record Current is taken as that current which produces an output 12 dB down from saturation.

Optimum Bias Current is that current which produces 2% or less third harmonic distortion at 750 CPS record signal.

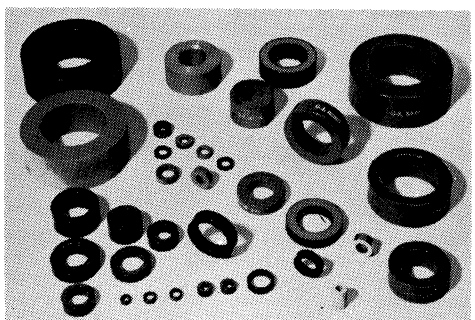
CLEVITE BRUSH

G-L INDUSTRIES, INC.
G-L Electronics Division...

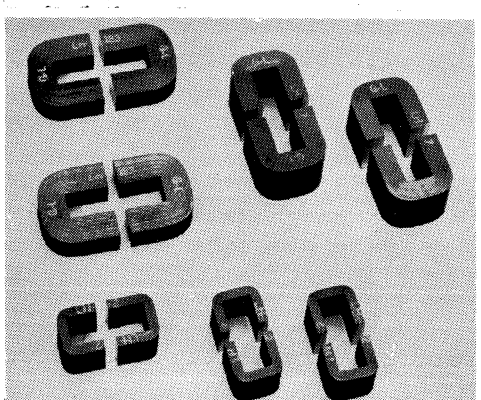
manufacturers of magnetic components



MAGNETIC LAMINATIONS Request Bulletin TB-108A



TAPE WOUND CORES Request Bulletin TB-105



"C" CORES Request Bulletin TB-109

MAGNETIC LAMINATIONS
...nickel alloys and grain-oriented silicon steel

Available without tooling charge in a wide variety of standard EI, EE, F, DU, IU, L shapes, in 6 and 14 mil thicknesses, of non-oriented (round loop) and oriented (square loop) 50% nickel alloys, high permeability 80% nickel alloys, and grain-oriented silicon steel.

Exclusive G-L "Hy-Q" finish and use of highest quality carbide dies, provides high stacking factor, high interlaminar resistance, and high "Q" in transformers, filters, reactors, chokes, and inductors.

Maximum initial permeability is obtained from precisely controlled hydrogen anneals in closed furnaces. In the 80% nickel alloys, G-L "Mu-Max" laminations have raised the minimum initial permeability available to the designer by an average of 30%.

Special shapes are tooled in G-L's own Die Shop either with steel dies for economical short-runs or in carbide for maximum die life. Typical specialties are head laminations, spacers, and shields in thicknesses down to 1 mil, with thickness tolerances as close as 50 microinches.

TAPE WOUND CORES and BOBBIN CORES

Promptly produced in gapless toroidal form—in sizes from 1/16" OD and 1/32" tape width...to more than 10" OD and 2-3/4" tape width, weighing thousands of grams.

Wide selection of available alloys, as tabulated below, cover applications from tiny pulse transformers for transistorized ignition systems to massive cores for mag-amp controlled power supplies of missile launching submarines.

Cores are wound with 1/8 mil to 14 mil thick tape in various nickel alloys and silicon steel—uncased, or cased in a choice of aluminum, molded phenolic, or new glass filled nylon boxes...or on stainless or ceramic bobbins. Aluminum cased cores optionally available with G-L's "EE" coating, which not only eliminates taping before winding the core, but also provides a seal resistant to vacuum impregnation. The "EE" coating is neither tacky nor brittle, exhibits no cold flow, and does not soften at high temperatures. Aluminum cased cores, "EE" coated, have been used successfully in magnetic amplifiers at temperatures as high as 200°C., and have survived the shock of missile launching and in-flight centrifugal and centripetal forces, as high as 200 G.

"C" CORES

A wide range of 4 mil "C" cores from the smallest requirements up to approximately 4-1/2" in overall length are now available from stock. G-L "C" cores are produced by new manufacturing techniques with special emphasis on maintaining precise dimensional and electrical uniformity, to assure easy assembly and low power losses.

Because of new improved impregnation materials and techniques, "C" cores manufactured by G-L will operate continuously in temperature environments in excess of 200 degrees Centigrade without deterioration of the interlaminar bond.

AVAILABILITY:

LAMINATIONS—Stocks of all popular standard shapes, alloys, and thicknesses warehoused on both East and West Coasts for immediate shipment.

TAPE WOUND CORES—Stocks of IEEE, EIA standard sizes cased in plastic, aluminum, and EE coated, warehoused on both East and West Coasts for immediate shipment. Most other sizes available in quantity in less than two weeks.

"C" CORES—Prototype stock maintained on both East and West Coasts for immediate delivery.

BOBBIN CORES — Catalog bobbin sizes available in quantity in three weeks or less...bobbin cores are normally made to customer specifications.

G-L INDUSTRIES, INC.
G-L Electronics Division

Factory, Engineering Offices & East Coast Warehouse
300 Harvard Avenue
Westville, New Jersey 08093
609 GL 6-7300
TWX 609-456-6429

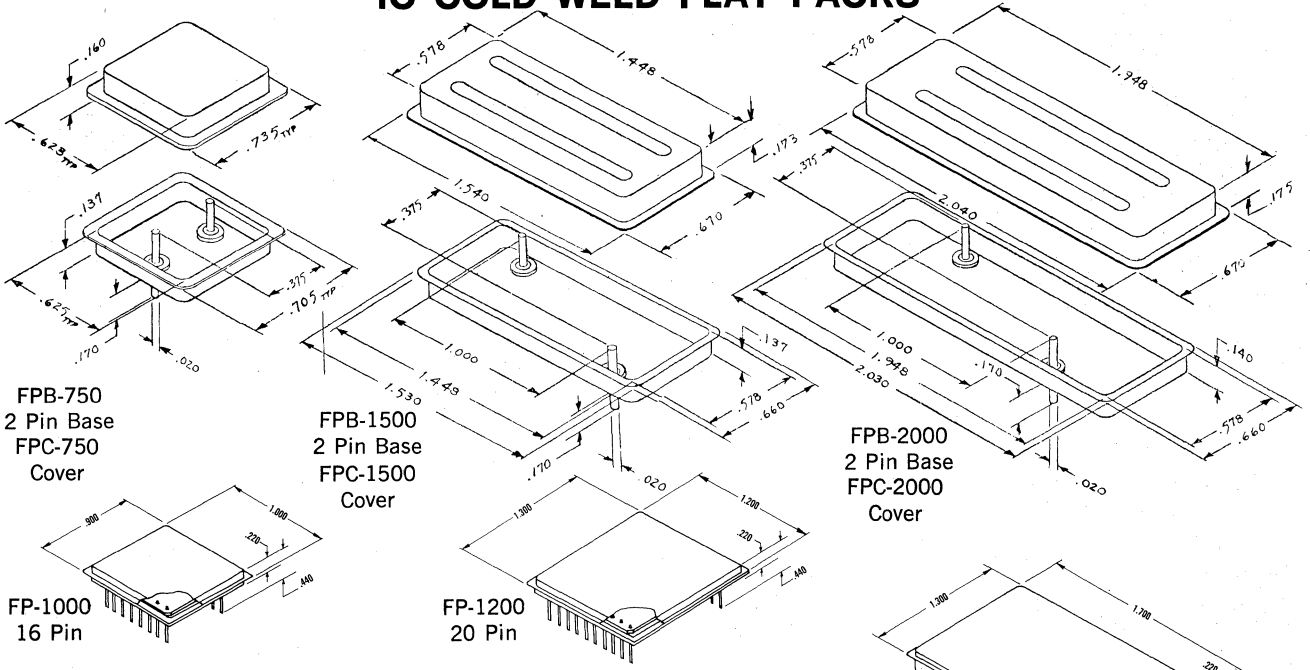
West Coast Warehouse
Collins & Hyde, Inc.
5380 Whittier Boulevard
Los Angeles, California 90022
(213) 685-6540
TWX 910-580-3646

REPRESENTATIVES THROUGHOUT UNITED STATES AND CANADA

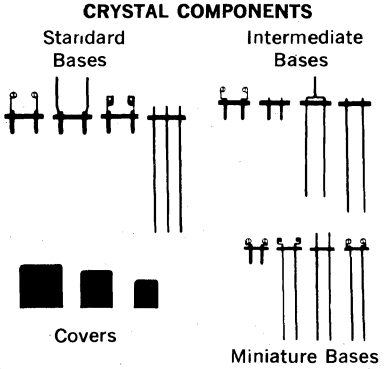
G T I CORPORATION
Saegertown Components Division

COMPONENTS

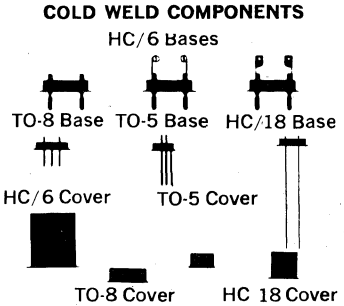
IC COLD WELD FLAT PACKS



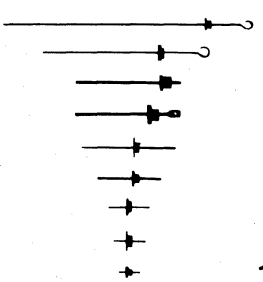
CRYSTAL COMPONENTS



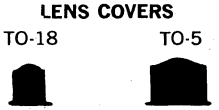
COLD WELD COMPONENTS



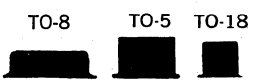
PIN SEALS



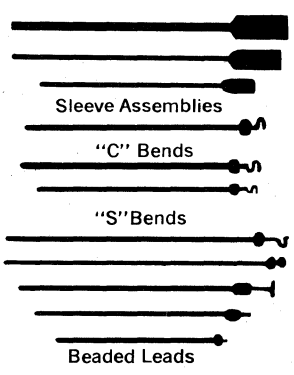
LENS COVERS



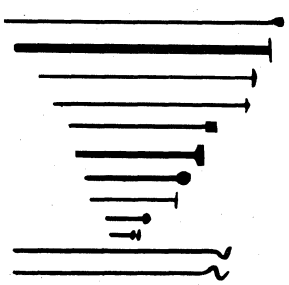
WINDOW COVERS



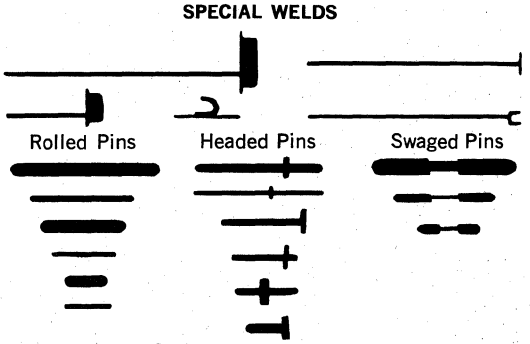
DIODE HARDWARE



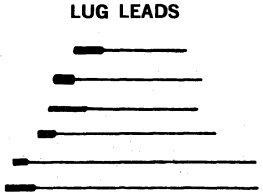
HEADED LEADS



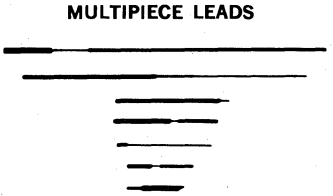
SPECIAL WELDS



LUG LEADS



MULTIPIECE LEADS



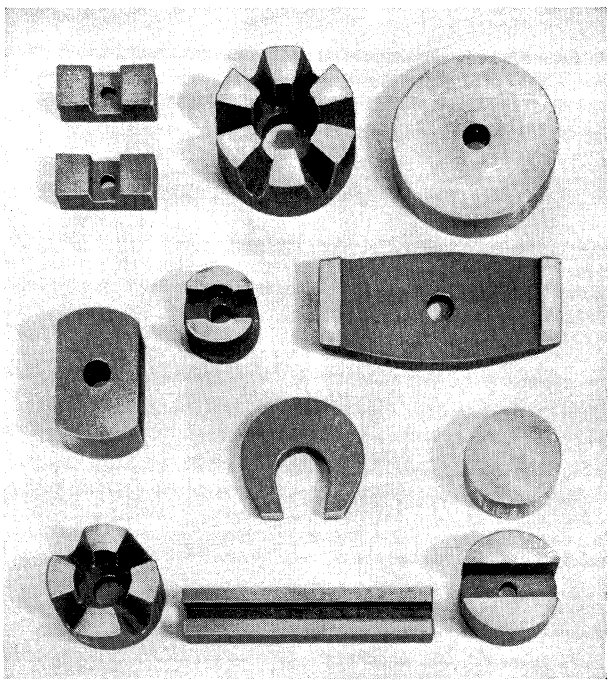
STRAIGHT CUT LEADS

PERMANENT MAGNETS

Many GE permanent magnets are stocked and may be ordered by catalog number. Where a stocked magnet does not meet all the application's requirements, General Electric can design a magnet that does. Engineering design assistance or information on stocked and special magnets is available on request.

ALNICO MAGNETS

- Radio and television speakers
- Telephones
- Refrigerator latches
- Electron tube assemblies
- Motors
- Generators
- Toys and novelties
- Space vehicles and missiles
- Controls



In today's industries, Alnico is still the most widely used permanent magnet material, and the growing family of Alnico grades continues to find new and ever-increasing usage.

This broad acceptance is the result of the wide range of magnetic properties obtainable with Alnico, the high degree of stability with respect to time and temperature, and the vast array of sizes and shapes that can be manufactured economically through General Electric's mass production methods.

The Alnicos are precipitation-hardened alloys made by conventional casting or sintered powder metallurgical techniques and a specialized heat treatment. Precise control of the various Alnico chemistries plus the heat treating process give the material its well-known qualities of high magnetic induction and high resistance to demagnetization.

The family of GE Alnico permanent magnets includes cast Alnico 3, 4, 5, 5DG, 5-7, 6, 8, 9, and sintered Alnico 2, 5, and 8. These various grades offer industry proven magnetic materials with a wide range of magnetic inductions and coercivities (resistance to demagnetization) in the exact shape and size required.

The versatility of Alnico, plus General Electric's advanced research and design and application engineering capabilities, continues to broaden the acceptance of these most widely used magnets.

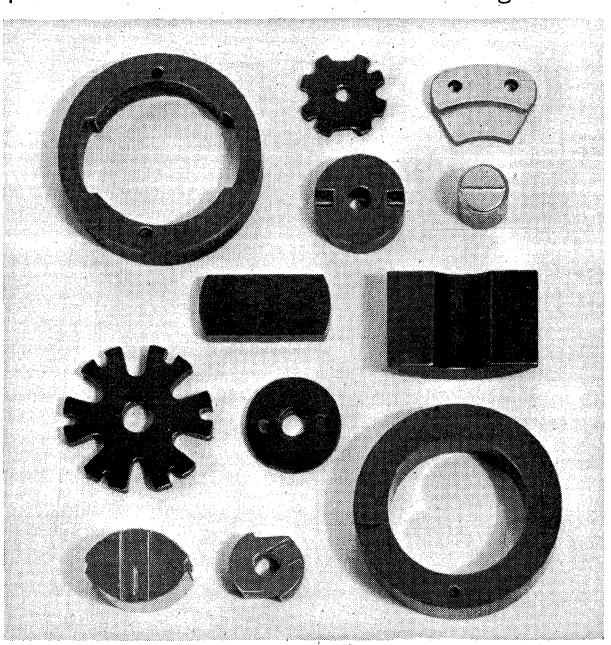
LODEX® MAGNETS

- Hearing aids
- Core meters
- Miniature motors
- Speedometers
- Reed switches
- Timing motors

Lodex, the trade name of General Electric's recently developed magnet material, can be formed economically into precise close-tolerance shapes and small sizes for intricate applications.

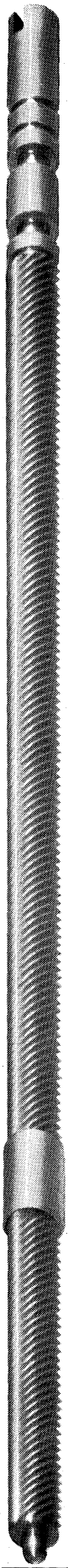
A product of GE research and development, Lodex production techniques eliminate form grinding or high-temperature treating. This new magnetic material, consisting of elongated single domain iron cobalt particles in the size of smoke particles uniformly dispersed in a lead matrix, is pressed or extruded (rather than cast or sintered) into its final shape. Such a manufacturing process makes it possible to produce magnet shapes to extremely close physical and magnetic tolerances and to maintain close piece-to-piece magnetic uniformity.

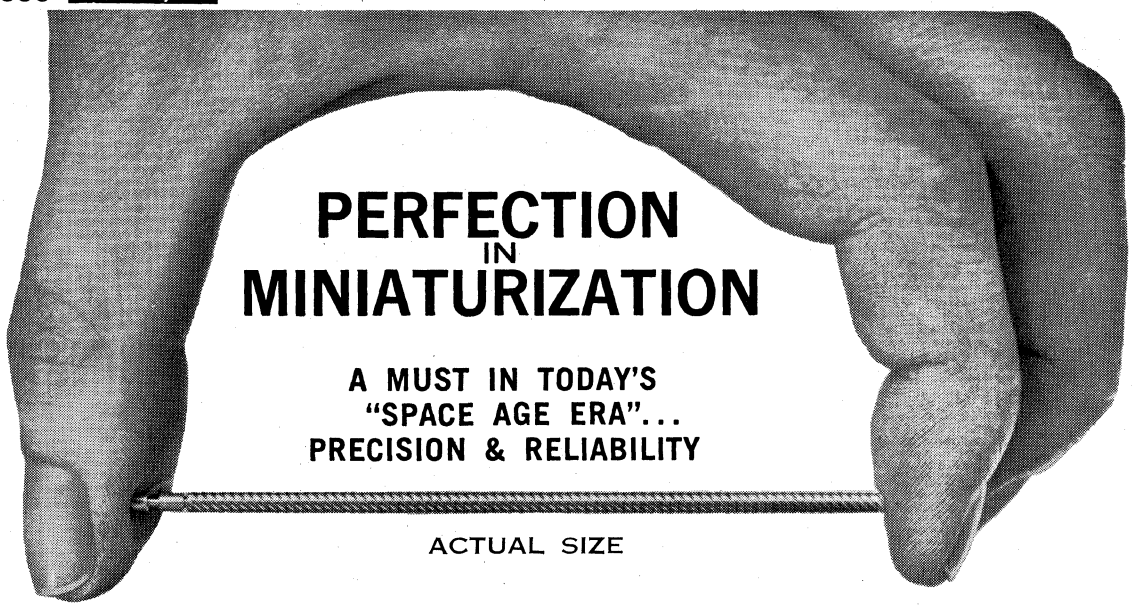
Since its introduction, the family of Lodex magnets has found widespread and growing usage among manufacturers requiring intricate, tight tolerance shapes with a high degree of magnetic uniformity. Designers know that this physical and magnetic uniformity in their applications virtually eliminates the need for final testing of the end product and permits automation in the production process.



For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC





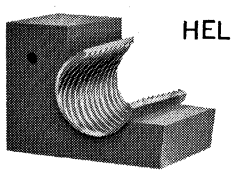
PERFECTION IN MINIATURIZATION

A MUST IN TODAY'S "SPACE AGE ERA"... PRECISION & RELIABILITY

ACTUAL SIZE

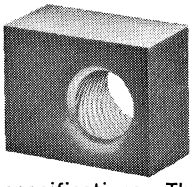
Shown above is a miniature version (exact size) of the highly dependable and reliable HELISHAFT. Because of the extreme need for compactness, *Helitronics* has perfected the miniaturization of all its components; HELISHAFT*, HELIBLOC*, HELINUT* and HELISLIDE*. These poly-start threaded components working as highly efficient teams, divide the work load precisely and equally over each of the multiple threads, realizing a unique degree of accuracy and smoothness of flow, while minimizing wear. The high degree of refinement in today's electronic and mechanical techniques requires that same degree of perfection in all components of the equipment.

All industries including Microwave, Electronic Instruments, Missile, Medical, and Scientific Toys, have recognized the important part Helitronic parts are playing in today's demand for *progress*, with *reliability* and *dependability*.



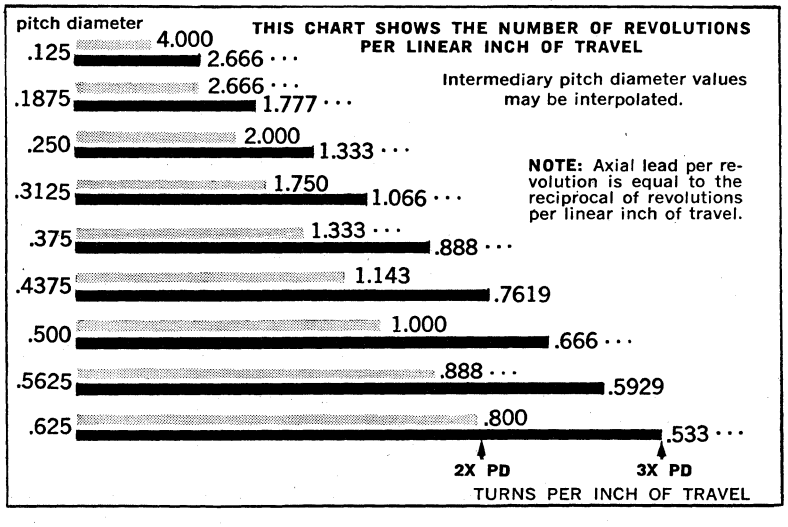
HELINUT*

The HELINUT, a poly-start thin-walled internally threaded metal sleeve (a wall thickness as low as .010) is precisely mated to each individual HELISHAFT. The HELINUT is used as an embedment in our HELISLIDE. It can be potted, or press-fit and staked for your specific needs.



HELIBLOC*

Utilizing the favorable characteristics of Teflon†, the HELIBLOC is a poly-start internally threaded lead-nut or contact slider block, made in a variety of shapes and sizes, to fit your specifications. The design of the HELIBLOC has been tested and proven in the field to be a repetitively reliable mate for the HELISHAFT.





Send for your FREE informative & descriptive literature on all components of the Helitronic unit. All inquiries must be on company letterhead. For immediate information call the plant; area code 201 621-7773. Write our sales office for a representative to call on you.

*T.M.-PAT. PEND. ALL RIGHTS RESERVED
†TEFLON T.M. E. I. DUPONT

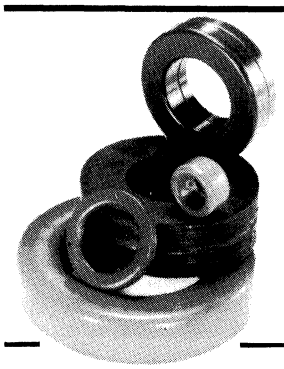
HELITRONICS CORP.

SALES OFFICES and RESEARCH, DEVELOPMENT, PRODUCTION:
916 MCarter Hwy., Newark, N. J. (area code 201) 621-7773

The INTER-TECHNICAL Group, Inc.

UNITED STATES AFFILIATE OF THE TELCON GROUP OF COMPANIES

P. O. BOX 23
IRVINGTON-ON-HUDSON, N. Y. 10533
TEL: 914-591-8822
TWX: 710-564-0802



TELCON METALS LTD.

is one of the largest and oldest manufacturers of nickel, iron and cobalt alloys for magnetic applications. Their fully integrated facilities provide raw materials and fabricated components covering the whole range of commonly used magnetic materials.

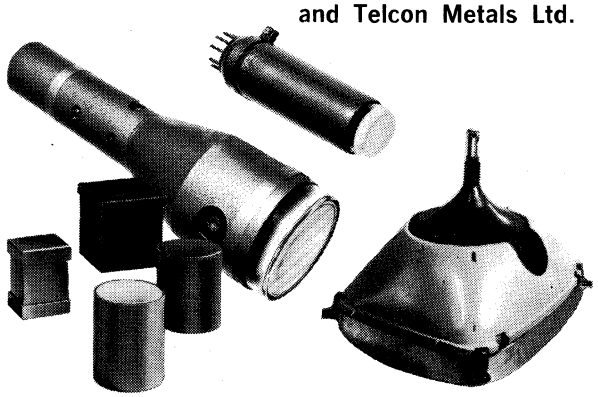
NEW SATMUMETAL COMBINES INITIAL PERMEABILITY OF 65,000 AND SATURATION FLUX DENSITY OF 15,000 GAUSS AT COST COMPARABLE TO 80% NICKEL IRON ALLOY. Available in the form of toroidal cores wound from 0.002", 0.004" and 0.008" strip and certain lamination patterns.

TELCON HIGH PERMEABILITY MAGNETIC ALLOYS AND FABRICATED TOROIDS

80% NICKEL	50% NICKEL	OTHER ALLOYS	ULTRATHIN FOIL
Round TELCON 79 TELCON 40 TELCON 60 TELCON 100 **Square** ORTHO TELCON 79	**Round** RADIOMETAL 50 SUPER RADIOMETAL HYRHO RADIOMETAL **Square** HCR ALLOY	PERMENDUR PERMENDUR 24 SUPERMENDUR VICALLOY RADIOMETAL 36 Magnetic Compensating Alloy REMENDUR	As thin as 0.000125" in a wide range of materials including many of those listed and others including Beryllium copper, tantalum, and zirconium.

MAGNETIC SHIELDS UP TO 30" DIAMETER FOR CATHODE RAY TUBES & TRANSFORMERS

by Magnetic & Electrical Alloys Ltd. and Telcon Metals Ltd.



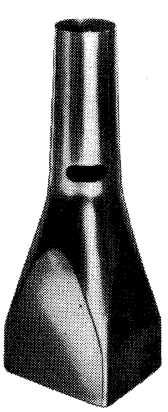
An extensive range of standard shields are available for cathode ray tubes, transformers, chokes, photo multipliers, vibrators, high gain amplifiers and magnetic tape recorder heads. Special patterns also can be produced to meet individual requirements. Shields can be supplied in a wide range of magnetic alloys and are available either single or multilayer. Technical assistance available on your shielding problems.

TELFORM

DEEP DRAWN COMPLEX SHAPES

A NEW CONCEPT IN MAGNETIC SHIELD CONSTRUCTION

Specially developed for quantity production of high efficiency complex shields, new TELFORM construction utilizes precision drawn segments to drastically reduce welded seams. The result is extra close fitting shields with improved shielding characteristics. This new technique is applicable for CRT tubes up to approximately 20" long. No premium charge even though dimensions, finish and appearance are far more uniform throughout batches than conventionally fabricated shields. Rapid delivery after initial tooling. Available in 80%, 50% and 36% nickel-iron alloys up to 0.10" thick.



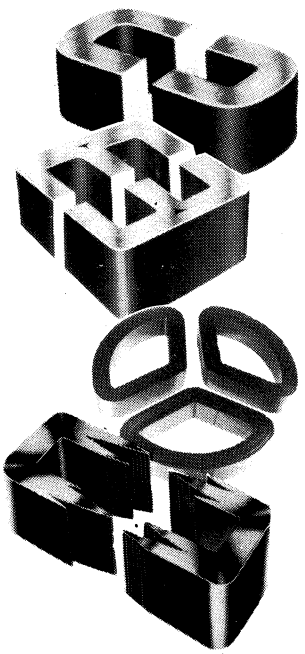
Extremely Competitive Prices on Custom Shields. Send for Illustrated Catalog and Ask for a Quotation.

OTHER TELCON PRODUCTS:

- Thermostatic Bimetals • High Permeability Strip, Rod & Wire For Component Manufacturing & Shielding
- Glass to Metal Seal Alloys.

TELMAG E, C and TOROIDAL

Tape-wound cores



- Made to EIA Spec. RS217 & trade specifications primarily from American Allegheny-Ludlum "Silectron" by our British associate TELCON MAGNETIC CORES LTD. . . . Europe's largest manufacturer of grain oriented silicon cores.
- Available in all American standard or special sizes to American core numbers. Popular types available from New York warehouse for immediate delivery.
- Sold at prices that help you solve your constantly rising cost level problem—due to the unique combination of American material and one of the largest manufacturing facilities in the world.
- Now also available "Circular E cores" for improved performance of 3-phase transformers. Savings in weight, larger window area, better cooling and magnetically balanced circuits offer broad advantages over conventional 3-phase cores.
- **NEW** OLMAG 12/13 mil concentrically wound "C" cores with **matched saw tooth legs** on mating cores, reduces magnetizing current up to 60% and iron losses up to 25%. Almost all bonding is eliminated, with only edge bonding in the region of the cuts to assist in assembly within the bobbin.

COMPLETE PUBLISHED STOCK & PRICE LIST AVAILABLE. LET US ADD YOUR NAME TO OUR MAILING LIST . . . AND CONVINCE YOURSELF!

"C" CORE COMPRESSED AIR BANDING TOOL by TELMAG



Manufacturing rejects caused by variations in banding of "C" transformer cores can now be eliminated. The new "C" core Compressed Air Banding Tool provides consistent banding stresses in assembly-line operation. By making cores useful which were formerly rejected, the tool soon pays for itself.

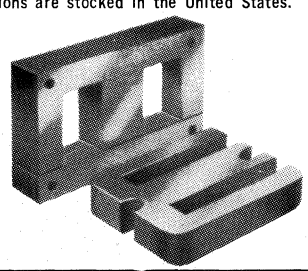
NiFe MAGNETIC LAMINATIONS for TRANSFORMERS & CHOKES

by Magnetic & Electrical Alloys Ltd. . . .

. . . one of the largest commercial manufacturers of high quality NiFe alloy laminations in Europe. To find out the cost savings that M.E.A. can provide let us quote on your next requirement. For off-the-shelf delivery at the lowest quantity prices, many std. laminations are stocked in the United States.

SINGLE "E" LAMINATIONS TO REPLACE "EI187" AND "EE24-25" TYPES IN 6 MIL

An exclusive M.E.A. development that increases performance, reduces material cost, reduces labor cost. No modification of bobbin, clamps or other parts required, and when the final lamination has been inserted into the bobbin, the single "E" is practically self-clamping. End result is a 50% saving in assembly cost.



Specify BERYLLIUM COPPER SPRINGS micro-processed

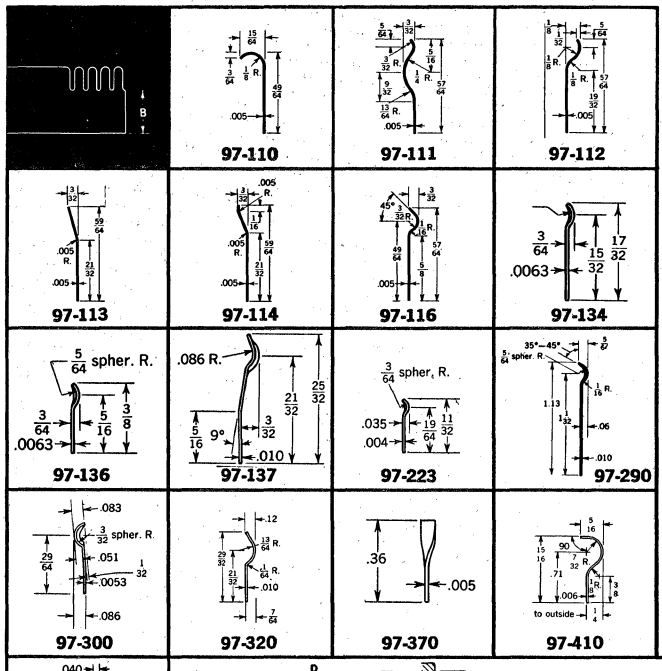
Specially developed equipment and production processes, combined with the broad experience of I-S engineers, assure higher efficiency and better performance in springs for electronic controls and high frequency applications. Only 100% laboratory certified raw material is used in the production of micro-processed precision springs.

All strips and rings on these two pages are made of beryllium copper Alloy No. 25, conforming to ASTM-B194 and Federal QQ-C-533a Alloy 172. Strips are especially useful for grounding and bonding in high frequency equipment. Rings are made from contact finger stock, and are open in free position. All jig hardened to close tolerances.

ALL ARE STANDARD PRODUCTS AVAILABLE FROM STOCK!

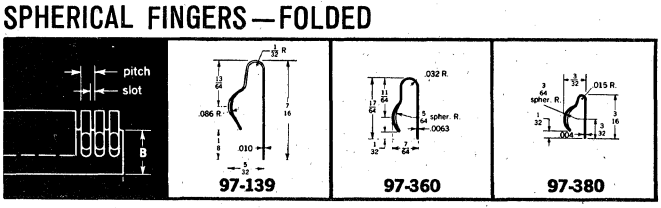
FINGER CONTACT STRIPS

FINGERS ON ONE EDGE

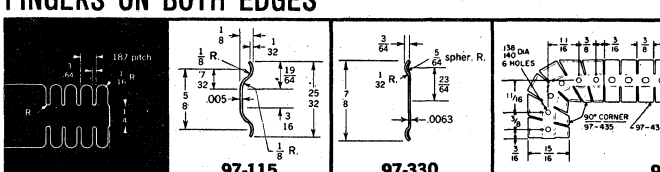


catalog number	A	D	E	T
97-438	1.27	5/32	.26	.005
97-440	1.90	3/16	13/32	.007

SPHERICAL FINGERS—FOLDED



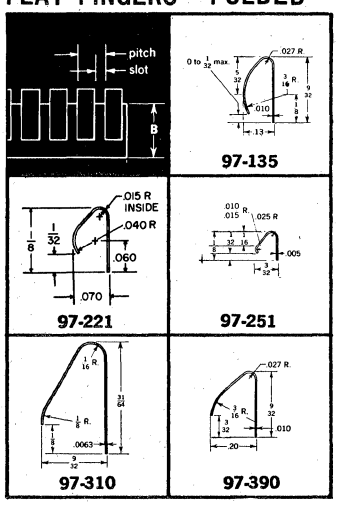
FINGERS ON BOTH EDGES

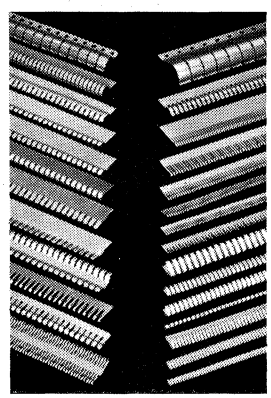


Fastener 97-445 for 97-435 and 97-436

Kits available. Write for Bulletin A-65.

FLAT FINGERS—FOLDED





ENGINEER'S SAMPLE ASSORTMENT

One each of 29 items listed here.
Cat. No. 97-272.
Price: $20.00.

Catalog Number	Pitch	Slot	B	Stock Length	Weight Lbs. per 1000 in.
97-110	.187	.047	5/8	16"	1.3
97-111	.187	.047	5/8	16"	1.3
97-112	.187	.047	5/8	16"	1.3
97-113	.187	.047	5/8	16"	1.3
97-114	.187	.047	5/8	16"	1.3
97-115	.187	.047		16"	1.1
97-116	.187	.047	41/64	16"	1.3
97-134	.075	.025	7/32	16"	.9
97-135	.134	.040	15/64	16"	1.4
97-136	.075	.025	1/16	16"	.6
97-137	.094	.031	5/16	16"	2.0
97-139	.094	.031	5/16	16"	2.0
97-221	.060	.020	3/32	12"	.33
97-223	.060	.020	1/8	16"	.35
97-251	.127	.050	3/32	12"	.3
97-290	.075	.025	11/16	16"	3.0
97-300	.165	.040	3/16	16"	.8
97-310	.187	.062	3/8	16"	1.4
97-320	.172	.047	3/8	16"	2.4
97-330	.075	.025		16"	1.3
97-360	.075	.025	7/32	16"	.9
97-370	.095	.030	.16	16"	.43
97-380	.060	.020	1/8	16"	.35
97-390	.134	.040	15/64	16"	1.4
97-410	.157	.040	11/32	16"	1.8
97-430	.154	.059	1/4	16"	1.4
97-436	.375	.015	7/32	24"	1.2
97-438	.375	.040		25 ft.	1.6
97-440	.500	.040		25 ft.	3.6

COMPLETE ENGINEERING AND DESIGN SERVICE

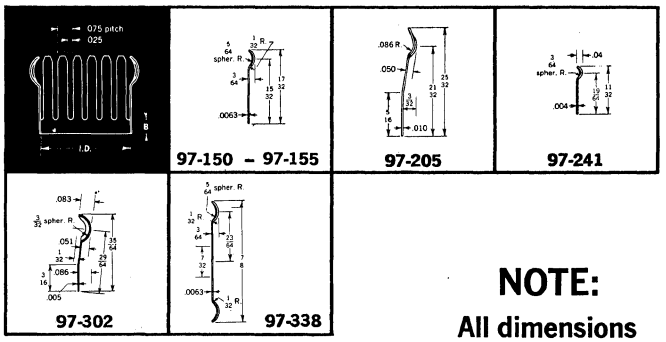
Our engineers are available at all times to assist you in solving your problems in the application of micro-processed beryllium copper springs. Their extensive knowledge and wide facilities often enable them to recommend better parts at lower cost. Prototype quantities produced quickly and economically.

FINISHES AVAILABLE:

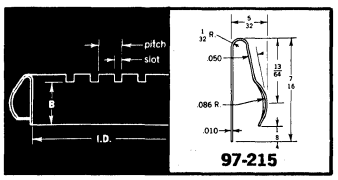
Standard finger contact strips and high frequency contact rings are supplied "As Heat Treated" (purchaser to apply finish) or "Bright Finish" (tarnish-resistant). Other finishes also available: Silver plated—or gold, rhodium, nickel or cadmium. Write for complete catalog.

FINGER CONTACT RINGS

MALE RINGS

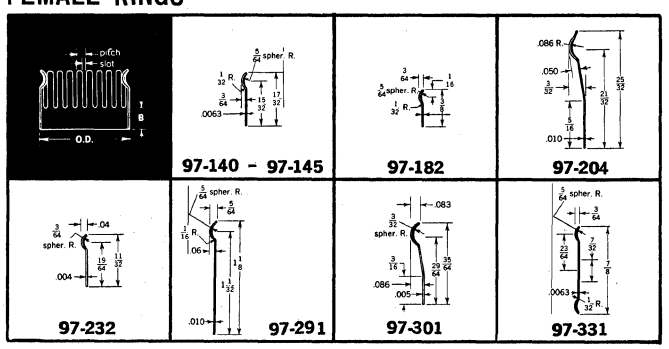


MALE RINGS—FOLDED FINGERS

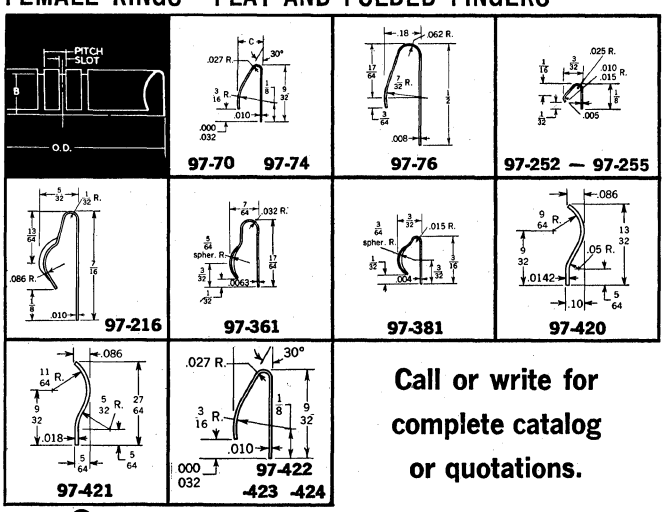


NOTE:
All dimensions shown in inches. Other diameters in all designs supplied to order.

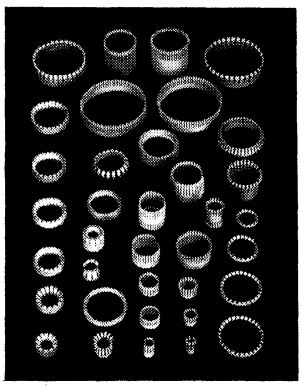
FEMALE RINGS



FEMALE RINGS—FLAT AND FOLDED FINGERS



Call or write for complete catalog or quotations.



ENGINEER'S SAMPLE ASSORTMENT

Thirty-six different contact rings, all identified. One or more from each family of rings shown here. Cat. No. 97-273. Price: $15.00.

Catalog Number	MALE Pitch	Slot	I.D.	Fingers	Nominal Ring Dia.	B	Weight in Lbs. per M	Made from Strip
97-150	.075	.025	.208	9	1/4	7/32	.6	97-134
97-151	.075	.025	.327	14	3/8	7/32	1.0	97-134
97-152	.075	.025	.447	19	1/2	7/32	1.3	97-134
97-153	.075	.025	.685	29	3/4	7/32	2.0	97-134
97-154	.075	.025	.949	40	1.0	7/32	2.8	97-134
97-155	.075	.025	1.449	61	1 1/2	7/32	4.3	97-134
97-205	.094	.031	.886	30	1.0	5/16	5.3	97-137
97-215	.094	.031	1.240	42	1 1/2	5/16	8.6	97-139
97-241	.060	.020	.339	18	3/8	1/8	.4	97-223
97-302	.165	.040	1.842	35	1 31/32	3/16	4.6	97-300
97-338	.075	.025	.447	19	1/2		1.8	97-330

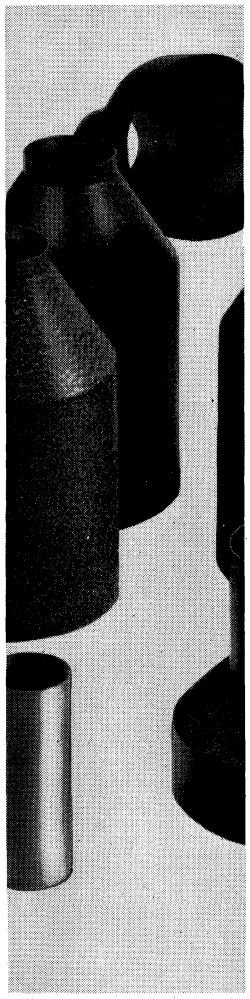
Catalog Number	FEMALE Pitch	Slot	O.D.	Fingers	Nominal Pin Dia.	B	Weight in Lbs. per M	Made from Strip
97-70	.135	.040	1.219	28	1 1/64	15/64	5.5	97-135
97-74	.135	.040	.875	20	43/64	15/64	3.9	97-135
97-76	.165	.015	.637	12	11/32	1/4	3.2	97-340
97-140	.075	.025	.292	12	1/4	7/32	.8	97-134
97-141	.075	.025	.436	18	3/8	7/32	1.3	97-134
97-142	.075	.025	.555	23	1/2	7/32	1.6	97-134
97-143	.075	.025	.795	33	3/4	7/32	2.3	97-134
97-144	.075	.025	1.057	44	1.0	7/32	3.1	97-134
97-145	.075	.025	1.558	65	1.5	7/32	4.3	97-134
97-182	.075	.025	.555	23	1/2	1/16	1.1	97-136
97-204	.094	.031	1.040	34	1.0	5/16	6.6	97-137
97-216	.094	.031	1.244	41	1.0	5/16	7.0	97-139
97-232	.060	.020	.536	28	1/2	1/8	.6	97-223
97-252	.127	.050	1.250	31	1.085	3/32	1.1	97-251
97-253	.127	.050	1.155	28	.985	3/32	1.0	97-251
97-254	.127	.050	.905	22	.735	3/32	.8	97-251
97-255	.127	.050	.650	16	.480	3/32	.6	97-251
97-301	.165	.040	1.737	33	1 5/8	3/16	4.3	97-300
97-331	.075	.025	.795	33	3/4		3.0	97-330
97-361	.075	.025	1.008	42	27/32	7/32	2.3	97-360
97-381	.060	.020	1.207	63	1 1/16	1/8	1.3	97-380
97-420	.193	.075	.500	8	.323	1/16	1.9	
97-421	.100	.050	.500	15	.368	1/16	2.2	
97-422	.154	.050	.600	12	.368	1/4	2.3	
97-423	.159	.050	.775	15	.540	1/4	3.	
97-424	.135	.040	1.050	24	.810	15/64	4.7	

INSTRUMENT SPECIALTIES CO., INC. Little Falls, New Jersey
Phone: 201-256-3500 • TWX 201-256-3784

Magnetic Shield Division has the total magnetic shielding capability to assist you in solving any shielding problem. 80% of current shield designs originated with MSD and this design and engineering experience is available to you for research, planning and fabrication.

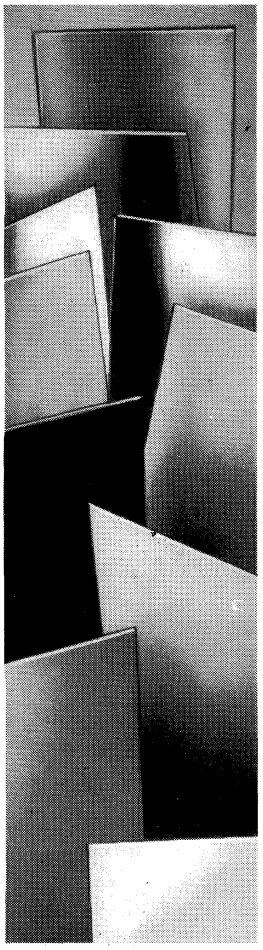
Research through Production for all your magnetic shielding needs

The Six MSD's



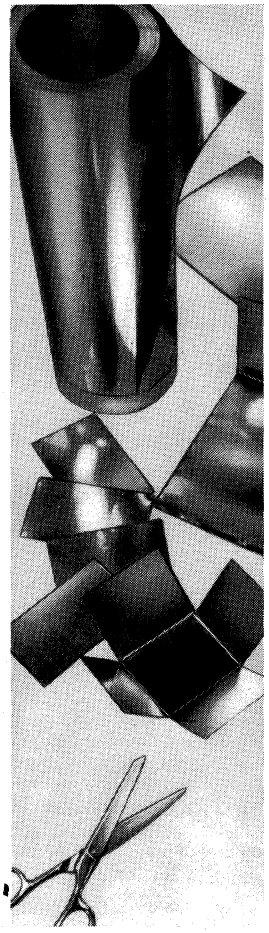
1 FABRICATION

MSD's Netic and Co-Netic Magnetic Shields can be fabricated in any size, shape and quantity, from a miniature tube to a shielded room.



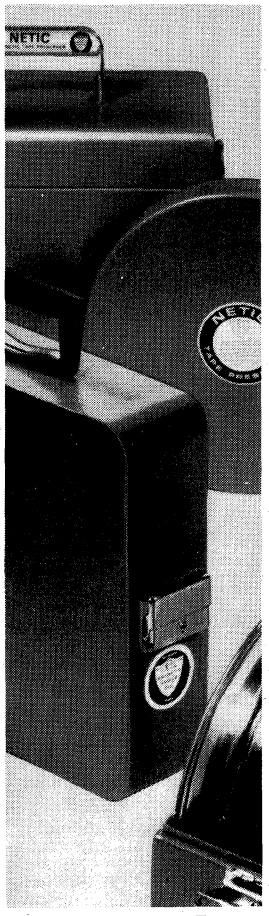
2 SHEET STOCK

For fabrication in your plant or ours. Low cost shielding solutions are provide by fully hydrogen annealed Perfection Annealed stock which normally requires no further heat treatment.



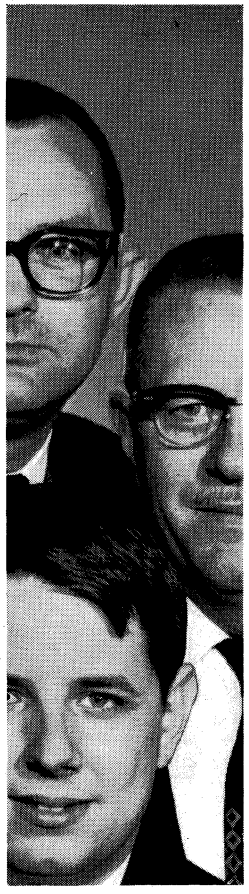
3 FOIL

MSD Netic and Co-Netic Foils are ideal for prototype evaluation and production applications. Available in both plain and adhesive backing, they can be easily shaped in minutes to fit your needs.



4 TAPE PRESERVER CONTAINERS

Used world-wide to protect against loss of valuable tape data. Round and rectangular portable units include the new, smartly designed "Executive." Stacked, sectionalized units for permanent storage are also available.



5 TECHNICAL ASSISTANCE

The concentration of design experience and engineering knowledge that has provided over 80% of the magnetic shield designs now in use is yours to assist you in solving an engineering, R & D or production problem. Phone 312, 766-7800.

6 FAST, CONVENIENT DELIVERY is the SIXTH MSD. Some items from stock. Fabricated items 3-4 weeks.

MAGNETIC SHIELD DIVISION PERFECTION MICA COMPANY
740 THOMAS DRIVE, BENSENVILLE, ILLINOIS 60106
Phone: 312 766-7800 • TWX: 910-256-4815

Netic and Co-Netic Alloys Stocking Guide

Co-Netic AA and Netic S3-6 Sheets are stress annealed for ease in forming, spinning, stamping and drawing operations. They must be hydrogen annealed after fabrication to obtain maximum magnetic shielding characteristics. Perfection Annealed Stock has been fully hydrogen annealed to obtain maximum magnetic shielding properties. This can be used directly for prototype and production fabrication if severe forming and drawing is not involved.

SHEET

CO-NETIC AA ALLOY STRESS ANNEALED SHEET*

Thickness	Width	Maximum Number Sheet Per Crate	Weight in Pounds Each Sheet Length 15″	Length 30″	Length 60″	Length 90″	Length 120″
.014″	30″	20	1.88	3.76	7.53	11.28	15.05
.020″	30″	18	2.69	5.38	10.75	16.14	21.50
.025″	30″	14	3.36	6.72	13.44	20.16	26.88
.031″	30″	12	4.17	8.33	16.67	24.99	33.33
.040″	30″	8	5.38	10.75	21.50	32.28	43.00
.050″	30″	8	6.72	13.44	26.88	40.32	53.75
.062″	30″	6	8.33	16.66	33.33	49.98	66.65
.095″	30″	4	12.77	25.53	51.07	76.59	102.13

		Tare Weight In Pounds				
Crating	Cardboard	10	Will Not Ship By Cardboard			
	Wood	13	21	35	60	71

CO-NETIC AA ALLOY PERFECTION ANNEALED SHEET**

Thickness	Width	Maximum Number Sheets Per Crate	Weight in Pounds Each Sheet Length 15″	Length 30″	Length 60″	Length 96″
.014″	30″	20	1.88	3.76	7.53	12.05
.020″	30″	18	2.69	5.38	10.75	17.20
.025″	30″	14	3.36	6.72	13.44	21.50
.031″	30″	12	4.17	8.33	16.67	26.67
.040″	30″	8	5.38	10.75	21.50	34.40
.050″	30″	8	6.72	13.44	26.88	43.01

		Tare Weight In Pounds			
Crating	Cardboard	10	Will Not Ship By Cardboard		
	Wood	13	21	35	61

NETIC S3-6 ALLOY SHEET

Thickness	Width	Maximum Number Sheet Per Crate	Weight in Pounds Each Sheet Length 15″	Length 30″	Length 60″	Length 90″	Length 120″
.014″	30″	20	1.71	3.41	6.83	10.23	13.65
.020″	24″	18	1.95	3.90	7.80	11.71	15.60
.025″	26″	14	2.25	4.50	9.00	13.51	18.00
.031″	26″	12	3.28	6.55	13.10	19.65	26.20
.049″	26″	8	5.18	10.35	20.70	31.05	41.40
.062″	26″	6	6.55	13.10	26.20	39.30	52.39
.095″	26″	4	10.03	20.07	40.14	60.21	80.27

		Tare Weight In Pounds				
Crating	Cardboard	10	Will Not Ship By Cardboard			
	Wood*	13	21	35	60	71

Stock Shipped Same Day As Ordered

Stock Shipped Same Day As Ordered

*Stress Annealed For Ease of Fabrication. Must Be Final Annealed For Maximum Attenuation Characteristics.

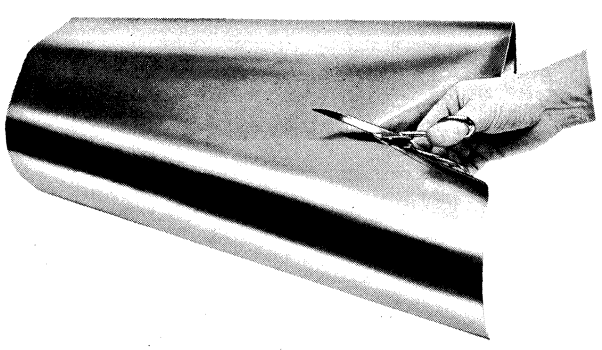
**Perfection Annealed Stock Has Been Fully Hydrogen Annealed. No Further Annealing Necessary For Prototype & Production Fabrication If Severe Forming & Drawing Is Not Involved.

NETIC, CO-NETIC — Netic is basically used in fields of high intensity because this shielding alloy will not saturate easily, but it will achieve only medium attenuation. CO-NETIC is basically used in fields of low intensity in order to utilize its high attenuation characteristics. When to use NETIC, CO-NETIC, or combination depends on the attenuation required, and the magnitude and type of field to be shielded against.

PHYSICAL DATA ON SHIELDING ALLOYS
(STRESS ANNEALED CONDITION)

	CO-NETIC AA	NETIC S3-6
Density (gram/cm³)	8.21	7.8
Coefficient of expansion Per Degree C. (20°/100°)	12.42 x 10⁻⁶	13.10 x 10⁻⁶
Tensile strength (lbs/in² x 10³)	57.1	40.0-45.0
Yield point (lbs/in² x 10³)	28.5	28.0
Hardness-Rockwell B	60/75	20/40
Modulus of elasticity (lbs/in² x 10⁶)	22.50	29.5
Melting point (°F)	2680	2775
Shear point x (10³ PSI)	42.75	35.0
Elongation (2″ sec.)	35%	—
Thermal conductivity (cal/sec/cm²/cm/°C)		
at 20°C	.138	.126
at 100°C	.134	.126
Tolerance on thickness	±.004	±.004

FOIL



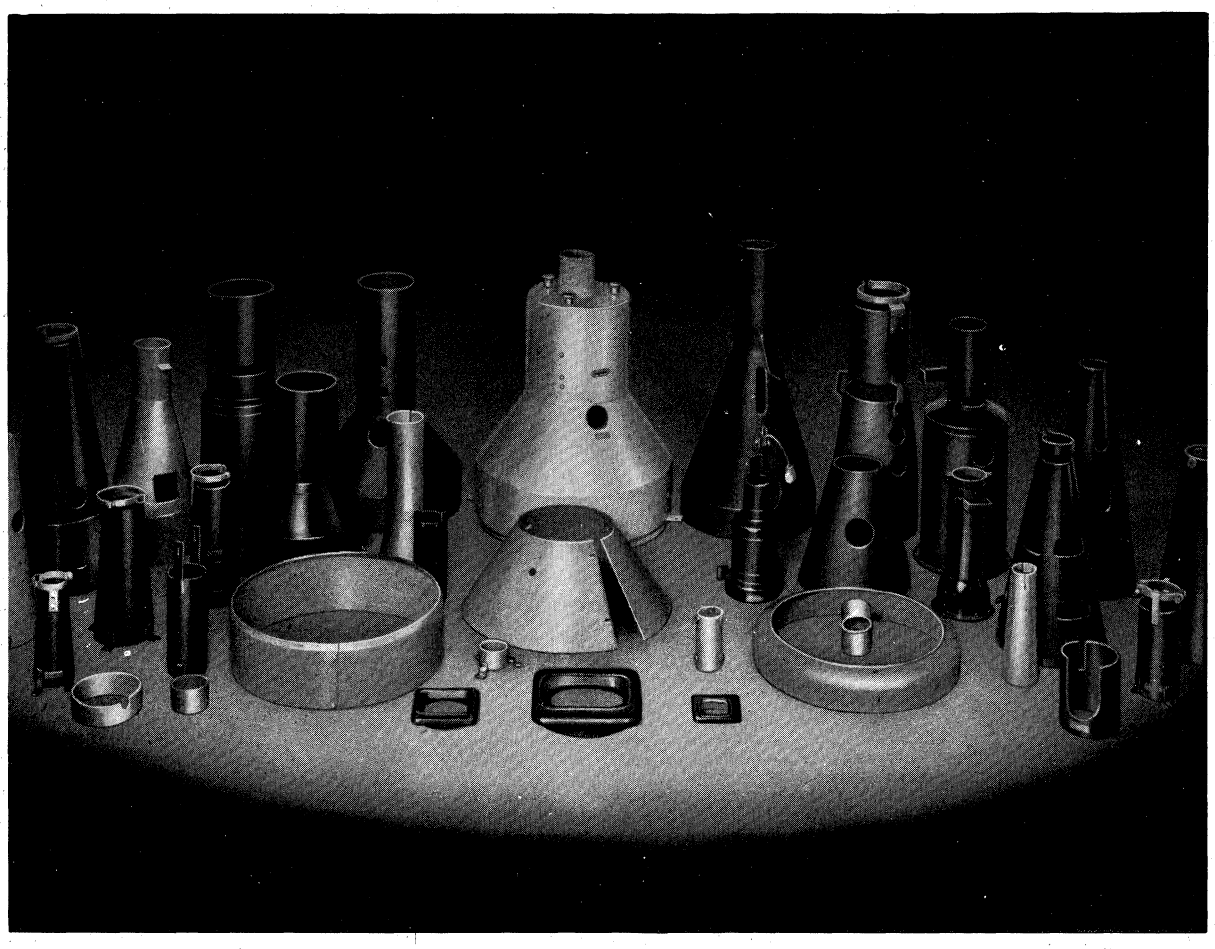
No Backing — Shipped Same Day As Ordered.
Adhesive Backed — Shipped Within One (1) Week After Ordered.
Thickness Tolerance ±.001″.
Both CO-NETIC AA And BLUE NETIC Foils Can Be Slit To Any Desired Width with or without Backing. Shipped One (1) to (2) Weeks After Order.
All foil has been Perfection Annealed for maximum attenuation. No further heat treating is necessary to maintain optimum shielding parameters

CO-NETIC AA PERFECTION ANNEALED FOIL

Thickness	Width	Maximum Length Per Carton In Feet	Feet Per Pound	Adhesive Backed Feet Per Pound
.010″	15″	100	1.86	—
.010″	15″	50	—	1.51
.010″	4″	100	6.98	—
.010″	4″	50	—	5.67
.006″	15″	100	3.10	—
.006″	15″	50	—	2.24
.006″	4″	100	11.63	—
.006″	4″	50	—	8.40
.004″	15″	100	4.63	—
.004″	15″	50	—	2.94
.004″	4″	100	17.24	—
.004″	4″	50	—	10.99
.002″	4″	100	34.48	—
.002″	4″	50	—	16.12

BLUE NETIC PERFECTION ANNEALED FOIL

Thickness	Width	Maximum Length Per Carton In Feet	No Backing Feet Per Pound	Adhesive Backed Feet Per Pound
.004″	19⅜″	100	3.97	—
.004″	19⅜″	50	—	2.44
.004″	4″	50	19.23	—
.004″	4″	50	—	11.73



MILLEN MAGNETIC SHIELDS

MU-METAL and/or **NICOLOI** annealed after fabrication. Stock shields or custom-made.

Typical of the MILLEN line of magnetic shields are:

CATALOG NUMBER	FACE DIAMETER	NECK DIAMETER	LENGTH	TYPICAL TUBE
SHIELDS FOR CATHODE RAY TUBES				
80801-C	1 11/32	1 31/64	3 1/4	1EP1
80802-A	2 3/16	1 9/16	5 1/4	2BP1
80803-B	3.45	2	9 7/16	3KP1
80805-F	6 1/8	1 7/8	13 7/16	5UP1
SHIELDS FOR MULTIPLIER PHOTOTUBES				
80801-B	1.500	1.500	3 5/8	1P21
80802-E	2 5/16	2 5/16	5 7/16	6810-A
80803-J	3 1/2	2 1/2	4 7/16	6363
80805-M	5 15/32	2 19/32	5 11/16	6364
SHIELDS FOR CHARGE STORAGE TUBES				
80803-L	3 7/16	3 7/16	12 1/4	6499
80805-N	5 1/2	3 1/4	14	6866

MILLEN

INDUSTRIAL ELECTRONICS MASTER DATA BOOK

Comprehensive Coverage of

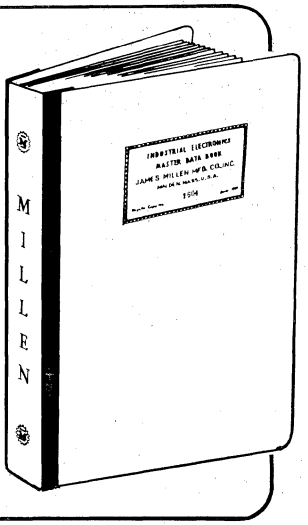
MILLEN PRODUCTS

with

Dimensional Drawings

Available to:

Industry Personnel
Qualified Engineers
Purchasing Agents
Design Draftsmen



JAMES MILLEN MFG. CO., INC.

MAIN OFFICE AND FACTORY

MALDEN, MASSACHUSETTS, U.S.A.

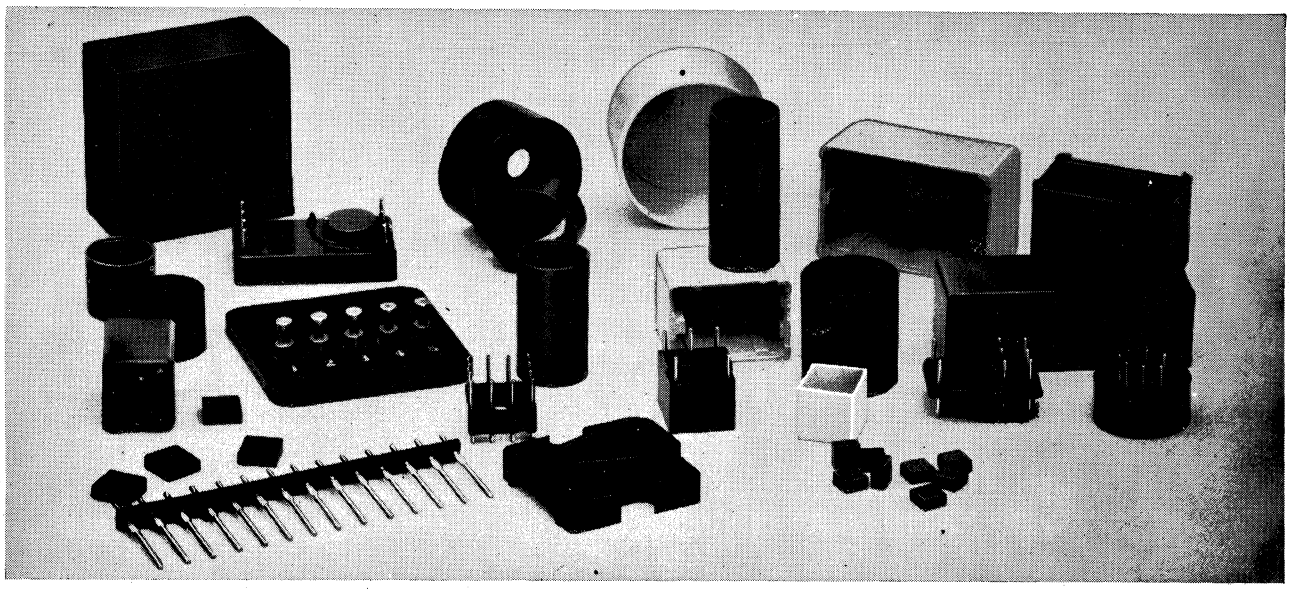
MAGNETIC SHIELDS FOR CATHODE RAY TUBES

TUBE TYPES	MILLEN SHIELD	(INCHES) FACE DIAMETER INSIDE	(INCHES) NECK DIAMETER INSIDE	LENGTH (INCHES)	TUBE BASE CLAMP	ANODE HOLE	CONTACT CUTOUT	MIN. D.C. FIELD REDUCTION IN GUN AREA 2.5 Gauss	1.0 Gauss	USE WITH MILLEN BEZEL #	SOCKET SHIELD BEZEL ASSEMBLY
1CP-	80801-A	1.38	1.38	2.75	NONE	0	0	335	290	80071	90091-A
1EP-	80801-C	1.34	1.48	3.25	NONE	0	0	415	340	80071-B	80091-C
2AP-	80802-D	2.19	1.56	5.25	1.37	0	0	425	400	80072	80092-D
2BP-	80802-A	2.19	1.56	5.25	1.47	0	0	425	400	80072-B	80092-A
3AP-	80803-B	3.45	2.00	9.44	1.64	0	0	500	450	80073	80093-B
3ABP-	80803-K	3.45	3.45	8.75	NONE	2	0	405	375	80073-C	80093-K-1
3ACP-	80803-E	3.45	2.37	7.94	2.25	1	0	500	450	80073-C	80093-E-1
3ADP-	80803-H	3.45	2.50	8.44	1.50	1	1	425	400	80073-C	80093-H
3AHP-	80803-MB	3.06 x 1.62	1.69	8.00	NONE	0	0	425	400	80173-B	80093-MB
3AQP-	80803-D	3.45	1.75	7.62	1.50	0	0	425	400	80073	80093-D
3ASP-	80809-MA	3.06 x 1.62	1.69	7.50	NONE	1	0	550	500	80173-B	80093-MA
3AYP-	80803-M	3.06 x 1.62	1.69	7.50	NONE	0	0	550	500	80173-B	80093-M
3BP-	80803-C	3.45	2.37	7.94	2.25	0	0	425	400	80073-C	80093-C-1
3BDP-	80803-M	3.06 x 1.62	1.69	7.50	NONE	0	0	550	500	80173-B	80093-M-2
3BGP-	80803-MA	3.06 x 1.62	1.69	7.50	NONE	1	0	550	500	80173-B	80093-MA-2
3BFP-	80803-R	3.45	1.25	12.13	1.50	1	0	500	435	80073-C	80093-R-1
3DP-	80803-C	3.45	2.37	7.94	2.25	0	0	425	400	80073	80093-C
3FP7-	80803-E	3.45	2.37	7.94	2.25	1	0	500	450	80073	80093-E
3GP-	80803-A	3.45	2.00	9.44	1.69	0	0	500	450	80073	80093-A
3JP7-	80803-E	3.45	2.37	7.94	2.25	1	0	500	450	80073-C	80093-E-1
3KP-	80803-B	3.45	2.00	9.44	1.64	0	0	500	450	80073	80093-B
3MP-	80803-F	3.45	1.75	6.44	1.50	0	0	425	400	80073	80093-F
3RP-	80803-D	3.45	1.75	7.62	1.50	0	0	425	400	80073	80093-D
3SP-	80803-M	3.06 x 1.62	1.69	7.50	NONE	0	0	550	500	80173-B	——
3WP-	80803-G	3.45	1.75	9.44	1.50	0	0	550	500	80073-C	80093-G-1
3XP-	80803-M	3.06 x 1.62	1.69	7.50	NONE	0	0	550	500	80173-B	80093-M
3YP-	80803-MC	3.06 x 1.62	1.69	5.75	NONE	0	0	550	500	80173-B	80093-MC
S.C.3042	80805-A	6.12	1.87	15.50	1.69	0	0	550	500	80075-M	80095-A-2
S.C.3093	80805-K	6.12	2.50	15.75	2.25	0	1	425	400	80075-C	80095-K
S.C.3377	80803-S	3.6 x 3.6	2.00	12.13	NONE	1	1	550	500	80174-A	NONE
S.C.3561	80805-U	4.37 x 6.37	4.37	18.25	NONE	1	0	550	500	NONE	NONE
4KP-	80804-A	3.6 x 3.6	1.56	9.69	1.47	0	0	550	500	NONE	NONE
4MP-	80803-U	3.6 x 3.6	2.00	12.13	NONE	1	1	550	500	80174-A	80093-U
5ABP-	80805-H	6.12	2.50	15.00	2.25	1	0	600	540	80075-B	80095-H
5ADP-	80805-H	6.12	2.50	15.00	2.25	1	0	600	540	80075-B	80095-H
5AFP-	80805-D	5.50	4.50	16.00	NONE	3	2	500	460	80075-B	80095-D
5AGP-	80805-J	6.12	2.50	16.38	2.25	1	1	550	500	80075-B	80095-J
5AHP-	80805-W	5.13	2.38	7.25	1.50	1	2	500	450	80075	NONE
5AMP-	80805-K	6.12	2.50	15.75	2.25	0	1	550	500	80075-B	80095-K
5AQP-	80805-H	6.12	2.50	15.00	2.25	1	0	600	540	80075-B	80095-H
5ATP-	80805-K	6.12	2.50	15.75	2.25	0	1	550	500	80075-B	80095-K
5AUP-	80805-Y	6.12	6.12	11.00	NONE	1	0	350	330	80075-B	NONE
5AWP-	80805-C	5.50	2.69	15.00	NONE	2	1	600	540	80075-B	80095-C
5AXP-	80805-Y	6.12	6.12	11.00	NONE	1	0	350	330	80075-B	NONE
5BDP-	80805-C	5.50	2.69	15.00	NONE	2	1	600	540	80075-B	80095-C
5BFP-	80805-Y	6.12	6.12	11.00	NONE	1	0	350	330	80075-B	NONE
5BGP-	80805-V	6.13	2.50	16.38	2.25	1	1	600	540	80075-B	80095-V
5BHP-	80085-A	5.44	2.38	16.00	2.25	1	1	600	540	80075-B	80095-A4
5BNP-	80805-Y	6.12	6.12	11.00	NONE	1	0	350	330	80075	NONE
5BTP-	80805-33-B	5.63	2.63	10.50	NONE	1	0	550	500	80075-B	NONE
5CP-	80805-B	6.12	2.50	15.50	2.25	1	0	600	540	80075	80095-B
5CAP-	80085-A	5.44	2.38	16.00	2.25	1	1	600	540	80075-J	80095-A4
5CBP-	80085-B	5.44	2.38	18.25	2.25	1	1	600	540	80075-J	80095-B5
5CEP-	80805-Y	6.12	6.12	11.00	NONE	1	0	350	330	80075-B	NONE
5CKP-	80805--Y	6.12	6.12	11.00	NONE	1	0	350	330	80075-B	NONE
5DWP-	80085-C	5.44	2.38	18.50	2.25	1	1	600	540	80075-J	80095-C4
5DYP-	80805-W	5.13	2.38	7.25	1.50	1	2	500	450	80075-B	NONE
5FP-	80805-Y	6.12	6.12	11.00	NONE	1	0	350	330	80075-B	NONE
5GP-	80805-A	6.12	1.87	15.50	1.69	0	0	550	500	80075	80095-A
5HP-	80805-A	6.12	1.87	15.50	1.69	0	0	550	500	80075	80095-A
5JP-	80805-G	6.12	1.87	14.25	1.69	1	4	600	540	80075	80095-G
5LP-	80805-E	6.12	1.87	14.56	1.62	1	0	600	540	80075	80095-E
5MP-	80805-F	6.12	1.87	13.44	1.50	0	0	600	540	80075	80095-F
5NP-	80805-A	6.12	1.87	15.50	1.69	0	0	550	500	80075	80095-A
5RP-	80805-C	5.50	2.69	15.00	NONE	2	1	600	540	80075-B	80095-C
5SP-	80805-D	5.50	4.50	16.00	NONE	3	2	500	450	80075-B	80095-D
5UP-	80805-F	6.12	1.87	13.44	1.50	0	0	600	540	80075	80095-F
5WP-	80805-Y	6.12	6.12	11.00	NONE	1	0	350	330	80075-B	NONE
5XP-	80805-C	5.50	2.69	15.00	NONE	2	1	600	540	80075-B	80095-C
5YP-	80805-J	6.12	2.50	16.38	2.25	1	1	550	500	80075-B	90095-J

JAMES MILLEN MFG. CO., INC.
MAIN OFFICE AND FACTORY
MALDEN, MASSACHUSETTS, U.S.A.

MILTON ROSS PRECISION-FORMED ENCAPSULATION SHELLS AND HEADERS

For Volume Production of Packaged Components and Circuit Modules



Milton Ross shells and headers provide neat, functional packaging for complete electronic sub-assemblies or individual components, without the cost of making and maintaining a large inventory of encapsulation molds.

For simple small-part encapsulation, the user need only place the part or parts to be protected in the shell, add the desired potting agent (in powder, pellet, or liquid form), and cure. If a complete shell-header package is desired—for plug-in mounting, for instance—the part or assembly is simply wired to the header pins and then press-fitted into the shell before potting and curing.

There are no pockets or mold marks on the finished package. The shell-header combination completely envelops the protected components, improving their appearance and enhancing their physical and electrical stability. Each encapsulated component is uniform in size and color, from shell to shell and batch to batch. Above all, the components inside are protected from vibration, dust, humidity—in fact, from almost any adverse environmental condition. Lead dressing and parts spacing are maintained, conductors are insulated.

It is highly probable that your encapsulating specs can be met with off-the-shelf stock. Standard Milton Ross shells are available in cylindrical, square, or rectangular shapes; with wall thicknesses of 0.025″, 0.035″, or 0.045″; and with dimensions on any side ranging from 3/16″ to 2½″, in sixteenth-inch increments. All dimensions are held within ±0.005″.

Shells and headers are available with molded-in keys or flatted areas for automated handling or quick visual orientation. In addition, trademarks, ratings, and part numbers can be molded in. If your needs cannot be met with stock shells, Milton Ross will tool standard-shape shells and headers to your dimension specs—with no tooling charge on orders of 1,000 or more.

SHELL AND HEADER MATERIALS AND COLORS

Because of their favorable chemical, electrical, and physical characteristics, glass-filled diallyl phthalate and mineral-filled alkyd are standard Milton Ross shell and header materials. For special purposes, a wide variety of other materials is available, including thermosetting compounds (epoxies, silicones, phenolics, and melamines), and thermoplastics (polycarbonates, polystyrenes, and polyethylene).

The precision-made pins molded into the Milton Ross headers are available in brass, nickel, copper, and with many varieties of precious-metal plating.

Standard shell and header color is black. DAP shells are also available as standard in blue, green, orange, pink, red, tan, yellow, brown, coral, and gray.

THE MILTON ROSS COMPANY

511 Second St. Pike, Southampton, Pa. 18966 • 215-355-0200 • TWX 510-667-1702
4559 Sheila St., Los Angeles, Calif. 90022 • 213-268-9222 • TWX 910-321-4012
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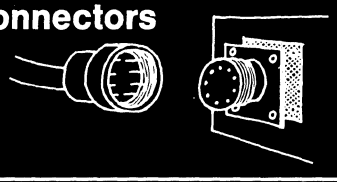
If you want to shield...

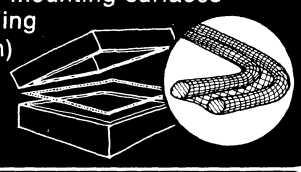
Electrical connectors



use

Metex Porcupine Metalastic.™
Its many contact points make this an ideal gasket for RFI/EMI. Silicone rubber provides a pressure and moisture barrier.

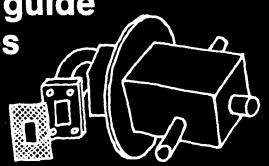
Metal boxes
with flat mounting surfaces (no sealing problem)



use

Metex double round, single fin mesh strip.
This is provided in many different metals and sizes.

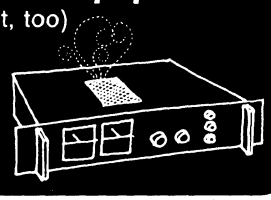
Wave guide flanges



use

Metex Feltex™ material.
Designed for wave guides, specifically provided for either pressurized or non-pressurized systems.

Electronic equipment
(and cool it, too)



use

Metex Shield-Cell honeycomb panels.
It's designed to meet specific attenuation requirements over specified frequency ranges. Many standard sizes and materials are available.

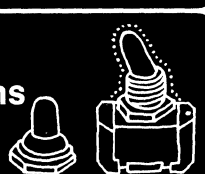
Communications cables



use

Metex "Zip-Ex"® zip-on metallic sheath.
Provides 100% reliable electromagnetic shielding. Knitted mesh sheath zips on any shape before or after installation.

Switches/ push buttons
(also keep out moisture)



use

Metex Flex-Shield shielded rubber boots.
Metal mesh, embedded in flexible rubber, gives maximum reliability against RFI-EMI.

QUICKLY

call

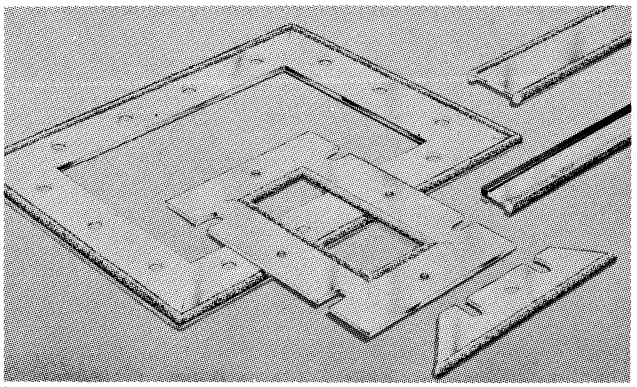
(201) 287-0800 for 48-hour premium service (for your rush rush requirements)

For technical assistance on your particular requirements—write:

98A

METEX CORPORATION
970 New Durham Road
Edison, New Jersey 08817
(201) 287-0800 • TWX 710-998-0578
West Coast: Cal-Metex Corp., 509 Hindry Ave., Inglewood, Calif. 90301 • (213) 674-0650 • TWX 910-328-6100

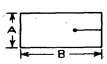
METALEX™ MOUNTING STRIP EXTRUSIONS



METALEX™ consists of a resilient, single fin METEX Electronic Weatherstrip® mechanically joined to an aluminum extrusion. Structural rigidity and ease of attachment are the results of the aluminum mounting strip. Spot-weiding, screwing, riveting, and similar fastening techniques can be utilized.

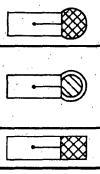
For complete information, write for METEX Data Sheet ME-7.

Single Mesh



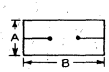
Dimensions (a)	Dimensions (b)	Extrusion Number
.093″	.375″	603793
.093″	.437″	604393
.125″	.375″	6037
.125″	.500″	6050
.125″	.625″	6062
.125″	.750″	6075
.125″	1.000″	60100
.125″	1.250″	60125

Metex Electronic Weatherstrip for Above Extrusions



Cross Section Diameter	Cross Section Width	Cross Section Thickness	Metex Part Number Monel	Metex Part Number Aluminum
3/16	—	—	-8	-7
1/4	—	—	-3	-5
3/16	over Sponge Neoprene Core		-10	-9
3/16	over Sponge Silicone Core		-13	-15
1/4	over Sponge Neoprene Core		-12	-11
1/4	over Sponge Silicone Core		-16	-17
—	1/8	5/32	-4	-6
—	1/8	3/16	-2	-1

Double Mesh



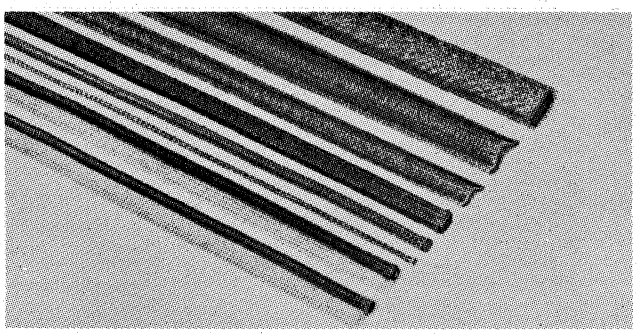
Dimensions (a)	Dimensions (b)	Extrusion Number
.125″	.500″	605D
.125″	.625″	606D
.125″	1.250″	6012D

Sponge Rubber Seal for METALEX



Cross Section Width	Cross Section Thickness	Metex Part Number Neoprene	Metex Part Number Silicone
1/8	3/16	NA	SA
3/16	3/16	NC	SC
3/16	1/4	NE	SE

SPECIAL ENGINEERED RF STRIP



Special Engineered RF Strips are designed by METEX to solve difficult and unusual RF gasketing problems in the most economical manner. They are made by knitting or wrapping METEX over a large variety of cores or by forming METEX into unusual cross sections. These special strips are used to solve such problems as a high degree of joint misfit or under conditions where the applied closing pressure on the joint is relatively low.

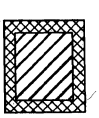
For complete information, write for METEX Data Sheet ME-9.

Spring-Type Cross Section



Width	For Channel Width	METEX Part No. Monel
9/16″	1/2″	10-210
5/8″	1/2″ to 9/16″	10-613
13/16″	3/4″	10-215
1-1/16″	3/4″ to 7/8″	11-002
1-1/8″	7/8″ to 1″	10-764
1-5/16″	1″ to 1-1/8″	10-774
2″	1-3/8″ to 1-3/4″	11-511

Rectangular Cross Section 2 Covers —Monel



DIMENSIONS Height	DIMENSIONS Width	PART NUMBERS Neoprene Sponge	PART NUMBERS Silicone Sponge
1/8″	1/8″	11-845	10-319
1/8″	5/32″	11-518	10-666
1/8″	3/16″	11-846	11-320
1/8″	1/4″	11-847	11-853
3/16″	3/16″	11-848	11-854
1/4″	1/4″	11-564	11-855
1/4″	3/8″	10-888	11-856
1/4″	1/2″	11-849	11-857
3/8″	1/2″	10-328	11-858
3/8″	5/8″	11-850	11-859
1/2″	1/2″	11-851	11-860
1/2″	3/4″	11-852	11-861

Single-Fin Cross Section 2 Covers —Monel



DIMENSIONS Diameter	DIMENSIONS O/A	PART NUMBERS Neoprene Sponge	PART NUMBERS Neoprene Tubing	PART NUMBERS Silicone Sponge
1/8″	1/2″	11-862	11-871	10-690
1/8″	5/8	11-863	11-872	10-877
1/8″	3/4″	11-864	10-833	11-878
3/16″	1/2″	10-630	11-873	11-879
3/16″	5/8″	11-865	10-523	11-880
3/16″	3/4″	11-866	11-874	11-881
1/4″	5/8″	10-819	10-778	11-882
1/4″	3/4″	11-867	11-875	11-883
1/4″	1″	11-868	11-876	11-884
1/2″	1″	11-869	—	11-885
5/8″	1-3/8″	11-870	—	10-734

Round Cross Section 2 Covers —Monel



DIMENSIONS Diameter	PART NUMBERS Neoprene Sponge	PART NUMBERS Neoprene Tubing	PART NUMBERS Silicone Sponge
1/16″	—	10-861	11-890
1/8″	10-541	10-570	11-891
3/16″	10-571	11-887	11-892
1/4″	10-627	11-888	11-893
5/16″	10-626	10-913	11-894
3/8″	11-886	—	11-895
7/16″	10-747	—	11-896
1/2″	10-845	—	11-897
3/4″	10-633	—	11-898

METEX CORPORATION
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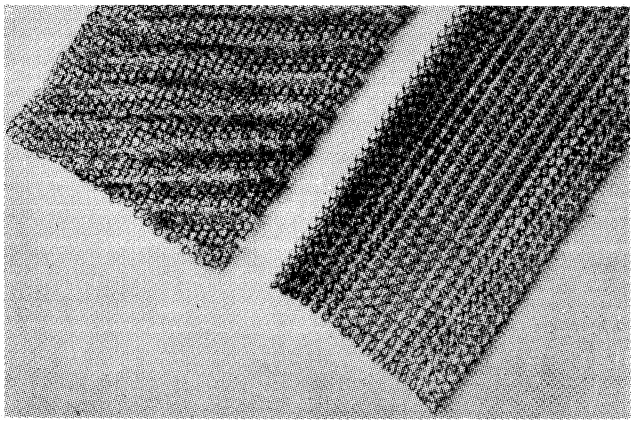
Telephone (201) 287-0800 • TWX 710-998-0578
West Coast: Cal-Metex Corporation
509 Hindry Ave., Inglewood, California 90301

KNITTED WIRE MESH



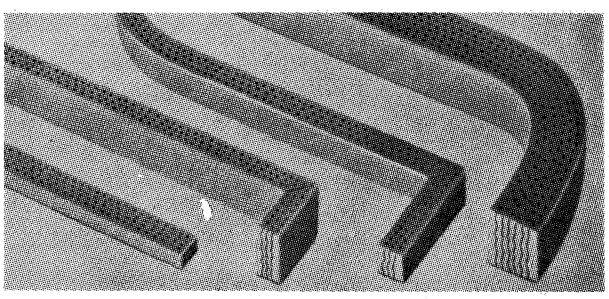
This material is produced as a two-ply flattened cylinder of varying width, loop spacing, wire sizes and metals. A crimping operation achieves a three-dimensional form for added resiliency. This mesh tape is used as a shielding or grounding material to cover or join irregularly shaped surfaces.

For complete information, write for METEX Data Sheet ME-8.

Width	Openings Per Inch	Machine Designation	Note
5/8"- 3/4"	12-15	16- 3/4	1
3/4"- 7/8"	12-15	20- 7/8	1
1" -1 1/8"	12-15	26-1 1/16	1
1" -1 1/4"	20-24	32-1 1/8	2
1 3/8"-1 5/8"	9-12	34-1 5/8	1
1 3/4"-2 1/8"	20-24	48-1 5/8	2
2" -2 1/2"	9-12	42-2 1/4	
2 3/8"-2 3/4"	6-9	38-2 3/4	
2 3/4"-3 1/8"	12-15	62-2 1/4	1
3 1/2"-4"	6-9	56-4	
3 3/4"-4 1/4"	12-15	98-4	1
6" -7 1/2"	6-9	76-5 1/2	
6" -7 1/2"	9-12	100-5 1/2	
6" -7 1/2"	12-15	130-5 1/2	1

NOTES: (1) Can be used up to .005" dia. wire size. (2) Can be used up to .0045" dia. wire size.

POLASTRIP
Oriented Wire Shielding Material



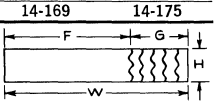
This unique METEX advance consists of oriented wire mesh embedded in a matrix of elastomeric material. It is the only material of its kind which offers a combination of pressure, and RFI seal in a reliable, fail-proof construction. It will yield an overall system attenuation from 125 to 135 db. Other innovations in the Polastrip family are: Combo-Polastrip for flat flange applications; Polaring — a continuous strip without a joint molded in a circular form; Polaframe — Polastrip bonded to aluminum extrusion; Polasheet — for complex gaskets die cut from Polastrip.

For complete information, write for METEX Data Sheet ME-10.

DIMENSIONS	PART NUMBERS			
Width Height	Monel in Solid Silicone	Monel in Sponge Silicone	Aluminum in Solid Silicone	Aluminum in Sponge Silicone
1/8 x 1/8"	14-004	14-032	14-048	14-068
1/8 x 5/32"	14-096	14-097	14-098	14-099
1/8 x 3/16"	14-019	14-033	14-049	14-069
1/8 x 1/4"	14-100	14-101	14-102	14-103
3/16 x 1/8"	14-020	14-034	14-050	14-070
3/16 x 3/16"	14-011	14-014	14-051	14-071
3/16 x 1/4"	14-017	14-035	14-052	14-073
3/16 x 5/16"	14-016	14-036	14-053	14-073
3/16 x 3/8"	14-104	14-105	14-106	14-107
1/4 x 1/8"	14-010	14-013	14-054	14-074
1/4 x 3/16"	14-021	14-037	14-055	14-075
1/4 x 1/4"	14-003	14-012	14-056	14-076
1/4 x 5/16"	14-022	14-038	14-057	14-077
1/4 x 3/8"	14-023	14-039	14-058	14-078
1/4 x 1/2"	14-108	14-109	14-110	14-111
5/16 x 1/8"	14-024	14-040	14-059	14-079
5/16 x 3/16"	14-025	14-041	14-060	14-080
5/16 x 1/4"	14-026	14-042	14-061	14-081
5/16 x 5/16"	14-027	14-043	14-062	14-082
5/16 x 3/8"	14-112	14-113	14-114	14-115
5/16 x 1/2"	14-116	14-117	14-118	14-119
3/8 x 1/8"	14-028	14-044	14-063	14-083
3/8 x 3/16"	14-120	14-121	14-122	14-123
3/8 x 1/4"	14-029	14-045	14-064	14-084
3/8 x 5/16"	14-124	14-125	14-126	14-127
3/8 x 3/8"	14-030	14-046	14-065	14-085
3/8 x 1/2"	14-128	14-129	14-130	14-131
3/8 x 5/8"	14-132	14-133	14-134	14-135

DIMENSIONS	PART NUMBERS			
Width Height	Monel in Solid Silicone	Monel in Sponge Silicone	Aluminum in Solid Silicone	Aluminum in Sponge Silicone
1/2 x 1/8"	14-088	14-090	14-092	14-094
1/2 x 3/16"	14-089	14-091	14-093	14-095
1/2 x 1/4"	14-031	14-015	14-066	14-086
1/2 x 5/16"	14-136	14-137	14-138	14-139
1/2 x 3/8"	14-140	14-141	14-142	14-143
1/2 x 1/2"	14-009	14-047	14-067	14-087
1/2 x 5/8"	14-144	14-145	14-146	14-147
1/2 x 3/4"	14-148	14-149	14-150	14-151
5/8 x 1/8"	14-152	14-158	14-164	14-170
5/8 x 3/16"	14-153	14-159	14-165	14-171
5/8 x 1/4"	14-154	14-160	14-166	14-172
5/8 x 3/8"	14-155	14-161	14-167	14-173
5/8 x 1/2"	14-156	14-162	14-168	14-174
5/8 x 5/8"	14-157	14-163	14-169	14-175

COMBC POLASTRIP



DIMENSIONS			PART NUMBERS	
"W" "H" Width Height	"F" Flange	"G" Gasket	Monel in Solid Silicone	Monel in Sponge Silicone
3/8 x 1/8"	3/16"	3/16"	14-176	14-187
1/2 x 1/8"	1/4"	1/4"	14-177	14-188
5/8 x 1/8"	3/8"	1/4"	14-178	14-189
3/4 x 1/8"	1/2"	1/4"	14-179	14-190
3/8 x 3/16"	3/16"	3/16"	14-180	14-191
1/2 x 3/16"	1/4"	1/4"	14-181	14-192
5/8 x 3/16"	3/8"	1/4"	14-182	14-193
3/4" x 3/16"	1/2"	1/4"	14-183	14-194
1/2 x 1/4"	1/4"	1/4"	14-184	14-195
5/8 x 1/4"	3/8"	1/4"	14-185	14-196
3/4 x 1/4"	1/2"	1/4"	14-186	14-197

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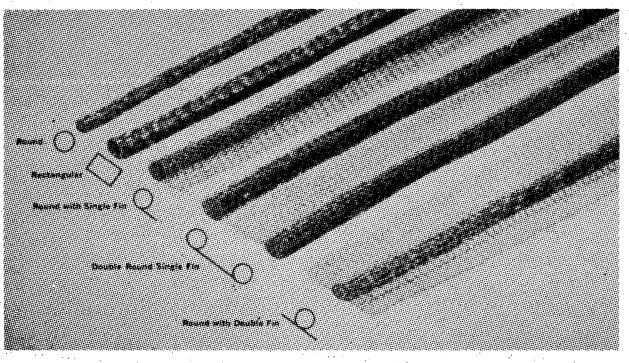
509 Hindry Ave., Inglewood, California 90301

STANDARD ELECTRONIC WEATHERSTRIP®



METEX Electronic Weatherstrip, made from knitted wire mesh, combines resiliency, flexibility and conductivity that make it possible to establish electrical continuity in even the most intricately shaped joints for an effective RF shield. It is available in rectangular, round, round with single fin and double round with single fin. A single round, double-fin type, (not listed) is available in 48 sizes.

For complete information, write for METEX Data Sheet ME-2.

Rectangular Cross Section

Width	Height	Metex Part Number Monel	Aluminum	Silver-Plated Brass
1/16	1/16	10-408	10-401	10-410
3/32	3/32	10-424	10-267	10-313
1/8	1/16	10-218	10-499	11-070
1/8	3/32	10-377	10-728	10-252
1/8	1/8	10-199	10-204	10-230
1/8	5/32	10-194	10-182	10-338
3/16	1/16	10-213	10-649	11-141
3/16	3/32	10-203	11-028	10-233
3/16	1/8	10-177	10-171	11-145
3/16	3/16	10-168	10-143	10-757
1/4	1/16	10-144	10-179	10-643
1/4	3/32	10-167	11-140	10-900
1/4	1/8	10-153	10-173	10-458
1/4	3/16	10-958	10-495	11-142
1/4	1/4	10-169	10-268	10-478
5/16	1/16	10-777	11-143	11-146
5/16	3/32	10-332	10-158	11-147
5/16	1/8	10-336	10-654	10-699
5/16	3/16	10-516	10-653	11-148
5/16	1/4	10-581	10-389	11-149
5/16	5/16	10-390	11-144	11-150
3/8	1/16	10-149	10-206	10-644
3/8	3/32	10-197	10-448	11-151
3/8	1/8	10-192	10-761	10-547
3/8	3/16	10-217	10-414	11-082
3/8	1/4	10-310	10-787	11-153
3/8	3/8	10-265	10-708	11-154
1/2	1/16	10-780	10-801	11-818
1/2	3/32	10-285	10-442	11-819
1/2	1/8	10-286	10-159	10-656
1/2	3/16	11-639	11-814	10-509
1/2	1/4	11-523	11-623	11-820
5/8	1/16	10-812	11-620	11-828
5/8	3/32	10-238	11-821	11-829
5/8	1/8	11-607	10-939	10-459
5/8	3/16	11-815	11-822	11-830
5/8	1/4	10-818	11-823	10-684
5/8	3/8	11-816	11-621	11-831
3/4	1/16	10-258	11-081	11-832
3/4	1/8	10-251	10-784	11-833
3/4	3/16	10-547	11-824	11-834
3/4	1/4	11-530	11-825	11-835
1	1/16	11-539	10-635	11-836
1	1/8	11-092	11-826	10-454
1	3/16	11-817	11-067	11-837
1	1/4	11-598	11-827	11-838

Double Round, Single Fin Cross Section

Diameter	Overall Dimension	Metex Part Number Monel	Aluminum	Silver-Plated Brass
1/16	1/2	10-922	11-263	11-268
1/16	5/8	10-041	11-264	11-269
1/16	3/4	11-261	11-265	11-270
1/16	7/8	11-262	11-266	11-271
1/8	1/2	10-449	10-045	11-272
1/8	5/8	10-012	10-430	10-677
1/8	3/4	10-085	10-697	11-273
1/8	7/8	10-515	10-407	11-274
1/8	1	10-625	11-267	11-275
3/16	5/8	10-019	11-279	10-678
3/16	3/4	10-049	10-048	11-285
3/16	7/8	10-735	10-416	11-286
3/16	1	10-344	11-280	11-287
1/4	3/4	10-949	11-281	11-288
1/4	7/8	11-276	11-282	11-289
1/4	1	10-452	10-701	11-290
3/8	1	11-277	11-283	11-291
3/8	1-1/4	11-278	11-284	11-292

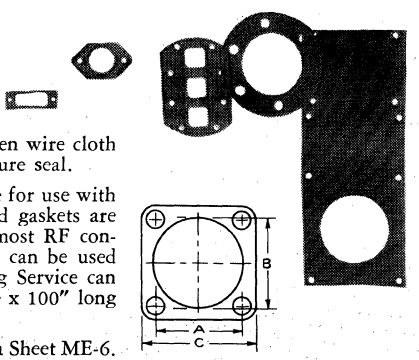
Round Cross Section

Diameter	Metex Part Number Monel	Aluminum	Silver-Plated Brass
1/16	10-064	10-131	10-412
3/32	10-056	10-775	10-309
1/8	10-006	10-035	10-118
5/32	10-311	10-124	11-155
3/16	10-020	10-029	10-253
1/4	10-250	10-032	10-337
5/16	10-439	10-026	10-548
3/8	10-017	10-877	11-329
7/16	10-088	11-156	11-157
1/2	10-110	10-575	11-158

Single Round, Single Fin Cross Section

Diameter	Overall Dimension	Metex Part Number Monel	Aluminum	Silver-Plated Brass
1/16	3/8	10-983	10-827	10-825
1/16	1/2	10-756	10-053	11-177
1/16	5/8	10-091	11-165	10-871
1/16	3/4	11-160	11-166	11-178
3/32	3/8	10-826	10-828	10-824
3/32	1/2	10-977	11-167	11-179
3/32	3/4	10-998	11-168	11-180
1/8	3/8	10-008	10-095	10-343
1/8	7/16	10-076	10-065	10-114
1/8	1/2	10-060	10-043	11-062
1/8	9/16	11-161	11-169	11-182
1/8	5/8	10-061	10-334	10-340
1/8	3/4	10-079	11-170	11-183
5/32	1/2	11-162	11-171	11-185
5/32	3/4	11-163	11-173	11-186
3/16	7/16	10-075	11-174	11-187
3/16	1/2	10-092	11-175	11-188
3/16	5/8	10-058	10-066	10-288
3/16	3/4	10-051	10-031	11-189
3/16	7/8	11-164	11-176	11-190
1/4	1/2	11-331	11-194	11-207
1/4	5/8	10-109	10-341	10-342
1/4	3/4	10-106	10-034	10-247
1/4	7/8	10-534	11-195	11-208
1/4	1	11-330	11-196	11-209
5/16	5/8	10-530	10-028	10-542
5/16	3/4	10-362	11-197	11-210
5/16	7/8	10-592	11-198	11-211
3/8	5/8	10-568	11-199	11-212
3/8	3/4	11-191	10-546	11-213
3/8	7/8	10-009	11-200	11-214
3/8	1	10-270	10-536	11-215
7/16	3/4	11-192	11-201	11-216
7/16	7/8	10-098	11-202	11-217
7/16	1	10-274	11-203	11-218
1/2	3/4	10-789	11-204	11-219
1/2	7/8	11-193	11-205	11-220
1/2	1	11-040	11-206	11-221

METALASTIC GASKETS



METEX Metalastic Gaskets are made from woven wire cloth and rubber to provide an efficient RF and pressure seal.

A standard line of Metalastic Gaskets is available for use with AN Connectors, Series 3100 and 3102. Standard gaskets are also available for Type SP, PC, and PT, and most RF connectors. Specially engineered Metalastic Gaskets can be used to solve difficult problems. METEX Engineering Service can design Metalastic Gaskets in sizes up to 8" wide x 100" long to meet special requirements.

For complete information, write for METEX Data Sheet ME-6.

Shell Size	Dimension "A"	"B"	"C"	"D"*	Metex Part No. .020 Neoprene	.020 Silicone
8	.594	.500	.875	.172	40-008	42-495
10	.719	.625	1.000	.172	40-010	42.371
12	.813	.750	1.094	.172	40-012	42-470
14	.906	.875	1.188	.172	40-014	42-483
16	.969	1.000	1.281	.172	40-016	42-488
18	1.063	1.125	1.375	.203	40-018	42-489
20	1.156	1.250	1.500	.203	40-020	42-484
22	1.250	1.375	1.625	.203	40-022	42-485
24	1.375	1.500	1.750	.203	40-024	42-490
28	1.563	1.750	2.000	.203	40-028	42-491
32	1.750	2.000	2.250	.219	40-032	42-492
36	1.938	2.188	2.500	.219	40-036	42-493
40	2.188	2.438	2.750	.219	40-040	42-494
44	2.375	2.781	3.000	.219	40-044	42-599
48	2.625	3.031	3.250	.219	40-048	42-600

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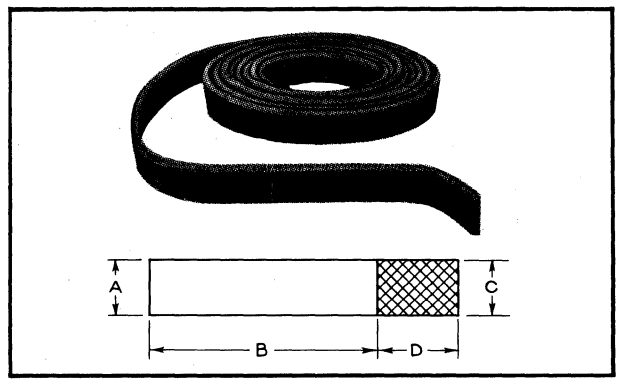
STANDARD & CONTEX™ COMBO-STRIP



METEX Combo Strips are combination RF shielding and sealing gaskets in strip form. In Combo-Strip, METEX Electronic Weatherstrip® and a sealing material are attached to make a single unit that is both RF and pressure tight. The material used for the sealing portion is usually closed cell sponge neoprene, although any sealing material may be furnished where required.

Combo-strips are available with pressure sensitive adhesive backing. Add letters "SB" to part numbers to obtain adhesive backing.

METEX Engineering Service will be happy to develop special strips to answer problems not solved by stock items listed.

For complete information, write for METEX Data Sheet ME-3.

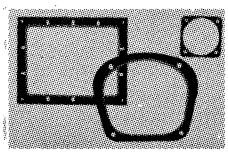
Single RF Shield

DIMENSIONS				PART NUMBERS	
A	B	C	D	Monel — Neoprene Sponge	Monel — Silicone Sponge
1/16″	1/4″	1/16″	1/8″	11-756	11-772
1/16″	3/8″	1/16″	1/8″	11-757	11-773
1/16″	1/2″	1/16″	1/8″	11-692	11-774
1/16″	5/8″	1/16″	1/8″	11-739	11-775
3/32″	1/4″	3/32″	1/8″	11-344	11-776
3/32″	3/8″	3/32″	1/8″	11-332	11-777
3/32″	1/2″	3/32″	1/8″	11-758	11-778
3/32″	3/4″	3/32″	1/8″	11-333	11-779
1/8″	1/8″	1/8″	1/8″	11-138	11-780
1/8″	3/16″	1/8″	3/16″	11-136	11-781
1/8″	1/4″	1/8″	1/8″	11-135	11-782
1/8″	1/4″	1/8″	1/4″	11-130	11-783
1/8″	3/8″	1/8″	1/8″	11-132	11-784
1/8″	1/2″	1/8″	1/8″	11-134	11-785
1/8″	1/2″	1/8″	1/4″	11-131	11-786
1/8″	1/2″	1/8″	1/2″	11-133	11-787
1/8″	5/8″	1/8″	1/8″	11-055	11-788
1/8″	3/4″	1/8″	1/8″	11-759	11-789
3/16″	3/16″	1/8″	1/8″	11-760	11-790
3/16″	1/4″	5/32″	1/8″	11-056	11-515
3/16″	1/4″	3/16″	1/8″	11-622	11-791
3/16″	3/8″	3/16″	1/8″	11-761	11-792
3/16″	1/2″	3/16″	1/8″	11-762	11-793
3/16″	3/4″	3/16″	1/4″	11-763	11-794
1/4″	1/4″	1/4″	1/8″	11-764	11-795
1/4″	1/2″	1/4″	1/8″	11-766	11-797
1/4″	3/4″	1/4″	1/8″	11-767	11-798
3/8″	1/4″	3/8″	1/8″	10-817	11-800
3/8″	1/2″	3/8″	1/4″	11-768	11-801
3/8″	3/4″	3/8″	1/4″	11-769	11-802
Double RF Shield					
1/8″	1/4″	1/8″	1/8″	11-765	11-796
1/8″	3/8″	1/8″	1/8″	11-770	11-799
1/8″	1/2″	1/8″	1/8″	11-771	11-803
1/8″	1/4″	5/32″	1/8″	11-804	11-805
1/8″	3/8″	5/32″	1/8″	11-681	11-806
1/8″	1/2″	5/32″	1/8″	11-807	11-810
3/16″	1/4″	3/16″	1/8″	11-808	11-811
3/16″	1/2″	3/16″	1/8″	11-809	11-812

COMBINATION RF GASKETS

METEX Combination RF Gaskets are designed for use in joints that must be both pressure and RF tight. In these gaskets, sealing material and METEX RF Weatherstrip® are bonded into a single component.

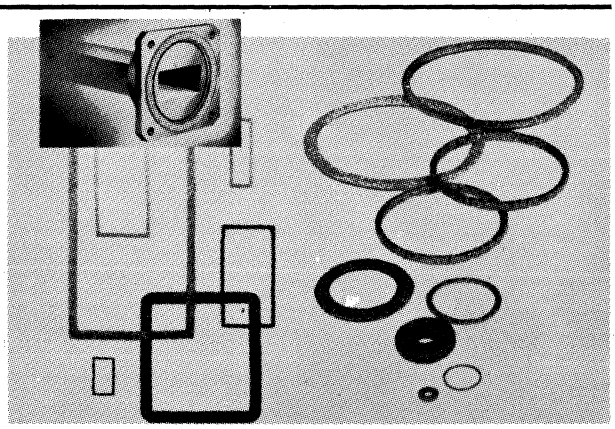
METEX Compressed RF Gaskets are usually used in smaller rectangular and round combinations. In the larger sizes, METEX Electronic Weatherstrip is joined to make a continuous gasket. The joint in the strip is carefully made and wrapped with a fine, knitted mesh to retain the strip ends. After wrapping, the entire joint is reformed so that the cross section is the same as the strip.



The material usually used for the sealing portion of the combination gasket is a 35-45 or 45-55 durometer Neoprene. Where special conditions must be met, other materials may be used.

For complete information, write for METEX Data Sheet ME-5.

COMPRESSED RF GASKETS



METEX Compressed RF Gaskets are made from knitted wire mesh that is die formed to the required size and shape under pressure. There are no joints, metal clips or shavings in the gaskets to cause trouble. Each individual gasket is made from a mesh that is knitted from one or two continuous wires. The gaskets are inherently conductive and resilient and will compensate for joint unevenness.

The shapes of METEX Compressed RF Gaskets are limited only by the size and shape of the dies.

METEX Electronics has available a large stock of forming dies for compressed gaskets. We suggest that designers consult with METEX Engineering Service on availability.

For complete information, write for METEX Data Sheet ME-4.

Asesa Flange No.	Metex Part No.	Gasket Material	Asesa Waveguide No.	Substitute for "O" Ring M. S. No.
UG-40 B/U	17-4	Monel	RG-52/U	90064-13
UG-52 B/U	307-1	Monel	RG-51/U	90064-14
UG-54 B/U	406-1	Monel	RG-48/U	90064-17
UG-136 B/U	17-15	Aluminum	RG-67/U	90064-13
UG-137 B/U	307-3	Aluminum	RG-68/U	90064-14
UG-148 C/U	358-1	Monel	RG-49/U	90064-16
UG-343 B/U	426-1	Monel	RG-50/U	90064-15
UG-406 B/U	358-2	Aluminum	RG-95/U	90064-16
UG-417 A/U	32-912	Monel	RG-69/U	90065-2
UG-418 A/U	32-913	Aluminum	RG-103/U	90065-2
UG-435 A/U	32-911	Monel	RG-104/U	90065-3
UG-437 A/U	30-618	Aluminum	RG-105/U	90065-3
UG-440 B/U	426-2	Aluminum	RG-106/U	90064-15
UG-541 A/U	157-2	Monel	RG-91/U	90064-12
UG-541 A/U	157-2	Monel	RG-107/U	90064-12
UG-553/U	32-909	Monel	RG-112/U	90065-1
UG-554/U	32-910	Aluminum	RG-113/U	90065-1
UG-585 A/U	406-2	Aluminum	RG-75/U	90064-17
UG-596 A/U	439-2	Monel	RG-53/U	90064-11
UG-596 A/U	439-2	Monel	RG-66/U	90064-11
UG-598 A/U	439-3	Aluminum	RG-121/U	90064-11
UG-600 A/U	527-3	Monel	RG-96/U	90064-10

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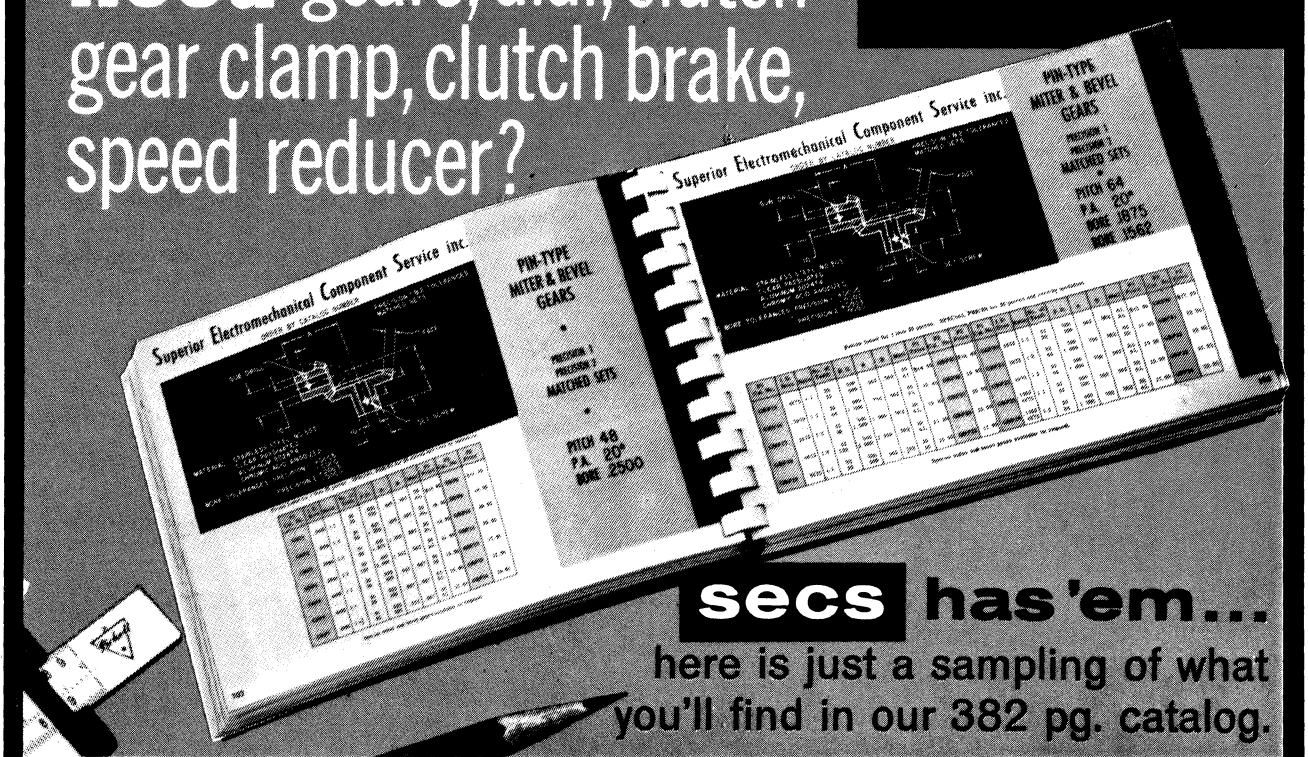

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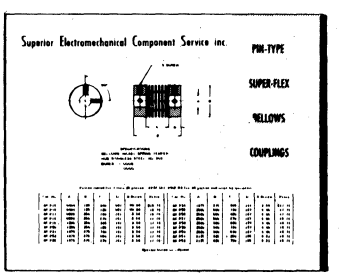

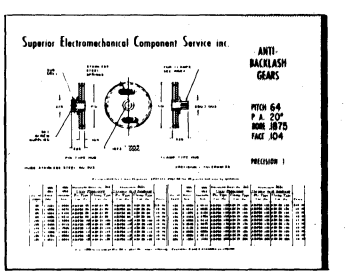

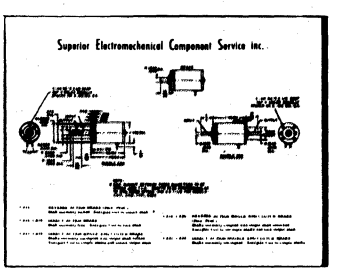

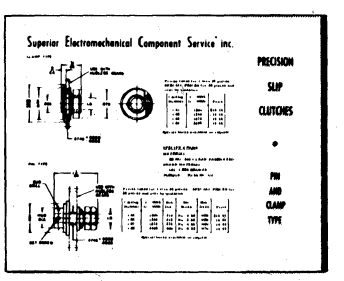

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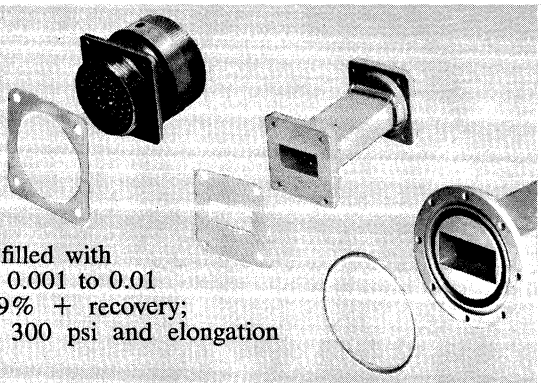
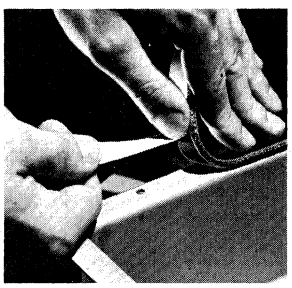
EMI/RFI SHIELDING

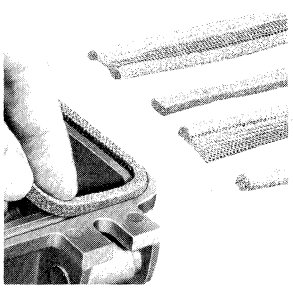
CONDUCTIVE SILVER/SILICONE GASKETS



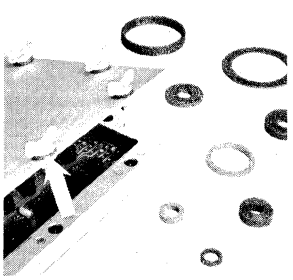
CONSIL® — a highly conductive silicone made possible by a fine network structure of continuously contacting pure silver particles, with all openings in the silver lattice filled with resilient silicone rubber. The volume resistivity ranges from 0.001 to 0.01 ohm-cm³. There is a 20% compression with 50 psi and 99% + recovery; practically no compression set. Tensile strength exceeds 300 psi and elongation ranges from 60% to 150% at rupture. Patent Pending.



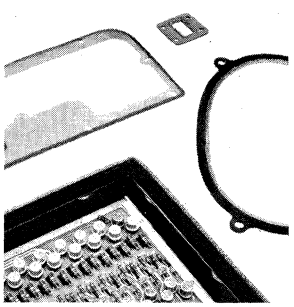
TECKSTIK® — is an easily installed EMI/RFI shielding gasket with a fluid seal, which has a pressure-sensitive adhesive back. Resilient and conductive, it eliminates radiated emissions while sealing out fluids or retaining cooling air. Available in rolls or complete gaskets.



TECKNIT STRIPS — are resilient, conductive, knitted wire mesh gaskets to shield joints having a periphery greater than 4" and simple in shape. Rectangular cross sections are installed in cast or machined enclosures, while round and fin types are used on sheet metal enclosures.

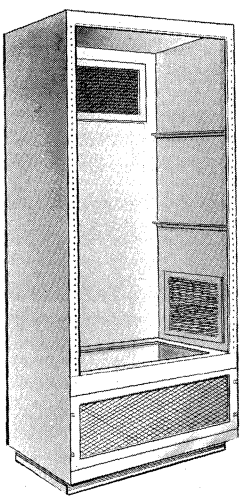


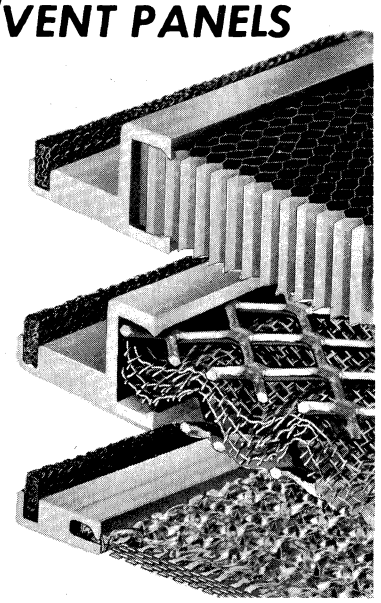
DUOGASKET® — are complete gaskets for sealing and shielding, combining die cut or molded rubber gaskets with a shielding gasketing to provide a single, dual purpose component. Used in all installations where EMI/RFI Shielding Increase must be optimized and pressure or fluid sealing is required.



FORMED GASKETS — are both standard and custom engineered round or rectangular mesh gaskets, which combine excellent resiliency and conductivity to assure RFI-tight joints. Such applications are waveguide choke flange joints, mounting RFI fitters, castings, covers and small EMI/RFI joints.

SHIELD/VENT PANELS





DESIGNED TO PERMIT THE FLOW OF COOLING AIR WHILE MAINTAINING THE SHIELDING INTEGRITY OF AN ELECTRONIC EQUIPMENT ENCLOSURE.

TECKCELL® PANELS are framed, gasketed, metal honeycomb panels ready-to-install. They provide ideal ventilating while negligibly reducing the flow of air and extremely effective EMI/RFI shielding in a wide range of metals, frame styles and chemical plating. The straight sided cells create little or no air turbulance.

TECKSCREEN® PANELS are used on electronic equipment enclosures which must be EMI/RFI shielded and, at the same time, require filtered inlet cooling air. Most standard air movers or blowers can be mounted behind this all metal, woven wire, filter medium. Twelve panel sizes are available to cool 19" or 24" cabinets.

TECKAIRE® PANELS are layers of aluminum expanded foil in an aluminum extrusion designed to filter inlet cooling air in electronic enclosures. Requiring less than 1/4" of enclosure depth, it combines excellent dust arrestance and EMI/RFI shielding properties with minimal restrictions to air flow.

TECKNIT®

Technical Wire Products Inc.

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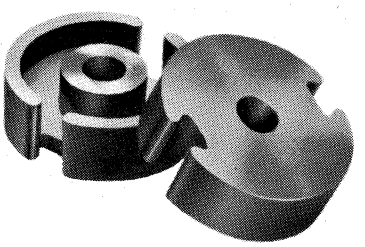


Standard Characteristics of Typical Materials Mn-Zn 〈F series〉

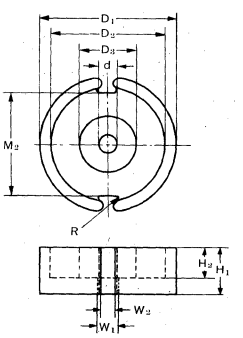
Items \ Materials		1801F	2001F	2002F	2003F	2004F
μiac		1800	2000	2000	2000	2000
B_{10} (G)		3900	4000	4000	4000	4000
Br (G)		900	700	700	700	700
Hc (Oe)		0.30	0.25	0.25	0.25	0.25
tanδ/μiac (x 10^{-6})	10kHz	1.2	1.0	1.0	1.0	1.0
	50kHz	2.0	1.3	1.3	1.3	1.3
	100kHz	4.0	2.0	2.0	2.0	2.0
	500kHz	50.0	13.0	13.0	13.0	13.0
$\Delta\mu/\mu^2/\Delta T$ (x 10^{-6}) ($^{20°C}_{+60°C}$~)		0.5~1.5	0.5~1.5	−0.5~0.5	−1.5~−0.5	1.0~2.0
DF (x 10^{-6})		−3	−3	−3	−3	−3
ρ (Ω-cm)		50	700	700	700	700
Tc (°C)		160	150	150	150	150

Pay special attention to the temperature coefficients of 2001F, 2002F, 2003F and 2004F respectively.

AL Values and Eff. Permeabilities

	AL values nH/N²	Eff. permeabilities μe
FP1408-I22	100 ±3%	63
	160 ±3%	101
	250 ±3%	157
	315 ±3%	198
	400 ±5%	252
FP1811-I22	100 ±3%	48
	160 ±3%	76
	250 ±3%	119
	315 ±3%	149
	400 ±5%	190
FP2213-I22	160 ±3%	64
	250 ±3%	99
	315 ±3%	125
	400 ±3%	158
	630 ±5%	249
FP2616-I22	250 ±3%	80
	315 ±3%	100
	400 ±3%	127
	630 ±3%	200
	1000 ±5%	318
FP3019-I22	250 ±3%	66
	400 ±3%	105
	630 ±3%	165
	1000 ±3%	263
	1600 ±5%	420

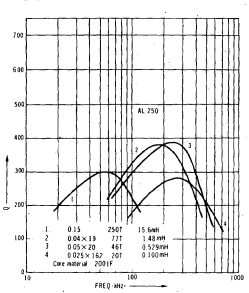
Form and Dimensions



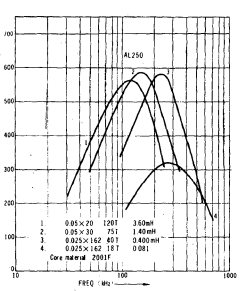
Types \ Items	D_1	D_2	D_3	d	H_1	H_2	W_1	W_2	M_2	R	core factors $\Sigma l/A$ (cm^{-1})	Eff. magnetic volume Ve(cm^3)
FP1408-I22	$14.0^{+0}_{-0.5}$	$11.6^{+0.5}_{-0}$	$6.0^{+0}_{-0.2}$	$3.0^{+0.3}_{-0}$	$4.2^{+0}_{-0.3}$	$2.8^{+0.2}_{-0}$	3.8	$2.8^{\pm0.3}$	$9.5^{\pm0.4}$	0.5R	7.89	0.495
FP1811-I22	$18.0^{+0}_{-0.5}$	$14.9^{+0.5}_{-0}$	$7.6^{+0}_{-0.3}$	$3.0^{+0.3}_{-0}$	$5.3^{+0}_{-0.3}$	$3.6^{+0.3}_{-0}$	4.6	$3.2^{\pm0.3}$	$12.0^{\pm0.4}$	0.7R	5.97	1.12
FP2213-I22	$22.0^{+0}_{-0.6}$	$17.9^{+0.6}_{-0}$	$9.4^{+0}_{-0.4}$	$4.5^{+0.3}_{-0}$	$6.8^{+0}_{-0.3}$	$4.6^{+0.3}_{-0}$	5.0	$3.6^{\pm0.4}$	$15.2^{\pm0.6}$	0.7R	4.97	2.00
FP2616-I22	$26.0^{+0}_{-0.8}$	$21.2^{+0.7}_{-0}$	$11.5^{+0}_{-0.5}$	$5.5^{+0.3}_{-0}$	$8.15^{+0}_{-0.3}$	$5.5^{+0.3}_{-0}$	5.4	$3.8^{\pm0.4}$	$18.4^{\pm0.6}$	0.8R	4.00	3.53
FP3019-I22	$30.0^{+0}_{-0.8}$	$25.0^{+0.7}_{-0}$	$13.5^{+0}_{-0.5}$	$5.5^{+0.3}_{-0}$	$9.5^{+0}_{-0.3}$	$6.5^{+0.3}_{-0}$	5.8	$4.0^{\pm0.4}$	$21.8^{\pm0.6}$	0.9R	3.30	6.19

Mountain parts such as bobbins and holders are fully provided.

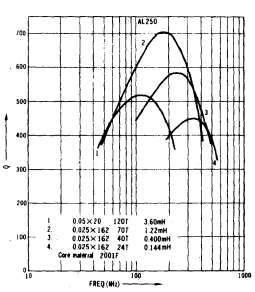
Typical Q Curves



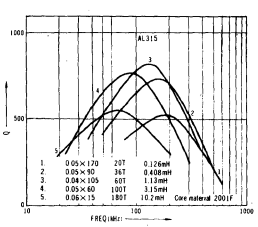
FP1408-I22 AL250



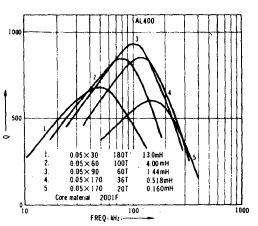
FP1811-I22 AL250



FP2213-I22 AL250



FP2616-I22 AL315



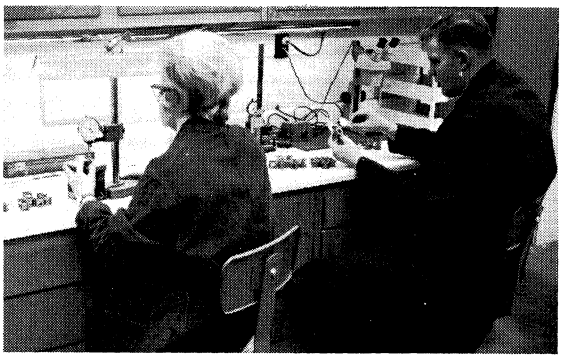
FP3019-I22 AL400

For further information write to:

Tohoku Metal Industries, Ltd. Tokin

No. 13-10. 7-chome. Ginza, Chuo-ku, Tokyo, Japan Telephone: Tokyo 542-6171 Cable Address: TOHOKUMETAL TOKYO

INTRODUCTION TO THERMOTECH





QUALITY ASSURANCE

At Thermotech, quality is no accident. It is the result of high standards and careful supervision . . . it reflects our corporate attitude, philosophy, and way of doing business.

This basic motivation is shared by every member of Thermotech Industries. An exacting Quality Control System is employed through every step of engineering and manufacturing . . . from the rigid requirements established for raw materials and components through the final inspection of the finished product.

At Thermotech, customers' specifications and requirements generally are exceeded and time consuming rejects virtually eliminated.

TOOL MOLDMAKING

An efficient tool and moldmaking department assures the rapid production of consistently high-quality precision parts at a reasonable cost. Self contained, well equipped and operated by expert Thermotech tool and moldmakers. Tool lead time is reduced and mold modifications are facilitated.

Ninety percent of this important work is accomplished in Thermotech's own well-equipped facilities thus developing many exclusive money saving mold-making processes.

INDEX TO STANDARD PRODUCTS

	CATALOG	EEM INSERTION
Introduction	page 2	page 1
Flange Designs	page 3	page 2
Round Core Stock Bobbins	page 4	page 3
Rectangular Stock Bobbins	page 5	page 4
Reed Switches	page 6	page 5
Cup Core Stock Bobbins	page 6	page 5
Square Stack Stock Bobbins	page 6	page 5
Transformer Square Stacks with Stacked lugs	page 7	page 6
Terminal lugs for Stacked Bobbins	page 7	page 6
Terminal lugs for Printed Circuits	page 7	page 6
Thermotech Products, Service and Equipment	page 8	

THERMOTECH
COIL FORMS & COMPONENTS DIVISION
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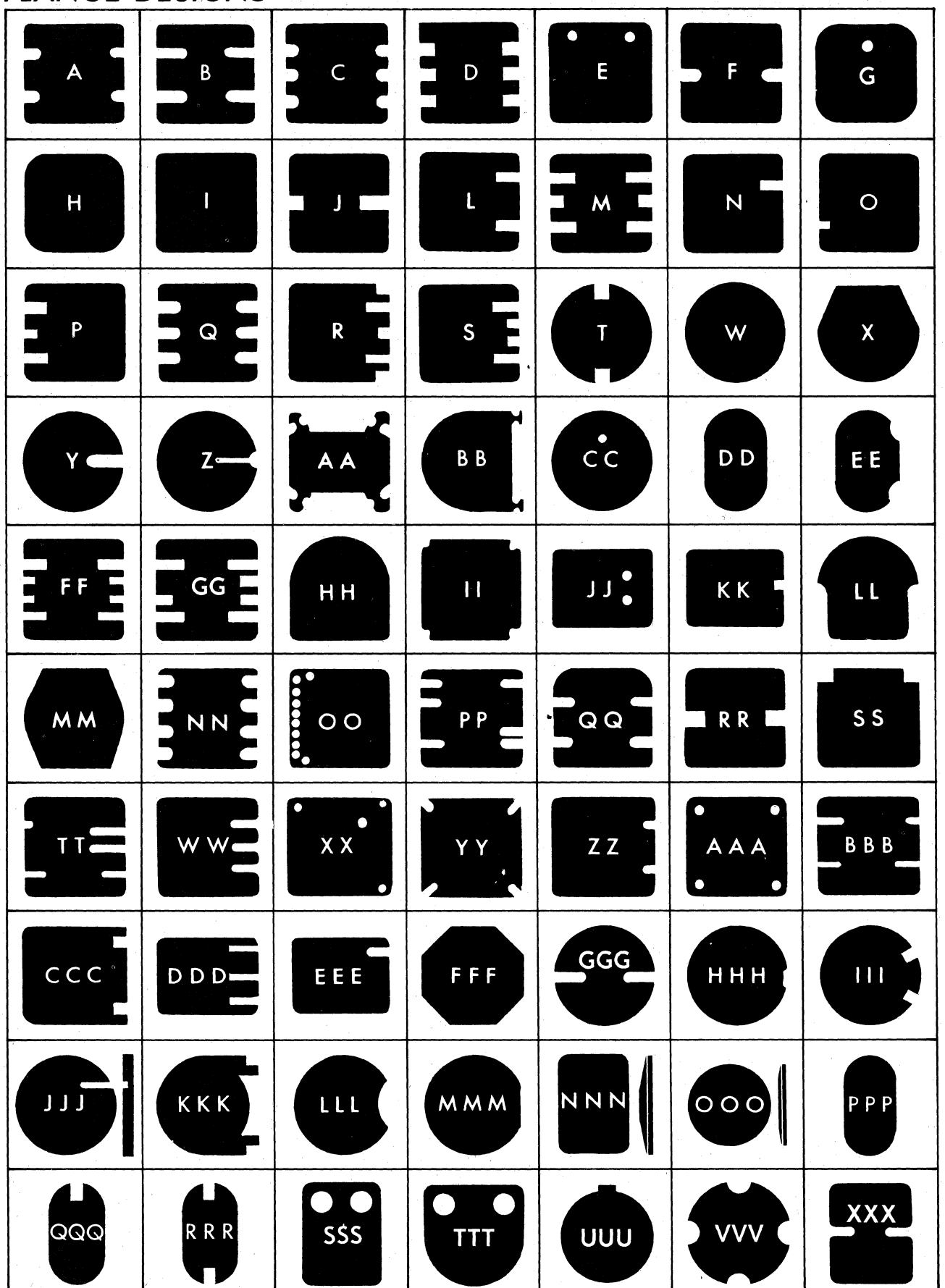
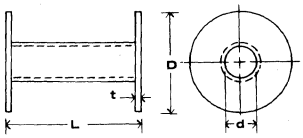
FLANGE DESIGNS



Custom Coil forms molded in Thermoplastic, Thermosets and Fluorocarbons. 2

ROUND CORE STOCK BOBBINS



N NYLON
GN NYLON GLASS REINFORCED
D DELRIN
NL NYLATRON
P POLYCARBONATE (LEXAN)
PP POLYPROPYLENE
FL FLUOROCARBON

*When two dimensions are given, flanges are rectangular.

*When two dimensions are given the first is the core thickness and the second is the thickness of the flange.

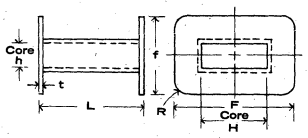
**Tapered flanges.

***Allow 3 to 4 weeks delivery.

Part Number	Hole Diameter d	Flange Diameter D*	Length Overall L	Wall Thickness t*	Flange Design	Material
2-314	.030	.184	.180	.012	T-T	N
2-226***	.050	.170	.200	.010	W-W	N/NG
2-135	.063	.180	.206	.012	W-W	N
2-367	.067	.132	.300	.020	W-W	N
2-421	.094	.330	.685	.015	W-W	N/GN
2-403	.098	.280	.330	.015	W-W	GN
2-290	.098	.280	.370	.015	W-W	GN
2-236***	.099	.328	.681	.015	W-W	N
2-354	.104	.197	.650	.012	W-W	GN
2-289	.110	.230	.140	.012	HH-KKK	N
2-149***	.110	.290	.360	.020	W-W	N
2-436	.110	.290	.800	.018	Y-Y	GN
2-399	.110	.312	.130	.015	W-W	LEXAN
2-125***	.113/3 ribs	.280	.435	.014	W-W	N
2-125A***	.113	.280	.435	.014	W-W	N
2-401	.114	.290	.390	.021	W-W	GN
2-297	.120	.345	.750	.015	W-W	N
2-402	.120	.396	.406	.025	W-W	N
2-402A	.120	.396	.406	.025	W-VVV	N
2-271***	.125	.285	.300	.015/.020	W-W	N
2-272***	.125	.342	.300	.015/.020	W-W	N
2-201	.125	.342	.540	.020/.015	W-W	N
2-156***	.125	.430	.627	.020	W-W	N/GN
2-207***	.128	.496	.352	.018	W-W	N
2-281	.130	.230	.770	.014	W-W	N/GN
2-282	.130	.300	.770	.014	W-W	N/GN
2-164	.135	.360	.255	.018	W-GGG	N
2-383	.136	.250	.126	.014	W-W	N
2-208	.138	.375	.875	.030	W-Y	N
2-208A	.138	.375	.875	.030	W-T	N
2-441	.140	.593	.820	.032	W-W	N
2-238***	.150	.496	.386	.017	W-W	N
2-247	.152	.800/1.000	.950	.075	I-I	N
2-287***	.155	.400	.280	.012	W-W	N
2-410	.157	.300	.168	.010	W-W	N
2-427	.180	.530	1.350	.020/.045 to .065	**000-000	N
2-392	.188	.495	.280	.029	W-W	N
2-232	.190	.405	.620	.030	W-W	N
2-301	.190	.495	.453	.018	W-LLL	N
2-432	.190	.650	.333	.032	W-UUU	N-NG
2-418	.191	.750	.505	.030	W-W	N
2-420	.192	.500	.350	.030	W-W	N
2-409	.193	.650	.345	.026	W-W	N
2-318	.194	.418	.125	.020	W-Y	N
2-140	.195	.500	.436	.015	W-W	N
2-313	.200	.538 x .538	.625	.025	I-E	N
2-245	.203	.830	.345	.025	W-W	N
2-425	.205	.375	.430	.020/.030	W-W	N
2-179	.218	.625	1.090	.020/.025 to .040**	000-000	NL
2-340	.218	.808	.503	.030/.020	000-000	N
2-151	.220	.625	.950	.020/.025 to 040**	000-000	N/GN
2-168***	.221	.592	.935	.020	W-LL	NL
2-302	.250	.495	.621	.018	W-LLL	N
2-131	.255	.618	.934	.026	W-W	N
2-131A	.255	.725	.934	.025	W-W	N
2-123***	.285	1.000	.990	.024	W-CC	N
2-105***	.290	1.000	.980	.030	Z-W	N
2-105A***	.290	1.000	.980	.030	Y-W	N
2-303	.305	.625	.692	.020	W-W	N
2-188***	.310	.510	.375	.015	W-III	D/N
2-415	.315	.875	.575	.035/.035-.070	W-W	N
2-180	.315	.875	.600	.035	W-MM	N/GN
2-435	.315	.875	.650	.032	W-MM	
2-181	.315	.875	.700	.035	W-MM	N/GN
2-411	.316	.750	1.187	.022	W-W	GN
2-144	.316	.875	.590	.035	W-W	N/GN
2-320	.316	.875	.595	.027	W-W	N
2-118	.316	.875	.690	.035	W-W	N/GN
2-187	.316	1.155	.500	.031	W-HHH	N
2-363	.320	.725	.850	.030	III-III	GN
2-235***	.320	.750	.562	.022	W-W	N/FL
2-431	.320	.755	1.337	.050	W-TTT	N-GN
2-296	.320	.875	.590	.025	W-X	N
2-296A	.320	.875	.590	.025	X-T	N
2-248	.320	.935	.535	.027	W-W	N/GN
2-273	.325	.456	1.163	.015	W-W	N/GN
2-273A	.325	.502	1.163	.015	W-W	N/GN
2-193***	.328	.812	1.250	.040/.047	W-W	N/GN
2-422	.330	.720 Sq.	1.030	.032	E-E	GN
2-165***	.333	.859x.859	1.176	.045/.057	I-I	N
2-130***	.370	.872	.982	.025	W-W	N
2-178	.375	.635	.135	.010	W	N
2-426	.375	.718	.937	.025	W-CC	N
2-115***	.376	.656	.968	.035	W-W	N/FL
2-120	.376	1.000	.968	.032	BB-W	N
2-429	.377	1.367		.060/.030	W-W	D
2-360	.378	.962	1.100	.020/.030	W-Y	GN
2-126	.380	1.000	.620	.024	W-W	N
2-395	.380	1.125	.562	.030	W-W	N
2-167	.382	.677	.310	.025	W-W	N/GN
2-319	.385	.980	.605	.028	W-W	N
2-143	.385	1.125	.628	.031/.047	W-HH	N
2-199***	.385	1.125	1.093	.035	HHH-HHH	N
2-127	.388	1.000	.995	.027	W-W	N
2-366	.390	.900	.812	.030	W-W	GN
2-353	.408	1.000	1.187	.036/.047	W-W	LUMARITH
2-380	.418	1.050	.255	.035/.025	W-W	D
2-312	.420	1.210	.425	.030	000-000	N
2-430	.430	.755	.650	.015	W-W	N-GN-NL
2-244***	.435	.725	.650	.020	W-III	N/GN
2-222***	.500	.935	.730	.030	W-III	N/GN
2-237	.516	1.500	1.093	.040	W-W	N
2-330	.518	1.303	1.063	.042	W-W	GN
2-176	.572	1.406	1.750	.060	W-W	N
2-195***	.600	1.525	1.810	.065	W-FFF	N
2-122	.632	1.375	.490	.032	W-W	N
2-357	.635	.990	.620	.032	Y-Y	N
2-122A	.638	1.375	.495	.030	W-W	N
2-376	.660	1.213	.910	.025/.030	W-CC	D
2-372	.765	1.750	1.562	.042	W-W	GN
2-228***	.795	1.645	1.344	.020	W-MMM	NL
2-286***	.967	1.985	2.040	.080	W-JJJ	N
2-262	1.614	2.375	.600	.050	W-W	N

Send prints or samples for prompt, competitive price or quotation

RECTANGULAR STACKS - STOCK BOBBINS



N NYLON
GN NYLON GLASS REINFORCED
D DELRIN
NL NYLATRON
P POLYCARBONATE (LEXAN)
PP POLYPROPYLENE
FL FLUOROCARBON

*When two dimensions are given, flanges are rectangular.

*When two dimensions are given the first is the core thickness and the second is the thickness of the flange.

**Tapered flanges.

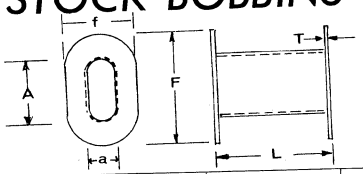
***Allow 3 to 4 weeks delivery.

Part Number	Hole h	Hole H	Flange f	Flange F	Length Overall L	Wall Thickness t *	Flange Design	Matl.	Lamination Number Or Application
3-121	.015	.098	.500	Dia.	.227	.020	W-W	N	
3-368	.024	.073	.169	.218	.238	.012	I-O	GN	
3-304	.033	.066	.298	.240	.270	.012	CCC-CCC	N	Microsyl Core
3-254***	.033	.066	.250	.280	.280	.012	I-I	N	Microsyl Core
3-292	.034	.068	.135	.185	.281	.012	F-F	GN	Mycrosyl Core
3-292A***	.034	.068	.135	.185	.281	.015	F-F	GN	
3-205	.036	.070	.166	.200	.360	.014	I-I	N	
3-377	.055	.070	.185	.200	.100	.015	H-I	GN	
3-279	.056	.302	.203	.449	.301	.015	I-I	N	Microsyl Core
3-177***	.063	.101	.355	.400	.500	.025	G-H	N	
3-378	.070	.105	.200	.235	.100	.015	H-H	GN	
3-412	.070	.465	.175	.615	.450	.020	I-I	N	
3-389	.070	.365	.185	.500	.450	.015	I-I	N	
3-382	.071	.168	.192	.306	.437	.016	I-I	N	
3-212***	.079	.154	.185	.260	.125	.012	I-I	N	
3-148	.096	.146	.270	.320	.151	.012	II-II	N	
3-433	.096	.400	.270	.580	.151	.012	I-I	N	
3-252***	.097	.115	.239	.279	.125	.020/.012	I-I	N	
3-136	.100	.150	.275	.329	.273	.015	I-I	N	EE 30-31 9/64" Stack
3-337	.100	.150	.275	.329	.275	.012	I-B	N	EE 30-31 9/64" Stack
3-145	.100	.187	.277	.364	.270	.015	I-I	N/GN	EE 30-31 3/16" Stack
3-145A	.100	.188	.278	.364	.270	.015	I-Q	N	EE 30-31 3/16" Stack
3-145B	.100	.188	.278	.364	.270	.015	Q-Q	N	EE 30-31 3/16" Stack
3-310	.100	.199	.300	.400	.110	.012	I-I	GN	Microsyl Core
3-299	.100	.200	.280	.390	.210	.012	H-H	N/GN	EI-187 3/32" Stack
3-269***	.102	.197	.285	.385	.209	.012	I	N/GN	Microsyl 3/16 x .742 Stack
3-190***	.103	.114	.270	.270	.148	.018	F-F	N	
3-288***	.103	.266	.266	.430	.150	.015	I-I	N	EI-094 1/4" Stack
3-211***	.104	.140	.294	.330	.230	.012	I-I	N	
3-331	.106	.206	.240	.340	.604	.012	I-G	N	Microsyl Core
3-249	.106	.263	.266	.424	.406	.025	I-I	N	
3-424	.110	.396	.240	.550	1.120	.032	I-I	D	
3-398	.125	.250	.375	.502	.309	.020	I-I	N	
3-356	.130	.318	.368	.555	.305	.020	H-H	N	EE 28-29 5/16" Stack
3-256***	.130	.192	.360	.438	.300	.020	I-I	N	
3-253***	.131	.145	.375	.375	.474	.012	XX-XX	N	
3-153	.131	.255	.373	.498	.311	.020	I-JJ	N/GN	EE 28-29 1/4" Stack
3-240	.145	.625	.395	.875	.308	.018	H-H	N	
3-315	.156	.215	.406	.465	.150	.020	I-F	N	
3-321	.156	.312	.310	.450	.370	.015	I-I	N/GN	
3-291	.156	.312	.385	.540	.370	.014	I-RR	GN	
3-327	.165	.200	.500	.535	.425	.025	D-D	N	EI 187 x 5/32" Stack
3-128***	.168	.521	.627	.968	.839	.032/.025	DD-EE	N	
3-333	.180	1.690	.609	2.230	.855	.062	H-H	N	
3-295***	.176	.266	.290	.380	.170	.015	I-EEE	N	E 25 1/4" Short Stack
3-241	.190	.440	.500	.750	.969	.020	H-H	N	
3-204***	.192	.255	.436	.566	.455	.030	I-I	N	
3-332	.194	.256	.500	.570	.340	.015	I-I	GN	EI 187 1/4" Stack
3-246	.197	.225	.445	.480	.675	.020	I-I	N/GN	
3-258	.197	.275	.562	.625	.400	.020	I-WW	N	
3-307	.197	.571	.550	.925	.240	.020	I-I	N	EI 186 9/16" Stack
3-173	.198	.258	.332	.392	.656	.017/.021	I-I	N	
3-250	.200	.263	.360	.424	.406	.025	I-I	N	
3-134	.200	.263	.558	.597	.427	.023/.020	D-D	N	EI 187 1/4" Stack
3-134A	.200	.263	.558	.597	.427	.023/.020	D-I	N	EI 187 1/4" Stack
3-134B	.200	.263	.558	.597	.427	.023/.020	FF-FF	N	EI 187 1/4" Stack

Part Number	Hole h	Hole H	Flange f	Flange F	Length Overall L	Wall Thickness t *	Flange Design	Matl.	Lamination Number Or Application
3-191	.200	.296	.535	.670	.420	.028	I-L	N	
3-191A	.200	.296	.535	.670	.420	.025	D-D	N	
3-191C	.200	.296	.535	.670	.420	.025	I-I	N	
3-138	.200	.335	.535	.695	.425	.020	I-I	N	EI 187 11/32" Stack
3-338	.200	.355	.535	.695	.425	.022	L-DDD	N	EI 187 11/32" Stack
3-298***	.200	.355	.437	.695	.656	.020	I-I	N	EI 188
3-306	.200	.385	.535	.885	.425	.025	NN-NN	GN	EI 187 3/8" Stack
3-283	.200	.385	.540	.720	.425	.030	I-I	FL/N/GN	EI 187 3/8" Stack
3-283A	.200	.385	.540	.720	.425	.025	D-D	N/GN	EI 187 3/8" Stack
3-283B	.200	.385	.540	.625	.425	.025	D-D	N/GN	EI 187 3/8" Stack
3-325	.200	.760	.450	1.000	1.120	.025	I-ZZ-ZZ	N	EI 75 3/16" Stack
3-274***	.207	.406	.437	.636	.610	.030	QQ-QQ	N	Arnold AM-6 "C" Core
3-358.	.228	.256	.557	.557	.500	.020/.025	H-H	N/GN/PP	
3-284	.250	.390	.562	.718	1.085	.030	I-I	N	Arnold AH 246 "C" Core
3-391	.258	.383	.565	.690	1.120	.026	I-I	N	
3-322	.260	.450	.532	.722	.675	.025	I-SS	N	1314 W Lamination
3-322A	.260	.450	.532	.722	.675	.025	I-I	N	1314 W Lamination
3-224	.260	.385	.840	.967	.706	.032	Q-Q	N	
3-224A	.260	.385	.840	.967	.706	.032	M-M	N	
3-414	.260	.508	.500	.860	.500	.030	I-I	N	
3-166	.260	.510	.785	1.070	1.195	.020/.025 to .045**	NNN-NNN	NL	Arnold AH 40 "C" Core
3-221***	.260	.513	.800	1.060	1.170	.028/.035 to .068**	NNN-NNN	N	Arnold AH 40 "C" Core
3-379	.266	.515	.725	.970	.406	.020	I-I-I	N	
3-150***	.266	.515	.720	.970	.490	.033	I-I	N	EE 24-25 1/2" Stack
3-150A***	.266	.515	.720	.970	.490	.040	D-D	N	EE 24-25 1/2" Stack
3-362	.266	.515	.720	.970	.490	.040	I-S	N	
3-255	.266	.515	.720	.975	.490	.040	H-H	N	EE 24-25 1/2" Stack
3-227	.266	.391	.720	.875	.476	.030	I-I	N	EE 24-25 3/8" Stack
3-227A	.266	.391	.720	.875	.476	.030	Q-Q	N/GN	EE 24-25 3/8" Stack
3-116***	.266	.630	.500	1.110	.469	.020	I-I	N	DU 124 5/8" Stack
3-175***	.312	.385	.875	.865	.660	.030	OO-OO	N	E 38 5/16" Stack
3-142***	.325	.465	.710	.850	.425	.035	I-I	N	Ferrox Cube 206 F440
3-142A***	.325	.465	.710	.850	.425	.035	WW-WW	N	Ferrox Cube 206 F440
3-417	.335	.640	.700 .700	1.210 1.000	.297	.030	I-SSS	N/GN	
3-119	.348	.510	.813	.984	.719	.022	I-I	N	F 13 1/2" Stack
3-393	.385	.510	.986	1.100	.796	.028	I-I	N	
3-172***	.390	.662	1.050	1.302	1.035	.028	I-I	N/GN	
3-341	.435	.844	1.807	1.900	.555	.035	I-I	GN	
3-242***	.448	.510	1.038	1.100	.796	.032	I-L	N	EI 21 7/16" Stack
3-192***	.453	.468	.968	1.000	.968	.031	H-H	N	
3-231	.453	.531	.969	1.062	.969	.038	I-I	N	
3-428	.500	.758	1.120	1.312	.562	.032	I-I	N/GN	
3-355	.510	.635	1.100	1.225	.796	.030	NN-NN	N	
3-355A	.510	.635	1.100	1.225	.796	.032	I-M	N	
3-163	.510	1.020	1.170	1.800	.850	.055	KK-KK	N	
3-413	.525	.595	1.300	1.500	1.350	.045	Special	N/GN	
3-442	.560	1.560	1.160	2.140	.500	.050	I-I	N	
3-329	.573	1.151	1.375	1.937	1.000	.040	I-AAA	N/GN	
3-370	.578	.640	1.109	1.171	.828	.025	I-I	N	
3-323	.633	.758	1.359	1.484	1.115	.031	I-I	N/GN	EI 75 5/8" Stack
3-225	.635	.755	1.205	1.343	.916	.030	I-I	N	EI 625 3/4" Stack
3-225A	.635	.755	1.205	1.343	.916	.030	I-L	N	EI 625 3/4" Stack
3-104***	.635	1.015	1.370	1.750	1.370	.050	I-I	N	
3-400	.690	.846	1.296	1.445	.492	.030	I-TT	GN	
3-396	.953	1.515	2.077	2.640	1.188	.032	I-I	GN	
3-397	.953	1.515	2.077	2.640	1.312	.032	I-I	GN	

Custom Coil Forms molded in Thermoplastic, Thermosets and Fluorocarbons

REED SWITCHES-STOCK BOBBINS

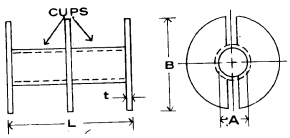


N NYLON
GN NYLON GLASS REINFORCED
D DELRIN
NL NYLATRON
P POLYCARBONATE (LEXAN)
PP POLYPROPYLENE

*When two dimensions are given the first is the core thickness and the second is the thickness of the flange.
**Tapered flanges.
***Allow 3 to 4 weeks delivery.

Part Number	HOLE		FLANGE		Length Overall L	Wall Thickness T	Flange Design	Matl.
	a	A	f	F				
8-251	.102	.506	.312	.719	.656	.017	PPP-PPP	N
8-437	.110	.240	.290	.420	.800	.018	QQQ-QQQ	GN
8-438	.110	.350	.290	.530	.800	.018	QQQ-QQQ	GN
8-439	.110	.460	.290	.640	.800	.018	QQQ-QQQ	GN
8-440	.110	.680	.290	.860	.800	.018	QQQ-QQQ	GN
8-352	.130	.505	.420	.800	.875	.030	PPP-QQQ	N
8-347	.130	.505	.500	.875	.687	.015/.030	PPP-PPP	N/GN
8-345	.130	.505	.500	.875	1.405	.015/.030	PPP-PPP	N/GN
8-350	.130	.505	.550	.927	.875	.030	PPP-PPP	N
8-349	.130	.505	.650	1.000	.875	.030	PPP-PPP	N
8-419	.194	.382	.475	.662	1.062	.025	PPP-PPP	N
8-348	.194	.382	.688	.875	1.062	.025/.030	PPP-PPP	N/GN
8-351	.220	.450	.590	.810	1.437	.025/.030	PPP-PPP	N
8-346	.255	.755	.875	1.375	.687	.025/.040	PPP-PPP	N/GN

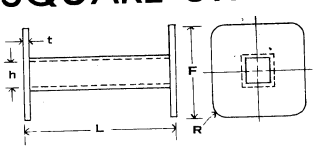
CUP CORE - STOCK BOBBINS



N NYLON
GN NYLON GLASS REINFORCED
D DELRIN
NL NYLATRON
P POLYCARBONATE (LEXAN)
PP POLYPROPYLENE

Part Number	Hole Diameter A	Flange Diameter B	Length Overall L	Number of Cups	Wall Thickness t	Matl.	FOR USE WITH
6-278	.160	.290	.137	1	.012	D	
6-276	.194	.350	.168	1	.014	D	
6-277	.194	.350	.168	2	.014	D	
6-101***	.205	.450	.280	1	.015/.020	N	General Ceramics Cup Core F261, F211, F280
6-160	.449	.705	.440	1	.027	Delrin	General Ceramics Cup Core F1027-1 General Ceramics Bobbin B477-1
6-161	.449	.705	.440	2	.020	Delrin	General Ceramics Cup Core F1027-2 General Ceramics Bobbin B477-2
6-162	.449	.705	.440	3	.020	Delrin	General Ceramics Cup Core F1027-3 General Ceramics Bobbin B477-3
6-157	.461	.831	.429	2	.025	Delrin	General Ceramics Cup Core F1148-2 General Ceramics Bobbin B479-2
6-158	.539	.980	.508	2	.035	Delrin	General Ceramics Cup Core F1153-2 General Ceramics Bobbin B480-2
6-159	.649	1.142	.563	2	.035	Delrin	General Ceramics Cup Core F1152-2 General Ceramics Bobbin B481-2
6-159A	.649	1.142	.563	1	.035	Delrin	

SQUARE STACK STOCK BOBBINS



N NYLON
GN NYLON GLASS REINFORCED
D DELRIN
NL NYLATRON
P POLYCARBONATE (LEXAN)
PP POLYPROPYLENE
FL FLUOROCARBON

*When two dimensions are given, flanges are rectangular.
*When two dimensions are given the first is the core thickness and the second is the thickness of the flange.
**Tapered flanges.
***Allow 3 to 4 weeks delivery.

Part Number	Hole Square h	Flange Square F*	Length Overall L	Wall Thickness t**	Flange Design	Material	Lamination Number
4-110	.104	.270 x .310	.271	.015/.012	A-I	N	EE 30-31
4-110A	.104	.270 x .310	.271	.015/.012	B-I	N	EE 30-31
4-110B	.104	.270 x .310	.271	.015/.012	D-I	N	EE 30-31
4-110C	.104	.270 x .310	.271	.015/.012	I-I	N	EE 30-31
4-223	.104	.270	.150	.012	KK-KK	N/GN	EI 094
4-112	.125	.376	.312	.020	I-I	N/FL	EE 28-29
4-112B	.130	.376	.312	.020	II-II	N	
4-112A	.125	.376	.312	.020	C-C	N or GN	EE 28-29
4-133	.128	.368	.307	.016	I-I	N/FL	EE 28-29
4-261	.131	.375	.220	.020	I-I	N	
4-114***	.133	.273	.300	.018	I-I	N	EE 28-29
4-183***	.145	.428	.268	.025	NN-NN	N	
4-326	.162	.370 x .400	.310	.012	I-I	N	35E
4-423	.164	.365	.305	.012	I-I	N	
4-316	.168	.355	.165	.015	I-YY	N	
4-111	.194	.545	.245	.020	I-I	N/FL	EI 186, F 14
4-111A	.194	.545	.245	.020	D-D	N	EI 186, F 14
4-102D	.200	.535	.425	.025	I-B	N	
4-108***	.200	.535	.675	.020	I-I	N/FL	EE 186-187
4-209***	.200	.575 x .535	.332	.026	NN-NN	N	
4-102	.200	.535	.425	.025	C-C	P/N/GN	E 187
4-102A	.200	.535	.425	.025	I-I	N/GN	EI 187
4-102B	.200	.535	.425	.025	I-JJ	N	EI 187
4-102C	.200	.535	.425	.020	I-I	N	EI 187
4-233***	.200	.535	.425	.035	I-I	N	EX 187
4-336	.200	.535	.425	.025	I-BBB	N	
4-359	.204	.557	.552	.020/.025	H-H	N/GN/PP	
4-239***	.220	.640	.340	.030	I-I	N	
4-385	.255	.495	1.220	.026	I-I	N	
4-106	.257	.750 x .656	.480	.020	I-F	N	EE 24-25
4-109***	.257	.665 x 1.000	.492	.022	AA-AA	N	EE 24-25
4-132***	.257	.740	.550	.028	G-H	N	
4-182***	.257	.430	.406	.025	I-I	N	
4-373	.258	.543 x .625	1.120	.026	I-I	N	
4-384	.258	.617	1.486	.020/.028	I-I	N	
4-113	.262	.740	.476	.026	H-H	N	EE 24-25
4-113B	.262	.720 x .750	.476	.035	H-H	N	EE 24-25
4-113C	.266	.720 x .750	.476	.035	I-I	N	EE 24-25
4-113D	.266	.720 x .750	.476	.033	J-I	N	EE 24-25
4-113E***	.266	.720 x .750	.475	.035	I-M	N	EE 24-25

Part Number	Hole Square h	Flange Square F*	Length Overall L	Wall Thickness t**	Flange Design	Material	Lamination Number
4-113F***	.266	.720 x .750	.476	.035	M-M	N	EE 24-25
4-113G	.266	.720 x .750	.476	.026	C-C	N or GN	EE 24-25
4-113H	.266	.720 x .750	.476	.020	H-H	N or GN	EE 24-25
4-234	.266	.745 x .750	.496	.035	Q-Q	N	
4-229***	.270	.750	.585	.025	H-G	N	
4-113A	.275	.720 x .750	.476	.050	N-O	N	EE 24-25
4-293	.281	.625	1.020	.015	I-I	N	"C" Core
4-137***	.380	.860	.682	.030	I-I	N	EE 26-27
4-374	.383	.850	1.188	.030	I-I	N	
4-300***	.385	.860	.682	.030	D-D	N/GN	EE 26-27
4-129	.390	.967	.706	.045	Q-Q	N/FL	EE 26-27
4-243	.390	.968	.755	.037	Q-Q	N	EI 375
4-103C	.390	.975	.735	.030	TT-I	N	EI 375
4-103	.395	.968	.735	.035	I-I	N	EI 375
4-103E	.395	.968	.735	.031	D-D	N	EI 375
4-103G	.395	.968	.735	.032	F-F	N	
4-103H	.395	.968	.735	.032	F-I-F	N	
4-103A	.395	.970	.730	.035	P-P	N/FL	EI 375
4-103B	.395	.970	.730	.030	I-M	N/FL	EI 375
4-103D	.395	.970	.730	.040	R-R	N	EI 375
4-103F	.395	.975	.730	.030	TT-I	N	EI 375
4-405	.505	.870	.985	.025	I-I	N	
4-328	.510	1.100	.796	.030/.036	L-L	PP	EI 21
4-107	.510	1.093	.796	.025	I-I	N	EI 21
4-107A	.510	1.100	.796	.040	P-P	N	EI 21
4-107B	.510	1.100	.796	.040	S-S	N	EI 21
4-107C	.510	1.100	.796	.040	GG-GG	N	EI 21
4-107D	.510	1.100	.796	.031	I-PP	N	EI 21
4-189***	.510	1.250	.810	.050/.060	I-I	N	
4-152	.640	1.218	.918	.038	L-L	N/GN	EI 625
4-152A	.640	1.218	.918	.038	I-I	N/GN	EI 625
4-324	.697	1.344	1.000	.031	I-I	N/GN	EI 68
4-196	.758	1.480	1.115	.035	I-I	N	EI 75
4-259	.880	1.740	1.270	.040	I-I	N	EI 11

Send prints or samples for prompt, competitive price or quotation.

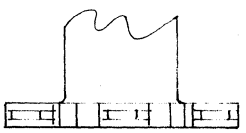
TRANSFORMER STOCK BOBBINS SQUARE STACKS WITH STAKED LUGS

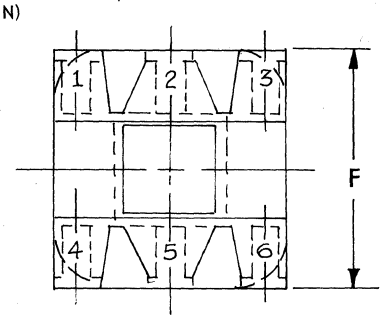
Part Number	Hole Square h	Flange Square F	Length Overall L	Height H	Material	Lamination Number
5-511	.266	.875	.476	.569	N	EE 24-25 1/4" Stack
5-502	.390	1.000/ .980	.734	.795	N	EI 375 3/8" Stack
5-503	.510	1.100/1.125	.796	.860	N	EI 21 1/2" Stack
5-508	.510/.635	1.100/1.125	.792	.858	N	EI 21 5/8" Stack
5-509	.635		.921	.983	N	EI 625 5/8" Stack

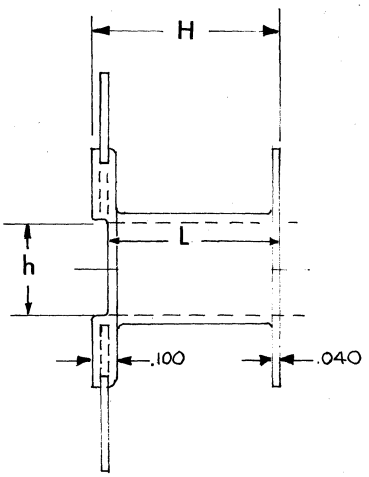
N NYLON

WHEN ORDERING STATE

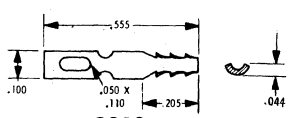
1. BOBBIN PART NUMBER
2. LUG PART NUMBER
3. NUMBER OF LUGS REQUIRED
4. POSITION OF LUGS BY STATION (SEE DRAWING OF BOBBIN)







TERMINAL LUGS FOR STAKED BOBBINS



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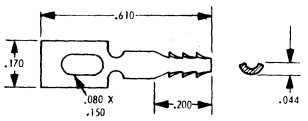

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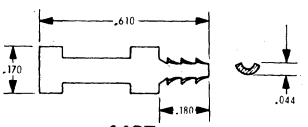

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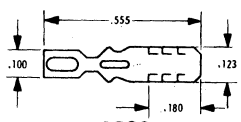

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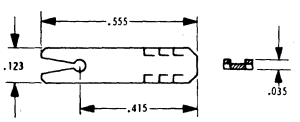

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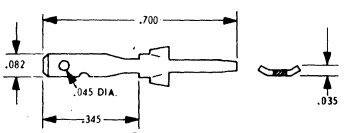


4574

1. Material brass pre-solder coat
2. Lugs will withstand 6 lb. pull test

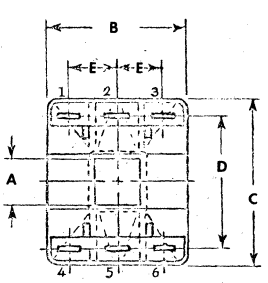
TRANSFORMER BOBBIN FOR PRINTED CIRCUIT

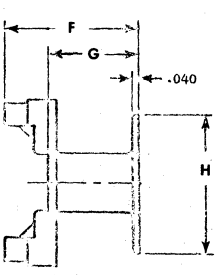
Part Number	A	B	C	D	E	F	G	H	Lamination Number	Available With Lug
7-700	.260 Sq.	.725	.875	.720	.250	.691	.476	.725/.750	EE 2425 1/4" Stack	4574
7-701	.390 Sq.	.975	1.125	1.000	.312	.938	.735	.975 Sq.	EI 375 3/8" Stack	4574

MATERIAL – NYLON

WHEN ORDERING STATE

1. BOBBIN PART NUMBER
2. LUG PART NUMBER
3. NUMBER OF LUGS REQUIRED
4. POSITION OF LUGS BY STATION (SEE DRAWING OF BOBBIN)

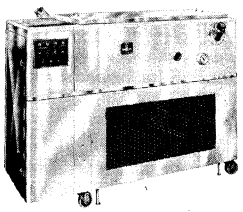




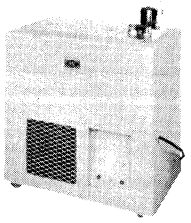
Custom Coil Forms molded in Thermoplastic, Thermosets and Fluorocarbons.

AMINCO

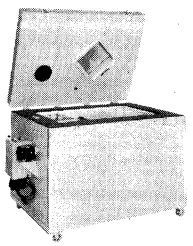
EQUIPMENT FOR THE ELECTRONICS ENGINEER



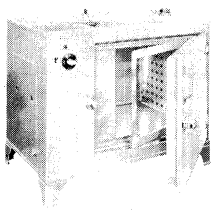
ENVIRONMENTAL TEST CABINETS provide closely controlled atmospheres (temperature and R.H.) in spaces ranging from bench top chambers to walk-in rooms. AMINCO-AIRE features unique temperature-humidity control system that conditions air before it enters test chamber. Temp. and R.H. conditions maintained constant within ±¾° F. dry bulb and ± ½% R.H. Variable cycles and pre-cut cams available to meet most MIL SPECS. 150, 300 & 450 CFM Models. Catalog 565-EEM.



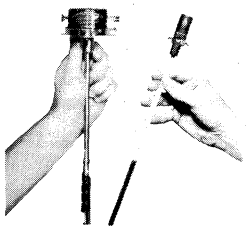
WIDE-RANGE LABORATORY BATH can be used for precisely-controlled constant-temperature bath or circulating controlled-temperature liquids through external apparatus. Contains both refrigerating and heating elements. Temperature range from —29° C to +71° C with temperature uniformities between ±.02 and ±.08° C. Two models available with capacities of 16 and 50 gal. Ideal for cooling water for low temp. viscometer tests, etc. Catalog 565-EEM.



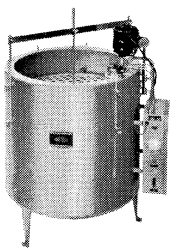
SUB-ZERO CABINET is dry-ice or liquid CO_2 operated, priced well below mechanically-operated units and has low maintenance cost. Provided with observation window. Hand holes, sleeve inserts and recording thermometers available as accessories. Range: +250 to —120° F. Cabinet temperature can be lowered ambient to —100° F. in about 90 minutes. Two sizes, with work chambers: 24 x 24 x 24 in.; and 18 x 16 x 20 in. Explosion proof models also. Catalog 565-EEM.



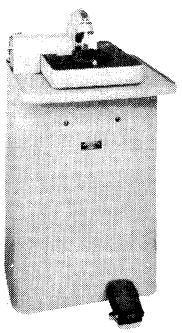
OVENS — Highest quality ovens at the lowest price per cubic foot of work space. Wide range of models includes: forced convection types for precise temperature control, minimum power consumption; high-temperature models for temperatures to 1000° F. Stainless or cold-rolled steel or combinations of both. Explosion-resistant fitting, explosion-proof motors. Catalog 565-EEM.



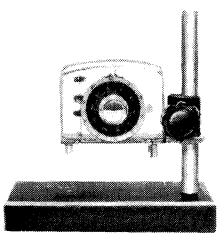
THERMOREGULATORS·AMINCO offers both bimetal and mercury thermoregulators for precise control of temperature in either liquid or air media. Units available with various temp. ranges with a lower limit of —95° C to an upper limit of +538° C; control accuracy of up to ±0.005° C under optimum conditions. Perforated protective tubes available for all thermo-regulators. Vertical, horizontal or oblique mounting. Bulletins 2366 and 2370-EEM.



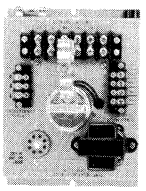
GENERAL PURPOSE BATH. Operates with oil or water. Circulates controlled-temperature liquids through apparatus such as refractometers, polarimeters, viscometers, etc. Ambient to 300°C; uniformity ±0.04 to ±0.18°C. Heavy-duty motorized stirrer. Adjustable immersion shelf, four hanging rods. Heats quickly, maintains high operating temperature. Capacity: 27 gal. Bulletin 530-EEM.



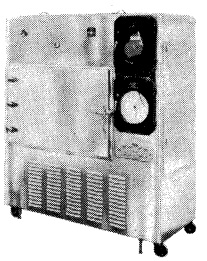
CUTTING-OFF MACHINE provides an inexpensive substitute for expensive machine tools . . . performs smooth, complex cuts in ceramics, stone, quartz, steel and other metals. Especially suitable for cutting tubing of all kinds. For example, machine will cut 1/32-in. slices of 1½-in. diameter glass tubing, with smooth, parallel edges. Bulletin 2312-EEM.



MAGNE-GAGE measures, non-destructively—in 45 seconds—metal and non-metal coatings on iron and steel; nickel coatings on magnetic base or on iron or steel; curved and flat surfaces with ±10% accuracy. Non-magnetic coatings up to 0.080 in. thick on iron & steel; nickel coatings up to 0.001 in. thick on non-magnetic base metals; polished nickel coatings up to 0.002 in. thick on iron or steel. Portable. Bulletin 2253-EEM.



AMINCO manufactures relays of proven dependable performance, including: **ELECTRONIC RELAYS** for power amplication of 200,000,000 — reliability up to 5,000,000 operations; **SUPERSENSITIVE RELAYS** for power amplification of 50,000 and a life xpectancy of 50,000,000 operations (unaffected by line-voltage variations of ±10%); **POWER RELAYS,** including mercury-plunger type, shatterproof, for millions of trouble-free operations. Relays, immersion heaters, motor-driven stirrers & accessories, circulating pumps, described in Catalog 361-EEM.



CLIMATE-LABS provide controlled temp. and R.H. in four models offering 9- or 3-cu. ft. test chambers, each with or without program control. PC models maintain conditions within ±1% R.H. and ±1° F. B models maintain conditions within ±¾° F. and ±½% R.H. 3-PC Model capable of performing Step 7A of MIL-STD-202B, Method 106B, automatically. Variable cycles and precut cams for most MIL Specs Catalog 565-EEM.

AMINCO

AMERICAN INSTRUMENT CO., INC.

8030 Georgia Ave., Silver Spring, Maryland 20910 **Phone: (301) 589-1727**

For the name of your local Aminco Sales Office, consult listing under American Instrument Co. in the YELLOW SECTION

SECTION 2550 eem File System

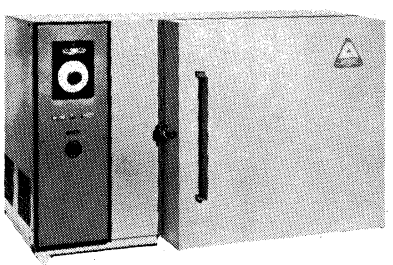
Environmental Test Chambers

MOST COMPLETE, MOST RELIABLE LINE IN THE INDUSTRY! DELIVERED FROM STOCK AT PRODUCTION-LINE PRICES!

Associated Testing Laboratories, Inc., one of the country's largest independent environmental testing facilities serving the aerospace and electronics industry, offers through its Manufacturing Division a complete line of environmental test chambers for research, production, reliability testing and quality control.

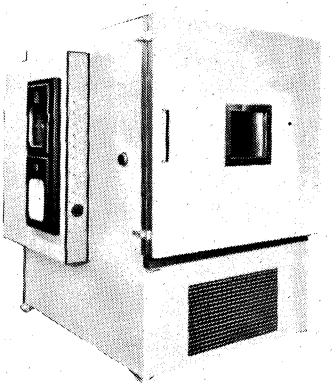
Originally designed for use in Associated's own testing laboratories, these chambers have been time-tested and use-proven in industry after industry, as well as in thousands of hours of on-the-line operations at our own laboratories, performing tests to the most rigorous government specifications. Associated's environmental chambers are a standard line of equipment, manufactured in production quantities and delivered from stock. Detailed specifications, technical data and price information are available directly from our plant or from your regional Associated representative.

LOW-HIGH TEMPERATURE CHAMBERS



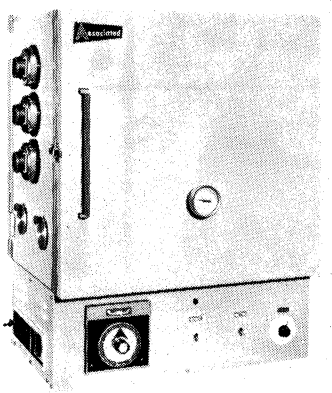
A complete line of chambers for military and commercial testing offering a choice of mechanical refrigeration or CO_2 cooling • Rack, bench and stacking types • Sizes from 0.5 to 27 cubic feet • Low Temperatures to −120°F, high temperatures to +500°F • Solid state controllers, choice of ±½°F or ±¼°F control stability • Adjustable high temperature fail-safe • Wide range of options • Prices for CO_2 chambers start at $335., prices for mechanically refrigerated chambers start at $875. • **Delivery From Stock.**

TEMPERATURE-HUMIDITY CHAMBERS



Performance features normally found only in custom-built chambers, built in production quantities and at production prices • Sizes 4, 8, and 27 cubic feet • Choice of single stage or cascade refrigeration • Optional CO_2 capability • Temperature ranges from −100°F to +350°F • Humidity ranges from 20% to 95% • Forced air circulation • 2-Pen 2-Cam programming recording controllers • Adjustable high temperature fail-safe • Integral demineralizer • **Delivery From Stock.**

BURN-IN TEST CHAMBERS



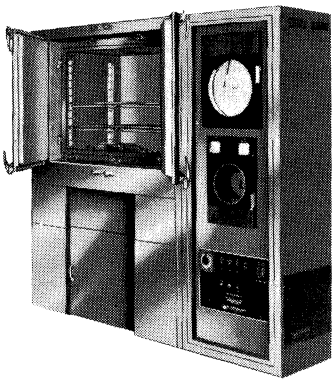
Designed specifically for life and burn-in testing of semiconductors, integrated circuits, and axial lead devices • Test temperatures from ambient to +300°F, with choice of ±½°F or ±¼°F temperature control stability • Rise time ambient to upper limit in 30 minutes • Printed circuit board trays offer maximum burn-in capacity on axial lead devices of up to 2,200 units per chamber • Low temperature CO_2 capability optional • Prices for standard printed circuit boards and chambers available upon request.

• *Write or call for free catalog of Environmental Test Chambers and Test Equipment.*

ASSOCIATED TESTING LABORATORIES INC.

200 Route 46, Wayne, New Jersey 07470 • Phone (201) 256-2800 • TWX (710) 988-5712
West Coast Office: 6100 Wilmington Ave., Los Angeles, Calif. 90001 • (213) 589-9196

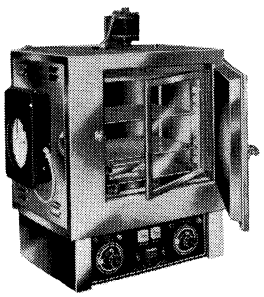
BLUE M TEMPERATURE CONTROLLED EQUIPMENT FOR ELECTRONICS RESEARCH AND PRODUCTION



FULL-RANGE TEMPERATURE/HUMIDITY CHAMBERS

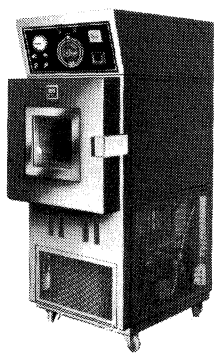
Maximum capability cabinets to perform all current MIL humidity tests. Dual wet and dry bulb POWER-O-MATIC 60® Saturable Reactor Control Systems assure absolute stability and reliability. High speed stabilization and the finest control tolerances available insure accurate reproduction of today's test requirements plus the capability of meeting future requirements when existing standards are tightened. These mechanical convection, horizontal air-flow units feature programming and separate monitoring recorder. Temperature range: −18°C. to +93°C. (±½°C.). Meets MIL-202C, Method 106-B, Step 7A; automatically performs −10°C. dip without changing cams. Maintains R. H. ±½%. Chamber sizes: 5.8, 11, 27, and 64 cu. ft.

Similar units for single steady state tests available. Also new, compact top loading cabinets with similar operating characteristics.



NEW AIR-COOLED TEMPERATURE/HUMIDITY CABINETS

HUMIDAIRE Combination Temperature/Humidity Cabinets, with independent wet and dry bulb POWER-O-MATIC 60. Saturable Reactor Control Systems provide extreme accuracy from +12°C. above ambient to +93°C. (±½°C.). Use air for cooling, not costly conditioned water. Saves 30,000—100,000 gallons a year. The most reliable and economical chamber ever developed for long-term high temperature/humidity testing. Ideal for such steady state tests as MIL-202C, Method 103B—continuous operation for 56 days. Four sizes: 1.47, 3.24, 5.5 and 10 cu. ft.



NEW VERSA-RANGE REFRIGERATED TEST CHAMBERS

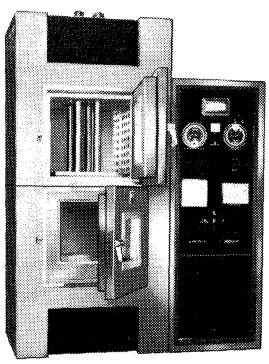
Incomparable control accuracy, reliability and dependability—plus a choice of two versatile ranges: −100°F. to +400°F. and −40°F. to +200°F. Five chamber sizes—3 to 64 cu. ft.—for each range. POWER-O-MATIC 60 control carefully matched with heating system and exclusive quality non-cycling mechanical refrigeration system for maximum efficiency and economy. Rapid pull-down. Also compact top-opening models and chest type cold chambers with ranges to −40°F. and −120°F.

THESE ARE ONLY EXAMPLES OF OUR COMPLETE TEMPERATURE/HUMIDITY AND REFRIGERATION CONTROL CAPABILITY

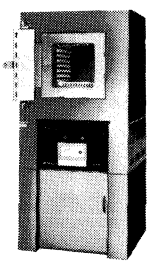
BLUE M THERMAL SHOCK TEST CHAMBERS DESIGNED FOR MIL-STD-202C

DUAL THERMAL SHOCK TEST CABINETS

MEET METHOD 107B CONDITIONS A, B, C & F

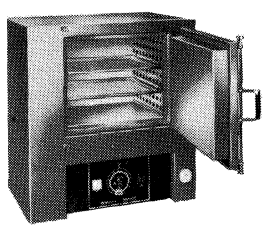


2.3 cu. ft. work chamber moves vertically from lower cold chamber to upper heat chamber as required by spec. Cold chamber uses CO_2 or LN_2 to reduce incoming load to −55°C or −65°C. Has solid-state instrumentation. Heat chamber, with range of +204°C (+400°F), regulated by POWER-O-MATIC 60 Control for reliable, straight-line performance. Also available: 3-stage Thermal Cycling Test Cabinets to meet Method 102A, Preferred Conditions C & D. Test accomplished in one unit instead of two as is customary. Operation of both models is fully automatic—with reliability and accuracy to meet spec. easily.



BLUE M FURNACES

A wide variety of research and production models to suit the strictest needs. Box type muffle furnaces, Globar units — in bench and floor models — new tube furnace. Most have solid-state instrumentation for extremely accurate temperature control and unmatched reliability. Temperatures to +3000°F. Quality materials and workmanship throughout.



BLUE M OVENS

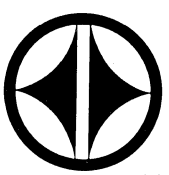
All types. Mechanical and gravity... batch, aging, vacuum, life-test, hazard-safe, gas forming, annealing. Simple lab models to units for Mil Specs. Sizes to 96 cu. ft.... temperatures to +1200°F. Most have patented POWER-O-MATIC 60 Control, others feature patented POWER-O-MATIC 70(TM) Solid-State Proportioning Control. All accessories, including programming, available.

FOR FULL DETAILS ON THESE PRODUCTS AND FOR INFORMATION ON OUR COMPLETE CONTROLLED TEMPERATURE CAPABILITY, WRITE:

BLUE M

BLUE M ENGINEERING COMPANY, A Division of Blue M Electric Company
Corporate Headquarters: BLUE ISLAND, ILLINOIS 60406

Look in the Yellow Section for Manufacturers' Sales Offices

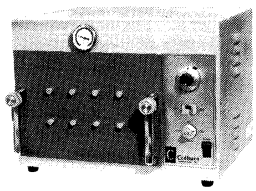


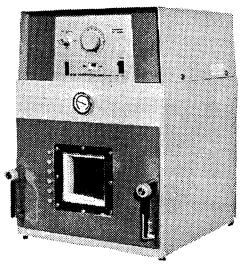
Tell them you found them in **eem**

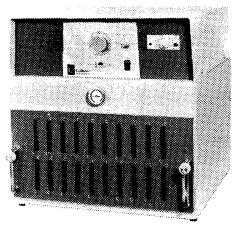
Colburn Instruments, Inc.

A DIVISION OF PADIC, INC.

Colburn environmental test chambers offer these features





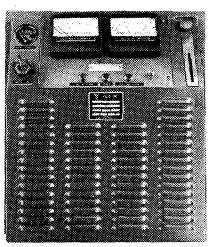


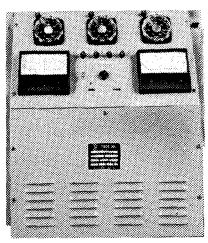
- SOLID STATE CONTROLLER provides close tolerance temperature control with adjustability to satisfy any testing application.
- SOLID STATE POWER RELAY provides electrical noise-free operation, increases longevity.
- REMOVABLE CONTROL PACKAGE provides extreme versatility of temperature control, available on Model 0640 with any combination of nine special features.
- ACCESSORY EQUIPMENT provides testing flexibility, simplifies testing.

Colburn close tolerance, low gradient test chambers provide rapid response with no overshoot of set temperature, reducing test time and exposure.

Environmental Water Chillers

AEROSPACE/MACHINE TOOLS

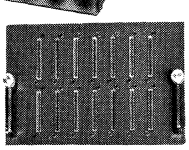




Developed to satisfy the rigid requirements of today's space programs, Colburn water chillers are finding wide acceptance as remote cooling systems for heavy machinery such as hydraulic presses and plastic and rubber extruders. Temperature range from +40°F to +120°F.

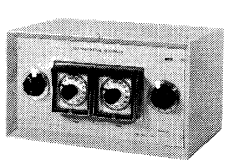


Mark II, a new series of sequential scanners for environmental test chambers that offers simultaneous load and read capability in testing two- and three-lead devices.



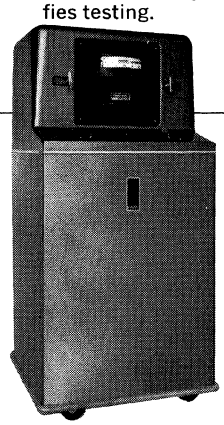
These doors are designed to facilitate testing semiconductors. Up to twenty 44-pin connectors can be accommodated to enable testing of 80 diodes or 40 transistors at one time. Test cards with mounted devices are secured inside the chamber and are powered and/or monitored from outside.

Time-Temperature Sequencers: Provides automatic continuous cycling between any two temperatures within the range of the chamber. Any time duration can be set for either temperature, independent of the other.



Customized systems...

Colburn Instruments welcomes all inquiries for development of environmental systems regarding heating, cooling or humidity control.

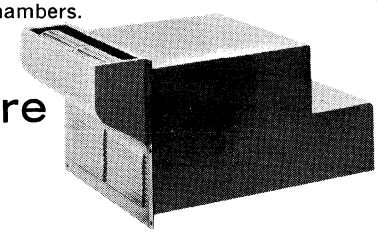


Colburn temperature conditioning units offer

- HIGH THERMAL CAPACITY—more thermal work from these units than is typically available with temperature chambers of 100 cubic feet and up.
- CLOSED LOOP CONDITIONING—provides control capabilities of extreme temperatures, saves testing time and expense.
- SERVO FEED-BACK SIGNAL—allows conditioning unit to control the temperature where it's needed, at the test specimen.
- ACCESSORY EQUIPMENT—provides testing flexibility, simplifies testing.

Colburn close tolerance temperature conditioning units convert simple, inexpensive enclosures into automatically-controlled high/low temperature chambers.

temperature humidity coolers



FOR ELECTRONIC PERIPHERAL EQUIPMENT

Ideal for controlling both temperature and humidity within electronic enclosures. Especially well-suited for instrumentation tape recorders. Variable controller enables wide operating range in an ambient of 0 to 140°F. Maintains enclosures at 68°F to 72°F; humidity at 25-35%. Accommodates 19 inch rack mounting.

ENVIRONMENTAL GROUND SUPPORT
HEATING • COOLING • HUMIDITY
COMMERCIAL/MILITARY

Colburn Instruments, Inc.
354 CORAL CIRCLE, EL SEGUNDO, CALIF. 90245
TELEPHONE (213) 772-1600

UNHOLTZ-

Charge/voltage amplifiers for shock and vibration monitoring

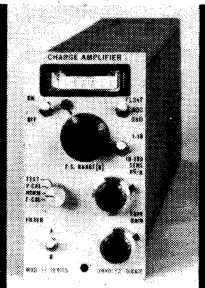
CONDITIONS SIGNALS FROM PIEZOELECTRIC TRANSDUCERS FOR DRIVING TAPE AND GALVO RECORDERS

Popular series of signal conditioning amplifiers features individual double shielded power supplies, vinyl-clad, totally enclosed case, solid state printed circuitry, ultra low noise levels, portability of separate units, wider frequency range, and switchable integral charge or remote-preamp operation. Panel height only 5¼ inches with meters. Full scale ranges of .1 g to 10 Kg with accelerometer sensitivities from 1 pC/g to 100 pC/g.

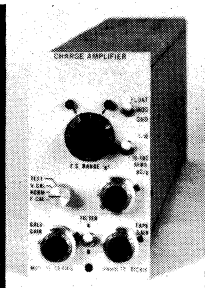
D11 SERIES



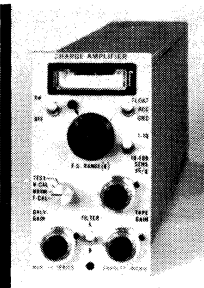
Model D11V
Tape output only
$525.00



Model D11MV
Tape and meter
$575.00



Model D11GV
Tape and galvo
$590.00



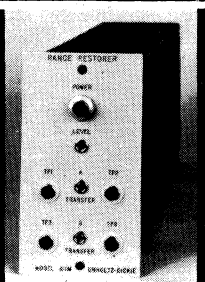
Model D11MGV
Tape, galvo, meter
$640.00

Basic D11 series permits operation with grounded accelerometers while eliminating usual ground loop problems. Differential circuitry provides rejection of common mode signals by a factor of 1000 or more.

OPTIONAL FEATURES

S	10mV/g Servo Output	$50.00
O	1 kHz Internal Calibration Oscillator — fixed amplitude, sine wave	$50.00
F	Floating DC output for amplifiers supplied with meters	$25.00
—8	Large Meter (2½ inch scale) with 8¾ panel height	$20.00
LF2	Extended low frequency response (±5% down to 0.5 Hz)	$25.00

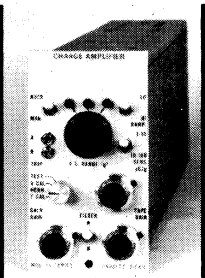
AUTORANGER SERIES



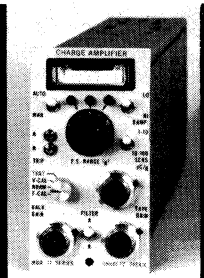
Model 811M
Range restorer
$1200.00



Model 11MAV
Tape and meter
$745.00



Model 11GAV
Tape and galvo
$760.00



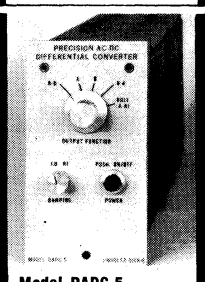
Model 11MGAV
Tape, galvo, meter
$810.00

AUTORANGER series selects best of 3 adjacent full scale ranges. Pilot light and dc code signals indicate range selected. Range sequences of 1, 3, 10 . . ., or 1, $\sqrt{10}$, 10 . . . or 1, 10, 100 . . . are offered. Companion RANGE-RESTORER converts tape recorded data to original dynamic range.

OPTIONAL FEATURES

S	10mV/g Servo Output	$50.00
O	1 kHz Internal Calibration Oscillator — fixed amplitude, sine wave	$50.00
F	Floating DC output for amplifiers supplied with meters	$25.00
—8	Large Meter (2½ inch scale) with 8¾ panel height	$20.00

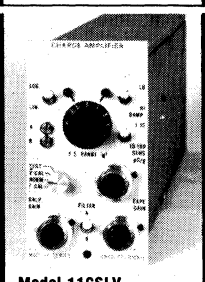
LOG AMP SERIES



Model DADC-5
Differential AC-DC converter
$900.00



Model 11MSLV
Tape and meter
$800.00



Model 11GSLV
Tape and galvo
$815.00

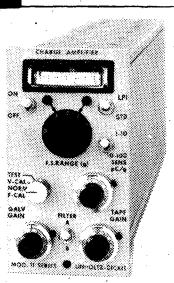


Model 11MGSLV
Tape, galvo, meter
$865.00

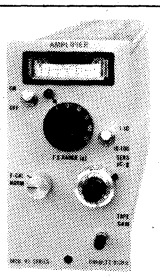
Log amp series compresses 1000:1 input signal variation to 4:1 output signal variation. Waveform and frequency content of output is same as input. When combined with companion DADC-5, direct measurement of transmissibility can be made down to 5 Hz.

OPTIONAL FEATURES

TC	Special connector and circuitry for insertion of tracking filter	$50.00
O	1 kHz Internal Calibration Oscillator — fixed amplitude, sine wave	$50.00
F	Floating DC output for amplifiers supplied with meters	$25.00
—8	Large Meter (2½ inch scale) with 8¾ panel height	$20.00



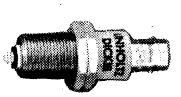
Model 11MGV-LF1
Extended low frequency response (±5% down to 0.2 Hz). Same options as D11 series except "D" feature not available. LF1 option is $50.00.



Model V11MS $445.00
Tape, meter, servo

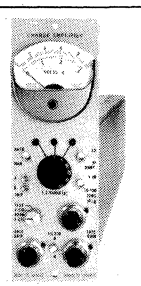
Galvo	$65.00
Osc.	$50.00

Economy Model V11 series operates with either charge type remote preamp (11CA-2) or voltage type remote preamp (11PA-2).



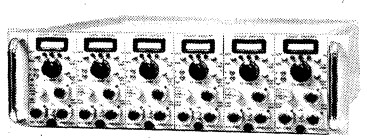
Model 11CA-2
Remote Charge Preamp or
Model 11PA-2
Remote Voltage Preamp
These two preamps operate with all types of series 11 signal conditioning amplifiers

Model 11CA-2	**$80.00**
Model 11PA-2	**$50.00**



Model 11 series with —8 option

Export prices slightly higher; check with factory.



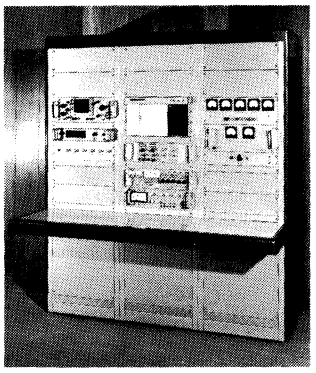
Model 11RA Rack Frame Adapter
with six channels of Model 11

Model 11RA	**$125.00**
Model 11RA-8	**$175.00**
Blank panel	**$7.50**

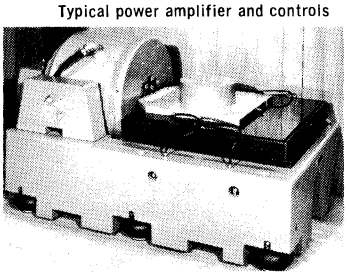


Model 11P-2
Dual Channel
Portable Adapter
with 2 channels of Model 11
Model 11P-2 $70.00

DICKIE CORP.



Typical power amplifier and controls



Shaker and slip table on seismic base

Complete vibration test systems

System Model Number	System Force Sine lbs. pk	SHAKER TABLE				Frequency Range Hz	SYSTEM COOLING		
		Stroke inches	Bolt Circle Max. Dia.	Suspension Stiffness lbs/in.	Weight lbs.		Amplifier	SHAKER Arm.	SHAKER Field
*TA 280	150	3.0	—	Nil	5	dc-1000	Air	Air	Air
*TA 6/250	1000	6.0	—	Nil	11	dc-1000	Air	Air	Air
72-7	200	1.0	4.50	225	4	5-10000	Air	Air	Air
76-7	350	1.0	4.50	225	4	5-10000	Air	Air	Water
340-7	350	0.5	2.25	50	2.5	5-10000	Air	Air	Water
279	450	1.0	4.50	225	5.3	5-5000	Air	Air	Water
*TA 161	1000	1.0	5.75	250	14	dc-2000	Air	Air	Air
262	1200	1.0	5.75	250	14	5-3000	Air	Air	Air
262-8	1200	1.0	8.0	400	20	5-3000	Air	Air	Air
464	1700	1.0	5.75	250	14	5-3000	Air	Air	Air
464-8	1700	1.0	8.0	400	20	5-3000	Air	Air	Air
252	1200	1.25	8.0	600	20	5-3000	Air	Air	Air
282	1400	1.25	8.0	600	20	5-3000	Air	Air	Air
454	1750	1.25	8.0	600	20	5-3000	Air	Air	Air
484H	2000	1.25	8.0	600	20	5-3000	Air	Air	Air
484H-PH	2000	1.25	5.75	300	14	5-3000	Air	Air	Air
680AAA-24	2400	1.25	8.0	600	27	5-5000	Air	Air	Air
680CMA-27	2750	1.25	8.0	600	26	5-3000	Air	Air	Air
687M-32	3200	1.25	8.0	600	26	5-3000	Air	Air	Water
690M-45	4500	1.25	12.0	1200	34	5-3000	Air	Air	Air
1590M-50	5000	1.25	12.0	1200	34	5-3000	Air	Air	Air
1596M-60	6000	1.25	12.0	1200	34	5-3000	Air	Air	Water
*TA 1696M-60	6000	1.25	12.0	1200	36	dc-3000	Water	Air	Water
*TA1600M-80	8000	1.25	16.0	3000	90	dc-3000	Water	Air	Water
*TA3200M-100	10000	1.25	16.0	3000	90	dc-3000	Water	Air	Water

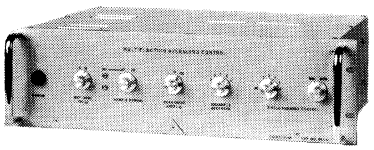
*Powered by solid state, direct coupled power amplifier with dc load support.

MULTIPLE SHAKER SYSTEMS FOR LARGE LOADS, HIGH FORCE RATINGS, OR SPECIAL APPLICATIONS ARE AVAILABLE

Accessory instruments

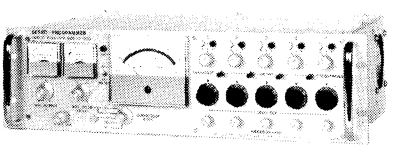
Shaker system controls and protective functions

New '69



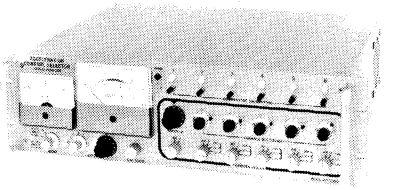
MULTIFUNCTION AVERAGING CONTROL
Model MAC-6C

Features: Phase insensitive averaging for at least 6 inputs ■ Allows averaged shaker system control for sine and random tests ■ Sine tests: absolute average of output yields average of input magnitudes ■ Random tests: spectral density of output yields average of input spectral densities ■ Freedom from detector time constant problems ■ DC output for recording.



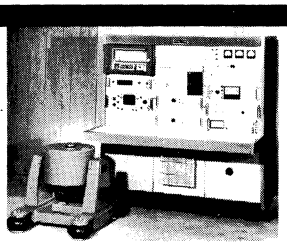
SERVO PROGRAMMERS
Models SP5 and SP2

Features: Combines functions of amplitude servo and vibration programmer in one instrument ■ Programmer contains up to five program segments with servo controlled acceleration, velocity or displacement selectable for each segment (SP5) ■ Simplified closed-loop presetting of vibration levels before actual test is performed ■ Optional safety shutdown at pre-set level of acceleration ■ Solid state, plug-in, printed circuit construction ■ Analog output for recording levels.



ACCELERATION CONTROL SELECTOR
Model ACS-6
Solid State Switching

Features: Automatically switches to highest (or lowest) accelerometer for amplitude servo control ■ Up to 6 input acceleration signals ■ Switching speed continuously variable with frequency ■ Weighted switching from .01 to 10 times nominal acceleration ■ Wide dynamic range ■ Pilot light indicates controlling channel.



Calibration systems for accelerometers

AUTOMATIC CALIBRATION SYSTEMS

Unholtz-Dickie automatic calibration systems, based on Model 106A shaker automatically plot accelerometer calibration curves of charge or voltage sensitivity vs. frequency to any level up to 100 g and 10 kHz. Original data is permanently plotted — eliminating operator error in readout and transcription. Continuous curve detects all variations, expansion or compression of vertical scale for optimum accuracy and readability of curves. One per cent accuracy of unknown accelerometer relative to reference.

ABSOLUTE CALIBRATION OPTICAL SYSTEM

Model DO-5000. New optical instrument gives digital readout of absolute displacement.

Piezoelectric accelerometers





Sub miniature
0.8 grams

General purpose
high sensitivity

For accurate vibration measurements this D21 series of shear mode types insure freedom from case sensitivity and lowest cross axis sensitivity. A range of sizes covers most applications, down to a 0.65 gram sub-miniature model. This series uses Lead Ziconate-Titanate crystals. Also available are Bismouth composition crystals for high temperatures.

Complete information is available on all products. Write to Unholtz-Dickie.

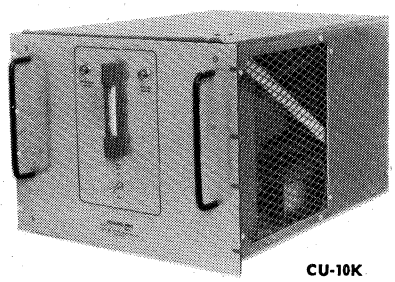
manufacturers of shaker systems, advanced instrumentation, and accelerometers

UNHOLTZ-DICKIE CORPORATION

3000 WHITNEY AVE. / HAMDEN, CONN. 06518 / (203) 288-3358

COOLING UNITS
HEAT EXCHANGE - REFRIGERATING

Electro IMPULSE, INC.



CU-10K

CU SERIES

Heat exchange cooling units are useful whenever it is desirable to prevent runaway heat conditions. Heat is absorbed by a circulating coolant liquid, then exhausted into the ambient by forced air passing through a radiator.

Use this series when coolant temperatures can be allowed to rise above ambient.

Model	Capacity Watts	Coolant Flow GPM (0-Back Pressure)	Input Power Frequency	Amps	Suitable Liquids*	Back Pressure P.S.I.
CU-500	500	.3	110v - 60 Hz 24v - DC	6	0	15
CU-1500	1500	.5	24v - DC		0	40
CU-2500	2500	1	110v - 60 Hz	6	ETH	50
CU-5000	5000	2	110v - 60 Hz	10		50
CU-5000S	5000	2	110v - 400 Hz			60
CU-10K	10000	2	110v - 60 Hz	11	—	50
CU-10K-S	10000	2	110v - 400 Hz		W	60
CU-20K	20000	4	110v - 60 Hz	12	—	60
CU-50K	50000	10	220v - 60 Hz	12		20
CU-100K	100000	20	220v - 60 Hz	15	O	20

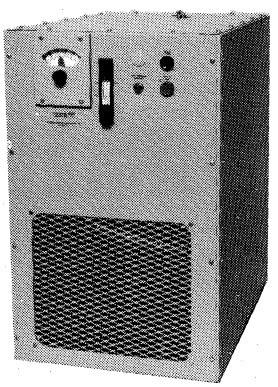
*Suitable Liquids: Water — W. Oil — O. Ethylene Glycol with inhibitors — ETH.
Optional Equipment Available: Flow Switch, Thermometers, Thermostat, Flowmeter, Heater and Water De-ionizer.

RU SERIES

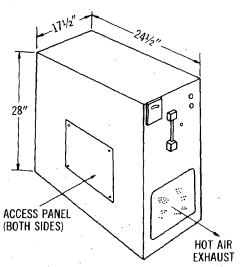
Models from this series are required when coolant temperatures must be below ambient. Using refrigeration, they can provide temperatures to 0 degrees C and below, while removing up to 6800 watts of heat.

These units are ideal for remote applications. Coolant temperatures are low, flow rate is steady, and the final heat sink can be in a location which will not cause overloading of air-conditioning equipment.

Special options can provide temperature control of ±1 degree C, while combinations of refrigeration and heating can hold temperatures at any point above ambient.

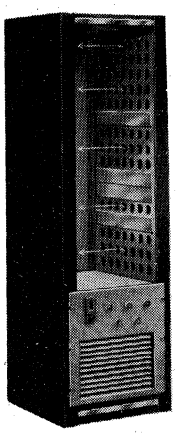


RU-75



Model	Capacity Watts	Coolant Flow GPM (0-Back Pressure)	Max. Back Pressure P.S.I.	Operating Power 60 cps	HP
RU-12.5	212.5	1	60	115	.5
RU-25	425	1	60	115	.5
RU-50	850	1	60	115	.7
RU-75	1,275	1	60	115	1
RU-100	1,700	2	60	115	1
RU-200	3,400	2	60	220	1.3

Optional Equipment Available: Thermometer, Thermostat, Flow Meter, Heater.
In chart above, change model designation to RC for Rack Cooler specifications, and to RUH for Refrigeration-Heating Combination shown at left.

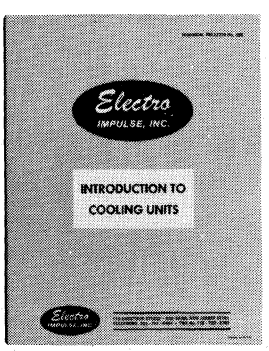


RACK COOLER

This series is designed for air, rather than liquid cooling. A sealed volume of air is cooled by a refrigeration system and continually re-circulated within the enclosure. Cool sensitive rack-mounted electronic equipment, or use duct work and manifolds for extensive cooling of radar or other electronic control consoles and cabinets.

For specifications, see chart above and merely substitute "RC" for "RU" in the Model column.

REQUEST FREE APPLICATION BULLETIN #696: "INTRODUCTION TO COOLING UNITS"

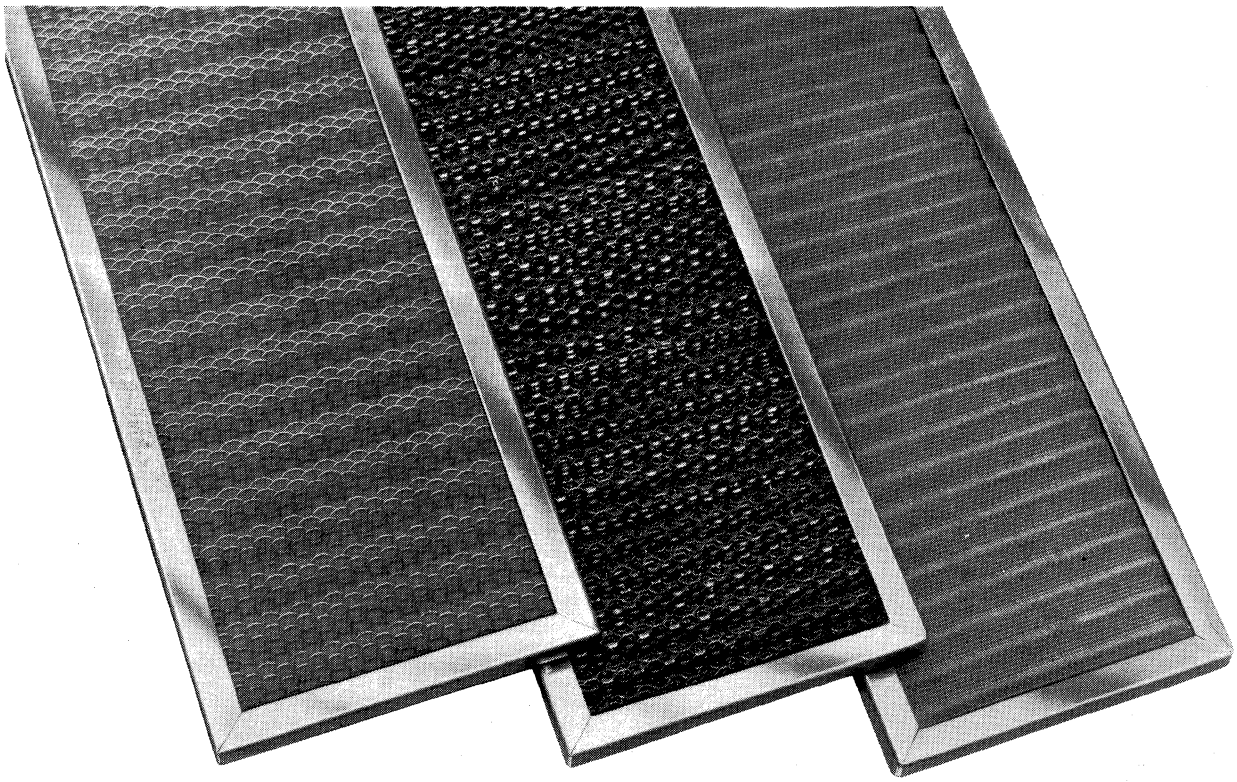


Electro IMPULSE, INC.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

116 CHESTNUT STREET • RED BANK, NEW JERSEY 07701
TELEPHONE: 201 - 741-0404 • TWX No. 510-237-5767

SEE OUR OTHER PRODUCTS ON PAGES 1372, 1668, 1669

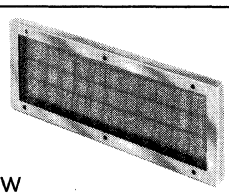


EVANS air filters

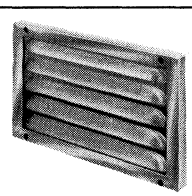
for Electronic Cabinet Application

. . . used on Computers . . . Card Readers . . . Tape Transports . . . Transceivers . . . Power Supply Units . . . both large and small cabinetry. Evans Air filters are permanent. Rigid. Aluminum. Made to withstand the brutal abuse of military field conditions. Frames have mitered corners for smooth, close tolerance fit. Die cut, expanded aluminum grids are criss crossed and precision fitted into each filter. Patented Brillo Lock design gives more air delivery with positive cleaning results.

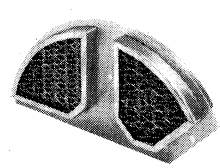
Tolerance:	± 1/32″
Velocity:	200 to 900 FPM
Efficiency:	75% AFI Test
Finishes:	Available in chemical film finish to meet requirements of MIL-C-5541 . . . MIL-F-14072 . . . MIL-A-8625
Sizes:	Filter of 1/2″ or 3/4″ dimension. Made to a maximum area 400 sq. inches . . . with maximum length 25″ on one side without special bracing. For complete information write or call.



LOW RESISTANCE FILTER
Special serts permit fastening solidly to blower unit. Made for air drop equipment.



LOUVERED FILTERS
For outside application. Louvers protect filter media from water, ice, snow.



HEAVY DUTY UNIT
For rugged military use. Extra rigid frame made from .063 aluminum.

The George Evans Corporation 121-37th Street, Moline, Illinois 61265
Phone 309/762-9456

GLOBE

BLOWER & FAN SELECTOR

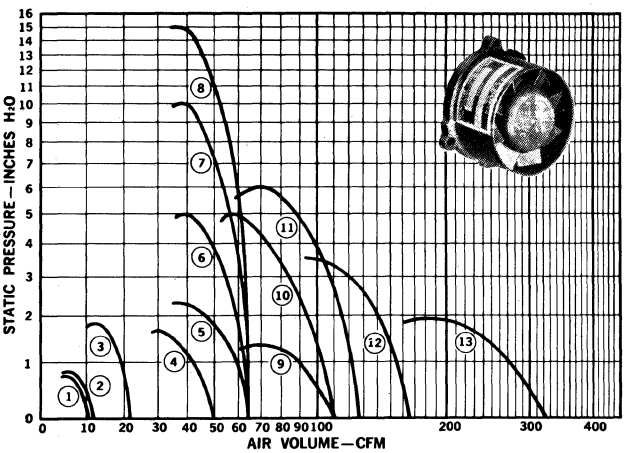
24 HOUR delivery on many units

Globe Industries offers a wide range of A.C. and D.C. fans and blowers for every cooling need. Many standard models are stocked for 24-hour delivery. And because Globe is the largest precision motor source, we can move fast to provide engineered specials in prototype or production quantities. Check your needs below. Hundreds of other units available. Request Catalog BBL.

GLOBE INDUSTRIES *DIVISION OF TRW INC.*
2275 Stanley Ave., Dayton, Ohio 45404, Tel: 513 222-3741

A.C. AND D.C. VANEAXIAL BLOWERS

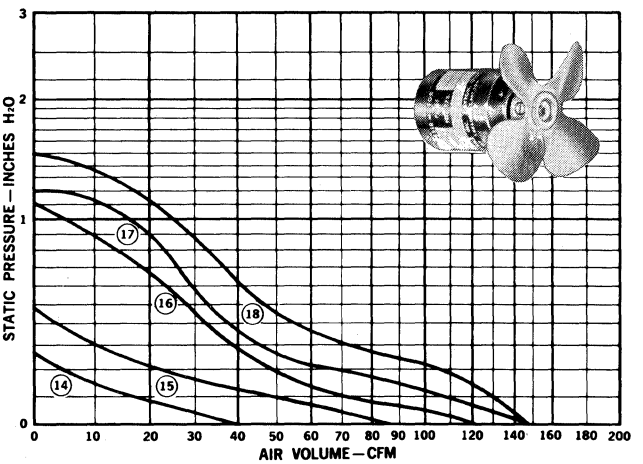
Curve No.	Type	Dia.	Weight	Power Source	Part No.
1	VAX-1-DC	1⅛″	1.4 oz.	26 v.d.c.	19A1040
2	VAX-1-AC	1⅛″	1.5 oz.	26 v.a.c., 400 cps. 1-phase	19A1173
3	VAX-1.5 AC	1¾″	4.2 oz.	115 v.a.c., 400 cps	19A1233
4	VAX-2-MM	2″	5 oz.	26 v.d.c.	19A907
5	VAX-2-MC	2″	5 oz.	200 v.a.c., 400 cps 3-phase	19A774
6	STAX-3-FC	3″, 1 stage	48 oz.	200 v.a.c., 400 cps 3-phase	19A920
7	STAX-3-FC	3″, 2 stage	28.6 oz.	200 v.a.c., 400 cps 3-phase	19A921
8	STAX-3-FC	3″, 3 stage	29 oz.	200 v.a.c., 400 cps 3-phase	19A922
9	VAX-3-BD	3″	16 oz.	28 v.d.c.	19A827
	VAX-3-GN	3″	16 oz.	115 v.d.c., or 115 v.a.c., 60 cps. 1-phase	19A908
10	VAX-4-FC	4″	2 lbs.	200 v.a.c., 400 cps 3-phase	19A1348
11	VAX-4.5-LC	4 1/16″	5½ lbs.	200 v.a.c., 400 cps 3-phase	19A1350
12	VAX-3-FC	3″	14 oz.	115 v.a.c., 400 cps 3-phase	19A798
13	VAX-4.5-GR	4¾″	4½ lbs.	115 v.d.c., or 115 v.a.c., 60 cps 1-phase	19A832



A.C. AND D.C. FANS

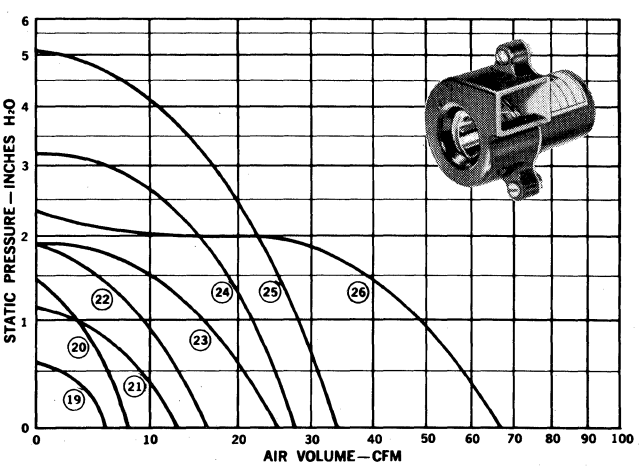
Air volume varies with direction of air flow and type of enclosure.

Curve No.	Type	Dia.	Power Source	Part No.
14	FC	3″ fan	115 v.a.c., 60 cps 1-phase	19A643
15	MC	4″ fan	115 v.a.c., 60 cps 1-phase	19A552
15	FC	4″ fan	115 v.a.c., 60 cps 1-phase	19A644
16	FC	4½″ fan	115 v.a.c., 60 cps 1-phase	19A645
17	FC	5½″ fan	115 v.a.c., 60 cps 1-phase	19A647
18	FC	5″ fan	115 v.a.c., 60 cps 1-phase	19A646



A.C. AND D.C. CENTRIFUGAL BLOWERS

Curve No.	Type	Dia.	Power Source	Part No.
19	SS	1″ blower	27 v.d.c.	19A566
20	SC	1″ blower	115 v.a.c., 400 cps 1-phase	19A565
21	MM	1½″ blower	27 v.d.c.	9A589
22	MC	2″ blower	115 v.a.c., 400 cps 1-phase	19A518
23	LL	2″ blower	27 v.d.c.	3A851
24	MC	2½″ blower	115 v.a.c., 400 cps 1-phase	19A532
25	FC	2″ blower	115 v.a.c., 400 cps 3-phase	19A725
26	YC	1½″ blower	115 v.a.c., 60 cps 1-phase	19A1185



McLEAN'S JET SET

THE LARGEST, SMARTEST, MOST RELIABLE LINE OF BLOWERS, FANS, AND COOLING EQUIPMENT IN THE FIELD!

There's One For Every Requirement!

Send for 1969 Catalog

mcLean®

McLEAN

ENGINEERING LABORATORIES

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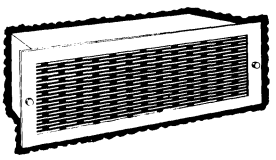


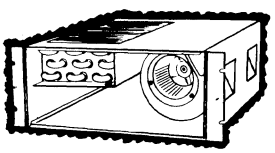
PACKAGED RACK BLOWER

Pressurizes and cools. Removes air pollution. Over 100 models, up to 1000 CFM. Commercial. Mil-Spec. EMI Shielded.



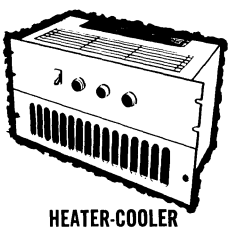
PACKAGED FAN (REVERSIBLE)

Low cost. Minimum space. Shallow depth. Pressurizes or exhausts. Four models, to 1200 CFM. Commercial. Mil-Spec. EMI Shielded.



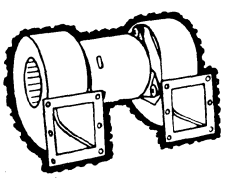
HEAT EXCHANGER

Maintains cabinet at 80°F max. with 1 KW heat dissipation. Air recirculates in rack and is cooled by exchanger in blower case.



HEATER-COOLER

For field installations, unheated military huts, unattended control stations. Maintains even 65°F with surrounding air as low as 10°F.



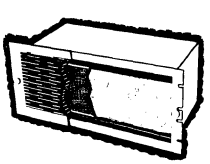
CENTRIFUGAL BLOWER

Single or dual. For spot cooling or pressurizing. 10 to 1000 CFM. Exhaust in any position. Commercial and Mil-Spec.



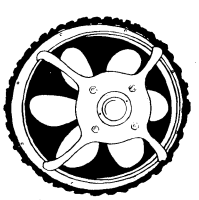
VENTURI-MOUNTED FAN

Rugged economy. 420 CFM, push or pull. Mounts top, bottom, or side. No vibration. Quiet. Commercial or Mil-Spec.



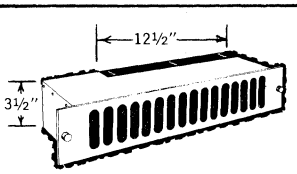
EMI SHIELDED UNITS

Cuts signal leakage either inward or outward in the airstream. Certified to MIL-I-6181D.



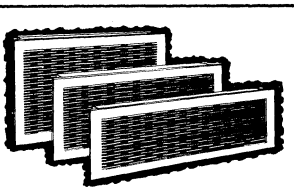
ORIFICE FAN — PANEL FAN

Extra-low-cost cooling. Up to 550 CFM. Strong, quiet, vibration-free. Easy to install. Life lubrication.



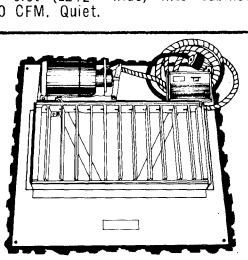
SLOT BLOWER

Ideal for densely packed circuitry. Fits 3½" panel slot. Forces narrow air slot (12½" wide) into cabinet. 150 CFM. Quiet.



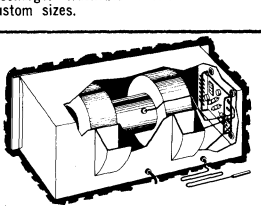
FILTER-GRILLE PANEL

Self-contained. Easy to install. Provide more exhaust louver area for improved air discharge. Washable filter. Standard or custom sizes.



TEMPERATURE CONTROLLED LOUVER

Solid-state! Fail-safe! Modulates cool air flow between 55-85°F. Automatic!



SOLID-STATE TEMPERATURE CONTROLLER

Cuts audible noise level. Modulates blower speed! Keeps equipment operating between 80-90°F. More reliable than air conditioning—but costs less.

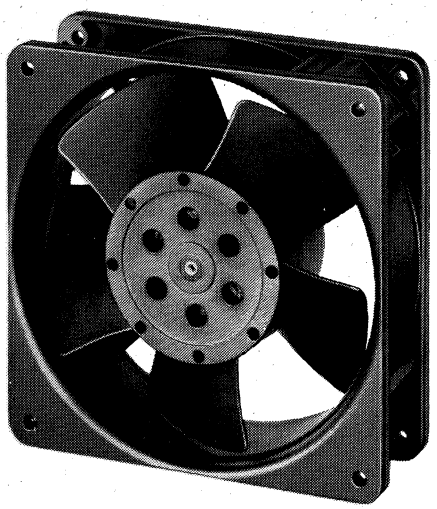
PAMOTOR

MINIATURE AXIAL FANS

MODELS 4500 and 4550 (Shaded-pole Type)

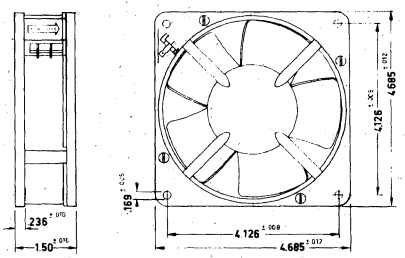
$4\frac{11}{16}$" x $4\frac{11}{16}$" x $1\frac{1}{2}$" • ALL-METAL • LOW-NOISE LEVEL

*Provides 115 cfm with less than 37.5 dB SIL**



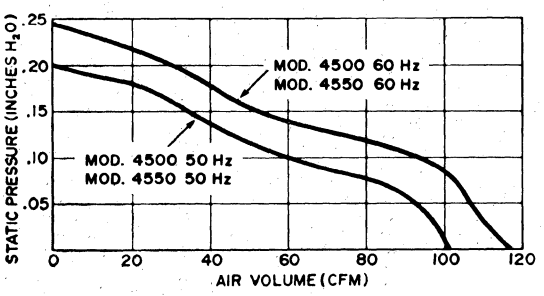
- All-metal precision hubs, impellers, and die-cast housings eliminate warping often found in plastic fans.
- Designed for applications in wide variety of electronic apparatus, such as computers, laboratory and office machines, industrial and military communications equipment, industrial control equipment, sound systems, power supplies, telephone equipment, etc.
- Designed to operate continuously at room temperature (25° C) for over 100,000 hours—even at uppermost limit of 55° C, 20,000 operational hours, continuous duty may be expected.
- Delivers more air at a lower noise level, yet priced under similar conventional plastic fans.
- Powerful shaded-pole motor operates with low internal heat rise—efficient inside-out design.
- Hand-fitted proven broached dual-sleeve bearing system assures longer, more reliable operation.
- Weighs just 1¼ lbs. and is interchangeable with similar, less reliable $4\frac{11}{16}$" fans.
- Operates over range of 105 to 125 VAC at dual frequency of 50/60 Hz.
- Has Underwriters' Laboratories Inc. Yellow Card Component Recognition Number E41168.
- Accessories available for use with this model include mounting brackets, filter, metal screen assembly, finger guard, plug and cord assembly.

*Speech Interference Level

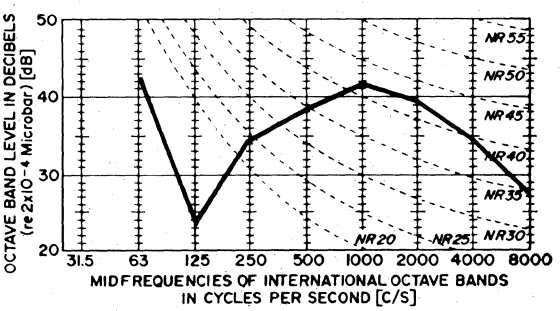


Characteristic	MODEL 4500	MODEL 4550
Voltage	117 volts	230 volts
Frequency*	60 Hz	60 Hz
Air Flow	115 cfm	115 cfm
Speed	2900 rpm	2850 rpm
Input Power	20 watts	17 watts
Weight	1 lb. 4 oz.	1 lb. 4 oz.

*These models also operate at 50 Hz.
Additional data available upon request.



TYPICAL PERFORMANCE CURVE



NOISE LEVEL CURVE

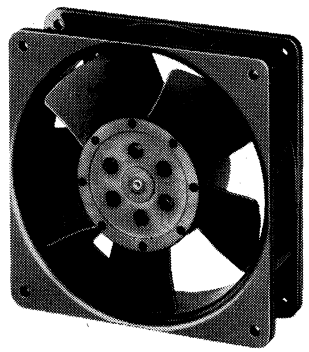
THESE AND A HOST OF OTHER SPECIAL APPLICATION ALL-METAL FANS ARE AVAILABLE FOR IMMEDIATE DELIVERY FROM PAMOTOR AND KEY DISTRIBUTORS IN THE U.S. AND CANADA. CONTACT PAMOTOR OR YOUR DISTRIBUTOR FOR MORE DATA AND PRICES.

PAMOTOR INC. 770 Airport Blvd., Burlingame, Calif. 94010
Phone: (415) 347-1203 • TWX: 910-374-2353

PAMOTOR

MINIATURE AXIAL FANS

MODELS 4506 and 4556 (Shaded-pole Type)
$4^{11}/_{16}$" x $4^{11}/_{16}$" x $1^{1}/_{2}$" • ALL-METAL • 115 CFM



Ball bearing fans for 85° C ambient temperature operation

- Designed for over 20,000 hours of operation at 85° C.
- Low noise level of less than 37.5 dB SIL (Speech Interference Level).
- Designed to meet UL requirements.
- Offer same performance characteristics as Models 4500 and 4550.
- Standard accessories available include mounting brackets, filter, metal screen assembly, finger guard, plug and cord assembly.

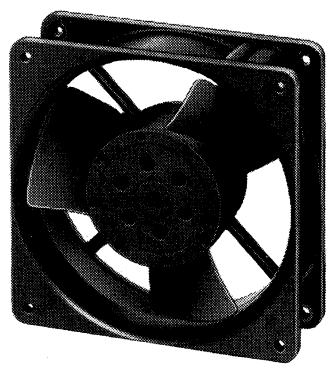
MODEL 4800 (Shaded-pole Type)
$4^{11}/_{16}$" x $4^{11}/_{16}$" x $1^{1}/_{2}$" • ALL-METAL • 70 CFM

Specifically designed for noiseless performance . . . noise level less than 20 dB SIL.

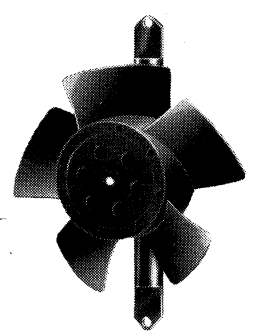
- Designed for applications in Hi-Fi/stereo equipment, TV, office copying machines, etc. where noiseless performance is a prime requirement.
- Hand-fitted proven broached dual-sleeve bearing system with large oil reservoir ensures longer, more reliable operation.
- Designed to meet UL requirements.

Characteristic	MODEL 4800
Voltage	115 volts
Frequency*	60 Hz
Air Flow	70 cfm
Speed	1650 rpm
Input Power	10 watts
Weight	1 lb. 4 oz.

*This model also operates at 50 Hz.
Additional data available upon request.



MODELS 4700 and 4750 (Shaded-pole Type)
$4^{1}/_{8}$" (DIA.) x $1^{1}/_{2}$" • ALL-METAL • 65 CFM

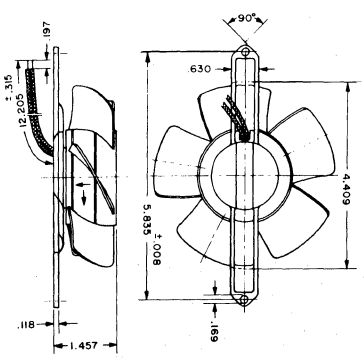


low-cost fans for use where venturi housing is not needed

- "Bracket" models save space and weight when equipment arrangement serves as venturi housing.
- Attach to heat sinks and reduce space requirements.
- Designed to meet UL requirements.

Characteristic	MODEL 4700	MODEL 4750
Voltage	115 volts	220 volts
Frequency*	60 Hz	60 Hz
Air Flow	65 cfm	55 cfm
Speed	2800 rpm	2500 rpm
Input Power	21 watts	19 watts
Weight	1 lb.	1 lb.

*These models also operate at 50 Hz.
Additional data available upon request.



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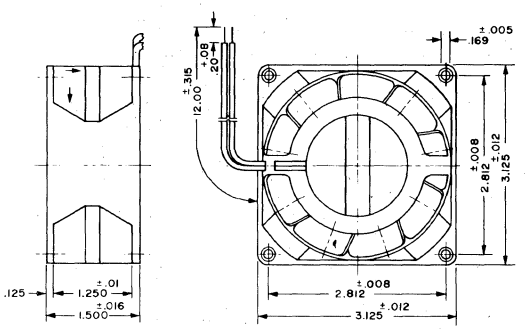
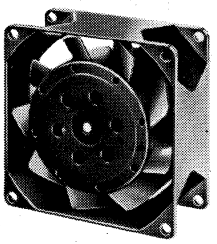
PAMOTOR MINIATURE AXIAL FANS

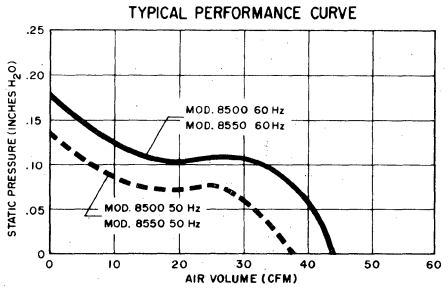
MODELS 8500 and 8550 (Shaded-pole Type)
3 1/8" x 3 1/8" x 1 1/2" • ALL-METAL • 43 CFM

Ultra-compact . . . 1/8" thinner than other 3 1/8" fans

- Unmatched low noise level of 28.8 dB SIL.
- Ideal for tight dimensional applications where performance and cost are prime considerations.
- Standard mounting dimensions for EIA 3½" rack panels.
- All-metal construction ensures longer life in various low-profile electronic equipment.
- UL recognition number E41168.







Characteristic	MODEL 8500	MODEL 8550
Voltage	115 volts	220 volts
Frequency*	60 Hz	60 Hz
Air Flow	43 cfm	37 cfm
Speed	3200 rpm	2600 rpm
Input	13 watts	13 watts
Weight	1 lb. 2½ oz.	1 lb. 2½ oz.

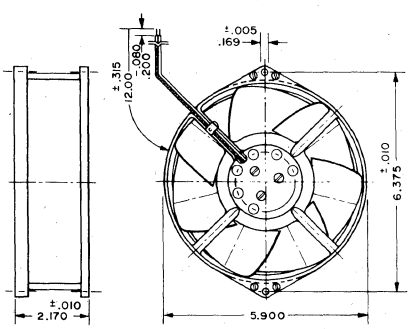
*These models also operate at 50 Hz. Additional data available upon request.

MODELS 7500 and 7550 (Shaded-pole Type)
6" (DIA.) x 2" • ALL-METAL • 250 CFM

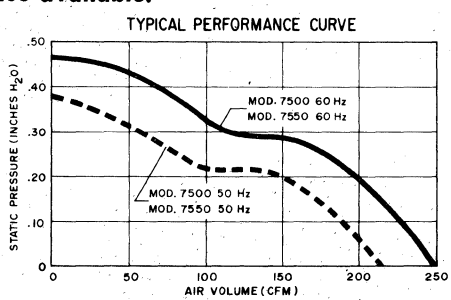
use one to replace two or more fans where max. air movement is needed with low 40.5 dB noise level

- High air delivery ideal for cooling large enclosures with high resistance to air flow.
- New design of pressure type blades will sustain delivery as high as 200 cfm at .2 inches of water back pressure.
- UL recognition number E41168.

MODELS *7506/7556*, ball bearing fans for 85° C ambient temperature operation, also available.







Characteristic	MODEL 7500	MODEL 7550
Voltage	115 volts	220 volts
Frequency*	60 Hz	50 Hz
Air Flow	250 cfm	220 cfm
Speed	3250 rpm	2700 rpm
Input	40 watts	36 watts
Weight	2 lbs. 11½ oz.	2 lbs. 11½ oz.

*These models also operate at 50 Hz. Additional data available upon request.

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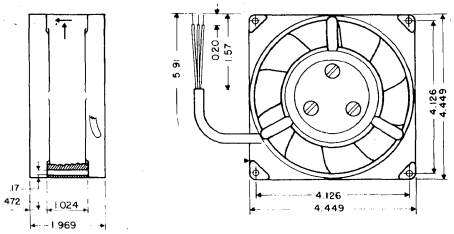
PAMOTOR

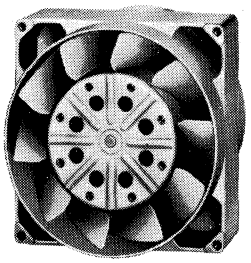
MINIATURE AXIAL FANS

MODELS 1000A, 1100, and 1300 (Induction Type)
$4\frac{7}{16}$" x $4\frac{7}{16}$" x $1\frac{31}{32}$" • ALL-METAL • 125 CFM

The ultimate in reliability and performance in a 4½" fan

- Impedance protected for longer, more efficient operation.
- Universal 4⅛" mounting makes these models interchangeable with similar, less reliable $4\frac{11}{16}$" fans.
- Powerful inside-out motor is impedance protected.
- Standard accessories include mounting brackets, filter, metal screen assembly, finger guard.
- UL recognition number E41168.



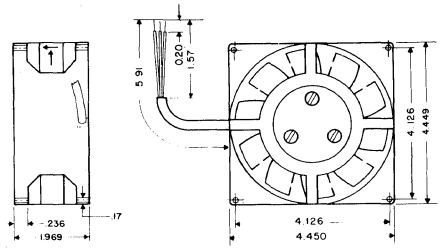


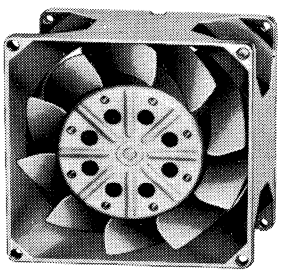
Characteristic	MODEL 1000A		MODEL 1100	MODEL 1300	
Voltage	115 volts	115 volts	115 volts	220 volts	220 volts
Frequency	60 Hz	50 Hz	400 Hz	60 Hz	50 Hz
Air Flow	125 cfm	100 cfm	100 cfm	125 cfm	110 cfm

MODELS 2000 and 2050 (Induction Type)
$4\frac{7}{16}$" x $4\frac{7}{16}$" x $1\frac{31}{32}$" • ALL-METAL • 130 CFM

Highest free air delivery in a $4\frac{7}{16}$" package

- Hand-fitted sleeve bearings ensure reliable performance.
- Extremely low internal heat rise extends life beyond that of conventional fans.
- Stator windings for motor are uniform, allowing for minimum magnetic field density within the air gap.
- Universal 4⅛" mounting.
- UL recognition number E41168.
- Accessories include filter, metal screen assembly, finger guard, and mounting brackets.



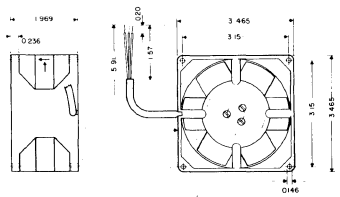


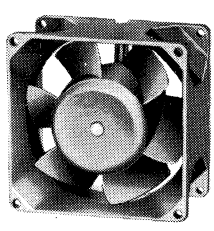
Characteristic	MODEL 2000		MODEL 2050	
Voltage	115 volts	115 volts	220 volts	220 volts
Frequency	60 Hz	50 Hz	60 Hz	50 Hz
Air Flow	130 cfm	116 cfm	130 cfm	116 cfm

MODELS 3000 and 3050 (Induction Type)
$3\frac{15}{32}$" x $3\frac{15}{32}$" x $1\frac{31}{32}$" • ALL-METAL • 65 CFM

Unmatched design and performance in a compact 3½" fan

- Continuous reliable operation in a compact package . . . dynamically balanced rotor.
- Extremely low-noise level.
- Precision hubs, impellers, and die-cast housings.
- Efficient inside-out motor design.
- UL recognition number E41168.





Characteristic	MODEL 3000		MODEL 3050	
Voltage	115 volts	115 volts	220 volts	220 volts
Frequency	60 Hz	50 Hz	60 Hz	50 Hz
Air Flow	65 cfm	58 cfm	65 cfm	58 cfm

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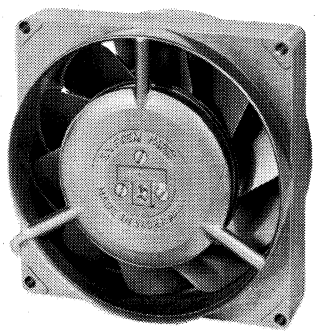
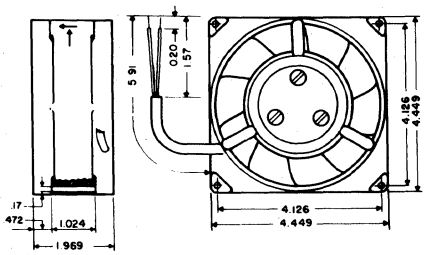
PAMOTOR MINIATURE AXIAL FANS

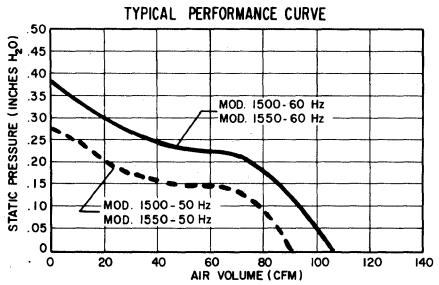
MODELS 1500 and 1550 (Shaded-pole Type)
$4\frac{7}{16}$" x $4\frac{7}{16}$" x $1\frac{31}{32}$" • ALL-METAL • 105 CFM

Universal 4⅛" mounting for interchangeability





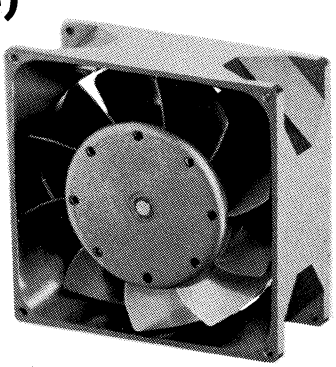
- All-metal component parts are natural heat sinks, ensuring cooler operation.
- Special moisture resistant finish prevents corrosion or deterioration under humid atmospheric conditions or in extreme temperature variations.
- Long operating life without maintenance.
- UL recognition number E41168.
- Standard accessories include mounting brackets, filter, metal screen assembly, finger guard.

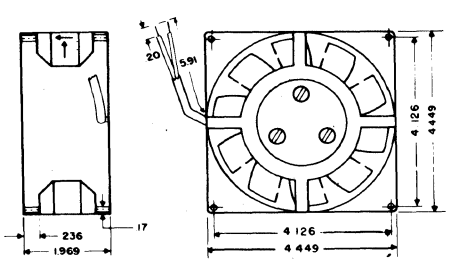


Characteristic	MODEL 1500		MODEL 1550	
Voltage	115 volts	115 volts	220 volts	220 volts
Frequency	60 Hz	50 Hz	60 Hz	50 Hz
Air Flow	105 cfm	90 cfm	105 cfm	90 cfm
Speed	3400 rpm	2850 rpm	3400 rpm	2850 rpm
Input Power	25 watts	27 watts	25 watts	27 watts
Weight	2 lbs. 10 oz.	2 lbs. 10 oz.	2 lbs. 10 oz.	2 lbs. 10 oz.

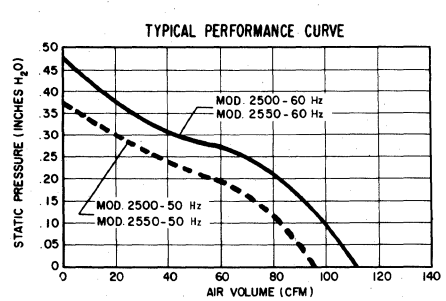
MODELS 2500 and 2550 (Shaded-pole Type)
$4\frac{7}{16}$" x $4\frac{7}{16}$" x $1\frac{31}{32}$" • ALL-METAL • 115 CFM

Low-cost design with efficient inside-out type motor





- Long operating life without maintenance.
- Universal 4⅛" mounting for interchangeability.
- 50-60 Hz operation at 115 or 220 VAC.
- Standard accessories include mounting brackets, filter, metal screen assembly, finger guard.
- UL recognition number E41168.



Characteristic	MODEL 2500		MODEL 2550	
Voltage	115 volts	115 volts	220 volts	220 volts
Frequency	60 Hz	50 Hz	60 Hz	50 Hz
Air Flow	115 cfm	95 cfm	115 cfm	95 cfm
Speed	3400 rpm	2850 rpm	3400 rpm	2850 rpm
Input Power	25 watts	27 watts	25 watts	27 watts
Weight	2 lbs. 1 oz.	2 lbs. 1 oz.	2 lbs. 1 oz.	2 lbs. 1 oz.

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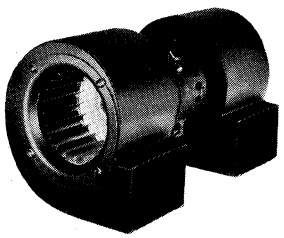
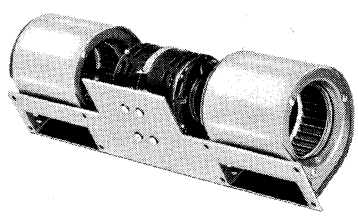


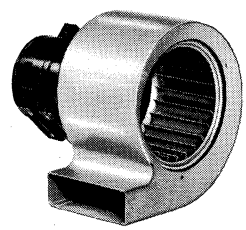
TWIN CENTRIFUGAL BLOWER

- 10-1000 CFM
- Multi-position exhaust
- Meets commercial and mil specs
- For cooling or pressurization



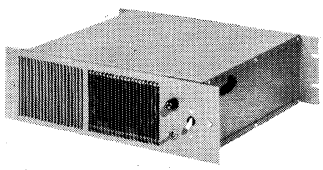
TWIN PANEL BLOWER

- Easy installation
- Permanent lubrication
- Suitable for high temperatures
- Dual voltage and dual frequency
- Up to 300 CFM



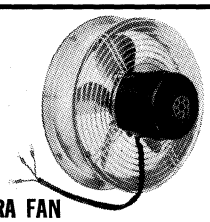
SINGLE CENTRIFUGAL BLOWER

- 10-1000 CFM
- Multi-position exhaust
- Meets commercial and mil specs
- For cooling or pressurization



CABINET BLOWER

- Pressurizes and cools
- Up to 1000 CFM
- Dual and single blowers
- EMI and RFI shielded
- Over 35 models available
- Meets commercial and mil specs



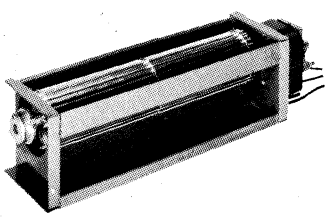
VENTURA FAN

- Rugged
- All-angle mounting
- Quiet
- Safety screens
- Permanent lubrication
- Up to 500 CFM
- Meets commercial and mil specs



SPOT COOLING FAN

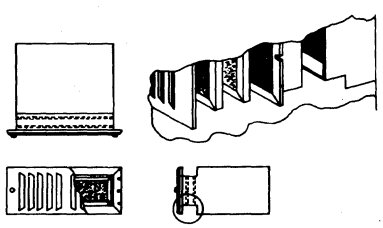
- Compact
- Extra low-cost cooling
- Up to 150 CFM
- Vibration free
- Lifetime lubrication



TANGENTIAL

New concept in air moving . . . assuring uniform air-flow over its entire length. Ultra-compact too.

RFI SHIELDED CABINET BLOWERS



- Morrison can provide an RFI shielded Cabinet Blower, conforming to the best of current specifications on their line of Packaged Electronic Cabinet Blowers.
- All bonding of RFI proofing components are under positive mechanical compression, including monel gasketing.
- All applicable material and finish specifications for RFI proofing are met without sacrifice in air delivery

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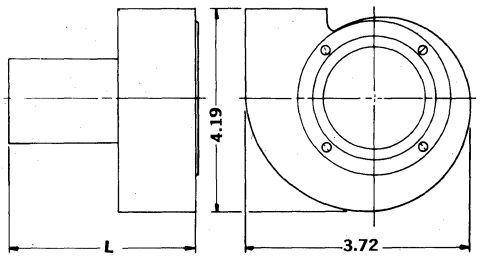
- GROUND
- INSTRUMENT
- SHIPBOARD
- POWER SUPPLIES
- OSCILLOSCOPES

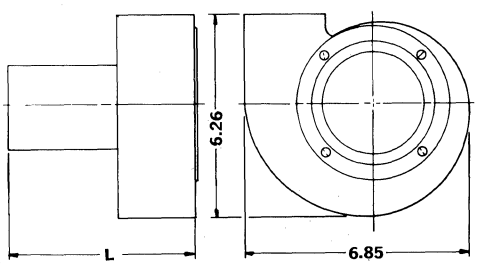
TYPE B2500

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
	ELECTRICAL								
B2500-1	50/60	1	115	1.0	.11	10	3400	**23**	3.32
B2500-2	50/60	1	115	1.0	.12	11	3300	**23**	4.08
B2500-3	50/60	3	208	—	.06	12	3400	**21**	3.44
B2500-4	400	1	115	0.5	.45	46	7500	**50**	3.94
B2500-5	400	1	115	.05	.3	30	5000	**33**	4.08
B2500-6	400	3	208	—	.20	38	7500	**50**	3.94
B2500-7	320-1000	1	115	1.25	.8	80	7200	**45 min**	4.29



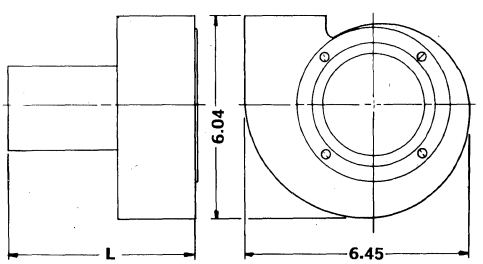
TYPE B3500

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
	ELECTRICAL								
B3500-1	50/60	1	115	1.0	0.45	50	3300	**85**	5.19
B3500-2	50/60	1	115	2.5	0.69	72	3300	**248**	7.91
B3500-3	50/60	1	208	2.0	0.75	90	3200	**175**	6.13
B3500-4	50/60	3	208	—	0.26	75	3300	**180**	6.13
B3500-5	400	1	115	4.0	1.4	140	5300	**140**	5.57
B3500-6	400	1	115	1.0	1.5	120	3500	**185**	6.63
B3500-7	400	1	115	1.0	1.5	120	3500	**240**	7.91
B3500-8	400	3	208	—	0.85	100	3750	**100**	5.06
B3500-9	400	3	208	—	1.25	160	3750	**255**	7.91



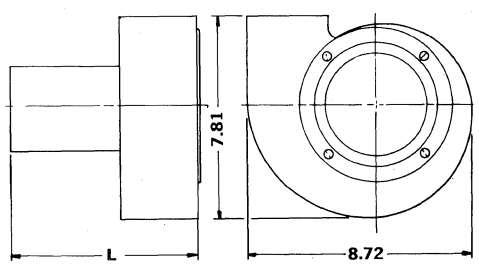
TYPE B400

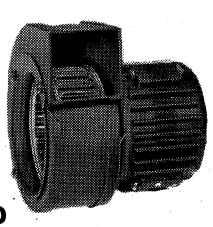
Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
	ELECTRICAL								
B400-1	50/60	1	115	1.0	0.22	25	3200	**49**	4.53
B400-2	50/60	1	115	1.0	0.5	50	3150	**88**	6.40
B400-3	50/60	3	200	—	0.2	64	3300	**125**	7.00
B400-4	400	1	115	1.0	0.95	85	3600	**100**	6.28
B400-5	400	3	208	—	0.8	110	5450	**93**	5.40
B400-6	400	3	208	—	1.5	260	5650	**265**	7.59
DOUBLE BLOWER									
B400-7	50/60	1	115	4.0	0.50	55	3400	**115**	8.00
B400-8	50/60	3	208	—	0.45	120	3400	**280**	12.56
INVERTED									
B400-9	50/60	1	115	1.0	0.38	40	3300	**75**	4.47
B400-10	50/60	3	208	—	0.28	35	3300	**75**	4.47



TYPE B4500

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
	ELECTRICAL								
B4500-1	50/60	1	115	2.5	1.8	200	3200	**290**	7.97
B4500-2	50/60	3	208	—	1.3	215	3200	**340**	8.53
B4500-3	50/60	3	115	—	1.5	260	3100	**390**	9.03
B4500-4	50/60	3	115	—	1.8	310	2950	**455**	9.72
B4500-5	50/60	1	115	2.0	0.35	35	1650	**150**	6.41
B4500-6	50/60	1	115	4.0	0.7	75	1700	**240**	7.97
B4500-7	400	3	208	—	2.6	175	3700	**170**	5.81

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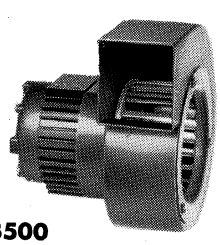
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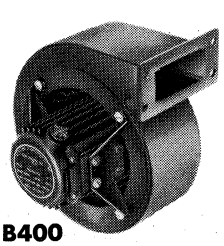
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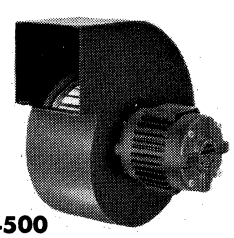

B4500

• SYNCHRONOUS MOTORS • INDUCTION MOTORS • P. M. GENERATORS • BRUSHLESS DC MOTORS • SERVO MOTORS
• TACHOMETER GENERATORS • DRAG CUP MOTORS • INDUCTION GENERATORS • FANS • BLOWERS

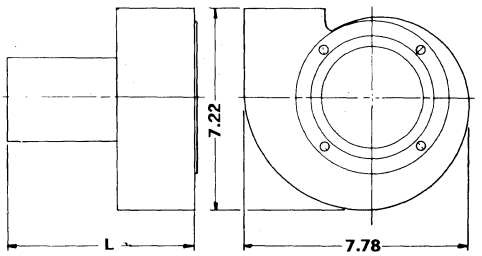
FEATURES . . .

• 50-60 or 400 CPS • Variable or Dual frequency • 1 or 3 phase • BRUSHLESS DC • up to 440 Volts AC • Superior performance • greater efficiency • Rugged construction • Permanently lubricated for long life • Dynamically balanced • Quality controlled per MIL-Q-9858 • Meet or exceed MIL & UL specifications • Ambient temperature range: −55°C to +125°C and up • High Altitude • Versatile mountings and adaptors • Operate in any position • Compact.

RC

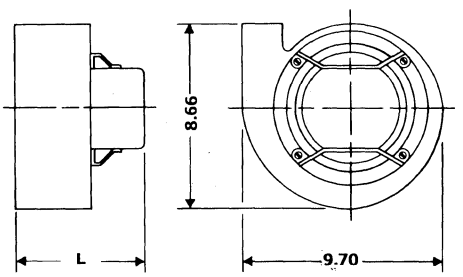
TYPE B500

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
			ELECTRICAL						
B500-1	50/60	1	115	4.0	1.0	120	3200	**160**	6.65
B500-2	55/60	1	115	2.5	2.0	220	3100	**255**	9.16
B500-3	50/60	1	208	4.0	0.6	125	3200	**160**	6.65
B500-4	50/60	1	208	2.5	1.2	220	3250	**255**	9.16
B500-5	50/60	3	208	—	0.8	110	3250	**160**	6.65
B500-6	50/60	3	208	—	1.2	190	3250	**265**	9.16
B500-7	400	3	208	—	1.25	220	3600	**180**	6.65
INVERTED									
B500-8	50/60	1	115/230	4.0	1.0	110	3200	**155**	5.17
B500-9	50/60	1	115	2.0	0.30	30	1700	**77**	4.94
B500-10	50/60	3	208	—	0.6	95	3300	**152**	5.17
B500-11	400	3	208	—	2.4	190	3700	**174**	5.17



INVERTED TYPE B600

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
			ELECTRICAL						
B600-1	60	1	115	2.5	2.0	210	3000	**200**	6.31
B600-2	60	1	208	2.5	1.1	210	3000	**200**	6.31
B600-3	60	3	208	—	0.9	300	3000	**300**	6.31
B600-4	60	3	200	—	0.22	56	1600	**175**	4.75



START with type design No. *(this is not a part No.)

ADD Ambient temperature — Min. and Max. Optional accessories you require. Special environmental conditions. For modified or custom design, send your specs.

SEND to or call RC for quotation, drawing and part No.

Rotation & Blast — CCW rotation — 12 o'clock outlet blast shown on sketch is standard. CCW & CW rotation and any of eight blasts available. Specify desired rotation and blast required.

OPTIONAL ACCESSORIES

OUTLET { Flange / Ductclamp

INLET { Screen / Rim with Clamp / Cone

BALL BEARING STEP-UP BLOWERS

NOW YOU CAN GET HIGH SPEED (8000 RPM) WITH 60 CPS SUPPLY.

- **LONG LIFE** — MIL tested and approved for 10,000 hrs. in extreme environments.
- **SAVE SPACE** — Replace large slow speed blowers and fans.
- **QUIET** — Replace geared speed increasers.
- **BRUSHLESS** — Replace noisy, troublesome DC and universal motors.

RC PRODUCTION MODELS QUICKLY AVAILABLE — SEND FOR DATA.

BRUSHLESS DC BLOWERS

IMPROVE YOUR PRODUCT

Transistorized: No Maintenance
Eliminates Brushes
No Brush Dust
Interchangeable with DC Motors

Life: Extremely Long & Reliable • No Brushes to wear • Silent • Frictionless • No Arcing • Explosion Proof.

RFI: Reduced to Minimum.

Low Input Power: 50% Efficient.

Altitude: Superior at High Altitudes.

Dielectric: Vastly Improved

Environmental: Passes severe environmental conditions of all MIL SPECS.

Continuous Duty:

Speeds: Wide Selection of High Speeds attainable. Available with speed variation feature.

Applications: To replace Brush Type DC Motors, Blowers, Fans in any Electronic Equipment. • In Explosive Atmosphere • Aircraft • Submarines • Space Vehicles • Powered by Solar Batteries.

Motor Types: Induction Motors • Blowers • Fans.

— Send For Data

BLOWER CABINETS

FOR STANDARD 19" RACKS — QUIET, CLEAN, FILTERED COOLING IN A COMPACT PACKAGE.

Mount Quickly & Easily to any Standard EIA Notched 19" Rack.

Also Available: 150 through 800 CFM, All Frequencies and Voltages.

Commercial • MIL-Spec • RFI Shielded

Mounting: Simple and fast to any standard EIA notched 19" Rack.

Front Panel: • 2 Panel Styles — Recessed Models save 1¾". Panel Space. Delivers same air as standard model.

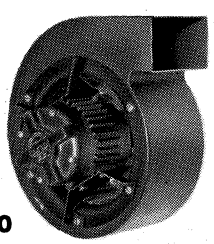
Grille: • Stainless Steel, Heavy Gauge • Attractive, enhances your equipment • CRS with Prime Coat is desired.

Filter: • Washable • Permanent • Quickly removed • Easily Cleaned from front. Also available for 150 through 800 CFM.

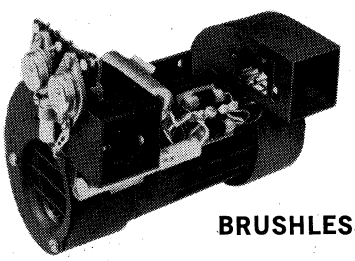
Commercial MIL Spec — RFI Shielded.

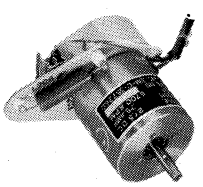
PART NUMBER 2-3000-A-1A1

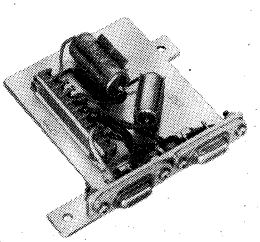
- 115 vac, 50/60 cps, 1 Phase 300 CFM.
- Shaded Pole, Self-Cooled
- Sleeve Bearings
- Filter Size — 6½" x 16¾" x ½"
- Front Panel, Size 7" h x 19" L



B600







BRUSHLESS DC BLOWERS

ROTATING COMPONENTS

1560 FIFTH AVE., BAY SHORE, N. Y. 11706

DIVISION OF INSTRUMENT SYSTEMS CORPORATION

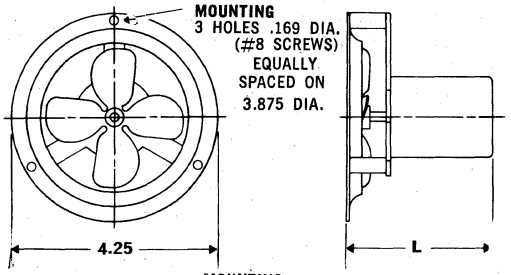
516-666-8500 — TWX 516-666-7047

FANS

FOR MIL SPEC • QUALITY INDUSTRIAL
• AIRBORNE • COMPUTER
• GROUND • INSTRUMENT
• SHIPBOARD • POWER SUPPLIES
• OSCILLOSCOPES

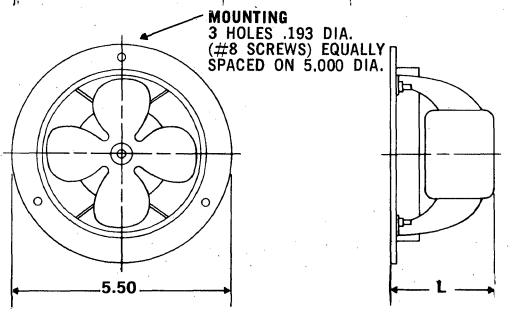
TYPE F300

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
F300-1	50/60	1	115	1	.1	9	3300	**40**	3.00
F300-2	50/60	3	208	—	.06	10	3500	**32**	2.86
F300-3	60/400	1	115	1	.12/.35	12/25	3000	**35**	3.00
F300-4	400	1	115	1	.15	25	11000	**100**	3.25
F300-5	400	3	200	—	.15	23	11000	**100**	2.59



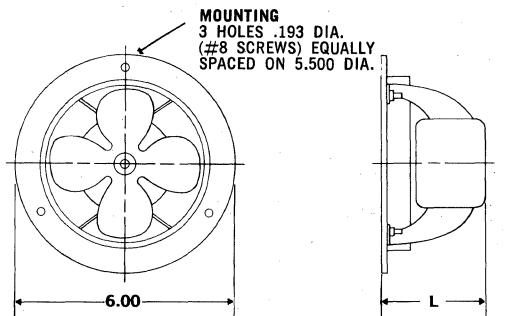
TYPE F400

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
F400-1	50/60	1	115	1	0.08	9	3450	**85**	2.91
F400-2	50/60	3	208	—	0.06	12	3450	**85**	2.91
F400-3	60/400	1	115	0.5	0.24 0.20	21 36	3200 3700	**80** **100**	3.41
F400-4	400	1	115	0.5	0.50	46	7500	**180**	3.41
F400-5	400	3	115	—	0.40	38	7500	**180**	3.41
F400-6	400	3	200	—	0.22	53	8500	**210**	3.41



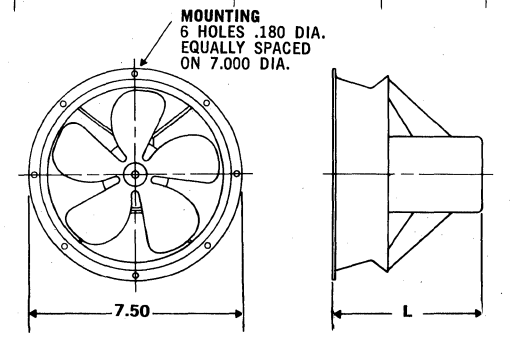
TYPE F4500

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
F4500-1	50/60	1	115	1	0.08	9	3300	**110**	2.94
F4500-2	50/60	1	115	0.5	0.06	7	1700	**58**	2.94
F4500-3	50/60	1	230	1	0.05	10	3200	**105**	2.94
F4500-4	50/60	3	115	—	0.27	16	3500	**120**	3.44
F4500-5	50/60	3	208	—	0.06	13	3400	**115**	2.94
F4500-6	50/60	3	208	—	0.07	11	1750	**60**	3.44
F4500-7	60/400	1	115	1	0.39 0.57	26 63	3350 3500	**115** **120**	4.44
F4500-8	400	1	115	1	0.5	60	7000	**240**	4.44
F4500-9	400	3	200	—	0.28	72	7100	**250**	3.44
F4500-10	400	3	200	—	0.27	50	6000	**225**	4.44



TYPE F5500

Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	AIR CFM @ 0" SP	MECH. L
F5500-1	50/60	1	115	1	0.18	20	3450	**180**	3.63
F5500-2	50/60	1	115	2	0.5	40	3350	**315**	4.63
F5500-3	50/60	1	115	1	0.20	23	1750	**95**	3.63
F5500-4	50/60	3	115	—	0.20	16	3450	**180**	3.63
F5500-5	50/60	3	208	—	0.20	16	3450	**180**	3.63
F5500-6	50/60	3	208	—	0.06	11	1750	**95**	3.63
F5500-7	400	1	115	1	0.55	65	6400	**315**	4.88
F5500-8	400	3	200	—	0.29	56	5500	**290**	4.88



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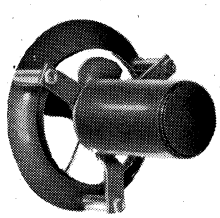
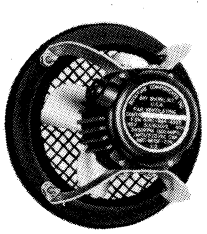
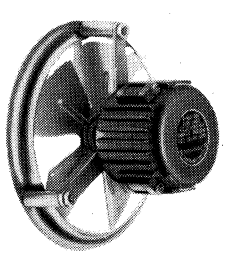


F400
F4500



F4500



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• TACHOMETER GENERATORS • DRAG CUP MOTORS • INDUCTION GENERATORS • FANS • BLOWERS

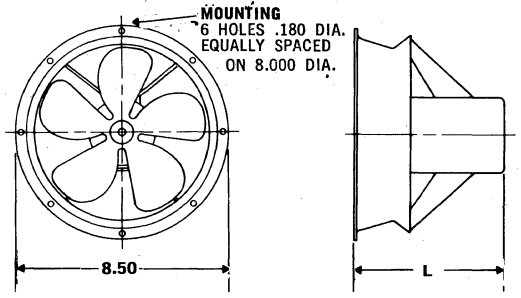
FEATURES...

• 50-60 or 400 CPS • Variable or Dual frequency • 1 or 3 phase • BRUSHLESS DC • up to 440 Volts AC • Superior performance • greater efficiency • Rugged construction • Permanently lubricated for long life • Dynamically balanced • Quality controlled per MIL-Q-9858 • Meet or exceed MIL & UL specifications • Ambient temperature range: −55°C to +125°C and up • High Altitude • Versatile mountings and adaptors • Operate in any position • Compact.

RC

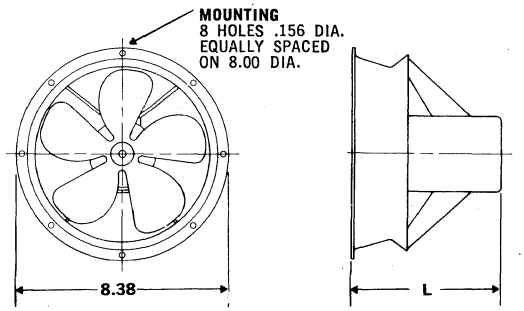
TYPE F6500

	ELECTRICAL							AIR	MECH.
Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	CFM @ 0" SP	L
F6500-1	50/60	1	115	1	0.21	24	3300	**300**	3.88
F6500-2	50/60	1	115	2	0.20	23	1700	**160**	3.88
F6500-3	50/60	3	208	—	0.20	23	3300	**305**	3.88
F6500-4	50/60	3	115	—	0.22	23	3300	**305**	3.88
F6500-5	400	1	115	1	0.77	66	3800	**350**	4.94
F6500-6	400	3	208	—	0.83	75	3900	**360**	4.94
F6500-7	400	3	208	—	0.78	90	5600	**500**	4.94



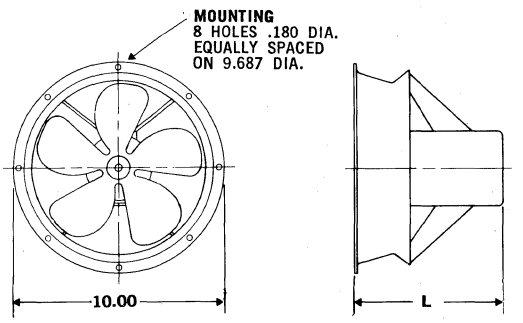
TYPE F700

	ELECTRICAL							AIR	MECH.
Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	CFM @ 0" SP	L
F700-1	50/60	1	115	4	0.5	58	3300	**500**	5.94
F700-2	50/60	1	115	4	0.5	58	3300	**500**	5.94
F700-3	50/60	1	115	4	1.0	90	3300	**600**	5.94
F700-4	50/60	3	208	—	0.3	40	3300	**500**	5.00
F700-5	50/60	1	115	2	0.45	45	1700	**250**	5.00
F700-6	400	1	115	1	1.25	95	3700	**550**	5.75
F700-7	400	3	208	—	1.00	106	3700	**550**	5.10



TYPE F800

	ELECTRICAL							AIR	MECH.
Type Design No.	Freq. CPS	Ph.	Volts	Cap. Mfd.	Nom. Amps	Nom. Watts	Nom. RPM	CFM @ 0" SP	L
F800-1	50/60	1	115	2	1.6	60	3300	**500**	6.25
F800-2	50/60	1	115	3	0.55	65	3300	**630**	6.25
F800-3	50/60	1	115	4	1.0	120	3300	**810**	6.75
F800-4	50/60	1	115	2.5	1.5	170	3300	**1000**	7.88
F800-5	50/60	1	115	2	0.3	25	1700	**260**	4.69
F800-6	50/60	1	115	2	0.3	25	1700	**330**	4.69
F800-7	50/60	1	115	2	0.35	30	1700	**400**	4.69
F800-8	50/60	1	115	2	0.45	45	1700	**500**	4.69
F800-9	50/60	3	208	—	0.6	85	3300	**800**	6.75
F800-10	50/60	3	208	—	0.75	130	3300	**950**	6.75
F800-11	400	1	115	1	1.25	95	3800	**540**	6.25
F800-12	400	1	115	1	1.2	125	3800	**740**	6.75
F800-13	400	3	208	—	1.0	150	3800	**780**	6.75
F800-14	400	3	208	—	1.6	210	3800	**900**	7.88
F800-15	400	3	208	—	3.7	680	5600	**1650**	7.88



HOW TO ORDER OR INQUIRE

START with type design No. *(this is not a part No.)

ADD Air flow direction A or B.
Ambient temperatures — Min. and Max.
Optional accessories you require.
Special environmental conditions.
For modified or custom design, send your specs.

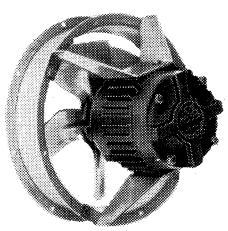
SEND to or call RC for quotation, drawing and part No.

OPTIONAL ACCESSORIES

- Front Screen Guard
- Rear Finger Guard
- Vibration Isolators

AIRFLOW
A
B

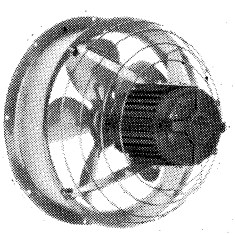
F5500
F6500



F700



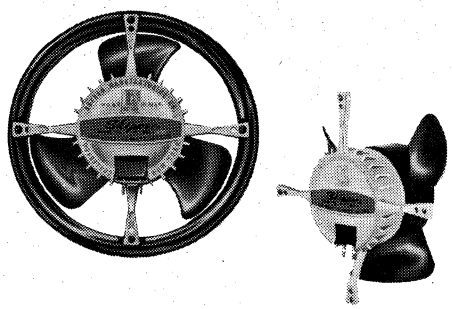
F800

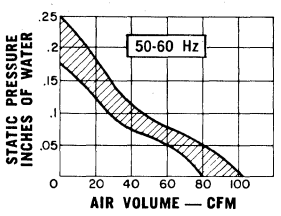


ROTATING COMPONENTS
1560 FIFTH AVE., BAY SHORE, N. Y. 11706

DIVISION OF INSTRUMENT SYSTEMS CORPORATION
516-666-8500 — TWX 516-666-7047

Skipper® FAN



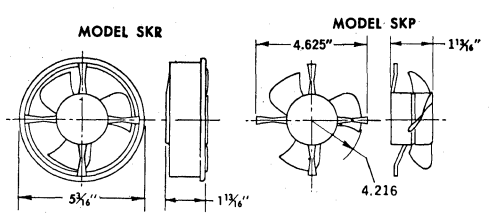


The Skipper Fan signals the best in really economical cooling for computers, office copying equipment, transmitters — all commercial applications requiring 100 cfm of cool air.

It incorporates high quality, precision design and the LOWEST COST. And that's not all. It is designed to SAVE in installation expense — requiring no mounting nuts or bolts — no bolt holes to drill. Consider these features:

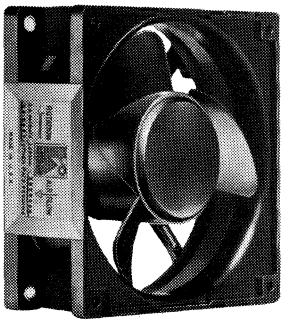
- Requires no mounting nuts or bolts.
- 100 cfm.
- Quiet — just 38 db SIL.
- Thin — only 1-13/16".
- Small diameter 5-3/16".
- Lightweight — 14 oz.
- Reversible air direction (using optional plate part no. 19561-2).
- Designed to operate in temperatures up to 140°F (60°C).
- Designed to meet UL specifications.
- Complete accessories.

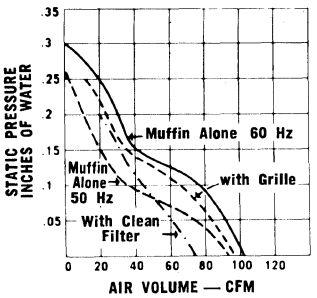
WEIGHT 14 OUNCES



For Further Information Request Catalog Sheet E-2775

muffin® fan

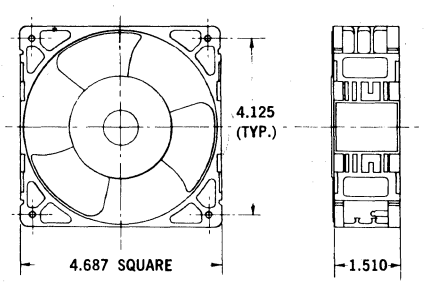




The Muffin Fan is the most reliable commercial tubeaxial fan available. The Muffin Fan can be expected, with a 90% survival rate, to operate up to 10 years at room temperature. Installed in equipment, it minimizes component derating, increases the life expectancy of the equipment and assures top performance. Ultra-long-life bearings are precisely aligned for vibration-free operation. Encapsulated motor winding adds years to life of unit. Molded in bus-bar motor leads. Completely integrated design of motor, blades, optional venturi, grille and filter in a performance matched assembly. The Muffin Fan is designed for 115 VAC, 50-60 Hz, 1 Phase applications. Models for 230 VAC are also available. It has UL yellow card component recognition. File No. E-31293.

WEIGHT 1.0 POUND

MOUNTING HOLE DIMENSIONS 4.125"

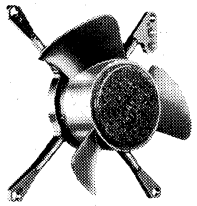


For Further Information Request Catalog Sheet E-2820

ROTRON® INCORPORATED
WOODSTOCK,
NEW YORK 12498
TEL: 914 679-2401
PACIFIC DIVISION 1912 WEST BURBANK BOULEVARD, BURBANK, CALIFORNIA 91506
TEL: 213 849-7871

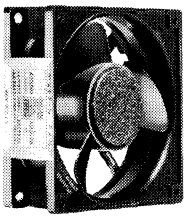
Sentinel, Muffin, Whisper, and Centaur Fans

AVAILABLE IN 4 VERSIONS



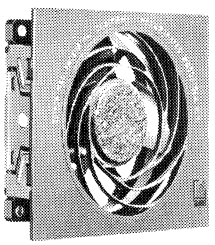
"SKELETON FAN"

Consists of a motor-driven propeller with 4 mounting arms containing molded-in leads. It can be mounted as an air-stirring device among hot components or can be mounted in a round, sharp-edged or bellmouth aperture in the equipment enclosure.



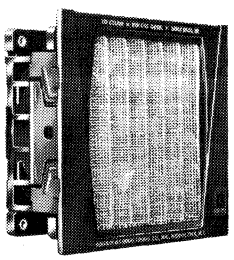
"VENTURI FAN"

An assembly of the "SKELETON FAN" mounted in a 4.68" square molded plastic VENTURI BLOCK only 1.50" thick. May be used in either a round or square opening in an equipment panel. Mounting holes are provided on both upstream and downstream sides to permit the fan to push or pull air. It may also be used with the MOUNTING CLIPS described in this folder.



"GRILLE FAN"

The "GRILLE FAN" results from the addition of the GRILLE and MOUNTING CLIPS to the "VENTURI FAN". The "VENTURI FAN" may be mounted against the inside surface of the equipment enclosure and the grille snapped into place from the outside. The grille is an advanced aerodynamic design which minimizes the accumulation of lint and dust, and keeps the acoustical noise level to the minimum while insuring maximum airflow.



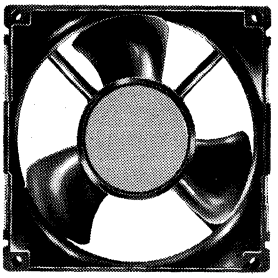
"FILTER FAN"

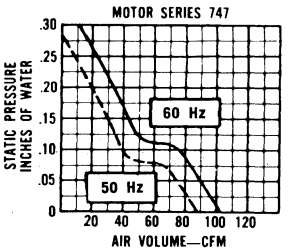
A complete cooling package consisting of matched fan and filter for maximum efficiency. The FILTER BOX locks in place between the GRILLE FRAME and the "VENTURI FAN" adding less than .75" to over-all depth. This unit completely eliminates guess work and risks involved in unmatched fan/filter assemblies. FILTER BOX, GRILLE and MOUNTING CLIPS are also available as separate accessories for existing "VENTURI FAN" installations.

Accessory Items For Sentinel, Muffin, Whisper and Centaur Fans.

Mounting Clips No. 13996 (Set)
Spiral Grille No. 16238
Filter Assembly No. 15449
Filtercoat No. 18440
Finger Guard No. 20132-2
Plug & Cord Assembly No. 16415

Sentinel® FAN

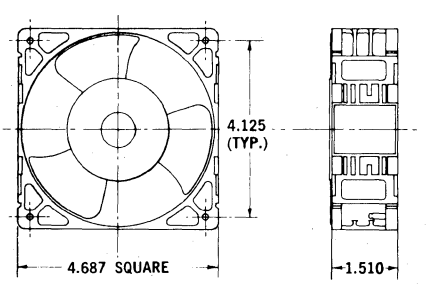




The Sentinel Fan has retained the high air performance, versatility, compact design and low noise level of the Muffin Fan but is designed for the more "rugged" application where the ambient temperature is higher. It is also for the customer that requires long, trouble free life without the requirement for maintenance. The Sentinel Fan may be used in a maximum ambient of 100°C and will withstand greater shock and vibration than the Muffin Fan was designed for. To achieve this design criterion the Sentinel Fan incorporates a glass-filled phenolic venturi block, an encapsulated stator, stainless steel ball bearings and an aluminum heat sink which draws heat from the windings to provide a cool running motor. The Sentinel Fan was designed to meet U.L. approval and has been satisfactorily qualified to MIL-E-4970A. The Sentinel Fan is designed for 115 VAC, 50-60 Hz, 1 Phase applications. Models for 230 VAC are also available.

WEIGHT 1.0 POUND

MOUNTING HOLE DIMENSIONS 4.125"



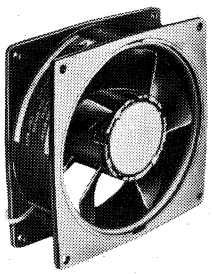
For Further Information Request Catalog Sheet E-2810.

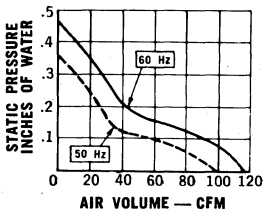
ROTRON® INCORPORATED

WOODSTOCK,
NEW YORK 12498
TEL: 914 679-2401

PACIFIC DIVISION 1912 WEST BURBANK BOULEVARD, BURBANK, CALIFORNIA 91506
TEL: 213 849-7871

SPARTAN FAN



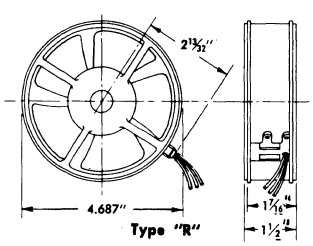


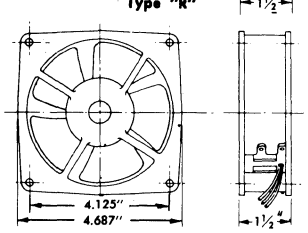
Delivers 110 CFM free delivery for military applications. Dimensions of $4\frac{11}{16}$" square by $1\frac{1}{2}$" in depth make this fan dimensionally interchangeable with the Muffin Fan. Powered by a multi-slot, double-shielded, ball bearing induction motor which is lubricated for life at a maximum ambient of 100°C. Electrical connection is made by means of 12" leads. The Spartan Fan is designed for 115 VAC, 50-60 Hz, 1 Phase and 400 Hz, 1 Phase and 400 Hz, 3 Phase. The Type "R" version contains round mounting rims for use with standard motor mounting clamps. The air-flow direction may be reversed by turning fan end-for-end. The Venturi Ring, spiders and hub are a single aluminum casting suitable for shock and vibration requirements. The Spartan Fan meets applicable military specifications for ground and shipboard use.

OPTIONAL ACCESSORIES: Terminal Block.
"Synclamps" for Clamping Rim Mtg. Part #109074-337. (3 Required Per Fan).
"Rever-Synclamps" for Clamping Rim Mtg. Part #309074. (3 Required Per Fan).

WEIGHT 1.0 POUND

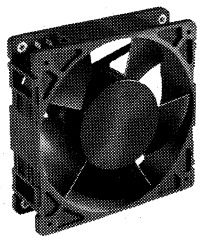
MOUNTING HOLE DIMENSIONS 4.125"



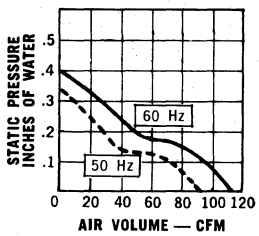


For Further Information Request Catalog Sheet E-2802.

CENTAUR® FAN



Available in 4 Versions



New aerodynamic principles by Rotron permit the new Centaur to achieve greater aerodynamic efficiencies than ever before from axial flow fans — and with low acoustical disturbance and compact size.

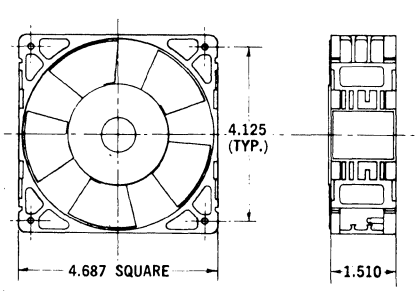
The Centaur with its computer designed five-bladed impeller molded of high impact polycarbonate is precisely matched to a powerful shaded pole motor — available with either oil-impregnated sleeve bearings or precision ball bearings lubricated for life. The recommended operating ambient temperature is −40°C to +55°C with sleeve bearings, and −40°C to +72°C with ball bearings. The motor is mounted to a spider of die cast aluminum which is in turn assembled to a venturi of high temperature resistant black phenolic.

The Centaur will deliver 120 cfm of air, free delivery operating at 115 volts, 60 Hz, or 100 cfm free delivery at 230 volts, 50 Hz making it possible for the design engineer to select a fan to deliver the same cfm on European power sources as Muffin fans or Sentinel fans at 60 Hz power used in the U.S.A.

The Centaur is designed to be physically interchangeable with the Muffin fan or the Sentinel fan.

WEIGHT 1.0 POUND

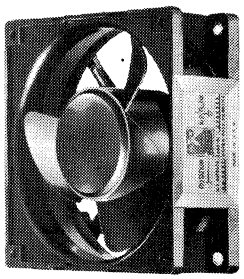
MOUNTING HOLE DIMENSIONS 4.125"



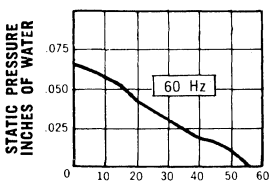
For Further Information Request Catalog Sheet E 2850.

ROTRON® INCORPORATED
WOODSTOCK,
NEW YORK 12498
TEL: 914 679-2401
PACIFIC DIVISION 1912 WEST BURBANK BOULEVARD, BURBANK, CALIFORNIA 91506
TEL: 213 849-7871

Whisper® Fan



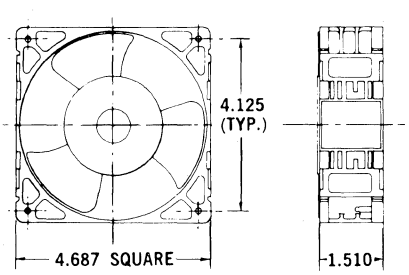
MARK I
Available in 4
Versions



Breathing 55 cubic feet of cool air over, under and around every heat-generating component, the Whisper Fan improves performance of hi-fi equipment, radio-TV receivers and O.E.M. equipments by minimizing drift due to temperature change within the enclosure. So quiet you have to feel the breeze to know it's going. Only 18 db SIL. Also supplied as Whisper Fan Kit complete with special mounting, hardware, plug and cord for electrical connections and detailed instructions. Whisper Fan is designed for 115 VAC only, 50-60 Hz, 1 Phase.

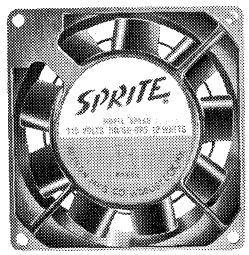
WEIGHT 1.0 POUND

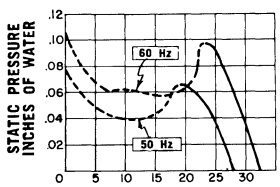
Mounting hole dimensions 4.125"



For Further Information Request Catalog Sheet E-2801

SPRITE® FAN





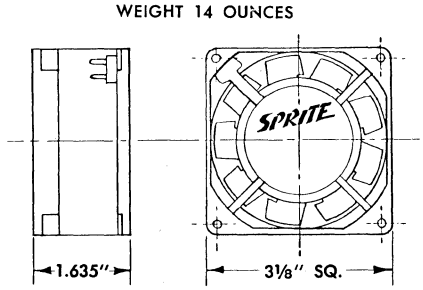
The Sprite fan has been designed especially for commercial cooling applications in low-profile electronic equipment, where size and reliable LOW COST performance are the important requirements.

It is only 3-1/8" square, still, this rugged little fan with its nine-bladed propeller delivers 35 cfm — tailored to produce high pressure at the ranges approaching free delivery. (See Curve)

Review these important features:

- Small — only 3-1/8" square.
- Peppy — delivers 35 cfm.
- Reversible air flow — Simply turn fan end-for-end.
- Impedance protected.
- Designed to meet UL requirements.
- Designed to operate in temperatures up to 140°F (60°C).
- Quiet — only 35 db SIL.
- Long life — up to five years.

WEIGHT 14 OUNCES

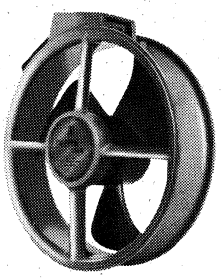


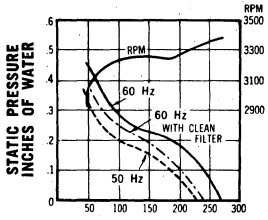
For Further Information Request Catalog Sheet E-2760

® ROTRON INCORPORATED
WOODSTOCK,
NEW YORK 12498
TEL: 914 679-2401
PACIFIC DIVISION 1912 WEST BURBANK BOULEVARD, BURBANK, CALIFORNIA 91506
TEL: 213 849-7871

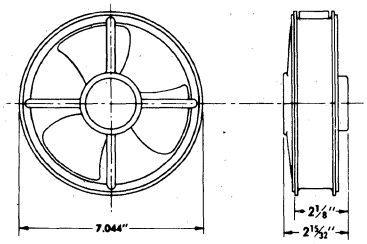
FEATHER® FAN

For Further Information Request Catalog Sheet E-3001





The Feather Fan delivers 270 CFM for flushing computer consoles, power supplies, heat exchangers and electronic control equipment that can spare little room for a cooling device. The fan's depth dimension of only $2\frac{15}{32}$" x 7" diameter imposes little space displacement on the system to be cooled. The Feather Fan is constructed of high-impact polycarbonate plastic which is resistant to extreme temperatures and boasts outstanding dimensional stability. The fan is powered by multi-slot induction motor that incorporates prelubricated stainless steel ball bearings for an ambient temperature range of −55°C to +65°C. 115 VAC, 50-60 Hz, 1 phase. A capacitor is provided which is mounted on the fan venturi. The electrical connection is made to tinned brass terminals and a mating plug and cord is available. The fan is provided with clamping rims for easy mounting and the airflow is reversible by turning the fan end-for- end. A matched filter box #124110 which is permanent, nonloading and washable is optional as are fan guards.

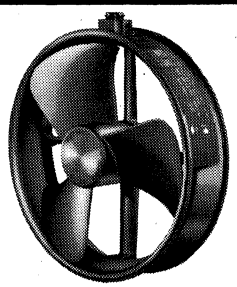


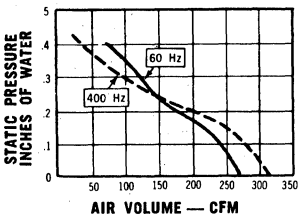
WEIGHT 1.5 POUNDS

OPTIONAL ACCESSORIES:
Rim Guard #14559.
Panel Guard #14651.
Plug & Cord #16398.
Filter Box #124110.
Mounting Clamp #16410 (3 required per fan).
Panel Mount Guard Clip #14611 (3 required per guard).
Rotron Filtercoat #18440.

SAUCER® FAN

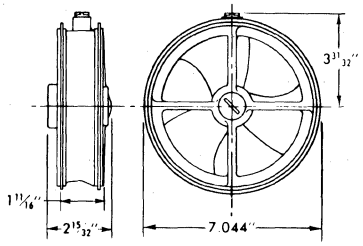
For Further Information Request Catalog Sheet E-3000





The Saucer Fan is ideally suitable for integration into modern electronic packages requiring 270 CFM of cooling air. Its axial length or thickness is strictly limited to the minimum measurement required by a highly efficient propeller, with no further space sacrificed for the driving motor. In other words, **"It is all fan"**. Airflow is reversible by turning the fan end-for-end. Clamping rims at each end of venturi provide easy mounting. Electrical connections are made to a compact terminal block. The Saucer Fan meets applicable military specifications for ground equipment.

A 400 Hz version is also available.



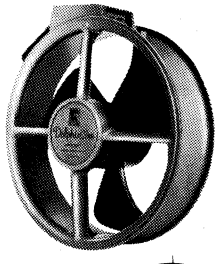
WEIGHT 1.6 POUNDS

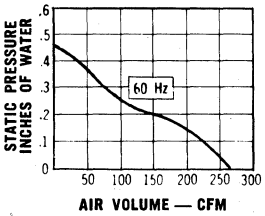
MOTOR	ELECTRICAL							AIR
Series	Volts	Phase	Hz	Cap. Mfd.	RPM	Watts at Free Delivery	Line Amps.	CFM
654DS	**115**	**1**	**400**	—	**3600**	**26**	**0.25**	**310**
650JS	**200**	**3**	**400**	—	**3580**	**25**	**0.13**	**310**
340ZS	115	1	50-60	2.0	3300	26	0.23	270
544JS	200	3	50-60	—	3300	24	0.10	270
559DS	115	1	50-60	2.0	1680	10.5	0.10	140

OPTIONAL ACCESSORIES:
Flush Mount Guard #14651, Rim Mount Guard #14559, Clip #14611. (For mounting flush mount guard)
"Synclamps" for clamping rim mounting part #109074-337 (3 required per fan)
"Rever-Synclamps" for clamping rim mounting part #309074 (3 required per fan)
Filter Box #121802.

Dolphin™ FAN

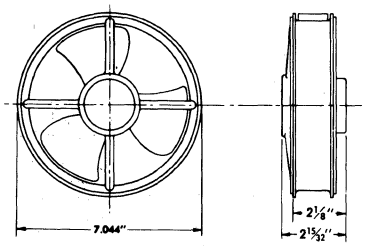
For Further Information Request Catalog Sheet E-3002





The Dolphin is designed for LOW BUDGET applications where its application requirements are not as demanding. The Dolphin is $2\frac{15}{32}$" by 7" diameter and delivers 265 CFM at free delivery. It is powered by a multislot induction motor rotating on oil impregnated sleeve bearings rated for ambient temperatures not exceeding 65°C. Motors are available for 115 V, 60 Hz, 1 phase and 230 V, 60 Hz, 1 phase operation.

A capacitor can be provided neatly mounted on the venturi. The Dolphin is manufactured with high-impact polycarbonate plastic which is universally recognized for its dimensional stability. The Dolphin is provided with clamping rims for easy mounting and the airflow is reversible by turning the fan end-for-end.



WEIGHT 1.5 POUNDS

OPTIONAL ACCESSORIES:
Rim Guard #14559.
Panel Guard #14651.
Plug & Cord #16398.
Filter Box #124110.
Mounting Clamp #16410 (3 required per fan).
Panel Mount Guard Clip #14611 (3 required per guard).
Rotron Filtercoat #18440.

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TEL: 914 679-2401

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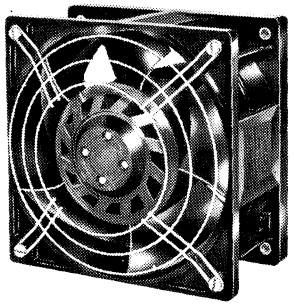
TARZAN® FAN

For Further Information Request Catalog Sheet M-8000.

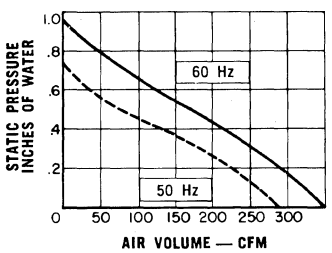


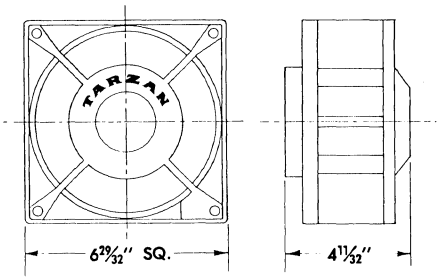
WEIGHT 5 POUNDS

The Tarzan fan brings an entirely new concept of air moving device versatility to the science of electronic cooling — CENTRIFUGAL BLOWER PERFORMANCE IN A COMPACT AXIAL FLOW FAN. This unique Rotron aerodynamic design (patent applied for) develops much greater pressure than comparably sized axial flow fans.

Its straight line performance curve permits the packaging engineer to realize full potential from the Tarzan at any point along the curve with no instability normally found in a curve of an axial flow fan.

When considering a squirrel cage centrifugal blower to deliver 175 cfm at 1/2" water static pressure — CONSIDER A TARZAN FIRST — SAVE SPACE — eliminate discharge diffusers.





More features:

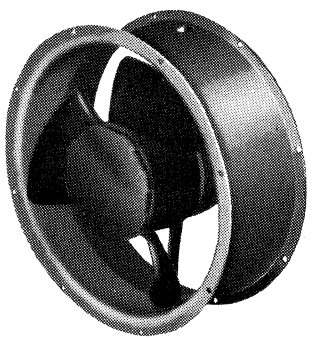
- Long maintenance free life.
- Economically priced.
- Reversible air flow — Simply turn fan end-for-end.
- Ball bearings — lubricated for life.
- 115 VAC, 50/60 Hz.
- 230 VAC, 50/60 Hz.

Optional accessories:

- Plug and Cord #17555.
- Filter Box #20990.
- Finger Guard #21196-2.

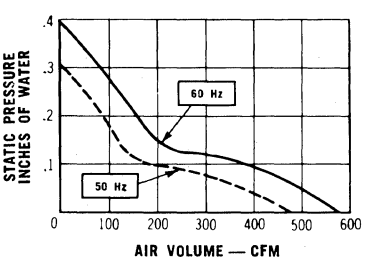
Caravel® FAN

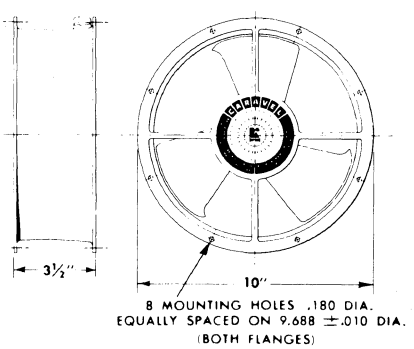
For Further Information Request Catalog Sheet E-3050



WEIGHT 4.3 POUNDS

The Caravel Fan delivers an air volume of 575 CFM while holding a narrow depth dimension of only 3½" x 10" diameter. This high performance and compact design makes it ideal for flushing large racks and cabinets. The fan may be mounted directly to a panel or cabinet wall using the holes located around the circumference of the venturi. Airflow may be reversed by turning the fan end-for-end. The motor is sealed and is provided with ball bearings for long, quiet life. No maintenance is required. The electrical connection is made to a terminal block and a mating plug and cord is optional. The Caravel is suitable for the most rugged commercial applications where the cabinet temperature does not exceed 140°F. Thermal protection for the motor, designed to meet UL approval, is available on special order.





CARAVEL TYPE CHART

TYPE	VAC	PHASE	Hz	CFM
CL2T	115	1	50/60	575
CL3T	230	1	50/60	575

OPTIONAL ACCESSORIES: Screen Guard #19694
Plug & Cord #17555

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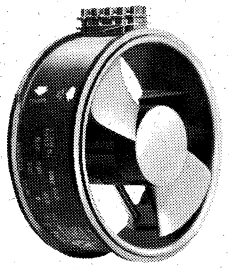
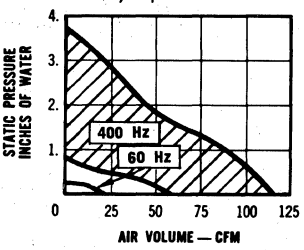
TEL: 213 849-7871

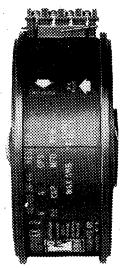
PROPIMAX® 2

For Further Information Request Catalog Sheet E-2900

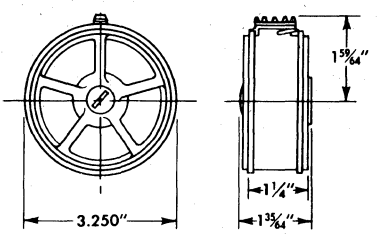


The PROPIMAX-2 is ideal for 400 Hz airborne and missile applications where high shaft speeds are mandatory to obtain maximum air performance in a minimum of space. Selection from constant speed or high altitude varying speed "Altivar"® motors, which change shaft speed directly with altitude. A 50-60 Hz design is also available. The units are lubricated for a maximum ambient temperature of 125°C and will have a life expectancy of 2000 hours of continuous duty in an ambient atmosphere of 14.7 psia and 72°C. For fan life specifications for motor series 366ZS contact factory. The airflow is reversible by turning venturi ring end-for-end. There are clamping rims at each end of venturi for quick mounting. A single terminal block for all electrical connections. Meets applicable military specifications.





WEIGHT 6.5 OUNCES



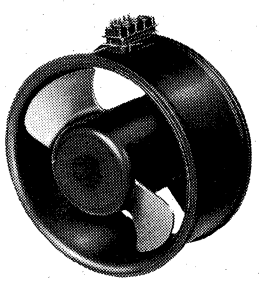
MOTOR	ELECTRICAL							AIR
Series	Volts	Phase	Hz	Cap. Mfd.	RPM	Full Watt Load	Line Amps.	Max. CFM
606NS	115	1	50-60	1.0	3100	7.0	0.06	17
366ZS	115	1	400	0.75	21000	41.0	0.37	122
464ZS	115	1	400	0.15	11000	10	0.10	62
367JS	200	3	400	—	20500	34	0.13	118
415ZS*	115	1	400	0.15	12300	18	0.18	67
395JS*	200	3	400	—	12500	18	0.10	65
704WS	200	3	400	—	11500	17	0.12	65

*Altivar

OPTIONAL ACCESSORIES: "Synclamps" for Clamping Rim Mtg. Part #109074-337. (3 Required Per Fan).
"Rever-Synclamps" for Clamping Rim Mtg. Part #309074. (3 Required Per Fan)

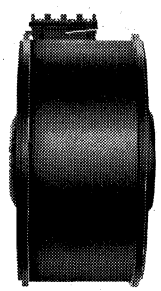
PROPIMAX-3 & 3B

For Further Information Request Catalog Sheet E-2901.

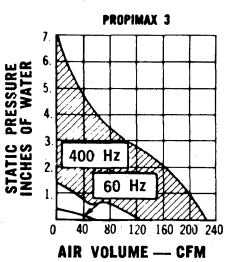


The PROPIMAX 3 and 3B will deliver up to 220 CFM free delivery and will work against high air impedance. It is ideal for cooling small airborne systems which must place maximum emphasis on size and weight. This means heavy component density with large heat loads and high air impedance in relation to the envelope dimensions of the system. The PROPIMAX 3 has a two bladed propeller and is powered by a constant speed 400 Hz motor operating at 22,000 RPM. The PROPIMAX 3 will deliver large volumes of air against relatively high static pressures. The PROPIMAX 3B is provided with a four bladed propeller for operation at speeds of 12,000 RPM or less on 400 Hz. The PROPIMAX 3B will deliver large volumes of air against lower static pressure levels. The PROPIMAX 3B offers a choice of a constant speed 11,000 RPM design and high altitude, variable speed "ALTIVAR"® motors which change speed directly with altitude. There is also a 50-60 Hz design available.

The units are lubricated for a maximum ambient temperature of 125°C and will have a life expectancy of 2,000 hours of continuous duty in an ambient atmosphere of 14.7 psia and 72°C. For more stringent duty conditions fan life specifications must be individually defined. Airflow is reversible by turning fan end-for-end. There are clamping rims at each end of the venturi for quick mounting. A single terminal block for all electrical connections. Meets applicable military specifications.

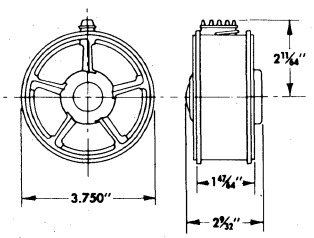


WEIGHT 15.2 OUNCES



OPTIONAL ACCESSORIES:

"Synclamps" for Clamping Rim Mtg. Part #109074-337. (3 Required Per Fan).
"Rever-Synclamps" for Clamping Rim Mtg. Part #309074. (3 Required Per Fan)



PROPIMAX 3

MOTOR	ELECTRICAL							AIR
Series	Volts	Phase	Hz	Cap. Mfd.	RPM	Full Watt Load	Line Amps.	Max. CFM
409ZS	115	1	400	2.5	22,500	100	1.0	220
341JS	200	3	400	—	22,500	80	0.3	220

PROPIMAX 3B

MOTOR	ELECTRICAL							AIR
Series	Volts	Phase	Hz	Cap. Mfd.	RPM	Full Watt Load	Line Amps.	Max. CFM
763ZS	115	1	60	0.5	3,450	10.5	0.12	58
754DS	115	1	400	2.0	11,100	60	0.6	190
718ZS	115	1	400	0.25	7,400	25.5	0.3	125
400ZS*	115	1	400	0.5	6,250	35	0.3	110
473JS	200	3	400	—	11,000	64	0.26	190
387JS*	200	3	400	—	8,300	67	0.3	190
805ZS	115	1	50 60 400	0.25	2,400 3,100 3,300	24 21.5 22	0.24 0.23 0.21	40 52 57

* Altivar

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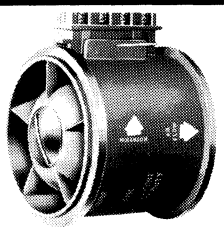
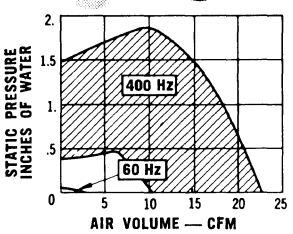
VANEAXIAL FANS

Vaneaxial fans are usually employed in high component density assemblies which require high performance under relatively high air impedance and at the same time offer minimum space for the cooling device. Vaneaxial fans in this group offer exceptional reliability under extreme operating conditions. These fans are generally of high frequency (400 Hz) power designs with resulting extremely high motor rpm. This speed provides the excellent pressure building abilities within their small physical size. They can also be supplied with 50-60 Hz motors. Models with Altivar motors are available for high altitude use in aircraft and unmanned high atmosphere vehicles.

AXIMAX® 1

For Further Information Request Catalog Sheet F-3100.



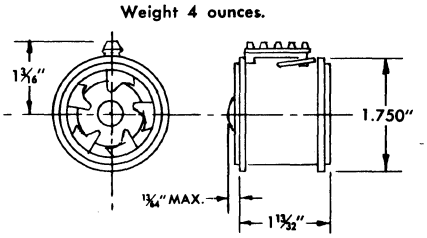


The smallest and lightest of a family of miniature, high frequency fans for use in tightly packaged airborne "black boxes" where size and weight must be held to an absolute minimum, where reliability is critical and where high heat loads must be dissipated with cooling air. The Aximax 1 will answer all of these requirements while overcoming considerable air resistance. It will deliver 17 CFM at 1" w.g. Mounting is by Clamping rims.

The Aximax 1 is available for both pressurized and non-pressurized applications and is built for single-phase or three-phase operations, and meets applicable military specifications.

A 50-60 Hz motor is available.

Weight 4 ounces.

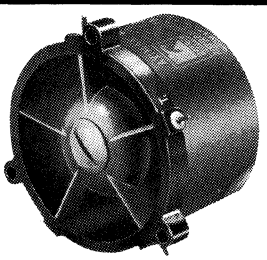


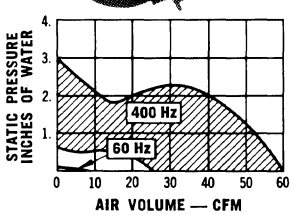
MOTOR	ELECTRICAL							AIR	
Series	Volts	Phase	Hz	Cap. Mfd.	RPM	Full Watt Load	Line Amps.	Max. CFM	Max. S.P. at 0 Del.
606NS	115	1	50-60	1.0	3200	7	0.06	2.6	0.03
623YS	115	1	400	0.25	22750	16	0.15	22	1.5
367JS	200	3	400	—	22500	17	0.1	22	1.5
464YS	115	1	400	0.15	11400	8	0.09	11	0.4

OPTIONAL ACCESSORIES: Altivar Motor.
"Synclamps" for Clamping Rim Mtg. Part #109074-337. (3 Required Per Fan).
"Rever-Synclamps" for Clamping Rim Mtg. Part #309074. (3 Required Per Fan)

AXIMAX 2

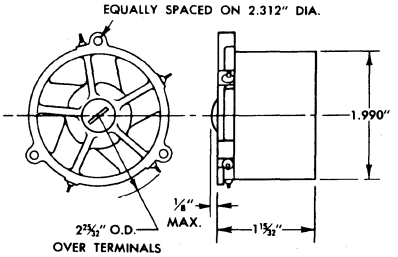
For Further Information Request Catalog Sheet F-3200.





Air delivery of 60 CFM, free delivery, is provided from a fan 2" in diameter by 1.5" axial length. The Aximax 2 is designed for maximum cooling against high static pressures with a minimum space and weight loss. It is available from a choice of constant speed or variable speed motor designs for low or high ambient densities. The Aximax 2 can be supplied with clamping rim mounting and electrical connection to a compact terminal block or as shown in the sketch. It meets applicable military specifications. A 50-60 Hz motor is also available.

Weight: 4.5 ozs.



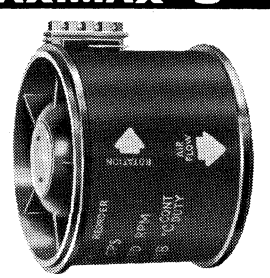
MOTOR	ELECTRICAL							AIR	
Series	Volts	Phase	Hz	Cap. Mfd.	RPM	Full Watt Load	Line Amps.	Max. CFM	Max. S.P. at 0 Del.
606NS	115	1	50-60	1.0	3150	7.0	0.06	8	0.08
368YS	115	1	400	0.5	20000	38	0.33	58	2.8
367JS	200	3	400	—	20500	34	0.13	60	3.0
464YS	115	1	400	0.15	11000	10	0.10	30	0.9
415YS*	115	1	400	0.15	11000	18	0.2	32	1.0
395JS*	200	3	400	—	11000	18	0.1	32	1.0
414YS**	115	1	400	0.25	19500	14	0.14	30	2.5
398JS**	200	3	400	—	20500	12	0.06	32	2.8

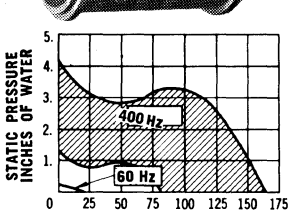
*Varying Low Density
**Varying High Density

OPTIONAL ACCESSORIES:
Altivar Motor, Clamping Rim Mounting.

AXIMAX 3

For Further Information Request Catalog Sheet F-3300.

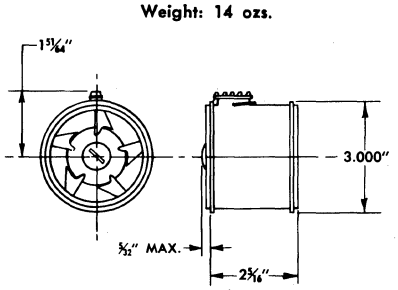




The Rotron Aximax 3 vaneaxial fan is specifically designed for high frequency cooling applications where high air deliveries against high static pressures are to be obtained in a minimum of space, therefore requiring high shaft speed. For airborne equipment, including missiles, the features of the fan will be found particularly attractive. Selection can be made from constant speed motors or varying speed motors for low ambient densities. Airflow is reversible by turning fan end for end. The Aximax 3 is mounted by clamping rims. It meets most applicable military specifications.

A 50-60 Hz motor is also available.

Weight: 14 ozs.



MOTOR	ELECTRICAL							AIR	
Series	Volts	Phase	Hz	Cap. Mfd.	RPM	Full Watt Load	Line Amps.	Max. CFM	Max. S.P. at 0 Del.
599NS	115	1	50-60	0.5	3500	3.5	0.03	23	0.13
341JS	200	3	400	—	22000	126	0.41	157	4.5
422DS	115	1	400	1.0	11300	21	0.26	78	1.2
528YS	115	1	400	2.0	22500	130	1.2	157	4.5
473JS	200	3	400	—	11800	25	0.22	82	1.25
387JS*	200	3	400	—	13900	56	0.25	98	1.7
400YS*	115	1	400	0.5	11000	35	0.30	76	1.1
558YS	115	1	50 60 400	0.25	3200 4500	14 17	0.15 0.16	21 31	0.1 0.2

*Altivar

OPTIONAL ACCESSORIES: Altivar Motor.
"Synclamps" for Clamping Rim Mtg. Part #109074-337. (3 Required Per Fan).
"Rever-Synclamps" for Clamping Rim Mtg. Part #309074. (3 Required Per Fan)

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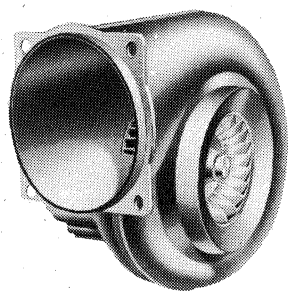
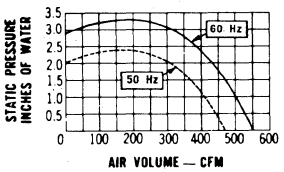
Model CXH33A

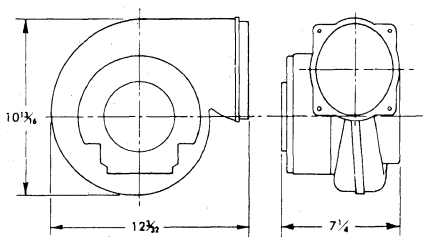
Model CXH29A

CENTRIMAX®

- Delivers more air with more efficiency than conventional squirrel cage blower.
- Package size substantially smaller than assembled squirrel cage blower.
- Motor completely integrated with impeller design.
- No maintenance — oversize, double shielded, precision ball bearings — lubricated for life.
- Ultimate in reliability — no centrifugal starting switches or relays which are the cause of most single phase motor failures.
- Every unit comes equipped with adjustable blast direction — impeller housing can be rotated 360°.

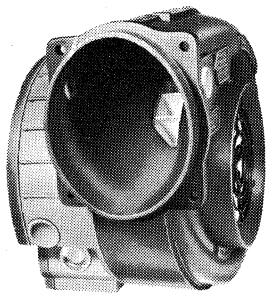


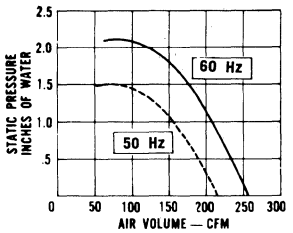


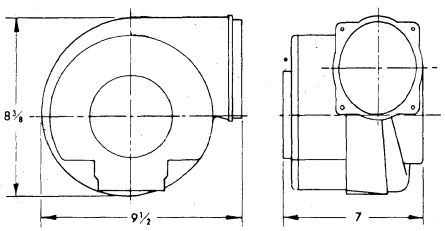


Model	Volts	Hz	Phase	Watts	Amps.	Cap. Mfd.	CFM
CXH33A2	115	50-60	1	420	3.7	12.0	540
CXH33A3	230	50-60	1	380	1.7	6.0	545
CXH33A33	220	50-60	3	400	1.1	—	530

- Can be installed in any attitude and mounted from any one of three mounting surfaces.
- Designed to accept standard, readily available round ducting.
- Blower housing fabricated from flame retardant polyester resin.
- Never rust, never bend.
- Thermal safety cut out feature available as optional.
- Operating temperature from −20°C to 85°C.
- Available in 115 VAC, 60 Hz, single phase; 230 VAC, 50 Hz, single phase; 208-230 VAC, 50-60 Hz, three phase.







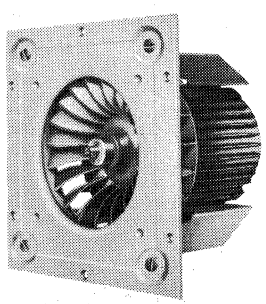
Model	Volts	Hz	Phase	Watts	Amps.	Cap. Mfd.	CFM
CXH29A2	115	50-60	1	145	1.4	6.0	250
CXH29A3	230	50-60	1	135	0.65	6.0	245
CXH29A33	220	50-60	3	130	0.45	—	245

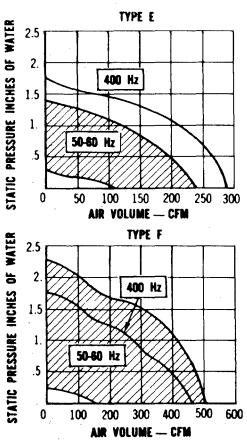
For Further Information Request Catalog Sheet G-3350.

Model G

For complete details request Rotron catalog sheet G-3340.

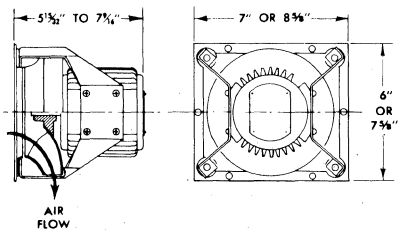
TYPES E & F





The Model G blowers are another type of blower incorporating the centraxial impeller. This blower uses the impeller without a scroll type housing. It consists of a mounting inlet plate holding the motor and the centraxial impeller. It has the unique feature of drawing the air in axially and discharging it uniformly radially 360° around the impeller. The Model G blower incorporates great flexibility in installing the blower in tight spaces.

Two basic sizes of the Model G blower are available. The Type E with airflows up to 285 cfm and maximum static pressures at no delivery up to 1¾" and the Type F with airflows up to 500 cfm and maximum static pressure at no delivery up to 2¼". Motors are available for either 115 or 230 volts, single or three phase, and 50/60 or 400 Hz. Applicable military specifications can be met. Protective screens on the inlet and mounting for the Rotron Model 2A Airflow Switch are available as accessories.



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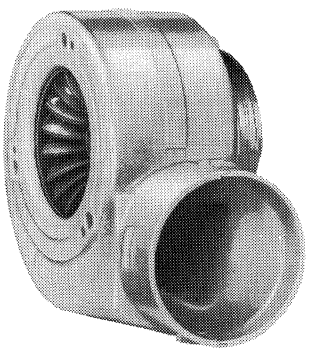
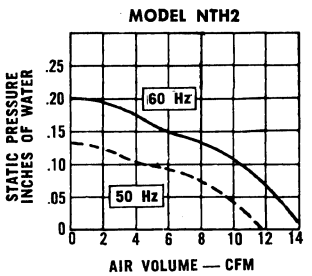
CENTRAXIAL BLOWERS

Centraxial blowers, so named for their unique impellers, are far more efficient than squirrel cage blowers of similar capacity or size. The centraxial impeller functions similarly to a turbine impeller. Therefore, you might compare efficiency by comparing a water turbine to an old fashioned water wheel. Centraxial blowers cost less to buy, cost less to install because of their built-in versatility and cost less to operate since they require less power to get performance.

They operate in the specific speed range of 9,000 to 80,000.

NUGGET® BLOWER





The Nugget (Model NTH2) is a new, compact, low cost blower ideally suitable for spot cooling applications in test instruments, transmitters, TV cameras, office machinery, and tape recorders. Its centraxial wheel, a new design concept by Rotron affords greater efficiency than standard squirrel cage wheels — greater volume to pressure characteristics. It is only $3\frac{19}{32}$" x $4\frac{1}{32}$" x $2\frac{3}{32}$". The Nugget delivers 14 CFM. The Nugget incorporates a specially designed miniature subfractional horsepower induction motor that draws only 7 watts. 115 VAC, 50-60 Hz, 1 Phase, 3200 RPM. The rugged blower housing is injection molded from polycarbonate plastic to form a combination of features which will prove helpful and convenient to any packaging engineer. The Nugget is also available without housing to be used as an air stirring device (Model NTP2). This model requires a space of only $2\frac{1}{2}$" x 2".

OPTIONAL ACCESSORIES:

Plug & Cord Assembly, Part No. 17555 (For both models)

Rim (inlet), Part No. 17469 (For Model NTH2 only)

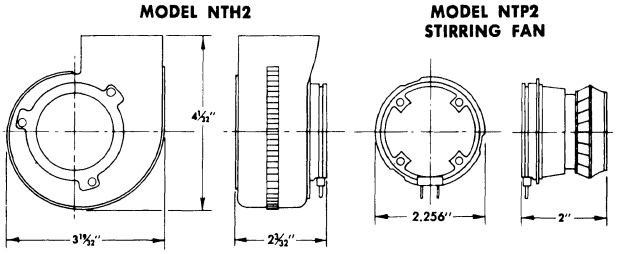
Inlet Clamp Part No. 17597-1 (For Model NTH2 only) (Use with Rim #17469)

Outlet Clamp, Part No. 17597-1 (For Model NTH2 only)

Flange (Outlet) Part No. 17471 (For Model NTH2 only)

3 Brass Inserts, Part No. 19803 to be used on Blower Inlet, Model NTH2

WEIGHT 0.6 POUNDS



For Further Information Request Catalog Sheet G-3310.

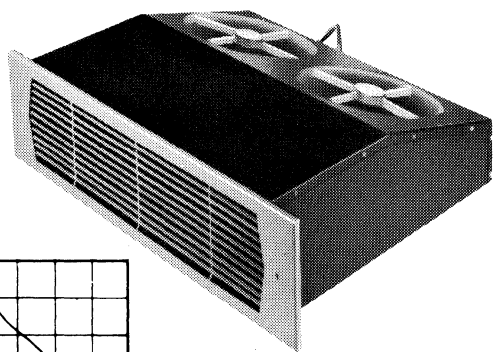
CABINET COOLING PANELS

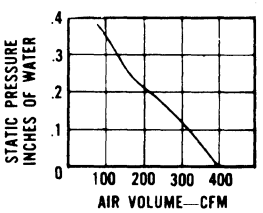
Rotron cooling panels are designed to flush standard 19" enclosed relay racks with clean, filtered air. They may be used to flush several racks simultaneously, if the racks form a single enclosure.

Cooling panels should be mounted in the base of the rack in order to take advantage of the natural convection currents in addition to the forced flow from the fans. For maximum cooling effect, adequate louvering or screening should be provided at the top of the cabinet to allow free passage of the cooling air.

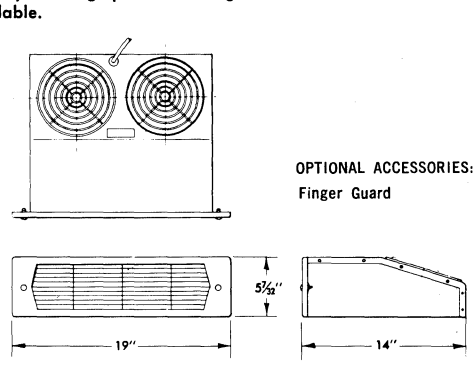
It is always recommended that the cooling panel be used as a pressure-building device for the enclosure, instead of a suction device, since a slight positive pressure inside the housing prevents seepage of dust to the equipment inside. Because the air is drawn to the fans through a filter, equipment is kept as clean as possible.

TWINPAX®-2





The Twinpax-2 is a cooling panel consisting of twin Feather Fans; a permanent, washable aluminum filter mounted in a compact, well constructed box and an attractive grille which enhances the appearance of the customers equipment. The high air performance of 400 CFM is directed upward so as to minimize dead spots or eddying within the cabinet to assure maximum cooling of all components within the system. The Twinpax-2 requires only $5\frac{1}{4}$" of panel height in the base of the rack and may be quickly installed by means of standard EIA notching. When installed and operating it will dissipate 1.9 kw of heat with a 15°F temperature rise. The noise level is only 55 db (SIL). The power requirement is 115-230 VAC, 50 60 Hz, 1 Phase. Capacitors and an electrical cord are provided. The fans have prelubricated stainless steel ball bearings suitable for years of maintenance-free operation over an ambient temperature range of —55°C to +65°C. A Twinpax-1, military cooling panel utilizing two Rotron Saucer Fans is also available.



OPTIONAL ACCESSORIES:
Finger Guard

For Further Information Request Catalog Sheet L-7100.

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Spiral® BLOWERS

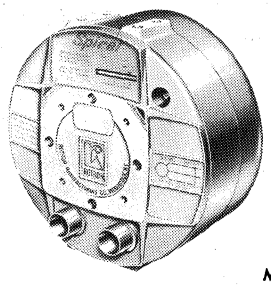
Spiral blowers are revolutionary new motor-blower packages designed to develop unusually high positive or negative air pressure at low to moderate volume of air. Thus, performance achieved without the use of sliding seals or vanes. Contacting surfaces are confined to the precision extra wide ball bearings, lubricated for extremely long life — no maintenance is required.

Life expectancy is enhanced by their low speed motors as well as by the absence of brushes or commutators. The RF noise, characteristic of the universal motors generally used in vacuum cleaner type blowers, is eliminated.

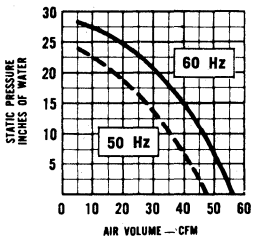
Optional accessories include adjustable trimmer valve, differential pressure gauges for instantaneous trimming to system requirements and a thermal protector.

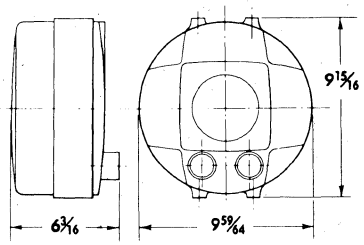
SIMPLEX SPIRAL

For Further Information Request Catalog Sheet J-6600.



MODEL SL2



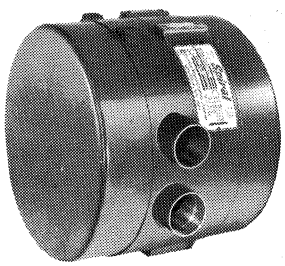


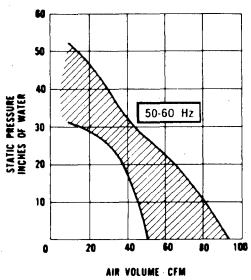
Features:

- Economically priced.
- Only 10" in diameter by 5½" in depth.
- New Rotron induction motor.
- High strength aluminum die castings.
- Precision ball bearings.
- Lubricated for life.
- No RF noise interference.
- Available in: 115 volts, 50-60 Hz, single phase; 208/230 volts, 50-60 Hz, 3 phase; 220/230 volts, 50 Hz, single phase.

DUPLEX SPIRAL

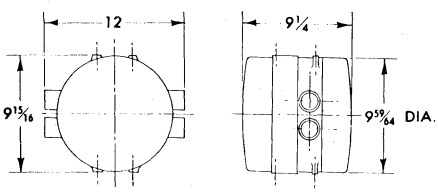
For Further Information Request Catalog Sheet J-6610.





The Duplex Spiral offers greater performance characteristics than the Spiral Model SL2 above. By internal ducting of the airflow from two impellers, higher pressures are achieved with Model SL4; Model SL5 extends the airflow range, and Model SL6 provide an economical source of **two** independent high pressure air streams, which can be utilized at different pressure levels. While the dimensions of all these models are the same, the functions cannot be changed in the field. The Duplex Spiral is designed for use in ambient temperatures up to 55°C, in typical applications as:

- Magnetic tape slack control and capstan motor cooling in one package (Model SL6).
- Document and card handling equipment.
- Paper tape and card reading equipment.
- Power supply for fluid amplifiers.
- Laser head cooling.
- Printed circuit motor cooling.
- Materials handling.
- Waveguide pressurization, or cooling.
- Actuation of machine elements.
- Gas sampling and purification.
- Air bearings for tape and film.
- Microwave cavity cooling.
- For holding photographic film or paper on rollers OR frames.



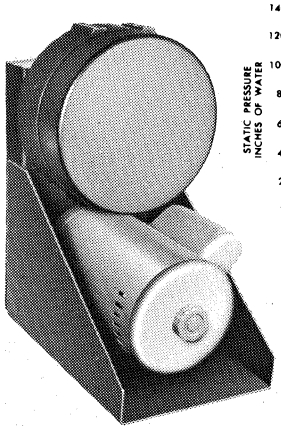
Remember these features:

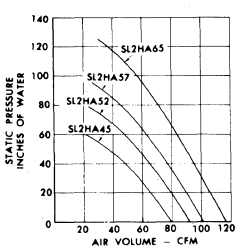
- Two independent air sources from one package.
- Two jobs for the price of one.
  OR
- Extended performance — pressures — vacuums to 2 PSIG.
  OR
- Extended performance — airflow delivery up to 94 CFM.
- Oil free air flow — no possible contamination.
- Quiet.
- Low Speed — 3300 RPM.
- Economically priced.
- Continuous duty.
- Available for single or three phase, 50-60 Hz power, 115 or 208/230 VAC.
- Optional accessory — Dust filter.

BELT DRIVEN SPIRAL BLOWER

For complete details, request Rotron catalog sheet J-6620.

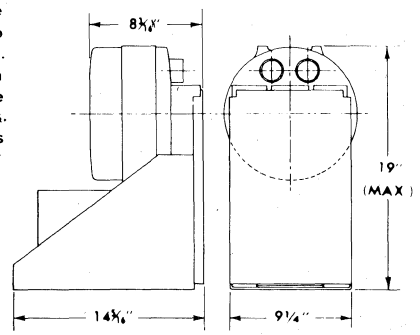
MODEL SL2HA





To obtain even higher pressures and airflows than can be obtained with a Model SL2 or Duplex Spiral shown above, Rotron has adopted the Model SL2 to be belt driven from an external motor. This permits the blower speed of the Model SL2 Spiral to be increased for higher air performance. Pressures or vacuums up to 4½ psig can be obtained. Flows at free delivery of 115 cfm can be obtained. The flexibility of different pulley ratios permits the designer to meet altitude and frequency requirements without overdesign.

Motors used with this blower are induction motors with no brushes to wear and operate at 3450 rpm. They are available in all common voltages and frequencies and have permanently lubricated ball bearings. Belts are designed for 10,000 hours life with no maintenance or adjustments.



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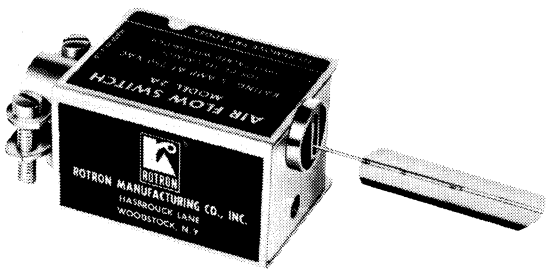
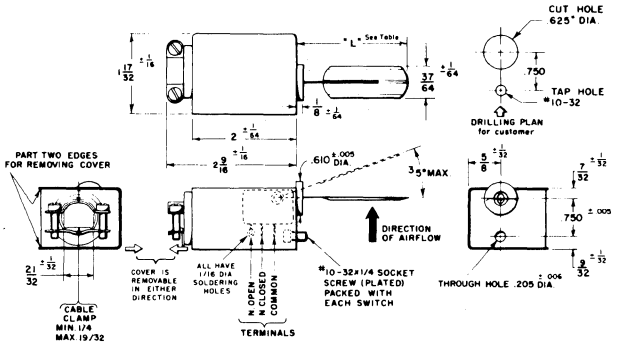
AIRFLOW INTERLOCK SWITCH

For Further Information Request Catalog Sheet K-6800.

The Rotron Model 2A Airflow Interlock Switch provides insurance against equipment damage due to a loss of the cooling airflow regardless of the reason for the malfunction. The Model 2A Airflow Switch is a velocity actuated switch, not pressure actuated, and senses the loss of airflow because of an obstruction, or air leak up-stream from its location, or due to the failure of the cooling fan. The switch is a single pole double throw type and normally open and normally closed contacts are available which may be used to turn off the power to the endangered equipment or actuate alarm systems. Eight different vane sizes are available to size the switch for various air velocities. A convenient determinator kit permits quick selection of the proper air vane for a particular application.





Rotron Model 2A Airflow Switches Will Actuate and De-Actuate in an Airstream of the Following Velocity in Ft./Min. For "Standard" Air (29.9 Inch HG, 70°F).

		HORIZONTAL AIRSTREAM							
		VERTICAL-UP AIRSTREAM		ARM HORIZONTAL		ARM VERTICAL VANE DOWN		VERTICAL-DOWN AIRSTREAM	
Type No.	Dim. "L" Max.	Increasing Air Ft./Min.	Decreasing Air Ft./Min.	Increasing Air Ft./Min.	Decreasing Air Ft./Min.	Increasing Air Ft./Min.	Decreasing Air Ft./Min.	Increasing Air Ft./Min.	Decreasing Air Ft./Min.
		Actuate	Deactuate	Actuate	Deactuate	Actuate	Deactuate	Actuate	Deactuate
1000	2 23/32	785	700	735	630	750	615*	NOT USABLE	NOT USABLE
1350	2 7/32	1125	1030	1025	970	1000	890	720**	685**
1600	1 15/16	1340	1212	1215	1095	1225	1130	1040'	865**
1800	1 21/32	1550	1450	1460	1335	1500	1375	1280	1115*
2000	1 7/16	1800	1675	1790	1580	1760	1580	1595*	1425*
2450	1 1/8	2340	2120	2120	1867	2270	2035	2125	1950
3000	15/16	2925	2700	2690	2420	2880	2570	2780	2395
4000	3/4	4000	3680	3720	3485	3870	3520	3760	3565

NOTE: All figures shown above are ±10% except: *Denotes ±15% **Denotes±20%

BATAC® DELTAC

SOLID STATE INVERTERS AND CONVERTERS FOR USE WITH ROTRON FANS AND BLOWERS

A variety of solid state Batac inverters capable of converting 12, 28, 32 and other DC voltages to 60 Hz and 400 Hz are available for use with Rotron Aximax 1, Aximax 2 and Aximax 3 Vaneaxial fans. Rotron Propimax 2, Propimax 3 and 3B Tubeaxial fans and some Model D blowers can also be used.

Also available for use with the aforementioned fans is a variety of solid state Deltac converters capable of increasing or decreasing output frequency with respect to input, on 115 VAC, single phase supplies.

Designs are compact and offer high reliability, consistent with other Rotron products.

For further details, contact Rotron Application Engineering Department.



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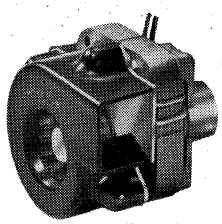
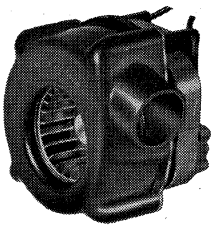
Superior . . . **RIPLEY COMPANY, INC.** **RIPLEY** ESTABLISHED 1936 *through Research* **MIDDLETOWN, CONN.**

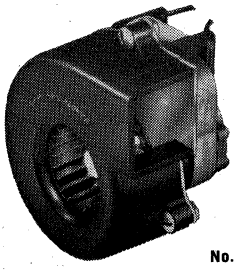
SPACE-SAVING *Precision Bearing* MOTOR-BLOWERS



No. 1½



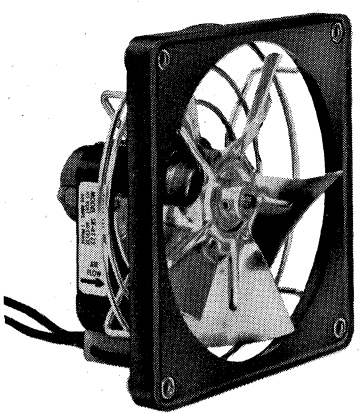
No. 2



No. 2½

A new line of compact Motor-Blowers are now available with air deliveries ranging from 5 to 19 cfm free air output. Designed to fill the requirements where space is a problem and a minimum of 5-year maintenance free performance is imperative. The precision bearing "power-pac" motor with permanent sealed-in lubrication requires no oiling and operates at an extremely low noise level. The unit can be mounted in any position. The low input wattage required is a cost saving factor of particular advantage in multiple installations.

MODEL NUMBER	TYPE	INPUT VOLTAGE	WATTS	DUTY CYCLE	RPM	OUTPUT FREE AIR CFM	DIMENSIONS H x W x D	LIST PRICE
UK-1500	1½	115 V. AC-60 Cycle	7.5	Continuous	3400	5	2 15/16" x 3⅝" x 3 1/16"	$9.69
UK-2000	2	115 V. AC-60 Cycle	7.5	Continuous	3300	10	3¾" x 3½" x 3¼"	$9.78
UK-2500	2½	115 V. AC-60 Cycle	8	Continuous	3250	19	4⅜" x 3⅞" x 3¼"	$9.90



GUARANTEED FOR FIVE YEARS

AXIAL FAN

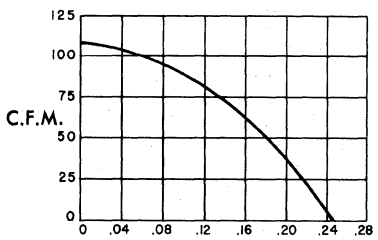
THE BIG VALUE IN RUGGEDNESS COMPACTNESS & HIGH EFFICIENCY

SPACE SAVING DESIGN

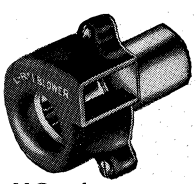
MODEL SK-4125

108 CFM Axial Fan designed for electronic and instrumentation cooling. Guaranteed for Five Years — (upon approval of application). Mounts on 4⅛" square — vertical or horizontal operating position. Permanently sealed-in lubrication — maintenance free. Overall mounting plate size is 4 1/16" square and depth is 3 1/16".

108 CFM CAPACITY



L-R MOTOR & BLOWER ASSEMBLIES



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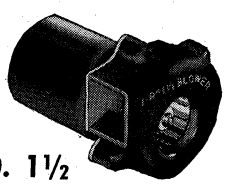

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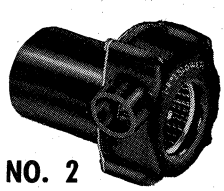

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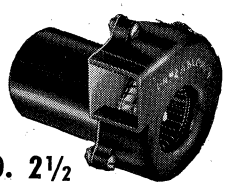

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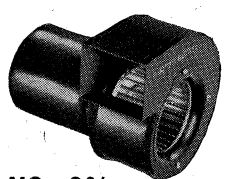

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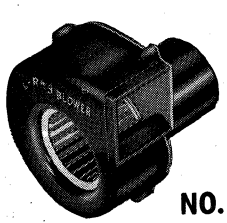

NO. 3

CUSTOM ENGINEERED

to meet your exact application requirements

Laboratory facilities have been expanded to provide engineering service when it's the most valuable — in the initial stages of your new design application.

. . . or STOCKED

for immediate delivery

Ripley offers a full line of air-moving units, axial fans, motor-blower assemblies, precision-bearing blowers. Write for price list and free catalog.

For quick response, contact Sales Department Telephone (203) 346-6677

Active Electronic Filters

These filters single out or eliminate frequency ranges of interest and help to focus on the significant frequencies. All instruments are portable, lightweight, low power units.

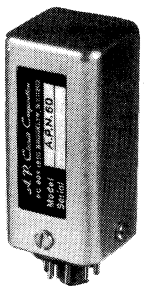

FIG. A



FIG. B

- **Notch Filters**
- **Variable Filters**
- **Fixed Filters**

Literature upon request

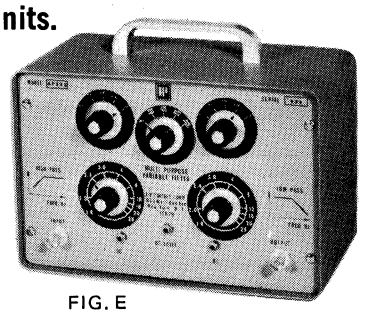

FIG. E
5.5 lbs.

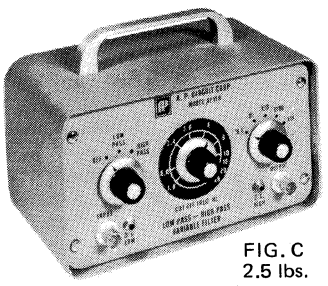

FIG. C
2.5 lbs.

ACTIVE NOTCH, LOW PASS, HIGH PASS FILTERS

These filters are available in a number of standard versions. Additional frequencies are available upon request.

60 Hz NOTCH FILTER – APN 60 reduces 60 Hz content to less than 1% of input voltage but passes all other frequencies from D.C. to 200 KHz. The rejection bandwidth can be narrowed to 1 Hz. Q's up to 60 can be obtained by an external adjustment. A power supply is available.

FIXED LOW PASS, HIGH PASS FILTER – Any cutoff frequency from 0.01 Hz to 20 KHz. 24 DB/octave skirt.

ALL UNITS FEATURE: Unity gain in passband, max. swing 4 volts R.M.S., input impedance 1 megohm, output impedance 200 ohm driving up to 20,000 ohm load. 9 volt radio batteries supply the power.

MODEL	FIG.	FUNCTION	PRICE
APN 60	A	60 Hz NOTCH	$155.
APN 50	A	50 Hz NOTCH	155.
APN 120	A	120 Hz NOTCH	155.
APN 400	A	400 Hz NOTCH	155.
APS I		NOTCH POWER SUPPLY	58.
APL	B	LOW PASS	105. *
APH	B	HIGH PASS	105. *

** Price Higher Below 2 Hz.*

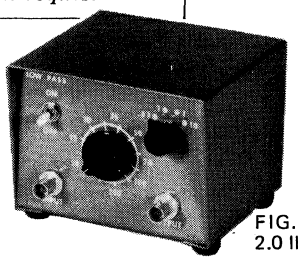

FIG. D
2.0 lbs.

PORTABLE VARIABLE FILTERS

These fully transistorized variable filters let you set cut off frequencies continuously and are available in a variety of versions as shown in the table below.

All units feature: Unity gain in passband, max. swing 4 volts R.M.S., 24 DB/octave skirt, max. attenuation 80 DB, input impedance 1 megohm, output impedance 200 ohm driving up to 20,000 ohm load. 9 volt radio batteries supply the power.

Model *	Figure	Low Pass	High Pass	Band Pass	Band Reject	Tuning Range	Price
APVL-41-4	D	✓				0.2Hz–2KHz	330.-
APVL-42-4	D	✓				2Hz–20KHz	330.-
APVL-43-5	D	✓				0.02Hz–2KHz	375.-
APVL-44-5	D	✓				0.2Hz–20KHz	375.-
APVL-1	D	✓				1 Decade †	210.-
APVH-41-4	D		✓			0.2Hz–2KHz	330.-
APVH-42-4	D		✓			2Hz–20KHz	330.-
APVH-43-5	D		✓			0.02Hz–2KHz	375.-
APVH-44-5	D		✓			0.2Hz–20KHz	375.-
APVH-1	D		✓			1 Decade †	210.-
APVLH-41-5	C	✓	✓			0.2Hz–20KHz	430.-
APVLH-42-4	C	✓	✓			2.0Hz–20KHz	385.-
APVLH-43-4	C	✓	✓			0.2Hz–2KHz	385.-
APVLH-44-5	C	✓	✓			0.02Hz–2KHz	430.-
AP-230-4	E	✓	✓	✓		2Hz–20KHz	580.-
AP-235-5	E	✓	✓	✓		0.02Hz–2KHz	680.-
AP-240-4	E	✓	✓	✓		0.2Hz–2KHz	580.-
AP-245-5	E	✓	✓	✓		0.2Hz–20KHz	680.-
AP-250-4	E	✓	✓	✓	✓	0.2Hz–2KHz	650.-
AP-255-5	E	✓	✓	✓	✓	0.2Hz–20KHz	750.-
AP-260-5	E	✓	✓	✓	✓	0.1Hz–10KHz	800.-
AP-265-5	E	✓	✓	✓	✓	0.02Hz–2KHz	750.-
AP-270-4	E	✓	✓	✓	✓	2.0Hz–20KHz	650.-

** Last Digit indicates Number of Decades covered.*

† Available Ranges 0.1-1.0, 0.2-2.0, 0.5-5.0 and multiples of 1, 10, 100, 1000. Other ranges upon request.

For Additional Information write to Dept. P.

A.P. CIRCUIT CORPORATION

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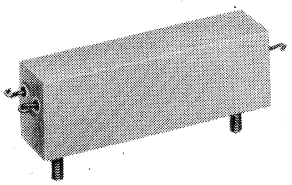
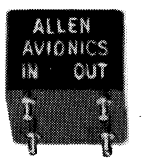
FILTERS

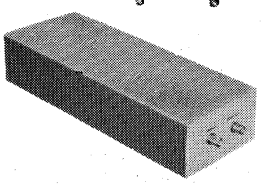
CUSTOM-BUILT L-C FILTERS

200 CYCLES TO 50 MEGACYCLES FAST PROTOTYPES

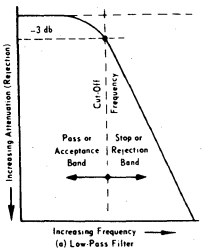
TYPES: LOW PASS, HIGH PASS, BAND PASS, BAND STOP.
FREQUENCY RANGE: 200 Cycles to 50 Megacycles.
IMPEDANCE RANGE: 50 ohms to 100 K ohms.
CONSTRUCTION: Epoxy encapsulated or hermetically sealed in steel cans.
SIZE: From .625 x .625 x .450 depending on electrical specifications.
DELIVERY: Prototypes can often be delivered in 1 week.

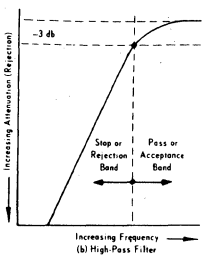


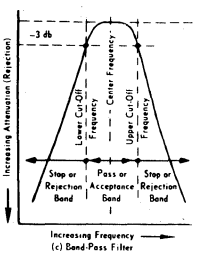


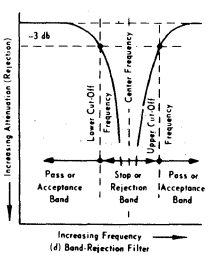












TYPICAL FILTERS

LOW PASS

Cut Off Frequency (3 db max.)	Attenuation (Minimum)	Maximum Passband Ripple	Impedance Ohms	Size Inches
375 kc	30 db @ 510 kc 50 db @ 645 kc	.5 db	600	1.5 x 2 x .8
3.3 mc	40 db @ 5.2 mc 50 db @ 5.95 mc	.25 db	100	1.2 x 1.5 x .8
16.5 mc	40 db @ 26 mc	.25 db	100	.625 x .625 x .450
27.5 mc	20 db @ 39.5 mc 30 db @ 46.5 mc	1 db	75	.625 x .625 x .450

HIGH PASS

Cut Off Frequency (3 db max.)	Attenuation (Minimum)	Maximum Passband Ripple	Impedance Ohms	Size Inches
350 kc	30 db @ 285 kc 50 db @ 245 kc	1 db	500	1.5 x 2 x .8
3.5 mc	20 db @ 2.65 mc 40 db @ 2.05 mc	.25 db	400	1.2 x 1.5 x .8
10.5 mc	20 db @ 8.05 mc 40 db @ 6.25 mc	.25 db	100	1.2 x 1.5 x .8
17.5 mc	20 db @ 11.6 mc 40 db @ 7.75 mc	.25 db	75	.625 x .625 x .450

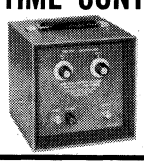
BAND PASS

Center Freq.	Bandwidth (3 db max.)	Attenuation (Minimum)	Maximum Passband Ripple	Impedance Ohms	Size Inches
80 kc	20 kc	20 db below 66 kc above 97 kc	1 db	500	1.5 x 2 x .8
1.2 mc	300 kc	30 db below 985 kc above 1.46 mc	3 db	500	1.2 x 1.5 x .8
4.5 mc	1 mc	20 db below 3.8 mc above 5.4 mc	1 db	75	1.5 x .8 x .5
8 mc	1.6 mc	20 db below 6.8 mc above 9.4 mc	1 db	100	1.5 x .8 x .5

BAND STOP

Notch Freq.	Bandwidth (3 db max.)	Attenuation (Minimum)	Maximum Passband Ripple	Impedance Ohms	Size Inches
680 kc	150 kc	35 db from 665 kc to 695 kc	.5 db	500	1.5 x 2 x .8
3.6 mc	800 kc	20 db from 3.45 mc to 3.75 mc	.25 db	75	1.2 x 1.5 x .8
10.7 mc	2.5 mc	20 db from 10.3 mc to 11.1 mc	.25 db	150	1.2 x 1.5 x .8

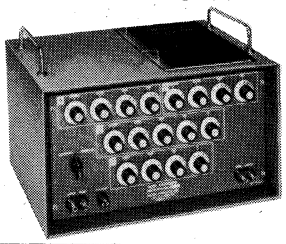
RISE TIME CONTROL — MODEL 50-1



The model 50-1 was designed for precise adjustment of the rise and fall time of pulse generators. This unit slows the pulse by a controlled amount by means of Gaussian filters. Any of 110 different filters can be selected by the use of two decade switches. Rise times are controlled in 10 nanosecond steps from 0 to 1.1 microseconds. The 50 ohm input allows for direct impedance match to the output of most pulse generators.

SPECIFICATIONS:
Impedance: 50 ohm.
Filter Type: Gaussian (passive).
Overshoot: 5%.
Maximum Rise (and Fall) Time: 1.1 microseconds.
Steps: .01 microseconds.
Accuracy of Rise Time Reading: 10%.
Size: 7″ x 8″ x 8″.

FILTER SYNTHESIZER — MODEL 10K-1M



Design a filter in a minute.
Check it in your circuit in another minute.
Install the components on your breadboard.

The filter synthesizer is composed of all passive elements. As you use it, you always know the circuit that is in use, and the values that are being used.

Design the filter with the nomographs supplied. No knowledge of filter design theory is required. Choose any impedance between 100 and 1000 ohms. (Higher and lower impedances not on the nomographs can be calculated from formulas supplied.) Choose any frequency between 10 kc and 1 megacycle. (For other frequencies use the formulas.)

Choose one of the different types of elliptical high or low pass filters. Set the values from the nomographs into the decade capacitors and inductors and check the filter in your circuit. If it is satisfactory, install the capacitors and inductors in your breadboard and the filter is finished.

Frequency Range: 10 kc to 1 megacycle (Higher and lower with a restriction on impedance).
Impedance Range: 100 to 1000 ohms (Higher and lower with a restriction on frequency).
Type: High pass or low pass elliptical function filters 20 db to 40 db attenuation.
Construction: All networks passive and controlled by decades.

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LOWPASS • L-C FILTERS • HIGHPASS

LOWPASS FILTERS—SERIES "FL"

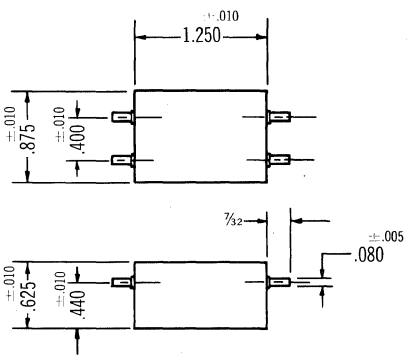
Size: 1¼ x ⅞ x ⅝ inches
Impedance: 100Ω
1db maximum ripple in passband
1db maximum insertion loss (referenced at 350kc)
20db Min. Attenuation at 3db cut-off Freq. x 1.15
40db Min. Attenuation at 3db cut-off Freq. x 1.4

Maximum 3db Attenuation	Minimum 20db Attenuation	Minimum 40db Attenuation
30 meg.	34.50 meg.	42.00 meg.
29	33.40	41.60
28	32.20	39.20
27	31.05	37.80
26	29.90	36.40
25	28.75	35.00
24	27.60	33.60
23	26.45	32.20
22	25.30	30.80
21	24.15	29.40
20	23.00	28.00
19	21.85	26.60
18	20.70	25.20
17	19.55	23.80
16	18.40	22.40
15	17.25	21.00
14	16.10	19.60
13	14.95	18.20
12	13.80	16.80
11	12.65	15.40
10	11.50	14.00
9	10.35	12.60
8	9.20	11.20
7	8.05	9.80
6	6.90	8.40
5	5.75	7.00

IMMEDIATE DELIVERY!

The "FL" & "FH" Filter Series are a group of 9 Pole Tchebycheff Low & Highpass Filters which are diminutive in size. Both Filter Groups contain components made to meet the requirements of the latest applicable Mil-Specs and conform to the best electrical and mechanical design practice.

ALL FILTERS LISTED CAN BE DELIVERED FROM STOCK



HIGHPASS FILTERS—SERIES "FH"

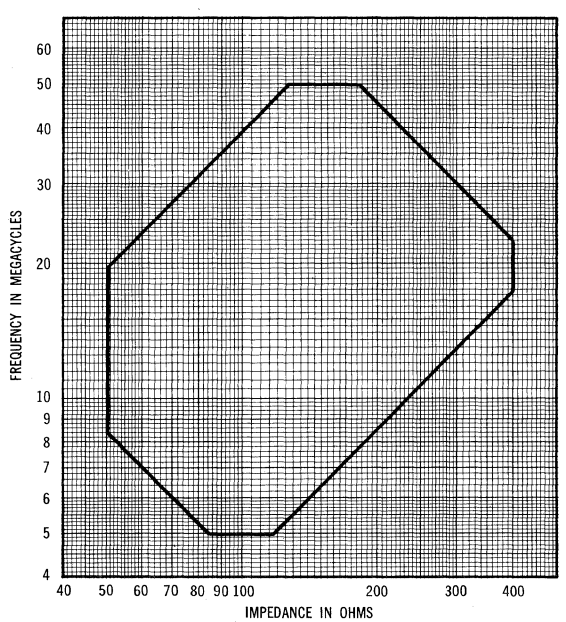
Size: 1¼ x ⅞ x ⅝ inches
Impedance: 100Ω
1db maximum ripple in passband
1db maximum insertion loss (referenced at 30 meg.)
20db Min. Attenuation at $\frac{\text{3db cut-off Frequency}}{1.15}$
40db Min. Attenuation at $\frac{\text{3db cut-off Frequency}}{1.40}$

Maximum 3db Attenuation	Minimum 20db Attenuation	Minimum 40db Attenuation
20.0 meg.	17.40 meg.	14.30 meg.
19.0	16.50	13.55
18.0	15.65	12.85
17.0	14.75	12.15
16.0	13.90	11.45
15.0	13.05	10.70
14.0	12.15	10.00
13.0	11.30	9.30
12.0	10.45	8.55
11.0	9.55	7.85
10.0	8.70	7.15
9.0	7.80	6.40
8.0	6.95	5.70
7.0	6.10	5.00
6.0	5.20	4.30
5.0	4.35	3.55
4.0	3.48	2.86
3.0	2.61	2.14

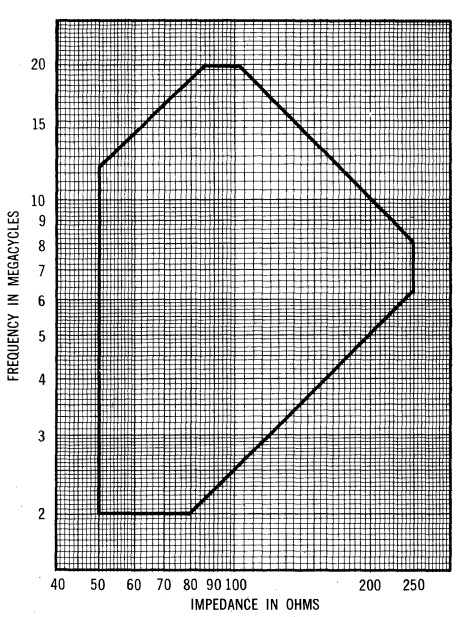
TO ORDER SPECIFY "FL" FOR LOWPASS OR "FH" FOR HIGHPASS AND THE CUT-OFF FREQUENCY

A VERY USEFUL APPLICATION is the series connection of a Lowpass & Highpass unit to produce an effective Bandpass Filter. Custom built Filters can be put into this package if they are within the Impedance-Frequency limits of the graphs.

LOWPASS



HIGHPASS



All-tronics, inc.

RADIO INTERFERENCE FILTERS

RECTANGULAR TYPES

EFFECTIVE TO 400 MEGAHERTZ

SELECT ELECTRICAL AND MECHANICAL FEATURES EXACTLY TO YOUR NEEDS.

STANDARDIZED FILTERS!

QUICK DELIVERY!

FOLLOW THESE EASY STEPS—

1. DETERMINE CURRENT AND VOLTAGE OF CIRCUIT WHERE THIS FILTER WILL BE USED.
2. OBTAIN BASIC PART NUMBER FROM TABLE BELOW BASED ON SUPPRESSION REQUIREMENTS.
3. SELECT MOUNTING STYLE AND TERMINAL TYPE FROM FOLLOWING PAGES.
4. BUILD UP PART NUMBER THIS WAY —

70D 6.3G W11

BASIC PART NUMBER — MOUNTING STYLE — TERMINAL TYPE

AMPERES	Case Size a	b	c	0-70 Volts DC Series Basic Part No.	db	400 VDC/150 VAC 0-70 Hertz Series Basic Part No.	db	150 VAC 50-1000 Hertz Series Basic Part No.	db	600 VDC/250 VAC 0-70 Hertz Series Basic Part No.	db	250 VAC 50-1000 Hertz Series Basic Part No.	db
0.40	1 1/8	1	11/16	70D0.4E	48	400D0.4E	24	400A0.4E	24	*	*	*	*
	1 3/4	1 1/4	7/8	70D0.4F	60	400D0.4F	47	400A0.4F	47	600D0.4F	42	600A0.4F	42
	2	1 3/4	1 1/8	70D0.4G	90	400D0.4G	90	400A0.4G	90	600D0.4G	90	600A0.4G	90
0.63	1 1/8	1	11/16	70D0.6E	48	*	*			*	*	*	*
	1 3/4	1 1/4	7/8	70D0.6F	56	400D0.6F	40	400A0.6F	40	600D0.6F	35	600A0.6F	35
	2	1 3/4	1 1/8	70D0.6G	90	400D0.6G	85	400A0.6G	92	600D0.6G	83	600A0.6G	87
	2	2	1 1/4	*	*	*	*	*	*	600D0.6H	90	600A0.6H	90
1.0	1 1/8	1	11/16	70D1.0E	47	*	*	*	*	*	*	*	*
	1 3/4	1 1/4	7/8	70D1.0F	53	400D1.0F	30	400A1.0F	30	600D1.0F	30	600A1.0F	30
	2	1 3/4	1 1/8	70D1.0G	87	400D1.0G	74	400A1.0G	87	600D1.0G	75	600A1.0G	80
	2	2	1 1/4	*	*	*	*	*	*	600D1.0H	88	600A1.0H	90
2.5	1 1/8	1	11/16	70D2.5E	24	*	*	*	*	*	*	*	*
	1 3/4	1 1/4	7/8	70D2.5F	35	*	*	*	*	*	*	*	*
	2	1 3/4	1 1/8	70D2.5G	75	400D2.5G	57	400A2.5G	60	600D2.5G	59	600A2.5G	64
	2	2	1 1/4	70D2.5H	80	400D2.5H	63	400A2.5H	67	600D2.5H	69	600A2.5H	70
4.0	2	1 3/4	1 1/8	70D4.0G	72	400D4.0G	48	400A4.0G	52	600D4.0G	50	600A4.0G	52
	2	2	1 1/4	70D4.0H	82	400D4.0H	68	400A4.0H	68	600D4.0H	62	600A4.0H	62
	3 1/16	2 7/8	1 5/8	*	*	*	*	*	*	600D4.0J	77	600A4.0J	85
6.3	2	1 3/4	1 1/8	70D6.3G	72	400D6.3G	43	400A6.3G	45	600D6.3G	44	600A6.3G	47
	2	2	1 1/4	70D6.3H	80	400D6.3H	60	400A6.3H	60	600D6.3H	55	600A6.3H	55
	3 1/16	2 7/8	1 5/8	*	*	400D6.3J	88	400A6.3J	90	600D6.3J	75	600A6.3J	75
10	2	1 3/4	1 1/8	70D10G	60	400D10G	40	400A10G	43	600D10G	27	600A10G	30
	2	2	1 1/4	70D10H	72	400D10H	50	400A10H	54	600D10H	35	600A10H	35
	3 1/16	2 7/8	1 5/8	70D10J	90	400D10J	72	400A10J	75	600D10J	63	600A10J	66
16	2	2	1 1/4	70D16H	55	400D16H	25	400A16H	25	*	*	*	*
	3 1/16	2 7/8	1 5/8	70D16J	77	400D16J	65	400A16J	65	600D16J	49	600A16J	55
25	3 1/16	2 7/8	1 5/8	70D25J	70	400D25J	55	400A25J	55	600D25J	44	600A25J	48
	3 1/16	2 7/8	2 1/8	70D25K	84	400D25K	60	400A25K	65	600D25K	55	600A25K	60
40	3 1/16	2 7/8	1 5/8	70D40J	50	400D40J	20	400A40J	23	600D40J	35	600A40J	35
	3 1/16	2 7/8	2 1/8	70D40K	75	400D40K	50	400A40K	50	600D40K	45	600A40K	45
63	3 1/16	2 7/8	1 5/8	70D63J	50	400D63J	19	400A63J	22	600D63J	35	600A63J	35
	3 1/16	2 7/8	2 1/8	70D63K	55	400D63K	50	400A63K	50	600D63K	40	600A63K	45
	3 1/2	3 1/2	2 1/2	70D63L	80	400D63L	60	400A63L	60	600D63L	45	600A63L	54
100	3 1/16	2 7/8	2 1/8	70D100K	55	400D100K	50	400A100K	50	600D100K	40	600A100K	45
	3 1/2	3 1/2	2 1/2	70D100L	60	400D100L	55	400A100L	55	600D100L	45	600A100L	50

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RADIO INTERFERENCE FILTERS

TUBULAR TYPES

EFFECTIVE TO 10 GHz

SELECT ELECTRICAL AND MECHANICAL FEATURES EXACTLY TO YOUR NEEDS.

FOLLOW THESE EASY STEPS —

1. DETERMINE CURRENT AND VOLTAGE OF CIRCUIT WHERE THIS FILTER WILL BE USED.
2. OBTAIN BASIC PART NUMBER FROM TABLE BELOW BASED ON SUPPRESSION REQUIREMENTS.
3. SELECT MOUNTING STYLE AND TERMINAL TYPE FROM THIS PAGE.
4. BUILD UP PART NUMBER THIS WAY —

STANDARDIZED FILTERS!

70R2.5M M 10

BASIC PART NUMBER — MOUNTING STYLE — TERMINAL TYPE

AMPERES	Case Size		0-70 Volts DC Series		400 VDC/150 VAC 0-500 Hertz Series		600 VDC/250 VAC 0-500 Hertz Series	
	Dia.	Length	Basic Part No.	db	Basic Part No.	db	Basic Part No.	db
1.0	1	2½	70R1.0M	75	400R1.0M	70	600R1.0M	55
	1	4	70R1.0P	90	400R1.0P	85	600R1.0P	70
2.5	1	2½	70R2.5M	75	400R2.5M	60	*	*
	1	4	70R2.5P	88	400R2.5P	70	600R2.5P	55
	1⅜	4⅛	*	*	400R2.5R	90	600R2.5R	75
4.0	1	4	70R4.0P	75	400R4.0P	65	600R4.0P	45
	1⅜	4⅛	70R4.0R	90	400R4.0R	85	600R4.0R	70
6.3	1	4	70R6.3P	70	*	*	*	*
	1⅜	4⅛	70R6.3R	85	400R6.3R	65	600R6.3R	45
	1½	4⅜	*	*	400R6.3S	90	600R6.3S	75
10.0	1	4	70R10P	60	*	*	*	*
	1⅜	4⅛	70R10R	80	400R10R	65	600R10R	45
	1½	4⅜	*	*	400R10S	80	600R10S	60
16.0	1⅜	4⅛	70R16R	70	400R16R	55	600R16R	35
	1½	4⅜	70R16S	85	400R16S	70	600R16S	50
20.0	1½	4⅜	70R20S	70	400R20S	60	600R20S	40

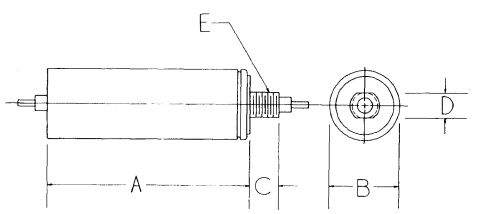
MOUNTING STYLES

IF BASIC PART NUMBER ENDS WITH THIS LETTER

STYLE M

STYLE M DIMENSIONS ARE

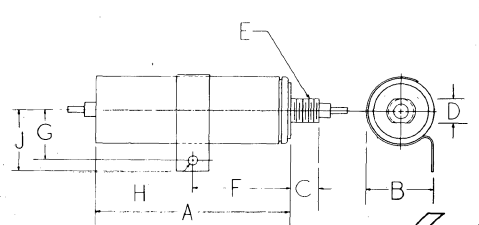
	A	B	C	D	E
M	2½	1	7/16	3/8	7/16-20NF
P	4	1	7/16	3/8	7/16-20NF
R	4⅛	1⅜	5/8	17/32	5/8-24NF
S	4⅜	1½	5/8	17/32	5/8-24NF



STYLE L

STYLE L DIMENSIONS ARE

	A	B	C	D	E	F	G	H	J
M	2½	1	7/16	3/8	7/16-20NF	1¼	¾	0.156	15/16
P	4	1	7/16	3/8	7/16-20NF	2	¾	0.156	15/16
R	4⅛	1⅜	5/8	17/32	5/8-24NF	2⅛	1	0.195	1¼
S	4⅜	1½	5/8	17/32	5/8-24NF	2⅜	1⅛	0.195	1⅜

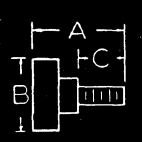


TERMINALS

IF BASIC PART NUMBER ENDS WITH ONE OF THESE LETTERS

FOR 0-10 AMP. CURRENT RANGE USE TERMINAL TYPE

THREADED TERMINAL



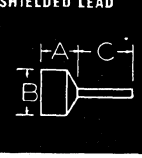
		THREAD SIZE	A	B	C
MP	10	4-40	½	5/16	3/16
RS	11	6-32	5/8	7/16	9/32
RS	12	8-32	5/8	7/16	5/16

SOLDER TERMINAL (90°)



MP	17	—	½	5/16	—
RS	31	—	½	15/32	—

SHIELDED LEAD



MP	27	—	5/16	5/16	6
MP	28	—	5/16	5/16	12
MP	29	—	5/16	5/16	24
MP	30	—	5/16	5/16	36
RS	23	—	5/16	13/32	6
RS	24	—	5/16	13/32	12
RS	25	—	5/16	13/32	24
RS	26	—	5/16	13/32	36

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RADIO INTERFERENCE FILTERS

STANDARDIZED FILTERS

Standardized filters are low pass filters. Rectangular and some tubular filters are pi types while the lower insertion loss tubulars are L types. They are supplied with two terminals to be connected in series with a power line. This places an inductor in series with the line and a capacitor is internally connected from terminal to the case. The filter case must be grounded for proper operation. The internal inductors and capacitors are especially designed for radio frequency filter operation to provide good filtering action over a wide frequency range.

CURRENT RATINGS

Filters are rated for continuous use at a maximum ambient temperature of 85°C (185°F). They are made to withstand occasional momentary surges for normal motor starting, etc. If you have an intermittent duty problem contact factory for a suitable rating.

VOLTAGE RATINGS

The filters are rated for continuous use at the specified voltage at temperatures up to 85°C (185°F). Filters with a dual voltage rating (e.g. 400 VDC/150 VAC) are rated for the higher voltage only in direct current applications. The rating drops to the lower value for alternating current applications. Any filter may be used at a lower voltage than its rating.

CASE SIZES

All rectangular filters are in deep drawn seamless cases. They are hermetically sealed with solder sealed covers. Dimensions shown for cases are basic sizes, but because of their deep drawn nature, dimensions will vary slightly depending upon the point of measurement.

Cases and brackets are steel, hot tin dipped finish.

TERMINALS

Standard terminal types are shown. If two different terminals are desired on one filter, insert both terminal types in the part number — for example 70D6.3GW1121. For mounting styles L, M, S, V, Y the first terminal type listed in the part number will be supplied on the end near the mounting studs or flange.

INSERTION LOSS

The column marked ***db*** in the table of basic part numbers is the insertion loss at a frequency of 150 kilohertz. Insertion loss is a measure of the effectiveness of a filter at a particular frequency. The insertion loss is the logarithmically adjusted ratio of signal input to signal output measured in a standard circuit of 50 ohms input and output impedance. The larger the number of ***db***, the greater is the signal reducing ability of the filter.

The following table will help to illustrate the ratio between the interference voltage input to a filter and the output voltage as stated in ***db***.

db	*Voltage Input : Voltage Output*
0	1:1
6	2:1
20	10:1
40	100:1
60	1,000:1
80	10,000:1
100	100,000:1

All the *db* figures in the chart represent the insertion loss for each filter at 150 kilohertz. A complete description of insertion loss requires a graph or a tabular chart showing a number of *db* readings at frequencies spread throughout the useful range of the filter. The filters in this catalog have a useful range from below 150 kilohertz to above 250 megahertz. They have been designed to maintain approximately the stated level of insertion loss in the frequency range of 150 kilohertz to about 10 megahertz and then to follow a gently sloping reduction maintaining effective levels of insertion loss to between 250 and 400 megahertz. This corresponds to the normal frequency distribution of radio interference generated by most electrical machinery, electromechanical devices and a great deal of electronic equipment.

The tubular filters are designed for more severe requirements and will maintain the stated level of insertion loss from 150 kilohertz to greater than 10 Gigahertz.

VOLTAGE DROP

All filters are designed to have a voltage drop of low value so that they will not interfere with proper operation at the equipment in which they are installed. The 70 volts D. C. series has a maximum drop of 0.3 volt when operated at full rated current. The 400 VDC/150 VAC and the 600 VDC/250 VAC have a drop of less than one percent of the AC rating when carrying full rated current.

WHY USE FILTERS?

Much electronic and electrical equipment produces interference which disrupts radio communication and seriously affects the safety and efficient operation of aircraft, marine, industrial and military communications. As a result, the Federal Communications Commission is enforcing statutes which require control of interference and interference sources. The various military branches of the Department of Defense are specifying interference free operation in much of the equipment they now purchase. Manufacturers of sensitive and complex electronic equipment find that often their devices do not function properly as a result of interference produced in parts of their own or nearby systems.

The answer to this is radio frequency interference control. This control can be accomplished by one or more of the following methods.

1. Redesign to use non-interfering type components instead of those which generate interference. Example—Replace commutator type universal cooling blower motor with interference free induction motor.
2. Provide effective shielding to prevent direct radiation. Example—Interference producing ignition system of a internal combustion engine shielded with complete metallic housings over spark plugs, cables and magneto.
3. Install radio interference filters in power lines to prevent interference signals from being conducted to distant areas on those power lines. Example—Filters installed in power lines to a direct current aircraft motor to prevent motor interference from being conducted to the radio installation.

Interference reduction and control is generally a judicious balance among these three methods. Usually no one method is completely effective. Once the equipment design is finalized, further interference reduction becomes a combination of shielding and filtering. They complement each other and in most cases neither shielding nor filtering is completely effective alone.

HOW TO USE FILTERS EFFECTIVELY

First one must learn to recognize the serious sources of radio frequency interference. Interference is generated wherever there is a spark or electrical discharge. Commutator type electric motors and generators, electric arc and fluorescent lamps, switches and relays, thyratron and other gaseous discharge tubes may all be sources of radio interference of which the manufacturer or user may not be aware. Electronic equipment which utilizes oscillating circuits may generate radio frequency signals to perform necessary functions. These signals become radio interference when they leave the confines of the circuits and equipment where they are needed and interfere with other radio frequency sensitive equipment. An example of this is the oscillator used in a superhetrodyne receiver. Among electronic generators those dealing with critically shaped waveforms such as saw tooth or square wave and pulse generators can cause a considerable amount of interference as a result of harmonics of the fundamental frequencies.

For best results, isolate the severe interference producing sources and prevent them from contaminating interference free equipment or lines nearby. This can be accomplished by shielding and enclosing case construction around the interference sources combined with filters in the power lines.

Filters will reduce the radio interference currents flowing in power lines to very low levels. This is essential to prevent unwanted signals from traveling great distances and radiating into space from these distant power lines. Filters are not a complete cure for all radio interference problems. They need the help of adequate shielding and isolation to be completely effective.

The physical placement of a filter is important. Improper positioning can sometimes nullify the effectiveness of a filter. The radio interference filter should be mounted close to a shielded source, or considering the whole chassis a source, close to the power line entrance. Input and output lines of the filter should be separated. For best results use mounting styles L, M, S, V or Y and project one terminal through a shielding partition or bulkhead in the chassis or wiring enclosure. Shielded lead style terminals can also help isolate input and output lines. Be sure that shielded leads have the outer covering grounded to chassis at both ends.

LITERATURE AVAILABLE

A five page reprint entitled ***"Radio Interference Filters — Their Design and Use"*** showing how to obtain best results when using filters for radio interference reduction in electronic equipment is available on request.

ALL-TRONICS PRODUCTS

In addition to Standardized Filters, ***All-Tronics, Inc.*** is a supplier of custom designed radio interference filters to the original equipment market. Filters with unusual ratings, peculiar shapes, extended environmental requirements and rigid specifications are available to order. If you have any applications for which our Standardized Filters do not completely meet your requirements, forward your specifications to us and our engineering department will gladly recommend a design to solve your problem.

In keeping with our comprehensive coverage of the RF filter field we also manufacture screen booth filters, line stabilization networks, encapsulated, impregnated and hermetically sealed networks, assemblies and coils to specifications.

All-Tronics, Inc. reserves the right to improve design specifications or withdraw items from this catalog in the light of new technological advances.

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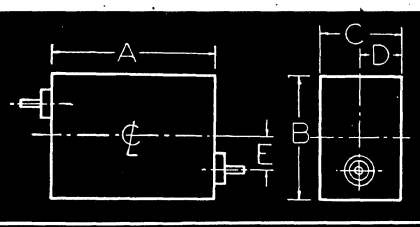
All-tronics, inc.

RADIO INTERFERENCE FILTERS

STANDARD MOUNTING STYLES & DIMENSIONS

IF BASIC PART NUMBER ENDS WITH THIS LETTER

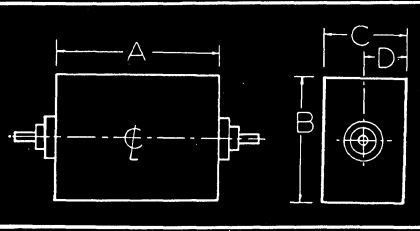
STYLE N



STYLE N DIMENSIONS ARE

	A	B	C	D	E
E	1⅛	1	11/16	11/32	¼
F	1¾	1¼	⅞	7/16	¼
G	2	1¾	1⅛	9/16	½
H	2	2	1¼	⅝	⅝

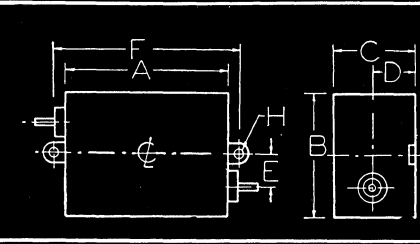
STYLE N



STYLE N DIMENSIONS ARE

	A	B	C	D
J	3 1/16	2⅞	1⅝	13/16
K	3 1/16	2⅞	2⅛	1 1/16
L	3½	3½	2½	1¼

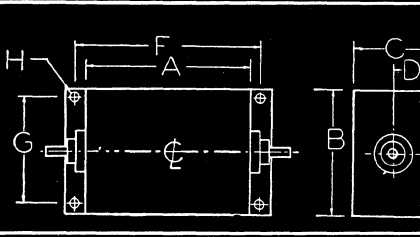
STYLE P



STYLE P DIMENSIONS ARE

	A	B	C	D	E	F	H
E	1⅛	1	11/16	11/32	¼	1 1/16	5/32
F	1¾	1¼	⅞	7/16	¼	2⅛	3/16
G	2	1¾	1⅛	9/16	½	2⅜	3/16
H	2	2	1¼	⅝	⅝	2⅜	3/16

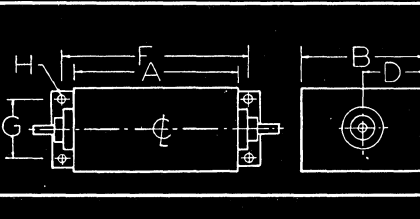
STYLE P



STYLE P DIMENSIONS ARE

	A	B	C	D	F	G	H
J	3 1/16	2⅞	1⅝	13/16	3⅝	2⅛	.195
K	3 1/16	2⅞	2⅛	1 1/16	3⅝	2⅛	.195
L	3½	3½	2½	1¼	4½	2	.195

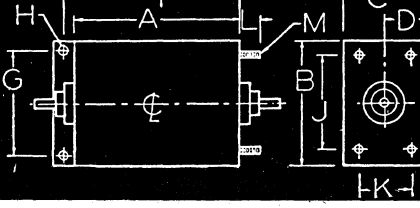
STYLE R



STYLE R DIMENSIONS ARE

	A	B	C	D	F	G	H
J	3 1/16	2⅞	1⅝	1 1/16	3⅝	⅞	.195
K	3 1/16	2⅞	2⅛	1 1/16	3⅝	1⅜	.195
L	3½	3½	2½	1¾	4½	1¾	.195

STYLE S



STYLE S DIMENSIONS ARE

	A	B	C	D	F	G	H	J	K	L	M
J	3 1/16	2⅞	1⅝	13/16	3⅜	2⅛	.195	2	⅞	15/32	10-32
K	3 1/16	2⅞	2⅛	1 1/16	3⅜	2⅛	.195	2	1⅜	15/32	10-32
L	3½	3½	2½	1¼	4	2	.195	2¼	1¾	15/32	10-32

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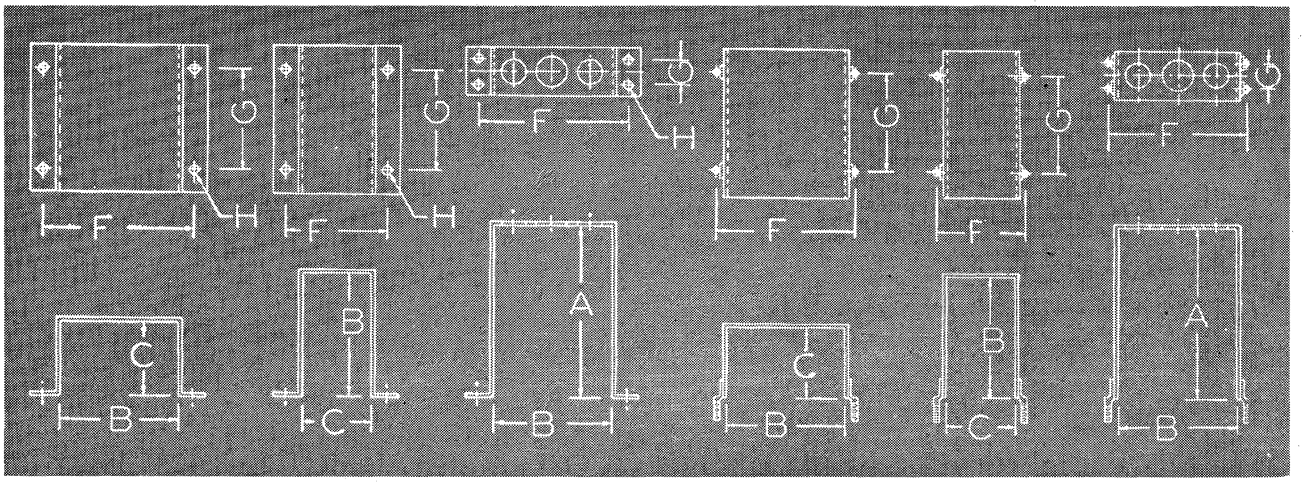
RADIO INTERFERENCE FILTERS

WRAP-AROUND MOUNTING BRACKETS

STYLE T STYLE U STYLE V STYLE W STYLE X STYLE Y



IF BASIC PART NUMBER ENDS WITH THIS LETTER

BRACKET DIMENSION ARE

	STYLE T B	C	F	G	H	STYLE U B	C	F	G	H
E	1	11/16	1 3/8	1/2	5/32	1	11/16	1 1/16	1/2	5/32
F	1 1/4	7/8	1 5/8	7/8	5/32	1 1/4	7/8	1 1/4	7/8	5/32
G	1 3/4	1 1/8	2 1/4	1	3/16	1 3/4	1 1/8	1 5/8	1	3/16
H	2	1 1/4	2 1/2	1	3/16	2	1 1/4	1 3/4	1	3/16
J	2 7/8	1 5/8	3 3/8	1 1/2	7/32	2 7/8	1 5/8	2 1/8	1 1/2	7/32
K	2 7/8	2 1/8	3 3/8	1 1/2	7/32	2 7/8	2 1/8	2 5/8	1 1/2	7/32
L	3 1/2	2 1/2	4	2	1/4	3 1/2	2 1/2	3	2	1/4

	STYLE V A	B	F	G	H	STYLE W B	C	F	G	H
E	1 1/8	1	1 3/8	*	5/32	1	11/16	1 7/32	1/2	6-32
F	1 3/4	1 1/4	1 5/8	7/16	5/32	1 1/4	7/8	1 7/16	7/8	6-32
G	2	1 3/4	2 1/4	1/2	3/16	1 3/4	1 1/8	1 15/16	1	6-32
H	2	2	2 1/2	5/8	3/16	2	1 1/4	2 3/16	1	6-32
J	3 1/16	2 7/8	3 3/8	7/8	3/16	2 7/8	1 5/8	3 5/32	1 1/2	10-32
K	3 1/16	2 7/8	3 3/8	1 1/4	3/16	2 7/8	2 1/8	3 5/32	1 1/2	10-32
L	3 1/2	3 1/2	4	1 1/2	1/4	3 1/2	2 1/2	3 25/32	2	10-32

*Only two mounting holes.

	STYLE X B	C	F	G	Stud Size	STYLE Y A	B	F	G	Stud Size
E	1	15/16	7/8	1/2	6-32	1 1/8	1	1 3/16	‡	6-32
F	1 1/4	7/8	1 1/32	7/8	6-32	1 3/4	1 1/4	1 3/8	7/16	6-32
G	1 3/4	1 1/8	1 1/4	1	6-32	2	1 3/4	1 29/32	1/2	6-32
H	2	1 1/4	1 7/16	1	6-32	2	2	2 5/32	5/8	6-32
J	2 7/8	1 5/8	1 29/32	1 1/2	10-32	3 1/16	2 7/8	3 5/32	7/8	10-32
K	2 7/8	2 1/8	2 13/32	1 1/2	10-32	3 1/16	2 7/8	3 5/32	1 1/4	10-32
L	3 1/2	2 1/2	2 25/32	2	10-32	3 1/2	3 1/2	3 25/32	1 1/2	10-32

‡Only two mounting studs.

ALL WRAP AROUND BRACKETS ARE PERMANENTLY ATTACHED AND CENTRALLY LOCATED ON FILTERS. WRITE FOR INFORMATION ON REMOVABLE BRACKETS IF NEEDED.

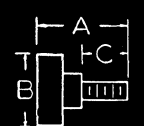
TERMINALS

IF BASIC PART NUMBER ENDS WITH ONE OF THESE LETTERS

USE TERMINAL TYPE

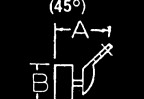
FOR THIS CURRENT RANGE

THREADED TERMINAL

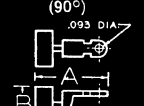


Supplied with Nut and Lockwasher.

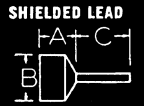
SOLDER TERMINAL (45°)



SOLDER TERMINAL (90°)



SHIELDED LEAD



		AMP.	THREAD SIZE	A	B	C
EFGH	10	0-2.5	4-40	1/2	5/16	3/16
FGH	11	0-10	6-32	5/8	7/16	9/32
FGHJ	12	0-16	8-32	5/8	7/16	5/16
JKL	13	4-25	10-32	3/4	1	5/16
JKL	14	10-63	1/4-20	1	1	3/8
JKL	15	25-100	3/8-16	1 1/4	1 1/2	9/16
EFGHJ	16	0-16	—	13/32	5/16	—
EFGHJ	17	0-16	—	1/2	5/16	—

			WIRE SIZE			
EFGH	18	0-2.5	20	5/16	5/16	6
EFGH	19	0-2.5	20	5/16	5/16	12
EFGH	20	0-2.5	20	5/16	5/16	18
EFGH	21	0-2.5	20	5/16	5/16	24
EFGH	22	0-2.5	20	5/16	5/16	36
FGH	23	2.5-10	18	5/16	13/32	6
FGH	24	2.5-10	18	5/16	13/32	12
FGH	25	2.5-10	18	5/16	13/32	24
FGH	26	2.5-10	18	5/16	13/32	36

All-tronics, inc.
45 BOND ST., WESTBURY, L. I., N. Y. 11590 • 516-333-3090 • TWX: 510-222-3655

NEW

VCF's

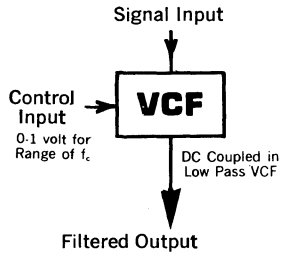
(VOLTAGE CONTROLLED FILTERS)



Actual Size
Patent Pending

SPECIFICATIONS

Cutoff Frequency Range	Up to 100:1 f_{cmin} to f_{cmax} from 0.1 Hz to 20,000 Hz
Input Impedance	> 100 KΩ
Cutoff Control Voltage	0 to 1 volt
Voltage Output (max)	70% of ± Power Supply Voltage
Minimum Load Impedance	1 KΩ
Output Impedance	5Ω (max)
Gain	0, 10, 20 or 30 db
Asymptotic Rolloff Slopes	6, 12, 18, 24 or 30 db/octave
Power Supply Voltage	±3 to ±15 VDC
Size	⅜" x 2.1" x 2.1"
Temperature Range	−30°C to +70°C (standard)
Price	100 Lot — $100 to $200 per unit Single Lot — $260 to $525



WHAT IS A VCF?

ARITECH VCF's are active filters having voltage controlled components that provide smooth continuous translation of the frequency and phase response without affecting the shape of the response. The filters are compact, stable, and extremely reliable — even for the most sophisticated applications.

WHY WAS THE VCF DEVELOPED?

The VCF was developed to handle signal processing requirements that are not readily satisfied by single fixed filter techniques.

VCF's lend themselves to automatic as well as manual signal processing, because of their unique ability of being externally voltage controlled.

Variable band pass and notch requirements can be satisfied by cascading low pass and high pass filters in series or in parallel, respectively.

ORDERING INFORMATION

SPECIFY MODEL NUMBER per example below

Slope (db/octave) — 30 — Type (Butterworth High Pass) — BHP — 150 — 15000 / Cutoff Frequency Range (Hz) — 0 — In-band Gain (db)

Band pass and notch filter designs having independent voltage-controlled center frequencies and band widths and featuring extremely steep skirts are also available.

PHASE SHIFTER/METER

(Bulletin PSM-360A)



- 10 Hz to 1 MHz Phase Meter and Phase Shifter
- Shifts and Measures 0° to 360°
- Direct Reading in Degrees
- High Input Impedance and Input Sensitivity
- DC Output Proportional to the Phase Shift being Measured or Generated

DIGITAL IC TESTER

(Bulletin ICT-516)



- A Logical and Simply Connected Program
- Prewired Patch Plugs
- Rapid Manual Testing
- Self-Contained — Can Test All Digital Logic for Functional Failures
- Input and Output Indicator Lights for Visual Analysis
- Universal Input Connector — Accepts Up to 16 Pins

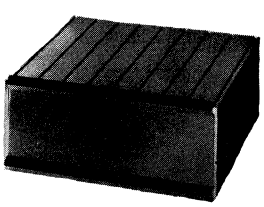
TONE BURST & GATING GENERATOR (Bulletin TG-210)



- DC to 1 MHz Input Frequency Range
- Switching Transients and Feedthrough > 60 db Down
- Greater than 30 db Input Dynamic Range
- Tone Burst and Dwell Time Independently Variable from 1 to 1024 Cycles in 20 Steps
- Gating Voltage Output
- Pulse Output

INSTRUMENT ENCLOSURE & POWER SUPPLY SYSTEMS (Bulletin ENC-1000)

- Two Interlocking Aluminum Extrusions
- Good-Looking Simplicity
- Rugged Construction: ⅛" Wall
- Versatile Built-in Mounting for Multiple Circuit Boards
- Includes Rubber Feet, Tilt Bail, Rear Panel, Complete Hardware
- Optional Power Supplies
- 3½" x 8⅜" x 7½" HWD
- Single or Dual Rack Adapters Available
- Clear Chromate Finish
- Blue Finish on Cover (Optional)



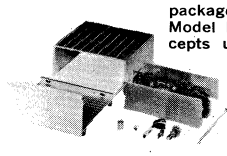
POWER SUPPLY SPECIFICATIONS

Type	Low Voltage	High and Split Voltage
Voltage (DC)	V ±10%	V ±0.5 Volts
Current	Up to 1 amp	Up to 200 ma
Impedance	<0.2Ω	<0.02Ω
Regulation (Line & Load)	<0.2 V	<0.02 V
Ripple	<0.005 V	

POWER SUPPLY MODELS AVAILABLE

Model	Output (DC) Voltage Levels (Volts)
PS-LV	3.6 or 5.2
PS-SL	3.6 or 5.2, and $\pm\frac{12}{6}$ and 18,
PS-HV	or ±15 and 30
PS-SV	$\pm\frac{12}{6}$ and 18, or ±15 and 30
PS-HL	3.6 or 5.2 and 18 or 30

Examples: PS-SL1 — 5.2 and ±15 and 30
PS-SV1 — ±15 and 30
PS-HL1 — 5.2 and 30



Now designers can power and package circuitry with ease. Model ENC-1000 cabinet accepts up to 5 circuit cards without any additional mounting hardware. High quality power supply; versatile multiple output voltages. Excellent heat transfer characteristics. Suited for dense packaging. Easy assembly, appealing design.

DESIGNERS KIT AND ACCESSORIES

Model	Description
PB-1000	Precut Breadboards (2¾" x 8" x 1/16")
AK-1000	Accessories Kit Including: Pilot Lamp, 2 BNC Connectors, 11 Position Rotary Switch, DPDT Switch plus Spare Fuse
R1 or R2	19" x 3½" x 7½" Single or Dual Rack Adapter
NEX	Blue Finish on Cover

For more information, contact ARITECH CORP 130 Lincoln St., Brighton, Mass. 02135 Telephone: 617-254-2990

Clevite Ceramic Filters

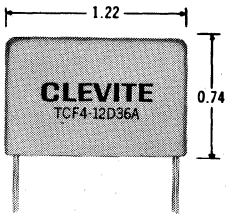
for the man with designs on something better.

Small, lightweight and rugged. Steep-sided selectivity. Large range of bandwidths. Non-microphonic. Permanently-tuned. Immune to magnetic fields. High stop band rejection free of spurious response. Highly stable with both temperature and time.

Computer Designed TCF Hybrid Ceramic Filter

High efficiency design combines the input advantage of a tuned transformer with the stability and high performance of Clevite cermic filters. This design offers manufacturers of quality communications equipment greater selectivity at a lower cost. Made specifically for CB, mobile, aircraft and marine radios . . . in a package less than 0.6 cu. in.

(A selection of other bandwidths and characteristics to cover a range of applications from FM to CW is available on special request.)



TCF-4 CERAMIC FILTERS

Model Number	Bandwidth 6dB (Min.) (kHz)	Bandwidth 60dB (Max.) (kHz)	Insertion Loss (dB)	Stopband Rejection (dB)	Impedance (Kilohms) In**	Impedance (Kilohms) Out
TCF4-8D20A[1]	8	20	8	60	40	1.5
TCF4-12D36A[1]	12	36	8	60	40	2.2
TCF4-18G45A[2]	18	45	6	50	40	2.2

1.—Center Frequency* 455kHz ±1.0. 2.—Center Frequency* 455kHz ±1.5.
*Stability: TIME—within +0.2% for 5 years.
TEMP—within 0.2% from −20 to +60°C.
**Max. Ratings: 100 volts DC, 5 ma DC.

TCF-6 CERAMIC FILTERS

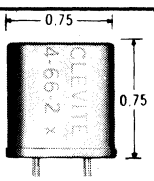
Model Number	Bandwidth 6dB (Min.) (kHz)	Bandwidth 60dB (Max.) (kHz)	Insertion Loss (dB)	Stopband Rejection (dB)	Impedance (Kilohms) In**	Impedance (Kilohms) Out
TCF6-4D10A[1]	4	10	10	60	40	4.7
TCF6-30D55A[3]	30	55	5	60	20	1.0
TCF6-35D60A[3,4]	35	60	5	60	20	1.0
TCF6-12F36A[1]	12	36***	10	90	40	2.2

3.—Center Frequency* 455kHz ±2.0.
4.—Available on special order at a center frequency of 500kHz.
*Stability: TIME—within +0.2% for 5 years.
TEMP—within 0.2% from −20 to +60°C.
Max. Ratings: 100 volts DC, 5 ma DC, *@90dB.

For more information, write for Bulletin 94026. Clevite Corporation, Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146.

Split Ring Low Frequency Filter

These miniature, fixed-tuned filters combine very narrow band widths and high performance with small size and weight. Optimum applications include low frequency communications receivers, selective calling systems and control circuits.

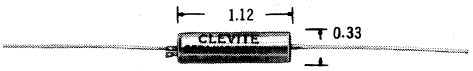


Model Number	Center Frequency (kHz)	Insertion Loss (dB)	Impedance (Kilohms)
TSR-9B	9	4	56
TSR-12B	12	4	56
TSR-15B	15	4	56
TSR-18B	18	4	47
TSR-21B	21	4	47
TSR-24B	24	4	47
TSR-27B	27	4	33
TSR-30B	30	4	33

(Note: These Filters are available at all center frequencies from 9kHz to 50kHz.)
Bandwidth: (%f_0): 1% @ 3dB; 13% @ 20dB.
Stability: TIME—within 0.2% for 5 years.
TEMP—within 0.2% from −40°C to +85°C

For more information, write for Bulletin 94. .3. Clevite Corporation, Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146.

Compact D-11 Ladder Filter — 60dB Stopband Rejection



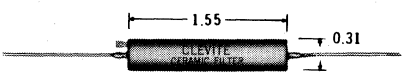
Improved D-11 cermic i-f filters are designed for communications circuit applications where the precise center frequency tolerance and high stop band rejection of the widely-used 17 disc Clevite ladder filter are not required.

Model Number	Center Frequency Tolerance (kHz)	Bandwidth 6dB (Min.)* (kHz)	Bandwidth 60dB (Max.)* (kHz)	Insertion *Loss (dB)
TL-6D11-12A	±2	6	12	6
TL-10D11-20A	±2	10	20	4
TL-16D11-32A	±2.5	16	32	5
TL-20D11-38A	±2.5	20	38	5
TL-30D11-57A	±3	30	57	5
TL-40D11-72A	±3	40	72	4

Packaged Size: 1.12 ±.030 x .327 Dia. Max. *At Room Temperature 27°C.
Center Frequency: 455kHz. Also available at 500kHz on special order.
Stability: TIME—within + 0.2% for 5 years.
TEMP—within 0.2% from −40°C to +85°C.
Impedance: 10kHz B/W and below—2000 ohms.
(In and Out) 16kHz B/W and above—1000 ohms.
Stopband Rejection: 60dB.

For more information, write for Bulletin 94021. Clevite Corporation, Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146.

Standard 17-disc Ceramic Ladder Filter



Clevite 17-disc ceramic ladder filters are designed for i-f stages of military and top-of-the-line commercial superheterodyne radio receivers used in airborne or ground AM and FM communications equipment.

Model Number	Bandwidth 6dB (Min.)* (kHz)	Bandwidth 60dB (Max.)* (kHz)	Insertion Loss * (dB)
TL-2D5A	2	5	10
TL-4D8A	4	8	7
TL-6D11A	6	11	6
TL-8D14A	8	14	5
TL-10D16A	10	16	4
TL-16D25A	16	25	5
TL-20D32A	20	32	5
TL-30D45A	30	45	5
TL-40D55A	40	55	4
TL-45D65A	45	65	4

Center Frequency: 455kHz: ±1kHz for narrow band;
±2kHz for bandwidths above 20kHz.
Stability: TIME—within +0.2% for 5 years.
TEMP—within 0.2% from −40°C to +85°C.
*At Room Temperature 27°C.
Impedance: 10kHz B/W and below—2500 ohms.
(In and Out) 16kHz and 20kHz B/W—1500 ohms.
30kHz B/W and above—1200 ohms.

For more information, write for Bulletin 94017. Clevite Corporation, Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146.

CLEVITE

ESC LC FILTERS.....

design and performance checked BEFORE prototyping



To meet your specific filter requirements, ESC first constructs a mathematical model based on actual physical components available. Through the use of high speed computer techniques with ESC's inhouse IBM 1130, the electrical characteristics and physical dimensions of your proposed filter are immediately tested and "proven out." Typical computer output data includes input impedance, attenuation, phase, phase delay, and group delay—all versus frequency. It is therefore possible for ESC to evaluate your filter needs, develop a suitable design and submit a quotation in a fraction of the time previously required.

The products illustrated to the right were designed and produced by ESC and are representative examples of our filter capabilities.

Please do not request that we send you a filter catalog or other descriptive literature—we don't have any. All of our designs are custom. We do have a Filter Questionnaire, however. If you fill it out, we will be able to discuss your specific requirements with you.

• LOW PASS • HIGH PASS • BAND PASS • SINGLE SIDEBAND • RFI • MINIATURE • PRINTED CIRCUIT • AUDIO • MOBILE COMMUNICATIONS • TELEMETRY • SPECIAL APPLICATIONS

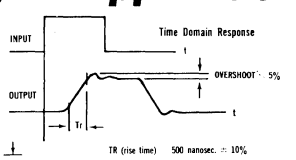
From design through production of custom-designed LC filters, contact ESC.

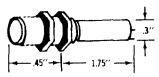
as sophisticated as your application

RFI TUBULAR FILTER WITH CONTROLLED OVERSHOOT AND RISE TIME

FREQUENCY RESPONSE

Flat within ± ½ db to 200 kHz
2 MHz > 3 db
30 MHz > 60 db
30 MHz—1 GHz > 40 db

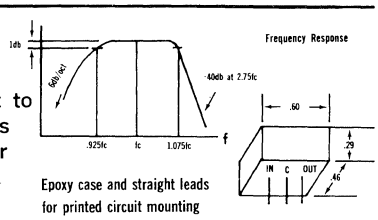




Z source = 75Ω
Z load = 50kΩ

ULTRAMINIATURE TELEMETERING FILTERS

Center frequencies from 400 Hz to 165 kHz. Available in bandwidths of ± 7½% and ± 15% of center frequency (fc)
Z source/load = 10kΩ

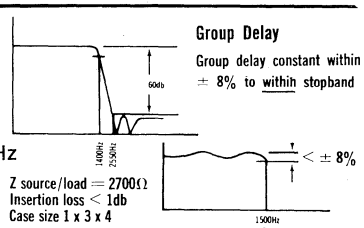


Epoxy case and straight leads for printed circuit mounting

CONSTANT GROUP DELAY LOWPASS FILTER WITH HIGH DISCRIMINATION

FREQUENCY RESPONSE

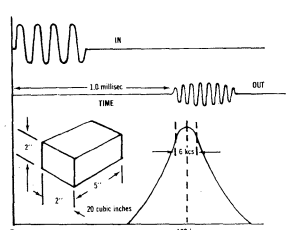
Passband flat within ± .1 db
Cutoff frequency (< 3 db), 1400 Hz
Attenuation at 2550 Hz and above, > 60 db



Z source/load = 2700Ω
Insertion loss < 1db
Case size 1 x 3 x 4

BANDPASS DELAY LINE FOR HIGH DELAY IN SMALL PACKAGE

Center frequency 100kHz
Passband ± 3kHz < 1 db
Group delay 1.0 millisec.
Z source/load = 1kΩ



WRITE TODAY FOR YOUR COPY OF ESC'S FILTER QUESTIONNAIRE.

ESC ELECTRONICS CORPORATION

534 BERGEN BOULEVARD • PALISADES PARK, N. J. 07650 • (201) 947-0400

World's Leading Producer of Delay Lines

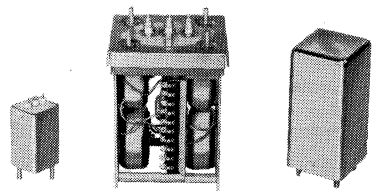
Look in the Green Section for Products and their Manufacturers



Tell them you found them in eem

HERTZ FILTERS

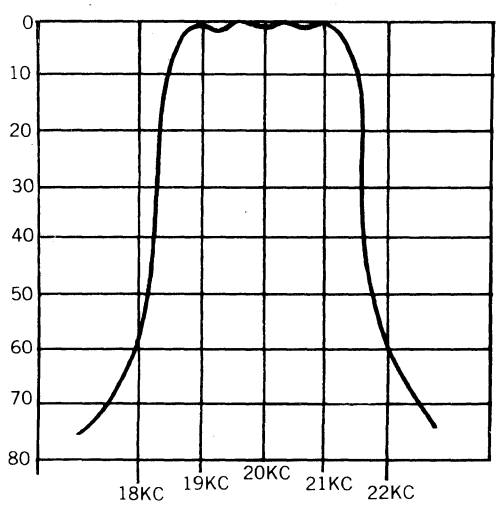
BAND PASS FILTERS CUSTOM DESIGNED TO FILL YOUR NEEDS



Hertz Filter Corporations' engineering department is made up entirely of specialists in the field of custom design of band pass filters. They are all fully experienced and prepared to help you solve your filter problems. Call or write Hertz for reliable service and prompt delivery.

FEATURES

1. Filters, Band Pass, Passive
2. Center Frequencies — 50 Hz to 50 Meg Hz
3. Shape factors — better than 2.0 for ratios of 60 db to 3 db
4. Bandwidth to center frequency ratio — up to 10%
5. Phase linearity — within 10° through passband
6. Low passband insertion loss
7. Better than 80 db attenuation 50% above and below center frequency
8. Input and output impedances as required
9. Low input and output impedances in stop band
10. Low passband ripple
11. L, C, and R elements only



PARTIAL LIST OF HERTZ FILTERS
(all filters in accordance with MIL-F-18327)

BAND PASS PART NO.	PASS BAND	STOP BAND	Z_0	I.L.@CF	SIZE
BP-7907-1	3db(150-300)Hz	60db(50-850)Hz	600	1db	2 x 2¼ x 4
BP-7907-2	3db(300-900)Hz	60db(110-1700)Hz	600	1db	2 x 2¼ x 4
BP-7907-3	3db(600-1200)Hz	60db(210-3400)Hz	600	1db	2 x 2¼ x 4
BP-7907-4	3db(1.2-2.4)KHz	60db(.43-6.8)KHz	600	1db	2 x 2¼ x 4
BP-7907-5	3db(2.4-4.8)KHz	60db(.85-13.5)KHz	600	1db	2 x 2¼ x 4
BP-7907-6	3db(4.8-9.6)KHz	60db(1.7-27)KHz	600	1db	2 x 2¼ x 4
BP-7907-7	3db(8.9-11.2)KHz	60db(3.1-32)KHz	600	1db	2 x 2 x 3
BP-7996-1	3db(825-1,175)Hz	40db(650-1,350)Hz	30K	3db	1 x 2¼ x 4½
BP-8004-10	3db(8-26)KHz	30db(4-30)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-11	3db(19.5-33.5)KHz	30db(16.5-36.5)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-12	3db(26.25-40.25)KHz	30db(23.25-43.25)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-13	3db(32.6-52.6)KHz	30db(27.6-57.6)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-7897-1	3db(37.5-40.5)KHz	30db(34.5-43.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-2	3db(40.5-43.5)KHz	30db(37.5-46.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-3	3db(43.5-46.5)KHz	30db(40.5-49.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-4	3db(46.5-49.5)KHz	30db(43.5-52.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-5	3db(49.5-52.5)KHz	30db(46.5-55.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-6	3db(52.5-55.5)KHz	30db(49.5-58.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-7	3db(55.5-58.5)KHz	30db(52.5-61.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-8	3db(58.5-61.5)KHz	30db(55.5-64.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-9	3db(61.5-64.5)KHz	30db(58.5-67.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-10	3db(64.5-67.5)KHz	30db(61.5-70.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-11	3db(67.5-70.5)KHz	30db(64.5-73.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-12	3db(70.5-73.5)KHz	30db(67.5-76.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-13	3db(73.5-76.5)KHz	30db(70.5-79.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-14	3db(76.5-79.5)KHz	30db(73.5-82.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-15	3db(79.5-82.5)KHz	30db(76.5-85.5)KHz	10K/1K	4db	1¼ x 1¼ x 2

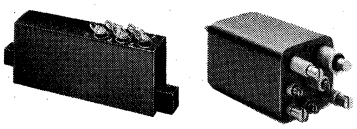
LOW PASS PART NO.	PASS BAND	STOP BAND	Z_0	SIZE
LP-7907-1	4db@300Hz, 1db@225Hz	60db@850Hz	600	2 x 2 x 3
LP-7907-2	4db@600Hz, 1db@450Hz	60db@1700Hz	600	2 x 2 x 3
LP-7907-3	4db@1.2KHz, 1db@.9KHz	60db@3.4KHz	600	2 x 2 x 3
LP-7907-4	4db@2.4KHz, 1db@1.8KHz	60db@6.8KHz	600	2 x 2 x 3
LP-7907-5	4db@4.8KHz, 1db@3.6KHz	60db@13.5KHz	600	2 x 2 x 3
LP-7907-6	4db@9.6KHz, 1db@7.2KHz	60db@27KHz	600	2 x 2 x 3
LP-7907-7	4db@11.2Hz, 1db@10KHz	60db@32KHz	600	1⅜ x 1⅝ x 2¾
LP-7996-1	5db@1,175Hz, 2db@1,000Hz	40db@650Hz	30K	1⅜ x 1⅝ x 2¾
LP-8004 10	5db@26KHz, 1db@17KHz	30db@30KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-11	5db@33.5KHz, 1db@26.5KHz	30db@36.5KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-12	5db@40.25KHz, 1db@33.25KHz	30db@43.25KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-13	5db@52.6KHz, 1db@42.6KHz	30db@57.6KHz	10K/2K	1¼ x 1¼ x 2

PART NO. HIGH PASS	PASS BAND	STOP BAND	Z_0	SIZE
HP-7907-1	4db@150Hz, 1db@225Hz	60db@50Hz	600	2 x 2 x 3
HP-7907-2	4db@300Hz, 1db@450Hz	60db@110Hz	600	2 x 2 x 3
HP-7907-3	4db@600Hz, 1db@900Hz	60db@210Hz	600	2 x 2 x 3
HP-7907-4	4db@1.2KHz, 1db@1.8KHz	60db@.43KHz	600	2 x 2 x 3
HP-7907-5	4db@2.4Hz, 1db@3.6KHz	60db@.85KHz	600	2 x 2 x 3
HP-7907-6	4db@4.8Hz, 1db@7.2KHz	60db@1.7KHz	600	2 x 2 x 3
HP-7907-7	4db@8.9KHz, 1db@10KHz	60db@3.1KHz	600	1⅜ x 1⅝ x 2¾
HP-7996-1	5db@825Hz, 2db@1,000Hz	40db@1,350Hz	30K	1⅜ x 1⅝ x 2¾
HP-8004-10	5db@8KHz, 1db@17KHz	30db@4KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-11	5db@19.5KHz, 1db@26.5KHz	30db@16.5KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-12	5db@26.25KHz, 1db@33.25KHz	30db@23.25KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-13	5db@32.6KHz, 1db@42.6KHz	30db@27.6KHz	10K/2K	1¼ x 1¼ x 2

HERTZ FILTER CORPORATION
50 WASHINGTON AVENUE • GARDEN CITY PARK, L. I., N. Y. 11040
TEL: (516) Pioneer 7-7250

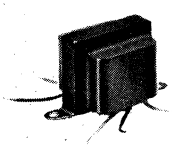
GENISCO

FILTERS / TRANSFORMERS CHOKES / COILS / SWITCHES ENGINEERING SERVICES



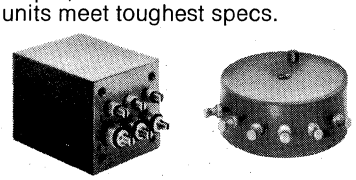
CONSTANT VOLTAGE TRANSFORMERS

Regulate voltage within ±1%, even with input variations as great as ±15% with closely controlled source frequency. Response time 1.5 cycles or less. Harmonic content in output voltage wave held to minimum. 175 watts to 15 KW.



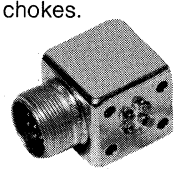
AUDIO TRANSFORMERS

Commercial and military types for subsonic, sonic, ultrasonic frequencies, renders harmonic and intermodulation distortion negligible. Minimum hum pickup. Frequency response for input, output, driver and modulation units meet toughest specs.



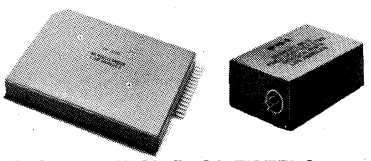
REACTORS

Wide variety of chokes and reactors. Includes modulation reactors, splatter chokes, filter reactors, swinging chokes, smoothing chokes, charging chokes, high Q chokes.



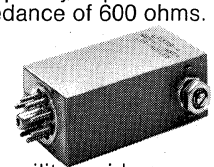
ELECTRIC WAVE L-C FILTERS

PC high-performance types designed and manufactured to the most rigid customer specifications. Available in complete range of sizes and shapes, including subminiature packaging to meet all customer requirements.



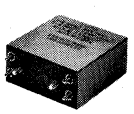
LOW AND HIGH PASS FILTERS

Series of inexpensive standard low and high pass designs available. One typical low pass design delivers constant output within ±0.3% from DC to 20 cps and attenuation of greater than 35 db at 100 cps, 25 ohms input, 3 megohms output. Typical high pass design from an M derived, two section filter has 30 db attenuation at a cut-off ratio of 0.67 of the 3 db frequency. Input and output impedance of 600 ohms.



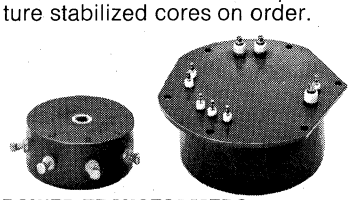
DELAY LINES

Qualified for military airborne and missile applications. Attenuation less than ½ db per microsecond delay with 0.25 microsecond pulse width.



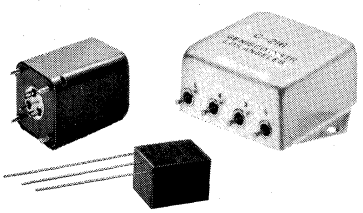
TOROIDAL INDUCTORS

Open coil, encapsulated coil and hermetically sealed coil types in wide range of sizes and capacities. Over 700 models to choose from. Inductances range from .010 mH to 1 H. Dimensions held within ±1/16 inch or better. Temperature stabilized cores on order.



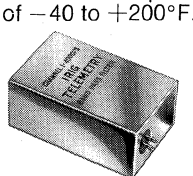
POWER TRANSFORMERS

Includes step-up, step-down, isolation and auto to 100 KVA. Meet or exceed MIL-T-27A and B. Hermetic metal cased. Sealed encapsulated. Open frame impregnated. Also high shock versions of all three. Operating temperatures to 170°C+, as specified. Life expectancy 10,000 hours minimum.



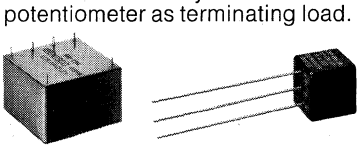
PULSE TRANSFORMERS

Wide variety of values in microhenries to millihenries range. Virtually any package size and style. Hermetically sealed in metal cases or plastic encapsulated. Core types include toroid, cup, tape. Per applicable mil specs. 250 to 750 ohms impedance. Taps —0 to 10 microseconds — located within 25 nanoseconds at various points. Temperature coefficient of delay not to exceed 0.00005 microsecond per microsecond per °F. over a temperature range of —40 to +200°F.



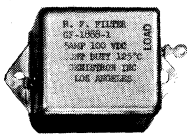
TELEMETRY FILTERS

Set of 80 excellently matched comb. filters. Holds 3 db points within ±1 cps within 25 cps bandwidth from 0 to 2,000 cps. Voltage gain obtained by 25K ohm output with input impedance of 500 ohms. Enables output voltage to be set accurately with potentiometer as terminating load.



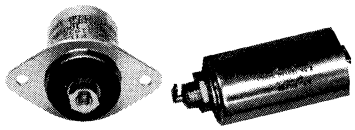
TUNED CIRCUIT NETWORKS

For 400 cps tuned circuits using simple combinations of capacitors and inductors. Specifications ordinarily made for Q, dc resistance, inductance, capacitance and tuning frequency of the network. Produced in accordance with exacting Genisco specifications.



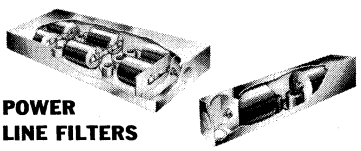
RADIO INTERFERENCE FILTERS

Per MIL-F-15733D. 1 to 50 amp, 100 VDC to 120 VAC, 400 cps, 400 VDC. Insertion loss per characteristic B or D as required, measured per MIL-STD-220. Both 85°C and 125°C ratings, typical voltage drop .25. All other electrical and mechanical requirements are met.



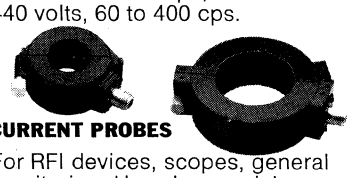
ARC SUPPRESSORS

Available in ratings from 1.0 through 4.0 microfarads, in 25, 50, and 100 amp groups. Suitable for work at high amperages on voltages of 100 VDC and below. Capacitors designed to meet or exceed MIL-C-11693-B.



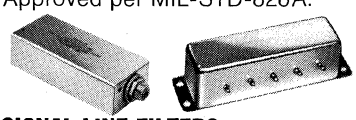
POWER LINE FILTERS

Shielded enclosure, RF filters. Over 100 db isolation over 14 Kc to 1,000 Mc range. Attenuation per MIL-STD-220A. Design and construction per MIL-F-15733D. Operating temperature −55° to +65°C. Filter panels from 2 X to .5 X to 4 X 125 amps, 120 to 440 volts, 60 to 400 cps.



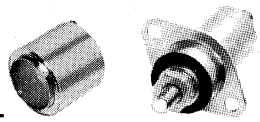
CURRENT PROBES

For RFI devices, scopes, general monitoring. Use also as pickup devices and/or sensors for signal conditioning equipment. Useful range few cycles to 1,000 Mcs. Apertures ¼ to 8 inches. Sensitivity to 0.5 microamps. Power line limits of 10 to 300 amps. Approved per MIL-STD-826A.



SIGNAL LINE FILTERS

Designed for line communications such as telephone, teletype, carrier current, data phone and computer links. Transmission loss in the pass band is 1 db or less, and has a high insertion loss, generally greater than 100 db at frequencies of 14 kc up to 1.0 Gc. Meet applicable sections of MIL-F-18327 and MIL-F-15733D.

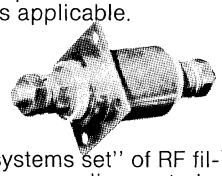


SPECIAL CAPACITORS AND NETWORKS

Non-standard sizes, shapes and electrical values are a specialty. Years of experience and wide engineering background are combined to provide the highest reliability in special capacitors and networks. Engineering experience in systems analysis and study help provide you with a part carefully designed and evaluated for your specific need. Short delivery cycles for these non-standard items.

ISOLATION NETWORK

The Isolation Network is designed to meet the requirements of MIL-STD-188B and FED-STD-222 for low level digital transmission reference systems. It additionally receives a pulse on the input, transduces the pulse through a metallic shielded wall and reconstitutes the pulse in the output section. This achieves total electrical isolation of input and output. It is applicable to signal, clock, and control circuits for military digital DC communication equipment where a serial binary interface appears. It is packaged to form a completely functional unit which will connect directly into the communications network. It shall be used to couple the loop and line side of cryptographic and cryptographic control equipment as applicable.

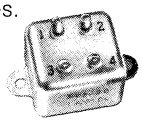


SHEILDED ROOM FILTERS

Complete "systems set" of RF filters for use on power lines entering or leaving electronic shielded enclosures. Each of five different filters provides over 100 db of isolation or filtering over the frequency range of 14 kc to 1000 mc. isolation or attenuation is in accordance with MIL-STD-220A and filters are manufactured in accordance with MIL-F-15733D. Operating temperature from −55°C. to +65°C. Current and voltage of different panels ranges from 2 X .5 amps to 4 X 125 amps, 120 volts to 440 volts and 60-400 cps.

RFI TRANSIENT-FREE SWITCHES

Genisco RFS-Series Switches are solid state AC or DC switching devices that allow the turning on or off of AC or DC currents with a minimum of electrical transients and/or circuit noises.



DC 1 AMP AND 5 AMP

Our new DC transient free switch is a small, low-cost unit designed for 28 VDC service. It is available in 1 amp and 5 amp configurations, and both models exceed the requirements of MIL-STD-826A when switching a full rated load. Current requirement 20 ma. Voltage Drop 1 volt.



AC RFI-FREE SWITCH/ CONTROLLER

One-amp, combination RFI-free switch and controller which can serve as a transient-free on/off switch for AC power circuits. Designed for a 115-volt, 50-400Hz power line. Current requirement less than 2 ma. Measures only 1¾ x 2 x ¾ inches. Weighs only three ounces. Turns AC power circuits on and off with minimal electrical noise generation. After control terminals are shorted, electronic logic waits until line voltage reaches a zero crossing before applying power to the load. Conversely, when control terminals are opened, load power continues until load current crosses zero. Switch meets the noise limits of MIL-STD-826A without additional filtering or shielding.

RFI/EMI ENGINEERING SERVICES

Genisco Technology components reflect the continual advances being made through Genistron's outstanding capabilities in RFI/EMI research, development, engineering and production. By devoting all efforts exclusively to radio frequency/electromagnetic interference and system compatibility control, Genistron has built up what may well be the greatest single-source wealth of knowledge in this specialized area. For RFI/EMI components, applications engineering assistance or consultation, write us or contact our representative nearest you.

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Rosemont, Illinois 60018
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Washington, D.C. facility:
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Beltsville, Maryland 20705
(301) 345-8900

HELIX RESEARCH ASSOCIATES, INC.
8384 HERCULES STREET, LA MESA
CALIFORNIA 92041 (714) 465-3557

FILTER NETWORKS UNLIMITED

To solve our clients filter problems, Helix Research Associates offers a management and engineering team with more than 50 years experience in design and production of highly customized and sophisticated electronic wave filters. By extensive untilization of computers during design plus a vast library of normalized designs, HRA provides its clients with rapid response and optimum design characteristics at the greatest possible savings in cost.

HRA's manufacturing facilities utilize the most advanced techniques known and is itself continually helping to advance the state-of-the-art. With rigidly enforced Quality Assurance and Quality Control procedures, HRA's clients are assured high production of the best possible quality on schedule.

HRA filters can be packaged to meet specific volume requirements. Whether your requirements are conventional, exotic, commercial, or military, HRA can solve your filter design problems and manufacture in quantity to your exact requirements.

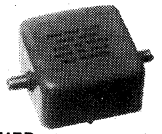
The examples below are typical of HRA solution to unique customer filter requirements and represent only a small sampling of HRA's Filter Networks Unlimited. Write, wire or phone for the complete story.



ACTIVE BANDPASS FILTER



RFI FILTER



PHASE MATCHED BANDPASS FILTER

TYPICAL FILTERS

SERIES 1400 LC FILTERS — 60 Hz to 100 MHz

Type	Frequency Center	Bandwidth Passband	Factor Shape	Loss Insertion	Ripple	Impedance	Operating Temperature	Size
Model 1420 Band Pass	106 Hz	3 DB/12 Hz	40 DB/3 DB 5:1	7 DB	0.1 DB	10KΩ	0°C to +65°C	3.0″ x 2.5″ x 7.0″
Model 1418 Narrowband Bandpass	2.012 KHz	3 DB/25 Hz	80 DB/3 DB 8:1	8 DB	0 DB	25KΩ	−10°C to +55°C	4.3″ x 3.0″ x 2.6″
Model 1402* Narrowband I.F. Bandpass	10.7 MHz	3 DB/150 KHz	60 DB/3 DB 4:1	13 DB	0 DB	1.2KΩ	−55°C to +85°C	2.38″ x 1.00″ x .75″
Model 1414 Low Pass	N/A	3 DB/19.75 MHz	60 DB/3 DB 1.4:1	2 DB	0.5 DB	400Ω	−30°C to +65°C	1.0″ x 1.0″ x .6″
Model 1419 Wideband Bandpass	19.8 MHz	0.1 DB/6 MHz	60 DB/0.1 DB 4:1	0.5 DB	0.1 DB	50Ω	−55°C to +85°C	2.90″ x 1.40″ x .75″
Model 1412* Narrowband I.F. Bandpass	30 MHz	3 DB/800 KHz	60 DB/3 DB 3.5:1	10 DB	0 DB	600Ω	0°C to +55°C	2.56″ x 1.31″ x 1.31″

*I.F. Bandpass Filters Available in Various Bandwidths.

SERIES 1500 RFI FILTERS — 1 MA to 20 AMPS

Type	Rated Voltage	Rated Current	DC Resistance	Attenuation	Operating Temperature	Size
Model 1501 Broadband	230VAC 500 VDC	1.0 Amp	50 Milliohms	20 DB @ 100 KHz, 60 DB @ 1 MHz > 70 DB @ 10 MHz	−55°C to +100°C	2.10″ x 1.25″ x 1.00″
Model 1503 Balanced Network Low Frequency	30 VDC	10 Amps	12 Milliohms	20 DB @ 100 Hz, 35 DB @ 1 KHz > 60 DB @ 100 KHz	−55°C to +85°C	2.0″ x 2.0″ x 1.5″
Model 1504 Noise Suppression	115 VDC	3 Amps	35 Milliohms	30 DB @ 10 KHz, 70 DB @ 100 KHz > 80 DB @ 1 MHz	−55°C to +85°C	2.0″ x 2.0″ x 1.0″

SERIES 1600 PHASE MATCHED AND LINEAR PHASE FILTERS — 60 Hz to 100 MHz

Type	Phase Characteristics	Center Frequency	3 DB Bandwidth	Shape Factor	Insertion Loss	Impedance	Operating Temperature	Size
Model 1601 Bandpass	Phase Matched Sets to ±1°	400 Hz	100 Hz	40 DB/3 DB 12:1	0.5 DB	10 K ohm	0°C to +50°C	1.3″ x 1.8″ x 2.0″
Model 1602 Bandpass	Linear Phase of ±4° at fc ±200 KHz	10.7 MHz	400 KHz	60 DB/3 DB 5.6:1	8 DB	50 ohm	−55°C to +85°C	2.38″ x 1.00″ x .75″
Model 1603 Bandpass	Phase Matched Sets to .5° Absolute	30 MHz	4 MHz	40 DB/3 DB 12:1	1 DB	50 ohm	−55°C to +55°C	1.75″ x 1.75″ x 1.00″
Model 1604 Bandpass	Linear Phase of ±4° at fc ±200 KHz	36 MHz	800 KHz	60 DB/3 DB 4:1	13 DB	600 ohm	0°C to +50°C	2.56″ x 1.31″ x 1.31″

SERIES 1700 ACTIVE FILTERS — 1 Hz to 100 KHz

Type	Center Frequency	Passband Bandwidth	Shape Factor	Insertion Gain	Power Required	Operating Temperature	Size	Notes
Model 1701 Bandpass	9 KHz	3 DB/1 KHz	50 DB/3 DB 12:1	0 DB ±1 DB	+24 VDC 50 mw	0°C to +60°C	1.5″ x 1.5″ x 1.0″	Phase Matched Pairs, ±1°
Model 1702 Bandpass	60 Hz	3 DB/4 Hz	20 DB/3 DB 10:1	0 DB ±1 DB	±12 VDC 600 mw	0°C to +60°C	1.5″ x 1.5″ x .5″	N/A
Model 1703 Low Pass	N/A	3 DB/400 Hz	36 DB/Octave	0 DB ±1 DB	±15 VDC 600 mw	−20°C to +85°C	1″ x 1″ x 2″	Linear Phase
Model 1704 High Pass	N/A	3 DB/120 Hz	36 DB/Octave	0 DB ±.5 DB	±12 VDC 50 mw	−40°C to +65°C	1.0″ x 1.0″ x .3″	N/A

SERIES 1800 LOW PASS TELEMETRY FILTERS

Type	IRIG Channel	Deviation	Input Square Wave	Output Sine Wave	Impedance In/Out	Power Required	Temperature Range	Size Volume
Active	1 - 6	Up to ±15%	48 to 52% Duty Cycle	Flat within 1.6 DB over Passband	50 K / 10 K	0.6 ma or 10 VDC 2 ma at 35 VDC	−40°C to +85°C	0.2 cu. in.
Passive	12 - 21, A - H 1A - 21A	Up to ±15%	48 to 52% Duty Cycle	Flat within 1.6 DB over Passband	10 K / 10 K	N/A	−40°C to +100°C	Down to 0.1 cu. in.
Passive	Tape	Up to ±40%	48 to 52% Duty Cycle	Flat within 1.6 DB over Passband	10 K / 10 K	N/A	−40°C to +100°C	0.3 cu. in.

hisonic inc.
249 N. TROOST,
OLATHE, KANSAS 66061
Telephone: 913-782-0012 Telex: 4-2562

STANDARD FILTERS

For Highest Selectivity

Standard filters are designed by modern network methods for minimum stop to pass band ratios. Applications are those requiring optimum utilization of frequency spectrum.

A PARTIAL LIST OF HISONIC FILTERS BY PART NUMBER

BAND PASS FILTERS

PART NUMBER	FREQ.	INS. LOSS	SOURCE/ LOAD	PASS BAND	STOP BAND	SIZE
20-0184-10	100 c/s	5 db	600/600	3 db @ ± 20 c/s	60 db @ 50 c/s 54 db @ 250	3 x 3½ x 6
20-0199-10	210 c/s	2 db	600/4.6M	3 db @ ± 4 c/s	60 db @ 170 c/s	3 x 3½ x 4½
20-0038-11	800 c/s	9 ± 1 db	15K/15K	3 db @ ± 160 c/s	35 db from 1600 to 1Mc/S	1 3/16 x 1 1/16 x 2¼
20-0205-10	1150 c/s	2.8 db	600/10K	3 db @ ± 10 c/s	30 db @ ± 300 c/s	2 Sq. x 3½
20-0206-10	1600 c/s	.2 db	600/10K	3 db @ ± 50 c/s	50 db @ ± 350 c/s	2 Sq. x 3½
20-0018-10	1940 c/s	6 db	1K/1K	3 db @ ± 500 c/s	40 db @ ± 1 Kc/S	1 5/8 x 1 3/4 x 2¼
20-0027-10	3.35 K/S	6 db	1K/1.6K	3 db @ ± 180 c/s	30 db @ 1200 c/s	2½ Sq. x 1¼
20-0029-10	4 Kc/S	3 ± ½ db	1K/1.6K	3 db @ ± 175 c/s	30 db @ ± 1000 c/s	1¾ Sq. x 2¼
20-0030-10	8 Kc/S	6 db	1K/100K	3 db @ ± 225 c/s	40 db @ 11.5 Kc/S	1 13/32 Sq. x 2 3/16
20-0080-10	12 Kc/S	11 db	33K/33K	3 db @ ± 200 c/s	60 db @ ± 6000 c/s	2 x 3 x 2¼
20-0020-11	18 Kc/S	8 db	47K/500	3 db @ ± 250 c/s	30 db @ ± 2 Kc/S	2 x 3 x 1½
20-0091-11	26 Kc/S	6 ± ½ db	10K/30K	3 db @ ± 1500 c/s	40 db @ ± 12.5 Kc/S	2 x 2¼ x 3¼
20-0100-10	48 Kc/S	4 db	15K/5M	± 1 db @ ± 50 c/s	60 db @ ± 4 Kc/S	1½ x 1 29/32 x 3 35/32
20-0093-10	64.75 Kc/S	5 db	600/20K	3 db @ ± 2200 c/s	60 db @ ± 6250 c/s	2⅝ x 4⅛ x 3 7/16
20-0104-10	88 Kc/S	6 db	600/600	.5 db @ ± .1 Kc/S	20 db @ ± 4 Kc/S	2 1/32 x 2 1/32 x 1¼
20-0177-11	142.5 KC/S	20 db	5K/5K	3 db @ ± 1.75 Kc/S	70 db @ ± 9 Kc/S	1¾ x 2 x ⅞
20-0168-11	156 Kc/S	6 db	300/1K	.5 db @ ± 10 Kc/S	60 db @ ± 39 Kc/S	¾ x 1¾ x 3
20-0105-10	216 Kc/S	6 db	600/600	.5 db @ ± .1 Kc/S	20 db @ ± 4 Kc/S	2 3/32 x 2 17/32 x 1 1/64
20-0103-10	216 Kc/S	1.5 db	600/600	.25 db @ ± 52 Kc/S	55 db @ 304 Kc/S	2 3/64 x 1 3/64 x 2 5/32
20-0157-10	336 Kc/S	2.5 db	600/600	.2 db @ 312 to 360 Kc/S	70 db @ 250 & 450 Kc/S	1 1/32 x 2 1/32 x 2 5/32
20-0098-10	338 Kc/S	3 db	600/600	within .5 db @ 310 to 367 Kc/S	70 db @ 479 Kc/S	2 13/64 x 3 x 1 1/64
20-0097-10	384 Kc/S	3 db	600/600	within .5 db @ 360 to 408 Kc/S	70 db @ 528 Kc/S + 112	2 13/64 x 3 x 1 1/64
20-0101-10	384 Kc/S	2.5 db	600/600	within 2 db @ 360 to 480 Kc/S	70 db @ — 88 Kc/S	2 3/64 x 1 3/64 x 2 5/32
20-0095-10	424 Kc/S	2.5 db	124/124	within 1 db @ ± 424 c/s	50 db @ 848 Kc/S	1 x 1½ x 1
20-0096-10	435 Kc/S	2.5 db	600/600	3 db @ ± 29 Kc/S	55 db @ 516 Kc/S	2 13/64 x 3 x 1 1/64
20-0169-10	781 Kc/S	3 db	1K/1K	±.5 db @ 10 Kc/S	40 db @ 39 Kc/S + 436	¾ x 1¾ x 2
20-0185-10	2.172 Mc/S	5 db	135/135	.5 db @ ± 120 Kc/S	50 db @ — 376 Kc/S	2¾ x 7 x 1 1/64
20-0014-10	3 Mc/S	1 ± ½ db	300/300	3 db @ ± .55 Mc/S	40 db @ ± .8 Mc/S	2¼ x 2½ x 4
20-0179-10	14 Mc/S	15 db	500/500	3 db @ ± .15 Mc/S	65 db @ 1 Mc/S	1⅝ x 2 x 1⅛
20-0234-10	21.5 Kc/S	6 db	600/2500	3 db 21.5 to 24.3 Kc/S	25 db @ 21.06 Kc/S 40 db @ 20.46 & 35 Kc/S	1 1/16 x 2 5/32 x 1
20-0215-10	31.8 Kc/S	7 db	3K/1.5K	3 db 31.8 to 34.5 Kc/S	25 db @ 31.29 Kc/S 40 db @ 30.69 & 45 Kc/S	1 1/16 x 2 1/64 x 1

LOW PASS FILTERS

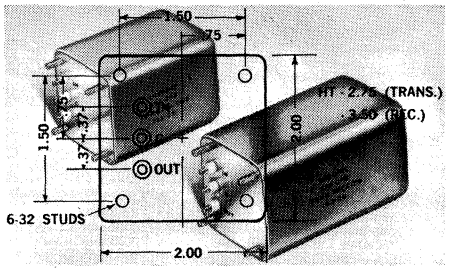
PART NUMBER	SOURCE/ LOAD	PASS BAND	STOP BAND	SIZE
20-0153-10	10/5M	2 ± 1 db @ 15 to 37 c/s	40 db @ 400 c/s	1¼ Sq. x 1½
20-0127-10	1K/10K	3 db @ 40 c/s	40 db @ 75 c/s	1½ Sq. x 2
20-0212-10	1K/1K	3 db @ 185 c/s	60 db @ 430 c/s	⅞ x 1⅝ x 1½
20-0213-10	1K/1K	3 db @ 300 c/s	24 db @ 1200 c/s	⅞ x 1⅝ x 1½
20-0221-10	15K/47K	.5 db @ 430 c/s	25 db @ 800 c/s	¾ x 1¾ x 3
20-0145-11	600/600	3 db @ 2350 c/s	40 db @ 2575 c/s	3½ x 3 x 6
20-0268-10	1K/1K	±.5 db .3 to 3 Kc/S	50 db above 4 Kc/S	1¼ x 3 3/16 x 2 31/32
20-0223-10	600/600	±.5 db .25 to 3 Kc/S	35 db 3.4 to 4.5 Kc/S	1½ x 4 x 1¼
20-0117-10	600/600	±.5 db .25 to 3.4 Kc/S	35 db 3.8 to 5.0 Kc/S	1½ x 4 x 1¼
20-0072-10	10K/10K	within 1 db 300 c/s to 30 Kc/S	40 db @ 44 Kc/S	1½ Sq. x 2
20-0102-10	600/600	within .25 db 36 to 140 Kc/S ±.1	35 db @ 164 Kc/S	2 5/16 x 2 13/16 x 1 1/64
20-0198-10	75/75	—.5 db @ 2.05 Mc/S	40 db @ 2.5 Mc/S	2⅜ Sq. x 1¼

HIGH PASS FILTERS

20-0001-10	2K/2K	3 db @ 300 c/s	50 db @ 120 c/s	1¼ Cube
20-0214-10	2K/2K	3 db @ 350 c/s	40 db @ 175 c/s	⅞ x 1⅝ x 1½
20-0145-12	600/600	3 db @ 2575 c/s	40 db @ 1000 c/s	3½ x 3 x 6
20-0002-11	100/150	3 db @ 5 Kc/S	50 db @ 4 Kc/S	1¾ x 2⅜ x 4¼

CUSTOM FILTERS. Low, band or high pass and band stop filters with optimum characteristics can be supplied to your special requirements and MIL-F-18327. Construction utilizes toroidal inductors and high quality capacitors of special films or silvered mica, according to frequency and space requirements. Operating frequencies range to 10 mc/s. Temperature stabilization for both amplitude and frequency can be effected. Mechanical styles may be epoxy encapsulated or hermetically sealed steel in sizes from 0.2 to 200 cu. in.

OTHER PRODUCTS: Precision Inductors • Transformers & Reactors • Tuned Circuits • Amp/Phase Equalizers • Lumped Constant Delay Lines.



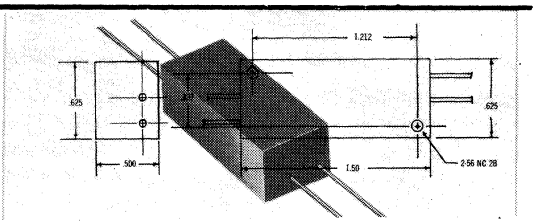
SERIES 03 TELEGRAPH TONE CHANNEL BAND PASS

(170 cycle spacing)

SPECIFICATIONS:

Relative Attenuation	Freq.	Receiver No.	Trans. No.
(Receive Filters)	425	03-01	03-21
3 db max at ± 42.5 cps	595	03-02	03-22
20 db min at ± 85 cps	765	03-03	03-23
40 db min at ± 128 cps	935	03-04	03-24
(Transmit Filters)	1105	03-05	03-25
3 db max at ± 42.5 cps	1275	03-06	03-26
15 db min at ± 85 cps	1445	03-07	03-27
30 db min at ± 128 cps	1615	03-08	03-28
	1785	03-09	03-29
Insertion Loss—10 db max	1955	03-10	03-30
	2125	03-11	03-31
Terminations	2295	03-12	03-32
Input: 600 ohms	2465	03-13	03-33
(inputs all channels may	2635	03-14	03-34
be operated in parallel)	2805	03-15	03-35
Output: Receive 50K ohms	2975	03-16	03-36
Transmit 600 ohms	3145	03-17	03-37
	3315	03-18	03-38

In addition to series listed, other tone channel series with spacings from 85 to 500 c/s are available.



SERIES 272 VCO TELEMETRY FILTERS

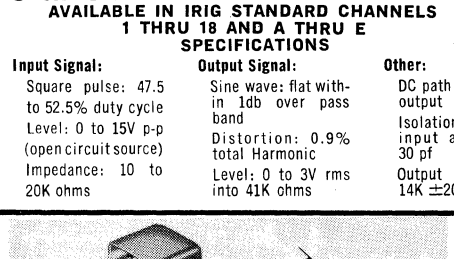
AVAILABLE IN IRIG STANDARD CHANNELS 1 THRU 18 AND A THRU E

SPECIFICATIONS

Input Signal:
Square pulse: 47.5 to 52.5% duty cycle
Level: 0 to 15V p-p (open circuit source)
Impedance: 10 to 20K ohms

Output Signal:
Sine wave: flat within 1db over pass band
Distortion: 0.9% total Harmonic
Level: 0 to 3V rms into 41K ohms

Other:
DC path at input and output
Isolation between input and output 30 pf
Output impedance: 14K ±20%



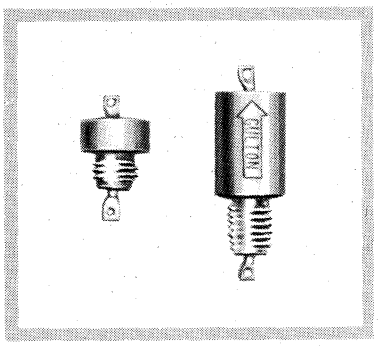
SERIES 68 MINIATURE LOW PASS

SPECIFICATIONS:

Relative Attenuation	f_c cps	Part No.
3 db ± .5 @ f_c	330	68-01
20 db min @ 1.3 f_c	450	68-02
40 db min @ 1.5 f_c	600	68-03
	660	68-04
Insertion loss—1 db max	790	68-05
	900	68-06
Terminations	1050	68-07
Input—10K ohms	1200	68-08
Output—10K ohms	1600	68-09
	2100	68-10
Physical Specifications	3000	68-11
Case Hermetically Sealed Steel	3300	68-12
Size (330 to 900 cps)	4000	68-13
1.26"x1.26"x1.5" High	4500	68-14
Mounting: two 6-32 studs	5250	68-15
spaced 1.25"	6000	68-16
Size (1050 to 13000 cps)	8000	68-17
1"x1"x1" High	10500	68-18
Mounting: two 4-40 studs	11500	68-19
spaced 1"	13000	68-20
Terminals—3 solder type		

Gulton

EMI BROAD BAND LOW PASS FILTERS
SUBMINIATURE AND MINIATURE



Gulton offers the widest range of broad band low pass filters on the market today. . . subminiature BUTTON series, miniature TEMPERATURE STABLE series and standard broad band series. They are available in 50, 100 and 150 VDC voltage ratings and 60 ma. to 15 amp. current ratings. Note. . . BUTTON series. . . the smallest broad band filters.

BUTTON SERIES L NETWORK 50 VDC

PART NUMBER	FIG. NO.	CURRENT DC Max.	CAPACITANCE Min.	VOLTAGE DC	MINIMUM INSERTION LOSS - FULL LOAD					
					30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
MF-420-BPG	1	15 amp.	1.4μf	50	15	28	33	44	60	70
MF-470-BPG	2	15 amp.	1.4μf	50	15	28	33	44	60	70

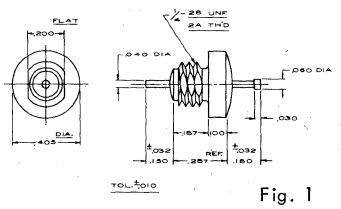


Fig. 1

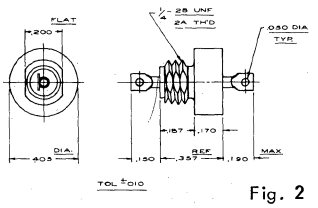


Fig. 2

STANDARD BROAD BAND SERIES L NETWORK 50 VDC

PART NUMBER	FIG. NO.*	CURRENT DC Max.	RESISTANCE DC Max.	MINIMUM INSERTION LOSS					
				30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
LD-FB05B-100S	1	60 ma.	70	44	70	70	70	70	70
LD-FB05D-100S	1	150 ma.	12	24	52	64	70	70	70
LD-FB05E-100S	1	250 ma.	4	18	42	56	70	70	70
LD-FB05F-100S	1	300 ma.	2.3	16	35	44	62	70	70
LD-FB05G-100S	1	450 ma.	1.2	15	31	37	55	70	70
LD-FB05N-100S	1	10 amp.	.01	15	28	33	44	64	70

*Can also be supplied in configurations shown in Figures 2 and 3.

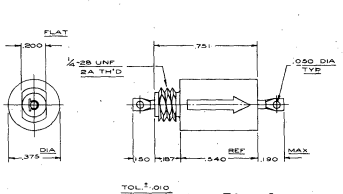


Fig. 1

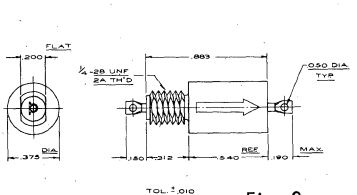


Fig. 2

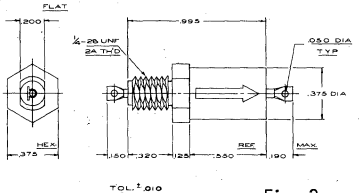


Fig. 3

Gulton Industries, Inc. Microceramics Division
Metuchen, New Jersey 08840
Phone: 201-548-2800 • TWX-710-998-0592

Gulton

TEMPERATURE STABLE BROAD BAND FILTERS
LOW PASS

Gulton TEMPERATURE STABLE broad band filter line offers 50 VDC, 100 VDC and 150 VDC ratings in L, Pi and T networks. The TEMPERATURE STABLE line features:

- Guaranteed minimum insertion loss with full load applied from -55°C to +125°C
- No voltage derating to +125°C
- Low DC resistance

Contact Gulton for data on the 100 VDC and 150 VDC rated L, Pi and T network broad band filters.

L NETWORK 50 VDC

PART NUMBER	FIG. NO.*	CURRENT DC Max.	RESISTANCE DC Max.	MINIMUM INSERTION LOSS FULL LOAD -55°C to +125°C					
				30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	10 GHz
LD-FA05B-100G	1	60 ma.	35	44	70	70	70	70	70
LD-FA05C-100G	1	100 ma.	15	30	60	70	70	70	70
LD-FA05D-100G	1	150 ma.	6	24	52	64	70	70	70
LD-FA05E-100G	1	250 ma.	4	21	44	58	70	70	70
LD-FA05F-100G	1	300 ma.	2.3	19	40	50	70	70	70
LD-FA05G-100G	1	450 ma.	1.2	16	32	40	60	70	70
LD-FA05J-100G	1	1 amp.	.2	12	30	38	55	70	70
LD-FA05L-100G	1	3 amp.	.1	11	29	35	46	70	70
LD-FA05M-100G	1	5 amp.	.04	7	18	25	37	68	70

Pi NETWORK 50 VDC

PART NUMBER	FIG. NO.*	CURRENT DC Max.	RESISTANCE DC Max.	MINIMUM INSERTION LOSS FULL LOAD -55°C to +125°C					
				30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	10 GHz
PD-CA05B-100G	1	60 ma.	35	47	80	80	80	80	80
PD-CA05C-100G	1	100 ma.	15	40	76	80	80	80	80
PD-CA05D-100G	1	150 ma.	6	34	71	80	80	80	80
PD-CA05E-100G	1	250 ma.	4	28	64	80	80	80	80
PD-CA05F-100G	1	300 ma.	2.3	20	58	74	80	80	80
PD-CA05G-100G	1	450 ma.	1.2	4	50	69	80	80	80
PD-CA05J-100G	1	1 amp.	.2		43	62	80	80	80
PD-CA05L-100G	1	3 amp.	.1		30	49	80	80	80
PD-CA05M-100G	1	5 amp.	.04		20	40	75	80	80

T NETWORK 50 VDC

PART NUMBER	FIG. NO.*	CURRENT DC Max.	RESISTANCE DC Max.	MINIMUM INSERTION LOSS FULL LOAD -55°C to +125°C					
				30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	10 GHz
TD-BA05B-100G	1	60 ma.	70	50	80	80	80	80	80
TD-BA05C-100G	1	100 ma.	30	44	80	80	80	80	80
TD-BA05D-100G	1	150 ma.	12	36	80	80	80	80	80
TD-BA05E-100G	1	250 ma.	8	30	70	80	80	80	80
TD-BA05F-100G	1	300 ma.	4.6	18	54	70	80	80	80
TD-BA05G-100G	1	450 ma.	2.4	17	45	62	80	80	80
TD-BA05J-100G	1	1 amp.	.4	14	32	44	70	80	80
TD-BA05L-100G	1	3 amp.	.2	12	28	36	55	80	80
TD-BA05M-100G	1	5 amp.	.08	10	26	34	48	80	80

*Can also be supplied in configurations shown in Figures 2 and 3.

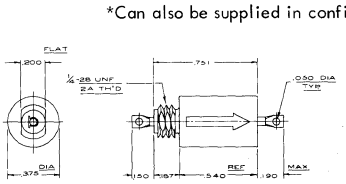


Fig. 1

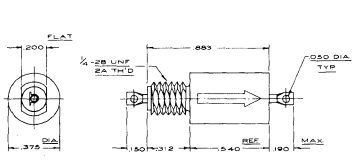


Fig. 2

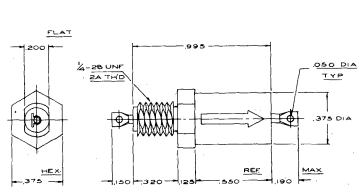


Fig. 3

Gulton Industries, Inc. **Microceramics Division**
Metuchen, New Jersey 08840
Phone: 201-548-2800 • TWX-710-998-0592

HOPKINS ENGINEERING CO.

FILTERS

- EMI/RFI Custom
- Power
- Shielded Panelboards
- Signal Communications
- Gen. Purpose Tubular/Rectangular
- UL Data Processing
- Band Pass/Wave
- Special Chokes

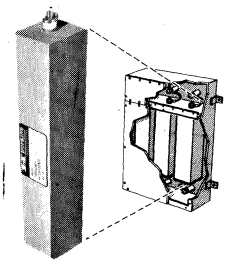
12900 Foothill Blvd., San Fernando, California 91342 • Telephone: (213) 361-8691 • TWX 213-764-5998 • Cable Address: HOP

POWER FILTERS

Hopkins Power Line Filters are designed, built and tested to deliver maximum trouble-free continuous service year-after-year. Available as individual power filters, or housed in cabinet assemblies, these units are intended for use in shielded enclosures, secure installation and general power applications. They are available in various current ratings from 1 AMP through 200 AMPS.

1960 Series

The 1960 Series filters furnish 100 DB of attenuation from 14KHZ to 10GHZ when measured in accordance with Mil Standard 220A load conditions.

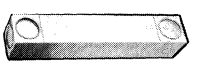


12600 Series

The 12600 Series filters furnish 100 DB of attenuation from 14KHZ to 10GHZ when measured in accordance with Mil Standard 220A. Also measured under full load conditions from 14KHZ to 20MHZ with special buffer networks to allow valid measurements below 100KHZ.

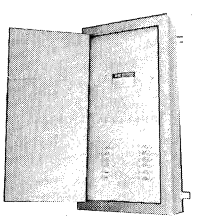
1776 Series and 1620 Series

Filters are also available in single and dual circuit units offering lower performance characteristics when required.

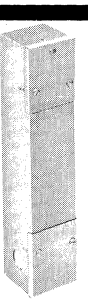


RF SHIELDED & FILTERED CIRCUIT BREAKER PANELBOARD

Hopkins R-F Shielded and Filtered C/B Panelboards are intended for use in installations where secure communication is mandatory. The unique design of these Panelboards maintains shielding integrity with the cabinet door **open.** Designs are available utilizing both the 1960 Series and 12600 Series filters. Circuit Breaker Complement must be specified when ordering.



COMMUNICATIONS/ SIGNAL LINE FILTERS

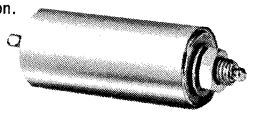


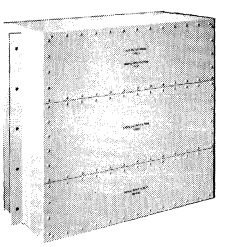
258B-S2

This unit is a Voice and Signal Line Filter offering 100 DB attenuation from 14KHZ to 1GHZ per Mil Standard 220A with outstanding reliability. Originally designed for use in 600 OHM balance system, it has been widely used in other applications such as Secure Communications.

F-4386 & F-4386-1

These Voice and Signal Filters are designed to meet the requirements of DCA Cir 175-6A Application #1. They are single circuit bulkhead mounting tubular filters intended for cabinet installation.





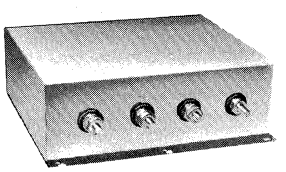
Special cabinet designs are available incorporating any number of the above filters modified for cabinet installation. These units are constructed with an R-F Shielded bulkhead between input and output housings in order to maintain shielding integrity required for secure installations.

UL RECOGNIZED FILTERS FOR DATA PROCESSING EQUIPMENT

The 44 Hopkins RFI Filters designed expressly for data processing equipment provide maximum suppression of Radio Frequency Interference and other extraneous signals detrimental to efficient operation of data processing equipment.

Hopkins RFI Filters are designed and tested to deliver maximum, trouble-free duty for many years.

You will speed production and save both time and money in the manufacture of your data processing equipment when you specify, whenever possible, off-the-shelf Hopkins RFI Filters which are included as recognized components.



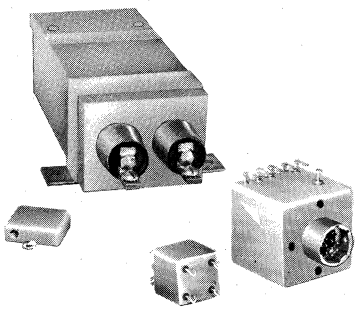
The Hopkins line offers the widest selection of RFI filters recognized under the component program of Underwriters' Laboratories, Inc.

U.L. Yellow Card listings available upon request. Available in various amperage ratings and case styles.

CUSTOM AND GENERAL PURPOSE EMI/RFI FILTERS

Custom Filters

Hopkins has long been a leader in the design and development of special custom filters to satisfy specific customer requirements. Thousands of designs are on file incorporating all voltage, current ratings and case configurations. Design and performance are verified by computer. Our complete Engineering and Manufacturing Facility is available to assist in the solution of your particular filter problems.

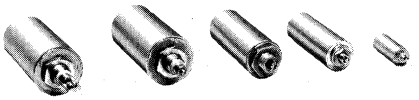


General Purpose Tubular Filters—14000 Series

Intended for use in critical applications where the "feed-thru" characteristic is necessary for good high frequency performance. Available in various circuit configurations from a single element capacitor thru multiple element Pi and T sections. Various performance characteristics are available to allow the user to select the unit best suited to his needs. Typical ratings from 50VDC @ 1 Amp. to 277 VAC @ 50 Amp.

All units designed to meet requirements of MIL-F-15733.

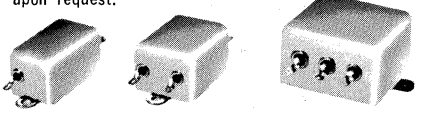
These Units are available mounted in cabinets on special request. Contact Factory.

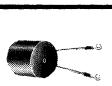


General Purpose Rectangular Filters—16000 Series

These units are intended to be used where installation is not critical. They are available in one, two and three circuit configuration as well as a wide variety of voltage and current ratings. Various attenuation characteristics allow the user to select the unit best suited to fit his particular needs. Typical ratings are from 50 VDC @ 1 Amp. to 277 VAC @ 50 Amp. All units are designed to meet the requirements of MIL-F-15733.

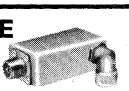
Electronic Wave Filters utilizing modern network design techniques are available as custom filters upon request.



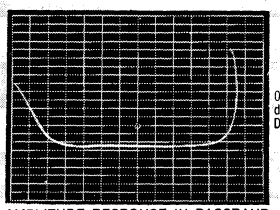


SPECIAL CHOKES

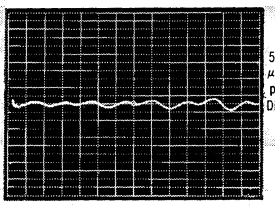
BAND PASS/WAVE FILTERS



HOW KAPPA GETS CONSTANT DELAY IN STEEP RESPONSE FILTERS!



AMPLITUDE RESPONSE IN PASSBAND



PASSBAND GROUP DELAY DISTORTION

Difficult? . . . of course! . . . but

WE PROGRAMMED A GENERAL SOLUTION

in double precision **FOR** a high-speed digital computer, to enable us to meet the demands of systems requiring delay distortionless transmission.

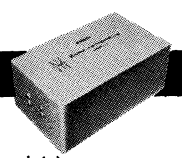
ANY PREDETERMINED ENVELOPE DELAY

can now be attained

BY ITERATION OF THE POLES AND ZEROES

of a complete system with up to 50 equalizer sections. By **ACHIEVING EQUAL RIPPLE RESPONSE** this method outperforms any other equalization technique in minimizing delay distortion. KAPPA design engineers can assist you in attaining **ECONOMICALLY** an improved accuracy of time correlation between signals in data transmission systems.

KAPPA 2211 SERIES FILTERS



(TYPE: BAND PASS)

PASS BAND RESPONSE :	
Frequency Range:	3300-6000 Hz (1 db points)
Amplitude ripple:	± 0.25 db.
Group Delay Distortion:	Less than ± 100 usec.
Insertion Loss at 4500 Hz:	Less than 2.5 db
STOP BAND RESPONSE :	Min 50 db at 3000 Hz and lower Min 50 db at 6420 Hz and higher
Impedance Range:	500-6000 ohms
Pass Band Harmonic Distortion:	Less than –65 db
Intermodulation Distortion between equal simultaneous level tones:	55 db below –10 dbm
Environmental:	MIL F-18237 B

For prompt engineering assistance call us collect at (201) 541-4226

Contact us for the name of your nearest representative or consult listing in this directory. Complete new catalog available.

KAPPA NETWORKS, INC.
Delay Line Specialists • Electric Wave Filters
Manufacturing Engineers
165 ROOSEVELT AVENUE • CARTERET, NEW JERSEY 07008 • TEL. (201) 541-4226

KAPPA FILTERS

Excellence in Design

Uniformity in Production

Timely Delivery

Low Pass
High Pass
Band Pass
Band Stop
RFI
Delay Correcting Networks
DC to 100 MHZ

SPECIFY:
Type:
Frequencies:
Cutoff:
Max. Attenuation:
Impedance:

We will computer-design your special Filter requirements for production reality.

Feel free to consult our well-staffed Filter Department for any help, anytime.

KAPPA NETWORKS, INC.
Delay Line Specialists
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165 ROOSEVELT AVENUE CARTERET, NEW JERSEY 07008
TEL (201) 541-4226
World's largest manufacturer of broadcast quality delay lines.

KNOX ELECTRONICS INC. P.O. BOX 6184, LEAWOOD, KANSAS 66206 • (913) MI 9-5275

ELECTRONIC WAVE FILTERS

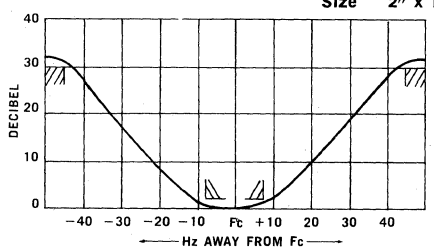
KNOX ELECTRONICS designs and manufactures filters to meet MIL-F-18327C requirements. Modern network design techniques are utilized to meet the most exacting filter specifications. Range of frequencies available are from Sub-Audio to 100 MHz.

TELEGRAPH
TELEMETERING
LOW PASS
HIGH PASS
BAND PASS
BAND REJECTION
LOW PASS — BAND PASS COMBINATION
LOW PASS — HIGH PASS COMBINATION
SUPER GROUP TYPES FOR TELEPHONE SYSTEMS
CRYSTAL FILTERS BANDPASS, BAND REJECT
SINGLE SIDE BAND
AMPLITUDE AND PHASE EQUALIZERS
DISCRIMINATORS
HIGH Q COILS

TYPICAL FILTERS

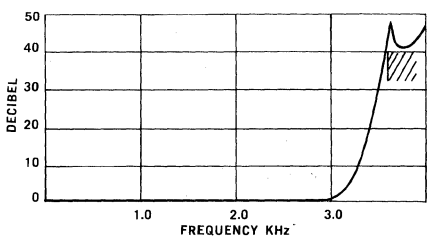
BAND PASS

Frequency	90 Hz
Bandwidth 0.4 db	10 Hz min.
Shape Factor 30/0.4	6:1
Source Impedance	250 ohm
Load Impedance	250 ohm
Insertion Loss	4.0 db max.
Temperature	−55°C to +85°C
Size	2″ x 1.5″ x 2″



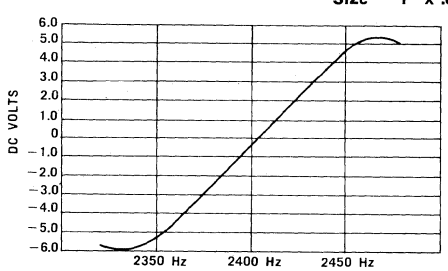
LOW PASS

Frequency	0 - 3000 Hz
Zin = Zout	600 ohm
Return loss from 0 - 3.0 KHz	20 db min.
Shape Factor 40/0.5	1.2:1
Insertion Loss	1.0 db max.
Band Pass Variation	±0.1 db
Temperature	−40°C to +85°C
Size	2.5″ x 2.0″ x 1.5″



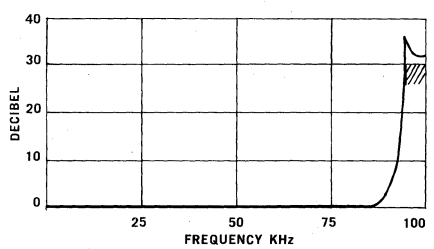
DISCRIMINATOR

Frequency	2400 Hz
Source Impedance	600 ohm
Load Impedance	100 K ohm
Temperature	−55°C to +85°C
Output Linearity	±5% @ ± 50Hz
Space	±170 Hz
Size	1″ x .85″ x 1.5″



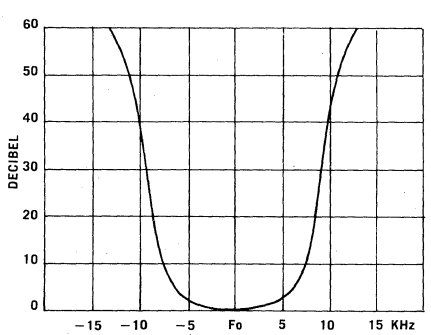
LOW PASS

Frequency	53 KHz
Band Pass Variation 0 - 53 KHz	0.05 db max.
Attenuation 95 KHz to 2 MHz	30 db min.
Phase Linearity 0 - 53 KHz	1.0° max.
Insertion Loss	0.5 db max.
Temperature	−10°C to +55°C
Size	2.5″ x 3″ x 1.5″



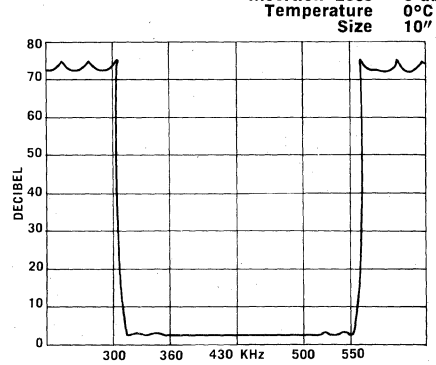
BAND PASS

Frequency	455 KHz
Bandwidth 6 db	13 KHz min.
Shape Factor 80/6	2.5:1
Source Impedance	47.0 K ohms
Load Impedance	10.0 K ohms
Insertion Loss	12 db max.
Temperature	−40°C to +85°C
Size	1.5″ x 1.5″ x 3″



BAND PASS SUPER GROUP

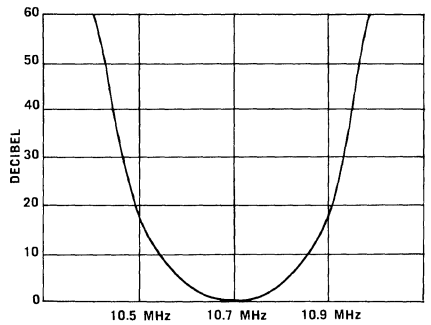
Frequency	430 KHz
Bandwidth ±0.5 db max.	312 to 552 KHz
Attenuation 60 to 303 KHz	70 db min.
560 KHz to 2 MHz	70 db min.
@ 308 KHz	40 db min.
Return Loss: From 312 to 552 KHz	23 db min.
Input Impedance	75 ohm
Output Impedance	75 ohm
Insertion Loss	6 db max.
Temperature	0°C to 60°C
Size	10″ x 2″ x 6″



TYPICAL FILTERS (Cont'd)

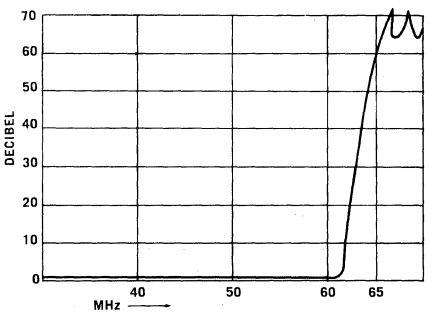
BAND PASS

Frequency	10.7 MHz
Bandwidth 3 db	215 to 230 KHz
Bandwidth 60 db	580 KHz max.
Insertion Loss	14 db max.
Phase Linearity	15° max.
Source Impedance	50 ohms
Load Impedance	50 ohms
Temperature	−55°C to +85°C
Size	2.4″ x .7″ x .75″



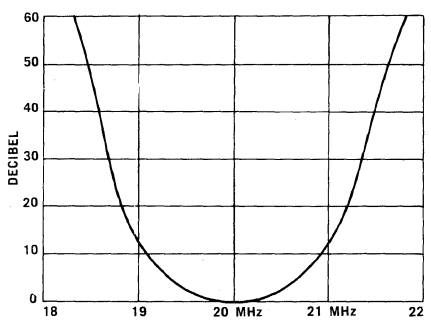
LOW PASS

Frequency	60 MHz
Band Pass Variation .20 - 61 MHz	.8 db max.
Insertion Loss	1 db max.
V.S.W.R. 10 - 61 MHz	1.1:1
RF Power	50 Watts max.
Temperature	−40°C to +85°C
Impedance In - Out	50 ohms
Size	6″ x 2″ x 1.5″



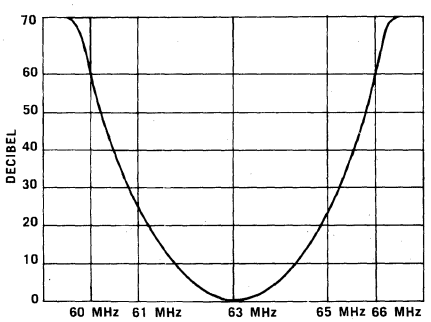
BAND PASS

Frequency	20 MHz
Bandwidth 3 db	1.0 MHz min.
Bandwidth 52 db	4.0 MHz max.
Zin = Zout	200 - 260 ohms
Insertion Loss	6 db max.
Temperature	−40°C to +85°C
Size	2.3″ x .75″ x 1″



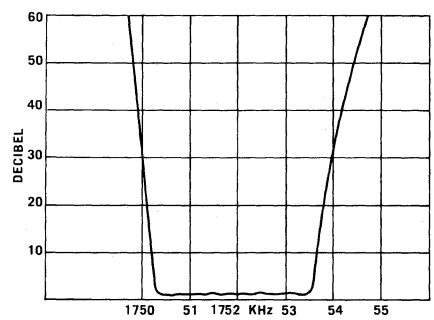
BAND PASS

Frequency	63 MHz
Bandwidth 3 db	±600 KHz min.
Bandwidth 60 db	±3 MHz max.
Input Impedance	500 ohms ±20%
Output Impedance	100 ohms ±20%
Insertion Loss	10 db max.
Temperature	−55°C to +85°C
Size	2¼″ x 15/16″ x 1⅛″



UPPER SIDE BAND CRYSTAL FILTER

Carrier Frequency	1750 KHz
Bandwidth 2 db	3.2 KHz
Carrier Rejection	30 db min.
Attenuation: 0 to 1749.7 KHz and	
1745.5 KHz to 20 MHz	60 db min.
Ripple	1.5 db max.
Insertion Loss	6 db max.
Temperature	−40°C to +80°C
Source Impedance	250 ohms
Load Impedance	250 ohms
Size	3.3″ x 2″ x 1.1″



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LEAWOOD
KANSAS 66206
(913) MI 9-5275

KOKUSAI ELECTRIC CO., LTD.
9, Nishikubo-Sakuragawa-cho, Minato-ku, Tokyo, Japan Cable Address: SINESHIBA TOKYO Phone: Tokyo (503) 2211

KEC MECHANICAL FILTER

100 Hz to 500 KHz

Selectivity, stability, reliability and compactness of our filters are unique in the industry. (Patented in U.S.A., Federal Republic of Germany, Great Britain, France and Japan.)

Typical Intermediate Frequency Mechanical Filters

Center Freq.	Type	Min 6dB Bandwidth	Max (※)dB Bandwidth	Pickup Sideband U (Upper) L (Lower)	Case Type
455 KHz	MF-455-30MA	6.0 KHz	15.0 KHz (45)	—	MA
〃	MF-455-10AZ	2.0 KHz	6.0 KHz (60)	—	Z
〃	MF-455-10CK	2.0 KHz	6.0 KHz (60)	—	K
〃	MF-455-150E	30.0 KHz	60.0 KHz (60)	—	E
〃	MF-455-60H	12.0 KHz	20.0 KHz (60)	—	H
500 KHz	MF-500-15H	3.0 KHz	7.0 KHz (60)	—	H
500 KHz	MF-500-30H	6.0 KHz	14.0 KHz (60)	—	H
Carrier Freq.					
456.5 KHz	MF-455ZM-24AM	2.4 KHz	4.2 KHz (66)	L	M
453.5 KHz	MF-455ZM-24BM	2.4 KHz	4.2 KHz (66)	U	M
456.5 KHz	MF-455ZM-24AJ	2.4 KHz	4.2 KHz (66)	L	J
453.5 KHz	MF-455ZM-24BJ	2.4 KHz	4.2 KHz (66)	U	J
455 KHz	MF-455ZU-21H	2.1 KHz	5.2 KHz (60)	U	H
455 KHz	MF-455ZL-21H	2.1 KHz	5.2 KHz (60)	L	H

Low Frequency Mechanical Filters

Characteristics (Filter use)

Type	—	FK-32R		FK-33R	FK-34R		FK-352R		FK-353R	FK-354R
	FK-331R	FK-332R			FK-334R		FK-342R		FK-343R	FK-344R
Available Freq. Hz	100～299	300～600	601～1200	1201～2300	2301～5000	5001～6000	300～600	601～1000	1001～2000	2001～2300
3 dB Bandwidth	±0.35% or over	±0.9Hz or over	±0.15% or over				±0.9Hz or over	±0.15% or over		
20 dB Bandwidth	—			±1.3% or less			±15Hz or less		±15% or less	
25 dB Bandwidth	±5% or less	±15Hz or less		—			—			
Insertion Loss	10dB or less	7dB or less					9dB or less			

Characteristics (Oscillator use)

Type		FK-32S		FK-33S	FK-34S		FK-352S		FK-353S	FK-354S
	FK-331S	FK-332S			FK-334S		FK-342S		FK-343S	FK-344S
Available Freq. Hz	100～299	300～500	601～1200	1201～2300	2301～5000	5001～6000	300～600	601～1000	1001～2000	2001～2300
Freq. Stability	±0.35% or less	±0.9Hz or less	±0.15% or less				±0.9Hz or less	±0.15% or less		

Telephone Channel Mechanical Filters

Carrier Freq. KHz	64	72	80	88	96	104
	68	76	84	92	100	108
Case Type	There are two types, V & CF: "V" contains single-filter "CF" contains double-filters					
Characteristics	They satisfy the CCITT Recommendations					

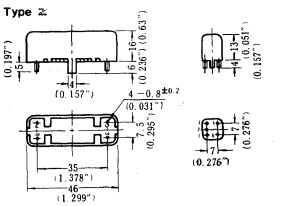
Telegraph Tone Channel Mechanical Filters

Carrier Freq. Hz	2125	2295	2465	2635	2805
	2975	3145	3315	3485	3655
Case Type	ML-G				
The filters spacing at 120Hz are also available					

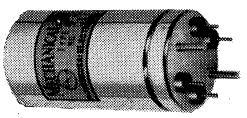
Z



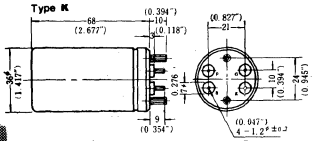
Type Z



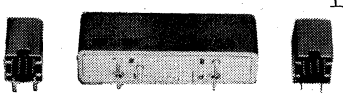
K



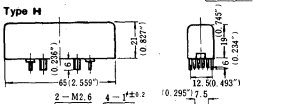
Type K



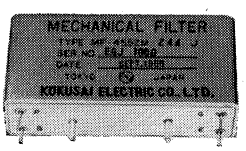
H



Type H



J



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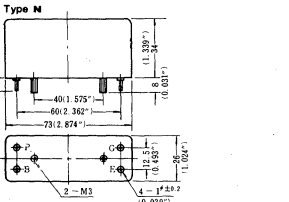
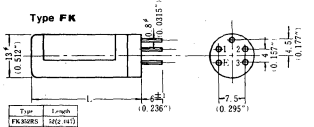


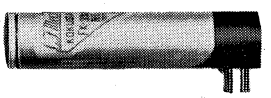
FK

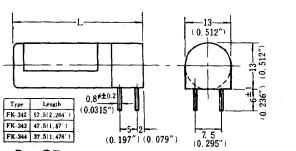


Type FK



FK

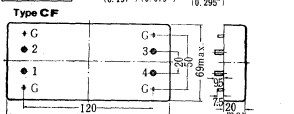




CF



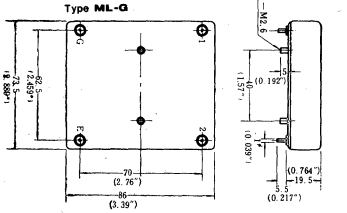
Type CF



ML-G



Type ML-G



Note: The frequency and bandwidth range in the tables don't show our production limits. Other specifications are available in the range from 100 Hz to 500 KHz.

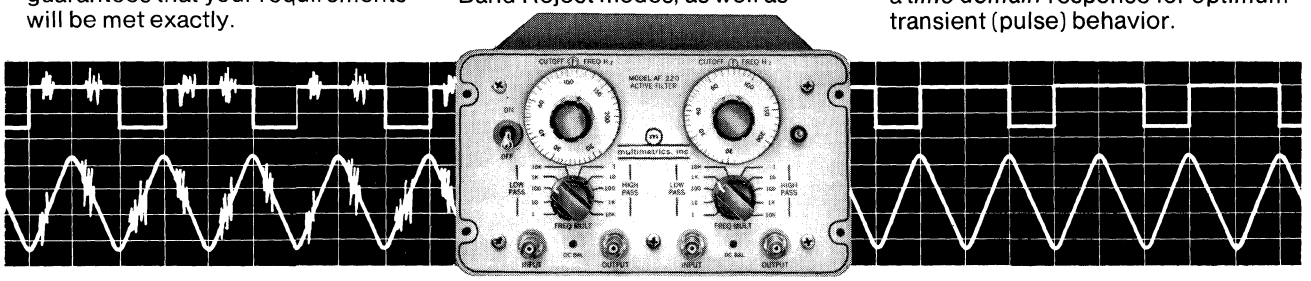
Fight signal pollution.

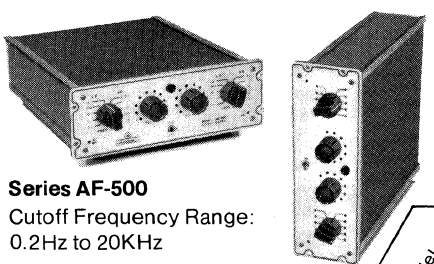
From 0.001Hz to 2MHz, unwanted noise or undesired information present in your signal processing equipment needn't be tolerated.

Our broad range of active filters, stocked for immediate delivery, guarantees that your requirements will be met exactly.

In our extensive line of Variable Active Filters, all individual channels are operable as either Low Pass or High Pass filters. In addition, the interconnection of independent channels allows Band Pass and Band Reject modes, as well as steeper attenuation slopes, to be obtained.

Selectable T/D response permits altering the performance of the Low Pass mode from the optimum frequency domain (Butterworth) to a *time domain* response for optimum transient (pulse) behavior.





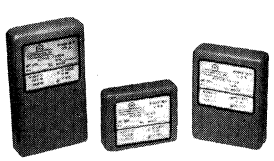
Series AF-500

Cutoff Frequency Range: 0.2Hz to 20KHz

Accuracy: ±5% (Continually adjustable or digitally adjustable—single digit)

The Series AF-500 is available with empirical, continuous tuning or digitally tuned for fractional octave filter applications.

This series is packaged for bench or NIM bin mounting.



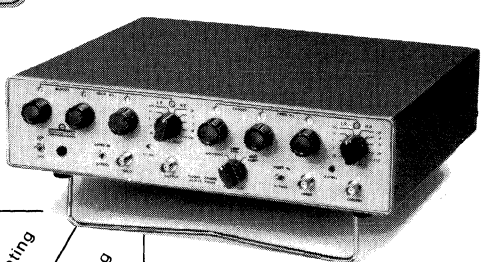
Series AF-300

Fixed Frequency Modules are available in virtually an infinite number of configurations to meet your signal conditioning requirements—Low Pass, High Pass, Bandpass or Band Reject functions with Butterworth, Bessel, Chebyshev, Legendre and other response parameters. Standard Fco multiples are 1, 2, 3, 5 and 10 from 0.1Hz to 100KHz, 60, 120, 180Hz and 2-4 pole units available from stock.

Series AF-100 & AF-200

Cutoff Frequency Range:
AF-100—20Hz to 2MHz
AF-200—0.2Hz to 20KHz

Accuracy: ±5%
(Continuously adjustable)



Series AF-400

Cutoff Frequency Range: 0.01Hz to 99.9KHz

Accuracy: ±2%
(Digitally adjustable)

Operates from Battery or 115/230VAC.

Model	Frequency Range, Hz	Accuracy	Channels	Slope/ Channel	Functions	Mounting	Tuning
AF-110	20 to 2M	±5%	1	24 db/ octave	HP, LP	Bench, rack	Continuous
AF-120	20 to 2M	±5%	2	24 db/ octave	HP, LP, BP, BR	Bench, rack	Continuous
AF-210	0.2 to 20K	±5%	1	24 db/ octave	HP, LP	Bench, rack	Continuous
AF-220	0.2 to 20K	±5%	2	24 db/ octave	HP, LP, BP, BR	Bench, rack	Continuous
AF-410	0.01 to 99.9K	±2%	1	24 db/ octave	HP, LP, By Pass	Bench, rack	Digital
AF-420	0.01 to 99.9K	±2%	2	24 db/ octave	HP, LP, BP, BR, By Pass	Bench, rack	Digital
AF-510	0.2 to 20K	— —	1	24 db/ octave	HP, LP	Bench, NIM BIN	Empirical
AF-510D	0.2 to 20K	±5%	1	24 db/ octave	HP, LP	Bench NIM BIN	Digital
AF-520	0.2 to 20K	— —	2	24 db/ octave	HP, LP, BP, BR	Bench, NIM BIN	Empirical
AF-520D	0.2 to 20K	±5%	2	24 db/ octave	HP, LP, BP, BR	Bench NIM BIN	Digital

Other frequencies, response characteristics and pole configurations are readily generated by our computer-design techniques.

Call or write us or our reps for information on conditioning your problem signals. Our engineers talk your language.

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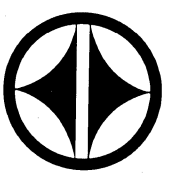
Look in the Yellow Section for Manufacturers' Sales Offices



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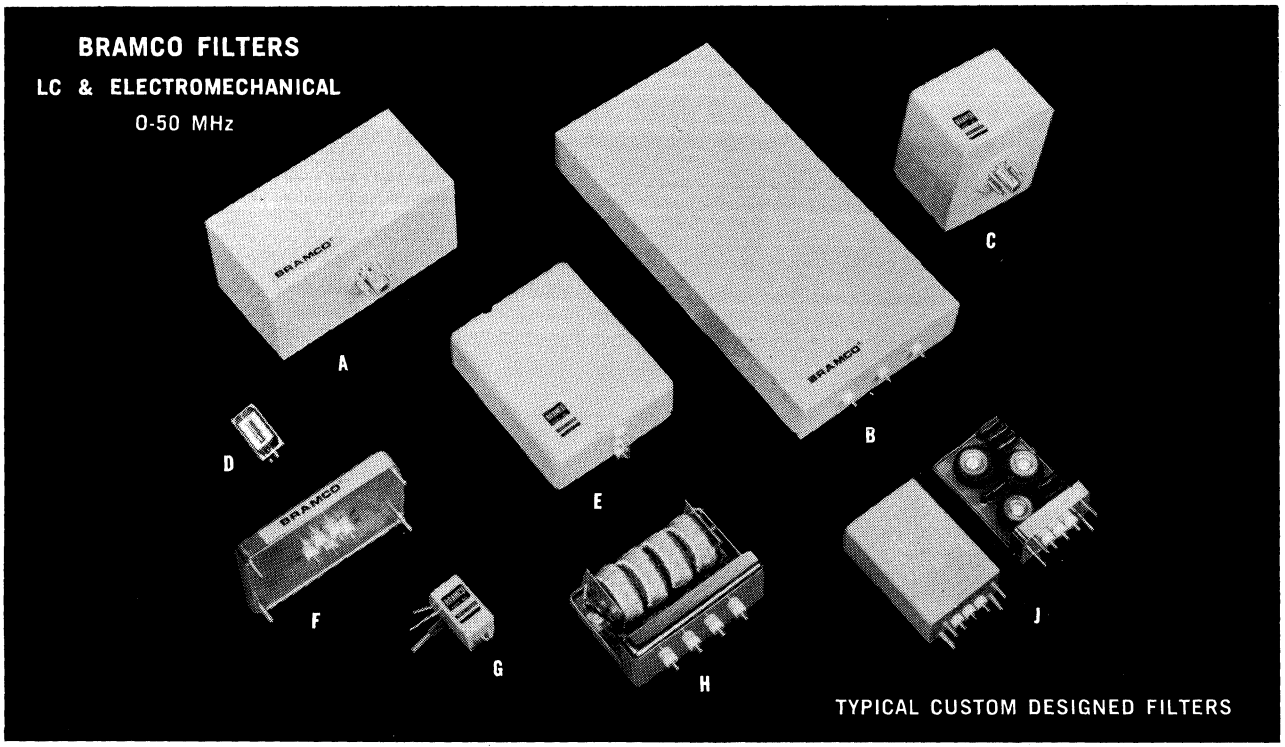

A. Tone Telegraph Bandpass Receive Filter
(MIL-F-18327/7)
Insertion loss: less than 8 db in the pass band
fc: 425 to 3825 Hz in 170 Hz increments
Transformer isolation between input and output
Size: 4 15/16" x 2 9/16" x 2 9/16"

B. Tone Accessory Band Stop Filter
For use with 600 ohm source and load
Typical insertion loss: 3 db, 20 Hz to 1.43 kHz
60 db, 1.58 kHz to 1.9 kHz
3 db, 2.1 kHz to 20 kHz
Size: 9" x 4½" x 1¼"

C. Tone Telegraph Bandpass Transmit Filter
(Mil-F-18327/7)
Specifications same as receive filter (A) except insertion loss less than 5 db in the passband
Size: 2 15/16" x 2 1/16" x 2 9/16"

D. RF20
Contactless Resonant Reed Filter, 80 to 3000 Hz
Works as audio tone filter or stable frequency source (±0.15%) for audio tone generator. See Section 4500 for more details.

E. Tone Accessory Low Pass Filter
For use with 600 ohm source and load
Typical insertion loss: less than 3 db, 20 Hz to 3 kHz
greater than 60 db, 3.45 kHz to 20 kHz
Size: 4" x 3¼" x 1¼"

F. Dual Hipass - Lowpass Filter
Insertion loss, lowpass section: less than 1 db, 20 Hz to 400 Hz
less than 3 db, 400 Hz to 4 kHz
greater than 40 db, 9.5 kHz to 20 kHz
Insertion loss, highpass section: less than 1 db, 9 kHz to 20 kHz
greater than 40 db, 20 Hz to 4 kHz
Operating Temperature: −40 to +85°C
Size: ⅝" x 2¼" x 3¾"

G. EIA Land Mobile Low Pass Voice Filter
1000 ohms source and load impedance
Insertion loss: less than 2 db in passband
greater than 10 db at 4.4 kHz
greater than 30 db at 9.5 kHz and above
Operating Temperature: −30 to +60°C
(EIA Shock and Vibration specs)
Size: ¾" x ⅝" x 1¼"

H. Tone Telegraph Bandpass Receive Filter
fc: 420 Hz to 3180 Hz in 120 Hz increments
Insertion loss: typically 6 to 10 db in the passband
Size: 3¼ x 2¼" x 1¼"

J. Radio Receiver Low Pass Filter
(Mil-F-18327/14, Type FR60X11YY1)
Insertion loss: less than 1 db from 200 Hz to 3 kHz
less than 3 db at 3.5 kHz
greater than 20 db at 3.5 kHz
greater than 45 db from 4.5 kHz to 20 kHz
Operating Temperature: −55°C to +85°C
Size: 2¾" x 1 29/32" x 31/32"

At Bramco the emphasis is in custom engineering LC and electromechanical filters.

We offer broad experience, fast engineering response. Know how to squeeze into tight spots, odd shapes. Use computer synthesis program for optimum design. Build to Mil-F-18327 or commercial specs.

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STANDARD WEE-FIL® FILTERS FOR CUSTOM REQUIREMENTS

Temperature Range: 0 to 105°C. ■ Frequency Range: 50 KHz to 10 MHz. ■ Constructed to meet the requirements of MIL-F-18327, Grade 5 Class R.

LOW PASS WEE-FILS

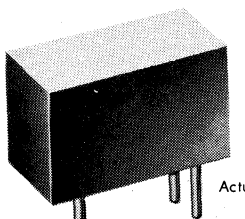


FIG. 1 Single Section

SL20 Wee-Fil Filter
20 db Single Section drops sharply from 3 db attenuation at f_c to 20 db at 1.5 f_c.
See Fig. 1 for size.

SL35 Wee-Fil Filter
35 db Single Section 3 db attenuation at f_c drops sharply to 35 db at 3.5 f_c.
See Fig. 1 for size.

DL35 Wee-Fil Filter
35 db Double Section drops sharply from 3 db attenuation at f_c to 35 db at 1.5 f_c.
See Fig. 2 for size.

DL50 Wee-Fil Filter
50 db Double Section drops sharply from 3 db attenuation at f_c to 50 db at 2 f_c.
See Fig. 2 for size.

HIGH PASS WEE-FILS

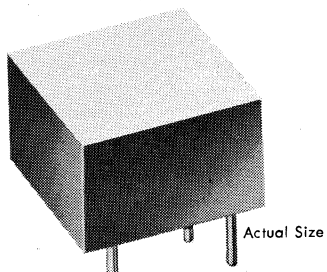


FIG. 2 Double Section

SH20 Wee-Fil Filter
20 db Single Section drops sharply from 3 db attenuation at f_c to 20 db at 0.67 f_c.
See Fig. 1 for size.

SH35 Wee-Fil Filter
35 db Single Section drops sharply from 3 db attenuation at f_c to 35 db at 0.4 f_c.
See Fig. 1 for size.

DH35 Wee-Fil Filter
35 db Double Section drops sharply from 3 db attenuation at f_c to 35 db at 0.67 f_c.
See Fig. 2 for size.

DH50 Wee-Fil Filter
50 db Double Section drops sharply from 3 db attenuation at f_c to 50 db at 0.5 f_c.
See Fig. 2 for size.

BANDPASS WEE-FILS

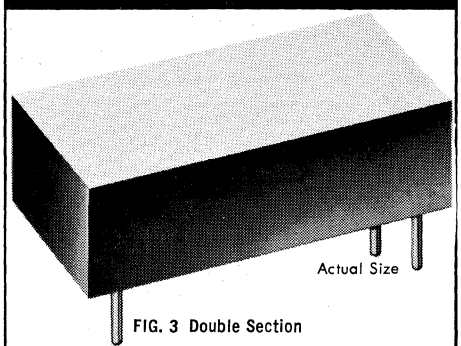


FIG. 3 Double Section

SB20 Wee-Fil Filter
20 db Single Section reaches 20 db attenuation at 3.5 times the bandwidth of the 3 db passband.
See Fig. 2 for size.

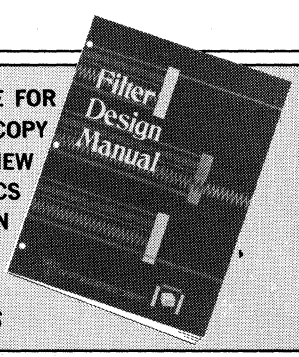
DB30 Wee-Fil Filter
30 db Double Section reaches 30 db attenuation at 3.5 times the bandwidth of the 3 db passband.
See Fig. 3 for size.

DB45 Wee-Fil Filter
45 db Double Section reaches 45 db attenuation at 3.5 times the bandwidth of the 3 db passband.
See Fig. 3 for size.

NYTRONICS WEE-FIL FILTERS
. . . afford fast delivery and low price due to Nytronics' standardization of parts and computer programming of design, parts requisition and test procedure printout. For applications having the same input and output impedance and operating frequency of 10MHz, max, specify Wee-Fil Filters.

For custom filters, consult your nearest NYTRONICS representative.

WRITE FOR YOUR COPY OF THE NEW NYTRONICS FILTER DESIGN MANUAL



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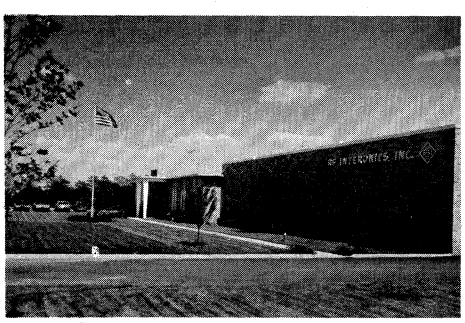
If RFI is your problem, RFI is your answer. RFI? RF Interonics, Inc., leading producer of RFI/EMC filters and capacitors.

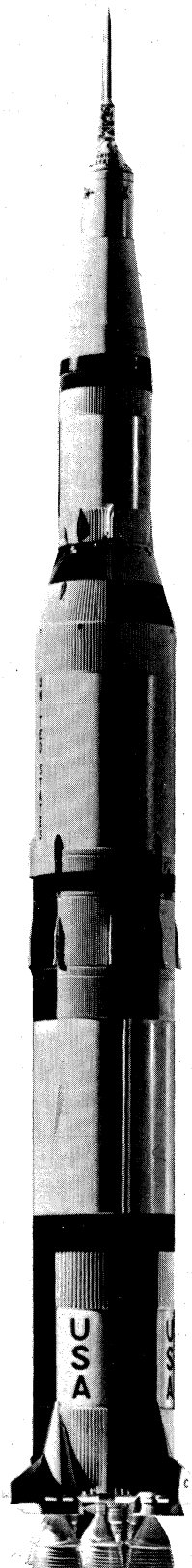
RF Interonics, Inc., with its proven record of unsurpassed technical competence, is prepared to solve your most complex RFI/EMC filter problems.

The RF Interonics facility is the most modern of its type in the country, and is industrially engineered for the efficient manufacture of high reliability radio frequency filters and capacitors. The plant is fully air conditioned and humidity controlled. Clean rooms are maintained for capacitor winding and the assembly of NASA quality filters. A complete in-house capability includes sheet metal fabrication, inductor winding, vacuum impregnation and all necessary processing and test equipment to assure adequate control and quick-reaction time.

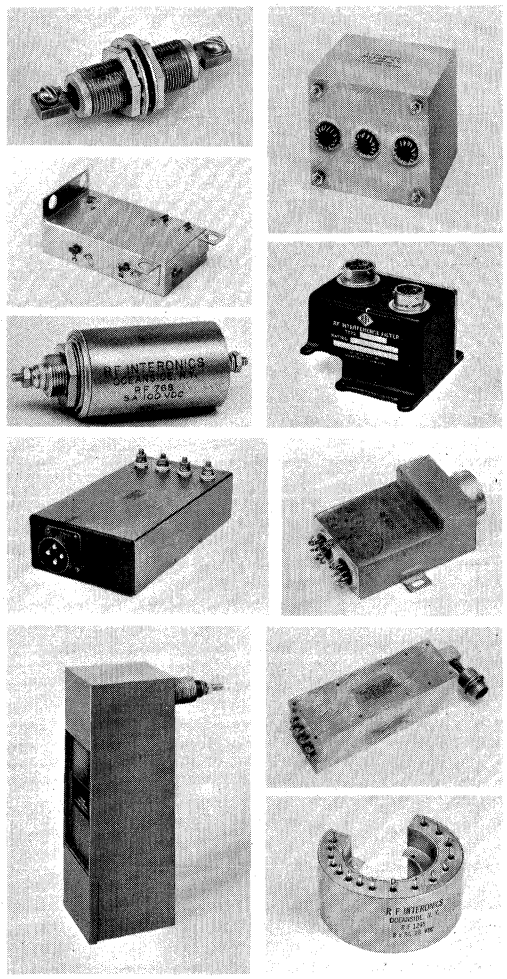
More than 5,000 filter designs are available as standard or custom-engineered assemblies. Filters are produced with current ratings ranging from 1 milliampere to 1,500 amperes, and voltages from 0.1 volt to 20,000 volts.

All filters conform to the requirements of MIL-F-15733E. Where required, parts are produced in conformance with NASA specifications NPC 200-3 and NPC 200-4.





Filters designed and built by RF Interonics are aboard Saturn V as part of the LEM Rendezvous and Landing Radar; the LEM Descent Engine; the Instrument Unit; and the S-II Second Stage. (Photo courtesy North American Rockwell)



CYLINDRICAL FILTERS. Covering a broad range of current and voltage ratings, providing high attenuation over the complete RF interference spectrum.

MULTI-CIRCUIT FILTER PACKAGES. Many circuits in one compact filter assembly. Incorporating the input connector eliminates need for a separately-shielded RF compartment.

SINGLE-CIRCUIT FILTERS. Chassis-mounted (utilizing mounting brackets), or bulkhead-mounted (through a panel that isolates filter input from output).

SHIELDED ROOM FILTERS. Easily bulkhead-mounted directly to shielded enclosures or equipment panels. Removable access covers on shielded side (often an RF leakage source) have been eliminated.

FEED-THROUGH CAPACITORS. Designed and built to exceed MIL-C-11693. Available in a wide range of current and voltage ratings, with attenuation over a broad frequency range.

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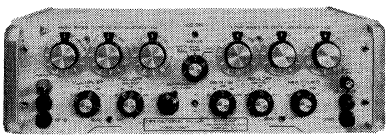
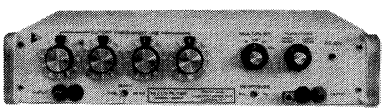
by Rockland Laboratories, Inc.



OPERATIONAL FILTER® Model 1000F $1495

FILTER — AMPLIFIER — OSCILLATOR 0.001 Hz — 11.1 KHz

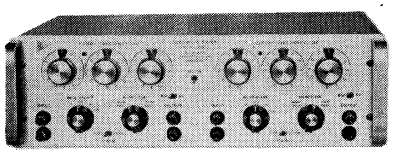
The Series 1000 OPERATIONAL FILTERS are the first multifunction laboratory instruments for frequencies in the range of .001 Hz to 11 KHz. These solid-state, precision instruments offer the following operating modes: FILTER — Low Pass, High Pass, Band Pass, Band Reject, Sharp Null; AMPLIFIER — Low Noise, low drift amplifications of up to 40 db over any selected filter band-width, or up to amplifier bandpass; OSCILLATOR — General purpose laboratory sine wave oscillator covering the entire filter tuning range, and capable of external synchronization. High pass and low pass rolloffs are separately adjustable to a maximum of 24 db/octave. Butterworth or RC response is selectable by front panel switch. Input, single ended or differential. Input impedance 1 megohm. Output impedance 50 ohms. Maximum output voltage swing, 28 volts p-p. AC (115/230 V, 50 - 400 Hz) or DC (+ and –20 V) operation. Chassis dimensions, 5¼" height x 17" width x 14" depth. Bench/rack convertible. Weight 18 lbs.



HI/LO FILTER® Model 1020F $745

HIGH-PASS or LOW-PASS Variable Electronic Filter 0.001 Hz — 111.1 KHz

The Hi/Lo Filter, Model 1020F, is a versatile, low-noise, low distortion, solid state filter which provides either low-pass or high-pass response and exact 4th order (24 db/octave) Butterworth or simple RC characteristics. The cutoff frequency is selected digitally over a span of 8 decades (0.001 Hz to 111 KHz). Hi/Lo Filters can be used individually, or two units can be interconnected to obtain band-pass (series connection) or band-reject (parallel connection) filter response; or to achieve greater high-pass or low-pass attenuation slopes (48 db/octave). Additional units can be connected in series to produce higher order characteristics if required. Series connection can also provide high overall gain, since each unit gives up to 20 db gain. Input impedance, 10 megohm. Output impedance 50 ohms. Output voltage swing, at least 20 volts p-p. AC (115/230 V, 50 - 400 Hz) or DC (+ and –20 V) operation. Chassis dimensions, 3½" height, 17" width, 11" depth. Bench/rack convertible. Weight 12 lbs.



DUAL HI/LO FILTER® Model 1022F $1425

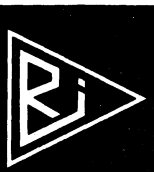
HIGH-PASS, LOW-PASS, BAND-PASS or BAND REJECT 0.001 Hz — 111.1 KHz

The Dual Hi/Lo Filter consists of two identical and independent filters mounted side by side in a single chassis. Each section is a low-noise, solid state active filter which provides either high pass or low pass response and exact 4th order (24 db/oct) or 8th order (48 db/oct) Butterworth or RC characteristics. Cutoff frequency is digitally selected over the 7 decade range from .01 Hz to 111 KHz, with other ranges optional. The filter sections can be used separately or they can be interconnected to obtain band-pass (series connection) or band-reject (parallel connection) filter response; or to achieve greater high-pass or low-pass attenuation slopes. Additional units can be connected in series to produce higher order characteristics if required. Series connection can also provide high overall gain, since each section gives up to x10 gain. Input impedance, 10 megohm. Output impedance 50 ohms. Output voltage swing, at least 20 volts p-p. AC (115/230 V, 50 - 400 Hz) or DC (+ and –20 V) operation. Chassis dimensions, 5¼" height, 17" width, 14" depth. Bench/rack convertible. Weight 18 lbs.

MODEL	TUNING RANGE	PASS BAND LIMITS	ATTENUATION SLOPES	GAIN	MAXIMUM OUTPUT NOISE IN HIGHEST GAIN SETTING MV RMS	CALIBRATION ACCURACY FOR FREQUENCY SETTING	PRICE
OPERATIONAL®			Adjustable to 0, 6, 12,	Adj. to			
1000F	.001 Hz - 11 KHz	DC - 100 KHz	18, 24 db/oct	.0, 6, 20, 40 db	3	±2%	$1495.00
1000F-01	.01 Hz - 11 KHz	"	"	"	3	±2%	$1375.00
1000T	999 sec - 1 msec	"	"	"	3	±2%	$1650.00
1000T-01	99 sec - 1 msec	"	"	"	3	±2%	$1530.00
HI/LO®			fixed	Adj. to			
1020F	.001 Hz - 111 KHz	DC - 1 MHz	24 db/oct	0 or 20 db	0.5	±2%	$ 745.00
1020F-01	.01 Hz - 111 KHz	"	"	"	0.5	±2%	$ 695.00
DUAL HI/LO®				Adj. to 0 or 20 db			
1022F-01	.01 Hz - 111 KHz	DC - 1 MHz	fixed 24 db/oct	for each section	0.5	±2%	$1425.00
1022F-02	.001 Hz - 11 KHz	"	"	"	0.5	±2%	$1425.00
1022F-03	.1 Hz - 111 KHz	"	"	"	0.5	±2%	$1325.00
1022F-04	.01 Hz - 11 KHz	"	"	"	0.5	±2%	$1325.00
1042F-01	.01 Hz - 111 KHz	"	fixed 48 db/oct	"	1.0	±2%	$2025.00
1042F-02	.001 Hz - 11 KHz	"	"	"	1.0	±2%	$2025.00
1042F-03	.1 Hz - 111 KHz	"	"	"	1.0	±2%	$1875.00
1042F-04	.01 Hz - 11 KHz	"	"	"	1.0	±2%	$1875.00

OTHER PRODUCTS

- **CUSTOM DESIGN FILTERS**
- **SEISMIC INSTRUMENTATION**
- **OCEANOGRAPHIC INSTRUMENTATION**
- **AMPLIFIERS**
- **PRESSURE SENSORS**
- **EDUCATIONAL EQUIPMENT**



ROCKLAND LABORATORIES, INC.

POST OFFICE BOX 57 • TAPPAN, NEW YORK 10983 • TEL: 914-359-1818

Precision instruments for engineering and the physical sciences

NETWORKS • FILTERS

Featuring CUSTOM DESIGNS at STOCK PRICES

(Prototypes available as early as 2 weeks)

LOWPASS • BANDPASS • HIGHPASS • BAND REJECT

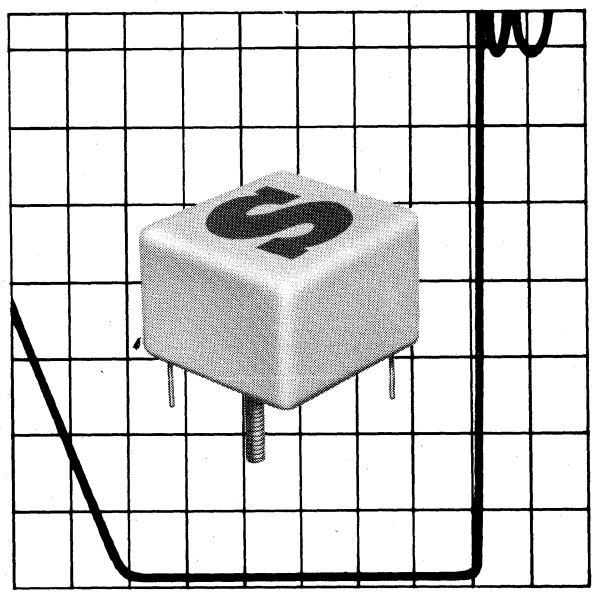
TRANSVERSAL • HILBERT TRANSFORM • ADAPTIVE • DIGITAL • N-PATH

DELAY CORRECTED • PHASE MATCHED • PHASE COHERENT

LC • CRYSTAL • ACTIVE

OUR COMPETENT ENGINEERING DEPT. WELCOMES A DISCUSSION OF YOUR FILTER PROBLEMS

•



Advanced Computer Programming with an extensive computer facility plus a tremendous library of normalized designs added to the finest engineering capability in the industry enables SEG to react to your needs with amazing speed and to MIL Spec.

We have extensive experience in meeting your needs for such applications as: Telemetry, Over and under shoot control, aliasing, FSK, data-handling, time-domain synthesis, tunable characteristics, group delay, phase and intercept control.

WE SOLVED THESE PROBLEMS LAST YEAR:

MINIATURIZATION: 11.5 MHz 2 cubic inch IF Filter; 300 KHz—3db BW; 1.6 MHz—60 db BW

DCA SPECS: A group Delay Equalizer that matches-in cliff-sided Multiplex Channels

RINGING: A Time Domain Equalizer that wipes it out in narrow band RF systems

SINGLE FREQUENCY: A 10 KHz Band Pass Filter with 1 Hz 3db BW and 4 Hz 60 db BW

PULSE COMPRESSION & EXPANSION: Linear Time Delay (Quadratic Phase) Filters (Chirp)

FREQUENCY SWITCHING: Band Reject Filters that switch by digital logic

ANTENNA MATCHING: Antenna Couplers with Bandpass Filters for high selectivity and optimum matching at lower radio frequencies.

FILTERS • LINE EQUALIZERS • LINE SIMULATORS • DELAY LINES • INSTRUMENTS

SEG ELECTRONICS CORPORATION

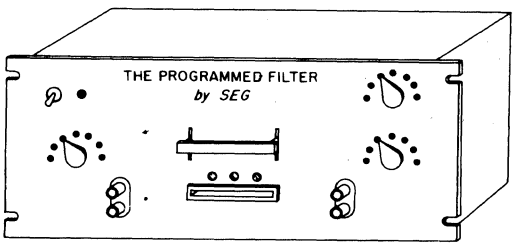
2589 PITKIN AVENUE • BROOKLYN, N. Y. 11208 • 212 - 277-3770

The PROGRAMMABLE FILTERS by SEG

INFINITE LC NETWORK CHARACTERISTICS

APPLICATIONS:

Filter: BP, HP, LP, BR
Delay Compensated Filter
Delay Uncompensated Filter
Group Delay Equalizer
Telephone Line Simulator
Multi-band Filters
Modem Tester



Seg Electronics new Programmable Filter answers a vital need of the industry. The most commonly used functions such as Butterworth, Chebychev, Bessel and Cauer filters in various numbers of poles are supplied in a deck of punch-cards. Simply inserting the proper punch card, setting source and load impedance reproduces the desired characteristic. Included in the deck are the well-known Seg "worst-case" line Simulator characteristics. At any time punch-cards with special characteristics of delay and amplitude response can be ordered from Seg at a nominal cost by furnishing the desired data.

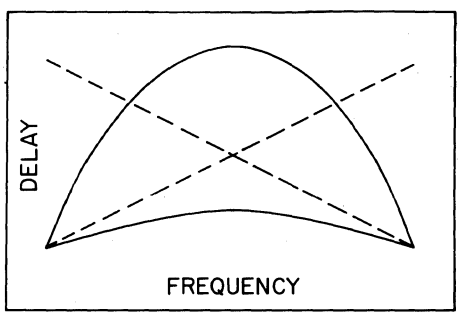
The range of characteristics is limitless. Some less common examples: Arithmetic Symmetry, periodically repeated characteristics, transfer functions with complex coefficients, time-domain characteristics, Time delay variation with flat amplitude, Hilbert transforms, time delay equalized versions of standard filter characteristics.

With this instrument there is no longer a need for building prototypes to determine whether your spec works or not — prevents over- and under-design. Pat. Applied For.

NEW Concept SWITCHABLE LINE EQUALIZERS by SEG

GROUP DELAY FOR USE WITH TELEPHONE LINES

SATELLITE COMMUNICATIONS GROUND STATIONS



Match the characteristic parabolic delay of your telephone lines by selection of the correct parabola and slope at the flick of a switch.

Model FA1292 (TV IF)

Model FA1355 (Telephone line)

First of a highly versatile series of easily adjusted delay equalizers.

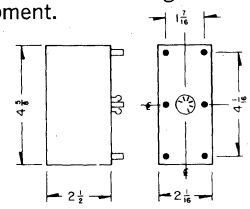
"Worst Case" TELEPHONE LINE SIMULATOR by SEG

SEG LINE SIMULATORS are passive, stable, 600 ohm networks. They effectively simulate a nominal worst case condition of attenuation and envelope delay of the Bell Telephone data lines, 4, 4A, 4B, 4C.

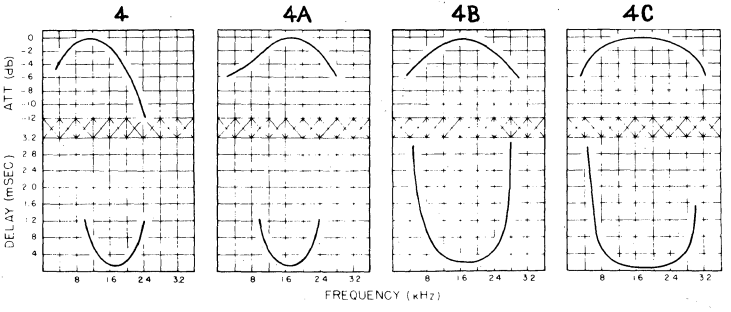
Variations in characteristics can be supplied to order including such perturbations as noise, FM modulation, switchable attenuation, delay ripple, and for F1A&C Message Weighting, Telephoto 1 and 2.

SEG LINE SIMULATORS are government specified test equipment.

$350 EA



Characteristic curves for delay and attenuation for each model.



MODELS: FA1205 BP1157 BP1158 BP1186

FIXED OR ADJUSTABLE EQUALIZERS & SIMULATORS (AMPLITUDE & DELAY) are Regularly Designed to Requested Specs

FILTERS • LINE EQUALIZERS • LINE SIMULATORS • DELAY LINES • INSTRUMENTS

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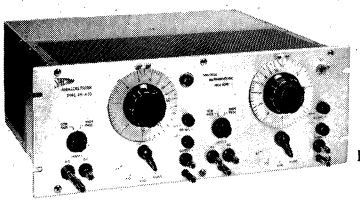
SPECTRUM Analog electronic filters

ACTIVE FILTERS

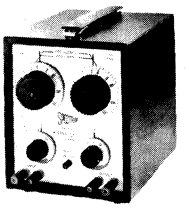


VERY HIGH SIGNAL CAPACITY
(65 VOLTS PEAK-TO-PEAK)
+
LOW NOISE LEVEL
(150 MICROVOLTS RMS)
=
EXCELLENT DYNAMIC RANGE
(>100 DB)

TYPE LH-42D

PROTOTYPE - Seven-pole Butterworth maximally flat pass band voltage transfer, high pass or low pass; 42 db/octave terminal slope in stop band.
PASS BAND CHARACTERISTICS - Lower limit - d.c. (zero frequency); upper limit 5mc/sec. (controlled to 2.5mc/sec.)
INPUT CHARACTERISTICS - 5 megohms resistive paralleled by 10 pf capacitance. Alternative a-c input terminals with 2 ufd blocking capacitor; max. permissible swing - 65 volts peak-to-peak.
OUPUT CHARACTERISTICS - Impedance seen by load - 150 ohms or less; d-c coupling with panel offset adjustments; maximum short circuit current capability - ± 10 ma. Noise - 150 microvolts rms or less.
POWER REQUIREMENTS - 105-125 volts, 50-60 cycle.
DIMENSIONS - 7" high x 19" wide x 14-1/2 deep.
WEIGHT - 44 lbs. ALSO AVAILABLE IN CABINET!

MADE IN 8 CUTOFF TUNING RANGES			
STYLE A	20 - 200,000 cps.	STYLE E	0.2 - 20,000 cps.
STYLE B	2 - 20,000 cps.	STYLE F	0.2 - 200,000 cps.
STYLE C	0.2 - 2,000 cps.	STYLE G	0.02 - 2,000 cps.
STYLE D	2 - 200,000 cps.	STYLE H	0.02 - 20,000 cps.

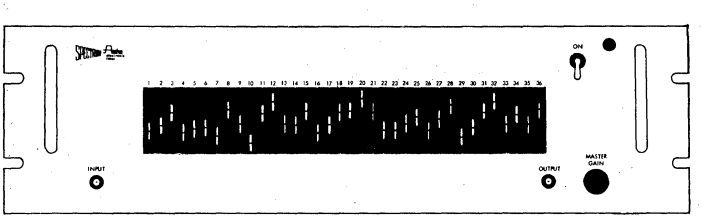


SOLID STATE TUNABLE BANDPASS FILTER...

TYPE BB4-1

FUNCTION - Bandpass filter comprised of cascade of independently tuned low pass and high pass filters.
PROTOTYPE - Four-pole Butterworth (each section) with maximally flat pass band and 24 db/octave stopband slope.
PASS BAND - 20cps to 200,000cps or any segment thereof dependent upon tuning control settings; (dial reading x decade multiplier).
INPUT IMPEDANCE - One megohm resistive shunted by 10 pf capacitance.
OUTPUT CHARACTERISTICS - Internal impedance of 70 ohms; max. signal capacity of 28 volts peak-to-peak into 10,000 ohm load.
PASS BAND GAIN - Unity ±1 db.
PASS BAND FLATNESS - Butterworth (maximally flat) ± 1 db.
NOISE - 500 microvolts rms with input shorted.
DYNAMIC RANGE - 86 db.
CUTOFF ACCURACY - ± 5% of indicated frequency, high pass or low pass.
POWER REQUIREMENTS - 105-125 volts, 50-60 cycle.
DIMENSIONS - 7-1/4" high x 6-1/4" wide x 8-1/4" deep.
WEIGHT - 10-1/2 lbs.
ALSO AVAILABLE IN RACK MOUNTING VERSION!

THE BPA SERIES

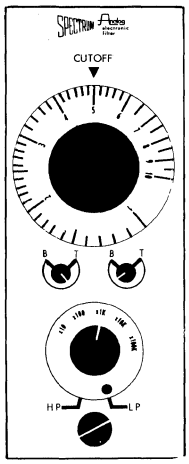


THIRD-OCTAVE ARRAYS FEATURING...

- Up to 36 individual plug-in filters per 5¼" rack panel
- 60 db per octave skirt selectivity
- ASA standard center frequencies from sub-audio to video; (others on special order)
- All silicon solid state
- Vertical slide attenuators for convenient equalizing or spectrum shaping
- Applicable, with auxiliaries, for third-octave real-time spectrum analysis

Series BPA ANALOG Filter assemblies are a low-cost, flexible answer to spectrum shaping and analysis problems in many situations. For example:

- Timbre modification in electronic music composition and production
- Equalization or band shaping for shake-table drivers
- Empirical extraction of voice intelligence from noise masked recording
- Third-octave spectrum analysis of sound meter data for legal or safety purposes



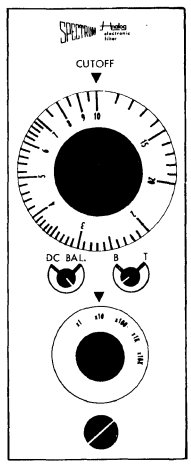
NOW! A VERSATILE, TUNABLE ELECTRONIC FILTER SYSTEM THAT EVERY LAB. CAN AFFORD

THE SPECTRUM TYPE LH-3 BUILDING-BLOCK MODULE

Previously available active filters offer a rigidly limited choice of cut-off rate and/or operating mode; i.e. "X" db/octave (unchangeable) combined with either Butterworth (maximally amplitude flat), Thompson (maximally flat time delay) or, in some cases a mode quaintly referred to as "simple R-C", subtly passed off as a linear phase mode, which it is not.

The Spectrum LH-3 building-block is a three-pole design offering a choice of high pass or low pass roll-off at 18 db/octave. Unlike any filter previously offered, the characteristic mode is panel adjustable to Butterworth (maximally flat), Thompson (linear phase) or to any intermediate transitional condition.

Using a cascade of the basic modules (up to six per panel) the user can construct any desired low pass, high pass or band pass characteristic required in multiples of the basic three-pole structure; i.e. six-pole, nine-pole, twelve-pole, etc. with a standard continuous tuning range from 10 cps. through 1 megacycle/sec.



THE SPECTRUM LBT SERIES...

Modular Signal-Conditioning ANALOG Filters.

A tunable low pass configuration stressing those characteristics most frequently required in instrumentation systems:

(a) Selectable mode, from flat amplitude to flat time-delay.

(b) Direct coupling, to preserve d-c values in signals.

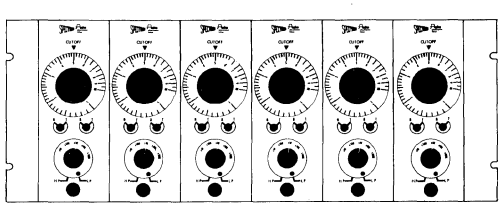
(c) Continuous tuning, for on-the-spot optimization of signal band limiting.

(d) Plug-in format, for on-the-line interchangeability.

Available in various designs from three to six poles, with matching racks.

MODULAR SIX-PAK

Rack panel carriers accept plug-in units described above. The system may be expanded as required. Quick change feature guarantees system reliability. Modules may be preset for instant modification of channel characteristics.



OTHER PACKAGING CONFIGURATIONS

May be supplied, such as single or dual module bearing portable table cabinet (similar to BB4-1 illustrated on opposite page).

SPECTRUM INSTRUMENTS, INC. (founded 1953) offers a background of extensive experience in the design of active filters and spectrum analyzers to customer requirements. We solicit your inquiries, as we can frequently suggest alternative sources of hardware not within our immediate sphere of interest as manufacturers.

SPECTRUM

INSTRUMENTS, INC. **(914) 779-8111**

102 COLUMBUS AVENUE, BOX 474,

TUCKAHOE, N.Y. 10707

TT *miniature* FILTERS



SPECIFY ANY FREQUENCY AND IMPEDANCE IN THE RANGES LISTED FOR THESE STANDARD FILTERS

These pages give complete electrical, mechanical and price information for ordering standard filters. Quality control per MIL-Q-9858.

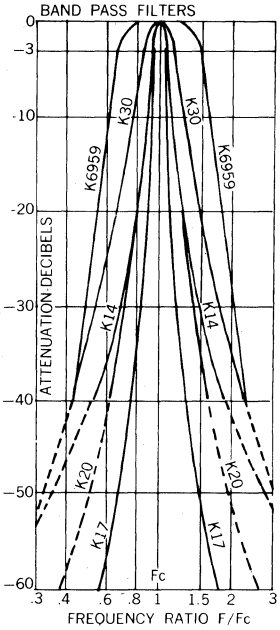
BANDPASS FILTERS FOR ANY CENTER FREQ. FROM 30 Hz TO 200KHz (Specials from 20Hz upward)

Model No.	F_C Center Freq. Range Min.	Max.	Bandwidth —3db	ATTENUATION	Source, Ohms Min.	Max.	Load, Ohms Min.	Max.	Case No.	Approx. Price
K10	1KHz	9.9KHz	±1% F_C	30db at .92F_C	1K	500K	1K	500K	4	$39
K11	10KHz	200KHz	±1% F_C	and 1.1F_C	1K	10K	1K	10K	2	$39
K13	30Hz	99Hz	±5% F_C	60db at .5F_C and 2F_C	1K	500K	1K	500K	5	$55
K14	100Hz	10KHz	±5% F_C	40db at .5F_C	500	10K	100	1Meg	3	$32
K16	10KHz	100KHz	±5% F_C	and 2F_C	100	3K	100	500K	1	$32
K17	100Hz	10KHz	±5% F_C	60db at .5F_C	500	10K	100	1Meg	4	$39
K18	10KHz	100KHz	±5% F_C	and 2F_C	100	100K	100	500K	3	$39
K20	100Hz	3.9KHz	±7.5% F_C	40db at .57F_C	500	10K	500	10K	4	$42
K21A	4KHz	100KHz	±7.5% F_C	and 1.75F_C	500	10K	500	10K	3	$45
K30	100Hz	3.9KHz	±15% F_C	40db at 0.4F_C	500	10K	500	10K	4	$42
K31A	4KHz	100KHz	±15% F_C	and 2.5F_C	500	10K	500	10K	3	$45

The bandwidth for any of the above filters can be increased or decreased to specification.

WIDE BAND FILTERS: Bandwidths of ±25% or greater can be obtained by ordering TT standard High pass and Low pass filter sections as a composite network. Select numbers from the Series H and J listings on the next page which give the desired attenuation slopes and combine these numbers. For example to obtain a slope of 40db at 0.65 of the lower freq. cut-off, F_{c1}, (High pass section) and 40db at 1.6 of the upper freq. cut-off, F_{c2}, (Low pass section) use H69A and J59A. Specify the two as K6959. **The high pass model number is first, followed by the low pass number.** Models with dissymmetrical attenuation slopes can be combined. Also specify the three db down cut-off frequencies F_{c1} and F_{c2} and impedance. The price is the sum of the HP and LP section prices.

TYPICAL RESPONSE CURVES FOR STANDARD BAND PASS FILTERS



Telemetering: Refer to model K20, K21A, K30 or K31A. TO ORDER specify IRIG Channel number or letter, source and load impedances.

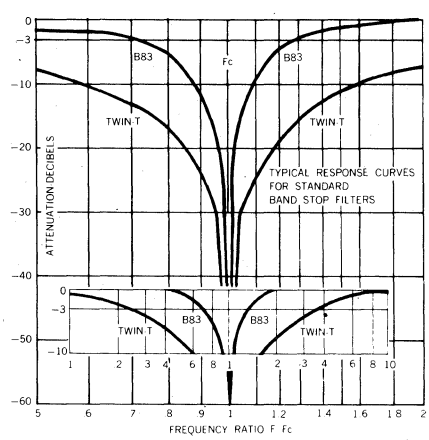
TO ORDER BANDPASS FILTERS — Specify (1) T T Model No., (2) minus 3db frequencies, (3) source impedance, (4) load impedance.

SPECIALS are available for center frequencies from 20Hz upward and 40db to 3db bandwidth ratios as sharp as 1.2:1.

TO ORDER Specials, specify (5) bandwidth and (6) stop band attenuation required in addition to the above data. Terminations are regarded as resistive unless otherwise specified.

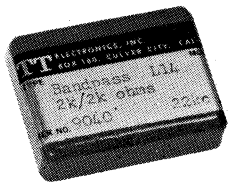
BAND REJECT STANDARD FILTERS FOR ANY CENTER FREQUENCY FROM 10Hz TO 100KHz

Model No.	F_C Center Freq. Range Min.	Max.	Bandwidth —3db	Attenuation	Impedance Min.	Ohms Max.	Circuit	Case No.	Approx. Price
B83	10Hz	100KHz	.77F_C & 1.3F_C	50 db Notch	600	1 Meg.	L-C	4	$30
D	10Hz	100KHz	.25F_C & 4 F_C	35 db Notch	SEE ORDERING INSTRUCTIONS BELOW		Twin-T	2	$11
E	10Hz	100KHz	.25F_C & 4 F_C	56 db Notch			Twin-T	2	$17
F	10Hz	100KHz	.25F_C & 4 F_C	60 db Notch			Twin-T	2	$27
R20	100Hz	3999Hz	3db Bandwidth to 40db		10K	50K	L-C	3	$29
R20	4KHz	100KHz	Bandwidth Ratio = 5 or less		1K	10K	L-C	4	$33



TO ORDER REJECT FILTERS — Specify (1) T T Model No. or Letter, (2) center frequency, (3) source impedance, (4) load impedance. For Model R20 and R30 specify 40db bandwidth. Twin-T prices and cases apply to all filters using capacitor values from 0.1 MFD to 500 MMFD. $C = 1/8.85\ F_{HZ}\ (R_{source}\ D_{load})^{1/2}$. C is in farads. Filters with null frequencies as low as 1 Hz are available. Series E and Series F networks are available with octal plug-in bases. LOADS up to 10 megohms can be used with B83 filters at increased insertion loss. Low freq. B83 filters require 10K or higher loads for specified response. Prices are higher for some low frequency - low impedance or high impedance models. Multi-notch units are available. Terminations are regarded as resistive unless otherwise specified.

TT *miniature* FILTERS



FAST DELIVERY — PROTOTYPE IN 2 WEEKS
AVAILABLE IN FLAT CASES FOR PC BOARD MOUNTING

HIGH PASS

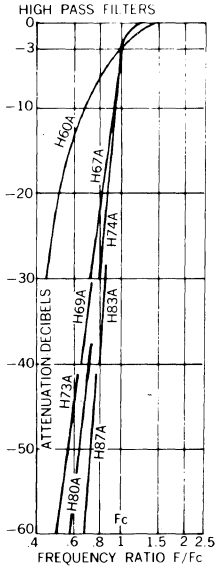
STANDARD FILTERS FOR ANY CUT-OFF FREQ. FROM 75Hz TO 100KHz

Model No.	Min. Attn. db	Cut-off Ratio F/Fc	Approx. Price	Case No.
H60A	30	.45	$25	
H62A	40	.35	$25	
H64A	50	.25	$25	
H66A	60	.19	$25	
H67A	30	.72	$31	
H69A	40	.65	$31	75Hz to 999Hz Case 4 1KHz to 100KHz Case 3
H71A	50	.56	$31	
H73A	60	.50	$31	
H74A	30	.79	$39	
H76A	40	.73	$39	
H78A	50	.67	$39	
H80A	60	.58	$39	
H81A	30	.83	$46	
H83A	40	.79	$46	
H85A	50	.73	$46	
H87A	60	.67	$46	

SPECIALS: Special units available for cut-off frequencies down to 60Hz and above 100KHz.

TO ORDER specify (1) T T Model No. (2) minus 3DB freq., (3) impedance. See table below.

TYPICAL RESPONSE CURVES FOR STANDARD HIGH PASS FILTERS



LOW PASS

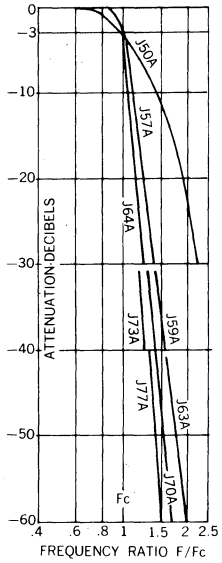
STANDARD FILTERS FOR ANY CUT-OFF FREQ. FROM 75Hz TO 100KHz

Model No.	Min. Attn. db	Cut-off Ratio F/Fc	Approx. Price	Case No.
J50A	30	2.2	$25	
J52A	40	2.9	$25	
J54A	50	3.9	$25	
J56A	60	5.3	$25	
J57A	30	1.4	$31	
J59A	40	1.6	$31	75Hz to 999Hz Case 4 1KHz to 100KHz Case 3
J61A	50	1.8	$31	
J63A	60	2.0	$31	
J64A	30	1.2	$39	
J66A	40	1.4	$39	
J68A	50	1.5	$39	
J70A	60	1.7	$39	
J71A	30	1.18	$46	
J73A	40	1.3	$46	
J75A	50	1.4	$46	
J77A	60	1.5	$46	

SPECIALS: Special units available for cut-off frequencies down to 10Hz and above 100KHz.

TO ORDER specify (1) T T Model No. (2) minus 3DB freq., (3) impedance. See table below.

TYPICAL RESPONSE CURVES FOR STANDARD LOW PASS FILTERS

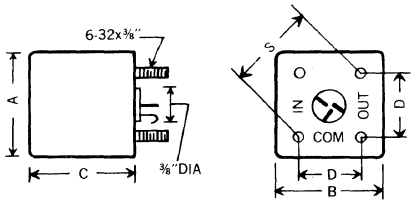


IMPEDANCE GUIDE: Source and load impedances are equal and resistive for standard HP and LP filters. The insertion loss is less than 0.5db for ±10% matching.

SPECIALS for other impedances and unequal terminations are available. Units with cut-off ratios as sharp as 1.11 (0.9 High pass) with 50db stop bands are available.

F_c-3DB	75Hz	100Hz	500Hz	1KHz	5KHz	10KHz	50KHz	100KHz
IMPED:	39K	5K to 39K	1K to 39K	1K to 39K	1K to 39K	1K to 20K	1K to 10K	1K to 3K

CASE DIMENSIONS AND MOUNTING INFORMATION



Case No.	A	B	C	D	S	Studs
1	.75	.75	1.38	—	.56	(2) 4-40 x 3/8
2	1.19	1.19	1.25	.75	—	(4) 6-32 x 3/8
3	1.31	1.31	1.75	—	1.25	(2) 6-32 x 3/8
4	1.63	1.63	2.38	1.19	—	(4) 6-32 x 3/8
5	1.94	1.81	2.44	1.38/ 1.25	—	(4) 6-32 x 3/8

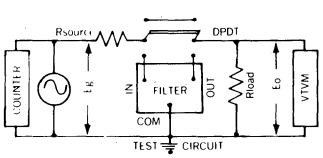
- You may request PC board flat case dimensions by specifying filter model number and available height.
- All TT Filters are epoxy encapsulated to withstand shock and vibration. All units are also hermetically sealed in drawn steel cases which reduce stray pickup. **NOTE:** Mount clear of power transformers or other strong magnetic fields.
- 7 pin miniature plug-in bases are optional. Octal bases are available.
- Some low-frequency low-impedance combinations may require slightly larger cases. Customer will be advised of this when ordering. Some high frequency types can be supplied in smaller cases.

RESPONSE TEST: With the switch in the down position set the oscillator freq. at 10F_c (HP or BR) .IF_c (LP or BR) or at F_c (BP) and osc. level for zero db at filter output, E_o. Read E_g and keep this voltage constant throughout test. Do not keep the filter input voltage constant. Read E_o in db at other frequencies to obtain response curve.

NOTE: R source and R load are external resistors.

INSERTION LOSS: Obtain zero db reference as above, then throw switch to up position and read output db holding E_g constant.

MAXIMUM OUTPUT, 20 milliwatts. Our production test level is 0.77VRMS unless specified otherwise. The B83 types are limited to .77V for any specified impedance.



OTHER T T FILTERS

- ANTENNA
- COMB
- CROSSOVER NETWORKS
- EQUALIZER
- HARMONIC
- INTERFERENCE
- INTERSTAGE
- LINEAR PHASE
- NEEDLE SCRATCH
- PHASE MATCHED
- PULSE
- SINGLE SIDEBAND
- TONE AUTOMATION
- TONE TELEGRAPH
- VIDEO

TT ELECTRONICS
INC./P.O. BOX 180/CULVER CITY, CALIF. 90230/Phone (213) 870-6001

FILTERS

Texscan Microwave Products' standard line includes tubular bandpass and lowpass filters ranging in size from 3/16 to 1-1/4 inches which operate within the frequency range of 10 MHz to 13 GHz, and tunable bandpass filters which cover the frequency range of 48 MHz to 4 GHz.

BANDPASS • LOWPASS TUNABLE • MULTIBAND • CUSTOM



BA Series

250 MHz to 13 GHz
3/16 inch diameter

A microminiature, fixed, bandpass, filter, 3/16 inch diameter, which features high frequency coverage, low VSWR, excellent stability and light weight. Its small size makes it ideal for printed circuit board use, space applications, or man-pack requirements.



LA Series

1 to 13 GHz
3/16 inch diameter

A microminiature, fixed, lowpass, filter, 3/16 inch diameter, which features high frequency coverage, low VSWR and excellent stability. Its small size and light weight make it ideal for printed circuit board use, space applications, and man-pack requirements.



BB Series

70 MHz to 5 GHz
3/8 inch diameter

A subminiature, fixed, bandpass, filter, 3/8 inch diameter, which has features similar to the BA series plus the additional advantages of lower frequency coverage, lower insertion loss, higher power rating and adaptability for most connector types.



LB Series

100 MHz to 5 GHz
3/8 inch diameter

A subminiature, fixed, lowpass, filter, 3/8 inch diameter, which has features similar to the LA series plus the additional advantages of lower frequency coverage, lower insertion loss, higher power rating and adaptability for most connector types.



BC Series

50 MHz to 4 GHz
1/2 inch diameter

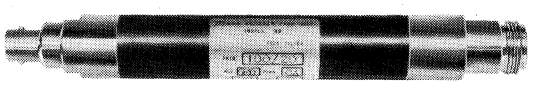
A low priced, fixed, bandpass, filter, 1/2 inch diameter, with frequency coverage from 50 MHz to 4 GHz. This series is ideal in meeting low loss and medium power applications for prototype or production use. Delivery can be made in less than 48 hours. Many optional features are available to increase the flexibility of this series.



LC Series

40 MHz to 4 GHz
1/2 inch diameter

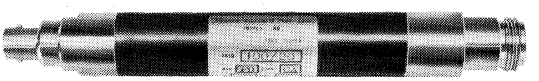
A low priced, fixed, lowpass, filter, 1/2 inch diameter, with frequency coverage from 40 MHz to 4 GHz. This line is most competitive for either prototype or production requirements. Delivery can be made in less than 48 hours. Many optional features are available to increase the flexibility of this series.



BD Series

25 MHz to 2 GHz
3/4 inch diameter

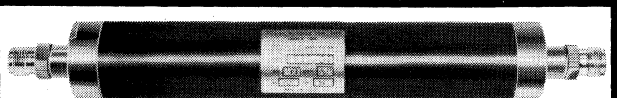
A medium power, fixed, bandpass, filter, 3/4 inch diameter, which features low insertion loss and low frequency coverage. It is constructed in part aluminum and can accept all connector types.



LD Series

25 MHz to 2 GHz
3/4 inch diameter

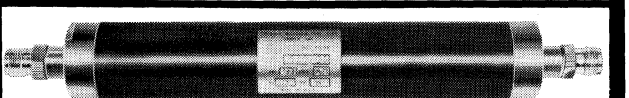
A medium power, fixed, lowpass, filter, 3/4 inch diameter, which features low insertion loss and low frequency coverage. It is constructed of aluminum and can accept all connector types.



BE Series

10 MHz to 1 GHz
1-1/4 inches diameter

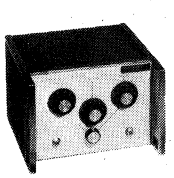
This high power, fixed, bandpass, filter series has the lowest insertion loss of all the bandpass series. It is 1¼ inches in diameter and is ideal for receiver and transmitter applications where insertion loss of 0.1 db is desirable and selectivity is of major importance.



LE Series

10 MHz to 1 GHz
1-1/4 inches diameter

This high power, fixed, lowpass filter series has the lowest insertion loss and lowest cutoff frequency of the lowpass series. It is 1¼ inches in diameter and is constructed of aluminum.



MBF Series 48 MHz to 2 GHz

Tunable bandpass filters covering the frequency range of 48 MHz to 2 GHz. Two or three tunable filters are packaged as one unit to enable the user to have continuous frequency coverage.



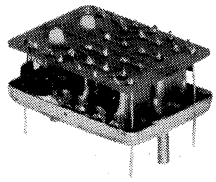
VF Series 48 MHz to 4 GHz

Tunable bandpass filters covering the frequency range of 48 MHz to 4 GHz with any single model covering more than an octave. These units are available with either a three or five section response and have a 3 db bandwidth of 5%. Several options are available to increase the flexibility of this series.

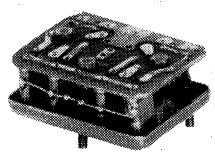
tmp Texscan MICROWAVE PRODUCTS CORP. 4610 North Franklin Road Indianapolis, Indiana 46226 Phone: 317-545-6481
TELEX. 27-2110 TWX: 810-341-3184 Cable Address: TEXSCAN

FREQUENCY CONTROL DEVICES

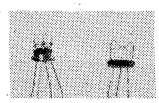
Besides manufacturing precision quartz crystals, shown in Section 2300 of EEM, Tedford Crystal Labs. is rapidly becoming a leader in the field of crystal filters and oscillators. Our present capability includes bandpass, band-reject and single sideband crystal filters in either monolithic or discrete configurations. Tedford Labs. also offers a complete line of temperature compensated crystal oscillators.



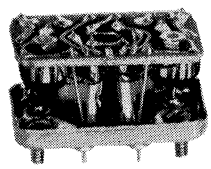
SINGLE SIDEBAND

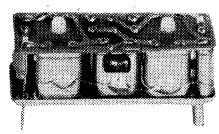


BAND-REJECT



MONOLITHIC





BANDPASS

CRYSTAL FILTERS

Crystal filters have found a wide range of uses in the communications field and Tedford Crystal Labs. stands ready to assist the design engineer in specifying his particular filter. By using the latest techniques employing multi-electrode crystals or monolithic crystal filters, Tedford Labs is able to offer a compact design at a minimum cost. As an aid in the first phase of design, consult the chart at the right to determine the feasible relationship between frequency and bandwidth. A step-by-step procedure for specifying crystal filters is available, upon request, from Tedford Crystal Labs.

DISCRETE CRYSTAL FILTERS

Off-the-shelf types are listed, custom designed types available upon request.

Center freq.	BW 3db	BW 60db	Type
21.900 MHz	2.000 KHz	15.000 KHz	Band Pass
14.200 MHz	5.000 KHz	27.000 KHz	Band Pass
10.700 MHz	240.0 KHz	1100.0 KHz	Band Pass
9.000 MHz	2.000 KHz	3.800 KHz	Single Sideband Pair
646.00 KHz	200 Hz	7.000 KHz	Band Pass
455.00 KHz	500 Hz	3.500 KHz	Band Pass

MONOLITHIC CRYSTAL FILTERS

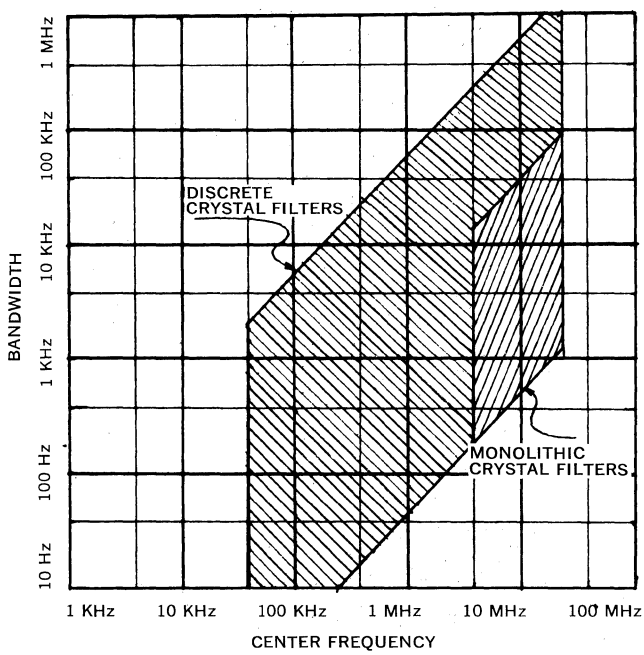
Our capabilities include a line of monolithic crystal filters in the frequency range of 5 to 30 MHz. Custom engineered two pole filters are now available with either CHEBISHEV or BUTTERWORTH transmission characteristics. Filters with 3db bandwidths from 0.005 to 0.25%, insertion loss of 0.5 to 2db, and 3db to 30db ratio of 1:5 are now available.

CENTER FREQ.	BW 3db	BW 30db	INSERTION LOSS	RATIO
10.700 MHz	23.000 KHz min.	92.000 KHz max.	1db max.	1:4
11.700 MHz	23.000 KHz min.	92.000 KHz max.	1db max.	1:4
11.700 MHz	15.000 KHz min.	60.000 KHz max.	1db max.	1:4
21.900 MHz	7.000 KHz min.	35.000 KHz max.	1db max.	1:5
21.900 MHz	15.000 KHz min.	60.000 KHz max.	.7db max.	1:4
21.900 MHz	5.000 KHz min.	25.000 KHz max.	1db max.	1:5
21.400 MHz	15.000 KHz min.	60.000 KHz max.	.7db max.	1.4
20.000 MHz	14.000 KHz min.	58.000 KHz max.	.7db max.	1:4

NOTE: Input and output impedance are dependent upon ripple, frequency range and transmission characteristics. Typically they range between 100 ohms and 5K ohms with ripple between 0 and 1db. Temperature drift tolerances of ±0.005% in the temperature range of —40 to +70°C are possible.

CUSTOM DESIGNS AVAILABLE

Why not give us a shot at your next spec on crystals, crystal filters, integrated filters or temperature compensated crystal oscillators (TCXO)? Maybe we can cut your costs, and give you a better product in the bargain. Write for free product catalogs.



TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO)

Tedford Crystal Labs. is presently developing a complete line of TCXO's. Using computer-aided design techniques your particular needs can be met with optimum cost and quick delivery. TCXO's are available in the frequency range of 5 to 18 MHz, with the following tolerances.

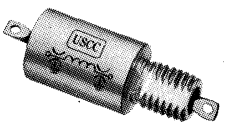
Standard Stability	±5ppm	—30 to +70°C
Custom Design Stability	±1ppm	—30 to +70°C
Custom Design Stability	±0.5ppm	—10 to +50°C

TEDFORD CRYSTAL LABORATORIES, INC.
4914 Gray Road, Cincinnati, Ohio 45232
Phone 513/542-5555

TEDFORD CRYSTAL LABS, INC.
FREQUENCY CONTROL DEVICES

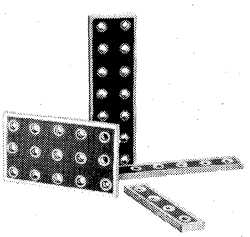
RFI/EMI Filters

USCC



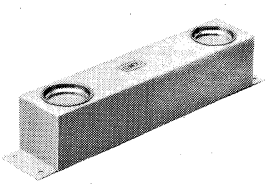
RFI/EMI Filters
Ceramic Dielectric

Modern technology in electromagnetic and radio frequency interference suppression has led to the development of the USCC line of miniature ceramic dielectric filters. These devices are designed to suppress broadband noise in the 10 kHz to 10 GHz range. Available in both Pi and L Section configurations, the feedthrough type packaging is ideal for either chassis or bulkhead mounting. Voltage ratings from 50 Vdc through 400 Vdc and current ratings up to 10 amperes are available. These units are effective in all high frequency filter applications. For additional information, contact USCC.



Multichannel
RFI/EMI Filters

USCC state-of-the-art technology in the design of monolithic ceramic capacitors has evolved into the development of multichannel feedthrough ceramic RFI/EMI filters. Space requirements are less than 1/10 the volume of previously available devices. Capacitance values up to .35 Mfd at 50/100/200 Vdc are available. For multichannel solutions to RFI/EMI filter problems, contact USCC.

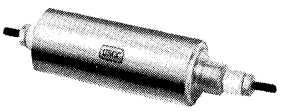


Communications Filters
Audio and Signal Line

To meet the growing need for secure communications, USCC has developed a complete line of high performance communications filters. Intended for applications encompassing both signal and voice lines, they are available in feedthrough tubular designs and rectangular configurations for surface mounting. Up to 100 dB is offered from 14 kHz to 10 GHz. Voltage ratings up to 600 Vdc and current ratings to .5 ampere are offered. For further information and custom designs, contact USCC.

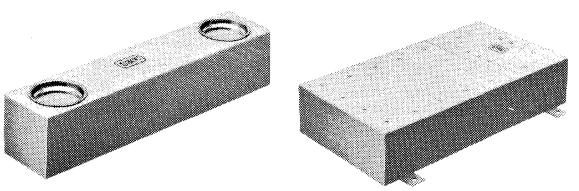
RFI/EMI Filters

USCC



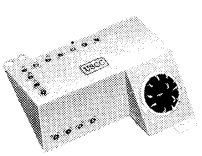
General Purpose RFI/EMI Filters

An increasing demand for General Purpose RFI/EMI filters for applications having moderate levels of interference voltages has prompted USCC to design filters offering a variety of dielectrics and ratings. Standard designs include both tubular and bathtub cases, Pi and L sections in various plastic and ceramic dielectrics. Voltage ratings up to 600 Vdc and current ratings up to 50 amperes are available. For a standard or special requirement, contact USCC.



Power Line High Performance Filters

USCC offers a complete line of high performance power line filters for use in all maximum security communications installations. Single filter installations, filter cabinet assemblies and filtered circuit breaker cabinet assemblies are available. Standard ratings to 440 Vac and currents to 200 amperes are offered. All units are designed to meet the latest specifications. For complete information, contact USCC.



Custom Filters

Recognizing the need for custom designed filters encompassing unique characteristics, USCC offers a comprehensive filter technology to solve the toughest problems. Our advanced assembly techniques allow us to produce single and multicircuit units to the most rigid standards. For a detailed proposal call, write or visit: USCC.

U.S. CAPACITOR CORPORATION ■ 2151 N. LINCOLN STREET, BURBANK, CALIF. 91504 ■ (213) 843-4222 ■ TWX: 910-498-2222

UTC® PIONEERS IN MINIATURIZATION

SPECIALS
(CUSTOM BUILT)
and STOCK
FOR EVERY APPLICATION

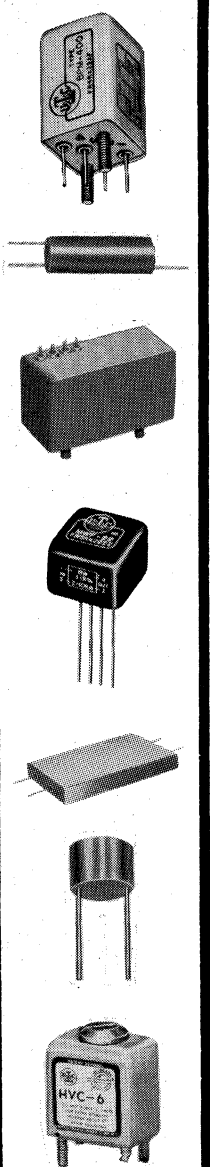
IMMEDIATE DELIVERY ON ALL STOCK ITEMS

ELECTRIC WAVE FILTERS

Almost forty years of experience in the design and production of electric wave filters have resulted in UTC being a first source for top quality, reliability and advanced engineering . . . for both special and stock applications. Present designs incorporate a wide variety of core structures, winding methods, and capacitors to provide maximum performance. stability and reliability. Military (to MIL-F-18327C) and industrial types are available both metal cased and molded. Range of frequencies is from DC to 30 MHz.

AIRCRAFT
BAND PASS
BAND REJECT
DISCRIMINATORS
400 HERTZ LINE BP
400 HERTZ LINE LP
HIGH PASS
INTERSTAGE
LINEAR PHASE
LOW FREQUENCY
LOW PASS
TELEGRAPH
TELEMETERING
ULTRAMINIATURE

LUMPED CONSTANT DELAY LINES



HIGH Q INDUCTORS

Almost four decades of specialization in high Q coils are reflected in the permalloy dust toroid, ferrite, and laminated structures produced by UTC today. The foremost engineering staff of its type is supported by the most modern, fully equipped materials and test laboratories. In addition, extensive life testing and rigid quality control standards create the top quality and highly reliable components associated with the UTC name. Metal cased and molded units are engineered to specifications or available from stock. Inductors ranging in applications from DC to 30 MHz, both military (to MIL-T-27C) and commercial types, are available, offering maximum Q for minimum size.

TOROIDS
TAPPED TOROIDS
LOW FREQUENCY
L DECADES
VARIABLE
TAPPED VARIABLE
VERNIER VARIABLE
MINIATURE

Write for catalog containing over 1,350 stock items with UTC top quality.
Short form catalog pages appear in The Radio-Electronic MASTER

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CIRCON Miniature & Sub-Miniature CIRCON

HARDWARE • INDICATOR LAMPS • COMPONENTS

Premium Quality Electronic and Instrument Miniature Precision Hardware

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Gold Plated and Shot Burnished



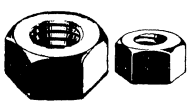
Every eyelet a precision product with absolute uniformity from part to part.
Lengths from 1/16" to 7/16" in 1/32" increments.
New MICROLETS now available in lengths from 1/64" to 3/16" in 1/32" increments.

RIVETS & TERMINAL LUGS



For instrument, electronic, and printed circuit applications involving space requirements smaller than normal subminiature hardware permits. Sizes from 1/16" x 1/32" and up in 1/32" increments. Shot burnished and 24 carat gold plated.

NUTS



Instrument nuts in sizes from #000 to #4. Precision manufactured of controlled formula non-magnetic brass cadmium plated.

EYELET SETTING TOOLS



Superior quality tools designed to provide flexible inexpensive tooling for precision setting of Circon eyelets in laboratory, model shop, instrument room and limited production applications. May be used in drill press, arbor press, kick press, punch press, air press, or they may be used as simple hand or vise-held tools.

SCREWS



Precision Instrument Screws of cadmium plated brass or stainless steel. Instrument head (oval modified fillister) or flat head. (82°). Size from #000 to #4 — Lengths from 1/8" and up in 1/16" increments. Taps available for all screw sizes.

WASHERS



Split Lock and Flat instrument washers in sizes #000 to #4. Precision manufactured to be smooth, clean and free from burrs. Insulating washers formed of an improved grade of XXXP modified phenolic laminate. Suitable for use in vigorous environment, at all frequencies. Sizes from #00 to #4.

MINIATURE & SUB-MINIATURE INDICATOR LAMPS

For Printed Circuit and Regular Applications

POLA LENS
VARIABLE INTENSITY INDICATORS
Used with Circon sub-miniature lampholders, the POLA-LENS makes it possible to vary the incident light from full brightness to near extinction to meet ambient requirements. Gradual change in lighting control is accomplished by simple hand rotation of the lens.



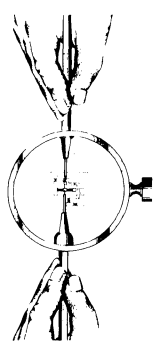
SCREW BASE MOUNTING



FLARE-MOUNT

- **SMALLER SIZE** — Only 3/8" diameter. Minimum projection from front and rear of panel.
- **WIRELESS INSTALLATION** in printed circuit design and simplified wiring in conventional installations.
- **WIDE RANGE OF LIGHT INTENSITIES** for both low-level and high-level applications.
- **STANDARD COLORS** — Lenses available from stock include red, green, yellow, blue, white, transluscent and clear.
- **ALL VOLTAGES AVAILABLE** — 1.3, 2.7, 6, 14, 28 volts and neon. Single or double-contact models.
- **MESSAGE INDICATIONS** — including numerals, warnings, letters and labels.
- **REPLACEABLE LAMPS** of standard construction having long life and proven performance.

SUPPLIED WITH EITHER INCANDESCENT OR NEON BULBS

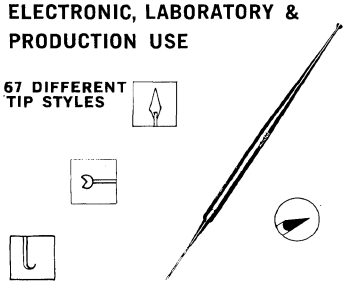


microProbe for ELECTRICAL TESTING

A hand probe designed for testing contacts in small and inaccessible areas. Ideal for microscopic electrical testing. Supplied with a phone tip to fit your favorite meter or instrument and a banana plug adapter. 20 different tip configurations include a .005" diameter micropoint for fine work, sharp points, forks, loops and hooks, each in either straight shank, 45° or 90° bend.

microTools FOR INSTRUMENT, ELECTRONIC, LABORATORY & PRODUCTION USE

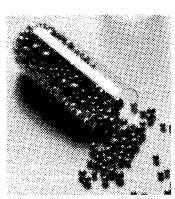
67 DIFFERENT TIP STYLES



CUSTOM TIP — Selection from 67 different styles. Each tip designed and engineered to do a specific microelectronic or instrument job in the best way.
FINEST MATERIALS — Selected tool steels. Permanent metal handles. Entire tip area behind working element is 24 carat gold plated and shot-burnished to insure corrosion resistance and a contaminant free tool.
PRECISION MANUFACTURE — Cutting edges, points and working surfaces precision forged, machined, ground or honed to microscopic perfection.
SMALL SIZE — Active working elements from 0.001 to 0.1 in size. Hinged lid boxes and individual tip protection provides visual selection with easy use and storage.
Interchangeable tips include: Needle Point, Knife, Spade, Chisel, Graver, 45°, 90° corner and bifurcated Manipulators, Hooks, Loop, Burnisher, Scale, Brush, Spatula, Probe and Taps.

GOLDEN SOLDER BALLS

Precise Spheres of Eutectic Solder for Specialized Soldering Needs



Designed to be used in the Pulse-Dot System, the correct amount of solder can be chosen from twelve graded sizes of balls from .005" to .060" in diam. 24K gold plated. Gold color disappears when melting temperature is reached. Balls contain no fluxing agent permitting user to choose most suitable flux. Many other uses in the engineering and instrument field.

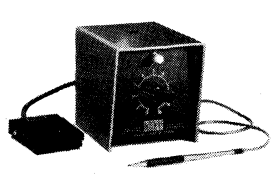
Precision Quality Products for Industry

FACTORY DIRECT SERVICE BY AIR

CIRCON COMPONENT CORPORATION

SANTA BARBARA AIRPORT • GOLETA, CALIFORNIA
AREA CODE: 805 967-1113

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES



SPECIFICATIONS FOR PULSE • DOT CONTROLLER
Anodic Finish — Black & Gray

Size	6" x 6" x 5"
Weight	6 Pounds
Input	120 VAC
Output	0 - 6.0 VAC
Power	0 - 18 Watts Max.

PULSE • DOT SYSTEM

A new way to microsolder with the smallest tool on the market

The Pulse Controller regulates temperature from 200 to 1800°F by setting the dial. The Solder Loop is a microminiature heating element which does not require tinning or dressing. Pencil size handle balanced for delicate manipulation under the microscope. Available in three sizes: One watt for thin film microcircuits, Two watt for micro diodes and Three watt for small transistor leads.

SPECIFICATIONS FOR PULSE • DOT LOOP

Size	Loop Radius	Working Wattage
Micro Solder Loop	.025 in.	1
Micro-Min Solder Loop	.040 in.	2
Miniature Solder Loop	.050 in.	3

STAINLESS STEEL CAPTIVE HARDWARE

Simple! Fast! Sure! PMP Presserts offer a number of advantages.

PRECISION METAL PRODUCTS CO.
41 ELM STREET, STONEHAM, MASSACHUSETTS 02180 Tel. (617) 438-3650





FL Flush Nuts — Fit flush on both surfaces of panel, replacing tapped holes providing both the strength and wear resistance of a nut. Designed for installations where space is limited, loads are light, and panel thickness permits an adequate number of threads in nut.



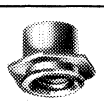
EXH Extension Nuts — Dimensionally the same as FL Flush style except for extension beyond the panel surface on the hex side. Recommended for thin panels as extension provides additional threads. Extension may be used as a spacer or standoff for mounting panels or brackets to chassis.



EXR Extension Nuts — Dimensionally similar to FL and EXH styles except that the nut opposite the hex is extended beyond the panel surface. Provides additional threads in thin panels and may be used as a standoff mounting.



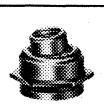
EXRR Round Extension Nuts — They are designed for stand-off applications. These nuts have a round extension on the hex side which provides extra threads beyond the panel surface. Dimensionally similar to FL, EXH & EXR styles.



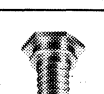
LN Self-Locking Extension Nuts are designed to provide all the wear-resistant benefits of Pressert fasteners, plus the self-locking feature. In addition to providing additional threaded surfaces, the oval shaped extension adds increased holding power by being self-locking. Threads treated with Vydax (Du Pont) to assure compliance with Spec. MIL-N-25027, insertion and removal.



FN Floating Nuts permit correcting up to .015 misalignment in mating holes. Misalignment adjustment is accomplished by the lateral movement through 360° of a threaded insert, which is trapped in the Pressert-type body. Pressert type FN Floating Nuts project less than 1/8 inch above the panel surface. Both the threaded insert and body are machined from stainless steel. Threads are Class 2B in all sizes.



FLN Floating Locknuts — The construction of the self-locking type — FLN is similar to Type FN, except the floating insert extends above the Pressert retaining base, and has a self-locking thread. A dry Teflon-type lubricant (Du-Pont) Vydax is applied to the thread to facilitate easier insertion and removal of the screw.



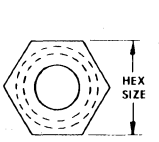
ST Style Studs provide mounting studs in soft materials, without any projection beyond the outside surface. With stud locked in panel, assembly of other parts is easier, faster. Hex, major and minor diameters same as FL style.

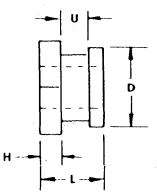
ORDERING INFORMATION

When Presserts are ordered, furnish this information —

For example: 34N(.062)EXH 3 is —

Hex Size in 16ths	Thread Size	Nut or Stud (N or S)	Panel Thickness	Style (FL, EXH, EXR, ST)	Extension in 32nds
3 (3/16")	4 (4-40)	N (nut)	(.062) 1/16"	EXH Extension hex side	3 3/32" beyond panel





Threads and Sizes

STYLE	Series Number	Hex Size	Thread Size	Mounting Hole ±.002	"D" Diam. ±.002
FL EXH EXR EXRR ST	32N or S	3/16	2-56	.161	.157
	42N or S	1/4	2-56	.203	.199
	34N or S	3/16	4-40	.161	.157
	44N or S	1/4	4-40	.203	.199
	46N or S	1/4	6-32	.203	.199
	56N or S	3/16	6-32	.265	.261
	58N or S	3/16	8/32	.265	.261
	510N or S	3/16	10/32	.265	.261
	720N or S	7/16	1/4-20	.386	.382
	728N or S	7/16	1/4-28	.386	.382
	818N or S	1/2	5/16-18	.453	.449
	916N or S	9/16	3/8-16	.516	.512

Panel Thicknesses	±.004 L Dim.	±.003 H Dim.	±.003 U Dim.
.040	.038	.012	.018
1/16 (.062)	.058	.019	.029
3/32 (.093)	.085	.029	.043
1/8 (.125)	.117	.029	.043
5/32 (.156)	.147	.029	.043
3/16 (.187)	.177	.029	.043

Panel Thicknesses	±.004 L Dim.	±.003 H Dim.	±.003 U Dim.
1/8 (.125)	.117	.029	.043
5/32 (.156)	.147	.029	.043
3/16 (.187)	.177	.029	.043
1/4 (.250)	.236	.029	.043
5/16 (.312)	.296	.029	.043

Extension Length in 32nds
1
2
3
4
5
6
7
8
to 32*

*Studs only

Type FL	1 - 299 Net
32N-( )-FL	$ 9.35/C
34N-( )-FL	9.35/C
42N-( )-FL	10.00/C
44N-( )-FL	10.00/C
46N-( )-FL	10.00/C
56N-( )-FL	10.50/C
58N-( )-FL	10.50/C
510N-( )-FL	10.50/C
720N-( )-FL	14.30/C
728N-( )-FL	14.30/C
818N-( )-FL	15.70/C
916N-( )-FL	17.00/C

Type EXH-EXR-EXRR	1 - 299 Net
32N-( )-EX	$ 9.85/C
34N-( )-EX	9.85/C
42N-( )-EX	10.40/C
44N-( )-EX	10.40/C
46N-( )-EX	10.40/C
56N-( )-EX	11.00/C
58N-( )-EX	11.00/C
510N-( )-EX	11.00/C
720N-( )-EX	15.70/C
728N-( )-EX	15.70/C
818N-( )-EX	17.60/C
916N-( )-EX	19.10/C

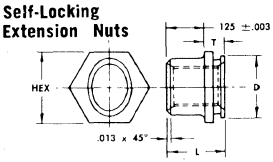
300 - 999 Less 15%

Type Stud 6-16	1 - 299 Net
32S-( )-L	$13.15/C
34S-( )-L	13.15/C
42S-( )-L	14.05/C
44S-( )-L	14.05/C
46S-( )-L	14.05/C
56S-( )-L	15.25/C
58S-( )-L	15.25/C
510S-( )-L	15.25/C
720S-( )-L	21.00/C
728S-( )-L	21.00/C
818S-( )-L	29.70/C
916S-( )-L	31.80/C

1000 - 2999 Less 30%

Type Stud 20-32	1 - 299 Net
32S-( )-L	$15.45/C
34S-( )-L	15.45/C
42S-( )-L	16.70/C
44S-( )-L	16.70/C
46S-( )-L	16.70/C
56S-( )-L	19.30/C
58S-( )-L	19.30/C
510S-( )-L	19.30/C
720S-( )-L	28.50/C
728S-( )-L	28.50/C
818S-( )-L	33.00/C
916S-( )-L	39.95/C

Self-Locking Extension Nuts

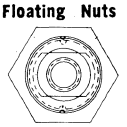


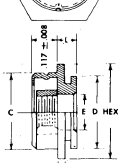
PART NO.	HEX SIZE (in 16ths)	THREAD SIZE	D ±.002	MOUNTING HOLE ±.002
44LN	4-(1/4)	(4-40)-2B	.199	.203
46LN	4-(1/4)	(6-32)-2B	.199	.203
58LN	5-(5/16)	(8-32)-2B	.261	.265
510LN	5-(5/16)	(10-32)-2B	.261	.265

AVAILABLE FOR

PANEL THICKNESS	L—REF.
.062	.183
.093	.210
.125	.242
.187	.302
.250	.361

Floating Nuts





PART NO.	THD.	HEX	TYPE	PANEL THICKN'S	D ±.002	C ±.008	E +.005 −.000	H	L ±.004	MTG HOLE ±.002
114 FN (.062)	4-40	11/32	N	1/16	.288	.296	.144	.019	.058	.292
114 FN (.093)	4-40	11/32	N	3/32	.288	.296	.144	.029	.085	.292
66 FN (.062)	6-32	3/8	N	1/16	.326	.322	.169	.019	.058	.330
66 FN (.093)	6-32	3/8	N	3/32	.326	.322	.169	.029	.085	.330
66 FN (.125)	6-32	3/8	N	1/8	.326	.322	.169	.029	.117	.330
78 FN (.062)	8-32	7/16	N	1/16	.382	.357	.196	.019	.058	.386
78 FN (.093)	8-32	7/16	N	3/32	.382	.357	.196	.029	.085	.386
78 FN (.125)	8-32	7/16	N	1/8	.382	.357	.196	.029	.117	.386
710 FN (.062)	10-32	7/16	N	1/16	.382	.385	.221	.019	.058	.386
710 FN (.093)	10-32	7/16	N	3/32	.382	.385	.221	.029	.085	.386
710 FN (.125)	10-32	7/16	N	1/8	.382	.385	.221	.029	.117	.386

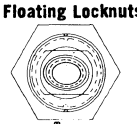
Type Lock Nut	1 - 299 Net
44LN-( )	$15.40/C
46LN-( )	15.40/C
58LN-( )	16.00/C
510LN-( )	16.00/C

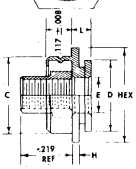
300 - 999 Less 15% 1000 - 2999 Less 30%

Type Floating Nut	1 - 299 Net
114N-( )-FN	$31.00/C
66N-( )-FN	31.00/C
78N-( )-FN	34.00/C
710N-( )-FN	34.00/C

300 - 999 Less 15% 1000 - 2999 Less 30%

Floating Locknuts



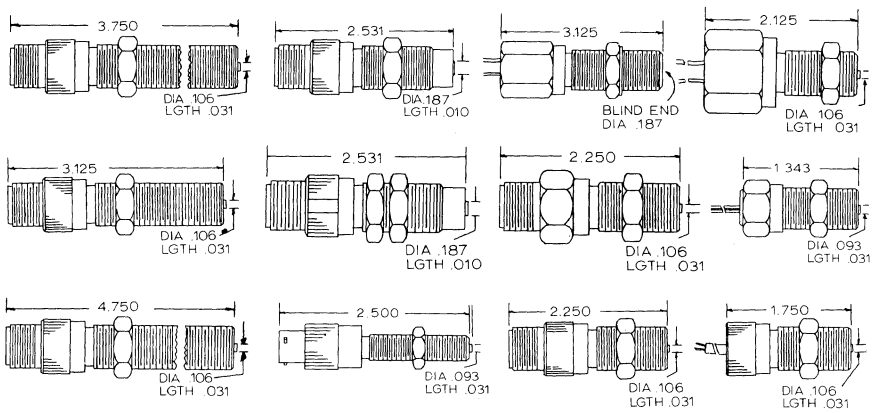


PART NO.	THD.	HEX	TYPE	PANEL THICKN'S	D ±.002	C ±.008	E +.005 −.000	H	L ±.004	MTG HOLE ±.002
114 FLN (.062)	4-40	11/32	N	1/16	.288	.296	.144	.019	.058	.292
114 FLN (.093)	4-40	11/32	N	3/32	.288	.296	.144	.029	.085	.292
66 FLN (.062)	6-32	3/8	N	1/16	.326	.322	.169	.019	.058	.330
66 FLN (.093)	6-32	3/8	N	3/32	.326	.322	.169	.029	.085	.330
66 FLN (.125)	6-32	3/8	N	1/8	.326	.322	.169	.029	.117	.330
78 FLN (.062)	8-32	7/16	N	1/16	.382	.357	.196	.019	.058	.386
78 FLN (.093)	8-32	7/16	N	3/32	.382	.357	.196	.029	.085	.386
78 FLN (.125)	8-32	7/16	N	1/8	.382	.357	.196	.029	.117	.386
710 FLN (.062)	10-32	7/16	N	1/16	.382	.385	.221	.019	.058	.386
710 FLN (.093)	10-32	7/16	N	3/32	.382	.385	.221	.029	.085	.386
710 FLN (.125)	10-32	7/16	N	1/8	.382	.385	.221	.029	.117	.386

Type Floating Lock Nut	1 - 299 Net
114N-( )-FLN	$43.00/C
66N-( )-FLN	43.00/C
78N-( )-FLN	45.00/C
710N-( )-FLN	45.00/C

300 - 999 Less 15% 1000 - 2999 Less 30%

RPM MEASUREMENT and CONTROL

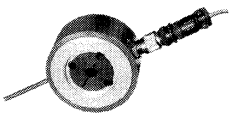


A few of the many Airpax Magnetic Pickups available.

MAGNETIC PICKUPS

Convert mechanical motion to an ac voltage without physical contact or external power. The pickup creates an external magnetic field which, when interrupted by a magnetic discontinuity, i.e., a ferrous gear tooth, generates an ac voltage.

TACHOMETER TRANSDUCER



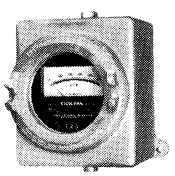
A self-generating unit, when used with a magnetic pickup. Designed to provide an electrical signal linearly proportional to the rotating speed of a shaft to which it is attached.

The Airpax solid state electronic tachometer system uses a frequency discriminator to convert a varying or alternating input signal to a proportional dc output. The conversion accuracy is nominally 0.25% over frequency ranges to 100 kHz.

Supplied in a variety of enclosures designed for industrial and military applications and accessory components, the system represents the most accurate, inexpensive electronic tachometer or frequency converter available.

TACH-PAK

An electronic tachometer using a system of transistor amplifiers and a saturating core transformer to convert RPM, speed or frequency into a dc output.



TACH-TROL

An industrial tachometer that converts RPM, speed or frequency to high level output current ranges (1-5, 4-20, 10-50 mA dc) which is linearly proportional to the input signal.



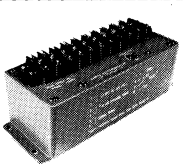
DIGITAL TACHOMETER

An industrial device that accepts and counts signals over a given time interval providing a displayed readout in engineering units, i.e., RPM, FPM, CPS, etc.



ZERO SPEED SWITCH

Is used when an alarm switching or equipment shutdown function is required as the speed of a rotating shaft approaches zero.

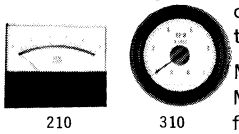


SWITCHING TACHOMETERS

Monitor the RPM of rotating equipment and provide 1, 2 or 3 switchpoints (set-points) where predetermined action (alarm, programming or verification) takes place.



METERS



210 310

Model 210 accepts standard 0-1 mA dc output of a tachometer for visual monitoring of RPM, speed or frequency.

Model 310 is a rugged meter (similar to Model 210) but offers a 250° arc scale for increased readability.

MILLIVOLT TO CURRENT CONVERTER

Converts a dc mV input from a thermocouple or other mV source to a proportional dc mA output. Magnetic-transistor amplifier provides stable operation, reliability and input-output isolation. Request Bulletin MC-12.



Catalog S1-1 provides complete information on RPM Measurement and Control instruments. Yours on request.

AIRPAX ELECTRONICS
SEMINOLE DIVISION, P. O. BOX 8488, FORT LAUDERDALE, FLORIDA 33310
PHONE: (305) 587-1100
TELEX: 051-4448
TWX: 510-955-9866

api INDICATING & CONTROLLING

Temperature controllers

Two-mode temperature controllers offer solid-state sophistication at low cost for plastics, textiles, packaging, hydro-carbon processing, semi-conductor manufacture.

Model 227 is the smallest, lowest-priced instrument among two-mode controllers with indicating meters and integral control elements. Requires no adjustments except temperature setting. Maintains temperature on a straight line at set point, without "droop" or overshoot. Spans as small as 100°F or 50°C. Wide choice of outputs. One week delivery in standard ranges. ***Request Bulletin No. 63.***

Models 225 and 226 are more sophisticated controllers designed for applications where certain adjustments are desirable. Proportioning SCR output and adjustable high and low alarms are standard. Choice of analog or digital set point. ***Request Bulletin No. 49.***

Series 700 temperature controllers, for OEM and in-plant use, maintain temperature within ±.5°F. Adjustment seldom needed. Push-button calibration for external resistance of sensors. Continuous indication with 1% accuracy. Vibration-proof.

On/Off, Time Proportioning or SCR Proportioning in either analog or digital set point models. Stocked in standard ranges. ***Request Bulletin No. 49.***

Compack temperature controllers are miniaturized instruments with reliable solid-state circuitry and rugged taut-band meter movements. Choice of On/Off, Time Proportioning or SCR Driver output. Adjustable single or double set points. Continuous temperature indication. Upright and edge-reading models stocked for quick delivery in standard ranges between 0 to 300° and 0 to 3000°F. ***Request Bulletin No. 49.***

Panel meters, meter-relays, controllers

DC meters available from stock include 15 Panelist and Stylist models with standard 1% tracking and frictionless taut-band construction in 20 to 100 μa ranges, at no extra charge.

Other models available in all standard AC and DC ranges. Taut-band standard between 0 to 3 and 0 to 100 μa; 0 to 3 and 0 to 25 mv. Taut-band is special in ranges above 100 μa. Most taut-band DC meters can be calibrated for 0.5% tracking, 1% accuracy, or 0.5% accuracy. Square and rectangular models range from 2¼" to 10" in width.

Additional panel meter types include: (1) black phenolic in both front-mounting and recessed-mounting Stylist models, (2) Mod meters, with interchangeable slide-out scales for measuring different variables, (3) long-scale meters for narrow rack panels, (4) edge-reading meters for maximum space saving, (5) VU meters for recording and broadcasting applications, and (6) ruggedized-sealed meters. ***Request Bulletin No. 47.***

Indicating pyrometers are stocked in 10 ranges to read temperatures from −200° to +3000°F. Standard accuracy is 2%, with 1% available. Same case styles as panel meters. ***Request Bulletin No. 47.***

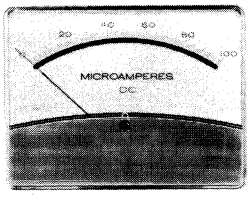
Contactless (optical) meter-relays are offered in Panelist, Stylist and edge-reading styles. Adjustable single or double set points, reliable control action at set point, continuous indication of input signal, operation from small (unamplified) signals.

Stocked in most popular ranges and sizes. Circuit modules with choice of On/Off, SCR Driver and 3-Zone control. ***Request Bulletin No. 48.***

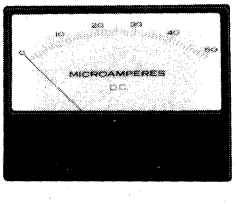
Other controlling instruments include contactless (optical) meter-relay pyrometers, contacting (locking-coil) meter-relays, and contacting (magnetic) meter-relays.

The Ultimeter, while not a meter-relay, allows circuit designers to combine signal indication and easy set point adjustment with the latest integrated circuit techniques at lowest possible cost. Contains 1% linear meter movement and 0.5% linear potentiometer, both precisely calibrated to the meter dial.

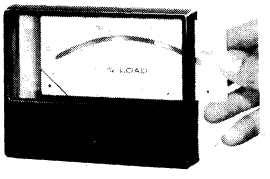
Designed for use with IC op amps, IC comparators, Schmitt triggers, Darlingtons, SCR's, or output relays. Combination then suitable for proportional controllers, simple panel loaders, component testing bridges and other systems. ***Request Bulletin No. 64.***



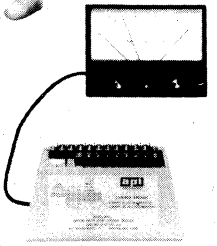
Panelist—clear acrylic, six models.



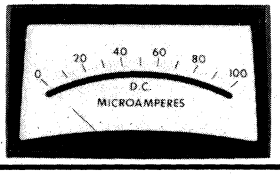
Panelist—black phenolic, three models.



Mod Meter.

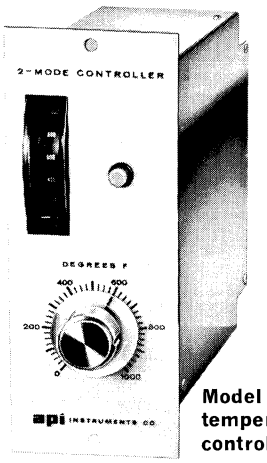


Contactless (optical) meter-relay with circuit module.



Stylist—recessed-mounting, four models.

INSTRUMENTS



Model 227 two-mode temperature controller.



Model 226 (digital set point) two-mode temperature controller.



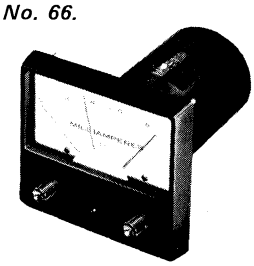
Series 700 temperature controller

Compack IV controllers are five times more sensitive and considerably faster than comparable instruments previously available for On/Off control. Standard full-scale ranges as sensitive as 0 to 1 μa and 0 to 1 mv.

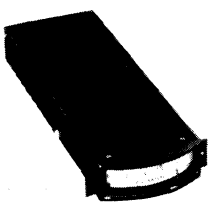
Control is independent of meter movement, triggering electronically when signal strength equals set point value. Other features are easy set point adjustment, standard 1% accuracy, small space requirement, simple installation. Ranges up to 0 to 50 amperes DC and 0 to 500 volts DC.

Also available in edge-reading model, Compack V.

Request Bulletin No. 66.



Compack IV— integral controller.

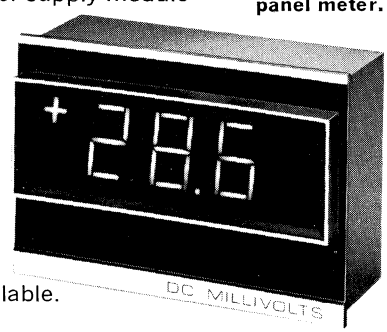


Compack V— integral controller.

Digital products

Model 4301 is a 3-digit DPM that requires only 1½" behind the panel when its exclusive detachable power supply is remotely mounted. Power supply module adds just 2½" when plugged into meter. Seven-bar segmented digits (⅞" high) are readable from 40 feet at angles to ±70°.

Model 4301 digital panel meter.



Standard accuracy ±.1% of reading, ±1 digit. Features include print command, display-hold, 30% overrange, auto-polarity, BCD output. Ranges are 0 to 99.9 mv to 0 to 999 volts DC, and 0 to 9.99 μa to 0 to 999 ma DC. Set points available.

Request Bulletin No. DP-1.

Model 4304 is a 3½-digit instrument with similar specifications, but with 100% overrange. Standard ranges are 0 to 199.9 mv to 0 to 199.9 volts DC, and 0 to 19.99 μa to 0 to 199.9 ma DC.

Systems DPM's, 3½ and 4-digit, will be available in mid-1969.

Other API products

Graphic recorders are available in two models: *Temprint* for temperature, *Versaprint* for other variables. Inkless, clamper-bar type instruments operate on unamplified current or voltage signals. Standard ranges available.

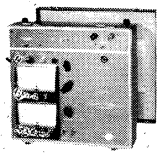
Request Bulletin No. 31.

api INSTRUMENTS CO.
Chesterland, Ohio 44026 | (216) 729-1611

INSULATION TESTING INSTRUMENTS

ASSOCIATED RESEARCH, INC

Portable DC HYPOTS® to 100 KV



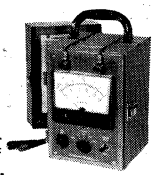
Output of the several portable DC HYPOTS is continuously variable from 0 to maximum with the voltage metered directly in the output. Leakage current measurements are on four range meters reading down to as low as 0.05 microamps. Features: 2% metering accuracies, electronic circuit protection, by-pass and metered return terminals, grounded steel cases, silicon rectifiers, plug-in high voltage leads, etc.

Model	Output Voltage	Output Current	Price
5205	0-5 KV	2.0	$ 550
5212	0-10 KV	2.0	675
5220	0-15 KV	2.0	735
5271	0-50 KV	2.5	2250
5321	0-100 KV	5.0	3115

Request Portable DC HYPOT Bulletins

Insulation Resistance Testers

Ranges from 100 to 10 million megohms at test potentials to 10 KV.



The VIBROTEST megohmmeter provides a wide selection of battery and line-powered instruments for accurate insulation resistance measurements of circuits, components, cables, motors, etc. They are direct reading and push button operated requiring no cranking or leveling.

Select from 17 models ranging from pocket-size to portable 10 KV with variable voltage. Some models combine megohm with ohm and AC-DC volt scales in one instrument. Five popular models are:

Model	DC Test Voltage	Max. Megohms	Features	Price
2000	500	100	Pocket-size	$ 95
201	500	200	Includes 2K ohm and six AC-DC volt scales	148
211	1000	2000	200 K ohm range	255
2850	500 / 50	10 Million	Constant test voltage through 6 decades	345
2955	0-2,500	50,000	Adjustable test voltage	890

Request VIBROTEST Megohmmeter Bulletins by model number.

Testing Manual Available



This 60 page collection of Bulletins covers specs, prices and applications of insulation resistance testers, AC HYPOT Juniors, portable and mobile DC test sets, corona and materials test equipment, kilovoltmeters, precision ohmmeter, current transformers, phase sequence indicators.

Request Manual 2900 on company letterhead

A-C HYPOT Jrs... to 10 KV, limited current



Portable a-c dielectric strength testers providing outputs continuously variable from 0-1500 V up to 10,000 V a-c. Use of neon breakdown and leakage current indicators in conjunction with collapsing field-type high voltage transformers assures rapid and safe production testing.

The leakage current indicator is adjustable from 0.3 to 3 ma. A 4½" kilovoltmeter provides high accuracy. Short-circuit current cannot exceed 18 ma.

Three popular models are:

Model	Output Voltage	Price
411	0-2,500	$155
404	0-4,000	170
422	0-10,000	245

HYPOT Jr. Automatic "Squawker" Models

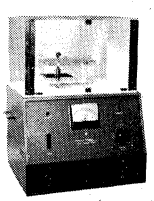
Available with output voltages from 0-1500 volts to 0-6000 volts a-c. Similar to the standard HYPOT Jr. models but include an audible signal unit and external control terminals.

DC and Combined AC/DC HYPOT Jrs.

offer same features as described above, plus test potentials to 5 KV.

Request AC & DC HYPOT Jr. Bulletins.

Insulating Materials Testers



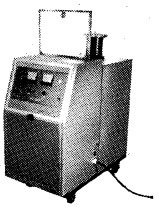
A full range of testers for solid and liquid insulating materials to 100 KV and higher is available. Due to the rapid progress of insulating materials and testing techniques, new equipment is added whenever required to meet ASTM, MIL and Federal test specifications.

Model 4501 Materials Testing HYPOT 0-35 KV at 2 KVA

This popular model meets dielectric strength testing requirements of Specification D-149, ASTM Standards on Electrical Insulation Materials. Output continuously variable from 0-35 KV a-c at 2 KVA (intermittent rating). Magnetic breaker trips when specimen breaks down. Output termination in jacks at center of the lucite cabinet top accepts the interchangeable ARI materials testing fixtures. Optional features: interlocked clear lucite test cage and selection of ARI plug-in materials testing fixtures, automatic rate of rise, dual sensitivity circuit breaker, etc.

Request Insulation Materials Tester Bulletin

High Voltage Test Equipment to 500 KV AC and 1,000 KV DC



A full range of instruments for extra high voltage dielectric strength testing. AC or DC potentials at capacities of up to 150 KVA or more. Control and measurement features include: automatic rate of voltage rise, memory circuit to record breakdown voltage, output current metering, separate low voltage control and high voltage test cabinets and many others.

AR has over 30 years experience in the design and manufacture of heavy duty very high voltage test equipment. All instruments are ruggedly constructed and fully tested in our own high voltage laboratory.

Corona Testing Equipment



New instruments detect, display and measure corona caused by voids, surface or other conditions in insulation sample or equipment under test.

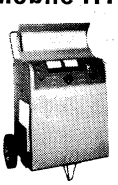
Instruments include: specially constructed corona-free HYPOT test set, a pickup network to extract the true corona signal and the corona detection display module. The detector also incorporates a calibrator to make quantitative corona measurements down to 0.1 picocoulombs.

These modules are available as individual units or as a complete integrated instrument. Standard models with test potentials of 10 to 100 KV AC include these two popular models:

Model	Output KV	KVA Capacity	Cabinet Style	Price
4074	10	0.25	Bench	$2250
4309	35	1.0	Console	3950

Request Bulletin 4-1.9.

Mobile HYPOTS... to 150 KV DC



Heavy-duty mobile test sets for determining insulation leakage and dielectric strength of cables, bushings, switchgear, transformers, motors and generators.

Outputs continuously variable from 0 to 45 KV and on up to 150 KV, with ratings of 2.5, 5, 10 ma. at full voltage.

Features include: 4½" kilovoltmeter connected directly across the high voltage output; three-range 4½" microammeter electronically protected against overload; zero return interlock; connector for remote safety interlock; fast-acting magnetic circuit breaker in output to protect high voltage circuits and external load; thermal overload breaker to protect input circuits; long-life silicon high voltage rectifiers; metered return and bypass return terminals for measurement of load (leakage) or bypass (guard) currents.

Request Mobile DC HYPOT Bulletin 5-1.16

ASSOCIATED RESEARCH, INC.
3773 W. BELMONT AVE., CHICAGO, ILL. 60618 • (312) 267-4040

AR ASSOCIATED RESEARCH, INC

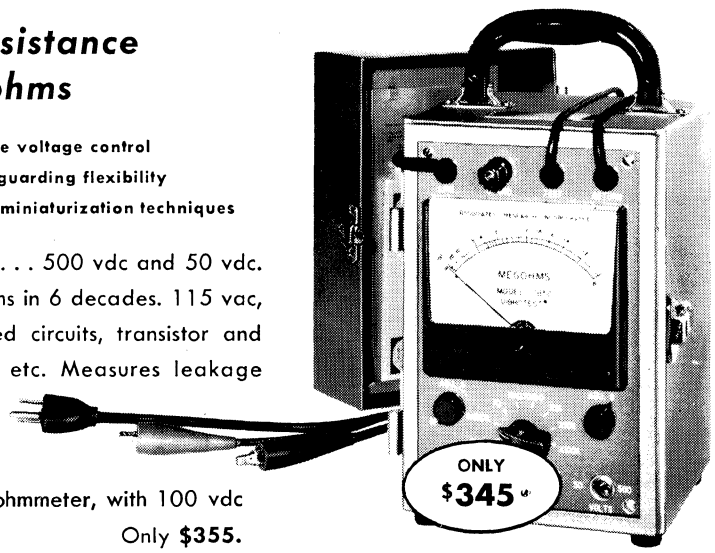
INSULATION TESTING INSTRUMENTS

NEW VIBROTEST® MEGOHMMETER MODEL 2850

Measures insulation resistance to ten million megohms

ADVANCED FEATURES

- constant test voltage over full range
- positive line voltage control
- maximum guarding flexibility
- no overload damage
- latest tube-miniaturization techniques



Versatile, accurate, reliable. Dual test voltage . . . 500 vdc and 50 vdc. 24" total scale length . . . 1 to 10,000,000 megohms in 6 decades. 115 vac, 50/60 cycle input. Measures resistance on printed circuits, transistor and miniaturized circuit components, cables, motors, etc. Measures leakage resistance of capacitors. Measures grounded and ungrounded sections of three-terminal resistors.

Also available . . . Model 2851 Vibrotest Megohmmeter, with 100 vdc and 500 vdc dual test voltages. Only **$355.**

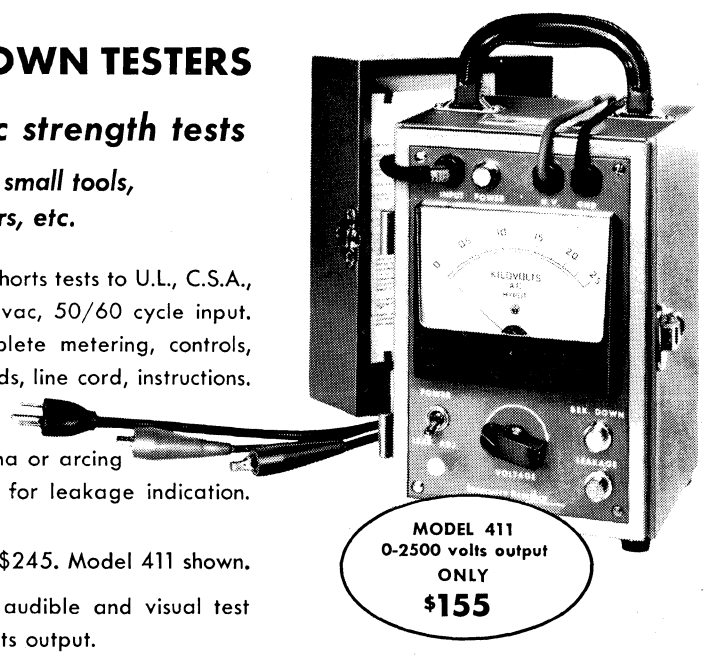
Immediately available from factory stocks

Get all facts . . . write for Bulletin 2-1.4

HYPOT® JUNIOR BREAKDOWN TESTERS

Make faster, safer AC dielectric strength tests

of electronic parts and components, small tools, appliances, motors, transformers, etc.



Simple to operate. Make breakdown, leakage and shorts tests to U.L., C.S.A., ASTM, NEMA, IEEE, MIL and EASA standards. 115 vac, 50/60 cycle input. Continuously adjustable output. Included are: complete metering, controls, safety features, case with removable cover, test leads, line cord, instructions.

Visual Indicator Models . . .
Have neon "breakdown" light for breakdown, corona or arcing indication . . . and separate neon "leakage" light for leakage indication. Five models from 0-1500 to 0-10,000 volts output.

Priced from $145 to $245. Model 411 shown.

Automatic "Squawker" Models . . . Provide audible and visual test indications. Four models from 0-1500 to 0-6000 volts output.

Priced from $265 to $290.

Now in factory stock for fast delivery

For complete details, write for Bulletin 4-1.3

10-35.33

Instruments for measuring: • Insulation resistance...the VIBROTEST® • Earth resistivity...VIBROGROUND® • Ground resistance . . . the VIBROGROUND® • High voltage breakdown, AC-DC . . . the HYPOT® • Special instrumentation for laboratory, production, and maintenance needs.

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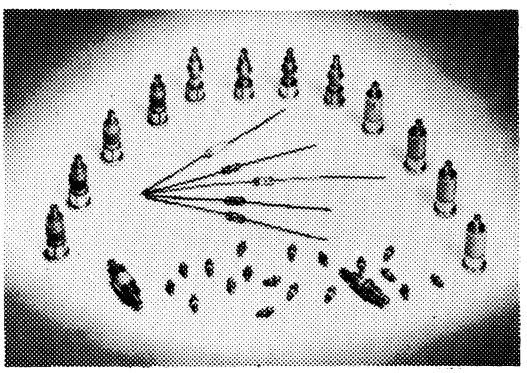
ASSOCIATED RESEARCH, INC.

3773 W. BELMONT AVE., CHICAGO, ILL. 60618 • (312) 267-4040

AR

SEMICONDUCTOR DEVICES



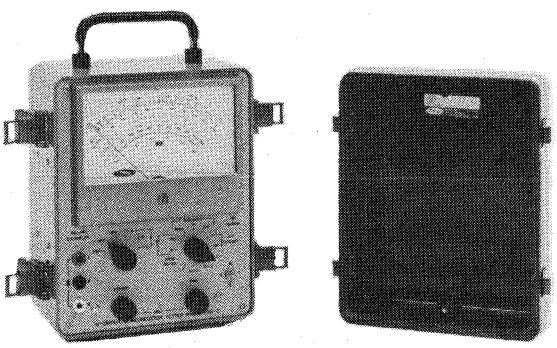
☐ VARACTORS
- Broad line of standard varactors with cutoff frequencies up to 180 GHz
- Custom diodes are also available to specific requirements.
- Specifically designed for switch, multiplier and parametric amplifier applications.
- Available in a variety of microwave packages.

☐ TUNING VARACTORS
- Total capacitances ranging from 3.3 pf to 27 pf with Q's up to 1200 and breakdown voltages up to 120 V.
- Capacitance ratios as high as 10:1.
- Available in a variety of packages.

☐ CRYSTAL VIDEO DIODES
- Designed for operation from 50 MHz to 40 GHz
- Available for use with all AEL detector mounts for highest sensitivity.
- Yield higher performance with most holders.

☐ MIXER DIODES
- Custom designed for L- and S-band operation.
- Guaranteed noise figure is 5 db max.
- Wide dynamic range.

☐ DIODE ATTENUATOR DIAT®
- 50 and 75 ohm design centers
- Minimum intermodulation distortion
- Environmental stability
- RF characterization
- 10 to 500 MHz
- Large resistance swing.



The **AEL MODEL 259C IN-CIRCUIT SEMI-CONDUCTOR TESTER** measures leakage in-circuit of transistors, diodes and field-effect transistors (F.E.T.'s). The device provides a rapid means for testing all semiconductors, and includes an Automatic Beta Calibration circuit, which automatically sets the collector current of the transistor under test at 1 milliamp.

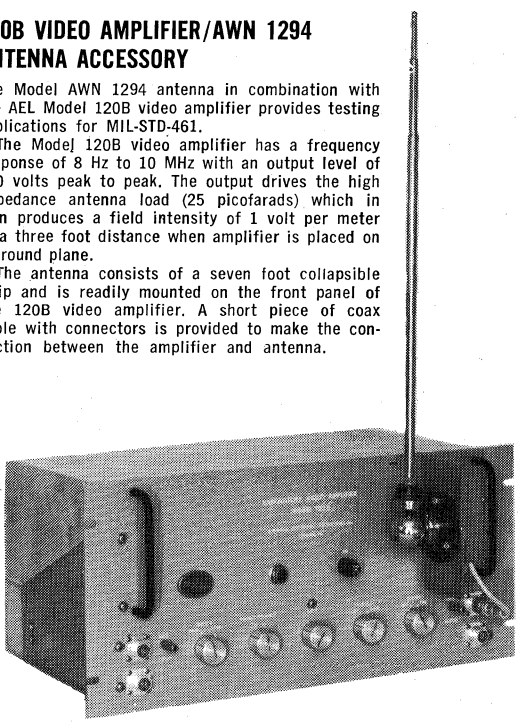
- ☐ MEASURES LEAKAGE IN-CIRCUIT of Transistors, Diodes and F.E.T.'s.
- ☐ CHECKS TRANSISTORS, DIODES, RECTIFIERS AND F.E.T.'s in- or out-of-circuit.
- ☐ MEASURES TRANSISTORS AND DIODES IN-CIRCUIT FOR REVERSE LEAKAGE down to 500 ohms of loading.
- ☐ MEASURES F.E.T. TRANSCONDUCTANCE (Gm) to 10,000 micromhos.
- ☐ SIMPLE, COMPLETELY SAFE means for testing all semi-conductors.
- ☐ MEASURES HIGH- AND LOW-POWER Transistors for 1000 cycle Beta (h_{fe}) within range of 1 to 1000—diodes and rectifiers for opens or shorts, IN-CIRCUIT, with as little as 20 ohms load across the device terminals—resistance between semi-conductor electrodes.
- ☐ SMALL, LIGHTWEIGHT, RUGGED.
- ☐ OPTIONAL ACCESSORY—Model 246 in-circuit test probe.

120B VIDEO AMPLIFIER/AWN 1294 ANTENNA ACCESSORY

The Model AWN 1294 antenna in combination with the AEL Model 120B video amplifier provides testing applications for MIL-STD-461.

The Model 120B video amplifier has a frequency response of 8 Hz to 10 MHz with an output level of 100 volts peak to peak. The output drives the high impedance antenna load (25 picofarads) which in turn produces a field intensity of 1 volt per meter at a three foot distance when amplifier is placed on a ground plane.

The antenna consists of a seven foot collapsible whip and is readily mounted on the front panel of the 120B video amplifier. A short piece of coax cable with connectors is provided to make the connection between the amplifier and antenna.

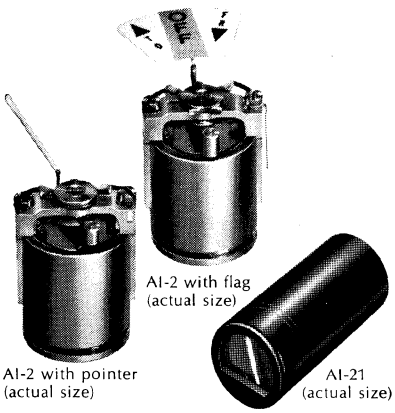


AMERICAN ELECTRONIC LABORATORIES, INC.

Main Offices: P.O. Box 552, Lansdale, Pa. 19446 (215) 822-2929 • TWX: 510-661-4976 • Cable: **AMERLAB**
Washington, D.C. Division: 6629 Iron Place, Springfield, Va. 22151 • (703) 354-5700

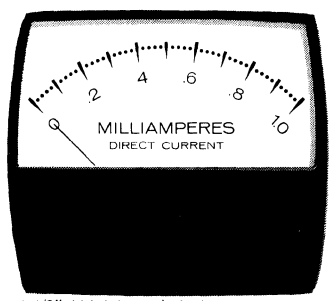
Neat...Compact...Accurate

PLUS a wide variety of styles



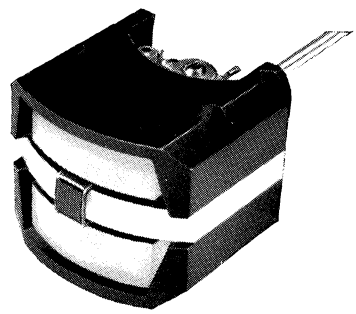
Ammon Series AI miniature, self-shielded mechanisms are designed to provide optimum performance in airborne indicating systems or wherever critical indicating and control functions are required. Self-shielding makes compass effect negligible. Units may be mounted side-by-side with no interaction. Panel material has no influence on calibration. Their compact size, coupled with the versatility of synchro-type and conventional type mounting methods, offers design engineers great freedom in adapting them to specific applications.

AI-2 mechanisms offer these advantages reduced size and weight, high torque-to-weight ratio, self-shielding, enclosed movement and negligible compass influence. Model AI-2 is 11/16" in diameter, 1" in length and weighs 3/4 of an ounce. Model AI-17 is 7/8" square and flange mounted, .832" in body diameter, 1-25/64" in length, weighs 1.6 ounces, constructed of brass, and hermetically sealed. Model AI-20 is 7/8" square and flange mounted, .832" in body diameter, 1-11/32" in length, weighs one ounce, constructed of hi-temp plastic, and sealed against dust and moisture. Model AI-21 is 7/16" in diameter, 31/32" in length and weighs 11.5 grams. Choice of pointer or flag is available on all models.



1-1/2" AM-1 (actual size)

Ammon AM-1 self-shielded panel meters have smart, sophisticated styling . . . easy reading scale . . . a most complete selection of sizes ranging from sizes 1-1/2 to 4-1/2". Rugged high torque mechanisms offer 1% linearity, 2% accuracy and sensitivity to 20 ua. Completely shielded to eliminate error from magnetic panels. Mounts bezel-to-bezel on any material without interaction or effect on calibration. Choice of colors or finishes, custom dials — ASA/MIL 4-stud mounting in AM-1 and AM-4 models and ASA/MIL 3-stud mounting in AM-2 and AM-3 models.



APT-1; 1 cu. in., 3.15 oz. (actual size)

Ammon APT-1 moving coil mechanism is a highly stable, linear and accurate mechanism for indicating, control or recording systems. 18-0-18° linearity is 1%. Coil design with over 75% of winding "working" in high energy, uniform field air gap assures greater accuracy. Coil system weighs 0.85 gm, develops 26.4 mmg of torque; 31:1 T/W. Mechanism offers negligible vibration pivots and jewels — custom damping — wide range of sensitivities.

Consult the factory or your AMMON representative for complete details or for any assistance you require.

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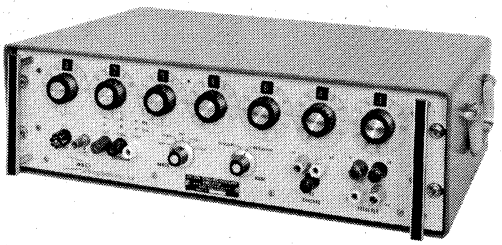
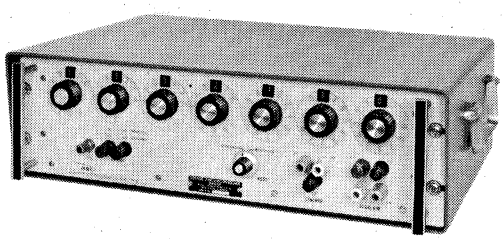
Advanced Test Instrumentation

Decade Synchro/Resolver Standards

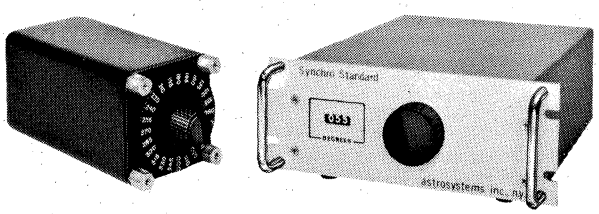
Decade Synchro/Resolver Standards provide a completely passive, extremely precise technique for testing and simulating synchro/resolver systems and components to absolute accuracies of 2 seconds of arc. Units are available with 1° to .0001° resolution and feature direct angular readout. A front panel switch provides for standard output voltages of 11.8, 26 and 90 and 115 volts. Wire for Data File No. 105.

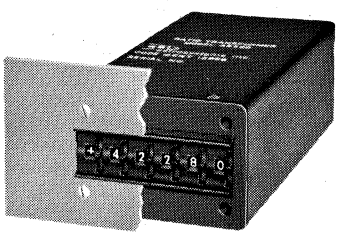




Decade Synchro/Resolver Bridges

Decade Synchro/Resolver Bridges, completely passive direct angular readout inductive type instruments, simulate synchro or resolver receivers (CT) to an absolute accuracy of 2 seconds of arc, traceable to the National Bureau of Standards. The unit is designed for testing all types of synchro, resolver and servo systems using a proportional nulling method, or by using the proportional voltage gradient method. Write for Data File No. 105.





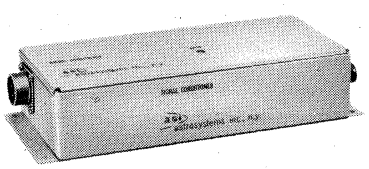
Synchro and Resolver Standards and Bridges

Synchro and Resolver Standards and Bridges test and simulate synchros, resolvers and servo systems quickly and economically. All units are accurate to 2 arc seconds, traceable to the National Bureau of Standards. Units are available with 5°, 10° and 15° resolution to cover a wide range of applications for both laboratory and system use. Write for Data File No. 105.

Decade Ratio Transformers

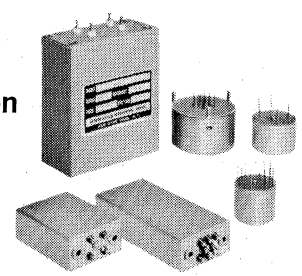
A complete line of Decade Ratio Transformers is available with guaranteed accuracy to 0.5 parts per million. Low output impedances eliminate loading errors and reduce pickup and noise effects. Rack and miniature panel mounted units are available. Write for Data File No. 106.

AC Signal Conditioning Modules



Astrosystems isolated solid state AC Signal Conditioning Modules feature input impedances to 13 megohms combined with a common-mode rejection of 80 db. Three input configurations are available as standard; differential, three-wire synchro or four-wire resolver. Write for Data File No. 118.

Instrumentation Transformers



Astrosystems high precision toroidal transformers are produced to accuracies of better than 0.5 parts per million. Available are matched high precision isolation transformers, bridging transformers, high precision voltage scaling transformers and Scott "T" transformers. Write for Data File No. 117.

See our line of Analog to Digital and Digital to Analog Converters listed under "Converters"

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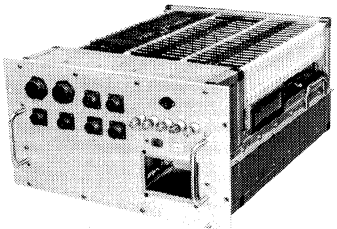
Automatic Test Instrumentation

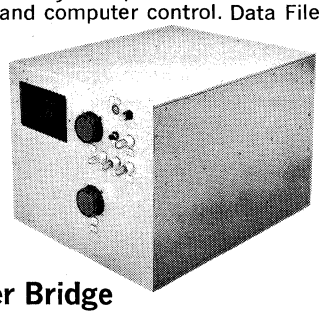


Programmable Synchro Resolver Testers

Astrosystems designs and produces standard and custom synchro and resolver testers. These devices automatically measure synchro/resolver parameters such as accuracy, phase shift and transformation ratio. Programmable indexing tables can also be supplied as part of complete synchro/resolver and servo test systems. Options include error print out and computer control. Data File No. 107.

Automatic Test Building Blocks

Building blocks are available for use in general purpose and special purpose automatic test systems. Devices include stimuli equipment such as synchro simulators, programmable AC voltage generators, programmable power supplies and automatic servo inputs. Measurement devices include voltage measuring blocks, response monitors and phase indicators. Write for Data File No. 107.



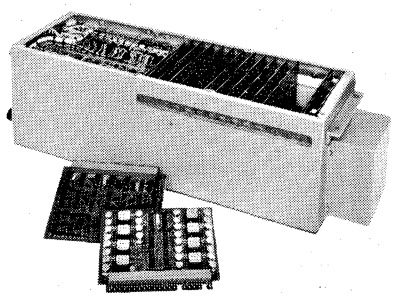


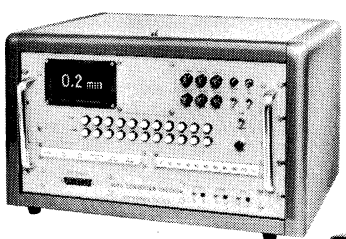
Automatic Synchro/Resolver Bridge

The Automatic Synchro Resolver Bridge reads out synchro or resolver inputs on a direct in-line decimal display to an accuracy of 0.01°, completely automatically. This solid state readout eliminates the necessity for complex manual setting of synchro bridges and error detectors. BCD or binary electrical digital outputs are provided. Write for Data File No. 111.

Automatic Synchro/Resolver Converters

Automatic Synchro/Resolver Converters provide for programmed synchro/resolver outputs and measurement of synchro/resolver inputs in the same unit. These solid state devices are available with resolutions and accuracies to 16 binary bits (20 seconds of arc). Standard units cover the frequency range from 200Hz to 10K Hz without deterioration in accuracy. Write for Data File No. 107.

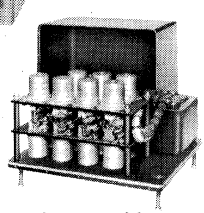




Automatic Converter Tester

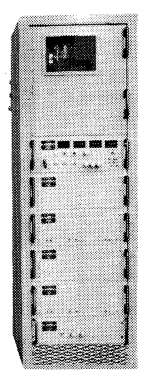
Automatic Converter Testers are completely self contained devices for laboratory or production testing of all types of synchro, resolver and voltage digital conversion equipment. The units feature push button selection of tests such as accuracy, phase shift and transformation ratio, with an in-line decimal display of error in actual measurement parameters. Write for Data File No. 107.

Programmable AC Voltage Modules



Programmable AC Voltage Modules provide an AC voltage output equivalent to a programmed digital input. Applications include both test and system applications where a high precision programmed AC voltage input is required. Standard output accuracy is better than 10 parts per million, traceable to the National Bureau of Standards. Data File No. 107.

Automatic Test Systems



Astrosystems designs and manufactures complete general purpose and special purpose automatic test systems. These units are constructed from standard building blocks and provide programming, stimuli, measurement and recording functions. Programming and data readout can be tape or computer controlled. Simple programming allows tests to be accomplished by relatively unskilled personnel. Data File No. 107.

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Digital Phase Comparators

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High Precision Low Frequency Variable Oscillators

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Oven Proportionally Controlled

Sub-Miniature Crystal Oscillators
No Ovens Utilized

High Stability Crystal Oscillators
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Frequency Voltage Controlled

Temperature Compensated Oscillators

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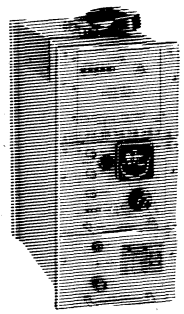
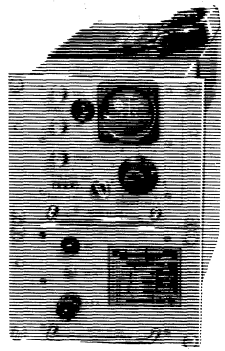
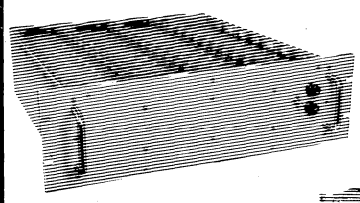


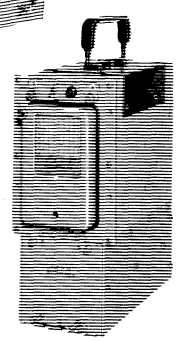
PORTABLE DIGITAL CLOCKS



HIGH STABILITY FREQUENCY STANDARDS

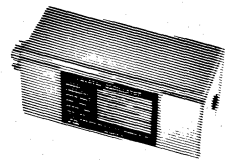


DISTRIBUTION AMPLIFIERS

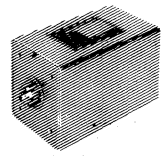


DIGITAL PHASE COMPARATORS

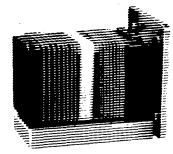
COMPONENTS



CRYSTAL OSCILLATORS

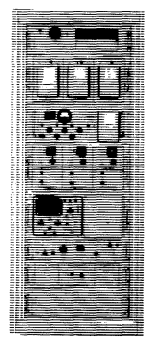


LINEAR DISCRIMINATORS



PROPORTIONAL OVENS

SYSTEMS

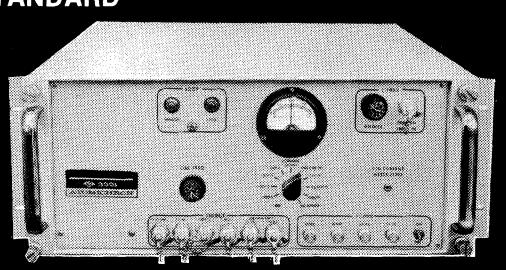


FREQUENCY-TIME STANDARD

and now... Precision Frequency Standards *by* Atomichron® MODEL 3501

CESIUM BEAM PRIMARY TIME AND FREQUENCY STANDARD
Atomic and UTC Time Scales

Model 3501 Atomichron is a compact, solid-state, self-contained, cesium-beam primary time and frequency standard, designed for scientific, industrial and military applications. The 3501 provides output frequencies accurate to ± 1 parts in 10^{11} for the life of the cesium beam resonator, with a 1,000-second stability of ± 3 parts in 10^{12}, rms. The fundamental primary-loop frequency is 14.59+ MHz. Standard output frequencies (10 MHz, 100 kHz, 1 PPS and 14.591479 MHz) and standard time-scale selection (Atomic Time A.1 or Universal Time UTC) are provided by an internal frequency synthesizer (secondary loop) with a 10 MHz reference oscillator. No accessories are required to convert the unit from one time scale to another.



MILITARY NOMENCLATURE AN/USQ-43

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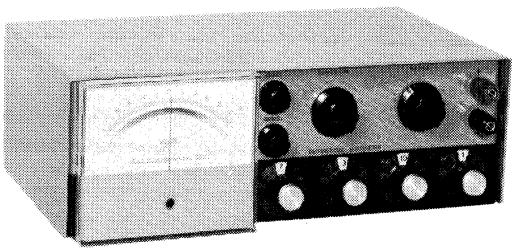
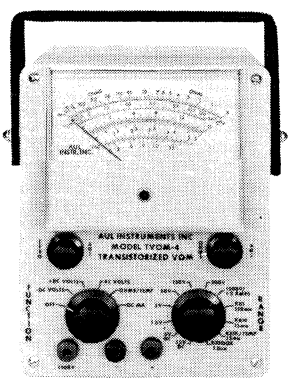
***RELIABILITY THROUGH DESIGN**



DIFFERENTIAL MULTIMETERS

FEATURE:

- Differential and Direct Measurements
- AC and DC voltage and current and resistance
- ±0.2% DC Accuracy, ±0.5% AC Accuracy
- All Solid State Design; Overload Protection
- Portable — Battery and Line Operation
- Low Cost

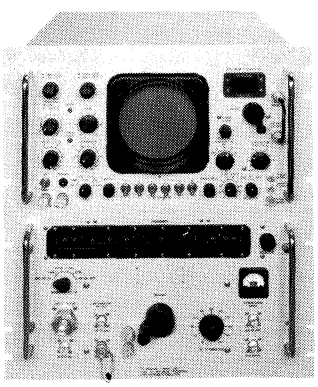


SOLID STATE MULTIMETERS

FEATURE:

- High Input Impedance
- Millivolt Microampere Sensitivity
- Multifunction: Voltage - Current - Resistance - Temperature
- Overload Protection
- Taut Band Meter Movement
- Low Cost

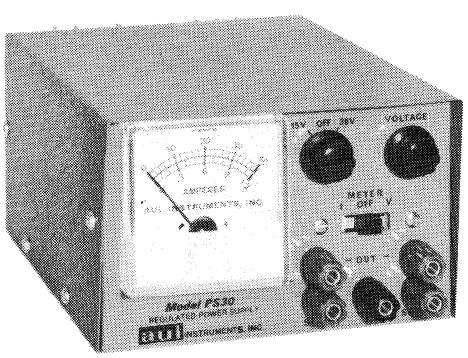
Prices start at $44.00



SPECTRUM ANALYZERS

FEATURE:

- 10 mHz to 63 gHz Frequency Range
- Single, Self Contained Unit
- Ruggedized, Meets Military Specifications
- IF and RF Crystal Markers
- Variable Dispersion, Resolution and Sweep Speed
- Low Cost



REGULATED POWER SUPPLIES

FEATURE:

- Low Ripple and Noise
- Wide Voltage and Current Range
- Good Line and Load Regulation
- Monitoring Meter
- Fully Repairable
- Low Cost

Prices start at $45.00

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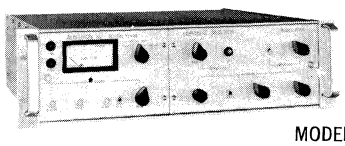
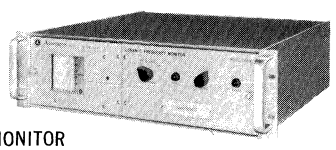
Time/frequency instruments & inverter/converter power supplies

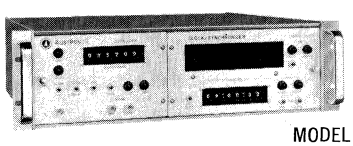
AUSTRON TIME/FREQUENCY INSTRUMENTS



MODEL 2000
LORAN-C MONITOR



MODEL 2004
LORAN-C FREQUENCY MONITOR



MODEL 2070A
CLOCK/SYNCHRONIZER

AUSTRON, Inc., offers a complete line of instruments for time/frequency calibration and control. Designed to maximize utilization of Loran-C, VLF, and Omega transmissions, AUSTRON instruments find applications in time synchronization, timekeeping, frequency calibration, propagation studies, and ionospheric event monitors.

The Model 2000 receives and automatically phase-tracks all Loran chains. Direct cycle identification. Ground or skywave tracking for micro-second timing. Electronic servo. Loop or whip antenna system available.

The Model 2004 is a low cost, automatic phase-tracking Loran-C receiver for frequency calibration. Electronic servo. Eliminates VLF type diurnal phase shifts. Parts in 10^{13} for one day averaging, traceable to USNO and NBS.

The Model 2070A provides in-line, digital time-of-day display. Synchronized by Loran-C or other electrical reference. Includes Loran-C repetition period generator. Internal Crystal Frequency Standard of 2×10^{-10}/day is optional.

The Model 2040 Loran-C Signal Simulator generates Master or Slave test signals at any repetition period for Loran-C receivers. Phase shifter for signal time adjustment. Doppler simulator and Loran-D format optional.

The Model 2010A Oscillator Control Unit permits phase-locking a crystal frequency standard to a higher stability reference such as an atomic standard or Loran-C receiver output. The unit uses a third order servo system for automatic correction of systematic oscillator aging in the event of primary reference failure.

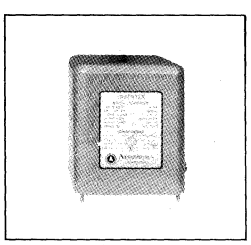
The Model 2062A Group Repetition Period and Time of Coincidence Generator adapts skywave monitors and visual receivers for timing by odd-rate Loran-C stations. The unit also provides visual and electrical indication of TOC seconds.

The Model 2082 Loran-C TRF Receiver is optimized for visual or photographic monitoring and analysis of Loran-C signals. Unit includes two adjustable notch filters. Additional filters optional.

Data sheets for these instruments and others are available. Also write for the following application notes:

1) A Loran-C Skywave Timing Experiment
2) A Frequency Control Experiment
3) Loran-C for Time and Frequency

POWER SUPPLIES



DC-AC
SQUARE WAVE POWER INVERTER

The AUSTRON Model 1008 is an all silicon, solid state unit supplying a square wave output of 250VA. The package is 5.4 x 4.8 x 6.2 inches, weighs 11 lbs. −20°C to +65°C, output frequency tolerance 0.2% or optional adjustment. Output voltage adjustable with taps.

AUSTRON is active in the following areas of POWER SUPPLIES:

- MODULAR DC-DC CONVERTERS — microwatts to 750 watts.
- MODULAR SWITCHING MODE REGULATOR — integrated circuit power regulator.
- MODULAR DC-AC INVERTERS — 25VA to 750VA.
- STANDBY POWER SYSTEMS — battery charger and inverter system.

Austron power supplies feature all silicon semiconductors. Extremely high efficiency allows for high temperature operation, permits full MIL environmental certification.

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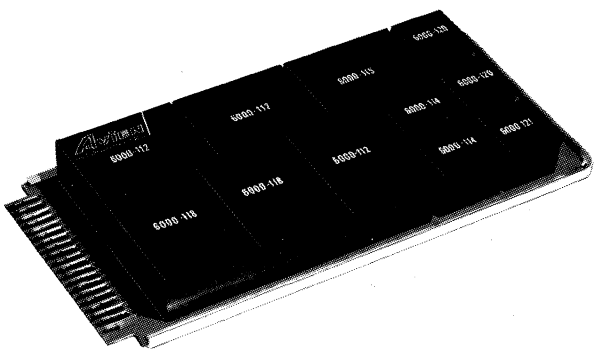
AVIEN INCORPORATED

MODEL 6100 / Synchro-To-Digital Converter

DIGITIZE SYNCHRO AND RESOLVER OUTPUTS TO 12 BITS WITH ONE LOW COST CARD



FEATURES:

- Complete synchro-to-digital converter on one 4⅝″ x 11¼″ printed circuit card.
- Solid state "no adjustment" encapsulated construction ideally suited for rugged industrial applications (−55° to +125°C model available, specify Model 6100M).
- Operation from standard ±15V dc and +5V dc system voltages or 115V, 60Hz with mating 4⅝″ x 11¼″ power supply card.
- Plug-in functional modules provide maximum flexibility to facilitate OEM applications, including ... custom card size, multiplexing, multi-speed synchro, resolvers, output codes, display time ...
- High input impedance ... permits use of the converter for readout, logging, computer input ... while simultaneously permitting the synchro to provide direct signals for servo system operation and/or control.
- Laboratory standards system accuracy available to the industrial user for the first time at low cost and small size ... Avien's Model 6100 S/D supplies precision 400Hz for synchro excitation, permitting industrial system use of a synchro under laboratory measurement conditions.
- System accuracy will be within 6′ of specified synchro/resolver accuracy.
- Multiplex Capability ... up to 200 inputs.
- Tracking ... up to 72,000°/sec.
- High speed conversion for fast control, i.e. valves, chemical mixing, nuclear reactors ...

DESCRIPTION:

The Avien Model 6100 Synchro-to-Digital Converter provides, on a single card, all the electronics (including clock and excitation reference) necessary to convert a 3-wire synchro signal to a 4-digit BCD output signal (12 bit accuracy). Proprietary techniques permit achievement of an overall system accuracy implied by the synchro accuracy itself ... by utilization of a little known but important element in all servo specifications ... accuracy specified under precise frequency and amplitude excitation conditions. The Avien Model 6100 offers laboratory instrument performance (previously found only in bulky units) at the lowest cost and size.

SPECIFICATIONS:

EXCITATION OUTPUT 400 Hz ±0.1%, 26 V rms ±1%
Note—This signal is provided from an integral module on the card.

INPUT SIGNAL 3-wire synchro output
11.8 V rms

OUTPUT BCD, 4 digits plus decimal

RESOLUTION 2′38″

LOGIC LEVELS +5 V ±10% = Logic "1"
0 V to .5 V = Logic "0"

LSD 6′

CONVERSION TIME <20 ms

DISPLAY TIME
Standard Unit: .1 to 10 seconds (factory preset to customer requirements)
Optional Feature: Continuously variable from .1 to 10 seconds

PACKAGE One P.C. board 4⅝″ x 11¼″

TRACKING Standard Unit: (18,000 − 50x)°/sec
Optional Feature: (72,000 − 200x)°/sec
Where x is the shaft angle in degrees at the start of the conversion interval.

POWER REQUIREMENTS ±15 V ±5% at 200 mA
+5 V ±10% at 200 mA

OPERATING TEMPERATURE 0° to +70°C
−55° to +125°C (optional, specify Model 6100M)

ACCURACY
6′ peak error from all sources, excluding input signals (synchro or resolver).

SYSTEM ACCURACY
Peak system error will not exceed peak conversion accuracy by more than the manufacturer's specified accuracy of input device (synchro or resolver)

MULTIPLEX CAPABILITY

Standard Unit: $N = \frac{50}{R}$

Optional Feature: $N = \frac{\text{Excitation Frequency}}{2R}$

Where: N = Number of multiplex inputs
R = Number of readouts/second for each input

Call, wire, or write for details and evaluation sample of the smallest, lowest cost, highest performing SYNCHRO-TO-DIGITAL CONVERTER available.

Progressive changes in design may be made without prior announcement.

PAT. PENDING

AVIEN INCORPORATED

58-15 Northern Blvd. ■ Woodside, N.Y. 11377 ■ (212) 932-4600 ■ TWX: 710-582-2640

AVIEN INCORPORATED

DIC* / Digital Integrated Circuit Test System

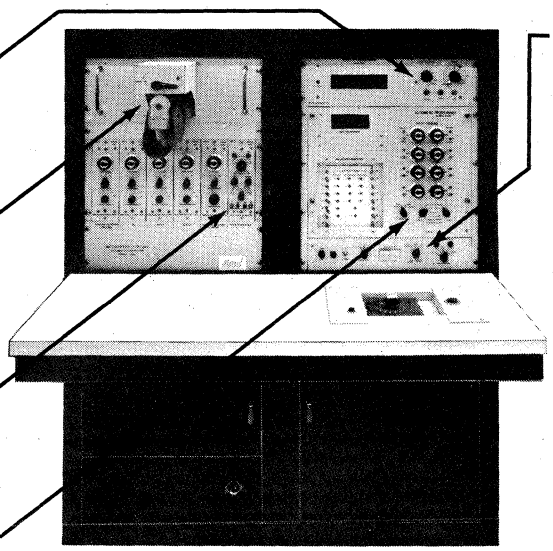
A NEW LOW COST CONCEPT IN AUTOMATIC TEST, MEASUREMENT AND DISPLAY OF DIGITAL INTEGRATED CIRCUIT PARAMETERS.

DIGITAL COMPARATOR VOLTMETER
Analyzes failures by measuring voltages (0 to ±100 Vdc, 0.1mV resolution) and currents (0 to ±100mAdc, 10nA resolution).

TAPE READER
All your test and measurement requirements are on punched Mylar tape 82 bits wide. No internal memory or factory programming is required. Unlimited number of tests.

STIMULI
Test any digital IC with up to four voltage (0 to ± 100 Vdc), and one voltage/current (0 to ±100 Vdc/0 to ± 100 mAdc) plug-in supplies.

PROGRAMMER
Preset digital voltages and device leads for the IC... takes less than one minute... then you are ready to test millions of IC's.



MODEL 2400

CONTROL PANEL

Choice of operating modes:
- Diagnostic Test—provides operating status of the Model 2400 using self-test tape.
- Continuous—accept/reject indication upon completion of all tests.
- Stop on Failure—failed test number and parametric measurement displayed.
- Single Test—test number and parametric measurement displayed with accept/reject indication.
- Manual/Power Soak—power applied continuously to unit under test.
- Automatic Handler—provides interface with Automatic Handler.

Choice of data logging modes:
- Log All—continuous data logging of each test and measurement.
- Log Failures—record parametric measurement on test failures.
- Off—no data logging.

CONSTRUCTION

- Modular IC circuitry.
- Kelvin connections provide precision measurements of high currents at low voltage... and low voltage at high currents... also permits remote measurements (i.e. environmental testing).
- Shielded circuits and wiring... compensation for lead capacitance... circuit capacitances automatically discharged.
- Plug-in modules avoid obsolescence.
- "Swing-Out" accessibility simplifies maintenance.
- Floor Cabinet—46" w x 59" h x 24" deep.
- Power—115V, 50/60 Hz, 1Ø, 3 amps.

HERE IS WHAT IT CAN DO:

- Uniquely designed for dc parametric test and measurement of digital integrated circuits—Avien's specialty.
- High-volume incoming inspection testing of **all** digital IC's—3,000 IC's per shift **without** automatic handler.
- QA failure analysis—each failure can be analyzed in detail with the widest range of input/output voltages and currents and with display of high accuracy parametric measurements.
- Engineering evaluation—device performance can be tested, measured, displayed, and recorded under the widest range of applied stimuli.
- Test data logging—BCD output can be used to record all test data for on-line and off-line analysis.
- DC testing of any device within the input/output voltages and current capability of the 2400 DIC* Test System.
- Digital IC Classification—unlimited number of tests permits the widest range of machine instruction for parametric classification of devices.

HERE IS WHAT YOU GET:

Avien Model 2400 DIC* Test System comes complete, ready to be plugged in to test your IC's. You get:
- Model 2400 DIC* Test System.
- Tape punch and 100 feet of tape to get you started (the average program requires one foot of tape).
- Enough test work sheets for about 50 IC types.
- Operating manuals, schematics, and instructions.
- On-site training program.
- Complete set of IC test sockets and adapters (Kelvin connected).
- Full warranty.

Call for full details on the Model 2400 DIC* Test System and Avien's LEASE/PURCHASE Plan which can put a Model 2400 in your plant for minimal cost.

Progressive changes in design may be made without prior announcement.

PATS. PENDING

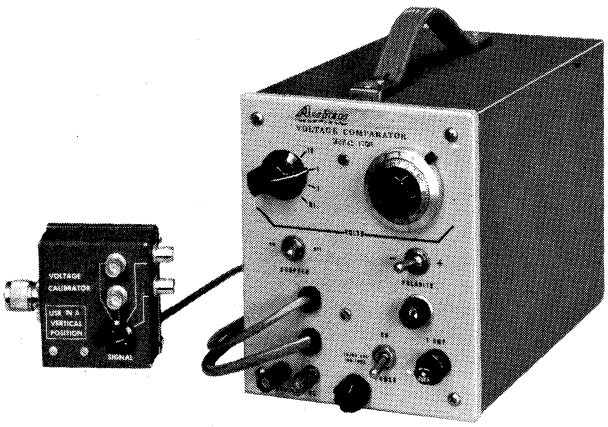
AVIEN INCORPORATED

58-15 Northern Blvd. ■ Woodside, N.Y. 11377 ■ (212) 932-4600 ■ TWX: 710-582-2640

AVIEN INCORPORATED

MODEL 6000 / Voltage Calibrator

FOR PRECISE VOLTAGE AND BANDWIDTH CALIBRATION OF OSCILLOSCOPE SIGNALS.



FEATURES:

- Excellent Long Term Stability
- Low Temperature Coefficient, .003%/°C
- Overall Accuracy ±0.1% of Full Scale
- Rise Time Less Than 3 Nanoseconds
- Precision D.C. Voltage Available at Front Panel
- Four Probe Inputs
- Fits Compartment of Oscilloscope Dolly
- 0-10 Volt Input Range Expandable to 400 Volts with Series 6007 Attenuators

DESCRIPTION

The Model 6000 is a precision instrument for voltage calibration and bandwidth measurement with an accuracy of 0.1% of full scale. The voltage or current amplitude of the signal under measurement is compared with the DC voltage of the calibrator which forms two clear horizontal lines (see figure 1). The signal and the DC voltage are alternately connected to the input of the oscilloscope. A typical pulse measurement is shown in figure 1 and a sine wave in figure 2.

The mercury chopper is mounted in a box which is connected directly to the oscilloscope input connector, thus minimizing signal distortion.

Amplitude distortion is prevented by not using any active elements between the signal to be measured and the oscilloscope.

The mercury chopper closes in the nanosecond region without any jitter to the leading edge, permitting oscilloscope bandwidth measurements up to 100 MHz. Figure 3 shows the leading edge applied to the input of a Tektronix Model 545A oscilloscope. The amplitude of this wave may be varied from 100 microvolts to 10 volts. It is therefore a simple matter to use this fast wave front to measure the high frequency cutoff of the oscilloscope. The combination of an accurate DC voltage and a means of measuring the high-frequency bandwidth will insure accurate measurement of high frequency pulses or continuous waves.

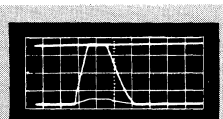


Figure 1

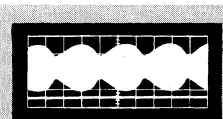


Figure 2

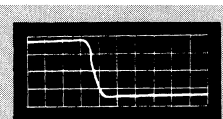


Figure 3

SPECIFICATIONS

VOLTAGE SCALE:
0 to 10 volts in four scales. With the Model 6007 attenuator, the maximum voltage input is 400 volts.

ACCURACY:
0.1% of full scale. Zero temperature compensated zener diodes, having a temperature coefficient of 0.003%/°C are used. Resistors for determining D.C. voltage output have a temperature coefficient of <25 ppm/°C.

RISE TIME OF MERCURY CHOPPER:
<3 nanoseconds.

CHOPPER NOISE:
<1.5 millivolts up to 10 K ohm source impedance.
<2.0 millivolts up to 1 megohm source impedance.

ACCESSORIES:
Series 6007 Attenuators for voltage range expansion.

POWER INPUT:
50/60 cps, 105-125 volts, 15 watts.

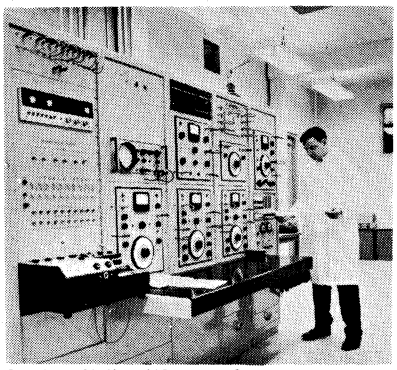
PHYSICAL SPECIFICATIONS:
Size: height 7 in., width 5¾ in., depth 10¼ in.
Weight: 10 lbs., net.

Progressive changes in design may be made without prior announcement.

AVIEN INCORPORATED
58-15 Northern Blvd. ■ Woodside, N.Y. 11377 ■ (212) 932-4600 ■ TWX: 710-582-2640

product data

Systems and instrumentation for AC voltage measurements, analysis, and recording – from 2 Hz to 200,000 Hz.



Courtesy National Gypsum Company

B & K INSTRUMENTS:

- Accelerometers
- Acoustical Absorption Measuring Apparatus
- Artificial Ears and Voices
- Audiometer Calibrators
- Beat Frequency Oscillators
- Cathode Followers
- Complex Modulus Measurement Systems
- RLC Comparison Bridges
- Distortion Analysis Systems
- Electromagnetic Transducers
- Environmental Test Equipment
- Frequency Response Tracers
- Hearing Aid Test Systems
- High Speed 1/3 and 1/1 Octave Band Analysis Systems
- Instrumentation Tape Recorders
- Low-Frequency RF Voltmeters
- Measurement Amplifiers
- Megohmmeters
- Microphone and Accelerometer Calibration Systems
- Narrow Band Frequency Analysis Systems
- Noise Exposure Meters
- Octave Band Frequency Analysis Systems
- Phonograph Cartridge Test Systems
- Probability Density Analysis Systems
- Production Noise and Vibration Testors
- Random Noise Generators
- RMS Graphic Level Recorders
- RMS Polar Plotting Systems
- RMS Voltmeters
- Sound Level Meters
- Spectral Density Analysis Systems
- Statistical Distribution Analysis Systems
- Strain Measurement Systems
- Stroboscopes
- Vibration Exciter Control Generators
- Vibration Plotting Systems

B & K Instruments, Inc. specializes in the application and marketing of Bruel & Kjaer instruments and complete systems for measurement, analysis, control, and recording of AC voltages from 2 Hz to 200,000 Hz. To provide customers with immediate access to men familiar with their problems and with application experience in their area, the B & K staff is divided into specific market groups:

EDUCATIONAL — Teaching dynamic measurements; sound, vibration, strain, and shock.

HUMAN ACOUSTICS — Speech and hearing, hearing aids, psycho-acoustics, neuro-physiological research, heart sound.

AEROSPACE ENVIRONMENT — Data acquision, data processing, vibration environmental testing, instrument and transducer calibration, and bio-acoustics testing.

PRODUCT NOISE AND VIBRATION — Product noise and vibration analysis, control, or reduction; materials testing, architectural acoustics, traffic, airport noise, and similar fields.

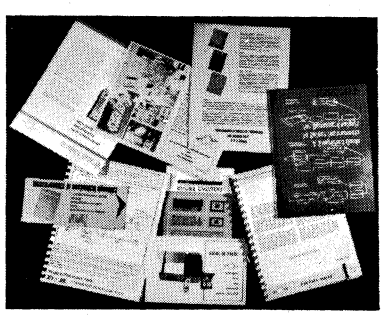
COMMUNICATIONS — Recording, reproduction, broadcasting, and dictating equipment; telephone equipment, hydrophones, and related equipment.

GENERAL INSTRUMENTS — Measurement of voltages, resistance, impedance, phase angles, and other values.

Within each market group is a pool of practical experience and know-how, available through the B & K field representatives, or by direct contact to Cleveland.

Individual Bruel & Kjaer instruments are unique and unmatched for accurate, professional measurements. A separate staff is maintained in Cleveland to assist customers in integrating instruments into reliable systems — or to design and manufacture custom systems to solve specific measurement, control, or analysis problems.

B & K instruments and systems are available for sale, lease, or rental. Factory-trained field representatives are located in most major cities.



Each B & K instrument is described in an individual Specification Sheet. The entire line is presented in condensed form in an annual Condensed Catalog. A quarterly journal, the B & K Technical Review, reports new developments in the field and from Bruel & Kjaer research. For the B & K instrument user, a Service Note program keeps him up-to-date on new servicing and calibration techniques, accessories, and ideas for assuring effective use of his instruments. An Application Note series discusses new solutions to difficult or unusual problems. All publications are available free, on request.

B&K INSTRUMENTS, INC.
Bruel & Kjaer Precision Instruments
5113 West 164th Street • Cleveland, Ohio 44142
Telephone: (216) 267-4800 • TWX: (810) 421-8266

Beckman®

INSULATION TEST EQUIPMENT

WIDE-RANGE MEGOHMMETERS

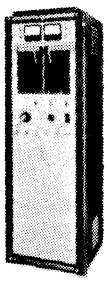


Model L Series — Including Digital Readout. Designed for laboratory and high speed testing of motor and transformer winding insulation, cable insulation, high value resistors, capacitor insulation, and for the measurement of surface and volume leakage of insulating materials. Meets requirements for testing insulation resistance in accordance with ASTM D-257, and Federal Spec. LP-406B, Method 4041.

Model	Test Voltage	Resistance Range Low	Resistance Range High	Power Consumption	Weight Net	Weight Shipping	Size
L-4B	200 or 500 fixed	1 meg. 2.5 meg.	100,000 meg. 250,000 meg.	50 watts	14	17	15" x 8" x 10"
L-6C	100 to 600*	1 meg.	100,000 meg.	80 watts	15	18	15" x 8" x 10"
L-7	100 to 600*	1 meg.	5 x 10^{13} ohms	75 watts	20	24	8" x 10½" x 11½"
L-8	10 to 1000**	10^5	10^{14}	35 watts	18	22	7½" x 11" x 13"
L-9†	10 to 1000*	10^4	10^{14}	145 watts	140	165	21" x 19" x 21"

* Continuously variable, built-in voltmeter for accurate setting.
** Continuously variable, selectable by switch.
† Features digital readout, automatic or manual range selection.

AC BREAKDOWN TESTERS Model PA Series



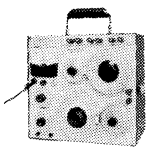
Type PA variable high voltage AC breakdown testers are designed to meet the requirements of ASTM specification D-149, and Federal specification LP-406, Method 4031, as well as all general purpose breakdown testing. Provided with motor-driven control of output voltage with any desired rise of secondary voltage. Available with wide variety of testing jigs.

PA-5-152	15,000 V. rms. 2KVA
PA-5-155	15,000 V. rms. 5KVA
PA-5-252	25,000 V. rms. 2KVA
PA-5-255	25,000 V. rms. 5KVA
PA-5-502	50,000 V. rms. 2KVA
PA-5-505	50,000 V. rms. 5KVA
PA-50-1005	100,000 V. rms. 5KVA

For even greater versatility, dual range units using multiple winding transformers are available on order. These provide two meters and a total of six scales. Typical dual-range models as follows:

PA-5-252/052	25 kv or 5 kv rms. 2KVA
PA-5-502/102	50 kv or 10 kv rms. 2KVA
PA-50-5010/1510/510	50 kv or 15 kv or 5 kv rms. 10KVA

IMPEDANCE BRIDGE Model ZB-2A

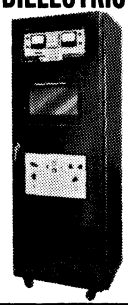


Model ZB-2 is a universal type bridge for the precise measurement of AC and DC Resistance, Inductance and Storage Factor, and Capacitance and Dissipation Factor. The instrument provides clear in-line readout, features simplified operation, and covers an exceptionally wide range for all types of measurements. In-line readings for DQ and RCL facilitate faster and more accurate reading. A new meter null detector is utilized on both AC and DC measurements to eliminate the conventional "electron-ray" or "eye" tube.

Range:	Resistance	0.0001 ohm to 11 megohms AC or DC (8 ranges)
	Capacitance	1 pf to 1100 μf (7 ranges)
	Inductance	1 μh to 1100 h (7 ranges)
	D	0.001 to 1.05 at 1 KC } Provision for
	Q	0.02 to 1000 at 1 KC } external extension
Accuracy:	Resistance	±(0.1% + 1 dial div.)
	Capacitance	±(0.2% + 1 dial div.)
	Inductance	±(0.3% + 1 dial div.)
	D Factor	±(5% + 0.0025)
	Q Factor to 10 HY	±(5% + 0.0025)
	at 100 HY	±(5% + 0.015)
	at 1000 HY	±(5% + 0.055)

Internal Oscillator Frequency: 1KC± 1%
Internal DC Supply: 10 V at 250 ma (DC Low)
200 V at 10 ma (DC High)

DIELECTRIC BREAKDOWN TESTER Model PDA-1



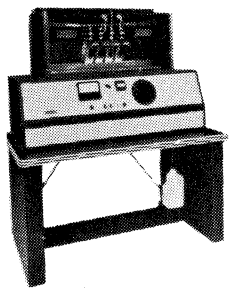
Designed to provide simple, safe, accurate means of determining dielectric strength and breakdown voltage in the laboratory or factory (conforms to requirements of ASTM specifications D-149 and Federal specification L-P-406 method 4031).

Push button selection — four different leakage current meter ranges (six operating modes) — enclosed test cubicle, fail-safe circuitry, interlocked doors and oil immersed gravity-drop shorting switch allows safe use by unskilled personnel.

- Continuously adjustable (automatic or manual) test output voltage control uses full 100% rotation to allow fine control for critical testing (choice of AC or DC).
- Provides for transient suppression and introduction of non-linear resistance into transformer.
- Maximum versatility of test jig set-up using plug-in jigs or high voltage cable to external "hi-pot" testing circuits.
- Self contained unit — portable yet provides easy access to all parts for maintenance.

TRACKING and EROSION RESISTANCE TEST -- TERT-1

Evaluates relative track and erosion resistance of various materials using Liquid Contamination Inclined Plane method described in ASTM and IEEE specifications. Test represents service exposure evaluation of wide range of insulated material subject to AC surface current. Test conditions simulate water film on insulation surface in which ionizable and other contaminants may dissolve. Contaminant rate easily controlled to simulate different service stresses and outside conditions. Tests conducted on 2" x 5" specimen; actual test covers 1" x 2" track area. Test criteria is either "time to track a fixed distance at a fixed voltage," or "voltage to initiate tracking" — depending on specific service requirement evaluation.

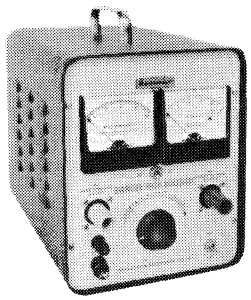


WHEATSTONE BRIDGES
Model RN Series



Universally used for the measurement of all types of resistance devices and circuits where high accuracy is required. Models available for performing Murray-Varley Loop tests.

Model	Total Resistance of Decade	Ratio Dial Settings	Circuits
RN-1	9X(1+10+100+1000)	.001, .01. .1, 1.0, 10, 100, 1000	.....
RN-2	9X(1+10+100+1000)	.001, .01, .1, 1.0, 10, 100, 1000, M10 M100, M1000	Murray & Varley
RN-3	10X(1+10+100)+9(1000)	1/1000, 1/100, 1/10, 1/9, 1/4, 1/1, 10/1, 100/1, 1000/1, M10, M100, M1000	Murray & Varley

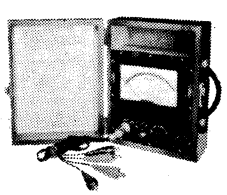


INSULATION TEST SETS

Used in testing insulation where AC voltages are desired. Dual instruments are also available which provide choice of AC or DC output. Includes kilovoltmeter, current meter and automatic overload limiter circuits. Metering accuracies are ±3%. The basic model number covers AC types. Add the prefix AC/DC to the basic model number for the dual output type.

Model	Type	Voltages	Current Meter
3000	AC or AC/DC	0 to 3,000	10 MA
1000	AC or AC/DC	0 to 10,000	10 MA
2500-DC	DC only	0 to 25,000	100 μA
4000-DC	DC only	0 to 40,000	50 μA

LOW RESISTANCE OHMMETER Model LRO-1



Designed for the measurement of resistance of sensitive relay contacts, fuses, bus-bars and connections, rail joints, pipe or conduit, switch contacts, transformer windings, motor windings, bonding, grounding and similar applications. The current through the unknown resistance never exceeds 110 ma. Extreme accuracy for the most critical measurements. Entirely self-contained, including 1½ V flashlight battery. Ranges: .1 ohm, 1 ohm and 10 ohms. 100 meter scale divisions. One scale division on .1 ohm range is .001 ohm. Accuracy of ±1½% or better on LRO-1. Accuracy is based on full scale values. Maximum current through piece under test = 0.11 amp.

Beckman® INSTRUMENTS, INC.
CEDAR GROVE OPERATIONS
89 COMMERCE ROAD
CEDAR GROVE, NEW JERSEY • 07009
INTERNATIONAL SUBSIDIARIES: Geneva; Munich; Glenrothes, Scotland; Tokyo; Paris; Capetown; London; Mexico City.

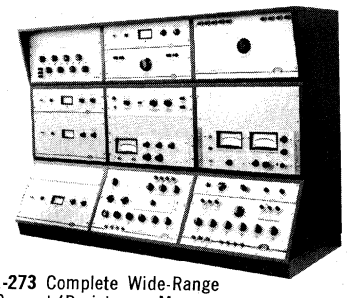
Additional Beckman Products in Power Supply Section 4000

JAMES G. BIDDLE CO.

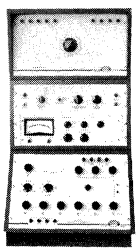
PIONEERS IN MODERN POTENTIOMETRY AND BRIDGE INSTRUMENTATION

VERITOR™ ULTRA-PRECISE MEASURING & GENERATING MODULES & SYSTEMS

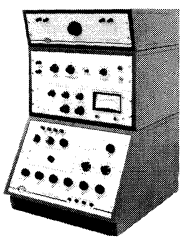
Veritor Systems are fully integrated standards-laboratory consoles that take the tedium, time, and trouble out of testing—anywhere in the plant. They are as much at home at 1,500 volts as at 10 millivolts, and have **nanovolt** sensitivity and resolution—yet are so completely guarded, shielded and free from ground loops, pickup, thermals, and other sources of uncertainty that you'll never again spend hours setting up and verifying in order to take a few minutes worth of measurements! This series comprises 14 different models, for both measuring **and** generating NBS-traceable **voltage, current** and **resistance,** to state-of-the-art accuracies.



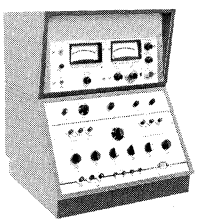
Model 71-273 Complete Wide-Range Voltage/Current/Resistance Measuring/Generating System. Write for Bulletin 71-6 EEM.



Veritor Model 71-111 Complete Wide-Range DC Voltage-Measuring System: 15 ranges from 16 millivolts full-scale to 1.6KV; nanovolt resolution, fully guarded, noise free. No accessories required — just set the range and take 6-digit readings!



Veritor Model 71-121 Complete Wide-Range DC Current Measuring System: 8 ranges, from 75 mA f.s. to 15A f.s., plus 3 EMF ranges, from 16 mV f.s. to 1.6 Volts f.s. Same convenience as 71-111 (left).



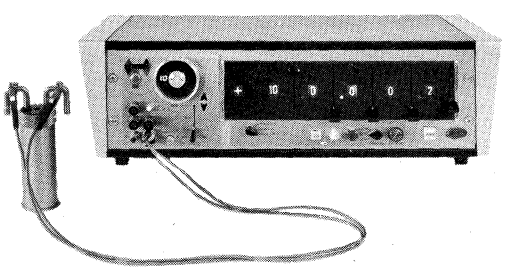
Veritor Model 71-131 Complete Wide-Range Resistance Meas System Continuous 0.1 ohm to 11,111 megohms. Fully Guarded. Direct-reading-Resistance-Deviation, 0-100/1000 PPM. Regulated dual-range guarded power supply. Sensitive detector. No accessories required.

VERITOR MODEL		71-111	71-121	71-131	71-141	71-171	71-211	71-213	71-221	71-223	71-241	71-243	71-271	71-273
MEASURES:														
DC VOLTAGE	TO	1.6KV	1.6V	—	1.6KV	1.6KV	1.6KV	1.6KV	1.6V	1.6V	1.6KV	1.6KV	1.6KV	1.6KV
DC CURRENT	TO	—	15A	—	15A	15A	—	—	15A	15A	15A	15A	15A	15A
RESISTANCE	FROM	—	—	0.1Ω	—	0.1Ω	—	—	—	—	—	—	0.1Ω	0.1Ω
	TO			11,111Meg.		11,111Meg.							11,111Meg.	11,111Meg.
GENERATES:														
DC VOLTAGE	TO	—	—	—	—	—	150V,50W	1.5KV,50W	—	—	150V,50W	1.5KV,50W	150V,50W	1.5KV,50W
DC CURRENT	TO	—	—	—	—	—	—	—	1.5A,50W	15A,50W	15A,50W	15A,50W	1.5A,50W	15A,50W
RESISTANCE	TO	—	—	111,111Ω	—	111,111Ω	—	—	—	—	—	—	11,111,111Ω	11,111,111Ω

MENTOR

PRECISION TEST INSTRUMENTS

Laboratory Accuracy...Production-Line Convenience



Full five-digit, wide range, multi-parameter capability with 3-in-1 facility: Use them for fully automatic limit testing (800/900 Series has adjustable "Go" Band Limits and "Lo-Go-Hi" indication) . . . Use them in a semi-, or fully-automatic system to guide the adjustments of input parameters to pre-set targets and limits . . . Use them as error-free, logic-assisted manual measuring instruments. Standard models priced from $1585. Two series of Standard Instruments: 800/900, primarily for Limit Testing/Adjusting . . . 400/500, primarily for Manual Logic-Assisted Measurements.

PARAMETERS	DC Volts	AC Volts	Ohms—K-Ohms	Ratio
RANGES	0-11/110/1100	0-11/110/1100	0-110/1100/11000	0—.99999
Accuracy % Rdg + % f.s. Reference Condition 25 ± 1°C. 7 hr.	0.002 + 0.0009	11v 20Hz—10 KHz 0.035 + 0.01	0.005 + 0.001	
Rated 1 Year 20-30°C. 0-70 R.H. 102-132 V AC	0.01 + 0.0015	0.07 + 0.01	0.015 + 0.001	0.0025 + 0.001

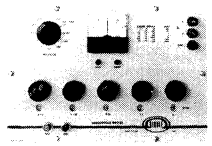
STANDARD MODELS		DC Volts	AC Volts	Ohms—K-Ohms	Ratio
Catalog No.	Catalog No.				
403	803			●	●
404	804	●			
405	805	●		●	●
504	904	●	●		
505	905	●	●	●	●

BIDDLE VERSITOR® PORTABLE INSTRUMENTS

VERSITOR® INSTRUMENTS are compact, modern potentiometers and bridges, designed to travel wherever a precision measurement is required, and to preserve their full rated accuracy for years. They feature ultra-sensitive solid state null detectors driving rugged, fast response taut-band meters. Corrosion-proof, impact-resistant cases; laboratory-grade circuit components, battery operated.

RESISTANCE BRIDGES—Bulletin 72-7

High Precision 5-Dial Wheatstone



72-434

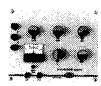
PARTIAL SPECIFICATIONS

Range: 0.1Ω to 11.111 MΩ
Limit of Error: ± (0.03% + 0.001Ω)
Detector Sensitivity: 1μv/div.
Detector Resolution:

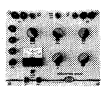
@ 0.1Ω	0.02 %
@ 1Ω	0.005%
10Ω to 1MΩ	0.002%
@ 10MΩ	0.01 %

Bridge Resolution: 0.001%

Moderate Accuracy 4-Dial Wheatstone



72-430



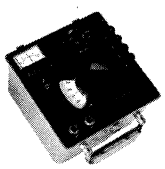
72-432

PARTIAL SPECIFICATIONS

Models 72-430 and 72-432
Range: 0.1Ω to 11.1MΩ
Limit of error: ± (0.1% of reading + 0.01Ω)
Detector Sensitivity: 8μv/div. (1.6 mm)
Detector Resolution: ± 0.01% (10Ω to 1MΩ)
Bridge Resolution: ± 0.01%
Model 72-432 has additional ratios of M1, M10, M100, M1000 for Murray Loop tests.

Portable Compact Kelvin Bridge

Moderate Accuracy

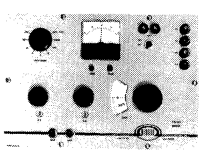


72-436

PARTIAL SPECIFICATIONS

Range: 0.0001Ω to 110Ω
Limit of Error: 0.3% to 1%
Detector Sensitivity: 8μv/div.
Detector Resolution:
on all ranges
0.1% at maximum setting
1 % at minimum setting
Bridge Resolution: 0.1%

High Precision Kelvin Bridge



72-438

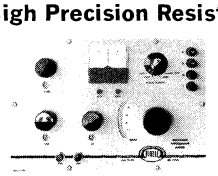
PARTIAL SPECIFICATIONS

Range: 0.5μΩ to 1111Ω
Limit of error: ± (0.03% of reading + 0.2% of slidewire range)
Detector Sensitivity: 1μv/div.
Detector Resolution:

@ 0.0001Ω	0.1%
@ 0.001Ω	0.03%
0.01 to 1111Ω	0.01 to 0.002%

Bridge Resolution: 0.001%

High Precision Resistance Temperature Bridge

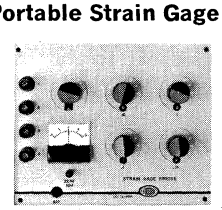


72-490

PARTIAL SPECIFICATIONS

Range: 0 to 1111.1Ω
Limit of Error: ± (0.03% of reading + 0.0025Ω)
Detector Sensitivity: 4 μv/div.
Detector Resolution: 0.001Ω or 0.002%
Bridge Resolution: 0.001Ω (1 ppm F.S.)

Portable Strain Gage Bridge



72-4010

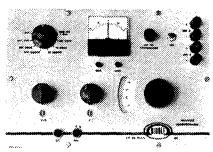
PARTIAL SPECIFICATIONS

Range: Resistance 0 to 111.1Ω
Ratio .5 to 1.111
Rheostat 0 to 211.1Ω
Limit of Error:
Resistance and Rheostat ± 0.01Ω
Ratio ± 0.01%
Detector Sensitivity: 18μv/div.
Detector Resolution: 0.01Ω
Bridge Resolution: 0.01Ω

POTENTIOMETERS

High Precision Portable

NO STANDARD CELL REQUIRED



72-3110

NOT NECESSARY TO STANDARDIZE

This self-contained portable laboratory standard is designed to measure millivolt inputs or develop known millivolt outputs for checking or calibrating purposes.

Main Range: —11.1 to +111.1 millivolts
Auxiliary Range: +988.9 to +1111.1 millivolts
(for calibrating standard cells and Zener diode voltage supplies)
Limit of Error: ± (0.03% of reading + 2μv) without RJC
± (0.03% of reading + 4μv) with RJC—Bulletin 72-62

COMPACT PORTABLE MILLIVOLT-VOLT —TEMPERATURE



72-310

Model No.	Calibration	Ranges	Limit of Error	Smallest Division
72-310	mV	0-11.1 0-111	0.05% + 5μV	0.005mV 0.05mV
72-312	Volts	0-0.182 0-1.82	0.05% + 5μV	0.022V 0.22V
72-314	mV	—11 to +111	0.05% + 5μV	0.02mV
72-316	°C, °F	Any single Range —300° to +3000°	0.2% of span	2°-10°
72-318	°C, °F	Any two ranges	0.2% of span	2°-10°

Bulletin 72-61

Accessory Modules



72-542



72-910



72-920

Run-Up Box
A battery-operated, low-impedance source of adjustable DC millivoltage.

Volt Box
Expands the voltage range to 1000V in four ranges.

Shunt Box
Adapts the MV Potentiometer for DC measurements up to 1 ampere in three ranges.

Solid State Null Detector

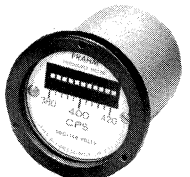
a 4μV per division zero center meter driven by a solid state high gain differential amplifier, powered by two mercury batteries.



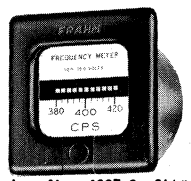
72-807

FRAHM® RESONANT REED FREQUENCY METERS

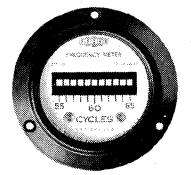
NEW . . . 1½", 5, 7, or 9 reeds, 50, 60 and 400 cycle Frahm Miniature Frequency Meter with metal case, hermetically sealed.



Catalog No. 2997—2½", 11 reeds, 400 cycle Frahm Miniature Frequency Meter with metal case.



Catalog No. 4997-2—3½", 11 reeds, 400 cycle, Frahm Frequency Meter with square plastic case.



Catalog No. 4967—3½", 11 reeds, 60 cycle, Frahm Frequency Meter with plastic case.

3½" meters available in round plastic, or metal (sealed), or round plastic with square bezel. Portable instruments available in all ranges shown with 3½" cases.

15 TO 1500 CPS (SPECIAL UP TO 1700 CPS) 2 TO 122 REEDS. MOLDED PLASTIC OR METAL CASES. SEALED IF REQUIRED. 1 1/2" TO 8 1/2" • PANEL MOUNTING OR PORTABLE

The first resonant reed instrument in the U.S.A. was introduced 50 years ago by James G. Biddle Co. We have maintained this leadership ever since, to place at your service the greatest knowledge of materials, processes, and controls—the finest facilities to produce quality instruments for unfailing accuracy and long life.

Basic specifications are shown in the table at right.

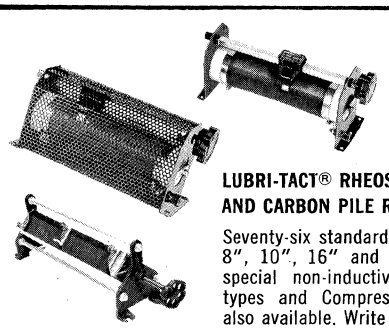
Specially designed instruments will be made to your requirements.

Write or phone if you have applications which require special modifications of range, methods of actuating, scale graduations or other design characteristics.

For standard specs and prices write or phone for BULLETIN 32 EEM.

Catalog Number	Range, Cycles	Number of Reeds	Interval Between Reeds, Cycles	Type of Case	Sealed	Accuracy %
2854	48-52	9	0.5	1½" Metal	Yes	0.3
2864	58-62	9	0.5	1½" Metal	Yes	0.3
2896	380-420	9	5.0	1½" Metal	Yes	0.3
2955	45-55	11	1.0	2½" Metal	Yes	0.3
2966	57.5-62.5	11	0.5	2½" Metal	Yes	0.3
2997	380-420	11	4.0	2½" Metal	Yes	0.3
4860	59-61	21	0.1	3½" Metal	Yes	0.1
4890	390-410	21	0.1	3½" Metal	Yes	0.1
4956	47.5-52.5	11	0.5	3½" Plastic	No	0.3
4959	48-52 58-62	10	1.0	3½" Plastic	No	0.3
4964	58-62	9	0.5	3½" Plastic	No	0.3
4967	55-65	11	1.0	3½" Plastic	No	0.3
4997	380-420	11	4.0	3½" Plastic	No	0.3
5066	55-65	21	0.5	3½" Plastic	No	0.3
5097	380-420	21	2.0	3½" Plastic	No	0.3

Voltages 100 to 150 v—D.C. resistance 100 ohms per volt. Instruments meet MIL Specifications. Cases meet ASA standard diameter dimensions.



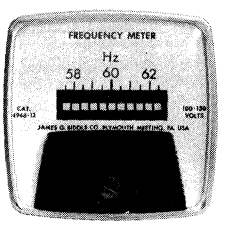
LUBRI-TACT® RHEOSTATS AND CARBON PILE RHEOSTATS

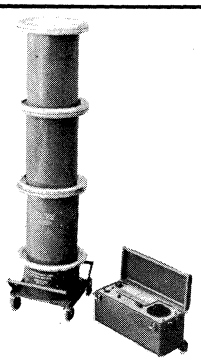
Seventy-six standardized ratings available in 8", 10", 16" and 20" sizes. A variety of special non-inductive, double and graded types and Compression Carbon Rheostats also available. Write for Bulletin 41-EEM.

The New Look!

3½" FREQUENCY METER

Available with all 5, 7, 9, 10 and 11 reed instruments listed in our Bulletin 32. A handsome addition to any modern panel at no additional cost.





DIELECTRIC TEST SETS

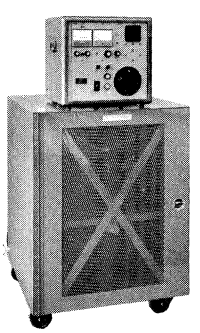
From 5 to 150 kv, both a-c and d-c. Excellent safety features and output voltage regulation.

For information on all ranges—Request file 22-EEM.

CORONA TEST EQUIPMENT

. . . for measuring corona starting and extinction voltage, apparent corona charge, relative corona current.

. . . for use in non-destructive or breakdown dielectric tests on electrical insulating materials, individual insulation structures and insulation of electrical equipment. Write for Bulletin 66-EEM.

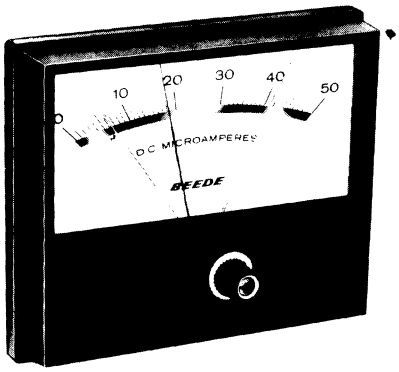


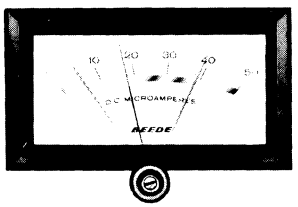
JAMES G. BIDDLE CO.

PLYMOUTH MEETING, PA. 19462 / PHONE: 215-646-9200, TELEX. 083-4423

BEEDE... value by design

NON-CONTACTING CONTROL METER RELAYS





The Beede Control Meter Relay is an instrument that combines a permanent magnet-moving coil meter with an adjustable photoelectric sensor, switching circuit and output switch. As the indicated variable being monitored passes the adjustable set point, an output relay is either energized or de-energized. Units are available with either one or two adjustable set points. BEEDE has greatly simplified the design of the conventional non-contacting meter relay, significantly reducing the number of parts incorporated in the unit, resulting in price savings of up to 50% without a loss of quality features.

FEATURES

- **Optical, non-contacting control-continuous indication**
- **Wide variety of options available for easy, inexpensive customizing**
- **Inherently Fail Safe**
- **AC or DC power input**
- **Directive Drive Set Pointers**
- **Bulb Life in excess of 10 yrs.**
- **Meter movement and dial custom designed to your specifications if required**
- **Meter permanently free of static influence**
- **Attractive modern "Centurion" style case**
- **Large easy-to-read dial**

SPECIAL PYROMETER FEATURES

- **Models available from 0-300° F**
- **Electrical ambient temperature compensation**
- **Thermocouple break protection**
- **Internal potentiometer to compensate for external lead resistance**
- **Deadband externally adjustable**

SPECIFICATIONS

Accuracy ±2%
ON-OFF operation or latching with manual reset
Output: SPDT relay for each set point. DPDT relays available. Solid State Output available
Standard Deadband is 0.5% max. standard
Power Requirements 105 to 130 Volts AC. Other AC and DC models available
Ambient Temperature 40° F to 165° F is standard

MOVEMENTS

MAG-BAND TAUT BAND
0-10 uA DC minimum range
MAG-B PIVOT AND JEWEL
0-50 uA DC minimum range
Size: 4 inch (3" and 6" sizes will soon be available)

MODELS AVAILABLE

	Mounting	Single Set Point	Double Set Point
Complete Package	Front of Panel Behind Panel	MR-14-05 MR-14-06	MR-24-05 MR-24-06
Optical Element Only	Front of Panel Behind Panel	MR-14-05-01 MR-14-06-01	MR-24-05-01 MR-24-06-01
Separate Control Package	Front of Panel Behind Panel	MR-14-05-02 MR-14-06-02	MR-24-05-02 MR-24-06-02

PANEL METERS

A wide variety of standard Beede Panel Meter Case styles is available, featuring the new "Centurion" line. A number of standard Beede meter movements, available in a complete range of sensitivities and electrical characteristics, are used to meet specific electrical requirements. BEEDE also installs meter movements in special customer cases or supplies meter movements separately for customer installation.

METER MOVEMENTS

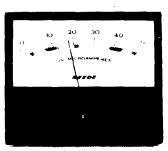
MAG-BAND TAUT BAND . . . Self-shielded, high-torque, excellent balance and no drift. Maximum sensitivities: 0-5 uA DC; 0-5 MV DC ± 1% or ± 2% accuracy.

MAG-B . . . Rugged, high-torque, self-shielded pivot and jewel movement. Maximum sensitivities: 0-50 uA DC; 0-20 MV DC ± 1% or ± 2% accuracy.

250° MOVEMENT — A fine tracking, sturdy, self-shielded 250° movement.

ALSO . . . external magnet, AC repulsion and miniature core magnet movements.

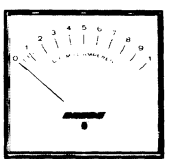
CENTURION LINE





Models available:
Front-of-Panel
Behind-the-Panel
4" case, AC and DC

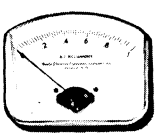
DESIGNER LINE





Models available:
Front-of-Panel
Behind-the-Panel
2", 3", 4", 6" case,
AC and DC

PANORAMA LINE



Models available:
Front-of-Panel
3", 4", 7" case
AC and DC

CLEAR FRONT LINE



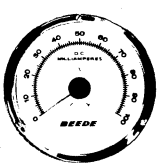
Models available:
Front-of-Panel
1", 2", 3", 4" case
AC and DC

TRADITIONAL LINE



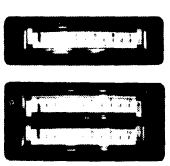
Models available:
Front-of-Panel
3" square
4" rectangular
and 2¾" dia.
3½" dia. round cases
AC and DC

250°



Models available:
3", 6" diameter
AC and DC

EDGEWISE



Models available:
2½" by ⅝" panel
opening by 3"deep
AC and DC

For further information write for catalogs: MR-2 Meter Relay and PM-2 Panel Meters

BEEDE

BUY VALUE/BUY BEEDE

ELECTRICAL INSTRUMENT CO., INC.

Penacook, New Hampshire 03301

BIRD RF POWER 50-OHM COAXIAL QUALITY INSTRUMENTS

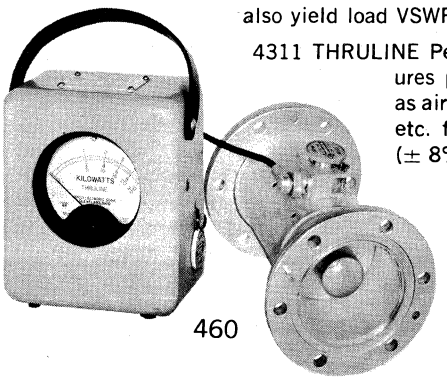
TO MEASURE, TERMINATE, ATTENUATE & FILTER



43

THRULINE® RF DIRECTIONAL WATTMETERS

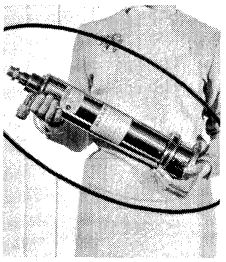
Insertion instruments for measuring and monitoring incident and reflected power in coaxial transmission lines with ± 5% of full scale accuracy. Insertion VSWR is less than 1.05. Net power under any load condition is the difference between incident and reflected power readings, which also yield load VSWR from a nomograph.

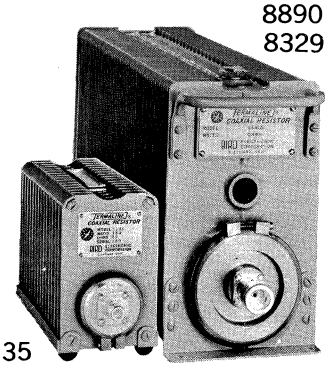

460

4311 THRULINE Peak **and** CW Wattmeter **also** measures power of **pulsed RF** systems such as air navigational aids, telemetry, radar, etc. from 0.4 microsecond pulse width (± 8% accuracy).

Models 4111-12-13 are new palm-sized CW Wattmeters with one forward and one reflected power scale for servicing transmitters in the 2-30 MHz or 25-175 MHz frequency range.

Line Sections with single or double element sockets for all THRULINE Wattmeters, as well as 7/8" diameter instruments available.


15kW to 50kW

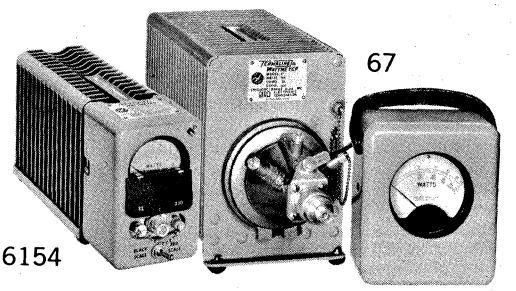

8890
8329
8135

TERMALINE® RF COAXIAL LOAD RESISTORS

For accurate, non-radiating termination of 50-ohm RF coaxial transmission lines are designed for use in permanent installations, development testing and trouble shooting of transmitters, intermediate components, power tubes, and accessories.

TENULINE® POWER ATTENUATORS

In addition to terminating a 50-ohm system, deliver an output signal 30 dB below the input, for RFI measurements, for extending the range of low-power wattmeters, for isolation of system components, etc.

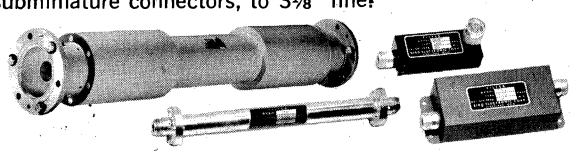

6154
67

TERMALINE® RF ABSORPTION WATTMETERS

Are direct reading instruments for absorbing and measuring RF power in 50-ohm coaxial line systems through the frequencies of 2 to 1000 MHz. The load section of the TERMALINE Wattmeter serves as a dummy load. The indicating meter is calibrated to read RF power directly in watts with ±5% of full scale accuracy. TERMALINE Wattmeters are available from milliwatts to kilowatts.

COAXIAL RF FILTERS

Custom engineered or field-proven designs. High rejection attenuation filters available with Low-pass cut-off from 16 to 2700 MHz (about fifty designs at 400 MHz), Hi-pass cut-off frequencies from 30 to 1000 MHz, Band-pass as narrow as 5% of center frequency. Sizes from ½ cubic inches, with subminiature connectors, to 3⅛" line.



BIRD ELECTRONIC CORPORATION

San Francisco, Cal.: Bird Electronic Ph: (415) 568-1110
Inglewood, Cal.: 5005 W. Century Blvd. Ph: (213) 674-1446
Waltham, Mass.: 235 Bear Hill Road Ph: (617) 899-4162
Altamonte Springs, Fla.: 703 Beverly Ph: (305) 831-1530
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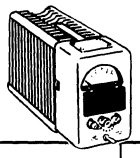
Palatine, Ill.: 234 N. Northwest Hiway Ph: (312) 359-0300

30303 Aurora Road/Cleveland (Solon), Ohio 44139/Phone: 216-248-1200/TWX: 216-248-6458/Cable:BIRDELEC

TERMALINE® RF ABSORPTION WATTMETERS



Maximum Power	Calibrated Frequency Range	Power Scales Available	Connector	Model	U.S. Price
AIR-COOLED					
2W	30-500MHz	25, 50, 100, 250, 500, 1000 milliwatts, 2 watts	BNC/F	6254	$115
60W	30-500MHz*	Dual range: 0-15/0-60W	N/F	611	175
80W	30-500MHz*	Dual range: 0-20/0-80W	N/F	612	175
80W	30-500MHz*	Choice of two compatible scales (eg.: 1-5W, 5-25W, 2-20W)	N/F	61	220
150W	25-1000MHz**	Four range: 0-5/0-15/0-50/0-150W	N/F	6154	265
500W	30-500MHz*	Triple range: 0-25/0-100/0-500W	QC(1)	67	350
1000W	2-30MHz	0-1000W	QC(1)	694	365
1200W	30-500MHz	Triple range: 0-120/0-600/0-1200W	QC(1)	6835	485
WATER-COOLED					
2500W	30-500MHz*	Triple range: 0-100/0-500/0-2500W	QC(1)	67C	$390

*Special calibration 500-1000 MHz available at time of order.
**25-500 MHz ±5%, 500-1000 MHz ±10% Accuracy.

TERMALINE® RF COAXIAL LOAD RESISTORS

TENULINE® POWER ATTENUATORS

Max. Power	Freq. Range	Max. VSWR	Connector Input	Model	U.S. Price
AIR-COOLED					
2W	0-4GHz	1.1	N/M or F	8011 or 10	$ 20
5W	0-4GHz	1.2	N/M or F	80	25
5W	0-4GHz	1.2	M or F: C, BNC, TNC	80	30
10W	0-4GHz	1.2	N/M or F	8053 or 52	30
20W	0-3.5GHz	1.3	N/F	80A	30
25W	0-3.5GHz	1.25	QC(3)	8080	40
50W	0-4GHz	1.2	QC(1)	8130	49
80W	0-4GHz	1.2	N/F	81B	65
NEW 100W	0-2.5GHz	1.2	QC(3)	8160	125
150W	0-4GHz	1.2	QC(1)	8135	75
NEW 225W	0-2.5GHz	1.2	QC(3)	8161	157
500W	0-2.5GHz	1.25	QC(1)	8201	165
600W	0-3GHz	1.25	QC(1)	8401	175
1000W	0-2GHz	1.25	QC(2)	8251	365
1000W	0-2.5GHz	1.25	QC(2)	8833**	365
2500W	0-2GHz	1.25	QC(2)	8890**	425
2500W	0-2GHz	1.25	3⅛" EIA Flanged	8891**	450
2500W	0-2GHz	1.25	1⅝" EIA Flanged	8892**	435
WATER-COOLED					
1000W	0-3.5GHz	1.25	M or F: N,C	8710/11	$200
2500W	0-2.5GHz	1.25	QC(2)	8230	180
NEW 5kW	0-2GHz	1.2	1⅝" EIA Flanged	8720	325
NEW 10kW	0-1.4GHz	1.15	3⅛" & 1⅝" EIA Fl.	8732/6	Inquire
15kW	0-500MHz	1.1	3⅛" (Adapters to 1⅝" and 6⅛" available)	See note below	on request
25kW	0-500MHz				
50kW	0-500MHz				

Six models of 15, 25, and 50kW Load Resistors are available with 50-ohm EIA or 51.5-ohm Unflanged Input Connectors. Write for details.

30 dB ATTENUATORS (AIR COOLED)					
NEW 50W	0-500MHz	1.1	QC(1) in. (1) out	8321	$125
NEW 200W	0-500MHz	1.1	QC(1) in. (1) out	8322	225
500W	0-500MHz	1.1	QC(1) in. (1) out	8325	400
NEW 1000W	0-500MHz	1.1	QC(2) in. (1) out	8327**	475
2000W	0-500MHz	1.1	QC(2) in. (1) out	8329**	600

**Overtemperature Thermoswitch available.

THRULINE® RF DIRECTIONAL WATTMETERS

Order one or more Elements with your Thruline Wattmeter to suit your frequency and power ranges.

Thruline Model	Connectors	Plug-in Elements: Frequency (MHz)	Plug-in Elements: Power Ranges (watts)	U.S. Price
43	QC(1)			$95
		2-30	50, 100, 250, 500, 1000, 2500, 5000	$30 each
		25-60, 50-125 100-250, 200-500, 400-1000	5, 10, 25, 50,100, 250, 500, 1000	
		60-80, 80-95, 95-125 110-160, 150-250, 200-300, 275-450, 425-850, 800-950	1 watt	$50 each
		60-80, 80-95, 95-150, 150-250, 200-300, 250-450, 400-850, 800-950	2.5 watts	
		950-1260, 1100-1800, 1700-2200, 2200-2300	1, 2.5, 5, 10, 25	$75 each
4311	QC(1)	Description on opposite page.		$575
	For Peak and CW Power use Elements listed above, or select from Peak Power Elements below.			
		25-60, 50-125, 100-250, 200-500, 400-1000	2.5kW, 5kW, 10kW	$75 each
		950-1260	50, 100, 250, 500, 1000, 2.5kW, 5kW	

Cowhide Carrying Case Model CC-1 $17.50

Mini-Monitor™ Thruline Model	Connectors	Freq. Range	Power Scales	U.S. Price
NEW 4111	UHF, N, BNC	25-175MHz	150/15W	$93
NEW 4112	N, UHF, BNC	2-30MHz	200/20W	93
NEW 4113	N, UHF, BNC	2-30MHz	1000/100W	93
NEW 4114	N, UHF, BNC	450-470MHz	50/5W	93

Carrying Case Model CC-2 $6.50

Thruline Model	Connectors	Plug-in Elements: Frequency (MHz)	Plug-in Elements: Power Ranges (kilowatts)	U.S. Price
4712	1⅝" EIA Flanged			$206
		2-30	1, 2.5, 5, 10, 25	$ 50 each
		25-60, 50-125	.25, .50, 1, 2.5, 5, 10	
		.1-.25, .2-.5, .4-1 GHz	.25, .50, 1, 2.5, 5	
460	3⅛" EIA Flanged			$235
		2-30	5, 10, 25, 50, 100	$ 50 each
		25-60, 50-125, 100-250, 200-500, 400-1000	1, 2.5, 5, 10, 25	
4902	6⅛" EIA Flanged			$600
		2-30	25, 50, 100, 250	$ 50 each
		25-60, 50-125 100-250, 200-500, 400-1000	2.5, 5, 10, 25, 50	

QC-TYPE CONNECTORS *(Quick Change)*

Adaptable to particular TERMALINE, THRULINE,and TENULINE units, these connectors may be quickly changed in the field. Connector types available are: Female or male BNC, TNC, N, C, SC, HN, LC, UHF, LT, ⅞" and 1⅝" EIA Flanged.

Normally supplied: (1) Female N, (2) Female LC, (3) Male N

Prices in effect April 15, 1968 and are subject to change without notice before the next edition EEM. Please request a firm quotation at time of order. F.O.B. Cleveland, Ohio.

OTHER BIRD INSTRUMENTS

THRULINE® RF DIRECTIONAL POWER SENSORS
BIRD WATTCHER® RF POWER MONITOR/ALARM
TERMALINE® CALORIMETERS
SENTRILINE® FILTER-COUPLERS
COAXWITCH® COAXIAL SELECTOR SWITCHES

BIRD ELECTRONIC CORPORATION

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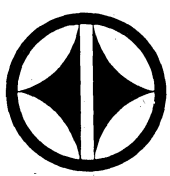
Look in the Green Section for Products and their Manufacturers



Tell them you found them in **eem**

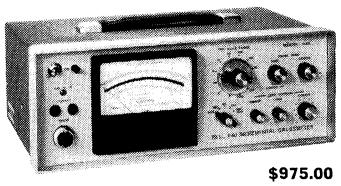
F.W. BELL INC

INSTRUMENTS

GOLD SEAL GUARANTEE
All ceramic-encapsulated transverse probes guaranteed one year against breakage

HALL EFFECT GAUSSMETERS

In addition to the three popular high performance models of the Hall Effect Gaussmeters shown below Bell offers many other models; including direct read-out of ac fields; digital readout, analog output; general purpose for measuring dc fields to 30 kG and others. Write for details on full line.



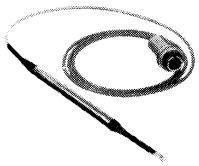
$975.00

INCREMENTAL—Model 640
Above: A new precalibration technique allows direct interchangeability of probes without recalibration. With built-in calibration accuracy of ±0.3%, instrument accuracy is ±1.0% to 30 kG (3 tesla) and ±0.5% to 10 kG (1 tesla) when used with high-linearity probes. Controlled feedback permits incremental operation up to 30 kG. 1000X scale expansion with automatic and true zero center meter readout permits direct measurement of small incremental variations in both a positive and negative direction.



$675.00

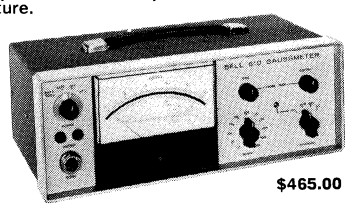
PRECALIBRATED—Model 620
Above: The instrument offers twelve (12) ranges non-overlapping from 0.1 gauss (10^{-5} tesla) FS to 30 kG (3 tesla) FS. With High Field Probe, 100 kG measurements possible. Both dc and ac fields are indicated directly on the panel meter. Ac fields up to 400 Hz are read out (independent of dc fields) as an RMS value for sine wave fields.



PROBE
Wide variety of both transverse and axial probes available.

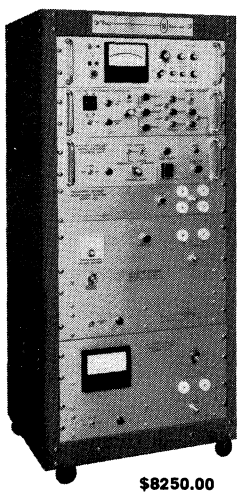
***T-6011**
($120.00)

SELF-CALIBRATED—Model 610
Below: Instrument accuracy is ±1.5% FS to 10 kG and 2.5% FS to 30 kG when using the appropriately selected standard probe. A new calibration technique allows interchangeability of probes with simple built-in recalibration feature.



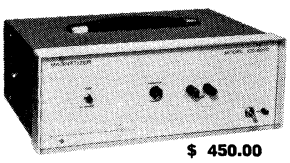
$465.00

INDUSTRIAL MAGNET PROCESSING EQUIPMENT



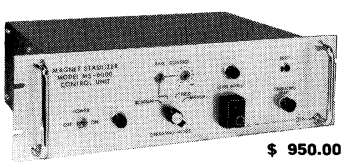
$8250.00

Model 460—Magnet Processing System. Automatic Magnetizing and Stabilizing. Saturate Level Test. Stabilized Level Test. Go-No Go Light Indicators. Cycle Time 5 Seconds.



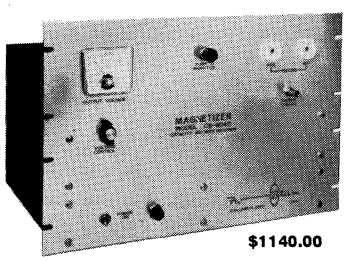
$ 450.00

Model CS-6020 Magnetizer—Solid State Construction. Energy 16 Watt Seconds. Magnets up to 1 cubic inch.



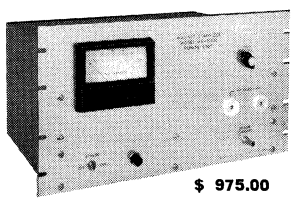
$ 950.00

Model HU-7048 Stabilizer Control—Automatic Stabilizing to Preset Level.



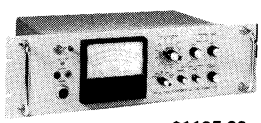
$1140.00

Model CS-6040 Magnetizer—Solid State Construction. Rapid Recycle Rate. 450-900 Watt Seconds. Positive Energy Level Control. Magnets up to 5 lbs.



$ 975.00

Model HU-7049 Stabilizer—Power Unit. AC Supply for Pull Back of Magnets. SCR Control.



$1125.00

Model HU-7051—Narrow banded Gaussmeter. Continuously measure dc component of magnet in presence of the large ac pull back.

F. W. Bell, Inc. can fill your permanent magnet processing requirements including magnetizers, stabilizers, magnetic field measurements and all associated fixtures and handling equipment.

NONDESTRUCTIVE TESTING INSTRUMENTS

Model MRA-100



$795.00

The Model MRA-100 Portable Eddy Current Tester, with five separate frequencies, provides a wide variety of nondestructive testing applications. The high resolution Hall probe supplied, which is independent of frequencies, allows excellent resolution of small surface and sub-surface anomalies or defects to satisfy most testing needs. Calibrated, absolute, air null, work null and expanded modes of operation are possible. Blank meter scales are provided and can be calibrated by the user as needed. A set of test samples, and instructions, is supplied to direct the user to the optimum test configuration for a given application.

Many other model Magnetic Reaction Analyzers offered in the Bell Line are suited for a wide variety of nondestructive testing applications. Write for details, specifications.

*Probes: A wide variety of standard and special probes is available.
Write for a complete catalog or assistance with your application.

Prices and specifications are subject to change without notice.

Leaders in Hall Effect Components, Instruments and Systems

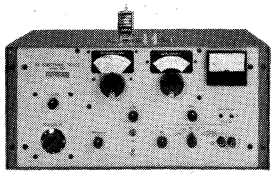
F.W. BELL INC.

1356 Norton Avenue, Columbus, Ohio 43212
Phone 614-294-4906 TWX 810-482-1716

BOONTON ELECTRONICS CORPORATION

Boonton Electronics Corporation, engaged exclusively in developing and producing precision electronic laboratory instrumentation and high speed automated production testing equipment, is represented worldwide by skilled independent sales engineering representatives, who are thoroughly qualified to offer guidance and consultation on your electronic instrumentation problems. Check the yellow pages of this directory under Boonton Electronics for our representative in your area.

IMPEDANCE INSTRUMENTATION



Model 33A/1

RF Admittance Bridge

Measures 2-terminal shunt capacitance and conductance at high frequencies. Specified capacitance resolution obtains with 10 times lower test level than earlier Model 33A with accuracy improved to ± 0.5%. Inductance, resistance, dissipation factor, and Q may readily be determined. Internal and external dc bias. Major applications in diode, transistor, and IC measurements.

Capacitance Measurement: 0 to 150 pF from 1 MHz to 50 MHz; to 30 pF at 100 MHz; accuracy, ± 0.5%; resolution, 0.02 pF

Conductance Measurement: 0 to 25,000 μmhos; accuracy, ±2%; resolution, 0.5 μmho

Test Signal: 7 internally supplied crystal controlled frequencies of 1, 5, 10, 20, 30, 50, and 100 MHz; level continuously adjustable from 0.1 V down to as low as 1 mV

DC Bias: Internal, continuously adjustable from —6 to +100 V; external, to ±250 V

Price: $2750.00

Model 33B/1

Ultra High Conductance Resolution RF Admittance Bridge

Conductance range, 0 to 5000 μmhos with resolution of 0.1 μmho. Otherwise similar to Model 33A/1

Price: $3300.00

Model 33C/1

Ultra High Capacitance Resolution RF Admittance Bridge

Capacitance range, 0 to 15 pF with resolution of 0.002 pF; basic accuracy ± 1%. Otherwise similar to Model 33A/1

Price: $2950.00

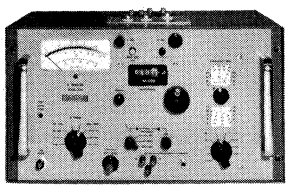
Model 33D/1

Ultra High Capacitance and Conductance Resolution RF Admittance Bridge

Capacitance range 0 to 15 pF with resolution of 0.002 pF. Conductance range 0 to 5000 μmhos with resolution of 0.1 μmho. Basic accuracy ± 1%. Otherwise similar to Model 33A/1. Price: $3,500.00.

Capacitance Range Extensions

Accessories available for measuring higher values of capacitance at frequencies up to 30 MHz for Model 33A/1 and to 20 MHz for Model 33B/1



Model 35A

Q Bridge—100 KHz to 50 MHz

Dramatically new, non-resonant 3-terminal bridge. Provides direct reading measurements of capacitance up to large values and Q over wide ranges with continuously adjustable test frequency. Low test signal levels. No external work coils. Internal or external dc bias.

Capacitance Measurement: 20 to 1,000 pF (100 KHz to 50 MHz); 2 to 10,000 pF (100 KHz to 10 MHz); indirectly 0.005 to 20 pF; basic accuracy, 0.5%

Q Measurement: 5 to 10,000; basic accuracy, 5% for Q's up to 100, (10 + Q/500)% for Q's 100 to 10,000

Test Signal: Frequency continuously adjustable from 100 KHz to 50 MHz; levels <50 mV; continuously adjustable

Dual External DC Bias: HI to GND and/or LO to GND; differential ±200V

Internal DC Bias: HI to LO; 0 to 150V

Price: $3,000.00



Model 71A

Capacitance/Inductance Meter—1 MHz

Quick, convenient, direct reading, 3-terminal measurements of capacitance or 2-terminal measurements of inductance. Internally supplied 1 MHz test signal. Operates with low test signal level, permitting semi-conductor tests. Linear meter scales. Provision for dc bias. Linear dc output proportional to capacitance or inductance reading for display on dvm, x-y plotter, for data logging, or, with suitable voltage comparator, for go/no go testing.

Capacitance Measurement: 0 to 1000 pF in 7 ranges; accuracy, ±1%; resolution, 0.01 pF

Inductance Measurement: 0 to 1000 μH in 7 ranges; accuracy, ±1%; resolution 0.01 μH

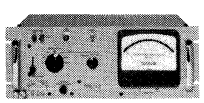
Test Signal: Frequency 1 MHz; level, 15 mV rms for capacitance measurements, < 1 mV for inductance measurements

Q Range: Specified accuracies apply for test specimens having Q's of 3 or more; lower with readjustment

DC Bias: Externally supplied up to ±200 V

DC Analog Output: 0 to 100 mV or 300 mV fs depending on range numerics; also > 1 V fs for loads > 10 MΩ; linearity, 0.1% of reading; response time, 10 ms

Price: $950.00; rack-mounting version with built-in standard, Model 71AR, $1025.00



Model 71CR

Capacitance/Inductance Meter—100 KHz

Quick, convenient, direct reading, 3-terminal measurements of capacitance or 2-terminal measurements of inductance. Internally supplied 100 KHz test signal. Operates with low test signal level, permitting semi-conductor tests. Linear meter scales. Provision for dc bias. Linear dc output proportional to capacitance or inductance reading for display on dvm, x-y plotter, for data logging, or with suitable voltage comparator, for go/no go testing.

Capacitance Measurement: 0 to .01 μF in 7 ranges; accuracy ± 1%; resolution, 0.1 pF

Inductance Measurement: 0 to 10 mH in 7 ranges; accuracy ± 1%; resolution 0.1 μH

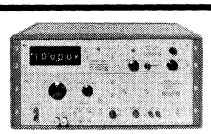
Test Signal: Frequency, 100 KHz; level, 15 mV for capacitance measurements, <1 mV for inductance measurements

Q Range: Specified accuracies apply for test specimens having Q's of 3 or more; lower with readjustment

DC Bias: Externally supplied up to ±200V

DC Analog Output: 0 to 100 mV or 300 mV fs depending on range numerics; also >1 V fs for loads > 10 MΩ; linearity, 0.1% of reading; response time, 10 ms

Price: rack-mounting with built-in standard, Model 71CR, $1100.00



Model 700A

Digital Capacitance/Inductance Meter—1 MHz

Continuous digital readout of 3-terminal capacitance or 2-terminal inductance at 1 MHz. Provisions for remote capacitance measurements and dc bias of capacitance specimen. Internal capacitance standard for both high Q and low Q (Q=3) calibration check. BCD output 1, 2, 4, 8 coded sequence.

Capacitance Measurement: 0 to 1000 pF in 3 ranges; lowest range, 10 pF, fs: 4 digit resolution and over-range (5th digit); basic accuracy, ± 0.5%

Inductance Measurement: 0 to 100 μH in 3 ranges; lowest range, 1 μH, fs; 4 digit resolution and over-range (5th digit); basic accuracy, ±1%

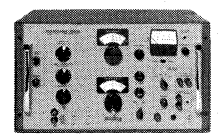
Test Signal: 1 MHz, crystal controlled; level, 15 mV for capacitance, <1 mV for inductance

Q Range: Specified accuracy applies for Q's down to 3; lower with readjustment

DC Bias: Monitored internal and external; ± 100V internal ± 200V external

Response Time: 333 ms

Price: $2,500.00



Model 74D

Capacitance Bridge—100 KHz

Precision measurements of capacitance and conductance over very broad ranges at 100 KHz. Excellent stability with negligible warm-up drift. Test signal level adjustable to low values for semiconductor testing. 3-terminal arrangement permits use of remote test jig without errors owing to cable capacitance to ground. 2-terminal operation also provided. "Linear" mode for limit operation permits go/no go testing. Provision for differential or comparison measurements. Balancing simple and convenient, with no false or sliding nulls. All zeroing controls vernier driven. Internally supplied or external dc bias.

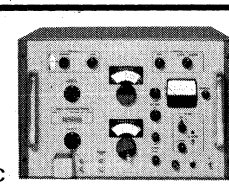
Capacitance Measurement: 0 to 110,000 pF; accuracy, ±0.1%; resolution, 0.0002pF

Conductance Measurement: 0 to 1000 μmhos; accuracy, ±5%; resolution, 0.001 μmho

Test Signal: Internally supplied, 100 KHz; level continuously adjustable from 1 mV to 4 V

DC Bias: Internal, —6 V to +100 V; External, up to ±400 V

Price: $1800.00



Model 75C

Capacitance Bridge—5 KHz to 500 KHz

Versatile 3-terminal bridge with adjustable test frequency. Permits determination of effects of frequency upon test. Includes built-in dc bias supply. Convenient operation; eliminating false and sliding nulls. Completely self-contained including bridge circuit, tunable oscillator and detector.

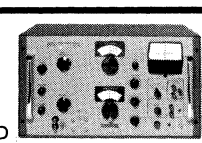
Capacitance Measurement: 0 to 1000 pF; accuracy, ±0.25%; resolution, 0.0002 pF

Conductance Measurement: 0 to 1000 μmhos; accuracy, ±5%; resolution, 0.001 μmho

Test Signal: Internally supplied; continuously adjustable in frequency from 5 KHz to 500 KHz; level adjustable from 1 mV to 3 V

DC Bias: Internal only; continuously adjustable from —5 V to +110 V

Price: $2300.00



Model 75D

Capacitance Bridge—1 MHz

This new bridge replaces 75A and 75B series. Provides 3-terminal measurements of capacitance and conductance allowing remote connection without errors due to stray capacitance to ground. Makes 2-terminal measurements using Ground Plane Adapter supplied. Inductance is read by conversion from equivalent capacitance measurement. The detector is needle sharp yet shows balance direction from the most extreme off-range setting and an additional differential detector mode allows capacitance or inductance sorting of components. Internal and external dc bias.

Capacitance Measurement: 0 to 1000 pF; accuracy, ±0.25%; resolution, 0.00005 pF with phase sensitive detector; 0.0005 pF with amplitude sensitive detector

Conductance Measurement: 0 to 1000 μmhos; accuracy, ±5%; resolution, 0.01 μmho

Inductance Measurement: 25 μH to ∞; basic accuracy, ±0.25%

Test Signal: 1 MHz, crystal controlled; level adjustable from 1 mV to 300 mV

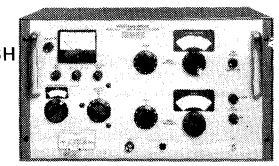
Dual External DC Bias: HI to GND and/or LO to GND; differential ±400 V, max.

Internal DC Bias: HI to LO; —6 V to +150 V

Price: $1800.00

IMPEDANCE INSTRUMENTATION *(cont.)*

Model 63H



Models 63H, 63L and 63M

Inductance Bridges

Direct reading measurements of inductance and series resistance. Convenient operation, eliminating false balance and sliding nulls. Exceptional stability. Completely self-contained, with bridge circuit, oscillator, detector, and null indicator in single, compact bench cabinet. Particularly useful for quality assurance or production tests, as well as for laboratory studies.

Model 63H

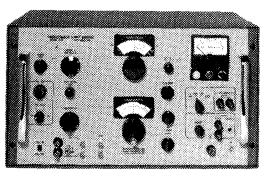
Inductance Measurement: 0 to 110 mH; accuracy, ±0.25%; resolution, 0.0002 μH
Series Resistance Measurement: 0 to 11,000 Ω; accuracy, ±3%; resolution, 0.0002 Ω
Test Signal: Internal oscillator-detector continuously adjustable from 5 KHz to 500 KHz; max. open-circuit level, 3 V

Model 63L

Inductance Measurement: 0 to 11 H; accuracy, ±0.25%; resolution,0.02 μH
Series Resistance Measurement: 0 to 110,000 Ω; accuracy, ±3%; resolution, 0.005 Ω
Test Signal: Internal oscillator-detector continuously adjustable from 400 Hz to 40 KHz max. open-circuit level 5.5 V

Model 63M

Inductance Measurement: 0 to 1.1 H; accuracy, ±0.25%; resolution, 0.002 μH
Series Resistance Measurement: 0 to 110,000 Ω; accuracy, ±3%; resolution, 0.002 Ω
Test Signal: Internal oscillator-detector continuously adjustable from 1 KHz to 100 KHz; max. open-circuit level 5.5 V
Price: Models 63H and 63M, $2500.00; Model 63L, $2750.00



Model 77B

Capacitance Limit Bridge—1 MHz

Automatic, high-speed, dual or single limit tests, or conventional manual measurements of capacitance or inductance. In automatic mode, test is insensitive to specimen loss. "High," "Low," or "Go" test decisions indicated by front panel lamps as well as by continuity closures for actuation of materials handling equipment. Internally supplied crystal controlled 1 MHz test signal. Operates with low test level. Built-in dc bias supply; provision for external bias. 3-terminal arrangement permits remote measurements.

Capacitance Measurement: Automatic Mode, 0 to 1000 pF with 0.001 pF resolution; Manual, 0 to 1000 pF with 0.0001 pF resolution; basic accuracy ±0.25%
Inductance Measurement: Manual or Automatic, 25 μH to ∞; basic accuracy, ±0.25%
Conductance Measurement: (Manual only) 0 to 1000 μmhos; basic accuracy, ±5%; resolution, 0.05 μmho
Tolerance Limits: Programmable at front panel controls from ±0.0005 pF to ±200 pF; basic accuracy, ±1% of limit setting
Test Time: Approx. 50 ms
Test Signal: Internally supplied; 1 MHz, crystal controlled; level adjustable from 250 mV to 15 mV for Automatic Mode, to 1 mV for Manual
Decision Output: Green, red, and amber panel lamps indicating "Go," "High," and "Low," respectively; continuity contacts available at rear panel in conformance with test decisions
DC Bias: Internal, continuously adjustable from —6 V to +150 V; external, to ±400 V
Price: $2500.00

Model 77B-S1

Capacitance Limit Bridge—100 KHz

Essentially similar to Model 77B. Has basic capacitance/inductance accuracy of ±0.1%. Operates with internally supplied 100 KHz crystal controlled test signal. Capacitance range, automatic or manual, is 0.001 pF to 1000 pF. Inductance range, 2.5 mH to ∞. Otherwise specifications are as shown for Model 77B.
Price: $2500.00

RF POWER INSTRUMENTATION



Model 41A

RF Microwattmeter

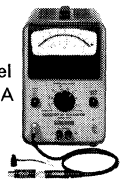
Exceptionally stable microwave power meter providing reliable measurements over a 70 dB range with one power detector. Use of full wave diode detector overcomes limitations of stability, sensitivity, and overload of thermal types. No zero balancing except for fractional microwatt measurements. Can be calibrated from low frequency rf source. Stable dc output proportional to $\sqrt{P}$.
F.S. Power Range: 0.01 μW (—50dBm) to 10mW (+10dBm)
Power Sensitivity: 0.001 μW (—60dBm)
Basic Accuracy: ±0.5 dB
Drift: Less than 0.001 μW/hr
Overload Limit: Input of 300 mW (+25dBm) will not damage power detector.
Input Connector: Type N, Precision
Price: 41A, $600.00; rack-mounting Model 41-AR, $625.00

Power Detectors

	Model 4A	Model 4B
Frequency Range:	0.2 MHz to 7 GHz	0.2 MHz to 12.4 GHz
VSWR:	≤1.3 to 3 GHz ≤1.5 to 7 GHz	≤1.3 to 3 GHz ≤1.5 to 11 GHz ≤1.75 to 12.4 GHz
Price:	$160.00	$250.00

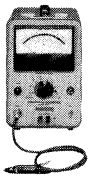
RF VOLTAGE INSTRUMENTATION

Model 91 DA



Sensitive RF Voltmeters

This series of RF Voltmeters provides reliable, reproducible voltage measurements from the low radio frequencies to the gigahertz region over a wide range of amplitudes. The versatility of these instruments plus their accuracy and convenience of operation have established them as standards of performance for the industry. The primary differences among the Models 91DA, 91H, 91C, 91K and 91L are indicated in the specification table below. All five models are characterized by low noise, excellent stability, high input impedance and low input capacitance.



Model 91 H

	Model 91DA	Model 91H	Model 91C	Model 91K	Model 91L
Full Scale Voltage Range:*	1 mV to 3 V	1 mV to 3 V	3 mV to 3 V	10 mV to 30 V	1 mV to 1 V
dB Range:	81 dB**	81 dB**	71 dB**	81 dBm	71 dBm
Voltage Sensitivity:	300 μV	100 μV	1 mV	1 mV	100 μV
Basic Accuracy:	2%	3%	5%	3%	3%
Frequency Range:	20 KHz to 1.2 GHz			0.5 MHz to 600 MHz	*with 91-23A:* 0.2 MHz to 2.5 GHz *with 91-12E:* 20 KHz to 1.2 GHz
Input Resistance: (f<10 MHz)	100 KΩ (at low level) to 1 MΩ (at high level)			>4 MΩ	same as 91H
VSWR:	≤1.2 at frequencies below 1.2 GHz			≤1.2 at 600 MHz	*with 91-23A:* ≤1.2 below 2.5 GHz *with 91-12E:* ≤1.2 below 1.2 GHz
Waveform Response:	True rms below 30 mV (3 V with Model 91-7C 100:1 Voltage Divider) graddally becoming peak-to-peak (calibrated in rms) at 3 V.			Same as 91H except all voltages are 10 times greater	Same as 91H
Price:	$700.00† $825.00††	$650.00† $775.00††	$550.00† $675.00††	$680.00 $805.00††	$ 975.00† $1,100.00††

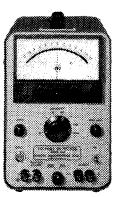
*to 300 V with Model 91-7C 100:1 Voltage Divider
**dBm scale available; order Model nos. with suffix S4
All instruments except 91C have DC Analog; Input capacitance of all probes is approx. 2.5 pF
†Includes 91-12E RF Probe, 91-13B RF Probe Tip and 91-8B 50 ohm Adapter (also 91-23A with 91L)
††With complete Accessory Kit, consisting of 91-12E RF Probe, 91-13B RF Probe Tip, 91-6C Unterminated BNC Adapter, 91-7C 100:1 Voltage Divider, 91-8B 50 ohm Adapter, 91-14A Tee Adapter, 91-15A 50 ohm Termination, all in 91-18A Accessory Storage Box.

DC VOLTAGE INSTRUMENTATION

Model 56A

Sensitive DC Null Detector

Electronic galvanometer providing exceptionally high sensitivity and high input impedance. Especially valuable as indicator in conjunction with dc bridges. Zero-center scale. 60 dB scale compression in Hunt Mode virtually eliminates range switching when measuring specimens of unknown value. Provision for remote mode switching. Amplifier output available at front panel terminals. Either floating or grounded operation.

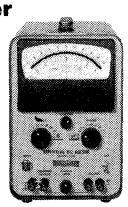


Voltage Sensitivity: 1 μV to 100 V end scale in 8 ranges
Current Sensitivity: 0.1 pA to 10 μA, es
Input Resistance: 10 MΩ, all ranges
OperatingModes: Hunt (60 dB meter scale compression); Calibrate (linear meter scale)
Amplifier Output Capability: ±1 mA into 1000 Ω
Amplifier Gain: —40 to +100 dB
Price: $495.00 (rack mounted Model 56AR, $520.00)

Model 95A

Sensitive DC Microvolt/Picoammeter

Unusually broad range of dc voltage and current measurements covered in 42 ranges. Front panel range and function switching uniquely simple and convenient. Zero-center meter. Fast response. Exceptionally stable amplifier output at front panel. Amplifier output gain and reference level adjustable without interaction with meter. Either floating or grounded operation for voltage; floating for current.



Voltage Range: 10 μV to 1000 V end scale; Accuracy, ±3%; sensitivity, 1 μV
Current Range: 1 pA to 1 A es; Accuracy, ±4%; sensitivity, 0.1 pA
Voltmeter Input Resistance: 10 MΩ, all ranges
Amplifier Output: ±1 V es across 1000 Ω
Amplifier Gain: 100,000 max.
Price: $600.00 (rack mounted Model 95A-R, $625.00)

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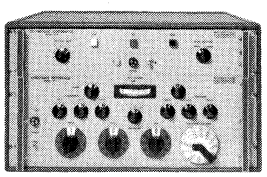
BOONTON ELECTRONICS CORPORATION
AUTOMATION PRODUCTS DIVISION

PRECISION INSTRUMENTATION FOR HIGH-SPEED GO/NO-GO AND COMPLEX LIMIT TESTING

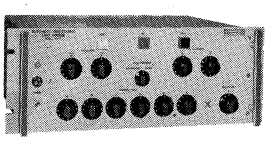
A wide selection of modular units for manufacturing test, process control, incoming inspection, sorting, batching and data logging.



Model 122D Automatic Resistance Limit Bridge

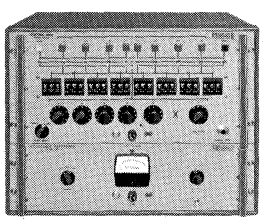
High-precision, 4-wire resistance measuring system which performs dual-limit go/no-go resistance tests at very high rates of speed for either production testing or manual operation. Nominal values programmable from 0.1 Ω to 100 M Ω. Plus and minus tolerances individually adjustable from 0 to ±29.9%. Excitation voltage adjustable from 0 to 100 V, dc. Test results indicated visually by front panel lamps and by continuity contacts. Negligible drift; no need for recalibration; unattended operation possible over extended periods. Test time, 50 milliseconds, minimum; cycle time adjustable from 2 to 20 tests/second.

Alternative versions available: Model 122D-S1 with nominal value programmable from 0.01 Ω to 10 M Ω, and tolerance limits programmable from 0% to ±9.99% in 0.01% steps. Model 122D-S2 with nominal value programmable from 0.01 Ω to 100 M Ω, and tolerance limits programmable from 0% to ±9.99% in 0.01% steps. Accuracy of all units ±0.05% from 10 Ω to 10 M Ω; ±0.15% above 10 M Ω and decreasing below 10 Ω to ±0.5% at 1.0 Ω.



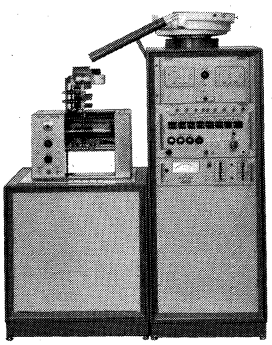
Model 122CD Automatic Resistance Limit Bridge

An integral, highly compact, low-cost rack-mounting automatic 4-wire resistance limit bridge which provides an economical approach to high-speed go/no-go testing. Nominal values selectable from 0.1 Ω to 10 M Ω. Tolerance limits individually programmable from 0 to ±11%. System accuracy, ±0.05% from 10 Ω to 1 M Ω; ±0.1% from 1 M Ω to 10 M Ω, and decreasing below 10 Ω to typically ±0.75% at 1.0 Ω. Excitation continuous dc 50 milliwatt max. dissipation in test resistor. Test speed 50 milliseconds per 2 limit classification. Test decisions indicated by front panel lamps and by mercury-wetted relay contacts. Negligible drift; unattended operation possible over extended periods. Operates in manual and triggered modes. Decisions stored until completion of next test. Size: 7" x 19" panel; 6¾" x 17" x 16" chassis. Primary power, 105-125 V, 50/60 Hz, 75 W.



Model 124C Resistance Sorting Bridge

An automatic, 8-limit, 4-wire resistance bridge for high speed sorting of resistors into categories or "zones". Provision for up to 10 category sorting. Decision outputs for Go_1 through Go_8 plus "High" and "Lo" are indicated by front panel lamps as well as being issued by continuity contacts. System accuracy ±0.05%. Nominal values programmable from 0.1 Ω to 10 M Ω with 5-digit resolution. Sorting limits individually adjustable from 0 to ±11.1% in 0.01% steps. Test speed, 25 ms per test (single limit); 150 ms per final classification, max. Excitation voltage across test resistor continuously adjustable from 0 to 100 V, dc and is monitored at front-panel meter. "Normalized" position of excitation control assures specified system accuracy and limits power dissipation in test resistor to 50 mW max. Operates in manual and triggered modes. Decisions stored until completion of next test. Size: 17" h x 19½" w x 23" d, overall with cabinet. Primary power, 105-125 V, 50/60 Hz, 300 W.



Typical system for 11 category classification of capacitors

Test Systems For Axial Leaded Components

The typical equipment combination illustrated shows a highspeed, axial leaded capacitor sorting system for 11-category classification of components into eight Accept Zones, Capacitance High and Low, plus DF Reject at a 1 KHz test frequency. Parts are sorted and binned at a rate of 6,000 to 8,000 pieces per hour.

Bulk components are introduced into an integral vibratory bowl, which presents a continuous flow of parts to the hopper of the Model 850B Component Feeder. A small reservoir of parts is maintained in tracks and then transported to the test head. The electrical tests are performed, and the tested components are collected in the proper bin, ready for stock or further processing.

Programming of the test equipment consists of merely setting a nominal capacitance value and per cent tolerance limits as boundaries for the desired Capacitance Accept Zones and the DF limit.

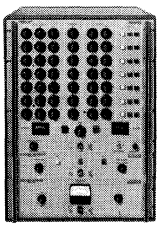
These test systems are designed for high-volume production applications, and a virtually unattended operation is practical. Typically, a half hour reserve of parts may be maintained in the bowl, thus accommodating multiple-station testing by a single operator. All test results are displayed visually in the form of colored lamps and are transmitted to the handling equipment in the form of contact closures.

The mechanical portion of these systems has been designed to make changeovers to accommodate various parts sizes as simple as possible. Track and transport wheel spacing adjustments and hopper exchange is accomplished in only a few minutes. The vibratory bowl accommodates most sizes with only minor baffle adjustments to reject components with badly bent leads.

The axial lead test systems are modular in construction and many combinations of modules are available to suit particular requirements. Systems are available for classification of resistors, capacitors, inductors and other axial leaded components such as diodes and varactors.

The handling system is compatible with the Models 122D, 122CD, 124C, 171K-C-M and 174K-C-M.

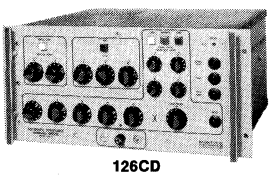
High-Speed Test Instruments & Systems



Model 125A Resistance Scanning Bridge

Primarily intended for final inspection of microcircuit resistor networks. Automatically tests up to 7 resistances on a substrate or other type of multi-resistor assembly in predetermined sequence, providing individual HI/LO/GO decisions plus an "Accept" or "Reject" decision for the total circuit at conclusion of test cycle. Number of resistances per scan selectable from 1 to 7; additional multiples of 7 can be added by slave units. Nominal resistance values are individually selectable from 0.1Ω to 10 MΩ with 3 digit resolution. Tolerances for each resistance are individually selectable from 0 to ±11.0% with 2 digit resolution. Basic system accuracy, ±0.05%. Results of individual resistance tests and final "Accept" or "Reject" decisions are indicated by panel lamps. Individual and final test results are also available as contact closures for actuation of associated materials handling equipment or for data logging. Running totals of "Accept" and "Reject" decisions are kept by front panel electro-mechanical counters. Test time is 50 mS per resistance; 350 mS per 7 resistor scan. Excitation voltage across resistor adjustable at front panel. "Normalized" position of this control guarantees specified accuracy and automatically adjusts voltage to limit power dissipation in test resistor to 50 mW. Programming can be converted from front panel selectors to static card reader by means of add-on Model 52-7A.

Models 126CD/126A/126B/126CD-S5 Resistance Trimming Bridges



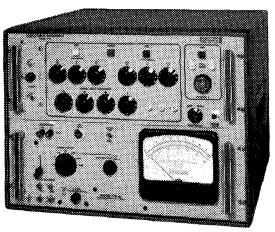
126CD

The Model 126CD is an integral rack mounting, 4 wire Resistance Limit Bridge primarily intended for controlling the trimming of thick film resistors. Upon receipt of a start test signal, the bridge first compares the untrimmed resistor to the "Minimum Start" value, and if this test is acceptable, the trimming command is issued. When the resistor reaches the "Stop" value, the trim command is removed, and after an adjustable delay to make certain that the adjustment process has stopped, a final, double limit inspection is performed with a measurement accuracy of ±0.05%. Each model 126CD is an integral measuring system with its own control logic, isolated power supply and input-output connectors, making the unit suitable for combination with other units for simultaneous trimming of multiple resistor networks. Final values are programmable to 10M ohms, and final value tolerance limits are independently adjustable from 0 to ±11.1%. The power dissipation in a resistor being trimmed is limited to a maximum of 25 mW.

The Model 126A is a programmable version of the Model 126CD and may be used to sequentially trim any number of resistors with complete flexibility. Programming of minimum start value, stop value, final value and tolerance limits is done by means of external B-C-D contact closures.

The Model 126B is a special purpose resistance trimming bridge which is intended for the simultaneous processing of resistors in closed loop configurations such as bridge circuits and delta networks. This bridge provides precisely regulated excitation levels of 0.5 to 1.0VDC.

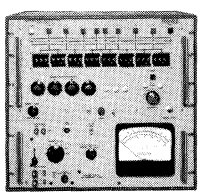
The Model 126CD-S5 is a modified model 126CD which incorporates means for use of external standard arm resistors. With this feature, a simple form of programming may be attained, "match" trimming may be accomplished and greater accuracy may be reached for very low values of resistors. An accessory programming device (Model 126-1A) is available for use with this bridge, which provides means for use of 10 plug-in external standards.



171M

Models 171K, 171C & 171M Capacitance-Inductance Test Systems

The Models 171K, 171C and 171M are a family of high-speed automatic test systems providing test frequencies of 1KHz, 100KHz and 1MHz. The systems consists of a universal, main frame, control unit plus one or more measurement modules. At 1KHz, go, high, low tests for capacitance plus an accept-reject test for dissipation factor are performed and at the 100KHz and 1MHz frequencies, HI/LO/GO inductance tests as well as the basic capacitance tests may be made. Test time is 50mS for the combined "C" and "D" decisions, which are presented in the forms of panel lamps and mercury-wetted relay contacts. Six full scales provide measurement ranges of 100pF to 10μF at 1KHz, 10pF to 10,000pF at 100KHz and 1pF to 1000pF at 1MHz. At 1KHz, dissipation factor may be checked over a range of 0.001 to 0.1 and at 100KHz and 1MHz, inductance may be tested over the respective ranges of 1μH to 10,000μH and 0.1μH to 1000μH. Several fixed excitation levels are available at 1KHz, and at 100KHz and 1MHz the excitation level is 15mV for C and less than 1mV for L. Interface accessory units are available to provide 0 to 10VDC analog outputs with sample and hold features for use with external DVMs, printers and recorders. A 3-terminal measurement permits remote tests without serious errors due to cable capacitance. Panel size is 12¼" x 19" for the Model 171K and 14" x 19" for the Models 171C or 171M.



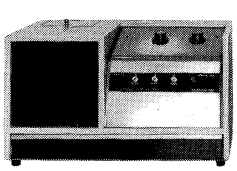
174M

Models 174K, 174C, 174M Capacitance-Inductance Sorting Systems

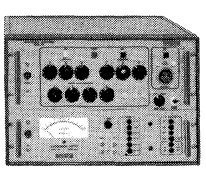
The Models 174K, 174C and 174M are multi-category sorting versions of the Models 171K, 171C, 171M. In lieu of a simple High, Low, Go classification for capacitance or inductance, these systems, by virtue of a different control unit, provide (8) go categories plus high and low. The Measurement Modules for these systems are identical to their Model 171 counterparts. Maximum classification time is 125mS and all decision outputs are provided in panel lamps as well as mercury-wetted relay contacts. Panel size is 15¾" x 19" for the Model 174K and 17½" x 19" for either the Model 174C or 174M.

Test Systems For Unleaded Components

Test systems consist of a bowl fed component handler in combination with one of several pieces of high-speed automatic test equipment. A typical equipment combination illustrated shows a multilayer ceramic capacitor sorting system capable of classifying 0.050" x 0.080" pieces into HI/LO/GO capacitance categories and "D" Reject at a rate exceeding 10,000 parts per hour. Bulk components are introduced into an integral vibratory bowl which presents a continuous flow of oriented components to a test head. The electrical tests are performed subsequent to individual part pick-up and the tested components are selected in the proper bin ready for stock or further processing. Changeover of part sizes is accomplished by snap-in tooled components and the system is industrial engineered for virtually unattended operation. Many combinations of test equipment and mechanical feeder are available to meet specific requirements. Standard systems are available incorporating the models 171K, 171C, 171M, 174K, 174C, 174M, capacitance-inductance testing equipment plus several models of resistance testing equipment such as the Model 124C Resistance Sorting Bridge and Model 122D Resistance Limit Bridge. Complete details are available upon request.



ENGINEERED AUTOMATION
Model 001-5



AUTOMATION PRODUCTS
Model 171K

BOONTON ELECTRONICS CORPORATION
AUTOMATION PRODUCTS DIVISION

Write for complete technical data

1279 ROUTE 46, PARSIPPANY, N.J. 07054
TEL. 201-335-9550 ☐ TWX 710-986-8241

The products listed above are indicative of Boonton Electronics capability in the area of Automation Products. However, they should not be considered as totally inclusive of our line. Many variations of these units are available and we are always interested in knowing of new requirements for automatic test instrumentation. For complete technical details on these and other instruments and systems please contact our Sales Engineering Representatives in your area (see yellow pages of this directory) or the factory.

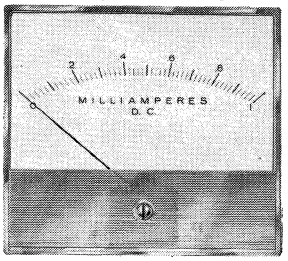
Hoyt SINCE 1904

HOYT ELECTRICAL INSTRUMENTS

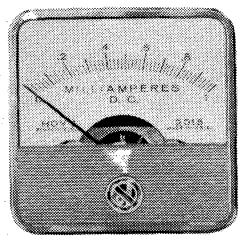
BURTON-ROGERS CO./Sales Div., 42 Carleton St., Camb., Mass. 02142 (617) 491-7400

For Original Equipment and Replacement Applications

Prices Subject To Change



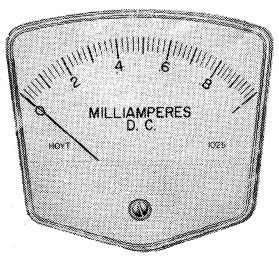
MODEL Nos. 2025, 2035, 2045, 2060, 2080 DC/2026, 2036, 2046, 2061, 2081 AC—Clear Plastic Styrene Cases, Available with Bezel for mounting behind panel (2) Mirror dial available.



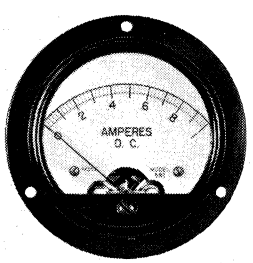
MODEL No. 2015 DC/2016R AC



MODEL No. 685 D.C. Pancake Edgewise Meter.

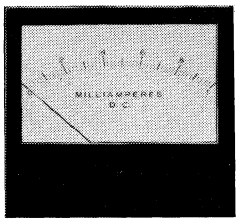


MODEL Nos. 1025, 1037, 1045, 1060 DC/1026, 1038, 1046, 1061 A.C./Clear Plastic Styrene Case



MODEL Nos. 582 & 17/3, D.C.(1) MODEL Nos. 584 and 552, A.C.

Moving Coil Meters built on d'Arsonval principle using jewel bearings, polished steel pivots. 2% accuracy. Alnico magnets. Permanently correct balance assured by HOYT cross-arm balance. High torque to weight ratio. Quick response and good damping. Knife-edge or lance pointers. 100° movements standard on most models. Special cases available. Inquiries invited on special types.



MODEL 680 D.C., 681 A.C.
Dull bakelite finish →

PRICE LIST:

PANEL MOUNTING

Size:	1½"	2½"	3½"	4½"	6"	8"
			#2035	#2045, #680		
		#2025	#1037	#1045, #683		
		#1025	# 17L	# 574, #685		
		#17/3	# 653	# 641, #673		
Approx.	# 668	# 635	# 582	# 645, #570	#2060	
Range *Resist.*	#2015	# 649	# 597	# 600, #607	#1060	#2080

6¾"—8½" ROUND PANEL METERS	3" x 4" PORTABLE METERS	5" x 4" PORTABLE METERS
	#583* #602*	#578* #515*

*Prices on request.

D.C. MILLIAMMETERS

0/1	*60*	$13.85	$13.05	$13.85	$15.35	$18.30	$29.95

Above prices also apply to 0/3, 0/5, 0/10, 0/15 MA Standard ranges.

0/25	*1.7*	14.25	13.40	14.25	15.65	18.90	30.50

Above prices also apply to 0/25, 0/30, 0/50, 0/100, 0/150, 0/200, 0/300, 0/500 MA Standard ranges.

D.C. MICROAMMETERS

0/20	*3000*	—	23.25	24.15	25.55	—	—
0/50	*2000*	20.40	19.75	20.40	21.85	—	—
0/100	*2000*	17.85	17.20	17.85	19.30	22.35	33.80
0/200	*1000*	15.50	14.70	15.50	16.90	19.95	31.50
0/500	*200*	14.70	13.95	14.70	16.10	19.10	30.70

Zero center microammeters available for most models in 25/0/25,50/0/50, 100/0/100, 500/0/500 UA. Prices on request.

D.C. MILLIVOLTMETERS

0/50	*3*	13.85	13.05	13.85	15.35	18.30	29.98

D.C. AMMETERS

0/1	*0.005*	13.85	13.05	13.85	15.35	18.30	29.95
0/5	*0.004*	14.30	13.60	14.30	15.75	19.20	30.80

Above prices for 0/5 amp. range also apply to standard ranges of 0/10, 0/15, 0/25, 0/30*, 0/50* amps on all models (self-contained shunts). No. 668 uses external shunt over 5 amps. See Shunt Table below.

D.C. VOLTMETERS

0/1	*1000Ω/V.*	14.80	14.20	14.80	16.20	19.20	30.80

Above prices also apply to standard ranges of 0/3, 0/5, 0/10, 0/15, 0/25, 0/30*, 0/50*, 0/100, 0/150*, 0/300* volts on all models.

0/500	*2000Ω/V.*	—	14.80	15.60	17.05	20.10	31.65

Above prices also apply to standard ranges at 0/600, 0/750 volts on all models except #668.

NOTE:

If "in-between" ranges are required, add $3.70 to price of next higher range listed. If "zero-center" ranges are required, add $5.80 to price of that range. For in-between ranges on moving-coil type Voltmeter 150 volts and up, add $5.80 to next higher range.

Please specify type of case on order from chart above.

All prices are net — subject to change or withdrawal without notice.

(1) Models marked also available in surface mounting metal case. Unless specified, all meters are calibrated on non-magnetic panels. If steel panels are used, give thickness of steel and size of panel hole (No extra charge).

(2) Bezels for behind panel mounting of models 2015, 2025, 2035, 2045 add /B to model no., $30.80 extra.

* These ranges carried IN STOCK . . . Models #582, 597, and 683 only (For non-magnetic panels).

METER SIZE		MODEL DC	MODEL AC	CASE TYPE PANEL MTG.	SCALE LENGTH DC	SCALE LENGTH FLANGE	BODY DIAM. AC - DC	BODY DEPTH AC - DC
1½"		668	669/R	Styrene Sq.	1.800"	1.740"	1.500"	1.000"
1½"	(2)	2015	2016/R	Styrene Sq.	1.800"	1.740"	1.500"	1.000"
2½"		17/3	552	Bakelite Rd.	2.015"	2.690"	2.200"	1.375"
2½"		1025	1026	Styrene	2.500"	2.87" x 2.59"	2.160"	1.120"
2½"	(2)	2025	2026	Styrene	2.500"	2.81" x 2.37"	2.160"	1.120"
2½"		635	636	Bakelite Sq.	2.015"	2.375"	2.200"	1.400"
2½"		649	650	Styrene Sq.	2.480"	2.625" x 2.375"	2.200"	1.125"
2½"		685	686/R	Metal Edgewise	2.000"	3" x 1.25"	2.375"	.900"
3½"	(1)	17/L	560	Metal Rd. Flush	2.480"	3.219"	2.500"	1.500"
3½"		582	584	Bakelite Rd.	2.720"	3.500"	2.750"	1.375"
3½"		1037	1038	Styrene	3.812"	3.500"	2.750"	1.125"
3½"	(2)	2035	2036	Styrene	3.435"	3.50" x 2.97"	2.750"	1.100"
3½"		597	598	Bakelite Sq.	2.720"	3.000"	2.750"	1.375"
3½"		653	654	Styrene Sq.	3.435"	3.375" x 3.125"	2.750"	1.125"
3¾"	(1)	570	580	Metal Rd. Flush	2.850"	3.750"	3.000"	1.688"
3¾"		607	610	Bakelite Sq.	2.850"	3.625" x 3.313"	2.250"	1.063"
4¼"		641	642	Styrene	4.250"	4.500" x 3.844"	2.750"	1.125"
4½"	(1)	574	617	Metal Rd. Flush	3.875"	4.500"	3.750"	1.594"
4½"		600	601	Bakelite Sq.	4.034"	4.500" x 4.000"	2.750"	1.063"
4½"		645	646	Styrene Sq.	4.470"	4.625" x 4.188"	2.750"	1.125"
4½"		647	648	Bakelite Sq.	4.470"	4.500" x 4.188"	2.750"	1.125"
4½"		680	681	Bakelite Sq.	4.470"	4.652" x 4.188"	2.750"	1.125"
4½"		683	684	Bakelite Sq.	4.470"	4.500" x 4.188"	2.750"	1.125"
4½"		1045	1046	Styrene	4.500"	4.81"	2.750"	1.125"
4½"	(2)	2045	2046	Styrene	4.500"	4.50" x 4.03"	2.750"	1.090"
6"		1060	1061	Styrene	5.375"	6.000" x 4.500"	2.750"	1.100"
6"		2060	2061	Styrene	5.375"	5.72" x 4.49"	2.750"	1.100"
8"		2080	2081/R	Styrene	9.125"	7.75" x 6.56"	3.500"	1.100"

STANDARD SWITCHBOARD SHUNTS AND AMMETER RANGES

On High Current Ammeters, add 0/50 millivoltmeter price to external shunt price below. Shunts include 3 ft. leads. Standard Ammeter and Shunt Ranges on types 17/3, 582 and 647 only; others listed are special ranges at slight extra cost.

0/25 —$10.45	0/30 —$10.45	0/50 —$ 9.65	0/75 —$ 9.65	0/100—$ 9.65	0/150 —$10.45
0/200—$10.45	0/300—$11.20	0/500—$16.30	0/600—$19.25	0/800—$25.60	0/1000—$31.45

Hoyt SINCE 1904

HOYT ELECTRICAL INSTRUMENT WORKS, INC.
BURTON-ROGERS COMPANY SALES DIVISION

HOYT ELECTRICAL INSTRUMENTS

BURTON-ROGERS CO./Sales Div., 42 Carleton St., Camb., Mass. 02142 (617) 491-7400

Precision Quality and Craftsmanship Since 1904

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Prices Subject To Change

AC Meters for 60 cycle Voltage and Current Measurements are repulsion type with air damping. Same case styles and sizes match HOYT D.C. meters; see DC-AC Specifications Chart on opposite page. 2% accuracy. Choice of pointer available; special shields supplied at additional cost.

VU METERS, with "A" scale, available in #649, #653, #645, and #683 case styles. Prices on request.
NOTE: A. C. Meters calibrated at any special frequency. Prices on request.

PRICE LIST:

	Size:	PANEL MOUNTING 2½"	3½"	4½"	6"	8"	PORTABLE 3" x 4"	5" x 4"
Range	*Approx. Resist.*	#2026 #1026 # 552 # 636 # 650	#2036 # 560 #1038 # 654 # 584 # 598	#684/R, # 684 #580 # 642 #610 # 646 #617 #1046 #691 #2046	Quantity Prices On Request #1061 #2061	#2081/R	#562* #517* *Prices on request **NOTE:** Bezels for behind panel mounting of models 2026 - 2036 - 2046 — add /B to model no. $2.05 extra.	

A.C. MILLIAMMETERS

0/10	*2700*	$12.60	$13.65	15.35	$18.30	—	—

Prices for ranges: 0/30, 0/50, 0/100, 0/150, 0/200, 0/300, 0/500 MA for all models — same as 0/10 MA. range above

A.C. AMMETERS

0/1	*0.271*	12.60	13.65	15.35	18.30

Above prices also apply to all models of standard single ammeter ranges—0/3, 0/5*, 0/10, 0/15, 0/25, 0/30*, 0/50* amps. A.C. Ammeters are self-contained to 50 amps.

For High Current Ranges—See Transformer Section below.

A.C. VOLTMETERS (Repulsion Type)

0/25	*1476*	13.05	13.65	15.35	18.30

Above prices also apply to all models in standard ranges of 0/30, 0/50, 0/100 volts.

0/150*	*25,000*	14.30	15.00	16.65	19.55
0/300*	*50,000*	14.30	15.00	16.65	21.00
0/500	*83,300*	—	21.70	23.05	26.15
0/600*	*99,960*	—	21.70	23.05	26.15

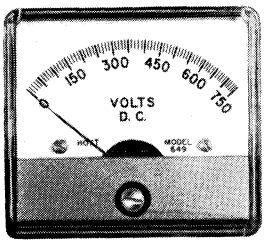
* These ranges carried IN STOCK on Models #584, #598 and #684 only (calibrated for non-magnetic panels).
NOTE: If "in-between" ranges are required, add $3.70 to next higher price as shown above (add $5.50, if above 150 volts). Standard calibration is for non-magnetic panels. Steel panel calibration at no extra charge if order specifies thickness of steel and size of panel hole. Please specify type of meter case.
DIAL COSTS: Standard range dials only — $1.30 each; special hand drawn single range dials. Prices on Request; other custom dials on special order.

5% RECTIFIER TYPE VOLTMETERS

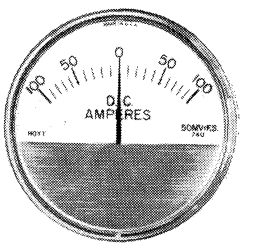
Available in the following ranges: 0/5, 0/10, 0/15, 0/25, 0/30, 0/50, 0/100, 0/150, 0/300 volts.

Above ranges apply to models #584-R, #598-R, #654-R at $20.65. ea.

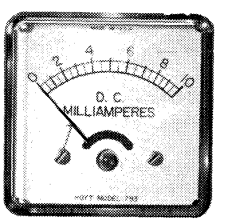
Above ranges apply to models #642-R, #646-R, #684/R at $22.90 ea.



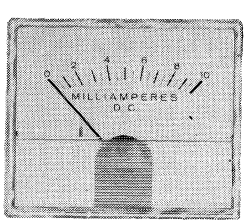
MODEL No. 649, 653, 645 DC/ 650, 654, 646 AC
Clear Plastic Styrene Cases



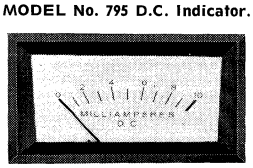
MODEL No. 740 D.C. Indicator 2¼".



MODEL No. 793 D.C. Shown. No. 793-M type masked front. Also 2½" No. 693 Metal Case.



MODEL No. 795 D.C. Indicator.



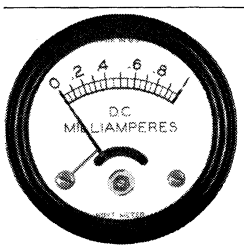
MODEL No. 795/B Die cast metal bezel for behind panel mounting. Dull black finished.

HIGH CURRENT DONUT TYPE TRANSFORMERS (In Stock)

For prices on HIGH CURRENT AC AMMETERS, add price of ammeter model above to transformer price below, plus an additional $4.50 except on model #552, #584 and #684. Transformers have 2 ft. leads and 2 VA burden. Other ranges available on request.

50/5	$11.65	100/5	$11.65	200/5	$11.65	500/5	$18.65
75/5	11.65	150/5	11.65	300/5	11.65	600/5	18.65

MOVING MAGNET INDICATORS



MODEL No. 640, D.C.
2¼" Metal Case

Feature long scales, accuracy within 5%. Attractive appearance with sturdy movement; round or square cases at low cost. Standard finish on metal cases is black. Chrome Plate is available at slight additional cost. Many types of mounting arrangements available.

MODEL DC	CASE TYPE PANEL MTG.	SCALE LENGTH DC	FLANGE	BODY DIA. DC	BODY DEPTH DC
640	Nar. Metal Rd.	1.400"	2.281"	2.000"	1.078"
640	Metal Surface	1.400"	2.375"	2.000"	—
693	Metal Sq.	1.400"	2.625"	2.000"	0.563"
793†	Plastic Sq.	1.715"	2.375"	2.000"	0.500"
740	Plastic Rd.	1.715"	2.375"	2.000"	0.520"
795	Plastic Sq.	1.715"	2.375"x2.81	2.000"	0.520"

D.C. MILLIAMMETERS

Range	*Approx. Resist.*	#640	#693	#740 #793†	#795
0/1	*1000*	5.15	$5.20	$5.60	$5.90
0/3	*700*	3.80	3.95	4.30	4.60
0/5	*480*	3.50	3.60	3.95	4.35
0/10	*180*	3.30	3.40	3.75	4.10
0/15	*130*	2.80	2.85	3.30	3.75
Prices for 0/25, 0/30, 0/50, 0/100, 0/150, 0/200, 0/300, 0/500 MA. ranges:		$2.75	$2.80	$3.25	$3.60

† or 793-M Masked Front - Specify

D.C. AMMETERS

Range	*Approx. Resist.*	#640	#693	#740 #793†	#795
0/1	*.1*	$2.75	$2.80	$3.25	$3.60
Above prices also apply to 1/0/1, 3/0/3, 0/5, 5/0/5, 0/10, 10/0/10, 0/15 amp. ranges.					
20/0/20	*.0015*	3.45	3.50	3.85	4.20
Above prices also apply to 0/25, 0/30, 30/0/30 amp. ranges.					
0/50	*.0011*	3.75	3.80	4.10	4.50
50/0/50	*.001*	3.75	3.80	4.10	4.50
0/75	*.001*	4.30	4.40	4.90	5.20
0/100	*.001*	5.00	5.10	5.50	5.80

D.C. VOLTMETERS

Range	*Approx. Resist.*	#640	#693	#740 #793†	#795
0/1	*37*	$2.75	$2.80	$3.25	$3.60
Above prices also apply to 0/3, 0/5, 0/10, 0/15 volt ranges.					
0/25	*1375*	3.25	3.30	3.60	4.05
0/30	*1650*	3.25	3.30	3.60	4.05
0/50	*2200*	3.45	3.50	3.85	4.20
0/100	*20,000*	3.45	3.50	3.85	4.20
0/150	*30,000*	3.50	3.60	3.95	4.35
0/300	*60,000*	4.75	4.85	5.20	5.55

HOYT ELECTRICAL INSTRUMENT WORKS, INC.
BURTON-ROGERS COMPANY SALES DIVISION

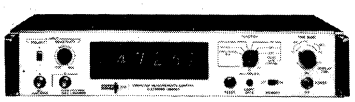
Hoyt SINCE 1904

CMC COUNTERS

ALL-SILICON SOLID-STATE SERIES 600

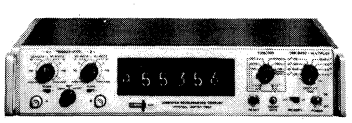
The 600 Series features reliable, all-silicon, solid-state instruments that offer direct frequency measurement to 20 MHz, with prescaling to 225 MHz, with heterodyning to 3.3 GHz, plus the measurement of period, multiple period, average, frequency ratio, time interval, and totalizing, with both preset functions and portability available — all at a minimum cost.

CMC's 600 series are the first counters built with all silicon semiconductors for higher reliability, superior temperature stability. Maximum frequency ranges of 2.5,15, 20 and 225 MHz. Simplified design techniques and advanced "Mother Board" circuitry reduce components by 10 per cent over competitive models. Temperature operation —20 to +65°C standard, —30 to +75°C available. All silicon memory (display storage), a standard feature, is not subject to slow response and upper temperature limitations of photoconductor memory circuits.



MODEL 608 $740.00

Measures frequency and period, determines frequency ratio and totalizes. Frequency, period and frequency ratio measurement ranges: 2 Hz to 15 MHz. Period average and multiple ratio: 1, 10 and 100. In-line long-life biquinary display. Five decades are standard, a sixth is optional.



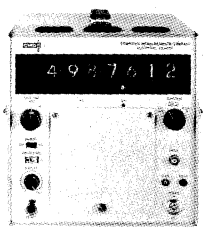
MODEL 609 $1195.00

Measures frequency, period, multiple period average, frequency ratio, time interval, and totalizes. Frequency measurement range: 0 to 5 MHz. Period: 0 to 1 MHz. Multiple period average measurement from 0 to 20 MHz, from 10^0 to 10^7 periods in decade steps. 1 MHz crystal time base; stability ±2 parts in 10^7 per month. Six decade in-line biquinary display, automatically positioned decimal point.



MODEL 614 $1300.00

Preset Multi-function Counter extends applications to normalizing and multiplication by any preselected constant. Gate time presets to any interval from 10 μsec to 100 seconds. Gate time presets by remote selection. Direct displays as mph, rpm, ms, per N periods, etc. 614 also measures frequency and period and totalizes. Frequency range: 2 Hz to 2.5 MHz. Period and frequency ratio ranges: 2 Hz to 500 kHz. Preset count circuitry operates dependably at frequencies through 300 kHz-up to three times as fast as other variable gate time counters. 100 kHz crystal time base; stability ± 2 parts in 10^6 per week. Standard five decade in-line biquinary display (sixth optional) with automaticaily positioned decimal point.



MODEL 616 $1975.00

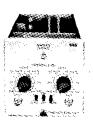
Model 616 provides low-cost direct frequency measurement from 10 Hz to 225 MHz by means of a unique prescaler built into the instrument. It can be rack-mounted. All-silicon semiconductor circuitry assures dependable operation over wide temperature ranges. 1 MHz crystal time base; stability ± 2 parts in 10^7 per month. Seven decade in-line display is standard — eighth decade optional. Standard automatic decimal and display storage.

MODEL 631 $775.00



Model 631, turret-type, positive switching 100 MHz to 1.3 GHz Heterodyne Converter.

MODEL 633 $300.00



Model 633, 1 μsec resolution Time Interval Plug-in with range from 1 μsec to 10 sec.

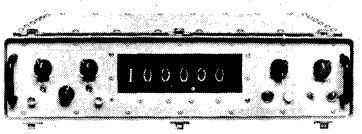
MODEL 635 $825.00



Model 635, continuous tuning, 200 MHz to 3.3 GHz Heterodyne Converter.

SOLID-STATE MILITARY COUNTERS

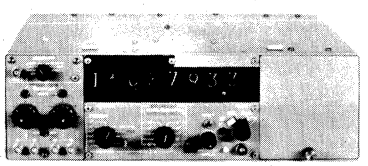
5-MHz COUNTER



MODEL 687 $1875.00

Model 687 is a 5 MHz fully militarized counter that measures frequency, period, multiple period average, frequency ratio, time interval and totalizes. Meets MIL-E-16400 including temperature, humidity and vibration specs.

100-MHz COUNTER



MODEL 880 $3750.00

Model 880 is the first solid-state counter fully militarized to meet Mil Specs. It measures frequency, period, multiple period average, frequency ratio, frequency ratio average, time interval with internal and external clock, and totalizes; scales input frequency in decade steps; provides standard frequency outputs. If you want the safety of a counter providing full Mil Specs reliability at a price surprisingly close to a commercial counter, then check these specs: 0 to 100 MHz frequency range; oscillator stability of 1 part in 10^9; meets or exceeds MIL-E-16400, including applicable temperature, humidity, vibration, shock, and RFI specs; built-in time interval measurement. Eight decade in-line display. Militarized plug-ins available (see below).



MODEL 884
555 MHz
$530.00



MODEL 885
3.2 GHz
$825.00

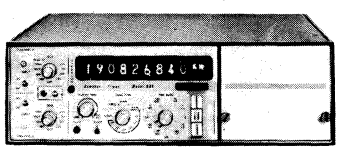
PLUG-INS FOR MILITARIZED 880

Model 884: Heterodyne Converter, turret-type, positive switching, 100 MHz to 555 MHz acceptance tested to MIL-E-16400, MIL-S-901, MIL-I-16910. Model 885: Heterodyne Converter, continuous tuning, 200 MHz to 3.2 GHz.

CMC COUNTERS

INTEGRATED-CIRCUIT 200-MHZ SERIES 900

The Model 901 Universal Counter-Timer is the first to be introduced in CMC's completely new series of integrated-circuit instruments. The Model 901 is also the industry's first, true, 200-MHz, universal counter-timer capable of achieving its range without prescaling, heterodyning, or using plug-ins...while also offering as part of its main-frame capability the measurement of frequency, period, multiple period average, time interval, ratio, multiple ratio averaging, totalizing, scaling, and the measurement of time interval from an external standard...plus a heterodyning capability for gigahertz operation.



MODEL 901 $2475

Gate times are 1 μsec to 100 seconds in decade steps. A special feature of the display control is a fast reset of 10 μsec to accommodate those requiring maximum data gathering abilities.

Input sensitivity of the 901 is 10mV for both A and B amplifiers.

The readout has nine decades with automatically positioned decimal point, large readout tube with units symbols, and an overflow lamp.

Printer output in the form of BCD in the 1-2-4-8 code is a standard feature.

Remote programming of the entire front panel controls, except trigger levels and attenuators, is an optional feature.

Time Interval mode offers resolution to 10 nanoseconds. Gate output useful in determination of the amplifier trigger points in the Time Interval mode, is a standard feature of the 901.

Frequency Extender Plug-ins



MODEL 931 $825

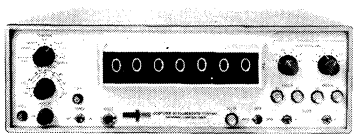
Turret type, positive switching 100 MHz to 1.3 GHz Heterodyne Converter. Sensitivity is 50 mV across its entire range.

MODEL 935 $875

Continuous tuning 100 MHz to 3.3 GHz Heterodyne Converter. Sensitivity is 50 mV across its entire range.

ECONOMICAL SERIES 700

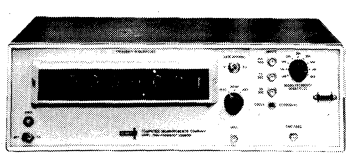
The CMC 700 Series combines versatility with operational simplicity and features economical, solid-state, electronic counters capable of direct readings to 100 MHz and heterodyning to 500 MHz...includes a highly accurate preset counter-controller and a counter/plug-in combination that can't be matched for performance and price.



MODEL 727 $1725.00

UNIVERSAL COUNTER-TIMERS

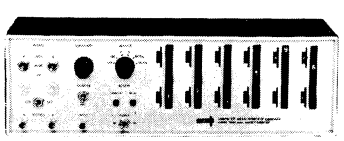
Model 727 directly measures frequency from 0 Hz to 50 MHz, single period from 1 μsec to 10^8 seconds and time interval from 0.3 μsec to 10^8 sec, multiple period multipliers of 1 to 10^7 in decade steps. Oscillator stability ±3 parts in 10^7 per month. Seven decade in-line readout. Memory is standard.



MODEL 738/735 $1650.00

100-MHz DIRECT READING FREQUENCY METER WITH 500-MHz PLUG-IN

Frequency from 10 Hz to 100 MHz measured directly. Seven decade readout. Extends to 500 MHz in 50-MHz steps with Model 735 turret-type, positive-switching, heterodyne converter provided free with the purchase of the basic instrument.

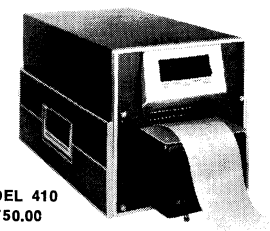


MODEL 786 $1255.00

SOLID-STATE DUAL PRESET COUNTER-CONTROLLER

Absolute accuracy, 100 mV sensitivity, 100 kHz recycling rate. Six decades with count capacity to 999,999. "Count" and "Reset" contact closures at rear panel for remote operation.

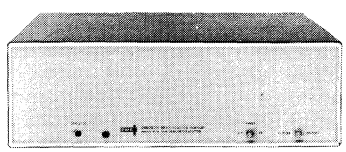
10-Line/Second DIGITAL PRINTER



MODEL 410 $1750.00

HIGH SPEED, NEW LARGE DIGITS, SOLID-STATE DRIVE AND LOGIC

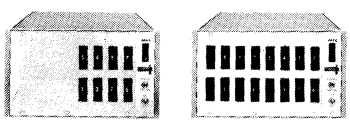
Fastest, easiest to read, not a modified adding machine or calculator. 35 millisecond data acquisition. Prints 10 columns at 10 lines per second. Electrically positioned decimal without loss of digit. Left zero elimination. New simple electromagnetic design eliminates commutators and moving contacts. Column suppression on command. Fan-fold or roll paper. Half-rack size. Up-front pushbutton controls. Error identifying seven segment printed characters. Eight columns are standard. Additional or lesser numbers of columns optional.



MODEL 403 $1375.00

SOLID-STATE TAPE PERFORATOR ADAPTER

Model 403 couples counters with 1-2-4-8 BCD output to the Tally Series 420 Paper Tape Perforator. Compatible with all CMC solid-state counters having standard digital printer output plug, and modifiable to accept other manufacturer's equipment. Accessory output allows simultaneous operation of digital printer in parallel with Tally 420. Up to 6 decades provided (8 optional). Accepts 60 characters per second. Punch command —4V to —12V pulse, 50 μsec wide (min.), into 10,000 ohms.



MODEL 404 $950.00 **$1485.00**

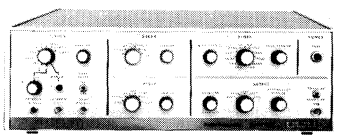
SOLID-STATE GO, NO-GO COMPARATOR

Model 404 compares a binary coded decimal number, obtained from printer output receptacle of a counter with two selected preset numbers in the comparator for go, no-go operation. Provides visual display in "HI", "LO", and "IN" limit lights as well as contact closure outputs for control purposes. Half-rack size permits dual mounting. Weighs only 17 lbs. and uses just 45 watts power. Four decade preset standard, 8 optional. Remote presetting of limits optional

PULSE GENERATORS, TIME DELAY GENERATORS, AND TARGET SIMULATORS

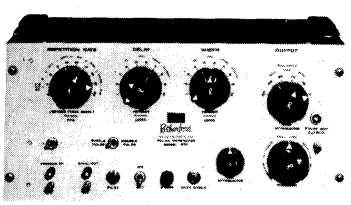
PULSE GENERATORS

CMC's famous line of pulse generators includes both portable and laboratory instruments offering repetition rates from 20 Hz to 50 MHz... rise-and-fall rates as fast as 5 nsec at 10-volt amplitude...and a uniform high level of accuracy and performance.



MODEL 220 $1225.00

NEW 50 MHz PULSE GENERATOR
This new all silicon, solid-state pulse generator adds 50 MHz capability to the famous Rutherford instrument line. Other specs include: 50 MHz repetition rate; delay from less than 10 nanosec to 10 millisec; width from 10 nanosec to 10 millisec; baseline offset variable from −5 volts to +5 volts; ±10 volt amplitude polarity switched; rise and fall time from 5 nanosec to 1 millisec.

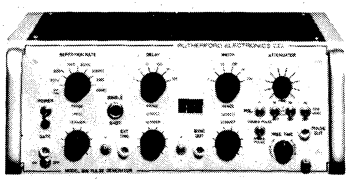


MODEL B-7B $695.00
MODEL B-7D $695.00
MODEL B-7F $825.00

BASIC PULSE GENERATOR
B-7B is a general purpose instrument with repetition rate to 2 MHz and 50V into 50 ohms. Variable rise/fall time control.

B-7D has all specifications of B-7B and simultaneous positive and negative output pulses; separate and independent rise/fall time controls.

B-7F has all B-7B features plus: 2 Hz repetition rate; separate rise/fall time controls; and double pulse output.



MODEL B-14 $340.00
MODEL B-15 $390.00
MODEL B-16 $595.00

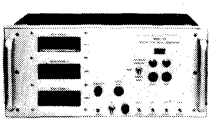
PORTABLE PULSE GENERATORS
Model B-14 is a low cost, portable unit with repetition rate of 20 Hz to 2 MHz. Delay is 0 to 10 msec. Amplitude is 15V into 1k, 8V. into 50 ohms. Pulse width of 60 nsec to 10 msec. Rise/fall time is less than 10 nsec fixed.

B-15 has same rise/fall time, delay, and pulse width. Also offers a repetition rate of 5 Hz to 5 MHz.

B-16 offers repetition rate of 20 Hz to 20 MHz. Variable rise/fall times of less than 5 nsec to greater than 200 nsec. Pulse width 15 nsec to 10 msec. Amplitude 10V. Single or pulse pair operation.

Rack mount available for B-14, -15, -16.

TIME DELAY GENERATORS



MODEL A-10 $2215.00
MODEL A-11 $1070.00
MODEL A-12 $3120.00

SOLID-STATE DELAY GENERATORS
A-10 has time delays 0 to 1 sec in 100 nsec increments. Accuracy 0.001% of delay. Jitter less than 1 nsec. Amplitude 10V. Rise time 15 nsec.

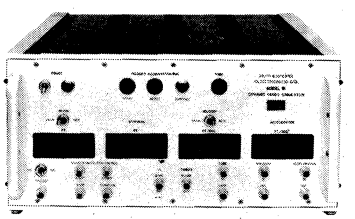
A-11 has same features as A-10 with exception of amplitude, 6V and rise time 10 nsec.

A-12 was designed for fail-safe operation in explosives testing or other tests where premature triggering might destroy information. Amplitude, 70V; rise time, 100 nsec.

DYNAMIC TARGET SIMULATOR



The Model 301 is a truly unique off-the-shelf instrument that aids in the design, evaluation, checking, and calibration of tracking systems. It does this by producing artificial targets which can be easily and accurately set to various ranges and which can be dynamically moved at various velocities and/or accelerations. It features all solid-state digital logic...low jitter, high accuracy, high stability...1-foot target resolution...and is available for portability or rack mounting.



MODEL 301 $6330.00

DYNAMIC TARGET SIMULATOR
Model 301 is a moving target simulator. It is applicable to tracking radars, weapons control systems, or sonar for calibration, production checkout, or operator training.

The standard Model 301 has a target Range from 0 to 1,000,000 feet in one foot increments with 0.1% of setting accuracy. It has a target Velocity from 0.0 to 100,000.0 feet/second in 0.1 foot/second increments with 0.005% of setting accuracy. Target Acceleration can be set from 0.00 to 10,000.00 feet/second/second in 0.01 foot/second/second increments with 0.005% of setting accuracy.

Special versions of the Digital Target Simulator are available with increased accuracies. 301's have also been built with remote-programming capabilities and ruggedized to meet MIL specifications.

Your local CMC representative will demonstrate these products on your premises at your convenience. Call him or call CMC direct.

COMPUTER MEASUREMENTS COMPANY

A Division of Pacific Industries

12970 Bradley Avenue
San Fernando, California 91342
Phone (213) 367-2161
TWX 910-496-1487

All prices f.o.b. factory

CABLEMASTER

A compact, versatile unit for rapid and efficient testing of electrical cable assemblies, harnesses, connectors, and bulk cable

■ Ease of Operation

Simplified operating procedures permit the Model 400-C to be operated by non-technical personnel. Controls are conveniently located and are arranged to provide efficient operation. Test results are displayed on a digital readout to reduce errors. When a fault is located in a cable being tested, the test sequence automatically stops and an alarm is sounded to alert the operator. Testing can be continued at the operator's discretion.

■ Mobile Carrier for Increased Versatility

The Model 400-C is designed to provide maximum convenience and versatility for in-plant or field applications. It is equipped with a mobile carrier to permit easy movement to any location. The Unit can also be removed from the carrier if desired.

■ Permanent Test Record (Optional)

The 400-C is available with an optional printer to provide a complete and permanent record of each test. The type of test, circuit tested, and test results are recorded on a continuous paper tape. Failures are printed in red for easy identification. With the printer in operation the Cablemaster will not stop when a fault is located, but will record the fault and proceed with the test.

■ Insulation Resistance Range From 1 to 5000 Megohms

The Model 400-C automatically checks each conductor against all others to determine insulation resistance under any impressed voltage between 20 and 1000 vdc. Use of plug-in resistance standards and environmental sealing of critical components eliminates acceptance level drift caused by humidity or temperature changes within normal operating conditions. Rapid change from one acceptance level to another is easily accomplished.

■ Continuity Resistance Range from 0.5 to 59 Ohms — 0.5 to 3 Amperes

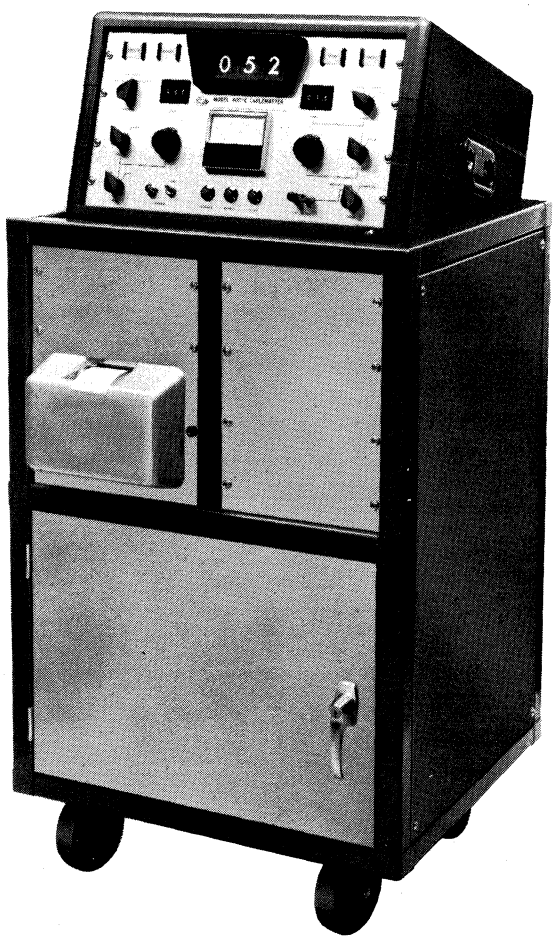
Termination-to-termination continuity on a maximum of 200 simple or complex circuits is quickly accomplished in one test setup. Resistance test level is selected with convenient digital switches.

■ Simplified Testing Capability for Multiple Conductors

A unique programming circuit permits testing of multiple and simple circuits mixed in any sequence. No special programming is required and setup time is greatly reduced.

■ Dielectric Strength (Hipot) Range From 0 to 3000 Volts AC or DC

The Model 400-C automatically checks each conductor against all others for shorts and leakage. Any test voltage up to 3000 vac or vdc can be selected by the operator. The voltage range is continuously variable and is monitored on the precision meter provided on the front panel. Hipot dwell time can be set for any period up to three minutes.



Model 400-C shown with optional console

SPECIFICATIONS

Test Capacity:
- Insulation Resistance: 400 circuits
- Hipot: 400 circuits
- Continuity: 200 circuits

Test Ranges:
- Insulation Resistance: 1 to 5000 megohms
- Hipot: 0 to 3000 volts ac or dc
- Continuity: Resistance 0.5 to 59 ohms; Current 0.5 to 3 amperes

Dwell Time: 0.5 to 180 seconds

Max. Test Rate: 120 tests per minute

Input Power: 110 to 125 volts ac, 50 - 60 cps

Weight: 130 pounds

Dimensions (cabinet): 21 x 13½ x 18½ inches

Information on special models and multipliers available on request.

Other models include new portable units and the Model 400-S, a new concept in shipboard cable checkout.

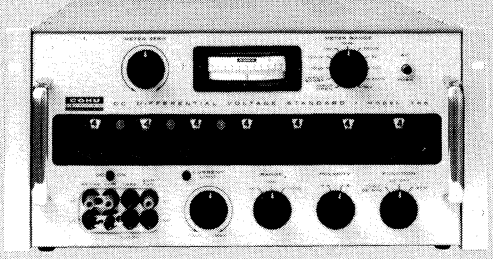
cablemaster®

a division of
Accurate Electronics Corporation

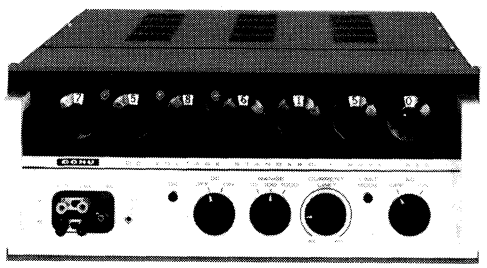
13215 LEADWELL ST., NORTH HOLLYWOOD, CALIFORNIA • 91605 • PHONE (213) 875-0500

COHU

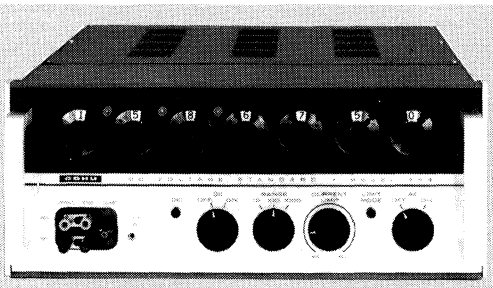
dc voltage standards



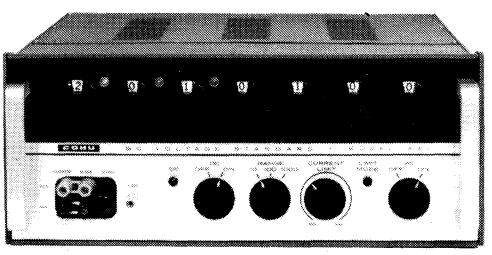
MODEL 365 - DIFFERENTIAL DC VOLTAGE STANDARD - A multifunctional instrument which can be used as: a null indicating, potentiometric, dc voltage measuring instrument (differential voltmeter); a direct reading transistorized dc voltmeter (TVM); or a precision dc voltage source (dc voltage standard). The differential voltmeter and dc voltage standard modes provide 0.001% accuracy and voltages from zero to over 1100 volts with seven-place precision.



MODEL 355 - 10 PPM DC VOLTAGE STANDARD - Provides accuracy to within 0.001% (including all stability variations) for 90 days. Three decade ranges supply voltages from zero to over 1100 volts with seven-place precision and an output current to 50 milliamperes at any voltage setting. Complete isolation and excellent guard shielding permit full output voltage with either positive or negative terminal grounded.



MODEL 353 - 20 PPM DC VOLTAGE STANDARD - Provides accuracy to within 0.002% (including all stability variations) for 6 months. Three decade ranges supply voltages from zero to over 1200 volts with seven-place precision and an output current to 50 milliamperes at any voltage setting. Noise and hum is less than 15 μV rms on the 10V range. Features include: overcurrent protection, overvoltage protection and all solid state active circuitry.



MODEL 351 - 30 PPM DC VOLTAGE STANDARD - A completely solid-state dc voltage standard that can be operated continuously for 12 months to an accuracy within 0.003% (including all stability variations). Output voltage, 0 to $\pm$ 1111.1110V dc, with a resolution as small as 1 μV. Output current to 50 mA at any voltage setting. A rackmounting kit is included for easy and fast conversion from a bench model to a rackmount model. FSN4931-913-3062



MODEL 324AN - DIFFERENTIAL VOLTAGE CALIBRATOR - Combining a passive null indicator with the Model 324A DC Voltage Calibrator creates a system capable of measuring unknown voltages by differential comparisons. Accuracy is to within 0.01%, 100 ppm, over a voltage range of 0 to $\pm$1111.110V dc. Output current to 25mA at any voltage setting, as a dc calibrator. As a null indicator, meter sensitivity at null point is 300 μV/mm.

COHU
ELECTRONICS, INC
SAN DIEGO DIVISION
BOX 623, SAN DIEGO, CALIFORNIA 92112
PHONE 714-277-6700 · TWX 910-335-1244

COHU also manufactures programable dc standards, wideband and differential dc amplifiers, and precision multimeters. Complete catalog of equipment specifications and application notes furnished upon request.

behlman division

CALIFORNIA INSTRUMENTS CORPORATION

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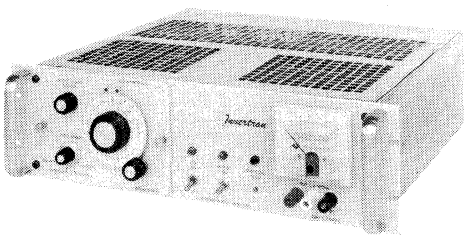
3511 Midway Drive / San Diego, California 92110 / 714-224-3241

the most respected name in AC power

Invertron



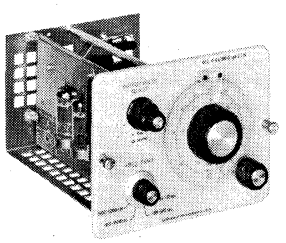
INVERTRONS are versatile AC power sources which supply both stable output voltage and output frequency independent of varying input conditions. These units may be used to regulate for varying lines and loads as well as to provide low-distortion multiphase power.

Precision AC Power Supplies
AC Power Amplifiers
Frequency Converters

- Power output from 40 VA to 45,000 VA.
- Fixed and variable plug-in oscillators from 45 Hz to 5 KHz.
- Frequency accuracies of 1%, 0.5%, 0.1% and 0.001%.
- Available in 1ϕ, 2ϕ, and 3ϕ models.
- Optional input voltages from 117V 1ϕ to 460V 3ϕ.
- Rack or cabinet-type mounting.

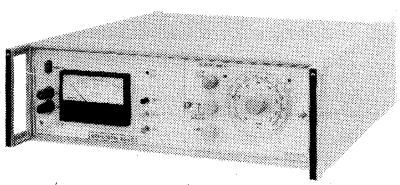
SINGLE PHASE		TWO PHASE		THREE PHASE	
Model	Output (VA)	Model	Output (VA)	Model	Output (VA)
*R161A	160	*2XR161A	320	*R-123A	120
*R351A	350	*R702A	700	*3XR161A	480
R751B	750	R1502B	1500	R503A	500
R1501A	1500	R3002A	3000	R1003A	1000
C2501A	2500	C5002A	5000	R2253B	2250
C3501A	3500	C7002A	7000	R4503A	4500
C5001A	5000	C10002A	10000	C7503A	7500
C10001A	10000	C20002A	20000	C10003A	10000
C15001A	15000	C30002A	30000	C15003A	15000
				C30003A	30000
				C45003A	45000

1. (*) Available with optional input voltages of 117-208-220-230.
2. Models R751B, R1502B and R2253B: optional input voltages of 208-220-230-440-460.
3. Balance of models have optional input voltages of 208-220-230-440-460 3ϕ.
4. All "R" designated models may be ordered as cabinet models by replacing the letter "R" with the letter "C."



INVERTRON Plug-in Oscillators (1ϕ, 2ϕ, and 3ϕ)

TYPE	FREQUENCY RANGE	FREQ. ACCURACY
External Drive	45-5000 Hz	—
Fixed Frequency	Any single frequency from 45 to 5000 Hz	±1%, ±0.1%, ±0.001%
Continuously Variable	Single Band: 45-75 Hz; 300-500 Hz; 700-900 Hz; 750-850 Hz	±0.1%, ±0.2%, ±0.5%
	Four Band: 45-150 Hz; 150-500 Hz; 450-1500 Hz; 1500-5000 Hz	±1%, ±0.5%

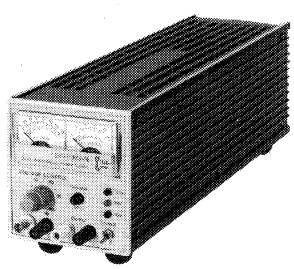


FA201 Power Amplifier

The FA201 is a silicon solid-state power amplifier with 200 VA power capability. This broad-band unit provides full power output from 45 to 20,000 Hz. A wide choice of companion oscillators creates a precise INVERTRON system for any specialized requirement. Units may be combined to provide 2ϕ and 3ϕ operation with 400 VA and 600 VA ratings. The output is electronically protected against short circuits.

QA/QOA Quarter-Rack Power Amplifiers

The quarter-rack QA/QOA is a silicon solid-state 40 VA linear power amplifier available with both fixed and variable-frequency quarter-rack oscillators. Three amplifiers and one oscillator may be combined to provide a versatile 3ϕ power source with 120 VA power capability. Units feature Turn-On Transient Suppression and Amplitude-Disturbance Limiting. Write for detailed specifications.



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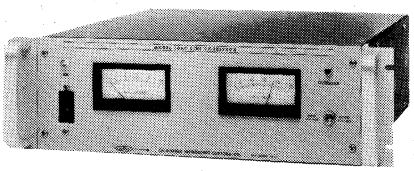
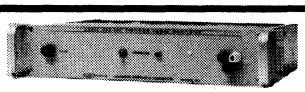


MODEL 1060 DYNAMIC AC LINE CORRECTOR

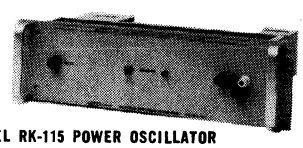
MODEL 1060 DYNAMIC AC LINE CORRECTOR

- Attenuates 10 microsecond AC line transients by 34DB.
- Super-regulation line and load 0.025%.
- Harmonic line distortion reduced 50:1.
- Impulse settling time less than 50 microseconds.
- 100 DB common-mode isolation.
- Peak amplitude instability less than 0.01%.

The **elin** Dynamic AC line Corrector provides power purity and stability by eliminating both line and load high-speed transients and by regulating for varying line and load conditions. All-silicon solid-state. Weighs only 40 pounds. Mounts in 5¼" in 19" rack. Units available in 1 KVA and 3 KVA models for 50, 60 and 400 Hz applications.



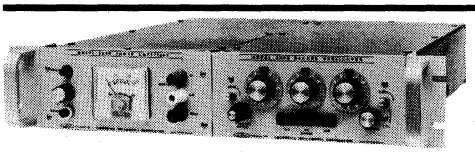
MODEL RK2-102 POWER OSCILLATOR



MODEL RK-115 POWER OSCILLATOR

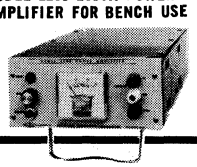
RK SERIES POWER OSCILLATORS

2, 6, 15, 25, 35 and 50 VA outputs. Single voltage and frequency output 10-300 volts, 200-5000 Hz. Line regulation: 0.1%; Load regulation: adjustable to zero with 0.05% resolution. Frequency stability: 0.1%. Total harmonic distortion to 0.1%. Other versions available with multiple output voltages and 2- and 3-phase outputs.



MODEL 2200 POWER AMPLIFIER AND MODEL 2000 DIGITAL OSCILLATOR FOR 19" RACK MOUNT

MODEL 2200 200VA POWER AMPLIFIER FOR BENCH USE

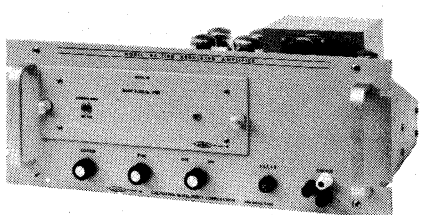


MODEL 2000 DIGITAL OSCILLATOR FOR BENCH USE



MODELS 2200 AND 2500 POWER AMPLIFIERS/FREQUENCY CHANGERS

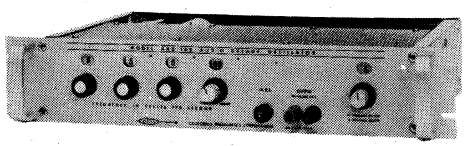
Model 2200 (200VA) and Model 2500 (500 VA) all-silicon solid-state AC Power Amplifiers are the most compact units available. Full power from 105 to 130 volts output. Regulation: 0.02% per volt. Low distortion. Overload, thermal and short-circuit protection. Broad selection of companion plug-in oscillators. 2- and 3-phase combinations ideal for motor drive and many other applications.



MODEL RA-1100 POWER AMPLIFIER

AC POWER AMPLIFIERS/FREQUENCY CHANGERS

Model RA 1100: 100VA output. Frequency response 45-5000 Hz. Front-panel adjustment of output voltage from 0-130 volts. Adds less than 0.25% distortion. Regulation: 0.1%. Versatile selection of plug-in oscillator modules. Also Model 1160A (160VA) and Model 1500 (500VA) AC Power Amplifiers.



MODEL ADO-102 DIGITAL OSCILLATOR

MODEL ADO-102 DIGITAL OSCILLATOR

From 10 Hz to 100 kHz, with direct digital selection and reading of frequency to 1%. Front-panel adjustment of output voltage from 0 to 50 volts. Output power: 2 VA. Frequency stability: 0.5%. Total harmonic distortion: less than 0.1%. Hum, noise and jitter less than —66 db of full output voltage. Remotely programmable versions also available.

CALICO DIVISION

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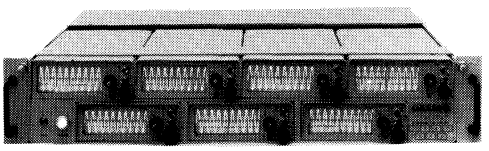
7000 SERIES MONITOR OSCILLOSCOPES

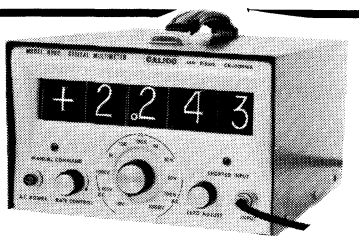
For analog tape recorders or any multichannel monitoring application. Accuracies and linearities equal to laboratory scopes. From one to seven independent, interchangeable plug-in oscilloscope modules in 3½" x 19" Rack Adapter/Power Supply. Bandwidth: DC to 5 mHz within one db. High-intensity 1 x 3" rectangular CRT for large viewing area. Models available with external triggering . . . identical amplifiers for phase comparison . . . common sweeps (slaved to master) . . . medical/biophysical model . . . and 10 mHz version for video monitoring.



MODEL 7000
COMPLETE WITH POWER SUPPLY
AND RACK SLIDES

8000 SERIES DIGITAL MULTIMETERS

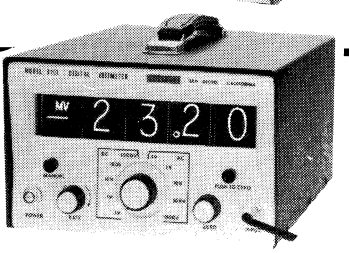
Complete multimeter capability at an economical price. All-electronic, all solid-state. DC volts, AC volts, ohms . . . in one unit. Readout: Large, illuminated 4-digit, with function, overload, range and automatic polarity indication. Resolution: 0.01%. Accuracies: DC—0.05%; AC to 100 kHz—1%; Ohms—0.1%. Display time: 1 sec. to 10 sec. with manual override. Models available with DC volts only . . . AC-DC volts only . . . Ohms only . . . printout capability . . . rack mounting . . . and OEM versions.



MODEL 8000
DIGITAL
MULTIMETER

8100 SERIES LOW-LEVEL DIGITAL MULTIMETERS

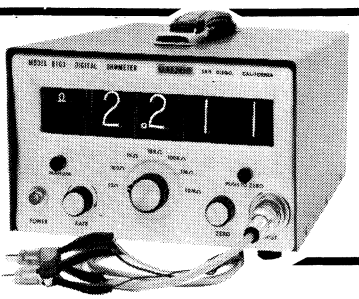
Low-level digital voltmeters, ohmmeters and multimeters. All solid-state, all-electronic. Readout: Large, illuminated 4-digit with function, overload, range and automatic polarity indication. Resolution: to 10 microvolts, 1 milliohm. Accuracies: DC—0.05%; AC—1%; Ohms—0.1%. Models available with DC volts only . . . ohms only . . . printout capability . . . rack mounting . . . and OEM versions.



MODEL 8101
DIGITAL
VOLTMETER

8103 LOW-LEVEL DIGITAL OHMMETERS

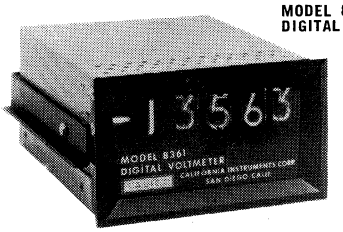
Wide-range, low-level digital ohmmeter 0.001 to 10,000,000 ohms in seven ranges. One milliohm resolution. 0.1% accuracy. Full four-digit illuminated readout with 10% over-range. All-electronic, all solid-state. Includes four-wire input cable with Kelvin clips. Also Model 8113 with only 100 micro-ampere source current, and Model 8103-421 with 100 micro-ohm resolution — 1 ohm full scale through 1 megohm.



MODEL 8103
DIGITAL
OHMMETER

8361/8461 SERIES DIGITAL PANEL METER

The Model 8361 provides a five-digit display including 20% over-range. It is only 2½" H x 3⅝" W x 5" D. Features are: BCD 1-2-4-8 output code, 5 readings per second, programmable decimal, read and hold, non-blinking NIXIE® display, active filter option, 10 megohm input impedance, 100 DB of CMR and automatic polarity. The companion Model 8461 features a four-digit display, including 20% overrange. For OEM applications, cost savings can be realized by omitting metal case and bezel, overrange indication and/or polarity indication.



MODEL 8361/8461
DIGITAL PANEL METER

8300 SERIES DIGITAL MULTIMETERS

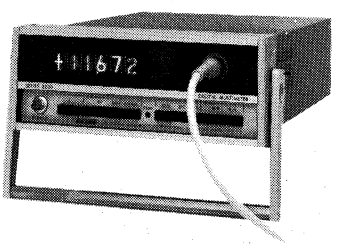
■ SEVEN FUNCTIONS

- Frequency counter
- DC & AC volts
- DC & AC current
- Ohms
- Ratio

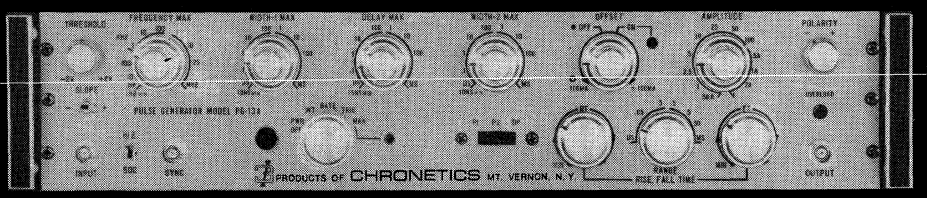
■ FEATURES

- .01% Accuracy
- .01% Resolution
- Guarded input high CMR
- Push button range and function
- Plug-in options

New NIXIE®-readout Series 8300 Digital Multimeters feature compact size, four full digits plus overrange into the fifth digit, readout storage printout, automatic polarity indication, 10 microvolt sensitivity, and damage-proof ohmmeter. The plug-in options allow expansion from a single-range DC voltmeter to a complete multimeter, including printout.



MODEL 8300
DIGITAL MULTIMETERS

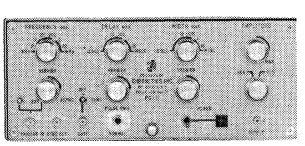


SUMMARY DATA

MODEL	CLOCK PRF	AMPLITUDE[2]	Z OUT	RISE/FALL TIME	WIDTH	DELAY	DUTY CYCLE (MAX)	DC OFFSET
PG-2	1 Hz-10 MHz 20 MHz Max.[1]	10 mV-10V + or −	50 ohms	<10 ns-20 ms[4]	< 35 ns-200 ms	0-200 ms	100%	±5V
PG-11	<10 Hz-> 20 MHz 30 MHz Max.[1]	0-15V + or −	50 ohms	5 ns	25 ns-10 ms	20 ns-10 ms	85%	
PG-13A	1 Hz-25 MHz	100 mV-100V + or −	50 ohms or 1K, min.	<10 ns-50 ms[4]	10 ns-500 ms[5]	15 ns-500 ms	10% @ 2A 50% @ 1A 100% @ < 0.5A	±5V ±100 mA
PG-14	1 Hz-50 MHz	100 mV-20V + or −	50 ohms or 10K, min.	2 ns-50 ms[4]	<5 ns-500 ms	10 ns-500 ms	100%	±5V ±100 mA
PG-31	0.1 Hz-10 MHz 20 MHz Max.[1]	20 mV-20V[3] + and − 2 Channels	50 ohms or 500 ohms	10 ns	< 30 ns-1 sec[5]	50 ns-1 sec	100%	To 10V To 400 mA
PG-32	0.1 Hz-10 MHz 20 MHz Max.[1]	20 mV-20V[3] + and − 2 Channels	50 ohms or 500 ohms	10 ns-1 sec[4]	< 30 ns-1 sec[5]	50 ns-1 sec	100%	To 10V To 400 mA
PG-33	0.1 Hz-10 MHz 20 MHz Max.[1]	10 mV-10V[3] + and − 2 Channels	50 ohms or 500 ohms	5 ns-1 sec[4]	< 30 ns-1 sec[5]	50 ns-1 sec	100%	To 10V To 400 mA
1012[6]	10 Hz-9.99 MHz 20 MHz Max.[1]	0-9.9V[2] + or −	50 ohms	5 ns-9.9 ms	40 ns-9.9 ms	0-9.99 ms	85%	±9.9V

Notes:
1. Effective PRF in double pulse mode
2. Max. Range into 50-ohm loads
3. Separate or combined (bipolar) channels; same polarity on Special Order
4. Variable linearly — 100:1 dynamic range. Separate control of Rise and Fall Times
5. Independent control Pulse 1 / Pulse 2 (double pulse mode)
6. Fully programmable

ADVANCED PULSE GENERATORS



Chronetics' 3-I Pulse Generators represent the most versatile and wide-range instruments in the pulse generator field. Eleven standard models, all solid state, meet most user requirements.

Repetition rates from 0.1 Hz to 100 MHz, output amplitudes from 0 to ±100 volts or ±2A, rise/fall-times of less than 2 ns, wide dynamic ranges, high duty cycles, bipolar outputs, etc. are all available on standard instruments.

3-I Pulse Generators are exceptionally flexible. Most provide single or double pulses of either polarity, single-shot, pulse bursts. Bipolar outputs and current/voltage modes are available. Usually prf, amplitude, risetime and falltime, width, delay and DC-offset are independently and continuously variable.

Price/performance engineering makes 3-I Pulse Generators best buys in the pulser field. Prices begin as low as $375 for the compact, rugged and high-performing PG-11. Sales/Service is on a world-wide basis with more than 45 field offices to respond promptly to any need.

Compare 3-I performance.

CHRONETICS

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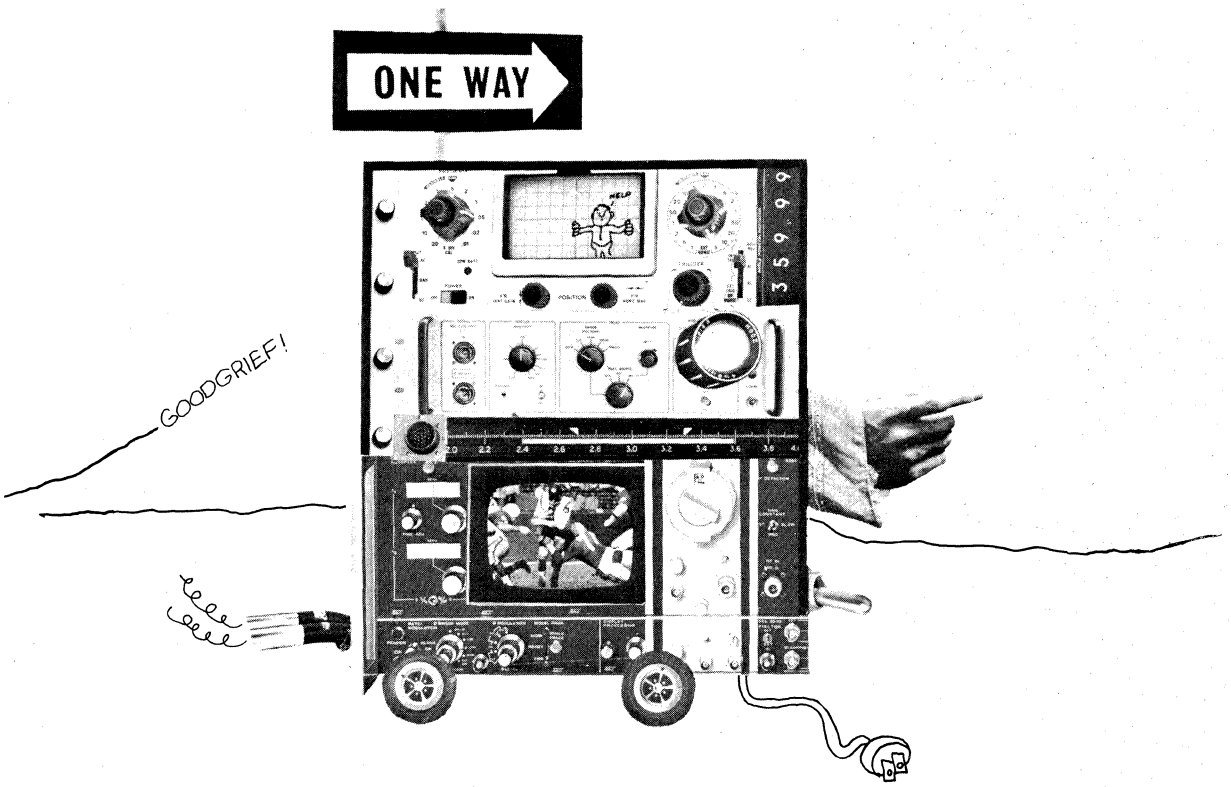
Europe: 39 Rue Rothschild, Geneva, Switzerland (022) 31 81 80 TELEX 22266

Introducing the Continental Oscillodigimicrowavascope!

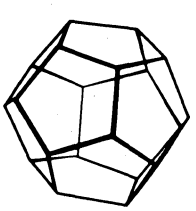


The Continental Oscillodigimicrowavascope is a little incredible. It's our Instrurental. The most sophisticated instrument of all. It can do anything *any* electronic instrument on earth today can do. It will do what instruments *yet* to be invented will do, as soon as they're invented!

But you can't buy a Continental Instrurental. Because this totally capable instrument is really a bold, dynamic Instrument Rental Plan originated by Continental Leasing Company, the largest, most reliable instrument rental organization in the Western World!

The Continental Instrurental is what you want to make it. What you need it to be. Exactly. Different instrument combinations which, as your needs advance, you can exchange quickly for other combinations! All on one rental basis. All without missing a production or r&d stroke.

So don't just hobble along. Check into this dynamic, **lowest cost** Instrument Rental Plan now. Wherever you are, 7 days a week, day or night, call Continental collect on (201) 549-8500.



continental leasing co. inc.

Write for your Instrurental Brochure now!

30 Park Avenue, Arlington, Massachusetts 02174

DM 440 BASIC SPECIFICATIONS

Display	4 full digits plus overrange digit, polarity, range and units. With plug-in card modules — AC volts rms, K ohms, DC millivolts, and DC ratio.
Ranges	DC volts: ±0.001 to 1000. in 3 ranges (±10.000, ±100.00, and ±1000) with 20% overrange. 1000 V maximum input on all ranges.
Ranging	Automatic, manual, and remote, selectable on front panel.
Accuracy	±0.01% of reading ±1 digit.
Stability	Accuracy will remain as specified for not less than 90 days from calibration, over the temperature range of 15°C to 35°C.
Linearity	Within 1 digit at all readings.
Reading Time	100 milliseconds at full scale, 110 milliseconds at 120% of full scale.
Input Impedance	Greater than 10,000 megohms on 10-volt range, full time. 10 megohms on 100-volt and 1000-volt ranges, full time. No impedance variation at any time.
Common Mode Rejection	Infinite at DC; 140 dB at all frequencies up to 1KHz with up to 1K ohm source imbalance in either input lead. Common mode voltage up to 1000 VAC peak.
Operating Temperature	0°C to +55°C.
Power Requirement	115 or 230 V rms, 47-63 Hz (47-440 Hz option available) 55VA.
Normal Mode Rejection	Infinite at 20 Hz and integral harmonics including 60 Hz, 400 Hz, and 1000 Hz.*
Input Isolation from Earth Ground	1000 volts DC or peak AC.
Maximum Safe Input	1000 volts DC or AC rms continuous on 10 VDC, 100 VDC or 1000 VAC ranges.
Automatic Range Change Time	100 milliseconds plus one reading time per range change.
Weight	22 pounds.
Dimensions	6¼" high x 19" long x 8½" wide.

* ASA TEST CONDITIONS

PLUG-IN ACCESSORIES

DC mV ACCESSORY

Input Impedance — 100 megohms (minimum, full time) on all ranges.

Resolution — 1μV/digit on 10mV range, 10μV/digit on 100mV range, 100μV/digit on 1V range.

K OHMS ACCESSORY

Input Ranges — 1K, 10K, 100K, 1,000K, 10,000K (plus 20% overrange).

AC ACCESSORY

Input Impedance — 1 megohm shunted by less than 60 pF on all ranges.

Ranges — 10, 100 & 1,000 Vrms full scale + 20% overrange (600 Vrms maximum input 47 Hz to 100 KHz).

Frequency Response — 47 Hz to 10 KHz ± 0.1%, 10 KHz to 20 KHz ± 0.25%, 20 KHz to 100 KHz ± 1%.

DC RATIO ACCESSORY

OPTIONS

- Remote Range Control • Remote Function Control
- Rear Panel Input Option • 10 Line Print Output
- 8421 Variable Level Outputs • Rack Adapter
- Current Measurement



BEST COMBINATION OF SPECS, PERFORMANCE AND FEATURES FOR YOUR DVM DOLLAR

$995 — BASIC DM 440 DC METER
$1695 — WITH mV, K OHMS, AC AND DC RATIO ACCESSORIES

SPECIAL FEATURES

- **INTERNAL PLUG INS: AC, KILOHMS, RATIO, DC PRE-AMP**
- **20% OVERRANGE ON ALL RANGES AND FUNCTIONS**
- **10 READINGS PER SECOND**
- **EXTREMELY HIGH INPUT IMPEDANCE—FULL TIME**
- **FULL 1,000-VOLT MEASURING CAPABILITY**
- **0°C TO 55°C OPERATING RANGE**
- **INTEGRATED CIRCUITS FOR RELIABILITY**
- **GUARDED INPUT PROVIDES IN EXCESS OF 140 dB CMR AT 1 KILOHM IMBALANCE TO 1 KHz**
- **RUGGED CYCOLAC FRONT AND REAR PANELS**
- **1 Mv RESOLUTION**
- **KELVIN INPUT ON OHMS**
- **10,000 MEGOHN INPUT**

OTHER FEATURES

RUGGED CYCOLAC PANELS — Strong, lightweight. Scratches and mars do not show.

COMBINATION HANDLE/TILT BAR — Standard equipment. Latches positively in place.

EXTRA LARGE NON-SKID FEET — Prevent accidental movement or tipping.

OVERLOAD PROTECTION IN ANY RANGE OF AC AND DC/MV FUNCTIONS — Internal circuit techniques protect functions against short term 1,000 volt overload in any range.

EXTREMELY RAPID RANGE CHANGES — 1 reading time plus 100 milliseconds.

RELIABLE, COMPACT ICs — Save space, reduce weight and cost, and insure reliability.

RUGGED PRINTED CIRCUIT BOARDS CONTAIN GOLD PLATED CONTACTS WITH NICKEL UNDERCOATING — Gold to gold contacts with nickel undercoating insures long board life, improve accuracy, reduce non-linearities.

PERIODIC MAINTENANCE ELIMINATED — No mechanical choppers, incandescent lights or other high failure/short life components.

INSTANT INPUT SAMPLE INITIATION — Input voltage is sampled for 50ms. Sample period may be started instantaneously by an external pulse with print option.

AUTOMATIC POLARITY — Both DC and mV functions.

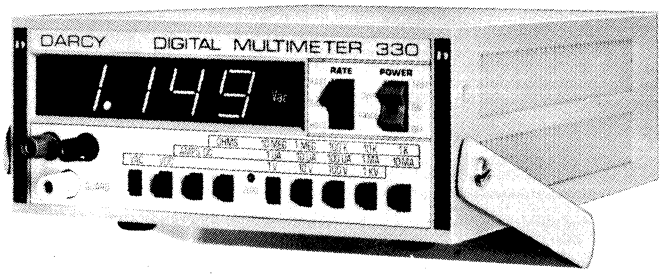
AUTOMATIC RANGE — On DC, AC, Kilohms and mV.

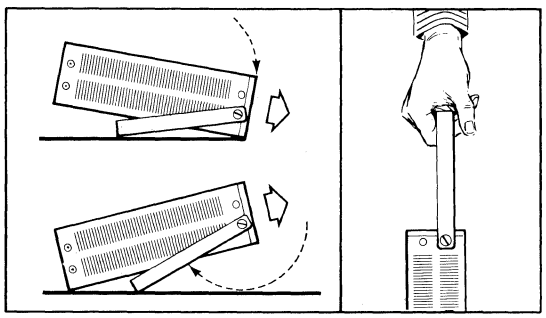
DC PRE-AMP OFFSET ADJUST — Provides compensation to offset thermals in circuit being measured (operational in mV function only).

DARCY INDUSTRIES

"DVMS — JUST FOR GOOD MEASURE"

1723 CLOVERFIELD BLVD. • SANTA MONICA, CALIF. 90404 • Phone (213) EX 3-9611 • TWX (910) 343-6963





HANDY, FUNCTIONAL, HANDLE/TILT BAR — A rugged carrying handle which also functions as a tilt mechanism, allowing the unit to be tilted up or down, is provided as standard equipment.

DM 330 BASIC SPECIFICATIONS

Display: 3 full digits, reads 1500 at full scale. Polarity, range, and units. With AC option — AC volts.

Ranges: DC Volts: ±1 mv/digit to ±1000V full scale. DC input resistance, 10 meg Ω constant. DC current: ±1 na/digit to ±10ma full scale, (Higher ranges optional).

Absolute maximum input current, 25ma on any range, or 30 times range, whichever is less.

AC volts (optional): 50 Hz to 10 KHz with 10 megohm input resistance shunted by 110 pF.

Resistance: 1Ω/digit to 10 megohms, full scale.

Maximum voltage across unknown resistor is 10 v DC at full scale.

CURRENT THROUGH UNKNOWN RESISTOR	RESISTANCE RANGE
1 μa	10 meg
10 μa	1 meg
100 μa	100K
1ma	10K
10ma	1K

Ranging: Pushbutton selected.

Accuracy (all ranges): ±0.1% of reading ±1 digit on DC, KΩ and current functions. 1% ±1 digit on AC Volts.*

Settling Time: .1 sec to within .1% of full scale on DC, KΩ and current functions.

Normal Mode Rejection: Infinite at 60 Hz and multiples thereof.

Common Mode Rejection: >100 dB up to 1 KHz with 1 KΩ source imbalance. >120 dB at DC.

Operating Temperature: 0°C to +55°C.

Power Requirements: 115 or 230 Vrms, (specify at time of order) 47-440 Hz, 15 watts.

Input Isolation From Earth Ground: 500V DC or peak AC.

*Over the temperature range of 15°C to 35°C.

Special Features and Prices

1 nanoamp Current Resolution

Full Multimeter Capability — DC volts, AC volts, DC current, KΩ measurements, all built in.

High Accuracy — ±.1% ±1 digit on DC volts, KΩ and current functions. ±1% ±1 digit on AC volts.

100dB Common Mode Rejection

High Speed Readings — Up to 10 readings/sec.

Brilliant In-Line Display — 25,000 hour life for numerals, decimals and function displays.

Portable — 7½ lbs. ½ rack size (8½" wide x 3⅞" high x 12" long).

Overrange Capability — 3 full digits, reads 1500 at full scale.

DM 330 (with AC volts) **$389**

DD 330 (without AC) **$349**

Expensive DVM Features & Capability At Very Low Cost.

RUGGED CYCOLAC CABINET® — Strong, lightweight, scratches and mars do not show.

EASY TO READ FUNCTIONAL DISPLAY — Automatically positioned decimal point, units display, and automatically selected polarity symbol. Large, easy to read numerals including overrange digit. Front panel test switch checks all segments. Front panel rocker switch selects reading speed from 1 reading/sec to 10 readings/sec.

REAR PANEL POWER CORD WINDUP — Eliminates lost or dragging cords.

UNIQUE CURRENT MEASUREMENT CIRCUIT — Active input circuit provides **sensitivity of 1 na/digit.** Voltage drop is under 10 mv, even at full scale.

RELIABLE ICs AND ULTRA-STABLE ZENER — ICs save space and reduce price. Stability ensured through temperature compensated ultra-stable zener in reference circuit.

OVERLOAD PROTECTION IN ANY RANGE OF AC, DC, AND CURRENT FUNCTIONS — Internal circuit techniques protect against short term 1000 volt overloads.

UNUSUAL ACCURACY AND STABILITY — 0.1% on DC, KΩ and current. 1% on optional AC. All functions retain rated accuracy over temp. range of 15°C to 35°C.

HIGH COMMON MODE AND NORMAL MODE REJECTION — CMR of 100dB from DC to k KHz with 1 KΩ source imbalance. Normal mode rejection is infinite at 60 Hz and multiples thereof.

OPTIONAL AC VOLTS MEASUREMENT BUILT IN — Range of 50 Hz to 10 KHz with accuracy of 1% ±1 digit with a 10 megohm input impedance.

DARCY INDUSTRIES

"DVMS — JUST FOR GOOD MEASURE"

1723 CLOVERFIELD BLVD. • SANTA MONICA, CALIF. 90404 • Phone (213) EX 3-9611 • TWX (910) 343-6963

Curtis ELAPSED TIME INDICATORS

SMALLEST SIZE, LOWEST COST, AC or DC, ANY VOLTAGE

HOW THEY WORK

The Curtis Elapsed Time Meter utilizes the patented Curtis Ampere Hour Meter. This is basically a mercury microcoulometer fabricated from precision bore, glass capillary tubing. Filling the capillary bore are two columns of mercury separated by a small electrolyte gap. Electrodes are inserted into the mercury and are sealed to the glass. Application of pure or pulsed DC signals causes mercury at the anode to be electrochemically transferred across the gap to the cathode at a time rate proportional to the current. Mercury transfer effectively moves the gap along the tube length as a function of the current-time integral. A constant-current supply thus provides a precision timing device.

TYPICAL APPLICATIONS

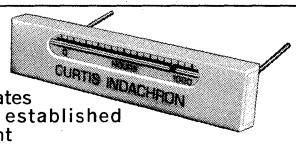
TEST EQUIPMENT UTILIZATION & CALIBRATION—Facilitates calibration based on actual hours of use. Experience has shown savings up to 50% compared to calendar-basis calibration programs. Also provides accurate utilization data on test instruments and other tools and equipment, enabling substantial savings in capital investments.

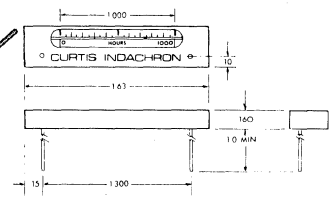
RELIABILITY ENGINEERING—Simple method of determining Mean-Time-To-Failure or sub-system replacement time without costly, unreliable logging.

WARRANTY—Low-cost Curtis meters permit warranty of equipment based on actual usage as well as by calendar period. This affords a definite sales advantage and protects both supplier and buyer. Recommend unit 120 PC.

MODEL L-Series Indachron

Developed for use on OEM equipment as a very low-cost means of validating warranties and for P.M. scheduling. Under $2.00 each in production quantities. AC and DC Models. Various time scales and electrical ratings available. Meters can be mounted on printed circuit cards, or direct to chassis with standard adhesive strips.





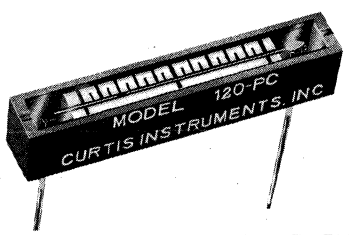
Model 120 L: Operates from DC current established in parent equipment

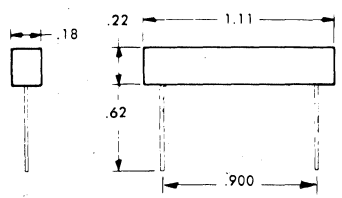
Model 420 L: Operates from any DC voltage

Model 520 L: Operates from 115 VAC

MODEL 120-PC Series

For installation directly on printed circuit cards for "mean-time-to-failure" or preventative maintenance instrumentation. Can be instrumented from available DC voltages for any time scale by use of series resistor. Radial leads spaced for mounting on printed circuit boards. Full scale of .65 inches= 4.16 milliamp-hours.

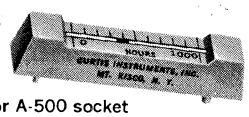


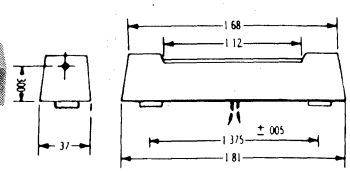


MODEL 150-S Series

Operates directly from DC voltage with calibrating series resistor: full scale of 1 inch = 10.4 milliamp hours. Stud mounting, plug-in, or printed-card configurations available. Fully reversible, no threshold.

150SF two-4/40 inserts
150SS with mounting studs (SF and SS have 8" Teflon leads)
150SP two .080 pins for A-500 socket
150SP-2 Polarized pins for A-501 Socket
150SC Radial leads for direct mtg.

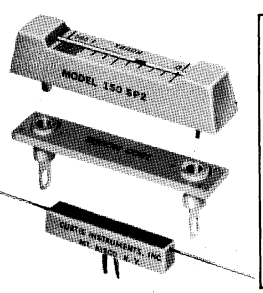


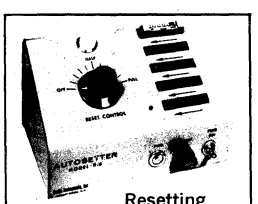


MODEL 500-CP Series

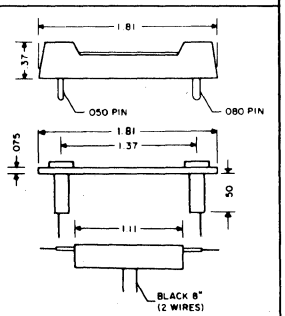
Permits instant replacement of the indicator with rezeroed unit. Available in 500, 600, or 1,000 hour scales. 115 VAC. Any scale, any voltage, can be provided. Model 550-SSR with integral zener regulating circuit also available.

Military Units meeting MIL-I-81219 provide lowest power, lowest weight, smallest size and lowest cost for ground and airborne applications. Write for full data.

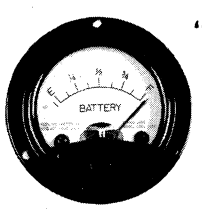




Resetting is accomplished automatically on the Curtis Autosetter.



INFINITE MEMORY INTEGRATORS



BATTERY "FUEL" GAUGES

Meter displays % of discharge (amp-hrs remaining in rechargeable battery systems.) Typical of applications for Curtis 921 Millivolt Integrator.

MILLIVOLT HOUR INTEGRATOR MODEL 921

Printed circuit module using capacitive readout techniques with the Curtis microcoulometer. 0-100 MV input signal provides a 0-100 microampere output analog of the integral. Infinite memory storage, high and low limit detectors, high accuracy, and small size are other significant features. 12 to 36 VDC. 4½" x 4½" overall.

BIPOLAR INTEGRATOR MODEL 922

A portable instrument integrates positive and negative signals to 100 mV. Readout on 4½" taut band meter. Permanently stores recorded integral until reset. Accuracy ±2%; Typical linearity 0.5%. 115 VAC/60 Hz.

Curtis Instruments, Inc. 200 Kisco Avenue Mount Kisco, N. Y. 10549 | (914) 666-2971 TWX 710-571-2163

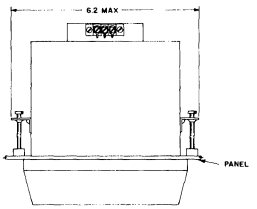
New Digital Panel Meters

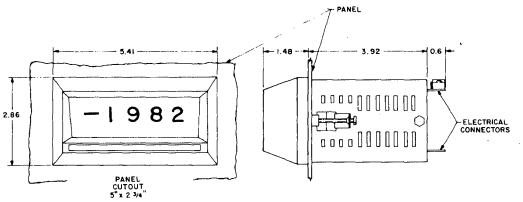


• Low Price • High Performance • New Styling

This new line of DPM's offers features found only in the more expensive models. New integrated circuit techniques are used to give you outstanding performance and reliability while reducing costs.

Write for information on Datascan's full line of Digital Panel Meters — including the new 4-digit model.





MODEL	Uni-polar 510	Auto-polarity 520 *	High Input Impedance Isolated 530
Number of Digits	3½	3½	3½
Full-Scale Reading	999	999	999
Overrange	100%	100%	100%
Accuracy	0.1% ± 1 Digit	0.1% ± 1 Digit	0.1% ± 1 Digit
Stability	0.01%/°C	0.01%/°C	0.01%/°C
Operating Temperature Range	0° to +60°C	0° to +60°C	0° to +60°C
Encode Rate	10/sec.	10/sec.	10/sec.
Input Impedance	1meg ohm/V 10 meg ohm max.	1meg ohm/V 10 meg ohm max. (100 meg ohms optional)	>100 meg ohms
Normal Mode Rejection Ratio	20db @ 60 H_z then 20db/decade	20db @ 60 H_z then 20db/decade	20db @ 60 H_z then 20db/decade
Maximum Common Mode	N. A.	N. A.	500 Vac.
Common Mode Rejection Ratio	N. A.	N. A.	80 db
Display Type	NIXIE type continuous and non-blinking	NIXIE type continuous and non-blinking	NIXIE type continuous and non-blinking
OUTPUTS—Electrical	BCD	BCD	BCD
OVERLOAD PROTECTION	100 times full scale	100 times full scale	100 times full scale
Polarity Indication	minus sign lights when input is reversed	indicates "minus" when input is negative polarity	indicates "minus" when input is negative polarity
Weight	Approx. 2 lbs.	Approx. 2 lbs.	Approx. 2 lbs.
Input Power	115V, 50 to 400H_z, 5W	115V, 50 to 400H_z, 5W	115V, 50 to 400H_z, 5W
Decimal Point Selection	in the display tubes, internally jumpered (can be programmed at rear connector)	in the display tubes, internally jumpered (can be programmed at rear connector)	in the display tubes, internally jumpered (can be programmed at rear connector)
Connector	15-pin double-sided (30 contacts) edge connector	15-pin double-sided (30 contacts) edge connector	15-pin double-sided (30 contacts) edge connector
SIZE	See Outline Drawing	See Outline Drawing	See Outline Drawing
Case	High Impact polystyrene, Black	High Impact polystyrene, Black	High Impact polystyrene, Black
Mounting	Front Loaded	Front Loaded	Front Loaded
Delivery	Stock	Stock	Stock

The new Model 525 provides an accuracy of ± 10% of reading for negative inputs and 0.1% for positive inputs. All other specifications: identical to Model 520.

SPECIALS

a. Special ranges are available — consult Datascan.
b. Case colors, other than black are available in special quantities — call Datascan.
c. Custom Digital Voltmeters tailored electrically and mechanically to your needs for OEM applications (over 100) are available.

MODEL DESIGNATIONS	Range	Suffix No.	Range	Suffix No.	Range	Suffix No.
	100mv	—V1	1μa	—A1	1ma	—A4
	1 V	—V2	10μa	—A2	10ma	—A5
	10 V	—V3	100μa	—A3	100ma	—A6
	100 V	—V4				

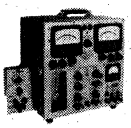
Datascan

DATASCAN, INC.
1111 Paulison Avenue, Clifton, N. J. 07013
Telephone 201-478-2800

PRECISION INSTRUMENTS TO MEASURE

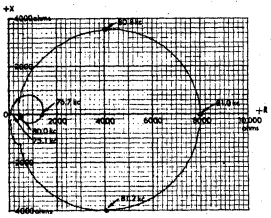
■ IMPEDANCE ■ ADMITTANCE ■ TRANSFER FUNCTION
■ PHASE ANGLE ■ CURRENT ■ QUALITY FACTOR Q
■ REAL AND IMAGINARY POWER

WIDEBAND COMPLEX IMPEDANCE-ADMITTANCE METERS



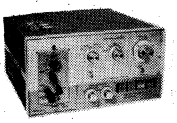
MODEL 100C

Measures R, X, G, B, |Z|, |Y|, $<\theta_x$ and $<\theta_y$ as well as amplitude, phase and real and imaginary components of voltage transfer ratio under CW conditions.



Complex impedance plane locus of piezoelectric ceramic (Plotted on X-Y recorder in 20 seconds)

- **MEASURES**
  - Impedance
  - Admittance
  - Transfer function
  - Power
- **FOR**
  - Transducer calibration
  - Production testing of resistors, capacitors and inductors
  - Filter and other network design and analysis
  - Physiological studies
- **FEATURING**
  - Rapid measurements
  - Direct reading—no bridge balance
  - Wide frequency range—100Hz to 200KHz (Broader on special request)
  - DC Outputs for frequency or complex plane plotting



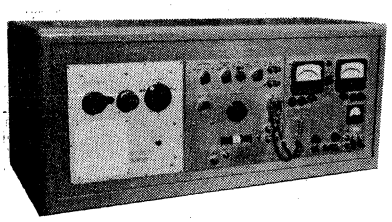
MODEL 202

Measures R, X, G, B, |Z|, |Y|, and real and imaginary components of output to input voltage ratio under pulse conditions.

Standard or special plug-ins and adapters are available for measuring under a wide variety of conditions, including at high and low power, balanced or unbalanced connections, differential admittance, hybrid bridge or comparator circuits, etc. Typical units are described at the right.

TYPICAL ADAPTER CHARACTERISTICS

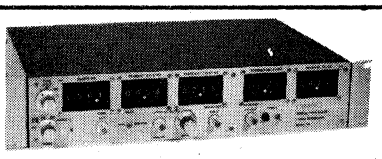
Model	Measures	Ranges
100-PA-1001A	Z or Y	1Ω to 50KΩ; 1μ℧ to 50Kμ℧; 100 to 200,000Hz
100-PA-1002	Y w/one lead at ground	1μ to 5Kμ℧; 100 to 200,000Hz
100-PA-1004	Low Z	0.1Ω to 5KΩ; 100 to 200,000Hz
100-PA-1008	Differential Y	50μ℧ to 500Kμ℧; 100 to 100,000Hz
100-PA-1010A	Z at high input power	1Ω to 10KΩ; 3 to 3000v; 100 to 50,000Hz
100-PA-1011B	Hi V Cap. and Y	up to 0.1mf, 0.1μ℧; 6 to 6000v.
100-PA-1012A	Piezo activity tester	Y; fr; fa; 100kHz to 250kHz
100-PA-1013	Transfer function	Gains of 0.01 to 10,000; 100Hz to 200kHz



DIELECTRIC TEST FACILITY

System S-4

- For rapid laboratory and production testing of ferroelectric and other components — measures capacitance and dissipation at low and high voltage levels as well as f_R and f_A.
- System is complete
- Frequency: 1kHz (or as otherwise specified)
- Applied voltage: 6V to 6 KV rms, up to 1 KVA zero p.f. leading
- Capacitance range: up to 0.1 mfd.
- Loss tangent: up to 100%
- Systems can be tailored to specific requirements

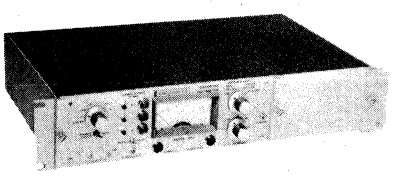


TONE BURST/ TIMING GENERATOR

SERIES 206

A digitally programmable gate generator providing full range independent control of tone burst duration, blanking period, and repetition frequency. Compatible with transmitter / receiver configurations employed with transducer beam pattern, phased array, and transmission media pulse testing systems. Particularly suited for production AC testing.

- Single tone burst or internally/externally controlled gating repetition rate.
- Signal Frequency: 50 Hz to 3 MHz.
- Transmitter/Receiver Gates: 10μ sec. to 1 sec.
- Receiver Delay: 100μ sec. to 10 sec.
- Special circuit design produces zero crossing gating and eliminates switching transients, pedestal, and spurious signal outputs.
- **Remotely Programmable.**



AC SAMPLING VOLTMETER

SERIES 215

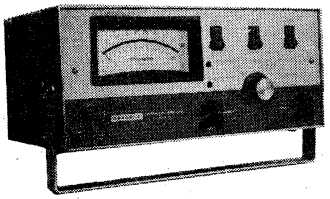
A true average voltage AC Sampling Voltmeter for analysis of complex AC waveforms of single transients, repetitive signals or multiplexed signals. Serves as an excellent high quality gated receiver or production AC testing voltmeter.

- Manual/automatic selection of sampling periods.
- Internally delayed or externally triggered sampling for measurement of any selected portion of signal waveform.
- Excellent noise discrimination during signal measurement.
- Signal Bandwidth: 100 Hz to 1 MHz.
- Sampling rates up to 1000 samples/second.
- Sample and hold D.C. output for DVM or A/D conversion and automatic print-out.

WIDE BAND PHASEMETER

301 Series

Excellent general purpose instruments for electrical or electronics laboratories, or inspection departments and ground support systems.



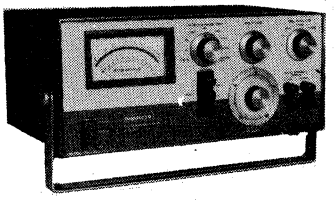
Available in portable or rack mount.

- Completely transistorized
- 5 Hz to 500 Hz
- Input levels: 50 mv to
- 5 Hz to 500 kHz amplitudes, no attenuator controls
- Accuracies to 0.1°
- Square wave output
- DC output available —0 to +3,600 volts corresponding to 0 to 360° —at low impedance

VECTOR IMPEDANCE AMPLITUDE METER

320 Series

An inexpensive instrument for rapid testing of impedance or transfer function.



Available in portable or rack mount.

- Completely transistorized
- Has AC outputs for use by 301 phasemeter to measure phase angle of impedance or transfer function
- 5 Hz to 500 kHz
- Range: 1 ohm to 10 megohms
- Capacitance: 0.1 pfd to 10,000 mfd
- Inductance: 1 microhenry to 100,000 henries
- Self contained oscillator

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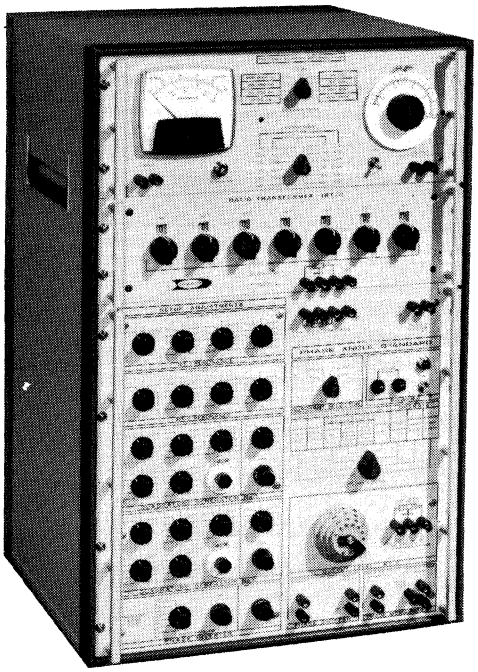
Impedance — Admittance Meters ■ Phase Meters ■ Transfer Function Meters ■ Instrument Transformers ■ Oscillators ■ Complete Instrumentation Systems



DYTRONICS

MODEL 311/RT-1/717 PRIMARY PHASE ANGLE STANDARD

- 0.015° accuracy
- Frequency range 30Hz to 10,000Hz
- Self-calibrating
- Shift or measure phase angle
- Maximum 125 volt output
- 12 microdegrees resolution

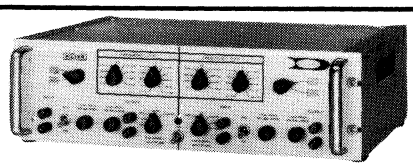
The first authentic Primary Phase Angle Standard for industry.

Dytronics offers an array of instrumentation for the measurement and generation of phase angle. This successful and advanced measurement technique pioneered by Dytronics is recognized as the finest throughout the world. See our catalog for complete information or contact Dytronics Company Inc., 4800 Evanswood Drive, Columbus, Ohio 43224.

See our catalog for a complete list of models and specs

Model Number	Frequency Range	Accuracy	Measure Phase?	Shift Phase?	Coverage 0° to 360° without Ambiguity?
222	20Hz-500kHz	±0.1*	Yes	No	Yes
301	10Hz-30kHz	±2°	Yes	Yes	Yes
311/RT-1/717	30Hz-10kHz	±0.015°*	Yes	Yes	Yes
312	4kHz-500kHz	±0.02°*	Yes	Yes	Yes
341	400Hz	±0.1°	Yes	Yes	Yes
400K	400Hz	±0.05°	No	Yes	No
410	0.1Hz-130kHz	±0.15°*	No	Yes	Yes
445	100Hz-50kHz	±5°	No	Yes	Yes

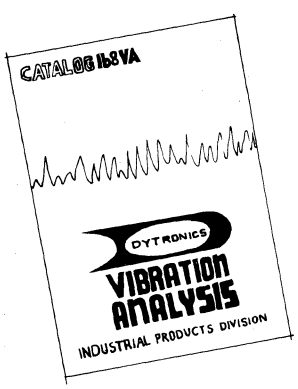
*Value applies to major part of frequency range. Accuracy slightly lower at frequency extremities.



VARIABLE FREQUENCY FILTERS

Dytronics Tunable Electronic Filters covering the frequency range from d-c to the lower radio frequencies. Within this range there is a filter to meet every requirement. See our catalog for more complete information.

Model Number	Tuning Range	Description
718	3kHz-400kHz	Narrow-band tunable filter
719	0.1Hz-1kHz	Ultra low-frequency band-pass filter
720	1Hz-10kHz	Low-frequency band-pass filter
721	1Hz-100kHz	Digital-data filter
723	1Hz-100kHz	Multiple characteristic filter
730	0.1Hz-10kHz	Notch filter



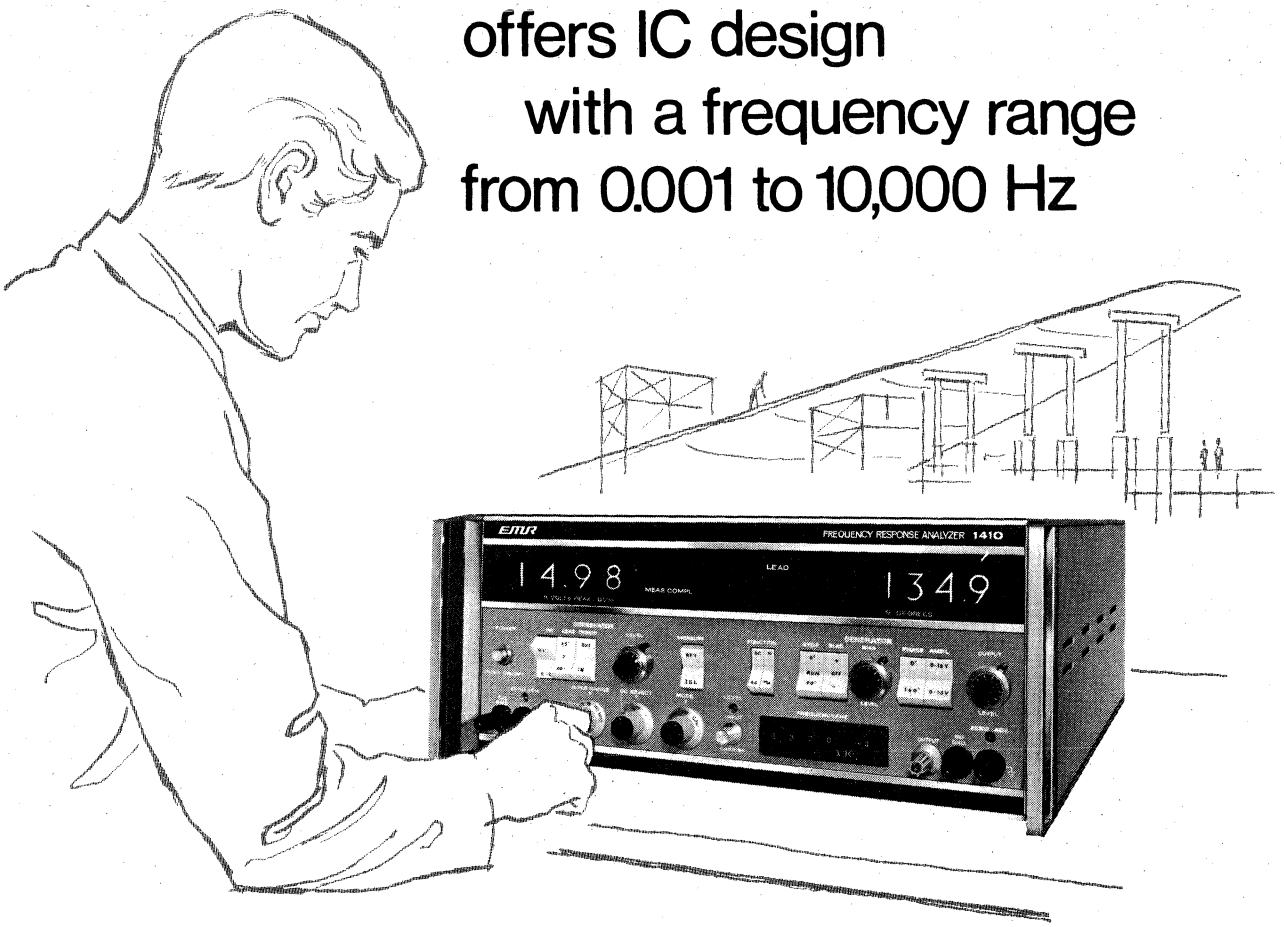
CATALOGS AVAILABLE

Instrument Division
Write today for our catalog listing additional specifications and models of phase angle, filters, sensitive voltmeters, telemetry calibrators, impedance comparators and many others.

Industrial Division
Solve vibration problems by using Dytronics vibration analyzers. Write for our catalog.

DYTRONICS COMPANY, INC.
4800 Evanswood Drive
Columbus, Ohio 43229

Only one Frequency Response Analyzer offers IC design with a frequency range from 0.001 to 10,000 Hz



It's The EMR Model 1410. ● Frequency range: 0.001 Hz - 10 kHz ● Accuracy: phase ±½°, amplitude ±1% of reading or 0.35% F.S. ● Rejection: 40 db harmonic and noise ● Digital readout of phase and amplitude ● Optional plug-in modules ● Compact 7" x 19" x 18" size.

Now for the first time, all the essentials you need for dynamic analysis of DC and AC control systems have been combined in one easy-to-use instrument. Integrated circuitry and exceptional versatility put the Model 1410 miles ahead of any other frequency response analyzer. Gain and phase characteristics are displayed in digital form for direct Bode plotting. Advanced design even includes a built-in DVM which may be used independently. Optional extras offer such additional features as computer interfacing, remote programming and print out, and auto ranging. EMR Model 1410 is ideal for monitoring process variables or assessing the performance of any feedback control system. Write or call today for Bulletin 1400; EMR-Hatboro, Hatboro, Pennsylvania 19040, (215) 672-1240.

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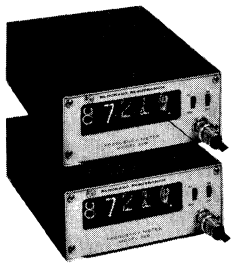
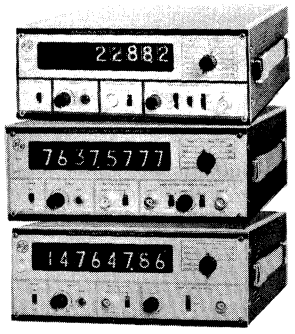


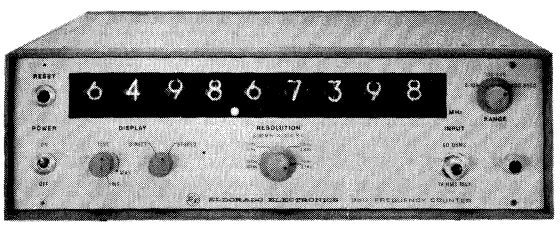
200 Series
Crystal Time Base
Display Storage
Panel Mount
100 kHz: 4 digit $325
15 MHz: 5 digit $395
1 μs Time Interval: $395

1600 Series
Counter/Timers
with Display Storage
25 MHz: 5 digit $ 550
25 MHz: 7 digit $ 650
200 MHz: 6 digit $1,050
200 MHz: 8 digit $1,250
500 MHz: 8 digit $1,650



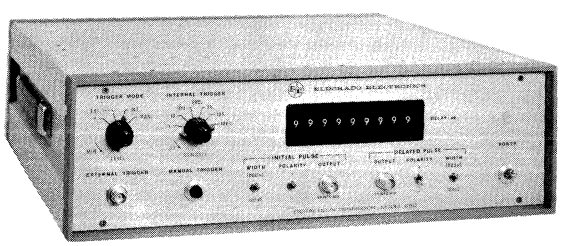
1400 Series
Universal Counter/Timers
15 MHz $ 950
Preset $1,050
150 MHz $1,450
500 MHz $1,825

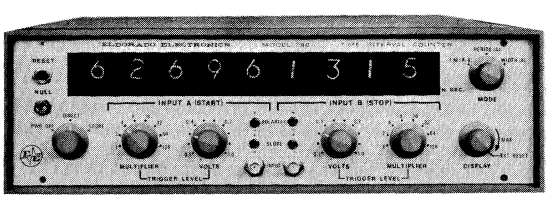




900 Series
Microwave Frequency Counters
Fast Sample, Optional Offsets
Remote Programming
6.5 GHz: 7 digit $4,250

600 Series
Digital Delay Generator
Remote Programming
500 kHz Rep Rate
10ns Steps $3,500
1ns Steps $4,500





700 Series
Time Interval Counter
Full Input Conditioning
TIM, Period, Width,
Rise Time
1ns $6,500
10ns $1,750

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E-H RESEARCH LABORATORIES, INC.

pulse generators and accessories

Model	Feature	Clock	Amplitude	Risetime	Width	Delay	Duty Factor	Price
120E	fast clean waveform at high rep rates	100 Hz to 20 MHz	dual pulses −70mV to −20mV	<1.2 ns at 10V <1.5 ns at 20V	10 ns to 100 ns	fixed 100 ns	10% max	$1675
122	rep rates to 200 MHz tr <1.0 ns	1 kHz to 200 MHz	±150 mV to 5V	<1.0 ns at 5V	2 ns to 100μs	2 ns to 100μs	>40%	$2875
123A	1A into 50Ω at 50% duty factor	1 kHz to 20 MHz	±200mV to 50V	<7.0 ns	20 ns to 300μs	50 ns to 100μs	>50%	$1775
125A	clean 300 ps rise-time at 1 MHz	10 Hz to 1 MHz	−10V fixed	<200 ps	<1 ns to 100μs	30 ns to 100μs	10% max	$2275
127	burst mode from trigger input	10 Hz to 50 MHz	±160mV to 20V	<2.5 ns at 20V	10 ns to 10 ms	±10 ns to ±10 ms	>60%	$2615
131	1A into 50Ω at low cost	10 Hz to 100 kHz	±100mV to 50V	<10 ns	100 ns to 500μs	−1μs to +1 ms	10% at 50V 20% at 25V	$ 575
132A	1A into 50Ω at 3.5 MHz	5 Hz to 3.5 MHz	±400mV to 50V	<12 ns to 100 ns	100 ns to 10 ms	100 ns to 10 ms	25% at 50V 50% at 25V	$ 715
133A	1A into 50Ω variable linear ramp	1 kHz to 5 MHz	±200mV to 50V	<10 ns to 10μs	50 ns to 300μs	75 ns to 100μs	>50%	$2275
139B	versatile 10V ramp at 50 MHz rates	10 Hz to 50 MHz	±30mV to 10V	6 ns to 3 ms	10 ns to 10 ms	10 ns to 10 ms	>50%	$1275
1121/1421	50V at 2 ns, ±5V offset remote programming opt.	1 kHz to 1 MHz	±500mV to 50V	<2.0 ns at 50V	10 ns to 1μs max	10 ns to 1μs	10% max	$3875
1139/1420	all pulse parameters programmable	1 kHz to 10 MHz	±3 to ±10V	5 ns to 13.3μs	10 ns to 10μs	10 ns to 10μs	50%	$7300
129*	Ultra high rep rate up to 50% DC offset	10 kHz to 500 MHz	±.2V ±2V	500 ps	1 ns to 100 ns	—	50%	—
134*	100V amplitude at high rep rates	up to 5 MHz	up to ±100V	12 ns	—	—	—	—
137	Variable ramps at high rep rates, up to 50% DC offset	10 Hz to 100 MHz	±125mV ±5V	Variable, 2 ns to 160 ms	5 ns 1 ms	5 ns to 1 ms	50%	$1950

*preliminary data, products to be introduced April 1969.

microwave swept oscillators

amplifiers □ components □ accessories

The E-H 570 series covers the full microwave spectrum from 1 GHz-40 GHz with models 571-577.



The new EH-570 Series—the sweeper that meets or exceeds specifications over its entire frequency band—at all power levels. Features: highest leveled output power □ lowest residual and incidental FM □ highest stability and accuracy □ 5 programmable frequencies with digital readout □ remote frequency programmability with 100 kHz bandwidth □ 5¼" height; lighter weight.

E-H RESEARCH LABORATORIES, INC.

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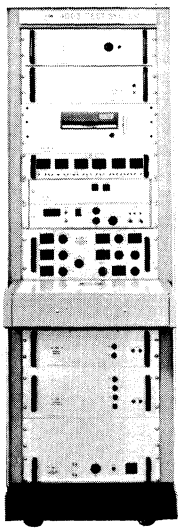
In Europe: E-H Research Laboratories (Ned) N.V., Box 1018, Eindhoven, The Netherlands, Telex 51116
In Japan: Iwatsu Electric Company, Limited, No. 710, 2-Chome Kugayama Suginami-Ku, Tokyo, Japan

All prices F.O.B. Oakland, Calif. All prices and technical information subject to change without notice.

component test systems

dynamic semiconductor test systems



The E-H 4000 series systems for automatic pulse and functional testing of integrated circuits and other components range from simple, punched card programmed systems to complex computer control array testers.

Single-Shot measurements of time and voltage in the μsec to sub ns area.

Wide signal dynamic range and equivalent bandwidth.

Signal detection at the test fixture.

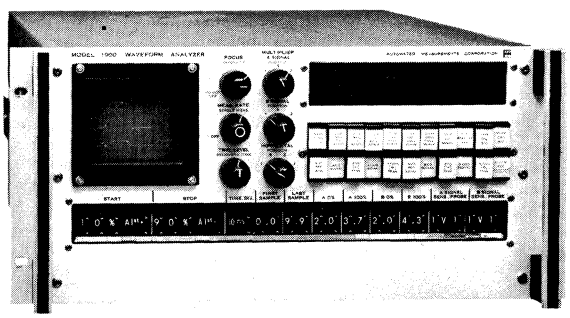
Fast rise programmable pulse generators.

All measurement results available in recordable form.

from AUTOMATED MEASUREMENTS CORPORATION, a subsidiary of E-H Research Laboratories, Inc.:

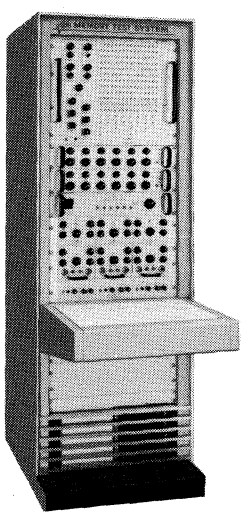
Programmable (ASC II) wave form analyzers, control units, comparators, power supplies.

AMC 9000 series printed circuit card tester.



AMC Model 1000 wave form analyzer, 10 remote sampling channels, digital readout and limits comparison.

memory test systems



E-H has a full range of memory element testers:

Model 8100 programmed current generator for high speed drives.

Model 8305 programmed wire element test station.

Models 8321-8350 automatic core test systems for high throughput multiplex operation of models 8803 dual core handler systems, up to 36 cores/second.

Series 8500 and 8600 computer control analyzers systems for production test and diagnostic routines on planes, stacks and wire elements.

Programmable systems elements; series 1623, 10 channel, up to 25 MHz word generators.

Models 1030-1033 high speed current drivers. Model 153 Strobed Volt Meter.

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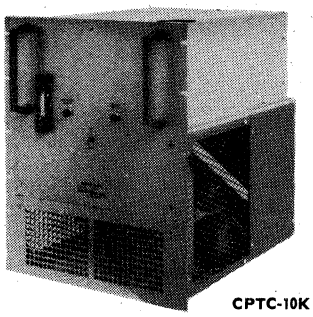
DUMMY LOADS

Electro IMPULSE, INC.

CPTC SERIES



CPTC-10K

- 5,000 to 100,000 watts average power
- Frequency range to 10 GHz
- Completely self-contained, requiring only a power line connection
- Nominal input impedance is 50 ohms — other available.

These units are fully self-contained, incorporating an oil-filled termination, an oil to air heat exchanger and circulating system.

Pressure, flow and temperature interlocks insure complete protection for both transmitter and termination.**

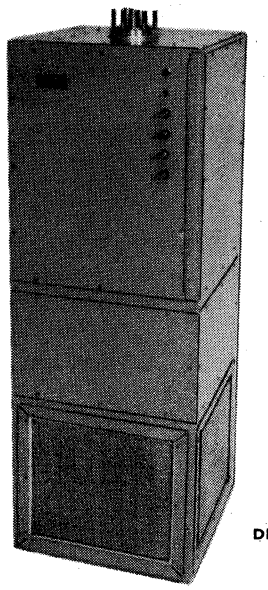
Although 50 ohms is the standard input impedance for this series, impedances of 72, 300 or 600 ohms can be supplied. Please specify all requirements when ordering.

**On most units.

Model	*Frequency Range MHz	Suggested Connector Choice Available	Total Average Power Watts	VSWR Maximum
CPTC-5K	DC-1000	1⅝	5,000	1.15
CPTC-10K	DC-1000	3⅛	10,000	1.15
CPTC-20K	DC-1000	3⅛	20,000	1.15
CPTC-30K	DC-1000	3⅛	30,000	1.15
CPTC-50K	DC-1000	6⅛	50,000	1.15
CPTC-100K	DC-1000	6⅛	100,000	1.15

*Ranges to 10 GHz can be supplied.

DPTC SERIES



DPTC-25K

Model*	Average Power	VSWR	Input Power 60 cps	Input Power 50/60 cps**
DPTC-10K	10,000	1.1	115v ¼ HP 1 Phase	220v ¼ HP 1 Phase
DPTC-25K	25,000	1.15	115/230v ½ HP 1 Phase	220v ½ HP 1 Phase
DPTC-50K	50,000	1.2	208/230v ½ HP 1 or 3 Phase	208/230v ½ HP 1 or 3 Phase
DPTC-100K	100,000	1.2	208/230v 2 HP 3 Phase	208/230V 2 HP 3 Phase

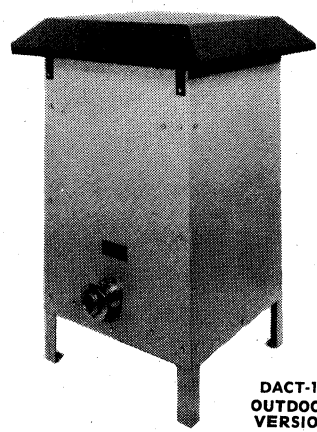
*For Duct Load change prefix to DDL.
**De-rate Power Handling Capacity by 20% at 50 cps.

HIGHEST PULSE CAPACITY IN THE INDUSTRY!
UP TO 100,000 WATTS!
DC-32 MHz

Dry forced air cooling offers the most economical way to terminate this high power. Ducted models can be arranged to use outside air and duct heat out of the immediate area.

DACT SERIES

UNIQUE 25-MONTH WARRANTY!



DACT-14 OUTDOOR VERSION

ABSOLUTELY NO MAINTENANCE!

NO POWER REQUIREMENT!

Power Ratings Available:
3,000, 5,000, 10,000, 15,000 20,000 watts.

VSWR:
1.1:1.

Frequency Range:
Standard to 30 MHz — Models available to 55 MHz.

Impedance:
50 ohms standard. 72, 300, 600 ohms available.

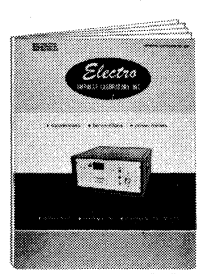
Maximum Ambient Temperature:
52°C. No minimum!

Mounting Orientation:
Non-critical.

UNITS MAY BE PULSED

WRITE FOR CATALOG #684
FOR OTHER ELECTRO IMPULSE PRODUCTS

- CALORIMETERS
- ATTENUATORS
- POWER METERS
- COOLING UNITS
- THERMOELECTRIC PROBE
- WAVEGUIDE LOADS
- COMPLETE LINE OF TERMINATIONS



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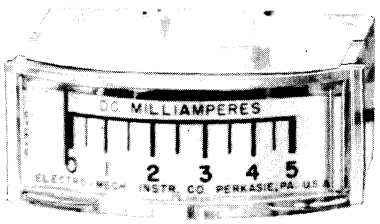
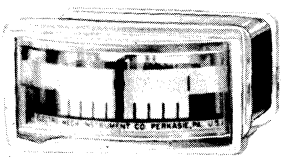
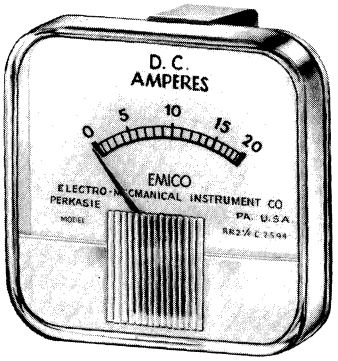


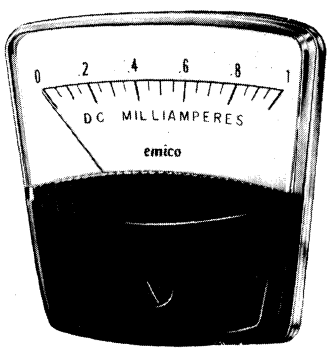
EDGE READING METER
Model 13
1 3/16" x 3/4"



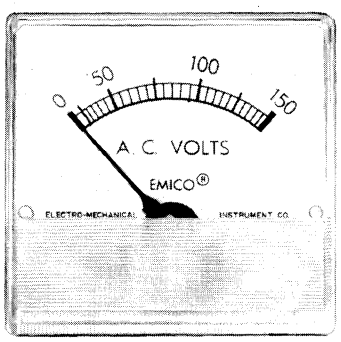
EDGE READING METER
Model 12 1¼" x 5/16"



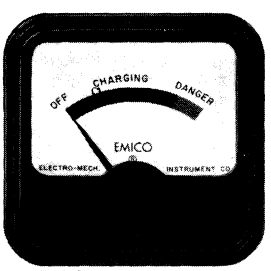
PLASTIC BEZEL METER
Model 42 2 5/16" square



STARLINE METER
Model 32
approx. 3" square



PLASTIC BEZEL METER
Model 52 approx. 2 3/8" square

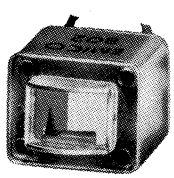


METAL BEZEL METER
Model 72 2¼" square

MICRO-MINIATURE CIRCUIT INDICATORS



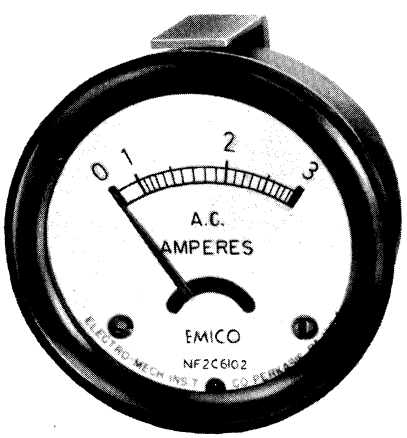
For monitoring on-off conditions, malfunctions, or battery charge conditions, select either Model 802P (pointer-type) or 802F (flag-type) indicator. Rugged, dependable, extremely low-cost. Available with either wire leads or plug-in jacks for easy installation. For technical details, request Bulletin R12-A.



Model 202F approx. ½" square

Model 802P approx. ½" square

EMICO designs and engineers meters to your exact requirements, including any custom dial face, with special scale, trademark, name or colors. Send details or drawings for prompt quotation.



METAL BEZEL METER
Model 73
2¼" diameter

Phone: (215) 257-6561 TWX: 510-661-5170

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a wholly-owned subsidiary of THE LEECE-NEVILLE CO.

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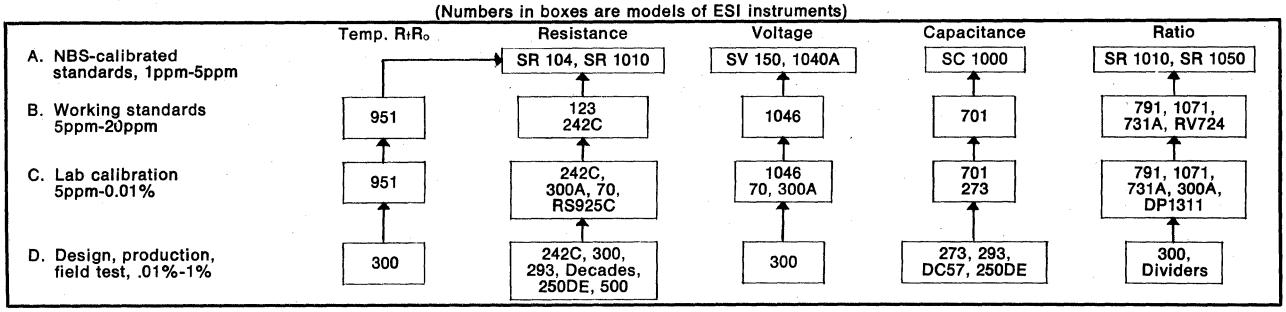
ESI produces a comprehensive line of instruments, standards and system components for the precise measurement of resistance, voltage, capacitance, inductance and ac/dc ratio. The full spectrum of critical application is covered: standards and laboratory calibration, design work, production and field test.

All calibrations on ESI instruments are traceable to the National Bureau of Standards through ESI transportable reference standards. These standards are test reported by NBS and maintained by ESI. They form the base from which our professional grade instruments derive their warranted accuracy.

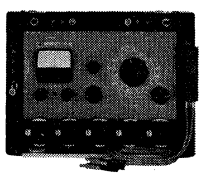
For more complete information than given here, please request our comprehensive metrology catalog.

ESI TRACEABILITY—APPLICATION CHART

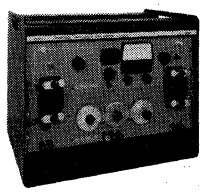
(Numbers in boxes are models of ESI instruments)



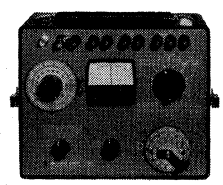
MULTI-PURPOSE INSTRUMENTS



300 PVB® Potentiometric Voltmeter Bridge. Portable, battery-operated DC measuring at 0.02% accuracy or 0.01% in the 300A. Functions in several ranges each as voltmeter, voltage source and ammeter; serves as 4-terminal Kelvin bridge, ratiometer and null detector. Accessories provide resistor sorting, AC voltage, high voltage, pH and temperature measurements.



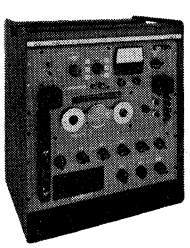
293 Universal Impedance Measuring System. Measures resistance and conductance (0.05% accuracy), inductance and capacitance (0.1%) in five figures of direct, in-line readout, plus D or Q. Sensitivity of 5 microvolts; variable output generator.



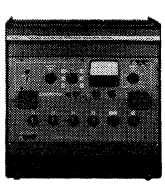
250 DE Portable Impedance Bridge. Measures R, C, L at 0.1%, 0.2% and 0.3%. Includes solid-state AC-DC detector and generator; operates on four 1.5V D batteries. Provision for external bias, range extension.

MODEL	DESCRIPTION	RANGE	NOMINAL ACCURACY	PRICE
300	Measuring E, I, R and ratio (battery)	0-511 V, 0-5.11 A, 0-511 MΩ	0.02%	$ 975.
300A	(same)	(same)	0.01%	1045.
250DE	Measures R, C, L battery operated (line operation and rack mount opt.)	0-12 MΩ 0-1200 μF 0-1200 H	0.1% 0.2% 0.2%	550.
293	Universal bridge for R, G, C, L AC/DC gen.-det. (Bridge alone—$600)	0-1.2 MΩ 0-1200 mmho 0-1200 μF 0-1200 H	0.05% 0.05% 0.1% 0.1%	1200.

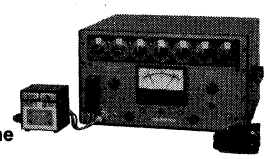
RESISTANCE MEASUREMENTS



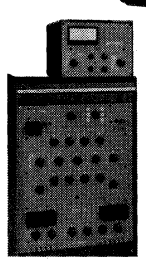
242C Resistance Measuring System. Most versatile system at 10 ppm direct readout accuracy. Four-terminal comparisons to 1 ppm, with 0.1-ppm resolution. Matched generator-detector with complete guarding and shielding provides easy operation over wide range (10 microhms - 120 megohms). Data logging available, as is less accurate, less expensive Model 242B.



231C Guarded Wheatstone System. Direct-reading accuracy of 0.01%. Range 10 milliohms to 12 gigohms with high resolution. Completely guarded internally; Model 801 Generator-Detector provides variable generator output 0 to 600V, detector ranges of 1000 volts to 3 microvolts. Lower range, less expensive 232A System also available.



500 Automated Resistance Deviation Bridge. High volume resistor sorter and tester with 0.01% accuracy or better; ranges from under 1 ohm to over 100 megohms. Available in variety of systems from semi-automated to completely automatic with temperature coefficient readout.



123 Resistance Comparison System. For absolute ratio comparison of resistance standards to 0.2 ppm direct reading. Wide range to 10 megohms. Wenner balance ensures traceability, stability. Includes Model 900 Nanovolt Galvanometer.

MODEL	DESCRIPTION	FULL SCALE RANGES	NOMINAL ACCURACY	PRICE
500	Auto Kelvin bridge and sorting fixture	1111 Ω to 11 MΩ (1 mΩ steps)	0.01%	$2850.
242B	Kelvin bridge, gen.-det. and decade standard	0.1 mΩ-120 MΩ (1 μΩ resolution)	50 ppm	3900.
242C	(same)	(same)	10 ppm	5500.
240	Kelvin comparison bridge, 5 ratio ranges	1 ppm resolution	10-30 ppm	1050.
240C	(same, except trimmable)	0.1 ppm resolution	2 ppm	1600.
231C	Wheatstone bridge, guarded gen.-det.	1.2 Ω -12 GΩ	0.01%	2300.
232A	Wheatstone bridge, gen.-det.	1.2 Ω -12 GΩ	0.01%	1500.
123	Double ratio set, nanovolt detector	1:1, 10:1 ratios	0.2 ppm	7600.
122	Direct-reading double ratio set	1:1, 10:1 ratios	0.2 ppm	4700.

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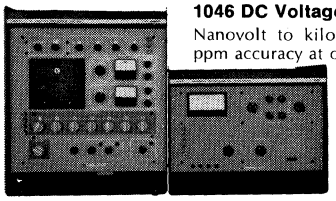
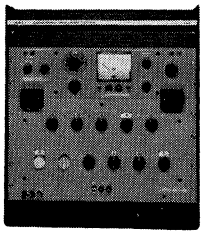
esi® Precision Instruments

VOLTAGE MEASUREMENT



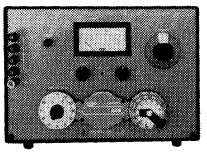
1046 DC Voltage Measurement System. Nanovolt to kilovolt with one system; 5 ppm accuracy at one volt, 0.5% at 1 microvolt; nanovolt sensitivity and resolution; standard cell comparison to 0.005 ppm. Includes both Models 1045A1 and 945.

CAPACITANCE MEASUREMENT



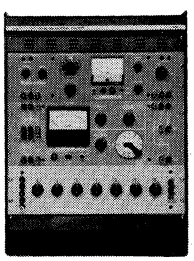
701 Capacitance Measuring System. Two and three-terminal capacitors measured from 0 to 1.2 microfarads with 0.01% accuracy. Resolution of 1 ppm and continuous tuning from 20 cycles to 20 Kc.

273 Capacitance Bridge. Compact, wide-range bridge with matched generator and sensitive detector gives 0.1% accuracy. Features nine ranges to 12,000 microfarads; 2, 3 or 4 terminal connections; complete shielding; checks C and D in seconds.

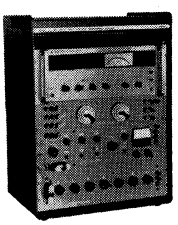


MODEL	DESCRIPTION	FULL SCALE RANGES	NOMINAL ACCURACY	PRICE
1046	Precision DC voltage system, 7 dial	1 nV-1111 V (1 nV steps)	5 ppm	**$8500.**
1045A1	Potentiometric DC voltmeter, two internal detectors	11 V-1111 V (1 μV steps)	5 ppm	**4850.**
945	Nanovolt potentiometer with galvanometer	1 nV-1 V (1 nV resolution)	ext. ref. source	**3650.**
1040A	Guarded absolute voltbox	1:1, 1:10, 1:100 ratios	1-4 ppm	**1100.**
701	Capacitance measuring system, gen.-det.	12 pF-1200 nF (0.0001 pF resolution)	0.01%	**2450.**
273	Capacitance bridge, 4-terminal, gen.-det.	120 pF-12,000 μF (0.01 pF resolution)	0.1%	**900.**

RATIO MEASUREMENT

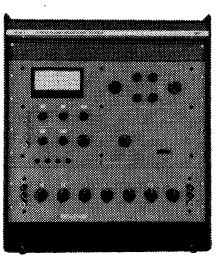


791/1071AC Ratio Calibration Systems. Calibrate AC ratio transformers and resistive decade voltage dividers; compare standard capacitors and inductors; provide 0.5 ppm linearity, traceable to NBS. 791 also determines residual reactances.



731A DC Ratio and Voltage Calibration System. 7-decade lab standard voltage divider, plus guarded absolute ratio voltbox with built-in, self-calibration.

TEMP. R_t/R_o MEASUREMENT

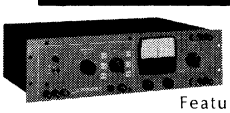


951 Temperature Measuring System. 10 ppm measurement of thermometer/ice-point resistance ratio. Features direct readout of R_t/R_o or resistance; 2 nanovolt sensitivity. Combines Mueller bridge and potentiometric methods of temperature measurement.

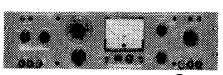
MODEL	DESCRIPTION	RANGE	NOMINAL ACCURACY	PRICE
†*731A	DC ratio and voltage calibration (less power supply)	7-dial K-V divider (0.1 ppm/step)	1-10 ppm	**$2700.**
791	AC ratio measuring system, gen.-det.	7-dial transformer (0.1 ppm/step)	0.5-5 ppm	**2750.**
†*1071	AC ratio measuring system, gen.-det.	7-dial transformer (0.1 ppm/step)	0.5-5 ppm	**2000.**
951	Temp. meas., R_t/R_o	0-1111 Ω	10 ppm	**6150.**

*Special order †Certified report of calibration supplied

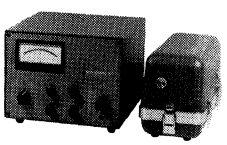
GENERATORS-DETECTORS



801 DC Generator-Detector. Features solid state construction with complete guarding and shielding; 3-microvolt full-scale sensitivity; power-limited output to 1 watt; 600 volts maximum.



861A AC Generator-Detector. Gang-tuned 20 hertz to 20 kilohertz, variable; 1-microvolt sensitivity, very low noise; variable generator output, power-limited.



900 Nanovolt Galvanometer. Precision nullmeter for low-level signal measurement. Wide range: 10 nanovolts to 3 millivolts. No critical adjustments: Operates from any source resistance. Two nanovolt sensitivity with 2% accuracy end scale, all ranges.

MODEL	DESCRIPTION	GEN. OUTPUT	DETECTOR SENS.	INPUT R.	PRICE
801	DC generator-detector 3 μV-1000 V end scale	0-600 V	0.1 μV	100 k-100 MΩ	**$1250.**
803A	DC generator-detector	0-200 V	5 μV	500 kΩ	**475.**
830	DC generator, guarded and isolated	0-200 V	———	———	**550.**
861A	AC generator-detector, variable freq.	0-200 V, 20 Hz-20 kHz	0.25 μV	1 MΩ	**850.**
865	AC/DC generator-detector	0-6 V	5 μV	10 MΩ	**575.**
900	Nanovolt galvanometer, 10 nV-3 mV 2nd scale (recorder output opt.)	———	2 nV	1000 Ω	**2175.**

AUTOMATED MEASUREMENT

Since 1963 ESI has pioneered in bringing automation to precision measurement, ranging from data acquisition and computer processing to physical handling. Complete data logging, interfacing and computer programming is now available with all major calibration systems.

Our Model 70 Programmable Meter Calibrator is an integrated system for large calibration labs, which cuts manpower requirements to one-tenth what is needed for normal flow of common meters.

In the field of measuring precision resistors ESI has developed extensive capabilities in automation and speed, while maintaining accuracy and traceability. Our Model 500 series of resistor testers offer GO-NO-GO systems which virtually eliminate operator error while providing 0.01% accuracy on precision resistors at a fraction of a second per measurement. Systems using the 500 series also can provide temperature coefficient readouts automatically for large batches of resistors or can precisely control resistor manufacturing process. Your inquiries and custom requirements are invited.

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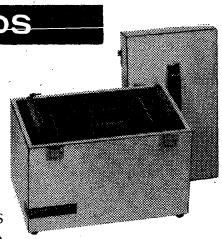
esi® Standards, Calibration and System Components

STANDARDS



SR 104 Transportable Resistance Standard.

Calibration to 1 ppm is available on this 10-kilohm standard. Unique features include a temperature coefficient of less than 0.2 ppm/°C and stability of 1 ppm/yr.

SR 1010 Resistance Transfer Standard.

Twelve aged premium resistors, shielded, provide transfer measurements from a standard resistor to one of different value; accurate to 1 ppm.



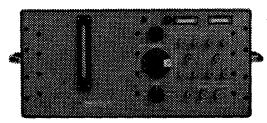
SC 1000 Standard Capacitor.

3-terminal, one nanofarad capacitor for calibrating bridges, capacitors. Stability of 20 ppm/yr. guaranteed.



SV 150 Standard Voltage Cell.

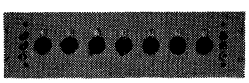
First voltage standard easily transported. Four cells sealed in controlled evironment with integral batteries for maintaining power during shipment. Sealed batteries rarely need servicing and cannot spill



MODEL	DESCRIPTION	VALUE	NOMINAL ACCURACY	PRICE
†SR 104	10k transportable resistance standard	10 kΩ	5 ppm (1 ppm/yr. stability)	$ 600.
SR 1	Standard resistor	.01 Ω	500 ppm	50.
		0.1 Ω	300 ppm	40.
		1, 10, 100Ω; 1, 10, 100 kΩ	50 ppm	35.
		1 MΩ	100 ppm	65.
		10 MΩ	100 ppm	145.
SR 1010	Resistance transfer standard (12 steps)	1, 100 Ω	50 ppm	325.
		1, 10, 100 kΩ (per step)	50 ppm	325.
SR 1010/LTC	Low temperature coefficient model	10 Ω/step	50 ppm	445.
SR 1010/MT	Resistance transfer standard, trimmable	10 kΩ/step	1 ppm	850.
SR 1050	High resistance transfer standard (11 steps)	100 kΩ/step	50 ppm	575.
		1 MΩ/step	50 ppm	675.
		10 MΩ/step	50 ppm	965.
†SC 1000	Standard Capacitor	1 nF	20 ppm	295.
SV 150	Standard cell bank	4 standard cells	———	1650.

†Certified report of calibration supplied

WORKING STANDARDS



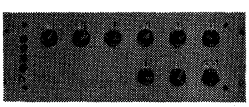
RV 722 DEKAVIDER® Decade Voltage Divider. 7-decade Kelvin-Varley circuit provides 0.5 ppm initial linearity, 0.1 ppm resolution and outstanding performance at low settings. Temp. coefficient of 0.5 ppm/°C.



DT 72A DEKATRAN Decade Transformer Standard. Laboratory voltage divider having 0.1-ppm resolution with 7-dial in-line readout. Over-windings provide additional 0.1 taps. Calibration certificate supplied.



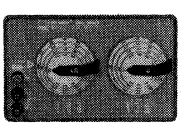
DC 57 DEKAPACITOR® Capacitance Decade. Low-loss, 1% accuracy standard. Four decades and interpolating, variable air capacitor for continuous resolution. Range to 1.111120 microfarads.



RS 925C Resistance Standard. Four-terminal, provides 10 significant figures and accuracy of 0.0005%. Value: 1.2 megohm in 10 milliohm steps. First four decades trimmable. RS 624 is 6-decade, less accurate version.



DB 52 DEKABOX In-line Decade. Resistors used for precision dc and audio frequency. Low temperature, power coefficients; minimal leakage. Six-dial DB 62 also available.



DB 877 DEKABOX® Decade Resistor. Compact design employs two coaxial dials (ESI patent) for 8 full decades to 12 megohms at 0.02% accuracy long term.

MODEL	DESCRIPTION	VALUE	NOMINAL ACCURACY	PRICE
†RV 622A	Resistive divider (Kelvin-Varley), 6 decades	10 kΩ	5 ppm	$ 500.
		100 kΩ	5 ppm	570.
†RV 722	Standard divider (Kelvin-Varley), 7 decades	100 kΩ	1 ppm	995.
†RV 724	Standard divider—7 decades, over ranging	11 kΩ	1 ppm	1400.
†DT 72A	Ratio transformer—7 decade standard	1.1111110	0.5 ppm	650.

MODEL	DESCRIPTION	PER STEP	TOTAL RESISTANCE	NOMINAL ACCURACY	PRICE
*DB 655	6-Decade resistor—tilting bench model	0.1, 1 Ω	120 kΩ, 1.2 MΩ*	0.02%	$ 230.
		10 Ω	12 MΩ*	0.02%	275.
DB 877	8-Decade resistor—tilting bench model	0.1 Ω	12 MΩ	0.02%	295.
DB 52	Decade resistor—5 decades in-line	0.01, 0.1 Ω	1.1111, 11.111 kΩ	0.02%	160.
		1 Ω	111.11 kΩ	0.02%	170.
		10 Ω	1.1111 MΩ	0.02%	190.
		100 Ω	11.111 MΩ	0.02%	260.
DB 62	Decade resistor—6 decades in-line	0.01 Ω	11.1111 kΩ	0.02%	180.
		0.1 Ω	111.111 kΩ	0.02%	190.
		1.0 Ω	1.11111 MΩ	0.02%	210
		10 Ω	11.1111 MΩ	0.02%	290.
*RS 624	6-Decade resistance standard, 2-terminal, rack panel	1.0 Ω	1.2 MΩ	0.01%	795.
RS 925A	9-Decade resistance standard, 4-terminal	100 μΩ	1.2 MΩ	0.005%	1450.
RS 925C	9-Decade standard, trimmable, highest accuracy	100 μΩ	1.2 MΩ	0.0005%	2500.
DC 57	4-Decade capacitor—plus air variable		1.11 μF	1.0%	240.

*Special order †Certified report of calibration supplied

FOR INDIVIDUAL DECADES AND COMPONENTS, SEE ESI PAGE IN PRECISION RESISTOR SECTION #4750

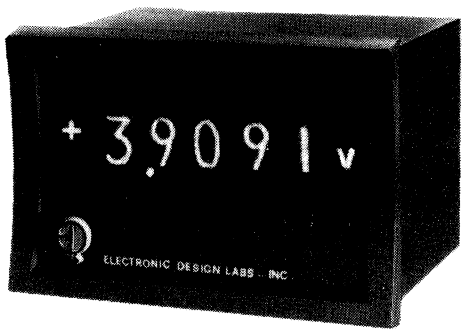
Electro Scientific Industries, 13900 N.W. Science Park Dr., Portland, Oregon 97229

EDL 700

SERIES-DIGITAL MINI PANEL METERS

17 MODELS

MEASURE AC/DC VOLTAGE WITH UP TO 400% OVER RANGE

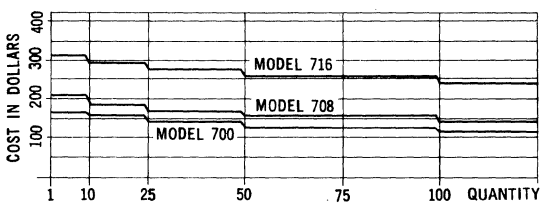


SPECIFICATIONS

V(RMS), V D.C. ACCURACY*	TO CHOOSE FROM 0.2% TO 0.01% ±1 DIGIT, FROM 17 MODELS. OVER A TEMP. RANGE FROM +10°C TO +40°C
V(RMS), V D.C. RESOLUTION*	TO CHOOSE BETWEEN 1mV OR 100UV DEPENDING ON MODEL
V(RMS), V D.C. FULL SCALE*	.0999 TO 3.9999V
V(RMS), V D.C. VOLTAGE RANGES*	FROM 100mV TO 1KV F.S. DC VOLTS, 100UA TO 10A D.C., F.S. 100mV TO 600V (RMS) F.S.
DC STABILITY	150UV/°C, TO 10UV/°C, DEPENDING ON MODEL. RATED ACCURACY AFTER 15 MIN. WARM UP. RECOMMENDED CALIBRATION PERIOD 6 MONTHS
DC INPUT IMPEDANCE	GREATER THAN 1,000 MEG OHMS
AC REJECTION	BETTER THAN 60 DB @ 60 Hz
INTERFERENCE REJECTION	BETTER THAN 80 DB COMMON MODE FROM DC TO 60Hz WITH 1K OHMS SOURCE UNBALANCED
MAX. COMMON MODE VOLTAGE	500V PEAK
OVER VOLTAGE PROTECTION	100 TIMES F.S. WITHOUT DAMAGE OR DEGRADATION OF PERFORMANCE (NOT TO EXCEED 1KV)
CONVERSION RATE	60, 30, 15 SAMPLES PER SEC. DEPENDING ON MODEL
OVER RANGE	0 to 400% DEPENDING ON MODEL
POLARITY	AUTOMATIC POLARITY INDICATORS FOR + & −
OUTPUTS	1-2-4-8 BCD "0" = +0.4V MAX., "1" = +2.5V MIN. FOR EACH DIGIT
DECIMAL POINT	PROVIDED IN DISPLAY TUBES AND LIGHTED BY MEANS OF JUMPERS TO GND @ REAR CONN.
OPERATING TEMP. RANGE	0°C TO +50°C
INPUT POWER	115 or 230V AC 10%, SWITCH SELECTED, 47-1000 Hz, FUSED AND FILTERED (RFI), APPROX. 6 WATTS
WEIGHT	1.5 LBS.

* AC VOLTAGE (RMS) MEASUREMENT CAPABILITIES: AC TO DC CONVERTER PLUG IN P.C. CARDS TO CHOOSE FROM. FREQUENCY RANGE: 45 Hz TO 10 KHz, 20 Hz TO 20 KHz, 20 Hz TO 15 MHz. INPUT IMPEDANCE 10 MEG OHMS (SHUNTED BY 20 pf) ON ALL MODELS.

PRICING

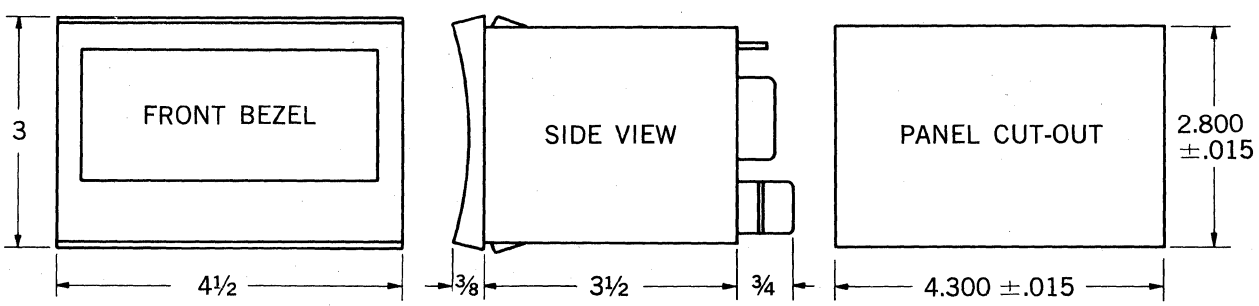


SHOWING LOW COST, MEDIUM COST AND HI-PERFORMANCE UNITS OF THE 17 MODELS TO CHOOSE FROM

DRAWINGS

PHYSICAL OUTLINE & INSTALLATION DIMENSIONS

PANEL THICKNESS 1/16, 3/32, 1/8



ALL DIMENSIONS IN INCHES

ELECTRONIC DESIGN LABS, INC.

P.O. BOX 7837, PHILADELPHIA, PENNA. 19101 • TEL: (215) 925-9500

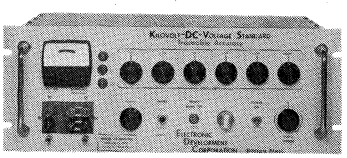
ELECTRONIC DEVELOPMENT CORPORATION

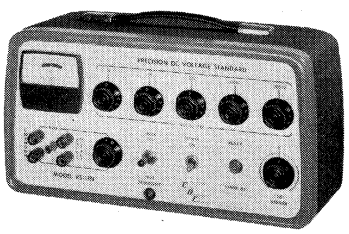
precision engineered
AC/DC voltage and current calibrators
(also standards, sources and references)

DC Voltage Standards

All solid state. Short circuit and overload proof. Fully automatic recovery and zero balance. 30 second warm-up. Stability better than .001% of setting per day.

MODEL	VS-11	VS-111	VS-1000
E_{out}	±11.1110 v	±111.110 v	±1111.110
I_{out}	50 mA	50 mA	10 mA
Absolute Accuracy	±0.005%	±0.005%	±0.007%
Z_{out}	.02Ω	0.1Ω	0.1Ω
Weight	8 lbs.	9 lbs.	20 lbs.
Prices	$620	$795	$995





Options: *Rack Mountable* — $25 additional (add "R" to model number). *Null Meter* — differential measurements with built in null detector. ∞ Z at null — $25 additional (add "N" to model number).

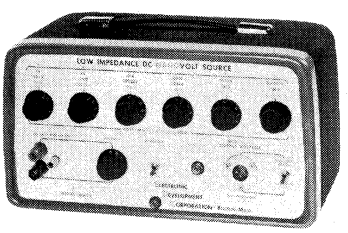
Electronic Galvanometer — differential measurements with built in, protected meter. Input impedance: ∞ at null, 1 MΩ off null, sensitivity 25 μV—$200 additional (add "G" to model number).

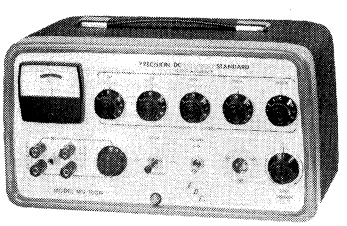
Applications: Calibrators, standards, references, sources and power supplies. EDC DC Voltage Standards are used in calibration laboratories, design and engineering laboratories, field service and production line Q.C.

DC Voltage Standards (special purpose)

EDC introduces a new **Low-Impedance DC Millivolt Standard (Model MV-105)** and a new **DC Nanovolt Standard (Model MV-106).** All solid state. Short circuit and overload proof. Fully automatic recovery and zero balance. 30 second warm-up. Stability better than .001% of setting per day.

MODEL		MV-100	MV-105 NEW	MV-106 NEW
E_{out} Ranges	(1)	±11.1110 v	±11.1110 v	±11.11110 v
	(2)	±111.110 mV	±111.110 mV	±111.1110 mV
	(3)	—	—	±11.11110 mV
Resolution	(1)	100 μV	100 μV	10 μV
	(2)	1 μV	1 μV	100 nV
	(3)	—	—	10 nV
I_{out} Volt Range		50 mA	50 mA	50 mA
Z_{out}	(1)	.02Ω	.02Ω	.02Ω
	(2)	20Ω	1.0Ω	10Ω
	(3)	—	—	10Ω
Accuracy (limit of error)	(1)	±.005%	±.005%	±.005%
	(2)	±.01%	±.01%	±.01%
	(3)	—	—	±.01%
Weight		8 lbs.	8 lbs.	8½ lbs.
Prices		$720	$750	$950





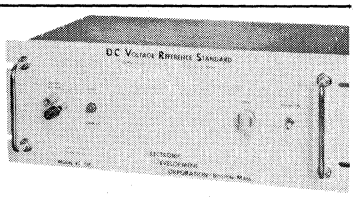
Options: For *rack mountable models, null meters,* and *electronic galvanometers* see "options" listed above.

Applications: Thermocouple and transducer calibration, simulation and measurements. Recorder calibration and linearity. Transducers: bridge excitation. Amplifiers: checking gain and linearity.

Digitally Programmable DC Voltage Standards

True digital programming from BCD logic signals. Serial by digit or parallel entry. Sign and each decade independently selected. The output is isolated from both the chassis and the control circuit. Short circuit and overload protected, fully automatic recovery.

MODEL	MV-100P NEW	VS-11P	VS-111P
E_{out}	166.65 mV	±11.110 v	±111.10 v
Accuracy	±0.015%	±0.01%	±0.01%
I_{out}	N/A	50 mA	100 mA
Z_{out}	20Ω	.03Ω	0.1Ω
Prices	$1995	$1020	$1195



Digital programming: Input programming readers such as punch paper tape, punch card, incremental magnetic tape, pin board, programmer drum, stepping switches or key board.

Memory features: Preserves the register contents without maintaining digital inputs. Programmer can then be used for other functions.

Options: Detailed specifications on these and other models on request.

Multi-purpose Voltmeter and Calibrator

TVM, ΔVM, and source

EDC has been building exclusively solid state instrumentation for 12 years. The **Model 2900** is our latest achievement.

This instrument is a highly versatile transistorized voltmeter, differential voltmeter (infinite impedance null detector) and DC voltage calibrator at a very low cost.

MODEL EDC 2900 NEW

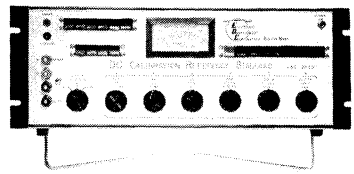
INPUT SPECIFICATIONS

TVM Mode:	
E_{in}	10 μV to 1200 Vdc in 8 ranges
Z_{in}	20 MΩ
Resolution	1 ppm
ΔVM Mode:	
E_{in}	10 μV to 1200 Vdc
Z_{in}	∞ at null, 20 MΩ off null
Sensitivity	10 μV

OUTPUT SPECIFICATIONS

Accuracy	±0.003%
Output	10 nV to ±111.1110 Vdc in 4 ranges
Resolution	1 ppm
Stability	.0005% day
Current	100 mA
Z_{out}	30 milliohms
Weight	10 lbs.
Price	$1650

Recorder output terminals available at rear panel



DC Current Standards

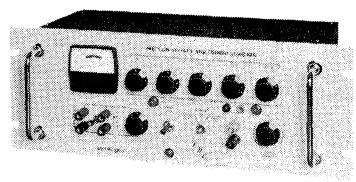
Short circuit and open-circuit proof. 30 second warm-up. Automatic zero.

MODEL	CR-10	CR-100	CR-102
OUTPUT			
I mode	±11.1110 mA	±111.110 mA	±111.110 mA
E mode	±11.1110 Vdc	—	±11.1110 Vdc
COMPLIANCE			
I mode	50 V	100 V	125 V
E mode	50 mA	N/A	100 mA
Accuracy	±0.02%	±0.02%	±0.02%
Prices	$900	$975	$1100

Options: *Null detector* built in and protected for differential voltage measurements. ∞ Z at null. $25 additional (add "N" to model number).

Rack Mountable — $25 additional (add "R" to model number).

Applications: Transducer, relay characteristics, precision checking of zener diodes, calibration of gyro torquers, relays, controllers and recorders.

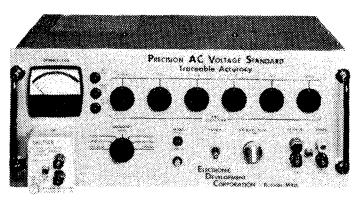


AC Voltage (RMS) Standards

Completely solid state. Short circuit protection. 60 second warm-up. Automatic zero. Low output impedance. Fully self-contained and portable.

MODEL	AC-1000	AC-200	AC-100 NEW
E_{out}	100 μV to 1111.110 V in 2 ranges	100 μV to 211.110 V in 2 ranges	1 mV to 111.110 V
Resolution	10 μV & 1 mV	10 μV & 1 mV	1 mV
E Accuracy	0.01%	0.01%	0.01%
Burden	50 VA or 2 Amps	25 VA or 1 Amp	100 mA
Frequency Range	45 Hz to 5 kHz	30 Hz to 20 kHz	10 Hz to 50 kHz
	Unlimited number of frequencies attained by use of external oscillator via front panel terminals		
5 Internal Frequencies	50, 60, 400 Hz, 1 kHz + Optional f plus line	50, 60, 400 Hz, 1 kHz + Optional f plus line	line only
Z_{out}	.001Ω to 1Ω	.001Ω to .2Ω	.001Ω to .1Ω
Distortion	0.1%	0.1%	0.1%
Weight	50 lbs.	45 lbs.	30 lbs.
Prices	$2690	$2490	$2190

Applications: Calibration of VOM, DVM, VTVM; design and evaluation of amplifiers, converters, filters, rectifiers, filter regulators, demodulators, transformers, and inductors; power source for servo applications.



All EDC instruments are traceable to the U.S. National Bureau of Standards. Certification supplied with each instrument / All instruments are available under GSA Contract / Export prices slightly higher / Line (Mains) power: 115 Vac, 60 or 400 Hz; or 220 Vac, 50 Hz / Instruments available for no-charge evaluation. Contact your local sales representative or the main plant.

ELECTRONIC DEVELOPMENT CORPORATION

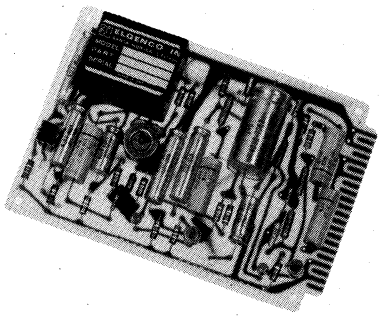
Electronic Development Corp.

423 West Broadway

Boston, Massachusetts 02127 **Tel. (617) 268-9696**

ELGENCO NOISE GENERATORS

SOLID STATE NOISE GENERATORS



FIXED RANGE NOISE GENERATOR CARDS

AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical non-clipped Gaussian waveform.
OUTPUT LEVEL: (open circuit) 3 volts rms.
AMPLITUDE CONTROL: Continuously variable.
SIZE: 4½" x 6½" x 1".
POWER: —30 volts dc.

SERIES 3602A, 3603A, and 3606A

OUTPUT IMPEDANCE: 600 ohms ±10%.
MAX. LOAD: 300 ohms.

Some of the many frequency ranges available are listed below. Write for further information.

MODEL 3602A

·12124 20 Hz to 20 kHz ±1db	$174
·11124 10 Hz to 20 kHz ±1db	$209
·12154 20 Hz to 50 kHz ±1db	$194
·11154 10 Hz to 50 kHz ±1db	$229

MODEL 3603A

·12115 20 Hz to 100 kHz ±1db	$214
·11115 10 Hz to 100 kHz ±1db	$249
·12125 20 Hz to 200 kHz ±1db	$229
·11125 10 Hz to 200 kHz ±1db	$264
·12155 20 Hz to 500 kHz ±1db	$249
·11155 10 Hz to 500 kHz ±1db	$284

MODEL 3602A

·22154 20 Hz to 50 kHz ±2db	$174
·21154 10 Hz to 50 kHz ±2db	$209
·22115 20 Hz to 100 kHz ±2db	$179
·21115 10 Hz to 100 kHz ±2db	$214
·22125 20 Hz to 200 kHz ±2db	$199
·21125 10 Hz to 200 kHz ±2db	$234
·22155 20 Hz to 500 kHz ±2db	$214
·21155 10 Hz to 500 kHz ±2db	$249
·32155 20 Hz to 500 kHz ±3db	$174
·31155 10 Hz to 500 kHz ±3db	$209

MODEL 3606A

·52124 20 Hz to 20 kHz ±½db	$299
·51124 10 Hz to 20 kHz ±½db	$334
·52154 20 Hz to 50 kHz ±½db	$319
·51154 10 Hz to 50 kHz ±½db	$354
·52115 20 Hz to 100 kHz ±½db	$339
·51115 10 Hz to 100 kHz ±½db	$374
·52125 20 Hz to 200 kHz ±½db	$354
·51125 10 Hz to 200 kHz ±½db	$389
·52155 20 Hz to 500 kHz ±½db	$374
·51155 10 Hz to 500 kHz ±½db	$409

SERIES 3607A

OUTPUT IMPEDANCE: 200 ohms ±10%
MAX. LOAD: 700 ohms.

Some of the many frequency ranges available are listed below. Write for further information.

MODEL 3607A

·15316 5 kHz to 1 mHz ±1db	$345
·35316 5 kHz to 1 mHz ±3db	$195
·25356 5 kHz to 5 mHz ±2db	$570
·35356 5 kHz to 5 mHz ±3db	$460

SOLID STATE NOISE GENERATORS



Model 602A-200 5 Hz to 5 mMz, 3 Ranges. . . **$395**

FREQ. RANGES: 5 Hz to 20 kHz, 5 Hz to 500 kHz, 5 Hz to 5 mHz.
OUTPUT SPECTRUM: 20 Hz to 20 kHz — ±1 db, 20 Hz to 500 kHz — ±2.5 db, 500 kHz, to 5 mHz — ±5 db.
OUTPUT LEVEL: (open circuit), 20 kHz range — 3 volts, 500 kHz range — 2.5 volts, 5 mHz range — 2 volts.
OUTPUT IMPEDANCE: 200 ohms ±10%.
MAXIMUM LOAD: (on direct output) 700 ohms.
OUTPUT STEP ATTENUATOR: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit.
Accuracy: ±3% to 100 kHz, ±10% to 5 mHz.
Output Impedance: 200 ohms ±1%.
SPECTRAL DENSITY: Approximate spectral density (mv/$\sqrt{}$Hz) for 1 volt rms output. 20 kHz band — 5, 500 kHz band — 1.2, 5 mHz band — 0.4.
AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical non-clipped Gaussian waveform all ranges.
OUTPUT METER: 0-5 volts rms.

Model 602A-1390 5 Hz to 5 mHz, 3 Ranges. . **$330**

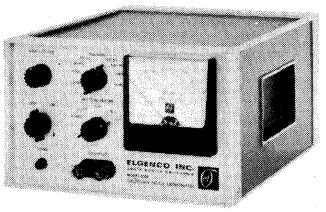
FREQ. RANGES: 5 Hz to 20 kHz, 5 Hz to 500 kHz, 5 Hz to 5 mHz.
OUTPUT SPECTRUM: 20 Hz to 20 kHz — ±1 db, 20 Hz to 500 kHz — ±3 db, 500 kHz, to 5 mHz — ±8 db.
OUTPUT LEVEL: (open circuit), 20 kHz range — 3 volts, 500 kHz range — 2 volts, 5 mHz range — 1 volt.
OUTPUT IMPEDANCE: 900 ohms ± 10%.
MAXIMUM LOAD: (on direct output) no limit.
OUTPUT STEP ATTENUATOR: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit.
Accuracy: ±3% to 100 kHz, ±10% to 5 mHz.
Output Impedance: 200 ohms ±5%.
SPECTRAL DENSITY: Approximate spectral density (mv/$\sqrt{}$Hz) for 1 volt rms output. 20 kHz band — 5, 500 kHz band — 1.2, 5 mHz band — 0.6.
AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical non-clipped Gaussian waveform all ranges.
OUTPUT METER: 0-5 volts rms.

Model 603A 5 Hz to 5 mHz, 3 Ranges. **$545**

FREQ. RANGES: 5 Hz to 20 kHz, 5 Hz to 500 kHz, 5 Hz to 5 mHz.
OUTPUT SPECTRUM: 10 Hz to 500 kHz — ±1 db, 500 kHz to 5 mHz — ±3 db.
OUTPUT LEVEL: (open circuit) 3 volts rms all ranges.
OUTPUT IMPEDANCE: 200 ohms ± 10%.
MAX. LOAD: (on direct output) 700 ohms.
OUTPUT STEP ATTENUATOR: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit.
Accuracy: ±3% to 500 kHz, ±5% to 5 mHz.
Output Impedance: 200 ohms ± 1%.
SPECTRAL DENSITY: Approximate spectral density (mv/$\sqrt{}$Hz) for 1 volt rms output. 20 kHz band—5, 500 kHz band—1.2, 5 mHz band — 0.4.
AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical non-clipped Gaussian waveform all ranges.
OUTPUT METER: 0-5 volts rms.

MODEL 3609A Power Supply Card **$67**
(supplies power for up to 2 noise generator cards)
SIZE: 4½" x 6½".
INPUT: 115/230 volts ±10/20 volts, 50 to 1000 Hz.

SOLID STATE NOISE GENERATORS



Model 610A 5 Hz to 5 mHz, 8 Ranges. **$1,275**

FREQ. RANGES: 5 Hz to 2 kHz, 5 Hz to 5 kHz, 5 Hz to 20 kHz, 5 Hz to 50 kHz, 5 Hz to 200 kHz, 5 Hz to 500 kHz, 5 Hz to 2 mHz, and 5 Hz to 5 mHz.
OUTPUT SPECTRUM: Uniform ± 0.5 db from 10 Hz to 500 kHz and ± 2.0 db from 500 kHz to 5 mHz.
OUTPUT LEVEL: 0 to 1 volt rms, adjustable by front panet amplitude control. A dynamic range of 5 to 1 peak to rms value is provided.
OUTPUT STEP ATTENUATOR: X1.0, X0.1, X.01, X.001, X.0001. Accuracy ± 0.1 db to 500 kHz; ± 0.25 db to 5 mHz.

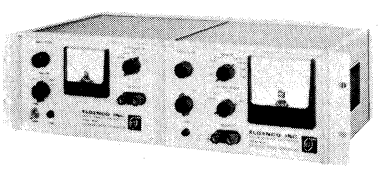
SPECTRAL DENSITY: Approx. for 1 volt rms output.

Band	mv/$\sqrt{}$Hz	Band	mv/$\sqrt{}$Hz
2 kHz	17.5	200 kHz	1.75
5 kHz	11.0	500 kHz	1.10
20 kHz	5.5	2 mHz	0.55
50 kHz	3.5	5 mHz	0.30

AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical Gaussian all ranges.
OUTPUT METER: 0 to 1 volt rms. Accuracy ±2% of full scale to 2 mHz; ±5% to 5 mHz.
MAXIMUM LOAD: 500 ohms on direct output.
OUTPUT IMPEDANCE: 50 ohms direct output.
POWER REQUIREMENTS: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac.



Model 602A with full rack width mounting option.



Models 602A and **610A** combined by dual unit adapter kit.

OPTIONS & ACCESSORIES FOR MODELS 602A, 603A, 610A, & SERIES 624A

Rechargeable battery option	add $135
Full rack width cabinet and rack mounting hardware option	add $35
Adapter kit, dual unit and rack mounting hardware	$7
Adapter kit, single unit rack mounting (includes blank panel to make dual unit)	$56
Rechargeable battery kit	$145

ELGENCO, INC. 1550 Euclid Street • Santa Monica, Calif. • (213) 451-1635 • TWX 910-343-6475

ELGENCO NOISE GENERATORS

SOLID STATE NOISE GENERATORS

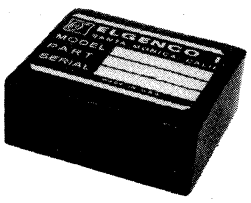


Series 624A Fixed Range Noise Generators

OUTPUT LEVEL: (open circuit) 3 volts rms.
OUTPUT IMPEDANCE: 200 ohms ±10%.
MAX. LOAD: 700 ohms.
OUTPUT STEP ATTENUATOR: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit.
Output Impedance: 200 ohms ±1%.
AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical non-clipped Gaussian waveform.
OUTPUT METER: 0-5 volts rms.
POWER: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac.
DIMENSIONS: 5¼" high x 8⅝" wide x 11" deep.
Some of the many frequency ranges available are listed below. Write for further information.

MODEL 624A

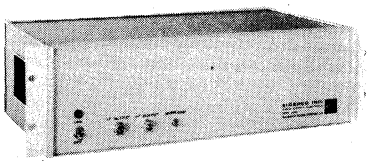
-12124 20 Hz to 20 kHz ±1db	$305
-11124 10 Hz to 20 kHz ±1db	$340
-12154 20 Hz to 50 kHz ±1db	$325
-11154 10 Hz to 50 kHz ±1db	$360
-12115 20 Hz to 100 kHz ±1db	$345
-11115 10 Hz to 100 kHz ±1db	$380
-12125 20 Hz to 200 kHz ±1db	$395
-11125 10 Hz to 200 kHz ±1db	$430
-12155 20 Hz to 500 kHz ±1db	$415
-11155 10 Hz to 500 kHz ±1db	$450
-22154 20 Hz to 50 kHz ±2db	$305
-21154 10 Hz to 50 kHz ±2db	$340
-22115 20 Hz to 100 kHz ±2db	$310
-21115 10 Hz to 100 kHz ±2db	$345
-22125 20 Hz to 200 kHz ±2db	$330
-21125 10 Hz to 200 kHz ±2db	$365
-22155 20 Hz to 500 kHz ±2db	$345
-21155 10 Hz to 500 kHz ±2db	$380
-32155 20 Hz to 500 kHz ±3db	$305
-31155 10 Hz to 500 kHz ±3db	$340
-52124 20 Hz to 20 kHz ±½db	$430
-51124 10 Hz to 20 kHz ±½db	$465
-52154 20 Hz to 50 kHz ±½db	$450
-51154 10 Hz to 50 kHz ±½db	$485
-52115 20 Hz to 100 kHz ±½db	$470
-51115 10 Hz to 100 kHz ±½db	$505
-52125 20 Hz to 200 kHz ±½db	$520
-51125 10 Hz to 200 kHz ±½db	$555
-52155 20 Hz to 500 kHz ±½db	$540
-51155 10 Hz to 500 kHz ±½db	$575



ENCAPSULATED NOISE SOURCE MODULES

Series 1602A, 1603A, and 1606A.....**$95 to $340**
Various frequency ranges and output flatness available. Size: 1¾" x 1½" x ¾". Write for details.

SOLID STATE NOISE GENERATORS



MODEL 632A Dual Output DC to 400 Hz and 5 Hz to 40 kHz.....**$2,595**

LOW FREQUENCY OUTPUT

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±1.0%.
OUTPUT SPECTRUM: Uniform ±0.1 db from DC to 350 Hz.
MAXIMUM OUTPUT: 1.0 volts rms. A dynamic range of 5 to 1 peak to rms value is provided.
MAXIMUM SPECTRAL DENSITY: Approx. 1.5 x 10^{-3} volts²/Hz.
OUTPUT MEAN: Less than 5 mv.
OUTPUT IMPEDANCE: Approximately 1,000 ohms.

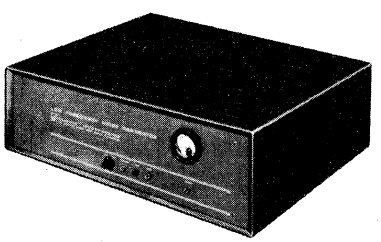
HIGH FREQUENCY OUTPUT

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±2%.
OUTPUT SPECTRUM: Uniform ±0.5 db from 10 to 35,000 Hz.
MAXIMUM OUTPUT: 1.0 volts rms. A dynamic range of 5 to 1 peak to rms values is provided.
MAXIMUM SPECTRAL DENSITY: Approx. 2 x 10^{-5} volts²/Hz.
OUTPUT MEAN: Less than 1 mv.
OUTPUT IMPEDANCE: Approximately 100 ohms.

NOISE REGULATOR: rms output level continuously stabilized against a reference voltage.
OVERLOAD INDICATOR: Panel overload indicator lights when input noise level to regulator is out of regulation range.
POWER: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac.
DIMENSIONS: 5¼" high x 17" wide x 11" deep. 19" wide with rack mounting flanges mounted (supplied).

Model 631A 5 Hz to 40 kHz.....**$1,645**

VACUUM TUBE NOISE GENERATORS



Model 301A DC to 40 Hz.....**$2,195**

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±1%.
OUTPUT SPECTRUM: Uniform ±0.1 db from 0 to 35 Hz.
MAX. OUTPUT: 12 volts rms into a 1 megohm input resistance. Dynamic range of 5 to 1 peak-to-rms is provided.
MAX. SPECTRAL DENSITY: Approx. 2.5 volts²/Hz.
D.C. UNBALANCE: Less than 50 mv.
NOISE REGULATOR: rms output level continuously stabilitzed against a reference voltage.
OVERLOAD INDICATOR: Panel overload indicator lights when input noise level to regulator is out of regulation range.
POWER: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac.
MOUNTING: Standard relay rack panel 7" high x 19" wide. Can be supplied in deluxe cabinet as shown for $75 extra.

Model 321A DC to 120 Hz.....**$2,295**

OUTPUT SPECTRUM: Uniform ±0.1 db from 0 to 105 Hz.
MAX. SPECTRAL DENSITY: Approx. 1.0 volts²/Hz.

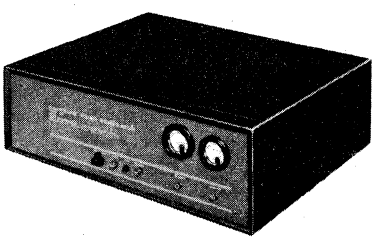
OTHER SPECIFICATIONS SAME AS MODEL 301A

VACUUM TUBE NOISE GENERATORS

Model 331A 5 Hz to 20 kHz.....**$1,395**

OUTPUT SPECTRUM: Uniform to plus or minus 0.5 db from 10 to 20,000 Hz.
OUTPUT LEVEL: 0 to 5 volts rms, adjustable by self contained attenuator. A dynamic range of 7 to 1 peak to rms value is provided.
SPECTRAL DENSITY: Approx. 1 mv/$\sqrt{}$Hz for 5 volt rms output.
AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±1%.
NOISE REGULATOR: rms output level continuously stabilized against a zener reference voltage.
OVERLOAD INDICATOR: Panel overload indicator lights when input noise level to regulator is out of regulation range.
OUTPUT METER: 0 to 5 volts rms.
MAX. LOAD: 10,000 ohms.
POWER REQUIREMENTS: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac.
MOUNTING: Standard relay rack panel 7" high x 19" wide and is 15" deep. Can be supplied in deluxe cabinet as shown for $75 extra.

MODEL 331A-23	5 Hz to 2 kHz	**$1495**
MODEL 331A-53	5 Hz to 5 kHz	**$1495**
MODEL 331A-54	5 Hz to 50 kHz	**$1495**
MODEL 331A-25	5 Hz to 200 kHz	**$1595**
MODEL 331A-55	5 Hz to 500 kHz	**$1745**



Model 311A Dual output DC to 40 Hz and 5 Hz to 20 kHz.....**$2,595**

LOW FREQUENCY OUTPUT

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±1%.
OUTPUT SPECTRUM: Uniform ±0.1 db from 0 to 35 Hz.
MAX. OUTPUT: 12 volts rms into a 1 megohm input resistance. Dynamic range of 5 to 1 peak-to-rms is provided.
MAX. SPECTRAL DENSITY: Approx. 2.5 volts²/Hz.
D.C. UNBALANCE: Less than 50 mv.

HIGH FREQUENCY OUTPUT

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±2%.
OUTPUT SPECTRUM: Uniform ±0.5 db from 10 to 20,000 Hz.
MAX. OUTPUT: 15 volts rms.
MAX. SPECTRAL DENSITY: 7.5 x 10^{-3} volts²/Hz.

NOISE REGULATOR: rms output level continuously stabilized against a reference voltage.
OVERLOAD INDICATOR: Panel overload indicator lights when input noise level to regulator is out of regulation range.
POWER: 115 v. ±10 v, 50/60 Hertz ac.
MOUNTING: Standard relay rack panel 7" high x 19" wide. Deluxe cabinet as shown not available.

Model 312A Dual output DC to 120 Hz and 5 Hz to 20 kHz.....**$2,695**

LOW FREQUENCY OUTPUT

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±1%.
OUTPUT SPECTRUM: Uniform ±0.1 db from 0 to 105 Hz.
MAX. OUTPUT: 12 volts rms into a 1 megohm input resistance. Dynamic range of 5 to 1 peak-to-rms is provided.
MAX. SPECTRAL DENSITY: Approx. 1.0 volts²/Hz.
D.C. UNBALANCE: Less than 50 mv.

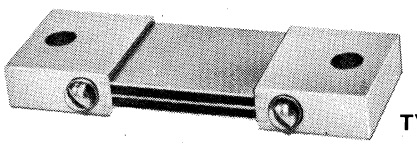
HIGH FREQUENCY OUTPUT

OTHER SPECIFICATIONS SAME AS MODEL 311A

ELGENCO, INC. 1550 Euclid Street • Santa Monica, Calif. • (213) 451-1635 • TWX 910-343-6475

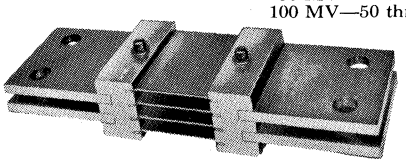
World's Largest Selection of D.C. AMMETER SHUNTS

ACCURACY ¼%



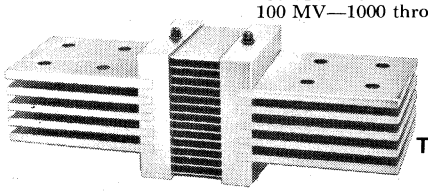
TYPE A

50 MV—15 through 600 amperes
100 MV—50 through 600 amperes



TYPE C

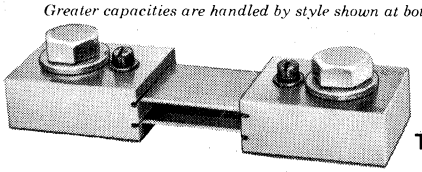
50 MV—1000 through 2000 amperes
100 MV—1000 through 2000 amperes



TYPE F

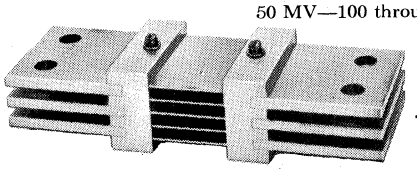
50 MV—2500 through 30000 amperes
100 MV—2500 through 10000 amperes

Style shown here has rated capacities of 10,000 amps and under. Greater capacities are handled by style shown at bottom of page.



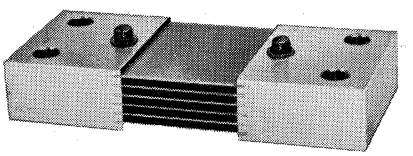
TYPE TRW-50

50 MV—100 through 600 amperes



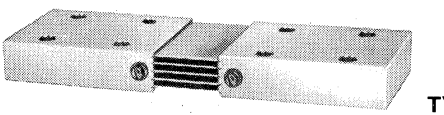
TYPE WT

50 MV—1000 through 10000 amperes
100 MV— 600 through 6000 amperes



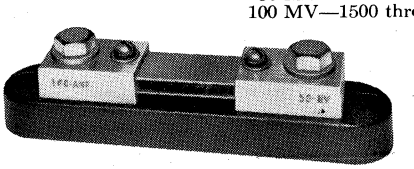
TYPE B

50 MV—300 through 1200 amperes
100 MV—300 through 1200 amperes



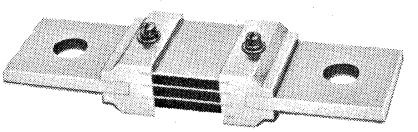
TYPE E

50 MV—1500 through 2000 amperes
100 MV—1500 through 2000 amperes



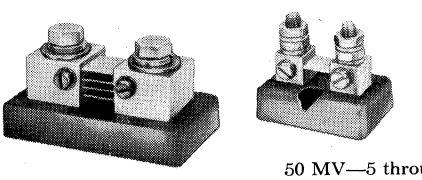
TYPE HA

50 MV—1 through 500 amperes
100 MV—1 through 500 amperes



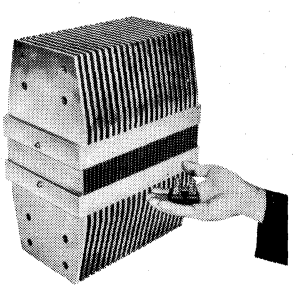
TYPE W

50 MV—500 through 1000 amperes
100 MV—120 through 500 amperes



LIGHTWEIGHT TYPES

50 MV—5 through 1200 amperes



Large capacity Type F shown with Lightweight Type

We offer the widest selection of standard model shunts available anywhere. Both switchboard and portable types. In addition, we produce custom made shunts to your specifications. Our standard models, illustrated on this page, have current ratings up to 30,000 amperes. Many of these can be shipped immediately. Custom made shunts, of course, take a little time to produce. But whether you order a standard or special model, we promise fast service, fine craftsmanship and a personal interest in your complete satisfaction.

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Ga. 30054: Atlanta
Electro-Tech, Inc.
3020 Commerce Way
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Phone: 212/726-4551

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Stark Electronic Inst., Ltd.
540 Finley Ave.
Phone: 416/942-2120

WAVEFORM GENERATORS & SYNTHESIZERS



MINIATURE WAVEFORM GENERATOR

A Combination Waveform and Pulse Generator

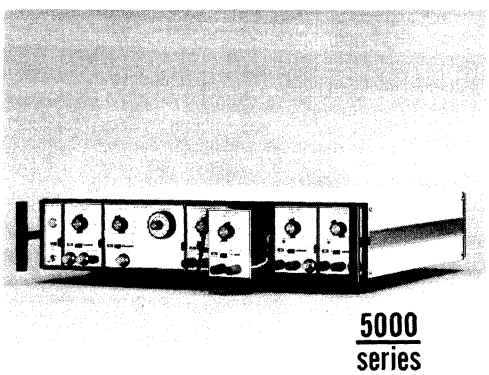
Other miniature waveform generators are:

MODEL 100 WAVEFORM GENERATOR
.001Hz to 3MHz; square and triangle to 5MHz. Sine, Square, Pulse, Triangle and Ramp. Variable 0 to 20V P-P into 600 ohms with variable ±5V D.C. offset. $445

MODEL 103 VCF All Model 100 features plus a precision control of frequency with an external voltage (VCF).

MODEL 104 Triggered All Model 100 features plus manual or external gating and triggering (single shot).

MODEL 105 Triggered VCF All Model 100 features plus the combination of gating, triggering and voltage controlled frequency.



MODULAR WAVEFORM GENERATOR

The 5000 modular system offers the capabilities of building a wide variety of waveform, pulse or signal generators from basic independent modular units. 3½" Thin

Some modules for this system are:

GENERATORS	FREQUENCY RANGE
G5210	0.0001Hz to 2MHz (triangle for sine shaping limited to 1MHz)
G5211 (VCF)	0.0001Hz to 2MHz (triangle for sine shaping limited to 1MHz)
G5212 (ramp)	1000 sec to 1μsec designed to drive VCF G5211
G5213 (ramp)	1000 sec to 1μsec built-in gating, triggering and ramp-hold

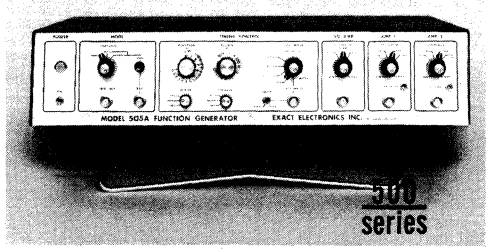
WAVEFORMS
G5210
G5211 (VCF)
G5212 (ramp)
G5213 (ramp)

MODE CONTROLS
C5110 Gate and Trig to generator—variable start-stop point. Adds haversine waveform.

AMPLIFIERS
A5410 Square output only. Features fast rise and fall times. 28V P-P into 600 ohms.
A5420 Built-in sine shaper. External input provided. 28V P-P into 600 ohms.
A5422 General purpose amplifier for ramp generator and S5510

SINE SHAPER
S5510 No output, requires A5422. Ultra low distortion. Available August 1969.

Cabinet/power unit 5001 ±18V regulated, ±30 unregulated, ±8V unregulated



WAVEFORM GENERATOR (SLIM LINE 3.5")

A Combination Waveform and Pulse Generator

Other 500 series waveform generators are:

MODEL 502 WAVEFORM GENERATOR .001 Hz to 1MHz; Sine, Square, Pulse, Triangle and Ramp $385.

MODEL 500 WAVEFORM GENERATOR .0001Hz to 1MHz, square and triangle to 2MHz; Sine, Square, Pulse, Triangle and Ramp. Three independent output amplifiers and attenuators, 25V P-P into 600 ohms with variable D.C. offset. Will drive 50 ohms at reduced amplitude. $495

MODEL 503 VCF GENERATOR All Model 500 features plus precision control of frequency with an external voltage (VCF). 50:1 sweeping ratio. VCF input signal conditioning. $545

MODEL 504 TRIGGERED GENERATOR All Model 500 features plus manual or external gating and triggering (single shot). Variable start-stop point adds haversine waveform. $545

MODEL 505 TRIGGERED, VCF All Model 500 features plus gating, triggering and voltage controlled frequency (reference Models 503 and 504). $645

NEW 201 COMPLEX WAVEFORM SYNTHESIZER SOLID STATE 3½" THIN PACKAGE.

DIGITAL
ANALOG

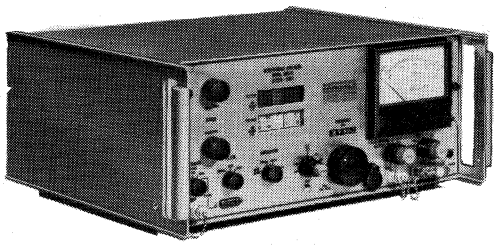
Produces forty individual and incremental voltage levels, twenty if both the amplitude level and the pulse width are variable. Both digital and analog (variable slope) outputs. Increment programming enables each individual increment to be set to a pre-determined D.C. level by monitoring with VOM or DVM. Increments variable from 20 sec to 2μsec.

EXACT ELECTRONICS INC.
455 S.E. 2nd Avenue, Hillsboro, Oregon 97123 • TEL. (503) 648-6661

TO MEET MODERN RFI/EMC NEEDS

EMC-10 SERIES INTERFERENCE ANALYZERS

20 Hz to 50 KHz



EMC-10 is an approved, fully solid-state receiving instrument which not only tunes the entire range of 20 Hz to 50 KHz, but can be remotely tuned over this range without mechanical drive. When used in its wide-band, non-selective mode, response extends all the way to 500 KHz.

The Model EMC-10E version incorporates built-in electronic scanning within its own housing for automatically sweeping from 20 Hz to 50 KHz in addition to all regular features of EMC-10.

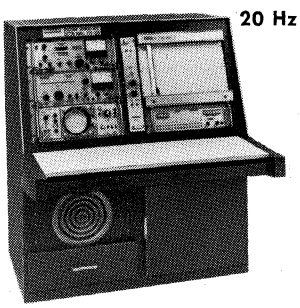
Because the instrument can operate from internal long-life, rechargeable batteries, it can be easily carried into the field, as well as used in tight quarters, without the nuisance of a power connection. Each feature has been carefully engineered, and the overall unit designed to meet the requirements of commercial and military specifications. Its extreme sensitivity of 3 nanovolts in its 5 Hz bandwidth position contributes greatly to its versatility. With 170 DB dynamic range, including 40 DB on the meter, and excellent amplitude and frequency accuracies, many testing problems are eliminated.

EMC-10 and EMC-10E also have full capability of a versatile wave analyzer and outputs for X-Y plotting, spectrum analysis and a tracking signal for network and circuit response.

A wide range of antennas, probes and other accessories are optionally available.

SPECTRUM SURVEILLANCE SYSTEM MODEL FSS-250

20 Hz to 1000 MHz



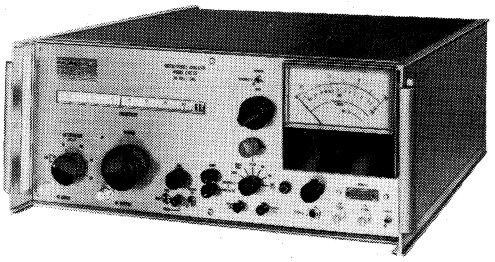
The FSS-250 system incorporates Interference Analyzers Models EMC-10 and EMC-25R, Electro-Scan Programmer Model ESC-125A and Spectrum Analyzer Model SPD-125, all as described above, mounted together with 11" x 17" X-Y plotter Model EXY-125A in a console with amplifier, speaker and various other conveniences, and tested as a completely integrated automatic testing facility. It may be used for RFI/EMC studies, spectrum profiling, continuing frequency surveillance and numerous other applications calling for a programmable, automated system.

With FSS-250 it is possible to set up programming to cover any portion, or all, of the frequency range of 20 Hz to 1000 MHz and automatically plot the signal levels against frequency on the X-Y plotter. The operator can also analyze each of the 15 octave EMC-25R bands in spectrum analysis form on the spectrum analyzer scope, and can switch to fine grain display of a selected signal.

As the first fully solid-state, electronically scannable spectrum surveillance system, Model FSS-250 can be installed either in a laboratory or a mobile van, along with proper antennas and pick-up devices to perform RFI/EMC and field strength measurements or searches for unwanted or elusive signals.

EMC-25 SERIES INTERFERENCE ANALYZERS

14 KHz to 1 GHz



Model EMC-25 is a universal, broad-coverage calibrated receiver designed for RFI/EMC testing and general use. It provides in a single, compact, solid-state package, full frequency coverage from 14 KHz to 1000 MHz and meets the latest military and commercial specifications for both manual and automated data acquisition.

Excellent sensitivity, selectivity and operational simplicity are provided. A choice of two bandwidths at all frequencies is standard. Detector functions provided are Carrier, Peak, Quasi-Peak, Metered Slideback and % Modulation, both AM and FM. Outputs for phones, external meter, X-Y recorder, Pre-IF, Post-IF and AM and FM video are included.

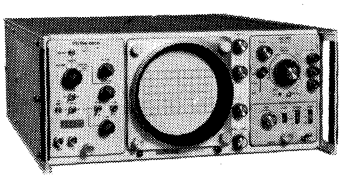
EMC-25 provides capability for being electronically scanned over its entire frequency range; and Model EMC-25R includes remote control of band sequencing. It can be operated from its own internal battery supply or from an external AC or DC source.

Special versions of less than full frequency coverage are available on special order.

ACCESSORIES AND PICK-UP DEVICES

Included in the wide choice of pick-up devices and accessories to EMC-25 are the following:

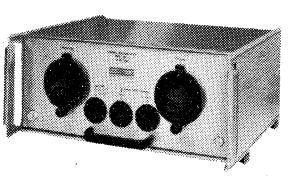
(1) Electro-Scan Programmer, Model ESC-125A—This instrument adds full programming and automation to EMC-25R. With proper selection, the instrument is automatically scanned and band stepped by the Programmer with the output being plotted on an X-Y plotter or other recording device.



(2) Spectrum Analyzer Adapter, Model SPD-125 For the first time a whole-octave "quick-look" display can be made available to help in test planning. Specific signals can be selected from the spectrum display, and these ballooned for close-look "pan" display.

(3) Standard Accessory Kit, 14 KHz to 1000 MHz, Model AAK-25A—A complete set of antennas, probes and other needed accessories for full coverage of the EMC-25 frequency range is optionally available.

(4) Tunable Rejection Filters, Models TRF-11 Through 14, 14 KHz to 1000 MHz. Each precision rejection filter in this series of five permits attenuation of an unwanted signal by at least 80 DB at any frequency in its range. While designed for use with RFI/EMC instruments, they can easily be used in any receiving system for rejecting unwanted signals.



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A SUBSIDIARY OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
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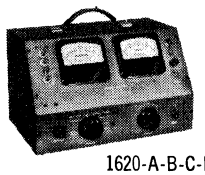
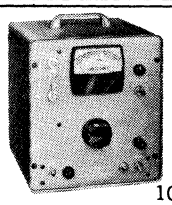
FREED TRANSFORMER CO., INC.


1620-A-B-C-D


1020-C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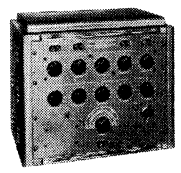
2030-A-B-C


1110-C

MEGOHMMETERS

Freed can supply a complete range of insulation resistance measuring equipment with fixed and variable d.c. test voltages from 5 to 5000 volts. Insulation and leakage measurements can be made on transformers, motors, cables, electronic assemblies and components, dielectric materials, electrical appliances and tools, capacitors and resistors.

Type	Resistance Range	Test Voltage	Accuracy	Power Requirements	Size and Weight	Price
1620	0.1 to 4,000,000 megohms 1 to 2,000,000 megohms @ 500 volts	Variable 50 to 1000 volts d.c.	±5% at full scale	105-125 volts 50-60 cycles	15" x 9" x 7½" 24 lbs. *	350.00
1620-A	0.01 to 4,000,000 megohms 0.1 to 200,000 megohms @ 50 volts 1 to 2,000,000 megohms @ 500 volts	Variable 5-100 volts d.c. 100-1000 volts d.c.	±5% at full scale	105-125 volts 50-60 cycles	15" x 9" x 7½" 24 lbs. *	365.00
1620-B	1 to 2,000,000 megohms 10 to 2,000,000 megohms @ 2500 volts	Variable 250-2500 volts d.c.	±5% at full scale	105-125 volts 50-60 cycles	15" x 9" x 7½" 24 lbs. *	395.00
1620-C	All features same as Type 1620 with additional circuitry for capacitor measurements	Variable 50 to 1000 volts d.c.	±5% at full scale	105-125 volts 50-60 cycles	15" x 9" x 7½" 24 lbs. *	375.00
1620-D	0.01 to 40,000,000 megohms 0.1 to 2,000,000 megohms @ 50 volts 1 to 20,000,000 megohms @ 500 volts	Variable 5-100 volts d.c. 100-1000 volts d.c.	±5% at full scale except highest range ±10%	105-125 volts 50-60 cycles	15" x 9" x 7½" 25 lbs. *	415.00
1020-C	0.1 to 2,000,000 megohms 0.1 to 200,000 megohms @ 50 or 100 volts d.c. 1 to 2,000,000 megohms @ 500 volts d.c.	Fixed 50, 100, 500 volts Regulated	±3% all ranges except highest range ±5%	105-125 volts 50-60 cycles	9½" x 10½" x 8" 18 lbs. *	280.00
1020-D	0.1 to 2,000,000 megohms 0.1 to 200,000 megohms @ 100 or 200 volts d.c. 1 to 2,000,000 megohms @ 500 volts d.c.	Fixed 100, 200, 500 volts Regulated	±3% all ranges except highest range ±5%	105-125 volts 50-60 cycles	9½" x 10½" x 8" 18 lbs. *	290.00
* 266	0.6 megohm to 500 teraohm @ 500 v. 0.6 megohm to 100 teraohm @ 100 v.	Fixed 100-500 v.d.c. Regulated	±5% at full scale	105-125 Volts 50-60 Hz	11½" x 9" x 9" 18 lbs.	425.00
* 668	0 to 20,000 megohms @ 1000 v 0 to 50,000 megohms @ 2500 v 0 to 100,000 megohms @ 5000 v	Fixed 1000-2500 5000 v.d.c.	±2.5% of scale length	battery operated transistor supply built in charger	16" x 12½" x 6½" 23 lbs.	850.00
2030-A	10 to 2,000,000 megohms	Fixed 500 volts d.c.	±5% full scale	battery operated transistor supply	6" x 8" x 4" 8 lbs.	205.00
2030-B	1 to 20,000,000 megohms	Fixed 500 volts d.c.	±5% full scale	battery operated transistor supply	6" x 8" x 4" 8 lbs.	250.00
2030-C	1 to 2,000,000 megohms	Fixed 50 volts d.c.	±5% full scale	battery operated transistor supply	6" x 8" x 4" 8 lbs.	225.00
2030-D	1 to 2,000,000 megohms	Fixed 100 volts d.c.	±5% full scale	battery operated transistor supply	6" x 8" x 4" 8 lbs.	225.00
2030-E	1 to 2,000,000 megohms	Fixed 200 volts d.c.	±5% full scale	battery operated transistor supply	6" x 8" x 4" 8 lbs.	225.00
* 667	0 to 10,000 megohm	Fixed 100-250-500 1000 v.d.c.	± 2.5% of scale length	battery operated transistor supply	8½" x 4½" x 5" 4½ lbs.	175.00

Rack type available — 1620 series 19" x 10½" x 9½"
1020 series 19" x 7" x 9½"

* Norma Instruments, Freed exclusive U.S. agent.

INCREMENTAL INDUCTANCE BRIDGES

Direct in-line readings of inductance and conductance of iron core component at audio frequencies with or without superimposed direct current. The bridge uses the Owens circuit with provisions for measuring the series or parallel inductance and conductance of the unknown inductor; five precision resistance and capacitance decades are provided to indicate these values. "Q" or storage factor can be measured as the product of the inductive reactance and the conductance.

Type	Inductance Range	Conductance Range	Frequency Range	D.C. Current	Accuracy	Dimensions and Weight	Price
1110-C	1111.1 h to 1 mh 5 decades 1.1 h to 1 μh 2 decades	0.015 μmho—100 mho "Q" = 600 max @ 100 cycles	20 cycles to 10KC	up to 2 amperes	±0.5% to 5 KC ±2% to 10 KC	21¾" x 17½" x 15¼" 50 lbs.	525.00
1115	111.1 h to 100 μh 5 decades 0.11 h to 0.1 μh 2 decades	0.15 μmho—1000 mho "Q" = 600 max @ 100 cycles	20 cycles to 10 KC	up to 15 amperes	±1% to 5 KC ±3% to 10 KC	21¾" x 28" x 15¼" 80 lbs.	825.00
1185	111.1 h to 100 μh 5 decades 0.11 h to 0.1 μh 2 decades	0.15 μmho—1000 mho "Q" = 600 max @ 100 cycles	20 cycles to 10 KC	up to 30 amperes	±1% to 5 KC ±3% to 10 KC	21¾" x 33¼" x 15¼" 100 lbs.	1250.00

COMPARISON & LIMIT BRIDGE

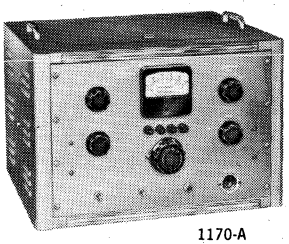
A rapid and convenient method for laboratory or production testing of resistors, capacitors and inductors. Components may be sorted for tolerances up to ±20% or selected in matched pairs.

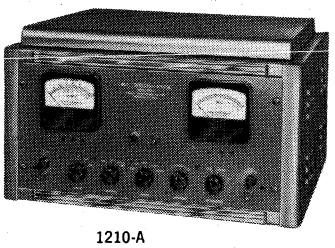
Type	Inductance Range	Capacitance Range	Resistance Range	Test Frequency	Accuracy	Dimensions and Weight	Price
1010-A	10 μh-100 h	10 Pf-100 mf.	1 Ω-20 MΩ	50 or 60 cycles 1 KC-10 KC	±0.1% on 5% range	10½" x 12" x 12" 17 lbs.	350.00

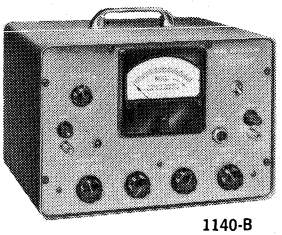
Prices quoted are subject to change without notice

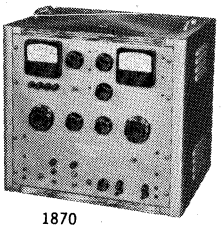
FREED TRANSFORMER COMPANY, INC. 1795 WEIRFIELD ST. (Ridgewood) Brooklyn, N. Y. 11227

FREED TRANSFORMER CO., INC.


1170-A


1210-A


1140-B


1870

LOW FREQUENCY "Q" INDICATORS

Direct indication of "Q" at low frequencies, inductance, distributed capacity, impedance and dielectric loss can also be measured. Instrument may be used to study the magnetic properties of iron core material for stability as a function of applied voltage and losses as a function of the frequency.

Two units are available, the 1030-A indicates "Q" as a product of meter readings multiplied by dial settings.

Type	Test Frequency	Q Range	Accuracy	Test Voltage	Power Requirements	Dimensions and Weight	Price
1030-A	20 cycles to 200 K.C.	1-1000	±5% 20 cycles to 50 KC— to 200 KC at reduced accuracy	Voltage to series circuit, 0.01 to 10 volts voltage across coil variable to 100 volts	105-125 volts 50-60 cycles	21" x 23" x 15" 120 lbs.	1250.00

IMPEDANCE & ADMITTANCE BRIDGE

An audio frequency bridge for measuring the complex impedances of inductors, transformers, filter networks and capacitors.

Type	Frequency Range	Impedance and Admittance	Accuracy	Maximum Applied Voltage	Dimensions and Weight	Price
1120	20 to 20,000 cycles	XL, XC and R up to 1000 ohms, BL, BC and G up to 1000 microhms	R: ±1% G: ±2% X: ±1% up to 5 KC B: ±1% up to 5 KC	125 Volts	10½" x 12" x 12" 25 lbs.	455.00

UNIVERSAL BRIDGE

The Freed Type 1150-A Universal Bridge offers the laboratory a combination of eight bridges in one instrument. This bridge will measure the reactive and resistive component of impedances, capacitance, resistance and phase angle.

In the Hay and/or Owen bridge configuration the incremental permeability of an inductance can be measured.

Type	Inductance Range	Capacitance Range	Resistance Range	"D" Hay Bridge	Price
1150-A	5 μh 1110 h	5 pf-10 mf	0.05 Ω-1 MΩ	0.001-10 Q = 0.1-1000	825.00
	"Q" Maxwell 0.01-50	"Q" Series Owen 0.01-600 @ 100 cycles	"Q" Parallel Owen 80 @ 100 cycles	"Q" Parallel Resistor-Condensor Bridge 0.01-11.1	
	Accuracy Inductance ±0.5% up to 1 KC. ±2% to 10 KC. Capacitance ±1% @ 1 KC. "D"-"Q" ±5% @ 1 KC. Resistance (ac.) ±1% @ 1 KC.			Dimensions and Weight 21¾" x 24½" x 17" 65 lbs.	

NULL DETECTORS

Sensitive null detectors for bridge measurements, with self contained selective filters to limit the amplifier characteristics at various bridge measuring frequencies.

Type	Sensitivity	Frequency Range	Filter	Power Requirements	Dimensions and Weight	Price
1140-B	10μ volts @ 1 KC for 15% meter deflection filter in	20 to 20,000 cycles	Fixed 60, 400, 1000 cycles Adjustable ±5% of center Other frequencies available	105-125 volts 50-60 cycles	Cabinet 12" x 8½" x 10"—18 lbs. Rack—19" x 6" x 10"	250.00
2076	1μ volts @ 1 KC for 15% meter deflection filter in	20 to 20,000 cycles	Fixed 60, 400, 1000 cycles Adjustable ±5% of center Other frequencies available	Transistorized Battery operated	Cabinet—8" x 6" x 8" Rack—19" x 5¼" x 8"	295.00

NULL DETECTOR — VACUUM TUBE VOLTMETER

Designed primarily for a.c. bridge measurements, a dual purpose instrument for indicating bridge balance and the a.c. excitation across the unknown.

Type	Null Sensitivity	Frequency Range	Filter	Power Requirements	Dimensions and Weight	Price
1210-B	10 M volts @ 1 KC for 15% meter deflection	20-20,000 cycles	Fixed 60, 400, 1000 cycles provision for other frequencies	105-125 volts 50-60 cycles	*21" x 12" x 13" 37 lbs.	350.00
	Voltage Range	Input Impedance	Frequency Range	Accuracy	Rack	
	0.1 to 150 volts ac. 0.15-1.5-15-150 volts full scale	500 KΩ in parallel with 25 PF.	20 to 20,000 cycles ±1db	2% of full scale	19" x 8¾" x 9½"	

D.C. SUPPLY

A constant voltage transformer regulated current source designed for use with the Freed Incremental Inductance Bridges. Solid state bridge rectification, L-C filters and low internal impedance provides good current regulation with a minimum of circuit complexity.

Type	Current Ranges	Voltage Ranges	Regulation	Power Requirement	Dimensions and Weight	Price
1170-A	4 ranges, 0-5, 25, 100 and 1000 milliamperes	Maximum no load voltage 1000 Ma, 270V, 100 Ma, 270V, 25 Ma, 85 V, 5 Ma, 48 V	± 1% for line variation 105-125 V	105-125 volts 60 cycles	19" x 10½" x 13½" 66 lbs.	350.00

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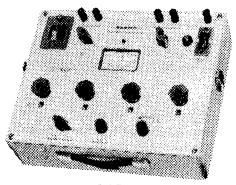
FREED TRANSFORMER COMPANY, INC. 1795 WEIRFIELD ST. (Ridgewood) Brooklyn, N. Y. 11227

FREED TRANSFORMER CO., INC.



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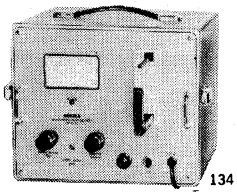

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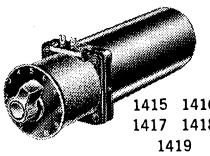

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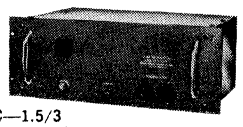


RAC—1.5/3

INDUCTANCE COMPARISON BRIDGE

A complete production unit for comparing transformer and inductor impedances under dynamic conditions against a standard resistor. The instrument has a self-contained metered 500 Ma. d.c. supply, metered 135 volt a.c. source and a direct reading percentage deviation indicator, provision for connecting external test frequencies up to 10 Kc. is provided.

Type	Inductance Range	Deviation Range	Test Frequency	D.C. Current Range	Dimensions and Weight	Price
1870	25 mh - 100 h	±20%, accuracy 1% ±30%, accuracy 5%	60-10,000 cycles	0.5 ma., 0-25 ma., 0-100 ma., 0-500 ma.	22" x 19½" x 15" 150 lbs.	550.00

DISTORTION METER

The type 1970 Distortion Meter is a wide range low input impedance instrument, designed with passive circuitry resulting in high stability, low residual distortion and hum levels.

Type	Frequency Range	Input Impedance	Input Voltage	Sensitivity	Dimensions and Weight	Price
1970	20 cycles to 1 megacycle	75-150 300-600	1 to 200 volts	Distortion level of 0.02% for 1 volt input	19" x 10½" x 12" 30 lbs.	525.00

A.C. LINE REGULATOR

A distortion free 60/400 Hz electromechanical a.c. line regulator. Features a tubeless fast response phase reversible magnetic amplifier preceded by a transistor comparison amplifier with zener reference.

Type	Nominal Input Voltage-Frequency	Output Voltage	KVA Rating and Regulation Range	Regulation Accuracy	Response Speed Volts/sec.	Dimensions and Weight	Price
R.A.C. 1.5/3	115 Volts 60 or 400 Hz	Adjustable 110-120 volts	3 KVA for ± 10% regulation 1.5 KVA for ± 20% regulation	±0.25% for ± 10% regulation range ±0.5% for ± 20%	10@ ± 10% 20@ ± 20%	19" x 7" x 13" 45 lbs.	450.00

DECADE CAPACITORS

The Freed series of Decade Capacitors cover a wide range of values and can be supplied as individual decades from 0.0001 PF. per step to 1 mf. per step or in various combinations of assembled decade boxes. All capacitors are non-inductively wound and heat treated for stability.

Type	Total Capacity	Dielectric	Dissipation Factor	Accuracy	Dimensions and Weight		Price
1415	10 μf in steps of 1 μf	Mylar	<0.005	±1%	3" x 3" x 7"	2 lbs.	40.00
1416	1 μf in steps of 0.1 μf	Polystyrene	<0.0002	±1%	3" x 3" x 7"	2 lbs.	55.00
1417	0.1 μf in steps of 0.01 μf	Polystyrene	<0.0002	±1%	3" x 3" x 7"	2 lbs.	40.00
1418	0.01 μf in steps of 0.001 μf	Polystyrene	<0.0002	±1%	3" x 3" x 7"	2 lbs.	40.00
1419	0.001 μf in steps of 0.0001 μf	Polystyrene	<0.0002	±1%	3" x 3" x 7"	2 lbs.	45.00
1250	1.110 μf in steps of 0.001 μf	Polystyrene	<0.0002	±1%	13¾" x 6" x 4½"	8 lbs.	180.00
1351	11.111 μf in steps of 0.0001 μf plus 100 pf variable air capacitor	Mylar Polystyrene Air	<0.005	±1%	19" x 10¾" x 8"	25 lbs.	305.00
1352	1.111 μf in steps of 0.0001 μf	Polystyrene	<0.0002	±1%	19" x 5¼" x 10"	13 lbs.	220.00
1353	11.111 μf in steps of 0.0001 μf	Mylar Polystyrene	<0.005	±1%	19" x 5¼" x 10"	14 lbs.	275.00

Maximum operating voltage, 500 VDC or peak. Capacitors can be supplied to better than ±1%, write for complete information.
In addtion to listed equipment, Freed manufactures a complete series of decade inductors, AC and DC regulated power supplies, comparison and limit bridges.
Write for complete catalog.

DECADE INDUCTORS

Each unit is an assembly of four toroids wound on a stabilized Molybdenum permaloy dust core. The coils have a nominal inductance of 1-2-3-4 and are connected in series and switched to vary the inductance from 0-10.

Type	Frequency Range, Cycles	Maximum*	Inductance per Step	Total Inductance	Accuracy	Dimensions and Weight		Price
1220	500-20,000	230 @ 4 KC	0.001 h	0.01 h	±2%	3" x 3" x 9"	4½ lbs.	$100.00
1230	500-20,000	280 @ 3 KC	0.01 h	0.1 h	±1%	3" x 3" x 9"	4½ lbs.	95.00
1240	500-20,000	260 @ 3 KC	0.1 h	1. h	±0.5%	3" x 3" x 9"	4½ lbs.	100.00
1270	500-20,000	190 @ 2 KC	1. h	10 h	±0.25%	3" x 3" x 9"	4½ lbs.	110.00
1341	100-2,000	100 @ 1 KC	10 h	100 h	±0.25%	3" x 3" x 9"	4½ lbs.	120.00
1280	500-20,000	280 @ 3 KC	0.001 h	1.11 h	See note	13¾" x 6⅛" x 5½"	16 lbs.	325.00
1290	500-20,000	280 @ 3 KC	0.001 h	11.11 h	See note	15" x 7" x 5½"	20 lbs.	425.00
1310	500-20,000	280 @ 3 KC	0.01 h	11.1 h	See note	13¾" x 6⅛" x 5½"	16 lbs.	325.00
1164†	30-2,000	60 @ 300	0.1 h	111 h	±1%	15" x 7" x 5½"	28 lbs.	285.00

† Type 1164 inductors are wound on special nickel alloy laminated cores.

Inductance per step:	1 mh	10 mh	100 mh	1 h	10h
Nominal Accuracy:	±2%	±1%	±0.5%	±0.25%	±0.25%

*Maximum Q depending on inductance value and a.c. voltage across coil.

SHORTED TURNS INDICATOR

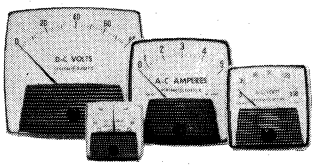
The *type 134 shorted turns indicator is a high sensitivity instrument which will detect the presence of one or more shorted turns in a coil using up to #44 wire. Eddy current losses are minimized by the use of a very low frequency built in test oscillator. The instrument will test most types of audio, power, IF, chokes, relays, and other coreless coils. Power requirement: 115 Volt 60Hz Wt. 13.5 lbs.
Dimension: 11" x 9" x 10" Price $395.00

TRANSFORMER RATIO METER

The *type 277 will measure transformer ratio of 1 to 1011 in three decade ranges with an accuracy of 0.1%. The instrument can also be operated as a ratio comparison tester with a deviation range of ± 1%.
Power requirements: 115 volts 60Hz, Size 17" x 13" x 6" wt: 25 lbs. price — $925.00 *Norma Instruments, Freed Exclusive U.S. Agent.

PANEL, SWITCHBOARD, AND RECORDING INSTRUMENTS

BIG LOOK™ PANEL METERS

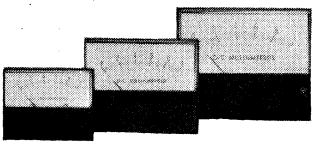


features: 1½-, 2½-, 3½-, and 4½-inch sizes . . . a-c, d-c, and rectifier types . . . iron-vane mechanism in a-c models . . . pivot and jewel, or taut band mechanism for 2½-, 3½-, and 4½-inch d-c models . . . electroluminescent and expanded scales available . . . completely sealed cases on 2½ and 3½-inch models . . . available in all standard scale ranges.

specifications: . . . accuracy ±2% (3% on rectifier types) . meets ASA Spec C39.1 . . . displays a-c and d-c volts, amperes, milliamperes, percent motor load, and other parameters equivalent to d-c microamperes, milliamperes, etc.

Write for Bulletin GEC-1076

HORIZON LINE® PANEL METERS

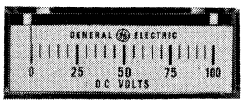


features: 2½-, 3½-, and 4½-inch sizes . . . a-c, d-c, and rectifier types . . . iron-vane mechanism in a-c models . . . pivot and jewel, or taut-band mechanism for d-c models . . . expanded scale available for all models . . . all meters have snap-on snap-off covers.

specifications: . . . accuracy ±2% (3% on rectifier types) . . . meets ASA Spec C39.1 . . . displays a-c and d-c volts, amperes, percent motor load, and other parameters equivalent to d-c microamperes, milliamperes, etc.

Write for Bulletin GEC-1076

TYPE 185 EDGEWISE PANEL METERS

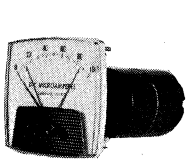


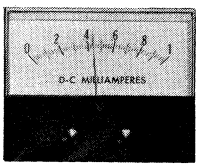
features: . . . 2¼-inches wide by 1-inch high by 3-inches deep . . . horizontal or vertical scale . . . d-c meters have moving-coil D'Arsonval mechanism . . . rectifier-type D'Arsonval mechanism in a-c meters . . . shielded, dust-tight, one-piece molded cycolac window . . . flush case sides permit mounting of two, three or more units.

specifications: . . . accuracy d-c meters 2% of full scale (3% on a-c meters) . . . meets ASA SPEC C39.1 . . . displays a-c and d-c volts, amperes, microamperes and milliamperes.

Write for Bulletin GEC-1076

TYPE 195 AND 196 METER RELAYS





features: . . . 2½-, 3½-, and 4½-inch sizes in BIG LOOK Type 195 styling and 3½- and 4½-inch sizes in HORIZON LINE Type 196 . . . d-c type with pivot and jewel mechanism . . . single and double set-points . . . contactless control . . . "piggyback" mounting of relay and meter.

specifications: . . . accuracy ±2% . . . ON/OFF contact standard . . . DPDT relay rated at 5 amps, 120 volts a-c . . . displays a-c parameters.

Write for Bulletin GEC-1076

TYPE 236 ELAPSED-TIME METERS



Commercial case, with reset knob

In conduit-mounted case

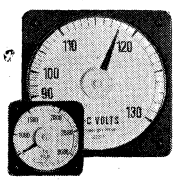


features: distinctive appearance and excellent readability designed to match BIG LOOK ammeters and voltmeters . . . wide selection of mounting styles including 2½- and 3½-inch sizes for panel mounting and 2½-inch size mounted in conduit case or portable stand . . . sealed models, both 2½- and 3½-inch sizes.

Write for Bulletin GEC—1076

SWICTHBOARD A-C TYPES AB-16, AB-18; D-C TYPES DB-16, DB-18 (semiflush)

Type AB-16 (bottom)
Type AB-18 (top)



features: non-parallax scale plates . . . magnetic damping . . . rugged, spring-mounted jewels . . . self-contained resistors to simplify wiring of transformer-rated instruments . . . magnetic shielding . . . rugged, dust-tight, moisture-resistant cases.

specifications: accuracy ±1% of full scale . . . scale length 7.1 in. (AB-18, DB-18) . . . 14.2 in. (AB-16, DB-16)

Write for Bulletin GEC-1507

SWITCHBOARD A-C TYPE AB-30, D-C TYPE DB-30 (semiflush)

features: non-parallax scale plate . . . easy-to-read, large, black numerals and pointer plus convex, shadow-proof cover . . . magnetic shielding . . . rugged drawn-steel case and molded lucite cover resist shock, dust, and moisture.

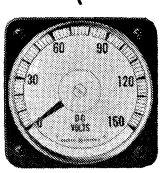
Predetermined scales for 5A and 150V transformer-rated instruments.

specifications: accuracy ±1% of full scale . . . scale length 5.1 in. . . . size 4¼ x 4¼ in.

Write for Bulletin GEC—1507

SWITCHBOARD A-C TYPE AB-40 D-C TYPE DB-40 (semiflush)

Type DB-40 voltmeter



features: High sensitivity . . . ratings as low as 50 microamperes . . . taut-band suspension on a-c and d-c ammeters and voltmeters eliminates mechanism friction and jewel roll . . . permits higher sensitivities . . . insures greater resistance to shock and vibration . . . weather-tight construction . . . non-parallax scale plate.

specifications: accuracy ±1% of full scale . . . scale length 7.1 in. . . . size 4¼ x 4¼ in.

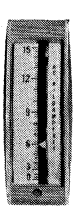
Write for Bulletin GEC—1507

SWITCHBOARD TYPE 180 EDGEWISE INSTRUMENTS (semiflush)

features: space-saving, slimline design . . . cluster mounting . . . flush case-sides for easy stacking . . . vertical or horizontal models . . . non-parallax scale plate . . . magnetic shielding . . . durable, one-piece molded lucite case . . . gasketed to resist moisture, dust and fungus . . . large 4½ in. scales.

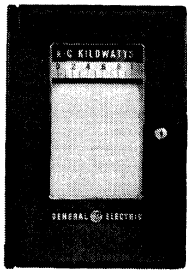
specifications: accuracy a-c 1.5% horizontal . . . 2.0% vertical, d-c 1.5% vertical or horizontal . . . scale length approx. 4.5 in. . . . size (flange) 1¾ in. wide x 6 in. long.

Write for Bulletin GEC—1507



PANEL, SWITCHBOARD, AND RECORDING INSTRUMENTS

DIRECT-OPERATED RECORDERS TYPE CH-1

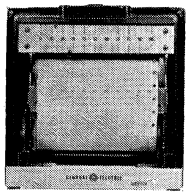


features: ink-type marking mechanism with throw-away inkwell or . . . Telechron motor-driven tapper-type inkless mechanism . . . extra-long 150 ft. record roll . . . multispeed synchronous motor or optional spring-clock drives . . . high readability . . . fast response . . . heavy-duty cases . . . rugged, spring-mounted jewel bearings . . . this recorder also available in portable case.

specifications: accuracy 1% . . . record roll size 6 in. overall width, 4½ in. calibrated width, 150 ft. long . . . AC voltmeter, AC wattmeter and AC varmeter; electro-dynamometer-type measuring mechanism . . . AC ammeter: attraction-repulsion ironvane-type measuring mechanism . . . DC instruments: permanent magnet, moving-coil mechanism . . . this recorder available in portable case.

Write for HBK-8111

4" SOLID-STATE SERVO-OPERATED RECORDERS TYPES 520, 521



Type 520 recorder, single pen

features: measure, indicate and record any variable represented by a d-c millivolt signal . . . null-balance, servo-operated . . . solid state amplifiers . . . wide range of chart speeds (½ in/hr. to 1440 in/hr . . . up to 8 control and alarm switches . . . control or transmitting slidewire . . . companion to GE-MAC controller Type 524 . . . printed wire boards . . . highly sensitive . . . compact, flexible process instrumentation, reliable . . . easy to maintain.

specifications: accuracy ±½% of full scale . . . response time: one or 5 seconds nominal full scale response as specified . . . optional quick change dual response of 1 and 5 seconds nominal . . . input signal: spans of 1 mv to 1 volt d-c . . . amplifier: plug-in type, transistorized amplifier 4 x 10^5 gain . . . chart size 4⅜ in., calibrated width 4 in., length 65 ft. . . . chart speeds: ½ in./hr. to 1440 in./hr. . . . maximum sensitivity 1 millivolts d-c full scale . . . refillable plastic inkwell . . . writing capacity up to 3 months . . . Type 520 single pen. Type 521 two-pen.

Write for HBK-8115

DIRECT-OPERATED TYPE CF-4

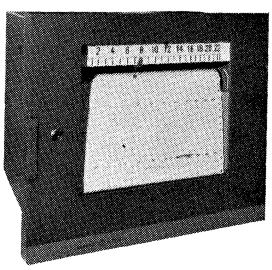


features: tapper-type inkless recording mechanism . . . sturdy case designed to harmonize with modern control equipment panels . . . dependable Telechron motor drives . . . this recorder available in portable case.

specifications: accuracy ±2% . . . record roll size 4 in. wide, 3½ in. calibrated width, 65 ft. long . . . AC motor driven chart drive . . . 3 in. per hour standard chart speed . . . other chart speeds available . . . this recorder available in portable case.

Write for HBK-8110

12" SERVO-OPERATED RECORDERS TYPES HF, HR, HL, HT, HG

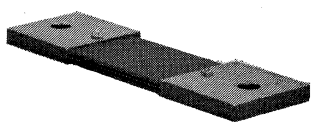


features: same basic amplifier for AC and DC measuring circuits . . . interchangeable universal slidewire . . . 3000-turn measurement slidewire provides high degree of resolution and sensitivity . . . simple conversion from potentiometric to bridge-measuring circuits . . . individual switch set-point adjustments . . . continuous standardization . . . unit mounted components, isolated by function . . . all measurement and recording elements including amplifier are mounted on swing-out panel for convenience . . . printed circuits speed trouble-shooting work . . . range resistors are mounted on replaceable card . . . no soldering required . . . high accuracy measurement plus sufficient torque to operate a variety of control devices.

specifications: accuracy ¼% of full scale . . . response time: strip chart ink types 1, 2, 4, 10, 24 sec. full scale, printed types 1.2, 2.4, 5, 12, 30, 60, 144 sec/point print speed . . . round chart 4, 10, 24 seconds, full-scale . . . input signal: direct input 1.0 millivolt to 1.0 volt d-c. (higher inputs available using voltage-divider circuits . . . amplifier: plug-in unit, transistorized, printed wiring . . . power gains $5X10^{13}$ . . . strip chart size 12 in. wide (10¾ in. calibrated width) 130 ft. long . . . round chart 12 in. diameter (4 9/16 in. calibrated radius) . . . synchronous motor chart drives . . . chart speeds: ½ to 60 motor rpm, ½ in. to 360 in. per hour strip-chart speed . . . round chart speeds standard 24 hours . . . ink-type marking mechanism . . . maximum sensitivity one millivolt d-c full scale . . . meets ASA specifications C39.4.

Write for HBK-8117

TYPE 140 SHUNTS



features: . . . lighter and smaller than earlier designs, easier to handle and install . . . full length manganin strips provide greater structural strength . . . silver-plated terminals permit low-resistance contact . . . removable bases and adjustable bolts for easier installation and mounting . . . "chimney" design for maximum self-cooling.

specifications: . . . accuracy ¼% (calibrated) of rated millivolts . . . ratings minimum 10A, 50MV, 100MV, maximum 10KA, 50MV, 100MV . . . standard 6-ft. leads for back-of-panel wiring feature machined terminals and FLAMENOL® insulation, suitable for operating temperatures up to 75C and line-to-ground voltages up to 600 volts maximum . . . approx. weights for 50 millivolt rated models .5 to 70 lbs., 100 millivolt rated models .75 to 90 lbs.

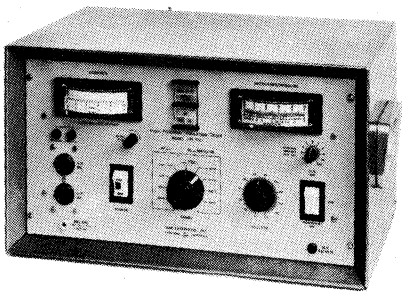
Write for Bulletin GEC-1076

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

gar enterprises
2031 North Lincoln Avenue • Pasadena, California 91103 • Tel. (213) 798-0785

HIGH POTENTIAL INSULATION TESTER MODEL HPT-100



MEASURES OR TESTS ☐ DC Insulation ☐ AC Insulation ☐ DC Leakage Current ☐ AC Leakage Current ☐ Megohm ☐ Corona **ON INDUSTRIAL AND MILITARY** ☐ Transformers ☐ Capacitors ☐ Cables ☐ Motors ☐ Insulation Materials ☐ Appliances ☐ High Voltage Rectifiers **FOR** ☐ Quality Control ☐ Production Testings ☐ Research and Development ☐ Maintenance ☐ Repair

Easy To Use, Illuminated Functional Operation

FEATURES

DC OR AC DIELECTRIC STRENGTH TESTS
- ☐ Edgewise meter calibrated to read 0-10 kvdc or 0-5 kvac
- ☐ 0-1000 vdc expanded scale provded by using leakage current meter
- ☐ KV meter re-calibration

DC OR AC LEAKAGE CURRENT MEASUREMENTS
- ☐ I.C. operational amplifier used for linear, damage-free measurement of leakage current.
- ☐ DC and AC leakage current range switch
- ☐ Microamp meter re-calibration

INSULATION RESISTANCE MEASUREMENTS
- ☐ 5 ranges up to 5000 megohms at 500 vdc
- ☐ Up to 100,000 megohms at 10 kvdc

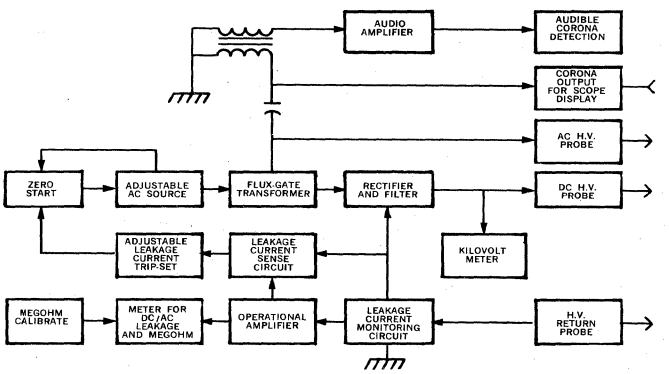
CORONA LEVEL VOLTAGE TESTS
- ☐ Scope output for visual peak-to-peak corona level indication
- ☐ Speaker output with volume control for audio corona detection

SAFETY PROVISIONS
- ☐ Continuously adjustable leakage current trip-set-point from 1 ua to 5 ma may be used for NON-DESTRUCTIVE high potential tests
- ☐ Flux-gate H.V. transformer (model HVT-1) automatically decreases the output voltage when overloaded or short circuited.
- ☐ Zero start interlock to minimize erroneous application of test condition
- ☐ Positive selection of DC or AC function by relay logic to have only DC or AC output, but not both
- ☐ Leakage current trip set, flux-gate transformer and zero start interlock doubles as safety feature to the operator

SIMPLICITY
- ☐ Easy-to-operate, illuminated instructional display

CONVENIENCE
- ☐ High voltage on/off/momentary switch for abrupt voltage application on the sample under test

BLOCK DIAGRAM



SPECIFICATIONS

INPUT VOLTAGE 115 vac, 60 hz

POWER CONSUMPTION 70 watts

OUTPUT VOLTAGE DC: 0-10 kv continuously variable AC: 0-5 kv continuously variable

LEAKAGE CURRENT DC: 5 ranges zero to 5ua/10ua/50ua/100ua/500ua AC: 4 ranges zero to 100ua/500ua/1ma/5ma

MEGOHM INSULATION RESISTANCE AT 500 VDC 5 ranges: 1-50/5-250/10-500/50-2500/100-5000 megohm

ACCURACY DC: ±3% current and voltage AC: ±4% current and voltage for up to 1ma range AC: ±5% voltage for 5ma range MEGOHM: ±5%

LEAKAGE CURRENT TRIP-SET-POINT DC: 1ua-500 ua continuously adjustable AC: .02ma-5ma continuously adjustable

NON-DESTRUCTIVE HIGH POTENTIAL TEST APPLICATION Continuously adjustable leakage current trip-set-point from 1ua to 5ma may be used for non-destructive high potential tests

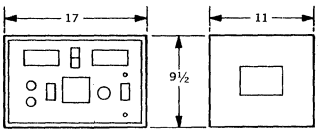
CORONA Scope output per MIL-T-27B and per ASTM D1868-61T Audible output via speaker for corona detection

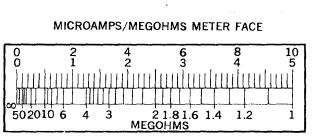
ZERO START FOR H.V. OUTPUT Minimizes erroneous electrical test condition. Eliminates hysteresis from previous on-off usage

FINISH Cabinet: Hammertone. Panel: Semi-gloss light green. Other colors available on special orders

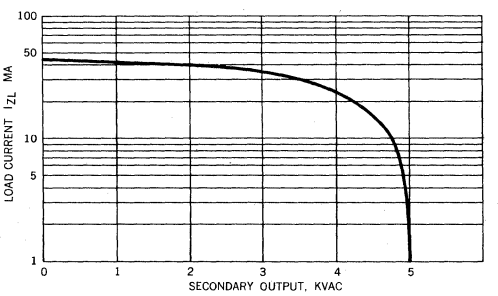
WEIGHT 35 pounds

PORTABILITY Handles provided for ease of carrying

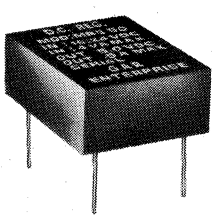




OIL FILLED H.V. TRANSFORMER, HVT-1 USED IN THE HIGH POTENTIAL INSULATION TESTER GAR MODEL HPT-100



MINIATURE VOLTAGE REGULATOR



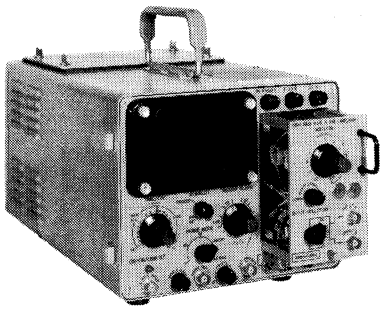
Designed for installation in computers, control, automation GSE, and other digital logic systems.

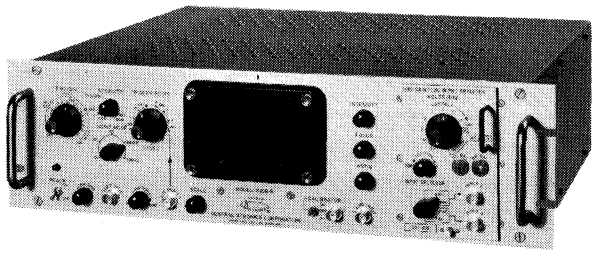
The Model MRS Series Voltage Regulator: 1) dissipates only 20% of the power consumed by conventional regulators; 2) distributes power to digital systems in the form of higher voltage and lower current; 3) delivers high current only at the point of installation; 4) reduces system noise by reducing buss bar currents.

SPECIFICATIONS

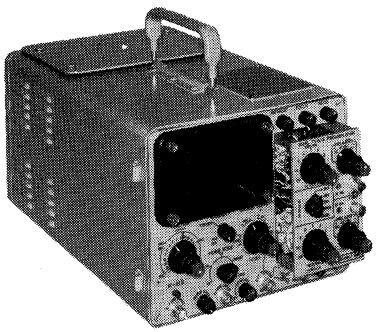
1. Input voltage range: 16-24 VDC
2. Output voltage:
   Model MRS 45 — 4.5 VDC
   Model MRS 50 — 5.0 VDC
   Model MRS 55 — 5.5 VDC
3. Load current: 0-500 ma
4. Efficiency: 65% @ Full Load
5. Line regulation: ±0.5% Max.
6. Load regulation:
   No load to full load: ±0.5% Max.
7. Output ripple: 40 m v P-P Max.
8. Temperature stability: 2.0 m v/°C
9. Operating temperature: 0-65°c
10. Overload and short circuit protection: Protected against dead short and above 150% overload
11. Recovery time:
    (a) No load to full load: 0.75m sec
    (b) Full load to no load: 4.5 m sec
12. Size: 1 1/16 x 1 1/4 x ½ inches high Leads: ⅝ inches long

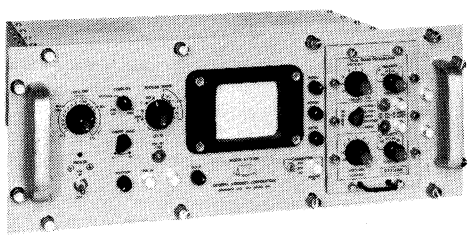
FULL-MIL CUSTOM DISPLAYS for SYSTEM REQUIREMENTS—TRANSISTORIZED PORTABLE OSCILLOSCOPES





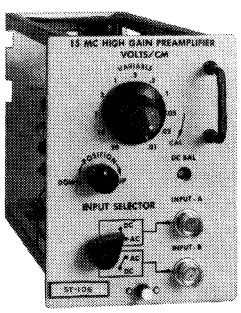
ALL MIL 6-10 MHz PORTABLE. Meets requirements of MIL-E-16400 — proof of ruggedness and reliability. Ideal for use in A/N equipment design. Transistor-cool operation — draws only 24.5 watts. 2½" x 2" useful display area on rectangular screen. 19 calibrated sweep ranges in 1-2-5-10 sequence from 0.1 μsec to 0.1 sec/div. Dimensions: 8¾" wide, 6½" high, 14" deep. Only 18 lbs. Available in bench and rack mounts as shown. **MODEL K-106.**





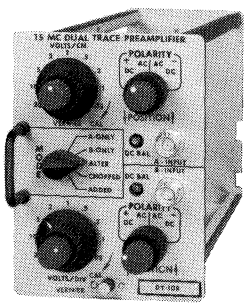
15 MHz PORTABLE
Same specifications as K-106 (above) with 15 MHz bandwidth. Available in both bench and rack mounts as shown. **MODEL K-115.**

ACCESSORIES FOR ALL-MIL PORTABLES GIVE HIGH GAIN — DUAL TRACE

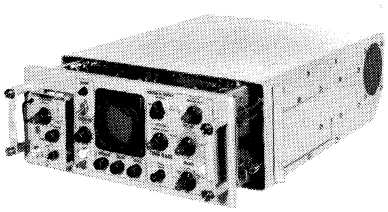


HIGH GAIN PLUG-IN AMPLIFIERS — Single trace amplification for Models K-106 and K-115. Two inputs selectable. Calibrated sensitivity from 10 mV to 20 V/div in eleven selectable positions in a 1-2-5-10 sequence. **MODEL ST-106 (dc to 6 MHz), MODEL ST-115 (dc to 15 MHz).**

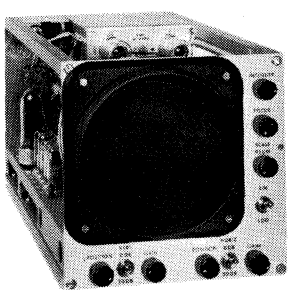
DUAL TRACE PLUG-IN AMPLIFIERS — Provide dual trace presentation on a single gun tube for Models K-106 and K-115. Available in five operating modes. **MODEL DT-106 (dc to 6-10 MHz), MODEL DT-115 (dc to 15 MHz).**



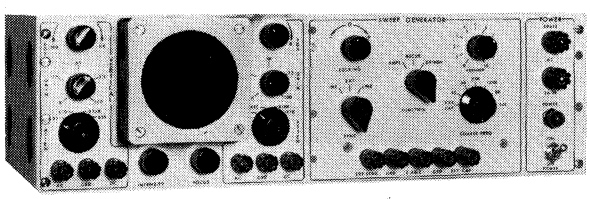
TYPICAL CUSTOM DESIGN SYSTEM MODELS



MILITARIZED MONITOR—A compact, bright trace, MIL efficient, rack-mounted oscilloscope, 10 MHz bandwidth—plug-in versatility. Simplicity of design insures ease of installation and maintenance. High brightness 10 kV insures easy reading on the 3" CRT. **MODEL K-14-R.**



POPULAR PRICED 5" SCREEN LIGHT-WEIGHT — Reliable low-cost monitor featuring equal X and Y, full screen positioning and true portability. Adaptable to many applications. Measures 7¾" x 7¾" x 17¾". Weighs only 23 lbs. Sensitivity, 0.1 v/cm. **MODEL K-12-R.**



3" ROUND DISPLAY IN AN EQUAL X-Y PORTABLE—Trimmed to a mere 8½" in depth . . . 5" in height and 19" in width, for high performance within space limitations. Rugged, Mil-guided construction. Excellent stability. Also available in conventional housing. **MODEL K-13-R.**

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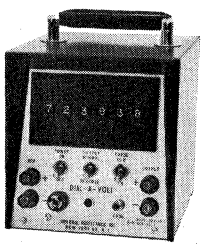
GENERAL ATRONICS

ELECTRONIC INSTRUMENT DIVISION • PHILADELPHIA, PENNSYLVANIA 19118

HI-ACCURACY, STABILITY, PERFORMANCE
DC INSTRUMENTATION

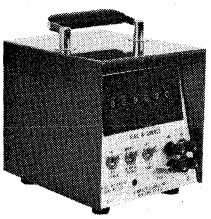
General Resistance's DC instrumentation line makes GR **first source** for high-accuracy, stability and performance in DC Voltage, Current and Resistance Equipment. Nearly everything for DC Voltage, Current, Resistance and Ratio Calibration is available from GR.

Your test instrumentation can be no better than its calibration standard and GR's instruments are among the best of those. The examples here are a small part of the total GR line. Write for your complete catalog.



DIAL-A-VOLT
Dialable Voltage Reference

±1 μV to ±10 V. Accuracy up to 0.0015% • Stability: 0.001% • Resolution: 1 PPM • to 7 Decades • In-Line Readout • From $399.



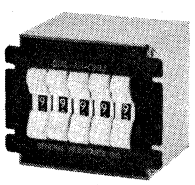
DIAL-A-SOURCE
Dialable E/I (Zero Impedance) DC Calibration Source

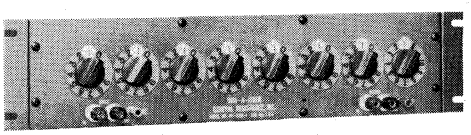
±0.1 μV to ±10 V @ up to 25 mA • Stability ±10 PPM • Accuracy to ±0.0015% • to 6 Decades • In-Line Readout • 5 Models • from $875.

DIAL-A-VIDER
Dialable Volt/Ratio Divider

Linearity to ±3 PPM • Resolution to 1 PPM • Phase Angle @ 10 Kc < 0.1° • to 7 Decades • In-Line Readout • 5 Models, Bench/OEM • From $119.







DECADE RESISTANCE UNITS
DIAL-AN-OHM DIAL-A-STAT
RESIST-O-STAT
Universal / Dialable / Precision Resistance Decades

GR offers one of the widest lines of accurate resistance decades available. All use GR precision wirewound resistors and combine excellent accuracy with simplicity of operation at low prices: Dial-An-Ohm units are as low as $17/decade, Dial-A-Stat units from $83, Resist-O-Stat units from $95. In bench or OEM configurations.

VOLTAGE DIVIDERS
Primary / Secondary Standard Voltage Dividers

Complete line of Primary Standard and Secondary Standard Voltage Dividers using Kelvin-Varley (isohmic) circuits and GR precision wirewound resistors. ±0.5 PPM (DV4107) or ±1 PPM (DV5008) Accuracy. Stability ±0.5 PPM/yr (DV4107) or ±1 PPM/yr. Prices start as low as $339 (DV5008, 8 dials) for a 1 PPM Divider.

RESISTANCE MEASUREMENT
Systems, Bridges

Complete line of automatic, semi-automatic, manual R-measuring systems and bridges with accuracies to ±0.001% are available from GR. Auto systems are GO/NO-GO with high speed production capability. Write for complete data on GR R-measuring systems and bridges.

GR's DC instrumentation capability is available to you whatever your need from an automatic high-accuracy system for production resistance measurement to a high-quality zener reference. GR's sales/service is world-wide. Write or 'phone for complete new catalog.

Prices f.o.b. Mt. Vernon, New York, domestic

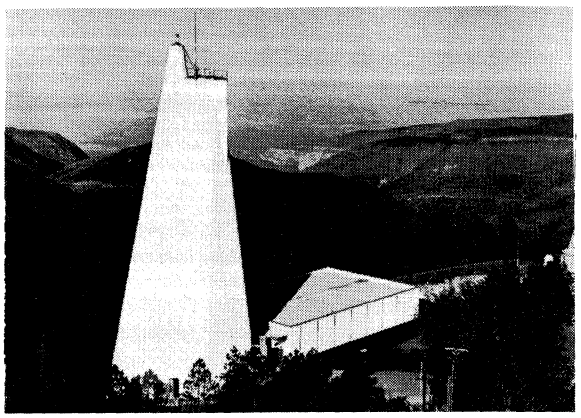
U.S.A.: 500 NUBER AVENUE, MT. VERNON, NEW YORK (212) 292-1500 TWX 710 560 0014
EUROPE: 39 RUE ROTHSCHILD, GENEVA, SWITZERLAND (022) 31 81 80 TELEX 22266

GENERAL RESISTANCE
DIVISION OF CHRONETICS

GEO SPACE SYSTEMS, INC.

PRECISION INSTRUMENT SYSTEMS AND EQUIPMENTS

COMPLETE INSTRUMENT CONTROL SYSTEMS



MOVABLE TURRET ASSEMBLY & CONTROL SYSTEM SACRAMENTO PEAK OBSERVATORY

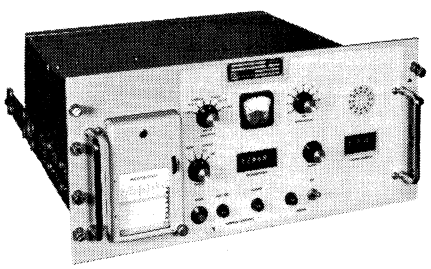
The Air Force Cambridge Research Laboratories' Sacramento Peak Vacuum Telescope is a vivid demonstration of the Company's depth of diversified talent and systems capability.

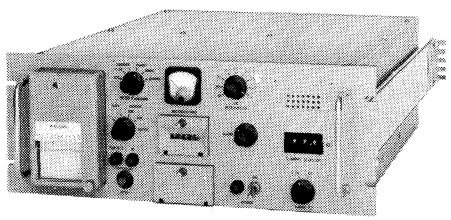
This telescope, with associated instrumentation and electronics, is located at Sunspot, New Mexico, 9200 feet above sea level. It stands 136 feet above ground level and extends 221 feet into the heart of the mountain. It is schduled to become operational in 1969.

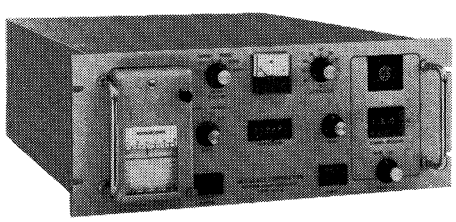
The instrumentation and electronics furnished by Geo Space Systems, Inc., will serve as the operating controls of the telescope. It is designed to auto-track or track on a programmed basis, the sun, other stars or planets and will enable scientists to learn more about the physical composition and activity of these bodies. The instruments can provide continuous automatic compensation for the rotation of these bodies with respect to their celestial coordinates during all tracking phases. One hoped-for result of these studies will be the ability to forecast accurately solar flares. This ability will be of great importance to world-wide communications and to space programs.

The GSS role in this program involved design, production and installation of an optimum switched, non-linear servo control system to drive the 10,000 ft/lb torque motor which rotates the 230 ton evacuated optical tube forming the lower part of the telescope; and the servo control systems operating the upper turret section and its precision components, including solar-optical error detectors yielding auto-track accuracy within 30 arc sec. GSS is also building and installing the large spectrograph and the Echelle spectrograph.

TIME/FREQUENCY CONTROL EQUIPMENT

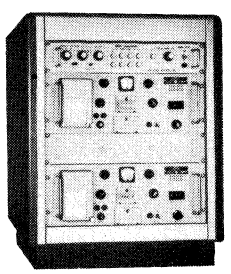






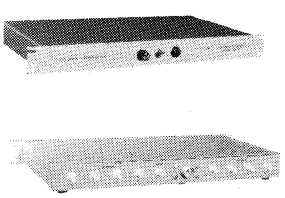
GSS VLF RECEIVERS

The GSS VLF receivers are designed for precision phase monitoring of VLF stations or rating of local standards. They are also capable of monitoring the new Omega stations when used with a suitable commutator. Characteristics are standard inputs of 100 kHz or 1 MHz, tuning range of 10 to 30 kHz in 50 Hz increments, mechanical or electronic servo, .006 Hz servo bandwidth, 10 nanovolt sensitivity and a built-in chart recorder for read-out. Units are line operated with optional DC standby input available.



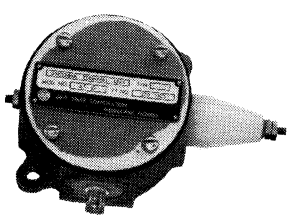
OMEGA SYSTEM

The Omega Navigation System provides navigation for ships and aircraft with excellent accuracy. Results are obtained with readouts of "lane crossings" and an analog position voltage. Suitable outputs are also provided for interfacing with a computer for more sophisticated readout and data analysis.



VLF ANTENNA MULTICOUPLER

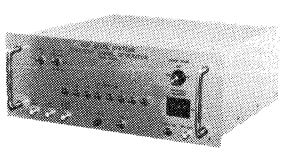
This multicoupler can reduce such problems as desensitization, phase shift, cross-coupling interference, and coherent ground circuit interference. Input impedance is 50Ω, with 8 independent 50Ω outputs featuring 50 db isolation, and a gain of 3 db.



VLF LONG-WIRE AND WHIP ANTENNAE

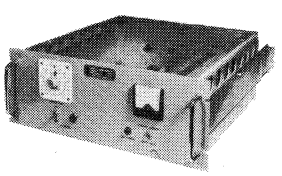
The AT-10 long wire antenna and matching network provide excellent VLF reception, and allows use of a 50Ω coaxial transmission line.

The WA-10 whip antenna excels in areas of heavy horizontally polarized man-made noise.



COHERENT SIGNAL GENERATOR

This instrument furnishes a stable and controllable input signal for complete, rapid testing of performance characteristics of VLF receivers, including sensitivity, stability, accuracy, time constant and lag, deadband, noise rejection, adjacent channel rejection, intermodulation distortion, image response, and desensitization. The reference and the GSC-12 outputs are simultaneously monitored by the receiver under test, yielding data that is an absolute measure of the receiver's response.



BATTERY POWER SUPPLY

The GSS standby battery power supplies have been designed to furnish emergency DC power to critical equipment when primary AC power fails. Stable output voltage is obtained from nickel-cadmium batteries for long periods. Integral circuits provide fast and trickle charge. In the fast charge mode, batteries are restored to full charge in less than 8 hours. Full voltage life is dependent upon Amp/Hour rating of batteries supplied and the load current. Indication of approximate charge status is provided by a front panel meter and indicator lights.

As a leading manufacturer of standard frequency correlation and time signal synchronization equipment, Geo Space Systems, Inc. has successfully met the growing needs for time synchronization between geographically separated stations.

With its equipment serving the U. S. Army, Navy, NASA and FAA, and by meeting their stringent requirements, Geo Space is continually expanding its efforts to develop new approaches and instrumentation in this field.

GEO SPACE SYSTEMS, INC.
6301 49TH STREET NORTH, P. O. BOX 13575
ST. PETERSBURG, FLORIDA 33733
Phone: 813 - 525-1161

HICKOK

DMS 3200

DIGITAL MEASURING SYSTEM

(Fully solid state with IC's)



This all-solid-state precision measurement system offers unlimited expansion capability through plug-in additions, resulting in a specialized instrument for each type of measurement. New plug-ins now broaden the measurement capability of this field-proven unit. Over 10,000 are in use at present.

Scaling controls make possible resolution of up to seven digits on the three-digit display by utilizing the overrange capability of many of the plug-ins, thus providing high resolution and accuracy with minimum investment. Companion devices such as the PR 4900 Digital Printer and 1050 Digital Set-Point Controller further extend the utility of the DMS 3200 System.



DC VOLTMETER PLUG-IN DP 100 **$175**
00.1 mv to 999. volts
± 0.1% rdg ± 1 digit

DC MICROVOLTMETER PLUG-IN DP 110 **$450**
0.001 mv to 999.9 volts
± 0.05% rdg ± 1 digit
4-digit resolution

AC VOLTMETER PLUG-IN DP 130 **$375**
0.01 mv to 999. volts
± 0.1% rdg ± 1 digit
22 Hz to 1.0 MHz

EVENT COUNTER/SLAVE PLUG-IN DP 140 **$90**
Up to 1,000,000 counts/sec
Cascade with second DMS to obtain 6-digit display

1 MHz COUNTER PLUG-IN DP 150A **$230**
00.1 Hz to 999. kHz
± 0.0005% rdg ± 1 digit
7-digit resolution

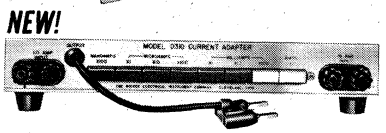
80 MHz COUNTER PLUG-IN DP 160 **$395**
00.1 Hz to 80.0 MHz
± 0.00005% rdg ± 1 digit
7-digit resolution

OHMMETER PLUG-IN DP 170 **$275**
.001 ohm to 999. megohms
± 0.1% rdg ± 1 digit
Microamp test current

CAPACITY METER PLUG-IN DP 200 **$275**
.001 picofarad to 9,999 mfd
± 0.1% rdg ± 1 digit
Low DC test voltage

TIME INTERVAL METER PLUG-IN DP 210 **$230**
0.01 ms to 999. seconds
± 0.0005% rdg ± 1 digit
Period or time interval

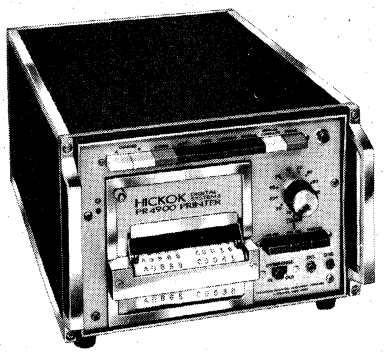
NEW!



DC CURRENT METER ADAPTER D 310 **$90**
.0001 microamp to 9.99 amps
± 0.15% rdg ± 1 digit

PR 4900

DIGITAL PRINTER



From $760

This professional printer provides print-out of up to 10 columns of digital information from one or two independent sources. It is a companion unit to the Hickok DMS 3200 Digital Measuring System; however, it may be used with any device which provides 10-line decimal or BCD coded data outputs. Voltage, frequency, time period, resistance, capacitance or event counts are examples of data which may be recorded in printed form on paper tape for storage and future reference.

1050

DIGITAL SET-POINT CONTROLLER

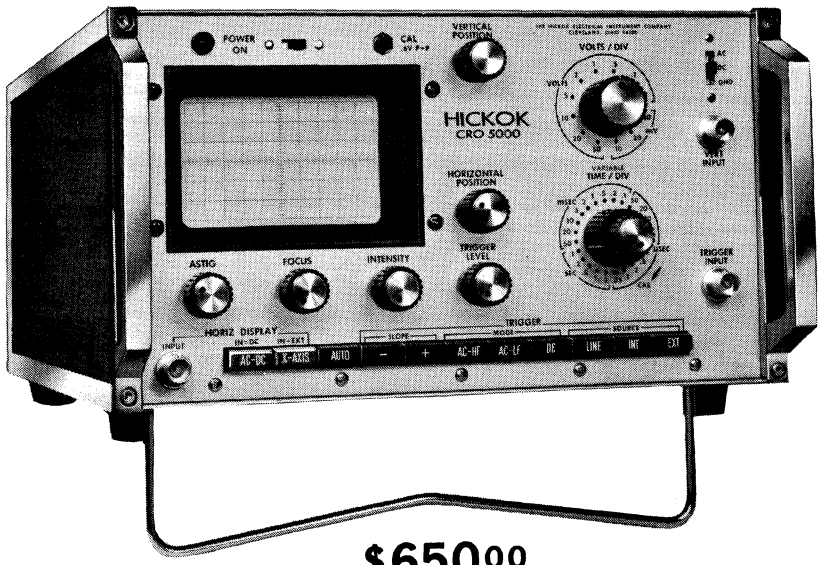


$230

The Model 1050 Digital Set-Point Controller, when used with the Hickok DMS 3200 Digital Measuring System, can start and/or stop the operation of any peripheral function at predetermined measurement values, as selected by the operator. Set-points are absolute, assuring start or stop functions at specific values with zero set-point error.

When used with the DMS Main Frame and the appropriate DP Series plug-in digital measurements of voltage, frequency, period, resistance, capacity, events (and with appropriate transducers, pressure, flow, temperature, strain, etc.) can be used to activate external mechanical feeds, drives, print-outs, reject hoppers, feed motors, fuel adjustments, blowers, tabulation recorders, etc.

HICKOK CRO 5000 25 MHz Oscilloscope (all solid state)

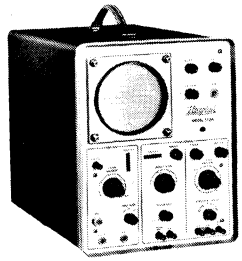


$650.00

This high-precision laboratory oscilloscope equals the basic performance of higher priced, sophisticated 'scopes, yet meets the industry need for such performance in the $600 price range. Emphasis has been placed mainly upon those characteristics most important in precise measurements, eliminating some of the more exotic and somewhat superfluous functions found in higher priced instruments. The result is an all-solid-state instrument in the medium price range with extraordinary stability, sensitivity, bandwidth, sweep-speed range, trigger capability, reliability, and ruggedness.

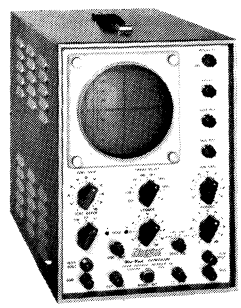
- **25MHz vertical bandwidth (to 3db down points)**
- **Usable to 50MHz**
- **All solid state for high stability and reliability**
- **12 calibrated vertical attenuator ranges 10 mv/div to 50 volts/div (±3.0% accuracy)**
- **24 calibrated sweep ranges 0.05 microseconds/div to 2 sec/div (±3.0% accuracy)**
- **Vertical delay line assures viewing of full leading edge of pulses**
- **"Sweep Delay" of up to 40 divisions**
- **Sweep speed continuously variable between ranges**
- **X-axis channel bandwidth DC — 5MHz**
- **4" flat-faced CRT, 6 x 10 division graticule**
- **3.8 kv HV provides sharp, bright trace**
- **Vertical amplifier will handle overloads, with negligible distortion of waveforms increased to 5 times screen height**
- **Internal 1.0% calibration squarewave**
- **Fast, convenient push-button selection of trigger modes**
- **Positive, solid triggering on all displays**
- **Small — 11¼" W, 6⅞" H, 19" D; 24 pounds**

HICKOK



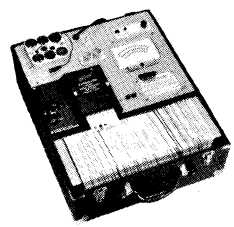
770A OSCILLOSCOPE — General purpose industrial oscilloscope with calibrated 4MHz DC vertical amplifier, 18 direct reading calibrated sweep rates from 1μ sec/cm to 0.5 sec/cm, choice of free-running, driven or automatic sweep modes. Flat-faced 5" post-accelerated CRT.

$475.00



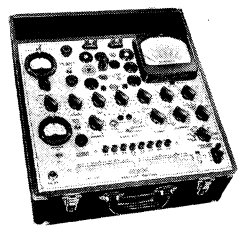
677 OSCILLOSCOPE — Low cost utility and service instrument with 5" CRT. Vertical amplifier response within 3db from 5Hz to 4.5MHz. Built-in calibrator simplifies peak-to-peak measurements. Horizontal sweep has preset positions for TV vertical and horizontal signals.

$249.50



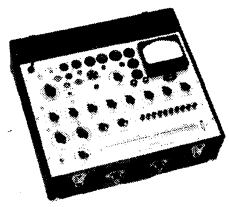
123R CARDMATIC TUBE TESTER—Automatic tube testing using card-programmed switch, eliminates errors. A fast, automatic tube tester which includes tests for saturation and cut-off in addition to mutual conductance.

$725.00



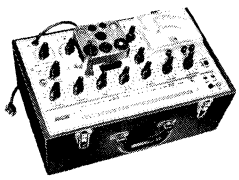
539C TUBE TESTER — Laboratory and industrial instrument. Provides both handbook condition tests and tests "tailored" to specific individual conditions. Roll chart data.

$595.00



752A TUBE TESTER — Communications and industrial maintenance instrument. Includes tests for 4-digit industrial tube types, VR tubes, and low power thyratrons. Best buy for general purpose industrial maintenance. Roll chart data.

$415.00



6000A TUBE TESTER — Service technician's high-speed, portable tester. Tests all popular entertainment types, also transistors and diodes. Time-saving leakage and short indicators. Replaceable socket plate for obsolescence protection. Roll chart data.

$279.50

870 Dynamic Beta Transistor Tester
$395.00

890A Dynamic Beta In-circuit Transistor Tester
$215.00

THE HICKOK ELECTRICAL INSTRUMENT CO. • 10514 Dupont Avenue • Cleveland, Ohio 44108



HICKOK

CARD READERS

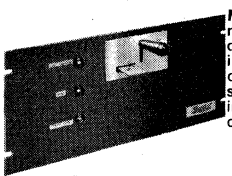
- CONTROL
- AUTOMATION
- DATA COLLECTION



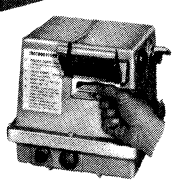
MODEL 50 — Manually operated card reader — 50 contacts (5x10). Card actuated multiple switch containing 50 wiping-type contacts, each capable of carrying up to 10 amps. Solenoid release makes contacts instantly. Manually opened. Card size: 3¾" x 1½" — 50 individual bottom-contact connections. Upper contacts — 5 common columns. **$195.00**



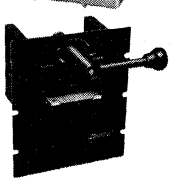
MODEL 50M — Motorized card reader — 50 contacts (5x10). Similar in most respects to the Model 50, manually operated card reader, except that this model utilizes a ⅙ hp fast action motor instead of the spring actuated closing mechanism. Card size: 3¾" x 1½" — 50 individual bottom-contact connections. Upper contacts — 5 common columns. **$425.00**



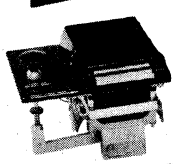
MODEL 50P — Panel mounted card (badge) reader — manually operated — 50 contacts (5x10 matrix) for data collection systems requiring heavy duty industrial type installations. Once inserted, card is locked in position and can only be withdrawn when reader is opened by external signal. Card or badge will only operate reader if inserted in correct position. Available also in 80-, 120- and 264-contact configuration. **$650.00**



MODEL 80 — The HICKOK all-weather badge reader is an inherently explosion-proof data input device controlled by punched cards (badges). The enclosure is cast aluminum and the reader is operated by means of the card entry door. Unit is approximately 10⅜" wide x 9" high x 7½" deep. All switching is accomplished by means of hermetically sealed switches providing an inherently safe reader. **Prices on request**



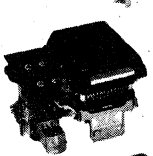
MODEL 120 — Lever operated 120-contact card (badge) reader for heavy duty industrial applications — 15x8 matrix. Utilizes high current capacity pin-sleeve type contacts assuring positive action even under severe environmental conditions. Card is positively locked in place during "read" period and can only be withdrawn when lever is returned to "open" position. 120 individual bottom-contact connections — upper contacts bussed in 15 common columns. **$500.00**



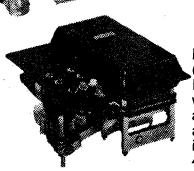
MODEL 186 — Manually operated card reader — 186 contacts (11x17). Card actuated multiple switch containing 186 wiping-type contacts, each capable of carrying up to 10 amps. Solenoid release makes contacts instantly. Manually opened. Card size: 5⅝" x 3". 186 individual bottom-contact connections. Upper contacts — 11 common columns. **$295.00**



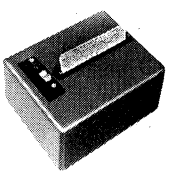
MODEL 324 — Manually operated card reader using pin-sleeve contacts and having the same contact arrangement and spacing as the Model 540M except that it has only 27 columns. The configuration is 12x27. The card will activate a microswitch if inserted correctly and release the handle which then may be moved to the "close" position. The "read" light indicates the program card is being read. Connections to each of 324 discrete bottom contacts. Upper contacts bussed in 27 common columns. **$650.00**



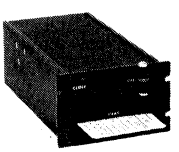
MODEL 186M — Motorized card reader — 186 contacts (11x17). Similar in most respects to the Model 186, manually operated card reader, except that this model utilizes a ⅙ hp fast action motor instead of the spring actuated closing mechanism. Card size: 5⅝" x 3". 186 individual bottom contact connections. Upper contacts — 11 common columns. **$495.00**



MODEL 540M — Motorized card reader — 540 contacts (12x45). Designed to accept standard size Remington Rand cards. Card actuated multiple switch containing 540 wiping-type contacts, each capable of carrying up to 10 amps. Uses a heavy duty, fast action, ⅙ hp motor for actuating switch mechanism. Card size: 7⅜" x 3¼". 540 individual bottom contact connections. Upper contacts — 45 common columns. **$1295.00**



MODEL 960M — Permits high reliability "block reading" of full 80-column punched tab cards, 960 discrete outputs — 12x80 matrix. Computer use-proven multi-stranded brush type contacts provide absolutely dependable closure even if card is key-punched slightly out of position — literally no chance of misread. Motorized drive — push button operated — features mechanism which completely swallows card during read cycles. Heavy-duty rugged design. Over 1,000,000 cycle life. **$1490.00**

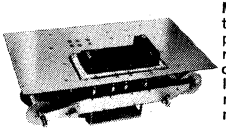


MODEL 960 SL — Small size, manually operated, reliable card reader which reads all 12 rows and 80 columns of a standard punched tab card. It is a "block reader" with 960 discrete outputs featuring an automatic card swallow mechanism and multi-stranded brush type contacts assuring absolutely dependable contact closure even if card is key-punched slightly out of position. Small size (3" high x 5" wide x 9" deep) permits installation in smaller control panels. Operates in any position. Unique design allows entire unit to be taken apart and reassembled in a matter of minutes if necessary. Rugged, over 1,000,000 cycle life. Available with full diode matrix if required. **$650.00**

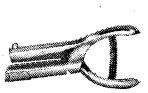


FOR CREDIT CARDS

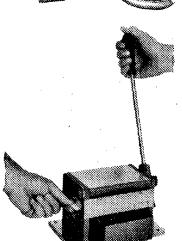
MODEL 264 — Credit card (badge) reader having 264 individual contacts arranged in a standard 12-row-x-22-column Hollerith-type format. Reader actuates simply by inserting card in the slot provided. Read head features highly reliable multi-stranded brush type contacts, assuring positive "read" even if the card is key-punched slightly out of tolerance. Card is released and ejected simply by depressing the front panel control lever. The Model 264 is ideal for data collection systems. Standard credit card size. **$250.00**



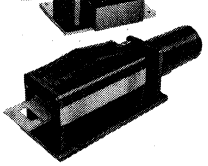
MODEL 540MT — Highly versatile sequentially operated tape reader capable of controlling up to 540 contacts per program image on the tape. Tape is indexed, fed and read automatically at predetermined time intervals. The duration or interval of programs are controlled variables. Ideal for automatic test systems requiring a predetermined number of test conditions or for numerical control machine applications. **Prices on request.**



MODEL CP-5 — Hand punch for use in punching program cards. Heavy duty steel construction — nickel plated. Use with program cards pre-printed with locating circles. Use 3/16" hole size for Models 50, 50M, 186, 186M, 372M card readers. Use ⅛" hole size for Model 540M card reader. **$12.50**



MODEL CP-10 — Master card punch specifically designed to provide a rapid means of precisely punching program cards. 187 machined pins assure cleanly punched holes. Lever operated. For use with Models 186 and 186M (and old Model 185) card readers. Can also be used for Model 50 and 50M cards when supplied with adapter kit. **$500.00**



MODEL CP-15 — Master card punch for precisely punching program cards for the 540 contact (Model 540M) card reader. As many as 540 holes may be punched simultaneously. Simple, easy to operate motor driven unit. **$2500.00**



MODEL CP-540-LK — Keyboard type card punch for Mylar program cards. Designed to punch the 540 contact Rem-Rand type cards column by column. Will punch any or all 12 holes in a given column simultaneously. Automatic advance to next column. Specifically developed to program cards for the HICKOK Models 540M and 324 card readers. **$1295.00**

THE HICKOK ELECTRICAL INSTRUMENT COMPANY
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Here's why:

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The guiding philosophy of the Heath Company is to offer the best value in instruments. Best value is achieved by offering quality design, precision where it counts, omitting the frills, and selling direct to you. The result is more performance for your dollar.

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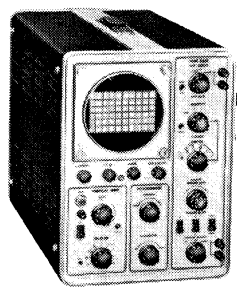
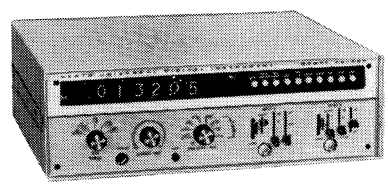
Heath maintains a staff of technical consultants whom you can call upon for advice on any instrument we manufacture. We help on the selection of the right instrument, its application, maintenance.

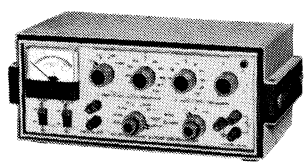
Here's what:



Oscilloscopes

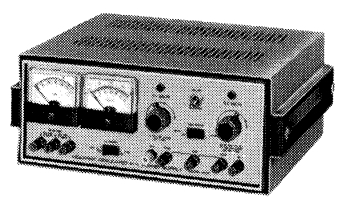
Universal Digital Instruments

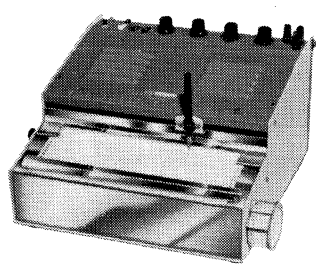




Generators

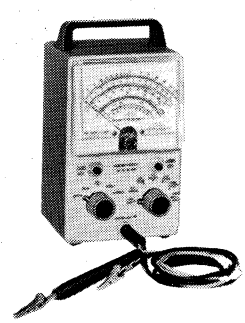
Power Supplies





Recorders

Meters



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8 AUDIO VOLTAGE SOURCE MODELS
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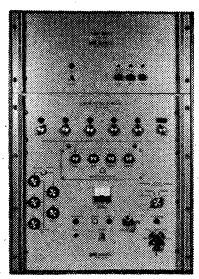
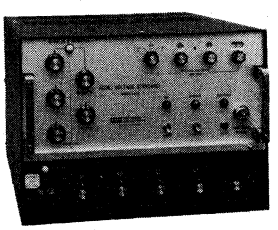
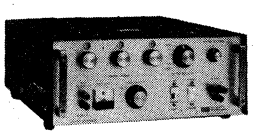


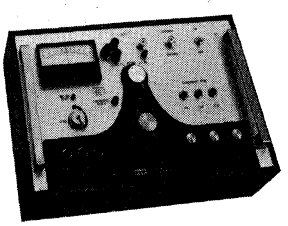
MODEL 325A



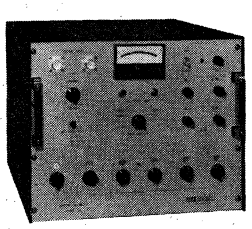
MODEL 631B



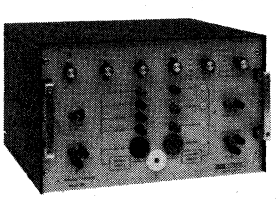
MODEL 613



MODEL 6A



MODEL 10



MODEL 250

A decade in the AC instrument business provides Holt with the depth and experience to solve any AC measurement or calibration problem. Holt led the industry to the **FIRST** Audio Voltage Standard, the **FIRST** 1 for 1 commercial Thermal Transfer Standard, the **FIRST** fully — protected Thermo — Element circuit and the **FIRST** Automatic AC Ammeter Calibrator to 100 amperes. Bring us your AC problems . . . . . we've got to protect our reputation.

MODEL	GENERAL DESCRIPTION	PRICE
11	THERMAL VOLTAGE CONVERTER SET - Three Thermoelements and five Resistor Modules providing eighteen, overlapping Voltage ranges from 1 Volt to 1200 Volts. Calibration options available to 3 MHz with NBS Traceability.	$ 995 *
325A	AUDIO VOLTAGE STANDARD - 30 Hz to 35 KHz, all solid state, fully variable internal oscillator. Output voltage automatically maintained to accuracies of ±.02% at any setting from 1 MV to 1011 volts. The broadest capability of any Audio Voltage Standard with highest reliability.	$15,900 *
323C	Audio Voltage Standard - 35 Hz to 20 kHz. 5 internal frequencies and output voltage range from 10 mv to 1000 volts. Regulated output maintained at 0.02% mid-band regardless of voltage setting.	$7480 *
631B	Audio Voltage Standard - 50 Hz to 10 kHz, fully variable internal oscillator. Output voltage from 1 mv to 1011 volts. All solid state with automatic overload protection. One year recalibration period.	$6950 **
630A	Audio Voltage Standard - Same voltage and frequency range as the Model 631. Five internal, fixed frequencies or can be used with an external oscillator. Voltage Deviation System calibrated in percent of output. ±.035% basic, mid-range accuracy.	$5800 **
613	AC Voltage Calibrator - 50 Hz to 5 kHz, 3 internal frequencies. Output voltage variable from 1 mv to 1000 volts. Completely variable in frequency from external oscillator. 0.25% accuracy.	$2500 **
612	AC Voltage Calibrator - 50 Hz to 5 kHz, 3 internal frequencies and 14 voltage outputs, .5 volts to 1000 volts. 0.25% accuracy. Can be used with external oscillator for continuously variable frequency.	$1290 **
AVA-30M	Audio Voltage Amplifier - 1 volt RMS input required for completely variable output voltages, 0 to 1000 volts. Low distortion and excellent gain stability. 35 Hz to 20 kHz.	$ 950 *
32	ULTRA AUDIO FREQUENCY AMPLIFIER - 10 KHz to 100 KHz, up to 1000 volts over the entire frequency range. The first all-solid-state amplifier providing this broad coverage. Unique tuning circuit permits cancellation of capacitive load power losses. Short term amplitude instabilities never exceed ± .01%.	$6000 **
10	Thermal Voltmeter - For direct, true RMS, voltage measurement with NBS traceability. Self standardizing, no transfer required. All solid state, full thermoelement protection. Voltage range, 1 volt to 1011 volts, frequencies to 1 MHz. Six-dial voltage readout, .005% stability and .001%/division resolution. Absolute accuracies to 0.015%.	$4900 ** †
6A	Thermal Transfer Voltmeter - Identical to the Model 6 with its own internal, solid state null detector. Large, self-contained meter provides up to 10 ppm/division resolution. Guaranteed thermocouple protection. Lightweight and portable.	$ 880 **†
250	AC AMMETER CALIBRATOR - generates over 100 amperes when driven with any source of AC voltage. Standardizes currents to 100 amperes and frequencies up to 20 KHz. Standardization is automatic with Holt Model 631B or manual with any 1 volt AC voltmeter. Accuracy to ±0.03% is achievable.	$2200 **
HCS-1	Primary AC Shunt Set - Transfer Shunts 5 ma to 26 amp. to 50 kHz. .02% AC-DC difference. Includes 7 modules, carrying case and transfer unit. For use with TVI, Model 6 or 6A.	$ 850 *†
275	Direct Current Standard - Direct reading, regulated DC current source accurate to 0.1%. 500 milliamps to 10 amps. Stable, low noise output ideal for ammeter and shunt calibration.	$2060 *

* Rock Mounted - cabinet additional
** In Bench Cabinet - rack mount on special order
† Holt test report - (NBS Traceable) - no charge. NBS Test Report - additional

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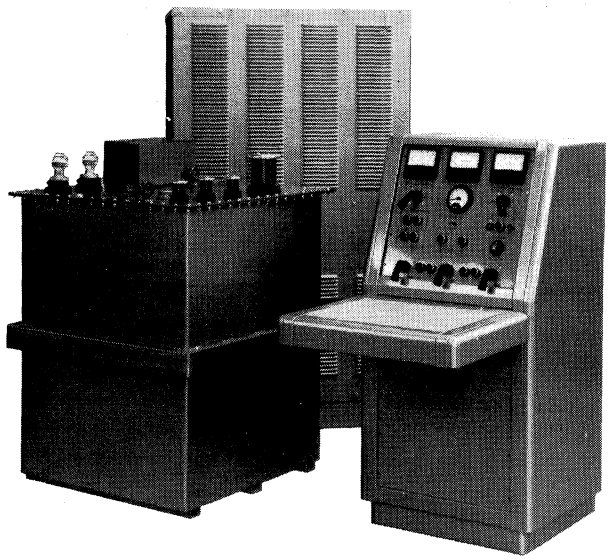
PHONE 414 - 834-2222

HIPOTRONICS INC.

AC INSULATION TESTERS



Hipotronics AC Insulation Testers are conservatively engineered, to insure quality and dependability. The most advanced techniques and years of high voltage experience go into every unit, from the smallest AC Hipots to heavy units rated in excess of 2000 KVA. Using Hipotronics' own transformers, corona free performance to full rating is guaranteed.

All units are designed for maximum operator and equipment protection. The surge devices preclude injury to any component from repeated short circuits at full output and the many safety devices insure operator protection.

FEATURES

- **Continuously adjustable output control from zero to maximum.**
- **Continuously adjustable electronic thyratron operated overload – prevents excessive burning of cable or insulation when failure occurs.**
- **Back-up magnetic overload circuit breaker.**
- **Triple range output connected KV meter, 4½" square, 2% accuracy.**
- **Single range current meter in grounded HV return.**
- **Circuit breaker input.**
- **HV on and off pushbuttons.**
- **Zero start interlock – compels operator to always raise voltage from zero.**
- **External interlock provision.**
- **Main, HV on and failure pilot lights.**
- **Surge and transient protection on all meters, transformers etc.**
- **Corona-free to full output.**
- **Meets ASTM, IPCEA, MIL, UL etc. specifications.**
- **Less than 5% waveform distortion on all models.**

OPTIONAL EXTRAS

Corona Detection Equipment: Any AC or AC/DC units may be supplied with Hipotronics' own advanced corona detector as part of an integrated system. See catalog sheet for features and prices of Hipotronics Corona System.

Motorized output control, single speed $250

Motorized output control with 10 to 1 range of adjustment $350

Burn Feature – bypasses overload and inserts line reactor in series with HV transformer's primary.

Price depends on KVA of unit.

½ KVA ..... $ 50
1 KVA ..... $ 75
2 KVA $100
5 KVA $200

Multi-pi secondary – increases secondary current capability X4 at ¼ output, X2 at ½ output, thus increasing test capacity. Price depends on unit but in general ..$50 + $10 per KVA extra

DC OUTPUT CHANNEL for 1.3 or 2.6 times AC rating with current capability of 10 ma. Price is around $14 KV of DC output i.e. a Model 715-1 with 20 KV DC output would cost $280 extra.

HV on Dwell timer – allows operator to preset maximum HV on time $150

Memory KV – maintains KV meter reading at breakdown value on motorized units $200

Floor model cabinet with clear plastic 2 foot door $200

Caster mounted HV section ..... $ 50

Test Jigs – Any ASTM jig – ¼" dia., 2" dia., oil cup, ¼" x 4, etc. $150

SPECIFICATIONS

Hipotronics will provide more complete details including sizes, weights, input voltage, and delivery time on a particular unit. While size and configuration of units depends on KV and KVA rating as well as optional extras that might be required, the following is an approximation:

Up to 25 KV Units generally air-insulated and in one cabinet.

Over 25 KV High voltage section hermetically sealed in oil.

100 KVA and up Consists of slope front desk type control console, a G.E. Inductrol regulator, and an oil tank containing the HV transformer, meter multiplier and power separation filter for corona testing if desired.

Over 200 KVA Normally as other units above 100 KVA, with a fourth section containing the main circuit breaker and contactor.

SERIES RESONANT

Hipotronics Inc., recommends the use of Series Resonant Dielectric test sets for very high KVA capacitive load testing. Write for details.

MODEL NUMBER AND ORDERING INFORMATION

Hipotronics uses this system. AC Insulation testers are preceded by the number "7". The next number or numbers is the KV rating, the number after the hyphen is the KVA rating, i.e.

715-5 is a 15 KV @ 5 KVA AC unit
7150-500 is a 150 KV @ 500 KVA AC unit

When DC outputs are available they are indicated with numbers following the AC designation, i.e.

715-1/20 is a 15 KV @ 1 KVA AC tester with 20 KV DC available.

Corona testers are indicated by the letters CT following the number designation, i.e. **750-2CT**

When requesting further information or quotation, please include complete details of your requirements and any special restrictions that might be applicable. If you are not sure which units best suit your needs, describe the tests to be performed, including capacitance of the load (i.e. rating and length of cable), test standards used IPCEA, NEMA, etc.

MODELS – Prices

OUTPUT VOLTAGE	KVA									
	½	1	2	5	8	15	30	50	100	150
1 KV	400	425	500	700	800					
1.5 KV	400	425	500	700	800					
2.5 KV	410	435	510	710	810					
5 KV	420	450	540	740	840	1700	3700			
10 KV	475	500	590	790	890	1800	3800	7500		
15 KV	500	550	640	840	940	1900	3900	7700		
25 KV		750	1100	1400	1500	2100	4500	7900	15,000	18,000
30 KV		850	1150	1600	1700	2350	4700	8000		
50 KV			1400	1800	2000	2400	4800	8200	15,000	18,200
75 KV				2700	2900	3300	5200	8500	15,300	18,500
100 KV					3500	4000	5500	8900	15,800	19,000
125 KV								9500	16,000	19,300
150 KV								9900	17,000	20,000
200 KV								12,000	19,500	22,000
250 KV										25,000
500 KV										50,000

SEND FOR CATALOG

HIPOTRONICS INC.

High-Potential Electronics
Brewster, New York 10509, (914) BR 9-8091

HIPOTRONICS INC.

DC INSULATION TESTERS

Hipotronics DC Insulation Testers are specifically designed for insulation testing with sufficient current capacity to charge high capacitive loads.

All units are designed for maximum equipment and operator protection. The surge devices preclude injury to any component from repeated short circuits at full output, and the many safety features insure operator protection.

An instantaneous overload relay turns the HV off and the internal shorting relay discharges the sample under test immediately after failure.

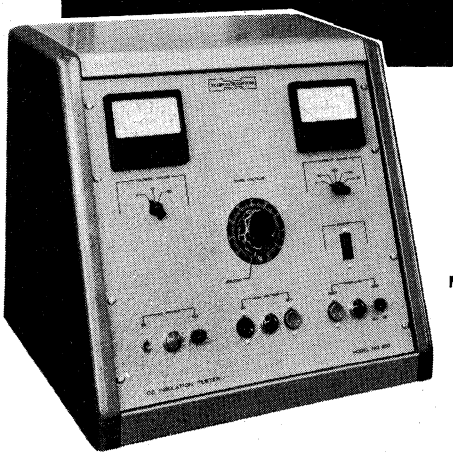
All units are ruggedly constructed for plant or field use and are designed for long life trouble free operation. Every unit is shorted many times at full output before shipping to insure the effective operation of all surge devices.

SAFETY FEATURES

- Output shorting relay with discharge resistor, gravity operated.
- Instantaneous adjustable overload relay in grounded return.
- Instantaneous overload circuit breaker in primary of HV transformer.
- Zero start interlock – compels operator to always raise voltage from zero.
- External interlock provision for test cage door or "dead man" switch.
- Surge limiting resistor in HV output.
- Shielded output cable or bushing.
- Three wire grounding type cord and plug on 115 volt units.
- 115 volt control circuitry in 220 volt models.

CONVENIENCE FEATURES

- Solid state rectifiers
- Triple range output connected KV meter with recalibration facilities
- Triple range current meter in grounded return
- HV on and off push buttons with HV on pilot light
- Continuously adjustable output control
- Hermetic sealed oil filled HV section on all models 30 KV and up
- 4½" square Weston meters with 2% accuracies

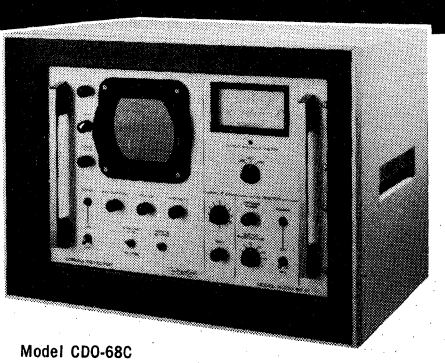


Model 250

Input	Voltage	Current	Model	Insulation	Size* Control	Size* HV Section	KV Meter	Current Meter	Price
115 Volt 60 Hz	0-5 KV	10 ma.	25	AIR	17"x9"x11"H	None	0-1/2.5/5	0-100 ua/1ma/10ma.	$330
	0-10 KV	10 ma.	210	AIR	17"x9"x11"H	None	0-2.5/5/10	0-100 ua/1ma/10ma.	385
	0-20 KV	10 ma.	220	AIR	17"x9"x11"H	None	0-5/10/25	0-100 ua/1ma/10ma.	495
	0-30 KV	10 ma.	230	AIR		None	0-6/12/30	0-100 ua/1ma/10ma.	550
	0-50 KV	10 ma.	250	OIL		None	0-10/25/50	0-100 ua/1ma/10ma.	825
	0-60 KV	10 ma.	260	OIL		None	0-12/30/60	0-100 ua/1ma/10ma.	880
	0-75 KV	10 ma.	275	OIL	22"x18"x18"H	17"dia.x20"H	0-15/37.5/75	0-100 ua/1ma/10ma.	1045
	0-100 KV	10 ma.	2100	OIL		17"dia.x20"H	0-25/50/100	0-100 ua/1ma/10ma.	1540
	0-120 KV	10 ma.	2120	OIL	Sloped Front	19"dia.x30"H	0-30/60/120	0-100 ua/1ma/10ma.	1870
	0-150 KV	10 ma.	2150	OIL	Deluxe Type	19"dia.x30"H	0-37.5/75/150	0-100 ua/1ma/10ma.	2310
220 Volt 60 Hz	0-200 KV	10 ma.	2200	OIL		30"Wx30"Dx35"H	0-40/80/200	0-100 ua/1ma/10ma.	3850
	0-250 KV	10 ma.	2250	OIL		36"Wx34"Dx38"H	0-50/100/250	0-100 ua/1ma/10ma.	5500
	0-300 KV	10 ma.	2300	OIL		40"Wx36"Dx40"H	0-60/120/300	0-100 ua/1ma/10ma.	7920
	0-400 KV	10 ma.	2400	OIL		48"Wx38"Dx44"H	0-80/200/400	0-100 ua/1ma/10ma.	10,450
	0-500 KV	10 ma.	2500	CHECK FACTORY FOR INFORMATION					
	0-600 KV	10 ma.	2600						
	0-750 KV	10 ma.	2750						
	0-1000 KV	10 ma.	21000						

CORONA DETECTORS

All Hipotronics AC, DC, or AC/DC Insulation test sets are corona free to full rating and can be supplied with Hipotronics advanced Corona Detector Oscilloscope to provide a complete and integrated corona test system. These systems meet or exceed testing requirements as specified by ASTM, IPCEA, MIL-C-17D and MIL-T-27. Request a complete quotation to fill your requirements.



Model CDO-68C

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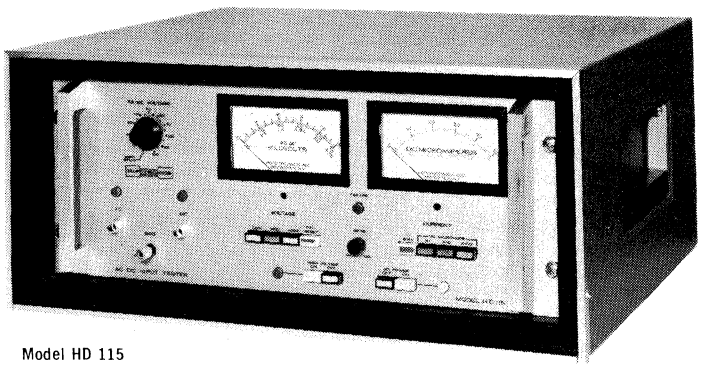
HIPOTRONICS INC.

High-Potential Electronics

HIPOTRONICS, INC. / BREWSTER, N. Y. 10509 / (914) 279-8091

HIPOTRONICS INC. NON-DESTRUCTIVE HIPOT & INSULATION TESTERS

100 Series
NON-DESTRUCTIVE HIPOT AND INSULATION TESTERS



Model HD 115

The Hipotronics line of non-destructive AC/DC hipot test sets utilize an all new, solid state overload circuit for unprecedented reliability and speed of operation. Reaction time is remarkably low, sensitivity is variable over a range of 1 to 110% of rated output current. With circuit sensitivity set at maximum, corona discharge or leakage currents of sufficient magnitude will trip the HV before insulation failure occurs. No warmup time is required.

Each unit is packaged on a rack mounted panel installed in a new, attractive desk-top cabinet. The unit may be removed from the cabinet and mounted to a standard equipment 19" rack in minutes. Controls have been human engineered to provide ease of operation, safety, readability, and an attractive, professional appearance.

Two versions are available: a standard unit with minimal control features, and a deluxe unit with all the most desired controls for laboratory precision testing programs.

FEATURES IN STANDARD MODEL:

• AC input on and off switches • Input fuse and pilot light • Output control continuously adjustable from zero to maximum • Single range, output connected KV meter, 2% full scale accuracy, 3½" arc • Single range current meter in grounded HV return. 2% full scale accuracy, 3½" arc, 0-5 ma AC/DC • Meters are recessed for protection • KV meter recalibration facility • Continuously adjustable, solid state overload circuit from 50 ua to 5 ma • Failure indicator and reset button • Front panel, re-entrant output jacks with shielded HV output lead and ground lead • AC/DC meter switch with reminder lights over output jacks • External interlock provision • Surge limiting resistor in DC output • Deluxe, 21"W x 19"D x 10"H cabinet (slightly larger for 25 KV unit) • Pushbutton range and function switches

ADDITIONAL FEATURES IN DELUXE MODEL:

• Zero start interlock with HV on and off buttons—compels operator to start test at zero volts • Triple range KV meter • Triple range DC current meter, 0-50/500/5000 ua DC • High Voltage On pilot light

OPTIONAL EXTRAS (ALL UNITS):

- HV test probe $10
- Gravity operated output shorting solenoid with discharge resistor $35
- Audible failure signal $15

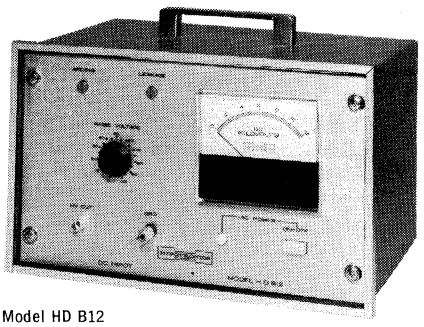
SPECIFICATIONS:

Input	115 VAC, 60 Hz, 5 amps max.
Size & Weight	21"W x 19"D x 10"H; appx. 60 lbs.
Output Current	5 ma. AC or DC at full rated voltage
Meters	2% full scale accuracy, 3½" arc

Model	Output Voltage	KV Meter Ranges	Price
H 103	0-2.5 KV AC/0-3 KV DC	0-3 KV AC/DC	$270
HD 103	0-2.5 KV AC/0-3 KV DC	0-.6/1.2/3 KV AC/DC	340
H 106	0-5 KV AC/0-6 KV DC	0-6 KV AC/DC	290
HD 106	0-5 KV AC/0-6 KV DC	0-1.2/3/6 KV AC/DC	360
H 115	0-12 KV AC/0-15 KV DC	0-15 KV AC/DC	370
HD 115	0-12 KV AC/0-15 KV DC	0-3.75/7.5/15 KV AC/DC	440
H 125	0-10 KV AC/0-25 KV DC	0-25 KV AC/DC	465
HD 125	0-10 KV AC/0-25 KV DC	0-5/10/25 KV AC/DC	535

Special requirements will be filled. Consult factory for quote.

AC and DC PRODUCTION HIPOT TESTERS
A and B Series



Model HD B12

Designed for use by unskilled or semi-skilled personnel in mass testing of electrical components, transformers and appliances. Simple to operate, reliable for go no/go testing. Indicators provide information on component leakage and internal arcing. Continuously variable output voltage and output connected KV meter provide optimum test accuracy at lowest cost.

FEATURES:

• Detachable test leads enter front panel • Continuously adjustable output from zero to maximum • Output connected KV meter for maximum accuracy • "Arcing" detector employs corona pickup network for best sensitivity • "Leakage" detector sensitivity continuously adjustable from 500 ua to 5 ma • Three-wire grounding cord and plug • Shielded output lead thru re-entrant jack • AC input switch, fuse, and pilot light • Each model has a corresponding deluxe model with a solid state audible failure alarm circuit incorporated in its design

OPTIONAL:

HV probe $10

SPECIFICATIONS:

Size & Weight	7"H x 12"W x 8"D; appx. 20 lbs.
Input	115 VAC, 60 Hz, 3 amps max.
Short Circuit Current	
AC Units	18 ma.
DC Units	5 ma.
KV Meter	3% full scale accuracy, 3" arc

Model	Output	Price
A3	3 KV AC	$145
DA3	3 KV AC	170
A5	5 KV AC	160
DA5	5 KV AC	185
A10	10 KV AC	190
DA10	10 KV AC	215
H B4	4 KV DC	150
HD B4	4 KV DC	175
H B6	6 KV DC	170
HD B6	6 KV DC	195
H B12	12 KV DC	210
HD B12	12 KV DC	235

HIPOTRONICS INC. *High-Potential Electronics*

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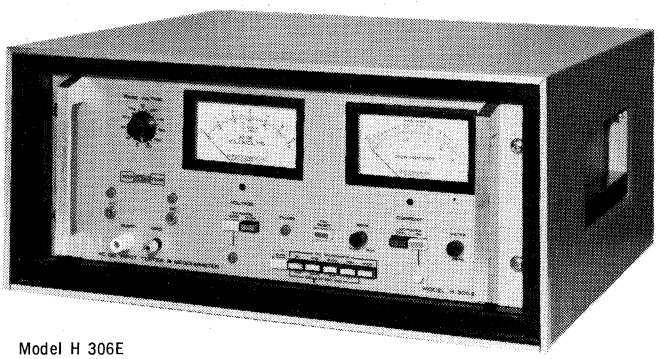
HIPOTRONICS, INC. / BREWSTER, N. Y. 10509 / (914) 279-8091

HIPOTRONICS INC.

HIPOT TESTERS & MEGOHMMETERS

300 Series
AC/DC HIPOT TESTERS AND MEGOHMMETERS



Model H 306E

The 300 series of Hipot Testers and Megohmmeters are voltage test sets which perform three different functions. They may be used for AC Hipot, DC Hipot and DC megohm tests. The "A" units perform 1R tests to 1000 megohms and the "B" units to 100,000 megohms at 500 volts. Megohms at any other voltage may be determined from the volt and current meter readings.

New design package is human engineered for easy operation, flexibility, and safety, and is available in two series:

A SERIES: Four current ranges
Two resistance ranges
Reads currents as low as 1 ua
Measures megohms to 1,000

B SERIES: Current amplifier permits reading as low as 0.01 ua as high as 100,000 megohms
Six current ranges
Four resistance ranges

FEATURES:

- Overload circuit has continuously adjustable sensitivity from 50 ua to 5 ma. Maximum sensitivity allows non-destructive testing of insulation and dielectrics.
- Reset button and failure indicator.
- Unit is mounted in an attractive, dust-proof, bench-top cabinet. May be removed from cabinet and mounted on a standard equipment rack.
- Dual range output connected KV meter, with set point for megging clearly marked.
- Pushbutton range and function switches.
- Front panel test lead connections, with AC and DC output reminder lights.
- Input on and off switches, pilot light, and fuse.
- Recalibration facilities.

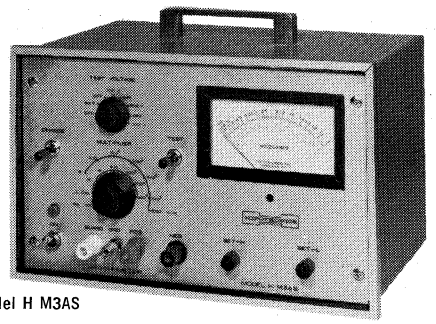
SPECIFICATIONS:

Input	115 VAC, 60 Hz, 1 amp max.
Size & Weight	21"W x 19"D x 10"H; appx. 50 lbs.
Meters	2% full scale accuracy, 3½" arc
Current meter ranges:	
A Series	0-50/500/5000 ua DC; 5 ma AC/ 1-100 megohms, x1, x10
B Series	0-.5/5/50/500/5000 ua DC; 5 ma. AC/ 1-100 megohms, x1, x10, x100, x1000

Model	Output Voltage (KV) AC	DC	Output Current	Megohm Ranges	Price
H 301A	1.0	1.5	5 ma.	2	$415
H 301B	1.0	1.5	5 ma.	4	550
H 303A	2.5	3.0	5 ma.	2	435
H 303B	2.5	3.0	5 ma.	4	570
H 306A	5	6	5 ma.	2	465
H 306B	5	6	5 ma.	4	605

Special requirements will be filled. Consult factory for quote.

MEGOHMMETERS



Model H M3AS

Hipotronics megohmmeters are precision instruments for use in production or laboratory testing of cables, capacitors, printed circuits, transformers, electronic assemblies, etc.

- The output voltages are both regulated with a ferro-resonant line and a solid state electronic regulator. Even with large capacitive loads on the 20 million range, there is no bounce.
- The indicating device is a high quality Weston with better than 2% accuracies on all ranges below 1 million and 3% on 10 million. The VTVM circuit driving the meter on the higher range models has no zero shift on any range.
- The short circuit protection is such that the output may be continuously shorted without injury to any component.
- Self contained calibrating resistors in the seven range models permit the operator to periodically verify the calibration.
- A three terminal output network (positive, negative and guard) permits grounded or ungrounded tests to be made.
- Dual color scale on multiple output voltage models improves readability.
- The units also contain a resistor and switch position for discharging both the internal and load capacitance.
- Available in 6 models, all with 115 Volt, 60 Hz input and AC input switch, fuse and pilot light.
- Two models have mandatory 2-hand operation.

Model	Output Voltage	Range	Price
H M1	500	1-100 megohms (X1, X10)	$170
H M3A/3AS	50	1-100 megohms ($X.1/1/10/10^2/10^3/10^4$)	$315/$340
(H M3AS has mandatory two-hand operation)	100	2-200 megohms ($X.1/1/10/10^2/10^3/10^4$)	
	500	1-100 megohms ($X1/10/10^2/10^3/10^4$)	
	1000	2-200 megohms ($X1/10/10^2/10^3/10^4$)	
H M6B/6BS	50	1-100 megohms ($X.1/1/10/10^2/10^3/10^4$)	$255/$280
(H M6BS has mandatory two-hand operation)	250	5-500 megohms ($X.1/1/10/10^2/10^3/10^4$)	
	500	1-100 megohms ($X1/10/10^2/10^3/10^4/10^5$)	
M6C	250	1-100 megohms ($X.1/1/10/10^2/10^3/10^4$)	$250

HIPOTRONICS INC. High-Potential Electronics
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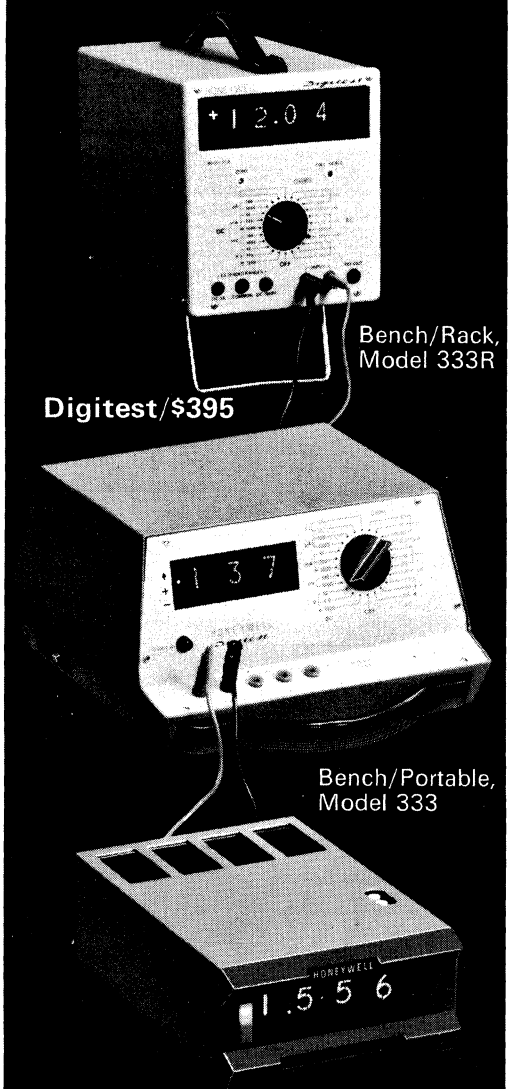
One instrument or an entire system...



VT-100 Panel Meter/$245

The three digital meters (measuring AC/DC volts, current and ohms) shown above have been vital in the solutions to many measurement problems:

VT-100 Digital Panel Meter. Plug-in card feature changes range and function to any of 20 different configurations. Full scale calibration, automatic zero and 100% overrange. Accuracy to .2% or reading ± 1 digit.

Digitest, Model 333. Portable battery operation (as well as AC) with ±.5% accuracy and 100 UV resolution. 3½-digit readout with overrange indicator.

Digitest, Model 333R. Same specs as Model 333 but with an overrange digit.

Honeywell

Whatever it takes, Honeywell sales engineers can draw from Honeywell's great depth of instrumentation and systems capability to zero in on precise solutions for industrial, aerospace, medical, educational and other fields. And they're eager to put their problem-solving capabilities to work for *you*.

Below, we've listed selected product lines by category, plus a number of helpful services. For full information on items of interest, call your local Honeywell sales engineer or write: Honeywell, Test Instruments Division, P.O. Box 5227, Denver, Colorado 80217.

Amplifiers/ Preamplifiers
AC
DC – Wideband
Differential
Galvanometer
Medical
RFI/EMI
Subaudio
Transducer
VHF/UHF

Analyzers
Spectrum

Biomedical Instrumentation
Analog and Digital Recording Systems
Analytical Measuring Instrumentation
Computers
Magnetic Tape Recorders
Patient Monitoring Systems
Physiological Data Channels
Readouts
Signal Conditioning
Transducers

Converters
A/D
Physical to Electrical

Detectors
Interference
RF
RFI/EMI

Digital Voltmeters
Multimeters
Digital Panel Meters
Temperature Reading

Engineering Services
Design
Systems
Modification
Installation

Filters
Band Pass
Power Line
RFI
Signal Line

Galvanometers
Oscillographic Recording

Magnetic Tape Recorders
Analog, FM, Direct, Wideband, Digital

Metrology Service
Certified Calibration, NBS Traceable
Contract Service
Installation Service
Instrumentation Calibration & Repair

Monitors
Analog
Digital

Oscillograph Recorders
Accessories
Fiber Optic – X-Y-Y'-Z axes
Ink Writing
Light Beam – Visicorders
Microfilm
Systems

Oscilloscopes, Monitor
Multi-CRT
Single Screen Multi-Channel

Oscilloscopes, Recording
Fiber Optic – X-Y-Y'-Z axes

Power Supplies
AC Line Regulator
Precision AC
Strain Gage

Receivers
VHF/UHF
LF/VLF

Recorders
Accessories
Digital
Magnetic Tape
Microfilm
Oscillograph – Ink Writing
Oscillograph – Light Beam
Recording Oscilloscope
Strip Chart
X-Y Graphic

RFI/EMI Instrumentation
Accessories
Amplifiers
Antennas
Filters
Generators
Power Line Test Sets
Preamplifiers
Receivers
RFI Compliance Testing
Stabilization Networks
Surveillance Systems

Services
Metrology
Engineering
RFI/EMI Testing

Signal Conditioning
AC – Amplifiers
Attenuators
Bridge Balance
DC – Wideband Amplifiers
Excitation Units
Galvanometer Amplifiers
Strain Gage Amplifiers
Thermocouple Amplifiers
Transducer Amplifiers

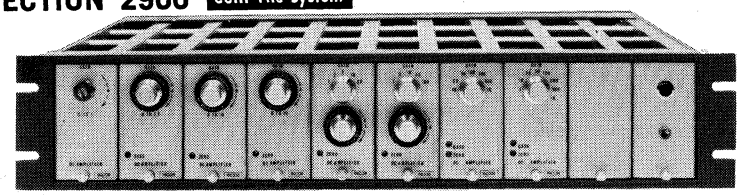
Systems, Automatic Measuring and Recording
Analog
Biomedical
Die-Casting
RFI
RF Surveillance
Specialized Industrial

Training Courses
Instrumentation Operation and Service

Transducers
Accessories
Biomedical
Excitation Units
Linear Accelerometers
Linear Displacement
Load Cell
Micro-Scale
Pressure, Absolute
Pressure, Differential
Pressure, Gage
Readouts
Thermocouples
Universal Transducing Cell

Voltmeters
Digital
Tuned RF

Honeywell engineers sell solutions



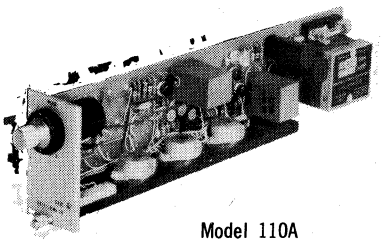
INCOR

WIDEBAND DC INSTRUMENTATION AMPLIFIERS

INCOR's Instrumentation Amplifiers are solid state devices containing their own regulated power supplies. Designed specifically to fulfill DC instrumentation requirements, each has the ability to drive all types of galvanometers, A to D converters, multiplexers, tape recorders and extremely long data lines.
Amplifiers provide low output impedance and frequency response from DC to 100 KHz. Up to ten amplifiers may be mounted in the INCOR Series 103 Rack Adapters, or supplied with individual cases for single channel bench operation.

SINGLE-ENDED FLOATING

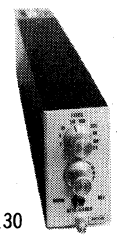
Model	Output Volts	Available Output Current, MA	Gain	Input Z	Source Resistance for Specs.	Max. Usable Source Resist.	Linearity	Front Panel Gain Vernier	Front Panel Zero Control	Price
102	±3	100	0 to 1	50 K	∞	∞	.2%	Yes	No	$ 95
112	±3.6	100	0 to 2.5	50 K	∞	∞	.1%	Yes	Yes	140
110A	±10	100	0 to 10	50 K	10 K	∞	.05%	Yes	Yes	150
116	±10	100	0 to 20	100 K	10 K	∞	.05%	Yes	Yes	190
114	±10	100	1, 3, 10, 30, 100	10 meg.	2 K	20 K	.05%	Yes	Yes	250
116A	±10	100	1, 2, 5, 10, 20	10 meg.	2 K	50 K	.05%	Yes	Yes	230
300	±10	100	1, 3, 10, 30, 100	1 meg.	±10 & ±50 Volt/Vernier Zero Suppression					295



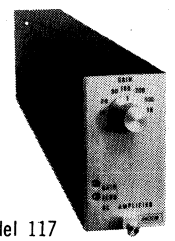
Model 110A

WIDEBAND DIFFERENTIAL

Model	Output Volts	Maximum Current	Gain with Vernier	Input Z	Source Z for Specs.	Maximum Usable Source Z	Linearity	Common Mode Voltages	Current Limit Provisions	Price
501	±10	100 MA	10, 30, 100 300, 1,000	50 meg.	1 K	10 K	.05%	±500 V	Yes	$450
117	±10	100 MA	10, 20, 50, 100, 200, 500, 1K	50 meg.	50 K	100 K	.01%	±10 V	Yes	350
115	±10	100 MA	0 to 200	50 meg.	10 K	50 K	.01%	±10 V	Yes	195
130	Attenuator for Galvonometers 1 to 10 K, Fixed and Variable Polarity and Off Switch, Adjustable Z.									90



Model 130



Model 117

STRAIN GAGE/TRANSDUCER POWER SUPPLIES

INCOR power supplies are designed specifically for low level DC instrumentation applications. They feature a high degree of guarded isolation from the power lines (0.1 picofarads) and ground (10,000 megohms minimum). Other features are high resolution 10 turn voltage control potentiometers, .01% time stability and .005% / °F temperature coefficient.
Up to 10 channels can be accommodated in the Model 103 rack, Fig. A.

Model	Voltage Range	MA Current Range	Noise to gnd., μv.	Line Reg. 95-135V	Ripple	Remote Sensing Current	Remarks	Price
215	0-15	0-200	5	.05%	1 MV	50 μa.	General purpose	$ 95
215A	0-15	0-200	1	.005%	50 μv.	1 μa.	.01%, low remote sensing current	130
230	0-30	0-100	1	.01%	100 μv.	1 μa.	.01%, low remote sensing current	130
224	0-24	5-100	1	.01%	100 nanoamps		Current regulated	130

Fig. A

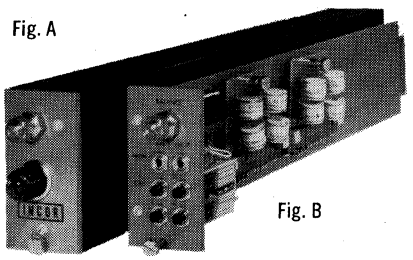
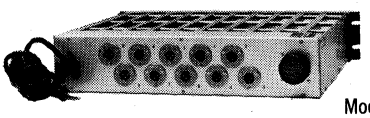


Fig. B

The Model RB-2 signal conditioning unit shown in Fig. B. There are two internal cards for bridge completion resistors and calibrating resistors. Spare resistor cards are available for $2.00 each and may be prepared for different transducers. Signal conditioning units may be combined with any power supply by combining their model numbers and prices.

Model	Balance and Calibration Units			Price
RB-2	10 turn Balance control	4 point shunt calibration	Excitation & balance monitor jacks	$65
RB-3	Same	4 point shunt calibration	Polarity switch Relay for remote or automatic calibration	80



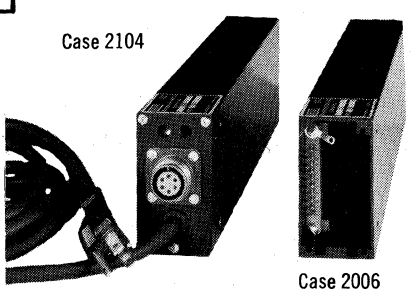
Model 103B

RACK ADAPTERS AND CASES

The INCOR series adapters provide interchangeable mountings. The amplifier units plug in from the front with complete access to operating controls and test points. The rack adapter provides for AC power distribution and signal input (XLR-3-14) and output connectors (MS3102A) for operation in a recording system. Blank filler panels are provided for all unused positions. Rack size is 19" x 3½" x 18" deep. Case 3" x 1.7" x 13".

Model	Amplifier Capacity	Connectors		Price
		Input	Output	
103	1-10	Amphenol 143-010-01		$ 90
103B	1-10	10 Rear	1-Rear 28-21S	125
103E	1-5	91-PC3F	80-PC2F	135
2006	1	Amphenol 143-010-01		9
2104	1	MS-3102A-14S-6S		18

Case 2104



Case 2006

INCOR

INSTRUMENTATION AMPLIFIERS & SUPPLIES, INC.
29 NEWTOWN ROAD • PLAINVIEW, N. Y. • 516-293-8717

INCOR reserves the right to modify specifications and prices

PHAZOR

The operation of the Phazors is unique in that the input and reference signals are applied to an electronic multiplier which derives the instantaneous product of their amplitudes. The multiplier output is then applied to a DC meter which produces a deflection proportional to the time average of this product.

Expressing this function mathematically we have: Meter Deflection = $\frac{k}{T}\int_0^T V_S \cdot V_R \, dt$

PHASE METERS

High Accuracy and Resolution • Measures 0°-360° Without Ambiguity • Rejects All Noise and Harmonics (without filters) • Wide Input Voltage and Frequency Range • Self Calibration Assures Accuracy

MODEL 200A



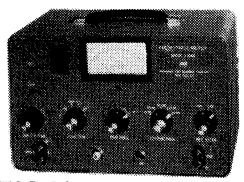
$440.00

APPLICATIONS: Measures phase shift in transformers, amplifiers, etc. • Readings not affected by noise and harmonics • Measures in-phase or quadrature voltage components • .01 degree can be measured employing special techniques.

SPECIFICATIONS

ACCURACY: ..... ±2 degrees
FREQUENCY: ..... 20 Hz to 20 KHz

MODEL 210AB



$795.00

This instrument retains the essential feature of other Phazor models in that accurate measurements can be made even though signals may be complicated by noise and harmonics. The quadrant is read directly on a projection readout. The angle within the quadrant is displayed on the meter.

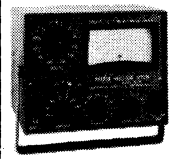
SPECIFICATIONS

ACCURACY: ..... ±2 degrees
FREQUENCY RANGE: 15 Hz–30 KHz
SENSITIVITY: ..... 5 millivolts

VECTOR VOLTMETERS

Precise Measurement of:
IN-PHASE VOLTAGE • QUADRATURE VOLTAGE
TRUE RMS VOLTAGE • PHASE ANGLE
NULL VOLTAGE

MODEL 300PB



$1,200.00

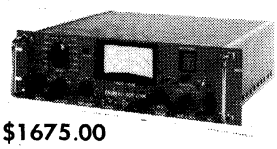
- Portable — All Solid State
- Direct Reading Phase and Quadrant Indicator
- Battery Operated — Eliminates Power Line Ground Loops

SPECIFICATIONS

INPUT VOLTAGE: ..... 1 MV–300 V
INPUT IMPEDANCE: ... 1 megohm
VOLTAGE ACCURACY: 2% full scale
PHASE ACCURACY: ... ±1 degree
FREQUENCY RANGE: 60 Hz–10 KHz
NULL SENSITIVITY: ... 10 microvolts
HARM. REJECTION: .. 40 db down without filters
WEIGHT: ..... 9 lbs., approx., with batteries

AC Power Pack Available — $150.00

MODEL 300B



$1675.00

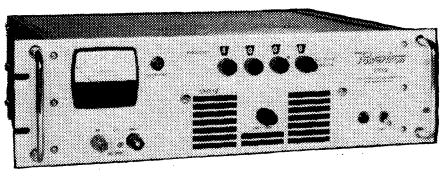
- Direct Reading Phase Angle
- Wide Frequency Range
- Rejection of Noise and Harmonics without Filters

SPECIFICATIONS

INPUT VOLTAGE: ..... 1MV to 300 V
INPUT IMPEDANCE: 10 megohm
VOLTAGE ACCURACY: 2% Full Scale
PHASE ACCURACY: ... ±1 degree
FREQUENCY RANGE: 15 Hz to 30 KHz
REF. VOLTAGE: ..... 5V to 220V
NULL SENSITIVITY: ... 10 Microvolts
HARM. REJECTION: ... 40 DB without filters
RACK PANEL SIZE: .... 19″Wx5¼″H

Powertron ELECTRONIC GENERATORS

Series 250S (Solid State)



$595.00
(Less Plug-In Osc.)

The Series 250S (illustrated above) and the Series 1000S Solid State supplies are designed to be used in modular form so that they may readily be stacked for 1Ø, 2Ø or 3Ø output power.

Fixed frequency and variable frequency plug-in oscillators are available for single phase, or poly-phase operation. The variable frequency oscillators are digitally set to three significant figures. They feature excellent stability and continuous resolution and are readily adaptable to remote programming.

A complete line of 1Ø, 2Ø & 3Ø models with power output ratings from 3 VA to 9 KVA and frequency accuracies to .0001%

These AC Power Supplies provide stable, low distortion AC power at frequencies within the audio frequency spectrum. The highly reliable and versatile power sources find wide application in calibration and test stations, motor drives, gyro wheel supplies, laboratory use, military component testing, and operating foreign equipment.

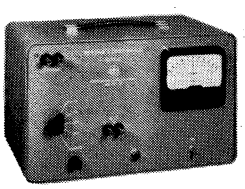
SPECIFICATIONS
(Series 250S Illustrated)

OUTPUT CIRCUIT: ..... 1Ø, Isolated
OUTPUT POWER: ..... 250 VA
POWER FACTOR: ..... Unity ±0.7 (at full power)
OUTPUT VOLTAGE: .... Selectable — 0-130V RMS or 0-190V, 0-75V, 0-67V, 0-38V, 0-30V, and 0-17V
FREQUENCY RANGE: .. 45 Hz — 10 KHz full power
20 Hz — 20 KHz derated
DISTORTION: ..... 0.1% mid-band
REGULATION: ..... 0.5%, 0—full load
0.1%, for ±5% line
RESPONSE: ..... 50 microseconds
HUM LEVEL: ..... 80 db down
SHORT CIRCUIT PROTECTION: Output may be shorted indefinitely
THERMAL PROTECTION: ..... Output transistors protected by thermal cutout
EXTERNAL AMPLIFIER INPUT: Available on rear
EXT. SYNC. INPUT: ..... Available on rear
CONVENIENCE OUTLETS: ..... Two switch-controlled outlets on rear
INPUT POWER: ..... 115V or 230V, 50-60Hz (400 Hz avail.)

WRITE FOR COMPLETE POWERTRON CATALOGS

IMPEDANCE COMPARATORS

MODEL 60



$250.00

PRECISE, RELIABLE AND RAPID COMPARISON OF COMPONENTS

The circuit consists of a bridge, two arms of which are precision resistors matched to .01%. The two remaining arms are the standard and the component under test. Any voltage resulting from bridge unbalance is amplified and fed to a phase discriminator. The percentage deviation is read directly in both sign and magnitude on a meter.

FEATURES: High Accuracy & Stability • Fast Response • Linear Meter Scales • Self Calibrated

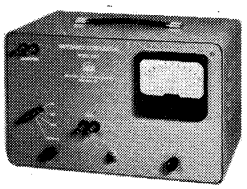
SPECIFICATIONS

FREQUENCY: ..... 60 Hz
FULL SCALE RANGES: ±1%, 5%, 10%, 20%
IMPEDANCE LIMITS:
Resistance ..... 5 ohms to 5 megohms
Capacitance ..... 500 mmfd. to 500 mfd.
Inductance ..... 15 milihy to 10,000 hy

SPECIFICATIONS

FREQUENCY: ..... Either 1 KHz or 10 KHz
FULL SCALE RANGES: ±5%, 10%, 20%
IMPEDANCE LIMITS:
Resistance ..... 5 ohms to 5 megohms
Capacitance ..... 50 mmfd. to 10 mfd.
Inductance ..... 100 microhy to 100 hy

MODEL 1010



$385.00

OTHER MODELS AVAILABLE } **MODEL 1000—1000 Hz—±1%, 5%, 10%—$395.00**
MODEL 1025—1KHz, 25 KHz—±5%, 10%, 20%—$425.00

WRITE FOR CATALOGS

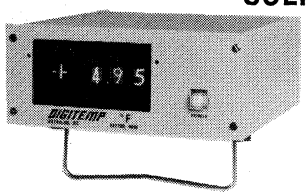
Manufacturers of: PHASE SHIFTERS, FREQUENCY STANDARDS, NULL DETECTORS, AUTOMATIC HI-POT TESTERS AND OTHER ELECTRONIC TEST EQUIPMENT

ITECO INDUSTRIAL TEST EQUIPMENT CO. 20 Beechwood Ave., Port Washington, N. Y. 11050
Phone: (516) PO 7-5253

INSTRULAB, INC. 1205 LAMAR STREET, DAYTON, OHIO 45404 • PHONE: (513) 223-2241

1500 & 1600 SERIES

SOLID STATE DIGITAL TEMPERATURE INDICATOR



Solid state circuitry, non-mechanical electronic tube readout and compact size team up in this Instrulab Series 1500 to produce a highly reliable temperature indicator with digital readout. Wherever the indication of temperature is required, the Instrulab 1500 does the job quickly, quietly, accurately and economically.

Automatic Polarity — Instrument automatically indicates sign of reading (+) or (—) and fixed decimal point is prominently displayed resulting in completely digitized readout.

Direct Readout — No Conversion Tables Needed — Reading is directly in degrees, positive or negative. No conversion tables or graphs are required. Assured accurate reading even when used by inexperienced personnel. Fahrenheit and Centigrade models available.

Large, Non-Blinking Readout Display — Prominent easy-to-read, 5/8" high digits are always present. Easily seen from a distance in fully-lighted rooms. Electronic tube readout is quiet, non-mechanical, has exceptionally long life.

Solid State, Integrated Circuitry — Entire circuit is solid state, using the latest integrated circuits as well as high-reliability discrete components. No relays, stepping switches or mechanical counters to wear out. Circuit provides high noise rejection. A highly sensitive and stable circuit amplifies and linearizes the senior output which is fed into a dual slope integrating digital readout to give an accurate repeatable readout in engineering units.

Compact Size — Instruments are available in two case sizes — Case #86 which is $3\frac{15}{32}$" H x 8 3/8" W x 11 1/2" deep, or in Case #87 which is $3\frac{15}{32}$" H x 17" W x 11 1/2" deep. In either case, optional ears may be purchased for rack or panel mounting.

Manual Hold — Instrument samples temperatures at 5-per-second rate. Indication may be manually held, where desired, by the use of an external switch to short circuit "hold" terminals.

BCD and Analog Output — Binary-coded (parallel) decimal or analog readouts for operating external recorders, printers, scanners, and other accessories are available as options.

Case — Normally supplied in the 86, 1/2 rack case. However, for some options such as control, manual selected multi-channel inputs of over 3 channels, etc., the unit is furnished in the 87, full rack case.

SPECIFICATIONS:

INPUT: Floating-sensor can be grounded without affecting reading

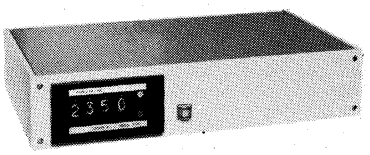
RESPONSE TIME: 1/2 second to within 99% of full scale step change.

CASE: #86 — $3\frac{15}{32}$" H x 8 1/2" W x 11 1/2" deep, for bench-top use. Ears furnished optionally to allow case to be rack-mounted or panel-mounted. Can be furnished in #87 Case also: $3\frac{15}{32}$" H x 17" W x 11 1/2" deep.

CONNECTIONS: All inputs and outputs except BCD are to screw-terminals at rear of case in a covered terminal compartment provided with "plugged" 1/2" conduit holes (7/8" diameter). BCD connections are to a PC connector. Model 1563 and 1663 have 3 input jacks on front panel with 4 position manual selector switch. One position is Power off — other 3 are input channel selector positions.

COLOR: Top, bottom and rear cover — pastel blue; sides and front panel — pastel gray.

CASE NO. 86



CASE NO. 87

OPTIONS:

A. BCD Output 8421 — buffered; 0 logic: 0 ±.4 VDC, positive sink for > 20 MA; 1 logic: 5 ±1 VDC, output impedance < 10K ohm. Available on connector at rear of case.
B. Reference Voltage Available — Consult Factory.
C. Print Command — Transition from 0 to 5 V. Furnished with BCD at no charge.
D. Analog output — 1.0 Mv/degree, linearized: load impedance 5K ohm minimum, available on screwed terminal strip at rear of case.
E. On-Off Control Form — 5 Amp. 117 VAC non-inductive set with 4 digital thumbwheels on front panel. Accuracy of setting 1%.
F. Same as E but with manual reset button for hi-limit shut-off.
G. Tilt Stand — Part No. 133-0081 for #87 Case.
H. Tilt Stand — Part No. 133-0082 for #86 Case.
J. Pair of Rack or Panel Mount adapter ears, Part No. 133-0083.

To order — specify Model No., Case No., Range No., and Options.

Example — to order one RTD Digital Temperature Indicator with a range of 0 to 1000°F with BCD with print command, on-off Control, and ears for rack-mounting, in Case No. 87 — specify: **1 ea. 1540-87-22-ACEJ Digital Temperature Indicator.**

Terms: Net 30 days. **F.O.B.:** Dayton, Ohio. **Delivery:** 4-6 weeks.
Prices and specifications subject to change without notice.

Model 1540—100 Ohm Platinum RTD Actuated

RANGES AND ACCURACY

Range No.	Range in Degrees	Resolution	Instrument Accuracy
21	−100 to +500°F	1°F	1°F ±1 Digit
22	0 to 1000°F	1°F	3°F ±1 Digit
23	−350 to +1000°F	1°F	5°F ±1 Digit
24	−200 to +500°C	1°C	3°C ±1 Digit
25	0 to 500°C	1°C	1°C ±1 Digit

Other ranges and accuracies available — consult Factory. Ranges within the limits of −150.0 to +150.0°F or °C can be furnished to a resolution of 0.1°F or °C.

Models 1560 & 1660—Thermistor (700 Series) Actuated

RANGES AND ACCURACY

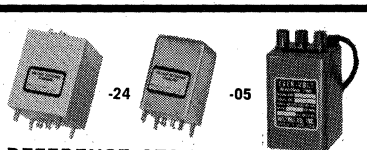
Range No.	Range	Resolution Model 1560	Resolution Model 1660	Overall Accuracy of Instrument and Sensor
11	22 to 122°F	0.1	0.01	±0.60°F
12	0 to 100°C	0.1	0.01	±0.35°C
13	−5 to +45°C	0.1	0.01	±0.20°C
14	−30 to +50°C	0.1	0.01	±0.30°C
15	30 to 100°C	0.1	0.01	±0.25°C
16	32 to 212°F	1.0	0.1	±0.50°F
17	23 to 113°F	0.1	0.01	±0.35°F

Instruments can be specially calibrated to give a closer tolerance over a narrow part of the above ranges. For other ranges and accuracies — consult Factory.

600 SERIES

AC INPUT

-25 -24 -05

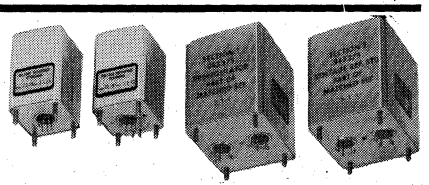


VOLTAGE REFERENCE STANDARDS

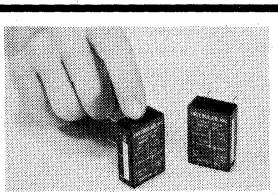
Model No.	DC Output Volts @ 10 MA	Output Impedance Ohms	Model No.	DC Output Volts @ 10 MA	Output Impedance Ohms
613-HA-24	5.0 ±5%	150	613-HA-25	5.3 ±5%	150
623-HA-24	6.3 ±5%	15	623-HA-25	6.3 ±5%	15
643-HA-24	9.3 ±5%	15	643-HA-25	9.3 ±5%	15
663-HA-24	11.7 ±5%	20	663-HA-25	11.7 ±5%	20
603-HA-24	1.0 ±5%	550	603-HA-25	1.0 ±5%	550
673-HA-24	12.6 ±5%	30	673-HA-25	12.6 ±5%	30

Ripple (%): 0.0002 **Temperature Coefficient (%/°C):** ±0.001
Regulation (%) (±10% Line): ±0.001 **Operating Temperature(°C):** −25 to +75
AC Isolation for -25 cased units is less than 0.01 pfd.

Military Units, Custom Designed for Aerospace and Military Applications.

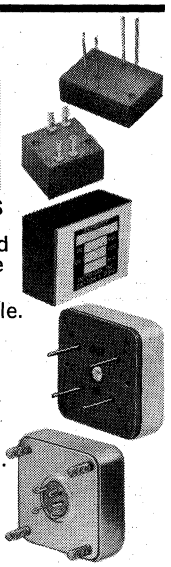


700 SERIES



MINIATURE VOLTAGE REFERENCE UNITS

Provides fixed D.C. voltage to a constant load regardless of wide variation of input voltage or ambient temperature changes.
Printed Circuit and Chassis Mounting available.
Complete prepackaged voltage reference.
Component size.
Encapsulated.
Wide selection of Temperature Coefficients and Regulation Voltages and Currents.
Does not require temperature compensation.
Simplifies Circuit Design.
Reduces Panel Space.
Does not require controlled temperature environment.

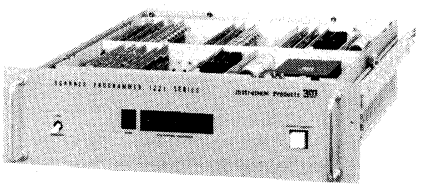


3M INSTRUMENTATION SWITCHING SYSTEMS...

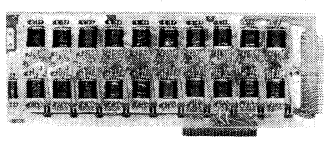
3M Reed Relay Switching Systems are built to solve high speed switching problems. Modular construction permits intermixing and field expansion of various types of switching configurations. Plug-in switching module assemblies are available with 1, 2, 3, 4, and 6-wire switching as well as multiple-pole form "C" and form "A-C" combinations. Low-level switching modules with thermal offset of less than 10 microvolts are available.

Standard 1-2-4-8 BCD programming logic is used in 3M Switching Systems. The switching speed is less than three milliseconds after program command. Pull-in and drop-out time is constant from channel to channel.

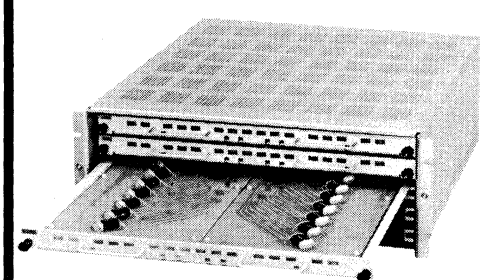
If our off-the-shelf family of modules does not meet your needs, our experience is available for custom design to your specifications.



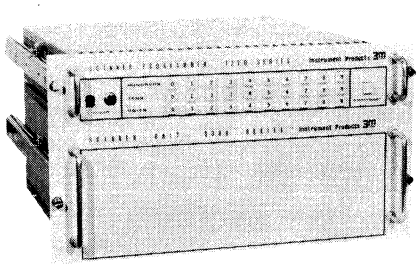
1221 Scanner Programmer



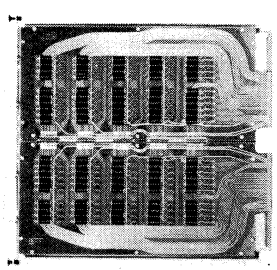
3380 Switching Module



3383 Scanner Chassis



3380/1220 Scanner



3990 Switching/Memory Module

3380/1220 Series Scanner

- Maximum of 1000 channels (single or multiple pole).
- Digital display of programmed channel number.
- 3380/1220 Series Scanner is packaged in standard rack-mountable chassis. The 3½" 1220 chassis is used for program decoding and power drive to the 7" 3380 chassis housing plug-in switching modules.
- 10 to 20 channels per plug-in switching module depending on relay configuration.

3383/1221 Series Guarded Scanner

- Completely guarded for high CMR in system applications.
- Output multiplex to enable routing of Scanner output to any of 10 destinations (optional).
- Binary program input (optional).
- Input storage registers for direct computer interface (optional).
- Guarded plug-in switching modules have 40 to 200 channels per assembly—depending on relay configuration.
- 3383/1221 Series Scanner is packaged in standard rack-mountable chassis. The 5¼" 1221 chassis is used for program decoding, guard isolation and power drive to the guarded 7" 3383 chassis housing plug-in switching modules.
- Low capacitance, typically less than 25 pf crosstalk for 100 channels of 3-wire switching.
- Maximum of 10,000 multiple pole channels.
- Decimal readout of channel number.

3990 Series Guarded Switching Matrix

- Random access, two-dimensional switching matrix to enable *multiple* connection paths from one side to the second side of the matrix.
- Solid-state integrated circuit memory for each crosspoint.
- Programmed from a 1-2-4-8 BCD source to select given crosspoints and direct "set" or "reset" commands.
- The 3990, like all 3M switching instruments, is built with modular techniques. A 10½" power supply/decode module will program/power up to 2000 individual relay crosspoints.
- Guarded construction techniques make the 3990 ideal in system applications requiring high CMR.
- Plug-in switching/memory modules are packaged in a 7" chassis with 500 crosspoints per chassis.
- Basic matrix configuration is 1 x 10 which may be wired in any multiple combination.

Instrument Products 3M COMPANY

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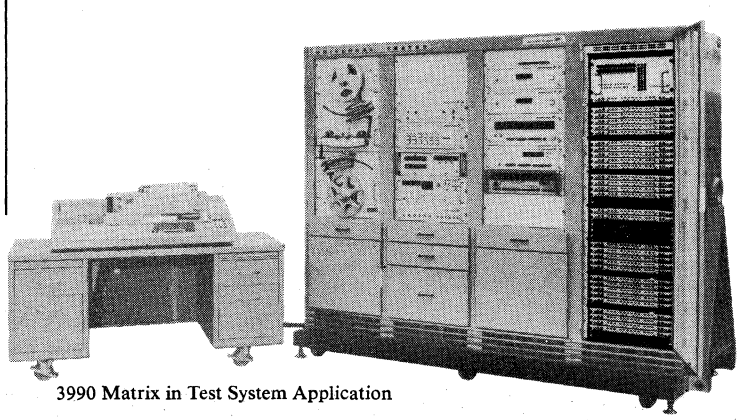
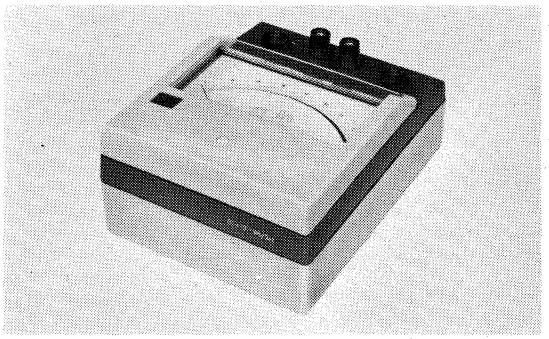


3990 Matrix in Test System Application

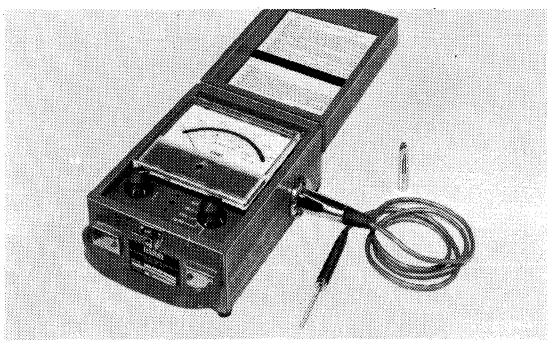


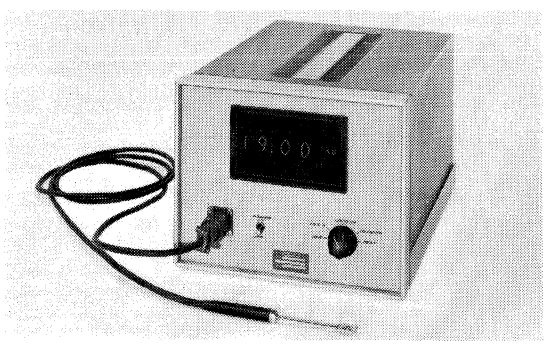
MODEL 621 F NORMA FLUXMETER

Joining the widely used model 251F is the new, small and rugged model 621F fluxmeter. This accurate instrument, with a simple scale of 10^{-4} Webers (10,000 Maxwells)/Scale Division is expressly intended for the educational field. The economical price and liberal education discount makes its purchase for student use possible even with the limited budgets that exist in many science departments.

MODEL A GAUSSMETER

With prices starting at $185.00 (including probe) and a ten year history of performance and durability, the Model A Hall Effect Gaussmeter is the answer to many engineering, production and inspection requirements. The instrument includes a built-in magnet standard and can be supplied with axial probes to a diameter of 0.125 inches and transverse probes to a thickness of 0.006 inches.



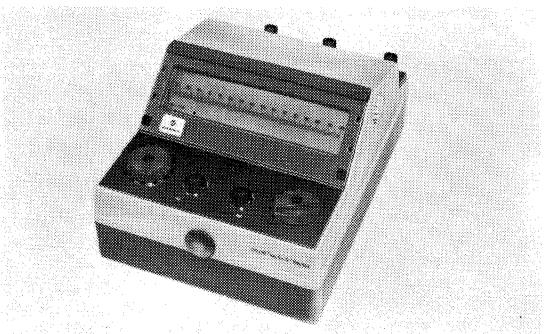


MODEL D GAUSSMETER

The model D Gaussmeter provides a digital (3 ½ digit) display for exceptional readability and high resolution. As a highly stable laboratory instrument the model D Gaussmeter is available with a wide selection of probes including special units for operation at 4.2°K or 200°C.

MODEL 251F NORMA FLUXMETER

The model 251F is a highly sensitive, versatile fluxmeter for laboratory and production use. The instrument provides ten ranges covering 5 x 10^{-6} to 5 x 10^{-3} Webers (500 to 500,000 Maxwells)/Scale Division. Search coils, carrying/storage cases, etc. are also available.



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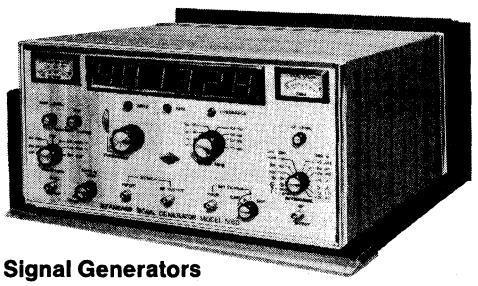
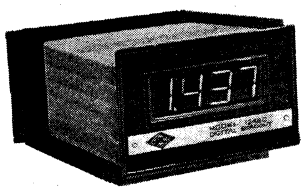


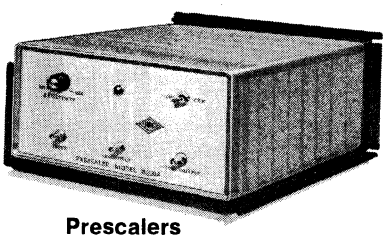
Signal Generators



Counter/Timers



BCD Readouts



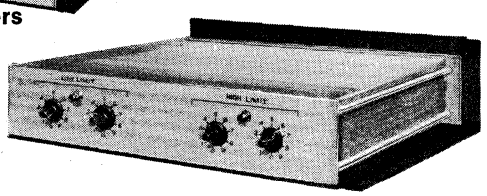
Prescalers



Elapsed Time Counters



Preset Counters



BCD Hi Lo Detectors

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Special Products Division

Specializing in CUSTOM DESIGN and manufacture of Power Supplies, Digital and RF Systems/Sub Systems. *Prices competitive with off the shelf equipment* in quantities of 50 or more units. This approach provides maximum equipment compatibility to fit the application at hand. Let us quote on your requirements, today.
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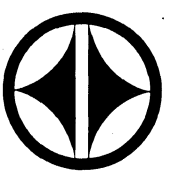
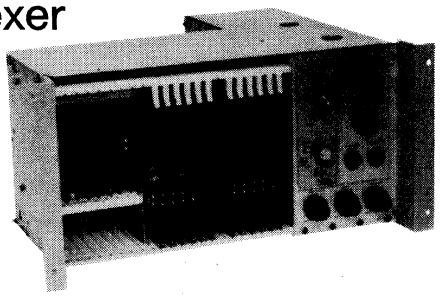


Tell them you found them in **eem**

IEC DATA PRODUCTS DIVISION

Low Level Analog Multiplexer

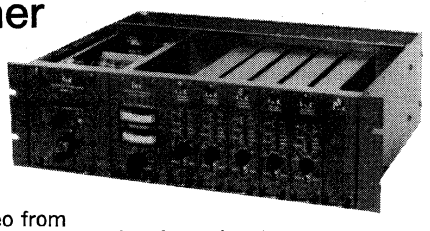


Model MX-500

Versatile interface for sampling low level signals in computer oriented data acquisition systems.

- Input– ±5 mv to ±500 mv F.S.
- Output– ±10 v F.S.
- Up to 50 kHz sample rate
- Easily expandable up to 1000 differential guarded channels
- Sequential or random channel address
- Automatic and programmable gain

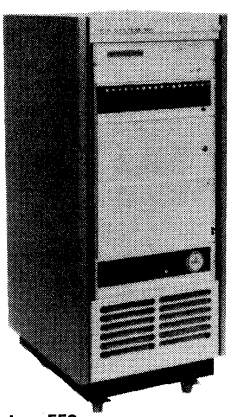
Post Detection Diversity Combiner



Model 810

- Combines detected video from dual receivers to recover data from signal fades and to improve SNR
- Adapts to most receivers by means of channel matching controls
- Operates with any type of diversity reception and modulation
- Wide video response from 5 Hz to 4 MHz

Remote Low Level Data Acquisition Terminal

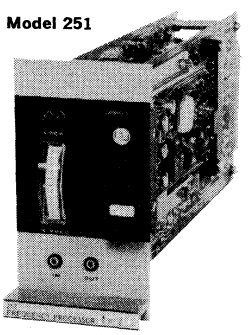


System 550

Complete unit for monitoring low-level analog signals at remote sites with real time digital data transmission to a central processor.

- Input level–±5 mv to ±500 mv F.S.
- Input channels–up to 1000 in groups of 10
- Output–12 bit binary serial PCM, transmitted up to 3 miles via standard coaxial cable
- Sample rate–up to 10,000 samples per second

General Purpose Phase-lock Receiver Module

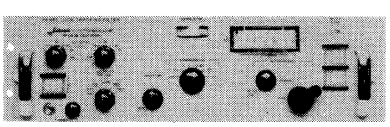


Model 251

- PM/AM demodulator
- Frequency tracker
- Multiplies frequency
- Zero phase shift filter
- Data synchronizer
- Input–periodic signals in the range from 1 kHz to 450 kHz–special units to 12 MHz–50 db dynamic range
- Outputs–clean square wave phase locked to the input frequency and multiples thereof–AM, PM and FM

Narrow Band Tracking Filters and Demodulators

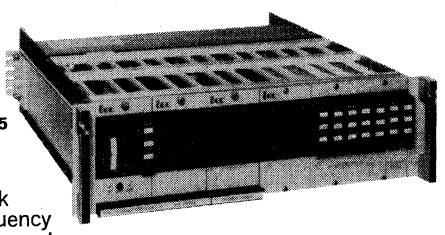
Model 450



The ultimate unit for narrow band phase lock recovery of noisy signals.

- Automatically tracks frequency varying signals
- Tunes–from 100 Hz to 120 kHz, continuously
- Outputs–clean sine wave phase locked at multiples of 1, 10 and 100 times the input frequency
- AM and PM data to 60 kHz bandwidth

Tape Data Synchronizers



Model 2755

Automatically tracks playback reference frequency to produce coherent clock, synchronous with data being read from tape. Selected output clock frequency is clean square wave free of drop-outs, containing the same record/reproduce pertubations as the data. When used as reference for coherent demodulation flutter errors are cancelled. The selected clock frequencies are produced at all standard tape speeds over a wide range of input reference frequencies.

IEC **INTERSTATE ELECTRONICS CORPORATION**

707 East Vermont Avenue, P.O. Box 3117, Anaheim, California 92803 ▪ (714) 772-2811
Subsidiary of "Automatic" Sprinkler Corporation of America

JULIE MULTI-VIDER — PPM MEASUREMENTS IN VOLTAGE, CURRENT, RESISTANCE, RATIO

It is no longer necessary (or desirable) to buy special purpose potentiometers, resistance bridges and other instruments because . . .

The plug-in Multi-Vider, the newest and most useful tool created by 12 years of Julie pioneering in DC instrument and system development, obsoletes other DC devices. Like the modern plug-in oscilloscope and the modern plug-in counter, the modern plug-in Multi-Vider works for everyone, everywhere, everyday . . . keeps your company up-to-date with the accelerating requirements of the DC art.

The most accurate DC instrument is the Divider . . . because it is a pure ratio instrument. The widely recognized Julie Ratiometric system, now in its newest form (the MV-1 Multi-Vider), exploits this fact to create a unique, optimum, integrated system of measurement that advances the state of the art 5 ways:

- ☐ It is now possible to measure resistance, current, voltage, and ratio with accuracies **of the order of a few parts per million** — not just at "cardinal values", but at **any** value; not just in the region of a few volts or ohms or amperes, but **over a range of several million to one.**
- ☐ These measurements can be made by relatively unspecialized personnel, without significant increase in the limit of uncertainty — manipulation error is **virtually eliminated** by the RATIOMETRIC system. The RATIOMETRIC system is equally tolerant of **environment** — the limit of error does not significantly increase when the equipment is moved out of the industrial laboratory into a production-test environment.
- ☐ Determinations that once took hours, and even days, of painstaking manipulation and checking can now be performed in a matter of minutes — even faster, if secondary-standard (0.001%) results are acceptable.
- ☐ Every test configuration employed in the RATIOMETRIC system is **self-checking,** and all are referenced to only **two** "NBS traceable" standards —emf and resistance. Any test, regardless of its precision or parameter range, may be validated in a matter of **minutes.**
- ☐ A complete RATIOMETRIC laboratory costs far less than a comparable complement of conventional standards equipment for measurement over the same ranges — despite the clear-cut superiority of the RATIOMETRIC approach. **Patents applied for on all instruments and systems.*

Julie instruments are normally supplied with stainless steel panels as shown on the following pages. They are also available, on special order, with painted panels as shown to right.

The Multi-Vider and Plug-ins

The basic Multi-Vider is an integrated, low-cost divider detector combination with provision for plug-in adapters. Of itself, the Julie Multi-Vider offers the best ratio capability for all applications. Inserting one of the many available Multi-Vider Plug-ins immediately converts the Multi-Vider to the best instrument in that class.

As an example, the Julie Model MV-1 MULTI-VIDER consists of:

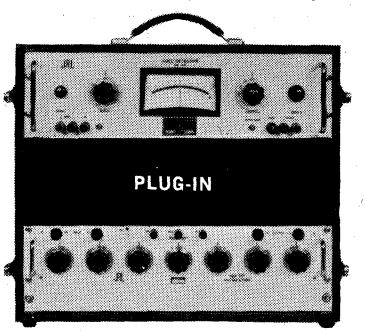
1. **VDR-307** Kelvin-Varley voltage divider — The divider reading is always easy to obtain and has a resolution of 7 places with a basic accuracy to 6 places (0.0001%). Price: $900.00
2. **ND106** Null Detector — a superior general-purpose galvanometer with a sensitivity of ±0.1μv. Price: $800.00
3. **PLUG-IN** — Julie plug-ins can be purchased for your individual requirements. They offer divider-accurate divider-easy, divider-reliable, DC readings from nanohms to gigohms, pico-amperes to amperes, and nanovolts to kilovolts.

Optional accessories include Julie power supply plug-ins which convert your Multi-Vider to ultra-precise voltage and current supplies.

With only two plug-ins, the Julie Multi-Vider measures all four:

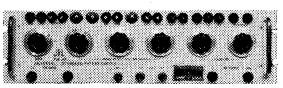
Resistance	**Ratio**
Voltage	**Current**

to an accuracy of 6 places with 7-place sensitivity.

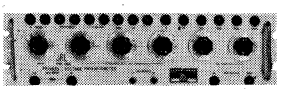


MODEL MV-1 Multi-Vider

TYPICAL VOLTAGE PLUG-INS

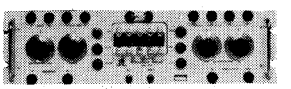


PVP-1001J

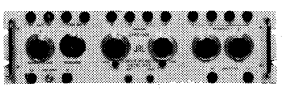


PVP-1000

TYPICAL RESISTANCE PLUG-INS

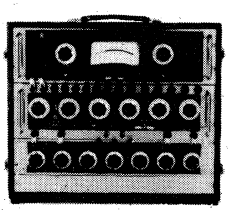


PRB-205



DRRS-108

VOLTAGE & CURRENT



MODEL MV-1 with Model PVP-1000 C Plug-in

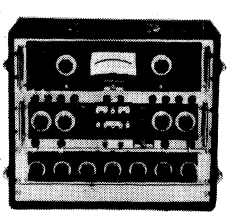
Usable for both laboratory and production test. Comprised of the following JRL primary standard instrument modules: **PVP-1000C** Potentiometer with integral precision volt box, **VDR-106/7 (or VDR-307)** Voltage Divider, **ND-106** Null Detector, and **SCO-106** Absolute Voltage Reference, all 4 of which can be used independently in a wide variety of applications. Primary standard accuracy is achieved through close control of error-contributing factors and by basing the design on JRL Type NB-1 resistor and JRL primary standard instruments. NBS-Certifiable.

Range and Accuracy
Potentiometric: 0 to 1.1 vdc
0.0003% ±1μv
0.0001% ±1μv with self-calibration
Extended: 1.1 to 1100 vdc
0.0002% ±0.1 ppm (fs) with self-calibration

Resolution: 0.00001%

Working Current
Source: Thermally-lagged mercury cells
Stability: 0.0001%/8 hrs.

RESISTANCE & RATIO



MODEL MV-1 with Model PRB-205 C Plug-in

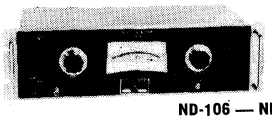
Measures absolute resistance, relative resistance (deviation), and resistance ratio. Accuracy is determined primarily by the resistance standard. Offers 7-digit resolution.
Consists of the **PRB-205C** Primary Resistance Bridge Component, **VDR-307** or VDR-106/7 Voltage Divider and **ND-106** Null Detector. Contains a convenient plug-in module with 5 JRL Resistance Standards **(MRS-106)** at an accuracy of 0.0015%. By calibration of the MRS to National Bureau of Standards reference levels, the accuracy of the PRB-205S System can be raised to 0.0005% ±0.1 ppm (fs) over entire range.

Range: 5 ranges from 1000 ohms to 10 megohm, fs
Limit of error: 0.0015% ±1 ppm (fs) guaranteed
0.0005% ±0.1 ppm (fs) w/calibration data on std and self-calibration of the Divider

Rel accuracy: 0.0001%
0.00001% w/self-calibration
Resolution: 0.00001%

JULIE MULTI-VIDER™ BASIC COMPONENTS AND MEASUREMENT PLUG-INS

NULL DETECTORS



ND-106 — ND-106/7

Range: ±3.0 microvolts to ±30 millivolts in 9 ranges f.s.
Sensitivity: 0.1 microvolts
Input impedance: 100,000 ohms
Stability: drift less than 1 microvolt/week
Output: ±1.5 volts full scale
Input: 115 vac, 60 cps, 200 ma

ND-106 Null detector and DC amplifier. Features fully solid-state circuitry and provides high sensitivity and high input impedance for use in ultra-accurate measuring systems such as the PRB-205S and PVP-1000S. Gain may be set to provide linear, calibrated, or logarithmic output. The ND-106/7 is a modified version that is used with the ND-107.

SA-106. This unit is similar to the ND-106 and has an output amplifier for use as an electronic servo in feedback control systems.

NANOVOLT NULL DETECTOR PREAMPLIFIER

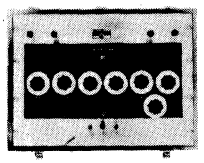


ND-107

A universal detector for all measurement applications (nanovolts to millivolts) is obtained by combining the all-solid-state model ND-107 Nanovolt Preamplifier with a modified basic null detector model ND-106/7.

This combination gives superior performance — low noise, high stability, high sensitivity — over the widest possible range of circuit impedances.

Sensitivity: 0.3 nanovolts
Resolution: 1.0 nanovolt, X1000 range
Input Range: 0 to ± 30 mv in 15 steps
Input Impedance: 10 ohms to 50,000 ohms
Stability: 3 nanovolts/24 hrs after 1 hour at constant ambient.



VDR-106/7

VOLTAGE DIVIDERS FOR DC AND AC

VDR models for primary and secondary standards and for production test.

SPECIAL FEATURES
SVD-108—Ovenized for increased stability from 20°C to 30°C
VDR-307—Basic Multi-Vider component
VDR327J—1.1 and 1.2 Over-ranges; basic Multi-Vider component
VDR-307H—1.2 Over-range used with JRL generating systems
VDR-327P—Data Logging Output

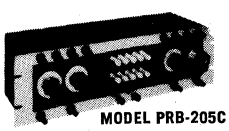
VDR Models	Standard						High Frequency
	SVD-108	106/7	307	327J	307H	327P	106A**
*Linearity	.1 PPM	.1 PPM	.1 PPM	.1 PPM	.1 PPM	.1 PPM	.1 PPM
Direct Reading Accuracy	.2 PPM	.5 PPM	1 PPM	1 PPM	1 PPM	1 PPM	2 PPM
Resolution	.01 PPM	.1 PPM	.1 PPM	.1 PPM	.1 PPM	.1 PPM	1 PPM
Max. Excitation	1000 vdc	1000 vdc	700 vdc	700 vdc	700 vdc	700 vdc	120 vrms
Total Resistance	100 Kohm	100 Kohm	100 Kohm	100 Kohm 110 Kohm 120 Kohm	100 Kohm 120 Kohm	100 Kohm	10 Kohm
Stability/ year	.00002%	.00005%	.0001%	.0001%	.0001%	.0001%	.00005%

See also Relay Operated Dividers under "Automated and Programmable Test Sets"
*Effective accuracy after calibration **0-20 Kilocycles

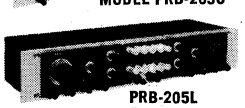
RESISTANCE PLUG-INS

RESISTANCE BRIDGES

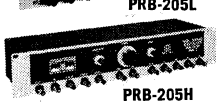
Primary resistance bridge adaptor instruments used in conjunction with a **VDR** Voltage Divider and **ND-106** Null Detector. Permit ultra-precise 2 or 4-terminal resistance measurements from 0 to 10^{12} ohms. Zero offset circuitry establishes the true zero point and eliminates all test lead effects. Special direct reading dials on PRB-205C allow precise measurements of resistance deviation to ±150 ppm from any nominal value. Integral and selectable bridge excitation is provided from highly stable mercury batteries controlled by a polarity reversing switch and push keys. Plug-in ultra-stable JRL resistance standards provide measurement traceability to NBS reference units.



MODEL PRB-205C



PRB-205L

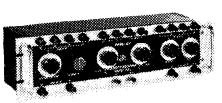


PRB-205H

Range	*Accuracy	*Accuracy With Self-Calibration
Model PRB-205C		
0-1000 ohm	±.0001% of setting ±.0001% f.s.	±.0001% of setting ±.00001% f.s.
0-10 Kilohms	±.0001% of setting ±.0001% f.s.	±.0001% of setting ±.00001% f.s.
0-100 Kilohms	±.0001% of setting ±.0001% f.s.	±.0001% of setting ±.00001% f.s.
0-1 Megohm	±.0002% of setting ±.0001% f.s.	±.0002% of setting ±.00001% f.s.
0-10 Megohms	±.0003% of setting ±.0001% f.s.	±.0003% of setting ±.00001% f.s.
Model PRB-205L		
0-0.1 ohms	±.0003% of setting ±.0001% f.s.	±.0003% of setting ±.00001% f.s.
0-1 ohm	±.0002% of setting ±.0001% f.s.	±.0002% of setting ±.00001% f.s.
0-10 ohms	±.0002% of setting ±.0001% f.s.	±.0002% of setting ±.00001% f.s.
0-100 ohms	±.0001% of setting ±.0001% f.s.	±.0001% of setting ±.00001% f.s.
Model PRB-205H		
100 Megohms	±.004% ±.0001% f.s.	
1,000 Megohms	±.009% ±.0001% f.s.	
10,000 Megohms	±.019% ±.0001% f.s.	
100,000 Megohms	±.04% ±.0001% f.s.	

* Absolute accuracy of measurement is equal to the absolute accuracy of the resistance standard used plus the accuracy of the bridge as shown above.

DIRECT READING RATIO SET



MODEL DRRS-108

The JRL Model DRRS-108, a new plug-in bridge device for the Multi-Vider system, offers the user a direct reading ratio set capable of measuring the Thomas pattern 1 ohm resistor with an accuracy of .1 ppm and a precision of .1 ppm. The unit permits making 1:1, 1:9, and 1:10 comparisons of 2 and 4 terminal standard resistors to the same accuracy and precision. The DRRS-108 is self-calibrated and offers a 7-place in-line digital readout.

- Low impedance permits use with nanovolt null detector
- Simple automatic calibration with self-contained 1:1 STD.
- Use with .001 ohm to 10 meg resistors

VOLTAGE PLUG-INS

POTENTIOMETERS AND VOLTAGE MEASURING DEVICES



PVP-1000C
TO 0.0002%

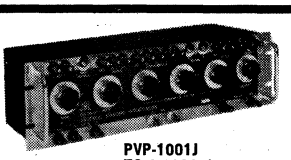
PVP-110C is a primary standard potentiometer instrument with integral thermally lagged mercury cells. It is used in combination with other standard modules (VDR-106/7 or VDR-307, SCO-106, ND-106) to provide a potentiometer system (PVP-110S) for precision measurements over a range from zero to 1.1 volts.

Accuracy: 0.0002% at 1 volt (as potentiometer) ±1 microvolt (as standard cell comparator) NBS-Certifiable.

PVP-1000C has all features of the PVP-110C plus a high voltage capability to 1100 volts DC. The low voltage ranges are extended by a highly accurate volt box with range multiplying factors of 3, 10, 30, 100, 300 and 1000.

PCVP-1000C has the features of the PVP-110C plus a set of internal current measuring shunts to permit current calibrations on several ranges. Shunts may be specified for current values to 10 amperes full scale.

NANOVOLT POTENTIOMETER



PVP-1001J
TO 0.0003%

The PVP1001J is a highly accurate voltage potentiometer capable of potentiometric (infinite input impedance) measurements over a wide range of voltage. Continuous reference monitoring, 20% over-range on all ranges, and self-calibrating capability make this potentiometer an extremely useful addition to the JRL plug-in primary standard measuring system. The PVP-1001J module contains the range resistors, working reference, and galvanometer reversal switching circuitry. Applications for this potentiometer include comparison of standard cells and zener reference elements and high resolution low voltage measurements on thermocouples and current shunts.

Range	Accuracy Direct Reading	Accuracy With Correction
0 - ± 12 volt	.0005% ± 1 μvolt	.0001% ± .1 μvolt
0 - ± 1.2 volts (standard cell comparison)	.0003% ± 1 μvolt	.0001% ± .1 μvolt
0 - ± .12 volts	.0005% ± .1 μvolt	.0002% ± .02 μvolts
0 - ± .012 volts	.0008% ± .01 μvolt	.0003% ± .3 nanovolts
0 - ± .0012 volts	.0013% ± .001 μvolt	.0004% ± .1 nanovolts

Resolution: .1 PPM; 10^7 discrete steps
Dimensions: 19" wide; 5¼" high; 6¼" deep

JULIE MULTI-VIDER™ — FOR AUTOMATED AND COMPUTERIZED TESTING

AUTOMATIC D.C. MEASUREMENT SYSTEMS CAN NOW ATTAIN 1 PPM ACCURACIES

The extension of the one-part-per-million art of DC measurement into the fields of high speed automatic and programmable test instruments and systems has been made possible with the development of a 1 PPM automatic and remotely programmable voltage divider by Julie Research Laboratories, Inc.

AUTOMATIC VOLTAGE DIVIDER RVD-106



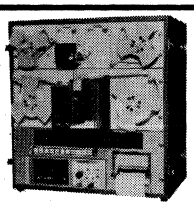
- .0001% accuracy
- Automatic
- Programmable
- May be manually operated

The six-digit (1 PPM) accurate Model RVD-106 is the latest in the JRL line of high precision relay operated voltage dividers.

The availability of the RVD-106 adds automation such as tape and computer programming capabilities, without degradation, to all JRL 1 PPM instruments such as bridges, potentiometers, voltage and current sources and ratio sets. A lower cost five-digit divider, RVD-105, is also available.

Range: ratio .000000 to 1.000000 (RVD-106); .00000 to 1.00000 (RVD-105)
Accuracy: ratio ± .0001% (RVD-106); ± .001% (RVD-105)
Resolution: 1 PPM (RVD-106); 10 PPM (RVD-105)
Response time: 10 milliseconds or less.

AUTOMATIC INPUT/OUTPUT CONTROL MODULE AIO-106



- 10-line Decimal Readout
- Punch Tape Memory
- Fully Automated

The new JRL Model AIO-106 Control Module provides visual readout, data logging and retrieval, and automatic voltage divider set and reset. When used with the new JRL data logging divider (VDR-327P), a permanent record of data is kept. When used with the new automatic, remotely programmable divider (RVD-106), not only is a permanent record of data kept but the divider can be reset from the memory of the AIO-106 to repeat each measurement on a group of components. The measured deviation from the initial reading on each component together with a component identification number is returned to memory storage and also printed out together with the original measured value.

AUTOMATIC DATA LOGGING VOLTAGE DIVIDER VDR-327P



- 7 Digits
- 10 Line Decimal and/or BCD Outputs
- .0001% accuracy

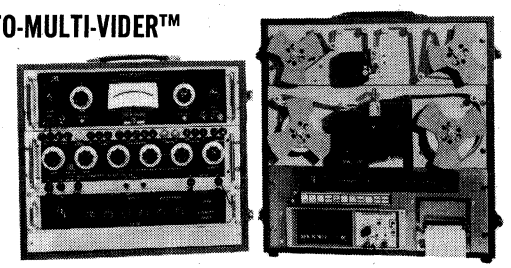
The JRL Model VDR-327P is identical to the VDR-327J with an added feature. Visual displays, paper tape or typewriter printers, tape punch and other computer I/O equipment can be fed from the outputs located at the rear of the device.

SCANNING MATRIX SM-106

- High speed scanning of short or long production runs
- Converts any conventional equipment into high speed tester
- Converts any Digital Voltmeter into high speed tester
- Automated programmable test tray

The JRL Scanning Matrix SM-106 represents one process for automated systematic component testing and measurement. Any number of components may be placed into the various connectors of the SM-106; then any scanning program will be followed so that several components per second are measured using external bridges, potentiometers, etc. Output and power input terminals are provided. Either four terminal or two terminal measurements are possible. Provision is made for manual scanning.

AUTO-MULTI-VIDER™



The portable plug-in type automated DC measurement system, the Auto-Multi-Vider (at left), incorporates the RVD-106 or the VDR-327P Kelvin Varley Voltage Divider as its basic readout module. The Auto-Multi-Vider and the JRL Model AIO-106 Control Module form a complete automatic measurement and data logging system. The outputs of this system (component identification number and measured value) are also available for multiplexing into other computer facilities. This unique system covers all DC parameters of measurement and generation and can be programmed to perform all automated test and calibration programs.

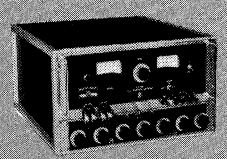
JULIE SOURCES — DC PRECISION VOLTAGE AND CURRENT SOURCES

HIGH VOLTAGE 0.0015%

MODEL DVS-106

Whether used for calibration of high-precision DC voltmeters or other purpose, DVS-106 provides ultra-stable output levels in 3 dual ranges from 0 to ±1200 vdc, fs. Each range affords 12 million dialable steps with a linearity of .0001% and an output stability which is maintained to within 0.002% for a period of at least 30 days.
Completely self-contained. Direct reading with full front panel control for all functions, including range selection, polarity reversal and automatic voltage as well as current monitoring and calibration.

Output range: 0 to ±12, 120, 1200 vdc
Resolution: 7 digits
Accuracy: 0.0015% of setting ±1 ppm (fs)
Linearity: 0.0005%
Stability: 0.0001% (fs)
0.0015% of setting + 0.0001% of fs, 7 days
0.0025% of setting + 0.0001% of fs, 6 mos.



HIGH CURRENT 0.003%

Model DCS 105

Model DCS 105 is a high precision current source which is a companion instrument to the DVS 106. It features high linearity (.0025% on the 10 amp range; .001% on the other ranges) and easy front panel calibration. DCS 105 is lightweight (40 lbs.) and highly reliable because of its all solid-state circuitry.

Julie high current sources can be used with Julie potentiometers to make high-accuracy, low resistance measurement systems. These systems feature a resolution of 10 pico-ohms and make yoke and lead compensation unnecessary. Accuracy of .001%.

- Simultaneous display of output voltage and current
- All solid state

Ranges: 0 to ± 1.2, 12, 120 ma
1.2, 12 amps
Accuracy: Low Ranges: .003%
1.2 amps .006%
12 amps .01%
Compliance: ±10V
Line Regulation: .0005%



CONTACT HOME OFFICE FOR SPECIAL DESIGNS OR OTHER REQUIREMENTS

JULIE RESEARCH LABORATORIES, INC.

211 WEST 61st STREET, NEW YORK, NEW YORK 10023 • (212) 245-2727

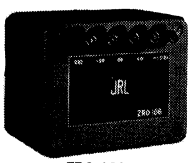
JULIE REFERENCES — REFERENCES, OPERATIONAL AMPLIFIERS AND SYSTEMS

SOLID STATE REFERENCES — OVENIZED



- Extremely rugged
- Short-Circuit Proof
- 3 Voltage Levels for Intercomparison

ZRO-106A
HALF-RACK MODEL

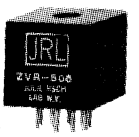


ZRO-106
BENCH MODEL

ZRO-106 is a Zener reference source enclosed in a proportional, temperature-controlled air bath. Extremely rugged and short-circuit proof, this reference has stability approaching that of saturated cells.
Also available is an ovenless reference ZVR-106.

Output levels: +1.018v., +1v., −5v, or any combination
Line regulation: 1 ppm 15% line change
Stability: 10 ppm/month
Power: 105-120 vac; can be supplied from external 24vdc supply or portable battery pack.

MINIATURE ZENER VOLTAGE REFERENCE MODULE



Model ZVR-500 Series

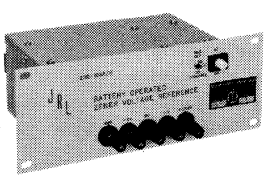
- *Zero Temperature Coefficient
- Fast Warm-Up time
- .0001%/day stability
- Smaller than a 1" cube
- Contains internal regulating circuitry

In the space-age technology of today comes the ever increasing demands for portability, reliability, compactness, and ruggedness. In this realm the demand for voltage references possessing such desirable features as high, long and short term stability, fast warm-up, *zero temperature coefficient, and excellent short circuit recovery characteristics, are also in the forefront.
To meet these demands Julie Research Laboratories has developed an entirely new voltage reference module, ZVR-500 series, which virtually discards the need of oven enclosed references. The unit is less than the size of a one inch cube; it can be mounted on a printed circuit board or plugged into a standard nine-pin socket. Several ZVR models are available; each is capable of delivering up to 1 ma of current to a constant load.

Model	Input (+10%)	Output (nominal)	*TC	Stability
ZVR-506	22 VDC	6.3 VDC	Less than .2 ppm/°C from 20° to 30°C	1 ppm/day
ZVR-512	24 VDC	12.6 VDC		10 ppm/mo.
ZVR-518	35 VDC	18.9 VDC		

Operating Temperature Range: 0°C to 50°C, 0 to 10,000 Feet Altitude.
Humidity: 0 to 90% R.H.
Storage Temperature Range: −55°C to 60°C, 0 to 40,000 Feet Altitude.

BATTERY OPERATED ZENER VOLTAGE REFERENCE



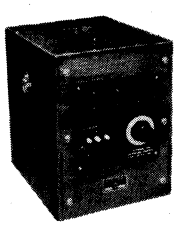
Model ZVR-106B

- Battery operated
- Internal charging circuit
- TC: Less than 1 ppm/°C
- Stable to 1 ppm/day

The ZVR-106B (bench model) and ZVR-106A/B (half rack model) combine the advantages of a miniature "Zero TC" reference module (JRL Model ZVR-506) low TC resistors (less than 1 ppm of ratio /°C) and an internal ni-cad power source with internal charging circuit to produce a completely portable, self-contained, high stable, voltage reference that can be used with confidence for almost any production or laboratory requirement.
There are three available output voltage taps: 5 V, 1 V, and a 1.018 V tap (nominal) useful for comparing cells, or quick easy determination of the zener's accuracy. Line regulation is better than 1 ppm/15% line change; while switching from battery operation to AC line operation changes the output less than 1 ppm. Lasts 10 hours on a single charge.

Either the ZRO or the ZVR may be used as references for operational amplifiers, dialable voltage sources, dialable current sources, and precision potentiometers.

VOLTAGE REFERENCES



SCO-106
Guaranteed
0.0001%

SCO-106 Primary standard voltage reference. Provides the highest accuracy and stability obtainable. This is derived from 3 saturated standard cells in a temperature stabilized enclosure which afford two orders of magnitude better accuracy than unsaturated cells customarily used for laboratory work. The SCO-106 is transportable under oven heat thus eliminating the need for lengthy restabilization.

Accuracy: ±0.0001% (voltage) absolute*
Stability: ±0.0001%/year
Temp Reg: ±0.05°C long term

*With NBS Certification.
With JRL Certification, 0.0002%.

OPERATIONAL AMPLIFIERS



OA 600 SERIES

Output Power Capability:
OA-601, ±10 ma, zero to 1000 ohms load
OA-602, ±40 ma, zero to 750 ohms load
OA-603, ±10 amps, zero to 1 ohm load
OA-604, ±1,200 volts, 35 ma capability
OA-605, ±150 volts, 50 ma capability

Julie self-powered OA series operational amplifiers are uniquely drift free and ultra-low in noise content. Specially designed for high precision DC applications, these amplifiers feature input stability of 100 nanovolts and typical gains from 10^6 (120db) to 10^8 (160db).
Julie precision resistors, references, dividers and amplifiers can easily be assembled into high precision generators and sources in a wide range of output configurations.

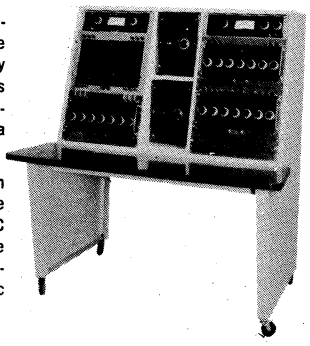
TYPICAL SYSTEM
DIALABLE VOLTAGE REFERENCE SOURCE DRU 207

Linearity: 0.0001% (fs)
Resolution: 7 digits
Output: 0 to ±3V
Stability: .2μv/24 hrs.
Output Impedance: 100 μohms

Components:
1 Standard Cell SCO 106
1 Operational Amp. OA 601
1 Voltage Divider VDR 307

AC/DC SYSTEMS — STANDARDS LAB, SYSTEMS, SPECIAL PACKAGES, TRAINING WORKSHOPS

ENGINEERING DATA AND ASSISTANCE



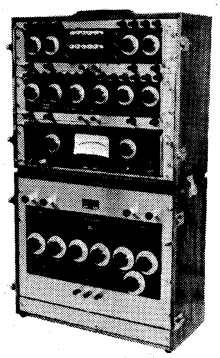
Multi-Vider systems may be assembled for special purposes from the basic Multi-Vider units and the many specific plug-ins. Special plug-ins can be designed for special applications. Automatic systems and data logging are our specialties.

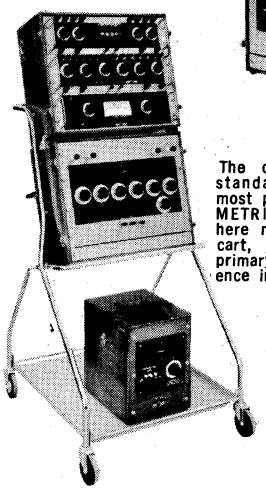
The exclusive JRL instrumentation console shown here contains, on the right, a complete RATIOMETRIC DC standards laboratory, and, on the left, a complete wide-range DC current source, assembled from basic RATIOMETRIC instrument modules.

Specifications, Ratiometrics Laboratory:

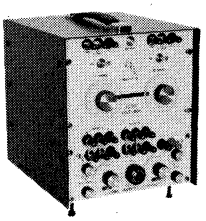
Performance of the complete system is specified by combining the specification abstracts in the preceding pages for:

Primary Standard
Voltage System: PVP-1000S
Resistance Bridge: PRB-205S
Voltage Divider: VDR-106/7
Voltage Reference: SCO-106
Null Detector: ND-106





The complete JRL portable standards laboratory — the most popular form of RATIOMETRIC facility — is shown here mounted on a portable cart, which also carries a primary standard emf reference in oven, SCO-106.



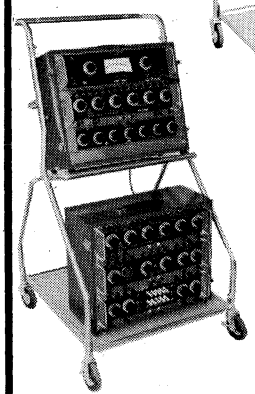
AC TO DC THERMAL TRANSFER STANDARD

The JRL Model **TRS-105** Thermal Transfer Standard is designed to provide rapid and simple referencing of any AC voltage up to 1,024 vrms to known DC voltages with a basic accuracy of .001% without the use of calibration curves or correction tables and with excellent thermal stability and DC reversal error. **Voltage Ranges: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1,024 vrms with each range useful from .5 to 1 times its maximum.**

AC/DC Uncertainty:

	to 64V	128 to 512V	1,024V
5 Hz through 10 KHz	.001%	.002%	.003%
10 KHz through 20 KHz	.002%	.003%	.005%
20 KHz through 50 KHz	.003%	.004%	.01%
50 KHz through 100 KHz	.02%	.1%	.2%
100 KHz through 1 MHz	.1% up to 10 V.		

Thermocouple Reversal Error: Less than .0005% of input.
Input Impedance: 100 ohms/volt.



Transit case available with each bench laboratory

PORTABLE MULTI-VIDER with Plug in Storage Rack

The Julie Multi-Vider and Plug-in Carrier shown here mounted on a cart is the most convenient way of utilizing the portability of the Multi-Vider system while still maintaining a high degree of flexibility.

JULIE LITERATURE AND TRAINING WORKSHOPS

This "miniature textbook" provides a detailed exposition of Ratiometrics as a philosophy, as a science, and as a "body of method." An index to the articles and papers published about the Ratiometric method and other state-of-the-art instrumentation techniques. Ten such documents published in an 18-month period are shown and summarized.

THE JULIE 2-DAY COURSE



Provided as a service without charge, the JRL Workshop is a special course of lectures and laboratory exercises in a new, simplified method of DC measurement, calibration and certification.

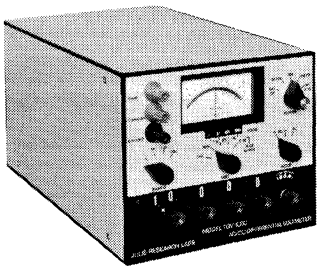
A session of the Julie school is pictured on the left. All aspects of the Ratiometric measurement method—philosophy, theory, instrumentation, techniques proof, procedures—are covered in these courses. A text-book is provided. This training program is one of the features that make Ratiometrics the cost complete, as well as the most accurate, method of DC measurement. As will be seen from the attendance summary, sent on request, scores of the world's leading electronic organizations — National Laboratories, Government Units, Colleges, Universities, Manufacturing Firms and others —have participated in the program.

CONTACT HOME OFFICE FOR SPECIAL DESIGNS OR OTHER REQUIREMENTS

JULIE RESEARCH LABORATORIES, INC.
211 WEST 61st STREET, NEW YORK, NEW YORK 10023 • (212) 245-2727

JULIE NEW DEVELOPMENTS—1969

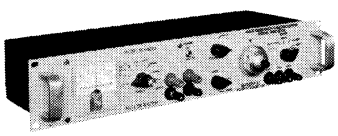
MODEL TDV-1000 AC/DC DIFFERENTIAL VOLTMETER



- ±.0025% DC Accuracy
- ±.05% AC Accuracy
- Infinite-Life Solid-State Chopper
- 80 Percent Fewer Calibration Adjustments
- 0-1100 Volts AC/DC on Four Ranges
- Battery or Line Operated
- 100 Microvolts F.S. Sensitivity
- Frequency Range of 10 Hz to 100 KHz
- Operates from 4°C to 40°C, from 0 to 10,000 Feet Altitude, at from 0 to 90% R.H.

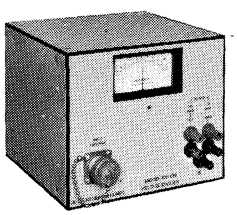
Included in its completely solid-state electrical design is an infinite-life solid-state chopper that never requires servicing. This instrument reflects real state-of-the-art accomplishments in modern instrumentation techniques. Size: 7″ L x 8½″ W x 14¾″ D.

MODEL NVS-503A and NVS-1103A MICROVOLT POTENTIOMETER and SOURCE



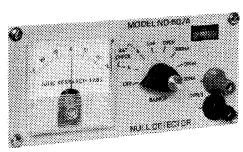
- Accuracy is ±.04% of Reading or ±.004% of Range or .1 uv Whichever is Greater
- Operates from 4°C to 40°C, from 0 to 10,000 Feet Altitude, at from 0 to 90% R.H.
- 5 Microvolts (0.2 nv Resolution) to 500 Millivolts in 6 Ranges for NVS-503A
- 10 Microvolts (0.2 nv Resolution) to 1.1 Volts in 6 Ranges for NVS-1103A
- Only 3½″ High Standard Rack Mount
- Completely Self-Powered
- Removable Null Detector

MODEL KV-10R and KV-5R HIGH VOLTAGE DIVIDERS



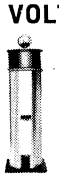
- 0-10KV D.C. Maximum Input (KV-10R); 0-5KV D.C. (KV-5R)
- .01% Accurate Ratios of 1,000:1 and 10,000:1 (KV-10R); 500:1 and 5,000:1 (KV-5R)
- 10 Megohms Input Resistance (KV-10R); 5 Megohms (KV-5R)
- Ratio Stability of .0015% per Year
- Size only 7″ L x 8½″ W x 8″ D
- Operates from 4°C to 40°C from 0 to 10,000 Feet Altitude at from 0 to 90% R.H.

MODEL ND-507A ELECTRONIC NULL DETECTOR



- 30-0-30 Nanoamperes (2na/scale division)
  300-0-300 Nanoamperes (20na/scale division)
  3-0-3 Microamperes (200 na/scale division)
- Maximum Drift of 10 Nanoamperes Per Hour After 60 Seconds Warm-Up
- Powered With Self-Contained Mercury Cell for 150 Hours of Operation
- Operates from 4°C to 40°C from 0 to 10,000 Feet Altitude at from 0 to 90% R.H.

MODEL HV SERIES ULTRA HIGH VOLTAGE DIVIDERS



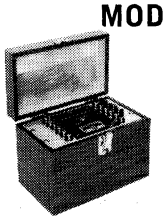
- HV-100, 100,000 V D.C. Maximum Input Voltage; 85,000 V D.C. (HV-85) (other inputs available upon request)
- Ratio Accuracy ±.05%
- Output Levels 10 V D.C. or 1 V D.C. (other outputs available upon request)

MODEL DR-100 (Series) PRECISION DECADE RESISTOR



- Standard Accuracy of .02%
- Accuracy of .0025% Available
- 6 Decades
- Resistances Up to 12 Megohms

MODEL NB-104S PORTABLE STANDARD REFERENCE RESISTOR



- Stability 1 PPM/year
- Accuracy ±5 PPM
- Resistance Value 10,000 ohms.

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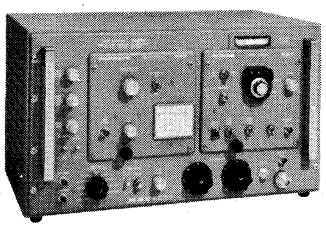
KAY Sweep and Marker Generators



1500C
20 Hz-4 GHz

1500C: The model 1500C is a high performance solid-state sweep and marker system which accepts a variety of sweep and marker plug-ins to cover the frequency spectrum from 20 Hz to 4 GHz. The basic rack unit contains a variable sawtooth sweep generator, a fast-acting AGC, birdie and pulse marker controls, and RF output circuits including precision attenuators and built-in detector.

860H: The model 860H includes all of the features of the model 1500C with the exception of the frequency marking facility. It is intended for use where the frequency marking is obtained from an external source or counter.

SWEEP PLUG-INS for the 1500C and 860H systems feature: A group of highly stable, low residual audio band modules; extremely flat wide band video, VHF and UHF plug-ins; and a new series of low cost, high output, solid-state microwave devices which extend the range of these systems to 4 GHz.

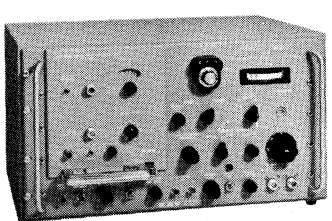
MARKER PLUG-INS for the 1500C include: Model PCM7631, 7632, 7633, and 932 which provide customer specified crystal pulse markers.

Model PCM861 which supplies either single frequency or harmonic birdie-pip markers.

Model PM7670 featuring a completely variable birdie-pip marker *plus* 1 and 5 MHz harmonic markers *plus* a counter output terminal for monitoring the variable mark and pin-pointing critical frequencies.

Frequency Range	Model	Sweep Width	RF Output	FEATURES
20 Hz—200 KHz	PC-141A	0*—20 KHz	1.0V RMS into 50 ohms	Ultra-stable, Narrow band plug-ins. Crystal-controlled beat-frequency oscillators provide 1.0 V rms output with excellent waveshape. Extremely low residual FM: <0.2 Hz. Drift: <3 Hz/min. Log or linear sweeps.
35 Hz—600 KHz	PC-142A	0*—40 KHz		
100 Hz—2 MHz	PC-130F	0*—2 MHz		Ultra-stable, narrow sweep plug-ins; wide sweeps to 2 MHz. Residual FM: <1 Hz. Drift: <30 Hz/min. Log or linear sweeps.
1 KHz—20 MHz	PC-152B	0*—20 MHz		Wide video sweep plug-in; sweeps from 20 MHz down to less than 1 KHz. Log or Lin sweeps. Spurious beats down more than 30 DB. Residual FM: <150 Hz.
50 KHz—115 MHz	PC-154A	0*—100 MHz		Solid-state wide sweep plug-in; very flat output: ±.25 DB; harmonic and spurious distortions >30 DB down. Residual FM: <100 Hz. Log and Linear sweeps.
1—175 MHz	PC-857A	0*—30%		Ultra stable, narrow band plug-in, very low residual FM.
2—220 MHz	PC-860F	0*—30%		Solid-state, fundamental frequency sweeps to 220 MHz; Twelve band direct reading dial; high output with excellent waveshape. Extremely low residual FM.
220—470 MHz	PC-867A	20 KHz—70 MHz	0.5V rms into 50Ω	Solid-state, VHF-UHF, fundamental frequency sweeps. Excellent waveshape.
Following Models Available for 1500-C, 860-H and 121-C Rack Systems				
100 MHz—1 GHz (Any octave)	PC-123A P-123A	0.2%—octave	0.5V rms into 50Ω	Solid-state octave sweeps to customer specifications. Excellent linearity over full octaves. Stable outputs.
.75—1.5 GHz	PC-120A P-120A	Nom. 0—Full octave	10 MW levelled 13 MW unlevelled	Completely solid-state octave-wide sweep plug-ins; high-level outputs. External or internal pin levelling. Quality not luxury prices; spurious distortion: >60 DB down, Harmonic distortion: >20 DB down.
1—2 GHz	PC-125A P-125A	Nom. 0—Full octave		
1.2—2.4 GHz	PC-126A P-126A	Nom. 0—Full octave	50 MW levelled 70 MW unlevelled	
1.5—3 GHz	PC-128A P-128A	Nom. 0—Full octave	15 MW levelled 18 MW unlevelled	
2—4 GHz	PC-127A P-127A	Nom. 0—Full octave	10 MW levelled 13 MW unlevelled	

* Residual



121C
500 KHz-4 GHz

121C: This solid-state instrument is an electronically swept wide sweep and marker generator which accepts a choice of UHF and microwave sweep plug-ins to provide extended frequency ranges and sweep widths. With its plug-ins, the 121C covers a range of 500 KHz—4 GHz, offers a new series of solid-state microwave sweeps featuring high output at low cost, and accepts a variety of narrow and wide-sweep plug-ins for special applications such as UHF TV.

The basic 121C system includes variable sweep rates, external modulation, CW and manual operation, built-in attenuator and detector plus a fine digital frequency control for smooth center frequency settings and remarkable adjustment during narrow operation.

Frequency Range	Model	Sweep Width	RF Output	FEATURES
500 KHz—1050 MHz	P-121A	5 KHz—350 MHz	0.5V rms	Electronic, wide-sweep, stable narrow sweeps.
900—1300 MHz	P-122	200 KHz—400 MHz	0.5V rms	Electronic, wide-sweep, stable narrow sweeps.
1.3—1.7 GHz	P-124A	500 KHz—400 MHz	0.5V rms	Electronic, solid-state, wide sweep.
.75—4 GHz	Microwave Plug-in Models P120 thru P128 see table above			

KAY ELECTRIC COMPANY
Maple Avenue
Pine Brook, N. J. 07058
(201) 227-2000
TWX: 710-734-4347

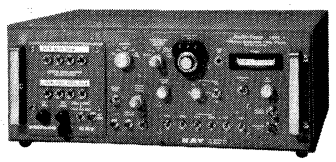
Midwest Office
U.S. Route 31 North
South Bend, Ind. 46613
(219) 272-2848

West Coast Office
P.O. Box 206
Goleta, Calif. 93017
(805) 967-9316

154C - 159C: These up-to-the-minute versions of Kay's 154 and 159 are completely solid-state, electronically swept, wide-sweep and marker generators which cover their ranges in a single wide sweep. The additional features of continuously variable sweep width and multiturn digital frequency dial provide exceptional fine touch settings over the video, IF and VHF range. The use of a broad output amplifier in these beat frequency units permits light coupling of the mixed oscillators, thus providing high RF levels with superior waveshape; distortion and spurious are minimal.

Performance characteristics include line lock, CW, manual, wide variable sweep rates, and external modulation input. Frequency range may be swept from HI to LO or from LO to HI as required. Automatic leveling may be controlled either externally or internally.

PCM7650B and PCM7660B marker plug-ins offer up to eight, optional, pulse or birdie markers at customer specified frequencies. New model PM7670 provides variable birdie marker plus harmonics of 1 and 5 MHz — plus counter output for critical measurements. Provision for a variable birdie marker derived



159C
1-300 MHz

from an external oscillator is included on these instruments. A built-in detector and precision step attenuator are standard features.

Freq. Range	Model No.	Sweep Width	RF Output	Flatness	Markers	Features
50 KHz-110 MHz	154C	5 KHz-100 MHz	1.0 V., 50Ω metered	±0.25 db	PM7660 up to 8 single markers to order. PM7650 up to 8 pulse birdie or 7 harmonic birdie markers to order. PM7670 variable birdie plus 1 and 5MHz harmonic birdie markers.	Solid-state, wide sweep: plug-in marker system. Sweeps full 110 MHz to low end 50 KHz. Pulse and harmonic markers. Sweep rates .01-1000 Hz.
1MHz-300 MHz	159C	20 KHz-300 MHz	0.5 V., 50Ω metered			Similar to 154C solid-state sweep and marker system. Very flat, very low harmonics and spurious.

KAY Sweep Synthesizers

101A: The model 101A is a sweep synthesizer which provides not only the solid-state 100 MHz wide sweep capability of Kay's proven 154C (see above) but also superb, low residual, narrow sweep features essential for steep-skirted, narrow band filter applications and for the design and production of pin-point frequency discriminating circuits. In addition it provides a new order of swept and cw stability, of narrow-band frequency marking, of calibrated (0.01%) cw output frequencies, and of digital/analog programmability through the use of newly developed IC synthesizer circuitry. The price at around $3000 for a unit that includes a "locked" range of 100 KHz to 100 MHz is a fraction of the cost of the usual synthesizers.

Front panel controls select stabilized (±5ppm/min; 20ppm/hr) cw operation, stabilized narrow-sweep operation variable up to 4% of center frequency, or free-running wide sweep operation variable up to 100 MHz of sweep between the limits of 50 KHz and 110 MHz. The stabilized frequency output is controlled by a direct-reading 3 place digital switch arrangement (calibrated to ±0.002%) and a digital-reading, vernier dial calibrated for overall accuracy of ±0.01%. Center frequency and sweep width are remotely programmable.

The standard 101A includes a wide range of variable sweep rates, manual sweep, external and cw modes of operation, front panel zero adjust, built-in attenuators, and detectors; plus a pin-point digital-frequency readout. It also includes provision for switched pulse and birdie markers using the models PM7650 and PM7660 as above. IC circuits are used in the new variable plug-in module model PM-10. This complex system consists of: (1) A direct reading variable pulse marker — only cycles wide and accurate to ±.05%. (2) A slave pulse marker that can be accurately and simultaneously set only cycles away. (3) A mixer-amplifier providing all marker coupling and 30 db of pre-amplifier gain.

PLUG-IN RF MODULES		K10237			K10324	K10325-6	K10327-8
MODULE		**FREE RUNNING**	**STABILIZED**	**STABILIZED**	**STABILIZED**	**STABILIZED**	**STABILIZED**
FREQUENCY RANGES VARIABLE:		.05-110MHz	1-10MHz	10-100MHz	0.1-1.0MHz	1.0-5.0MHz 5.0-10.0MHz	10-30MHz 30-70MHz
RESIDUAL FM LINE RELATED: RANDOM:		500Hz pk 100Hz pk	200Hz pk 100Hz pk	300Hz pk 100Hz pk	5Hz pk 5Hz pk	5Hz pk 5Hz pk	20Hz pk 20Hz pk
SWEEP WIDTH RANGES VARIABLE:		0-100MHz	In 2 Ranges; —— 0 to 1% of Center Frequency 0 to 4% of Center Frequency				
AM SPURIOUS HARMONIC: NON-HARMONIC:		below —— 30 db below —— 30 db			below —— 40 db below —— 50 db		
SWEEP LINEARITY 100 MHz SWEEP: (WIDE) 0-4% SWEEP: (MEDIUM) 0-1% SWEEP (NARROW)		±5% (of sweep width)	±.5% (of sweep width) ±100Hz				
STABILIZED OUTPUT FREQUENCIES	**FREQUENCY SETTABILITY** FIXED STEPS: VERNIER:		10KHz 20Hz	100KHz 200Hz	1KHz 2Hz	10KHz 20Hz	100KHz 200Hz
	FREQUENCY CALIBRATION FIXED STEPS: FIXED plus vernier:		±.002% Accuracy (% of indicated frequency) ±.01% Accuracy (% of indicated frequency)				
	FREQUENCY DRIFT ONE MINUTE ONE HOUR 10 VOLT LINE VAR. PER °CENTIGRADE		± 5ppm on 0-1% Sweep Range; ±20ppm on 0-4%. ±20ppm on 0-1% Sweep Range; ±80ppm on 0-4%. ±10ppm on 0-1% Sweep Range; ±20ppm on 0-4%. ±30ppm on 0-1% Sweep Range; ±120ppm on 0-4%.			(AFTER 10 MINUTE WARMUP)	

RF Output:
1.0V RMS into 50 ohms, metered

Flatness:
±.25 db over full range

Attenuator:
Switched 30, 30, 20, 10, 6, 3, 2, 1, 0.5 db plus 3 db Var. No shift in center frequency.

RF-Blanking:
Off 80 db below 25 MHz: Off 80 db less 6 db per octave above 25 MHz.

ALC:
Internal ALC plus connection for external ALC DETECTOR.

RF Detector:
50KHz - 110MHz

Sweep Modes:
.01 to 100Hz in 4 ranges, plus line lock.
Manual Control
CW Operation
External Modulation

Horizontal Output:
8 Volts, p-p, Triangular waveshape with Trace/Retrace ratio selectable 1:1 or 9:1.

Sweep Direction:
Switched Hi-Lo, Lo-Hi.

Programming:
BCD inputs for each of 3 switched decades plus analog for vernier.

Switching Time:
26Ms above 1MHz
260Ms below 1MHz

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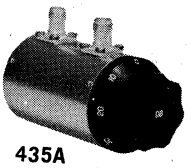
KAY

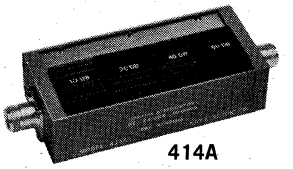
PRECISION ATTENUATORS



435A



431C



414A

MODEL		431-C	432-D	1/432-D	439-A	460-A	437-A	1/439A	433-A	434-A
ATTENUATION RANGE		0-41 DB In 1 DB steps	0-101 DB In 1 DB steps	0-22.1 DB In 0.1 DB steps	0-101 DB In 1 DB steps	0-132 DB In 1 DB steps	0-102.5 DB In 0.5 DB steps	0-22.1 DB In 0.1 DB steps	0-119 DB in 1 DB steps	0-99 DB In 1 DB steps
FREQUENCY		DC-1 GHz	DC-1 GHz	DC-1 GHz	DC-1 GHz	DC-1 GHz	DC-1 GHz	DC-1 GHz	DC-500 MHz	DC-1 GHz
CONTROLS		In-line toggle switches	In-line toggle switches	In-line toggle switches	Miniature In-line toggle switches	Miniature In-line toggle switches	Miniature In-line toggle switches	Miniature In-line toggle switches	Rotary-Digital	Rotary-Digital
TYPICAL OVERALL ACCURACY (±DB) OR % OF INDICATED DB	DC-250 MHz	0.5	0.6	0-.5 DB steps: ±.5 DB/step 1-10 DB steps: ±.2 DB/step	.6	0.5	0.5	0-.5 DB steps: ±.05 DB/step 1-10 DB steps: ±.3 DB/step	0.6	0.6
	250-500 MHz	0.9	1.2		.6	1.0	1.0		1.2	0.6
	500-1000 MHz	1.2	2.0		1.5	1.5	1.5			1.5
	1-2 GHz									
	2-4 GHz									
	4-6 GHz									
	6-12.4 GHz									
MAXIMUM VSWR	DC-250 MHz	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
	250-500 MHz	1.4:1	1.4:1	1.5:1	1.2:1	1.2:1	1.2:1	1.2:1	1.4:1	1.2:1
	500-1000 MHz	1.4:1	1.4:1	1.5:1	1.4:1	1.4:1	1.4:1	1.4:1		1.4:1
	1-2 GHz									
	2-4 GHz									
	4-6 GHz									
	6-12.4 GHz									
INSERTION LOSS TYPICAL (db)	DC-250 MHz	.1	.1	.1	.1	.1	.25	.1	1	.1
	250-500 MHz	.2	.3	.3	.2	.2	.35	.2	2	.25
	500-1000 MHz	.5	.6	.6	.5	.5	.7	.5		.5
	1-2 GHz									
	2-4 GHz									
	4-6 GHz									
	6-12.4 GHz									
POWER (watts)		1	1	1	1	1	1	1	½	1
DIMENSIONS (inches)		2 x 7 x 2	2 x 9¾ x 2		1¼ x 6¼ x ⅞				5 x 2¼	2¼ x 2 x 5¾

Kay in-line and rotary attenuators are designed to provide a means of inserting an accurate and fixed amount of loss in circuits operating in the DC-12.4 GHz range. Attenuation is controlled by field-proven high-frequency toggle switches. Solid silver contacts set in Teflon for low loss and superior match are employed throughout. The precision resistors used are 1% tolerance, carbon film resistors. The maximum total error is very low and incidental insertion loss is negligible. These units have met rigid environmental tests and are traceable to N.B.S.

The individually-switched steps are isolated in broad-tuned, shielded compartments, providing high accuracy and a flat frequency response over the specified range. All models are symmetrical, (bi-directional), attenuators. Most models are available in either 50, 75, or 90 ohms.

To afford maximum utility, Kay in-line attenuators are available for your special built-in applications. These attenuators are ideally suited for inclusion in a wide variety of equipment, such as test equipment, IF amplifiers, receivers, etc. In general, the electrical specifications are the same as for the in-line model. They differ, however, in mechanical configuration.

PROGRAMMABLE

A new series of programmable attenuators has been introduced to provide precise increments of fixed attenuation which may be switched from a remote position or be controlled by programmed opens and shorts on a 9 wire control system.

These models feature programmed values of attenuation in the DC-12.4 GHz region. Utilizing Kay's proven in-line models, these devices incorporate a new light-weight, low-cost control package that includes a low-level SCR network,

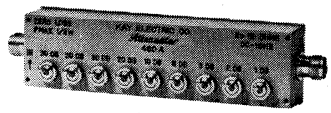
KAY ELECTRIC COMPANY

DC — 12.4GHz

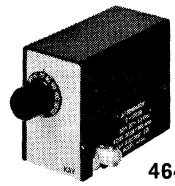
KAY



461A



460A



464A

464-A	467-A	435-A	436-A	1/435-A	400-A	461-A	424-A	414-A	495-A	411-A
0-120 DB In 10 DB steps	0-12 DB In 1 DB steps	0-10 DB In 1 DB steps	0-70 DB In 10 DB steps	0-1 DB In 0.1 DB steps	0-70 DB In 10 DB steps	0-132 DB In 1 DB steps	0-90 DB In 10 DB steps	0-130 DB In 1 DB steps	Single Step switched coax pads	Single Step switched coax pads
DC-1.3 GHz	DC-1.5 GHz	DC-2 GHz	DC-2 GHz	DC-1 GHz	DC-2 GHz	DC-4 GHz	DC-6 GHz	DC-12.4 GHz	DC-4 GHz	DC-12.4 GHz
Rotary-Step	Rotary-Step	Rotary-Step	Rotary-Step	Rotary-Step	Miniature Rotary-Step	Slide Switches	Slide Switches	Slide Switches	Slide Switches	Slide switches
1% ± .1	.2	0.1	1% ± .1	.025	± 1%	1% ± .1	1% ± .2		1% ± .1	
1% ± .2	.2	0.1	1% ± .1	.025	± 1%	1% ± .1	1% ± .2		1% ± .1	
2% ± .2	0.3	0.3	1% ± 0.2	.025	± 2%	1% ± 0.3	1% ± .2		1% ± .2	
	0.5 to 1.5 GHz				± 4%	2% ± .3	1.5% ± .2	1 BB or 5% whichever is greater	2% ± .2	1 DB or 5% whichever is greater
						2% ± .3	2% ± .2			
							2% ± .5			
1.2:1	1.2:1	1.1:1	1.1:1	1.1:1	1.1:1	1.05:1	1.05:1	1.1:1	1.05:1	1.1:1
1.2:1	1.2:1	1.2:1	1.2:1	1.2:1	1.1:1	1.05:1	1.05:1	1.1:1	1.05:1	1.1:1
1.4:1	1.25:1	1.3:1	1.3:1	1.4:1	1.15:1	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1
					1.25.1	1.25:1	1.2:1	1.2:1	1.2:1	1.2:1
						1.5:1	1.3:1	1.3:1	1.5:1	1.3:1
							1.5:1	1.5:1		1.5:1
								1.5:1		1.5:1
.1	.15	.1	.1	.1	.1	.1	.1	.1	.1	.1
.15	.25	.1	.1	.1	.1	.1	.1	.1	.1	.1
.3	.5	.2	.2	.2	.2	.2	.2	.2	.1	.1
					.5	.3	.2	.3	.1	.1
						.5	.3	.5	.2	.2
							.5	.6	.3	.3
								1.0		.5
1	1	1	1	½	¼	1	1	2	1	2
1¾ x 3 7/16 x 2 11/16		2 dia. x 2⅛	2 dia. x 2⅞	2 dia. x 2⅛	1¼ dia.x2 3/16	8⅜x2⅜x1⅝	2⅜x4¼x1⅝	2⅜x5⅛x1⅝	2⅜ x 1½ x 1⅝	

ATTENUATORS

facilitating use in large test systems where a low current drain is essential.

A rotary control arrangement is available for remote sequential control of attenuator levels.

4430B — DC - 1300 MHz
0-135 db in 1 db steps

4461A — DC - 4 GHz
0-132 db in 1 db steps

4424A — DC - 6 GHz
0-90 db in 10 db steps

COAXIAL ATTENUATORS

A new group of switched, coaxial attenuators is now available to span the DC - 12.4 GHz range. Developed from Kay's precision VHF - UHF attenuators, these devices eliminate the cumbersome technique of inserting and reinserting individual pads or the need to go thru a time-consuming rotary step-cycle.

Individual attenuation steps are controlled by finger operated, spring-loaded slide switches. These models consist of a complete coaxial system. Each segment is constructed with air dielectrics, and fine silver contacts insuring precision surfaces. Individual steps are isolated in broad-tuned, shielded compartments.

A variety of models is available to provide customer specified attenuation and frequency ranges covering the 0 - 132 db — DC-12.4 GHz range. Standard models are listed on the attenuator chart; many attenuators in this series are available in single coaxial pads, two or three step versions or special versions to suit customer specifications.

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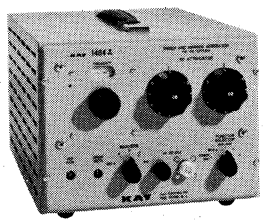
KAY RADIO AND TV GENERATORS



1484A

- **One Band, Application Oriented, Sweep and Marker Units.**
- **Easy to Use, Lower Cost Excellent for Production.**

1483B: The new 1483B is a solid-state sweep and marker generator used to design, test, and align UHF-TV receivers, it develops a full 0.5 volt rms output into load over the entire channel 14 to 83 frequency range. A front panel control permits switching of the sweep width from a wide 520 MHz (entire UHF-TV band) to continuously variable widths from 60 down to 5 MHz.

Channels 14 and 83 are provided at two separate switch positions, allowing easy selection of the extreme ends of the UHF band. Single or harmonic frequency birdie marker modules are available at customer specified frequencies. A variable marker input is provided. Provisions have been made for the use of two, optional, precise rotary attenuators. The attenuation ranges available include 0-10 DB in one DB steps, 0-33 DB in 3 DB steps, and 0-60 DB in 10 DB steps.

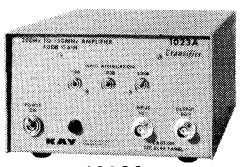
1484-A: A new UHF fundamental frequency, wide sweep generator is now available as a plug-in module for use in the 1484. The module provides a swept output in a single sweep with no spurious and no beats generated. Harmonic distortion is more than 30 db down and the 1.0 V rms output is flatter than ±.25 db overall. Sweep width is continuously variable from 0 to the 190 MHz range of the module.

The standard 1484 offers sweep and marker capabilities in a limited (e.g., 10.7 MHz, 88-108 MHz) range production type unit. Frequencies may be selected up to 1 GHz.

The 1484 may be specified with pulse, CW and harmonic birdie markers, RF turn-off or post injection markers. RF output is controlled by two optional attenuators and a 5 db variable RF level control.

The 1484 as well as the 1483 is half rack size and may be combined for production applications utilizing dual outputs.

Model No.	Frequency Range	Features
1483	UHF Channels	Compact, Low Cost
1484	Selectable to 1 GHz	Production Radio and TV Sweeps



1023A

- **High Output Video Amplifier**
- **300MHz Wide Flat Amplifier**

AMPLIFIERS

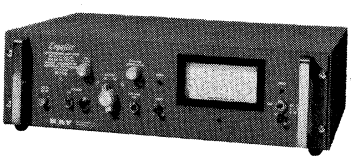
1022A, 1023A, 1024A: These solid-state video amplifiers include two wide-band models with excellent gain-bandwidth characteristics, (40 db - 150 MHz, 30 db - 300 MHz), and a high output 8 MHz unit delivering 15 volts rms into 50 ohms. Each of these amplifiers has unusually flat response over its full frequency range. Each is designed for accurate input and output impedances of 50 ohms, but can operate an accessory probe to provide amplification from high-impedance outputs without loading down the test signals.

For high impedance applications, the 965A broad-band probe is designed for operation with these 50 ohm input amplifiers.

LOG AMPLIFIERS

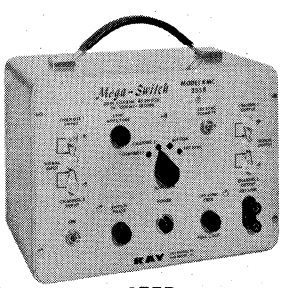
1025B: The 1025B gives overall response, and at the same time gives detailed, easily seen measurements of points on the curves as far down as 80 db. The unit permits highly accurate viewing of the skirts and sharp slopes of bandpass filters, single side-band filters, traps, etc. A control gives expansion of the top critical points simultaneously with the log display. 80 db log range, also available as undetected RF signal.

Model	Frequency	Features
1022	50KHz-8MHz	High 15V RMS Output Flat to Within .25DB
1023	1KHz-150MHz	40DB Gain; Compact Built-in Attenuator
1024	200Hz-300MHz	Wide Band Unit with 30DB Gain; Low Noise
1025	20KHz-220MHz	Log Amp with Dynamic Range of 80DB; Lin. Range



1025B

- **Log Amplifier for Swept Filter Applications.**



255B

COAXIAL SWITCH

Essentially, the 255B provides a high frequency DPDT coaxial switch whose rate of switching can be set by an internal generator or can be locked to an external sync signal. A phase shift control is included so that the starting point of the switching action can be varied.

In general, any application which can benefit by a "simultaneous" display, by the continual referencing of one significant characteristic vs. another; by the action, that is, of an automatic switch with superior switching, range, and control can profitably employ the 255B.

- FREQUENCY RANGE: DC to 1000 MHz
- VSWR: DC to 500 MHz — less than 1.15:1
  500 to 1000 MHz — less than 1.4:1
- CROSSTALK: Down more than 70 DB, (measured at 200 MHz)
- SWITCHING RATE: With external sync, 0.2 - 100 Hz;
  With internal sync, 5 - 100Hz

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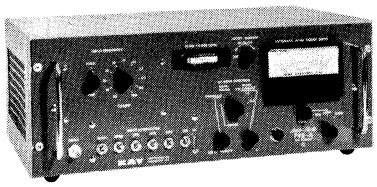
KAY SOLID-STATE NOISE FIGURE METERS



792A

- TUNED IF INPUT AMPLIFIER (NO SPURIOUS READINGS
- BROAD 10-1000 MHz SOURCE (NO CHANGING SOURCE IN MID-BAND)
- OPTIMIZED IN PRICE AND PERFORMANCE FOR 10-1000 MHz RANGE
- NOISE MEASUREMENTS TO 26.5 GHz
- 75Ω MEASUREMENTS FOR CATV COVERAGE

The 792A is a sensitive, solid-state, noise figure meter. Primarily focused on the frequency range below 1000 MHz, this instrument provides better accuracy and greater flexibility at considerably less cost than conventional noise generators. The 7921A hot wire noise source is a unique broad band generator and operates over the full 10-1000 MHz range.

Provision is made for later addition of noise sources covering the range to 26.5 GHz. In this way, an expanded applications requirement can be met without the full expense or added space demands of an additional unit.

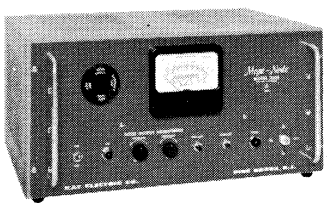
Additional noise sources provide variable impedance and balanced VHF outputs from temperature-limited diodes, waveguide output from argon gas tubes. Either 6 db or 15.2 db excess noise outputs can be selected for increased accuracy at low or high noise figures, respectively.

This wide coverage eliminates the inconvenience (and the inaccuracies) of changing noise generator source in mid-band, as is usually required.

INPUT FREQUENCY: 10-120 MHz Continuous Coverage
BANDWIDTH: Approx. 4% of Center Frequency
INPUT SENSITIVITY: 0 to 75 dbm (noise source on). Approx. 35 db gain required between lowest noise source & input.
INPUT IMPEDANCE: 50 ohms nominal
INPUT ATTENUATOR: Steps of 20, 10, 5, 3, 2, and 1 db.

Model No.	Frequency Range	Type	NF Range	VSWR	Excess Noise Output	Accuracy
7921A	10-1000 MHz	Hot Wire	0-20 db	1.2:1 to 900 MHz 1.35:1 to 1 GHz	6 db	±0.1 db 10-200 MHz ±0.2 db 200-400 MHz ±0.3 db 400-1000 MHz
NM-781	.4-4 GHz	Argon Waveguide	3-30 db	1.3:1	15.2 db	±0.5 db
RG-48/U RG-53/U	2.6-26.5 GHz	Argon Waveguide	3-30 db	1.1:1	15.45 db	±0.5 db

NOISE GENERATORS



780A

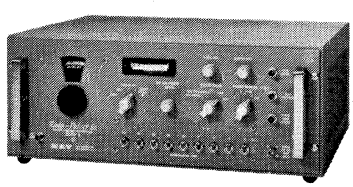
240, 403, 780: These models are calibrated random noise sources providing output over a wide frequency and power range. They employ noise diodes with tungsten filaments as temperature-limited noise generators. The plate voltage of the noise diode is regulated and the diode plate current, (proportional to noise power output), is variable by a front panel control. A calibrated meter provides direct reading in noise figure. The ability to vary the noise output in an accurately known way, greatly simplifies the measurement process since it permits precise matching of circuit noise rather than a more complicated referencing back to some fixed output.

Model	Frequency	Features
240	5-220MHz	0-23.8DB Noise Figure
403	3-500MHz	0-19DB Noise Figure
780	1-3GHz	0-20DB Noise Figure

PULSED RF SIGNAL GENERATOR

The 5070-B is a solid-state instrument whose pulsed output features sharp rise and decay and flat tops. The unit will serve as a CW generator, as well as a video pulse generator. It provides a stable CW signal from 10 MHz to 120 MHz, continuously variable, in five overlapping bands.

The features of flat, pulsed RF, continuously variable frequency, sharp 10 ns rise and decay time, and low leakage provide for reliable and accurate measurements. The RF output is held at the same peak levels during either CW or pulsed RF operation. The carrier pulses are flat (including overshoot) within ±5% and the rise and decay times are less than 70 db (to 85 db) below the carrier level at all frequencies.



5070B

CARRIER-OFF LEVEL: 85 db to 30 MHz, 80 db to 70 MHz, 70 db to 120 MHz.
PULSED CARRIER RISE AND DECAY TIMES: Less than 10 ns.
VIDEO PULSE RISE AND DECAY TIMES: Less than 20 ns.
PULSE REPETITION RATE: 50 pps to 5000 pps.
PULSE WIDTH: 100 ns to 100 μs.
ATTENUATOR: 101 db in 1 db steps plus approximately a 6 db continuous variation.

OTHER MODELS AVAILABLE
The Model 5071-A offers a wider frequency range of 10-250 MHz. The Model 5072-A expands the standard 5070-B to provide carrier-off levels of up to 95 db.

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KEITHLEY INSTRUMENTS

DC VOLTMETERS/NULL DETECTORS

MODEL	FEATURES	FULL-SCALE RANGES	ACCURACY	INPUT RESISTANCE	STABILITY	U.S.A. PRICES
	MICROVOLTMETERS					
148	Line/battery, most sensitive	10 nv-100 mv	2%	10^3-$10^6\Omega$	10 nv/24 hrs	$1395
147	Line/battery, optimized as null detector	30 nv-100 mv	2%	10^4-$10^7\Omega$	25 nv/24 hrs	$1395
149	Line, high sensitivity, medium price	100 nv-100 mv	2%	10^4-$10^7\Omega$	10 nv/hr	$ 925
150B	Line/battery, 60 cps rejection, current ranges	300 nv-1 v	2%	10^6-$10^8\Omega$	100 nv/24 hrs	$ 850
153	Line, high input resistance, current ranges	5 μv-1000 v	1-3%	$2x10^7$-$2x10^8\Omega$	2 μv/24 hrs	$ 575
NEW 155	Battery, low cost, portable	1 μv-1000 v	2%	10^6-$10^8\Omega$	0.5 μv/24 hrs	$ 325
	ELECTROMETERS					
640	Line or battery, 45 ranges, highest impedance, most stable, measures V, I, Q	30 μv-30 v	1%	$10^{16}\Omega$	20 μv/24 hrs	$1875
610C	Line, 81 ranges, measures V, I, R, Q	1 mv-100 v	1%	$10^{14}\Omega$	1 mv/24 hrs	$ 585
602	Battery, 75 ranges, measures V, I, R, Q	1 mv-10 v	1%	$10^{14}\Omega$	1 mv/24 hrs	$ 675
NEW 604	Line, widest bandwidth, differential input	1 mv-1 v	2%	$10^{14}\Omega$	4 mv/week	$ 895
600B	Battery, low cost, 67 ranges, measures V, I, R, Q	10 mv-10 v	2%	$10^{14}\Omega$	2 mv/24 hrs	$ 425
621	Line, low cost, 37 ranges, V, I, R	100 mv-100 v	2%	$10^{14}\Omega$	3 mv/hr	$ 425
	GUARDED DC DIFFERENTIAL VOLTMETERS					
630	Line, maximum accuracy for high impedance	300 mv-500 v	0.01%	∞ at null	0.01%/yr	$1695
662	Line, maximum accuracy, zener reference	100 mv-500 v	0.01%	∞ at null	0.01%/yr	$1075

DC AMMETERS/CURRENT AMPLIFIERS

MODEL	FEATURES	FULL-SCALE RANGES	ACCURACY	INPUT DROP	STABILITY	U.S.A. PRICES
	PICOAMMETERS					
NEW 410A	Economical, high sensitivity	$3x10^{-13}$-10^{-3}a	2%-4%	1 mv	0.5%/week	$ 495
412	Logarithmic, low drift	10^{-13}-10^{-7}a	0.2 dec	5 mv	0.05 dec/24 hrs	$ 565
413A	Logarithmic, high currents	10^{-12}-10^{-4}a	0.2 dec	5 mv	.17 dec/24 hrs	$ 595
NEW 414A	Solid state, high stability	10^{-10}-10^{-2}a	2%-4%	1 mv	0.5%/week	$ 325
NEW 414S	Solid state, zero suppression	10^{-10}-10^{-2}a	2%-4%	1 mv	0.5%/week	$ 425
416	Fastest speed	10^{-13}-$3x10^{-5}$a	2%-3%	1 mv	1%/8 hrs	$ 685
417	Fastest speed, zero suppression	10^{-13}-$3x10^{-5}$a	2%-3%	1 mv	1%/8 hrs	$ 875
418A	Remote ranging, programmable	10^{-12}-10^{-2}a	2%-3%	1 mv	1%/24 hrs	$1575
419	Automatic ranging, programmable	10^{-13}-10^{-2}a	2%-3.5%	1 mv	1%/24 hrs	$2450
NEW 440	Digital	10^{-10}-10^{-2}a	0.2-0.5%	1 mv	0.5%/week	$ 995
NEW 445	Digital, automatic ranging	10^{-9}-10^{-2}a	0.2-0.5%	1 mv	0.5%/week	$1500

CALIBRATION DEVICES

MODEL	TYPE	FULL-SCALE RANGES	ACCURACY	U.S.A. PRICES
260	Nanovolt source	10^{-9}-1 volt	0.25%-0.75%	$ 510
261	Picoampere source	10^{-14}-10^{-4} ampere	0.25%-1.6%	$ 565

REGULATED DC HIGH VOLTAGE SUPPLIES

MODEL	OUTPUT	MAXIMUM OUTPUT	ACCURACY	STABILITY	LINE REGULATION	LOAD REGULATION	RIPPLE & NOISE	U.S.A. PRICES
245	0-2100 volts	10 ma	1%	0.01% ± 2 mv/8 hrs	0.001% ± 2 mv	0.002% ± 2 mv	1 mv rms	$395
246	0-3100 volts	10 ma	1%	0.01% ± 2 mv/8 hrs	0.001% ± 2 mv	0.002% ± 2 mv	1 mv rms	$450
240A	0-1200 volts	10 ma	1%	0.02% ± 2 mv/8 hrs	0.005% ± 2 mv	0.005% ± 2 mv	1 mv rms	$345
241	0-1000 volts	20 ma	0.05%	0.005%/hr	0.005%	0.005%	1 mv rms	$885

RESISTANCE MEASURING DEVICES

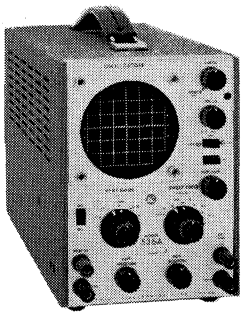
MODEL	FEATURES	FULL-SCALE RANGES	ACCURACY	U.S.A. PRICES
515	Megohm bridge, highest accuracy	$10^5\Omega$-$10^{15}\Omega$	0.05%-1%	$2195
500	Portable megohmmeter, logarithmic scales	$10^7\Omega$-$10^{13}\Omega$	20%	$ 185
501	Portable megohmmeter, logarithmic scales	$10^4\Omega$-$10^{10}\Omega$	20%	$ 185
502A	Portable milliohmmeter, linear scales	$10^{-3}\Omega$-$10^3\Omega$	3%-5%	$ 495
503	Line milliohmmeter, linear scales	$10^{-3}\Omega$-$10^3\Omega$	1%	$ 695

ELECTROMETER OPERATIONAL AMPLIFIERS

MODEL	FEATURES	CURRENT OFFSET	CURRENT TEMP. STABILITY	VOLTAGE TEMP. STABILITY	GAIN BAND-WIDTH	INPUT RESISTANCE	RMS VOLTAGE NOISE	U.S.A. PRICES
300	Highest input resistance, uses unregulated power supply	5 x 10^{-14}a	10^{-15}a/°C	500 μv/°C	150 kc	$10^{14}\Omega$	5 mv	$200
301	Differential input, solid state, uses unregulated power supply	10^{-14}a	doubles/5°C	150 μv/°C	500 kc	$10^{12}\Omega$	100 μv	$200
301K	Differential input, solid state, uses regulated power supply	10^{-14}a	doubles/5°C	150 μv/°C	500 kc	$10^{12}\Omega$	100 μv	$175
302	Low cost, small size, uses regulated power supply	10^{-14}a	doubles/5°C	150 μv/°C	150 kc	$10^{12}\Omega$	100 μv	$150
NEW 50200	Low power, light weight	10^{-14}a	doubles/5°C	150 μv/°C	100 kc	$10^{12}\Omega$	10 μv	$250

SEND FOR TECHNICAL LITERATURE: 28775 AURORA ROAD, CLEVELAND, OHIO 44139, TELEPHONE: (216) 248-0400

ELECTRONIC MEASURING INSTRUMENTS

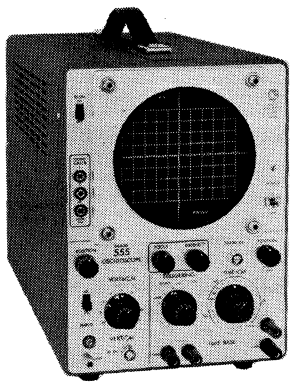


MODEL 536A (75mm) OSCILLOSCOPE

Vertical Axis
- Deflection Sensitivity: 20mVp-p/cm at 1KHz
- Frequency Response: DC 0～1.5MHz, within −3dB
  AC 2Hz ～1.5MHz, within −3dB
- Input Impedance: 1MΩ shunted by 22pF

Horizontal Axis
- Deflection Sensitivity: 300mV/cm at 1KHz
- Frequency Response: 2Hz～500KHz, within −3dB
- Input Impedance: Approx. 200KΩ shunted by 20pF

Sweep Generator
- Sweep Frequency: 10Hz～100KHz and TV. H (15.75kHz/2)
- Synchronization: Internal (+ & −), Line & External
- CRT: 3KP1F
- Dimensions: 140W×210H×355Dmm
- Net Weight: 7kg approx.

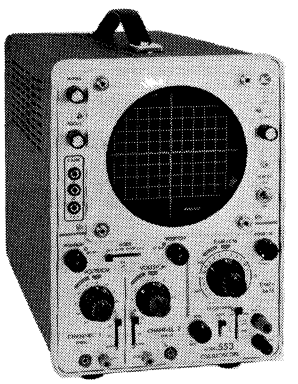


MODEL 555 (133mm) OSCILLOSCOPE

Vertical Axis
- Deflection Sensitivity: 20mV～10V/cm
- Frequency Response: DC 0～7MHz within −3dB
- Rise Time: Less than 0.05μs
- Input Impedance: 1MΩ parallel capacity less than 33pF

Horizontal (Time) Axis
- Sweep Range: 1μs～1sec/cm
- Sweep Calibration Accuracy: ±5%
- Magnifier: 5 times Accuracy: ±5%
- Trigger Range: 20Hz～7MHz

External Sweep
- Deflection Sensitivity: 1Vp-p/cm
  (possible up to about 200mVp-p/cm with 5 times magnifier)
- Frequency Response: 2Hz～200KHz
- CRT: 5UP1F or 5UP7F
- Dimensions: 205W×295H×450Dmm
- Net Weight: 11kg approx.



MODEL 553 (133mm) OSCILLOSCOPE (DUAL TRACE)

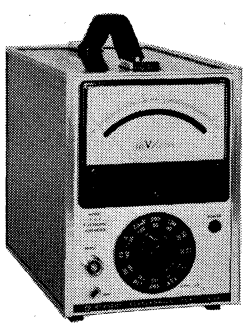
Vertical Axis
- Sensitivity: 10mV/cm～20V/cm accuracy ±3% 1-2-5 Sequence 11 position
- Frequency Response: DC～7MHz −3dB
- Input Impedance: 1MΩ parallel capacity 38pF
- Rise Time: 0.05μs

Time Base
- Time Range: 1μs/cm～1sec /cm
- Calibration Accuracy: ±5%
- Magnifier: 5 times accuracy ±5%

Trigger
- Trigger Source Internal, external, line

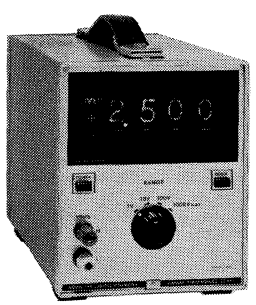
Horizontal Axis Sensitivity 1Vp-p/cm magnifier 0.2Vp-p/cm
- Input Impedance: 1MΩ parallel capacitor less than 40pF

Voltage Calibrator
- Output waveshape Square Wave
- Dimensions: 206W×295H×450Dmm
- Net Weight: 11kg approx.



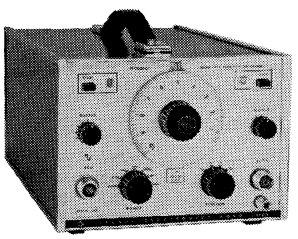
MODEL 165 AC HIGH SENSITIVE VOLTMETER

- RMS Scale: 0～1.5/5/15/50/150/500mV & 1.5/5/15/50/150/500V (12 ranges)
- dBm Scale: −60/−50/−40/−30/−20/−10/0 10/20/30/40/50dBm
- Input Impedance: 10MΩ on any range
- Accuracy: ±3% of full scale
- Stability: Less than 0.5% of full scale, for ±10% variations of line voltage
- Frequency Response: 5Hz～10MHz, ±10%
- Output: 100mV approx. at full scale indication.
- Distortion: 1%
- Frequency Response: 3Hz～15MHz, within +1, −3dB
- Dimensions: 140W×205H×295Dmm
- Net Weight: 3.5kg approx.



MODEL 155 DIGITAL VOLTMETER

- Methode of Conversion: Integrated Type
- Circuit: All Transistorized (Silicon Transistors, IC)
- Measuring Range: 4 range manually selected ±2.500V, ±25.00V, ±250.0V, ±1,000V, full scale
- Over Range: 150% (2500) or more
- Resolution: 1mV/digit
- Accuracy: ±(0.1% +1 digit) of reading, 15°C～35°C
- Polarity: Automatic change
- Input Resistance: 10MΩ on all range
- Input Terminal: Floating
- Indicator: Over-range
- Power Consumption: Approx. 16VA
- Dimensions: 130W×160H×265Dmm
- Net Weight: 4kg approx.



MODEL 455 FUNCTION GENERATOR

- Oscillation Frequency: 0.005Hz～100kHz (7 ranges)
- Accuracy: 2%±(dial scale ±0.05)
- Output: Sine, Triangular, Ramp and Square wave
- Max. output voltage: 30Vp-p or above
- Frequency characteristics
  - For 1kHz (Sine, triangular, Square wave) ±0.3dB or below
  - For 1kHz (Ramp wave) ±1dB or below
- Distortion (Sine wave): 20Hz～20kHz 1% or below 20kHz～100kHz 3% or below
- Output Impedance: 600Ω ±20%
- Square wave output voltage (at 50Ω terminal Output open): 1Vp-p or above
  Rise time (at 50Ω termination): 70 nsec or below
- Synchronous output: −10V peak or above
- Pulse width: 5μsec or below
- Start. Stop: possible
- Dimensions: 200W×155H×370Dmm
- Net Weight: 5.1kg approx.

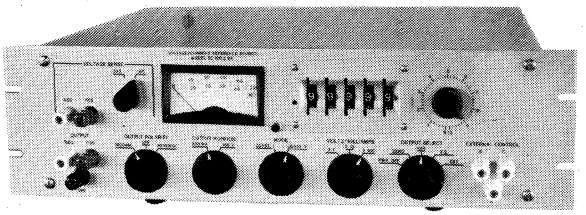
kikusui
KIKUSUI ELECTRONICS CORP.
3-1175, SHINMARUKO-HIGASHI, KAWASAKI-CITY, KANAGAWA-PREF., JAPAN.
Telephone: (044) 41-0111～7 Cable Address: "KIKUSUIDE" KAWASAKI.

✱MAIN PRODUCTS ● ELECTRONIC VOLTMETER ● DIGITAL VOLTMETER ● FUNCTION GENERATOR ● OSCILLOSCOPE ● CURVE TRACER ● PUNCTURE TESTER ● POWER SUPPLY

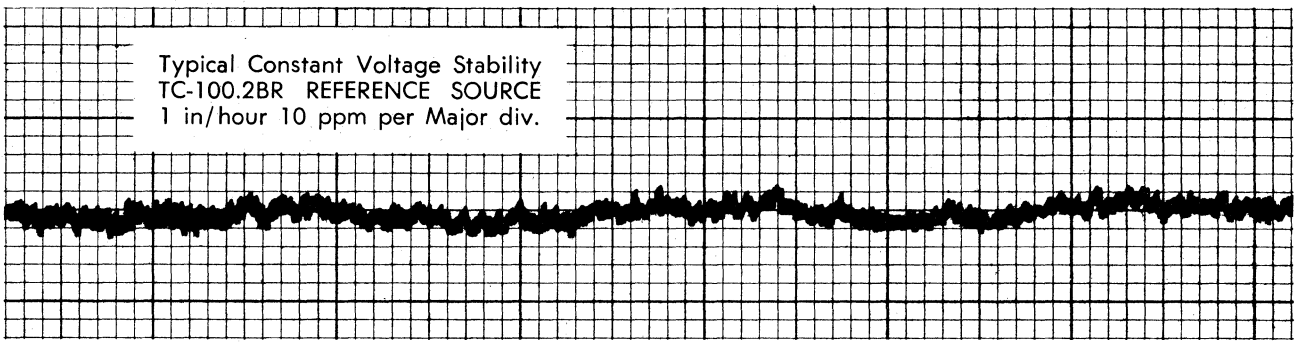
SOLE AGENT DATA INSTRUMENTS DIVISION
7300 CRESCENT BLVD. PENNSAUKEN, N.J. 08110
PHONE: (609) 662-3031 TWX: 710892-0786

PRECISION INSTRUMENTS
FOR RESEARCH, DEVELOPMENT, PRODUCTION TEST

VOLTAGE/CURRENT REFERENCE SOURCES

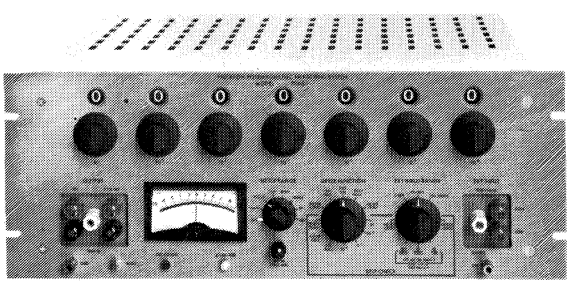


MODEL TC-100.2BR



MODEL NO.	OUTPUTS		ACCURACY		RESOLUTION		100 HOUR STABILITY	
	CONST. V.	CONST. I.	CONST. V.	CONST. I.	CONST. V.	CONST. I.	CONST. V.	CONST. I.
TC-100.2BR	0 to 100V 0 to 10V 0 to 1V @ 200mA max.	0 to 100mA 0 to 10mA 0 to 1mA @ 100V max.	0.005%	0.005%	100nV min.	100pA min.	.001%	.001%
TC-602CR	0 to 6V 0 to 60V @ 2A max.	0 to 60mA 0 to 600mA 0 to 2A @ 60V max.	0.01%	0.01%	1 μV min.	10nA min.	.001%	.002%

PRECISION POTENTIOMETRIC MEASURING SYSTEM PPMS-1



The Model PPMS-1 is a self-contained system with the basic components for making parts/million measurements of external resistance ratios or dc voltages up to 1000 volts.

The instrument consists of a 10-volt dc source with its saturated standard cell reference, along with other critical elements, housed in a proportional temperature controlled oven (maintained within 0.001°C), a self checking seven digit Kelvin-Varley divider, a null indicator having a basic sensitivity of 1 microvolt full scale and precision voltage dividers to scale down externally-applied voltages to within the primary range of 10 volts. A second standard cell, known as the comparison cell, is included for checking the working standard cell reference.

An output signal fully isolated from, but proportional to, the deflection of the null meter is provided for driving strip-chart and other recorders. Thus, the unit can also function as a self-contained monitor of the stability of other voltage supplies.

A unique method of self-checking the four most significant decades of the Kelvin-Varley divider WITHOUT additional equipment is built in. The built-in circuitry also provides for verifying oven temperature and monitoring standard cell voltage and for observing the resistance of the voltage divider.

*Instruments listed above are produced under license from PAR, Princeton Applied Research Corporation, and are available exclusively from North Hills Electronics.

For other North Hills products, see

Page 2056 — Precision AC and DC Power Sources
Page 1046 — Modules
Page 739 — Coils
Page 2869 — Wideband Transformers

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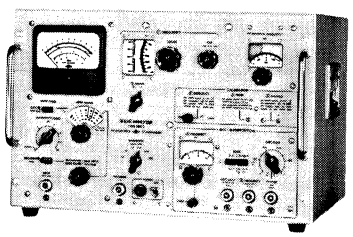
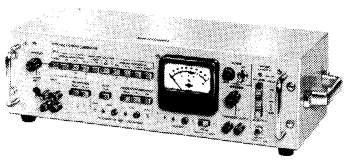
GLEN COVE, L.I., N.Y. 11542 • PHONE (516) 671-5700

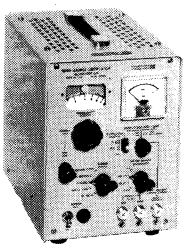
▪ COMPONENT ▪ AUDIO ▪ RF TEST EQUIPMENT *by* RADIOMETER



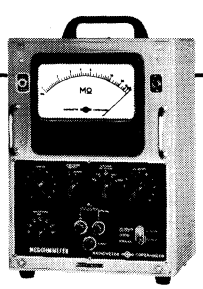
***FRA3 WAVE ANALYZER** — Frequency Coverage: 10Hz to 60kHz. Six Bandwidths: ±3, 6, 12, 25, 50 and 100 Hz. Sensitivity 30μV to 300V.f.s. Distortion, noise and hum: in the order of —100db. Recorder output. Internal BFO and Superposition Amplifier for Intermodulation Measurements.



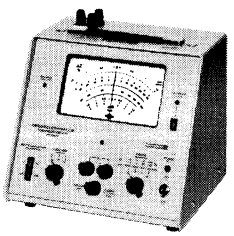
***SMG1 STEREO GENERATOR AND MODULATOR** — Both Composite and RF Outputs (100MHz). Exceptionally stable stereo signal in accordance with FCC standards. SCA modulation with FM subcarriers.



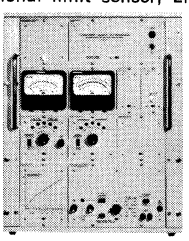
***RCO11 WIDE RANGE SINE-SQUARE WAVE GENERATOR** — 10Hz to 1MHz in 5 ranges. Metered Outputs: Sine wave; 50Ω and 600Ω (0.1mV to 1Vrms-monitored) also direct at approx. 10Ω (0 to 5V) Square wave: 50Ω and 600Ω (0.1mV to 1V peak to peak-monitored) 50ns rise time.



IM5 MEGOHM METER — High resistance measurements with low or high voltages as desired. 5 to 1000 volts for up to 10^7 MΩ. 50 to 1000 volts for up to 10^8 MΩ. Includes specific provisions for measuring capacitor dielectrics.



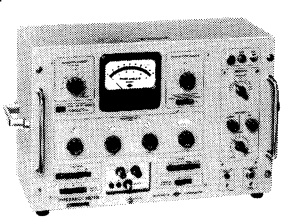
***TRB11 R-L-C COMPONENT COMPARATOR** — Rapid and accurate comparisons of magnitude and phase angle for components and networks. Manual or automatic operation without balancing. Resistance: 10Ω to 10 MΩ; Capacitance: 20 pF to 20 μF; Inductance: 1mH to 10 H. Magnitude Deviation: ±1.5% to 100% f.s. in four ranges. Phase Angle Deviation: ±.015 to 0.6 radians f.s. Output for automatic limit sensing. Test Frequency. 1kHz. Optional limit sensor, LMSI.



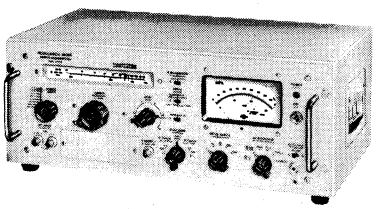
***CLT1 COMPONENT LINEARITY TEST EQUIPMENT** — Fast, nondestructive RELIABILITY TEST METHOD for detecting latent defects in resistors, capacitors and other components. May be used on laboratory basis or on-line for automatic check of up to 10 components per second. High sensitivity ■ Interference free. Impedance range: 0.01Ω to 100MΩ. 10kHz Test signal.



***CMB11 CAPACITANCE COMPARATOR** — For manual or automatic check of capacitance directly or against a standard. 7 ranges from ±1 to ±1000pF f.s. Test frequency: 1MHz. Optional limit sensor, LMSI.



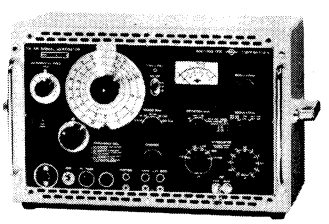
***GB11 VECTOR IMPEDANCE METER** — Accurate measurements of magnitude and phase angle of capacitive or inductive impedances from 1 ohm to 1.1 megohm. Frequency range 25 Hz to 1 MHz. Option for d-c polarization. Phase angle from 0 to ±90°



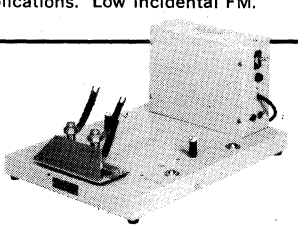
***AFM2 AM/FM MODULATION METER** — Frequency range: 5MHz to 1002MHz. AM: 3% to 100% f.s. FM: ±3kHz to ±300kHz, High Sensitivity: 3 mV to 10V input at 50Ω. Mod. Freq. Response: 10Hz to 200kHz. Automatic level control. L/R separation better than 46 db. Distortion less than 0.2%.



AFM1 AM/FM MODULATION METER — Freq. range: 3MHz to 1000MHz. AM: 3% to 100% f.s. FM: ±3kHz to ±300kHz. Accuracy: 3% f.s. AF and IF outputs for monitoring. Distortion: less than 0.5%.



MS27 FM/AM SIGNAL GENERATOR — Wide Range: 0.3 to 240MHz in 5 ranges. 0.5% accuracy with crystal calibration. Int. or ext. mod.: ±75kHz FM and 80% AM — Low distortion — ±50kHz incrimental frequency for narrow band applications. Low incidental FM.



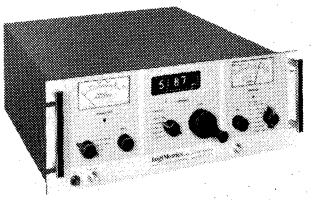
KPH1 COMPONENT TEST JIG — Electrically operated, rapid action clamp for testing large numbers of components with TRB11 and CMB11 Comparators, IM5 Megohm meter, etc. Automatically disconnects measuring circuit while changing components.

Specifications subject to change without notice. Detailed literature and demonstrations available on request. *Solid State Circuitry.

THE LONDON COMPANY 811 SHARON DRIVE • WESTLAKE, OHIO 44145
In Canada: Bach-Simpson Ltd., Box 2484, London, Ontario

LogiMetrics Digital RF Signal Generators

Model 910 —
100 kHz to 32 MHz, ddc to ±0.01% Accuracy & Resolution in an Economical, Production-Oriented Design Retaining Full 4-digit calibration. $1475.



Bands	Resolution
0.1–0.3 MHz	100 Hz
0.3–1.0 MHz	100 Hz
1.0–3.2 MHz	1 kHz
3.2–10 MHz	1 kHz
10–32 MHz	10 kHz

Accuracy: The total uncertainty, worst-case, in the frequency determination is less than 1.1 times the resolution figure quoted above.

Stability: The maximum drift observed (see note 1) will not exceed: ±1 least-significant digit per hour, after a 5-minute warmup; ±1 least-significant digit for a 10% change in line voltage; ±1 least-significant digit for a 10°C change in ambient temperature in the ambient range from 0° to 50°C.

Calibration: Direct reading, in correct units, with automatic decimal point positioning.

Output Level of CW signal adjustable from 100 μV to 1.0 V, by calibrated attenuator.

Power Level: –67 to +13 dBm, CW or peak modulated. (0 dBm = 1 milliwatt into 50 Ω).

Attenuator: 7 steps, 10 dB/step, plus continuously adjustable 18 dB calibrated vernier.

Monitor: 3½" meter, 0–0.3/0–1V, –15 to +3 dB.

Levelling: ±1 dB across range.

Accuracy: Monitor plus Attenuator uncertainty (worst-case), ±1.5 dB.

VSWR: Maximum of 1.15, terminated in 50Ω.

AMPLITUDE MODULATION
Internal: at 400 and 1000 Hz (nominal, ±5%), continuously variable 0–100%.

Envelope Linearity: < 1% distortion up to 30% AM. < 3% at 70% AM.

Monitor: 3½" meter, scaled: 0–100%.

FREQUENCY SHIFT CAPABILITY
Range of Control: 0.8% min. at high end of band; 0.02% min. at low end of any band.

SIGNAL ANOMALIES (see note 2).

PRINTOUT (Optional – see note 3).

POWER INPUT (see note 4).

PHYSICAL CHARACTERISTICS (see note 5; cabinet optional).

Model 920 —
50 kHz to 80 MHz, ddc to ±0.01% Accuracy & Resolution, 3 Volts/50 Ω Output. $1950.

Bands	Resolution
0.05–0.1 MHz	100 Hz
0.1–0.3 MHz	100 Hz
0.3–1.0 MHz	100 Hz
1.0–3.2 MHz	1 kHz
3.2–10 MHz	1 kHz
10–32 MHz	10 kHz
32–80 MHz	10 kHz

Accuracy: The total uncertainty, worst-case, in the frequency determination is less than 1.1 times the resolution figure quoted above.

Stability: The maximum drift observed (see note 1) will not exceed: ±1 least-significant digit per hour, after a 5-minute warmup; ±1 least-significant digit for a 10% change in line voltage; ±1 least-significant digit for a 10°C change in ambient temperature in the ambient range from 0° to 50°C.

Calibration: Direct reading, in correct units, with automatic decimal point positioning.

Output Level of CW Signal adjustable from 0.1 μV to 3.0V RMS, by precision attenuator, across 50 Ω.

Power Level: –127 to +23 dBm, CW or peak modulated. (0 dBm = 1 milliwatt into 50Ω).

Attenuator: 14 steps, 10 dB/step, plus continuously variable 18 dB calibrated vernier.

Monitor: 3½" meter, 0–1/0–3V, –15 to +3 dB.

Levelling: ±1 dB across range.

Accuracy: Monitor plus Attenuator uncertainty (worst-case), ±1.0 dB.

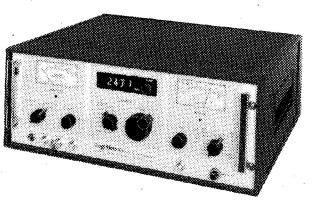
VSWR: Maximum of 1.1 terminated in 50Ω.

AMPLITUDE MODULATION
Internal: at 400 and 1000 Hz (nominal, ±5%), 0–100% at 1V RMS output and lower.

External: 20 Hz–20 kHz, when carrier permits; full 20 kHz range above 500 kHz. 0–100% at 1VRMS output and lower.

Envelope Linearity: < 1% distortion up to 30% AM; < 3% at 70% AM.

Monitor: 3½" meter, scaled 0–100%.



FREQUENCY SHIFT CAPABILITY
Range of Control: 0.8% min. at high end of any band; .02% min. at low end of any band.

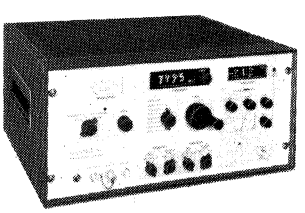
SIGNAL ANOMALIES (see note 2).

PRINTOUT (Optional – see note 3).

POWER INPUT (see note 4).

PHYSICAL CHARACTERISTICS (see note 5).

Model 930 —
50 kHz to 80 MHz ddc to ±0.01% Accuracy & Resolution. All 920 features, plus Stabilization & Programmable Frequency & Amplitude. $4200.



FREQUENCY BANDS, ACCURACY, STABILITY, & CALIBRATION.

OUTPUT LEVEL & ACCURACY.

MODULATION, DISTORTION, ETC.

} SAME AS FOR 920 ABOVE

ATTENUATOR: 1200 steps, 0.1 dB per step, plus continuously adjustable 18 dB calibrated vernier. Attenuator manually operable or programmable.

PROGRAMMABILITY
Frequency: by 8-4-2-1, BCD-coded, positive-true-logic, single-rail inputs, from any external source in which ZERO = 0.5 ±0.5V, and ONE = 3.5 to 20 Volts. Operates on any band, up to 1000 consecutive display values.

Amplitude: by BCD-coded inputs, as for frequency, over a 119.9 dB range, in 0.1 dB steps.

Model 940 —
2 MHz to 230 MHz ddc to ±0.01% Accuracy & Resolution. Stabilization and Programming Available as Standard Options. $2350.

Bands	Resolution
2–6 MHz	1 kHz
6–18 MHz	1 kHz
18–54 MHz	10 kHz
54–120 MHz	10 kHz
120–230 MHz	10 kHz

Accuracy: The total uncertainty, worst-case in the frequency determination is less than 1.1 times the resolution figure quoted above.

Stability: The maximum drift observed (see note 1) will not exceed: ±1 least-significant digit per hour, after a 5-minute warmup; ±1 least-significant digit for a 10% change in line voltage; ±1 least-significant digit for a 10°C change in ambient temperature in the ambient range from 0° to 50°C.

Calibration: Direct reading in correct units, with automatic decimal point positioning.

Output Level of CW signal adjustable from 0.1 μV to 1.0 V RMS, by precision attenuator, across 50 Ω.

Power Level: –127 to +13 dBm, CW or peak modulated (0 dBm = 1 milliwatt into 50 Ω).

Attenuator: 13 steps, 10 dB/step, plus continuously variable 18 dB calibrated vernier.

Monitor: 3½" meter, 0–0.3/0–1V, –15 to +3 dB.

Levelling: ±1 dB across range.

Accuracy: Monitor plus Attenuator uncertainty (worst-case), ±1 dB.

VSWR: Max. of 1.1 terminated in 50 Ω.

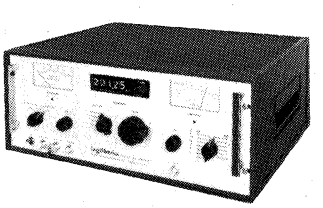
AMPLITUDE MODULATION
Internal: at 400 and 1000 Hz (nominal, ±5%), continuously variable 0–100%.

External: 20 Hz–20 kHz.

Envelope Linearity: < 1% distortion up to 30% AM. < 3% at 70% AM.

Monitor: 3½" meter, scaled 0–100%.

FREQUENCY SHIFT CAPABILITY
Range of Control: 0.8% min. at high end of any band; 0.02% min. at low end of any band.



SIGNAL ANOMALIES (see note 2).

PRINTOUT (see note 3).

POWER INPUT (see note 4).

PHYSICAL CHARACTERISTICS (see note 5).

NOTES:

1. Instabilities never affect accuracy, since they are immediately revealed by a change of frequency reading, and are therefore correctable by resetting. (This is *not*, of course, possible in conventional dial-calibrated generators.)
2. **Carrier Harmonics:** <3% of fundamental.

   Incidental FM: <100Hz + 10ppm @ 1kHz, 30% AM. Spurious AM: Hum and Noise at least 65 dB below carrier, down to thermal noise threshold of 50 Ω.

   RFI and Leakage permit receiver sensitivity measurements down to 0.1 μ V.
3. **Frequency Printout** is a standard option on the 910, 920, and 940.

   On 930: Frequency and Attenuation Printout (standard). BCD, 8-4-2-1, single-rail, positive-true logic. ZERO = 0.5 ±0.5V, up to 10 mA sink. ONE = 4.8 ±0.5V, from 1500 Ω.
4. **Line Voltage:** 105–125 or 210–250 VAC RMS.
   Line Frequency: 50–400 Hz.

   Power Requirement: 30 Watts nominal at >0.8 p.f. at 115V. (50W for Model 930.)
5. **Dimensions** (Rack panel): 7" High x 19" Wide x 18" Deep. (Cabinet): 7¾" High x 19¾" Wide x 18" Deep. (Cabinet optional on Model 910.)
   Weight: Net, 40 pounds maximum. Shipping, 65 pounds maximum.

LogiMetrics Digital RF Signal Generators

Featuring ddc — Direct Digital Calibration. The frequency you read is the frequency you get — to four significant digits! No drift, aging, or interpolation errors—ever!



These RF signal generators attain higher accuracy and resolution – **two orders of magnitude higher** – than the best conventional designs. In effect, each of these unique new generators provides the functional resources of **two instruments in one**: an ultra-stable, ultra-high resolution RF signal generator having high power output, low harmonic distortion, and excellent modulation linearity, and a high-speed digital frequency counter capable of direct high-frequency measurement over the required range. Ordinarily, such a combination would cost at least twice as much as a conventional (±1% calibrated) generator. However, the Series 900 designs are based on new and exclusive circuit concepts (patents applied for) that permit great simplification of the digital counter, thus reducing the price of the digitally calibrated instruments to little more than that of any high-quality RF source.

In LogiMetrics Series 900 Signal Generators, the dial is eliminated. It is replaced by "direct digital calibration" – **ddc**^{TM}– which displays the results of measuring the frequency by **directly counting** each cycle of the generated signal. This measurement is made (at all frequencies) with respect to a highly stable reference – a crystal "clock", of far greater accuracy and stability than is required for four-digit calibration.

DESIGN HIGHLIGHTS

PROGRAMMABILITY— Standard in Model 930. Digital control of both amplitude and frequency may be added in other models by use of accessories described below.

STABILIZATION– By feedback to frequency-shift (varactor-trimming) input; add accessory module Model 330, described below.

PRINTER OUTPUT– BCD-coded, compatible with most digital strip printers and other data-link/recording/processing equipments. Standard in Model 930, optional in others.

HIGH LEVELLING ACCURACY– Markedly better than conventional designs. Higher Attenuator/Monitor accuracy, too.

VERY LOW VSWR, DISTORTION, SPURIOUS.

COMPACT, COOL, LIGHTWEIGHT– All-solid-state, plus IC logic. . . completely modern design.

COMPLETE SYSTEM COMPATIBILITY– see below, and page 4, for details.

SYSTEM-COMPATIBLE ACCESSORY MODULES



Typical Accessory Module, Model 330 Digital Frequency Stabilizer/Programmer, measures 3½"h x 19"w x 18"d. Models 310 and 360 are same size.

MODEL 310 FREQUENCY-PROGRAMMING MODULE. Accepts BCD-coded digital words, and controls the frequency of any Series 900 instrument equipped for digital printout, so as to program its frequency in accordance with the coded instruction.

MODEL 330 FREQUENCY-STABILIZING MODULE. Compares BCD-coded printer output of generator to a frequency "word" selected by the six digital dials on its front panel. Differences are used to make proportional, bidirectional frequency adjustments, within the signal generator. Also functions as a manual or automated digital programmer similar to Model 310, but with an additional significant digit.

MODEL 360 AMPLITUDE PROGRAMMING MODULE. Accepts the output of any Series 900 instrument or comparable RF source, and attenuates it by an amount determined by a digitally coded word fed to it as an instruction. Attenuation is thus programmable over a 119.9 dB range, manually or automatically. Two modes: direct-reading in dB; direct-reading in dBm.

LogiMetrics division of Slant / Fin Corporation
100 Forest Drive • Greenvale, New York, 11548 • (516) 484-2600

Lorch-adret

PROGRAMMABLE SYNTHESIZERS DC VOLTAGE STANDARDS

PROGRAMMABLE DC VOLTAGE

Standard Model 102

with

HIGH ABSOLUTE ACCURACY

SIX DIGIT RESOLUTION

HIGH SPEED PROGRAMMING

SWITCHES OPERATE AT 5K OHMS
No Switch Cleaning Required

Output Voltage

10 volt range: 10 microvolts to 9.99999 volts in 10 microvolt steps
100 volt range: 100 microvolts to 99.9999 volts in 100 microvolt steps

Output Current
0 to 50 ma for any setting on 10 or 100 volt range

Absolute Accuracy
10 volt range: ±(0.003% of setting +100 microvolts)
100 volt range: ±(0.005% of setting +1 millivolt)
From 20° to 30°C and for a ±10% line voltage variation

Stability 7 days
10 volt range: ±(0.001% of setting +30 microvolts)
100 volt range: ±(0.0013% of setting +300 microvolts)

Noise
10 volt range: less than 25 microvolts rms
100 volt range: less than 250 microvolts rms

ACCESSORIES

Remote Digital Readout
Operates with main unit in local or remote program mode.

Remote Programmer
Voltages or Frequencies may be preset on eight rows of manual switches. Any preset program may be selected by a front panel push button or a single contact closure. Remote programmers may be cascaded.

Programmable Attenuator
0 to 99 db in 1 db steps; DC to 60 MHz; may be controlled by front panel decade switch, remote BCD program or remote programmer accessory.

Harmonic Generator
Generates a comb of frequencies to 100 MHz precisely derived from the synthesizer.

100:1 Precision Divider
Provides a 0.1 volt range on Model 102 DC standard.

IRIG Programmers for Telemetry and FM Tape Systems
These devices generate BCD signals which program Model 201 Synthesizer to frequencies covering all telemetry channels (both constant bandwidth and proportional bandwidth). Other programmers set FM tape system center frequencies and 20 frequencies across the band in accord with IRIG standards.

60MHz, 2MHz, 100KHz and 1KHz

PROGRAMMABLE SYNTHESIZERS

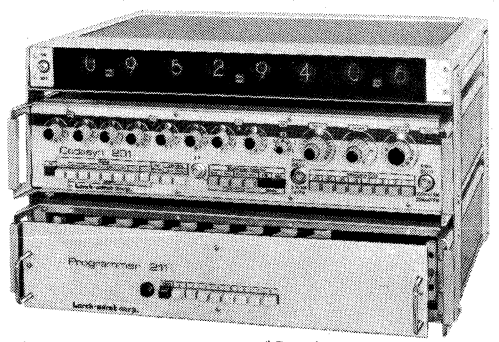
with

SIGNAL GENERATOR VERSATILITY

PROGRAMMABLE PHASE

SWEEP CAPABILITY

MANY USEFUL ACCESSORIES



Model 201 with Programmer and Readout.

SPECIFICATIONS

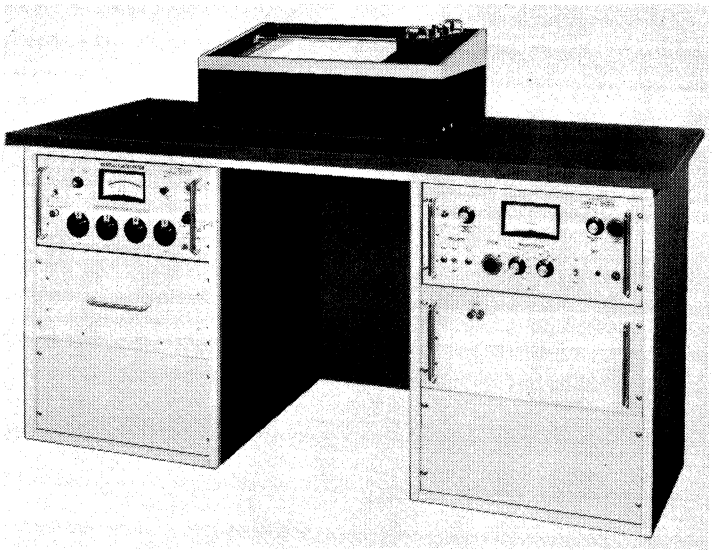
Model	301 100 KHz	201 2 MHz	202 60 MHz
Frequency Stability	3×10^{-5}/ week	1×10^{-7}/ day (2×10^{-9}/ day optional)	
Digital Decades	4	8	8
Resolution (with vernier)	0.1 Hz	0.001 Hz	0.001 Hz
Modulation AM	none	0 – 100%	0 – 100%
Deviation FM	100 KHz (external only)	2 MHz	10 MHz
Sweep Range	100 KHz	2 MHz	12 MHz
Output Level	+21 dbm	+13 dbm	+13 dbm
Attenuator	continuous	0 – 100 db	0 – 60 db
Spurious Output (nonharmonic)	– 60 db	– 70 db	– 80 db
Signal to Phase Noise	60 db	70 db	70 db
Rack Panel Height	3½″ (½ rack)	3½″	5¼″
Price	$2150.00	$3800.00	$6900.00

Model 303 features DIGITALLY PROGRAMMABLE PHASE in 1° steps (0.1° accuracy). Frequency range 0 to 1KHz.

Lorch-adret corp.
105 Cedar Lane, Englewood, N. J. 07631 • 201-569-8282 • TWX: 710-991-9718

MODEL V ALL-ELECTRONIC D.C. HYSTERESIGRAPH

by Lowell Electronics Corporation



The Model V Electronic DC Hysteresigraph replaces several laboratory pieces of equipment used in the point by point method of generating hysteresis curves. Traditionally the H axis is obtained by employing batteries, ammeter, rheostat, ballistic galvanometer and a reversing switch.

The operator is faced with the compound problem of monitoring power supply drift and balancing a ballistic galvanometer while reading flux and current.

The Model V DC Hysteresigraph does all this automatically by plotting a continuous B-H curve.

Operator time is decreased to approximately 20 seconds per curve and an infinite number of points plotted. No important data is overlooked or missed. Both major and minor loops may be programmed at will.

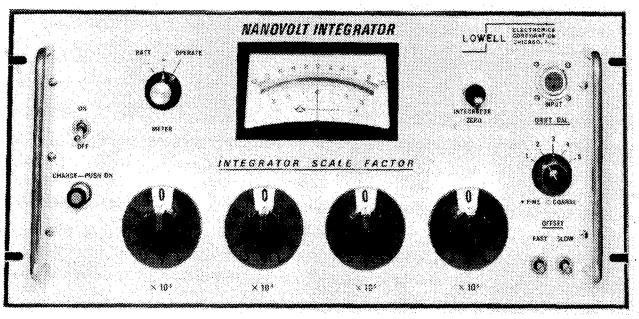
Driving samples to zero flux is insured by automatic recycle control so that initial permeability curves may be plotted.

The Hysteresigraph automatically does the following:

- Draws the positive half of the loop.
- Reverses the field when the preselected value of magnetization is reached.
- Draws the negative half of the loop and reverses direction of the field again when the desired value is reached.
- Initiates another reversal of field and completes the positive half of the loop.
- Lifts the pen from the recorder and turns off the current source.

Other programs are possible by manipulating front panel controls.

B AXIS CONTROLS



Integrating Fluxmeter—search coil employed in a Miller Integrator Circuit

Accuracy—0.05% or better

Stability—3% of display at ±100 Maxwell turns for one minute or better allows practical measurements as low as 10 Maxwell turns

Sensitivity—Scaled by operator. Displays of 10 Maxwell Turns per inch readily obtainable

The Nanovolt integrator is also sold as a separate unit

Input Impedance—essentially infinite

Output —5 to +5 volts at 5 ma

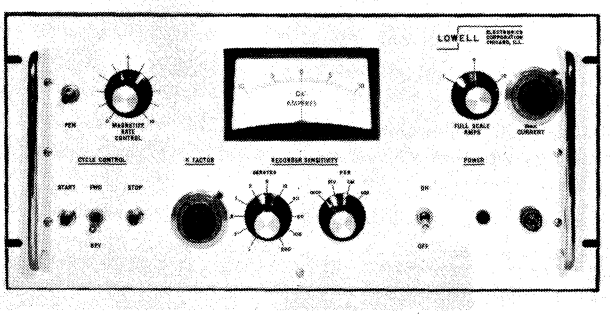
REMANENCE TEST SET

Operator positions piece part in solenoid, presses button, activating programmed power supply, and withdraws piecepart at end of program signal and reads remanence flux on digital display.

Magnetizing force up to 1000 Oersteds with flux sensitivities to 15 Maxwells.
Special as well as stock fixtures available.

Special magnetic system designed to your requirements.

H AXIS CONTROLS



Power Supply—Programmed −10 to +10 Amps, current regulated, 1 KW max, short circuit proof.

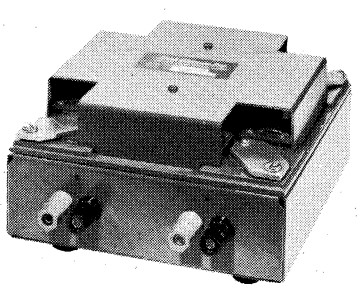
CONTROLS

Max current—Adjusts power supply output from 2 ma to 10 amps
Full scale amps—Meter scale selector
Magnetize rate control—Adjustable from 0 to 1 amp per second
Recorder Sensitivity—K factor control sets recorder to display 0 to 10^5 oersteds per division. Continuously variable with .1% calibrated multipliers
Forward-Reverse—Permits initial magnetization in positive or negative mode changes sweep direction without changing polarity

Size—Instrument is 30" high x 60" wide x 30" deep in a steel frame desk. A handy storage drawer is supplied. The top is walnut grain formica
Recorder x-y type 11" x 17" display

MAGNETICS TEST FIXTURES

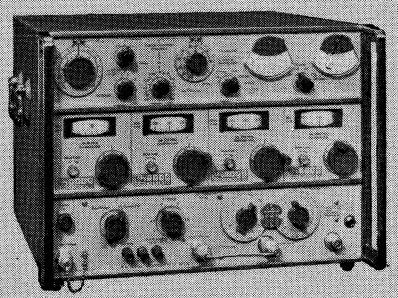
Typical one shown below—ask for information.



MODIFIED EPSTEIN FRAME

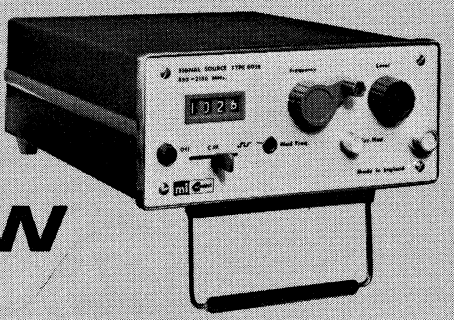
Sample size—2 cm wide x 13 cm long x .03 cm
K-Factor—5.024

LOWELL ELECTRONICS CORP.
9100 TERMINAL AVENUE
SKOKIE, ILLINOIS 60076
312/965-6500



MODEL 2006 SOLID STATE PRECISION SIG. GEN. — All solid state unit in which each frequency range is covered by separate fundamental RF oscillator unit. Generators will accept any 4 of 5 available units. Features very low microphony 12KHz deviation under ½ G acceleration. Low noise pure spectrum typically 12Hz telephone weighted, 40Hz flat over entire range.

NEW



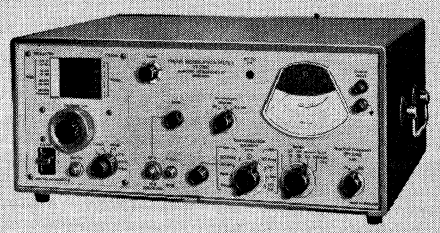
MODEL 6055 SOLID STATE SIG. SOURCE — All solid state microwave signal source operates on fundamentals 850MHz to 2150MHz with digital frequency readout. Unwanted harmonics are −25 db; spurious unrelated components −35 db. Resettability 0.1%; square wave AM. FM to special order.

SIGNAL GENERATORS — FM/AM/SWEEP/TRANSISTORIZED

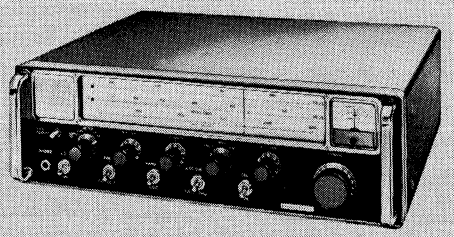
DESCRIPTION	FREQUENCY	FEATURES
AM SIG. GEN. (6625-900-1016) Model 144H/4	10KHz to 72 MHz	0.2μv to 2v ±0.5 db, 50Ω. Also max. direct output 2.75v, xtal check, 400KHz and 2MHz. Stability 0.002%/10 min. internal AM to 80% at 400Hz and 1KHz. Also external AM.
FM/AM SIG. GEN. Model 2002AS	10KHz to 72 MHz	0.1μv to 1v ±1 db, fully solid state, AM variable to 100%, FM deviation ±1KHz to ±50KHz max. dependent upon range. Incremental frequency controls with discrimination of 0.025% of carrier frequency and direct readout in KHz. Xtal calibrator 1MHz, 100KHz, 10KHz. Drift less than 30 ppm/15 minutes after warm-up. External frequency shift permits phase mod. or phase locking.
FM/AM SIG. GEN. (6625-913-7223) Model 995B	200 KHz to 220 MHz	0.1μv to 100mv. Calibrated, △F. Step attenuator, Crystal standardized; extremely stable. Deviation ±600KHz on top bands. Has simultaneous FM & AM. Special high sensitivity external FM mod. position with frequency/phase response suitable for stereo modulation. Also available for narrow band working FM spurious less than 25Hz. Model 995B/5.
MOBILE RADIO FM SIG. GEN. Model 1064B/6	30 MHz to 50 MHz 118 MHz to 185 MHz 450 MHz to 470 MHz	0.025μv to 10,000μv (100,000μv uncalibrated). Extremely stable; quick warm up. Direct reading FM to 15KHz deviation & Incremental Carrier Shifts to ±25KHz on all bands. Portable. IF plug-in xtals 290KHz to 16MHz.
FM SIG. GEN. (6625-929-4277) Model 1066B/1	10MHz to 470 MHz	0.1μv to 100mv. 50Ω, FM at 1KHz and 5KHz internal, deviation to ±100KHz, △F to ±100KHz, both meter monitored. Stability .0025% 10 min. Rack mounted available.
FM SIG. GEN. (6625-937-2801) Model 1066B/6	10MHz to 470 MHz	0.1μv to 100mv into 50Ω. FM modulation at 1KHz and 5KHz internal or 30Hz to 100KHz external. Deviations to 100KHz, 10MHz to 50 MHz, ±400KHz, 50MHz to 270MHz and ±300KHz. 270MHz to 470MHz. Modulation distortion 5% over telemetering band 215MHz to 265MHz, AM or FM less than 5% at max. deviation. Crystal calibrator gives check points at 1MHz and 10MHz.
AM SIG. GEN. (6625-812-9863) Model 801D/1	10MHz to 470 MHz	0.1μv to 1v, 50Ω. VSWR less than 1.2. Frequency accuracy 0.2%; xtal check. AM 0 to 90%, external pulse mod. 50Hz to 50KHz. Contactless range turret and ALC.
UHF FM SIG. GEN. Model 1060/3	470 MHz to 960 MHz	0.05μv to 223mv (minimum) into 50Ω. Stability ± x 10^{-5} per 10 minutes. FM at 1KHz internal, 30Hz to 100KHz external; deviations to ±300KHz monitored. AM or FM, less than 2% at max. deviation. AM preset 30% at 1KHz. Tests UHF systems both wide and narrow band.
SOLID STATE PRECISION FM SIGNAL GENERATOR Model 2006	4MHz to 1000MHz	Solid state precision FM unit accepts any 4 of 5 oscillators with bands 4 to 10MHz; 10 to 90MHz; 88 to 220MHz, 215 to 500MHz and 440 to 1000MHz. Stability 15ppm +1.5KHz per 15 minutes. Xtal calibrator, 10MHz, 1MHz, 100KHz. Output 0.1μv to 100mv into 50Ω. FM ±100KHz to ±300KHz max. dependent on frequency. Mod. frequencies 20Hz to 125KHz from internal tunable oscillator or external source.
SOLID STATE SIG. SOURCE Model 6055	850MHz to 2150MHz	Digital readout continuously tunable solid state microwave source. Scale accuracy 1%, residual FM 1ppm, harmonics 25 db down, output 30mW into 50Ω max. AM (square wave) 900Hz to 1.1KHz. FM model to special order.

mi MARCONI INSTRUMENTS
DIVISION OF ENGLISH ELECTRIC CORPORATION
111 CEDAR LANE □ ENGLEWOOD, NEW JERSEY 07631
TELEPHONE: (201) 567-0607

NEW



MODEL 2300 FM DEVIATION/AM MODULATION METER — Solid state instrument has xtal standardization, measures FM and AM, measures FM with up to 80% AM superimposed, sensitivity 20mv to 250MHz, 50mv to 500MHz, 100mv to 1000MHz. **Can be operated in both new telemetry bands using external oscillator.**



MODEL 990S EDDYSTONE RECEIVER — All solid state unit 230MHz to 870MHz with 6MHz and 1MHz AM bandwidth for AM video and 1MHz FM. 36.5MHz IF with 50mv IF output. Unit may be operated from 12v D.C. battery if desired. Panoramic adapter available.

FM DEVIATION METERS

DESCRIPTION	FREQUENCY	FEATURES
FM DEVIATION METER (6625-060-3320) Model 791D	4MHz to 1024MHz	Deviation ranges, ±5, ±25, ±75 and ±125KHz full scale. Accuracy 3%. Crystal standardized. Local oscillator can be xtal controlled for measuring deviations down to 10Hz.
FM DEVIATION/ AM MODULATION METER Model 2300	4MHz to 1000MHz	Wide range, mod. freq. up to 150KHz; deviation ranges ±5, ±15, ±50, ±150, ±500KHz. Local oscillator can be xtal locked, external oscillator can be used. De-emphasis 50μsec. 75μsec. switch selected. AM modulation two ranges 30% and 100% mod. freqs. 30Hz to 15KHz.

BRIDGES AND Q METERS

UNIVERSAL BRIDGE Model 1313A	1KHz and 10KHz 20Hz to 20KHz External	0.1μh to 110h, 0.1pf to 100μf, 0.003Ω to 110MΩ. Accuracy 0.1%. Built-in osc. and det. Direct reading; simplest possible operation. Uses adapter TM6113 for biasing inductors to 200ma.
PORTABLE UNIVERSAL BRIDGE Model 2700	1KHz internal 20Hz to 20KHz External	0.2μh to 110h, 0.5pf to 1100μf, 0.01Ω to 11MΩ. Accuracy 1%. Transistorized, simple. Measures incremental L, electrolytics & non-linear resistance using external bias supplies.
Q METER Model 1245A	1KHz to 300MHz	Q ranges 5 to 1000, △Q 25-0-25. Accuracy 5% to 100MHz, 20% to 300MHz. Calibrated capacitor 7.5 to 500pf, △C ranges ±1 and ±5pf. Extremely stable and easy to operate. Uses separate oscillators—see below. Dielectric and Series Loss Test Jigs available. Also HF & LF inductors.
POWER OSCILLATOR Model 1246	40KHz to 50MHz	For driving 1245A Q Meter, or 4v across 50Ω for general lab use.
POWER OSCILLATOR Model 1247	20MHz to 300MHz	For driving 1245A Q Meter, or 4v across 50Ω for general lab use.

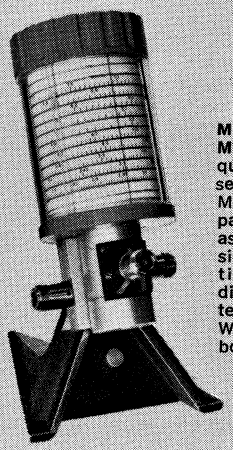
RECEIVERS FM/AM/CW/SSB

EDDYSTONE Model 850/4	10KHz to 600KHz	11 tube superheterodyne with top performance throughout VLF and LF bands. Three selectivities, 100Hz to 6KHz; 75 db image rejection. Has facility for eight xtal controlled spot frequencies.
EDDYSTONE Model 990R	27MHz to 240MHz	All solid state four range single conversion receiver for AM/FM. Two bandwidths of 30KHz and 125KHz. Local oscillator may be xtal locked to any of 8 internal customer selected crystals.
EDDYSTONE Model 990S	230MHz to 870MHz	Transistorized two range single conversion receiver for AM/FM. Bandwidth variable 6MHz an 1MHz. FM discriminator deviation to 250KHz.

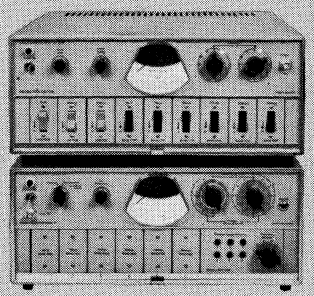
TELEVISION TEST EQUIPMENT

VIDEO SWEEP GEN. Model 1099	100KHz to 20MHz	3v max. level stabilized, 75Ω. Measurement accuracy 0.01 db. Includes 1MHz and 5MHz xtal markers. Tests color video tape recorders and video amplifiers. Accessory: 100 db step attenuator Model 1073A.
SINE² PULSE AND BAR GENERATOR Model 2905/5		Sine² pulse and bar generator for 525 line systems includes monochrome pulse and bar T/2, T and 2T. Also 10T and 20T with color burst, color sine² pulse and bar and sub-carrier added to staircase or sawtooth. External sub-carrier may be used.
LUMINANCE/CHROMINANCE GAIN & DELAY TEST SET Model TF2904/1		Measures gain and delay inequality with gain discrimination 0.5 db, delay discrimination 2 nanoseconds, visible display of misalignment with scope.
TV SIDEBAND ANALYZER Model TF2360	100KHz to 20MHz 30MHz to 90MHz 170MHz to 230MHz 470MHz to 960MHz	Provides a symmetrical or asymmetrical swept video signal for testing video amplifiers or transmitters using 625, 525 or 405 line systems, positive or negative modulation.
BLANKING AND SYNC MIXER Model TF2908		Reshapes blanking and sync pulses and mixes with video waveform (sine² pulse and bar, sweep, sawtooth, etc.). Permits sweep measurement with clamps or dc restoring circuits in normal operation. Output flat 0.2 db to 10MHz, 0.3 db to 20MHz.

NEW



MODEL 6049/1 FREQUENCY METER — Precision frequency meter has unique set of attaching accessories. May be used with standard passing coaxial attachment as absorption or transmission wavemeter or alternatively may be coupled directly into waveguide systems sizes WR-284, WR-229, WR-187 and WR-137 using bolt-on adapters.



MODEL 2090A NOISE LOADING TEST SET — This new unit measures Noise Power Ratio directly in db and pico-watts. A standardizing noise generator is built into the receiver to facilitate out of — band measurements. Band limiting and slot filters for all CCIR/CCITT and D.C.A. recommendations. Special frequencies to order.

INTERMODULATION AND BASEBAND TEST GEAR

DESCRIPTION	FREQUENCY	FEATURES
NOISE LOADING TEST SET TRANSISTORIZED (6625-670-0146) (AN/GSM 161) Model 2090A	12KHz to 12.388MHz (i.e. up to 2700 channels)	Solid state unit has built-in standardizing noise source in receiver for gain setting, out-of-band testing, etc. Includes noise generator, receiver and a choice of many different filters. NPR measurements can be made up to 75 db.
TWELVE CHANNEL NOISE GENERATOR (6625-948-4724) Model TM7816	300Hz to 3400Hz	Generates twelve non-related channels of Gaussian noise from twelve separate solid state sources. Output: each channel 1mW in 600Ω balanced, 300Hz to 3400Hz. Attenuation to −32 dbm in 2 db steps. Spurious noise in OFF channel (all other channels ON) is less than 10 dba (−75 dbm FIA weighted).
SSB SPECTRUM ANALYZER Model 1094A/3	100Hz to 30 MHz	60 db dynamic range, 2 db accuracy. 3 db selectivity at 6, 30 or 150Hz. Spectrum width variable 100 to 30,000Hz. If supplied without LF Adapter TM6448, range is 3 to 30MHz.
TWO-TONE SIGNAL SOURCE Model 2005	20Hz to 20KHz	Two continuously variable solid state oscillators 0.1% harmonic distortion, intermodulation −80 db, hum −80 db, monitored 111 db attenuator with balanced and unbalanced outputs. Recommended for SMPTE and CCIF two-tone testing.
SELECTIVE VOLTMETER Model 2330 (6625-168-0955)	20Hz to 50KHz	3 db bandwidth 6Hz; rejection ratio 65 db at 40Hz off tune. Sensitivity 30μv to 300 volts full scale. BFO output tracked in frequency and flat to 0.1 db. Includes RF detector for AM demodulation.
SOLID STATE DISTORTION FACTOR METER Model 2331	20Hz to 20KHz Fundamental 20Hz to 100KHz Max. Bandwidth	All transistorized unit measures distortion factor 0.05% to 100% in seven ranges from 0.1% to 100% f.s.d. Noise measurement to 100% in similar ranges. Switch bandwidth 100KHz or 20KHz with filters to give HF cut above 20KHz, LF cut below 400Hz and CCIF weighting characteristics. Voltage measurement 20Hz to 100KHz in ten ranges between 1mv and 30v f.s.d.

MICROWAVE TEST GEAR

FREQUENCY METER Model 6050/3	1GHz to 2GHz	Accuracy ±0.2% with 10MHz calibration increments. VSWR 1.5.1; sensitivity better than 4mv full scale; resonant dip 2.5 to 3.5 db.
FREQUENCY METER Model 6049/1	2.6GHz to 8.2GHz	Precision meter with ±0.1% accuracy; 5MHz increments to 5GHz, 10MHz increments to 8.2GHz. VSWR 1.5 for coax; 1.1 for waveguide attachments. Resonant dip 0.5 db coax.; 1 db waveguide.
FREQUENCY METER Model 6051	8.2GHz to 12.4GHz	Precision meter has accuracy ±2% and 10MHz frequency increments. Resonant dip generally greater than 1 db using re-entrant cavity. Scans complete X-band with four turns of control knob.
PRECISION ROTARY VANE ATTENUATOR Model 6052/3	8.2GHz to 12.4GHz	High accuracy unit with reduced overall length improved drive and clear readout. VSWR 1.15; insertion loss, 0.75 db max.; phase shift 2° max.; attenuation to —60 db. Accuracy 1% to —40db, 2% to —50 db, 3% to —60 db.
EDUCATION ANTENNA TEST BENCH MODEL 6452A	9 GHz	Unique test bench is ideal for advanced electronic students in studying microwave antenna properties. Plots polar diagrams. Includes dish, shunt slot linear arrays, fixed and radial horns, microwave experiments book. Write for further details.

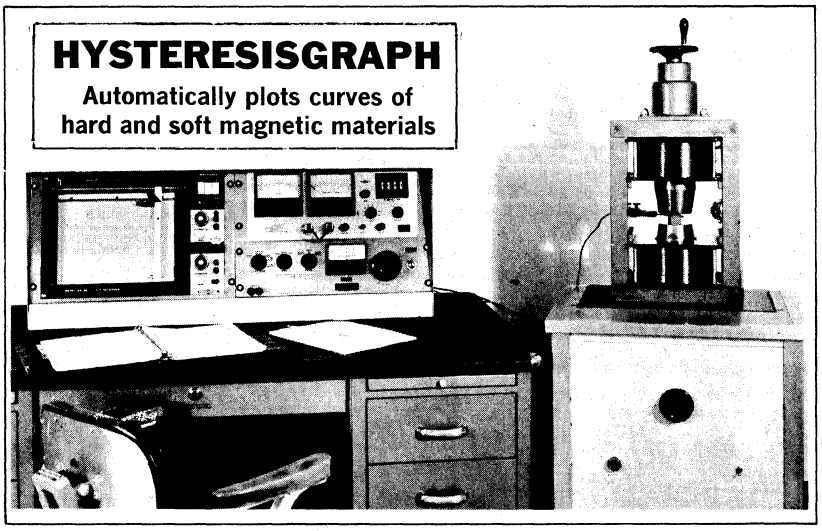
mi MARCONI INSTRUMENTS
DIVISION OF ENGLISH ELECTRIC CORPORATION

111 CEDAR LANE ☐ ENGLEWOOD, NEW JERSEY 07631
TELEPHONE: (201) 567-0607

MAGNETIC MEASUREMENTS — ELECTRONIC INTEGRATORS

HYSTERESISGRAPH

Automatically plots curves of hard and soft magnetic materials



The Magnemetric Permeameter with laboratory accuracy and flexibility is so easy to operate that anyone can use it! The Hysteresisgraph accommodates to the sample and to the operator's choice of recording scales; it doesn't dictate them! It is designed to test a broad range of magnetic materials and sample sizes simply, efficiently and accurately.

CONDENSED SPECIFICATIONS

B-SENSOR: Solid state electronic integrating fluxmeter
Range — 10^5 to 10^9 Maxwell turns 10 MT increments
Accuracy — 1% of full scale or better

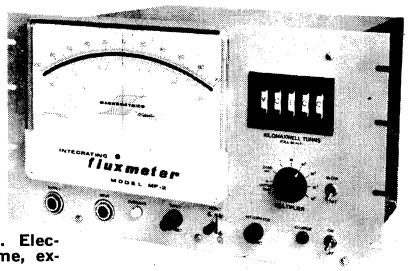
H-SENSOR: Solid state Hall effect Gaussmeter
Range — 10-30,000 Gauss in seven ranges
Accuracy — ¼% + Hall linearity and calibration error

RECORDER: 8½ x 11 paper size

CONTROL: Paper scale selector, scaling adjustment, built-in calibrator, metered drive control and hysteresis curve center finding adjustments.

INTEGRATING FLUXMETER MF-2

Fast, accurate, easy. Hysteresis loops of hard or soft materials plotted in minutes instead of hours as by ballistic galvanometer method. Easy evaluations of flux. Evaluates field uniformity as a true differential gaussmeter. Unit is all electronic.
Complete scales from 1 to 99.99 x 10^5 KMT. Output at full scale is ± 1 volt, 1% accuracy.



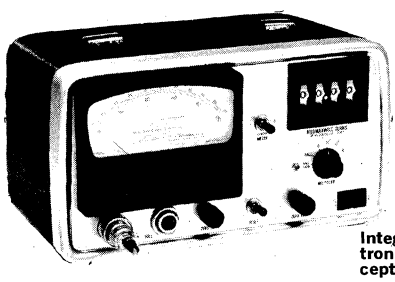
Integrating Fluxmeter MF-2. Electronic Integrator MI-2 — same, except for panel markings.

INTEGRATOR MI-2

For the physical or biophysical laboratory. Solves scaling problems by accommodating inputs from 10 microvolt seconds to 100 volt seconds. Full range .5 to 5000 microvolts of offset adjustment. Very high stability and 1% guaranteed accuracy.

INTEGRATING FLUXMETER MF-1

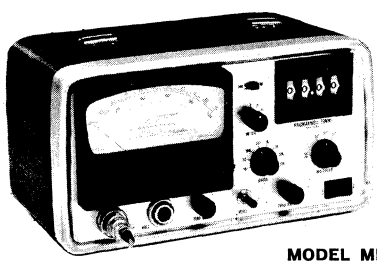
A high-speed instrument similar to the MF-2 but with less range, 10^2 to 99.99 x 10^4 KMT. All solid state, line and/or battery operated. Output ± 1 volt. Accuracy 1%.



Integrating Fluxmeter MF-1. Electronic Integrator MI-1, Same, except for panel markings.

INTEGRATOR MI-1

For applications requiring lower sensitivity and higher frequency limit than afforded by MI-2. Range from 10^3 to 10 volt seconds. Frequency limit 10^5 Hz. Made to the same high standard as the MI-2, 1% accuracy and high stability.



MODEL MF-1H

INTEGRATING FLUXMETER and HALL EFFECT GAUSSMETER

Combines an MF-1 Fluxmeter with a MG-1 Hall Gaussmeter. This is the essential cluster for most magnetic measurements including hysteresis curve tracing. Outputs are simultaneously available, panel meter is shared.

HALL GAUSSMETER MG-1

10-30,000 Gauss in 7 ranges
1/3 scale ratio
Accuracy ¼% + Hall probe error.
Full scale output ± 1 volt — also displayed on 5" mirror scale instrument.
Order suitable Hall Probe — HP-1 Transverse, HP-2 Axial.

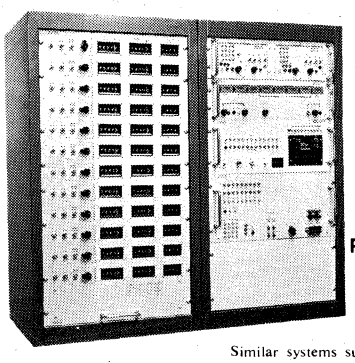
All Magnemetric Integrating and Hall Effect instruments operate from 115 V line or self-container batteries. All have low impedance 1 volt full-scale output allowing for ample loading.

MAGNEMETRICS specializes in instrumentation for magnetic measurement. For more detail on the Hysteresisgraph or on integrating of Hall effect fluxmeters, and related devices, write or call **MAGNEMETRICS.**

MAGNEMETRICS
A DIVISION OF
O.S. Walker Co., Inc.
WORCESTER, MASS. 01606

MASTECH, INC. Semiconductor Test Equipment

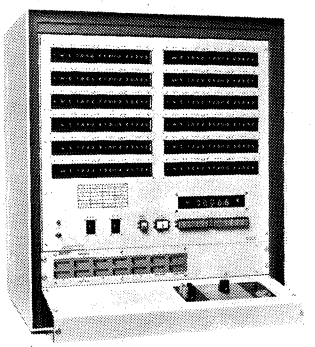
TRANSISTOR AND DIODE TEST SYSTEMS



MASTECH manufactures semiconductor test systems for use in incoming test, quality control and manufacturing lines.

Our high speed automatic go no-go type systems such as the Model 2600 are designed for use with mechanical loaders and segregators on transistor and diode production lines, including pellet check areas. Model 2600 employs a digital switch programmer, but other type programmers such as punched card readers and core memory devices can be used. All of the contact closures necessary for operation of the handling equipment are provided in the system, including the contacts for automatic bin selection. Type classification and priority selection is accomplished by insertion of pins into a diode pin matrix board.

Model 2600
Price $12,500 (12 Test)

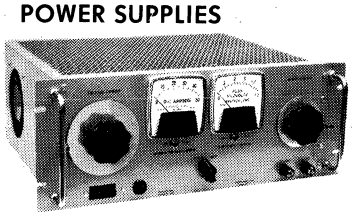


Model 2610
Price $9,500 (6 Test)

Similar systems such as the Model 2610 which feature a direct digital readout mode of operation have been designed for incoming test and quality control areas. These systems have the same programming means and high speed go no-go capabilities as the Model 2600 but in addition can be cycled on command to the go no-go balance point. At this point a direct digital display of the transistor or diode characteristic is presented.

All of these systems can be supplied with six, twelve or twenty-four test capability. Tests can be made in any desired combination or sequence and include hFE, breakdown or peak inverse voltage, sustaining voltage, leakage current, saturation or forward voltage drop and small signal beta. Other special sets designed to test PNPN devices, SCR's, and UJT transistors are available.

POWER SUPPLIES

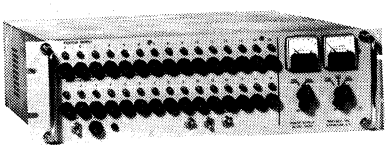


Model 1201C

Rectifier and diode aging and life testing requires power sources that deliver high forward currents and peak reverse voltages. The Model 1201 and Model 1401 Power Simulators provide this power efficiently and economically.

Model	Output Voltage & Current	Price
1201	0-750 Volts, peak, 0-100 Amps	$ 975.00
1201A	0-200 Volts, peak, 0-100 Amps	750.00
1201C	0-1500 Volts, peak, 0-100 Amps	1,400.00
1201D	0-1000 Volts, peak, 0-100 Amps	1,125.00
1401A	0-200 Volts, peak, 0-200 Amps	1,150.00

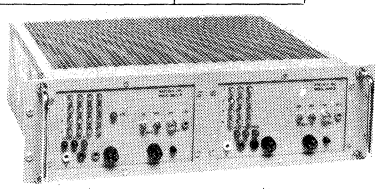
Model 2650



The Model 2650 series power supplies contain three identical precision regulated, power packs, two of which are connected to the output terminals. The third is used as a spare which can be switched in place of either of the other two. One power pack is connected to supply positive voltage to the loads and the other negative. There are fifteen separate outputs from both the positive and negative power packs, each of which is fused. The fuses are mounted on the front panel along with an indicator lamp which lights when the fuse is blown.

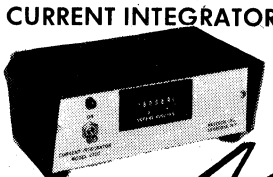
Model	DC Output Voltage & Current	Price
2650	24 Volts, 3 Amps	$1,050
2651	6 Volts, 9 Amps	1,190
2652	60 Volts, 3 Amps	1,800
2653	24 Volts, 9 Amps	1,650
2654	6 Volts, 3 Amps	1,000

Model 1602A&B
Price $900 each



Model 1602, Digital Programmed Power Supply, is used in our transistor test systems. It features fast response, remote programming in BCD code, gated output, built-in programming resistors, and excellent load and line regulation.

CURRENT INTEGRATORS



Model 2707
Price $285

Mastech Current Integrators are instruments which measure the product of time and current delivered by an energy source. They are useful wherever it is desirable to measure the quantity of electricity passed in an electrically energized circuit. The quantity can be measured in ampere-hours, ampere-minutes, or directly in coulombs, depending on the current and time involved. Models 2707 and 2708 measure ampere-minutes and ampere-hours respectively. Other models with different readouts are available on request. The instruments can also be furnished as voltage integrators.

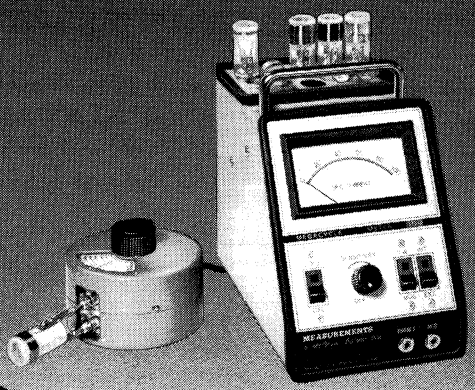
Technical bulletins along with additional price and delivery information are available on request.

MASTECH, INC.
PICKARD BUILDING • EAST MOLLOY ROAD
P.O. BOX 178 • SYRACUSE, NEW YORK 13211 PHONE 315 — 455-6662

Model 180 Standard Signal Generator



Model 159 Megacycle Meter



Laboratory Standards

Standard Signal Generators, Standard Frequency Meters, Megacycle (Grid-dip) Meters, Standard Frequency Synthesizers, Square Wave and Pulse Generators, Vacuum Tube Voltmeters, Standard Bolometer Bridges, Crystal Calibrators, Standard Deviation Meters, Amplitude Modulators, Intermodulation Meters, I-F Converters

SIGNAL GENERATORS

MODEL		FREQUENCY RANGE
65B	AM	75 kHz to 30 MHz
80	AM	2 MHz to 400 MHz
80-R	AM	5 MHz to 475 MHz
82	AM	20 Hz to 50 MHz
84 TVR	AM	400 MHz to 1000 MHz
95	FM	50 MHz to 400 MHz
180	AM	2 MHz to 400 MHz
180 R	AM	5 MHz to 475 MHz
188	FM	86 MHz to 108 MHz
210 B	FM	148 MHz to 174 MHz
210 S	FM	24 MHz to 52 MHz
560	FM	Mobile Bands
673	FM	Mobile Bands
800	FM	Mobile Bands

FREQUENCY METERS

MODEL	FREQUENCY RANGE
700	25 MHz to 50 MHz
760	Mobile Bands

SQUARE WAVE AND PULSE GENERATORS

MODEL	FREQUENCY RANGE
71	Square Wave 6 Hz to 100 kHz
72	Square Wave 5 Hz to 5 MHz
179	Pulse 60 Hz to 100 kHz

FREQUENCY SYNTHESIZER

MODEL	FREQUENCY RANGE
500-A	d.c. to 100 kHz

MEGACYCLE "GRID DIP" METERS

MODEL	FREQUENCY RANGE
159 Std.	Oscillator only (2.2 MHz to 420 MHz)
159 LF	Oscillator only (100 kHz to 4.5 MHz)
159 UHF	Oscillator only (420 MHz to 940 MHz)
159 P.S.	Power supply only
159 COMB.	Above oscillators, with one power supply

VACUUM TUBE VOLTMETERS

MODEL	FREQUENCY RANGE
67	Peak-to-peak (5 Hz to 100 kHz)
162	20 Hz to 300 MHz
162 R	Volt-Ohmeter (20 Hz to 300 MHz)

BOLOMETER BRIDGE

MODEL	FREQUENCY RANGE
202-C	2 MHz to 1000 MHz

CRYSTAL CALIBRATORS

MODEL	FREQUENCY RANGE
111	250 kHz to 1000 MHz
111 B	100 kHz to 1000 MHz

DEVIATION METER

MODEL	FREQUENCY RANGE
140 A	25 MHz to 1000 MHz (0-20 kHz Dev.)

FOR FURTHER INFORMATION ON THESE AND OTHER INSTRUMENTS SEND FOR CATALOG.

MEASUREMENTS
THOMAS A. EDISON INDUSTRIES • McGRAW-EDISON CO.

P.O. BOX 180, BOONTON, N. J. 07005
TELEPHONE (201) 334-2131

McGRAW-EDISON

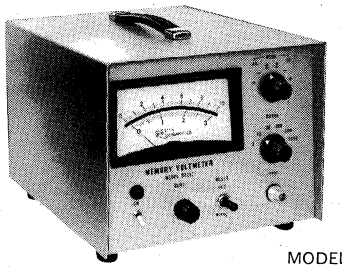
PRECISION VOLTAGE and CAPACITANCE TEST INSTRUMENTS

MICRO INSTRUMENT CO.

Write for your free copy of "Theory and Applications of Peak Voltage Measurements" or "Theory and Applications of Capacitance Measurements".

PEAK PULSE MEMORY VOLTMETERS AND SYSTEMS

Micro Instrument Co. offers a complete line of precision memory voltmeters and systems for industrial, commercial and aerospace measurement of peak pulse amplitude and one shot pulses. Features include: positive and negative readout of amplitude to 30 kV; digital or meter readout; strip-chart or printer operation; analog or digital outputs; continuous line monitoring with systems to 100 channels. For details on the complete line, contact your local representative or Micro Instrument Co. directly.



MODEL 5201C



MODEL 5203

DIGITAL READOUT MEMORY VOLTMETER — DUAL SHIELDING CABINET — MODEL 5203

The Model 5203 is a new 4-digit Memory Voltmeter, featuring digital readout of dc to 50 nanosecond single pulses with amplitudes to ±1000 volts in four ranges; it also has overrange capabilities, as well as an optional probe for measurements to 10 kV. It is a broad-band, dc to 50 MHz, all solid-state instrument that will measure any ac or dc coupled parameter that can be defined in terms of peak voltage; it holds the peak amplitude of one-shot or transient pulses, as well as repetitive pulses, until an input voltage of greater amplitude occurs, causing an increase in the reading, or until operator or automatic reset. Automatic reset permits using the digital Memory Voltmeter as a conventional RF digital voltmeter. Accuracy of wide band peak value will be displayed to 1% of full scale, with narrow band measurement ¼% of reading ±2 bits.
The Model 5203 is housed in a dual shielded cabinet to prevent radiated transient pick-up, ground loops or common mode errors; this also permits off-ground measurements to 1000v while maintaining the cabinet at ground potential for operator safety. The instrument's case is a 7 inch high half-rack cabinet for portable use or for rack mounting. Available features include: provision for remote programming of mode, range and reset; analog output; BCD output; sample-and-hold capability.

SPECIFICATIONS

Input: Single-ended. Ground isolated.
Voltage Range: 0.999, 9.99, 99.9 and 999V full scale. To 10 kV with optional H.V. probe.
Input Impedance: 1V range, 10K ohms; 10V range, 100K ohms; 100V range 1Mohms; 1000V range, 10Mohms. All ranges shunted by 100pF max.
Pulse Width Range: DC to 50 nanoseconds (wide band) DC to 400 microseconds (narrow)
Accuracy: 1% wide band; ¼%, ±2-bits narrow.
Readout: 4-digits in-line.
Price: $1,550.00

METER READOUT MEMORY VOLTMETER — DUAL SHIELDED CABINET — MODEL 5201C

The Model 5201C Memory Voltmeter is an all solid-state broad-band, dc to 20 MHz instrument, with amplitude memory. With ac and dc ranges from 0 to 1000 volts, the instrument will measure and store the maximum peak voltage applied. The voltage range may be extended to 30 kv; pulses as short as 50 nanoseconds duration will be recorded. Voltages of greater amplitude than the stored voltage will increase the reading, displaying the maximum voltage detected. In addition, a front panel switch permits automatic reset of the internal memory allowing operation as a standard peak-reading voltmeter that will follow the peak value of a varying waveform. The peak amplitude is displayed on a 5" taut-band, mirror-backed 1% panel meter. The instrument is housed in a dual shielded cabinet to prevent radiated transient pick-up. This construction also permits off ground measurement while maintaining the cabinet surface at ground potential for operator safety. The common side of the input is isolated from ground thus preventing ground loops in systems checkout work, or incorrect connection for power line monitoring applications. Portable cabinet standard, single or dual rack mount units available. Optional gate circuit available for sample and hold operation. Variable response control to reduce band width in 5 steps for added versatility.

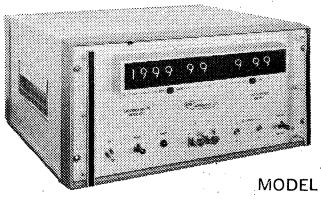
SPECIFICATIONS

Voltage Range: 0-3, 10, 30, 100, 300, 1000 v. Can be operated up to 1000 v above ground.
Input Impedance: 100k to 10 megohms (depending on range).
Pulse Width Range: DC to 50 nanoseconds.
Accuracy: ±3% of full scale.
Operating Modes: +, —, ± (dc or ac coupled).
Price: Model 5201C .....$ 750.00

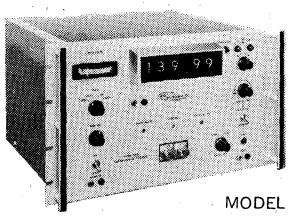
Single Rack Mount: Model 5201C-1 ..$ 800.00
Dual Rack Mount: Model 5201C-2 ...$1550.00
Gate Ckt. Option: .....$ 100.00
Hi Voltage Probes: (3, 10, 30kv) each$ 60.00

CAPACITANCE TEST INSTRUMENTS AND SYSTEMS

A complete line of capacitance test instruments are available from Micro Instrument Co. Included in the line are: 120 Hz, 1000 Hz and 120/1000 Hz; C and DF limit bridges and digital readout capacitance testers featuring true series capacitance measurements; high speed digital comparators; interface units for card punch and related BCD functions; digital capacitance ratiometer; capacitance-winder, auto-controller and systems for intermittency testing or for complete data logging. Contact your local representative or the factory for complete details.



MODEL 1212



MODEL 1206

1 MHz C & DF DIGITAL CAPACITANCE TESTER — MODEL 1212

The Model 1212 is the first instrument that simultaneously displays dissipation factor in digital form on a 1 MHz instrument along with the capacitance measurement. This all solid-state capacitance tester uses a true automatic bridge circuit for high accuracy measurements in ½ second. BCD output information is supplied for interfacing with printers, card punches, computers, etc. The conveniently located two and three-terminal (guarded) connections permit front panel component testing, while eliminating stray capacitance errors. A variety of test jigs and adapters are available to extend the rapid testing versatility of the unit.

SPECIFICATIONS

Capacitance Range: 0 to 1999.99 pF full scale.
Capacitance Accuracy: ±½% of reading ±3 digits.
Capacitance Readout: 6 in-line readout tubes.
D.F. Range: 0 to 9.99%
D. F. Accuracy: ±1% of reading ±3 digits.
Readout: 3-digit in-line readout tubes.
Single Level: 500 mV rms.
Test Time: 500 msec.
Display Time: Variable from 50 to 500 msec.
Stray Capacitance: 100 pF null control.
Trigger Operation: Input trigger pulse permits single readings to be displayed indefinitely; a repeat trigger pulse resets instrument to zero and displays next readings.
Outputs: 1-2-4-8 BCD (0 = 0V, 1 = +3.5v min. into 50K ohms)
Terminals: Guarded input test fixture provided with instrument for axial lead components.
Price: (rack mount).....$4,775.00

1 MHz HIGH SPEED DIGITAL CAPACITANCE TESTER — MODEL 1206

The Model 1206 is a new direct reading 1 MHz capacitance tester featuring high reliability integrated circuitry for fast test time of 50 milliseconds. The instrument also features a 50% over-range which minimizes switching at often used test values, permitting faster testing. The instrument provides direct digital readout of measurements from 0.001 pF to 1500 pF. The tester may be equipped with a wide range of comparators for high speed sorting. The instrument also provides low impedance, short circuit-proof output signals which will directly drive digital printers and can be interfaced to card punches, electric typewriters, etc. Automatic zero control circuit produces extreme stability and drift free operation.

SPECIFICATIONS

Ranges: 0.001 pF to 1500 pF.
Over-Range: Fifth digit 50% over-range.
Accuracy: ±¼% of reading ±1 digit.
Readout: 5-digit, in-line, readout, with blanking.
Signal Level: 0-100 pF range: 35mV rms max.
Test Time: 100 msec nominal.
Display Time: 25 msec adjustable from ¼ to 1 sec.
Maximum Frequency Variation: 1% (at full scale).
Low Q Tolerance: No accuracy loss for 10K ohms shunt resistance or greater.
DC Bias Supply: 0-100 vdc in two ranges.
Stray Capacitance: Front panel controls permit neutralization of up to 100 pF.
Off-Scale Indicator: Front panel light.
Off-Zero Indicator: Front panel light.
Outputs: 1-2-4-8 BCD (0 = 0v, 1 = +5v min). Source impedance 600 ohms maximum.
Terminals: Guarded input test fixture supplied.
Price: $3,000.00

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MICRO INSTRUMENT CO.

Write for your free life-test brochure and application notes. Detailed test methods information available. Contact factory.

LIFE TEST SYSTEMS, LIFE TEST POWER SUPPLIES and LIFE TEST CARDS

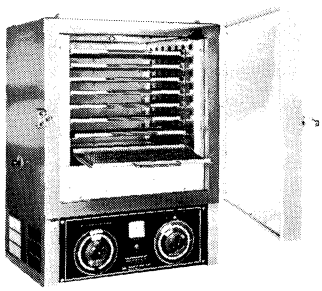
LIFE TEST SYSTEMS

LIFE TEST SYSTEMS

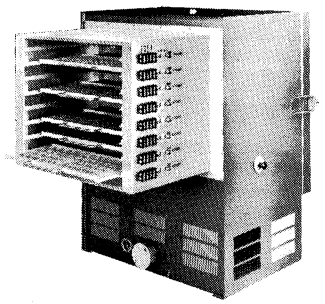
Micro Instrument Company offers, to the industry, the most versatile and reliable component power aging systems available. These systems have proven themselves through hundreds of thousands of hours of operation in customer facilities. Systems are available for testing resistors, capacitors, diodes, transistors, power transistors, rectifiers, and integrated circuits (both flat pack and TO-5 types). The power aging techniques employed include Reverse Bias Soak, Forward Bias Power Dissipation, Dynamic (AC Power Simulation) Operation for Diodes, DC and Dynamic Tests for Integrated Circuits, Resistor Power Dissipation, and Capacitor Voltage Soak. Systems are available for either ambient or elevated temperature testing.

STANDARD MODELS —

The Models 1024 and 1025 are modular systems, ideally suited for testing small components such as resistors, capacitors, signal diodes, and transistors. In these systems, the components to be tested mount on printed



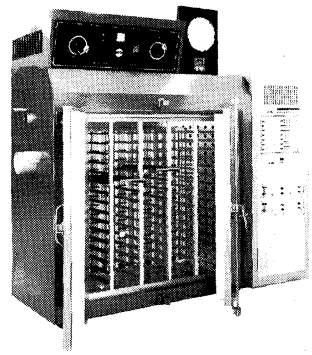
circuit cards with proprietary spring clips, or with printed circuit type transistor sockets. The systems have a capacity of eight cards, each mounting up to 200 axial lead or 100 3-lead components. Tests may be performed under reverse or forward bias conditions. The Model 1024 system connects each test device in series with a load resistor, which is installed on a connector assembly (resistor module) mounted on the outer wall of the test chamber. This system is used primarily for reverse



bias testing where parameter measurement at elevated temperature is not required. The Model 1025 system is similar to the Model 1024, but uses plug-in load cards for mounting the load resistors. The load card may be removed and a scanner head inserted for parameter measurement while the components are at elevated temperatures. The Models 1024 and 1025 provide exceptional versatility. Load resistor modules are readily changed, allowing easy conversion; for example, from a forward soak to a reverse bias test for diodes. Transistors may be operated with emitter and/or collector load resistors under power conditions or in a reverse bias circuit. Component mounting cards of many different circuit configurations are available for these systems. Variations of the basic systems are available with internal bias supplies.

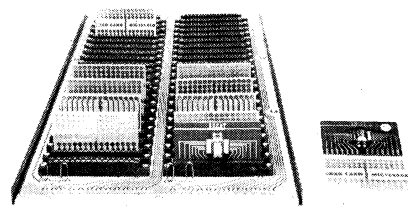
INTEGRATED CIRCUIT SYSTEM —

The Model 8500 Integrated Circuit Power Aging System consists of two interconnected assemblies: the temperature test chamber, and the power supply, pulse generator, and failure indicator console. The components to be tested are inserted in mother boards. The mother boards plug into rack connectors in the temperature chamber which distribute the various bias and signal drives. The mother board also contains monitor lines, and a signal mixing circuit to provide failure indication.



The Model 8500 is available in three basic sizes:

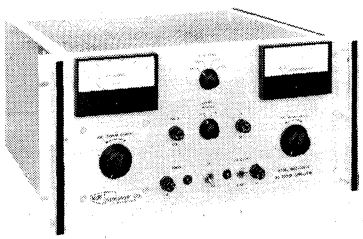
The -1 holds 32 mother boards
The -2 holds 48 mother boards
The -3 holds 80 mother boards



GENERAL INFORMATION —

Standard power aging systems operate in the temperature range of +40 to +150°C with overall accuracy including control, gradient, and drift of ±3°C. Special systems with temperature ranges to 325°C are available. Micro Instrument Company offers a wide variety of printed circuit cards and trays for holding components for various systems. Micro Instrument Company will be pleased to discuss any lift test requirement, suggesting possible test methods and system concepts.

SWITCHING TYPE LIFE TEST POWER SUPPLIES AND LIFE TEST SYSTEMS



SWITCHING-TYPE POWER SUPPLY — MODELS 9100-100, 9100-300

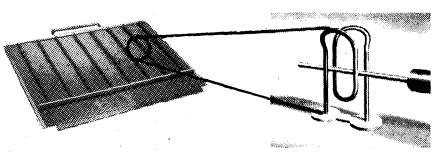
The Model 9100 Switching-Type Power Supply is used in life testing and power aging of semiconductor rectifiers. The output waveform consists of a half-sine wave adjustable from 0 to 15 volts peak (for forward conduction through the test rectifiers), and a half-sine wave adjustable from 0 to 1000 volts peak, depending on the model, (for reverse voltage stress on the test rectifiers). Both forward current and reverse voltage are indepedently adjustable. Forced-air cooled SCR's are used as switching elements; the SCR's are automatically turned off for over-load or over-temperature conditions.

SPECIFICATIONS

Average Rectified Forward Current (Io): 0 to 300 A (Model 9100-300). 0 to 100 A (Model 9100-100). Outputs in two equal channels.
Forward Voltage: 0 to 15 volts peak.
Forward Form Factor: 170° typical into rectifier & resistive load at max. forward volts.
Forward Current Metering: 0 to 150 A to (Model 9100-300. 0 to 50 A to (Model 9100-100).
Forward Current Interlock: Remote contact.
Forward Current Indication: Front panel light:
SCR Protection:
Peak Inverse Voltage: 0-200 volts (-2); 0-400 volts (-4); 0-600 volts (-6); 0-1000 volts (-10).
Peak Inverse Current: 350mA peak continuous.
Reverse Voltage Metering: 0-100, 300, 1000.
Transient Protection & SCR Protection
Input and Output: Terminal strips on rear.
Input Power: 208 or 230 volts, 60 Hz, single phase, 4500 VA (Model 9100-300), 120 volts, 60 Hz, single phase, 1800 VA (Model 9100-100).
Size: 17½" H (9100-300), 8¾" H (9100-100).
Weight: 275 lbs. (9100-300). 150 lbs. (9100-100).

Prices: In 1 to 4 quantities, complete including SCR's. Model 9100-300-2 (200v), $1703.00; -4 (400v) $1774.00; -6 (600v) $1884.00; -10 (1000v), $2168.00. Model 9100-100-2 (200v), $1276.00; -4 (400v) $1332.00; -6 (600v), $1395.00; -10 (1000v) $1620.00.

COMPONENT LIFE-TEST CARDS



These high-reliability epoxy-glass, printed circuit cards offer efficient power aging and testing to +150°C with low cost per position. The component mounting cards are available in a wide variety of configurations and sizes with mounting sockets or M.I.C. proprietary mounting clips. Automatic eyeletting and soldering insure uniformity of workmanship and high quality at low cost.

CARD TYPES — Many types of component cards are available, broadly categorized by connector pins (44 pin, 56 pin and 210 pin), by component type (two-lead and three-lead or combination), and by circuit (sensing, non-sensing, etc.).

SPECIAL CARDS — A wide variety of special designs are available, or can be made to customer requirements. Cost is comparable to standard designs except for an average one-time engineering charge of $150.00 to $250.00.

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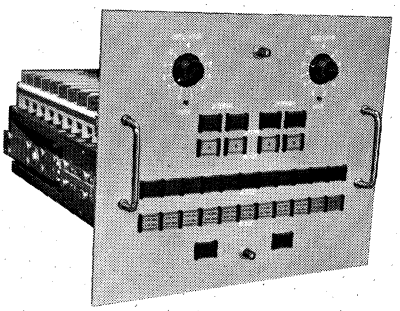
SIGNAL GENERATION SYSTEMS

● Hi-Stability ● Logic Control Switching ● Custom Applications



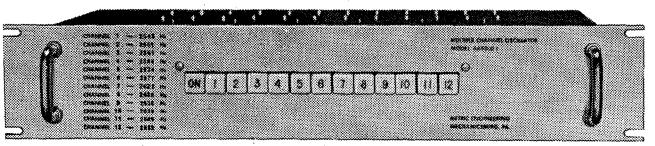
WIDE BAND TRANSMITTER EXCITER

- 2-30 MHz output frequency with inputs of 2 to 10 MHz
- Two internal 10 channel oscillators
- Logic Controlled switching and tuning
- ±.0005% Stability
- Harmonic distortion less than 1%
- Up to 1 watt output

Operates on 115 VAC or 230 VAC, 50 to 400 Hz

PURE SINE WAVE GENERATOR

- 12 Discrete frequencies in a 1KHz to 20KHz range
- Push Button Selectable
- Harmonic distortion less than .1%
- 1 VRMS into 600 ohm load balanced or unbalanced
- Individual level adjust and master level adjust





HI-FREQUENCY: HI-POWER

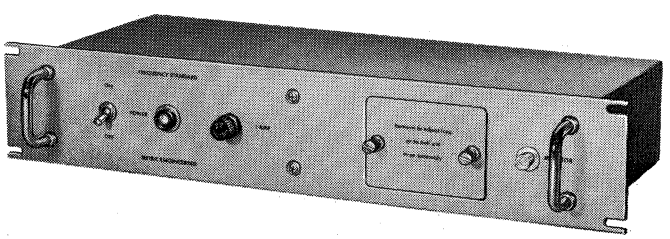
- 1 to 500 MHz frequency range
- Minimum of 5 watts into 50 ohms
- Turn-counting pot for output level adjust
- Less than 12 lbs. weight
- Stability to $\pm 1 \times 10^{-8}$

Operates on 117 VAC, 50 to 400 Hz

50 Hz, 60 Hz, or 400 Hz TIME STANDARD

- $\pm 1 \times 10^{-7}$ frequency stability
- 120 VRMS output voltage
- ±.5% output regulation
- 25 Watt output power
- Square wave or sine wave available
- Operates from 120 VAC, 50 to 400 Hz or 28 VDC





30 to 35 MHz TRANSMITTER EXCITER

- 1 VRMS output into 50 ohm load
- $\pm 5 \times 10^{-8}$ stability
- Sine wave
- Harmonic distortion less than 5%
- Remote keying capability

FCC approved in the 32 to 33 MHz range

DESIGN AND MANUFACTURE OF CUSTOM SYSTEMS IN SIGNAL GENERATION AND SWITCHING CONTROL ARE OUR SPECIALTY. LET *METRIC ENGINEERING* SOLVE YOUR PROBLEMS.

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PRECISION LABORATORY INSTRUMENTS!

SPECIALISTS IN BATTERY OPERATED SOLID-STATE INSTRUMENTS

MV-928A, 1mV to 3V F.S. Freq. Resp. 10KHz to 1.2GHz, basic accy. ±3%, 10KHz to 100MHz ±3%. 100MHz to 400MHz ±5%. 400MHz to 1.2GHz ±10%. Battery or 115/230V. 50-450Hz **$775**

MV828A, Same specs as above, without battery operation **675**

MV28B, Same as MV828A, except vacuum tube model **625**

MV-38B, Same as MV28B except 3mV-3V F.S. **525**

MV-952A, Ultra Sensitive Solid State Micro-Volt-Ammeter. Measures 10uV to 1KV DC F.S. with 1% basic accy. Current 10pA to 10mA with 2% basic accy. 1 to 100 meg input, Shunts, 1 meg to 1 ohm. Battery operated and/or 115/230, 50/450Hz **695**

MV-852A, Same as MV-952A, except without battery operation **625**

MV-07C, Measures same as above, but tube model and operates on 115/230, 50/60Hz only **575**

MV-27E, 250uV to 1KV, F.S. DC, 14 ranges, imp. 10-100 megs, 1% accy. **425**

MV-127B-L, 100uV to 1KV, F.S. DC, 15 ranges, inp. imp. 1-100 megs, 1% basic accy. **475**

MV-11E, 100pA to 10A, F.S. DC, 23 ranges, shunts 10 meg. .001 ohms, 1% basic accy. **425**

MV-111B-L, 100pA to 250mA, F.S. DC, 20 ranges, shunt 1 meg .004 ohm, 1% basic accy. **475**

MV-77B, 1mV-1KV, 1uA-1A, F.S. 1 ohm-5K meg. Input imp. 10-100 megs, 1, 2, 2% basic accy. **475**

MV-964A, Solid-State Multimeter, 100uV to 1KV, DC F.S. Current 100nA to 1A F.S. Ohms 1 to 100 megs center scale. Input imp. 10-100 megs. Shunts, 10K to .01 ohms. Basic accy. volts 1% current 2%, ohms 5 & 10%. Battery operated and/or 115/230, 50-450Hz **525**

MV-864A, Same as MV-964A, except without battery operation **445**

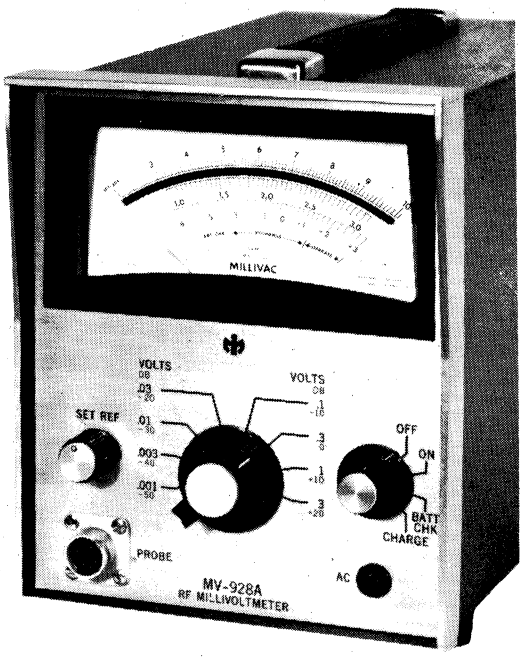
MV-279C, Direct reading Linear Scale ohmmeter, 1 ohm-10 megs F.S. 15 ranges Rx drop 10mV. 1% accy. **550**

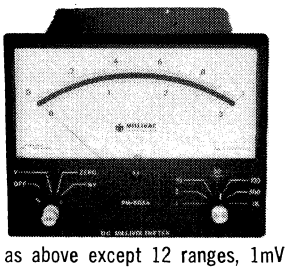
MV-276B, Wheatstone Bridge, 1 milliohm to 1000 megs, .05%, basic accy. Lead resistance cancellations and calibrated 1% unbal. Max. dissipation 1mW **1050**

MV-45A, 10uV to 1KV, F.S. AC, 17 ranges inp. imp. 10K to 3.3 meg, AC amp output 40db, 3% basic accy. **425**

VS-68B, Hi-Impedance Hushed Transistor Amplifier, 10K, 100K and 50 meg input. Transistorized **575**

VS-64A, Same as above except 10K and 100K input only **425**





PANEL MOUNTED ELECTRONIC VOLTMETERS

PM-504A, DC Voltmeter measures 100uV to 1KV, F.S. in 15 ranges. 100uV, 3%, All others 2% F.S. accuracy. Operates on 115/230V. 50/60 Hz, 10 megs input **$375**

PM-503A, Same as above except 12 ranges, 1mV F.S. to 1KV F.S. **$350**

PM-502A, Same as above except 11 ranges, 10mV, F.S. to 1KV F.S. **325**

PM-520A, Solid-State RF Millivoltmeter. Freq. Resp. 10KHz to 1.2GHz; Basic accy. ±3%, Measures 3mV to 3V F.S. in 7 ranges to 300V with 100/1 Divider. 10KHz to 100MHz, ±3% accy. 100MHz to 400MHz ±5% accy. 400MHz to 1.2GHz ±10% accy. 115/230V. 60 Hz **425**

PM-301A, VTVM, 10mV F.S. to 1KV F.S. in 11 ranges, 3% accuracy, 10 meg input, 115/230V 60Hz **280**

PM-311A-1, AC Voltmeter, 10mV F.S. to 300V F.S. in 10 ranges. Accuracy 1% 50Hz to 100KHz, 3% from 20Hz to 250Hz. Input 5 megs shunted by 25pF, −40 to 50db, 115/230V 50-400Hz **250**

PM-311A, Same as above, except 3, 4 and 5% accuracy **200**

PM-300-1, DC Multi-Range Voltmeter. 1V to 1KV F.S. in 7 ranges. 1% accuracy. 115/230V 50-400Hz. Input 10 meg **155**

PM-300, Same as above except 3% accuracy **120**

Also available, 4½" square single range AC or DC. Panel Mounted Meters

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NO. CALIF. & NO. NEVADA: Electronic Engineering Associates, Ltd., San Carlos, Calif. 415 - 593-2189

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ENGLAND: Lyons Instruments, Ltd., Hoddesdon, Herts, England

FRANCE: Tranchant Electronique, Clichy (Seine) France

GERMANY: Neumoller & Co., GMBH, Karlstrabe, Germany

HOLLAND: Projecto Instrument Co., Amsterdam, Holland

ITALY: Mottola Prodotti Industriali, Milan, Italy

ISRAEL: R. D. T. Electronics Engrg. Ltd., Tel-Aviv, Israel

All other countries: Please contact FRATHOM CO., INC., New York City, N. Y.

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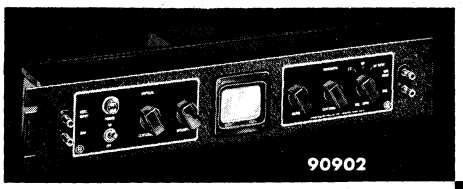
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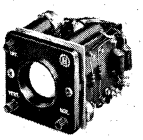
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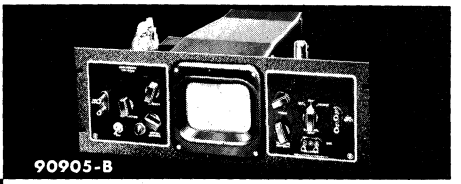
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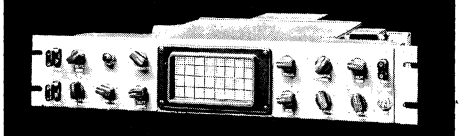
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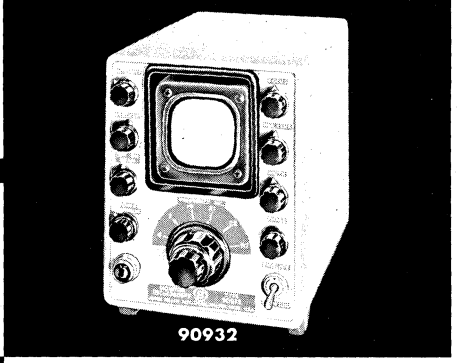
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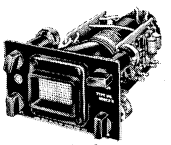
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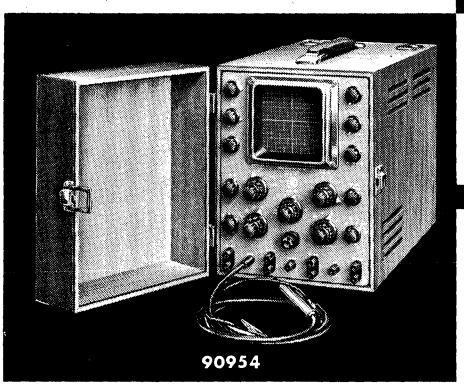
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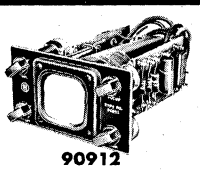
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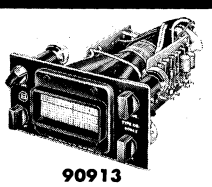
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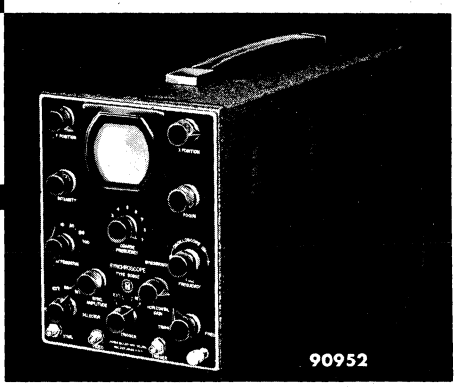

90952

"Designed for Application"® OSCILLOSCOPES AND ACCESSORIES

MODULE OSCILLOSCOPES

Miniature, packaged panel mounting cathode ray module oscilloscope indicators for monitoring. Designed to be built into equipment. Require minimum panel space. Use separate module power supply.
No. 90901 uses 1CP1 fixed focus cathode ray tube. Smallest and most economical of the module oscilloscopes. Panel 2⅜" square.
No. 90911 uses type 1EP1 flat face 1¼" cathode ray tube. Balanced deflection. Blanking input. Sharp focus. Panel 2⅜" square.
No. 90912 uses type 2BP1 two inch cathode ray tube. 3" x 5" panel.
No. 90912-R uses type 3UP1 2⅛" x 1-9/16" cathode ray tube.
No. 90913 uses type 3XP1 3" x 1½" rectangular cathode ray tube.
No. 90914 uses type 4KP1 3½" square cathode ray tube.
No. 90943 uses type 3KP1 Three inch C-R-T. Contains power supply.
No. 90945 uses type 5BP1 Five inch C-R-T. Contains power supply.

BASIC OSCILLOSCOPES

Rack mounted inexpensive basic oscilloscopes including cathode ray tube circuit, power supply; intensity, focus, and centering controls, magnetic shielding, safety features, switches, etc.
No. 90902 uses type 2BP1 two inch cathode ray tube. 3½" x 19" panel.
No. 90902-M designed to meet military specification MIL-T-945.
No. 90903 uses type 3KP1 three inch cathode ray tube. 5¼" x 19" panel. Power requirement — 105-125 volts 60 cycles — 19 watts.
No. 90903-R uses type 3XP1 3" x 1½" rectangular cathode ray tube.
No. 90905 uses type 5UP1 five inch cathode ray tube. 7" x 19" panel.
No. 90905-B uses type 5ADP1 five inch flat face precision tolerance cathode ray tube. Balanced deflection. Blanking input. 35 W at 117 V.
No. 90905-D for balanced direct coupled deflection. Uses 5ADP1.
No. 90905-R uses type 5BXP1 4⅝" x 2⅝" rectangular C-R tube.

COMPACT COMPLETE OSCILLOSCOPES

Extremely compact oscilloscopes complete with amplifiers, linear low frequency sweep, and power supplies. Balanced deflection for minimum distortion. High accelerating potential for good resolution.
No. 90923 uses type 3XP1 3" x 1½" rectangular cathode ray tube. 3½" x 19" panel. 0.4 V. p to p per cm. defl. d.c. to 275 kc.
No. 90923-C uses 3RP1. 5¼" x 10½" panel. 50 mv p to p per cm.
No. 90925 uses type 5BXP1 4⅝" x 2⅝" rectangular C-R tube. 3½" x 19" panel. 0.16 V. p to p per cm. defl. DC to 550 kc.
No. 90925-A Vertical amplifier is 50 mv. p to p per cm. to 2.5 mc.
No. 90925-B Low frequency linear sweep 3 seconds per sweep to 22 kc.

PORTABLE FIELD OSCILLOSCOPES

Especially suitable for use in factory, laboratory, and the field for design, installation, maintenance, and service. Well shielded against magnetic fields. Excellent linearity. Sharp focus. Compact.
No. 90915 uses 5AQP1. Frequency response either amplifier DC to 200 kc. Completely insulated front panel and case. Double shielded.
No. 90952 Synchroscope or Oscilloscope. 7½" x 5⅝" x 13"
No. 90954 uses 4KP1 3½" square CRT. 7½" x 9½" x 13½" insulated case. 23 pounds. Response DC to 1.2 mc. 0.1V. per cm.

MONITOR OSCILLOSCOPE

No. 90932 Amateur Band Monitor Oscilloscope is a complete oscilloscope for monitoring the modulated r-f output of a transmitter. Built-in link-coupled tuned circuits cover all amateur bands 3.5 to 54 mc. All circuits and accessories are built in. The monitor will display the r-f envelope and/or the trapezoidal monitoring pattern.

AMPLIFIER/SWEEP UNITS

Amplifier/Sweep Units are accessories which may be used with any basic or module oscilloscope. They contain a vertical amplifier, a horizontal amplifier, a sweep generator and power supplies.
No. 90921 Inexpensive rack mounted unit. 5¼" x 19" panel.
No. 90921-A DC to 1 mc. Vert. amp. Balanced deflection. 0.3V./cm.

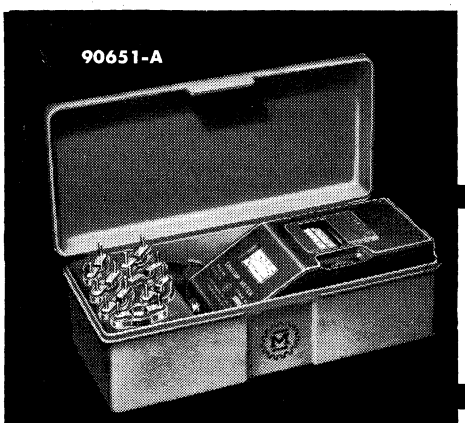
POWER SUPPLIES

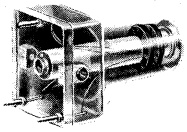
Compact high voltage and low voltage power supplies for oscilloscopes etc. 1⅞" x 2⅛" x 4⅝". Input 117 volts 50/60 cycles. Supply accelerating and centering potential for oscilloscopes.
No. 90202 is a plug-in supply for high voltage and heater power for any of the MILLEN Module Oscilloscopes. Output 750 volts dc at 3 ma.
No. 90202-M designed to meet military specification MIL-E-16400.
No. 90203 supplies B+ and heater to three amplifiers and a sweep.
No. 90203-A has external filter capacitors for military applications.

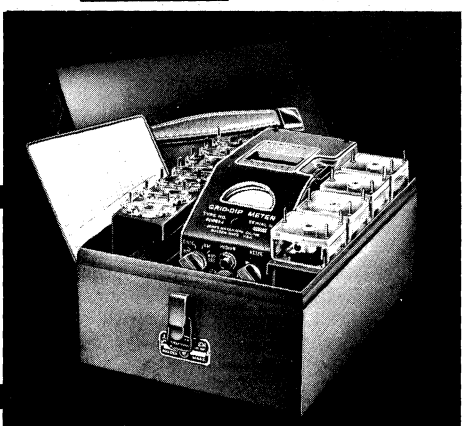
MODULE ACCESSORIES

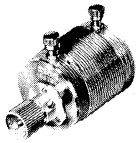
The MILLEN Module Oscilloscope Amplifiers and Sweep are compact plug-in units designed to provide the required deflection voltages for the MILLEN series of Module and Basic Oscilloscopes.
No. 90924 A-C coupled unit. Use as pre-amplifier or deflection amp.
No. 90926 Plug-in linear sawtooth sweep generator. Controls on top.
No. 90927 Several versions of direct coupled deflection amplifier.

JAMES MILLEN MFG. CO., INC.
MAIN OFFICE AND FACTORY
150 EXCHANGE ST., MALDEN, MASSACHUSETTS, U. S. A.

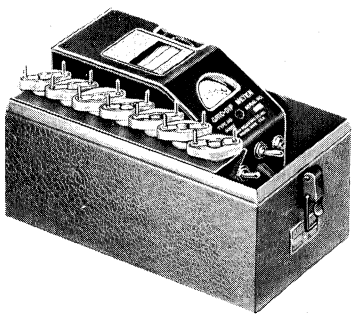


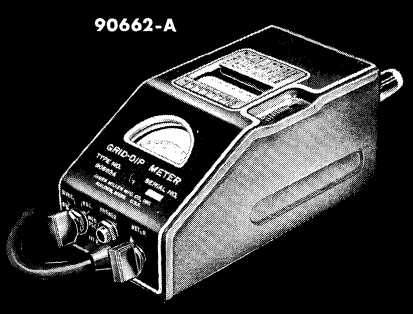


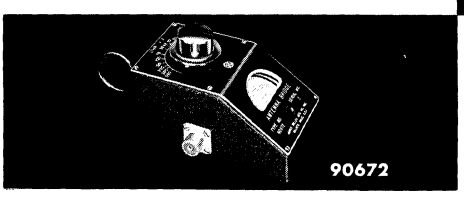




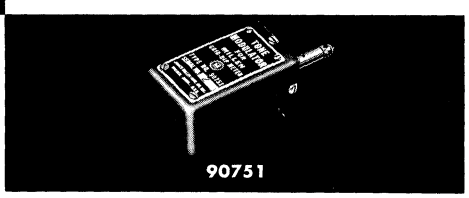












GRID DIP METERS

No. 90651-A GRID DIP METER

The No. 90651-A Grid Dip Meter has a transistor d.c. amplifier to increase sensitivity. It provides full scale meter reading at all frequenies from 1.7 to 300 mc. It has a modern, taut band meter to eliminate any possibility of meter ever becoming "sticky". These additions are made while still maintaining all of the features which have made the MILLEN No. 90651 Grid Dip Meter so thoroughly reliable it has become the standard of the industry. It uses the same stable oscillator without spurious dips, it has a transformer-type power supply, it has seven coils protected by form-fitting molded covers, etc.

No. 90651 STANDARD GRID DIP METER

The No. 90651 Grid Dip Meter is complete with a convenient polypropylene carrying case which keeps the coil/probes with the Grid Dip Meter and protects both. Frequency coverage is 1.7 to 300 mc. with the seven coil/probes furnished. Additional coils for extending the calibration to 160 kc. are available. See below.

No. 90662-A LABORATORY AND INDUSTRIAL GRID DIP METER

The No. 90662-A Industrial and Laboratory Grid Dip Meter is hand calibrated from 225 kc. to 300 mc. Calibration accuracy is +0.5%. Additional features are a d.c. amplifier for excellent sensitivity at all frequencies, modulation, easily read dial, three wire grounding-type power cord and suitable carrying case.

No. 90662 INDUSTRIAL GRID DIP METER

The No. 90662 Grid Dip Meter covers the frequency range of 225kc. to 300mc. and is hand calibrated with calibration accuracy of +0.5%. It is supplied with a carrying case, three wire grounding-type power cord and a plug-in modulator. The d.c. amplifier and internal modulator are not supplied.

No. 90661 INDUSTRIAL GRID DIP METER

The No. 90661 Grid Dip Meter covers the frequency range of 1.7 to 300 mc. and is hand calibrated with calibration accuracy of +0.5%. It is supplied with a carrying case and three wire grounding-type power cord. DC amplifier, modulator and L-F coils are not supplied.

ACCESSORIES

No. 90672 ANTENNA BRIDGE

The No. 90672 Antenna Bridge is an r-f bridge which uses a Grid Dip Meter as a source of signal. It is a sensitive bridge for measuring impedance in the range of 5 to 500 ohms for unbalanced impedances.

No. 90751 TONE MODULATOR

The No. 90751 Tone Modulator plugs into the 'phone jack of a Grid Dip Meter to provide 800 cycle modulation.

No. 46721 PROBE — Used where it is difficult to couple directly.
No. 46701 COIL KIT — Coil form and cover for Grid Dip Meter. No coil.
No. 46702 LOW FREQUENCY COIL/PROBE — 925 to 2000 kc.
No. 46703 LOW FREQUENCY COIL/PROBE — 500 to 1050 kc.
No. 46704 LOW FREQUENCY COIL/PROBE — 325 to 600 kc.
No. 46705 LOW FREQUENCY COIL/PROBE — 220 to 350 kc.
No. 46706 LOW FREQUENCY COIL/PROBE — 160 to 225 kc.
No. 46672-10 BALUN — Reactances tuned out for 10 meters and C.B.
No. 46672-15 BALUN — Reactances tuned out for 15 meter amateur band.
No. 46672-20 BALUN — Reactances tuned out for 20 meter amateur band.
No. 46672-40 BALUN — Reactances tuned out for 40 meter amateur band.
No. 46672-80 BALUN — Reactances tuned out for 80/75 meter band.

MILLEN
INDUSTRIAL ELECTRONICS
MASTER DATA BOOK

Comprehensive coverage of MILLEN PRODUCTS with Dimensional Drawings

Available to:

- **Industry Personnel**
- **Purchasing Agents**
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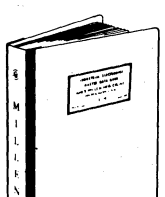
- **Design Draftsmen**



JAMES MILLEN MFG. CO., INC.

MAIN OFFICE AND FACTORY

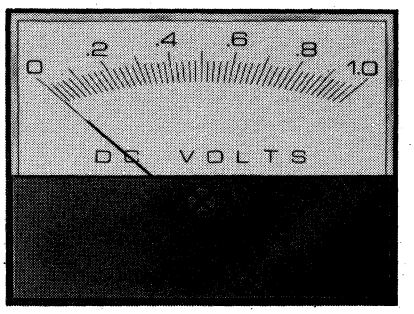
150 EXCHANGE ST., MALDEN, MASSACHUSETTS, U. S. A.

MODUTEC
TAUT BAND PANEL METERS

The Modutec family of precision, self-shielded, permanent-magnet / moving coil panel meters combines state-of-art movements with advanced, functional styling.
Each of the four Modutec series is available in a full range of five sizes.

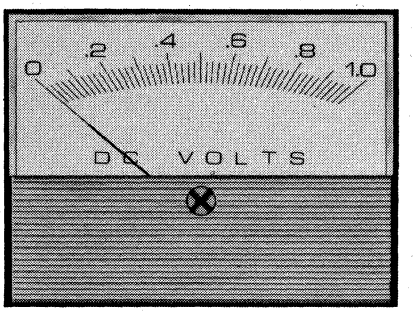
FEATURES AND SPECIFICATIONS

Movement — High torque, frictionless taut-band suspension assures long life and dependable high accuracy.
Scale — 100° long, linear, low-profile scales provide easy, accurate reading.
Accuracy: ±2% for DC meters; ±3% for AC meters (60 Hz sine wave).
Tracking: ±1.5% for DC meters; ±2% for AC meters.
Modutec meters meet or exceed the performance requirements of USA Standard C-39-1.



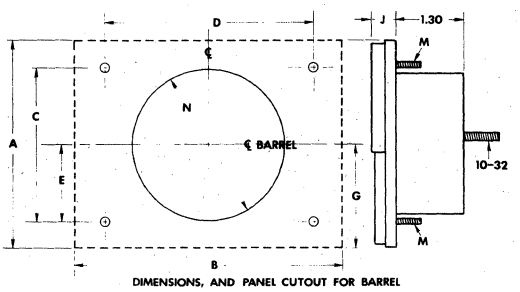
S SERIES
SURFACE MOUNT BLACK COVER

The handsome aspect ratio and clean cut detailing of these meters will add distinction to any instrument or control panel. Available in five sizes and a wide variety of ranges, this series provides new latitude for the equipment designer.



C SERIES
SURFACE MOUNT CLEAR COVER

This series features a case front of clear acrylic, polished on the outside and closely ribbed on the inside surface. The visual effect of this is to greatly reduce contrast between the meter and the adjacent panel, resulting in a very pleasing overall appearance.



DIMENSIONS, AND PANEL CUTOUT FOR BARREL

METER SIZE	A	B	C	D	E	G	J	M	N
1½"	1.75	2.24	1.31	1.31	.66	.83	.34	4-40	1.55
2½"	2.27	2.99	1.88	1.88	.94	1.13	.37	4-40	2.22
3½"	2.87	3.70	2.25	2.25	1.12	1.44	.41	4-40	2.82
4½"	3.96	5.10	3.56	4.00	1.54	1.74	.48	6-32	2.82
5½"	4.48	5.85	3.00	5.25	.85	1.59	.55	6-32	2.82

NOTE: Listings below are for S series. To designate C series, substitute "C" for "S" in catalog number. Prices are identical.

		1½"		2½"		3½"		4½"		5½"	
Range	Resistance	Catalog No.	Price	Catalog No.	Price	Catalog No.	Price	Catalog No.	Price	Catalog No.	Price
DC AMMETERS											
0-1	.050	1S-DAA-001	11.65	2S-DAA-001	11.05	3S-DAA-001	11.65	4S-DAA-001	12.35	5S-DAA-001	14.90
0-1.5	.033	1S-DAA-0015	11.65	2S-DAA-0015	11.05	3S-DAA-0015	11.65	4S-DAA-0015	12.35	5S-DAA-0015	14.90
0-2	.025	1S-DAA-002	11.65	2S-DAA-002	11.05	3S-DAA-002	11.65	4S-DAA-002	12.35	5S-DAA-002	14.90
0-3	.0166	1S-DAA-003	11.65	2S-DAA-003	11.05	3S-DAA-003	11.65	4S-DAA-003	12.35	5S-DAA-003	14.90
0-5	.0100	1S-DAA-005	11.65	2S-DAA-005	11.05	3S-DAA-005	11.65	4S-DAA-005	12.35	5S-DAA-005	14.90
0-10	.0050	1S-DAA-010	11.65	2S-DAA-010	11.05	3S-DAA-010	11.65	4S-DAA-010	12.35	5S-DAA-010	14.90
0-15	.0033	1S-DAA-015*	11.10	2S-DAA-015	11.05	3S-DAA-015	11.65	4S-DAA-015	12.35	5S-DAA-015	14.90
0-20	.0025	1S-DAA-020*	11.10	2S-DAA-020	11.05	3S-DAA-020	11.65	4S-DAA-020	12.35	5S-DAA-020	14.90
0-25	.0020	1S-DAA-025*	11.10	2S-DAA-025	11.05	3S-DAA-025	11.65	4S-DAA-025	12.35	5S-DAA-025	14.90
0-30	.0015	1S-DAA-030*	11.10	2S-DAA-030	11.45	3S-DAA-030	12.00	4S-DAA-030	12.80	5S-DAA-030	15.45
0-50	.0010	1S-DAA-050*	11.10	2S-DAA-050	11.45	3S-DAA-050	12.00	4S-DAA-050	12.80	5S-DAA-050	15.45
0-100	10.0	1S-DAA-100*	11.10	2S-DAA-100*	10.60	3S-DAA-100*	11.10	4S-DAA-100*	11.85	5S-DAA-100*	14.30
0-150	10.0	1S-DAA-150*	11.10	2S-DAA-150*	10.60	3S-DAA-150*	11.10	4S-DAA-150*	11.85	5S-DAA-150*	14.30
0-200	10.0	1S-DAA-200*	11.10	2S-DAA-200*	10.60	3S-DAA-200*	11.10	4S-DAA-200*	11.85	5S-DAA-200*	14.30
0-500	10.0	1S-DAA-500*	11.10	2S-DAA-500*	10.60	3S-DAA-500*	11.10	4S-DAA-500*	11.85	5S-DAA-500*	14.30
DC MICROAMMETERS											
0-20	5830	1S-DUA-020	17.20	2S-DUA-020	16.45	3S-DUA-020	17.20	4S-DUA-020	18.40	5S-DUA-020	22.30
0-50	2550	1S-DUA-050	12.60	2S-DUA-050	12.00	3S-DUA-050	12.60	4S-DUA-050	13.45	5S-DUA-050	16.35
0-100	640	1S-DUA-100	11.95	2S-DUA-100	11.40	3S-DUA-100	11.95	4S-DUA-100	12.75	5S-DUA-100	15.40
0-200	230	1S-DUA-200	11.25	2S-DUA-200	10.75	3S-DUA-200	11.25	4S-DUA-200	12.00	5S-DUA-200	14.50
0-500	135	1S-DUA-500	10.70	2S-DUA-500	10.20	3S-DUA-500	10.70	4S-DUA-500	11.25	5S-DUA-500	13.75
25-0-25	2550	1S-DUA-25U25	13.10	2S-DUA-25U25	12.50	3S-DUA-25U25	13.10	4S-DUA-25U25	13.95	5S-DUA-25U25	16.85
50-0-50	640	1S-DUA-50U50	12.50	2S-DUA-50U50	11.85	3S-DUA-50U50	12.50	4S-DUA-50U50	13.30	5S-DUA-50U50	16.00
100-0-100	230	1S-DUA-1H1	11.80	2S-DUA-1H1	11.20	3S-DUA-1H1	11.80	4S-DUA-1H1	12.55	5S-DUA-1H1	15.15
500-0-500	32	1S-DUA-5H5	10.80	2S-DUA-5H5	10.30	3S-DUA-5H5	10.80	4S-DUA-5H5	11.60	5S-DUA-5H5	13.90

Range	Resistance – Ohms	1½" Catalog No.	1½" Price	2½" Catalog No.	2½" Price	3½" Catalog No.	3½" Price	4½" Catalog No.	4½" Price	5½" Catalog No.	5½" Price
DC MILLIAMMETERS											
0-1	35	1S-DMA-001	10.45	2S-DMA-001	9.95	3S-DMA-001	10.45	4S-DMA-001	11.15	5S-DMA-001	13.45
0-3	7.2	1S-DMA-003	10.45	2S-DMA-003	9.95	3S-DMA-003	10.45	4S-DMA-003	11.15	5S-DMA-003	13.45
0-5	4.3	1S-DMA-005	10.45	2S-DMA-005	9.95	3S-DMA-005	10.45	4S-DMA-005	11.15	5S-DMA-005	13.45
0-10	2.2	1S-DMA-010	10.45	2S-DMA-010	9.95	3S-DMA-010	10.45	4S-DMA-010	11.15	5S-DMA-010	13.45
0-15	3.3	1S-DMA-015	11.65	2S-DMA-015	11.05	3S-DMA-015	11.65	4S-DMA-015	12.35	5S-DMA-015	14.90
0-20	2.5	1S-DMA-020	11.65	2S-DMA-020	11.05	3S-DMA-020	11.65	4S-DMA-020	12.35	5S-DMA-020	14.90
0-25	2.0	1S-DMA-025	11.65	2S-DMA-025	11.05	3S-DMA-025	11.65	4S-DMA-025	12.35	5S-DMA-025	14.90
0-30	1.7	1S-DMA-030	11.65	2S-DMA-030	11.05	3S-DMA-030	11.65	4S-DMA-030	12.35	5S-DMA-030	14.90
0-50	1.0	1S-DMA-050	11.65	2S-DMA-050	11.05	3S-DMA-050	11.65	4S-DMA-050	12.35	5S-DMA-050	14.90
0-100	.50	1S-DMA-100	11.65	2S-DMA-100	11.05	3S-DMA-100	11.65	4S-DMA-100	12.35	5S-DMA-100	14.90
0-150	.33	1S-DMA-150	11.65	2S-DMA-150	11.05	3S-DMA-150	11.65	4S-DMA-150	12.35	5S-DMA-150	14.90
0-200	.25	1S-DMA-200	11.65	2S-DMA-200	11.05	3S-DMA-200	11.65	4S-DMA-200	12.35	5S-DMA-200	14.90
0-300	.166	1S-DMA-300	11.65	2S-DMA-300	11.05	3S-DMA-300	11.65	4S-DMA-300	12.35	5S-DMA-300	14.90
0-500	.10	1S-DMA-500	11.65	2S-DMA-500	11.05	3S-DMA-500	11.65	4S-DMA-500	12.35	5S-DMA-500	14.90
0-750	.066	1S-DMA-750	11.65	2S-DMA-750	11.05	3S-DMA-750	11.65	4S-DMA-750	12.35	5S-DMA-750	14.90
DC VOLTMETERS											
0-1	↑	1S-DVV-001	11.10	2S-DVV-001	10.60	3S-DVV-001	11.10	4S-DVV-001	11.85	5S-DVV-001	14.30
0-1.5		1S-DVV-0015	11.10	2S-DVV-0015	10.60	3S-DVV-0015	11.10	4S-DVV-0015	11.85	5S-DVV-0015	14.30
0-2		1S-DVV-002	11.10	2S-DVV-002	10.60	3S-DVV-002	11.10	4S-DVV-002	11.85	5S-DVV-002	14.30
0-3		1S-DVV-003	11.10	2S-DVV-003	10.60	3S-DVV-003	11.10	4S-DVV-003	11.85	5S-DVV-003	14.30
0-5		1S-DVV-005	11.10	2S-DVV-005	10.60	3S-DVV-005	11.10	4S-DVV-005	11.85	5S-DVV-005	14.30
0-10		1S-DVV-010	11.10	2S-DVV-010	10.60	3S-DVV-010	11.10	4S-DVV-010	11.85	5S-DVV-010	14.30
0-15		1S-DVV-015	11.10	2S-DVV-015	10.60	3S-DVV-015	11.10	4S-DVV-015	11.85	5S-DVV-015	14.30
0-20		1S-DVV-020	11.10	2S-DVV-020	10.60	3S-DVV-020	11.10	4S-DVV-020	11.85	5S-DVV-020	14.30
0-25	1000Ω/V	1S-DVV-025	11.10	2S-DVV-025	10.60	3S-DVV-025	11.10	4S-DVV-025	11.85	5S-DVV-025	14.30
0-50		1S-DVV-050	11.10	2S-DVV-050	10.60	3S-DVV-050	11.10	4S-DVV-050	11.85	5S-DVV-050	14.30
0-100		1S-DVV-100	11.10	2S-DVV-100	10.60	3S-DVV-100	11.10	4S-DVV-100	11.85	5S-DVV-100	14.30
0-150		1S-DVV-150	11.10	2S-DVV-150	10.60	3S-DVV-150	11.10	4S-DVV-150	11.85	5S-DVV-150	14.30
0-200		1S-DVV-200	11.10	2S-DVV-200	10.60	3S-DVV-200	11.10	4S-DVV-200	11.85	5S-DVV-200	14.30
0-250		1S-DVV-250	11.10	2S-DVV-250	10.60	3S-DVV-250	11.10	4S-DVV-250	11.85	5S-DVV-250	14.30
0-300		1S-DVV-300	11.10	2S-DVV-300	10.60	3S-DVV-300	11.10	4S-DVV-300	11.85	5S-DVV-300	14.30
0-500		1S-DVV-500	11.80	2S-DVV-500	11.15	3S-DVV-500	10.20	4S-DVV-500	12.50	5S-DVV-500	15.05
0-750	↓	1S-DVV-750	11.80	2S-DVV-750	11.15	3S-DVV-750	10.20	4S-DVV-750	12.50	5S-DVV-750	15.05
DC MILLIVOLTMETERS											
0-50	1000Ω/V	1S-DMV-050	11.10	2S-DMV-050	10.60	3S-DMV-050	11.10	4S-DMV-050	11.85	5S-DMV-050	14.30
0-100	1000Ω/V	1S-DMV-100	11.10	2S-DMV-100	10.60	3S-DMV-100	11.10	4S-DMV-100	11.85	5S-DMV-100	14.30
Rectifier Type AC VOLTMETERS											
0-3	↑	1S-AVV-003	14.60	2S-AVV-003	13.90	3S-AVV-003	14.60	4S-AVV-003	15.50	5S-AVV-003	18.85
0-5		1S-AVV-005	14.60	2S-AVV-005	13.90	3S-AVV-005	14.60	4S-AVV-005	15.50	5S-AVV-005	18.85
0-10		1S-AVV-010	14.60	2S-AVV-010	13.90	3S-AVV-010	14.60	4S-AVV-010	15.50	5S-AVV-010	18.85
0-15		1S-AVV-015	14.60	2S-AVV-015	13.90	3S-AVV-015	14.60	4S-AVV-015	15.50	5S-AVV-015	18.85
0-25		1S-AVV-025	14.60	2S-AVV-025	13.90	3S-AVV-025	14.60	4S-AVV-025	15.50	5S-AVV-025	18.85
0-50	900Ω/V	1S-AVV-050	14.60	2S-AVV-050	13.90	3S-AVV-050	14.60	4S-AVV-050	15.50	5S-AVV-050	18.85
0-100		1S-AVV-100	14.60	2S-AVV-100	13.90	3S-AVV-100	14.60	4S-AVV-100	15.50	5S-AVV-100	18.85
0-150		1S-AVV-150	14.60	2S-AVV-150	13.90	3S-AVV-150	14.60	4S-AVV-150	15.50	5S-AVV-150	18.85
0-300		1S-AVV-300	14.60	2S-AVV-300	13.90	3S-AVV-300	14.60	4S-AVV-300	15.50	5S-AVV-300	18.85
0-500	↓	1S-AVV-500	15.45	2S-AVV-500	14.50	3S-AVV-500	15.45	4S-AVV-500	16.35	5S-AVV-500	19.65
Rectifier Type AC AMMETERS											
0-1	.07	1S-AAA-001	15.70*	2S-AAA-001	14.70	3S-AAA-001	15.70	4S-AAA-001	17.45	5S-AAA-001	19.95
0-1.5	.05	1S-AAA-0015	15.70*	2S-AAA-0015	14.70	3S-AAA-0015	15.70	4S-AAA-0015	17.45	5S-AAA-0015	19.95
0-2	.04	1S-AAA-002	15.70*	2S-AAA-002	14.70	3S-AAA-002	15.70	4S-AAA-002	17.45	5S-AAA-002	19.95
0-3	.025	1S-AAA-003	15.70*	2S-AAA-003	14.70	3S-AAA-003	15.70	4S-AAA-003	17.45	5S-AAA-003	19.95
0-5	.015	1S-AAA-005	15.70*	2S-AAA-005	14.70	3S-AAA-005	15.70	4S-AAA-005	17.45	5S-AAA-005	19.95
0-10	.0075	1S-AAA-010	15.70*	2S-AAA-010	14.70	3S-AAA-010	15.70	4S-AAA-010	17.45	5S-AAA-010	19.95
0-15	.005	1S-AAA-015	15.70*	2S-AAA-015	14.70	3S-AAA-015	15.70	4S-AAA-015	17.45	5S-AAA-015	19.95
0-20	.004	1S-AAA-020	16.40*	2S-AAA-020	15.40	3S-AAA-020	16.40	4S-AAA-020	18.15	5S-AAA-020	20.65
0-25	.0037	1S-AAA-025	16.40*	2S-AAA-025	15.40	3S-AAA-025	16.40	4S-AAA-025	18.15	5S-AAA-025	20.65
0-30	.0025	1S-AAA-030	16.40*	2S-AAA-030	15.40	3S-AAA-030	16.40	4S-AAA-030	18.15	5S-AAA-030	20.65
0-50	.0015	1S-AAA-050	16.40*	2S-AAA-050	15.40	3S-AAA-050	16.40	4S-AAA-050	18.15	5S-AAA-050	20.65
0-100	.015	1S-AAA-100	15.70*	2S-AAA-100	14.70**	3S-AAA-100	15.70**	4S-AAA-100	17.45**	5S-AAA-100	19.95**
0-150	.015	1S-AAA-150	15.70*	2S-AAA-150	14.70**	3S-AAA-150	15.70**	4S-AAA-150	17.45**	5S-AAA-150	19.95**
0-200	.015	1S-AAA-200	15.70*	2S-AAA-200	14.70**	3S-AAA-200	15.70**	4S-AAA-200	17.45**	5S-AAA-200	19.95**
0-500	.015	1S-AAA-500	15.70*	2S-AAA-500	14.70**	3S-AAA-500	15.70**	4S-AAA-500	17.45**	5S-AAA-500	19.95**

*Price includes external transformer. **5-amp meter with scale as indicated, requiring external current transformer.

Range	Resistance – Ohms	1½" Catalog No.	1½" Price	2½" Catalog No.	2½" Price	3½" Catalog No.	3½" Price	4½" Catalog No.	4½" Price	5½" Catalog No.	5½" Price
Rectifier Type AC MILLIAMMETERS											
0-25	90.0	1S-AMA-025	15.70	2S-AMA-025	14.70	3S-AMA-025	15.70	4S-AMA-025	17.45	5S-AMA-025	19.95
0-50	45.0	1S-AMA-050	15.70	2S-AMA-050	14.70	3S-AMA-050	15.70	4S-AMA-050	17.45	5S-AMA-050	19.95
0-100	6.0	1S-AMA-100	15.70	2S-AMA-100	14.70	3S-AMA-100	15.70	4S-AMA-100	17.45	5S-AMA-100	19.95
0-200	1.5	1S-AMA-200	15.70	2S-AMA-200	14.70	3S-AMA-200	15.70	4S-AMA-200	17.45	5S-AMA-200	19.95
0-500	0.4	1S-AMA-500	15.70	2S-AMA-500	14.70	3S-AMA-500	15.70	4S-AMA-500	17.45	5S-AMA-500	19.95

*These meters require external 50 mV shunts, which can be supplied from stock as follows (5-ft. leads included):

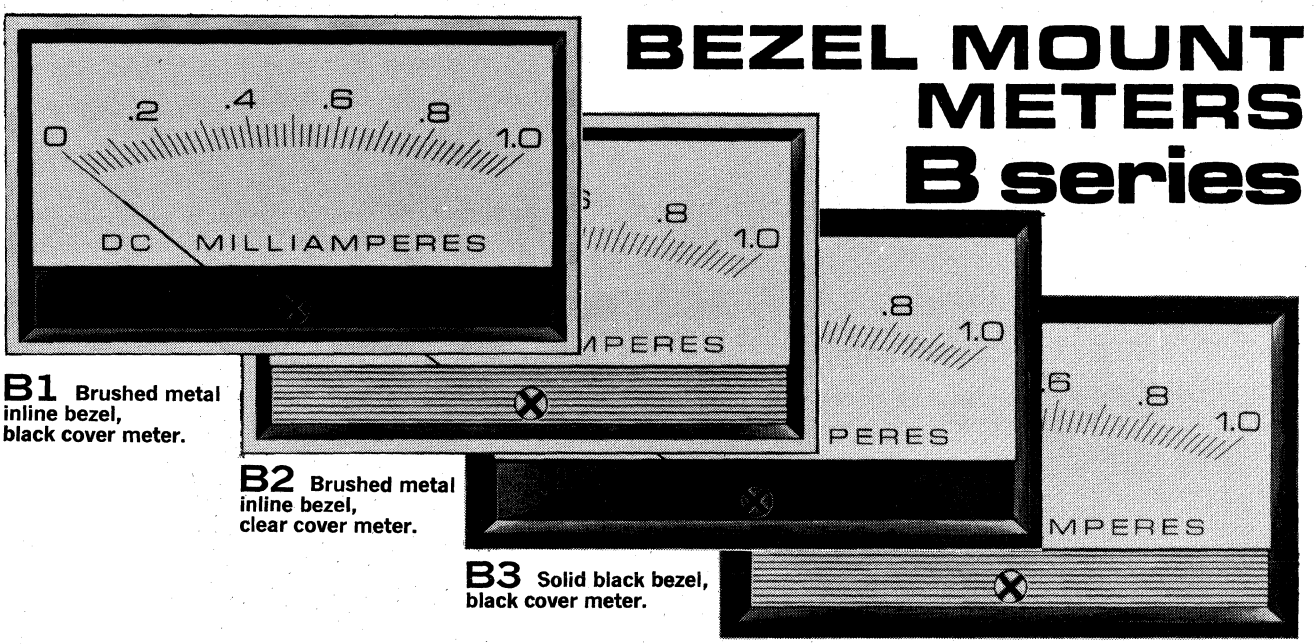
Amps	Cat. No.	Price	Amps	Cat. No.	Price	Amps	Cat. No.	Price
15	S50-015	$9.45	30	S50-030	$9.45	150	S50-150	$10.95
20	S50-020	9.45	50	S50-050	9.45	200	S50-200	10.95
25	S50-025	9.45	100	S50-100	9.45	500	S50-500	10.95

BEZEL MOUNT METERS → WINDO-MOUNT METERS →

OPTIONS, MODIFICATIONS, SPECIALS, DISCOUNTS →

MODUTEC
TAUT BAND PANEL METERS

BEZEL MOUNT METERS
B series



B1 Brushed metal inline bezel, black cover meter.

B2 Brushed metal inline bezel, clear cover meter.

B3 Solid black bezel, black cover meter.

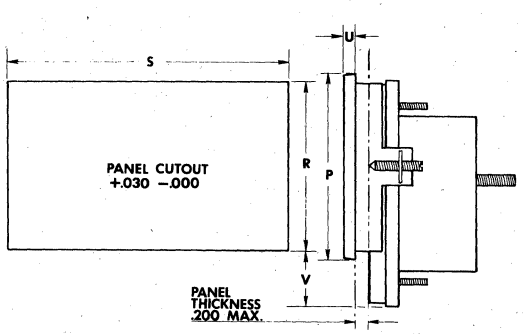
B4 Solid black bezel, clear cover meter.

Cast metal bezels are available for behind-panel mounting of S series or C series meters in all sizes. The cleanly designed bezel features minimum depth and cross-sectional area consistent with function, and is supplied in solid black finish or with brushed metal inline, as shown below.

When you order a bezel mount meter you are, in effect, ordering a complete package, comprising meter, bezel, hardware, template, and mounting instructions. To order, substitute "B" for the letter in the model designation, and add suffix "B1", "B2", "B3", or "B4". For example, 3B-DVV-025-B2 specifies a 3½" DC voltmeter, range 0-25 VDC, bezel mount with brushed metal inline over a clear cover meter.

Prices: Prices of bezel mount packages are obtained by adding to the basic meter prices (on the preceding page) as follows:

1½" — $1.75 3½" — $1.85 5½" — $1.95
2½" — $1.80 4½" — $1.90



METER SIZE	P	R	S	U	V
1½"	1.51	1.37	2.25	.08	.39
2½"	1.74	1.59	3.00	.09	.64
3½"	2.30	2.16	3.72	.09	.72
4½"	2.90	2.75	4.81	.10	1.10
5½"	3.29	3.14	5.86	.10	1.20

OPTIONS

The optional features listed below can be promptly incorporated in any standard meter. To order, add the appropriate suffix to the catalog number of the meter, and add the indicated charge to the list price before applying the quantity discount (see next page).

Improved Accuracy

Calibration	Add'l. Charge	Suffix
±1% tracking, ±1% accuracy	$4.00	A1
±0.5% tracking, ±2% accuracy	7.50	A2
±0.5% tracking, ±1% accuracy	10.00	A3

Colors Available as follows, additional charge $1.00

Color	Suffix	Color	Suffix
White	C1	Forest green	C6
Beige	C2	Tan	C7
Technical grey	C3	Dark brown	C8
Edgewater blue	C4	Ebony (gloss) black	C9
Apache red	C5		

Mirror Scale — M suffix, add'l. charge $1.00.

Illumination — K suffix. An accessory to provide illumination to Bezel Mount or Windo-Mount meters. Prices:
1½", 2½", 3½" meters $2.75
4½" and 5½" meters 3.00

Blank Dial — D suffix, add'l charge $0.50.

Closer Resistance Tolerance — R suffix, add'l. charge $1.00. Provides for improving tolerance to ±5%.

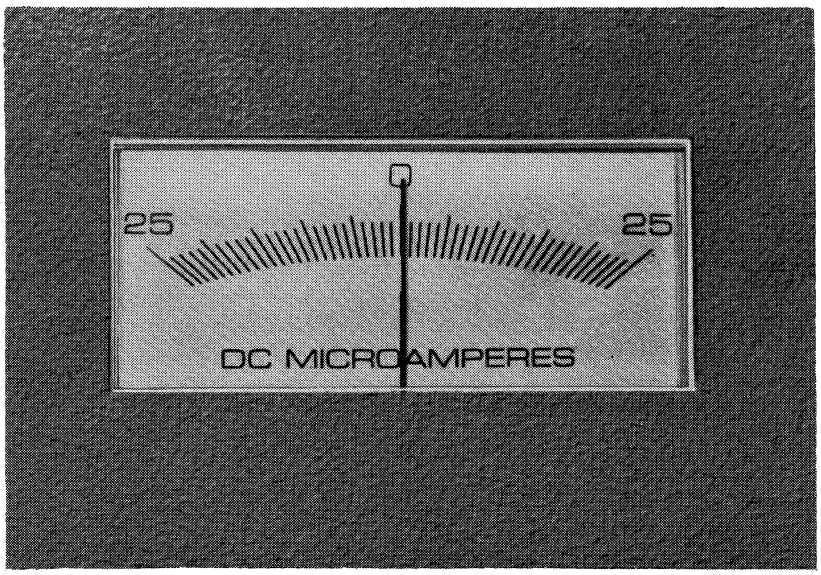
Sealed Case — S suffix, add'l. charge $2.50.

Temperature Compensation — T suffix, add'l. charge $3.50. Provides for extending the range to 25±30°C (it also increases resistance by 25%).

High Resistance Voltmeters — V suffix, add'l. charge $3.00. Increases resistance/sensitivity of DC voltmeters to 10K ohms/volt.

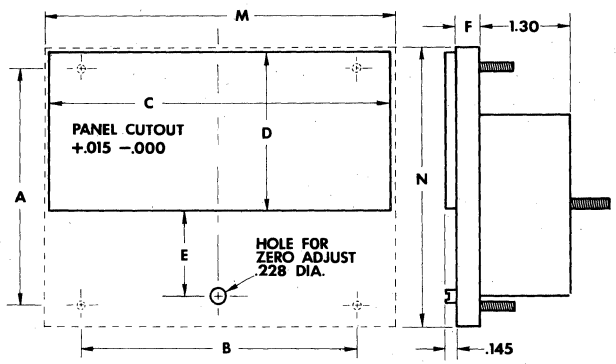
new, exclusive WINDO-MOUNT® METERS W series

TAUT BAND



If you want your panel to be the last word in sophisticated styling, specify Windo-Mount® meters! You see only the meter dial, through what appears to be a flush window in the instrument panel. Available in all standard Modutec sizes — concessions need be made to neither function nor appearance.
For illumination, see "Options" on preceding page. Mounting to panel can be done in several ways; for information request applications bulletin AB6-1 from your Modutec rep or from factory. Price: Add $0.75 to the prices given for S series meters (preceding overleaf).

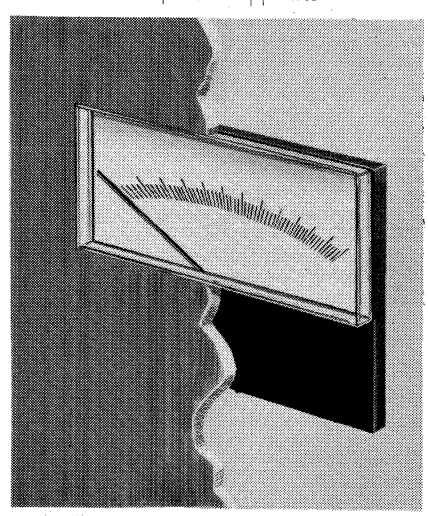
METER SIZE	A	B	C	D	E	F	M	N
1½"	1.31	1.31	2.145	.930	.535	.275	2.26	1.77
2½"	1.88	1.88	2.895	1.265	.638	.295	3.01	2.29
3½"	2.250	2.250	3.593	1.590	.804	.32	3.73	2.90
4½"	3.560	4.00	5.005	2.330	.856	.37	5.18	4.06
5½"	3.00	5.25	5.775	2.588	1.278	.37	5.97	4.60



MODIFICATIONS

Certain modifications of catalog meters, the specifications of which are normally detailed by the customer, can be accomplished quickly at Modutec factory modification centers, at costs proportionate to work required. Typical modifications:

Custom Dials or Scales — These can be produced from artwork supplied by Modutec or by customer.
Custom Colors — Meter covers can be finished with paint supplied by the customer.
Suppressed Zero — Up to 60% of the normal range may be suppressed.
Zero Right — Meters with zero-right movements and custom scale can be supplied.
Single-Point Calibration — Can be furnished to an accuracy of 1%.
Special Marking — Case or cover can be hot stamped with customer's name, trade-mark, etc.



SPECIALS

If your application demands special requirements beyond the listed options and modifications, communicate with us. Some of the areas of capability are:

Damping factor variation	VU meters
Response time variation	Multiple range meters
Special cases, covers	Externally adjustable
High sensitivity movements	(dead set) pointer

DISCOUNT SCHEDULE:

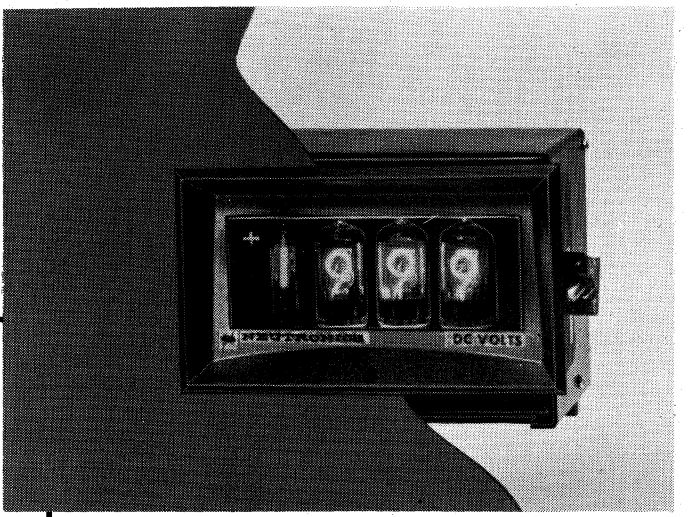
0-9 pcs. net; 10-24 pcs. 20%; 25-49 pcs. 25%; 50-99 pcs. 30%. Applies to options, modifications, and specials, except for one-time and setup charges.

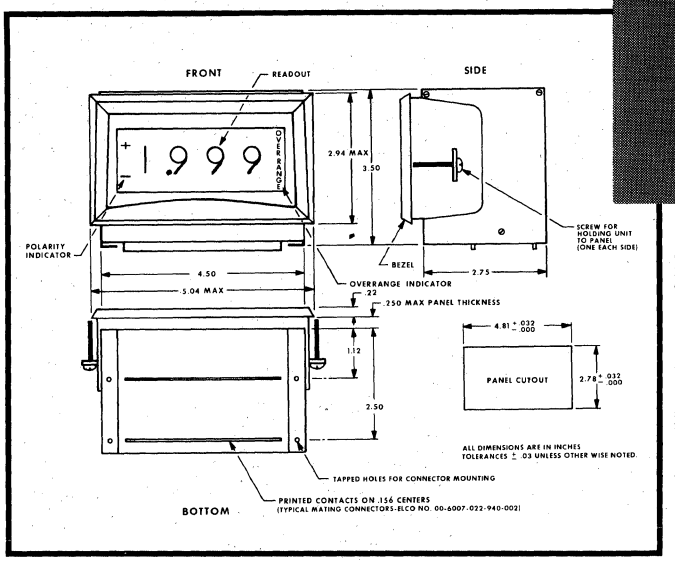
Standard meters shipped from stock. For fast service, contact your nearest Modutec representative, or call direct.

(PRICES EFFECTIVE JULY 1, 1969)

MODUTEC
INCORPORATED
18 Marshall St., Norwalk, Conn. 06854
Tel.: 203-853-3636 TWX: 710-468-2039

NEUTRONIC MODEL 100 SERIES DIGITAL PANEL METERS





FEATURES

- COMPACT: Physically interchangeable with most conventional 4.5″ Bezel Mount Panel Meters (3.5″ High x 4.5″ Wide x 2.75″ Deep).
- VERSATILE: Capable of measuring AC or DC Volts, Current (with DC Zero Suppression), or Ohms.
- TTL BCD DIGITAL OUTPUTS, REMOTE ENCODE AND ISOLATED ANALOG AND DIGITAL GROUNDS STANDARD: Ideally suited for Data Logging System requirements.
- AC OR DC OPERATION: Permits either stationary or mobile use.
- HIGH ACCURACY: ±0.1% of Reading ±01.% of Full Scale.
- HIGH INPUT IMPEDANCE: Greater than 1,000 Megohms on 0.2 Volt Range.
- 100 MICROVOLT RESOLUTION
- AUTOMATIC POLARITY AND OVERRANGE INDICATION
- NON-BLINKING WIDE ANGLE DISPLAY
- OVERLOAD PROTECTION

DESCRIPTION

The Neutronic Model 100 Series Digital Panel Meters were designed primarily as a high performance, low cost, 3½ digit instrument. They are direct replacements for most conventional 4.5″ bezel mount panel meters, thereby permitting instrument and system manufacturers to use interchangeably that meter which best suits their specific requirements.

MODEL 2000

RESISTANCE LIMIT BRIDGE

FEATURES

- 0 TO 1.2 GIGOHM RANGE
- ±0.005% ACCURACY AVAILABLE
- 1 PPM SENSITIVITY ON ALL RANGES
- LINEAR, DIRECT READING PERCENT DEVIATION
- AUTOMATIC DEVIATION METER RANGING
- NO DEVIATION METER ZERO OR CALIBRATION ADJUSTMENTS
- LOW OVERLOAD RECOVERY TIME
- TEST VOLTAGE PER MIL-R-93
- COMPLETELY FLOATING, GUARDED AND SHIELDED
- ALL SILICON SOLID STATE CIRCUITRY

DESCRIPTION

The Neutronic Model 2000 Resistance Limit Bridge is a human engineered, completely self-contained instrument, designed for use in the manufacture of resistors whenever control of a trimming process is required. The instrument incorporates a unique "Active Guarded Bridge" which permits features heretofore unobtainable in Resistance Limit Bridges. Namely, perfectly linear direct reading percent deviation, without any requirement for meter zeroing or calibration prior to use on any range.



ADDITIONAL NEUTRONIC PRODUCTS DETAILS ON REQUEST

Resistance Deviation Bridges • Automatic Resistance Bridges • Digital Clocks • Time Code Generators • Totalizing Counters • Preset Counters • AC & DC Power Supplies • Solid State Relays

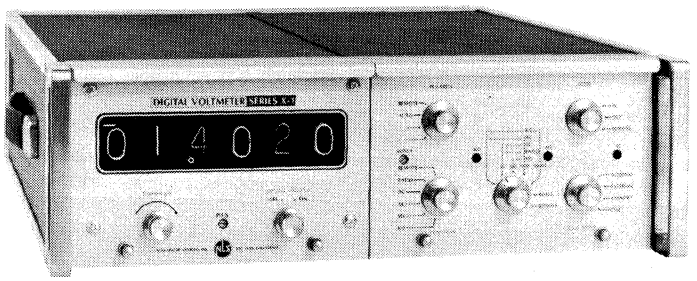
NEUTRONIC *Corporation*

New Concepts in Electronics

POST OFFICE BOX 625, ST. LOUIS, MISSOURI 63042 / 314/739-8817

NON-LINEAR SYSTEMS, INC.

ORIGINATOR OF THE DIGITAL VOLTMETER

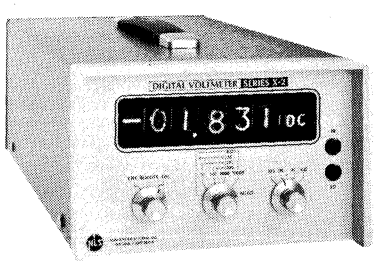


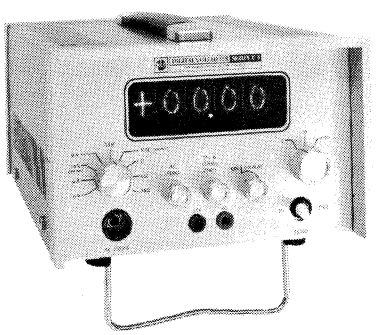
SERIES X-1 DIGITAL VOLTMETER

- Five digits plus sixth digit 20% over-range
- High speed—16 ms readings
  .001% linearity and resolution
- High Common Mode Rejection
- Prewired to accept plug-in options
- Options include—AC Converters, Ohms Converter, Millivolts Preamp, Active Filter, Ratio, Remote Trigger and Printout
- Automatic Ranging
- Automatic Polarity Indication
- Systems Compatible

EIGHT RANGE OHMMETER

- This special version of the X-1 has extended resistance measuring capability in 8 ranges from 11.9999 to 119.999 Megohms with extremely low test currents. Also measures DC volts, Millivolts and includes Active Filter.





SERIES X-2 DIGITAL VOLTMETER

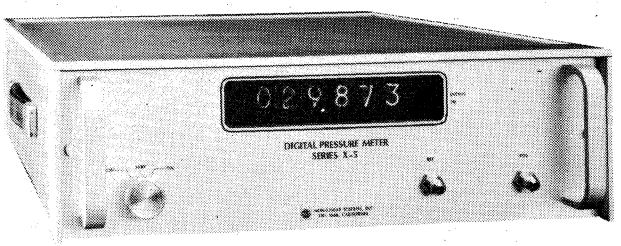
- Popular 4-digit model with 5th digit 20% over-range.
- Compact portable unit
- High Common and Normal Mode rejection
- Options include: AC Converter
  Ohms/Millivolts Converter
  Precision Preamp
  Automatic Ranging
  Ratio
  Printout
- Systems Compatible

SERIES X-3A DIGITAL MULTIMETER

- Wide Capability:
  DC Volts—10 μV to 1 KV in six ranges (to 30 KV with optional HV probe)
  AC Volts—0.5V to 300V in three ranges
  Ohms—10 milliohms to 2000 Megohms in nine ranges
  Current—10 picoamps to 200 milliamps in eight ranges (to two amps with optional shunt)
- 2000 digits per range (0.05% resolution)
- Fully protected inputs
- Automatic polarity and overload indicators scaled
- Analog output

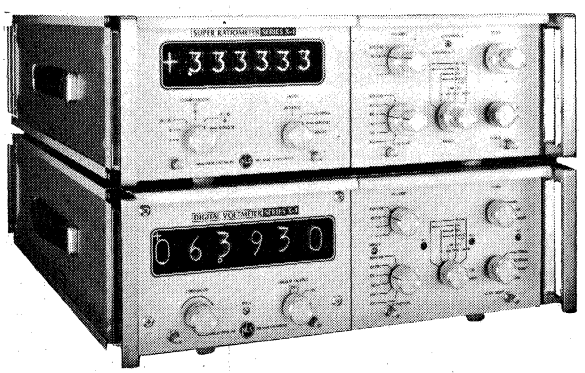
DEL MAR, CALIFORNIA
(714) 755-1134 / TWX: 910-322-1132

NON-LINEAR SYSTEMS, INC.



SERIES X-5 DIGITAL PRESSURE METER

- Direct digital readout of pressure in PSI or Inches of Mercury.
- Non Position Sensitive—reading is affected only 0.001% of full scale per degree of tilt.
- High Speed Operation—solid state electronics and only one moving part provide more than 30 readings/minute for improved production.
- Digital and/or Analog Data Outputs Available—to drive recorders or printers for permanent calibration and measurement records.
- Complete Portable Single-Package Construction—transducer and all electronics enclosed in a 5¼" high unit which is rack mountable for systems compatibility.
- "Take It With You"—unaffected by gravitational or barometric gradients.



SERIES X-6 SUPER RATIOMETER

- Measures and Computes Ratio ($\frac{A}{B}$), Difference (A—B), and Deviation ($\frac{A-B}{B}$) of any two analog inputs.
- Multifunction DC volts, AC volts, Ohms, Millivolts and Ratio (independent selection of each input function)
- Common Signal Path on both inputs
- Employs proven, high speed X-1 DVM

NEW
SERIES X-4 DIGITAL VOLTMETER

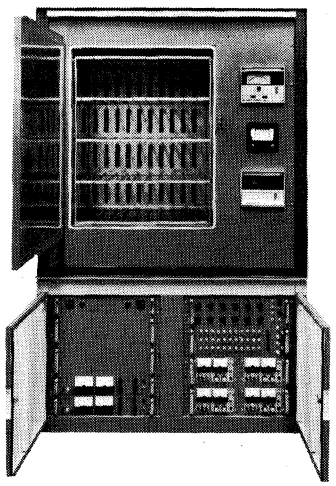
- Compact, miniaturized utility meter
- Three digits plus fourth digit 100% overrange
- Four ranges available: 0 to 1.999 VDC; 0 to 19.99 VDC; 0 to 199.9 VDC and 0 to 1000 VDC
- Digital (BCD 8-4-2-1) output available on rear connector
- Auto polarity indication
- Overload indicator
- Fast 60 readings/second
- Additional ACV, Ohms, Current, and Millivolt adapters available



S-1 DATA ACQUISITION SYSTEMS

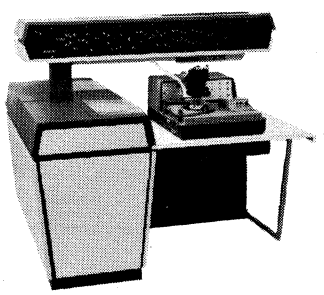
- Handles up to 1000 3-wire inputs
- Built around a .001% accuracy X-1 DVM
- Flexible modular construction
- Choice of input and output configuration to meet your requirements
- Programmable Function and Range Selection
- Field Expandable
- Wide selection of modules:
  - Scanners—crossbar or reed relay up to 1000 channels
  - Comparators—Hi, Lo, Go output
  - Digital Clocks—
  - Parallel-to-Serial Converters
  - Digital Printers
  - Incremental Mag Tape
  - Various output devices
  - Special interface units

NON-LINEAR SYSTEMS, INC.



MODULAR AGING SYSTEMS

- Especially designed to age MOS LSI devices
- Low cost-per-device
- High density device storage
- Quick change socket configuration
- Triple safety temperature control
- Low temperature gradients
- Expandable modular construction
- Programmable multiphase clock
- Over-voltage and short-circuit protection
- Real time data excitation
- Handles up to 40 lead devices



ARRAY TEST SYSTEMS

Non-Linear Systems manufactures LSIC Array Test Systems to completely exercise and test functional and DC parameters of LSI devices.
Operation is fully automatic for testing complex wafers or packaged units. Contact factory with your specific requirements.

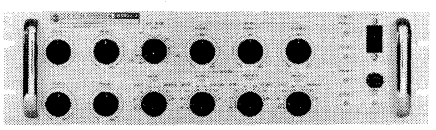
Non-Linear Systems maintains a world-wide staff of experienced applications engineers to serve you. Please call the factory *collect* for address of your local NLS sales office.

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA 92014
[714] 755-1134/TWX: 910-322-1132



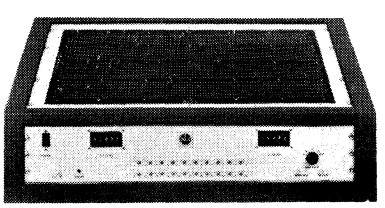
S-2 DATA ACQUISITION SYSTEMS

- Four digit X-2 DVM
- Compact, portable 10½" high
- Mag tape output
- 32 channel 4-wire Scanner
- Expandable with modules listed under S-1
- Low Cost



C-4A FOUR PHASE CLOCK PULSE GENERATOR

- Four clock pulses with independent amplitude, phasing and width controls.
- Common Rep Rate Control—from 100 H_Z to 3 MH_Z
- Linear Phase Tracking with Frequency
- Overload protection
- Amplitude continuously variable from 0 to —30 volts on each phase.



MODEL 22-1 WORD GENERATOR

- 22 Separate channels
- Word length variable from 10 to 100 bits/channel
- Rapid, simple programming
- Precision programmable level controls
- Bi polar outputs, plus or minus 15 V
- 2 MH_Z Clock

NORTH ATLANTIC industries, inc.

AC PHASE SENSITIVE

Resolver/Synchro Simulators & Bridges

Most instruments offer a dual mode capability, permitting a single model to work with both resolvers and synchros. All units feature input/output isolation, and also direct in-line readout of angle, i.e., 359.999°, thus eliminating operator confusion, reading error and fatigue. All dual-mode units are also available as single-mode resolver or synchro units.

Series 530—Resolver/Synchro Simulators

These simulators provide the ideal outputs for driving resolvers and synchros at 11.8, 26, 90 and 115 V line-line voltages. These line-line voltages are all available with either 26 V or 15 V 400 Hz excitation, and feature isolated input and output. Accuracy is 2 arc-seconds. Standard resolutions are .0001°, .001°, 1° and 5°, with standard units 3½" full-rack. Optional half-rack mounting for 1° and 5° resolution models.

Model 530/20, 540/20 Broadband Resolver/ Synchro Simulator & Bridge

These broadband instruments operate over the frequency range from 50 Hz to 10 KHz, and provide accuracy to 10 arc-seconds. Their flat frequency vs. accuracy characteristic makes either unit an ideal choice for test facilities requiring maximum utility from all instruments. Both the Simulator and the Bridge provide selectable resolver-and-synchro-modes for all standard line-line voltages in a 5¼" high full-rack unit. Angle is displayed as a non-ambiguous in-line readout from 0° to 360°.

Model 532—Miniature Synchro Simulator

Model 532 is a miniature synchro simulator offering precision performance in a small panel-mounted unit suitable for production test, ground support and similar systems. Direct simulation of 11.8 V 400 Hz line-line synchro transmitters (CX) is provided, with dial reading in 30° segments plus 5° increments selectable by sealed thumb-wheel switches and accurate to 30 arc-seconds. A similarly packaged Resolver Simulator, Model 531, is also available. Units can be supplied with several options, including 90 V line-line output.



Series 540—Resolver/Synchro Bridge

These bridges permit direct measurement of resolver and synchro transmitters. They feature a constant null gradient output voltage, isolated input and output, input impedance over 500K, and 400 Hz accuracy of 2 arc seconds. Standard resolutions are .0001°, 1°, and 5°, and are provided in a 3½" full-rack panel unit. Optional half-rack mounting for 1° and 5° resolution models.

Model 541/10—Miniature Resolver Bridge

This Miniature Resolver Bridge is designed for panel-mount applications in production and field test equipment. It measures the angular position of 400 Hz resolver transmitters with an accuracy of 5 arc-seconds. Manual balance is by coarse and fine sealed thumbwheel switches, with readout in 45° segments plus 5° steps. A Miniature Synchro Bridge, Model 542/10, is available in an identical package.

RTS-573

An integrated 400 Hz Resolver/Synchro Test Console for complete resolver and synchro testing. Tests include Phase Shift, TR, Angular Accuracy, Electrical Zero, Phasing, Total and Fundamental Nulls, Input Current.

Angle Position Indicators

High-speed performance 400 Hz servos for field test and production test measurement of synchro and resolver transmitters. The half-rack API-8025 provides accuracy of 6 arc minutes, repeatability of 30 arc seconds, and slew speed of 25°/second with a digital readout display. Optional retransmit components, dual-mode, and two-speed operation. Also available for operational use, 2" and 3" diameter units.

Model 545—Automatic Angle Position Indicator

This instrument is offered with .01° resolution and accuracy or with .001° resolution and 10-second accuracy for all line-to-line voltages from 11.8 to 90 V at 400 Hz. The digital angle is both displayed and available in BCD format at the rear connectors. Remote or front-panel selection of resolver or synchro input, line-line voltage range and operating mode. Operating modes selected as Track (the instrument continuously follows the input data), Update (the instrument tracks for 200 msec, then holds until receipt of another command), and Auto-Update (repetitive track/hold sequences) with a Variable Display Time of .5 to 3 seconds. Optional remote readout, analog d-c null output, data freeze command, signal frequencies 50 Hz to 4.8 KHz, multiplexed and multi-speed.

AC Ratio Boxes

These precision inductive voltage dividers provide ideal characteristics for use in ratiometric measurements. They feature high input impedance, low output impedance, and accuracy over a wide frequency band. All units have direct in-line non-ambiguous readout and occupy a minimum of panel space.

RB-503, RB-504—AC Ratio Boxes

For production test use, the RB-503 features 10 ppm accuracy from 50 Hz to 5 KHz, Zin 300K, Zo 3.5Ω, 0.35f volts input rating and a ratio range from 0 to 1.111110. RB-504 features 1 ppm accuracy from 300 Hz to 2 KHz, Zin 200K, Zo 8.5Ω, 0.7f volts input rating, and a ratio range from −0.111110 to +1.111110.

RB-503T, RB-504T—Inverting AC Ratio Boxes

Both models feature isolated input with full inversion capability. Ratio range is ±1.111110 with 0.35f volts input rating. The accuracy is 10 ppm and 3 ppm respectively for each model over the entire ratio range. Higher accuracy and input voltage rating is included through a built-in direct-input mode.

INSTRUMENTS, RATIO BOXES, AND ANGLE POSITION INDICATORS.

Model 503/10—AC Ratio Box

This broadband unit has a ratio range 0 to 1, operates from 50 Hz to 10 KHz with 10 ppm accuracy from 50 Hz to 3 KHz, and 100 ppm from 3 KHz to 10 KHz. This 3½" high full-rack unit is environmentally qualified for temperature, humidity, altitude, shock, and vibration.

RB-521—Miniature Ratio Box

For field use, this instrument features drip- and splash-proof construction while providing 10 ppm accuracy. Zin 250K, Zo 3.5Ω, 0.35f volts input rating.

Phase Angle Voltmeters

These multifunctional instruments combine phase-sensitive modes with the functions of a conventional a-c voltmeter operating over the range of 10 Hz to 100 KHz. They provide direct-reading voltage measurement of the total, fundamental, in-phase and quadrature components of an a-c signal to 2% full-scale, as well as phase angle to 1°. They feature calibrated voltage ranges of 300 μV (or 1 mV) to 300 V rms full-scale, built-in or plug-in harmonic-rejection filters, high quadrature overload capability, and operate with a wide range of reference voltages.

Model 214A, 214B, 214C—Four-Frequency Phase Angle Voltmeter

For production test use, these solid-state instruments provide phase sensitive operation at 1, 2, 3, or 4 frequencies 30 Hz to 20 KHz. Features include ±5% bandwidth without adjustment, adjustable meter scaling for go/no-go applications, and 300 μV to 300 V full-scale ranges. Rapid field change of frequency modules accomplished with simple one-control recalibration procedure. Available as Model 214A (no isolation), 214B (reference isolation), and 214C (signal and reference isolation). Optional rear connectors, 10 μV full-scale range.

Model 240, Model 245—Phase Angle Voltmeters

For field support use, these transistorized Phase Angle Voltmeters are designed for operation at a specified frequency from 30 Hz to 20 KHz. Similar performance to the Series 214 with operation at a fixed reference level. Optional d-c voltmeter function.

VM-202—Phase Angle Voltmeter

The original Phase Angle Voltmeter designed for production test use, provides phase-sensitive operation at a single-specified frequency 30 Hz to 10 KHz. Optional signal and/or reference isolation. Also available in 2- or 3-frequency Model VM-204.

Model 301A—Broadband Phase Angle Voltmeter

For production test and laboratory use, this broadband instrument is designed for continuous phase sensitive operation from 10 Hz to 100 KHz with a phase angle accuracy of 0.25° from 30 Hz to 30 KHz. Harmonic rejection filters are available and simply plugged in behind the swinging meter panel.

Model 215C—Militarized Phase Angle Voltmeter

Provides over-all functions of and similar performance to the Model 214C Phase Angle Voltmeter in a configuration qualified to MIL-T-21200, and designed for operation from 0° to 75°C. Construction includes drip-proof front panel, booted toggle switches, panel meter per MIL-M-10304B, sealed controls and RFI gaskets.

NORTH ATLANTIC industries, inc.
TERMINAL DRIVE, PLAINVIEW, NEW YORK 11803 • 516—681-8600

Model 212A, 212B, 212C—Transistorized Phase Angle Voltmeter

This solid-state instrument, successor to the famous VM-202, provides phase-sensitive measurement at a single pre-specified frequency from 30 Hz to 10 KHz with full-scale measurement from 300 μV to 300 V. Three basic models are available: Model 212A (no isolation), Model 212B (reference isolation), and Model 212C (signal and reference isolation).

Phase Sensitive Converters

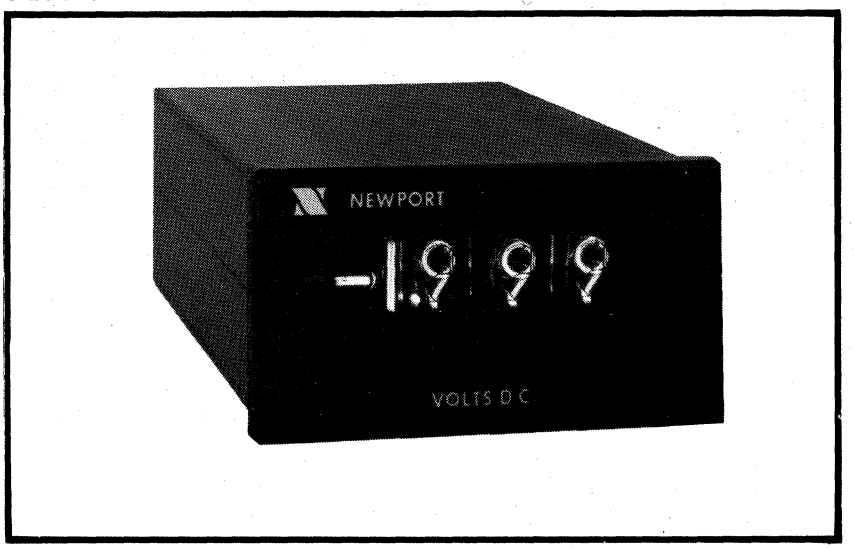
PSC-419—Phase Sensitive AC/DC Converter

For automatic test systems, this programmable instrument converts 400 Hz signal components to high-level d-c with 0.1% linearity and 0.003% scale factor change from −40° to +75°C. Input sensitivity 10 mV full-scale for 10 vdc full-scale output with 100 msec response time. Output impedance 0.2Ω. Accessory panel available to provide rack mounting and manual input controls. Optional operation at other frequencies to 10 KHz.

Phase Sensitive Converter—Model 431

Designed as a building block for the GPATS (General Purpose Automatic Test System), this special purpose Phase Sensitive Converter measures total, fundamental, in-phase and quadrature voltages, and reads angles directly. It operates in multiple frequency bands from 60 Hz to 15 KHz.





DIGITAL PANEL METERS

AC, DC, voltage, current, ratio
non-blinking display
overrange indication
0.1% R error, 1999 FS
0.5% R error, 199 FS for $150
isolation of analog from digital ground up to 60 readings per second

Definitions: "R" means reading; "FS" means full scale

	DC VOLTAGE METERS									AC VOLTAGE METERS					RATIO METERS
Model	20-1	20-2	20-3	20-4	200-1	200-2	200-3	200-4	200-5	220-1	220-2	220-3	220-4	22-1	Reference, ±10V ±20% 1999-count meters only
Full Scale	199mv	1.99v	19.9v	199v	19.99mv	199.9mv	1.999v	19.99v	199.9v	199.9mv	1.999v	19.99v	199.9v	199v	
Resolution	1mv	10mv	100mv	1v	10μv	100μv	1mv	10mv	100mv	100μv	1mv	10mv	100mv	1v	0.05 %FS
Impedance, ohms	10M				1G			10M		100K	1M	10M		1M	reference input, > 10M
Maximum Overdrive	100v	200v	1Kv		30v	100v	200v	1Kv		100v	200v	1Kv		1kvp.	reference input, 50 volts
Maximum Error 15 to 35 °C	1mv ±0.5 %R ±0.5 %FS				0.1 %R± 0.15 %FS	0.1 %R± 0.1 %FS	0.1 %R± 0.05 %FS	0.1 %R ±0.1 %FS		100μv ±0.2 %R ±0.15 %FS 48Hz to 500Hz				0.5 %R± 0.5 %FS	add 0.1 %R to the basic meter specification

	DC CURRENT METERS										AC CURRENT METERS					
Model	21-1	21-2	21-3	21-4	21-5	210-1	210-2	210-3	210-4	210-5	210-6	230-1	230-2	230-3	230-4	230-5	230-6
Full Scale	19.9μa	199μa	1.99ma	19.9ma	199ma	1.999μa	19.99μa	199.9μa	1.999ma	19.99ma	199.9ma	1.999μa	19.99μa	199.9μa	1.999ma	19.99ma	199.9ma
Resolution	10na	1μa	10μa	100μa	1ma	1na	10na	100na	1μa	10μa	100μa	1na	10na	100na	1μa	10μa	100μa
Voltage Drop	200mv full scale											200mv full scale					
Maximum Overdrive	3ma	10ma	30ma	100ma	500ma	1ma	3ma	10ma	30ma	100ma	500ma	1ma	3ma	10ma	30ma	100ma	500ma
Maximum Error 15 to 35 °C	10na ±0.5 %R ±0.5 %FS					2na ±0.15 %R ±0.1 %FS						2na ±0.25 %R ±0.2 %FS 48Hz to 500Hz					

BCD ELECTRICAL OUTPUT & CONTROL

1999-count meters only

EXTERNAL CONTROL, all F options

Measurements may be externally controlled as desired by use of the Measurement Enable input. While the Measurement Enable input is maintained true, measurements occur at 60 readings per second. While it is false, the last measurement is held in memory. This mode of external control is standard, but an internal storage element may be activated on request to allow control by pulses or transitions.

Measurement Enable input

	voltage level	loading effect
False:	+3.5v to +6v	0.1 ma max. into DPM
True:	—1v to +0.5v	1.5 ma max. from DPM

DATA READY SIGNAL, all F options

The Data Ready signal goes true upon completion of a measurement, and remains true until the next measurement is started. During this time, the BCD outputs constitute a valid reading available for use by an external device. The Data Ready signal normally remains true for at least 6 ms, and may be held true indefinitely by holding the Measurement Enable signal false. Data Ready signal characteristics are

True: +4.5v to +6.5v — 22K source resistance
False: 0v to +0.5v — 5 ma current sink

DIGITAL OUTPUTS, options F2 and F3

The BCD electrical output includes overrange and polarity bits, as well as the magnitude of the reading. Signal characteristics are

True: +4.5v to +6.5v — 22K source resistance
False: 0v to +0.6v — 3 ma current sink

GENERAL SPECIFICATIONS

Please consult the factory regarding non-standard ranges, programmable ranges, and non-standard settling times.

READING RATE

	1999 counts FS	199 counts FS
internal control mode:	standard, 4/sec optional, 60/sec	standard, 4/sec optional, 30/sec
external control mode:	0 to 60/sec	

SETTLING TIME after a full-scale step input, to within 0.1%FS: 140 msec

COMMON-MODE REJECTION, at 60 hertz

	500 V isolation	10 V isolation
with respect to digital ground:	80 db (option F3)	40 db (option E2)
with respect to case or power ground:	80 db	

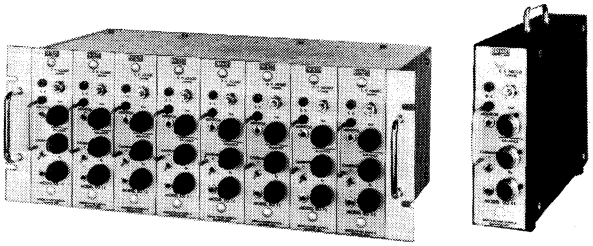
OPERATING ENVIRONMENT
temperature: —20 to +60°C
relative humidity: 0 to 90%

POWER REQUIREMENTS, 4.5 watts
standard: 120v RMS ±10%, 60 Hz
option C: 220v RMS ±10%, 50 Hz

CHARACTER HEIGHT: 0.6 inch **WEIGHT:** 2 pounds

NEWPORT LABORATORIES, INC.
630 East Young Street
Santa Ana, California 92705
Telephone (714) 540-4914

SIGNAL CONDITIONERS



The SG-11 series of Transducer Bridge Signal Conditioning Units are self-contained plug-in instruments designed to be used with various strain-gage transducers. Each consists of a highly regulated, adjustable power supply and the balance, calibration and monitoring circuitry to be used with four, six and eight wire shielded systems. The power supply circuit exhibits very high temperature and time stability and provides line and load regulation of 0.01%; excitation voltage is continuously adjustable from 0 to 16 volts at 0 to 150 mA. The all-silicon transistor circuitry features a self-restoring current limit circuit. These units can be wired for constant-current operation.

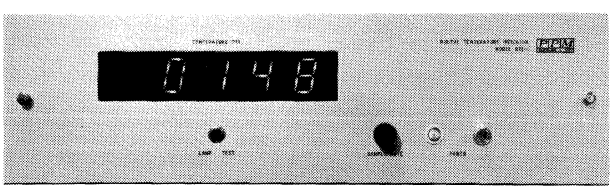
Extreme care has been taken to provide very high isolation to line — less than 0.03 pF coupling capacitance from power line to D.C. output — so that the instrument's performance approximates that of battery operation.

The BALANCE, CALIBRATION, and E. V. COARSE and FINE adjust controls are on the panel for easy adjustment and are all ten-turn potentiometers of very high resolution. A single shunt is used for calibration.

Two types of enclosures are available: a relay-rack mounting enclosure that permits the mounting of eight units side-by-side in a 19-inch rack and a portable enclosure, accepting a single plug-in unit. A plug-in power supply, only, is also available.

MODEL SG-11 PLUG-IN UNIT (eight shown in rack) **$187.50** each
MODEL SG-11-R RELAY-RACK MOUNTING ENCLOSURE (as shown) with solder terminals only **$90.00** each
MODEL SG-11-RC RELAY-RACK MOUNTING ENCLOSURE with MS connectors (mating connectors included) **$250.00** each
MODEL SG-11-P PORTABLE ENCLOSURE (as shown) **$39.50** each

Write for Bulletin SG and Application Notes.
Models for conditioning other transducers are also available.

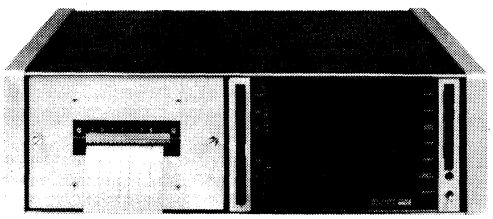


The Digital Temperature Indicator, Model DTI-1 series, accepts signals from various thermocouples, amplifies and linearizes these signals, and displays temperature in digital form. BCD outputs are available for external printers or comparators. Bulletin DTI.

ALPHA-NUMERIC DISPLAYS

We design and build a wide variety of data displays for commercial and industrial use. Digits up to 20 in. high — readable 500 feet away — with solid state control circuitry. Ask for quotation to meet your display requirements.

DATA LOGGERS



The Model DL-2 Data Logger is a complete data acquisition system in a compact, portable package. It will scan up to 100 differential signals, digitize them, and print out their values to four places, also printing range, polarity and channel number. All data is displayed in the form of ⅛ inch high characters on the printer wheels.

Data Logger with 10 Channels **$1995.00**
Data Logger with 100 Channels **$2445.00**

PPM offers custom systems and Systems Components for data acquisition and process control. PPM Data Acquisition Systems will accept as many as 1000 individual signals; these signals are scanned, digitized, and recorded in printed form or on punched or magnetic tape. Alarm outputs are available for signals falling outside of preset limits. For systems applications we offer several Systems Components, such as:

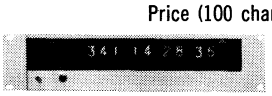
COUPLERS to drive various output devices such as card or paper tape punches, magnetic tape recorders, PPM (or other) printers, and electric typewriters.

PRINTERS to accept most data codes are available up to 30 columns wide (see Data Logger above). Bulletin DP.

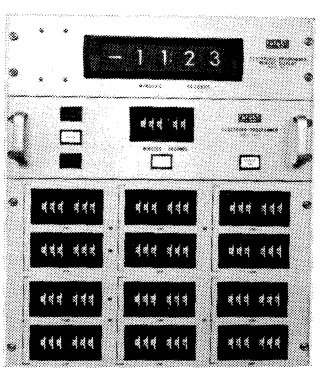
COMPARATORS to provide GO - NO GO comparison between digital data and preset limits or between two sets of digital data.

SCANNERS reed relay and low level, are available with a wide choice of options. These include programming pinboards, analog channel output, and others. Bulletin SN.

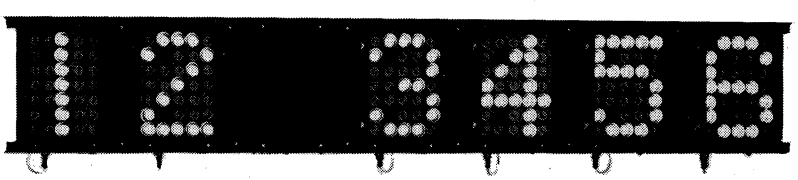
Price (100 channel 2-pole reed-relay scanner)..**$995.00**



↑ DIGITAL CLOCK
Modular construction affords flexibility in meeting your special requiremens. Options, include crystal oscillator time base, additional digits, and time interval output. Bulletin DC.
Price (6 Digit DC-4).....**$650.00**



ELECTRONIC PROGRAMMER →
The Model EP-1 provides relay contact operation at programmed start and stop times. Bulletin EP.



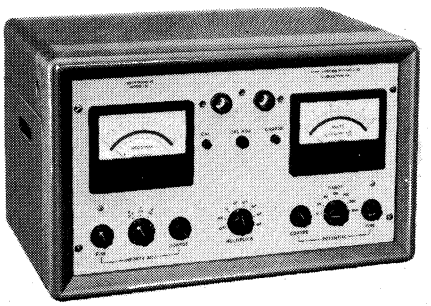
All priced equipment available from stock.

PPM CLEVELAND • OHIO

CALL US COLLECT WITH YOUR SPECIAL REQUIREMENTS
7016 EUCLID AVENUE • CLEVELAND, OHIO 44103
Telephone: (216) 361-4720

ultra high resistance testers

Meet the "MEGATROMETER"... for Measuring Resistance to 75,000 Million Megohms



ADVANTAGES:

Fast and Simple Operation — just as easy to us as an Ohmmeter!
Direct Reading — no nulling needed.
Low Cost — prices from $960.

USES:

Resistance measurements of ultra-high magnitude.
Insulation resistance measurements of ceramics and other materials.
Analyzing the effects of temperature, humidity, surface leakage and other critical characteristics of semiconductors and insulators.
Remote resistance measurements using extension cables and a Faraday Cage.

The "Megatrometer" is a self-contained test device capable of measuring resistances from 14,000 ohms to 7.5 x 10^{16} ohms. The test potential is continuously variable with ranges of 0-1,000 VDC or 0-1,500 VDC. It is accurate enough (±3% upper half scale) for general laboratory and engineering development, yet simple and rugged enough for use in production testing.

The unique circuitry of the "Megatrometer" employs an extremely small grid current which permits the determination of ultra-high resistance measurements. It is completely portable, no external AC supply is required as the unit uses mercury "D" cells and BC batteries. Battery life under normal usage is approximately six months. The "Megatrometer" is safe under all operating conditions, and can not be damaged by short circuits or severe mechanical shock.

SPECIFICATIONS:

Resistance & Test Potential Ranges

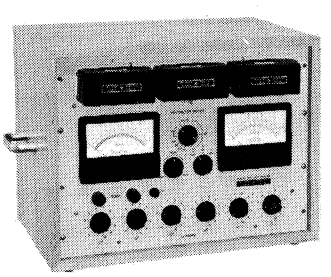
Model No.	Resistance Range	Test Potential
710	14,000Ω to 5 x 10^{15}	0-1,000 Volts, DC
710H	140,000Ω to 5 x 10^{16}	0-1,000 Volts, DC
710V	140,000Ω to 7.5 x 10^{16}	0-1,500 Volts, DC

Measurement Range for Various Test Potentials:

VOLTAGE	RANGE IN OHMS		
	710	710 H	710 V
3	14K – 5 x 10^{12}	140K – 5 x 10^{13}	140K – 5 x 10^{13}
10	50K – 5 x 10^{13}	500K – 5 x 10^{14}	500K – 5 x 10^{14}
25	4 x 10^{5} – 1.2 x 10^{14}	4 x 10^{7} – 1.2 x 10^{15}	4 x 10^{7} – 1.2 x 10^{15}
50	5 x 10^{6} – 2.5 x 10^{14}	5 x 10^{7} – 2.5 x 10^{15}	5 x 10^{7} – 2.5 x 10^{15}
100	1 x 10^{7} – 5 x 10^{14}	1 x 10^{8} – 5 x 10^{15}	1 x 10^{8} – 5 x 10^{15}
250-1000	2 x 10^{7} – 5 x 10^{15}	2 x 10^{8} – 5 x 10^{16}	2 x 10^{8} – 5 x 10^{16}
1500	–	–	2 x 10^{8} – 7.5 x 10^{16}

Accuracy: ±3% upper ½ scale. (Higher accuracies obtainable by using front panel calibration adjustment and plug-in resistor standards.)
Calibration: Built-in 10 Megohm 0.2% calibration standard. Push button on front panel permits fast, easy calibration.
Meters: Precision, fan-type with mirror scale.
Power Supply: 8 mercury "D" cells. (The internal transistorized power supply impedance at 1,000 volts is sufficiently high to preclude the possibility of shock so common to low impedance-type power supplies.)
Guard Circuit: A guard ring network intercepts all leakage current flowing across the electrode insulators and by-passes it around the electrometer circuit.
Dimensions: 21½" W x 13⅛" H x 15⅛" D in cabinet. Rack panel can be removed and mounted in a standard 19" relay rack.
Weight: Net approx. 40 lbs., shipping approx. 45 lbs.
Prices: Model No. 710 — $ 960. FOB Southampton, Pa.
Model No. 710H — $1,500. " "
Model No. 710V — $2,100. " "
Options: Volume Resistivity Jig — Plug-in design for rapid comparative measurements of resins, thin tapes, etc. up to 7.5 x 10^{17} ohms/cm³. Tests can be made in ten seconds. Dimensions: 5" x 2" x 2¼" . . . $85. **Extension Cables**—Dual, 6-ft., Teflon-insulated cables terminating in Faraday boxes at each end . . . $98.

Presenting the Precision Model 801 RESISTANCE STANDARD BRIDGE



ADVANTAGES:

High Accuracy — 0.04%!
Continuously Variable Test Potential — 0-1,000 VDC.
Plug-In Ratio Standards — 9 units serve as bridge arms.

USES:

Primary calibration laboratories.
Voltage coefficient analysis for matching of components.
Calibration of high Megohm resistors to close tolerances.

The Model 801 Resistance Standard Bridge is a self-contained precision instrument of exceptionally high resolution for resistance measurements from 1,000 ohms to 1.1 x 10^{14} ohms. Calibration is traceable to the National Bureau of Standards. The test potential is continuously variable up to 1,000 VDC. Six decades are included and battery operation assures the highest accuracy and stability as well as portability.

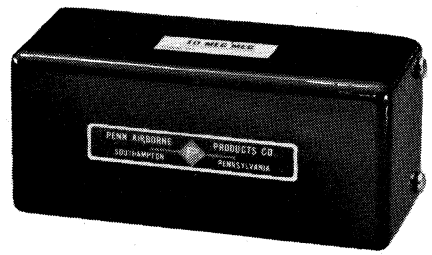
SPECIFICATIONS:

Resistance Range: 1,000 ohms to 1.1 x 10^{14} ohms.
Ratio Standards: 9-plug-in laboratory standard resistors supplied to serve as bridge ratio arms.
Meters: Precision, fan-type with mirror scale.
Power Supply: Batteries (internal).
Housing: Oak case, designed so it can be mounted in a standard relay rack.
Dimensions: 20½" W x 16" H x 14" D (with handles width is 24").
Weight: Net approx. 40 lbs., shipping approx. 45 lbs.
Price: $2,550 . . . FOB Southampton, Pa.

PENN AIRBORNE PRODUCTS COMPANY
INDUSTRIAL HIGHWAY • SOUTHAMPTON, PA. 18966 • PHONE: (215) 355-3400
FORMERLY MANUFACTURED BY MID-EASTERN ELECTRONICS, INC.

ultra high resistance standards

Certified RESISTOR STANDARDS with 1% or 0.2% Certification



ADVANTAGES:

Ultra-High Values — from 10 to 10 million Megohms.
Traceable to the National Bureau of Standards.
Economical!

USES:

As primary laboratory standards.
Calibration of test equipment for military specifications on resistance and leakage.
Extending the range of the "Megatometer," and the Resistance Standard Bridge.

Three basic types of Certified Resistance Standards in the ultra-high resistance range of 10 Megohms to 10,000,000 Megohms are available:

1). **Reference Series** — with resistance values selected to within 10% of listed values, measured to within 0.1%, and certified to within 1%.

2). **Precision Series** — with resistance values selected to within 10% of listed values, measured to within 0.02%, and certified to within 0.2%.

3). **Exact Series** — with resistance values selected to within 1% of listed values, measured to within 0.02%, and certified to within 0.2%.

Each Resistor Standard is the culmination of months of meticulous processing, ageing cycles, measured, labeled, stored, shelf aged and measured again. This process is repeated until stability in terms of long term drift is less than 0.2% during the first year.

Resistors are mounted in a specially designed Faraday Box which plugs into the terminals of the "Megatrometer," Standard Resistance Bridge or with special mounting for use with compatible instruments. Teflon insulation is used exclusively and surface leakages are virtually eliminated through a special silicone treatment.

SPECIFICATIONS:

Resistance Values Available & Prices:

RESISTANCE IN MEGOHMS*	UNIT PRICE		
	REFERENCE	PRECISION	EXACT
10	$ —	$ 72.00	$115.00
100	34.00	98.00	126.00
1,000	36.50	110.00	139.00
10,000	42.50	117.00	148.00
100,000	49.00	165.00	198.00
1,000,000	58.00	—	—
10,000,000	72.00	—	—

Voltage Coefficient: Approx. 0.001%/volt. The precise coefficient is given for each resistor of the Precision and Exact Series.

Temperature Coefficient: 10 Megohm units approx. 15PPM/°F; high Megohms approx. 0.2%/°F. The Precision and Exact Series supplied with temp./resistance curves.

Stability: The greatest portion of long term drift occurs during the first year after delivery — less than 0.2% for high Megohm units. Recalibration and recertification is recommended. Use Penn Airborne complete calibration facilities for prompt service.

Leakage: Teflon insulation employed and a guard terminal is used which connects to the guard ring electrode of a Megatrometer or Bridge.

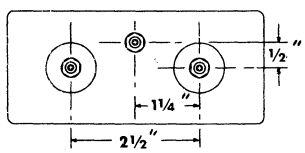
Certification: Reference Series resistors are certified to within 1%. The resistor's temperature coefficient is supplied on the certificate. Precision and Exact Series units are certified to within 0.2%, and a certificate plus a temp./resistance curve are furnished with each unit.

Dimensions: 5" W x 2¼" H x 2" D, with banana plugs extending 1" beyond the 2" dimension.

Standard Mounting:

Special Mounting: Consult Factory.

Weight: Shipping approx. ¾ pound per unit.



RECERTIFICATION of RESISTOR STANDARDS with RAPID Turnaround!

Even Exact Series resistors are subject to long term drift and eventual recalibration and recertification is necessary. At Penn Airborne we are equipped and staffed to provide fast recertification of not only our own ultra-high Resistance Standards, but also others.

Simply return your units with a purchase order. The units will be re-certified as stated under Certification.

Prices: Reference Series Resistors: **$25.** Precision or Exact Series Resistors: **$50.**

Turnaround: Normally within two weeks, with emergency aid available.



OTHER PENN AIRBORNE PRODUCTS...

As you probably surmise from our name, we do manufacture other equipment. Our original products are instruments for aerospace applications, including Liquid Oxygen quantity indicators, Exhaust Gas Temperature indicators and special control panels. We regularly work to quality control Mil-Q-9858A. Simply contact us for specifics.

PENN AIRBORNE PRODUCTS COMPANY

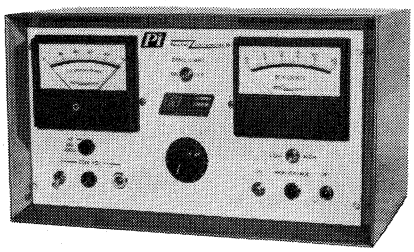
INDUSTRIAL HIGHWAY • SOUTHAMPTON, PA. 18966 • PHONE: (215) 355-3400

FORMERLY MANUFACTURED BY MID-EASTERN ELECTRONICS, INC.

DC Non-Destructive Hipot and Insulation Testers

SERIES H, H-AC/DC, and SL

Extremely reliable, widely used DC test sets for non-destructive qualitative laboratory or production testing of dielectric materials requiring accurate leakage measurements. Expressly designed for sensitive current measurement and detection of microampere leakage in insulation. High internal impedance and microamp overcurrent cutout promotes non-destructive testing and safety for operating personnel. Solid state rectifiers and surge protection provide extended life and reliability. Series "S" sets feature higher current and voltage capacity.



	MODEL	OUTPUT RANGE KV - MA	PRICE
AIR DC	H2	0-2 @ 5	$325
	H5	0-5 @ 5	350
	H10	0-10 @ 5	380
	H20	0-20 @ 1.5	400
	H30	0-30 @ 1	**450**
	H50	0-50 @ 1	500
AIR DC/AC	H2 AC/DC	0-2 @ 5 AC/DC	$275
	H5 AC/DC	0-5 @ 5 AC/DC	300
	H10 AC/DC	0-10 @ 5 AC/DC	330
OIL DC	S50L	0-50 @ 5	$ 700
	S120L	0-120 @ 5	1325
	S150L	0-150 @ 5	1650
	S250L	0-250 @ 5	3200

See "PP" Units Page 2061 in Section 4000 for Units with Low-Cost Controls

OPTIONS

MEMORY VM	$45
0 - 1/10/100μa CM	$45
GUARDED RETURN	$25
AUDIBLE ALARM	$30

FEATURES

High sensitivity — 50 μa F.S. current-meter

RANGES 0-50/500/5000 μa.

Accurate metering — directly at output.

Safety — high impedance, low current.

Interlocks — zero start, external.

Electronic high speed overload relay.

Long life, reliability — All solid state circuitry and surge protection.

GENERAL SPECIFICATIONS

Input	115-volt, 60-Hertz, 1-phase, 3-conductor grounding-type cord.
Output	Continuously adjustable — — 6-foot HV and grounded return cables.
Regulation	Approx. 25% N.L. to F.L.
Ripple	Approx. 2% at full load.
Overcurrent	Relay — continuously adjustable 10 - 5000 μa.
Metering	Dual-scale, VM 4½", 2% full-scale accuracy, 3 range CM. Taut Band, Mirror Scale.
Polarity	Negative output, positive grounded.

SEND FOR CATALOG

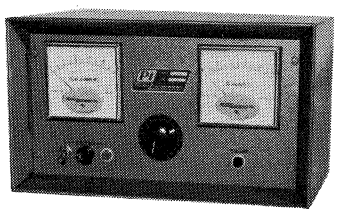
Standard Portable DC and AC Hipot Testers

SERIES S (DC) and P (AC)

Low-cost, self-protecting units for production testing of insulation materials; resistors, capacitors, harnesses, transformers, and relays. Built-in protective features automatically limit short-circuit current to a safe value. Also used for testing completed electrical appliances. Series S units are excellent for DC hipot tests, impulse testing or capacitor charging. Taut Band Meters.

MODEL	OUTPUT KILOVOLTS	PRICE
	DC	
S2	0-2	$150
S5	0-5	160
S10	0-10	200
S20	0-20	250
S30	0-30	300
	AC	
P2	0-2 KV	$140
P5	0-5 KV	150
P10	0-10 KV	170
P15	0-15 KV	220
P20	0-20 KV	250

Model S2



FEATURES

Simplicity — extremely simple controls for use by production personnel.

Reliability — small number of components; short-circuit protected.

Accuracy — direct metering of output.

Safety — self-protecting; output voltage merely drops to zero when output is shorted . . . is immediately reestablished when short is removed.

Arc detector — for breakdown or fault detection, in addition to currentmeter.

Continuously variable output by means of powerstat.

Totally enclosed dead-front construction.

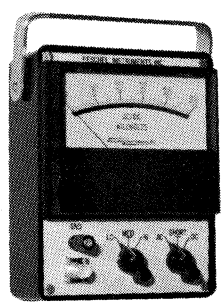
GENERAL SPECIFICATIONS

Input	115-volt, 60 Hertz, 1-phase, 3 conductor grounding-type line cord.
Output	Continuously adjustable — 6 foot leads with clips, rear of cabinet. Short circuit current 5 ma (DC), 10 ma (AC).
Metering	Single-scale, 3½", 2% DC, 4% AC accuracy. Currentmeters scaled 0-5 ma (DC) 0-10 ma (AC).
Polarity	DC negative, unless specified positive.

OPTIONS

DC output shorting solenoid	$25
Adjustable Audible overload alarm	30
Dual range meters	25

NEW AC/DC KILOVOLTMETERS



Portable triple-range AC/DC Kilovoltmeters designed for versatility in research, development, production or maintenance measurements. Features include high overload capacity, fast spike bypass, ±2% full-scale accuracy (on DC or ±4% on AC) and maximum circuit loading of less than 100 μa Taut Band, Mirror Scale.

GENERAL SPECIFICATIONS

Accuracy	2% F.S. DC or 4% AC.
Circuit Loading	Less than 100 μa
Ranges	Triple
Modes	AC, DC, and short
Size (case)	5½" x 7" x 3".
Weight (case)	2 lbs.
Movement	Taut band

OPTION — COWHIDE LEATHER CASE FOR METER — $12

MODEL	KV RANGES	MAX. VOLTAGE	PROBE LENGTH	PRICE
KVM10	0-2.5/5/10	25 KV	6"	$150
KVM25	0-5/10/25	40 KV	9"	160
KVM50	0-10/25/50	80 KV	15½"	185
KVM100	0-25/50/100	160 KV	28½"	225

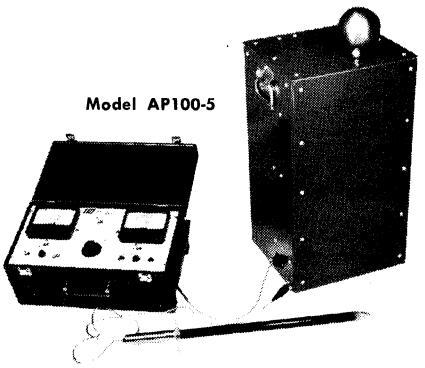
PHASE TO PHASE (INSULATED) SELF CONTAINED MODELS

MODEL	KV RANGES	MAX. VOLTAGE	PROBE LENGTH	PRICE
PKVM2.5	0-0.5/1/2.5	25 KV	3 foot leads	$160
PKVM5	0-1/2.5/5	25 KV		175
PKVM10	0-2.5/5/10	25 KV		200

MODEL PKVM UNITS MAY BE USED ON PHASE TO GROUND OR PHASE TO PHASE MEASUREMENTS AT 25 KV ABOVE GROUND WHILE MAINTAINING CASE AT GROUND.

Peschel Instruments Inc.

Cape Coral Industrial Park
Box 847, Cape Coral, Florida 33904 — (813) LI 2-3164



Model AP100-5

PORTABLE DC TEST SETS

Series AP

Lightweight air-insulated 2-piece units designed for plant or field use. Excellent for testing cables, insulators and rotating machinery . . . or for lab applications in electrostatic, ionization, or dielectric studies. Small formica suitcase houses control section; fiberglass case, the high-voltage section. Test sets provide true portability — 50 KV at 1 ma in a total weight of only 17 lbs, including controls. Test sets can be ordered as stackable units in stages of 50 or 100 KV.

Note: All units include shorting stick. Stacking sections @ $600 for 50 KV and $900 for 100 KV (5ma).

MODEL	OUTPUT KV — MA	VOLTMETER KV	CURRENT METER — μa	CONTROL UNIT SIZE	HV SECTION SIZE	NET WEIGHT	PRICE
AP25-1	0-25@1	0-10/25	50/500/1000	one piece	9x16x8	20#	$500
AP50-1*	0-50@1	0-25/50	100/1000	12x6x8	4x8x13	17#	500
AP50-5	0-50@5	0-25/50	50/500/5000	9x16x8	13x12x12	50#	950
AP100-1*	0-100@1	0-50/100	100/1000	12x6x8	13x12x21	50#	890
AP100-2	0-100@2	0-50/100	50/500/2500	9x16x8	13x12x21	65#	1300
AP100-5	0-100@5	0-50/100	50/500/5000	9x16x8	12x16x23	100#	1525

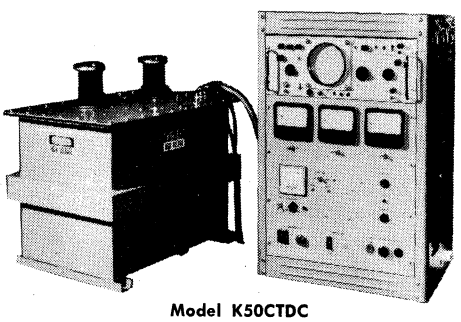
* HV on and off switches and pilot light not used on AP50-1 or AP100-1.

FEATURES

- Lightweight portability.
- Rugged construction — for field use.
- Sensitivity — 50 or 100 μa currentmeter for accurate leakage detection.
- Safety — high output impedance, surge-limiting resistor; no flammable oil.
- Ground relay prevents mis-use
- Low internal leakage.
- Surge protected meters and transformers.
- Long-life selenium rectifiers.

GENERAL SPECIFICATIONS

Input	115-volt, 60-Hertz, 1-phase; available with inverter for 6- or 12-volt DC input for field use.
Output	Continuously adjustable from zero.
Regulation	Approx. 20% N.L. To F.L.
Ripple	Approx. 2% rms.
Overload	Fused primary.
Metering	Multi-scale, 2% accuracy, Taut Band, Mirror Scale.
Polarity	Negative, unless specified positive.



Model K50CTDC

HIGH-VOLTAGE AC TEST SETS

SERIES K

Completely redesigned high-capacity units with elaborate control circuits for maximum convenience and safety. For testing in accordance with ASTM, MIL and IPCEA standards. Widely used by wire and cable manufacturers, laboratories, electric utilities, service organizations and schools. Convenience and safety features include fully interlocked controls, multiple overload devices, accurate dual-scale metering and function or status indicators, High-voltage transformer is ruggedly designed for testing service, with low end of secondary grounded. KVA ratings are standard one hour, intermittent testing. Available as corona test sets.

FEATURES

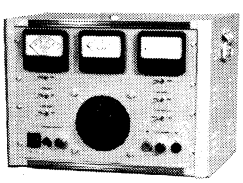
- Dual Output — both AC and DC, continuously adjustable.
- Simplified controls.
- Accuracy — meters directly at output.
- Safety — instantaneous overload circuit breaker.
- Reliability — dry-type rectifiers, surge protection.

GENERAL SPECIFICATION

Input	115-volt, 60-Hertz, 1-phase, 3-conductor grounding-type cord.
Output	Continuously adjustable, 8-foot HVDC leads and AC bushings.
Regulation	(DC) approx. 25% N.L. to F.L.
DC Capacity	Current rated ½ AC cap.
Ripple	(DC) approx. 5% rms.
Overload	Instantaneous circuit breaker.
Metering	Separate KV meter for DC and for AC rms; 2% DC & 4% AC F.S. accuracy. Common AC/DC milliammeter in ground lead of HV output; 4% full-scale accuracy. Taut Band, Mirror Scale.
Polarity	(DC) negative output, positive grounded.

HIGH-VOLTAGE AC/DC TEST SETS

SERIES KS



Dual output designed for both AC and DC dielectric or insulation testing, as well as power supply use. Simplified controls reduce cost . . . simplify use by inexperienced personnel . . . promote long trouble-free operation. Smaller units and lower voltage units in table top cabinets. Larger or higher voltage units in floor cabinets or as 2-piece units with HV section in oil tank. Optional extras include dual-scale meters ($50) and automatic output shorting on DC $25-45, (depending on voltage rating) — a recommended accessory for cable or capacitor testing.

MODEL	RMS & DC - KV	OUT-PUT	RMS & DC - MA	PRICE
KS 1-50	0-1	@	50	$350
KS 2-50	0-2	@	50	450
KS 2-100	0-2	@	100	550
KS 3-100	0-3	@	100	550
KS 5-50	0-5	@	50	600
KS 5-100	0-5	@	100	800
KS 10-10	0-10	@	10	450
KS 10-25	0-10	@	25	650
KS 20-5	0-20	@	5	450
KS 20-10	0-20	@	10	650
KS 30-10	0-30	@	10	1000
KS 50-5	0-50	@	5	1200
KS 50-20	0-50	@	20	1800
KS 50-40	0-50	@	40	2400
KS 70-50	0-70	@	50	3500

SEND FOR CATALOGUE

PI HIGH VOLTAGE TEST EQUIPMENT

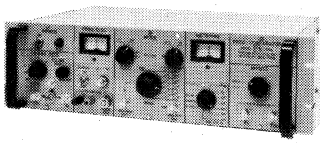
Peschel Instruments Inc.

Cape Coral Industrial Park
Box 847, Cape Coral, Florida 33904 — (813) LI 2-3164

PROMINENCE
IN FREQUENCY MEASUREMENT AND CONTROL

FREQUENCY COMPARATORS FOR
SHORT-TERM FREQUENCY AND PHASE STABILITY ANALYSIS, MEASUREMENT AND TROUBLESHOOTING

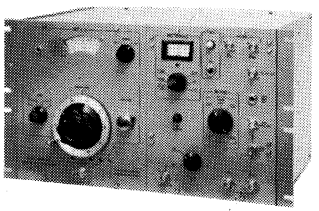
MODELS 103A, 104A, 105A AND 106A FREQUENCY COMPARATORS



MODEL 106A FREQUENCY COMPARATOR
Error multiplication for direct digital display, resolution to 1 part in 10^{12} in 1 second.

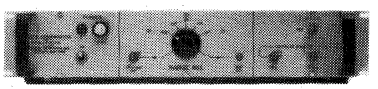
- **Six Selectable Decade Stages of Error Multiplication to 1,000,000**
- **Built-in Frequency Discriminator Gives Analog Frequency Difference Indications on Front Panel Meter and External Chart Recorder**
- **Built-in Phase Detectors with Resolution Greater Than 0.3 Degree Peak to Peak at Equivalent Frequency of 1GHz**
- **Allows Quick Accurate Measurement of Both Short and Long Term Performance of Frequency Sources, Active and Passive Networks, etc.**
- **Can Be Used with Peripheral Equipment to Make An Extremely High Resolution, Low Noise, Very Wide Dynamic Range Spectrum Analyzer**

MODEL 109 WIDE RANGE FREQUENCY EXTENDER.

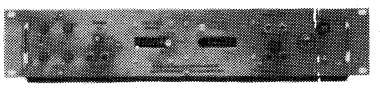


EXTENDS FREQUENCY RANGE OF P.R. FREQUENCY COMPARATORS

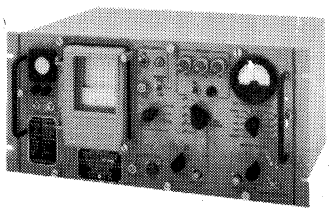
- **Frequency comparison or calibration methods of operation**
- **Accepts any frequency from 1 MHz to 108 MHz in comparison mode of operation and 0.6 to 220 MHz in calibration mode of operaton**
- **Resoluton better than 1 part in 10^{11} peak-to-peak in 1 second**
- **Allows short term phase stability of networks to be measured at any frequency from 1 to 108 MHz**



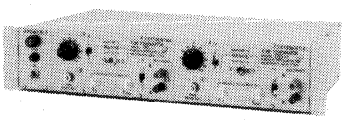
MODEL 091 FREQUENCY COMPARATOR
Error Multiplication to 1000



MODEL 112 TIME DIFFERENCE MONITOR

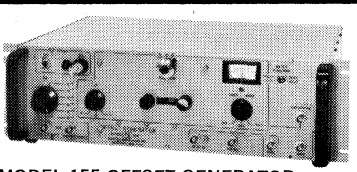


AN/URM-115A
FREQUENCY DEVIATION METER
Approved frequency comparator for military field use



MODEL 113
DIFFERENTIAL TIME COMPARATOR
Resolution of 0.1 nanosecond;
21 input frequencies

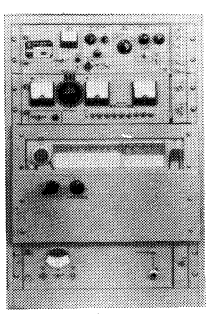
OFFSET GENERATORS FOR TIME SCALE CONVERSION



MODEL 155 OFFSET GENERATOR

- **Steps of 5 parts in 10^{10}**
- **Automatic Conversion of One Time Scale to Another, Such As A.1 to UT.2, without Affecting the Original Standard**
- **Enables Comparison of Two 1 MHz Signals Offset Beyond a Frequency Comparator's Frequency Range**

QUARTZ CRYSTAL MEASURING SYSTEM



- **Up to 1 part in 10^8 frequency accuracy**
- **Up to 1 part in 10^9 frequency reproducibility**

The Parzen Research Model 302 Universal Precise Crystal Measuring System is a highly advanced, state-of-the-art instrument which, when used in conjunction with immitance bridges allows the precise measurement of the properties of quartz crystals or similar devices over the frequency range 500 kHz to 216 MHz.

FREQUENCY DISTRIBUTION AMPLIFIERS AND SYSTEMS MODEL 120 SERIES

- **Low noise—less than 1 part in 10^{12} degradation**
- **Up to 40 isolated outputs**
- **High isolation**
- **10, 5, 1, and .1MHz frequency outputs**

PARZEN RESEARCH has internationally recognized competence in the field of precise frequency control, including ultra-stable frequency generation and synthesis, low-noise frequency multiplication and division, frequency source combination, standard frequency distribution, and highest-resolution frequency, phase, and time comparisons. Particular effort has been expended on the problems associated with excellent short-term stability.

OTHER PRODUCTS

- **MULTICOUPLERS, ANTENNA TUNERS, RF SWITCHING MATRICES, AUDITORY TRAINING EQUIPMENT, FREQUENCY SYNTHESIZERS**
- **VECTOR DYNAMICS DIVISION—SERVO SYSTEMS, DC MOTOR DRIVES AND INDUSTRIAL CONTROL SYSTEMS**

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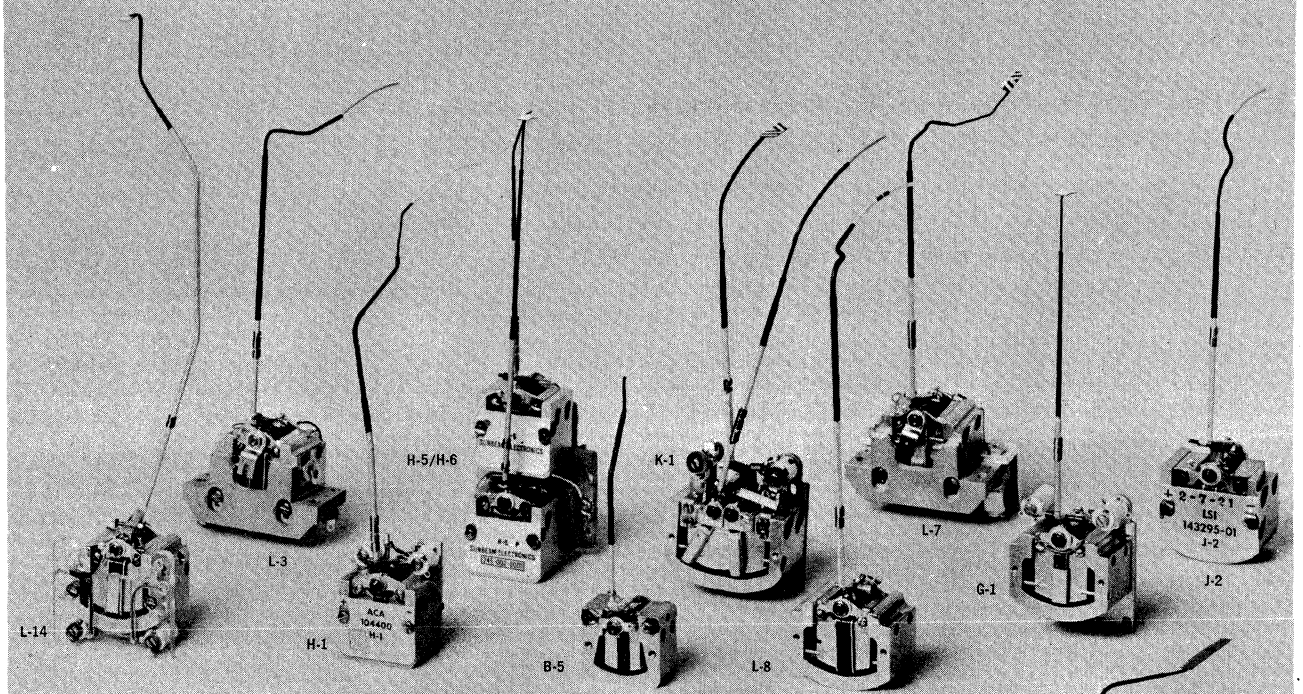
Avionic Mechanisms



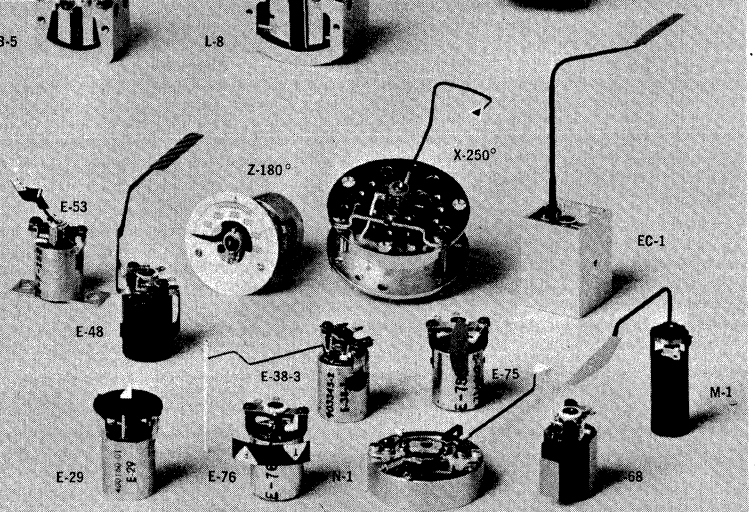
Capabilities in Depth

This comprehensive presentation of Phaostron pointer and flag mechanisms for prime flight instruments is indicative of Phaostron's highly specialized capability in the design and production of precision permanent magnet moving coil mechanisms for military, commercial and general aircraft markets.

Phaostron designs are production realities and are presently flying on numerous aircraft programs such as Boeing 747, C-5, C-141, P-3 Orion, AFFAS, etc. in such prime flight instruments as HSI, ADI, BDHI, attitude control indicators, two and three axis attitude indicators, DME, Ground Speed, VOR/LOC, Glide Slope, altimeters, etc.

Phaostron mechanisms are designed to satisfy severe environmental and exacting performance requirements such as:

Temperature	−55 to +125°C.
Vibration/Shock	5-500 cycles — 3G operational, 6G survival.
Ballistics	critical damping, fast response time.
Linearity	±5% or better as may be required.
Sensitivity	as required: 150-0-150 microamperes typical.
Pointer Length	up to 7" for environments as above.
Construction	self shielded magnetic circuits, telescopic pointer tubing, magnesium flag supports, die-cast balance crosses to provide maximum strength to thickness ratio.



B-5	Course Deviation Bar Pointer Display
E-29	Elevator and Aileron Flags
E-38-3	Course Deviation Bar Display
E-48	Glide Slope Warning Flag
E-53	Deviation Warning Flag
E-68	Deviation Indicator
E-75	Glide Slope Failure Flag
E-76	To-From Flags
EC-1	Glide Slope Warning Flag
G-1	Rate of Turn Pointer Display
H-1	Pitch Steering-Vertical Pointer Display
H-5/H-6	Rate of Turn/Glide Slope Pointer Displays
J-2	Pitch Steering-Vertical Pointer Display
K-1	Radar Altitude and Roll Steering-Dual Pointer Displays
L-3	Pitch Steering, Vertical Pointer Display
L-7	Radar Altitude Pointer Display
L-8	Roll Steering-Horizontal Pointer Display
L-14	Rate of Turn Pointer Display
M-1	Miniature, 7/16" diameter, Symbol Indicator Flag
N-1	Shallow Edgewise, 0.5" thick, Monitor Indicator Display
X-250°	250 degree Roll Pointer Mechanism
Z-180°	180 degree Mechanism

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90° Ruggedized Mil-M-10304C

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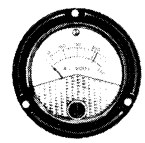
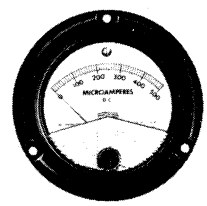
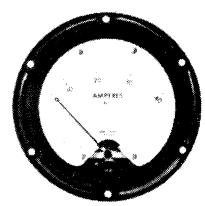
MR DESIGNATION	RANGE & SCALE	2½" MODELS 621-624-627 $NET EACH - LOTS OF				3½" MODELS 631-634-637 $NET EACH - LOTS OF				4½" MODELS 641-644-647 $NET EACH - LOTS OF			
		1-9	10-24	25-49	50-99	1-9	10-24	25-49	50-99	1-9	10-24	25-49	50-99
D C MICROAMMETERS		MR26				MR36				MR46			
MR*W020DCUAR	0-20	41.25	35.06	31.76	25.16	41.25	35.06	31.76	25.16	42.25	35.91	32.53	25.73
MR*W050DCUAR	0-50	25.00	21.25	19.38	15.23	25.00	21.25	19.38	15.23	25.30	21.55	19.68	15.53
MR*W100DCUAR	0-100	23.57	19.98	18.21	14.30	23.57	19.98	18.21	14.30	23.87	20.28	18.51	14.60
MR*W200DCUAR	0-200	22.13	18.80	17.14	13.25	22.13	18.80	17.14	13.25	22.43	19.10	17.44	13.55
MR*W500DCUAR	0-500	20.69	17.53	15.99	12.22	20.69	17.53	15.99	12.22	20.99	17.83	16.29	12.32
MR*W5T5DCUAR	50-0-50	23.57	19.98	18.21	14.30	23.57	19.98	18.21	14.30	23.87	20.28	18.51	14.60
MR*W1H1DCUAR	100-0-100	22.13	18.80	17.14	13.25	22.13	18.80	17.14	13.25	22.43	19.10	17.44	13.55
MR*W5H5DCUAR	500-0-500	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
DC MILLIAMMETERS													
MR*W005DCMAR	0-5	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W010DCMAR	0-10	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W050DCMAR	0-50	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W100DCMAR	0-100	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W200DCMAR	0-200	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W500DCMAR	0-500	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
DC AMMETERS													
MR*W001DCAAR	0-1	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W002DCAAR	0-2	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W005DCAAR	0-5	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W010DCAAR	0-10	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
DC VOLTMETERS													
MR*W100DCVVR	0-100	19.75	16.80	14.75	11.50	19.75	16.80	14.75	11.50	20.05	17.10	15.05	11.80
MR*W150DCVVR	0-150	19.75	16.80	14.75	11.50	19.75	16.80	14.75	11.50	20.05	17.10	15.05	11.80
MR*W500DCVVR	0-500	19.75	16.80	14.75	11.50	19.75	16.80	14.75	11.50	20.05	17.10	15.05	11.80
DC MILLIVOLTMETERS													
MR*W050DCMVR	0-50	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W050DCMVR	0-50	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
MR*W050DCMVR	0-50	19.25	16.35	14.45	11.20	19.25	16.35	14.45	11.20	19.55	16.65	14.75	11.50
AC MILLIAMMETERS													
MR*W010ACMAR	0-10	20.75	17.45	15.30	12.03	20.75	17.45	15.30	12.03	22.75	19.34	17.52	13.88
MR*W020ACMAR	0-20	20.75	17.45	15.30	12.03	20.75	17.45	15.30	12.03	22.75	19.34	17.52	13.88
MR*W050ACMAR	0-50	20.75	17.45	15.30	12.03	20.75	17.45	15.30	12.03	22.75	19.34	17.52	13.88
AC AMMETERS													
MR*W001ACAAR	0-1	20.75	17.45	15.30	12.03	20.75	17.45	15.30	12.03	22.75	19.34	17.52	13.88
MR*W005ACAAR	0-5	20.75	17.45	15.30	12.03	20.75	17.45	15.30	12.03	22.75	19.34	17.52	13.88
MR*W010ACAAR	0-10	20.75	17.45	15.30	12.03	20.75	17.45	15.30	12.03	22.75	19.34	17.52	13.88
MR*W050ACAAR	0-50	20.75	17.45	15.30	12.03	20.75	17.45	15.30	12.03	22.75	19.34	17.52	13.88
AC VOLTMETERS													
MR*W005ACVVR	0-5	22.25	18.75	16.45	13.25	22.25	18.75	16.45	13.25	24.25	20.61	18.67	14.79
MR*W010ACVVR	0-10	22.25	18.75	16.45	13.25	22.25	18.75	16.45	13.25	24.25	20.61	18.67	14.79
MR*W015ACVVR	0-15	22.25	18.75	16.45	13.25	22.25	18.75	16.45	13.25	24.25	20.61	18.67	14.79
MR*W150ACVVR	0-150	22.25	18.75	16.45	13.25	22.25	18.75	16.45	13.25	24.25	20.61	18.67	14.79
MR*W300ACVVR	0-300	22.25	18.75	16.45	13.25	22.25	18.75	16.45	13.25	24.25	20.61	18.67	14.79
MR*W500ACVVR	0-500	23.75	20.25	17.99	14.25	23.75	20.25	17.99	14.25	25.75	21.89	19.83	15.71

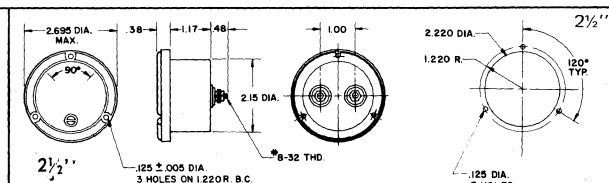






*MR26/MR36/MR46

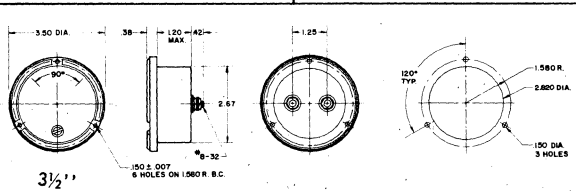
PLEASE SPECIFY WHEN ORDERING: MODEL SIZE, NUMBER AND RANGE.

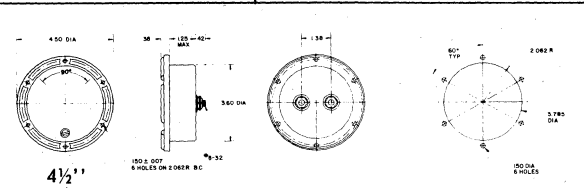


MODEL NUMBER CODE

621/631/641 . . . 90° DC Pivot Jewel
624/634/644 . . . 90° DC Taut Band
627/637/647 . . . AC Iron Vane

Complete line of Ruggedized Meters to MIL-M-10304C.





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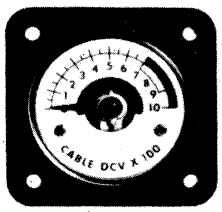
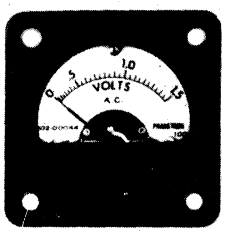


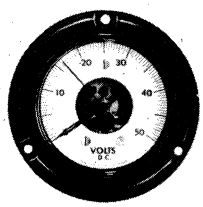


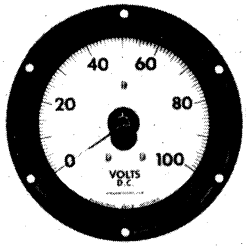
MR DESIGNATION	RANGE & SCALE	1 1½" MODEL 611 $NET EACH - LOTS OF 1-9	10-24	25-49	50-99
DC MICROAMMETERS					
MR13S100DCUAR	0-100	30.57	25.98	23.54	18.65
MR13S500DCUAR	0-500	27.69	23.54	21.32	16.89
DC MILLIAMMETERS					
MR13S001DCMAR	0-1	26.25	22.30	20.20	16.01
MR13S1U1DCMAR	1-0-1	26.25	22.30	20.20	16.01
DC MICROAMMETERS (Pivot & Jewel ± 2% F.S.)					
	0-50	25.00	21.25	19.38	15.23
	0-100	23.57	19.98	18.21	14.30
	0-200	22.13	18.80	17.74	13.25
	0-500	20.69	17.53	15.99	12.22
DC MILLIAMMETERS (Pivot & Jewel ± 2% F.S.)					
	0-1	19.25	16.35	14.45	11.20
	0-5	19.25	16.35	14.45	11.20
	0-10	19.25	16.35	14.45	11.20
	0-50	19.25	16.35	14.45	11.20
	0-100	19.25	16.35	14.45	11.20
	0-500	19.25	16.35	14.45	11.20
DC MILLIVOLTMETERS (Pivot & Jewel ± 2% F.S.)					
	0-50	19.25	16.35	14.45	11.20
DC VOLTMETERS (Pivot & Jewel ± 2% F.S.)					
	0-1	19.75	16.80	14.75	11.50
	0-3	19.75	16.80	14.75	11.50
	0-5	19.75	16.80	14.75	11.50
	0-10	19.75	16.80	14.75	11.50
	0-25	19.75	16.80	14.75	11.50
	0-50	19.75	16.80	14.75	11.50
	0-100	19.75	16.80	14.75	11.50
	0-500	19.75	16.80	14.75	11.50
AC VOLTMETERS (Pivot & Jewel - Rectifier ± 3% F.S.)					
	0-150	24.25	20.80	18.25	14.20
	0-300	24.25	20.80	18.25	14.20
	0-500	24.25	20.80	18.25	14.20

MR DESIGNATION	RANGE & SCALE	1" – 180° MODEL 602 $NET EACH - LOTS OF 1-9	10-24	25-49	50-99
DC MICROAMMETERS					
MR03W050DCUAR	0-50	83.93	75.68	68.26	64.54
MR03W100DCUAR	0-100	82.50	74.25	66.83	63.11
MR03W200DCUAR	0-200	81.06	72.81	65.39	61.67
MR03W500DCUAR	0-500	79.62	71.37	63.95	60.23
DC MILLIAMMETERS					
MR03W001DCMAR	0-1	78.28	70.00	62.60	58.90
MR03W005DCMAR	0-5	78.28	70.00	62.60	58.90
MR03W010DCMAR	0-10	78.28	70.00	62.60	58.90
MR03W050DCMAR	0-50	78.28	70.00	62.60	58.90
MR03W100DCMAR	0-100	78.28	70.00	62.60	58.90
MR03W200DCMAR	0-200	78.28	70.00	62.60	58.90
MR03W500DCMAR	0-500	78.28	70.00	62.60	58.90
DC MILLIVOLTMETERS (Pivot & Jewel ± 2% F.S.)					
	0-50	78.28	70.00	62.60	58.90
DC VOLTMETERS					
MR03W002DCVVR	0-2	79.28	71.00	63.60	59.90
MR03W010DCVVR	0-10	79.28	71.00	63.60	59.90
MR03W020DCVVR	0-20	79.28	71.00	63.60	59.90
MR03W050DCVVR	0-50	79.28	71.00	63.60	59.90
MR03W100DCVVR	0-100	79.28	71.00	63.60	59.90
MR03W150DCVVR	0-150	79.28	71.00	63.60	59.90

250° Ruggedized Mil-M-10304C







MR DESIGNATION	RANGE & SCALE	2½" 2½" MODEL 623 $NET EACH - LOTS OF 1-9	10-24	25-49	49-99	3½" MODEL 633 $NET EACH - LOTS OF 1-9	10-24	25-49	50-99	4½" MODEL 643 $NET EACH - LOTS OF 1-9	10-24	25-49	50-99
DC MICROAMMETERS		MR24				MR34				MR44			
MR*W200DCUAR	0-200	53.00	45.00	39.70	26.27	53.00	45.00	39.70	26.27	53.30	45.30	40.00	36.57
MR*W500DCUAR	0-500	53.00	45.00	39.70	26.27	53.00	45.00	39.70	26.27	53.30	45.30	40.00	26.57
DC MILLIAMPERES													
MR*W001DCMAR	0-1	47.50	40.40	35.60	25.00	47.50	40.40	35.60	25.00	47.80	40.70	35.90	25.30
MR*W005DCMAR	0-5	47.50	40.40	35.60	25.00	47.50	40.40	35.60	25.00	47.80	40.70	35.90	25.30
MR*W010DCMAR	0-10	47.50	40.40	35.60	25.00	47.50	40.40	35.60	25.00	47.80	40.70	35.90	25.30
DC VOLTMETERS													
MR*W010DCVVR	0-10	49.50	42.40	36.60	26.27	49.50	42.40	36.60	26.27	49.80	42.70	36.90	26.57
MR*W050DCVVR	0-50	49.50	42.40	36.60	26.27	49.50	42.40	36.60	26.27	49.80	42.70	36.90	26.57
MR*W150DCVVR	0-150	49.50	42.40	36.60	26.27	49.50	42.40	36.60	26.27	49.80	42.70	36.90	26.57
AC VOLTMETERS – RECTIFIER													
MR*W150ARVVR	0-150	54.50	47.40	41.60	31.27	54.50	47.40	41.60	31.27	54.80	47.70	41.90	31.57
MR*W300ARVVR	0-300	54.50	47.40	41.60	31.27	54.50	47.40	41.60	31.27	54.80	47.70	41.90	31.57
MR*W500ARVVR	0-500	54.50	47.40	41.60	31.27	54.50	47.40	41.60	31.27	54.80	47.70	41.90	31.57

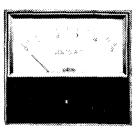
"indicating instruments of integrity"

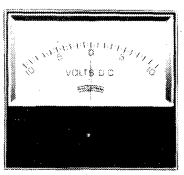
Custom II

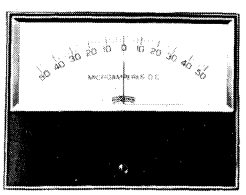
PHAOSTRON
A SUBSIDIARY OF VICTOREEN INC.

RANGE & SCALE	2½" MODELS 521-524-527 $ NET EACH - LOTS OF				3½" MODELS 531-534-537 $NET EACH - LOTS OF				4½" MODELS 541-544-547 $NET EACH - LOTS OF				4" x 6" MODELS 561-567 $NET EACH - LOTS OF			
	1-9	10-24	25-49	50-99	1-9	10-24	25-49	50-99	1-9	10-24	25-49	50-99	1-9	10-24	25-49	50-99
D C MICROAMMETERS (Taut Band & Pivot & Jewel ± 2% F.S.)																
TB 0-20	31.10	26.20	23.15	21.75	31.90	27.20	24.00	22.40	34.70	29.50	26.00	24.30	–	–	–	–
0-50	21.95	18.65	16.45	15.35	22.40	19.05	16.80	15.70	23.95	20.15	17.90	16.75	29.70	25.25	22.30	20.80
0-100	19.85	16.90	14.90	13.90	20.75	17.60	15.50	14.50	22.85	19.40	17.15	16.00	25.90	22.00	19.45	18.15
0-200	18.35	15.60	13.75	12.85	19.10	16.25	14.35	13.40	20.75	17.60	15.55	14.50	24.80	21.10	18.60	17.35
0-500	17.95	15.30	13.45	12.60	18.80	15.95	14.10	13.15	20.15	17.10	15.10	14.10	23.60	20.05	17.70	16.50
TB10-0-10	31.10	26.20	23.15	21.75	31.90	27.20	24.00	22.40	34.70	29.50	26.00	24.30	–	–	–	–
25-0-25	21.95	18.65	16.45	15.35	22.40	19.05	16.80	15.70	23.95	20.15	17.90	16.75	29.70	25.25	22.30	20.80
50-0-50	19.85	16.90	14.90	13.90	20.75	17.60	15.50	14.50	22.85	19.40	17.15	16.00	25.90	22.00	19.45	18.15
100-0-100	18.35	15.60	13.75	12.85	19.10	16.25	14.35	13.40	20.75	17.60	15.55	14.50	24.80	21.10	18.60	17.35
D C MILLIAMMETERS (Pivot & Jewel ± 2% F.S.)																
0-1	17.45	14.85	13.10	12.20	17.95	15.25	13.45	12.85	19.10	16.25	14.35	13.35	23.60	20.05	17.70	16.50
0-5	17.45	14.85	13.10	12.20	17.95	15.25	13.45	12.85	19.10	16.25	14.35	13.35	23.60	20.05	17.70	16.50
0-10	17.45	14.85	13.10	12.20	17.95	15.25	13.45	12.85	19.10	16.25	14.35	13.35	23.60	20.05	17.70	16.50
0-15	17.45	14.85	13.10	12.20	17.95	15.25	13.45	12.85	19.10	16.25	14.35	13.35	23.60	20.05	17.70	16.50
0-25	17.75	15.10	13.30	12.40	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.05	20.45	18.05	16.85
0-50	17.75	15.10	13.30	12.40	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.05	20.45	18.05	16.85
0-100	17.75	15.10	13.30	12.40	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.05	20.45	18.05	16.85
0-200	17.75	15.10	13.30	12.40	18.50	15.75	13.90	12.95	19.83	16.85	14.90	13.90	24.05	20.45	18.05	16.85
0-500	17.75	15.10	13.30	12.40	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.05	20.45	18.05	16.85
D C AMMETERS (Pivot & Jewel – Self Contained ± 2% F.S.)																
0-1	17.75	15.10	13.30	12.45	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
0-1.5	17.75	15.10	13.30	12.45	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
0-3	17.75	15.10	13.30	12.45	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
0-5	17.75	15.10	13.30	12.45	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
0-10	17.75	15.10	13.30	12.45	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
0-25	17.75	15.10	13.30	12.45	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
0-30	17.75	15.10	13.30	12.45	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
0-50	17.75	15.10	13.30	12.45	18.50	15.75	13.90	12.95	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
D C MILLI VOLTMETERS (Pivot & Jewel ± 2% F.S.)																
0-50	17.60	14.95	13.20	12.35	18.35	15.55	13.75	12.85	19.85	16.85	14.90	13.90	24.50	20.80	18.40	17.15
D C VOLTMETERS (Pivot & Jewel ± 2% F.S.)																
0-1	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-1.5	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-3	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-5	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-10	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-15	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-25	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-30	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-50	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-100	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-150	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-300	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
0-500	18.50	15.75	13.90	12.95	18.95	16.10	14.20	13.25	20.75	17.60	15.50	14.50	24.50	20.80	18.40	17.15
A C VOLTMETERS (Pivot & Jewel – Rectifier – ± 3% F.S.)																
0-150	23.60	20.05	17.70	16.50	24.15	20.30	18.20	17.00	26.90	22.90	20.20	18.85	29.80	25.40	22.40	20.90
0-300	23.60	20.05	17.70	16.50	24.15	20.30	18.20	17.00	26.90	22.90	20.20	18.85	29.80	25.40	22.40	20.90
0-500	23.60	20.05	17.70	16.50	24.15	20.30	18.20	17.00	26.90	22.90	20.20	18.85	29.80	25.40	22.40	20.90





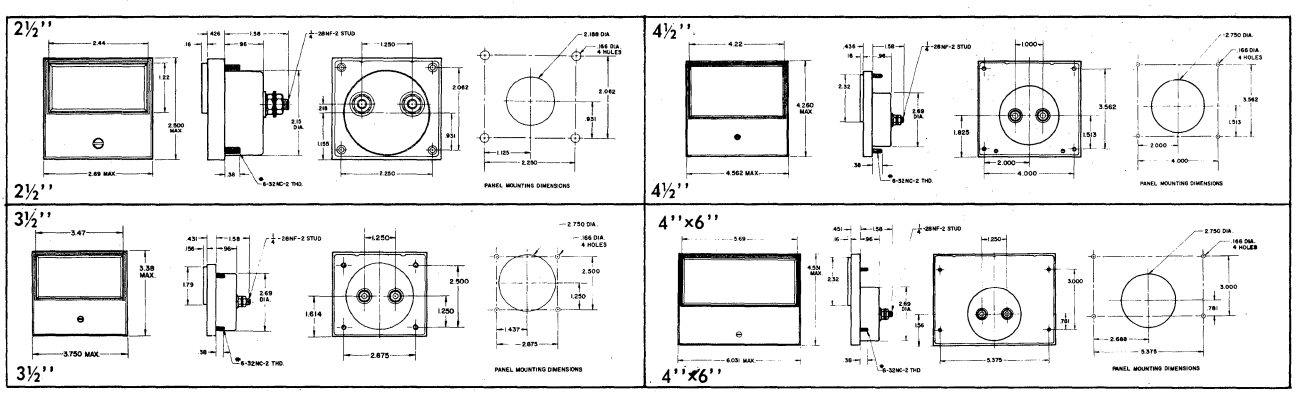




MODEL NUMBER CODE

531/541/561 ... 90° DC Pivot Jewel
534/544 ..... 90° DC Taut Band
537/547/567 ... AC Iron Vane

- Die Cast Aluminum Bezel with Plastic Window
- Internal Illumination Available
- "TB" Signifies Taut Band



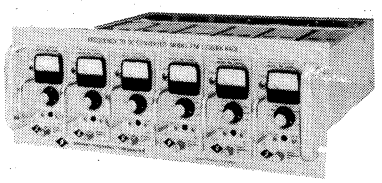
pioneer magnetics incorporated

1745 BERKELEY STREET, SANTA MONICA, CALIFORNIA 90404 / TEL: 213-393-0136

INSTRUMENTS FOR MEASUREMENTS AND CONTROL

frequency to dc converters

The Nation's Most Complete Line



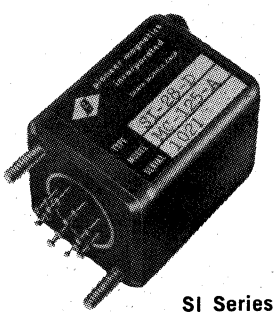
PM 1300 Series

INDUSTRIAL

Relay rack, cabinet plug-in module with built-in power or plug-in board.

SPECIFICATIONS:

Input Frequency: 15Hz to 100KHz Full Scale.
Input Voltage: 10 millivolts to 150 volts RMS.
D.C. Output Voltage: 0 to 5v or 0 to 10v.
Output Impedance: Less than 0.2 ohms.
Output Ripple: 5mv.
Linearity: ±0.025% (B.S.L.).
Temperature Coef.: ±0.005%/°F.
Temperature: 0 to 150°F.
Standard Options: Multiple ranges, improved ripple, temperature coefficient to ±.0005%/°F, expanded scale, monitor meter.



SI Series

RUGGEDIZED

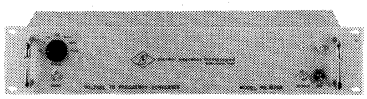
Several series of megacyclers are available for military and space applications. Highly dependable and accurate. Designed for compatibility with flowmeters, tachometers, radiation detectors, magnetic pickups.

SPECIFICATIONS:

Input Frequency: 15Hz to 100KHz Full Scale.
Input Voltage: 5 millivolt to 150 volts RMS.
D.C. Output: 0 to 5v or 0 to 10v.
Linearity: To ±.025% (B.S.L.).
Temperature Coef.: Standard ±.01%, ±.005% and ±.001%/°C.
Temperature: −60°C to +100°C.
Standard Options: Increased sensitivity, expanded scale, high power, higher frequency, monitor meter.

dc to frequency converters

The Nation's Most Complete Line



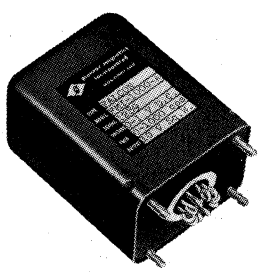
PM 1290 Series

INDUSTRIAL

Relay Rack, cabinet, plug-in module, or plug-board. A wide range of standard modules.

SPECIFICATIONS:

Input Ranges: 0.1 VDC to 1000 VDC Full Scale
Input Polarity: Unipolar or bipolar.
Output: Standard Full Scale frequencies from 500Hz to 1MHz.
Linearity: To ±.025% (B.S.L.).
Temperature Coef.: ±.005%/°F.
Temperature: 0 to 150°F.
Standard Options: Multiple ranges. Temperature coef. to ±.0005%/°C square wave output, internal calibration, expanded scale, polarity indication.



FMI Series

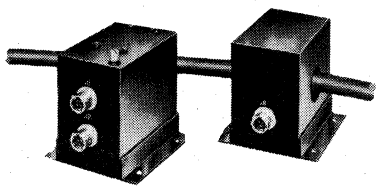
RUGGEDIZED

For space, military and adverse environment use. Designed for telemetering, digital measurement of analog quantities, speed and position control. Several series available for specific requirements.

SPECIFICATIONS:

Input Range: 0.1 VDC to 1000 VDC Full Scale.
Input Polarity: Unipolar or bipolar.
Output: Standard Full Scale frequencies from 10Hz to 1MHz.
Linearity: To ±.025% (B.S.L.).
Temperature Coef.: ±.005%/°C.
Temperature: −60°C to +100°C.
Standard Options: Temperature coef. to ±0.001%/°C square wave output, internal calibration, expanded scale.

current sensors



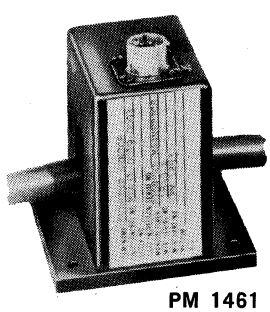
PM 1460 Series

INDUSTRIAL

Output signal directly proportional to cable current. DC output signal completely isolated from ground and power supply. Full power consumption lower than 50MV shunt.

SPECIFICATIONS:

D.C. Current Ratings: 1A to 2000A.
Output Voltage: 0 to 5 Volts DC.
Ripple: Less than 20mv.
Output Impedance: Less than 1000 ohms.
Linearity: ±1.0% of full scale (B.S.L.).
Response: Less than 10 milliseconds.
Isolation: 100 megohms, output to input and supply.
Options: Improved linearity, ripple and response; expanded scale; lower output impedance; remote sensor.



PM 1461 Series

RUGGEDIZED

Designed for major N.A.S.A. Aerospace project. Allows cable integrity intact while measuring current in DC bus line. Features accuracy, modest weight, economy.

SPECIFICATIONS:

D.C. Current Rating: 100mA to 1000A.
Output Voltage: 0 to 5 Volts DC.
Ripple: 20mv.
Output Impedance: Less than 1000 ohms.
Linearity: ±1.0% of full scale (B.S.L).
Response: Less than 10 milliseconds.
Environment: Full Military and Specs includes high shock, vibration, and −60°C to +100°C ambient.
Options: Lower ripple, faster response, remote sensor, AC models, expanded scale.

Quan-Tech LABORATORIES, INC.

WAVE AND SPECTRUM ANALYZERS

1 Hz to 100 KHz • ALL SOLID STATE



Model 304-TD

LOW FREQUENCY TRACKING WAVE AND SPECTRUM ANALYZER

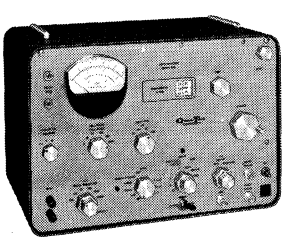
Frequency range: 1 Hz to 5 KHz. **Frequency readout:** 5 place electronic digital display. **Bandpasses:** Flat-topped, 1, 10, and 100 Hz at −3 db. **Skirt selectivity:** 24 db per ½ bandwidth. **Sensitivity:** 30μV to 300 V, FS. **Tuning:** Electronic, six selectable modes: manual, manual plus AFC, automatic sweep, tracking, search and track, external. **Outputs:** BFO, restored signal, sample of automatic sweep, analogs of meter reading and frequency setting, phase outputs for phase plot. Built-in master-slave capability for multi-channel analyzer systems. **Price:** $3575.

Model 304-T

Same as Model 304-TD except with 5000 division linear frequency dial in place of electronic display. **Price:** $3025.

Model 304

Same as model 304-T except without AFC, tracking, or master-slave capabilities. **Price:** $2700.



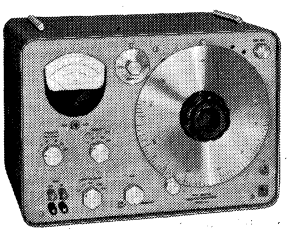
Model 305

TRACKING WAVE AND SPECTRUM ANALYZER

Similar to Model 304-TD except: **Frequency range:** 10 Hz to 50 KHz, 5000 division linear frequency dial. **Bandpasses:** 10, 100, and 1000 Hz. **Price:** $2800.

Model 305-D

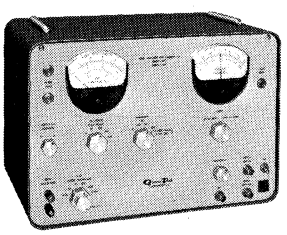
Same as Model 305 except 5 place electronic digital frequency readout instead of frequency dial. **Price:** $3350.



Model 303

WAVE AND SPECTRUM ANALYZER

Frequency range: 30 Hz to 100 KHz, semi-log frequency dial. **Bandpasses:** 10, 30, 100, and 1000 Hz at −3 db (100 and 1000 Hz bandwidths flat topped). **Sensitivity:** 100 μV to 300 V, FS. **Price:** $1700.



Model 1304

SLAVE ANALYZER AND PHASEMETER

For use with Model 304-T or 304-TD in multi-channel phase locked analyzer systems. The Model 1304 has a built-in phasemeter but no tuning controls. Mechanical impedance and transfer function analysis is simplified. Bandwidths and sensitivity are the same as for the Model 304-TD. **Price:** $2050.

Model 1305

Similar to Model 1304, but for use with Model 305 or 305-D. **Price:** $2050.

Model 3304

CROSS SPECTRAL DENSITY ANALYZER

For use with the Models 304T and 1304 for computing cross spectral density. Values of Cxy, Qxy, and Gxy are presented on front panel meters. **Price:** $1800.

Model 3305

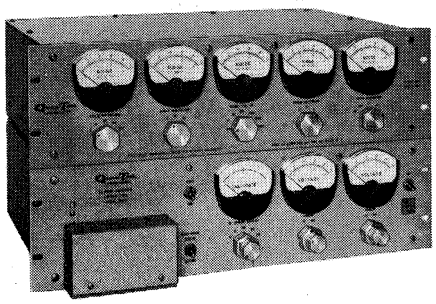
Similar to Model 3304, but for use with Models 305 and 1305. **Price:** $1800.

All prices shown are F.O.B. Whippany, N. J. Prices and specifications subject to change without notice.

43 SOUTH JEFFERSON ROAD, WHIPPANY, NEW JERSEY 07981 • PHONE (201) 887-5508 • TWX 710-986-8251

Quan-Tech LABORATORIES, INC.

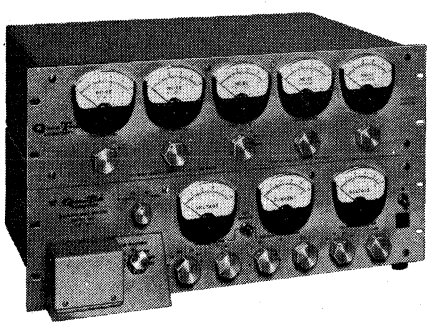
- TRANSISTOR NOISE ANALYZERS
- INTEGRATED CIRCUIT NOISE ANALYZER



Model 2283-2181 INTEGRATED CIRCUIT NOISE ANALYZER

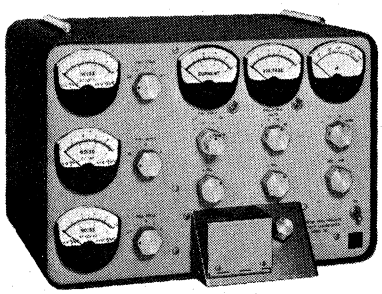
This extremely versatile noise measuring system was designed primarily for measuring noise in linear IC's and Op Amps. **Bias voltages:** plus and minus 12V fixed, plus and minus 0 to 30V independently variable at 100 ma. **Noise spectral density:** 3 to 3000 nanovolts. **Filter frequencies:** 10 and 100 Hz, 1, 10, and 100 KHz measured simultaneously.

Price: Model 2283 Control Unit $1600.
Model 2181 Filter Unit $2500.



Model 2173C-2181 TRANSISTOR NOISE ANALYZER

The most versatile unit available. Measures noise current and voltage at 10 and 100 Hz, 1, 10, and 100 KHz simultaneously. **Noise spectral density range:** 3 to 3000 nanovolts FS. **Base resistance range:** 0, 500, 1K, 10K, 100K, and 1M ohms plus external position. **Collector voltage range:** 0.3 to 60 volts. **Collector current range:** 0.3 μa to 30 ma. Also measures FET's. **Price:** $4995.

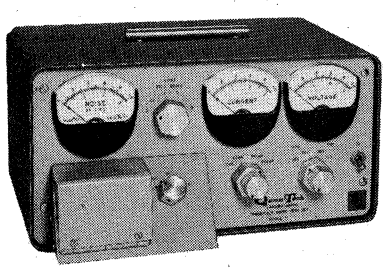


Model 310 TRANSISTOR NOISE ANALYZER

Measures noise current and voltage at 100 Hz, 1 KHz and 10 KHz as well as I_{cbo}, I_{ebo} and beta. **Noise spectral density range:** 0.01 to 3 μV, FS. 1 to 300 pa, FS. **Collector current range:** 0.05 to 30 ma. **Collector voltage range:** 0.1 to 30 V. **Base resistance range:** 0, 500, 1K, 10K plus external position. **Price:** $2725.

Model 311 TRANSISTOR NOISE ANALYZER

Similar to above, except that collector current range is from 5 to 1000 μa for noise measurement in low-collector-current devices. Measures Gm instead of beta. Also measures FET's. **Price:** $2725.



Model 512 TRANSISTOR NOISE TEST SET

Measures broadband noise figure directly in db. **Noise bandwidth:** 15.7 KHz (—3 db at 10 Hz and 10 KHz). **Noise figure range:** 0 to 62 db. **Collector voltage range;** ±3 to 30 volts. **Collector current range:** 10 μa to 1 ma. **Base resistance range:** 50, 500, 1K, 10K ohms plus external position. Also measures FET's **Price:** $1375.

All prices shown are F.O.B. Whippany, N. J. Prices and specifications subject to change without notice.

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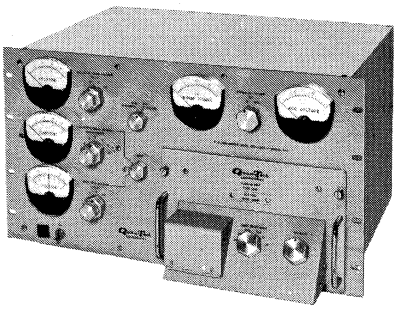
Quan-Tech LABORATORIES, INC.

- R.F. NOISE ANALYZERS
- RESISTOR & DIODE NOISE ANALYZERS
- SPECIAL INSTRUMENTS & SYSTEMS

Model 340 R.F. TRANSISTOR NOISE ANALYZER



Measures noise figure directly of transistors and FET's at radio frequencies. Plug-in heads available for test frequencies between 1 MHz and 60 MHz. **Noise figure range:** 0 to 40 db. **Base resistance range:** 50, 100, 200, 500, 1K, 2K, 5K ohms. **Collector voltage range:** ±1 to 30 volts. **Collector current range:** 30 μa to 30 ma. **Price:** $2500

Model 1340 MODEL 1340 TRANSISTOR TEST HEADS FOR USE WITH MODEL 340

1340 — 1 MHz	**Price:** $1400
1340 — 2 MHz	**Price:** $1800
1340 — 10.7 MHz	**Price:** $1400
1340 — 45 MHz	**Price:** $1800
1340 — 60 MHz	**Price:** $1800

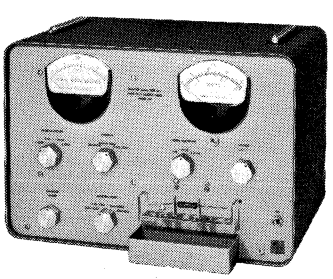
Model 1341 LINEAR I.C. TEST HEAD

For use with **Model 340.** Measures noise in integrated circuits at 10.7 MHz. Test sockets and associated circuitry are mounted on plug-in printed circuit boards and inserted in the front panel test jig. **Price:** $1800.

Special Instruments

Quan-Tech manufactures a great many "specials", ranging from one unit only to production quantities on an OEM basis. Our engineering department is extremely flexible and equipped to handle anything from minor modifications of standard instruments to the design and construction of an extremely complicated fully automatic noise measuring system. We are proud of our ability to meet difficult specifications that challenge the state of the art for low noise, stability, and accuracy. Your inquiry will receive a prompt reply.

Model 315 RESISTOR NOISE TEST SET

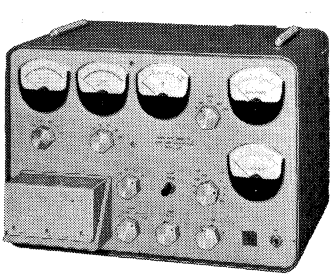


Measures noise in resistors in conformance with specifications recommended by NBS and Method 308 of MIL STD 202B. **Test-resistor range:** 100Ω to 22 megΩ. **Measurement range:** 0.6 μV in a decade to 1000 μV in a decade. **Outputs:** Sample of noise voltage; analogs of meter readings. External cable supplied for remote location of test jig. **Price:** $2375.

Model 2136 RESISTOR NOISE TEST SET

Similar to above, but measures resistors down to 10 Ω. **Price:** $2550.

Model 327 DIODE NOISE ANALYZER



Measures noise in back-biased semi-conductor diodes at 10 Hz and 1 KHz simultaneously. **Noise spectral density range:** 0.03 μV to 1 mV. **Test Voltage:** 0 to 500 V, continuously variable. **Test current:** 0 to 100 ma, continuously variable. Internally supplied ramp automatically sweeps test current and/or voltage within maximum ratings. A wide variety of outputs for data logging, external monitoring, actuating external equipment, etc. **Price:** $3250.

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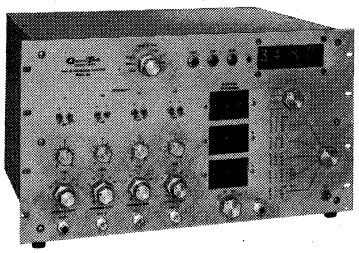
Quan-Tech LABORATORIES, INC.

- SOLID STATE AMPLIFIERS
- AMPLITUDE DISTRIBUTION ANALYZERS
- RANDOM NOISE GENERATORS



Model 318

IMPULSE DISTRIBUTION ANALYZER

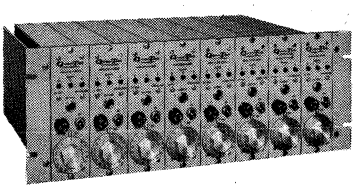
Determines amplitude & width of random or repetitive pulses, and stores the number of times that pulses occur within pre-selected amplitude or width ranges. 4 input channels, 4 amplitude threshold level controls, 3 adjustable time gates and 4 memory banks. Sampling time is selectable. **Frequency Response:** Dc to 15 MHz. **Amplitude Threshold sensitivity:** −10dBm to −60dBm, adjustable each channel, positive and negative inputs. **Input Impedance:** 75Ω, 135Ω, 600Ω switch selected. **Signal width Analysis:** 100 nanosecs to 99.9 millisecs in 4 decade ranges. Adjustable width thresholds 0-t_1; 0-t_2; 0-t_3; 0-∞. **Sampling times:** 1 sec; 1 min; 1 hr; manual timing, Ext. program. **Data Readout:** 4 digit visual; BCD printer output. **Price:** $4,500.



Model 206B

SELECTABLE GAIN AC AMPLIFIER

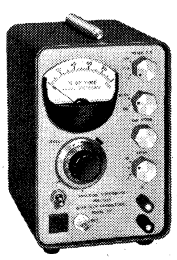
Bandwidth: 1 Hz to 100 KHz (within 0.5 db); — 3 db at 500 KHz. **Typical noise spectral density:** 5 x 10^{-9} V and 3 x 10^{-12} A at 1 KHz. **Gain:** 10, 100, & 1000, selectable at front panel; **Power:** 105-125 V AC or optional self-contained battery pack (automatically recharging). **Price:** $200. Batteries $35.



Model 2220

INSTRUMENTATION AMPLIFIER

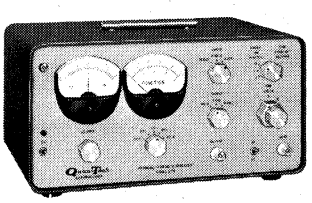
Modular amplifiers mount 8 units in a 7" rack panel. **Voltage gain:** 0 to 80 db in 5 db steps. **Controlled frequency characteristics:** (selected by plug-in cards) voltage gain flat 10 Hz to 100 KHz or 10 Hz to 20 KHz, rising 3 db/octave 10 Hz to 100 KHz or 6 db/octave 10 Hz to 20 KHz. **Price:** $590



Model 317

AMPLITUDE DISTRIBUTION ANALYZER

Determines amplitude-probability distribution of random signals. **Amplifier response:** 3 db down at approx. 12 Hz and 1 MHz; **Switching rate:** 5 MHz. **Amplitude ranges:** 100%, 10%, 1% FS; Normal or "inverted" operation; provision for external sweep of level. **Price:** $495.



Model 317B

PROBABILITY DENSITY ANALYZER

Measures manually or plots automatically amplitude probability density or cumulative probability functions of random, complex, and repetitive signals. **Frequency Range:** DC or 10 Hz to 1.75 MHz. **Sweep:** −3 sigma to +3 sigma, automatic or manual. Gated clock pulse for low probability density. **Price:** $990.



Model 420

RANDOM NOISE GENERATOR

Stable "white" noise output having true gaussian amplitude distribution. **Frequency range:** DC to 100 KHz; **Output spectral density:** 0.01 to 1000 μV, continuously variable, calibrated; **DC offset:** less than 10 mV at max. output. **Price:** $700

Model 421

RANDOM NOISE GENERATOR

Similar to Model 420 but covering higher frequencies. **Frequency Range:** 10 KHz to 12.5 MHz flat ±0.5 db. **Output Spectral Density:** .02 to 300 μV, continuously variable, calibrated, into 75 ohms. (1.34V RMS maximum for full bandwidth) **Price:** $1100.

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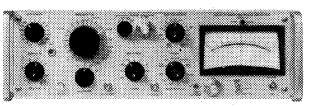
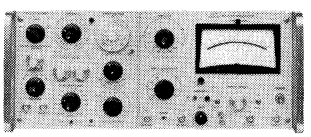
PRECISION INSTRUMENTS FOR ENGINEERING • DEVELOPMENT • RESEARCH

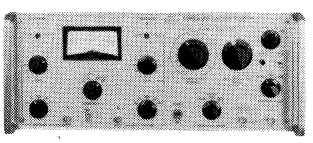
Lock-In Amplifiers: P.A.R. manufactures a full line of Lock-In Amplifiers which measure changes in amplitude or phase of coherent signals buried in noise. Input signal to the system is modulated at some reference frequency and phase-sensitive detection techniques are used to correlate the detected signal against the reference signal. Instruments are available with a minimum equivalent noise bandwidth as small as .00125 Hz. The maximum frequency range of PAR™ Lock-In Amplifiers extends from 1.5 Hz to 150 kHz. Maximum sensitivity is as high as one nanovolt full scale. Accessories include low-noise preamplifiers, light choppers, photomultiplier housings and power supplies. Prices range from $925 to $2,450.



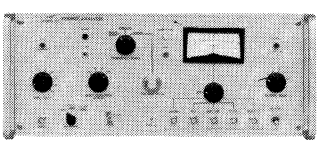
Signal Averagers: Two types of signal averagers are available from P.A.R. Boxcar Integrators extract pulses as small as 10 nanoseconds in duration from noise. Complete waveforms may be observed by automatic scanning of single time gate across repetitive signal. Waveform Eductors™ utilize fast analog techniques to provide a 100 channel signal averaging capability. Digital interface accessories are available to permit operation on signals of low repetition rates, and to provide interconnection with digital read-out and data processing equipment. Prices range from $1,950 to $4,200.



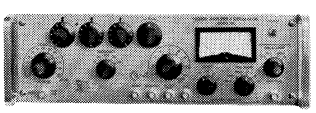
Correlation Function Computers: Perform autocorrelation to separate unknown signals from noise and crosscorrelation to determine degree of conformity between two signals. A combination of analog and digital techniques are utilized to simultaneously compute 100 points of the correlation function and provide real-time analysis. Delay ranges (or computation periods) extend from 50 microseconds to 207.5 seconds. Frequency range is from dc to 1 MHz. Prices range from $8,500 to $12,900.



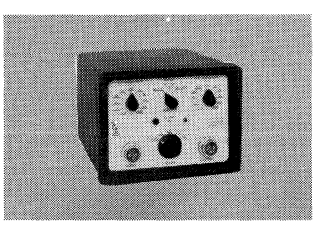
Fourier Analyzer: Extends the usefulness of Correlation Function Computers by transforming the correlation function from the time domain into the frequency domain to provide power density spectrum. The autocorrelation function is transformed into power density amplitude versus frequency and the crosscorrelation is resolved into the amplitude of cross spectral density plus phase angle as a function of frequency. Price is $2,950.



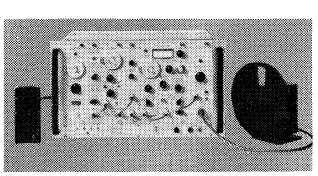
Tuned Amplifier/Oscillator: Combination Wave Analyzer, Distortion Analyzer, Low-Distortion Oscillator and Low-Noise Preamplifier. Frequency range is 1 Hz to 110 kHz with Q adjustable from 1 to 100 over the complete frequency range. Gain is continuously variable to 80 dB. Price is $1,350.



Preamplifiers: Extremely low-noise amplification for use ahead of other signal processing instruments or as general purpose instruments. The frequency range covered is from 1 Hz to 1 MHz with gains ranging to 10^4. Various input impedances are available. Models available provide transformer coupled input, high impedance inputs for photomultipliers, built-in adjustable high pass and low pass filters, and differential input capabilities. They are available in many configurations; battery-powered or line-operated; freestanding or modular. Prices range from $275 to $495.



RIM: Research Instrument Modules offer ease of assembly of signal processing instruments for general engineering applications. More than 20 modules are available: Lock-In Amplifier, Selective Amplifier, Preamplifiers, Variable Frequency Light Chopper, High Voltage Photomultiplier Power Supply, Four-Quadrant Analog Multiplier, Operational Amplifier, Power Amplifier, DC Photometer. All modules are designed in accord with specifications developed by the AEC for Nuclear Instrumentation Modules; thus the flexibility of a standardized modular instrument system previously available only to nuclear researchers has been extended to engineers and scientists in other fields of activity. Prices range from $325 to $1,075.



PAR PRINCETON APPLIED RESEARCH CORPORATION

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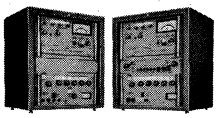
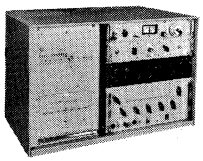
INSTRUMENTATION DIVISION

Since 1922

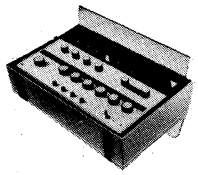
AC/DC Voltage, Current and Power Standards



Model 100 System
Direct Wattmeter Calibration



Model 300 A
Widest Range



Model 1000



Model 485

	Model 100 AC Current	Model 100 AC Voltage	Model 300A
Output Range	10mA-50A	1mV-1000V	0.01mV-100V
			0.02μA-20A
Accuracy	±.04%	±.04%	±0.15% AC ±0.1% DC
Long Term Stability	±0.005%	±0.005%	±0.01%
Maximum Burden	To 20VA	To 20VA	To 40VA
Frequency	50Hz-3KHz	50Hz-10KHz	50Hz-1KHz
Price	$7450.	$7450.	$7900.

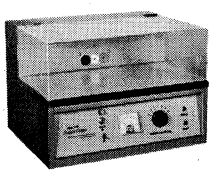
Model 1000 Potentiometer with accuracy of ±3 ppm to 2.3 V. Plant or field use. Self calibration and easy to read digital presentation.
Price: **$2100.**

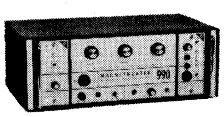
Model 485 Null detector, self-contained electronic galvanometer of all solid state design. Four ranges full scale ±10nA to ±10,000nA. Resolution and sensitivity better than 0.5nA.
Price: **$350.**

Model 170. A basic DC standard for use with laboratory potentiometers. Output is 1 volt with full-scale ranges of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 200, 300, 500 and 1000 volts. Limit of error is within ±10 ppm. Input sensitivity 1000 ohms/volt.
Price: **$1075.**

Magnet Chargers and Treaters

Model 2470-350
Variable output voltage with energies up to 440 watt-seconds for saturating up to 4 lbs. of Alnico V using wire-wound fixture. Accessory Booster available for doubling output.
$1,145.





Model 990
Magnetreater®
Completely solid state demagnetizer for stabilization of permanent magnets. Power continuously variable from less than 1VA to in excess of 80,000VA. Resolution, 0.1%. Can be programmed for automatic or semi-automatic operation.
$695.

Model 1500
Produces 225 watt-seconds for large Alnico meter magnets plus cobalt platinum and barium ferrite materials. Wire-wound fixtures plug into front panel through safety interlocks. **$1,170.**

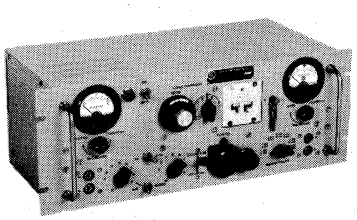
Model 942
Saturate Alnico magnets to 34 lbs. and high coercive force barium ferrite compounds of any shape or number of poles. Outputs to 3,600 watt-seconds. Safety interlocked.
$2,140. to $2,740.

Model 3260
First all solid state impulse charger variable output to 54 watt-seconds. Capable of magnetizing a wide range of materials and configurations. **$775.**

Model 107A
Saturates most medium size and instrument magnets, including core types, using variety of fixtures. Two output ranges: Maximum 18 watt-seconds. Booster unit also available.
$695.

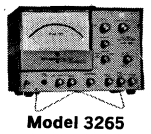
Crystal Impedance Meters

Model	Frequency Range	Impedance Range	Price
459A	800KHz-15 MHz	0-9,900 ohms	$1175.
531	10-140 MHz	10-150 ohms	825.
541C	2.5-1100 kHz	200 ohms-0.5 megohms	1175.
991	2.5 or 50 MHz	100-200 ohms	1795.
1207	75-200 MHz	10-125 ohms	1295.



Reference standards for measuring resonance and anti-resonance of quartz crystals in determination of capacitance, inductance and performance index. Meet U.S. MIL-C-3098C and U.K. Defence DEF-5271 A.

Gaussmeters



Model 3265

Model 220, a low cost unit ranging from 0.05 gauss to 20 kilogauss in 13 full-scale ranges. Measures permanent magnet, DC and AC fields 20 Hz to 800 Hz, up to 30 KHz with accessory readout. Built in probe calibration and zero center mode for determining polarity. Accuracy: ± 1% Price: **$540.00**

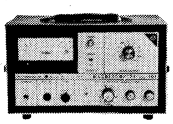
Model 750, a wide range device for flux density measurements from .02 gauss to 50 kilogauss in 24 full-scale ranges. Measures permanent magnetic fields, DC and AC from 20 Hz to 400 Hz. Easy to read 7" meter. Line or battery operation for field use. Accuracy: ± 1%① Price: **$640.00**

Model 3265, three-in-one gaussmeter capable of measuring absolute flux densities from .02 gauss to 50 kilogauss (DC and AC to 400 Hz). In the expanded scale mode, measurement to a resolution of 1 ppm and a differential mode for simultaneous measurement of two separate fields or field gradients. Accuracy: ± 1%① Price: **$995.00**
①Plus accuracy of reference.
Gaussmeters are solid state, Hall effect instruments that yield laboratory accuracy traceable to NBS.

Probes — Are InAs elements for temperature stability. Choice of flat, axial or tangential in various sizes to fit most gaps. Flat ranges from .006" thick x .135" wide x .625" long. **$95.00 to $470.00**

Reference Magnets — Traceable to NBS with 5 gauss to 20K gauss fields and gaps from .040" to .343" are standards for probe calibration. **$45.00 to $500.00.** AC reference magnet (1000 gauss peak-to-peak) also available at **$105.00**

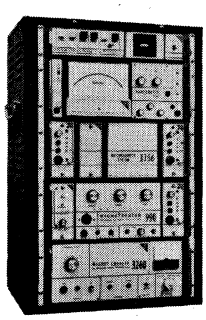
Magnetometer



Model 101

Solid state low level magnetic flux density measurements from 1 gamma to 100,000 gamma (1 oersted). Temperature compensation is provided to enable virtual drift-free operation.
Price: **$560.** — Standard Probe: **$105.**

Automagnetic® Systems



A combination of RFL standard magnetizing, measuring and demagnetizing equipment permits interconnection for semi-automatic and completely automatic systems, designed for individual requirements. Processing includes TWT, BAR and C shaped magnets, DC meters, Torque motors, accelerometers and other designs embodying permanent magnets.

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FORMERLY RADIO FREQUENCY LABORATORIES, INC.
Instrumentation Division • Boonton, New Jersey 07005 • U.S.A.
Tel. (201) 334-3100 / TWX: 710-987-8352 / CABLE: RADAIRCO, N. J.

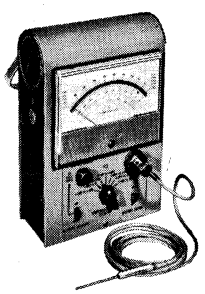
See page 1473 **Thermocontrol Division** Temperature Measurement Control
See page 2791 **Communication Division** Data Transmission Equipment

THERMOCONTROL DIVISION

Since 1922

Temperature Measurement and Control Equipment

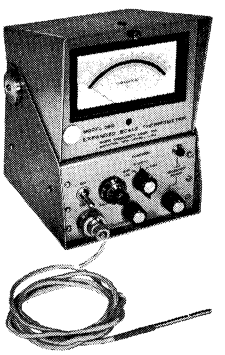
Direct-Reading Electronic Thermometers



Model 212
Wide Range

Model	Range	Accuracy②	Response	Probes	Application	Price
212	—100°C to 500°C	±0.75°C③	<0.5 min.	Platinum	Wide Range-Liquid & Air	$450.00
380T	—100°C to 500°C	±1%	<1 sec.	Thermistor	Liquid-Air-Surface Differential	200.00
385T	—25°C to 500°C	±1%	<1 sec.	Thermistor	Liquid-Air-Surface Expanded Scale	275.00
385E	—100°C to 500°C	±1%	<1 sec.	Thermistor	Liquid-Air-Surface	225.00
390	0°C to 100°C①	±1%	<1 sec.	Platinum	Expanded-Liquid-Air	490.00④

① Other ranges on request ② Of scale span ③ Absolute accuracy traceable to NBS ④ Batteries not included.
Thermometers feature solid state circuitry and are self-contained for portable operation. Wide range of probes available in many configurations, usually at no extra cost. Prices include probe and batteries.



Model 390
Expanded Scale

Proportional Temperature Thermometers

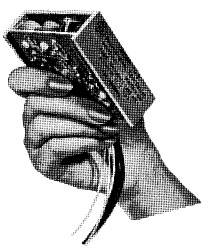
RFL offers a wide selection of controllers for most any application. A significant and major new advancement in the field is the new Model 70 Proportional Controller. This miniature, low cost unit provides true proportional control and is competitive with on-off or fixed temperature types.

Model	Range	Accuracy*	Load	Probe Resistance	Features	Price
40	—100°C to 500°C	±0.1°C	0-10 VDC out	300 to 8000 ohms	Servo equipped valve use	$151.00
90	—100°C to 500°C	±0.1°C	To 100 kW	300 to 8000 ohms	Low cost precision indicating	234.00
50	—100°C to 500°C	±0.05°C	To 300 kW	50 to 7000 ohms	High gain precision indicating	575.00
80	—100°C to 500°C	±0.1°C	To 100 kW	300 to 8000 ohms	Compact fast response non-indicating	155.00
70	—100°C to 500°C	±0.1°C	To 2 kW	300 to 8000 ohms	OEM installation-miniature-non-indicating	37.80

*of set point for 10% load

Prices less probes and are for 115V 1.5 kW 1ø

SCR's replace bulkier auto-transformers and saturable core reactors with a resultant line of light, compact and reliable controllers.



Model 70
Low Cost

COMPONENTS DIVISION

Custom Service/Engineering Consultation

The RFL Components Division offers a custom service with virtually unlimited coil winding capabilities. High quality coils are wound to meet special design requirements or to complete any inductive circuit application.

The goal of our Components Division is to provide a personalized service with quick delivery and competitive prices. Key engineers are always available for consultation either at RFL or your plant to help with any individual problem relating to coil design and manufacture.



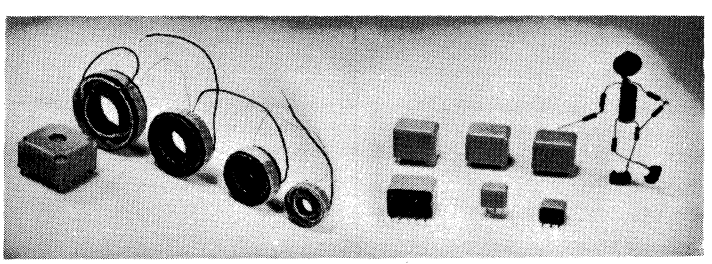
Applications

In addition to the wide range of coil combinations available, a large variety of mechanical and mounting configurations may be specified. These components are adaptable to chassis or circuit board applications. They are used for filters, magnetic amplifiers, blocking oscillators and low signal, high frequency devices.

Proven Reliability and Quality

RFL has designed more than 7,000 different coil combinations to date in support of our long established product line. Mean-time-between-failure figures and field experience in industry, military and aerospace over the years have attested to the reliability and built-in quality of every RFL manufactured component.

All inductors are precision wound under strict quality control supervision using the finest materials available. Typical sizes range from under ¼" to over 2" outside diameter. Inductances range from 0.06mH to 10.4H over wide frequency ranges.



RFL Industries, Inc.
FORMERLY RADIO FREQUENCY LABORATORIES, INC.
Thermocontrol Division • Boonton, New Jersey 07005 • U.S.A.
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See page 2791 Communication Division
Data Transmission Equipment

See page 1472 Instrumentation Division
Metrology, Magnetics

RCA

SOLID-STATE REGULATED DC POWER SUPPLIES

Type WP-700A and WP-702A



FEATURES

- **All solid-state circuitry**
- **Continuously adjustable voltage output — from zero to 20 volts and at full 200 mA correct capacity over this range**
- **Electronic short-circuit protection — a dead short across the output terminals won't harm either supply**
- **Front-panel overload-indicator lamps signal when maximum current condition is approached**
- **Exceptionally low ripple — .0005 rms volt max.**
- **Excellent line and load regulation**
- **Negative feedback regulator circuit maintains constant output voltage with low ripple**
- **Compact and lightweight**

DESCRIPTION

The WP-700A (single unit) and WP-702A (dual unit) are solid-state constant voltage dc power supplies. These versatile bench-type supplies are ideally suited for use in circuit design, servicing, industrial and educational applications. Typical applications include developmental transistor or integrated circuit projects, production line testing of dc operated equipment, industrial maintenance, life testing of devices that require a dc supply, classroom use, battery elimination for radio/phono service, component testing.

The WP-700A and WP-702A are identical, except that the WP-702A is a dual unit, with separate controls, output terminals, and meters for each section. The two sections of the WP-702A are electrically isolated from each other.

Output voltage of the WP-700A and WP-702A is continuously adjustable from 0 to 20 volts, at current levels up to 200 milliamperes. The power supply circuit automatically limits the current to prevent damage due to overload. The supplies will not be damaged even if connected to an external short circuit. A special overload indicator lamp is provided on the panel. The lamp will begin to glow when the current level approaches the 200 mA rating, and will glow brightly if the current exceeds 200 mA.

A meter is provided to indicate either output voltage or current level. The meter function is selected by a convenient panel switch.

All-silicon transistors and diodes are used in the WP-700A and WP-702A. Circuit design features include a negative feedback regulator circuit to maintain constant output voltage with low ripple regardless of varying line voltage or load resistance.

Three convenient five-way output terminals (+DC, −DC, and GND) are provided. The units are equipped with a three-wire AC power cord to permit grounding the external circuit to the power line ground, using the "GND" terminal.

The WP-700A and WP-702A are compact and lightweight, with attractively designed functional panels. The WP-700A measures 4 inches by 6½ inches by 3 inches, and weighs only 3 pounds. The WP-702A measures 6 inches by 12 inches by 3 inches, and weighs 3 pounds, 10 ounces. Both supplies have rugged aluminum cases, finished with blue-gray hammertone enamel.

SPECIFICATIONS

Output	0 to 20 volts, at 0 to 200 mA
Input	105-135 V AC, 50-60 Hz
Line Regulation	Less than 30 mV change in output voltage with power-line variation of 105-135 V AC
Load Regulation	Less than 50 mV load change for a 200 mA load change
Ripple	Less than 500 μV RMS
Meter Functions	0-20 volts 0-200 mA (function selected with panel switch)
Controls	Continuously variable voltage adjustment
Output Terminals	Three; DC+, DC−, GND. Positive or negative output can be obtained
Short Circuit Protection	External short circuit load will not damage supply
Overload Indicator	Panel lamp glows when current level nears 200 mA rating
Power Cord	3-wire power-line cord
Dimensions	WP-700A: 4 in. x 6½ in. x 3 in. WP-702A: 6 in. x 12 in. x 3 in.
Weight:	
Unpacked	WP-700A: 2 lbs. WP-702A: 3 lbs., 10 ozs.
Shipping Weight	WP-700A: 2 lbs., 11 ozs. WP-702A: 4 lbs., 13 ozs.

415 So. 5th Street, Harrison, N. J.

RCA ELECTRONIC COMPONENTS

RCA 5-INCH DUAL BAND OSCILLOSCOPE
Type WO-91C



SPECIFICATIONS

FEATURES

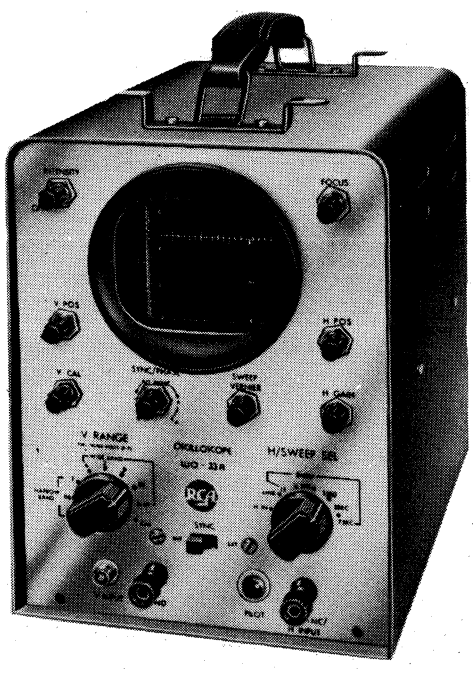
- Front-panel switch selection of wide-band or high-sensitivity operation
- Built-in voltage calibration — large 5-inch screen with VTVM-type voltage scales for fast, simultaneous peak-to-peak measurements and waveshape display
- Flat response (±1 db) from 10 Hz to 4.5 MHz — excellent performance on color TV waveforms
- 0.018 rms volt per inch maximum sensitivity for use at low signal levels
- 0.1 microsecond rise time for accurate display of fast, critical waveforms
- Two-stage TV type sync separator — preset TV "V" and "H" front-panel sweep positions for speedy, automatic lock-in at "Vertical" and "Horizontal" frequencies
- Continuously adjustable (to 100 kHz) sweep oscillator has excellent linearity
- Vertical polarity reversal control for "upright" or "inverted" trace display
- Z-axis input for direct modulation of CRT grid permits use of timing and calibration markers on trace
- Solid-state power supply circuit
- Provisions for connecting signals directly to the vertical deflection plates of the CRT
- Six methods for synchronizing on incoming signal — all selectable from front-panel
- Frequency-compensated 3-to-1 step attenuators provide overlapping display and voltage measurement ranges
- High-impedance, low-capacitance probe (10 megohms at only 11 pf) minimizes loading in critical circuits — assures more accurate display
- Shielded vertical-input connector and cable minimizes hum and stray-field pickup
- Compact, portable — measures 13½" high, 9" wide, 16½" deep — weighs 30 lbs.

DESCRIPTION

The RCA WO-91C 5-inch Oscilloscope incorporates several features that increase its versatility and greatly speed up TV testing and servicing. For example, simultaneous display and peak to peak voltage measurement of waveforms are made easily and accurately by means of a graph-screen scaled directly in volts to correspond to settings on the "V" range switch. Frequency-compensated V-range switch is calibrated in 3-to-1 steps instead of 10-to-1 for VTVM-type voltage measurements. Voltage calibration holds for all settings of range switch.

Choice of wide-band or narrow-band (high sensitivity) operation is provided by a front panel switch which changes the bandpass of the vertical amplifier. In the wide-band position, frequency response is flat within ±1 db from 10 Hz to 4.5 MHz, and in the narrow-band position, −1 db from 10 Hz to 0.5 MHz, and −6 db at 1.5 MHz. Sensitivity is 0.5 peak-to-peak volt per inch (0.018 rms volt) in the narrow-band position; 0.15 peak-to-peak volt per inch (0.053 rms volt) in the wide-band position.

RCA SUPER-PORTABLE 3-INCH OSCILLOSCOPE
Type WO-33A
(Available in wired or kit form)



SPECIFICATIONS

NOTE: Performance figures are for a line voltage of 117 volts, 60 cps.

ELECTRICAL

Frequency Response:
- Vertical Amplifier:
  - Wide-Band Positions (5.5 cps to 5.5 Mc) ..... flat within −3 db
  - High-Sensitivity Positions:
    - 20 cps to 150 Kc ..... flat within −3 db
    - 3 cps to 1.5 Mc ..... flat within −6 db
- Horizontal Amplifier (3.5 cps to 350 Kc) ..... flat within −6 db

Deflection Sensitivity:	*(Wide-Band) Positions* rms	p-p	*(High-Sensitivity) Positions* rms	p-p	
Vertical Amplifier:					
At V INPUT connector	0.10	0.3	.003	0.01	volt/in
With WG-349A (Direct)	0.10	0.3	.003	0.01	volt/in
With WG-349A (Low-Cap)	1.0	3.0	.03	0.1	volt/in
Horizontal Amplifier (at H INPUT terminal)			0.9		rms volt/in
Rise Time (Vertical Amplifier): Wide Band Mc Positions			0.1		μsec

Input Resistance and Capacitance:
- Vertical Amplifier:
  - At V INPUT Connector: 1 megohm shunted by approx. 50 pf
  - With WG-349A (Direct): 1 megohm shunted by approx. 90 pf
  - With WG-349A (Low-Cap): 10 megohms shunted by approx. 10 pf
- Horizontal Amplifier (at H INPUT terminal) ..... 10 megohms
- EXT SYNC Input Terminal ..... 250 K to 55 K

Sweep Oscillator:
- Frequency Range (continuously adjustable) ..... 15 cps to 75 Kc
- Sync ..... External; Positive and Negative Internal

Maximum AC Input Voltage (at Lo-Cap Probe): (In presence of 400 volts dc) ..... 600 p-p volts

Phase-Control Range ..... 0 to 160 degrees

Power Requirements:
- Voltage ..... 105-125 volts, 50-60 cps
- Average Power Consumption ..... 50 watts

MECHANICAL

Height ..... 8¾" Length ..... 10¼"
Width ..... 6½" Weight ..... 14 lbs.

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.

EQUIPMENT SUPPLIED

Direct/Low Capacitance Probe and Cable ..... Type No. WG-349A

TUBE COMPLEMENT

1 6BK7A	2 12AT7	1 6X4
1 6C4	1 6BR8	1 3AQP1

ACCESSORIES AVAILABLE

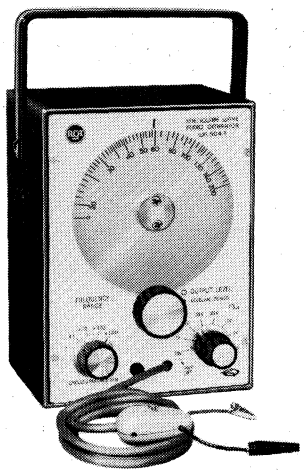
- WG-350A Demodulator Probe for RF applications from 500 KC to 250 Mc
- WG-271A Adaptor for using WG-300B Direct/Low-Capacitance Probe
- WG-300B Direct/Low-Capacitance Probe and Cable

415 So. 5th Street, Harrison, N. J.

RCA ELECTRONIC COMPONENTS

RCA TRANSISTORIZED SINE/SQUARE WAVE AUDIO SIGNAL GENERATOR

Type WA-504A



SPECIFICATIONS

Performance figures for line voltage of 120 volts, 60 Hz

GENERAL

Frequency Range .....20 Hz to 200 kHz (in four ranges)

Amplitude Variation of Output Voltage (30 Hz to 100 kHz) .....±1.5 dB

Frequency Stability (105 to 130 volts AC line) ....±0.5%

Dial Calibration Accuracy (20 Hz to 20 kHz) .....±5%, or 2 Hz, whichever is greater

Source Impedance (200 Hz) Output Range

100 V	0 to 3000 ohms
1 V	Approx. 900 ohms
.1 V	Approx. 91 ohms
.01 V	Approx. 9 ohms

Sine Wave

Output Voltage (100 k ohm, 75 pf load) 10v rms or more

Maximum Total Harmonic Distortion (30 Hz to 15 kHz) 0.25%

Square Wave:

Rise and Fall Time (Maximum output) ....less than 1.0 μS

Maximum Tilt .....less than 5.0%

Output Voltage .....10v p-p or more

Power Supply

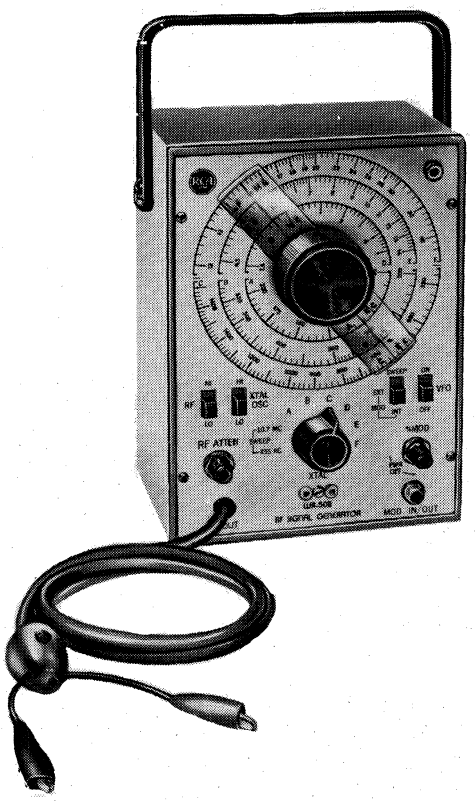
Voltage .....105-130 volts, 50-60 Hz

Average Power Consumption Approx. 8 watts

MECHANICAL

Height	7¾ inches
Width	5⅜ inches
Depth	4¾ inches
Weight	3 lbs.

RCA RF SIGNAL GENERATOR WITH SWEEP FEATURES



Type WR-50B

SPECIFICATIONS

(Performance figures with line voltage at 120 volts, 60 cps)

Sweep Output:
455 kc, center-frequency
10.7 Mc, center-frequency
Sweep width approximately 10% of center frequency

Variable Oscillator:
Six Ranges (fundamental frequencies)

A	85 kc to 200 kc
B	200 kc to 550 kc
C	550 kc to 1600 kc
D	1.5 Mc to 4.5 Mc
E	4.5 Mc to 14 Mc
F	12 Mc to 40 Mc

RF Output (all ranges)[1] 0.05 volt rms (minimum)

Dial Calibration Accuracy .....±2%

Internal Modulating Frequency .....Approx. 400 cps

Percent Modulation....Adjustable up to 30%

Audio Output.....At least 8 volts rms across 15K load

External Modulation .....Modulating frequency, 15 kc max.

[1] Open-circuit value.
[2] With WR-50B tuned to 1 Mc.

Voltage Required for 30% Mod. Using 400 cps[2].....Approx. 10 volts rms

Impedance at AF IN/OUT Connector (400 cps)[3] .....Approx. 10K

Crystal Oscillator[4]
Maximum Output .....0.02 volt rms
Internal Mod. Percentage.....Approx. 20%
Frequency Range 100 kc to 15 Mc (Fundamental)

Attenuator
VFO and Sweep Output.....2-step 10-to-1 attenuator switch with potentiometer for fine adjustment
Crystal Oscillator Output..Additional 7-to-1 attenuator switch

Tube Complement.....2 RCA 12AT7

Power Supply
Voltage Rating....105-130 volts 50/60 cps
Power Consumption .....15 watts

Dimensions:

Height	7¾"
Width	5⅜"
Depth	4¾"
Weight	5 lbs.

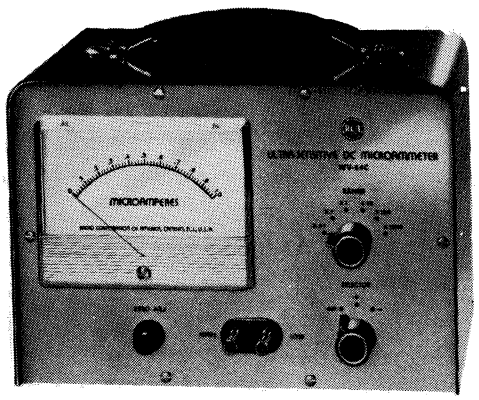
[3] With % MOD control at maximum.
[4] Varies with crystal cut and activity.

415 So. 5th Street, Harrison, N. J.

RCA ELECTRONIC COMPONENTS

RCA ULTRA-SENSITIVE DC MICROAMMETER

Type WV-84C



SPECIFICATIONS

ELECTRICAL

DC Microammeter:
Ranges, six ..... 0 to 0.01, 0.1, 1, 10, 100, 1000 μa
Input Resistance
X.01 μa Range .....50 megohms
X0.1 μa Range .....5 megohms
X1.0 μa Range .....0.5 megohms
X10 μa Range .....50,000 ohms
X100 μa Range .....5000 ohms
X1000 μa Range .....500 ohms
Over-all Accuracy
On X.01 Range .....±5% of full scale
On all other ranges ....±4% of full scale
Voltage drop on all ranges.....0.5 volts

DC Voltmeter:
(When used with external multiplier resistors supplied with the instrument.)
Ranges, three .....0 to 1, 10, 100 volts
Input Resistance
0 to 1-Volt Range .....100 megohms
0 to 10-Volt Range.....1000 megohms
0 to 100-Volt Range .....1005 megohms

Megohmmeter:
(When used with two RCA-VS055 batteries, not supplied with instrument.)
Ranges, two..... 900 to 9000, 9000 to 90,000 megohms
Tube Complement .....Two RCA-3S4
Battery Complement (not supplied with instrument)
"A" Battery .....2 RCA-VS004 1½ volts
"B" Battery ..... 2 RCA-VS102 22½ volts

MECHANICAL

Over-all Dimensions:
Height .....8¾"
Width .....10¾"
Depth .....6½"
Weight .....10 lbs. (including batteries)
Finish .....Blue-grey hammeroid case, Satin-aluminum panel

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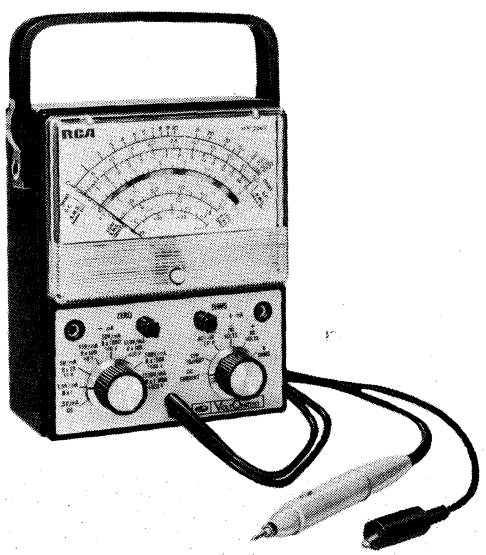
EQUIPMENT SUPPLIED

1 Resistor, 50 ohms, ±1%, 2 W .....Stock No. 97181
1 Resistor, 950 megohms, ±2%, 6W .....Stock No. 57977
Battery Complement (required but not supplied):
2 RCA VS004 1½ Volts
2 RCA VS102 22½ Volts

RCA ALL SOLID-STATE, BATTERY OPERATED VOLTOHMYST®

Type WV-500B



SPECIFICATIONS

FEATURES

- All solid-state circuitry
- Battery operated — completely portable
- Eight overlapping dc current ranges from 2 microamperes to 1500 milliamperes (1.5 amperes)
- Seven overlapping resistance ranges,
- Eight overlapping dc voltage ranges from 0.02 volt to 1500 volts (including special 0.5 dc volt range)
- Seven overlapping ac (rms) voltage ranges from 0.1 to 1500 volts
- Measures ac peak-to-peak voltages of complex waveforms from 0.5 to 4200 volts
- Frequency response — 30 Hz to 250 MHz with WG-301A crystal-diode accessory probe — ±1 db 30 Hz to 3 MHz (1.5 and 5-v ac ranges)
- 11 megohm resistance on all dc ranges
- Calibrated zero center scale
- Sturdy, wired-in single-unit dc/ac ohms probe with fully shielded flexible input cable
- Also includes leads or current measurement
- Mirror scale meter — movement electrically protected against burnout
- Compact, lightweight — measures 6⅞" x 5¼" x 3⅛"; Weight, 3½ lbs.

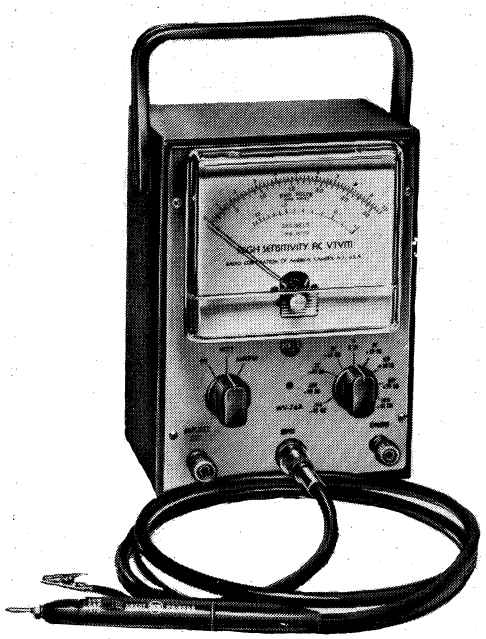
DESCRIPTION

The WV-500B VoltOhmyst is a solid-state, battery-operated electronic voltmeter. The instrument measures dc voltages from 0.01 to 1500 volts, dc current from 2 microamperes to 1500 milliamperes, ac (rms) voltages from 0.1 to 1500 volts, ac peak-to-peak voltages from 0.5 volts to 4200 volts, and resistance values from 0.2 ohms to 1000 megohms.

Seven overlapping ranges are provided for ac rms and resistance measurements, and eight ranges are provided for dc voltage and current measurement. Accuracy for the dc and ac rms functions is ±3% (of full scale reading).

RCA HIGH SENSITIVITY AC VTVM

Type WV-76A



SPECIFICATIONS

The calibration of the WV-76A is based on pure sine-wave input signal voltage.
(Performance figures are based on a line voltage of 120 volts)

ELECTRICAL

Frequency Range:
With WG-300B in "Direct" Position ±1 db 10 cps to 1.5 Mc
With WG-300B in "Low-Cap" Position ±1 db 10 cps to 500 Kc
AC-Voltage Measurements (with WG-300B in "Direct" Position):
Ranges.....0 to 0.01, 0.3, 0.1, 0.3, 1 volt; 0 to 3, 10, 30, 100 volts†
Accuracy.....±5% (full scale)
DB Measurements* (With WG-300B in "Direct" Position):
Ranges (nine).....−40, −30, −20, −10, 0, +10, +20, +30, +40 db
Accuracy .....±5%
Input Characteristics:
At Input Connector 1 meg shunted by 58 $\mu\mu$f
With WG-300B in "Direct" Position 1 meg shunted by 95 $\mu\mu$f
With WG-300B in "Low-Cap" Position 10 megs shunted by 13 $\mu\mu$f
Preamplifier:
Output Voltage.....0.8 output volt for 0.1 input volt
Output Impedance.....Less than 400 ohms
Gain.....38 db on 10 millivolt range
Power Supply:
Frequency .....50 to 400 cps
Voltage .....105-125 volts
Consumption .....35 watts
Tube Complement .....1 RCA 6AN8, 1 RCA 6BK7A

MECHANICAL

Width .....5⅜"
Height .....7⅜"
Depth .....4¾"
Weight (Net) .....5 lbs. (approx.)

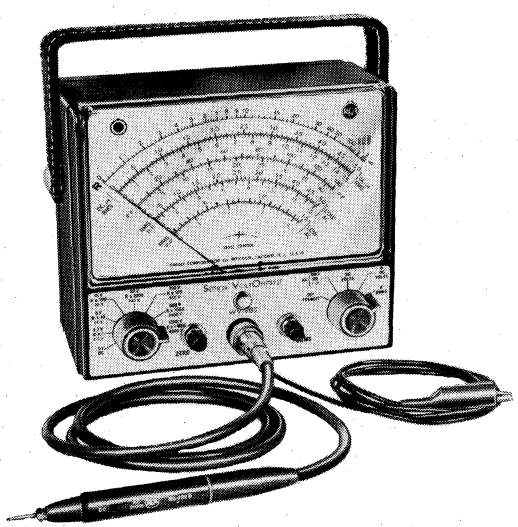
EQUIPMENT SUPPLIED

1 WG-300B Direct/Low-Capacitance Probe, 1 "Slip-On" Alligator Clip, 1 Clip Insulator, 1 Instruction Booklet

† When the WG-300B is set to the "Low-Cap" position, up to 500 volts or +56 db may be measured.
* Zero db = 1 milliwatt into 600 ohms.

RCA SENIOR VOLTOHMYST®

Type WV-98C



SPECIFICATIONS

ELECTRICAL

NOTE: Performance figures are for line voltage of 120 volts, 60 cps.
DC Voltmeter:
Ranges....0 to .5, 1.5, 5, 15, 50, 150, 500, 1500 volts
Input Resistance (With switch on WG-299D set to "DC"):
All Ranges .....11 Megohms
Over-all Accuracy .....±3% of full scale
AC Voltmeter:
Ranges
RMS Values of Sine-Waves....0 to 1.5, 5, 15, 50, 150, 500, 1500 volts
Peak-to-Peak Values of Sine-Waves and Complex Waves.....0 to 4, 14, 42, 140, 420, 1400, 4200 volts
Over-all Accuracy .....±3% of full scale (Accuracy of RMS ranges based on use of sine-wave signals having less than 0.5% total harmonic content.)
Input Resistance and Capacitance (With switch on WG-299D set to "AC-OHMS"):
1.5, 5, 50, 150-volt Range 0.83 meg, shunted to 70 $\mu\mu$f
500-volt Range 1.3 meg, shunted to 60 $\mu\mu$f
1500-volt Range 1.5 meg, shunted to 60 $\mu\mu$f
Frequency Response (1.5, 5.0 and 15 volts AC Ranges) ±1 db 30 cps to 3 Mc
Maximum Input Voltages:
DC Voltages with no ac voltage present .....1500 volts
AC Voltages with no dc voltage present:
RMS for Sine Waves.....1500 volts
Peak-to-Peak for Sine Waves..4200 volts
Peak-to-Peak for Complex Waves .....2000 volts
Combined AC and DC Voltages:
Sum of DC Voltage and AC Peak Voltage .....2000 volts
Ohmmeter:
Ranges, Seven .....0 to 1000 megohms
Meter Movement:
DC Current for Full-Scale Deflection .....200 microamperes
Power Supply:
Voltage Rating .....110-130 volts
Frequency Rating .....50-60 cps
Power Consumption (Approx.) .....6 watts
Battery .....1 RCA VS036
Tube Complement .....1 RCA 6AL5, 1 RCA 12AU7A

EQUIPMENT SUPPLIED

DC/AC-OHMS Probe and Cable (Type WG-299D), 1.5-Volt Battery (Type VS036), Slip-on Alligator Clip, Insulator, Instruction Booklet and Registration Card.

ACCESSORIES

Available on Separate Order
For Measuring AC Voltages at Frequencies from 50 KC to 250 Mc:
Crystal-Diode Probe .....Type WG-301A
For Increasing DC Voltage to 50,000 Volts:
High-Voltage Probe .....Type WG-289
Multiplier Resistor .....Type WG-206

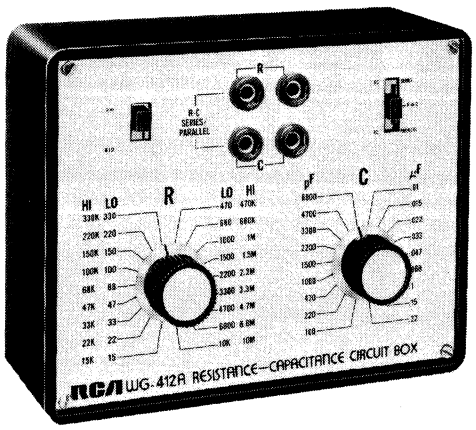
415 So. 5th Street, Harrison, N. J.

RCA ELECTRONIC COMPONENTS

RCA RESISTANCE-CAPACITANCE CIRCUIT BOX

Type WG-412A

SPECIFICATIONS



DESCRIPTION

The RCA WG-412A provides a convenient selection of standard resistor and capacitor values available either separately or in series or parallel R-C combinations. The unit includes 36 resistors ranging in value from 15 ohms to 10 megohms and 18 capacitors from 100 picofarads to .22 microfarads.

Both resistors and capacitors have a 10% tolerance. The resistors have a power rating of one watt. The capacitors have a voltage rating of approximately 600 volts.

Some uses of the R-C Circuit Box include component substitution in servicing and circuit design applications and establishing R-C circuits for checking impedance, resistance, and frequency characteristics. The unit is also useful for classroom applications to demonstrate Ohm's Law, capacitive reactance, and other circuit effects caused by introducing various resistance and capacitance combinations.

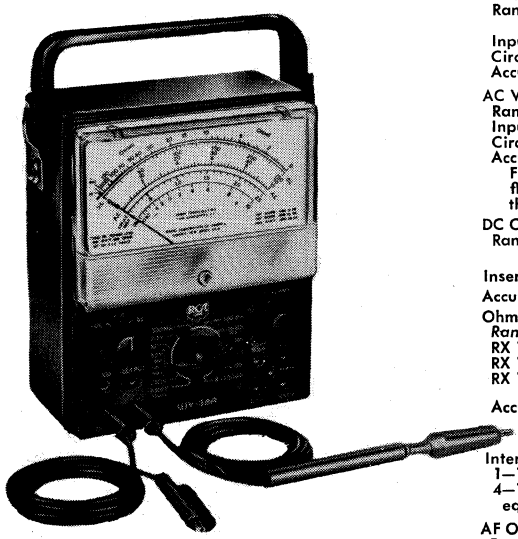
The R-C Circuit Box is provided with plug-in test leads with convenient alligator clip connectors (WG-413A). The unit measures 6⅞ inches by 5⅜ inches by 2⅞ inches and weighs approximately one pound, 12 ounces.

FEATURES

- 36 resistors in standard values from 15 ohms to 10 megohms (1 watt power rating, Tolerance ±10%)
- 18 capacitors from 100 pF to 0.22 uF 600V rating, (Tolerance ±10%)
- Simplified switching for separate R or C, or series or parallel R-C
- Standard ¾" terminal-jack
- Spacing accommodates dual banana-plug
- Complete with plug-in test leads and alligator-clip connectors
- Measures 6⅞" x 5⅜" x 2⅜" . . . Weighs 1 lb. 12 oz.

RCA VOLT-OHM-MILLIAMMETER

Type WV-38A



SPECIFICATIONS

ELECTRICAL

DC Voltmeter (at full scale):
Ranges ..... 0 to .25, 1.0, 2.5, 10, 50, 250, 1000, 5000 volts
Input Resistance ..... 20,000 ohms-per-volt
Circuit Loading ... 50 microamps. bleeder current
Accuracy ..... ±3%

AC Voltmeter (at full scale):
Ranges ..... 0 to 2.5, 10, 50, 250, 1000, 5000 volts
Input Resistance ..... 5000 ohms-per-volt
Circuit Loading .. 200 microamps. bleeder current
Accuracy ..... ±5%
Frequency Response (reference 1000 cps) flat within ½ db from 10 cps to 50 kc on the 2.5, 10, and 50 volt ranges.

DC Current (at full scale):
Ranges ..... 0 to 50 μA, 1 MA, 10 MA, 100 MA, 500 MA, 10 Amp.

Insertion Loss ..... 0.25 volt

Accuracy ..... ±3%

Ohms:

Ranges	*Scale Ends*	*Center Scale*	*Full Scale Currents*
RX 1	0-2000	12 ohms	120 MA
RX 100	0-200,000	1200 ohms	1.2 MA
RX 10,000	0-20,000,000	120,000 ohms	0.06 MA

Accuracy ..... ±3° of pointer position for exact value
Meter movement protected against burn-out.

Internal Batteries (not supplied):
1—1.5V "D" size cell, RCA VS 036 or equivalent
4—1.5V Penlight cells, RCA VS 034A or equivalent

AF Output (at full scale):
Ranges ..... 0 to 2.5, 10, 50, 250 volts
Input Resistance ..... 5000 ohms-per-volt
Circuit Loading ..... 200 microamperes
An internally connected 0.1 μf DC blocking capacitor permits output measurements in presence of DC voltages.

Decibel Levels (Zero DB is 1 milliwatt in 600 ohms):
2.5 V. Range ..... —20 to +10 DB
10 V. Range ..... —8 to +22 DB
50 V. Range ..... +6 to +36 DB
250 V. Range ..... +20 to +50 DB
(May be read on Output or AC positions)

MECHANICAL

Dimensions—(less handle):
Height ..... 6⅞"
Width ..... 5¼"
Depth ..... 3⅛"
Weight ..... 3½ lbs

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.

EQUIPMENT SUPPLIED

1—Red Test Lead and Probe
1—Slip-on Alligator Clip and Red Insulating Boot
1—Black Test Lead with Alligator Clip and Black Insulating Boot
1—Instruction Book
(Batteries not supplied)

ACCESSORIES AVAILABLE

WG-297	High Voltage Probe, less resistor
WG-210	Resistor 900 Megohm for H.V. Probe (10 x multiplier for 5000 V. range)
WG-211	Resistor 495 Megohm for H.V. Probe (100 x multiplier for 250 V. range)
WG-352A	RF Diode
WG-270A	Vinyl Carrying Case, includes convenient storage compartment for test leads.

415 So. 5th Street, Harrison, N. J.

RCA ELECTRONIC COMPONENTS

RCA IN-CIRCUIT/OUT-OF-CIRCUIT TRANSISTOR TESTER

Type WT-501A



FEATURES

- Battery operated — completely portable
- Tests both high-power and low-power transistors
- Tests for collector-to-base leakage (1_{CBO}), collector-to-emitter leakage (1_{CEO}), and DC Beta
- Adjustable collector current permits most transistors to be tested at their rated current level
- A complete DC forward current transfer ratio curve can be plotted up to 1 amp.
- Front panel NPN and PNP sockets for convenient matching in complementary symmetry applications
- Three color-coded test leads for in-circuit testing
- Special low-impedance circuitry assures reliable in-circuit testing of transistor current gain
- Includes zero control to cancel the effect of leakage on Beta reading
- Precision resistors insure accurate test results
- Tests relative front-to-back ratio of diodes at appropriate current levels
- Color-coded panel for simplified operation
- Mirrored scale
- Compact, lightweight — measures 6⅞" x 5¼" x 3⅛"; Weight — 2¾ lbs.
- Comes complete with 20-page instruction manual and latest RCA transistor manual

USES

The RCA WT-501A is designed to test transistors both in-circuit and out-of-circuit. Applications ranging from a quick check of dc beta to an extensive analysis of transistor performance make the versatile WT-501A valuable for use in the service shop, factory, or laboratory.

The sockets provided on the WT-501A will accommodate most low-power transistors with conventional terminal locations. In addition, the socket has an extra base pin for use with transistors having "in-line" terminals. The test leads provided for in-circuit testing can be used to connect transistors that do not fit the panel socket.

(NOTE: MOS and FET type transistors require a test similar to that used for vacuum tubes and cannot be tested with the WT-501A.)

DESCRIPTION

Completely portable and requiring no external power source, RCA's WT-501A tests transisors both in-circuit and out-of-circuit, tests both low and high-power transistors, and has both NPN and PNP sockets to allow convenient transistor matching for complementary symmetry applications. Three color-coded test leads are provided for in-circuit testing. Special low-impedance circuitry assures reliable in-circuit testing.

The instrument is designed to test transistors for dc beta from 1 to 1000, collector-to-base leakage (I_{CBO}) as low as two-microamperes, and collector-to-emitter leakage (I_{CEO}) from 20 amperes to one-ampere. Collector current is adjustable from 20 microamperes to one-ampere in four ranges, permitting most transistors to be tested at their rated current level. Power transistors can be tested with I_c up to one-ampere. A dc forward current transfer ratio curve can be plotted. The instrument can also test the relative in-circuit dc current gain of a transistor.

A 100 microampere meter movement is used in the measuring circuits for the various test functions, and precision resistors are used to insure accurate test results. Normal maintenance includes only replacing the batteries as necessary.

The instrument has two internal 1.5 volt "D"-size batteries. One of these batteries is used during in-circuit tests to provide voltage in reverse polarity to cancel the effect of circuit leakage. The batteries can be tested with the instrument itself using a simple procedure outlined in the instruction manual.

The WT-501A is also a convenient device for making a check of the relative front-to-back ratio of diodes. An important feature is the ability to check the diode at an appropriate current level.

Additional features of the WT-501A include a color-coded front panel for simplified operation, a mirror-scale meter which reduces the error in readings due to parallax, and handle clips for convenient storage of the test leads.

SPECIFICATIONS

DC BETA (hFE)
- Range ..... 1 to 1000
- Accuracy ..... ±5%

COLLECTOR CURRENT (I_c)
- 100 μA to 1 Amp. in four ranges; (0 to 1 mA, 10 mA, 100 mA, 1 A.)

COLLECTOR-TO-BASE LEAKAGE
- (I_{CBO}) ..... 0 to 100 μA

COLLECTOR-TO-EMITTER LEAKAGE
- (I_{CEO}) ..... 0 to 1 Amp.

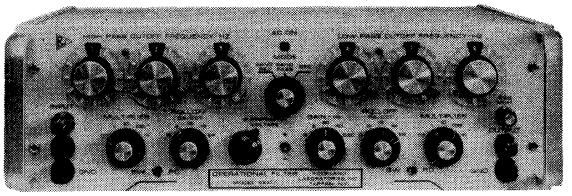
BATTERY VOLTAGE
- 1.5-volts, two "D" cells

METER SCALES ..... Beta
- Beta Cal (I_c) (Multiplier)
- Leakage Current (I_{CBO} & I_{CEO})

DIMENSIONS (less handle)
- Height ..... 6⅞ inches
- Width ..... 5¼ inches
- Dept ..... 3⅛ inches

WEIGHT (unpacked) ..... 2¾ pounds

PRECISION INSTRUMENTS
by Rockland Laboratories, Inc.



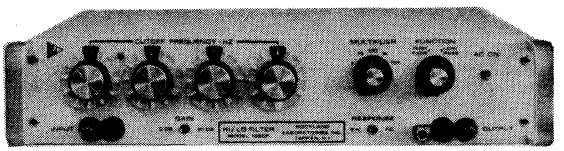
OPERATIONAL FILTER®

FILTERS The RLI line of solid-state, active filters covers the band .001 Hz to 100 KHz. The OPERATIONAL FILTER series features low pass, high pass, band pass and band reject response functions with variable roll-off (up to 24 db/octave), variable gain (up to 40 db) and AC or DC operation. The HI/LO and DUAL HI/LO FILTERS serve as either high pass or low pass filters with fixed rolloffs of 24 or 48 db/octave, 0 db and 20 db gain, and AC or DC operation. See Section 2700 for further details.

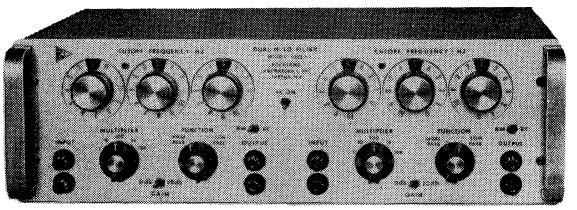
TILTMETERS A sensitive, two-axis tilt indicator consisting of a sensor and an indicator electronics console. The sensor is an inverted pendulum, with two degrees of freedom, equipped with orthogonal capacitor displacement transducers for simultaneous measurement of tilt about two perpendicular axes. The electronic circuitry provides visual meter readouts and analog outputs for continuous recording. Full scale settings of 1 arc sec, 10 arc sec, 1 arc min and 10 arc min are selectable by front panel switch. In the most sensitive scale setting, the tiltmeter resolution is .0005 arc sec which is adequate for recording earth tide or long-term tilts associated with tectonic crustal deformation. The lower sensitivity scales are suitable for recording tilts of gyro test piers, launch pads, dams, buildings, etc. AC or DC

MULTICHANNEL EVENT ANALYZERS For direct measurement of distribution functions for transient events distributed randomly in amplitude and time. The RLI Multichannel Event Analyzer is basically a pulse height analyzer and totalizer with 5 selectable threshold voltage levels. Hold times, i.e., the minimum time interval between counts, are adjustable by front panel control. Total counts are displayed by visual readout in 5 separate registers. An analog voltage proportional to total count is available for monitoring and telemetry purposes.

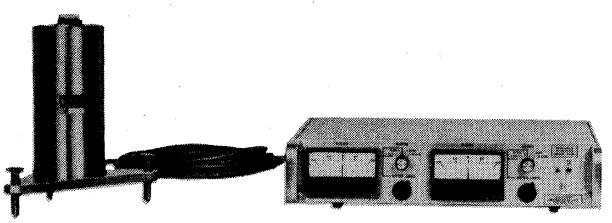
ELECTRONIC GALVANOMETERS Consists of a low noise preamplifier followed by an adjustable low-pass filter whose output is applied to a 1-sec galvanometer. The filter corner period and preamplifier gain are adjustable to obtain over-all responses equivalent to those of long-period galvanometers (from 10 sec to over 100 sec). This instrument is intended to replace mechanical galvanometers presently being used in photographic recording. Analog outputs suitable for tape recording are provided.



HI/LO FILTER®

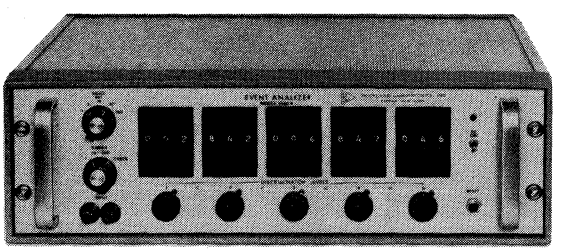


DUAL HI/LO FILTER®



TILTMETER

operation. Integral motor drives for automatic leveling, automatic caging and uncaging, and special purpose casings are available for adaptation of the system to remote operation. Base Price $2750.00.



EVENT ANALYZER

OTHER PRODUCTS

- **Custom Design Filters**
- **Seismic Instrumentation**
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- **Amplifiers** • **Pressure Sensors**
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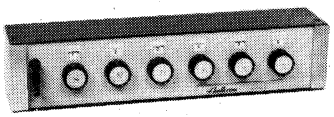
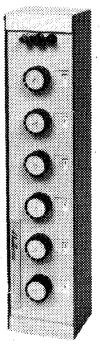
PRECISION RESISTANCE DECADES

SERIES 6800





Series 6800 precision resistance decades feature exceptional quality, operational ease, and styling. A simple slide mechanism permits in-line viewing with vertical or horizontal readout.

SPECIFICATIONS

D-C accuracy at terminals:
±0.02% — 10 ohms and above,
±0.003 ohm — below 10 ohms.

Zero Resistance:
4 milliohms per decade maximum. Each instrument is supplied with exact reading.

Power Rating per step:
0.50 watt — 1 ohm and greater
0.25 watt — 0.1 ohm steps
0.16 watt — 0.01 ohm steps
Maximum current per step marked on knobs.

Maximum Voltage:
1500 volts d-c. Individual resistor power ratings must not be exceeded.

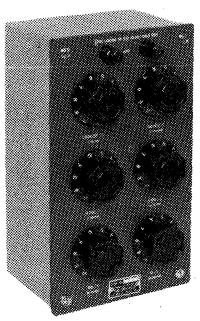
Stability:
±0.005% per year at rated power, 10°C. — 30°C.

Temperature Coefficient:
0±10ppm/°C. (10 ohms and above)
0±20ppm/°C. (under 10 ohms)

NUMBER OF DIALS	SIZE	MODEL NUMBER	RESISTANCE STEP INCREMENTS (Ohms)	MAXIMUM RESISTANCE (Ohms)	PRICE ($)
4	17⅓ x 5 x 5	6840	0.01	111.1	109
		6841	0.1	1,111	107
		6842	1.0	11,110	105
		6843	10	111,100	105
		6844	100	1,111,000	127
		6845	1000	11,110,000	192
5	19½ x 5 x 5	6850	0.01	1,111.1	139
		6851	0.1	11,111	137
		6852	1.0	111,110	135
		6853	10	1,111,100	157
		6854	100	11,111,000	222
6	19½ x 5 x 5	6860	0.01	11,111.1	159
		6861	0.1	111,111	157
		6862	1.0	1,111,110	177
		6863	10.0	11,111,100	242

Series 6800 precision decade resistance boxes are also available on 3½" x 19" panels for rack mounting.

SERIES 800



Series 800 decades offer a comprehensive range of all-purpose decades that provide reliable performance.

SPECIFICATIONS

Resistor D-C accuracy:
±0.05% — 10 ohms and above
±0.25% — 1.0 ohm steps
±1.0% — 0.1 ohm steps
±5.0% — 0.01 ohm steps

Zero Resistance:
4 milliohms per decade maximum.

Maximum Power:
½ watt per resistor.

Maximum Voltage:
2000 volts d-c. Individual resistor power ratings must not be exceeded.

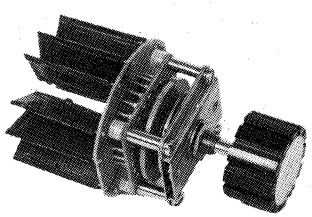
Stability:
±0.01% per year at rated power, 10°C. to 40°C.

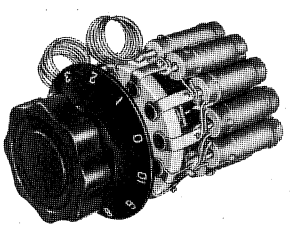
Temperature Coefficient:
0±20ppm/°C.

NUMBER OF DIALS	SIZE	MODEL NUMBER	RESISTANCE STEP INCREMENTS (Ohms)	MAXIMUM RESISTANCE (Ohms)	PRICE ($)
4	9⅝ x 7¼ x 5¼	817A	0.01	111.1	93
		819	0.1	1,111	91
		825	1.0	11,110	89
		826	10	111,100	89
		827	100	1,111,000	106
		828	1000	11,110,000	155
5	10⅞ x 6¼ x 5¼	817B	0.01	1,111.1	109
		8285	0.1	11,111	107
		829	1.0	111,110	105
		830	10	1,111,100	122
		831	100	11,111,000	171
6	10⅞ x 6¼ x 5¼	817C	0.01	11,111.1	125
		8315	0.1	111,111	123
		832	1.0	1,111,110	138
		833	10.0	11,111,100	187

Series 800 decade resistance boxes are also available in 2-dial and 3-dial sizes and also on 3½" x 19" panels for rack mounting.

UNMOUNTED RESISTANCE DECADES





Shallcross resistance decades are available unmounted for use in your proprietary designs. Characteristics are the same as for multi-dial boxes above. Series 6800 decades have isolated shaft. Series 800 shaft is electrically connected to switch rotor.

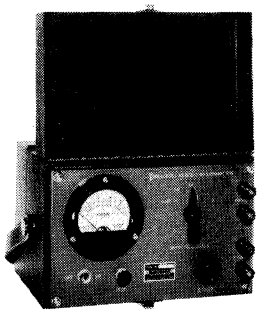
RESISTANCE STEP INCREMENTS (Ohms)	MAXIMUM RESISTANCE (Ohms)	6800 SERIES		800 SERIES	
		MODEL	PRICE ($)	MODEL	PRICE ($)
0.01	0.1	6800	22	434	17
0.1	1.0	6801	22	435	17
1.0	10.0	6802	20	436	15
10.0	100.0	6803	20	437	15
100.0	1,000	6804	20	438	15
1,000	10,000	6805	20	439	15
10,000	100,000	6806	20	440	15
100,000	1,000,000	6807	42	441	32
1,000,000	10,000,000	6808	85	442	64

Series 800 unmounted decades are available with dust cover and electrically isolated shaft. $4.00 extra.

Prices subject to change without notice.

For more details, call 919-965-2341 or write, requesting the Shallcross Instrument Catalog
SHALLCROSS · E. PRESTON ST. · SELMA, N.C. 27576 · SUBSIDIARY OF CUTLER HAMMER

Shallcross VALUES IN RESISTANCE MEASUREMENT



SERIES 670 LOW RESISTANCE TEST SETS

These portable test sets offer the facility and operating speeds necessary for efficient production line measurement of low resistances. Applications include testing welding bond resistance, switch contact resistance, etc. A pistol grip probe and fixed clamp are standard accessories for production line tests.

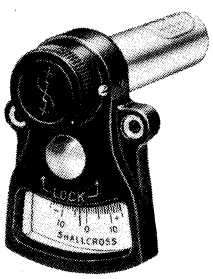
Price (Without accessories): $195

676B Fixed Clamp: $20 271 Test Standard: $20

657B Pistol Grip Probe: $30

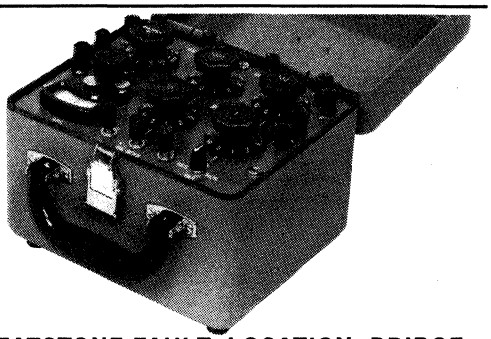
MODEL NUMBER	NO. OF RANGES	RANGES IN OHMS — READING FROM ZERO TO FULL SCALE VALUE INDICATED					
670-A	6	0.001	0.005	0.01	0.05	0.10	0.50
673-D	5	0.005	0.01	0.50	1.0	5.0	

SERIES 1960 GALVANOMETER WITH INTERNAL MAGNET CONSTRUCTION



These sensitive miniature galvanometers are used by O.E.M.'s throughout the industry. They are available off-the-shelf or on special order to your specifications.

MODEL NUMBER	SENSITIVITY (MICROAMPERES PER DIVISION)	PERIOD (SECONDS)	COIL RESISTANCE (Ohms)	EXTERNAL CRITICAL DAMPING RESISTANCE (Ohms)	PRICE ($)
1961-A	1.0	3	250	950	20
1961-B	0.5	3	1000	2400	20
1961-C	2.0	3	50	125	20
1961-D	4.0	3	20	50	20
1964-D	1.5	4	30	40	24
1966-B	0.25	4	1000	2000	24
1966-C	1.0	4	50	100	24

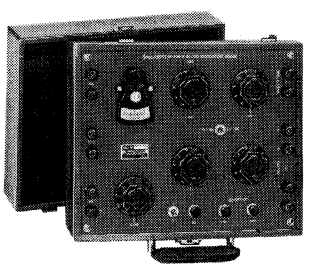


6100 WHEATSTONE-FAULT LOCATION BRIDGE

This all-purpose portable instrument is ideal for laboratory and field resistance measurements. Circuits are included for Murray, Varley, Hilborn, and Fisher loop tests. Reads resistances from 1.0 ohm to 1.011 megohm with ±0.1% accuracy. Includes 4.5 volt (3 cells) internal supply and sensitive galvanometer. Binding posts allow use of external power source and/or galvanometer. Weatherproof metal case is approximately 9"x8"x6". Price $240. Model 6101 wheatstone bridge is identical except that it does not include loop-test features. Price $200.

638-R KELVIN-WHEATSTONE BRIDGE

A portable Kelvin-Wheatstone Bridge offering exceptional versatility and practicality.



Wide measurement range:
0.001 ohm to 10 ohms (Kelvin). Accuracy ±0.75%.
1 ohm to 11 megohms (Wheatstone). Accuracy ±0.2%.

Power Source:
Internal, 4.5 volts (three 1.5 volt cells).
Binding posts for high-current source for Kelvin Bridge and high voltage source for high resistance measurement.

Galvanometer:
One microampere per millimeter scale division supplied. Binding posts for external galvanometer.

Case:
Polished wood, approximately 13" x 11" x7".

Price: $325.

SERIES 617 PERCENT LIMIT BRIDGE

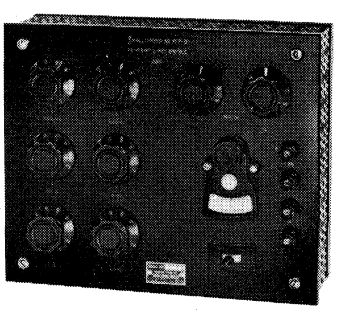
The series 617 bridges are designed for rapid production testing of resistors to each of six specified percentage tolerances from 0.25% to 10%.

- Six dial rheostat arms
- Individual plus and minus percentage selector dials
- May be used for conventional wheatstone measurements.

Model 617A
Resistances to 111,111 in 0.1 ohm steps — $275

Model 617I
Resistances to 1,111,110 in 1.0 ohm steps — $290

Model 617N
Resistances to 11,111,100 in 10 ohm steps — $339



Prices subject to change without notice.

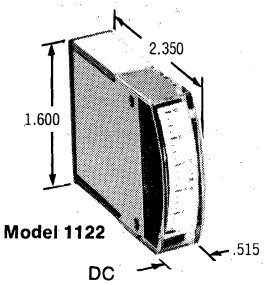
For more details, call 919-965-2341 or write, requesting the Shallcross Instrument Catalog
SHALLCROSS · E. PRESTON ST. · SELMA, N.C. 27576 · SUBSIDIARY OF CUTLER HAMMER

international instruments

SIGMA

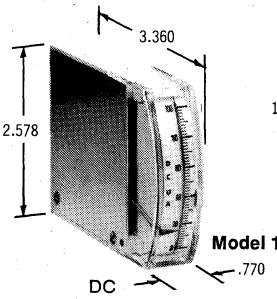
EDGEWISE PANEL METERS

Where compact panel size is essential, three International edgewise meters can be horizontally or vertically flush stacked in less space than one conventional-type meter. International edgewise meters feature D'Arsonval movements, Alnico V magnets, sapphire jeweled pivots and internal magnetic shielding. Cases have clear plastic front covers for maximum ambient illumination. All models are available in a wide variety of current or voltage ranges and can be supplied as db or VU meters.



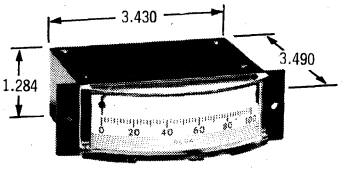
Model 1122

DC
0-100 ua to 0-3 amps
0-50 mv to 0-100 volts
AC (Rectifier-Type)
0-10 to 0-100 Volts

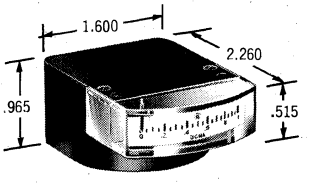


Model 1136

DC
0-50 ua to 0-15 amps
0-10 mv to 0-500 volts
AC (Rectifier-Type)
0-50 to 0-500 volts



Model 1145



Model 1120

Standard Ranges

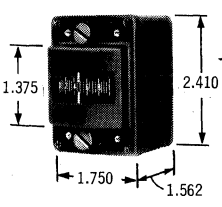
DC
0-100 ua to 0-3 amps
0-50 mv to 0-100 volts
AC (Rectifier-Type)
0-10 to 0-100 volts

DC
0-100 ua to 0-15 amps
0-50 mv to 0-500 volts
AC (Rectifier-Type)
0-10 to 0-500 volts

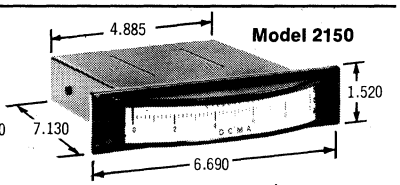
Military Models

International military-type panel meters conform to applicable sections of MIL-M-10304. All models are rugged, sealed, watertight and can be supplied either illuminated or non-illuminated. Designed for horizontal or vertical mounting.

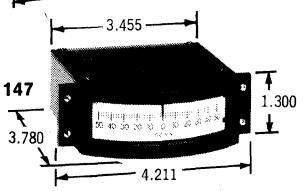
Model 2120

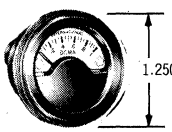


Model 2150

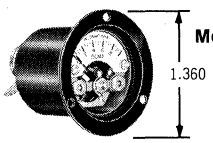


Model 1147

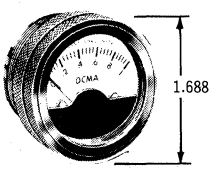




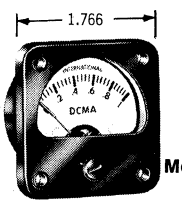
Model 100



Model 104



Model 150



Model 153

Miniature Meters

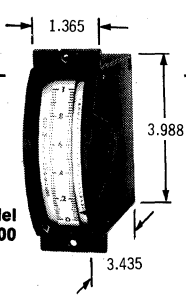
For use where minimum size, light weight and high reliability are essential. Scale lengths from 0.760 to 1.3" with initial accuracy of ±3%, D.C.
Standard ranges for International miniature meters:
DC: 0-100 ua to 0-15 amp; 0-50 mv to 0-500 volts; AC (Rectifier-Type): 0-10 to 0-500 volts. Also VU and db ranges.



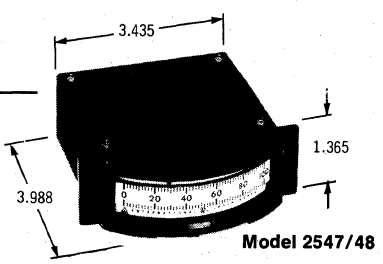
VOM-22

VOM-22 Miniature Multi-tester

Compact, rugged. Accuracy: ±3%, DC; ±5%, AC. Dust-tight, printed circuit rotary range-selection switch. 20,000 ohms/volt DC, 15,500 ohms/volt AC. 18 measurement ranges. Full-wave bridge rectifier. Leather case available.



Model 2500



Model 2547/48

Electronic Control Meters

For continuous indication of any quantity which can be represented by an electrical signal. Choice of horizontal or vertical mountings, special scales, AC and DC voltage ratings.

Sigma also markets a complete line of relays (see section 4500) and a wide range of precision snap switches (see section 5100).

SIGMA INTERNATIONAL INSTRUMENTS
DIVISION OF SIGMA INSTRUMENTS INC.
88 MARSH HILL RD., ORANGE, CONN. 06477
Tel. Area Code 203 795-4711 • Cable: INTERINST New Haven

Simpson®

PANEL INSTRUMENTS • CONTROLLERS • DIGITAL INSTRUMENTS • CHART RECORDERS • TEST EQUIPMENT • PORTABLE STANDARDS



260®

TEST EQUIPMENT

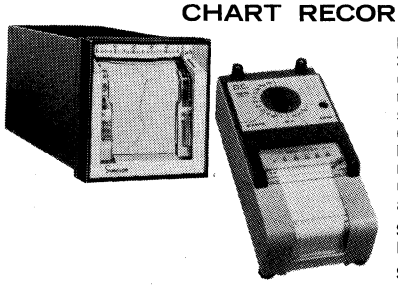
Select from 25 VOMs . . . including the world famous 260® and new solid-state model 313. Special VOMs have built-in temperature and AC current ranges. Also in Simpson's wide selection of test equipment: VTVMs, oscilloscopes, temperature testers, and plug-in accessories.

SEE LISTINGS IN RADIO-ELECTRONIC MASTER or write for bulletin 2078.

Simpson portable and multi-range standards are also listed in RADIO-ELECTRONIC MASTER, or write for bulletin 368.



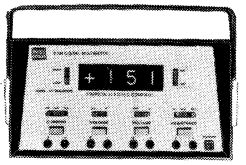
CHART RECORDERS



Model 2750 panel mounts in just 3¾ x 3¾" of space — yet records for over a month completely unattended. 43 electrical ranges stocked. Model 2755 has 10 event channels in the same size package. Model 2760 has temperature ranges. Multi-range models 604 and 605 provide electrical recordings at low cost-per-range.

SEE LISTINGS IN RADIO-ELECTRONIC MASTER or write for bulletin 368.

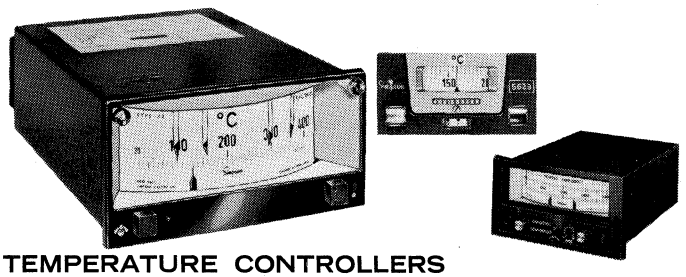
Simpson also has a wide selection of fast response potentiometric recorders and XY recorders. Write to Simpson with your requirements, or call your local Simpson Representative.



DIGITAL INSTRUMENTS

2700 Digital System has 4 full-time digits, automatic polarity selection, and ±0.05% accuracy. 5 plug-in modules provide DC voltage, resistance, AC voltage, DC current, and other ranges. Other Simpson digitals include the model 2725 20-MHz counter, and model 2701 digital VOM.

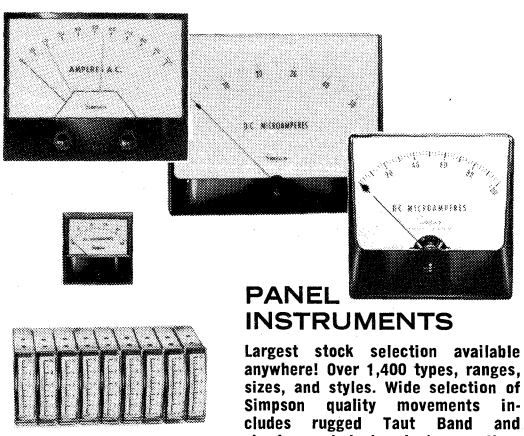
SEE LISTINGS IN RADIO-ELECTRONIC MASTER or write for bulletin 368.



TEMPERATURE CONTROLLERS

Simpson can meet your control needs with "off the shelf" delivery of stock ranges — or our Sales Engineers can custom design controller specifications for your application. Model 5623/RO-1 is just 17⅞" high — controls ±0.5% accuracy — and has built-in proportioning. Other models have 4 control points, SCR control, and plug-in mounting.

WRITE FOR COMPLETE INFORMATION or call your local Simpson Representative. See the Yellow Pages under "Controllers, Controls & Control Systems."



PANEL INSTRUMENTS

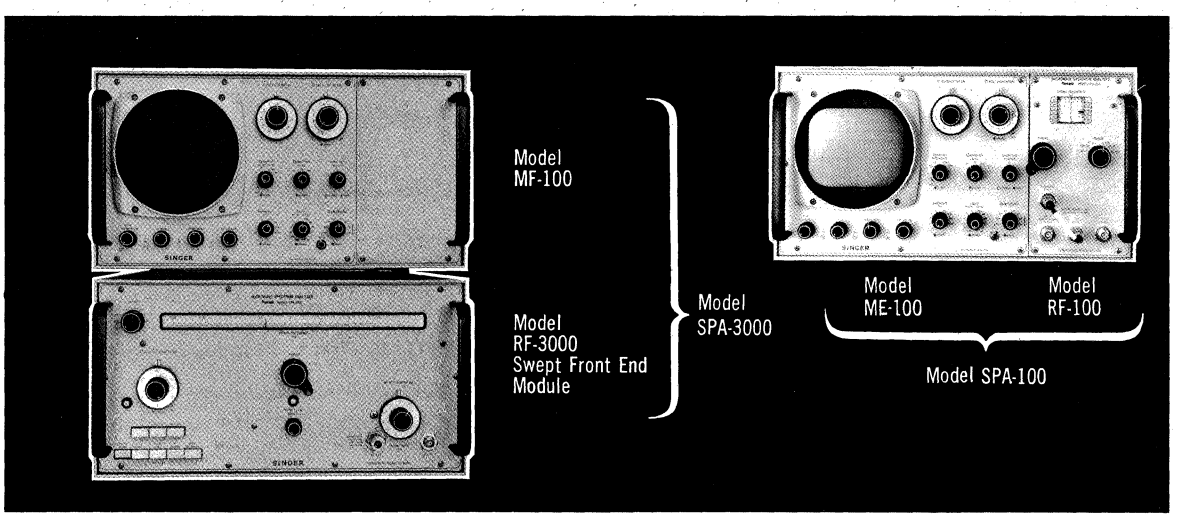
Largest stock selection available anywhere! Over 1,400 types, ranges, sizes, and styles. Wide selection of Simpson quality movements includes rugged Taut Band and shock-mounted jewel types. Your special panel instrument need may be stocked by Simpson . . . or your local Simpson Representative can give you fast, efficient help on special order types.

SEE LISTINGS IN RADIO-ELECTRONIC MASTER or write for bulletin 2079.

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie Street, Chicago, Illinois 60644 • Phone (312) 379-1121

Microwave Spectrum Analyzers



Model SPA-100

0.01 to 40 GHz

Model SPA-100A

1 to 40 GHz

Swept Front End Analyzer 3-GHz Dispersion

Model SPA-3000

0.01 to 40 GHz

Features

- RF sensitivities up to —105 dBm (S+N=2N @ 1-kHz bandwidth)
- Up to 3-GHz dispersion (to 9 GHz) and greater than 2-GHz dispersion to 40 GHz
- No in-band multiple responses negates the need for expensive external preselectors which degrade sensitivity and flatness
- 60-dB calibrated log scale usable at all dispersions and bandwidths
- Synchroscope capability for time domain analysis
- Built-in fool-proof phase lock and signal identification circuitry
- X-Y outputs
- Provisions for external remote programming, display and automated control
- Modular design and construction allows extensions of capability and ease of service.

Applications

CW, AM, FM, PM, pulse and random waveform analysis ☐ Intermodulation distortion measurements ☐ Accurate modulation index and deviation measurements of FM signals ☐ Stability measurements of r-f sources ☐ Simplified tuning of frequency multipliers ☐ RFI and EMC spectrum surveillance ☐ Direct reading of pulse spectrum power points and nulls.

Description

The PANORAMIC Model SPA-100 Microwave Spectrum Analyzer is a broadband instrument with accurate calibration capabilities. Of solid-state design and modular construction, the SPA-100 provides a full dispersion capability of 100 MHz over the entire 10 MHz to 40 GHz frequency range. This wide dispersion, even down to 10 MHz, is achieved through the use of an up-converter in the 10 MHz to 1 GHz band. (The up-converter is not incorporated in the SPA-100A.)

The high sensitivity, low distortion and wide range of bandwidths of the SPA-100 provides a large dynamic range display for all types of signals. The calibrated 60 dB log scale accuracy is constant for pulse spectra using the 1 MHz bandwidth as well as for CW, MCW, FM and AM signals, thus permitting accurate amplitude measurements. An extended time base with internal synchronization and the wide bandwidths permit time domain analysis of pulsed signals.

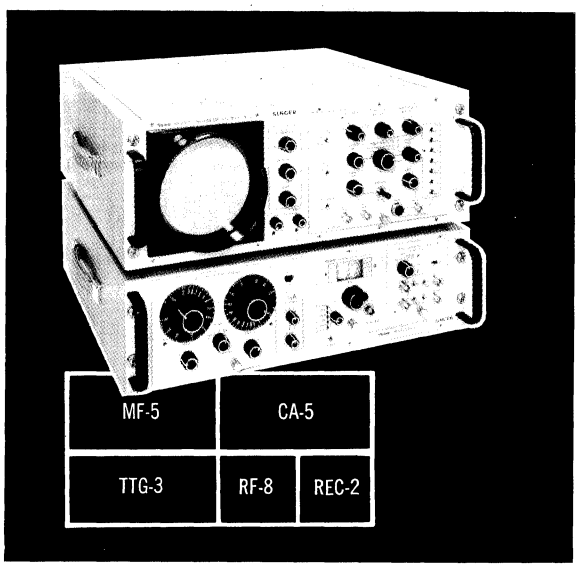
The modular construction of the analyzer allows the user to incorporate additional wide dispersion, higher or lower frequency or automated modules as required.

The PANORAMIC Model SPA-3000 Swept Front End Microwave Spectrum Analyzer combines the basic IF, video, sweep and display circuitry of the SPA-100 system main frame with the Model RF-3000 Swept Front End add-on module. This configuration provides calibrated display dispersions up to 3 GHz.

Request Application / Data Bulletin SA-11

SINGER
INSTRUMENTATION

High Resolution Communications System Analyzer



Model SSB-50-1

70 dB Dynamic Range ☐ 5 μv Sensitivity

Model SSB-50

60 dB Dynamic Range ☐ 20 μv Sensitivity

Features

Wide dynamic range (70 dB for Model SSB-50-1; 60 dB for Model SSB-50) ☐ 10 Hz resolution over entire tuning range (10 Hz - 40 MHz . . . useable to beyond 200 MHz) ☐ Extended frequency range permits AF and IF tests and and analysis of base-band and multiplexed signals ☐ Steep skirt selectivity and freedom from internal hum enables ±60 or ±50 Hz hum sidebands to be measured down to —60 dB ☐ Five pre-set sweep widths with resolution and scan rate automatically optimized ☐ Variable scan rates also provided.

Applications

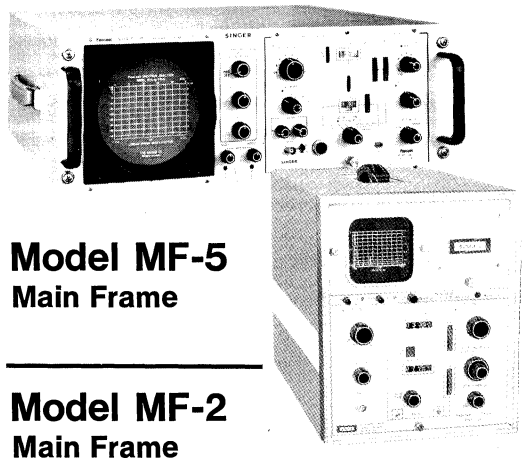
Best method known for set-up, operation, and maintenance of SSB, AM, FM and multiplexed communications equipment ☐ Measures transmitter linearity by two-tone intermodulation distortion test ☐ Hum sideband analysis ☐ Precise measurements of carrier suppression, residual sidebands, spurious hetrodyning products, parasitics, etc.

Description

The system offers the quickest and most convenient method of signal analysis of SSB, AM, FM and multiplexed communications equipment. It provides an exceptionally stable jitter-free display offering high resolution and excellent skirt selectivity. Operation is simple, with pre-set controls and variable mode controls. Among the built-in checkmarks are crystal controlled marker signals which check, at a glance, reading accuracies.

Request Application / Data Bulletin SA-10

Universal Spectrum Analyzers



Model MF-5
Main Frame

Model MF-2
Main Frame

Either Main Frame accepts any or all these Plug-in Modules

Module	Frequency Range
AL-2	20-35,000 Hz plus log scan
UR-3	100 Hz to 700 kHz
VR-4	1 kHz to 27.5 MHz
CA-5	450 to 550 kHz; 2 to 40 MHz with external VFO

Features

Plug-in modules for sonic through RF measurements are intergrangeable in either or both rack mount frame or portable frame ☐ Ideal for in-plant and on-site comparison measurements ☐ Directly calibrated displays and digital frequency readout for foolproof operation.

Applications

Fast swept band analysis of levels vs. frequency ☐ Monitoring audio, base-band and multiplex signals in communications systems ☐ Measuring telephone carrier channel equalization, measuring slope, noise and distortion ☐ Telemetry sub-carrier analysis ☐ VLF, video and RF band measurements.

Description

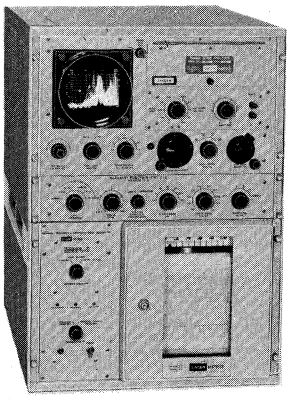
There are two main frames and a choice of four plug-in modules. The modules are interchangeable and vary in frequency coverage from 20 Hz to 27.5 MHz.
The Model MF-5 rack mount main frame requires only 7″ of panel height in standard 19″ rack cabinets.
The portable frame, Model MF-2, operates from internal or external batteries or from any AC line, 95-130/190-260V, 50-1000 Hz. Terminals on the rear of the frame also allow operation from DC power sources, 12 to 28 volts. The analyzer, including a module and internal battery pack, weighs 40 pounds. The modules are:
Model AL-2 (20 Hz to 35 kHz plus log scan) Sonic Module — Calibrated in absolute values in both frequency and level, and is a true swept band frequency voltmeter, reading in volts and dBm.
Model UR-3 (100 Hz to 700 kHz) Ultrasonic Module — covers the sonic, ultrasonic and low RF frequency range.
Model VR-4 (1 kHz to 27.5 MHz) Video Module — provides rapid broadband scans in its frequency range and precise, high-selectivity narrow-band displays.
Model CA-5 Panalyzer provides an untunable display centered at 500 kHz. Built-in mixer allows display of signals in 2 to 40 MHz range with external VFO.

Request Application / Data Bulletin SA-12

SINGER
INSTRUMENTATION

The Singer Company, Instrumentation Division, Bridgeport Operation / 915 Pembroke St., Bridgeport. Conn. 06608, U.S.A. / (203) 366-3201

Sonic Analysis Systems



SY Series

Panoramic Sonic Spectrum Analysis Systems

Features

Quick-look wide band directly calibrated log frequency scan from 5 Hz to 20,000 Hz ■ High resolution linear scans ■ Preset optimum resolution ■ Calibrated linear and 40 dB log amplitude scales ■ 60 dB dynamic measuring range ■ Jitter-free — less than 5 Hz/hour ■ Adjustable selectivity, smoothing filter, manual scan for random and discrete signals

Applications

Swept band vibration and noise analysis with graphic readout ■ Plotting of level vs frequency for random and discrete signals ■ Power and voltage spectral density plots ■ Harmonic and IM distortion analysis to –60 dB ■ Accoustical and speech spectrum measurements ■ Medical and geophysical analysis

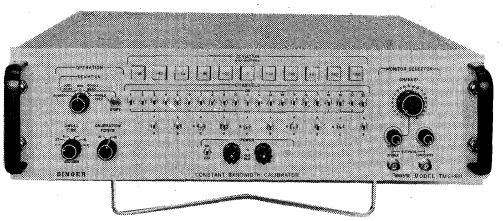
Description

The Sy System concept is based on the reliable time proven Model LP-1 aZ Sonic Spectrum Analyzer. With the addition of various accessories the critical parameters of if bandwidth and sweep width are controlable over a wide range. An optional chart recorder supplies a permanent record, and provides sweep times up to 16 hours. The system can be further extended to include a companion sweep generator for frequency response plotting of filters, amplifiers, etc. Sy Systems are unparalled for ease of operation, drift free analysis and exceptional selectivity . . . 2 Hz.

System	Applications
SY-1	Accoustics, complex vibrations and other random and discrete signal analysis. CRT and chart readouts, 5 Hz to 22.5 Hz with 2 Hz selectivity.
SY-2	Same as SY-1 plus addition of unit for power spectral density analysis of random signals. For tape loop data and for long term averaging.
SY-3	Same as SY-1 with CRT readout only. Scan intervals are 1 sec, 10 sec and manual
SY-4	Spectrum analysis and frequency response plots 20 Hz to 22.5 kHz. For tracing responses of filters, telephone networks, amplifiers, loudspeakers, etc. Aux. Unit C-2 provides added sweepwidths, variable selectivity and smoothing filter for convenience in narrow bandwidth tests.
SY-5	Same as SY-4, less Aux. Unit C-2

Request Detailed Catalog Sheet

Telemetering Subcarrier Calibrators



Model TMC-611

Constant Bandwidth
21 Channels — 11 Points

Model TMC-411E

Proportional Bandwidth
18 Channels — 5 Points

Model TMC-505

Proportional Bandwidth
18 Channels — 5 Points

Features

A selected single channel output and a composite output (available at both front and rear of unit) can be used independently and simultaneously ■ Manually selected dwell times ■ Manual random access deviation selection with illuminated push-button switches ■ Model TMC-611 provides a choice of either 3 or 11 deviation points associated with 21 standard IRIG ±2 kHz constant bandwidth "A" channels as well as optional IRIG ±4 kHz "B" channels (you can also select 5 ± 9 kHz "C" channels) ■ TMC-611 has provisions for remote computer control of deviation and channel selection ■ Models TMC-411E and TMC-505 provide output signals capable of testing 18 standard proportional bandwidth channels at 11 and 5 points respectively

Description

Precise, discrete frequencies are needed for the calibration and alignment of overall systems response, including subcarrier discriminators used on IRIG standard FM/FM Telemetering Systems. Panoramic Telemetering Simultaneous Calibrators, provide both a composite spectrum of frequencies and a selectable single channel frequency; they cover the range of telemetering calibrator requirements, which includes: a reasonable range of prices, diversification of equipment capable of meeting both the needs of constant and proportional bandwidth considerations.

All output signals are provided jitter free, with negligible switching transients, at an accuracy of 0.002%. Harmonic distortion and other unwanted outputs are at least 40 dB down. Modular design permits changes to be made to meet customer applications at minimum cost.

Request Application/Data Bulletin TEL-10

SINGER
INSTRUMENTATION

The Singer Company, Instrumentation Division, Bridgeport Operation / 915 Pembroke St., Bridgeport, Conn. 06608, U.S.A. / (203) 366-3201

Singer Instrumentation Analyzers Cover The Spectrum

FREQUENCY SPECTRUM	FREQUENCY COVERAGE	TYPICAL APPLICATIONS	SUGGESTED SPECTRUM ANALYZER	SUGGESTED AUXILIARY EQUIPMENT
Subsonic	0.5Hz to 2500Hz	Vibration, acoustic and process analysis	LF-2b LF-2bM (Automatic Frequency Range Switching)	Model G-5 Synchronous Sweep Generator for frequency response plotting
Subsonic/sonic	5Hz to 22.5kHz	Acoustics, complex vibrations, medical electronics, and other discrete signal analysis. CRT and strip chart readouts	SY-1	
Subsonic/sonic	5Hz to 22.5kHz	Same as SY-1 with Power Spectral Density Analysis Capability	SY-2	
Subsonic/sonic	5Hz to 22.5kHz	Same as SY-1 with CRT display only	SY-3	
Sonic	20Hz to 22.5kHz	Spectrum analysis and frequency response plots. Checking filter response, telephone networks, amplifiers, loudspeakers, etc.	SY-4	
Sonic	20Hz to 22.5kHz	Same as SY-4 but with limited choice of sweep widths and selectivity	SY-5	
Sonic	20Hz to 22.5kHz	Audio Spectrum Analysis. Basic analyzer portion of all SY systems	LP-1aZM	Model G-2a Synchronous Sweep Generator for frequency response plotting
Sonic	20Hz to 35kHz	Same as AR-1 with addition of Log Frequency Display	AL-2 (plug-in module used with MF-2 portable, or MF-5 rack mount (main frame)	
Ultrasonic	100Hz to 700kHz	Telephone Carrier System measurements, multiplex base-band analysis and as general purpose ultrasonic analyzer	UR-3 (plug-in module used with MF-2 portable, or MF-5 rack mount (main frame)	
Video	1kHz to 27.5MHz	Carrier System measurements. General purpose wide-dispersion video and communications system analyzer	VR-4 (plug-in module used with MF-2 portable, or MF-5 rack mount (main frame)	Model G-6 Synchronous Sweep Generator for frequency response plotting (1kHz - 15MHz)
RF	10Hz to 40MHz (usable to beyond 200MHz)	Communications system analysis. High resolution low distortion. (See data sheet for details)	SSB-50* (60dB dynamic range) SSB-50-1** (70dB dynamic range)	Model TTG-5a for transmitter and receiver distortion analysis
RF	450 to 550kHz	Analyzer portion of SSB-50. Use with external VFO or generator as high resolution analyzer (See data sheet for details)	CA-5 (60dB dynamic range) CA-5-1 (70dB dynamic range)	
Telemetry	350Hz to 120kHz	Monitor IRIG FM/FM telemetry signals. Log or Linear frequency display	Same as TMI-4/200	Ask your Singer Representative for Application/Data Bulletin TEL-10 which describes constant (TMI-611) or proportional (TMC-411E and 505) bandwith calibrators covering all IRIG channels.
Telemetry	35Hz to 200kHz	TMI-4/200		See above
Microwave	10MHz to 40GHz	Solid-state microwave analyzer with one composite tuning unit, x-y output, synchroscope operation. Low inherent incidental f-m, and manual sweep capability. 100MHz dispersion (See data sheet for details)	SPA-100 (10MHz - 40GHz) SPA-100A (1GHz - 40GHz)	
Microwave	10MHz to 40GHz	Same capabilities as SPA-100 but 3GHz wide dispersion capability. Phase locked oscillator for low incidental f-m. (See data sheet for details)	SPA-3000	

*Available without Range Extending Converter or Two-tone Generator as Models SSB-50A and SSB-50B respectively
**Available without Range Extending Converter or Two-tone Generator as Models SSB-50-1A and SSB-50-1B respectively

Telemetry Calibrators and Indicators are completely described in Application / Data Bulletin TEL-10. Request it from your nearest sales representative or directly from Singer Instrumentation.

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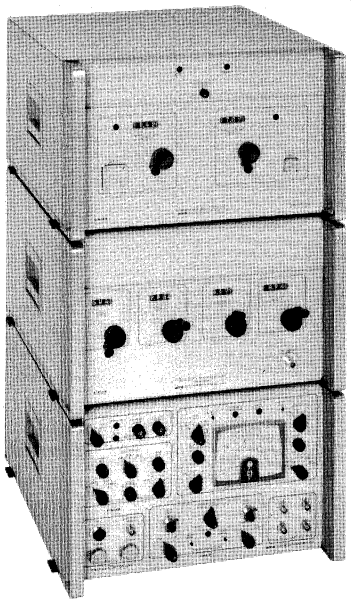
Noise and Field Intensity Analyzer/Surveillance Receiver



Model EMA-910

1 to 26.5 GHz

Features

- First solid-state noise and field intensity analyzer to provide such excellent characteristics over the full 1 to 26.5 GHz range
- Automatic scanning sweep over the entire frequency range or any portion, with automatic bandswitching over all four bands of the frequency selection unit from 1 to 10.5 GHz.
- Automatic scanning sweep over the entire frequency range or any portion of either of the two bands of the frequency selection unit of 10.0 to 26.5 GHz.
- Remotely programmable
- Programmable for frequency selection and/or sector scanning
- Choice of four bandwidths; operator can identify unknown signals as broadband or narrowband
- Analog frequency and amplitude outputs for X-Y recording
- Automatic signal level discrimination alerts operator to signal levels above predetermined value.

Description

The Model EMA-910 Noise and Field Intensity Measuring System consists of one or two Frequency Selection Units, a Data Evaluation Unit and accessory equipment. One Frequency Selection Unit, Model EMA-910-10, covers the 1 to 10.5 GHz range. The second, Model EMA-910-12, covers the 10.0 GHz to 26.5 GHz range. The Model EMA-910-11 Data Evaluation Unit is a solid-state instrument which accepts signals, as converted IF, from the Frequency Selection Units. It conditions and filters the signals through detection and weighting circuits and then supplies this information to readout devices.

The system provides for automatic continuous sector sweep over the entire range of any portion of it for the Model EMA 910-10. Bandswitching of the four bands is automatic and can be remotely programmed.

System sensitivity is typically minus 92 dbm over the frequency range of 10.0 to 26.5 GHz and minus 100 dbm over the frequency range of 1 to 10.5 GHz for S + N to noise ratio of 3 db.

Applications include EMI and field strength measurements for all commercial, military and federal requirements, as well as general surveillance work.

Instruments In The System

Model EMA-910-11 Data Evaluation Unit
Accepts converted IF signals from Frequency Selection Units for processing and readout.

Model EMA-910-10
Frequency Selection Unit
1-10.5 GHz range, in four tuning bands

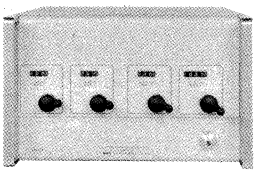
Model EMA-910-12
Frequency Selection Unit
10.0 to 26.5 GHz range, in two tuning bands.

Model 3100 Digital Display Unit
Provides simultaneous dual channel digital readout of frequency and signal amplitude on Nixie tubes. Compensation for r-f attenuation insertion is automatic, before display. The instrument also holds data for manual notation, digital recording or computer input.

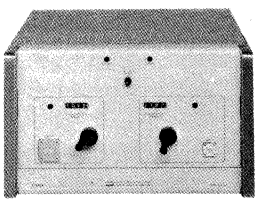
Model 8010 Frequency Call-Up Unit
Provides automatic remote tuning for spectrum surveillance of any of 10 pre-selected frequencies. Simple push buttons command the basic analyzer system to automatically scan to the selected frequencies.

Accessory Antennas

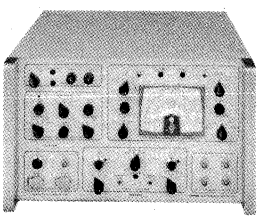
A complete line of calibrated antennas covering the entire 1 to 26.5 GHz frequency range of the Model EMA-910 is available. Included are a conical spiral antenna for surveillance in the 1 to 10.5 GHz range as well as horn antennas for each tuning band.



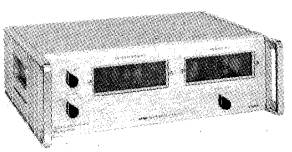
Model EMA-910-10
Frequency Selection Unit
1 to 10.5 GHz



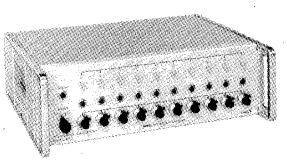
Model EMA-910-12
Frequency Selection Unit
10.0 to 26.5 GHz



Model EMA-910-11
Data Evaluation Unit
for signal processing



Model 3100
Digital Display Unit
for direct frequency and signal amplitude readout



Model 8010
Frequency Call-up Unit
Provides remote tuning of any of 10 pre-selected frequencies

Request Application / Data Bulletin NFIA-10

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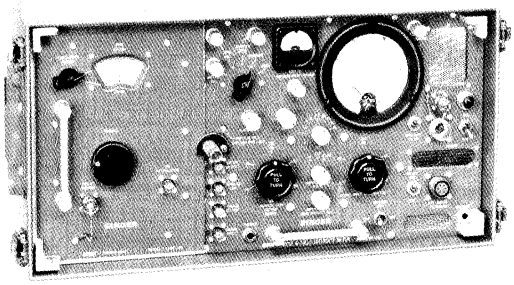
Noise and Field Intensity Meters



Model NF-105

14 kHz to 1000 MHz

Features

For over a decade, The Model NF-105 has been the standard instrument for measuring RFI in accordance with commercial and military requirements

- Output signal amplitude meter reads dB above 1 microvolt/MHz for broadband measurement and eliminates the need for charts or computations
- The frequency range is covered in five separate tuning units which can be purchased separately for economy and flexibility
- Tuning units can be changed in seconds.

Description

The Empire Model NF-105 Noise and Field Intensity Meter is the proven standard for electromagnetic compatability measurements. Hundreds are currently in use in mobile vans, aircraft and permanant installations throughout the world. It is a rugged and compact instrument that achieves light weight (70 lbs.) through the use of five quickly interchangeable tuning units. These interchangeable tuning units permit limited frequency requirements to be economically satisfied by the purchase of individual heads as required. Each unit contains RF and IF circuits. All tuned circuits are well tracked, permitting quick frequency scanning by means of single knob tuning.

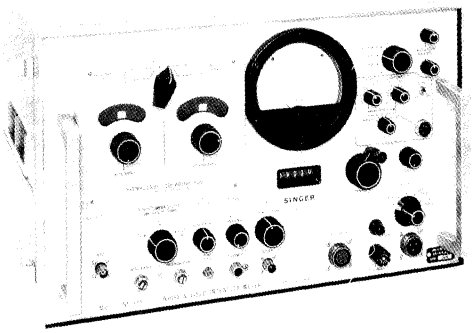
An impulse generator producing a flat spectrum throughout the frequency range of the instrument, is used for fast and accurate calibration of both CW and broadband measurements.

A complete range of Calibrated Pickup Devices are available which permit the determination of field strength of narrow band signals in microvolts per meter and that of broadband signals in microvolts per MHz (kHz) per meter

The five available tuning units and their frequency ranges are: Model T-X/NF-105, 14 kHz to 150 kHz (3 bands); Model T-A/NF-105, 150 kHz to 30 MHz (6 bands); Model T-1/NF-105, 20 to 200 MHz (2 bands); Model T-2/NF-105, 200 to 400 MHz (1 band): Model T-3/NF-105, 400 to 1000 MHz (2 bands)

For Measurements In Accordance With These Specifications:

FED-STD-222 (Federal), Approved
MSFC-279 (NASA), Category A
MSFC-280 (NASA), Approved
MIL-STD-285 (DOD)
MIL-STD-449A (DOD)
MIL-STD-461
MIL-STD-462
MIL-STD-752 (Ships)
MIL-STD-826A (USAF), Category A
MIL-I-6051 (EL)
MIL-S-10379A (Navy)
MIL-I-11683B (BUWEPS)
MIL-I-11748B (SIG. C)
MIL-I-12348AB (SIG. C)
MIL-I-13237 (SIG. C)
MIL--16910B (Ships)
MIL-I-17623 (Navy)
MIL-I-26600 (USAF), Category A
FCC Specifications and others.



Model NF-315A and Model NF-315

20 Hz to 15 kHz (Narrow Band)
20 Hz to 250 kHz (Broad Band)

Features

- Equipment circuitry is completely solid-state
- Time tested tuning techniques are employed to ensure reliable short and long term stability plus complete freedom from instabilities due to external effects. The inherent stability eliminates the need for equipment recalibration when tuning to a new frequency.
- The equipment is ruggedly constructed for field use and contains rechargeable nickel-cadmium batteries
- Measurements utilizing the Model NF-315A can be made to any military or commercial specifications.

Description

The Model NF-315A is a highly versatile Noise and Field Intensity Meter which combines both a tunable narrow band superheterodyne receiver and a complete wide band video receiver. The equipment can be used in either of two basic modes — tunable narrow band (measurement) mode or a fixed tuned wide band (surveillance) mode — with two bandwidths provided for each mode. On the tunable narrow band mode, The Model NF-315A covers the frequency range from 20 Hz to 15 kHz with a selectable 7 Hz or 70 Hz bandwidth, thereby providing rapid measurement, precise signal identification and optimum sensitivity.

In the fixed tuned wideband mode of operation, The Model NF-315A measures the composite strength of all signals within the frequency range from 20 Hz to 20 kHz or 20 Hz to 250 kHz as selected by the operator. The Model NF-315A offers the capability of sector scanning in conjunction with peak dumping circuitry to permit automated measurement and recording of applied signals. The Model NF-315 does not contain the sector scan capability but is otherwise identical to the Model NF-315A.

For Measurements In Accordance With These Specifications:

FED. STD. 222 (Federal)
MIL-STD-461; MIL STD-462
MIL. STD. 826A (USAF)
MSFC-279 (NASA)
MIL-I-16910B (Ships)
GM-07-59-2617 (Minuteman)
D2-2444-1 (Minuteman).

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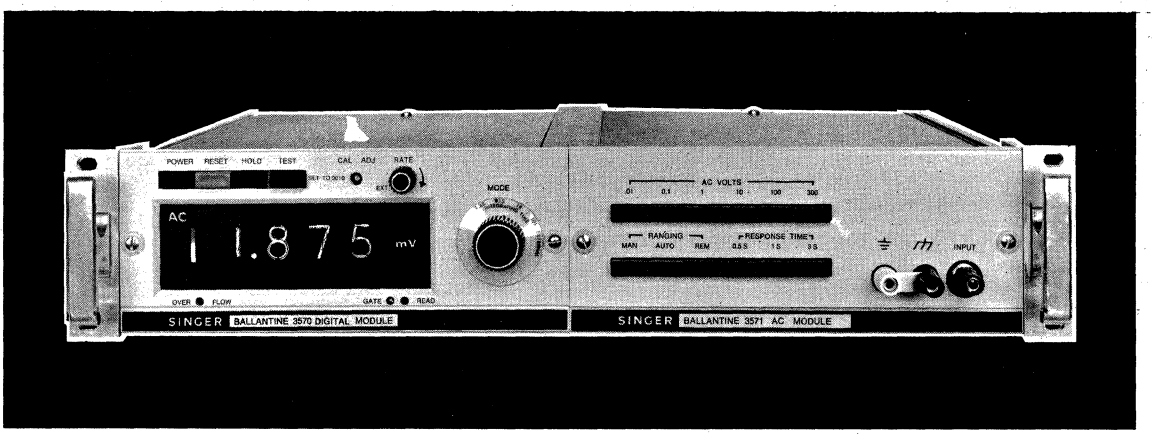
Wideband–Sensitive AC/DC Digital Voltmeters



Ballantine Model 3570 Series Digital Voltmeter
30 Hz to 10 MHz Response

A fully programmable sensitive voltage measuring system consisting of a Digital Display Module and associated AC and DC Converter Modules.

Features

System

- Front panel functions remotely programmable
- Modular printed circuit construction assures ease of maintenance
- Modules are 3.5 inches high and can be combined side-by-side for standard 19 inch rack-mount operation . . . or over-and-under for portable use.

Model 3570 Display Module —

- Four digit Nixie Readout with Overrange
- Dual-slope Integration with four panel selectable integration times
- System Compatability assured — all information available in digital form
- Optional 20 MHz Frequency Counter capability
- Auto-ranging option

Model 3571 AC Converter Module —

- 30 Hz to 10 MHz frequency coverage — unsurpassed by any instrument currently available
- 10 millivolt full scale sensitivity for low-level measurements
- 10 megohm input impedance
- Selectable Filter Time Constant for smoothing dc input to display
- Auto-ranging capability with Model 3570

Model 3572 DC Converter Module—

- 100 millivolt to 1000 volt full scale decade ranges
- Input resistance 10 megohms . . . 1000 megohms — panel selected on 100 millivolt and 1 volt ranges
- Auto-ranging capability with Model 3570
- External thermal potentials can be bucked-out by front panel control

Description

Ballantine, the recognized leader in AC voltage measurements now offers the FIRST Automatic Digital Voltage measuring system to 10 MHz. The digital display module in combination with associated converter modules forms a system with exceptional voltage and frequency coverage. Unique system features make it ideally suited for Automated Production Test Stands — High Accuracy Laboratory Applications — Data Acquisition Systems — Process Monitoring and Control.

FEATURED SPECIFICATIONS

	Display with AC Module	Display with DC Module
Range	10 mV, 100 mV, 1 V, 10 V, 100 V, 300 V FS	100 mV, 1 V, 10 V, 100 V, 1000 V FS
Accuracy	0.2% RDG +0.01% FS, 50 Hz-100 kHz 0.5% RDG +0.1% FS, 100 kHz-1 MHz 1% RDG +0.1% FS, 1 MHz-3 MHz 3% RDG +0.1% FS, 3 MHz-10 MHz	0.02 % RDG +0.01% FS
Input	10 M Ω, 25 pf	10 M Ω

Write for detailed catalog on complete line of AC Measuring Instruments

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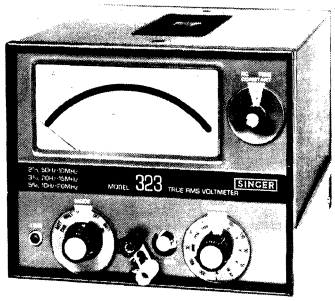
Broadband AC Voltmeters



Ballantine Model 323
Broadband True RMS AC Voltmeter (300μV to 350 Volts)

Features

- Measures True RMS of sine waves, square waves, noise voltages and a range of pulses
- Exceptional frequency coverage from 10 Hz to 20 MHz
- Unmatched accuracy — 2% of indication . . . 50 Hz to 10 MHz
- Up to 20 hours of operation from rechargeable batteries or operation from power line
- Logarithmic voltage scales for uniformly high accuracy and resolution for all readings

Description

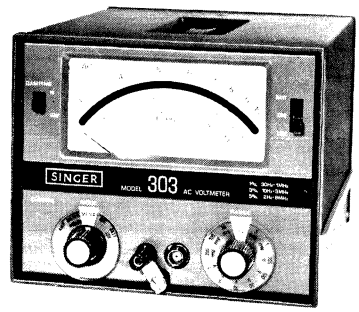
The Ballantine Model 323 True RMS Voltmeter is a solid state compact, portable, general purpose ac voltmeter. The instrument operates from either line power or internal rechargeable batteries.

Among the electrical features are high sensitivity wide voltage range, wide frequency range, high accuracy, high input impedance, and high stability.

The signal-rectifier response is TRUE RMS and should not be confused with AVERAGE or PEAK responding instruments calibrated to provide rms indication on sine waves only. Thus this instrument indicates the rms value on all types of waveforms which fall within its frequency and crest factor specifications.

The logarithmic meter provides the same high accuracy of indication at all points on the scale, while the associated linear decibel scale permits automatic conversion of voltage ratio to decibel units without recourse to charts or tables.

When desired, several time constants may be selected by means of a front panel control.



Ballantine Model 303
Broadband Average Responding Voltmeter (100μV to 350 Volts)

Features

- An all solid-state unit that provides UNEQUALED broadband coverage from 6 MHz down to 2 Hz
- Unexcelled 1% Accuracy
- Rechargeable Battery provides up to 30 hours operating time — Can be operated from line while recharging
- Signal Ground isolated from case ground for assignments where heavy ground currents or strong fields exist
- Fully overload protected

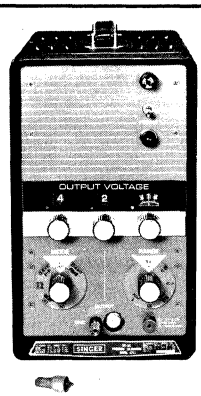
Description

The Model 303 is an all solid-state broadband AC Voltmeter designed to operate from a rechargeable battery or from line power. No other solid-state voltmeter provides frequency coverage from an unequaled low frequency of 2 Hz up to 6 MHz.

A 1% mid-band accuracy, coupled with a mirror-backed, five-inch, 10 dB logarithmic indicator allows unmatched reading ease. Voltages can be measured over a range from 300 μV to 350 V with the same accuracy at any point on the scale. Resolution is also constant at any point on the scale — a displacement equivalent to pointer width represents less than a 1/4% change in indication.

The Model 303 may be used in its METER +10 dB mode for increased sensitivity. Indications down to 100 μV over a frequency range of 10 Hz to 1 MHz can be made.

An amplifier mode is also available for low-noise, hum-free preamplification of low level signals.



Calibrators and AC Voltage Reference Standards

The Model 421A AC/DC Voltage Calibrator with associated Model 2421 Error Computer provides quick and accurate calibration of voltmeters, oscillators, recorders . . . with readout directly in % error — Micropotentiometer Model 440 provides a reference standard for developing an accurately known voltage up to 1 Volt at frequencies up to 900 MHz — High Frequency Transfer Voltmeter Model 393 provides accurate measurement of AC voltages (1 V-100 V) from 25 Hz to 30 MHz — Ballantine Model 390 A-T Voltmeter is a laboratory reference standard to calibrate signal generators and voltmeters from 0.5 to 300 volts, 10 MHz to 1000 MHz.

Write for detailed catalog on complete line of AC Measuring Instruments

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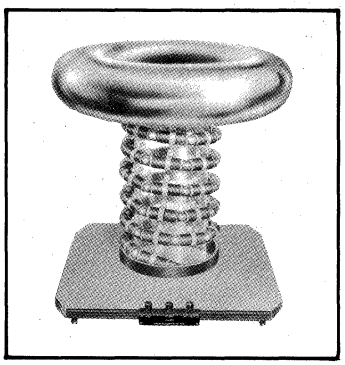
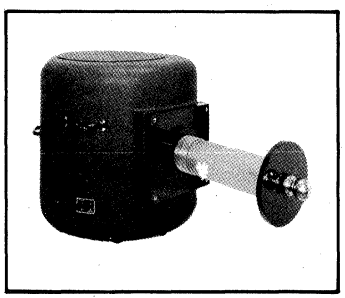
Electrical Metrology Instruments



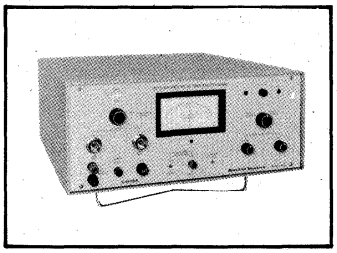
High Voltage Dividers
Model PARK DC Voltage Divider useable up to 100 KV with ratio accuracy 0.05%. Readout on any high input impedance voltmeter such as a digital voltmeter. Ratio 100 kv to 1 volt.
Other dividers available at lower & higher accuracies.



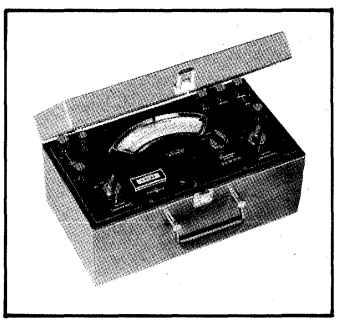
Portable & Panel Electrostatic Voltmeters
For use on both DC and RMS AC in ranges from 120 volts to 140,000 volts. Input impedance to 10^9 megohms on DC. Accuracy as high as 0.5% and accessories available to permit positive and negative peak measurements.

AC and DC Voltmeters and Ammeters
Model D Voltmeter provides high accuracy true RMS AC or DC measurements with 0.25% accuracy. An electro-dynamometer mechanism provides exceptional repeatability. The instrument can be used for making transfer measurements.

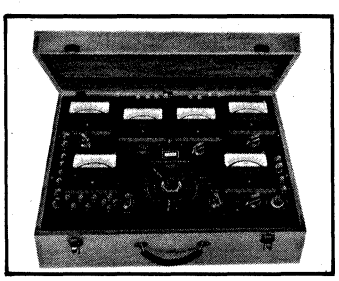
DC Portable Measuring Instruments
Model C, has a wide selection of ranges for DC measurement from 2 millivolts to 1500 volts and from 10 microamps to 50 amps. Accessories available to extend these ranges



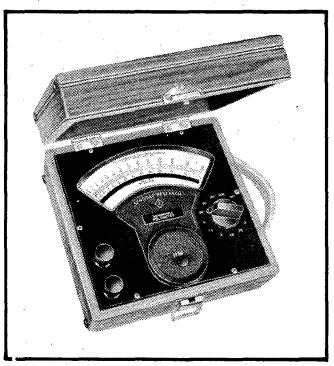
Self Balancing Primary AC-DC Transfer Standard & RMS to DC Converter
Model ATS Permits .01% true RMS measurements .25 to 1000 volts to 20 kHz in only a few seconds. It is a true Broad Band AC-DC Transfer Standard with high DC transfer accuracy from 2 Hz to 30 MHz.
DC output equals AC input over the full range to 1000 volts



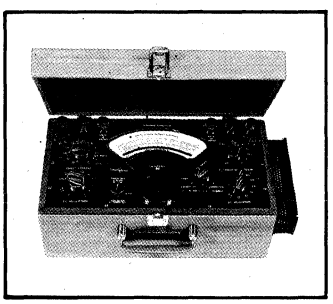
Portable & Panel AC & DC Wattmeters
Model VAW power analyzer permits measurement of voltage, current, power and power factor from 25 to 800 Hz in one economical unit. Voltage ranges to 500 volts with current ranges to 20 amps at unity Power Factor — useable to 50% P.F. Other wattmeters available at accuracies to 0.1% and Power Factors to 20% (Refer to Selection Chart)



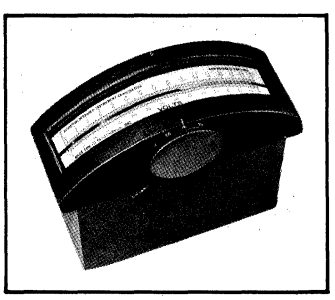
Magnetic Testing Instruments
Designed to make Epstein Sample measurements of magnetic properties of steel in accordance with ASTMA341-49 and A343-60T.



AC-DC Thermocouple Instruments
Accuracis to 0.5% with ranges 0.2 volts to 1500 volts and 1.0 ma to 100 amps at frequencies up to 20 MHz.



Portable & Panel Polyrangers
(Volt-Ammeters)
Both DC and AC/DC Versions available in a wide variety of range combinations of voltage and current in one self contained instrument.



AC & DC Panel Instruments
Most Portable designs can also be supplied in either edgewise or square flush design panel instruments for DC and AC Voltage Current & Watt Measurements to 0.25%. DC Ranges from 1 millivolt to 6000 volts and 1.5 microamperes to 50 amps. AC from 0.2 volts to 6000 volts and 1.0 milliamps to 50 amps.

Request new comprehensive catalog on precision measuring equipment. It describes more than 400 instruments.

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AC and DC Voltmeters and Ammeters

PORTABLE AND PANEL

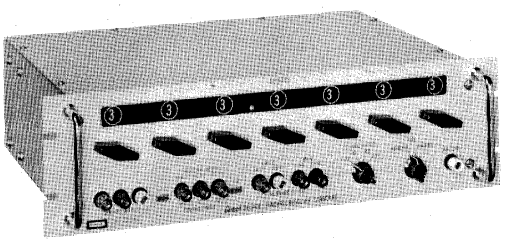
	MODEL		DC			AC				
	PORT.	PANEL AVAILABILITY		ACCURACY	RANGE SPAN	ACCURACY	RANGE SPAN	MAXIMUM FREQUENCY RESPONSE	SCALE LENGTH	PRICE RANGE
VOLTAGE	B			0.1%	5 Volts to 1000 Volts				12″	$1075
	L			0.1%	75 Volts to 750 Volts	0.1%	75 Volts to 750 Volts	400 Hz	12″	$1050-$1200
	C	X		0.25+0.5%	2 Millivolts to 1500 Volts				4″-6.3″	$110-$380
	D	X		0.25+0.5%	7.5 Volts to 1000 Volts	0.25%+0.5%	7.5 Volts to 1000 Volts	2500 Hz	4″-6.3″	$222-$422
	FLV	X				0.5%	5 Volts to 300 Volts	1000 Hz	6.3″	$307-$390
	MI	X				0.5%	7.5 Volts to 750 Volts	500 Hz	6.1″-6.3″	$150-$176
	TCM	X		0.5–0.75%	1 Volt to 1000 Volts	0.5–0.75%	1 Volt to 1000 Volts	5 MHz		$281-$563
	ESH	X		0.5+1%	5000 Volts to 140,000 Volts	0.5+1%	5000 Volts to 100,000 Volts	600 kHz	6″	$308-$1425
	ESD	X		0.5+1%	120 Volts to 6000 Volts	0.5+1%	120 Volts to 6000 Volts	1.5 MHz	4″-5.2″	$204-$733
CURRENT	BA			0.1%	5 Amps to 50 Amps					$1200
	LA			0.1%	5 Amps to 20 Amps	0.1%	5 Amps to 20 Amps	400 Hz	12″	$975
	CA	X		0.25+0.5%	10 MICS to 50 Amps				4″-6.3″	$110-$375
	DA	X		0.25+0.5%	50 MA to 20 Amps	0.25+0.5%	50 MA to 20 Amps	2500 Hz	4″-6.3″	$320-$430
	MIA					0.5%	150 MA to 20 Amps	500 Hz	6.1″-6.3″	$181-$183
	TCMA	X		0.5+0.75+1%	1 Milliamp to 2 Amps	0.5–0.75–1%	1 Milliamps to 2 Amps	20 MHz	6.3″	$387-$470
CURRENT/VOLTAGE	CP	X	V	.25%	1 Volt to 1000 Volts				6.3″	$340-$365
			I	.25%	10 MA to 10 Amps					
	DCP		V	0.5%	2 Volts to 500 Volts				4″	$225
			I	0.5%	2 MA to 2000 MA					
	UX	X	V	0.5%	5 MV to 1000 Volts	0.5%	.5 Volts to 1000 Volts	15 kHz	5.2″	$945
			I	0.5%	200 MICS to 5 Amps	0.5%	10 MA to 5 Amps	15 kHz		
	U88	X	V	0.5%	.02 Volts to 750 Volts	0.75%	.5 Volts to 750 Volts	5 kHz	5.2″	$625
			I	0.5%	.2 MA to 1500 MA	0.75%	10 MA to 3 Amps	15 kHz		
	USP	X	V	0.5%	5 MV to 1000 Volts	0.75%	.3 Volts to 750 Volts	5 kHz	5.2″	$525
			I	0.5%	.2 MA to 2 Amps	0.75%	15 MA to 3 Amps	15 kHz		
	U-SP		V	0.5%	.002 Volts to 1000 Volts	0.75%	.3 Volts to 1000 Volts	5 kHz	5.2″	$640
			I	0.5%	.2 MA to 20 Amps	0.75%	10 MA to 3000 MA	15 kHz		
	UVA	X	V	0.5%	50 MV to 1000 Volts	0.75%	10 Volts to 500 Volts	60 Hz	4″	$385
			I	0.5%	1 MA to 10 Amps	0.75%	10 MA to 10 Amps	60 Hz		
	VAW	X	V			0.5%	25 Volts to 500 Volts	800 Hz	5.2″	$495-$595
			I			0.75%	.5 to 10 Amps	800 Hz		
	AP	X	V	0.75%	.5 Volts to 1500 Volts	0.75%	.5 Volts to 1500 Volts	5 kHz	6.3″	$485
			I	0.75%	15 MA to 5 Amps	0.75%	15 MA to 5 Amps	15 kHz		

Request new comprehensive catalog on Precision Measuring Equipment. It describes more than 400 instruments.

SINGER
INSTRUMENTATION

The Singer Company, Instrumentation Division, Bridgeport Operation / 915 Pembroke St., Bridgeport, Conn. 06608, U.S.A. / (203) 366-3201

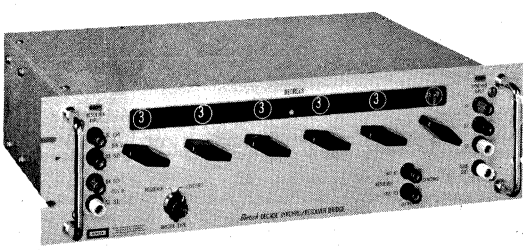
Synchro and Resolver Test Instruments



Model DSRS-5DR

Decade Synchro/Resolver Standards

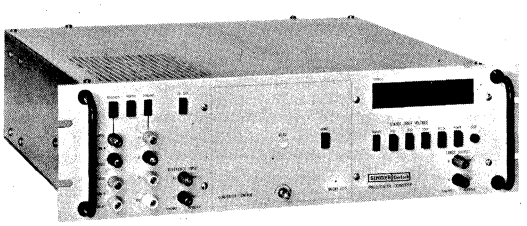
The DSRS series provide all of the features of a high-resolution Synchro Standard, and a high-resolution Resolver Standard in the space normally required by one. Two-second accuracy is provided by the time-proven Ratio RatioTran technique developed by Gertsch over a decade ago. The Synchro/Resolver Standards, simulating a perfect component, feature low unbalance impedance, permitting severe loading without introducing error. Use of this instrument for testing CT's, CDX's, RD's and RC's eliminates the need for master components, Dividing Heads and Bridges normally used for this application. Units with 5° resolution are also available.



Model DSRB-5CD-8R

Decade Synchro/Resolver Bridges

The DSRB series provide all of the features of a high-resolution synchro bridge, and a high-resolution resolver bridge in the space normally required by one. Two-second accuracy is provided through the use of a unique circuit, and the time-proven RatioTran technique. These rugged instruments are ideal for any application where both synchros and resolvers are used. In addition, they are completely passive and immediately ready for use, without any pre-use calibration or warm-up. Units with 5° resolution are also available.



Model ADC-1 / CC-1

Features

- 250 millisecond nulling and readout time
- 0.0005 degree resolution
- 0.001 degree accuracy
- All silicon, solid-state switching
- Nixie tube display of angular position
- Front and rear terminals
- Plug-in control unit
- Isolated sets of binding posts for the synchro and resolver inputs
- Bridge error voltage output — binding posts
- "Hold" control for continuous display of a selected angular readout
- Selectable resolution (0.1 to 0.0005 degree)

Synchro/Resolver-to-Digital Converters

This new angle-to-digital converter consists of a multi-purpose main frame (Model ADC-1) and a plug-in converter control module (Model CC-1). Together, these units function as a synchro or resolver-to-digital converter. The angular position is displayed on a set of Nixie tubes and supplied as an I.C. compatible true BCD output on the rear panel.

The Model ADC-1 main frame consists of a high-resolution synchro/resolver bridge with solid-state switching.

When the main frame is equipped with the CC-1 converter control, the successive approximation method is used to automatically null the bridge to the angular position of the incoming signal. The null setting of the bridge provides the angular output signal and display.

Gertsch RatioTran techniques are used in the bridging circuits to provide high accuracy and reliability. The automatic control systems are all solid-state with IC's used to improve reliability. Plug-in circuit boards are used to further minimize maintenance.

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The Singer Company, Instrumentation Division, Gertsch Operation / 3211 S. LaCienega Blvd., Los Angeles, Calif. 90016 / (213) 870-2761

Precision Measuring Equipment

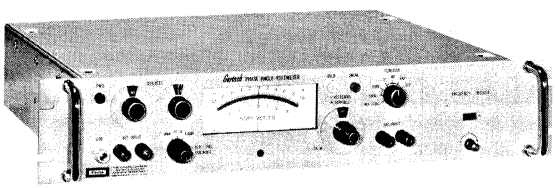
Phase Angle Voltmeters

Continuous, broad frequency coverage in this new Gertsch Model PAV-4 Phase Angle Voltmeter has extended its use to many new fields: transfer function analysis, filter analysis, and operational amplifier tests.

A unique, phase-lock oscillator circuit eliminates precise tuning (a light on the front panel indicates lock). When locked, the meter operates as a phase-sensitive voltmeter at the incoming reference frequency. Phase angle measurements, phase-sensitive null indications, inphase and quadrature voltage measurements, are provided in addition to fundamental voltage measurements and use as a standard AC voltmeter.

10 megohm input impedance (25 pf) is one of the features which minimizes loading effects. Both the signal and reference inputs may be isolated for differential measurements. Frequency coverage in the standard voltmeter and phase sensitive modes is 30Hz to 300KHz. Plug-in modules allow use as a variable or fixed frequency unit. The fixed frequency modules are designed for production lines and feature the elimination of operator calibration. Variable frequency modules are designed for broader applications.

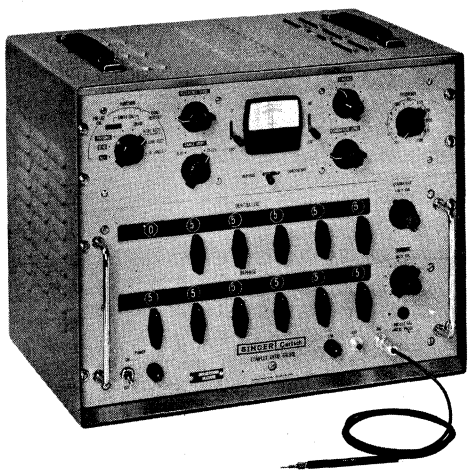
Model PAV-4



Complex Ratio Bridge

Model CRB-8 provides a highly accurate means of measuring in-phase and quadrature voltage ratios of three- or four-terminal networks such as transformers, synchros, AC transducers, resolvers, tach-generators, amplifiers, gyros, etc. Operating frequency range is 350 to 5100Hz. In-phase ratio accuracy as good as .001% is obtained over the entire range by means of a continuously tuned null amplifier which eliminates the need for any plug-in filters or networks. The in-phase and quadrature voltage ratios are read from the RatioTran voltage divider dials as rectangular coordinates (R + jX), or phase angle between signal and reference may be read directly in degrees. Virtually all solid-state circuitry is employed.

Model CRB-8

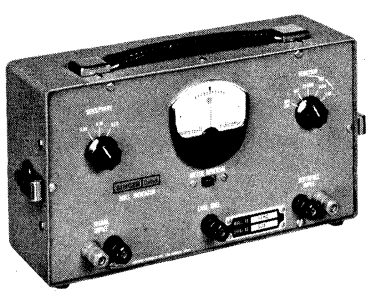


Null Indicators

Models NI-2, NI-3R, and NI-4R are small-size, phase sensitive, completely transistorized null indicators, that may be combined with any Gertsch Ratio Transformer to form an AC ratio bridge. Three ranges of sensitivity are provided: 10 uV, 100 uV, and 1000 uV. A maximum sensitivity of 10 microvolts allows excellent resolution for bridge circuit operation.

The NI-5 features a variable phase reference, a continuously adjustable full-scale sensitivity, and a linear meter scale.

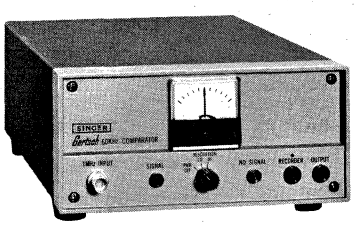
Model NI-2



Low Frequency Standards Receiver

The Gertsch Model RLF-1 VLF Comparator is a complete 1 MHz calibrating system, providing a means for referencing frequency standards and 1 MHz oscillators against the standards broadcast of WWVB, and for comparison of oscillators and other 1 MHz frequency devices against available, in-house 1 MHz standards. Calibration and comparison are fast and accurate with the Model RLF-1 Receiver.

Model RLF-1



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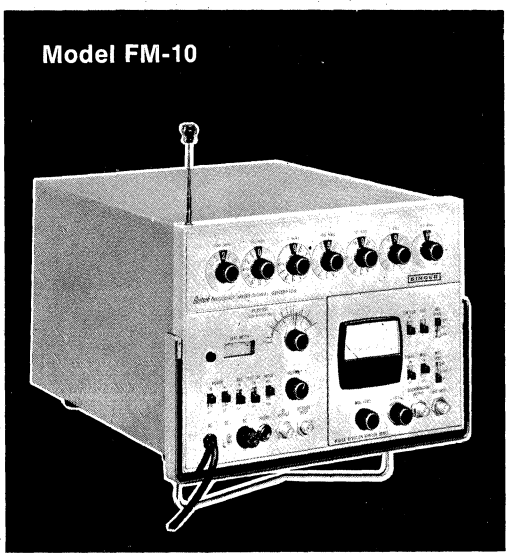
Frequency Measuring Equipment



Model FM-10 Heterodyne Frequency Meter (100 kHz to 50 MHz)

The Model FM-10 is a heterodyne frequency meter covering the range from 100 kHz to 500 MHz with direct dial readout. The instrument provides a calibrated R.F. output over an 80 db range which may be modulated in either AM or FM modes.

Accuracy of this instrument is one part per million per year, over a wide temperature range with provisions of upgrading the time base oscillator as technology advances. The 10 MHz time base oscillator is of the TCXO type and requires no oven or warm-up time. Greater accuracy of the time base oscillator may be achieved over a narrower temperature range.

The unit is completely portable, light-weight and operates from a 12 volt vehicular battery or standard AC power. A built-in antenna is provided to enable "off the air" measurements of frequency and modulation.

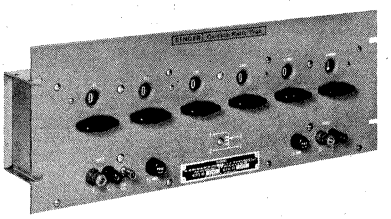
Plug-in modules are provided to increase the versatility of the unit. These include two FM deviation modules with either meter or oscilloscope presentations. Additional plug-in units that will be available will provide amplitude modulation and measurement, SSB and interference analysis and other special measurements.

Ratiotrans and Special Transformers

"RT" Series
Standard Ratio Transformers

The RatioTran precision variable AC voltage divider provides extreme accuracy and high resolution in the measurement and generation of voltage ratios. Instruments are available in a variety of functional types and form factors for use in such applications as checking resolvers and servos, voltmeter calibration, computer testing, transformer turns, ratio measurements, and ratio arms of bridges.

Model RT-5R

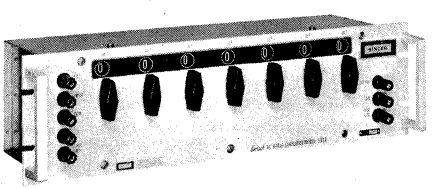


Ratio Standards

Many years of experience in the building of precision ratio transformers enable Gertsch to offer what they consider to be the ultimate in ratio standards.

This series of RatioTran precision voltage dividers was designed for instrument standards and calibration laboratories, or any applications where maximum accuracy is required.

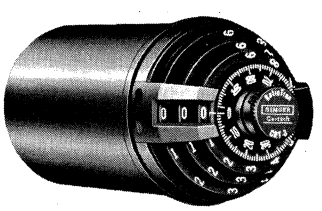
Model 1011R



Coaxial Ratiotrans

Gertsch Coaxial RatioTrans, are precision AC voltage dividers designed for applications where panel space and weight must be kept to a minimum.

Model CRT-3



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STICHT INSTRUMENTS

TACHOMETERS

FOR EVERY NEED . . . EVERY SPEED

ELECTRICAL TACHOMETERS

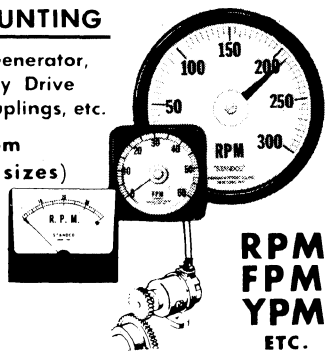
FOR PERMANENT MOUNTING

Furnished complete with Generator, Indicator and all necessary Drive Equipment such as gears, couplings, etc.

Indicator sizes from 3" to 18" (extra large sizes)

- Heavy duty design.
- Smooth, instant response to changes of speed.
- No Pointer Fluctuation.

Bulletins 720, 723



RPM FPM YPM ETC.

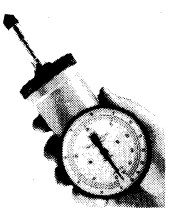
CENTRIFUGAL STATIONARY TACHOMETERS



For permanent mounting on machines and engines. Model "J", with 3", 4", 5½", 8" or 10" dial diameter. Flexible cable driven. Many standard ranges reading RPM, FPM, YPM, and other operations.

Bulletins 793, 794, 795, 796, 798

PORTABLE TACHOMETERS



CENTRIFUGAL HAND TACHOMETERS

With one, two, three, five or six ranges in one tachometer. All speeds up to 100,000 RPM with overspeed protection.

Type "UO"	Cat. No. 303	30-12,000 RPM	5 ranges
Type "UO"	Cat. No. 322	60-24,000 RPM	5 ranges
Type "UY"	Cat. No. 630	25-30,000 RPM	3 ranges
Type "UY"	Cat. No. 640	30-40,000 RPM	3 ranges
Type "UH"	Cat. No. 666	30-100,000 RPM	6 ranges

Bulletins 750, 751, 756, 765, 790



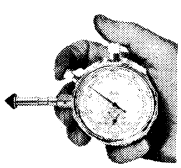
CHRONOMETRIC HAND TACHOMETERS

With built-in chronometric movement, timing period 3 or 6 seconds.

JAQUET

Guaranteed accuracy ½%.
Cat. 2302 0-2000 RPM
Cat. 2301 0-20,000 RPM
Cat. 2304 0-200 RPM

Bulletin 735



HASLER

Guaranteed accuracy ¼%
Cat. 4402 0-2000 RPM
Cat. 4401 0-20,000 RPM

Bulletin 745



VIBRATING REED TACHOMETERS

PORTABLE AND STATIONARY TYPES

Measure speed by touch.

Many different ranges from 600-30,000 RPM.

Bulletin 770

HIGH INTENSITY STROBOSCOPE



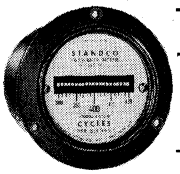
MODEL 510 AL

With Brilliant Daylight Flasher Unit for maximum readability.
Range 60-15,000 RPM
"Industry's Seeing Eye"

Bulletin 781

VIBRATING REED FREQUENCY METERS

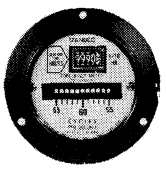
In 2½" and 3½" sealed or unsealed cases, meeting all MIL Specs. Rugged, dependable, accuracy ±0.5%, reeds aged. Standard voltage ranges: 100-150, 200-250, 400-450 volts.



Bulletin 806

REPRESENTATIVE RANGES

Cat. No.	Range CPS	No. of Reeds	Intervals Between Reeds
359	58-62	5	1
360	57-63	7	1
361	56-64	9	1
357	57.5-62.5	11	0.5
358	55-65	21	0.5
369	48-52 & 58-62	10	1
390	47-53 & 57-63	14	1
374	380-420	5	10
364	380-420	9	5
375	380-420	17	2.5
367	380-420	21	2
370	395-405	11	1

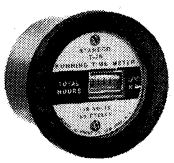


Bulletin 811

"STANDCO" COMBINATION FREQUENCY AND RUNNING TIME METERS

In 3½" flush mounting, round bakelite cases.

Cat. No.	Freq. Range	No. of Reeds	Time Range
TF-362	55-65 CPS	11 Reeds	9999.9 hrs.
TF-356	58-62 CPS	9 Reeds	9999.9 hrs.
TF-360	57-63 CPS	7 Reeds	9999.9 hrs.
TF-359	58-62 CPS	5 Reeds	9999.9 hrs.



Bulletin 810

"STANDCO" RUNNING TIME METERS

In 2½" and 3½" round, flush mounting, sealed or unsealed cases

3½"		2½"	
Type T-1	9999.9 hrs.	Type T-25	9999.9 hrs.
Type T-3	99,999 hrs.	Type T-30	99,999 hrs.
Type T-4	99,999 min.	Type T-35	99,999 min.
115V, 220V, 440V, 60 or 50 cycles		115V, 220V, 440V, 60 or 50 cycles	

"MEGOHMER" INSULATION TESTERS



DC GENERATOR (HAND CRANK) TYPES

"DWARF" MEGOHMER 500 volts, DC.

Bulletin 420

Cat. No. 701, 0.1-100 megohms
Cat. No. 702, 0.1-100 megohms 0-10,000 ohms

STANDARD MEGOHMER MARK II

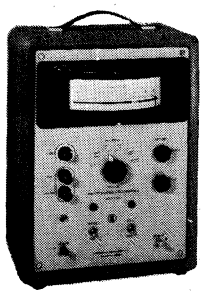
Multi-Range — Multi-Test Potential



Cat. No.	Test Potential	Insulation Range
718	1000 volts	0-200 megohms
	500 volts	0-100 megohms
	250 volts	0-50 megohms
	100 volts	0-20 megohms
		Continuity Range
		0-100 ohms

Cat. No.	Test Potential	Insulation Range
719	1000 volts	0-2000 megohms
	500 volts	0-1000 megohms
	250 volts	0-500 megohms
		Discharge
		Continuity Range
		0-20,000 ohms

Bulletin 435



HIGH RESISTANCE MEGOHMMETER

MODEL 29-U

20,000,000 MEGOHMS

Direct Reading: Unusual stability, fast in operation, high accuracy.

11 Ranges: From 300,000 ohms to 20 million megohms.

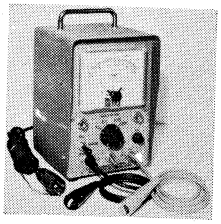
Power Supply: 115 volts AC, 60 cycles.

Test Potentials: 100 volts DC and 500 volts DC. Also: 0.5 volts to 1000 volts by external supply.

Bulletin 1029U

Precision Linear Ohmmeter

. . . . for accurate resistance testing



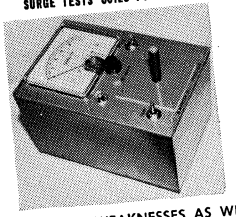
SERIES **203**

0.1 to 5000 Ohms Range

LINEAR RESISTANCE SCALES . . . CONTINUOUSLY SELF-CHECKING . . . GO/NO-GO LIMIT STYLE WITH BUZZER REJECTION SIGNAL.

High Energy Coil Tester

SURGE TESTS COILS FOR . . SHORTS . . GROUNDS . . OPENS



SERIES **640**

High Level Tester

DETECTS WEAKNESSES AS WELL AS DEFECTS . . . USE WITH CORE OR SOLENOID TYPE COILS . . . REQUIRES NO OPERATOR SKILL.

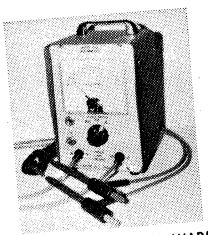
Coil & Winding Testers

WRITE FOR DATA SHEETS ON THE UNITS SHOWN ALL ARE STANDARD PRODUCTION ITEMS, AVAILABLE FOR EARLY DELIVERY . . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER CO.
MOORE & HAILEY STREETS
ARDMORE, OKLAHOMA
TELEPHONE: 405-223-4773 TWX: 405-223-6832

Adjustable Limit Megohmmeter

. . . . . with buzzer signal on rejections



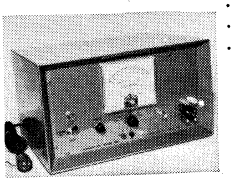
SERIES **205**

1 to 2000 Megohms

DRIFT FREE . . . NO WARM-UP . . . RUGGED TAUT BAND MOVEMENT . . . ADJUSTABLE REJECTION LIMIT WITH BUZZER SIGNAL.

Universal Comparator

tests coils and windings for impedance
. . . . . shorts
. . . . . opens
. . . . . turns



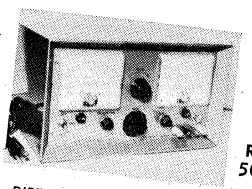
SERIES **635**

0.1 Percent Sensitivity

COMPARES COILS AND WINDINGS WITH STANDARD ON HIGH PRODUCTION GO/NO-GO BASIS . . . EXCELLENT AS A TURNS COUNT CHECKER . . .

Adjustable HI Voltage Surge Tester

tests coils and windings for shorts
. . . grounds
. . . . . opens



SERIES **648**

Ratings to 5000 Volts

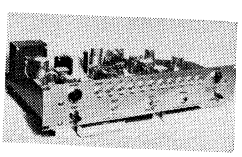
DIRECT READING PULSE-SURGE TESTER . . . REQUIRES NO ACTIVE MASTER . . . PRECISE ENERGY CONTROL . . . GO/NO-GO OPERATION FOR UNSKILLED PERSONNEL . . .

Automatic Test Equipment

WRITE FOR DETAILS ON THE EQUIPMENT SHOWN THESE ARE FULLY ENGINEERED, PROVEN, STANDARD DESIGNS AVAILABLE ON A REASONABLE DELIVERY SCHEDULE . . . LET US QUOTE ON YOUR REQUIREMENTS . . .

SLAUGHTER CO.
MOORE & HAILEY STREETS
ARDMORE, OKLAHOMA
TELEPHONE: 405-223-4773 TWX: 405-223-6832

Automatic Test Sequence Controller

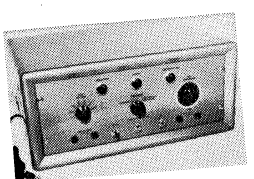


SERIES **910**

Brain Package

FULLY AUTOMATIC CONTROLLER WITH START — ACCEPT — REJECT — DELAY — SKIP — STOP — RESET FUNCTIONS . . . SELF-TIMING . . . PROGRAMMABLE.

Universal Cable & Harness Tester for continuity . . . breakdowns

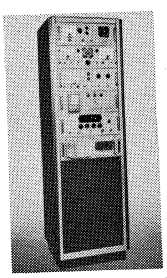


SERIES **701**

17 Circuit Capacity

SEMI-AUTOMATIC ECONOMY UNIT FOR GENERAL PURPOSE TESTING . . . REQUIRES NO OPERATOR SKILL . . . ELIMINATES COSTLY RE-WIRING.

Automatic Cable & Harness Tester for continuity . . . breakdowns . . . megohms

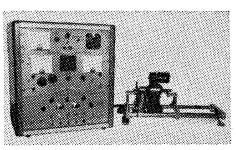


SERIES **707**

Expandable to 10,000 Circuits

INTERCHANGEABLE PROGRAM BOARDS FOR RAPID SET-UP CHANGES . . . MODULAR CONSTRUCTION . . . TESTING RATES TO 200 CIRCUITS/MINUTE . . . ALL LIMITS ADJUSTABLE.

Automatic Wound Armature Tester for insulation weakness . . . opens . . . grounds . . . shorted turns

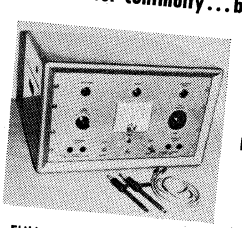


SERIES **920**

360 Parts Per Hour

CHECKS WOUND ARMATURES ON GO/NO-GO BASIS AT HIGH PRODUCTION RATES . . . HIGHLY EFFECTIVE PULSE-SURGE TEST SPOTS WEAKNESSES AS WELL AS DEFECTS.

Automatic Cable & Harness Tester for continuity . . . breakdowns



SERIES **706**

Expandable to 50 Circuits

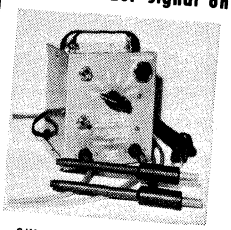
FULLY AUTOMATIC PROGRAMMABLE UNIT FOR HIGH PRODUCTION ON SIMPLE ASSEMBLIES . . . GO/NO-GO OPERATION . . . ADJUSTABLE LIMITS.

Insulation Testers

WRITE FOR DATA SHEETS ON THE INSTRUMENTS SHOWN . . . ALL ARE STANDARD PRODUCTION MODELS, AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK . . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER CO.
MOORE & HAILEY STREETS
ARDMORE, OKLAHOMA
TELEPHONE: 405-223-4773 TWX: 405-223-6832

High-voltage Insulation Tester
with buzzer signal on breakdowns
. . . grounds
. . . . shorts

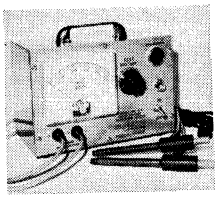


MODEL **101**

Watch what you are doing . . . not the tester

SIX TEST VOLTAGES . . 500 to 2500 V.A.C. PRICED SO YOU CAN AFFORD TO SPOT A FEW ALONG YOUR ASSEMBLY LINES.

Adjustable High-voltage Tester
with buzzer signal on breakdowns
. . . grounds
. . . . shorts

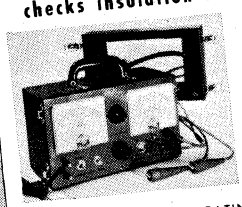


MODEL **106**

Voltmeter shows actual Test Voltage

CONTINUOUSLY VARIABLE TEST VOLTAGE RATINGS TO 10,000 VOLTS AC & DC . . RECOMMENDED FOR BREAKDOWN TESTING AT FINAL ASSEMBLY AND INSPECTION

High-voltage Leakage Tester
checks insulation for . . . leakage
. . . grounds
. . . . . arcing

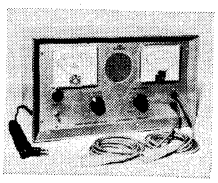


MODEL **122**

16 lb. Portable for lab and field work

VARIABLE VOLTAGE RATINGS TO 5 KV AC & D.C. DUAL RANGE LEAKAGE METER 0/100/1000 μa. . . . CAPACITY COMPENSATION. . . MEASURES INSULATION RESISTANCE, CAPACITY, POWER FACTOR.

High-voltage Leakage Tester
audibly signals excess leakage
. . . grounds
. . . . . arcing

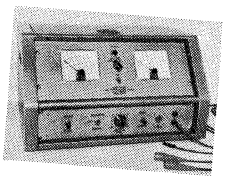


MODEL **103**

Measures Leakage . . . not capacity current

TEST VOLTAGE CONTINUOUSLY VARIABLE ADJUSTABLE LEAKAGE LIMIT. . CAPACITY COMPENSATION ON AC TESTS. . . RATINGS TO 10,000 VOLTS AC & DC. . . . LIMITED ENERGY. . NON-DESTRUCTIVE. . . FOR LAB AND PRODUCTION LINE SERVICE. . . . . .

Automatic H-V Insulation Tester
for precision checking . . . breakdowns
. . . leakage
. . . grounds

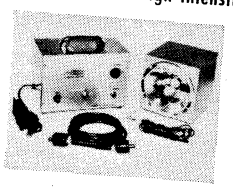


MODEL **103-MP**

Automatic Test Cycle

FULLY AUTOMATIC TEST CYCLE. . . CONTROLLED RATE-OF-RISE. . . ADJUSTABLE TEST VOLTAGE, DWELL TIME, & LEAKAGE LIMIT. . . CAPACITY COMPENSATION ON AC TEST. . . FOR PRECISION TEST OF CRITICAL PARTS & ASSEMBLIES. . .

Inspection Stroboscope
. . . with extra high intensity daylight lamp

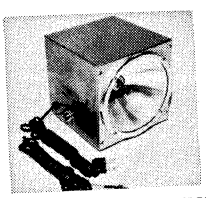


MODEL **167**

0/600 Flashes per Minute

SUPER INTENSITY TRIGGERED FLASH UNIT . . . PUSH-TO-SEE SWITCH. . . . FOR INSPECTION ON-THE-GO UNDER HIGH AMBIENT LIGHT CONDITIONS.

Inspection Stroboscope
. . . . . with high intensity daylight lamp



MODEL **161**

0/2,000 Flashes per Minute

LIGHT WEIGHT INEXPENSIVE TRIGGERED FLASH UNIT. . . . . PUSH-TO-SEE SWITCH. . . . INTENSE WHITE LIGHT FOR INSPECTION ON-THE-GO

MIDGET STROBOSCOPE FLASH HEAD

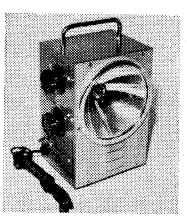


MODEL **166**

0/10,000 Flashes per Minute

FOR WORK ON MINIATURIZED EQUIPMENT . . . . FOR PRINTING TRADES. . . . FOR BIO-MEDICAL WORK. . ADAPTS TO ANY SLAUGHTER STROBOSCOPE. . .

Universal Stroboscope
. . . with high intensity daylight lamp



MODEL **163**

50/16,000 Flashes per Minute

UNIVERSAL UNIT FOR MOTION STUDY & INSPECTION ON-THE-GO . . . INSTANT STARTING . . . HIGH INTENSITY WHITE LIGHT . . . . TRIGGER EXTERNALLY OR OPERATE FROM INTERNAL OSCILLATOR

Stroboscopes

WRITE FOR DATA SHEETS ON THE INSTRUMENTS SHOWN . . . ALL ARE STANDARD PRODUCTION MODELS, AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK . . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER CO.
MOORE & HAILEY STREETS
ARDMORE, OKLAHOMA
TELEPHONE: 405-223-4773 TWX: 405-223-6832

Metered Precision Stroboscope
. . . . . with high intensity daylight lamp



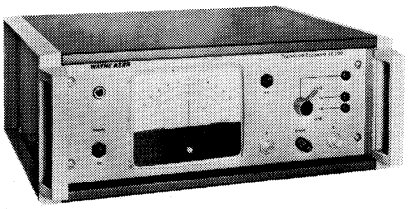
MODEL **165**

50/16,000 Flashes per Minute

PRECISION STROBOSCOPE TACHOMETER INSTANT STARTING. . . HIGH INTENSITY WHITE LIGHT. . . OPERATES FROM EXTERNAL CONTACTS OR INTERNAL OSCILLATOR. . EASILY SYNCHRONIZED. . OUTPUT JACKS TO COUPLE SCOPE, ETC. . . .

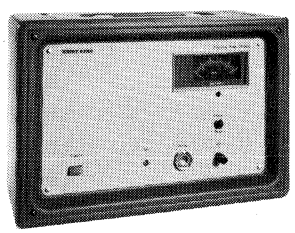
Innovations in Instrumentation... Wayne Kerr

THE MOST ADVANCED LINE OF TRANSDUCER EQUIPMENT FOR MEASURING DISTANCE, THICKNESS, VIBRATION, PRESSURE, TEMPERATURE, WEIGHT, FORCE



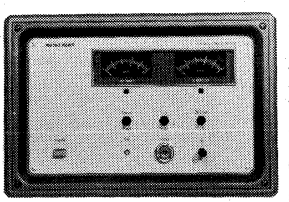
TE200 This capacitive transducer equipment provides two channels of measurement and also has a summing amplifier which can give an output of the readings A+B and A–B. Thru a 4 position selector switch the meter will read A, B, A+B or A–B to an accuracy of 1%. Linearity is .5%. Transducers can be provided to read from 50μ inch to .5 inch and can be located up to 100 feet from the TE200. Frequency response is 1 KHz. Applications include: In process (non-contacting) gaging, rotating component instrumentation, Vibration analysis, strain gaging and measurement of dielectric constant.

Price: $1690



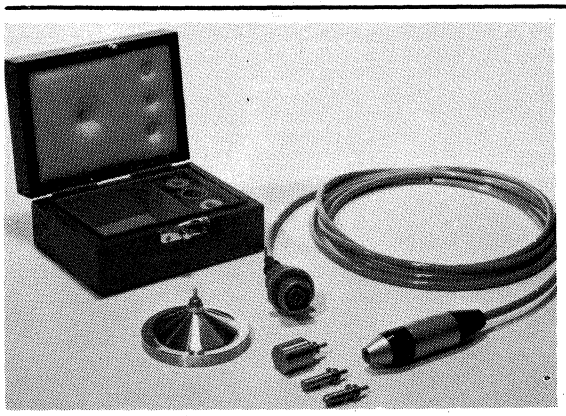
DM100B This single channel unit has the same basic specifications as the TE200 with the exception that its frequency response is 10 KHz and that without calibration the transducer must be no more than 10 feet from the equipment.

Price: $990



The B731A Vibration Meter and the DM100 Distance Meter are two versions of the same basic design. However, the B731A displays both peak-to-peak vibration amplitude and displacement (distance) directly on front-panel meters. The DM100 displays only displacement on a single front-panel meter.

Price: $1250



TRANSDUCER NUMBER	RANGE INCHES	OA LENGTH	O.D.	PRICE
MA1	.001	1.5	.312	$95
MB1	.005	1.5	.312	$95
MC1	.010	1.5	.312	$95
MD1	.050	1.5	.687	$95
ME1	.100	1.5	.812	$95

CAPACITIVE TRANSDUCERS — Wayne Kerr's capacitance probe consists of three concentric metal elements, electrically isolated from one another. The center-most element is one plate of a capacitor whose second plate is a grounded conductive object under observation. Variation in the thickness of the air gap between the sensing tip and the test object causes a linear change in the output voltage of the detection circuit. The second element is required to assure a uniform field between the sensing tip and the test object. Grounding the second element will make the detection circuit inoperative. To eliminate this problem, and to facilitate mounting, the third element is used. Information on probes suitable for temperatures to 1400°F. is available on request.

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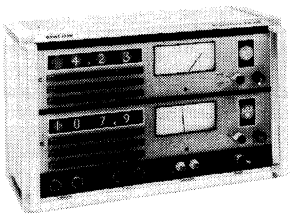
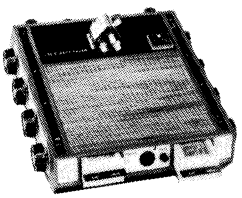
Innovations in Instrumentation... Wayne Kerr

PRECISION IMPEDANCE BRIDGES AND ACCESSORIES



B331 Mk II Reads C, R, L & G to .01% – This autobalance bridge features Push-Button simplicity which allows readings by unskilled operators within 30 seconds. Read out includes 4 digit in line numeric display and center zero meters plus units display, thereby making GO – NO GO readings easy. Can provide 2, 3 or 4 terminal measurements of components within a network.

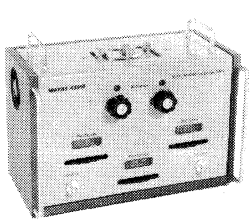


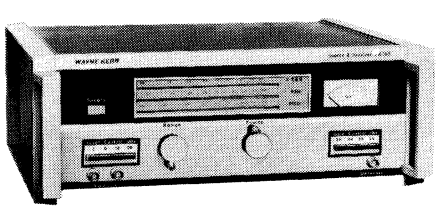
B201 Designed for highly precise simultaneous in-circuit measurement of capacitance and conductance over an extremely wide range. Applications include checking capacitors and components of printed circuits and encapsulated assemblies; impedance measurement of lines, filters, aerials and equalizing circuits.

Transformer – Ratio-Arm Bridges – the most accurate and convenient means ever developed for measurement of the basic electrical parameters – were pioneered and developed by Wayne Kerr. Advantages of these instruments include:

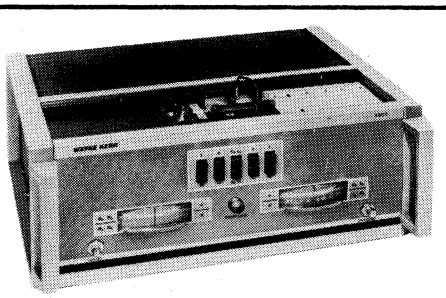
- Widest impedance ranges available at any frequency.
- 20 cps-250 MC range with only four instruments.
- Simultaneous readings of both resistive and reactive components with equal accuracy.
- Components measured without removal from circuit. Third terminal eliminates shunt impedances.
- 2, 3, and 4-terminal measurements, balanced and unbalanced.
- Direct measurement of components with superimposed DC, without zero adjustments, or substitutions.
- Extreme simplicity of operation.

MODEL	TYPE	FREQUENCY RANGE	MEASUREMENT RANGES	ACCURACY	PRICE
B201	RF	100 KC-5 MC	C: .001 to 100,000 pf G: 0.1μmho to 1 mho	0.1%	$1470
B221 Mk III	AF (L, C, R)	1592 cps Internal 200 cps to 50 KC External	C: 0.002$\mu\mu$F to 11μF R: 10ohm to 10,000 megohms L: 1mH to 10^{3}H	0.1%	$1280
B221Q Mk III	with Q221 Adaptor		C: 0.002$\mu\mu$F to 100,000μF R: 25μohms to 50,000 megohms L: 5mμH to 10^{3}H	0.1%	$1450
B331 Mk II	Push-Button Autobalance AF	1000 or 1592 Internal 50 cps to 20 KC External	C: 1pF to 10μF R: 10ohm to 100megohms	.01%	$3670
B541C Mk II	Autobalance Capacitance	1000 cps	(76 ranges) C: 0.01$\mu\mu$F-11μF	0.1%	$840
B601Z	with Z601 Adaptor	15KC - 5MC External	C: 0.01$\mu\mu$F-5,000μF R: 0.001ohm-10 megohms L: 0.001μH-50mH	1%	$895
B601	RF (L, C, R)		C: 0.01$\mu\mu$F-20,000$\mu\mu$F R: 10ohm to 10 megohms L: 0.5μH-50mH		
B602	RF (L, C, R)	100 KC to 10 MC	C: 1pF to 10nF R: 10ohm to 100 Kohms L: 1μH to 10mH	1.%	$1475
B641	Push-Button Autobalance AF	1000 or 1592 Internal 50 cps to 20 KC External	C: 1pF to 10μF R: 10ohm to 100 megohms L: 1mH to 10kH	0.1%	$1700
B801B	VHF Admittance L, C, R	1-100 MC External	C: ±0.5$\mu\mu$F to ±230$\mu\mu$F R: 10ohms-10Kohms L: 0.1μH-50mH	2%	$1210
B901	VHF Admittance L, C, R	50-250 MC External	C: ±0.1$\mu\mu$F to ±75$\mu\mu$F R: 10ohm-10kohm L: 5MμH-20μH	2%	$990





B801B This VHF Admittance Bridge is shown with the SR268 combined Source/Detector. The bridge features ease of operation in measuring antennas, cables, transmission lines, VHF amplifiers and receivers, VSWR and a wide variety of components, including shunt capacitance of coils. For semi conductor parameter measurements, the Q801A Transistor Adaptor is used in conjunction with the CU681 DC Control Unit and the bridge. The SR268 features simultaneous, single dial tuning from 100kHz to 100 MHz in 9 ranges.



B602 Features extreme simplicity in making measurements in all four quadrants of the complex plane over a wide RF frequency range. Employs the well known transformer ratio arm principle which was pioneered by Wayne Kerr. The B602 is used in conjunction with the SR268 Source/Detector and the Q602 Transistor Adaptor.

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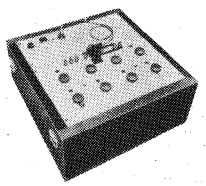
TINSLEY PRECISION MEASURING INSTRUMENTS

SMITH BRIDGE No. 3 — Type 4162B



This high precision instrument is based on the pattern originally described by F. E. Smith. It is used with a four terminal Platinum Resistance Thermometer (Type 5187H).

Accuracy of comparative resistance measurement is 0.0001 1μ equivalent to 0.001°C using a thermometer of ice-point resistance 25Ω, range −200°C to +700°C (73°K to 973°K).

The bridge is oil-immersed and temperature controlled by a temperature regulator at 25°C.

Two standard models are available: Type 4162B/25 for use with thermometers of ice-point resistance 25Ω (fundamental interval 10Ω) and Type 4162B/25/100 for use with thermometers of ice-point resistance 25Ω and 100Ω.

Dimensions: 36″ x 36″ x 23″. **Weight:** 350 lb.

GALVANOMETER — Type 5656



A new Tilt Scale Galvanometer available with or without built-in optical magnifier.

The scale rotates so that the instrument may be easily read from the operator's position.

Any of the Tinsley 4500 range of galvanometer suspensions can be fitted to this galvanometer.

Front panel zero adjuster and sensitivity switch.

Fitted with galvanometer clamp for transit.

Lamp easily replaceable without upsetting optical line up.

TABLE OF SENSITIVITY

Type 5656A Galvanometer with optical magnifier

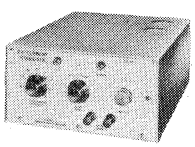
	Periodic time 2 sec.					
Resistance Ω	3	5	10	50	140	450
Sensitivity mm/μA	18	58	85	190	330	900
mm/μV	6	11	8.5	3.8	3.8	2
Damping resistance Ω	20	120	450	2,500	4,500	30,000

Type 5656B Galvanometer

	Periodic time 2 sec.					
Resistance Ω	3	5	10	50	140	450
Sensitivity mm/μA	8	25	36	80	146	390
mm/μV	1.6	5	3.6	1.6	1	0.8
Damping resistance Ω	20	120	450	2,500	4,500	30,000

Dimensions: 6¼″ x 6¼″ x 10″. **Weight:** 6 lb.

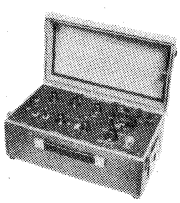
LOW CURRENT STABILIZER — Type 5751



The basic principal of operation is similar to that of the automatic current controller. The stabilizer is self-contained, the constant voltage transformer being built in, together with a Mallory reference cell which provides the reference voltage. Seven current ranges are provided and are selected by a switch on the front panel, a trim control is also provided and will modify the output current up to −4% of the selected value.

The current ranges are 0.1 μA, 0.5 μA, 1 μA, 10 μA, 20 μA, 50 μA, 100 μA.

PORTABLE POTENTIOMETER — Type 5597



Complete with self-contained reflecting galvanometer, standard cell and batteries, housed in a teak case with lid and anodized cover panel. Automatic compensation is provided for the temperature coefficient of the standard cell.

Three ranges:

x 1 range: 1.9 V in steps of 0.1 mV
Limit of error: ±(0.01% +0.2 mV)

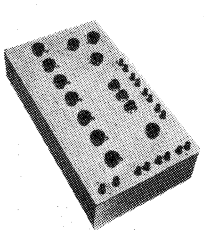
x .01 range: 0.19 V in steps of 10 μV
Limit of error: ±(0.01% +20 μV)

x 0.01 range: 0.019 V in steps of 1 μV
Limit of error: ±(0.01% to 2 μV)

Dimensions: 16½″ x 9½″ x 7½″. **Weight:** 12 lb.

STABAUMATIC POTENTIOMETER — Type 5545 and 5545A





A seven-dial potentiometer designed to be used with the Type 5750A Tinsley Automatic Current Controller. The Potential circuit consists of one fixed resistor only.

Switches operate in parallel on high value resistors outside the potential circuit thus eliminating thermo-electric effects. The instrument may also be used as a Resistance Bridge with six ranges. Three external measuring circuits are provided.

Type 5545A is supplied with connections for printer or read-out.

Ranges: voltage;
0 to 2.111 11 V in steps of 1 μV
0 to 211.111 mV in steps of 0.1 μV

Calibrated accuracy: ±(0.001% of reading +1 μV)

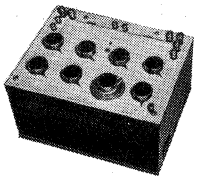
Long term limit of error:
±(0.003% of reading +1 μV)

Resistance: 0.01Ω to 21 MΩ, smallest step 0.000 1Ω

Dimensions: 22½″ x 12½″ x 9″. **Weight:** 25 lb.

"Stabaumatic" is a registered trademark.

PORTABLE KELVIN-WHEATSTONE BRIDGE — Type 2620

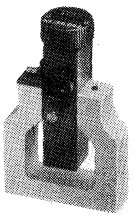


Built-in spot galvanometer. An external battery may be used for large currents when required.

Any one of four internal low resistance standards may be chosen by means of a selector switch when operated as a Kelvin bridge.

Measuring ranges: Kelvin bridge 10 μΩ to 10Ω (limit of error between 3% and 0.05%).
Wheatstone bridge 1Ω to 100kΩ (limit of error between 0.5% and 0.05%)

SUSPENSIONS FOR PORTABLE GALVANOMETERS



Suspensions are normally supplied complete with magnets. If a suspension 'without magnet' is required this is termed a 'spare suspension'.

Non-sticking Coil Stops can be fitted to Type 4500 suspensions at extra cost. These are adjustable over a wide range to limit angular deflection.

The values of resistance given in the tables below are nominal values only and the sensitivity may vary by ±10% — see List 175, sheet 2018 for sensitivity figures of suspensions when fitted into Portable Galvanometer boxes.

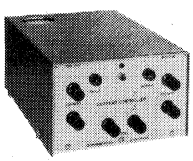
Type 4500 A very sensitive suspension with a light rectangular coil on silver gilt suspension strip.

	Periodic time 2 sec					
Resistance Ω	3	5	10	50	140	450
Sensitivity at 1 meter scale distance mm/μA	30	95	140	300	550	1,500
Damping resistance Ω	30	120	450	2,500	4,500	30,000

	Periodic time 2 sec					
Sensitivity at 1 meter scale distance mm/μA	9	24	30	65	147	380
Damping resistance Ω	8	44	130	650	1,800	6,000

Other suspensions are available.

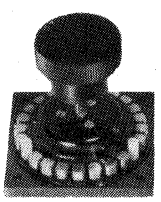
PRECISION CURRENT STABILIZERS (d.c.) — Type 5750



The automatic current controller (see page 16) may be used to supply a constant d.c. current for precision measurements and calibration of scientific apparatus. Model 5750 may be supplied for any single current range with a maximum value of 50 mA.

The stabilizer operates directly from the mains through a constant voltage transformer Type CV 25E, no intermediate batteries are used. Under the best conditions the current can be held stable to 1 part in a million for a period of several hours.

SWITCHES — Types 5500, 5501, 5502, 5503, 5504



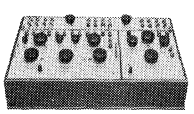
A wide range of instrument switches is available, from an 11 position minimum switch, Type 5501, to a 102 way switch, Type 5503.

Each model is available in many combinations of positions and poles. Units may be ganged if required.

All switches are molded in high insulation material and have been life tested to ensure reliable performance over long periods.

Type 5500, 5502 and 5504 are fitted with dust covers. Illustrations show switch with dust cover removed.

PRECISION a.c. and d.c. POTENTIOMETER — Type 4600



A co-ordinate potentiometer employing Type 4580 as the 'in-phase' potentiometer enables measurements to be made to a precision of 1 part in 10,000.

The instrument may be used in three ways:

1. As a d.c. potentiometer to E.S.M. accuracy.
2. As a co-ordinate potentiometer at power frequencies.
3. As a polar co-ordinate potentiometer at power frequencies using a phase-shifting transformer (Type 4165) with a two-phase primary and secondary to supply the current to the potentiometer.

"In phase" potentiometers: 1.6 V in steps of 0.000 1 V. 0.16 V in steps of 0.000 01 V. Limit of error: (a.c.) 0.05%. Limit of error: (d.c.) 0.1″.

"Quadrature" potentiometer: 1.8 V in steps of 0.1 V with slidewire readable to 0.2 mV. 0.18 V in steps of 0.01 V with slidewire readable to 0.02 mV. Limit of error: 0.1%.

Dimensions: 31″ x 18½″ x 9″. **Weight:** 86 lb.

National Sales & Service by:

DIVISION OF COMTEL CORPORATION

SOUTHFIELD ELECTRONICS

21250 10½ MILE ROAD • SOUTHFIELD, MICHIGAN 48075 • PHONE (313) 352-2627

Takeda Riken

Universal Counter, Digital Voltmeter, Digital Integrator, Electrometer, Frequency Counter, Frequency Synthesizer, Frequency Standard, Data Acquisition System, Operational Amplifier.

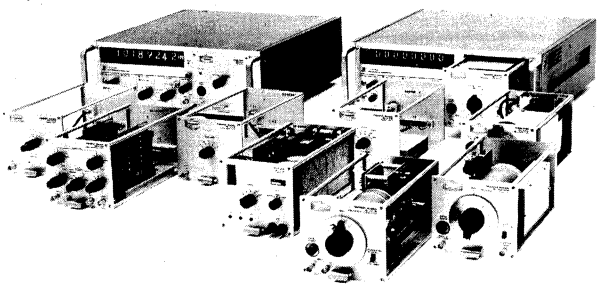
Electronic Counters

The ***-TR-5589L*** and **5589K** have the unique ANS (Automatic Noise Suppressor) circuit in their frequency measuring inputs for eliminating the disturbance of noise as well as improving the input sensitivity and dynamic range.

According to the wider direct counting range, it becomes inavoidable the effect of undesirable frequency supperimposing on a signal frequency. It is a quite normal condition for a very high speed counter something like ***-TR-5589L*** or **5589K** that the two or more different frequencies are fed into the counter input simultaneously, and resulted incorrect counting.

But the unique ANS feature rejects the effect of the supperimposed higher frequency noise up to 40% of the signal level, and results correct counting.

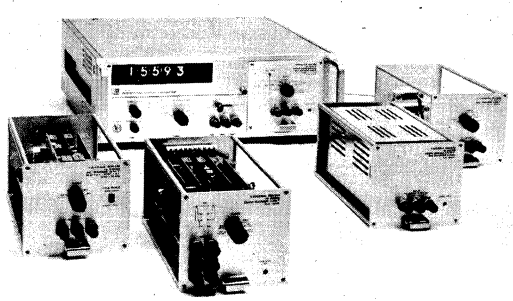
This provides convenient measurements of frequencies for communication system radar of transmitter tests and adjustments.



Electronic Counter Selection Guide

Model *1	Features	Frequency Range	Measurement *2	Registration	BCD Output	Time Base Stability (Gate Time)
-TR-3788C	Portable, 500 MHz direct counting	10 Hz to 500 MHz	F.	8-digit in-line		3×10^{-9}/day (4 ms to 4 s)
-TR-3787				7-digit in-line		5×10^{-8}/day (4 ms to 4 s)
-TR-5589L	Plug-in, multipurpose, high stability, 9-digit display ANS circuit included	10 Hz to 250 MHz Up to 12.5 GHz *3	F, P, R, TI, T, V.	9-digit in-line	Standard	5×10^{-10}/day (1 ms to 10 s)
-TR-5589K						3×10^{-9}/day (1 ms to 10 s)
-TR-5578C	Economical 82 MHz Counter with plug-in versatility. AC/DC Coupling.	DC to 82 MHz Up to 12.5 GHz *3	F, P, R, TI, T, V.	8-digit in-line	Standard	3×10^{-9}/day (1 ms to 10 s)

* 1: ***-TR-3000*** series; Frequency Counter, ***-TR-5000*** series; Universal Counter
* 2: F; Frequency, P; Period, R; Ratio, TI; Time Interval, T; Totalizing, V; DC Voltage.
* 3: With Frequency converter plug-in



Digital Voltmeters

The criteria used in selecting a digital voltmeter is, under actual operating conditions, to find out how the measured results are guaranteed. Especially, the measured results of voltage current, and resistance measurements are of basic importance in quality assurance.

To assure their quality, Takeda Riken inspects all measuring functions of all digital voltmeters produced under a highly accurate standard quality control system based on ETL (Japan Electrical Testing Laboratory) and NBS (USA National Bureau of Standards).

In selecting a digital voltmeter, it is necessary to analyze such factors as accuracy, resolution, sensitivity, stability, response speed, and noise rejection on the basis of quality assurance. For example, a ramp type digital voltmeter or comparison type digital voltmeter has high response speed, high accuracy, and high stability, but these types cannot reject noise effectively and therefore noise can not be removed when measurement is performed in a place where large noises are present. Takeda Riken manufactures digital voltmeters having high accuracy, high sensitivity, high resolution, and high noise rejection ratio by using a floating and guarded input circuit of the integrating type.

Digital Voltmeter Selection Guide

Model	Features	Ranges	* Measurements	Registration	Input impedance	BCD Output	Voltage Accuracy	Dc Voltage Resolution
-TR-6515 Integrating Digital Voltmeter	Plug-in versatility High input impedance. 1000MΩ /100V High accuracy. Autorange provided	± 300mV to 1000V full scale 5-ranges.	Vdc. (HSV, HV, Vac, R with plug-in unit)	5-digit in-line	Greater than 1000MΩ/300mV 3V range. (1000MΩ/300mV to 100V when plug-in unit used)	Std.	± 0.01% of rdg ± 1 digit (at + 20°C to + 30°C)	10μV (1μV when plug-in unit) used)
-TR-6715B Integrating Digital Voltmeter	Best suited for system application. Autorange provided.	± 300mV to 1000V full scale 5-ranges.	Vdc.	5-digit in-line	Greater than 1000MΩ/300mV, 3V ranges	Std.	± 0.01% of rdg ± 1 digit (at + 20°C to + 30°C)	10μV
-TR-6155M Digital Multimeter	5 functions in one.	± 0.1V to 1000V full scale, 5-ranges.	Vdc, F, R, Vac, Idc.	5-digit in-line	10MΩ /100, 1000V ranges	Std.	± 0.1% of full scale ± 1 digit	10μV
-TR-6834 Digital Volt-ohmmeter	High sensitivity. High performance. Portable, moderate price	± 39.99mV to 1000V full scale, 7-ranges.	Vdc, R (Idc with current unit)	4-digit	Greater than 1000MΩ/39.99 mV to 20.00V ranges		± 0.05% of rdg ± 1 digit	10μV
-TR-6334 Digital Volt-ohmmeter	Compact and light weight. Economical	± 1.8V to 1000V full scale, 4-ranges.	Vdc, R (Idc with current unit)	3-digit	Greater than 1000MΩ/1.8, 18V ranges		± 0.1% of rdg ± 1 digit	1mV

* Vdc: DC Voltage, F: Frequency Vac: AC Voltage, R: Resistance, HV: High Input Impedance, HSV: High sensitivity DC Voltge, Idc: DC Current.

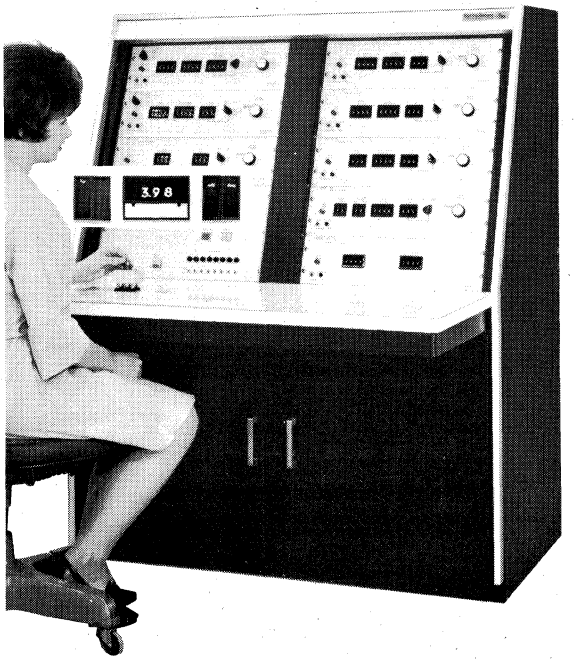
FOR DETAILS, WRITE,

Takeda Riken Industry Co., Ltd.

1-32-1, Asahi-cho, Nerima-ku, Tokyo, Japan Cables: TRITRONICS TOKYO Tel: 930-4111

Model 67 SCR/TRIAC Test System

New low-cost system gives you full parameter testing automatically!

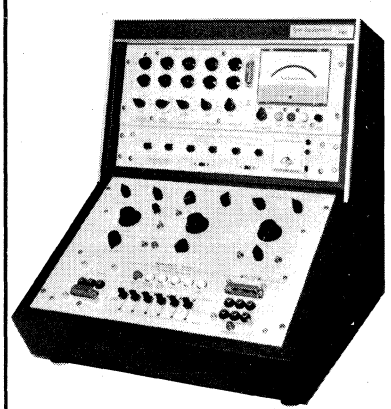


The new Test Equipment Corporation Model 67 is the *first* commercially available high speed automatic SCR/TRIAC test system. It offers full parameter testing with extreme accuracy, yet is priced economically for incoming inspection, production and quality assurance applications. You may specify a choice of up to eight parameter tests.

Wide test capabilities of the Model 67 include a 0-2000 v blocking voltage, 300 amp forward current and linear dv/dt to a maximum rate of 1000 v/μsec. Easy-to-read visual display (inset photo) gives the operator all test data, or tests may be performed GO/NO-GO. Simple digital thumbwheel switches provide for fast, accurate programming of test conditions.

The Model 67 may be customized to particular user requirements to include tape programming, punched out data, etc.

TEC offers test system design and engineering capabilities and on request will quote systems to meet specific user requirements.



MODEL 1

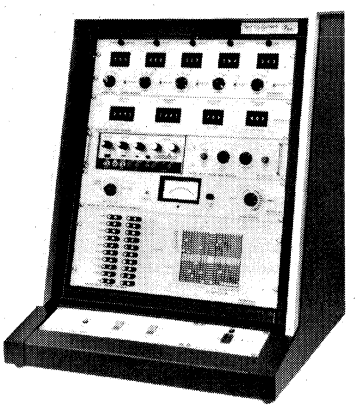
MODEL 1 SEMIAUTOMATIC TRANSISTOR AND DIODE TESTER — an economical and most versatile transistor and diode tester.

The availability of a full line of TEC accessory equipment makes the Model 1 a practical basic instrument for an expanded test system. Its versatility makes it ideally suited for most test applications.

Incoming Inspection—Automatic sequencing, ease of operation and GO/NO-GO limits.

Research & Development — Direct reading measurements with ±1% accuracy.

- **19 dc tests**
- **BV up to 1000 v**
- **1 na leakage full scale**



MODEL 80 INTEGRATED CIRCUIT TESTER

Versatile low cost unit tests all digital and linear IC's.

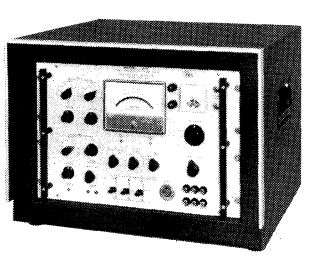
The low cost Model 80 IC tester from Test Equipment Corporation gives you the capability to test all digital and linear integrated circuits. *Application Notes describing the various tests are available on request.*

The Model 80 performs all static tests on digital IC's and most dynamic tests required for linear circuits. Dynamic tests on linear IC's include open and closed loop gain, input and output impedance, gain bandwidth, maximum output voltage swing, and others.

Its low cost makes the Model 80 an excellent choice for incoming inspection, engineering evaluation or production testing. Its modular construction offers additional versatility to allow selection of specific capabilities as required. If desired, the Model 80 may be used for a single test to sort devices on a GO/NO-GO basis.

MODEL 1-21 100 AMP PULSED TRANSISTOR AND DIODE TESTER—may be used independently or in a system with the TEC Model 1 semiautomatic tester to give automatic sequencing and GO/NO-GO limits. It measures pulsed H_{FE}, V_{be} (sat) and V_{ce} (sat) with a 330 μsec pulse at 2% duty cycle.

- **I_c Variable** 10 ma to 100 a
- **I_b Variable** 2 ma to 30 a
- **I_c Variable** 0.1 to 30 v



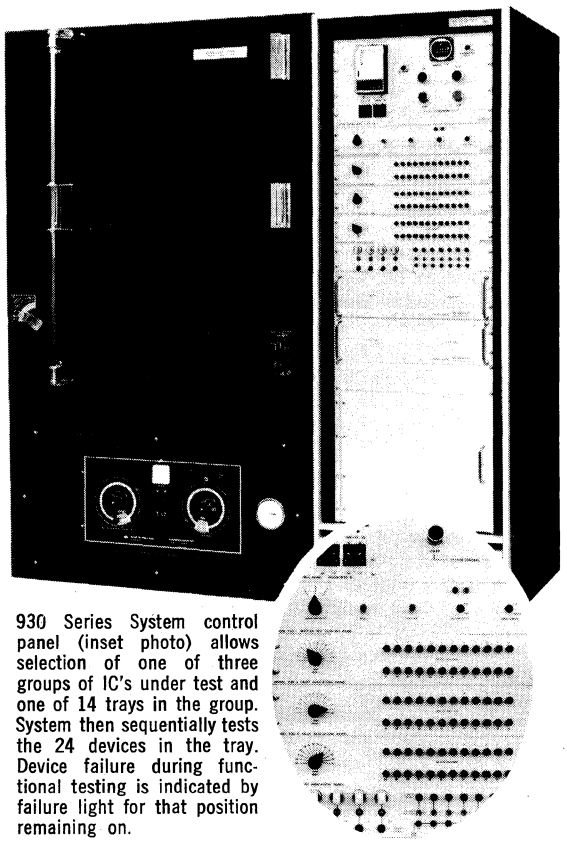
MODEL 1-21

Test Equipment CORPORATION

P.O. BOX 20215, DALLAS, TEXAS 75220 • 214/357-6271

930 Series Automated IC Burn-in System

New, completely automatic system functionally tests each device during burn-in cycle.



930 Series System control panel (inset photo) allows selection of one of three groups of IC's under test and one of 14 trays in the group. System then sequentially tests the 24 devices in the tray. Device failure during functional testing is indicated by failure light for that position remaining on.

The Test Equipment Corporation 930 Series Automated IC Burn-in System can test individually more than 1,000 IC's during the burn-in cycle. It is capable of life test and burn-in of linear and/or digital IC's under electrical stress at ambient temperatures of +40° to +200°C.

The 930 Series System's temperature chamber accommodates three groups of 14 trays. Each tray provides 24 universal sockets to accept flat-packs, TO-5's and DIPs. Bias and circuit components for individual devices may be changed easily as long as the devices in the three groups are the same (*either all digital or all linear*). The chamber itself is protected by an over-temperature control system.

A computer may be coupled to the 930 Series System to log functional data, device identification and time of failure. Typical data includes time, oven number if in a system, group and socket numbers. Only data from failed devices need be logged.

Quotations on variations of this or other TEC burn-in systems to your specific requirements are available on request.

Semiconductor Power Aging and Life Test Systems

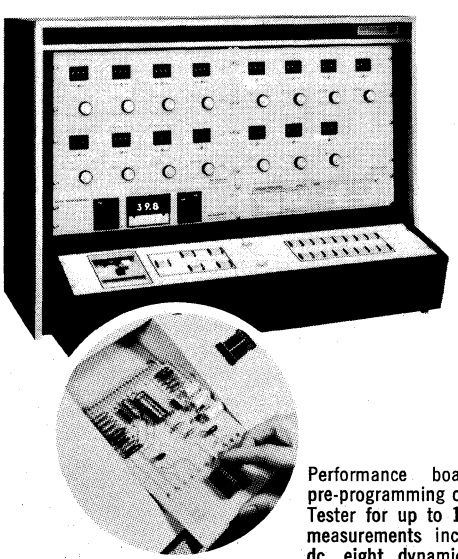
Test Equipment Corporation has for years designed and developed sophisticated environmental test equipment. This experience plus TEC total "in-house" manufacturing capabilities makes possible extremely fast turn-around, thus saving valuable time and money.

For further information, please write for descriptive "burn-in capabilities" brochure.



Model 79 Linear IC Tester

New automatic Linear IC Tester offers versatility at low cost.



Performance boards allow pre-programming of Model 79 Tester for up to 15 different measurements including five dc, eight dynamic and two customer-specified tests.

The wide range of automatic testing capabilities and low cost of the new Model 79 Linear IC (LIC) Tester from Test Equipment Corporation make it ideally suited for production, engineering and quality control applications.

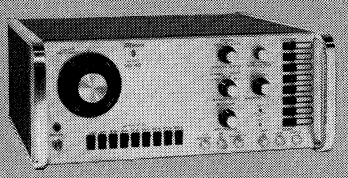
TEC's Model 79 "LIC" Tester is completely automatic with the exception of test limits and range selections and is pre-programmed on performance boards for up to 15 different test measurements. It provides five dc and eight dynamic tests. In addition, two auxiliary positions are available for customer-specified tests.

The Model 79 also features voltage/current crossover power supplies capable of 100 v/100 ma operation. The Tester is capable of low current measurements to 999 pa full scale, low voltage measurements to 99.9 μv full scale, and test time typically 100 ms or less per test. It accepts all IC package configurations.

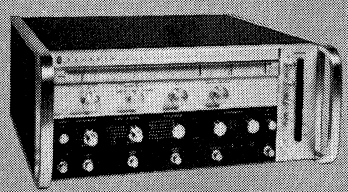
Test Equipment CORPORATION

P.O. BOX 20215, DALLAS, TEXAS 75220 • 214/357-6271

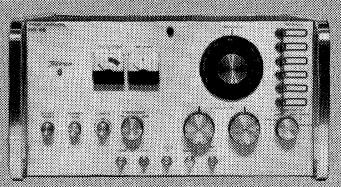
Texscan CORPORATION SWEEP SIGNAL GENERATORS



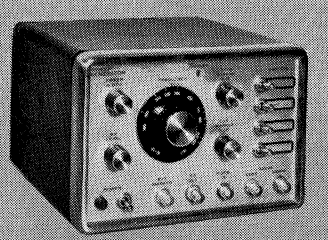
VS SERIES



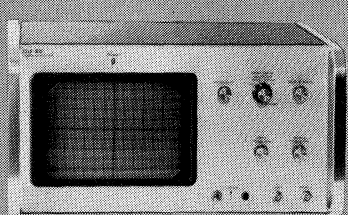
RS SERIES



HS SERIES



LS SERIES



DU SERIES

Texscan manufactures solid state sweep/signal generators which cover the frequency range of 500 Hz to 2300 MHz. Texscan's product line consists of five different types of instruments, each type being a complete line of instruments. Depending on the customer's application, he may require all the versatility that the RS series provides or he may be able to perform the required test with the lower VS series generator.

The VS instruments are designed so that warm up drift is negligible and component life is almost unlimited. Each unit has extended sweep rate capability including line, variable, manual and external.

The HS series are high power, wide tuning range units which provide more than 4 watts of leveled output over the frequency range of 20 MHz to 1000 MHz and offer a choice of four modes of operation: swept RF, modulated swept RF, CW and modulated CW.

MODEL NO.	FREQUENCY RANGE	SWEEP WIDTH	SWEEP RATE RANGE	LINEARITY	RF OUTPUT	PRICE
VS-20	500 Hz to 25 MHz	500 Hz-25 MHz	1 Hz to 60 Hz	1%	1v	$1095
VS-30	100 KHz to 100 MHz	100 KHz-100 MHz	5 Hz to 60 Hz	1%	1v	$ 895
VS-40	1 MHz to 300 MHz	200 KHz-300 MHz	5 Hz to 60 Hz	1%	.5v	$ 925
VS-50	2 MHz to 500 MHz	500 KHz-500 MHz	5 Hz to 60 Hz	1%	1v	$1250
VS-70	290 MHz to 1200 MHz	to 40%	5 Hz to 60 Hz	5%	.5v	$1095
VS-80	1 MHz to 1200 MHz	50 KHz to 40%	5 Hz to 60 Hz	5%	.5v	$1550
VS-120	1 GHz to 2.4 GHz	50 KHz to 20%	5 Hz to 60 Hz	3%	.25v	$1695
RS-50	3 MHz to 500 MHz	500 KHz to 500 MHz	.01 Hz to 100 Hz	1%	1v	$2250
RS-70	500 MHz to 1000 MHz	50 KHz to 500 MHz	.01 Hz to 100 Hz	1%	.5v	$2250
RS-120	1000 MHz to 2000 MHz	100 KHz to 1000 MHz	.01 Hz to 100 Hz	1%	.5v	$2250
HS-70	20 MHz to 100 MHz	15%	50/60 Hz	2%	4w	$2500
HS-75	100 MHz to 250 MHz	15%	50/60 Hz	2%	4w	$2500
HS-80	200 MHz to 425 MHz	15%	50/60 Hz	2%	4w	$2500
HS-85	400 MHz to 1000 MHz	15%	50/60 Hz	2%	4w	$2500
HS-86	500 MHz to 1000 MHz	15%	50/60 Hz	2%	8w	$3200
CS-76	460 MHz to 920 MHz	.1 MHz to 45 MHz	50/60 Hz	10%	.5v	$ 475
LS-40	1-250 MHz	.5 to 250 MHz	50/60 Hz	3%	.75v	$ 655
LS-45	250-500	.5 to 250 MHz	50/60 Hz	3%	.5v	$ 575
LS-70	500-1000	.5 to 500 MHz	50/60 Hz	3%	.5v	$ 575
TP-10.7	10.4-11	600 KHz	50/60 Hz	3%	1v	$ 475
TP-45	39-49	10 MHz	50/60 Hz	3%	1v	$ 475

Solid State Oscilloscopes

Model	Screen Size	Vertical Amp Band with/ Sensitivity	No. of Y inputs	Price
DU-88M	5" x 7"	DC-15KHZ/1MV/DIV-1V/DIV	1	$ 695.00
DU-89M	5" x 7"	DC-15KHZ/5MV/DIV-5V/DIV	1	$ 695.00

Reflection Coefficient Bridges

	RCB-3	RCB-3/75	RCB-4
FERQUENCY RANGE	0.5 MHz to 1 GHz	0.5 MHz to 1 GHz	0.5 MHz to 2.5 GHz
IMPEDANCE	50 ohms	75 ohms	50 ohms
PRICE	$75.00	$150.00	$150.00

Detectors

	CD-50	CD-51	CD-75
FREQUENCY RANGE:	100 kHz to 1000 MHz	5 MHz to 4000 MHz	100 kHz to 1000 MHz
INPUT IMPEDANCE:	50 ohms	50 ohms	75 ohms
PRICE:	$30.00	$75.00	$30.00

tc Texscan CORPORATION

2446 N. Shadeland Ave.
Indianapolis, Indiana 46219
Ph. (317) 357-8781
TWX. 810-341-3184
TELEX: 27-2110

Texscan CORPORATION RF TEST EQUIPMENT

The Texscan Corporation Component Division manufactures a broad line of coaxial components. These components include devices for both O.E.M. and laboratory use. The index below contains Texscan's standard components and will be useful for determining availability of a particular component.

Many modifications of Texscan's standard products have been produced for special applications and inquiries for specials are cordially invited.

Rotary Attenuators

Model	Attenuation Range	Steps	Frequency Range	Impedance	Control	Size	Price
RA-53	0 to 1db	0.1db	DC to 500 MHz	50 ohm	Manual	1⅞" × 2¼"	$ 95.00
RA-73	0 to 1db	0.1db	DC to 500 MHz	75 ohm	Manual	1⅞" × 2¼"	$ 95.00
MA-53	0 to 1db	0.1db	DC to 1000 MHz	50 ohm	Manual	1¼" × 1¾"	$135.00
RA-50	0 to 10db	1db	DC to 2000 MHz	50 ohm	Manual	1⅞" × 2¼"	$ 85.00
RA-70	0 to 10db	1db	DC to 1000 MHz	75 ohm	Manual	1⅞" × 2¼"	$ 85.00
MA-50	0 to 10db	1db	DC to 3000 MHz	50 ohm	Manual	1¼" × 1¾"	$125.00
RA-60	0 to 10db	1db	DC to 4000 MHz	50 ohm	Manual	2¾" × 2¼"	$275.00
RA-534	0 to 11db	0.1db	DC to 500 MHz	50 ohm	Manual Dual Concentric	1⅞" × 3¾"	$165.00
RA-734	0 to 11db	0.1db	DC to 500 MHz	75 ohm	Manual Dual Concentric	1⅞" × 3¾"	$165.00
560	0 to 11db	0.1db	DC to 500 MHz	50 ohm	Manual Bench Mount	2" × 4" × 6"	$235.00
RA-61	0 to 50db	10db	DC to 4000 MHz	50 ohm	Manual	1⅞" × 3"	$275.00
RA-54	0 to 50db	1db	DC to 1500 MHz	50 ohm	Manual Dual Concentric	1⅞" × 3¾"	$165.00
RA-74	0 to 50db	1db	DC to 1000 MHz	75 ohm	Manual Dual Concentric	1⅞" × 3¾"	$165.00
MA-51	0 to 60db	10db	DC to 3000 MHz	50 ohm	Manual	1¼" × 2⅜"	$125.00
RA-51	0 to 70db	10db	DC to 2000 MHz	50 ohm	Manual	1⅞" × 2¼"	$ 85.00
RA-71	0 to 70db	10db	DC to 1000 MHz	75 ohm	Manual	1⅞" × 2¼"	$ 85.00
570	0 to 80db	1db	DC to 1500 MHz	50 ohm	Manual Bench Mount	2" × 4" × 6"	$225.00
RA-100	0 to 100db	10db	DC to 1000 MHz	50 ohm	Manual	1⅞" × 3"	$140.00
RA-104	0 to 110db	1db	DC to 1000 MHz	50 ohm	Manual Dual Concentric	1⅞" × 4⅝"	$240.00
550	0 to 110db	1db	DC to 1000 MHz	50 ohm	Manual Bench Mount	2" × 4" × 6"	$275.00

Switch Attenuators

	SA-50	SA-58	SA-60	SA-70	SA-78
ATTENUATION	0 to 102 db, 1 db steps	0 to 82.5 db, 0.5 db steps	0 to 42 db, 1 db steps	0 to 102 db, 1 db steps	0 to 82.5 db, 0.5 db steps
ATTENUATION STEPS (db)	1, 2, 3, 6, 10, 20, 20, 20, 20	0.5, 1, 2, 3, 6, 10, 20, 20, 20	1, 2, 3, 6, 10, 20	1, 2, 3, 6, 10, 20, 20, 20, 20	0.5, 1, 2, 3, 6, 10, 20, 20, 20
IMPEDANCE	50 ohms			75 ohms	
FREQUENCY RANGE	DC to 1000 MHz				
PRICE	$85.00	$85.00	$65.00	$85.00 With Type F Conn. $95.00	$85.00 With Type F Conn. $95.00

Terminations and DC Blocks

	TF-50	TF-75	DC-50
IMPEDANCE:	50 ohms	75 ohms	50 ohms
FREQUENCY RANGE:	DC to 1000 MHz	DC to 1000 MHz	10 MHz to 1000 MHz
MAXIMUM VSWR:	1.15:1 @ 1000 MHz	1.15:1 @ 1000 MHz	1.5:1 @ 1000 MHz (properly terminated)
PRICE:	$10.00	$10.00	$10.00

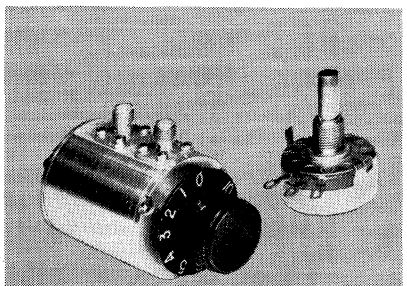
Fixed Pads

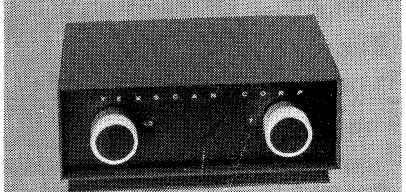
	FP-50	FP-60	FP-75
ATTENUATION:	1 to 20 db, any 1 db step	1 to 10 db any 1 db step, 15 db and 20 db	1 to 10 db any 1 db step 15 db and 20 db
IMPEDANCE:	50 ohms	50 ohms	75 ohms
FREQUENCY RANGE:	DC to 2000 MHz	DC to 4000 MHz	DC to 1200 MHz
CALIBRATION ACCURACY:	±0.1 db	± 0.2 db	±0.2 db
CONNECTORS:	BNC, TNC, or Type N	BNC, TNC, or Type N	BNC, TNC, 70 ohm Type N and Type F
PRICE:	BNC, TNC—$12.50 Type N—$16.00	BNC, TNC—$22.50 Type N—$27.50	BNC, TNC, Type F—$12.50 70 ohm Type N—$18.00

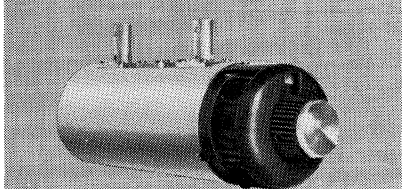
VOLTAGE TUNED OSCILLATORS

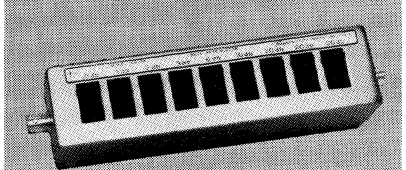
Model No.	VTS-25	VTS-50	VTS-100
Frequency Range	250-500 MHz	500-1000 MHz	1 - 2 GHz
Power Output Into 50 Ohm	750 MW	500 MW	250 MW
Non-Harmonic Spurious Rejection	50db	50db	50db
Tuning Voltage	+0.5 to +20 VDC	+0.5 to +28 VDC	+0.5 to + 40 VDC
Physical Size	1" x 1" x 2½"	1" x 1" x 2½"	1" x 1" x 2½"
Price	**$195.00**	**$195.00**	**$275.00**

Custom designs available upon request.

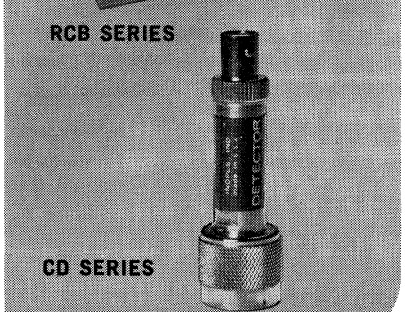

MA SERIES


500 SERIES


RA SERIES




RCB SERIES


CD SERIES

Telequipment Oscilloscopes

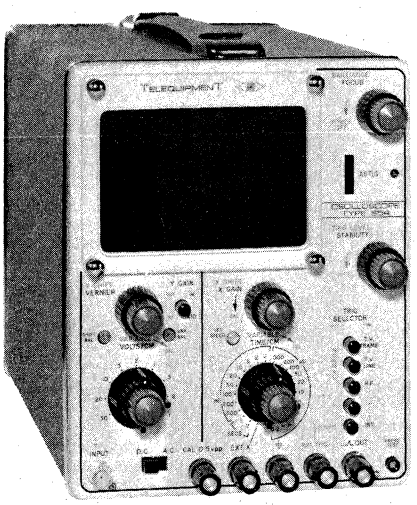
The Telequipment line of low-cost oscilloscopes is designed and manufactured in England, sold and serviced through the Tektronix marketing organization.

These instruments meet the requirements for affordable waveform measurements in education, service, and industry. The performance features include triggered sweep, 1-2-5 sequence step attenuators for vertical and horizontal deflection controls, calibration outputs, and 5-inch CRT's.

All Telequipment instruments are warranted against defective parts or workmanship for one year. Service and replacement parts are available through Tektronix field offices.

Below are examples of the Telequipment products, which also include plug-in oscilloscopes and bandwidths to 25 MHz.

The long-form catalog with full specifications and prices is available on request.



Type S54 Solid-State Oscilloscope

- Triggered sweep operation with TV frame or line capability
- DC to 10 MHz bandwidth
- 0.1 V/cm deflection factor, increasing to 10 mV/cm with X10 gain (DC to 4 MHz)
- Vertical attenuator and horizontal timing accurate within 5%
- 5-inch CRT, 6 x 10 cm illuminated graticule

Type S54 ..... **$395**

US Sales Price — FOB Beaverton, Oregon



Type D52 Double-Beam Oscilloscope

- Triggered sweep operation with internal source from either channel plus TV sync capability
- Double-beam — two identical, independent vertical channels
- DC to 6 MHz bandwidth
- 0.1 V/cm deflection factor, 10 mV/cm with X10 gain (DC to 1 MHz)
- Vertical attenuators and horizontal timing accurate within 5%

Type D52 ..... **$395**

US Sales Price — FOB Beaverton, Oregon

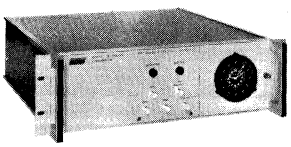
For information, contact your Tektronix field office or write: Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005

TELEQUIPMENT®

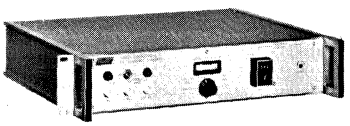
A SUBSIDIARY OF TEKTRONIX, INC.

These are specialized TRACOR instruments designed for your specific needs.

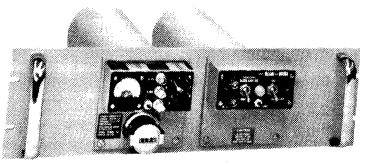
FREQUENCY STANDARDS



RUBIDIUM FREQUENCY STANDARD
Long Term Stability $5x10^{-11}$ (Std.Dev./Yr.)
Drift Rate $<1x10^{-11}$/month



CRYSTAL STANDARDS
Long Term Stability $<5x10^{-10}$/24 hours
5, 1, 0.1 MHz

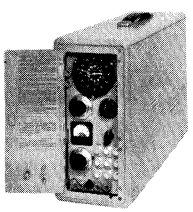


Long Term Stability $<5x10^{-11}$/24 hours
5, 1, 0.1 MHz

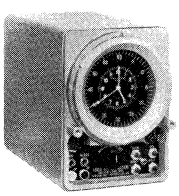
CLOCKS



PORTABLE
RUBIDIUM
ATOMIC
CLOCKS
$6x10^{-12}$/100
Sec. Avg
38 Pounds
14 Hrs.
Self-contained
Batteries

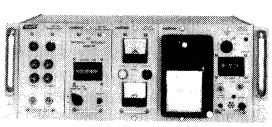


CRYSTAL
CLOCKS
$2x10^{-6}$ Secs/Day
38 Pounds
15 Hrs.
Self-contained
Batteries



PORTABLE
CHRONOMETERS
$1x10^{-3}$ Sec/Day
8 Pounds
80 Hrs.
Self- contained
Batteries

VLF RECEIVERS

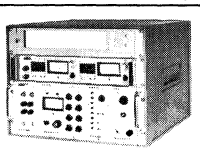


VLF TRACKING
RECEIVER/COMPARATORS
5.0 - 99.95 kHz continuous tuning



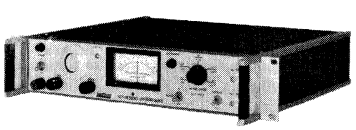
TWO FREQUENCY VLF RECEIVER
20 & 60 kHz for rating house standard

NAVIGATION SYSTEMS

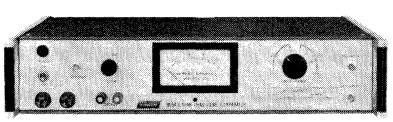


VLF/OMEGA NAVIGATIONAL SYSTEMS
4 Channel
Receives all Omega Frequencies
Digital Lane Counter

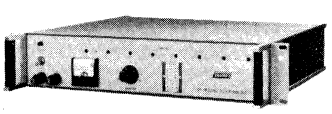
TIME AND FREQUENCY INSTRUMENTS



Instantaneous Determination of
Fractional Freq. Diff. to $1x10^{-11}$

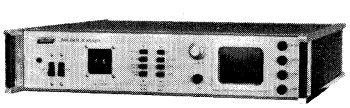


1 nanosecond time resolution
0.01 cycle phase resolution

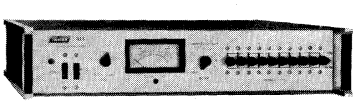


Provides up to 16 outputs
Front panel adjustment

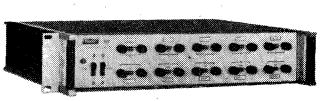
SPECTRAL SYSTEMS AND INSTRUMENTS



Scans and serial outputs
up to 80 data channels



Real Time PSD Analysis
From 0.1 Hz to 100 kHz
1-, 1/2-, 1/3-, 1/6- octave bandwidths



Programmable random noise from 0.1Hz to 100kHz
1-, 1/2-, 1/3-, 1/6- octave bandwidths

Industrial Instruments

TRACOR™

IA-107C

6500 TRACOR LANE, AUSTIN, TEXAS 78721 (512) 926-2800

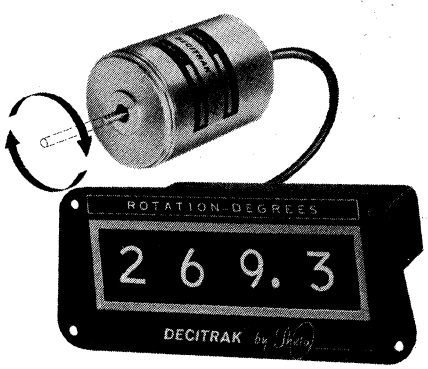
Theta DECITRAK® FOR REMOTE DIGITAL DISPLAY AND CONTROL

DECITRAK is the only complete system that transforms shaft-rotation, synchro/resolver outputs, and analog voltages into digital format for remote display, set-point control, computer interfacing, and data logging.

These sophisticated systems are assembled from shaft encoders, servos, and deceptively-simple modular circuits. Sophisticated... but still lower in price than anyone believed possible.

DECITRAK® SHAFT ENCODERS

- Available in 3-Digit to 6-Digit Versions
- Many Codes
- Really Low Cost
- Extraordinary Life
- Rapid Delivery
- Choice of 523 Solid-state Accessories



STANDARD MODELS

Shaft Revolutions for Full Range	Numerical Readout
1	000° to 359°
1 or 10	000 to 999
1 or 36	000.0° to 359.9°
1 or 36	−179.9° to +179.9°
10 or 100	0000 to 9,999
36 or 360	00000 to 359.99°
36 or 360	−179.99° to +179.99°
100 or 1000	00000 to 99,999
36, 360 or 3600	000000 to 359.999°
36, 360 or 3600	−179.999° to +179.999°
1000 or 10,000	000000 to 999,999
24	0 to 23 HR 59 MIN 59 SEC

A full line of optical incremental encoders is available up to 4,000 counts per rev., bidirectional.

DECITRAK® SYSTEMS



Built-in Models Perform:

- A/D Conversion
- Code Conversion
- Parallel/Serial Conversion
- Logic
- Relay Output
- Peak-Data Sensing
- Memory
- Set-Point Control
- Digital Subtraction

SYNCHRO-TO-DIGITAL CONVERTER



Here is a synchro/resolver-to-digital converter which is accurate, electrically versatile, and inexpensive. Electrical outputs from remotely located synchros and resolvers are converted into continuous digital display with provision for computer input and set-point control. Available in single-speed or dual-speed versions.

Write for Complete Catalog

Theta INSTRUMENT CORPORATION

Fairfield, New Jersey 07006 • (201) 227-1700

Theta PANEL-MOUNTED, PRECISE DIAL ASSEMBLIES

Patents Pending

Hundreds of style and size combinations to suit every need.

- Easy to mount on any panel
- Built-in adaptors
- Fine settings with vernier control
- Continuous rotation
- Many scales: 360°, ±180°, 1000, etc.

Immediate Delivery

MINI-DIAL®

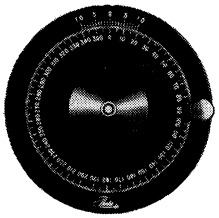
$50



100:1 vernier ratio. High setability. Only 3/16" square. 0.2° accuracy. Zero backlash. MIL construction.

MODEL DA

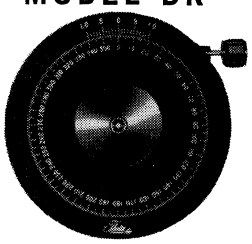
$85



Accuracy, 0.1°; 10:1 vernier ratio; 5" O.D. Built-in flexible coupling.

MODEL DR

$115



Accuracy 0.1°; 1440:1 vernier ratio for highly precise setability; 5" O.D.

VISI-DIAL®

$300



Digital in-line display of angle! Size, only 4 in. by 3½ in. Accuracy, 6 min.-of-arc. Resolution, ½ min.-of-arc. Vernier ratio, 36 to 1.

MIDGI-DIAL®

$300



- Digital display
- Only 2½ in. square.
- Accuracy, 6 min.-of-arc
- Resolution, 6 min.-of-arc
- Vernier ratio, 36 to 1

DIAL, MODEL D-1

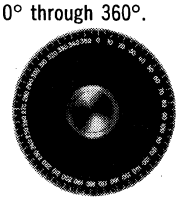
$12



180 divisions; accuracy, ±12 min.-of-arc. 2½ In. Dia.

DIAL, MODEL D-2

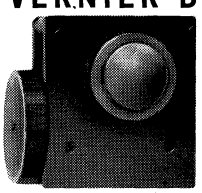
$12



360 divisions; accuracy ±6 min.-of-arc. 4 In. Dia.

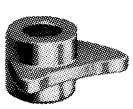
VERNIER DRIVE

$35



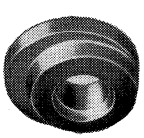
For fine positioning of tuning devices, pots, synchros. 100 turns of vernier drive produces 1 turn of output shaft. Has coarse control for 1:1 drive. Zero backlash. Self-locking. Drives 10 in.-oz.

SERVO CLAMPS TO HOLD MOTORS, SYNCHROS, POTS



LOW, LOW COST
ALUMINUM CLAMPS

- Maximum Gripping Surface
- Iridite Finish



QUICK RELEASE
STAINLESS STEEL CLAMPS

- Maximum Strength Under Shock
- Locks and Unlocks Without Removal of Screw (Simply Loosen)
- Passivated Finish

Holds Component Size	Screw Size Required	THETA Part No.	Quantity	Price Each
8, 10, 11	#3	A-1183-1	100	19¢
15, 18	#3	A-1183-2	500	15¢
15, 18	#4	A-1183-3	1000	10¢
8, 10, 11	#4	A-1183-4		
8, 10, 11	#6	A-1183-5	(For anodize finish instead of iridite, add 10¢ per clamp to the above prices.)	

Holds Component Size	Screw Size Required	THETA Part No.	Quantity	Price Each
8, 10, 11C*, 25	#4	A-1984-1	50	35¢
11M*, 15, 18	#4	A-1984-2	100	30¢
23	#4	A-1984-3	500	25¢
			1000	23¢
* 11M (military) servo mounts have a clamping groove located .093 in. from nearest seating surface; 11C (commercial) styles, .063 in.			5000	20¢
			10000	17¢

Write for Complete Catalog

Theta **INSTRUMENT CORPORATION**

Fairfield, New Jersey 07006 • (201) 227-1700

Theta PHASE GENERATORS

- Direct reading of phase shift
- Phase shifts 360° continuously
- Accuracy to 20 min.-of-arc
- Constant amplitude output
- Reliable, passive construction
- Stable temperature characteristics
- Easy panel-mounting

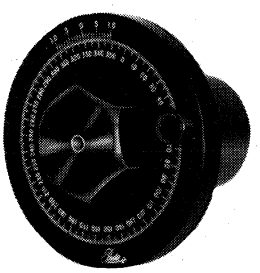
FOR PHASE SHIFTING AND MEASURING

Apply an AC input and it is phase shifted, continuously without amplitude change, at the turn of a dial. Read the exact value of phase shift from the dial face.

TYPICAL CHARACTERISTICS AT 400 cps

Input	115 Volts
Output	35 Volts
Input Impedance	9,000 ohms @ 45°
Output Impedance	7,000 ohms

MODEL PG-3



$350

Phase accuracy, 30 min.-of-arc. Dial readability, 6 min.-of-arc. Coarse knob ratio, 1:1. Vernier knob ratio, 10:1. Dial diameter, 5 in.

MODEL PG-9



$230

Phase accuracy, 1.5°. Dial readability, 1°. Coarse knob ratio, 1:1. Vernier knob ratio, 100:1. Dial size, 3 1/16 inch by 3 1/16 inch.

PHASE GENERATOR FOR LAB USE



$550

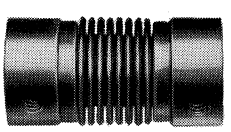
Phase Generator, Model PG-3, is mounted in a portable case. Built-in amplifier and attenuator completely isolates the Phase Generator from its load. Has switch which reverses the output by 180 degrees. Phase accuracy, 30 min.-of-arc. Variable output from 0 to 35 V by means of 10-turn pot. Operates into any load, 10KΩ or greater, without affecting accuracy or zero shift.

PRECISION BELLOWS COUPLINGS

Specifically Engineered for use with

- **POTENTIOMETERS**
- **RESOLVERS**
- **SYNCHROS**
- **ENCODERS**

Lowest Prices! High Accuracy!



$7.50

Substantial quantity discounts are offered.

Also available with clamp-type hubs at small additional price.

PERFORMANCE FACTORS

- One min.-of-arc. twist-error per in.-oz. torque
- Maximum rated torque, 15.5 inch-ounces

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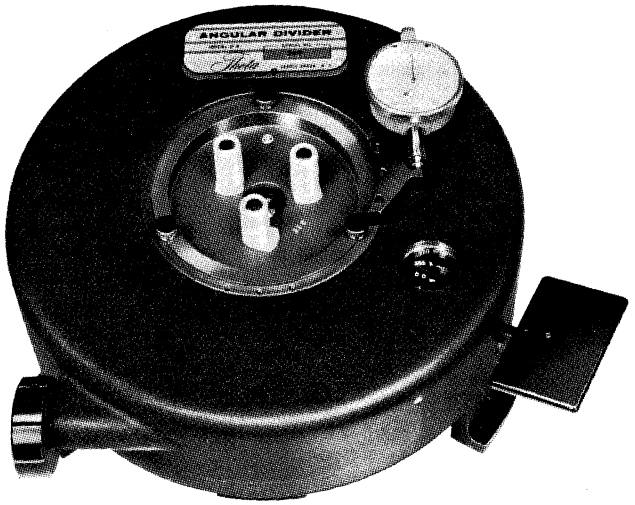
Theta **INSTRUMENT CORPORATION**

Fairfield, New Jersey 07006 • (201) 227-1700

Theta TEST EQUIPMENT FOR SYNCHROS AND RESOLVERS



PRECISION ANGULAR DIVIDERS

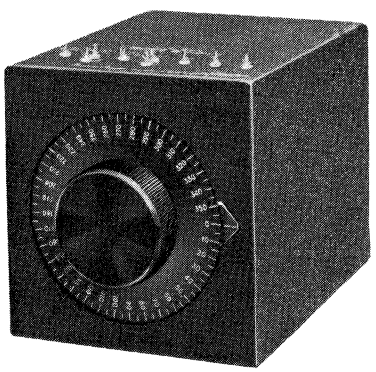
Positions synchros, resolvers, pancakes with less than 15 sec-of-arc error in accordance with Specification MIL-S-20708 B.

$1,500 From Stock

- Used and accepted by synchro manufacturers and government organizations.
- Unconditional two-year guarantee on performance and accuracy.
- Easy to operate — faster than any other device.
- Rugged — can take production line use and abuse without affecting performance.
- Adaptable — any size servo component accommodated by simple replacement of housing adapter and collet.

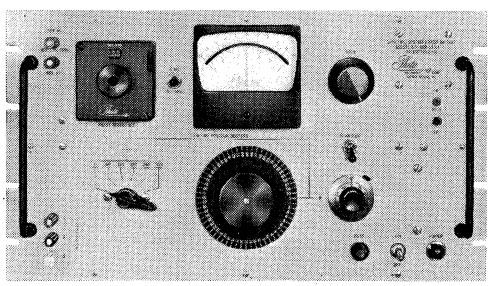
PLUS

a Full-Line of Equipment for MIL-Spec Testing



Panel-Mounted Synchro and Resolver Bridges

Measures electrical error at 5° intervals. Six basic models from $550. Immediate delivery.



Precision System Error Bridges®

For error measurement of systems which contain synchros or resolvers. Continuous measurement of error, 0° through 360°. State-of-the art accuracy: 7 sec.-of-arc with synchro/resolver source impedance as high as 7500 ohms. Models from $990. Delivery from stock.

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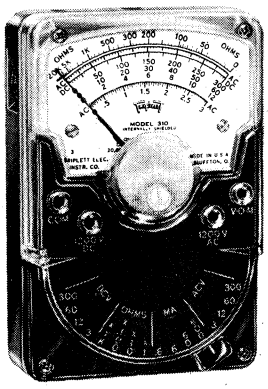
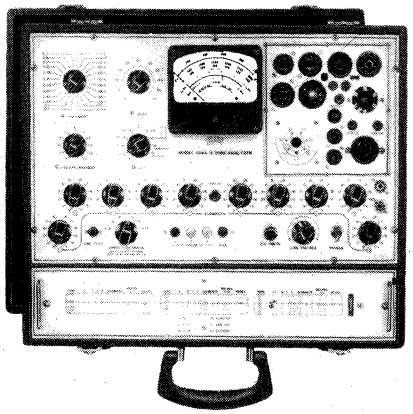
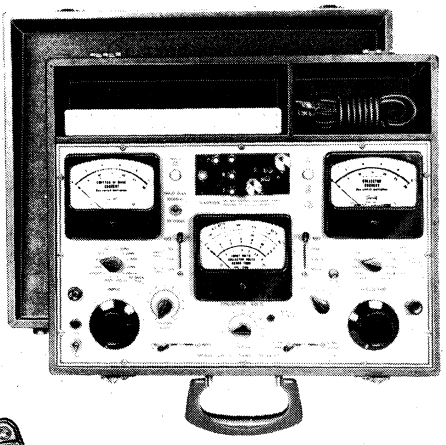
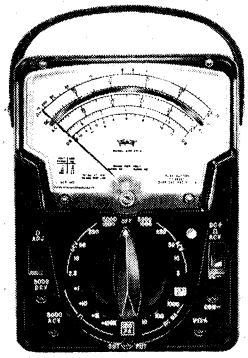
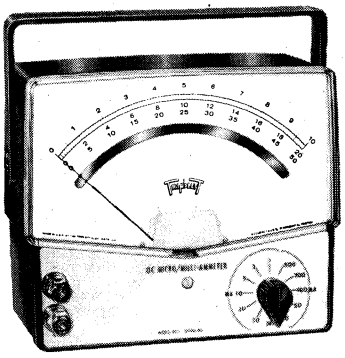

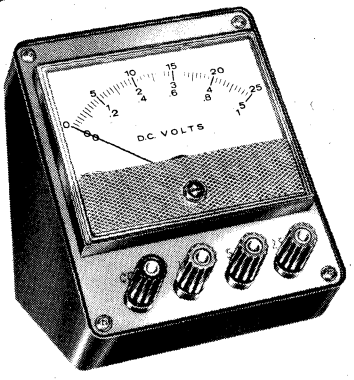
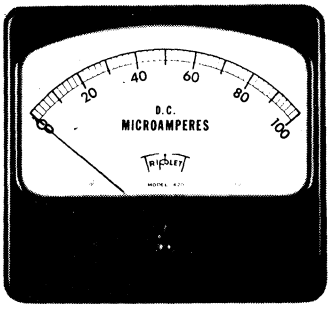

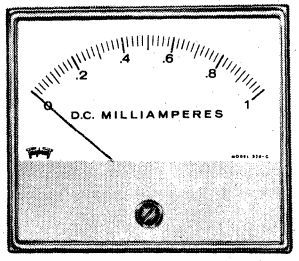

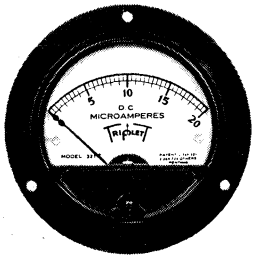

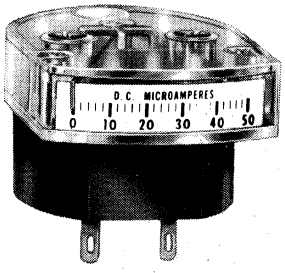

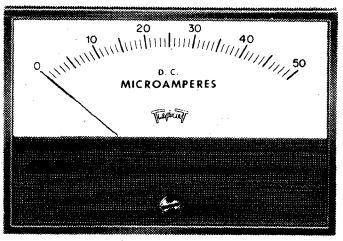

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Pioneers in the most advanced lines of Panel Instruments, Portable Instruments and Test Equipment (Electronic and Electrical) since 1904. Triplett's famous Bar-Ring movements set the standard of quality for the industry. This special rugged construction provides Self-Shielding, More Torque, Lower Terminal Resistance, Faster Response, and Greater Accuracy.

Triplett leadership in test equipment is marked by the world's most complete line of Volt-Ohm-Milliammeters.

All standard Triplett products are available nationally through authorized distributors.

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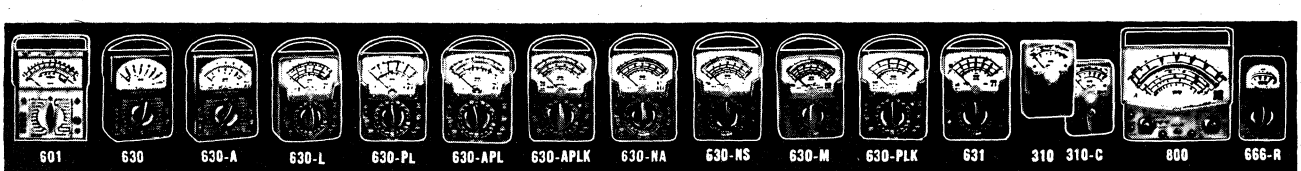

THE WORLD'S MOST COMPLETE LINE OF V-O-M's • AVAILABLE FROM YOUR TRIPLETT DISTRIBUTOR'S STOCK

Trymetrics offers a complete product line of four digit DVM's accepting a wide range of multi-function plug-in heads; and a series of unitized four digit DVM's with multimeter functions and DC voltage measuring capabilities.

All models feature full four digit resolution with accuracy better than ±0.01% of reading ±1 digit.

MODEL 4000 AND 4000P
- Full Four Digit Readout
- Accepts Wide Range of Plug-ins
- Manual and Automatic Ranging
- 20% Overscale Readout
- Automatic Polarity Indication
- High Accuracy: .01%
- Printer Output Option

MODEL 4100 AND 4100P
- Full Four Digit Readout
- Ultra-Stable Stored Display
- Accepts Wide Range of Plug-ins
- Manual and Automatic Ranging
- 20% Overscale Readout
- Automatic Polarity Indication
- Integrated Circuit Design
- High Accuracy: .01%
- Printer Output Option

MODEL 4230/4240
- Full Four Digit Readout
- Ultra-Stable Stored Display
- Unitized Construction
- Three or Four Manual DC Ranges
- 20% Overscale Readout
- Automatic Polarity Indication
- Integrated Circuit Design
- High Accuracy: .01%
- Printer Output Option

MODEL 4250A
- Full Four Digit Readout
- Ultra-Stable Stored Display
- New Modern Design
- Unitized Construction
- Five Automatic DC Ranges
- 20% Overscale Readout
- Automatic Polarity Indication
- Integrated Circuit Design
- High Accuracy: .01%
- Dual Switchable Inputs
- Printer Output Option

MODEL 4243
- Full Four Digit Readout
- Ultra-Stable Stored Display
- Unitized Construction
- Multimeter Functions DC-AC-OHMS
- 20% Overscale Readout
- Automatic Polarity Indication
- Integrated Circuit Design
- High Accuracy: .01%
- Printer Output Option

.01% four digit digital voltmeters

DC-AC-OHMS



Digital Voltmeters with Interchangeable Plug-in Heads



Unitized Digital Voltmeters and Multimeters

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■ FULL 4 DIGIT RESOLUTION ■ ACCURACY ±0.01% OF READING ±1 DIGIT ■ AUTOMATIC POLARITY AND OVERSCALE INDICATOR (20% OVERRANGING) ■ SAMPLING SPEEDS UP TO 10 SAMPLES/SECOND ■ SENSITIVITY TO 10 μV ■ HIGH COMMON MODE REJECTION ■ COMPLETE RANGE OF PLUG-IN HEADS FOR OPTIMUM FLEXIBILITY ■ ALL SILICON SOLID STATE CIRCUITRY-HIGH MTBF ■ OPERATION UP TO 50°C ■ PRINTER OUTPUT ■ ULTRA-STABLE VOLTAGE-TO-TIME CONVERSION SYSTEM ■ HIGH NOISE REJECTION WITH ADJUSTABLE INPUT FILTER AND POWER LINE SYNC CIRCUITRY.

PRICED FROM $595

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TRYMETRICS CORPORATION *A Subsidiary of Trygon Electronics, Inc.*

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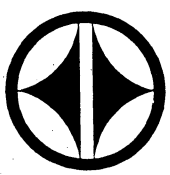
Look in the Green Section for Products and their Manufacturers



Tell them you found them in **eem**

PORTABLE high voltage testers

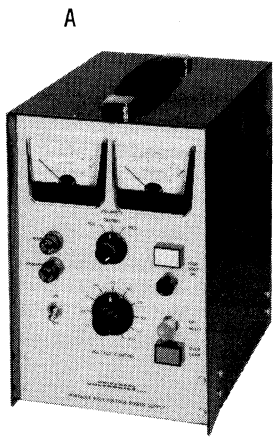
PORTABLE HIGH VOLTAGE POWER SUPPLIES
UVC standard portable power supplies, series "BAP" as shown (Photo A), offer the desirability of light weight, compact packaging and the flexibility of complete control instrumentation for field hi-pot testing. Availability is up to 32 KVDC and 40 milliamperes continuous duty on most models. Each supply is furnished with single range kilovolt meter and milliammeter; high voltage on and off pushbutton function with indicator lights; primary protective fuses and a fixed overload circuit.

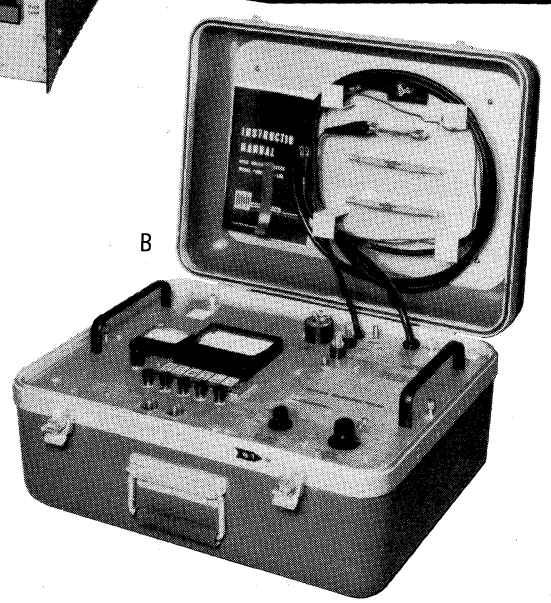
At voltage ratings in excess of 32 KVDC, two packages are furnished, each offering the advantage of easy portability. These supplies are available at ratings up to 60 KVDC and utilize air insulation.

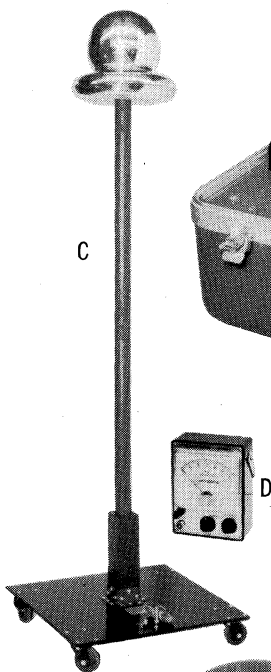
For non-destructive breakdown testing such as is required for coaxial cables, strain gauge equipment, capacitors and semi-conductors, UVC has introduced a line of multi-range, crow bar protected, suitcase style packaged portable power supplies (Photo B) at voltage ratings up to 45 KV. Each supply provides four modes of operation, selectable by means of a front panel control and the high voltage rises in each mode as an approximate ramp function up to its preset crest. Leakage current is also selected by means of a front panel control and should a preset value of current be exceeded, a crow bar circuit will be activated with response time in the order of less than 5 microseconds after initiation of breakdown. The kilovolt meter will hold the voltage reading at the point of breakdown indefinitely until the equipment is manually reset.

KILOVOLT METERS - HIGH VOLTAGE DIVIDERS
For precise high voltage measurement, UVC offers a complete line of 1% and 3% accuracy kilovolt meters (Photo C); 0.1% high voltage dividers as well as specially designed frequency compensated dividers (Photo D). Availability is up to 1000 KVDC.

STOCK AND CUSTOM TERMINATION HARDWARE
UVC offers specially designed termination hardware to minimize the effects of corona discharge. Standard shapes include cap nuts, toroids, spheres and cylinders (Photo E). These hardware items are used in all UVC high voltage and extra high voltage power supplies to reduce spacing requirements, and offer a more reliable high voltage design. Mounting tap sizes, materials and shape are not restricted to the standard configurations shown. We welcome the opportunity to discuss your special termination requirements.


A


B


C

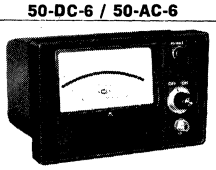
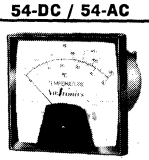
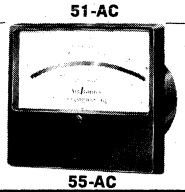
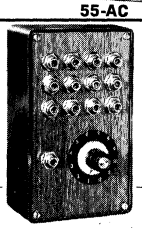
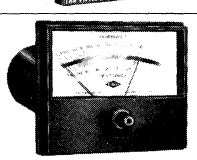
D

E

Write or phone for Catalog UVC-669 containing complete specifications for the extensive line of UVC high voltage power supplies.

UNIVERSAL VOLTRONICS
27 Radio Circle Drive, Mt. Kisco, N.Y. 10549 · 914-241-1300

VirTronics SHORT FORM SELECTION CHART

		FUNCTION	Meter Face	Price
PORTABLE INDICATORS ▲	 50-DC 50-AC	Portable single probe temperature indicator in specified range Converts to 12 position indication with 50-SB-12 Switch box. Field case available Bezel available	3 in. wide	DC $49.00 AC $69.00
	 50-DC-6 / 50-AC-6	Portable 6 probe temperature indication in specified range. Convert to 17 probe indicator with 50-SB-12 Switch box.	3 in. wide	DC $74.00 AC $94.00
	 54-DC / 54-AC	Portable, single position temperature indicator with the same function as 50-DC and 50-AC models, except extended scale readability on larger meter face.	4½ in. wide	DC $79.00 AC $99.00
PANEL INDICATORS ▲	 51-AC	Panel mounted single position temperature indicator with circuit enclosed in extended meter case. Perfect OEM application. Use with 51-SB-12 for multiple point applications.	3 in. wide	$64.50
	 55-AC	Panel mounted version of 54-AC extended scale meter. Perfect for OEM applications where readability is a factor. Use with 51-SB-12 for multiple point applications.	4½ in. wide	$94.00
SWITCHES ▲	 50-SB-12	Companion Switch box to convert any portable indicator to position temperature indication. Field case available Bezel available	none	$34.50
	 51-SB-12	Same as 50-SB-12 except panel mounted in a 3 x 3 inch area for minimum space OEM applications.	3 in. bezel	$32.00
CONTROLLERS ▲	 51-TC	Temperature Controller with adjustable calibrated knob to set control point. Red indicator light "on" below set point "off" above set point. OEM Designed.	3 in. bezel	$59.00
	 55-MR-TC	Panel mounted Meter-Relay with continuous temperature indication and control. Large meter face (4½) for extended readability. OEM Designed.	4½ in. wide	$175.00

▲ Standard Ranges Available from Stock

All A.C. instruments (ie. 50-AC) are powered by 115 volts A.C. 50/60 cycles and will accept a ±10% deviation of line voltage with no effect on meter accuracy. All D.C. instruments (ie. 50-DC) are powered by two (2) 1½ volt batteries. An adjustment for normal battery decay is provided.

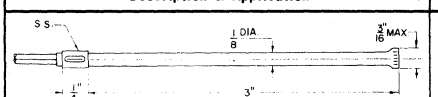
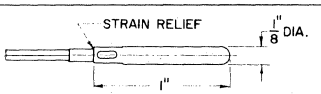
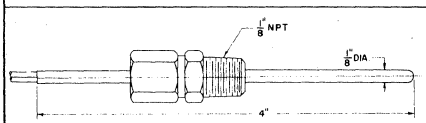
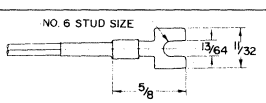
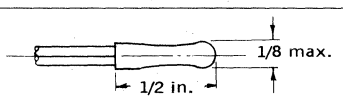
Center scale readability for 3 inch meters is 0.5% full scale. The 4½ inch indicator center scale readability is 0.25% full scale.

When ordering individual probes on separate order, or with the purchase of a new instrument, give the exact temperature range of the indicator for which the probe is to operate as its calibration is specific for each temperature scale. Probes calibrated for the same specific range may be interchanged regardless of their configuration. All probes are supplied with six (6) feet of number 26 ga. teflon insulated multitet cable. Several feet*of standard lamp cord may be used to extend this length with no recalibration required. OEM quantity discounts on all instruments and probes will be quoted on request.

* Up to 200 feet of No. 18 stranded copper.

STANDARD PROBES

Special probe styles will be quoted on request.

Description & Application	Catalog No.	Price
 **LIQUID IMMERSION** — Teflon covered for applications requiring chemical inertness. Solvent and acid baths. General laboratory measurements.	50-1-Specify Range	$12.50
 **GENERAL PURPOSE** — Stainless Steel sheath, may be used for liquid immersion, surface, or gas applications.	50-2-Specify Range	$12.50
 **IMMERSION** — Stainless Steel, with adjustable ss pipe fitting. For measuring temperature inside pipes or closed vessels.	50-3-Specify Range	$24.50
 **SURFACE MOUNTING** — Copper terminal connector with thermistor potted in shank. Mounted on surfaces with screw or tape.	50-4-Specify Range	$11.50
 **SURFACE MOUNTING** — Epoxy coated. For applications requiring minimum size such as small surfaces or vials. Cannot be immersed above coating in conductive liquids.	50-5-Specify Range	$10.50

STANDARD RANGES

Special Ranges quoted on request.

A	−80°C to +10°C (−112°F to +50°F)
B	−55°C to +30°C (−67°F to +86°F)
C	−10°C to +50°C (+14°F to +122°F)
D	0°C to +100°C (+32°F to +212°F)
E	+50°C to +150°C (+122°F to +302°F)
EE	+10°C to +150°C (+50°F to +302°F)
F	−15.6°C to +43.3°C (+60°F to +110°F)

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VOLTRON PRODUCTS, INC.

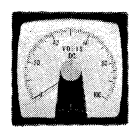
SIGNAL CONDITIONING INSTRUMENTATION

Voltron's established leadership in the field of meter technology is the result of a concerted effort to bring you a complete line of precision measuring instruments designed to the highest attainable standards of quality and accuracy. An innovative program of research and development constantly seeks ways to adapt the latest advances in materials and manufacturing technology to the improvement of our product. As a result of this far-reaching effort, Voltron introduced the only new concept in switchboard instrumentation to combine three developments in modern meter technology — the taut-band, axial air gap and transducer approach. □ At Voltron, reliability is designed-in. Our complete Quality Assurance facility, utilizing the latest in testing methodology, ensures the consistently superior performance of every Voltron instrument. From initial concept to finished product, our concern is to give you a product you can trust. □ To be sure of the best in precision measuring instrumentation in today's wide-ranging applications, call on Voltron.

FULL-SCALE TAUT-BAND PANEL METERS (90°, 200° and 240° arcs)

Incorporating VOLTAUT® taut-band suspension for frictionless, shock-proof operation.





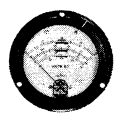
AC AND DC VOLTMETERS AND AMMETERS

AC and DC Current Ranges:	10 μA F.S. to 5 mA F.S. self-contained; over 5 mA with external components.
AC and DC Voltage Ranges:	to 300V F.S. self-contained.
Accuracy:	±1% F.S. basic.
Cases:	90° and 240° movements available.

WRITE FOR BULLETIN 4030.

EXPANDED-SCALE AND SPECIAL-PURPOSE PANEL METERS

With the precision and wide deflection capabilities inherent in the exclusive VOLTAUT® taut-band suspension system.



EXPANDED-SCALE VOLTMETERS AC AND DC

Center-Scale Ranges:	10-300 VDC, 6-300 VAC; down to 1V with external power; above 300V with external resistors.
Spans:	±4% to ±20% of center scale; ±1% to ±4% of center scale available.
Accuracy:	±0.5% of center scale at 25 ± 5°C, ±1% from 0° to 40°C; ±0.1% at 25 ±5°C, ±0.25% from −55° to 85°C available.

WRITE FOR BULLETIN 4040 (DC) AND 4050 (AC).

EXPANDED-SCALE FREQUENCY METERS

Supplied with external transducer, saturable-core discriminator or tuning-fork comparator.

Center-Scale Frequencies:	60 Hz or 400 Hz; any center-scale frequency from 50 to 5000 Hz available.
Spans:	±1% to ±10% of center scale; dual-scale models available; typically, ±1% and ±10% of same center frequency.
Accuracy:	tuning-fork type, ±0.05%.

WRITE FOR BULLETIN 4100.

TRANSISTORIZED VOLTMETERS AC, DC, AND PHASE-SENSITIVE

Ranges:	0.01, 0.03, 0.1, 0.3, 1.0, 3.0, 10, 30, 100 and 300V.
Accuracy:	±2% of F.S.
Input Impedance:	1 megohm for averaging type; 5 megohms for phase-sensitive type.

WRITE FOR BULLETIN 7000.

AC AMMETERS LINEAR AND LOGARITHMIC

Range:	10 mA to 10 Amperes F.S. self-contained; to 1000 Amperes F.S. with external transformer.
Accuracy:	±2% of F.S. from 300 to 2000 Hz.

WRITE FOR BULLETIN 4070.

POWER-FACTOR METERS

Range:	0-1-0 PF, other ranges available.
Nominal Frequency:	any one from 50-2000 Hz available.
Accuracy:	0.04 PF.

WRITE FOR BULLETIN 4130

WATT-VAR METERS

Ranges:	25 W/vars F.S. to 100 kW/kvar F.S.
Inputs:	120/208V ±10% at 400 ± 100 Hz; ±100 mA to 5 A.
Accuracy:	±2% of F.S. at 22°C, ±5% of F.S. from −55° to 71°C.

WRITE FOR BULLETIN 4120.

LOAD METERS

Measure I cos θ.

Scale:	0-125% load.
100% Load:	1 HP at 115 or 230 V, self-contained; other HP/load ratings with external current transformer.
Phases:	Single phase, 3-phase/3-wire, 3-phase/4-wire.

WRITE FOR BULLETIN 4140.

AM AND FM MODULATION METERS

Modulation Range:	0-2% AM or FM.
Modulation Definition (with sinusoidal modulation):	$\%AM = 100\,\frac{E\,max - E\,min}{E\,max + E\,min}$; $\%FM = 100\,\frac{F\,max - F\,min}{F\,max + F\,min}$
Accuracy:	±5% of F.S. (±0.1% of modulation).
Modulation Frequency Response:	1-75 Hz.

WRITE FOR BULLETIN 4160.

MINIATURE EDGEWISE METERS





Stackable ½" high panel meters for instrumentation applications.

Functions Available:	AC or DC Volts, Amps and Milliamps.
Scale Length:	1 5/16".
Accuracy:	±2% in standard versions; ±5% in expanded scale models.
Sensitivity:	100 μA up to 1 A.

WRITE FOR BULLETIN 4170A AND 4175.

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VOLTRON PRODUCTS, INC.

SIGNAL CONDITIONING INSTRUMENTATION

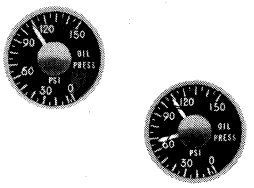
AIRCRAFT INDICATING INSTRUMENTS

Featuring the exclusive VOLTAUT® taut-band movement for accurate, frictionless operation — 10 to 20 times the sensitivity of equivalent jeweled movements. The extremely rugged construction of these instruments makes them useable in any position; they are not affected by heavy overloads, shock or vibration. Available for single or dual scales with any combination of color bands.

Available in MS-33639 or ATI 1", 1½", 2" and 3", single and dual configurations. Illuminated and non-illuminated.

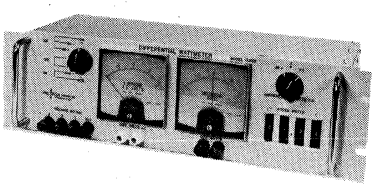
FUNCTIONS AVAILABLE

DC VOLTS	AC LOAD
DC AMPS	AC VARS
DC LOAD	AC WATTS
AC VOLTS	FREQUENCY
AC AMPS	TEMPERATURE
DIFFERENTIAL TEMPERATURE	
EXHAUST GAS TEMPERATURE	
ENGINE TACHOMETER	



WRITE FOR BULLETIN 4180A.

LABORATORY INSTRUMENTS



DIFFERENTIAL WATTMETER

Full Scale Range:	0-30 watts (available up to 100 watts and above with external transformers).
Differential Watt Range:	10, 100, and 1000 milliwatts.
Full Scale Accuracy:	±1% of reading, ±20 mW.
Differential Accuracy:	±0.04, 4.0 and 40mW.
Frequency Range:	200-3000 Hz at stated accuracy.

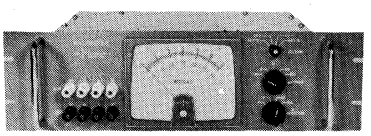
Input voltage can be any single voltage (single phase, 2-phase, 3-phase, 3- or 4-wire) from 10 to 120 V rms as specified by customer.

WRITE FOR BULLETIN 3021.

LOW-POWER LABORATORY WATTMETER

Models for single or polyphase low-power measurements where wattmeter burden must be extremely small.

Frequency Range:	50-2000 cps.
Accuracy:	±1% of full scale.
Current-circuit voltage-drop:	negligible.
Power Drain:	<than 0.2% of indicated power at unity PF.
Meter:	accurate to 10% PF without reconnection.
Full Scale Ranges:	(26 VAC) 0 to 1.2/3/12/30 watts F.S. (115 VAC) 0 to 1.2/3/12/30/120 watts F.S.



WRITE FOR BULLETIN 3020.

MINIATURE PORTABLE INSTRUMENTS TYPE E-11

Designed for use in laboratories, schools, workshops, field, etc., where high accuracy and extreme ruggedness are required. Featuring Voltron's unique taut-band suspension system for frictionless, shock-proof operation.

AC AMMETERS AND VOLTMETERS
DC AMMETERS AND VOLTMETERS
WATTS VARS
FREQUENCY POWER FACTOR
TEMPERATURE



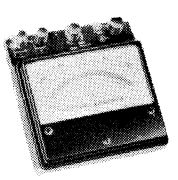
Accuracies:	±1% F.S. for DC instruments; ±1.5% F.S. for AC instruments.
Frequency:	choice of 60 or 400 Hz.
Scale length:	approximately 3½".
Sensitivity:	to 30 μA for DC; 300 μA for AC.

Expanded scale ranges available for accuracy of ±0.25%.

WRITE FOR BULLETIN E11.

ELECTRONIC GALVANOMETER TYPE E11.501

For fast and accurate null readings in DC systems.



Voltage Sensitivity:	10 μV/div. (approx. 5 μV/mm).
Response Time:	approximately 3 seconds.
Common Mode Rejection:	140 dB at DC, 50/60 Hz.
Input Resistance:	approximately 9 kohms.
Power Source:	9V transistor radio battery.
Battery Life:	approximately 300 hours, continuous.

WRITE FOR BULLETIN E11.501.

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VOLTRON PRODUCTS, INC.

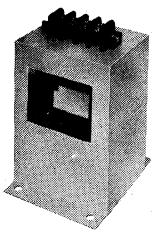
SIGNAL CONDITIONING INSTRUMENTATION

SIGNAL CONDITIONING TRANSDUCERS

AC VOLTAGE TRANSDUCERS

Accuracy: 0.5%.
Frequency Range: 50-3000 Hz, −25° to 70°C.
Response Time: .25 second to 99%.
Hipot: 1200 VAC.
Adjustable: ±5%.

WRITE FOR BULLETIN 5010.



AC CURRENT TRANSDUCERS

Accuracy: 0.5%.
Frequency Range: 50-3000 Hz.
Temperature Coefficient: <.01%/°C.
Input Current: 0-1, 2.5, 5 and 10 A.

WRITE FOR BULLETIN 5020.

WATT TRANSDUCERS

Accuracy: 0.5% with ±25% line voltage and 1 to 0.5 PF.
Frequency Range: 50-3000 Hz.
Response Time: .25 second to 99%.
Input Elements: one (500W), two (1000W) and three (1500W).
Adjustable: 60 to 120%.

WRITE FOR BULLETIN 5030.

PF TRANSDUCERS

Accuracy: 0.1 PF at nominal voltage and 60% current.
PF Ranges: 0-1-0, 0.3-1-0.3, 0.5-1-0.5, and 0.7-1-0.7.
Nominal Frequency: 50-3000 Hz.
Input Voltage: 120V ±20%.
Input Current: 0-5 A.
Phases: Single and 3-phase.

WRITE FOR BULLETIN 5040.

FREQUENCY TRANSDUCERS

Accuracy: 0.5%
Input Frequency: 55-65, 58-62, 350-450 and 380-420 Hz.
Voltage: 100-130V.
Overload: 1.5 X rated input, continuous; 2 X rated input, one second.
Hipot: 1200 VAC.

WRITE FOR BULLETIN 5050.

VOLTRIP GO/NO-GO LIMIT-DETECTOR

A precise, stable voltage-sensing device that signals, by means of a contact closure, when the voltage, current or other parameter being monitored reaches a pre-determined value. Also available to sense frequency and watts.

Completely solid state except for relay.
External resistors extend functions to current and resistance.
Dual limit models available.

MIL versions available for −55° to 71°C operation.
Voltage Range: 5 to 500V rms, 50 to 2000 Hz.
Auxiliary Power Required: 3 watts at 115V, ±10%, 60-1200 Hz.
Response Time: 50 ms.

WRITE FOR BULLETIN 6033.



4½" SWITCHBOARD INSTRUMENTS

Featuring Voltron's unique taut-band, axial air gap transducer approach for a wide range of functions:

DC AMMETERS AND VOLTMETERS
AC AMMETERS AND VOLTMETERS
WATTMETERS AND VARMETERS
FREQUENCY METERS
SYNCHROSCOPES
TACHOMETERS





Accuracies: ±1% of F.S. (±.01 for PF; ±2% for Frequency and Tachometers).
Frequency Range: 50-500 Hz.
Full Scale Deflection Angle: 250° (360° for synchroscopes).
Full Scale Length: approx. 7.25".
Weight: approx. 0.9 to 3.7 lb.

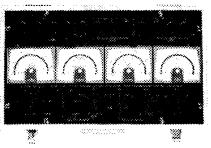
WRITE FOR BULLETIN SB68.

POWER ANALYZER

Requires no recalibration.

A versatile, portable test set offering high accuracy and low power consumption for general purpose use. Ideal for 50, 60 and 400 Hz measurements without recalibration or correction factors. Featuring large, easy to read 4½" — 200° rectangular meters with frictionless taut-band suspension systems for accuracy and protection against shock and vibration.

Accuracy: ±1%.
Phases: Single, 2-phase/3-wire or 3-phase/4-wire.
Size: 12" x 20" x 7".
Weight: 40 lb.



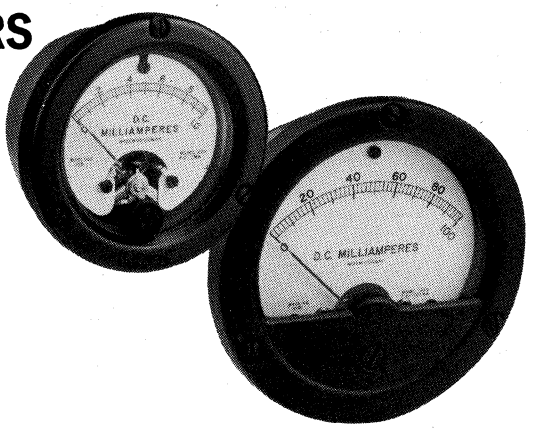
CHECKOUT RANGES:

Current: 0 to 125/250/500 A.
Voltage: 0 to 125/250/500 VAC.
Frequency: 45-55, 55-65, 375-425 Hz.
Watt/Var: 0 to 1/2/4/5/10/20/40/80/160 kW/kvar.

WRITE FOR BULLETIN PA69

403 S. RAYMOND AVENUE ■ PASADENA, CALIFORNIA 91101 ■ TELEPHONE: (213) 681-2751 ■ TWX: 910-588-3288

SEALED/RUGGEDIZED MILITARY & COMMERCIAL METERS



Many of the meters and accessory products described in these pages have been designed to conform to the requirements of the applicable military meter specifications or the unusual requirements of the environments in which they are to be used. This also provides significant benefits to those with industrial applications which commercial-grade meters do not fully satisfy.

GENERAL SPECIFICATION:

MOVEMENTS
D'Arsonval; U magnet, core magnet; moving iron vane, high strength ALNICO magnets standard.

ACCURACY
Standards as shown to the right, special accuracy ±1% or better available.

CASE/FINISH
5/8" and 1" aluminum with anodized finish. 7/8, 1½, 2½, 3½, 4½ steel cadmium-plated, iridite-treated.

MOUNTING
Standard hardware and mounting dimensions to appropriate military specifications.

SEALING
Watertight gasket sealing standard, epoxy or solder sealing available on some models.

TERMINALS
1/4-28 brass stud and solder lug construction.

SCALE/FINISH
Aluminum with black markings on white enameled background.

POINTER
Knife edge standard, lance or sword pointers available.

SHIELDING
Magnetically shielded construction for use on magnetic or non-magnetic panel.

WINDOW
High strength glass. Plastic or RFI shielded furnished on special applications.

RESISTANCE
Standard tolerances ±10%, special to ±1%.

PIVOTS & JEWELS
Springbacked jewels, osmium pivots standard.

SPECIAL METER DESIGNS

For special applications, WacLine offers a wide selection of custom design meters. Special features include:

Custom scale markings & logos • Mirrored scale • Self-contained multi-range designs • Expanded scale AC & DC Voltmeters • RFI shielding • Edge lighting • Dual meter configurations • Special terminal resistances • Special movement designs • Non linear movements • Suppressed zero ranges • High resistance Voltmeters • Vu & Db Meters.

Consult factory for Technical assistance on your custom design requirements.

SELECTION CHART FOR STANDARD SEALED METERS

SIZE	BEZEL SHAPE	AVAILABLE MODELS	TYPE OF MECHANISM	STANDARD ACCURACY	STANDARD DEFLECTION
5/8"	SQUARE	KOB	D.C. CORE MAGNET	±5%	82°
7/8"	SQUARE	F33	D.C. CORE MAGNET	±5%	100°
1"	ROUND	CIB	D.C. CORE MAGNET	±3%	90°
1½"	ROUND	CCD	D.C. U MAGNET	±3%	90°
	ROUND	CCX	A.C. RECT.	±3%	90°
	SQUARE	BCD	D.C. MAGNET	±3%	90°
	SQUARE	BCX	A.C. RECT.	±3%	90°
2½"	ROUND	ADD	D.C. U MAGNET	±2%	90°
	ROUND	ADX	A.C. RECT.	±3%	90°
	ROUND	ADA	A.C. IRON VANE	±2%	90°
	ROUND	ADL	D.C. CORE MAGNET	±2%	250°
2⅜"	SQUARE	DLD	D.C. U MAGNET	±2%	90°
	SQUARE	DLX	A.C. RECT.	±3%	90°
	SQUARE	DLA	A.C. IRON VANE	±2%	90°
3½"	ROUND	AED	D.C. U MAGNET	±2%	90°
	ROUND	AEX	A.C. RECT.	±3%	90°
	ROUND	AEA	A.C. IRON VANE	±2%	90°
	ROUND	AEL	D.C. CORE MAGNET	±2%	250°
3⅛"	SQUARE	DND	D.C. U MAGNET	±2%	90°
	SQUARE	DNX	A.C. RECT.	±3%	90°
	SQUARE	DNA	A.C. IRON VANE	±2%	90°
4½"	ROUND	AFD	D.C. U MAGNET	±2%	90°
	ROUND	AFX	A.C. RECT.	±3%	90°
	ROUND	AFL	D.C. CORE MAGNET	±2%	250°
	ROUND	AFA	A.C. IRON VANE	±2%	90°

The most widely used meters are described in the chart above to assist in the selection of the correct meter for each application.

Sizes and mounting dimensions meet requirements of MIL-M-10304 and MIL-M-17275 where applicable.

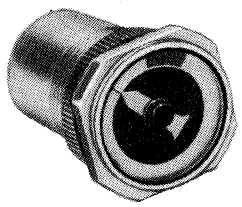
The availability of both round and square configurations in the most popular sizes offers greater flexibility in selecting a meter compatible with your styling requirements.

Write or call today for additional information on anyone of the models described.

WACLINE a division of Simmonds Precision
35 South St.Clair St., Dayton, Ohio 45402 □ 513-224-9921 □ TWX 810-459-1741

MINIATURE SEALED METERS

5/8 INCH



SERIES KOB

SMALL SIZE

One of the smallest meters available featuring true D'ARSONVAL movement. Requires less than 1/2 sq. in. of panel mounting space.

LIGHTWEIGHT

Complete meter including mounting hardware weighs less than 1 oz. Good application where weight and size are factors.

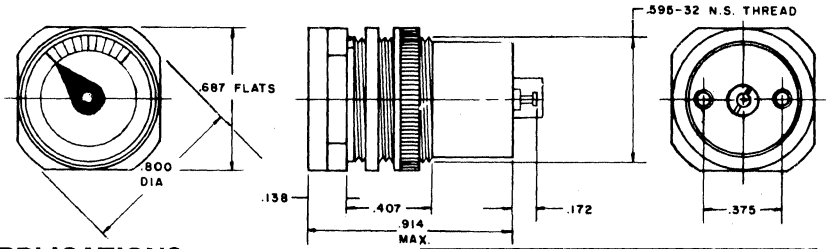
APPLICATIONS:

- **Position Indicators**
- **Null Indicators**
- **Voltage & Current**
- **Signal Strength**
- **Battery Condition**

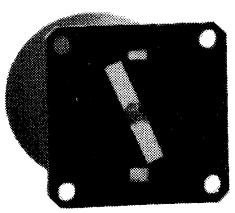
Low power requirements of this miniature meter makes it ideally suited for use in portable battery operated equipment.

STANDARD D.C. RANGES	WACLINE PART NO.	STANDARD RESISTANCE
0-100 ua	KOB6-M001	4500Ω
0-200 ua	KOB6-M002	3000Ω
0-500 ua	KOB6-M003	760Ω
0-1 ma	KOB6-M004	170Ω
0-5 ma	KOB6-M007	14Ω
0-10 ma	KOB6-M009	7Ω
0-100 mv	KOB6-M015	20Ω

Additional voltage and amperage ranges available using external resistors and shunts.



7/8 INCH



SERIES F33

SPACE-SAVING

Mounts from panel front or rear. Rugged construction of D'ARSONVAL movement suits this meter particularly for airborne or ground-support equipment in most environments.

APPLICATIONS:

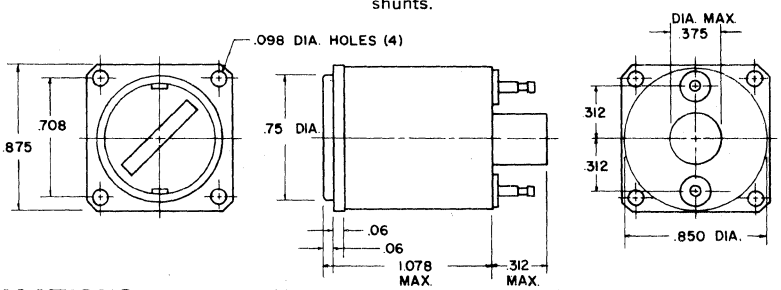
Rotating disc type dial provides maximum display for monitoring a wide variety of applications including:

- **Warning flags**
- **Position indicators**
- **"On"-"Off" Indicators**

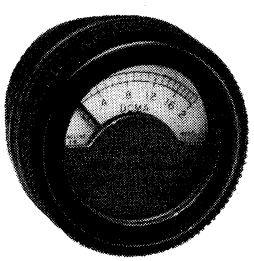
Masking of the display area permits hidden condition indication, such as Power Failure.

STANDARD D.C. RANGES	WACLINE PART NO.	STANDARD RESISTANCE
0-100 ua	F337-7011	2200Ω
0-200 ua	F337-7012	1000Ω
0-500 ua	F337-7013	300Ω
500-0-500 ua	F337-70C14	150Ω
0-1 ma	F337-7014	150Ω
0-100 mv	F337-7025	20Ω

Self-contained voltage ranges up to 6 volts are possible. Current ranges up to 20 milliamperes. Additional voltage and amperage ranges available using external resistors and shunts.



1 INCH



SERIES CIB2

ROUND, RUGGEDIZED

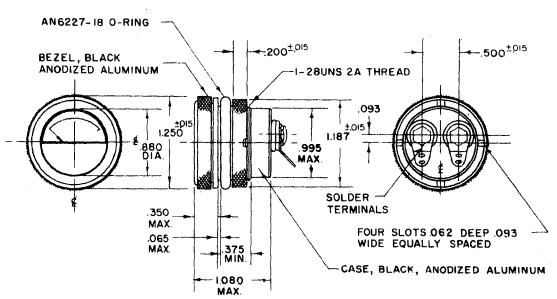
Meets requirements of MIL-M-17275. Core magnet design permits use on magnetic or non-magnetic panels. Watertight construction.

APPLICATIONS:

- **Military communications equipment**
- **Portable test equipment**
- **Airborne direction finders**
- **Vu & Db Meters**
- **Null indicators**

STANDARD D.C. RANGES	WACLINE PART NO.	POWER CONSUMPTION
0-100 ua	CIB2-E43	125 mv (max)
0-500 ua	CIB2-E41	75 mv (max)
500-0-500 ua	CIB2-E42	15 mv (max E.S.)
0-1 ma	CIB2-E20	30 mv (max)
0-50 mv	CIB2-E39	6 ma (max)

In addition to the standard ranges specified by MIL-M-17275 WacLine produces many additional ranges in this style meter. Consult factory for additional information.

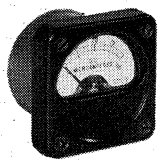


WACLINE a division of Simmonds Precision

35 South St.Clair St., Dayton, Ohio 45402 □ 513-224-9921 □ TWX 810-459-1741

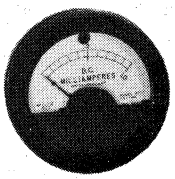
MILITARY METERS Conform to MIL-M-10304

1½ INCH



SERIES BCD
MR13 TYPE

Built to conform to requirements of MIL-M-10304, this ruggedized and sealed meter is widely used in communication equipment and aircraft applications where its small size, yet reliable performance, are a necessity.



SERIES CCD

The ruggedized movement and sealed case of this meter were designed to meet applicable portions of MIL-M-10304, even though the case style is not covered by Military Specification. Standard calibration is for non-magnetic panels.

STANDARD RANGES 1½" METERS

Scale Value	VDC	UADC	MADC	ADC	MVDC
0-1	X	–	X	X	–
0-5	–	–	X	X	–
0-10	X	–	X	X	–
0-50	X	–	X	S	X
0-100	X	X	–	–	X
0-500	–	X	–	–	–

X Available self-contained in both models BCD and CCD.

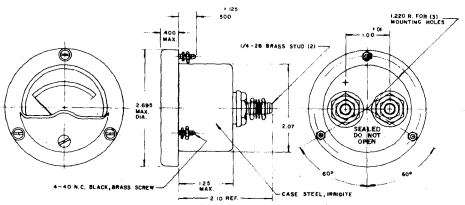
S Supplied as a 50 millivolt meter for use with external shunt (not furnished).

Note: Zero center ranges may also be supplied.

2½ & 3½ INCH



SERIES ADD
MR26 TYPE



SERIES AED
MR36 TYPE

WacLine offers almost every AC & DC variation of the 2½ and 3½ inch meters covered by Military Specifications. In addition many special ranges are available.

SCALE VALUE	METER SIZE	VOLTS D.C. 1000Ω/V	KILOVOLTS D.C.	MICRO-AMPERES D.C.	MICROAMMETER TERMINAL RESISTANCE IN OHMS	MILLI-AMPERES D.C.	AMPERES D.C.
0-1	2½" 3½"	– –	ADD3-2061 AED3-3061	– –		ADD3-2131 AED3-3131	ADD3-2161 AED3-3161
0-1.5	2½" 3½"	ADD3-2033 AED3-3033	ADD3-2063 AED3-3063	– –		ADD3-2133 AED3-3133	ADD3-2163 AED3-3163
0-2	2½" 3½"	ADD3-2034 AED3-3034	ADD3-2064 AED3-3064	– –		ADD3-2134 AED3-3134	ADD3-2164 AED3-3164
0-3	2½" 3½"	ADD3-2036 AED3-3036	ADD3-2066 AED3-3066	– –		ADD3-2136 AED3-3136	ADD3-2166 AED3-3166
0-5	2½" 3½"	ADD3-2038 AED3-3038	ADD3-2068 AED3-3068	– –		ADD3-2138 AED3-3138	ADD3-2168 AED3-3168
0-8	2½" 3½"	ADD3-2040 AED3-3040	ADD3-2070 AED3-3070	– –		ADD3-2140 AED3-3140	ADD3-2170 AED3-3170
0-10	2½" 3½"	ADD3-2041 AED3-3041	ADD3-2071 AED3-3071	– –		ADD3-2141 AED3-3141	ADD3-2171 AED3-3171
0-15	2½" 3½"	ADD3-2043 AED3-3043	ADD3-2073 AED3-3073	– –		ADD3-2143 AED3-3143	ADD3-2173 AED3-3173
0-20	2½" 3½"	ADD3-2044 AED3-3044	ADD3-2074 AED3-3074	ADD3-2114 AED3-3114	7500	ADD3-2144 AED3-3144	ADD3-2174 AED3-3174
0-30	2½" 3½"	ADD3-2046 AED3-3046	ADD3-2076 AED3-3076	ADD3-2116 AED3-3116	4500	ADD3-2146 AED3-3146	ADD3-2176 AED3-3176
0-50	2½" 3½"	ADD3-2048 AED3-3048	– –	ADD3-2118 AED3-3118	3000	ADD3-2148 AED3-3148	ADD3-2178 AED3-3178
0-80	2½" 3½"	ADD3-2050 AED3-3050	– –	ADD3-2120 AED3-3120	1700	ADD3-2150 AED3-3150	ADD3-2180 AED3-3180
0-100	2½" 3½"	ADD3-2051 AED3-3051	– –	ADD3-2121 AED3-3121	1270	ADD3-2151 AED3-3151	ADD3-2181 AED3-3181
0-150	2½" 3½"	ADD3-2053 AED3-3053	– –	ADD3-2123 AED3-3123	725	ADD3-2153 AED3-3153	ADD3-2183 AED3-3183
0-200	2½" 3½"	ADD3-2054 AED3-3054	– –	ADD3-2124 AED3-3124	460	ADD3-2154 AED3-3154	ADD3-2184 AED3-3184
0-300	2½" 3½"	ADD3-2056 AED3-3056	– –	ADD3-2126 AED3-3126	285	ADD3-2156 AED3-3156	ADD3-2186 AED3-3186
0-500	2½" 3½"	ADD3-2058 AED3-3058	– –	ADD3-2128 AED3-3128	150	ADD3-2158 AED3-3158	ADD3-2188 AED3-3188
0-800	2½" 3½"	ADD3-2060 AED3-3060	– –	ADD3-2130 AED3-3130	98	ADD3-2160 AED3-3160	ADD3-2190 AED3-3190

SCALE VALUE	METER SIZE	VOLTS A.C. 60 HERTZ	VOLTS A.C. 400 HERTZ	MILLI-AMPERES A.C. 60 HERTZ	MILLI-AMPERES A.C. 400 HERTZ	AMPERES A.C. 60 HERTZ	AMPERES A.C. 400 HERTZ	AMPERES RADIO FREQUENCY
0-1	2½"	—	—	—	—	ADA3-2531	ADA3-2631	ADR3-2831
	3½"	—	—	—	—	AEA3-3531	AEA3-3631	AER3-3831
0-1.5	2½"	ADA3-2333	ADA3-2433	—	—	ADA3-2533	ADA3-2633	ADR3-2833
	3½"	AEA3-3333	AEA3-3433	—	—	AEA3-3533	AEA3-3633	AER3-3833
0-2	2½"	ADA3-2334	ADA3-2434	—	—	ADA3-2534	ADA3-2634	ADR3-2834
	3½"	AEA3-3334	AEA3-3434	—	—	AEA3-3534	AEA3-3634	AER3-3834
0-3	2½"	ADA3-2336	ADA3-2436	—	—	ADA3-2536	ADA3-2636	ADR3-2836
	3½"	AEA3-3336	AEA3-3436	—	—	AEA3-3536	AEA3-3636	AER3-3836
0-5	2½"	ADA3-2338	ADA3-2438	—	—	ADA3-2538	ADA3-2638	ADR3-2838
	3½"	AEA3-3338	AEA3-3438	—	—	AEA3-3538	AEA3-3638	AER3-3838
0-8	2½"	ADA3-2340	ADA3-2440	—	—	ADA3-2540	ADA3-2640	ADR3-2840
	3½"	AEA3-3340	AEA3-3440	—	—	AEA3-3540	AEA3-3640	AER3-3840
0-10	2½"	ADA3-2341	ADA3-2441	ADA3-2511	ADA3-2611	ADA3-2541	ADA3-2641	ADR3-2841
	3½"	AEA3-3341	AEA3-3441	AEA3-3511	AEA3-3611	AEA3-3541	AEA3-3641	AER3-3841
0-15	2½"	ADA3-2343	ADA3-2443	ADA3-2513	ADA3-2613	ADA3-2543	ADA3-2643	—
	3½"	AEA3-3343	AEA3-3443	AEA3-3513	AEA3-3613	AEA3-3543	AEA3-3643	—
0-20	2½"	ADA3-2344	ADA3-2444	ADA3-2514	ADA3-2614	ADA3-2544	ADA3-2644	ADR3-2844
	3½"	AEA3-3344	AEA3-3444	AEA3-3514	AEA3-3614	AEA3-3544	AEA3-3644	AER3-3844
0-30	2½"	ADA3-2346	ADA3-2446	ADA3-2516	ADA3-2616	ADA3-2546	ADA3-2646	—
	3½"	AEA3-3346	AEA3-3446	AEA3-3516	AEA3-3616	AEA3-3546	AEA3-3646	—
0-50	2½"	ADA3-2348	ADA3-2448	ADA3-2518	ADA3-2618	ADA3-2548	ADA3-2648	MILLI-AMPERES RADIO FREQUENCY
	3½"	AEA3-3348	AEA3-3448	AEA3-3518	AEA3-3618	AEA3-3548	AEA3-3648	
0-80	2½"	ADA3-2350	ADA3-2450	ADA3-2520	ADA3-2620	ADA3-2550	ADA3-2650	
	3½"	AEA3-3350	AEA3-3450	AEA3-3520	AEA3-3620	AEA3-3550	AEA3-3650	
0-100	2½"	ADA3-2351	ADA3-2451	ADA3-2521	ADA3-2621	ADA3-2551	ADA3-2651	ADR3-2821
	3½"	AEA3-3351	AEA3-3451	AEA3-3521	AEA3-3621	AEA3-3551	AEA3-3651	AER3-3821
0-150	2½"	ADA3-2353	ADA3-2453	ADA3-2523	ADA3-2623	ADA3-2553	ADA3-2653	ADR3-2823
	3½"	AEA3-3353	AEA3-3453	AEA3-3523	AEA3-3623	AEA3-3553	AEA3-3653	AER3-3823
0-200	2½"	ADA3-2354	ADA3-2454	ADA3-2524	ADA3-2624	ADA3-2554	ADA3-2654	ADR3-2824
	3½"	AEA3-3354	AEA3-3454	AEA3-3524	AEA3-3624	AEA3-3554	AEA3-3654	AER3-3824
0-300	2½"	ADA3-2356	ADA3-2456	ADA3-2526	ADA3-2626	ADA3-2556	ADA3-2656	ADR3-2826
	3½"	AEA3-3356	AEA3-3456	AEA3-3526	AEA3-3626	AEA3-3556	AEA3-3656	AER3-3826
0-500	2½"	ADA3-2358	ADA3-2458	ADA3-2528	ADA3-2628	ADA3-2558	ADA3-2658	ADR3-2828
	3½"	AEA3-3358	AEA3-3458	AEA3-3528	AEA3-3628	AEA3-3558	AEA3-3658	AER3-3828
0-800	2½"	ADA3-2360	ADA3-2460	ADA3-2530	ADA3-2630	ADA3-2560	ADA3-2660	ADR3-2830
	3½"	AEA3-3360	AEA3-3460	AEA3-3530	AEA3-3630	AEA3-3560	AEA3-3660	AER3-3830

External resistors are required for all A.C. and all 2½" D.C. Voltmeters 500 volts or above, and 3½" D.C. Voltmeters 1000 volts or above. Appropriate resistors are normally included with each A.C. Voltmeter, but are not included with D.C. Voltmeters, except on special order.

External 50 MV shunts are required for all D.C. ammeters 15 amperes or above, and external 5 ampere current transformers are required for all A.C. ammeters 50 amperes or above for 2½" and 80 amperes or above for 3½" sizes. Shunts and transformers are furnished only on special order.

POINTERS—The standard meters listed in this catalog are normally supplied with black tubular aluminum knife edge pointers. Lance or sword pointers are also available on special order. Lance-type pointers are standard with fluorescent or self-luminous dials. When pointers other than black are desired to match special scaleplates, a small additional charge is usually made.

TERMINALS—Three standard terminal types are available on all WacLine meters at no additional charge. The fourth digit of each WacLine part number changes according to the terminal type. For example, meter number ADD3-2033 has a type 3 terminal. Unless otherwise specified, type 3 terminals will be provided on all meters.

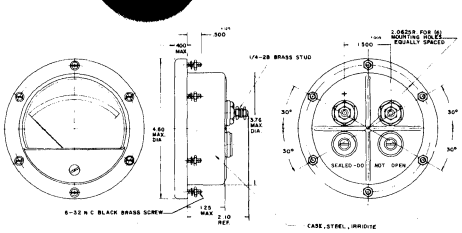
TYPE 1
10-32 brass stud with attached shakeproof solder terminal lug 2120-10-00, hex nut AN941-10, washer AN961-10.

TYPE 3
1/4-28 brass stud, 2 loose nuts and 2 loose washers with each stud.

TYPE 5
4-40 screw 3/16 long, attaching shakeproof solder lug.



4½ INCH
SERIES AFD
MR46 TYPE



The 4½ inch meter offers all the features of sealed and ruggedized meters produced by WacLine in other sizes. In addition, greater scale area provides improved readability and opportunity for multiple arc presentations. This style meter is widely used in multi-function portable test sets for military applications. Only two ranges are covered by Military specifications, but WacLine has the capability of producing most standard ranges in this meter size.

STANDARD RANGES 4½" METERS

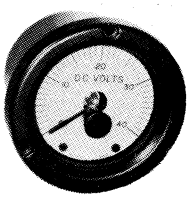
Scale Value	VDC	UADC	MADC	ADC	MVDC
0-1	X	—	X	X	—
0-5	—	—	X	X	—
0-10	X	—	X	X	—
0-50	X	X	X	S	X
0-100	X	X	—	—	X
0-500	—	X	—	—	—

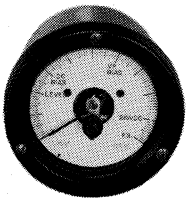
X Available self-contained.
S Supplied as a 50 millivolt meter for use with external shunt (not furnished).
Note: Zero center ranges may also be supplied.

WACLINE a division of Simmonds Precision
35 South St.Clair St., Dayton, Ohio 45402 □ 513-224-9921 □ TWX 810-459-1741

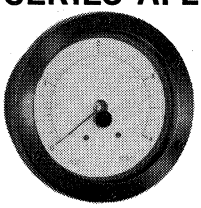
250° RUGGEDIZED & SEALED METERS

2½ INCH & 3½ INCH 250° SERIES ADL & AEL





4½ INCH SERIES AFL



LONGER SCALE—IMPROVED READABILITY

Featuring a scale length approximately two and one half times longer than a conventional meter, WacLine's 250° meters provide maximum resolution in a minimum of panel space. Completely sealed and ruggedized these meters are extremely reliable even under the most severe environmental conditions.

STANDARD RANGES* 250° METERS

SCALE VALUE	VDC 1000Ω/V	UADC	MADC	ADC	MVDC	VAC RECT. 60 HERTZ	SCALE VALUE	VDC 1000Ω/V	UADC	MADC	ADC	MVDC	VAC RECT. 60 HERTZ
0-1	X	–	X	X	–	–	0-50	X	–	X	S	–	–
0-2	X	–	X	X	–	–	0-100	X	X	X	S	X	–
0-3	X	–	–	–	–	–	0-150	X	–	–	–	–	X
0-5	X	–	X	X	–	–	0-200	X	X	X	S	–	–
0-10	X	–	X	X	–	–	0-300	X	–	–	–	–	X
0-15	X	–	–	–	–	X	0-500	X	X	X	S	–	–
0-30	X	–	–	S	–	X							

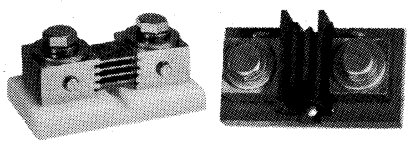
X Available self-contained in 2½", 3½", and 4½" sizes.
S Supplied as 100 MV for use with external shunt (to be ordered separately).

* Scale plate set-up charges may apply for some items which have not previously been produced.
Note: Zero center ranges may also be supplied.

SPECIAL DESIGN METERS & ACCESSORIES

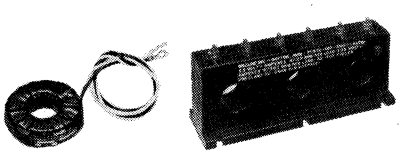
SHUNTS

Lightweight military shunts to meet MIL-S-61 for direct current values to 1200 amperes. Special commercial and aircraft designs also available.



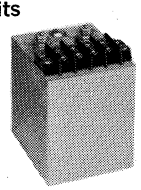
CURRENT TRANSFORMERS

Only two of a wide variety of current transformers produced by WacLine are shown. Single phase and three-phase models are offered. These transformers extend useful ranges for AC measurement of current and power.



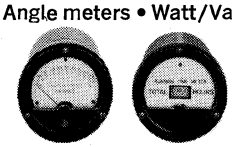
CONVERTERS & TRANSDUCERS

- Hall-generator Watt Converters
- Meter relays
- Frequency converters
- Power Factor & Phase Angle
- Control Relay circuits



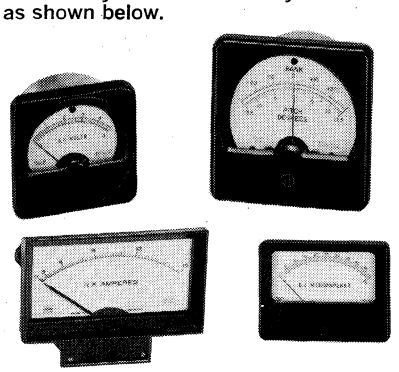
EXTENSION—CASE METERS

A full line of self-contained electronic meters includes: • Expanded scale AC Voltmeters (True RMS and Average sensing) • Expanded scale DC Voltmeters • Expanded scale frequency meters • • Elapsed Time Indicators • Power Factor & Phase Angle meters • Watt/Var meters



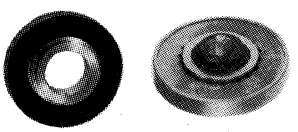
COMMERCIAL PANEL METERS

All of the sealed and ruggedized meters produced by WacLine for military applications have commercial application. The same quality and reliability which is built into our military meters is offered in a variety of commercial styled meters as shown below.



TACHOMETER GENERATORS

Pancake-style self-generating Tachometer Generators in a variety of sizes, 1" to 6". Output signals of up to 500 volts/1000 RPM. Linear output when used with high impedance loads. Custom designs available.



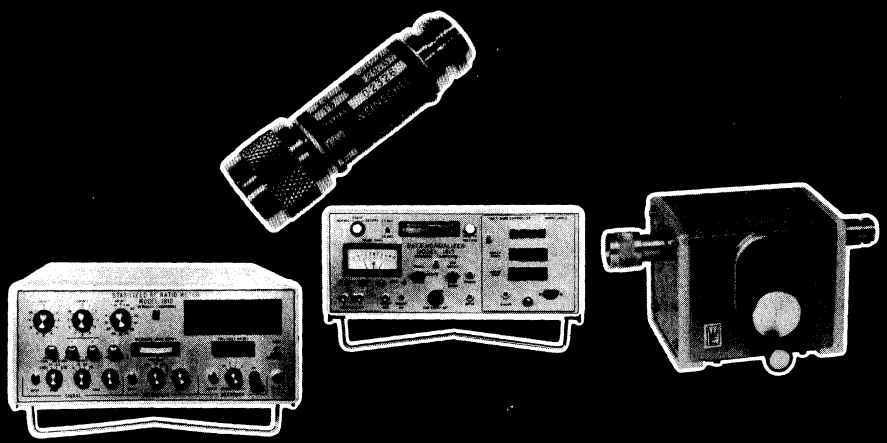
FLIGHT INSTRUMENTS

WacLine has produced for a number of years a complete line of aircraft cockpit meters for both commercial jet airliners and general aviation aircraft. Past accomplishments in such techniques as integral lighting and self-contained electronic circuitry to measure a wide variety of signals has recently been further advanced by introduction of the new Panoramic low parallax instrument.

FOR MORE DETAILED INFORMATION ON SPECIAL DESIGN METERS AND ACCESSORY PRODUCTS, CONSULT THE FACTORY.

WACLINE a division of Simmonds Precision

35 South St.Clair St., Dayton, Ohio 45402 □ 513-224-9921 □ TWX 810-459-1741



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Waveforms

Precision in **miniature**

VOLTMETERS [5Hz to 4MHz] ▪ OSCILLATORS [½Hz to 12MHz] ▪ TRANSMISSION SETS [30Hz to 400kHz]

SWEEP GENERATORS [5Hz to 5kHz] [20Hz to 20kHz] ▪ FREQUENCY RESPONSE METERS [20Hz to 20kHz]

400 SERIES OSCILLATORS – A family of stable, low-distortion bridged-T sine and sine/square wave oscillators. Standard with all 400s are large vernier driven dials, built-in attenuators and sync output. Models differ in frequency range, output power, square wave option, etc.

470 SERIES OSCILLATORS – *Precision-plus* counterparts of the 400 series featuring 1% dial accuracy, 0.1% distortion at 1 kHz and ±0.5 dB flatness.

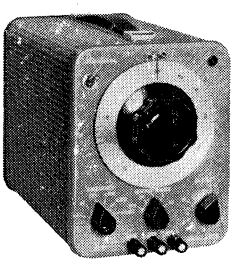
452 SERIES TRANSMISSION SETS – The complete "Gain Set" with oscillator and VTVM built-in, Models for audio and carrier bands. Direct reading in power (dBm), model 452A is calibrated within 0.25 dB from 30 Hz to 15 kHz. Level range (both send and receive) –70 dBm to +20 dBm. Rack mount (7" high) model 452A. Portable (with carrying case) model 452-A-C, add $50.00 to 452A price.

461 SERIES TWO-TONE GENERATORS For intermodulation testing in SSB, microwave and troposcatter radio systems. Tones are individually tunable. Built-in hybriding circuit with cross-modulation products 60 dB below output. Custom built to your choice of frequencies, levels and impedances.

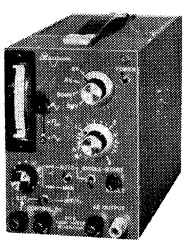
512F POWER OSCILLATOR – A unique, miniaturized laboratory sine-wave generator including the triple benefits of high power (50 V; 2 W), high signal purity (0.1% THD) and low source impedance (6Ω). Nearly a constant voltage source for filter and transformer measurement.

OPTIONAL FEATURES – Prices, weights and dimensions above are for portable instruments. Instruments of the 512, 401 and 402 type available with special decade ranging for non-recurring set-up charge of $200. Frequency response may be held closer than ±½ dB over a portion of the range – eliminating the need for metering the output in production testing of amplifiers, etc.

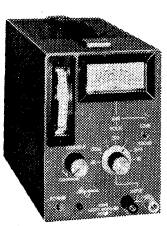
Send us your specifications for quotation.



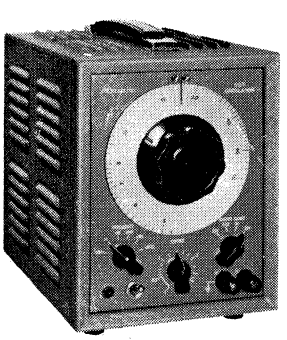
Model 401F Oscillator



Model 610B Sweep Generator



Model 620B
Frequency Response Meter



Model 512F
Sine-wave Generator

MINIATURE FLY-AWAY & SYSTEMS MODULES – An exciting family of instrument modules all with 6" by 4¼" front panels. May be carried in a field engineer's briefcase. Up to four may be mounted in a rugged carrying case that fits under your plane seat. Perfect for systems and test stands. Up to four can be mounted in 7" of rack height.

510 SERIES FLY-AWAY OSCILLATORS Wide tuning range, low distortion and log attenuator. 510B calibrated in volts, 510C calibrated in dBm. Bolt-on balancing transformers available.

511A FLY-AWAY AUDIO-VIDEO GENERATOR – This remarkable solid state instrument generates sine wave from 10Hz to 12 MHz and square waves from 10 Hz to 1 MHz. The perfect generator for audio and data recorders, telephone carrier systems, etc. 80 dB continuously variable attenuator. 1/8th the size of comparable instruments.

520 SERIES FLY-AWAY A-C VTVMs – 12 ranges from 1 mV to 300 V full scale; 10 MΩ input impedance; 4 MHz bandwidth. Two linear models: 520A with voltage scales uppermost, and 520D with dB scale uppermost. Model 520L has a logarithmic meter.

610 SERIES FLY-AWAY SWEEP GENERATORS – The world's first miniature sweep generator. All electronic and complete with all the features and properties found in instruments 20 times as large. Models 610B (20 Hz to 20 kHz) and 610C (5 Hz to 5 kHz) are standard. May be operated as externally programmed VCO over 6 frequency decades.

620B FLY-AWAY FREQUENCY RESPONSE METER – Used alone or with the 610B sweeper, model 620B provides automated frequency response plotting. Model 620B contains a log level meter and log frequency meter with front panel readout of both functions. DC analog outputs, fed to x and y of scopes and recorders draw log/log response curves of audio devices.

precision in miniature electronic instruments

OSCILLATORS ▪ VOLTMETERS ▪ TRANSMISSION SETS
SWEEP GENERATORS ▪ FREQUENCY RESPONSE METERS

SUMMARY OF SPECIFICATIONS

Generators	Frequency Range	Dial Accuracy	Bands	Frequency Response	Unloaded Output V	Output Power	Distortion 1 kHz	Source Impedance	Power Drain	Weight lbs.	Size (in) H W D	Price
401B	10Hz to 100kHz	± 3 %	4 decades	± 1 dB	20	160 mw	1/4%	600 Ω	60 W	12	8 x 6 x 10½	**$200.**
401C	10Hz to 100kHz	± 3 %	4 decades	± 1 dB	20	500 mw	1/2%	90 Ω	70 W	12	8 x 6 x 10½	**250.**
401F	1Hz to 1MHz	±(3% +.1Hz)	6 decades	± 1 dB	20	160 mw	1/4%	600 Ω	60 W	12	8 x 6 x 10½	**350.**
401H	5Hz to 600kHz	± 2%	5 decades	± ½ dB	20	160 mw	1/4%	600 Ω	60 W	12	8 x 6 x 10½	**240.**
402A	10Hz to 1.5MHz	± 2 %	5 decades	± ½ dB	16	100 mw	1/10%	600 Ω	60 W	12	8 x 6 x 10½	**560.**
403B	1Hz to 100kHz	±(3% +.1Hz)	5 decades	± 1 dB	20 sine; 20 pp sq	160 mw	1/4%	600 Ω	70 W	12	8 x 6 x 10½	**350.**
452A	10Hz to 100kHz	± 1 %	4 decades	± ¼ dB	16	100 mw	1/10%	50,150,250 and 600 Ω	100 W	30	7 x 19 x 8½	**1,190.**
471B	10Hz to 100kHz	± 1 %	4 decades	± ½ dB	20	160 mw	1/10%	600 Ω	60 W	12	8 x 6 x 10½	**300.**
471F	1Hz to 1MHz	±(1% +.1Hz)	6 decades	± ½ dB	20	160 mw	1/10%	600 Ω	60 W	12	8 x 6 x 10½	**450.**
473B	1Hz to 100kHz	±(1% +.1Hz)	5 decades	±½ dB	20 sine; 20 pp sq	160 mw	1/10%	600 Ω	70 W	12	8 x 6 x 10½	**450.**
510B	20Hz to 1MHz	±3% to 200kHz ±10% to 1MHz	4 decades + .2 to 1.1MHz	± 1 dB below 200kHz	10	4 ma	1 %	400 Ω	40 W	6	6 x 4¼ x 8	**250.**
510C	20Hz to 1MHz	±3% to 200kHz ±5% to 1MHz	4 decades + .2 to 1.1MHz	± ½ dB	5	10 mw	1/4%	600 Ω	40 W	6	6 x 4¼ x 6	**250.**
511A	10Hz to 12MHz	± 3 %	6 decades	± 1 dB	6 sine; 6 pp sq	200 mw	1/4%	50 Ω	30 W	6	6 x 4¼ x 6	**775.**
512F	½Hz to 500kHz	±(1% +.1Hz)	6 decades	± ½ dB*	50	2 W	1/10%	6 Ω	110 W	18	9½ x 7¼ x 11½	**475.**
610B	20Hz to 20kHz	±10%	1	±1/10 dB	5	10 mw	1 %	600 Ω	35 W	6	6 x 4¼ x 8	**1,000.**
610C	5Hz to 5kHz	±10%	1	±1/10 dB	5	10 mw	1 %	600 Ω	35 W	6	6 x 4¼ x 8	**1,350.**
610D	20Hz to 20kHz	±10%	1	±1/10 dB	5	10 mw	1 %	600 Ω	35 W	8	6 x 8½ x 8	**1,350.**

VOLTMETERS	Input Impedance	Voltage Ranges	Accuracy			
520A linear	10 MΩ; 24 pf	.001 V to 300 V	2% 20Hz to 1MHz	40 W	6	6 x 4¼ x 6	**300.**
520D linear		full scale	5% 10Hz to 2MHz				**300.**
520L logarithmic		12 ranges	5Hz to 4MHz as null indicator				**330.**
620B frequency response meter	6 kΩ	any ±2 dB or ±20 dB band between .01 V & 100 V	2% 20Hz to 20kHz	20 W	6	6 x 4¼ x 8	**600.**
620D frequency response meter			2% 20Hz to 20kHz	20 W	8	6 x 8½ x 8	**750.**

* ±2 dB on lowest range

ADDITIONAL SPECIFICATIONS – ALL GENERATOR MODELS

HUM: Less than 0.01% rated output (–80dB)
FREQUENCY STABILITY: ± ½%, 110 to 120 V
LINE FREQUENCY BEAT: ¼ dB maximum excursion near supply frequency
SUPPLY POWER: A MODELS: 105 to 130 V or 210 to 260 V, 50 to 400Hz

prices and specifications subject to change without notice

RACK AND PANEL MOUNTING—All Waveforms instruments are available for rack or panel mounting in systems. Request quotation.

NEW: WAVEFORMS HAZARDOUS FUME (GAS) DETECTORS. Based on a new "cold" adsorptive detection principle, these instruments will detect minute concentrations of C_3H_6, C_2H_5OH, C_6H_6 and most longer-chain hydrocarbons and aromatics. Applications include petrochemical, transportation, marine, etc.

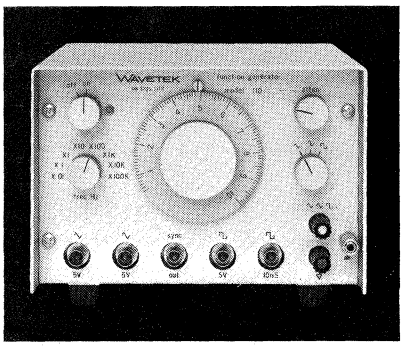
Waveforms

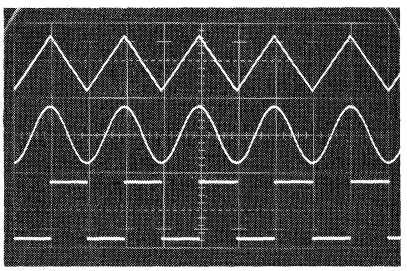
11922 VALERIO STREET, NO. HOLLYWOOD, CALIFORNIA 91605 TEL. (213) 764-1500

PRODUCTS OF UREI

Model 110
Function Generator

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Wavetek Model 110 Function Generator is a calibrated, high-purity source of sine, square and triangle waveforms. It is an all transistorized unit featuring complete plug-in printed circuit board construction, utilizing silicon semiconductors throughout. The Model 110 provides six simultaneous outputs over a dynamic frequency range of 0.005 Hz to 1 MHz. All outputs may be shorted simultaneously and the generator will continue to oscillate internally with less than 0.5% change in frequency. Its rugged construction, compact size and precision operating characteristics make the Model 110 a portable laboratory of test signals in one economical package.

VERSATILITY

Waveforms

Sine ∿, square ⊓, triangle △ and sync pulse.

Dynamic Frequency

0.005 Hz to 1 MHz (3.3 min. to 1 μsec).

Ranges

X.01 = 0.005 Hz to 0.1 Hz
X0.1 = 0.05 Hz to 1 Hz
X1.0 = 0.5 Hz to 10 Hz
X10 = 5 Hz to 100 Hz
X100 = 50 Hz to 1 kHz
X1K = 500 Hz to 10 kHz
X10K = 5 kHz to 100 kHz
X100K = 50 kHz to 1 MHz

Six Simultaneous Outputs

1. ∿, ⊓ or △ selectable with variable amplitude. Specs apply from 10% to 100% of max. amplitude setting.
   50-Ω output impedance (600-Ω output impedance available by removing one jumper wire, with corresponding decrease in output amplitude).
   30 V p-p max into 600-Ω load.
   10 V p-p max into 50-Ω load.
   Short circuit output current ±100 mA.
   Model 110B: 5 V p-p into open circuit, 600-Ω output impedance.
2. ⊓ 1 V p-p.
3. ⊓ 5 V p-p.
4. ∿ 5 V p-p.
5. △ 5 V p-p.
6. Sync pulse: At least −10 V into open circuit; less than 5 μsec duration.

Note: Outputs 2 through 5 are 500-Ω output impedance. Output voltage stated is into open circuit.

HORIZONTAL PRECISION

Dial Accuracy

±1% of full scale to 100 kHz.
±2% of full scale 100 kHz to 1 MHz.

Note: Dial is a high-quality composition pot, allowing true continuously variable frequency control.

Frequency Stability

Short term: Drift less than ±0.05% of setting for 10 min.
Long term: Drift less than ±0.25% of setting for 24 hr.
No critical components requiring internal oven.

Jitter

±0.025% cycle-to-cycle stability.

VERTICAL PRECISION

Frequency Response

Amplitude change with frequency less than 0.1 db 0.005 Hz to 100 kHz and 0.5 db 100 kHz to 1 MHz.

Peak-to-Peak Voltage Accuracy

±1% for outputs 3, 4 and 5.
±1% for output 1 at 30 V out.
±10% for output 2.

Amplitude Stability

Short term: ±0.05% of max p-p values for 10 min.
Long term: ±0.25% of max p-p values for 24 hr.

Symmetry

All waveforms are symmetrical about ground within ±1% of max p-p amplitude (zero adjust rear-panel control provided for output 1).

DC Offset Stability

Short term: ±0.05% of max p-p amplitude for 10 min.
Long term: ±0.25% of max p-p amplitude for 24 hr.

PURITY

Sine Wave Distortion

Less than:
0.5% 0.005 Hz to 10 kHz.
1.0% 10 kHz to 100 kHz.
2.0% 100 kHz to 600 kHz.
3.0% 600 kHz to 1 MHz.

Triangle Linearity

Greater than:
99% 0.005 Hz to 100 KHz.
95% 100 kHz to 1 MHz.

Square Wave Rise and Fall Time

Less than 10 nsec, output 2.
Less than 15 nsec, output 3.
Less than 100 nsec, output 1.

Total Aberrations

Less than 5% (overshoot, preshoot, etc.) when properly terminated.

Tilt

Less than 0.5%.

Time Symmetry (All Waveforms)

99.5% 0.005 Hz to 100 kHz.
99% 100 kHz to 1 MHz.

ENVIRONMENTAL

Temperature

All specifications listed, except stability, are for 25°C ±5°C.
For operation from 0°C to 55°C, derate all specifications by a factor of 2.

MECHANICAL

Dimensions

Model 110: 7¾ in. w, 5¼ in. h, 7½ in. d.
Model 110B: 7¾ in. w, 5¼ in. h, 11½ in. d.

Weight

7 lb net, 10 lb shipping.

Color

Clear anodized aluminum.

Controls

On-off power switch, frequency range switch, frequency dial, function selector switch, amplitude attenuator. Rear dc zero adjustment, 110; charge rate adjustment, 110B. All-silicon semiconductors, modular plug-in construction.

Power

Model 110: 105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 watts.
Model 110B: dc rechargeable ni-cad batteries provided with built-in charger. Fifteen hours of operation on batteries for every 16 hours of charge; simultaneous operation and charge. 105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 15 W.

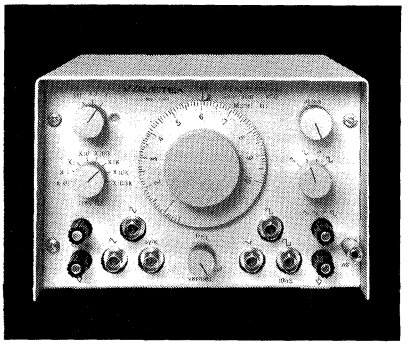
ORDER INFORMATION

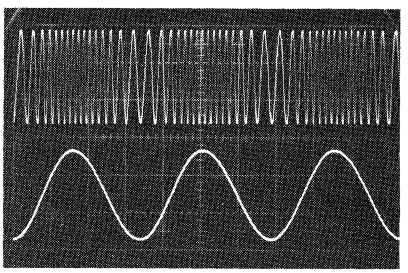
Prices (F.O.B. San Diego)

Model 110, $445 Model 110B, $545

Model 111 VCG

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Model 111 VCG is a precision source of sine, square, triangle and ramp waveforms. It offers control of frequency by external voltage—either dc programming or wideband ac frequency modulation. The instantaneous frequency of these waveforms is determined by the combination of the dial setting and the externally applied voltage. The VCG input is in parallel with the frequency dial. Set the dial at mid-frequency and increase the frequency with positive voltage or decrease it with negative voltage. Set the dial at the lowest point and increase frequency with positive voltage. Set the dial at the highest point and decrease frequency with negative voltage. Actually, the Model 111 VCG is a portable oscillator, square-wave generator, FM modulator, frequency shift keyer and sweep generator—all in one economical package.

VERSATILITY

Waveforms

Sine ∿ , square ⊓ , triangle △ , ramp ◿ , and sync pulse.

Dynamic Frequency

0.0015 Hz to 1 MHz (10 min to 1 μsec). In 8 ranges X.3 range multiplier.

Seven Simultaneous Outputs

1. ∿ , ⊓ , △ or ◿ selectable with variable amplitude. Specs apply from 10% to 100% of max amplitude setting.
   50-Ω output impedance. (600-Ω output impedance available by removing one jumper wire, with corresponding decrease in output amplitude.)
   30 V p-p max (15 V ◿) into 600-Ω load. 10 V p-p max (5 V ◿) into 50-Ω load. Short circuit output current ±100 mA.
   Model 111B: 5 V p-p into open circuit, 600-Ω output impedance.
2. ⊓ 1 V p-p.
3. ⊓ 5 V p-p.
4. ∿ 5 V p-p.
5. △ 5 V p-p.
6. ◿ 0 V to −2.5 V ramp; 50% duty cycle.
7. Sync pulse: At least −10 V into open circuit; less than 5 μsec duration.

Note: Outputs 2 thru 6 are 50-Ω output impedance. Output voltage stated is into open circuit.

VCG — Voltage-Controlled Generator

Over 20:1 frequency ratio (selectable in ranges of 3:1, allowing excellent range overlap). 4.75 V input for 20:1 frequency ratio (0.5 V per major dial division ±1%). Input impedance 10 kΩ.

HORIZONTAL PRECISION

Dial Accuracy

±1% of full scale to 100 kHz.
±2% of full scale 100 kHz to 1 MHz.

Electronic Frequency Vernier

One turn for one minor dial division.

Typical VCG Linearity

±0.1% frequency vs input voltage (frequency error 0.1% of total deviation—best straight-line method). 0.0015 Hz to 100 kHz generated frequency. From 10% to 100% of max dial frequency.

VCG Bandwidth

100 kHz.

Frequency Stability

Short term: Drift less than ±0.05% of setting for 10 min.
Long term: Drift less than ±0.25% of setting for 24 hr.

Jitter

±0.025% cycle-to-cycle stability.

VERTICAL PRECISION

Frequency Response

Amplitude change with frequency less than 0.1 db 0.0015 Hz to 100 kHz and 0.5 db 100 kHz to 1 MHz.

Peak-to-Peak Voltage Accuracy

±1% for outputs 3 through 6.
±1% for output 1 at 30 V out.
±10% for output 2.

Amplitude Stability

Short term: ±0.05% of max p-p values for 10 min.
Long term: ±0.25% of max p-p values for 24 hr.

Symmetry

All waveforms, except ramp, are symmetrical about ground within ±1% of max p-p amplitude (zero adjust rear-panel control provided for output 1).

DC Offset Stability

Short term: ±0.05% of max p-p amplitude for 10 min.
Long term: ±0.25% of max p-p amplitude for 24 hr.

PURITY

Sine Wave Distortion

Less than:
0.5% 0.0015 Hz to 10 kHz.
1.0% 10 kHz to 100 kHz.
2.0% 100 kHz to 600 kHz.
3.0% 600 kHz to 1 MHz.

Triangle and Ramp Linearity

Greater than:
99% 0.0015 Hz to 100 kHz.
95% 100 kHz to 1 MHz.

Ramp Fall Time

Less than 250 nsec.

Square Wave Rise and Fall Time

Less than 10 nsec, output 2.
Less than 15 nsec, output 3.
Less than 100 nsec, output 1.

Total Aberrations

Less than 5% (overshoot, preshoot, etc.) when properly terminated.

Tilt

Less than 0.5%.

Time Symmetry (All Waveforms)

99.5% 0.0015 Hz to 100 kHz.
99% 100 kHz to 1 MHz.

ENVIRONMENTAL

Temperature

All specifications listed, except stability, are for 25°C ±5°C.

MECHANICAL

Dimensions

Model 111: 7¾ in. w, 5¼ in. h, 7½ in. d.
Model 111B: 7¾ in. w, 5¼ in. h, 11½ in. d.

Weight

7 lb, 10 lb shipping.

Controls

Off-X.3-X1 power/dial multiplier switch, frequency range switch, frequency dial, frequency vernier, function selector switch, amplitude attenuator. Rear dc zero adjustment, 111; charge rate adjustment, 111B.

Power

Model 111: 105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 W.
Model 111B: dc rechargeable ni-cad batteries provided with built-in charger. Ten hours of operation on batteries for every 16 hours of charge; simultaneous operation and charge. 105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 15 W.

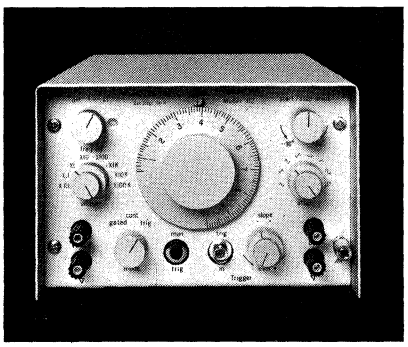
ORDER INFORMATION

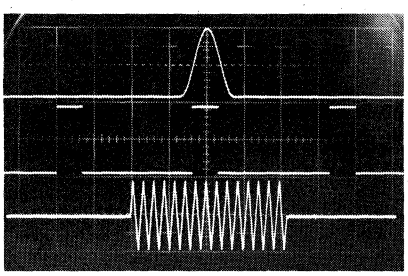
Prices (F.O.B. San Diego)

Model 111, $545 Model 111B, $645

Model 112
Triggered VCG

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Model 112 Triggered VCG offers precision control of frequency by external voltage—either dc programming or wideband ac frequency modulation. It also triggers from a manual front-panel control or from an external pulse or gate. One cycle is generated on command. If a gate signal is applied, the generator will operate until the gate is removed. The trigger start-stop point is adjustable over 360°. Trigger level and polarity may be selected from front-panel control. The Model 112 generates sine, square, triangle and ramp waves simultaneously in fixed-phase relationships. The frequency of these waveforms is determined by the combination of the dial setting and the externally applied voltage. The VCG input is in parallel with the frequency dial. The Model 112 Triggered VCG is a portable oscillator, square-wave generator, FM modulator, frequency shift keyer, sweep generator, and tone-burst generator. The Model 112 is a versatile, general-purpose instruments for laboratory and field use.

VERSATILITY

Waveforms

Sine ∿ , square ⊓ , triangle ∧ , ramp ◿ , and sync pulse.

Dynamic Frequency

0.0015 Hz to 1 MHz (10 min to 1 μsec). In 8 ranges X.3 range multiplier.

Nine Simultaneous Outputs

1. ∿ , ∩ , ⊓ , ⊓ , ∧ , ∩ , ◿ or ◹ selectable with variable amplitude.
   30 V p-p max (15 V ◿) into 600-Ω load.
   10 V p-p max (5 V ◿) into 50-Ω load. Short circuit output current ±100 mA.
   Model 112B: 5 V p-p into open circuit, 600-Ω output impedance.
2. ⊓ 1 V p-p.
3. ⊓ 5 V p-p.
4. ∿ 5 V p-p.
5. ∧ 5 V p-p.
6. ◹ 0 V to −2.5 V ramp; 50% duty cycle.
7. ∩ , ⊓ , ∩ , or ◿ selectable. 5 V p-p differential output 180° out-of-phase with outputs 2 through 6.
8. ∿ 2.5 V p-p offset +1.25 V.
9. Sync pulse: At least −10 V into open circuit; less than 5 μsec duration.

Note: Outputs 2 thru 7 are 50-Ω output impedance. Output voltage stated is into open circuit.

Trigger

Input impedance is 10 kΩ.

Trigger mode: Manual or external voltage of ±0.5 V will generate one cycle.

Gated mode: Discrete number of cycles may be generated by application of ±0.5 V gate.

Up to 100 V may be applied without damage to input circuitry.

Trigger level and slope are adjustable by front-panel controls. (These controls are similar to trigger adjustments of an oscilloscope.)

The start-stop point of the generated waveform is adjustable through 360°. Haversine is available by adjusting trigger start control to the −90° position and using offset sine wave output 8.

VCG—Voltage-Controlled Generator

Over 20:1 frequency ratio (selectable in ranges of 3:1, allowing excellent range overlap). 4.75 V input for 20:1 frequency ratio (0.5 V per major dial division ±1%). Input impedance 10 kΩ.

Stability*

Short term: ±0.05% for 10 min.

Long term: ±0.25% for 24 hr.

*Percentages apply to amplitude, frequency and dc offset.

HORIZONTAL PRECISION

Dial Accuracy

±1% of full scale to 100 kHz.

±2% of full scale to 1 MHz.

Electronic Frequency Vernier

One turn for one minor dial division.

Typical VCG Linearity

±0.1% frequency vs input voltage (frequency error 0.1% of total deviation—best straight-line method). 0.0015 Hz to 100 kHz generated frequency. From 10% to 100% of max dial frequency.

VCG Bandwidth

100 kHz.

Jitter

±0.025% cycle-to-cycle stability.

VERTICAL PRECISION

Frequency Response

Amplitude change with frequency less than 0.1 db 0.0015 Hz to 100 kHz and 0.5 db 100 kHz to 1 MHz.

Peak-to-Peak Voltage Accuracy

±1% for outputs 3 through 7.

±1% for output 1 at 30 V out.

±10% for output 2.

Symmetry

All waveforms, except offset sine and ramp, are symmetrical about ground within ±1% of max p-p amplitude (zero adjust rear-panel control provided for output 1).

PURITY

Sine Wave Distortion

Less than:

0.5% 0.0015 Hz to 10 kHz.

1.0% 10 kHz to 100 kHz.

2.0% 100 kHz to 600 kHz.

3.0% 600 kHz to 1 MHz.

Triangle and Ramp Linearity

Greater than:

99% 0.0015 Hz to 100 kHz.

95% 100 kHz to 1 MHz.

Ramp Fall Time

Less than 250 nsec.

Square Wave Rise and Fall Time

Less than 10 nsec, output 2.

Less than 15 nsec, output 3.

Less than 100 nsec, output 1.

Total Aberrations

Less than 5% (overshoot, preshoot, etc.) when properly terminated.

Tilt

Less than 0.5%.

Time Symmetry (All Waveforms)

99.5% 0.0015 Hz to 100 kHz.

99% 100 kHz to 1 MHz.

ENVIRONMENTAL

Temperature

All specifications listed, except stability, are for 25°C ±5°C.

MECHANICAL

Dimensions

7¾ in. w, 5¼ in. h, 11½ in. d.

Weight

10 lb, 15 lb shipping.

Power

Model 112: 105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 W. Ni-cad battery unit available.

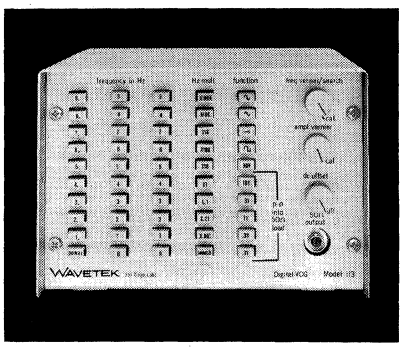
ORDER INFORMATION

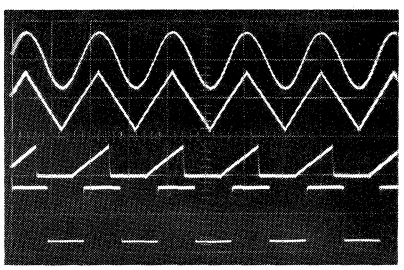
Prices (F.O.B. San Diego)

Model 112, $695 Model 112B, $795

Model 113
Digital VCG

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Model 113 Digital VCG is a precision source of sine, square, triangle and ramp waveforms. It offers pushbutton control of frequency, function and amplitude, plus voltage control of frequency by external input — either dc programming or wideband ac frequency modulation.

The amplitude is controlled by a precision 50-Ω attenuator that offers 10 db steps from 0.1 volt to 10 volts peak-to-peak. Both frequency and amplitude also may be controlled by vernier controls that allow overlap between the digitally selected values. Resolutions of the frequency vernier allows 4-digit control. Frequency pushbuttons may be switched over to a 1-turn control for frequency search.

A special pushbutton position is provided to give 30 volt peak-to-peak output with a vernier control. All waveforms are available by selection on the front panel output. Fixed amplitude outputs of each waveform also are available on the rear panel.

The Model 113 Digital VCG is a portable source of stimuli for laboratory or field use allowing ease of selection, accuracy and repeatability.

VERSATILITY

Waveforms
Sine ∿ , square ⊓ , triangle ∧ , and ramp ◿ .

Dynamic Frequency
0.001 Hz to 1 MHz (15 min. to 1 μsec.)

Ranges
X.001 = 0.001 Hz to 0.01 Hz
X.01 = 0.01 Hz to 0.1 Hz
X0.1 = 0.1 Hz to 1 Hz
X1.0 = 1 Hz to 10 Hz
X10 = 10 Hz to 100 Hz
X100 = 100 Hz to 1 kHz
X1K = 1 kHz to 10 kHz
X10K = 10 kHz to 100 kHz
X100K = 100 kHz to 1 MHz

Five Simultaneous Outputs
1. ∿ , ⊓ , ∧ , or ◿ , 30 V p-p max into 600-Ω load (15 V◿). precision attenuator providing 0.1, 0.3, 1, 3 and 10 V p-p into 50-Ω load with continuous vernier. Short circuit output current ±100 mA.
2. ⊓ 5 V p-p.
3. ∿ 5 V p-p.
4. ∧ 5 V p-p.
5. ◹ 0 V to −2.5 V ramp; 50% duty cycle.

Note: Outputs 2 through 5 are 500-Ω output impedance. Output voltage stated is into open circuit.

VCG—Voltage-Controlled Generator
0.5 V input for frequency change of first significant digit (±1%). Up to 100:1 frequency ratio. Input impedance 10 kΩ.

HORIZONTAL PRECISION

Frequency Accuracy
1% of selected frequency, 0.001 Hz to 100 kHz.
2% of selected frequency, 100 kHz to 1 MHz.

Typical VCG Linearity
±0.1% frequency vs. input voltage (frequency error 0.1% of total deviation—best straight-line method) 0.001 Hz to 100 kHz generated frequency.

VCG Bandwidth
100 kHz.

Frequency Stability
Short term: Drift less than ±0.05% of setting for 10 min.
Long term: Drift less than ±0.25% of setting for 24 hrs.
No critical components requiring internal oven.

Jitter
±0.025% cycle-to-cycle stability.

VERTICAL PRECISION

Frequency Response
Amplitude change with frequency less than 0.1 db, 0.001 Hz to 100 kHz and 0.5 db, 100 kHz to 1 MHz.

Peak-to-Peak Voltage Accuracy
±1% of selected output. 0.1 V to 10 V p-p into precision 50-Ω load.
±1% for outputs 2 through 5.

Amplitude Stability
Short term: ±0.05% of max p-p values for 10 min.
Long term: ±0.25% of max p-p values for 24 hrs.

Symmetry
All waveforms, except ramp, are symmetrical about ground within ±1% of max p-p amplitude (zero adjust rear-panel control provided for output 1).

DC Offset Control
Front panel vernier may be switched in for up to ±5 V dc offset on output 1; dc offset plus ac signal limited to ±15 V peak.

DC Offset Stability
Short term: ±0.05% of max p-p amplitude for 10 min.
Long term: ±0.25% of max p-p amplitude for 24 hrs.

PURITY

Sine Wave Distortion
Less than:
0.5% 0.001 Hz to 10 kHz.
1.0% 10 kHz to 100 kHz.
2.0% 100 kHz to 600 kHz.
3.0% 600 kHz to 1 MHz.

Triangle and Ramp Linearity
Greater than:
99% 0.001 Hz to 100 kHz.
95% 100 kHz to 1 MHz.

Ramp Fall Time
Less than 250 nsec.

Square Wave Rise and Fall Time
Less than 10 nsec, output 2.
Less than 100 nsec, output 1.

Total Aberrations
Less than 5% (overshoot, preshoot, etc.) when properly terminated.

Tilt
Less than 0.5%.

Time Symmetry (All Waveforms)
99.5% 0.001 Hz to 100 kHz.
99% 100 kHz to 1 MHz.

ENVIRONMENTAL

Temperature
All specifications listed, except stability, are for 25°C ±5°C. For operation from 0°C to 55°C, derate all specifications by a factor of 2.

MECHANICAL

Dimensions
7¾ in. w, 5¼ in. h, 11½ in. d.

Weight
7 lb, 10 lb shipping.

Color
Clear anodized aluminum.

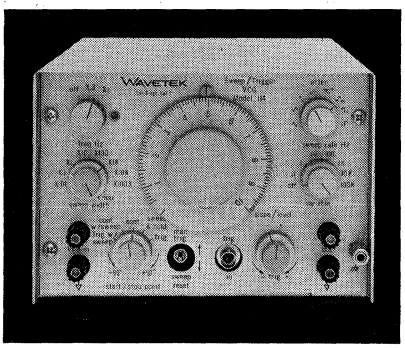
Power
105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 W

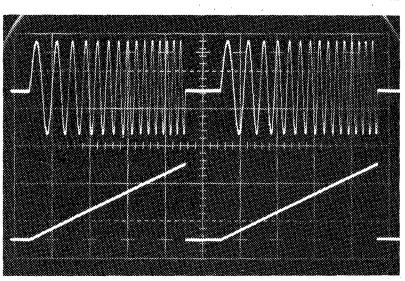
ORDER INFORMATION

Price (F.O.B. San Diego)
Model 113, $595

Model 114 Sweep–Trigger VCG

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Model 114 is two independent generators in a single compact unit. The first generator is a precision source of sine, square and triangle waveforms. The second is a ramp generator for sweeping the frequency of the first. Both generators may be operated continuously or triggered with independent frequency control. In the triggered mode, the start-stop point may be continuously varied through 360°. Also, sine² pulses are available from the offset sine output in the triggered mode. A unique feature of the Model 114 is the sweep-and-hold mode which allows static setting of both start and stop frequency. In addition to internal sweep control, terminals are provided for external voltage control of frequency (VCG) — either dc programming or wideband ac frequency modulation. The Model 114 Sweep-Trigger VCG is a portable oscillator, square-wave generator, FM modulator, frequency shift keyer, sweep generator and tone-burst generator. The Model 114 is a versatile, general-purpose instrument for both laboratory and field use.

VERSATILITY

Waveforms

Sine ∿ , square ⊓ , triangle △ offset sine ∿₀ , and sync pulse.

Dynamic Frequency

0.0015 Hz to 1 MHz (10 min to 1 μsec).

Nine Simultaneous Outputs

1. ∿ , ∩ , ⊓ , ⊔ , △ , ▽ , ∿₀ , or ∩° selectable with variable amplitude. Specs apply from 10% to 100% of max amplitude setting. 50-Ω output impedance.
   30 V p-p max (15 V ∿₀) into 600-Ω load. 10 V p-p max (5 V ∿₀) into 50-Ω load. Short circuit output current ±100 mA.
   Model 114B: 5 V p-p into open circuit, 600-Ω output impedance.
2. ⊓ 1 V p-p.
3. ⊓ 5 V p-p.
4. ⊓ 5 V p-p.
5. △ 5 V p-p.
6. ∩° 2.5 V p-p offset −1.25 V.
7. ∿ , ⊓ , △ , or ∿₀ selectable. 5 V p-p differential output 180° out-of-phase with outputs 2 through 6.
8. Sweep monitor (output of sweep generator), 2.5 V nominal.
9. Sync pulse: At least −10 V into open circuit; less than 5 μsec duration.

Note: Outputs 2 thru 7 are 50-Ω output impedance. Output voltage stated is into open circuit.

OPERATIONAL MODES

Continuous Mode—Operates as a standard VCG. Frequency determined by dial/range settings parallel with VCG input.

Trigger Mode—One complete cycle is generated by activating the manual trigger or applying a pulse or gate to the trigger input.

Sweep and Hold Mode—Generator runs at the selected frequency until triggered by the manual trigger or external pulse. When thus activated, the unit sweeps to a new frequency determined by the sweep-width control and holds this frequency until manually reset.

Continuous with Sweep Mode—Main generator continuously swept from frequency selected by main dial to upper frequency selected by width control.

Trigger with Sweep Mode—No output is generated until manual trigger is activated or trigger input is applied. The unit starts at the frequency selected by the dial and range settings and sweeps to a frequency controlled by the sweep-width control. The generator stops oscillating at this point and will not restart until triggered again. Tone-burst operation may be obtained in this mode by setting the sweep-width control to zero; the number of cycles generated for each trigger applied is determined by sweep-rate controls.

Trigger Controls

Input impedance is 10 kΩ. Input voltage is ±0.5 V to ±100 V. Trigger level and slope are adjustable by front-panel controls. Start-stop point of the waveform is adjustable through 360°.

Sweep Controls

Sweep width is adjustable from 0 to 100:1.

VCG — Voltage-Controlled Generator

Over 20:1 frequency ratio (selectable in ranges of 3:1, allowing excellent range overlap). 4.75 V input for 20:1 frequency ratio (0.5 V per major dial division ±1%). Input impedance to kΩ.

STABILITY*

Short term: ±0.05% for 10 min.
Long term: ±0.25% for 24 hr.

*Percentages apply to amplitude, frequency and dc offset.

HORIZONTAL PRECISION

Dial Accuracy

±1% of full scale to 100 kHz.
±2% of full scale 100 kHz to 1 MHz.

Typical VCG Linearity

±0.1% frequency vs input voltage (frequency error 0.1% of total deviation—best straight-line method). 0.0015 Hz to 100 kHz generated frequency. From 10% to 100% of max dial frequency.

VCG Bandwidth—100 kHz.

Jitter

±0.025% cycle-to-cycle stability.

VERTICAL PRECISION

Frequency Response

Amplitude change with frequency less than 0.1 db 0.0015 Hz to 100 kHz and 0.5 db 100 kHz to 1MHz.

PURITY

Sine Wave Distortion

Less than:
0.5% 0.0015 Hz to 10 kHz.
1.0% 10 kHz to 100 kHz.
2.0% 100 kHz to 600 kHz.
3.0% 600 kHz to 1 MHz.

Triangle Linearity

Greater than:
99% 0.0015 Hz to 100 kHz.
95% 100 kHz to 1 MHz.

Square Wave Rise and Fall Time

Less than 10 nsec, output 2.
Less than 15 nsec, output 3.
Less than 100 nsec, output 1.

Total Aberrations

Less than 5% (overshoot, preshoot, etc.) when properly terminated.

MECHANICAL

Dimensions

7¾ in. w, 5¼ in. h, 11½ in. d.

Weight

10 lb, 15 lb shipping.

Power

Model 114: 105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 W. Ni-cad battery unit available.

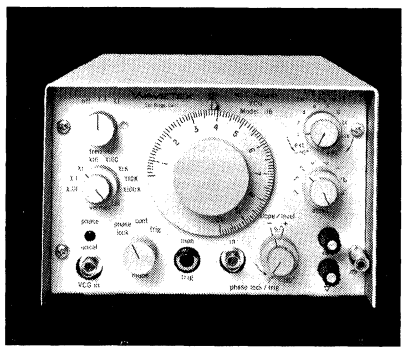
ORDER INFORMATION

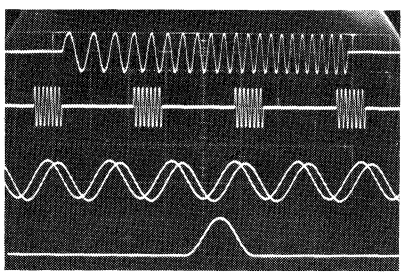
Prices (F.O.B. San Diego)

Model 114, $795 Model 114B, $895

Models 115 & 116
Trigger – Phase Lock VCGs

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Models 115 and 116 generators produce sine, square, triangle and ramp waveforms with trigger and phase-lock capabilities. In addition, the 116 provides tone burst operation giving discrete bursts of signal from 2 to 256 cycles in binary increments. The VCG feature offers precision control of frequency by external voltage, either dc programming or wide band ac frequency modulation. Trigger capability allows triggered or gated operation from an external pulse or gate and single cycle operation (or tone burst, Model 116) by manual push button. Phase-lock operation converts the generator to a slave unit where the frequency is locked to an external frequency input, such as a crystal or master system clock; the relative phase of the two sources is controllable over 360°. The combination of features in these compact portable instruments makes either one virtually indispensable for field or laboratory tests and design operations.

VERSATILITY

Waveforms

Sine ∿ , square ⊓ , triangle △ , ramp ◿ , and sync pulse.

Dynamic Frequency

0.0015 Hz to 1 MHz (10 min to 1 μsec).

Nine Simultaneous Outputs

1. ∿ , ◠ , ⊓ , ⊔ , △ , ◭ , ◿ or ◹ selectable with variable amplitudes. Specs apply from 10% to 100% of max amplitude setting.
   50-Ω output impedance.
   30 V p-p max (15 V◿) into 600-Ω load. 10 V p-p max (5 V◿) into 50-Ω load.

Models 115B and 116B: 5 V p-p into open circuit, 600-Ω output impedance.

2. ⊓ 1 V p-p.
3. ⊓ 5 V p-p.
4. ∿ 5 V p-p.
5. △ 5 V p-p.
6. ◹ 0 V to −2.5 V ramp; 50% duty cycle.
7. ∿ , ⊓ , △ , or ◿ selectable. 5 V p-p differential output 180° out-of-phase with outputs 2 through 6.
8. ∿$_0$ 2.5 V p-p offset +1.25 V.
9. Sync pulse: At least −10 V into open circuit; less than 5 μsec duration.

Note: Outputs 2 thru 7 are 50-Ω output impedance. Output voltage stated is into open circuit.

VCG—Voltage-Controlled Generator

Over 20:1 frequency ratio (selectable in ranges of 3:1, allowing excellent range overlap). 4.75 V input for 20:1 frequency ratio (0.5 V per major dial division ±1%). Input impedance 10 kΩ.

Trigger

Input impedance is 10 kΩ.
Trigger mode: Manual or external voltage of ±0.5 V will generate one cycle.
Gated mode: Discrete number of cycles may be generated by application of +0.5 V gate.
Up to 100 V may be applied without damage to input circuitry.
Trigger level and slope are adjustable by front-panel controls.
The start-stop point of the generated waveform is adjustable through 360°. Haversine is available by adjusting trigger start control to the −90° position and using the offset sine-wave output 8.

Phase Lock

Frequency range is 10 Hz to 1 MHz.
Input impedance is 10 kΩ.
Input amplitude requirements are minimum 800 mV p-p to lock and 5 V p-p sine wave for specified accuracy.
An input of 100 V will not damage circuitry. Unit will frequency lock to any input within 10 to 1 of dial frequency and will be phase locked to the fundamental of the dial frequency within specified accuracy. Phase accuracy is ±10° from 10 Hz to 10 kHz.
Indicator "phase uncalibrated" light illuminates when selected phase relationship is exceeded. Unit will maintain frequency lock even when light is on.

Tone Burst (Model 116 only)

Tone burst may be generated automatically on command in the trigger mode. Selectable from a front-panel control, the unit will generate 1, 2, 4, 8, 16, 32, 64, 128 and 256 discrete cycles. The unit may be gated from an external voltage and a discrete number of cycles may be generated by selection of the proper gate length (see Trigger).

STABILITY*

Short term: ±0.05% for 10 min.
Long term: ±0.25% for 24 hr.
*Percentages apply to amplitude, frequency and dc offset.

HORIZONTAL PRECISION

Dial Accuracy

±1% of full scale to 100 kHz.
±2% of full scale 100 kHz to 1 MHz.

Typical VCG Linearity

±0.1% frequency vs input voltage (frequency error 0.1% of total deviation—best straight-line method). 0.0015 Hz to 100 kHz generated frequency. From 10% to 100% of max dial frequency.

VCG Bandwidth

100 kHz.

Jitter

±0.025% cycle-to-cycle stability.

VERTICAL PRECISION

Frequency Response

Amplitude change with frequency less than 0.1 db 0.0015 Hz to 100 kHz and 0.5 db 100 kHz to 1 MHz.

PURITY

Sine Wave Distortion

Less than:
0.5% 0.0015 Hz to 10 kHz.
1.0% 10 kHz to 100 kHz.
2.0% 100 kHz to 600 kHz.
3.0% 600 kHz to 1 MHz.
Induced distortion due to phase lock operation: 1% 10 Hz to 100 kHz and 2% 100 kHz to 1 MHz.

Triangle and Ramp Linearity

Greater than:
99% 0.0015 Hz to 100 kHz.
95% 100 kHz to 1 MHz.

Ramp Fall Time

Less than 250 nsec.

Square Wave Rise and Fall Time

Less than 10 nsec, output 2.
Less than 15 nsec, output 3.
Less than 100 nsec, output 1.

Total Aberrations

Less than 5% (overshoot, preshoot, etc.) when properly terminated.

ENVIRONMENTAL

Temperature

All specifications listed, except stability, are for 25°C ±5°C.
For operation from 0°C to 55°C, derate all specifications by a factor of 2.

MECHANICAL

Dimensions

7¾ in. w, 5¼ in. h, 11½ in. d.

Weight

10 lb, 15 lb shipping.

Power

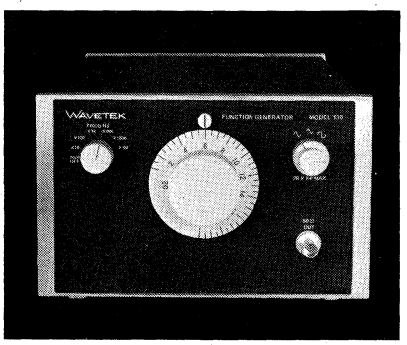
Models 115/116: 105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 W. Ni-cad unit available.

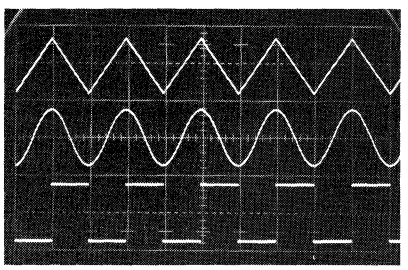
ORDER INFORMATION

Prices (F.O.B. San Diego)

Model 115, $745 Model 116, $845
Model 115B, $845 Model 116B, $945

Model 130
Function Generator





The Wavetek Model 130 Function Generator is a low-cost, high-purity source of sine, square, and triangle waveforms. It provides selectable and variable outputs over a dynamic frequency range 0.2 Hz to 2 MHz. Rugged construction, compact size and precision operating characteristics make the Model 130 a portable laboratory of test signals in one economical package. It is ideal for ultrasonic audio and video applications — from trouble-shooting to exotic IC design.

VERSATILITY

Waveforms

Sine ∿ , square ⊓ , triangle △ , and sync pulse.

Dynamic Frequency

0.2 Hz to 2 MHz.

Ranges

X10 = 0.2 Hz to 20 Hz.
X100 = 2 Hz to 200 kHz.
X1K = 20 Hz to 2 kHz.
X10K = 200 Hz to 20 kHz.
X100K = 2 kHz to 200 kHz.
X1M = 20 kHz to 2 MHz.

Outputs

Sine ∿ , square ⊓ , and triangle △
Selectable and variable over 40 db with vernier control.
50-Ω output impedance (600-Ω available by removing one jumper wire). Greater than: 20 V p-p into open circuit; greater than: 10 V p-p into 50-Ω load.
Sync Pulse: Approximately 10 V p-p square wave, 10 kΩ output impedance.

STABILITY

Short term: ±0.05% for 10 min.
Long term: ±0.25% for 24 hr.
Percentages apply to amplitude, frequency and dc offset.

HORIZONTAL PRECISION

Dial Accuracy

±2% of full scale, 2 Hz to 2 MHz.

VERTICAL PRECISION

Frequency Response

Amplitude change with frequency less than 0.5 db, 0.2 Hz to 200 kHz and 0.1 db, 200 kHz to 2 MHz.

PURITY

Sine Wave Distortion

Less than: 1.0%, 0.2 Hz to 200 kHz.
Less than: 5.0%, 200 kHz to 2 MHz.

Square Wave Rise and Fall Time

Less than 100 nsec.

ENVIRONMENTAL

Temperature

All specifications listed, except stability, are for 25°C ±5°C.
For operation from 0°C to 55°C, derate all specifications by a factor of 2.

MECHANICAL

Dimensions

8 in. w, 5¼ in. h, 10½ in. d.

Weight

10 lb net, 15 lb shipping.

Power

105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 watts.

ORDER INFORMATION

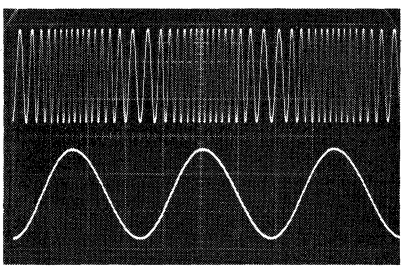
Price: (F.O.B. San Diego)

Model 130, $295.

Note: Specifications apply from 0.2 to 2 on the frequency dial. Price and specifications subject to change.

Model 131 VCG





The Model 131 VCG is a precision source of sine, square and triangle waveforms. It offers control of frequency by external voltage — either dc programming or wideband ac frequency modulation. The instantaneous frequency of these waveforms is determined by the combination of the dial setting and the externally applied voltage. The VCG input is in parallel with the frequency dial. Set the dial at mid-frequency and increase the frequency with positive voltage or decrease it with negative voltage. Set the dial at the lowest point and increase frequency with positive voltage. Set the dial at the highest point and decrease frequency with negative voltage. Actually, the Model 131 VCG is a portable oscillator, square-wave generator, FM modulator, frequency shift keyer and sweep generator — all in one economical package.

VERSATILITY

Waveforms

Sine ∿ , square ⊓ , triangle △ , and sync pulse.

Dynamic Frequency

0.2 Hz to 2 MHz

Ranges

X10 = 0.2 to 20 Hz.
X100 = 2 Hz to 200 kHz.
X1K = 20 Hz to 2 kHz.
X10K = 200 Hz to 20 kHz.
X100K = 2 kHz to 200 kHz.
X1M = 20 kHz to 2 MHz.

Outputs

Sine ∿ , square ⊓ and triangle △ . Selectable and variable over 40 db with

Model 134
Sweep Generator

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007

vernier control.
50-Ω output impedance (600-Ω available by removing one jumper wire). Greater than: 20 V p-p into open circuit. Greater than: 10 V p-p into 50-Ω load.
Sync Pulse: Approximately 10 V p-p square wave, 10 kΩ output impedance.

VCG—Voltage Controlled Generator
Approximately 5 V input for 100:1 frequency ratio.

STABILITY
Short term: ±0.05% for 10 min.
Long term: ±0.25% for 24 hr.
Percentages apply to amplitude, frequency and dc offset.

HORIZONTAL PRECISION
Dial Accuracy
±2% of full scale, 2 Hz to 2 MHz.

VERTICAL PRECISION
Frequency Response
Amplitude change with frequency less than 0.5 db 0.2 Hz to 200 kHz and 1 db. 200 kHz to 2 MHz.

PURITY
Sine Wave Distortion
Less than: 1.0% 0.2 Hz to 200 kHz.
Less than: 5.0%, 200 kHz to 2 MHz.

Square Wave Rise and Fall Time
Less than 100 nsec.

ENVIRONMENTAL
Temperature
All specifications listed, except stability, are for 25°C ±5°C.
For operation from 0°C to 55°C, derate all specifications by a factor of 2.

MECHANICAL
Dimensions
8 in w, 5¼ in h, 10½ in d.

Weight
10 lb net, 15 lb shipping.

Power
105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 watts.

ORDER INFORMATION
Price: (F.O.B. San Diego)
Model 131, $345.

Note: Specifications apply from 0.5 to 10 on the frequency dial. Price and specifications subject to change.



The Model 134 is two independent generators in a single compact unit. The first generator is a precision source of sine, square and triangle waveforms. The second is a ramp generator for sweeping the frequency of the first. Both generators may be operated continuously or triggered with independent frequency control.

In addition to internal sweep control, terminals are provided for external voltage control of frequency (VCG) — either dc programming or wideband ac frequency modulation. The Model 134 Sweep/Trigger VCG is a portable oscillator, square wave generator, FM modulator, frequency shift keyer, sweep and tone-burst generator.

Outputs
Sine ∿, square ⊓, and triangle △, selectable and variable over 40 db with vernier control. 50-Ω output impedance (600-Ω available by removing one jumper wire). Greater than 20 V p-p into open circuit; greater than 10 V p-p into 50-Ω load; sweep output may also be selected and attenuated offering < 10 V peak sawtooth into open circuit and < 5 V peak into 50-Ω.
Sync Pulse: Approximately 10 V p-p square wave, 10 kΩ output impedance.

VERSATILITY
Waveforms
Sine ∿, square ⊓, triangle △, and sync pulse.

Dynamic Frequency
0.2 Hz to 2 MHz.

OPERATIONAL MODES
Continuous—Operates as a standard VCG. Frequency determined by dial/vernier/range settings in parallel with VCG input.
Trigger—One complete cycle is generated by applying a pulse to the trigger input.
Gated—Same as trigger except that cycles continue for the duration of input trigger.
Continuous Sweep—The main generator is frequency modulated by the sweep generator. When swept, the main generator frequency rises from the frequency set by the dial and range settings to a frequency selected by the sweep-width controls. Sweep rate is set by panel controls.
Triggered Sweep—Same as continuous sweep mode except one complete sweep cycle is generated for each input trigger pulse. Main generator continues to oscillate between sweep cycles.
Tone-Burst—Main generator is gated by the sweep output (internally connected). The tone-burst rate and length can be independently controlled.

Trigger Input
+1 V 10 kΩ input impedance.

Sweep Time
10 μsec to 100 sec.

Sweep Width
Up to 1000:1 with calibrated control.

VCG — Voltage-Controlled Generator
Approximately 5 V input for 100:1 frequency ratio.

STABILITY
Short term: ±0.05% for 10 min.
Long term: ±0.25% for 24 hr.
Percentages apply to amplitude, frequency and dc offset.

HORIZONTAL PRECISION
Dial Accuracy
±2% of full scale, 2 Hz to 2 MHz.

VERTICAL PRECISION
Frequency Response
Amplitude change with frequency less than 0.5 db, 0.2 Hz to 200 kHz and 1 db, 200 kHz to 2 MHz.

PURITY
Sine Wave Distortion
Less than: 1%, 2 Hz to 200 kHz.
Less than: 5.0%, 200 kHz to 2 MHz.

Square Wave Rise and Fall Time
Less than 100 nsec.

ENVIRONMENTAL
Temperature
All specifications listed, except stability, are for 25°C ±5°C.
For operation from 0°C to 55°C, derate all specifications by a factor of 2.

MECHANICAL
Dimensions
8 in w, 5¼ in h, 10½ in d.

Weight
10 lb net, 15 lb shipping.

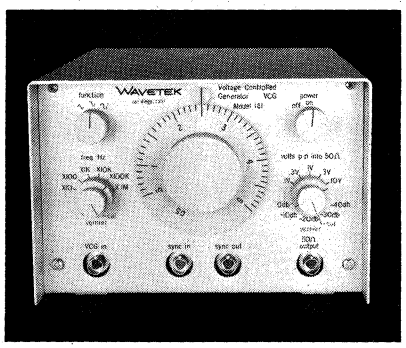
Power
105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 10 watts.

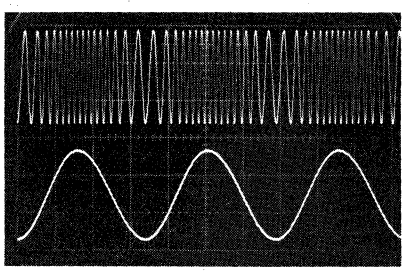
ORDER INFORMATION
Price: (F.O.B. San Diego)
Model 134, $495.

Note: Specifications apply from 0.5 to 10 on the frequency dial. Price and specifications subject to change.

Model 141 VCG

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Model 141 Voltage Controlled Generator (VCG) is a precision source of sine, square, and triangle waveforms generated from 0.5 Hz to 5 MHz. The instrument incorporates VCG circuitry which allows external frequency control over a 1,000:1 range. External control can be either dc programming or wideband ac frequency modulation.

A precision attenuator accurately controls the waveform output level. This attenuator is calibrated in 10-db steps from 10 volts peak-to-peak. Complementing the decade attenuation control is an overlapping vernier control that permits continuous amplitude adjustment.

A synchronizing input is also provided for locking the generator to an external frequency source. When used in this mode, the generator locks to any external signal of at least 5 volts peak-to-peak amplitude that is within 1% of the generator frequency. This permits the generator to produce highly accurate square and triangle waveforms when locked to a precision sine wave source. The all-solid-state Model 141 is contained in a rugged portable package. The precision waveforms, wide frequency range, and functional versatility combine to make it ideally suited as a general-purpose signal generator, an FM modulator, or a sweep generator.

VERSATILITY

Waveforms
Sine ∿, square ⊓, triangle △, and sync output.

Dynamic Frequency
0.5 Hz to 5 MHz (2 sec. to 200 nsec.).

Ranges
X10 = 0.5 Hz to 50 Hz
X100 = 5 Hz to 500 Hz
X1K = 50 Hz to 5 kHz
X10K = 500 Hz to 50 kHz
X100K = 5 kHz to 500 kHz
X1M = 500 kHz to 5 MHz

Main Output
Sine ∿, square ⊓, triangle △, triangle selectable. Maximum amplitude approximately 20 V p-p into an open circuit with calibrated 10 V, p-p into a 50-Ω load. Precision output attenuator in 10-db steps to −40 db with a 10-db vernier giving over-all attenuator capability greater than 50 db. Output impedance is 50-Ω. Short circuit output current is ±100 mA.

Sync Output
Positive- and negative-going pulses coincident with the positive and negative transitions of the square wave.

Amplitude and DC Offset Stability
Short term (10 min): Drift less than ±0.05% of setting.
Long term (24 hr): Drift less than ±0.25% of setting.

HORIZONTAL PRECISION

Frequency Accuracy (Dial Accuracy)
±1% of full scale to 500 kHz.
±3% of full scale to 5 MHz.

Jitter
±0.025% cycle-to-cycle stability to 1 MHz.

Vernier
Electronic frequency vernier provided for precision frequency adjustment.

Sync Input
The instrument may be synchronized to an external signal of at least 5 V p-p. Model 141 frequency must be within 1% of input frequency for lock to occur. A slight change in triangle and sine amplitude occurs when locked. Induced sine distortion is less than 1%.

Time Symmetry (All Waveforms)
99.5% to 500 kHz; 99% to 5 MHz.

VOLTAGE-CONTROLLED GENERATOR

VCG Control
Up to 1,000:1 frequency change with external voltage input. Frequency is limited to maximum of selected range. Required external signal for full voltage control is 2.5 V with an input impedance of 50 Ω.

VCG Input Frequency
DC to 1 MHz. VCG response less than 3 db down at 100 kHz.

VCG Linearity
±0.1%, output frequency vs input voltage—best straight-line method, from 0.5 to 5 times frequency range setting.

VERTICAL PRECISION

Peak-to-Peak Voltage Accuracy
±1%, reference 5 kHz at 0 and −10 db settings.
±3%, reference 5 kHz at −20, −30, and −40 db settings.

Frequency Response
Sine and square output: Amplitude change with frequency less than 0.1 db to 500 kHz, and 0.5 db to 5 MHz.
Triangle Output: Amplitude change with frequency less than 0.1 db to 500 kHz and 1.0 db to 5 MHz.

Amplitude Symmetry
All waveforms are symmetrical about ground within ±1% of max p-p amplitude.

WAVEFORM PURITY

Sine Wave Distortion
Less than:
0.5% to 5 kHz.
1.0% to 50 kHz.
2.0% to 500 kHz.
500 kHz to 5 MHz, all harmonics at least 30 db down.

Triangle Linearity
Greater than 99% to 100 kHz.

Square Wave Rise and Fall Time
Less than 30 nsec.

Total Aberrations
Less than 5%.

ENVIRONMENTAL

Temperature
All specifications listed except for stability are for 25°C ±5°C. For operation from 0°C to 55°C derate all specifications by a factor of 2.

MECHANICAL

Dimensions
7¾ in. w, 5¼ in. h, 11½ in. d.

Weight
7 lb, 10 lb shipping.

Power
105 V to 125 V or 200 V to 250 V; 50 to 400 Hz. Less than 10 W.

Controls
Power on/off switch, frequency range switch, frequency dial, frequency vernier, function selector switch, amplitude selection switch, amplitude vernier. Rear panel: dc zero adjust and external dc offset input.

ORDER INFORMATION

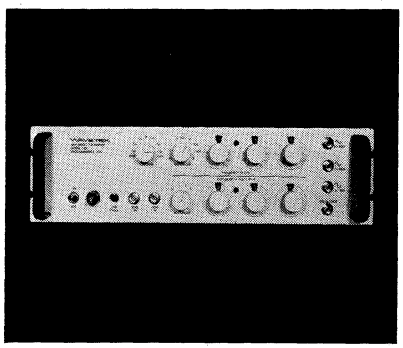
Price (F.O.B. San Diego)
Model 141, $645
Note: Specifications apply from 0.5 to 5 on the frequency dial after 30-min warmup.

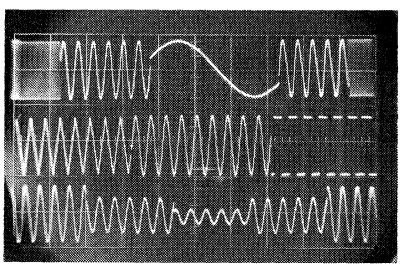
Audio Range Sweep Option
Specifications similar to the Model 141 except that the frequency dial range is from 0.2 to 2. This allows the entire audio band of 20 Hz to 20 kHz to be swept without range switching.

Price (F.O.B. San Diego)
Model 141-A, $645

Models 150 & 155 Programmable VCGs

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Series 150 Programmable Voltage-Controlled Generators are precision sources of sine, square and triangle waveforms that are designed for automatic system application. The Model 155 has local and remote digital control (Model 150 remote only) of frequency, function and amplitude. Additionally, both generators may be controlled by analog voltage in the following manner: the frequency may be programmed or modulated by an ac or dc signal. Generator output may be initiated by means of a trigger which will generate one complete cycle, and/or a gate input which will provide a signal burst of an integral number of cycles for the duration of the applied gate. In the Model 155, programming is accomplished using front-panel switches. The frequency range consists of 8 decade ranges with 3 decimal digits of resolution covering the dynamic range of 0.01 Hz to 1 MHz. The signal amplitude consists of 3 decade ranges with 3 decimal digits of resolution covering the dynamic range of 0.01 volt to 10 volts peak-to-peak. Output range scaling is accomplished using an attenuator with 50-Ω output impedance on all ranges. All specifications require that the output be terminated by a 50-Ω load. The functions and modes are selected by a multiple deck switch. All these controls may be activated remotely by contact closures through a 50-pin connector on the rear panel of both models. The 3-pin digit control of frequency and amplitude is 8421 BCD coded with only 12 lines required for each. The ranges and functions are controlled by 1 line per function. Standard interface options are available so that any logic input may be converted in the instrument to provide proper information control. The Series 150 Programmable VCGs may be driven by computers, punched cards, or tape and servo switch devices. They are useful in automatic test systems, automatic control tools, production test stands, and as precision laboratory test generators.

VERSATILITY

Waveforms
Sine ∿, square ⊓, and triangle △.

Dynamic Frequency
0.01 Hz to 1 MHz in 8 ranges.

Four Simultaneous Outputs
1. ∿, ⊓, △, selectable and digitally variable from 0.01 V to 10 V p-p into a 50-Ω load in 3 ranges with 3-digit resolution.
2. ∿ 1 V p-p into 50-Ω load.
3. △ 1 V p-p into 50-Ω load.
4. ⊓ 0.5 V p-p into 50-Ω load.

Note: All outputs may be shorted without damage to instrument. This specification includes frequency stability.

VCG Analog Voltage Control
Over 20:1 frequency ratio. Analog frequency control and/or modulation. Input impedance is 10 kΩ.

Trigger
Manual or external voltage input control generator in trigger mode. A pulse will generate 1 cycle and a gate will allow a burst of cycles, the number determined by the length of the gate.
Input impedance 10 kΩ.
Input trigger voltage ±5 V to ±100 V.

HORIZONTAL PRECISION

Program Frequency Accuracy
±1% +1 digit with following exceptions: X.01 range is ±2% +1 digit; X100K range is ±5% +1 digit.

Typical VCG Linearity
±0.2% of frequency vs. input voltage, (frequency error 0.2% of total deviation best straight-line method).
0 V to 5 V gives 10:1 frequency deviation. Absolute frequency accuracy same as programmed frequency.

VCG Bandwidth
100 kHz.

VERTICAL PRECISION

Amplitude change with frequency less than 0.1 db to 100 kHz and 0.5 db to 1 MHz.

Peak-to-Peak Voltage Accuracy
Output 1 ±1% +1 digit of the programmed voltage 0.01 Hz to 100 Hz and ±5% +1 digit of the programmed voltage 100 kHz to 1 MHz when properly loaded with 50-Ω. Outputs 2 through 4 ±1% of stated output when properly loaded with 50-Ω. This specification includes amplitude stability.

Symmetry
All waveforms are symmetrical about ground within ±1% of max. p-p amplitude.

DC Offset Stability
Short term: 0.05%; long term: 0.25%.

PURITY

Sine Wave Distortion
Less than:
1% 0.01 Hz to 99.9 kHz.
3% 100 kHz to 1 MHz.

Triangle Linearity
Greater than:
99% 0.01 Hz to 99 kHz.
95% 100 kHz to 1MHz.

Square Wave Rise and Fall Time
Less than 150 nsec. output 1.
Less than 10 nsec. output 4.

PROGRAMMING

Basic units are programmable by remote contact closure. Frequency, function and amplitude may all be programmed. Frequency and amplitude have 3 digits resolution programmed by 8421 BCD code. Range and function selection direct-line contact. The Model 150 is remote programming only. The Model 155 is local and remote control. Local switches override remote programming.

INTERFACE OPTIONS

Option 1—Logic Level.
8421 code "1" = ±5 V to ±20 V dc, 15 mA/line max "0" = 0 V to ±0.5 V, $600.
Option 2—Logic Level.
8421 code "1" = 0 V to ±0.5 V.
"0" = ±5 to ±20 V dc, 15 mA/line max, $600.
Option 2S
Same as above with "0" = +3.5 V dc, 15 mA/line max.

Note: Consult factory for other options available.

ENVIRONMENTAL

Specifications apply at 25°C ±5°C. For operation 0°C to 50°C, derate by factor of 2.

MECHANICAL

Dimensions
19 in. w, 5¼ in. h, 16¼ in. d.

Weight
10 lb, 15 lb shipping.

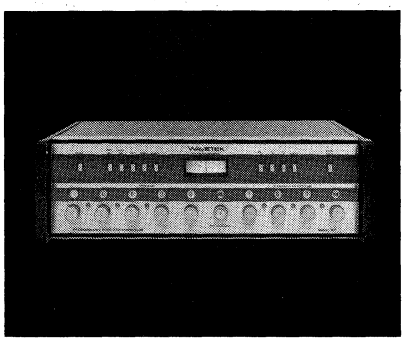
Power
105 V to 125 V or 200 V to 250 V; 50 Hz to 400 Hz. Less than 15 W.

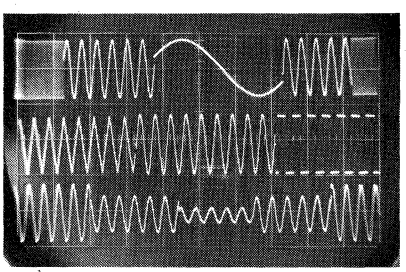
ORDER INFORMATION

Prices (F.O.B. San Diego)
Model 150, $995 Model 155, $1,195

Model 157 Programmable Waveform Synthesizer

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007





The Model 157 Programmable Waveform Synthesizer is a precision source of sine, square and triangle waveforms generated over a frequency range of 100 μHz to 1 MHz. This unique multifunction generator features:

1. 0.01% frequency accuracy.
2. 100 μHz (2.77 hr/cycle) to 1 MHz (1 μsec) frequency range.
3. Sine, square, triangle waveforms.
4. 1,000:1 VCG.
5. Triggered/gated operation.
6. Selectable amplitude to 10 volts peak-to-peak.
7. All parameters programmable.

The frequency, function and amplitude of the generator can be controlled locally with front-panel switching or remotely by BCD/binary programming. Frequency accuracy is 0.01% of programmed frequency with 5-digit resolution on each of 10 ranges. The output voltage level can be programmed from 1 millivolt to 10 volts, peak-to-peak, in four ranges with 0.2% accuracy and 3-digit resolution.

The frequency of the Model 157 can be modulated about an accurately set center frequency by application of an ac voltage input. With a sawtooth input, the frequency can be swept over a 1,000:1 ratio.

A trigger capability is included to allow a single cycle of any waveform, or a burst of cycles, when gated from an external source. In addition, a frequency-search control is provided on the front panel that provides continuous sweep over the selected range with one turn of the control.

The combination of extremely broad signal range, frequency accuracy, and programmability make this instrument ideally suited for the demanding requirements of automatic system testing. It may be programmed by computers, paper tape, magnetic tape, IBM cards, servo switches, or remote-control stations. The instrument will respond to a program change in 1 milliseconds. Typical applications for the Model 157 are:

Automatically swept tone-burst signal source for programmed sonar transducer checkout.

Precise source of discrete frequency changes for audiometric research.

Muscle and tissue stimulus for biomedical research.

Low-frequency triangle waveform for metal testing to determine elongation and modulus of elasticity of samples.

Precision source for the determination of soil compressibility in geophysical studies.

Extremely low-frequency signals for earthquake-simulation studies.

The automatic-programming concept of the Model 157 propels the voltage-controlled oscillator (VCO) into the Computer Age at a time when more and more manufacturers are converting to automatic data processing (ADP) to produce, test and calibrate electronic products. In the easily foreseeable future, the demand for programmable instruments will exceed that now known for conventional manually controlled instruments.

The binary-coded-decimal (BCD) format that commands the Model 157 is used universally and is one of the simplest codes to program. Because all controllers do not use the same logic levels, Wavetek has designed the Model 157 to be optionally available in all of the following commonly-used logic configurations:

Option A: Inverse logic with positive voltage (logical one = 0 volts, logical zero = +2 volts to +10 volts).

Option B: Inverse logic with negative voltage (logical one = 0 volts, logical zero = −2 volts to −10 volts).

Option C: True logic with negative voltage (logical one = −2 volts to −10 volts, logical zero = 0 volts).

Option D: True logic with positive voltage (logical one = +2 volts to +10 volts, logical zero = 0 volts).

When no logic configuration is specified on the sales order, the Option A configuration will be shipped as the standard instrument. When Option B, C, or D is ordered, the specified logic configuration will be supplied at no additional cost.

Besides digital programming of frequency, amplitude and function, the VCO sweep and the gated tone-burst can be automatically programmed from digital or analog sources.

VERSATILITY

Waveforms

Sine ∿, square ⊓, and triangle △.

Dynamic Frequency

100 μHz to 1 MHz in 10 ranges (2.77 hrs to 1 μsec).

Outputs

∿, ⊓, △, selectable and digitally variable from 0.001 V to 10 V p-p into a 50-Ω load in 4 ranges with 3-digit resolution (0.002 to 20 V p-p open circuit).

Note: Output may be shorted without damage to instrument.

VCG—Voltage-Controlled Generator

Over 1000:1 frequency ratio with 5 V signal. Input impedance is 10 kΩ.

OPERATIONAL MODES

Trigger Mode

Generator may be triggered to produce single cycles on command or gated to produce any discrete number of cycles by applying a + gate signal to trigger input for the length of the desired burst.

Input Impedance is 10 kΩ.

Plus gate required is +5 V to +50 V.

Auto Cal Mode

Generator has an automatic control loop to maintain the output frequency for high accuracy and stability.

Manual Cal Mode

Generator is manually calibrated using the control loop but is then automatically returned to the open-loop condition so that it may be swept or triggered.

Search Mode

Generator frequency control within the selected range is transferred from the digital controls to a single turn analog control for convenient manual sweeping of the entire range.

Sync In

Within the upper 4 ranges, the instrument may be frequency synchronized to an external signal of approximately 1 V p-p that is within 1% of the free-running frequency. The induced sine distortion will be less than 1%.

Sync Out

A fixed amplitude square wave is brought out at 1 k impedance for syncing scopes or other equipment.

Model 157 Programmable Waveform Synthesizer

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007

HORIZONTAL PRECISION

Auto Cal Mode

Frequency accuracy from programmed input or front-panel selector switches is ±0.01% of programmed frequency, ±1 digit.

Closed-loop stability is within ±0.005% of programmed frequency at constant temperature for a 24-hour period.

Settling time of control loop—Loop will settle to within the accuracy specification of its final value in less than 3 sec max (1 msec for small-step changes).

Manual Cal Mode

Instrument can be calibrated to within an accuracy of 0.02% of programmed frequency and triggered or frequency modulated about this accurate center frequency. Open-loop stability is within 0.05% of setting for eight-hour period at constant temperature.

VCG Bandwidth

1 MHz.

Slew rate—100% of range per μsec.

VCG Linearity

Frequency vs input voltage—best straight-line method.

±0.1% 100 MHz - 10 kHz.

±1% 10 kHz - 100 kHz.

±3% 100 kHz - 1 MHz.

VERTICAL PRECISION

Amplitude change with frequency is less than 0.1 db to 100 kHz and 0.5 db to 1 MHz.

Peak-to-Peak Voltage Accuracy % of Program

1 V to 10 V range ±(0.1% +5 mV).

0.1 V to 1 V range ±(1% +1 mV).

10 mV to 100 mV range ±(1% +0.1 mV).

1 mV to 10 mV range ±(1% ±0.1 mV).

Amplitude Symmetry

All waveforms are symmetrical about ground ±1% of full range.

Trigger start-stop point will be 0 V ±0.5% of output amplitude program.

PURITY

Sine Wave Distortion

Less than:

0.5% 100 μHz to 10 kHz.

1% 10 kHz to 100 kHz.

3% 100 kHz to 1 MHz.

Triangle Linearity

Greater than:

99% 1 Hz to 100 kHz.

95% 100 kHz to 1 MHz.

Square Wave Rise and Fall Time

Less than 100 nsec.

ISOLATION

Output signal can be raised above ground up to 250 V. Caution must be taken as all exposed BNC connectors are at raised potential.

ENVIRONMENTAL

Temperature

Specifications apply at 25°C ±5°C.

Operating temperature range 0°C to 50°C.

REMOTE CONTROL SPECIFICATIONS

Configuration A (Standard)

True or Logic **"1" = 0 V ±1 V.**

Note: 0 V sinks approximately 1.5 mA.

False or Logic **"0" = +2 V to +10 V.**

Note: Open circuit voltage is approximately +2 V.

Configuration B

True or Logic **"1" = 0 V ±1 V.**

Note: 0 V sinks approximately 1.5 mA.

False or Logic **"0" = −2 V to −10 V.**

Note: Open circuit voltage is approximately −2 V.

Configuration C

True or Logic **"1" = −2 V to −10 V.**

Note: −2 V sinks approximately 1.5 mA.

False or Logic **"0" = 0 V to −1 V.**

Note: Open circuit voltage approximately +0.7 V.

Configuration D

True or Logic **"1" = +2 V to +10 V.**

Note: +2 V sinks approximately 1.5 mA.

False or Logic **"0" = 0 V to +1 V.**

Note: Open circuit voltage approximately −0.7 V.

Program Transition Time

1 msec.

MECHANICAL

Weight

22 lb, shipping 27 lb.

Power

105 Vac or 125 Vac or 210 Vac to 250 Vac, 50 Hz to 400 Hz.

50 W of power required.

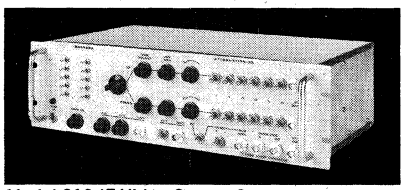
ORDER INFORMATION

Price: (F.O.B. San Diego)

Model 157, $2995

Sweep Generators for TV Industry

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007



Model 310 IF-Video Sweep Generator



860 Series Combination VHF-UHF Sweep Generators

200 Series Video Sweep Generator

These instruments provide a wideband, flat, sweep signal of from 0.1 MHz to 10 MHz. The instrument will also sweep portions as narrow as 1 MHz throughout the entire frequency range. The instrument is designed specifically for testing video stages and chroma applifiers in monochrome or color TV receivers. They also find applications in closed-circuit TV and other video transmission systems. Up to 10 crystal-controlled pulse-type markers are available at discrete customer frequencies and the markers are extremely flexible, providing plus or minus 35-volt pulses for oscilloscope Z-axis modulations. Also, they may be used to shut off the sweep oscillator allowing a useable presentation on wideband oscilloscopes. The markers may also be connected to the oscilloscope horizontal or vertical axis for pulse indications.

Frequency Range
0.1 to 10 MHz.
Sweep Width
1 MHz to 10 MHz.
Output Amplitude
1 V rms (75 Ω).
Output Amplitude Variation
±0.5 db over max sweep width.
Sweep Rate
Line frequency.
Attenuation
99 db, in 3-db steps.

300 Series IF Sweep Generator

These instruments provide fixed-frequency, fundamental outputs for alignment and evaluation of intermediate frequency amplifiers. Models are available between 20 and 80 MHz, fitting the requirements of U. S. or foreign television receivers. They are also ideal for military or industrial applications in this frequency range. Bandpass measurements or other points of interest on a demodulated IF envelope are easily identified with the accurate, sharp, crystal-controlled pulse-type markers provided. These markers, like the 200 series, may be used internally or externally. Several optional features are available with the 300 Series, providing extremely accurate, expanded views of the rejection traps for either IF, video or automatic color phase control. For further details, contact factory representative.

Frequency Range
20-80 MHz (U.S. or foreign standards).
Sweep Width
5 MHz to 15 MHz.
Output Amplitude
1 V rms (75 Ω).
Output Amplitude Variation
±0.25 db.
Sweep Rate
Line frequency.
Attenuation
99 db, in 3-db steps.

400 Series VHF Sweep Generator

This series provides any 13 television channels to either U. S. or foreign standards. All switching is from dc contacts, eliminating the maintenance problems in obsolete instruments which are switching oscillator-lumped constants. Markers are provided at the video and sound carriers of the standard selected and optional features allow the addition of extra markers, local oscillator tracking features or a total of 7 markers on an independent IF function position. Units are available for 5¼ inch x 19 inch rack mounting or in a portable 6 inch x 7 inch x 10 inch cabinet. Other optional features are available as standard items providing complete self-contained test stations for tuner manufacturers. Please contact the factory for specific details.

Frequency Range
Any 13 channels to U. S. or foreign standards.
Sweep Width
5 MHz to octave bands.
Output Amplitude
0.75 V rms (75 Ω).
Output Amplitude Variation
±0.25 db over any channel.
Attenuation
±0.5 db over max frequency range.
99 db, in 3-db steps.

500 Series UHF Sweep Generator

These instruments provide frequency coverage of from 435 to 930 MHz and are designed primarily for the evaluation and alignment of UHF TV tuners and receivers. Instruments are available with video and sound pulse-type markers on all 69 UHF channels with counterparts to European or other standards. Sweep width is continuously adjustable from 5 MHz to 60 MHz and, once preset, maintains a constant bandwidth throughout the entire tuning range.

Frequency Range
435 to 930 MHz.
Sweep Width
5 MHz to 60 MHz.
Output Amplitude
0.5 V rms (50 Ω).
Output Amplitude Variation
±0.25 db over any 50 MHz portion;
±0.5 db over max range.
Sweep Rate
Line frequency.
Attenuation
45 db, in 5-db steps.

Combination Sweep Generators

Since the 200, 300, 400 and 500 Series instruments just described are all of modular plug-in, solid-state construction, they easily lend themselves to a combination of multiple functions. Combination instruments available are described as follows:

Model 310 IF-Video Sweep Generator

This instrument provides the functions of both 200 and 300 Series, using a common 5¼ inch x 19 inch x 10 inch package. An additional savings of up to $500 under the cost of separate units, is attained by using common markers for both the video and IF functions. The Model 310 is ideal for the engineering laboratory, quality control or repair facilities in production TV receiver manufacturing facilities, or in the large-volume TV repair shops.

860 Series Combination VHF-UHF Sweep Generators

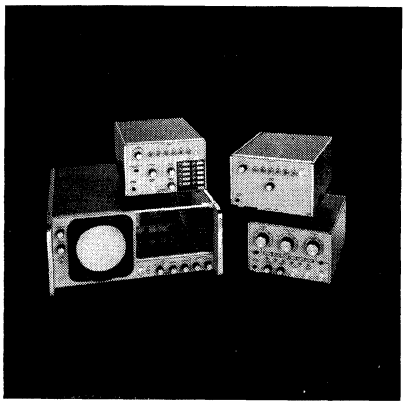
These instruments are a combination of the 400 and 500 Series VHF or UHF Sweep Generators. They provide the same frequency coverage, optional features and specifications and are designed for the engineering laboratory, quality control test station and repair facility. Due to space limitations, all optional features cannot be included and the factory or area representative should be consulted regarding the user's specific requirements.

Distribution Amplifiers

A single Series 300 Sweep Generator may be used with up to 20 Series 30 Distribution Amplifiers. Amplification, isolation, automatic leveling and adjustable amplitude of 0.1 to 1.5 V rms are provided at each test station with a flatness of ±0.25 db. More stations may be accommodated by using one amplifier to drive 20 additional stations.

Programmable Sweep Generators

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007



1000 Series Automatic Programmable Sweep Generators

A new series of sweep generators, unique in both operation and packaging, have been introduced by Wavetek-Indiana. These units provide all-modular construction, including power supply and cabinet. By removing the power supply and cabinet, the basic sweep-generator functions may be mounted in the Wavetek SA series laboratory type, 5-inch electrostatic X-Y display oscilloscope. This provides a completely integrated package with a minimum of space, interconnecting cables, etc.

All of the 1000 Series Sweep Generators utilize pin diode attenuator and leveling systems. This provides a method of leveling the sweep oscillator, or buffer amplifier, output without controlling B+; this results in little or no clipping of the RF envelope. Instead, leveling is controlled by bias on pin diode attenuator. Since the pin diode exhibits a wide attenuation range over the frequency with which they are used (and because they are in a closed-loop control system), the various 1000 Series instruments provide a continuously variable or dc programming output leveling adjustment of from 0 to 20 or 0 to 30 db.

The 1000 Series instruments also are completely voltage-tuned and voltage-swept, again allowing dc control from internal potentiometers or external analog programming. A unique feature available with the 1401, 1501, 1601 and 1001 programmer, provides automatic operation of both tuning and attenuation and, depending upon the test device and programming interface, the sweep oscillator bandwidth. This allows the instrument to be connected to the test device, adjusting itself automatically at the frequency to which the device is tuned. Attenuation is automatically programmed to maintain a constant, preset voltage from the test device and/or programming bandwidth to start or stop at the 3-db points. Analog voltages of all three parameters are readily available. These analog voltages may be compared with the desired parameters, providing error signals to automatically retune or adjust the set unit.

Many more applications and unique concepts are covered by the 1001 Series and various application notes are available from Wavetek-Indiana or the area representative. These instruments also find applications in communication checkout systems for the RF devices in telemetering, missile- or gun-control systems. The various instruments available are described in the following paragraphs.

1001 Sweep-Signal/CW Generator

This instrument provides frequency coverage of from 0.1 to 300 MHz and will sweep from 100 kHz to the entire frequency band. It includes a cw function removing the sweep and blanking for use in signal generator applications. To further enhance this use, the leveled output remains in operation (eliminating the need for calibrated output meters) and the output attenuation system is calibrated from +10 to −70 dbm. A companion programmer unit will allow complete automation or automatic operation of the variable parameters, frequency, attenuation and sweep width.

1312 Series Sweep Generator

This series provides extremely narrow or medium coverage of IF amplifiers and components in the frequency range from 5 to 250 MHz. Units are available for most specific bands of interest and the marker systems are designed for the specific band covered. The pulse-type marker output may be used to internally shut off the sweep signal or the extremely accurate ±35 V marker pulses may be added to the oscilloscope for Z-axis modulation. The marker width is always 1/100 of the display allowing easy-to-read indications on very sharp slopes. Instruments are available covering the 4 to 5, 10 to 12, 11 to 13, 20 to 22 or 70 MHz IF bands. Special instruments for other bands of interest are available with no increase in price. Please contact the factory or the area representative for specific details.

1401 VHF Sweep Generator

This instrument provides frequency coverage of from 5 to 300 MHz and is designed for use in VHF television applications where the complete automatic circuits are useful for the evaluation, alignment or repair of VHF TV tuners or receivers. Optional features are available providing an interface with detent or continuously tuned test systems, and also provide easy-to-read indications of oscillator conversion or gain. Without the automatic circuits, the 1401 is ideal for CATV or MATV applications and, again, special optional features are available.

1501 UHF Sweep Generator

This instrument is similar to the 1401, except that it covers the UHF broadcast band from 450 to 950 MHz. It may be used manually, automatically, with complete dc remote programming, or in the complete operation mode. Markers are available and frequency ranges preset for use to U. S. or all European television standards.

1601 Automatic FM Sweep Generator

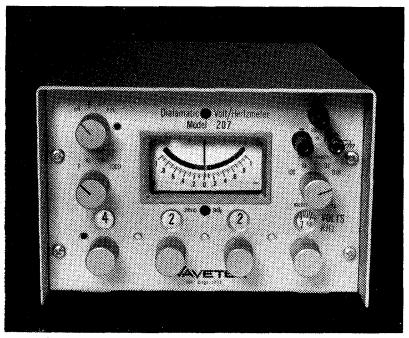
This instrument is similar to the 1401 and 1501 counterparts except that it covers the commercial FM broadcast band (88 to 108 MHz). It also provides complete manual, programming or automatic operation. Optional features are available for complete evaluation and alignment of the tuner, IF amplifier and ratio detector of a receiver, with all signals injected at the antenna terminals.

SA Series 5 Inch X-Y Display Oscilloscope

The SA basic scope frame will accept any of the 1000 Series instruments mentioned previously, providing power requirements, as well as internal connections of the three oscilloscope axes of horizontal, vertical and "Z". The instrument is all-solid-state (except CRT) and has a high-quality, electrostatic focus, 5AQP1 cathode ray tube. Vertical sensitivity is from 10 mV to 100 V/cm and is flat for frequency inputs of from dc to 500 kHz. A switch is provided on the front panel allowing the vertical amplifier to be internally connected to the built-in sweep generator or externally used for other applications.

Model 207 Dialamatic Volt/Hertzmeter

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007



The 207 Dialamatic Volt/Hertzmeter may be used to measure, monitor and tune dc voltage from 0 to 1,000 volts and frequency from 5 Hz to 100 MHz at accuracies to 0.01% of reading. This unique instrument is a differential dc voltmeter and frequency meter combined in a compact, economical package. The accuracy and resolution of the digital device are combined with the analog advantages of fast readings at low frequencies and drift or deviation measurement capability. The decade switch incorporates Wavetek's unique Transfermatic Switch, which automatically carries all transfer points, adding speed to the above advantages. The accuracy of the dc instrument is based on a matched pair of zener diodes and the frequency is based on the stability of a crystal. Frequency is converted to a voltage which is measured using ratio techniques. A novel input trigger circuit eliminates the need for slope and level adjustments and allows measurement of any waveform over a broad range of amplitude variations. The Dialamatic Volt/Hertzmeter may be used for production checkout, frequency alignment and tuning for tachometer and servo applications, and as a precision low-cost, general-purpose, broad-band measurement tool.

FREQUENCY

Frequency Ranges

Direct Input

1 kHz	5 Hz to 1 kHz
10 kHz	50 Hz to 10 kHz
100 kHz	500 Hz to 100 kHz
1,000 kHz	5 kHz to 1,000 kHz
÷ 100 Input	
100 kHz	1 MHz to 10 MHz
1,000 kHz	1 MHz to 100 MHz

Frequency Measurement Accuracy

±0.01% of reading +0.001% of range at constant temperature. Temperature coefficient ±0.0005% of range/°C (calibrated at 25°C).

Typical Response to Step Input

0.01% of range in 3 sec.
0.001% of range in 8 sec.

Deviation Response

Null meter responds to sinusoidal frequency deviations to 0.5 Hz. Meter deflection is down 3 db at 0.5 Hz.

Input Trigger Characteristics

Sensitivity—5 Hz to 1 MHz

The ac-coupled input accepts any time-symmetrical waveform and negative-going pulses from 250 mV p-p to 700 V p-p without need for manual adjustment of slope or lever. Threshold level for positive pulses increases as the duty cycle decreases.

Input Impedance—5 Hz to 1 MHz

For amplitudes less than 5 V peak-to-peak, 1 MΩ shunted by 40 pF.
For amplitudes above 5 V peak-to-peak, 100 kΩ shunted by 100 pF.

Sensitivity—1 MHz to 100 MHz

The ac-coupled input accepts voltage levels from 250 mV rms to 2.5 V rms, limited to 9 x 10^8 V/sec (about 1 V rms at 100 MHz sine wave). 5 V rms maximum input without damage to circuit.

Input Impedance—1 MHz to 100 MHz

50-Ω nominal.

Time Base

1 MHz crystal, ±0.005% accuracy.
Temperature drift ±0.005% −30°C to +90°C.
Stability 5 ppm per 30 days.
Note: Conforms to MIL-C-3098 type CR18.

Self-Check

Instrument may be calibrated in the field to the internal crystal frequency without need for additional calibration equipment.

DC VOLTAGE

Input

0 to ±1,000 V dc.

Selectable Voltage Ranges

1 V, 10 V, 100 V, and 1,000 V (decimal indicator automatically coupled to range switch).

DC Input Impedance

Infinite at null in 1 V and 10 V ranges, 10 MΩ at null in 100 V and 1,000 V ranges.

DC Accuracy

±0.01% of reading +0.001% of selected voltage range +10 μV at 25°C ±5°C.

DC Reference Stability

±0.002% after 15 min. warmup at constant temperature and line.

Common Mode Rejection

with 1 kΩ unbalance in either side of input and up to 70% humidity:

Voltage Range	dc	60 Hz	400 Hz
1 V & 10 V	130 db	100 db	90 db
100 V & 1,000 V	100 db	85 db	70 db

GENERAL

Warmup Time

Above specifications apply after 1-hour warmup. The instrument is ready for use immediately after turn-on.

Environmental

Specifications apply to 25°C ±5°C; for operation from 0°C to 50°C, derate by factor of 3.

Recorder Output

An electrical output is available for long-term drift and deviation testing with ±300 mV full-scale signal.

Controls & Readout

Power/Model SW off +, −, kHz.
Range Switch: 1-, 10-, 100-, 1,000-V/kHz.
Null Sensitivity,: ±0.01%, ±0.1%, ±1%, ±10%, ±100% of range for full-scale meter deflection.
Transfermatic Switch:* 5-digit decade switch with automatic transfer points.
Null Indicator: taut-band meter with mirror scale and knife-edge pointer.

Measurement Resolution

Transfermatic Switch Resolution: 1 part in 100,000 (0.001% of range).
Null Resolution: 0.0002% of range indicated by a change of 1 minor division at the most sensitive setting.

Direct Reading Meter

Full-scale sensitivity; dc voltage from 100 μV to 1,000 V; frequency from 100 Hz to 100 MHz.

Dimensions: 7¾ in. w, 5¼ in. h, 11 in. d.

Weight: 10 lb, 13 lb shipping.

Power Requirements

105 to 125 V or 200 to 250 V, 50 Hz to 400 Hz. Less than 20 W

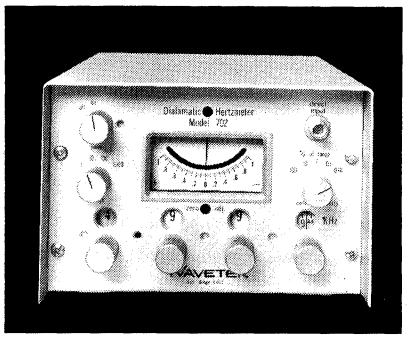
Price (F.O.B. San Diego)

Model 207, $1,095.

*Patent pending

Models 701 & 702
Dialamatic Hertzmeter

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007



The 700 Series Dialamatic Hertzmeter measures frequency from 5 Hz to 100 MHz at accuracies to 0.01% of reading. This is a unique instrument. It utilizes a series of decade switches and a null meter, providing techniques similar to those used in differential voltmeters. Thus, the accuracy and resolution of a digital device are combined with the analog advantages of fast readings at low frequencies and drift or deviation measurement capability. The decade switch incorporates Wavetek's unique Transfermatic Switch, which automatically carries all transfer points, adding speed to the above advantages. The accuracy of the instrument is based on the stability of a crystal. Frequency is converted to a voltage which is measured using ratio techniques. A novel input trigger circuit eliminates the need for slope and level adjustments and allows measurement of any waveform over a broad range of amplitude variations. The hertzmeter may be used to measure, tune and monitor frequencies with precision. It also is useful for production checkout of oscillators and filters, frequency deviation measurement such as FM telemetry checkout, frequency alignment and tuning for tachometer and servo applications, and as a low-cost general-purpose, broad-band measurement tool.

Frequency Ranges

Direct Input

1 kHz range	5 Hz to 1 kHz
10 kHz range	50 Hz to 10 kHz
100 kHz range	500 Hz to 100 kHz
1,000 kHz range	5 kHz to 1,000 kHz

÷ 100 Input, Model 702 only:

100 kHz range	1 MHz to 10 MHz
1,000 kHz range	1 MHz to 100 MHz

Frequency Measurement Accuracy

±0.01% of reading +0.001% of range at constant temperature.

Temperature coefficient ±0.0005% of reading/°C (calibrated at 25°C).

Measurement Resolution

Transfermatic Switch Resolution: 1 part in 100,000 (0.001% of range).

Null Resolution: 0.0002% of range which is indicated by a change of 1 minor division at the most sensitive setting.

Typical Response to Step Input

0.01% of range in 3 sec.

0.001% of range in 8 sec.

Deviation Response

Null meter will respond to sinusoidal frequency deviations from dc to 0.5 Hz. Meter deflection is down 3 db at 0.5 Hz.

Input Trigger Characteristics

Sensitivity—5 Hz to 1 MHz Input

The ac-coupled input accepts any time-symmetrical waveform and negative-going pulses from 250 mV peak-to-peak to 700 V peak-to-peak without need for manual adjustment of slope or level. Threshold level for positive pulses increases as the duty cycle decreases.

Input Impedance—5 Hz to 1 MHz

For amplitudes less than 5 V peak-to-peak, 1 MΩ shunted by 40 pF.

For amplitudes above 5 V peak-to-peak, 100 KΩ shunted by 100 pF.

Sensitivity—1 MHz to 100 MHz (Model 702 only)

The ac-coupled input accepts voltage levels from 250 mV rms to 2.5 V rms, limited to 9 x 10^8 V/sec (about 1 V rms at 100 MHz sine wave). 5 V rms maximum input without damage to circuit.

Input Impedance — 1 MHz to 100 MHz (Model 702 only)

50-Ω nominal.

Time Base

1 MHz crystal, ±0.005% accuracy.

Temperature drift ±0.005% −30°C to +90°C.

Stability 5 ppm per 30 days.

Note: Conforms to MIL-C-3098 type CR18.

Self-Check

Instrument may be calibrated in the field to the internal crystal frequency without need for additional calibration equipment.

Warmup Time

Above spfecifications apply after 1-hour warmup. The instrument is ready for use immediately after turn-on.

Operating Temperature Range

0°C to 50°C and less than 70% relative humidity.

Recorder Output

An electrical output is available for long-term drift and deviation testing with ±300 mV full-scale signal.

Controls & Readout

On-Off Switch, Range Switch: 1 kHz, 10 kHz, 100 kHz, 1,000 kHz.

Null Sensitivity: ±0.01%, ±0.1%, ±1%, ±10% and 100% of range for full-scale meter deflection.

Transfermatic Switch:* 5-digit decade switch with automatic transfer points.

Null Indicator: taut-band meter with mirror scale and knife-edge pointer.

Dimensions

7¾ in. w, 5¼ in. h, 11 in. d.

Weight

10 lb, 13 lb shipping.

Power Requirements

105 to 125 V or 200 to 250 V, 50 Hz to 400 Hz. Less than 20 W

Prices (F.O.B. San Diego)

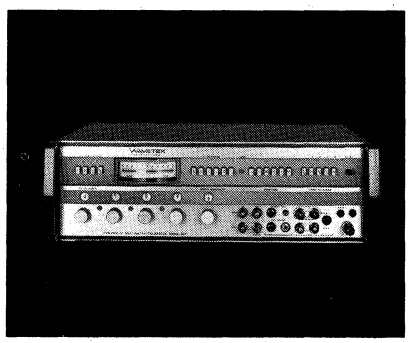
Model 701 (5 Hz to 1 MHz), $795

Model 702 (5 Hz to 100 MHz), $995

*Patent pending.

Model 220 Dialamatic Measurement System

WAVETEK
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007



The Wavetek Model 220 presents an entirely new concept in multiple-purpose meters. The versatility that is often found in low- to medium-accuracy multimeters is combined with the accuracy that is usually only found in special-purpose calibrators. The addition of the exclusive Wavetek Transfermatic Switch mechanism and the Model 220 nonsaturating null amplifier result in an instrument that has unequalled versatility, accuracy and ease of operation.

The Model 220 has the following features:

Measures dc voltages to 1,200 V.
Measures dc ratio.
Measures ac voltages to 1,200 V.
Measures frequency to 12 MHz.
Measures ohms to 12 ohms.
Measures ohms ratio.
Supplies calibrated dc voltage to 120 V.

The basic 0.005% accuracy of this instrument is such that it can be used as a general-purpose laboratory tool in research and development, and also as an indispensable aid in the maintenance and calibration of instruments that are less accurate.

The Model 220 is a precision potentiometric/null balance measuring device. The readout is a six-digit precision Kelvin Varley bridge interconnected by Wavetek's Transfermatic Switch. Output terminals are provided for permanent recording of off-null deflections.

Digital Readout
Six-digit potentiometric control with associated dial indicators: 4 switches, and 1 potentiometer in the least-significant decade having 2-digit resolution.

Analog Readout
Edge-reading, taut-band null indicator with selectable full-scale indication from ±0.01% of range to 100% of range.

Meter Sensitivity
±0.01 0.1, 1, 10 and 100% of range. The full-scale sensitivity of the null meter depends on the meter sensitivity and the range selected for the parameter being measured. When measuring dc volts, the dc range switch determines the meter sensitivity. For all other measurements, the plug-in range switch determines the sensitivity.

Full-Scale Meter Sensitivity in Volts and kHz.

Meter Sensitivity Setting in % of Range	Range Setting, Volts—kHz/kΩ 1	10	100	1,000
100	1	10	100	1,000
10	0.1	1	10	100
1	0.01	0.1	1	10
0.1	0.001	0.01	0.1	1
0.01	0.0001	0.001	0.01	0.1

Resolution (Null Meter)
1 ppm of range (½ minor division on mirror scale).

Resolution (Transfermatic Switch)
0.5 ppm of range (½ minor division on dial).

Voltage Reference Stability
±0.0005% per hr.
±0.0025% per yr.

Recorder Output
±300 mV output corresponding to full-scale meter deflection. Output impedance—10 kΩ.

Environmental
All specifications apply for 25°C ±5°C; for operation from 0°C to 50°C, derate by factor of 3.

Dimensions
17 in. w, 5¼ in. h, 16 in. d.

Weight
Approximately 15 lb net, 20 lb shipping.

Power Requirements
105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 50 watts.

DC/DC RATIO SPECIFICATIONS

Input
0 to 1,200 V dc in 4 ranges: 1 V, 10 V, 100 V, and 1,000 V, each range having 20% over-range capability.

Polarity
Front-panel pushbutton selected, plus or minus.

DC Accuracy
±0.005% of reading +0.001% of range (or 15 μV); 0 to 100 V ±0.01% of reading ±0.001% of range, 100 V to 1,200 V.

DC Input Impedance
Infinite at null on 1 V, 10 V, and 100 V ranges; greater than 10 megohms on 1,000 V range.

DC RATIO LINEARITY
0.001% of full scale (+10 V nominal input into 25 kΩ).

DC CALIBRATOR SPECIFICATIONS

Accuracy
0.005% of value ±0.001% of range from 0.00000 to 119.9999 V.

Output Current
1 mA.

Overload
A current trip relay is provided to open the calibrator if the output current is exceeded.

AC SPECIFICATIONS

Frequency Range
5 Hz to 100 kHz.

Input Voltage
1 mV to 1,000 Vac rms in 4 ranges.

Input Impedance
1 MΩ and 40 pF.

AC ACCURACY
±0.1% of reading ±0.005% of range, 50 Hz to 5 kHz, 1 mV to 120 V.
±0.5%, 5 Hz to 20 kHz, 1 mV to 120 V (10 Hz to 20 kHz on 1,000 V range).

HERTZMETER SPECIFICATIONS

Frequency Range
10 Hz to 12 MHz in 5 ranges.

Accuracy
±0.001% of reading +0.001% of range.

Typical Response to Step Input
±0.01% of range in 3 sec, ±0.001% of range in 8 sec.

Input Trigger Characteristics
250 mV (rms) sensitivity, ac-coupled input into zero crossing detector; max input 250 V rms.

Input Impedance
1 MΩ and 40 pF to 5 V input, 100 kΩ and 100 pF to 250 V.

Self-Calibration Feature
Frequency calibration and linearity can be checked for all ranges by means of 1 MHz and 500 kHz test signals on front panel.

OHMS/OHMS RATIO SPECIFICATIONS

Ohms Range
0 to 12 MΩ in 5 ranges.

Accuracy
±0.005% of reading +0.001% of range, 1 kΩ to 112 kΩ.
±0.01% of reading +0.002% of range, 1 kΩ and 1 MΩ ranges.

Test Current

Range	Test Current	Max Voltage Across Range
0 to 1,200-Ω	1 mA	1.2 V
1 kΩ to 12 kΩ	1 mA	12 V
10 kΩ to 120 kΩ	100 μV	12 V
100 kΩ to 1,200 kΩ	10 μV	12 V
1 MΩ to 12 MΩ	1 μV	12 V

Ohms Ratio Accuracy
±0.02%.

ORDER INFORMATION

Price: (F.O.B. San Diego)
Model 220, $2,395.

Note: Price and specifications subject to change.

Model 740 Phase Meter

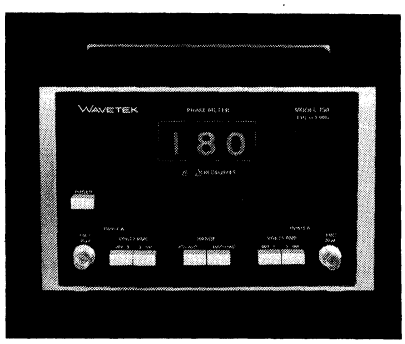
Model 750 Digital Phase Meter

WAVETEK®
9045 Balboa Ave., San Diego, Calif. 92123; Tel. 279-2200
P.O. Box 651, San Diego, Calif. 92112; TWX 910-335-2007



The Wavetek Model 740 Phase Meter is a rugged, portable, all-solid-state instrument for measuring the phase between any two alternating signals. The phase is displayed directly on a front-panel meter. In addition, a voltage of 0 to 3.6 volts dc is available for input to a DVM, resulting in a direct reading. The Model 740 has four selectable meter ranges. If high resolution is required, a phase offset arrangement allows all readings to be made on the most sensitive scale.

ACCURACY
Absolute Accuracy
±0.1%, 10 Hz to 100 kHz; ±0.3%, 100 kHz to 1 MHz.
Resolution
0.1°.
INPUT SIGNAL
Amplitude
1 mV to 10 V rms (2.8 mV to 28 V p-p).
Frequency
10 Hz to 2 MHz.
Input Impedance
1 MΩ and 20 pF.
Maximum DC
400 V.
RECORDER OUTPUT
0 to 3.6 V dc proportional to phase (10 mV/degree); impedance 1 kΩ.
READOUT CONTROLS
Meter readout with four scales: 0 to 18°, 0 to 36°, 0 to 180°, and 0 to 360°
Phase offset control: 0 to 180° in 10° steps.
Phase offset vernier: 0 to 10°.
Phase shift selector: 6 or 180°
POWER REQUIREMENTS
100 V to 130 V or 200 V to 250 V, 50 Hz to 400 Hz.
ORDER INFORMATION
Price: (F.O.B. San Diego)
Model 740, $895.
Note: Price and specifications subject to change.



The Wavetek Model 750 Digital Phase Meter is a precision, wideband, general-purpose instrument, designed to accurately measure the phase between any two signals. A four-digit readout displays the phase reading in degrees with 0.1° resolution. This all-solid-state unit will measure signals with an amplitude ratio of up to 10,000:1 over a frequency range of 10 Hz to 2 MHz. Unique signal input circuitry allows accurate measurements of signals having high harmonic distortion. The Model 750 combines versatility, accuracy and ease of operation—features formerly available only in larger cabinet models in a rugged, portable package.

ACCURACY
Absolute Accuracy
±0.1%, 10 Hz to 100 kHz: ±0.3%, 100 kHz to 2 MHz.
Resolution
0.1°.
Stability
±0.15° for 10 hours.
INPUT SIGNAL
Amplitude Ranges
1 mV to 10 V rms (2.8 mV to 28.28 V p-p); 0.3 V to 300 V rms (0.848 V to p-p).
Frequency
10 Hz to 2 MHz.
Input Impedance
1 MΩ and 20 pF.
Maximum DC
400 V.
RECORDER OUTPUT
0 to 3.600 Vdc (10 mV/degree) proportional to phase reading; output impedance 1 kΩ.
READOUT/CONTROLS
Four-digit Nixie readout 000.0° to 360.0°, power on-off amplitude range.
POWER REQUIREMENTS
100 V to 130 V or 200 V to 250 V, 50 to 400 Hz.
ORDER INFORMATION
Price: (F.O.B. San Diego)
Model 750, $1,495.
Note: Price and specifications subject to change.

Sales Representatives

New England
J. & J. Associates
(617) 899-0160 (203) 624-7800
(203) 749-4421

New York (Upstate)
Naco Electronics
(315) 474-7481 (914) 462-2730
(716) 473-4169 (315) 732-1801
(716) 381-9632

Eastern Seaboard
Eastern Instrumentation
(215) 927-6269 (516) 466-9505

Mid-Atlantic
W. A. Brown & Associates
(703) 836-1800 (703) 245-8272

Southeast
W. A. Brown & Associates
(305) 425-5505 (205) 536-8393
(919) 725-5384 (305) 564-8000
(404) 939-1674 (904) 243-6424

Ohio, Michigan, W. Pennsylvania
WKM Associates
(216) 885-5616 (313) 892-2500
(513) 434-7500 (412) 892-2953

Mid-West
Carter Electronics
(312) 312-5485 (317) 293-0696
(612) 869-3261

Plains States
Poly-Onics
(913) 648-4173 (314) 837-0597

Southwest
BFA, Inc.
(817) 283-4684 (713) 482-7563
(918) 835-7942

Rocky Mountain States
BFA Corp.
(303) 744-3301 (505) 268-4387
(602) 264-6536 (801) 355-2684

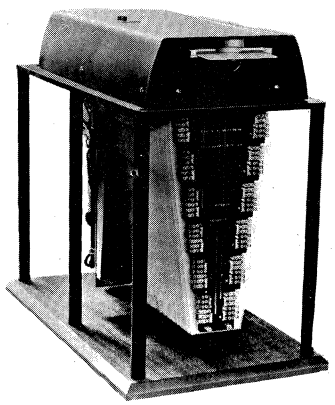
Northwest States
Rush S. Drake Associates
(206) 763-2755

California
Ward/Davis Associates
(213) 684-2840 (415) 968-7116
(714) 297-4619

Canada
R-O-R Assoc., Ltd.
(416) 291-7121

Hawaii
Electromed Corp.
949-0234

WRE CARD OPERATED *Programmers*

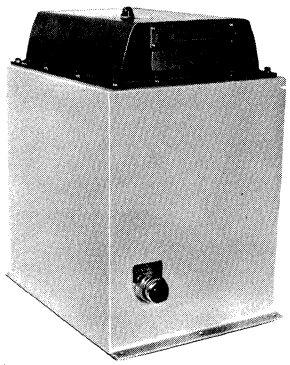


These advanced concept card actuated reader-programmers have high current carrying capabilities and provide complex switching on each data bit.

Built around a new mechanical switching arrangement that features single pole, double throw switches with silver, self-wiping contacts and excellent dry circuit characteristics.

Proper design with attention to insulation, mechanical strength and positive actuation assure long service life. Card reader instantly interprets and activates all desired contacts simultaneously.

provide complex switching on each data bit



READER/ACTIVATOR CAPACITY: Model 240P: 240 bits/240 isolated SPDT switches. Model 960P: 960 bits/960 isolated SPDT switches. Model 96: 96 bits/96 isolated SPDT switches.

DATA MEDIUM: Standard 12 x 80 EAM CARD (IBM format). Model 240: Utilizes total card data capacity by reading four, 12 x 20 bit zones (two zones each end of card). Model 950: Reads total 960 bit card simultaneously.

SWITCH CONTACT CONFIGURATION: Standard: Form A — SPST normally open. Form B — SPST normally closed. Form C — SPDT non-shorting. Form D — STDT shorting. Each of the standard configurations available on any bit within the programmer. Special switching per customer specifications.

SWITCH CONTACTS: Silver alloy, double-action, self-cleaning. Contact-to-contact resistance 0.003 to 0.015 ohms. Excellent dry circuit characteristics.

SWITCH CONTACT ELECTRICAL RATING: (Resistance load). Break 2 amperes at 28 Vdc; break 1 ampere at 110 Vac; and continuously carry 5 amperes.

PROGRAMMER ACTUATION: Model 240P and Model 960P are available motor driven only.

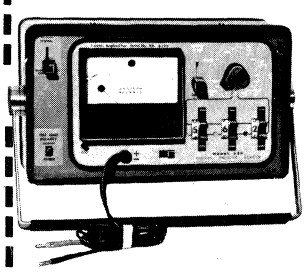
MOUNTING: Bench (horizontal) or rack (vertical) 10″ W, 15″ H, 13″ D.

NEMA ENCLOSURE: 14″ D, 7¾″ W, 13″ H.

SPECIALS: to customer specifications.

WRE DIGITAL SCALER INSTRUMENTATION

- ★ 3 significant figure in-line digital presentation
- ★ Within 1% of indicated value on all measurements
- ★ Passive solid state circuitry for long term stability
- ★ Automatic, fail-safe resettable protection system
- ★ Rugged, militarized, self-contained portables



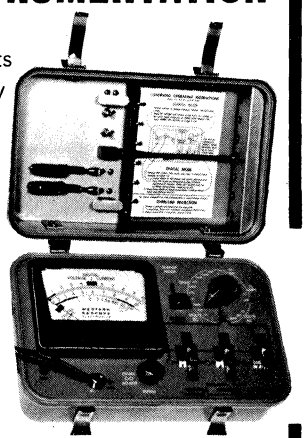
MODEL 320, IN BENCH CASE

DIGITAL TRUE RMS

Model 320 . . . Precise digital readout of the RMS value of complex waveforms containing both AC and DC components and with crest factors as great as 10 to 1. Accurate to within 1% of indicated value from 100 mv to 1000V. Freq. Resp.: 20 Hz to 100 kHz.
(Shown in bench case) Supplied in fiberglass lab case 10″ x 6½″ x 3¼″, 4½ lbs. net.

DIGITAL MULTIMETER

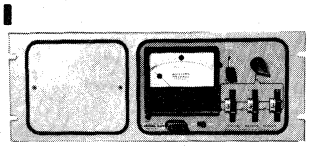
Model 300 . . . 3 figure digital. All readings within 1% of indicated. AC or DC voltage: 100 mv to 1000V; response 10 Hz to 100 kHz calibrated in RMS value of sine wave. DC current: 10 μA to 10 A. Resistance 1Ω to 1 MΩ (wheatstone bridge with direct digital readout). Resettable overload protection system. Supplied in waterproof, fiberglass case 10″ x 7¼″ x 4¾″, 6¾ lbs. net. Model 300M (Militarized) for use in extreme environments.



MODEL 300, IN FIELD CASE

DIGITAL DC VOLTMETER

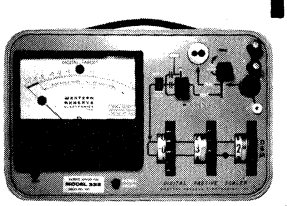
Model 310 . . . Readability, repeatability and within 1% of accuracy of actual readout — at a price of conventional analogs.
3 significant figure indication 100 mv to 1000V DC. (Shown in 19″ rack panel) supplied in fiberglass lab case, 3¾ lbs.
Model 311 available same except overload protection non-resettable.



MODEL 310, IN RACK MOUNT

TRANSMISSION LEVEL (dbm) *METER*

Model 332 . . . For measuring and setting transmission level. Direct reading in dbm for 600 and 900 ohm sources. (0 dbm = 1 milliwatt) 3 digit readout of —20.0 to +20.0 dbm, within ±0.1 db. Range to —35 dbm analog. Freq. response: 10 Hz to 100 kHz. RMS responding. Fail safe resettable overload protection. Fiberglass lab case shown, 10″ x 6½″ x 3¼″.



MODEL 332, IN LAB CASE

Adapters available for DC & AC current and transistor testing.

WESTERN RESERVE ELECTRONICS, INC.
12430 Euclid Avenue • Cleveland, Ohio 44106 • (216) 791-5112

Nickel-Cadmium and Silver-Zinc Battery Charger/Analyzer Systems

W R E

MODEL 1575 *Nickel-Cadmium System*

This battery charger-analyzer concept is thoroughly design tested as a system to provide maximum efficiency in programmed maintenance of nickel-cadmium batteries.

Required sequence of events is unitized in a functional package to increase work flow efficiency with minimum equipment. Since all units can function simultaneously, single system has capacity for 3 batteries at a time; i.e., one discharging, one charging, and one under evaluation.

Exhaustive tests have proven this system to assure a full charge — safely! . . . and provide cell restandardization in the process.

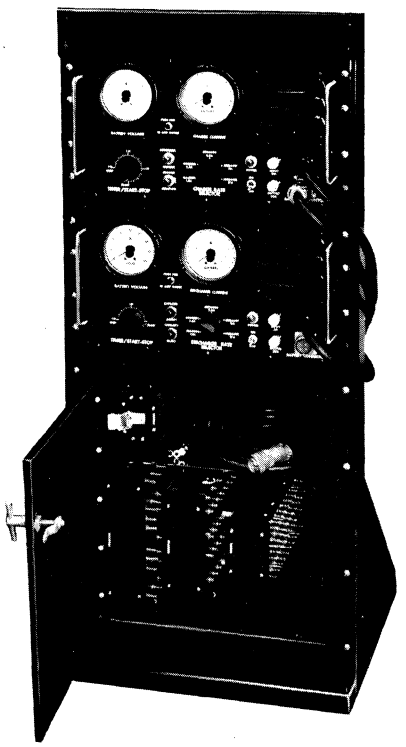
1) Deep discharge of each cell assures total emptying of battery safely — with all cells to "zero". This standardizing effect assures a zero-base for each cell.
2) 150% ampere-hour charge at precise prescribed rate assures "total-fill" of the battery.
3) Evaluation cycle "pulls" 100% of battery rated capacity in 2 hours. Analyzer automatically cuts off at either of 2 points . . . at preset voltage point, or at 2 hours . . . and "holds" the result.

ANALYZER, MODEL 1000 — Discharge Rate: 5 preselectable discharge current ranges: 1.8, 2.5, 5.5, 11, 17 amperes. Discharge Time: 0-2 hours, ±5%. Cut-off Voltage: Internally adjustable, 17-20 volts. Indicators: "Capacity Accept", "Capacity Reject", "Power On". Meters: 250°, 4½", ruggedized. Voltmeter: 0-40 volts. Ammeter: 2-range; 0-10, 0-20 amperes. Circuit: Solid state power switching. Physical: 19" W., 10½" H., 11" D., 33 lbs. Rugged, portable, rack mountable, drip-proof construction. Cooling is forced air.

CHARGER, MODEL 1500 — Charge Current: 5 preselectable ranges: 1.8, 2.5, 5.5, 11, 17 amperes, ±3%. Charge Time: 0-3 hours ±5%. Meters: 250°, 4½", ruggedized. Voltmeter: 0-40 volts. Ammeter: 2-range; 0-10, 0-20 amperes, Overload Protection: Charge terminates if output voltage rises above 33V on all ranges (except 2.5A range — 34.5V). Indicators: "Power On", "Charge Complete", "Abnormal Charge". Circuit: Solid state. Physical: 19" W., 10½" H., 11" D., 72 lbs. Rugged, portable, rack mountable, drip-proof. Cooling is forced air.

5 popular discharge fixtures for fixed resistive load to each cell at the C/2 rate, and MA and MS type battery cables are available from stock. Other fixtures are available on special order.

Specifications subject to change without notice.



Overall system, rack and cabinet, is approximately 22" W., 4' H., 12" D., 192 lbs. and is of strong steel construction with drip-proof finish. Discharge fixtures and cables fit neatly into the compartmentized storage cabinet.

MODEL 1525 *Silver-Zinc Battery Charger*

Also charges Nickel-Cadmium, Silver-Cadmium, and Lead-Acid Types

The Model 1525 is a portable, 3-channel battery charger that meets the most stringent requirements for charging Silver-Zinc batteries (such as BB-451/U types).

The unit is designed with modular plug-in circuits and features a precision, solid state electronic control that permits front-panel programming of cut-off voltages in one-tenth volt steps, from 0.0 to 36.0 volts. This programming extends the capabilities so that the equipment may be used for charging Silver-Cadmium, Nickel-Cadmium or Lead-Acid battery types.

Each of the 3 channels may be used independently at currents of 1.0 or 2.25 amperes, or connected in parallel to provide up to nine different currents (up to 6.75 amperes).

Fail-safe charging indication is provided via internal sensing circuitry which assures that the programmed charging current is flowing when the charging lamp is lighted. The system automatically prevents damage to batteries or charger due to operator error.

Single cell charge capability permits charge equalizing of a battery. The 1525 is thoroughly militarized . . . including R.F.I. suppression.

Accessories furnished include 3 special charging handles for BB-451/U Silver-Zincs, and universal charging cables for other batteries. Cables, line cord and instruction manual are neatly stored in the case lid. Self-contained, water tight portable case; 13⅜" W., 11" H., 11½" D., 38 pounds net.



Specifications subject to change without notice.

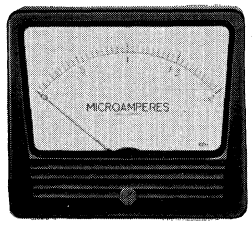
WESTERN RESERVE ELECTRONICS, Inc.
12430 Euclid Avenue • Cleveland, Ohio 44106 (216) 791-5112

Westinghouse offers a broad choice of panel instruments

Available through your local Westinghouse distributor. For a full listing of ratings and prices, ask for the descriptive bulletins and price lists shown for each instrument.

J-43012

You can be sure... if it's **Westinghouse**

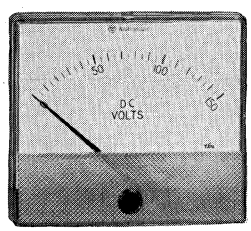


tbz® instrument

Foundation Line

Premium instruments for quality test or instrumentation equipment. Always custom built to meet a specific need. Sizes, 4½ and 5½ inches. Taut-band suspension. D-c: 5 microamps to 20 amps, voltmeters to 600 volts, self-contained. Accuracy and tracking to ½%. A-c rectifier: 5 microamps to 20 milliamps, voltmeters 200,000 ohms per volt. Transducer combinations listed at bottom of page.

Descriptive Bulletin 43-370 Price List 43-300

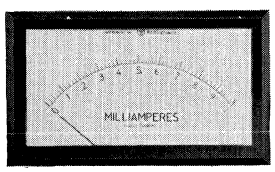


tbz® instrument

20/20 Custom Line, Surface Mounted

Taut-band suspension instruments priced to be generally competitive with quality pivot-and-jewel instruments. Accuracy, 2%. Sizes, 2½, 3½, 4½ and 5½ inches. Most ratings carried in stock. D-c: 50 microamps to 50 amps, 20 millivolts to 800 volts. A-c rectifier: 80 microamps to 20 milliamps, 3 to 800 volts. A-c moving iron: 5 milliamps to 50 amps, 1.5 to 600 volts. Transducer combinations are listed at bottom of page.

Descriptive Bulletin 43-320 Price List 43-300

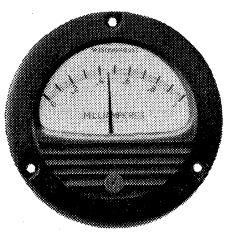


tbz® instrument

Rear-of-panel Mounting

Foundation or 20/20 instruments are available with rear-of-panel mounting kits, with or without illumination.

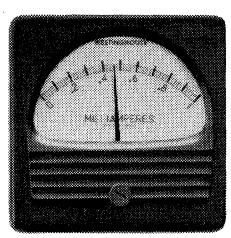
Descriptive Bulletins 43-320 and 43-370
Price List 43-300



Conventional Round

USA standard dimensions. Conventional pivot-and-jewel mechanisms. Sizes, 3½ and 4½ inches. D-c: 20 microamps to 50 amps, 50 millivolts to 800 volts. A-c rectifier: 100 amps to 10 milliamps, 0.5 to 600 volts. A-c moving iron: 5 milliamps to 50 amps, 1.5 to 800 volts. Radio frequency: 10 milliamps to 20 amps a.c. Transducer combinations are listed at bottom of page.

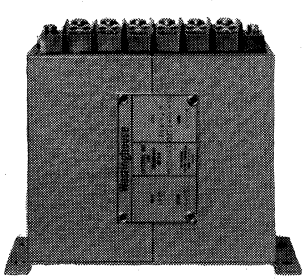
Descriptive Bulletin 43-350 Price List 43-300



Conventional Rectangular

USA standard dimensions. Conventional pivot-and-jewel mechanisms. Sizes, 3½ and 4½ inches. D-c: 20 microamps to 50 amps, 50 millivolts to 800 volts. A-c rectifier: 100 amps to 10 milliamps, 0.5 to 600 volts. A-c moving iron: 5 milliamps to 50 amps, 1.5 to 800 volts. Radio frequency: 10 milliamps to 20 amps a.c. Transducer combinations are listed at bottom of page.

Descriptive Bulletin 43-350 Price List 43-300



Panel Instrument Transducers

Combine with any panel instruments to read watts, vars, frequency, power factor, rms voltage, rms current, expanded voltage, speed or temperature. Standard frequencies, 60 and 400 Hz. Accuracy, 1%. Outputs compatible with characteristics of panel instruments.

Descriptive Bulletin 43-861 Price List 43-860

BRUSH

CLEVITE CORPORATION / BRUSH INSTRUMENTS DIVISION / 37TH AND PERKINS / CLEVELAND, OHIO 44114

MARK 200—MODULAR SERVO PENMOTOR RECORDERS

The Brush Mark 200 Recorder System Series 1707 combines the advantages of all solid state electronics with modular construction and a flexibility in application never before achieved. The result is a totally new concept in instrument design which allows any system to be tailored to specific requirements by selection from a broad range of "building block" subsystems.

6 STEPS TO CREATE YOUR OWN MODULAR SERVO PENMOTOR RECORDER

- CHOOSE YOUR OSCILLOGRAPH
- SELECT A SUITABLE PENMOTOR
- IDENTIFY APPROPRIATE CHANNEL-WIDTH COMBINATION
- SELECT SIGNAL CONDITIONER
- CHOOSE YOUR CABINET
- CREATE YOUR MODEL NUMBER

GENERAL SPECIFICATIONS

No. analog channels .....4/80 mm, 8/40 mm, or 4/8-channel "Multimarkers," or any in combination
No. event channels .....2 standard (others mounted interchannel at option)
Non-linearity .....±0.5% full scale
Chart speeds .....0.05, 0.1, 0.2 (or 0.25*), 0.5, 1, 2, 5, 10, 20 (or 25*), 50, 100, 200 mm/sec. Other chart speeds on special order.
*Specify whether 20 or 25
Chart-speed inaccuracy .....±0.25% @ nominal line frequency
Chart capacity .....high contrast: 500′; reproducible: 850′
Writing method .....pressurized ink
Trace width .....0.01″ nominal
Presentation .....true rectilinear
Timer .....standard timing pulses of 1 plus 10, 20, 30, or 60 seconds

CHOICE OF OSCILLOGRAPHS

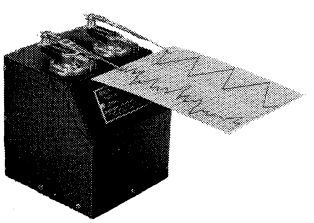
A flush mounted vertical oscillograph... a pull-out horizontal oscillograph...

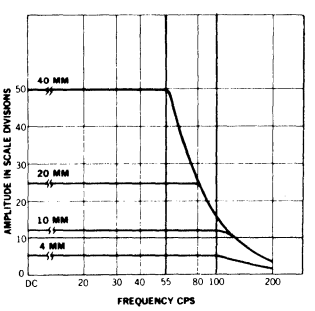
- identical performance characteristics
- push-button control of 12 chart speeds
- provision for quick chart paper loading
- easy accessibility to all internal parts

CHOICE OF PENMOTOR

DUAL 40MM PENMOTORS

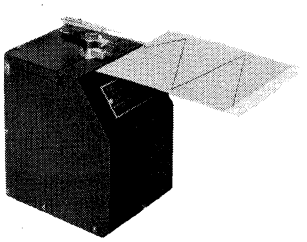
Containing two analog penmotors in a single magnet block, this compact unit gives you two 40mm analog channels powered by an associated dual-channel drive amplifier. Frequency response of this system is 55 Hz full scale, extending to 200 Hz at reduced amplitudes.





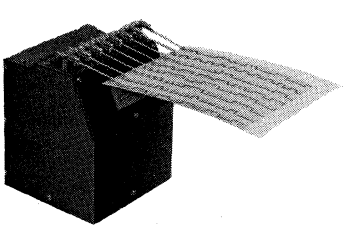
SINGLE 80MM PENMOTOR

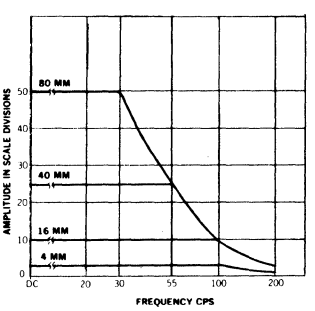
This 80mm deflection penmotor permits analysis of recorded data with accuracy and resolving power never before possible. Flat frequency response is better than 30 Hz full scale, to 55 Hz at 40mm p-p amplitude and extends to 200 Hz at reduced amplitudes.



8-CHANNEL EVENT "MULTIMARKER"

Eight event markers sharing a common magnet block, driven by a 5-volt-sensitivity high-impedance amplifier, provide for closely-spaced recording of multiple events in sequence—side-by-side with analog data if desired. Driven by one 8-channel event-marker amplifier.



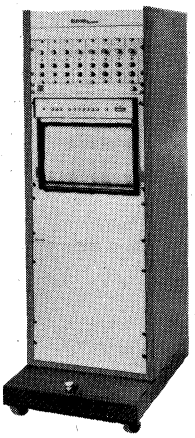


BRUSH

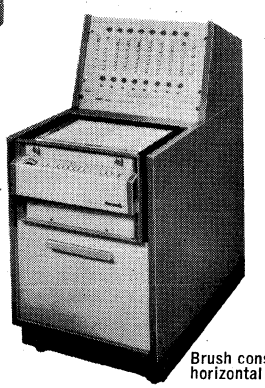
CLEVITE CORPORATION / BRUSH INSTRUMENTS DIVISION / 37TH AND PERKINS / CLEVELAND, OHIO 44114

MARK 200—MODULAR SERVO PENMOTOR RECORDERS

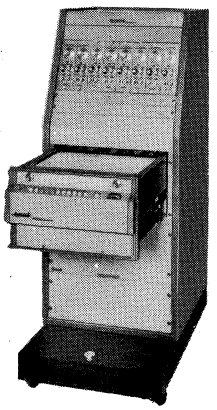
CHOICE OF CABINETS



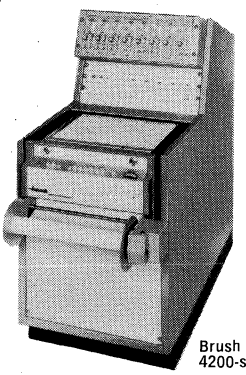
Brush cabinet with vertical oscillograph



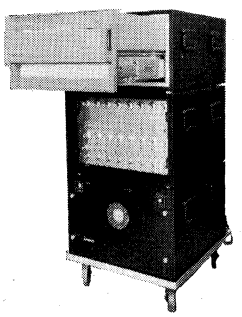
Brush console cabinet, horizontal oscillograph



Brush cabinet with horizontal oscillograph

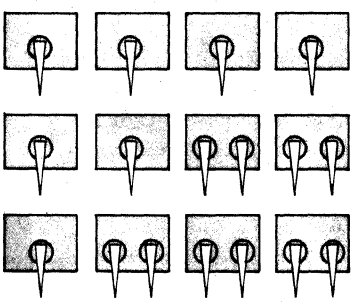


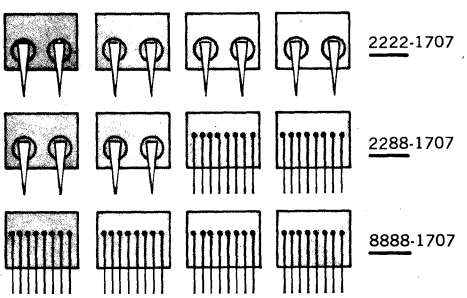
Brush console cabinet for 4200-series plug-in amplifiers



Brush portable model, disassembles into 3 sections

CHOICE OF CHANNEL-WIDTH COMBINATIONS





Standard Brush chart paper is available only for these six standard combinations. In the lefthand group of digits, "1" stands for an 80-mm penmotor; the digit "2" stands for a dual 40-mm penmotor; and the digit "8" stands for one 8-channel Multimarker module. Each pen in the 8-channel unit is an event marker capable of being deflected one direction only. The position of the digit in its numerical group corresponds to the penmotor's position in the oscillograph. Note that width of the channels must be in descending order starting from left of the oscillograph, and numerals are in ascending order.

CHART PAPER

1. Standard chart paper is available for the following penmotor combinations:

1111-1707	2222-1707	8888-1707
1122-1707	2288-1707	1222-1707

Penmotor combinations other than the above will require special chart paper at a one-time set-up charge plus cost of paper itself.

CREATE YOUR MODEL NUMBER

Each digit in the prefix stands for one of the four penmotor locations—from left to right facing the oscillograph.

1=a one-pen 80mm unit
2=a dual-pen 40mm unit
8=an 8-pen event "Multimarker" 8888
0=no penmotor used

8888 – 1707 – 200

BASIC SERIES NUMBER 1707

First digit:
1=vertical system
2=horizontal system
3=extended writing table

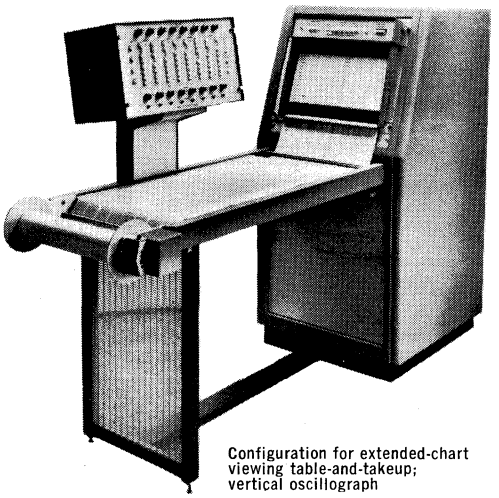
Second digit:
0=no front ends
1=4185 series preamps
2=4200 series preamps
4=4485 series preamps

Third digit:
0=with Brush cabinet
1=with shipping frame
2=Console cabinet
3=Emcor cabinet

MARK 200—MODULAR SERVO PENMOTOR RECORDERS

STANDARD SYSTEMS

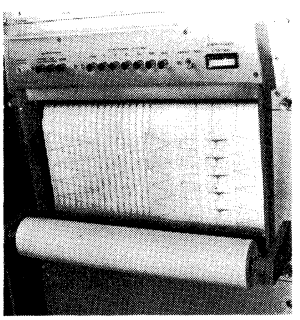
description	model number
VERTICAL	
4-80mm channels for 4185 series preamps	1111-1707-110
4-80mm channels for 4200 series preamps	1111-1707-120
4-80mm channels for 4485 series preamps	1111-1707-140
8-40mm channels for 4185 series preamps	2222-1707-110
8-40mm channels for 4200 series preamps	2222-1707-120
8-40mm channels for 4485 series preamps	2222-1707-140
4-8-channel event markers	8888-1707-100
HORIZONTAL	
4-80mm channels for 4185 series preamps	1111-1707-210
4-80mm channels for 4200 series preamps	1111-1707-220
4-80mm channels for 4485 series preamps	1111-1707-240
8-40mm channels for 4185 series preamps	2222-1707-210
8-40mm channels for 4200 series preamps	2222-1707-220
8-40mm channels for 4200 series preamps Portable model disassembles into three sections.	2222-1707-221-3705
8-40mm channels for 4485 series preamps	2222-1707-240
4-8 channel event markers	8888-1707-200



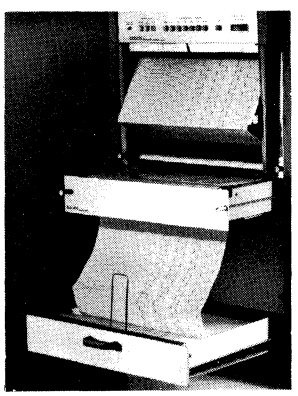
Configuration for extended-chart viewing table-and-takeup; vertical oscillograph

ACCESSORIES

description	model number
CHART TAKEUPS	
Internal takeup full roll, vertical oscillograph	11-2231-01
Same as 11-2231-01, but for 400 Hz	11-2231-04
External takeup full roll, horizontal oscillograph	11-2402-41
External takeup short run, vertical oscillograph	11-2402-51
External takeup short run, horizontal oscillograph	11-2402-61
Chart folder for producing Z-Fold pack, Rack mounting, including pack tray, for use with model 11-2983-502 chart paper	11-2271-20



11-2402-51 short-run chart takeup



11-2271-20 Z-fold accessory

description	model number
EVENT MARKER KITS (Factory installed)	
7-channel interchannel bi-directional event marker kit. Consists of 7 type 11-2222-00 standard markers.	11-2221-00
Standard 3-position bi-directional event marker (1 at each margin is standard on all oscillographs), when ordered separately.	RA 2103-90
Event marker, bi-directional d'Arsonval type, pulse-width discriminating. Left margin only.	11-2123-00
EVENT MARKER AMPLIFIERS (Factory Installed)	
Single-channel amplifier, 100k ohms input, positive 5V sensitivity, 0-4V not deflecting: used with standard or interchannel event markers	13-5511-00
Single-channel amplifier, 2.2k ohms input, negative 1V sensitivity, 0 to −1V not deflecting: used with standard or interchannel event markers	13-5511-01
Single-channel amplifier, for bi-directional event marker (11-2123-00) positive & negative 5V, 100k ohms input.	13-5511-02
7-CHANNEL KIT, COMPLETE WITH 8 AMPLIFIERS positive 5V sensitivity, 0-4V not deflecting (for vertical oscillograph only)	13-5581-00
MISCELLANEOUS	
Polarity reversal panels for 4200 series preamplifiers	11-1604-00
for 4485 series preamplifiers	11-1604-02
Viewing table, complete with chart takeup	11-1501-20

description	model number
MISCELLANEOUS (continued)	
Viewing table, complete with 5¼″ pedestal housing for 4100 and 4400 series preamplifiers and chart takeup	11-1501-21
Viewing table, complete with 10½″ pedestal housing for 4100 series preamplifiers and chart takeup	11-1501-22
Paper-bin accessory kit for console cabinet	11-1750-00
Data-loss indicator panel	0000[1]-1605-00
Data-loss sensor for 1 80 mm penmotor	11-1711-00
Data-loss sensor for 1 dual 40mm penmotor	11-1712-00
RFI kit to meet specification MIL-1-26600 class II except paragraph 3.1.2 "short run interference."	11-1730-00
24-volt relay kit for partial remote control	11-1506-00
90-volt relay kit for partial remote control	11-1506-10
Band tool assembly for both 40- and 80-mm penmotors	341409-915
Dust cover for console cabinet	465430
30° inclined writing table, vertical oscillograph	11-1501-10
Preamplifier extension cable	342960-915
Drive amplifier extension cable	11-1508-03
Amplifer calibration unit, for use with 4200 and 4485 series preamplifiers, Permits checking calibration on all channels, includes pen-centering control.	0000[1]-5403-20
Remote control panel. Provides pushbutton control of all chart speeds from remote position. Includes indicator light and interlock light.	443400-915 S3236

[1]Must agree with system prefix.

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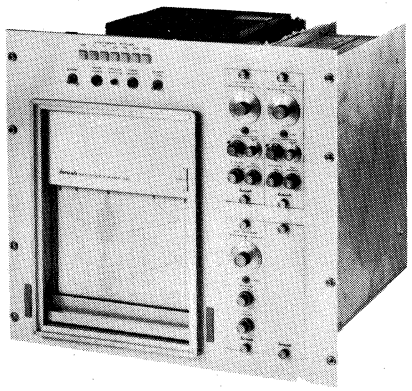
MARK 240—SERVO PENMOTOR RECORDER



This versatile, high-accuracy direct writing recorder is a complete, self-contained system designed for a very wide range of applications where resolution and precision in measurement are required. It may be mounted in standard 19″ racks to RETMA specifications, or in Brush racks, or bench-top cabinets.

Modular design permits selection of interchangeable plug-in pre-amplifiers of the solid state Brush 4200 Series, affording choice of high gain d-c units (with or without calibrated zero suppression) straight-through couplers, strain-gage, log-linear and phase-sensitive demodulator types; also with biomedical preamplifiers of the Brush 4300 Series.

The Mark 240 may be fitted with two each of either dual-channel 40mm or single-channel 80mm analog penmotors, or with 8-channel event "Multimarker" modules—either alike or in combinations. Analog modules include drive amplifiers mounted internally, providing requisite sensitivity for preamplifier inputs, position-feedback circuitry, signal-limited circuitry, and controls for damping and span adjust. "Multimarker" event amplifiers, also internally mounted, provide 5V ON, 0 to 4V OFF triggering and 100k impedance for "Multimarkers" when these are specified.

description	model number
STANDARD SYSTEMS (Rack Mounting)	
Basic Recorder, 4 40mm channels. Includes right and left hand event markers.	2200-6607-10
Basic Recorder, 2 80mm channels. Includes right and left hand event markers.	1100-6607-10
Basic Recorder, 1 80mm channel and 2 40mm channels. Includes right and left hand event markers.	1200-6607-10
Basic Recorder, 2 8-channel multimarker penmotors (16 channel). Marginal event markers are not included.	8800-6607-10
Mark 240 recording system in accordance with BUWEPS Drawing No. 1222474. Testing for compliance with paragraph III C5 has not been performed by Brush Instruments.	2200-6607-10815

POWER OPTIONS

1. For 115 V, 400 Hz operation change model number suffix to -14.
2. For pulse chart drive change model number suffix to -30. Signal conditioning (pulse-drive amplifier) may be required at extra cost.

NOTES

Base prices include basic recorder, penmotors, drive amplifiers and event markers. (Except 8800-6607-10 model which has no event markers.)

Preamplifiers (where required) are **not** included in unit price.

Accessories, other than event markers, are **not** included in unit price and must be priced separately.

AVAILABLE IN

- 2 80-mm analog channels
- 16 event channels
- 4 40-mm analog channels

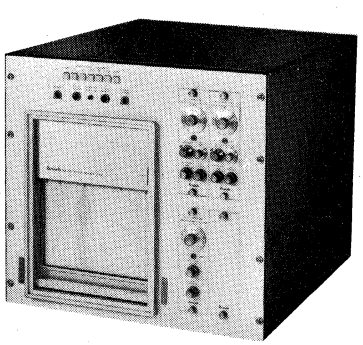
or a combination

SPECIFICATIONS

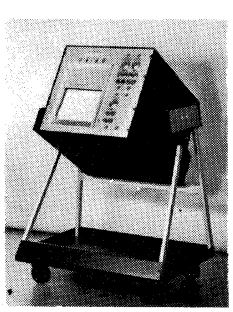
No. analog channels .....2 8mm, 4 40mm, or 2 8-channel "Multimarkers" or any combination
No. event channels .....2 standard (others mounted interchannel at option)
Non linearity .....±0.5% a-c or d-c
Chart speeds .....0.05, 0.1, 0.2 (0.25*), 0.5, 1, 2, 5, 10, 20 (or 25*), 50, 100, 200 mm/sec. Other chart speeds on special order.
*Specify whether 20 or 25
Chart speed inaccuracy .....±0.25% @ nominal line frequency
Chart capacity ..... high-contrast: 275′; reproducible: 400′
Writing method .....pressurized ink
Trace width .....0.01″ nominal
Presentation .....true rectilinear

ACCESSORIES

description	model number
ACCESSORIES	
External chart takeup	11-6402-02
Mobile cart	11-6405-10
One second timer	RA 2101-10
Interchannel event marker center mounting, when ordered separately.	RA 2103-90
Single-channel event marker amplifier, 100k ohms input, positive, 5V sensitivity, 0 to 4V not deflecting: used with standard or interchannel event markers.	13-5511-00
Single-channel event marker amplifier, 2.2k ohms input, negative 1V sensitivity, 0 to −1V not deflecting: used with standard or interchannel event markers.	13-5511-01
Benchtop cabinet—with handles	11-6407-00
Dust cover—for cart mounting only	11-6404-24
Band tool	341409-915



Benchtop cabinet optional at extra cost as shown in table.

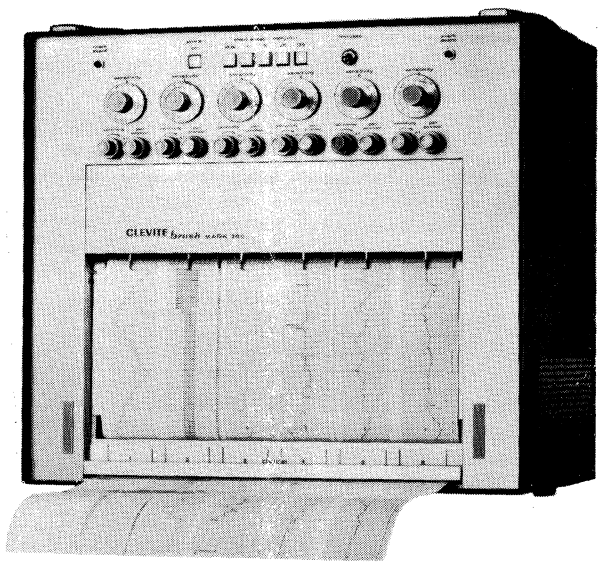


Cart is optional at extra cost as shown in table.

MARK 260—SERVO PENMOTOR RECORDER

A complete, self-contained portable recorder capable of handling the great majority of recording tasks with precision and utmost operator convenience. Simple and rugged in design, the Mark 260 offers features previously available only in more expensive recorders.

The recorder's patented pressurized inking system produces charts of unparalleled clarity. The system includes two disposable ink cartridges—sufficient for a year's normal recording—which can be replaced in minutes. Traces are immediately smudge-proof, uniform in width at any pen velocity. Presentation is rectilinear, to facilitate wave-form interpretation. Four event markers, two on margins and two interchannel, are standard.



SPECIFICATIONS

Number of channels .....6 analog, 4 event (2 on margins, 2 interchannel)
Channel span .....40mm (50 divisions)
Frequency response .....at 50-div.: Flat within ±2% of full scale from d-c to 40Hz
at 10-div.: Flat within ±2% of full scale d-c to 100 Hz; 3dB down @ 125Hz
Non-linearity .....±0.5% full scale a-c or d-c
Trace presentation .....rectilinear
Writing method .....pressurized ink
Chart description .....six 40mm grids graduated in 50 divisions each. 5mm increments on time axis. Event marker channels on both chart margins and interchannel 2-3 and 4-5.
Chart capacity .....high-contrast: 225 ft.
Chart speeds .....eight: 1, 5, 25 and 125mm/sec. plus same speeds in mm/min.
Timer .....internal timer produces 1-sec, pulses on left interchannel event marker. Rear-panel switch allows choice of timer or external input.
Input circuit .....differential, balanced-to-ground
Input impedance .....10 megohms balanced, 5 megohms each terminal to ground
Common-mode rejection ....60dB @ 60Hz, 1mV range with 1k ohms unbalance
Measurement range .....1mV/ chart division to 500V d-c full scale (50 chart divisions)
Maximum allowable input voltage to avoid damage .....500V d-c or p-p a-c either terminal (No. 1 or No. 2) to ground or between terminal 1 and 2 (354V rms sine-wave)
Signal limiters .....built-in, adjustable, prevent pen-damage from off-scale overloads
Power input .....115V a-c ±10%, 60Hz
Power consumption .....200 watts, 275VA @ 60Hz, 115V a-c
Dimensions .....17.5″ wide x 16.25″ high x 10.25″ deep
Weight .....65 lbs., less chart paper

description	model number
BASIC UNIT	
Mark 260 portable recorder 6 40mm channels; pressure ink; 1mV sensitivity.	15-6367-00
ACCESSORIES	
Chart take-up	11-6402-04
Rack mounting kit	11-1202-09
Adapter kit for mounting Mark 260 in mobile cart listed below	11-6260-00
Mobile cart (identical to the same shown for Recorder Mark 240) Adapter kit required	11-6405-10
Starter kit, includes 12 rolls chart paper, gram gage, 2 pen-adjust wrenches	11-6250-02
6-channel portable preamplifier carrying case	11-4163-10
Connecting cable for preamplifier, 1 channel	11-4310-06

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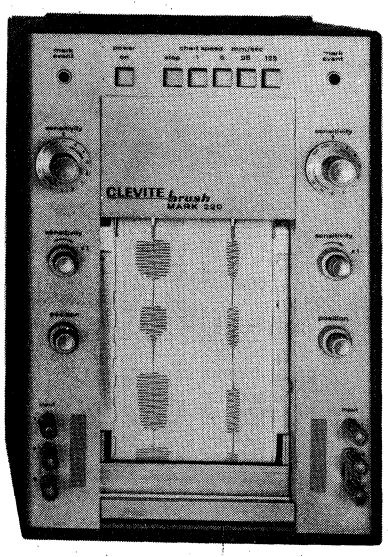
MARK 220—PORTABLE SERVO PENMOTOR RECORDER



Dual Channel Portable Preamplifier Carrying Case 11-4123-10

The Brush Recorder Mark 220 is a completely self-contained portable recorder which weighs just 25 pounds, measures 9 x 14 x 8 inches. It has two 40mm channels and four pushbutton chart speeds. Maximum sensitivity is 1 millivolt per chart division.

Voltages up to 500 volts d-c or peak a-c can be applied to its input terminals without damage to any component—no matter what the attenuator setting. Protection of pens against overload is afforded by electrical limiters on both channels.

A pen-position servo system, based on a frictionless transducer, assures extreme accuracy. Penmotor and transducer are fully enclosed and are immune to wear, time and dirt.

The pressurized ink system enables pen to write dry, smudge-free traces. Disposable, plastic ink cartridge can be replaced in minutes. If power is lost or chart paper runs out, the writing system stops immediately and ink is sucked from the pen tip back into the system. "Puddling" cannot occur.

Left-and right-margin event markers (standard) can be manually activated by buttons on the control panel or by external switch closure through convenient jacks on the rear panel.

Pen motion is rectilinear to facilitate interpretation of waveforms.

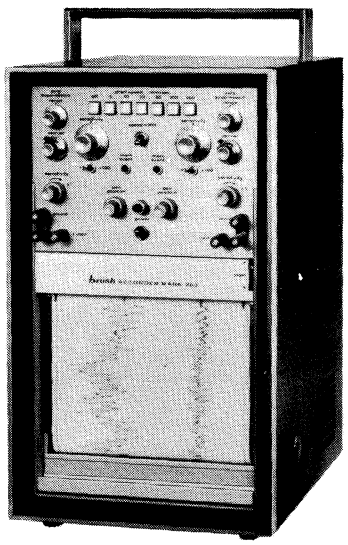
- **Priced for universal application**
- **Rectilinear marking for easy interpretation**
- **Lightweight, extremely portable**
- **Dual-channel convenience**
- **Unmatched trace clarity**
- **High-resolution, smudge-free ink recording**
- **Uses low-cost Accuchart® paper**
- **Contactless, position feed-back pendrive system ignores dirt wear**
- **Reliable, all solid-state electronics**
- **New, disposable, pressurized ink cartridge for greater convenience**

SPECIFICATIONS

Number of channels .....2 analog, 2 event
Analog-channel span .....40mm (50 divisions)
Frequency response .....at 50-div: flat within ±2% of full scale from d-c to 40Hz
at 10-div: flat within ±2% of full scale from d-c to 100Hz, 3dB down @ 125Hz
Trace presentation .....rectilinear
Trace width .....0.01″ nominal
Writing method .....pressurized ink
Writing fluid .....1 oz. (sufficient for one year of normal recording); replaceable throw-away cartridge
Chart description .....two 40mm grids graduated in 50 divisions across span. Graduated increments on time axis. Right, center and left event marker channels.
Chart capacity .....high-contrast: 275′; Reproducible: 400′
Chart speeds .....1, 5, 25 and 125mm/sec. pushbutton (electrically) selected
Chart-speed inaccuracy .....±0.25% @ nominal line frequency
Chart take-up .....optional at extra cost
Non-linearity .....±0.5% full scale a-c or d-c
Input circuit .....differential, balanced-to-ground
Input impedance .....10 megohms balanced, 5 megohms each terminal to ground
Common-mode rejection .....60dB @ 60Hz, 1mV range with 1k ohms unbalance
Measurement range .....1 millivolt per chart division to 500V d-c full scale (50 chart division)
Maximum input voltage .....500V d-c or peak a-c either input terminal (No. 1 or No. 2) to ground (354 volts rms sinewave)
Attenuator steps .....1, 2, 5, 10, 20, 50, 100 and 200mV/div: "off"
Power input .....115 volts a-c ±10%, 60Hz
Power consumption .....only 120 watts, 175VA @ 115 volts
Dimensions .....9⅛″ wide x 13 11/16″ high x 8⅛″ deep
Weight .....25 lbs.

description	model number
BASIC UNIT—MARK 220	
Mark 220 portable dual-channel system	15-6327-50
Telecommunications Mark 220. Same as 15-6327-50, but includes 1/10th-second timer, provisions for remote chart drive, a-c to d-c converter, protective cover with storage facility.	15-6327-51
ACCESSORIES	
Starter kit, including 12 rolls chart paper, gram gage, 2 pen-adjust wrenches, dust cover.	11-6250-00
Replacement kit, includes 12 rolls chart paper, 2 analog pens, 2 event pens, 1 ounce ink cartridge.	11-6251-00
1-second timer	11-6101-21
Chart takeup	11-6402-03
Rack-mounting kit	11-1202-08
Mid-channel event marker	11-6221-00
Dust cover	465971
Connecting cable for preamplifier, 1 channel	11-4310-02
Dual channel portable preamplifier carrying case	11-4123-10

MARK 280—WIDE CHART PORTABLE SERVO PENMOTOR RECORDER



The Recorder Mark 280 is a high-performance two-channel recording system which permits analysis of recorded data with accuracy and resolving power never before possible in a medium-frequency recorder. It combines a basic system accuracy of ½% (static and dynamic) with double-width 80 millimeter channels capable of displaying this accuracy usefully to the unaided eye.

Frequency response is not sacrificed. Peak-to-peak response at 80 millimeter amplitude is beyond 35 Hz, and is flat at usable amplitude to 200 Hz.

SPECIFICATIONS

No. analog channels .....2; 80mm wide (50 divisions)
No. event channels .....2; 3rd interchannel event marker is optional @ extra cost
Chart speeds .....0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, and 200mm/sec.
Trace width .....0.01″ nominal
Presentation .....true rectilinear
Writing method .....pressurized ink
Chart capacity .....high contrast paper: 275′ reproducible paper: 400′
Sensitivity .....0.5 millivolts per chart div.
Attenuator steps .....0.5, 1, 2, 5, 10, 20, 50 and 100mV/div; plus x100 multiples of above steps; "off"
Measurement range .....500V full scale
Frequency response (flat within 0.4 div.) .....to 35Hz (80mm p-p) to 60Hz (40mm p-p) to 100Hz (15mm p-p) to 140Hz (4mm p-p)
Signal input .....1 megohm impedance, constant; floating, shielded
Common mode rejection .....d-c —120dB; maximum voltage off ground, ±500V
Noise .....0.2 division peak-to-peak with 100k ohm source impedance. Any attenuator position
Non-linearity .....±0.25% full scale, a-c or d-c
Stability .....0.2 div./8 hrs.
Zero suppression (model 15-6327-10 only) .....8 ranges plus "off" and a vernier dial to read 3 significant figures of d-c suppression voltage from +500V d-c to —500V d-c

description	model number
STANDARD SYSTEMS—Mark 280	
Mark 280 portable dual channel system, forced-fluid writing, rectilinear, 80mm channel width, 0.5mV/div., sensitivity; with right and left bi-directional event markers.	15-6327-01
Mark 280 portable dual channel system same as 15-6327-01, but with calibrated zero suppression.	15-6327-10
Same as 15-6327-01 except for 115V, 400Hz operation.	15-6327-04
Same as 15-6327-01 but equipped with pulse-chart-drive*.	15-6327-30
Same as 15-6327-10 except for 115V, 400Hz operation.	15-6327-14
Same as 15-6327-10, but equipped with pulse-chart-drive*.	15-6327-40

*Signal conditioning (pulse drive amplifier) may be required at extra cost.

description	model number
ACCESSORIES	
Chart takeup	11-6402-00
Cart	11-6405-00
Rack mounting adapter	11-1202-06
One-second timer	11-6101-20
One-second timer for 400Hz operation	11-6101-24
Inter-channel event marker. Includes pen only when specified on original equipment. When ordered separately (later) prices shown do not include pen.	RA 2103-90
Band tool assembly	341409-915
Dual channel portable preamplifier carrying case	11-4123-10
Connecting cable for preamplifier, 1 channel	11-4310-08

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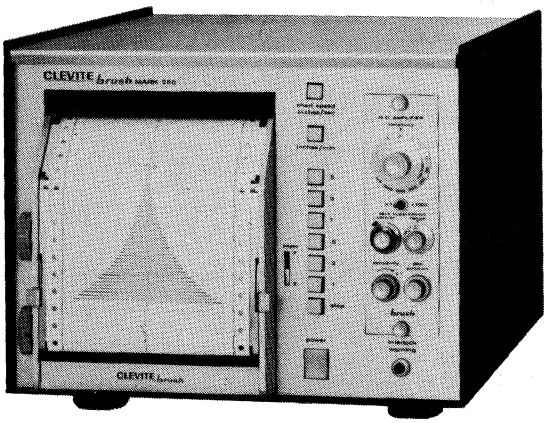
MARK 250—HIGH FREQUENCY STRIP CHART RECORDER

This versatile strip chart recorder combines the accuracy and resolution of the wide-chart servo recorder with the fast response and flexibility of the direct writing recorder.

The recorder is designed for use with any Brush interchangeable preamplifier, affording exceptional flexibility.

The chart magazine is detachable, can be removed to user's desk for review. Chart can be manually transported backward or forward. Twelve chart speeds, pushbutton actuated. Sprocketed chart drive is synchronous with line power.



description	model number
BASIC UNITS	
Mark 250 recorder, portable includes chart magazine with internal chart take-up and 1-second timer. Does not include preamplifiers.	15-6317-00
Mark 250 recorder, rack mounted	15-6617-00

description	model number
ACCESSORIES	
Right-hand event marker	11-6220-00
Left-hand event marker	11-6220-00
Removable chart magazine	11-6104-00
Dust cover for portable model	464809
Handle kit for portable Mark 250 recorder	11-6230-00

SPECIFICATIONS

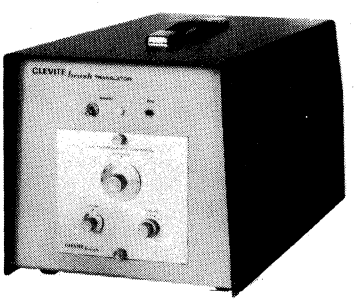
Span .....4½″ calibrated chart
Response .....40 milliseconds full scale
Non-linearity .....±0.5% of full scale, a-c or d-c
Presentation .....rectilinear
Writing method .....pressurized ink
Chart description .....4½″ grid, 50 divisions, 100′ (high contrast), 150′ (reproducible)
Chart speeds .....two ranges: 0.02, 0.05, 0.1, 0.2, 0.5, 1 sec/div. or min./div.
Basic sensitivity .....100mV/div., ±2.5V full scale; 50k ohms input impedance (supplemented by preamplifier)
Dimensions .....11 3/16″ high x 14″ wide x 18 3/16″ deep
Weight .....65 lbs.
Power requirements .....115V, 60Hz, 130 watts max.

INCREMENTAL CHART DRIVE (OPTIONAL)

Brush Recorders (Mark 200, 240 and 280) can be factory-equipped with a precision pulse-actuated stepping motor in place of the synchronous chart-drive motor. This option permits slaving chart speed to a variable other than time, and finds use in connection with digital systems or where chart speed can be a function of an independent variable.

In operation, the chart advances a precise and repeatable distance for each input pulse or switch interrupt, affording very exact chart positioning. Length of chart advance can be varied by pushbutton selection of chart speed control.

The option includes a rack-mounted pulse-amplifier (model 17-7680-00) and a plug-in frequency coupler (model 11-7280-00) which provides input pulse control. To order, add "900" following system model no. suffix, and call out Pulse Amplifier and Frequency Coupler by above model numbers.

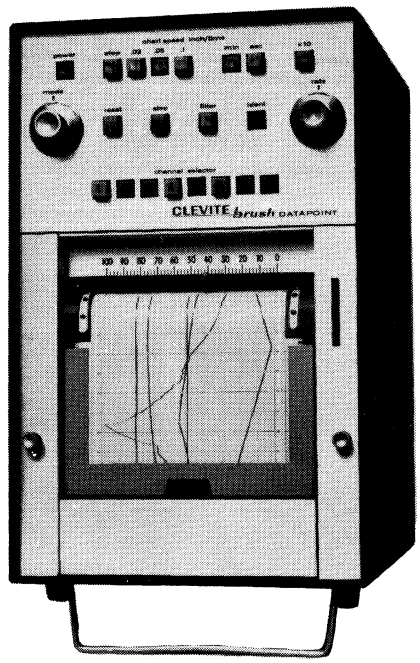


Portable pulse amplifier Model 13-7380-00 shown with input signal conditioner module Model 11-7280-00. Applicable in Mark 200, 240 and 280 Brush Recorders.

PULSE DRIVE COMPONENTS

description	model number
Portable pulse amplifier	13-7380-00
Input signal conditioner module (plugs into pulse amplifier)	11-7280-00
Rack mounting pulse amplifier	13-7680-00

DATAPOINT—A NEW CONCEPT IN RECORDING



Brush Datapoint, a high speed 8-channel multipoint recorder, operates in three modes: multipoint sampling, intensified sampling on one or two channels with less frequent sampling on the others, and continuous recording. And fast: continuously adjustable sampling from 20 points/second to 2 seconds/point. Twelve paper speeds.

FEATURES

Accepts and records mixed inputs on same chart. Multiplexes at low levels; needs only one amplifier. 99.5% accuracy with non-contact position feedback system. Push-button selection of any or all 8 inputs.

BASIC UNITS

description	model number
Datapoint 8-channel multipoint recorder, portable	15-6317-40
Datapoint 8-channel multipoint recorder, horizontal, rack-mounting	15-6617-40

ACCESSORIES

description	model number
8-channel multiplex thermocouple conditioner	13-4582-00

SPECIFICATIONS:

Presentation ..... Rectilinear

Paper ..... Z-fold pack with internal collection drawer. 75 foot length, 6 inches wide. Channel grid 4½ inches wide, 50 divisions, every 5th accentuated. In time axis, graduated 10 divisions per inch, every 5th accentuated.

Paper Speeds ..... 0.02, 0.05, 0.1 inches/minute and sec., plus "x10" multiplier

Paper Drive ..... Sprocketed drive, 12 speed transmission. Automatic shut-off when out of paper.

Non-Linearity ..... ±0.5% full scale, enforced by non-contact position feedback system.

Inputs ..... ±2.5 volts into 50,000 ohms impedance, compatible with Brush external preamplifiers.

Optional Inputs ..... Accessory amplifier with automatic thermocouple cold junction compensation, gain adjust and zero suppression. Has 8 additional input connections, to allow mixing external signal conditioner channels with thermocouple inputs. **Sensitivity:** 5 millivolts full scale into 1000 ohms impedance.

Power Requirements ..... 115V, ±10%, 60Hz, 100 watts, or 230V, ±10%, 50Hz, 100 watts,
or 115V square wave, 60Hz

Dimensions ..... 9″ wide x 14¼″ high x 12″ deep

Weight ..... 35 lbs.

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SIGNAL CONDITIONERS FOR BRUSH DIRECT WRITING SYSTEMS

SIGNAL CONDITIONERS... FOR FULL-RANGE VERSATILITY IN DIRECT WRITING

Signal conditioners described in this catalog are designed to provide amplification, control and signal-conditioning functions for Brush direct writing recording systems. They extend the application range of these systems to the full capability of the direct writing medium.

Choice from models shown includes low, medium and high gain d-c preamplifiers in both single-channel plug-in and rack-mounting multi-channel models; also special-purpose units for carrier-transducer, demodulator, high off-ground voltage and logarithmic applications. A series of signal-converters for graphic readout of frequency deviations, watts, amperes and a-c rms levels also is available.

For applications in clinical medicine or biomedical research, Brush offers special medically-oriented couplers for ECG, EEG, cardio-tachometer and physiological pressure measurements. Couplers of this series combine with fixed-gain preamplifier submodules, for added gain and signal-conditioning, and can be interchanged easily and quickly.

All Brush signal-conditioners have factory-fixed calibration and require no re-calibration when changed from one mode of recording to another.

SIGNAL CONDITIONERS, 4200 SERIES—DC

Self-powered Interchangeable Preamplifier Modules Interchangeable single-channel preamplifier modules of the 4200 series provide utmost system flexibility, convenient signal control over wide input ranges, and highest performance standards. All are fully-enclosed solid-state units of rugged construction, incorporating aerospace-quality components and assembly practices.

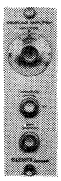
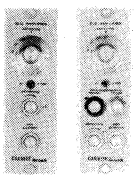
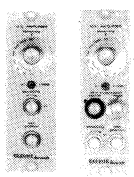
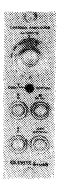
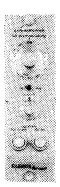
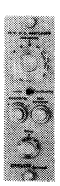
Each unit contains its own regulated power supply, which governs its specific operating frequency—thus operate completely independently. Calibration is factory-fixed.

For recording d-c inputs in the range from 0 to 500 volts, the series includes medium, high and very high gain types, with calibrated zero suppression features optional.

4200 SERIES—DC SPECIAL PURPOSE INTERCHANGEABLE PREAMPLIFIERS

For recording of inputs requiring special input circuitry, as from very high off-ground d-c voltages, from transducers requiring excitation, from carrier-operated electrical mechanisms or from sources having wide dynamic ranges—these single-channel preamplifier modules extend the capability of Brush direct writing systems into applications not otherwise easily adapted to recording.

Like other models of Brush single-channel modules, all units have self-contained power supplies—thus can operate independently in the same enclosure with units having different operating frequencies.

Description	Model No.	Measurement Range	Attenuator Steps
 **Medium Gain DC Preamplifier**	13-4211-20	50mV/div. to 250V Full Scale	0.05, 0.1, 0.2, 0.5, 1, 2, 5V/div. OFF (±0.5%)
 **High Gain Plug-In DC Preamplifiers**	13-4215-02 13-4215-12 with calibrated zero suppression	100V/div. to 500V Full Scale	100, 200, 500V/div; 1, 2, 5, 10, 20, 100mV/div. OFF, plus x 100 Mult. (±1.0%)
 **Very High Gain Plug-In DC Preamplifiers**	13-4215-62 13-4215-72 with calibrated zero suppression	1V/div. to 50V Full Scale	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000V/div. OFF, plus x 1000 Mult. (±1%)
 **Carrier Preamplifier** See Note 1.	13-4212-02	1 in/in/div. to 5 in/in Full Scale with 4 active gages	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000 in/in/div. OFF, CAL x 100 Mult. (internal) (±1%)
 **Phase-Sensitive Demodulator Preamplifier** See Note 2.	13-4216-02	**Error:** 0.5mV peak/div. to 50V peak Full Scale **Reference:** 10V to 120V rms 60Hz to 10kHz	0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000mV/div., OFF CAL (±1%)
 **Log-Linear Preamplifier** See Note 3.	13-4214-00	**a-c:** 10mV to 100V rms Full Scale **d-c:** 1V to 100V Full Scale	**a-c:** 10, 31.6, 100 316mV Full Scale; 1, 3.16, 10, 31.6, 100V Full Scale plus −50dB/F.S. (±2%) **d-c:** 1, 3.16, 10, 31.6, 100V F.S. (±2%)
 **High Voltage DC Preamplifier** See Note 4.	13-4215-82	0.5mV/div. to 1000V Full Scale	0.5, 1, 2, 5, 10, 20, 50, 100, 200mV/div. plus volts/div. Mult. (±1.0%)

Input Circuit	Input Impedance*	Common Mode Rejection d-c	60Hz	60Hz
Single Ended, Grounded	50k constant	—	—	—
Balanced, Floating, Guarded	1M constant	@ 1k unbalance 160dB	@ 1k unbalance 130dB	@ 10k unbalance 110dB
Balanced, Floating, Guarded	100k constant	@ 1k unbalance 160dB	@ 1k unbalance 120dB	@ 10k unbalance 100dB
Single Ended, Floating, Shielded	30k constant	@ 1k unbalance 120dB	@ 1k unbalance 120dB	@ 3k unbalance 110dB
Error: Balanced, Floating, Guarded **Reference:** Single Ended, Floating, Shielded	**Error:** 1M constant **Reference:** 1M constant	@ 1k unbalance 140dB	@ 1k unbalance 120dB	@ 10k unbalance 105dB
Single Ended, Grounded	10M constant	—	—	—
Full Floating, Shielded, and Fused	1M constant in mV Mode. 10M constant in "V" Mode.	@ 1k unbalance 130dB	@ 1k unbalance 120dB	@ 10k unbalance 100dB

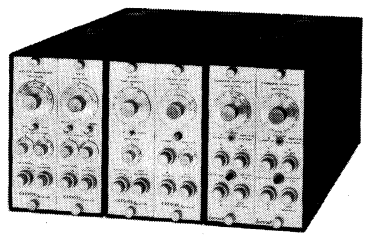
*When operating.

MOUNTING PROVISIONS

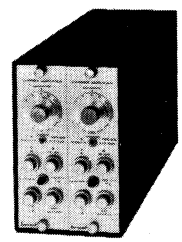
Single-channel signal conditioners are designed for use with all Brush direct-writing systems. They can function as primary signal conditioners in modular systems such as the Brush Mark 200 and Mark 240; or as supplementary signal conditioners to augment use of recorders with built-in preamplifiers, such as Brush portable recorders Mark 220, Mark 260 and Mark 280.

Mounting provisions are identical for all plug-in signal conditioner models. Plug-in connectors are compatible with the various signal conditioner receptacles available for Brush recording systems. Each module is fully-enclosed in heavy-gage steel to protect interior components. Thumb-screws used for mounting also afford safe hand-holds for insertion or withdrawal.

CARRYING CASES



Model 11-4163-10 (6-channel)

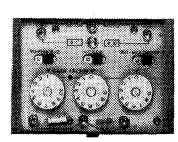


Model 11-4123-10 (2-channel)

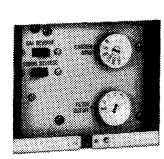
These rugged heavy-gage carrying cases, available in 2-channel or 6-channel models, provide convenient means for transport and use of Brush plug-in signal conditioners when used in conjuction with Brush portable recording systems.

Each dual-channel module (the 6-channel model comprises three modules bolted together) includes receptacles for each pre-amplifier, two sets of four output binding posts, an a-c power cord receptacle and a convenience outlet. Power for the 6-channel unit is distributed by patch-cords, supplied. Convenience outlets supply a-c power for recorder or associated instrumentation. Six-foot signal cords with appropriate connectors are available as accessory for connection of each channel with Brush portable recorders Mark 220, Mark 260, or Mark 280, and should be specified on order.

Note 1: Carrier Preamplifier Model 13-412-02
QUICK-ENTRY INTERNAL PANEL CONTAINS OTHER CONTROLS
Accessible with preamplifier partially withdrawn, this side panel has provision for setting transducer gage factors, phase adjustment, cal signal polarity and attenuator multiplier. Includes terminals for counting bridge-completion resistors; also for altering resistive and capacitive balance range.



Note 2: Demodulator Preamplifier Model 13-4216-02
QUICK-ENTRY INTERNAL PANEL CONTAINS OTHER CONTROLS
Accessible with preamplifier partially withdrawn, this side panel has provision for setting signal reverse, cal signal reverse, carrier band select and filter cut-offs.



Note 3: Log-Linear Preamplifier Model 13-4214-00
SELECTIVE FILTERING
In a-c Log and a-c Linear modes, low frequency cutoffs are selectable at —3dB down points of 7, 20, 100 and 500Hz. Filter roll-off is 12dB per octave.

In addition to high-pass filtering, each cutoff point switches in proper filter elements to eliminate a-c ripple in output. At nominal frequencies, ripple will not exceed 1dB. Step response of the preamplifier is affected as follows:

Cut-Off	Rise Time (10%-90%)
7Hz	0.4s
20Hz	0.1s
100Hz	0.02s
500Hz	0.004s
d-c	2ms

Note 4: High Voltage Preamplifier Model 13-4215-82
FILTERING CAUSES NO LOSS CALIBRATION
Selective filtering of extraneous electrical noise is accomplished without loss of calibration accuracy and with constant input impedance. Dial settings indicates 3dB down points of filter network.

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SIGNAL CONDITIONERS

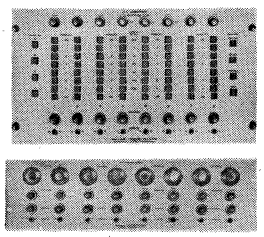
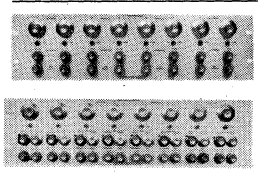
4100 and 4400 SERIES
MULTI-CHANNEL D-C PREAMPLIFIERS

For use with Brush Mark 200 multi-channel recording systems in medium- or high-gain applications, these rack-mounting 8-channel preamplifier units offer signal conditioning, control and amplification—also exceptional convenience and highest fidelity.

Series 4100 medium gain models are available in choice of pushbutton or rotary attenuator configurations, with maximum sensitivity of 50 mV/div. and 50,000 ohms input impedance. The pushbutton model is ideal for analog computer use and features external-switch pushbuttons which allow control of the computer from the recorder station. Rotary-attenuator model occupies less space, has identical specifications, but does not include external switching feature.

Series 4400 preamplifiers extend recording capability of the Mark 200 system to 1 mV/div. sensitivity, with floating inputs and 1 megohm input impedance. Models are available with or without calibrated zero suppression.

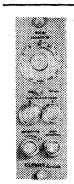
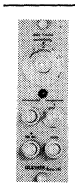
Units have built-in power supplies, hence can operate independently at 50 to 400 Hz a-c power, 115 or 230 volts. Mounting provisions are compatible with standard 19-inch racks to RETMA specifications.

Description	Model No.	Measurement Range	Attenuator Steps
 Medium Gain Multichannel d-c Preamplifiers	13-4185-05 (Push-button) 13-4185-25 (Rotary)	50mV/div. to 250V F.S.	0.05, 0.1, 0.2, 0.5 1, 2, 5V/div., OFF (±1%)
 High Gain Multichannel d-c Preamplifiers	12-4485-00 13-4485-10 with calibrated zero suppression	1mV/div. to 250V F.S.	1, 2, 5, 10, 20 50mV/div., OFF plus x multiplier (±1%)

4300 SERIES
BIOMEDICAL COUPLER-PREAMPLIFIERS

Brush biomedical coupler-preamplifiers (4300 Series) are specifically applicable for recording of biophysical data for use in medical and life-science research, or in clinical and diagnostic applications. The series includes ECG, EEG, biotachometer and universal-purpose a-c/d-c couplers, plus an integrator coupler for blood pressure measurements and others where transducer excitation is required. All are fully-enclosed solid state units, designed to combine utmost accuracy, stability, common-mode rejection and reliability with greatest convenience in use. All are factory-calibrated and have independent power supplies.

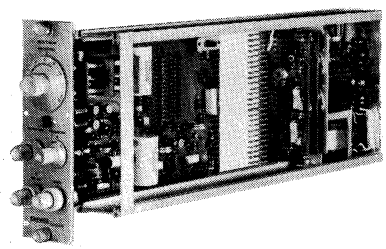
Biomedical couplers are designed to plug into a Universal preamplifier sub-module (model 13-4218-00), one per channel, which supplies final amplifier stages plus necessary signal isolation. Such combinations have response in the frequency range from d-c to 10 kHz and have ample output to drive tape recorders, computers, oscilloscopes or other devices in combination with the oscillograph.

Description	Model No.	Measurement Range	Sensitivity Steps
 **ECG Biomedical Coupler**	11-4307-01	20V/div. to 25mV F.S.	20, 50, 100, 200, 500V/div. (±1%)
 **EEG and High Gain a-c Biomedical Coupler**	11-4307-02	1V/div. to 50mV F.S.	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000V/div., OFF, (±2%)
 **Bio-Tach Computer Coupler**	11-4307-03	1bpm/div. to 500bpm F.S. **Hi level:** 13V/div. to 25mV F.S. **Low level:** 2mV/div. to 5V F.S.	1, 2, 5, 10bpm (±2%) CAL, OFF, ECG
 **Universal a-c/d-c Biomedical Coupler**	11-4307-00	**a-c:** 20V/div. to 25mV F.S. **d-c:** 1mV/div. to 25V F.S.	**a-c:** 20, 50, 100, 200, 500V/div. (±1%), OFF **d-c:** 1, 2, 5, 10, 20, 50, 100, 200, 500mV/div. (±1%)
 **Integrator Coupler**	11-4307-04	1mV to 10V	1, 2, 5, 10, 20, 50 and 100mV/sec/div.

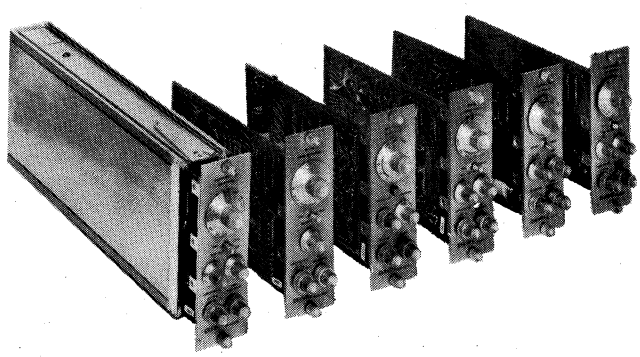
Input Circuit	Input Impedance	Common Mode Rejection d-c @ 1k unbalance	60Hz @ 1k unbalance	60Hz @ 10k unbalance
Single Ended, Grounded	50k constant	–	–	–
Single Ended, Floating, Shielded	1k constant	120dB	100dB	80 dB

Miscellaneous	Input Impedance	Common Mode Rejection (60Hz)	Max. Skin Potential
LEAD SELECTOR OFF, Leads 1, 2, 3, AVR, AVL, AVF, V, CF	100M each unit to chassis 700k between any pair of electrodes	60dB @ 5k unbalance	0.5V d-c
FILTER POSITIONS (–6dB or ½-amplitude points) **High:** 20, 30, 60, 90Hz; 1kHz **Low:** 0.1, 0.3, 10Hz	100M minimum for any sensitivity	80B @ 10k unbalance into a floating load; otherwise dB	0.5V d-c
THRESHOLD SENSITIVITY ("Trigger" voltage for rate modes) **Hi level:** 100V to 5mV (±20% adj) **Low level:** 20mV to 1V (±20% adj)	**High level:** 560k each terminal to chassis **Low level:** 100M each terminal to chassis	60dB @ 5k source unbalance	–
FILTER POSITIONS (C-3dB points) **High (a-c/d-c):** 10, 30, 100Hz ±i5%; 1, 10kHz ±15% **Low (d-c)** 0.05, 0.5, 1.5Hz ±15%	all a-c ranges: 20M all d-c ranges: 10M	**a-c ranges:** 60dB @ 5k unb., 40dB @ 50k unb. **d-c ranges:** 40dB @ 5k unb., 30dB @50k unb.	–
–		–	–

Universal Preamplifier 13-4218-00



Each of the various Brush biomedical signal conditioners consists of two separate sub-modules; a coupler and a medical amplifier. The coupler contains the control panel and circuitry peculiar to its nameplate function. The medical amplifier, or "back end" of each plug-in module, is a universal a-c/d-c high-gain amplifier and other circuitry which is exactly the same for each channel, regardless of function. It is ordered by a separate model number, 13-4218-00, one per channel. For one channel of ECG, for example, you must specify two model numbers: 11-4307-01 for the ECG Coupler and 13-4218-00 for its mating universal preamplifier. (Specifications refer to the combination.) The economic advantages of this arrangement are well established: when all of the couplers in your collection are not likely to be used simultaneously, your investment in idle circuitry can be sharply reduced.



SIGNAL CONDITIONERS

5201 SERIES
INPUT CONVERTERS

This series of interchangeable plug-in input converter modules provides for conversion of rms volts, rms current, watts and/or frequency deviations into corresponding d-c levels for direct recording on Brush oscillographs. They are widely used for performance evaluation of a-c operated motors, controls, voltage regulators, circuit breakers and other apparatus where a-c operating levels must be measured.

THE SERIES INCLUDES A TOTAL OF SEVEN MODELS:

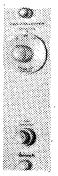
Frequency Deviation
Three models, for measurement in 45-55, 55-65, and 375-425 Hz ranges.

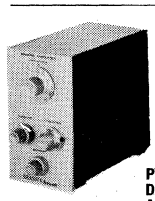
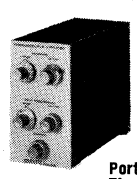
A-C Watts
One model, 0-250/500W @ 115V; 0-500/1000W @ 230V. Two frequency ranges: 55-65 Hz and 350-450 Hz.

A-C Volts
Two models, one with 0-300V range, the other with 90-140V and 180-280V ranges. Each has two frequency ranges: 55-65 Hz and 350-450 Hz.

A-C Amps
One model, with selected 0-1 amp, 0-2 amp or 0-5 amp measurement ranges.

All models are designed to be compatible with established electrical industry standards. All have floating inputs. Units simply plug into standard preamplifier receptacles and are self-powered.

Description	Model No.	Measurement Range	Sensitivity	Rise Time
 **INPUT CONVERTERS frequency deviation to d-c volts**	11-5201-02 11-5201-03 11-5201-04	45-55Hz[1] 55-65Hz[1] 375-425Hz[1]	0.2Hz/div. 0.2Hz/div. 1.0Hz/div.	100ms/50Hz 75ms/60Hz 25ms/400Hz
 **INPUT CONVERTER a-c watts to d-c volts**	11-5201-05	**@ 115V** 0-250W 0-500W **@ 230V** 0-500W 0-1000W	5 & 10W/div. 10 & 20W/div.	75ms/60Hz 25ms/400Hz
 **INPUT CONVERTERS a-c volts to d-c volts**	11-5201-06 11-5201-07	0-150V a-c 0-300V d-c 90-140V a-c 180-280V a-c	**ATTENUATOR STEPS** 3V a-c/div. 6V a-c/div. 1V a-c/div. 2V a-c/div.	30ms/60Hz 10ms/400Hz 50ms/60Hz 15ms/400Hz
 **INPUT CONVERTER a-c amps to d-c volts**	11-5201-08	0-1 amp a-c 0-2 amps a-c 0-5 amps a-c	**ATTENUATOR STEPS** 20ma/div. 40ma/div. 100ma/div.	50ms/60Hz 15ms/400Hz

Description	Model No.	Measurement Range	Attenuator Steps
 **Portable DC Bridge Amplifier**	13-4312-00	For transducers of 2mV/V to 10mV/V sensitivity	5, 10, 20, 50, 100% load, OFF ad CAL (±1%)
 **Portable Thermo-couple Amplifier**	13-4312-00	2mV full to 70mV full scale	2-10, 10-20, 20-30, 30-40, 40-50, 50-60, 60-70, mV full scale

Input Voltage (max)	Input Current (max)	Input Impedance	Input Frequency Ranges	Power Factor Range
—	—	5k or more on all ranges	—	—
135/270V	4.4/8.8 continuous	—	55-65Hz 350-450Hz	unity to 0.5 leading or lagging
—	—	12k or more on all ranges	55-65Hz 350-450Hz	—
—	—	Approx. ¼	55-65Hz 350-450Hz	—

Input	Common Mode Rejection d-c	Common Mode Rejection 60Hz
Balanced to common, with removable ground strap 50k constant		@ 1k unbalance 80dB
Potentiometric 100k minimum	@ 1k unbalance 80dB	@ 1k unbalance 80dB

BRUSH

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MARK 2300 LIGHTBEAM OSCILLOGRAPH

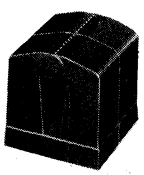
The Brush Series 2300 eight or sixteen channel oscillograph produces direct recordings of unmatched readability by an incandescent optical system possessing unique advantages in simplicity, safety, and economy. Dual-filament lamp insures fail-safe data acquisition.

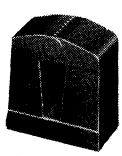
Writing speed is greater than 20,000 inches/second. Records are visible directly on exposure to ambient room light. They appear in fine traces at all writing speeds, uncluttered by UV jitter. Sixteen record speeds are controlled by pushbuttons, may be changed during operation with no loss of data.

Galvanometers are simple plug-in units with no setscrews, requiring no adjustment other than spot-zeroing. Matched solid-state galvo amplifiers, optional, further augment application range.

Brush's system of galvo drive amplifier design enables the user to avoid burdensome juggling of signal-source impedance, damping resistance, natural frequency, and sensitivity parameters for each test set-up.

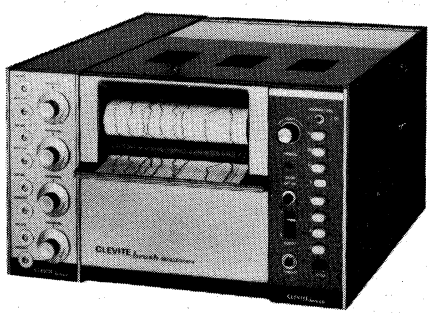
By routine use of one or both Brush drive amplifiers (-00 or -10), the investigator can proceed with the simplicity of preamplifier-and-pen oscillography.





Either 1 or 2 of 11-2130-00 magnet block must be ordered separately

description	model number
BASIC UNITS less galvanometers and accessories.	
Standard lightbeam oscillograph, (less magnet block)	16-2300-00
8-channel magnet block (order 2 for 16-channel/operation)	11-2130-00
GALVANOMETERS AND RELATED APPARATUS	
Galvanometer, flat frequency response 0-22Hz, sensitivity 6 microamps/inch	11-2111-30
Galvanometer, flat frequency response 0-45Hz, sensitivity 25 microamps/inch	11-2111-28
Galvanometer, flat frequency response 0-100Hz, sensitivity 55 microamps/inch	11-2111-20
Galvanometer, flat frequency response 0-170Hz, sensitivity 2.5mA/inch	11-2111-13
Galvanometer, flat frequency response 0-1000Hz, sensitivity 28mA/inch	11-2111-10
Galvanometer, flat frequency response 0-5000Hz, sensitivity 45mA/0.1 inch	11-2111-05
Fuse for -30, -28, -20, -13 galvos	233947-3
Fuse for -10 and -05 galvos	233947-8
Magnet block heater—8 channel	11-2107-00
Magnet block heater—16 channel	11-2107-01
SIGNAL CONDITIONERS (amplifiers, networks, etc.)	
Signal limiter, for use with 11-2111-10 galvanometer only	11-2113-30
Galvo damping network, adjustable	11-2113-10
Galvo damping network, fixed	11-2113-20
Matching network for use with 4200 series preamplifiers and 11-2111-20 galvo	11-2113-40



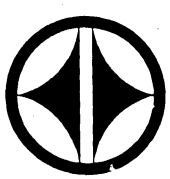
SPECIFICATIONS

Recording speeds .....Model 16-2300-00: 0.2, 0.4, 1, 2, 5, 10, 25 and 50 ips (±5%) plus 100.

Recording paper .....6″ wide direct writing photo recording paper. Accepts 125′ roll of standard of 225′ roll of thin-base paper. Also accommodates standard photographic papers.

description	model number
SIGNAL CONDITIONERS (amplifiers, networks, etc.) continued	
1-channel galvo drive amplifier, 200mV/inch	13-5311-00
2-channel galvo drive amplifier, 200mV/inch	13-5321-00
3-channel galvo drive amplifier, 200mV/inch	13-5331-00
4-channel galvo drive amplifier, 200mV/inch	13-5341-00
1-channel galvo drive amplifier, 2mV/inch	13-5311-10
2-channel galvo drive amplifier, 2mV/inch	13-5321-10
3-channel galvo drive amplifier, 2mV/inch	13-5331-10
4-channel galvo drive amplifier, 2mV/inch	13-5341-10
4-channel 6kHz carrier amplifier for use with 11-2111-10 galvos	13-5443-00
MISCELLANEOUS	
10-channel event marker (factory installed). For each additional 10-channel unit add $350.00	11-2112-10
Rack mounting kit for oscillograph and amplifier modules. 5300 series	11-1202-02
Trace interrupter (9″ cycle)	11-2105-00
Exposure hood	11-2106-00
Fotolyzer lamp—60Hz	11-2115-00
3-inch modular inverter for 12/28V d-c operation	11-2282-00
Record timer	11-2401-00
Handle, oscillograph only	11-2118-00
Handle, oscillograph and one amplifier module	11-2118-01
TIME LINE GENERATORS	
Time line generator for use on 60Hz line frequency only. Produces 10 lines per sec, every 5th accentuated, or 100 lines/sec, every 10th accentuated.	11-2104-00
Time line generator with internal oscillator for use on 50-400Hz line frequencies. Produces 1 line/sec., 10 lines/sec., or 100 lines/ sec.; time lines not accentuated	11-2104-40
GRIDLINE SYSTEMS	
Gridline system—1/10″ increments, every 5th accentuated	11-2108-01
Gridline system—2mm increments, every 5th accentuated	11-2108-02

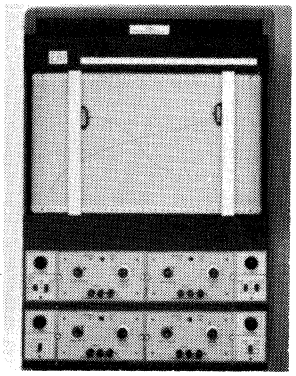
Look in the Green Section for Products and their Manufacturers



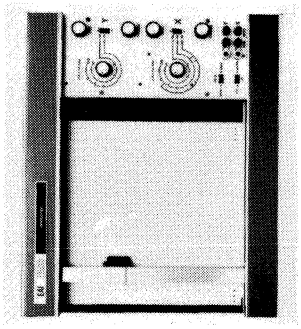
Tell them you found them in eem

EAI®

X-Y RECORDERS, DIGITAL RECORDERS

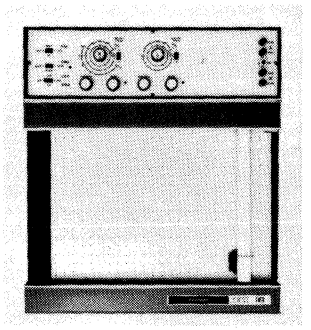


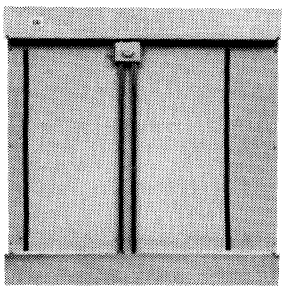
Series 1110 solid state VARIPLOTTER®
for systems or general laboratory applications.
The EAI VARIPLOTTER, Series 1110 combines proven superior accuracy, with solid-state circuitry, transformer-coupled servos, dual mode hydraulic damping, modular design and complete flexibility. The Series 1110 Variplotter is the most advanced 11" x 17" x-y plotter available today.
Superior accuracy and performance.
• 0.075% static accuracy • 0.05% repeatability • 100 microvolt/inch sensitivity • dual mode hydraulic damping • controlled flow ink cartridge.
Rugged and reliable.
• all-solid-state • blower type vacuum system • stainless steel arm rails • high strength arm beam • transformer coupled servos.
Maximum flexibility.
• modular plug in design • full line of accessories and input modules • $X_1Y_1X_2Y_2$ plotting capability • $X\text{-}Y_1Y_2$ plotting capability • rack or table mounting.



all solid-state VARIPLOTTER®, series 1125
...11" x 11½" recorder offering precision x-y plotting of any data available in D.C. voltage form. Designed for table-top or rack mounting, the new Series 1125 combines the accuracy, flexibility, speed and quality, that for more than 15 years has made EAI a leader in x-y recording equipment.

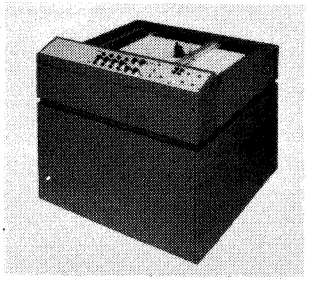
Series 1130-1133
11" x 17" recorders in four versatile formats, including X-Y, X-Y-Y_1 recording modes. This series incorporates a wide range of options for precision laboratory and systems applications. High quality components, simple construction and typical EAI reliability.

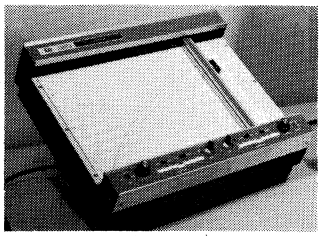




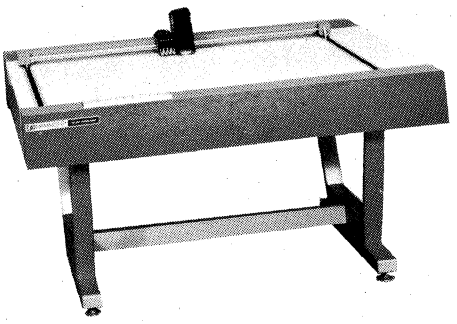
OEM series 17 X-Y recorder
The OEM-17 X-Y Recorder is a new concept in plotter design for the original equipment system manufacturer. The plotter employs a highly reliable low cost design employing a DC servo system. It offers flexibility in size and interface to accommodate your particular system requirements.

ALL-Solid-State VARIPLOTTER®
Series 205 30" x 30" X-Y plotting system. The Series 205 Transistorized VARIPLOTTER X-Y Plotting System by EAI provides fast, accurate and convenient plotting of any data that is available in d-c voltage form. A special model, capable of accepting 400 cps a-c voltage signals directly, is also available.





VARIPLOTTER® series 1140
The new Series 1140 VARIPLOTTER® combines long term repeatability with outstanding dynamic and static accuracies to assure an unusually reliable high-speed 11" x 17" X-Y Analog Plotter. Designed for recording of computer solutions, its high velocity is augmented by greater acceleration to provide ideal performance under a wide range of applications.



SERIES 430 DATAPLOTTERS®
The Series 430 Dataplotters® are an entirely new concept in the reduction of digital data to useful graphic format. Employing a servo drive system and a unique "look-ahead" acceleration control, the 430 Dataplotter is able to provide inked drawings from a digital input at plotting speeds of up to 20 IPS, for greatly enhanced tape and computer-time efficiency.

The 430 Dataplotters operate with resolution to 0.001", and employ position feedback to automatically and positively correct accidental displacement of pen or arm.

In addition to line plots, the 430 Dataplotters can also annotate alpha-numerics of typewriter quality.

Six-mode software is available.

Plotting surfaces up to 54" x 76" available.

MODULAR DIGITAL MEASURING SYSTEMS

EAI®

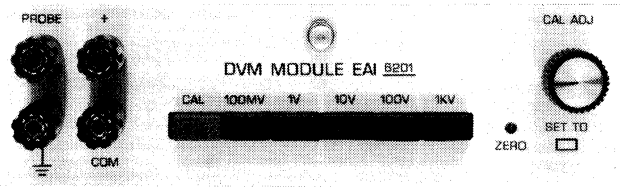


The EAI Series 6200 instruments introduce a major new concept in electronic measurement equipment, combining the precision and reliability expected from a laboratory instrument with the "plug-in" versatility necessary for a variety of routine measurements.

With EAI's "plug-in" concept, it's simpler and far less costly to keep pace with changing instrumentation needs. The user may start with the basic measuring system, then by selecting the desired "plug-in" input module you can tailor-make an instrument to meet your present needs. As requirements change, you can buy the needed plug-ins for the functions you want—at a fraction of the cost of a new instrument.

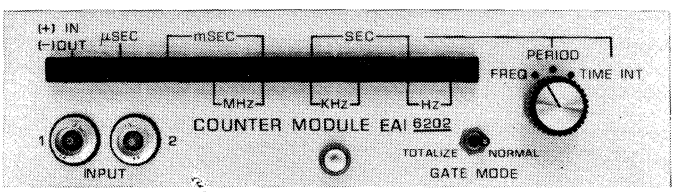
Digital Measuring System

The Series 6200 Digital Measuring System consists of the basic chassis containing the power supply, 4-digit NIXIE® Readout and silicon solid-state circuitry, plus provisions for up to two plug-in modules. For measurement of DC and AC voltages, frequency, period, time interval and other electrical parameters—the Series 6200 provides the display—the plug-in module determines the application. This plug-in approach permits buying only those measuring capabilities currently required, and provides unparalleled versatility in the low cost digital measuring field. EAI Instrument Division engineering will introduce additional input modules to keep the Series 6200 Instruments at "state of the art" level for years to come.



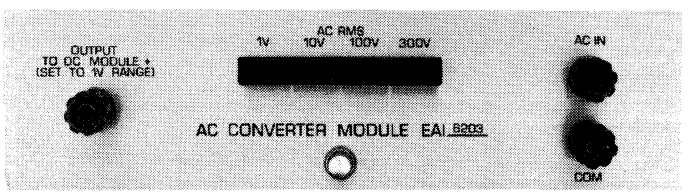
DC INTEGRATING DIGITAL VOLTMETER MODULE
Series 6201

The EAI Series 6201 Plug-In Module provides DC voltage measurement capability in five ranges, from 100.0 mv to 1000 volts, with an accuracy of ±0.1 percent ±1 digit. Automatic polarity selection and push-button ranging afford fast, easy operation, while the integrating function provides accurate voltage measurements even in the presence of high levels of superimposed hum and noise.



DIGITAL COUNTER MODULE
Series 6202

The EAI Series 6202 Plug-In Module provides multi-function measurement capability for the Series 6200 Digital Measuring System. When used with the 6200 Display Unit, the 6202 measures frequencies to 10MHz with ±.005% ±1 count accuracy and period or time intervals from 1 usec to 1000 seconds with 1 usec ±1 count resolution. Input sensitivity is 100 millivolts.



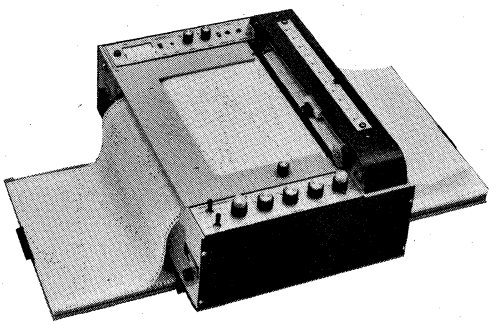
AC CONVERTER MODULE
Series 6203

The EAI Series 6203 Plug-In Module provides multi-function measurement capability for the Series 6200 Digital Measuring System. When used with the Series 6200 Digital Display Unit and the Series 6201 DC Integrating Digital Voltmeter Module, the 6203 provides AC voltage measurement capability in four ranges from 0 to 300 volts (rms) over a frequency range from 20 Hz to 100 KHz.

EAI® *Electronic Associates, Inc., Long Branch, New Jersey* 07740

(201) 229-4400

Omnigraphic™ Plotters Continue to Offer More Features, Less Cost



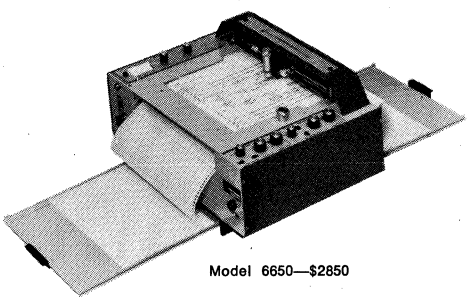
Model 6550—$2850

High speed point plotting for the Nuclear Lab:

Here is the popular OMNIGRAPHIC™ point plotter designed for use with pulse height analyzers, digital oscilloscopes, DVM's, counters or scanners. Simply plug in the 6550 and you get:

- ☐ A plotting speed of 1200 points/minute
- ☐ Four Step resolution from 0.025″ to 0.10″
- ☐ High accuracy of ± 0.2% with ± 0.1% repeatability
- ☐ Manually selectable 6 character printer head
- ☐ Z-fold chart paper tears to file size
- ☐ Bi-directional paper movement
- ☐ Plugs into the following Pulse Height Analyzers with only a cable change:

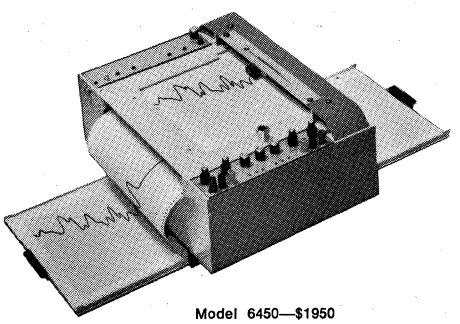
Fabri-Tec Intertechnique Laben Northern Scientific Nuclear Data Packard RCL-RIDL TMC Victoreen



Model 6650—$2850

The 6650 digital plotter records data from computers, encoders or other incremental signals:

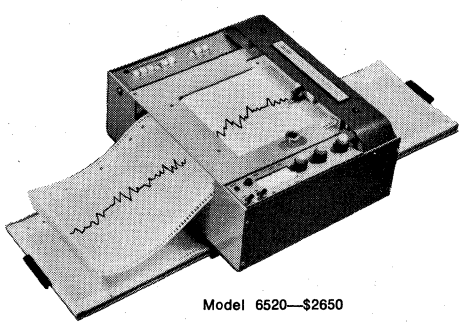
- ☐ Bi-directional stepping motor on each axis steps up to 18,000 increments/min.
- ☐ .01″ or .005″ step sizes
- ☐ Programmable pen control
- ☐ Accepts AC or DC input signals
- ☐ Z-fold chart paper
- ☐ Infinite Scale Expansion available
- ☐ Send for complete information on this and other computer plotters.



Model 6450—$1950

X-Y Plotting is now more convenient with the Omnigraphic™ 6450 because it has all the advantages of conventional X-Y's, yet offers:

- ☐ Z-fold paper eliminates hand loading of individual charts
- ☐ Automatic index or reversal of chart on command—local or remote.
- ☐ Slewing speed 20 in/sec. on Y (pen) axis and 15 in/sec. on X (paper) axis.
- ☐ 18 calibrated DC voltage ranges (continuously variable between ranges).
- ☐ Input impedence 1 megohm, all ranges fixed and variable
- ☐ Accuracy ± 0.2% of full scale, repeatability ± 0.1%
- ☐ 11″ x 17″ recording surface
- ☐ Pen control local or remote
- ☐ Front panel switch for automatic English/Metric scaling
- ☐ Ask about 2 pen model 6452



Model 6520—$2650

Here's an X-Y, Sequential Chart, External Chart Control, X-Y Programmed Voltage, Strip Chart and X-Y Programmed Movement: All in one recorder!

The 6520 does the job of six . . . without additions or modifications. Features include:

- ☐ Continuous or automatic paper feed.
- ☐ 18 speed selections from 2″/sec. to .05 in/hr. (144,000:1) range.
- ☐ Sensitivity 1mv full scale
- ☐ Pen speed 20 in/sec.
- ☐ Accuracy 0.2% full scale, repeatability .1%
- ☐ 20 voltage ranges.

Various optional features are available for special applications. Write today.

houston instrument | DIVISION OF BAUSCH & LOMB

4950 Terminal Avenue, Bellaire, Texas 77401
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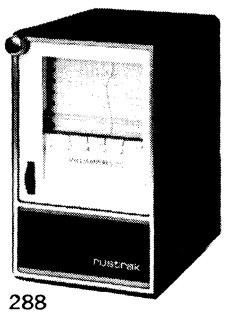
rustrak miniature chart recorders

Dependable miniature instruments for permanently recording power, temperature, pressure, strain, events or virtually any parameter that can be converted into an electrical signal. • Inkless, dry writing, rectilinear recording with wide range of sensitivities, writing and chart speeds. • Operate as chart tearoff or reroll. Quick, easy chart review and rewind. Sliding access window. • Most units about 5⅝"H, 3⅝"W, 4⅛"D. Weight about 3½ lbs. • Rugged die-cast aluminum case in epoxy suede-like charcoal gray finish. • Accuracy ±2% of full scale. Response time 0.8 sec. to 1.0 sec. Usable chart widths: single channel — 2-5/16", dual channel — 1" each.

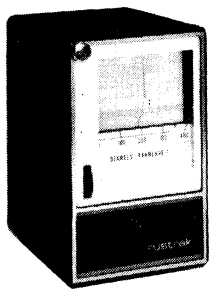


288

Single Channel DC Recorder.

Basic recorder in the Rustrak line. Ranges from 0-10 microamperes to 0-5 amperes DC; 0-10 millivolts to 0-500VDC. Multipliers and shunts available. Chart speeds 1/32" to 480" per hour. Many available options, features and accessories. AC models also available.

from **$99.50**

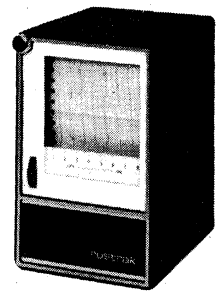


2122

Temperature Recorders.

Wide variety of temperature recorders using thermocouples, thermistors or nickel wire sensors. Ranges from −100°F. to +2400°F. and custom spans as narrow as 25°F. Also available in °C. and in single or dual channels.

from **$148.00**

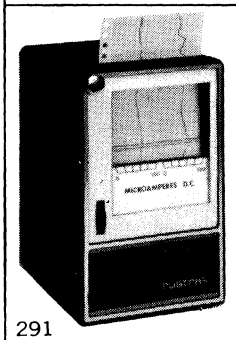


292-4

Event Recorders, Models 292-4 & 292-8.

Four or eight channels. Records worktime, productivity of machines and personnel; provides data for time study, cost analysis, security control. Chart speeds to 50 inches per minute with definition of up to 16 events per second.

from **$103.00**



291

Dual Channel DC Recorder.

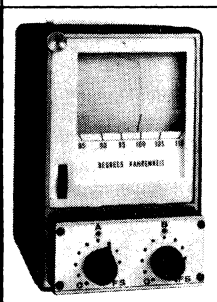
Same as basic Model 288 except dual channel with two galvanometers. Available in combinations of current and voltage or different ranges each channel. Useable chart width, 1" per channel. AC models also available.

from **$143.50**

Let Rustrak engineering "knowhow" develop an instrument for your particular application.

TRANSPORTATION
OCEANOGRAPHY
MILITARY
COMMUNICATIONS
ATOMIC ENERGY
MEDICAL
CHEMICAL
PROCESSING
RESEARCH
ELECTRONIC



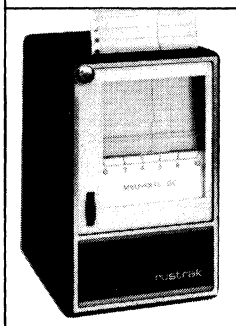


2133/F204AB

Recording-Controller Feature.

ON-OFF solid state controller feature available as option on most Rustrak recorders. Controls up to 5 amps resistive load at 30 VDC or 115 VAC. Set points continuously adjustable over entire chart range. Option price added to cost of companion recorder. Not available separately.

from **$95.00**

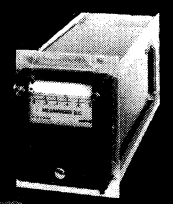


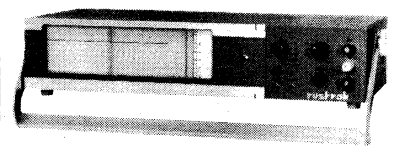
2194

One Microampere DC Recorder.

Solid state with full-scale sensitivity of 1 microampere, range of 0 to 10 millivolts DC and input impedance of 10,000 ohms. For use as temperature bridge and strain gauge readout or as a recorder accessory for laboratory and process instruments.

$180.00



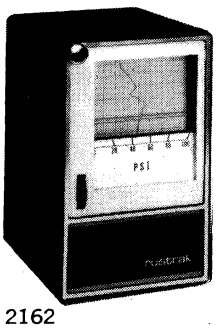


191

Multipurpose Recorder.

Two recording channels, one analog, one event. Twenty-one ranges up to 1000 millivolts, microamperes or milliamperes on analog channel. Displays 7½ inches of chart. On-off event marker has 10 millisecond response time. Carrying handle doubles as tilting support.

$425.00

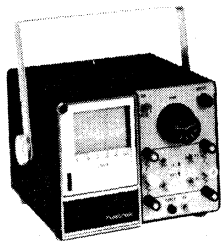


2162

Pressure Recorder.

Single channel pressure recording of most liquids and gases using a C-type Bourdon tube. Standard ranges 0-15, 0-30, 0-50, 0-100, 0-200, 0-300 and 0-500 psi. Many special offset ranges available.

from **$110.00**

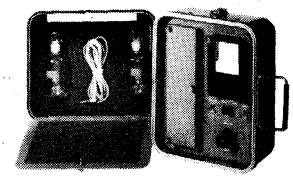


2195

Strain Gage Recorder.

Records resistance change of gages used for measuring strain, stress, displacement, load, torque, or any transducer using strain gauge sensing elements for static display. Maximum sensitivity: 500 micro-inches/inch. Self-contained instrument with regulated supply.

from **$385.00**



192

Dissolved Oxygen/Temperature Recorder.

Simultaneously records dissolved oxygen and temperature. Temp. range, 0 to 40°C. Operates unattended for about four weeks from two inexpensive batteries. Chart speed regulation, ±0.5%. For surveys in water pollution control programs.

$585.00

Many other types of recorders available. Send for catalog.

Rustrak *the miniature recorder people*

rustrak Instrument Div.
Gulton Industries Inc.
Manchester, N.H. 03103 • (603) 623-3591

In Canada:
Gulton Industries (Canada) Ltd.
P.O. Box 1150,
Gananoque, Ontario

Y-LAB GRAPHIC RECORDER PRICE BREAKTHROUGH

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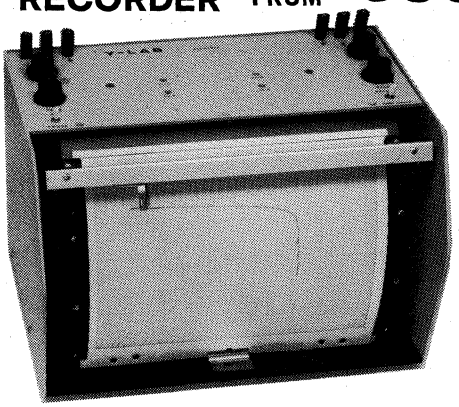
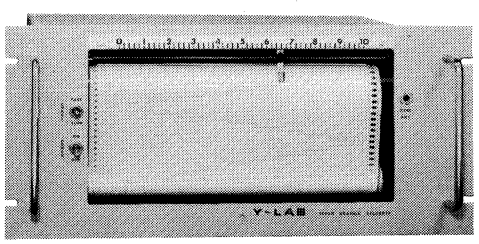
THE Y-LAB MODEL 30 X-Y RECORDER FROM $380.00



SPECIFICATIONS	MODEL 30A	MODEL 30B
CIRCUIT	Direct coupled servo amplifiers.	Chopper stabilized servo amplifiers.
SENSITIVITY (max)	100 millivolts/inch.	1 millivolt/inch
ACCURACY	½% full scale.	½% full scale.
INPUT RESISTANCE	Potentiometric (infinite) on max sensitivity. 50K on attenuated range.	Potentiometric on high sensitivity. 10K/volt on attenuated ranges.
ATTENUATOR	Continuously variable 100 mv/in to 1 v/in.	1-5-10-50-100-500 mv/in plus continuously variable.
SPEED	10 inches/second.	10 inches/second.
PRICE	$380.00.	$485.00.
GRAPH SIZE	8½" x 11" paper. Pen travel 7" x 10".	
DIMENSIONS	14" Wide x 9" High x 10½" deep.	
WEIGHT	15 pounds.	
POWER	115 volts; 50-60 cycles per second; 30 watts.	

THE Y-LAB MODEL 28 SERVO GRAPHIC RECORDER FROM $325.00



SPECIFICATIONS	
FULL SCALE SPAN	10 Millivolts.
INPUT RESISTANCE	Infinite at balance. Signal Source resistance greater than 50K will degrade accuracy.
INPUT ISOLATION	100 volts DC maximum relative to chassis.
LIMIT OF ERROR	½% of full scale.
LINEARITY REPEATABILITY STABILITY	Better than ¼% over a 30° F temperature and 105-125 line voltage.
PEN SPEED	One second full scale.
DAMPING	No overshoot.
CONTROLS	**Front Access:** Zero Set — pen may be zeroed anywhere on chart. Power Switch. Chart Speed Switch. Pen Lift. **Rear Access:** Full Scale Span. Servo Amp Gain. Input Terminals.

INKING SYSTEM

Capillary reservoir.

CHART SPEEDS

1 inch per minute and 1 inch per hour standard. Other speeds available on order.

CHART

12 inches x 100 feet; graduated 10 inches.

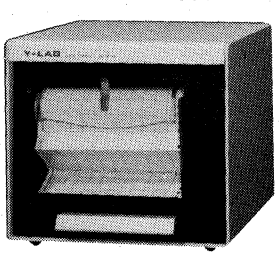
POWER

115 volts; 60 cps; 15 watts.

DIMENSIONS

19" wide x 8¾" high x 8" deep. Weight 15 lbs. Mounts in standard rack or cabinet.

THE Y-LAB MODEL 26 SERVO GRAPHIC RECORDER FROM $195.00



6" H x 7" W x 6½" D BENCH OR PANEL MOUNT

FEATURES

- 1% ACCURACY
  All the precision that is meaningful on a 4" chart.
- ½-SECOND PEN SPEED
  1 CPS response. No overshoot.
- FLOATING INPUT
  Immune to stray pickup.
- POTENTIOMETRIC
  Null balance circuit.
- FLIP FOLD CHART and TILT OUT DRIVE

POWER	115V 60 CPS 15 watts
CHART	5" x 25' calibrated 4"
CHART SPEED	1 in/min or 4 in/hr

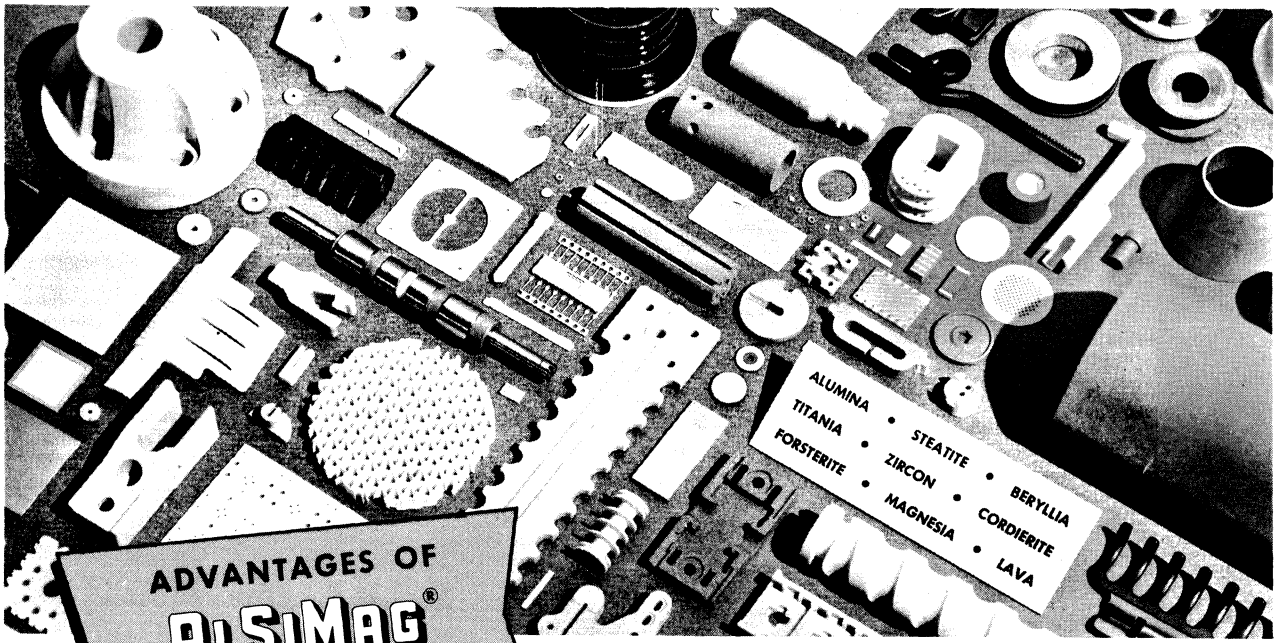
It is now economically practical to record all data from research, analytical and process instruments.

The MODEL 26 can be bench or panel mounted, and is designed to be compatible with all equipment having recorder output.

MODEL 26A — 1 volt full scale.....**$195.00**
MODEL 26B — 10 millivolt full scale.....**$235.00**

- **Circuitry on all models is silicon solid state with Zener reference.**
- **Simple straightforward design and elimination of frills make possible these remarkably low prices.**

YEISER LABORATORIES • 881 WEST 18th STREET • COSTA MESA, CALIFORNIA 92627 • PHONE: (714) 548-2458



ADVANTAGES OF ALSIMAG® TECHNICAL CERAMICS

MORE MATERIALS

For many decades American Lava has worked with leading firms to develop special ceramics for their advanced designs. The result is the greatest number of special ceramic compositions available from any source. This wealth of ceramic materials can help in two ways. First, it may give you the exact performance you require. Second, it enables you to select the most economical material that meets your design requirements.

MORE PROCESSES

American Lava offers the broadest processing capabilities in the industry. These include forming ceramics by all modern methods including pressing, extrusion, injection molding, isostatic pressing, plus metallization, plating, chemical milling, machining, grinding, lapping, and hermetic bonding.

Many of these processes were pioneered by American Lava. Examples are (1) the ability to produce certain as-fired ceramics to precision tolerances and (2) the proprietary AlSiBase process for producing thin flat ceramics.

MORE SPECIALIZED ENGINEERING TALENT

American Lava, built on engineering ability, has demonstrated that it is the best source for any problem involving technical ceramics.

GREATER PRECISION

Technical ceramics play an increasingly important part in American industry because they can meet especially demanding requirements. American Lava has the experience, know-how and facilities to produce ceramics to the closest tolerances, and to measure and inspect them by agreed means.

MORE MODERN DESIGNS

Technical leadership at American Lava Corporation is based on working with its customers to give them what they want. This currently involves work on composite substrates, composite packages, buried metal patterns, super-smooth and flat substrates, special temperature compensating dielectrics, ceramic capacitors and new ceramic coatings for metal and low expansion glass.

VOLUME PRODUCTION

American Lava has the resources, know-how and the desire to make commitments required to meet volume requirements of its customers. A long parade of firsts in new manufacturing capabilities have allowed American Lava to keep pace with the ever changing need for technical ceramics in volume.

EXPEDITED PROTOTYPES

Special procedures speed the production of prototypes for your evaluation. A chart giving the characteristics of our most frequently used AlSiMag ceramic compositions will be sent on request. Suggestions are available from our specialized engineering staff.

CODE IDENT. NO. 70371

American Lava Corporation

A SUBSIDIARY OF 3M COMPANY

PHONE 615 265-3411 • CHATTANOOGA, TENNESSEE 37405, U.S.A.

68th YEAR OF CERAMIC LEADERSHIP

For service, contact American Lava representatives in Offices of Minnesota Mining and Manufacturing Company in these cities (see your local telephone directory): Boston: Needham Heights, Mass. • Chagrin Falls, Ohio • Chicago: Elmhurst, Ill. • Dallas, Tex. Indianapolis, Ind. • Laurens, S. C. • Los Angeles, Calif. • Metropolitan New York: Ridgefield, N. J. • Up-State New York and Canada: Phoenix, New York • Orange, Conn. • Philadelphia, Penna. • Roanoke, Virginia • St. Louis: Lee's Summit, Mo. South San Francisco, Calif. • International: c/o American Lava Corporation, Chattanooga, Tenn. 37405, U.S.A., TELEX 558432.

Hypalox®

Ceramic Electronic Components

HYPALOX CERAMIC

is made of sintered aluminum oxide (Al_2O_3) in its highest chemical purity; a material that holds a special position amongst metallic oxides. Owing to its special atomic structure, its mechanical, chemical and electrical properties are extremely high. Its outstanding feature, however, is the insignificant decrease of these properties when used at high temperatures.

Advantages include

Absolute vacuum tightness at 2192°F (minimum wall thickness 0.004") • unchanged accuracy of size • compressive strength 85.34 tons/sq. in. • volume resistivity 3.94^5 ohm/in.

This material therefore meets all requirements necessary for heavy duty insulating parts in the electrical and electronic industries.

PHYSICAL PROPERTIES

MATERIAL	HYPALOX CERAMIC E2	HYPALOX CERAMIC E23	HYPALOX CERAMIC E37
Al_2O_3 content in %	97	99.7	> 99.7
Specific gravity lbs/inches³	0.133	0.141	0.144
Water absorption in %	0	0	0
Compressive strength tons/sq. inch	213.4	284.5	284.5
Tensile strength in tons/sq. inch	17.1	22.8	29.9
Flexure strength in tons/sq. inch	21.3	28.4	37.7
Modulus of elasticity in tons/sq. inch	26.9 x 10^4	26.9 x 10^4	26.9 x 10^4
Vickers hardness (est load 0.2 lbs) in tons/sq. inch	1281.2	1635.7	1635.7
Linear Coeffcient of thermal expansion (1.88°F) from 0 . . . 572°F 0 . . . 932°F 0 . . . 2012°F	 2.64 x 10^6 2.87 x 10^6 3.35 x 10^6	 2.64 x 10^6 2.87 x 10^6 3.35 x 10^6	 2.64 x 10^6 2.87 x 10^6 3.35 x 10^6
Thermal conductivity in cal/inch/sec — 1.88°F (1°C) at 68° 212° 932° 1472°	 0.018 0.013 0.006 0.005	 0.033 0.026 0.010 0.067	 0.394 0.032 0.012 0.007
Specific heat (in b.t.u.'s)	0.99 x 10^{-3}	0.99 x 10^{-3}	0.99 x 10^{-3}
Maximum working temperatures in °F	2192°F	3304°F	3304°F
Electrical resistance OHM • INCH at 68° 932° 1832°	 > 3.9^{13} > 1.0^{10} > 0.43^6	 > 3.9^{13} > 1.0^{10} > 0.43^6	 > 3.9^{13} > 1.0^{10} > 0.43^6
Dielectric strength kv/inch	381	762	1016
Dielectric constant ϵ at 68°F and 4000 Mcycles	approx. 9	approx. 9	approx. 9
Loss tangent σ at 68°F and 400 Mcycles	14 • 10^{-4}	9 • 10^{-4}	2 • 10^{-4}

E2 is our standard quality which will be sufficient in the majority of cases.

We can supply molded parts of complex shapes as well as mass-produced parts for the following applications — **Transmitter tubes:** Envelopes, windows, cathode supports. **Vacuum engineering:** Rings and tubes (on request with molybdenum-manganese metallization). **Electronics:** Substrates for micro-modules with defined surface roughness — natural finish up to 0.5 microns — ground up to 0.2 microns — polished up to 0.02 microns. **Electrical engineering:** Insulators for coils and resistance.

HYPALOX CERAMIC-METAL

The metallization is carried out according to the molybdenum-manganese process. This metallization is constant and suitable for brazing up to 2012°F under protective gas and vacuum. The most suitable solder is silver-copper eutectic.

The outstanding features of

HYPALOX CERAMIC-METAL COMPONENTS

are . . . high vacuum tightness (leakage smaller than 10^{-10} Torr.1/sec) • great stability • resistance to thermal shocks • reproduceable dimensional accuracy • working temperatures up to 1292°F.

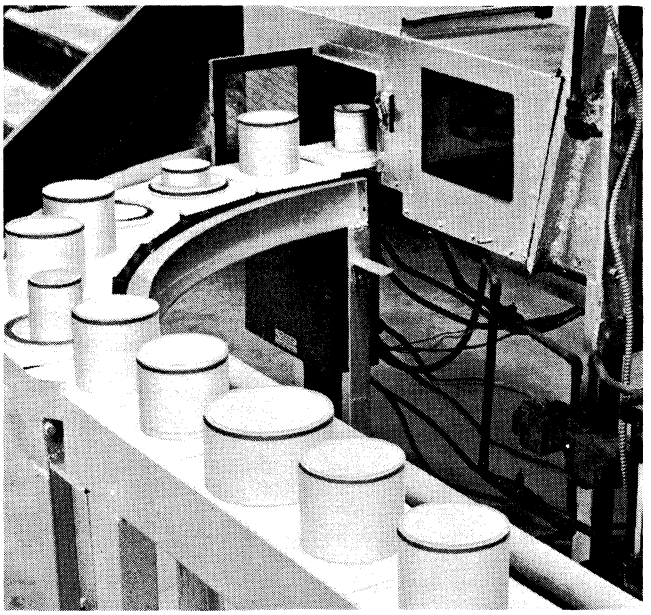
HYPALOX CERAMIC-METAL COMPONENTS

are used as — **Envelopes** for transmitter tubes, clystrons, magnetrons, travelling ware tubes. **Housings** for mercury vapour and silicone rectifiers, thyristors. **Terminals** for high vacuum installations and measuring instruments, pressure vessels.

AMERICAN FELDMUEHLE CORP.
P.O. Box 2160, Glenbrook, Conn., 06906 • Tel. (203) 325-1511

BASIC CERAMICS INCORPORATED

Complete Technical Ceramic Services... Design and Development Assistance, Fast Response Prototype, High Volume Production.



Metalizing

What We Do:

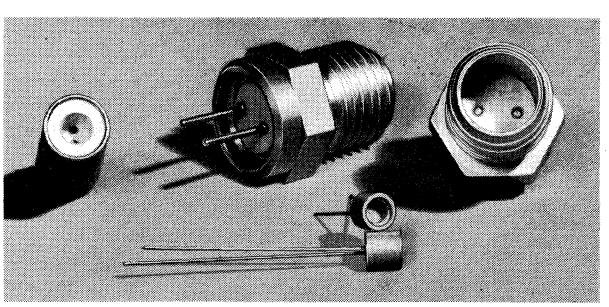
- Mix, and fire our own ceramics.
- Machine ceramic parts in the hard state to tolerances as precise as ± .00005
- Provide complete ceramic/metal services including metalized sub-assemblies
- Hermetically seal parts

Methods of Manufacture:

- Extrusion • Isostatic Pressing
- Dry Pressing • Casting
- Injection Molding
- (Green machining, hard machining with diamond grinders, lapping, polishing, drilling, honing, high and low temperature metalizing, plating, assembly brazing)

Ceramic Bodies Offered:

- Alumina (white) • Alumina (opaque)
- Forsterite • Beryllia • Steatite
- Zirconia • Titanium
- Castables (non-shrink)
- High-Temperature Ceramic Cements



Products Offered:

The following electronic products are now being manufactured:

★

Electron Tube Envelopes:
Full range including spark gap, traveling wave, magnetron and microwave.

★

Rods and Tubes:
Conventional, or extremely close tolerances.

★

Semiconductor Packages:
Including ceramic/metal sub-assemblies.

★

Insulators:
Tube, antenna, cyclotron, heater

★

Printed circuits on ceramic bases.

★

Feed-Throughs • Igniters

★

Microwave Windows • Internal Spacers

★

Heater Supports

★

Radar Flat Spiral Antenna

★

Coil Forms • Magnetron Wells

★

Radomes

BASIC CERAMICS INCORPORATED

Subsidiary of Basic Incorporated
221 Seventh Avenue • Hawthorne, New Jersey 07507 • Phone 201-427-4211

Offering a complete ceramic service from prototype through production.

CARBORUNDUM® TECHNICAL CERAMICS



COMBAT™ BORON NITRIDES
Standard & High Purity Grades of solids, powders, coatings that conquer where lesser materials fail

APPLICATIONS

Use COMBAT as fixture or jig materials for sealing or brazing operations in induction, vacuum, or atmosphere furnaces, for molten-metal crucibles, for heat-sinks and special insulators, for increasing thermal conductivity in silicone oils, resins and potting compounds, or for the jobs where lesser materials fail.

STRUCTURE

COMBAT boron nitrides have a hexagonal, platy crystalline structure similar to graphite. Like graphite, it orients during the hot-pressing operation, making many of the physical properties of the solid grades anisotropic.

FORMS

COMBAT boron nitrides are available as a solid hot-pressed product, a powder, and a coating, in three grades of each form.

DIELECTRIC PROPERTIES

COMBAT boron nitrides have dielectric strengths of nearly 1000 volts per mil; four times that of alumina. With this high strength, plus their low dissipation factor and dielectric constant, they are outstanding low-loss materials over a wide range of frequencies and temperatures.

THERMAL RESISTANCE

COMBAT boron nitrides are used at temperatures to 2800°C. in inert or reducing atmospheres—to nearly 3000°C in a dry hydrogen atmosphere—and between 985°C. and 1400°C. in oxidizing atmospheres, depending upon the grade.

The thermal expansion of COMBAT boron nitrides are lower than those of most refractory materials.

COMBAT's high thermal conductivity decreases slowly with increasing temperature. It exceeds that of beryllium oxide above 500°C.

COMBAT has exceptional resistance to thermal shock, standing water quench at 1200°C.

CORROSION RESISTANCE

Inorganic COMBAT boron nitrides are inert to most organic solvents and many corrosive agents such as molten iron, silicon, aluminum, cryolite, copper, and zinc. They are not wet by most molten metals and slags.

MACHINABILITY

COMBAT solids can be easily machined to close tolerances, with conventional tools. No further firing or heat treating is required. Machine, then use They can be threaded or otherwise physically joined to form strong assemblies.

PROPERTIES

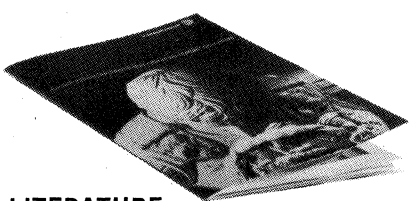
Density, gms/cc	1.90 to 2.12, depending on grade
Working temperature: Inert or reducing atmosphere, solid	up to 2775°C, depending on grade
Oxidizing atmosphere solid	up to 1400°C, depending on grade
Dielectric constant	3.7 to 4.11, depending on grade
Dielectric strength	to 986 volts/mil
Electrical resistivity	$< 2 \times 10^{14}$ ohm-cm
Coefficient of friction	low
Thermal shock resistance	excellent
Permeability	negligible
Hardness	up to 89.5 (15T) depending on grade

STRENGTH

Depending upon grade, COMBAT boron nitrides have moduli of rupture of 6,000 to 15,000 psi.

STOCK SIZES

ROUND DIAMETER	RECTANGULAR CROSS SECTION
1/8″	1/8″ x 1/8″
1/4″	1/4″ x 1/4″
3/8″	3/8″ x 3/8″
1/2″	1/2″ x 1/2″
5/8″	3/4″ x 3/4″
3/4″	1″ x 1″
1″	1 1/2″ x 1 1/2″
1 1/2″	2″ x 2″
1 3/4″	2 1/2″ x 2 1/2″
2″	3″ x 3″
2 1/2″	4″ x 4″
3″	5″ x 5″
4″	6″ x 6″
5″	8″ x 8″
6″	10″ x 10″
8″	—
9″	—
10″	—
14″	—



LITERATURE

For detailed borchure or specific application assistance, contact The Carborundum Company, Technical Ceramics Plant, Latrobe, Pa. 15650. Phone: 412 - KE 7-3331.

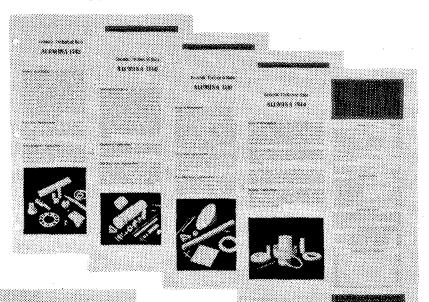
ALUMINA CERAMICS

94%, 96%, 98%, 100%

Specify Carborundum #1544, a 94% alumina composition, for metallizing applications. For a porous 100% alumina body, specify Carborundum #1510. Specify Carborundum #1542 or #1540 for 96% or 98% alumina coil forms, substrates, tuning shafts, etc.

Surfaces may be ground to very close tolerances, or furnished as fired. Two standard glazes are available.

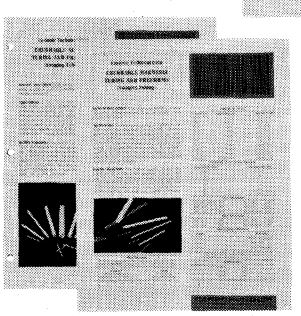
Ask for our new package of data and application sheets.



SWAGEABLE MAGNESIA TUBING

Magnesia preforms are certified to be at least 99.4% pure. This composition is easily and completely reduced to a dense, homogeneous powder.

Ask for Data Sheet A-1852.



CARBORUNDUM

The Carborundum Company • Technical Ceramics Plant • Latrobe, Pa. 15650 • 412-KE 7-3331

Dilectrix FLUOROFILM® TFE and TFE/FEP TEFLON TAPES AND FILMS

Fluorofilm is a void-free multilaminar cast film. It is fabricated by the unique Dilectrix continuous casting process, wherein each micro-thin lamina is independently sintered and cured. Each successive lamina is fused to the preceding one until the predetermined thickness is achieved. This process yields two important features: freedom from voids or pinholes and greater tensile strength.

Dilectrix Fluorofilm cast Teflon films and tape conform to Military Specification MIL-P-22241A. The basic film is cast in thicknesses from ⅛ mil to 5 mils, widths from ¼" to 12", and splice-free continuous lengths of 500 ft.

TYPE	THICKNESS RANGE (MILS)	DESCRIPTION	TYPICAL APPLICATIONS
C	⅛ to ¾	Cast TFE† film.	Delay lines, insulation and capacitor dielectric — General purpose insulation.
CD	¼ to ¾	Cast TFE film, Duplex wound. 2 rolls, of same film thickness, wound on one core.	In capacitors to eliminate dust between layers, loading of only 2 rolls on winders, stands higher tension when winding on mandrels.
CM	¼ to ¾	Cast TFE film. One side metallized. Pure aluminum vacuum applied, controlled thickness produces resistance of approx. 1 ohm/sq. in.	Conductor and dielectric in single unit for capacitor manufacture. Available with insulated margins. Reduces unit size and reject loss.
DF-100**	1, 2, 3, 4 & 5	Multilaminar TFE film. Processed for void-free and pinhole-free qualities.	Wire and cable wrapping, coil interlayer, slot and phase insulation. Anti-friction surfaces.
DF-1700**	1, 2, 3, 4 and 5	Multilaminar TFE. One side FEP coated and heat bondable.	Folded and weld-seamed, an excellent chemical tubing resistive to corrosive fumes, gases, liquids.
DF-1700-DB**	2, 3, 4 & 5	Multilaminar TFE film. Both sides FEP coated and heat bondable.	Insulation over wire shielding because it takes lower temperature to weld it together than is required for an extruded, unsintered TFE tape.
DF-1100**	2, 3 and 4	Multilaminar TFE film. One Side Receptive to Adhesives by a Proprietary Surface Treatment.	Same as DF-500 but for more exacting applications.
DF-1200**	2, 3 and 4	Multilaminar TFE film with Pressure Sensitive Backing.	Most versatile. Adheres to most any surface: Metal, wood, ceramics, plastics, etc. Used as harness bundling, spot insulation, slot linings, core wrapping. For non-slip surfaces, gasket facings, etc.
DF-1300	2½ only	Multilaminar TFE film. Black. Both Sides Coated for Epoxy Adhesion.	Coil wrappings where epoxy potting resins are used.
DF-1400	2½ only	Multilaminar TFE film. Black. Treated to make both sides conductive.	Ideal for low noise cable wrapping.

PHYSICAL AND MECHANICAL PROPERTIES

PROPERTY	TYPICAL FOR ALL DILECTRIX MULTILAMINAR CAST TEFLON FILMS VALUE	ASTM METHOD	FOR DF-1200 ONLY
Specific Gravity	2.1-2.2	D792-50	
Tensile Strength—Machine Direction lbs./sq. in.	4,300	D882-54T	3000
Transverse Direction lbs./sq. in.	3,500	D882-54T	3000
Elongation—Machine Direction—%	400	D882-54T	300
Transverse Direction—%	400	D882-54T	300
Thermal Stability, wt. loss/hr. at 600°F.	0.0002%	D-624	
Stiffness, 77°F, lbs./sq. in.	40,000-60,000	D-747	
Water Absorption, %	0.00	D570-42	
Moisture Permeability, 0.001" gms./100 sq. in./dia.	0.2		
Specific Heat (100°-260°F) BTU/lb./°F	0.25		
Coefficient of Thermal Linear Expansion/°F, 77°-140°F	5.5×10^{-5}	D696-44T	
Brittleness Temperature, °F	<-100		
Maximum Continuous Service Temperature, °F	+500 to −400		375
Flammability, in./min.	non-flammable	D635-44	
Resistance to weathering	excellent		
Static or Kinetic Coefficient of friction against polished steel	0.04		
Solvent Resistance	unaffected by any known solvent		
Chemical Resistance	excellent		
Bond Strength to Steel			40 oz./1" width

ELECTRICAL PROPERTIES

Dielectric Constant, 60-10^8 Cycles	2.0	D150-54T	
Power Factor, 60-10^8 Cycles	<0.0003	D150-54T	
Volume Resistivity, ohm-cm.	$>10^{15}$	D257-52T	
Surface Resistivity, 100% R.H., Megohms	3.6×10^6	D257-52T	
Dielectric Strength, Short Time (0.001") V/Mil.	3400	D149-55T	3000
Surface Arc Resistance, Sec.	Does not track	D495-48T	

*Dilectrix films are available in continuous roll lengths of 100 or 500 ft., in widths from ¼" to 12" in increments of 1/32". Price quotation and samples furnished upon request. **The above types are available in colors. †TFE is DuPont's Teflon*

Dilectrix CORPORATION *A SUBSIDIARY OF NATVAR CORPORATION • 69 Allen Blvd., Farmingdale, N. Y. 11735*

DOW CORNING

DOW CORNING® SILICONE MATERIALS

SILICONE ENCAPSULATING MATERIALS

Two-part SYLGARD® Resins

Sylgard resins are solventless, pourable, deep section curing silicone materials that provide tough, firm, yet resilient packages for electronic components and circuits. They provide excellent protection against high humidity, heat, cold, thermal shock, moisture and radiation; they are self-extinguishing and completely reversion-resistant.

Circuits embedded in Sylgard resin are easily repaired—the resin is cut away, the repair made, and fresh resin is poured in place. There is no loss in dielectric integrity.

As supplied, these resins flow readily around complex circuitry. If required, they may be thinned to very low viscosity with Sylgard® 1330 thinner.

Sylgard resins cure with the addition of a catalyst, without releasing volatile by-products. There is virtually no shrinkage, even when these materials are cured in deep sections. Curing rate can be heat-accelerated without causing bubbling. No moisture is required for curing, and no post-cure is necessary to prevent depolymerization.

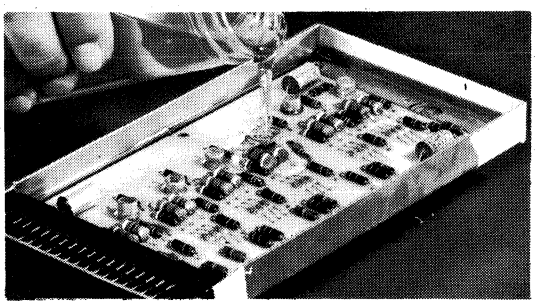
Both clear and opaque types are supplied. For maximum adhesion, a Sylgard® primer is recommended.

Sylgard® 182 and 183 resins are heat curing, offer a selection of pot life and cure times. Typical curing rate is 4 hours at 65 C. Serviceable temperature range is from −65 to 200 C for the clear resin (182); −65 to 250 C for the black (183).

Sylgard® 184 and 185 resins are similar to the above, but cure at room temperature. Typical cure time is 24 hours.

Sylgard® 186 and 187 resins, although similar to the rest of the family, offer extra physical strength and toughness. Their tear strength—100 ppi—is many times greater than the other Sylgard resins, and they provide more than three times the elongation. They are used where durability and maximum protection against mechanical damage are required.

Sylgard® 188 and 189 resins are specifically designed for use where shock absorption is vital.



One-part SYLGARD Resin

Sylgard® 3150 resin is a one-part, premixed, white, solventless resin that cures at moderate temperature to form a resilient, easily repairable encapsulant for electronic components. It cures without exotherm, even in confined spaces, and retains its physical and electrical stability over a wide frequency range and 100% RH. Its low viscosity (100 poises at 25 C) aids in potting and filling deep, intricately shaped components and assemblies.

Stress-free potting gel

Sylgard® 51 dielectric gel is supplied as a water-white, medium-viscosity liquid that readily surrounds components. With the addition of a catalyst and the application of heat, it cures to form a clear, resilient, jelly-like material that combines outstanding dielectric properties with thermal stability and moisture resistance. Typical electric strength is 800 volts/mil; dissipation factor at 100 Hertz is 0.0005.

No damaging stresses are exerted on delicate parts by this material during cure—after cure it develops virtually no stresses throughout its wide operating temperature span of −65 to 200 C.

Since this material is transparent, potted circuits can be traced visually. Test probes can be inserted through the gel for instrument checking of circuits and components—the gel "heals" itself immediately when the test probes are removed.

DOW CORNING CORPORATION, MIDLAND, MICHIGAN 48640 TELEPHONE 517-636-8940

DOW CORNING

DOW CORNING® SILICONE MATERIALS

SILICONE ENCAPSULATING MATERIALS

DOW CORNING RTV ENCAPSULANTS

Dow Corning's family of two-part room-temperature-curing silicone rubber encapsulants offers optimum processing flexibility plus outstanding environmental and electrical protection for many types of equipment. These materials stay rubbery and flexible from −65 to 250 C, and have good dielectric properties over this range. Their excellent resilience helps absorb mechanical shock and vibration, and they protect components against temperature extremes, moisture, dirt, weathering and corrosive atmospheres. Encapsulated circuits are easily repaired by cutting away old material and repouring fresh encapsulant. Package integrity is fully restored.

Production flexibility

Four of the RTV encapsulant bases are designed to be used with any one of three catalysts, in varying proportions, to give working times from less than a minute to more than an hour. Thus a minimum inventory of material is required to meet a variety of applications. When used in 10:1 base-to-catalyst ratio, these materials are well suited to automatic dispensing and mixing equipment. They can be cured at room temperature or under heat, depending on the catalyst used; the room-temperature-vulcanizing types cure in deep sections without exotherm.

Dow Corning® 3110 RTV encapsulant is a white, low-viscosity silicone rubber base.

Dow Corning® 3112 RTV encapsulant is a white, medium-viscosity silicone rubber base that cures to a high durometer, high-strength rubber.

Dow Corning® 3116 RTV encapsulant is a white, medium-viscosity silicone rubber base with a low specific gravity.

These three bases can be pigmented for color coding.

Dow Corning® 3120 RTV encapsulant is a red, medium-viscosity silicone rubber base that cures to a high durometer, high-strength rubber.

The catalysts used with these four bases are all paste-consistency materials containing active organo-metallic compounds. They are designed for easy measuring and for mixing by either automatic or mechanized methods.

Dow Corning® RTV standard (S) catalyst is the most widely used of the three. It permits at least 30 minutes working time, cures well in deep sections.

Dow Corning® RTV fast (F) catalyst is used for high-speed production. It is ideally suited for use with automated mixing and dispensing equipment where mixing is done just prior to dispensing. Working time with 10% of this catalyst is about 2 minutes. Rubbers using this catalyst cure well in deep sections.

Dow Corning® heat-accelerated (H) catalyst is used where long working time is desired but where fast curing is necessary. With this catalyst, thin sections (⅛ inch) of RTV encapsulants can be cured in as little as 5 minutes at 150 C.

Dow Corning® 1201 primer is recommended for maximum adhesion. *Dow Corning® 1200 primer* is an acceptable alternate, and should always be used when products catalyzed with Dow Corning RTV catalyst H are to be cured *without* heat.

Reversion Resistant

Dow Corning® 3118 RTV encapsulant is a buff-colored, medium-viscosity, reversion-resistant encapsulant specially designed to cure in deep sections. It is supplied with its own curing agent, a master-batched co-reactant polymer. The required curing agent concentration is 4% by weight of the RTV encapsulant base.

Pot life and cure time vary with temperature. At 25 C, pot life is 1½ hours, and curing time is 24 hours.

PROTECTIVE COATINGS AND VARNISHES

Dow Corning offers a variety of protective coatings, including resilient conformal coatings, varnishes and wax-like films, which give physical and electrical protection to electric motors, transformers, circuit boards, memory planes, and other equipment. These coatings are highly resistant to humidity, and retain their properties even after thermal cycling.

Dow Corning® 3140 RTV noncorrosive coating is a tough, transparent, rubbery conformal coating that cures without emitting corrosive by-products. Coating clarity allows easy visual inspection of components, simplifies component repair or replacement.

DOW CORNING

DOW CORNING® SILICONE MATERIALS

PROTECTIVE COATINGS AND VARNISHES (continued)

Silastic® S-2288 dispersion cures to a tough rubbery coating that withstands repeated flashover without tracking, reduces current leakage. It is used as an over-coating for porcelain and epoxy insulators, bushings and stand-offs, or any piece of electrical equipment subjected to severe arcing or tracking.

Dow Corning® 630 protective coating is transparent, dries to a flexible, non-melting, wax-like, water-repellent coating. It is easily removed for component repair by soaking in solvent and brushing, or by an ultrasonic solvent bath.

Dow Corning® GP-77 varnish is a tough, multipurpose impregnant for Class A, B, F and H systems. Applied by dipping, flooding or impregnating, this varnish is used on equipment designed for operation at temperatures to 200 C, including random- and form-wound stators, dry-type transformers, and high-speed armatures.

Dow Corning® 997 varnish is designed for continuous service at temperatures to 250 C, gives superior protection against overload, severe duty cycling, high-temperature ambients, many chemicals, corrosive atmospheres and other environmental hazards. It has many times the thermal life of organic Class B varnishes.

Dow Corning® 1890 protective sealer is an easy-to-apply silicone rubber dispersion used to form a tough, rubbery protective coating on motor stator windings, bus-bars, transformers, splices and connections and many types of electrical hardware. It protects against moisture, abrasive dust, chemicals and weathering, can be applied by spraying or brushing.

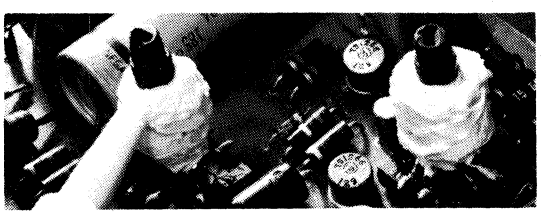
The Sylgard® resins and Dow Corning® RTV rubbers may also be used as protective coatings. For this application, they are usually used in their low-viscosity forms, and the RTV's are blended with the heat-accelerated catalyst to allow time for dipping, draining and other process operations. These materials are widely used as cushion coatings to protect circuits that are subsequently potted in organic materials.

ONE-PART RTV ADHESIVE/SEALANTS

One-part, ready-to-use Dow Corning® and Silastic® brand adhesive/sealants are general-purpose, room-temperature-curing materials suitable for a wide range of applications. When fully cured, they have all the physical and electrical properties typical of silicone rubber, including excellent heat stability, resistance to weathering, moisture and ozone, and excellent insulating properties.

They are supplied in collapsible tubes or dispensing cartridges, and are easily extruded onto the surface where the bond or seal is desired. They are easily worked with a spatula . . . do not sag or slump of their own weight, even on vertical or overhead surfaces. For maximum adhesion on surfaces other than silicone rubber, Dow Corning® 1203 primer is recommended.

Silastic® 732 adhesive/sealant is used to bond metals, glass, plastic, silicone rubber, asbestos and ceramics. Typical uses include insulating and sealing wire and cable splices and connections; holding conduit terminal boxes in place; and bonding components to printed circuits. It retains its flexibility from −60 to 260 C, provides excellent electrical insulating properties, and resists weathering, moisture, ozone and other harsh environmental conditions.



Dow Corning® 731 RTV adhesive/sealant is a special-purpose material manufactured under rigorously controlled conditions. The cured material is approved by the Food and Drug Administration for use in contact with foods. Typical applications include sealing steam kettles, sealing windows in oven doors, and sealing around chutes or tubing used for transporting hot foods. It withstands contact with hot cooking oils, free steam, water, prolonged hot and humid conditions, and cycles of freezing and thawing.

Dow Corning® 3145 RTV noncorrosive adhesive/sealant cures without releasing corrosive by-products. It is ideal for use in contact with copper, particularly printed circuit boards, small-diameter wire, and other corrosion-sensitive electronic components. It is a gray, toothpaste-consistency material that cures tack-free in 24 hours. It offers unusually high strength, and retains its resilience from −75 to 250 C.

DOW CORNING

DOW CORNING® SILICONE MATERIALS

DIELECTRIC COMPOUNDS

Dow Corning supplies a variety of non-hardening, water repellent, grease-like silicone compounds for use as water-repellent seals and insulators for switches, cable connectors, battery terminals and many other applications. These materials withstand harsh environments, are noncorrosive to metals, inert to most plastics, and practically nonvolatile.

Dow Corning® 103 compound is used to reduce corrosion on switch contacts and battery terminals; to lubricate rubber and plastic O-rings and seals; to insulate and waterproof ignition systems, control switches and circuit breakers; to prevent sticking of switches exposed to icing conditions, and many other uses. It is serviceable from −40 to 200 C, withstands a wide range of harsh environmental conditions.

Dow Corning® 107 compound is a light gray, translucent material that can be applied as supplied, or dispersed in a solvent and applied by brushing or spraying. It serves as an excellent mold release agent.

Dow Corning® 4 compound, similar to the 103 compound, features constant consistency from −100 to 200 C. It is designed to meet the requirements of MIL-I-8660B. Applications include use on battery terminals, switch contacts, relays, high tension ignition harness and as a lubricant for O-rings and seals made from rubber and plastics.



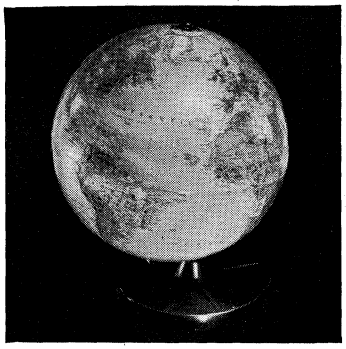
HEAT SINK COMPOUND

Non-hardening, non-melting heat sink compound provides the fast heat removal that keeps diodes, transistors, rectifiers and other electrical and electronic devices operating longer and more efficiently.

Dow Corning® 340 silicone heat sink compound is a grease-like silicone material heavily filled with heat-conductive metal oxides. Thermal conductivity (k factor) is in the range of 0.0015 cal/cm²-sec-(°C/cm).

Product Type	Product Designation	Packages
Potting and Encapsulating Resins	Sylgard® 51 dielectric gel	1, 8, 40, 400 lb. cans
	Sylgard® 182 resin, clear, heat cure	1, 11, 55, 5, 50 lb. kits
	Sylgard® 183 resin, black, heat cure	
	Sylgard® 184 resin, clear, RT cure	
	Sylgard® 185 resin, black, RT cure	
	Sylgard® 186 resin, translucent, RT cure (high strength)	
	Sylgard® 187 resin, black, RT cure (high strength)	
	Sylgard® 3150 resin, white, heat cure (one part)	1, 10, 50, 500 lb. cans
	Sylgard® primer	pint and gallon cans
RTV Rubber Encapsulants	Dow Corning® 3110 RTV encapsulant	1 lb., 10 lb. pail, 50 lb. pail
	Dow Corning® 3112 RTV encapsulant	
	Dow Corning® 3116 RTV encapsulant	
	Dow Corning® 3120 RTV encapsulant	
	Dow Corning® RTV catalyst F, S, H, 1 and 4	tubes, 1 lb., 5 lb. and 10 lb. cans
	Dow Corning® 3118 RTV encapsulant (4% catalyst)	1 lb., 10 lb. pail, 50 lb. pail
Varnishes and Protective Coatings	Dow Corning® GP-77 varnish	1 and 5 gallon cans, 55 gallon drums
	Dow Corning® 991 varnish	1 and 5 gallon cans, 55 gallon drums
	Dow Corning® 996 varnish	1 and 5 gallon cans, 55 gallon drums
	Dow Corning® 997 varnish	pint, gallon, 5 gallon, 55 gallon drums
	Dow Corning® 1890 protective sealer	2 lb. jar, 8 lb. and 38 lb. pails
	Dow Corning® 630 protective coating	pint, gallon, 5 gallon
	Dow Corning® 3140 RTV noncorrosive coating	2 oz. tubes; 1 lb. cans
Adhesive/Sealants	Silastic® 732 RTV adhesive/sealant	2 and 5 oz. tubes; 6 and 12 oz. cartridges
	Dow Corning® 899 RTV adhesive/sealant	12 cartridges/carton (cartridge 1/12 gal.)
	Silastic® 140 RTV adhesive/sealant	2 and 5 oz. tubes; 6 oz. cartridges
	Dow Corning® 3145 RTV adhesive/sealant	2 oz. tubes; 12 oz. cartridges
Compounds (Dielectric)	Dow Corning® 103 compound	2 and 8 oz. tubes; 10 and 50 lb. cans
	Dow Corning® 107 compound	2 and 8 oz. tubes; 10 and 50 lb. cans
	Dow Corning® 4 compound	2 and 8 oz. tubes; 10 and 50 lb. cans
	Dow Corning® 19 compound	8 oz. tubes; 10 lb. cans
Compounds (Heat Sink)	Dow Corning® 340 heat sink compound	5 oz. tubes; 14 oz. cartridges; 20 lb. and 100 lb. pails

DOW CORNING CORPORATION, MIDLAND, MICHIGAN 48640 TELEPHONE 517-636-8940



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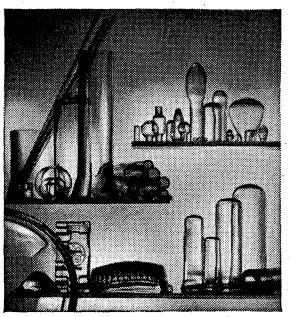
G
GLASS

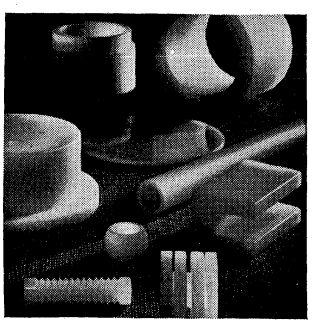
Machine-pressed shapes, formed to specification without additional grinding and polishing, can be furnished in a wide variety of glass compositions. At far right, is an example of an as pressed lens system for an audio visual entertainment unit for children. A highly experienced staff is available for customized orders in glass tubing, special glass formulations (beads) and other glass components.





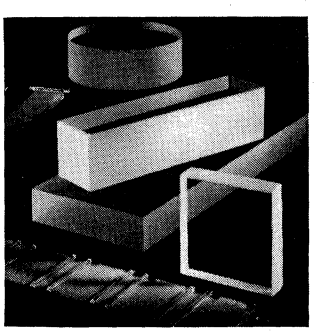
L
LUCALOX®

Lucalox®, a polycrystalline alumina, is available in standard tubing, rod, plates, discs and custom parts. This versatile ceramic is ideal for such critical applications as electrical insulators in corrosive environments, where wear surfaces require dimensional stability and for windows when low loss factor is important. Lucalox can transmit up to 90% of total light in the visible spectrum. Outstanding characteristics include: chemically inert to cesium, fluorine, sodium, potassium; transmits radiation in both visible and infrared wave lengths; surface may be polished to less than one micro-inch; high dielectric strength. Lucalox can be fabricated to complex specifications. Standard shapes in stock.



Q
QUARTZ

General Electric high purity fused quartz is available in clear and translucent tubing and rod, solid shapes, standard fabrication, and to custom specifications. In addition, fused quartz fiber products including yarn, matt, roving, overlay, and wool are manufactured. Fused Type 151 schlieren grade is available for critical optical and ultraviolet applications, schlieren windows, schlieren photography, laser optics, spectophotometer optical elements and other high ultraviolet transmission applications. New Type 125 fused quartz, a high-quality, economical material which features the absence of large bubbles, is suitable for commercial grade optical and mirror applications. It has low stress birefringence and high transmission in both UV and IR wavelengths.



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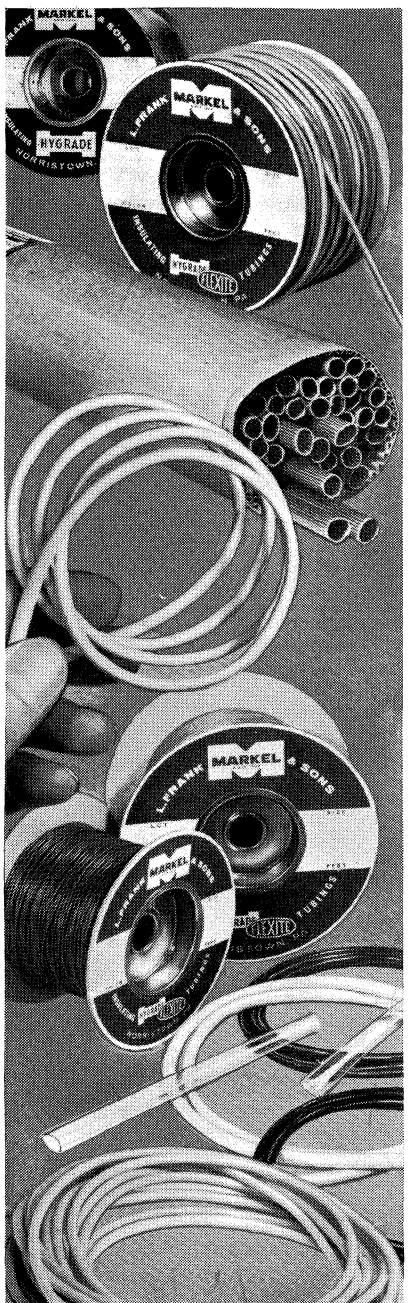
Insulating Tubings and Sleevings- High Temperature Wire and Cable



HYGRADE®

HYGRADE Fabric-Base Insulating Sleevings, the oldest and best known in the industry, are constructed of carefully braided fiberglass yarn, impregnated and coated with varnishes, vinyls, resins, or silicone rubber compounds.

HYGRADE SR-398 Silicone Rubber Coated Fiberglass Sleeving is a Class H material of closely woven glass braid coated with highly abrasion-resistant silicone rubber.

HYGRADE SV-862 Silicone Varnish Impregnated Fiberglass Sleeving is a flexible Class H insulation with unusual resistance to temperature extremes and weathering.

HYGRADE VF Flexible Fiberglass Sleeving is a tough, Class B insulation of plastic-covered fiberglass combining excellent electricals, flexibility, heat stability.

HYGRADE Polytube 463 Class F Flexible Fiberglass Sleeving is an acrylic-coated material compatible with the wire enamels used in motors and transformers.

HYGRADE Polytube 962 Class F Flexible Fiberglass Sleeving is a polyurethane-coated insulation compatible with the wire enamels in motors and transformers.

HYGRADE Thermoflex 1200 Class C Flexible Fiberglass Sleeving is made of 100% tightly braided fiberglass. For use at continuous temperatures as high as 1200°C.

HYGRADE Thermoflex 500 Class C Flexible Fiberglass Sleeving is made of tightly braided and pigmented fiberglass. For continuous operating temperatures to 500°C.

Ask for data sheets on these HYGRADE and FLEXITE products

FLEXITE®

Included in the FLEXITE line are extruded plastic tubings of Teflon, Silicone Rubber, Vinyls, Polyethylene, Nylon, and other plastics; Shrinkdown Heat Shrinkable extruded Tubings; and TGL Triangular Guide Line Wrapping Tape.

FLEXITE TFE Extruded Tubing of DuPont Teflon is a flexible material for continuous use at 250°C, with outstanding electricals, heat stability, chemical resistance.

FLEXITE AR-400 Modified Teflon Tubing is a flexible material with exceptional abrasion and cut-through resistance at temperatures from −70°C to 250°C.

FLEXITE SR-200 Silicone Rubber Extruded Tubing is made of an extremely elastic compound, and is excellent for high voltage applications at Class H temperatures.

FLEXITE Teflon FEP Extruded Tubing is a fluorocarbon tubing suitable for continuous use at 200°C. It possesses outstanding electricals and chemical resistance.

FLEXITE HT-105C Extruded Vinyl Tubing is U/L recognized for continuous use at 105°C. It is a strong, very flexible tubing suited for many general applications.

FLEXITE E Extruded Vinyl Tubing is an extremely flexible tubing designed primarily for low temperature applications (to −68°C), as in aeronautical instrumentation.

FLEXITE Polyethylene is a flexible Class A tubing offering excellent electricals, compatibility and abrasion resistance over a wide (−70°C to 80°C) temperature range.

FLEXITE Shrinkdown HT-105 Heat Shrinkable Tubing is a flexible material supplied in expanded sizes to cover shapes; it shrinks 50% on application of heat (190°F).

FLEXITE Shrinkdown PO-135 is a Class B flexible tubing which shrinks at 235°F. It is widely used to jacket cables, insulate terminals, and as a printed marker.

FLEXITE Shrinkdown TE-250 is a Heat Shrinkable Teflon Tubing for use at Class H temperatures. It shrinks at 621°F to make a form-fitting Teflon cover over shapes.

1 SOURCE *for* EXCELLENCE *in Insulating Tubings and Sleevings • High Temperature Wire and Cable*

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NATVAR – one source for all types of flexible electrical insulation

NATVAR COATED FIBERGLASS SLEEVINGS

Natvar coated fiberglass sleevings combine the strength and heat-resistance of a braided glass fiber sleeve with selected coatings to achieve strong, reliable insulations for all temperatures up to Class 180. The various coatings have been selected for the optimum combination of properties required for their respective temperature ranges. All Natvar coated sleevings are inspected and tested in accordance with ASTM Specification D-350. They conform to ASTM D-372 and applicable NEMA and military specifications.

NATVAR HEAT-GRIP® Irradiated Polyolefin Tubing

Here's the fast sure way to protect or insulate. Heat-Grip heat shrinkable tubing shrinks down to form a strong, flexible shield when moderate heat is applied. Won't melt or flow upon heating. Has longer heat life and greater resistance to solvents. Conforms to Spec. MIL-I-23053/5, Classes I and II. Heat-Grip is available in sizes 3/64" to 1" I.D. in five colors and clear.

Excellent for mechanical protection, color identification, product encapsulation, insulation.

NATVAR VINYL TUBINGS

Natvar vinyl tubings are available with a wide range of properties. Each class of tubing is produced from a vinyl compound especially formulated to yield the most favorable properties for the intended use. Natvar tubings are offered to conform to the following specifications: MIL-I-631D, Type F, Form U: Grade A, Class I, Category I; Grade A, Class II, Category I; Grade B, Class I and II, Category I; Grade C, Class I and II, Category I. MIL-I-7444B. MIL-I-22076A.

NATVAR COATED MATERIALS

Natvar manufactures a complete range of coated materials for a wide variety of Class 105, Class 130, Class 155 and Class 180 applications. Coated materials include cambric, polyester, paper, fiberglass and Nomex®. They are inspected and tested in accordance with appropriate ASTM and NEMA standards, and conform to Military Specifications where applicable.

COATED FABRICS AND PAPERS

CLASS 180°C
- Silicone Rubber Coated Fiberglass
- Silicone Varnished Fiberglass
- Coated Fiberglass and Quinorgo Combination
- Dura™ Resin B-Stage Products

CLASS 155°C
- Isoglas®
- Isoteraglas®
- Epoxy Coated Fiberglass
- Polyester Coated Fiberglass
- Polyteraglas®
- Isoplex®
- Coated Fiberglass and Quinorgo Combination
- F-LAR™ Coated Film
- "B" Stage Coated Products

CLASS 130°C
- Teraglas®
- Varnished Fiberglass
- Varnished A-B Fiberglass
- Varnished Polyester Film
- Coated Fiberglass and Quinorgo Combination
- Aboglas
- Acryliglas®

CLASS 105°C
- Varnished Cambric
- Oil Packed Varnished Cambric
- Varnished Papers
- Varnished Cambric and 100% Rag Paper Combination

FLEXIBLE SLEEVING

CLASS 180°C
- Silicone Rubber Coated Fiberglass Sleeving

CLASS 155°C
- Isolastane® Fiberglass Sleeving

CLASS 130°C
- Vinyl Coated Fiberglass Sleeving

EXTRUDED PLASTIC TUBING AND TAPE

CLASS 130°C
- Heat-Grip® Heat Shrinkable Polyolefin Tubing

CLASS 105°C
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- Vinyl Transformer Tubing
- High Temperature Vinyl Tape

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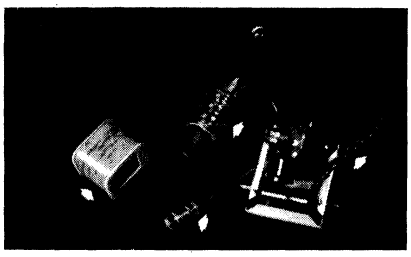
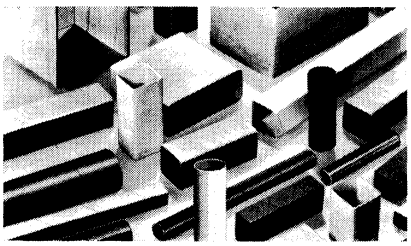


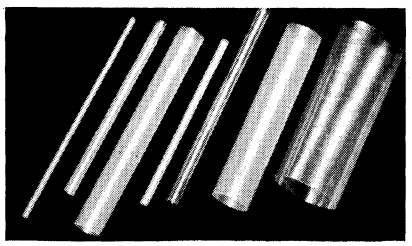
Choose the best Insulating Materials and Parts for your project!

HEAT-SHRINK MYLAR* TUBING
Having an extremely high dielectric strength, HS "Mylar" may be specified in very thin wall thicknesses to reduce space requirements. It is shrinkable as much as 50% to provide an immovable, tight fit. *TM-DuPont Co.

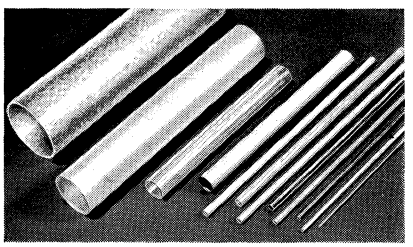
Specializing in the fabrication of insulating materials for the electrical/electronic industry since 1935, Precision Paper Tube Company can produce practically any insulating part required. Precision's manufacturing facilities, located in major market areas, can wind, slit, punch, impregnate, form and mold an endless variety of insulating materials and parts. Some are shown below. If you have an insulating problem, ask Precision to help.



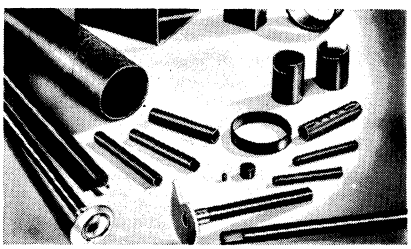
DIELECTRIC KRAFT TUBING
Meets general dielectric requirements for a variety of applications including; coil and transformer forms, capacitor covers, light shields, spacers, etc. Can be produced in almost any wall thickness and tubing dimension.



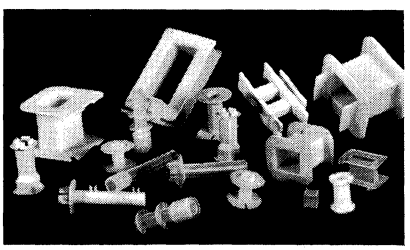
PLASTIC TUBINGS
Many types of plastic materials can be wound, extruded and formed by Precision to your requirements. Acetate, Mylar*, Teflon*, Kapton*, Butyrate, Propionate, Polyethylene and PVC are some of the materials available. *TM-DuPont Co.



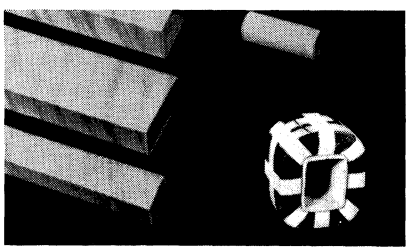
COMBINATION AND FOIL TUBING
To meet exacting conditions of tolerance, temperature stability, dielectric strength and/or mechanical strength, tubings can be produced in a wide combination of materials. Metal foils are also wound with other materials for shieldings, delay lines or voice coils.



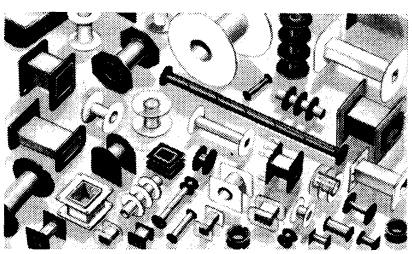
RESINITE PHENOLIC TUBING
This phenolic impregnated kraft tubing is mechanically stable, non-corrosive and reasonably priced. Resinite tubing may be punched, slit, cut and have lugs applied for a large number of applications such as coil forms, spacers and shafts.



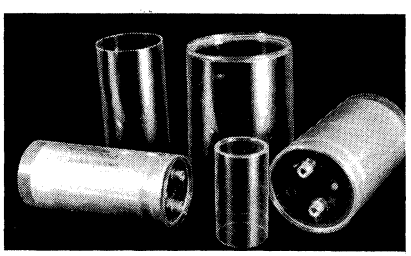
MOLDED PARTS
Molded bobbins, coil forms and insulating parts are available through Precision's extensive molding facilities. Services include engineering assistance in design and complete, modern tooling facilities on the premises.



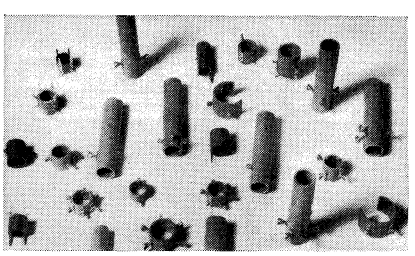
HIGH TEMPERATURE TUBING
Made to withstand temperatures up to 300°C., Precision's "Thermoform" tubings are produced from a variety of materials such as: mica, Quinterra*, asbestos, or Nomex* papers. Ideal where superior heat resistance is required. *TM-Johns Manville, *DuPont Co.



FABRICATED BOBBINS
A wide range of materials and the largest inventory of tooling in the industry allows you to have your choice of high quality bobbins at reasonable prices. Precision's patented "Plastilokt"® process assures positive affixing of flanges.



CAPACITOR COVERS
Either acetate or "Pol-Lar"® provide capacitor covers that can be heat-formed in a wide variety of shapes. May be supplied with sealed ends with or without lead holes. Available in a complete range of sizes.



COIL FORMS AND COLLARS
Precision can produce high quality coil forms and collars in a wide variety of sizes. Terminals are automatically applied to specification for printed circuit or tie-off applications. Forms are impregnated with an electrical grade phenolic resin.

FREE! Dielectric tubing material-selection chart.

Shows at a glance which material is best for a particular type of application. Gives temperature and breakdown voltage ranges.

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Paper Tube Company
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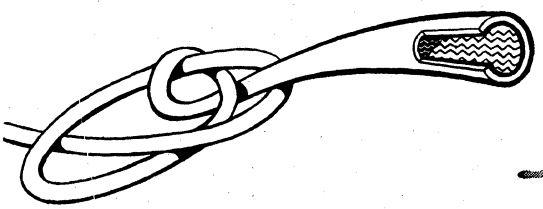
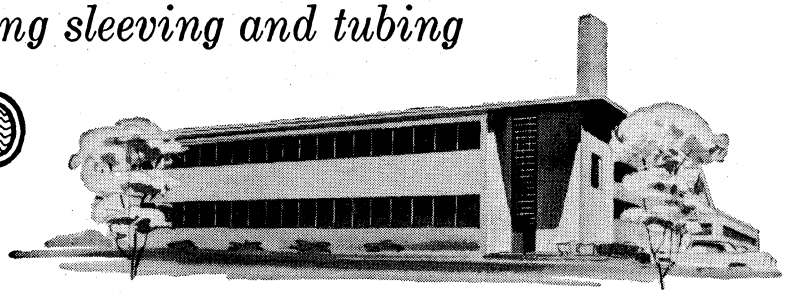
VARFLEX *the complete line*

of electrical insulating sleeving and tubing





Whatever your problem, heat, cold, flexibility miniaturization, high insulating or dielectric strength—Varflex can supply the required reliability and delivery. Our rapidly expanding plant is fully equipped to supply sleeving for any combination of characteristics you may need. In addition to maintaining large stock for off-the-shelf delivery, Varflex has the productive capacity to provide prompt delivery (often 48 hours) on special orders. As insulation specialists, we are ready to work with you on unusual specifications or applications.

Check your needs against this complete line:

VARGLAS SILICONE RUBBER. Tubing: The ultimate in flexibility, yet dielectric protection to 8000 volts. Class H-A-1 certified to meet Government Specification MIL-I-18057 (SHIPS). Class H-B-1 (4000 volts) available, also. Continuous exposure from minus 70° to 400°F. does not affect coating or Fiberglas braid. Sleeving: Made in Class H-C-1 (2500 volts), Class H-C-2 (1500 volts) and Class H-C-3.

VARGLAS SILICONE RESIN. Tubing: Class H-A-1 is recommended for applications requiring extremes of heat endurance and high dielectric strength (7000 volts). Class H-B-1 is identical except for dielectric guarantee (4000 volts). Good abrasion resistance. Both grades conform to MIL-I-3190A. Sleeving: Made in Classes H-C-1 (2500 volts), H-C-2 (1500 volts) and H-C-3.

SILFLEX SLEEVING. A light coating of Silicone resin on Fiberglas braid. Extremely flexible within a temperature range from minus 85°F. to 500°F.

VARGLAS SILICONE LEAD WIRE. Made from solid or stranded wire covered with one or more walls of Fiberglas braid and impregnated with Silicone. Built to your specifications.

VARGLAS SILICONE TYING CORDS. Continuous filament Fiberglass cords impregnated with Silicone resin, 1/64" to 1/8" diameter. Specify Type 46 for dry cure, Type 48 for tacky cure.

VARGLAS CLASS F TUBING. Made with synthetic resins such as epoxy, polyester or urethane on glass braid and offering better than Class B heat resistance (up to 155°C for continuous operation) while maintaining good electrical properties.

VARFIL TUBING AND SLEEVING. Fiberglas braids impregnated with polyester resin. Four grades available in coils as well as 36" lengths in most sizes. In a class by itself because of its toughness, flexibility, high temperature resistance and ability to withstand bending and twisting without dielectric loss. Compatible with varnish. Over 1000 hours at 125°C., with intermittent operation at 150°C.

VARFLO TUBING AND SLEEVING. Class B insulation. For those who need flexibility, solvent, oil and moisture resistance. Has good shelf life and will not lose dielectric strength when subjected to severe twisting. Three grades . . . Classes B-A-1, B-B-1 and B-C-1. Flame and fungus resistant if specified. B-A-1 approved under MIL-1-21557. Passes proposed Navy 90° bend test after 2,000 hours at 300°F with 3500 volt end point.

VARGLAS VARNISHED TUBING. Flexible continuous coatings of flame resistant varnish built up over Fiberglas braid in eight or more carefully controlled operations. Varnished tubings have thinner walls and good heat resistance.

VARGLAS VARNISHED SLEEVING. NEMA Classes B-C-1, B-C-2 and B-C-3 are similar except for dielectric strength. The impregnant is oleoresinous varnish.

VARGLAS ACRYLIC CLASS F (155°C). Highly resistant to acids, organic solvents, oils and water and exhibits fair resistance to alkalies. It is compatible with polyester, acrylic, epoxy, phenolic and formvar wire enamels. Designed to perform for long periods in the 150°C-175°C range without loss of any electric or physical properties. All standard grades.

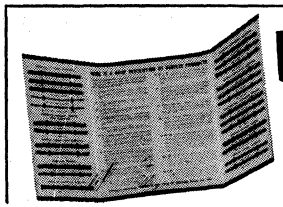
VARGLAS LECTON ACRYLIC. Specifically designed for hermetic motors. Non-contamination of Freon and other refrigerants in Class B motors. B-A-1, B-B-1, and B-C-1 grades.

VARGLAS NON-FRAY SLEEVINGS: Type H: The normalizing treatment given the Fiberglas braid removes the organic impurities and tends to hold the individual filaments together. The lack of any bonding agent means it may be subjected to temperatures as high as 1600°F. Recommended for applications where dielectric requirements are not of prime importance. Resists fungus and is noncorrosive. Type HP: Similar to Type H, but dyed various colors for coding purposes. Ideal as secondary insulation where primary covering might disintegrate due to high temperature or continual flexing. Colors may fade at 300°F. Type HO: A very light treatment of resin added after the braid has been normalized—just enough to hold the sleeving round for accurate cutting. Will distend to cover soldered joints or terminals. Available in eight colors. Colors fade at 300°F., but sleeving unaffected up to 1600°F. Better by 400° than formerly available.

VARGLAS LITEWALL SLEEVING. Wall thickness of Type A is .008" and of Type B, .006". Both types available untreated or treated. If treated, may be supplied in colors. Standard I.D. sizes 1/16" to 1/2" inclusive. Larger sizes on request.

SYNTHOLVAR EXTRUDED TUBING. Made from vinyl polymers. High dielectric and tensile strength. Will not support combustion nor absorb moisture. Smooth surface, thin wall and flexibility all make for ease in assembling operations. Super HH for installations where temperatures of 105°C. must be withstood. Type XLT will function at temperatures down to —65°C. Specify fungus resistant tubing where needed. Conforms to applicable MIL specifications.

COTTON OR RAYON TUBING. These tubings are furnished with varnish as the impregnant. They are braided from long staple yarns. Standard NEMA grades. They are Classes A-A-1 and A-B-1. Also, sleeving is available in three NEMA grades. Classes A-C-1, A-C-2 and A-C-3.



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Write for our folder containing 25 test samples.

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Varflex CORPORATION *Makers of Electrical Insulating Tubing and Sleeving*

Varflex products meet or exceed applicable government specifications including: **MIL-I-18057A, MIL-I-3190B, MIL-I-7444B, MIL-I-631D, MIL-I-21557**

TEFLON* TUBING

INSTANT DELIVERY

SPECIALIZING IN CLOSE TOLERANCES
PRODUCING ALL OUR PRODUCTS IN OUR OWN PLANT

SPECIAL CAPABILITIES

Extremely close tolerances on I.D., O.D., wall thickness and concentricity

Finer sizes than covered by published specifications

Straight lengths

Long lengths of expanded tubing in all sizes

SPECIFICATIONS

Zeus will manufacture and certify tubing to all of the published specifications or to a customer's engineered specifications

Common specifications for TFE Tubing

MIL-I-22129-C — Standard Wall	**AMS 3653C** — Standard Wall
MIL-I-23053A — Class 6 - Heat Shrink	**AMS 3655** — Thin Wall
CS 252-63 — Standard Wall	**AMS 3654A** — Lightweight Wall

Teflon extrusions have many uses:

Electrical insulation • Handling of hot or cold and corrosive liquids and gases • Mechanical applications to take advantage of the low coefficient of friction (Anti-stick properties) • Medical applications.

Many great properties of TFE

Tolerance to temperatures from +500°F to −100°F • Excellent electrical insulation properties (Dielectric breakdown voltages as high as 1000 volts per mil of thickness) • Corrosion resistance to all known alkalies, acids and solvents • Water absorption practically nil • Extremely low coefficient of friction.

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Extrusions from Polytetrafluoroethylene

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TFE TUBING

AWG Spaghetti Sizes

Fractional inch electrical sizes (choice of standard wall, thin wall, or lightweight)

Fractional inch industrial sizes (heavier walls than standard wall electrical sizes)

Special wall thickness on request

EXPANDED TFE TUBING

For Heat Shrink Applications

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- Medical, Electrical and Mechanical Grades
- Sizes to Published Specifications and
- Customers Close Tolerance Requirements
- Extra-Large Diameters Available
- Long Lengths
- Cut Pieces

TFE Profile Shapes

Long Lengths

Hollow or solid cross sections

Special Wire Constructions

TFE Heavy Wall Construction

Coaxial cores to extremely close tolerances and exceptional concentricity

Solid TFE beading

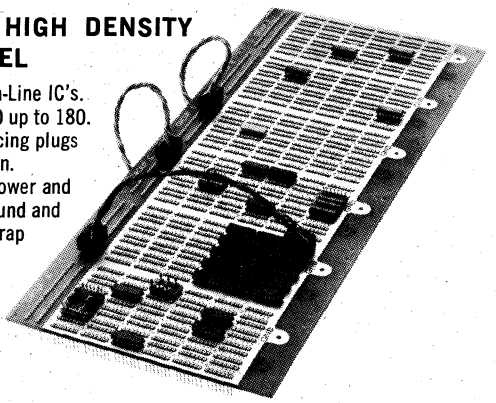
Cut pieces of tubing or shapes

Plug into AUGAT

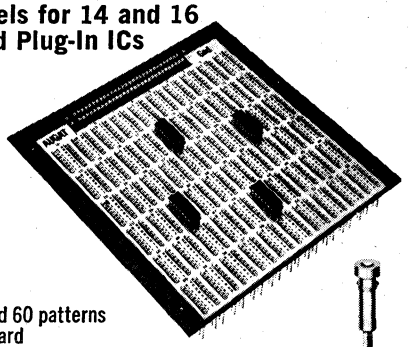
Where new concepts in IC handling originate

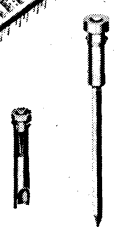
MODULAR TYPE HIGH DENSITY PACKAGING PANEL

for 14 and 16 Lead Dual-in-Line IC's. Patterns in multiples of 30 up to 180. Pattern accepts 3 inter-facing plugs for input-output connection. Double sided board with power and ground planes. Accepts round and flat lead packages. Wire-Wrap termination sufficient for 3 levels of 30 gauge wire.



HIGH DENSITY PACKAGING PANEL
Panels for 14 and 16 Lead Plug-In ICs

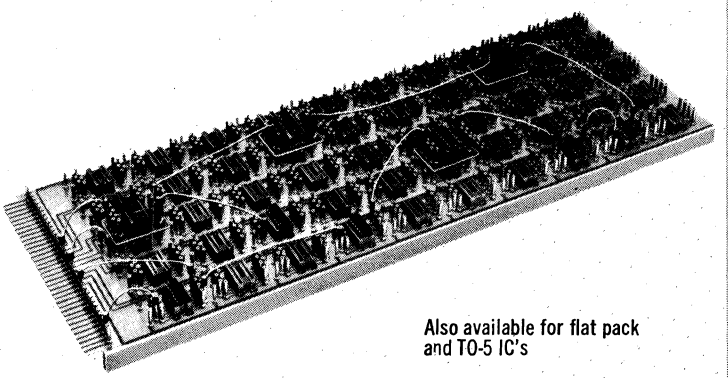




30 and 60 patterns standard
Double-sided board with power and ground planes at each pattern
Wiping action contacts assure high reliability
Wire-Wrap® or solder pot terminations

BREADBOARD AND TEST PANELS

10, 25 and 50 patterns standard. Eliminates soldering or welding IC leads. Also solderless jumper interconnections.

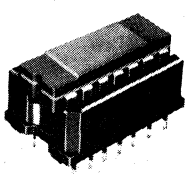


Also available for flat pack and TO-5 IC's

LOW PROFILE SOCKETS

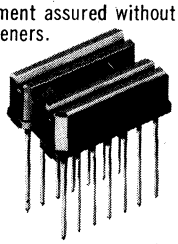
Available for 14 & 16 lead packages, accepts all packages with round or flat leads. Inner rail design. In diallyl phthalate or black phenolic with gold or tin plated contacts.

PC Style. Directly interchangeable! Exclusive socket configuration identical to IC package. Saves time, simplifies mounting on PC board.



Has wiping type beryllium copper contacts

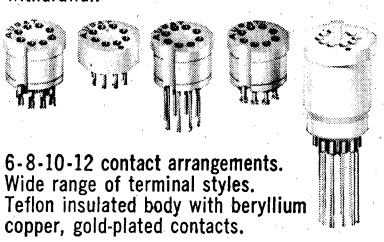
Wire-Wrap Style permits fast, easy mounting on boards. For .036 diameter holes. Retention and alignment assured without cement or special fasteners.



Contacts individually replaceable without removal of entire socket. Wire-wrap terminals — .025" square tails. Sufficient length for 3 levels of 30 gauge wire.

TO-5 CASE SIZE TEST AND PACKAGING SOCKETS

Positive retention — high contact reliability. Test sockets permit easy, fast insertion and withdrawal.



6-8-10-12 contact arrangements.
Wide range of terminal styles.
Teflon insulated body with beryllium copper, gold-plated contacts.

Large selection of Module and Transistor Sockets also available.

®Trademark Gardner-Denver Co.

Our flexible designs permit fast, easy modifications to suit particular requirements without premium charges or extended deliveries.

For fast, economical service on your I C Handling Problems, request Catalog 364.

Other AUGAT Products:

- Transistor Sockets
- Crystal Sockets
- Relay Sockets
- Lead Sockets
- Test Jacks
- Heat Sinks
- Component Holders
- Clamps
- Battery Holders

AUGAT INC. 36 PERRY AVE., ATTLEBORO, MASS. 02703

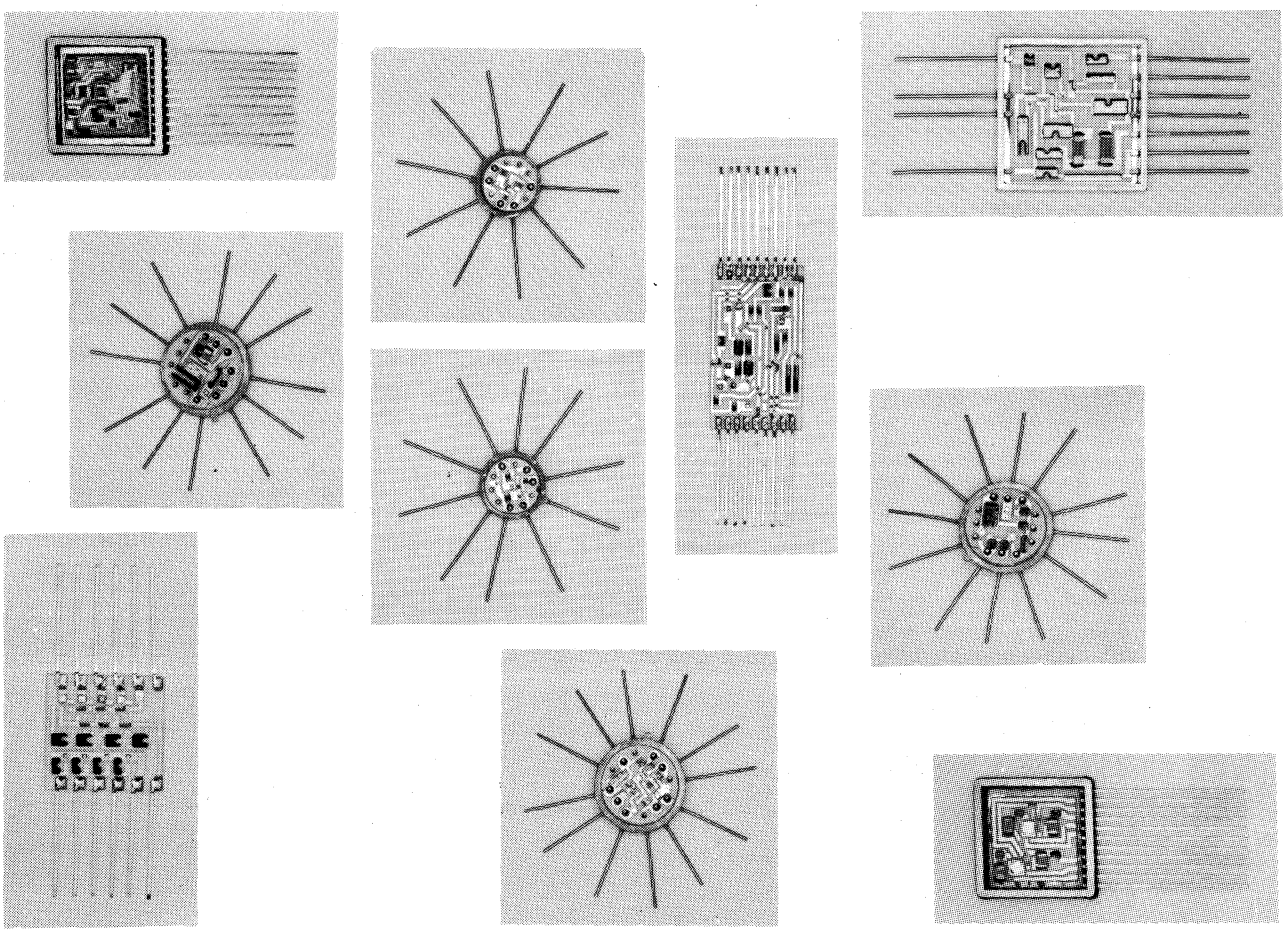
CTS CORPORATION ELKHART, INDIANA HYBRID CIRCUITS

CIRCUITRY TO SPECIFICATION

Over ten years of CTS cermet circuitry experience are concentrated in a 65,000 square foot facility in West Lafayette, Indiana, devoted to the manufacture of cermet passive and active circuits.

Cermet microelectronics offers many design possibilities to the forward-thinking engineer. Words such as high power, extremely low power, high frequency, precision, miniature size, low noise, and high reliability are all used to describe this concept. Another word "flexibility" should also be included. This is the key to the success of the CTS cermet microelectronics system. In order to provide the customer with an approach most consistent with his application, CTS offers both prototype and production facilities, several construction techniques, numerous packaging methods, three levels of quality control, and reliability data to demonstrate product performance under the environmental conditions you specify.

In order to achieve the best product for the lowest cost, CTS offers the flexibility required to optimize each application. Careful analysis of each requirement by our design engineering, production, and quality control personnel enables us to recommend the best product design consistent with your requirements.

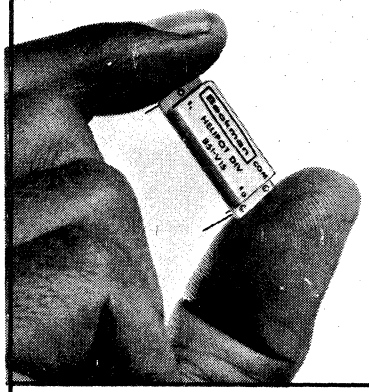


ORDERING INFORMATION: Place hybrid circuit orders at the following address:

CTS Microelectronics, Inc., P.O. Box 1278, Lafayette, Indiana 47902 • Telephone 317-463-2565 • TWX 810-342-1882

Helipot HYBRID MICROCIRCUITS

DC VOLTAGE REGULATORS



Helipot's hybrid cermet d-c voltage regulators are available from local stock throughout the country. They feature:

- ±0.05% regulation
- 500mA load capability
- 60 dB ripple rejection
- −55° to +125°C operation
- Short circuit proof models
- 0.5 sq. in. x 0.17 in. high
- Fully sealed and mil spec tested
- 24-hour burn-in

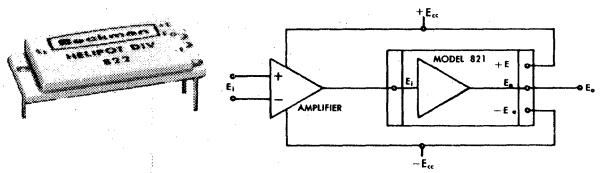
Voltage Range	POSITIVE		NEGATIVE	
	Fixed Output	Adjustable Output	Fixed Output	Adjustable Output
3 to 9 volts	Series 805	Model 806	Series 855	Model 856
9 to 21 volts	Series 801	Model 802	Series 851	Model 852
21 to 32 volts	Series 803	Model 804	Series 853	Model 854

LOW COST UNITS AVAILABLE TOO!

- Fixed outputs that can be externally adjusted
- ±0.003%/mA regulation
- 750 mA load capability
- 2 volt minimum input-output differential
- −55° to +125°C operation
- $10.80 each in 100-199 quantities

Series 809	Series 859
+5 to +28 Volts	−5 to −28 Volts

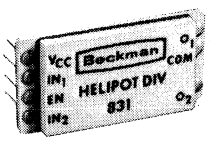
POWER AMPLIFIERS



Helipot Power Amplifiers, Models 821 and 822, are miniature, unity voltage gain power boosters designed to supplement the performance of available IC amplifiers (also most miniature hybrid or discrete packaged amplifiers). They feature:

- Fold-back current limiting.
- Peak output power to 5 watts.
- High voltage swing (±16 V).
- Wide total gain bandwidth.
- −55°C to +125°C operation.

LAMP & RELAY DRIVER



Model 831 Lamp and Relay Driver is a hybrid cermet unit that provides a convenient pre-engineered interface between digital IC levels (typical to computer logic) and output indication or control devices which demand considerably larger power levels. It is designed to provide the complete step up in power level required without the need for external pass transistors and features:

- 0 to +60 volts operating range
- 0 to 1 amp current capability (1.8 amps in parallel)
- Two circuits per package
- Standard DTL input levels
- −55° to +125°C operating temperature range.

OVERVOLTAGE CROWBARS

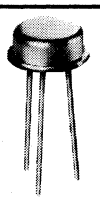


Voltage Range	5-10 V	10-40 V
Series	827	826

Series 826 and 827 Crowbars are designed for either direct shunt protection of the power line, or indirect control where SCR conduction triggers alarm or disable circuitry. Standard threshold points of 5, 6, 7, 8, 14, 18, 30 or 40 volts are trimable.
They feature:

- Low standby current.
- 500 ns maximum response time (return to safe voltage level).
- 5 μs maximum to reach SCR saturation.
- 10 amp peak surge capability.
- 4 amp continuous current capability ($T_C = 25°C$).
- −55° to +125°C operation.

HIGH SPEED FUSES



Model	817-0.5A	817-0.75A	817-1.5A
Current Rating (Notes 1 & 2)	0.5 amps	0.75 amp	1.5 amps

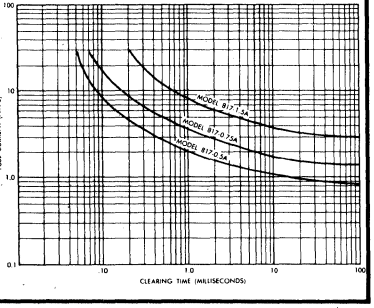
Note 1: Fuse life—1,000 hrs. minimum at rated current.

Note 2: Current rating tolerance of ±20% applies to ratings shown above and in the Figure. This tolerance also includes ambient temperature effects over −55° to +125°C.

The Series 817 High Speed Fuse is designed specifically to protect power transistors from short circuit destruction.

In addition to extremely fast response time (see Figure 1), the fuse features:

- 40 volt at 50 amp circuit interruption.
- −55° to +125°C operating temperature range.
- TO-46 all-metal hermetic packaging.
- Insulation resistance of 10^8 ohms at 150 volts.



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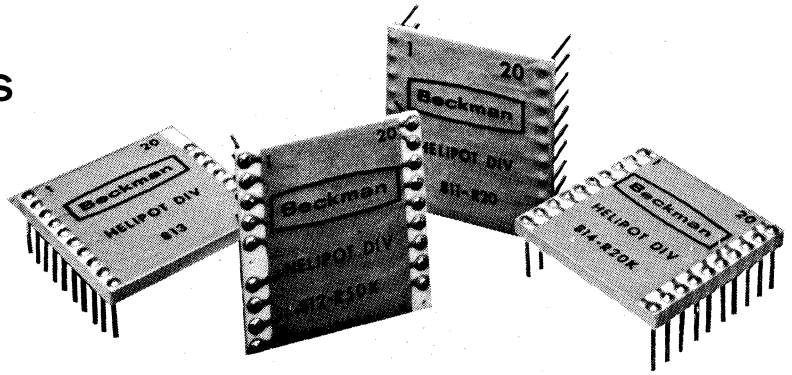
Helipot DAC/ADC COMPONENTS

LADDER NETWORKS



Helipot has a wide selection of Ladder / Resistor Networks to choose from, and most units are available from stock at economy prices.

They are constructed of Helipot's rugged cermet thick film passive elements and fused to alumina substrates at extremely high temperatures. By screen printing all resistors simultaneously, close temperature coefficient matching is achieved for all units and excellent temperature stability over the entire operating temperature range is assured.

Here are some outstanding features of Helipot's Ladder Networks:

- 60 ppm initial worst case accuracy at 25°C
- 0.6 ppm/°C tempco
- 20 ppm per year stability
- 50 ns settling
- Small size (1" x 1")
- Low profile (0.1" or 0.14")
- 100% testing at 5 temperature points
- Serialized accuracy data available on all networks

STANDARD STOCK MODELS

Model 811: A 12-bit Binary Ladder Network for use in DAC/ADC applications requiring fast switching and high accuracy over a wide temperature range.

Model 812: A 12-bit R-2R Binary Ladder Network designed specifically for MOSFET switching applications.

Model 813: A Binary Resistor Network designed for use with Fairchild's μA722 10-bit current source.

Model 814: An ultraprecision 14-bit R-2R Binary Ladder Network with accuracies to ±30 ppm from —20° to +80°C.

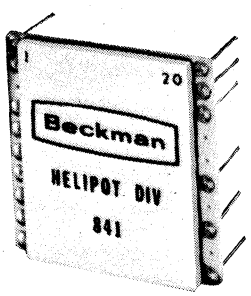
BCD Ladder Networks are also available in many standard configurations.

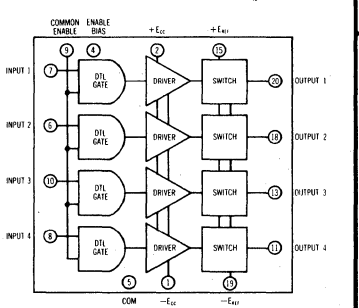
LADDER SWITCHES

The Model 841, 4-bit ladder switch is a miniature, hybrid, cermet thick film device for use in digital-to-analog conversion systems. It is designed primarily for use with Helipot's Series 811 high speed ladder networks, but can be used in other D to A systems (with either BCD or binary ladder networks) where precision, stability and small size are required. It features 4 switching sections with:

- 0 to 2 mV switch offset
- 5 (±3) ohms "on" resistance
- 200 ns rise and fall time
- 0 to 5 mA load range
- RTL, DTL or TTL input drive compatibility
- —55°C to +125°C operation.

An unusual feature of the 841 is its independence of reference voltage used. Plus and zero, zero and minus or plus and minus arrangements may be used without degradation of specifications.





Model 841 Block Diagram

LOW COST A to D CONVERTER

Model 835 is a 12-bit hybrid ADC building block. Its internal circuitry includes a twelve bit R-2R binary ladder network, a high speed precision comparator, analog switching and the digital registers and gating required for successive approximation conversion. The unit is capable of conversion at 250 kHz clock rates and provides serial output data.

LOW COST D to A CONVERTER

Model 845 is a self-contained hybrid 8-bit DAC which includes switches, an eight bit ladder, the reference supply and an output buffer amplifier. The unit is stocked in preset unipolar and bipolar output configurations.

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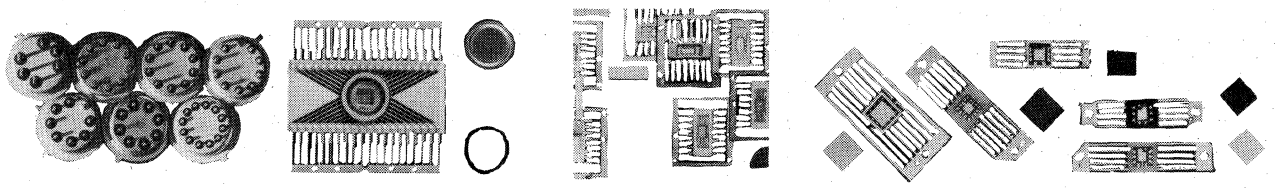
INSTRUMENTS, INC.

HELIPOT DIVISION 2500 HARBOR BOULEVARD, FULLERTON, CALIFORNIA • 92634 • (714) 871-4848

GTI CORPORATION
Providence Division

INTEGRATED CIRCUIT PACKAGES
METAL-TO-METAL CERAMIC SEALS



DUAL-IN-LINE PACKAGES

PART NUMBER	CAVITY SIZE	NO. OF. LEAD	MATERIAL (s)
FK25WH14-1	¼″ x ¾″	14	*"Kovar" base/compo glass
FK25WH14-4	¼″ x ¾″	14	"Kovar" base/compo glass/"Kovar" ring frame
FK25WH16-1	¼″ x ¾″	16	"Kovar" base/compo glass (short body)
FK25WH16-2	¼″ x ¾″	16	"Kovar" base/compo glass/"Kovar" ring frame (short body)
FK25WH16-3	¼″ x ¾″	16	"Kovar" base/compo glass (long body)
FK25WH16-5	¼″ x ¾″	16	"Kovar" base/compo glass/,"Kovar" ring frame (long body)
FK25WH16-7	¼″ x ¾″	16	"Kovar" base/compo glass/"Kovar" ring frame (long body, large pad)
FK2224-1	.940″ x 1.20″	24	all ceramic
FK2232-1	.940″ x 1.60″	32	all ceramic
FK2240-1	.940″ x 2.05″	40	all ceramic

"FLAT-PACKS"

FK22NAT10-6	¼″ x ¼″	10	all glass/flush pad	"Kovar" or ceramic lids, and preforms available for all packages.
FK2214-15	¼″ x ¼″	14	ceramic base/"Kovar" ring frame/single pad	
FK2214-16	¼″ x ¼″	14	ceramic base/"Kovar" ring frame/two pad	
FK2214-17	¼″ x ¼″	14	ceramic base/"Kovar" ring frame/three pad	
FK2214-18	¼″ x ¼″	14	ceramic base/"Kovar" ring frame/four pad	
FK2214-19	¼″ x ¼″	14	ceramic base/two pad special	
FK23NAT14-3	¼″ x ⅜″	14	all glass/flush pad	
FK23NAT14-8	¼″ x ⅜″	14	all glass/flush large pad	
FK2314-11	¼″ x ⅜″	14	"Kovar" base/"Kovar" ring frame	
FK2316-1	¼″ x ⅜″	16	"Kovar" base/"Kovar" ring frame	
FK2324-1	¼″ x ⅜″	24	"Kovar" base/"Kovar" ring frame	
FK2314-12	¼″ x ⅜″	14	ceramic base/compo glass	
FK12WH14-1	¼″ x 3/16″	14	"Kovar" base/compo glass	
FK12WH14-2	¼″ x 3/16″	14	"Kovar" base/compo glass/"Kovar" ring frame	

MONOLITHIC "HI-INTEGRITY" FILTER PACKS (COLDWELD)

FP750	.750″ x .750″	2	copper clad "Kovar", nickle plated
FP1500	1.530″ x .660″	2	copper clad "Kovar", nickle plated
FP1500-12	1.530″ x .660″	12	copper clad "Kovar", nickle plated
FP2000-2	2.030″ x .660″	2	copper clad "Kovar", nickle plated
FP1530	1.530″ x .660″	6	copper clad "Kovar", nickle plated

I.C. "HI-INTEGRITY" FLAT-PACKS (COLDWELD)

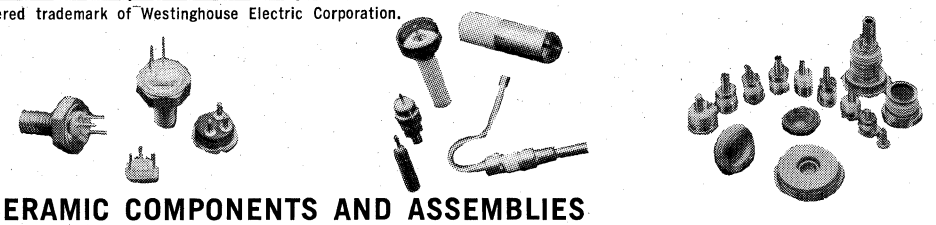
FP1000	1″ x .900″	16	copper clad "Kovar", nickle plated
FPS1000	.8″ x .7″	—	alumina substrate for FP1000
FPS1001	.8″ x .7″	—	alumina substrate for FP1000, metalized

TO-5 MULTI-LEADS

PART NUMBER	CAVITY SIZE	NO. OF LEAD	MATERIAL (s)
HK30AN-100	.200 pin circle .035 pin height	6) ½″ insulated	"Kovar"
HK30V-100	.200 pin circle .035 pin height	8) ½″ insulated	"Kovar"
HK30BY-100	.200 pin circle .035 pin height	7) ½″ insulated 1) ½″ welded	"Kovar"
HK30BX-100	.230 pin circle .035 pin height	10) ½″ insulated	"Kovar"

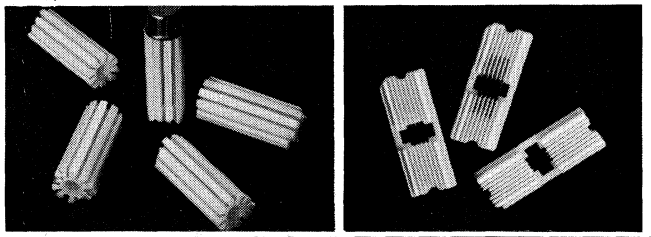
PART NUMBER	CAVITY SIZE	NO. OF LEAD	MATERIAL (s)
HK30CR-100	.230 pin circle .035 pin height	9) ½″ insulated 1) ½″ welded	"Kovar"
HK30CU-100	.230 pin circle .035 pin height	10) ½″ insulated	"Kovar"
HK30BQ-100	.200 pin circle .035 pin height	12) ½″ insulated	"Kovar"
Covers supplied as required			

*"Kovar" is a registered trademark of Westinghouse Electric Corporation.



METAL-TO-CERAMIC COMPONENTS AND ASSEMBLIES

A wide variety of standard and custom components and assemblies utilizing high alumina and beryllia ceramics are available. Among them are: rectifier housings with a standard hermeticity of 1×10^{-9}; high temperature components and connectors for fuel cells and thermionic and thermo-electric generators; miniature housings for varactors and other diodes; transistor packages; DO-4 and DO-5 rectifier housings; and feed-thru assemblies for systems in the 10^{-10} Torr range that resist temperatures up to 800°C.

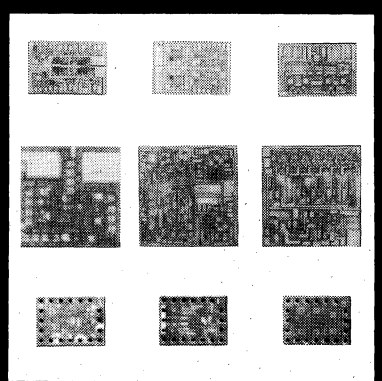


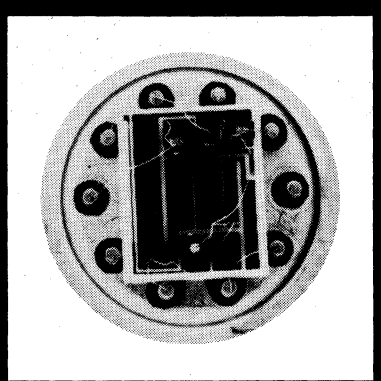
CARRIERS FOR INTEGRATED CIRCUITS

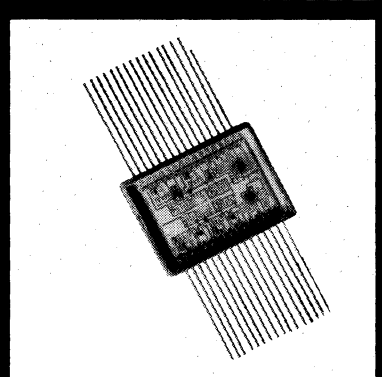
GTI's Clover Division supplies carriers for "Flat Pack" and TO-5 packaged circuits. Molded of DuPont Delrin® these carriers can be used for environmental testing as well as shipment of finished packages.

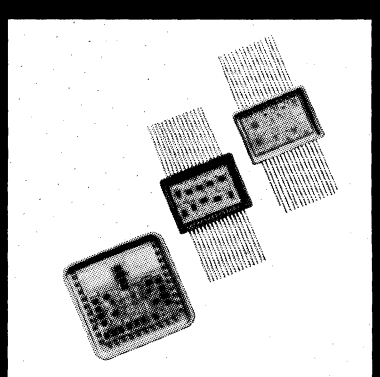
HUGHES

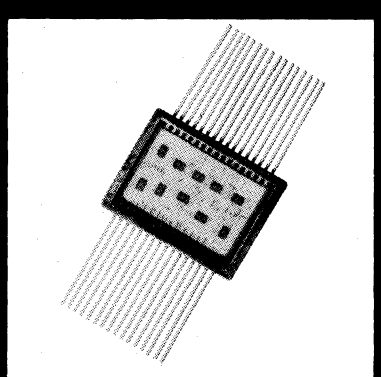
THIN FILM/THICK FILM HYBRID INTEGRATED CIRCUITS

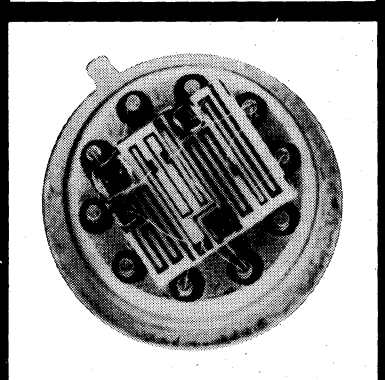


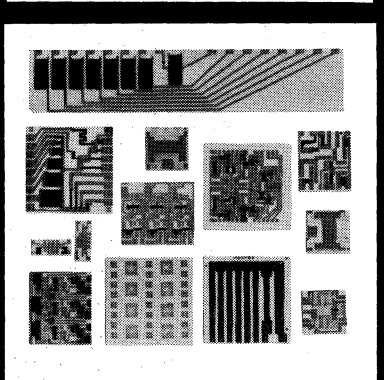






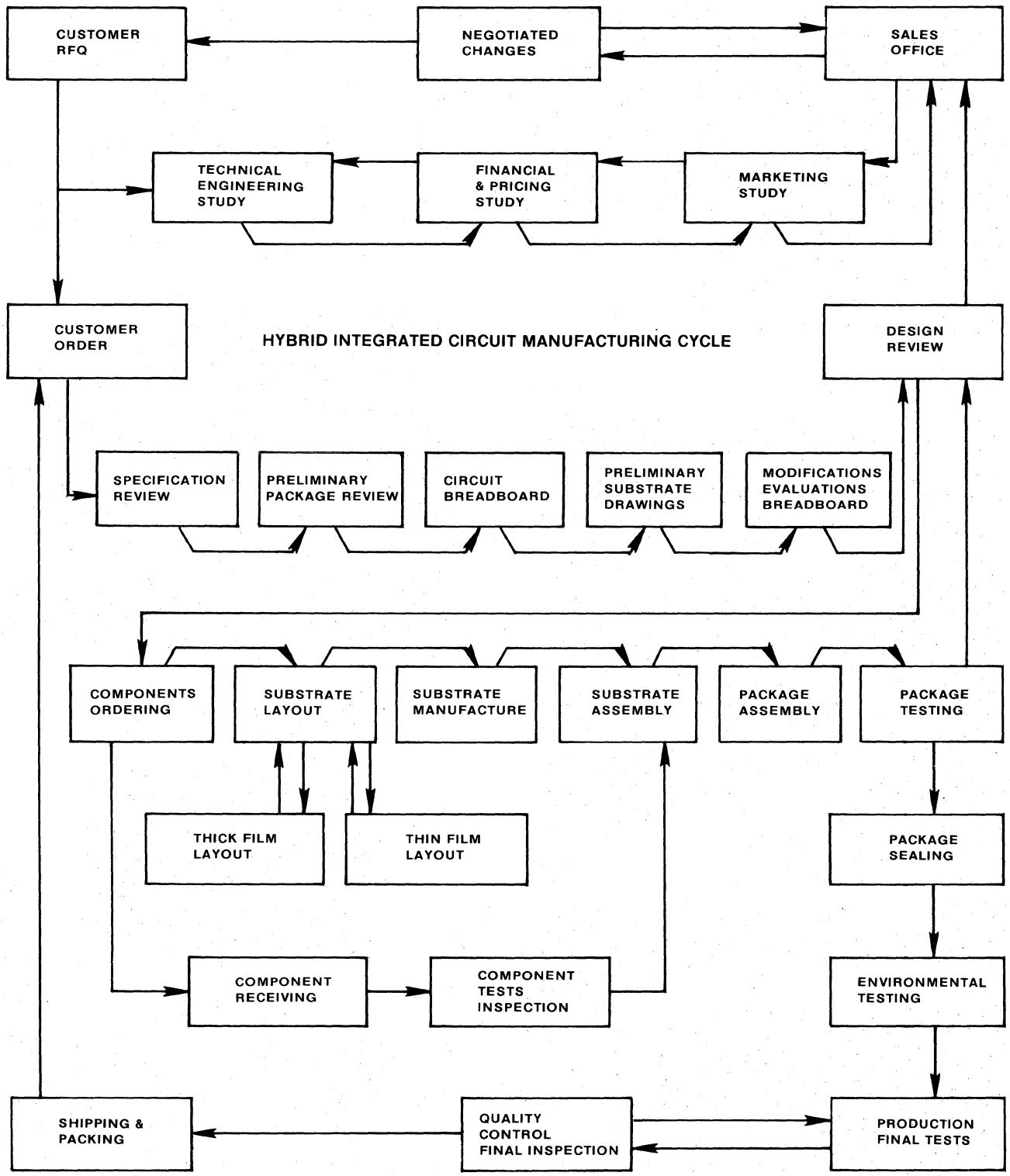






HYBRID INTEGRATED CIRCUIT MANUFACTURING CYCLE

A Chart indicating the major steps required from receipt of a request for quotation through order placement, manufacturing, and delivery is shown for a typical hybrid circuit. Note the necessary feed-back paths which provide ultimate product acceptance and maximum reliability.



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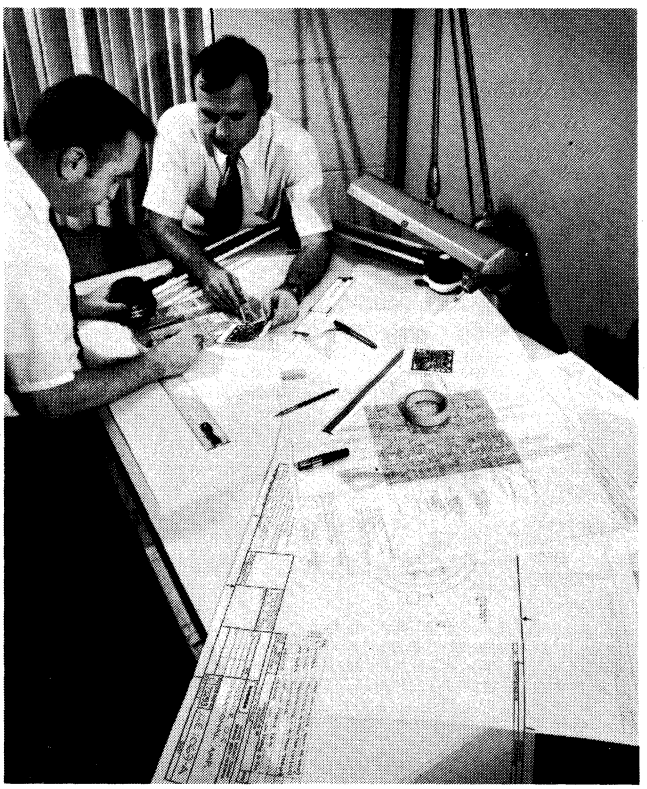
HYBRID CIRCUIT MANUFACTURE

Customer Specification Study

Electrical and mechanical design requirements which were analyzed during quotation preparations are again carefully reviewed. Responsible groups study electrical loading, power dissipation, materials compatibility, component selection, and package performance that must be achieved for the product to meet quality and reliability standards when operating under the customer's operational and environmental specifications.

Preliminary Manufacturing Studies and Design Review

Some phases of a hybrid circuit manufacturing process must be started in a preliminary effort to provide data for a Design Review Board. Drawings of schematics, substrate layouts, and package outlines are prepared. More important, hardware is roughly assembled or "breadboarded" so that testing procedures and test equipment may be planned. As designs are evaluated, manufacturing drawings are released by the review group followed with approved process specifications. The Design Review is conducted at periodic intervals to provide control and coordination during the manufacturing cycle. Actual manufacturing is preceded by the release of procurement drawings for the purchase of components. Much procedural planning is accomplished pending the receipt of hardware. The main goal of the Design Review Board is to resolve the following considerations:



CONSIDERATIONS OF A HYBRID DESIGN REVIEW BOARD:

1. **MECHANICAL DESIGN**

Substrates

Size of material — available area.

Type of material — alumina, silica, glass.

Method of attachment to package — weldment, adhesive, etc.

Method of manufacture — thick film, thin film.

Conductors

Sizes and lengths of conductors, sizes of pads and terminations.

Types of material—gold, palladium-gold, silver, nichrome, etc.

Method of manufacture—screening, evaporation.

Components and Package

Sizes consistent with package and substrate materials.

Types of components — beam leads, flip chips, lids, face up chips.

Method of Assembly

Wire bonding — thermal compression, ball bonding, ultrasonic bonding.

Weldments and adhesive pastes.

Soldering and reflow methods.

Flip chip construction.

Beam lead construction.

Conventional chip construction.

Package assembly.

2. ELECTRICAL DESIGN

Power Dissipation

Current loading.

Voltage drops — conductor lengths.

Termination pads.

Resistor and component values and tolerances.

Circuit Performance

Speed of response.

Stability.

Component selection.

Voltage offsets.

Conductor crossovers.

Electrical Tests and Equipment

Component tests.

Manufacturing tests.

Quality control and qualification tests.

Environmental behavior.

Final acceptance tests.

3. THERMAL DESIGN

Power Dissipation and Dispersal

Tracking effects.

Hot spots.

Component thermal properties.

Temperature coefficients of materials.

Environmental Conditions

Heat exchange to package.

Long term stability.

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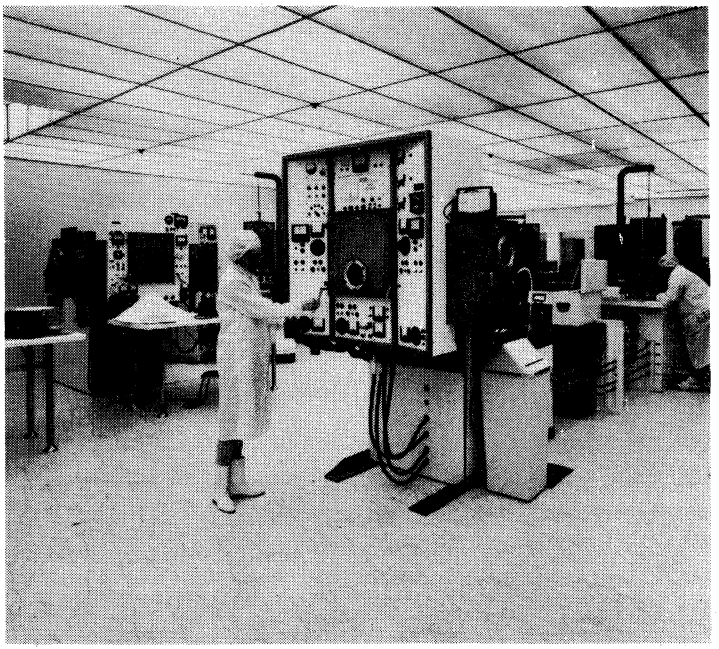
SUBSTRATE LAYOUT



A layout is drawn 20:1 times actual size in order to produce a highly accurate copy through the use of Rubylith "cut and strip" artwork. The layout drawing is reproduced on a coordinatograph machine with an accuracy of plus or minus .001". This master artwork is then photographically reduced to the final size and later used to form the masks for resistors and conductors if thin film is chosen; or the screens for resistors, conductors and glaze if thick film is chosen. The master artwork may be reduced, and by means of a step and repeat process, result in a single film negative with multiple patterns, each a faithful reproduction of the original artwork.

THIN FILM SUBSTRATES

The Thin Film Area comprises one of the largest collections of deposition equipment in the world.

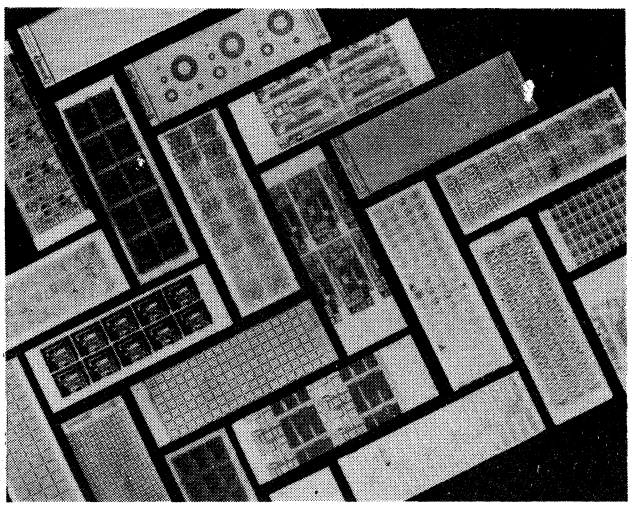


Hughes can deposit over 5000 square inches of Nichrome-gold per day with six systems in operation. Other systems are used for Aluminum and glass deposition. The Thin Film area can provide up to 5 microns of gold in order to obtain less than .01 ohms per square resistivities in the conductors of a substrate. Substrates can be produced from artwork within two days, but multilayered substrates require more preparation and time.

We prefer providing unglazed alumina substrates with resistors and conductor patterns, but we can supply other materials such as resistor chips with resistances as high as 1 megohm on a .065"x .065"x.006" silicon die. Thin film capacitors have been developed at HAC as integral parts of circuits or as chips.

Substrates are made using photoresist and etching techniques to obtain high resolution circuit patterns. After resistors are formed, they are stabilized at high temperature in air.

THIN FILM CHARACTERISTICS:



....Resolution of .0005 in. is obtainable on silicon.

....Resolution of .002 in. is obtainable on unglazed alumina.

....Resistor tolerances of 1% are attained.

....Temperature coefficient of resistance (TCR) can be better than 60 ppm/°C.

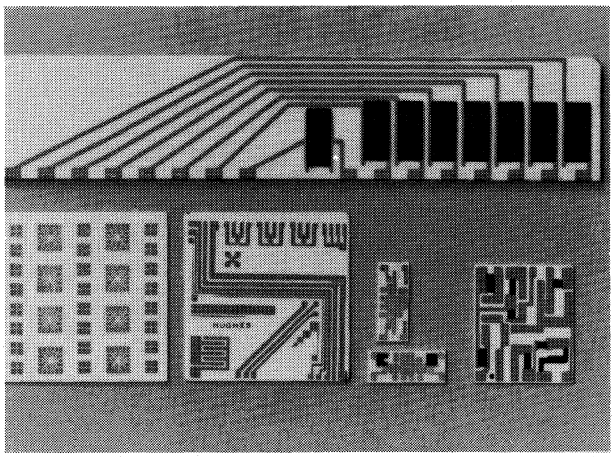
....Temperature coefficient of resistance tracking (TTCR) can be better than 10 ppm/°C.

....Stability is better than .3% per 1000 hours at 125°C.

....Material 2x3 in. is commonly used.

....Substrates may be supplied with materials deposited to customer requirements.

THICK FILM SUBSTRATES



Hughes prepared substrates are processed by screening processes to form the desired pattern of resistor and conductor paths to which the active devices can then be attached. Because thick film is composed of baked or "fired-on" metallic inks, various metallic combinations may be used to optimize the circuit function. At Hughes, thick film substrates are usually coated with "fired-on" glazing materials in order to provide additional long term stability.

By using screens prepared from reduced artwork of the customer's substrate requirements, conductor and glazing patterns are formed. Depending upon the pattern complexity, 165 mesh to 325 mesh stainless steel screens may be used. For extremely complex patterns, etched metal masks are employed.



The conductor screen is then properly aligned in a printer and the conductor ink is printed on the unglazed alumina substrate. Curing and firing take place in a 5-zone belt furnace. Resistor screens are then aligned and printed. Since the inks are limited to a number of controlled resistivity levels, several ink selections may be required to achieve the range of resistor values employed in a specific circuit. After all resistor inkings have been printed and cured, the substrate is refired, glazed, and again fired in a third furnace.

The trimming operation is performed on a Hughes semiautomatic pneumatic "sand blast" thick film resistor trimmer. Trim resolution is finer than 0.1%.



THICK FILM CIRCUIT LAYOUT SUBSTRATE CHARACTERISTICS

Resolution : 5 mil lines and spacing.
Resistor Tolerance : ± .25% at 25°C.
Temperature Coefficients :

Ohms/Square	Temperature Coefficient Range (−55°C/+125°C)
5 ohms	+ 300 PPM/°C
10 ohms	+ 130 PPM/°C
50-100K ohms	± 150 PPM/°C
100K-200K ohms	− 200 to −400 PPM/°C

Temperature Tracking Coefficient : 50 PPM/°C maximum for most inks.

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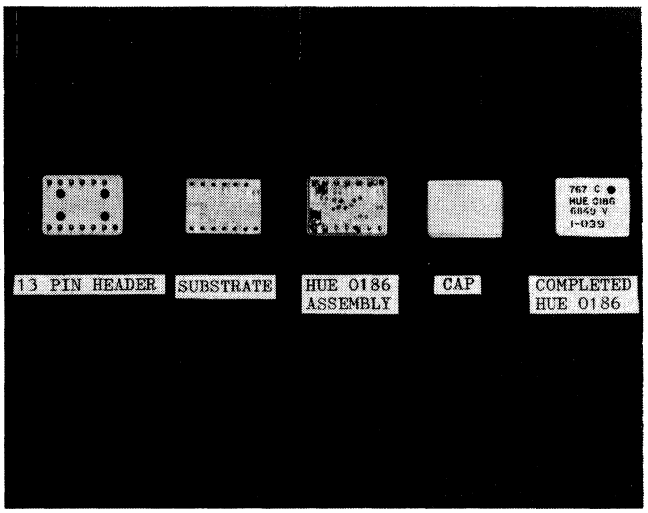
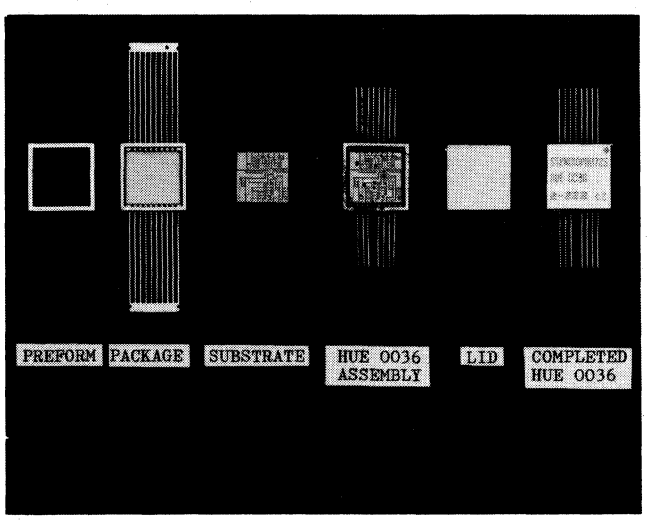
ASSEMBLY OF HYBRID CIRCUITS

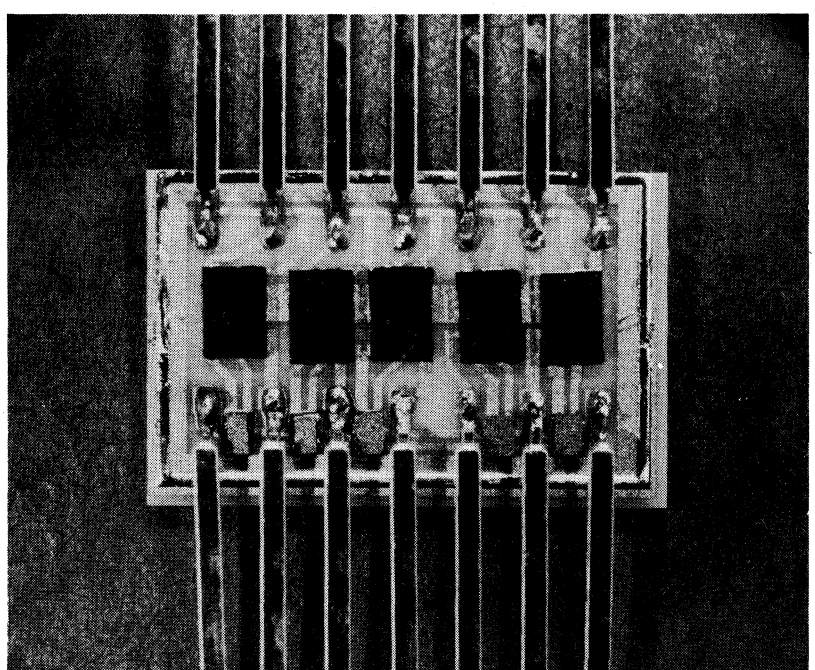
Normal practice is to place the substrate on the case or carrier; attaching the substrate to the carrier with the aid of a thermally conductive paste. If flip chips are being used, it is more practical to bond all the chips to the substrate before making the substrate adhere to the carrier. Two types of thermally conductive pastes are used at Hughes, one called "Scotch Cast" which is an insulator and is preferred for temperatures ranging from 125°C to 165°C, and the other a true epoxide called "Ohmex" which is electrically conductive and is used for projects with higher temperature requirements. The substrate and carrier are baked between +125°C and +150°C for two to three hours to cure the pastes. Typical eutectic chip attachment is also used when the design review indicates the desirability of such a die attach.





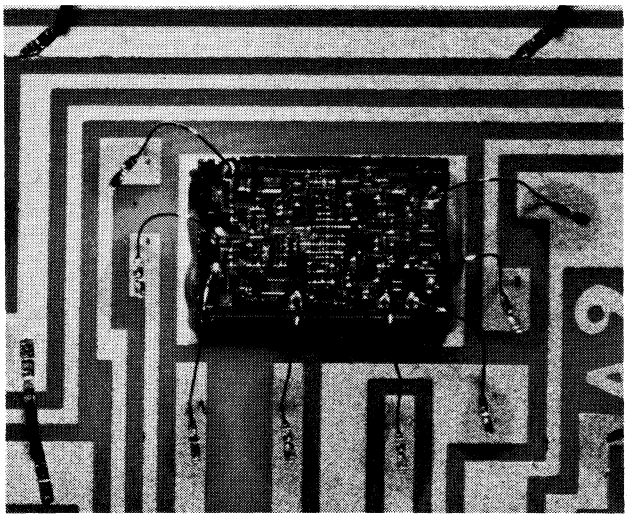
Many devices can be purchased, tested, and premounted on moly tabs from the manufacturers. Integrated circuits have a much higher basic price and usually require more complex testing. For these reasons, IC's are often purchased as chips, mounted on headers for testing, and then demounted for later assembly of the substrates. The overriding consideration being the need for thoroughly tested devices.

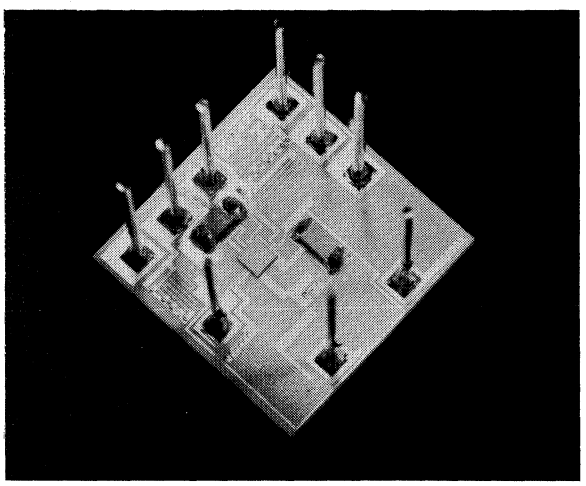
A DTL circuit is usually covered with a protective coating and mounted on a header for testing. Two machines are kept in readiness; one at 380°C for mounting and one at 400°C for demounting. Both operations take a few seconds. The other major components such as large capacitors or coils, that are not manufactured on the substrates are generally soldered into position after carefully tinning and forming the leads.

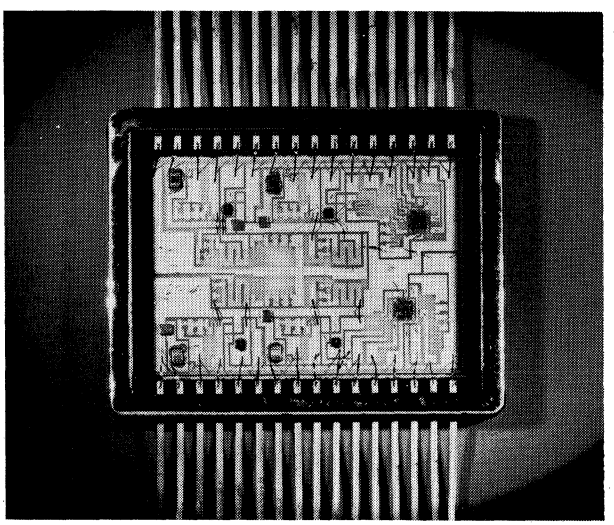


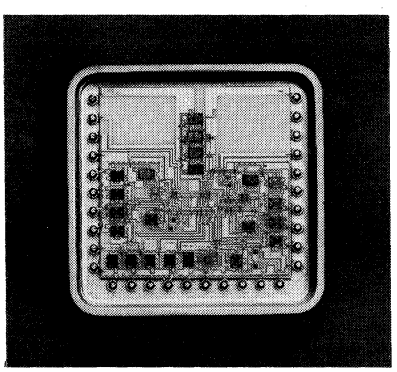
Flip chip devices require slightly different assembly techniques. Flip chips are mounted face down directly to the conductive patterns on the substrate. All connections to the circuit are made simultaneously through the use of a Hughes Ultrasonic Flip Chip Bonder. Flip chips are usually mounted early in the assembly of the substrate, thus avoiding the encumbrance of the package during the bonding process.

Conventional dice are mounted face up and the previously attached leads are interconnected with a dual tip bonder. Many devices such as IC's are left with redundant leads coming from the chip. These are deliberately left without connecting them to the substrate terminations until all testing is completed. Before final sealing and prior to visual inspection, the redundant leads are clipped and removed.









Final sealing may be done either by soldering the lid to the package, or by a weldment process to provide a hermetic seal. Both helium (fine leak) and oil bubble (gross leak) tests are normally used to check the hermeticity of the seals.

During the production assembly, many aids are made available to the production assemblers. Large scale layouts show component orientation and location. These visual aids are supplemented with Quality Control criteria and examples. A series of test stations and quality inspections maintain Process Control and provide data for the Product Review Board's evaluation.



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Package Testing

A great proportion of the manufacture of Hughes Hybrid Integrated Circuits is devoted to testing and, naturally, a great amount of this effort is reflected in the amount of test equipment available. Equipment is constantly being used during the manufacturing cycle for incoming receiving inspections of components, sub-assembly tests, first electrical tests, final pre-seal tests, pre-screening of material for environmental tests, high-temperature operational burn-in, life tests, and final inspection tests. Facilities are available for contractual use upon request.



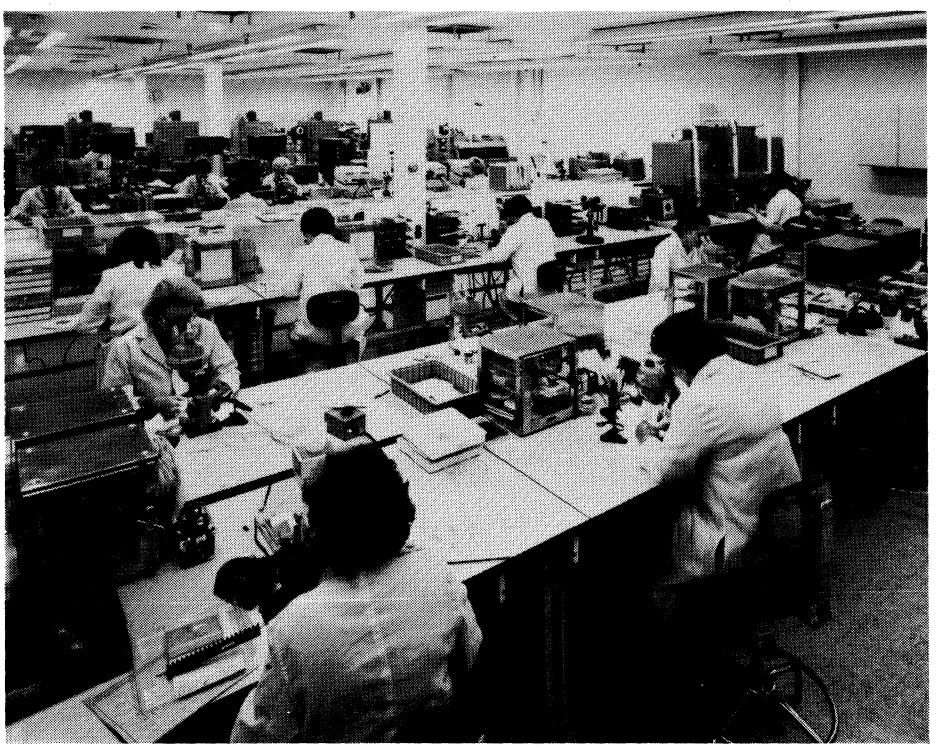
Hughes has served a great many High Reliability programs in the semiconductor industry and the experience has proved invaluable in the manufacture of hybrid circuits. Results of such programs as Surveyor, Apollo, Minuteman, Poseidon, and numerous other qualifactions have lead to such practices as screening all circuits to these environmental conditions:

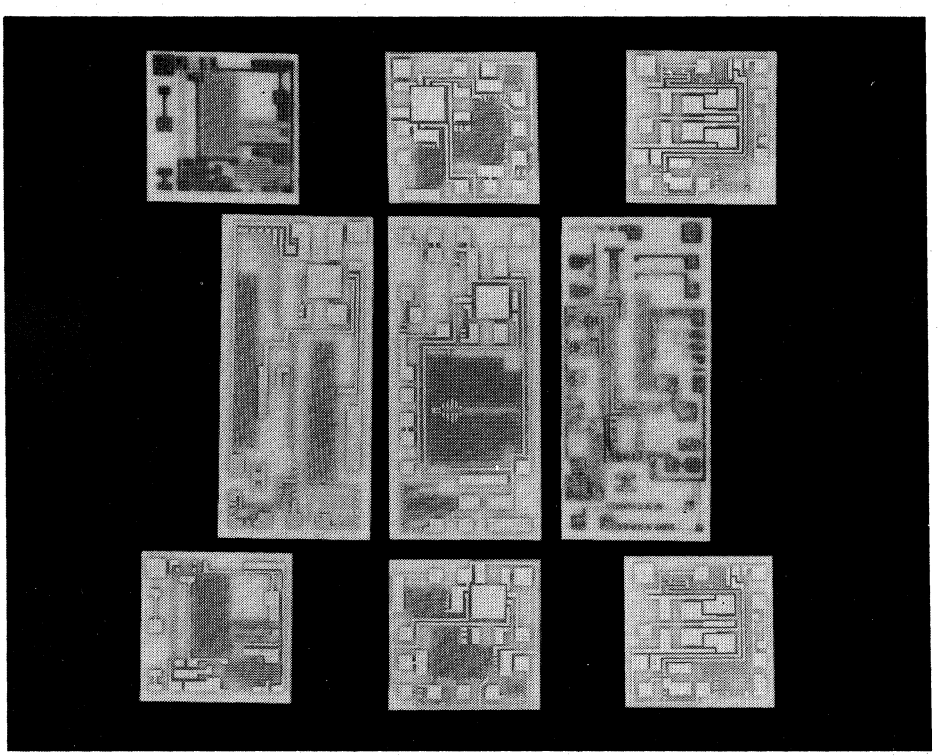
1. High Temperature Bake at 150°C for 24 hours.
2. Centrifuge Tests at up to 20000 g.
3. Temperature Cycling from −55°C to +150°C over 10 cycles.
4. Fine Leak Test less than 5×10^{-7} cc/sec.
5. Gross Leak Test or Bubble Test using Fluorochem at 125°C for one minute.

In addition, Hughes maintains a large number of "Burn-in" stations whereby not only Operating Life Tests may be performed, but also many devices may be burned-in or "aged" for 168 hours under loaded circuit conditions.

Hughes Hybrid Product Capability

Quotation requests are solicited on any or all phases of thick film or thin film manufacturing. Hughes has facilities for layout and masking, evaporation and etching, partial or total assembly, and complete Quality Control and Inspection facilities. The Hughes Newport Beach facility is qualified for any degree of high reliability testing program and offers those services. By using the selected and versatile facilities available at Hughes, any firm with some in-house capability can quickly become a supplier of their own sophisticated custom hybrid circuits.



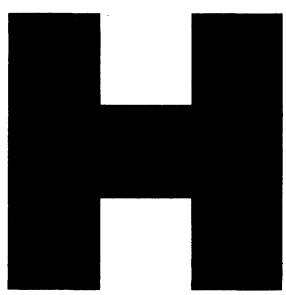


Hughes Technological Support

As indicated previously, Hughes Newport Beach houses many varied product lines and engineering groups. The Hybrid Integrated Circuits area has direct access to the following product line groups within the same building:

- Hughes MOS Integrated Circuits.
- Hughes Flip Chip and Equipment capability, which provide PNP and NPN transistors, diodes, and other elements in Flip Chip form in addition to supplying the dice handling equipment for testing. The same group also manufactures the ultrasonic bonding equipment for production assembly of hybrid circuits.
- Hughes Frequency Control Device Product Line which offers a variety of precision crystals and crystal filters.
- Hughes Microelectronics Laboratory provides technological support for thick and thin film products, monolithic products and many research phases in semiconductor manufacture.
- The Hughes Hybrid Integrated Circuits area has liaison with Hughes Aerospace Group (Culver City), the Applied Research Laboratories (Santa Barbara), Vacuum Tube Products Division (Oceanside), Ground Systems and Communications Group (Fullerton), Hughes Research Laboratories (Malibu), and Hughes Aircraft Company (El Segundo and Tucson, Arizona).

The Hughes Hybrid Integrated Circuit Product Line is a versatile and capable organization offering complete in-depth scientific engineering and complete modern manufacturing facilities for the production of hybrid circuits.



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MOS devices index

The products listed in this brochure define the MOS capability of Hughes. All products listed are available as off-the-shelf, either through direct OEM or Distributor inventory.

A great amount of effort has been directed towards the following goals for 1969 and 1970; further expansion of our already large emphasis on Custom Devices, and towards additions to more sophisticated LSI devices.

If the device you desire is not listed within this brochure, contact our Sales Department either through our Field Offices or through the Hughes-Hot Line/Toll Free (800) 854-3280.

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Note: Part numbers in brackets, i.e. (HRM 8013), are used for reference only.

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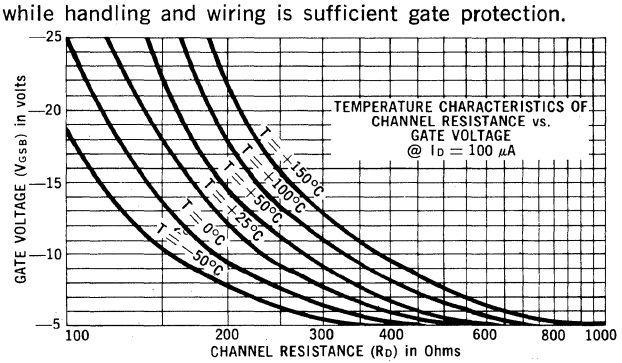
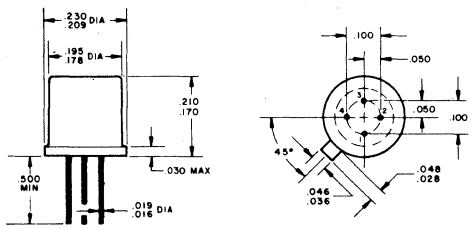
1| discrete devices

MOSFET SWITCH HDIG 1030 (HRN 1030)

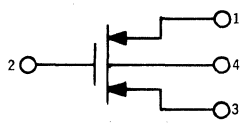
The Hughes HDIG1030 is a P-Channel enhancement-mode, insulated gate Field Effect Transistor. This device is designed primarily for efficient digital logic switching applications and chopper applications featuring zero offset, high input impedance and low "on" resistance. Typical input resistance of greater than 10^{15} ohms permits the HDIG1030. to be used in many electrometer applications.

HANDLING PRECAUTIONS: Owing to its very high input resistance, every precaution should be taken during the circuit wiring and testing of this device in order to prevent gate break-down. Shorting the gate lead to any of the other leads while handling and wiring is sufficient gate protection.





4 Lead TO-72



TERMINAL CONNECTIONS

1. Drain 2. Gate 3. Source 4. Substrate

ABSOLUTE MAXIMUM RATINGS

V_{GDSB} @ 25°C	±25v	Power Dissipation	
V_{GDSB} @ 125°C	+6v	@ Case Temp. 25°C	0.6w
V_{DS}	−25v	@ Free Air Temp. 25°C	0.20w
V_{SD}	−15v	Operating Temp.	(−55 to +125)°C
		Storage Temp.	(−65 to +200)°C

MOSFET SWITCHES

HDSW 2106 (HRN2106D)
HDSW 3005 (HRN3005D)
HDSW 8300 (HRN8300D)
HDSW 8318 (HRN8318D)
HDSW 8338 (HRN8338D)
HDSW 8348 (HRN8348D)

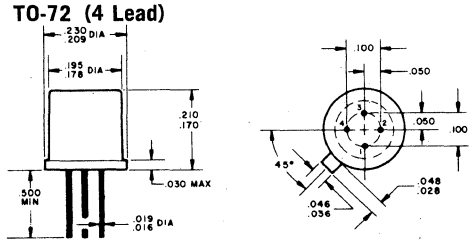
1| discrete devices

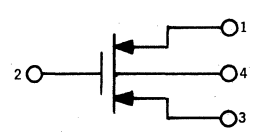
The Hughes family of P-Channel Enhancement Mode MOSFET devices described by this specification allows optimum selection of device characteristics for all switching applications. The Hughes 2 Volt threshold technology improves performance by minimizing drive requirements.

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Type HDSW	Description	Typical Ratings Cgd	Cgs	Cds	Ron	BV_{GDS}	BV_{DSB}	BV_{SDB}
8300	30 Volt Switch	2.5pf	2.5pf	1.8pf	300 Ω	−50v	−40v	−40v
8318	Gen. Purpose Switch	2.0pf	2.0pf	1.7pf	250 Ω	−50v	−25v	−25v
8338	Chopper	0.7pf	0.7pf	0.5pf	1000 Ω	−50v	−25v	−25v
8348	50 OHM Switch	8.0pf	8.0pf	5.0pf	50 Ω	−50v	−25v	−25v
2106	20 OHM Switch	11.0pf	11.0pf	8.0pf	20 Ω	−50v	−25v	−25v
3005	Low Leakage — 600 OHM Switch	0.7pf	0.7pf	1.2pf	600 Ω	−50v	−40v	−40v

CASE: TO-72 (4 Lead)





TERMINAL CONNECTIONS

1. Drain 2. Gate 3. Substrate 4. Source

ABSOLUTE MAXIMUM RATINGS

Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C
Power Dissipation @ 25°C Case Temp.	600 mw
@ 25°C Free Air	200 mw

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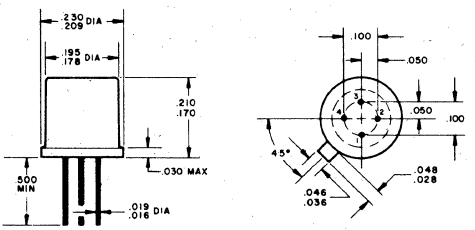
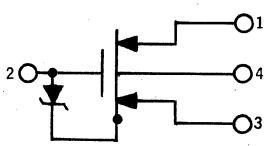
1 | discrete devices

MOSFET SWITCH HDSW 8346 (HRN 8346D)

The Hughes HDSW 8346 is a P-Channel Enhancement Mode MOSFET specifically designed for very linear AGC applications. Input protection is provided from gate to substrate.





CASE: TO-72

TERMINAL CONNECTIONS

1. Drain 2. Gate 3. Substrate 4. Source

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Drain to Source Breakdown Voltage	BV_{DSB}	−15	−25		V	−10ua
Source to Drain Breakdown Voltage	BV_{SDB}	−15	−25		V	−10ua
Gate Leakage Current	I_{GSB}		−0.01	−10.0	nA	−15v
Drain to Source Current	I_{DSB}		−0.05	−1.5	nA	−5v
Source to Drain Current	I_{SDB}		−0.05	−1.5	nA	−5v
Threshold Turn-on Voltage	V_T	−1.5	−2.5	−5.0	V	−10ua
Input Capacitance	C_{gsb}		6.0	8.0	pf	
Gate to Source Capacitance	C_{gs}		5.0	7.0	pf	
Gate to Drtain Capacitance	C_{gd}		5.0	7.0	pf	

ABSOLUTE MAXIMUM RATINGS

V_{GDSB} @ 25°C .....+0.3v
−25v
V_{DS} .....−15v
V_{SD} .....−15v

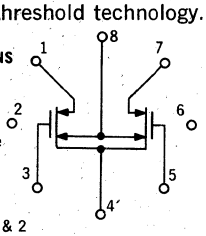
Operating Temp. ..−55°C to +125°C
Storage Temp. ....−65°C to +200°C
Power Dissipation @ 25°C Case Temp. — 600 mW
@ 25°C Free Air — 200 mW

2 | duals

HDIG8049 (HRM8049)
HDIG8551 (HRM8551)
HDSW8050 (HRM8049D)
HDSW8550 (HRM8550)

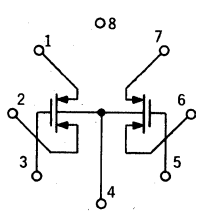
DESCRIPTION: Dual MOSFET's from Hughes are P-Channel, enhancement mode devices which feature low capacitances, good matching characteristics, and all the advantages of a −2 volt threshold technology.

TERMINAL CONNECTIONS
1. Drain 1
2. Open
3. Gate 1
4. Substrate
5. Gate 2
6. Open
7. Drain 2
8. Source 1 & 2



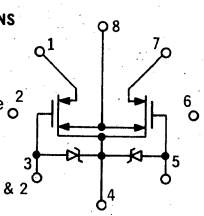
LOW LEVEL MODULATOR
HDIG8049

TERMINAL CONNECTIONS
1. Drain 1
2. Source 1
3. Gate 1
4. Substrate
5. Gate 2
6. Source 2
7. Drain 2
8. Open



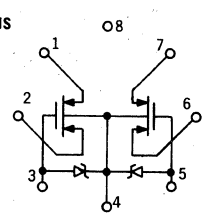
MATCHED AMPLIFIER DUAL
HDIG8551

TERMINAL CONNECTIONS
1. Drain 1
2. Open
3. Gate 1
4. Substrate
5. Gate 2
6. Open
7. Drain 2
8. Source 1 & 2



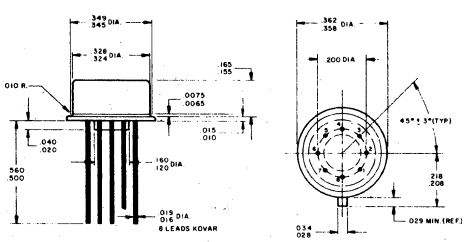
MODULATOR-DEMODULATOR
HDSW8050

TERMINAL CONNECTIONS
1. Drain 1
2. Source 1
3. Gate 1
4. Substrate
5. Gate 2
6. Source 2
7. Drain 2
8. Open



HIGH LEVEL DUAL SWITCH
HDSW8550

CASE: TO-99



Absolute Maximum Ratings	HDIG8049	HDIG8551	HDSW8050	HDSW8550
Gate-to-Substrate	±25	±25	+0.3V −25V	+0.3V −25V
Gate-to-Drain or Source Voltage	±25	±25	−25	−25
Drain to Source Voltage	−20	−30	−20	−30

Power Dissipation
@ Case Temp. 25°C ..... 600 mW
@ Free Air Temp. 25°C ..... 200 mW
Operating Temp. ..... −55°C to +125°C
Storage Temp. ..... −65°C to +200°C

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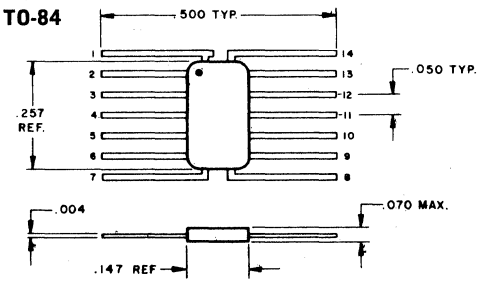
3| multiples

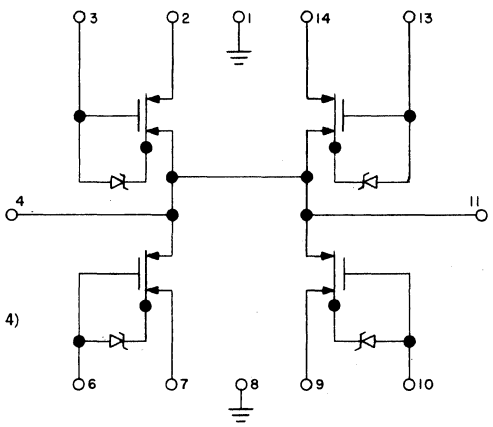
4 CHANNEL MOS SWITCH

HMUL 1441 (HRM 8052D)

The Hughes HMUL 1441 is a P-Channel, Enhancement Mode four channel switch having one common source and four outputs. This device is designed for efficient matrix switching and analog signal multiplexing. The Hughes 2 volt threshold technology minimizes drive requirements. Input protection is provided for all gate inputs.

CASE: TO-84





TERMINAL CONNECTIONS

1. V_{SS}
2. Drain #1
3. Gate #1
4. Source
5. N.C.
6. Gate #2
7. Drain #2
8. V_{SS}
9. Drain #3
10. Gate #3
11. Source (common w/pin 4)
12. N.C.
13. Gate #4
14. Drain #4

ABSOLUTE MAXIMUM RATINGS

	−25 Volts
V_{GB}	+0.3 Volts
V_{GD}	−25V
V_{GS}	−25V
V_{DS}	−15V
V_{SD}	−15V
Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

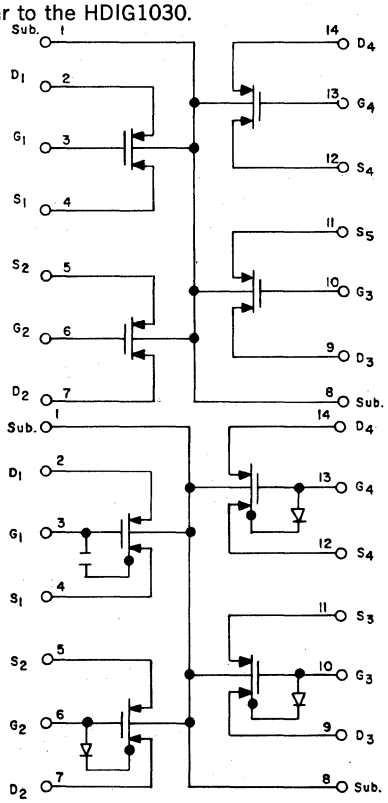
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Channel On Resistance	R_{on}		300	500	Ω	$V_G = 10$, $I_D = -1mA$
Channel Off Resistance	R_{off}	5	50		MΩ	$V_D = 5v$
Threshold Turn-on Voltage	V_T	−1.0	−2.5	−4.0	V	−10 μA
Input Leakage	I_G		0.05	10.0	nA	$BV_{DSB} = -15v$

3| multiples

MOSFET QUADS

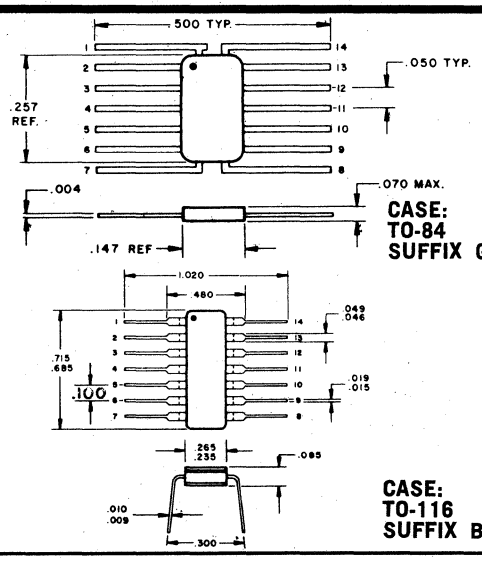
HMUL 1447G = (HRM 5008)
HMUL 1445G = (HRM 8014)
HMUL 1445B = (HRM 8114)
HMUL 1446G = (HRM 5008D)
HMUL 1444G = (HRM 8014D)
HMUL 1444B = (HRM 8114D)

The Hughes Quad devices are a monolithic arrangement of our P-Channel, enhancement mode MOSFETs. The MOSFET Quad devices are symmetrically packaged for ease of fabrication in multiplexer applications. Each device of the quad is electrically similar to the HDIG1030.



TERMINAL CONNECTIONS

1. Substrate
2. Drain
3. Gate 1
4. Source 1
5. Source 2
6. Gate 2
7. Drain 2
8. Substrate
9. Drain 3
10. Gate 3
11. Source 3
12. Source 4
13. Gate 4
14. Drain 4



ABSOLUTE MAXIMUM RATINGS

Power Dissipation	200 mW
	−25 Volts
V_{GB}	0 Volts
V_{GD}, V_{GS}	−25 Volts
V_{DS}, V_{SD}	−15 Volts
Operating Temp.	(−55 to +125)°C
Storage Temp.	(−65 to +175)°C

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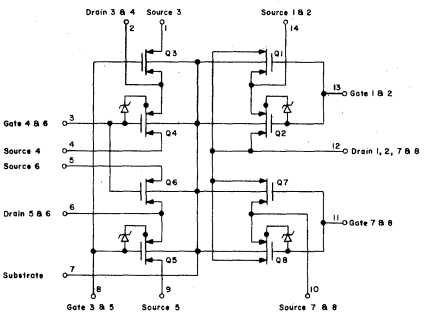
3 | multiples

The HMUL 1463 is an array of MOS monolithic switches arranged in such a manner that it can be utilized as a building block in all MOS systems or as a breadboarding gate for design of complex integrated circuits. Input protection is provided at all gate inputs.

TERMINAL CONNECTIONS

1. Source 3
2. Drains 3 & 4
3. Gates 4 & 6
4. Source 4
5. Source 6
6. Drains 5 & 6
7. Substrate
8. Gates 3 & 5
9. Source 5
10. Sources 7 & 8
11. Gates 7 & 8
12. Drains 1, 2, 7 & 8
13. Gates 1 & 2
14. Sources 1 & 2

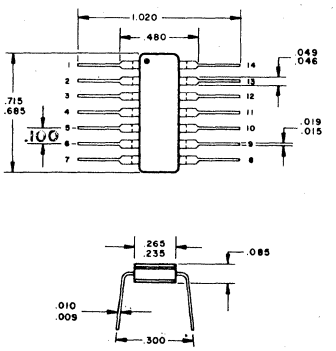


ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Drain to Source Leakage Current	IDSB		0.02	1.0	nA	−5V
Gate-Diode Leakage Current	IGSB		0.1	10	nA	−20V
Drain to Source Breakdown Voltage	BV_{DSB}	−20	−30		V	−10μA
Source to Drain Breakdown Voltage	BV_{SDB}	−20	−30		V	−10μA
Gate-Diode to Substrate Voltage	BV_{GB}	−20	−50		V	−10μA

MULTIPLE MOSFET SWITCH
HMUL 1463 (HRM 8215)

CASE TO-116



ABSOLUTE MAXIMUM RATINGS

V_{DD}	+0.3V, −20.0V
V_{GG}	+0.3V, −25.0V
Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C
Power Dissipation	200 mW

3 | multiples

The Hughes HMUL 1884 is an array of eight high quality MOS monolithic devices arranged symmetrically as a quad of single-pole, double-throw switches. Each MOSFET has a channel resistance of 260 ohms when biased with a minus 10 volt gate drive and has subnanoampere leakages when biased off. The inherently good matching characteristics of this device make it ideal for use with high quality resistor ladder networks in D to A circuits.

ABSOLUTE MAXIMUM RATINGS

Power Dissipation	200mW
Derating Factor	2.2mW/°C
Operating Temp.	85°C
Storage Temp.	200°C
Drain Voltage (V_{DD})	−20V, +0.3V
Gate Voltage (V_{GG})	−30V, +0.3V

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

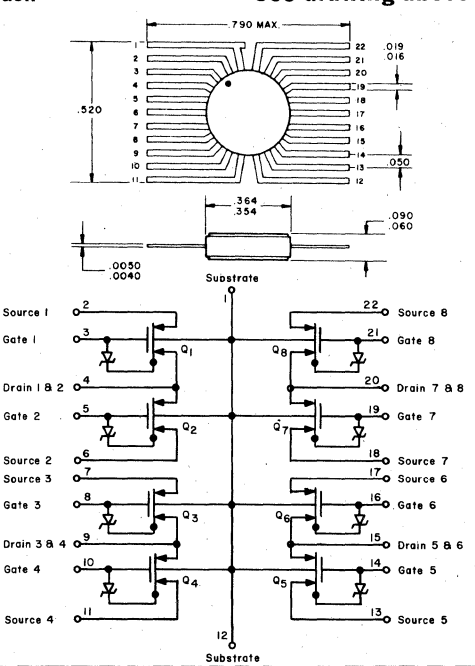
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Drain-to-Source Leakage Current	IDSB			1.0	nA	−10V
Gate-Diode Leakage Current	IGSB			10	nA	−15V
Drain-to-Source Breakdown Voltage	BV_{DSB}	−20			V	−10μA
Source-to-Drain Breakdown Voltage	BV_{SDB}	−20			V	−10μA
Gate-Diode to Substrate Voltage	BV_{GB}	−20			V	−10μA

MULTIPLE MOSFET SWITCH
HMUL 1884 (HRM 2206)

CASE: "A" Pack **See drawing above**

TERMINAL CONNECTIONS

1. Substrate
2. Source 1
3. Gate 1
4. Drain 1 & 2
5. Gate 2
6. Source 2
7. Source 3
8. Gate 3
9. Drain 3 & 4
10. Gate 4
11. Source 4
12. Substrate
13. Source 5
14. Gate 5
15. Drain 5 & 6
16. Gate 6
17. Source 6
18. Source 7
19. Gate 7
20. Drain 7 & 8
21. Gate 8
22. Source 8



HUGHES

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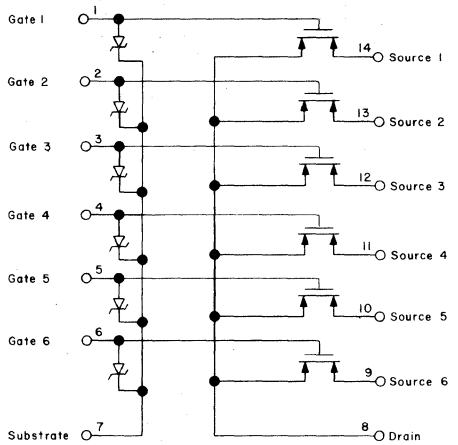
3| multiples

6-CHANNEL MOS SWITCH
HMUL 2661 (HRM 3203)

The Hughes HMUL 2661 is a P-Channel, Enhancement Mode Six Channel — single output switch, optimized for subnano-ampere leakage from drain-to-source terminals with signal levels as high as 20 volts impressed across the terminals. The device is used as a basic switching element for multiplexing applications. The Hughes 2 volt threshold technology minimizes drive requirements. Input protection is provided for all gate inputs.

CASE: TO-86 (Suffix K)
TO-116 (Suffix B)



TERMINAL CONNECTIONS

1. Gate 1
2. Gate 2
3. Gate 3
4. Gate 4
5. Gate 5
6. Gate 6
7. Substrate
8. Common Drain
9. Source 6
10. Source 5
11. Source 4
12. Source 3
13. Source 2
14. Source 1

ABSOLUTE MAXIMUM RATINGS

Gate Voltages	+0.3V −30.0V
Source Voltages	−30.0V
Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C
Power Dissipation	200 mw
Derating Factor	2.5 mw/°C

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Channel On Resistance	R_{on}		250	330	Ω	$V_G = -20$, $I_D = 1mA$
Channel Off Resistance	R_{off}	0.4	2		MΩ	$V_D = -20$*
Threshold turn-on Voltage	V_G	−1.0	−2.2	−4.0	V	−10μA
Input Leakage	I_G		0.1	10	nA	−20V

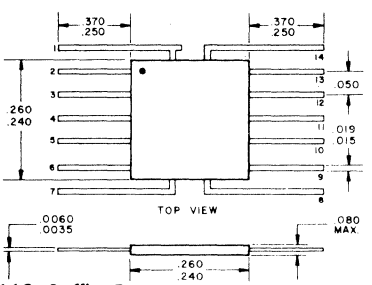
* Measurement is made with common drain at −20V and sources and gates at ground potential.

3| multiples

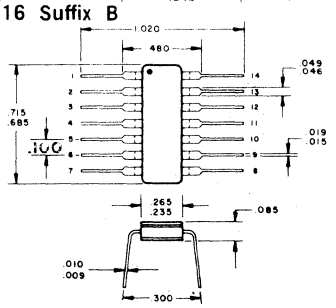
MOS TRIPLE DIFFERENTIAL PAIRS
HMUL 3362 (HRM 3213)

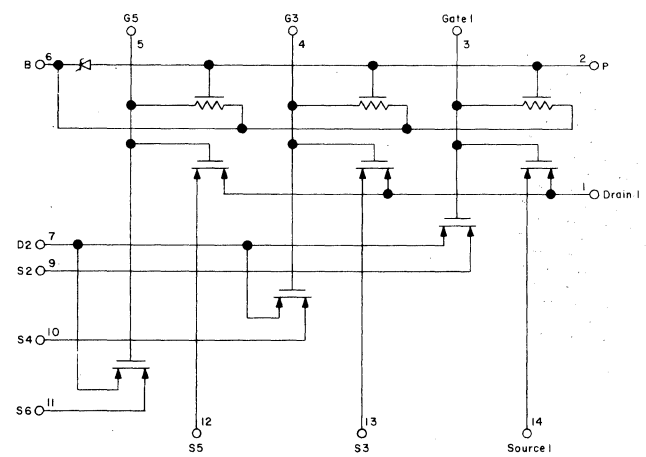
The Hughes HMUL 3362 is a P-Channel, Enhancement Mode, 6 Channel monolithic circuit, arranged as three pairs for differential switching and multiplexing applications. Each input gate is diode protected and shunted to the substrate with a high value resistance for gate pull-down.

CASE: TO-86 Suffix K



CASE: TO-116 Suffix B





ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Channel On Resistance	R_{on}		180	250	Ω	$V_G = 20$, $I_D = -1mA$
Channel Off Resistance	R_{off}	20	400		MΩ	$V_{DS} = -20V$
Threshold Turn-on Voltage	V_t	−1.0	−2.0	−4.0	V	−10μA
Input Leakage	IG		0.05	1.0	nA	−20V

ABSOLUTE MAXIMUM RATINGS

Gate Voltages	−30V +0.3V
Source Voltages	−30V
Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C
Power Dissipation	200 mW
Derating Factor	2.5 mW/°C

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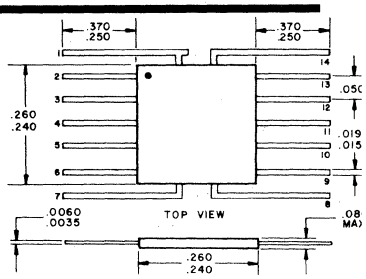
3 multiples

5-CHANNEL MOS SWITCH
HMUL 3551 (HRM 3210)
HMUL 3651 (HRM 3211)

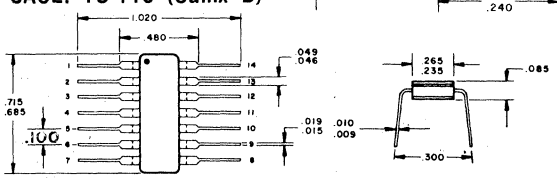
The Hughes HMUL 3551 is a P-Channel, Enhancement Mode five channel single output device designed as a basic switching element for multiplexing applications. Each input gate is diode protected and shunted to the substrate with a high value resistance for gate pull-down. The Hughes 2 volt threshold technology minimizes drive requirements.

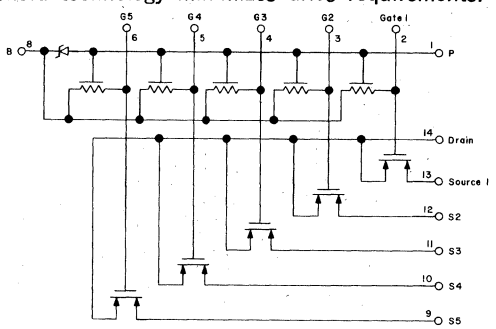
The Hughes HMUL 3651 is a P-Channel, Enhancement Mode five channel single output switch in series with a single-pole, single-throw MOSFET switch. It is designed as a basic switching element for multiplexing applications. Each input gate is diode-protected and shunted to the substrate with a high value resistance for gate pull-down. The Hughes 2 volt threshold technology minimizes drive requirements.

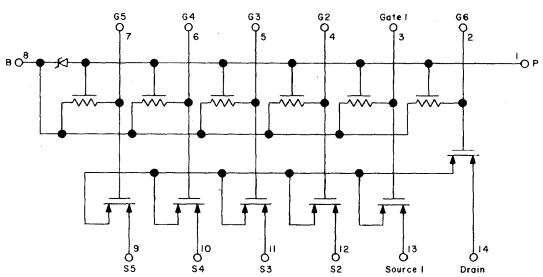
CASE: TO-86 (Suffix K)



CASE: TO-116 (Suffix B)







TERMINAL CONNECTIONS

1. Gate Pull-Down Resistors Bias Point
2. Gate 1
3. Gate 2
4. Gate 3
5. Gate 4
6. Gate 5
7. N.C.
8. Substrate
9. Source 5
10. Source 4
11. Source 3
12. Source 2
13. Source 1
14. Common Drain

ABSOLUTE MAXIMUM RATINGS

Gate Voltages	+0.3V −30.0V
Source Voltages	−30V
Operating Temp.	−55°C to 125°C
Storage Temp.	−65°C to 200°C
Power Dissipation	200mW
Derating Factor	2.5mW/°C

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Channel On Resistance	R_{on}		180	250	Ω	$V_G = 20$, $I_D = -1mA$
Channel Off Resistance	R_{off}	20	200		MΩ	$V_D = 20V$
Threshold Turn-on Voltage	V_T	−1.0	−2.0	−4.0	V	10μA
Input Leakage	I_G		0.05	1.0	nA	$BV_{DSB} = -20V$

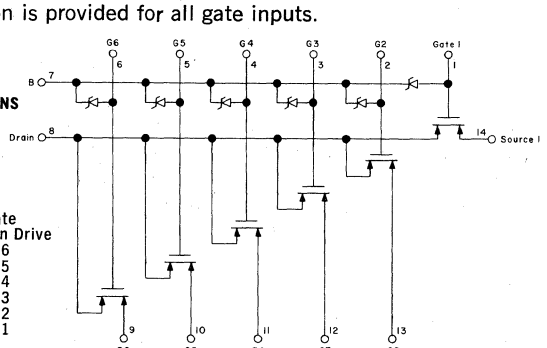
ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Channel On Resistance	R_{on}		360	500	Ω	$V_G = 20$, $I_D = -1mA$
Channel Off Resistance	R_{off}	20	200		MΩ	$V_D = -20V$
Threshold Turn-on Voltage	V_T	−1.0	−2.0	−4.0	V	−10μA
Input Leakage			0.1	1.0	nA	$BV_{DSB} = -20V$

6-CHANNEL MOS SWITCH
HMUL 3661 (HRM 3212)

See drawing above

The Hughes HMUL 3661 is a P-Channel, Enhancement Mode Six Channel-Single output switch, designed as a basic switching element for multiplexing applications. The Hughes 2 Volt threshold technology minimizes drive requirements. Input protection is provided for all gate inputs.



TERMINAL CONNECTIONS

1. Gate 1
2. Gate 2
3. Gate 3
4. Gate 4
5. Gate 5
6. Gate 6
7. Substrate
8. Common Drive
9. Source 6
10. Source 5
11. Source 4
12. Source 3
13. Source 2
14. Source 1

ABSOLUTE MAXIMUM RATINGS

Gate Voltages	+0.3V −30.0V
Source Voltages	−30.0V
Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C
Power Dissipation	200mW
Derating Factor	2.5mW/°C

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
Channel On Resistance	R_{on}		180	250	Ω	$V_G = 20$, $I_D = 1mA$
Channel Off Resistance	R_{off}	20	400		MΩ	$V_D = 20$
Threshold Turn-on Voltage	V_T	−1.0	−2.0	−4.0	V	−10μA
Input Leakage	I_G		0.05	1.0	nA	−20V

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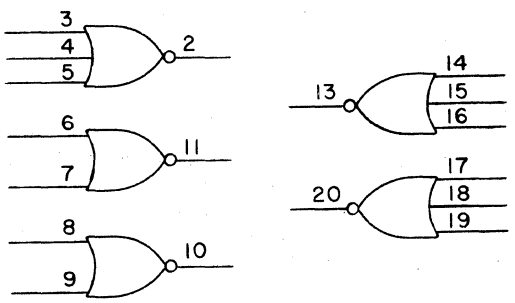
4 | logic

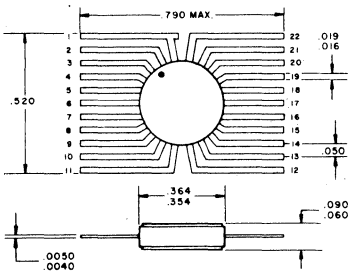
TRIPLE 3 PLUS DUAL 2 INPUT MOS NOR GATES

HLOG 2304 (HRM 2304)

The HLOG 2304 is a Monolithic, Triple 3 plus Dual 2 input NOR gates. Gate inputs may be externally interconnected to produce a large variety of circuit combinations, and is used as a basic building block in the design of large systems. Each input gate is diode protected and shunted to the substrate with a high value resistance for gate pulldown, thus making possible systems design trade-offs between the electrical characteristics of power dissipation, switching speed, and output voltage.



CASE: "A" Pack



TERMINAL CONNECTIONS

1. Substrate
2. Output 1
3. Gate Input
4. Gate Input
5. Gate Input
6. Gate Input
7. Gate Input
8. Gate Input
9. Gate Input
10. Output 3
11. Output 2
12. Drain Supply
13. Output 4
14. Gate Input
15. Gate Input
16. Gate Input
17. Gate Input
18. Gate Input
19. Gate Input
20. Output 5
21. V_{GG}
22. Substrate

ABSOLUTE MAXIMUM RATINGS

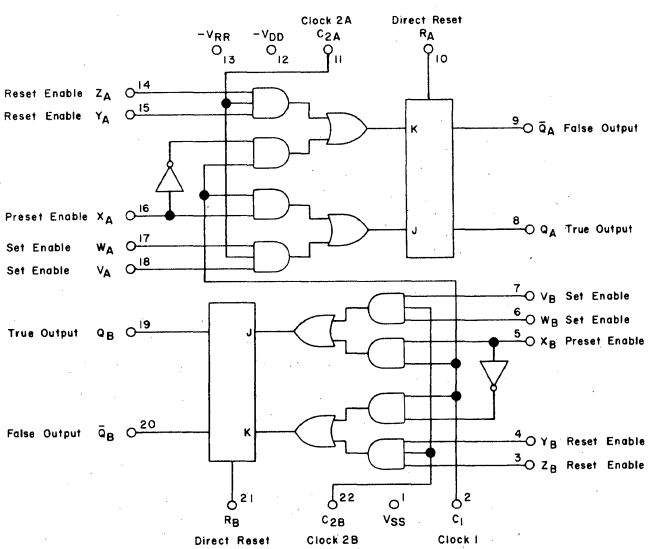
Case Dissipation	400mW Max.
Free Air Dissipation	100mW Max.
Operating Temp.	−55°C to +85°C
Storage Temp.	−65°C to +200°C
Input Voltage (V_{IN})	−30.0V
Gate Supply (V_{GG})	−30.0V
Drain Supply (V_{DD})	−20.0V

4 | logic

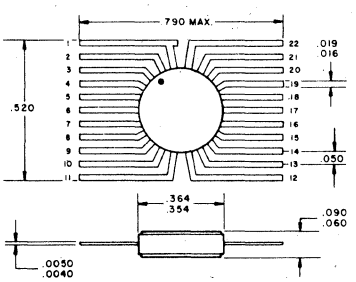
MOS DUAL J-K FLIP-FLOP

HLOG 2306 (HRM 2306)

The Hughes HLOG 2306 consists of two Universal J-K Flip-Flops of the synchronous master-slave type. AND gates forming the J and K inputs, together with a clocked preset function and a direct reset function, make the HLOG 2306 an extremely versatile logic element. The circuits may be used to make decade counters, various types of shift registers, and other logic functions. All input gates are diode-protected.



CASE: "A" Pack



TERMINAL CONNECTIONS

1. V_{SS}
2. Clock 1
3. Reset Enable
4. Reset Enable
5. Preset Enable
6. Set Enable
7. Set Enable
8. True Output
9. False Output
10. Direct Reset
11. Clock 2A
12. V_{DD}
13. V_{GG}
14. Reset Enable
15. Reset Enable
16. Preset Enable
17. Set Enable
18. Set Enable
19. True Output
20. False Output
21. Direct Reset
22. Clock 2B

ABSOLUTE MAXIMUM RATINGS

(V_{DD}) Drain Supply Voltage	−25V
(V_{GG}) Gate Supply Voltage	−25V
Power Dissipation	200mW
Derating Factor	2.0mW/°C
Operating Temp.	(−55 to +125)°C
Storage Temp.	(−65 to +200)°C
T_{on}	2.0μsec.
T_{off}	1.7μsec.

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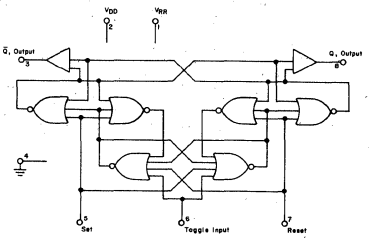
5 | counters

The HCTR 0101 is an asynchronous single bit binary element with direct reset and preset employing direct coupled NOR logic. The device features low power dissipation, high input impedance and excellent noise immunity. Extreme operating ranges of supply voltages and ambient temperature combine to make this flip-flop unique. The HCTR 0101 is a DC-500KC basic toggle element that can find applications in frequency dividers, counters, memory circuits, etc. All inputs are Zener diode-protected and all outputs are buffered through the use of psuedo push-pull amplifiers.

ABSOLUTE MAXIMUM RATINGS

Power Dissipation	100mW
V_{DD}	—12 volts
V_{GG}	—15 volts
V_{IN}	—12 volts
Operating Temp.	(—55 to +85)°C
Storage Temp.	(—65 to +200)°C

ASYNCHRONOUS MOS FLIP-FLOP
HCTR 0101 (HRM 8057)

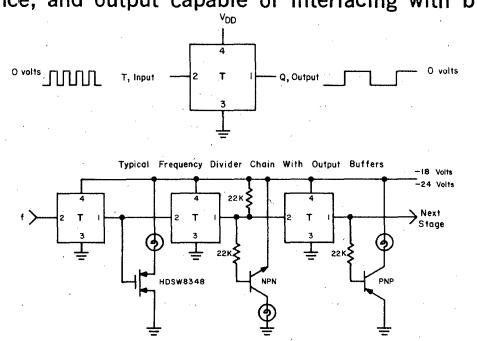


TERMINAL CONNECTIONS

1. V_{GG}
2. V_{DD}
3. Q, Output
4. Ground
5. Set
6. Toggle Input
7. Reset
8. Q, Output

CASE: TO-99

The Hughes HCTR 0102 is a low cost MOSFET Circuit designed for frequency division. Input frequencies of up to 500 KHz may be divided by two. An infinite chain of these devices can be cascaded to produce 2^N dividers. Features of this device are low power dissipation, extremely high input impedance, and output capable of interfacing with bi-polar logic.



TERMINAL CONNECTIONS

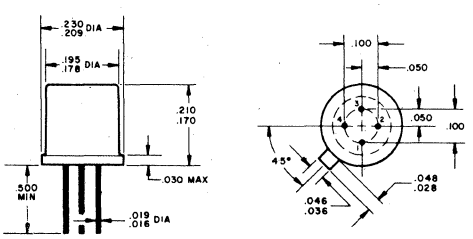
1. Q Output
2. T Input
3. GND
4. V_{DD}

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

Characteristics	Symbol	Min.	Max.	Units	Conditions
Supply Current	I_{DD}	0.4	2.5	mA	V_{DD}= —18V
Gate Voltage	BV_T	—18		V	V_{DD}= —18v, T= —10μA
Input Frequency	f1	250		KHz	V_{DD}= —24V
Input Frequency	f2	50		KHz	V_{DD}= —18V

MOSFET BINARY DIVIDER
HCTR 0102 (HRM F/2)

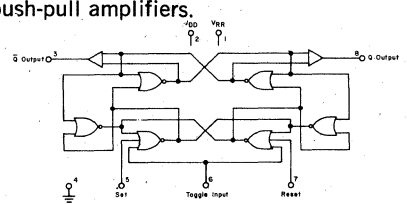
CASE: TO-72 **See drawing above**



ABSOLUTE MAXIMUM RATINGS

V_{DD}	—25V
V_{IN}	—25V
Operating Temp.	0° to +70°C
Storage Temp.	0° to +125°C
Power Dissipation	80mW

The HCTR 0201 is an asynchronous single bit binary element with direct reset and preset employing direct coupled NOR logic. The device features low power dissipation, high input impedance and excellent noise immunity. Extreme operating ranges of supply voltages and ambient temperature combine to make this flip-flop unique. The HCTR 0201 is a DC-1MHz basic toggle element that can find applications in frequency dividers, counters, memory circuits, etc. All inputs are Zener diode-protected and all outputs are buffered through the use of psuedo push-pull amplifiers.

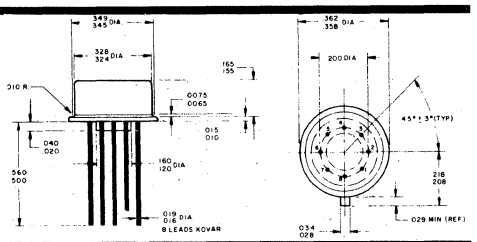


TERMINAL CONNECTIONS

1. V_{GG}
2. V_{DD}
3. Q, Output
4. Ground
5. Set
6. Toggle Input
7. Reset
8. Q, Output

ASYNCHRONOUS MOS FLIP-FLOP
HCTR 0201 (HRM 8047)

CASE: TO-99



ABSOLUTE MAXIMUM RATINGS

Power Dissipation	100mW
V_{DD}	—12 volts
V_{GG}	—25 volts
V_{GG}	— 25 volts
Operating Temp.	(—55 to +85)°C
Storage Temp.	(—65 to +200)°C

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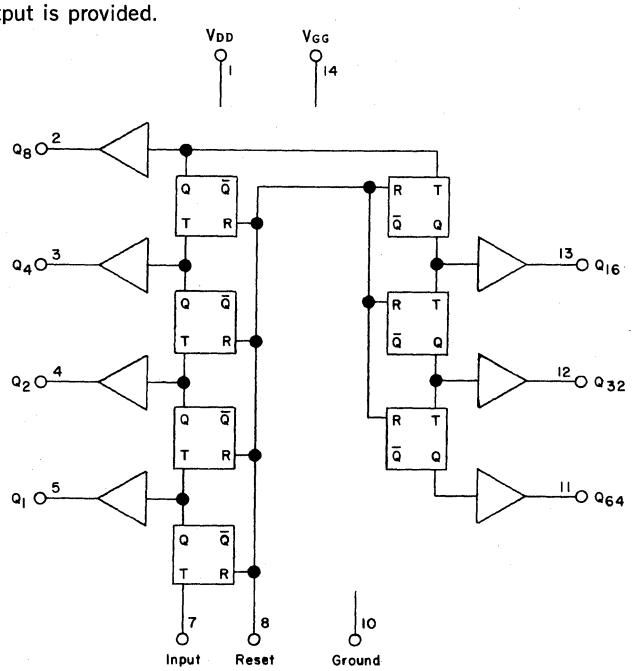
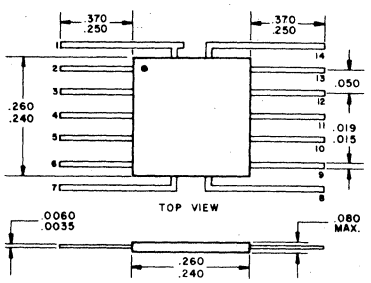
5 | counters

MOS 7-STAGE COUNTER
HCTR 0507 (HRM 2034)

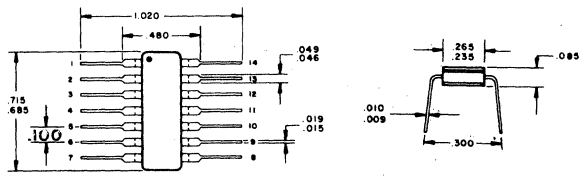
The Hughes HCTR 0507 seven stage counter is a DC stable counter with a direct, overriding reset. Features include input frequencies up to 2 MHz, wide variation in supply voltages, low power dissipation, and buffered outputs. Each true output is provided.



CASE: TO-86 (Suffix K)



CASE: TO-116 (Suffix B)



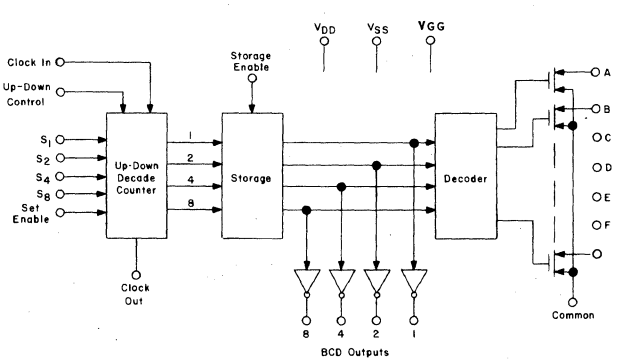
ABSOLUTE MAXIMUM RATINGS

V_{DD}	−18V
V_{GG}	−30V
Vin	+0.3V −30.0V
Prop. Delay (Between Stages)	140nsec.
Operating Temp.	−55°C to +85°C
Storage Temp.	−65°C to +150°C
Power Dissipation	200mW

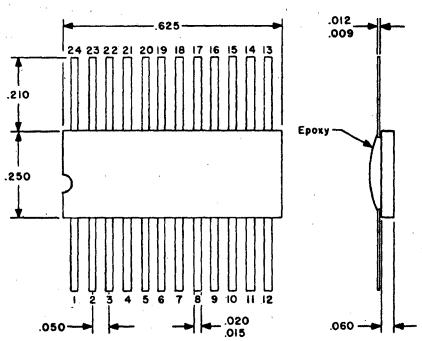
5 | counters

REVERSIBLE UP-DOWN COUNTER PLUS 7-SEGMENT DECODER (preliminary)
LCTR 0107 (HRM 3068)

The Hughes LCTR 0107 is a Reversible Up-Down Counter, Storage Register, and a Seven Segment Decoder Subsystem on a single chip. It is designed to be used in conjunction with 7-Bar electro-luminescent indicator to display numeric information.



CASE: "D" Pack



FEATURES

Buffered BCD Output
7-Segment Decoded outputs are isolated
Clock Frequency up to 1 MHZ
Clock output for cascading
Enable control to change from Count to Parallel Preset
Sample Rate @ 500nsec. min. for stored data

ABSOLUTE MAXIMUM RATINGS

V_{DD}	25V
V_{GG}	25V
Input Voltages	25V
Output Voltages	40V
Power Dissipation	200mW
Operating Temp.	0°C to 70°C
Storage Temp.	0°C to 100°C

TERMINAL CONNECTIONS

1. V_{SS}	7. Data Trans Line	13. BCD 8	19. D
2. Clock Out	8. V_{DD}	14. BCD 4	20. E
3. S_8	9. Count Control	15. BCD 2	21. A
4. Enable	10. S_2	16. BCD 1	22. C
5. S_4	11. Clock In	17. F	23. B
6. V_{GG}	12. S_1	18. G	24. Common

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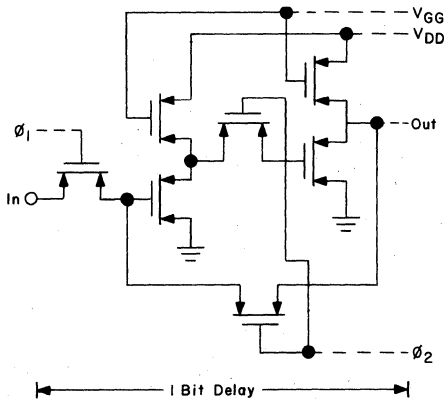
6 | static shift registers

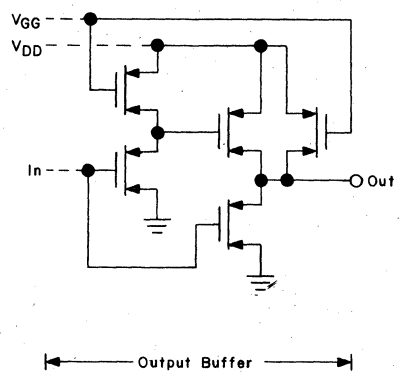
DUAL 16 BIT STATIC SHIFT REGISTER with OUTPUT BUFFER MOS INTEGRATED CIRCUIT

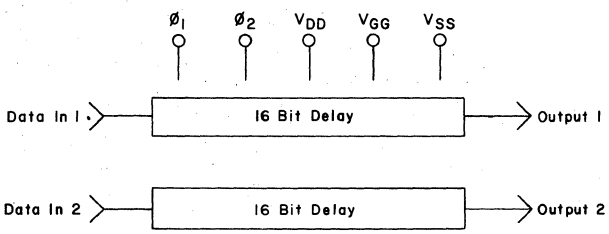
HSSR 2016 (HRM 2031)

CASE: TO-100 (TO-5 OUTLINE) SUFFIX R
TO-116 DIP SUFFIX B

The dual 16 bit Static Shift Register is a monolithic integrated circuit utilizing P-Channel Enhancement Mode MOS Technology. Designed to operate on a two phase clock for applications in BCD or Serial Binary or delay line storage applications.







ABSOLUTE MAXIMUM RATINGS

V_{DD}	+0.3V −25.0V
V_{GG}	+0.3V −30.0V
Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C
Power Dissipation	125mW

ELECTRICAL CHARACTERISTICS $T_A = 25°C$

	Min.	Typ.	Max.	Units	Conditions
Negative Supply Voltage (V_{DD})	−6	−10	−15	V	
Negative Supply Current (I_{DD})			−10	MA	Vin = 0V
Power Consumption		100	150	MW	Vin = 0V
Shift Rate	DC		2.5	MHz	
Clock 1 Level ($V\phi$)	−12	−15	−25	V	
Clock 0 Level ($V\phi$)	+0.3		−2.0	V	
*Clock Pulse Width ($\phi1$ or $\phi2$)	100			nsec.	
*Clock Pulse Spacing	0		50	nsec.	@ 2.5MHz
Clock t_r and t_f		50		nsec.	
Input 1 Level	−3.0		V_{DD}	V	
Input 0 Level	0		−2.0	V	
Output 1 Level		−8.0	−13	V	
Output 0 Level			−1.0	V	
Output t_r		300	400	nsec.	
Output t_f		300	400	nsec.	
Output on Resistance		500		OHMS	VO = 0
Input Capacitance		2		pf	Vin = 0V
Clock Capacitance		5		pf	Vϕ = 0V
Output Load Capacitance			20	pf	

*Do not Overlap Clocks

TERMINAL CONNECTIONS

1. GND
2. Data in #2
3. V_{GG}
4. Out #2
5. GND
6. NC
7. NC
8. NC
9. NC
10. $\phi1$ Clock
11. Out #1
12. V_{DD}
13. $\phi2$ Clock
14. Data in #1

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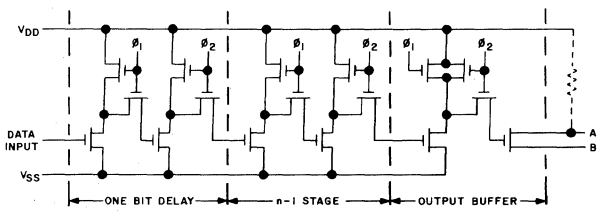
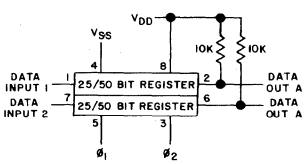
7 | dynamic shift registers

2ϕ DYNAMIC SHIFT REGISTERS
HDSR 2025 Dual 25 Bit
HDSR 2050 Dual 50 Bit

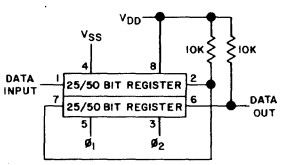
The Hughes P-Channel monolithic MOS 2ϕ dynamic shift registers will operate with clock repetition rates from 1000 Hz to 1MHz. V_{DD} and clock voltages may be varied over a wide range with power consumption of less than 100μ watt per bit. Low impedance outputs allow the outputs to be "OR'd". These are truly versatile 20 dynamic shift registers.



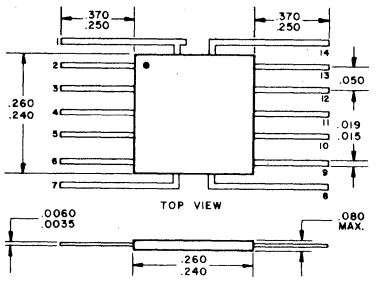
Dual 25/50 Bit Delay Element



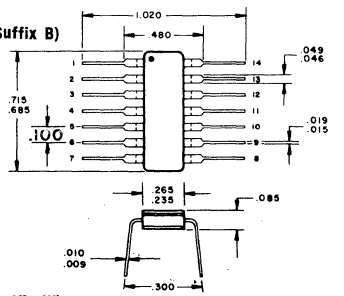
50/100 Bit Register



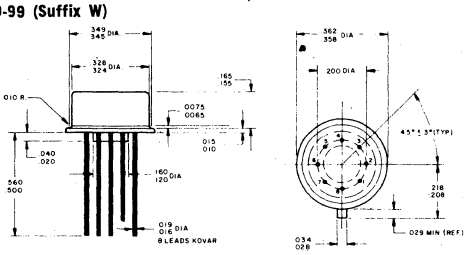
CASE: TO-86 (Suffix K)



TO-116 (Suffix B)



TO-99 (Suffix W)



TERMINAL CONNECTIONS

Type	No. Bits	Package	V_{SS}	V_{DD}	ϕ1	ϕ2	OUT 1A	OUT 1B	IN 1	OUT 2A	OUT 2B	IN 2
HDSR 2025W	Dual 25	8 Lead TO-99	4	8	5	3	2	4	1	6	4	7
HDSR 2050W	Dual 50	8 Lead TO-99	4	8	5	3	2	4	1	6	4	7
HDSR 2025B	Dual 25	14 Lead DIP TO-116	3	5	13	9	7	8	6	1	14	2
HDSR 2025K	Dual 25	14 Lead Flat Pack TO-86	3	5	13	9	7	8	6	1	14	2
HDSR 2050B	Dual 50	14 Lead DIP TO-116	3	5	13	9	7	8	6	1	14	2

ABSOLUTE MAXIMUM RATINGS

IN, ϕ1 ϕ2	+0.3 volts to −25 volts
V_{DD}	−20 volts
V Output	−20 volts
I Output	−5mA
Ton	500ns*
Toff	500ns*

*(Dependent on load)

POWER DISSIPATION

Ambient	200mW
Case	500mW
Operating Temp.	(−55 to +125)°C
Storage Temp.	(−65 to +200)°C

The Hughes low voltage P-Channel monolithic MOS dynamic Shift Registers will operate with clock repetition rates of 1000 Hz to 1 MHz. The low voltage process allow power consumption of less than 60 μw per bit. Low impedance outputs allows the outputs to be "OR'd". This shift register is very unique for low power, low voltage applications.

2ϕ DYNAMIC SHIFT REGISTERS
HDSR 2026 Dual 25 Bit

CASE: TO-86 (Suffix K) TO-116 (Suffix B) TO-99 (Suffix W)

TERMINAL CONNECTIONS

Type	No. Bits	Package	V_{SS}	V_{DD}	ϕ1	ϕ2	OUT 1A	OUT 1B	IN 1	OUT 2A	OUT 2B	IN 2
HDSR 2026W	Dual 25	8 Lead TO-99	4	8	5	3	2	4	1	6	4	7
HDSR 2026B	Dual 25	14 Lead DIP TO-116	3	5	13	9	7	8	6	1	14	2
HDSR 2026K	Dual 25	14 Lead Flat Pack TO-86	3	5	13	9	7	8	6	1	14	2

ABSOLUTE MAXIMUM RATINGS

IN ϕ1, ϕ2	+0.3 volts to −20 volts
V_{DD}	−15 volts
V Output	−15 volts
I Output	−5mA
Ton	500ns*
Toff	300ns*

*(Dependent on load)

Power Dissipation

Ambient	200mW
Case	500mW
Operating Temp.	(−55 to +125)°C
Storage Temp.	(−65 to 200)°C

NOTE: Schematic Diagram same as for HDSR2025 SHIFT REGISTER

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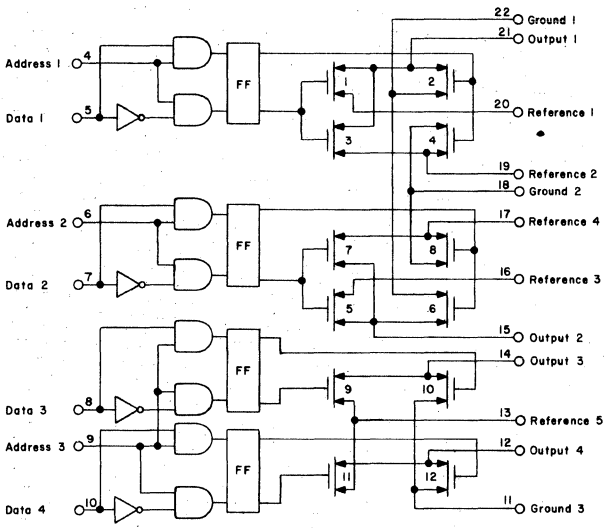
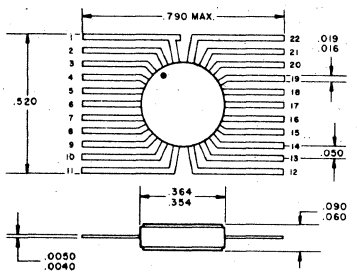
8 | multiplexers

MOS 4 BIT CONVERTER
HMUX 1756 (HRM 2302)

The HMUX 1756 is a complex monolithic MOSFET array having digital-to-analog and analog-to-digital applications. Four type D flip-flops allow DTL voltage levels to selectively set MOSFET switches in their ON or OFF condition, providing 4-bits of the active portion of a multi-bit ladder when used with external resistive dividers. All gate inputs are diode-protected against excessive electrical transients.



CASE: "A" Pack



ABSOLUTE MAXIMUM RATINGS

(V_{DD}) Drain Supply Voltage	−25V
(V_{GG}) Gate Supply Voltage	−25V
Power Dissipation	200mW
Derating Factor	2.0mW/°C
Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C
T_{on}	2.0μsec
T_{off}	4.0μsec

R_{ON} (Typ.) @ T = 25°C

1, 3, and 9	100Ω
5, 7, and 10	200Ω
2, 6, 11, and 12	400Ω
4 and 8	800Ω

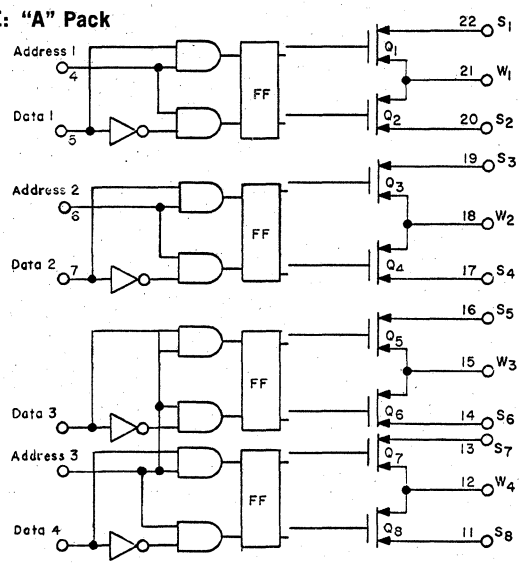
TERMINAL CONNECTIONS

1. −V_{GG}
2. −V_{DD}
3. +V_{SS}
4. Address
5. Data 1
6. Address 2
7. Data 2
8. Data 3
9. Address 3
10. Data 4
11. Ground 3
12. Output 4
13. Reference 5
14. Output 3
15. Output 2
16. Reference 3
17. Reference 4
18. Ground 2
19. Reference 2
20. Reference 1
21. Output 1
22. Ground 1

4 BIT MOS MULTIPLEXER
HMUX 1784 (HRM 2352)

The HMUX 1784 is a complex monolithic MOSFET array having digital switching applications. Four type D flip-flops allow DTL voltage levels to selectively set MOSFET switches in their ON and OFF condition, thus connecting or shunting other independent circuit elements. All gate inputs are diode-protected against excessive electrical transients.

CASE: "A" Pack



ABSOLUTE MAXIMUM RATINGS

(V_{DD}) Drain Supply Voltage	−25V
(V_{GG}) Gate Supply Voltage	−25V
Power Dissipation	200mW
Derating Factor	2.0mW/°C
Operating Temp.	−55°C to +125°C
Storage Temp.	−65°C to +200°C

NOMINAL OPERATING VOLTAGES

V_{DD}	−15
V_{GG}	−26
V_{SS}	+5
Address	−15
Data	0 to +5
Outputs	0 to −10

OPERATION

With the Address inputs tied to V_{DD}, a Data input of +5 volts turns on the even numbered switches, and a Data input of 0 volts turns on the odd numbered Switches.

DIMENSIONAL OUTLINE:

1. V_{GG}
2. V_{DD}
3. V_{SS}
4. Address 1
5. Data 1
6. Address 2
7. Data 2
8. Data 3
9. Address 3
10. Data 4
11. S_8
12. W_4
13. S_7
14. S_6
15. W_3
16. S_5
17. S_4
18. W_2
19. S_3
20. S_2
21. W_1
22. S_1

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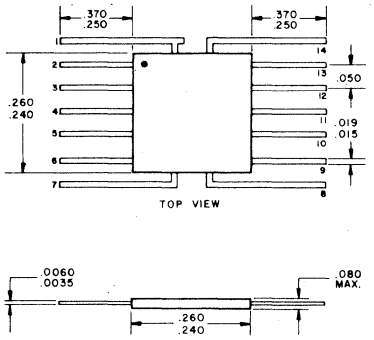
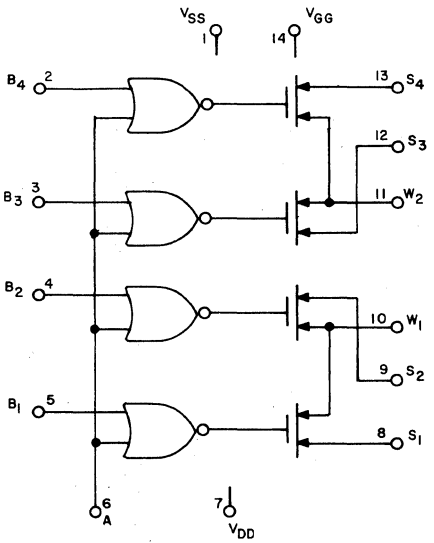
8 | multiplexers

MOS DUAL 2 CHANNEL COMMUTATOR
HMUX 2542 (HRM 8068)

CASE: TO-86

The Hughes HMUX 2542 is a dual two-channel MOSFET commutator. The circuit has applications as a multiplexer, a chopper, a digital to analog converter, or a summing network. By properly biasing the inputs, this commutator may be used to gate 10 volt peak-to-peak signals with a 4 volt level change at the input.





TERMINAL CONNECTIONS

1. V_{SS}
2. B_4
3. B_3
4. B_2
5. B_1
6. A
7. V_{DD}
8. S_1
9. S_2
10. W_1
11. W_2
12. S_3
13. S_4
14. V_{GG}

ABSOLUTE MAXIMUM RATINGS

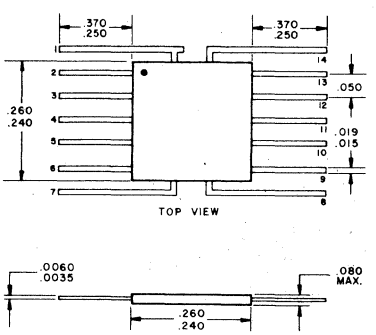
V_{DD}	−30 Volts +0.3 Volts
V_{GG}	−40 Volts* +0.3 Volts
Input and Output Voltages	−20 Volts +0.3 Volts
Power Dissipation	300mW
Operating Temp.	(−55 to +85)°C
Storage Temp.	(−65 to +200)°C
Propagation Time	800nsec

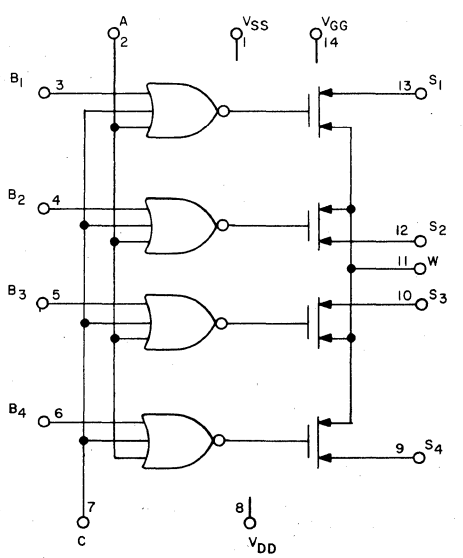
*To be measured with $-30V < V_{DD} < -10V$

4-BIT MOS MULTIPLEXER
HMUX 2641 (HRM 8013)

CASE: TO-86

The Hughes HMUX 2641 is a four switch MOSFET high level commutator. The circuit has applications as a multiplexer, a chopper, a digital-to-analog converter, or a demodulator. By properly biasing the inputs, the commutator may be used to gate 10 volt peak-to-peak signals with a 4 volt level change at the input.





TERMINAL CONNECTION

1. V_{SS}
2. A
3. B_1
4. B_2
5. B_3
6. B_4
7. C
8. V_{DD}
9. S_4
10. S_3
11. W
12. S_2
13. S_1
14. V_{GG}

ABSOLUTE MAXIMUM RATINGS

V_{DD}	−30 Volts +0.3 Volts
V_{GG}	−40 Volts* +0.3 Volts
Input and Output Voltages	−20 Volts +0.3 Volts
Power Dissipation	300mW
Operating Temp.	(−55 to +85)°C
Storage Temp.	(−55 to +150)°C

*To be measured with $-30V < V_{DD} < -10V$

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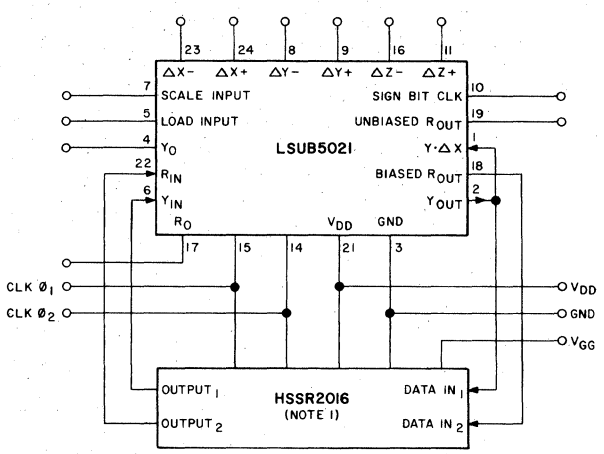
9 | sub-systems

The Hughes **LSUB 5021** Digital Differential Analyzer Adder Element is a monolithic MOS P-Channel large scale integrated circuit. This element used in conjunction with two shift registers forms a Digital Differential Analyzer of the ternary type. The DDA is designed for serial operation and can be used to implement the algorithms for rectangular and trapezoidal integration as well as multiplication and division. The DDA has many control system applications and can be used to solve differential equations thus making it useful for function generation.

The function diagram shows the adder element connected to two shift registers to form an integrator. The numbers in the shift registers are serial, least significant bit (LSB) first, sign bit last; negative numbers are in 2's complement form. Scaling is accomplished for each integrator by inserting a single "one" into the scale input at the appropriate bit time. The timing diagram shows the relative timing of the 2-phase clocks. For detailed information concerning the use of the DDA, consult the Hughes MOS Applications Staff.

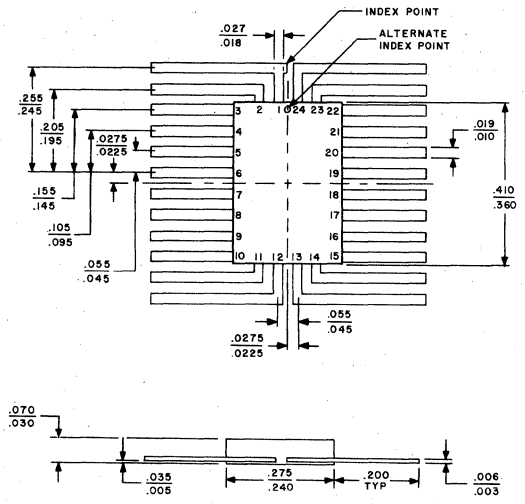
FUCTION DIAGRAM



NOTE 1: The HSSR2016 is a dual 16 bit, d.c. to 1 Mc, shift register.

MOS: DIGITAL DIFFERENTIAL ADDER (preliminary)
LSUB 5021

CASE: "F" Pack



FEATURES

- Serial, ternary integrator usable with any length shift register
- Arbitrary Scaling
- Two separate initial conditions load inputs for each adder
- Biased or unbiased R remainder
- Adders are separate and can be used independently
- $\Sigma \triangle Y$ is possible using additional elements
- Inputs protected against static damage

ABSOLUTE MAXIMUM RATINGS

Clock Voltages ($\phi 1$ and $\phi 2$)	−30V to +0.3V
Input Voltages	−30V to +0.3V
Drain Voltage	−25V to +0.3V
Storage Temp.	−65°C to +200°C
Operating Temp.	−55°C to +85°C

10 | memories

11 | custom circuits

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gates

HSG0-HSG99 series TTL gates

Type Numbers Military	Type Numbers Commercial	Package	Max. Operating Frequency (Mc)	Logic Level "1" (volts)	Logic Level "0" (volts)	Fan In (No. of Leads)	Fan Out Max.	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Propagation Delay (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Max. Total Package Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: dual 4-NAND gates															
HSG40	—	D-K	20	3.3	0.26	4	15 (1)	0	5	10	5.0	8.0	15	900	(M) —55 to +125
HSG41	—	D-K	20	3.3	0.26	4	7 (1)	0	5	10	5.0	8.0	15	900	(M) —55 to +125
—	HSG42	D-K	20	3.3	0.26	4	12 (1)	0	5	10	5.0	8.0	15	900	(C) 0 to +75
—	HSG43	D-K	20	3.3	0.26	4	6 (1)	0	5	10	5.0	8.0	15	900	(C) 0 to +75
description: expandable quad 2-input OR gates															
HSG50	—	D-K	20	3.3	0.26	9	15 (1)	0	5	12	6.0	8.0	30	900	(M) —55 to +125
HSG51	—	D-K	20	3.3	0.26	9	7 (1)	0	5	12	6.0	8.0	30	900	(M) —55 to +125
—	HSG52	D-K	20	3.3	0.26	9	12 (1)	0	5	12	6.0	8.0	30	900	(C) 0 to +75
—	HSG53	D-K	20	3.3	0.26	9	6 (1)	0	5	12	6.0	8.0	30	900	(C) 0 to +75
description: single 8-NAND/NOR gates															
HSG60	—	D-K	20	3.3	0.26	8	15 (1)	0	5	12	5.0	8.0	15	900	(M) —55 to +125
HSG61	—	D-K	20	3.3	0.26	8	7 (1)	0	5	12	5.0	8.0	15	900	(M) —55 to +125
—	HSG62	D-K	20	3.3	0.26	8	12 (1)	0	5	12	5.0	8.0	15	900	(C) 0 to +75
—	HSG63	D-K	20	3.3	0.26	8	6 (1)	0	5	12	5.0	8.0	15	900	(C) 0 to +75
description: expandable dual output, dual 2-NOR gates															
HSG70	—	D-K	20	3.3	0.26	6 (1)	15 (1)	0	5	12	6.0	8.0	40	900	(M) —55 to +125
HSG71	—	D-K	20	3.3	0.26	6 (1)	7 (1)	0	5	12	6.0	8.0	40	900	(M) —55 to +125
—	HSG72	D-K	20	3.3	0.26	6 (1)	12	0	5	12	6.0	8.0	40	900	(C) 0 to +75
—	HSG73	D-K	20	3.3	0.26	6 (1)	6 (1)	0	5	12	6.0	8.0	40	900	(C) 0 to +75
description: exclusive-OR gates with complement															
HSG90	—	D-K	20	3.3	0.26	8	15 (1)	0	5	11	5.0	8.0	35	900	(M) —55 to +125
HSG91	—	D-K	20	3.3	0.26	8	7 (1)	0	5	11	5.0	8.0	35	900	(M) —55 to +125
—	HSG92	D-K	20	3.3	0.26	8	12 (1)	0	5	11	5.0	8.0	35	900	(C) 0 to +75
—	HSG93	D-K	20	3.3	0.26	8	6 (1)	0	5	11	5.0	8.0	35	900	(C) 0 to +75

HSG100-199 series TTL gates

description: expandable triple 3-input OR gates															
HSG100	—	D-K	20	3.3	0.26	10 (2)	15 (1)	0	5	12	6.0	8.0	25	900	(M) —55 to +125
HSG101	—	D-K	20	3.3	0.26	10 (2)	7 (1)	0	5	12	6.0	8.0	25	900	(M) —55 to +125
—	HSG102	D-K	20	3.3	0.26	10 (2)	7 (1)	0	5	12	6.0	8.0	25	900	(C) 0 to +75
—	HSG103	D-K	20	3.3	0.26	10 (2)	6 (1)	0	5	12	6.0	8.0	25	900	(C) 0 to +75
description: expandable dual 4-input OR gates															
HSG110	—	D-K	20	3.3	0.26	9 (2)	15 (1)	0	5	12	6.0	8.0	20	900	(M) —55 to +125
HSG111	—	D-K	20	3.3	0.26	9 (2)	7 (1)	0	5	12	6.0	8.0	20	900	(M) —55 to +125
—	HSG112	D-K	20	3.3	0.26	9 (2)	12 (1)	0	5	12	6.0	8.0	20	900	(C) 0 to +75
—	HSG113	D-K	20	3.3	0.26	9 (2)	6 (1)	0	5	12	6.0	8.0	20	900	(C) 0 to +75
description: expandable single 8-NAND/NOR gates															
HSG120	—	D-K	20	3.3	0.26	9 (2)	15 (1)	0	5	18	5.0	8.0	15	900	(M) —55 to +125
HSG121	—	D-K	20	3.3	0.26	9 (2)	7 (1)	0	5	18	5.0	8.0	15	900	(M) —55 to +125
—	HSG122	D-K	20	3.3	0.26	9 (2)	12 (1)	0	5	18	5.0	8.0	15	900	(C) 0 to +75
—	HSG123	D-K	20	3.3	0.26	9 (2)	6 (1)	0	5	18	5.0	8.0	15	900	(C) 0 to +75
description: dual 4-NAND/NOR drivers															
HSG130	—	D-K	20	3.3	0.26	4	30 (1)	0	5	25	30	30	30	900	(M) —55 to +125
HSG131	—	D-K	20	3.3	0.26	4	15 (1)	0	5	25	30	30	30	900	(M) —55 to +125
—	HSG132	D-K	20	3.3	0.26	4	24 (1)	0	5	25	30	30	30	900	(C) 0 to +75
—	HSG133	D-K	20	3.3	0.26	4	12 (1)	0	5	25	30	30	30	900	(C) 0 to +75
description: quad 2-NAND/NOR gates															
HSG140	—	D-K	20	3.3	0.26	2	15 (1)	0	5	10	5.0	8.0	15	900	(M) —55 to +125
HSG141	—	D-K	20	3.3	0.26	2	7 (1)	0	5	10	5.0	8.0	15	900	(M) —55 to +125
—	HSG142	D-K	20	3.3	0.26	2	12 (1)	0	5	10	5.0	8.0	15	900	(C) 0 to +75
—	HSG143	D-K	20	3.3	0.26	2	6 (1)	0	5	10	5.0	8.0	15	900	(C) 0 to +75
description: quad 2-input OR expanders															
HSG150	—	D-K	20	3.3	0.26	10	15 (1)	0	5	4.0	—	—	20	900	(M) —55 to +125
HSG151	—	D-K	20	3.3	0.26	10	7 (1)	0	5	4.0	—	—	20	900	(M) —55 to +125
—	HSG152	D-K	20	3.3	0.26	10	12 (1)	0	5	4.0	—	—	20	900	(C) 0 to +75
—	HSG153	D-K	20	3.3	0.26	10	6 (1)	0	5	4.0	—	—	20	900	(C) 0 to +75
description: triple 2-input buss drivers															
HSG160	—		20	3.3	0.26	—	—	0	5	—	8 (5)	30 (1)	18	900	(M) —55 to +125
HSG161	—	D-K	20	3.3	0.26	—	—	0	5	—	8 (5)	30 (1)	18	900	(M) —55 to +125
—	HSG162	D-K	20	3.3	0.26	—	—	0	5	—	8 (5)	70 (1)	18	900	(C) 0 to +75
—	HSG163	D-K	20	3.3	0.26	—	—	0	5	—	8 (5)	70 (1)	18	900	(C) 0 to +75
description: dual 4-input OR expanders															
HSG170	—	D-K	20	3.3	0.26	4	15 (1)	0	5	3.0	—	—	5.0	900	(M) —55 to +125
HSG171	—	D-K	20	3.3	0.26	4	7 (1)	0	5	3.0	—	—	5.0	900	(M) —55 to +125
—	HSG172	D-K	20	3.3	0.26	4	12 (1)	0	5	3.0	—	—	5.0	900	(C) 0 to +75
—	HSG173	D-K	20	3.3	0.26	4	6 (1)	0	5	3.0	—	—	5.0	900	(C) 0 to +75
HSG180	—	D-K	20	3.3	0.26	4	15 (1)	0	5	3.0	—	—	—	900	(M) —55 to +125
HSG181	—	D-K	20	3.3	0.26	4	7 (1)	0	5	3.0	—	—	—	900	(M) —55 to +125
—	HSG182	D-K	20	3.3	0.26	4	12 (1)	0	5	3.0	—	—	—	900	(C) 0 to +75
—	HSG183	D-K	20	3.3	0.26	4	6 (1)	0	5	3.0	—	—	—	900	(C) 0 to +75

Notes: (1) Minimum. (2) Maximum number any unit has; others have fewer. (5) Maximum.

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gates cont'd

HSG 100-199 series TTL gates — (cont'd)

Type Numbers Military	Type Numbers Commercial	Package	Max. Operating Frequency (Mc)	Logic Level "1" (volts)	Logic Level "0" (volts)	Fan In (No. of Leads)	Fan Out Max.	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Propagation Delay (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Max. Total Package Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: triple 3-NAND/NOR gates															
HSG190	—	D-K	20	3.3	0.26	3	15 (1)	0	5	10	5.0	8.0	45	900	(M) —55 to +125
HSG191	—	D-K	20	3.3	0.26	3	7 (1)	0	5	10	5.0	8.0	45	900	(M) —55 to +125
—	HSG192	D-K	20	3.3	0.26	3	12 (1)	0	5	10	5.0	8.0	45	900	(C) 0 to +75
—	HSG193	D-K	20	3.3	0.26	3	6 (1)	0	5	10	5.0	8.0	45	900	(C) 0 to +75

HSG200-299 series TTL gates

description: expandable AND/NOR gates															
HSG210	—	D-K	—	1.6	1.5	9 (2)	11 (1)	0	8	6.0	3.0	4.5	21 (3)	1000	(M) —55 to +125
HSG211	—	D-K	—	1.6	1.5	9 (2)	6 (1)	0	8	6.0	3.0	4.5	21 (3)	1000	(M) —55 to +125
—	HSG212	D-K	—	3.5	0.25	9 (2)	9	0	5	6.0	3.0	4.5	44	1000	(C) 0 to +75
—	HSG213	D-K	—	3.5	0.25	9 (2)	5	0	5	6.0	3.0	4.5	44	1000	(C) 0 to +75
description: NAND/NOR gates															
HSG220	—	D-K	—	3.5	0.25	2	11	0	5	6.0	2.5	4.0	88	1000	(M) —55 to +125
HSG221	—	D-K	—	3.5	0.25	2	6	0	5	6.0	2.5	4.0	88	1000	(M) —55 to +125
—	HSG222	D-K	—	1.7	1.5	2	9 (1)	0	7	6.0	2.5	4.0	76 (3)	1000	(C) 0 to +75
—	HSG223	D-K	—	1.7	1.5	2	5 (1)	0	7	6.0	2.5	4.0	76 (3)	1000	(C) 0 to +75
description: quad 2-input AND/NOR expanders															
HSG230	—	D-K	40	1.7 (1)	1.2 (5)	10	—	0	5	2.0	—	—	28	1000	(M) —55 to +125
HSG231	—	D-K	40	1.7 (1)	1.2 (5)	10	—	0	5	2.0	—	—	28	1000	(M) —55 to +125
—	HSG232	D-K	40	1.7 (1)	1.2 (5)	10	—	0	5	2.0	—	—	28	1000	(C) 0 to +75
—	HSG233	D-K	40	1.7 (1)	1.2 (5)	10	—	0	5	2.0	—	—	28	1000	(C) 0 to +75
description: NAND/NOR gates															
HSG240	—	D-K	—	3.5	0.25	4	11	0	5	6.0	2.5	4.0	44	1000	(M) —55 to +125
HSG241	—	D-K	—	3.5	0.25	4	6	0	5	6.0	2.5	4.0	44	1000	(M) —55 to +125
—	HSG242	D-K	—	1.7	1.5	4	9 (1)	0	7	6.0	2.5	4.0	38	1000	(C) 0 to +75
—	HSG243	D-K	—	1.7	1.5	4	5 (1)	0	7	6.0	2.5	4.0	38	1000	(C) 0 to +75
description: expandable AND/NOR gates															
HSG250	—	D-K	—	1.6	1.5	10 (4)	11 (1)	0	8	6.0	3.0	4.5	26 (3)	1000	(M) —55 to +125
HSG251	—	D-K	—	1.6	1.5	10 (4)	6 (1)	0	8	6.0	3.0	4.5	26 (3)	1000	(M) —55 to +125
—	HSG252	D-K	—	3.5	0.25	10 (4)	9 (1)	0	5	6.0	3.0	4.5	156	1000	(C) 0 to +75
—	HSG253	D-K	—	3.5	0.25	10 (4)	5	0	5	6.0	3.0	4.5	156	1000	(C) 0 to +75
description: NAND/NOR gates															
HSG260	—	D-K	—	1.6	1.5	8	11 (1)	0	8	6.0	3.0	4.0	19 (3)	1000	(M) —55 to +125
HSG261	—	D-K	—	1.6	1.5	8	6 (1)	0	8	6.0	3.0	4.0	19 (3)	1000	(M) —55 to +125
—	HSG262	D-K	—	3.5	0.25	8	9	0	5	6.0	3.0	4.0	22	1000	(C) 0 to +75
—	HSG263	D-K	—	3.5	0.25	8	5	0	5	6.0	3.0	4.0	22	1000	(C) 0 to +75
description: dual 4-input AND/NOR expanders															
HSG270	—	D-K	40	1.6	1.5	4	11	0	8	1.0	—	—	8 (3)	1000	(M) —55 to +125
HSG271	—	D-K	40	1.6	1.5	4	6	0	8	1.0	—	—	8 (3)	1000	(M) —55 to +125
—	HSG272	D-K	40	1.7 (5)	1.2 (5)	4	9	0	5	1.0	—	—	7.0	1000	(C) 0 to +75
—	HSG273	D-K	40	1.7 (5)	1.2 (5)	4	5	0	5	1.0	—	—	7.0	1000	(C) 0 to +75

HSM/C 900 series DTL gates

description: dual 4-NAND gate															
HSM930	HSC930	D-J-T	—	2.6 (1)	0.4 (5, 11)	5 (4)	8	0	5	25 (12)	—	—	8.5 (6, 7)	1000	(M) —55 to +125 (C) 0 to +75
description: dual 4-buffer															
HSM932	HSC932	D-J-T	—	2.6 (1)	0.4 (5, 11)	5 (4)	25	0	5	30 (12)	—	—	27 (6, 7)	1000	(M) —55 to +125 (C) 0 to +75
description: dual 4-diode array															
HSM933	HSC933	D-J-T	—	—	—	4	—	—	—	—	—	—	—	—	(M) —55 to +125 (C) 0 to +75
description: dual 4-power gate															
HSM944	HSC944	D-J-T	—	—	—	4	27	0	4	40	—	—	40	1000	(M) —55 to +125 (C) 0 to +75
description: quad 2-NAND gate															
HSM946	HSC946	D-J-T	—	—	—	2	8	0	4	50	—	—	20	600	(M) —55 to +125 (C) 0 to +75
description: fast quad 2-input gate															
HSM949	HSC949	D-J	—	3.8 (1)	0.4 (1, 11)	2	7	0	5	20 (12)	—	—	12.5 (3, 13)	1000	(M) —55 to +125 (C) 0 to +75

Notes: (1) Minimum.
(2) Maximum number any unit has; others have fewer.
(3) Typical and/or 50% of Duty Cycle.
(4) Includes expandable terminal in number given.
(5) Maximum.
(6) Typical.
(7) Ratio.
(11) Indicates values given are for output.
(12) Average propagation delay.
(13) Power dissipation per circuit.



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gates cont'd

HSM/C 900 series DTL gates — (cont'd)

Type Numbers Military	Type Numbers Commercial	Package	Max. Operating Frequency (Mc)	Logic Level "1" (volts)	Logic Level "0" (volts)	Fan In (No. of Leads)	Fan Out Max.	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Propagation Delay (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Max. Total Package Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: fast dual 4-input gate															
HSM961	HSC961	D-J	—	2.6 (1)	0.4 (5)	5 (4)	7	0	8	25	—	—	33	—	(M) —55 to +125 (C) 0 to +75
description: triple 3-NAND gate															
HSM962	HSC962	D-J-T	—	2.6 (1)	0.4 (5)	3	8	0	8	30	—	—	33 (3)	—	(M) —55 to +125 (C) 0 to +75
description: fast triple 3-input gate															
HSM963	HSC963	D-J	—	2.6 (1)	0.4 (5)	3	7	0	8	25	—	—	50 (3)	—	(M) —55 to +125 (C) 0 to +75

HSM54H00/HSC74H00 series hi-speed TTL gates

description: quad 2-input NAND gate															
HSM54H00	HSC74H00	A-D-J	—	2.0 (1)	0.8 (5)	2	10	0	7 (5)	10 (5)	—	—	—	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: triple 3-input NAND gate															
HSM54H10	HSC74H10	A-D-J	—	2.0 (1)	0.8 (5)	3	10	0	7 (5)	10 (5)	—	—	—	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: triple 3-input AND gate															
HSM54H11	HSC74H11	A-D-J	—	2.0 (1)	0.8 (5)	3	10	0	7 (5)	15 (5)	—	—	—	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: dual 4-input NAND gate															
HSM54H20	HSC74H20	A-D-J	—	2.0 (1)	0.8 (5)	4	10	0	7 (5)	10 (5)	—	—	—	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: dual 4-input AND gate															
HSM54H21	HSC74H21	A-D-J	—	2.0 (1)	0.8 (5)	4	10	0	7 (5)	15 (5)	—	—	—	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: 8-input NAND gate															
HSM54H30	HSC74H30	A-D-J	—	2.0 (1)	0.8 (5)	8	10	0	7 (5)	11 (5)	—	—	—	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: expandable 2-wide, 4-input AND-OR-invert gate															
HSM54H55	HSC74H55	A-D-J	—	2.0 (1)	0.8 (5)	10 (2, 4)	10	0	7 (5)	10 (5)	—	—	—	1000 (6)	(M) —55 to +125 (C) 0 to +70

HSM5400/HSC7400 series TTL gates

description: quad 2-input NAND gate															
HSM5400	—	A-D	—	2 (1)	0.8 (5)	2	10	0	7 (5)	29 (5)	—	—	40 (3)	1000 (6)	(M) —55 to +125
—	HSC7400	A-D-J	—	2 (1)	0.8 (5)	2	10	0	7 (5)	29 (5)	—	—	40 (3)	1000 (6)	(C) 0 to +70
description: quad 2-input NAND gate — no collector load															
HSM5401	—	A-D	—	2 (1)	0.8 (5)	2	10	0	7 (5)	29 (5)	—	—	40	1000 (6)	(M) —55 to +125
—	HSC7401	A-D-J	—	2 (1)	0.8 (5)	2	10	0	7 (5)	29 (5)	—	—	40	1000 (6)	(C) 0 to +70
description: quad 2-input NOR gate															
HSM5402	—	A-D	—	2 (1)	0.8 (5)	2	10	0	7 (5)	29 (5)	—	—	40	1000 (6)	(M) —55 to +125
—	HSC7402	A-D-J	—	2 (1)	0.8 (5)	2	10	0	7 (5)	29 (5)	—	—	40	1000 (6)	(C) 0 to +70
description: hex inverter gate															
HSM5404	—	A-D		CONTACT FACTORY											
—	HSC7404	A-D-J		CONTACT FACTORY											
description: quad 2-input AND gate															
HSM5408	—	A-D		CONTACT FACTORY											
—	HSC7408	A-D-J		CONTACT FACTORY											
description: triple 3-input NAND gate															
HSM5410	—	A-D	—	2 (1)	0.8 (5)	3	10	0	7 (5)	29 (5)	—	—	30	1000 (6)	(M) —55 to +125
—	HSC7410	A-D-J	—	2 (1)	0.8 (5)	3	10	0	7 (5)	29 (5)	—	—	30	1000 (6)	(C) 0 to +70
HSM5411	—	A-D		CONTACT FACTORY											
—	HSC7411	A-D-J		CONTACT FACTORY											
description: dual 4-input NAND gate															
HSM5420	—	A-D	—	2 (1)	0.8 (5)	4	10	0	7 (5)	29 (5)	—	—	20	1000 (6)	(M) —55 to +125
—	HSC7420	A-D-J	—	2 (1)	0.8 (5)	4	10	0	7 (5)	29 (5)	—	—	20	1000 (6)	(C) 0 to +70

Notes: (1) Minimum.
(2) Maximum number any unit has; others have fewer.
(3) Typical and/or 50% of Duty Cycle.
(4) Includes expandable terminal in number given.
(5) Maximum.
(6) Typical.

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gates cont'd

HSM5400/HSC7400 series TTL gates — (cont'd)

Type Numbers Military	Type Numbers Commercial	Package	Max. Operating Frequency (Mc)	Logic Level "1" (volts)	Logic Level "0" (volts)	Fan In (No. of Leads)	Fan Out Max.	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Propagation Delay (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Max. Total Package Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: single 8-input NAND gate															
HSM5430	—	A-D	—	2 (1)	0.8 (5)	8	10	0	7 (5)	29 (5)	—	—	10	1000 (6)	(M) —55 to +125
—	HSC7430	A-D-J	—	2 (1)	0.8 (5)	8	10	0	7 (5)	29 (5)	—	—	10	1000 (6)	(C) 0 to +70
description: dual 4-input NAND buffer gate															
HSM5440	—	A-D	—	2 (1)	0.8 (5)	4	30	0	7 (5)	29 (5)	—	—	20	1000 (6)	(M) —55 to +125
—	HSC7440	A-D-J	—	2 (1)	0.8 (5)	4	30	0	7 (5)	29 (5)	—	—	20	1000 (6)	(C) 0 to +70
description: BCD to decimal driver															
HSM5442	—	A-D		CONTACT FACTORY											
—	HSC7442	A-D-J		CONTACT FACTORY											
description: dual 2-wide, 2-input expandable AND/OR invert gate															
HSM5460	—	A-D	—	2 (1)	0.8 (5)	5 (2, 4)	10	0	7 (5)	29 (5)	—	—	20	1000 (6)	(M) —55 to +125
—	HSC7460	A-D-J	—	2 (1)	0.8 (5)	5 (2, 4)	10	0	7 (5)	29 (5)	—	—	20	1000 (6)	(C) 0 to +70
description: dual 2-wide, 2-input AND/OR invert gate															
HSM5451	—	A-D	—	2 (1)	0.8 (5)	4	10	0	7 (5)	29 (5)	—	—	20	1000 (6)	(M) —55 to +125
—	HSC7451	A-D-J	—	2 (1)	0.8 (5)	4	10	0	7 (5)	29 (5)	—	—	20	1000 (6)	(C) 0 to +70
description: 4-wide, 2-input expandable AND/OR invert gate															
HSM5453	HSC7453	A-D-J	—	2 (1)	0.8 (5)	9 (4)	10	0	7 (5)	29 (5)	—	—	10	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: 4-wide, 2 input AND/OR invert gate															
HSM5454	HSC7454	A-D-J	—	2 (1)	0.8 (5)	8	10	0	7 (5)	29 (5)	—	—	10	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: dual 4-input expander															
HSM5460	HSC7460	A-D-J	—	2 (1)	0.8 (5)	4	—	0	7 (5)	34 (5)	—	—	20	1000 (6)	(M) —55 to +125 (C) 0 to +70

HSM/C9000 series TTL gates

description: quad 2 gate															
HSM9002	HSC9002	D-J	—	3	0.4	4	12	0	5	10	—	—	12	—	(M) —55 to +125 (C) 0 to +75
description: triple 3 gate															
HSM9003	HSC9003	D-J	—	3	0.4	4	12	0	5	10	—	—	12	—	(M) —55 to +125 (C) 0 to +75
description: dual 4 gate															
HSM9004	HSC9004	D-J	—	3	0.4	4	12	0	5	10	—	—	12	—	(M) —55 to +125 (C) 0 to +75
description: dual exclusive OR gate															
HSM9005	HSC9005	D-J	—	1.0	—	2	12	0	5	12	—	—	12	—	(M) —55 to +125 (C) 0 to +75
description: dual 4-extender															
HSM9006	HSC9006	D-J	—	—	—	—	10	—	—	6	—	—	11	—	(M) —55 to +125 (C) 0 to +75
description: single 8 gate															
HSM9007	HSC9007	D-J	—	1.5	0.4	8	12	0	5	10	—	—	12	—	(M) —55 to +125 (C) 0 to +75
description: dual buffer															
HSM9009	HSC9009	D-J	—	1.5	0.4	4	30	0	5	15	—	—	22	—	(M) —55 to +125 (C) 0 to +75

flip-flops

HSM/C 900 series DTL flip-flops

description: J-K flip-flop															
HSM948	HSC945	D-J-T	—	—	—	5	9	0	4	50	—	—	42	600	(M) —55 to +125
HSM948	HSC948	D-J-T	—	—	—	5	8	0	4	40	—	—	40	600	(C) 0 to +75
description: AC binary															
HSM950	HSC950	D-J-T	—	—	—	4	10	0	4	20	—	—	50	600	(M) —55 to +125 (C) 0 to +75

Notes: (1) Minimum. (2) Maximum number any unit has; others have fewer.
(4) Includes expandable terminal in number given. (5) Maximum. (6) Typical.



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flip-flops (cont'd)

HSM/C 900 series DTL flip-flops — (cont'd)

Type Numbers Military	Type Numbers Commercial	Package	Max. Operating Frequency (Mc)	Logic Level "1" (volts)	Logic Level "0" (volts)	Fan In (No. of Leads)	Fan Out Max.	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Propagation Delay (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Max. Total Package Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: common clock input															
HSM993	HSC993	D-J-T								dual HSM945 and dual HSC945					
HSM994	HSC994	D-J-T								dual HSM948 and dual HSC948					
description: separate clock input															
HSM997	HSC997	D-J-T								dual HSM948 and dual HSC948					
HSM999	HSC999	D-J-T								dual HSM945 and dual HSC945					

HSM/C 1890-1896 series DTL flip-flops

description: dual clocked flip-flop															
HSM1890	HSC1890	D-J	—	3.1	0.4	—	9	0	5	75 (5)	—	—	140	—	(M) —55 to +125 (C) 0 to +70
description: fast dual clocked flip-flop															
HSM1896	HSC1896	D-J	—	4	0.4	—	8	0	5	65 (5)	—	—	100	—	(M) —55 to +125 (C) 0 to +70

HSF0-HSF99 series TTL flip-flops

description: set-reset flip-flops															
HSF10	—	D-K	20	3.3	0.26	6	15	0	5	20	5.0	8.0	30	900	(M) —55 to +125
HSF11	—	D-K	20	3.3	0.26	6	7	0	5	20	5.0	8.0	30	900	(M) —55 to +125
—	HSF12	D-K	20	3.3	0.26	6	12	0	5	20	5.0	8.0	30	900	(C) 0 to +75
—	HSF13	D-K	20	3.3	0.26	6	6	0	5	20	5.0	8.0	30	900	(C) 0 to +75
description: S-R clocked flip-flops															
HSF20	—	D-K	20	3.3	0.26	9	15	0	5	20	5.0	8.0	40	900	(M) —55 to +125
HSF21	—	D-K	20	3.3	0.26	9	7	0	5	20	5.0	8.0	40	900	(M) —55 to +125
—	HSF22	D-K	20	3.3	0.26	9	12	0	5	20	5.0	8.0	40	900	(C) 0 to +75
—	HSF23	D-K	20	3.3	0.26	9	6	0	5	20	5.0	8.0	40	900	(C) 0 to +75
description: single-phase S-R-T flip-flops															
HSF30	—	D-K	10	3.3	0.26	6	15 (1)	0	5	18	5.0	8.0	30	900	(M) —55 to +125
HSF31	—	D-K	10	3.3	0.26	6	7 (1)	0	5	18	5.0	8.0	30	900	(M) —55 to +125
—	HSF32	D-K	10	3.3	0.26	6	12 (1)	0	5	18	5.0	8.0	30	900	(C) 0 to +75
—	HSF33	D-K	10	3.3	0.26	6	6 (1)	0	5	18	5.0	8.0	30	900	(C) 0 to +75
description: AND input J-K flip-flops															
HSF50	—	D-K	20	3.3	0.26	10	15	0	5	25 (5)	5.0	8.0	40	900	(M) —55 to +125
HSF51	—	D-K	20	3.3	0.26	10	7	0	5	25 (5)	5.0	8.0	40	900	(M) —55 to +125
—	HSF52	D-K	20	3.3	0.26	10	12	0	5	25 (5)	5.0	8.0	40	900	(C) 0 to +75
—	HSF53	D-K	20	3.3	0.26	10	6	0	5	25 (5)	5.0	8.0	40	900	(C) 0 to +75
description: OR input J-K flip-flops															
HSF60	—	D-K	20	3.3	0.26	12	15 (1)	0	5	25 (5)	5.0	8.0	60	900	(M) —55 to +125
HSF61	—	D-K	20	3.3	0.26	12	7 (1)	0	5	25 (5)	5.0	8.0	60	900	(M) —55 to +125
—	HSF62	D-K	20	3.3	0.26	12	12 (1)	0	5	25 (5)	5.0	8.0	60	900	(C) 0 to +75
—	HSF63	D-K	20	3.3	0.26	12	6 (1)	0	5	25 (5)	5.0	8.0	60	900	(C) 0 to +75

HSF100-HSF199 series TTL flip-flops

description: separate clock 35 MHz and 50 MHz															
HSF100	—	D-K	35	3.3	0.26	4	15 (1)	0	5	—	1.0 (6)	1.7 (6)	50	900	(M) —55 to +125
HSF101	—	D-K	35	3.3	0.26	4	7 (1)	0	5	—	1.0 (6)	1.7 (6)	50	900	(M) —55 to +125
—	HSF102	D-K	35	3.3	0.26	4	12 (1)	0	5	—	1.0 (6)	1.7 (6)	60	900	(C) 0 to +75
—	HSF103	D-K	35	3.3	0.26	4	6 (1)	0	5	—	1.0 (6)	1.7 (6)	60	900	(C) 0 to +75
description: common clock dual J-K flip-flop															
HSF110	—	D-K	35	3.3	0.26	5	15 (1)	0	5	—	1.0 (6)	1.7 (6)	50	900	(M) —55 to +125
HSF111	—	D-K	35	3.3	0.26	5	7 (1)	0	5	—	1.0 (6)	1.7 (6)	50	900	(M) —55 to +125
—	HSF112	D-K	35	3.3	0.26	5	12 (1)	0	5	—	1.0 (6)	1.7 (6)	60	900	(C) 0 to +75
—	HSF113	D-K	35	3.3	0.26	5	6 (1)	0	5	—	1.0 (6)	1.7 (6)	60	900	(C) 0 to +75
description: separate clock 35 MHz and 50 MHz															
HSF120	—	D-K	50	3.3	0.26	4	15 (1)	0	5	—	1.0 (6)	1.7 (6)	50	900	(M) —55 to +125
HSF121	—	D K	50	3.3	0.26	4	7 (1)	0	5	—	1.0 (6)	1.7 (6)	50	900	(M) —55 to +125
—	HSF122	D-K	50	3.3	0.26	4	12 (1)	0	5	—	1.0 (6)	1.7 (6)	60	900	(C) 0 to +75
—	HSF123	D-K	50	3.3	0.26	4	6 (1)	0	5	—	1.0 (6)	1.7 (6)	60	900	(C) 0 to +75
description: common clock dual J-K flip-flop															
HSF130	—	D-K	50	3.3	0.26	5	15 (1)	0	5	—	1.0 (6)	1.7 (6)	50	900	(M) —55 to +125
HSF131	—	D-K	50	3.3	0.26	5	7 (1)	0	5	—	1.0 (6)	1.7 (6)	50	900	(M) —55 to +125
—	HSF132	D-K	50	3.3	0.26	5	12 (1)	0	5	—	1.0 (6)	1.7 (6)	60	900	(C) 0 to +75
—	HSF133	D-K	50	3.3	0.26	5	6 (1)	0	5	—	1.0 (6)	1.7 (6)	60	900	(C) 0 to +75

Notes: (1) Minimum. (5) Maximum. (6) Typical.

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flip-flops cont'd

HSF200-HSF299 series TTL flip-flops

Type Numbers Military	Type Numbers Commercial	Package	Max. Operating Frequency (Mc)	Logic Level "1" (volts)	Logic Level "0" (volts)	Fan In (No. of Leads)	Fan Out Max.	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Propagation Delay (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Max. Total Package Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: AND input J-K flip-flop															
HSF250	—	D-K	30	3.3	0.26	12	11 (1)	0	5	20 (5)	4.0	6.0	40	900	(M) —55 to +125
HSF251	—	D-K	30	3.3	0.26	12	6 (1)	0	5	20 (5)	4.0	6.0	40	900	(M) —55 to +125
—	HSF252	D-K	40 (9)	1.5	1.7	10	9	0	7	20 (5)	4.0	6.0	40 (3)	900	(C) 0 to +75
—	HSF253	D-K	40 (9)	1.5	1.7	10	5 (1)	0	7	20 (5)	4.0	6.0	40 (3)	900	(C) 0 to +75
description: OR input J-K flip-flop															
HSF260	—	D-K	30	3.3	0.26	—	16 (1)	0	5	—	6.0	4.0	40	—	(M) —55 to +125
HSF261	—	D-K	30	3.3	0.26	—	9 (1)	0	5	—	6.0	4.0	40	—	(M) —55 to +125
—	HSF262	D-K	30	3.3	0.26	—	13 (1)	0	5	—	6.0	4.0	40	—	(C) 0 to +75
—	HSF263	D-K	30	3.3	0.26	—	7 (1)	0	5	—	6.0	4.0	40	—	(C) 0 to +75

HSM5400/HSC7400 series TTL flip-flops

description: D-C clocked J-K flip-flop															
HSM5470	HSC7470	A-D-J	20 (1)	2.0 (1)	0.8 (5)	9	10	0	7 (5)	50 (5)	—	—	10	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: J-K master slave flip-flop															
HSM5472	HSC7472	A-D-J	10 (1)	2.0 (1)	0.8 (5)	9	10	0	7 (5)	50 (5)	—	—	10	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: dual J-K master slave flip-flop															
HSM5473	HSC7473	A-D-J	10 (1)	2.0 (1)	0.8 (5)	4	10	0	7 (5)	50 (5)	—	—	20	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: dual D-type edge-triggered flip-flop															
HSM5474	HSC7474	A-D-J	15 (1)	2.0 (1)	0.8 (5)	4	10	0	7 (5)	50 (5)	—	—	20	1000 (6)	(M) —55 to +125 (C) 0 to +70
description: quad bi-stable latch															
—	HSC7475	A-D	—	2.0 (1)	0.8 (5)	2	10	0	7 (5)	—	—	—	160 (3)	—	(C) 0 to +70
description: dual J-K master slave flip-flop															
—	HSC7476	A-D	10 (1)	2.4	0.4	2	10	0	5	50 (5)	—	—	40	—	(C) 0 to +70
description: dual A.C. clocked J-K flip-flop															
HSM5479	—	D-J	25 (1)	2.0 (1)	0.8 (5)	4	5	0	7 (5)	35 (5)	—	—	20	1000 (6)	(M) —55 to +125
—	HSC7479	A-D-J	25 (1)	2.0 (1)	0.8 (5)	4	5	0	7 (5)	35 (5)	—	—	20	1000 (6)	(C) 0 to +70
description: dual J-K master slave flip-flop															
HSM54107	HSC74107	A-D-J	10 (1)	2.4	0.4	2	10	0	5	50 (5)	—	—	40	—	(M) —55 to +125 (C) 0 to +70

HSM/C 9000 series TTL flip-flops

description: J-K flip-flop, multi-input															
HSM9000	HSC9000	D-J	—	3.0	0.4	—	10	0	5	25	—	—	45	—	(M) —55 to +125 (C) 0 to +75
description: J-K flip-flop															
HSM9001	HSC9001	D-J	—	3.0	0.4	—	10	0	5	25	—	—	45	—	(M) —55 to +125 (C) 0 to +75

linear amplifiers

HSM/HSC 700 series linear amplifiers

Type Numbers Military	Type Numbers Commercial	Package	Frequency Range or Band Width (Mc) Upper Limit	Frequency Range or Band Width (Mc) Lower Limit	Input Level (volts) A	Input Level (volts) B	Output Level (volts) A	Output Level (volts) B	Gain (db)	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Rise Time t_r (ns)	Fall Time t_f (ns)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: wideband DC amplifier															
HSM702	—	Q-T	30	—	—6 (1)	1.5	±5	±5	92 (6)	—6	12	120 (5)	—	—	(M) —55 to +125
—	HSC702	D-Q-T	30	—	—6 (1)	1.5	±5	±5	92 (6)	—6	12	120 (5)	—	—	(C) 0 to +70

Notes: (1) Minimum. (3) Typical and/or 50% of Duty Cycle. (5) Maximum. (6) Typical. (9) Maximum clock rate.



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linear amplifiers cont'd

HSM/HSC 700 series — linear amplifiers — (cont'd)

Type Numbers Military	Type Numbers Commercial	Package	Frequency Range or Band Width (mC) Upper Limit	Frequency Range or Band Width (mC) Lower Limit	Input Level (volts) A	Input Level (volts) B	Output Level (volts) A	Output Level (volts) B	Gain (db)	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Rise Time t_r (ns)	Fall Time t_f (ns)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: high performance operational amplifier															
HSM709	—	Q-T	—	—	±5	±5	±14	±14	45K (7)	—18	18	—	—	—	(M) —55 to +125
—	HSC709	D-Q-T	—	—	±5	±5	±14	±14	45K (7)	—18	18	—	—	—	(C) 0 to +70
description: hi-speed differential comparator															
HSM710	—	Q-T	—	—	±7	±7	5	—	1700 (17)	—7	14	—	—	—	(M) —55 to +125
—	HSC710	D-Q-T	—	—	±7	±7	5	—	1500 (17)	—7	14	—	—	—	(C) 0 to +70
description: dual comparator															
HSM711	—	Q-T	—	—	±7	±7	7	—	1500 (17)	—7	14	—	—	—	(M) —55 to +125
—	HSC711	D-Q-T	—	—	±7	±7	7	—	1500 (17)	—7	14	—	—	—	(C) 0 to +70
description: operational amplifier															
HSM712	HSC712	T							CONTACT FACTORY						
description: internally compensated operational amplifier															
HSM741	—	T	—	—	±15	±15	±14	±14	200K (17)	—22	22	300	—	—	(M) —55 to +125
—	HSC741	T	—	—	±15	±15	±14	±14	100K (17)	—22	22	300	—	—	(C) 0 to +70
description: dual hi-gain operational amplifier															
HSM4709	—	Q-T							dual HSM709						
—	HSC4709	D-Q-T							dual HSC709						
description: dual hi-speed differential comparator															
HSM4710	—	Q-T							dual HSM710						
—	HSC4710	D-Q-T							dual HSC710						

HLM100/200 series linear amplifiers

description: operational amplifier															
HLM101	—	D-J	—	—	—30	30	—15	15	99	—22	22	—	—	90 (7,8)	(M) —55 to +125
HLM201	—	D-J	—	—	—30	30	—15	15	103	—22	22	—	—	90 (7,8)	(C) 0 to +70

linear voltage regulators

HLM100/200/300 series

Type	Package	Input Range (volts)	Output Range (volts)	Output Current (mA)	Line Regulation (%/V)	Load Regulation (%)	Temp. Range (°C)
HLM100	D-J	8.5 to 40	2 to 30	12	0.1	0.5	—55 to +125
HLM200	D-J	8.5 to 40	2 to 30	12	0.1	0.5	0 to +70
HLM300	D-J	8 to 30	2 to 20	12	0.1	0.5	0 to +70

temperature controlled differential pair

HSM/C 726

Type	Package	BV_{CBO} (volts)	LV_{CEO} (volts)	BV_{EBO} (volts)	I_C (mA)	Input Offset Voltage Drift (mV/°C)	Input Offset Current Drift (pA/°C)	Operating Temperature Range (°C)
HSM726	T	40	40	5	5	1.0	10	—55 to +125
HSC726	T	40	40	5	5	2.0	10	0 to +85

counters

HSC7400 series TTL counters

Type Numbers Military	Type Numbers Commercial	Package	Max. Operating Frequency (Mc)	Logic Level "1" (volts)	Logic Level "0" (volts)	Fan In (No. of Leads)	Fan Out Max.	Power Supply Span (volts) Neg.	Power Supply Span (volts) Pos.	Turn-on Turn-off Delay Time (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Supply Current (mA)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
description: decade counter															
—	HSC7490	A-D-J	10 (1)	2.4	0.4	—	10	0	5	40	—	—	32	—	(C) 0 to +70
description: divide by twelve counter															
—	HSC7492	A-D-J	10 (1)	2.4	0.4	—	10	0	5	100	—	—	31	—	(C) 0 to +70
description: 4-bit binary counter															
—	HSC7493	A-D-J	10 (1)	2.4	0.4	—	10	0	5	135	—	—	31	—	(C) 0 to +70

Notes: (1) Minimum. (7) Ratio. (8) Db. (17) Voltage Ratio.

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shift registers

HSM/C 5400-7400 series TTL shift registers

Type Numbers		Package	Max. Operating Frequency (Mc)	Logic Level		Fan		Power Supply Span (volts)		Propagation Delay (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Max. Total Package Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
Military	Commercial			"1" (volts)	"0" (volts)	In (No. of Leads)	Out Max.	Neg.	Pos.						
description: 8-bit shift register															
HSM5491	HSC7491	A-D-J	18	2.0 (1)	0.8 (5)	3	20	0	7 (5)	40	—	—	175	1000	(M) —55 to +125 (C) 0 to +70
description: 5-bit shift register															
HSM5496	HSC7496	A-D-J	CONTACT FACTORY												

decoders

HSM5400/HSC7400 series TTL decoders

Type Numbers		Package	Decodes		Max. Operating Frequency (Mc)	Logic Level		No. of Lines		Power Supply Span (volts)		Transition Time (ns)	Rise Time t_r (ns)	Fall Time t_f (ns)	Max. Total Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
Military	Commercial		From	To		"1" (volts	"0" (volts)	In	Out	Neg.	Pos.						
description: BCD to decimal decoder/driver																	
HSM5441	HSC7441	A-D-J	2	4	—	2.0 (1)	0.8 (5)	4	10	0	7 (5)	—	—	—	—	1000	(M) —55 to +125 (C) 0 to +70
HSM5445	HSC7445	A-D-J	CONTACT FACTORY														

multivibrators

HSM/C 900 series DTL multivabrators

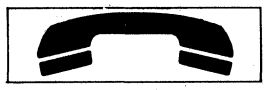
Type Numbers		Package	Max. Operating Frequency (Mc)	Logic Level		Fan		Power Supply Span (volts)		Min. Delay (ns)	Max. Rise Time t_r (ns)	Max. Fall Time t_f (ns)	Max. Total Package Power Dissipation (mW)	Max. Noise Rejection (mV)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
Military	Commercial			"1" (volts)	"0" (volts)	In (No. of Leads)	Out Max.	Neg.	Pos.						
description: monostable multivibrator															
HSM951	HSC951	D-J-T	—	—	—	3 (4)	10	0	4	25	—	—	35	1000	(M) —55 to +125 (C) 0 to +70

miscellaneous networks

HSM 5400/HSC7400 series TTL full adders

Type Numbers		Package	Max. Operating Frequency (Mc)	Logic Level		Power Supply Span (volts)		Max. Total Package Dissipation (mW)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
Military	Commercial			"1" (volts)	"0" (volts)	Neg.	Pos.		
description: gated full adder									
HSM5480	HSC7480	A-D-J	—	2.0 (1)	0.8 (5)	0	7 (5)	21 (3)	(M) —55 to +125 (C) 0 to +70
description: 2-bit binary full adder									
HSM5482	HSC7482	A-D-J	—	2.0 (1)	0.8 (5)	0	5.3	35 (3)	(M) —55 to +125 (C) 0 to +70
description: 4-bit binary full adder									
HSM5483	HSC7483	A-D-J	—	2.0 (1)	0.8 (5)	0	7 (5)	70 (3)	(M) —55 to +125 (C) 0 to +70

Notes: (1) Minimum. (3) Typical and/or 50% of Duty Cycle. (4) Includes expandable terminal in number given. (5) Maximum.



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miscellaneous networks cont'd

HSM/C 900 series DTL gate/inverters

Type Numbers		Package	Max. Operating Frequency (Mc)	Logic Level		Power Supply Span (volts)		Max. Total Package Dissipation (mW)	Operating Temperature Range (°C) (M-Military) (C-Commercial)
Military	Commercial			"1" (volts)	"0" (volts)	Neg.	Pos.		
description: hex single input gate/inverter									
HSM936	HSC936	D-J	—	2.6 (1,10)	0.4 (5,11)	0	5	8.5 (3,13)	(M) —55 to +125 (C) 0 to +75
description: fast hex single input gate/inverter									
HSM937	HSC937	D-J	—	3.8 (1,10)	0.4 (5,11)	0	5	12.5 (3,13)	(M) —55 to +125 (C) 0 to +75

HSM2000 series DTL absolute maximum ratings

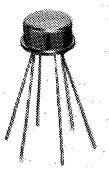
Type Number	Package	Supply Voltage, Continuous (volts)	Supply Voltage, Pulsed <1sec (volts)	Output Current Into Outputs (mA)	Input A Voltage, Continuous (volts)	Input A Voltage (volts)	Input B Voltage, Continuous (volts)	Max. V_{CC} Current per Circuit @ $V_{CC}=5.5V$ (mA)	Operating Temperature Range (°C)
description: quad level translator									
HSM2000	D	8 (14)	20	30	32	80 (15)	16	4.6	—55 to +125

Type Number	Package	Max. Voltage Applied to Pin 8 (volts)	Max. Voltage Applied to Pin 10 (volts)	Operating Power (mW)	Operating Temperature Range (°C)
description: high voltage, high current driver					
HSM2001	D	+40	8	200	—55 to +125

Type Number	Package	Supply Voltage to Pin 14, Continuous (volts)	Supply Voltage, Pulsed <1sec (volts)	Max. Voltage Applied to Pin 8 (volts)	Output Current Into Pin 6 or 13 (mA)	Output Current Into Pin 8, Continuous (mA)	Output Current Into Pin 8 (Amps)	Max. V_{CC} Current @ $V_{CC}=5.5V$ (mA)	Operating Temperature Range (°C)
description: lamp driver									
HSM2002	D	+8 (14)	+20	+40	30	400	1 (16)	44	—55 to +125

Notes: (1) Minimum.
(3) Typical and/or 50% of Duty Cycle.
(5) Maximum.
(10) Indicated value at Maximum Rated Fan-In.
(11) Indicates values given are for output.
(13) Power Dissipation per circuit.
(14) At Operating Temperature Range, Continuous
(15) Transient <100ms and <1% Duty Cycle.
(16) Transient <1sec and <10% Duty Cycle.

MALLORY INTEGRATED CIRCUITS





For complete catalog, request Bulletin #9-1C.

Mallory offers designers of commercial and industrial electronic equipment low cost integrated circuits. In most cases, the Mallory IC is less expensive than discrete component equivalents.

This page describes Mallory integrated circuits currently in production. Changes are swift, and we ask that you contact us if the circuit you require is not included here. We have the capability to supply both standard and custom circuits in production volume.

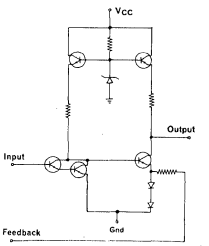
PREAMPLIFIER AND DUAL PREAMPLIFIER — MIC 0101 (Single Channel) MIC 0103 (Dual Channel)

The Malloy MIC 0101 is a silicon monolithic integrated circuit audio preamplifier designed to accept input signals in the 50 to 500 microvolt range. Open loop voltage gain is 60 db with a 20K ohm minimum input impedance. The circuit is self biasing and has an internal zener diode for power supply filtering.

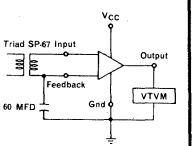
Mallory MIC 0103 is a dual preamplifier containing two identical circuit chips. The separation between channels is 50 db minimum. All other specifications are identical to the MIC 0101.

GENERAL SPECIFICATIONS	Maximum	Minimum
Supply voltage V_{CC}	24V	9V
Supply current at 12V (per channel)	8 ma	4 ma
Operating temperature	85°C	−40°C
Voltage gain	66 db	57 db
Power supply ripple amplification	0 db	—
Harmonic distortion at .2V output	1%	—
Input impedance	—	20K ohm
Output impedance	3500 ohm	2500 ohm
Audio noise at output, RMS unfiltered	10 mv	—
Channel separation (MIC 0103 only)	—	50 db

EQUIVALENT CIRCUIT



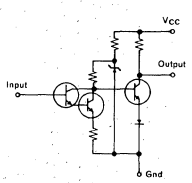
TEST CIRCUIT



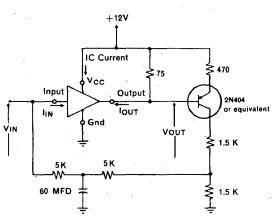
DRIVER AMPLIFIER — MIC 0201D - MIC 0201M

The Mallory MIC 0201 silicon monolithic integrated circuit is designed to drive a PNP germanium output transistor in Class A operation. It features DC drive capability to 40 ma, internal zener diode filtering and feedback biasing. A unique feature of the MIC 0201 is its ability to accommodate output transistors with wide ranges of current gain.

EQUIVALENT CIRCUIT



TEST CIRCUIT

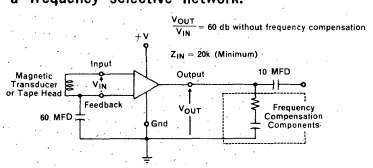


GENERAL SPECIFICATIONS	Maximum	Minimum
Supply Voltage	16V	10V
IC Current at 12V	12 ma	7 ma
Input Imp. $\frac{\Delta V_{IN}}{\Delta I_{IN}}$	—	50K ohms
Output Imp. $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	150 ohms	—
Voltage Gain (0201 Test Circuit) $\frac{V_{OUT}}{V_{IN}}$	43 db	23db
Power Dissipation	600mw (TO-5 Case) 450mw (Molded Case)	— —
Operating Temp. Range	+170°C (TO-5 Case) +125°C (Molded Case)	−30°C −30°C
Power Derating Factor (Derate above 25°C)	4.1mw/°C (TO-5 Case) 4.5mw/°C (Molded Case)	— —

All ratings at 25°C unless otherwise noted.

APPLICATIONS — PREAMPLIFIER AND DUAL PREAMPLIFIER

This application is intended for use with a magnetic transducer such as a magnetic tape playback head. The circuit offers high voltage gain and high input impedance. Typical voltage gain is 60 db and input impedance is greater than 20 K ohms. Frequency compensation may be achieved by loading the output of the IC with a frequency selective network.



The preamplifier may be driven from a transformer input with not other external components. Voltage gain is 60 db typical and the input impedance presented to the transformer is 220 ohms.

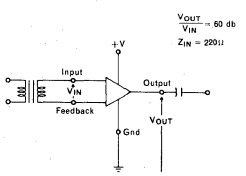
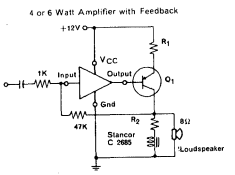


Figure 2

6 WATT AMPLIFIER

The driver amplifier integrated circuit MIC 0201 can be used in conjunction with a PNP germanium output device to provide a low cost, high quality 6 watt audio amplifier. Both circuits illustrated can provide up to 6 watts of audio power at less than 10% distortion.

4 or 6 Watt Amplifier with Feedback

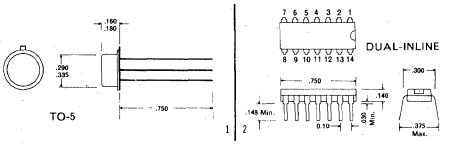


Distortion at 5 Watts	Frequency Response	Sensitivity Volts in for 2 Watt Output	External Components	Input Impedance
4.20%	25 Hz - 15 KHz	100 mv	2 res	1.1 K

PACKAGE STYLES

Mallory integrated circuits are packaged in two popular styles.

1. The TO-5 metal container offers true hermetic sealing and long flexible leads for easy insertion into prototype circuits.
2. The dual in-line molded plastic package is more economical and has leads which are ridged. This construction is ideal for using with automated insertion equipment in volume production.



ORDERING INFORMATION

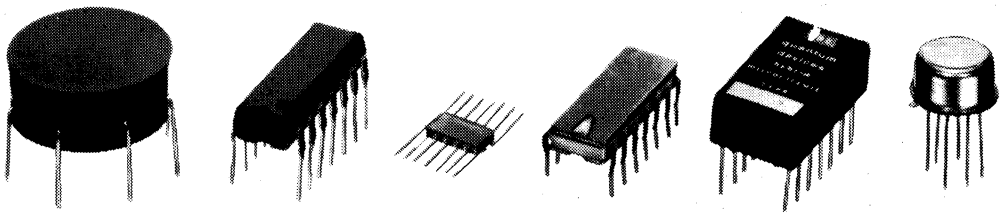
Part Number	Case Style	Part Number	Case Style
MIC 0101D	TO5 CAN	MIC 0201M	INLINE MOLDED
MIC 0201D	TO5 CAN	MIC 0103H	TO5 CAN
MIC-0101M	INLINE MOLDED	MIC 0103M	INLINE MOLDED

Standard Mallory components are available from authorized Mallory distributors throughout the United States.

P. R. MALLORY & CO. INC.
INTEGRATED CIRCUIT DEPARTMENT
Indianapolis, Indiana 46206; Telephone: 317-636-5353

MALLORY

Custom Hybrid Microcircuits



QUANTUM DEVICES CORP. can transform your existing circuitry system to a hybrid microcircuit. By using automated techniques, hybrid microcircuits can be produced with low production costs and high volume capability. Increased reliability and drastic reduction in size are some of the benefits of hybrid microcircuits.

Discrete devices such as transistors diodes, capacitors and integrated circuits can be carefully tested and selected before being bonded to a ceramic substrate containing the thin film resistor network. This type of control guarantees the performance of the complete circuit.

Thin film resistor networks are used for low noise characteristics and excellent temperature coefficients. By drastically reducing handling and heating operations the reliability of the module is increased with the advantage of faster assembly and lower costs.

Many package configurations and sizes are available.

Steps To Obtain a Custom Hybrid Microcircuit

A. Customer breadboards circuit and tests feasibility.

B. Customer supplies schematic and parts list to Q.D.C.

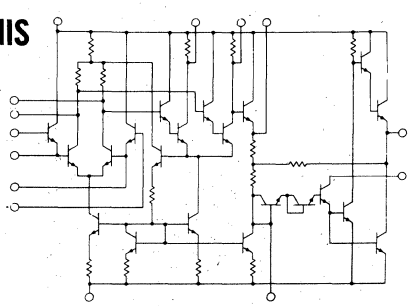
C. Q.D.C. engineering reviews circuit and discusses any predictable forseen problems with customer.

D. Circuit is manufactured into a hybrid microcircuit.

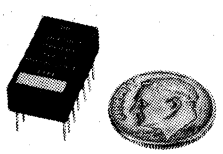
E. Circuit is final tested and delivered to customer.

- LOW TOOLING COSTS
- EXTREME REDUCTION IN CIRCUIT SIZE
- FAST DELIVERY OF PROTOTYPES
- RESISTORS TO
  0.1 ± TOLERANCE
  25 ± PPM TCR
  5 ± PPM TRACKING
- DISCRETE CHIPS BONDED TO CIRCUIT
- MILITARY ENVIRONMENTS
- INCREASED RELIABILITY
- TEMPERATURE CONTROLLED SUBSTRATES
- HERMETIC SEALING AVAILABLE

CHANGE THIS



TO THIS



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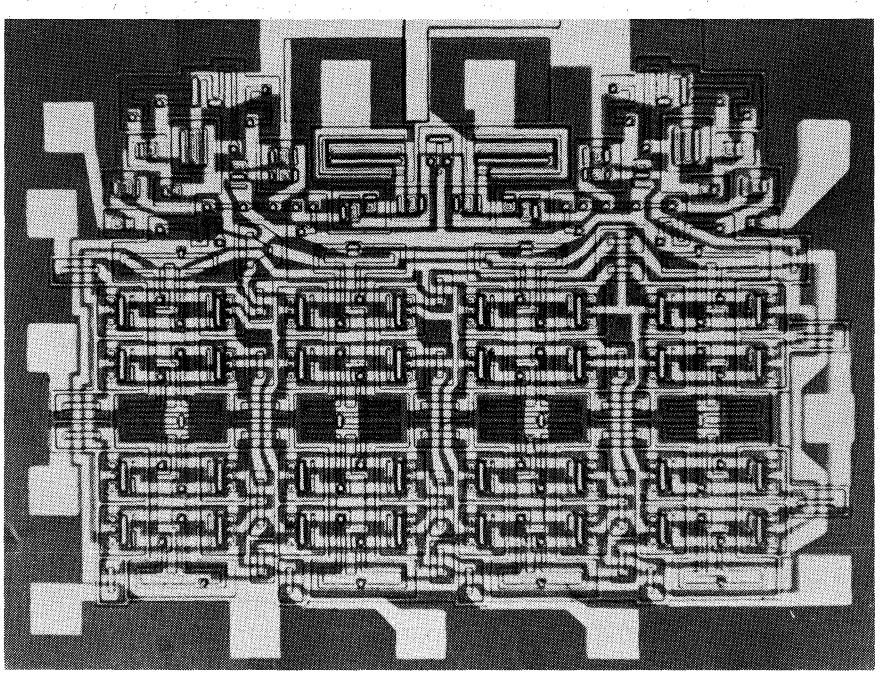
DIGITAL INTEGRATED CIRCUITS



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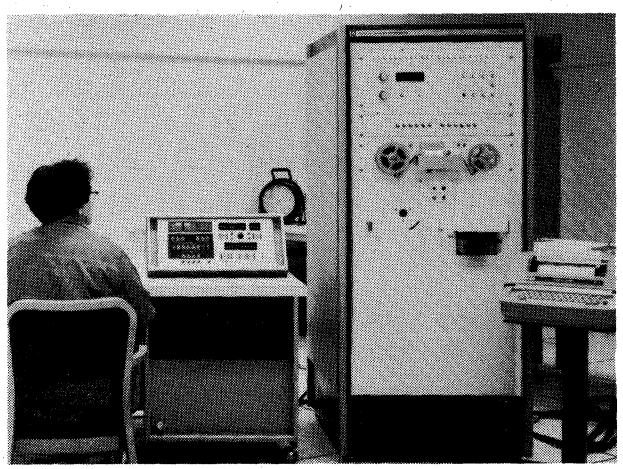
TRANSITRON ELECTRONIC CORPORATION

LINEAR INTEGRATED CIRCUITS REFERENCE GUIDE

TRANSITRON DEVICE TYPE	FUNCTION	TEMPERATURE RANGE
TDC1710V	Differential Comparator (μA710)	M
TDC1710F	Differential Comparator	M
TDC1710P	Differential Comparator	M
TDC1710LID	LID Packaged Differential Comparator	M
TDC2710V	Differential Comparator (μA710C)	I
TDC2710F	Differential Comparator	I
TDC2710P	Differential Comparator	I
TDC2710E	Differential Comparator	I
TDC2710LID	LID Packaged Differential Comparator	I
TDC1711V	Dual Differential Comparator (μA711)	M
TDC1711F	Dual Differential Comparator	M
TDC1711P	Dual Differential Comparator	M
TDC1711LID	LID Packaged Dual Differential Comparator	M
TDC2711V	Dual Differential Comparator (μA711C)	I
TDC2711F	Dual Differential Comparator	I
TDC2711P	Dual Differential Comparator	I
TDC2711E	Dual Differential Comparator	I
TDC2711LID	LID Packaged Dual Differential Comparator	I
TDC4711V	High Sink Current Dual Differential Comparator	M
TDC4711F	High Sink Current Dual Differential Comparator	M
TDC4711P	High Sink Current Dual Differential Comparator	M
TDC5711V	High Sink Current Dual Differential Comparator	I
TDC5711F	High Sink Current Dual Differential Comparator	I
TDC5711P	High Sink Current Dual Differential Comparator	I
TDC6711V	Dual Output Dual Differential Comparator	M
TDC6711F	Dual Output Dual Differential Comparator	M
TDC6711P	Dual Output Dual Differential Comparator	M
TDC7711V	Dual Output Dual Differential Comparator	I
TDC7711F	Dual Output Dual Differential Comparator	I
TDC7711P	Dual Output Dual Differential Comparator	I
TDC8711V	High Sink Current Dual Differential Comparator	M
TDC8711F	High Sink Current Dual Differential Comparator	M
TDC8711P	High Sink Current Dual Differential Comparator	M
TDC9711V	High Sink Dual Output Differential Comparator	I
TDC9711F	High Sink Dual Output Differential Comparator	I
TDC9711P	High Sink Dual Output Differential Comparator	I
TDD1100E	BCD To Decimal Decoder Driver	I
TDD1100F	BCD To Decimal Decoder Driver	I
TDD1100P	BCD To Decimal Decoder Driver	I
TDD1101E	High Sink BCD To Decimal Decoder Driver	I
TDD1101F	High Sink BCD To Decimal Decoder Driver	I
TDD1101P	High Sink BCD To Decimal Decoder Driver	I
TOA1709V	Operational Amplifier (μA709)	M
TOA1709F	Operational Amplifier	M
TOA1709P	Operational Amplifier	M
TOA1709LID	LID Packaged Operational Amplifier	M
TOA2709V	Operational Amplifier (μA709C	I
TOA2709F	Operational Amplifier	I
TOA2709P	Operational Amplifier	I
TOA2709E	Operational Amplifier	I
TOA2709LID	LID Packaged Operational Ampliefier	I
TOA3709V	Operational Amplifier	I
TOA3709F	Operational Amplifier	I
TOA3709P	Operational Amplifier	I
TOA3709LID	LID Packaged Operational Amplifier	I
TOA4709V	High Performance Operational Amplifier (μA7094)	M
TOA4709F	High Performance Operational Amplifier	M
TOA4709P	High Performance Operational Amplifier	M
TOA7709V	High Input Impedance Operational Amplifier	M
TOA7709F	High Input Impedance Operational Amplifier	M
TOA7709P	High Input Impedance Operational Amplifier	M
TOA7809V	High Input Impedance Operational Amplifier	M
TOA7809F	High Input Impedance Operational Amplifier	M
TOA7809P	High Input Impedance Operational Amplifier	M
TOA8709V	High Input Impedance Operational Amplifier	I
TOA8709F	High Input Impedance Operational Amplifier	I
TOA8709P	High Input Impedance Operational Amplifier	I
TOA8809V	High Input Impedance Operational Amplifier	I
TOA8809F	High Input Impedance Operational Amplifier	I
TOA8809P	High Input Impedance Operational Amplifier	I
TOA1741V	Internally Compensated OP Amplifier (μA741)	M
TOA1741F		
TOA2741V	Internally Compensated OP Amplifier (μA741C)	I
TOA2741P		
TSA1150F	Sense Amplifier Flop-Flop Output	M
TSA1150P	Sense Amplifier Flop-Flop Output	M
TSA2150F	Sense Amplifier Flip-Flop Output	I
TSA2150P	Sense Amplifier Flip-Flop Output	I
TVR2000V	Voltage Regulator	M
TVR2001V	Voltage Regulator	I
TVR2000P	Voltage Regulator	M
TVR2001P	Voltage Regulator	I

DEVICE TYPE	FUNCTION	TEMPERATURE RANGE
TOA1809	DUAL OP AMP	MILITARY
TOA2809	DUAL OP AMP	COMMERCIAL
TOA1741WV	OP AMP	MILITARY
TOA2741WV	OP AMP	COMMERCIAL
TOA7741V	OP AMP	MILITARY
TOA8741V	OP AMP	COMMERCIAL
TOA7741WV	OP AMP	MILITARY
TOA8741WV	OP AMP	COMMERCIAL
TOA1841	DUAL OP AMP	MILITARY
TOA2841	DUAL OP AMP	COMMERCIAL

RAYTHEON CAPABILITIES IN MICROELECTRONICS



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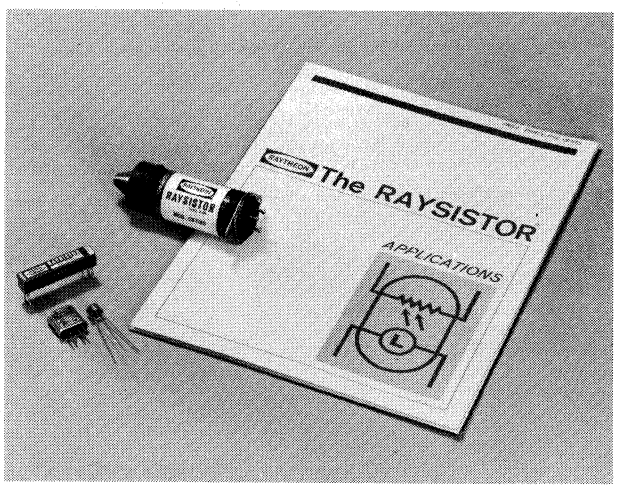

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RAYTHEON



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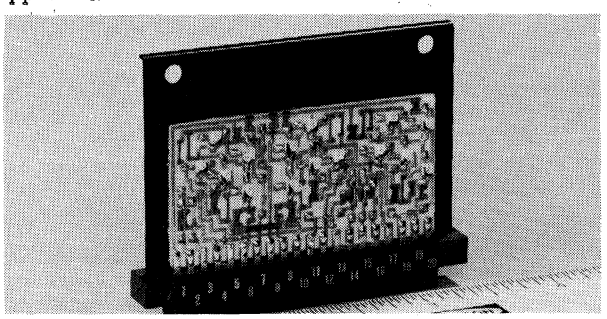
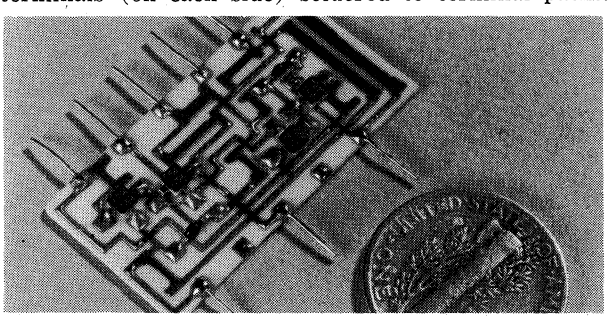


NAFI-type module has two 1" x 2" thick film circuits epoxy-sealed to aluminum heat exchanger, and to terminals (on each side) soldered to terminal paths.



Typical thick film circuit module used in high-reliability programs. Devices are also available in modified TO-5 packages.

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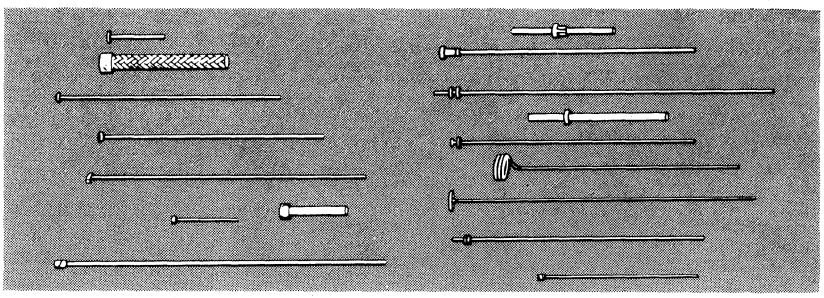

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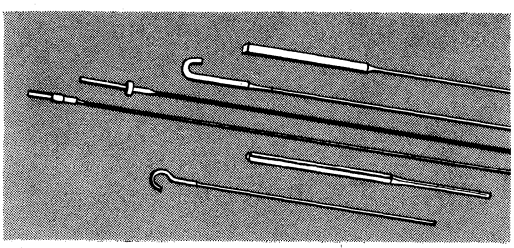

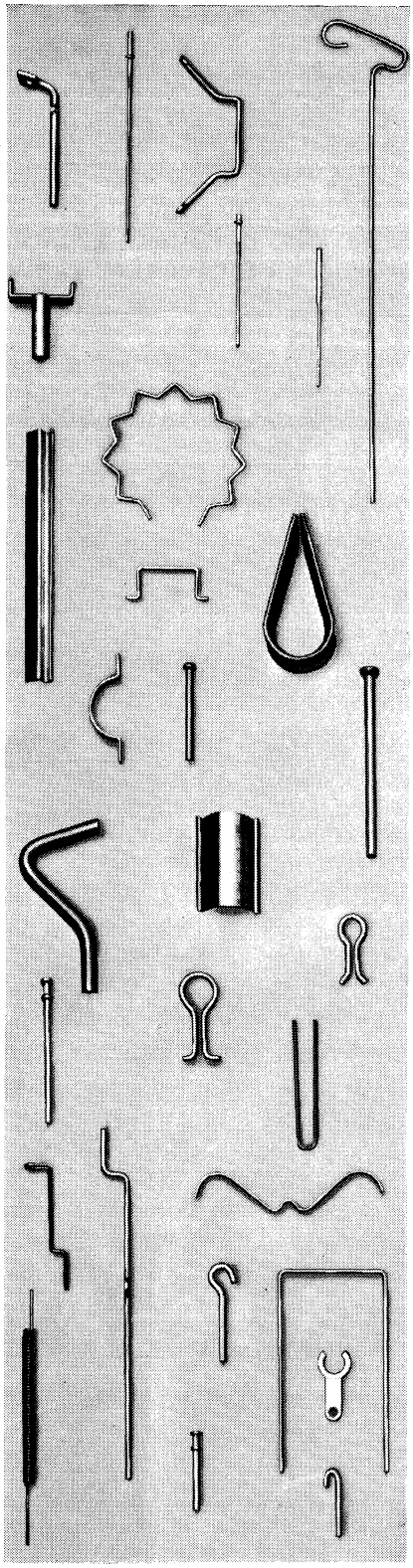

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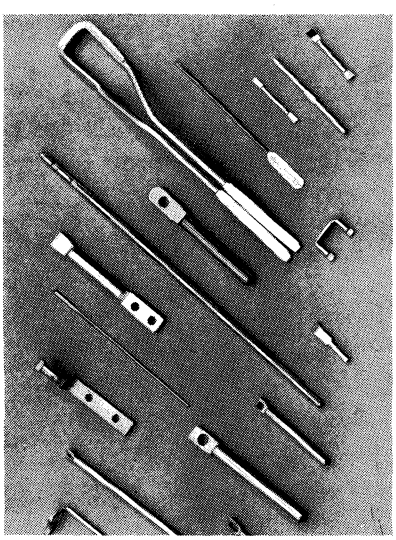

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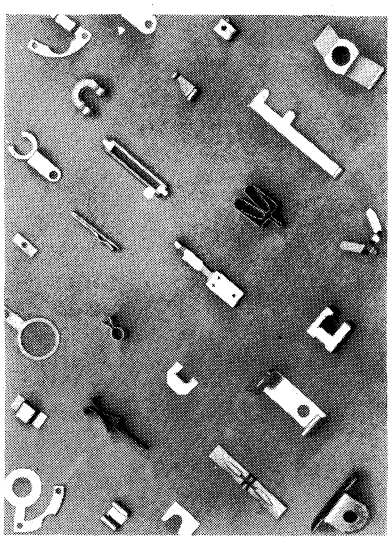
In great variety to meet all needs for improved sealing, connections, etc., in wire as fine as .015 to .125. Rounded or square cut ends. Shaped to your specifications.



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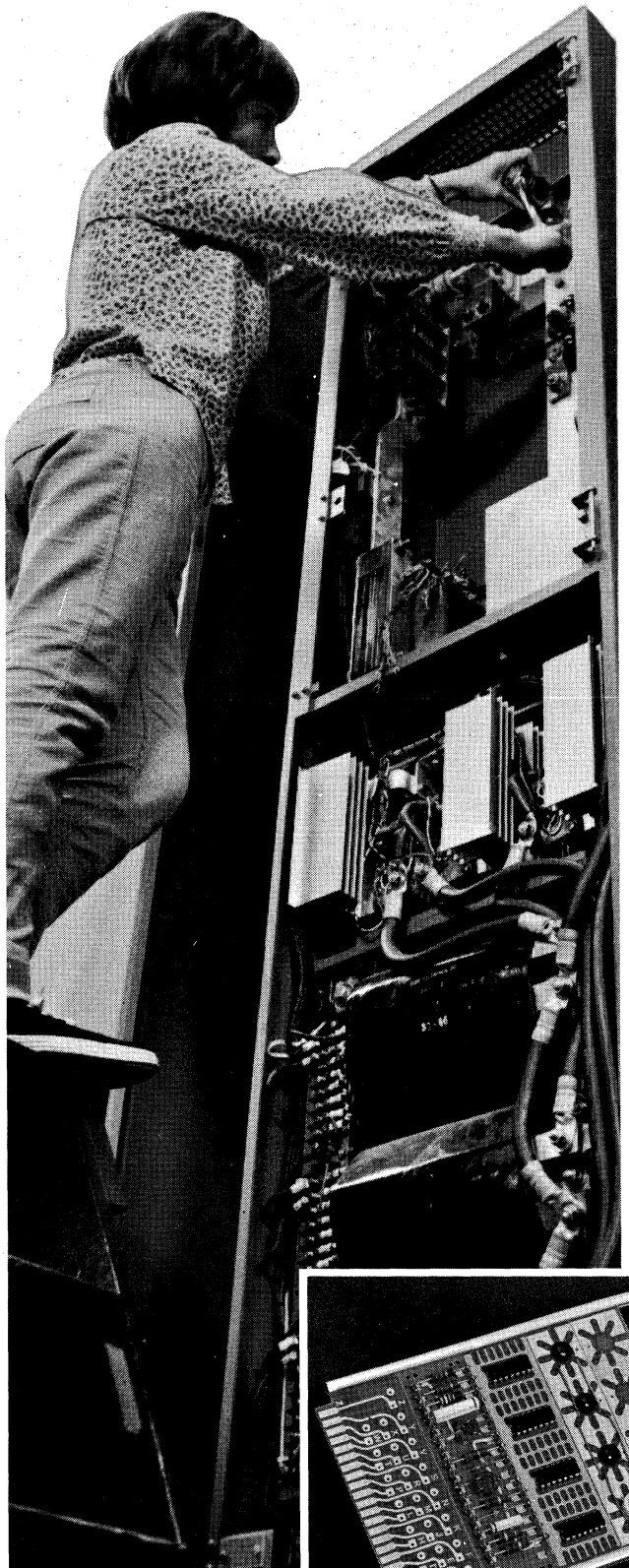

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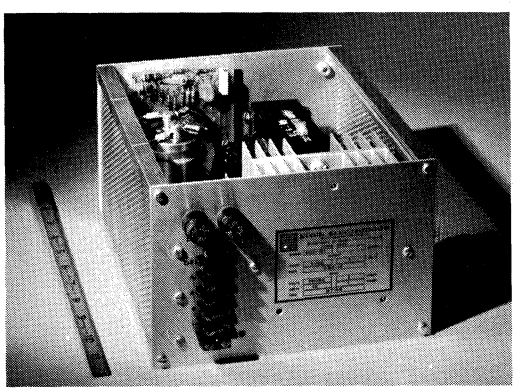
Integrid® Cards



Power Supplies

THAT TOUGH GLASS SEAL PROBLEM... FUSITE SOLVED IT FOR YOU YESTERDAY

We've been specializing in difficult sealing applications for over 25 years, so probably the solution to your particular problem is already in our files.

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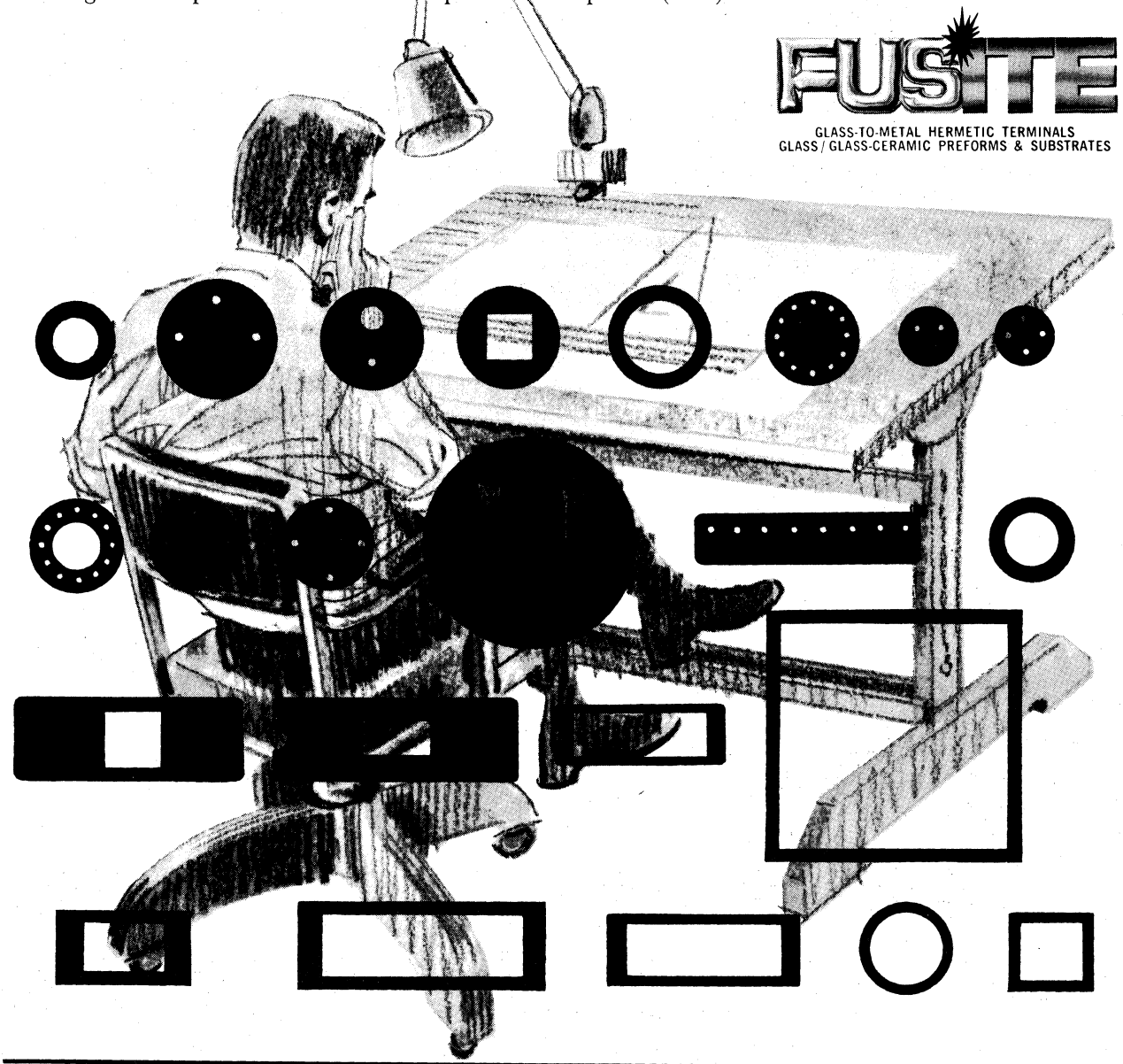
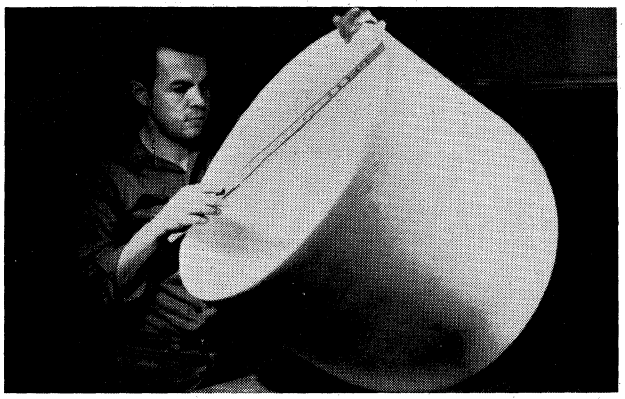
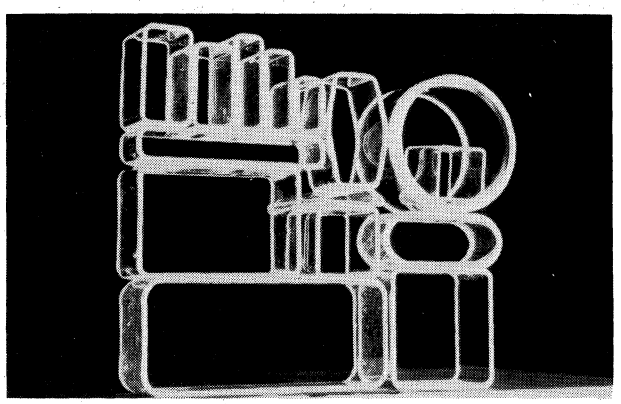
For solutions to all your sealing glass problems, call Fusite in Cincinnati. Or, if your interests are overseas, call one of these plants: Fusite N.V., Konigweg 16, Almelo, Holland; Fusite-Japan, Gotemba, Japan; Terminal Products, Hormigueros, Puerto Rico; or, Fusite GmbH, Dieselstrasse 5, Karlsruhe, West Germany. Fusite Corporation, 6000 Fernview Ave., Cincinnati, Ohio 45212 . . . phone (513) 731-2020.

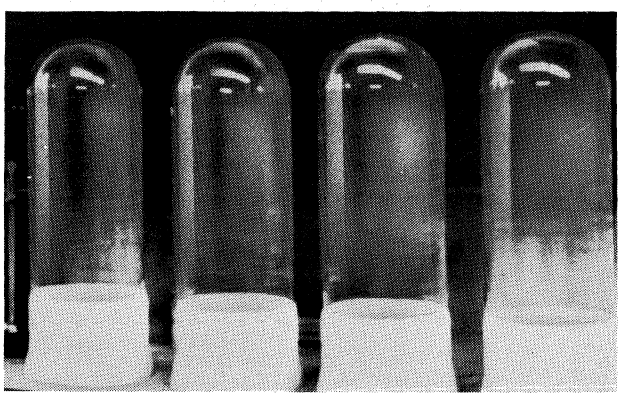
FUSITE

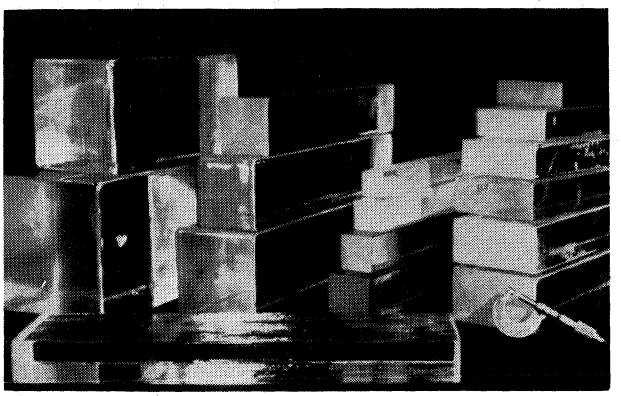
GLASS-TO-METAL HERMETIC TERMINALS
GLASS / GLASS-CERAMIC PREFORMS & SUBSTRATES











Fused quartz or fused silica. Call on Amersil.

When your plans call for fused quartz or fused silica, call us. Amersil produces both in forms that are highly pure, non-contaminating, resistant to acid and thermal shock, and exhibit high dielectric strength. Our materials can be ordered in a variety of forms and sizes that are either transparent, opaque, or combinations of each. Both types are available as furnace tubes, epitaxial reactors, bell jars, insulators, slice boats, diffusers, distillation apparatus, beakers, flasks, joints . . . and tubing, rod, plates and discs. Amersil is also sales agent for Worden Quartz microbalances and springs.

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28

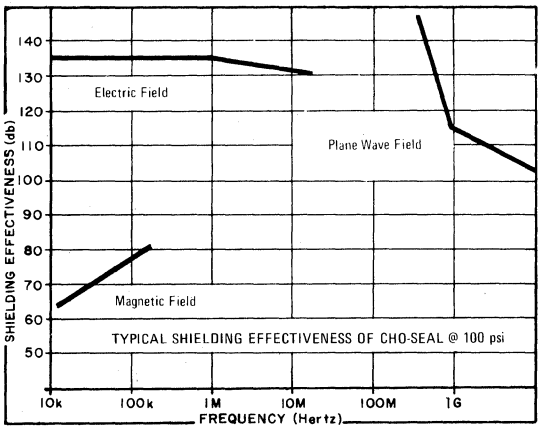
CHOMERICS, INC. CONDUCTIVE COMPOSITE MATERIALS FOR INDUSTRY

Chomerics, Inc. is engaged in the proprietary development and manufacture of electrically conductive composite materials for shielding sealing, grounding, bonding, contacting and terminating. These materials are based on patented techniques* which transform plastics and elastomers into highly conductive materials, without significantly degrading their original properties. Chomerics' products include conductive elastomers, molded RFI gaskets, waveguide gaskets, conductive adhesives, conductive caulking, potting and coating compounds, and conductive heat-shrinkable tubing.

* U.S. Patents 3,140,342; 3,194,860; 3,202,488; and other patents pending.

CHO-SEAL CONDUCTIVE ELASTOMERIC SHEETS

SPECIFICATION LIMITS	PROPERTY		AERO.-200 GRADE			AERO.-125 GRADE				GSE GRADE		COMM.GR		Spec
			1220	1221	1224	1212	1214	1215	1217	1225	1228	1226	1229	1227
	Shielding Effectiveness (db) At 100 psi	Magnetic (10 kHz)	68	70 (fluoro)	70	78	71	71	70 (fluoro)	70	70	70	70	70
		Electric (1 MHz)	>140	←									→	>140
		Plane (10 GHz)	110	110	120	84	125	125	120	74	90	70	90	120
	Shielding Effectiveness (db) At 200 psi	Magnetic (10 kHz)	68	68	71	78	71	71	71	70	71	70	71	71
		Electric (1 MHz)	>140	←									→	>140
		Plane (10 GHz)	119	119	128	110	125	125	125	87	100	80	100	128
	Continuous Use Temp. (°C)		200 ↑ -55	200 ↑ -55	200 ↑ -55	125 ↑ -55	125 ↑ -55	125 ↑ -55	125 ↑ -55	85 ↑ -55	85 ↑ -55	55 ↑ -55	55 ↑ -55	200 ↑ -55
	Max. DC Vol. Resistivity • (ohm-cm)		.005	.004	.003	.009	.009	.009	.015	.030	.080	.030	.090	.030
	Shore A Durometer (±5)		90	73	62	79	71	63	76	79	63	63	55	61
	Density (gm/cc) (±0.15)		4.25	4.15	3.25	3.35	3.65	3.65	4.05	3.15	3.35	2.55	3.15	3.25

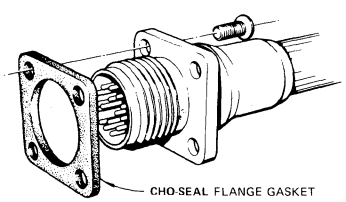


Chomerics offers four grades of highly electrically conductive elastomeric sheets. These materials consist of silver-plated copper particles dispersed in a binder of silicone rubber. Aerospace grades available in standard thicknesses of .020, .032, .062, .093 and .125 inch, and in sizes of 10 x 10, 10 x 15, 20 x 15 and 30 x 20 inches. Commercial and GSE grades are available 12" wide x 36" long in thicknesses of .020, .032 and .062 inch.

RFI CONNECTOR FLANGE GASKETS

Chomerics Cho-Seal combination RF/Pressure Gaskets are electrically and thermally conductive elastomers of dimensionally stable characteristics. Cho-Seal gaskets are designed to provide an RF shield as well as a pressure seal between the connector flange and mounting panel.

Cho-Seal gasket characteristics include high-power RF capabilities, low flange leakage, compliance with MIL specifications for systems use, maximum heat transfer, and minimal outgassing (silicone). Total attenuations are in the 85–115+ db range between 14 kHz and 15 GHz – depending on the magnitude and uniformity of closure force.



DETERMINING PART NUMBER

The dash number identifies the material (see Table 2).

The Chomerics base number identifies the dimensional characteristics of the gasket (see Table 1).

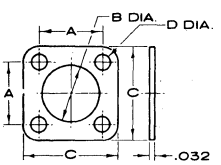
1961 - 1215

TABLE 2

MATERIAL	USE TEMP. (°C)
CHO-SEAL 1224	-55 to 200
CHO-SEAL 1212	-55 to 125
CHO-SEAL 1225	-55 to 85

In addition to the standard Cho-Seal gasket shown, special sizes and shapes are also available.

TABLE 1



SHELL SIZE	CHOMERICS BASE NUMBER			NOMINAL DIMENSION			
	MIL-C-26482	MIL-C-5015	MIL-C-81511	A ± .010	B +0.20 -0.00	C ± .015	D ± .015
6	1946			.469	.375	.738	.141
8			1947	.594	.630	.840	.135
8	1948	1948		.594	.500	.875	.156
10			1949	.719	.750	.965	.135
10S, SL	1950	1950		.719	.625	1.000	.156
12, 12S, SL	1951	1951		.813	.750	1.094	.156
14, 14S	1952	1952		.906	.875	1.188	.156
14			1953	.906	1.005	1.153	.135
16, 16S	1954	1954		.969	1.000	1.281	.156
16			1955	.969	1.135	1.258	.156
18	1956	1956		1.062	1.135	1.375	.156
18			1957	1.062	1.260	1.351	.156
20	1958	1958		1.156	1.250	1.500	.172
22	1959	1959		1.250	1.375	1.625	.172
24	1960	1960		1.375	1.500	1.750	.203
28		1961		1.562	1.750	2.000	.203
32		1962		1.750	2.000	2.250	.219
36		1963		1.938	2.250	2.500	.219
40		1964		2.188	2.500	2.750	.219
44		1965		2.375	2.781	3.000	.219
48		1966		2.625	3.031	3.250	.219

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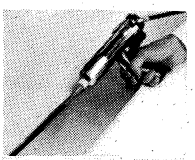
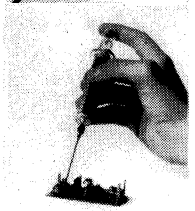
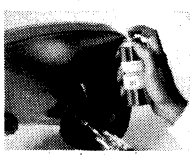
CONDUCTIVE ADHESIVES, CAULKS, PAINTS, GREASES







	PART NUMBER	NO. OF COMPO-NENTS	DENSITY (gm/cc)	CURE TEMP* (°F)	CURE TIME (hours)	VOLUME RESISTIVITY (ohm-cm)	POT LIFE	SHEAR STRENGTH (PSI)	BINDER	USE TEMP. (°F)	DISTINGUISHING CHARACTERISTICS
ADHESIVES	584-22	2	2.7	270	1.0	10^{-3}	8 hrs.	1200	Epoxy	-65 to 325	Pure Ag filler; high temp; long pot life
	584-208	2	2.7	R.T./235	24/.25	10^{-3}	90 min.	1000	Epoxy	-80 to 210	Pure Ag filler; tacky uncured
	ENT-105	2	2.5	R.T./235	24/.25	10^{-3}	30 min.	1400	Epoxy	-65 to 260	Pure Ag filler; avail. in hand-mix kits
	582	1	2.7	300	4.0	10^{-3}	—	1500	Epoxy	-65 to 300	Pure Ag filler; 1 - component
	360-22	2	4.2	270	1.0	10^{-3}	8 hrs.	900	Epoxy	-65 to 325	High temp. (325°F); long pot life
	360-18	2	4.2	R.T./235	24/.25	10^{-3}	30 min.	1100	Epoxy	-65 to 255	Easily spread; thick glue line
	360-208	2	3.8	R.T./235	24/.25	10^{-3}	90 min.	1000	Epoxy	-80 to 210	No contact pressure req'd
	360-20C	2	4.2	R.T./235	24/.25	10^{-2}	90 min.	1000	Epoxy	-80 to 210	Fills large gaps
	370	1	4.2	300	4.0	10^{-3}	—	1900	Epoxy	-65 to 300	1 - component; high strength
	365-57	2	4.2	200/400	2.0/6.0	10^{-2}	4 hrs.	1000	Epoxy	-65 to 400	High temp. applications (400°F)
	260-18	2	3.3	R.T./235	24/.25	10^{-3}	30 min.	600	Epoxy	-65 to 255	Easily spread; medium glue line
	260-208	2	3.3	R.T./235	24/.25	10^{-3}	90 min.	1500	Epoxy	-80 to 210	No contact pressure req'd
	260-10C	2	2.8	R.T./235	24/.25	10^{-1}	90 min.	1400	Epoxy	-80 to 210	Medium application thickness
	1025	2	3.2	250/325	1.0/.25	10^{-2}	2 hrs.	150	Silicone	-100 to 255	Bonds silicones
CAULKING	1011	2	4.2	R.T./300	24/.25	10^{-2}	90 min.	—	Silicone	-100 to 255	Thick; high temp; short pot life
	1013	2	2.0	310	.25	10^{-2}	6 hrs.	—	Silicone	-100 to 255	Thin; high temp; long pot life
	4061	1	4.2	Non-curing		10^{-2}	—	—	Polyisobutylene	-65 to 125	Highest reliability; small bead
	4066	1	5.3	Non-curing		10^{-2}	—	—	Epoxy	-65 to 125	For conduits and pipe threads
	4330	1	1.8	Non-curing		10^{-2}	—	—	Polyisobutylene	-65 to 125	Low cost (low density); small bead
	4660	1	2.1	Non-curing		10^{-2}	—	—	Polyisobutylene	-65 to 125	Low cost (low density); large bead
COATING	212	2	0.8	R.T./235	24/.25**	200 ohm/sq.	8 hrs.	—	Epoxy	-65 to 210	Low cost epoxy (carbon)
	581X-29	2	1.7	R.T./235	24/.25**	10^{-2}	45 min.	—	Epoxy	-65 to 255	Silver-filled; brush application
	581Y-29	2	1.5	R.T./235	24/.25**	10^{-2}	90 min.	—	Epoxy	-65 to 255	Silver-filled; spray application
	4130	1	1.1	Non-curing		200 ohm/sq.	—	—	Latex	-65 to 180	Low cost; 1 - component (carbon)
	4900	1	1.5	Non-curing		.05 ohm/mil	—	—	Acrylic	-65 to 200	1 - component spray
GREASE	4210	1	1.0	Non-curing		102	—	—	Silicone	-40 to 400	Low thermal conductivity
	4220	1	3.1	Non-curing		10^{-2}	—	—	Silicone	-40 to 400	High elec. and thermal conductivity
SPLICING	1020	1	3.5	350	3 min.	10^{-2}	—	—	Silicone	-100 to 255	For splicing GSE-grade mat'l
	1022	1	3.5	350	3 min.	10^{-2}	—	—	Silicone	-100 to 255	For splicing Aero-grade mat'l

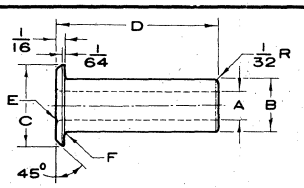
* Where a choice of cure cycles is available, values are separated by a slash. Values on each side of slash in "Cure Temp." column correspond to those in "Cure Time" column.

** Requires 1-hour air drying at room temperature, followed by elevated cure.

This wide selection of conductive compounds provides the most economical solution to shielding, bonding, grounding, and static-discharging problems. Where very thin applications are required, a silver-filled resin should be selected. If slightly thicker compounds will work, Chomerics' patented silver-plated copper filler provides lower cost materials with the same excellent conductivity. Where only moderate conductivity is required, a carbon-filled resin should be selected.

CONDUCTIVE STRAIN RELIEF BUSHINGS

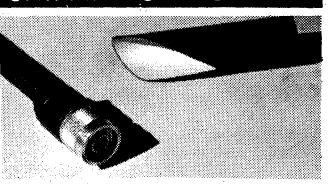
These AN 3420 bushings, in conjunction with standard MS 3057A cable clamps, provide a reliable method of terminating shielded cables. Molded from CHO-SEAL 1215 conductive silicone rubber, they are completely interchangeable with standard non-conductive AN 3420 bushings.



AN NUMBER	PART NO.	MATERIAL A DIA.	B DIA.	C DIA.	D	E RAD.	F RAD.
3420- 3	2322- 3	.130	.210	.374	2.875	1/32	1/32
3420- 4	2322- 4	.220	.302	.500	2.750	1/32	1/32
3420- 6	2322- 6	.312	.427	.614	2.625	1/32	1/16
3420- 8	2322- 8	.437	.552	.739	2.500	1/16	1/16
3420-10	2322-10	.562	.615	.864	2.375	1/16	1/16
3420-12	2322-12	.625	.740	1.039	2.250	1/16	1/16
3420-16	2322-16	.750	.927	1.059	2.125	1/16	1/16
3420-20	2322-20	.937	1.240	1.591	2.000	1/16	1/16
3420-24	2322-24	1.250	1.365	1.842	1.875	1/16	1/16

CONDUCTIVE HEAT SHRINK TUBING

New!



Chomerics' new CHO-SHRINK* conductive heat-shrinkable tubing provides a totally new approach to shielding cables, components, or connectors. A thin, uniform metal coating on the inside surface of standard TFE, polyolefin or PVC shrink tubing enables the simultaneous achievement of RF shielding, insulating and corrosion protection.

Chomerics can apply a conductive coating to the inside surface of any heat-shrinkable plastic tubing. Since the coating does not affect the physical, electrical, or chemical properties of the basic tubing, material selection should be based on the properties of the tubing. The following table can be used as a guide.

PROPERTY	MATERIAL PVC	POLYOLEFIN	TFE
Operating Temp. (°F)	14 to 221	-66 to 275	-88 to 432
Shrink Temp. (°F)	250	275	625
Tensile Strength (psi)	2,000-4,000	2,000-3,000	5,000
Dielectric Strength (v/m)	750	800-1,000	1,000
Shrink Ratio	1.3:1 to 2:1	2:1 to 3:1	1.3:1 to 4:1

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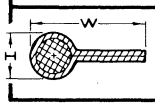
RFI/EMI GASKETS

These highly reliable gaskets use no wire mesh or oriented wires to achieve electrical continuity. Instead, they combine the excellent conductivity of silver with the resiliency and memory of silicone rubber to provide the highest shielding effectiveness of any RFI gasket material. In addition to the standard configurations listed here, custom gaskets can be molded or die cut to meet your requirements.

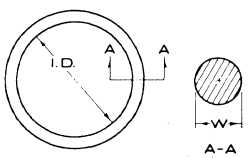
CHO-WELT STRIP GASKETS

These highly compressible gaskets provide RFI shielding around doors, access panels or enclosures with very low closure forces. They consist of a soft neoprene sponge core, surrounded by a .020" layer of conductive silicone rubber.

New!

CROSS SECTION	PART NO.	NOMINAL DIMENSION		
		H	W	LENGTH
	5-2099-0001	.290	.750	96" max

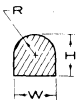
CONDUCTIVE O-RINGS



Note: Chomerics also carries a standard line of conductive d-rings. Contact the factory or your nearest Chomerics sales representative for sizes and part numbers.

RFI STRIP GASKETS

Standard RFI strip gaskets include both O and D cross sections. Part numbers below include material designations. Choose CHO-SEAL 1212 for high durometer gaskets, CHO-SEAL 1214 for medium durometer, and CHO-SEAL 1215 for low durometer. CHO-SIL 1401 is softer than any of the above CHO-SEAL materials.

CROSS SECTION	PART NO.	NOMINAL DIMENSIONS			
		H ±.005	W ±.005	R ±.005	LENGTH *
	3-1597-1215		.051		30" max
	3-1687-1215		.070		60" max
	3-1720-1215		.103		60" max
	3-1720-1401		.103		36" min
	3-1721-1401		.139		36" min
	4-1362-1212	.070	.062	.031	60" max
	4-1362-1214	.068	.062	.031	60" max
	4-1362-1215	.068	.062	.031	60" max
	4-1363-1212	.090	.080	.040	60" max
	4-1363-1214	.089	.078	.039	60" max
	4-1363-1215	.089	.078	.039	60" max
	4-1364-1212	.135	.125	.062	60" max
	4-1364-1214	.131	.122	.061	60" max
	4-1364-1215	.131	.122	.061	60" max
	4-1364-1401	.131	.122	.061	36" min
	4-1499-1215	.156	.118	.059	72" max
	4-1577-1214	.175	.178	.089	60" max
	4-1577-1215	.175	.178	.089	60" max
	4-1577-1401	.170	.175	.089	36" min

* Lengths given as maximums are unspliced lengths.

PART NO. *	MS 29513 DASH NO	DIMENSIONS W. DIA.	DIMENSIONS I.D.	PART NO.	MS 29513 DASH NO	DIMENSIONS W. DIA.	DIMENSIONS I.D.	PART NO.	MS 29513 DASH NO	DIMENSIONS W. DIA.	DIMENSIONS I.D.
0-2231-1224		.030 ±.004	.442 ±.005	0-0014-XXXX		.070 ±.004	.860 ±.007	0-1409-XXXX		.097 ±.004	9.740 ±.030
0-2232-1224		.030	.577 ±.007	0-1843-XXXX		.070	.926 ±.007	0-1632-XXXX		.097	10.197 ±.030
0-2259-1224		.030	.692 ±.007	0-2029-XXXX		.070	1.110 ±.010	0-1754-XXXX		.101	2.805 ±.020
0-2233-1224		.030	.817 ±.007	0-1844-XXXX		.070	1.176 ±.010	0-1359-XXXX		.101	3.153 ±.020
0-1413-1224		.039	.425 ±.005	0-2084-XXXX		.070	1.230 ±.010	0-1360-XXXX		.101	3.613 ±.020
0-2253-XXXX		.048	.292 ±.005	0-2228-XXXX		.070	1.362 ±.010	0-1921-XXXX		.103	.612 ±.007
0-1406-XXXX		.050	.533 ±.007	0-0024-XXXX		.070	1.485 ±.010	0-1847-XXXX		.103	.799 ±.007
0-1405-XXXX		.051	.446 ±.005	0-2229-XXXX		.070	1.674 ±.015	0-2086-XXXX		.103	1.240 ±.010
0-1407-XXXX		.057	.402 ±.005	0-0028-XXXX		.070	1.735 ±.015	0-1845-XXXX		.103	1.362 ±.010
0-1376-XXXX		.063	.541 ±.007	0-0032-XXXX		.070	1.980 ±.015	0-1846-XXXX	130	.103	1.612 ±.015
0-1342-XXXX		.063	.648 ±.007	0-2230-XXXX		.070	3.009 ±.020	0-2031-XXXX	132	.103	1.737 ±.015
0-1631-XXXX		.068	.847 ±.007	0-0052-XXXX		.070	3.220 ±.020	0-2087-XXXX		.103	1.790 ±.015
0-1770-XXXX		.068	1.182 ±.010	0-2040-XXXX		.070	3.489 ±.020	0-2030-XXXX	142	.103	2.362 ±.020
0-1478-XXXX		.068	3.165 ±.020	0-1692-XXXX		.070	4.300 ±.020	0-1691-XXXX		.103	3.987 ±.020
0-1558-XXXX		.068	4.013 ±.020	0-2034-XXXX		.070	6.772 ±.030	0-1567-XXXX		.103	4.612 ±.020
0-1635-XXXX		.068	4.308 ±.020	0-2008-XXXX		.070	7.290 ±.030	0-0112-XXXX		.103	6.965 ±.030
0-1404-XXXX		.068	4.332 ±.020	0-2320-XXXX		.076	.656 ±.007	0-1900-XXXX		.103	12.000 ±.030
0-1529-XXXX		.068	11.600 ±.030	0-2321-XXXX		.076	.779 ±.007	0-1824-XXXX		.113	4.261 ±.020
0-2226-XXXX	011	.070	.301 ±.005	0-1827-XXXX		.084	.852 ±.007	0-1717-XXXX		.114	9.560 ±.030
0-2227-XXXX	013	.070	.426 ±.005	0-0044-XXXX		.084	2.678 ±.020	0-1573-XXXX		.115 ±.004	2.876 ±.020
0-1980-XXXX	014	.070	.489 ±.005	0-0068-XXXX		.084	4.139 ±.020	0-1713-XXXX		.139 ±.005	7.734 ±.030
0-0008-XXXX		.070	.495 ±.005	0-0076-XXXX		.084	4.636 ±.020	0-0128-XXXX		.139	7.965 ±.030
0-0010-XXXX		.070	.610 ±.007	0-2151-XXXX		.085	4.500 ±.020	0-1608-XXXX		.147	3.690 ±.020
0-2085-XXXX		.070	.635 ±.007	0-0020-XXXX		.087	1.250 ±.010	0-1607-XXXX		.147	2.265 ±.020
0-1689-XXXX		.070	.667 ±.007	0-0038-XXXX		.087	2.360 ±.020	0-1782-XXXX		.188	.673 ±.007
0-1690-XXXX		.070	.738 ±.007	0-1609-XXXX		.087	5.810 ±.020	0-1410-XXXX		.197	9.740 ±.030
0-0012-XXXX		.070	.735 ±.007	0-1459-XXXX		.095	.897 ±.007	0-1746-XXXX		.210	3.475 ±.020
0-1981-XXXX	019	.070 ±.004	.801 ±.007	0-1378-XXXX		.095 ±.004	1.074 ±.010	0-1354-XXXX		.243 ±.005	3.409 ±.020

* XXXX shall indicate material as follows: Specify material 1214 for temperatures below 125°C Specify material 1224 for temperatures up to 200°C

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(617) 648-8650
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WAVEGUIDE GASKETS

Chomerics' standard line of waveguide gaskets includes flat and molded configurations to fit most JAN, CPR, and CMR flanges. No knurled surfaces to mar machined flanges – just highly conductive silicone rubber which conforms perfectly to flange irregularities. These gaskets assure RF integrity, pressure retention, and low insertion losses. Chomerics, Inc. offers gaskets with raised lips around the guide opening for highly pressurized systems.

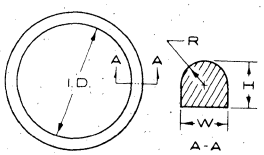
CHO-SEAL COVER FLANGE GASKETS

EIA WAVEGUIDE SIZE	PART NO.	FLANGE DESIGNATION		
		JAN	CPR	CMR
WR28	5000-X	UG-599/U	—	—
WR42	5005-X	UG-595/U UG-597/U	—	—
WR62	5010-X	UG-419/U	—	—
WR90	5015-X	UG-39/U UG-135/U	—	—
	5115-X	—	CPR-90-F	—
	5215-X	—	—	CMR-90
WR112	5020-X	UG-51/U UG-138/U	—	—
	5120-X	—	CPR-112-F	—
	5220-X	—	—	CMR-112
WR137	5025-X	UG-344/U UG-441/U	—	—
	5125-X	—	CPR-137-F	—
	5225-X	—	—	CMR-137
WR159	5130-X	—	CPR-159-F	—
	5230-X	—	—	CMR-159
WR187	5035-X	UG-149A/U UG-407/U	—	—
	5135-X	—	CPR-187-F	—
	5235-X	—	—	CMR-187
WR229	5140-X	—	CPR-229-F	—
	5240-X	—	—	CMR-229
WR284	5045-X	UG-53/U UG-584/U	—	—
	5145-X	—	CPR-284-F	—
	5245-X	—	—	CMR-284
WR340	5050-X	UG-533/U UG-554/U	—	—
	5150-X	—	CPR-340-F	—
WR430	5055-X	UG-435A/U UG-437A/U	—	—
	5155-X	—	CPR-430-F	—
WR650	5060-X	UG-417A/U UG-418A/U	—	—
	5160-X	—	CPR-650-F	—

* X shall indicate material as follows: Specify -1 for temperatures up to 200°C. Specify -2 for temperatures up to 125°C.

MATERIAL: Conductive Silicone (Expanded metal reinforced)
THICKNESS: 0.027" ±.003"

CHO-SEAL 1212 CHOKE FLANGE WAVEGUIDE GASKETS



EIA WAVEGUIDE SIZE	PART NO.	JAN FLANGE DESIGNATION	NOMINAL DIMENSIONS			
			I.D.	W	H	R
WR28	6510	UG-600A/U	.413	.089	.056	.045
WR42	6515	UG-596A/U UG-598A/U	.595	.081	.049	.040
WR62	6520	UG-541A/U	.875	.155	.123	.077
WR90	6530-A 6530-B	UG-136A/U UG-40A/U UG-136B/U UG-40B/U	1.340 1.310	.095 .124	.088 .077	.048 .058
WR102	6535	UG-1494/U	1.392	.095	.085	.047
WR112	6540	UG-52B/U UG-137B/U	1.550	.105	.078	.052
WR187	6555*	UG-148C/U UG-406B/U	2.683	.115	—	—
WR284	6565	UG-54B/U	3.935	.240	.182	.120

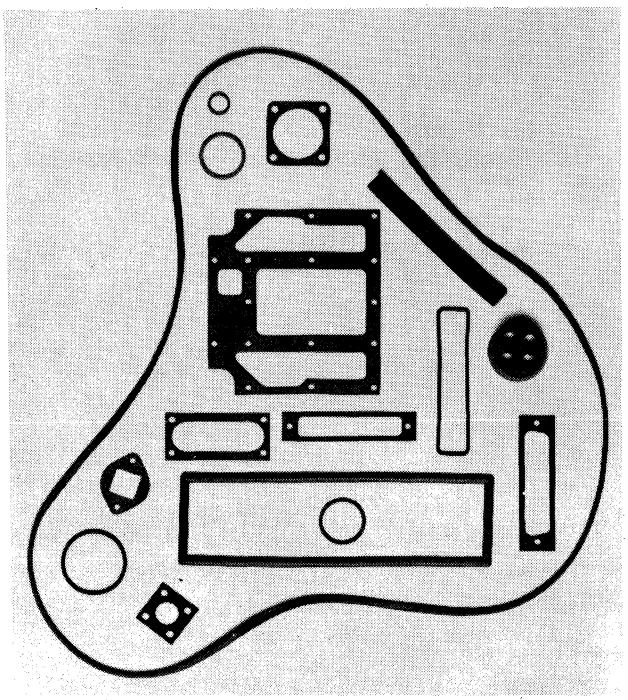
* Standard "O" type cross-section.

CUSTOM RFI/EMI GASKETS

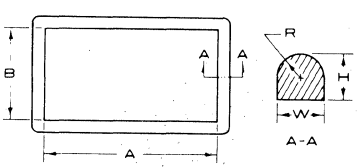
Chomerics RFI/EMI gaskets combine the conductivity normally associated with metals and the sealing qualities of rubber. They provide RF supression and pressure retention without marring metal surfaces, and are reliable, lightweight, and reuseable.

These patented materials consist of Chomerics' "essential silver" powder dispersed in binders of silicone or fluorosilicone. Variations in compounding result in materials with a wide range of physical and chemical properties, all exhibiting low dc volume resistivity (between 10^{-2} and 10^{-3} ohm-cm), excellent shielding effectiveness (up to 125 db at 100 psi flange force in plane wave fields), and good heat stability (from -55°C to 200°C in some cases).

Custom shapes or sizes are easily die cut or molded. Compatibility with specific environmental conditions can be designed into the gasket material.



CHO-SEAL 1212 GROOVED CONTACT FLANGE WAVEGUIDE GASKETS



	EIA WAVEGUIDE SIZE	PART NO.	FLANGE DESIGNATION	NOMINAL DIMENSIONS				
				A	B	W	H	R
SINGLE	WR62	6620	CPR-62-G	.722	.410	.127	.083	.064
	WR90	6630	CPR-90-G	.993	.493	.127	.083	.064
	WR112	6635	CPR-112-G	1.253	.628	.127	.083	.064
	WR187	6655	CPR-187-G	2.025	1.025	.192	.121	.096
	WR284	6665	CPR-284-G	2.980	1.480	.185	.124	.092
DUAL	WR62	6720	CPRD-62-G	1.345	.382	.127	.080	.064
	WR90	6730	CPRD-90-G	1.931	.487	.120	.082	.060
	WR112	6735	CPRD-112-G	2.415	.610	.120	.082	.060
	WR187	6755	CPRD-187-G	3.975	.985	.185	.124	.092
	WR284	6765	CPRD-284-G	5.970	1.500	.188	.120	.094

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Zinc: Metal, Sulfide, powder, crystal chips, melt and vapor phase crystals; Zinc Selenide and Zinc Telluride powders.

Sodium Nitrite: Crystals.

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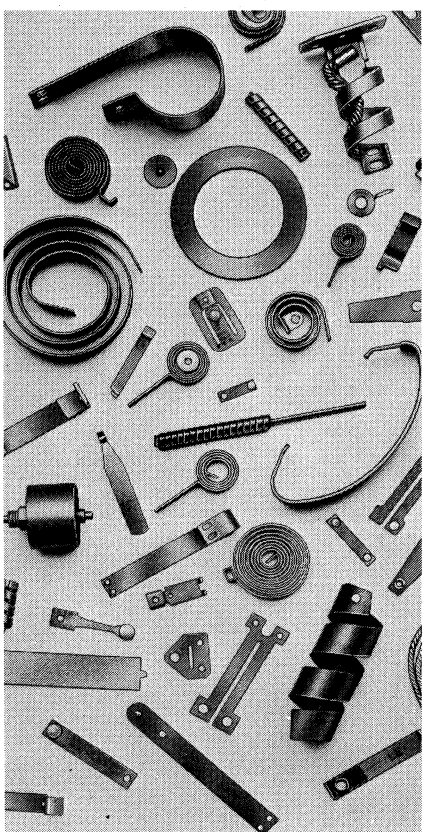

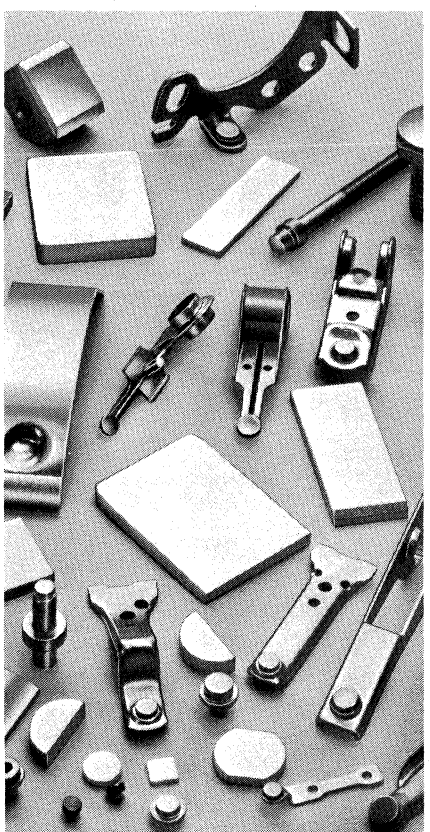

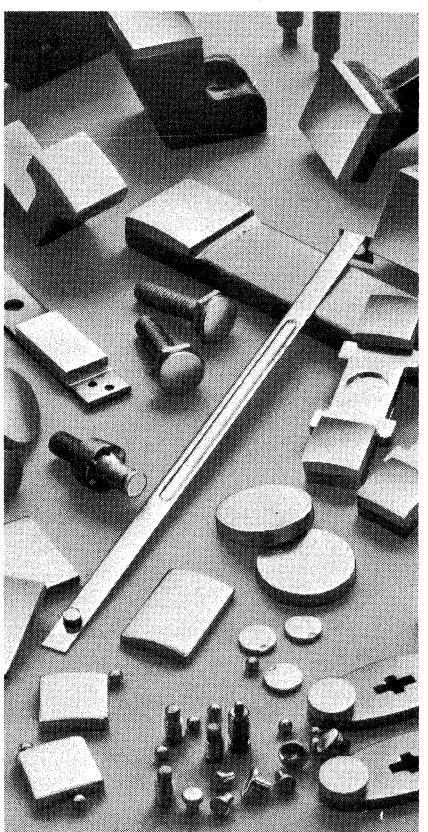

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MICROWAVE

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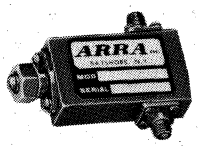
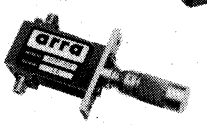
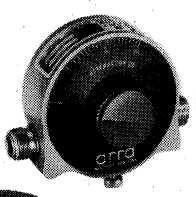


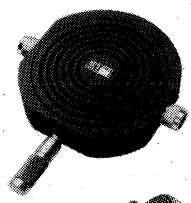


MINIATURE ATTENUATORS 2 OUNCES BANDS FROM 2-18 GHz

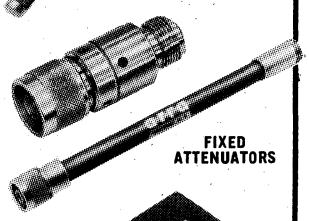




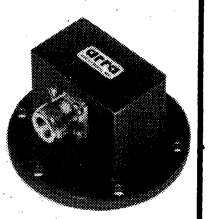
DIRECT READING VARIABLE ATTENUATOR



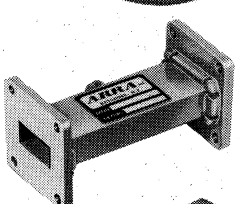
100 WATTS AVERAGE POWER

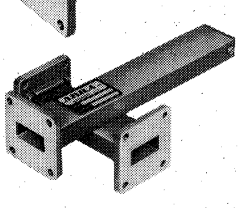


FIXED ATTENUATORS



WAVEGUIDE TO COAXIAL ADAPTERS





WAVEGUIDE COUPLERS & ATTENUATORS

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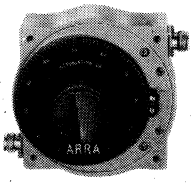
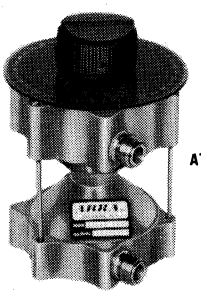
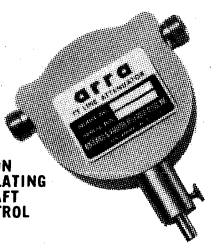


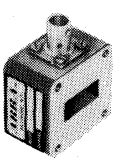
OCTAVE BAND 100 db 1.5 db ACCURACY



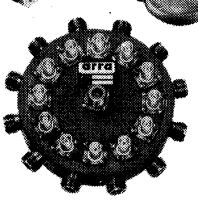
120 db ATTENUATION RANGE



NON TRANSLATING SHAFT CONTROL





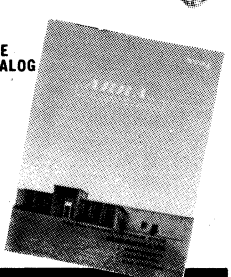


COAXIAL & WAVEGUIDE DIODE SWITCHES

COAXIAL & WAVEGUIDE TERMINATIONS



WRITE FOR CATALOG



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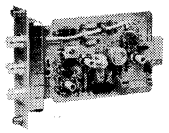
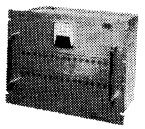




ARI specializes in amplifier systems for use with high insertion loss elements, such as delay lines. Driver amplifier shown, Type A, provides 34 db gain at 60 Mc/s. BW is 30 Mc/s, output 1 watt phase stability within 2°, amplitude within 0.25 db. Post amplifier, Type B, provides 54 db gain with 250 MW output to follow lossy element.

These amplifiers can be packaged in standard multiple chassis as shown above. Unit holds 30 ARI modules, plus power supply and fans, where required. Other rack-units hold 2, 4, or 15 units.



SOLID-STATE ANTENNA MULTICOUPLERS



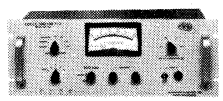
RECEIVERS — ULF-UHF

ARI designs and manufactures receivers for standard and special purposes. Included are our VLF rocket and satellite units, LF beacon, HF radar, VHF radar, UHF balloon, Dopplometers, and many others. Write for free receiver catalog . . . or send us your specifications.

VLF-UHF combining optimum noise figure, dynamic range, intermodulation distortion and VSWR. Units shown are AMC-110 (3-300 Kc/s) and AMC-136 (130-140 Mc/s). Other units at HF and UHF. Prices start at $310.

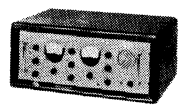
RADIO ASTRONOMY

ARI is eminent in the field of radio astronomy equipment at metric and longer wavelengths. Our radiometers are in constant use in almost every part of the world. In addition to the items shown, we manufacture a Polarimeter of the Cohen configuration in the HF-VHF range, various receivers for measuring cosmic noise intensities on the ground and in space, and special antenna systems. ARI Random Noise Generators are standard equipment at many observatories for radiometer system calibration. Send for free Radio Astronomy brochure.



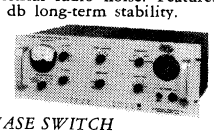
EDSON RADIOMETER

The ER-110 can be used ith any HF-VHF receiver to form a precision 0.1 db long-term stability radiometric instrument. It makes use of a closed-loop Ryle-Vonberg configuration to continuously calibrate to a thermionic servo diode.



ARI-100C RIOMETER MARK II

A highly sensitive, ultra-stable instrument for measuring intensities of electro-magnetic fields. The RIOMETER is used principally for recording changes in ionospheric absorption of extra-terrestrial radio noise. Features 0.1 db long-term stability.



PHASE SWITCH

The ARI-140 Phase Switching Receiver is a complete phase sensitive interferometer (less antennas) in a single package. Based on the Ryle configuration, the unit enables precise measurement of the interferometer pattern. The ARI-140 is equipped with plug-in r.f. heads to cover a range from 3-250 Mc/s.

RF RANDOM NOISE GENERATORS

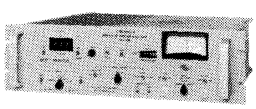


STABILITY, ZERO- WARM-UP TIME, FREQUENCY COVERAGE 100 c/c TO 2000 mc/s. ARI Random Noise Generators provide the unique feature of servo-control of the output level to insure stability with variations in line voltage and ambient temperature. The units are specifically suitable for continuous production-line testing and for calibration of sensitive receivers and radiometers. Other advantages gained from the servo-control system are excellent long-term stabilities (0.05 db), and millisecond warm-up. A remote programming capability is standard equipment providing the ultimate in resettability. Another unique feature of ARI noise sources is meter calibration in both db noise figure and degrees Kelvin.

The Model NS-L is the only commercially available device that provides RF random noise at laboratory accuracies in the VLF ranges. It uses lightweight rechargeable batteries to completely rid the output signal of power-line contamination.

Model	Frequency	
NS-L	100c/s-500 Mc/s	$845.
NS-B	1-500 Mc/s	450.
NS-H	1-2000 Mc/s	825.

PRECISION FREQUENCY AND TIMING



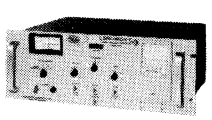
LORCHRON*

Loran-C Timing Receiver. Latest techniques, incorporating integrated-circuit micrologic. All-electronic servo system, lightweight and portable. TIMING SYNCHRONIZATION TO ONE MICROSECOND within Loran-C area.



DIGICHRON*

Numerical readout of hours, minutes and seconds. Thumb-wheel digital switch to set output pulse delay from 0 to 999,999 microseconds. Useful with any clock standard for display, and removal of propagation delay.



LORCHRON-C

For frequency comparison and synchronization. NO DIURNAL SHIFT, as experienced at VLF, within Loran-C area. Measurement can be made to 1 x 10^{-9} in two minutes, and 1 x 10^{-12} in a day.

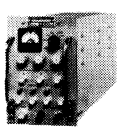
* TM

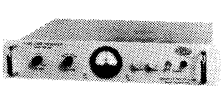
LORAN-C

Thirty Loran-C stations are currently in operation with locations in Europe, Africa, the North Atlantic, Continental U.S., Alaska, Hawaii, and in the vicinity of Japan. Operation is on an assigned frequency of 100 Kc/s is controlled to atomic standards. Times of transmission of some of the chains are being steered by the Naval Observatory to provide synchronization to the Observatory Master Clock.

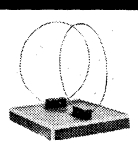
The instruments shown can be used to derive time reference and frequency synchronization for Loran-C signals. In addition, ARI manufactures Loran-C r.f. amplifier units, repetition rate generators, simulators, and antenna systems. Send for our free brochures on Loran-C Timing and Instrumentation.

RF TIME DISTRIBUTION





Range timing by transmission of RF signals modulated by standard IRIG codes is a simple technique for covering a large area at minimum cost. ARI manufactures complete systems to suit any requirement, and can provide field services for installation, operation, and maintenance. Transmitters are available for AM and FM service using either single, or multiplexed time codes. Receivers such as the airborne TCR-136 or the ground based TCR-141 as shown are available in both AM and FM configurations to suit your particular timing needs. Send for free brochure.



LOOP ANTENNAS

Crossed-loop (shown), single loops and loop-whip cardiod arrays, ULF-HF. General purpose L1-L single loop available from stock is balanced, electrostatically shielded and has an effective height of 1 cm at 20 Kc/s. $140.

WRITE FOR ARI PRODUCT AND PRICE CATALOG

AEROSPACE RESEARCH INC. *130 Lincoln Street, Boston, Massachusetts 02135 617-254-7200*

AMPHENOL RF SWITCHES

AMPHENOL
THE BUNKER-RAMO CORPORATION

Series 360 DYNAFORM FUNCTIONS AND PART NUMBERS

Conn.	Term.	Schematic	Coil Volts	SPDT Outline Dwg. A	SPDT Outline Dwg. B	DPDT Outline Dwg. C	DPDT Outline Dwg. D	Transfer Outline Dwg. E
BNC	SH	1	26 DC 110 DC 115 AC	360-11891-12 360-11891-34 360-11891-45	360-11891-13 360-11891-35 360-11891-46	360-11896-12 360-11896-34 360-11896-45	360-11896-13 360-11896-35 360-11896-46	
	NS	2	26 DC 110 DC 115 AC	360-11891-14 360-11891-36 360-11891-47	360-11891-15 360-11891-37 360-11891-48	360-11896-14 360-11896-36 360-11896-47	360-11896-15 360-11896-37 360-11896-48	
	50 Ω RT	3	26 DC 110 DC 115 AC	360-11891-16 360-11891-38 360-11891-49	360-11891-17 360-11891-39 360-11891-50	360-11896-16 360-11896-38 360-11896-49	360-11896-17 360-11896-39 360-11896-50	
	75 Ω RT	3	26 DC 110 DC 115 AC	360-11891-18 360-11891-40 360-11891-51	360-11891-19 360-11891-41 360-11891-52	360-11896-18 360-11896-40 360-11896-51	360-11896-19 360-11896-41 360-11896-52	
	95 Ω RT	3	26 DC 110 DC 115 AC	360-11891-20 360-11891-42 360-11891-53	360-11891-21 360-11891-43 360-11891-54	360-11896-20 360-11896-42 360-11896-53	360-11896-21 360-11896-43 360-11896-54	
	TRANS	4	26 DC 110 DC 115 AC					360-11891-22 360-11891-44 360-11891-55
TNC	SH	1	26 DC 110 DC 115 AC	360-11892-12 360-11892-34 360-11892-45	360-11892-13 360-11892-35 360-11892-46	360-11897-12 360-11897-34 360-11897-45	360-11897-13 360-11897-35 360-11897-46	
	NS	2	26 DC 110 DC 115 AC	360-11892-14 360-11892-36 360-11892-47	360-11892-15 360-11892-37 360-11892-48	360-11897-14 360-11897-36 360-11897-47	360-11897-15 360-11897-37 360-11897-48	
	50 Ω RT	3	26 DC 110 DC 115 AC	360-11892-16 360-11892-38 360-11892-49	360-11892-17 360-11892-39 360-11892-50	360-11897-16 360-11897-38 360-11897-49	360-11897-17 360-11897-39 360-11897-50	
	75 Ω RT	3	26 DC 110 DC 115 AC	360-11892-18 360-11892-40 360-11892-51	360-11892-19 360-11892-41 360-11892-52	360-11897-18 360-11897-40 360-11897-51	360-11897-19 360-11897-41 360-11897-52	
	95 Ω RT	3	26 DC 110 DC 115 AC	360-11892-20 360-11892-42 360-11892-53	360-11892-21 360-11892-43 360-11892-54	360-11897-20 360-11897-42 360-11897-53	360-11897-21 360-11897-43 360-11897-54	
	TRANS	4	26 DC 110 DC 115 AC					360-11892-22 360-11892-44 360-11892-55
N	SH	1	26 DC 110 DC 115 AC	360-11890-12 360-11890-34 360-11890-45	360-11890-13 360-11890-35 360-11890-46	360-11895-12 360-11895-34 360-11895-45	360-11895-13 360-11895-35 360-11895-46	
	NS	2	26 DC 110 DC 115 AC	360-11890-14 360-11890-36 360-11890-47	360-11890-15 360-11890-37 360-11890-48	360-11895-14 360-11895-36 360-11895-47	360-11895-15 360-11895-37 360-11895-48	
	50 Ω RT	3	26 DC 110 DC 115 AC	360-11890-16 360-11890-38 360-11890-49	360-11890-17 360-11890-39 360-11890-50	360-11895-16 360-11895-38 360-11895-49	360-11895-17 360-11895-39 360-11895-50	
	75 Ω RT	3	26 DC 110 DC 115 AC	360-11890-18 360-11890-40 360-11890-51	360-11890-19 360-11890-41 360-11890-52	360-11895-18 360-11895-40 360-11895-51	360-11895-19 360-11895-41 360-11895-52	
	95 Ω RT	3	26 DC 110 DC 115 AC	360-11890-20 360-11890-42 360-11890-53	360-11890-21 360-11890-43 360-11890-54	360-11895-20 360-11895-42 360-11895-53	360-11895-21 360-11895-43 360-11895-54	
	TRANS	4	26 DC 110 DC 115 AC					360-11890-22 360-11890-44 360-11890-55

COIL CHARACTERISTICS

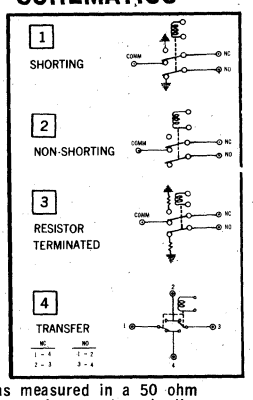
@ 20°C

Nominal Voltage	Operating Range	Resistance, ohms ±10%
26 DC	20 - 32	260 ohms
110 DC	85 - 130	5100 ohms
115 AC (50 - 400 Hz)	90- 130	1500 ohms thru diodes

ELECTRICAL CHARACTERISTICS

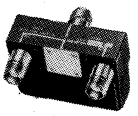
Conn.	Term.	Typical VSWR (Frequency Gc) .03	0.2	0.4	1.0	2.0	4.0	6.0	8.0	Typical Crosstalk - db (Frequency Gc) .03	0.2	0.4	1.0	2.0	4.0	6.0	8.0
BNC	SH	1.03	1.06	1.08	1.10	1.20	1.25	1.30	1.35	70	66	60	53	42	35	25	15
	NS	1.03	1.06	1.08	1.10	1.21	1.27	1.31	1.35	68	64	58	51	40	33	22	15
	50 Ω RT	1.03	1.06	1.08	1.14	1.25	1.50	—	—	40	35	31	24	17	14	—	—
	75 Ω RT	1.03	1.06	1.08	1.14	1.25	1.50	—	—	40	35	31	24	17	14	—	—
	95 Ω RT	1.03	1.06	1.08	1.14	1.25	1.50	—	—	40	35	31	24	17	14	—	—
	TRANS	1.05	1.08	1.10	1.20	1.50	—	—	—	45	38	32	24	17	—	—	—
TNC	SH	1.03	1.06	1.08	1.10	1.20	1.25	1.30	1.35	70	66	60	53	42	35	25	15
	NS	1.03	1.06	1.08	1.10	1.21	1.27	1.31	1.35	68	64	58	51	40	33	22	15
	50 Ω RT	1.03	1.06	1.08	1.14	1.25	1.50	—	—	40	35	31	24	17	14	—	—
	75 Ω RT	1.03	1.06	1.08	1.14	1.25	1.50	—	—	40	35	31	24	17	14	—	—
	95 Ω RT	1.03	1.06	1.08	1.14	1.25	1.50	—	—	40	35	31	24	17	14	—	—
	TRANS	1.05	1.08	1.10	1.20	1.50	—	—	—	45	38	32	24	17	—	—	—
N	SH	1.03	1.04	1.07	1.10	1.15	1.18	1.20	1.25	70	66	60	53	42	35	25	15
	NS	1.03	1.04	1.07	1.10	1.17	1.20	1.22	1.25	68	64	58	51	40	33	22	15
	50 Ω RT	1.03	1.05	1.08	1.12	1.18	1.50	—	—	41	35	31	24	17	14	—	—
	75 Ω RT	1.03	1.05	1.08	1.12	1.18	1.50	—	—	39	32	30	23	16	14	—	—
	95 Ω RT	1.03	1.05	1.08	1.12	1.18	1.50	—	—	37	31	29	22	15	14	—	—
	TRANS	1.05	1.10	1.15	1.20	1.50	—	—	—	45	38	32	24	17	—	—	—

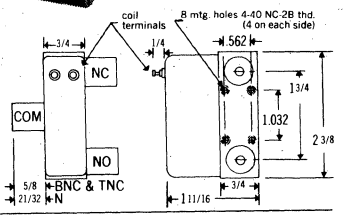
SCHEMATICS



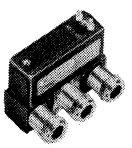
NOTE: High frequency electrical characteristics are typical values (not maximum) as measured in a 50 ohm circuit and may be used for most design analyses. For more exacting applications, maximum values in the frequency range may be obtained upon request. SWR measured to common with a matched 50 ohm termination. **For additional specifications request Amphenol RF Switches Catalog SS-1.**

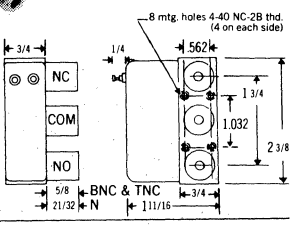
A SPDT



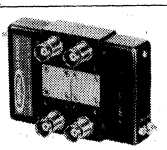


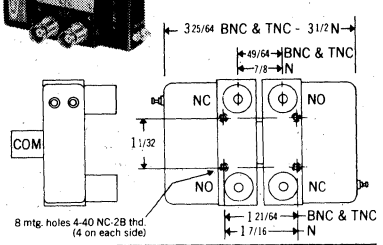
B SPDT



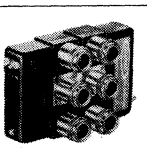


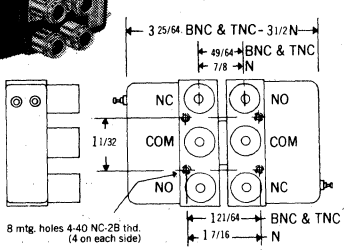
C DPDT



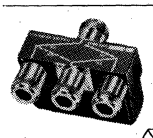


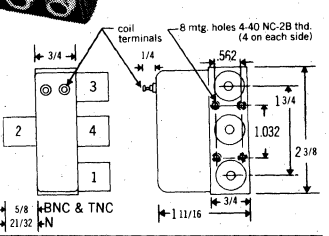
D DPDT





E TRANSFER





AMPHENOL RF SWITCHES

AMPHENOL
THE BUNKER-RAMO CORPORATION

HIGH ISOLATION MICROWAVE SWITCHES

DESCRIPTION

These compact coaxial switches, with superior isolation characteristics over its entire zero to 12.4 GHz operating range, are particularly suitable in applications where crosstalk interference must be kept to an absolute minimum.

Amphenol's Series 303 units described here represent a few of the variations available. Other connector types, auxiliary contacts, and hermetically sealed units as well as transfer types in both the miniature and standard sizes are also available. Please contact us for additional information and specifications.

CHARACTERISTICS

ELECTRICAL

Frequency range	0-12.4 GHz
Characteristic impedance	50 ohms
Crosstalk (isolation)	60 db min. @ 12.4 GHz
SWR	1.5:1 max. @ 12.4 GHz
Insertion loss	0.5 db maximum
Contact resistance	60.0 milliohms
RF power rating (power off during switching)	100 watts @ 1 GHz
High RF voltage rating	1000 volts peak @ 60 Hz
Switching time	operate: 15 ms max. release: 10 ms max.

MECHANICAL

Mechanical life	1,000,000 cycles min.

ENVIRONMENTAL

Characteristics are in accordance with applicable portions of MIL-S-3928B.

NOTE —
Other voltages and connectors are available as well as indicator light circuit.

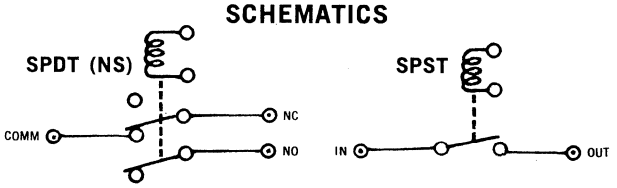
FUNCTIONS AND PART NUMBERS

Connector	Coil Volts	SPDT (with cover) Outline Dwg. A Fail-Safe	SPDT (with cover) Outline Dwg. A Latching	SPDT (Economy Version) Outline Dwg. C
OSM△/BRM	6 DC	303-10179-1	303-10179-21	303-10116-1
	12 DC	303-10179-2	303-10179-22	303-10116-2
	26 DC	303-10179-3	303-10179-23	303-10116-3
	48 DC	303-10179-4	303-10179-24	
	120 DC	303-10179-5	303-10179-25	
	115 AC	303-10179-6	303-10179-26	303-10116-6

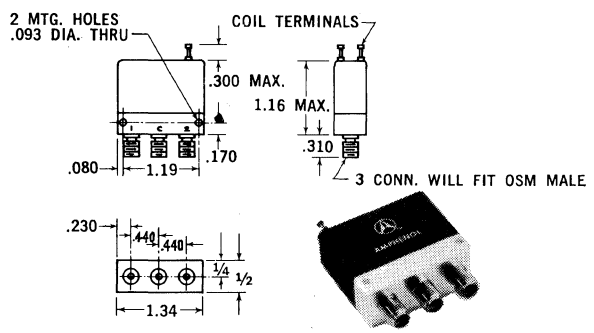
Connector	Coil Volts	SPDT (with cover) Outline Dwg. B Fail-Safe	SPDT (with cover) Outline Dwg. B Latching	SPST (Shutter) Outline Dwg. D
TNC	6 DC	303-10168-1	303-10168-21	
	12 DC	303-10168-2	303-10168-22	
	26 DC	303-10168-3	303-10168-23	303-10969
	48 DC	303-10168-4	303-10168-24	
	120 DC	303-10168-5	303-10168-25	
	115 AC	303-10168-6	303-10168-26	
N	6 DC	303-10167-1	303-10167-21	
	12 DC	303-10167-2	303-10167-22	
	26 DC	303-10167-3	303-10167-23	
	48 DC	303-10167-4	303-10167-24	
	120 DC	303-10167-5	303-10167-25	
	115 AC	303-10167-6	303-10167-26	

△ Registered trademark of Omni-Spectra, Inc.

SCHEMATICS



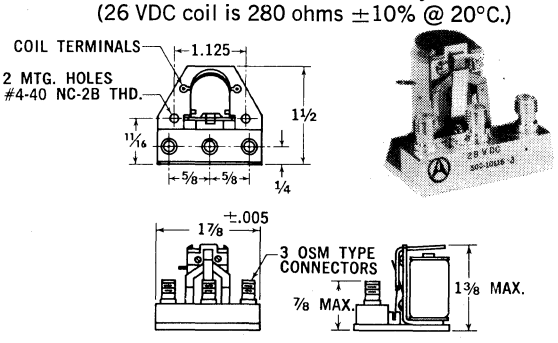
OUTLINE DWG. A SPDT (Miniature)



(26 VDC coil is 165 ohms ±10% @ 20°C.)

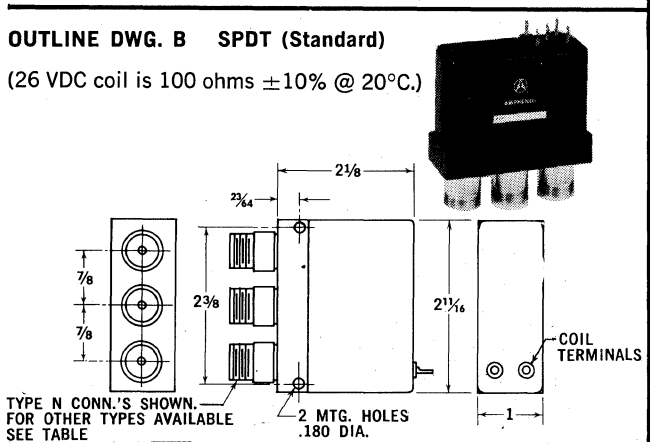
OUTLINE DWG. C SPDT (Min. Economy)

(26 VDC coil is 280 ohms ±10% @ 20°C.)



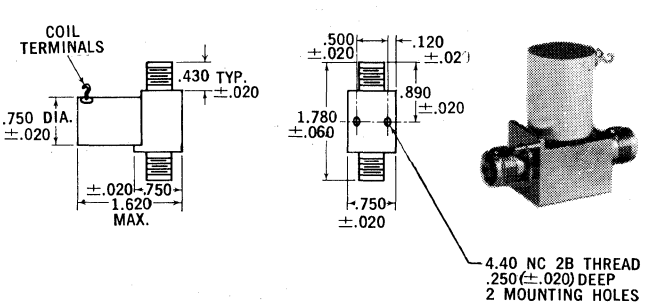
OUTLINE DWG. B SPDT (Standard)

(26 VDC coil is 100 ohms ±10% @ 20°C.)



OUTLINE DWG. D SPST (Standard)

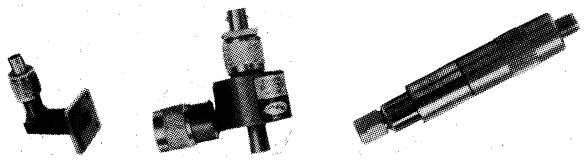
(26 VDC coil is 135 ohms ±10% @ 20°C.)



AEL

CRYSTAL VIDEO DETECTORS DIODES/MOUNTS

☐ **STANDARD DETECTORS**



Each of these detectors is designed to work with a specific AEL silicon point-contact diode. Careful mount design achieves an overall detection sensitivity closely approaching the theoretical diode sensitivity (while preserving uniform response over the specified bandwidth.)

Diodes are normally not supplied with these particular detector mounts. The standard AEL diodes recommended can be ordered by number, stocked, and used interchangeably without the need for special selection.

COAXIAL INPUT — 0.05 to 11 GHz

BROADBAND
Typical Tangential Sensitivity @ 2 MHz Bandwidth (—dbm): 50

OCTAVE BAND
Typical Tangential Sensitivity @ 2 MHz Bandwidth (—dbm): 52 to 56

NARROW BAND
Typical Tangential Sensitivity @ 2 MHz Bandwidth (—dbm): 54 min. (@ 4 MHz bandwidth with 4 K video load)

WAVEGUIDE INPUT — 8.2 to 40.0 GHz

Typical Tangential Sensitivity @ 2 MHz Bandwidth: 48 to 52

☐ **SPECIAL-PURPOSE DETECTORS**

Diodes are included with all of these special-purpose detectors. Diodes and mounts are carefully matched to give optimum performance in specific applications.

Most models can be custom engineered for frequency ranges other than those listed, and can be qualified to common MIL Specs.

MATCHED PAIRS FOR TRACKING — 2.60 to 5.15 GHz
Min. Tangential Sensitivity @ 2 MHz Bandwidth (—dbm): 51-52

MINIATURE NARROW-BAND DETECTORS — 0.10 to 4.40 GHz
Min. Tangential Sensitivity @ 1 MHz Bandwidth (—dbm): 55 to 58

MINIATURE DETECTORS — 1.0 to 18.0 GHz
Typical Tangential Sensitivity @ 2 MHz Bandwidth (—dbm): 46 to 53

DIODES for Standard Detectors
Test Frequency GHz: 5 to 33. Tangential Sensitivity* (—dbm): 50 to 56

*Maximum theoretical sensitivity in a perfectly matched lossless system with 2 MHz video bandwidth.

Send us your requirements

HYBRID & MICROWAVE INTEGRATED CIRCUITS

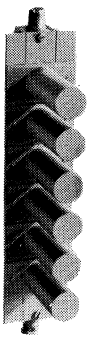
Thin/Thick Film Hybrid Circuits DC — 500 MHz

Standard & Custom from design through production. Standard circuits include video preamps, IF & RF Amps, VHF/UHF Receivers, Ring Counters, etc.

Microwave IC's

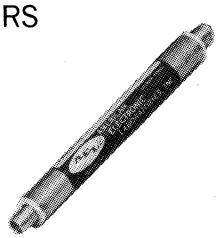
Mixers, Oscillators, Detectors, Switches, Limiters, Filters, etc. including sub-assemblies such as front ends and paramps.

FILTERS



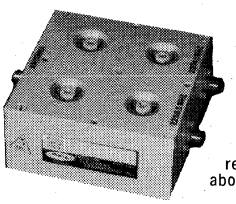
BAND REJECT FILTER 40 MHz TO 4 GHz SERIES FRL AND FRN

Series FRL and FRN are band reject filters using sectional construction techniques. Standard filters utilize 4 sections with minimum rejection levels of 60 db and passband bandwidths of 2%. Additional sections provide rejection levels of up to 100 db. Narrow band units (as narrow as 0.5%) and tunable versions are also offered. Tuning ranges of up to 40% between 40 MHz and 500 MHz and up to an octave above 500 MHz are obtainable.



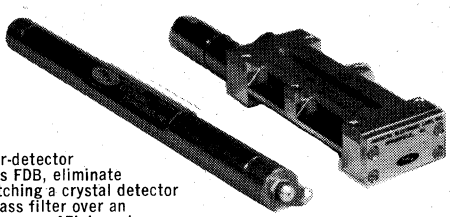
SERIES FBF 3000 TUBULAR BAND PASS FILTERS

The Series FBF 3000 Tubular Band Pass Filters operate over the frequency range from 100 MHz to 1000 MHz. These ⅜″ diameter filters feature performance essentially equivalent to presently available ½″ diameter designs. Standard designs are available with 3 db bandwidths from 2 to 25%.



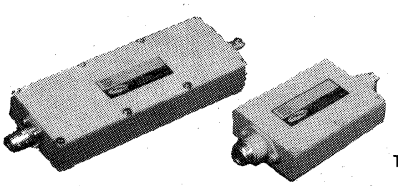
DIPLEXER SERIES FMN-250

The Series FMN-250 Diplexers are intended for missile applications, operating in the 2200 to 2300 MHZ telemetry band. The units are ruggedly constructed to meet severe environmental requirements and are sealed so that operation above 150,000 feet is possible.



INTEGRATED FILTER-DETECTORS SERIES FDB
Folded Coaxial
Straight Coaxial

AEL integrated filter-detector combinations, Series FDB, eliminate the problems of matching a crystal detector to a separate bandpass filter over an extended frequency range. AEL impedance matching techniques ensure maximum tangential sensitivity over the entire frequency band.



LUMPED CONSTANT HIGH PASS, LOW PASS AND BANDPASS FILTERS

The series FBA Bandpass Filters cover the frequency range from 2 MHz to 1000 MHz. The AEL FBA 1000 series filters are narrow band filters available with bandwidths ranging from 2 per cent to 20 per cent while AEL FBA 4000 series bandpass filters feature wider bandwidths from 20 per cent to two octaves.

The AEL FLA 1000 series and FLA 3000 series low pass filters are standard units operating from 2 to 1000 MHz. The FLA 1000 filters are eleven element units having Tchebycheff response, while the FLA 3000 filters are nine branch elliptical type units offering greater selectivity.

The AEL FHA 1000 series and FHA 3000 series high pass filters are available from 2 MHz to 750 MHz. The FHA 1000 series are eleven element Tchebycheff filters while the FHA 3000 series, offering greater selectivity, are nine branch elliptical filters.

AMERICAN ELECTRONIC LABORATORIES, INC.

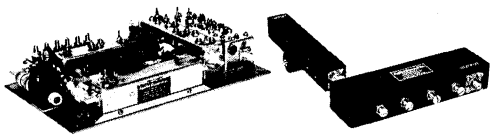
AEL

Main Offices: P.O. Box 552, Lansdale, Pa. 19446 (215) 822-2929 • TWX: 510-661-4976 • Cable: **AMERLAB**
Washington, D.C. Division: 6629 Iron Place, Springfield, Va. 22151 • (703) 354-5700

advances in RF techniques

In recent years, Applied Research Inc. has contributed notably to the state of the art with unique originations in RF components and equipments. Much must remain undiscussed; the production items below are representative.

BROADBAND FREQUENCY MULTIPLIERS



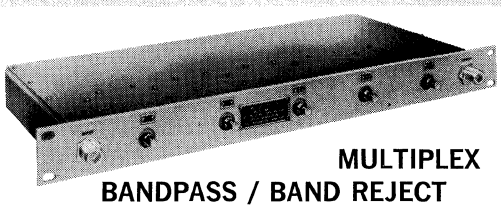
SIGNAL SOURCES / SYNTHESIZERS
VACUUM TUBES / SOLID STATE
VARACTOR / SNAP-ACTION DIODES / TRANSISTOR

5-15,000 MHz

A complete line of frequency multipliers operating up to 15,000 MHz has been developed and is presented by APPLIED RESEARCH. These units utilize solid state devices, vacuum tube devices or combinations of both.
Using the frequency multiplier as the basic tool, lines of Signal Sources, Frequency Synthesizers and Multiplier Chains are now available.

Some general characteristics are:

Frequency Range:	5 - 15000 MHz
Bandwidths:	up to 27%
Power Output:	up to 5 watts
Efficiency:	as high as 50%



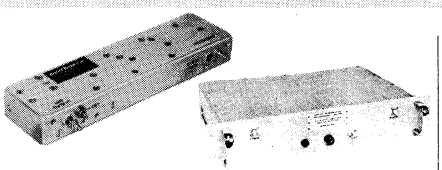
MULTIPLEX
BANDPASS / BAND REJECT
LOW POWER / HIGH POWER

FILTERS (5-12,000 MHz)

By applying advanced network design techniques, Filters have been developed operating in the frequency range up to 12,000 MHz with electrical performance approximating theoretical expectations. In addition to Bandpass, Band Reject and Multiplex Filters, advanced network designs are available for antenna couplers, Diplexers, Interdigital Filters and many other types.

Some general characteristics are:

Frequency Range:	5 - 12,000 MHz
Bandwidths:	up to several octaves
Insertion Loss:	as low as 0.25 dB
Power:	up to 3.5 kW(cw)
Band Reject Notches:	as narrow as ¼ % fo
Band Reject Attenuation:	as great as 75 dB



AMPLIFIERS

SOLID STATE VACUUM TUBE

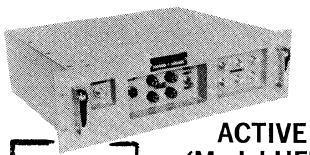
APPLIED RESEARCH presents an integrated line of RF amplifiers in both solid state and vacuum tubes for operation in the frequency spectrum up to 3000 MHz. Their truly exceptional performance features many advanced characteristics. Units are also available in weatherproof cases for antenna mounting or other outdoor applications.

Included within this line are:
Phase-matched amplifiers / Low noise amplifiers / Broadband amplifiers / Power amplifiers / Linear and high dynamic range amplifiers /

Some general characteristics are:

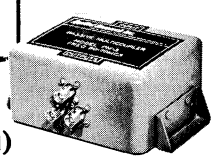
Frequency Range:	**up to 3000 MHz**
Bandwidths:	**up to multiple octaves**
Gains:	**up to 120 dB**
Phase Matching:	**to within 1° over an octave**
Noise Figures:	**as low as 1.5 dB**
Power Output:	**up to 20 watts**

MULTICOUPLERS



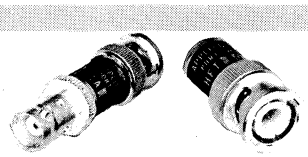
ACTIVE (Model HFM)

3-4000 MHz



HYBRID (Model PM)

Model HFM and PM Multicouplers provide the ultimate in performance and sensitivity in signal distribution.
Model HFM Active Multicouplers, by combining filter networks and active elements, feature multiple outputs, broad bandwidths (if desired), low noise and high dynamic range.
Model PM Hybrid Multicouplers offer compact size, minimal insertion loss, broad bandwidths (if desired) and low cost.



FIXED PAD ATTENUATORS & TERMINATONS

DC—3GHz

FOR TYPES BNC, TNC
C, N & OSM CONNECTORS

APPLIED RESEARCH presents an integrated line of fixed pad attenuators, terminations and impedance-matching transformers. These products provide means for rapid and accurate division of voltages over the frequency range of DC to 3GHz, and for the matching of different impedances with minimum loss over a broad frequency band. The unit cost is within the practical price range of the large and small equipment user, as well as the research and experimental user.

Some general characteristics are:

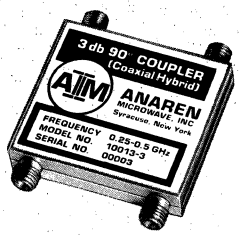
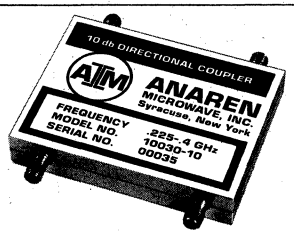
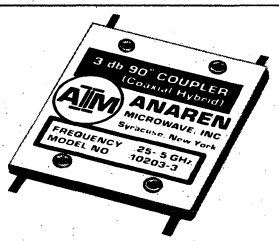
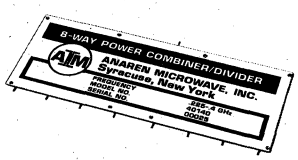
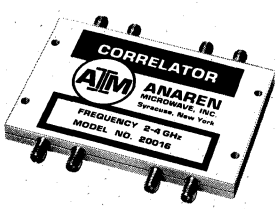
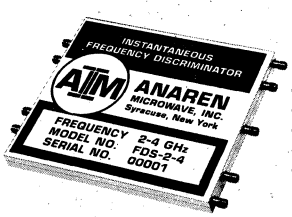
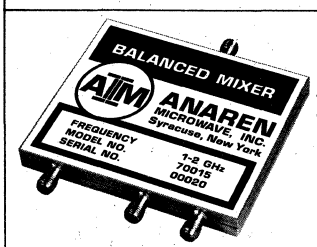
Frequency Range:	DC—3GHz
VSWR:	1.25:1
Attenuation Accuracy:	±0.5 dB
Impedances (nominal):	50, 75, 90 ohms
Attenuation values:	1, 2, 3, 4, 6, 10, 12, 15 20 dB (standard)

SYSTEMS RF COMPONENTS

APPLIED RESEARCH INC.

76 SOUTH BAYLES AVENUE PORT WASHINGTON, NEW YORK 11050
PHONE: 516 883-5700 TWX: 510-223-0822

ANAREN MICROWAVE, INC. PRODUCT DIRECTORY

PRODUCT	DESCRIPTION	TYPICAL OCTAVE L-BAND SPECIFICATIONS
	**3 db 90° COUPLERS (COAX HYBRIDS)**	
	• 60 MHz – 18 GHz • octave, multi-octave bandwidths • rugged, reliable stripline circuit • withstands severest environments	• VSWR: 1.1 • isolation: 32 db • insertion loss: 0.15 db • coupling: 3 db ±0.4 db • power rating: 200W avg., 5 KW peak
	**10 db, 20 db DIRECTIONAL COUPLERS**	
	• 60 MHz – 12.4 GHz • octave, multi-octave bandwidths • other coupling values available • dual directional designs available	• directivity: 25 db • coupling variation: ±1 db • VSWR: 1.1 • insertion loss: 0.15 db • power rating: 200W avg., 5 KW peak
	**ULTRA-MINIATURE 3 db 90° COUPLERS**	
	• stripline, solder-tab design • 20 MHz – 12.4 GHz • standard octaves, plus specials • operates over −60°C to +185°C	• VSWR: 1.1 • isolation: 32 db • insertion loss: 0.15 db • power rating: 200W avg., 5 KW peak • 3/100 cu. in.; 1/30 ounce
	**HIGH ISOLATION POWER AMPLIFIER DIVIDERS AND COMBINERS**	
	• 4, 8, 16-way octave designs • 0.125-8 GHz – also specials • ultra-miniature 225-400 MHz designs • low input and output VSWR – independent of amplifier match	8:1 Power Combiner: • insertion loss: 0.4 db • input VSWR: 1.1 (independent of amplifier impedance) • isolation: 28 db • power rating: 200W avg., 5 KW peak • size: 4″ x 1.50″ x 0.07″
	**CORRELATORS**	
	• RF/RF 60 MHz – 18 GHz in octaves • RF/Video 60 MHz – 12.4 GHz • RF/RF miniature, stripline, solder-tab 60 MHz – 8 GHz • versatile application in phase measurement and adaptive circuits	• VSWR: 1.3 • isolation: 18 db • insertion loss: 1.0 db • ampl. balance: ±1.0 db • phase linearity: ±6°
	**INSTANTANEOUS FREQUENCY DISCRIMINATORS**	
	• wideband electronic warfare applications • FM communication applications • lab frequency monitoring • exceptional linearity • RF or video outputs	• VSWR: 1.4 • linearity: ±7° • insertion loss: 1.0 db • size: 8″ x 8″ x 1/2″
	**MIXERS**	
	• single-ended, balanced • octave bandwidths 0.25-12.4 GHz • IF output DC – 400 MHz • excellent VSWR, isolation • stripline solder-tab options • integrated or replaceable diodes	Balanced mixer configuration: • VSWR: 1.2 • RF/LO isolation: 30 db • conversion loss: 6 db • noise figure: 7.0 db • L.O. power: 8 MW

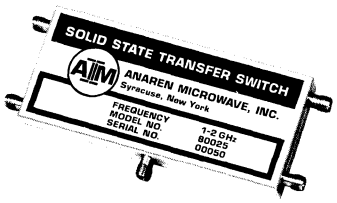
EXCELLENCE IN MICROWAVE SIGNAL SENSING / PROCESSING

DESCRIPTION	TYPICAL OCTAVE L-BAND SPECIFICATIONS	PRODUCT

SOLID STATE SWITCHES

- transfer, SPDT, SPNT, DPNT types
- octave bandwidths 0.125-12.4 GHz
- drivers available
- low VSWR under all switching conditions
- stripline solder-tab option

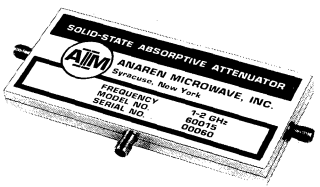
- isolation: 30 db
- insertion loss: 0.9 db
- switching speed: 50 nsec.
- power rating 5 watts CW
- input VSWR: 1.25



SOLID STATE VARIABLE ATTENUATORS/MODULATORS

- octave bandwidths 60 MHz-12.4 GHz
- multi-octave bandwidths available
- excellent match
- small size, light weight
- stripline solder-tab option

- VSWR: 1.2
- max. atten. per section: 30 db
- residual attenuation: 0.9 db
- switching speed: 50 nsec.
- power rating: 1/2 watt CW



DETECTORS

- octave bandwidths 0.125-12.4 GHz
- combined high sensitivity with excellent match
- matched pairs available

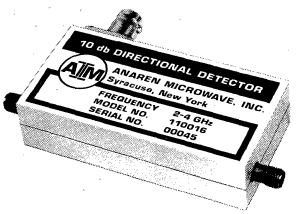
- VSWR: 1.5
- tangential sensitivity: −50 dbm
- frequency response: ±0.5 db
- sensitivity: 500 MV per MW



10 db, 20 db DIRECTIONAL DETECTORS

- 60 MHz – 12.4 GHz
- octave, multi-octave
- other coupling values available
- dual directional designs available

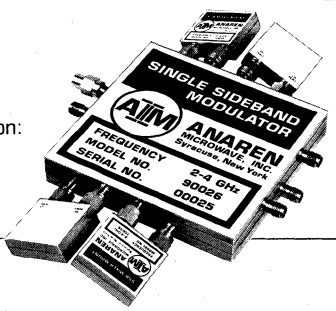
- directivity: 20 db
- VSWR: 1.2
- frequency response: ±0.3 db
- insertion loss: 0.25



SINGLE SIDEBAND MODULATORS

- octave bandwidth RF 0.225-12.4 GHz
- octave bandwidth IF 30 MHz-1 GHz

- carrier suppression: 15 db
- unwanted sideband suppression: 20 db
- conversion loss: 10 db



• Unique wideband sensors/processors • Custom subsystems for EW, radar, navigation, communications • New stripline solder-tab designs • Ultra-miniature size, lightweight • Computer controlled/ optimized designs • Exceptional wideband electrical performance • Laminated stripline construction • Precision, controlled manufacture • Outstanding ruggedness, reliability • New approaches to cost-effectiveness • Stock delivery/quick reaction capability based on—NEW CONCEPTS!

Order through our nearby representative or direct. Send for detailed specifications and applications information.

ANAREN MICROWAVE, INC.*

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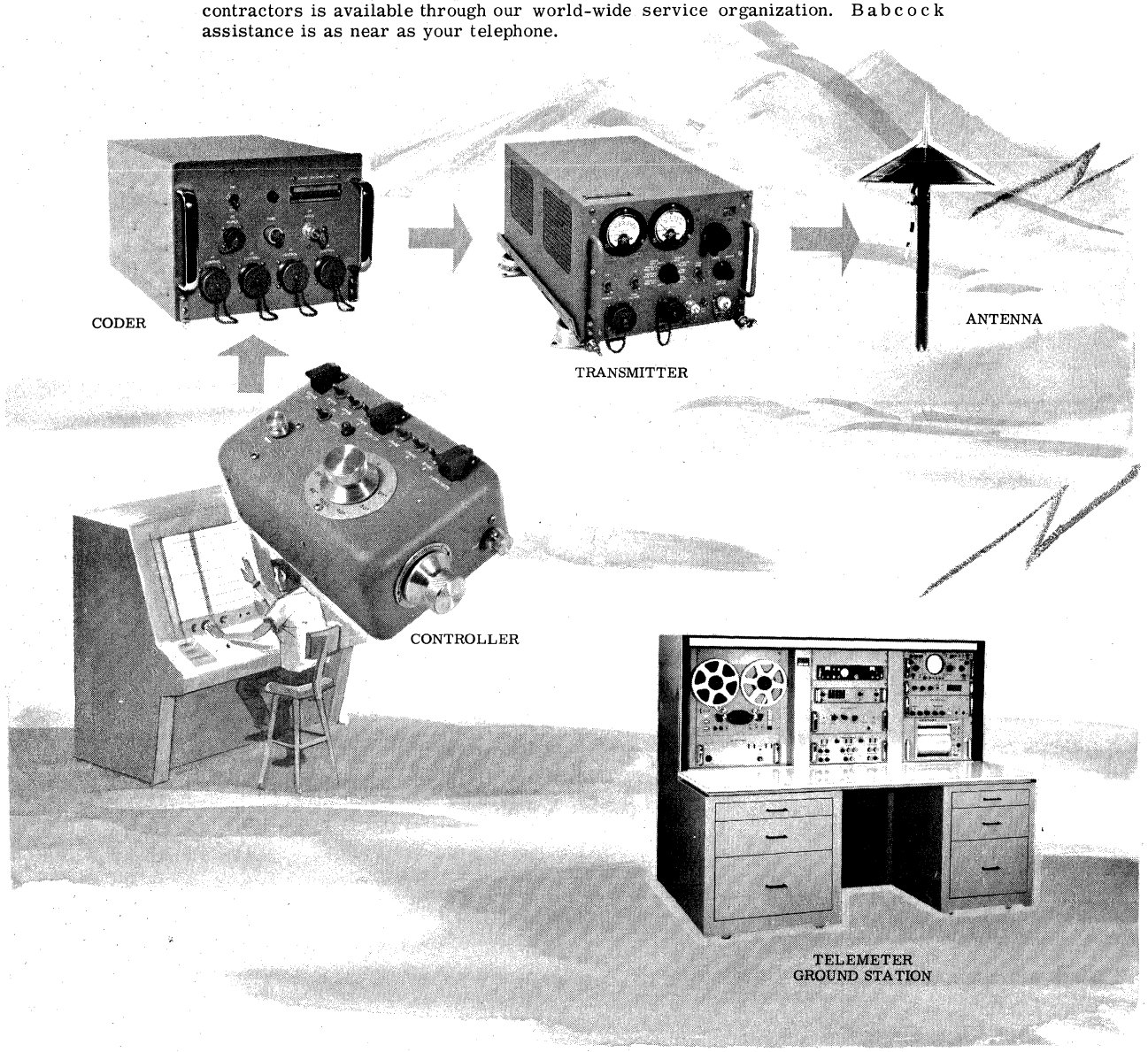
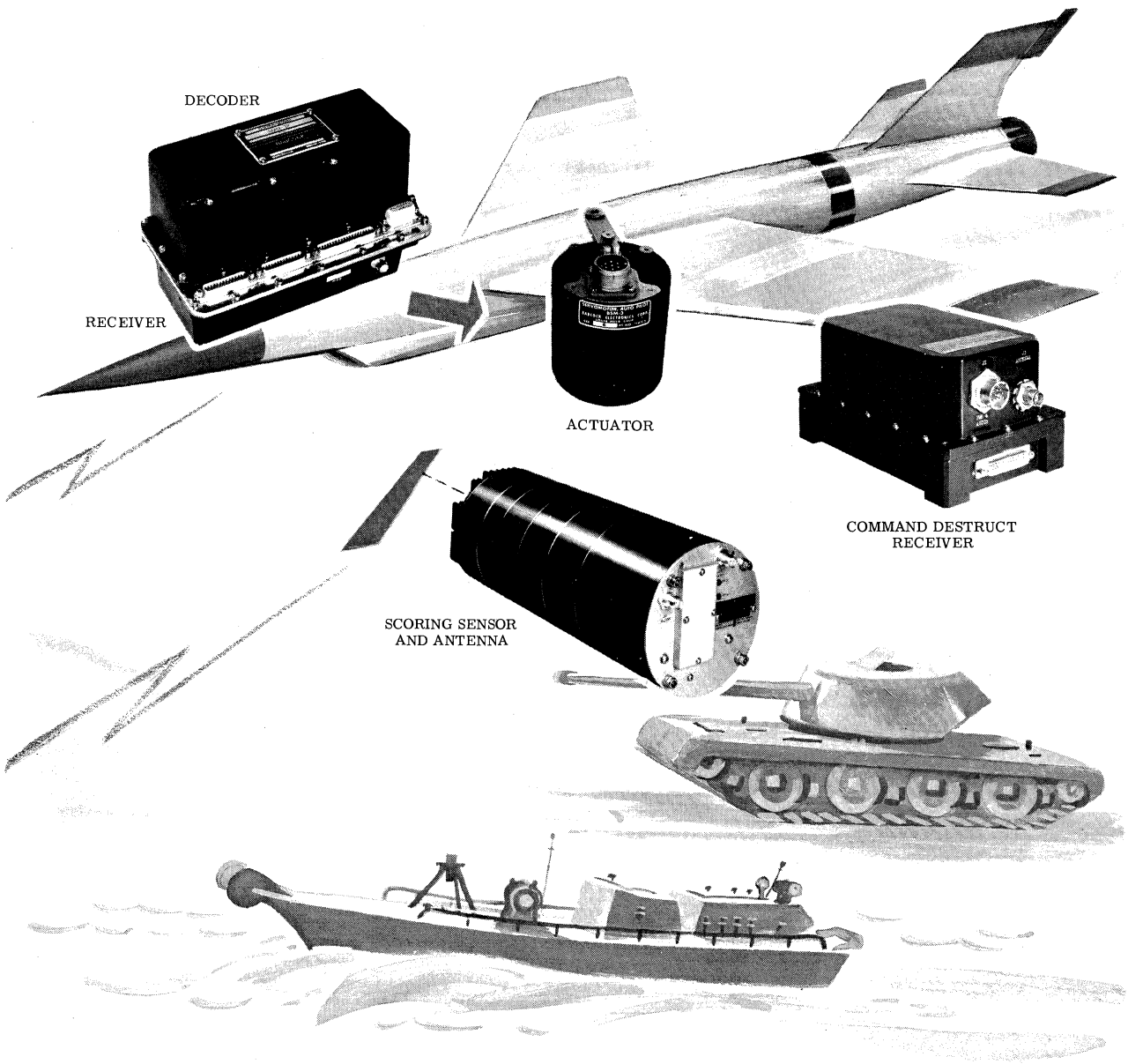
*TM Anaren Microwave, Inc.

Let Babcock SOLVE YOUR RADIO CONTROL SYSTEM PROBLEMS

whatever the mission

Babcock Electronic Systems Division is a pioneer in the remote control and guidance field. We currently specialize in the design and manufacture of quality electronic equipment and systems for remote radio control, range safety, electronic scoring (miss-distance indicators), telemetry, electronic warfare, and related instrumentation and accessories. Our products are used in industry as well as all branches of the Armed Forces. Babcock radio control equipment is in use directing unmanned vehicles ranging from space probes to patrol boats . . . Command-destruct systems, supplied by Babcock, safeguarding life and property during critical missile launch operations . . . . and the Atomic Energy Commission uses locomotives controlled through Babcock equipment during nuclear experiments. Wherever the need arises for specialized techniques and applications, Babcock is ready to accept the challenge. Application assistance to interested contractors is available through our world-wide service organization. Babcock assistance is as near as your telephone.





BABCOCK ELECTRONICS CORPORATION

A SUBSIDIARY OF ESTERLINE CORPORATION

ELECTRONIC SYSTEMS DIVISION

3501 HARBOR BLVD. COSTA MESA, CALIF. 92626

PHONE: (714) 540-1234 TWX 910-595-1517

You've found one source for:

CIRCULATORS & ISOLATORS

Model No.	Frequency Range (gc)	Type	RF Connectors
C3R21	4.4 - 5.0	3 Port	BRM
C4R96	8.2 - 10.0	4 Port	BRM
C3N28	2.75 - 4.0	3 Port	N
C4N94	4.4 - 5.0	4 Port	N
C5N03	5.4 - 5.9	5 Port	N
C2W35	4.4 - 5.0	Isolator	UG149A

DIRECTIONAL COUPLERS & HYBRIDS

Model No.	Frequency Range (mc.)	Coupling Attenuation (db)	RF Connectors
323R31	1 - 2 (gc)	3	BRM
323R62	4 - 8 (gc)	6	BRM
308N2	500 - 1000	20	Type N
313N3	300 - 2000	30	Type N
362A7	30 - 1000	70	1⅝" Flange
382A6	120 - 1000	60	3⅛" Flange

DC OUTPUT DIRECTIONAL COUPLERS

Model No.	Frequency Range (mc.)	Power Range (watts)	RF Connectors
596N2	1700 - 2400	0 - 4	Type N
263N5	2 - 30	0 - 60	Type N
576N6	28 - 1000	0 - 400	Type N
536.63	2 - 30	0 - 1200	Type LC
402A8	28 - 1000	0 - 4000	1⅝" Flange
442A9	28 - 1000	0 - 12000	3⅛" Flange

WAVEGUIDE DIRECTIONAL COUPLERS

Model No.	Frequency Range (gc)	Coupling Attenuation (db)	Overall Length—Inches
WL3A	1.12 - 1.70	30	4¾
WN3B	1.70 - 2.60	30	1⅞
WR4B	2.20 - 3.30	40	1⅞
WS4A	2.60 - 3.95	40	3⅝
WC5A	3.95 - 5.85	50	3⅝
WX6A	8.20 - 12.40	60	1⅞

DUMMY LOADS & TERMINATIONS

Model No.	Frequency Range (mc.)	RF Power Dissipation (watts)	RF Connectors
680R	0 - 10 (gc)	200 (mw)	BRM
601N	0 - 3000	5	N
634N	0 - 3000	150	N
674N	0 - 3000	400	N, 70 ohms
636N	0 - 3000	600	N
638A	0 - 2000	6000	3⅛" Flange

RF FILTERS & WAVEMETERS

Model No.	Frequency Range (gc)	Type	RF Connectors
FCTS504	3.4 - 3.6	Tunable BP	BRM
FCRS201	3.5	Band Reject	BRM
FCLB15B	980	Low Pass	1⅝" Flange
FCTA201	400 - 450	Tunable	TNC
FCTL213	1200 - 1400	Tunable	N
FIWE271	5.3 - 6.3	Wavemeter	C-MB

RF COAXIAL SWITCHES

Model No.	Frequency Range (mc.)	Type	RF Connectors
S21N373	0 - 3000	SPDT	N
S21R563	0 - 5000	SPDT	BRM
S21R383	0 - 5000	SPDT	BRM
S23R383	0 - 3000	DPDT	BRM
S54N473	0 - 3000	Transfer	N
S11N253	0 - 3000	Latching	N

RF WATTMETERS

Model No.	Frequency Range (mc.)	Power Range (watts)	RF Connectors
621N	1 - 100	0 - 120 (mw)	N
651N	25 - 1000	0 - 25, 100, 500	N
612A	44 - 1000	0 - 6000	3⅛" Flange
711N	8 - 1000	0 - 30, 75, 300	N
712N	25 - 1000	0 - 2.5, 5, 10	N
706N	28 - 1000	0 - 400	N

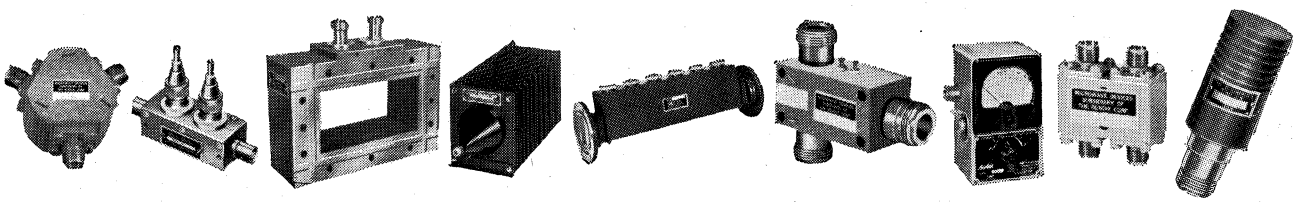
INTEGRATED DEVICES

Device	Model No.	Specifications
Triplexer	FCPC332	3 Channel, 4.7 to 4.9 gc; loss 1.5 db; VSWR 1.5
Coupler-Filter-Switch	CFSA391	200-400 mc., 1 vdc output, low pass SPDT
Dual Preselector	FCBS363	2 Channel, 3.4 to 3.7 gc; loss 1.5 db; VSWR 1.5
Frequency Multiplier	FMSE10	Input Freq. 2.74-3.35 gc, dblr., bdwth. 20%
Circulator-Coupler	C4CN036	4.4-5.0 gc, 4 pt. Cir.
Switch-Coupler	SC2NI83	4.2 gc, Transfer Swt., pwr. & VSWR Monitor

MINIATURE COMPONENTS

Model No.	Frequency Range (gc)	Type	RF Connectors
MDC101	1 - 4	D.C. Block	BRM
MMT104	4 - 8	Monitor Tee	BRM
AFR03	0 - 5	Attenuator	BRM
AMN92	4.4 - 5.0	Variable Atten.	N
PMR03	5.4 - 6.5	Phase Shifter	BRM
PEN32	5.4 - 5.9	Phase Shifter	N

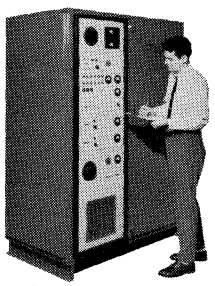
They're all available for fast delivery. Need a special microwave device? We're equipped to modify or build to meet your specific requirements. Write or call for our new catalog: Microwave Devices Division, The Bendix Corporation, Hurricane Rd., Franklin, Indiana 46131. Phone: (317) 736-6136.



Bendix Electronics

HIGH POWER

Pulse Modulators
Pulse Generators
D.C. Supplies
Transmitters

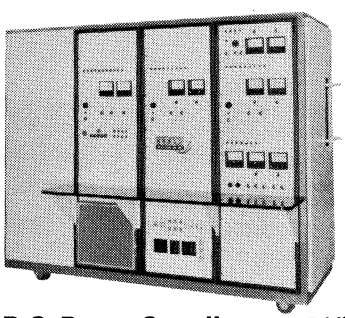


Model 698-L2 Power Amplifier used in FM tropospheric systems provides 1 KW in the 610-985 MHz band.

Cober Electronics, Inc., manufactures a very broad line of High-Power Products. These are assembled to customers' specifications from packaged modules and standard Cober designs, making it as easy and as economical to buy custom equipment as it is to buy standard units. The categories below illustrate the range within which these products fall.

Transmitters and Power Amplifiers
Troposcatter & Satellite Communications & Test

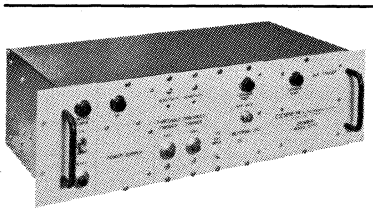
Cober transmitters are supplied at powers from several hundred watts up to megawatts in the UHF and Microwave frequency areas. They form the heart of troposcatter and earth-satellite transmitting systems or are designed as test sets for antenna-pattern studies, R.F.I. susceptibility measurements, and microwave component testing.



Model 1421 Power Supply drives exotic Crossed Field Amplifier microwave tubes. It contains five supplies in floating arrangement, is highly regulated, and has two modulators for pulsed modes.

D.C. Power Supplies 5 KV to over a Million Volts

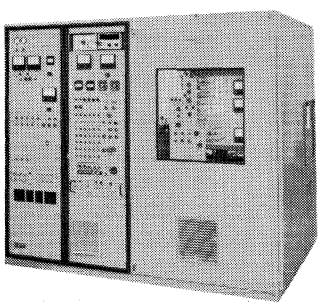
Industrial and Mil-spec DC supplies offer high regulation up to .001%. Multiple output units, with various supplies floating at high voltage are a specialty. Unregulated brute force units that furnish large amounts of power at minimum cost are also available.



Model ST-77 Electronic Crowbar acts within 5 microseconds of an arc or fault to protect valuable microwave tubes and loads.

High Power Components

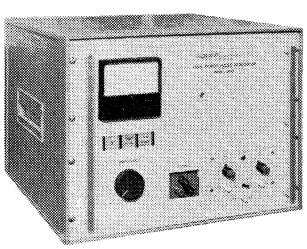
Specialized high power components and modules are available for customers building or modifying their own systems. These include:
• Electronic Crowbars • Electronic Regulators (up to .001% regulation) • Pulse Current Viewing Transformers • High Voltage Discharge Solenoids.



Model 1445 85 KV Grid Modulator powers T.W.T.'s. Pulse width is variable from 1 to 10 microseconds and rep rate adjustable to over 20KC.

Pulse Modulators 5 KW to 100 Megawatts

Cober's high-power modulators drive a wide range of microwave and power tubes, as well as such devices as laser and plasma tubes. Units are available from a few kilowatts to over 100 megawatts with pulse widths as narrow as 25 nanoseconds to long pulses of thousands of microseconds. State-of-the-art rise times and high rep rates are our specialty. Full mil-spec, solid-state modulators are supplied for systems use, and soft-tube and hard-tube units are supplied for laboratory and industrial applications.



Model 605P 24 KW Pulse Generator, available from stock $3,990.

Pulse Generators 24 KW

Cober's line of pulse generators is characterized by their pulse fidelity and flexibility. The Model 605P shown is a 24 Kw Pulse Generator with a rise time of 20 nanoseconds and pulse widths variable from 50 nanoseconds to more than a millisecond at repetition rates from a single shot to 1 MHz. It is used for driving LSA devices, Gunn diodes, microwave tubes, Pockel cells, and general laboratory applications. Other pulse generators in Cober's line provide pulse widths to D.C. or offer unique characteristics, such as built-in bias supplies to allow convenient use as a grid pulser.

Send us your high power problems; our applications engineering department will give you a speedy and effective response.

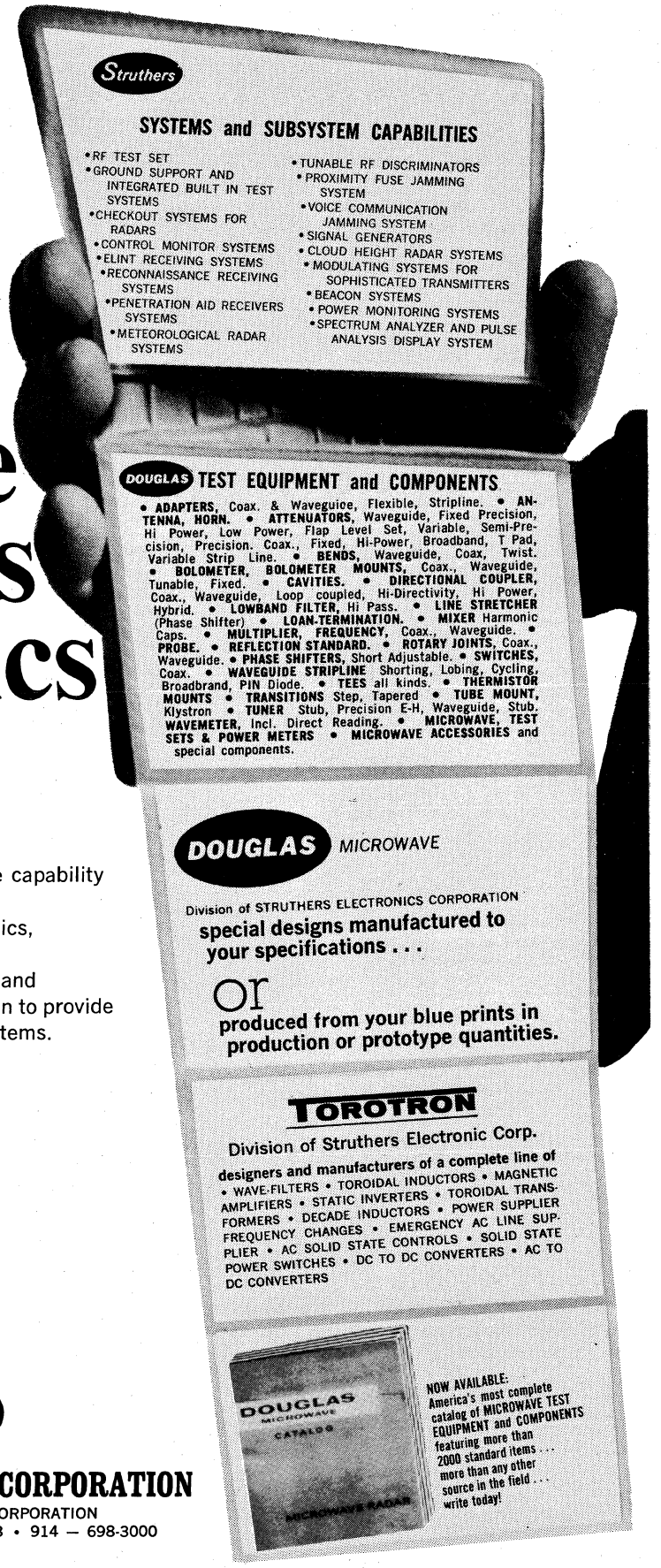
The High-Power People

COBER ELECTRONICS, INC.

7 Gleason Avenue, Stamford, Connecticut 06902, Tel: (203) 327-0003

Meet the Struthers electronics family.

Struthers Electronics Corporation has the capability to answer the latest demands.
The Douglas division of Struthers Electronics, using microwave module concepts, has developed integrated microwave systems and subsystems. Now, we have the organization to provide you with both microwave modules and systems. Please send us your requirements.



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THIN FILM PRECISION RESISTORS for MICROWAVE APPLICATIONS

A newly developed Ionized Plasma coating technique enables Struthers to offer Thin Film Coating to custom requirements. **METALLIC** and **NONMETALLIC** materials can be deposited **ON ANY SUBSTRATE,** to tolerances and uniformity not heretofore obtainable.

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AREAS OF APPLICATIONS:

MICROWAVES • Film resistors and capacitors.

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Complete machine shop and grinding facilities are available for special applications or production requirements.

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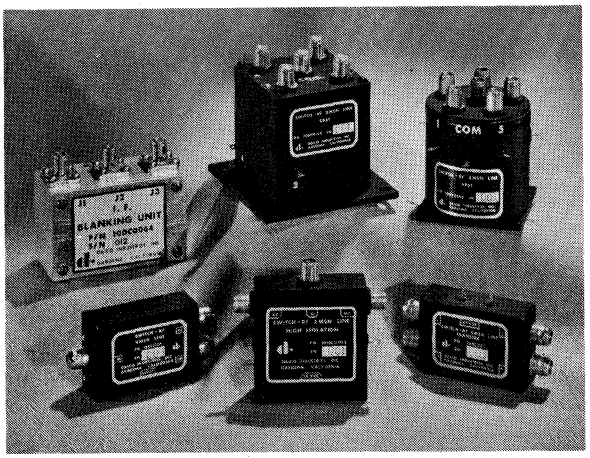
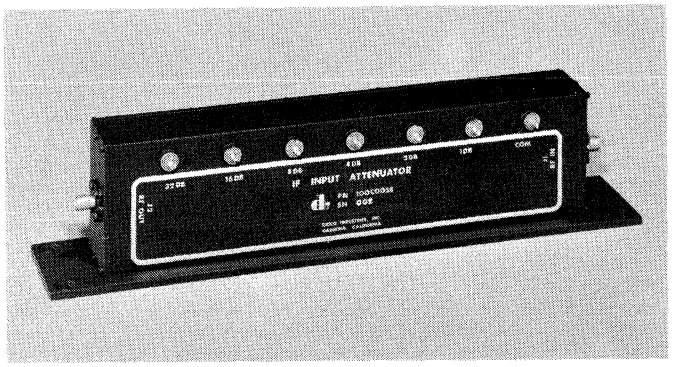
DAICO INDUSTRIES, INC.

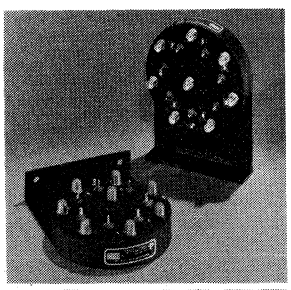
RF SWITCHES · ATTENUATORS AIRCRAFT EQUIPMENT

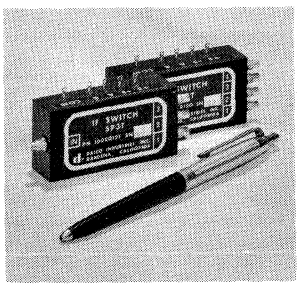


MINIATURE COAXIAL SWITCHES
DC — 1000 MHz
Remotely controlled — Fail Safe
For rugged lightweight systems
To seven throw and transfer
Low actuating power
High Isolation

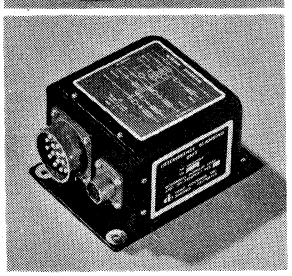
STEP ATTENUATORS
Remote applications
Fast switching
Frequencies through "S" band
Low actuating power
Programmable
Attenuation levels through 120 db



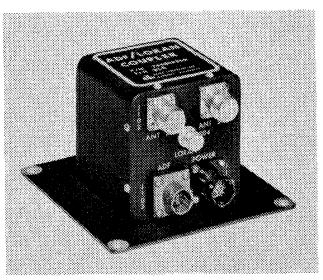




SOLID STATE SWITCHES
Multi-position, antenna
High Power
Receiver STC
With binary decoding and drivers
Matched attenuator



INTERFERENCE BLANKING UNIT
Provides blanking of sensitive ECM receivers. Unusual packaging allows new pulse forms or additional channels.



ADF/LORAN COUPLER
Permits simultaneous use of ADF and Loran receivers with Direction Finding Sense antenna without mutual interference.

SOLID STATE/REED RF SWITCHES, ATTENUATORS, AIRCRAFT EQUIPMENT

DAICO INDUSTRIES, INC.

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DYNOGRAPHIC Electronic Corporation

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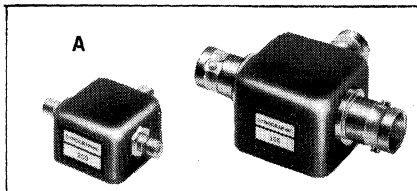
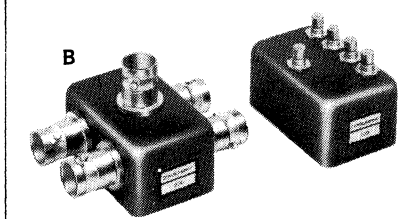
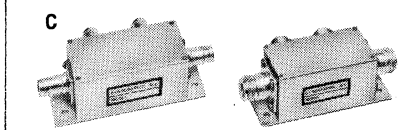
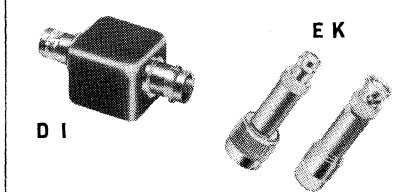
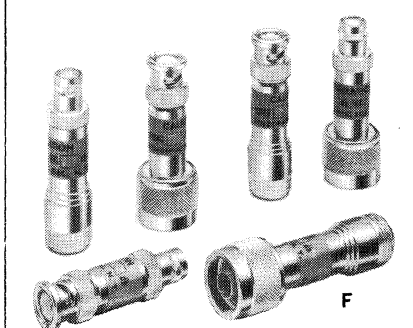
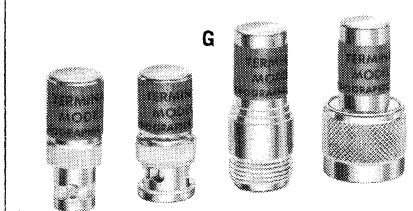


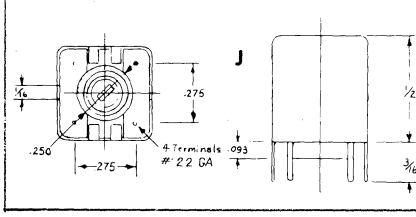












(A) TWO WAY POWER DIVIDER — QUADRATURE 90° HYBRIDS — 180° MAGIC "T"

Description
Dynographics quality miniature and subminiature wide band reactive power dividers are designed for high isolation with excellent amplitude and phase characteristics.
Application:
Signal division or summation matching and isolation circuitry for balanced and unbalanced mixers.
A wide range of connectors can be provided with BNC and Selectro type connectors normally in stock.
Please specify style or type of connectors when ordering.

Specifications

Frequency MHz	2-100	20-200
Model	**100**	**200**
Isolation db	30	30
Phase Balance	1°	1°
Amp. Balance db	0.2	0.2
Loss db	0.3	0.3
Power Watts	1.0	1.0
VSWR	1.3	1.3

Size ..... Length 1", Width 1", Ht. 3/4"
Weight ..... BNC or TNC, 1.4 oz., Selectro 0.6 oz.

(B) FOUR WAY POWER DIVIDER

Description
Dynographics quality miniature and subminiature wide band reactive power dividers are designed for high isolation with excellent amplitude and phase characteristics.
Application:
Signal division or summation matching and isolation circuitry for balanced and unbalanced mixers.
A wide range of connectors can be provided with BNC and Selectro type connectors normally in stock.
Please specify style or type of connectors when ordering.

Specifications

Model	**4-32**	**4-100**	**4-200**
Frequency MHz	2-32	10-100	20-200
Isolation db	30	30	30
Phase Balance	1°	1°	1°
Amp. Balance db	0.2	0.2	0.2
Loss db	0.5	0.5	0.5
Power Watts	1.0	1.0	1.0
VSWR	1.3	1.3	1.3

Sizes ..... Length 1 39/64", Width 1", Ht. 3/4"
Weight ..... BNC or TNC, 2.1 oz., Selectro 1.6 oz.

(C) DIRECTIONAL COUPLER

Description
Dynographic Electronics quality wide band, low loss Directional coupler with high directivity is now available with a 20db coupling factor. Model D20 couplers can be obtained with a wide ranbe of con-measuring both **incident and reflected power.** These coupler can be obtained with a wide range of connectors. The BNC, TNC and Type N are normally in stock.

Please specify styler or type of connectors when ordering.

Specifications

Frequency Range	2-50 MHz
Directivity	35db
Insertion Loss	0.3db Maximum
VSWR	1.09:1 Maximum
Input Power	1 watt
Coupling	20db
Coupling Flatness	±0.15db Maximum

Sizes incl. connector	**Length**	**Width**	**Height**
BNC or TNC	2 15/16"	1 31/32"	1 3/16"
Type N	4"	2"	1 7/16"

Weight
BNC or TNC ..... 5.0 oz.
Type N ..... 6.8 oz.

(D) L-C ELECTRIC WAVE FILTERS

Precise filters in the range of frequencies from Hz. to 300 MHz. may be designed and produced with accuracy. Modern network synthesis permits optimum network design with the minimum number of components. Dynographic can produce filter networks with the following characteristics: Elliptic Function, Butterworth, Chebyshev, Inverse Chebyshev, Butterworth Thompson and minimum phase shift filters.

(E) MINIATURE COAXIAL FILTERS:

Band pass low pass and high pass filters, designed to operate from 200 MHz to 10 GHz. These units are designed for sharp skirt, low insertion loss and low VSWR in the pass band.

(F) FIXED COAXIAL ATTENUATORS

Model FT50 achieves its broad frequency range using new high reliability components. These reliable inline attenuators are available at standard, or non standard values of attenuation. Each pad is calibrated at two frequencies; 10 MHz and 1000 MHz with measured values recorded on the body of the attenuator. All combinations of BNC, TNC, and N type attenuators are stock items although a wide range of additional connectors can be provided upon request.

★ 50 to 90 ohm minimum loss attenuators.

Please specify style or type of connectors when ordering.

Specifications

Attenuation Values	1 , 2, 3, 6, 10, 20db Standard
Average Power	1 watt
Impedance	50 Ohms
Nominal Loadlife	25% per year max.
Temp. Coeff	±100 PPM from —55°C to +125°C
Frequency Range	**DC to 2000 MHz**
VSWR	Less than 1.2:1 at 1000 MHz Less than 1.5:1 at 2000 MHz
Attenuation Accuracy	DC to 500 MHz ±0.25db DC to 1000 MHz ±0.5db DC to 2000 MHz ±1.0db
Calibration Accuracy	±0.1db

Connectors	**BNC-BNC**	**BNC-N**	**N-N**
Length	1 15/16"	2 7/32"	2 9/16"
Weight	.9 oz.	1.6 oz.	2.1 oz.

(G) FIXED TERMINATIONS

Description
Dynographic Electronics Model T-50 type termination designed to give low cost, reliable broad band operation. Usable from DC to 2000 MHz. These units are available from stock. Each termination is quality controlled and tested. A wide range of connector types can be provided with BNC, TNC and type N normally in stock.

Please specify style or type of connectors when ordering.

Specifications	**Gold Label**	**Silver Label**
Frequency	DC to 1000 MHz	DC to 1000 MHz
Max. VSWR	1.05	1.10
Power Watts	.5	.5
Temp. Coeff.	100 PPM from —55°C to +125°C	100 PPM from —55°C to +125°C
Nominal Load Life	25% per year max.	25% per year max.

Connector	**BNC**	**TNC**	**Type N**
Weight	.75 oz.	.75 oz.	1.5 oz.
Size	1 3/16"	1 3/16"	1 1/2"

(H) FREQUENCY GENERATION:

Divide, mix, multiply, amplify with low spurious and harmonic content.

(I) WIDE BAND TRANSFORMERS

2:1 and 4:1 Transformers can be used for Impedance Matching, Balanced Mixers, Phase Detectors, Antennas and interstage coupling. Frequency Range .1 MHz to 500 MHz.

(J) HI Q COIL MEET MIL-C15305

Variable miniature coils are available in standard values from .1μh to 100,000μh with Q values up to 150.

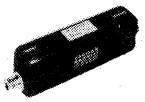
(K) DC BLOCKS AND INLINE CRYSTAL DETECTORS GOOD TO 4GMz

DYNOGRAPHIC Electronic Corporation
57 BLOOMINGDALE RD., HICKSVILLE, N. Y. 11801
516 Wells 5-8080

We would appreciate an opportunity to submit a quotation on any current or future requirements you may have.

MICROWAVE FERRITE COMPONENTS

BROADBAND COAXIAL ISOLATORS



TYPE N FEMALE CONNECTORS



Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Dimensions - Inches L	W	H	Model Number
0.5- 1.0	10	1.5	1.25	9 3/16	x1 7/8	x2 1 3/16	U10P
†1.0- 2.0	15	1.0	1.15	7 7/16	x2 1/4	dia.	L20PS
1.0- 4.0	10	1.0	1.25	7 7/16	x1 1/2	dia.	LS10P
†2.0- 4.0	20	1.0	1.20	6 7/8	x2 1/8	dia.	S11PS
3.8-11.7	10	1.0	1.30	6 5/8	x1 1/2	dia.	SCX10P
†4.0- 8.0	15	1.0	1.20	6 5/8	x2 1/8	dia.	C20PS
4.0-11.0	10	1.0	1.25	7 5/8	x2	dia.	CX10P
†7.0-11.0	15	1.0	1.25	5 3/32	x1 3/4	dia.	CX20PS
†8.0-12.0	10	1.0	1.25	4 1/8	x1 3/4	dia.	X20PS
1.0- 1.5	15	1.0	1.10	7 7/16	x1 3/8	x1 7/8	L15P
1.5- 2.0	20	1.0	1.15	6 7/16	x1 3/8	x1 7/8	L13P
2.0- 3.0	20	0.8	1.18	5 15/16	x1 1/2	dia.	S12P
3.0- 4.0	25	1.0	1.18	5 15/16	x1 1/2	dia.	S16P
4.0- 4.5	35	0.6	1.20	6 5/8	x1 1/2	dia.	C16P
4.5- 5.0	35	0.6	1.20	6 5/8	x1 1/2	dia.	C17P
5.0- 7.0	20	1.0	1.20	6 3/4	x1 1/2	dia.	C13P
7.0- 8.5	20	0.8	1.20	6 3/4	x2	dia.	CX13P
8.5- 9.0	35	0.6	1.20	6 5/8	x2	dia.	X14P
9.0- 9.5	35	0.6	1.20	6 5/8	x2	dia.	X15P

† Magnetically shielded units. Type N female connectors standard.

LIGHTWEIGHT COAXIAL ISOLATORS

3/4" DIA. MAX.

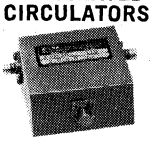


OCTAVE BANDWIDTH

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Dimensions - Inches L	W	H	Model Number
0.6- 1.0	10	1.3	1.25	9 3/8	x1 1/4	dia.	U10N
1.0- 2.0	15	1.0	1.20	10	x 3/4	dia.	L19N
1.0- 2.0	15	1.0	1.20	9 3/4	x 3/4	dia.	L19NR
2.0- 4.0	12	1.0	1.20	6 3/4	x 3/4	dia.	S10N
2.0- 4.0	15	1.0	1.25	7 3/4	x 3/4	dia.	S21N
2.0- 4.0	15	1.0	1.25	7 3/4	x 3/4	dia.	S21NR
2.1- 4.2	15	1.0	1.25	7 5/8	x 3/4	dia.	S22NR
3.7- 7.4	10	1.0	1.25	5 13/32	x 3/4	dia.	SC16N
4.0- 7.0	12	1.0	1.25	5 27/64	x 3/4	dia.	C17N
4.0- 7.0	12	1.0	1.25	5 45/64	x 3/4	dia.	C17NR
4.0- 8.0	10	1.0	1.20	5 27/64	x 3/4	dia.	C19N
4.0- 8.0	10	1.0	1.25	5 27/64	x 3/4	dia.	C21NR
7.0-11.0	10	0.9	1.25	3 13/16	x 3/4	dia.	CX15N
7.0-11.0	10	0.9	1.25	3	x 5/8	dia.	CX15NR

Magnetically shielded units. Connectors: Series N, type N; Series NR, type OSM.

OCTAVE TERMINATED CIRCULATORS



Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Dimensions - Inches L	W	H	Model Number
0.5- 1.0	15	0.75	1.45	5 rad.	x 1 1/2		U30YI
1.0- 2.0	18	0.35	1.28	3 7/8	x3 7/8	x1	L30T30
2.0- 4.0	18	0.35	1.28	2	x2	x 7/8	S30T30
4.0- 8.0	18	0.4	1.28	1 13/32	x1 13/32	x 3/4	C30T30
8.0-12.0	18	0.5	1.28	1 3/4	x1	x 1 1/16	X30T30
12.0-18.0	18	0.6	1.28	3/4	x 1 5/16	x1	Ku30T30

Connectors: Type OSM female.

HIGH RATIO TERMINATED CIRCULATORS

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Dimensions - Inches L	W	H	Model Number
1.7- 2.4	60	1.0	1.20	7 1/4	x3 1/4	x1 1/8	LS10JI
2.0- 4.0	35	0.7	1.20	4	x2	x 7/8	S30D30
2.2- 2.3	60	0.9	1.20	6	x2 3/4	x1 1/8	S33JI
2.7- 2.9	60	0.8	1.20	5 1/2	x2 1/2	x1 1/8	S35JI
4.8- 5.4	60	0.8	1.20	3 1/2	x2	x 7/8	C34JI
5.4- 5.9	60	0.8	1.20	3 1/4	x1 5/8	x 7/8	C35JI
7.2- 7.8	60	0.8	1.20	3 1/4	x1 5/8	x 7/8	C33JI
8.5- 9.5	60	0.9	1.20	3	x1 1/2	x 7/8	X24JI

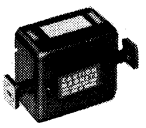
LABORATORY COAXIAL ISOLATORS



Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Body Dimensions Inches L	W	H	Model Number
0.5- 1.0	10	1.5	1.20	9 3/16	x3 3/8	x2 7/16	U10PT
1.0- 2.0	15	1.0	1.15	7 7/16	x3 3/8	x2 7/16	L20PT
1.0- 4.0	12	1.3	1.25	7 7/16	x3 3/8	x2 7/16	LS10PT
2.0- 4.0	20	1.0	1.20	6 7/8	x3 3/8	x2 7/16	S11PT
4.0- 8.0	15	1.0	1.20	6 5/8	x3 3/8	x2 7/16	C20PT
4.0-11.0	10	1.0	1.25	7 5/8	x3 3/8	x2 7/16	CX10PT
8.0-12.0	10	1.0	1.25	4 1/8	x3 3/8	x2 7/16	X10PT

BROADBAND WAVEGUIDE ISOLATORS



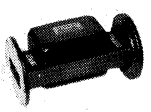


*Bilaterally Matched

COVER FLANGES STANDARD

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Length Inches	Model Number
2.6 - 3.95	15	1.0	1.15	14	S102LI
2.6 - 3.95	20	1.0	1.15	14	S103LI
2.6 - 3.95	30	1.7	1.15	16	S104LI
3.3 - 4.9	25	1.0	1.15	8 1/4	CS110LI
3.95- 5.85	25	0.8	1.10	7	C878LI
3.95- 5.85	25	0.8	1.15	7	C879LI
3.95- 5.85	25	1.0	1.15	8 1/4	C102LI
3.95- 5.85	30	1.0	1.10*	7	C876LI
3.95- 5.85	30	1.0	1.15*	7	C877LI
3.95- 5.85	30	1.2	1.15	8 1/4	C110LI
3.95- 5.85	30	1.2	1.15*	8 1/4	C110LIA
3.95- 5.85	40	1.0	1.15*	8 1/4	C111LI
5.85- 8.2	30	1.0	1.10*	5	Xb951LI
5.85- 8.2	30	1.0	1.15	6 1/4	Xb103LI
5.85- 8.2	30	1.0	1.15*	5	Xb952LI
5.85- 8.2	40	1.2	1.15*	7 5/8	Xb910LI
7.05-10.0	30	1.0	1.10*	5	XL920LI
7.05-10.0	30	1.0	1.12*	5	XL921LI
7.05-10.0	30	1.0	1.15	6 1/8	XL103LI
7.05-10.0	30	1.0	1.15*	6 1/8	XL103LIA
7.05-10.0	35	1.0	1.15*	7 1/8	XL910LI
7.05-10.0	40	1.2	1.15*	7 1/8	XL911LI
8.2 -12.4	30	1.0	1.10	5	X110LI
8.2 -12.4	30	1.0	1.10*	4 1/2	X956LI
8.2 -12.4	30	1.0	1.10*	5	X110LIA
8.2 -12.4	30	1.0	1.15	5	X111LI
8.2 -12.4	30	1.0	1.15*	4 1/2	X957LI
8.2 -12.4	40	1.0	1.10	5 29/32	X910LI
8.2 -12.4	40	1.2	1.15	5 29/32	X911LI
10.0 -15.0	25	1.0	1.15	5	M110LI
10.0 -15.0	30	1.0	1.15*	5	M111LI
12.4 -18.0	24	1.0	1.15*	5	Ku103LI
12.4 -18.0	25	0.8	1.10*	4	Ku916LI
12.4 -18.0	30	1.0	1.10*	4	Ku915LI
12.4 -18.0	30	1.0	1.15*	5	Ku110LI
12.4 -18.0	35	1.0	1.15*	6	Ku910LI
12.4 -18.0	40	1.2	1.15*	6	Ku911LI
13.0 -17.0	40	1.0	1.15	5	Ku130LI
18.0 -26.5	25	1.0	1.15	4 1/2	K110LI
18.0 -26.5	30	1.5	1.15	4 1/2	K111LI

STANDARD WAVEGUIDE ISOLATORS



Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Length Inches	Model Number
3.5 - 4.0	25	0.6	1.10	5 1/2	CS180LI
4.0 - 4.5	30	0.6	1.10	5 1/2	CS230LI
4.7 - 5.1	35	1.5	1.15	5	C101MI
5.4 - 5.9	50	1.0	1.10	4 1/2	Xb121LIA
5.925- 6.425	50	1.0	1.10	4 1/2	Xb121LIB
6.425- 6.875	50	1.0	1.10	4 1/2	Xb121LIC
6.875- 7.125	50	1.0	1.10	4 1/2	Xb121LID
7.125- 7.65	50	1.0	1.10	4 1/2	Xb121LIE
7.125- 7.75	60	1.0	1.10	4 1/2	XL500LI
8.2 -10.0	25	1.0	1.10	3 1/2	X345LI
8.5 - 9.6	35	1.0	1.10	2 1/2	X106LI
9.2 - 9.6	35	0.8	1.10	2 1/2	X320LI
10.7 -11.7	40	0.7	1.20	2	M6LI
13.0 -17.0	40	1.0	1.15	5	Ku130LI
16.0 -18.0	20	1.0	1.10	2 1/2	Ku107LI
23.0 -25.0	22	0.6	1.10	2 1/2	K106LI

FULL BANDWIDTH TERMINATED CIRCULATORS

LOW-LOSS

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Dim. - Inches Diam.	H	Model Number
3.95- 5.85	17	0.5	1.30	4 1/2	x 3 7/8	C102LYI
5.85- 8.2	17	0.5	1.30	3 1/2	x 3 1/8	Xb111LYI
7.05-10.0	17	0.5	1.30	3	x 2	XL106LYI
7.0 -11.0	17	0.5	1.30	3	x 2	Xa102LYI
8.2 -12.4	20	0.3	1.20	2 1/2	x 2	X112LYI
12.4 -18.0	17	0.5	1.30	2 1/8	x 1 45/64	Ku134LYI
18.0 -26.5	17	0.5	1.30	2	x 1 1/2	K134LYI

Power (maximum): 10 Kw peak; 10 watts average.
Terminale: 1 W maximum standard.

MINIATURE WAVEGUIDE ISOLATORS



XLM Series	7.05 –10.0 GHz
XM Series	8.2 –12.4 GHz
WM Series	13.3 –14.4 GHz
KM Series	12.4 –18.0 GHz
KMA Series	18.0 –26.5 GHz
RM Series	26.5 –40.0 GHz
Length	1/2 inch
Bandwidth	200 Mc. (average)
Isolation	20.0 db (average)
Ins. Loss	0.4 db (average)
VSWR	1.15 (average)

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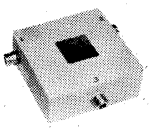
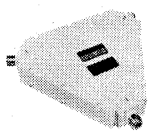
MICROWAVE FERRITE COMPONENTS

COAXIAL CIRCULATORS



3-PORT



Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Body Dimensions Inches L W H	Wgt. Ounces Nom.	Model Number
.100-.110	15	0.9	1.35	10 dia.x1½	135	V16Y10
.110-.122	15	0.8	1.35	9 dia.x1½	120	V17Y10
.122-.135	15	0.8	1.35	9 dia.x1½	120	V18Y10
.135-.155	15	0.7	1.35	9 dia.x1½	120	V21Y10
.155-.190	15	0.7	1.35	9 dia.x1½	120	V22Y10
.190-.240	15	0.6	1.35	7½ dia.x1½	104	V24Y10
.225-.300	17	0.5	1.30	7 dia.x1½	96	V25Y10
.25- .35	17	0.6	1.30	7 x6½x1½	104	V25T
.35- .50	17	0.6	1.30	4¾x4¾x1⅝	56	U35T
.50- .70	17	0.5	1.30	3¾x3¾x1⅝	38	U36T
.70-1.00	17	0.5	1.30	3 x3 x1¾	28	U22T
1.50-1.80	20	0.4	1.25	3¼x3¼x1⅛	20	L22T
1.70-2.40	20	0.3	1.20	3 x3 x1⅛	18	LS10T
2.00-3.00	18	0.3	1.25	2¾x2¾x1⅛	16	S31T
2.50-3.50	18	0.3	1.25	2¼x2¼x1⅛	9	S35T
3.00-4.00	20	0.3	1.25	2¼x2¼x1⅛	9	S32T
3.60-4.40	20	0.3	1.25	1¾x1¾x1	7	SC10T
4.00-5.00	20	0.4	1.20	1½x1½x1	6	C31T
5.00-6.20	20	0.4	1.20	1½x1½x ⅞	6	C32T
5.4- 5.9	20	0.3	1.25	⅝x 1/16x ½	1¾	C10T
7.0-10.5	15	0.6	1.35	⅞x1 x 1⅜	3	CX23T
8.0-10.0	18	0.5	1.30	1/16x ¾x ⅝	1¾	X27T
10.0-12.0	18	0.5	1.30	⅝x ¾x ⅝	1¾	X28T

3-PORT OCTAVE MINIATURE

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Dimensions - Inches L W H	Model Number
0.5- 1.0	15	0.75	1.45	5 rad. x 1½	U30Y
1.0- 2.0	18	0.35	1.28	3⅞ x3⅞ x1	L30T40
2.0- 4.0	18	0.35	1.28	3 x2 x ⅞	S30T40
4.0- 8.0	18	0.4	1.28	1 13/32x1 13/32x ¾	C30T40
8.0-12.0	18	0.5	1.28	1 5/16x1 x 1/16	X30T40
12.0-18.0	18	0.6	1.28	¾ x 1 5/16x1	Ku30T40

Connectors: Model U30Y: type N female; all other models: type OSM female.

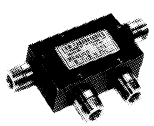
3-PORT SUB-MINIATURE

10% BANDWIDTH

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Dimensions - Inches L W H	Model Number
1.6- 1.9	20	0.4	1.25	1⅝ x1⅝ x 1/16	L12T
1.9- 2.2	20	0.3	1.25	1½ x1½ x ⅝	S12T
2.2- 2.5	20	0.3	1.25	1¼ x1¼ x ⅝	S15T
2.5- 3.3	20	0.3	1.25	1 x1 x ⅝	S13T
3.3- 4.0	20	0.3	1.25	13/16x 13/16x ½	S14T
4.0- 5.4	20	0.3	1.25	⅝ x ⅝ x ½	C12T
5.4- 7.0	20	0.3	1.25	½ x ⅝ x ½	C14T
7.0- 7.0	20	0.3	1.25	½ x ⅝ x ½	X12T
12.0-18.0	20	0.3	1.25	½ x ½ x ½	Ku12T

Specify center frequency when ordering.
Connectors: OSM female.

4-PORT



Frequency GHz	Isolation db Min. 1-4, 3-2	Isolation db Min. 4-3, 2-1	Insertion Loss db Max. 1-2, 3-4	Insertion Loss db Max. 2-3, 4-1	VSWR Max.	Body Dimensions Inches L W H	Model Number
1.7-2.4	40	18	0.3	0.6	1.25	6 x3½x1⅛	LS10D
2.0-4.0	35	14	0.4	0.7	1.25	4 x3 x1⅛	S30D10
2.2-2.4	40	20	0.3	0.6	1.25	4 x2¼x1⅛	S33D11
2.4-2.7	40	25	0.3	0.6	1.25	4½x2¾x1¼	S27D13
2.7-3.3	40	20	0.3	0.6	1.25	4¼x2½x1⅛	S28D14
4.4-5.0	40	20	0.3	0.5	1.20	2¾x1¼x ⅞	C31D15
5.4-5.9	40	20	0.3	0.6	1.25	2½x1½x ⅞	C35D14
8.5-9.5	40	20	0.4	0.8	1.20	2½x1½x ⅞	X24D10

Connectors: N female.

5-PORT



Frequency GHz	Isolation db Min. 2-1	Isolation db Min. 3-2	Insertion Loss db Max. 1-2	Insertion Loss db Max. 2-3	VSWR Max.	Body Dimensions Inches L W H	Model Number
1.7-2.4	40	40	0.6	0.6	1.25	7¾ x3¾ x1⅛	LS10J
2.2-2.3	40	40	0.5	0.6	1.15	6½x3 x1⅛	S27J11
2.7-3.3	40	40	0.6	0.6	1.25	5 x3 x1⅛	S35J11
3.1-3.5	40	40	0.4	0.5	1.20	5 x2½x1	S23J13
5.4-5.9	40	40	0.5	0.6	1.20	4 x1¾x ⅞	C35J10
7.2-7.8	40	40	0.6	0.6	1.25	3½x1¾x ⅞	C35J12
8.5-9.5	40	40	0.6	0.6	1.25	3 x1½x ⅞	X21J14

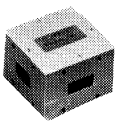
coave*



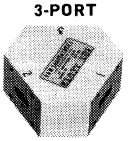
Frequency GHz	Isolation db Min. 3-2	Isolation db Min. 3-1	Isolation db Min. 2-1	Insertion Loss db Max. 1-2	Insertion Loss db Max. 2-3	VSWR Max. 1	VSWR Max. 2	VSWR Max. 3	Model Number
3.7- 4.2	42	40	40	0.4	0.5	1.20	1.15	1.25	SC10J13
5.9- 6.45	40	40	40	0.4	0.6	1.15	1.15	1.25	C38J10
6.6- 7.1	40	40	40	0.4	0.5	1.15	1.15	1.20	C33J15
7.2- 7.8	40	40	40	0.4	0.6	1.15	1.15	1.20	C33J16
7.6- 8.5	40	20	20	0.5	0.6	1.20	1.15	1.20	CX21D11
8.7- 9.3	40	40	40	0.5	0.6	1.15	1.15	1.25	X21J11
9.9-10.2	40	40	40	0.5	0.6	1.15	1.15	1.20	X21J13
10.4-11.0	40	40	40	0.5	0.6	1.15	1.15	1.20	X22J14
10.9-11.6	40	40	40	0.5	0.6	1.15	1.15	1.20	X22J16
12.8-13.3	40	20	20	0.4	0.8	1.25	1.20	1.25	Ku20D11

* Pronounced co-wave.

WAVEGUIDE T CIRCULATORS



3-PORT



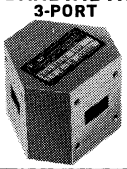
Frequency GHz	Isolation db Min.	Ins. Loss db Max.	VSWR Max.	Body Dimensions Inches L W H	Model Number
2.8- 3.2	20	0.3	1.20	6½x6½x5½	S101LT
3.2- 3.6	20	0.3	1.20	6½x6½x5½	S102LT
3.6- 4.0	20	0.3	1.20	6½x6½x5½	S103LT
4.0- 5.2	20	0.2	1.20	4⅜x4 x3⅝	C103LT
5.2- 6.7	20	0.2	1.20	3⅛x3¾x3⅛	Xb103LT
5.9- 7.2	20	0.2	1.20	3⅛x3¾x3⅛	Xb104LT
7.0- 8.5	20	0.2	1.20	2½x2⅝x1⅞	XL102LT
7.7- 8.9	20	0.2	1.20	2½x2⅝x1⅞	XL103LT
8.2-10.2	20	0.2	1.20	2 x2½x1¾	X110LT
8.5- 9.6	20	0.2	1.20	2 x1⅞x1⅝	X104LT
10.2-12.4	20	0.2	1.20	2 x1⅞x1⅝	X111LT
10.5-11.7	20	0.2	1.20	1⅞x1⅞x1½	M101LT
11.7-13.2	20	0.2	1.20	1⅞x1⅞x1½	M102LT
12.4-15.4	20	0.3	1.20	1¾x1¾x1 5/16	Ku107LT
14.0-17.0	20	0.3	1.20	1¾x1¾x1 5/16	Ku108LT
16.0-18.0	20	0.3	1.20	1¾x1¾x1 5/16	Ku105LT
22.0-24.0	20	0.5	1.20	1⅞ dia. x 2 5/32	K102LY
31.0-33.0	20	0.5	1.20	1⅞ dia. x 2 5/32	R102LY

4-PORT

SPECIFICATIONS

V S W R (maximum):	1.20
Insertion Loss (maximum):	0.2 db (single section) 0.4 db (double section)
Isolation (minimum):	20.0 db (single section) 35.0 db (double section)
Peak Power (maximum):	10 kw
Average Power (maximum):	10 w
Weight	Approximately twice that of 3-port unit.
Dimensions:	On request
Model Number:	Add letter "D" to Model Number in table.

FULL BANDWIDTH 3-PORT



Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Dim. - Inches Diam. H	Model Number
3.95- 5.85	17	0.5	1.30	4½ x 3⅞	C102LY
5.85- 8.2	17	0.5	1.30	3½ x 3⅛	Xb111LY
7.05-10.0	17	0.5	1.30	3 x 2	XL106LY
7.0 -11.0	17	0.5	1.30	3 x 2	Xa102LY
8.2 -12.4	20	0.3	1.20	2½ x 2	X112LY
12.4 -18.0	17	0.5	1.30	2⅛ x 1 15/64	Ku134LY
18.0 -26.5	17	0.5	1.30	2 x 1½	K134LY

Power (maximum): 10 Kw peak; 10 watts average.

3-PORT H-PLANE

HIGH POWER

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Power Cw. Max.	Dimensions Inches L W H	Model Number
4.4- 5.0	20	0.3	1.20	2 KW	4⅜x4x3⅝	C104HT
8.2-10.2	20	0.3	1.20	1 KW	2x2½x1¾	X110HT

3-PORT E-PLANE

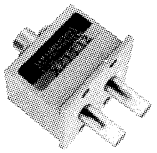
HIGH POWER

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Power Kw Peak	Power W. Ave.	Dim. - Inches L W H	Model Number
8.8 - 9.20	20	0.4	1.20	100	100	2 x1¾x1¾	X128TE
9.6 -10.1	20	0.4	1.20	40	50	2½x2½x2½	X101TE
15.95-16.35	20	0.4	1.20	40	50	2 x2 x1½	Ku112TE

DIFFERENTIAL PHASE SHIFT CIRCULATORS

Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Kw Peak	W. Ave.	Waveguide Type	Weight Length Inches	Weight Lbs. Nom	Model Number
5.9- 6.4	25	0.5	1.20	20	20	RG-50/U	14	16	C102LD
8.5- 9.6	20	0.4	1.25	250	250	RG-51/U	11⅛	7	XL102HD
9.0- 9.5	25	0.3	1.15	250	250	RG-51/U	11⅛	7	XL101HD
8.5- 9.6	25	0.4	1.25	200	200	RG-52/U	7½	5½	X101HD
13.2-14.0	25	0.5	1.25	20	20	RG-91/U	7½	4	Ku101LD
16.0-17.0	25	0.5	1.25	20	20	RG-91/U	7½	4	Ku103LD

PLUG-IN WAVEGUIDE



Frequency GHz	Bandwidth	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Body Dimensions Inches A B C	Waveguide Type	Model Number
3.7 - 4.2	Full	20	0.3	1.20	2 1/16 x 1 x2 5/16	WR-229	SC10T12
3.95- 5.85	10%	20	0.3	1.20	1 11/16 x 1 x2 1/8	WR-187	C37T10
5.85- 8.2	10%	20	0.3	1.20	1 1/32 x 1 x1 3/16	WR-137	C39T10
7.05-10.0	10%	20	0.4	1.20	1 x 1 x1 13/64	WR-112	X21T19
8.2 -12.4	10%	20	0.4	1.20	⅞ x 23/32x1 1/8	WR-90	X21T12

PLUG-IN STRIPLINE



Frequency GHz	Isolation db Min.	Insertion Loss db Max.	VSWR Max.	Body Dimensions Inches Dia. Hgt. †	Model Number
1.10- 1.25	20	0.5	1.25	2½ x 3 3/4x1⅛	L23YP10
1.36- 1.40	20	0.4	1.20	2½ x 3 3/4x1¼	L23YP
1.53- 1.66	20	0.4	1.20	2½ x 3 3/4x1⅛	L25YP10
1.70- 1.85	18	0.5	1.25	2¼ x 3 1/2x1⅛	L25YP
2.20- 2.50	20	0.4	1.20	2½ x 3 3/4x1⅛	S33YP
3.05- 3.15	25	0.3	1.20	1¾ x 3 3/4x1⅛	S34YP10
3.07- 3.30	20	0.4	1.25	1¾ x 3 3/4x1⅛	S34YP
5.40- 5.90	20	0.3	1.20	1 13/32x 3 3/4x1⅛	C35YP
*10.0 -12.0	20	0.4	1.20	1¼ x 3 3/4x1⅛	X22YP

* Any 10% bandwidth. † Ground plane spacing.

WRITE FOR COMPLETE CATALOG

SPECIFICATIONS SUBJECT TO CHANGE

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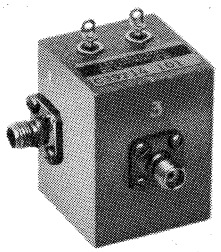
ELECTRICALLY CONTROLLED COMPONENTS

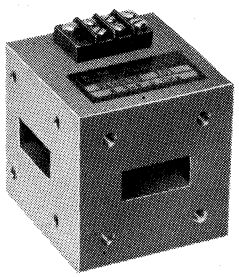


HIGH SPEED SWITCHABLE FERRITE COAXIAL CIRCULATORS

ISOLATION: 20db minimum — INSERTION LOSS: 0.3db maximum — VSWR: 1.25 maximum

Frequency - GHz	*Switch Speed Microseconds Max.	Body Dimensions - Inches A	B	C	Weight - Ounces Nominal	Model Number
3.7 - 4.2	50	1¾	1⅝	1¾	8	SC10T14
4.2 - 5.0	35	1½	1⅜	1¾	7	C31T14
5.0 - 6.0	35	1⅜	1¼	1¾	6	C32T14
6.0 - 7.2	35	1¼	1⅛	1⅝	5	C38T14
7.2 - 8.5	35	1¼	1⅛	1⅝	5	C39T14
8.0 - 10.0	35	1¼	1⅛	1⅝	5	X21T20
10.0 - 12.0	35	1¼	1⅛	1⅝	5	X22T20

* 10% to 90% points of RF power. Connectors: OSM female

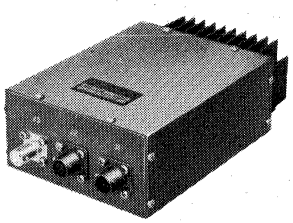


HIGH SPEED SWITCHABLE FERRITE WAVEGUIDE CIRCULATORS

ISOLATION: 20db minimum — INSERTION LOSS: 0.5db maximum — VSWR: 1.25 maximum

Frequency - GHz	*Switch Speed Microseconds Max.	Body Dimensions - Inches A	B	C	†Flange Type	Weight - Ounces Nominal	Model Number
8.5 - 9.6	50	2	2¼	2	UG- 39/U	15	X160LTS
8.5 - 9.6	5	2	2¼	2	UG- 39/U	15	X170LTS
9.2 - 9.5	10	2	2¼	2	UG- 39/U	15	X161LTS
14.0 - 15.0	5	1 27/32	2 13/64	1 19/32	UG-419/U	12	Ku148LTS
16.0 - 17.0	5	1 27/32	2 13/64	1 19/32	UG-419/U	12	Ku149LTS
21.0 - 22.0	5	1¼	2⅛	2	UG-595/U	7	K115LTS
34.5 - 35.5	5	1 3/32	2⅛	2	UG-599/U	4	R123LTS

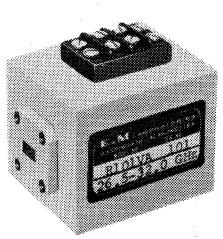
* 10% to 90% points of RF power. † Cover with tapped holes



SOLID STATE SWITCH DRIVERS

Model Number	Input Current Amperes Nominal	*Body Dimensions - Inches A	B	C	D	Use with Circulator Model Number
EDS2110	0.5	3	4	1	½	SC10T14
EDS2131	0.4	3	4	1	½	C31T14
EDS2132	0.3	3	4	1	½	C32T14
EDS2138	0.3	3	4	1	½	C38T14
EDS2139	0.3	3	4	1	½	C30T14
EDS2121	0.3	3	4	1	½	X21T20
EDS2122	0.3	3	4	1	½	X22T10
EDS1160	0.3	3	4	1	½	X160LTS
EDS1170	2.0	3	4	1	½	X170LTS
EDS1161	0.3	3	4	1	½	X161LTS
EDS1148	2.0	4	5	2 1/32	1 5/16	Ku148LTS
EDS1149	2.0	4	5	2 1/32	1 5/16	Ku149LTS
EDS1115	2.0	4	5	2 1/32	1 5/16	K115LTS
EDS1123	2.0	4	5	2 1/32	1 5/16	R123LTS

* "D" dimension: ½" end cover; 1 5/16" transistor heat dissipating fins.
Input Voltage: +9.0 V. DC. Other input voltages available on special order.
NOTE: Input power is a function of switching speed and RF bandwidth. Variations of all models available on special order.



FERRITE WAVEGUIDE VARIABLE ATTENUATORS

Frequency - GHz	Attenuation db Min.	Insertion Loss db Max.	VSWR Max.	Coil Resistance ohms	DC Coil Current ma Max.	Length Inches	Weight Ounces Nominal	Flange Type	Model Number
4.4 - 5.1	12	1.0	1.35	30	200	6½	40	UG-149A/U	C104VA
5.4 - 5.9	18	1.0	1.35	25	250	5½	28	UG-344/U	Xb101VA
7.05 - 10.0	30	1.0	1.25	30	200	6	24	*UG- 51/U	XL102VA
8.2 - 12.4	30	1.0	1.30	50	200	5	18	*UG- 39/U	X101VA
12.4 - 18.0	20	1.0	1.35	30	200	3¼	12	*UG-419/U	Ku102VA
22.0 - 25.0	25	1.0	1.30	15	100	3½	4	*UG-595/U	K101VA
26.5 - 32.0	25	1.0	1.30	600	100	2	3	*UG-599/U	R101VA

* Standard cover flanges with tapped holes.

FERRITE WAVEGUIDE VARIABLE PHASE SHIFTERS

Frequency - GHz	Phase Shift Min.	Insertion Loss db Max.	VSWR Max.	DC Coil Current ma Max.	Length Inches	Weight Ounces Nominal	Flange Type	Model Number
†5.4 - 5.9	180°	1.0	1.3	150	7	16	N female	C102LPC
6.4 - 6.9	180°	1.0	1.3	200	6	32	UG-344/U	Xb101LP
8.0 - 9.0	360°	1.0	1.25	300	6	32	*UG- 51/U	XL101LP
8.5 - 10.2	330°	1.0	1.3	500	7¾	28	*UG- 39/U	X121LP
16.4 - 16.6	360°	1.0	1.3	200	6	12	*UG-419/U	Ku111LP
22.0 - 23.0	360°	1.0	1.3	250	3½	4	*UG-595/U	K101LP

† Coaxial * Standard cover flanges with tapped holes

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SOLID STATE AMPLIFIERS

HIGH LEVEL BROADBAND AMPLIFIERS

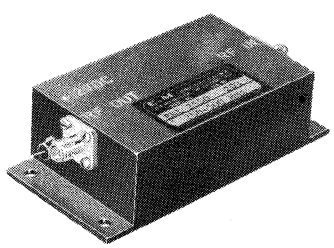
Frequency MHz	Noise Figure db Max.	Gain db Min.	Gain Flatness ±db	(1) Power Output dbm. Min.	VSWR Max. Input	VSWR Max. Output	Model Number
(3) 10-300	8	20	0.75	+23	2.5	3.0	EBA1002
(2) 10-400	8	20	0.5	+20	2.5	2.0	EBA1001
(2) 10-400	8	20	1.0	+27	2.5	3.0	EBA1003
50-100	8	25	1.0	+27	2.5	2.5	ESK5010
50-100	6	25	1.0	+20	2.0	2.5	ESH5010
100-200	8	25	1.0	+27	2.0	3.0	ESK1020
100-200	6	25	1.0	+20	2.0	2.5	ESH1020
150-300	8	25	1.0	+27	2.0	3.0	ESK1530
150-300	6	25	1.0	+20	2.0	2.5	ESH1530
200-400	8	23	1.0	+27	2.0	3.0	ESK2040
200-400	6	25	1.0	+20	2.5	2.5	ESH2040
250-500	8	23	1.0	+27	2.5	3.0	ESK2550
250-500	7	23	1.0	+20	2.0	2.5	ESH2550
500-1000	8	23	1.0	+10	2.0	2.5	ESM50001

NOTES: (1) At 1 db gain compression.
(2) 5-450 MHz: 3 db bandwidth (nom). Low frequency response to 10 kHz optional.
(3) 2nd and higher order intermodulation products: −55 db min. from two +10 dbm output signals.
4. Impedance level: 50 ohms.
5. Connectors: OSM female. Other types available on order.
6. All series have silicon transistors.

LOW NOISE BROADBAND AMPLIFIERS

Frequency MHz	Noise Figure db Max.	Gain db Min.	Gain Flatness ±db	(1) Power Output dbm. Min.	VSWR Max. Input	VSWR Max. Output	Model Number
10-400	4.5	25	0.5	+7	2.5	2.0	EBL1004
10-450	4.5	25	0.5	+3	2.5	2.0	EBL1005
10-450	3.5	25	0.5	+3	2.5	2.0	EBL1005LN
10-600	4.5	23	1.0	+3	2.5	2.5	EBL1006
10-600	3.5	23	1.0	+3	2.5	2.5	EBL1006LN
50-100	2.5	25	1.0	0	2.5	2.0	EGM5010
50-100	3.5	25	1.0	+7	2.5	2.0	ESL5010
100-200	2.5	25	1.0	0	2.5	2.0	EBM1020
150-300	3.0	25	1.0	+7	2.5	2.0	ESL1530
200-400	3.0	25	1.0	+7	2.5	2.0	ESL2040
250-500	3.0	25	1.0	+7	2.0	2.0	ESL2550
500-1000	4.5	24	1.0	+5	2.0	2.5	ESN5001
500-1000	3.5	24	1.0	+5	2.0	2.5	ESN5001LN
500-1000	3.5	24	1.0	+5	2.0	2.5	ESN5001LNA

NOTES: (1) At 1 db gain compression.
(2) 5-450 MHz: 3 db bandwidth (nom). Low frequency response to 10 kHz optional.
(3) 5-500 MHz: 3 db bandwidth (nom). Low frequency response to 10 kHz optional.
4. Impedance level: 50 ohms.
5. Connectors: OSM female. Other types available on order.
6. Series EGM: germanium transistors. All others: silicon transistors.



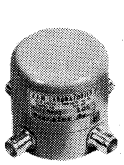
INPUT POWER REQUIREMENTS

Model Series	D.C. Input Power
EBA 1001	+20V @ 130 ma nominal
EBA 1002	+15V @ 125 ma nominal
EBL 1004	+15V @ 40 ma nominal
EBL 1005	+15V @ 30 ma nominal
EGM (all)	+15V @ 15 ma nominal
ESH (all)	+24V @ 100 ma nominal
ESK (all)	+24V @ 250 ma nominal
ESL (all)	+15V @ 40 ma nominal
ESM 5001	+15V @ 100 ma nominal
ESN (all)	+15V @ 50 ma nominal

NOTE: All units available with modified DC input voltages on special order.

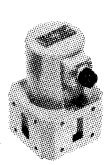
MICROWAVE SWITCHES

COAXIAL



Frequency GHz	Crosstalk db Min.	Ins. Loss db Max.	VSWR Max.	Type	Model Number
0. - 0.5	50	0.25	1.20	SPDT	V10SC
0 - 2.0	40	0.25	1.25	Transfer	VS10SC
0 - 3.0	30	0.25	1.30	SP4T	VS13SC
0 - 6.0	40	0.30	1.25	SPDT	VC12SC
0 - 6.0	40	0.30	1.25	Transfer	VC13SC
.075 - .15	60	0.20	1.20	SP5T	V16SC
0.5 - 1.1	25	0.15	1.30	DPDT	VL10SC
0.8 - 2.4	70	0.15	1.15	Transfer	VS12SC
0.8 - 2.5	35	0.25	1.30	SP3T	VS11SC
3.8 - 4.3	25	0.20	1.25	SP5T	SC10SC
4.5 - 5.5	25	0.30	1.30	SPDT	C15SC

WAVEGUIDE



Frequency GHz	Crosstalk db Min.	Ins. Loss db Max.	VSWR Max.	Type	Model Number
5.85 - 8.2	40	0.2	1.10	SPDT	Xb10S
5.85 - 8.2	40	0.2	1.10	Transfer	Xb13S
7.05 - 10.0	40	0.2	1.10	SPDT	XL10S
7.05 - 10.0	40	0.2	1.10	Transfer	XL13S
7.05 - 10.0	40	0.2	1.10	SP3T	XL15S
8.2 - 12.4	60	0.2	1.10	SPDT	X10S
8.2 - 12.4	40	0.2	1.10	Transfer	X13S
12.4 - 18.0	40	0.2	1.10	SPDT	Ku10S
12.4 - 18.0	40	0.2	1.10	Transfer	Ku13S
15.0 - 22.0	40	0.2	1.10	SPDT	P11S
18.0 - 26.5	40	0.2	1.10	SPDT	K11S

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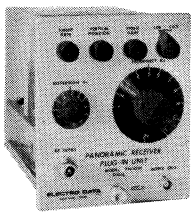
ELECTRO/DATA INC.

- YIG Devices
- Panoramic Receivers
- Advanced Systems Components



YIG TUNED Panoramic Receiver Plug-In

Four models cover the entire frequency spectrum from 100 Mc to 25 Gc with greater than decade band tuning ranges. With these units, an ordinary oscilloscope is converted into a preselected wide band, microwave receiver which gives a panoramic display of signals on the scope face. The entire frequency spectrum or any segment of it, may be displayed in a single sweep.

SPECIFICATIONS

For these Tektronix oscilloscopes: 531A, 532, 533A, 536, 541A, 543A, 543B, 544, 545A, 545B, 546, 547, 549, 551, 555, 556, 581A, 585A

MODEL	Tuning Range (Gc)	Dispersion (Gc)	Resolution Typ. (Mc)	TSS (—dbm)	Price
PN1010A	.10-1.0	.1-1.0	3-6	63-97	$2,895
PN1011	1.0-12.4	.4-11	4-10	45-58	1,995
PN1012	.5-5.	.4-4.5	4-7	42-56	2,195
PN1013	1.8-25	1.5-23	5	45-58	2,795

Other units available for 561, 564 series

Ask for Bulletin: PN1000

TUNNEL DIODE DETECTORS

SPECIFICATIONS

Type N Input	Freq. Gc	TSS (—dbm)	Price
D10	1-12.4	50	$75.00
D11	1-2	54	60.00
D12	2-4	54	60.00
D13	4-8	52	60.00
D14	8-12.4	50	60.00

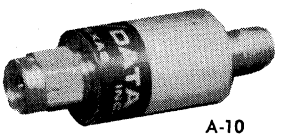
When ordering with integral D.C. return, add "R" to Model number and $20 to price. Models with miniature input connectors also available.

Ask for Series D Bulletin



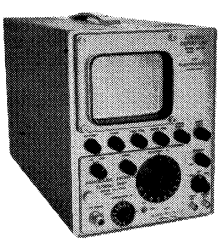
- Highest sensitivity
- Broadband, flat response
- Field replaceable diodes
- Low price includes diodes with mount

Broad Band Miniature Amplifier



A-10

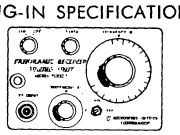
- Broad band 20 to 1000 Mc
- High gain 18 db
- Low noise, 4 db typical
- Solid state, miniature size
- Price $300.00
- Bulletin: A-10



SPECTRUM DISPLAY UNIT DU-501

This portable, battery operated display unit provides panoramic viewing from 100 Mc to 25 Gc when used with the three plug-ins listed below. Price $2675.

PLUG-IN SPECIFICATIONS



TU-VL501A .10-1.0 Gc
Resolution . . . . . 5 Mc Typ.
Dispersion . . 100 to 1000 Mc.
Price $3,000.00

TU-LX501 1-12.4 Gc
Resolution . . . . . 15 Mc Typ.
Dispersion . . 100 to 11,000 Mc.
Price $2,000.00

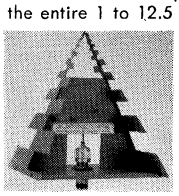
TU-LK501 1.8-25 Gc
Resolution . . . . . 5 Mc
Dispersion . . . . . 1 to 23 Gc
Price $2,600.00

Bulletin: DU-501

LOG PERIODIC ANTENNAS

Broad Band Coverage 1-12.5 Gc. Compact, Rugged, Lightweight Portable.

Measured antenna patterns show only a single main lobe with a 15 db front to back ratio over the entire 1 to 12.5 Gc band.

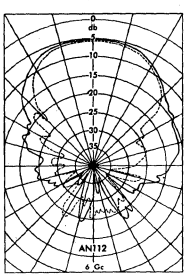


AN112 6¼" x 6½" x 8"

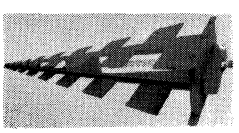
SPECIFICATIONS

- Broad bandwidth — 1 to 12.5 Gc
- High Gain — 11 db (50° beamwidth)
- Linear Polarization 20 db

- High front to back ratio in both horizontal and vertical planes — 15 db.
- Low VSWR — 2: 1 nominal with 50 ohm input.
- Connectors: Type "N" or miniature
- Price, $175 each Bulletin: AN112



Measured typical radiation pattern
Solid, vertical
Dashed, horizontal

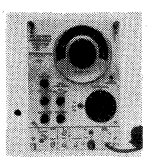


AN112F 1¾" x 6½" x 8"

SPECIFICATIONS

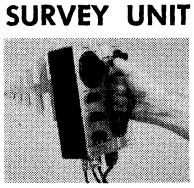
- Broad bandwidth — 1 to 12.5 Gc
- High Gain — 8 db (90° bandwidth)
- Linear polarization 15 db
- Price, $175 each
- Bulletin: AN112F

PANORAMIC RECEIVER R-10



Self contained YIG tuned receiver accurately tunes any selected decade band from 100 Mc to 25 Gc. Price: $3,750. Bulletin: R-10

HAND HELD SURVEY UNIT



This compact receiver utilizes a YIG tuned RF preselector and sensitive crystal video circuit to cover 1-12.4 Gc. Price $2,900. Bulletin: RLX-100

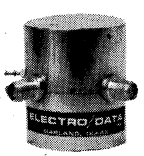
Crystal Marker Generator



MK-1

Covers 1-12.5 Gc. 100/500 Mc spacing. Self contained power supply. Price: $995. Bulletin: MK-1

YIG FILTERS



4 models cover from 100 Mc to 25 Gc with greater than decade electronic tuning ranges. Solid state, rugged compact construction. Bulletin: YIG Filters.

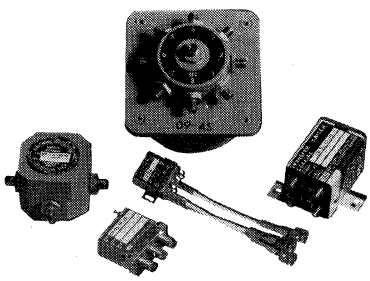
Write for detailed product information

3121 Benton Street
Garland, Texas 75040
(214) BRoadway 6-6167

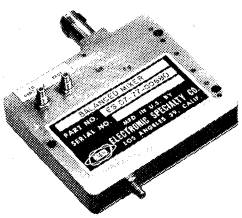
ELECTRO/DATA INC.

Electronic Resources Inc. designs & produces an expanding line of components and subsystems in a 190,000 sq. ft. computer equipped plant.

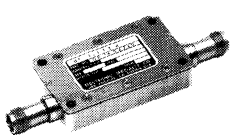
MICROWAVE DEVICES:



COAXIAL SWITCHES
DC to 18 GHz



BALANCED MIXERS
frequencies: S-X Band



COMBLINE FILTERS
Computer designed, frequencies S-KU Band, also inter-digital, bandpass filters, diplexers & multiplexers

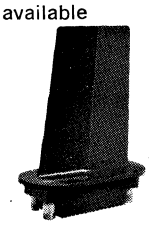
OTHER MICROWAVE DEVICES INCLUDE: Couplers, Power Dividers, Multipliers, Amplifiers

AIRBORNE ANTENNAS:

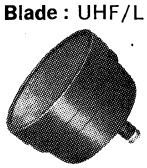
Typical of ERI's antenna capability for standard or custom specifications (and many are available off-the-shelf).



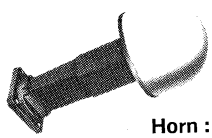
Stub: 2-10 GHz



Blade: UHF/L Band



Spiral: 2-12 GHz



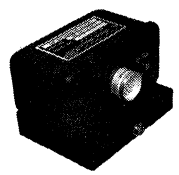
Horn: 7-10.75 GHz

Poly-Environ Mineral Insulated COAXIAL CABLE ASSEMBLIES:

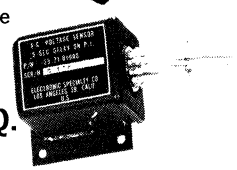


The answer for 1700°F, environments. ERI coax cable is vibration, crush, and abrasion resistant, suitable for radiation environments, hermetically sealed and designed for RF power handling applications. Coax assemblies are available as small as .090" dia. with ERM (mates with OSM) and other connectors.

Custom ELECTRONIC CONTROLS:



ANTENNA SELECTORS
UHF, Solid State



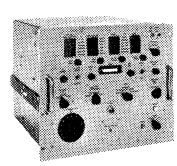
VOLT./FREQ. SENSORS
AC or DC, Solid State

OTHER CONTROLS INCLUDE: Static Inverters, AC to DC and DC to DC Power Control Systems, A to D and D to A Digital Systems

ELECTRONIC SUBSYSTEMS:



DIGITAL CONTROLS



SIGNAL GENERATORS



ERI

ELECTRONIC RESOURCES INC.
(formerly Electronic Specialty Co., Los Angeles Electronics Division)
4561 Colorado Boulevard
Los Angeles, California 90039
(213) 246-6767 • TWX 910-497-2264

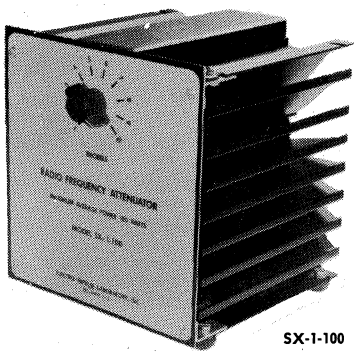
Electro IMPULSE, INC.
116 CHESTNUT STREET • RED BANK, NEW JERSEY 07701
TELEPHONE: 201 - 741-0404 • TWX No. 510-237-5767

HIGH POWER RF ATTENUATOR

- Power Capacities to 5000 watts
- Variable in 1 db steps
- VSWR less than 1.25
- Input and output impedance: 50 ohms (DC to 100 MHz)

These attenuators are arranged in a T-pad configuration, switched in one db steps. Use either connector as input, with no loss of accuracy.

Usable to 500 MHz with slightly different characteristics.



SX-1-100

AUTOMATIC DIRECT READING CALORIMETERS

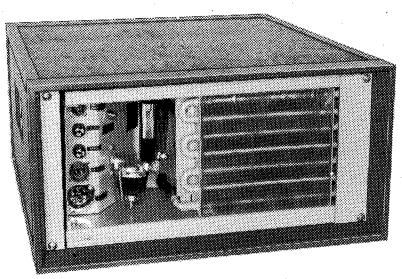
1% ACCURACY

TRACEABLE TO NATIONAL BUREAU OF STANDARDS!

One percent accuracy is independent of frequency and waveshape, but does not include load error. A VSWR vs. frequency chart can be furnished with your choice of any standard waveguide or coaxial load. (No extra cost on 1% models).



ADR-100



ADR-100, REAR VIEW

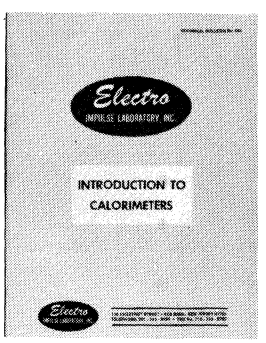
AUTOMATED PRECISION

Instead of time consuming manipulation of Controls, Flow Adjustments, Reading of Thermometers, Flow Meters, Graphs and other error producing devices.

Model	Max. Power	Load*
ADR-1	1 watt	
ADR-10	10 watts	CHOOSE ANY
ADR-100	100 watts	STANDARD
ADR-1000	1000 watts	LOAD
ADR-5000	5000 watts	DC-40GHz
ADR-10000	10000 watts	

*Price includes choice of Standard Load and Connector.

WRITE FOR FREE APPLICATION BULLETIN #685: "INTRODUCTION TO CALORIMETERS"

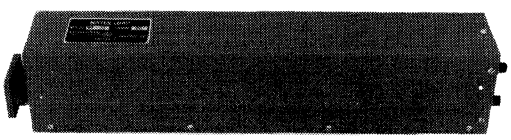


SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

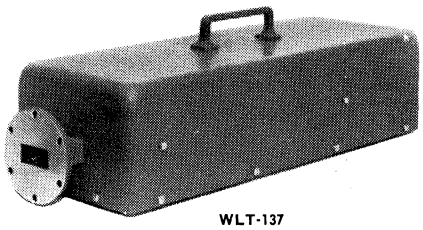
Electro IMPULSE, INC.

116 CHESTNUT STREET • RED BANK, NEW JERSEY 07701
TELEPHONE: 201 - 741-0404 • TWX No. 510-237-5767

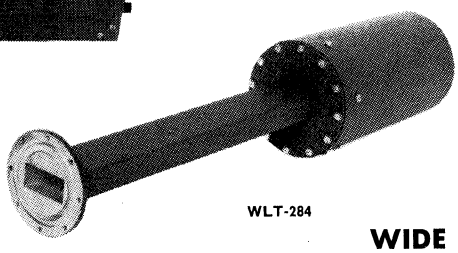
WAVEGUIDE WATER LOADS



WL-112



WLT-137



WLT-284

MODELS TO 40 GHz

WIDE VARIETY OF CONNECTORS

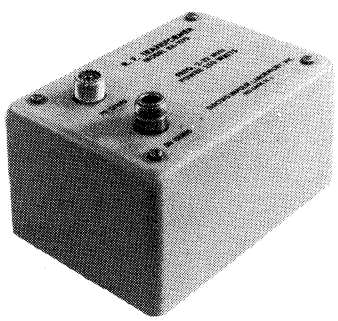
- Calibration resistor precisely located in coolant flow path permits calibration of Load using only a source of DC or 60 Hz power
- Quick-connect couplings on coolant connections guarantee safe, sure and convenient operation
- Specify frequency range desired when ordering
- Compact, portable
- Use with our Calorimeter Bridges or Calorimetric Power Meters
- Extremely low RF radiation
- Low VSWR guarantees most accurate termination and power transfer

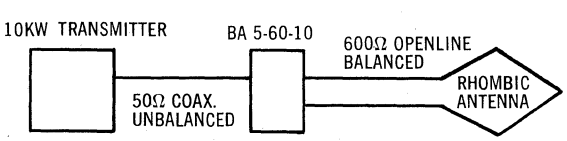
Model	Frequency Range GHz	VSWR Max.	Power Rating Watts	Weight	Connector
WL-650	1.12 - 1.70	1.2	40 KW	6	UG-417/U
WL-430	1.70 - 2.60	1.2	30 KW	5	UG-435/U
WL-284	2.60 - 3.95	1.2	25 KW	5	UG-53/U
WL-187	3.95 - 5.85	1.2	10 KW	5	UG-149/U
WL-137	5.85 - 8.20	1.2	5 KW	4	UG-344/U
WL-112	7.05 - 10.0	1.2	3 KW	3	UG-51/U
WL-90	8.20 - 12.4	1.2	2 KW	2	UG-39/U
WL-42	18.00 - 26.5	1.2		2	
WL-28	26.6 - 40.0	1.2		2	

- Optional equipment includes Closely Coupled Thermopiles, Output Meters reading directly in watts and Flow Meters
- Loads can be furnished with power ratings up to maximum feasible waveguide applications

BALUNS

- High efficiency Baluns permit use of 600 ohm twin line between Transmitter and Antenna
- Insertion VSWR 1.2
- Impedances are 50, 75, 200 and 600 ohms
- Insertion loss less than 0.15 db
- Maximum load (antenna) VSWR 3:1
- Ambient temperature range (typical) −40°C to +50°C
- Frequencies to 34 MHz





TYPICAL BALUN APPLICATION

SPECIFICATIONS — HIGH POWER MODELS

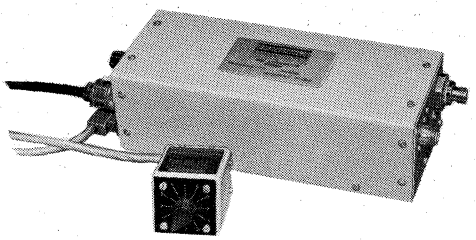
Model	Input Output Z	Peak Power	Average Power
BA 5-60-10	50/600	40KW	10KW
BA 5-7.5-10	50/75	40KW	10KW
BA 5-60-25	50/600	100KW	25KW
BA 5-7.5-25	50/75	100KW	25KW
BA 5-20-100	50/200	Inquire	100KW

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SEE OUR OTHER PRODUCTS ON PAGES 1250, 1372

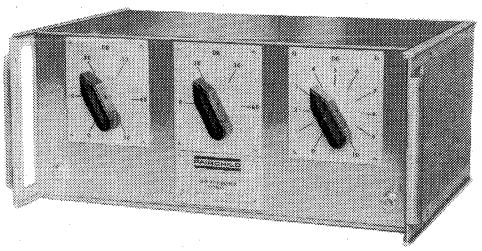
SINGLE-MOTOR-DRIVEN COAXIAL STEP ATTENUATORS

MA-600 and MA-1200 Series, 1, 2 or 4 watts, DC to 4 GHz
MA-610 and MA-1210 Series, 1 and 2 watts, DC to 10 GHz
All Attenuation Steps to 60 DB.



These motorized 6-position and 12-position units permit remote control of precise attenuation steps over the frequency range of DC to 4 GHz or DC to 10 GHz.
Because of the "Turn-Only" features, only a single motor is needed to position properly the selected attenuator pad. System complexity is reduced and operating reliability enhanced, while maintaining the low VSWR, high accuracy characteristics of the basic attenuator pads.
Control is achieved through a multi-conductor cable attached either to a Control Box or another remote switch of user's choosing.
Normal power requirement is either 115V AC or 28 V DC.

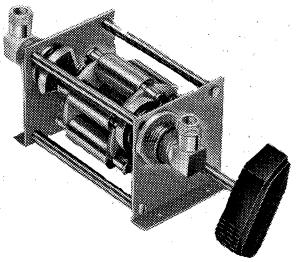
MULTI-TURRET STEP ATTENUATOR SYSTEMS

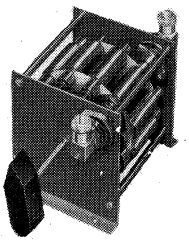


These Coaxial Attenuator Systems consist of two or more "Turn-Only" manual or motor-driven step attenuators mounted together on a chassis and tested as a system. Standard systems consist of two or more 6- or 12-position turrets, as described, installed on an enclosed, rigid chassis behind a 7" high panel, 19" wide, for standard rack mounting. For manually operated step attenuators, control knobs are also located on the front panel, while leads for power and control of motor-driven step attenuator systems are usually located at the rear of the chassis.
As all units are engineered to customers' needs, an almost unlimited variety of combinations of special step attenuators can be provided as systems. For motor-driven, remotely controlled systems, programming and other unique switching arrangements can be furnished.

"TURN-ONLY" COAXIAL STEP ATTENUATORS

SA-600 and SA-1200 Series, 1, 2 or 4 watts, DC — 4 GHz
SA-610 and SA-1210 Series, 1 or 2 watts, DC — 10 GHz





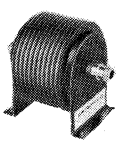
These low-VSWR, high accuracy, six-position and 12-position step attenuators can be switched to any position by merely rotating the easy-turn control knob. The unique mechanical arrangement is such that as soon as turn motion is initiated to change the setting, the end connectors are disengaged, allowing the attenuator pads to turn to the selected position.
Switching can be either clockwise or counterclockwise, permitting the user to select the desired position with a minimum of rotary motion. A positive detent action gives the user assurance that his step attenuator is properly positioned.
External cables may be permanently mounted directly, eliminating connectors entirely at the step attenuator outputs.
Turrets operating up to 12 GHz are available on special request. 15-step units also available.

HIGH-POWER FIXED PADS



5-Watt Dissipation—Model FA-505

Low VSWR and highly uniform attenuation versus frequency is exhibited by these carefully-designed units. Full 5-watt dissipation can be handled in either direction by units of up to 20 DB attenuation ratio and unilaterally up to 60 DB. Conservative rating allows for reasonable overloads.

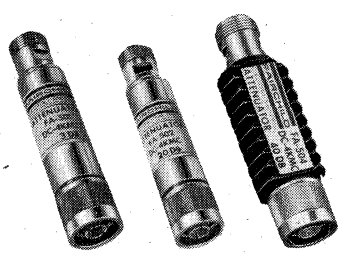


10-Watt Dissipation—Model FA-5010

Electro-Metrics' 10-watt microwave coaxial attenuators provide highly accurate attenuation throughout the frequency range of DC to 1.5 GHz. When used with a suitable termination, such as Fairchild EMC Model FT-502, this attenuator will serve as an excellent dummy load.

50-Watt Dissipation—Model FA-815

This Fairchild coaxial microwave power attenuator provides high accuracy throughout the frequency range of DC to 1 GHz while dissipating a full 50 watts. It may be used as a dummy load for transmitters, or to reduce transmitter outputs, as well as for isolating bolometers and couplers from high powered sources.



BROADBAND FIXED PADS

FA-511, 1 watt, DC to 10 GHz
FA-512, 2 watt, DC to 10 GHz
FA-501, 1 watt, DC to 4 GHz
FA-502, 2 watt, DC to 4 GHz
FA-504, 4-watt, DC to 4 GHz

Fairchild coaxial attenuator pads exhibit low VSWR and a high uniformity of attenuation over their specified frequency ranges.
New manufacturing techniques insure permanence of all characteristics despite rough handling and temporary overloads. Standard units are available for any attenuation level up to 60 DB. All production data fully traceable to National Bureau of Standards. Normal finish is nickel over brass.

FAIRCHILD
ELECTRO-METRICS CORPORATION
A SUBSIDIARY OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
100 CHURCH ST., AMSTERDAM, NEW YORK 12010

performance guaranteed

precision microwave resistors

Every Filmohm component is pre-tested and performance-guaranteed to assure reliable system response. Precision test equipment, advanced production methods and strict quality controls combine to produce stability and uniformity in every Filmohm product.

WAVEGUIDE

FILMCARD®
For attenuators and terminations . . . low cost. Std thickness .004 to .062". Resistance from 25 to 750 ohms/square. Protective plastic overcoat available. **Bulletins P-2 & UFC-1.**



METALLIZED GLASS & FOTOCERAM® ATTENUATOR ELEMENTS
Attenuations to 70 db for frequencies from L- thru K-Band. In all shapes and values for low VSWR, high precision attenuators. **Bulletins A-1 & FCA-1.**



METALLIZED MICA ELEMENTS
Ideal for high microwave frequencies and stripline terminations . . . and as rotary vane and guillotine attenuator elements. 25 to 400 ohms/square; .001" to .005" thick. **Bulletin C-1.**



METAL FILM MYLAR®
Ultra-thin, flexible, easily cut. High stability resistive or conductive film in large sheets or custom shapes. **Bulletin CRM-1.**



COAXIAL

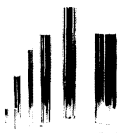
COAXIAL DISC & ROD RESISTORS
For coaxial terminations, loads, tee or pi pads. Low T.C., highly stable metal resistance film fused to Pyrex, Alumina, Plastic or High Temperature BeO substrate . . . sealed with microthin quartz coating. **Bulletins M-1-1, CD-2, & DR-1.**



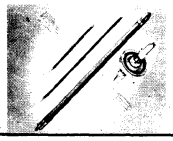
COAXIAL TERMINATION RESISTORS
Metallized film alumina or high temperature BeO base resistors for miniature, 3/8 and 7/8 lines. Usable to 12.4 Gc. **Bulletins CTR-1 & CT-1.**



HI-POWER COAXIAL LOAD RESISTORS
Non-inductive, for dummy loads and terminations. Metal film tubular glass, almuina or hi temp BeO resistors in sizes to 2" OD x 18" long. **Bulletin HP-1**



COAXIAL ATTENUATOR ELEMENTS, TEE PADS
For all military and standard commercial pads in 3/8 and 7/8 line sizes. Distributed-film type. Frequency: 1 to 12.4 Gc. **Bulletins CA-2 & CTP-1.**

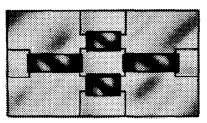


STRIPLINE

STRIPLINE RESISTORS & PELLET RESISTORS
Film-deposited metallic resistive materials on thin mica, BeO and alumina substrates. Ideal for short terminations in stripline designs. **Bulletins SL-2 & SPR-1.**



STRIPLINE TEE PADS
Two dimensional stripline tee pads, install in series with the center conductor of stripline. Attenuations from .1 to 25 db. Usable to 4 Gc. **Technical Note TN-1 & Bulletin SL-2.**



STRIPLINE TERMINATIONS
Easy-to-install, small and inexpensive. Standard 50 ohm matching impedance. Broadband, dc to 10.5 GHz, with VSWR less than 1.1 to 1.2 at high end. Dissipate as much as 1.5 watts. **Bulletin ST-1**



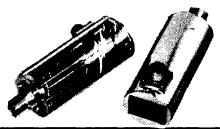
BOLOMETERS

Disc, Coaxial, Fuse, Waveguide Crystal Cartridge BOLOMETERS & THERMISTORS . . . 39 types in all . . . in stock! Interchangeable with all widely used types . . . chart available.



INSTRUMENTS

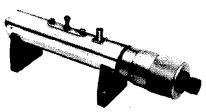
COAXIAL THERMAL VOLTMETERS
Wide-range AC-DC Transfer Devices for precise voltage measurements up to 50 Kc. In 6 ratings from ¼ volt to 100 volts. **Bulletin TDO-1.**



MICROPOTENTIOMETERS
Based on designs by NBS, these units are voltage standards for DC to 1000 Mc in nominal ranges of 1 microvolt to .33 volts. **Bulletin MP-1.**



A-T VOLTMETER
Micrometer adjustment provides readout of standard attenuations calibrated in voltage for high-accuracy measurement from 10 Mc to 1000 Mc. Calibration charts from NBS. **Bulletin ATV-1.**



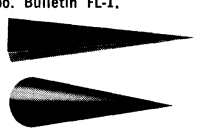
STEP ATTENUATOR

Series TA-700 Turret Attenuators provide 60 db attenuation in 10db steps, accurate to 1.0 db (including frequency sensitivity) from dc to 12.4 GHz. Bulletin TA-700



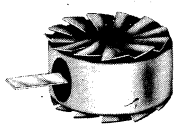
FILMLOAD

A lossy material supplied in various standard shapes, sizes and in a castable liquid form too. Bulletin FL-1.

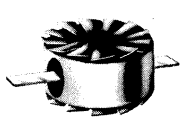


NOW IN RESILIENT pill-form...

■ CRUSH-TO-FIT ATTENUATORS ■ CRUSH-TO-FIT TERMINATIONS
■ CRUSH-TO-FIT RF (CAPACITOR) BYPASSES ■ CRUSH-TO-FIT SHORTS



The easy installation of pill-form now offered in a host of standard ⅛" and ¼" strip transmission line components with low VSWR, excellent match. Write for complete details on "Pill-form Components".



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We manufacture the most adaptable line of microwave frequency sources available anywhere. Our standard models are manufactured to meet your individual requirements. How is this possible? Because of their unusually flexible circuit designs and modularized mechanical construction, our production models are designed to be customized. This results in virtually "off-the-shelf" availability of "specials" with reduced delivery time and lower costs to you.

If you don't see exactly what you want listed on these pages, select the model having the nearest frequency range, power output, method of tuning or degree of frequency stability to meet your requirement. Then contact our Application Engineering Department. Chances are, one of our standard models can be scheduled through production to meet your exact requirements in a matter of days.

VOLTAGE TUNED — High Power

- Bandwidths up to 15%
- Extremely fast tuning rates
- Voltage/frequency curve approximately linear
- Power output to 2.0 watts
- Spurious outputs —40 dB on most models



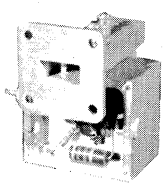
FS-2

L Band

Model	Frequency Range (GHz)	Voltage Tuned Bandwidth	Power Output (mW)	Harmonic Suppression (dB)	Dimensions (Inches) L W H
FS-2M	0.2– 0.6	12%	1000	—25	2½ x 1⅛ x 1$^{9}/_{32}$
FS-2	0.6– 1.2	12%	1000	—25	2½ x 1⅛ x 1$^{9}/_{32}$
FS-2H	0.6– 1.2	10%	2000	—25	2½ x 1⅛ x 1$^{9}/_{32}$
FS-14A	2.3– 2.9	325 MHz	250	—40	3$^{15}/_{16}$ x 1⅝ x 1$^{5}/_{16}$
FS-14B	2.8– 3.3	400 MHz	200	—40	3$^{15}/_{16}$ x 1⅝ x 1$^{5}/_{16}$
FS-14C	3.1– 3.6	450 MHz	200	—40	3$^{15}/_{16}$ x 1⅝ x 1$^{5}/_{16}$
FS-14D	3.5– 4.3	500 MHz	200	—40	3½ x 1⅛ x 1$^{5}/_{16}$
FS-14E	4.2– 4.9	500 MHz	175	—40	3½ x 1⅛ x 1$^{5}/_{16}$
FS-14F	4.9– 5.6	600 MHz	125	—35	3½ x 1⅛ x 1$^{5}/_{16}$
FS-14G	5.4– 6.0	600 MHz	100	—35	3½ x 1⅛ x 1$^{5}/_{16}$
FS-24	8.0–10.0	500 MHz	40	—35	4⅝ x 1⅛ x 1$^{5}/_{16}$
FS-24M	10.0–10.4	400 MHz	25	—35	4⅝ x 1⅛ x 1$^{5}/_{16}$
FS-35	12.4–18.0	800–1000 MHz	25	—35	5 x 1⅛ x 1$^{5}/_{16}$

VOLTAGE TUNED — Low Power

- Up to octave tuning ranges
- Rapid tuning rates
- Rugged compact package
- Low DC power drain



FS-48

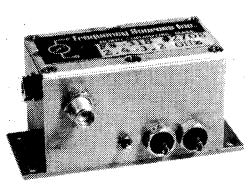
Ku-Band

Model	Frequency Range (GHz)	Voltage Tuned Bandwidth	Power Output (mW)	Harmonic Suppression (dB)	Dimensions (Inches) L W H
FS-6	0.3– 1.8	15%	20	—25	2½ x ⅞ x 1
FS-6H	0.3– 1.8	10%	100	—25	2½ x ⅞ x 1
FS-36	0.2– 1.5	Octave	10	—15	2½ x ⅞ x 1
FS-36H	0.2– 1.2	Octave	150	—15	2½ x ⅞ x 1
FS-47	1.0– 2.0	Octave	100	—15	2½ x ⅞ x 1
	2.0– 4.0	Octave	15	—15	2½ x ⅞ x 1
FS-25	1.8– 2.5	200 MHz	10	—30	2½ x ⅞ x 1
FS-50	1.2– 2.8	10% Fund.	40	—30	1¾ x 1½ x 1¼
FS-23	2.5– 5.0	15%	15–10*	—35	3 x 1½ x 1
FS-18	4.8–11.0	500 MHz	25–3*	—35	3$^{7}/_{16}$ x ⅞ x 1
FS-18W	8.5–11.0	1100 MHz	1	—35	3$^{7}/_{16}$ x ⅞ x 1
FS-48	15.0–18.0	1000 MHz	5	—35	2½ x 2 ½ x 2⅜

* High end of band.

CAVITY STABILIZED

- Mechanically tuned, wide bandwidth
- ±0.05% stability —30°C to +71°C
- Low FM noise content
- AFC and oven stabilized options
- Fundamental frequencies to 4 GHz



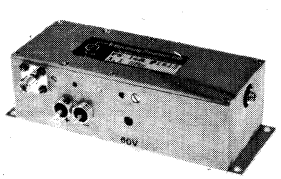
FS-31S

S Band

Model	Frequency Range (GHz)	Tuning Range (MHz)	Power Output (mW)	Harmonic Suppression (dB)	Dimensions (Inches) L W H
FS-26	1.2– 1.5	300	10	—40	3 x 1 x 1¼
FS-28	1.5– 2.3	800	10	—35	2½ x 1 x 1¼
FS-31	2.0– 3.0	1000	10	—35	2 x 1 x 1¼
FS-31S	2.4– 3.2	800	10	—35	2 x 1 x 1¼
FS-31A	3.0– 4.0	1000	10	—35	2 x 1 x 1¼
FS-27H	3.2– 6.0	500	20	—30	3 x 1 x 1¼
FS-37A	4.0– 4.5	500	10	—50	2½ x 1 x 1⅝
	4.5– 4.9	400	10	—50	2½ x 1 x 1⅝
	4.9– 5.4	500	10	—50	2½ x 1 x 1⅝
	5.4– 5.9	500	10	—50	2½ x 1 x 1⅝
FS-37B	5.9– 6.5	600	10	—50	2½ x 1 x 1⅝
	6.4– 6.9	500	10	—50	2½ x 1 x 1⅝
FS-37C	6.8– 7.3	500	10	—40	2½ x 1 x 1⅝
	7.0– 7.5	500	10	—40	2½ x 1 x 1⅝
FS-37D	7.5– 8.0	500	5	—40	2½ x 1 x 1⅝
	8.0– 8.6	600	5	—40	2½ x 1 x 1⅝
	8.6– 9.2	600	5	—40	2½ x 1 x 1⅝
FS-37E	9.2– 9.8	600	5	—40	2½ x 1 x 1⅝
	9.8–10.4	600	5	—40	2½ x 1 x 1⅝

MECHANICALLY TUNED — High Power

- Operating temperatures —55°C to +71°C
- Frequency stability ±0.5%
- AFC available on most models
- Rugged, compact package



FS-14R

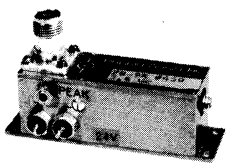
S & C Band

Model	Frequency Range (GHz)	Tuning Range (%)	Power Output (mW)	DC Input (Volts)	Harmonic Suppression (dB)	Dimensions (Inches) L W H
FS-7	0.1– 1.7	15	200–50*	24–28	—25	2½ x ⅞ x 1
FS-7R	0.1– 1.8	1	250–100*	24–28	—25	2½ x ⅞ x 1
FS-148	0.2– 0.5	20	2000	40	—25	2½ x 1⅛ x 1$^{9}/_{32}$
FS-2R	0.6– 1.4	1	1000	40	—25	2½ x 1⅛ x 1$^{9}/_{32}$
FS-165	1.6– 1.8	1	250	12	—25	1½ x ¾ x ¾
FS-14R	2.4– 3.5	1	500	40	—40	3$^{15}/_{16}$ x 1⅝ x 1$^{5}/_{16}$
FS-14L	3.5– 6.0	1	400–150*	40	—40	3½ x 1⅛ x 1$^{5}/_{16}$
FS-24R	7.0–10.5	1	100	40	—40	4⅝ x 1⅛ x 1$^{5}/_{16}$
FS-35R	12.4–18.0	1	40	40	—35	5½ x 1⅞ x 1¼

*High end of band.

MECHANICALLY TUNED — Low Power

- Ample power for L.O. applications
- ±0.1% stability over 0°C to +60°C
- Excellent pulse capabilities
- Low DC power drain
- Special designs −55°C to +95°C



FS-9R

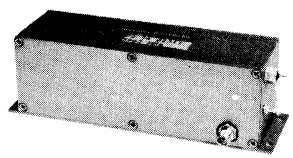
C Band

Model	Frequency Range (GHz)	Tuning Range	Power Output (mW)	DC Input (Volts)	Harmonic Suppression (dB)	Dimensions (Inches) L W H
FS-8	0.5– 1.8	1%	100	20–28	−25	2½ x ⅞ x 1
FS-5	0.5– 1.8	15%	25	20–28	−25	2½ x ⅞ x 1
FS-19	0.8– 1.2	20%	10	20–28	−25	1⅜ x ¾ x 13/16
FS-19A	1.2– 1.8	20%	10	20–28	−25	1⅜ x ¾ x 13/16
FS-4R	2.0– 4.0	1%	15–7*	20–28	−25	3½ x ⅞ x 1
FS-3R	2.0– 4.0	1%	60–30*	20–28	−25	3½ x ⅞ x 1
FS-1R	4.0– 6.5	50 MHz	7–4*	20–28	−25	2½ x ⅞ x 1
FS-9R	2.0– 6.0	50 MHz	20	20–28	−25	2½ x ⅞ x 1
FS-17R	7.0–10.0	50 MHz	10	20–28	−35	3/16 x ⅞ x 1

*High end of band.

CRYSTAL CONTROLLED

- Ultrastable frequency control
- High harmonic suppression
- Compact, rugged design
- Available 0.06 GHz to 18.0 GHz



FS-34

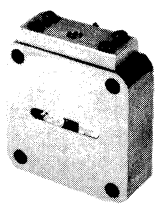
C & X Band

Model	Frequency Range (GHz)	Power[3] Output (mW)	Frequency Stability (0-60°C)	Harmonic Suppression (dB)	DC Input (Volts)	Dimensions (Inches) L W H
FS-21A	0.06– 0.25	20–10	±0.003%	−35	15[4]	3½ x 1⅜ x 1⅛
FS-21B	0.25– 0.45	10–5	±0.003%	−35	15[4]	3½ x 1⅜ x 1⅛
FS-38	0.06– 0.45	20–5	±1.0PPM	−35	15[2][4]	5 1/16 x 2 21/32 x 2 25/32
FS-21CLP	0.45– 1.50	20–5	±0.003%	−60	15[4]	5 x 2½ x 1 19/64
FS-21CMP	0.45– 2.00	175–10	±0.003%	−60	28[4]	5 x 2½ x 1 19/64
FS-21CHP	0.45– 2.00	1000–50	±0.003%	−60	28[4]	5 x 2½ x 1 19/64
FS-39	0.45– 2.00	70–1	±1.0PPM	−60	28[2][4]	6 59/64 x 3 55/64 x 2½
FS-30A	2.00– 2.50	15–10	±0.003%	−60	+15	4 39/64 x 1⅞ x 1 1/16
FS-30	2.50– 5.00	10–5	±0.003%	−60	+15	4 39/64 x 1½ x 1 1/16
FS-30HP	2.50– 5.00	60–25	±0.003%	−60	+28	4 39/64 x 1½ x 1 1/16
FS-34	5.00–10.00	5–2	±0.003%	−30[1]	+28	4 39/64 x 1½ x 1 1/16
FS-34HP	5.00–10.00	15–5	±0.003%	−30[1]	+28	4 39/64 x 1½ x 1 1/16
FS-29A	2.50– 5.00	25–8	±1.0PPM	−60	+28[2]	6 3/16 x 2 31/32 x 2¾
FS-29B	5.00–10.00	5–2	±1.0PPM	−30[1]	+28[2]	6 3/16 x 2 31/32 x 2¾
FS-49	12.40–18.00	5–0.5	±0.003%	−40	+28	5⅛ x 2 5/16 x 2

Notes:
(1) ½ f_o and 2 f_o suppressed greater than 30 dB. All other spurious signals greater than 60 dB.
(2) Additional +28 volt supply required for oven.
(3) Minimum power output. Lower figure applies to highest frequency.
(4) Isolated supply terminals.

AVALANCHE DIODE SOURCES

- Fundamental frequencies to 18 GHz
- −40°C to +70°C temperature range
- High efficiency
- Up to 100 mW available



FS-202

X Band

Model	Frequency Range (GHz)	Tuning Range (MHz)	Power Output (mW)	Harmonic Suppression (dB)	Output Connector W/G	Output Connector Coax	Dimensions (Inches) L W H
FS-40	5.0–12.4	100	10	−40		X	2 x ¾ x 15/16
FS-40W	8.2–12.4	100	10	−40	X		1 9/16 x 1⅛ x 1¾
FS-202	8.2–12.4	Fixed	100	−40	X		⅝ x 1⅝ x 1⅞
FS-40K	12.4–18.0	Fixed	10	−40	X		⅝ x 1 5/16 x 1 9/16
FS-42	5.0–12.4	10%	10	−35		X	2 x ¾ x 1⅜
FS-43	8.2–12.4	150 Elec.	10	−35		X	2¾ x ¾ x 15/16

Notes:
Most models available optimized for pulse operation.
Models FS-40, 40W, 42 and 43 have built-in current control as standard.

CRYSTAL STABILIZED — Phase Lock

- High output power
- ±0.003% stability 0°C to +60°C
- Low DC power consumption
- Low harmonic responses
- Available from 0.6-18.0 GHz



FS-24PL

Model	Frequency Range (GHz)	Power Output (mW)	DC[1] Input (Volts)	Harmonic Suppression (dB) Min.	Dimensions (Inches) L W H
FS-2-PL	0.6– 1.4	1000	50	−25	5⅜ x 4⅛ x 1 9/16
FS-14R-PL	2.4– 3.5	500	50	−40	5⅜ x 4⅛ x 1 9/16
FS-14L-PL	3.5– 6.0	200	50	−40	5⅜ x 4⅛ x 1 9/16
FS-24-PL	7.0–10.5	100	50	−40	5⅜ x 4⅛ x 1 9/16
FS-35-PL	12.4–18.0	40	50	−40	6 x 5⅜ x 1 5/16

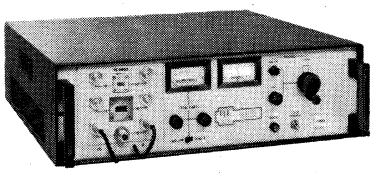
Notes:
(1) 400 mA max. Terminals isolated from case.

MULTIPLIERS

- Input frequencies from 50 MHz
- Output frequencies to Ku-band
- Both passive and active available
- Custom designed
- Rugged, compact packages

Model	Output Frequency (GHz)	Output Power (mW)	Passive Or Active	Input Power (mW)	Multiplication	Dimensions (Inches) L W H
FS-156	1.2	300	P	2500	8	4⅜ x 2 5/16 x 1⅜
FS-195	1.25	100	P	1000	4	2½ x 2½ x 1⅛
FS-155	1.3	0.5	P	200	45	4⅜ x 2 5/16 x 1⅜
FS-178	1.2–1.4	200	A	20	2	5 x 2¾ x 1½
FS-174	3.9–4.1	30	P	1000	10	4 x 3 x 1½
FS-143	4.6–5.2	5	P	30	3	3½ x 1⅛ x 1 5/16
FS-209	5.0	10	P	100	6	3½ x 1⅛ x 1 5/16
FS-206	7.3–8.2	3	P	150	5	3 7/16 x ⅞ x 1
FS-201	10.5	2	P	30	6	3 7/16 x ⅞ x 1

130A series SYNCHRONIZERS



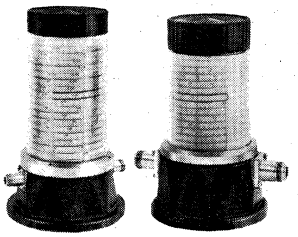
FEL 1-40GHz CONTINUOUSLY TUNABLE SYNCHRONIZER

to phase-lock klystrons, backward-wave oscillators, solid state and triode oscillators to a crystal reference

- ultra frequency stability . . . 1 part in 10^8/second, or 1 part in 10^7/day
- continuously tunable from 1GHz to 40GHz . . . also available in shorter ranges with add-on range capabilities
- single control operation
- solid-state and completely self-contained; cabinet or rack mount
- low power consumption
- deliverable from current production

For use with an oscillator source in the research lab, on the production line, or rack mounted for tactical environments . . . to provide an extremely stable signal for microwave frequency standards, doppler systems, MTI techniques, radio astronomy receivers and parametric amplifier pumps.

WDA series DIRECT-READING WAVEMETERS

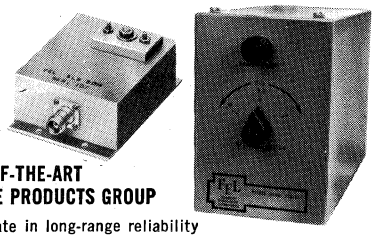


FEL WDA 940, WDA 3712 DIRECT-READING PRECISION FREQUENCY METERS

just 2 absorption type meters—instead of the usual 4 to 5—cover the full frequency range from 960MHz to 12400MHz

- WDA 940, 960-4200MHz
- WDA 3712, 3700-12400MHz
- direct readout in MHz
- special alloys and precision-ground invar threads assure smooth operation, minimum wear
- reduced cost
- superior temperature stability

For measuring cw, am, fm or pm microwave signals. Ideal for frequency measurement of microwave transmitters, microwave receivers, local oscillators and signal generators.



FEL STATE-OF-THE-ART SOLID-STATE PRODUCTS GROUP

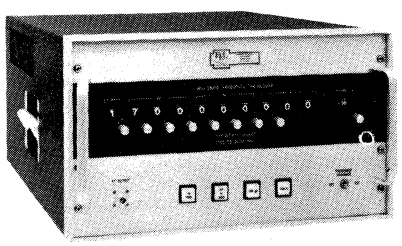
for the ultimate in long-range reliability

- Sources, 500MHz to 16MHz . . . high output power, wide running range, high spectral purity, superior MTBF
- Up/Down Converters, 1-9GHz . . . high power output, conversion efficiency, spectral purity, integrated source or LO
- Amplifiers, 100MHz to 2GHz . . . low noise, high gain, high output
- Multipliers, 100MHz to 10GHz . . . high efficiency, wide range

The FEL state-of-the-art solid-state products listed above are available from current production. We invite your inquiries for solid-state oscillators, VCOs, broadband frequency multipliers, IMPATT oscillators, amplifiers, up and down converters, and related products custom-engineered to meet your requirements for airborne, missile-borne, ground-based, or laboratory applications.

FREQUENCY ENGINEERING LABORATORIES

PRECISION MICROWAVE INSTRUMENTS AND COMPONENTS



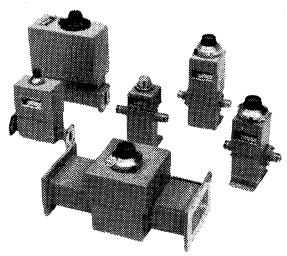
FEL 700A 1.2-2.4GHz COHERENT MICROWAVE SYNTHESIZER

generates ultra-stable, spectrally-pure RF energy

- ultra frequency stability . . . 2 parts in 10^9/day
- simplified tuning
- frequency selection in increments of 1Hz with digitally calibrated front dials or electronic programming
- solid-state, self-contained, compact
- rear-panel jacks supply reference outputs at 100kHz, 1, 5 and 100MHz
- optional remote programming with 10 line bcd code
- 10mw output across entire range

Applications include laboratory use as a microwave frequency standard, telemetry, local oscillators for coherent radar and MTI systems, automatic and manual testing of frequency sensitive devices.

CUSTOM ENGINEERED PRODUCTS



Extensive engineering and manufacturing capabilities make Frequency Engineering Laboratories an ideal supplier of custom engineered microwave components, instruments, sub-systems or complete fixed station or tactical systems. Your inquiries are invited, for:

- airborne interdigital filters
- tunable bandpass and band reject filters
- special wavemeters with direct, micrometer or tape readout
- diplexers and multiplexers
- reference cavities, pre-selector mixers, discriminators, converters
- frequency sources, frequency monitors and custom microwave instrumentation

Specification sheets for these and all other FEL products are available by writing or calling:

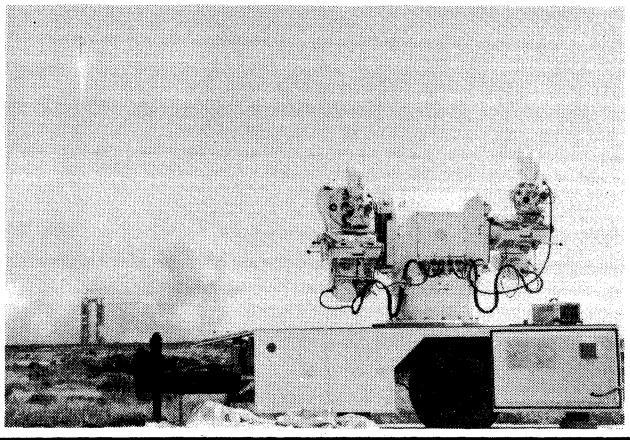
FREQUENCY ENGINEERING LABORATORIES
a division of Harvard Industries, Inc.
Farmingdale, New Jersey 07727
(201) 938-9221 / TWX (201) 938-2456

Expansion has created excellent opportunities for qualified engineers; send complete resume to Supervisor, Professional Employment.

GEO SPACE SYSTEMS, INC.

RANGE INSTRUMENTATION EQUIPMENT — PRECISION PEDESTALS

COMPLETE TRACKING SYSTEMS



MOBILE OPTICAL TRACKING SYSTEM

The Mobile Optical Tracking System is a precision, high load capacity, servo controlled position pedestal, mobilized for usage in rugged terrain. It can be controlled locally from the pedestal, or from its mobile control van—or a permanent site—located up to 12 miles from the pedestal.

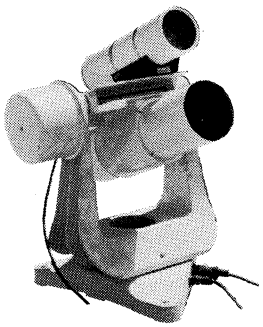
The pedestal is controlled by infrared or TV edge track auto-track systems, or by manual joystick control. The control system features auto-override to allow momentary selection of manual mode, and a coast function allowing the pedestal to continue at the established rate for a minimum of 10 seconds should the target be lost.

Versatility is the key to the control system design. Operational switches allow the operator to select a variety of tracking modes, change system bandwidth, or introduce special functions for ease of tracking and improved accuracy.

The system requires only two hours site installation and collimation time. Two men are necessary for calibration and set-up, but normal system operation is a one-man job. Position accuracy is 2 arc seconds (static) and 0.003 mr/mr/sec (dynamic). Its angular displacement is 345° azimuth, −10° to 90° elevation. Stable tracking rates in the speed range of 5 arc sec/sec to 70 deg/sec may be obtained. Camera platforms are capable of accepting cameras weighing 500 pounds with a maximum load capacity of 1480 pounds symmetrical and balanced. Balancing of the load requires no counterweights, utilizing crank controlled weight displacement for balancing.

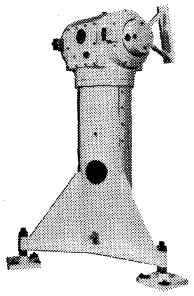
The flexible capabilities of MOTS allows many system variations, making it easily adaptable to the user's specific requirements.

PEDESTALS AND TRACKING EQUIPMENT



SERVO CONTROLLED INSTRUMENT POSITIONER

This positioner is a rugged, lightweight unit capable of remote control, auto-track, and pre-programming. Handling a symmetrical load of up to 75 lbs., it utilizes dc servo control in a closed loop system.



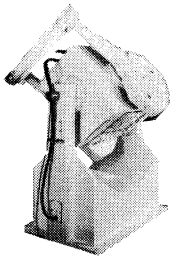
PRECISION SERVO CONTROLLED PEDESTAL

This instrument positioning system features continuous azimuth travel with ±100° elevation, is capable of mounting symmetrical loads up to 200 pounds, and has a positioning accuracy (static) of ±.1°. Along with the solid state servo controller, the complete system can be pre-programmed, operated in a pre-position select or auto-track mode.



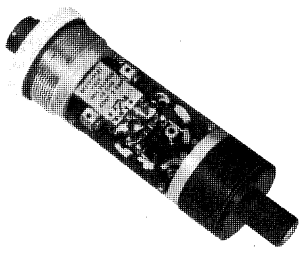
AZIMUTH/ELEVATION POSITIONER

The GSS Model 8175 Azimuth/Elevation Positioner is a lightweight, precision positioning unit capable of remote, manual or autotrack control. The versatile mounting arrangement permits balanced loads of up to 75 pounds with a rated velocity of 30 degrees/second and an acceleration of 30 degress/second and an acceleration of 30°/sec². Elevation travel is −10 degrees to 190 degrees. Azimuth travel is limited by cable wrap up, or approximately ±180 degrees. Drive power is supplied by a dual-channel, complimentary transistor servo-amplifier.



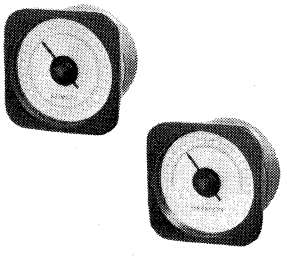
XY PEDESTAL POSITIONER

The XY Pedestal positioning system is a high rigidity antenna positioner capable of maximum sky coverage including target fly-over. A unique X-shaft cam reduces "key hole" around support pillows to a minimum. Instrument loads of up to 1200 pounds can be positioned to .1° static accuracy. The tracking unit rate is 10° per second with a dynamic error of .3° maximum. The maximum acceleration is 35° per sec².



SUN SENSOR AND CONTROL

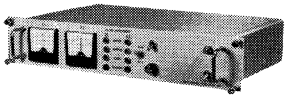
The SS-101 furnishes switch contact closures when an intense light source passes through the field of view. The unit is fully compatible with any electrically driven sun shutter equipment and its light sensitivity threshold is adjustable.



SERVO/SYNCHRO DRIVEN REMOTE AZIMUTH AND ELEVATION INDICATORS

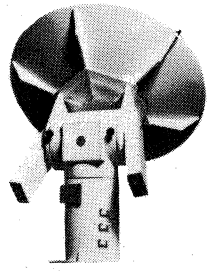
These indicators display remote angular or linear position, or any other calibrated quantity that can be represented by shaft rotation or linear displacement.

A wide variety of dial calibrations, colors, mounting arrangements and synchro ratios can be provided.



AUTO-TRACK INTEGRATION EQUIPMENTS

These solid state units will couple an angle-error sensing device to an elevation-over-azimuth positioning pedestal to achieve a completely automatic tracking system. They also allow addition of a remote manual control (joystick) to the system, provide a provision for automatic switchover to null detector tracking, and allow retention of existing means of pedestal control.



AUTOMATIC TELEMETRY TRACKING SYSTEMS

These systems have been designed using the GSS precision servo controlled pedestal. A variety of antennae from conical scanning telemetry types to helix and cross dipole arrays can be mounted on and positioned by the servo driven pedestal. Antenna polarization can be selectable from remote control. Automatic tracking rates to 30 deg/sec are obtainable.

Design excellence and trouble-free performance are recognized attributes of the Geo Space Systems' servo positioned pedestal equipment that has been developed and manufactured for a number of critical national test range applications.

A staff of professional design engineers and consultants and an experienced field engineering team are maintained to offer a full range of expert services to prospective users.

GEO SPACE SYSTEMS, INC.
6301 49TH STREET NORTH, P. O. BOX 13575
ST. PETERSBURG, FLORIDA 33733
Phone: 813 - 525-1161

HADRON

THE NEW CONCEPT IN LASERS AND LASER COMPONENTS

Hadron has the capability to determine whether a laser can provide a better and more economical solution to your problem — be it in the area of manufacturing processes or laboratory applications. The laser having the right characteristics can then be supplied. This avoids the pitfalls that frequently confront the laser purchaser — that is, obtaining an expensive instrument whose capabilities far exceed those required for his particular needs or obtaining a laser whose capabilities are not sufficient to solve his particular problems.

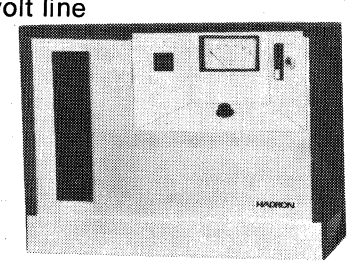
LPM LASER POWER SUPPLY

Maybe you have several pulsed lasers and find that each requires a different power supply. Or maybe you are aware of the special problems that face the designer of laser power supplies and, therefore, prefer to buy your energy source.

Hadron can furnish you with a versatile supply that provides the energy for solid-state lasers of all types. Take the features of our LPM Laser Power Supply.

- Laser head or flashlamp components can be mounted inside power-supply cabinet
- Provides an ouput of several hundred joules at repetition rates of 30 PPM
- Incorporates modular design as well as compact and rugged construction
- Provides a wide range of stable outputs
- Can be customized to operate with various laser systems
- Combines simplicity of design with ease of operation and maintenance
- Provides long trouble-free operating life
- Operates from 120-volt line

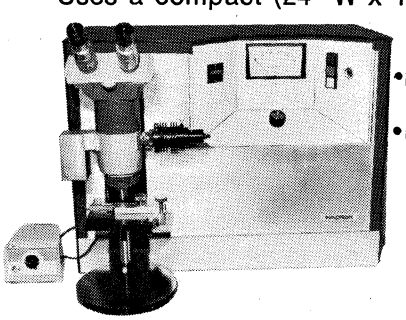
In addition, Hadron can supply power sources for pulsed laser systems requiring an input power in the order of 100 kilowatts at repetition rates of several Hertz.



LPM SOLID-STATE LASER SYSTEM

Maybe you require a laser system that is easily applicable to your needs in microwelding, trimming, drilling, or general laboratory applications. Or maybe you need a laser system that is reliable, economical, simple to operate, small in size, and adaptable to a wide range of uses. Hadron can provide you with a laser to satisfy all these requirements. Take the features of our LPM Ruby Laser System.

- Provides an output energy of up to 5 joules, a pulse width of 800 microseconds, and a repetition rate of up to 1 pulse per second
- Incorporates modular design and rugged construction
- Adapts to a wide range of tooling requirements and production rate processes
- Available with standard fixtures for different applications
- Uses a compact (24″ W x 18″ H x 12″ D) and lightweight (125 pounds) design
- Necessitates little maintenance
- Requires a power of 120 volts/20 amperes, single phase



HADRON is the exclusive distributor for the Compagnie Générale D'Électricité laser product line in the United States. We thus have available such advanced equipments as: • High-peak-power high-brightness systems • Laser ranging systems — ground, airborne, and satellite • Laser gyroscopes • Medical laser systems • Alignment systems • Laser materials • For complete specifications, price and delivery information, call or write: HADRON • 300 Shames Drive/Westbury, N. Y. 11590 • 516-334-4402

HADRON

LAD Electro-Systems, Inc.

HIGH ENERGY PULSE SOURCES

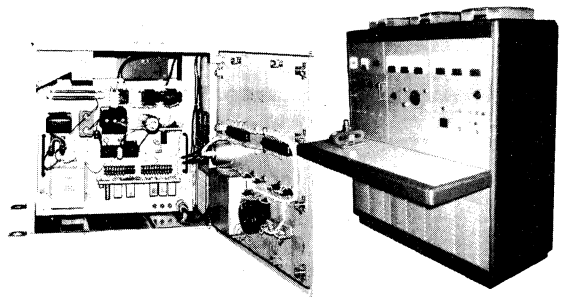
- Complex loads
- Variable repetition rates
- Variable pulse shapes and widths

APPLICATIONS:

- Aerospace
- Military
- Commercial
- Industrial

CUSTOM DESIGNED PULSE SYSTEMS

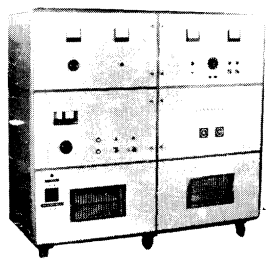
for RADAR, LASER, ARC DISCHARGE DEVICES, LABORATORY and PRODUCTION TESTING

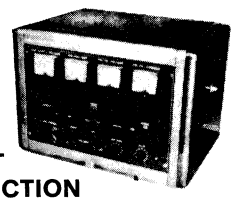


RADAR/LASER/MASER MODULATORS

The ability to shape a pulse to specific requirements provides invaluable information on the performance of a device and the obvious advantage of optimizing an energy-time relationship. The ability to vary the output impedance over a wide range makes the modulator suitable whether pumped optically, electrically or by microwave.

Energy, from millijoules up to many joules, can be delivered to your load under controlled conditions, or dumped as in simple capacitor discharge into loads from one ohm to many kilohms.





- SHAPED PULSE
- HIGH POWER
- COMPACT CONSTRUCTION
- BUILT-IN SAFETY FEATURES
- SOURCE IMPEDANCE MATCHES LOAD

TYPICAL LAD MODULATORS

Model No.	Joules per Pulse	Peak Voltage	Peak Current	Pulse Width	Pulse Rep. Rate	Duty Max.
410	0.025	50KV	2A	0.25 μsec	60—5000	.0012
412	0.5	0.5KV	50A	1, 3, 8, 20	10—1000	.01
226	4.8	20KV	9A	5—35	50—5000	.12
1207	15	60KV	86.5A	1—5	50—5000	.002
1201	90	150KV	120A	5	50—500	.001

PULSE FORMING NETWORKS

LAD Pulse Forming Networks and Pulse Capacitors meet exacting requirements for both systems and laboratory applications. Designed and built to applicable MIL specifications, they are available in a wide range of ratings and performance characteristics.

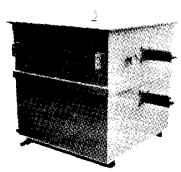
Networks can be supplied individually or as part of pulse packages, with single or multiple pulse widths.

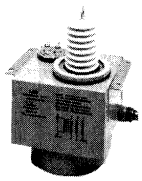
TYPICAL LAD PULSE FORMING NETWORKS

Part #	Peak Voltage KV	PW usec	PRF	Impedance Ohms	No. Meshes	% Ripple
PFN118	26	60	300	130	20	2%
PFN114	25	1	790	50	5	5%
PFN115	20	.5	2000	50	3	5%
PFN155	18	½-2	50-4000	32	2-12	5%
PFN173	16	.51	1000	25	3	5%
PFN146	16	.18	2000	65	2	2%
PFN154	15	2.75	364	50	12	2%
PFN117	15	65.0	300	1500	20	2%
PFN134	14	.1	4000	39	3	5%
PFN141	14	.15	4800	39	5	5%
PFN189	10.5	¼-2	20	25	1-8	5%
PFN203	7.5	10	60	82	1	N.A.
PFN204	5.2	1-20	.01Du	260	3-60	5%
PFN165	5	8-35	.0052Du	63	8-33	1%
PFN195	1	1-5	60	5	5-25	5%
PFN167	.35	16	200	25	12	2%

High Voltage — High Power

PULSE TRANSFORMERS





LAD produces a broad line of pulse transformers for use in high power ground, aerospace and shipboard radar systems. These LAD high voltage devices deliver high levels of peak pulse power over a wide range of pulse width and repetition rates.

FEATURES

- Optimum Pulse Fidelity
- High Quality
- Custom Packaging
- Meet Applicable Mil Specs

LAD Electro-Systems, Inc.

LAD PRODUCES A COMPLETE LINE OF

- Pulse Components
- Keep-Alives
- Pulsed Keep-Alives
- Current Viewing Transformers
- Energy Storage Capacitors

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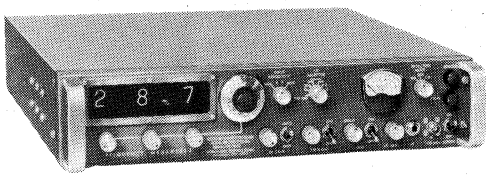
LORCH COMMUNICATION EQUIPMENT AND ACCESSORIES • RF COMPONENTS

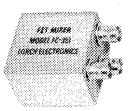
WIDE DYNAMIC RANGE RECEIVER
Model HR-240 - 2 to 32 MHz



A sensitive, wide dynamic range receiver with locally or remotely controlled all-electronic tuning. All front panel knobs and switches, including frequency tuning may be controlled locally or by remote program.

Frequency Range	2 to 32 MHz
Tuning Time	5.0 milliseconds
Dynamic Range	over 100 db
Spurious Response Rejection (including Image and IF)	over 100 db
Sensitivity (3 KHz Bandwidth)	−133 dbm
Gain Variation vs. Frequency (2 to 32 MHz)	±1 db
Reception Modes	AM, USB, LSB, and CW
Size	17″ W x 21″ D x 5¼″ H

DOUBLE BALANCED FET MIXER
Model FC-351



A double balanced FET mixer with extremely low intermodulation distortion, high power handling capability and excellent isolation between all ports.

Frequency Range, all ports	0.2 to 100 MHz
Conversion Loss and Noise Figure	9 db max.
Two Tone Intermodulation Ratio (3rd and 5th Order) Two RF tones, each 0 dbm	80 db
Compression Level (2 db compression)	+30 dbm
Dynamic Range	155 db
Isolation	To 50 db
DC Power Required	None

WIDE BAND BALANCED MIXERS

Low intermodulation and spurious products

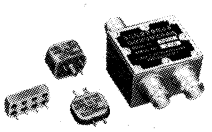


Frequency Range	rom 10 KHz to 12.4 GHz
Conversion Loss	As low as 5 db
Isolation	To 85 db
Two Tone Intermodulation Ratio, Third Order Two tones, −30 dbm	To 115 db
Dynamic Range	To 140 db
Temperature Range	−65°C to +125°C

Hermetically Sealed

Standard Pin Packages, Connector Versions, Custom Packaging. High power versions of mixers and product detectors available on special order.

WIDE BAND ELECTRONIC SWITCHES



RF Frequency Range	1 to 100 MHz
Switching Frequency Range	DC to 50 MHz
RF Input Level for 1 db Compression	To +15 dbm
Insertion Loss, ON Condition	To 2 db
Insertion Loss, OFF Condition	To 70 db
Temperature Range	−65°C to +125°C

Hermetically Sealed

Standard Pin Packages, Connector Versions, Custom Packaging

WIDE BAND HYBRID JUNCTIONS and POWER SPLITTERS

2, 3, 4, 5, 6, 8 and MULTIWAY

Frequency Ranges	From 10 KHz to 400 MHz
VSWR	1.2 to 1
Isolation	To 35 db
Phase Balance	±1°
Amplitude Balance	0.1 db
Temperature Range	−65°C to +125°C
Input Power	To 50 watts

Hermetically Sealed

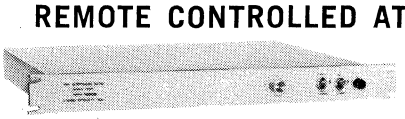
TO-5 Can, Standard Pin Packages, Connector Versions, Custom Packaging

HF PRESELECTION FILTER, Model PF-290

A low insertion loss filter bank locally or remotely controlled, designed to reduce interference in the congested HF range. Available with or without a built-in preamplifier.

Frequency Range	2 to 32 MHz
Number of Pass Bands	10
Pass Band Insertion Loss	2 db max. (without amplifier)
Rejection below (Low frequency cut-off −20%) and above (High frequency cut-off +20%)	35 db
Rejection above 38 MHz	60 db min.
Noise Figure (with amplifier)	7 db
Gain (with amplifier)	10 db
Switching Time	5.0 milliseconds

REMOTE CONTROLLED ATTENUATORS



Model AT-300
Model AT-310

This family of attenuators may be locally or remotely controlled. Attenuators are available in a large variety of values.

Frequency Range	DC to 100 MHz
Number of Positions	Six (AT-300) Ten (AT-310)
Attenuation Accuracy	±0.5 db
Switching Time	5 milliseconds
Minimum Insertion Loss	0 db (nominal)
Maximum Attenuation	60 db

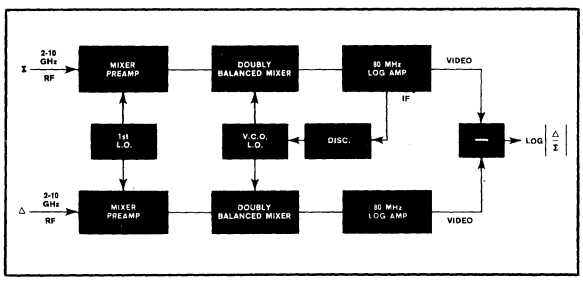
FET LINEAR ATTENUATORS, FREQUENCY MULTIPLIERS, RF TRANSFORMERS, DIRECTIONAL COUPLERS, WIDEBAND AMPLIFIERS

LORCH ELECTRONICS CORP.
105 Cedar Lane, Englewood, N. J. 07631 • 201-569-8282 • TWX: 710-991-9718

LEL System and Subsystem Capabilities

LEL is particularly well qualified and eminently capable in the design, development and production of systems and sub-systems equipment for ECM, monopulse, pulsed radar, phased array and similar applications. In addition to our long and varied experience in these areas, the LEL/Varian organization is well provided with the advanced techniques and equipment required to produce complex systems equipment in volume . . . on a quick reaction basis. Some recent LEL projects indicative of these capabilities are presented herein.

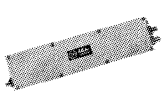
ECM and ECCM



The diagram above is typical of systems work in which LEL has been recently involved. Many Component parts of such systems are standard, catalogued LEL units like these:



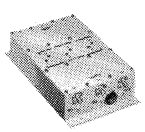
Mixer-preamplifiers Series BMP-1-160 operate over 2-10 GHz



Log Amplifiers Series ITL-6 have 1 dB matching referred to input



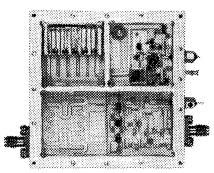
Octave amplifiers Series OTX 10-2000 MHz, 4-6 dBNF 0 dBm power output



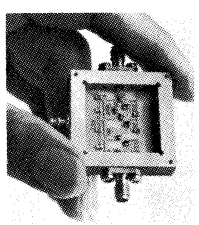
IF amplifiers Series ITA 8 3 Triple channel, phase and gain matched

Integrated Circuit Subsystems

Utilizing advanced in-house design, test and production equipment, LEL is applying integrated circuit techniques to a wide variety of microwave subsystems. The program has already resulted in several microwave products combining the size and reliability advantages of IC's with the electrical performance normally yielded by conventional techniques.

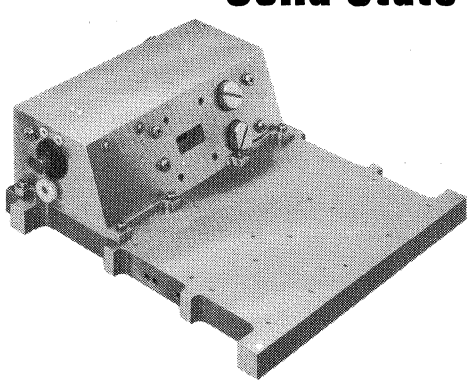


One such product, a telemetry down converter, consists of four 1″ x 2″ alumina substrates packaged in an aluminum housing which occupies a total space of 2.5 cubic inches. Included in the package are local oscillator, multiplier, mixer and IF amplifier with associated circuitry. Total power drain of the unit is only 2 watts.



Similarly, LEL's new model IHP-1 IC preamplifiers, available with either 10 MHz or 100 MHz bandwidth, are low noise, (2-3 dB) high dynamic range devices measuring only 0.5 cubic inches. Coming along in comparably small packages are low noise RF amplifiers, log amps, mixer-preamplifiers and other receiving subassemblies.

Solid State Microwave Receivers



Typical LEL capabilities in this area are the series OMR airborne receivers available for operation from 500 MHz through 40 GHz.

The X-Band model shown here features a field tunable RF input and an L.O. search range of 40 MHz. Model shown incorporates a klystron. Similar models with all solid state L.O.'s are available. The AFC lock-on sensitivity is −95 dBm and the video output is held constant for signals between −90 dBm and −25 dBm input. The receiver is designed in accordance with MIL-E-5400. Other solid state microwave receivers and receiver/converters are available, some with special characteristics which may be particularly suitable for your appiication.

LEL DIVISION
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LEL IF Amplifiers and Components

IF PREAMPLIFIERS

for quality, low noise, long term performance in such applications as radar, communications, guidance and navigation systems.

standard models

Model No.	Center Freq. MHz	Bandwidth @ 3 dB MHz	Gain dB	Max. Noise Figure dB
■ miniature tube type				
IF-31-30-08-S	30	8	40	1.5
IF-31-60-08-S	60	8	40	2.5
IF-31-60-20-S	60	20	40	3.0
IF-31-70-08-S	70	8	40	3.0
IF-31-70-20-S	70	20	40	3.5
IF-31-30-08-P	30	8	40	1.5
IF-31-60-08-P	60	8	40	2.5
IF-31-60-20-P	60	20	40	3.0
IF-31-70-08-P	70	8	40	3.0
IF-31-70-20-P	70	20	40	3.5
IF-31-30-08-PP	30	8	40	1.5
IF-31-60-08-PP	60	8	40	2.5
IF-31-60-20-PP	60	20	40	3.0
IF-31-70-08-PP	70	8	40	3.0
IF-31-70-20-PP	70	20	40	3.5
IF-31-30-08-50	30	8	40	2.0
IF-31-60-08-50	60	8	40	3.0
IF-31-60-20-50	60	20	40	3.5
IF-31-70-08-50	70	8	40	3.5
IF-31-70-20-50	70	20	40	4.0
■ solid state				
ITP-3-60-10-50	60	10	30	2.5
ITP-3-60-20-50	60	20	30	2.5
ITP-3-60-100-50	60	100	30	2.5
■ variable bandwidth — tube type				
1MV-1-30-10-50	30	0.3-10	30	2.5
1MV-1-60-20-50	60	0.8-20	30	3.0
1MV-1-70-20-50	70	1.0-20	30	3.5
■ variable bandwidth — solid state				
ITV-1-30-10-50	30	1.0-10	25	8
ITV-1-60-10-50	60	1.5-15	25	8
ITV-1-70-10-50	70	2.0-20	25	8

Source impedances:

-S = single ended mixer,
-P = balanced mixer, reversed diodes,
-PP = balanced mixer, push-pull diodes,
-50 = IF 50 ohms.

MAIN AND POST IF AMPLIFIERS

- **low noise**
- **high gain stability**
- **wide bandwidth**
- **high gain**
- **fast recovery**
- **light weight**

LEL main amplifiers provide sufficient amplification to bring weak signals to levels adequate for detection. LEL post amplifiers, for use with preamplifiers, provide the major portion of system gain.

standard models

Model No.	Center Freq. MHz	Bandwidth @ 3 dB MHz	Gain dB	NF dB	Input	Description
main amplifiers						
IF-30-30-02-50	30*	2	110	2.0	50 ohms	General purpose
IF-30-30-02-S	30*	2	110	1.5	300 ohms, 12pf	Single ended mixer
IF-30-30-02-P	30*	2	110	1.5	Parallel diodes	Bal. mixer
IF-30-30-02-PP	30*	2	110	1.5	Push-pull diodes	Bal. mixer
IMK-1-30-10-50	30*	10	100	3.0	50 ohms	Internal AGC
IMM-2-30-10-50	30*	10	90	2.0	50 ohms	Fast recovery
IMM-3-30-10-50	30*	10	80	2.0	50 ohms	Hi gain stability
IF301-30-10-50	30	10	80	3.0	50 ohms	Narrow band
IF301-60-10-50	60	10	80	3.0	50 ohms	Narrow band
IF301-70-10-50	70	10	80	3.5	50 ohms	Narrow band
IF-302-60-20-50	60	20	80	3.0	50 ohms	Wide band, high gain
IF-302-70-20-50	70	20	80	3.5	50 ohms	Wide band, high gain
ITM-2-30-10-50	30*	10	100	2.5	50 ohms	Solid state
ITM-3-30-10-50	30*	10	100	2.5	50 ohms	Solid state, miniature

Outputs: IMM-2 = video. All others = IF and video.
***Also available with 60 or 70 MHz IF CF.**

standard models

Model No.	Center Freq. MHz	Bandwidth @ 3 dB MHz	Gain dB	Max. NF dB	Gain Control Range dB	Output	Output Capability dBm
post amplifiers (50 ohm inputs)							
IMD-1-30-08-50	30	8	25	—	0	IF	+30
ITA-5-60-20-50	60	20	70	7	40	IF, Video	+7
ITA-5-160-30-50	160	30	70	7	40	IF, Video	+7
ITA-7-30-03-50	30	3	75	7	50	IF, Video	+7
ITA-7-30-10-50	30	10	75	7	50	IF, Video	+7
ITA-7-60-10-50	60	10	75	7	50	IF, Video	+7
ITA-9-30-40-50	30	40	30	—	0	IF	+30
ITA-34-21.4-03-50	21.4	3	75	7	50	IF, Video	+10
ITA-34-21.4-08-50	21.4	8	75	7	50	IF, Video	+10
ITA-34-30-03-50	30	3	75	7	50	IF, Video	+10
ITA-34-30-08-50	30	8	75	7	50	IF, Video	+10
ITA-34-60-03-50	60	3	75	7	50	IF, Video	+10
ITA-34-60-08-50	60	8	75	7	50	IF, Video	+10
ITA-35-30-03-50	30	3	75	15	75	IF, Video	+10
ITA-35-30-08-50	30	8	75	15	75	IF, Video	+10
ITA-35-60-03-50	60	3	75	15	75	IF, Video	+10
ITA-35-60-08-50	60	8	75	15	75	IF, Video	+10

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LEL IF Amplifiers and Components

LOG AMPLIFIERS AND LIMITERS

for

- **Wide dynamic range**
- **Exceptional accuracy**

LEL log amplifiers are sequential detection type units. Most solid state models offer logging accuracy of ±1 dB. Input impedances are 50 ohms. Outputs are video.

standard models

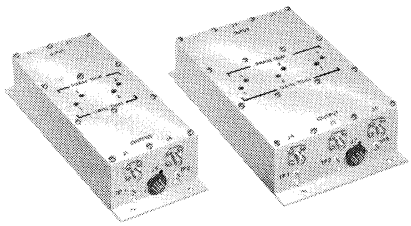
Model No.	Center Freq. MHz	Bandwidth @ 3 dB MHz	Input dynamic range dB	Sensitivity mV/dB
solid state				
ITL-1-30-04-50	30	4	60	50
ITL-1-30-08-50	30	8	60	50
ITL-1-60-04-50	60	4	60	50
ITL-1-60-08-50	60	8	60	50
ITL-2-30-10-50	30	10	80	20
ITL-2-30-18-50	30	18	80	20
ITL-2-60-10-50	60	10	80	20
ITL-2-60-20-50	60	20	80	20
ITL-2-70-10-50	70	10	80	20
ITL-2-70-30-50	70	30	80	20
ITL-2-160-10-50	160	10	80	20
ITL-2-160-30-50	160	30	80	20
ITL-4-30-10-50	30	10	80	20
ITL-4-60-10-50	60	10	80	20
ITL-4-70-10-50	70	10	80	20
ITL-5-30-08-50	30	8	70	40
ITL-5-60-08-50	60	8	70	40
ITL-6-80-20-50	80	20	70	20

limiters, IF, constant phase

Series ITLM limiters have extremely low phase shift, typically less than 7.5° over a dynamic range of 70 dB. For both phase and amplitude information, specify model ITLL which combines a log amplifier with the ITLM constant phase limiter in a single chassis.

Model No.	CF MHz	BW MHz	Input dynamic range dBm	Limited output dBm
ITLM-2-30-10-50	30	10	–70 to 0	0
ITLM-2-60-10-50	60	10	–70 to 0	0
ITLM-2-70-10-50	70	10	–70 to 0	0

PHASE-AND-GAIN MATCHED AMPLIFIERS



for multi-channel gain-and-phase tracking systems.

LEL gain-and-phase matched amplifiers may be used in varying combinations of the basic 2- or 3-channel units. Characteristics of these amplifiers are matched over the temperature and gain control ranges. Associated matched mixer-preamplifiers and monopulse comparators are also available from LEL.

specifications:

Phase match:	(Dual) 2.5°, (Triple) 3.5°
Amplitude match:	(Dual) 1 dB, (Triple) 1.5 dB
IF center freq.	30, 60 or 70 MHz
IF bandwidth	3 or 10 MHz
Gain	65 dB
Gain control	40 dB
Input	50 ohms
Output capability	+10 dBm
Power req.	–20 V @ 80 mA and 0 to +10 VDC/channel

DISCRIMINATORS AND AFC UNITS

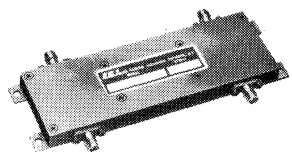
for FM, pulse or phase systems

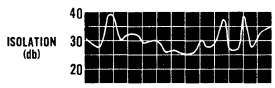
Model No.	CF MHz	BW (p-p) MHz	Sens. V/MHz	Description
pulse discriminators				
ITF-1-30-10-50	30	10	1	solid state with built-in limiter
ITF-1-60-10-50	60	10	1	
ITF-1-60-20-50	60	20	1	
ITF-1-70-10-50	70	10	1	
ITF-1-160-10-50	160	10	1	
IF-32-30-08-50	30	8	3	FM & pulse
IF-32-60-08-50	60	8	3	
IF-42-30-07-50	30	7	40	phantastron circuit
IF-42-60-07-50	60	7	40	
AFC units — solid state				
ITF-2-30-10-50	30	10	300	search-lock Hybrid
ITF-2-60-10-50	60	10	300	
ITF-2-70-10-50	70	10	300	

Inputs: 50 ohms for all models. **Outputs:** Video (ITF-1, IMF-1, IF-32), DC (ITF-2, IF-42, IF-32).

LEL STRIPLINE COMPONENTS

Broadband Directional Couplers: 0.5 to 11.0 GHz





Series BBC Directional Couplers permit use of a single coupler over an entire microwave frequency decade with excellent symmetry, directivity and VSWR at any included frequency.

- **Directivity: 20 dB (typ.), 15 dB (min.)**
- **Coupling tolerance: +1 dB**
- **VSWR: 1.35:1 (typ.), 1.5:1 (max.)**
- **Connectors: OMS**

Standard Models

Freq. Range GHz	Coupling dB	Model No.
0.5-5.0	3.0	BBC-300-550
0.5-5.0	8.34	BBC-834-550
0.5-5.0	10.0	BBC-100-550
0.5-5.0	20.0	BBC-200-550
1.0-11.0	3.0	BBC-330-111
1.0-11.0	8.34	BBC-834-111
1.0-11.0	10.0	BBC-100-111
1.0-11.0	20.0	BBC-200-111

POWER DIVIDERS

for dependable, low loss operation

Excellent for such applications as phased array systems. Minimum isolation is 15 dB (2-way) and 13 dB (4-way). Maximum VSWR is 1.8:1 (2-way) and 2:1 (4-way).

Standard Models

Range GHz	Outputs	Insertion Loss (max.)* dB	Model No.
high isolation dividers/combiners			
1.0-2.0	2	3.6	CSI-1-1002
2.0-4.0	2	3.6	CSI-1-2002
3.2-5.8	2	3.6	CSI-1-3002
1.0-2.0	4	7.0	CSI-1-1004
2.0-3.8	4	7.0	CSI-1-2004
3.2-5.8	4	7.0	CSI-1-3004
binary power dividers			
0.5-4.0	4	3.6	DSB-1-5402
0.5-4.0	4	7.0	DSB-1-5404

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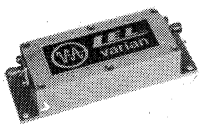
LEL RF Amplifiers Mixer-Preamplifiers

MICROWAVE AMPLIFIERS
10-4000 MHz



for maximum gain bandwidth coverage, more power and greater dynamic range in ECM, monopulse, guidance, telemetry and TWT replacement applications.

Low noise, solid state LEL amplifiers cover all frequencies between 10 and 4000 MHz. The design features the lowest noise figure commensurate with maximum input power handling capability, providing low intermodulation and low harmonic distortion. Other features include: small size, light weight (5 oz.), modular, all solid state construction, and operating temperature ranges between −40° and +70°C. Maximum power requirement is −20 VDC @ 50 mA. Standard models shown below can be qualified to MIL-I-16400 and MIL-E-5400 class II. Higher power outputs are readily available.

STANDARD MODELS

Model No.	Passband MHz	Gain dB	Noise Figure dB	Power Output dBm	Max. Output VSWR
OTX-1-10	10-250	24	3-4	0	1.5:1
OTX-1-250	250-500	20	3-5	0	2:1
OTX-1-500	500-1000	20	4-6	0	2:1
OTX-1-1000	1000-2000	25	4-6	0	2:1
OTX-1-1000P	1000-2000	25	5-7	+10	2:1
OTX-1-2000	2000-4000	20	9-11	0	2.5:1
TP-8-1435	1435-1535	25	4.5-5.5	0	2:1
TP-8-2200	2200-2300	25	5-6	0	2:1

ANTENNA PREAMPLIFIERS

for superior performance in telemetry and long range communications. Weather-proof models TP-5, -6, -7 are for pole mounting. RTP-3 units are small, light, solid state amplifiers with very low power drain.

STANDARD MODELS

Model No.	Center Freq. MHz	Bandpass @ 3 dB MHz	Gain dB	Max. N.F. dB
TP-5-237	237	215-260	23	4.0
TP-6-136	136	131-141	23	2.5
TP-6-400	400	395-405	23	4.0
TP-7-108	108-162	3	23	2.5-3.5
TP-7-160	160-225	4	23	2.0-3.5
TP-7-225	225-400	4	20	2.5-4.5
TP-7-400	400-550	5	18	4.5-6.5
RTP-3-10	10-400	10	20-28	4.0

for high performance operation in radar and communications applications.

Choose your required combination of mixer and preamplifier characteristics from the separate tables below. LEL delivers complete assemblies carefully mated both electrically and mechanically. All units operate into terminated 50, 75 or 93 ohm lines. Test measurement data for noise figure, power gain and bandwidth over the specified frequency range are supplied with each unit.

STANDARD MIXER CHARACTERISTICS

Frequency GHz	Model No.	*N.F. with 30 MHz IF of 1.2 dB	Typ. RF Input VSWR	Typ. L.O. Input Power mW	L.O./RF Min. Isolation dB
waveguide/waveguide hybrid					
3.95-4.5	CBH	6.5 to 7.0	1.3:1	1	13
4.5-5.15	CCH	6.5 to 7.0	1.5:1	1	13
5.15-5.85	CDH	6.5 to 7.0	1.2:1	1	13
7.3-8.5	XAH	6.5 to 7.0	1.2:1	1	13
8.5-9.6	XBH	6.5 to 7.0	1.2:1	1	13
9.4-10.3	XCH	6.5 to 7.0	1.2:1	1	13
10.3-12.0	XDH	8.5 to 9.5	1.2:1	1	13
12.4-14.5	KAH	8.5 to 9.0	1.2:1	1	13
14.5-17.0	KBH	8.5 to 9.0	1.2:1	1	13
23.0-25.0	KCH	9.0 to 9.7	1.3:1	1	13
34.0-36.0	KDH	9.0 to 10	1.2:1	1	13
waveguide/waveguide orthogonal and tee					
8.2-12.4	XDB	8.0 to 9.0	3.5:1	2	15
12.4-18.0	KAB	8.0 to 9.0	3.0:1	2	15
18.0-26.5	KFT	10.5 to 11.5	5.0:1	2	15
26.5-40.0	KGT	11.0 to 12.0*	5.0:1	2	15
*17 dB max. between 38 and 40 GHz					
coax to coax					
0.2-1.0	UFK	7.0 to 8.0	2:1	2	15
0.9-1.8	LAK	7.0 to 8.0	2:1	2	15
1.0-2.0	LAC	8.0 to 8.5	1.3:1	1	6
1.7-2.4	SAC	8.0 to 8.5	1.3:1	1	6
2.0-4.0	SBC	8.0 to 8.5	1.3:1	1	6
4.0-7.0	CAC	8.0 to 8.5	1.3:1	1	6
4.0-8.0	CJC	8.0 to 9.5	1.3:1	1	6

STANDARD PREAMPLIFIER CHARACTERISTICS

Center Frequency MHz	Bandwidth MHz	†RF to IF Gain dB	*IF N.F. over 1.2 dB dB	Max. Mixer Input Signal dBm
-2 miniature tube preamps				
30	8	24	0	−10
30	12	20	0	−7
60	8	24	0.4	−10
60	12	20	0.4	−7
70	8	23	0.7	−10
70	12	20	0.7	−7
-3 miniature tube preamps				
30	8	40	0	−33
30	12	32	0	−27
60	8	40	0.4	−33
60	12	32	0.4	−27
60	20	24	0.8	−20
70	8	38	0.7	−33
70	12	30	0.7	−27
70	20	24	1.1	−20
-7 solid state preamps				
30	12	24	1.0	−24
30	20	19	1.0	−24
60	12	24	1.0	−24
60	20	19	1.0	−24
70	12	24	1.0	−24
70	20	19	1.0	−24
-9 solid state preamps				
160	50	24	3.0	−10
250	100	20	3.0	−5

Noise figure of mixer-preamplifiers is obtained by adding range given for the mixer selected and the figure shown under "IF N.F. over 1.2 dB" for the required preamplifier. EXAMPLE: A CBH mixer mating with a -3 preamplifier having a 60 MHz center frequency and 8 MHz bandwidth has a noise figure range of 6.5 to 7.0 dB plus 0.4 dB; thus the noise figure range is 6.9 to 7.4 dB.

†**RF to IF power gain:** 6 dB (assumed mixer loss) has been deducted from preamplifier gain in determining stated values.

‡**For linear operation,** an input power increase of 3 dB over the stated "mixer input signal" level will result in less than 1 dB of output signal compression.

BROADBAND MIXER PREAMPLIFIERS

LEL series BMP-1 Mixer-preamplifiers, for broadband receiver and MIL-E-5400 airborne applications, are particularly useful in ECM, multi-antenna, monopulse direction finding equipment.

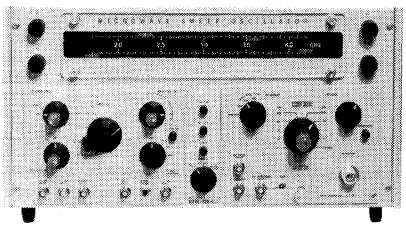
SPECIFICATIONS: Model BMP 1-160-100-50 (2-10 GHz)
RF range (1.5-12.0 GHz max.).....2-10 GHz
IF range (available to 1 GHz).....160 MHz
IF bandwidth .....100 MHz
Noise figure ...11.5 dB typical, 13.0 dB Max.
VSWR .....1.5:1 Max.
Isolation (L.O. to RF) .....8 dB min.
L.O. drive level.....2 mW
Gain (RF to IF).....17 dB
Power required .....±20V @ 25 mA
Size.....4 3/16" x 2 3/4" x 1 5/16"
Weight .....1 lb.
Connectors .....OSM or equivalent

LEL DIVISION
varian / akron street / copiague / new york 11726 / 516 AM 4-2200 / 516 PY 9-8200 / TWX 510-224-6692

MICRO-POWER

Microwave Instruments and Power Supplies

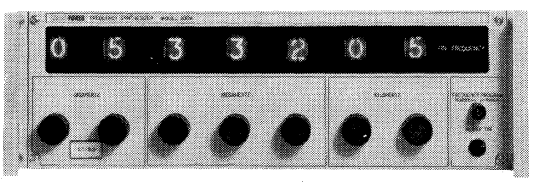
MICROWAVE SWEEP OSCILLATOR
Model 221 – 200 MHz to 40 GHz



- 2 ppm peak residual FM
- Extreme stability with line voltage change
- 0 to 100% calibrated △ f control
- Solid state or BWO plug-ins from 0.2 to 40 GHz

This easy-to-operate sweep oscillator offers the advantages of solid state devices in the 1 to 4 GHz frequency ranges, while also accepting a wide choice of BWO plug-ins for frequencies up to 40 GHz. Most bands are available with either internal or external, grid or diode leveling. All oscillators offer power meter leveling for exceptionally flat response. FM rate is DC to over 5 MHz.

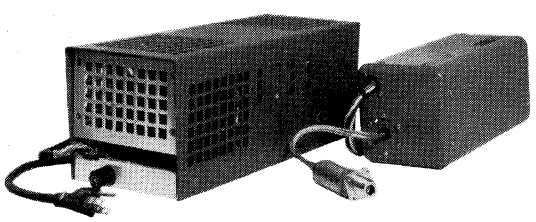
MICROWAVE FREQUENCY SYNTHESIZER – Model 300A
1.0 to 12.4 GHz



- Frequency stability $1x10^{-8}$ per day, $1x10^{-9}$ per sec. using internal reference; higher using 1 MHz external reference
- 15-30 mW output power (leveled)
- 10 msec. in-band frequency switching time

The new Model 300A extends the state-of-the-art of frequency synthesizers well into the microwave region by providing coherent phase-stable signals in the range of 1.0 to 12.4 GHz. Frequencies can be selected with 10 KHz resolution using either front-panel switches or external digital programming. A signal light positively indicates that the rf output frequency is the same as that shown by the digital frequency display.

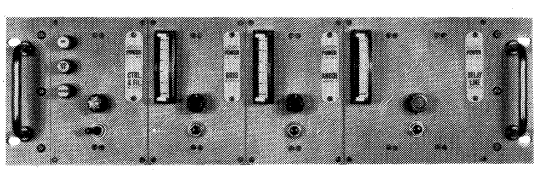
PROGRAMMABLE MICROWAVE SOURCE – Model 101 – 1.0 to 40 GHz
in octave or waveguide ranges



- Voltage and/or resistance controlled source of microwave frequencies
- Programming speed 1 msec. for full band
- Linearity ±0.5% for full band
- For use in ground checkout equipment, production test stands, etc.

Use of the Model 101 eliminates the need for the systems engineer to select the proper BWO and then design and build the necessary power supplies and linearizing networks. Instead, it is only necessary to specify the required rf output. The input can be swept by any function, stepped or set at a fixed value. It can also be programmed through a digital to analog converter.

POWER SUPPLIES FOR MICROWAVE TUBES



- Modular power supplies for greater flexibility
- High regulation and stability (0.002% for line, 0.005% for load, 0.001 to 0.0001% ripple) for low incidental FM of oscillators and high phase stability of amplifiers
- All modules are 3½ in. or 5¼ in. rack-mounting units

Micro-Power power supply modules are available in a wide variety of outputs for powering BWO's, voltage tunable magnetrons, medium and high voltage klystrons, and TWT amplifiers. Choice of standard module combinations increases selectivity in matching supply characteristics to specific tube types and project requirements. Electrode supply voltages can be swept or otherwise varied at up to 20,000 volts/sec/mA.

For complete information on these products call your local Micro-Power field engineering office or contact **MICRO-POWER INC.**

25-14 Broadway, Long Island City, N.Y. 11106. Telephone (212) 726-4060.

Measurement Specialties Laboratory, Inc.
14532 ERWIN STREET • VAN NUYS • CALIFORNIA 91401 • (213) 780-2334

TYPE N, TNC, & BNC CONNECTOR GAGE

Model No. 31A



DESCRIPTION: The MSL Model 31A Connector Gage is a precision inspection tool for measuring the critical assembly tolerances for **both** male and female Type N, TNC, & BNC coaxial connectors. The dimension measured is the distance from the mating plane of the outer conductor to the mating plane of the inner conductor.

A female connector is measured by moving the sliding barrel to the recessed position, as shown in the photo on the left. A male connector is measured by moving the sliding barrel to the extended position, as shown in the photo on the right. The measured dimension is read directly from the dial gage. A go/no-go scale is superimposed on the dial face to provide the operator with a simple but accurate means of determining specification compliance.

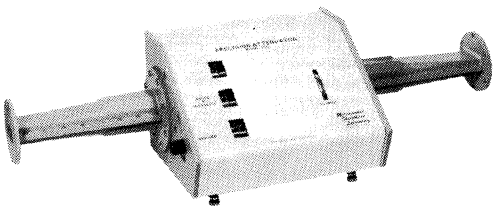
- **ONE GAGE MEASURES TYPE N, TNC, & BNC CONNECTORS**
- **MEASURES BOTH MALE AND FEMALE CONNECTORS WITHOUT ADAPTERS, ADJUSTMENT, OR RECALIBRATION**
- **GO/NO-GO SCALE SUPERIMPOSED ON DIRECT READING DIAL**
- **ACCURACY—0.001 inch**
- **ASSURES CONFORMANCE WITH MIL-C-39012**

PRICE—$190 FOB VAN NUYS, CALIF.
US Patent No. 3318007

Measurement Specialties Laboratory, Inc.
14532 ERWIN STREET • VAN NUYS • CALIFORNIA 91401 • (213) 780-2334

PRECISION ATTENUATORS

Model No. 250



- ABSOLUTE ATTENUATION STANDARD
- RANGE—0 to 60 decibels
- RESOLUTION—0.0001 degree of vane rotation
- LOW PHASE SHIFT
- LOW VSWR
- FREQUENCY INSENSITIVE

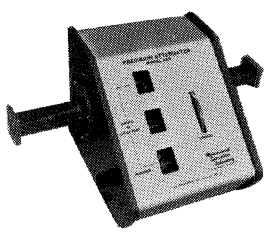
The MSL 250 Series Rotary Vane Waveguide Attenuator represents the ultimate in precision, accuracy and high reliability for microwave attenuation measurements. The angular rotation of the attenuating vane is displayed on three dials to a resolution of 0.0001 degree. Seven waveguide models cover the frequency range of 3.95 to 40.0 GHz.

Designed primarily as an absolute standard of attenuation for use by Primary Standards Laboratories and Advanced Research Laboratories, the Model 250 has also found special applications in sophisticated Operational Systems and Instrumentation Packages (including in-flight applications).

The Model 250 guarantees extremely high resolution, minimum phase shift, low VSWR, and frequency insensitivity, plus inherent stability. . .The requirements for an absolute standard of microwave attenuation.

Attenuation calibration services are available from the National Bureau of Standards in Boulder, Colorado. For information about current calibration accuracies and frequencies of calibration, contact Office of Coordinator, Calibration Services, Radio Standards Engineering Division, National Bureau of Standards, Boulder, Colorado 80302. (303) 447-1000.

Model No. 260



- ABSOLUTE ATTENUATION STANDARD
- RANGE—0 to 60 decibels
- RESOLUTION—0.02 degree of vane rotation
- LOW PHASE SHIFT
- LOW VSWR
- FREQUENCY INSENSITIVE

The MSL 260 Series Precision Attenuator is a rotary vane waveguide attenuator with a high precision drive mechanism, permitting vane angle readout to 0.02 degree. Seven waveguide models cover the frequency range of 3.95 to 40.0 GHz.

The Model 260 is well suited for both systems and laboratory applications where a reliable and high precision microwave attenuator is required. These devices are used extensively as attenuation standards for calibrating less accurate microwave attenuators.

The inherent frequency insensitivity, low phase shift, and high precision of this attenuator make the Model 260 an ideal transfer standard of microwave attenuation.

Attenuation calibration services are available from the National Bureau of Standards in Boulder, Colorado. For information about current calibration accuracies and frequencies of calibration, contact Office of Coordinator, Calibration Services, Radio Standards Engineering Division, National Bureau of Standards, Boulder, Colorado 80302. (303) 447-1000.

SPECIFICATIONS

Model 250

Frequency Range: 3.95 to 40.0 GHz (7 Waveguide Bands).
VSWR: 1.10:1 Max. Typically less than 1.05:1.
Insertion Loss: 1db Max. Typically Less Than 0.5db.
Power Dissipation: 10 W Average—3.95 to 12.4 GHz
5 W Average—12.4 to 18.0 GHz
2 W Average—18.0 to 26.5 GHz
1 W Average—26.5 to 40.0 GHz
Phase Shift Variation: 3 degrees max. Typically less than 0.5 degrees.
RF Leakage: Greater than 80db below input level.
Resolution: 0.0001 Degree of Vane Rotation.

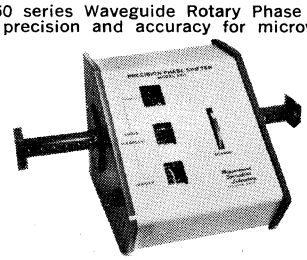
Model 260

Frequency Range: 3.95 to 40.0 GHz (7 Waveguide Bands).
VSWR: 1.10:1 Max. Typically Less than 1.05:1.
Insertion Loss: 1db Max. Typically less than 0.5db.
Power Dissipation: 10 W Average—3.95 to 12.4 GHz
5 W Average—12.4 to 18.0 GHz
2 W Average—18.0 to 26.5 GHz
1 W Average—26.5 to 40.0 GHz
Phase Shift Variation: 3 degrees max. Typically less than 0.5 degrees.
RF Leakage: Greater than 80db below input level.
Resolution: 0.02 Degree of Vane Rotation.

PRECISION PHASE SHIFTER

Model No. 550

The MSL 550 series Waveguide Rotary Phase Shifters provides the ultimate in precision and accuracy for microwave phase measurements. The electrical phase shift is displayed on three dials to a resolution of 0.02 degree. The units are well suited for laboratory applications where independent adjustments of phase and amplitude are required. Other applications include their use as direct transfer standards for less accurate standards used in areas such as component and systems production testing and inspection functions. The display features a −360° to +360° direct readout to permit rapid determination of the particular direction of phase shift encountered. Each 360° segment is clearly indicated by a color dot which appears in the display window to inform the user of the particular segment being used and to assure the accuracy of the Phase Shifter.



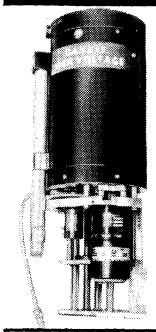
Frequency Range: 5.3 to 18.0 GHz (3 Waveguide Bands)
VSWR: 1.35:1 Max.
Insertion Loss: 3db Max.
Power Dissipation: 10 W Average— 5.3 to 12.4 GHz
5 W Average—12.4 to 18.0 GHz
Differential Phase Angle Range: −360° to +360°
Resolution: 0.02 Degree

NOTE: ABOVE INSTRUMENTS ALSO AVAILABLE FOR REMOTE COMPUTER CONTROLLED APPLICATION. INFORMATION AND PRICES AVAILABLE UPON REQUEST.

Phase calibration services are available from the National Bureau of Standards in Boulder, Colorado. For information about current calibration accuracies and frequencies of calibration, contact Office of Coordinator, Calibration Services, Radio Standards Engineering Division, National Bureau of Standards, Boulder, Colorado 80302. (303) 447-1000.

MICROWAVE

"Dynamic Disciplines" Products that



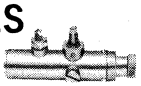
HIGH POWER, RF TETRODE PULSE, CW CAVITIES

Up to 125 KW Output (Pulse Service)

- Tunable from 40-1350 MHz over entire range on most units.
- Input VSWR, 2:1 or better.
- No neutralizing.
- Gang tuning available.
- Servo tuned models available.*
- Input and output coupling matched
- Temperature stable.
- Optimum cooling.
- MIL Spec design.

MODEL	FREQ. RANGE MHz	OPERATION	POWER OUTPUT	SERVICE
11023	40-200	Class B	1.0 KW	CW Amp.
11022	230	Class C	15 KW Peak	Pulse Amp.
11024	40-200	Class B	0.1 KW	CW Amp.
11050	150	Class C	30 KW	Pulse Osc.
11051	150	Class C	125 KW	Pulse Amp.
11055	200-400	Class B lin.	1.0 KW	CW Amp.
11006	225-400	Class B lin.	.12 KW	CW Amp.
11009*	225-400	Class C	1.2 KW Peak	Pulse Amp.
11010*	225-400	Class B lin.	.12 KW	CW Amp.
11012	225-400	Class B lin.	2.5 KW	CW Amp.
11018	280-315	Class B	1.0 KW	CW Amp.
11029	360-480	Class B	.15 KW	CW Amp.
11030	360-480	Class B	1.5 KW	CW Amp.
11056	375	Class B	0.1 KW	CW Amp.
11057	375	Class B	1.4 KW	CW Amp.
11001	400-450	Class B lin.	2.5 KW	CW Amp.
11031	400-800	Class C	15 KW	Pulse Amp.
11019	400-800	Class B lin.	1.0 KW	CW Amp.
11004	410-460	Class C	14 KW	Pulse Amp.
11005	410-460	Class C	2.5 KW	Pulse Osc.
11205	420	Class C	35 KW	Pulse Osc.
11046	800-1000	Class B	1.0 KW	CW Amp.
11011	1250-1350	Class C	10 KW Peak	Pulse Amp.

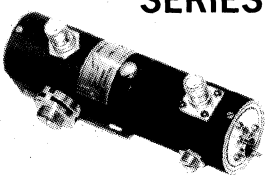
"MINI-CAV" OSCILLATOR, AMPLIFIER, TRIPLER CAVITIES



Meet rigid demands for reliability, small size and light weight in airborne and similar equipment.

MODEL	FREQ. GHz	POWER OUTPUT	SIZE DIA.	SIZE LENGTH	WEIGHT (APPROX.)
9010*	.988-1.012	3.5 KW min.	1½"	4½"	1 lb.
9012*	2.84-3.18	10 W peak min.	1"	6 3/16"	12 oz.
9013*	4.82-5.22	5.0W peak	1"	6 3/16"	14 oz.
9017*	.960-1.06	2.5 KW peak min.	1½"	5 1/16"	2 lbs.
9019*	2.84-3.00	10 W peak	1"	6 3/16"	12 oz.
9022B*	5.40	15 W	5/8"	2 3/32"	3 oz.
9023*	9.0	3.0 W min.	11/16"	2 3/16"	4 oz.
9024*	2.8	10 W peak	1"	3 13/16"	7 oz.
8207†	.940-.980	6KW peak	1½"	5 9/16"	20 oz.
9009A†	4.30	1.0 KW min.	1 3/8"	3 9/16"	12 oz.
9018†	4.30	.25 KW peak	1"	2 3/32"	5 oz.
6016**	1.75-1.80	5.0W	1½"	6 1/16"	2 lbs.
7009**	1.23-1.37	1.0 W min.	1½"	10½"	1½ lbs.
9015**	4.30	2.0 MW	5/8"	2 11/32"	3 oz.
1004††	1.80-2.00	25 MW min.	1¼"	3"	12 oz.
1005††	1.075-1.10	1.0W	1 3/32"	2"	12 oz.
5015***	2.12-2.35 output .7083-.7833 input	150 MW min.	1½"	7"	2 lbs.

*Grid Pulsed Oscillators †Plate Pulsed Oscillators **CW Oscillators ††CW Amplifiers ***CW Tripler



SERIES "N" STANDARD TRIODE CAVITIES

Minimum Range: 10%

Amplifiers and oscillators, designed for narrow band operation.

STANDARD OPERATING CONDITIONS

	Application	Series No.	High Frequency Limit MHz	P in mw	GAIN DB 1 GHz	2 GHz	3 GHz	
CW AMPLIFIERS	Lo Noise	1000	3400	1	17	16	11	
	Med. Power	2000		100	13	11	8	
	Med. Power	2002	2240	2000	13	8		

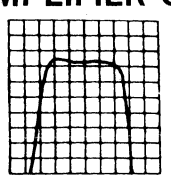
					POWER OUT WATTS 1 GHz	2 GHz	3 GHz	4 GHz
CW OSCILLATORS	Lo-Power	6000 / 7000*	5250		0.4	0.3	1	.05
	Med. Power	6002 / 7001*	4500		1.4	0.8	0.7	0.5
	Med. Power	6003 / 7003*	2520		28	18		

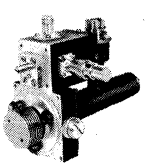
				DUTY CYCLE	All Pulse Widths: 1.0 usec.			
PULSED OSCILLATORS	Lo-Power	8000 / 9000*	5250	.001	18	12	8	6
	Hi-Power	8002 / 9002*	4500	.001	1950	1850	1800	1750
	Hi-Power	8003* / 9003*	2520	.003	1700	1500		

*Re-entrant

BROAD BAND AMPLIFIER CAVITIES

Give maximum utilization of the gain-bandwidth product, VHF through S-Band. Bandwidths more than double those of ordinary cavities. Flat-top response for easy cascading, with minimum reduction in overall system bandwidth. Eliminate mechanical tuning in many uses. Excellent phase stability, linearity. Compact.





Model	Freq. MHz	Gain db	Bandwidth-db pts	Power Output
3029*	216	10	4.0 MHz @ 3.0 db	300 watts
3031*	216	10	4.0 MHz @ 3.0 db	3.0 kilowatts
3021*	420	10	20 MHz @ 3.0 db	5.0 kilowatts
3022*	420	23	20 MHz @ 3.0 db	200 watts
2041†	425	9.0, nom.	47 MHz @ 3.0 db	60 watts
3012*	425	8.0	50 MHz @ 1.0 db	2.5 kilowatts
3014*	425	26	50 MHz @ 1.0 db	400 watts
11026*	425	6.0	50 MHz @ 1.0 db	10 kilowatts
11033*	430.5	7.0	33 MHz @ 1.0 db	8.0 kilowatts
3045*	470	19	100 MHz @ 3.0 db	20 watts
3017*	476	12	8.0 MHz @ 3.0 db	15 watts
3023*	476	12	8.0 MHz @ 3.0 db	250 watts
3042*	1025-1150	7.0	120 MHz @ 3.0 db	1.5 kilowatts
3046*	1545	23	20 MHz @ 3.0 db	100 watts
3047*	1545	13	20 MHz @ 3.0 db	2.0 kilowatts
3015†	1800	10	30 MHz @ 1.0 db	22 watts
3028†	2000	10	30 MHz @ 3.0 db	20 watts
1009†	2101.8	16	12 MHz @ 3.0 db	400 milliwatts
3020†	2101.8	11, min.	15 MHz @ 3.0 db	15 watts
3006B†	2106	7.0	10 MHz @ 3.0 db	10 watts
3040†	2250	9.0, min.	4.0 MHz @ 3.0 db	22 watts
1010†	2282.5	10	15 MHz @ 3.0 db	50 milliwatts
3005*	2846-2866	9.0	26 MHz @ 3.0 db	500 watts

*Pulse Operation †CW Operation

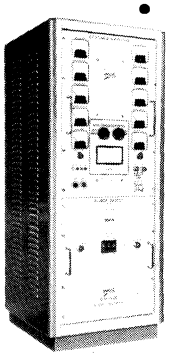
MICROWAVE CAVITY LABORATORIES, Inc.
10 North Beach Avenue
LaGrange, Illinois 60525
Area Code 312 354-4350

MARKETPLACE

Carry the MCL MICROWAVE Seal of Quality

HIGH POWER, RF ADD-ON AMPLIFIER SYSTEMS

- *40-18,000 MHz Coverage*
- *100 WATTS to 2.5 KW*
- *CW or Pulse Operation*



An exclusive MCL advancement which affords quick, economical modernization of older installations. Replaces multi-unit lashups with neat, standard 19" rack-mounted, high power amplifier systems. Complete with power supply, cooling source, sequential circuitry, fusing and protective interlock.

CW TETRODE AMPLIFIER SYSTEMS

Model	Freq. Range MHz	Power Output	Gain db.	Bandwidth at 3.0 db.
10270-11043	40-200	1.0 KW	13	1.0 MHz
10270-11044	200-400	1.0 KW	13	5.0 MHz
10270-11045	400-800	1.0 KW	13	6.0 MHz
10270-11046	800-1000	1.0 KW	12	4.0 MHz
11017	400-450	2.5 KW	13	6.0 MHz
10161-11071	40-200	100 watts	13	1.0 MHz
10161-11070	200-400	100 watts	13	3.0 MHz
10161-11072	400-800	100 watts	13	5.0 MHz
10161-11073	800-1000	100 watts	12	5.0 MHz

KLYSTRON AMPLIFIER SYSTEMS

High Gain, High Efficiency
Or Broad Band Tuning Modes

Model	Tube Type	Freq. MHz	Power Output	Max. Gain Tuned		Max. B.W. Tuned	
				Gain db.	BW MHz	Gain db.	BW MHz
10282	4K3SJ	1700-2400	1.0 KW	47-45	4.0-6.0	—	—
10283	4K3SL	1700-2400	1.0 KW	41-38	9.0-12	38.3	13-14
10284	4K3SK	2400-2700	1.0 KW	43-42	10-15	—	—
10285	4K3SN	2850-3050	1.0 KW	45	7.0	—	—
10276	VA888	4400-5000	1.0 KW	51	6.0-8.0	41	13-19
10233	VA834B	4400-5000	1.0 KW	51	5.5-7.5	41	11-17
10277	VA834D	5500-5850	1.0 KW	51	5.5-7.5	41	11-17
10278	VA861	5900-6400	1.0 KW	58	7.0-8.0	48	11
10286	VA866	7100-8500	1.0 KW	59	12	50	20
10287	VA930	15000-18000	0.5 KW	50	12	40	20

MCL CUSTOM CAPABILITIES

Any of the components or systems advertised on these pages can be modified for your individual requirements.

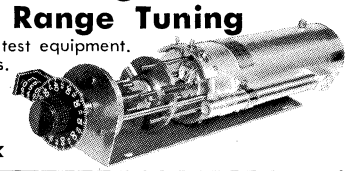
Write for complete catalog covering more than 50 standard and custom engineered product varieties including solid state components and accessories such as pre-selectors, diplexers, low, high and bandpass filters, switches, mixers, power dividers, power samplers, detectors, attenuators and loads.



SERIES "E" RF TRIODE OSCILLATORS, AMPLIFIERS

150-4000 MHz Coverage With Extended Range Tuning

Use as system components or test equipment. Modified to your requirements.



PULSED OSCILLATORS

Available from stock

Model Number	Frequency MHz	Min Power Output KW	Model Number	Frequency MHz	Min. Power Output KW
8038	150-300	1.5	8019	600-1200	1.0
8021	200-400	1.5	8028	1000-1500	1.0
8026	250-500	1.5	8029	1450-2000	1.0
8018	300-600	1.5	8027	2000-3000	1.0
8022	400-800	1.5	8030	3000-4000	1.0
8024	500-1000	1.5			

CW OSCILLATORS

Model Number	Frequency MHz	Power Output	Model Number	Frequency MHz	Power Output
6020	200-550	80 W	7015	550-1000	100 Mw
6021	550-1215	50 W	7016	1000-2500	100 Mw
6022	1215-2500	25 W	7017	2500-3500	100 Mw

CW AMPLIFIERS

Model Number	Frequency MHz	Power Output
2026	200-550	80 W
2027	550-1215	50 W
2028	1215-2500	40 W

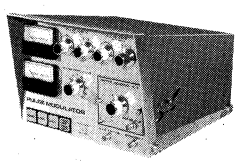
MODEL 10330, SERIES "E" PULSE MODULATED SIGNAL GENERATORS

Complete With Power Supply

Powerful and versatile test instruments built around Series "E" triode oscillators. Available as complete, rack-mounted signal source, with integral pulse modulator (same circuitry as Model 10299B below). Coverage from 150 to 4000 MHz is facilitated by interchangeable RF heads supplied according to specified generator model number. Models 10330-8046 through 10330-8051 cover 150 to 1000 MHz in six individual ranges at 1.5 kilowatts output. Models 10330-8052 through 10330-8056 cover 600 to 4000 MHz in five individual ranges at 1.0 kilowatt output.

SERIES 10299B HIGH POWER PULSE MODULATOR

Designed as companion modulators to Series "E" pulsed oscillators.

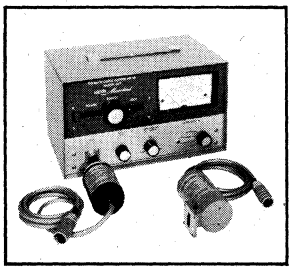


- **Available in three standard, adjustable output voltage ranges:** 0-1.5 KV@ 6.0amperes, peak; 0-3.0 KV @ 3.0 amperes, peak; and 0-6.0 KV @ 1.5 amperes, peak. Peak voltage readout accurate to 2.0% of full scale, from 100 pulses per second up. (Other voltages and currents at average power levels to 100 watts, available on special order.)
- **Pulse characteristics:** repetition rate: 100 Hz to 12 kHz. Width, variable, 0.5 to 10 microseconds. Rise and fall time: as low as 200 nanoseconds into resistive load.
- **Duty cycle:** .001 to .01 with 2.0% readout accuracy. Overload cut-off, adjustable over same range.

MICROWAVE CAVITY LABORATORIES, Inc.

10 North Beach Avenue
LaGrange, Illinois 60525
Area Code 312 354-4350

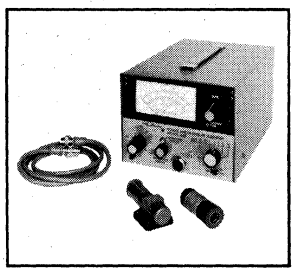
POWER METERS



Model 443 — $550. plus mounts

Thermocouple Power Meter For Average and Peak Power Measurements

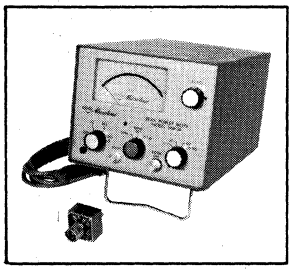
- Wide dynamic range: 0.3 μw to 100 mw full scale (—35 DBM to +20 DBM)
- High accuracy: 1% full scale, 2.3% total RF error



Model 447 — $450. plus mounts

Temperature Compensated Meter For Power Calibration and Monitoring in Production Tests

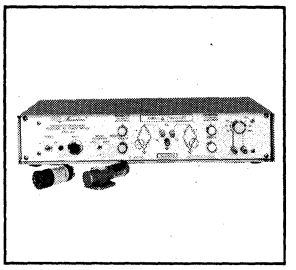
- Good accuracy: 3% for meter, 4% total RF error
- Direct reading: from 1 μw to 10 mw (—30 DBM to +10 DBM)



Model 66A3A — $890. plus mounts

Peak Power Meter For Continuous, Instant Readings of Peak Power

- Direct readout: 3 to 300 mw independent of pulse width, shape and PRF
- Accuracy: within 8% total rms error — RFI shielded

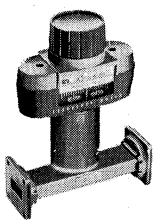


Model 445 — $975.

Precision RF Power Bridge For Standard Use For Precise Calibration

- Very high accuracy: 0.15% for bridge, 1.15% total RF error
- Automatic temperature compensation — range of 10μw to 10 mw from 10 MHz to 12.4 GHz.

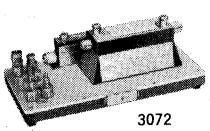
FREQUENCY METERS — Coaxial .2 to 10.5 GHz, Waveguide 2.6 to 26.5 GHz



Coaxial — provided as a packaged unit Waveguide — for reaction-type frequency measurements, direct reading

Frequency (GHz)	0.2-0.5	0.5-1.5	1.5-2.4	3.95-5.85	5.85-8.20	7.05-10.0	12.4-18.0	18.0-26.5
Absolute MHz Accuracy	0.5	1.0	2.0	0.060%	0.065%	0.070%	0.095%	0.105%
Maximum Grad. Incr. (MHz)	2	5	10	2	2	2	5	10
Nominal Q	500	700	500	10,000	8,500	8,000	5,000	4.000
Model	804	805	806	12C1	12G1	12H1	12U1	12K1
Price	$495	$425	$495	$400	$375	$300	$275	$350

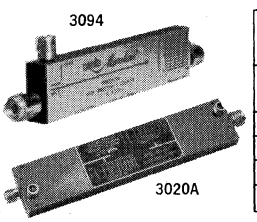
HIGH DIRECTIVITY REFLECTOMETER COUPLERS



3072

Reflectometer Coupler Set Model 3070 Series (10db coupling)			
Freq. (GHz)	Tracking (db)	Directivity (db)	Model
0.95-2.2	0.3	40	3072
1.7 -4.2	0.3	40	3073
3.7 -8.3	0.3	35	3074
7.0 -12.4	0.3	33	3075
Price $975			

High Directivity Model 3090 Series (10db coupling)	
Directivity (db)	Model
40	3092
40	3093
35	3094
33	3095
Price $400 - $450	



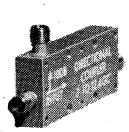
3094

3020A

Dual Directional Model 3020 Series (20db coupling)			
Freq. (GHz)	Tracking (db)	Directivity (db)	Model
0.05-1	±0.3	35	3020A
1.0-4.0	±0.3	27-30	3022
4.0-8.0	±0.3	25	3024
Price $250			

PRECISION COUPLERS AND HYBRIDS

MINIATURE COUPLERS 4000 Series

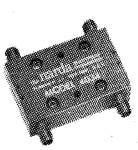


Freq. (GHz)	Flatness (db)	Directivity (db)	Model	Price
.030-.060	±1	25	4000B	$200.
.060-.125	±1	25	4001B	$200.
.125-.250	±1	25	4002B	$125.
.250-.500	±1	25	4010B	$125.
.500-1.0	±1	25	4011B	$125.
1.0 - 2.0	±1	20	4012B*	$125.
2.0 - 4.0	±1	20	4013B*	$125.
4.0 - 8.0	±1	17	4014*	$150.
7.0-12.4	±1	17	4015*	$170.
12.4-18.	±.5	15	4016*	$175.

Coupling values: 10, 20, 30 db

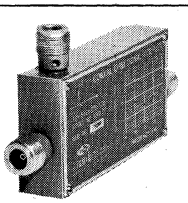
*Also available 6 db value

HYBRID JUNCTIONS



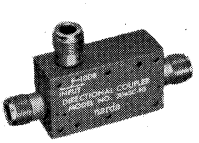
TYPE N				NPM MINIATURE			
Flatness (db)	VSWR	Model	Price	Flatness (db)	VSWR	Model	Price
				±.5	1.25	4027B	$250.
				±.5	1.25	4028B	$250.
				±.5	1.25	4029B	$250.
±.5 ±.4	1.1 1.1	3029 3030	$250. $250.	±.5	1.25	4030B	$125.
±.25	1.2	3031	$225.	±.5	1.25	4031B	$125.
±.25	1.2	3032	$225.	±.5	1.25	4032B	$125.
±.25	1.25	3033	$225.	±.5	1.25	4033B	$125.
±.5	1.3	3034	$250.	±.5	1.30	4034	$175.
±.5	1.35	3035	$250.	±.5	1.35	4035	$175.
				±.7	1.50	4036	$250.
Coupling value: 3 db				Coupling value: 3 db			

HIGH DIRECTIVITY 3000 Series



Flatness (db)	Directivity (db)	Model	Price
±1	30	3000	$150.
±1	30	3001	$150.
±1	25-30	3002**	$150.
±1	25-27	3003**	$150.
±1.2	17-20	3004**†	$200.
†(4.0 to 10. GHz)			
Coupling values: 10, 20, 30 db			

MAXIMAL FLATNESS EXTENDED FREQUENCY



Freq. (GHz)	Flatness (db)	Directivity (db)	Model	Price
.150-.40 (MHz)	±.5	25	3059-20	$125.
.010-.200	±.5	20	3060-20	$ 98.
.125-.250	±.2	20	3039-20	$200.
.240-.500	±.2	20	3040**	$250.
.50-1.0	±.2	20	3041	$200.
.92-2.2	±.2	20	3042B	$200.
1.7-4.2	±.2	20	3043B	$200.
3.7-8.3	±.2	17	3044B	$200.
7.0-12.4	±.2	15	3045C**	$250.
Coupling values: 10, 20, 30 db				

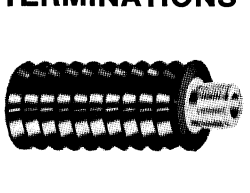
**Available in 10. 20, 30 db — priced accordingly.

narda Microline®

THE NARDA MICROWAVE CORPORATION
PLAINVIEW, L.I., NEW YORK 11803

516 - 433 - 9000 • TWX: 510 - 221 - 1867 • CABLE: NARDACORP PLAINVIEW NEWYORK

TERMINATIONS



COAXIAL — DC TO 12.4 GHz

Frequency	Power Avg.	Power Peak	VSWR	Model	Price
2-12.4 GHz	500W	5KW	1.3-1.4	368	$500
.7-12.4 GHz	175W	10KW	1.1-1.2	369	$250
DC-10 GHz	5W	2KW	1.05-1.2	370	$60
2-12.5 GHz	10W	10KW	1.05 max.	371	$55
DC-12.4 GHz	20W	2KW	1.05-1.5	374	$65
DC-12.4 GHz	10W	2KW	1.05-1.3	375	$65
DC-12.4 GHz	50W	40KW	1.05-1.3	376	$85
2-12.4 GHz	10W	10KW	1.05	372*	$110

*Sliding Termination

Prices include Type N connectors — other connectors are available.

WAVEGUIDE — 1.12 TO 40 GHz

LOW POWER						
FREQ. BAND	FREQ. RANGE GHz	Power Avg.	Power Peak	VSWR	Model	Price
C	3.95- 5.85	5W	2KW	1.015	303C	$70
XN	5.85- 8.20	2W	1KW	1.015	302C	$60
XB	7.05-10.00	2W	1KW	1.015	301C	$40
X	8.20-12.40	1W	1KW	1.015	300C	$35
KU	12.40-18.00	1W	1KW	1.015	299C	$40
K	18.00-26.50	.5W	.2KW	1.015	298C	$60
V	26.50-40.00	.5W	.2KW	1.015	V297C	$60

HIGH POWER						
FREQ. BAND	FREQ. RANGE GHz	Power Avg.	Power Peak	VSWR	Model	Price
S	2.60- 3.95	3.5KW	3.2KW	1.1	324B	$220
C	3.95- 5.85	2.0KW	1.0MW	1.1	323B	$175
XB	7.05-10.00	600W	460KW	1.1	321B	$110
X	8.20-12.40	500W	290KW	1.1	320B	$85
KU	12.40-18.00	250W	160KW	1.15	319B	$110
K	18.00-26.50	150W	80KW	1.1	318B	$125

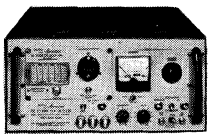
PRECISION COAX 7MM SLIDING TERMINATIONS

Model	5372
Frequency (GHz)	2.0 to 17.0
VSWR (max.)	VSWR element: 1.05, 2.0 to 3.7 GHz 1.02, 3.7 to 17.0 GHz Add VSWR of APC-7 pair to slide at frequency of operation: 1.003 + 0.002 (fGHz)
Power (watts, average)	10
Price	$250.

PRECISION COAX 14MM SLIDING TERMINATIONS

Model	6372
Frequency (GHz)	1.0 to 8.5
VSWR (max.)	VSWR element: 1.03 (max.) at 1.0 GHz 1.02 (max.) at 2.0 GHz Add VSWR of GR-900 pair to slide at frequency of operation: 1.001 + 0.001 (fGHz)
Power (watts, average)	20
Price	$250.

PULSED SIGNAL SOURCES and KLYSTRON POWER SUPPLIES

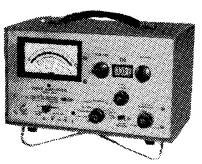


Model 18500 — High Power Pulse Signal Sources from 200 to 9500 MHz with 5 KW output with 11 interchangeable RF heads. Get continuously variable peak power, repetition rates and pulse widths. External pulse capability.

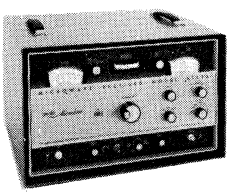


Model 62A1A — Universal Klystron Power Supply features automatic switching of meter scales as the beam voltage is advanced for continuously variable beam from 200 to 4000 volts. Precise regulation of 0.01%. Maximum ripple of 3 mw. ONLY $1650.

ATTENUATION CALIBRATION

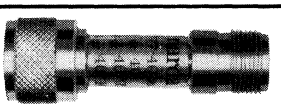


VSWR Amplifier Model 441F is qualified to meet MIL-I-38702. Sensitivity — 0.1 μVolt for full scale deflection. Recorder output for full scale deflection — 1ma into 1500 ohms. Digital indication in 2 db steps, up to 70 db. Temperature compensated from 0° to +55°C for accuracy. $450.



Model 61A1B — Attenuation Calibrator is capable of highly accurate measurements over the frequency range of 10 MHz to 40 GHz. Features: 100 db single-step attenuation measurements; built-in noise generator; power and attenuation measurements to below −117 DBM; precision and resolution better than 0.05 db. $2825

ATTENUATORS



FIXED ATTENUATORS

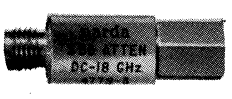
	757C-777C ATTENUATORS					MEDIUM, HIGH POWER		
Model	777*	757B**	773**	771**	774††	768	766	765
Freq. Range	DC to 12.4 GHz	DC to 12.4 GHz	DC to 6 GHz	DC to 3 GHz	DC to 10 GHz	DC to 11 GHz	DC to 4 GHz	DC to 5 GHz
Attenuation	3, 6, 10, 20, 30, 40, 50, 60 db values				3, 6, 10, 20 db values	3, 6, 10, and 20 db		
Impedance	50 ohms							
VSWR (Max.)	1.15-1.30	1.20-1.25	1.20-1.25	1.20	1.30 max.	1.10-1.30	1.10-1.15	1.20-1.30
Power Rating	2W avg., 500W peak 3-6 db 2W avg., 300W peak 10, 20, 30, 40, 50, 60 db					20W Average 1 KW peak		50W Avg. 2 KW peak
Temp. Stability	.0001 db/db/°C					.001 db/db/°C		
Price (for type N) 3-20 db 30-60 db	$85. $100.	$45. $60.	$30. $40.	$20. $30.	$35.	$125.	3-10 db $60. 20 db $70.	$250.

*For TNC & NPM add $25. When ordering TNC use suffix "T", for NPM use prefix "4"

**For TNC & NPM: 3 db to 20 db values add $15. 30 db to 60 db values add $20.

††Available in Type N only (1 male/1 female)
Peak power rating based on measurements made at a duty cycle .001

NEW — micro-pad™



Model	4778	4779
Freq. Range (GHz)	DC-12.4	DC-18
Attenuation (db)	3,6,10,20	3,6,10,20
Impedance (Ohms)	50	50
VSWR. (Max.)	DC-4 GHz: 1.15 4-12.4 GHz: 1.30	DC-4 GHz: 1.15 4-12.4 GHz: 1.30 12.4-18 GHz: 1.35
Power	Average (watts) 2 Peak (KW) 0.2	2 0.2
Price	$60	$75

STEP ATTENUATORS



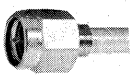
- Positive detent — absolute repeatability — better than 0.05 db.
- Zero position insertion loss — less than 0.5 db
- Precision spring RF contact assembly — low VSWR

Model	710, 710P	711, 711P	712	713
Frequency	DC to 12.4 GHz	DC to 12.4 GHz	DC to 12.4 GHz	DC to 12.4 GHz
Attenuation	0 to 60 db in 10-db steps	0 to 10 db in 1-db steps	0 to 60 db in 1-db steps	0 to 60 db in 10-db steps
VSWR (max.)	1.35	1.35	1.35	1.35
Price	$450.	$625.	$1250	$450.

OSM®

MINIATURE COAXIAL MICROWAVE

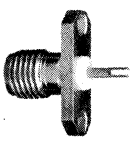
CONNECTORS



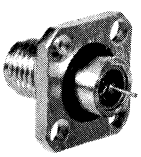
OSM Miniature, Semi-rigid Cable Types



OSM Miniature, Flexible Cable Types



OSM Miniature, Flange Mount Types



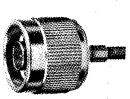
OSM Miniature, Hermetically Sealed Types



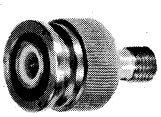
OSM Miniature, Integrated Circuit Types



OSSM Subminiature, Semi-rigid and Flexible Cable Types



Types N and TNC Coaxial Connectors

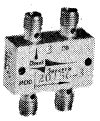


Between Series Adapters

COMPONENTS



Couplers, Coaxial Directional



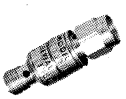
Couplers, 3dB Hybrid



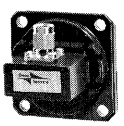
Detectors, Crystal and Back Diode



Power Dividers, Two-way and Four-way



Attenuators, Fixed Coaxial



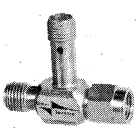
Waveguide Adapters



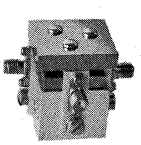
Terminations, Precision Coaxial



Terminations, Miniature Coaxial

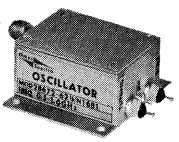


Monitor Tees, Monitor Tee/DC Blocks

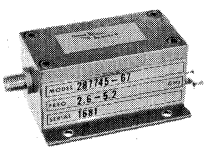


Integrated Circuit Fixtures and Mounts

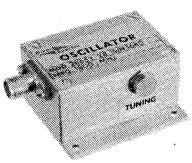
SOLID STATE DEVICES



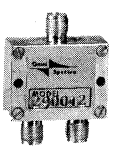
Solid State Oscillator
Electrically Tunable
Series 28670
125MHz to 1.0 GHz



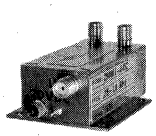
Solid State Oscillator
Electrically Tunable
Series 28770
1.0 GHz to 5.0 GHz



Solid State Oscillator
Mechanically Tunable
Series 28650
10 MHz to 2.2 GHz



Balanced and Double Balanced Mixers



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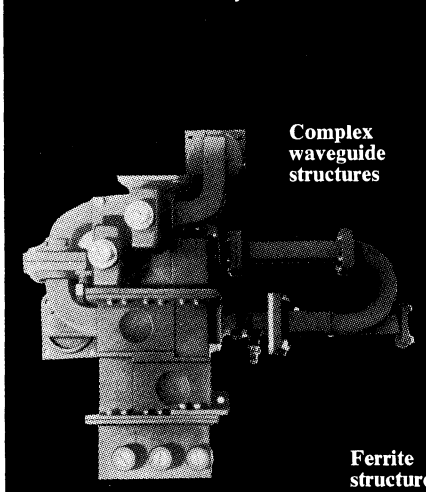
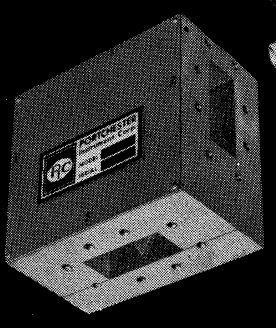
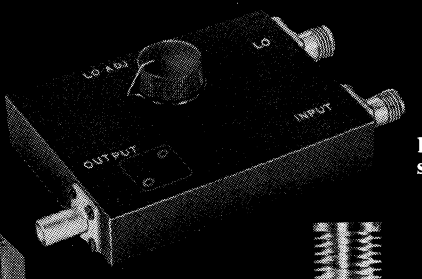


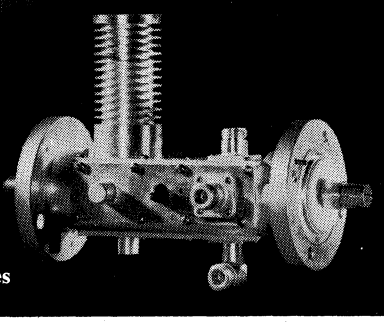
Complex waveguide structures



Ferrite structures



FLATLINE® structures



Coaxial structures



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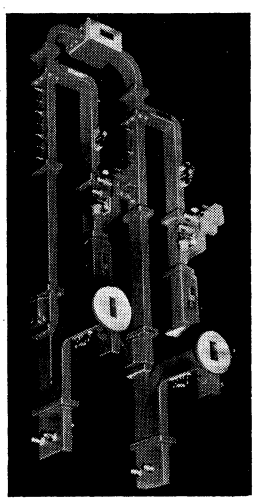

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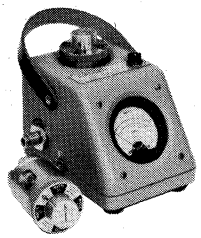
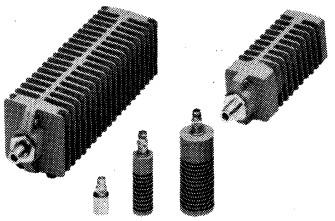
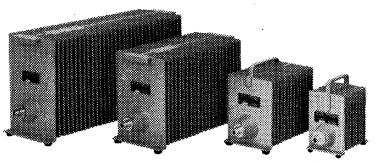
EQUIPMENT BY SIERRA.....



Model 164B In-Line RF Wattmeter



Model 160 Series Dry Coaxial Loads



Model 160B Series Silicone Dielectric Coaxial Loads

Model 164B In-Line RF Wattmeter

- Measures both incident and reflected power on 50-ohm transmission systems
- Power ranges from 100 milliwatts to 5000 watts
- Frequency ranges from 2 to 1000 MHz
- Ten plug-in elements, each with four full-scale power ranges
- Insertion VSWR, with Type N connector, less than 1.08, except on 1-watt ranges
- Direct-reading VSWR scale
- Accuracy, ±5% full scale, all ranges
- "Twist-Off" r-f connectors, eight different types
- Weight, 7½ lbs. with one plug-in element
- Price, in standard FMN configuration, $95.00

Plug-In Elements for 164B Wattmeter

Model	Frequency Range (MHz)	Power Ranges (Watts)	Price
180A-52	25–52	1, 5, 10, 50	$110.00
180A-148	50–148	1, 5, 10, 50	$110.00
180A-470	144–470	1, 5, 10, 50	$110.00
180A-1000	460–1000	1, 5, 10, 50	$110.00
181A-250	25–250	10, 50, 100, 500	$ 75.00
181A-1000	200–1000	10, 50, 100, 500	$ 75.00
270A-30	2–30	50, 100, 500, 1000	$115.00
270A-75	10–75	50, 100, 500, 1000	$115.00
270A-470	70–470	50, 100, 500, 1000	$115.00
271A-30	2–30	100, 500, 1000, 5000	$125.00

Model 160 Series Dry Coaxial Loads

- Power ratings to 100 watts
- Frequency ranges from DC to 11 GHz
- Impedance, 50 ohms
- Dry construction, no dielectric coolant
- Operate in any position
- "Twist-Off" connectors accepted by 50- and 100-watt models

Summary Specifications, 160 Series Loads

Model	Average Power Rating (watts)	Overload Average Power (minutes) 50%	100%	Connector Types	Frequency Range	Maximum VSWR	Size & Weight	Price
160-1	1	5	1	N	DC-11 GHz	1.1, DC-4 GHz 1.15, 4–6 GHz 1.25, 6–11 GHz	¾" D x 1¾" L 3 oz.	$20.00[1]
160-5	5	5	1	N	DC-11 GHz	1.1, DC-4 GHz 1.2, 4–6 GHz 1.5, 6–11 GHz	1" D x 3⅛" L 4½ oz.	$25.00[1]
160-20	20	5	1	N	DC-6 GHz	1.1, DC-1 GHz 1.15, 1–4 GHz 1.5, 4–6 GHz	1⅝" D x 4½" L 8 oz.	$30.00[1]
160-50D	50	5	1	"Twist-Off"	DC-5 GHz	1.1, DC-1 GHz 1.2, 1–4 GHz 1.4, 4–5 GHz	2¼" W x 2½" H x 7⅜" L 1½ lbs.	$49.00[2]
160-100D	100	5	1	"Twist-Off"	DC-5 GHz	1.1, DC-1 GHz 1.2, 1–4 GHz 1.4, 4–5 GHz	3" W x 3¾" H x 11½" L 3½ lbs.	$75.00[2]

1. Delivered with Type N connectors, male or female.
2. Delivered with Type N or UHF connectors, male or female. Types C, HN, and BNC are $10.00 additional. Types LC and TNC are $30.00 additional.

Model 160B Series Silicone Dielectric Coaxial Loads

- Power ratings of 150, 300, 600, and 1000 watts
- Frequency coverage to 5 GHz
- Impedance, 50 ohms
- Sealed aluminum housings
- Long-life, non-carbonizing silicone dielectric fluid
- Up to ⅓ smaller than comparable loads
- "Twist-Off" connectors, eight different types

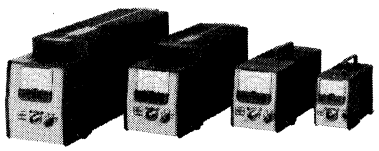
Summary Specifications, 160B Series Loads

Model	Average Power Rating (watts)	Overload Average Power (minutes) 50%	100%	Frequency Range	Maximum VSWR	Size & Weight	Price
160B-150	150	10	5	DC-4 GHz	1,1, DC–500 MHz 1.2, 500 MHz–4 GHz	3½" W x 6" H x 6½" L, 2¾ lbs.	$ 70.00[1]
160B-300	300	10	5	DC-4 GHz	1.1, DC–1 GHz 1.2, 1–4 GHz	4⅞" W x 7⅜" H x 9¾" L, 6¾ lbs.	$ 95.00[1]
160B-600	600	10	5	DC-5 GHz	1.1, DC–1 GHz 1.2, 1–3 GHz 1.5, 3–5 GHz	6" W x 8¼" H x 14" L, 15½ lbs.	$155.00[1]
160B-1000	1000	10	5	DC-5 GHz	1.1, DC–1 GHz 1.2, 1–3 GHz 1.5, 3–5 GHz	6⅜" W x 9⅜" H x 20" L, 29½ lbs.	$265.00[1]

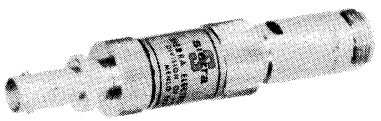
1. Delivered with Type N or UHF connectors, male or female. Types C, HN, and BNC are $10.00 additional. Types LC and TNC are $30.00, and 1⅝" rigid line is $70.00 additional.

Prices and specifications subject to change without notice.

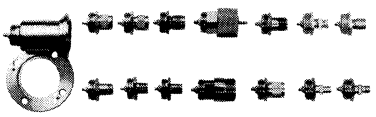
for the measurement of RF Power



Model 401A Series RF Termination Wattmeters



Model 148 Crystal Detector



Sierra "Twist-Off" Connectors

Model 401A Series RF Termination Wattmeters

- Power ratings of 120, 250, 500, and 1000 watts
- Four switch-selectable power ranges on 250-, 500-, and 1000-watt models
- Frequency ranges from 2 to 1000 MHz
- Wide dynamic range (500 to 1)
- Accuracy, ±5% full scale
- Maximum VSWR, 1.2
- Partially expanded meter scale simplifies measurements in low power ranges
- Sealed terminations (no bellows, no air vents)
- Long-life, non-carbonizing silicone dielectric fluid
- "Twist-Off" connectors, eight different types

Summary Specifications, 401A Series RF Termination Wattmeters

Model	Maximum Power Rating (watts)	Power Ranges (watts)	Frequency Range (MHz)	Size & Weight	Price
401A-120L	120	0–30 0–120	2–30	3½" W x 6" H x 8⅝" L, 4⅞ lbs.	$195.00[1]
401A-120M	120	0–30 0–120	30–500	same	$195.00[1]
401A-120H	120	0–30 0–120	400–1000	same	$195.00[1]
401A-250L	250	0–7 0–25 0–70 0–250	2–30	4⅞" W x 7⅜" H x 13" L, 9 lbs.	$275.00[1]
401A-250M	250	0–7 0–25 0–70 0–250	30–500	same	$275.00[1]
401A-500L	500	0–15 0–50 0–150 0–500	2–30	6" W x 8¼" H x 17¼" L, 18 lbs.	$325.00[1]
401A-500M	500	0–15 0–50 0–150 0–500	30–500	same	$325.00[1]
401A-1000L	1000	0–30 0–100 0–300 0–1000	2–30	6⅜" W x 9⅜" H x 23" L, 33 lbs.	$450.00[1]
401A-1000M	1000	0–30 0–100 0–300 0–1000	30–500	same	$450.00[1]

1. Delivered with Type N or UHF connectors, male or female. Types C, HN, and BNC are $10.00 additional. Types LC and TNC are $30.00 additional, and 1⅝" rigid line is $70.00 additional.

Model 148 Crystal Detector

- Functions in either 50- or 75-ohm coaxial systems (converts simply by replacing an interchangeable terminating resistor)
- Frequency range, 30 to 1200 MHz
- As a detector or a demodulator, will accept input powers up to 80 milliwatts
- Maximum VSWR, 1.5
- Price, $75.00 (75-ohm resistor available as Part No. SP 5129-1-75, price $5.00)

Sierra "Twist-Off" Connectors

- Readily replaceable in the field
- Choice of eight different connector types
- Accommodate virtually all 50-ohm transmission lines

Ordering Information, "Twist-Off" Connectors

Type	Stock Number
N	914600012 male 914600013 female
C	914600082 male 914600081 female
UHF	914600022 male 914600023 female
HN	914600078 male 914600079 female
LC	914600080 male 914600075 female
BNC	914600083 male 914600076 female
TNC	914600085 male 914600084 female
1⅝" rigid line	914600071

Prices and specifications subject to change without notice.

Complete data on all equipment shown available from:

Sierra Electronic Operation / 3885 Bohannon Drive / Menlo Park, California 94025 / Phone (415) 322-7222 / TWX: 910-373-1282

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MINIATURE MIXERS, HYBRIDS & AMPLIFIERS

- DOUBLY BALANCED MIXERS
- BALANCED MIXERS
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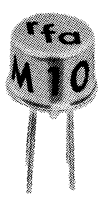
- SPECIAL MIXERS, HYBRIDS, AMPLIFIERS
- QUADRATURE HYBRIDS
- MIXER PREAMPLIFIERS
- IF AMPLIFIERS

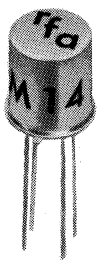
MINIATURE MIXERS (DC-1000 MHz)

M10



Case TO-33

M14



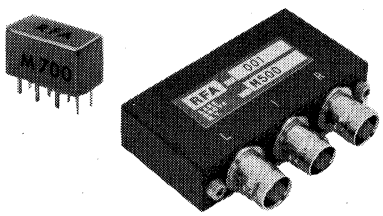
Case TO-5

DOUBLY BALANCED (DB) AND SINGLY BALANCED (SB) MIXERS (DC-1000 MHz)

Model No.	Type	Freq. (MHz)	Con. Typ.	Eff. Max.	Isol. (dB) Typ.	Isol. (dB) Min.	Case TO-	Del. Weeks	Price (1-4)
M10	DB	.25-900	6 dB	10 dB	30	10	33	Stock/3	$60
M11	DB	10-1000	6	10	30	10	33	Stock/3	60
M14	SB	.25-500	6	10	30	10	5	Stock/3	10*
M16	SB	10-1000	6	10	30	10	33	Stock/3	40

* In 1,000 quantity.

STANDARD MIXERS (DC-500 MHz)



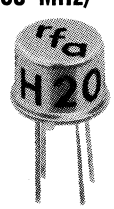
HIGH ISOLATION, LOW CROSS MODULATION (DB) MIXERS (DC-500 MHz)

Model No.	Type	Freq. (MHz)	Con. Typ.	Eff. Max.	Isol. (dB) Typ.	Isol. (dB) Min.	Case Inch	Price (1-4)
M500	DB	.2-500	6 dB	9 dB	50	45	2.3 x .6 x 1.7	$85*
M600	DB	.2-500	6	9	45	40	2.3 x .6 x 1.7	75
M700	DB	.2-500	6	9	45	40	.4 x .4 x .8	60

BNC Connectors are standard for the M500 and M600. Add $20 for OSC Connectors.
* Tightly controlled cross modulation and balance.

POWER DIVIDERS (1-1000 MHz)

H20



H21

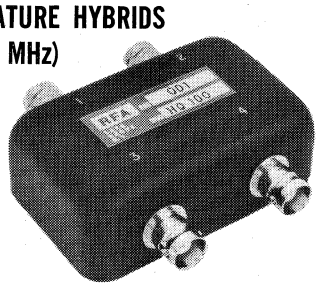


MINIATURE POWER DIVIDERS (1-1000 MHz)

Model No.	Type	Freq. (MHz)	Ins. Loss (dB) Typ.	Ins. Loss (dB) Max.	Isol. (dB) Typ.	Isol. (dB) Min.	Case TO-	Del. Weeks	Price (1-4)
H20	2 Way	1-200	.5	.8	45	35	33	Stock/3	$45
H21	2 Way	*.2-1 GHz	.7	1.0	25	20	5	Stock/3	45

* 10% bandwidth at any center frequency from 200 to 1,000 MHz.

QUADRATURE HYBRIDS (1-1000 MHz)



FOUR PORT HIGH ISOLATION QUADRATURE HYBRIDS (1-1000 MHz)

Model No.	Type	Freq. (MHz)	Ins. Loss (dB) Typ.	Ins. Loss (dB) Max.	Isol. (dB) Typ.	Isol. (dB) Min.	Case Inch	Price (1-4)
HQ100	Quad	1-100*	.2	.5	50	30	1 x 1.8 x 2.8	$75

Add $10 for frequencies other than 30 or 60 MHz. BNC Connectors are standard. Add $20 for OSM Connectors.
* The bandwidth is 10% with any center frequency from 1 to 100 MHz.
Request information on unlisted types and specials.

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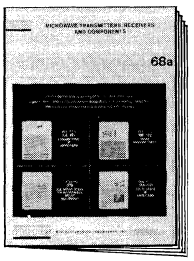
Our new catalogs describe our comprehensive line of standard models, custom designs, and many other receiver and transmitter components. Send for catalogs and see listings on following pages. EEM Section 3400.



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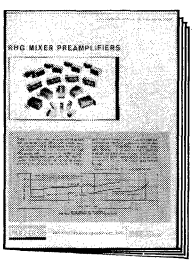
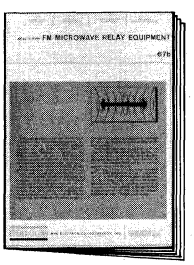
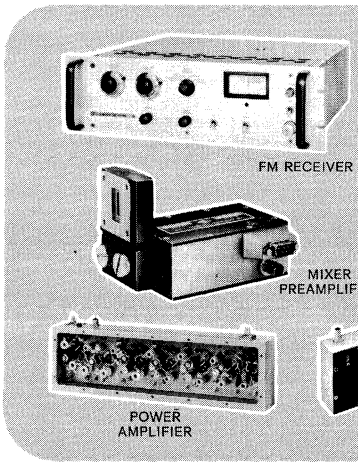
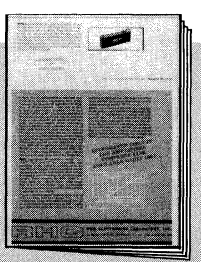


new!
BULLETIN MP-102
MIXER PREAMPLIFIERS

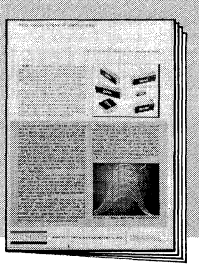


new!
CATALOG 69b
ALL SOLID STATE FM MICROWAVE RELAY EQUIPMENT





BULLETIN LA-101
LOGARITHMIC IF AMPLIFIERS



BULLETIN IFA-103
SOLID STATE IF AMPLIFIERS

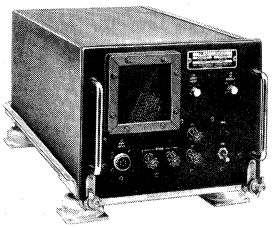
RHG ELECTRONICS LABORATORY · INC
94 MILBAR BOULEVARD ■ FARMINGDALE ■ LONG ISLAND ■ NEW YORK 11735 (516) 694-3100

SEE DETAILED LISTING OF RHG PRODUCTS ON FOLLOWING NINE PAGES

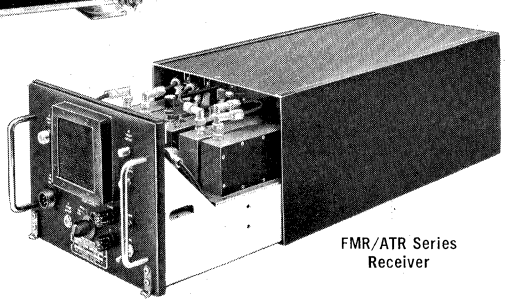
RHG all solid-state FM MICROWAVE RELAY EQUIPMENT

AIR-TO-AIR RELAY LINKS

- Meets Mil-E-5400
- Basebands to 20 MHz
- Power to 100 watts



FMT/ATR Series Transmitter



FMR/ATR Series Receiver

This series of Microwave FM-TV links is intended for high resolution FM-TV transmission and reception. Links are available in L, S, C, and X bands and are all solid state with the exception of the output TWT amplifier used with some of the higher power models.

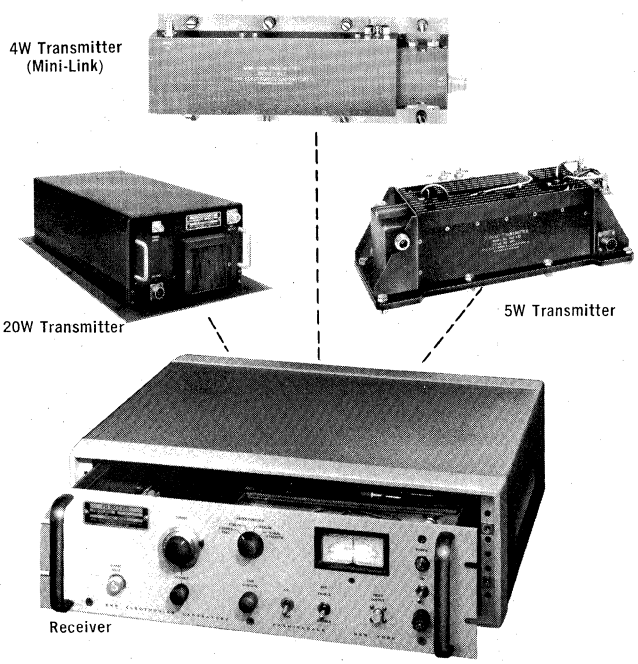
RANGE OF SPECIFICATIONS

SYSTEM SPECIFICATIONS

Frequency	Fixed tuned from 0.5 to 10 GHz
Baseband Response	±0.5 db, 10 Hz to 12 MHz (<1% tilt on 60 Hz square wave)
Differential Gain	±0.5 db
Differential Phase	3°
Video Signal-to-Noise	50 db p-p/RMS at —40 dbm received input level
Transmitter Power	to 5 watts (all solid state) to 100 watts (with TWT booster)
Receiver Noise Figure	11 db typical (without TDA) 5 db typical (with TDA)
IF/Discriminator Bandwidth	50 MHz
Dynamic Range (AGC/MGC)	>45 db
Video Level	1.4V p-p input produces ±9 MHz deviation, producing 1.4V p-p receiver output
Pre and De-emphasis	Supplied to appropriate CCIR and EIA recommendation

AIR-TO-GROUND RELAY LINKS

- Meets Mil-E-5400
- High Resolution
- Power to 100 watts



4W Transmitter (Mini-Link)

20W Transmitter

5W Transmitter

Receiver

RHG offers a complete capability in air-to-ground Relay Link Systems for aircraft and missile applications. These systems offer a proven performance capability for transmission of TV, Telemetry, and other wideband information.

While the configurations shown are typical, several other standard packages are available.

RANGE OF SPECIFICATIONS

SYSTEM SPECIFICATIONS

Operating Frequency	0.5 to 10 GHz
Transmitter Power	to 100 watts
Video Baseband	Basebands to 20 MHz available
Video Levels	Input and Output: 0.5-1.5V (adjustable)
Video Impedance	75Ω ±5%
Differential Gain	±0.5 db (50% APL)
Differential Phase	<2° (50% APL)
Signal/Noise	>50 db (p-p signal/RMS noise)
Pre/De-Emphasis	Per CCIR rec. #405 Switchable in or out
System Deviation	Up to 30 MHz p-p

MECHANICAL AND ENVIRONMENTAL

The ground receivers are packaged for standard 19″ relay rack mounting. Transmitter configurations fall into three general categories. The high power systems are housed in standard ATR cases, with integral cooling. The low power units are mounted on an aluminum plate suitable for conduction cooling. The receivers meet the requirements for military ground environments. The transmitters are designed to MIL-E-5400, Class 1A, with Temperature-Altitude per Figure 6, Curve A.

SPECIAL OPTIONS

- Auxiliary equipment, such as camera, monitors, and antennas can be supplied.
- A complete range of power inputs can be accommodated on special order.
- Special packaging for non-standard form factor applications can be supplied.

FOR ADDITIONAL MODELS AND COMPLETE INFORMATION, SEND FOR CATALOG 69B

all solid-state FM MICROWAVE RELAY EQUIPMENT RHG

SYSTEM PERFORMANCE

Model	Frequency	Output Power (min.)	Antenna Gain (nom.)	Received Signal Level at 10 mi.	at 20 mi.
MRS 2APM	fixed tuned in 1.7 to 2.4 GHz band	2.0 watts (+33 dbm)	50 db	—40 dbm	—46 dbm
MRS 7APM	fixed tuned in 5925 to 8400 band	0.5 watts (+27 dbm)	72 db	—35 dbm	—41 dbm

Note 1:
Indicated received signal levels are based on free space path loss without allowance for profile. Calculations made at 2.0 and 7.0 GHz, respectively. Note that received signal levels as low as —75 dbm will result in a 30 db signal/noise ratio (P-P/RMS).

SYSTEM SPECIFICATIONS

Baseband Response	10 Hz to 4.5 MHz (±0.5 db); ±1 db to 6 MHz <(1% tilt on 50 Hz square wave)
Differential Phase	±0.5°
Differential Gain	±0.25 db
Video Signal-to-Noise	58 db p-p/RMS (EIA Weighting)
Video Signal-to-Hum	50 db
Operative Temperature Range	—10° to 50°C

Additional Transmitter Specifications

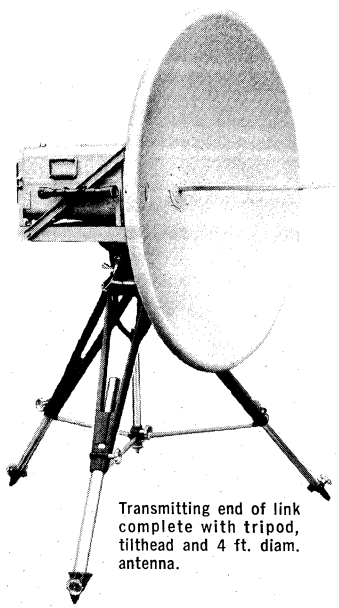
Output Power	2W at 2 GHz 0.5W at 7 GHz
Stability	±0.05%
Video Input	0.7 to 1.4V p-p (adjustable)

Additional Receiver Specifications

Noise Figure	11 db (typ)
Dynamic Range	45 db (—75 to —35 dbm)
Video Output	0.7 to 1.4V p-p (adjustable)

GROUND STATIONS—PORTABLE

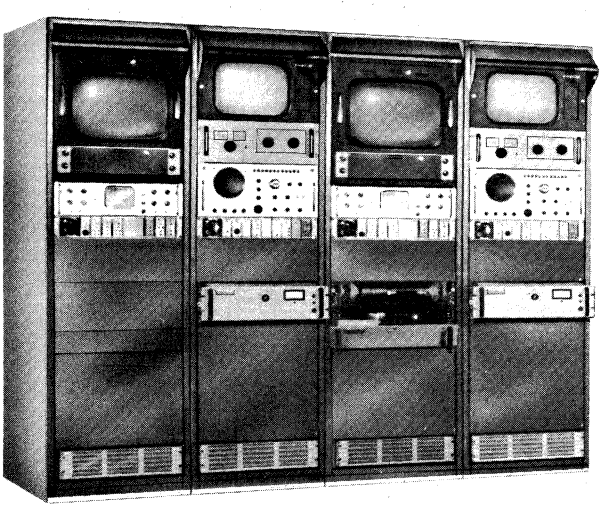
• All solid state • L, S, C, and X bands



Transmitting end of link complete with tripod, tilthead and 4 ft. diam. antenna.

The "MRS" series of portable microwave FM-TV relay links are completely self-contained transmitter-receiver combinations which include the antenna tripod and tilt head for both ends. The link is intended for the transmission of color or monochrome FM-TV, wideband video data, or multichannel telephony.

GROUND STATION-FIXED



All solid state FM Microwave Relay equipment is available from RHG for:

- Color or Monochrome TV Transmission
- Telephony
- Wide Band Video Data Links

FEATURES

1. All solid state
2. High Resolution—to 20 MHz baseband
3. Wide Frequency Coverage UHF thru X-Band

Also Available:

- Complete Antenna & Waveguide installation
- Auxiliary test equipment, monitors and cameras
- Multiplex and Demultiplex gear
- Diversity or hot standby

Write or call RHG where experienced telecommunications engineers are available to discuss your relay link problem.

RHG ELECTRONICS LABORATORY, INC.

94 MILBAR BOULEVARD
FARMINGDALE, LONG ISLAND
NEW YORK 11735 (516) 694-3100

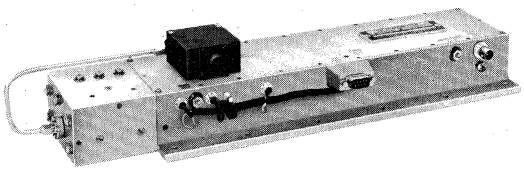
RHG

MICROWAVE FM TRANSMITTERS

■ *WIDEBAND PERFORMANCE* ■ *ALL SOLID STATE* ■ *HANDLE VIDEO, TELEMETRY AND MULTIPLEX*
■ *LOW DISTORTION* ■ *L, S, C AND X BAND* ■ *POWER OUTPUTS TO 100 WATTS*

MINI-LINK SERIES

• <75 cubic inches • 5 lbs.



The "MLT" miniature series is designed for those applications requiring a compact module, which incorporates only the essential elements and features without sacrifice of performance.

"MLT" WIDEBAND MODELS

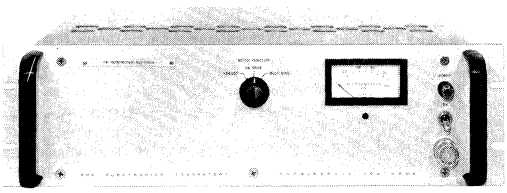
Model No.	(in band of) Frequency GHz	Baseband	Output Power (watts)
MLT1.7	1.71 to 1.85	10 Hz to 6.0 MHz ±0.5 db <1% tilt on 50 Hz square wave	4.0
MLT2.2	2.2 to 2.3		2.0
MLT3.7	3.7 to 4.2		1.0
MLT4.4	4.4 to 5.0		0.75
MLT5.9	5.9 to 6.5		0.50
MLT7.1	7.1 to 8.4		0.30

"MLTW" VERY WIDEBAND MODELS

MLTW1.7	1.71 to 1.85	10 Hz to 12 MHz ±1.0 db <1% tilt on 50 Hz square wave	4.0
MLTW2.2	2.2 to 2.3		2.0
MLTW3.7	3.7 to 4.2		1.0
MLTW4.4	4.4 to 5.0		0.75
MLTW5.9	5.9 to 6.5		0.50
MLTW7.1	7.1 to 8.4		0.30

NOTES:
1. Power: +24 VDC @ 1.5 A (typical)
2. Size: 17″ x 4½″ x 2¼″ (nominal)
3. Weight: 5 lbs. (approx.)

19″ RACK MOUNTED



The "FMT" series is designed for standard 19″ rack mounting. This unit is completely self contained, all solid state, and fully RFI protected.

"FMT" WIDEBAND MODELS

Model No.	In Band of (GHz	Baseband	Output Power (watts)
FMT1.7	1.71 to 1.85	±0.5 db 10 Hz to 6 MHz <1% tilt on 50 Hz square wave	4.0
FMT2.2	2.2 to 2.3		2.0
FMT3.7	3.7 to 4.2		1.0
FMT4.4	4.4 to 5.0		0.75
FMT5.9	5.9 to 6.5		0.5
FMT7.1	7.1 to 8.4		0.5
FMT1.7HP	1.71 to 1.85		20
FMT2.2HP	2.2 to 2.3		20
FMT3.7HP	3.7 to 4.2		20
FMT4.4HP	4.4 to 5.0		20
FMT5.9HP	5.9 to 6.5		20
FMT7.1HP	7.1 to 8.4		20

"FMTW" VERY WIDEBAND MODELS

FMTW1.7	1.71 to 1.85	±1.0 db 10 Hz to 12 MHz <1% tilt on 50 Hz square wave	4.0
FMTW2.2	2.2 to 2.3		2.0
FMTW3.7	3.7 to 4.2		1.0
FMTW4.0	4.4 to 5.0		0.75
FMTW5.9	5.9 to 6.5		0.5
FMTW7.1	7.1 to 8.4		0.5
FMTW1.7HP	1.71 to 1.85		20
FMTW2.2HP	2.2 to 2.3		20
FMTW3.7HP	3.7 to 4.2		20
FMTW4.4HP	4.4 to 5.0		20
FMTW5.9HP	5.9 to 6.5		20
FMTW7.1HP	7.1 to 8.4		20

NOTES:
1. All models listed above are available in "ATR" configuration. Add suffix "ATR" to model number shown. Packaging is B1D1 size to mate with shock mount tray M591405-B1D1 (not supplied). These units require 115 V 400 Hz power. Other power options available.
2. Std. units require 115 V 60 Hz.

"ATR" STYLE—AIRBORNE



The "FMT-ATR" series is designed for airborne applications, and offers electrical performance identical to the regular "FMT" series.

ADDITIONAL INFORMATION

1. Deviation: Wideband models ±4 MHz; Very wideband models ±8 MHz
2. Video levels: Rated deviation produced by 0.7 to 1.4 V p-p (adjustable)
3. Output load: All models designed for 50Ω load. "FMT" and "FMTW" models incorporate terminated 3 port circulator, protecting against open, shorted, and poor VSWR loads
4. Stability: ±0.5% from −20 to +55°C. (all models.) Up to ±.003% with AFC option
5. RFI: All models incorporate RFI protection
6. Fidelity: Typical linearity <5% over full deviation, <2% over 50% deviation. Complete fidelity data related to intended usage available on request

AVAILABLE OPTIONS

1. Deviations: Up to ±24 MHz
2. Video: Up to 24 MHz
3. Power: Up to 100 watts
4. Frequency: 0.5 to 13 GHz
5. Selectable Frequency: Models with step or continuous tuning available
6. Pre-emphasis: Standard or special networks are available
7. Subcarriers: Standards at 6.5, 7.5 and 8.5 Specials up to 20 MHz
8. AFC: Stabilities to ±.002% available
9. Multiplex: Complete multiplex facilities for TV, Telemetry, Telephony are available

SEE "SYSTEM PERFORMANCE CONSIDERATIONS" ON OPPOSITE PAGE WHEN ORDERING TRANSMITTER-RECEIVER COMBINATIONS

MICROWAVE FM RECEIVERS

RHG

■ *WIDEBAND FM-TV* ■ *VIDEO DATA LINKS* ■ *MULTICHANNEL TELEPHONY* ■ *BANDWIDTH TO 50 MHz*
■ *LOW DIFFERENTIAL PHASE AND GAIN* ■ *FIXED OR TUNEABLE*

WIDEBAND MODELS

• 30 MHz IF BW • 6 MHz Baseband

Model No.	Tuning	In Band of (GHz)	RF Preselector	AFC
FMR1.7	Fixed	1.71 to 1.85	STD.	OPT.
FMR2.2	Fixed	2.2 to 2.3	STD.	OPT.
FMR3.7	Fixed	3.7 to 4.2	STD.	OPT.
FMR4.4	Fixed	4.4 to 5.0	STD.	OPT.
FMR5.9	Fixed	5.9 to 6.5	STD.	OPT.
FMR7.1	Fixed	7.1 to 8.4	STD.	OPT.
FMR1.7-1.8	Tuneable	1.71 to 1.85	OPT.	STD.
FMR2.2-2.3	Tuneable	2.2 to 2.3	STD.	STD.
FMR3.7-4.2	Tuneable	3.7 to 4.2	OPT.	STD.
FMR4.4-5.0	Tuneable	4.4 to 5.0	OPT.	STD.
FMR5.9-6.5	Tuneable	5.92 to 6.43	OPT.	STD.

VERY WIDEBAND MODELS

• 50 MHz IF BW • 12 MHz Baseband

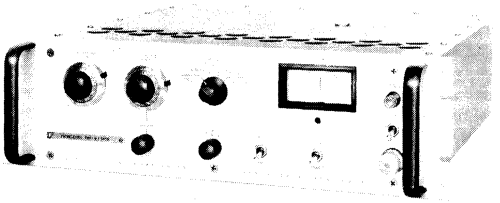
Model No.	Tuning	In Band of (GHz)	RF Preselector	AFC
FMRW1.7	Fixed	1.71 to 1.85	STD.	OPT.
FMRW2.2	Fixed	2.2 to 2.3	STD.	OPT.
FMRW3.7	Fixed	3.7 to 4.2	STD.	OPT.
FMRW4.4	Fixed	4.4 to 5.0	STD.	OPT.
FMRW5.9	Fixed	5.9 to 6.5	STD.	OPT.
FMRW7.1	Fixed	7.1 to 8.4	STD.	OPT.
FMRW1.7-1.8	Tuneable	1.71 to 1.85	OPT.	STD.
FMRW2.2-2.3	Tuneable	2.2 to 2.3	STD.	STD.
FMFW3.7-4.2	Tuneable	3.7 to 4.2	OPT.	STD.
FMRW4.4-5.0	Tuneable	4.4 to 5.0	OPT.	STD.
FMRW5.9-6.5	Tuneable	5.92 to 6.43	OPT.	STD.

ADDITIONAL SPECIFICATIONS:

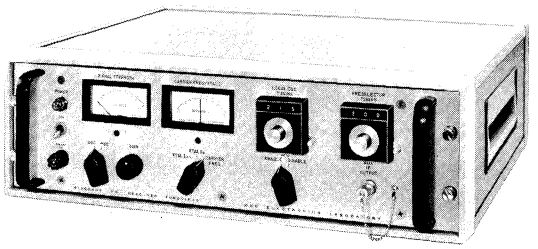
1. Noise Figure: 9 db (typ.) all units plus preselector loss, if applicable.
2. RF Isolator: Standard on all units.
3. AGC: 45 db (min.)
4. Video Baseband: ±0.5 db over 10 Hz to 6 MHz (12 MHz, ±1.0 db) on wideband models with <1% tilt on a 50 Hz square wave.
5. Video Output: 2 supplied at 75Ω impedance level. (1.4 V-P-P).

STANDARD MODIFICATIONS

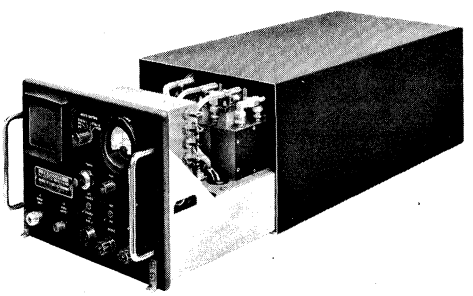
1. De-emphasis: Standard CCIR plug-in networks are available.
2. Power Input: Units designed for 12, 24 or 28 VDC are available.
3. Diversity Operation: Manual and automatic diversity operation can be supplied with post detection combining.
4. Subcarrier Demodulators: Available to meet customer needs.



The photos on this page show three packaging options available for the FMR series. They are available in L, S, C or X-band and have low thermal and intermodulation noise characteristics. They are wideband, phase equalized and can provide distortion-less baseband signals of up to 12 MHz.



Receivers intended for mounting in standard 19″ relay racks require 5¼″ of panel height. The unit illustrated above is shown in a bench type instrument case, which is an optional extra.



RHG's complete line of FM receivers are also available for airborne applications. They are packaged in B1D1 size standard "ATR" cases with built-in cooling. They utilize shock mount tray MS91405-B1D1 (not supplied).

SYSTEM PERFORMANCE CONSIDERATIONS

When individual transmitters or receivers are ordered, RHG utilizes a suitable laboratory standard mating test receiver or transmitter to perform final test on this unit.

When a transmitter-receiver combination is ordered, RHG will perform applicable system tests on the units, as well as individual tests. These tests are conducted with the transmitter and receiver connected by suitable attenuators to provide a received signal level of −40 dbm nominal.

Typical fidelity characteristics are as follows:

TV TESTS: (Std. 525 line pre and de-emphasis utilized)
Using std. test signals per EIA RS-170
Diff. gain: ±0.25 db
Diff. phase: ±0.5°
Video Signal to noise: 58 db p-p/rms (EIA weighting)
Video Signal to hum: 50 db

NPR TESTS: (Using Marconi noise loading test set TF2091 & TF2092)
At baseband loading of 4 MHz. providing p-p deviation of 8 MHz, typical NPR is −40 db at the midband slot.

HARMONIC DISTORTION:
Single tone harmonic distortion, measured over this system baseband, at rated deviation is typically <2%.

INTERMODULATION (Two tone):
Utilizing two signals, each producing one-half the rated deviation, and producing in band 2nd and 3rd order products, these products are typically greater than 40 db down.

SPECIAL TESTS:
Any special testing requested to document some particular or unusual aspect of performance can be performed on a complete system, or an individual receiver or transmitter. RHG engineering personnel are available to discuss these requirements when applicable.

RHG

RHG ELECTRONICS LABORATORY, INC.

94 MILBAR BOULEVARD
FARMINGDALE, LONG ISLAND
NEW YORK 11735 (516) 694-3100

RHG

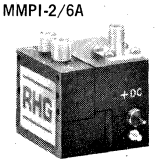
MIXER PREAMPLIFIERS

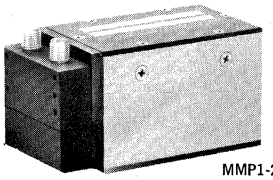
■ *0.1 to 40 GHz* ■ *NOISE FIGURES TO 6DB* ■ *RFI PROTECTION*

MINIATURE COAXIAL SERIES

• 1.5 cubic inches • 2.5 ounces

MMPI-2/6A





MMP1-2/5B

The MMP1-2/6A ultraminiature model occupies 1.5 cubic inches, weighs only 2½ ounces and requires less than 1/20 watt of power. Its companion, the MMP1-2/5A standard miniature model, is packaged in 4.5 cubic inches and weighs 6 ounces.

RF Band & Price	Std. Min. Model No.	Ultramin. Model No.	IF Freq/BW	N.F. (db)
L BAND	MMP1-2/5A	MMP1-2/6A	60-10	7.2
1.0-2.0 GHz	MMP1-2/5B	MMP1-2/6B	60-20	7.2
MMP/5 Series $625	MMP1-2/5C	MMP1-2/6C	30-10	7.2
MMP/6 Series $695	MMP1-2/5D	MMP1-2/6D	70-10	7.2
S BAND	MMP2-4/5A	MMP2-4/6A	60-10	7.7
2.0-4.0 GHz	MMP2-4/5B	MMP2-4/6B	60-20	7.7
MMP/5 Series $625	MMP2-4/5C	MMP2-4/6C	30-10	7.7
MMP/6 Series $695	MMP2-4/5D	MMP2-4/6D	70-10	7.7
C BAND	MMP4-8/5A	MMP4-8/6A	60-10	8.5
4.0-8.0 GHz	MMP4-8/5B	MMP4-8/6B	60-20	8.5
MMP/5 Series $625	MMP4-8/5C	MMP4-8/6C	30-10	8.5
MMP/6 Series $695	MMP4-8/5D	MMP4-8/6D	70-10	8.5

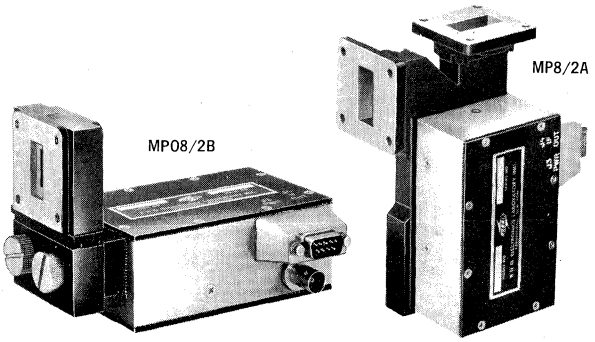
NOTES:
1. Gain: 25 db min.
2. LO Injection: +3 dbm (typ)
3. LO-RF Isolation: 6 db (typ)
4. Input VSWR: 1.5/1 (typ)
5. Supply voltage: +12 VDC

WAVEGUIDE SERIES

• Hybrid and Crossed-Field • Premium Diodes

MP8/2A

MPO8/2B



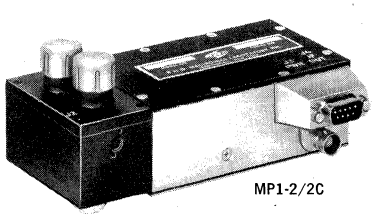
The waveguide series of mixer-preamps consist of a low-noise all-silicon preamplifier, integrated with either a short-slot hybrid mixer or a crossed-field mixer. Frequency coverage from X- through K-band is provided.

RF Band & Price	Hybrid Model No.	Crossed Field Model No.	IF Freq/BW	N.F. (db)
X BAND	MP7/2A		60-10	MP Series
7.5-8.5GHz	MP7/2B		60-20	7.2 db
MP Series $625	MP7/2C		30-10	MPO Series
	MP7/2D		70-10	8.0
X BAND	MP8/2A	MPO8/2A	60-10	MP Series
8.5-9.6 GHz	MP8/2B	MPO8/2B	60-20	7.3
MP Series $540	MP8/2C	MPO8/2C	30-10	MPO Series
MPO Series $540	MP8/2D	MPO8/2D	70-10	8.0
X BAND	MP9/2A	MPO9/2A	60-10	MP Series
9.5-10.2 GHz	MP9/2B	MPO9/2B	60-20	8.0
MP Series $645	MP9/2C	MPO9/2C	30-10	MPO Series
MPO Series $595	MP9/2D	MPO9/2D	70-10	8.7
K BAND		MPO10/2A	60-10	9.5 db
8.0-12.0 GHz		MPO10/2B	60-20	9.5 db
Price $895		MPO10/2C	30-10	9.5 db
		MPO10/2D	70-10	9.5 db
K BAND		MPO15/2A	60-10	9.8 db
12.0-18.0 GHz		MPO15/2B	60-20	9.8 db
Price $895		MPO15/2C	30-10	9.8 db
		MPO15/2D	70-10	9.8 db

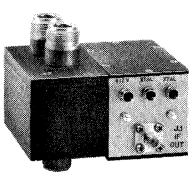
NOTES:
1. Gain: 25 db Min.
2. LO Injection: 0 to +3 dbm
3. LO-RF Isolation: 12 db (Hybrid) 20 db (crossed field)
4. Input VSWR: 1.25/1 (Hybrid) 3/1 (crossed field)
5. Supply Voltage: +12 VDC

COAXIAL SERIES

• 32 Models • Low Noise Figure



MP1-2/2C



MPX1-2/2D

This series consists of dual crystal balanced hybrid mixers, electrically and mechanically integrated with low-noise all-silicon preamplifiers. The preamplifier portion of the units is available in two sizes as shown in the photos.

RF Band & Price	Std. Size Model No.	Min. Size Model No.	IF Freq/BW	N.F. (db)
UHF BAND	MP5-1/2A	MPX5-1/2A	60-10	8.8 db
0.5-1.0 GHz	MP5-1/2B	MPX5-1/2B	60-20	8.8 db
MP Series $525	MP5-1/2C	MPX5-1/2C	30-10	8.8 db
MPX Series $575	MP5-1/2D	MPX5-1/2D	70-10	8.8 db
L BAND	MP1-2/2A	MPX1-2/2A	60-10	7.5 db
1.0-2.0 GHz	MP1-2/2B	MPX1-2/2B	60-20	7.5 db
MP Series $495	MP1-2/2C	MPX1-2/2C	30-10	7.5 db
MPX Series $545	MP1-2/2D	MPX1-2/2D	70-10	7.5 db
S BAND	MP2-4/2A	MPX2-4/2A	60-10	7.8 db
2.0-4.0 GHz	MP2-4/2B	MPX2-4/2B	60-20	7.8 db
MP Series $495	MP2-4/2C	MPX2-4/2C	30-10	7.8 db
MPX Series $545	MP2-4/2D	MPX2-4/2D	70-10	7.8 db
C BAND	MP4-8/2A	MPX4-8/2A	60-10	8.0 db
4.0-8.0 GHz	MP4-8/2B	MPX4-8/2B	60-20	8.0 db
MP Series $545	MP4-8/2C	MPX4-8/2C	30-10	8.0 db
MPX Series $595	MP4-8/2D	MPX4-8/2D	70-10	8.0 db

NOTES:
1. Gain: 25 db Min.
2. LO Injection: 0 to +3 dbm
3. LO-RF Isolation: 6 db (typ.)
4. Input VSWR: 1.5/1 (typ.)
5. Supply Voltage: +12VDC

STANDARD MODIFICATIONS

1. RFI Protection: Standard on MPX and MMP series, $50 additional on all other units.
2. High Power Preamps: Providing +20 dbm output capability are available on most models.

LOWER NOISE UNITS

Noise figures shown are single sideband, and represent typical performance for production units. Lower noise units, especially for spot RF frequencies can be supplied on special order. The use of "super-premium" diodes and/or transistors will generally result in improved noise figure. An AIL-type 70 Hot-Cold noise standard assures accuracy. Noise figures under 6.0 db have been achieved on special designs.

FOR ADDITIONAL MODELS AND COMPLETE INFORMATION, SEND FOR CATALOG MP102A

MIXER PREAMPLIFIERS

RHG

■ *IF BANDWIDTHS TO 240 MHz* ■ *PHASE MATCHING TO 5°* ■ *HOT CARRIER DIODES*

COAXIAL SERIES

RF Band & Price	Model No.*	IF Freq/BW	N.F. (db)
L BAND	MMP1-2/7A	60/10	8.2
1.0-2.0 GHz	MMP1-2/7B	60/20	8.2
Price $725	MMP1-2/7C	30/10	8.2
per channel	MMP1-2/7D	70/10	8.2
S BAND	MMP2-4/7A	60/10	8.7
2.0-4.0 GHz	MMP2-4/7B	60/20	8.7
Price $725	MMP2-4/7C	30/10	8.7
per channel	MMP2-4/7D	70/10	8.7
C BAND	MMP4-8/7A	60/10	9.5
4.0-8.0 GHz	MMP4-8/7B	60/20	9.5
Price $775	MMP4-8/7C	30/10	9.5
per channel	MMP4-8/7D	70/10	9.5

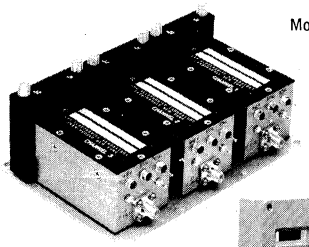
WAVEGUIDE SERIES

X BAND	MPO8/7A	60/10	9.0
8.5-9.6 GHz	MPO8/7B	60/20	9.0
Price $775	MPO8/7C	30/10	9.0
per channel	MPO8/7D	70/10	9.0
K BAND	MPO10/7A	60/10	10.5
8.0-12.0 GHz	MPO10/7B	60/20	10.5
Price $1095	MPO10/7C	30/10	10.5
per channel	MPO10/7D	70/10	10.5

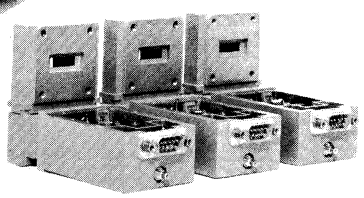
NOTES:
1. Gain: 20 db min (all models)
2. Gain and phase trim std.
3. AGC: 20 db (min)
4. Phase matching ±5°
5. Gain matching ±1.0 db
6. Matching held over AGC of 20 db and temp of −30 to +71°C
7. LO injection: 0 to +3 dbm
8. Power: +12 VDC @ 40 ma (typ)
9. Xtal current monitoring provided.

GAIN AND PHASE MATCHED MODELS

• 5° and 1 db matching • Coax and waveguide



Model MP2-4/7C
(3 channel)



Model MPO8/7A
(3 channel)

This series offers the user a wide range of standard models for monopulse, phased array, and other applications where precise matching over temperature and AGC range is needed. Specifications apply to two and three channel devices. To order, specify model no. and number of channels.

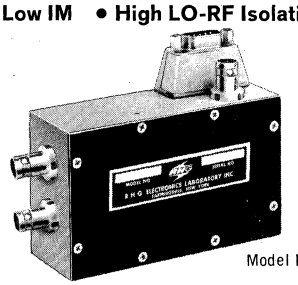
DOUBLE BALANCED

RF Band & Price	Model No.	IF Freq/BW	N. F. db Typical
0.1 to 1.0 GHz Price $695	DMP/8A	60/10	100- 200 <8.5
	DMP/8B	60/20	200- 500 <9.0
	DMP/8C	30/10	500- 800 <10.0
	DMP/8D	70/10	800-1000 <11.0

NOTES:
1. LO injection: +5 dbm
2. RF-LO isolation: 30 db min
3. RF-IF gain: 20 db min
4. Output: <0.5 compression @ +10 dbm
5. Connectors: BNC
6. Size: 4x2⅜x1⅜ plus connectors

DOUBLE BALANCED MIXER PREAMPS

• Low IM • High LO-RF Isolation



Model DMP/8B

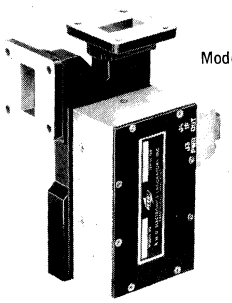
This series offers the user wideband high performance and are ideal as the second converter in double conversion systems.

Preamp Type	Cent. Freq. (MHz)	Band Width (MHz min.)	RF-IF Gain (db min.)	Additional N.F. (db)	Additional Cost
4KK	10	2	25	0	$ 50
4LL	20	6	25	0	50
4AA	60	40	25	0.5	100
4JJ	70	30	25	0.5	75
4BB	120	40	25	1.2	150
4MM	130	60	20	1.5	175
4CC	150	100	20	2.0	250
4DD	160	40	25	1.5	150
4EE	160	60	20	2.0	200
4FF	238	50	20	2.0	225
4GG		10 to 150	30	5.0	295
4HH		10 to 250	20	6.0	345
4NN	200	100	20	2.5	295
4PP	300	20	20	2.0	250
4QQ	370	20	20	2.0	275
4RR	450	30	20	3.0	350

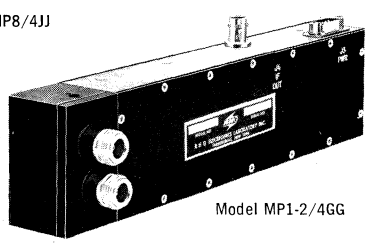
NOTES:
1. These increments must be added to the values shown in the table on the opposite page for mixer style delivered.
2. A complete line of standard matching post amplifier units is available. Refer to "EBT," "EVT" and "EST" series.

WIDEBAND AND SPECIAL PREAMPS

• IF Bandwidths to 240 MHz • IF Center Freq. to 450 MHz



Model MP8/4JJ



Model MP1-2/4GG

These wideband preamps are available with the standard mixer types shown on the opposite page. To order, replace suffix 2A, 2B, 2C, or 2D with the suffix shown in "TYPE" column. Virtually any other IF combination is available on request.

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RHG ELECTRONICS LABORATORY, INC.

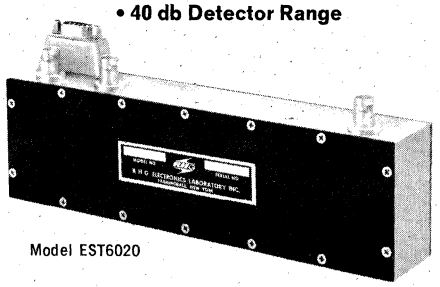
94 MILBAR BOULEVARD
FARMINGDALE, LONG ISLAND
NEW YORK 11735 (516) 694-3100

RHG LINEAR IF AMPLIFIERS

■ *WIDE RANGE OF MODELS* ■ *GAIN AND PHASE MATCHED* ■ *MIL GRADE*

"SUPER" IF AMPLIFIER

• All Silicon • Closed Loop AGC
• Phase and Gain Matching Available
• 40 db Detector Range



Model EST6020

The "EST" Series is designed for use in military receiving systems requiring the utmost in performance and reliability. The units are built to comply with MIL-E-5400 and MIL-E-16400 and operate from −54°C to +71°C providing MTBF's in excess of 25,000 hours. Units may be obtained in gain and phase matched sets.

"EST" SERIES

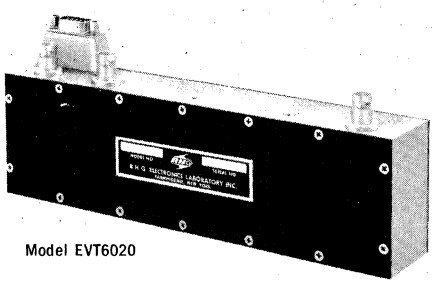
Model	Center Freq. (MHz)	Bandwidth (MHz)	Rise-time (μsec)	Gain to IF (db)	Gain to Video (db)	Noise Figure (db)	Price
EST3002	30	2	0.50	80	90	2.5	$545
EST3004	30	4	0.25	80	90	2.5	545
EST3010	30	10	0.10	80	90	2.5	545
EST6004	60	4	0.25	80	90	2.5	545
EST6010	60	10	0.10	80	90	2.5	545
EST6020	60	20	0.05	80	90	2.5	595

NOTES:
1. IF output capability >+13 dbm (1 V at 50Ω for <1 db compression
2. IF input and output: designed for 50Ω system. Input VSWR1.5:1 Nom.
3. Video output: emitter follower, direct coupled. Capability 5V into 93Ω
4. AGC: Closed loop provision built in with AGC delay to establish desired output level. Compression ratio 60 db in to 3 db out. AGC may be disabled and MGC will provide 60 db of manual control.
5. RFI protection consists of special filtered power connector assembly and RFI gasketing standard on all models
6. Power requirements: +12V at 160 ma (nom.), −12V at 160 ma (nom.)

STANDARD MODIFICATIONS
1. Units can be gain matched to ±2 db and phase matched to ±10° over 50 db AGC range. Add suffix "MAT" $200 additional per unit.
2. Wide Range Linear Detector—A new exclusive RHG detector circuit offering a linear detected output (±0.5 db over 30 db) is available. Add suffix "LD." $200 additional.

SOLID STATE

• All Silicon • IF and Video Outputs
• MIL Grade • Risetimes to 25 Nanoseconds



Model EVT6020

The "EVT" Series are all solid state, high gain amplifiers. They feature a high power IF output plus a low impedance detected output. They are capable of pulsed and CW amplification. Power required is ±12 VDC at 160 ma.

"EVT" SERIES

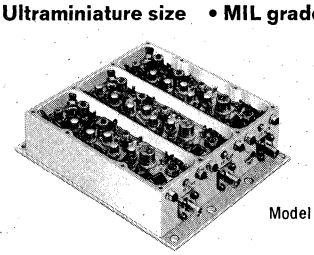
Model	Center Freq. (MHz)	Bandwidth (MHz)	Rise-time (μsec)	Gain to IF (db)	Gain to Video (db)	Price
EVT1002	10	2	0.50	80	90	$425
EVT2004	20	4	0.25	80	90	425
EVT3002	30	2	0.50	80	90	345
EVT3004	30	4	0.25	80	90	345
EVT3010	30	10	0.10	80	90	345
EVT4510	45	10	0.10	80	90	395
EVT6010	60	10	0.10	80	90	345
EVT6020	60	20	0.05	80	85	375
EVT7010	70	10	0.10	75	85	375
EVT7030	70	30	0.03	60	70	495
EVT12020	120	20	0.05	65	75	525
EVT16040	160	40	0.025	60	70	895

NOTES:
1. IF Output: +10 dbm (min.)
2. Video Output: +5 V into 93Ω
3. Gain control range of 50 db is obtained with 0 to −5 VDC (typical)
4. Low noise input with VSWR <2:1. Standard on all models from 30 to 70 MHz. (NF ≃ 4 db).

STANDARD MODIFICATIONS
1. Low Noise Mixer Input (for reversed mixer xtals): 2 connectors plus crystal monitors. Add suffix "M" $75.00 additional
2. RFI Protection: Includes power line filtering and RF gasketing. Add suffix "RFI" $50 additional

MATCHED 3 CHANNEL IF AMPLIFIERS

• Phase matched to 5° • Gain matched to 1 db
• Ultraminiature size • MIL grade



Model ETM3010

The "ETM" series provides three matched IF amplifier channels suitable for use in monopulse and similar applications. Its small size and low power drain make it ideal for airborne applications.

"ETM" SERIES

Model	Center Freq. (MHz)	Bandwidth (MHz)	Gain (db)	Rise-time (μsec)	Price
ETM3004	30	4	80	0.25	$2950
ETM3010	30	10	70	0.10	3150
ETM6010	60	10	70	0.10	3250
ETM6020	60	20	65	0.05	3450

NOTES:
1. AGC range: 50 db (min)
2. Tracking: Channels A and B will be within 5° and 1 db of Channel C over 50 db AGC range, and temperature of −30 to +70°C.
3. Input Impedance: 50Ω at VSWR <1.15:1
4. Output Impedance: Designed for 50Ω load
5. Output Capability: 0.5 VRMS (+6 dbm) at <1 db compression
6. Noise Figure: <10 db—low noise versions to 2.5 db available. Specify suffix "LN"—$100 additional.
7. Power: +12 V at 150 ma (typical)
8. Size: Approx. 7 cubic inches per channel

FOR ADDITIONAL MODELS AND COMPLETE INFORMATION, SEND FOR LINEAR IF AMPLIFIER BULLETIN IFA 103A AND LOGARITHMIC IF AMPLIFIER BULLETIN LA 101A

LOGARITHMIC IF AMPLIFIERS

RHG

■ *TRUE LOG COMPRESSION* ■ *FREQ. COVERAGE TO 200 MHz* ■ *MIL AND MISSILE GRADE* ■ *RISETIMES TO 10 NSEC.* ■ *DYNAMIC RANGES TO 90 DB*

"LT" and "LLT" SERIES

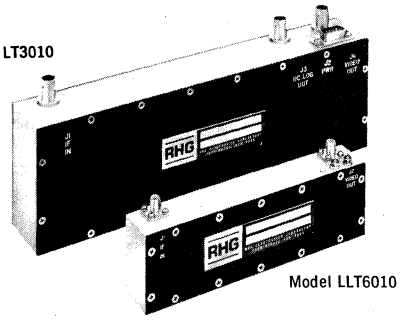
Standard Model	Miniature Model	Center Freq. (MHz)	Band-width (MHz)	Rise-time (μsec.)	Input Range db	LT Price	LLT Price
LT1003	.....	10	3	0.5	80	$ 695	.....
LT2005	.....	20	5	0.2	80	695	.....
LT3002	LLT3002	30	2	0.5	80	525	$825
LT3010	LLT3010	30	10	0.15	80	525	825
LT4510	.....	45	10	0.15	80	$ 695	.....
LT6010	LLT6010	60	10	0.15	80	525	825
LT6020	LLT6020	60	20	0.07	80	595	825
LT7010	LLT7010	70	10	0.15	80	$ 595	825
LT12040	.....	120	40	0.03	60	995	.....
LT16020	.....	160	20	0.07	70	1250	.....
LT200100	.....	200	100	0.01	60	3500	.....

NOTES:
1. Std. Models—9 1/16 x 3 x 1½. Min. Models—6 x 1¾ x 1.
2. Video output voltage: 0.25 to 2.5 volts into 93Ω (typical most units)
3. Log accuracy: ±1 db over 60 db range; ±2 db over balance of range
4. Dynamic range: 50μv to .50 volts on all units except LT12040 and LT200100 are 100μv to 0.1V and LT16020 is 40μv to .125 V.

OPTIONS:
1. RFI Protection—includes power line filtering and RF gasketing. Add suffix "RFI" $50 additional. (Std on LT200100.)
2. DC coupled Video Amplifier. Replaces the standard AC coupled video amplifier. Add suffix "DC" $75 additional. (Not avail. LT200100).

SOLID STATE

- **Risetimes to 10 nanoseconds**
- **Center frequencies to 200 MHz**
- **Miniature and Standard Models**



The "LT" series provides the widest range of performance parameters. Their high performance coupled with their built in quality make these units ideal for "new system" requirements. Power required is ±12 VDC at 160 ma.

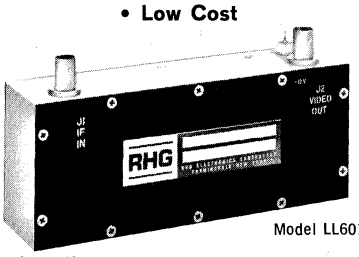
"LL" SERIES

Model	Center Freq. (MHz)	Band-width (MHz)	Rise-time (μsec.)	Input Dynamic Range Volts	db	Price
LL3002	30	2	0.5	250 μv to .25 v	60	$325
LL3004	30	4	0.25	250 μv to .25 v	60	325
LL3010	30	10	0.15	250 μv to .25 v	60	325
LL6002	60	2	0.5	250 μv to .25 v	60	325
LL6010	60	10	0.15	250 μv to .25 v	60	325

NOTES:
1. Input Impedance: 50Ω, VSWR 1.5 (typical)
2. Video output voltage: 0.2 to 2.0 volts into a 93Ω load (typical)
3. Log accuracy: ±1 db over the dynamic range
4. Power required: −12 VDC @ 60 ma

SOLID STATE – ECONOMY

- **Low Cost**



Model LL6010

The "LL" series offers true log amplification in an economical package design. Features not required in all applications have been eliminated providing a low-cost high- quality design.

"TSL" SERIES...The RHG Model TSL log test sets facilitate the specialized alignment and testing of log IF amplifiers.

Log Linearity: A dynamic test method permits adjustment of linearity while viewing a "plot" of signal input power versus output voltage on an ordinary oscilloscope (not supplied). Non-linearities can be measured to within ±¼ db. Front panel attenuator provides calibration.

Log Slope: A calibrated control provides settings from 10 to 100mv per db in 10 steps. A vernier provides non-calibrated continuous adjustments between steps.

Dynamic Range: Direct measurement is provided with a display showing the entire curve from "lift off" to saturation. A built-in source provides levels from +10 dbm to—90 dbm. A meter and screwdriver adjust provides calibration.

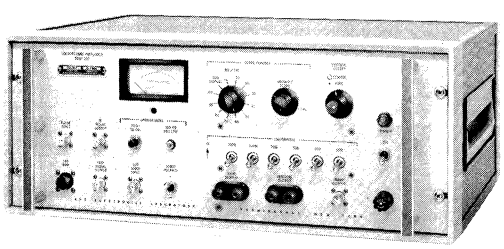
Pulse Response: An RF source capable of complete "turn off" and fast risetime (several RF cycles) is provided. This tunnel diode oscillator can be gated on and off by any standard pulse generator providing 10 volts or more. (Pulse generator not supplied.)

Matching*: An optional attachment permits two log amplifiers to be observed simultaneously, thus facilitating the matching of the units.

Modulation Check*: An optional attachment provides a modulated (constant percentage) RF signal which is swept, in amplitude, over the dynamic range. Variations in the demodulated output can be measured, providing a sensitive indication of the change of log slope over the dynamic range.

LOG AMPLIFIER TEST SET

- **Rapid Dynamic Testing of Log Amplifiers**



Additional Specifications

IF Frequency	30 or 60 MHz (10 to 100 MHz available on order)
Test Signal Range	+10 to −90 dbm
Power Available	±12 V at 250 ma for unit under test
Metering	Carrier level

Prices: **Model TSL-30 (30 MHz) $3995**
Model TSL-60 (60 MHz) $3995
Model TSL-XX (any freq. between 10 & 100 MHz).....$4295

*Matching and modulation check options not included in price.

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RHG ELECTRONICS LABORATORY, INC.

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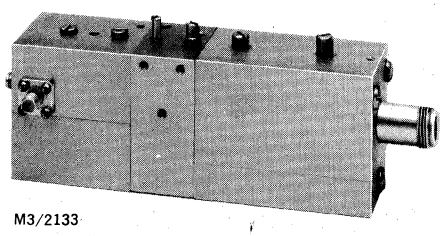
RHG

FILTERS AND MULTIPLIERS

MICROWAVE FREQUENCY MULTIPLIERS

- **High Conversion Efficiency**
- **Wideband Operation**
- **Computer aided designs**
- **L through X band**



M3/2133

The "M" series is designed to produce moderate microwave power levels when driven by suitable sources. They are tailored to meet the requirements of wide band FM microwave relay applications. Inquiries on requirements for other frequency, bandwidth and power combinations are welcomed.

"M" SERIES MULTIPLIERS

Band	Model No.	Frequency (MHz) Input/Output	Mult. Factor	Bandwidth (MHz) Input/Output	No. of Stages
VHF-L	M6/250	250/1500	6	25/35	1
VHF-S	M6/300	300/1800	6	25/35	1
VHF-S	M6/380	380/2280	6	25/35	1
VHF-C	M12/380	380/4560	12	25/40	2
VHF-X	M18/355	355/6400	18	35/80	2
VHF-X	M20/388	388/7755	20	30/50	2
VHF-X	M25/384	384/9600	25	30/60	2
S - C	M2/2200	2200/4400	2	25/40	1
S - X	M3/2133	2133/6400	3	35/80	1
S - X	M4/1939	1939/7755	4	35/50	1
S - X	M5/1920	1920/9600	5	35/60	1

NOTES:

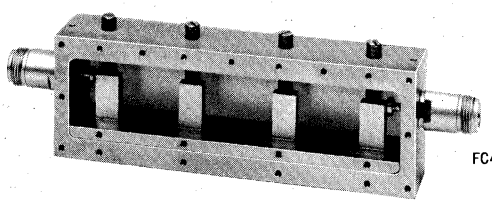
1. Impedance Level: Input and output designed for 50Ω system. The use of an output isolator recommended with poor VSWR loads.
2. Efficiency: Typical efficiencies range from 2/n to 1/n where "n" is multiplying factor.
3. Power Levels: Maximum input levels range from 15 watts for VHF inputs to 5 watts for S band inputs.
4. Connector Types: N and OSM with others available.

SPECIALS

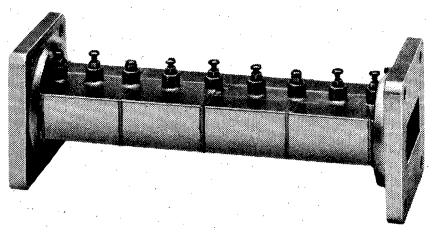
The models shown are typical of the wide range of multipliers and multiplier chains produced by **RHG**. Special combinations covering a wide range of parameters are available. Contact factory for details.

MICROWAVE FILTERS

- **Controlled phase characteristics**
- **Computer designed**
- **L thru X band**
- **Fixed and tunable units**



FC4-1.8



FW4-7.2

The FC and FW series of microwave filters offer the user a wide range of characteristics from L through X band. The FC series provides multipole performance coupled with a very wide tuning range utilizing advanced combline techniques. The FW series offers low insertion loss and a readily adjustable passband characteristic to facilitate trimming overall system parameters.

These filters are ideal for use in wideband FM systems where phase linearity and group delay are important considerations. RHG engineers can provide designs tailored to specific requirements in this area.

COAXIAL

Model	(GHz) Tuning Range	Bandwidth (1db)	Poles	Ins. Loss (typ)	VSWR (typ)
FC2-1.3	1.3-1.8	2-10%	2	0.5	1.2
FC4-1.3	1.3-1.8	2-10%	4	1.0	1.2
FC6-1.3	1.3-1.8	2-10%	6	1.5	1.30
FC2-1.8	1.8-2.3	2-10%	2	0.5	1.2
FC4-1.8	1.8-2.3	2-10%	4	1.0	1.2
FC6-1.8	1.8-2.3	2-10%	6	1.5	1.30
FC2-2.2	2.2-3.0	2-10%	2	0.5	1.2
FC4-2.2	2.2-3.0	2-10%	4	1.0	1.2
FC6-2.2	2.2-3.0	2-10%	6	1.5	1.30

NOTES:

1. Loss based on 3% bandwidth.
2. Connectors-type "N," OSM available.
3. Passband response is Butterworth.

WAVEGUIDE

Model	Available in band of (GHz)	Bandwidth (%)	Adjustment Range of (MHz)	Poles	Ins. Loss (db typ)	VSWR (typ)
FW4-4.4	4.4-5.0	0.5-2%	100	4	0.75	1.2
FW5-4.4	4.4-5.0	0.5-2%	100	5	1.0	1.2
FW6-4.4	4.4-5.0	0.5-2%	100	6	1.2	1.2
FW4-5.9	5.9-7.2	0.5-2%	100	4	0.75	1.2
FW5-5.9	5.9-7.2	0.5-2%	100	5	1.0	1.2
FW6-5.9	5.9-7.2	0.5-2%	100	6	1.2	1.2
FW4-7.2	7.2-8.5	0.5-2%	100	4	0.75	1.2
FW5-7.2	7.2-8.5	0.5-2%	100	5	1.0	1.2
FW6-7.2	7.2-8.5	0.5-2%	100	6	1.2	1.2

NOTES:

1. Loss based on 1% bandwidth.
2. Waveguide flange types.
   - 4.4-5.0 UG-149A/U
   - 5.9-7.2 UG-50/U
   - 7.2-8.5 UG-51/U

RHG

RHG ELECTRONICS LABORATORY, INC.

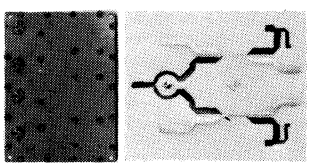
94 MILBAR BOULEVARD
FARMINGDALE, LONG ISLAND
NEW YORK 11735 (516) 694-3100

RAVEN ELECTRONICS INC.

MICROWAVE SUBSYSTEMS

A family of microwave subsystems featuring integrated components has been developed in Raven Electronics' engineering laboratories, and produced for a number of applications. Units operating from S-band through Ku-band are included in the capability.

Both stripline and waveguide subsystems have been fully lab-tested and are currently undergoing field study.



In addition, Raven is also delivering microwave subsystems making use of traveling-wave tube amplifiers, YIG filters, broad band upconverters, and solid state test oscillators.

OTHER PRODUCTS

Component Product Line
Airborne or Ground Sensors
- A. Frequency
- B. Voltage
- C. Phase
- D. Combinations of above

Timers (All Variations)
- A. Electromechanical
- B. Solid State

Power Supplies
- A. Inverters
- B. Frequency Changers
- C. TWT High Voltage Supplies
- D. Conventional DC Supplies
- E. Telemetry Calibrators

Programmers
- A. Sequential
- B. Logic

Flashers
- A. Electromechanical
- B. Solid State

System Product Line
- A. Panoramic Receivers
- B. Radar Warning Receivers
- C. Radar Homing Systems
- D. Monopulse Direction Finders
- E. Elint Systems
- F. Electronic Warfare System Analysis
- G. Frequency Measuring Systems

UFH/L Band Dual Blade AM-110



SPECIFICATIONS

UHF: Frequency — 225 to 420 MHz, VSWR 225 to 420 Mc — 2.0:1 Max. referenced to 50Ω, Polarization — Vertical, Gain — Equivalent to a λ/4 monopole, Power Capability — 50 watts average, Radiation Pattern —Omni-azimuth.

L-Band: Frequency — 950 to 1220 Mc, VSWR — 1.8:1 max., Polarization — Vertical, Gain — Equivalent to a λ/4 monopole, Power Capability Average — 2 watts, Peak — 2500 watts, Radiation Pattern — Omni-azimuth.

UHF and L-Band: Isolation — —50 db, Weight — 1.5 lbs.

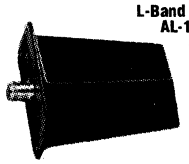
L-Band Sleeved Dipole AL-106



SPECIFICATIONS

Frequency — 1.25 to 1.35 GHz, VSWR — 2.0:1 max. referenced to 50Ω, Gain — 1.0 db nominal, Polarization — Parallel to dipole axis, Power Handling Capability — 100 watts average, Temperature Range — +65 to +165°F, Pattern — Omnidirectional, Weight — 2 oz. max.

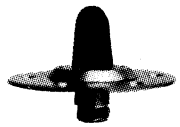
L-Band Blade AL-109



SPECIFICATIONS

Frequency — 500 to 1000 MHz, VSWR — 2.0:1 referenced to 50Ω, Pattern — Omnidirectional, Polarization — Vertical, Efficiency — 85%, Weight — 7 oz. max.

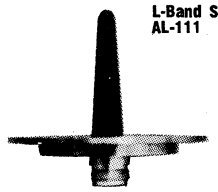
S/C/X-Band Stub AM-142



SPECIFICATIONS

S/C/X-Band AM-142: Frequency — 2.0 — 10.0 GHz, VSWR (ref. to 50Ω) — 2.0:1 max., Polarization — Vertical, Pattern — Omnidirectional, Power Handling — 100 watts average, Efficiency — 85%, Weight — 3 oz.

L-Band Stub AL-111



SPECIFICATIONS

Frequency — 1.435 to 1.485 GHz, VSWR — 1.6:1 max. referenced to 50Ω, Polarization — Vertical, Power Handling Capability — 100 watts average, Weight — 4 oz. max.

S/C/X-Band Spiral Antenna AM-139



SPECIFICATIONS

Frequency — 2.0 to 11.0 GHz, VSWR — 2.5:1 max., Gain — 0 db @ 2.0, 2 db @ 3.0, 4 db @ 5.0, 6 db @ 7.0, 8 db @ 11.0 GHz, Beamwidth — 70° ±15°, Beam Tilt — 3° nominal, 7° maximum, Polarization — Circular with ellipticity ratio on axis less than 1.0 db, at —10 db beamwidth less than 4.0 db. Designed to MIL-E-5400 Class 2, Weight — 7 oz.

MICROWAVE COMPONENTS

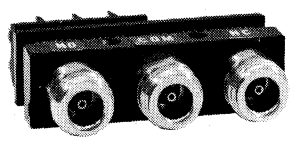
Stripline Switch SL-101



SPECIFICATIONS

Frequency — DC to 1.0 GHz, VSWR — 1.2:1 max., Isolation — 40 db min., Insertion Loss — 0.3 db max., Switching Time — 5 milliseconds max., Operating Power — 13 volts DC, 100 milliamps, Configuration — SPST, Life — Ten million cycles, Weight —1 oz.

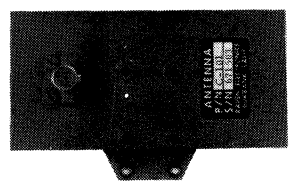
Coaxial Switch SU-101



SPECIFICATIONS

Frequency — DC to 400 MHz, VSWR — 1.2:1 max. referenced to 50Ω, Isolation — 40 db min., Insertion Loss — 0.3 db max., RF Power Handling Capability — 25 watts average, Switching Time — 5 milliseconds max., Operating Power — 26 volts DC, 200 milliamps, Configuration — Single pole, double throw, Life — Ten million operations, Weight — 4 oz. max.

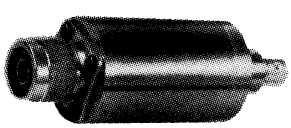
Balun C-101



SPECIFICATIONS

Frequency — 108 to 122 MHz, Input — 50Ω coaxial, Output 200Ω balanced, Weight — 6 oz. max.

S-Band Detector DS-101



SPECIFICATIONS

Frequency — 2150 to 2250 MHz, VSWR — 1.2:1 max. referenced to 50Ω, Output — 100 mv at —6 dbm (500Ω load), Tracking — 0.1 db, Weight — 3 oz. max.

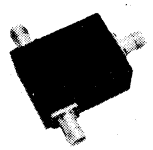
Detector Mount DX-106



SPECIFICATIONS

Frequency — 8.0 to 12.0 GHz, VSWR — 2.5:1 max. referenced to 50Ω, 2.2KΩ video load, Tangential Sensitivity — 50 dbm with 2.0 MHz video bandwidth, Weight — 1.5 oz. max.

3-port Circulator CS-102



SPECIFICATIONS

Frequency — 2.5 to 3.5 GHz, Isolation — 20 db min., Insertion Loss — 0.5 db max., VSWR — 1.2:1 max. referenced to 50Ω, Weight — 8 oz. max.

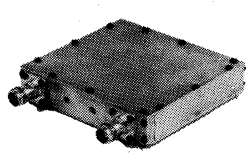
Low Pass Filters FL-105 and FX-104



SPECIFICATIONS

FL-105 (Shown): Cut-off frequency — 1.40 GHz, VSWR — 1.31:1 below 1.35 GHz, Insertion Loss — 0.5 db from DC to 1.30 GHz, Rejection (at 1.6 GHz) — 15.0 db, Weight — 3 oz. max. **FX-104:** Cut-off frequency — 12.4 GHz, VSWR — 1.35:1, Insertion Loss — 0.25 db max in pass band, Isolation (at 13.75 GHz) — 20 db min., Weight — 1 oz. max.

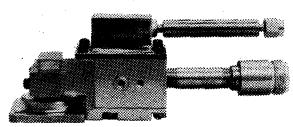
Band Pass Filter FL-106



SPECIFICATIONS

Pass Band — 900 to 1100 MHz, Insertion Loss — 1.0 db in pass band, Rejection — 40 db from DC to 800 MHz and from 1200 to 10,000 MHz, VSWR — 1.6:1 max. in pass band, Weight — 8 oz. max.

Mixer (Frequency Translator) MS-111



SPECIFICATIONS

Input Frequency — 2.0 to 6.0 GHz, at 0 dbm max., L. O. Frequency — 14.0 GHz at +10 dbm, Output Frequency — 8.0 to 12.0 GHz, Conversion Loss — 8 dbm nominal, Input VSWR — 2.5:1 max. referenced to 50Ω, Weight — 5 oz.

RAVEN ELECTRONICS, INC.
101 WEST ALAMEDA AVE., BURBANK, CALIF. 91502 (213) 849-7747

MINIATURE COAXIAL COMPONENTS

COAXIAL FILTERS

MINIATURE LOW PASS FILTERS



R L C Electronics' miniature low pass filters are available with cut-off frequencies ranging from 100 MHz to 5 GHz. These filters combine minimum insertion loss and low VSWR in the Pass Band, together with sharp skirt selectivity and high rejection in the Stop Band. This is accomplished by the utilization of multi-section, modern network design. Miniaturization of these units is accomplished by utilizing advanced coaxial techniques and optimum selection of materials. Both lumped constant and distributive techniques are utilized in the fabrication of these filters.

Model No.	Pass Band (MHz)	3 db Point (Typical) (MHz)	30 db Point (Typical) (MHz)	60 db (Min) Stop Band (MHz)
F-10-100	DC-100	125	150	180-500
F-10-200	DC-200	250	300	360-1000
F-10-300	DC-300	375	450	540-1500
F-10-400	DC-400	500	600	720-2000
F-10-500	DC-500	625	750	900-2500
F-10-600	DC-600	750	900	1080-3000
F-10-800	DC-800	1000	1200	1440-4000
F-10-1000	DC-1000	1250	1500	1800-5000
F-10-1500	DC-1500	1875	2250	2700-7500
F-10-2000	DC-2000	2500	3000	3600-10,000
F-10-3000	DC-3000	3750	4500	5400-15,000
F-10-4000	DC-4000	5000	6000	7200-20,000
F-10-5000	DC-5000	6250	7500	9000-25,000

Pass Band VSWR: 1.5
Pass Band Insertion Loss: 0.5 db max.
Power Rating: 25 watts average
Impedance: 50 ohms
Connectors: Type N, BNC, TNC, RSM *Male and female
Price: $60.00

MINIATURE HIGH PASS FILTERS



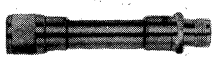
R L C Electronics' miniature high pass filters are available with cut-off frequencies from 100 MHz to 1000 MHz. These filters have no spurious response below the cut-off frequency. High dielectric materials and unique construction assure reliable operation for this miniature line of coaxial filters. Low VSWR and low insertion loss in the pass band are inherent in the design of these filters.

Model No.	Pass Band (MHz)	3 db Point (Typical) (MHz)	30 db Point (Typical) (MHz)	60 db (Min) Stop Band (MHz)
F-20-100	100-170	90	70	DC-50
F-20-200	200-340	180	140	DC-100
F-20-300	300-510	270	210	DC-150
F-20-400	400-680	360	280	DC-200
F-20-500	500-850	450	350	DC-250
F-20-600	600-1020	540	420	DC-300
F-20-800	800-1360	720	600	DC-400
F-20-1000	1000-1700	900	700	DC-500

Pass Band VSWR: 1.5
Pass Band Insertion Loss: 0.5 db max.
Power Rating: 25 watts average
Impedance: 50 ohms
Connectors: Type N, BNC, TNC, RSM *Male and Female
Price: $60.00

* To designate connector type, add suffix N, B(BNC), T(TNC), or R(RSM) to model number. (Example: F-20-100-R).

PRECISION LOW PASS FILTERS



R L C Electronics' precision low pass filters are available with cut-off frequencies ranging from 600 MHz to 12.4 GHz. These filters combine extremely sharp skirt selectivity and high rejection in the stop band, together with minimum pass band insertion loss, low VSWR and reasonable size. Extremely low pass band, VSWR and insertion loss are maintained by proper impedance matching of these filters. Sharp skirt selectivity is obtained by the utilization of multi-section modern network design. These filters incorporate extremely rugged features allowing them to be utilized in severe environments.

Model No.	Pass Band (MHz)	3 db Point (Typical) (MHz)	30 db Point (Typical) (MHz)	60 db (Min) Stop Band (MHz)
F-30-600	DC-600	630	720	810-3000
F-30-800	DC-800	840	960	1080-4000
F-30-1000	DC-1000	1050	1200	1350-5000
F-30-1500	DC-1500	1575	1800	2025-7500
F-30-2000	DC-2000	2100	2400	2700-10,000
F-30-3000	DC-3000	3150	3600	4050-15,000
F-30-4000	DC-4000	4200	4800	5400-20,000
F-30-5000	DC-5000	5250	6000	6750-25,000
F-30-6000	DC-6000	6300	7200	8100-30,000
F-30-7000	DC-7000	7350	8400	9450-35,000
F-30-8000	DC-8000	8400	9600	10,800-40,000
F-30-10.0	DC-10000	10500	12000	13,500-50,000
F-30-12.4	DC-12400	13000	14900	16,740-62,000

Pass Band VSWR: 1.35
Pass Band Insertion Loss: 0.5 db max.
Power Rating: 100 watts average
Impedance: 50 ohms
Connectors: Type N, BNC, TNC, RSM *Male and Female
Price: $40.00

PRECISION HIGH PASS FILTERS



R L C Electronics' precision high pass filters are designed for operation over the frequency range of 1000 MHz to 10,000 MHz. Sharp rejection below the cut-off frequency and no spurious responses are assured in the use of these filters. Low insertion loss and low VSWR in the pass band are accomplished by the utilization of impedance matching and transforming end sections and combining them with precise coaxial fabrication. Rugged, lightweight construction makes the units suitable for extreme environmental conditions.

Model No.	Pass Band (MHz)	3 db Point (Typical) (MHz)	30 db Point (Typical) (MHz)	60 db (Min) Stop Band (MHz)
F-40-1000	1000-2000	900	700	DC-500
F-40-1500	1500-3000	1350	1050	DC-750
F-40-2000	2000-4000	1800	1400	DC-1000
F-40-3000	3000-6000	2700	2100	DC-1500
F-40-4000	4000-8000	3600	2800	DC-2000
F-40-5000	5000-10,000	4500	3500	DC-2500
F-40-6000	6000-12,000	5400	4200	DC-3000
F-40-8000	8000-16,000	7200	5600	DC-4000
F-40-10.0	10,000-18,000	9000	7000	DC-5000

Pass Band VSWR: 1.8 nominal
Pass Band Insertion Loss: .8 db max.
Power Rating: 100 watts average
Impedance: 50 ohms
Connectors: Type N, BNC, TNC, RSM *Male and Female
Price: $60.00

MINIATURE TUBULAR BAND PASS FILTERS — BPF-500 series



R L C Electronics' miniature tubular band pass filters are designed for operation over the frequency range of 60 MHz to 4000 MHz. These fixed tuned filters are constructed utilizing 3 to 6 sections with 3 db bandwidths of 2, 5, 10 and 20% of center frequency. These filters utilize direct coupled sections and have a maximally flat (Butterworth) response. Outside of the pass band no spurious responses exist from DC to 12.4 GHz.

***VSWR:** 1.5 **Impedance:** 50 ohms
Connectors: Type N, BNC, TNC, RSM
Price: 3 Sections $ 75.00
4 Sections 90.00
5 Sections 110.00
6 Sections 130.00
Power Rating: 25 watts

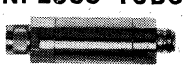
MEDIUM POWER TUBULAR BAND PASS FILTERS — BPF-750 series



R L C Electronics' medium power tubular band pass filters are available with center frequencies from 60 MHz to 4000 MHz. These fixed tuned filters are fabricated utilizing either 3, 4, 5 or 6 sections with a variation of 3 db bandwidths from 2 to 20% of center frequency. There are no spurious responses of these filters from DC to 12.4 GHz. These filters utilize direct coupled sections for optimum response.

Price: 3 Sections $ 90.00
4 Sections 110.00
5 Sections 130.00
6 Sections 150.00
Power Rating: 50 watts

MINI-LOSS TUBULAR BAND PASS FILTERS — BPF-1250 series



R L C Electronics' mini-loss tubular band pass filters are capable of handling 200 watts of average power. These units utilize lo-loss components, which insure optimum selectivity and minimum loss in the pass band. They are constructed using 3 to 5 sections with 3 db bandwidths of 2 to 20%.

Price: 3 Sections $110.00
4 Sections 130.00
5 Sections 150.00
Power Rating: 200 watts

Model No.	3 db Bandwidths Center Freq. Range	2% (A) No. Sec.	2% (A) 40 db Bandwidth	2% (A) Pass Band Ins. Loss (in db)	5% (B) No. Sec.	5% (B) 40 db Bandwidth	5% (B) Pass Band Ins. Loss (in db)	10% (C) No. Sec.	10% (C) 40 db Bandwidth	10% (C) Pass Band Ins. Loss (in db)	20% (D) No. Sec.	20% (D) 40 db Bandwidth	20% (D) Pass Band Ins. Loss (in db)
BPF-500-( )-( )-( )-( ) †	60 to 4000 MHz	3	11%	3½	3	24%	3	3	48%	2	—	—	—
		4	7%	4	4	17%	3	4	34%	2½	4	66%	1½
		5	6%	4½	5	14%	3½	5	28%	2½	5	55%	1½
		6	5%	5	6	12%	4	6	24%	2½	6	50%	1½
BPF-750-( )-( )-( )-( ) †	60 to 4000 MHz	3	11%	2½	3	24%	2½	3	48%	1½	—	—	—
		4	7%	3	4	17%	2½	4	34%	1½	4	66%	1
		5	6%	3½	5	14%	2½	5	28%	1½	5	55%	1
		6	5%	3½	6	12%	2½	6	24%	1½	6	50%	1
BPF-1250-( )-( )-( )-( ) †	60 to 4000 MHz	3	11%	2	3	24%	1½	3	48%	1	—	—	—
		4	7%	2	4	17%	1½	4	34%	1	4	66%	½
		5	6%	2½	5	14%	1½	5	28%	1	5	55%	½

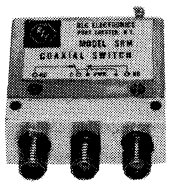
† **NOTE:** When ordering a filter, you must specify center frequency, 3 db bandwidth (A, B, C, D), number of sections (3, 4, 5, 6), and connectors (N, B(BNC), T(TNC) or R(RSM).
Example: BPF-500-60-C-5-T, i.e. — 60 MHz center frequency, 10% 3 db bandwidth, 5 sections with Type TNC connectors.

Special filters requiring closer tolerances, different frequency ranges, special connectors, higher power rating, etc. can be provided. Specifications subject to change without notice.

MINIATURE COAXIAL COMPONENTS

COAXIAL SWITCHES

REMOTE "MITI-MIN" COAXIAL SWITCHES

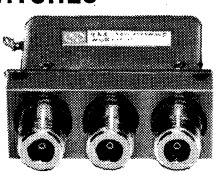


RLC Electronics' Remote "MITI-MIN" Coaxial Switch is of a single pole, two position type. The switch provides extremely high reliability, long life and excellent electrical performance characteristics over the frequency range of DC — 12.4 GHz. The characteristics of the switch feature extremely low insertion loss and extremely low VSWR over the entire frequency range and in addition, very high isolation over the same frequency range. The "MITI-MIN" package utilizes high density packaging techniques, hence the over-all volume of the switch is less than .75 cubic inch. Fail-safe operation is provided.

Model No.	Switch Type	Freq. Range	Insertion Loss	VSWR	Isolation	Power Rating RF	Impedance	Connectors—RF	Operating Voltage	Connectors—Power	Life	Switching Time	Weight	Price
SR-2 Min.	Single pole, two position	DC — 12.4 GHz	0.4 db max.	1.5 max.	60 db min.	50 watts, average	50 ohms	RSM Female	28 V dc at 200 ma nom.	Feed through solder lugs	1,000,000 cycles min.	20 milli-seconds max.	2 oz.	$125 each

Add $25.00 for indicator — Add $15.00 for AC operation

REMOTE COAXIAL SWITCHES



R L C Electronics' remote coaxial switches employ advance techniques to provide maximum performance, reliability and long life. These switches are of the single pole, two position type. Features of these switches include low VSWR and low insertion loss from DC to 12.4 GHz, as well as extremely high isolation over this extended frequency range. These switches are suitable for either laboratory or production use. The size, weight and reliability enhance its inclusion as an integral part of a complex system. An indicator circuit is available, if needed. Fail-safe operation is provided. **SR-2** Price $100.00. Add $25.00 for Indicator. Add $15.00 for AC operation.

Model No.	Switch Type	Freq. Range (GHz)	Insertion Loss	VSWR	Isolation	Power Rating, RF	Impedance	Connectors, RF	Operating Voltage	Connectors, Power	Life	Switching Time
SR-2 *-**	Single pole, two position	0 - 7 7 - 12.4	0.3 db max 0.6 db max	1.25 max 1.6 max	60 db min	50 watts average	50 ohms	Type N, TNC, BNC, RSM *Female	115 Vac at 90 ma nom** 28 Vdc at 300 ma nom**	Feed through solder lugs	1,000,000 cycles min	15 milli-seconds max

REMOTE MULTI-POSITION COAXIAL SWITCHES

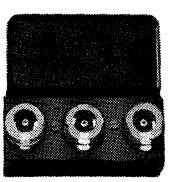


R L C Electronics' remote multi-position coaxial switches are precision assemblies, employing advanced RF techniques to provide maximum performance, reliability and long life. Features of these switches, include low VSWR and low insertion loss from DC to 12.4 GHz, as well as extremely high isolation over this extended frequency range. These switches are suitable for either laboratory or production use. The size, weight and reliability enhance their inclusion as an integral part of a complex system. An indicator circuit is available, if needed. Fail-safe operation is provided.

Model No.	Switch Type	Freq. Range GHz	Insertion Loss	VSWR	Isolation
SR-3-*-**	3 position	0 - 7 7 - 12.4	0.3 db max 0.6 db max	1.25 max 1.6 max	60 db min
SR-4-*-**	4 position	0 - 7 7 - 12.4	0.3 db max 0.6 db max	1.25 max 1.6 max	60 db min
SR-6-*-**	6 position	0 - 7 7 - 12.4	0.3 db max 0.6 db max	1.25 max 1.6 max	60 db min

	SR-3	SR-4	SR-6
Price	$200.00	$240.00	$280.00
Add for Indicator	$30.00	$40.00	$60.00
Add for AC operation	$21.00	$28.00	$42.00

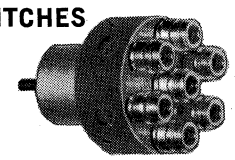
REMOTE MINIATURE COAXIAL SWITCHES



R L C Electronics' remote miniature coaxial switches provide a small, compact switch with excellent microwave characteristics. These switches are of the single pole, two position type. Features of this switch include extremely low VSWR and insertion loss over the frequency range of DC to 3.3 GHz. Fail-safe operation is provided. This series of switches operates on DC only.
Price: CS-221 $25.00

Model No.	Switch Type	Freq. Range GHz	Insertion Loss	VSWR	Isolation
CS-221-*	Single pole, two position Break before make.	0 - 1 1 - 3.3	0.1 db 0.3 db	1.1 1.5	50 db 30 db

MANUAL COAXIAL SWITCHES



R L C Electronics' manual coaxial switches employ precision mechanical assembly, together with advanced microwave techniques, to afford a highly reliable small, efficient coaxial switch. Standard switches are available in single-pole, two position; single-pole three position; single-pole four position; and single-pole six position. Features of the switch include low VSWR and low insertion loss from DC to 12.4 GHz and high isolation extended over this frequency range.
Price: SM-2- $100.00 SM-3- $150.00
SM-4- $160.00 SM-6- $170.00

Model No.	Switch Type	Freq. Range GHz	Insertion Loss	VSWR	Isolation
SM-2-*	2 position	0 - 7 7 - 12.4	0.3 db max 0.6 db max	1.25 max 1.6 max.	60 db min
SM-3-*	3 position	0 - 7 7 - 12.4	0.3 db max 0.6 db max	1.25 max 1.6 max.	40 db min
SM-4-*	4 position	0 - 7 7 - 12.4	0.3 db max 0.6 db max	1.25 max 1.6 max.	40 db min
SM-6-*	6 position	0 - 7 7 - 12.4	0.3 db max 0.6 db max	1.25 max 1.6 max.	40 db min

HOW TO ORDER
Specify model number of switch. Add suffix N, B(BNC), T(TNC), or R(RSM) for connector. Add suffix to designate operating voltage and suffix to add indicator circuit, if required. Thus, SR-2-N-A-I is an SR-2 switch with an N connector, operating voltage of 115 Vac and equipped with an indicator circuit.

Special switches requiring closer tolerances, different frequency ranges, special connectors, higher power rating, etc. can be provided. Specifications subject to change without notice.

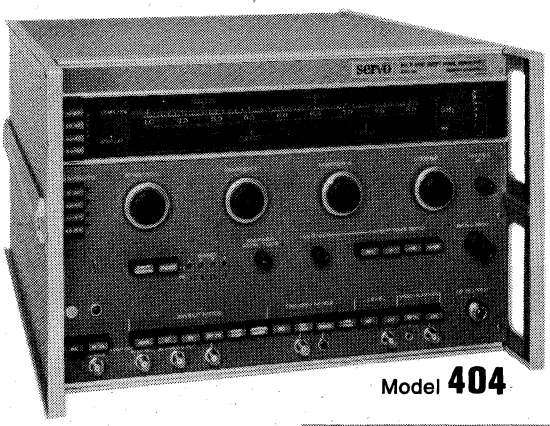
RLC Electronics, Inc.
25 Martin Place
Port Chester, New York
(914) WE 7-4770

SPECIFICATIONS (ALL SWITCHES)

Impedance: 50 ohms
Life: 1,000,000 cycles, min.
Switching Time: 15 milliseconds, max.**
Power Rating: 50 watts average (except for CS 221, which is rated at 100 watts, average)
Connectors, RF: Female N, TNC, BNC or RSM**
Operating Voltage: 115 Vac (specify suffix A)*
28 Vdc (specify suffix D)*
Indicator Circuit: To specify, add I to model number.*
Connectors, Power: Feed through solder lugs*

***APPLICABLE TO REMOTE SWITCHES ONLY** **Except SR-2 MIN

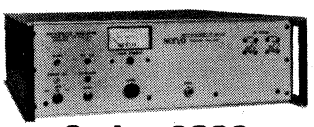
servo 4-BAND MICROWAVE SWEPT SIGNAL GENERATOR



Model **404**

- **Covers from 1.0 to 12.4 GHz in one continuous, automatic sweep**
- **Self-contained, built-in programmer, no plug-ins required**
- **Versatile, automatic/manual band selection**
- **Solid state, integrated circuit design**
- **Human-engineered with push-button controls for ease and speed of operation**
- **Compact package, only 10½" high**

servo MICROWAVE TWT AMPLIFIERS



Series 2000

- 1.0 to 18.0 GHz frequency range
- Gain at least 30 dB
- 10 or 20-watt power output
- TWT thermal sensor
- Helix overload and current meter



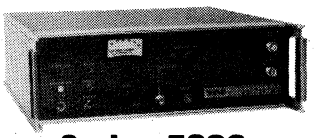
Series 3000

- Ultra-broad frequency range of 1.0 to 12.4 GHz in a single instrument
- 1-watt power output
- Pulse modulation capability
- Complete TWT protection



Series 4000

- 1.0 to 11.0 GHz frequency range
- 10-watt power output
- Pulse modulation capability
- Front panel gain and helix controls
- Excellent gain and phase stability



Series 5000

- NEW—All solid state power supply
- 1.0 to 12.4 GHz frequency range
- 1-watt power output

servo "SERVOMATIC"® SYSTEM ANALYZERS

Model **1999**

For design, analysis and production testing of complex servo-mechanisms and control systems

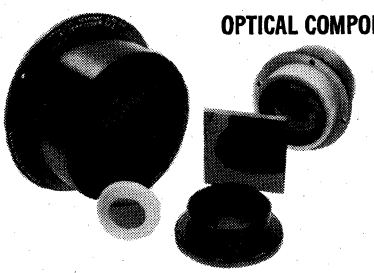


- **Function Generator**
- **Internal Modulator**
- **Phase Shifter**
- **Precision Attenuator**

All Combined
In <u>One</u> Compact Instrument

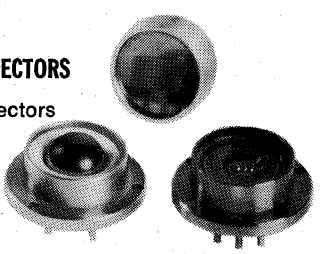
servo INFRARED & ELECTRO-OPTICAL

OPTICAL COMPONENTS & SYSTEMS



- Lenses
- Refractive Optical Systems
- Catadioptric Optical Systems
- IR Transmitting Materials

THERMISTOR BOLOMETER IR DETECTORS



- Immersed & Unimmersed Detectors
- Infrared Telescope Assemblies

For detection, measurement, analysis and control of IR radiation

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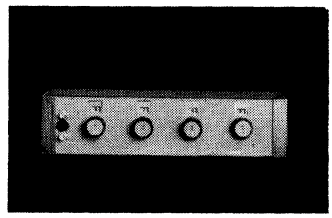
Shallco

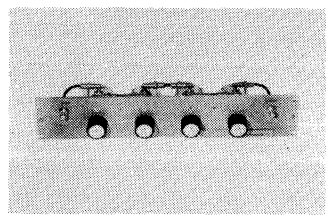
PRECISION RF ATTENUATOR SPECIFICATIONS

HIGHWAY 301 SOUTH
SMITHFIELD, N. C. 27577
919 - 934-3135

BENCH MODELS



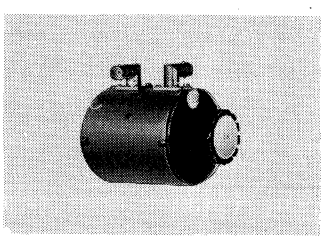
RACK MOUNTED MODELS



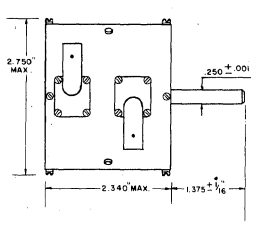
POWER RATING	FREQUENCY RANGE	VSWR	INSERTION LOSS	IMPEDANCE
.5 Watt 0 to 10 db .25 Watt above 10 db	DC to 1000 MHz	Less than 1.05 at 100 MHz, 1.15 at 500 and 900 MHz	Less than .05 db at 100 MHz, .1 at 500 MHz, .2 at 900 MHz	50 Ohm

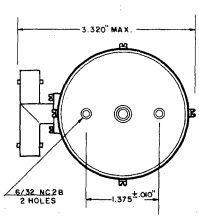
MODEL		NO. DIALS	DB PER STEP	TOTAL DB	ATTENUATION ACCURACY VS FREQUENCY 0-100 MHz	0-250 MHz	0-900 MHz	DIMENSIONS (NOMINAL INCHES)	
8841	8841RM	4	0.1	111	±1% + .05 db	±2% + .05 db	±3% + .05 db	17⅓ x 5 x 5	19 x 3½ x 2⅝
8831	8831RM	3	0.1	61	±1% + .05 db	±2% + .05 db	±3% + .05 db	17⅓ x 5 x 5	19 x 3½ x 2⅝
8821	8821RM	2	0.1	11	±1% + .05 db	±2% + .05 db	±3% + .05 db	10¼ x 5 x 5	19 x 3½ x 2⅝
8811	8811RM	1	0.1	1	±.05 db	±.07 db	±.1 db	10¼ x 5 x 5	19 x 3½ x 2⅝
8832	8832RM	3	1.0	110	±1% + .05 db	±2% + .05 db	±3% + .05 db	17⅓ x 5 x 5	19 x 3½ x 2⅝
8822	8822RM	2	1.0	60	±1% + .05 db	±2% + .05 db	±3% + .05 db	10¼ x 5 x 5	19 x 3½ x 2⅝
8812	8812RM	1	1.0	10	±.05 db	±.3 db	±.4 db	10¼ x 5 x 5	19 x 3½ x 2⅝
8823	8823RM	2	10.0	100	±1% + .05 db	±2%	±3%	10¼ x 5 x 5	19 x 3½ x 2⅝
8813	8813RM	1	10.0	50	±1% + .05 db	±2%	±3%	10¼ x 5 x 5	19 x 3½ x 2⅝
8814	8814RM	1	50.0	50	±1% + .05 db	±2%	±3%	10¼ x 5 x 5	19 x 3½ x 2⅝

UNMOUNTED MODELS



OUTLINE DRAWINGS



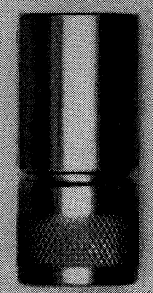


MODEL	STEPS	DB PER STEP	TOTAL DB	ATTENTION ACCURACY VS FREQUENCY 0-100 MHz	0-250 MHz	0-900 MHz
8801	10	0.1	1.0	±.05 db	±.07 db	±.1 db
8802	10	1.0	10.0	±.05 db	±.03 db	±.4 db
8803	5	10.0	50.0	±1%	±2%	±3%
8804	1	50.0	50.0	±1%	±2%	±3%

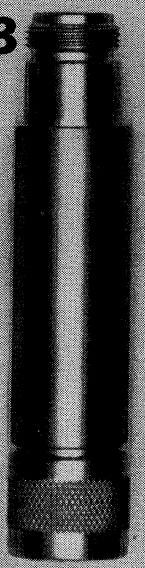
75 OHM IMPEDANCE RF ATTENUATORS WITH ELECTRICAL SPECIFICATIONS SIMILAR TO 50 OHM MODELS (UP TO 900 MC) ARE AVAILABLE ON REQUEST. CONNECTORS ALL MODELS TYPE BNC.

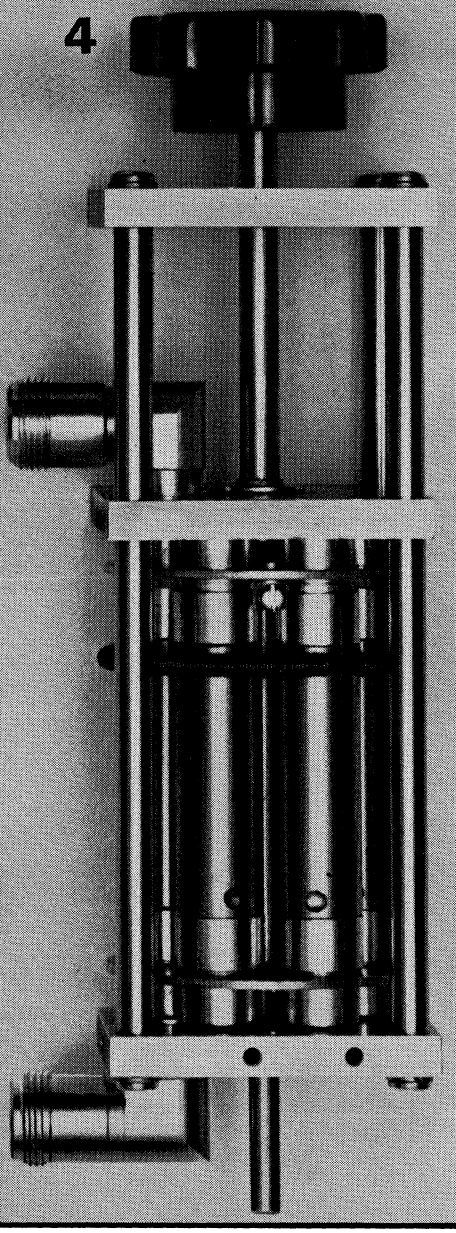
STODDART COAXIAL ATTENUATORS

A COMPLETE LINE OF ATTENUATOR PADS, TERMINATIONS, TURRET AND MULTI-TURRET MODELS









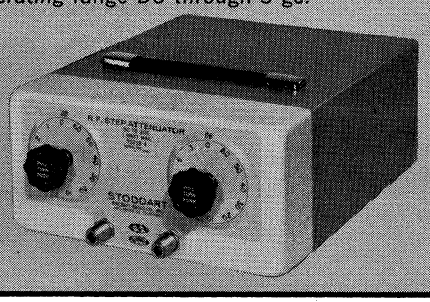
1 ***NO. 90594.*** *50-ohm termination. Operating range DC through 10 gc.*

2 ***NO. 90513.*** *Attenuator available in any values between 0 and 60 db, including fractional db. Operating range DC through 3 gc.*

3 ***NO. 90595.*** *Attenuator available in 20, 40, and 60 db. Operating range DC through 10 gc.*

4 ***TURRET ATTENUATOR.*** *Precision step attenuator operates on "pull-turn-push" principle. Smooth, positive positioning. Turrets contain 6, 10, or 12 pads. Extremely wide range of db values, plus combinations.*

5 ***RF STEP ATTENUATOR.*** *Available in two- or three-turret models, the step attenuator offers any combinations of db values from zero to 120 db, including fractional db. Operating range DC through 3 gc.*



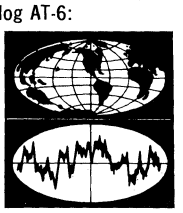
Stoddart Electro Systems offers precision coaxial attenuators and terminations for all applications. They are available in all commonly used db values, with Type C, N, or TNC connectors in any desired combinations. Power rating is 2 watts average for high-power carbon types, and 1 watt average for standard platinum-film types.

Stoddart-developed coaxial attenuator pads are made of a thin, very stable resistive film fired to a special ceramic substrate. These units combine inherent high accuracy from DC up to 10 gc with exceptionally low phase shift, minimal noise figures, and negligible skin effect. In addition, these units are dimensionally stable, shock and vibration resistant, and essentially unaffected by moisture and chemicals. Performance is stable to temperature from 4°K (liquid helium) to 500°K. On request, precision calibration with certification traceable to the National Bureau of Standards will be provided.

The turret mechanism was developed by Stoddart for use in its own high-precision RI/FI measuring instruments. Design is extremely rugged, positive, and trouble free.

Stoddart attenuator products are available from stock, and quantity discounts may be obtained. Request Attenuator Catalog AT-6:

PQR/28
28 years of Precision, Quality, Reliability



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STODDART ELECTRO SYSTEMS A DIVISION OF TAMAR ELECTRONICS

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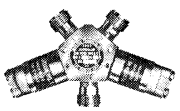
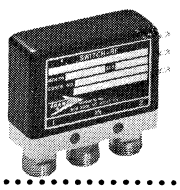


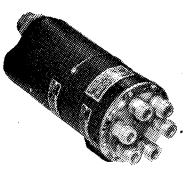
TYPE-Y was designed to meet the requirement for a small, lightweight, coaxial switch having good R.F. performance over a broad bandwidth (0-11 GHz) with million cycle reliability. Two independent solenoids allow make-before-break or break-before-make operation; both may be on or off simultaneously. Approx. size 4" X 2½" X 1".



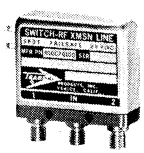
TYPE-A coaxial switch weighs only 12 oz. - extremely light for a multi-position switch. It has a broad bandwidth, 0-11 GHz. Four independent solenoids allow complete control over make/break contact operation. All positions can contact simultaneously. Fail-safe is easily provided by solenoid selection. Approx. size: 3" X 3" X 4" high.



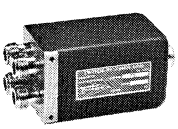
TYPE-D is a SPDT, 0-12.4 GHz, coaxial switch available with 3 actuators - LATCHING, FAIL-SAFE, and PULSE. In the TYPE-DS, solid state circuitry replaces all auxiliary contacts and provides a high input impedance for pulse operation; fail-safe but only .84 watts for holding. Connectors: N, TNC, OSM. Approx. size: 1" X 2¾" X 2" high.



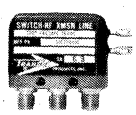
TYPE-E and TYPE-EM are rugged, service proven switches which have been continually improved ...frequency to 12 GHz with over 60 db isolation and life to 100,000 operations. TYPE-E is motor actuated. TYPE-EM is manual. Switches qualified to MIL specifications with SA nomenclatures. Approx. size: dia. 3", length E - 7" and M - 3".



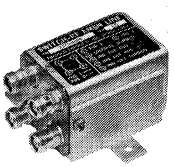
TYPE-DT is a SPDT, 0-12.4 GHz, coaxial switch for small connector types. It offers the following choices: (1) TNC or OSM connectors, (2) latching or fail-safe, (3) 28 VDC or 115 VAC, and (4) with or without indicator circuits. 1,000,000 operation reliability. All this flexibility in about 2 cubic inches, 5 oz. Approx. size: 5/8" X 1¾" X 1¾" high.



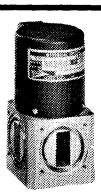
TYPE-H is a coaxial transfer switch with excellent R.F. performance thru 12.4 GHz. Options: TYPE-N or other connector types, LATCHING ...with PM latch or FAIL-SAFE...rotary solenoid, 28 VDC or 115 VAC, with or without indicator circuits. Features: high isolation, 60 db, and high vibration spec., 20 g's. Approx. size: 1¾" X 1¾" X 2½" to 3¼".



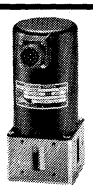
TYPE-DO is a micro size coaxial switch with excellent R.F. performance from D.C. to 18 GHz. It is the result of Transco's fast reaction to meet the need of the ECM industry for extended frequency in less than 1 cubic inch with state-of-the-art R.F. performance and reliability of one million actuations Approx. size: ½" X 1¼" X 1" high.



TYPE-HT is a very small, lightweight, 0-12.4 GHz, coaxial transfer switch for connector types TNC or smaller. Available LATCHING or FAIL-SAFE, It has the same features and options as the TYPE-H. The latching is a 2 coil rotary design with PM latch. The fail-safe is a one coil rotary solenoid design. Stringent environmental specifications. Approx. size: 1¼" X 1½" X 2".



TYPE-GH are lightweight, 90° E-Plane switches available in WR-62, WR-90, WR-102, and WR-112. They are remote control, spring return, solenoid operated. Designed for use in a pressurized system, they feature: anti-bounce rotor braking device for more consistent switching action, printed circuitry, and switch position indicator. Size related to frequency.



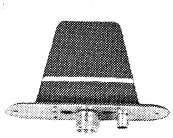
TYPE-GV variable waveguide switch; fast, reliable switching...without blanking the transmitter. May be used as 3-port 2 position (SPDT) or as a power divider. (Five position power divider shown). See TYPE-GH for waveguide sizes available. Features: low VSWR and Insertion Loss with high reliability. Size related to frequency.



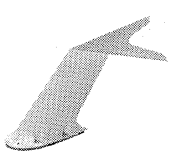
TYPE-T11 is a blade antenna, UHF and L-BAND, aerodynamically shaped and qualified for high performance Mach 2-3 aircraft. The radiation pattern is omnidirectional for both UHF and L-BAND. Pattern shaping elements control patterns and improve horizon coverage. Filters and test probes are incorporated. Approx. size: 3½" X 7½" base, 8" high.



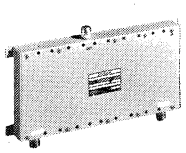
TYPE-T20 omnidirectional, spiral antennas, normal mode Archimedes, broadband with pattern maxima at 45° are available in L, S, and C bands. They have approx. one octave bandwidth. Antennas are omnidirectional with VSWR less than 2:1, have TNC connectors, and meet MIL-E-5400. Approx. diameters: L-Band 18", S-Band 6", and C-Band 3½".



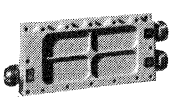
AT-741/A was designed to meet MIL-A-25708 (USAF) Amendment 1 for airborne IFF and/or TACAN application. The "A" signifies the addition of a probe coupled 17.5 ± 1.5 db to a BNC type connector. Frequency 960 to 1220 MHz with VSWR 1.5 from 1000 to 1100 MHz. Transco also manufactures flush mounted AT-740/A. Approx. size: 1¾" X 5¼" X 3¼" high.



TYPE-T16 communication antenna is omnidirectional and has VSWR under 2:1 from 118 MHz to 152 MHz. It was designed to meet MIL-A-6271 and MIL-E-5274 for both military and commercial VHF communication bands. Features reduced height, narrow profile for low side loading, true airfoil shape for reduced drag. Size: 10½" high.



TYPE-IM Interdigital Diplexer allows two equipments of adjacent frequency bands to operate with one broadband antenna. Diplexer has low VSWR and Insertion Loss for each equipment in its operating band and also provides high isolation between each equipment. Band-A 650 to 890 MHz, band-B 960 to 1220 MHz. Approx. size: 4½" X 8½" X 1".



TEEBRID is a 3-port hybrid with internal termination for in-phase power dividing or power combining, octave and multi-octave bandwidths. Unequal or equal power division (or combining) is independent of termination mismatch. All three ports are impedance matched. High R.F. power...stringent environmental specifications. Approx. size: 2" X 3½" X ¾".

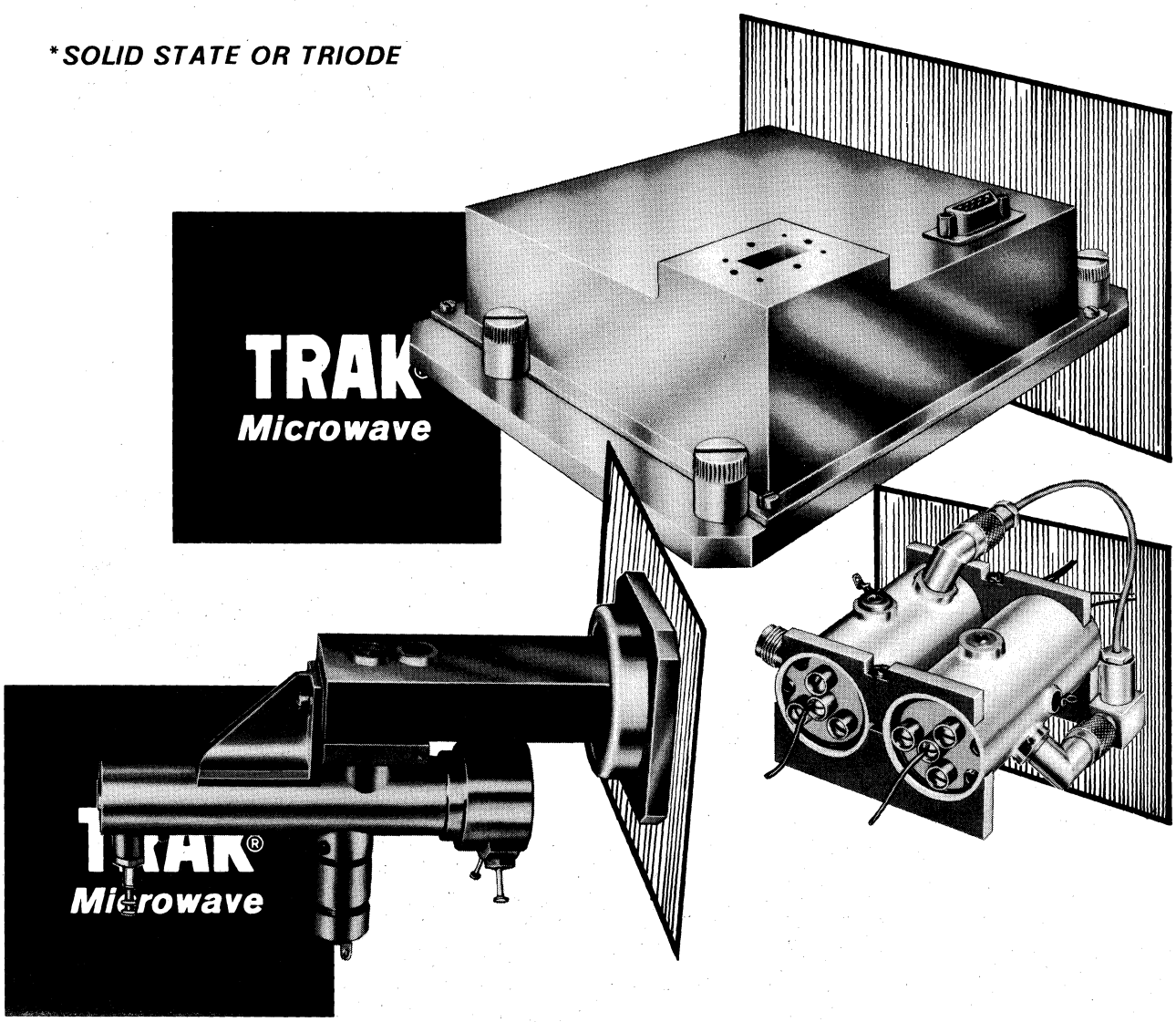
In MICROWAVE SOURCES*

TRAK'S developments today are Industry's standards tomorrow

Trak development engineers are an intent, imaginative and dedicated group. Keeping abreast of the state-of-the-art is not enough. They seek to advance it . . . and do. Trak production engineers, technicians, draftsmen, skilled machinists, production and assembly workers transform microwave sources from the breadboard into your system . . . in prototype models or production quantities.

The value of Trak products is measured in performance and not just the competitive price. Is it any wonder that Trak sources are found in the most advanced microwave systems?

**SOLID STATE OR TRIODE*





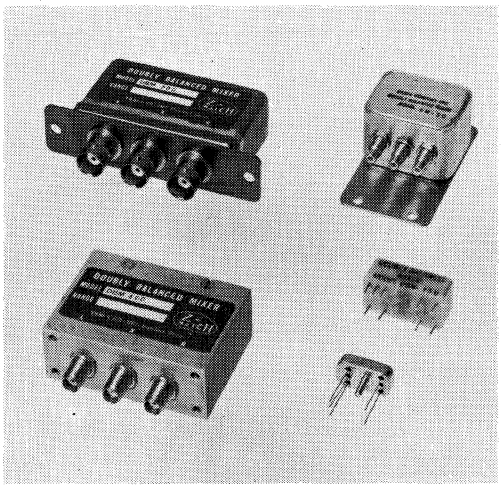
- Solid State Oscillators
- Solid State Multipliers
- Solid State Subassemblies
- Solid State Modules
- Solid State Comb Line Generators
- Solid State IF Test Generators
- Triode Oscillators
- Triode Multipliers
- Triode Amplifiers
- Interdigital Pass Band Filters
- Laboratory Test Equipment
- Trak-Pak Systems

TRAK MICROWAVE CORPORATION

4726 Kennedy Road, Tampa, Florida 33614, Ph. 813/884-1411, TWX 810/876-0644

Z-MATCH

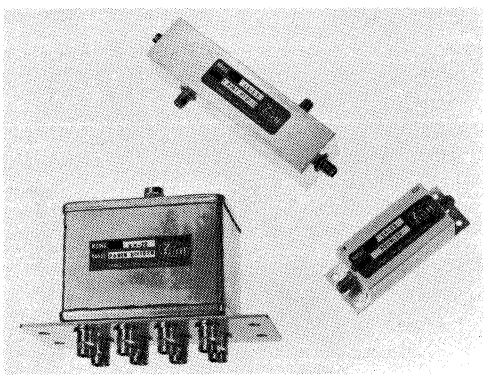
DOUBLY BALANCED MIXERS



Doubly balanced mixers are rapidly becoming indespensible in receiver work and many other applications because of their ability to produce the fundamental sum and difference of two signals while greatly reducing spurious outputs. They are also very useful as modulators, current controlled attenuators, switches, and phase detectors. The Z-Match line of doubly balanced mixers employ four carefully matched Schottky-barrier diodes arranged as a ring modulator, with input and output circuits connected through wide band transformers especially designed for this function. This combination of components plus careful pruning in our test department produces a package that has very low conversion loss, wide bandwidth, and high isolation between ports. It greatly simplifies the circuitry usually needed with conventional mixers. Intermodulation products are greatly reduced; 1/F noise is low, and there is minimal feed-through of carrier and LO signals.

As illustrated in the photograph above, we make a wide variety of mixer shapes to fit different needs. We have a full line of models with coaxial connectors suitable for bench use in test set-ups or for circuits using cable-connected modules, and there is a complete series designed for economy and use in high-volume PC board or stripline packaging. There are also sub-miniature units and special designs tailored to make optimum use of available space or meet stringent electrical requirements. All are designed for high reliability and most are potted, using the techniques which we have developed over many years in manufacturing military components. The range of frequencies covered extends all the way from 2000 Hz to 8.0 GHz. Full specifications are given in our Wideband Data, Bulletin 104.

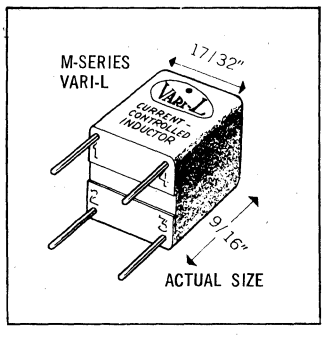
OTHER WIDEBAND PRODUCTS



It is our policy to make as complete and representative a line as possible of signal processing components and to have them on the shelf for quick delivery. We direct our primary efforts toward these ends. Many times, however, we asked to help solve a particularly difficult circuit problem or to make combined modules incorporating two or more mixers, wideband transformers, hybrids, etc. As a result of this type of activity we have numerous special devices including Frequency Doublers (Model WD-100 for instance which produces a flat output from 2 to 4 GHz), Power Dividers, closely phase-balanced 5° at 2.5 GHz) mixer pairs or triads, directional couplers, 3 and 4 port hybrids, and so on. These devices are not stocked in depth but are readily available for engineering evaluation and for quoting purposes. We invite your specific inquiry.

VARI-L

ELECTRICALLY VARIABLE INDUCTORS

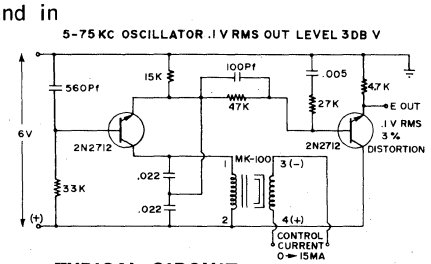


The VARI-L inductor consists of a high-Q coil wound on a ferromagnetic core, and an electromagnetic element for controlling its inductance. The coil is connected into an oscillator, amplifier or filter, along with suitable capacitance to establish the initial resonant frequency, and current in the control winding then does the tuning. The rate of control can be slow — for semi-fixed operation — or fast, up to several thousand Hz, for sweep or frequency modulation. The control current is usually in the milliampere range or can be made in the ampere range for transistor drive circuits.

The component is entirely solid-state, with no moving parts to get out of adjustment or wear out, so it can safely be located remote from the tuning point or potted as part of your own intricate sub-assembly.

VARI-L tuning has been in use for 16 years in numerous industrial instruments and in critical military applications including outer space (one of our units is still telemetering back data after seven years in orbit) and oceanography. It is a natural choice for such sweep services as TV alignment generators, spectrum analyzers and panoramic receivers, but it is often selected because of its non-mechanical advantages such as remote control, subminiaturization, or automatic (closed-loop) tuning.

Our most popular variable inductors are in the "MITE" series illustrated above, but we also make larger units for higher-power circuits or multi-function service. Send for Bulletin 167 or write and describe your special requirements.

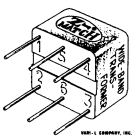


TYPICAL CIRCUIT

VARI-L CO., INC., 207 GREENWICH AVENUE, STAMFORD, CONN. 06904 • (203) 323-2176 • TWX 710-474-3369

Z-MATCH

WIDEBAND TRANSFORMERS



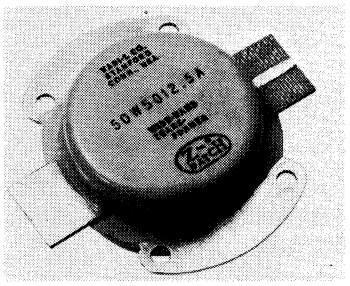
Standard in the industry for — **Impedance matching • Antenna matching • Balanced mixers • Phase detectors • Wideband input, output, and interstage coupling • Frequency doubler • Bal. to unbal. transformations • Pulse transformer • Reflectometry devices • Voltage/current step-up or step-down.** 16 years experience in the design and manufacture of wideband devices back up the design of these highly reliable circuit components. Max. insertion loss is .5 dB, max. VSWR is 1.3:1, and power handling (except for starred types below) is 2 watts over the low/part of the range and 4 watts toward the high end. They may be used reciprocally. Operating temperature range is −55° to +85°C. Applications bulletin is packed with the units or is available upon request.

TYPES AVAILABLE FROM STOCK:

Model	DESCRIPTION	Range of Frequency for Response = −1 db max.
5012.5A	50 ohm unbal./12.5 ohm unbal.	100 KHz - 1 GHz
5050A	50 ohm unbal./50 ohm unbal.	100 KHz - 1 GHz
5050B	50 ohm unbal./50 ohm unbal. ph. rev.	100 KHz - 1 GHz
5050C	50 ohm unbal./50 ohm bal. symmetrical	50 KHz - 700 MHz
5050F	50 ohm unbal./50 ohm unbal. ph. rev. DC isol.	100 KHz - 500 MHz
5075B	50 ohm unbal./75 ohm unbal. ph. rev.	4 MHz - 300 MHz
50200A	50 ohm unbal./200 ohm unbal.	250 KHz - 500 MHz
50200D	50 ohm unbal./200 ohm bal. unsymmetrical	250 KHz - 500 MHz
50200E	50 ohm unbal./200 ohm bal. symmetrical	100 KHz - 1 GHz
50200F	50 ohm unbal./200 ohm unbal. ph. rev. DC isol.	200 KHz - 500 MHz
50200K	50 ohm bal./200 ohm bal. symmetrical	250 KHz - 1 GHz
50450A	50 ohm unbal./450 ohm unbal.	50 KHz - 50 MHz
*5060H	50 ohm unbal./600 ohm bal. DC isol.	100 KHz - 100 MHz
7575B	75 ohm unbal./75 ohm unbal. ph. rev.	150 KHz - 1 GHz
7575C	75 ohm unbal./75 ohm bal.	100 KHz - 1 GHz
*75124H	75 ohm unbal./124 ohm bal. DC isol.	50 KHz - 25 MHz
75300A	75 ohm unbal./300 ohm unbal.	250 KHz - 500 MHz
75300D	75 ohm unbal./300 ohm bal. unsymmetrical	250 KHz - 500 MHz
75300E	75 ohm unbal./300 ohm bal. symmetrical	250 KHz - 900 MHz
75300K	75 ohm bal./300 ohm bal. symmetrical	400 KHz - 900 MHz
100100B	100 ohm unbal./100 ohm unbal. ph. rev.	200 KHz - 1 GHz
100100C	100 ohm unbal./100 ohm bal.	100 KHz - 1 GHz

*.5 watt max. types.

WIDEBAND POWER TRANSFORMERS



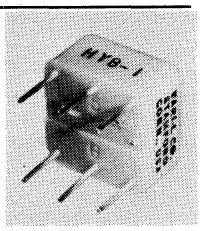
Z-Match wideband power transformers handle up to 50 watts C.W. over their specified frequency range at an ambient temperature of 25°C. They are constructed in a stripline configuration best suited to circuits employing the new high-frequency planar transistors and are equipped with a copper heat sink which bolts firmly to the circuit board ground plane. Their brass enclosure is filled with a high-temperature, low-loss potting material rated for good electrical and mechanical stability over a temperature range of −55° to +125°C. All types shown below are DC coupled.

Pulse performance is excellent, the rise time being less than .5 nanosecond, and the peak power handling ability is 1 KW. The internal conductors will carry steady-state currents up to a total average value of 4 amperes. The transformers are reciprocal and may be used for impedance/voltage step-up or step-down at the ratios shown below.

TYPES AVAILABLE FROM STOCK:

Model	DESCRIPTION	Range of Frequency for Response = −1 db max.
50W5012.5A	50 ohm unbal./12.5 ohm unbal.	2 MHz - 1 GHz
50W5050C	50 ohm unbal./50 ohm bal. sym.	2 MHz - 1 GHz
50W502A	50 ohm unbal./2 ohm unbal.	2 MHz - 750 MHz
50W50200E	50 ohm unbal./200 ohm bal. sym.	2 MHz - 1.5 GHz
50W505C	50 ohm unbal./5 ohm bal. sym.	2 MHz - 500 MHz
50W50200A	50 ohm unbal./200 ohm unbal.	2 MHz - 750 MHz
50W5012.5C	50 ohm unbal./12.5 ohm bal., sym.	2 MHz - 750 MHz

WIDEBAND HYBRID JUNCTION/TRANSFORMERS



These are DC isolated transformers, identical in size and packaging techniques to the wideband transformers above, that comprise a four-port network which splits the outputs into signals of equal amplitude, either in phase or 180° out of phase with one another. The primary winding has an impedance of 50 ohms and the impedance ratio is 4:1. They are shown in our Bulletin 368 connected in various ways including such applications as Vectoral addition or subtraction, DC-isolated power division/addition, Doubly or Single balanced mixers, and Phase comparison/injuection. They also serve as conventional, DC isolated wideband transformers.

TYPES AVAILABLE FROM STOCK:

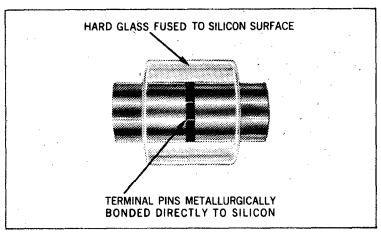
Model	Useful Range, MHz
HYB-1	.250 - 500
HYB-2	.250 - 300
HYB-3	.100 - 200

Model	Useful Range, MHz
HYB-4	2.5 - 250
HYB-5	3.5 - 350

VARI-L CO., INC., 207 GREENWICH AVENUE, STAMFORD, CONN. 06904 • (203) 323-2176 • TWX 710-474-3369

UNITRODE

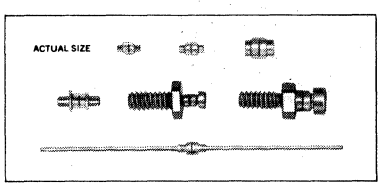
HIGH POWER **PIN MICROWAVE** SWITCHING DIODES



The unique Unitrode package for the first time makes it possible to use PIN diodes in high peak and average power applications. A hard-glass sleeve fused to the terminal pins and to the periphery of the silicon chip assures ultimate reliability under severe RF stress conditions.

A Family of PIN Diodes Designed for High Power, Low Loss Microwave Switching Applications from 2MHz to Above X-Band.

Applications are in high power Duplexers, Phase Shifters, Receiver Protectors, RF Attenuators and RF Modulators.



Special packaging, such as insulated studs, ribbon leads, and pills for stripline, are also available.

- **Series resistance to 0.1 ohms; Total capacitance to 0.5 pf**
- **Low reverse loss at zero volts bias**
- **Low parasitic inductance from whiskerless construction**
- **Megawatt peak-power duplexing now economically feasible due to diode high-current capability (up to 1000 amps peak RF)**

POWER DISSIPATION	Part No.	PIV[1]	ELECTRICAL CHARACTERISTICS	
UM 2000 Series 20 Watt average dissipation 75 KW peak dissipation for 1 μsec pulse	UM 2012 UM 2014 UM 2016 UM 2018 UM 2020	1200 1400 1600 1800 2000	Forward series resistance [2] Capacitance [3] Cutoff frequency Average thermal impedance	0.4 ohms max. 0.9 pf max. 300 GHz typ. 10°C/watt max.
UM 4900 Series 80 watt average dissipation 300 KW peak dissipation for 1 μsec pulse	UM 4902 UM 4904 UM 4906 UM 4908 UM 4910	200 400 600 800 1000	Forward series resistance Capacitance Cutoff frequency Average thermal impedance	0.15 ohm max. 3.0 pf max. 200 GHz typ. 2°C/watt max.
UM 6000 Series 10 watt average dissipation 30 KW peak dissipation for 1 μsec pulse	UM 6002 UM 6004 UM 6006 UM 6008	200 400 600 800	Forward series resistance Capacitance Cutoff frequency Average thermal impedance	0.8 ohms max. 0.5 pf max. 350 GHz typ. 18°C/watt max.
UM 7000 Series 20 watt average dissipation 75 KW peak dissipation for 1 μsec pulse	UM 7002 UM 7004 UM 7006 UM 7008 UM 7010	200 400 600 800 1000	Forward series resistance Capacitance Cutoff frequency Average thermal impedance	0.3 ohms max. 0.9 pf max. 300 GHz typ. 10°C/watt max.

Notes:

1. *Leakage current at PIV at 25°C is 10 μa. max.*
2. *Series resistance R_s measured at 1 GHz and 500 ma bias current.*
3. *Total capacitance is measured at 1 GHz and zero reverse bias and remains relatively constant at all reverse bias levels at frequencies above 100 MHz.*

Typical forward voltage drop at 500 ma is 1.0 volt for UM 2000 and UM 7000, 1.1 volt for UM 6000 Series, and 0.9 volt for UM 4900 Series.

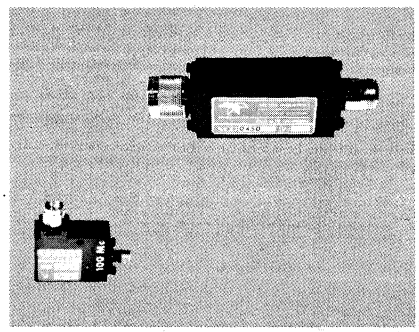
For more info—fast—call Len Bloom of our Microwave Division COLLECT

UNITRODE CORPORATION
582 PLEASANT STREET • WATERTOWN, MASS. 02172 • TELE. (617) 926-0404 • TWX (710) 1296 • TELEX 922-414

Custom

MICROWAVE COMPONENTS

FREQUENCY MULTIPLIERS



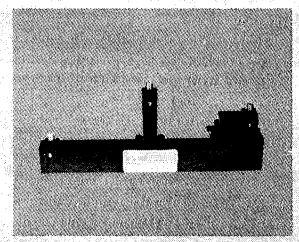
Specifications

F_o	100 MHz to 18 GHz
Multiplication	2X to 4X
Spurious Rejection	50 dB, typical
Instantaneous Bandwidth	35%
Insertion Loss	10 dB, typical

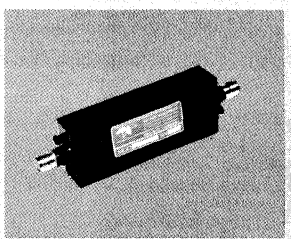
FREQUENCY TRANSLATORS

Specifications

Input Frequency	50 MHz to 18 GHz
Output Frequency	50 MHz to 18 GHz
L. O. Frequency	50 MHz to 18 GHz
Conversion Loss	8 dB, typical
VSWR (All Ports)	1.6:1, maximum
Interband Isolation	45 dB, typical



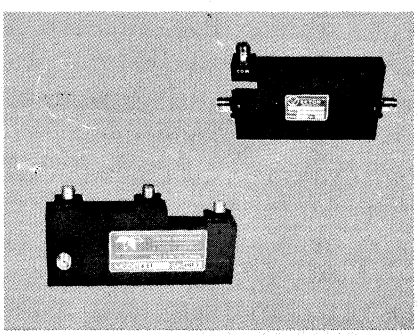
BAND REJECT FILTERS



Specifications

F_o	1 to 12.4 GHz
Rej. Band Atten.	60 dB, min
Rej. Bandwidth	60 dB $\pm$0.015 F_o 1 dB $\pm$0.025 F_o
Passband Width to 1 dB	Dc to 0.975 F_o & 1.025 F_o to 1.2 F_o
Passband Inser. Loss	1 dB, max

MULTIPLEXERS



Specifications

Passband Width	0.25 to 18 GHz
Stopband	Dc to 18 GHz
Inband Inser. Loss	0.3 to 1 dB
Outband Rejection	30 to 90 dB
VSWR	1.5:1, typical
Number of Bands	2 to 8, contiguous or non-contiguous

INTEGRATED COMPONENTS

Filters, detectors, multiplexers, couplers, doublers, mixers, diode switches and isolators integrated into single, compact package. No interface problems!

AND MORE!

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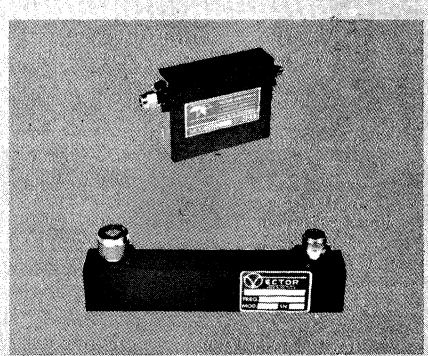
BANDPASS FILTERS

Specifications

F_o	0.25 to 18 GHz
Passband Width	1% to 135%
Stopband	To 18 GHz
Insertion Loss	0.3 to 1 dB



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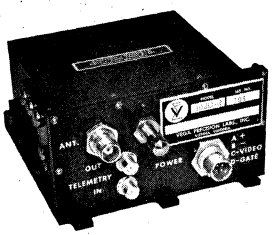
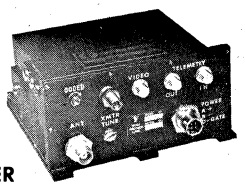


C-BAND RADAR TRANSPONDER

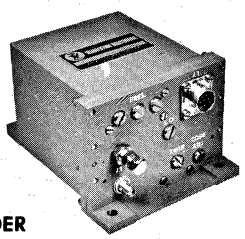
MODEL 302C-2 **Freq:** 5.4-5.9 GHz; **Receiver Type:** Superhet with sensitivity of - 70 dbm; **Transmitter Type:** Magnetron wity 400 w min. peak power output; **Input Power:** 22 to 32 VDC; **Size:** 43 cu. in.; **Weight:** 43 oz.; **Temp:** - 35° to + 75° C; **Altitude:** 230,000 ft.; **Humidity:** 100%; **Shock:** 125 g in any direction, 3 shocks in opposite directions along each axis for 6 μ sec each; **Acceleration:** 125 g applied along any axis for 3 minutes; **RFI:** Per MIL-I-26600. **Vibration:** sinusoidal, 5 to 25 Hz 0.4 in. DA and 15 g 15 to 2500 Hz.



S-BAND RADAR TRANSPONDER

MODEL 312S

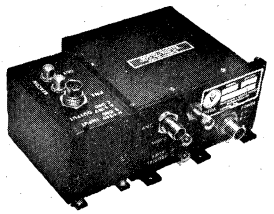
Freq: 2775 - 3000 MHz; **Receiver Type:** Superhet with sensitivity of -70 dbm; **Transmitter Type:** Triode cavity with 300 w min. peak power output; **Input Power:** 22 to 32 VDC; **Size:** 50 cu. in.; **Weight:** 47 oz.; **Temp:** -55° to +75° C; **Altitude:** 230,000 ft.; **Humidity:** 100% **Shock:** 125 g in any direction, 3 shocks in opposite directions along each axis for 6 μ sec each; **Acceleration:** 125 g applied along any axis for 3 minutes; **RFI:** Per MIL-I-26600; **Vibration:** sinusoidal, 5 to 25 Hz, 0.4 in. DA and 15 g 15 to 2500 Hz.



C-BAND RADAR TRANSPONDER

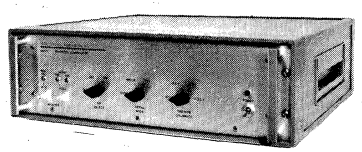
MODEL 321C

Freq: 5400-5900 MHz; **Receiver Type:** Superhet with sensitivity of - 70 dbm, 100% firing; **Transmitter Type:** Triode cavity with 300 w min. peak power outputs; **Input Power:** 24 to 32 VDC, 45 w; **Size:** 38 cu. in.; **Weight:** 44 oz.; **Temp:** -37° to +75° C.; **Altitude:** 230,000 ft.; **Acceleration:** 125 g; **Shock:** 125 g; **Vibration:** Sine, 5 to 25 Hz, 0.4 DA 25 to 2500 Hz, 15 g. **RFI:** Per MIL-I-26600.



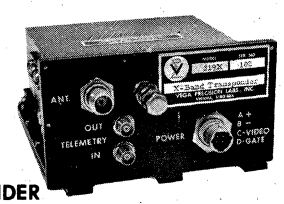
TELESPONDER TELEMETRY SYSTEM

MODEL 603C is used in missile, satellite, drone, target and aircraft application as an enchancement device and telemetry system for a C-band tracking radar. The Model 603C telemetry system is designed to work in conjunction with Vega Models 202CD, 302CD transponders. The 603C telemetry system is comprised of two separate units: the Model 706-7 Seven Channel Telemetry Airborne Encoder and the Model 707-7A Seven Channel Telemetry Ground Demodulator. The 706-7 airborne unit is mated with the desired transponder whereas the 707-7A ground unit is mated with an appropriate C-band tracking radar, Model 706-7. **Encoder specs include: Telemetry Input Impedance:** 200,000 ohms min; **Telemetry Input Channels:** 1 to 7, serial or parallel combinations; **Telemetry Input Voltage:** 0.0 V to +5.0 VDC; **Sync Channels:** one; **Sampling Rates per Channel:** 80/sec. (160 prf); **Spacing Between Transponder and Telemetry Reply Pulse:** min. 50 μ sec., max. 137 μ sec.; **Accuracy of Voltage to Time Conversion:** ± 1% of + 5 v.



7-CHANNEL TELEMETRY DEMODULATOR

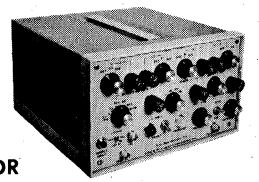
MODEL 707-7A is compatible for use with the FPS-16 and FPQ-6 radars and is an active portion of the ground readout system of the return pulse from a Vega transponder and 706-7A encoder. The demodulator outputs are suitable for readout onto a Model 1508 Minneapolis Honeywell Visicorder or for storage by a digital tape unit. The digital output for recording is a continuous serial binary train using either NRZ-M or NRZ-C format.



X-BAND RADAR TRANSPONDER

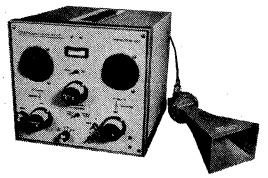
MODEL 319X

Freq: 9100 - 9600 MHz; **Receiver Type:** Superhet with sensitivity of -65 dbm; **Transmitter Type:** Magnetron with 400 w min. peak power output; **Input Power:** 22 to 32 VDC; **Size:** 43 cu. in.; **Weight:** 43 oz.; **RFI:** Per MIL-I-26600; **Humidity:** 100%; **Temp:** -35° to +75° C.



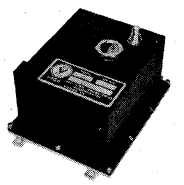
PULSE CODE GENERATOR

MODEL 715 is capable of producing up to five pulses, independently variable in position from 0 to 100 μ sec. Pulse width is variable from .25 μ sec. to 1000 μ sec. in four overlapping ranges. Incorporated is a recovery time feature which allows a coded pulse pair to be delayed from the first pair, up to 1000 μ sec. Any of the five pulses may be used without the presence of any others. **Other specs include:** Repetition rate of 5 pps to 500 KHz; Stability of 2% at 1000 pps; Amplitude of 0.15 v into 50 ohms and 20 v into 1000 ohms; Polarity, neg. or pos.; Rise and fall time of 10 nanosec or less; Delay from .25 μ sec. to 100 μ sec.



C-BAND INTERROSPONDER

MODEL 609C is a C-band transponder test set which is essentially a small radar device used in operationally checking a C-band transponder as it would be normally interrogated by the tracking radar. The unit is also designed to operate with the Vega Model 707-7A Telemetry Demodulator for checking out the Vega Telesponder Telemetry System. The unit provides either single or double pulse interrogation with a code spacing adjustment. The self-contained unit operates on 24 to 30 VDC and/or 115 V, 60 - 400 cps. An internal battery supply with self-contained charging circuit is optional. A waveguide horn antenna is available with the unit or can be user supplied. Checks the following transponder parameters: Receiver Frequency; Receiver Sensitivity; Transmitter Frequency; Transmitter Power Output; Code Spacing. X-Band available.



S-BAND RADAR TRANSPONDER

MODEL 206S

Freq.: 2700 - 2950 MHz; **Receiver Type:** Crystal video with sensitivity of -41 dbm (min.); **Transmitter Type:** Triode cavity with 150 w power output and 300 - 500 w on special order; **Input Power:** 6.9 VDC ± 10% or 28 VDC ± 10%, 9 watts quiescent; **Size:** 25.5 cu. in; **Weight:** 26 oz.; **Pressurized:** 15 PSI; **Temp.:** - 20° to +70° C; **Vibration:** 5 to 200 cps at 10 g 3 min. sweep; **Shock:** 100 g all planes, 11 msec duration; **Acceleration:** 80 g in all planes.

Full specifications are available on request and quotations can be made to your requirements and special applications. All these units are of high environmental specifications for space, aircraft, targets and other uses.

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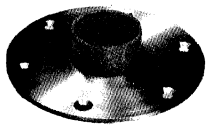
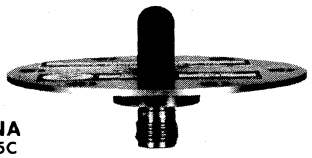


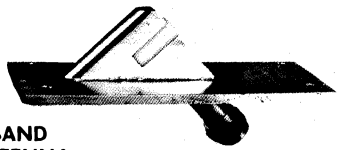
X-BAND ANTENNA
MODEL 835X

Loop Vee Antenna was developed primarily for aircraft application in association with an X-Band radar transponder. The antenna is a circularly polarized omni-directional antenna enclosed within a fiberglass radome. The antenna is characterized by its compactness and is extremely lightweight while still maintaining the electrical and environmental characteristics required by this type antenna. The height of the radome is approximately one-half inch and the diameter of the radome is approximately one inch. Mounting of the antenna is accomplished via a three-inch diameter mounting plate which also serves as a ground plane for the antenna. A C-Band version (Model 836C) of this antenna is available. **Freq.:** 9.0 - 9.69 GHz; **VSWR:** < 1.5:1; **Beamwidth:** 70° ; **Pol:** circular; **Power:** 1.5 kw peak; **Connector:** TNC; **Weight:** 1.5 oz.

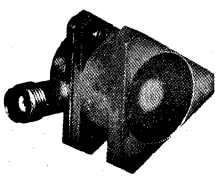


C-BAND ANTENNA
MODEL 845C

Stub Antenna was developed primarily for aircraft application in association with a C-Band radar transponder. The antenna is a vertical polarized omni-directional antenna enclosed within a radome. The antenna is characterized by its compactness and is extremely lightweight while still maintaining the electrical and environmental characteristics required by this type antenna. The height of the radome is approximately three-quarter inch and the diameter of the radome is approximately three-eighth inch. Mounting of the antenna is accomplished via a three-inch diameter mounting plate which also serves as a ground plane for the antenna. **Freq.:** 5.4 - 5.9 GHz; **VSWR:** < 1.5:1; **Beamwidth:** 70°; **Pol:** Vert.; **Power:** 1.5 kw peak; **Connector:** TNC; **Weight:** 1.5 oz.

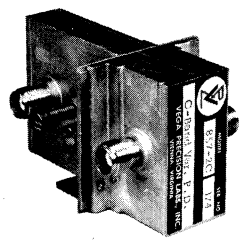


C-BAND ANTENNA
MODEL 801C is a lightweight slotted blade antenna developed as part of a C-Band Radar Transponder System for use on the Nike Apache Vehicle. Linear radiation coverage with minimum aerodynamic drag were key requirements in the design of this antenna. The body of the antenna is constructed of stainless steel which gives excellent reliability in missile environments with no degradation in electrical performance. The antenna may be used as a single element or in multi element arrays depending on the particular application and desired pattern coverage. The companion dividers are Models 853-2C, 854-3C and 855-4C (two-way, three-way and four-way respectively). **Freq.:** 5.4 - 5.9 GHz; **VSWR:** < 2.0:1; **Imp:** 50 ohms; **Pol:** Linear; **Connector:** TNC; **Weight:** < 3.0 oz.; **Power:** 1.0 kw peak.



C-BAND ANTENNA
MODEL 820C

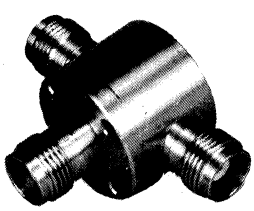
Antenna is an optical quartz-loaded, cavity backed helix radiator which produces a right hand circular polarized radiation pattern. The use of quartz material provides for high and low temperature stability with no degradation in electrical performance. Flush mounting is normally used on reentry vehicles with no performance deterioration as a result of reentry heat. Low thermal conductivity of the quartz material controls the heat transfer from the face of the antenna so that very little reentry heat is conducted to the antenna connector. This permits the use of standard mating connectors. Companion power dividers Models 853-2C, 854-3C and 855-4C are used for arraying two, three or four antennas about the missile. **Freq.:** 5.4 - 5.9 GHz; **VSWR:** < 1.5:1; **Pol:** RHC; power 1.5 kw peak; **Gain:** 6.0 db; **Beamwidth:** 130°; **Temp.:** 1700° front surface exposure; **Weight:** < 2.0 oz.; **Shock:** 300 g's.



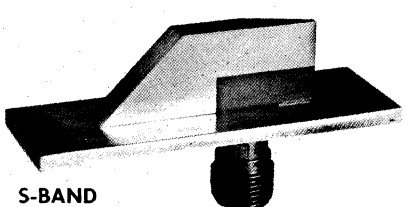
C-BAND POWER DIVIDER
MODEL 857-2C Variable Power Divider was designed to divide the output power of a C-Band Radar Transponder equally between two antenna elements when mounted in airborne vehicles and using unequal lengths of coaxial transmission lines. The design is such that the output power to each leg can be varied from a balanced condition to that of all power in either output leg. With the power divider adjusted to compensate for unequal cable losses, equal power will be radiated by each element of a two element array. The input VSWR is less than 1.3:1 and is tunable over the frequency range of operation. Also available are Models 856-2S (S-Band, 2.7 - 3.0 GHz) and 858-2X (X-Band, 9.1 - 9.6 GHz). **Freq.:** 5.4 - 5.9 GHz; **Insertion Loss:** < 0.5 db; **Power:** 1.0 kw peak; **Size:** 3 1/4" x 2 1/2" x 2"; **Weight:** 12 oz.



S-BAND ANTENNA
MODEL 815S was developed as part of a lightweight S-Band Antenna System for use in the Nike Tomahawk missile for purpose of transmitting tracking data. The antenna is a cavity backed helix with the helix embedded in quartz which is also used as the dielectric cavity. Mounting is accomplished via a mounting flange which can be adapted to a variety of mounting configurations. Flush mounting is used on reentry vehicles with no performance deterioration as a result of reentry heat. Low thermal conductivity of the quartz allows little of the heat to be conducted to the antenna connector therefore standard mating connectors may be used. A C-Band version of this antenna is also available. **Freq.:** 2.7 - 2.95 GHz; **Pol:** RHC; **Gain:** 7.0 db; **Beamwidth:** 130° nominal; **VSWR:** < 1.5:1; **Temp:** 1000° F, front surface exposure; **Vibration (random):** 48 g. rms; **Shock:** 78 g; **Acceleration:** 100 g.

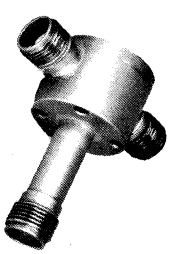


C-BAND POWER DIVIDER
MODEL 853-2C was developed as part of a lightweight C-Band Antenna System which can be installed in any of a large groupe of missiles. Model 853-2C and 855-4C, three-way and four-way respectively, are also available. The body of the power divider is constructed of stainless steel which gives exellent reliability in missile environments. The interior of each power divider consists of an output arm which goes through one or more transformer stages, and then couples with two or more output arms to complete the power division. Each power divider has pre-drilled holes for mounting purposes. **Freq.:** 5.4 - 5.9 GHz; **VSWR:** < 1.3:1; **Imp:** 50 ohms; **Insertion Loss:** < 0.5 db; **Power Div:** ± 0.5 db; **Power:** 1.5 kw peak;; Weight: 853-2C, 2.3 oz.; 854-3C, 2.5 oz.; 855-4C, 2.7 oz.



S-BAND ANTENNA
MODEL 802S

Slotted Blade Antenna was developed for Telemetry and Command functions on the Nike Apache vehicle. The antenna provides linear radiation coverage with minimum aerodynamic drag. The body of the antenna is constructed of stainless steel which gives excellent reliability in missile environments with no degradation in electrical performance. The antenna may be used as a single element or in multi element arrays depending on the particular application and desired pattern coverage. The companion power dividers are Models 850-2S, 851-3S and 852-4S (two-way, three-way and four-way respectively). **Freq.:** 2.2 - 3.3 GHz; **VSWR:** 2.0:1; **Imp:** 50 ohm; **Pol:** Linear; **Power:** 1.0 kw peak; **Connector:** TNC; **Weight:** < 2.0 oz.



S-BAND POWER DIVIDER
MODEL 850-2S was developed as part of a lightweight S-Band Antenna System for use in the Nike Tomahawk missile. Models 851-3S and 852-4S, three-way and four-way respectively, are also available. Tracking coverage may be obtained with two, three or four antennas in operation with the use of the appropriate power divider. The interior of the power divider consists of an input arm which goes through one or more transformer stages, and then couples with two or more output arms to complete the power division. TNC connectors are brazed to the power divider body in which mounting holes are provided: **Freq.:** 2.7 - 2.95 GHz; **VSWR:** < 1.25:1, **Insertion Loss:** < 0.5 db; **Vibration (random):** 48 g rms; **Shocks:** 78 g; **Acceleration:** 100 g; **Weight:** 850-25, 2.2 oz.: 851-3S, 2.4 oz.; 852-4S, 2.7 oz.

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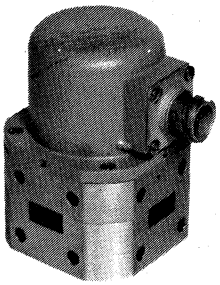
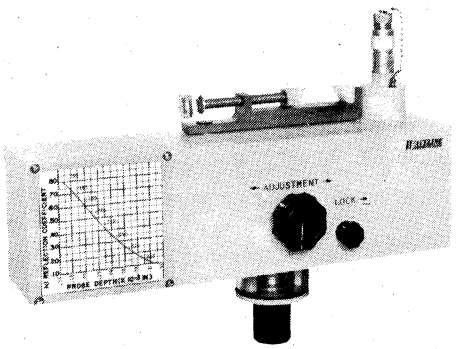
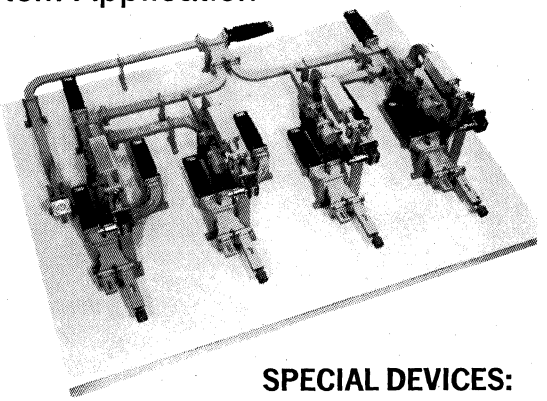
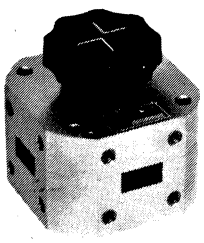


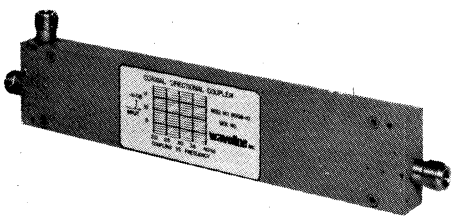




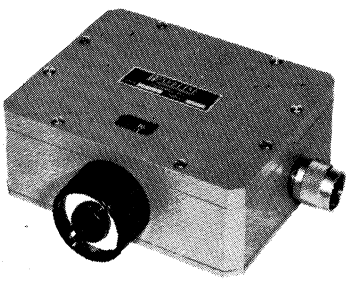
SPECIAL DEVICES:



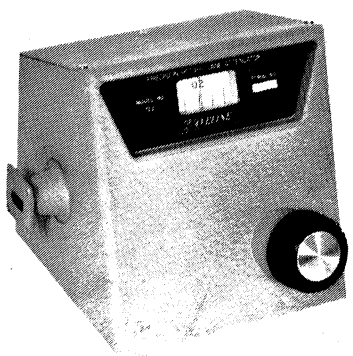
SWITCHES:

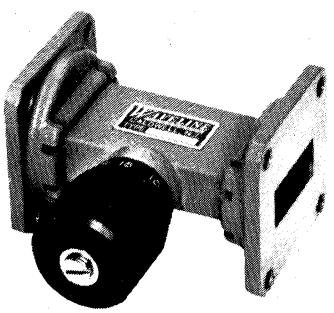


DIRECTIONAL COUPLERS:

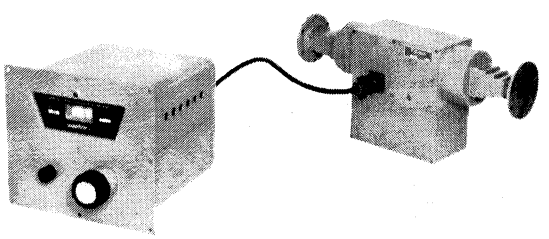


TEST INSTRUMENTS:





ATTENUATORS:



ATTENUATORS: 100 units are available from simple vane to remotely controlled Rotary Vane Types. This selection enables you to satisfy every requirement of attenuation, phase measurement and control in waveguide and coaxial lines. **SWITCHES:** Solenoid and manually operated four way units in "E" and "H" planes provide switching in all bands from 2.6 to 40.0 GHz. Isolation greater than 60 db; VSWR less than 1.10. Special units are available. **DIRECTIONAL COUPLERS:** Available for every application in any frequency band include broad wall, narrow wall, ultra-flat coupling, cross-guide and high directivity coaxial units. Hundreds of custom units have been produced to meet special requirements. **SPECIAL DEVICES:** Waveline's capability to design and manufacture special components offers the widest range of engineering and production skills possible from one facility. Waveline is capable of generating basic designs in the form of a prototype or production of system components in strict compliance with your specifications. **TEST INSTRUMENTS:** A complete line of instrumentation is available for all testing functions in bands from DC-12.4 GHz for coax and 2.6-40.0 GHz for waveguide. Over 1300 standard units are available. Send for our new 1969 catalog, showing one of the most complete microwave component lines in the industry. Write—Waveline Inc., P.O. Box 718, West Caldwell, New Jersey or call (201) 226-9100.

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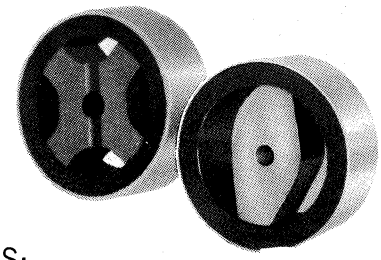
AEROFLEX

brushless-wide angle D. C. Torque Motors



TYPICAL APPLICATIONS:

Inertial Systems . . . Remote Positioning Devices . . . Stable Platforms . . . Process Control Systems . . . Vane and Control Surface Actuators . . . Throttle Control Systems . . . Chart Recorder Pen-Motor . . . Special Meter-movements . . . Precision Load Testing . . . Multi-input Summing Transducers . . . Low Velocity, High Sensitivity Tachometers . . . Direct Servo Drives.

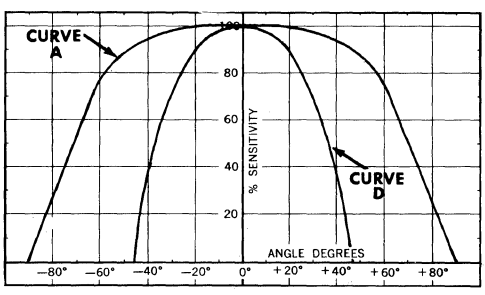
FEATURES:

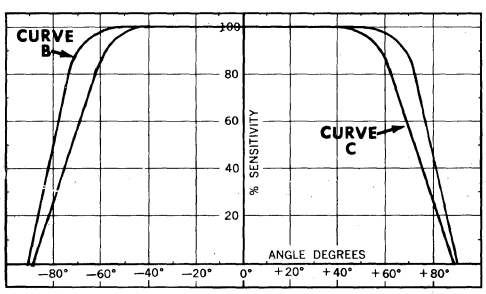
- No commutator, brush or contact friction
- Unlimited life
- Infinite resolution
- Linear torque output vs. current input
- No radio noise or explosion hazard
- No motor ripple or "slot lock"
- Proven in outer space
- Fully submersible

Brushless D.C. Torque Motors (Partial Listing)

Basic Part Number	Continuous Torque (Oz. In.)	Power For Cont. Torque At 25°C (Watts)	Peak Torque (Oz. In.)	Power For Peak Torque (Watts)	Recomm'd Angular Excursion (°'s)	Torque Sensitivity (Oz. In./Amp.)	Back EMF (V/Rad/Sec)	Elect. Time Constant L/R (Sec)	Resistance At 25°C (Ohms)	Rotor Inertia (Oz. In. Sec²)	Viscous Damping		Weight Oz.	Pancake Dimensions* (Add letter "P" to basic part number)			Curve Letter
											Infinite	Zero		O.D. (Inch)	I.D. (Inch)	Thick. (Inch)	
											Source Impedance (Oz. In./Rad/Sec)						
TQ10Y-30	.5	1.7	1.3	12	90	3.0	.021	$3x10^{-4}$	60	$16x10^{-6}$	$1.5x10^{-5}$	$1.1x10^{-3}$	1	1.000	.125	.350	A
TQ10Y-31	1	3	4	35	90	7.6	.055	$2x10^{-4}$	175	$40x10^{-6}$	$4x10^{-5}$	$2.4x10^{-3}$	2	1.000	.125	.700	A
TQ10Y-32	1	3	4	35	90	5.8	.041	$2x10^{-4}$	100	$40x10^{-6}$	$4x10^{-5}$	$2.3x10^{-1}$	2	1.000	.125	.700	A
TQ18-25	2	3	4	12	50	9.0	.063	$2x10^{-4}$	60	$32x10^{-5}$	$2x10^{-4}$	$2x10^{-5}$	2.5	1.718	.250	.350	D
TQ18-7	6	8	20	85	50	15	.106	$2x10^{-4}$	48	$67x10^{-5}$	$5x10^{-4}$	$3.3x10^{-2}$	3.8	1.718	.25	.700	D
TQ18W-23	4	12	8	50	120	8.5	.06	$8x10^{-4}$	48	$48x10^{-5}$	$3.3x10^{-4}$	$1.1x10^{-2}$	3.5	1.718	.187	.700	C
TQ18W-30	1.5	8	3	30	120	3.2	.025	$5x10^{-4}$	36	$24x10^{-5}$	$3x10^{-4}$	$2x10^{-3}$	2.5	1.718	.187	.350	B
TQ25-2	25	14	80	150	50	27	.190	$5x10^{-3}$	16	$32x10^{-4}$	$5x10^{-3}$	.32	9	2.50	.250	1.00	D
TQ34-4	40	20	130	220	50	45	.31	$1x10^{-3}$	25	$91x10^{-4}$	$1x10^{-2}$	.56	16	3.375	.250	.725	D
TQ34W-1	20	16	50	220	120	21	.15	$3.6x10^{-3}$	18	$42x10^{-4}$	$5x10^{-3}$	.18	13	3.313	.250	.625	C
TQ34W-10	20	16	50	220	120	33	.24	$3.6x10^{-3}$	44	$42x10^{-4}$	$5x10^{-3}$	.18	13	3.313	.250	.625	C
TQ35W-1	18	20	65	250	120	26	.183	$4x10^{-3}$	37	$40x10^{-4}$	$2.7x10^{-3}$	.13	21	3.50	.75	.75	C
TQ40W-1	120	55	310	350	120	31	.22	$3x10^{-3}$	3.5	$4x10^{-2}$	$2x10^{-2}$	1.9	51	4.00	.75	1.50	A
TQ52-2	200	35	840	600	20	110	.79	$3x10^{-3}$	12	$136x10^{-3}$	$2x10^{-2}$	7.2	80	5.187	.984	1.25	D
TQ52W-1	220	80	550	500	120	60	.42	$6.5x10^{-3}$	6	$107x10^{-3}$	$1x10^{-2}$	4.2	80	5.125	.750	1.50	A
	(Lb Ft)		(Lb Ft)			Lb Ft/ Amp.				LB In Sec²	LbIn/Rad/Sec		Lb				
TQ74-2	6	260	15	1600	30	1.84	2.5	$6x10^{-3}$	25	.05	.06	2.2	19	7.375	1.00	2.29	D
TQ82W-1	2.5	90	7	650	120	.64	.87	$28x10^{-3}$	5.6	.03	.02	1.2	11.3	8.187	.812	1.38	A
TQ103-2	10	200	22	1500	34	1.0	1.36	$10x10^{-3}$	2	.24	.12	8	28	10.25	.812	2.00	D
TQ120-1	10	115	25	700	40	2.3	3.1	$15x10^{-3}$	6	.316	.20	14	40	12.00	1.375	2.25	D
TQ150-2	35	200	110	2000	30	5	6.78	$2x10^{-2}$	5	1.5	1.7	110	90	15.00	1.375	3.31	D
TQ160-1	30	200	125	2500	50	5	6.78	$2.5x10^{-2}$	4	1.5	1.7	110	105	16.00	1.375	3.31	D

* ALSO AVAILABLE IN FLANGE, SYNCHRO TYPE MOUNTING AND COMPLETELY HOUSED ASSEMBLIES.





Brushless D.C. Tachometers

Basic Part Number	Output Sensitivity V/Rad/Sec	Output Sensitivity Curve	Resistance (Ohms)	Rotor Inertia (Lb. In. Sec²)	Pancake Dimensions*		
					O.D. (Inch)	I.D. (Inch)	Thick (Inch)
TG10Y-35	.18	A	1900	2.5×10^{-6}	1.000	.125	.700
TG18W-24	.17	B	1700	1.5×10^{-5}	1.718	.187	.350
TG18W-25	.50	C	3600	3×10^{-5}	1.718	.187	.700
TG18-14	.77	D	3600	4.2×10^{-5}	1.718	.250	.700
TG34W-12	1.8	C	2000	2.6×10^{-4}	3.313	.250	.625
TG34-8	3.0	D	2600	5.7×10^{-4}	3.375	.250	.725
TG52W-5	4.5	C	1200	6×10^{-3}	5.125	.750	1.500
TG52-4	4.0	D	400	8.4×10^{-3}	5.187	.984	1.250

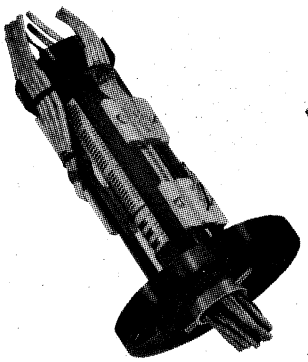
SPACE/WEIGHT SAVER

For design applications where space and weight are critical factors. Aeroflex has a series of Brushless D.C. Torquer-Tachometer combinations integrated within a single assembly. They are available in a wide range of torque and sensitivity values.

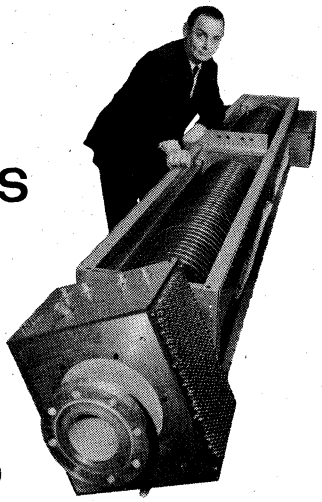
The complete line of Aeroflex Torque Motor Products is covered in our latest catalog. Write directly to

TORQUE MOTOR PRODUCTS DIVISION
AEROFLEX LABORATORIES, INC.
SOUTH SERVICE ROAD • PLAINVIEW, LONG ISLAND, N. Y. 11803
TEL. (516) 694-6700 • TWX: 510-224-6417

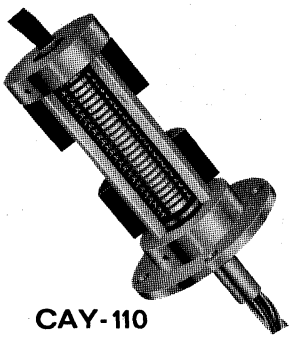
BEARING MOUNTED SLIP-RING ASSEMBLIES



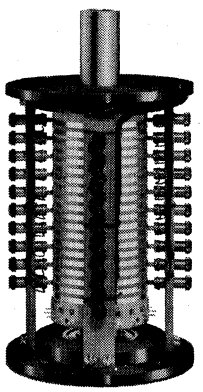
CAY-150



EAY-502



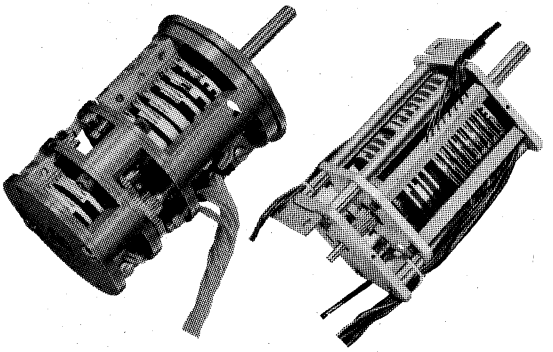
CAY-110



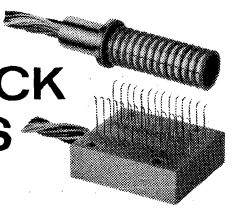
CAY-125

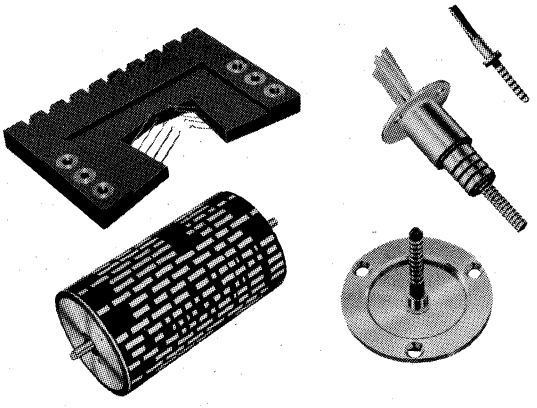
SHAFT POSITION ENCODERS

analog-digital converters

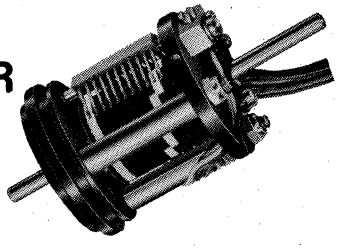


SLIP-RING AND BRUSH BLOCK ASSEMBLIES AND SWITCHING COMMUTATORS





ROTARY SELECTOR SWITCH



Illustrated is a partial selection of the many and varied products available from Airflyte's complete line of rotating components. Airflyte's extensive services and facilities, from research and design to prototype and mass production, enable the manufacture of both standard and modified components, geared to customer specifications and application. Tooling costs can be eliminated in most instances by the availability of a large selection of company-owned jigs, fixtures, dies and molds. Airflyte Electronics invites your inquiry.

Airflyte

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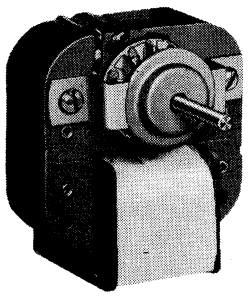
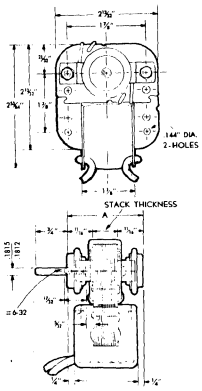
model JS





shaded pole induction motors

The Model JS Motors are mass produced with minor variations to meet the demands of specific jobs which require a highly efficient miniature power plant. It can be used as the vital power source on all kinds of electrical and mechanical devices for electronic, electro, radio and time controls, TV and radio tuners, turntable drives for phonographs and Hi-Fi, can openers, fans, hair dryers, coin operated mechanisms, switches, signals, business machines and other special uses. These motors are equipped with impregnated bronze bearings for continuous duty. They can be furnished with or without internal fans and for clockwise or counter-clockwise rotation.

The specifications shown can be varied within limits to meet your design requirements. This would include such things as corrosion resistant finish, water resistant (impregnated coil), threaded or stepped shaft, variation of the mounting arrangement, and variations in the torque and watts input.

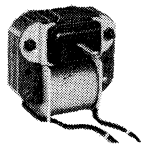
specifications

	JS0300	JS0500	JS0600*	JS0700	JS0800*	JS1100	JS1200
Stack Thickness	0.350	0.500	0.600	0.750	0.850	1.100	1.250
Voltage	117	117	117	117	117	117	117
Frequency	60	60	60	60	60	60	60
Locked Amps.—Cold	0.30	0.38	0.71	0.88	0.92	0.93	1.0
Locked Watts—Cold	15	21	35	45	50	55	62
Starting Torque—Cold—Oz. In.	0.66	.90	1.75	2.35	2.70	2.95	3.20
Idle Amps.—Hot	0.25	0.29	0.54	0.60	0.64	0.65	0.70
Idle Watts—Hot	11	15	22	28	30	32	40
Idle R.P.M.—Hot	3350	3465	3470	3475	3475	3500	3500
Full Load Amps.	0.26	0.32	0.57	0.70	0.72	0.76	0.82
Full Load Watts	13	19	29	38	42	44	53
Full Load Torque—Oz. In.	0.75	1.60	2.70	3.50	4.20	4.75	5.30
Full Load R.P.M.	2900	2900	2900	2900	2900	2900	2900
Full Load H.P.	0.002	0.004	0.008	0.010	0.012	.013	0.015
"A" Dimension (Internal Fans)	1 23/32	1 7/8	31/32	2 1/8	2 7/32	2 15/32	2 5/8
"A" Dimension (No Fans)	1 1/16	1 11/16	1 13/16	1 31/32	2 1/16	2 5/16	2 15/32
Weight	12 oz.	1 lb.	1 lb. 2 oz.	1 lb. 6 oz.	1 lb. 8 oz.	1 lb. 13 oz.	2 lb. 1 oz.
Duty	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.

* Available from stock.

custom motors for many applications

H



High starting torque, making it suitable for remote controls, air circulation, gear trains, valve controls, pumps, and many other special applications.

4 speed JPQ phonomotor



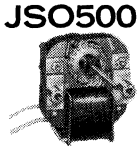
Single lever shifts, indexes speeds and neutral position with free movement. Electronic dynamically balanced rotor. Vibration-proof mountings. Minimum rumble and hum. Unexcelled speed regulation. Designed to meet U. L. requirements. Occupies minimum space. The Model JPQ is also available with transformer winding for transistor amplifier applications.

JS long life



Built on standard Alliance frame, has a large oil reservoir on each bearing to extend motor life. In order to reduce wear, the mating parts are given precision treatment. Ideal for long life applications.

JSO500



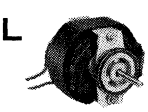
Built on standard Alliance frame. Large sealed oil reservoir and the mating parts are given precision treatment to give extended life. The mounting shown is not standard but illustrates the flexibility of mounting.

JSG



Variations can be made for mounting, temperature of operation, clutching, torque, output shaft speed, humidity, etc. This type unit also available with friction drive of extremely quiet operation but having limited torque ranges. Duty cycle may vary from intermittent to continuous, dependent upon torque and ambient temperature. The JSG is used for TV tuners, rotisseries, remote controls, vending machines.

L



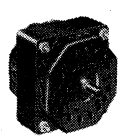
A shaded pole induction motor for typewriters, business machines, fan applications, and similar equipment demanding high torque, compact design and low cost. Standard motors are wound with Class "A" insulation, 117 volt, 60 cycles. Available in 1¼" and 1½" stack thickness. A clutch is available with this type of motor. Further details can be obtained through our Sales Department.

R



A compact power source for reversible rotation requirements. This motor requires a capacitor. The motor can be provided in various stack thicknesses providing a range of electrical and torque characteristics. The specifications shown here are typical for a .375 stack motor.

S



This motor is for transcription type turntables, **stereo** tape, **stereo** disc and Hi-Fi applications. It is designed and manufactured to give the ultimate in motor performance for High Fidelity equipment. The motor's electrical and physical characteristics can be changed to meet your torque, heat and mounting requirements.

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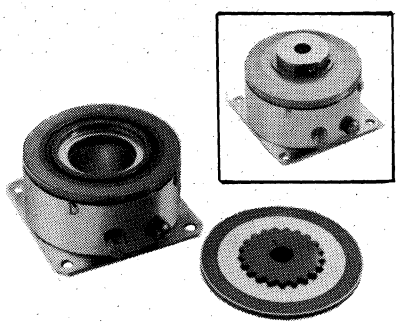
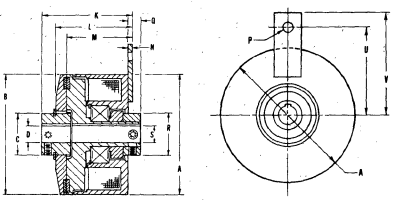
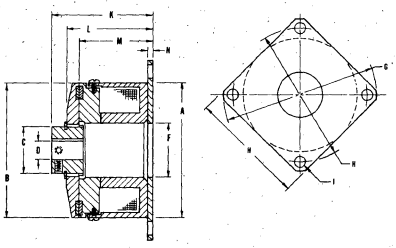
Longer Life • Cleaner Operation with Apilon® (Ceramic Type) Friction Faces





- Typical life of wear surfaces at least ten (10) times conventional material.
- Life expectancy approximately 120 million cycles (based on work performed per cycle of 144 in. oz. for Size 20 and 288 in. oz. for size 40).



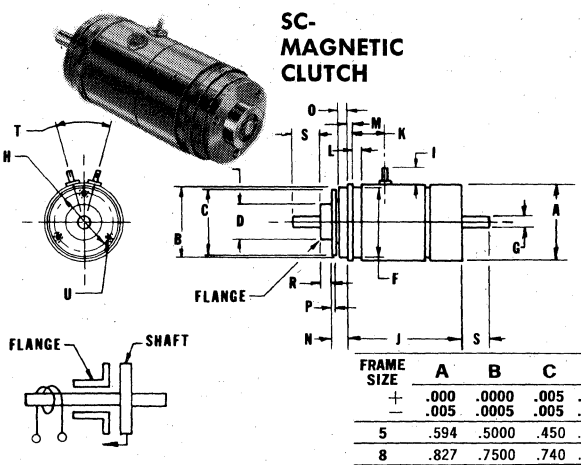
- Dust due to wear products substantially reduced.
- Physically and electrically interchangeable with most conventional units.
- A.P.I. Engineering available to establish life expectancy for specific application.

COMMERCIAL

Model	Torque	Watts	A	B	C	D	F	G	H	I	J	K	L	M	N	P	Q	R	S	U	V
±	Lb. In.	D.C.	.015 .015	.015 .015	.002 .002	Max. with Max. Keyway	.001 .000	.001 .001	.005 .005	.010 .010	.015 .015	.015 .015	.015 .015	.015 .015	.015 .015	.010 .010	.015 .015	.015 .015	Max. with Max. Keyway	.015 .015	.015 .015
10	4	4	1⅛	1⅛	5/8	¼ x 1/16 x 1/32	.437	1.499	1.312	⅛	1⅛	1	.718	.625	1/16	—	—	—	—	—	—
20	20	6	1 13/16	1 13/16	5/8	3/8 x 3/32 x 3/64	.750	2.436	2.125	3/16	1 13/16	1⅜	1.156	1.000	1/16	⅛	3/16	5/8	¼ x 1/16 x 1/32	1 3/16	1⅜
30	40	8	2⅛	2⅛	5/8	3/8 x 3/32 x 3/64	1.000	2.874	2.500	3/16	2⅛	1 21/32	1.250	1.062	1/16	⅛	¼	¾	3/8 x 1/16 x 1/32	1⅜	1 5/16
40	70	10	2⅝	2⅝	1 3/16	¾ x 3/16 x 3/32	1.061	3.499	3.125	3/16	2⅝	1 25/32	1.437	1.250	1/16	⅛	¼	1	3/8 x ⅛ x 1/16	1 5/16	1¾

SUBMINIATURE CLUTCH & BRAKE

SC-MAGNETIC CLUTCH



Typical A. P. I. Specifications for ultra precision clutch and brake units ... combining excellence in design, materials, workmanship and reliability. All units contain precision ball bearings fully protected from moisture and contamination by special seals. A. P. I. units meet government specifications for environmental tests. Infinite variations of design and mountings are available.

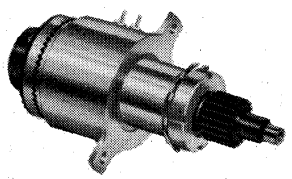
FRAME SIZE	Torque @ 24 V.D.C. Oz. In. Min.	Drag Torque (Oz. In.) Max.			Response Time @ 28 V.D.C. (Mili. Sec.) (Nom.)	Inertia x 10^{-6} (In. Lb. Sec.^{2}) (Calc.)		Weight (Nom.) Oz.	Watts @ 24 V.D.C. (Nom.)
		Ener.		De-Ener.					
	Clutch	Shaft & Flange	Shaft	Flange		Shaft	Flange		
5	6	.05	.05	.05	4	.22	.5	.9	2.5
8	25	.10	.05	.05	8	1.0	2.5	2.4	3.0
11	60	.20	.10	.10	10	4.5	10.0	5.5	3.5
14	110	.40	.20	.20	22	10.0	15.0	8.5	4.0
18	240	.40	.20	.20	40	40.0	45.0	16.5	4.5

FRAME SIZE	A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	R	S	T	U
+ −	.000 .005	.0000 .0005	.005 .005	.0000 .0005	.005 .005	.0000 .0005	.005 .005	Ref.	.015 .015	Ref.	Min.	.003 .000	.005 .005	.005 .005	.002 .002	.005 .005	.020 .020	Ref.	No.
5	.594	.5000	.450	.2190	.530	.0935	.344	.118	.882	.235	.060	.047	.125	.060	.056	.079	.300	37°	0-80
8	.827	.7500	.740	.3750	.750	.1248	.625	.197	1.240	.368	.078	.060	.170	.100	.061	.120	.300	30°	2-56
11	1.090	1.0000	.934	.5000	1.000	.1248	.750	.179	1.485	.431	.078	.060	.177	.100	.064	.177	.375	30°	2-56
14	1.370	1.2500	.934	.5000	1.250	.1873	.750	.161	1.620	.255	.078	.060	.203	.125	.064	.177	.375	30°	2-56
18	1.740	1.5620	1.200	.6250	1.562	.2498	1.000	.132	1.930	.300	.078	.092	.237	.132	.090	.177	.500	30°	2-56

ENERGIZED — Output Shaft Coupled to Input Flange.

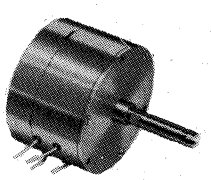
DE-ENERGIZED — Output Shaft and Input Flange Free to Rotate.

SPECIAL ENGINEERED UNITS



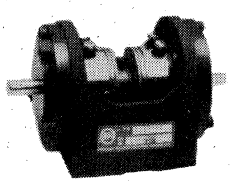
TOOTH TYPE CLUTCH

Special design to meet military reliability for airborne electronics. Specifications include operation in an explosive vapor, temperature, altitude, vibration, salt spray and humidity environments.



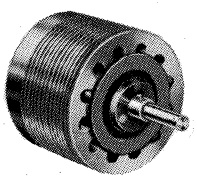
DUPLEX BRAKE

Compact Brake for use in a missile tape drive system. Hysteresis and friction brake with separate coils for excitation applied to a common shaft.



APILON®-FACED CLUTCH BRAKE PACK

Precision pre-aligned clutch/brake package eliminates installation problems. Ball bearing supported shafts permit direct coupling or belt drives. Packs available to house above Commercial Models 10, 20 and 40.



HYSTERESIS CLUTCHES / BRAKES

A continuous slip device capable of providing precise, infinitely adjustable torque control. Units are basically direct current sensitive . . . having excellent reliability, repeatability and linearity.

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PRECISION ENGINEERED • PRECISION MADE • COMPETITIVELY PRICED

MOTORS • FANS • BLOWERS

HP MOTORS

Units shown cover a wide application range. Complete facilities are available for precisely-engineered standard and custom-designed models, for critical military and commercial applications. Quality controlled for utmost efficiency, reliability and longer life.

MOTORS

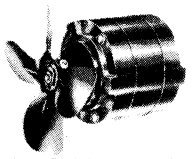


HYSTERESIS SYNCHRONOUS MOTORS — Widely used in the tape recorder and turntable industries. Single, dual or three speed models. Made to your exacting torque and speed specifications. Modifications available to suit any physical requirement. Frame diameters 1 1/16", 1 3/4", 2", 3 5/16", 3 7/8", 4 3/8" and 5 3/8".

Model No.	RPM	Amps	Volts	Freq	Phase	Cap	Rated	Torque Oz. In. P.I.	Torque Oz. In. P.O.	Torque Oz. In. ST	Length (In.)	Diam. (In.)
A52AZU-1	600	.12	115	60	1	2.0	.75	.92	1.08	.64	3	2
A52BBADU-1	900/1800	.21	115	60	1	3.0	.68	.88/.96	.96/1.04	.72/.72	3	2
A54PBLDU-1	6000/12000	1.3	115	400	1	1.0	2.0	2.7/2.9	2.8/3.2	3.6/3.3	3-1/2	2
A74LAP-1	3600	.30	105	60	1	2.5	3.0	4.1	6.5	3.4	4-1/8	3-5/16
C78UBU-1	12000	3.3	115	400	1	2.0	5.6	7.6	11.5	14.0	5-5/8	3-5/16
A72LAEDP-1	900/3600	.40	115	60	1	4.0	3.5	5.2/4.9	6.5/6.5	4.7/3.8	3-3/4	3-5/16
A72DCBZU-1	600/1200	.25	115	60	1	5.0	2.0	3.2/4.6	4.0/5.7	1.5/2.2	3-3/4	3-5/16
A73KBMAU-1	1800/3600	1.0	115	50/60	1	5.0	8.5	12/11	18/12	14/11	4-1/4	3-5/16
C76LAHBEDU-1	900/1800/3600	.70	108	60	1	5.0	4.0	7/8/6	8/11/8	5/5/4	5-1/8	3-5/16
D84GZU-3	600	.60	115	60	1	5.0	8.4	9.0	10.0	6.2	4-61/64	3-7/8
D86KDU-2	900	.50	115	60	1	6.0	11	11.5	13.0	11.5	5-29/64	3-7/8
A88LDU-1	900	1.0	115	60	1	4.0	15	17.5	19.0	23.0	5-61/64	3-7/8
A80HCU-1	1200	.40	115	60	1	2.0	4.0	5.0	5.5	8.0	3-61/64	3-7/8
D80KBU-7	1800	.45	115	60	1	2.0	5.6	6.0	6.5	8.0	3-61/64	3-7/8
D84QBU-3	1800	1.0	115	60	1	4.0	18.5	20	21	27	4-61/64	3-7/8
A86RBU-4	1800	.60	230	60	1	5.0	27.7	28.5	33	44	5-29/64	3-7/8
A80HAU-1	3600	.30	115	60	1	5.0	1.8	2.5	3.0	5.0	3-61/64	3-7/8
A88UAU-3	3600	1.7	115	60	1	7.0	28.0	30.5	32.5	30.0	5-61/64	3-7/8
D84HCEZU-11	600/1200	.40	115	60	1	5.0	5.5	6/9	7/10	4/6	4-61/64	3-7/8
A88KCGZU-1	600/1200	.60	115	60	1	4.0	11.0	12/17	13/19	8/9	5-61/64	3-7/8
A86KBFZU-1	600/1800	.40	115	60	2	–	7.5	11/11	18/11	13/11	5-29/64	3-7/8
A84FBDDR-1	900/1800	.35	115	60	1	6.0	4.0	6.0/6.2	7.0/9.0	6/5	4-61/64	3-7/8
D86MBKDU-1	900/1800	.70	115	60	1	6.0	11.1	12/12	12/13	14/12	5-29/64	3-7/8
A86NBLCU-1	1200/1800	.70	115	60	1	6.0	14.0	17/15	18/17	18/17	5-29/64	3-7/8
A84KAGBDDU-1	900/1800/3600	.60	115	60	1	6.0	3.0	5/8/6	5/10/7	6/5/4	4-61/64	3-7/8
A116KZU-1	600	.50	115	60	2	–	14.0	18.5	21	35	5-5/16	4-3/8
A114LDU-1	900	.90	115	60	1	6.0	15	23	27	26	4-13/16	4-3/8
A112SCU-1	1200	2.5	115	60	1	7.0	55	61	66	65	6-13/16	4-3/8
A116UWU-1	12000	5.0	208	400	3	–	8.3	11.0	13.2	138.0	5-5/8	4-3/8
A1110PBNZU-1	600/1800	2.0	115	60	1	8.0	45/20	50/28	54/32	55/22	6-13/16	4-3/8
C116KCHDGZU-1	600/900/1200	.60	115	60	1	5.0	8.3	12/13/16	14/17/25	10/10/11	5-5/16	4-3/8
A118QAMBKDU-1	900/1800/3600	2.0	105	60	1	6.0	11.0	17/12/15	20/14/16	17/11/9	5-13/16	4-3/8
A98GZKZU-1	300/600	.60	115	60	2	–	14.0	20/21	24/24	12/28	5-61/64	5-3/8
A912YAWBU-1	1800/3600	7.0	115	60	1	25.0	150/80	180/92	192/96	232/116	6-61/64	5-3/8
A90CZEDHBU-2	450/900/1800	1.0	115	60	1	10.0	8.0	10/11/9	10/14/10	9/9/8	3-61/64	5-3/8

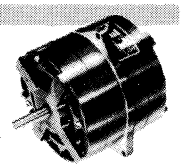
GEAR MOTORS — Available to special order for precision applications in all frame sizes.

ROTOR & STATOR ASSEMBLIES — In all frame sizes for memory drum, video-head, special pump and similar applications.



INDUCTION MOTORS — Self-cooled or totally enclosed. Suitable for a wide variety of applications. Frame diameters from 1 1/16" to 5 3/8".

Model No.	Nom RPM	Volts	Freq	Phase	Amps	Cap	Torque Oz. In. Rated	Torque Oz. In. S.T.	HP	Length (In.)	Diameter (In.)
A405EJM-3	3200	115	60	1	.12	1.0	.1	.1	1/3000	1-7/8	1-3/4
C50EJU-1	3450	115	60	1	.30	3.0	1.0	2.5	1/300	2-1/2	2
A52RWR-1	10000	115	400	3	.45	–	5.0	7.0	1/20	3	2
A74NJM-3	3350	115	60	1	.40	4.0	12	4	1/25	4-1/8	3-5/16
A88TKU-1	1725	115	60	1	1.7	5.0	60	35	1/10	5-61/64	3-7/8
A114NMU-1	860	115	60	1	.80	6.0	30	30	1/40	4-13/16	4-3/8
A118VKU-1	1725	115	60	1	2.1	4.0	96	23	1/5	5-13/16	4-3/8
A118XWM-1	1700	208	60	3	1.1	–	150	350	1/4	5-13/16	4-3/8
A116ZXM-1	3400	440	60	3	1.2	–	150	–	1/2	5-5/16	4-3/8
A92VLU-1	1125	115	60	1	1.5	7.5	90	80	1/10	4-29/64	5-3/8
C94ZXR-1	3400	115	60	3	4.8	–	150	480	1/2	5-35/64	6-1/4



TORQUE MOTORS — Used in Tape Recorder, Servo and positioning applications. Will not overheat in continuous duty. Exceptionally low external flux field. Frame diameters from 1 1/16" to 5 3/8" to meet exact speed/torque specifications.

Model No.	No Load RPM	Volts	Freq	Phase	Amps	Cap	Stall Torque Oz. In.	Poles	Diameter (In.)	Length (In.)
A44GKM-1	1715	115	60	1	.11	1.0	4.0	4	1-3/4	3-3/16
A70KKP-1	1715	115	60	1	.21	4.0	16	4	3-5/16	3-1/8
A72QKP-2	1720	115	60	1	1.1	6.0	60	4	3-5/16	3-5/8
A74NKP-10	1720	115	60	1	1.0	4.0	40	4	3-5/16	4-1/8
C78PKP-1	1720	115	60	1	1.3	12.0	70	4	3-5/16	5-3/8
A114GZU-1	850	208	60	3	.4	-	48	8	4-3/8	4-13/16
A118KMP-1	850	115	60	1	2.3	10.0	160	8	4-3/8	5-13/16
A1110SMP-1	850	115	60	1	3.6	15.0	240	8	4-3/8	6-13/16
A118RLU-1	1125	115	60	1	1.7	15.0	140	6	4-3/8	5-13/16
A96SLP-1	1125	115	60	1	4.6	25.0	300	6	5-3/8	5-29/64
A96RMP-1	835	115	60	1	2.5	20.0	225	8	5-3/8	5-3/16

RELUCTANCE SYNCHRONOUS MOTORS — Used in facsimile and timing applications requiring phasing. Carefully designed to your requirements. Available for 60 and 400 cycle applications.

Model No.	RPM	Volts	Freq	Phase	Amps	Cap	Torque Oz. In. P.I.	Torque Oz. In. P.O.	Torque Oz. In. ST.	HP	Length (In.)	Diameter (In.)
A80KFU-1	1800	115	60	1	0.4	3.0	6.0	8.0	8.0	1/100	3-61/64	3-7/8
A80MFU-9	1800	115	60	1	0.6	4.0	18.6	19.5	14	1/30	3-61/64	3-7/8
A82PFU-1	1800	115	60	1	0.8	6.0	27	28	18	1/20	4-29/64	3-7/8
A88UFU-1	1800	115	60	1	1.9	5.0	57	70	22	1/10	5-61/64	3-7/8
A82QEU-1	3600	115	60	1	1.1	4.0	14	16	10	1/25	4-29/64	3-7/8
A110LHU-1	900	115	60	1	0.7	5.0	15	27	13	1/75	3-13/16	4-3/8

FANS • BLOWERS



AXIAL-FLOW FANS — Can be supplied with or without Venturi rings. Complete unit ready to mount in your equipment for required static pressure conditions. 50, 60, 400 cycle, variable frequency and dual frequency models available.

Model No.	Volt	Freq	Phase	Nom RPM	CFM @ "0" SP	No Del " S.P.	Fan O.D. (In.)	Venturi O.D. (In.)	Mount B.C. (In.)	Overall Length (In.)	Cap	Weight
A4H3Q-1CC	208	60	3	3400	120	.45	4½	5-7/8	5-1/2	3-11/32	–	17 oz.
A4H95Q-1C	115	60	1	3300	100	.6	4	5-11/32	5	4-1/16	1.0	18 oz.
A4K2H-1C	115	320/1000	1	4300	100	–	4	5-11/32	5	3-11/32	.75	18 oz.
A4L2H-1C	115	400	1	6500	140	1.6	4	5-1/2	5	3-13/32	1.0	22 oz.
A5G3Q-1C	115	50/60	1	3300	110	.48	4½	6	3-1/2	2-15/16	1.0	22 oz.
A5K3G-1C	115	400	1	4000	150	.51	4½	6	3-1/2	2-15/16	0.5	22 oz.
A7M8Q-1C	115	50/60	1	3300	325	.65	6½	7	7-3/4	2-7/8	2.0	4 lb.
A7N13P-1C	115	50/60	1	1700	445	.6	8	10	9-11/16	5-5/8	2.0	5¼ lb.
A8V12B-1C	50/214	130/557	3	1800	200/815	.24/2.5	8	10	9-11/16	5-5/8	–	5¼ lb.
A8S11Q-2CC	115	60	1	3300	715	2.6	8	10	9-11/16	6-21/64	4.0	5¾ lb.
A11V98P-1C	115	60	1	1700	1020	.5	11½	14	13-1/2	3-3/4	5.0	7½ lb.



CENTRIFUGAL BLOWERS — For 50, 60, 400 or variable frequency power supplies up to 1600 CPS. Highest pressure to volume ratio, for the most efficient "Hot Spot" cooling.

Model No.	Nom RPM	Volts	Freq	Phase	Full Load Watts	Cap	CFM @ 0" S.P.	Length (In.)	Width (In.)	Height (In.)	Approx. Weight	Simplex or Duplex
C4B1P-1C	1700	115	60	1	7	.7	2	2-3/4	2-27/32	2-15/16	11 oz.	Simplex
C5D2Q-9CC	3600	115	50/60	1	18	2.0	20	4-3/16	5	4-1/8	24 oz.	Simplex
C5H4Q-1CC	3300	115	60	1	22	1.0	37	4-3/4	3-13/16	4-3/32	28 oz.	Simplex
C5N3J-1CC	4800	208	400	3	100	–	65	5-3/64	3-13/32	3-13/32	30 oz.	Simplex
C5N41G-1CC	5400	208	400	3	40	–	50	4-17/32	4-13/32	4-5/8	29 oz.	Simplex
C7M7Q-6CC	3300	115	60	1	38	4.0	75	5-27/32	5-1/8	5-1/2	4½ lb.	Simplex
C7P8Q-1CC	3300	115	60	1	38	4.0	120	5-15/16	4-15/16	5-1/2	4½ lb.	Simplex
C7V3J-1	10200	208	400	3	315	–	212	8	3-7/8	3-11/16	6¼ lb.	Duplex
C7W60Q-1	3300	115/230	50/60	1	180	2.5	445	13-1/16	6-13/64	6-25/32	10¾ lb.	Duplex
C8Q6G-4C	4800	115	400	1	110	1.5	117	6-5/16	5-9/64	5-1/2	4 lb.	Duplex
C8U8Q-2	3300	115	45/65	1	130	4.0	320	10-29/64	6-3/4	6-19/32	12 lb.	Duplex

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Precision Rotating Components

SERVO MOTORS

Cedar has long been a leader in the manufacture of precision servo motors and motor tachometers and offers a complete line of sizes and types, both with and without gear heads. Machine winding and other advanced production techniques along with large volume manufacture assure the most economical price available. At the same time, rigid reliability testing and quality assurance programs built up through years of experience guarantee the finest quality and dependability.

SYNCHROS

Cedar synchros are of uniformly high quality and reliability. The quality is a result of advanced design concepts, modern manufacturing techniques and materials and meticulous care in assembly and testing. Cedar Synchros are tested per MIL-S-20708C and ARP-461B-SAE and are available in a variety of windings and shaft configurations.

SERVO PACKAGES

Cedar servo packages have been successfully used on leading missles and aircraft, ranging from the LTV A7A autopilot synchronizer to the Polaris A3 pulse sum-to-analog converter. Other Cedar packages include integrators, in-line servos, geared assemblies and custom units.

STEPPER MOTORS

Because their output is in discrete increments, Cedar stepper motors have many advantages over conventional motors for precise positioning applications. They are bi-directional and have high torque output. They can be run at high stepping rates or as slow as you wish. Because shaft rotation is incremental, damping is not required. Cedar Stepper Motors are available in both permanent magnet and variable reluctance types, and with a wide variety of stepping angles. All meet the full requirements of MIL-E-5272.

DC LOW INERTIA MOTORS

Cedar proprietary manufacturing techniques produce DC low inertia motors that match or exceed printed circuit motor performance, at lower cost. The motors are designed to power computer peripheral equipment, control systems, business machines or any application requiring fast acceleration and deceleration.

SUBMINIATURE RATE GYROS

Cedar's high performance rate gyros have been designed for stability augmentation systems, autopilot damping, radar antenna stabilization and fire control applications. Two and three axes rate gyro packages can also be provided to include demodulators, amplifiers, phase splitting capacitors, chokes, etc., as required.

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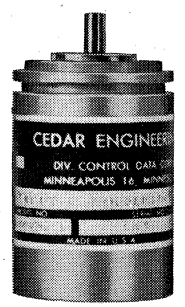
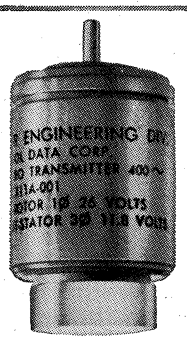
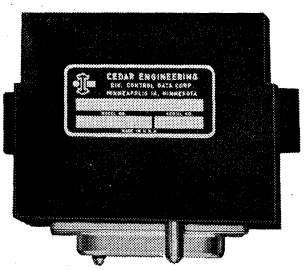


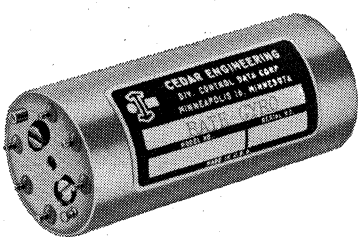
SERVO MOTORS



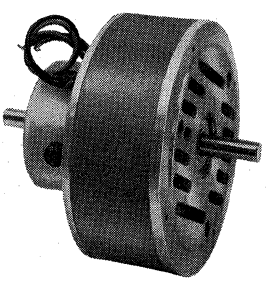
SYNCHROS



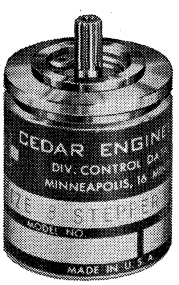
SERVO PACKAGES



SUBMINIATURE RATE GYROS

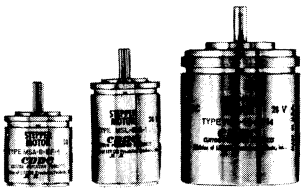


DC LOW INERTIA MOTORS



STEPPER MOTORS

BUY CLIFTON QUALITY IN SERVO MOTORS



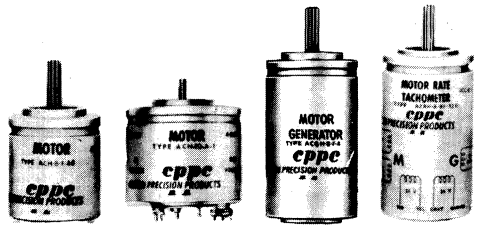
STEPPER MOTORS



Clifton offers a wide variety of permanent magnet or variable reluctance type stepper motors in sizes 8 through 15.

We also design and manufacture the logic and pulse source modules which control our stepper motors.

Stepper motors are extremely useful where signals are presented as pulse trains rather than analog voltages.



AC MOTORS, GENERATORS, AND TACHOMETERS

Clifton offers a wide variety of AC motors in sizes 8, 10, 11, 15. Our motors exhibit a very high degree of efficiency, also higher torque to inertia ratios and lower and more uniform starting voltages. All motors are high temperature resistant.

Because of higher torque/inertia ratios, our generators and tachs are smaller and lighter.

Clifton also offers temperature compensated integrating tachs and high signal to noise integrating type tachs. Gear heads available on motors and tachometers.



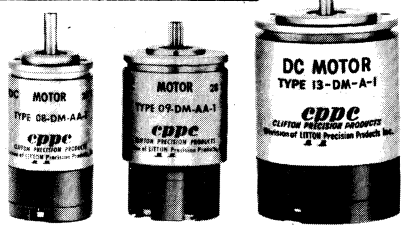
TORQUERS

Clifton can custom design torque motors to your special need. Our deep experience in the flat, "hollow shaft" configuration qualifies us uniquely in this field. A Clifton torque motor actuates the fins on Redeye, the Army ground to air missile.

BLOWER MOTORS

This typical Clifton Blower conforms to MIL-B-23071. It exhibits remarkable reliability i.e. "life" in the order of 1000 hr. accelerated life with temperature variations. It is very low in self-generated vibration.





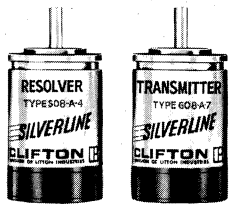
DC MOTORS

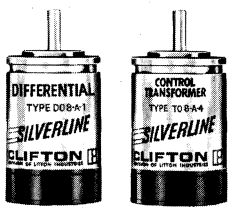
Clifton offers many different types including a new line of low cost sizes 8, 9, and 13.

Units are available which accept either 28, 20 or 14 volt inputs; also with governor which maintains constant speed within ±1%. Gearheads available for our DC motors. DC tachometers also available.

AND SYNCHROS

SILVERLINE THE NEW GENERATION OF CLIFTON SYNCHROS





Higher Accuracy. 5′ Standard • Outstanding Repeatability of Calibration Pattern • Stability of Calibration over Temperature • 150°C Standard Operating Temperature • Lower Null Voltage

Keeping pace with the developing aerospace field, Clifton has developed SILVERLINE, a new, superior line of standard synchros.

These units, a natural evolution from our present line of quality synchros, embody certain new manufacturing techniques and space age materials. The result is a standard synchro which outperforms present synchros in the above five distinct ways.

CLIFTON
DIVISION OF LITTON INDUSTRIES

General Sales Office: 5050 State Rd., Drexel Hill, Pa.
215 622-1000 TWX: 510 669-8217

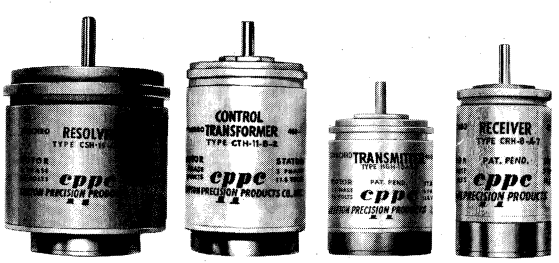
SEE SECTION 4900, page 2664 for a description of our wide line of Servo Packages, Servo Amplifiers, Digital Indicators and S/D, D/S Converters.

GYRO PICKOFF SYNCHROS AND RESOLVERS

Gyro pick-offs generally require individual mounting configurations and electrical parameters. Clifton can custom design them for your particular needs. Beryllium, aluminum or stainless steel housings. A wide selection of bores, stack heights, widths and diameters are available from existing laminations. Our gyro pick-offs are used extensively in the Apollo program.

Custom designed torque motors also available.



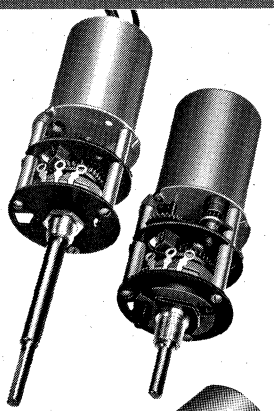


SYNCHROS

Clifton synchros offer high accuracy (7′ max. error is typical), low nulls, low phase shifts, corrosion resistant construction, stainless steel or aluminum housings. Double ended shafts, BuWeps types and ultra high temperature resistant types (450°F) are available. Clifton manufactures an extremely wide variety of transmitters, receivers, control transformers, differentials, resolvers, precision computing resolvers. linear transformers, as well as a complete line of motors and motor rate tachometers.

DALE® SIOUX DIVISION ELECTROMECHANICAL PRODUCTS

REVERSIBLE AC MOTOR DRIVEN POTENTIOMETERS



FOR USE IN ■ Home Entertainment Appliances ■ Instrumentation ■ Controls

FEATURES

■ Available with all standard potentiometers: Single, ganged, or with power switch—dimensions change accordingly. ■ Patented Dale Motor Load Decoupler eliminates coasting and allows manual control independent of gear motor inertial load.

■ Long life expectancy ■ No lubrication in normal use ■ Operates in any position ■ Special terminal configurations available

SPECIFICATIONS

Operating Voltage: 6, 12, 24, 117 V.A.C., or any specified

Power Input: 7.5 Volt Amperes

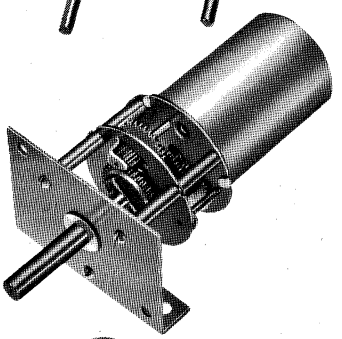
Output: Approximately 5.6 R.P.M.

Torque at Potentiometer Shaft: 10 in./oz. minimum (with decoupler); 21 in./oz. minimum (without decoupler).

Reversing: Accomplished by switching capacitor as shown in hysteresis motor circuit diagram below.

Dimensions: Length: 3.275" (not including shaft) Diameter: 1.531

REVERSIBLE AC GEARHEAD MOTORS



FOR USE WITH ■ Switches ■ Potentiometers ■ Ideal for light industrial and consumer product controls

SPECIFICATIONS

MECHANICAL

Overall Dimensions: Length: 3.275" (not including shaft) Diameter: 1.320"

Shipping Weight: .32 lbs.

Will meet normal industrial environmental requirements.

Mounting: Horizontal standard, vertical optional; bracket provided for chassis mounting and mounting control.

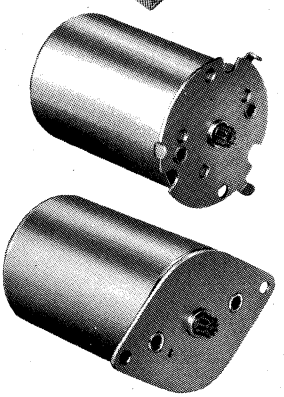
Output Torque: 14 in./oz. at 5.3 and 1.8 R.P.M.

ELECTRICAL

Operating Voltage: 117 volts AC, 60 cycles standard. Available from 6 to 220 volts AC, 60 cycles. D.C. versions available.

Capacitor size: Dependent on input voltage. (Capacitor not part of motor.)

REVERSIBLE AC HYSTERESIS SYNCHRONOUS MOTORS



FOR USE IN ■ Low Power Driving Mechanisms ■ Control Circuits ■ Entertainment Appliances

FEATURES

■ Output shaft configuration can be specified. Standard units provided with gear.

■ Mounting arrangement can be varied to meet customer requirements.

■ Self-lubricating bearings.

■ Aluminum housing.

■ Long life expectancy.

■ Reversing accomplished by switching external capacitor as shown in circuit diagram.

SPECIFICATIONS

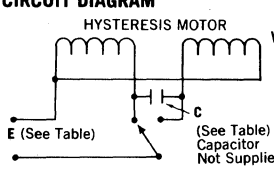
Operating Voltage: 6, 12, 117 V.A.C., or any specified.

Power Input: 7.5 Volt Amperes

Output: Approximately 1800 R.P.M.

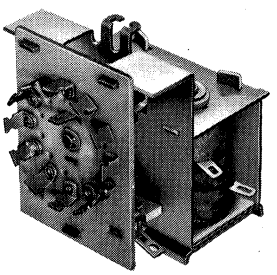
Torque: 0.125 in./oz.

CIRCUIT DIAGRAM



E VOLTAGE	C CAPACITANCE	C VOLTAGE
6	170 MFD	20
12	50 MFD	25
24	16 MFD	50
117	.68 MFD	300

AC & DC STEPPING RELAYS



FOR USE IN ■ Control Circuits ■ Television Controls ■ Hi-Fi, Stereo & Radio ■ Appliance

FOUR TYPES AVAILABLE ■ Uni-Directional A.C. & D.C. ■ Bi-Directional A.C. and D.C.

SPECIFICATIONS

ELECTRICAL

Coil: Wound to any resistance to operate up to 150 volts.

Power Required: 2.5 watts with Plate Sequence Switch (Fig. A); 4.5 watts with Wafer Sequence Switch (Fig. B).

Contact Arrangement: Single Pole 4, 6, 10, 12 or 13 throw sequence. Auxiliary power switch operates at predetermined position of sequence.

Contact Rating: From Dry Circuit to 1 amp at 24 V.A.C. on Sequence Switch. Optional power switch 5 amps at 117 V.A.C.

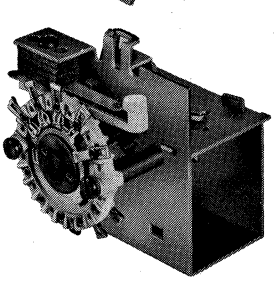
MECHANICAL

Overall Dimensions: Height: 2.200"
Width: 2.190"
Depth: 2.005"

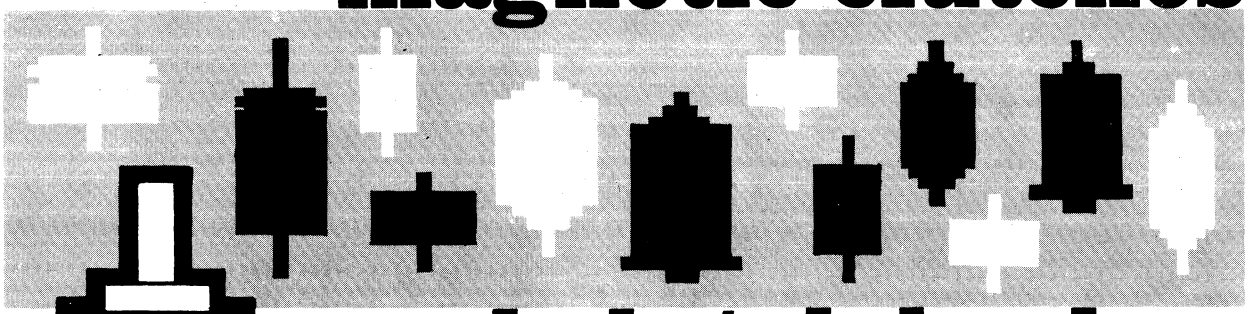
Shipping Weight: 0.27 lbs. Uni-Directional; 0.40 lbs. Bi-Directional

Will meet normal commercial environmental requirements. Standard auxiliary power switch may be omitted.

Mounting: Vertical or horizontal using one screw and two locating tabs.

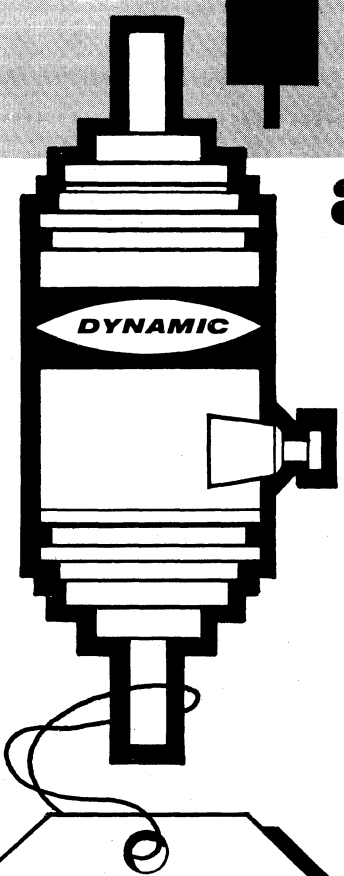


magnetic clutches



and clutch brakes

(frame sizes 5 to 18, operating voltage 24-26 volts DC)



The broadest, most complete off-the-shelf selection of precision magnetic clutches and clutch brakes is always available to fit your servo design requirements. Units are available to be either engaged or disengaged when coil is energized. Dynamic, a pioneer and leader in such devices, provides four basic types of units.

1 **Electro-magnetic friction.** Available in standard and the new wafer length. For electro-magnetic coupling / control requiring high torque to size/ weight ratio. Used in commercial and military projects.

2 **Hysteresis.** Provide extreme stability under all ambient conditions. Free from engagement shock. Output torque is linear to the input control current.

3 **Magnetic particle.** For smooth, shock-free engagement. Low power control for fast responses.

Special orders only.

4 **Eddy current.** For inversely speed sensitive, extremely smooth, shock-free engagement.

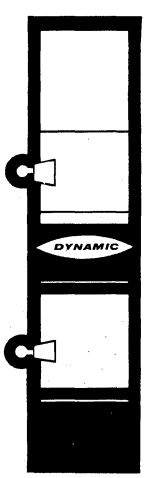
Special orders only.

features

of the clutches and clutch brakes:

- Designed to meet environmental MIL-E-5272C
- High torques
- Long life — in excess of 3,000,000 cycles at 60% full rated torque
- Unaffected by wide temperature ranges
- No fungus nutrients
- No loss of torque when wet from condensation, etc.
- Close concentricity and squareness of shafts to mounting diameters and faces
- No rotation of shafts when engaging or disengaging
- Fast response
- Low breakaway
- No magnetic thrust load
- Epoxy sealing of complete coil provides absolute moisture protection and insulation
- Molded phenolic terminals
- Optional Servo mounts
- Optional flange type mounting adapters

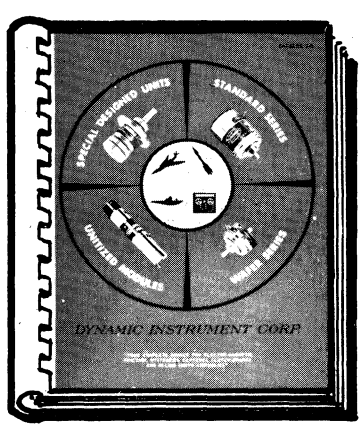
Special units on short notice—however check the extensive Dynamic line first.



unitized modules

Dynamic unitized modules for in-line assemblies include: magnetic clutches and brakes, spring returns, potentiometers, encoders, commutator switches, synchros, gearheads, tachometers and servomotors.

For 50 page comprehensive brochure containing outline drawings, specifications and application data send request on company letterhead.



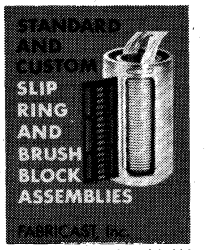
DYNAMIC INSTRUMENT CORP.

Dept. EEM 115 East Bethpage Road, Plainview, L. I., N. Y. 11803 (516) MYrtle 4-6000 TWX — 510 - 224-6482

MANUFACTURERS OF SLIP RING ASSEMBLIES PHONE 213 / 443-3247 (S. El Monte)

Fabricast, Inc.

9835 ALPACA STREET, SOUTH EL MONTE, CALIFORNIA PHONE 213 / 283-9239 (Los Angeles)



REQUEST YOUR NEW CATALOG NOW

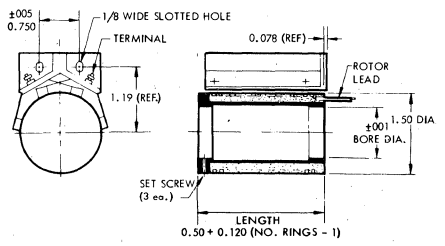
STANDARD CATALOG

SLIP RING ASSEMBLIES *to choose from*

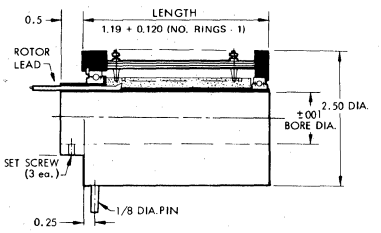
...bore sizes thru 8 inches.

FABRICAST, INC. ...BEST DELIVERY ITEMS

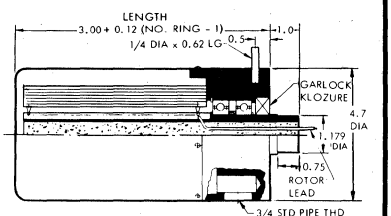
SLIP RING ASSEMBLY TYPE 1057
SEPARATE ROTOR AND BRUSH BLOCK
5 AMP -- 50 RINGS MAX -- BORE 1.002 DIA MAX



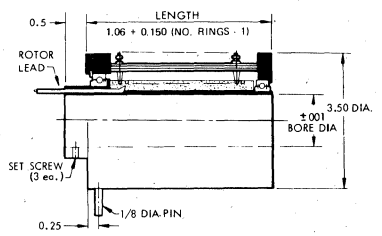
SLIP RING ASSEMBLY TYPE 1186
SELF-CONTAINED -- SHAFT MTG
5 AMP -- 50 RINGS MAX -- BORE 1.002 DIA MAX



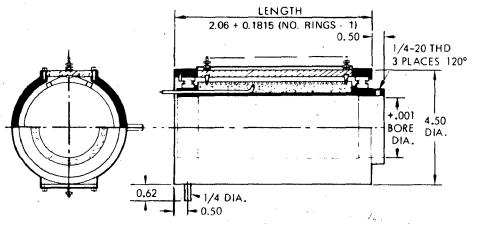
SLIP RING ASSEMBLY TYPE 1302
SELF-CONTAINED -- SEALED HOUSING
5 AMP -- 50 RINGS MAX -- SOLID BORE



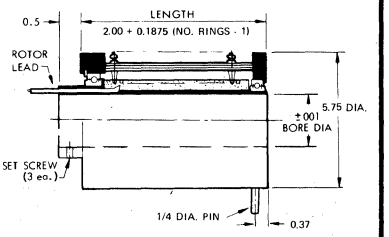
SLIP RING ASSEMBLY TYPE 1289
SELF-CONTAINED -- SHAFT MTG
5 AMP -- 100 RINGS MAX -- BORE 1.752 DIA MAX



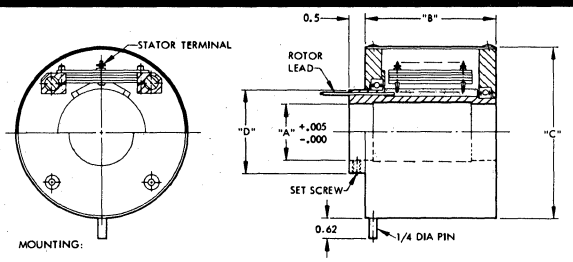
SLIP RING ASSEMBLY TYPE 1067
SELF-CONTAINED -- SHAFT MTG
5 AMP -- 100 RINGS MAX -- BORE 2.502 DIA MAX



SLIP RING ASSEMBLY TYPE 1390
SELF-CONTAINED -- SHAFT MTG
5 AMP -- 100 RINGS MAX -- BORE 4.252 DIA MAX



SLIP RING ASSEMBLY SELF CONTAINED COVERED STATOR TERMINALS



STANDARD METHOD - SLIP RING ASSEMBLY SECURED TO CUSTOMER SHAFT BY SET SCREWS IN ROTOR ASSEMBLY. STATOR RESTRAINED FROM TURNING BY 1/4 DIA PIN IN HOUSING.

OPTIONAL METHOD - STATOR FLANGE MOUNTING WITH DRIVE SLOT IN ROTOR SLEEVE.

BORE DIA "A" INCHES NOMINAL	BORE DIA "A" INCHES RANGE	TYPE NO.	NO. RINGS MAX.	CURRENT AMPS	LENGTH "B" INCHES	Hous. Diam. "C"	Sleeve Exten. Dia. "D"
SOLID	——	1292	41	5 AMP STD 10 AMP OR LO NOISE TWO PARALLEL RINGS	.85 + .088 (no. rings - 1)	2.50	2.19
SOLID	——	1293	19		1.12 + .110 (no. rings - 1)	1.62	.62
SOLID	——	1294	48		1.12 + .110 (no. rings - 1)	2.25	.87
SOLID	——	1295	200		7.50 + .150 (no. rings - 1)	5.00	2.50
.250	.250 - .377	1296	48		1.25 + .110 (no. rings - 1)	2.25	.87
.500	.378 - .565	1297	50		1.25 + .120 (no. rings - 1)	2.75	1.05
1.000	.566 - 1.002	1298	50		1.25 + .120 (no. rings - 1)	3.00	1.30
1.000	1.000 - 1.750	1272	100	5 AMP STD 10 AMP OR LO NOISE 4 BRUSHES PER RING	2.00 + .150 (no. rings - 1)	5.25	2.56
2.000	1.750 - 2.625	1273	100		2.00 + .150 (no. rings - 1)	6.25	3.50
3.000	2.625 - 3.750	1274	58		2.00 + .160 (no. rings - 1)	7.50	4.50
4.000	3.750 - 4.750	1275	48		2.00 + .186 (no. rings - 1)	9.00	6.00
5.000	4.750 - 5.750	1276	63		2.00 + .186 (no. rings - 1)	10.50	7.00
6.000	5.750 - 6.750	1277	58		2.00 + .1875 (no. rings - 1)	12.00	8.00
8.000	6.750 - 8.750	1278	58		2.00 + .1875 (no. rings - 1)	15.00	10.00
1.000	1.000 - 1.250	1282	16	50 AMP STD 100 AMP 4 BRUSHES PER RING	3.00 + 1.050 (no. rings - 1)	8.00	2.56
2.000	1.250 - 2.000	1283	16		3.00 + 1.050 (no. rings - 1)	9.00	3.50
3.000	2.000 - 3.125	1284	9		3.00 + 1.120 (no. rings - 1)	10.00	4.50
4.000	3.125 - 4.375	1285	8		3.00 + 1.116 (no. rings - 1)	11.50	6.00
5.000	4.375 - 5.375	1286	10		3.00 + 1.116 (no. rings - 1)	12.50	7.00
6.000	5.375 - 6.375	1287	10		3.00 + 1.125 (no. rings - 1)	13.50	8.00
8.000	6.375 - 8.375	1288	10		3.00 + 1.125 (no. rings - 1)	16.00	10.00

PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type	Shielded - S Unshielded - U
X	X	X	X	X	

CHARACTERISTICS

RINGS: Coin Silver 5 AMP ring.
Copper 50 AMP ring.

BRUSHES: Silver Graphite.
Fabricast Grade FAG 180 (80% AG — 20% C)
Two brushes per ring.
Brushes individually removable and replaceable

NOISE: 10 Milliohms dynamic resistance MAX.
5 Milliohms MAX with 4 brushes per CKT.

CURRENT: Noted in tabulated block.
Rating may be doubled with 4 brushes per CKT.

HI-POT: 1200 VAC 60 CYCLE for 15 seconds.

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

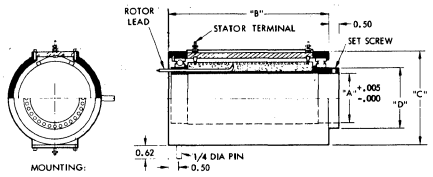
LEADS: 5 AMP Leads — 20 GA. per MIL-W-16878 TYPE "E"
50 AMP Leads — 8 GA. per MIL-W-16878 TYPE "B"

HOUSING: Bell, Bell Spacer and Cover type construction

COVER: Easily removable for brush and ring inspection.

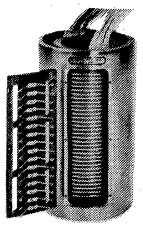
BEARINGS: Shielded or sealed ball bearings.

SLIP RING ASSEMBLY — SELF CONTAINED — RIGID HOUSING



STANDARD METHOD - SLIP RING ASSEMBLY SECURED TO CUSTOMER SHAFT BY SET SCREWS IN ROTOR ASSEMBLY. STATOR RESTRAINED FROM TURNING BY 1/4 DIA PIN IN HOUSING.

OPTIONAL METHOD - STATOR FLANGE MOUNTING WITH DRIVE SLOT IN ROTOR SLEEVE.



BORE DIA "A" INCHES NOM	BORE DIA "A" INCHES RANGE	TYPE	NO. RINGS MAX.	CURRENT AMPS	LENGTH "B" INCHES	HOUSING DIA "C"	SLEEVE EXTENSION DIA "D"
SOLID		1230	100	5 AMP STD 10 AMP OR LO NOISE TWO PARALLEL RINGS	3.50 + .120 (no. rings - 1)	2.50	1.30
.500	000 - .750	1186	50		1.56 + .120 (no. rings - 1)	2.50	1.30
.750	000 - 1.002	1186	40		1.56 + .120 (no. rings - 1)	2.50	1.30
1.000	.750 - 1.252	1197	70		2.50 + .130 (no. rings - 1)	3.50	2.30
1.500	1.250 - 1.752	1289	100		1.56 + .150 (no. rings - 1)	4.00	2.60
2.250	1.750 - 2.252	1067	75		2.06 + .1815 (no. rings - 1)	4.50	2.92
3.000	2.250 - 3.252	1262	60		3.50 + .160 (no. rings - 1)	6.50	5.00
1.000	000 - 2.00	1271	15	50 AMP STD	3.50 + 1.050 (no. rings - 1)	4.50	2.92
3.000	2.00 - 3.252	1291	9	50 AMP STD	4.50 + 1.120 (no. rings - 1)	6.50	5.00

PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems at high RPM

RINGS: Coin Silver 5 AMP Rings. Copper 50 AMP Rings.

BRUSHES: Silver Graphite. Fabricast Grade FAG 180 (80% AG — 20% C). Two brushes per ring. Brushes individually removable and replaceable.

NOISE: 10 Milliohms dynamic resistance MAX. 5 Milliohms MAX with 4 brushes per CKT.

CURRENT: Noted in tabulated block. Rating may be doubled with 4 brushes per CKT.

HI-POT: 1200 VAC 60 CYCLE for 15 seconds.

ROTOR: One piece steel sleeve. Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

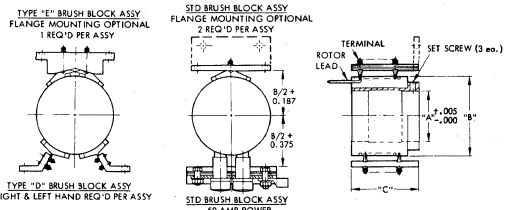
ROTOR LEADS: 5 AMP Leads — 20 GA per MIL-W-16878 TYPE "E". 50 AMP Leads — 8 GA per MIL-W-16878 TYPE "B"

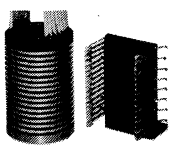
HOUSING: One piece steel tubing construction.

COVER: Easily removable for brush and ring inspection.

BEARINGS: Shielded or sealed ball bearings.

SLIP RING ASSEMBLY — SEPARATE ROTOR AND BRUSH BLOCK





BORE DIA. "A" INCHES NOMINAL	BORE DIA. "A" INCHES RANGE	TYPE	NO. RINGS MAX.	CURRENT AMPS	SLIP RING DIA "B"	LENGTH "C"
SOLID	000 - .127	2050	18	5 AMP STD	.500	.625 + .125 (no. rings - 1)
SOLID	000 - .377	2087	48	5 AMP STD	.875	.625 + .110 (no. rings - 1)
.375	000 - .627	2112	52	5 AMP STD	1.125	.625 + .125 (no. rings - 1)
.750	.62 - 1.002	2150	52	5 AMP STD	1.500	.625 + .120 (no. rings - 1)
1.250	1.00 - 1.502	2237	78	5 AMP STD	2.375	.750 + .130 (no. rings - 1)
1.500	1.25 - 1.752	2268	107	5 AMP STD	2.687	1.000 + .150 (no. rings - 1)
2.000	1.75 - 2.502	2350	78	5 AMP STD	3.500	1.000 + .1815 (no. rings - 1)
2.500	2.37 - 2.875	2375	48	5 AMP STD	3.750	1.000 + .200 (no. rings - 1)
3.000	2.75 - 3.752	2462	58	5 AMP STD	4.625	1.250 + .160 (no. rings - 1)
4.000	3.25 - 4.002	2500	40	5 AMP STD	5.000	1.250 + .250 (no. rings - 1)
5.000	4.00 - 5.002	2600	48	5 AMP STD	6.000	1.250 + .186 (no. rings - 1)
6.000	5.00 - 6.002	2700	63	5 AMP STD	7.000	1.250 + .186 (no. rings - 1)
7.000	6.00 - 7.002	2800	58	5 AMP STD	8.000	1.250 + .1875 (no. rings - 1)
8.000	7.00 - 9.002	2900	58	5 AMP STD	10.000	1.250 + .1875 (no. rings - 1)
1.000	.750 - 1.187	3268	16	50 AMP STD	2.687	2.000 + 1.050 (no. rings - 1)
1.500	1.187 - 1.500	3300	6	50 AMP STD	3.000	2.000 + 1.000 (no. rings - 1)
2.000	1.500 - 2.000	3350	16	50 AMP STD	3.500	2.000 + 1.050 (no. rings - 1)
3.000	2.000 - 3.125	3462	9	50 AMP STD	4.625	2.000 + 1.120 (no. rings - 1)
4.000	3.125 - 4.500	3600	8	50 AMP STD	6.000	2.000 + 1.116 (no. rings - 1)
5.000	4.500 - 5.500	3700	10	50 AMP STD	7.000	2.000 + 1.116 (no. rings - 1)
6.000	5.500 - 6.500	3800	10	50 AMP STD	8.000	2.000 + 1.125 (no. rings - 1)
7.000	6.500 - 8.500	3900	10	50 AMP STD	10.000	2.000 + 1.125 (no. rings - 1)

PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S, Unshielded - U)	Type Brush Block
X	X	X	X	X	X

CHARACTERISTICS

RINGS: Coin Silver 5 AMP Rings. Copper 50 AMP Rings.

BRUSHES: Silver Graphite. Fabricast Grade 180 (80% AG — 20% C). Two Brushes per ring. Brushes individually removable and replaceable.

NOISE: 10 Milliohms dynamic resistance MAX. 5 Milliohms MAX with 4 brushes per CKT.

CURRENT: Noted in tabulated block. Rating may be doubled with 4 brushes per CKT.

HI-POT: 1200 VAC 60 CYCLE for 15 seconds.

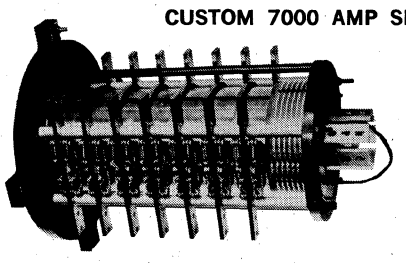
ROTOR: One piece steel sleeve. Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

ROTOR LEADS: 5 AMP Leads — 20 GA per MIL-W-16878 TYPE "E". 50 AMP Leads — 8 GA per MIL-W-16878 TYPE "B"

BRUSH BLOCK: Laminated phenolic. Optional mounting methods shown.

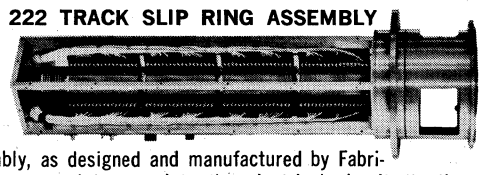
CUSTOM SLIP RING CAPABILITY

CUSTOM 7000 AMP SLIP RING ASSEMBLY



This slip ring assembly, as designed and manufactured by Fabricast, Inc., is used to supply 7000 amperes of current to the rotating mandrel of the world's second largest spin forging machine.

CUSTOM 222 TRACK SLIP RING ASSEMBLY



This slip ring assembly, as designed and manufactured by Fabricast, Inc. was used to complete the electrical circuits to the rotating arm of an astronaut carrying centrifuge.

The unit consists of 50 amp. power, 5 amp. instrumentation and 50 megacycle coaxial modules.

MANUFACTURERS OF SLIP RING ASSEMBLIES PHONE 213 / 443-3247 (S. El Monte)

Fabricast, Inc.

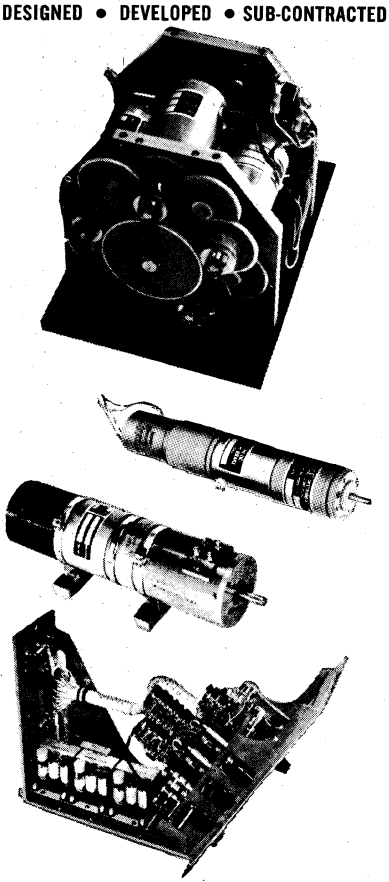
9835 ALPACA STREET, SOUTH EL MONTE, CALIFORNIA PHONE 213 / 283-9239 (Los Angeles)

FAE PRECISION ROTARY COMPONENTS

PRECISION INSTRUMENT PARTS AND COMPONENTS AVAILABLE FROM STOCK!

SPECIAL APPLICATIONS

DESIGNED • DEVELOPED • SUB-CONTRACTED



WE MANUFACTURE—

- CLUTCHES
- BRAKES
- CLUTCH-BRAKES
- DIFFERENTIALS
- GEAR HEADS
- SPEED REDUCERS
- BELLOWS COUPLINGS
- GEAR CLAMPS
- GEAR DEVICES
- SERVO PACKAGING

CUSTOM MADE UNITS—

All components can be custom engineered to your specific applicational requirements and MIL specifications.

EXCELLENT DELIVERY—

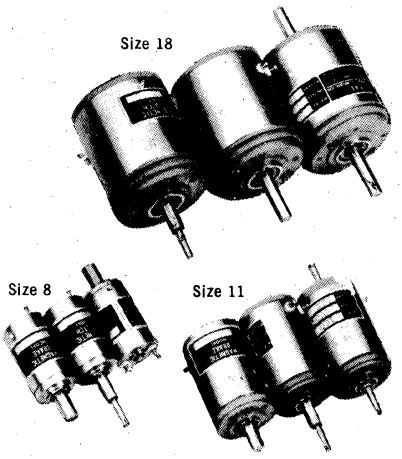
FAE maintains large and complete standard parts inventories. Most popular items are available from stock. Special shafts offer negligible delays.

Engineering Representatives—

FAE Representatives are highly skilled and experienced specialists as well as veteran engineers. Phone or write for immediate service. Consult **eem** for nearest office.

SEND FOR COMPLETE CATALOG ILLUSTRATED WITH DRAWINGS AND DETAILED SPECIFICATIONS

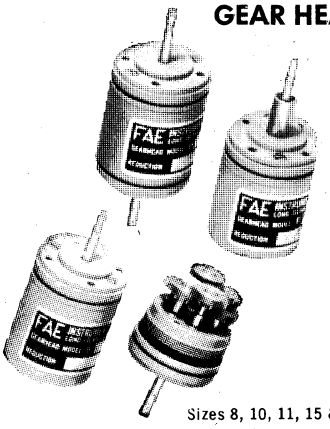
MINIATURE MAGNETIC CLUTCHES • CLUTCH BRAKES • BRAKES



FEATURING—

- ★ Torque range to 100 inch/ounces
- ★ Friction or crown-tooth clutch faces
- ★ Direct action and reverse action types
- ★ Engagement time—3 to 20 milliseconds
- ★ 24-28 Volts, D.C. standard. No delay penalties for special voltages or special shaft configurations.
- ★ Precision ball bearings used throughout
- ★ Designed to meet MIL-E-5272A environmental specifications

GEAR HEAD AND SPEED REDUCERS

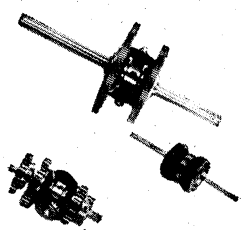


Sizes 8, 10, 11, 15 & 18

FEATURING—

- ★ Precision ball bearings throughout
- ★ Hardened stainless Class II precision gearing
- ★ Large selection of standard ratios. Special exact ratios for timing systems available
- ★ Integral safety slip clutch. Eccentric output shafts, pinion or special output shafts available.
- ★ Special frame sizes, adapters for all non-standard motors

HOLLOW AND SOLID SHAFT PRECISION DIFFERENTIALS

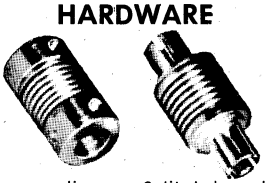


All Sizes to 1/16 Shaft Dia.

FEATURING—

- ★ High accuracy and long life
- ★ Precision ball bearings used throughout
- ★ Hardened stainless steel gearing. Choice of end gears to order
- ★ Simple pinion gear adjustment for desired backlash vs. starting torque
- ★ Zerol 3-bevel, extremely rugged high torque models available
- ★ Sub-miniature 3/32 enclosed planetary type available

PRECISION MINIATURE HARDWARE



Bellows couplings • Split hub and solid hub • Phosphor bronze • Induction soldered Palladium plated • All sizes plus any special.

HARDENED STAINLESS STEEL BALANCED CLAMPS



ALL SHAFT AND HUB SIZES AVAILABLE

FAE INSTRUMENT CORPORATION 16 NORDEN LANE HUNTINGTON STA., N. Y. 11746

SPECIALTY MOTORS

NEW! Cooling-fan Assemblies

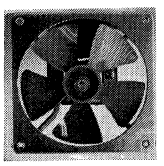
For Electronic-equipment Cabinets

New 100 CFM fan assembly is powered by reliable GE shaded-pole motor and is equipped with a durable, five-blade molded fan and brackets. The two-pole Unitized® motor features a recirculating oil lubrication system for extra long bearing life. The assembly is only 2⅞ inches deep from mounting plate to end of motor, and measures slightly under 4¾ inchs square with mounting holes 4⅛ inches between centers.

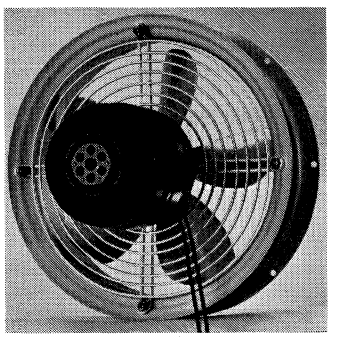
500 CFM fan assembly is powered by GE unit-bearing, four-pole, shaded-pole motor with recirculating oil lubrication system, and includes five-blade metal fan and grill. Measuring less than 6¼ inches deep from front to back, it has a ten-inch diameter fan venturi with eight holes around venturi flange for easy mounting. Also available with two-pole motors for even greater air-flow.

The units, which require only simple ON-OFF switches for operation, are designed for years of quiet, dependable, continuous-duty operation without maintenance. These blowers are available for 115- or 230-volt, 60-cycle duty. 50-cycle designs are available with somewhat lower output. For complete information, write for Bulletin GEA-8258.

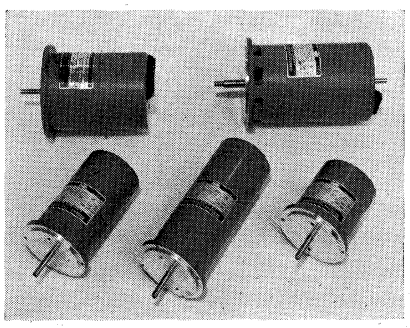




100 CFM fan assemblies



500 CFM fan assemblies



NEW . . . ADVANCED

Hyper-Servo MOTORS* | ***for electronic drives***

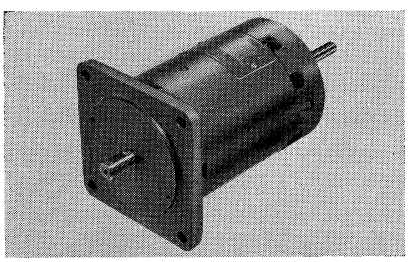
For such demanding computer applications as single-capstan tape transports, disc packs, high-speed printers, card sorters and card readers, General Electric has created this new line of high performance d-c servo motors. The motors respond in less than one millisecond with acceleration rates faster than any motor previously offered by General Electric. Write for Bulletin GEA-8251. Characteristics: Torque-to-inertia ratio approaches one-half million rad/sec^2; pulse torque-to-inertia ratio exceeds one-half million rad/sec^2; inertial time constant is as low as one millisecond; diameter is 3.4 inches and larger; weight is as little as five pounds.

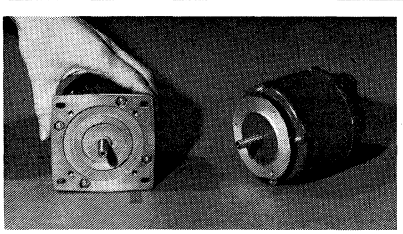
* Trade-mark of the General Electric Company.

Reel Drive Motors

For Computer Tape Transports

GE's full line of fhp direct-current motors includes four frame sizes widely used for reel drives: 3⅝″, 3 13/16″, 4⅝″, and 6⅝″ diameters. Special end mountings and shaft extensions meet exacting application requirements. Series, split-series, compound, shunt, and compensated-shunt winding designs offer a broad design choice. Stall torque ratings from 3 to 120 ounce-feet and higher span various application needs, and motor voltage requirements are normally matched to your system design. Write for Bulletin GEC-1795.





SYNCHRONOUS, REVERSIBLE

Low-speed Gearless Servo Motors

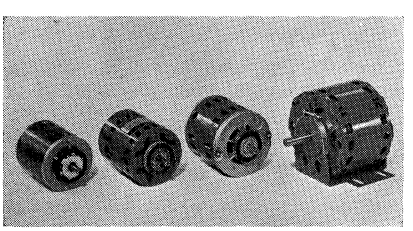
For servo, stepping, and other low-speed high-torque applications, General Electric provides a line of low-speed, synchronous inductor motors in 4⅛-inch diameter models. These motors provide a choice of 50, 75, 150, or 250 oz. in. torque at exactly 75 rpm without the use of speed-reducing devices. The motors provide fast starting, stopping, and reversing for 50- or 60-cycle applications at either 120 or 240 volts. For complete information write for Bulletin GEC-1294.

Small, Compact, A-c Induction Motors

Provide High Power in a Lightweight Package

Small in size, but high in reliability, General Electric compact, powerful, a-c induction motors are available in four sizes from 15 mhp to ½ horsepower. These reversible motors provide consistent, quiet, long-life operation in any mounting position. Synchronous motors for constant-speed applications are available in 3-, 3.4-, and 3⅞-inch diameter models. Special designs can be provided for various torque motor applications such as tape reel drives. For dimensions, features, ratings, and application information, write for Bulletin GEA-8254.

Typical Electronic Applications: Computer memory drums, tape reels, capstans, disc filers, card stackers, card printers, card punchers, and data cells.



For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC



STANDARD PRECISION AC MOTORS

Bulletin No. M-501 — SIZE 5 (.500 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-1218	28	2	400	24,000	.015	1.375
B-1219	28	2	400	12,000	.02	1.375
B-1220	28	2	400	8,000	.01	1.375
B-1221	6.3	2	60	3,600	.02	1.375
B-1222	6.3	2	60	1,800	.02	1.375
B-1223	6.3	2	60	1,200	.01	1.375

These standard motors available with matching precision Size 5 gearheads in a wide range of exact ratios. Gearheads add 1.250 (max.) to length of motor for complete assembly.

Bulletin No. M-801 — SIZE 8 (.750 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-1345	28	2	400	24,000	.06	1.25
B-1346	28	2	400	12,000	.05	1.25
B-1347	28	2	400	8,000	.09	1.25
B-1348	6.3	2	60	3,600	.06	1.25
B-1349	6.3	2	60	1,800	.05	1.25
B-1350	6.3	2	60	1,200	.09	1.25

These standard motors available with matching precision Size 8 gearheads in a wide range of exact ratios. Gearheads add 1.250 (max.) to length of motor for complete assembly.

Bulletin No. M-1001 — SIZE 10 (.950 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-980	26	2	400	8,000	.10	1.312
B-981	26	2	400	12,000	.15	1.312
B-982	26	2	400	24,000	.12	1.312
L-983	26	2	400	7,500	.20	1.312
L-984	26	2	400	11,400	.25	1.312
L-985	26	2	400	23,000	.15	1.312

These standard motors available with matching precision Size 10 gearheads in a wide range of exact ratios. Gearheads add 1.250 (max.) to length of motor for complete assembly.

Bulletin No. M-1101 — SIZE 11 (1.062 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-208	200/115	3	400	12,000	.45	1.375
B-203	115	2	400	12,000	.45	1.375
B-209	28	2	400	12,000	.4	1.375
B-206	115	2	400	8,000	.4	1.375
B-210	26	2	400	8,000	.4	1.375
B-211	115	3	400	6,000	.22	1.375
B-205	28	2	400	4,000	.18	1.375

These standard motors available with matching precision Size 11 gearheads in a wide range of exact ratios. Gearheads add 1.250 (max.) to length of motor for complete assembly.

Bulletin No. M-1301 — SIZE 13 (1.250 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-1251	115	2	400	24,000	.8	2.00
B-1252	115	2	400	12,000	1.0	2.00
B-1253	115	2	400	8,000	.8	2.00
B-1254	115	2	60	3,600	.8	2.00
B-1255	115	2	60	1,800	.9	2.00
B-1256	115	2	60	1,200	.6	2.00

These standard motors available with matching precision Size 13 gearheads in a wide range of exact ratios. Gearheads add 1.50 (max.) to length of motor for complete assembly.

Bulletin No. M-1501 — SIZE 15 (1.437 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-1201	115	2	400	24,000	.75	1.562
B-1202	115	2	400	12,000	1.0	1.562
B-1203	115	2	400	8,000	1.35	1.562
B-1204	115	2	400	6,000	1.45	1.562
B-1205	115	2	60	3,600	1.0	1.562
B-1206	115	2	60	1,800	1.7	1.562
B-1207	115	2	60	1,200	2.0	1.562

These standard motors available with matching precision Size 15 gearheads in a wide range of exact ratios. Gearheads add 1.562 (max.) to length of motor for complete assembly.

Bulletin No. M-1801 — SIZE 18 (1.750 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-1301	115	2	400	24,000	1.25	2.250
B-1302	115	2	400	12,000	1.4	2.250
B-1303	115	2	400	8,000	1.3	2.250
B-1304	115	2	60	3,600	1.6	2.250
B-1305	115	2	60	1,800	2.1	2.250
B-1306	115	2	60	1,200	1.5	2.250

These standard motors available with matching precision Size 18 gearheads in a wide range of exact ratios. Gearheads add 1.625 (max.) to length of motor for complete assembly.

Bulletin No. M-2001 — SIZE 20 (2.00 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-1209	115	2	400	24,000	1.7	1.750
B-1210	115	2	400	12,000	2.0	1.750
B-1211	115	2	400	8,000	3.4	1.750
B-1212	200/115	3	400	6,000	3.2	1.750
B-1213	115	2	400	4,000	2.0	1.750
B-1214	115	2	60	3,600	2.4	1.750
B-1215	115	2	60	1,800	3.0	1.750
B-1216	115	2	60	1,200	4.0	1.750
B-1217	115	2	60	900	4.3	1.750

These standard motors available with matching precision Size 20 gearheads in a wide range of exact ratios. Gearheads add 1.75 (max.) to length of motor for complete assembly.

Bulletin No. M-2501 — SIZE 25 (2.500 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-1276	115	2	400	24,000	4.0	2.750
B-1277	115	2	400	12,000	4.3	2.750
B-1278	115	2	400	8,000	3.3	2.750
B-1279	115	2	400	6,000	2.8	2.750
B-1281	115	2	400	4,000	3.0	2.750
B-1282	115	2	60	3,600	4.0	2.750
B-1283	115	2	60	1,800	5.0	2.750

These standard motors available with matching precision Size 25 gearheads in a wide range of exact ratios. Gearheads add 2.50 (max.) to length of motor for complete assembly.

Bulletin No. M-3301 — SIZE 33 (3.250 DIA.)

MODEL	VOLT	PHASE	FREQ.	SPEED	TORQUE (OZ. IN.)	LENGTH (IN.)
B-1326	115	2	400	24,000	8.0	3.50
B-1327	115	2	400	12,000	10.0	3.50
B-1328	115	2	400	8,000	12.0	3.50
B-1329	200/115	3	400	6,000	8.0	3.50
B-1330	115	2	400	4,000	5.0	3.50
B-1331	115	2	60	3,600	15.0	3.50
B-1332	115	2	60	1,800	16.0	3.50
B-1333	115	2	60	1,200	8.0	3.50
B-1334	115	2	60	900	8.0	3.50

These standard motors available with matching precision Size 33 gearheads in a wide range of exact ratios. Gearheads add 3.25 (max.) to length of motor for complete assembly.

Bulletin No. M-FHP-01 — FRACTIONAL HORSEPOWER

MODEL	VOLT	PHASE	FREQ.	TYPE	H.P. or TORQUE	DIAMETER	LENGTH	SPEED (RPM)
B-266A	115	1	400	Syn.	.2 H.P.	3⅛	4½	12,000
B-642A	115	1	400	Syn.	.04 H.P.	3⅛	4½	4,000
B-907	200/115	3	400	Syn.	.17 H.P.	3¼	4½	8,000
B-812	200/115	3	400	Syn.	.4 H.P.	5½	4.0	12,000
B-1009	200/115	3	400	Syn.	16 oz. in.	6½	2¼	1,500
B-844	115	2	60	Syn.	⅛ H.P.	5½	4.0	3,600
L-916	200/115	3	400	Ind.	.5 H.P.	3¼	3½	11,000
L-818	200/115	3	400	Ind.	.6 H.P.	3⅞	4.0	7,500
L-874	115	1	60	Ind.	1/30 H.P.	3 SQ.	3½	1,600
LS-920	115	2	400	Servo.	50 Watts	3¼	3½	7,500
LS-893	115	2	400	Servo.	100 Watts	3¼	4½	7,500

Several standard units stocked in depth. Write or telephone for delivery.

Gaylord-Rives
AEI AN AMERICAN ELECTRONICS COMPANY

422 S. Pasadena Ave., Pasadena, Calif.
Sycamore 6-5944 (Area Code 213) MUrray 1-3189
Federal Stock Code #16942 Zip Code 91105

APPLIED AC MOTOR EQUIPMENT

STANDARD STOCK GEARMOTORS

Gaylord-Rives Standard Gearmotors feature rugged, economical, planetary gearheads in many different ratios, driven by standardized Size 13 high quality production motors. Maximum package length is 3.062 inches, and mounting is by means of 1⅜" diameter forward flange, with four (4) holes. Shaft diameter is .1875, and standard shaft length is 1.00 inches from the mounting. Write for complete data in Bulletin GM-1301.

TYPE BCH60 SYNCHRONOUS GEARMOTORS 115V, 60 HZ., 1ϕ

Speeds of 800, 545, 400, 272, 266, 181, 177, 121, 88, 82, 60, 59, 41, 40, 39, 27, 26, 19, 18, 13, 12, 9, 8, 6, 5, 4, 3, 2, 1.4, 1.3, .97, .94, .66, .44, .30, .21, .14, .10, .06, .04, and .03 RPM, ± 0.1%

TYPE BCH400 SYNCHRONOUS GEARMOTORS 115V, 400 HZ., 1ϕ

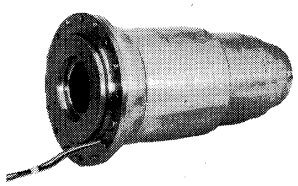
High Performance Military Rated

Speeds of 5333, 3636, 2666, 1818, 1777, 1212, 1185, 808, 592, 550, 404, 275, 269, 263, 183, 179, 131, 122, 89, 87, 83, 61, 59, 58, 41, 40, 39, 29, 27, 20, 19, 18, 13, 12, 9, 8, 6, 4, 3, 2, 1, .91, .67, .45, .31 and .20 RPM, ± 0.1%

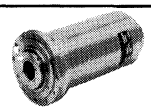
MULTIPLE SPEED MILITARY AC MOTORS

MODEL NO.	SPEED	VOLTS	FREQ.	PHASE	TORQUE (in. oz.)	WATTS	SIZE	LENGTH
B-1373	24000/12000	115	400	1/1	.06/.06	10/9	11	2.0"
B-364A	3600/1800	115	60	1/1	.12/.15	12	11	2.0"
B-1374	12000/6000	115	400	2	.2/.4	23/17	13	2.0"
B-1375	3600/1800	115	60	1	.6/.7	28/22	15	2.0"
B-1344	12000/6000	28	400	2	.7/.6	23/27	15	2.0"
B-122A	12000/6000	24/14	400/200	2	1.5/1.6	30/30	1.5"	2.5"
B-730	3600/1800	115	60	1/1	2/2	21/20	2.5"	2.75"
B-370	12000/6000	115	400	1	.6/.5	24/22	15	2.0"
B-1325	3600/1800	115	60	1	1/1	18/13	18	2.25"
B-808A	6000/3000	115	400	1	1.7/3	30/60	25	2.75"
B-928	1200/900/600	115	60	1	10 in. lbs.	430/400/290	6¼"	9"

HOLLOW SHAFT MOTORS









Gaylord-Rives offers a complete service in the design, development, and supply of Hollow Shaft Motors for use in the fields of radar, optics, and other demanding military and special industrial applications. Many special designs, not listed here, have already been developed, and are available to the system designer. Special housing and bearing materials, adapters for waveguide couplings, balancing services for attached loads, and other engineering services are also provided.

MODEL NO.	BORE DIA.	SPEED	VOLTS	FREQ.	PHASE	DIA.	LENGTH	NOTES
B-1367	¼"	12000	200/115	400	3	1.5"	2.0"	
B-1368	½"	8000	115	400	3	2¾"	3½"	
B-1369	¾"	1800	115	60	2	3½"	4"	
B-1370	1"	600	115	60	2	3½"	4½"	
B-1371	1¼"	600	200/115	60	3	4¼"	4½"	
B-1372	1½"	900	200/115	60	3	5½"	6.0"	
BG-959B	2.08"	1800	200/115	60	3	6⅞"	14¼"	With PM Gen.
BGM-140	1.317"	1800	200/115	60	3	4¼"	10"	With PM Gen.
B-951	1.0"	12000	40	400	1	4½"	4½"	
B-933	1¼"	3600	115	60	½	3⅞"	2.0"	
LGM-131	2.00"	1180/700	200	60	3	11"	9"	With PM Gen.
L-858	2.00"	1760/860	440	60	3	11"	9"	With PM Gen.

LOW SPEED AC MOTORS

Model No.	Speed	Volts	Freq.	Phase	Torque	Watts	Frame	Length
B-1351	3,000	200/115	400	3	.6	15	2.0	2.0
B-1352	450	200/115	60	3	.7	13	2.0	2.0
B-1353	2,000	115	400	½	.60	11	2.0	2.0
B-1354	300	115	60	½	.40	12	2.0	2.0
B-1355	3,000	200/115	400	3	3.5	36	2.5	2.75
B-1356	450	200/115	60	3	4	30	2.5	2.75
B-1357	2,000	115	400	2	1.1	80	2.5	2.75
B-1358	300	115	60	2	1.4	38	2.5	2.75
B-1361	3,000	200/115	400	3	8	60	3.25	4.50
B-1362	450	200/115	60	3	8	40	3.25	4.50
B-1363	2,000	115	400	2	4	100	3.25	4.50
B-1364	300	115	60	2	5	75	3.25	4.50
B-828	1,500	115	400	2	.8	17	2¾	2.0
B-1359	225	115	60	2	.7	20	2.75	2.0
B-1360	360	115	60	2	.7	25	2.75	2.0

LARGER AC MOTORS

MODEL NO.	SPEED	FREQ.	VOLTS	PHASE	RATING	DIA.	LENGTH
B-743	12,000	400	200/115	3	1 HP	5¼"	6"
B-1160A	12,000	400	200/115	3	1½ HP	5½"	10"
B-1365	6,000	400	200/115	3	.6 HP	5½"	6"
B-126	1,500	400	200/115	3	1½ HP	11"	22"
B-956A	1,800	60	200/115	3	1 HP	9½"	12"
LS-675A	1,750	60	200	2	1 HP	7"	14¾"
LS-1366	5,500	400	200	2	1 HP	7"	14¾"
L-1343	11,000	400	200	3	1.0 HP	3¼"	5.0"

PERMANENT MAGNET GENERATORS

BuOrd Size	Poles
5	2
8	2 and 4
11	2 and 4

See Our Ad for Matched Inverters

Inquiries regarding special motor designs are solicited. Many special types not shown have been produced and are available for use in optics, infra-red, underwater application, valve-drives, actuators, etc. etc. Special units also available for space use, or extremely high-vacuum environment. New designs will be proposed for specific applications, including high-temperature, separate rotors and stators, high frequencies, etc.

Special Motor Development

Write for complete catalog information — special proposals promptly supplied.

Gaylord-Rives AEI AN AMERICAN ELECTRONICS COMPANY

422 S. Pasadena Ave., Pasadena, Calif.
Sycamore 6-5944 (Area Code 213) MUrray 1-3189
Federal Stock Code #16942 Zip Code 91105

HORSEPOWER

or

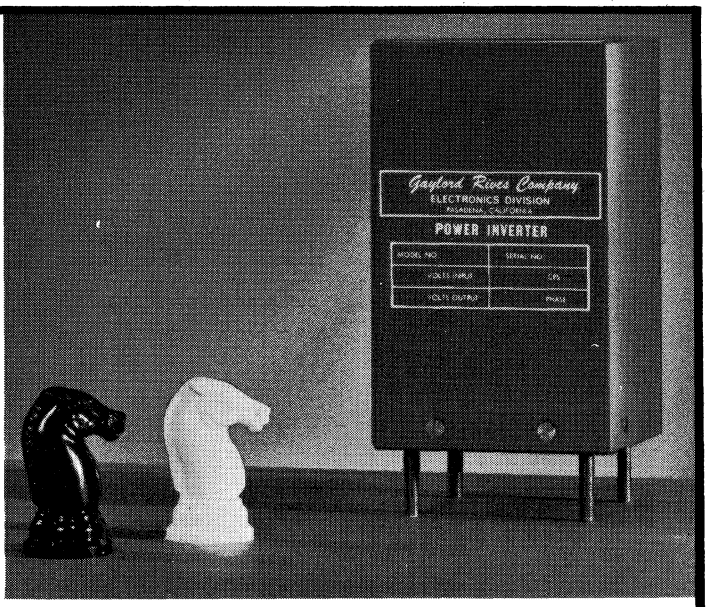
Mini-power?

High motor power, or low, or all through the range between, Gaylord-Rives has matched inverters and motors to meet the demanding specifications for modern inverter/motor systems. All of the motors are also available with precision gearing, allowing an extremely wide range of speeds and torques. Multiple-speed systems, described in separate bulletins, solve many system problems for the designer interested in wide-range dynamic performance.

SPECIAL FEATURES AVAILABLE

- Temperature Compensated Frequency Control to ±¼%
- Mu-Metal Housings for High Shielding of Unit
- Simple, Instant Reversal of Phasing in Two-phase Units
- External Adjustment of Inverter Frequency
- Reverse Polarity and Short-Circuit Protection
- Units can be synchronized from external signal

Fully Developed **Low Cost** **Dependable**



GAYLORD-RIVES MOTOR/INVERTER SYSTEMS

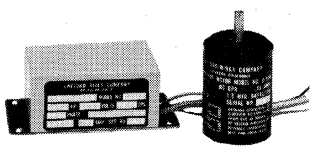
Truly matched, highly efficient and reliable motor and inverters are now available for the system designer, removing problems of coordination between these items, and allowing motors and inverters to work together for the best end result.

Gaylord-Rives **matched motor/inverter combinations** are produced for operation from the 1 watt D.C. range to the 500 watt range, with drive frequencies from 30 CPS to 2000 CPS for both synchronous and induction motors.

Coordinated design between inverter and motor results in proper voltage and current wave shape to the motor, and Gaylord-Rives **Full-Phase Drive** design increases motor performance through elimination of bi-filar motor windings.

Several different package sizes are available, allowing freedom in selection of inverter form factor and correct physical inverter size for the motor to be driven. All units are completely solid-state, mechanically rugged, and components are totally encapsulated against environmental effects.

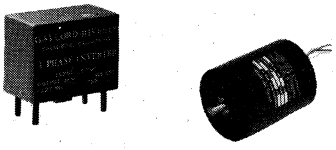
TYPICAL SYSTEM PERFORMANCE



MODEL SIG-24 INVERTER
B-177 MOTOR

System Input: 28 V.D.C.
Motor Output: 1.8 oz. in Torque at 12,000 RPM
Peak Efficiency: 43% (System)
Stall Torque: 2.0 oz. in.
Stall Power: 50 Watts @ 28 V.D.C.
BULLETIN 1M-6802

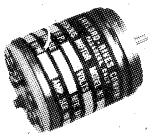
SIZE 18



MODEL SIG-4 INVERTER
B-653B MOTOR

System Input: 28 V.D.C.
Motor Output: 4.3 oz. in Torque at 12,000 RPM
Peak Efficiency: 64% (System)
Stall Torque: 7.5 oz. in.
Stall Power: 110 Watts @ 28 V.D.C.
BULLETIN 1M-6801

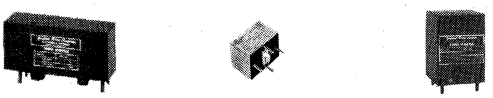
SIZE 25



MODEL SIG-40 INVERTER
B-921 MOTOR

System Input: 23.5 V.D.C.
Motor Output: .25 oz. in. Torque at 2000 RPM
Peak Efficiency: 26% (System)
Stall Torque: .20 oz. in.
Stall Power: 1.7 Watts @ 23.5 V.D.C.
BULLETIN 1M-6803

LOW POWER **SIZE 15**



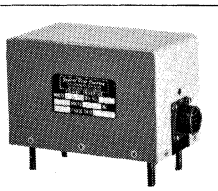
OTHER INVERTER PRODUCTS

Model	Input	Output	No. Phases	Rating	Freq.
SIG-4	28 V.D.C.	28 V.	2	120 W.	400 Hz.
SIG-5	28 V.D.C.	115 V.	1	60 W.	400 Hz.
SIG-8	28 V.D.C.	28 V.	2	200 W.	400 Hz.
SIG-25	28 V.D.C.	28 V.	1	20 W.	180 Hz.
SIG-27	28 V.D.C.	28 V.	1	15 W.	30 Hz. Up
SIG-31	28 V.D.C.	28 V.	1	15 W.	400 Hz.
SIG 42	28 V.D.C.	28 V.	2	300 W.	400 Hz.

WRITE FOR BULLETIN I-6801

MODEL SIG-47

Input: 115V, 60 Hz, One Phase
Output: 115V, 400 Hz, One Phase, Sq. Wave, Frequency Adjustable ±5%, 60 W.



NEW 60/400 Hz Frequency Changer

Write for complete catalog information — special proposals promptly supplied.

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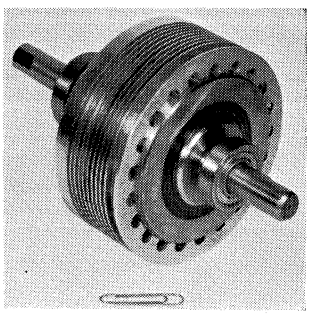
GEMCOR

ELECTRO MECHANICAL COMPONENTS



HYSTERESIS CLUTCHES & BRAKES

offer maximum reliability — smooth clutching — minimum maintenance. They are ideal for tension control and power absorption devices where smoothly variable slip torque is required. Torque is proportional to control current. Clutch-brake combinations also available.

SPECIFICATIONS	MODELS					
	PMC-6 PMB-6	PMC-16 PMB-16	PMC-30 PMB-30	PMC-35 PMB-35	PMC-120 PMB-120	
TORQUE - RATED OZ. IN.	6	16	30	35	120	
OUTPUT INERTIA SLUG FT^2	1.55×10^{-6}	3.03×10^{-6}	5.5×10^{-6}	6.3×10^{-6}	5.4×10^{-5}	
CONTROL WATTAGE	2.5	4.5	5	12	5	
	PMC-175 PMB-175	PMC-325 PMB-325	PMC-.75K PMB-.75K	PMC-1.5K PMB-1.5K	PMC-3K PMB-3K	PMC-5K PMB-5K
TORQUE - RATED OZ. IN.	175	325	750	1500	3000	5000
OUTPUT INERTIA SLUG FT^2	1.5×10^{-4}	2.0×10^{-4}	6.3×10^{-3}	1.26×10^{-2}	2.68×10^{-2}	4.05×10^{-2}
CONTROL WATTAGE	3	7	8.1	17	25	6

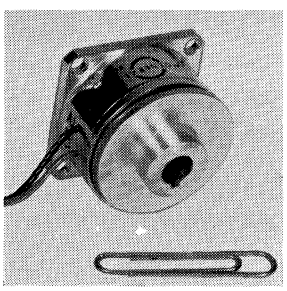
FIXED FIELD TYPE HYSTERESIS CLUTCHES also available. This type does not require commutator and brushes.

FRICTION CLUTCHES & BRAKES — FLANGE MOUNTED

LOW COST • HIGH TORQUE • LOW CONTROL POWER • FAST RESPONSE
MIN. EFFECT BY AMBIENTS

SPECIFICATIONS	MODELS						
	FC-25 FB-25	FFC-35 FFB-35	FFC-60 FFB-60	FFC-160 FFB-160	FFC-480 FFB-480	FFC-960 FFB-960	FFC-3.5K FFB-3.5K
TORQUE - RATED OZ. IN.	25	35	60	160	480	960	3500
OUTPUT INERTIA - SLUG FT.^{2}	1.06×10^{-6}	2×10^{-6}	2.8×10^{-5}	5.11×10^{-6}	1.7×10^{-5}	6.56×10^{-5}	5.86×10^{-4}
CONTROL WATTAGE	3	6	3.6	9	10	10	30

CLUTCH-BRAKE COMBINATIONS AVAILABLE

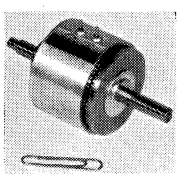


FAIL-SAFE BRAKES

FOR POSITIVE SHAFT BRAKING
WHEN POWER FAILS PREVENTS
CREEPING • COASTING • HUNTING
Torque Ranges 8 to 7000 oz. in.

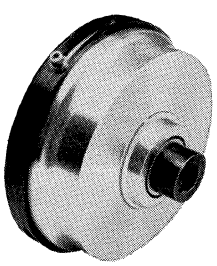
CROWN TOOTH CLUTCHES & BRAKES

MAX. TORQUE — MIN. SIZE
POSITIVE ENGAGEMENT
LOW CONTROL POWER
FAST RESPONSE



DYNAMOMETERS

GEMCOR WILL DESIGN NON-STANDARD INSTRUMENT TYPE DYNAMOMETERS TO CUSTOMER'S EXACT REQUIREMENTS. SUBMIT FULL PARTICULARS.



NEW!

ADJUSTA-TORQ
CLUTCHES & BRAKES

- CONSTANT REPEATABLE SLIP TORQUE
- LIFE LIMITED ONLY BY BEARINGS
- CAN BE RUN IN OIL

USE AS A TORQUE LIMITING SLIP DEVICE, CLUTCH COUPLING, CONSTANT DRAG BRAKE OR IN TENSIONING APPLICATIONS.

POWER SUPPLY UNITS

TO CONVERT A.C. CURRENT TO D.C. FOR OPERATING ALL TYPES CLUTCHES & BRAKES.

VARIABLE AND FIXED VOLTAGES.

COMPACT DESIGN.

SPECIALS

GEMCOR WILL DESIGN NEW UNITS OR MODIFY EXISTING UNITS TO SUIT CUSTOMER'S SPECIAL REQUIREMENTS. THIS SERVICE IS AVAILABLE ON HYSTERESIS, FRICTION, CROWN TOOTH, MAGNETIC PARTICLE AND SUBMINIATURE TYPES.

GENERAL ELECTRO-MECHANICAL CORP.
BUFFALO 7, NEW YORK

GEMCOR

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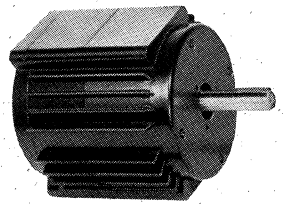
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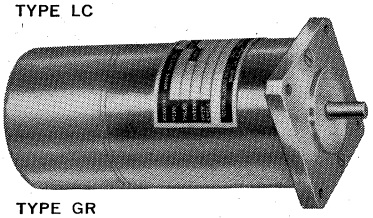
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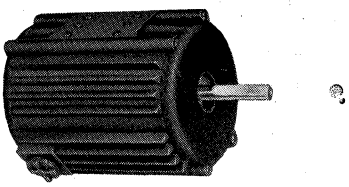
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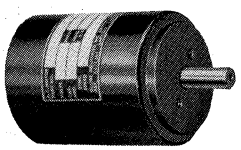
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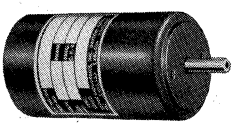
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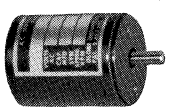
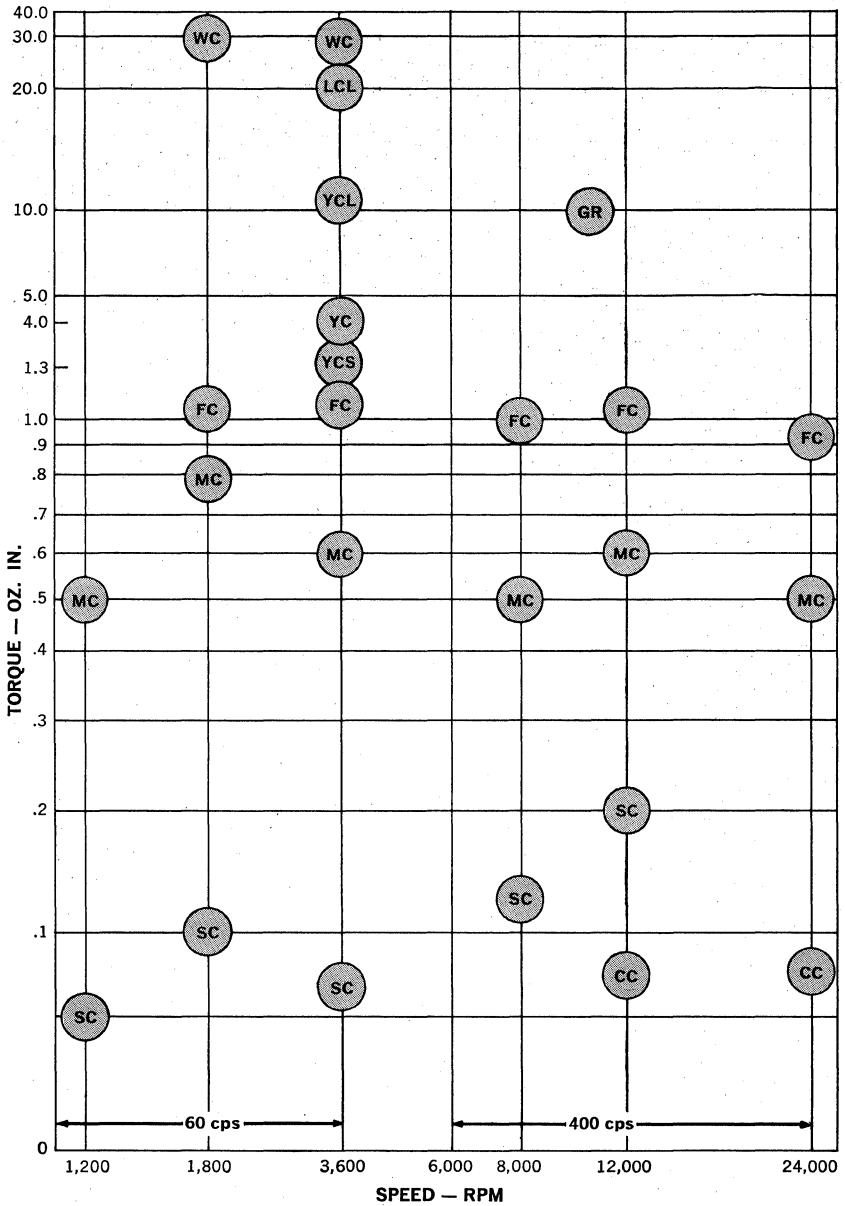

TYPE SC


TYPE CC



GLOBE MIL-SPEC A.C. MOTORS COVER THE TORQUE MAP

Comparable performance units, but with relaxed environmental specs are available. These are custom designed for commercial/industrial high volume OEM applications. Please inquire.

TYPE	DIA. (")	LENGTH (")	VOLTAGE	POLES	WEIGHT (oz.)
WC	3½	4½	115 v.a.c.	Consult Factory	
LC	3¾	3 5/32*	to 208 v.a.c.	2, 4	72.0
GR	2¼	4 1/32	115 v.a.c./v.d.c.	2	36.0
YCS	2¾	1 15/16**	to 230 v.a.c.	2, 4, 6	26.0
FC	1 1/16	2¼	to 200 v.a.c.	2, 4, 6, 8	11.5
MC	1¼	2¼	to 200 v.a.c.	2, 4, 6	6.5
SC	1 1/16	1 5/16	to 200 v.a.c.	2, 4, 6	2.4
CC	21/32	1 3/16	to 26 v.a.c.	2, 4	2.0

*LCL 3 27/32 **YC 2 7/16, YCL 3 7/16

When you need helpful service in precision miniature and small motors, check first with Globe. Catalog standard a.c. motors are rated above; custom units also available. Globe hysteresis synchronous motors deliver exact speeds. Induction units produce giant torques for their size. Both types are available with standard integral planetary geartrains to match your speed-torque requirements. Request catalog AC-66.

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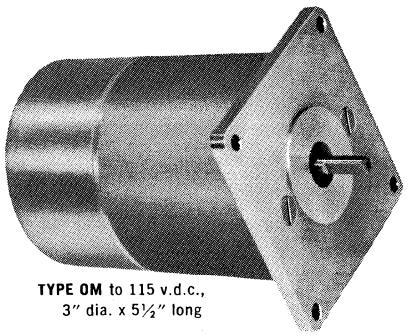
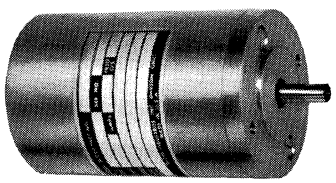


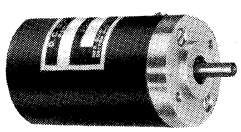
TYPE OM to 115 v.d.c., 3″ dia. x 5½″ long



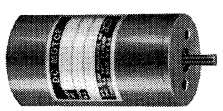
TYPE GRP to 115 v.d.c., 2¼″ dia. x 3¾″ long



TYPE BL to 115 v.d.c., 1½″ dia. x 2 15/16″ long



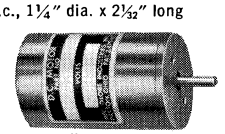
TYPE BD to 115 v.d.c., 1½″ dia. x 2 7/16″ long



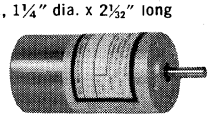
TYPE LL to 75 v.d.c., 1¼″ dia. x 2⅜″ long



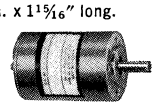
TYPE JM to 115 v.d.c., 1¼″ dia. x 2 1/32″ long



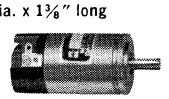
TYPE MM to 50 v.d.c., 1¼″ dia. x 2 1/32″ long



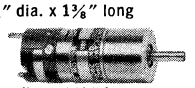
TYPE HM to 75 v.d.c., 1″ dia. x 1 15/16″ long.



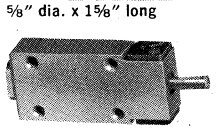
TYPE SS to 50 v.d.c., ⅞″ dia. x 1⅜″ long



TYPE SD to 50 v.d.c., ¾″ dia. x 1⅜″ long

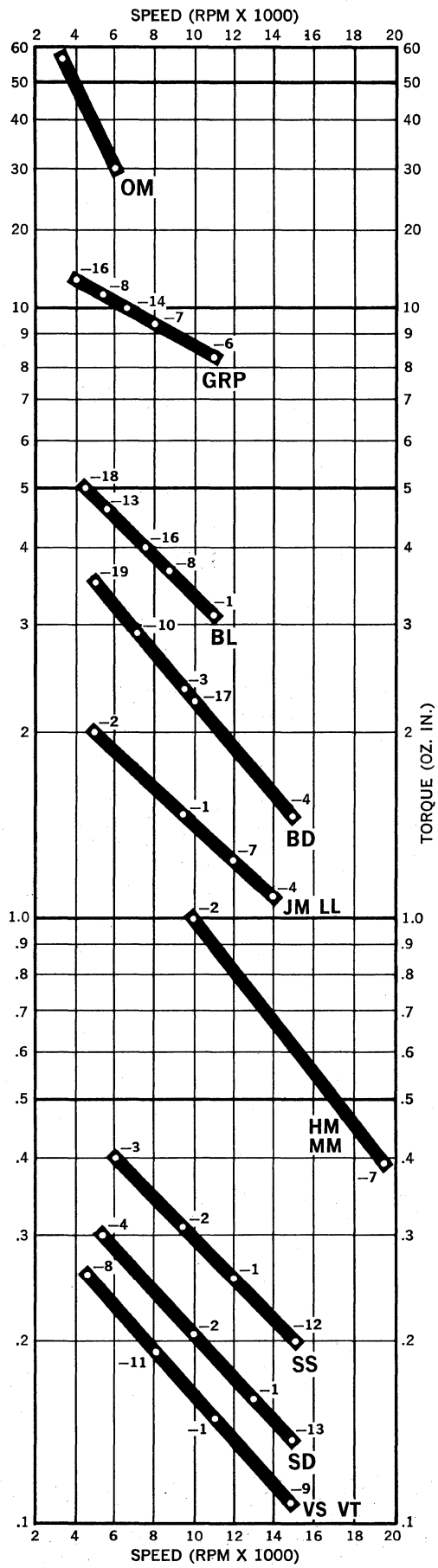


TYPE VT to 50 v.d.c., ⅝″ dia. x 1⅝″ long



TYPE VS to 50 v.d.c., ⅞″ x 7/16″ x 1⅞″ long

RELATIVE SIZE & DIMENSIONS



Your best source for MIL-spec D.C. motors

Globe makes it easy to get the motors you need by the thousands or one at a time. Most applications requiring small d.c. motors can be met with Globe catalog standard units. A few standard armatures are shown. Integral geartrains can be supplied in a variety of ratios. We also maintain a shelf stock of many units for 24-hour prototype shipment. Globe's complete line of compact, permanent magnet and wound field motors adds up to your best source for precision miniature d.c. motors and gearmotors. Request catalog A, for details.

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2275 Stanley Ave., Dayton, Ohio 45404, Tel: 513 222-3741

GLOBE

Higher and lower speeds can be furnished with reduced performance. Only permanent magnet types shown. Dash numbers indicate armatures and represent the normal rated load point for a specific motor. For wound field types, a.c. motors, gearmotors, and blowers, contact Globe.

Comparable performance units, but with relaxed environmental specs are available. These are custom designed for commercial/industrial high volume OEM applications. Please inquire.

GRAPHALLOY

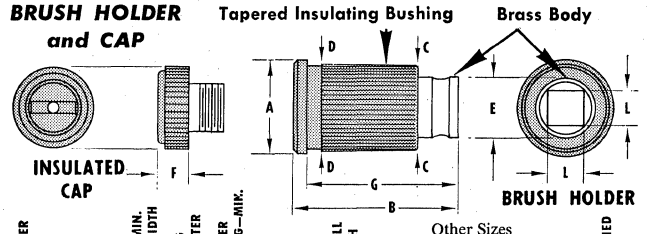
SILVER GRAPHALLOY BRUSHES and BRUSH & SLIP-RING ASSEMBLIES . . .

GRAPHALLOY BRUSHES

are used on such equipment as . . . **SERVO SYSTEMS • SYNCHROS • CHOPPERS • RADAR • GYROS • INVERTERS • THERMOCOUPLE and STRAIN GAGE CIRCUITS • GUIDED MISSILES • PULSE SYSTEMS • DIGITAL COMPUTERS • WAVE GUIDES • SONAR • TRANSDUCERS • TORQUE INDICATORS**

Silver GRAPHALLOY Brushes have been widely used because *of* LOW *and* CONSTANT CONTACT DROP, EXTREMELY LOW ELECTRICAL NOISE *and* LONG LIFE. Over 200 grades are now serving in a wide variety of applications. Silver GRAPHALLOY Brushes on ½"-diameter coin silver slip rings have operated successfully in highly critical electrical circuits at speeds up to 100,000 R.P.M. *Our Engineering Department will assist in determining the exact grade of* GRAPHALLOY *for your needs.* Ask for our Brush Inquiry Form 109.

BRUSH HOLDER and CAP



BRUSH HOLDER & CAP NO.	BRUSH SIZE	SUGGESTED MIN. SLIP-RING WIDTH	**MOUNTING HOLE DIAMETER	BRUSH HOLDER TO SLIP RING—MIN.	A	B	F	C	D	E	G	L
						OVERALL LENGTH						BROACHED HOLE
14326	1/8" sq.	3/16"	13/32"	1/16"	.437"	7/8"	3/16"	.404"	.418"	.281"	25/32"	.129"
11509†	5/32" sq.	1/4"	13/32"	1/16"	.437"	7/8"	3/16"	.404"	.418"	.281"	25/32"	.160"
11570†	3/16" sq.	1/4"	7/16"	1/16"	.484"	7/8"	3/16"	.441"	.451"	.313"	25/32"	.193"
19011†	1/4" x 3/16"	5/16"	9/16"	1/8"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256 x .193"
11527†	1/4" sq.	5/16"	9/16"	1/8"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256"
14292†	3/8" x 1/4"	7/16"	43/64"	1/8"	.718"	1 7/16"	1/4"	.672"	.682"	.533"	1 5/16"	.382 x .256"
12166†	3/8" sq.	7/16"	13/16"	1/8"	.921"	1 13/16"	1/4"	.813"	.828"	.628"	1 5/8"	.382"
31392†	1/2" sq.	9/16"	1 1/8"	1/8"	1.237"	1 13/16"	1/4"	1.126"	1.141"	.878"	1 9/16"	.503"
35439†	3/4" x 1/2"	7/8"	1 33/64"	1/8"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"
35440†	3/4" sq.	7/8"	1 33/64"	1/8"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"

†Shunts are provided. **Mounting hole diameter for brush holder dimension D.

Request and fill in Brush Inquiry Sheet, Form 109, so that we can supply the proper grade of brush material.

SLIP RINGS
Solid Coin Silver

Standard Coin Silver Slip Rings, both *cylindrical* and *flat* types, are illustrated at right. We recommend the cylindrical type rings with three brushes per ring . . . spaced at 120°. The cylindrical type are designed for press fitting over standard steel shafting. The flat type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type or slip-ring assemblies can be furnished with leads attached.



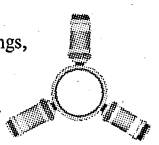
No. 168 Series flat type **to 20" O.D.**

Standard "Flat" rings have ¼" radial contact surface and ⅛" radial spacing between adjacent rings.

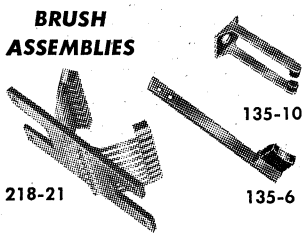


No. 116 Series cylindrical type **to 36" O.D.**

Copper Slip Rings, flat or cylindrical, are available.



BRUSH ASSEMBLIES



CONTACTS

GRAPHALLOY, because of its inherent non-welding and arc-quenching characteristics, is used widely for contacts. Ask for Data Sheet 950.

BUSHINGS, Oil-free



Replace oil-lubricated bushings in synchros, instruments, timers and missiles.

Advantages: 1) Lower friction at room temperatures. 2) No oil to solidify at low temperatures. 3) No oil to carbonize at prolonged elevated temperatures.

*Ask for Data Sheets 270 and 277 on Miniature Bronze-*GRAPHALLOY *Bushings.*

CONNECTORS

(garter springs)



These silver-plated coil spring Connectors make for positive electrical connection to the brass body of the brush holder by snapping into the groove on the holder. The connecting lead can be pre-soldered to the Connector.

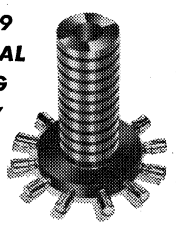
GARTER SPRING CONNECTORS	BRUSH SIZE	BRUSH HOLDER NO.
127-9	1/8" sq.	14326
127-9	5/32" sq.	11509
127-10	3/16" sq.	11570
127-14	1/4" x 3/16"	19011
127-14	1/4" sq.	11527
127-18	3/8" x 1/4"	14292
127-20	3/8" sq.	12166
127-24	1/2" sq.	31392
127-32	3/4" x 1/2"	35439
127-32	3/4" sq.	35440

CLUTCH FACINGS and CLUTCH GEAR ASSEMBLIES



Torque remains same within close operating limits despite changes in temperature and humidity. For instrumentation, guided missiles, constant friction devices.

Model 319 CYLINDRICAL SLIP-RING assembly

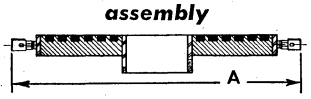


Solid Coin Silver Rings

MODEL	RINGS	LENGTH
319-4	4	2 9/16"
319-6	6	3 5/16"
319-10	10	4 13/16"
319-14	14	6 5/16"

O.D. Slip-ring 1⅝" Terminal 4" Assembly I.D.: .814"/.813" Range: Same as for Model 399

Model 409 FLAT SLIP-RING assembly



Solid Coin Silver Rings

MODEL	RINGS	OVERALL O.D.—"A"
409-2	2	5½"
409-4	4	7"
409-6	6	8½"
409-10	10	11½"

Hub: O.D. 2" I.D. 1.753"/1.751" Length 1⅛" To 5 amps., 125 v. More rings on application.

SPRING BINDING POSTS

(with or without Insulated Cap)

O.D.: ⅜", ½", 17/32"
Lgth.: ⅝", ¾", 25/32"

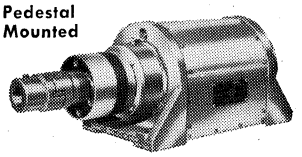
Also Miniature Spring Type!



19185 22978

Model 399 BRUSH and SLIP-RING assembly

Pedestal Mounted



MODEL	RINGS	bolt slot distances CL to CL WIDTH	bolt slot distances CL to CL LENGTH	**OVERALL LENGTH
399-4	4	4½"	7¾"	13¼"
399-6	6	4½"	8½"	14"
399-10	10	4½"	10"	16"
399-14	14	4½"	11½"	18"

Specifications: Width 6½"—Height 6½".Shaft CL above base 3¼".
Applications: from strain gage or thermocouple up to 5 amperes, 125 volts, 250°F.
Speeds to 5,000 RPM.
Three Silver-GRAPHALLOY Brushes per solid coin silver slip ring.
Extraneous noise level low.
Rugged in design and construction.
Readily connected mechanically and electrically.
Complete coupling provided for 15/16" shaft.
More rings and higher speeds available upon application.

Write for data sheets

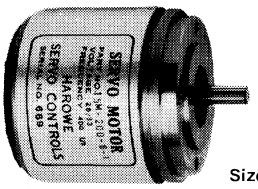
CALL ON OUR OVER 50 YEARS OF DESIGN EXPERIENCE FOR HELP IN SOLVING YOUR BRUSH PROBLEMS!

GRAPHITE METALLIZING CORPORATION : 1036 NEPPERHAN AVENUE YONKERS, NEW YORK 10702

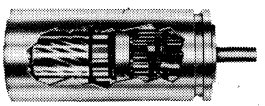
Harowe SERVO, STEPPER & SYNCHRONOUS MOTORS

SERVO MOTORS

- Standard: Sizes 5, 8, 10, 11, 15 and 18 . . . 60 and 400 Hz
- Braked, viscous-damped, inertially damped, and high acceleration types available
- Also BuWeps and QPL types
- 2, 4, 6, or 8 poles
- Wide choice of torque and speed ratings plus mechanical options
- Low starting voltage: typically 2% of control voltage
- High torque per watt efficiency
- Integral-gearhead types have one-piece stainless steel case for better cooling.
- **Throughbore** construction guarantees maximum alignment accuracy by simultaneously grinding the I.D. of stator, bearing cap, and housing in one pass.

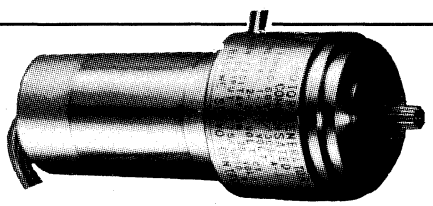


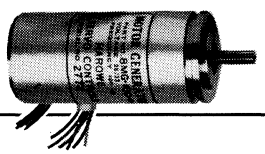
Size 15


Size 8 with Integral Gearhead

MOTOR-GENERATORS & INTEGRATING TACHOMETERS

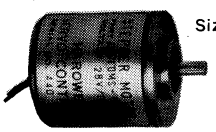
- Standard: Sizes 5, 8, 10, 11, 15, and 18 . . . 60 and 400 Hz
- Damping, rate, and integrating types available
- Also high acceleration — low inertia types
- Short length designs available for space-critical applications
- Outputs up to 4 volts/1000 rpm (uncompensated types)
- **Integrating Tachometers** — Temperature-compensating thermistors operate below 10% of rated dissipation for long life. Typical linearity: ±0.25% from −55° to 125°C.

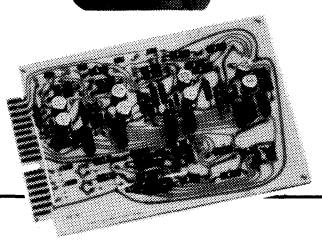

Size 11 Integrating Tachometer with Size 15 Motor


Size 8 Motor-Generator

STEPPER MOTORS & CONTROLLERS

- Standard: Sizes 5, 8, 10, 11, 15, 18 and 23
- High stepping rates — a product of high stall torques and low rotor inertia
- Permanent Magnet and Variable Reluctance types
- Stepping rates to 1000 steps/second synchronizing; 8000 slewing
- Step angles of 15°, 30°, 45°, 60°, and 90° standard
- Stepping accuracy — 2% non-cumulative
- **Complete line of logic controllers** incorporate Schmitt trigger circuit permitting either sine or square-wave inputs. Industrial types employ printed circuit cards; military types in hermetically sealed cans.


Size 10 Stepper Motor


Industrial Type Controller

SYNCHRONOUS MOTORS

- Sizes 5, 8, 10, 11, 15, 18, 23 and 25
- Single, 2, and 3-phase winding; 2 to 8 poles
- Patented design gives highest torque per watt
- Pull-in torque always exceeds pull-out torque — assuring synchronization
- BuWeps and pancake types
- Special designs for fast acceleration, minimum power input, minimum flutter
- Available with integral gearheads — motor and gearhead combinations are the shortest available
- All motors can be driven by sine or square-wave sources.


Size 11 Synchronous Motor

Write for complete specs.
Or call 215-692-2700
(TWX 510-663-0335)
for price and delivery.
You'll like the answers!

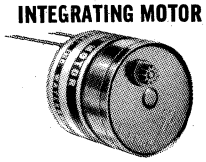
Harowe SERVO CONTROLS, INC.

48 WESTTOWN ROAD • WEST CHESTER, PA. 19380
Precision Synchros Too — See Section 4900, Page 2667

H·S·I® ELECTRO-MECHANISMS

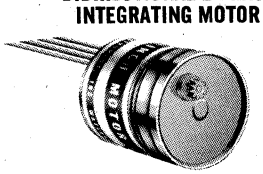
Advanced concepts for integration of electrical and mechanical energy into useful components and systems.

SERIES 33000 "BIG INCH" SINGLE PHASE, SYNCHRONOUS INTEGRATING MOTOR



Ideal drive for elapsed time indicators, stop clocks, pulsers and interrupters, chart drives. **Fast Start-Stop:** Rotor locks in on first line frequency cycle; stops instantly without coast. **Compact:** Approximately 1" diameter by 1" long. **High Torque:** Higher than many motors twice its size. **Low Wattage:** One watt input at rated voltage. Standard voltage ratings 20V and 115V 60 Hz. Cool operation. **Unidirectional:** Shaded pole starting. No mechanical no-backs. **Sealed Gears:** Heavy duty, permanently lubricated. Standard speeds 360, 300, 60 and 3.6 RPM. **Low Cost:** For high volume applications. Tooled for mass production.
Reference: Bul. No. 33-1

SERIES 33600 "BIG INCH" BIDIRECTIONAL 2-PHASE INTEGRATING MOTOR

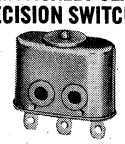


Instantly reversible by switching capacitor from one coil to the other.

The fast start/stop and reversing characteristics of 33600 series motor makes it ideally suited for control functions where shafts, potentiometers, indicators, etc. must be precisely positioned.

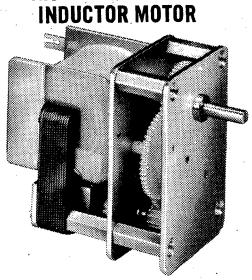
The motor can "inch" in either direction in small increments and stop without coast. **Compact:** Approximately 1" in diameter by 1¼" long. Standard voltage ratings 20V and 115V 60 Hz 2 watt. Other characteristics same as for 33000 series motor.
Reference: Bul. No. 33-2

SERIES 6100 HERMETICALLY SEALED PRECISION SWITCHES



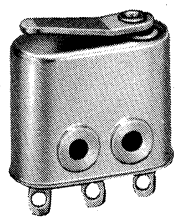
Patented Elastomer Seal and one-piece snap action blade performs reliably under extreme vibration conditions. **Temp. rating:** −65° +300°F. Available to +400°F. **Electrical ratings:** 28 VDC/115 VAC. 5 amp resistive, 3 amp inductive. Meets requirements of MIL-S-8805. **Actuators:** Leaf, roller, toggle and push button. Low operating force.
Reference: Cat. No. 72

SERIES 38 A.C. SYNCHRONOUS INDUCTOR MOTOR



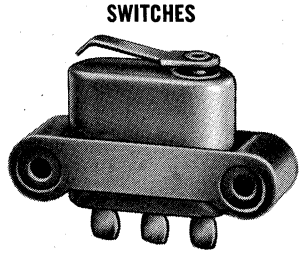
High Torque: Low power input. **Instant Start:** Locks in with line frequency within one cycle. No mechanical device needed to insure correct rotation. Readily adaptable to chart and other drives requiring constant speed output. **Compact:** 1¼" x 1 13/16" x 2". Standard speeds 60, 30, 20, 10 rpm.
Reference: Bulletin No. 38-1

SERIES 6300 HERMETICALLY SEALED PRECISION SWITCHES



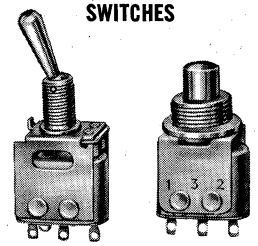
Housing: Corrosion resistant housing with integral wobble diaphragm. One piece snap action blade as in 6100 Series, proven in years of performance. **Standard rating:** −85°F +300°F. **Electrical ratings:** 28 VDC/115 VAC. 5 amps resistive, 3 amps inductive, 3 amps motor. Meets requirements of MIL-S-8805. **Operating force:** recommended for extreme environmental conditions.

SERIES 6200 HIGH TEMPERATURE HERMETICALLY SEALED SWITCHES



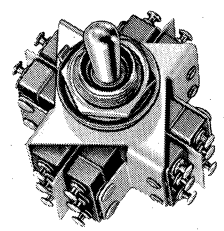
With metal to metal and glass to metal seals corrosion resistant steel base and housing heliarc welded to avoid use of fluxes normally used in solder sealing. Actuator operates switch through metal diaphragm integral with housing. **Standard rating:** −65° +660°F. **Electrical ratings:** 28 VDC/115VAC: 5 amps resistive, 3 amps inductive, 3 amps motor. Meets requirements of MIL-S-8805.
Reference: Cat. No. 72

PUSH-BUTTON AND TOGGLE ACTUATED, HERMETICALLY SEALED SWITCHES



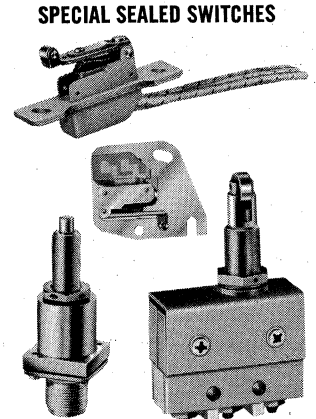
Incorporate Series 6100 basic switch to meet requirement of MIL-S-8805, enclosure 4. Also available with 6300 Series switch to meet enclosure 5 requirements of MIL-S-8805. Toggle switches are available in various configurations of one-pole and 2-pole, 2-position and 3-position. Push-Button switches are single or double pole, momentary. Corrosion resistant materials used throughout.
Reference: Bul. No. 61T-1

SERIES 5300 4 WAY TOGGLE SWITCH



2 pole double throw each position. Center off. Momentary contact, maintained contact, or combinations. 28 VDC/115 VAC: 5 amps resistive, 3 amps inductive. **Reference: Bul. No. 53T-3.** Available with water tight panel seal.

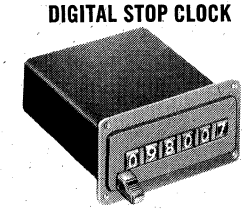
SPECIAL SEALED SWITCHES



H.S.I. has had years of experience in providing answers to difficult switching problems. Let our engineers help you.

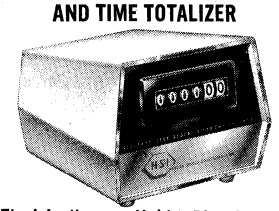
For information on all product lines, send for Catalog 101; and for complete data on individual products, refer to Bulletin Number indicated.

SERIES 42 HIGH SPEED DIGITAL STOP CLOCK



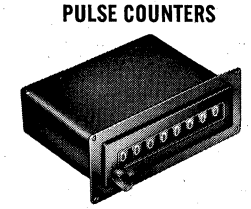
Planetgear® totalizer measures or integrates time intervals in 1/100 second increments. Operates on 115V 60 Hz line power. Time readings displayed in large easily read numerals. Available with 6 or 8 digits. Non-reset, manual reset or electrical reset. Accurate — long life.
Reference: Bul. No. 42-3 for panel mounting models.

SERIES 42005 DIGITAL STOP CLOCK AND TIME TOTALIZER



Electrically resettable Planetgear® totalizer enclosed in attractive instrument type case with line cord, remote reset switch and cord for laboratory use. Totalizes in 1/100 second increments to 9999.99 seconds on 115V 60 Hz supply.

SERIES 44 PLANETGEAR® PULSE COUNTERS



Non-Reset, Manual Reset, Electrical Reset Models. AC or DC comprise unique Planetgear digital counter driven by an HSI stepper motor. Large 5/16" high figures easily read. Long life, reliable. Pulse rate: up to 40 PPS standard; up to 100 PPS on special order. 6 and 8 digits standard.
Reference: Bul. No. 44-1R

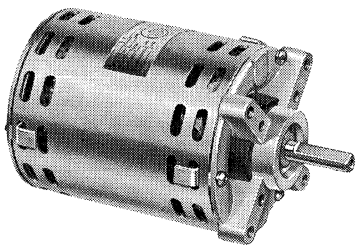
H·S·I®

HAYDON SWITCH & INSTRUMENT, INC.

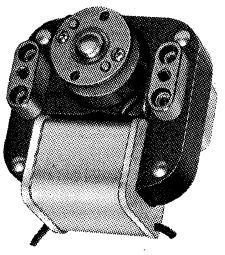
Where Optimum Performance is Standard

1500 Meriden Road, Waterbury, Conn. 06720
Area Code (203) 756-7441

COMPUTER-RATED FRACTIONAL HORSEPOWER MOTORS



When Howard rates a motor 1/20 hp, we're not about to under-power your system with a 1/25 hp motor. We always True Rate our fhp motors this way. Our computer guarantees it . . . and your products benefit.



A-LINE SHELL FRAME INDUCTION MOTORS
- Permanent Capacitor
- Capacitor Start
- Reluctance Synchronous
- Hystersis Synchronous
- Variable Speed Permanent Capacitor

B-LINE CAST FRAME INDUCTION MOTORS
- Permanent Capacitor
- Reluctance Synchronous

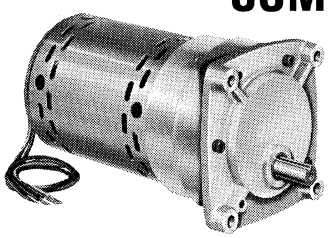
DC SHUNT MOTORS

SHADED POLE MOTORS
- U-Line Unit Bearing
- K-Line Skeleton—Conventional Bearing
- Variable Speed

UNIVERSAL MOTORS
- B-Line Cast Frame
- D-Line Cast Case
- A-Line Shell Frame

SAME-DAY SHIPMENT OF STANDARD MODELS

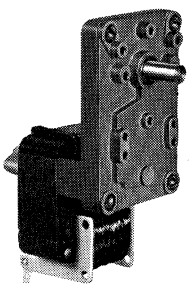
COMPUTER-MATED GEARMOTORS



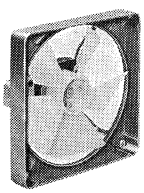
Howard gear trains and motors are computer-mated and computer-rated. This means that when Howard matches and rates a gearmotor, it's a true rating for your job. It means, too, that no Howard Gearmotor will ever destruct or destroy itself . . . or your system.

INDUCTION • UNIVERSAL AC/DC • RELUCTANCE SYNCHRONOUS • SHADED POLE

SAME-DAY SHIPMENT OF STANDARD MODELS

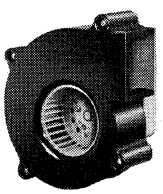


FANS & BLOWERS GUARANTEED FIVE YEARS



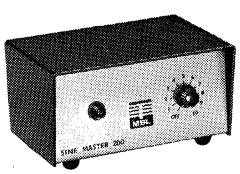
Our modest 5-year guarantee on Howard Fans and Blowers is based on an engineered lifespan of 10 years. And our customers report the fans are still blowing strong 12 or even 14 years after installation. More than 10 million successful installations.

- **Unit Bearing motor**
- **Indestructible nylon blades**
- **UL yellow card listing**
- **All metal construction**
- **Fans standard mount on 4⅛" centers**



SAME-DAY SHIPMENT OF STANDARD MODELS

NEW SINE MASTER SOLID STATE AC MOTOR SPEED CONTROLS for HOWARD Fractional HP Motors

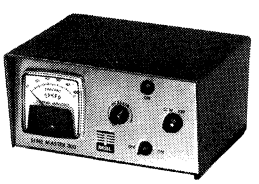


SINE MASTER 200

Regulated speed control for shaded pole induction and universal motors.

- Motor speed regulated by controlling the energy input to the motor
- Power is self-controlled to meet motor demands
- Maintain rated starting torque over entire control range
- Computer-mated to selected Howard fhp motors
- Priced competitively with DC-type controls
- Eliminate brush problems and maintenance of DC motors
- Electrical limit of 130 VRMS maximum and 4 amps in 40° C ambient
- Speed range of 20:1 for two-pole induction motors

COMPLETE DATA SHEETS ON REQUEST



SINE MASTER 300

Automatic, governed speed control for permanent capacitor induction motors, universal and shaded pole induction motors.

MSL

HOWARD

HOWARD INDUSTRIES
DIVISION OF MSL INDUSTRIES, INC.
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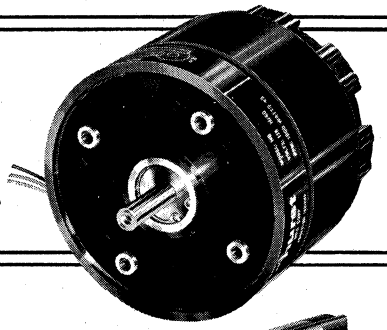
414-632-2731 TWX 910-271-2387

CALL ON hurst-POWER HEAVY DUTY HYSTERESIS SYNCHRONOUS MOTORS

HEAVY DUTY SYNCHRONOUS MOTORS

hurst NEW! Honey Bee

Ideal for tape drive applications. Inverted rotor construction for reduced flutter. 1/50 HP, start torque 12 in. oz. at 1800 RPM; pull in torque 11 in. oz. 40°C heat rise, full load. Sealed ball bearings. Stainless steel shaft 5/16" x 1". (Special shafts available.) Also available at 900 RPM.

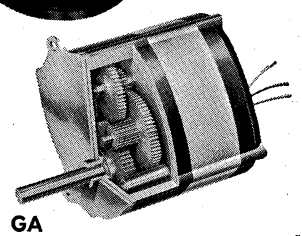


MODEL HB

hurst MODEL GA
600 IN. OZ. OF TORQUE AT 1 RPM (Reversible)

For long life and higher torque applications. Offers instrument manufacturers high performance and economy. Wide range of speeds.

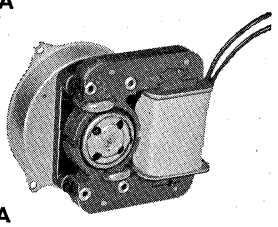
- HEAVY DUTY GEARING
- NO LUBRICATION REQUIRED
- CAPACITOR INCLUDED



MODEL GA

hurst MODEL EA
150 IN. OZ. OF TORQUE AT 1 RPM (Unidirectional)

Open frame, shaded pole, extremely cool running. Bronze bearings, brass gears, hardened steel pinions and wheel shafts, stainless steel output shaft. For dependable, low-cost timing applications. Wide range of speeds.



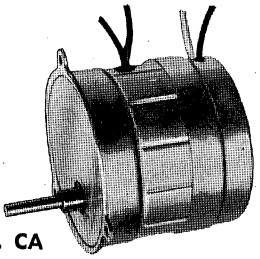
MODEL EA

hurst MODEL DA
120 IN. OZ. OF TORQUE AT 1 RPM (Reversible)

Timing accuracy both clockwise and counter-clockwise, SPDT switching. Case 2½" diam., 1¾" long. Will not overheat. Capacitor included. Wide range of speeds.

hurst MODEL CA
100 IN. OZ. OF TORQUE AT 1 RPM (Reversible)

Features 1200 rpm rotor speed for quiet performance. Extremely versatile (animated displays, program instruments, outdoor advertising, etc.). Wide range of output speeds. Will not overheat. Capacitor included.



MODEL CA

hurst MODEL SM
RATED 40 IN. OZ. OF TORQUE AT 1 RPM (Unidirectional)

For tough jobs demanding accurate timing. Excellent shock and vibration resistance. Starts instantly at full torque. Will not overheat. Wide range of output speeds.

hurst MODEL PC-SM / MODEL PC-DA
CLUTCH AND BRAKE MOTOR 40 IN. OZ. OF TORQUE AT 1 RPM (Unidirectional) / **CLUTCH AND BRAKE MOTOR 120 IN. OZ. OF TORQUE AT 1 RPM (Reversible)**

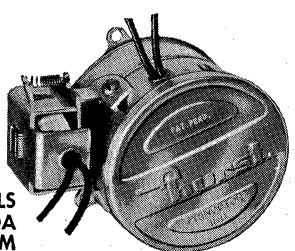
Both are positive clutch and instantaneous brake motors. For extremely fast starts and stops. Motor runs continuously with clutch and brake controlled by switching actuator only. Clutch starts output shaft within 20 milliseconds; brake stops output shaft within 1/5° at 1 rpm; within 12° at 60 rpm. Motor on AC voltage; actuator AC or DC. Either can be supplied in any voltage combination when motor is AC. Will not overheat. Wide range of speeds.



MODELS DA SM

hurst MODEL AR-DA / MODEL AR-SM
100 IN. OZ. OF TORQUE AT 1 RPM (Reversible) / **40 IN. OZ. OF TORQUE AT 1 RPM (Unidirectional)**

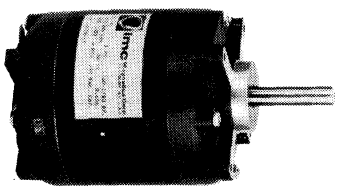
Automatic reset. Planetary-type clutch operates directly upon output shaft. When de-energized, shaft is manual or automatic reset. Addition of external return spring to output shaft provides automatic reset on either model. Motor on AC voltage; actuator on AC or DC. Either can be supplied in any voltage combination when motor is AC. Will not overheat. Capacitor included. Wide range of speeds.



MODELS PC-DA PC-SM AR-DA AR-SM

AVAILABLE AT YOUR LOCAL HURST DISTRIBUTOR

hurst MFG. CORP. PRINCETON, INDIANA



375 to 28,800 rpm in Hysteresis-synchronous, Reluctance-synchronous, Induction and Torque types.

Working, from fleapower to 5 hp levels (0.75 to 5.375-inch OD).

Accepting inputs from 18 to 1000 Hertz, from 6 to 440 Volts.

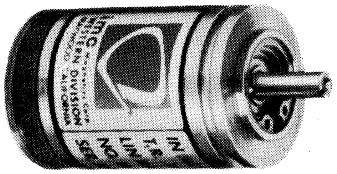
88 pages of catalog list all parameters and options.



40 vaneaxial fan models, from IMCUBE (1-inch cube) to 14.5-inch diameter, up to 3450 cfm.

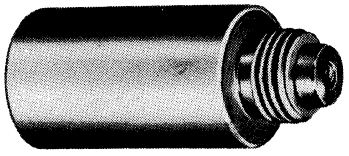
Or a tubeaxial or propeller fan, or a centrifugal blower. 147 pages of catalog airmovers can't be listed in this space.

Eastern Division, 570 Main Street, Westbury, N.Y. 11591, Tel. (516) 334-7070, TWX 510-222-4469



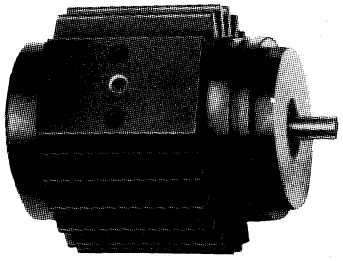
Find your angle with a Size 8 or 11 synchro (CT, CDX, CX, TX &c.) or a Size 15 resolver.

Econosync (low cost) and BUWEPS types are factory stocked for immediate delivery.



24 solenoids that pull up to 32 pounds. hold up to 60 pounds, (0.375 to 2.26-inch OD).

All are immediately available to work with consistent reliability in your system.

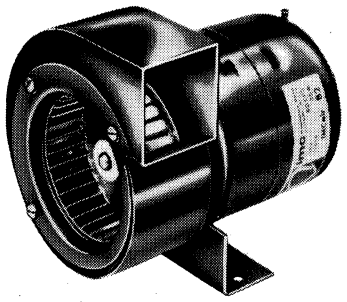


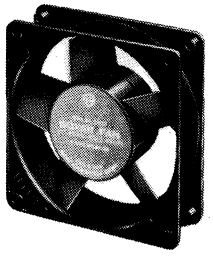
Steppers off the shelf. 26-factory stocked models.

Permanent Magnet and Variable Reluctance types in Sizes 5 to 35.

Controllers & Pulses Sources.

Western Division, 6058 Walker Ave., Maywood, Calif., 90270, Tel. (213) 583-4785, TWX 910-321-3089





Boxer, MiniBoxer, Tandem Boxer, Superboxer, Hi Fi Boxer, and Grand Prix Boxer fans. IMCair Blowers and fans. New Condor fans.

Outputs from 38 to 575 cfm.

Sizes from less than 20 cubic inches to the slim 3.5-inch depth by 10-inch-diameter.

All Distributor stocked.

New Hampshire Division, Route 16B, Rochester, N.H. 03867, Tel. (603) 332-5300

Here's a page out of our book.

It's called the IMC Master Catalog. They are available only through your IMC sales representative.

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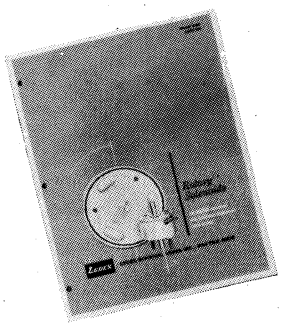
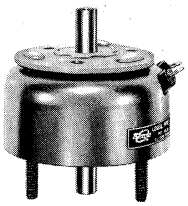
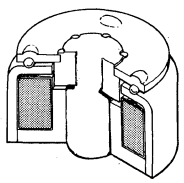
LEDEX DIVISION, LEDEX INC., 126 Webster St., Dayton, Ohio 45402
CUSTOM CIRCUITRY & CONTROLS phone (513) 224-9891

OVER 350 STOCK MODEL SOLENOIDS

LEDEX ROTARY SOLENOIDS







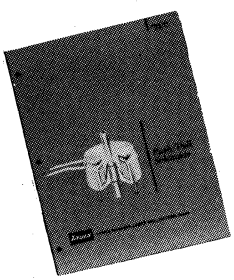
Ledex Rotary Solenoids step, turn, pull, push, index, hammer, punch or trigger — whenever there's a need for fast and dependable direct rotary action. Known for high force-to-size, ability to resist shock. Family of 8 basic sizes with right and left hand strokes from 25 to 95 degrees. Torque to 117 pound-inches. Wide choice of stock models offer economy and quick starts on prototypes. LIFE: 100,000,000 actuations.

GROSS TORQUE IN POUND-INCHES

Rotary Srtoke			25°		35°		45°		67½°		95°	
Duty Cycle			1/10	1/20	1/10	1/20	1/10	1/20	1/10	1/20	1/10	1/20
Size	Diam. (in.)	Ht. (in.)										
1E	1	5/8	.8	1.1			.43	.62				
2E	1 1/8	21/32	1.4	1.7	1.1	1.3	.72	.89				
3B*	1 5/16	7/8	2.7	3.2	2.0	2.3	1.4	1.7	.65	.8		
3E		51/64	2.7	3.2	2.0	2.3	1.44	1.8	.70	.89		
4E	1 5/16	61/64	4.5	5.2	3.1	3.5	2.6	3.1	1.6	1.9	1.0	1.2
5B*	1 7/8	1 13/64	8.3	10.0	6.9	8.3	5.0	6.0	3.3	4.0	1.6	1.9
5S		1 3/4	12.1	13.2	7.8	9.2	6.3	6.9	3.9	4.9	1.9	2.6
6S	2 1/4	1 27/64	27.8	30.6	18.6	20.5	11.0	12.1	8.8	9.7	5.2	5.7
7S	2 3/4	1 55/64	42.4	46.6	38.0	42.0	29.8	32.8	17.5	19.3	10.5	11.6
8S	3 3/8	2 5/16	98.0	117	64.0	77.0	54.0	65.0	29.0	35.0	17.0	20.0

* 3B and 5B have random wound coils; all other are precision wound.

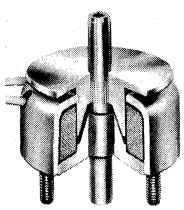
LEDEX PUSH/PULL SOLENOIDS

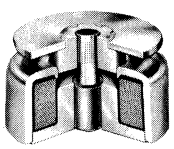


Ledex precision push/pull solenoids are designed for extremely rapid response and high force to size, and are engineered to respond in less than 10 milliseconds at intermittent duty. They are available with conical or flat-face plungers. A comparison of the two designs (table below) demonstrates the performance at 1/10 duty.

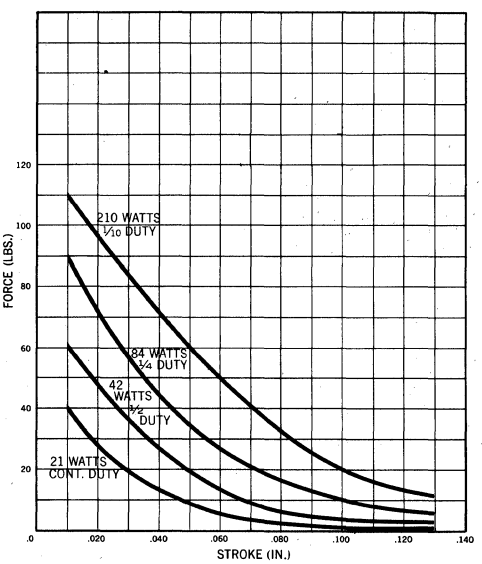
For short strokes, the flat face model really packs a wallop. The conical face gives more mid-range punch.

Catalog lists 35-stock models for quick starts on prototype work, technical data, force and stroke curves, and graphs showing hold-in resistor values and resistance factors.



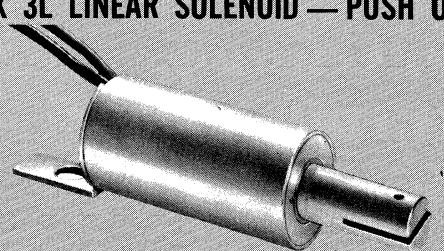


	Stroke (Inches)	Pounds Force with Flat Face Plunger 1/10 Duty	Pounds Force with Conical Face Plunger 1/10 Duty	Input (Watts)
SIZE 0	.010 .060	— —	5.3 2.3	45
SIZE 1	.020 .060	12.5 3.3	7.5 5.5	50
SIZE 2	.020 .060	16.5 4.5	11 7	70
SIZE 3	.020 .060	27 10	16 13	90
SIZE 4	.020 .120	45 8	18 10.5	140
SIZE 5	.020 .120	96 12	35 27	210
SIZE 6	.020 .120	— —	85 70	320



TYPICAL PERFORMANCE OF LEDEX SIZE 5, FLAT FACE SOLENOID

LEDEX 3L LINEAR SOLENOID — PUSH OR PULL



The 3L linear solenoid has an output force of 1.75 to 15 pounds, depending on input, stroke, and duty cycle. Originally developed for the automotive industry, it offers top performance at economy prices. Stroke from .040 to .50 inches. Stock model part 171707-001 for 24 to 56 VDC and 171707-008 for 12 to 24 VDC, priced at $5.00; below $3.00 in lots of 500 or more.

LEDEX DIVISION, LEDEX INC.
126 Webster St., Dayton, Ohio 45402 phone (513) 224-9891

SERIES 50 STEPPING MOTORS with torque to 160 ounce inches

Running torque of the New Series 50 design is about four times that of stepping motors previously available from Ledex Inc. A key to the superior performance is in a newly developed tooth clutch drive. It has a positive action, self-locking drive that contributes to greater usable torque output. For friction loads the clutch provides a positive grip (no slip). When driving inertia loads, the drive also acts as a built-in electromechanical clutch brake to eliminate the natural tendency of overdriving at the end of a step.

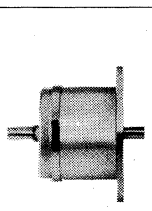
Torque of the Series 50 stepping motor is further increased by the incorporation of a new spring-loaded ball detent, accurate to ±1°, non-accumulative. This accuracy provides near-perfect alignment of the internal mechanism to assure consistently high starting torque.

Engineered for construction simplicity and economy, all parts are permanently lubricated and completely enclosed for protection and tamper-free operation. Minimum life expectance is three million steps. For bidirectional models this means three million steps for each end.

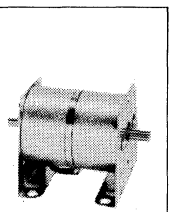
The Series 50 stepping motor is designed for uniform torque distribution throughout the stroke. A common output shaft permits direct coupling of a load at one end and a manual knob or position indicator at the opposite end. The shafts of both unidirectional and bidirectional models can be manually turned in CW and CCW directions.

Some typical positioning uses include potentiometers, counters, switches, tape advances, gear trains, valves, cams, gate actuators, indicators, governors, and a variety of indexing and control mechanisms.

18 POSITION, 20° STEP INCREMENTS



Wt: 14 oz.



Wt: 24 oz.

UNIDIRECTIONAL STOCK MODELS PLATE MOUNTED	BIDIRECTIONAL STOCK MODELS FOOT MOUNTED
216000-023	216001-023
216000-024	216001-024
216000-026	216001-026
216000-030	216001-030
216000-032	216001-032

Stock model 12-position (30° step increments) Series 50 stepping motors have approximately 75% of the output torque of 18-position models. For complete data ask for catalog 7000.

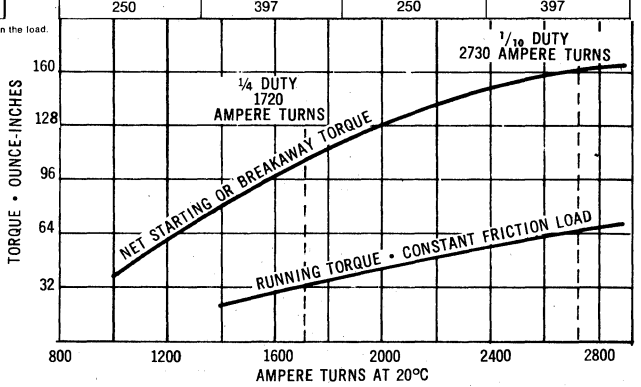
COIL DATA

COIL AWG NO.	OHMS RESISTANCE AT 20° C	NO. OF TURNS
19	.31	110
20	.43	125
21	.74	168
22	1.26	224
23	**2.03**	**288**
24	**3.20**	**360**
25	4.91	440
26	**7.72**	**550**
27	11.1	636
28	18.8	840
29	30.5	1038
30	**44.9**	**1275**
31	70.9	1596
32	**109**	**1974**
33	175	2096
34	210	3042
35	414	3600
36	600	4200

*No. or negligible, inertia component in the load.

TYPICAL PERFORMANCE (18 positions)

FRICTION LOAD* (oz.-in.)	EXTENDED PERIOD OF OPERATION—NORMAL SPEED: 1/4 DUTY CYCLE 1720 ampere turns 84 watts max. at 20° C — PULSE ON (ms)	PULSE OFF (ms)	STEPS PER SECOND	EXTENDED PERIOD OF OPERATION—NORMAL SPEED: 1/10 DUTY CYCLE 2730 ampere turns 210 watts max. at 20° C — PULSE ON (ms)	PULSE OFF (ms)	STEPS PER SECOND	SHORT PERIOD OF OPERATION—MAXIMUM SPEED: 1720 ampere turns 84 watts max. at 20° C — PULSE ON (ms)	PULSE OFF (ms)	STEPS PER SECOND	SHORT PERIOD OF OPERATION—MAXIMUM SPEED: 2730 ampere turns 210 watts max. at 20° C — PULSE ON (ms)	PULSE OFF (ms)	STEPS PER SECOND
8	30	90	8	22	198	4	30	18	20	22	18	25
16	35	105	7	25	225	4	35	18	18	25	18	23
24	40	120	6	28	252	3	40	18	17	28	18	21
32	45	135	5	30	270	3	45	18	15	30	18	20
40				33	297	3				33	18	19
48				35	315	2				35	18	18
56				40	360	2				40	18	17
64				42	398	2				42	18	16
	VOLTS D.C.			VOLTS D.C.			VOLTS D.C.			VOLTS D.C.		
	4.9			7.8			4.9			7.8		
	6.0			9.5			6.0			9.5		
	7.6			12.1			7.6			12.1		
	9.7			15.4			9.7			15.4		
	12.1			**19.2**			**12.1**			**19.2**		
	15.3			**24**			**15.3**			**24**		
	19.2			31			19.2			31		
	24			**38**			**24**			**38**		
	30			48			30			48		
	39			61			39			61		
	48			77			48			77		
	61			**96**			**61**			**98**		
	76			120			76			120		
	95			**150**			**96**			**150**		
	120			192			120			192		
	152			242			152			242		
	198			314			198			314		
	250			397			250			397		



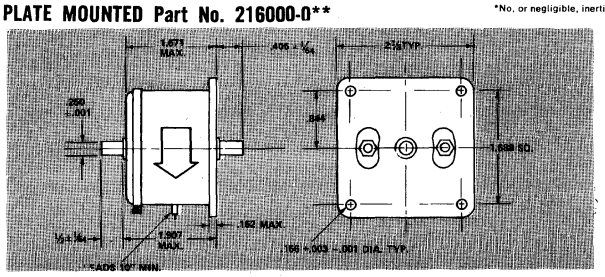
TOP CURVE When friction component of the load is high in the beginning—as in driving a valve. Lower curve applies when friction load is consistent throughout the stroke.

The number of copper wire turns and the current magnitude determine torque available.

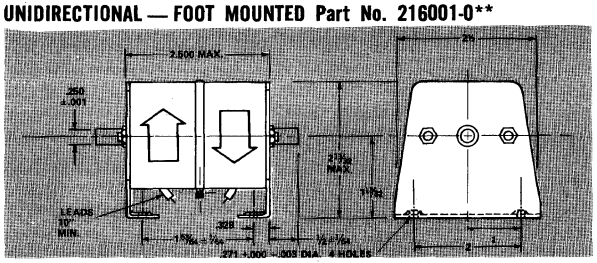
$$\text{Ampere turns} = \frac{E}{R} \times \text{Turns}$$

With E, R and number of turns given for each coil at specified operating conditions, using these curves it is possible to interpolate torque output at other operating conditions.

UNIDIRECTIONAL — PLATE MOUNTED Part No. 216000-0**



UNIDIRECTIONAL — FOOT MOUNTED Part No. 216001-0**



**To order a stepping motor same as a stock model but with a different coil awg, substitute the awg desired for the last two digits of the part number.

APPROXIMATE PRICE RANGE*

	Unidirectional	Bidirectional
1 to 9 stock models	$23 - $24	$37 - $39
1000 production	$10 - $12	$16 - $18

* Contact factory for firm prices.

How to use performance data

EXAMPLE 1: Load is consistent friction of 32 oz.in. The stepping motor must step as rapidly as possible for a minute or less, then is allowed to rest for a minimum of 30 minutes. Input is 24 VDC.

From the performance chart (short period of operation —maximum speed), 2730 ampere turns are required to obtain 20 steps per second. The ON pulse at this speed would be 30 ms, OFF interval 18 ms. Referring to coil data and the lower section of the chart, the coil for a 24 VDC stepping motor to operate under these conditions is 24 awg. Unidirectional stock model is 216000-024.

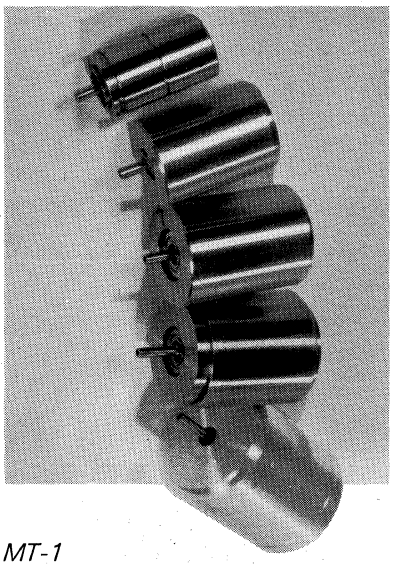
EXAMPLE 2: Load is consistent friction of 64 oz.in. The stepping motor must step for an extended period (continuously or for more than one minute). Input is 120 VAC rectified (90-100 VDC). From the chart under 1/10 duty cycle 2730 ampere turns are required to move the 64 oz.in. load. The ON pulse is 42 ms and the OFF interval is 398 ms, for a stepping rate of 2 steps per second. Referring to the coil data and the lower section of the performance chart, the closest operating voltage value between 90 and 100 is 96 VDC. Coil awg is 30. Bidirectional stock model part number is 216001-030.

THE BASIC DIFFERENCE between the "extended" and "short" periods of operation columns is in the length of the OFF interval and the speed obtainable. A longer OFF interval is required between ON pulses during sustained or continuous operation to allow for coil cooling. For short periods (one minute or less), the OFF interval is reduced to a minimum, but a 30 minute cooling period is required between operations.

Kintron MOTORS

PRECISION INSTRUMENT AC/DC

Kintron motors are custom designed for applications where efficiency and precision are particularly important . . . meeting MIL and other stringent specifications. Quick response for prototype requirements.



AC

HYSTERESIS SYNCHRONOUS — *Type AH*

Frame Sizes	*5, 8, 10, 11, 13, 15, 18, 20*
Wave Shape	*Square or sine wave*
Frequency	*20 to 1200Hz*
Phases	*1 (with capacitor), 2 or 3*
Poles	*2, 4, 6, 8, 12, 16*
Efficiency	*To 55% for 4 poles (1200 rpm) @ 400 Hz*
Windings	*Single or bifilar. Multiple windings for 2 or 4 speed operation (as high as 8:1 speed ratio).*

Similar specifications to above

SERVO — Low Inertia *Type AS*

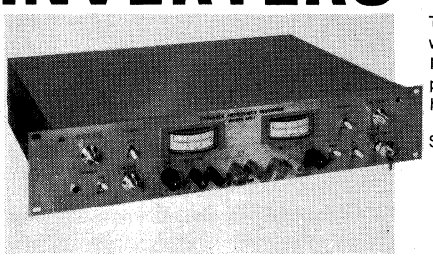
TORQUERS *Type AT (pancake configuration)*

DC

PM MOTORS — *Type DM* — High efficiency, 6-28 VDC, 2000 to 25,000 rpm.

HIGH RESPONSE SERVO MOTORS *Type DMT* — Sophisticated position servo systems customized for each application. Utilizes high resolution optical tachometer feedback.

INVERTERS



TEST INVERTER — Lab Type — *Model MT-1*

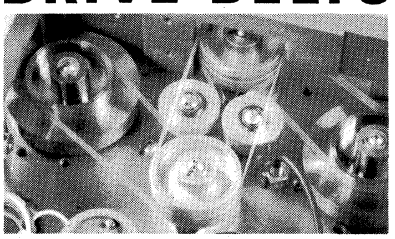
The MT-1 is a test instrumentation inverter, variable frequency, square wave power source for operating and testing small instrumentation motors. It may be used for any purpose requiring one or two phases of square wave power 90 degrees apart. Of prime value in quality assurance testing of hysteresis synchronous motors and engineering experimentation.

Specifications

Input: *115 volts AC, 60 cycle, single phase.*

Output:
(1) AC voltage w/equivalent DC voltage readings on two meters 0-15 scale and 0-45 scale.
(2) Frequency range adjustable from 55 Hz to 1250 Hz.
(3) 2 Phase, reversible by panel switch.
(4) 150 Watt output.

DRIVE BELTS

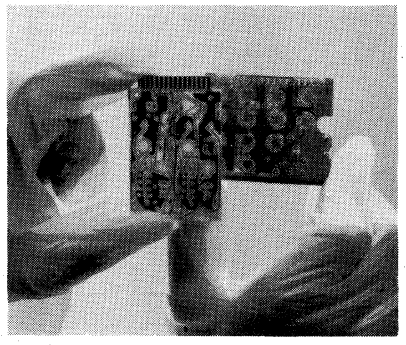


SEAMLESS — Mylar*/ Polyurethane / Kapton*

Ultimate in smooth, low flutter, precise power transmission due to uniform thickness — ideal for tape recorders, servo systems, speed reduction systems, etc. PERMIT SIMPLIFIED DESIGNS: 15:1 ratio stages (or greater) — precise/stable belt length eliminates need for tension idlers — direct drives from shafts as small as 0.040 inch. BETTER DRIVE: Over 20,000 PSI tensile strength — flexure to 10^6 belt cycles — stable, no creep, no set, no stretch — high immunity to environment. WIDE RANGE OF SIZES: 1 to 100 inches circumference, 0.05 to 1 inch width (max: 5% of belt length), 1, 1.5, 2, 3, 5, 7.5, 10 and 14 mils thickness. All orders are computer-analyzed at no charge, assuring system design validity.

*DUPONT TRADEMARK

PRINTED CIRCUITS



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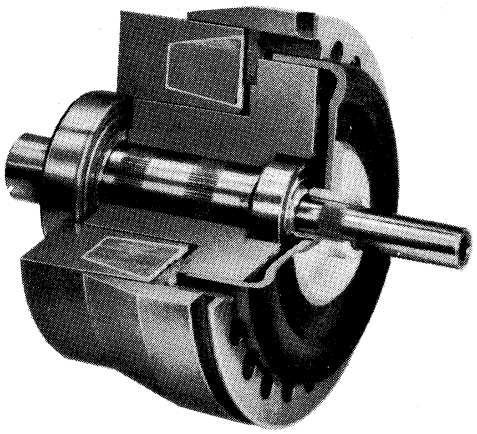

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HIGHEST REPEATABILITY
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For such precision-demanding applications as tensioning control, load simulation, high-performance servo systems, speed control. Stable in almost any environment. High heat dissipation capability.

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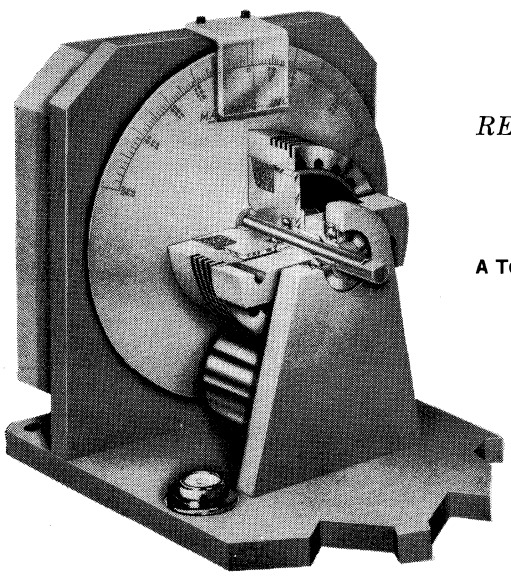

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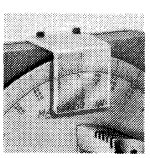
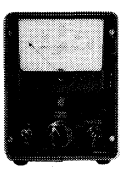
Simple and reliable for determining torque–speed characteristics in laboratory, receiving inspection, production testing.

A Torque-Speed Readout for Every Need



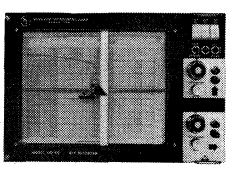
Direct Dial



Meter



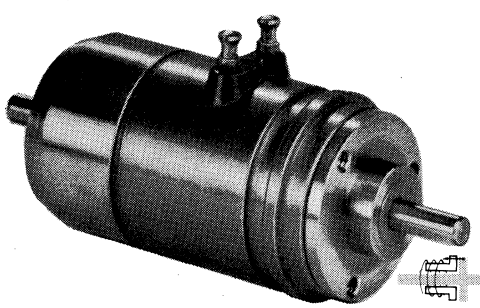
Digital Tachometer



X-Y Plot

Ask for bulletin 2000D

FRICTION CLUTCHES & BRAKES



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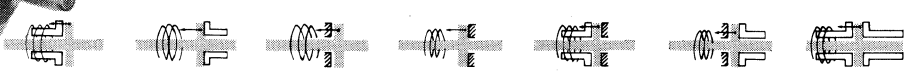

Clutch | Failsafe Clutch | Brake | Failsafe Brake | Clutch-Brake | Clutch-Brake | Duplex Clutch

Ask for catalog FCB

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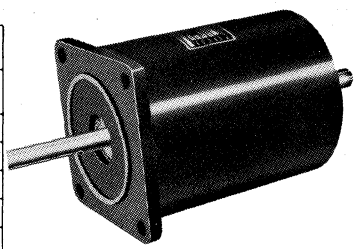
McLEAN COMPUTER DESIGNED FHP MOTORS

All motors feature: air-cooled bearings to reduce temperature and extend life; dimensionally stable aluminum alloy motor frames; rotors that exceed requirements of MIL-M-17059 to assure extra-smooth running; and other quality features.

HYSTERESIS SYNCHRONOUS MOTORS

OUTPUT PERFORMANCE ON 115 VOLTS, 60 Hz.			
FRAME	RPM	PULL-OUT TORQUE	CAPACITOR
47	1200	15 oz-in.	3 Mfd.
47	1800	14 oz-in.	3 Mfd.
47	3600	12 oz-in.	5 Mfd.
59	1200	55 oz-in.	8 Mfd.
59	1800	60 oz-in.	6 Mfd.
59	1200/3600	45/25 oz-in.	9 Mfd.



REQUEST DATA SHEET CM 672

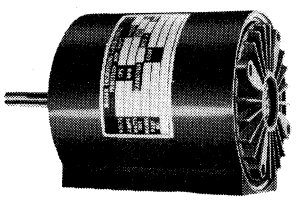
FEATURES

- The starting torque approximates the running torque. Self-starting.
- The motor runs at synchronous speed, but is not phase polarized as are the polarized synchronous motors shown elsewhere.
- The direction of rotation of the shaft is reversible externally.
- Dual voltage and/or dual speed motors available.

POLARIZED SYNCHRONOUS MOTORS

PERFORMANCE ON 115 VOLTS, 60 Hz., WITH INTERNAL FAN		
FRAME USED	47 FRAME	59 FRAME
Speed	3600 RPM	3600 RPM
Line current	1.2 amp.	1.5 amp.
Capacitor required	5 Mfd.	8 Mfd.
Stall torque	10-14 oz-in.	27 oz-in. max.
Pull-in torque	15-18 oz-in.	25 oz-in.
Pull-out torque	15 oz-in.*	14 oz-in.*
Reversible	yes	no

*Must not be exceeded for continuous duty.



REQUEST DATA SHEET CM 673

FEATURES

- Ideal where repeated phase synchronization is required between line voltage and shaft position for one or more motors.
- Single or dual voltage, but only single speed, motors available.
- Currently available for 3600 rpm only at 60 Hz. Other speeds and frequencies available when the need materializes.

INDUCTION MOTORS

PSC and 3-PHASE

McLEAN 47 FRAME MOTOR

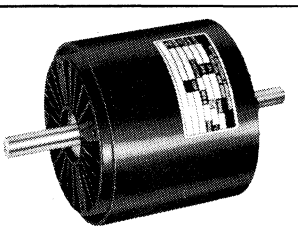
OUTPUT PERFORMANCE ON 115 VOLTS				
RPM	WATTS	HERTZ	VENTILATION	PHASE
1600	30	60	totally enclosed	single
1600	40	60	open, with circulation	single
3200	60	60	totally enclosed	single
3200	80	60	open, with circulation	single
5400	80	400	open, with circulation	single
5400	100	400	open, with circulation	three

McLEAN 59 FRAME MOTOR

OUTPUT PERFORMANCE ON 115 VOLTS					
RPM	WATTS	"B"	HERTZ	VENTILATION	PHASE
1600	20	2⅝	60	open, with circulation	single
3300	20	2⅝	60	open, with circulation	single
1600	100	4⅛	60	totally enclosed	single
1600	165	4⅛	60	open, with circulation	single
3200	250	5⅛	60	open, with circulation	single
3200	525	6⅞	60	open, with circulation	single
3200	100	4⅛	400	open, with circulation	single
3200	130	4⅛	400	open, with circulation	three

FEATURES

Optimum design achieved using McLean high speed electronic digital computer with our internally programmed analysis.



Starting and running torques matched to fan and blower loads, where the motors are so used.

Direction of rotation of the shaft is reversible externally.

Dual voltage and/or dual speed motors available.

Face mount is standard, but base mount is available in 47 Frame Size Motor and flange mount is available in 59 Frame Size Motor.

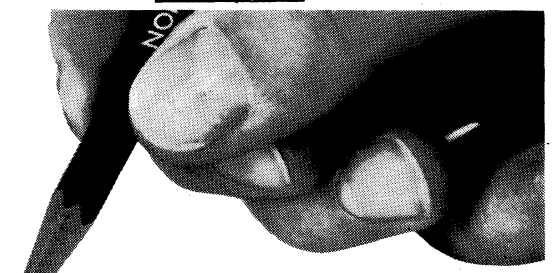
Available for single-phase use in 2, 4, 6, 8, and 12-pole speeds, and for three-phase use in the same speeds.

REQUEST DATA SHEET CM 671

McLEAN ENGINEERING LABORATORIES mclean®

Princeton Junction, New Jersey 08550 • Phone 609-799-0100 • TELEX: 84-3422

Northfield miniature precision instrument bearings- interchangeable with ball bearings -at only ⅓ the cost!



HERE'S HOW DESIGN ENGINEERS CUT BEARING COSTS WITHOUT LOSS OF ACCURACY

Here are the reasons why:

- ⅓ the cost of miniature precision ball bearings
- I.D., O.D., concentricity and facial squareness held to .0002″
- Precision made of sintered bronze (MIL-B-5687, Type I, Comp. A) with 4% Molybdenum Disulphide added at sintering
- Vacuum impregnated with instrument oil (MIL-L-6085A)
- Low coefficient of friction and excellent resistance to radial loads and impact
- Full range of sizes — flanged and sleeve types
- Immediate delivery from stock
- Used in gyro stabilizers, airborne compasses, analog and digital computers, inertial guidance systems, ground control approach instruments, infrared guidance systems, sound recording equipment, etc.

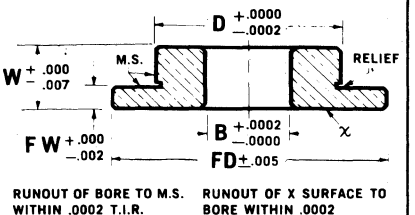
Write for latest brochure.

Typical Characteristics

Tensile Strength (psi)	16,000
Compressive Strength (psi)	18,000
Hardness (Rockwell No.)	H45-H54
Coeff. of Thermal Expan. per °F (x 10^{-6})	10.5
Coeff. of Friction (Break-away)	.07

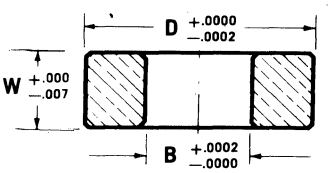
IN STOCK, AVAILABLE FOR IMMEDIATE DELIVERY OF PRODUCTION QUANTITIES

SERIES 127 FLANGED BEARINGS



RUNOUT OF BORE TO M.S. WITHIN .0002 T.I.R. RUNOUT OF X SURFACE TO BORE WITHIN .0002

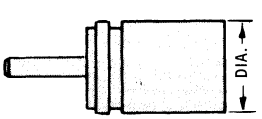
SERIES 238 SLEEVE BEARINGS



RUNOUT OF BORE & O.D. WITHIN .0002 T.I.R. FACIAL SQUARENESS HELD WITHIN .0002

Specify NORTHFIELD Miniature Precision MICROSPIN Instrument Bearings as direct replacement for miniature precision ball bearings

Miniature adjustable mechanical limit stops

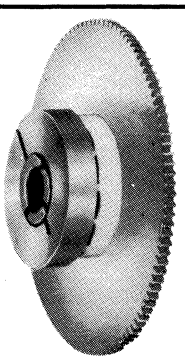


HIGH TORQUE RATINGS AND REPEATABILITY IN SMALLER DIMENSIONS

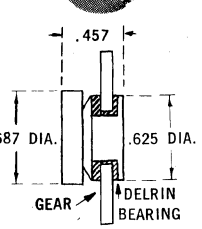
Model	Dia.	Torque Rating
BUORD Size 5	.500 max.	40 OZ. IN.
BUORD Size 8	.753 max.	80 OZ. IN.

Improved Quality Features: Outstanding repeatability • Low starting torque • Long Life—rugged construction • Hardened and ground lead screw • Precision engineered to MIL-E-5272 C. Immediate delivery from stock.

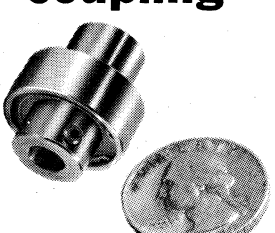
Improved gear type miniature adjustable slip clutch



TOP QUALITY FEATURES: Delrin bearing and clutch plate achieve smooth torque transmission with minimum charge from pre-set torque • Adjustable from zero to 50 inch ozs. torque • Precision engineered to MIL-E-5272 C • Stainless steel gear. Anodized aluminum hub and clamp • Low cost.



Miniature slip clutch coupling



• Simple interconnection between shafts • Teflon coated clutch faces for overload protection • Range: 0-50 oz. in. slip torque • No lubrication • Spring loaded, friction-type • Self-locking • Slip speeds to 1200 RPM.

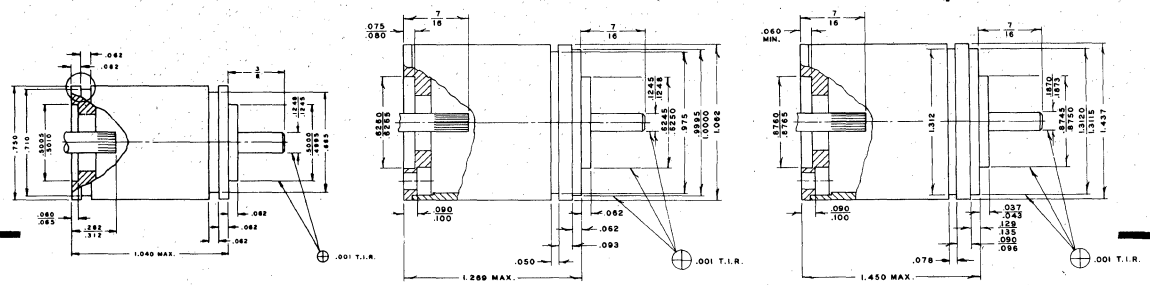
Write or call for specifications and prices.

NORTHFIELD
PRECISION INSTRUMENT CORPORATION

Northfield Precision Instrument Corp.
4400 Austin Blvd., Island Park, N. Y., 11558
(516) 431-1112

Standard Gearheads and Speed Reducers

Precision Miniaturizations for Your Exact Requirements



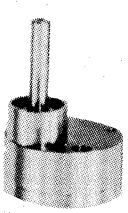
Size 8 Size 11 Size 15

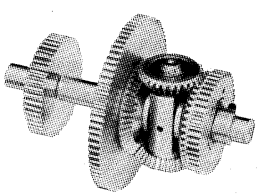
General Mechanical Specifications

RATIOS	SIZE 8	SIZE 11	SIZE 15
DIRECT AND REVERSE	7.79 to 4809.96	14.77 to 14493.54	11.73 to 1214.93
*BACKLASH at output shaft	30′ to 45′ @ 1 oz.	30′ to 45′ @ 3″ oz.	30′ to 45′ @ 5″ oz.
STARTING TORUE at input shaft	.005″ oz. max.	.005″ oz. max.	.008″ oz. max.
OPERATING LOAD TORQUE	5″ oz. max.	25″ oz. max.	35″ oz. max.
MOMENTARY LOAD TORQUE	30″ oz. max.	100″oz. max.	100″ oz. max.
MOTOR PINION DATA			
Number of teeth	13	13	15
Pitch Diameter	120	120	96
Pressure Angle	20°	20°	20°
Pitch Diameter	.1083/.1078	.1083/.1078	.1562/.1557
Outside Diameter	.1247/.1242	.1247/.1242	.1771/.1766

*Depending on Ratio. BuOrd. Sizes 8 to 18. One Week Delivery In Prototype Quantities.

Special Gearheads **Differentials**



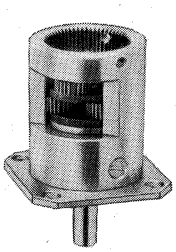


Coaxial Shaft Speed Reducers
Sizes 8 thru 18

2-Speed Gearheads
Sizes 8 and larger



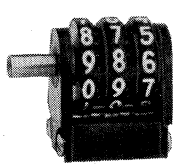
Planetary Gearheads





COUNTERS

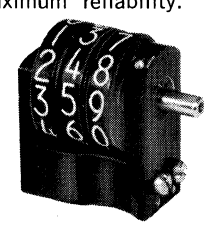
Planet readout counters can be designed for navigational, tracking, ranging, time, positioning, computing, fire control and industrial applications. Typical parameters include high speed, low torque, light-weight, miniaturization and maximum reliability.



A-513-1
Three Digit
Decimal Counter

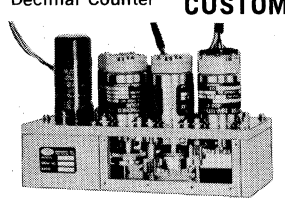


A-681-1
Digital Fuel
Metering Counter
(Internal Pinion Type)

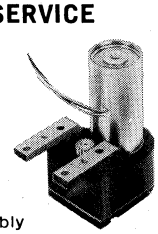


A-749-1
Digital Counter
(Internal Pinion Type)

CUSTOM SERVICE

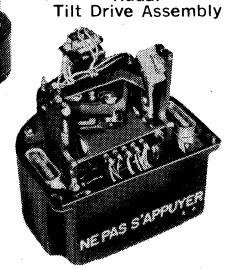


Distance to Destination Servo Assembly



Airborne Weather
Radar
Tilt Drive Assembly

Planet will translate your assembly drawings and specifications into servo systems and sub systems. Where drawings and specifications are lacking, Planet will design and build complete servo packages to your performance requirements. Matching electrical, mechanical and indicating requirements is a Planet specialty.

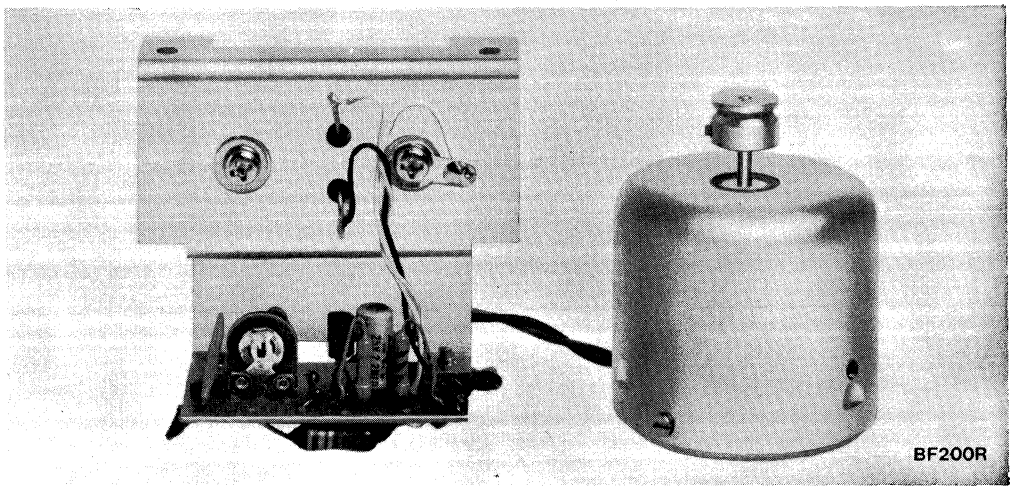


Mirror Drive Unit

Catalog and Price List on Request

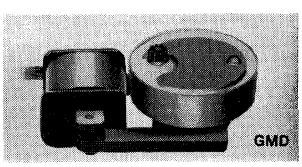
planet instrument, inc.
1521 Progress Road
Phone 219 483-8194
Fort Wayne, Indiana 46808
TWX 810-332-1419

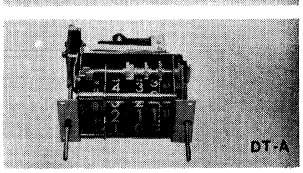
Sankyo DC(MICRO) MOTORS



TYPE	Dimensions		Rated Voltage (V)	Range of Voltage (V)	Rated Torque (gr-cm)	Rated Speed (rpm)	Load Current (mA)	Starting Torque (gr-cm)	Life (Hr)	Direction of Revolution	Speciality Use	Remarks
	ϕ (m/m)	Length (m/m)										
SY173L	40	32.4	6	4.5～ 6	3	2000	80	35	600	L	Record player	
DMF54R-02	38	34.8	6	4.5～ 6	9	2400	140	30	600	R	Tape recorder	
RK201R	47.9	48	13.2	10 ～16	30	2400	210	100	1000	R	Car player	
BF110R	38	30	4.5	3.5～ 5.7	8	2000	160	30	1500	R	Tape recorder	Electrical Governor Motor
BF200R	38	34.1	13.2	(5.5～)9 ～16	15	2200	180	30	1500	R	Car recorder & player	
ZF200	46	50	9	6 ～ 9	20	2200	300	45	3000	L, R	High class player, Electronic calculator	Brushless & Transistor Motor
UP550R	20	44.5	4.5	4 ～ 6 4.5～ 6	14	3700 5000	160	60	30	R	8m/m cine camera	
VM250B	25	36.5	7	6.5～ 7.5	0.4	3600	45	25	500	L, R	Auto tuner	

Sankyo AC(TIMING) MOTOR and DIGITAL CLOCK w/TIMER





GMD

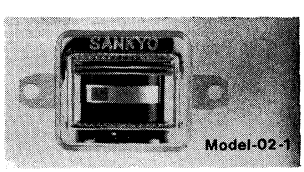
Synchronous type timing motor, 100 to 240 VAC, 50 or 60Hz, 2 to 3W, 3/550 to 3.6rpm, 0.2 to 3kg-cm torque. Other model GMC, GME (Synchronous types) and GMA (Inductor type) are available.

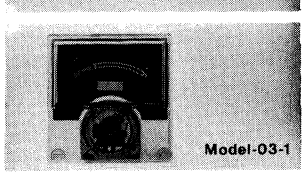
DT-A

DIGITAL CLOCK W/TIMER FOR RADIO, TV. ETC.

Sankyo LEVEL METERS METERS

Various kinds of Level Meters for Tape-recorders, Television Sets, etc.





Current sensitivity	Internal resistance	Pointer rest	Uses
OVU: 130μA ±10% FULL: 250μA ±20%	380Ω ±10%	Left & Right	Level & Batt

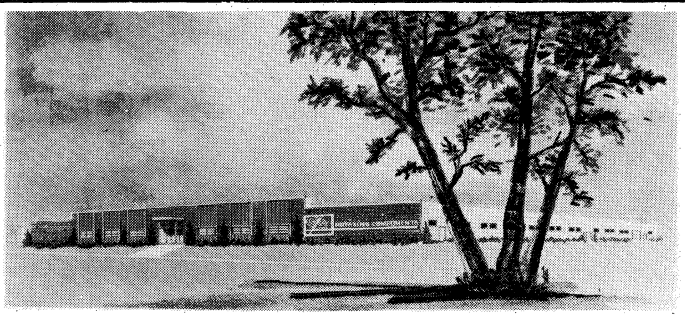
Current sensitivity	Internal resistance	Pointer rest	Uses
OVU: 130μA ±10% FULL: 250μA ±20%	650Ω ±10%	Left & Right	Level & Batt

For further information please write to,

Sankyo

EXPORT DEPARTMENT/ SANKYO SEIKI MFG. CO., LTD.: Shimbashi, Tokyo, Japan. Tel: 591-8371
AMERICAN SANKYO CORP.: Rm. 801-3, 95 Madison Ave., N.Y.C., N.Y. 10016, U.S.A. Tel: LE-2-8020
SANKYO (EUROPE) EXPORT und IMPORT G.M.B.H.: 4 Düsseldorf, Bahnstraße 45-47, W. Germany Tel: 325652/3

AC PRECISION MOTORS by RC

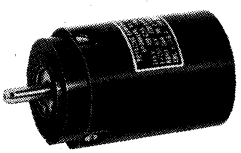


RCI is a leading designer and manufacturer of precision rotating equipment. The RCI engineering and production staffs combine a wealth of experience and know-how to provide components of high quality at low cost. This team constantly accepts and meets the challenge of special design problems in today's dynamic electronic field, which demand greater reliability under more severe environmental conditions... and in smaller packages. Our customers have come to rely on our ability to achieve this on a production basis.

THE SOURCE FOR THE BROADEST VARIETY OF ROTATING COMPONENTS FOR THE MILITARY AND INDUSTRIAL ELECTRONICS INDUSTRY

- SYNCHRONOUS MOTORS
- INDUCTION MOTORS
- PM GENERATORS
- BRUSHLESS DC MOTORS
- SERVO MOTORS
- GEAR MOTORS
- TACHOMETER GENERATORS
- DRAG CUP MOTORS
- INDUCTION GENERATORS
- FANS
- BLOWERS

INDUCTION DRIVE MOTORS

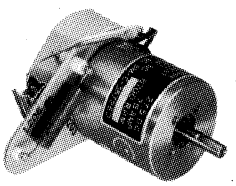


Powerful • Rugged • Extremely Reliable • Versatile in Application

Frequencies:	50-60-400 cps • Variable Frequency • Dual Frequency
Speeds:	450 thru 22,000 rpm • 1-2-3 Speeds
Horsepower:	1/2000 to ¼ H.P.
Voltages:	To 440V AC • Single or Dual Voltages
Phases:	1-2-3 • Reversible or Unidirectional
Bearings:	Precision Life Lubricated Ball Bearings
Mounting:	Face, Base, Flange, Servo
MIL SPECS:	Exceed MIL-M-7969, MIL-M-17059, MIL-M-13787, MIL-E-16400, MIL-E-5400, MIL-E-5272, MIL-STD-202 Also for quality commercial applications
Life:	In excess of 10,000 hours in many designs
Gearheads:	Available with all models Hundreds of models available

BRUSHLESS DC MOTORS

• **IMPROVE YOUR PRODUCT** • **REPLACE BRUSH TYPE MOTORS, FANS, BLOWERS.**



OPERATE FROM DC POWER SOURCES • SOLAR CELLS.

LIFE — extremely long — no brushes to replace — no brush dust.

SAFER — no sparking in explosive atmosphere.

RFI — minimal.

MIL SPEC APPROVED for severe environments.
SPEEDS — wide selection as required.
QUIET — no brush noise.
EFFICIENT — low input power.
SUPERIOR at high altitudes.
USES — Aircraft — Submarines — Spacecraft — Ground Equipment — Any Electronic Equipment.

RCI PRODUCTION MODELS QUICKLY AVAILABLE — SEND FOR DATA

GEAR MOTORS



R.C.I. offers a wide range of integral motor-gearhead combinations with synchronous and induction motors as well as Servo motors in all R.C.I. frame sizes including 8, 10, 11, 15, 18, on up to 3⅞ O.D.

- Precision engineered for long life.
- Torque up to 4000 in oz.
- All Ratios.
- Backlash: 30 minutes maximum.
- Temperature Range: −55°C to + 150°C.
- Lubrication: MIL-L-6085, MIL-G-3278.
- Environmental Testing: MIL-E-5272.
- Mechanical slip clutch available on request.
- Ball bearings are stainless steel ABEC 5 or better as reqd.
- All gears precision class 2 or better per AGMA 236.04

BALL BEARING STEP-UP MOTORS

NOW — HIGH SPEED (8000 RPM) is possible with 60 CPS supply.

LONG LIFE — MIL TESTED AND APPROVED 10,000 hours in extreme environments.

SAVE SPACE — REPLACE large, slow speed blowers and fans.

QUIET — REPLACE geared speed increasers.

BRUSHLESS — REPLACE noisy troublesome DC and Universal Motors.

RCI PRODUCTION MODELS QUICKLY AVAILABLE SEND FOR DATA

ROTATING COMPONENTS
1560 FIFTH AVE., BAY SHORE, N. Y. 11706
DIVISION OF INSTRUMENT SYSTEMS CORPORATION
516-666-8500 — TWX 516-666-7047

TAPE DECK COMPONENTS
HYSTERESIS & BRUSHLESS DC MOTORS

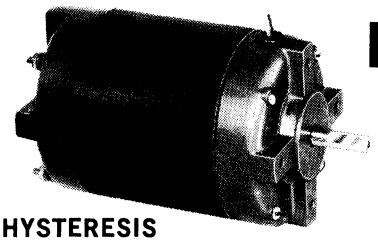
NEW This Year from Rotating Components

The addition of this New Frame Size means that RC can now supply the correct AC Synchronous Motor to the manufacturer of 90% of all Tape Decks, Reader Printouts, Teletype-writers, Photo Copiers, Thermo-Faxers and Transceivers.

CHECK THE WIDE RANGE OF THE RC LINE

SIZES: 0.937″ to 3.875″ OD (21 Frames).
FREQUENCIES: 15 to 400 CPS (60 and 400 are standard).
SPEEDS: 600 to 24,000 RPM.
HORSEPOWER: 1/1000 to 1/10.
PHASES: 1, 2, 3.
VOLTAGES: Up to 440 volts.
ENCLOSURES: Enclosed or open, self cooled.
BEARINGS: Ball.
GEARTRAINS: Large variety of ratios.

MOUNTING
face • base • servo.



POWER PLUS 3.875″ OD HEAVY DUTY

HYSTERESIS

TYPE DESIGN No.	O.D. (Inches)	FREQ. (Hz)	SPEED (RPM)	TORQUE PULL-IN (Oz. In.)	INPUT POWER (Watts)	PHASES	VOLTS	*LENGTH (Inches)
9H-1	3.88	60	600	3.5	18	1	115	3.97
9H-2	3.88	60	600	10	25	1	115	5.72
9H-3	3.88	60	900	4.5	22	1	115	3.97
9H-4	3.88	60	900	10	30	3	115	4.97
9H-5	3.88	60	1200	5.5	25	1	115	3.97
9H-6	3.88	60	1200	20	65	1	115	4.97
9H-7	3.88	60	1800	16	80	1	115	4.97
9H-8	3.88	60	1800	30	85	3	208	5.72
9H-9	3.88	60	3600	7	40	1	115	3.97
9H-10	3.88	60	3600	25	130	3	220	5.72

AIRCRAFT APPLICATION

9H-11	3.88	400	4000	8	75	1	115	4.97
9H-12	3.88	400	4800	8	90	1	115	4.97
9H-13	3.88	400	6000	13	135	3	208	5.72

DC BRUSHLESS MOTORS

IMPROVE YOUR PRODUCT

Transistorized: No Maintenance
Eliminates Brushes
No Brush Dust
Interchangeable with DC Motors

Life: Extremely Long & Reliable • No Brushes to wear • Silent • Frictionless • No Arcing • Explosion Proof.

RFI: Reduced to Minimum.

Low Input Power: 50% Efficient.

Altitude: Superior at High Altitudes.

Dielectric: Vastly Improved.

Environmental: Passes severe environmental conditions of all MIL SPECS.

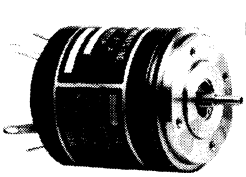
Continuous Duty:

Speeds: Wide Selection of High Speeds attainable. Available with speed variation feature.

Applications: To replace Brush Type DC Motors, Blowers, Fans in any Electronic Equipment. • In Explosive Atmosphere • Aircraft • Submarines • Space Vehicles • Powered by Solar Batteries.

Motor Types: Induction Motors • Blowers • Fans.

— Send For Data



ALSO NEW FROM RC

NOT AN AC MOTOR WITH INVERTER BUT A TRUE DC BRUSHLESS COMMUTATORLESS MOTOR

FEATURES

- SPEED CONTROL ±10%
- VOLTAGE REGULATION 17V - 38V
- RFI REDUCED TO MINIMUM
- LIFE EXTREMELY LONG AND RELIABLE

TYPICAL DATA

Volts DC	Rated Torque oz. in.	Stall Torque oz. in.	Speed RPM	Input Power Watts
26	.3	.5 •	3300	1.25

ROTATING COMPONENTS
1560 FIFTH AVE., BAY SHORE, N. Y. 11706

DIVISION OF INSTRUMENT SYSTEMS CORPORATION
516 - 666-8500 — TWX 516 - 666-7047

AC SYNCHRONOUS MOTORS
HYSTERESIS • POLARIZED • RELUCTANCE

The RC STANDARDS shown are representative of a broad selection of of sizes, speeds and torques which RCI will be pleased to modify or custom design to your exacting specifications. Call or send your requirements for a prompt proposal.

CHECK THE WIDE RANGE OF THE RC LINE

SIZES: 0.937" to 3.875" OD (21 Frames).

FREQUENCIES: 15 to 400 CPS (60 and 400 are standard).

SPEEDS: 600 to 24,000 RPM.

HOREPOWER: 1/1000 to 1/10.

PHASES: 1, 2, 3.

VOLTAGES: Up to 440 volts.

ENCLOSURES: Enclosed or open, self cooled.

BEARINGS: Ball or sleeve.

GEARTRAINS: Large variety of ratios.

MOUNTING

face • base • servo.

SHAFTS

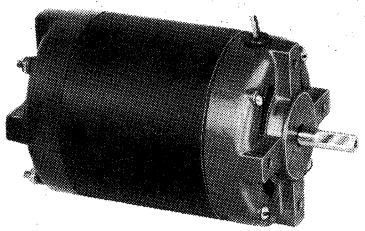
- pinion • flatted
- tapered • threaded
- slotted • plain.

HOOKUP

- leads • terminals
- connectors • lugs.

WINDING PROTECTION (UL)

- thermal overload protection.
- current overload protection.
- high impedance protection.



POWER PLUS
3.31" OD HEAVY DUTY

HYSTERESIS — SINGLE SPEED

Type Design No.	O.D. (Inches)	Frequency (CPS)	Speed (RPM)	Torque Pull-In (oz. in))	Input Power (Watts)	Phases	Volts	Length (Inches)
7H-1	3.31	60	3600	18.0	80	3	208	5.59
7H-2	3.31	60	3600	14.0	110	1	115	4.84
7H-3	3.31	60	3600	7.0	45	1	115	4.27
7H-4	3.31	60	1800	20.0	80	3	208	5.59
7H-5	3.31	60	1800	10.0	60	1	115	4.27
7H-6	3.31	60	1200	15.0	50	1	115	5.59
7H-7	3.31	60	1200	4.0	30	1	115	3.59
7H-8	3.31	60	900	3.0	14	1	115	3.59
7H-9	3.31	400	6000	10.0	150	3	115	5.59
7H-10	3.31	400	6000	3.0	55	1	115	3.59

HYSTERESIS — TWO SPEED

7H-11	3.31	60	1800 900	8.0 4.5	70 60	1	115	4.84

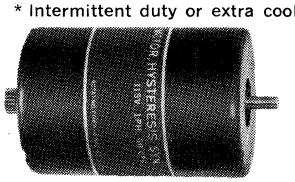
RELUCTANCE

7S-1	3.31	60	1800	15.0	72	1	115	5.59

POLARIZED

7P-1	3.31	60	3600	5.4	90	1	115	3.81
7P-2	3.31	60	3600	6.3	90	1	115	3.81
7P-3	3.31	60	3600	10.0*	150	1	115	4.97

* Intermittent duty or extra cooling provisions required.



COMPACT POWER
2.31" OD

Type Design No.	O.D. (Inches)	Frequency (CPS)	Speed (RPM)	Torque Pull-In (oz. in))	Input Power (Watts)	Phases	Volts	Length (Inches)
8H-1	2.31	60	3600	12.0*	80	1	115	3.44
8H-2	2.31	60	3600	3.0	30	1	115	3.44
8H-3	2.31	60	3600	1.8	18	1	115	2.44
8H-4	2.31	60	1800	5.0	30	1	115	3.44
8H-5	2.31	60	1800	2.2	23	1	115	2.44
8H-6	2.31	400	12000	1.1	35	3	115	2.44
8H-7	2.31	400	8000	2.1	35	1	115	3.44

* Intermittent duty or extra cooling provisions required.

FEATURES . . .

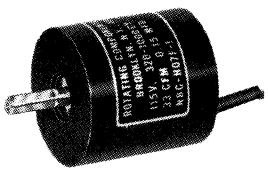
- meet military and UL specs • for airborne, shipboard, and ground equipment.
- quality controlled per MIL-Q-9858.
- ambient temperature range −55°C to +125°C and up • high altitude.
- long life • rugged construction • permanently lubricated.
- superior performance • greater efficiency.
- compact • operate in any position • dynamically balanced.

RC

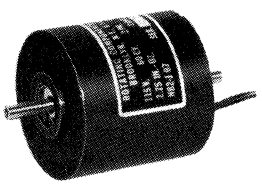
MINIATURE INSTRUMENT TYPE



.937 O.D.



1.062 O.D.



1.25 O.D.

HYSTERESIS

Type Design No.*	O.D. (Inches)	Frequency (CPS)	Speed (RPM)	Torque Pull-In (oz. In.)	Input Power (Watts)	Phases	Volts	Length (Inches)
18H-1	.937	400	12,000	.10	8.0	3	115	1.225
19H-1	1.062	400	24,000	.08	14.2	2	115	1.35
19H-2	1.062	400	8,000	.35	12.0	1	115	1.91
19H-3	1.062	400	8,000	.175	7.5	3	115	1.29
19H-4	1.062	400	6,000	.10	7.0	3	115	1.29
19H-5	1.062	60	3,600	.29	8.75	2	26	1.35
25H-1	1.25	400	12,000	.5	15.0	3	115	2.25
25H-2	1.25	400	12,000	.5	16.0	1	115	2.25
25H-3	1.25	400	8,000	.40	13.0	1	115	2.25
25H-4	1.25	60	3,600	.6	12.0	1	115	2.25
25H-5	1.25	60	1,800	.9	13.0	3	115	2.25

***HOW TO ORDER OR INQUIRE**

START With type design number (this is not a part number).
ADD Features and specifications you require.
WE Will supply a final drawing and part number to meet your needs.

CHARACTERISTICS AND APPLICATIONS

HYSTERESIS TYPE

CHARACTERISTICS

- Constant speed regardless of load or voltage variation. Speed will vary directly with frequency.
- Capable of pulling high inertia loads into synchronism
- Smooth starting.
- Free of noise, hunting, vibration.
- High efficiency.
- Locks into synchronism in an infinite number of positions.
- Adapts to multi speed designs.

RELUCTANCE TYPE

CHARACTERISTICS

- Locks into synchronism at fixed positions.
  2 pole — any of 2 positions 180° apart.
  4 pole — any of 4 positions 90° apart.
- High starting torque.
  Not recommended for inertia loads.

APPLICATIONS:
HYSTERESIS AND RELUCTANCE MILITARY & INDUSTRIAL

• Computers • Teleprinters • Aircraft landing lights • Audio tape recorders • Video tape recorders • Turntables • Timing devices • Frequency conversion (when coupled with PM Generator) • Positioning devices • Light choppers • Facsimile equipment • Scanners.

POLARIZED TYPE

CHARACTERISTICS

- For complete control of shaft position where phasing is a requirement.
- Locks in at one fixed position with respect to the input signal. (4 pole will lock in at one of 2 positions 180° apart.)

APPLICATIONS

- X-Ray cameras.
- Light choppers.
- Multipole devices at remote points.
- Facsimile equipment.
- Positioning devices.

ROTATING COMPONENTS
1560 FIFTH AVE., BAY SHORE, N. Y. 11706
DIVISION OF INSTRUMENT SYSTEMS CORPORATION
516-666-8500 — TWX 516-666-7047

INSTRUMENT SERVO MOTORS

Available with Gearheads

SIZES: 8 to 18 in all standard and BuOrd types

SIZE 8

RC Series 8S



Size -1 -2
O.D. .750" .750"
Length 1.165" .840"
Weight 1.6 oz. 1.1 oz.
Rotor Inertia (gm-cm²) .27 .18

SIZE 10

RC Series 10S



O.D. .938" Length $1^{5}/_{16}$"
Weight 1.5 oz
Rotor Inertia (gm-cm²) .46

SIZE 11

RC Series 11S and BuOrd Mk 14 Mod 2 & 3



O.D. 1.062" Length 1.360"
Weight 4.5 oz.
Rotor Inertia (gm-cm²) 1.1

SIZE 15

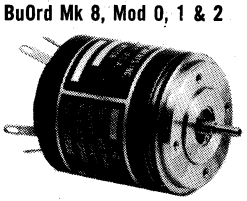
RC Series 15S and BuOrd Mk 7 Mod 0, 1 & 2



O.D. 1.437" Length 1.485"
Weight 7 oz.
Rotor Inertia (gm-cm²) 3.3

SIZE 18

RC Series 18S and BuOrd Mk 8, Mod 0, 1 & 2



O.D. 1.750" Length 1.750"
Weight 12 oz.
Rotor Inertia (gm-cm²) 4.0

FREQ.	MOTOR NO.	TORQUE AT STALL OZ-IN	VOLTS: FIXED PHASE	VOLTS: CONTROL PHASE SERIES	VOLTS: CONTROL PHASE PARALLEL	R.P.M. NO LOAD	WATTS PER PH. AT STALL	P.F. PER PH. AT STALL	AMPERES FIXED PHASE	IMPEDANCE CONTROL PHASE: SERIES	IMPEDANCE CONTROL PHASE: PARALLEL
400 CPS	8S46-03-1	.30	115	115	57.5	6200	3.5	.64	.047	1400+j1825	350+j456
	8S46-21-1	.30	26	40	20	6200	3.5	.64	.209	170+j220	43+j55
	8S46-23-1	.30	26	26	—	6200	3.5	.64	.209	71.5+j93.5	—
	8S46-21-2	.20	26	40	20	6200	3.1	.66	.176	235+j290	59+j73
	8S46-23-2	.20	26	26	—	6200	3.1	.66	.176	99+j108	—
	8S46-40-2	.20	18	40	20	6200	3.1	.66	.254	235+j290	59+j73
	8S46-43-2	.20	18	18	—	6200	3.1	.66	.254	48+j59	—
400 CPS	10S44-01-1	.28	115	40	20	10,000	2.8	.73	.033	303+j293	73+j76
	10S44-03-1	.28	115	115	57.5	10,000	2.8	.73	.033	2520+j2430	630+j607
	10S44-08-1	.28	115	80	40	10,000	2.8	.73	.033	1210+j1170	303+j293
	10S44-21-1	.28	26	40	20	10,000	2.8	.73	.146	303+j293	73+j76
	10S44-23-1	.28	26	26	—	10,000	2.8	.73	.146	129+j124	—
	10S44-43-1	.28	18	18	—	10,000	2.8	.73	.210	62+j60	—
	10S46-21-1	.28	26	40	20	4000	3.8	.75	.180	275+j223	69+j56
	10S46-21-2	.30	26	40	20	6500	3.1	.63	.191	99+j123	—
	10S46-23-1	.28	26	26	--	4000	3.8	.75	.180	116+j94	—
	10S46-23-2	.30	26	26	—	6500	3.1	.63	.191	234+j292	75+j73
	10S46-43-1	.28	18	18	—	4000	3.8	.75	.260	55+j45	—
	10S46-43-2	.30	18	18	—	6500	3.1	.63	.276	48+j59	—
400 CPS	11S46-01-1	.60	115	40	20	6200	3.6	.6	.053	151+j215	38+j54
	11S46-03-1	.60	115	115	57.5	6200	3.6	.6	.053	1250+j1780	313+j445
	11S46-04-1	.60	115	180	90	6200	3.6	.6	.053	2860+j4100	715+j1025
	11S46-21-1	.60	26	40	20	6200	3.6	.6	.24	149+j209	596+j836
	11S46-23-1	.60	26	26	—	6200	3.6	.6	.24	63+j88	—
60 CPS	11S62-03-1	.50	115	115	57.5	3200	3.5	.9	.034	3040+j1460	760+j365
400 CPS	15S44-01-1	1.4	115	40	20	10,000	10	.7	.11	910+j847	258+j212
	15S44-03-1	1.4	115	115	57.5	10,000	10	.7	.11	750+j700	188+j175
	15S44-05-1	1.4	115	230	115	10,000	10	.7	.11	3000+j2800	750+j700
	15S44-23-1	1.4	26	26	—	10,000	10	.7	.50	40+j36	—
	15S48-00-1	1.4	115	36	18	4800	6.2	.5	.11	48+j87	12+j22
	15S48-01-1	1.4	115	40	20	4800	6.2	.5	.11	59+j108	15+j27
	15S48-02-1	1.4	115	60	30	4800	6.2	.5	.11	133+j248	34+j62
	15S48-03-1	1.4	115	115	57.5	4800	6.2	.5	.11	490+j890	122+j222
	15S48-04-1	1.4	115	180	90	4800	6.2	.5	.11	1200+j2180	300+j537
	15S48-05-1	1.4	115	230	115	4800	6.2	.5	.11	1960+j3560	490+j890
	15S48-23-1	1.4	26	26	—	4800	6.2	.5	.50	25+j46	—
60 CPS	15S62-03-1	1.4	115	115	57.5	3200	6.2	.85	.06	1600+j990	400+j247
	15S62-05-1	1.4	115	230	115	3200	6.2	.85	.06	6400+j4000	1600+j1000
	15S62-23-1	1.4	26	26	—	3200	6.2	.85	.27	80+j50	—
	15S64-02-1	1.4	115	60	30	1600	6.2	.85	.06	1520+j1200	380+j300
	15S64-03-1	1.4	115	115	57.5	1600	6.2	.80	.06	1400+j1100	350+j275
	15S64-05-1	1.4	115	230	115	1600	6.2	.80	.06	5600+j4300	1400+j1075
	15S64-23-1	1.4	26	26	—	1600	6.2	.80	.27	70+j55	—
400 CPS	18S44-01-1	2.7	115	40	20	9800	16	.6	.23	37.5+j48.6	9.3+j12.1
	18S44-03-1	2.7	115	115	57.5	9800	16	.6	.23	315+j403	79+j101
	18S48-00-1	2.3	115	36	18	4800	9.5	.45	.19	27+j56	6.7+j4.2
	18S48-01-1	2.3	115	40	20	4800	9.5	.45	.19	33+j69	8.2+j17
	18S48-02-1	2.3	115	60	30	4800	9.5	.45	.19	71+j156	18+j39
	18S48-03-1	2.3	115	115	57.5	4800	9.5	.45	.19	280+j575	70+j143
	18S48-04-1	2.3	115	180	90	4800	9.5	.45	.19	666+j1370	167+j342
	18S48-05-1	2.3	115	230	115	4800	9.5	.45	.19	1100+j2300	275+j575
	18S48-06-1	2.3	115	280	140	4800	9.5	.45	.19	1660+j3420	415+j855
	18S48-07-1	2.3	115	300	150	4800	9.5	.45	.19	2140+j3960	500+j1015
	18S48-23-1	2.3	26	26	—	4800	9.5	.45	.80	15+j31	—
60 CPS	18S62-01-1	2.3	115	40	20	3400	10	.7	.10	97+j95	24+j24
	18S62-03-1	2.3	115	115	57.5	3400	10	.7	.10	803+j790	201+j198
	18S62-06-1	2.3	115	230	140	3400	10	.7	.10	4750+j4660	1188+j1163

NOTE: Electrical characteristics are nominal and are measured at stall

Environment: up to 125°C. Standard models listed above are Class F insulated for 90°C max. ambient.

Applicable MIL Specs: MIL-E-5400, MIL-E-5272, MIL-S-22432

Shafts: plain or pinion, in all standard lengths and diameters.

Special Motors: RC's servo motors can be supplied in a wide range of modified or special designs to meet user needs. Call or write for quotations on your requirements.

• SYNCHRONOUS MOTORS • INDUCTION MOTORS • P. M. GENERATORS • BRUSHLESS DC MOTORS • SERVO MOTORS
• TACHOMETER GENERATORS • DRAG CUP MOTORS • INDUCTION GENERATORS • FANS • BLOWERS

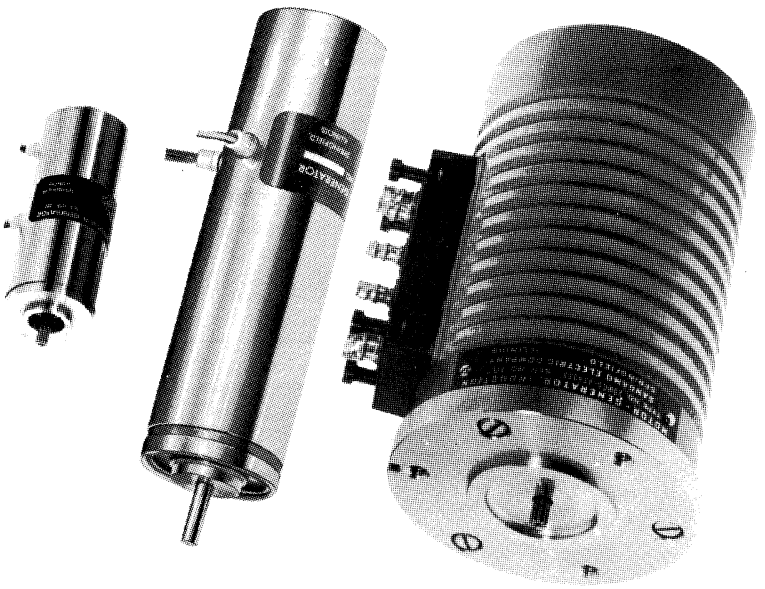
TACHOMETER GENERATORS

AVAILABLE WITH GEAR HEADS

SIZE 8 THRU 25

FEATURES

- Available in 60 ~ and 400 ~ configuration — other frequencies on special order.
- Rear shaft extension available.
- Integral gear heads — ratios from 1:5 to 78, 125.
- Made to exacting standards to meet all applicable Mil Stds.
- Special configurations available combining drag cup motors with generator to obtain the characteristics of a very low inertia unit.



MOTOR CHARACTERISTICS

		8MG5-656347	10MG1-654101	10MG1-654104	10MG-2 654907	10MG2-654923	10MG2-654930	10MG-3 656354	20MG1-655501	20MG7-656301
Frequency	CPS	400	400	60	400	400	400	400	400	60
No Load Speed	RPM	6500	6500	2700	6500	6200	5700	6200	10,500	2900
Torque Stall	Oz. in.	.13	.3	.25	.3	.45	.35	.6	2.5	.50
Moment of Inertia	Gr. Cm²	.63	2.85	3.46	1.10	1.10	1.10	1.10	11.3	11.0
Excitation Voltage	ϕ1	26	26	15	52	55	115	115	115	115
	ϕ2	33	26	20	26	115	26	55	115	115
Input Power	ϕ1	1.53	3.9	2.0	2.2	2.8	3.9	4.0	20	3.1
	ϕ2	1.54	3.9	3.6	2.2	4.0	2.0	4.0	20	3.1

GENERATOR CHARACTERISTICS

Excitation Voltage	ϕ1	10	26	20	26	26	26	26	55	115
Input Power	ϕ1	1.7	3.9	3.8	1.7	2.2	2.2	2.2	3.5	2.9
Output Grad. V/1000 RPM	Volts	.18	.34	.15	.32	.68	.68	.68	.8	3.8
Null Voltage	Volts	.013	.023	.020	.030	.024	.024	.024	.035	.100
Inphase Comp.	Volts	.007	.004	.008	.010	.008	.008	.008	.011	.050

The above tabulation is representative of our complete line. Many variations of these models are available. These variations, include but are not limited, to • Integral Gearheads with ratios from 5:1 to 78,125:1 • Special Output shafts • Special Voltages.

CALL RC FOR A QUOTATION FOR YOUR SPECIAL NEEDS.

ROTATING COMPONENTS

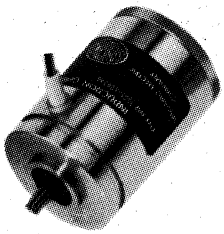
1560 FIFTH AVE., BAY SHORE, N. Y. 11706

DIVISION OF INSTRUMENT SYSTEMS CORPORATION

516-666-8500 — TWX 516-666-7047

INSTRUMENT SERVO COMPONENTS
AC INDUCTION TACHOMETERS • AC DRAG CUP MOTORS

AC INDUCTION TACHOMETERS



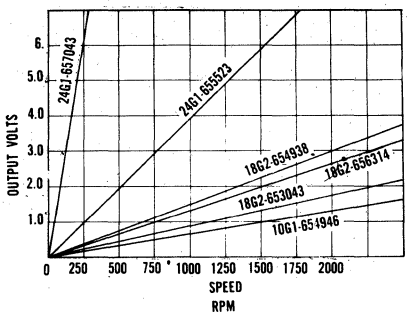
10G1-654946

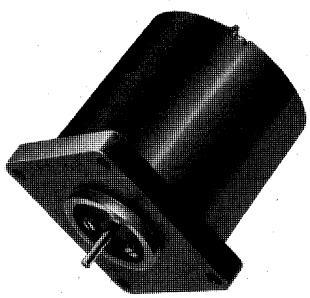
CHARACTERISTICS

- Also known as rate generator, tachometer-generator or damping generator. It is a two phase instrument with drag cup rotor.
- When operated with one phase excited, the induction generator produces an output voltage proportional to the shaft speed and a frequency identical to the supply.

APPLICATIONS

- Speed Indication.
- System stabilizer or damping generator in closed loop servo system.
- Rate generator in a velocity servo system.





24G1-655523

Size	RC1 Part No.	C.P.S.	GENERATOR INPUT					GENERATOR OUTPUT				
			Volts	Power Watts	Current (ma)	Impedance ohms	Voltage Gradient v/1000rpm	Impedance ohms	Max. Total rms (volts)	In Phase Fund. Comp (volts)	Quadrature Fund. Comp. (volts)	Total Harmonic Cont. (volts)
10	10G1-654946	400	26	2.2	97	228+J142	.68	2500	.024	.002	.012	.016
18	18G2-653043	400	55	3.5	120	243+J389	.8	4650	.035	.004	.012	.002
18	18G2-654938	400	115	12.5	120	868+J404	1.5	4640	.035	.006	.018	.002
18	18G2-656314	60	115	3.0	32	2920+J2100	1.3	2100	.025	.009	.010	.001
24	24G1-655523	60	115	3.4	38	2230+J2050	3.9	860	.050	.001	.008	.003
24	24G1-657043	60	115	3.4	38	2320+J1890	24.5	26,400	.600	.100	.500	.020

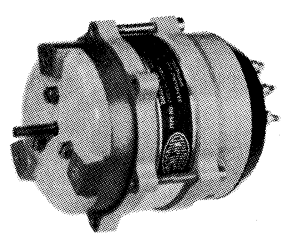
FEATURES OF AC INDUCTION TACHOMETERS AND DRAG CUP MOTORS

- Quality controlled per MIL-Q-9858.
- Meet MIL specs.
- Precision engineered.
- 60 or 400 cps, other frequencies available.
- Available from size 8 to size 24.
- Wide temperature range.
- Variety of mountings available.

DRAG CUP MOTORS
AVAILABLE WITH GEARHEADS



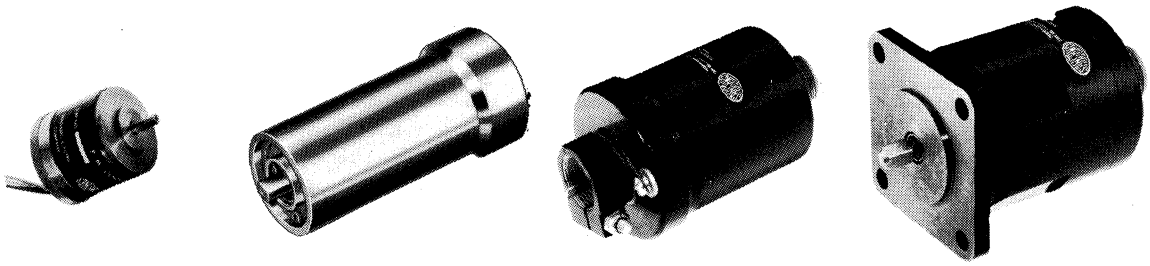




• Very low inertia for special servo motor applications • Very low starting voltage • Cog free operation at low speeds — no slot lock • Straight line torque — speed curve • High torque to inertia ratio • Will meet or exceed applicable portions of MIL-E-5272.

Size	RCI Part No.	C.P.S.	Torque at Stall oz. in.	VOLTS		Rpm No Load	WATTS STALL		CURRENT STALL MA		STALL IMPEDANCE OHMS	
				Fixed Phase	Control Phase		$\phi 1$	$\phi 2$	$\phi 1$	$\phi 2$	$\phi 1$	$\phi 2$
10	10DCM1-656360	400	.08	76.5	5.15	17,000	1.5	1.5	28.1	390	1910 + J1940	9.86 + J8.74
10	110-10676	400	.08	10	20	10,000	.25	.30	30	20	288 + J233	816 + J800
18	18DCM1-655526	60	.41	115	115	7,800	3.5	3.8	40.5	41.5	2140 + J1725	2140 + J1720
24	24DCM1-654801	400	.45	55	110	12,700	5.7	3.6	92	60	675 + J180	675 + J548

AC PERMANENT MAGNET TACHOMETER GENERATORS



10PMG1-654945 14PMG1-656303 25PMG1-65554 33PMG1-656341

Available from RC in many variations of two general classifications: — MINIATURE INSTRUMENT TYPE & INSTRUMENTATION TYPE.

The RC line of PM Generators provide an AC voltage and frequency output which are directly, proportional to the speed of the driven shaft.

MINIATURE INSTRUMENT TYPE

FEATURES

- Generates a pure sine wave with extremely low harmonic content.
- Available — 2, 4 or 8 pole; single or 2 phase.
- High reliability • Precision construction.
- Meets or exceeds MIL-E-5272.

APPLICATIONS

- Use as a speed sensing device based on either amplitude or frequency.
- As a source for variable frequency voltage.
- As a miniature frequency converter when coupled with a synchronous motor.

AIRCRAFT INSTRUMENTATION TYPE

FEATURES

- Generates a three phase A.C. sinusoidal signal.
- High resistance to rotor demagnetization by use of special Alnico magnets and improved stator design.
- Rugged and reliable under extreme aircraft environmental conditions of vibration, shock and temperature.
- Meet or exceed MIL-G-9398, MIL-E-5413, MIL-E-5272.

OPTIONAL MECHANICAL FEATURES

- **MOUNTING** — Servo - Flange (Pad) - Face - Base.
- **SHAFTS** — Plain - Floating with Shear Feature per MS28054 - Flatted - Slotted.
- **HOOKUP** — AN Connectors - Leads - Terminals.

APPLICATIONS FOR...

- HELICOPTERS • JET ENGINE AIRCRAFT • TURBO PROP AIRCRAFT • PROPELLER AIRCRAFT • ANY ROTATING DEVICE.

AS

- SPEED INDICATOR — In conjunction with a tachometer indicator utilizing change in frequency due to change in shaft speed.
- With a voltmeter measuring output voltage amplitude.
- SPEED CONTROL — Synchronize two or more rotating shafts by using two PM Generators driving a synchronous differential. Difference of speed (and therefore frequency) will actuate a differential to make the correction.
- FREQUENCY CONVERTER — When coupled with a synchronous motor.
- SOURCE for variable frequency voltage.

SIZE	RC PART NO.	MECHANICAL AND ELECTRICAL CHARACTERISTICS							
		NO. OF PHASES	NO. OF POLES	OUTPUT VOLTAGE (VOLTS)	IMPEDANCE (OHMS)	D.C. RESISTANCE (OHMS)	MAX. HARMONIC CONTENT (%)	DRIVING TORQUE 3600 RPM NO LOAD (OZ.-IN)	WEIGHT (OZ)
10	10PMG1-654945	2	2	6.0[1]	95[3]	93.5	2	0.07	2.5
14	14PMG1-656303	1	8	20.0[2]	55[4]	50.0	2	0.5	8.0
25	25PMG1-655554	3	4	30.0[5]	—	36.0	—	—	25.0
25	25PMG1-656342	3	4	30.0[5]	—	36.0	—	—	25.0
33	33PMG1-656341	3	4	30.0[5]	—	36.0	—	—	25.0

NOTES:

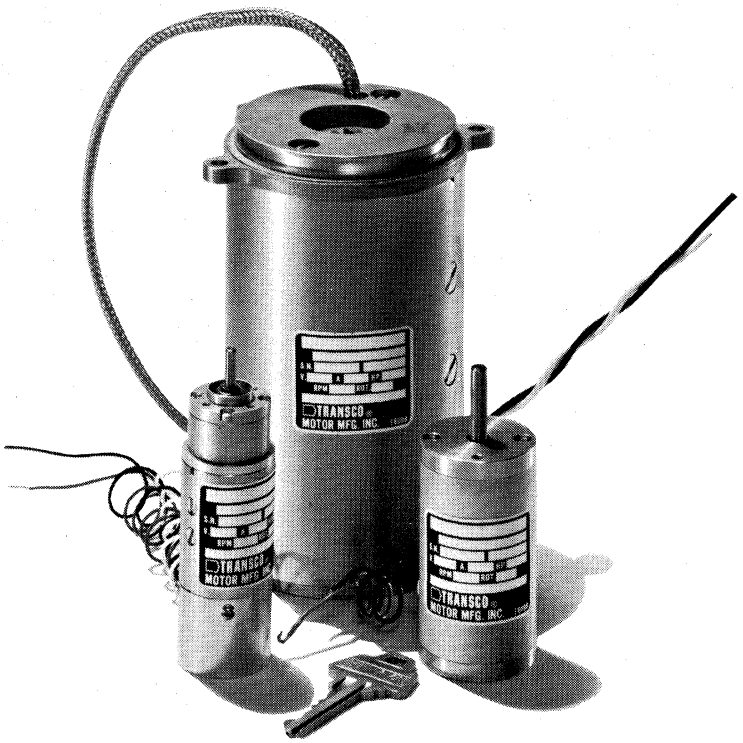
[1]At 3600 r.p.m. with no load. [2]At 6000 r.p.m. with load. [5]At 1800 r.p.m. (no load).
[3]At 3600 r.p.m. [4]At 6000 r.p.m.

ROTATING COMPONENTS
1560 FIFTH AVE., BAY SHORE, N. Y. 11706
DIVISION OF INSTRUMENT SYSTEMS CORPORATION
516-666-8500 — TWX 516-666-7047

SECTION 3500 eem File System

formerly: TRANSCO MOTOR MFG. INC.

DESIGNED TO DO A JOB



SERVO MOTOR LINE
formerly mfg. by:
Beckman
INSTRUMENTS, INC.

SUB FRACTIONAL H. P. ELECTRIC MOTORS

PARTIAL LIST OF MOTOR TYPES/SIZES:

*AC/DC	TYPE	O.D.	FRAME SIZE	VOLTAGE	AMPS	R.P.M.	TORQUE N.R.L. oz. in.	TYPE
AC	Induction Motor With Gearhead	3/4	7	115	.03	1250	6	407
AC	Induction Motor With Gearhead	1	10	115	.3	290	15	410
AC	Induction Motor	1 1/4	12	115	.50	10500	1.0	412
AC	Induction Motor	1 1/4	12	115	.125	10500	.2	412
AC	Induction Motor With Brake	1 1/4	12	115	.50	10000	0.6	412
AC	Split-Series, Universal	1 1/2	15	115	.38	13000	2.0	115
AC	Induction Motor, Thermal Protection	1 1/2	15	115	0.35	11000	1.0	415
AC	Induction Motor	1 1/2	15	115	.21	6500	.5	415
AC	Induction Motor, 3 ∅	1 1/2	15	115/200	.80	10000	10	415
AC	Induction Motor With Brake	1 7/8	18	115	2.2	9000	12	418
DC	Series Motor	7/8	8	28	2.5	20000	.5	308
DC	P.M. Gear Motor With Gearhead	7/8	8	27	.23	42.5	20	208
DC	Permanent Magnet	1 1/4	12	28	1.2	22500	1.0	212
DC	Permanent Magnet W/Gearhead & Governor	1 1/4	12	40	1.3	106	40	212
DC	Split-Series Motor With Brake	1 1/4	12	26	.45	11000	.4	112
DC	Split-Shunt Reversing	1 1/4	12	26	.55	6000	0.3	712
DC	Split-Series Motor With Brake	1 1/2	15	26	2.1	10000	2.5	115
DC	Permanent Magnet	2	20	28	.14	1000	6	220
DC	Shunt	2 1/4	22	27	26.5	10000	9.5	822
DC	Split-Series Motor	2 1/4	22	24	36.5	8000	16	122
DC	Split-Series With Gearhead	2 3/8	23	100	3.0	1800	96	123
DC	Split-Series Brake Motor	2 3/4	27	12	75.	4200	60	127
DC	Split-Series Motor	5 3/8	53	110	1.85	870	140	153

*400 cps, 1 phase except as noted

WRITE FOR PRODUCT CATALOG WITH NOMOGRAPH AND MOTOR SELECTION DATA

Sawyer Industries, Inc.

213/ 442 - 5981 • 213/ 686 - 1790 • TWX 910 - 587 - 3534

SAWYER INDUSTRIES, INC. • 5445 PECK ROAD • ARCADIA, CALIFORNIA 91006

See YELLOW SECTION for Local Offices, Phones

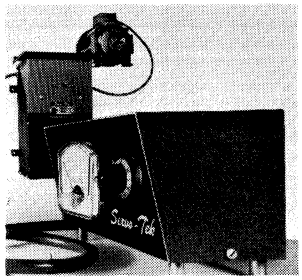
SERVO-TEK—FOREMOST IN SPEED MEASUREMENT AND CONTROL

Proven Performance, Reliability and Ease of Maintenance for the Most Demanding Industrial Applications

SOLID-STATE

"500" SERIES PRECISION ADJUSTABLE-SPEED DRIVES

ALL MOTORS TOTALLY ENCLOSED, FAN-COOLED



SPEED RANGE Infinitely adjustable from less than 24 rpm to more than 3600 rpm (150:1) while delivering full-rated torque. Continuous duty rating at all speeds.

REGULATION Temperature-compensated tachometer feed-back provides both line and load regulation of better than ⅓ of 1% of rated speed.

MAINTENANCE Design eliminates vacuum tubes, selenium rectifiers and time delays. Utilizes silicon diodes, transistors and a magnetic amplifier for exceptionally long service life. Modular plug-in construction requires only a screwdriver for servicing.

REMOTE CONTROL A 10-turn potentiometer provides precise adjustment and can be placed in any convenient location. Meter monitors operation and continuously indicates speed.

GEARED MOTORS Motors are available with integral gear reducers.

BRAKING-REVERSING Relay-controlled braking and reversing models available.

1 HP AS ILLUSTRATED

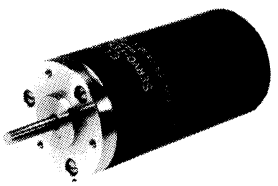
$687.00*

Other Models from ⅛ hp to 1½ hp proportionately priced

D-C PERMANENT-MAGNET

TACHOMETER GENERATORS

TEMPERATURE-COMPENSATED



Applications

SERVOS—The highly linear output and wide speed range are ideal for velocity or integrating servos. Low-driving torque permits its use as a damping or rate signal in all types of servos.

TEMPERATURE-COMPENSATED — The voltage output @ +25°C. will not deviate from this amount by more than 1/100 of 1% per degree of change when operated at any temperature within the designed temperature range of −20°C. to +75°C.

SIZE — Miniature. Approx. Dia. 1⅛".

OUTPUT — Various models with outputs as high as 45v/1000 rpm.

LINEARITY — Linearity from 0 to 12,000 rpm is better than 1/10 of 1% of voltage output at 3600 rpm.

BRUSH LIFE—Better than 100,000 hours (10 years) of continuous operation at 3600 rpm.

BIDIRECTIONAL OPERATION — Output in either direction is held to a ¼ of 1% tolerance.

RIPPLE — The rms value will not exceed 3% of the d-c value at any speed in excess of 100 rpm.

CONSTRUCTION — Aluminum housings with protective treatment; stainless steel shafts; fully-shielded stainless steel ball bearings; Mylar insulation.

SINGLE UNITS PRICED FROM

$25.50

Our Engineering Test Report describing performance characteristics, test procedure and test results, is available at no charge, upon requst.



D-C PERMANENT-MAGNET

SERVO MOTORS

Model SU-680D-29 delivers 12.7 watts of Continuous Power Output at 8600 rpm

Applications:

Chart Recorder Pen Drives, Null-seeking Devices, Capstan Drives for Tape Transports, Proportioning Applications, Prime Mover in Servo-Mechanisms.

Specifications:

DYNAMIC: Maximum No-Load Speed @ 23v D-C — 10,000 ±500 rpm; Full Load Torque @ 8600 rpm—2.0 Oz.-In. (max.); Stall Torque @ 23v D-C (Theo.) — 15.0 Oz.-In. (min.); Frictional Torque — 0.25 Oz.-In. (max.); Acceleration at Stall (Torque/Inertia) — 38,000 RAD/SEC² (min.); Case Temperature Rise @ Full Load (Free Air Dissipation) — 55°C. (max.); Case Temperature Rise Per Watt of I^2R loss (Free Air Dissipation)—6°C.

STATIC: D-C Resistance — 4.24 Ohms (typ.); Inductance—1.85 Millihenry (typ.); Rotor Inertia — 30.0 GM-CM² (typ.); Total Weight — 8.25 Oz. (max.); Length—3.25 in., excluding shaft; Maximum Ambient Temp. — 40°C.

FUNCTIONAL CONSTANTS: Inertial Time Constant — 30.0 Milliseconds (max.); Electrical Time Constant—0.45 Milliseconds (typ.); Torque Constant—2.8 Oz.-In./Amp. (min.); Voltage Constant (Back E.M.F.)—0.019v @ (1) RAD/SEC. (min.); Viscous Damping Factor—1.25 x 10^{-3} Oz.-In./rpm (min.)

Model SU-680D-29

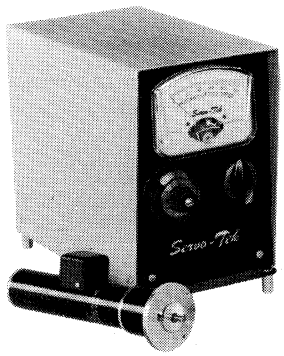
$44.00

Oher Models Available from $26.00

MINIATURE SOLID-STATE D-C

VELOCITY SERVO

COMPLETELY NEW TOOL FOR AUTOMATION, INSTRUMENTATION



This precision electronic Adjustable-Speed Drive replaces small synchronous motors for chart drives, sequence switches, programmers, etc. Provides adjustable or preselected speeds from rated down to less than ½ of 1% of maximum (200:1) without loss of torque.

Features

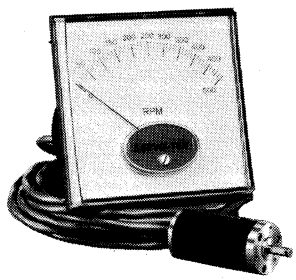
Solid-state — Instant response — Tachometer feed-back — Stability better than ½ of 1% of rated speed—Line or load regulation better than ½ of 1% of rated speed —Visual speed indication—Modular plug-in construction — Input power frequency 50 to 400 cps — Two basic models provide either ¼ or 1.2 in.-oz. @ 3600 rpm — Various geared torque units with ratios as high as 7200:1 provide full speed outputs of as low as 0.5 rpm with torque to 100 in.-oz. — Components separately available for incorporation into your equipment.

SINGLE UNITS PRICED FROM

$242.50*

ACCURATE

SPEED INDICATING SYSTEMS



A truly versatile "package" provides accurate speed indication for almost anything that moves. Nearly every industrial process or machine can benefit by the economy and safety of continuous speed indication.

SELF-POWERED—No batteries or external power required.

LOW VOLTAGE—Connecting cable can be as long as 500 ft.

PERMANENTLY LUBRICATED BALL BEARINGS.

EASILY READ 4½" INDICATOR.

TAUT BAND MOVEMENT — Withstands vibration and shock.

STANDARD RANGES — 0 to 100, 250, 500, 1000, 2000, 3000, 4000, 6000, 8000, 10,000 and 12,000 rpm. These speeds can also be provided to read "Percent of Full Speed" or "Percent of Capacity."

0 to 10 rpm available at small additional cost.

Complete System includes Generator, Indicator (specify range), Mounting Base, Coupling and 15 ft. of Connecting Cable.

SINGLE UNITS PRICED FROM

$88.00

PRICES shown are subject to a quantity discount schedule.

*An additional discount is available to resale organizations and original equipment manufacturers using these drives as an integral part of their product.

SERVO-TEK
PRODUCTS COMPANY
1086 Goffle Road, Hawthorne, N.J. 07506
(201) 427-3100

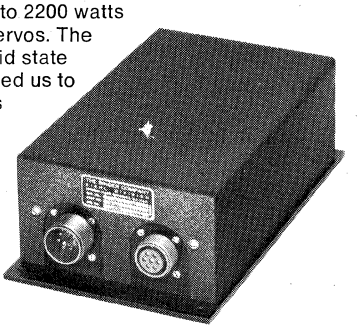
6741 Sepulveda Blvd., Van Nuys, Calif. 91401 • (213) 786-0690
1855 Gulf-to-Bay Blvd., Clearwater, Fla. 33515 • (813) 442-4164
CABLE ADDRESS: SERVOTEK, HAWTHORNE, N.J., U.S.A.
WESTERN UNION: FAX, HAWTHORNE, N.J.
Overseas Affiliate: NECO ELECTRONICS (Europe) LTD., North Street, Clapham Common, London S.W. 4

Diehl Built-in Performance to help you build in Performance

At Diehl we build in not only reliability, but performance as well. Diehl components are designed to perform efficiently, economically and with a maximum product life. Our experience, design and production capabilities all add up to top performing components which help you build top performance into your products.

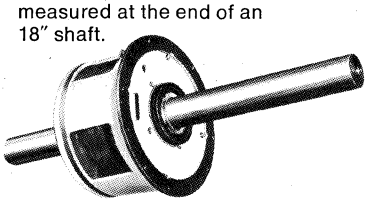
Servo Amplifiers

A full line of servo-amplifiers to fulfill requirements of less than 800 watts with 60 Hz or 400 Hz outputs up to 2200 watts needed for 1 HP servos. The introduction of solid state circuitry has enabled us to produce amplifiers that are lighter, more efficient and more stable.



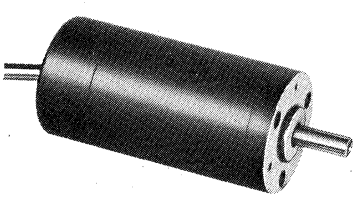
Spindle Drives

Both synchronous and induction types from fractional to 10 Hp. 80% to 95% efficiency for cool running and minimal thermal expansion. Life expectancy, 3 to 30 years depending on specifications and design. Shaft run out of .0001 for fractional ratings or .0005 for integral ratings when measured at the end of an 18″ shaft.



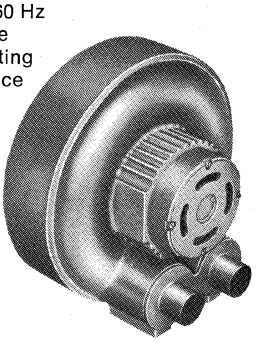
Tachometers

Low ripple. For systems requiring a highly linear (0.1%) speed/voltage relationship and low ripple performance. Life expectancy exceeds 10,000 hours at 3600 RPM and 25°C. Available with servo type mounting, face or flange mounting configurations. Operating temperature —55° to 75°C.



Vortex Blowers

High pressure or vacuum air delivery in single stage blowers at low RPM. Operate on unique principle of regenerative flow. Performance from a single stage means less weight, less bulk, lower cost, lower noise, longer life and easier servicing. Available for 60 Hz or as belt drive design permitting your own choice of drive motor.



Whatever your problem call your Diehl Representative today—or call us.

THE SINGER COMPANY · Diehl Division

Finderne Avenue, Somerville, N.J. 08876/(201) 725-2200/TWX 710-480-9325

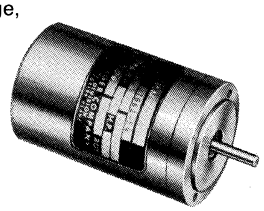
35A

Diehl Built-in Reliability to help you build in Reliability

With our seventy-nine years of experience, building reliability and performance into our components comes naturally. That's why our motors have high-strength aluminum alloy housings and end bells... stainless steel shafts... dynamically balanced rotors with spring-loaded precision bearings. Why our spindle drives have pre-loaded ABEC-7 bearings to insure no end play... our tachometers, high silver content commutators. These are just a few examples, but enough, we feel, to point out why Diehl components can help you build reliability into your own products.

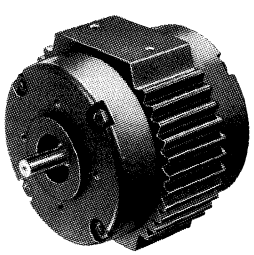
DC Motors-Gears

Permanent magnet and wound field (shunt, series, compound) ¾" to 2½" diameter with wide RPM range, wide ambient temperature range, plus many options such as a variety of gear trains, brakes, etc.



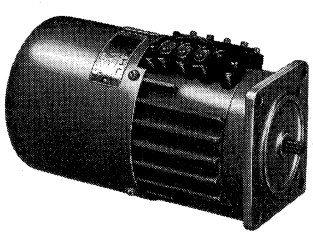
AC Motors

Induction or synchronous motors of the hysteresis or reluctance type. A broad range of power running from sub fractional up to 15 HP. Noise and vibration free with total shaft runout and concentricity error to meet the most exacting specifications.



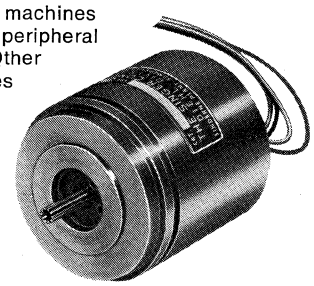
Servomotors

Complete line of instrument servo components, power servo components, servo amplifiers and commercial instrument motors to fit just about any design. Self-contained, fan cooling for precise control.



Stepper Motors

Precision control via discrete steps and high slew rates. Typical 15° stepping angle is compatible with all 24 tooth sprockets. High holding torque, high stepping speed and fast response. Ideal for business and office machines and small peripheral devices. Other step angles readily available.



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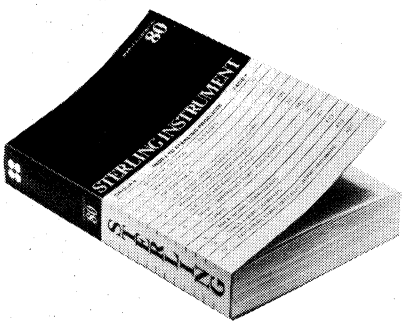
35

Sterling has 44,000 stock answers in precision electromechanical components



Gear Products

SPUR GEARS
- Pin Type • Pin Type, Miniature Hub
- Clamp Type • Clamp Type, Miniature Hub
- Flange Mounting • Hubless • Non Metallic

ANTI-BACKLASH GEARS
- Spur Gears .104" Face
- Spur Gears "P" Series 1/8" Face • Cluster Gears
- Mini-Lash Gears .104" Face
- Mini-Lash Gears "P" Series 1/8" Face
- Worm Wheels • Miter Gears

OTHER GEARS
- Bevel And Miter Gears
- Worm Gears And Worms
- Worm Wheels Anti-Backlash • Helical Gears
- Pinion Shafts • Internal Gears • Gear Racks

CLUSTER GEARS
- Cluster Gear And Hubs
- Anti-Backlash Cluster Gears

HUBS
- Cluster Gear Type • Pin Type
- Clamp Type • Hub*Lock Gear Hub
- Precision, Removable Gear Type
- Phase Adjustable Hubs

HUB*LOCK
- Spur Gears • Anti-Backlash Gears

NONCIRCULAR GEARS

Differentials

- Hollow Shaft Differential
- Solid Shaft Differential
- Low Backlash Differential
- 1/8" And 3/16" Bore Hollow Shaft Differential
- Standard Differential
- Anti-Backlash Differential
- Single End Differential
- Differential End Gears—Hubless
- Differential End Gears—Clamp Type

Gear Heads, Speed Reducers, Limit Stops

GEAR HEADS
- Special Gearheads • Low Backlash Gearheads

SPEED REDUCERS
- Special Speed Reducers
- Low Backlash Speed Reducers
- Single End Speed Reducers
- Friction Type Speed Reducers
- Worm Gear Speed Reducers
- Right Angle Ratio Drives

LIMIT STOPS
- Mechanical Limit Stops
- Adjustable Mechanical Limit Stops
- Electro Mechanical Limit Stops
- Adjustable Electrical Stop

Magnetic Clutches and Brakes

MAGNETIC CLUTCHES & BRAKES—SIZE 11
- Magnetic Clutches
- Reverse Acting Magnetic Clutches
- Magnetic Clutches With Reverse Acting Brakes
- Reverse Acting Clutches With Magnetic Brakes
- Triplex Clutches • Magnetic Brakes
- Reverse Acting Magnetic Brakes

MAGNETIC CLUTCHES & BRAKES—SIZE 18
- Magnetic Clutches
- Reverse Acting Magnetic Clutches
- Magnetic Clutches With Reverse Acting Brakes
- Reverse Acting Clutches With Magnetic Brakes
- Duplex Clutches • Triplex Clutches
- Magnetic Brakes
- Reverse Acting Magnetic Brakes

Slip Clutches and Couplings

SLIP CLUTCHES
- Standard Assemblies • Precision Type
- Precision In-Line Type

OVER-RUNNING CLUTCHES
- Hub Or Clamp Type • Combination Hub/Clamp

COUPLINGS
- Sleeve And Shaft Couplings
- Hub*Lock Couplings
- Phase Adjustable Coupling • Helical
- Bellows • Hi-Flex
- Phase Adjustable Bellows Couplings
- Oldham • Flexible And Offset Couplings
- Multi Jawed Couplings

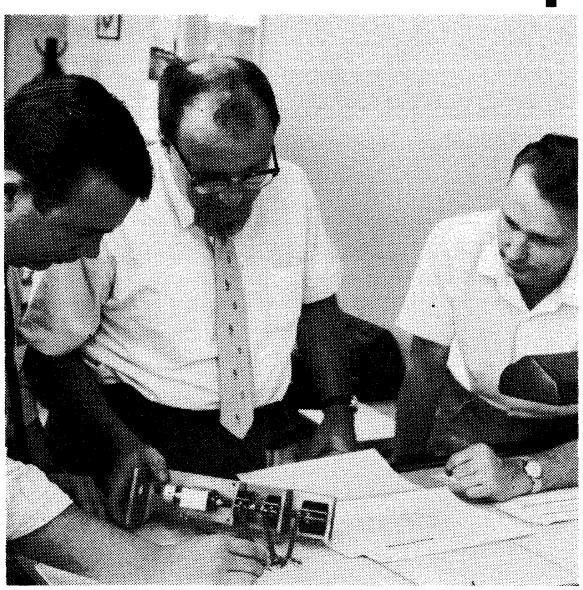
PRECISION UNIVERSAL JOINTS

Drive Components, Shaft Accessories

- Shafting • Oil Impregnated Bearings
- Sinteroil Bearings • Ball Bearings
- Shim Spacers • Shaft Spacers, Collars
- Thrust Washers
- Shaft Reducers And Extenders
- Cam Followers • Adjustable Cam Assemblies
- Grooved Pulleys
- Miniature Sprockets And Chains
- Neutriflex® Drive Belts
- Neutriflex® Belt Gear Pulleys

Clamps

- Synchro Mounting Clamps
- Balanced Gear Clamps
- Synchro Locking Clamp • Two Piece Clamps
- Reduced Clearance Clamps
- Threaded Split-Hub Clamps
- Unbalanced Gear Clamps
- Screw Type Gear Clamps
- Gearhead Attaching Clamps



Breadboard Components

- Breadboard Kits
- Adjustable Hanger Assembly
- Servo Mounting Plates And Posts
- Component Hangers
- Bearing Adapters And Mounts

Dials, Knobs, Counters

- Counters • Dials • Dial Indexes
- Vernier And Dial Sets • Handcranks And Knobs

Fasteners, Stand-Offs, Electronic Hardware

SCREWS
- Socket Head Set Screws
- Machine (Round, Fillister, Flat) Head Screws
- Shoulder Screws • Captive Screws
- Thumb Screws

NUTS
LOCK AND PLAIN WASHERS
PINS
- Dowel, Roll Pins
- Spiral, Groove, Taper Pins

PRECISION SPACER POSTS
STAND-OFFS
- Round, Threaded Stand-Offs
- Round, Insulated Stand-Offs
- Round, Clearance Stand-Offs
- Hexagonal, Threaded Stand-Offs
- Swage Type, Round Stand-Offs
- Swage Type, Hexagonal Stand-Offs

ELECTRONIC HARDWARE
- Panel Bushings and Bearings
- Chassis Fastener • Potentiometer Shaft Lock
- High Voltage Coupling • Insulating Washers
- Ferrules • Handles

STERLING HAS SOME CUSTOM-MADE ANSWERS, TOO.

The Sterling engineering staff has contributed to many important system and subsystem designs. We are prepared to design from scratch, or work closely with your engineers developing an electro mechanical assembly or system that best serves your needs.

FREE Master Catalog #80 — 44,000 stock parts plus a technical section for application information that is a must for anyone who buys or specifies or designs with electromechanical components.

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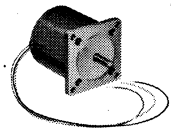
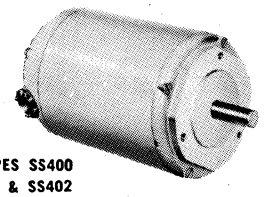
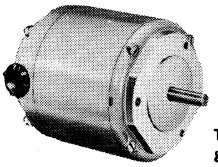
SLO-SYN®



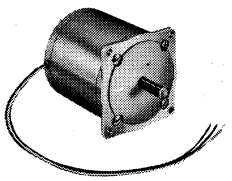
TYPE SS25



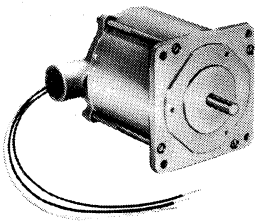
TYPES SS400 & SS402



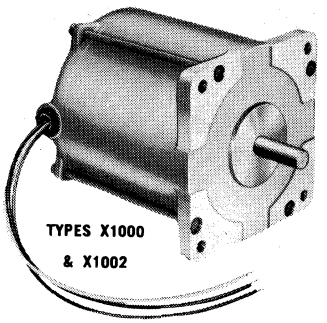
TYPES SS150 & SS152



TYPES HS50 & HS52



TYPES X250 & X252



TYPES X1000 & X1002

A-C OPERATION — Standard SLO-SYN Synchronous/Stepping Motors are permanent magnet a-c motors having extremely rapid starting, stopping and reversing characteristics and a slow basic shaft speed of 72 rpm synchronous with a line frequency of 60 hertz. Three-lead types need only a single-pole, three-position switch for complete forward, reverse and "off" control. No excessive inrush current when energized because starting and operating current are nearly identical. Can be completely stalled without overheating and with no harmful effects on components. Starts or stops in less than 5° of shaft rotation; no need for mechanical or electrical braking. When used with an auxiliary high speed motor, the SLO-SYN motor can remain coupled to the load and safely overdriven. Phase shifting resistor and capacitor must be used when operating from a single-phase source but not from two-phase. All standard motors are rated for continuous duty at maximum ambient temperature of 40°C. Types SS150 and SS152 use Class A insulation; all others have Class B.

D-C STEPPING — When used for phase-switched d-c stepping, the motors can be connected to provide either 100 or 200 steps per revolution. Accuracy of the steps is ±.09° noncumulative. Three-lead types require a center-tapped d-c supply and single-pole, double-throw switching; four-lead types require a single-ended power supply and single pole, double-throw switching. Bifilar motors can also be used with transistorized switching circuits. With a suitable control potentiometer instead of switches, a SLO-SYN motor can be made to rotate steplessly, permitting extremely accurate positioning. All motors have lubricated-for-life bearings.

PRECISION STEPPING

For phase-switched d-c stepping, types HS25, HS50, HS50D and HS50L make 200 steps per shaft revolution. Each 1.8° step is accurate within ±3% (.06°) noncumulative. May be operated at speeds greater than 500 steps per second if accelerating and decelerating circuits are used. With proper circuitry, the motors may be operated at speeds of 1000 steps per second or higher without missing any steps.

200 RPM

Types TS25, TS50 and TS52 are similar to standard models but operate at synchronous speeds of 200 rpm and take 36 or 72 steps per revolution when used for d-c stepping.

RATINGS AND SPECIFICATIONS FOR A-C APPLICATIONS

TYPE	MAXIMUM AMPERES	TORQUE (Oz-In)	MAXIMUM MOMENT OF INERTIA OF A RIGIDLY ATTACHED LOAD (Lb-In²)	PHASE-SHIFTING COMPONENTS*				APPROXIMATE MOTOR WEIGHT (POUNDS)	
				RESISTOR	RESISTOR PART NUMBER	CAPACITOR	CAPACITOR PART NUMBER	NET	SHIPPING
120 Volts, 50/60 hertz, 1 Phase, 200 RPM at 60 hertz									
TS25	0.2	25	0.12	300 ohm, ±5%, 25 watt	R-TS25/50	1.5 mfd ±6%, 330 VAC	C-TS25	2	2½
TS50	0.3	50	0.25	300 ohm, ±5%, 25 watt	R-TS50	3.75 mfd ±6%, 330 VAC	C-SS150/TS50	4¾	5¾
120 volts, 50/60 hertz, 1 phase, 72 RPM at 60 hertz									
SS25§	0.1	25	0.15	500 ohm ±5%, 5 watt	R-SS25	0.75 mfd ±6%, 330 VAC	C-SS25	1¼	1½
SS50§	0.3	50	0.5	250 ohm ±5%, 25 watt	R-SS50/150	2.6 mfd ±6%, 330 VAC	C-SS50	3	3½
SS50M†§	0.3	50	0.5	250 ohm ±5%, 25 watt	R-SS50M/150M	2.6 mfd ±6%, 330 VAC	C-SS50M	3	3½
SS150	0.4	150	1.5	250 ohm ±5%, 25 watt	R-SS50/150	3.75 mfd ±6%, 330 VAC	C-SS150/TS50	6½	8
SS150M†	0.4	150	1.5	250 ohm ±5%, 25 watt	R-SS50M/150M	3.75 mfd ±6%, 330 VAC	C-SS150M	6½	8
SS250	0.6	250	3	150 ohm ±5%, 50 watt	R-SS250/400	6.5 mfd ±6%, 330 VAC	C-SS250/400	6½	8
SS250M†	0.6	250	3	150 ohm ±5%, 50 watt	R-SS250M	6.5 mfd ±6%, 330 VAC	C-SS250M	6½	8
X250‡	0.6	250	3	150 ohm ±5%, 50 watt	R-SS250/400	6.5 mfd ±6%, 330 VAC	C-SS250/400	7¾	9
SS400	0.6	400	4.5	150 ohm ±5%, 50 watt	R-SS250/400	6.5 mfd ±6%, 330 VAC	C-SS250/400	12¼	13¾
X1000‡	3.0	1000	9	65 ohm ±5%, 160 watt	R-X1000	30 mfd ±6%, 330 VAC	C-X1000	31	33
X1500	3.0	1500	12	50 ohm ±5%, 375 watt	R-X1500	30 mfd ±5%, 330 VAC	C-X1000/1500	38	41
SS1800	4.0	1800	16	40 ohm ±5%, 375 watt	R-SS1800	60 mfd ±6%, 330 VAC	C-SS1800	45	50
240 Volts, 50/60 hertz, 1 Phase, 200 RPM at 60 hertz									
TS52	0.2	50	0.25	1200 ohm ±5%, 25 watt	R-SS152/TS52	1.0 mfd ±6%, 660 VAC	C-SS152/TS52	4¾	5¾
240 Volts, 50/60 hertz, 1 Phase, 72 RPM at 60 hertz									
SS52§	0.2	50	0.5	1000 ohm ±5%, 10 watt	R-SS52	0.67 mfd ±6%, 660 VAC	C-SS52	3	3½
SS152	0.2	150	1.5	1200 ohm ±5%, 25 watt	R-SS152/TS52	1.0 mfd ±6%, 660 VAC	C-SS152/TS52	6½	8
SS252	0.3	250	3	500 ohm ±5%, 50 watt	R-SS252/402	1.75 mfd ±6%, 660 VAC	C-SS252/402	6½	8
X252‡	0.3	250	3	500 ohm ±5%, 50 watt	R-SS252/402	1.75 mfd ±6%, 660 VAC	C-SS252/402	7¾	9
SS402	0.3	400	4.5	500 ohm ±5%, 50 watt	R-SS252/402	1.75 mfd ±6%, 660 VAC	C-SS252/402	12¼	13¾
X1002‡§	1.5	1000	9	250 ohm ±5%, 200 watt	R-X1002	8 mfd ±6%, 660 VAC	C-X1002	31	33
SS1802	2.0	1800	16	130 ohm ±5%, 320 watt	R-SS1802	15 mfd ±6%, 660 VAC	C-SS1802	45	50

*External resistor and capacitor must be ordered separately. †Militarized. ‡Explosion-proof. §For 60 hertz. Other phase-shifting components required for 50 hertz.

THE SUPERIOR ELECTRIC COMPANY
1000 MIDDLE STREET, BRISTOL, CONNECTICUT 06010

SEE OTHER SUPERIOR ELECTRIC PRODUCT PAGES

Synchronous / Stepping Motors FOR A-C CONSTANT SPEED • FOR D-C STEPPING

THREE-LEAD SLO-SYN SYNCHRONOUS/STEPPING MOTORS — RATINGS FOR STEPPING APPLICATIONS

MOTOR TYPE	TS25	TS50	TS52	SS25	SS50 SS50M	SS52	SS150 SS150M	SS152	SS250 SS250M X250	SS252 X252	SS400	SS402	X1000	X1002	SS1800	SS1802
D-C VOLTS	60	50	100	80	50	100	35	70	32	64	30	60	11.5	23	9.5	19
AMPERES PER WINDING	0.15	0.25	0.13	0.07	0.15	0.08	0.35	0.18	0.50	0.25	0.60	0.30	3.2	1.6	4.7	2.4

FOUR-LEAD SLO-SYN SYNCHRONOUS/STEPPING MOTORS RATINGS FOR STEPPING APPLICATIONS

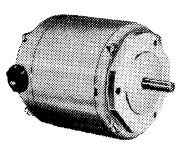
TYPES	D-C INPUT VOLTS PER WINDING	AMPERES PER WINDING
SS25-1014	16	0.35
SS25-1012	40	0.14
SS25-1013	80	0.07
SS50-1012	2.5	3.1
SS50-1011	10	0.75
SS50-1002	25	0.30
SS50-1014	50	0.15
SS150-1007	2	6.3
SS150-1018	7	1.75
SS150-1015	17.5	0.70
SS150-1025	35	0.35
SS250-1010	3	5.3
SS250-1009	8	2.0
SS250-1008	16	1.0
SS250-1007	32	0.50
SS400-1005	15	1.2
SS400-1007	30	0.6
X1000-1005	11.5	3.2
X1000-1008	23	1.6
SS1800-1004	9.5	4.7
SS1800-1005	19	2.4

SLO-SYN PRECISION STEPPING MOTORS RATINGS FOR DC STEPPING APPLICATIONS

TYPES	DC VOLTS	AMPERES PER WINDING
HS25	5.4	1.5
HS50	3	4
HS50L	4.5	3.5

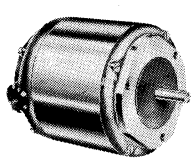
BIFILAR SLO-SYN SYNCHRONOUS/STEPPING MOTORS RATINGS FOR STEPPING APPLICATIONS

TYPE	D-C VOLTS	AMPERES PER WINDING
TS50-1001	3	4.0
SS25-1002	5.9	0.88
SS25-1001	11.8	0.44
SS25-1011	23.6	0.22
SS50-1010	2	3.3
SS50-1009	5.5	1.3
SS50-1008	8	0.85
SS50-1001	14	0.53
SS50-1007	35	0.21
SS150-1023	1.4	8.5
SS150-1009	2.5	4.0
SS150-1010	10	1.25
SS150-1017	25	0.5
SS250-1006	2.5	5.0
SS250-1027	4.6	3.1
SS250-1002	9	1.55
SS250-1004	22.5	0.61
X250-1003	4.6	3.1
X250-1002	9	1.55
SS400-1021	5.3	3.4
SS400-1002	8.3	2.2
SS400-1006	21.2	0.85
X1000-1002	10	3.6
X1000-1007	25.4	1.42
SS1800-1007	11.5	3.9
SS1800-1002	14.4	3.1
SS1800-1006	23	2.0



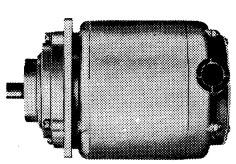
BIFILAR

Used for d-c stepping where use of push-pull circuitry and center-tapped power supply is not possible or where increased torque at high stepping speeds is required.



SPECIAL ENVIRONMENT

High Vacuum types for vacuums to 10^{-6} Torr; High Temperature types for temperatures to 130°C; High Radiation types withstand dosage of 3,000 megarads. All available from 50 to 1800 oz-in; High Vacuum 25 oz-in also.

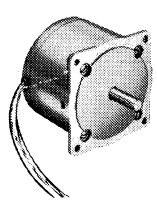


PLANETARY GEAR

Basic .50 and 150 oz-in types and type X250 available with planetary gear assemblies in speeds of 16.6, 3.32, 0.665, 0.133 or 0.027 rpm; 16.6 rpm available in other 250 and on 400 oz-in types.

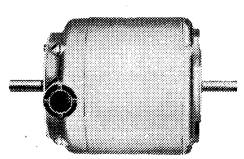
FOUR-LEAD

Designed for d-c stepping to provide the flexibility needed for use with equipment requiring isolated windings with no common connection.



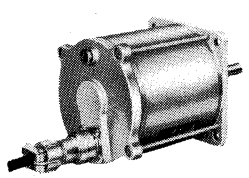
DOUBLE END

Three-lead, bifilar and four-lead types with output shaft at each end of motor available in all listed torque ratings. 50, 150 and 250 oz-in types available also with planetary gear assemblies in 16.6, 3.32, 0.665, 0.133 or 0.027 rpm speeds.



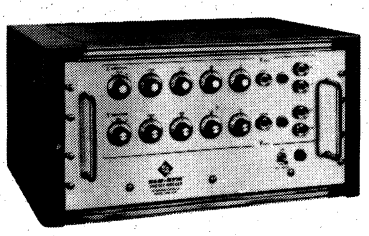
VISCOUS DAMPED

Type HS50D precision stepping motor has a unique fluid system resulting in a step function approaching critical damping. Speed of response and running characteristics are essentially unaffected by the silicone viscous damping fluid. Possesses characteristics of types described under PRECISION STEPPING on facing page.



IN SECTIONS 2100, 4000 AND 5600

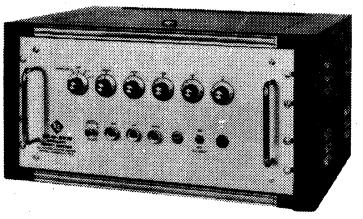
SLO-SYN® *Preset Indexers*



TWO-AXIS
TYPE 2SP1800-4



SINGLE-AXIS
TYPE SP1800B-4

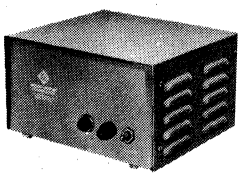


ABSOLUTE
TYPE SA1800-5

Used to control indexing of SLO-SYN bifilar motors. The index angle, or position, can be preset by dial setting on the control panel the number of 1.8° steps to be driven. Have provision for actuating any external equipment needed to perform related operations. Index, jog and free run can be initiated manually from the control panel or from an external switch. Can be made to cycle automatically with proper external switching. Single- and two-axis models are available with counting ranges to 99,999 steps. Two-axis models provide independent control of two SLO-SYN motors. Speed adjustable from 4 steps/second up to maximum possible with motor used. Optional backlash take-up circuit.

ABSOLUTE PRESET INDEXERS permit either absolute or incremental positioning modes. In the absolute positioning mode, the number set on the controls determines the final position of the motor relative to the starting, or "zero" point. When incremental positioning is used, the motor will move the preselected number of steps each time the INDEX button is pressed. Optional backlash take-up circuit.

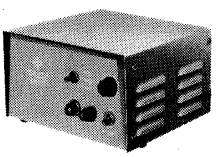
SLO-SYN® *Translator*



TYPE ST1800B

Pulse-to-step converter designed for use with appropriate bifilar SLO-SYN motors converted for incremental stepping. Convert low level signal pulses or square waves into the correct switching sequence needed to step a SLO-SYN motor at 200 steps/revolution (1.8° per step). Input is 105-125 volts a-c, 1 ampere. Signal input impedance is 500 ohms. Used for programmed positioning, indexing and indicating operations.

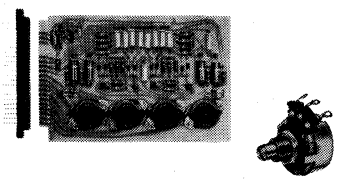
SLO-SYN® *Adjustable Speed Drive*



TYPE ST1800BV

Essentially, SLO-SYN Adjustable Speed Drive type ST1800BV is a translator which includes a built-in oscillator to supply the triggering signals. Oscillator frequency can be adjusted to vary the speed from 4 steps/second up to the maximum permissible with the motor used. Direction of rotation can be controlled either from the front panel or from a remotely located switch.

SLO-SYN® *Translator Module*



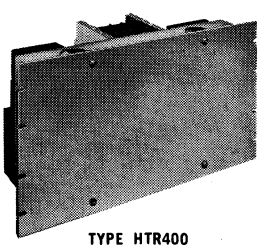
TYPE STM1800V

Plug-in circuit boards with logic capabilities for stepping a SLO-SYN motor in 1.8° increments. Type STM1800 is a basic translator which will provide bi-directional motor operation. Type STM1800V is similar but includes a built-in oscillator which can be adjusted to drive the motor at speeds from 4 steps/second up to maximum at which the motor will drive the load.

SLO-SYN® *High Speed Drives*

Translator

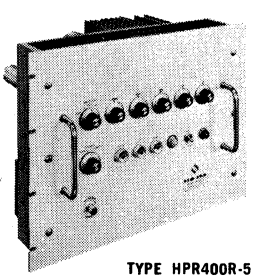
Drive SLO-SYN Precision Stepping Motors up to 2000 steps per second without losing any steps. Triggering the translator circuits is an internal oscillator which can supply a variable frequency range adjustable from 50 to 2000 steps per second. Triggering pulses can be supplied by tape readers, computers, oscillators, pulse generators and other signal producing equipment.



TYPE HTR400

Preset Indexer

Drive SLO-SYN Precision Stepping Motors in indexing and other positioning operations. Acceleration and deceleration circuits permit driving motors up to 2000 steps per second without missing any steps. Decade counter controls on front panel allow the operator to select any desired positioning increment. Optional backlash take-up circuit.



TYPE HPR400R-5

THE SUPERIOR ELECTRIC COMPANY

1000 MIDDLE STREET, BRISTOL, CONNECTICUT 06010

SEE OTHER SUPERIOR ELECTRIC PRODUCT PAGES IN SECTIONS 2100, 4000 AND 5600

VERNITRON CATALOG DIGEST

SERVO MOTORS

VERNITRON TYPE NUMBER	05M4B-AAO-AO	08M4K-AAO-AO	08M4N-ABO-AO	10M4C-AAO-AO	10M4J-AAO-AO	11M4D-ABO-AO	11M6D-AAO-AO	11M4R-AAO-AO	15M6D-AEO-AO	15M4L-ADO-AI	18M4B-AEO-HO	18M4H-ABO-CO	18M6H-ABO-CO	23M6C-ABO-BO	23M4E-AAO-AO
Figure Number	1	3	3	4	4	5	5	5	6	6	7	7	7	8	8
Weight	.6	1.1	.75	1.4	1.7	4.6	4.6	3.3	8.0	8.0	12	14	14	35	30
Stall Torque	.10	.20	.20	.30	.33	1.0	1.0	.70	2.0	1.45	2.3	5.0	8.0	18	6.0
No Load Speed	9500	9500	7000	6500	9700	6200	3450	6700	3200	6500	4800	10,000	3300	3200	10,000
Frequency	400	400	400	400	400	400	60	400	60	400	400	400	60	60	400
Rotor Inertia	.05	.40	.30	.47	.46	1.1	1.1	.65	3.3	1.0	4.0	5.0	5.0	15	10.0
Volts Input (Fixed Phase or Fixed ø)	26	26	26	115	26	115	115	115	115	115	115	115	115	115	115
Volts Input (Control Phase)	36/18	26	26	40CT	40/20	115/57.5	36CT	36CT	230/115	115/57.5	40/20	115/57.5	115/57.5	36/18	115/57.5
Stalled Impedance (F ø)	230+J200	190+J180	200+J175	2300+J3000	140+J115	634+J987	1700+J1700	1160+J1640	1300+J950	390+J670	250+J590	120+J196	325+J390	140+J190	150+J183
Stalled Impedance (Control ø)	440+J380	190+J180	200+J175	210+J270	310+J270	634+J987	221+J221	116+J164	5200+J3800	390+J670	35+J85	120+J196	325+J390	14+J19	150+J183
Power Input (Fixed ø)	1.8	1.9	1.9	2.0	3.0	6.5	4.0	3.7	6.0	8.0	9	30	16	29	36
Power Input (Control ø)	1.8	1.9	1.9	3.0	3.0	6.5	4.0	3.7	6.0	8.0	9	30	16	29	36
Acceleration @ Stall	150,000	40,000	47,500	45,000	50,000	66,000	66,000	80,000	53000	100,000	40,000	70,000	110,000	85,000	50,000
Figure of Merit	15,000	8,000	10,000	13,500	16,000	66,000	66,000	56,000	133,000	145,000	96,000	350,000	900,000	1,500,000	300,000
Motor Torque Constant	200	550	550	525	580	620	2000	1400	760	890	4000	3000	5700	35,000	4200
Motor Damping Factor	6.9	15	20	32	24	108	216	71	550	158	335	300	1800	4000	460
Motor Velocity Constant	29	36	27.5	16	24	5.8	9.3	20	1.4	5.6	12	10	3.0	9.0	9
Motor Corner Frequency	138	37	68	68	52	100	200	110	167	158	83	60	360	265	49
Motor Time Constant	.0072	.027	.015	.014	.019	.010	.005	.010	.006	.006	.012	.017	.028	.003	.022
Reversing Time	.011	.043	.025	.023	.030	.017	.008	.016	.010	.010	.020	.028	.004	.006	.037
		.750"L	.625"L	.625" L	1.000" L	L=1.438" w/leads Lt=1.938	L=1.438" w/leads Lt=1.938"	L=1.050" w/leads	Lt=1.800"	L=1.530"	Lt=2.015"	Lt=2.850"	Lt=2.850"	Lt=3.000"	Lt=2.100"

DAMPING DEVICES

MOTOR GENERATOR

VERNITRON TYPE NUMBER	08G4C-AAO-AO	11G4D-AA1-AO	15G6L-AA2-CO	18G4E-AC1-BO	18G6E-AC3-BO	23G6A-AA1-AO	23G4B-AA1-BO
Figure Number	1	5	7	9	9	10	11
Weight	2	3.5	15	29	29	40	40
Frequency	400	400	60	400	60	60	400
Stall Torque	.20	.70	2.0	5.0	8.0	18	6.0
No Load Speed	6500	6500	3000	10,000	3000	3000	9500
Rotor Inertia	.33	1.0	5.3	5.0	10.0	18	18
Motor Fixed ø (volts)	26	115	115	115	115	115	115
Motor Control ø (volts)	26	36CT	36CT	115/57.5	115/57.5	115	115/57.5
Motor Fixed ø Impedance	200+J175	1160+J1640	1300+J950	120+J196	325+J390	140+J190	150+J183
Motor Control ø Impedance	200+J175	116+J164	130+J95	120+J196	325+J390	140+J190	150+J183
Motor Fixed ø Power	1.9	3.7	6.0	30	16	29	36
Motor Control ø Power	1.9	3.7	6.0	30	16	29	36
Generator Input Voltage	26	115	115	115	115	115	115
Generator Output Voltage	.45	1.0	3.0	3.1	3.0	3.2	3.2
Generator Input Power	1.5	2.5	1.5	5.4	1.5	1.5	6.0
Generator Input Impedance	570+J550	2200+J2650	3600+J4200	900+J1200	3600+J4200	3600+J4200	1000+J1100
Null Voltage	.015	.025	.050	.030	.050	.050	.025
Phase Shift	±10°	±10°	+14°	±10°	+14°	+14°	±10°
Length	1.250	1.842	3.258	4.400	4.400	4.625	3.710

INERTIALLY DAMPED

VERNITRON TYPE NUMBER		08D4B-CC0-A1	11D4A-ADO-DO	15D6B-ABO-A3	15D4C-AC0-AO	18D6B-AAO-AO
Figure Number		1	2	3	3	4
Weight		3.0	6.0	12	12	18
Frequency		400	400	60	400	60
Stall Torque		.30	.63	2.0	.7	4.0
No Load Speed		6300	6300	2700	9500	3000
Rotor Inertia		.48	1.5	6.0	6.0	6.5
Motor Fixed ø (volts)		115	115	115	115	115
Motor Control ø (volts)		40/20	40CT	40/20	36/18	40/20
Motor Fixed ø Impedance		1800+J2340	1275+J1800	1450+J1080	600+J800	750+J750
Motor Control ø Impedance		225+J292	150+J210	170+J130	60+J80	87+J86
Motor Fixed ø Power		2.8	3.5	6.0	6.5	9.0
Motor Control ø Power		2.8	3.5	6.0	6.5	9.0
Flywheel Inertia		5	10	100	100	100
Flywheel Damping		200	350	1250	1500	1000
Corner Frequency	W1 (RAD/SFC)	6	4	4.2	0	4.4
	W2 (RAD/SFC)	40	35	12.5	15	10
	W3 (RAD/SFC)	500	300	250	250	282
Max. Kv in System (sec⁻¹)		3000	2500	750	∞	670
Length (max.)		1.680	2.125	2.650	2.650	3.310

COMPUTING DEVICES

RATE GENERATORS

VERNITRON TYPE NUMBER	08C4A-AA1-AO	11C4A-AA1-AO	15C4A-AA1-AO
Frequency (CPS)	400	400	400
Excitation Voltage Generator (volts)	26	115	115
Power Input Generator (watts)	2.2	—	—
Voltage Gradient (volts/1000 RPM)	.63	—	—
Phase Shift (deg.)	5° Lag	5° Lag	5° Lag
Position Error (In Phase) (volts)	—	8	8
Position Error (Quadreture) (volts)	—	15	15
Axis Error In Phase (volts)	—	4	4
Axis Error Quad. (volts)	—	5	5
RMS Null Voltage (volts)	.015	—	—
Temperature Sensitivity	.05%/C°	.05%/C°	.05%/C°
Length (L)	1.0		

INTEGRATORS

VERNITRON TYPE NUMBER	08I4A-AA1-AO	08I4A-AA1-A1	11I4B-AA1-AO	15I4A-AB2-AO	15I4E-AB1-BO	15I4A-AA3-AO	15I4B-AA1-AO
Frequency (CPS)	400	400	400	400	400	400	400
Excitation Voltage Generator (volts)	26	26	115	115	115	115	115
Power Input Generator (watts)	2.5	2.5	5.5	6	5.5	5.5	4
Voltage Gradient (volts/1000 RPM)	.5	.5	2.75	2.75	2.75	2.75	1.0
Phase Shift (deg.)	0°	0°	0°	0°	0°	0°	0°
Position Error (In Phase) (volts)	—	—	7	10	—	8	2
Position Error (Quadreture) (volts)	—	—	11	20	—	15	6
Axis Error In Phase (volts)	—	—	7	5	—	4	5
Axis Error Quad. (volts)	—	—	.10	10	—	5	5
RMS Null Voltage (volts)	.015	.015	—	—	.015	—	—
Temperature Sensitivity	±1% (−55°C to 125°C)	±5% (−15°C to 75°C)	±3% (0°C to 85°C)	±3% (0°C to 85°C)	±5% (−55°C to 100°C)	±25% (−15°C to 75°C)	±05% (0° to 125°C)

VERNITRON CORPORATION

MOTOR PRODUCTS DIVISION:
50 Gazza Boulevard, Farmingdale, New York • (516) 694-5002 • TWX: 510-224-6890
CONTROL COMPONENTS DIVISION:
1742 South Crenshaw Boulevard, Torrance, California • (213) 328-2504
TWX: 910-349-6250
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Cables: VERNITRON, Farmindale, N.Y.

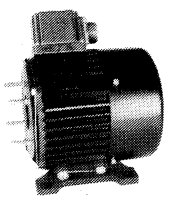
We have the motor you have in mind.

We have all types of precision motors, precision gears, and gear trains for commercial and government end use in electronics, avionics, and aerospace industries. If you need a particular custom model, our engineering group is backed by a complete manufacturing capability to produce reliable, long-lasting products.

AIRCRAFT MOTORS—AC AND DC

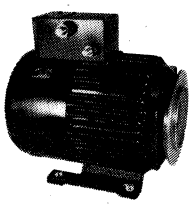
Frames from 2" to 8" diameter. DC and 400 cycle AC. Outputs from ⅛ to 30 hp; any required speed. Designed to military specifications. Can be equipped with gearheads and brakes, face or foot mounts.

Applications: Pumps, actuators, hoists, radar antennas, vane axial blowers.



AC Aircraft Motors. Diameters from 2" to 8". Outputs to 30 hp.

Model shown: 400 C.P.S. Self cooled, aircraft pump drive. 5" dia. by 6.00 LG, 3.0 hp. @ 5,600 rpm. Weight 12 lbs.

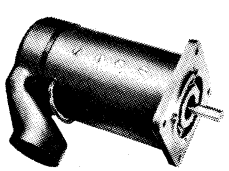


DC Aircraft Motors. Shunt, series or compound. Diameters from 2" to 6.5". Outputs from 1/100 to 10 hp.

Model shown: A 28-volt DC motor with radio noise filter, 6 hp at 6,000 rpm, used to drive a pump on a missile vehicle launcher.

TORQUE MOTORS

Typical Applications: Reel drive motors for magnetic tape transports and other closed servo loop systems such as antenna drives. (1) small time constant (2) fast response (3) high reliability (4) long life. Diameters up to 5⅜". Lock rotor torque up to 2,000 oz-in.



Model shown: 5⅜" dia. by 10½" long, special attachment for forced-air cooling, 115 VDC, 1,750 oz-in lock rotor torque.

SMALL MOTORS—AC AND DC

Typical Applications: Aerospace and ground systems equipment; drives for safe-arm devices, blower and fans, small actuators. Diameters as low as ⅞" in DC and 1.0" in AC. Can be equipped with gear reductions, brakes, clutches, governors and radio noise filters.

Small 400 cycle AC Motors. Five frames from 1" to 2" diameter. Induction and synchronous types. Any phase, voltage or speed.



Model shown: High-slip fan motor, 1 oz-in @ 10,000 rpm. 1.45" dia. x 1.87" long. Weight 8 oz.

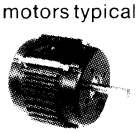


Small Permanent Magnet and Wound Field DC Motors. Seven frames from ⅞" dia. to 2" dia. Outputs up to ⅛ hp. Speeds from 1,000 to 30,000 rpm.

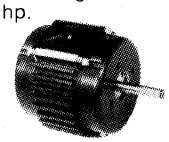
GENERAL PURPOSE AC MOTORS INDUCTION-SYNCHRONOUS

Fifteen different frames from 2¾" to 5⅜" diameter. Any frequency, phase, voltage or poles. Outputs up to 12 hp. Commercial or military specifications. Motors available in face or foot-mounted smooth housings, or cooling fins with mounting flats.

Here are two motors typical of this group.



Frame 211: 2¾" dia. over cooling fins, 2½" over mounting flats. Output from 1/250 to ¼ hp.



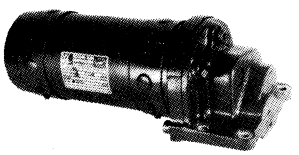
Frame 441: 5⅜" dia. over cooling fins, 5.0" over mounting flats. Output from ¼ to 12 hp.

GEAR MOTORS—AC



Model shown: A 208-volt, 400 cycle gearmotor, 10.7 hp. @ 2,400 rpm, used on a heat exchanger. 23 lbs. weight.

GEAR MOTORS—DC



Model shown: 29 VDC two speed motor. 25 lb/in. @ 3,600 & 1,800 rpm. 6.6 lbs. weight.

HYSPERSYN SYNCHRONOUS MOTORS

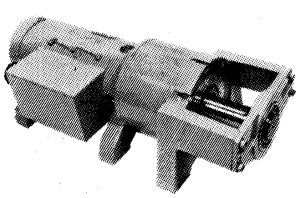
Typical Applications: Computer memory drums; facsimile devices. Patented features offer high torque, efficiency, and power factor; excellent damping. Any frequency. Rotor-Stator sets or complete motors.



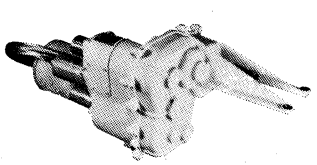
Hyspersyn: High starting, synchronizing and pullout torques; no drift. Diameters 2½" to 18". Outputs up to 5 hp.

ACTUATORS

Special actuators, AC or DC, linear or rotary, can be supplied to fit your requirements.



Model shown: A 115-volt DC motor with clutch, brake, noise filter, and gear box; output: 285-lb-ft @ 20 rpm; used on an antenna-drive system.



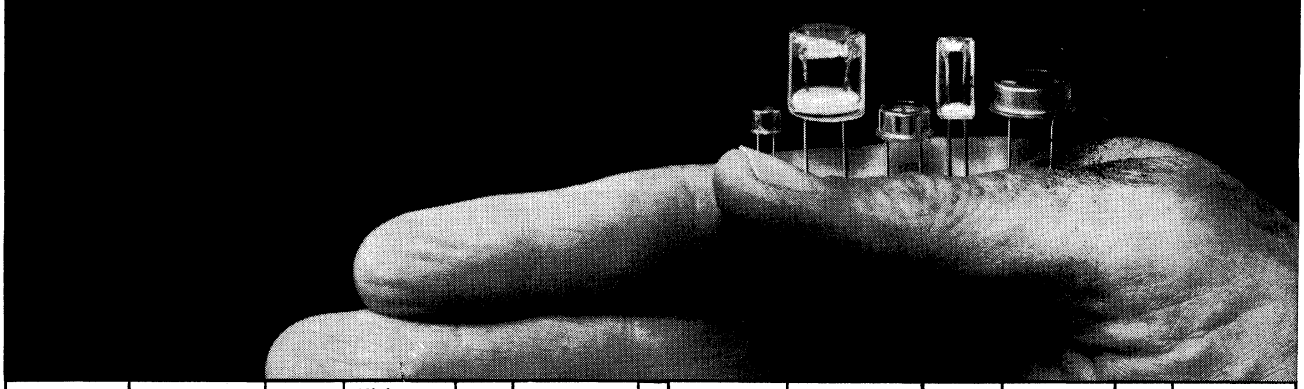
Model shown: 24 VDC four speed actuator. 1,000 oz-in @ 6,000, 3,000, 1,500, 750 rpm. Capable of reversing & shifting. Utilizes unique two speed motor. Weight 27 lbs.

For more information, write for our catalog and capability brochure.
ELECTRO PRODUCTS DIVISION, Western Gear Corporation
75 West Green Street, Dept. E, Pasadena, California 91101

WESTERN GEAR CORPORATION

Photoconductive Cells

This listing represents less than half of the Clairex standard and special photocells available. A 16-page design manual is available on request.



Photocell ordering abbreviation	Diam. X Length (inches)	Resistance @ 2 fc ± 33⅓%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)
CL5M2	.55 X .18	55K	1:100	250	2000-500[1]
CL602	.25 X .5	1 meg.		300	75
CL702	.36 X .18	1 meg.		300	125
CL902	.21 X .15	1 meg.		250	50

Type 2 CdS (photosensitive material designated by last number in ordering abbreviation, i.e. CL5M2). Peak spectral response 5150 angstroms, bluest response photosensitive material, high stability, lowest temperature error.

CL503	.5 X .5	7.2K	1:10,000	250	500-250[1]
CL5M3	.55 X .18	7.2K		250	2000-500[1]
CL603	.25 X .5	133K		300	75
CL603A	.25 X .5	75K		300	75
CL603AL	.25 X .5	3.5K		170	75
CL703	.36 X .18	133K		300	125
CL703A	.36 X .18	67K		300	125
CL703L	.36 X .18	2.7K		100	125
CL903	.21 X .15	133K		250	50
CL903A	.21 X .15	67K		250	50
CL903L	.21 X .15	6.0K		100	50

Type 3 CdSe, peak spectral response 7350 angstroms, fast response, and very high light-to-dark resistance ratio. Can be used for high speed switching or counting. Sensitive to near infra red. For use with incandescent or neon lamps.

CL504	.5 X .5	1.5K	1:1000	250	500-250[1]
CL5M4	.55 X .18	1.5K		250	2000-500[1]
CL504L	.5 X .5	0.25K		170	500-250[1]
CL5M4L	.55 X .18	0.25K		170	2000-500[1]
CL604	.25 X .5	30K		300	75
CL604L	.25 X .5	1.5K		170	75
CL704	.36 X .18	30K		300	125
CL704L	.36 X .18	0.6K		100	125
CL904	.21 X .15	30K		250	50
CL904L	.21 X .15	2K		100	50

Type 4 CdSe, peak spectral response 6900 angstroms, lowest resistance photocells available. Can be used for "on-off" applications when low resistance is desired. For use with incandescent or neon lamps.

CL505	.5 X .5	9K	1:100	250	500-250[1]
CL5M5	.55 X .18	9K		250	2000-500[1]
CL505L	.5 X .5	1.5K		170	500-250[1]
CL5M5L	.55 X .18	1.5K		170	2000-500[1]
CL605	.25 X .5	166K		300	75
CL605L	.25 X .5	7.5K		170	75
CL705	.36 X .18	166K		300	125
CL705L	.36 X .18	3.3K		100	125
CL905	.21 X .15	166K		250	50
CL905L	.21 X .15	10K		100	50

Type 5 CdS, peak spectral response 5500 angstroms (closely matches the human eye), most stable, lowest memory photocell available. Can be used in light measuring applications and precision low speed switching. For use with incandescent, fluorescent or neon lamps.

CL705HL	.36 X .18	28K	1:1000	100	125
CL905HL	.21 X .15	100K		100	50
CL905HN	.21 X .15	700K		100	50

Type 5H CdS, peak spectral response 5500 angstroms (closely matches the human eye). Combines high speed, stability, linearity, and uniform color temperature response.

Photocell ordering abbreviation	Diam. X Length (inches)	Resistance @ 2 fc ± 33⅓%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)
CL507	.5 X .5	7.2K	1:1000	250	500-250[1]
CL5M7	.55 X .18	7.2K		250	2000-500[1]
CL607	.25 X .5	133K		300	75
CL707	.36 X .18	133K		300	125
CL707L	.36 X .18	2.7K		100	125
CL907	.21 X .15	133K		250	50
CL907N	.21 X .15	66K		100	50

Type 7 CdS, peak spectral response 6150 angstroms, moderate speed and ratio. Can be used in general beam breaking applications. For use with incandescent, neon or fluorescent lamps.

CL707H	.36 X .18	500K	1:1000	300	125
CL707HM	.36 X .18	100K		250	125
CL707HL	.36 X .18	10K		100	125
CL907H	.21 X .15	600K		250	50
CL907HN	.21 X .15	300K		100	50
CL907HL	.21 X .15	24K		100	50

Type 7H CdS Peak Spectral response 6200 angstroms. Very fast decay time coupled with low resistance and high linearity. Ideal for beam breaking applications.

Photocell ordering abbreviation	Diam. X Length (inches)	Resistance @ 2 fc ± 33⅓%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)	Type
CL703/2	.36 X .18	50K	1:10,000	300	125	3 CdSe
CL703L/2	.36 X .18	6.5K	1:10,000	100	125	3 CdSe
CL704/2	.36 X .18	17K	1:1000	300	125	4 CdSe
CL704L/2	.36 X .18	1.5K	1:1000	100	125	4 CdSe
CL705/2	.36 X .18	166K	1:100	300	125	5 CdSe
CL705L/2	.36 X .18	7.5K	1:100	100	125	5 CdS

DUAL ELEMENT

Photocells contain two separate elements with two separate leads and one common lead.



PHOTOMOD®

PHOTOCELL-LAMP ASSEMBLIES

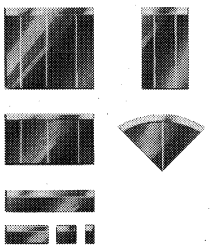
Part No.	Rated Lamp Voltage	Resistance (Max. Ohms) @ Rated Lamp Voltage	Max. Allowable Cell Voltage @ Peak AC
CLM3006A	6	160	120V
CLM4006A	6	55	120V
CLM4012A	12	30	120V
CLM3012A	12	160	120V
CLM5H10A	10	3000	120V
CLM7H16A	16	550	170V
CLM3120A	120	1150	120V
CLM4120A	120	160	120V

FOOTNOTE: [1] With and without heat sink.

CLAIREX ELECTRONICS, INC.

1239 BROADWAY, NEW YORK, N.Y. 10001 • WRITE FOR NAME OF YOUR NEAREST CLAIREX REPRESENTATIVE OR DISTRIBUTOR.

The experienced source for standard and custom SENSOR TECHNOLOGY Photovoltaic Devices, Hybrid Circuits, and Packaged Systems



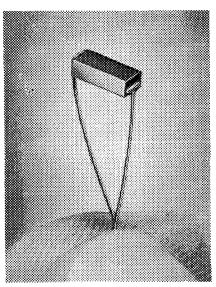
SILICON SOLAR ENERGY CONVERTERS

Excellent photovoltaic components for systems feature high reliability, instant response, and long life characteristics. No other power supplies needed. Amplification of cell output immediately gained with simple transistor circuitry. Normally used in the following categories: A) photo-electric where control mechanisms are activated by light. B) power for converting light directly into DC power or storing in rechargeable batteries. C) read-out when "read-out" information from punched cards and tapes is obtained by cells arranged in mosaic patterns.

STANDARD READOUT PHOTOCELLS

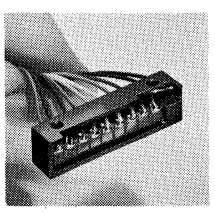
Standard Type Numbers	Overall Dimensions cm x cm	Photo-Active Area cm^2	Average Weight grams	Min. Current Output mA	Voltage Output volts	Power Output mW
ST-100	1 x 2	1.8	0.25	35	0.4	14.0
ST-101	1 x 1	0.9	0.12	17	0.4	6.8
ST-102	1 x .5	0.45	0.06	7.5	0.4	3.0
ST-200	.5 x 2	0.8	0.14	15	0.4	6.0
ST-201	.5 x 1	0.4	0.07	7.5	0.4	3.0
ST-202	.5 x .5	0.2	0.04	3.8	0.4	1.5
ST-203	.5 x .25	0.1	0.015	1.8	0.4	7.2
ST-300	1⅛" diameter	4.8	0.82	90	0.4	36.0
ST-301	¼ of SS-30	1.2	0.20	20	0.4	8.0
ST-400	2 x 2	3.8	0.50	80	0.4	32
ST-500	.5 x 2.5	1.0	0.17	15	0.4	6.0

Speed of Response — Dependent upon the load resistance, the response time is 20 microseconds. Can be as low as from 3 to 5 microseconds. *Reverse Voltage* — Cells can be engineered to operate with reverse voltage. Bias voltage should not be in excess of —10.0 volts DC. *Temperature* — —65°C to +175°C is the recommended operating temperature range.



EDGE-CONTACT SILICON PHOTOVOLTAIC READOUT CELLS

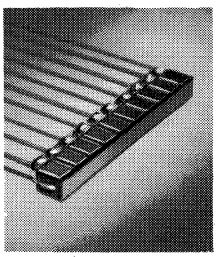
Electrically identical to common top and bottom contact types, but with new and distinct advantages: smaller size by attaching to side of active area and saving valuable light conversion area, easier to mask, closer positioning to light sources, easier to mount accurately. Flat unobstructed surfaces permit designs previously impossible, with more efficiency and lower cost. Available with any number of segments up to 1.5" total length (nine segments). Ideal for applications such as punched card, punched tape and related readers as well as rotary pulse generators, encoders and the general line of optical transducers where close spacing of the input mechanism is necessary.



ULTRA CELL®

New silicon photovoltaic devices with remarkable reverse leakage and speed of response. Available in all physical geometries presently supplied for devices with normal characteristics. Improves, sometimes even makes practical, applications using single cells, arrays or groups of cells.

Reverse Leakage: 2μA@—5.0VDC Speed of Response: 1—3.5μSec.



SILICON PHOTOCELLS FOR READOUT ASSEMBLIES

Offer distinct advantages over other photocells because of short transient response time. Function over extreme temperature ranges without affecting built-in characteristics. Feature low impedance output for matching transistor input networks. Also provide excellent speed of response, stable output characteristics and low noise output for application to perforated tape readers, punched card data systems, analog-to-digital encoders, shaft positioning equipment, and industrial control systems. Available in numerous cell forms and specialized packages for any need.

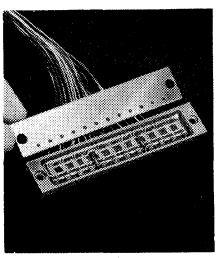
STANDARDS — STN AND STP SERIES

SENSOR TECH PART NO. N-on-P	SENSOR TECH PART NO. P-on-N	NUMBER OF READOUT POSITIONS	OVERALL LENGTH (INCHES)	CENTER TO CENTER SPACING (INCHES)
STN-4-800	STP-4-800	4	0.328	0.087
STN-5-800	STP-5-800	5	0.415	0.087
STN-6-800	STP-6-800	6	0.502	0.087
STN-7-800	STP-7-800	7	0.589	0.087
STN-8-800	STP-8-800	8	0.676	0.087
STN-9-800	STP-9-800	9	0.763	0.087
STN-10-800	STP-10-800	10	0.850	0.087
STN-4-100	STP-4-100	4	0.328	0.100
STN-5-100	STP-5-100	5	0.480	0.100
STN-6-100	STP-6-100	6	0.580	0.100
STN-7-100	STP-7-100	7	0.680	0.100
STN-8-100	STP-8-100	8	0.780	0.100
STN-9-100	STP-9-100	9	0.880	0.100

1. Overall width (in.) 0.200 2. Contact width (in.) 0.040 3. Thickness (in.) 0.150

	Typical Load Current (μa)	Typical Load Voltage (mv)	Typical Short Circuit (μa)	Open Circuit Voltage (mv)
100 Series	270	270	315	325
800 Series	180	180	250	225

Maximum Response Time: 20 μseconds. *Operating Temperature Range:* —65°C to +175°C. *Reverse Voltage:* —1.0 VDC bias voltage produces best results. —5.0 VDC is possible, but special design is required for higher voltages.



Typical Twelve Position Card Reader

CUSTOM PHOTOVOLTAIC THIN-FILM READOUT ASSEMBLIES

Provides the system designer with previously unavailable capability in the area of light sensitive arrays. Features small size, modular layout, intimate sensor/amplifier connections and adaptability of the entire unit to most forms of optical housing. Reduces the complexity of final product design. Initial amplifiers are DTL or TTL compatible. Complete opto-hybrid subsystems possible.

Power Requirement: +5V ±.25V @ 5mA/circuit. *Switching Time:* 1μs or less from full off to full on. *Light Level:* 500 foot candles. *Operating Temperatures:* —25°C to +80°C Non-operating temp. —55°C —100°C.



CUSTOM HYBRID CIRCUITS

Sensor Technology can produce thin-film hybrid circuits according to a wide assortment of customer specifications. All phases of production, from thin-film layout to production and testing, are undertaken at our plant by a highly qualified staff. Both epoxy molded and hermetically sealed packages are available.

CUSTOM CAPABILITY

Sensor Technology has a staff of skilled engineers well able to meet the requirements for creativity and adaptability in today's fast moving electronics industry. Let them innovate for you if none of our standard units meet your requirements. Their capability for developing custom products is equal to the quality of our standard line. Call Sensor Technology today.

SENSOR TECHNOLOGY, INC.

7118 GERALD AVE. * VAN NUYS, CALIFORNIA 91406
TELEPHONES: (213) 781-2154 * (213) 873-1533

UNITED DETECTOR TECHNOLOGY

1732 21st Street, Santa Monica, California 90404 • Phone (213) 393-3785

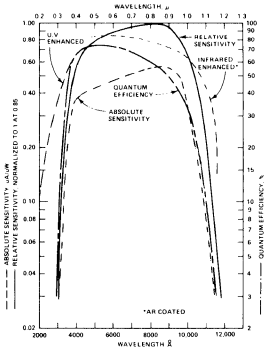
Photodetector Features for all UDT Models

- ☐ SPEED TO 4 NANOSECONDS
- ☐ MAXIMUM SENSITIVITY
- ☐ BROAD SPECTRAL RESPONSE
- ☐ ACTIVE AREAS TO 8 CM²

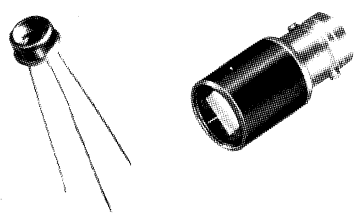
GENERAL NOTE

Employing the Schottky Barrier technology, United Detector Technology has capitalized on the improved sensitivity and spectral response characteristics offered by this proprietary technique. The response curves to the right represent all UDT devices. These curves depict the quantum efficiency, absolute sensitivity and relative sensitivity of all devices. The first dotted line (on the left) shows the increase in quantum efficiency that can be expected with U.V. enhancement.. The dotted line farthest to the right represents the increase in quantum efficiency that can be expected with infrared enhancement. Both U.V. and I.R. enhancement features are optional.

SPECTRAL CHARACTERISTICS OF ALL MODELS OF UDT PHOTODIODES



STANDARD SERIES PHOTODETECTORS



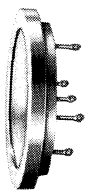
United Detector Technology's standard series of detectors are circular configured and mounted in specially formed anodized aluminum housings terminated to a BNC connector. Two exceptions, the PIN-3 and PIN-5, because of their small size are mounted in TO-18 and TO-5 transistor cans respectively. "LC" designates the low capacity series. The low capacity group is constructed on particularly high resistivity (40 K ohm-cm) silicon. The PIN-12LC has the lowest distributed capacity per unit area of any other detector on the market. The capacity given for each detector is the value when fully depleted, usually about 90 volts.

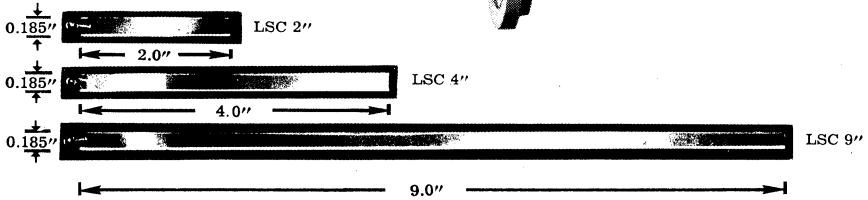
SPECIFICATIONS

Pin No.	Area (cm^2)	Min. Capacity (pf)
3	0.01	1
5	0.03	5
10	1.3	130
6LC	0.08	31
8LC	1.0	50
12LC	3.0	35

LIGHT POSITION SENSING PHOTODETECTORS

	PIN SC/10	PIN SC/25
Mounting Diameter (O.D.)	.975″	2.225″
Active Area Dimension (L)	.4″	1.25″
Active Area	.16 in.	1.56 in.





SPECIFICATIONS

UDT No.	Area (cm^2)
SC/10	1.0
SC/25	15
LSC 2″	3.2
LSC 4″	6.4
LSC 9″	14.5

United Detector Technology light position sensing devices are sensitive silicon photodetectors that give two electrical output signals. One corresponds to the position of a light spot on the surface and the other corresponds to the intensity of the light spot.

The single axis LSC series offer position sensing over standard lengths of ½, 2, 4 and 9 inches. Non-standard lengths are available on special order.

The two-axis SC-10 and SC-25 detectors provide position sensing over a 0.4 and 1.25 inch square area respectively.

Position sensitivity is 0.2 microamperes/milliwatt/mill with resolution of one millionth of an inch and linearities better than 5%.

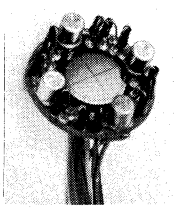
Both single and dual axis models offer all the advantages of United Detector Technology's high quality line of standard model Schottky barrier photodetectors.

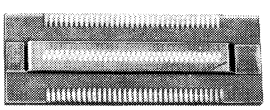
CUSTOM ENGINEERED PHOTODETECTORS

The Schottky technology employed by United Detector Technology is very readily adaptable to new geometries and to modified characteristics. Many specialized photodetectors have been designed for our military and industrial customers, and in most cases without the high cost of custom engineering.

Geometries possible include lengths to 10 inches, widths to 1 inch, diameters to 2 inches. Linear arrays with densities up to 50 elements per linear inch. Single element size down to 10 mils.

Special characteristics include UV response from 1000Å to 3000 Å, greater than 10% of maximum. Capacitance at 90 volts less than 30 pf/cm . Quantum efficiency at 1.06 micron greater than 50%; at 1.15 greater than 30% with IR enhancement.





VACTEC

PHOTOCONDUCTIVE CELLS

VACTROLS

Five types, ranging from CdS to CdSe with resistance tolerance ±33⅓%

HOW TO ORDER (example)

VT-102
series — material — resistance

MATERIAL	PEAK SPECTRAL RESPONSE
Type 0 CdS (Broad Spectrum)	5650 A
Type 1 CdSe (High Speed)	7350 A
Type 2 CdS (High Stability)	5150 A
Type 3 CdS (High Speed)	5500 A
Type 4 CdSe (Low Resistance)	6750 A

VT-100 Series (Plastic)
200 MW @ 25°C

Part No.	2 Ft.-C Resis. KΩ	Max. Volt.
VT-10L	1.6	200
VT-101	3	200
VT-101H	6	200
VT-102L	9	300
VT-102	16	300
VT-103L	32	300
VT-103	66	300
VT-104	136	300
VT-111	2.3	200
VT-111H	4.6	200
VT-112L	9.2	300
VT-112	22	300
VT-113L	44	300
VT-113	60	300
VT-121	3	200
VT-121H	6	200
VT-122L	9	300
VT-122	16	300
VT-123L	32	300
VT-123	66	300
VT-124	136	300
VT-132	10	200
VT-133L	14	200
VT-133	28	200
VT-14L	.6	200
VT-141	1.2	200
VT-141H	2.4	200
VT-142L	4.8	300
VT-142	7	300
VT-143L	14	300
VT-143	28	300



VT-100 (.065" Thickness) (Diam. .368") Plastic

VT-100E Series (Epoxy)
200 MW @ 25°C

Part No.	2 Ft.-C Resis. KΩ	Max. Volt.
VT-101E	3.3	100
VT-101HE	6.6	100
VT-102LE	9.9	300
VT-102E	17.6	300
VT-111E	2.5	200
VT-111HE	5.0	200
VT-112LE	10.0	300
VT-112E	24.2	300
VT-121E	3.3	100
VT-121HE	6.6	100
VT-122LE	9.9	300
VT-122E	17.6	300
VT-133LE	15.4	200
VT-133E	30.8	200
VT-14LE	.66	200
VT-141E	1.32	200
VT-141HE	2.64	200
VT-142LE	5.3	200



VT-100 E (Diam. ½") (¼" Thick)

VT-200 Series (TO-18)
50 MW @ 25°C

Part No.	2 Ft.-C Resis. KΩ	Max. Volt.
VT-201	4.3	100
VT-202	8	100
VT-202H	15	100
VT-203	22	300
VT-203H	44	300
VT-204L	88	300
VT-204	110	300
VT-205	1000	300
VT-211	2.3	100
VT-211H	3.5	100
VT-212L	6	100
VT-212	7.8	100
VT-213L	16	100
VT-213	22	300
VT-213H	32	300
VT-214L	64	300
VT-214	140	300
VT-221	6.8	100
VT-222	10	100
VT-222H	20	100
VT-223	40	300
VT-223H	65	300
VT-224L	80	300
VT-224	500	300



VT-200 TO-18 (Diam. .183)

VT-200 Series (TO-18) cont.

VT-225	1000	300
VT-232	100	100
VT-233L	150	100
VT-233	350	100
VT-234	700	100
VT-235	1400	300
VT-241	2	100
VT-241H	4	100
VT-242L	8	100
VT-242	15	100
VT-242H	30	300

VT-300 Series (TO-5)
125 MW @ 25°C

Part No.	2 Ft.-C Resis. KΩ	Max. Volt.
VT-30L	1.8	200
VT-301	3	200
VT-301H	6	200
VT-302L	10	300
VT-302	16	300
VT-303L	32	300
VT-303	70	300
VT-304	144	300
VT-305	1000	300
VT-311L	2.1	200
VT-311	4.2	200
VT-312L	8.4	300
VT-312	22	300
VT-312H	30	300
VT-313L	60	300
VT-314	140	300
VT-32L	1.95	200
VT-321	3.9	200
VT-321H	7.8	200
VT-322L	15.6	300
VT-322	31.2	300
VT-325	1000	300
VT-333L	14	200
VT-333	28	200
VT-34L	.6	200
VT-341	1.2	200
VT-341H	2.4	300
VT-342L	4.8	300
VT-342	7	300
VT-343L	14	300
VT-343	28	300



VT-300 TO-5 (Diam. .325)

VT-500 Series (TO-8)
500 MW @ 25°C

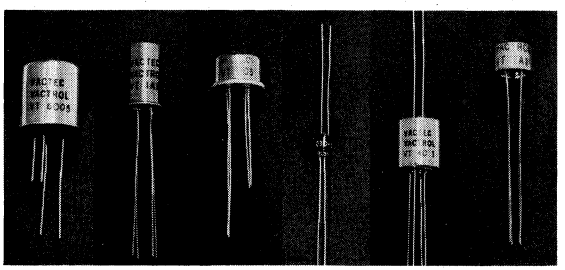
Part No.	2 Ft.-C Resis. KΩ	Max. Volt.
VT-50L	1.3	200
VT-501	2.6	200
VT-501H	4	300
VT-502L	8	300
VT-502	16	300
VT-503L	32	300
VT-503	66	300
VT-51L	.7	200
VT-511L	1.4	200
VT-511	2.3	300
VT-511H	4.6	300
VT-512L	9.2	300
VT-521	2.6	200
VT-521H	5	300
VT-522L	9	300
VT-522	18	300
VT-523L	36	300
VT-533L	12.5	200
VT-533	25	200
VT-54L	.25	200
VT-541	.5	200
VT-541H	1	200
VT-542L	1.5	300
VT-542	2	300



VT-500 TO-8 (Low Profile)

DUAL ELEMENT CELLS

Part No.	2 Ft.-C Resis. KΩ	Max. Volt.
VT-302/2	16	200 (ea. ½)
VT-303L	32	200 (ea. ½)
VT-312/2	5	200 (ea. ½)
VT-313L/2	10	200 (ea. ½)
VT-34L/2	1.5	200 (ea. ½)
VT-341/2	3	200 (ea. ½)



Standard Unit	Hermetic TO-5	LED Hermetic	LED	Dual Isolated Photo-conductor LED	Low Profile TO-5 LED
1.5v (incand.) to 115v (neon). Less than $1.00 for 1000 or more.	25c to 30c more than standard VACTROL in modest quantities.	Low signal require-ments compared to lamp devices. All solid state. Less than $7.00 in volume.	Epoxy sealed Epoxy sealed. Less than $7.00 in volume.	Compliments the complete line. Expensive compared to others.	Coming soon. A smaller LED package. Anticipated price $6.00 in volume.

PHOTOVOLTAIC CELLS

Photovoltaic cells start with a layer of selenium onto which a junction of CdSe is formed. A subsequent layer of CdO or Au acts as a current collector. The two types are specified as A for the Au layer and B for the CdO type. B is high output for low light and best for amplifier use. Specify A or B after part number, e.g. S100 E**B**.

STANDARD SIZES

UNMOUNTED SIZES			MOUNTED SIZES		
Part Number	Size (Inches)	Minimum Microamp Output	Part Number	Dimensions (Inches) Thickness	Diameter
RX5	.250 diameter	12	R10M	¾	1¾
RX10	.375 diameter	20	R100M	¾	2¼
RX15	.500 diameter	30	R10M1	13/32	1¾
RX80	1.000 diameter	130	R10E	13/32	1¾
R1	1.130 diameter	220	R75E	7/16	2
R5	1.375 diameter	305	*RX80H	¼	1⅛
R10	1.500 diameter	360	*RX80T	1¼	1¼
R75	1.770 diameter	400	R100K	19/32	2 5/16
R100	2.000 diameter	750			
SX10	.250 x .484	14	R100G	23/32	2 9/16
S1	.440 x .730	80			
S2	.654 x .765	110	Metal — epoxy case octal plug		
S3	.622 x 1.118	150	S100M	T(¼) x W(13/32) x L(129/32)	
S4	.654 x 1.160	250	Plastic case — acrylic window		
S5	.535 x .875	100			
S7	.843 x .875	205	S100E	same as S100M	
S8	.875 x .875	220			
S10	.640 x 1.459	240	Epoxy encapsulated		
S11	.890 x 1.118	250			
S13	1.500 x 1.500	650			
S14	1.437 x 1.937	730			
S17	.281 x .875	75			
S50	.250 x 4.188	305			
S55	.500 x 5.859	720			
S56	.437 x 6.000	725			
S100	.886 x 1.689	360			
S150	.250 x 6.000	360			

*Hermetic cases

NOTE: Unmounted Cells less than 045" thick

NOTE: The above microampere output based upon a cell temperature of 75°F., a color temperature of the light source of 2850°K, 100 foot candles, 150 ohm load.

PAM-1 PHOTOCELL AMPLIFIER MODULE

The Vactec Photocell amplifier module (PAM) consists of a matched selenium photocell and a high gain operational amplifier. All solid state unit replacement for phototube and associated amplifier.



Specifications

Input	± 15 VDC; ± 15 ma max.
Output	0-10 VDC; 2 K min. load resistance (1)
Sensitivity	Below 0.001 fc.
Photometric Response (min. with 2850° K Source)	6u V/fc/ohm

(1) Load resistance is the parallel combination of feedback and external load.

Write for Se bulletin SPV4B or CdS & CdSe bulletin PCD5 for complete information.

VACTEC, INC.
2423 Northline Industrial Blvd.
Maryland Heights, Missouri 63042
Phone Area 314, 872-8300

BULOVA LIGHT CHOPPERS/SCANNERS

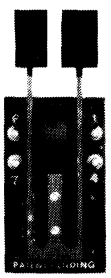
APPLICATION AREAS

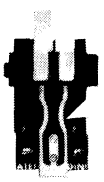
- Spectrophotometers
- Mass Spectrometers
- Radiometers
- Bolometers
- IR Detectors
- Star Trackers
- Horizon Sensors
- Burglar Alarm Systems
- Intrusion Systems
- Telemetry Systems
- Colorimeters
- Densitometers
- Ion Beam Choppers
- Information Storage Systems

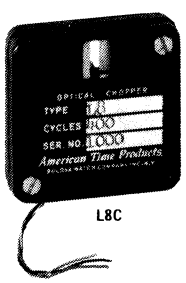
A NEW CONCEPT OF LIGHT MODULATION THAT OUTMODES MOTOR DRIVEN TYPES

Light choppers are used to chop light and similar energy beams, switch a radiation source to two or more sensors, switch two sources alternately to one sensor, scan an area with a radiation source, and for many other purposes. Based upon the balanced vibrating members of a tuning fork, optical choppers offer outstanding advantages over motor driven types. **Features**— • Power requirements as low as 500 mw • No lubrication needed • No wearing parts • Lightweight—1/2 to 3 ounces maximum • Reference signal voltage available • Small size—as small as 7/8″ x 3/4″ x 3″

LIGHT CHOPPERS


L40C


L2C



L8C

Patent Pending

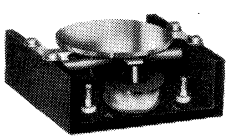
STANDARD APERTURES (mm.)

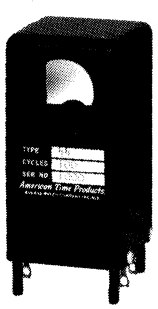
Frequency	L40C	L2C	L8C
10	10		
30	10		
50	10		
100	10		
150	10		
200	8	5.0	4.0
400	5	3.0	3.0
800	2	2.0	1.0
1000	1.2	1.5	.8
2000		.625	.5
2500		.375	
3000		.300	

The length of aperture is 10 mm. minimum.

OPTICAL SCANNERS

(Patented)


MODEL L-50



MODEL L-44

Performance Benefits

- No wearing parts
- Low power requirements
- Small size
- No lubrication needed
- Lightweight
- Reference signal voltage available

TORSIONAL TYPE

L44 for frequencies 100 to 1099 Hz
L45 for frequencies 1,100 to 10 KHz

A fixed frequency device which can, in its simplest form, be used to cause a light, or energy beam to scan a target in a harmonic manner.

SPECIFICATIONS

Fixed Frequency (CPS-HZ)	Angular Amplitude (Peak to Peak)*	Maximum Mirror Size (MM)
100	20°	30 x 30
200	14°	20 x 20
400	10°	15 x 15
800	7°	10 x 10
1000	6°	10 x 10
2000	5°	7 x 7
4000	4°	7 x 7
6000	3°	5 x 5
10000	2°	2-1/2 x 2-1/2

*Angle is doubled upon reflection.

Standard mirrors 9 x 10.5 MM
Maximum angular velocity in degrees per second is π F 0
ACCURACY: Normally ±2; better on request.
REFERENCE SIGNAL: Squared wave; 5V rms min. into 50K ohms.
OPERATING TEMPERATURE: −55°C to +85°C. Other ranges available.
INPUT: Approx. 400 mw at 24 to 28V DC Driver Amplifier for 115V AC also available.
SIZE: 1-1/2 in. sq. x 3 in. high max.
WEIGHT: 4 ounces approx.

TAUT BAND TYPE L-50

A mechanically resonant device in which the restoring force is a taut ribbon. Power to start and maintain the oscillations is furnished by a solid state driver powered from d.c., optional 110V AC drivers are also available.

Freq. Range HZ	Mirror Angle Peak to Peak	Stock Mirror Size
5 to 24	30°	25 x 25 MM
25 to 40	25°	15 x 15 MM
41 to 99	20°	15 x 15 MM
100 to 149	15°	10 x 10 MM
150 to 199	10°	10 x 10 MM
200 to 400	5°	10 x 10 MM

ACCURACY: Normally ±2% from 0 to 40°C (higher on request).
REFERENCE SIGNAL: 1V p to p min. into 50K ohms.
OPERATING TEMPERATURE: −40 to +50°C.
INPUT: To driver unit 6 to 28 V DC.
SIZE: 1-1/2 x 1-1/2 x 3/4″ high.
WEIGHT: .75 oz. approx.

Manufacturer of the widest range of Frequency Control Components: Crystals • Crystal Oscillators • Crystal Filters • LC Filters • Tuning Forks • Fork Oscillators • Ovens • Coils • Servo Amplifiers

BULOVA atp
BULOVA AMERICAN TIME PRODUCTS
ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

GAMMA SCIENTIFIC

Systems to solve light measurement problems.

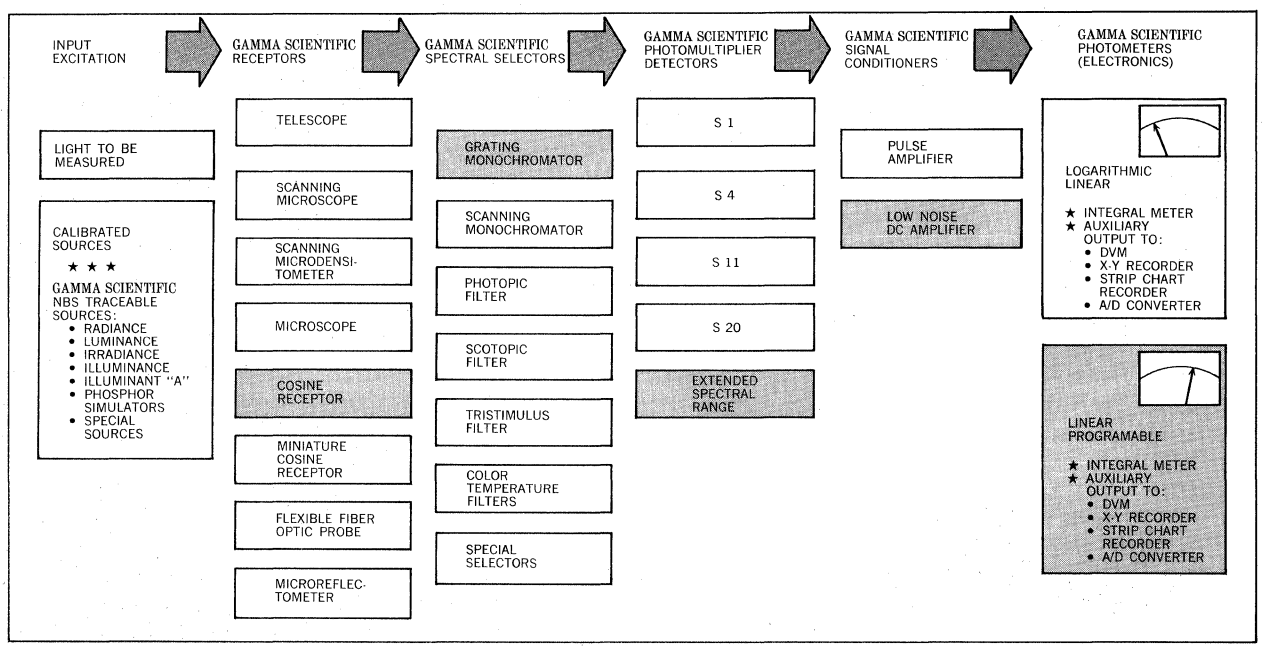
You'll find two basic differences in Gamma Scientific's light measurement instrumentation.

First, we offer a **systems approach.** No special engineering. No special adapters to build. No calibration problems. All Gamma Scientific instruments and accessories are fully compatible. You can build a complete, operable **system** in minutes using **standard** modules like those shown on the right. And we'll guarantee the performance from input to output.

The second difference is **flexibility.** We build a complete line of fully compatible plug-in heads, accessories and attachments. You can change from one configuration to another quickly... meet your various instrumentation needs with **the same basic system.** This flexibility eliminates the limitations of single-purpose equipment.



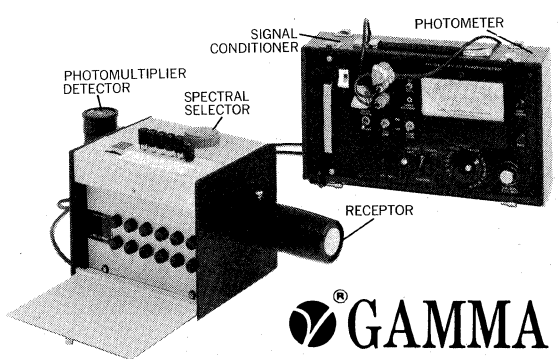
Here are the standard building blocks for your system:



For example:

System 2020SR, indicated by the shaded blocks above and photo at right, is a subnanowatt spectroradiometric system. It provides:

- ★ Wavelength range 350-750nm
- ★ Direct reading at any 7 selectable wavelengths
- ★ High efficiency (f3.5) diffraction grating
- ★ Half-power bandwidth 4nm
- ★ Maximum sensitivity 0.01nw/cm²/nm
- ★ Wavelength accuracy ±2.5nm
- ★ Price $2590.00



Let us help you select the light measurement system to meet your requirements. Call 714/291-2230 **collect.** Or, write to Manager of Applications Engineering, Dept. 301, Gamma Scientific, Incorporated, 2165 Kurtz Street, San Diego, California 92110.

GAMMA SCIENTIFIC Incorporated

AMGLO CORPORATION *THE NO. 1 SOURCE FOR LIGHT*

4333 N. RAVENSWOOD AVENUE • . CHICAGO, ILLINOIS 60613 • 312-477-9494

LINEAR FLASHTUBES

Amglo manufactures 36 different types of standard pyrex and quartz linear tubes. New standard tubes include designs in excess of 500 types.

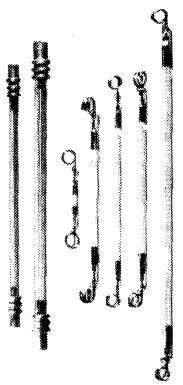
Listed below are a few of the various types:

Part No.	Arc Lgth. (inches)	OD mm	Typical Input Joules*
LSP160	1" Pyrex	6	100
LSP360	3" Pyrex	6	150
LSP380	3" Pyrex	8	200
LSP680	6" Pyrex	8	250
LSP12100	12" Pyrex	10	350
LSP20100	20" Pyrex	10	700
LXQ360	3" Quartz	6	300
LXQ660	6" Quartz	6	600
LXQ380	3" Quartz	8	600
LXQ680	6" Quartz	8	800
LXQ6100	6" Quartz	10	1200
LXQ6150	6" Quartz	15	2500

* Depending on pulse width Ratings for 1-2 MS pulse width.

Other Linear Tubes available with special electrodes.

Tube Diameter to 25mm OD and lengths to 30".

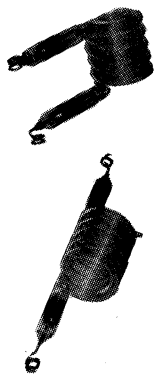


HELICAL FLASHTUBES

Amglo Helical Tubes are available in Pyrex and Quartz in ID's from ¼" to 4" and tubing diameter to 25mm.

Part No.	Turns	DIA.	Tubg. Dia. mm	Typical Input Joules
HSP28-½A	2	½" Pyrex	8	200
HSP48-½A	4	½" Pyrex	8	400
HSP58-½A	5	½" Pyrex	8	450
HSP510-½A	5	1½" Pyrex	10	1000
HXQ28-½A	2	½" Quartz	8	800
HXQ48-½A	4	½" Quartz	8	2000
HXQ510-1½A	5	1½" Quartz	10	4000
HXQ515-1A	5	1" Quartz	15	10000

Helical Lamps available in 6mm OD to 25mm OD Quartz and Pyrex and ID's to 4".



H-88 SERIES SIGNAL, STROBOSCOPE AND PHOTOGRAPHIC FLASHTUBES

The H-88 series tubes were especially created for applications requiring heavy duty use under exacting conditions. The tube is constructed of 6mm O.D. Pyrex with Iron triple carbonate coated electrodes. The H-88 is ideal for aircraft strobe beacons, high intensity warning lights, photographic speed-light and high speed stroboscope applications.

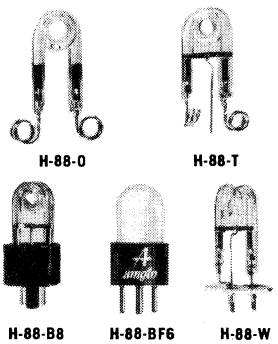
H-88-O
Tube only — two turn Helix ⅜ I.D. 1 1/16" Centers, 1¾" Overall length. Flexible braid connection. Triggering may be accomplished with a fine wire wrapped around tube making contact with silver stripe.

H-88-T
Same as H-88-O except with trigger band.

H-88-B8
T-88-T Mounted in Octal Base. Mounts in standard octal socket type 78S8 Dia. 1⅛ x 2¼" high exclusive of pins.

H-88-BF6
H-88-B series with frosted cover for flat diffused light.

H-88-W
With White Reflective Base.
The H-88 is available in 4 pin, Octal and 3 pin wafer bases.



GENERAL SPECIFICATIONS:
Operating voltage: 450-900. *Maximum Input:* 125 joules/flash. *Maximum recommended average power:* 10 watts. *Output:* 4500 Lumen seconds at 125 joules. At 10 joules (450 volts) the peak output is approximately 1 million lumens (250 lumen-seconds) at a flash rate of 60 per minute.

TYPE HD-2

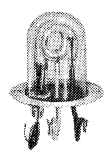
Operating voltage 350-500V. Energy input 30 to 150 Watt-seconds. For use with electrolytic condenser of 450 volt rating. Use AMGLO ST25 Trigger Transformer.

Part & Description

HD-20
Tube only

HD-2
Tube mounted in Reflective Base with Glass Cover

HD-2R
HD-2 mounted in AR 365 Reflector



TYPE HD-2A

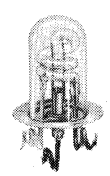
Operating voltage and energy input similar to HD-2. Employs two turn helix with central cathode housing, producing longer life characteristics than HD-2. Use with AMGLO MT55 Trigger Transformer.

Part & Description

HD-2AO
Tube only

HD-2A
Tube mounted in Reflective Base with Glass Cover

HD-2AR
HD-2 mounted in AR 365 Reflector

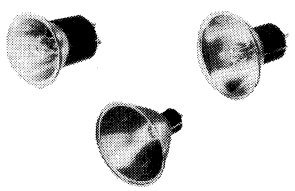


REFLECTOR ASSEMBLIES

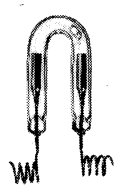
FOR USE IN STROBOSCOPES, WHEEL AND BALANCING EQUIPMENT.

ARA400SD-H88P4 Semi Diffused Flat Field
ARA400S-H88P4 Specular Finish
ARA400S-H88TP4 with built in Trigger Coil

ARA400 Series is 4 7/32" Diameter x 3⅞" Deep, operating at 350-600 Volts. Other sizes available.
Ratings (H88 type tube)
Max. Energy: 125 Joules per flash
Repetitive Flashing: 60/minute
10 Joules/flash — 100 flashes/second — .1 joules/flash



U-35-O



Glass portion of 6 MM tube 1½" long x ¾" wide. Mounts on ½" Centers. Flexible Braid Electrode Connections. For noncritical applications, a fine wire may be wrapped around nose of tube to apply trigger pulse.

U-35T



Same as U-35-O except with adjustable Trigger Band. Ideal for Stroboscopes and Amglo Flat Field Series Reflectors.

U-35-B



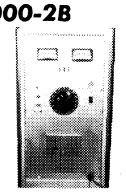
U-35-T Mounted with white Reflective Disc in 3 Pin Base. Plugs into standard 6 Prong Radio Tube Socket Type 78S6. Dia. 1⅛" x 1¾" high, exclusive of pins.

ELECTRICAL SYSTEMS AMGLO PS-4000-2B

Energy charging supply for use in Flash Photolysis. High Energy Stroboscopes, Flash Photography, Laser Excitation.

The PS 4000-2B is a versatile equipment designed for reliable continuous use. The unit features Variable Energy up to 1200 Joules/Flash at a rate of up to 6 Flashes/second. Pulse width is variable from 20 Microseconds to 1 Millisecond, depending on Flashead selected.

The PS 4000-2B is truly representative of the Quality and Workmanship expected of the No. 1 Source for Light.



AMGLO AC 5000-1

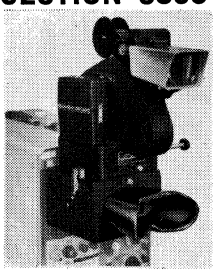
Energy Storage Charging Supply

The AC 5000-1 is a low cost 0-5KV supply containing a versatile trigger module. The AC 5000 will charge an External 50 MFD Capacitor to 4000 Volts in 10 seconds.



EXPERIENCE

The production of reliable and efficient flashtubes is an art understood and practiced by relatively few organizations in the world. The development of these devices involves an intimate and extensive knowledge of plasma physics, precious metal properties, vacuum technology and electronic control systems. In addition, the ability to produce these devices requires the utilization of skilled and highly specialized craftsmen. The AMGLO Corporation is a leader in this field because it has the background, craftsmen, and over 30 years of practical experience in producing flashtubes.



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DATA RECORDING CAMERA SYSTEMS

FEATURING:

RAPROMATIC® 35mm processing with On-Camera developing, fixing and viewing.

Adaptable for recording a wide variety of visible phenomena such as: Oscilloscope Traces • Large Screen Radar Displays • Ionosphere Patterns

RAPROMATIC PROCESSING provides built-in film processing and viewing "On-Camera" within 60 seconds of exposure. Development and fixing are fast and thorough. Film is processed and fed thru "On-Camera" viewer where it can be evaluated within one minute of shooting.

TYPES

3800-C
FOR CONTINUOUS MOTION FILM ADVANCE

3800-P
FOR PULSE MOTION FILM ADVANCE

FEATURES

- Automatically develops and fixes up to 100 feet of 35mm film.
- Produces high quality negatives viewable in 60 seconds. No loss of resolution.
- No pumps, applicators, time/temperature devices, free fluids.
- Mounts on Type 3625 cameras.

SPECIFICATIONS

POWER REQUIREMENTS: 115 volts, 60 cycles, 1.5 amp.
DIMENSIONS: Approx. 11¾" high, 6½" wide, 14½" deep.
WEIGHT: 13 pounds.
FINISH: Magazine—black wrinkle; viewer—buff enamel.



PORTABLE FILM PROCESSOR TYPE 3801

This processor makes the advantages of the Rapromatic system available for developing films used in conventional magazines or in other types of photography. It will handle up to 100' of 16mm or 35mm film. In addition to its delivering high quality negatives which can be viewed immediately, very short lengths of film can be processed from cassettes or daylight loading spools. Electric and manual/electric drive units are available.
For washing film prior to storage the Type 3803-1 Washer Dryer is an ideal companion accessory.



RAPROROLL®

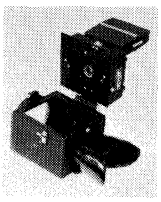
Raproroll Developing Web Type 3802A is designed for use in Type 3800. Rapromatic Magazines. Raproroll 3802B is for use with Type 3801 Portable Film Processor, described below. Shelf life: unlimited if kept in freezer; 3 months at normal room temperature. Type 3809 (DuPont 931B Rapid Reversal) 35 mm film is recommended for use with Raproroll, but other pre-hardened-emulsion films may be used. Consult Spedcor for advice. When ordering Raproroll specify film type, size, length; e.g., Raproroll Type 3802A, 35mm, 100 feet, for Type 3809 (DuPont 931B) film.



JUNIOR WASHER DRYER TYPE 3806

This unit was designed expressly for use with Type 3800 Rapromatic magazines. Freshly processed film can be completely washed, dried, and placed on a storage reel automatically and continuously, immediately after passing through the viewer on the magazine. It is sufficiently compact to mount on an oscilloscope. Its 2-quart water capacity will handle a fully loaded magazine without interruption.
This unit is so compact and convenient that it is being widely adopted by photo labs for small-run 35mm processing.

TYPE 3625 for 35mm FILM



FEATURES

- Binocular viewing through dichroic mirror — no parallactic errors.
- Flat-field, non-distorting optics; slip hinge construction for quick access to exposure controls.
- Able to photograph fast transients by holding shutter open until the transient occurs.
- Data chamber permits simultaneous recording of data and scope traces.
- Can be used with most oscilloscopes.
- Negligible camera-to-scope RF and inductive interference, with RFI suppressed models.

SPECIFICATIONS:

Power requirements: 115 volts, 60 cycles, 0.5 amp.

Weight: 11½ pounds

Size: Approx. 13½" high, 7½" wide, 13½" deep.

Finish: Black wrinkle.

CAMERAS: The complete Type 3625 camera assembly consists of a periscope incorporating a binocular viewer with viewing port control, light hood, and bezel clamp; a camera with 38mm f/1.9 Wollensak Raptar lens, an electrically operated holding shutter synchronized with the film advance system, a ground glass focusing slide, and a 3-element data chamber.

The data chamber permits insertion of a card with written information into a data frame for simultaneous recording with the scope trace. The data chamber has its own optical system for projecting the data onto the edge of the film, and in addition incorporates a 4-digit counter for numerical frame sequencing and a 24-hour clock which operates for 36 hours per winding. The data elements are strobe illuminated and easily accessible.
NOTE: Data chambers cannot be subsequently added to camera assemblies ordered without them.

The camera assemblies are electrically controlled by means of a cable-connected momentary contact push-button switch. Circuitry in the camera housing controls the shutter and the drive mechanism of its associated magazine. Automatic actuators are optionally available.

The Type 3625 cameras are designed for use with Rapromatic Type 3800 magazines and with the conventional 35mm magazines Type 3642 and 3643, all described below.

TYPE 3003-A FOR SINGLE FRAME POLAROID FILM

This single frame camera system consists of:
1. A periscope with light hood and bezel clamp, permitting binocular viewing of the CRT screen through a dichroic mirror, which reflects image to film holder without parallactic error; **2.** A camera with 75mm f/1.9 flat-field lens, apertures from f/1.9 to f/16, Alphax #3 heavy duty shutter with speeds of T, B, 1, 1/2, 1/5, 1/10, 1/25, 1/50, and 1/100 second, 1:0.9 and 1:0.7 object-to-image ratios. Designed to multiple images on a single frame; **3.** Type 3640-A Polaroid roll film holder which accommodates all types of 3¼" x 4½" print size Polaroid films.

TYPE 3050 FOR POLAROID FILM PACK

1. Same description as for 1 and 2 of Type 3003-A; **2.** Type 100 Polaroid film pack holder; accommodates all Polaroid films available in film pack form.

MAGAZINES WITHOUT RAPROMATIC PROCESSING FOR TYPE 3625 CAMERAS

Type 3642 Continuous Motion Film Magazine

Variable drive—1/16" to 8" per second • Remaining film footage indicator provided

Type 3642 continuous motion film magazine accommodates 100 feet of 35mm daylight loading film. A synchronous motor drives the film through a variable gear train, providing film transport speeds of 1/16, 1/8, 1/4, 1/2, 1, 2, 4 and 8 inches per second, linear with respect to line frequency. Speeds as low as 1"/minute and as high as 16"/second are available with modification. Aperture size is 1" x 1½".

The magazine is electrically connected to the camera assembly, closing the camera actuating switch opens the shutter and starts continuous motion of the film; releasing the switch closes the shutter and stops the film. Opening and closing operations each require 25-30 milliseconds. The mechanism may be readily hooked up for continuous monitoring or remote programming.

Rapromatic portable processing equipment, described above, is recommended for convenient processing of film used with this magazine.

Type 3643 Pulse Advance Film Magazine

Capable of operation to rate 1 frame/second • Frame counter provided

Type 3643 pulse film advance magazine holds up to 100 feet of 35mm daylight loading film. Aperture size is 1" x ¾" (16 frames per foot). A modification is available with aperture size 1" x 1½" (8 frames per foot), for large screen recording applications. The drive motor is synchronized with the shutter mechanism and, when actuated, advances the film by one frame (±0.030"). A built-in neon light indicates advance of film to a new frame each time the shutter switch is released.

The magazine is electrically connected with the camera assembly. Closing the camera actuating switch opens the shutter. Releasing the switch closes the shutter and advances the film one frame. Opening and closing operations each require 25-30 milliseconds; successive shots can be taken as rapidly as 1 shot per second. Electronic devices are available for automatic operation.

CAMERA ACCESSORIES

Type 3600-C Hood. Enables the camera system to be used with any size cathode-ray tube for PPI, weather radar displays, etc.

Type 3625-5 Lens Modification. Enables the camera to be used in large screen applications.

Type 3625-4 Adjustable Shutter Timer. Pulses the Type 3625 Series Cameras at repetitive rates ranging from 1 second to 3 hours, with shutter speeds ranging from 1 second to 6 seconds.

Type 3625-6 Fixed Shutter Timer. May be ordered to pulse at fixed repetitions ranging from 1 pulse per second to 1 pulse in 24 hours.

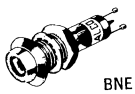
Type 3625-7 Transient Porgrammer. Triggered by the negative slope of the scope gate pulse, this device illuminates the scope graticule and data chamber, closes shutter, advances film, and reopens shutter for next event. Variations in sequence can be provided for computer-monitored and other applications.

SPECIFICATIONS

INPUT SENSITIVITY: Trigger pulse amplitude — 1.4v minimum; Negative slope of trigger pulse — .25v/μsec minimum; Maximum input voltage — ±25v.
INPUT IMPEDANCE: 50KΩ.
EXT. SOURCE: Source resistance 50KΩ maximum; Time constant (source resistance x shunt capacitance) not to exceed 50μsec, e.g., if source resistance is 10KΩ, total shunt capacitance must be less than .005μf.
OUTPUT RELAY CONTACTS: 1 form A to operate camera system; 1 form C for external use.
NOTE: Relay de-energized for approx. 1 sec. after application of input trigger.
REPETITION RATE: .9 pulses/sec. maximum.

PILOT LIGHTS

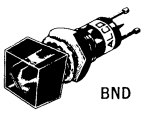
PILOT LIGHT ASSEMBLIES


BNE

BNE Series — featuring a 1-piece body construction, this miniature neon pilot is ideally suited to indicate toggle switch positions, or for other display configurations with space limitations. A particular characteristic of this model is the compact lens system protruding slightly above the panel. Operating voltage, 75 VAC without resistor; for 115 VAC operations use external resistors (150K for standard intensity, 33K for high intensity) not supplied. Single 5/16-32 mounting.


BNF

BNF Series — similar to the BNE Series except that the lens system extends a greater distance beyond the panel for a bright illumination. This model has a permanent built-in neon and operates on 75 VAC. An external resistor required for 115 VAC. Turret type lugs are used for simplified hookup. Single 5/16-32 mounting.


BND

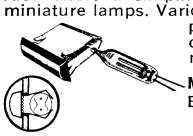
BND Series — combines an entirely new look in a space-saving pilot assembly. The neon protrudes beyond the panel to provide maximum light intensity. This model is available with or without built-in series resistor for 75V or 115V operation, and is also available as standard or high intensity. Single 3/8-32 mounting.

Model	Color	Description	One-24	25-99	100-499	500-999
BNE-2	*	Standard, less resistor	.49	.33	.29	.24
BNE-3	*	Hi-Intensity, less res.	.59	.39	.35	.29
BNF-2	*	Standard, less resistor	.49	.33	.29	.24
BNF-3	*	Hi-Intensity, less res.	.59	.39	.35	.29
BND-2	*	Standard, less resistor	.49	.33	.29	.24
BND-2R	*	Std., with 150K res.	.59	.39	.35	.29
BND-3	*	Hi-Intensity, less res.	.59	.39	.35	.29
BND-3R	*	Hi-Int., with 33K res.	.69	.46	.41	.35

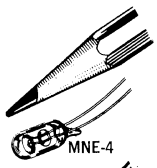
*Red, Amber, Clear, White — Specify Choice.

BNG SERIES LAMP HOLDERS

Alco offers a simplified, low-cost, snap-type lamp holder for miniature lamps. Various types are available, each adaptable to particular panel thickness, and can be ordered in red, amber, clear. Detailed information supplied on request. Less lamp.



Model	100-over	500-over	1000-over
BNG( )	.09 ea.	.08 ea.	.07 ea.




MNE-4L


MNE-4SL

BRITE-GLO® NEON LAMPS

Extremely small size lamp (equivalent to T-1 3/16). Smallest neon in the industry. Bullseye appearance gives the largest glow where needed on top. Rounded top places the illuminated area closer to the viewing point. Metal base (Model MNE-4SL) increases light output and protects lamp from damage.

Model	Description	One-24	25-99	100-499	500-999
MNE-4	With Short Bare Leads	.49	.33	.29	.24
MNE-4L	With 10" Insulated Leads	.53	.35	.31	.26
MNE-4SL	With 10" Insulated Leads and Metal Base	.59	.39	.35	.29

PANEL MOUNTED ASSEMBLIES

PLN-100 Neon — panel mounted neon Brite Glo lamp assembly incorporates the crater electrode T-1 3/8 **MNE-4L** in a black phenolic case. It has 10" leads and mounts in a 1/4" hole.

PL-105 Incandescent — panel mounted lamp assembly is ultraminiature in size. A mate to the Brite Glo panel mounting series (PLN-100 above) only with incandescent lamp that operates on 5V @ 60 ma. and having 100,000-hr. life. Mounts in 1/4" hole; has 10" insulated leads.

Model	Panel Mtg. Lamp	One-24	25-99	100-499	500-999
PLN-100	10" Leads Neon	.89	.59	.54	.45
PL-105	10" Leads Incand.	.79	.53	.48	.40


PLN-100

PL-105

ME-680L

MC-680

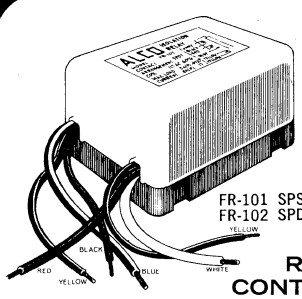
BRITE GLO® INCANDESCENT

Ultraminiaturized series that mounts in a 3/16" hole. Available only with the most popular 5V @ 60 ma. rated lamps having a 100,000-hr. life. Sealed high temperature plastic assembly contains a standard #680 T-1 lamp. Supplied either with long wire leads (Type ME-680L), or with pin contacts (Type ME-680). The ME-680 can also be used for PC boards. Colors available: Red, White, Green, Blue, Yellow — specify

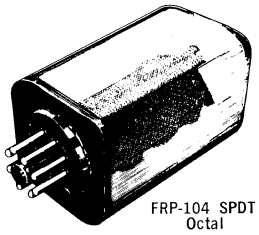
Model	Description	One-24	25-99	100-499	500-999
ME-680	With Pin Contacts	.89	.59	.54	.45
ME-680L	With Long Leads	.89	.59	.54	.45
*MC-680	With Pin Contacts	.99	.67	.60	.49
*MC-680L	With Long Leads	.99	.67	.60	.49

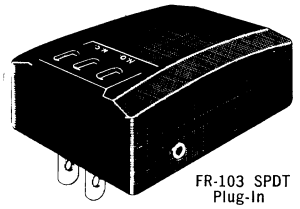
*Contains a #683 T-1 lamp.

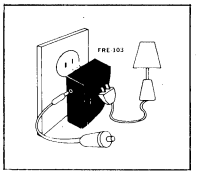
LARGER QUANTITY PRICES QUOTED UPON REQUEST



FR-101 SPST
FR-102 SPDT


FRP-104 SPDT
Octal


FR-103 SPDT
Plug-In


One of 28 Design Ideas
Remote Switching Lamp

RELAY FOR REMOTE CONTROL APPLICATIONS

MODELS FR-101 SPST AND FR-102 SPDT BASIC. This remote control component combines an isolated step-down transformer and a sensitive AC relay in a single laminated core that fits in a compact midget size package measuring on 2 1/8" x 1 3/4" x 1 1/4". It converts a 95-125 VAC power source to 30V that can be run through ordinary surface wiring without shocks and hazards. Operations of devices and machinery from remote distances are made possible for low voltage requirements. Typical uses are for safe switching and remote control applications, modern appliances, machine tools, and other automatic apparatus demanding remote control circuits thereby eliminating shock hazards. Contact rating 5 amp @ 117 VAC.

Maximum Load:
5 amps @ 117 volts.

Operating Voltage:
95 to 125 volts.

Current Consumed:
Under 40 ma.

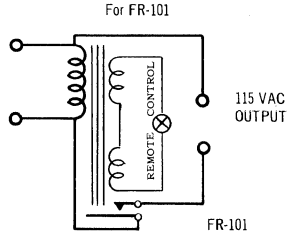
Isolated Voltage:
Under 30 volts.

Terminals:
6-inch leads for FR-101 & 2.
Plug-in for FRE-103.
Octal Base for FRP-104

Life:
Over 50,000 operations.

Size With Cover:
2 1/8" x 1 3/4" x 1 1/4" (FR-101 & 2).

SCHEMATIC DIAGRAM
For FR-101



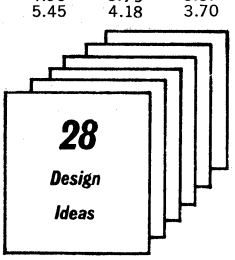
FR-101

FRP-104 SPDT OCTAL PLUG — A standard octal base plug feature is added to the basic relay for the industrial user. The relay is protected by a plastic dust cover. SPDT @ 5 amps. Specifications are the same as FR-102.

FR-103 SPDT PLUG-IN — Simply plug relay into outlet; it provides the actuating voltage to a 117 VAC alarm or remote accessory. Has a 3-way receptacle to select N.O. or N.C. circuit. Side jack serves as plug-in for remote switch or sensor. Specs same FR-102.

Model	Contacts	Description	One-99	100-499	500-999
FR-101	SPST	Basic Relay	3.85	2.95	2.57
FR-102	SPDT	Basic Relay	4.45	3.51	3.03
FR-103	SPDT	Plug-in	4.95	3.79	3.37
FRP-104	SPDT	Octal	5.45	4.18	3.70

28 Design Idea Booklet Supplied (Free) shows circuits on how to build typical remote control circuits of appliances; machine tools; TV commercial killers; fire, smoke and burglar alarms; garage doors; sprinklers — and other apparatus requiring safe, remote control circuitry.



PROMPT SERVICE FROM LAWRENCE, MASS. – (617)686-3887

ALCO® ELECTRONIC PRODUCTS, INC.
MAILING ADDRESS: P. O. BOX 1348, LAWRENCE, MASSACHUSETTS 01842

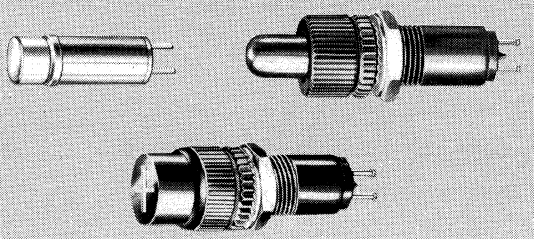
INDICATOR LIGHTS

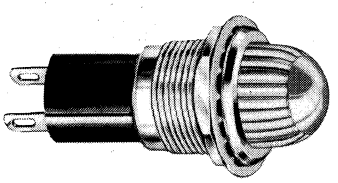
(Illus. approx. 90% actual size unless otherwise noted.)

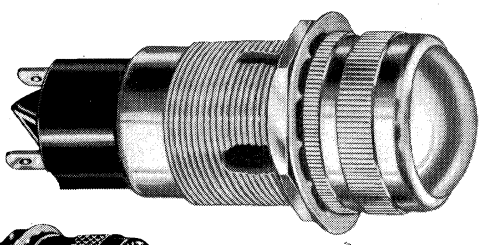
DIALCO®

Ultra-Miniature DATALITES® —and multiple indicators. Meet requirements of MIL-L-3661B. Incandescent and Neon. Mount in 3/8" clearance hole. For data processing, computer and automation applications.

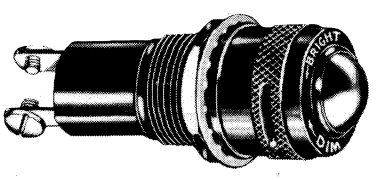
ASK FOR CATALOGS L-160 AND L-203.



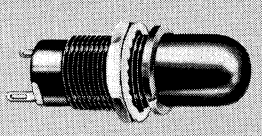


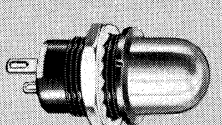


Miniature and Large Indicator Lights. Incandescent and Neon. **Miniature** units mount in 9/16" or 11/16" clearance holes; **Large** units in 1" clearance hole. Wide choice of cap shapes and colors—also include caps with mechanical dimming feature.

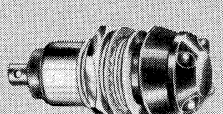


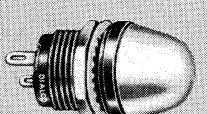
ASK FOR CATALOG L-161.

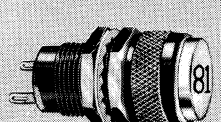






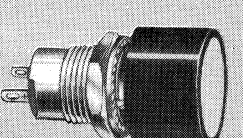


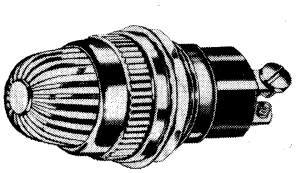


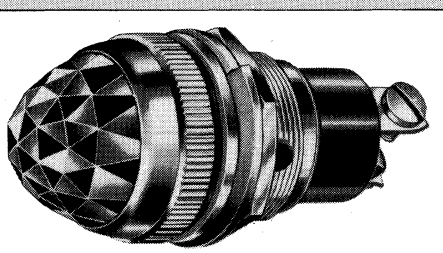


Sub-Miniature Indicator Lights. Incandescent and Neon. Mount in 13/32" to 17/32" clearance holes. Meet or exceed environmental requirements of MIL-L-6723 and MIL-L-3661B. Edge Lighting Indicators meet requirements of MIL-L-7806, conform to MS25010-Revision D.

ASK FOR CATALOGS L-157, L-158, L-178.







Oil-Tight Indicator Lights. Incandescent and Neon. Mount in 11/16", 1" or 1-3/16" clearance holes. For heavy duty industrial applications.

ASK FOR CATALOG L-200.



MIL-L-3661B

A complete line of indicators to meet military requirements set forth in MIL-L-3661B.

ASK FOR CATALOG CR-680.

DIALIGHT CORPORATION

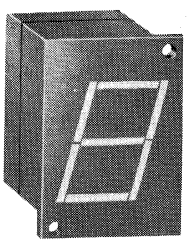
60 STEWART AVE., BROOKLYN, N.Y. 11237 • Area Code 212 497-7600

CURRENT LITERATURE

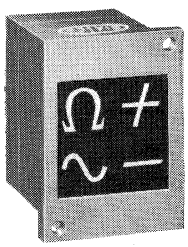
	Catalog No.
Sub-Miniature Indicator Lights	
Two Terminals, Fully Insulated	L-178
One Terminal (for Grounded Circuits)	L-157
Edge Lighting for Plastic Plates	L-158
Sub-Sub-Miniatures (with Long Life Lamps)	L-168
Indicator Light—911 Series	L-205
Datalites: Ultra-Miniature Indicator Lights	
Lampholders, Cartridges, Multiple Indicators	L-160
Permanent Lamp Indicator Lights (Ultra-Miniature)	L-203
Telephone Lamp Indicators	
Tele-Strips and Indicator Lights	L-164
Illuminated Push Button Switch—913 Series	L-204
Illuminated Push Button Switch—922 Series	L-173
Illuminated Snap-in Mounting Push Button Switches and Matching Indicator Lights	L-209
Twin Lamp Placard Lights	L-170
Single Plane Numeric Readout	L-181
Heavy Duty Oil-Tight Indicator Lights	L-200
Press-To-Test Indicator Lights	L-201
Flashing Indicator Light	L-202
Digest of Indicator Lights	
(Sampling of "The Complete Line")	L-161
Incandescent Indicator Lights—120V	L-206
Transistorized Indicator Light for IC	L-207
A Cross Reference of DIALIGHT Catalog numbers to Military Type Designations and MS Drawings	CR-680

Send for your copies of these Catalogs.

DIALCO®



(U.S. Pat. No. 3,220,0[illegible])



(Illus. approx. 75% actual size.)

Single Plane Numeric Readouts.

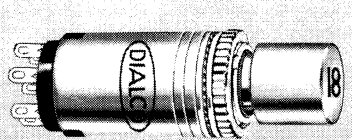
Incandescent and Neon—
14 to 170 volts.

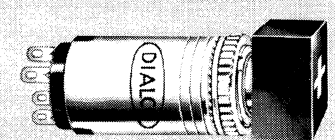


TWO SIZES:
3/4" or 1" characters. Display 10 numbers and 10 letters. Compatible Caption Modules.

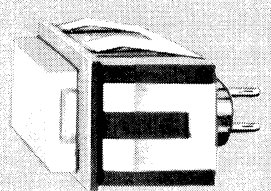
(Illus. approx. 50% actual size.)

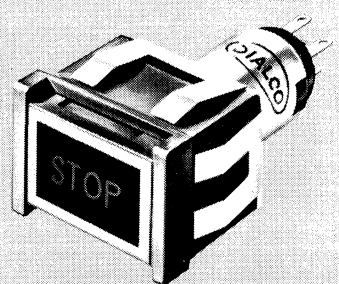
ASK FOR CATALOG L-181.





Illuminated Push Button Switches and Matching Indicators. NEW low-profile snap-in switches... and standard mounting switches. Momentary non-snap, snap or alternate switch actions. Ratings up to 5 amps. Cap sizes and shapes include 1/2", 5/8" and 3/4" round or square; 3/4" x 1" rectangle.





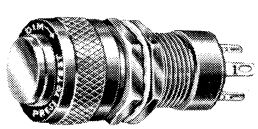
ASK FOR CATALOGS L-169 and L-209.



Transistorized Indicator Lights. Incandescent and Neon. A "single package" containing light source, switching circuit, and all power circuit and bias voltage connections.

ASK FOR CATALOG L-207.

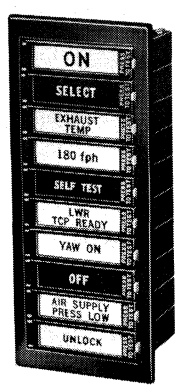
Press-to-Test Indicator Lights. Incandescent and Neon. Mount in 15/32", 5/8" and 1" clearance holes. Equal or exceed the operational and environmental requirements of MIL-L-7961B.



ASK FOR CATALOG L-201.

Twin Lamp Placard Lights. Conform to the operational and environmental requirements of MIL-L-3661B, MIL-E-5272 and ABMA-MPD-11023 and 11064.

ASK FOR CATALOG L-170.



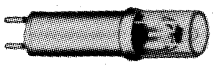
(Illus. approx. 50% actual size.)

DIALIGHT CORPORATION

60 STEWART AVE., BROOKLYN, N.Y. 11237 • Area Code 212 497-7600

DRAKE INDICATOR LIGHTS..

BI-PIN CARTRIDGE-



— **LAMPS,** bodies aluminum, 6 volts and up, long life incandescent or neon, fit Drake or any mfgr.'s holders. Inexpensive all plastic cartridges also available.



— **LAMPHOLDERS,** black anodized aluminum, indexed to accept lamps with legends; ideal for data processing or other computer applications — commercial or Military.



— **CONNECTOR AND FASTENER,** economical for commercial application with cartridge lamp eliminating lampholder.

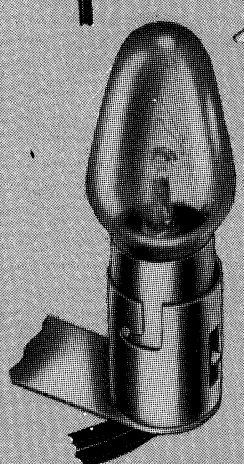
LAMPHOLDERS

Thousands of lampholder and bracket combinations for any application. The more popular are detailed in Brochure 6504.

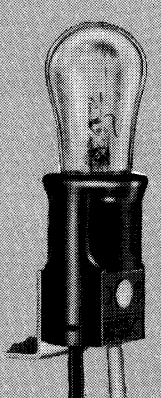


MINIATURE BAYONET— For instruments, radio, TV, automotive, marine and other miniaturized devices.

← Shell without & with housing

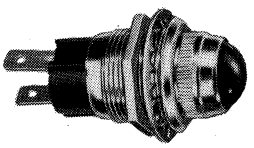


CANDELABRA SCREW — For illumination, on-off indicators in appliances and other equipment. →



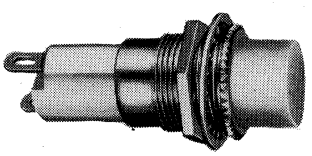
DC CAND. BAYONET — Rugged construction for appliances, vending machines and automotive. ←

"PSB" SLIDE BASE INDICATOR LIGHTS



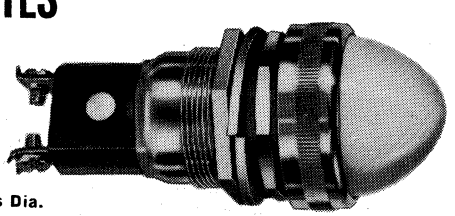
Uses Sylvania PSB slide base lamps; choice of 9 styles of lenses and solder or screw base lugs.

"Deluxe Molded" Indicator Lights

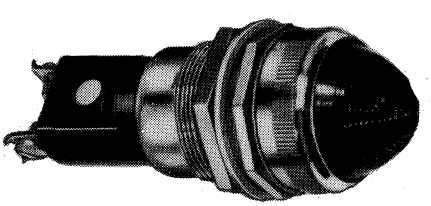


Drake's durable and finest — using T3¼ min bayonet lamps and 120 V. incandescent for commercial application. Incandescent or neon. Screw or friction fit lenses of many shapes and variety, also mech. dimmer for Military use. "Titelite" type for water-proof and oil-tite application.

"TITELITES"



1¼" Lens Dia.

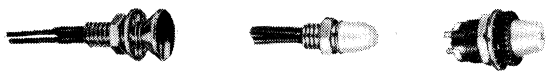


1" Lens Dia. Available for MIL-L-3661/38

Oil, water or dust-proof indicator lights with many lens styles for most incandescent lamps.

..LAMPHOLDERS...Reliability Since 1932

"ASTROLITES" and "GEMLITES"



"Astrolites" — Military or commercial — are Drake's tiniest, with built-in long life incandescent T1 lamp. Choice of 5, 12 volts; wire leads.

"Gemlite," small for commercial application with 2 lug termination using T1 Sub-Midget Flanged replaceable lamp in 5, 12, and 28 volts.

"TINYLITES"



Exclusive Drake, economical, with midget screw based lamp, for limited space requirements, choice of dome, or flat faced lens, with or without legends.

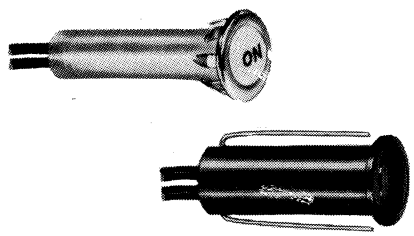
"MF" INDICATOR LIGHTS



Incandescent and neon Midget Flanged lamps are used both for commercial and Military having hundreds of varieties, lens shapes and colors including "Press-to-Test," "Titelite," etc.

DRAKE MANUFACTURING CO.
4626 N. OLCOTT AVENUE
HARWOOD HEIGHTS, ILLINOIS 60656
312 AREA 867-7227 • TWX 910-221-0236

"GLO-LITES"



Commercial one-piece nylon, amber, red or white body and lens (flush or protruding lens with or without metal bezels). Built-in resistor and long life neon lamp. Choice of NEW "Twist-lock," plug button or nut mount; wire or lug termination. Also NEW High Temp. Aluminum "Glo-Lite."

ALL PHOTOS APPROXIMATELY ¾ ACTUAL SIZE.

DRAKE

Free Literature . . .
on the Complete Drake Line

Lit. No.	Description
6209-B	"Titelite" Data Sheet
6302-B	Indicator Light Catalog
6403	Project Data Sheet — for customer's specification requirements
6504	Lampholder Brochure
6507-A	120 V. Incan. Indicator Light Folder
6607-A	"Astrolite" — "Gemlite" Data Sheet
6700	Low Cost Ind. Light Data Sheet
6702-A	"Lite-Panel" Brochure
6706	Drake Numbering System
6713	"Glo-Lite" Folder
6800	1¼" Lens "Titelite" Data Sheet
6802	Bi-Pin Cartridge Lamp Catalog
6807	5200 Type Indicator Light
6900	Drake Representative List
6901	Product Index Chart
6904	Resale Price List

Request Literature Today

Ask your Drake Representative for location of nearest Distributor.

ELDEMA INDICATOR LITES

C-LITES

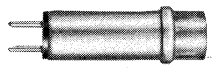
Eldema C-Lites are 2-pin cartridge lamps that are easily inserted from the front of the panel into the D-Holder assembly. C-Lites are in three basic series: CF—incandescent, CG—neon, and CR—neon with built-in resistor. Clear anodized aluminum case — stainless steel pins — plastic lens cap — high dielectric insulation — meets Mil-L-3661. Mate with all DH Series holders.

INCANDESCENT C-LITES

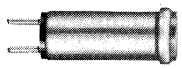
SERIES CF - Mates with all DH Holders

STYLE

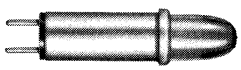
CF03
Short Flat



CF02
Flush



CF01
Dome



LENS COLORS

ACS	Amber Clear
BCS	Blue Clear
CCS	Cloudy Clear
GCS	Green Clear
RCS	Red Clear
WCS	Water Clear
YCS	Yellow Clear
ATS	Amber Translucent
BTS	Blue Translucent
GTS	Green Translucent
RTS	Red Translucent
WTS	White Translucent
YTS	Yellow Translucent

SPECIFY STYLE — LENS COLOR AND LAMP NUMBER

Example: CF03-RTS-2187

LAMP NO.	VOLTS	M.A.	LIFE HRS
2158*	3	15	10,000
680	5	60	50,000
1730	6	40	1,000
2114	6	60	3,000
1784	6	200	1,000
2180	6.3	40	50,000
2181	6.3	200	50,000
1869*	10	15	50,000
2107*	10	40	5,000
2174	12	40	3,000
1705	14	80	750
2182	14	80	50,000
2102	18	40	1,000
1762	28	40	1,000
2187	28	40	25,000

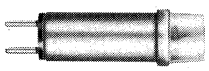
*Use with clear colors only.

NEON C-LITES Mates with DH Holders

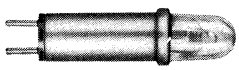
SERIES CG- SERIES CR

STYLE

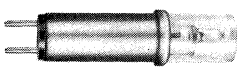
CG03 or CR03



CG01 or CR01



CG04 or CR04



LENS COLORS

CLEAR ONLY

ACS	Amber Clear
CCS	Cloudy Clear
RCS	Red Clear
WCS	Water Clear
YCS	Yellow Clear

SPECIFY STYLE — LENS COLOR LAMP OR LAMP/RESISTOR

Examples: CG03-RCS-N110
CR01-ACS-N123

NEON LAMP-CG SERIES

N110 - Standard brightness
N120 - High brightness

NEON LAMP/RESISTOR-CR SERIES

N114 - Standard brightness medium life - 56K
N117 - Standard brightness long life - 100K
N121 - High brightness medium life - 22K
N123 - high brightness long life - 33K

C-LITES

SERIES CN, CL AND CM

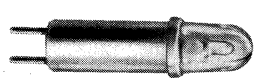
These are special purpose C-Lite types, each with mating single lamp D-Holders. The CL and CM have long life, higher voltage incandescent telephone type lamp bulbs. The CN is an older style neon C-Lite with resistor.

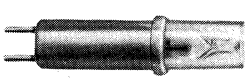
NEON C-LITES

SERIES CN- - neon lamp built-in resistor

Mate with DN Holders

CN01-RCS-N117





CN04-WCS-N123

Slightly longer than new CR series. Otherwise the two types are identical. Specify in same manner except use CN instead of CR. CN03 style is available.

INCANDESCENT C-LITES

TYPE CL24

Mate with DL lampholders with D06, D09 or D25 lens caps. Bulb end exposed.

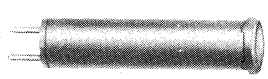


PART NO.	VOLTS	MA	LIFE HRS
CL24-6PS	6	140	5,000+
CL24-12PS	12	170	5,000+
CL24-24PS	24	73	5,000+
CL24-28PS	28	40	5,000+
CL24-48PS	48	53	5,000+
CL24-60PS	60	50	5,000+
CL24-120PS	120	25	5,000+

INCANDESCENT C-LITES

TYPE CM65

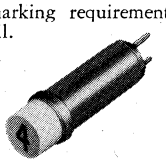
Mate with DM lampholders with D06, D09 or D25 lens caps. Light diffusing frosted lens.



PART NO.	VOLTS	MA	LIFE HRS
CM65-6PS	6	140	5,000+
CM65-12PS	12	170	5,000+
CM65-28PS	28	40	5,000+
CM65-48PS	48	53	5,000+
CM65-60PS	60	50	5,000+
CM65-120PS	120	25	5,000+

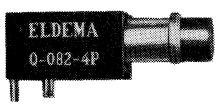
LENS MARKING

Eldema flat top lens styles may be provided with hot stamped legends. Normal markings in black-other colors to order. Specify marking requirements in complete detail.



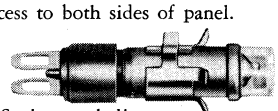
Q-SERIES

CLIPS AND SOCKETS



Q-082-4P P.C. Board Socket with CF03 C-Lite. Socket Mounts in 4 .040 Holes on .200 Centers.

Mounts C-Lites in 19/64" hole — ½" centers. Requires access to both sides of panel.



Q-081-905, Spring steel clip.
Q-082-2K, Socket with solder lug terminal.
Q-082-1M, Socket with solder cup terminals (not illustrated).
Q-145-008, Rubber washer to ease installation (not shown).

ELDEMA INDICATOR LITES

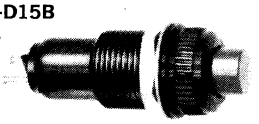
D-HOLDER

Eldema D-Holders mate with the plug-in C-Lite cartridge lamps. The standard DH Series is available in single lampholders, dual lampholders and matching switchlites. Other special length single lamp holders — Series DN, DL and DM to mate with the longer C-Lites are included. Anodized housings, nickel plated hardware — high temperature plastic lens caps — meets MIL-L-3661. RFI/EMI shielded versions are also available.

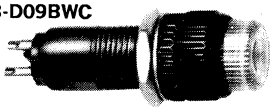
DHO-10B-D14B with CF03



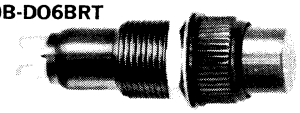
DHN-10B-D15B with CF03



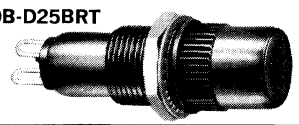
DHO-30B-D09BWC



DHN-60B-DO6BRT



DHN-60B-D25BRT



DH SERIES SINGLE LAMPHOLDERS

Mate with CF, CG and CR C-Lites

HOLDER STYLE

DHO - Rear mounting, 3/8" hole
DHN - Front mounting, 15/32" hole

HOLDER TERMINAL AND FINISH

10B - Turret pin black housing
30B - Solder cup black housing
60B - Solder lug black housing

SPECIFY HOLDER STYLE — TERMINAL AND FINISH THEN LAMP COLLAR OR LENS CAP STYLE AND LENS COLOR.

For example: DHO-10B-D14B
DHN-60B-D06BRT

For clear anodized finish change letter B in terminal - finish and in lamp collar or lens cap to S - DHN-60S-D06SRT.

An installation wrench that mates with the knurled ring on rear mounting holders and switchlites is available. Part number — Z-090-375

LAMP COLLARS

D14B - Use with DHO
D15B - Use with DHN or DHO

Note: No lens color specified for collars. For use with C-Lite cartridges with colored lenses.

LENS CAP STYLE

D06B - Smooth lens
D07B - Long smooth lens
D09B - Fluted lens, clear colors only
D25B - Shroud lens, translucent colors only.

Note: For use with C-Lite cartridges with water clear lenses.

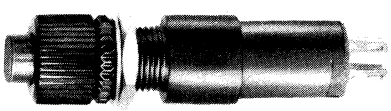
LENS COLORS

AC - Amber Clear*
BC - Blue Clear
CC - Cloudy Clear*
GC - Green Clear
RC - Red Clear*
WC - Water Clear*
YC - Yellow Clear*
AT - Amber Translucent
BT - Blue Translucent
GT - Green Translucent
RT - Red Translucent
WT - White Translucent
YT - Yellow Translucent

*Recommended for neon C-Lites

DH SERIES - TYPE DHS MOMENTARY SWITCH-LITE

Rear mounting, 3/8" hole
Mate with CF, CG and CR C-Lites



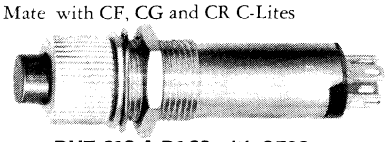
DHS-60B-A-D16B with CF03
Black anodized finish

DHS-60B-A-D16B normally open
DHS-60B-B-D16B normally closed
DHS-60B-P-D16B press-to-test

Black or clear finish — specify B — black, S — clear (underlined letters in part numbers by illustrations, 2 places)

DH SERIES - TYPE DHT MOMENTARY SWITCH-LITE

Front mounting, 15/32" hole
Mate with CF, CG and CR C-Lites



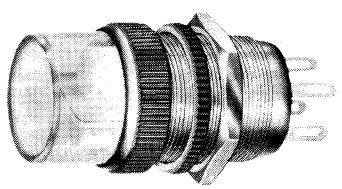
DHT-61S-A-D16S with CF03
Clear anodized finish

DHT - 61B-A-D16B normally open
DHT - 61B-B-D16B normally closed
DHT - 61B-P-D16B press-to-test

Four lug terminals — separate light and switch circuit — 1/2 amp rating for normally open and closed types.

DH SERIES - TYPE DHF DUAL LAMPHOLDER

Front or rear mounting 3/4" hole.

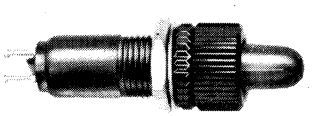


DHF-61B-D17BWC

Mates with any two CF, CG, or CR C-Lites. Four lug terminals — clear lens. Black anodized finish.

DN SERIES SINGLE LAMPHOLDERS

Rear mounting 3/8" Hole.
Mate with CN neon C-Lites

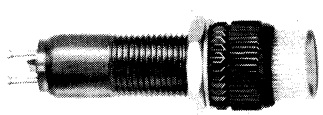


DNO-10B-D14B with CN01

Slightly longer than DHO holder, otherwise identical and specified in same manner except use DNO instead of DHO. Rear mounting 3/8" hole only.

DL SERIES SINGLE LAMPHOLDERS

Rear mounting 3/8" Hole.
Mate with CL24 C-Lites

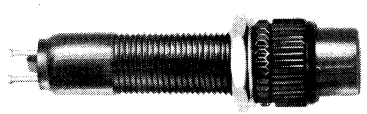


DLO-10B-D09BWC

Medium length holder for high voltage incandescent CL24. Specify in same manner as DHO — requires lens cap.

DM SERIES SINGLE LAMPHOLDERS

Rear mounting 3/8" Hole.
Mate with CM65 C-Lites



DMO-10B-D06BRT

Long length holder for high voltage CM65 C-Lites. Specify in same manner as DHO — requires lens cap.

For complete Technical information and detailed catalogs contact our representative listed in the EEM yellow pages.

ELDEMA DIVISION
GENISCO TECHNOLOGY CORPORATION
18435 SUSANA ROAD
COMPTON, CALIFORNIA 90221
(213) 774-1850

ELDEMA INDICATOR LITES

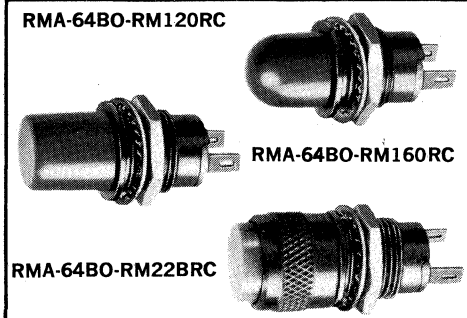
R – LITES

R-Lites are Eldema's product family of relampable holders and lens caps for the midget flange based T-1 ¾ incandescent and T-2 neon bulbs. The lamps and lens caps are replaceable from the front of the panel. There are five R-Lite groups — each with its own features — the holder and lens cap part numbers in each group start with the same two letters to insure mating parts.

RM AND RN SERIES

The RM-RN groups meet MIL-L-3661 and MIL-L-6723. The RM is for incandescent lamps — the RN Series with a built in resistor is for neon lamps. Standard types RMA and RNA — waterproof types RMW and RNW — two tin plated lug terminals — black anodized aluminum cases — high impact plastic lenses. Mount from the front in 15/32" holes.

RMA-64BO-RM120RC



RMA-64BO-RM160RC

RMA-64BO-RM22BRC

RM SERIES

HOLDER P/N

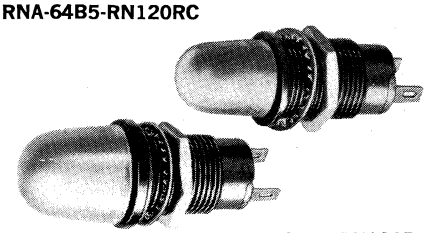
RMA - 64BO Standard — black finish

RMW - 62BO Waterproof — black finish

SPECIFY HOLDER LENS STYLE AND LENS COLOR

CAP STYLE	LENS COLORS	
RM120 Dome	AC	Amber Clear
RM160 Flat top	BC	Blue Clear
RM22B Rotating type	CC	Cloudy Clear
RM130 Waterproof dome	GC	Green Clear
	RC	Red Clear
	WC	Water Clear
	YC	Yellow Clear
	AT	Amber Translucent
	BT	Blue Translucent
	GT	Green Translucent
	RT	Red Translucent
	WT	White Translucent
	YT	Yellow Translucent

RNA-64B5-RN120RC



RNW-62B5-RN130RC

RN SERIES

HOLDER P/N

RNA - 64B5 Standard — black finish with 62KΩ for NE2D lamp

RNA - 64B2 Standard — black finish with 27KΩ for NE2J lamp

RNW - 62B5 Waterproof — black finish with 62KΩ for NE2D lamp

RNW - 62B2 Waterproof — black finish with 27KΩ for NE2J lamp

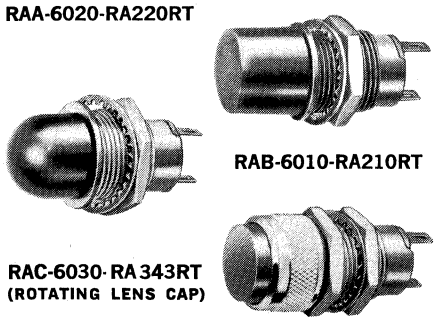
CAP STYLE	LENS COLORS	
RN120 Dome	AC	Amber Clear
RN130 Waterproof dome	CC	Cloudy Clear
	RC	Red Clear
	WC	Water Clear
	YC	Yellow Clear

SPECIFY HOLDER LENS STYLE AND LENS COLOR

RA SERIES

The RA Series is for flange based T-1 ¾ incandescent bulbs. Three mounting styles are available and three metal finishes. Rugged two terminal lamp holders — brass housings — tin plated lug terminals — high impact strength plastic lens caps.

RAA-6020-RA220RT



RAB-6010-RA210RT

RAC-6030-RA343RT (ROTATING LENS CAP)

HOLDER STYLE

RAA - 15/32" Front mounting
RAB - 17/32" Front mounting
RAC - 15/32" Front or rear mounting

HOLDER FINISH

6010 Bright nickel
6020 Black nickel
6030 Polished chrome

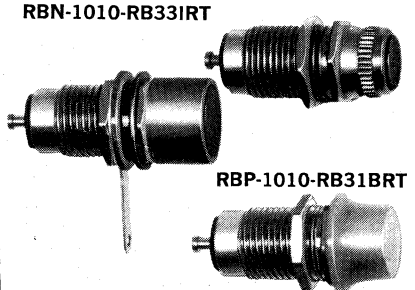
SPECIFY HOLDER STYLE HOLDER FINISH LENS STYLE AND LENS COLOR

CAP STYLE	LENS COLORS	
RA210 Dome	AC	Amber Clear
RA220 Flat top	BC	Blue Clear
RA341 Bright nickel	CC	Cloudy Clear
RA342 Black nickel	GC	Green Clear
RA343 Polished chrome	RC	Red Clear
	WC	White Clear
	YC	Yellow Clear
	AT	Amber Translucent
	BT	Blue Translucent
	GT	Green Translucent
	RT	Red Translucent
	WT	White Translucent
	YT	Yellow Translucent

RB SERIES

Low cost relampable holders and lens caps for T-1 ¾ based incandescent lamps. The holder is one piece nickel plated brass construction — Type RBN, single center terminal grounded to panel — Type RBP, with insulating washers and external lug terminal added to electrically isolate holder from the panel.

RBN-1010-RB33IRT



RBP-1010-RB31BRT

RBN-1010-RB190WT

HOLDER PART NUMBER

RBN - 1010 Single center terminal Front mounting 3/8" hole.

RBP - 1010 Insulating washers Two terminals, 27/64" hole.

SPECIFY HOLDER, LENS STYLE AND LENS COLOR

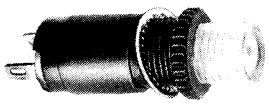
CAP STYLE	LENS COLORS	
RB190 All plastic, bell shape	AT	Amber
RB31B Black shroud lens End on viewing only	BT	Blue
RB331 Flat top lens, bright nickel plated ring.	GT	Green
	RT	Red
	WT	White
	CC	Cloudy

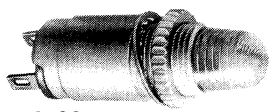
ELDEMA INDICATOR LITES

RL SERIES

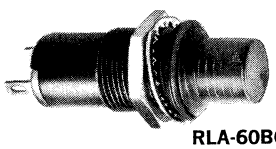
In the RL Series the lamp holders and lens caps accommodate either based incandescent or neon lamps for uniform appearance. Neon holders may have built in resistors. Two tin plated lug terminals — black or clear anodized housings — fresnel ring light diffusing lens caps give maximum brilliance. This series matches Eldema Logic-Lites.

RLD-60BO-RL090WC





RLD-60SO-RL130CC



RLA-60BO-RL150RC

HOLDER STYLE

RLA - Front mounting, 15/32" Hole
RLD - Rear mounting, 3/8" Hole, 1/8" Panel
RLE - Rear mounting, 3/8" Hole, 3/16" Panel

HOLDER FINISH AND RESISTOR

60B0	- Black finish	No Resistor
60S0	- Clear finish	No Resistor
60B2	- Black finish	with 27KΩ for NE2J lamp
60S2	- Clear finish	with 27KΩ for NE2J lamp
60B5	- Black finish	with 62KΩ for NE2D lamp
60S5	- Clear finish	with 62KΩ for NE2D lamp

SPECIFY HOLDER STYLE, FINISH AND RESISTOR-LENS STYLE AND LENS COLOR

FRESNEL RING LENS CAPS

STYLE	COLORS
RL090 Flat top	AC - Amber Clear*
	BC - Blue Clear
RL130 Dome	CC - Cloudy Clear*
	GC - Green Clear
RL150 Skirted	RC - Red Clear*
	WC - Water Clear*
	YC - Yellow Clear*

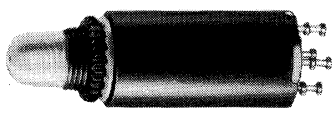
*Recommended for neon lamps

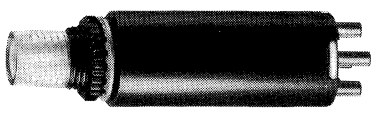
SMOOTH FACE LENS CAPS

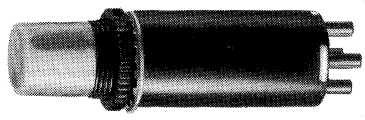
STYLE	COLORS
RL100 Flat top	AT Amber Translucent
	BT Blue Translucent
RL140 Dome	GT Green Translucent
	RT Red Translucent
RL160 Skirted	WT White Translucent
	YT Yellow Translucent

LOGIC-LITES

Indicator lights with built-in transistorized lamp driver networks. Available in neon and relampable incandescent types for operation from IC and discrete component circuits. Matching indicator lights and switchlites are also available. Contact Eldema for more detailed information.



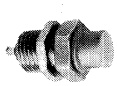




H-LITES

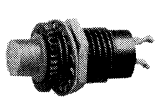
Eldema Series HL holders and lens caps are for sub-miniature based T-1 incandescent lamps. Military type construction — brass housing — either single or two terminal style — relampable from the front of the panel — mount on centers as close as 0.360. RFI/EMI shielded versions available-see H-Lite brochure.

HLA-1010-HL230WT

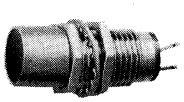




HLB-1010-HL321RT



HLC-2020-HL230WT



HLD-1010-HL321RT

HOLDER PART NUMBER

HLA-1010	Front mounting ¼" hole, single terminal, bright finish.
HLB-1010	Front mounting 5/16" hole, lug and center terminal — bright finish — insulating washers.
HLC-2010	Two terminal — front mounting 5/16" hole, bright finish.
HLC-2020	Two terminal — front mounting 5/16" hole, black finish.
HLD-1010	Two terminal — front or rear mounting — 5/16" hole — bright finish
HLD-1020	Two terminal — front or rear mounting — 5/16" hole — black finish.

LENS CAP STYLE

HL230	All plastic
HL321	Shroud, bright finish
HL321	Shroud, black finish

LENS COLORS

AT	Amber Translucent
BT	Blue Translucent
GT	Green Translucent
RT	Red Translucent
WT	White Translucent
YT	Yellow Translucent
WC	Water Clear
CC	Cloud Clear

SPECIFY HOLDER — LENS STYLE AND LENS COLOR.

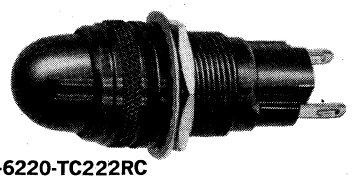
Eldema products are available from authorized stocking parts distributors throughout the United States and Canada.

ELDEMA DIVISION
GENISCO TECHNOLOGY CORPORATION
18435 SUSANA ROAD
COMPTON, CALIFORNIA 90221
(213) 774-1850

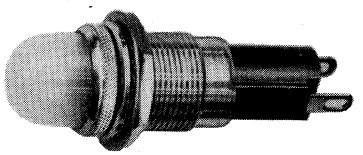
ELDEMA INDICATOR LITES

T-SERIES

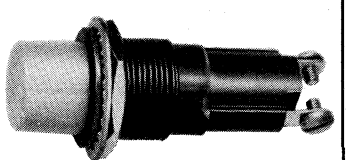
Eldema T-Series lampholders and lens caps are for the T-3¼ bayonet based incandescent and neon lamps. Four basic types — TAF and TCF for incandescents — TAG and TCG with built-in resistors for neons. Meets Mil-L-3661 — polished chrome, black nickel or bright nickel finish — front mounting in 11/16" holes water proof types — lug or screw terminals.



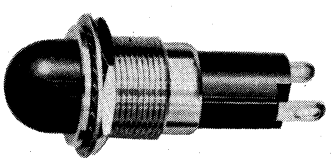
TCF-6220-TC222RC



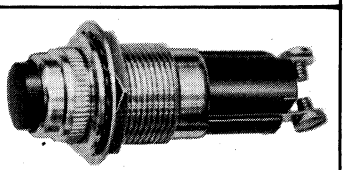
TAG-6032-TA263CD



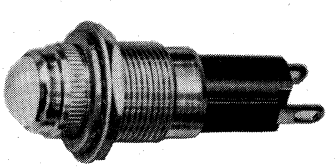
TAF-7020-TA160AT



TAF-6030-TA120RT



TAF-7030-TA243RT



TAF-6030-TA223CD

HOLDER STYLE

TAF - Incandescent lampholder Screw-in lens caps

TAG - Neon lampholder Screw-in lens caps

TCF - Incandescent lampholder Screw-on lens caps

TCG - Neon lampholder Screw-on lens caps

NOTE: TAF and TAG holders mate with lens caps starting with letters TA. TCF and TCG holders mate with TC lens caps.

HOW TO SPECIFY HOLDER FEATURES:

Example — 6010

First digit: (Terminals)	6 = Solder lug 7 = Screw terminal
Second digit: (Mounting)	0 = Standard part 2 = Water proof
Third digit: (Finish)	1 = Bright nickel 2 = Black nickel 3 = Polished chrome
Fourth digit: (Resistor)	0 = None (TAF & TCF) 2 = 27KΩ for NE51H lamp 4 = 56KΩ for NE51 lamp 7 = 100KΩ for NE51 lamp 25,000 hour life rating

SCREW-IN LENS CAP STYLE

TA120	- Smooth dome — clear or translucent colors
TA130	- Fluted dome — clear colors only
TA140	- Semi-Fluted dome — clear colors only
TA160	- Flat top — clear or translucent colors
TA223†	- Convex — clear or diffusing colors (no cloudy clear)
TA243†	- Flat top — clear, translucent or diffusing colors
TA263†	- Smooth dome — clear or diffusing colors (no cloudy clear)
TA283†	- Fluted dome — clear colors (no cloudy clear)

SCREW-ON LENS CAP STYLE

TC223† Smooth dome — clear or diffusing colors (no cloudy clear)

TC243† Fluted dome — clear colors only (no cloudy clear)

† These lens caps have a metal ring with polished chrome finish specified by the digit 3. For bright nickel, change to 1, black nickel, change to 2. For example: TA221RC and TC242RC.

To specify water proof lens caps in the TA styles change the first digit as follows: TA100 series to TA400, TA200 series to TA300. For example: TA120RC to TA420RC. Standard TC lens cap may be used. All necessary sealing gaskets are on the TC holder when it is specified water proof.

LENS COLORS

AC — Amber Clear*	AT — Amber Translucent	AD — Amber Diffusing
BC — Blue Clear	BT — Blue Translucent	BD — Blue Diffusing
GC — Green Clear	GT — Green Translucent	GD — Green Diffusing
RC — Red Clear*	RT — Red Translucent	RD — Red Diffusing
WC — Water Clear*	WT — White Translucent	WT — White Translucent
YC — Yellow Clear*	YT — Yellow Translucent	YD — Yellow Diffusing
CC — Cloudy Clear*		CD — Clear Diffusing

* These colors recommended for neon lamps

Diffusing colors have surface nearest lamp frosted — Note white is translucent only.

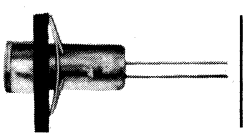
SPECIFY HOLDER STYLE — HOLDER FEATURES — LENS STYLE AND LENS COLOR

SEE PART NUMBERS BY ILLUSTRATIONS FOR EXAMPLES

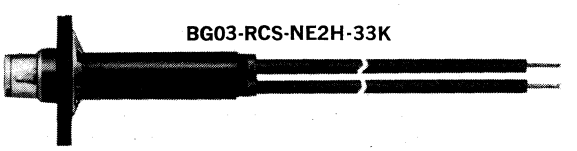
B — LITES

Commercial neon indicators permanently, clip mounted — 5/16" mounting hole all plastic construction — inexpensive — two basic types — neon lamp with resistor and attached wire leads and neon lamps only with bare wire leads. Mounting clips furnished. Designed for 120 volt operation.

BG90-RC-NE2H



BG03-RCS-NE2H-33K



ELDEMA INDICATOR LITES

J-LITES

Permanent mounting indicators with built-in long life sub-miniature T-1 incandescent lamps. Front panel mounting in 0.193 hole — moisture and dust proof — completely sealed — 6 inch leads — commercial and military versions.

JK8111-050-220WT



JK9151-050-210RT



SPECIFY HOUSING — LAMP NO. LENS SHAPE — LENS COLOR

HOUSING STYLE

JK8111 Commercial - brass case
JK9151 Military - steel case

LAMP NO.	VOLTS	M.A.	LIFE HRS
-050-	5	60	100M
-100-	10	27	10M
-120-	12	60	16M
-280-	28	24	16M

LENS STYLE

210 Dome
220 Flat top

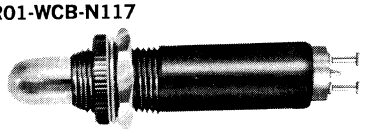
LENS COLORS

AT Amber Translucent
BT Blue Translucent
GT Green Translucent
RT Red Translucent
WT White Translucent
YT Yellow Translucent
WC Water Clear

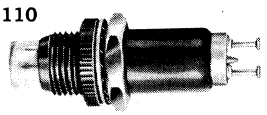
E-LITES

Two basic types — Series EG, neon lamp only — Series ER, neon lamp with built-in resistor — permanent neon lamp indicators — military type construction — black anodized aluminum body — tin plated turret terminals, high impact plastic lens — five lens colors. Use wrench Part number Z-090-375 to simplify installation.

ER01-WCB-N117



EG03-WCB-N110



STYLE - NO RESISTOR

EG01 Dome lens
EG03 Flat lens

STYLE WITH RESISTOR

ER01 Dome lens
ER03 Flat lens

LENS COLORS

ACB Amber Clear
CCB Cloudy Clear
RCB Red Clear
WCB Water Clear
YCB Yellow Clear

LAMP - EG SERIES

N110 Medium brightness
N120 High brightness

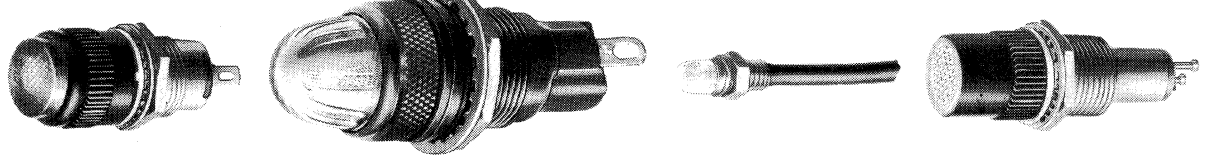
LAMP/RESISTOR - ER SERIES

N117 Medium brightness, 25,000 hr — 100KΩ
N123 High brightness, 25,000 hr — 33KΩ

SPECIFY STYLE — LENS COLOR — LAMP OR LAMP/RESISTOR

RFI/EMI SHIELDED INDICATOR LITES

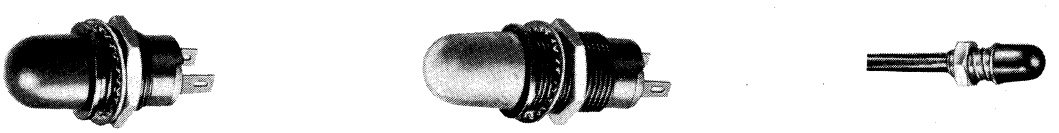
Special lens caps with internally retained wire mesh cloth used in lampholders with a conductive finish provides effective attenuation for interference shielding requirements. Shielded versions of most Eldema products are available and match the standard units. Contact Eldema for the technical bulletin covering complete RFI/EMI tests and results of these shielded indicator lights.



R-LITES T-SERIES J-LITES D-HOLDER

MIL-LITES

Specific Eldema parts meet MS25256, MS25257 and MS25446 per MIL-L-6723. Under MIL-L-3661 Eldema meets almost all configurations for lamp holders (LH nos.), Lens caps (LC nos.), and indicator lites (LHC nos.). Complete cross reference information is available upon request.

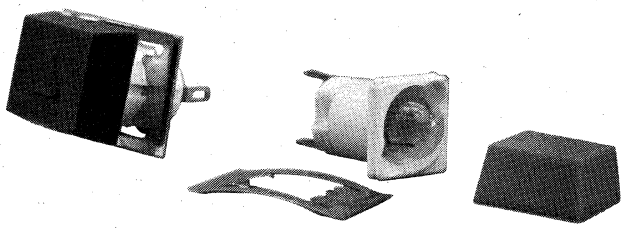


Complete catalogs and cross-reference information to Military parts and those of other manufacturers are available from our representative listed in the EEM yellow pages.

ELDEMA DIVISION
GENISCO TECHNOLOGY CORPORATION
18435 SUSANA ROAD
COMPTON, CALIFORNIA 90221
(213) 774-1850

INDICATING LIGHTS

CR103 TYPE B MINIATURE SQUARE INDICATING LIGHTS



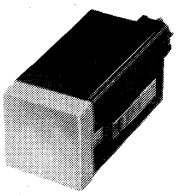
The CR103 Type B general-purpose miniature indicating light is a small, "square look" unit that provides positive visual indication on control panels and consoles, data processing equipment, and wherever production and automated systems exist. A complete light consists of a base unit with bulb, lens and spring clip.

FEATURES

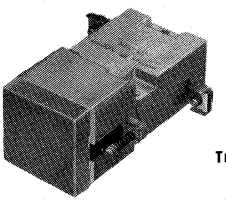
2-pin type lamp replaceable from front of panel; interchangeable lenses of snap-on construction; choice of red, white, green, or yellow lenses; optional arrow indicator on lens ideal for flow charts; low power requirement of 6, 12, or 24 volts; simple one-hole mounting.

Write for Bulletin GEA-7398

CR103 TYPE C SQUARE INDICATING LIGHTS



Full-voltage type



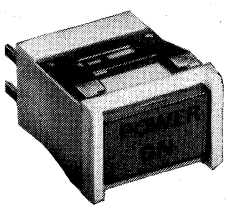
Transformer type

CR103 C square indicating lights are designed for use in a wide variety of applications such as: business machines, operator panels, consoles, control desks, motor control centers, and for the panel building, electronic and intrumentation fields.

Full voltage and transformer types in a variety of colors are available. Lenses may be translucent type or transparent type used with a diffuser. Legends can be engraved and filled on translucent lenses.

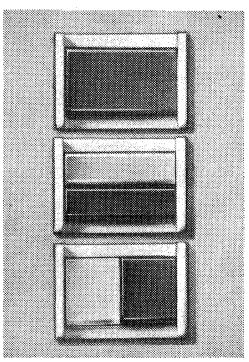
Write for Bulletin GEA-7366

CR103 TYPE D INDICATING LIGHTS



With solid lens cap installed

Solid or split color fields give added flexibility. Colors can be mixed in the split field forms for even more combinations.



General Electric's new line of CR103 Type D indicating lights are designed for a wide variety of applications such as control and instrument panels, office machines, laboratory instruments, computers and other data processing equipment. Matching illuminated push button switches are shown in Section 5100 on page of General Electric switches.

FEATURES

- Units snap into panels from front without tools, and can be gang-mounted horizontally to save space or for group functions.
- Convenient slide-on lens caps in five colors; four housing colors. Units are single button only, and have solid horizontally- or vertically-split color fields. 2-lamp and 4-lamp forms are available.
- Legend inserts for all forms can be printed or engraved on acetate or similar material of 10 mils or less thickness.

Write for Bulletin GEA-7390

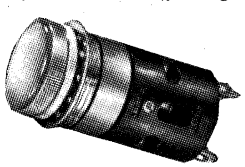
CR103 TYPE H INDICATING LIGHTS



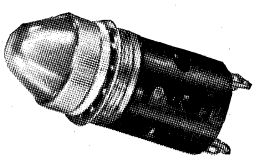
With spherical lens for $^{11}/_{16}$-in. mtg. hole



With crown lens for $^{15}/_{32}$-in. mtg. hole



With crown lens for 1-in. mtg. hole



With torpedo lens for 1-in. mtg. hole

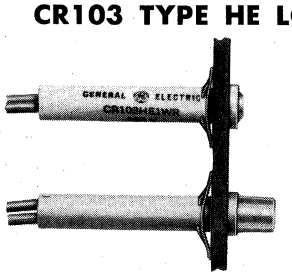
CR103 Type H indicating lights give bright visual indication of circuit operating conditions for applications where oil-tightness is not required.

FEATURES

- **Vivid Colors** — yellow (amber), blue, green, red, white and clear.
- **Even Illumination** — Lexan diffuses light and gives off an even glow.
- **Durable** — lenses will not shatter, resist high temperatures.
- **Compact** — forms for $^{15}/_{32}$, $^{11}/_{16}$, or 1-inch mounting holes.
- **Rating Flexibility** — wide variety of lamp voltages available. Lamp is supplied by the customer.
- **Ease of Installation** — lamps and lenses install from the front.

Write for Bulletin GEA-8119

CR103 TYPE HE LOW-COST MINIATURE INDICATING LIGHTS



CR103 Type HE indicating lights are new, low-cost units for applications requiring a minimum of space. They are ideally suited for business machines, major appliances, small panels, meters, gages, timers, illuminated pointers, dial indicators, and many other places where panel appearance and visual display are important.

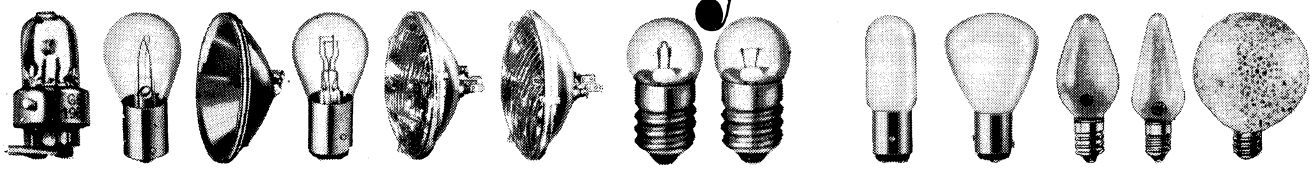
Only $1^{11}/_{16}$" long, they mount with a speed nut in a $^{5}/_{16}$" dia hole. Choice of amber, clear, red, or white lenses in flush or cylindrical lens style. Body colors are black, gray, tan, or white. For 120, 240, or 480 volts.

Write for Bulletin GEA-8119

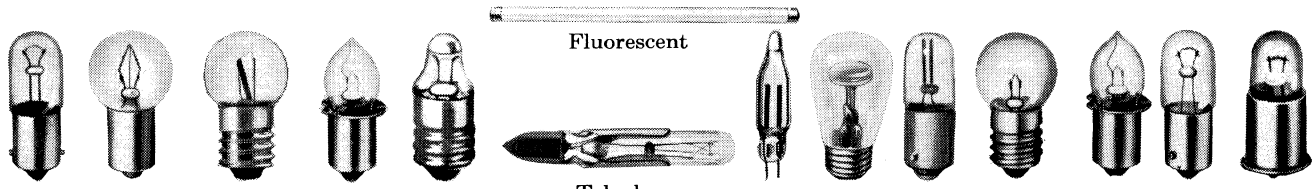
For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

GE Miniature Lamps for every need

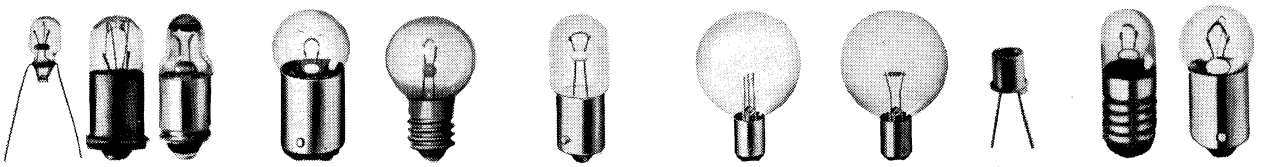


Aircraft Automotive Bicycle & Motorcycle Black Light Christmas

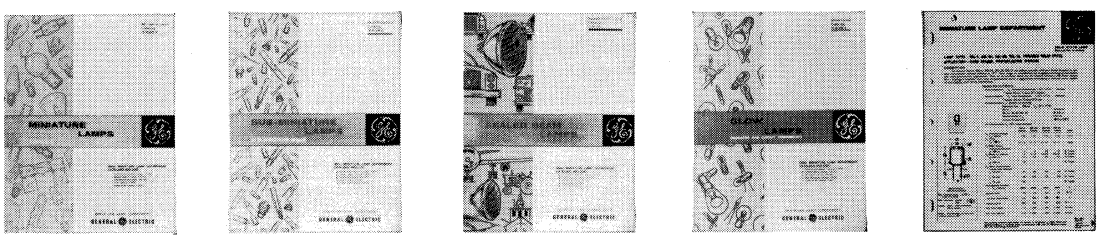


Fluorescent

Coin Machine Flasher Flashlight Telephone Glow Hand Lantern Indicator



Instrument Marine Medical Radio & TV Searchlight Signal Solid State Toy



MINIATURE SUB-MINIATURE SEALED BEAM GLOW SOLID STATE

GE Miniature Lamps for Your Products

Save time and money by selecting the lamp you need before your product design is frozen. Consider factors like size, power source, shock, life, light, temperature and assembly cost. Get complete and up-to-date electrical and physical specifications for over 1200 lamps from the General Electric catalogs shown above. Contact one of the offices below, or write General Electric, Miniature Lamp Dept., M9-1, Nela Park, Cleveland, Ohio 44112.

For helpful service contact one of these offices:

ATLANTA, GA.	120 Ottley Drive, N. E. P. O. Box 13917	30324	875-0921
BALTIMORE, MD.	1401 Parker Rd. Mail: P. O. Box 7427, Baltimore, Md.	21227	242-5700
BOSTON, MASS.	50 Industrial Place, Newton Upper Falls, Mass.	02164	332-6200
CHARLOTTE, N.C.	1001 Tuckaseegee Rd.	28208	376-6585
CHICAGO, ILL.	550 West Jackson Blvd.	60606	332-4712
CINCINNATI, OHIO	49 Central Ave.	45202	421-6810
CLEVELAND, OHIO	12910 Taft Ave.	44108	266-4337
COLUMBUS, OHIO	800 Northwest Blvd.	43212	294-4115
DALLAS, TEXAS	6500 Cedar Springs Road	75235	351-3725
DENVER, COLO.	6501 Stapleton Dr., North	80216	388-4611
DETROIT, MICH.	15135 Hamilton Ave.	48203	883-0200
EL PASO, TEXAS	2800 N. Stanton St., Room 210	79910	533-1961
HONOLULU, HAWAII	Room 215 Marine Finance Bldg., 1109 Bethel Street	96813	537-3280
HOUSTON, TEXAS	5615 Lymbar Drive	77035	923-2549
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JACKSONVILLE, FLA.	4077 Woodcock Dr., Suite 222	32207	359-1205
N. KANSAS CITY, MO.	535 East 14th Ave.	64116	471-0123
LOS ANGELES, CALIF.	2747 S. Malt Ave.	90022	723-2541
LOUISVILLE, KY.	2311 S. Brook Street	40208	637-3651
MEMPHIS, TENN.	2021 S. Latham St.	38109	948-2642
MIAMI, FLA.	3655 N. W. 71st St.	33147	693-3811
MILWAUKEE, WIS.	8100 West Florist Ave., Mail: P. O. Box 299	53201	462-3860
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NEW ORLEANS, LA.	4800 River Road, Mail: Box 10236, Jefferson Branch	70121	835-6421
NEW YORK, N.Y.	219 E. 42 St.	10017	751-1311
OAKLAND, CALIF.	999-98th Avenue	94603	569-3422
OKLAHOMA CITY, OKLA.	Executive Terrace Bldg., 2809 N.W. Expressway	73116	842-4028
PHILADELPHIA, PA.	Rt. 202, At Expressway, King of Prussia, Pa.	19406	688-5900
PITTSBURGH, PA.	238 W. Carson St.	15219	471-9050
PORTLAND, ORE.	2800 N.W. Nela St.	97210	223-2101
RICHMOND, VA.	1510 Willow Lawn Dr., Mail: P. O. Box 8627	23226	282-7644
ROCHESTER, N.Y.	Gibbs St. Bldg., 31 Gibbs St., Room 500	14604	454-2990
ST. LOUIS, MO.	1530 Fairview Ave.	63132	429-6930
SEATTLE, WASH.	2400—6th Avenue, South	98134	622-8081
UTICA, N.Y.	c/o Radio Receiver Dept., P. O. Box 175, 1001 Broad St.	13501	724-1293

MINIATURE LAMP DEPARTMENT

GENERAL ELECTRIC

Hudson Lamps: Tiny Bulbs for Your Big Lighting Jobs.

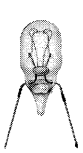
Fig. 1


Fig. 2


Fig. 3


Fig. 4


Fig. 5


Fig. 6


Fig. 7


Fig. 8


Fig. 9


Fig. 10

Illustrations Actual Size

Designers and production men prefer these dependable incandescent lamps for use in aircraft instruments, computers, read-out devices, edge-lighted panels, switch buttons, instrument pilot lights, and similar uses where space is limited, replacement difficult, and reliability essential.

Lamp Number	Military Std. Number	Bulb	Base	DESIGN Volts	DESIGN Amperes	Approximate M S C P	Approx. Hours Life	FILAMENT Type	FILAMENT Light Center Length Inches	Fig. No.
331	—	T-1 3/4	S. C. Mid. Flanged	1.35	.06	.01	500	C-2R	3/8	3
1728	—	T-1 3/4	5/8″ Wire Term.	1.35	.06	.01	500	C-2R	—	1
2301	—	T-1 3/4	Mid. 2-Pin (White)	1.35	.06	.01	500	C-2R	7/16	2
368	—	T-1 3/4	S. C. Mid. Flanged	2.5	.20	.15	500	C-2R	3/8	3
1767	—	T-1 3/4	Midget Screw	2.5	.20	.15	500	C-2R	1/2	5
1769	—	T-1 3/4	Midget Screw	2.5	.20	.15	500	C-2R	1/2	5
1783	—	T-1 3/4	5/8″ Wire Term.	2.5	.20	.15	500	C-2R	—	1
2302	—	T-1 3/4	Mid. 2-Pin (Brown)	2.5	.20	.15	500	C-2R	7/16	2
338	—	T-1 3/4	S. C. Mid. Flanged	2.7	.06	.03	500	C-2R	3/8	3
1738	—	T-1 3/4	5/8″ Wire Term.	2.7	.06	.03	500	C-2R	—	1
2303	—	T-1 3/4	Mid. 2-Pin (Lt. Grn.)	2.7	.06	.03	500	C-2R	7/16	2
2129	—	T-1 3/4	5/8″ Wire Term.	3.0	.30	.34	1,500	C-2R	—	1
2304	—	T-1 3/4	Mid. 2-Pin (Black)	3.0	.30	.34	1,500	C-2R	7/16	2
345	—	T-1 3/4	S. C. Mid. Flanged	6.0	.04	.05	1,000	C-6	3/8	3
1730	—	T-1 3/4	5/8″ Wire Term.	6.0	.04	.05	1,000	C-6	—	1
2305	—	T-1 3/4	Mid. 2-Pin (Silver))	6.0	.04	.05	1,000	C-6	7/16	2
328	MS25237	T-1 3/4	S. C. Mid. Flanged	6.0	.20	.34±15%[1]	1,000	C-2R	3/8	3
328-10	MS25237	T-1 3/4	S. C. Mid. Flanged	6.0	.20	.34±10%[1]	1,000	C-2R	3/8	3
328R[2]	MS25237	T-1 3/4	S. C. Mid. Flanged	6.0	.20	—	1,000	C-2R	3/8	3
337	—	T-1 3/4	Midget Grooved	6.0	.20	.6	1,000	C-2R	3/8	4
1768	—	T-1 3/4	Midget Screw	6.0	.20	.6	1,000	C-2R	1/2	5
1784	—	T-1 3/4	5/8″ Wire Term.	6.0	.20	.6	1,000	C-2R	—	1
2306	—	T-1 3/4	Mid. 2-Pin (Orange)	6.0	.20	.6	1,000	C-2R	7/16	2
349	—	T-1 3/4	S. C. Mid. Flanged	6.3	.20	.34	5,000	C-2R	3/8	3
2112	—	T-1 3/4	5/8″ Wire Term.	6.3	.20	.34	5,000	C-2R	—	1
2307	—	T-1 3/4	Mid. 2-Pin (Dk. Blu.)	6.3	.20	.34	5,000	C-2R	7/16	2
344	—	T-1 3/4	S. C. Mid. Flanged	10.0	.014	.004	5,000+	C-2F	3/8	3
1869	—	T-1 3/4	5/8″ Wire Term.	10.0	.014	.01	5,000+	C-2F	—	1
2308	—	T-1 3/4	Mid. 2-Pin (Beige)	10.0	.014	.01	5,000+	C-2F	7/16	2
367	—	T-1 3/4	S. C. Mid. Flanged	10.0	.04	.05	5,000+	C-2R	3/8	3
2107	—	T-1 3/4	5/8″ Wire Term.	10.0	.04	.05	5,000+	C-2R	—	1
2309	—	T-1 3/4	Mid. 2-Pin (Lt. Blue)	10.0	.04	.05	5,000+	C-2R	7/16	2
330	—	T-1 3/4	S. C. Mid. Flanged	14.0	.08	.5	750	C-2F	3/8	3
336	—	T-1 3/4	Midget Grooved	14.0	.08	.5	750	C-2F	3/8	4
383	—	T-1 3/4	Midget Screw	14.0	.08	.5	750	C-2F	1/2	5
1705	—	T-1 3/4	5/8″ Wire Term.	14.0	.08	.5	750	C-2F	—	1
2310	—	T-1 3/4	Mid. 2-Pin (Yellow)	14.0	.08	.5	750	C-2F	7/16	2
370	—	T-1 3/4	S. C. Mid. Flanged	18.0	.04	.25	1,000	C-2F	3/8	3
346	—	T-1 3/4	Midget Grooved	18.0	.04	.25	1,000	C-2F	3/8	4
2102	—	T-1 3/4	5/8″ Wire Term.	18.0	.04	.25	1,000	C-2F	—	1
2311	—	T-1 3/4	Mid. 2-Pin Dk. Grn.)	18.0	.04	.25	1,000	C-2F	7/16	2
327	MS25237	T-1 3/4	S. C. Mid. Flanged	28.0	.04	.34±25%	1,000	C-2F	3/8	3
327-15	MS25237	T-1 3/4	S. C. Mid. Flanged	28.0	.04	.34±15%	1,000	C-2F	3/8	3
327R[2]	MS25237	T-1 3/4	S. C. Mid. Flanged	28.0	.04	—	1,000	C-2F	3/8	3
334	—	T-1 3/4	Midget Grooved	28.0	.04	.34	1,000	C-2F	3/8	4
335	—	T-1 3/4	Midget Screw	28.0	.04	.34	1,000	C-2F	1/2	5
369	—	T-1 3/4	Midget Screw	28.0	.04	.34	1,000	C-2F	1/2	5
1762	—	T-1 3/4	5/8″ Wire Term.	28.0	.04	.34	1,000	C-2F	—	1
1764	—	T-1 3/4	1″ Wire Term.	28.0	.04	.34	1,000	C-2F	—	1
2312	—	T-1 3/4	Mid. 2-Pin (Red)	28.0	.04	.34	1,000	C-2F	7/16	2
680	MS24367	T-1	1-1/2″ Wire Term.	5.0	.06	.03 ±15%	100,000	—	—	6
682	MS24515	T-1	Sub-Midget Flg'd.	5.0	.06	.03 ±15%	100,000	—	—	7
683	MS24367	T-1	1-1/2″ Wire Term.	5.0	.06	.05 ±15%	100,000	—	—	6
685	MS24515	T-1	Sub-Midget Flg'd.	5.0	.06	.05 ±15%	100,000	—	—	7
713	MS24367	T-1	1-1/2″ Wire Term.	5.0	.075	.09 ±15%	100,000	—	—	6
714	MS24515	T-1	Sub-Midget Flg'd.	5.0	.075	.08 ±15%	100,000	—	—	7
715	MS24367	T-1	1-1/2″ Wire Term.	5.0	.115	.15 ±15%	50,000	—	—	6
718	MS24515	T-1	Sub-Midget Flg'd.	5.0	.115	.14 ±15%	50,000	—	—	7
6801	—	T-1	1-1/2″ Wire Term.	5.0	.06	.03 ±15%	100,000	—	—	6
6831	—	T-1	1-1/2″ Wire Term.	5.0	.06	.05 ±15%	100,000	—	—	6
7131	—	T-1	1-1/2″ Wire Term.	5.0	.075	.09 ±15%	100,000	—	—	6
7151	—	T-1	1-1/2″ Wire Term.	5.0	.115	.15 ±15%	50,000	—	—	6
6802	MS90451	T-1	1-1/2″ Wire Term.	5.0	.06	.03 ±15%	100,000	—	—	10
6832	MS90451	T-1	1-1/2″ Wire Term.	5.0	.06	.05 ±15%	100,000	—	—	10
7132	MS90451	T-1	1-1/2″ Wire Term.	5.0	.075	.09 ±15%	100,000	—	—	10
7152	MS90451	T-1	1-1/2″ Wire Term.	5.0	.115	.15 ±15%	50,000	—	—	10
6803	MS24367	T-3/4	1-1/2″ Wire Term.	5.0	.06	.03 ±15%	100,000	—	—	9
6833	MS24367	T-3/4	1-1/2″ Wire Term.	5.0	.06	.05 ±15%	100,000	—	—	9
7133	MS24367	T-3/4	1-1/2″ Wire Term.	5.0	.075	.09 ±15%	100,000	—	—	9
7153	MS24367	T-3/4	1-1/2″ Wire Term.	5.0	.115	.15 ±15%	50,000	—	—	9

[1] At 5 volts; at 6 volts, approximately 0.6 cp

[2] Coated Aviation Red

SUB-MINIATURE LAMPS

(Top Section of chart at right.) Designed for maximum service life under conditions of shock and vibration. Will not introduce noise into audio circuits. Manufactured and tested to rigid quality control standards.

"TU-PIN" SUB-MINIATURE LAMPS

Ideal for printed circuits and transistor sockets. Bases color coded to electrical characteristics. Easy to insert and remove, especially in difficult locations. So small twelve can be mounted in one square inch.

MICRO-MINIATURE LAMPS

(Lower Section of chart at right.) Design lives of 100,000+ hours is common. Tipless bulbs for undistorted end viewing. Pre-aged and photometered to assure reliability, stability, and electrical accuracy.

ENGINEERING ASSISTANCE

Hudson manufactures all standard miniature, sub-miniature, and micro-miniature lamps, most of which are described in our Catalog #106. If you have an application for which no standard lamp is suitable, Hudson will design and manufacture a special lamp to meet your requirements. Please ask us for recommendations, which are furnished to you without obligation, of course.

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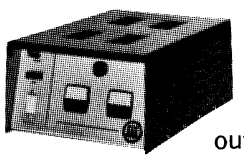
Xenon Flash & Strobe Lamps Outstanding features: seal integrity, extended life, reliable triggering, high conversion efficiency.
Operating characteristics: 8 to 18,000 joules, glass to metal seals and solder seals; output of 15 to 50 lumen-seconds per joule input.
Model Numbers: F-38, F-38-U, F-42, F-81, F-47, F-47-U, F-70, F-60, F-90, F-91, FRT-6, FFT-6, FRT-76, Mini Strobe.



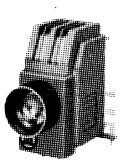
Power Supplies Outstanding features: constant power to lamp throughout lamp life, solid-state, rugged design, low current ripple, ample starting energy to restart hot lamps.
Operating characteristics: 35 to 500 watts; integrated starter circuits, DC output, 50 or 60 cycle and 117 to 220 volts.
Model numbers: CA-35, CA-75/100, CA-150, CA-200, CA-350, CA-500, CA-610, modulators.



Mercury Short Arc Lamps Outstanding features: extreme arc stability, intense source of ultraviolet and visible radiation, performance proved reliability, constant lumen output throughout lamp life.
Operating characteristics: 100 to 500 watts; 2,000 to 30,000 lumens.
Model numbers: III-107, III-110, III-610, III-660, III-200-2, III-200-3, III-202, III-203, III-350, III-500-2, III-360, III-120.



Xenon Short Arc Lamps Outstanding features: ultra arc stability, intense sources of ultraviolet and infrared radiation, history-proven reliability, capable of continuous, modulated or pulsed operation.
Operating characteristics: 35 to 300 watts; 600 to 7,500 lumens.
Model numbers: X-35, X-36, X-50, X-75, X-76, X-150, X-200, X-300, X-80, X-160, X-310.



Lamphousings Outstanding features: 2″ or 3″ optics, positive linkage focusing adjustment in X-Y-Z axis, spherical rear mirror, detachable backplate for ease of lamp installation and prefocusing.
Operating characteristics: will hold 35 to 350 watt short arc lamps, pyrex or quartz optics, collimated light, integral filter sets.
Model numbers: LH-350, LH-350 Quartz, LH-360 W, LH-360 WO, LH-370, LH-370 Quartz.

Custom Design Capability Illumination Industries offers the highest concentration of experience and talent for creative and rapid response to unique customer requirements.
The company's engineering and manufacturing staff have a depth of experience unequalled in the industry and they welcome the opportunity of assisting customers in the solution of their lamp and power supply problems.

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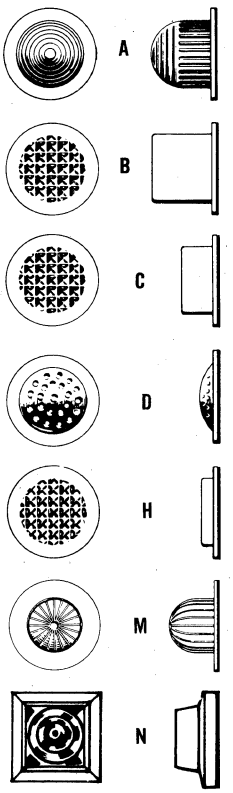
omni-glow

VERSATILE GENERAL PURPOSE NEON PILOT LIGHTS

. . . for all your line-voltage applications—usually outlasts the product on which it is installed. Mounts in a jiffy in a ½" hole. Tamperproof, resists vibration and shock. A variety of lens shapes and colors are available, with imprinted legends as required. Leads are tailored to your production needs. UL and CSA approved. OMNI-GLOW is also available with seasoned and selected neon lamps with associated resistors, capacitors and diodes to meet your circuit requirements.

- Choice of 7 lens shapes, variety of colors, imprinted legends (if desired), 4 standard ring finishes, 4 body lengths.
- Long-lived neon pilot lights operate more than 10,000 hours.
- Mount in a jiffy in ½" hole with choice of speednut, snap-fit, or tubular clip.
- UL and CSA approved.
- Choice of lugs or leads.
- Also available with long-lived incandescent lamps.

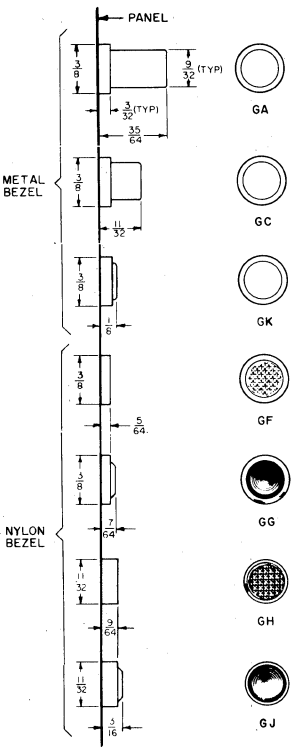


glo-dot

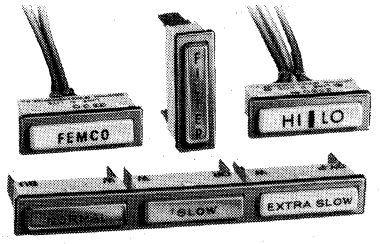
MINIATURE NEON PILOT LIGHTS

. . . tiny, yet complete neon pilot light mounts in 5/16" dia. hole with push-on speed nut. Rugged and long-lived. GLO-DOT is available with insulated leads and complete built-in strain relief—is UL approved. A variety of lens and body colors satisfy application and appearance requirements.

- Choice of 7 lens shapes, variety of colors, imprinted legends (if desired), 4 standard ring finishes, 4 body lengths.
- Complete with built-in resistor, neon lamps for extra-long life.
- UL and CSA-approved.
- Variety of leads and terminations.
- Also available with bare lamp leads for lowest cost applications not requiring UL or CSA approval.
- Also available with long-lived incandescent lamps.



LINE-O-LITE

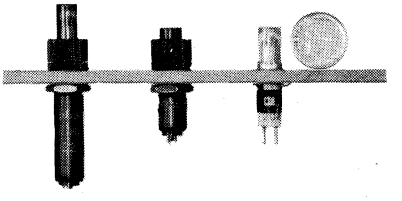


A series of neon pilot lights specifically designed to produce an attractively illuminated legend or bar of light. Line-O-Lite can be printed either vertically or horizontally on a variety of colored lenses. Message area ½" by 1 3/32". Easy installation—snaps into a 1.280 by 400/.395" rectangular hole. Can be provided with leads or quick-connect tabs—as desired.

- Ideal for display of illuminated legend.
- Wide selection of attractive bezel finishes.
- Long-lived lamp, resistor built-in.
- Wide variety of lens colors available.
- UL and CSA-approved.

MINI-CATOR

MINIATURE INDICATOR LIGHTS



For use in electronic instrumentation, computers, display panels, precision machinery and electronic equipment in general — including military applications. Neon models available for 65 VAC (90 VDC) and over, with or without built-in resistor. Incandescent models available for 6.3V-.20A, 14V-.08A and 28V-.04A, as well as other voltages and currents. MINI-CATOR consists of replaceable lamp cartridge and mating lampholder. Lamp cartridge has nylon body for long-life ruggedness. Lampholder with built-in resistor for neon cartridges available.

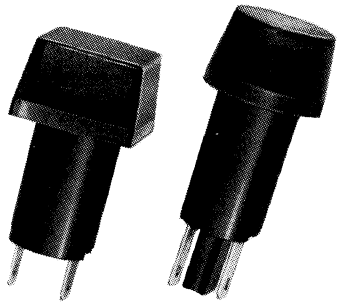
- Lens available in variety of colors, with or without imprints.
- Lampholders mount in 3/8" hole for space economy.
- Lamp cartridge may be mounted directly in 19/64" dia. hole with mounting clip and lamp connector.

INDUSTRIAL DEVICES, INC.
Edgewater 14, New Jersey
Phone: 201-943-4084

ELECTRO-MECHANICAL PRODUCTS

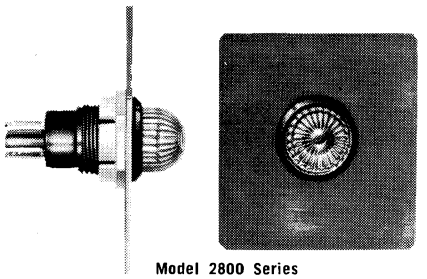
MINI-SLIDE

PILOT LIGHT ASSEMBLIES



Model 3040 Series Model 3060 Series

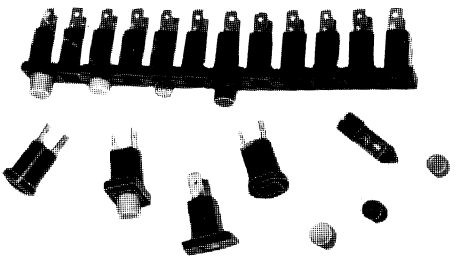
- Two lens shapes, round and square for either model series.
- Sockets for "Pilot" lamps including 120 volt lamp and "Indicator" lamps.



Model 2800 Series

- Screw-in design for easy relamping from front of pane.
- Unique torque-limiting, self-locking nylon mounting nut.

INDIVIDUAL SOCKETS
MULTI-SOCKET STRIPS • END CAPS



- Round and rectangular single sockets.
- Socket strips of 12 sockets on ½″ or ¾″ centers, individual or common ground.

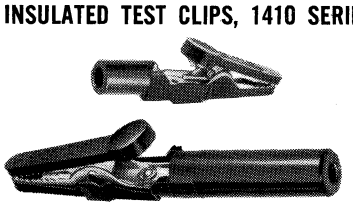
- Attractive on or off. Uniform brilliant light.
- Economical yet reliable and rugged.
- Lenses in a full range of colors.
- Easy to install with push-on speednut mounting, simple panel preparation. Keyed to prevent rotation.
- Lenses can be imprinted.
- Easy relamping from front of panel. No special tools needed.
- Lamps are extremely long-lived, rugged, reliable, available from 4 volts to 120 volts.
- U.L. approved (phenolic sockets) for 120 volts.
- Either solder or use quick-connect receptacles.

SHORT SLIDE-BASE LAMPS

A complete line of rugged, long-life miniature incandescent lamps is available to fit Industrial Devices individual and multi-socket strips. Several types are offered to cover a wide range of voltages up to 120 volts and ratings up to three watts. Lamps are available in two lengths; the shorter "Indicator" and the longer "Pilot" lamps.

safe-t-klip

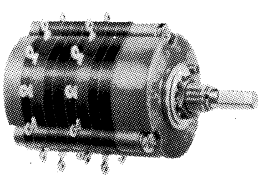
INSULATED TEST CLIPS, 1410 SERIES



- Provides protection from shocks or shorts.
- All surfaces protected with tough nylon.
- Six models for leads, test prods (2 types), banana plugs, and new Fused Safe-T-Klip.
- Protects in excess of 600 volts.
- Meets military requirements.
- Available in red and black.
- U.S. patent #2,754,490.

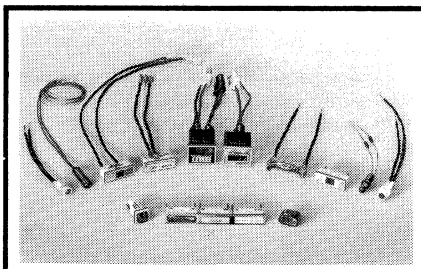
rotary instrument switch

Series 2000



- Extremely low contact resistance — Less than one milliohm.
- Extremely high insulation resistance — More than one million megohms.
- Totally Enclosed — Dust Tight
- Long Life — In Excess Of One Million Cycles.
- 12 Position, 1-6 Pole.
- External Adjustable Stops.

Series 2000 Rotary Instrument Switches are shorting types (make-before-break) which feature solid silver contacts, hardened beryllium copper detent spring, and nylon detents for smooth action. This exceptionally stable, long-lived rotary switch is available from one to six poles for a wide range of applications including precision bridges and decades, thermocouple switching, and laboratory test equipment.



specials . . . of every description

IDI specializes in designing or adapting pilot lights to particular specifications. Lights can be provided as complete assemblies to meet circuit design requirements — a capability that can drastically reduce cost by eliminating delicate assembly of resistors, capacitors or diodes. Whatever your requirement, special pilot light or pilot light assembly, IDI progressive manufacturing techniques and engineering capabilities will provide quick, economical service.

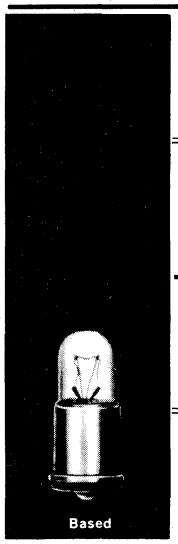
INDUSTRIAL DEVICES, INC.

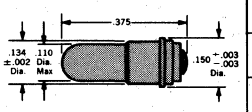
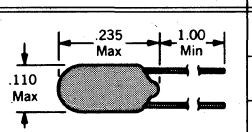
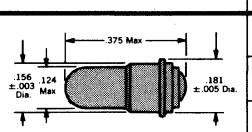
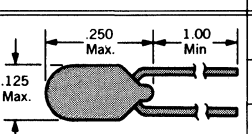
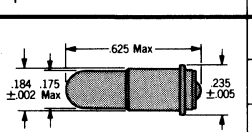
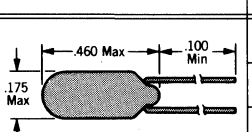
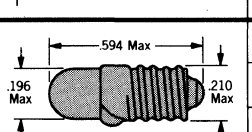
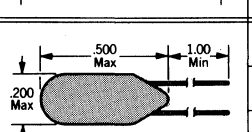
Edgewater 14, New Jersey Phone: 201-943-4084

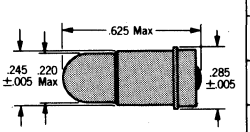
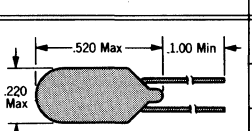
IEE Subminiature Incandescent Lamps

Handworkmanship insures accurate filament location and superior mechanical characteristics. • Handblown, seamless and tipless envelope provides unmatched clarity. • Machined bases for precision fit. • All lamps aged to stability and selected to insure long life and uniform brightness. • Cost savings as much as 40% below competitive manufacturers.

Orders for any one T-size lamp may be grouped for best price.



		Lamp No.	Volt	Amp	M.S.C.P.*	Average Life (Hrs.)	Price** (Each)	
T 7/8 LAMPS BASED		1	5	.115	.132	40,000	.44	A totally new lamp designed and developed by IEE. Now being widely accepted throughout the industry as a standard. This lamp offers all the features of a standard T1 lamp but requires much less space. Supplied in both standard types and commercial types for low cost applications.
		A3	14	.04	.132	16,000	.588	
		A5	12	.06	.132	16,000	.588	
T 7/8 LAMPS UNBASED		3	5	.115	.147	40,000	.35	
		AU3	14	.04	.147	16,000	.49	
		AU5	12	.06	.147	16,000	.49	
T 1 LAMPS BASED		685	5	.06	.048	100,000	.417	IEE offers price savings of up to 50% on T 1 lamps, and at the same time provides higher quality. This includes aging and selection as a standard at no increase in price. Aging and selection provide a lamp with much longer life and more uniform light.
		714	5	.075	.080	60,000	.417	
		718	5	.115	.132	40,000	.417	
T 1 LAMPS UNBASED		683	5	.06	.053	100,000	.287	
		713	5	.075	.088	60,000	.287	
		715	5	.115	.147	40,000	.287	
T 1-1/4 LAMPS BASED		632	28	.04	.34	5000	.308	IEE provides industry standards on T 1-1/4 lamps and also ages and selects them at no increase in price. Models are also offered with average life of 100,000 hours.
		646	14	.08	.50	2500	.308	
		628	6	.20	.63	3000	.277	
T 1-1/4 LAMPS UNBASED		627	28	.04	.36	5000	.183	
		640	14	.08	.53	2500	.183	
		634	6	.20	.66	3000	.160	
T 1-1/2 LAMPS BASED		317	14	.065	.400	500	.098	IEE T 1-1/2's are special lamps developed to meet the increasing demand for a quality lamp at a very low price for commercial applications.
		318	7	.065	.120	1000	.093	
		333	28	.040	.400	1000	.119	
T 1-1/2 LAMPS UNBASED		GU1	7	.065	.150	1000	.079	
		GU2	14	.065	.400	500	.091	
		GU3	28	.040	.400	1000	.105	

		Lamp No.	Volt	Amp	M.S.C.P.*	Average Life (Hrs.)	OEM† or 100,000 and over	
T 1-3/4 LAMPS BASED		327	28	.04	.34	5000	.178	Standard IEE T 1-3/4 lamp life rated at 3 to 5 times the industry standard. However, the lamps are priced considerably below the industry standard. IEE also ages and selects these lamps and does not increase the pricing for this service. The lamps are well stabilized and have a very uniform output of light.
		328	6	.20	.34 at 5V	3000	.160	
		330	14	.08	.50	2500	.178	
T 1-3/4 LAMPS UNBASED		2187	28	.04	.29	25,000	.154	
		1784	6	.20	.36 at 5V	3000	.120	
		1705	14	.08	.52	2500	.139	

†Any OEM user is entitled to purchase T 1-3/4 lamps from OEM price bracket regardless of quantity ordered.

*Mean spherical candle power. **Qty. price on 100,000 and over.

IEE Subminiature lamps are used exclusively in IEE Rear-Projection Readouts. See page 1189

Industrial Electronic Engineers, Inc., 7720 Lemona Ave., Van Nuys, California

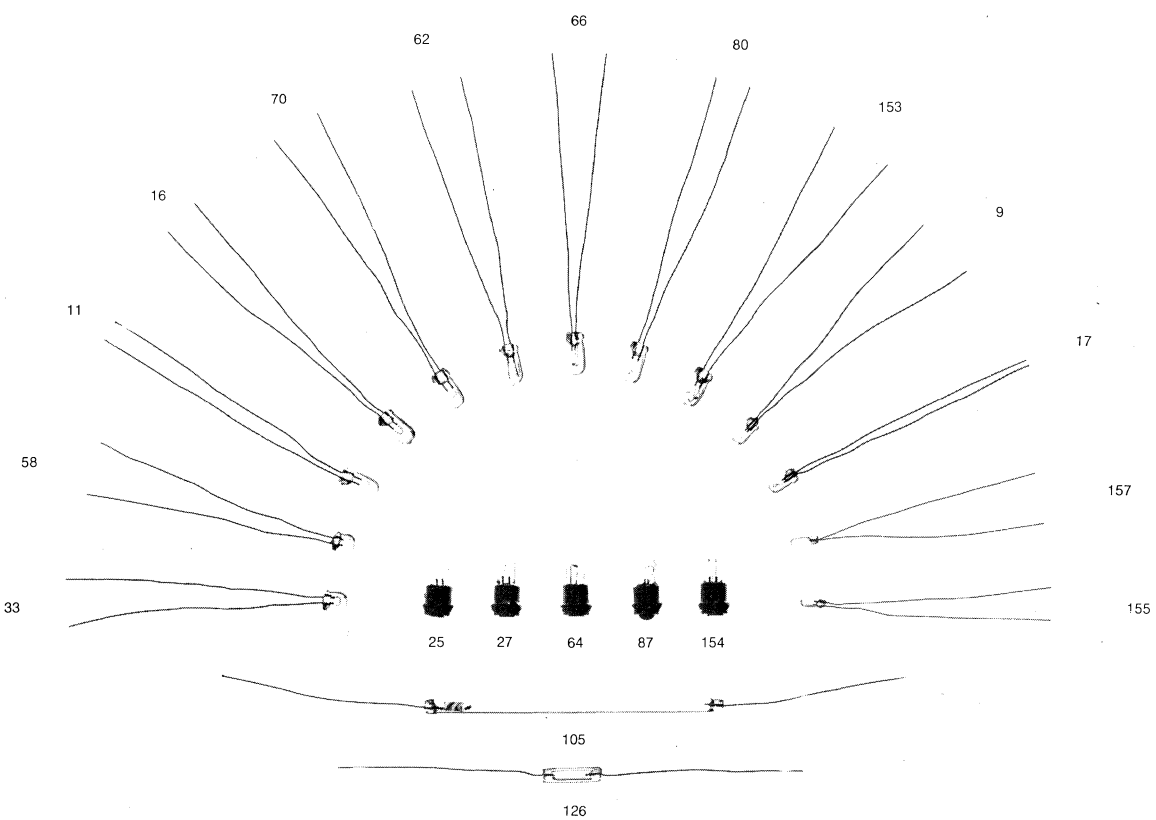
LAMPS, Inc. is the world's largest manufacturer of subminiature and microminiature lamps. And we got big because our specifying and quality control standards are higher than industry and military standards. Example: light output variations of ±15%, versus the conventional ±25%.

We'd like to tell you about all our LAMPS. But we just can't do that. You see, there are already about 1,000 design configurations of the 130 basic types of LAMPS. And, by the time you read this, we'll be producing LAMPS that just didn't exist—even as ideas—when EEM went to press.

Some of the most widely used LAMPS are described in the chart. They're only a sample. So, if you don't see what you want, ask for it. If we don't already stock it, we can probably make it. Call us collect or drop us a line. Right now. We'll be happy to send you a complete catalog, and to counsel with you about your particular LAMP requirement.

USASI NUMBER	MILITARY SPECIFICATION NUMBER	LAMPS, INC. NUMBER	DESCRIPTION**	DESIGN VOLTS	DESIGN AMPS ±10%	MSCP	AVERAGE LIFE (HOURS)
7152	MS90451-7152	33	T-1 RLU	5.0	.115	.15±15%	40,000
6832	MS90451-6832	58	T-1 RLU	5.0	.060	.05±15%	100,000
683	24367-683 AS15	11	T-1 UFU	5.0	.060	.05±15%	100,000
715	24367-715 AS15	16	T-1 UFU	5.0	.115	.15±15%	40,000
7214	NA	70	T-1 UFU	5.0	.115	.22±15%	5,000
685	24515-685 AS15	25	T-1 UFB	5.0	.060	.05±15%	100,000
718	24515-718 AS15	27	T-1 UFB	5.0	.115	.15±15%	40,000
6838	NA	62	T-1 SFU	28.0	.024	.15±25%	16,000
7219	NA	66	T-1 SFU	12.0	.060	.15±25%	16,000
7204	NA	80	T-1 SFU	3.0	.008 ±.0015	.01 NOM	16,000
7222	NA	153*	T-1 SFU	28.0	.024	.15±25%	16,000
6839	MS3338-6839 AS25	64	T-1 SFB	28.0	.024	.13±25%	16,000
7228	NA	87	T-1 SFB	3.0	.008 ±.0015	.01 NOM	16,000
7243	NA	154*	T-1 SFB	28.0	.024	.13±25%	16,000
6833	MS90452-6833	9	T-¾ UFU	5.0	.060	.05±15%	100,000
7153	MS90452-7153	17	T-¾ UFU	5.0	.115	.15±15%	40,000
7097	NA	157	T-½ UFU	5.0	0.020	0.034 NOM	5,000
7091	NA	155	T-⅜ UFU	1.5	0.051	0.02 ±15%	5,000
7104	NA	105	LF	6.0	0.12		25,000
6835	NA	126	AL	5.0	0.060	0.05 ±25%	100,000

*High Reliability 3-support Filament
**RLU = reduced length unbased; UFU = unsupported filament unbased; UFB = unsupported filament based; SFU = supported filament unbased; SFB = supported filament based; LF = line filament; AL = axial lead.

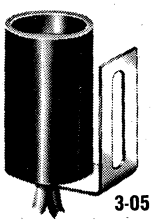


LAMPS INCORPORATED

17000 South Western Avenue, Gardena, California 90247 (213) 323-7578

MINIATURE BAYONET

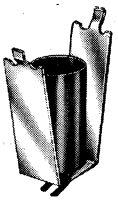
3-00 SERIES



3-05

TYPICAL MOUNTING

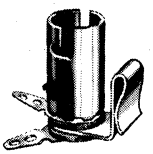
2-00 SERIES



2-15

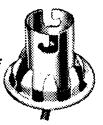
TYPICAL MOUNTING

7-00 SERIES



7-01

2-00-1 SERIES* 2-40-1



*Sockets can be supplied with one lead or one terminal for use in grounded circuits.

Example: To specify grounded socket 7-01 becomes 7-01-1, 2-15 becomes 2-15-1, etc.

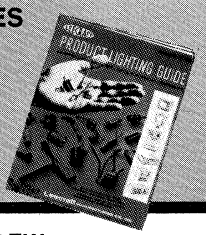
LEECRAFT®

LAMPHOLDERS

PILOT LIGHT SOCKETS

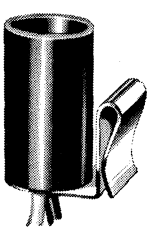
SPECIAL ASSEMBLIES

- WRITE FOR PRODUCT LIGHTING GUIDE
- PROTOTYPE SAMPLES available on request



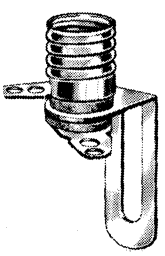
CANDELABRA SCREW

4-00 SERIES



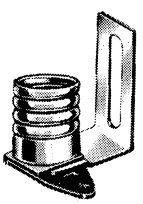
4-45

6-00 SERIES



6-06

18-00 SERIES

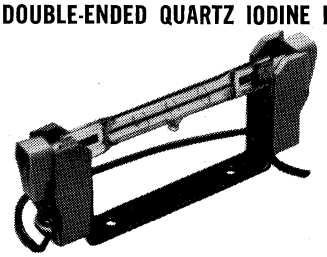


18-79



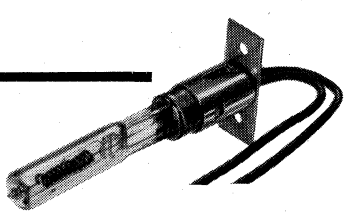
S-6
7C7-120V
10C7-120V

LAMPHOLDERS FOR SINGLE-ENDED and DOUBLE-ENDED QUARTZ IODINE LAMPS



Recessed Single Contact • 2600 Series

Complete assembly — two holders mounted on common bracket, or separate sockets. Brackets in all lengths.



Double Contact • 2200 Series

Positions lamp more accurately, prevents shaking loose from vibration.

MIDGET SCREW

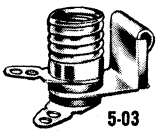
16-00 SERIES SOLDER, TERM.
•
16-200 SERIES WIRE LEADS



16-08

MINIATURE SCREW

5-00 SERIES SOLDER TERMINALS or WIRE LEADS



5-03

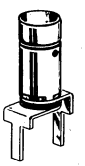
MIDGET GROOVED

25-200 SERIES WIRE LEADS

25-00 SERIES SOLDERING TERMINALS

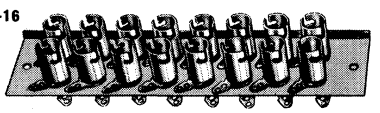
Used in data processing and automation fields with **Lens-End Lamp** Nos. **253, 253X,** and **261.**

Send for Data Sheet No. 25A.



25-35

No. 7M-16

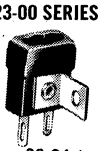


MULTIPLE ASSEMBLIES

Can be made to your specifications.

WEDGE BASE

23-00 SERIES



23-24

23-200 SERIES



23-223

24-00 SERIES



24-07A



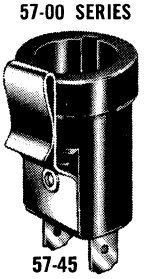
#159—6V
#161—12V
#158—12V
#259—6.3V

23-00 SERIES — Molded housing, terminal.
23-200 SERIES — Molded housing with wire leads.
24-00 SERIES — Wafer type terminals.

CANDELABRA BAYONET

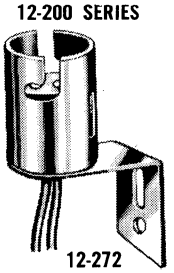
DOUBLE CONTACT

57-00 SERIES



57-45

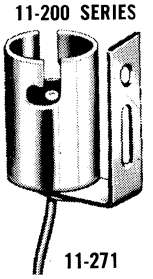
12-200 SERIES



12-272

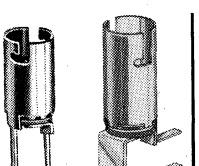
SINGLE CONTACT

11-200 SERIES



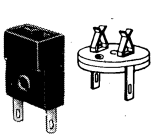
11-271

PRINTED CIRCUIT LAMPHOLDERS



BAYONET
7-35 7-35XP11

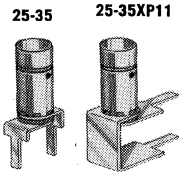
WEDGE BASE



23-07 24-07A

SUBMINIATURE. MIDGET-GROOVED BASE

25-35 25-35XP11



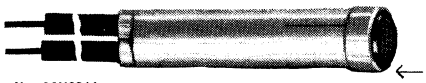
Terminals permit fast, easy soldering, especially wave soldering. Wire leads, solder-type or quick-connect.

LEECRAFT®
Leecraft MANUFACTURING CO., INC.
21-16 44th Road, Long Island City, N.Y. 11101 • (212) EXeter 2-8800 • TELEX 12-6977

INDICATOR LIGHTS
NEON AND INCANDESCENT AND SPECIAL ASSEMBLIES

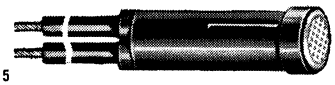
TINEON INDICATOR LIGHTS

Long Life, High Brightness Lamps — Press fit into 5/16" hole — For neon types rated 110-250V — Nylon housing in colors (white standard) — Speed nut furnished — Plastic lens in colors — Legends — Built-in Resistor — Insulated Leads.
All Tineons are available with Incandescent Lamp.



3600 Series (with built-in resistor) Available in 3 flange dimensions

No. 36N2311



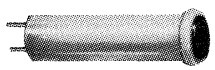
4100 Series (with neon less resistor or incandescent)

No. 41N1315



TINEONS
45 Series (Blade Terminals)

No. 45R2111T8



46 Series (Pin Type Terminals)

No. 46N2311

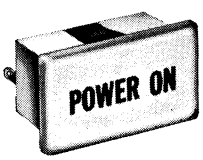
WITH ALUMINUM BEZEL
All Tineons may be furnished with aluminum bezel. Please specify when ordering.



No. 36EN2111 (Hi-Hat red lens) With aluminum bezel

RECTANGULAR INDICATOR LIGHTS

Long Life High Brightness Neon Lamps — Snap into panel securely without additional hardware — Choice of lens colors — Series 3100 has chrome bezel and plastic lens — Series 47 has one-piece plastic lens and body — Complete range of voltages — UL and CSA listed.



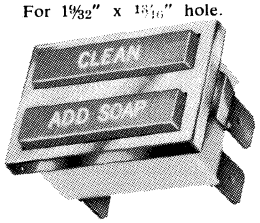
No. 47-3T (legend to specification)
For 1 3/16" x 5/8" hole

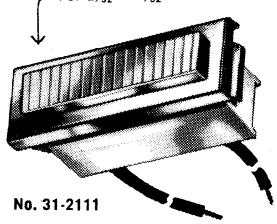
Barrier separates light into two separate message areas. Individual or simultaneous operation.



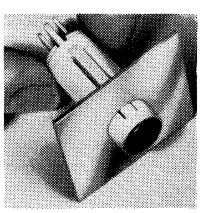
No. 31D-ORN
Dual Message Lights
For 1 9/32" x 13/32" hole

DUAL BEZEL
No. 31-ML2
For 1 9/32" x 1 3/16" hole.

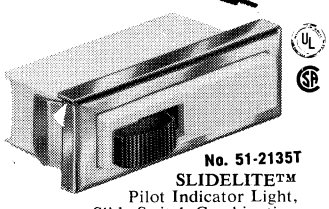




No. 31-2111



2900 Series
REAR - ASSEMBLY, SNAP - IN LIGHTS Neon or incandescent. All voltages. Snap in from rear, lock firmly. Simpler, swifter assembly. Eliminate threading leads as in front-of-panel lights. No additional hardware. Mtg. hole .510-.520".

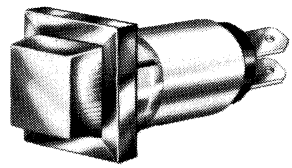


No. 51-2135T
SLIDELITE™
Pilot Indicator Light, Slide-Switch Combination
Ultra-compact. Simple snap-in installation. Wide voltage range, choice of lights. May be message stamped. Lens colors: red, amber, clear, white, blue, green, others on request. Leads or terminals. 1 25/64"x 15/32"x 23/32". Rating: 125 V. 6 Amps.

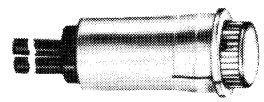
SNAPLITE INDICATOR LIGHTS

With long-life lamps, high brightness types. Built-in resistors — when neon lamps — to suit applied circuit voltage, provide required lamp life, eliminating replacement need. Features: Snap into place in 1/2" hole with no additional hardware. Wide variety of lens and housing colors. Tab or solder terminals; or wire leads. AVAILABLE WITH CHROME RINGS. To specify Chrome Rings add R after 1st 2 Digits, i.e., 32-2111 becomes 32R2111.

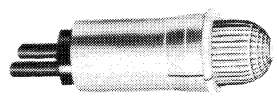
SQUARE LENS
32R2911T 7/32" high



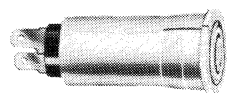
FLAT CYLINDRICAL LENS
32-2111 3/16" high



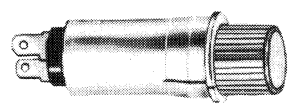
STOVE PIPE LENS
32-2211 13/32" high



FLUSH LENS
32-2311T 1/32" high



HI-HAT LENS
32-2511T 5/16" high



NOTE: Total height above panel equal to lens height plus 1/16" flange thickness. 5/32" flange thickness for Square Lens.

HOW TO ORDER LEECRAFT INDICATORS WITH INCANDESCENT LAMPS

Incandescent lamps to meet low voltage characteristics may be supplied in place of neon lamps with all indicators illustrated on this page. To specify incandescent in place of neon lamps insert lamp code after series number. Some of more popular voltages are listed.

CURRENT (Milliamperes)	VOLTAGE (Volts)	CODE LAMP
200	6	G1
40	6	G2
14	10	G6
80	14	G3
40	28	G5

EXAMPLE: 41N2313 with 14 Volt 80 Mil. LAMP becomes 41N-G3-2313.
32-2111 with 6 volt 200 Mil. LAMP becomes 32-G1-2111

Leecraft Series	Volts	Terminations
3200	110-125	Insulated wire leads
3500	210-250	Insulated wire leads
3200T	110-125	.187 tab terminals
3500T	210-250	.187 tab terminals

1/3W, 125V
1/3W, 250V

CATALOG NUMBERS • 3200 SERIES WIRE LEADS*

Lens Color	Cylindrical Lens	Flush Lens	Stove Pipe Lens
Red	32-2111	32-2311	32-2211
Amber	32-2113	32-2313	32-2213
Clear	32-2117	32-2317	32-2217
White (Translucent)	32-2115	32-2315	32-2215

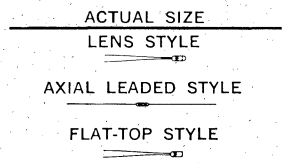
To specify Square Lens, use 32R291 plus 1, 3, 7 or 5 for lens color. Example: With red lens—32R2911. To specify Hi-Hat Lens, use 32-251 plus 1, 3, 7 or 5. Example: With clear lens—32-2517.

* To specify TAB TERMINALS in place of WIRE LEADS, add "T" after number, i.e., 32-2111 becomes 32-2111T.

WRITE FOR PRODUCT LIGHTING GUIDE. PROTOTYPE SAMPLES AVAILABLE ON REQUEST.

Leecraft MANUFACTURING CO., INC.
21-16 44th Road, Long Island City, N.Y. 11101 • (212) EXeter 2-8800 • TELEX #12-6977

Pinlite® / WORLD'S SMALLEST INCANDESCENT LAMPS AND MICROMINIATURE ASSEMBLIES



The microminiature Pinlite® lamp is made possible through a unique manufacturing method developed by Pinlites Inc. Although the smallest standard size lamp is only .016" in diameter, smaller sizes are produced on special order. Pinlites Inc., with its vast experience and technical know-how in the production and design of microminiature components, also offers an additional service . . . the designing of micromodules and microminiature assemblies to meet specific customer requirements. Pinlites comply with Mil Spec 5422-E and can withstand shock and vibration in excess of 50 G's.

Use Pinlites when speed of response, small size, and low power are important!

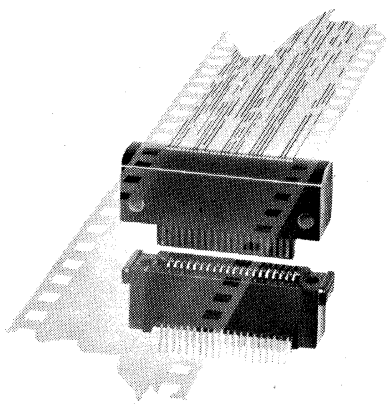
PINLITE® FEATURES

- Lowest Power Consumption
- Lowest Series "L" & Shunt "C"
- IR and UV Emission
- Smallest Size
- Fastest Response (Audio Range)
- Vibration & Shock Resistant
- Built-in Lens Concentrates Light Beam Up to 10X Normal Intensity
- Three Styles for Greater Versatility; lens, axial leaded, flat-top

PINLITE® APPLICATIONS

- Transistor Indicators
- Microwave Noise Sources
- Modulated Light Source
- Microwave Bolometers
- Optical Point Sources
- Medical & Industrial Light Probes
- Remote Electronic Attenuators
- Read Out Devices
- Pointer & Meter Scale Illuminators
- Photometric Instrumentation
- Light Actuated Switches
- Telemetry
- Indicator Lamps (colored Pinlites)

MULTI-TRACK HEADS . . . compact coding devices with up to 40 individually controlled light sources per inch

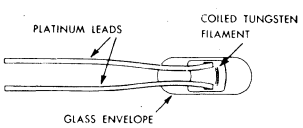


Coding devices by Pinlites Inc. are the only available microminiature light sources that mate with commercially available photo sensing heads. A number of sizes are being offered as standard models to be used in conjunction with perforated tapes, photo sensitive film or other optical sensing devices to provide a convenient means of relating time sequences and/or controlling intermittent on-off applications. By stacking these units a dense matrix can be obtained of up to 400 individually controlled light sources per square inch. For technical data on standard models, information and prices on non-standard models, write for our 1969 catalog.

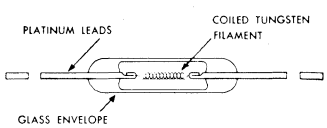
Shown here are 32-lamp, Multi-Track Heads with printed circuit board connector, top, and integral cabling. Top photo illustrates use with photo sensitive film.

SPECIFICATIONS FOR STANDARD PINLITE LAMPS

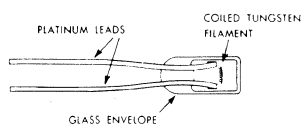
LENS STYLE



AXIAL LEADED STYLE



FLAT-TOP STYLE



Style	AXIAL LEADED					LENS				
Type	10-10	13-7	15-15	15-45	30-30	L12-3	L12-6	L12-12	L15-30	L15-45
Operating Voltage ..... (Volts)	1.0	1.35	1.5	1.5	3	1.25	1.25	1.25	1.5	1.5
Operating Current ..... (Milliamps)	10	6.00	15	45	30	3	6	12	30	45
Diameter ..... (Inches)	.016	.016	.016	.030	.030	.030	.030	.030	.030	.030
Length ..... (Inches)	.070	.070	.070	.125	.125	.080	.080	.080	.080	.080
Cold Resistance ..... (Ohms)	16	38	13.5	4	11	86	35	16	5.5	4
Hot Resistance ..... (Ohms)	100	215	100	33	100	400	200	100	50	33
Pulse Response* .... (Milliseconds)	4	4	5	10	7	3	4	5	7	10
Total Light Output .... (Millilumens)	25	20	60	220	250	5	15	50	160	220
Life Expectancy ..... (Hours)	750	500	800	1000	1000	500	750	1000	1000	1000
Lead Diameter ..... (Mils)	3	3	3	5	5	4	4	4	4	4
Lead Length ..... (Inches)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Lead Material	..... Platinum					..... Platinum				
Filament Material	..... Tungsten					..... Tungsten				
* To ½ Brightness.										
PRICES* Sample Quantity (1-9)	5.50	7.95	5.00	4.40	4.40	5.50	10.00	6.00	5.50	5.50	5.50
Qty. Prices (5000 - up)	2.80	4.50	2.50	2.00	2.00	2.75	5.25	2.25	1.95	1.95	1.95

FLAT TOP

All specifications for the flat-top lamps are the same as lens style lamps. When ordering, simply prefix numbers at left in "TYPE" column with "F" in place of "L" (e.g.—L12-3 becomes F12-3).

DUAL FILAMENT

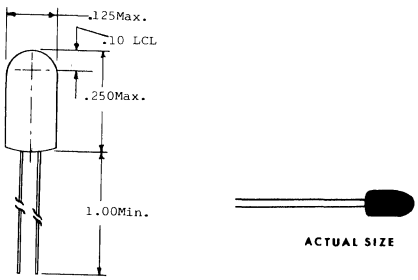
Same rigid characteristics apply as with other Pinlites plus the redundant feature for fail-safe operation. Write or call for details.

* f.o.b. Shipping Point. Prices subject to change without notice. DELIVERY — Most quantities from stock.

SEE OTHER LISTING FOR PINLITES' MINIATURE READOUT DEVICES AND ENCODERS

Pinlites Inc. 1275 BLOOMFIELD AVE., FAIRFIELD, N. J. 07006 • (201) 226-7724

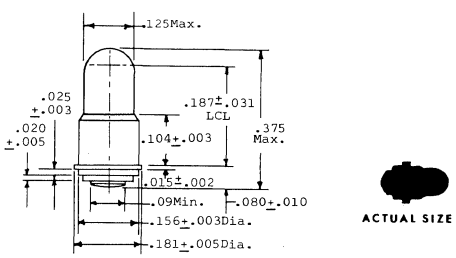
MINIATURE INCANDESCENT Lamps



Lamp No.	Military Std. No.
D11	24367-683-AS15
D32	24367-680-AS15
D16	24367-715-AS15

T-1 UNBASED LAMPS

PL NO.	INDUSTRY NO.	DESIGN		CANDLE POWER M. S. C. P.	RATED AVG. LAB LIFE (HOURS)
		VOLTAGE	AMPS		
1015		1.5	.015	.015 NOM.	5M
1025		2.5	.125	.050±15%	10M
103		3	.008	.010±15%	16M
105		5	.015	.02 NOM.	5M
D10		5	.060	.050±25%	100M
D11	683	5	.060	.050±15%	100M
D31		5	.060	.050±25%	100M
D32	680	5	.060	.030±15%	100M
D58	(.125" x .145")	5	.060	.050±15%	100M
D15		5	.115	.150±25%	40M
D16	715	5	.115	.150±15%	40M
D20		5	.115	.200±25%	5M
D39		5	.115	.187±25%	10M
107		7	.010	.015 NOM.	INFINITE
110		10	.027	.080±25%	10M
112		12	.060	.130±25%	16M
115		15	.015	.015 NOM.	INFINITE
118		18	.026	.100±25%	16M
124		24	.025	.130±25%	25M
128		28	.029	.190±25%	16M
132		32	.030	.200±25%	5M



Lamp No.	Military Std. No.
D25	24515-685-AS15
D29	24515-682-AS15
D27	24515-718-AS15

T-1 BASED LAMPS

PL NO.	INDUSTRY NO.	DESIGN		CANDLE POWER M. S. C. P.	RATED AVG. LAB LIFE (HOURS)
		VOLTAGE	AMPS		
1016		1.5	.015	.015 NOM.	5M
1026		2.5	.125	.050±15%	10M
104		3	.008	.010±15%	16M
106		5	.015	.02 NOM.	5M
D12		5	.060	.050±25%	100M
D25	685	5	.060	.050±15%	100M
D34		5	.060	.050±25%	100M
D29	682	5	.060	.030±15%	100M
D17		5	.115	.150±25%	40M
D27	718	5	.115	.150±15%	40M
D28		5	.115	.200±25%	5M
D44		5	.115	.187±25%	10M
108		7	.010	.015 NOM.	INFINITE
111		10	.027	.080±25%	10M
113		12	.060	.130±25%	16M
116		15	.015	.015 NOM.	INFINITE
119		18	.026	.100±25%	16M
125		24	.025	.130±25%	25M
129		28	.029	.190±25%	16M
133		32	.030	.200±25%	5M

The PL Lamps described represent a few of the more popular PL types. Inquiries are invited regarding those not included in this list, as well as lamps to be designed at a minimum cost for a new or special application.

PL

• • • • •

Precision Lamp Engineers

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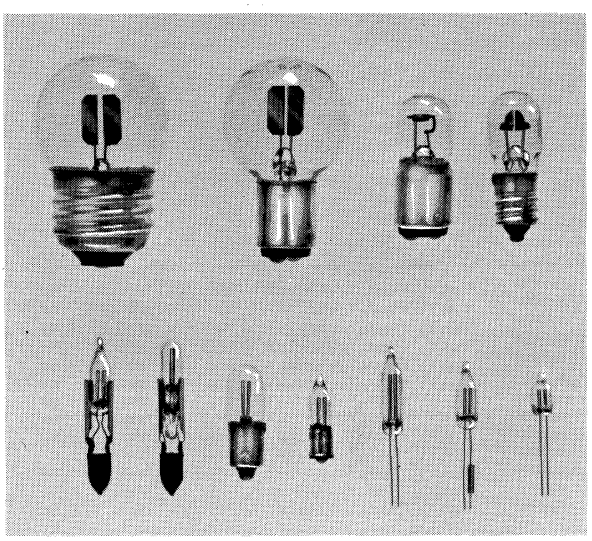

If there is a Gas Discharge Device or Glow Lamp to meet your needs,



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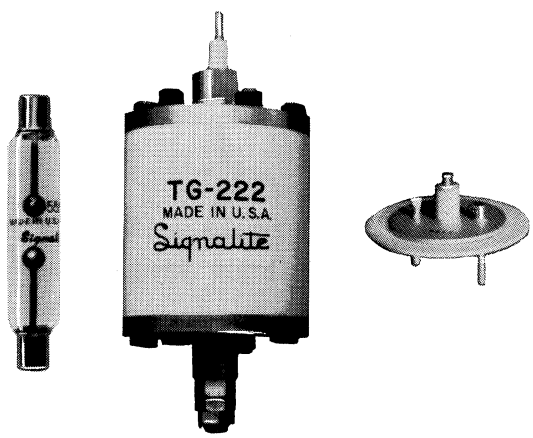
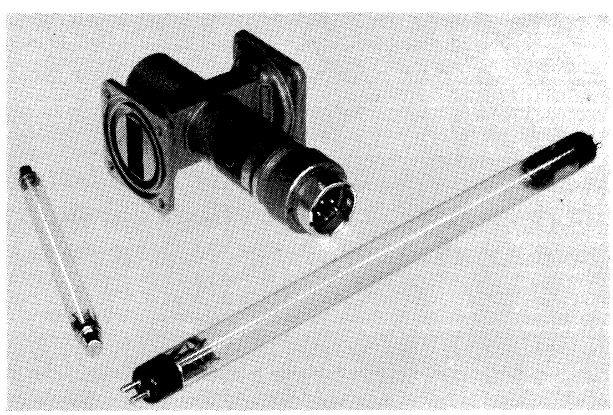




Signalite "300" Spark Gap Brochure . . . fully details the complete Signalite line of over 300 types of two-electrode spark gaps and triggered spark gaps, includes application notes, characteristics, mounting arrangements, photographs, etc.

NOISE SOURCES AND MINIATURE NOISE GENERATORS

Signalite is the largest source in the world for your noise source and noise generator requirements. With the addition of the TUCOR (ESCO) line, Signalite now offers over 200 different types for use in noise figure test equipment and for monitoring system receiver sensitivities, from UHF to 90 GHz.





Signalite "200" Noise Source Brochure . . . provides a complete dissertation on over 200 types of microwave noise sources and miniature generators available, including fundamental noise measurement discussions, typical applications, detailed characteristics, etc.

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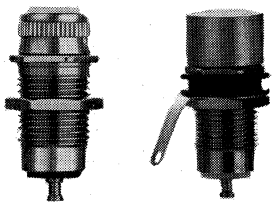
SLOAN

INDICATOR LIGHTS



855S Std. Lens Shown

855SI DS Lens Shown

855

For use with T-1¾ based lamps

- Front removable

855S Single terminal, mounts in ⅜" dia. hole

855SI Insulated for two terminal applications, mounts in 27/64" dia. hole.

Coding collars at rear of body in E I A colors to simplify wiring

HOW TO ORDER
(Example)

855SI - R - 2 - M

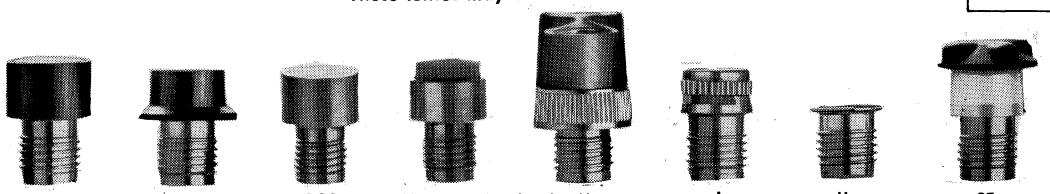
BODY TYPE

LENS COLOR
Gen'l Purpose Lens Material (translucent)*
R—Red
W—White
B—Blue
G—Green
A—Amber
C—Clear*

CODING COLLAR
0—Black
1—Brown
2—Red
3—Orange
4—Yellow
5—Green
6—Blue
7—Violet
8—Gray
9—White

LENS STYLE

These lenses may be used with both 855S and 855SI body styles.



DS Black Anodized Bezel

D

DSC Aluminum Anodized Bezel

Q—Aluminum Anodized Bezel
QB—Black Anodized Bezel

M

I

U

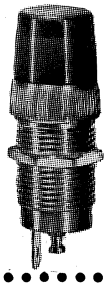
SE

Special (G.E. Lexan) Lens Materials (NO INCREASE IN PRICE)

(Transparent)	(Translucent)
RL—Red	RLUC—Red
BL—Blue	WLUC—White
GL—Green	BLUC—Blue
AL—Amber	GLUC—Green
CL—Clear	ALUC—Amber

*M-Lens available in Clear.

All M-Lens color transparent



856S

For use with T-1¾ based lamps

- Front removable

Two terminal, mounts in 7/16" dia. hole

HOW TO ORDER *(Example)*

856S - R - M

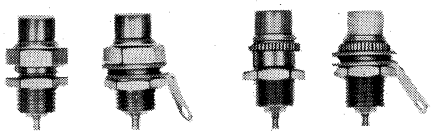
MODEL

LENS COLOR
R—Red
W—White
B—Blue
G—Green*
A—Amber
C—Clear

LENS STYLE
M—Bright nickel metal trim
MB—Black metal trim

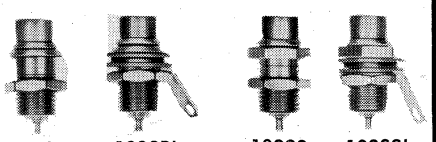
*Not recommended for use with neon.

STANDARD



102S 102SI Hex Flange

102SK 102SKI Knurled Flange



102SR 102SRI Round Flange

102SS 102SSI Short Hex Flange



DS & DSC

Q & QB

102

For use with T-1 based lamps

- Front removable

102S 102SK 102SR 102SS
Single terminal, mount in ¼" dia. hole

102SI 102SKI 102SRI 102SSI
Insulated for two terminal applications, mount in 5/16" dia. hole

HOW TO ORDER
(Example)

102SR - W - DS

BODY TYPE

LENS COLOR

Gen'l Purpose Lens Material (translucent)
R—Red
W—White
B—Blue
G—Green
A—Amber

Special (G.E. Lexan) Lens Materials (NO INCREASE IN PRICE)

(Transparent)	(Translucent)
RL—Red	RLUC—Red
BL—Blue	WLUC—White
GL—Green	BLUC—Blue
AL—Amber	GLUC—Green
CL—Clear	ALUC—Amber

LENS STYLE
STD—Standard
DS—Black Anodized Bezel
DSC—Aluminum Anodized Bezel
Q—Aluminum Anodized Bezel
QB—Black Anodized Bezel

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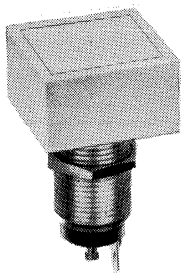
See YELLOW SECTION for Local Offices, Phones

SLOAN

INDICATOR LIGHTS



Patent Number 3,300,638

301 *Contempo*

For use with T-1¾ based lamps.

- Front removable.

Push to install—pull to remove.

Two terminal mounts in 7/16" dia. *ROUND* hole.

Any number can be mounted touching side by side.

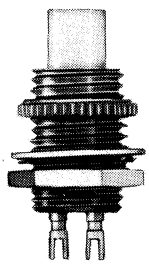
HOW TO ORDER

(Example)

301 - A

MODEL — LENS COLOR (Bezel is opaque soft white)

R—Red
W—White
B—Blue
G—Green
A—Amber



106S

T-1 incandescent lamp built-in.
Mounts in 5/16" dia. hole.

T-1 LAMP SPECIFICATIONS

Sloan	Volts	Hours Life	MSCP	Amps
F1	5.0	200,000	.03	.060
F2	5.0	100,000	.05	.060
F9	5.0	10,000	.05	.060
F11	5.0	100,000	.03	.060
F12	5.0	100,000	.05	.060
F15	5.0	100,000	.09	.075
F19	5.0	50,000	.15	.115
F38	28.0	10,000	.20	.030
F44	18.0	10,000	.15	.026
F45	12.0	10,000	.15	.060
F46	10.0	10,000	.10	.027
F47	14.0	10,000	.15	.065
F56	5.0	100,000	.03	.060
F57	5.0	60,000	.09	.075
F58	5.0	40,000	.15	.115

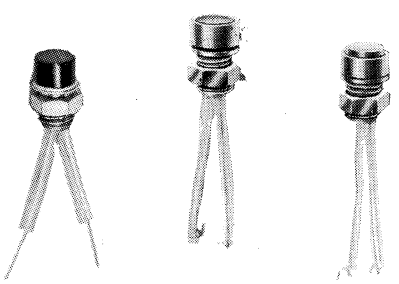
HOW TO ORDER

(Example)

106S - B - F38

MODEL — LENS COLOR — SLOAN LAMP NO.

Gen'l Purpose Lens Material (translucent)	Special (G.E. Lexan) Lens Materials (NO INCREASE IN PRICE) (Transparent)	(Translucent)
R—Red	RL—Red	RLUC—Red
W—White	BL—Blue	WLUC—White
B—Blue	GL—Green	BLUC—Blue
G—Green	AL—Amber	GLUC—Green
A—Amber	CL—Clear	ALUC—Amber



STANDARD — DS & DSC — Q & QB

105S

T-1 incandescent lamp built-in.
Mounts in 13/64" dia. hole.

T-1 LAMP SPECIFICATIONS

Sloan	Volts	Hours Life	MSCP	Amps
F1	5.0	200,000	.03	.060
F2	5.0	100,000	.05	.060
F9	5.0	10,000	.05	.060
F11	5.0	100,000	.03	.060
F12	5.0	100,000	.05	.060
F15	5.0	100,000	.09	.075
F19	5.0	50,000	.15	.115
F38	28.0	10,000	.20	.030
F44	18.0	10,000	.15	.026
F45	12.0	10,000	.15	.060
F46	10.0	10,000	.10	.027
F47	14.0	10,000	.15	.065
F56	5.0	100,000	.03	.060
F57	5.0	60,000	.09	.075
F58	5.0	40,000	.15	.115

HOW TO ORDER

(Example)

105S - B - Q - F38

MODEL — LENS COLOR — SLOAN LAMP NO.

Gen'l Purpose Lens Material (translucent)	Special (G.E. Lexan) Lens Materials (NO INCREASE IN PRICE) (Transparent)	(Translucent)
R—Red	RL—Red	RLUC—Red
W—White	BL—Blue	WLUC—White
B—Blue	GL—Green	BLUC—Blue
G—Green	AL—Amber	GLUC—Green
A—Amber	CL—Clear	ALUC—Amber

LENS STYLE
STD—Standard
DS—Black Anodized Bezel
DSC—Aluminum Anodized Bezel
Q—Aluminum Anodized Bezel
QB—Black Anodized Bezel

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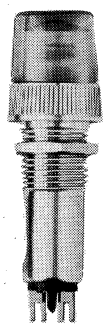
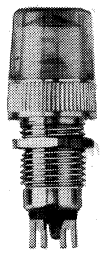
INDICATOR LIGHTS



WITH RESISTOR



WITHOUT RESISTOR

857

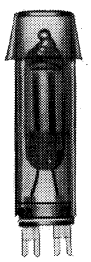
Neon or incandescent lamps built in, with or without resistor.
Mounts in 3/8" dia. hole.

HOW TO ORDER
(Example)

857 - R - NE-2H- 22K

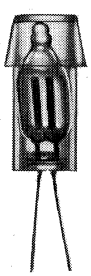
- 857 — MODEL
- R — LENS COLOR
- NE-2H — LAMP
- 22K — RESISTOR WHEN REQUIRED

R—Red
W—White
B—Blue
G—Green
A—Amber
C—Clear
} Incandescent only



858

Long-lamp T-2 neons, T-1¾ and T-1 incandescent lamps built in. Also short bulb neons with resistor.
Mounts in 5/16" dia hole with Tinnerman nut.
See Model 105 for T-1 lamp specifications.



859

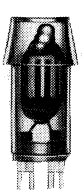
Long or short-lamp neons with or without resistor attached, T-1¾ incandescent (availab!e).
Mounts in 5/16" dia. hole with Tinnerman nut.

HOW TO ORDER
(Example)

858 - C - A1C - 68K

- 858 — MODEL
- C — COLOR
- A1C — LAMP
- 68K — RESISTOR WHEN APPLICABLE

R—Red
W—White
B—Blue
G—Green
A—Amber
C—Clear
} Incandescent only



862

Short-lamp neons, T-1¾ and T-1 incandescent lamps built-in.
Mounts in 5/16" dia. hole with Tinnerman nut.
See Model 105 for T-1 lamp specifications.

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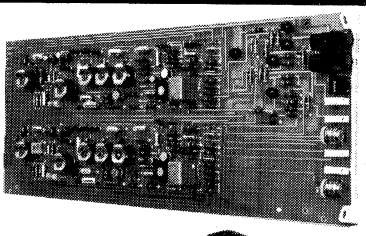
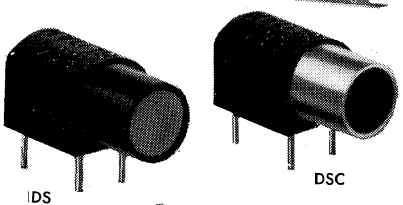
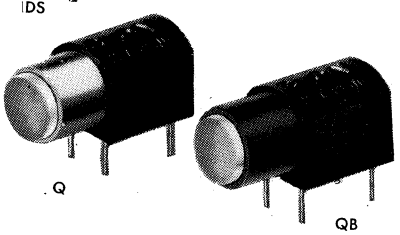




DS DSC



Q QB

Patents Pending

864 Pee Cee

HOW TO ORDER

(Example)

864 - RTP - Q - 8 - N

MODEL	LENS COLOR	LENS STYLE	DIA.	NEON
	RL — Red Transparent RLUC — Red Translucent WLUC — White Translucent *BL — Blue Transparent *BLUC — Blue Translucent *GL — Green Transparent *GLUC — Green Translucent AL — Amber Transparent ALUC — Amber Translucent CL — Clear Transparent	DS—Black Anodized Bezel DSC—Aluminum Anodized Bezel Q—Aluminum Anodized Bezel QB—Black Anodized Bezel	8-8/16 7-7/16	

**Not recommended for use with neon.*

Description

Right angle, printed circuit board mounted, indicator light.

Lamp Accommodation

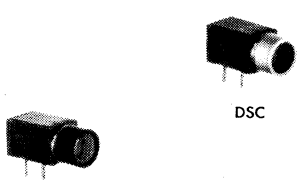
T-1¾ midget flanged base incandescent. Special lens available for NE-2D or NE-2J neon lamps.

Mechanical

LAMPHOLDER BODY: Black general purpose phenolic.

LENS ASSEMBLY: Anodized aluminum bezel with plastic lens. (Twist lock attachment of lens assembly to lampholder body.)

MOUNTING: Lampholder is mounted by inserting the terminals directly into printed circuit board and flow soldering. Can be mounted on ½" centers.



DSC DS



Q QB

Patents Pending

101 Pee Cee

HOW TO ORDER

(Example)

101 - RTP - Q

MODEL	LENS COLOR	LENS STYLE
	RL — Red Transparent RLUC — Red Translucent WLUC — White Translucent *BL — Blue Transparent *BLUC — Blue Translucent *GL — Green Transparent *GLUC — Green Translucent AL — Amber Transparent ALUC — Amber Translucent CL — Clear Transparent	DS—Black Anodized Bezel DSC—Aluminum Anodized Bezel Q—Aluminum Anodized Bezel QB—Black Anodized Bezel

**Not recommended for use with neon.*

Description

Right angle, printed circuit board mounted, indicator light.

Lamp Accommodation

T-1 midget flanged base incandescent.

Mechanical

LAMPHOLDER BODY: Black general purpose phenolic.

LENS ASSEMBLY: Anodized aluminum bezel with plastic lens. (Twist lock attachment of lens assembly to lampholder body.)

MOUNTING: Lampholder is mounted by inserting the terminals directly into printed circuit board and flow soldering. Can be mounted on ¼" centers.

GENERAL COMMENTS (Models 864 and 101)

The Sloan Company "Pee Cee" replaceable lamp indicator light is designed specifically for printed circuit board mounting. This unit is mounted by inserting the terminals directly into the board and flow soldering directly into the circuit; two pins provide circuit contacts. Lamps are replaceable from the front by removing the lens. The "Pee Cee" series helps prepare the way for new packaging concepts:

- Permits elimination of front panel.
- Substantial contribution of soldered assemblies to production economy; can be automated.
- One central circuit board for indicator lights. (Mother Board)

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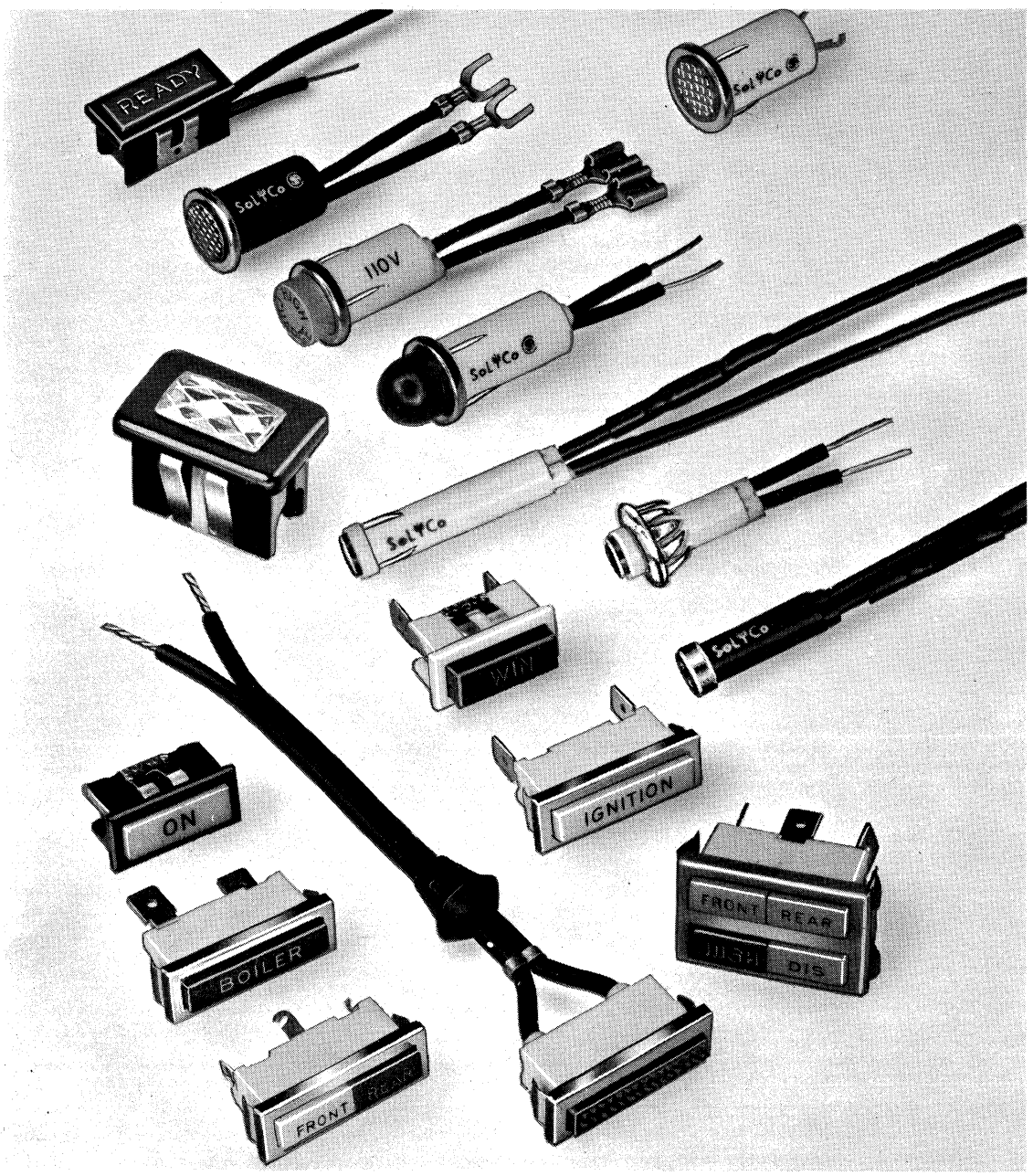

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- Neon and incandescent lamps.
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- Rectangular and round lights snap into panel.
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- Variety of terminals.
- Recognized under the component program of Underwriters Laboratories, Inc., and CSA approved.

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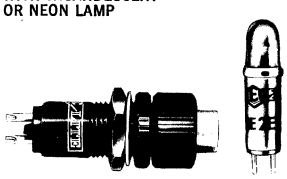
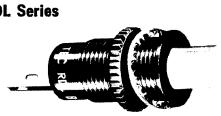
REPLACEABLE CARTRIDGE LITE
WITH INCANDESCENT OR NEON LAMP



RCL, RCLH Series

Replaceable Cartridge Lites feature neon or incandescent lamps, four lens styles and ten lens colors. Individually mountable, or, ideally, mounted in the RCLH Series Cartridge Lite Holder that permits fast, simple cartridge replacement.

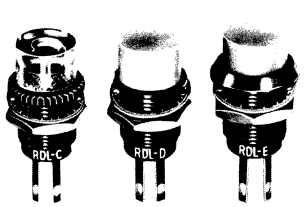
REPLACEABLE LAMP DISPLAY LITE
RDL Series



RDL-B Series



RDL-A Series



RDL-E Series

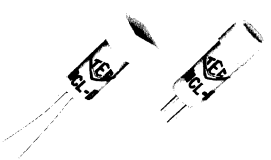
Five basic models offer unique variety in appearance, lens style and mounting methods. RDL-A and B Series use standard midget flange base neon or incandescent lamps; RDL-C, D, and E Series use incandescent only. Removable lens for fast lamp replacement.

FRONT MOUNTING LITE
FML Series



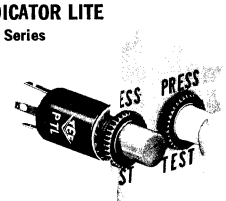
Slip-in installation (no hardware required) of this incandescent or neon lamp indicator is important where rear panel access is limited. Flexible nylon collet type body slides into panel mounting hole from the front and is locked firmly in place by the slip-in lens. Lite is insulated from panel and can contain 1/4 w resistor.

MINIATURE CARTRIDGE LITE
MCL Series



Economical, single unit construction with plastic lens-body in both neon or incandescent lamp models. Square or round lenses, internal series resistor, 2" long wire leads or .040 pin terminals are offered. Lite clip mounts or plugs-in by means of front or back mounted cartridge holders.

PRESS-TEST INDICATOR LITE
PTL Series



WITH REPLACEABLE LAMP

Unique design allows close mounting and combines lamp test and lamp replaceability into a single compact unit. Easy front panel relamping. Pressing the flat top lens tests the lamp independent of the circuit indicator signals.

MINIATURE DISPLAY LITE
MDL Series



An extremely versatile indicator that mounts from the rear with a single knurled nut and lock washer. A variety of optional features are available; spherical or flat top lens in 13 colors, wide range of permanently wired incandescent or neon lamps, internal current limiting resistor, two body colors and selection of terminals.

SWITCH INDICATORS

SUBMINIATURE BUTTON-LITE
SBL Series



Extremely small, the SBL Series Button Switch is designed for use in display and control panels where space is at a premium. The body diameter of the SBL Series is .360" and the back panel projection is only 9/16" including terminals. Lamp options are incandescent or permanently wired, long-life T-1 type neon. Integral switch has a SPST-NO-DB action.

SBS Series—Switch function only.

ALTERNATE ACTION SWITCH
ABL Series

CONVENTIONAL INDICATOR WITH REPLACEABLE LAMP & SWITCH

ABS Series

BUTTON SWITCH ONLY



Double break switch controls two circuits...when one circuit is closed the other opens—mechanical memory holds this status until switch is actuated again (SPDT-DB). Both series are rated for loads to 100 ma at 115 VAC. ABL includes replaceable neon or incandescent lamp.

MINIATURE BUTTON-LITE
MBL Series



Combines a permanently wired neon or incandescent lamp and isolated independent momentary contact switch... SPST-NO-DB or SPST-NC-DB options are available. Switch life exceeds 1 million operations at 100 ma at 115 VAC. Switch is activated by depressing the indicator's push-button lens.

REPLACEABLE LAMP BUTTON-LITES
RBL Series



Combination switch/indicator with replaceable neon or incandescent lamp. Three versions: RBL-1, snap-action SPDT momentary contact switch, operates with high currents to 5 amps; RBL-2, snap-action SPDT momentary contact switch, dry circuits or currents to 1 amp; RBL-3, snap action SPST-NO-DB momentary contact, 100 ma at 120 VAC; RBL-4, SPDT-DB or SPDT switch action, 100 ma at 115 VAC. Switch life exceeds 1 million operations at rated current.

SWITCHES

MINIATURE BUTTON SWITCH
MBS Series



A compact, highly reliable momentary contact push-button switch, the MBS Series is available with SPST-NO-DB, SPST-NC-DB or SPDT-DB options: Switch contact ratng is 100 ma at 115 VAC, non-inductive, with a switch life of one million operations at rated current.

SUBMINIATURE BUTTON SWITCH
SBS Series



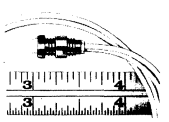
This extremely small push-button switch is only .360" in diameter and back panel projection is only .468". SPST-NO-DB momentary contact switch has a life of 1,000,000 operations at 100 ma at 115 VAC.

SBL Series—Adds integral incandescent lamp with switch.

SUBMINIATURE INDICATORS

SUBMINIATURE DISPLAY LITE
SDL Series

WITH INCANDESCENT OR NEON LAMP



Front mounted for use where panel space is limited or where indications must be small such as decimal points. Mounts on 1/4" centers horizontally or vertically. Only .240" diameter. Choice of connector hook-up or insulated wire leads.

SUBMINIATURE INDICATOR LITE
SIL Series

WITH NEON OR INCANDESCENT LAMP



Rugged, long life T-1 incandescent or neon lamp is permanently mounted in an extremely small body that is .360" in diameter and only .250" long. Ideal for applications where panel space is limited and many indications are required.

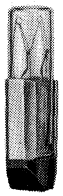
SUBMINIATURE TRI-LITE INDICATOR
S3L Series



This extremely small indicator offers three separate color indications; red, green, and amber. Ideal for use where a large number of indications are required in a limited amount of space. Three rugged long-life incandescent lamps with color filter boots are permanently wired in a .360" diameter by .600" long body.

MINIATURE LAMPS & SIGNALING DEVICES

PILOT LAMPS



T-2 SLIDE BASE

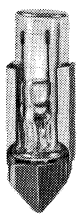
Type	Mfg. Code	Rated Volts	Avg. Current (Amps.)	M.S.C.P.	Min. Lab. Life (Hours)
6PSB	30672-0	6	.140	.12	5,000
12PSB	31272-0	12	.170	.48	5,000
24PSB	32472-0	24	.073	.85	5,000
28PSB	32982-0	28	.040	.17	5,000
48PSB	34872-0	48	.053	.52	5,000
60PSB	36072-0	60	.050	.67	5,000
120PSB	32072-0	120	.025	.36	5,000



T-2½ MIN. BAY

6MB	35100-0	6	.140	.12	5,000
12MB	35101-0	12	.170	.48	5,000
24MB	35103-0	24	.073	.85	5,000
28MB	35104-0	28	.040	.17	5,000
48MB	35105-0	48	.053	.52	5,000
60MB	35107-0	60	.050	.67	5,000
120MB	35108-0	120	.025	.36	5,000
120MB/6	35109-0	120	.052	1.30	3,000

INDICATOR LAMPS



INDICATOR LAMPS — SLIDE BASE

Type	Mfg. Code	Rated Volts	Avg. Current (Amps.)	M.S.C.P.	Min. Lab. Life (Hours)
4ESB	30450-0	4	.040	.02	5,000
5ESB	30550-0	5	.040	.04	5,000
6ESB	30650-0	6	.040	.025	5,000
10ASB	31040-0	10	.010	Red Glow	15,000
10CSB	31030-0	10	.017	.048	5,000
10ESB	31063-0	10	.040	.05	10,000
12ESB	31255-0	12	.040	.06	5,000
16CSB	31630-0	16	.017	.016	5,000
16ESB	31650-0	16	.040	.10	5,000
18ESB	31860-0	18	.040	.11	5,000
24CSB	32490-0	24	.017	.02	5,000
24ESB	32455-0	24	.040	.12	5,000
28ESB	32900-0	28	.040	.24	5,000
48ESB	34861-0	48	.040	.16	5,000

PILOT & INDICATOR CARTRIDGE LAMPS

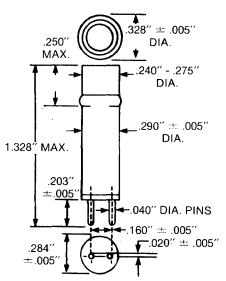


FIGURE I

Lamp No.	Mfg. Code	Volts	Avg. Currr. (Amps)	Base	MIL No.
#21	30021-0	6	.140		
#31	30031-0	12	.170		
#41	30041-0	24	.073	Bi-Pin	
#51	30051-0	28	.040	Car-	
#61	30061-0	48	.053	tridge	MS18238-1
#71	30071-0	60	.050		MS18238-2
#81	30081-0	120	.025		

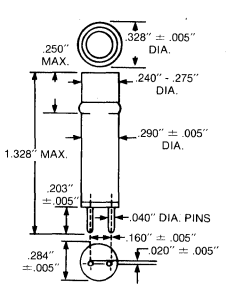
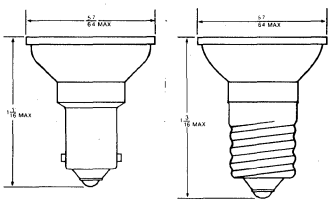


FIGURE II

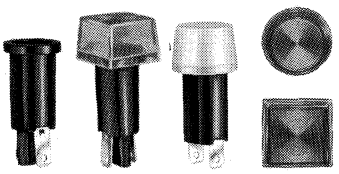
Lamp No.	Mfg. Code	Volts	Avg. Current (Amps.)	Base
#901	30901-0	4	.040	
#905	30905-0	5	.040	
#909	30909-0	6	.040	
#913	30913-0	10	.010	
#914	30914-0	10	.017	
#915	30915-0	10	.040	Bi-Pin
#918	30918-0	12	.040	Car-
#925	30925-0	16	.017	tridge
#926	30926-0	16	.040	
#930	30930-0	18	.040	
#933	30933-0	24	.017	
#934	30934-0	24	.040	
#938	30938-0	28	.040	
#941	30941-0	48	.040	

ANNUNCIATOR LAMPS



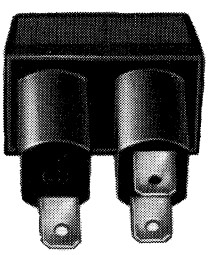
Type	Mfg. Code	Volts	Base
12RC	35121-0	12	Candelabra
60RC	35127-0	60	Candelabra
120RC	35128-0	120	Candelabra
12RB	35221-0	12	Miniature Bayonet
60RB	35227-0	60	Miniature Bayonet
120RB	35229-0	120	Miniature Bayonet

PANEL LIGHTS



Round Lens Mfg. Code	Color	Square Lens Mfg. Code
30160-0	Red	30170-0
30161-0	Clear	30171-0
30162-0	Amber	30172-0
30163-0	White	30173-0
30164-0	Green	30174-0
30165-0	Blue	30175-0

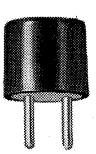
TWIN LIGHT CIRCUIT INDICATOR



LENS NO.	LENS COLOR
30180-0	Red
30182-0	Amber
30183-0	White
30184-0	Green
30185-0	Blue

PLUG-IN PANEL LIGHT, T-LITE





SPECIFICATIONS	PANEL LITE	T-LITE
Operating Volts	6 Volts	5 to 6
Current	130 MA.	60 MA.
Life	Over 5000 Hours	5000 Hours Minimum
Colors	Red-Amber-White Blue-Green	Red-Yellow-White
End View Lighted Area	Approximately 5/8"	5/16" Diameter

SYLVANIA
GENERAL TELEPHONE & ELECTRONICS

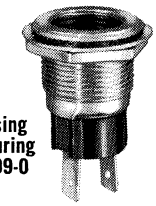
MINIATURE LAMPS & SIGNALING DEVICES

PILOT LIGHT HARDWARE

Phenolic Pilot Manufacturing Code 30094-0

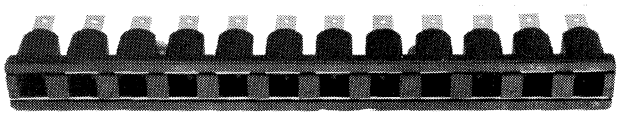


Universal Pilot Housing Manufacturing Code 30099-0

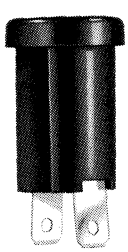


Color	FLAT TOP TRANSLUCENT Mfg. Code	JEWELED Mfg. Code	TRANSPARENT Mfg. Code
RED	30200-0	30100-0	30110-0
GREEN	30212-0	30102-0	30112-0
BLUE	30213-0	30103-0	30113-0
YELLOW	30214-0	—	30114-0
AMBER	—	30106-0	30111-0
CLEAR	—	—	30116-0
WHITE	30233-0	—	—
	FLUTED	**TRANSLUCENT**	
RED	30120-0	30130-0	—
GREEN	30122-0	30132-0	—
BLUE	30124-0	—	—
YELLOW	—	30131-0	—
AMBER	30126-0	—	—
CLEAR	30125-0	—	—
WHITE	—	30133-0	—

INDICATOR LIGHT HARDWARE



Type	Mfg. Code
Strip Socket, ½″ Centers, Common Ground	Strip - 31250-0
Strip Socket, ¾″ Centers, Common Ground	Strip - 31275-0
Strip Socket, ½″ Centers, Individual Contacts	Strip - 33250-0
Strip Stocket, ¾″ Centers, Individual Contacts	Strip - 33275-0

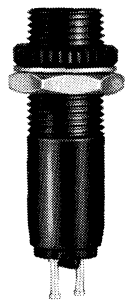




Color	PROFAX* Mfg. Code	PYREX GLASS Mfg. Code
Red	38001-0	38071-0
Yellow	38002-0	38072-0
White	38003-0	38073-0
Green	38004-0	38074-0
Blue	38005-0	38075-0

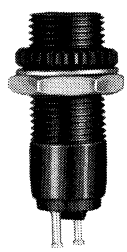
* Tinnerman clips for socket mounting included

CARTRIDGE LIGHT HARDWARE



Pilot Cartridge Housing	MIL No.	Mfg. Code
SM-2*	MS 18236	30095-0
SM-2A**	MS 18236	30096-0

* Turret Lugs ** Solder Lugs



Indicator Cartridge Housing	MIL No.	Mfg. Code
SM-1A*	MS 18235	30097-0
SM-1A**	MS 18235	30098-0

* Turret Lugs ** Solder Lugs



Color	Transparent Mfg. Code	Translucent Mfg. Code
Amber	30140-0	30145-0
Clear	30141-0	30146-0
Red	30142-0	30147-0
Blue	30143-0	30148-0
Green	30144-0	301-490

SUB-MINIATURE LAMPS

T-1

WIRE TERMINAL

Lamp Number	Mfg. Code	DESIGN Volts	DESIGN Amps	M.S.C.P. Approx.	Life (Hours)	Fila.	M.O.L. Inches
2128	35620-0	3.0	.0125	.001	16,000	C-6	0.25
6802	35621-0	5.0	.06	.032 ±25%	100,000	C-2R	0.145
6802AS15	35622-0	5.0	.06	.032 ±15%	100,000	C-2R	0.145
6801	35623-0	5.0	.06	.032 ±25%	200,000	C-2R	0.187
6801AS15	35624-0	5.0	.06	.032 ±15%	200,000	C-2R	0.187
680	35600-0	5.0	.06	.032 ±25%	200,000	—	—
680AS10	35679-0	5.0	.06	.032 ±10%	200,000	C-2R	0.25
680AS15	35600-1	5.0	.06	.032 ±15%	200,000	C-2R	0.25
6832	35625-0	5.0	.06	.053 ±25%	100,000	C-2R	0.145
6832AS15	25626-0	5.0	.06	.053 ±15%	100,000	C-2R	0.145
6831	35627-0	5.0	.06	.053 ±25%	100,000	C-2R	0.187
6831AS15	35628-0	5.0	.06	.053 ±15%	100,000	C-2R	0.187
683	35603-0	5.0	.06	.053 ±25%	100,000	—	—
683AS10	35690-0	5.0	.06	.053 ±10%	100,000	C-2R	0.25
683AS15	35603-1	5.0	.06	.053 ±15%	100,000	C-2R	0.25
S8-683F1	35629-0	5.0	.063	.060 ±25%	60,000	C-2R	0.25
7132	35630-0	5.0	.075	.088 ±25%	25,000	C-2R	0.145
7132AS15	35631-0	5.0	.075	.088 ±15%	25,000	C-2R	0.145
7131	35632-0	5.0	.075	.088 ±25%	25,000	C-2R	0.187
7131AS15	35633-0	5.0	.075	.088 ±15%	25,000	C-2R	0.187
713	35601-0	5.0	.075	.088 ±25%	25,000	—	—
713AS10	35691-0	5.0	.075	.088 ±10%	25,000	C-2R	0.25
713AS15	35601-1	5.0	.075	.088 ±15%	25,000	C-2R	0.25
7152	35634-0	5.0	.115	.147 ±25%	40,000	C-2R	0.145
7152AS15	35635-0	5.0	.115	.147 ±15%	40,000	C-2R	0.145
7151	35636-0	5.0	.115	.147 ±25%	40,000	C-2R	0.187
7151AS15	35637-0	5.0	.115	.147 ±15%	40,000	C-2R	0.187
715	35602-0	5.0	.115	.147 ±25%	40,000	—	—
715AS10	35692-0	5.0	.115	.147 ±10%	40,000	C-2R	0.25
715AS15	35602-1	5.0	.115	.147 ±15%	40,000	C-2R	0.25
S8-715F1	35638-0	5.0	.125	.22 ±25%	5,000	C-2R	0.25
S8-1088	35639-0	10.0	.027	.10 ±25%	16,000	C-2F	0.25
S8-1089	35640-0	12.0	.06	.15 ±25%	16,000	C-2F	0.25
S8-1111	35641-0	14.0	.065	.15 ±25%	12.000	C-2F	0.25
S8-1092	35642-0	18.0	.026	.15 ±25%	10,000	C-2F	0.25
6838	35643-0	28.0	.024	.15 ±25%	16,000	C-2F	0.25

AXIAL LEAD

6804	35644-0	5.0	.06	.032 ±25%	100,000	C-6	0.40
6804AS15	35645-0	5.0	.06	.032 ±15%	100,000	C-6	0.40
6834	35646-0	5.0	.06	.053 ±25%	100,000	C-6	0.40
6834AS15	35647-0	5.0	.06	.053 ±15%	100,000	C-6	0.40
7134	35648-0	5.0	.075	.088 ±25%	25,000	C-6	0.40
7134AS15	35649-0	5.0	.075	.088 ±15%	25,000	C-6	0.40
7154	35680-0	5.0	.115	.147 ±25%	40,000	C-6	0.40
7154AS15	35681-0	5.0	.115	.147 ±15%	40,000	C-6	0.40

BI-PIN BASE

7680	35682-0	5.0	.06	.032 ±25%	200,000	—	—
7683	35683-0	5.0	.06	.053 ±25%	100,000	—	—
S7-714	35684-0	5.0	.075	.088 ±25%	25,000	C-2R	0.36
7715	35685-0	5.0	.115	.147 ±25%	40,000	—	—
S7-1098	35686-0	10.0	.027	.10 ±25%	10,000	C-2F	0.36
S7-1099	35687-0	12.0	.06	.15 ±25%	16,000	C-2F	0.36
S7-1112	35688-0	14.0	.065	.15 ±25%	21,000	C-2F	0.36
S7-1100	35689-0	18.0	.026	.15 ±25%	10,000	C-2F	0.36
ST-6839	35690-0	28.0	.024	.15 ±25%	16,000	—	—

SUB-MIDGET FLANGED BASE

682	35610-0	5.0	.06	.032 ±25%	200,000	—	—
682AS10	35693-0	5.0	.06	.032 ±10%	200,000	C-2R	0.375
682AS15	35610-1	5.0	.06	.032 ±15%	200,000	C-2R	0.375
685	35613-0	5.0	.06	.053 ±25%	100,000	—	—
685AS10	35694-0	5.0	.06	.053 ±10%	100,000	C-2R	0.375
785AS15	35613-1	5.0	.06	.053 ±15%	100,000	C-2R	0.375
714	35611-0	5.0	.075	.088 ±25%	25,000	—	—
714AS10	35695-0	5.0	.075	.088 ±10%	25,000	C-2R	0.375
714AS15	35611-1	5.0	.075	.088 ±15%	25,000	C-2R	0.375
718	35612-0	5.0	.115	.147 ±25%	40,000	—	—
718AS10	35696-0	5.0	.115	.147 ±10%	40,000	C-2R	0.375
718AS15	35612-1	5.0	.115	.147 ±15%	40,000	C-2R	0.375
S8-718F1	35691-0	5.0	.125	.22 ±25%	5,000	C-2R	0.375
S8-1098	35692-0	10.0	.027	.10 ±25%	10,000	C-2F	0.375
S8-1099	35693-0	12.0	.06	.15 ±25%	16,000	C-2F	0.375
S8-1112	35694-0	14.0	.065	.15 ±25%	12,000	C-2F	0.375
S8-1100	35695-0	18.0	.026	.15 ±25%	10,000	C-2F	0.375
6839	35696-0	28.0	.024	.15 ±25%	16,000	—	—

SUB-MINIATURE LAMPS

T-1¾

WIRE TERMINAL

Lamp Number	Mfg. Code	DESIGN Volts	DESIGN Amps	M.S.C.P. Approx.	Life (Hours)	Fila.	M.O.L. Inches
1784AS10	35406-0	6.0	.20	.34@5V ±10%	1,000	C-2R	0.52
1784AS15	35407-0	6.0	.20	.34@5V ±15%	1,000	C-2R	0.52
2180	35408-0	6.3	.04	.02	50,000	C-2V	0.52
1739	35569 0	6.3	.075	.22	500	C-2R	0.52
8350	25409-0	6.3	.15	.45	3,000	C-2R	0.52
2181	25589-0	6.3	.20	.40	50,000	C-2V	0.52
2112	35410-0	6.3	.20	.55	3,000	C-2R	0.52
1869	35578-0	10.0	.014	.002	10,000	C-2F	0.52
2107	35581-0	10.0	.04	.08	30,000	C-2F	0.52
2182	25584-0	14.0	.08	.30	50,000	C-2F	0.52
2160	35411-0	14.0	.08	.50	750	C-2F	0.52
2132	35412-0	14.0	.08	.50	750	C-2F	0.52
1705	35567-0	14.0	.08	.50	750	C-2F	0.52
1705L	35413-0	14.0	.088	.50	10,000	C-2F	0.52
2162	35414-0	14.0	.088	.50	10,000	C-2F	0.52
2102	35583-0	18.0	.04	.15	1,000	C-2F	0.52
2185	35415-0	28.0	.04	.20	50,000	C-2F	0.52
2187	35416-0	28.0	.04	.30	25,000	—	—
1762	35591-0	28.0	.04	.34	1,000	C-2F	0.52
1764	35571-0	28.0	.04	.34	1,000	—	—
1764AS15	35417-0	28.0	.04	.34 ±15%	1,000	C-2F	0.52
1764AS25	35418-0	28.0	.04	.34 ±25%	1,000	C-2F	0.52

MIDGET FLANGED BASE

387	35592-0	28.0	.04	.30	25,000	—	—
387AS15	35437-0	28.0	.04	.30 ±15%	25,000	C-2F	0.625
387AS25	35438-0	28.0	.04	.30 ±25%	25,000	C-2F	0.625
387R(Red)	35439-0	28.0	.04	—	25,000	C-2F	0.625
340	35556-0	28.0	.04	.34	1,000	C-2F	0.625
327	35590-0	28.0	.04	.34	1,000	—	—
327A (Amber)	35440-0	28.0	.04	—	1,000	C-2F	0.625
327AF (All Frost)	35441-0	28.0	.04	—	1,000	C-2F	0.625
327AS10	35442-0	28.0	.04	.34 ±10%	1,000	C-2F	0.625
327AS15	35590-1	28.0	.04	.34 ±15%	1,000	C-2F	0.625
327AS25	35443-0	28.0	.04	.34 ±25%	1,000	C-2F	0.625
327R(Red)	35590-3	28.0	.04	—	1,000	C-2F	0.625
327/15	35590-2	28.0	.04	—	1,000	C-2F	0.625
376	35444-0	28.0	.06	.34	25,000	C-2F	0.625

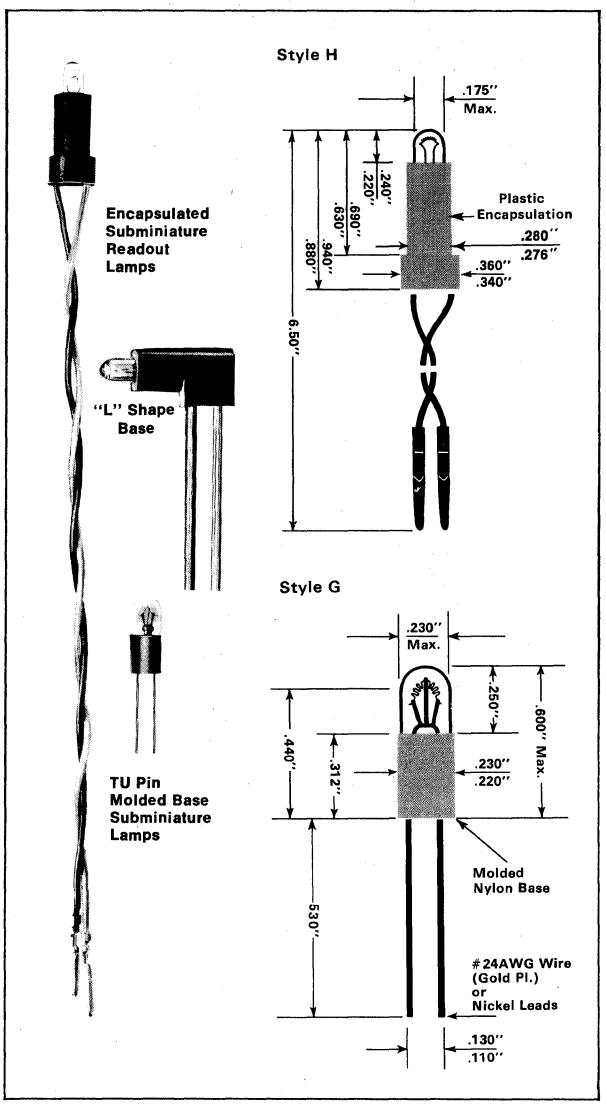
MIDGET GROOVED BASE

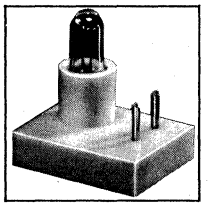
698	35457-0	1.35	.06	.01	500	C-2R	0.625
337	35554-0	6.0	.20	.34@5V	1,000	C-2R	0.625
337AS10	35458-0	6.0	.20	.34@5V ±10%	1,000	C-2R	0.625
337AS15	35459-0	6.0	.20	.34@5V ±15%	1,000	C-2R	0.625
337AS25	35460-0	6.0	.20	.32@5V ±25%	1,000	C-2R	0.625
337L	35461-0	6.3	.20	.55	3,000	C-2R	0.625
379	35462-0	6.3	.20	.40	50,000	C-2V	0.625
398	35452-0	6.3	.20	.55	3,000	C-2R	0.625
709	35463-0	10.0	.014	.008	10,000	C-2F	0.625
397	35464-0	10.0	.04	.08	30,000	C-2F	0.52
386	35465-0	14.0	.08	.30	50,000	C-2F	0.625
336	35588-0	14.0	.08	.50	750	C-2F	0.625
346	35560-0	18.0	.04	.20	1,000	C-2F	0.625
457	35466-0	22.0	.04	.30	2,000	C-2F	0.625
388	35451-0	28.0	.04	.30	25,000	C-2F	0.625
334	35552-0	28.0	.04	.34	1,000	—	—
334AS15	35467-0	28.0	.04	.34 ±15%	1,000	C-2F	0.625
334AS25	35468-0	28.0	.04	.34 ±15%	1,000	C-2F	0.625

BI-PIN BASE

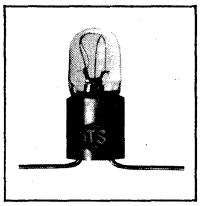
S7-331	35469-0	1.35	.06	.01	500	C-2R	0.625
S7-368	35470-0	2.5	.20	.22	500	C-2R	0.625
S7-338	35471-0	2.7	.06	.04	6,000	C-2R	0.625
S7-375	35472-0	3.0	.015	.002	10,000	C-6	0.625
S7-345	35473-0	6.0	.04	.03	10,000	C-2V	0.625
S7-328	35474-0	6.0	.20	.34@5V	1,000	C-2R	0.625
S7-332	35475-0	6.0	.20	.10	50,000	C-2F	0.625
7377	35476-0	6.3	.075	.23	500	C-2R	0.625
7380	35477-0	6.3	.04	.02	50,000	—	—
S7-349	35478-0	6.3	.20	.55	3,000	C-2R	0.625
S7-350	35479-0	6.3	.15	.45	3,000	C-2R	0.625
7381	35480-0	6.3	.20	.40	50,000	C-2V	0.625
7344	35481-0	10.0	.014	.002	10,000	C-2F	0.625
S7-367	35482-0	10.0	.04	.08	30,000	C-2F	0.625
7382	35483-0	14.0	.08	.30	50,000	C-2F	0.625
S7-330	35484-0	14.0	.08	.50	750	C-2F	0.625
S7-370	35485-0	18.0	.04	.20	1,000	C-2F	0.625
S7-459	35486-0	22.0	.04	.30	2,000	C-2F	0.625
7387	35487-0	28.0	.04	.30	25,000	—	—
7327	35488-0	28.0	.04	.34	1,000	C-2F	0.625

TUNG-SOL MOLDED BASE LAMPS AND SPECIAL ASSEMBLIES

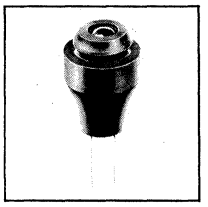




Plug-in module activates photo-electric sensor in high speed check sorter.



Molded base permits bending lead wires at acute angles.



Soft plastic encapsulation permits push-in mounting in sheet-metal panels.

The molded base lamp provides important advantages that simplify production and contribute added reliability to the end product. The molded base is permanently bonded to the bulb. It replaces the previously cemented-on metal base. The former receptacle that had to be wired into the circuit is completely eliminated. The molded base lamp is self-mounting. In fact, the Tu-Pin lamp can be applied with automated equipment.

The molded base technique makes it possible to provide a wide variety of lamp packages—built-in key ways, plug-in types, unusual positioning of the leads and multi-purpose configurations.





Strip-mounted, grain-size, 21-mil lamps snap into molded plastic holder to form a condition monitor for computer circuit boards. Lamp sockets are numbered to correspond to individual circuits. Test probe contacts are provided. Units can be operated in either normally "on" or "off" condition and can be wired to a door switch or test push button.

TUNG-SOL®
TUNG-SOL DIVISION
Wagner Electric Corporation
630 W. Mt. Pleasant Avenue, Livingston, N. J. 07039
TWX: 710-994-4865 Phone: (201) 992-1100; (212) 732-5426

ELECTRICAL CHARACTERISTICS / PHYSICAL CHARACTERISTICS

Lamp No.	Style	Design Volts	Design Current	Nominal Light Output	Average Rated Life	Midget Base Style	Max. Bulb Diam.	MOL	Filament Type	Indicator Base Color
2301	G	**1.35**	.06	.02	500	Tu-Pin Molded	.230	.600	S-2	Ind. White
2302	G	**2.5**	.20	.25	500	Tu-Pin Molded	.230	.600	C-2R	Ind. Brown
2303	G	**2.7**	.06	.04	500	Tu-Pin Molded	.230	.600	C-2R	Ind. Lt. Grn.
2304	G	**3.0**	.30	.34	1500	Tu-Pin Molded	.230	.600	C-2R	Ind. Black
2305	G	**6.0**	.04	.03	1000	Tu-Pin Molded	.230	.600	C-2V	Ind. Silver
2306	G	**6.0**	.20	.60	1000	Tu-Pin Molded	.230	.600	C-2R	Ind. Orange
2307	G	**6.3**	.20	.50	3000	Tu-Pin Molded	.230	.600	C-2R	Ind. Dk. Blue
2319	G	**6.3**	.20	.40	50,000	Tu-Pin Molded	.230	.600	C-2F	
2308	G	**10.0**	.014	.006	5000	Tu-Pin Molded	.230	.600	C-2F	Ind. Pink
2309	G	**10.0**	.04	.10	5000	Tu-Pin Molded	.230	.600	C-2V	Ind. Lt. Blue
2310	G	**14.0**	.08	.50	750	Tu-Pin Molded	.230	.600	C-2F	Ind. Yellow
2339	G	**15.0**	.040	.075	25,000	Tu-Pin Molded	.230	.600	C-2F	
2311	G	**18.0**	.04	.25	1000	Tu-Pin Molded	.230	.600	C-2F	Ind. Dk. Grn.
2318	G	**24.0**	.080	.50	20,000	Tu-Pin Molded	.230	.600	C-2F	
2312	G	**28.0**	.04	.34	1000	Tu-Pin Molded	.230	.600	C-2F	Ind. Red
2329	G	**28.0**	.046	.34	2500	Tu-Pin Molded	.230	.600	C-2F	Ind. Gray
2334	G	**6.3**	.075	.25	1000	Tu-Pin Molded	.230	.600	C-2R	Ind. Red
EN1748	H	**2.5**	400	800 ft.-cd[5]	Indef.	Encapsulated	.175	.880	C-2R	Ind. Black
EN1748S	H	**2.5**	400	1250 ft.-cd[6]	Indef.	Encapsulated	.175	.880	C-2R	Ind. Black

®Reg. T.M. Wagner Electric Corporation

TUNG-SOL SUBMINIATURE LAMPS

All base and bulb types for read-out and indicator applications

SPECIFICATIONS: T-1 3/4 LAMPS

ELECTRICAL CHARACTERISTICS					PHYSICAL CHARACTERISTICS					
Lamp No.	Design Volts	Design Current	Nominal Light Output	Average Rated Life	Midget Base Style	Max. Bulb Diam.	MOL	Filament Type	LCL	Application
331	1.35	.06	.02 CP	500	Flange	.230	.625	S-2	.375	Indicator(4)
440	1.5	.05	.012 CP	Indef.	Flange	.230	.625	C-2R	.375	Indicator
1769	2.5	.20	.20 CP	500	Screw	.230	.718	C-2R	.500	Indicator
1767	2.5	.20	.25 CP	500	Screw	.230	.625	C-2R	.500	Indicator(4)
364	2.5	.40	.28 CP	5000	Flange	.230	.625	C-2R	.375	Indicator
4(1)	2.5	.40	800 ft.-cd(5)	Indef.	Groove	.240	.813	C-2R		Read-out
4S(1)	2.5	.40	1250 ft.-cd(6)	Indef.	Groove	.240	.813	C-2R		Read-out
1748(1)(2)	2.5	.40	800 ft.-cd(5)	Indef.	Leads*	.240	.687	C-2R		Read-out
1748S(1)(2)	2.5	.40	1250 ft.-cd(6)	Indef.	Leads*	.240	.687	C-2R		Read-out
2169(2)	2.5	.35	.21 CP	10,000	Leads*	.230	.520	C-2R		Indicator
1738(2)	2.7	.06	.04 CP	500	Leads*	.230	.520	C-2R		Indicator
338	2.7	.06	.04 CP	500	Flange	.230	.625	C-2R	.375	Indicator
342	6	.04	.03 CP	1000	Screw	.230	.718	C-2V	.500	Indicator
345	6	.04	.03 CP	1000	Flange	.230	.625	C-2V	.375	Indicator(4)
328	6	.20	.60 CP	1000	Flange	.230	.625	C-2R	.375	Indicator(4)
337	6	.20	.60 CP	1000	Groove	.230	.625	C-2R	.375	Indicator
1768	6	.20	.60 CP	1000	Screw	.230	.625	C-2R	.500	Indicator(4)
1730(2)	6	.04	.03 CP	1000	Leads*	.230	.520	C-2V		Indicator
2134(2)	6	.04	.03 CP	1000	1 3/4" Leads	.230	.520	C-2V		Indicator
1784(2)	6	.20	.60 CP	1000	Leads*	.230	.520	C-2R		Indicator
380	6.3	.040	.02 CP	50,000	Flange	.230	.625	C-2V	.375	Indicator
1739(2)	6.3	.075	.25 CP	1000	Leads*	.230	.520	C-2R		Indicator
1775	6.3	.075	.25 CP	1000	Screw	.230	.625	C-2R	.500	Indicator(4)
350	6.3	.15	.45 CP	3000	Flange	.230	.625	C-2R	.375	Indicator(4)
349	6.3	.20	.50 CP	3000	Flange	.230	.625	C-2R	.375	Indicator
379	6.3	.20	.40 CP	50,000	Groove	.230	.625	C-2V	.375	Indicator
381	6.3	.20	.40 CP	50,000	Flange	.230	.625	C-2V	.375	Indicator
2112(2)	6.3	.20	.50 CP	3000	Leads*	.230	.520	C-2R		Indicator
2181(2)	6.3	.20	.40 CP	50,000	Leads*	.230	.520	C-2V		Indicator
344	10	.014	.002 CP	5000+	Flange	.230	.625	C-2F	.375	Indicator(4)
367	10	.04	.10 CP	Indef.	Flange	.230	.625	C-2V	.375	Indicator
374	10	.014	.006 CP	5000+	Flange	.230	.625	C-2F	.375	Indicator
1869(2)	10	.014	.002 CP	5000+	Leads*	.230	.520	C-2F		Indicator
1917(2)	10	.014	.006 CP	5000+	Leads*	.230	.520	C-2F		Indicator
2107(2)	10	.04	.10 CP	Indef.	Leads*	.230	.625	C-2V		Indicator
2207	10	.04	.10 CP	20,000	Groove	.230	.625	C-2V	.375	Indicator
384	11	.025	.05 CP	2000	Flange	.230	.625	C-2F	.375	Indicator
1916(2)	12	.019	.012 CP	Indef.	Leads*	.230	.520	C-2V		Indicator
336	14	.08	.50 CP	750	Groove	.230	.625	C-2F	.375	Indicator
373	14	.08	.50 CP	750	Screw	.230	.718	C-2F	.500	Indicator
382	14	.08	.30 CP	50,000	Flange	.230	.625	C-2F	.375	Indicator
386	14	.08	.30 CP	50,000	Groove	.230	.625	C-2F	.375	Indicator
330	14	.08	.50 CP	750	Flange	.230	.625	C-2F	.375	Indicator(4)
1705(2)	14	.08	.50 CP	750	1" Leads	.230	.520	C-2F		Indicator
2182(2)	14	.08	.30 CP	50,000	Leads*	.230	.520	C-2F		Indicator
346	18	.04	.25 CP	1000	Groove	.230	.625	C-2F	.375	Indicator
370	18	.04	.25 CP	1000	Flange	.230	.625	C-2F	.375	Indicator
457	22	.04	.30 CP	2000	Groove	.230	625	C-2F	.375	Indicator
327	28	.04	.34 CP	1000	Flange	.230	.625	C-2F	.375	Indicator(4)
327X	28	.046	.34 CP	2500	Flange	.230	.625	C-2F	.375	Indicator(4)
334	28	.04	.34 CP	1000	Groove	.230	.625	C-2F	.375	Indicator(4)
335	28	.04	.34 CP	1000	Screw	.230	.718	C-2F	.500	Indicator
340(3)	28	.04	.34 CP	1000	Flange	.230	.625	C-2F	.375	Indicator(4)
369	28	.04	.34 CP	1000	Screw	.230	.593	C-2F	.500	Indicator
1762(2)	28	.04	.34 CP	1000	Leads*	.230	.520	C-2F		Indicator(4)
387	28	.04	.30 CP	25,000	Flange	.230	.625	C-2F	.375	Indicator
388	28	.04	.30 CP	25,000	Groove	.230	.625	C-2F	.375	Indicator
2187(2)	28	.04	.30 CP	25,000	Leads*	.230	.520	C-2F		Indicator
1764(2)	28	.04	.34 CP	1000	1" Leads	.230	.520	C-2F		Indicator
1860(2)	28	.04	.34 CP	1000	1" Tinned Leads	.230	.520	C-2F		Indicator
1762X(2)	28	.046	.34 CP	2500	Leads*	.230	.520	C-2F		Indicator

These lamps are normally supplied in clear glass. Colored bulbs will be made on special order. Unless otherwise specified, all lamps have metal bases.

SPECIFICATIONS: T-3/4 LAMPS

Lamp No.	Design Volts	Design Current	Nominal Light Output	Average Rated Life	Midget Base Style	Max. Bulb Diam.	MOL	Filament Type	LCL	Application
2	5	.021	.034	Indef.	1 3/16" Tinned leads	.102	.200	C-6		Digital
8666	5	.08	.15	3000	Leads	.102	.200	C-2R		Indicator

Reference Notes Indef.—Life over 5000 hours. (1) Lens end. (2) Wire leads. (3) High temperature solder. (4) Application in aircraft service. (5) Through 3/16" min. dia. window at 3/8" from lamp tip. (6) Through 1/8" min. dia. window at 3/8" from lamp tip.

Wire Lamp Types Not Shown—Type F. 2264—2129—2176—2183—2119—2201—2265 and 2002.

*Standard lead length is approximately 11/16" unless otherwise specified.

TUNG-SOL® TUNG-SOL DIVISION/Wagner Electric Corporation
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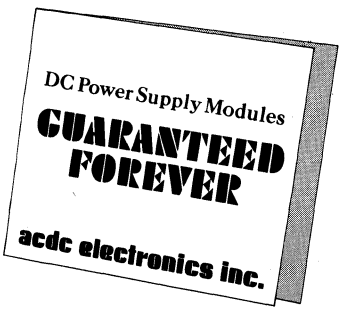
ACDC POWER SUPPLY MODULES

ACDC specializes in the production of modular DC power supplies using uniquely versatile packaging concepts. Since ACDC first began to make power supplies in 1950, there have been many innovations in power supply technology. A large number of these have been the product of ACDC engineering talent. As new modules are introduced or design improvements made to existing power supplies in the ACDC line, bulletins will be issued to supplement this catalog. To ensure that you receive up-to-the-minute modular DC power supply information, send us your name and address and we'll place you on our mailing list. For detailed power supply information, call us toll-free, or contact one of our representatives. See listing in yellow section.

ACDC POWER SUPPLY WARRANTY

When used within its specified operating environments, this ACDC power supply is unconditionally guaranteed to meet all published specifications for an unlimited length of time. This guarantee covers all parts of the module, including semi-conductors, fuses, and mechanical parts, without regard to the date of purchase or installation. All terms of this guarantee are fully transferable when the power supply is sold as original equipment.

If at any time the power supply is in need of warranty service or calibration it may be returned directly to the factory where, without charge, it will be adjusted to meet its original specifications. ACDC will pay surface freight charges to and from the factory.



NEW MINIATURE POWER SUPPLY

The JR! New from ACDC. Now, for the first time, precision regulated DC power in truly miniaturized form. Just think! AC conversion and isolation in one fifth the size and weight with remarkably improved efficiency. But that's not all! The prices are competitive with conventional designs. Yes, again ACDC has opened the door to a totally new era of power conversion. Look around! There's nothing quite like it anywhere—nothing even close! It's the new generation! That's why we call it the JR, a new name for a completely new concept.

FEATURES:

5 times more power per unit volume than conventional approaches, and
50% better efficiency.
0.1% regulation.
Remote Sensing.
Remote Programming.
Short circuit proof.
Overvoltage protection option.
Fits into 1¾" rack panel assembly.

SPECIFICATIONS:

Input: 105-125 VAC, 47-420Hz.

Output: (See table for voltage range and current)

Regulation: 0.1% +5mV NL-FL
±0.1% for ±10% input variation

Ripple: 1mV RMS, 25mV Peak-Peak.

Typical Efficiency: 70% @ 5V, 80% @ 15V and above.

Transient Response: Output voltage returns to within regulation limits within approximately 500 μsec in response to a 100% load change.

Remote Sensing: To compensate for DC voltage drop of of up to 0.5 volts in the load cables, remote sensing terminals are provided to monitor voltage at the load.

Temperature Coefficient: 0.02%/°C maximum.

Ambient Temperature: Units are designed to operate with either conductive or convective heatsinking. When conductively heatsinked, the base temperature of the unit must be maintained at a maximum of 80°C. Since these modules dissipate approximately 21 watts at 5 volts or 13 watts at 15 and 25 volts, provision must be made to remove this heat. For operation in convective air ambients of up to 71°C, an optional heatsink which attaches to the mounting surface of the unit is available. Consult the factory for more detailed cooling information.

Remote Voltage Adjustment: Resistance may be inserted in the negative sensing lead to adjust the output voltage remotely at approximately 1000 Ω/V.

Overload Protection: The supply is protected against overloads and short circuit by a foldback type voltage/current characteristic.

Overvoltage Protection: A completely independent overvoltage protection module is available which attaches to the supply and straddles the output terminals. This protection does not depend on the regulating circuitry of the supply and crowbars the output if it reaches the adjusted trip voltage. Trip voltage adjustable from 5-30 volts.

Input Current Fusing: Input current fusing provided internally.

Connector: Barrier strip (⅜" centers).

Construction: Black anodized aluminum case. Unit may be removed from case for complete serviceability.

Mounting: See outline drawing.

NOMINAL OUTPUT VOLTAGE	OUTPUT VOLTAGE RANGE	CURRENT	MODEL NO.	PRICE
5	3-5.5	10A	JR5K10	$250.00
15	12-18	4A	JR15K4.0	250.00
25	22-30	2A	JR25K2.0	250.00

(If unit is ordered with overvoltage protection add $30.00 to above prices).

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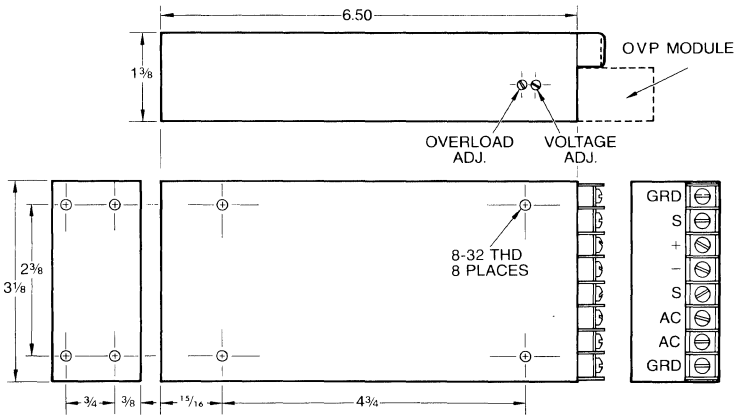
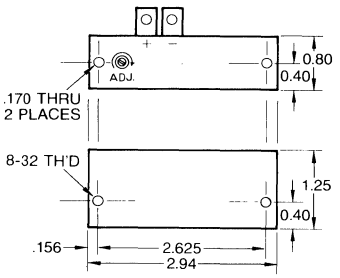
CASE SIZE K1

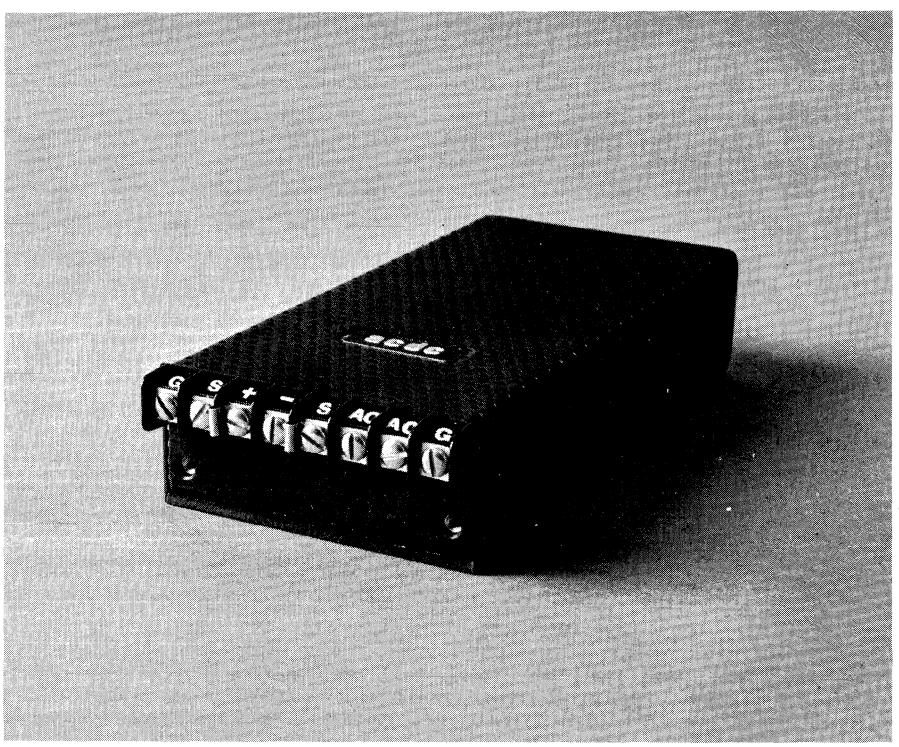


OVER VOLTAGE PROTECTION MODULE

(ADJUSTABILITY: 5 TO 30 VDC @ 10 A MAX)



OV2—$30.00



SPECIFICATIONS	BX & OA SERIES 0.01% REGULATION	BC SERIES 0.5% REGULATION	IC SERIES 0.05% REGULATION
INPUT	105-125 Volts, 47-63Hz (Useable also to 400Hz—consult factory for derating). All models of 20A and greater are provided with 105-125/210-250V input.		
OUTPUT	Voltage range shown in tables is continuously variable between limits by externally accessible screwdriver adjustment of multiturn pot. Output is floating—either positive or negative terminal may be grounded. Current: Zero to full load as shown in tables.		
REGULATION	0.01% or 0.001 volt for line changes of 10%. 0.01% or 0.002 volt for NL to FL changes.	0.5% or 0.02 volt for line changes of 10%. .0.5% or 0.04 volt for NL to FL changes.	0.05% for line changes of 10%. 0.05% for NL to FL changes.
RIPPLE	0.5mV or 0.001% max. RMS (whichever is greater).	10mV or 0.01% max. RMS (whichever is greater).	2mV RMS and 20mV P-P max.
OUTPUT IMPEDANCE	DC—1KHz 0.0001 R_L or 0.001 ohm max. 1—10KHz 0.0003 R_L or 0.01 ohm max. 10—100KHz 0.006 R_L or 0.3 ohm max. (whichever is greater). R_L is the rated load.	DC—1KHz 0.005 R_L or 0.04 ohm max. 1-100KHz 0.02 R_L or 0.3 ohm max. (whichever is greater). R_L is the rated load.	DC—1KHz 0.001 R_L or 0.005 ohm max. 1-100KHz 0.005 R_L or 0.3 ohm max. (whichever is greater). R_L is the rated load.
TRANSIENT RESPONSE	Output voltage returns to within regulation limits within 50μsec. in response to a 50% step change in load current.		
STABILITY	Max. 0.1% or 10mV for eight hour period after initial warm-up.	Typical 1% for eight hour period after initial warmup.	Typical 10mV for eight hour period after initial warmup.
TEMPERATURE COEFFICIENT	Maximum 0.015% or 1mV per degree Centigrade.	Typically 0.1% or 5mV per degree Centigrade.	1mV per degree Centigrade max.
AMBIENT TEMPERATURE	**OPERATING:** Full rated output at operating temperatures of 0 to 71°C without forced air or heatsinking. **STORAGE:** —55°C to +85°C.		
REMOTE SENSING	To compensate for DC voltage drop of up to 0.5 volts in the load cables, remote sensing terminals are provided to monitor voltage at the load.		
REMOTE VOLTAGE ADJUSTMENT OR PROGRAMMING	Terminals are provided to adjust the output voltage by means of a remote variable resistor. On the wide range models, in addition to being internally adjustable over the full range, remote programming is possible at an accurately adjustable 1000 ohms/volt and a separate zero adjustment is provided. Remote voltage adjustment is not provided on dual output models but may be ordered as a special feature.		
OVERLOAD PROTECTION	All models are inherently protected against overload and short circuits of any duration. Except for certain higher voltage units, no fuses or reset buttons are used—automatic recovery is electronically accomplished. On these units short circuit protection by means of an accessible, replaceable fuse is furnished.		
OVERVOLTAGE PROTECTION (Optional: Add $30.00 unless alternate price is specified in catalogue listing)	Any model, up to 50 volts, can be furnished with overvoltage protection which "crowbars" the output in the event of a rise in the output voltage of 10% or 2 volts (whichever is greater). On the dual models, overvoltage protection "crowbars" both voltages to near zero in the event of a rise of one or both of the voltages of 20% or 4 volts (whichever is greater). (Optional feature available at extra cost—specify when ordering by adding -1 to model number).		
INPUT CURRENT, FUSING	The input current drawn from the AC line may be determined from the following: $I_{IN} = I_{DC} E_{DC}^{0.7} \times 0.052$. Fuse ratings should be at least 50% higher.		
CONNECTOR	Cases A through F are supplied with a solder hook terminal header. Case M1 is furnished with an attached 10 terminal P.C. edge connector which may be used either as a solder connection or readily removed by the user and mounted in his equipment to provide plug-in convenience. G and H cases have a barrier strip ($^7/_{16}$" center—center terminal spacing) as shown on outline drawings.		All cases have barrier strip termination.
CONSTRUCTION	Power supply modules are constructed of heavy gage aluminum with integral extruded heatsinks; color is black. Removable covers of perforated steel have a light gold enamel finish. The regulating circuitry is mounted on a printed circuit board.		
MOUNTING	Units can be mounted in any position on either one of two sides as shown in the outline drawing. Mounting faces have threaded mounting holes. See case outline drawings.		
PART NUMBER ASSIGNMENTS	Catalog model numbers followed by -1 have overvoltage protection.		
MILITARY SPECIFICATIONS:	The listed catalog models are constructed with the highest quality components and have MTBF ratings in the neighborhood of 50,000 hours, per MIL-HDBK-217. ACDC will also build supplies to meet specific MIL specifications such as MIL-E-4158A, MIL-E-16400, MIL-T-21200, and meet environmental requirements such as MIL-E-5400, MIL-E-5272, MIL-E-4970, and RFI specifications MIL-I-26600 and MIL-I-6181. ACDC's own environmental laboratory is able to perform qualification testing when required, and is used extensively to prove out designs. In order to provide the most efficient design, customer inquiries are invited, stating exact specifications and environmental conditions required of the end product.		

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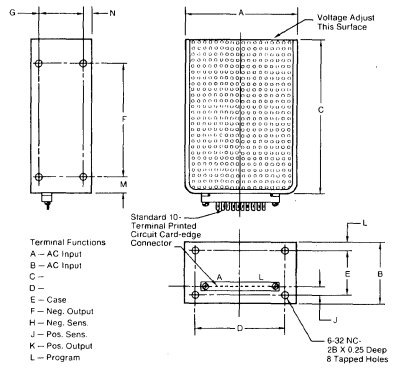
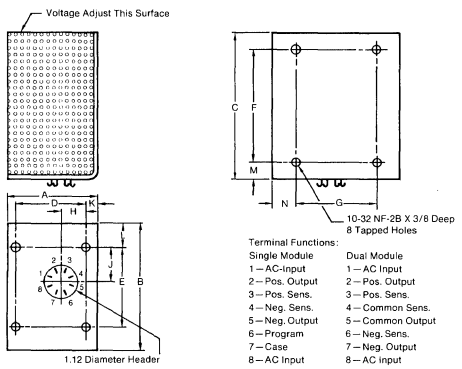


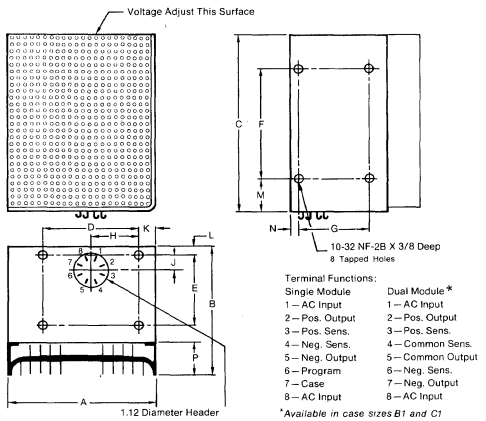
CASE SIZE M1

A	3.44	D	2.750	G	1.375	M	0.50
B	1.88	E	1.375	J	0.289	N	0.25
C	4.75	F	3.500	L	0.25	Approx. weight	1.6 lbs.



CASE SIZE A1

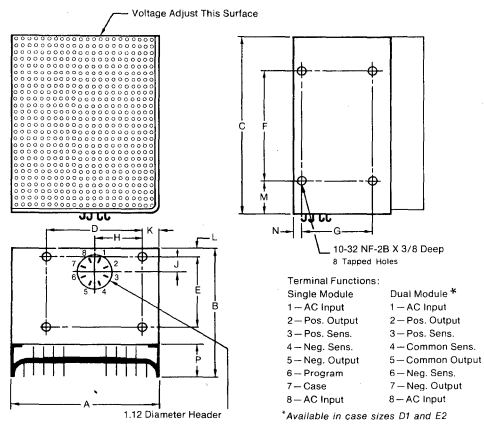
A	3.12	D	2.437	G	2.750	K	0.41	N	0.81
B	4.37	E	2.750	H	0.875	L	0.81	Approx. weight	4 lbs.
C	5.00	F	3.875	J	1.187	M	0.56		



CASE SIZES A2, B1, B2, C1

	A2	B1	B2	C1
A	4.50	5.00	5.00	5.00
B	4.12	4.37	5.25	5.25
C	5.00	6.00	6.00	6.00
D	3.000	3.250	3.250	3.250
E	2.187	2.375	2.375	3.375
F	3.250	3.750	3.750	3.625
G	2.000	2.375	2.375	3.250

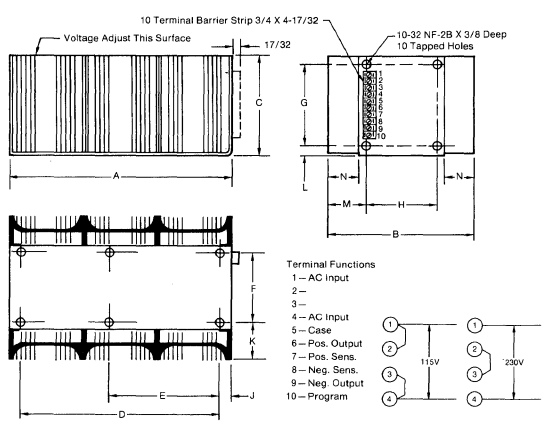
	A2	B1	B2	C1
H	1.000	1.625	1.625	3.000
J	1.500	0.500	0.500	1.687
K	0.75	0.56	0.56	1.19
L	0.28	0.28	0.28	0.28
M	1.25	1.12	1.12	0.56
N	0.28	0.28	0.28	0.28
P	1.12	1.12	2.00	1.12
Approx. weight	5 lbs.	8 lbs.	8 lbs.	11 lbs.



CASE SIZES D1, D2, E1, E2

	D1	D2	E1	E2
A	5.00	5.00	8.25	8.25
B	6.87	6.00	6.62	5.75
C	6.00	6.00	6.50	6.50
D	3.625	3.625	7.000	7.000
E	3.875	3.875	3.500	3.500
F	4.250	4.250	4.750	4.750
G	3.750	3.750	3.500	3.500

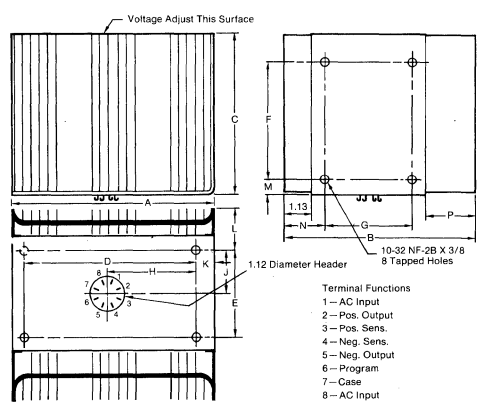
	D1	D2	E1	E2
H	1.500	1.500	3.625	3.625
J	0.500	0.500	1.750	1.750
K	1.09	1.09	0.75	0.75
L	0.28	0.28	0.56	0.56
M	0.87	0.87	0.62	0.62
N	0.28	0.28	0.56	0.56
P	2.00	1.12	2.00	1.12
Approx. weight	14 lbs.	14 lbs.	18 lbs.	18 lbs.



CASE SIZES G1, H1

	G1	H1
A	15.00	15.00
B	8.00	9.75
C	6.75	6.75
D	13.875	13.875
E	7.500	7.500
F	4.625	4.625
G	5.500	5.500

	G1	H1
H	4.625	4.625
J	0.75	0.75
K	1.69	2.56
L	0.62	0.62
M	1.69	2.56
N	1.12	2.00
Approx. weight	42 lbs.	46 lbs.



CASE SIZE F1

A	8.25	D	7.000	G	3.500	K	0.75	N	1.69
B	7.75	E	3.500	H	3.625	L	1.69	P	2.00
C	6.50	F	4.750	J	1.750	M	0.62	Approx. weight	25 lbs.

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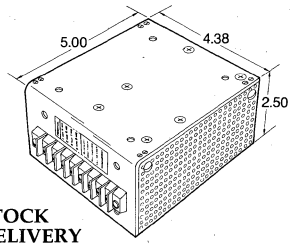
DC POWER SUPPLY MODULES / IC SERIES / 0.05% REGULATION / 5 VDC



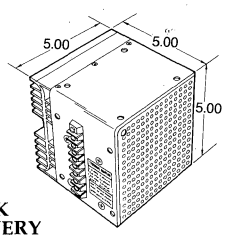
STOCK DELIVERY

2.7A @ 40°C—$98.00
OR
2.5A @ 55°C
2.0A @ 71°C

Case size: J1
Approx. weight: 4 lbs.
OPV: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
5	4.75-5.25	IC5N2.7



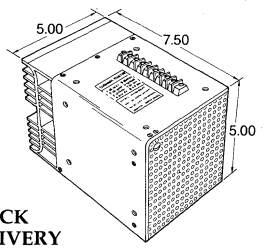
STOCK DELIVERY

9.5A @ 40°C—$134.00
OR
8.0A @ 55°C
6.2A @ 71°C

Case size: L1
Approx. weight: 7.5 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
5	4.75-5.25	IC5N9.5



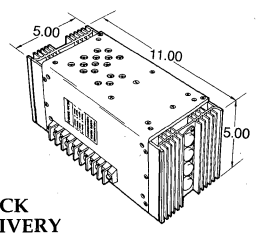
STOCK DELIVERY

13.5A @ 40°C—$186.00
OR
11.5A @ 55°C
9.2A @ 71°C

Case size: N1
Approx. weight: 11 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
5	4.75-5.25	IC5N13.5



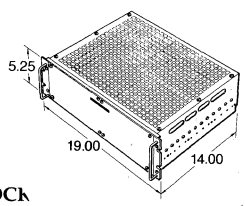
STOCK DELIVERY

25.0A @ 40°C—$258.00
OR
21.5A @ 55°C
16.5A @ 71°C

Case size: P1
Approx. weight: 19 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
5	4.75-5.25	IC5N25



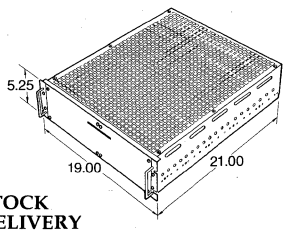
STOCK DELIVERY

70A @ 40°C—$529.00
OR
60A @ 55°C
50A @ 71°C

Case size: S1
Approx. weight: 52 lbs.
OVP: $60.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
5	4.75-5.25	IC5N70



STOCK DELIVERY

100A @ 40°C—$835.00
OR
90A @ 55°C
75A @ 71°C

Case size: S2
Approx. weight: 83 lbs.
OVP: $85.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
5	4.75-5.25	IC5N100

DC Power Supply Modules
GUARANTEED FOREVER
acdc electronics inc.

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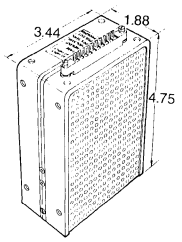
DC POWER SUPPLY MODULES / BX SERIES / 0.01% REGULATION / UP TO 30 VDC / 71°C OPERATING



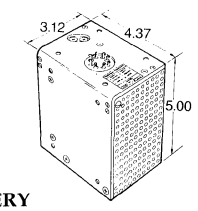
STOCK DELIVERY

300MA – $76.00

Case size: M1
Approx. weight: 1.6 lbs.
OVP: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BX2N0.3
4	3-5	BX4N0.3
5*	4-6	BX5N0.3
6	5-7	BX6N0.3
8	7-9	BX8N0.3
10	9-11	BX10N0.3
12	11-13	BX12N0.3
14	13-15	BX14N0.3
16	15-17	BX16N0.3
18	17-19	BX18N0.3
20	19-21	BX20N0.3
22	21-23	BX22N0.3
24	23-25	BX24N0.3
26	25-27	BX26N0.3
28	27-29	BX28N0.3



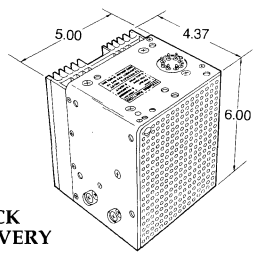
STOCK DELIVERY

1.2A – $116.00

Case size: A1
Approx. weight: 4 lbs.
OVP: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BX2N1.2
4	3-5	BX4N1.2
5*	4-6	BX5N1.2
6	5-7	BX6N1.2
8	7-9	BX8N1.2
10	9-11	BX10N1.2
12	11-13	BX12N1.2
14	13-15	BX14N1.2
16	15-17	BX16N1.2
18	17-19	BX18N1.2
20	19-21	BX20N1.2
22	21-23	BX22N1.2
24	23-25	BX24N1.2
26	25-27	BX26N1.2
28	27-29	BX28N1.2



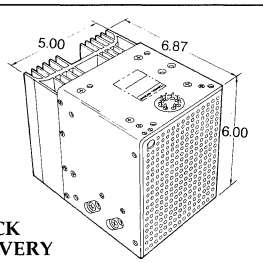
STOCK DELIVERY

2.5A – $137.00

Case size: B1
Approx. Weight: 8 lbs.
OVP: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BX2N2.5
4	3-5	BX4N2.5
5*	4-6	BX5N2.5
6	5-7	BX6N2.5
8	7-9	BX8N2.5
10	9-11	BX10N2.5
12	11-13	BX12N2.5
14	13-15	BX14N2.5
16	15-17	BX16N2.5
18	17-19	BX18N2.5
20	19-21	BX20N2.5
22	21-23	BX22N2.5
24	23-25	BX24N2.5
26	25-27	BX26N2.5
28	27-29	BX28N2.5



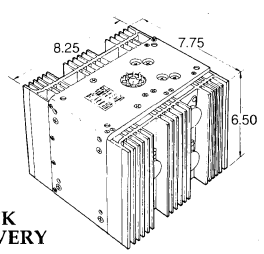
STOCK DELIVERY

5.0A – $184.00

Case size: D1 (voltages thru 10V packaged in C1 case)
Approx. weight: 14 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BX2N5.0
4	3-5	BX4N5.0
5*	4-6	BX5N5.0
6	5-7	BX6N5.0
8	7-9	BX8N5.0
10	9-11	BX10N5.0
12	11-13	BX12N5.0
14	13-15	BX14N5.0
16	15-17	BX16N5.0
18	17-19	BX18N5.0
20	19-21	BX20N5.0
22	21-23	BX22N5.0
24	23-25	BX24N5.0
26	25-27	BX26N5.0
28	27-29	BX28N5.0



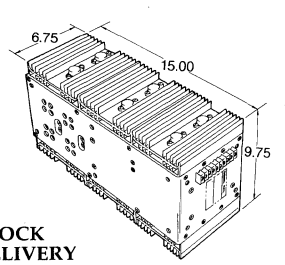
STOCK DELIVERY

10.0A – $274.00

Case size: F1 (voltages thru 6V packaged in E1 case)
Approx. weight: 25 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BX2N10
4	3-5	BX4N10
5*	4-6	BX5N10
6	5-7	BX6N10
8	7-9	BX8N10
10	9-11	BX10N10
12	11-13	BX12N10
14	13-15	BX14N10
16	15-17	BX16N10
18	17-19	BX18N10
20	19-21	BX20N10
22	21-23	BX22N10
24	23-25	BX24N10
26	25-27	BX26N10
28	27-29	BX28N10



STOCK DELIVERY

20.0A – $395.00

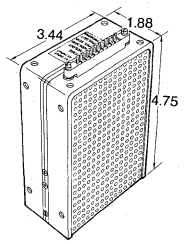
Case size: H1 (voltages thru 14V packaged in G1 case)
Approx. weight: 46 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BX2N20
4	3-5	BX4N20
5*	4-6	BX5N20
6	5-7	BX6N20
8	7-9	BX8N20
10	9-11	BX10N20
12	11-13	BX12N20
14	13-15	BX14N20
16	15-17	BX16N20
18	17-19	BX18N20
20	19-21	BX20N20
22	21-23	BX22N20
24	23-25	BX24N20
26	25-27	BX26N20
28	27-29	BX28N20

See also new IC line of integrated circuit supplies.

DC POWER SUPPLY MODULES / BC SERIES / 0.5% REGULATION / UP TO 30 VDC / 71°C OPERATING

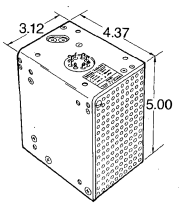


300MA – $73.00

Case size: M1
Approx. weight: 1.6 lbs.
OVP: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BC2N0.3
4	3-5	BC4N0.3
5*	4-6	BC5N0.3
6	5-7	BC6N0.3
8	7-9	BC8N0.3
10	9-11	BC10N0.3
12	11-13	BC12N0.3
14	13-15	BC14N0.3
16	15-17	BC16N0.3
18	17-19	BC18N0.3
20	19-21	BC20N0.3
22	21-23	BC22N0.3
24	23-25	BC24N0.3
26	25-27	BC26N0.3
28	27-29	BC28N0.3

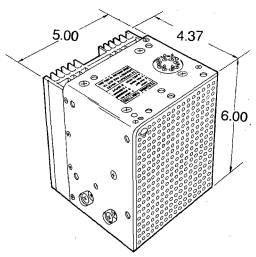


1.2A – $111.00

Case size: A1
Approx. weight: 4 lbs.
OVP: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BC2N1.2
4	3-5	BC4N1.2
5*	4-6	BC5N1.2
6	5-7	BC6N1.2
8	7-9	BC8N1.2
10	9-11	BC10N1.2
12	11-13	BC12N1.2
14	13-15	BC14N1.2
16	15-17	BC16N1.2
18	17-19	BC18N1.2
20	19-21	BC20N1.2
22	21-23	BC22N1.2
24	23-25	BC24N1.2
26	25-27	BC26N1.2
28	27-29	BC28N1.2

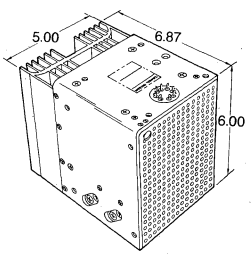


2.5A – $132.00

Case size: B1
Approx. weight: 8 lbs.
OVP: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BC2N2.5
4	3-5	BC4N2.5
5*	4-6	BC5N2.5
6	5-7	BC6N2.5
8	7-9	BC8N2.5
10	9-11	BC10N2.5
12	11-13	BC12N2.5
14	13-15	BC14N2.5
16	15-17	BC16N2.5
18	17-19	BC18N2.5
20	19-21	BC20N2.5
22	21-23	BC22N2.5
24	23-25	BC24N2.5
26	25-27	BC26N2.5
28	27-29	BC28N2.5

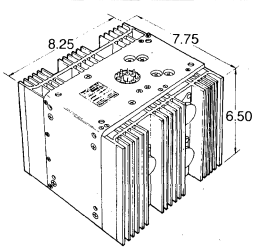


5.0A – $178.00

Case size: D1 (voltages thru 10V packaged in C1 case)
Approx. weight: 14 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BC2N5.0
4	3-5	BC4N5.0
5*	4-6	BC5N5.0
6	5-7	BC6N5.0
8	7-9	BC8N5.0
10	9-11	BC10N5.0
12	11-13	BC12N5.0
14	13-15	BC14N5.0
16	15-17	BC16N5.0
18	17-19	BC18N5.0
20	19-21	BC20N5.0
22	21-23	BC22N5.0
24	23-25	BC24N5.0
26	25-27	BC26N5.0
28	27-29	BC28N5.0

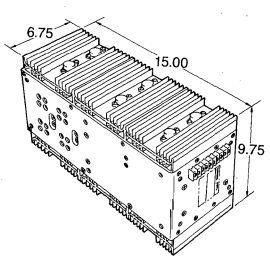


10.0A – $265.00

Case size: F1 (voltages thru 6V packaged in E1 case)
Approx. weight: 25 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BC2N10
4	3-5	BC4N10
5*	4-6	BC5N10
6	5-7	BC6N10
8	7-9	BC8N10
10	9-11	BC10N10
12	11-13	BC12N10
14	13-15	BC14N10
16	15-17	BC16N10
18	17-19	BC18N10
20	19-21	BC20N10
22	21-23	BC22N10
24	23-25	BC24N10
26	25-27	BC26N10
28	27-29	BC28N10



20.0A – $384.00

Case size: H1 (voltages thru 14V packaged in G1 case)
Approx. weight: 46 lbs.
OVP: $30.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

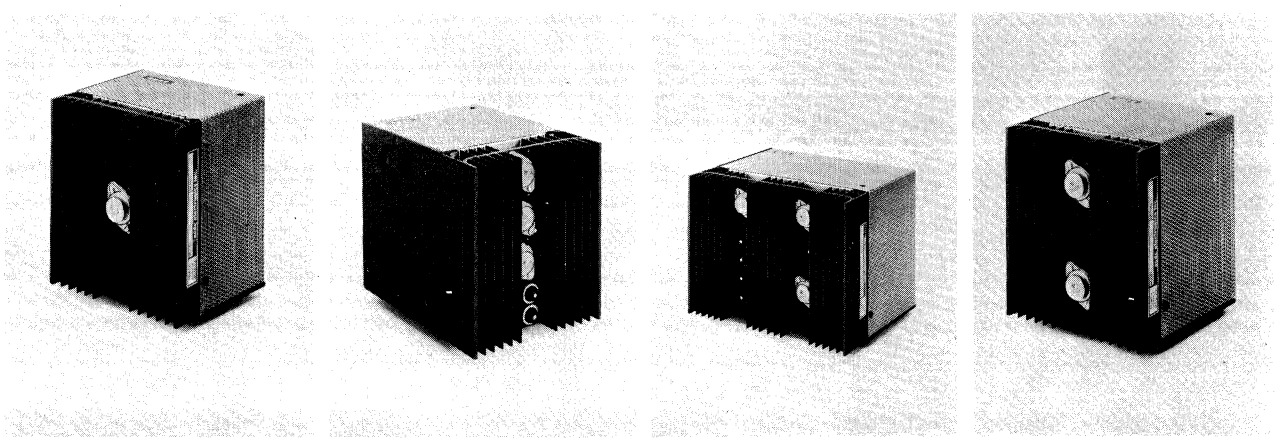
VOLTS	VOLTAGE RANGE	MODEL NO.
2	0-3	BC2N20
4	3-5	BC4N20
5*	4-6	BC5N20
6	5-7	BC6N20
8	7-9	BC8N20
10	9-11	BC10N20
12	11-13	BC12N20
14	13-15	BC14N20
16	15-17	BC16N20
18	17-19	BC18N20
20	19-21	BC20N20
22	21-23	BC22N20
24	23-25	BC24N20
26	25-27	BC26N20
28	27-29	BC28N20

See also new IC line of integrated circuit supplies.

DC POWER SUPPLY MODULES / BC AND BX SERIES / 30 TO 400 VDC / 71°C OPERATING

VOLTS	VOLTAGE RANGE	CURRENT AMPS	SIZE CODE	0.01% REG. MODEL NO.	0.01% REG. PRICE	0.5% REG. MODEL NO.	0.5% REG. PRICE
30	29-31	0.3	M1	BX30N0.3	$ 92	BC30N0.3	$ 82
		1.2	B1	BX30N1.2	139	BC30N1.2	128
		2.5	C1	BX30N2.5	197	BC30N2.5	189
		5.0	E1	BX30N5.0	257	BC30N5.0	248
32	31-33	0.3	A1	BX32N0.3	$118	BC32N0.3	$112
		1.2	B1	BX32N1.2	139	BC32N1.2	128
		2.5	C1	BX32N2.5	197	BC32N2.5	189
		5.0	E1	BX32N5.0	257	BC32N5.0	248
34	33-35	0.3	A1	BX34N0.3	$118	BC34N0.3	$112
		1.2	B1	BX34N1.2	139	BC34N1.2	128
		2.5	C1	BX34N2.5	197	BC34N2.5	189
		5.0	E1	BX34N5.0	257	BC34N5.0	248
36	35-37	0.3	A1	BX36N0.3	$118	BC36N0.3	$112
		1.2	B1	BX36N1.2	139	BC36N1.2	128
		2.5	C1	BX36N2.5	197	BC36N2.5	189
		5.0	E1	BX36N5.0	257	BC36N5.0	248
38	37-39	0.3	A1	BX38N0.3	$118	BC38N0.3	$112
		1.2	B1	BX38N1.2	139	BC38N1.2	128
		2.5	C1	BX38N2.5	197	BC38N2.5	189
		5.0	E1	BX38N5.0	257	BC38N5.0	248
40	39-41	0.3	A1	BX40N0.3	$118	BC40N0.3	$112
		1.2	B1	BX40N1.2	139	BC40N1.2	128
		2.5	C1	BX40N2.5	197	BC40N2.5	189
		5.0	E1	BX40N5.0	257	BC40N5.0	248
42	41-43	0.3	A1	BX42N0.3	$118	BC42N0.3	$112
		1.2	B1	BX42N1.2	139	BC42N1.2	128
		2.5	C1	BX42N2.5	197	BC42N2.5	189
		5.0	E1	BX42N5.0	257	BC42N5.0	248
44	43-45	0.3	A1	BX44N0.3	$118	BC44N0.3	$112
		1.2	B1	BX44N1.2	139	BC44N1.2	128
		2.5	C1	BX44N2.5	197	BC44N2.5	189
		5.0	E1	BX44N5.0	257	BC44N5.0	248
46	45-47	0.3	A1	BX46N0.3	$118	BC46N0.3	$112
		1.2	B1	BX46N1.2	139	BC46N1.2	128
		2.5	C1	BX46N2.5	197	BC46N2.5	189
		5.0	E1	BX46N5.0	257	BC46N5.0	248
48	47-49	0.3	A1	BX48N0.3	$118	BC48N0.3	$112
		1.2	B1	BX48N1.2	139	BC48N1.2	128
		2.5	C1	BX48N2.5	197	BC48N2.5	189
		5.0	E1	BX48N5.0	257	BC48N5.0	248
50	49-51	0.3	A1	BX50N0.3	$118	BC50N0.3	$112
		1.2	B1	BX50N1.2	139	BC50N1.2	128
		2.5	C1	BX50N2.5	197	BC50N2.5	189
		5.0	E1	BX50N5.0	257	BC50N5.0	248
60	55-65	0.1	M1	BX60N0.1	$ 93	BC60N0.1	$ 88
		0.4	A1	BX60N0.4	148	BC60N0.4	138
		0.6	B1	BX60N0.6	168	BC60N0.6	147
		1.2	C1	BX60N1.2	193	BC60N1.2	178
70	65-75	0.1	M1	BX70N0.1	$ 93	BC70N0.1	$ 88
		0.4	A1	BX70N0.4	148	BC70N0.4	138
		0.6	B1	BX70N0.6	158	BC70N0.6	147
		1.2	C1	BX70N1.2	193	BC70N1.2	178
80	75-85	0.1	M1	BX80N0.1	$ 93	BC80N0.1	$ 88
		0.4	A1	BX80N0.4	148	BC80N0.4	138
		0.6	B1	BX80N0.6	158	BC80N0.6	147
		1.2	C1	BX80N1.2	193	BC80N1.2	178
90	85-95	0.1	M1	BX90N0.1	$ 93	BC90N0.1	$ 88
		0.4	B1	BX90N0.4	158	BC90N0.4	147
		0.6	B1	BX90N0.6	163	BC90N0.6	150
		1.2	C1	BX90N1.2	249	BC90N1.2	228
100	90-110	0.2	A1	BX100N0.2	$148	BC100N0.2	$138
		0.4	B1	BX100N0.4	176	BC100N0.4	167
		0.6	B1	BX100N0.6	186	BC100N0.6	178
		1.2	D1	BX100N1.2	249	BC100N1.2	228
150	140-160	0.1	A1	BX150N0.1	$138	BC150N0.1	$126
		0.2	A1	BX150N0.2	148	BC150N0.2	138
		0.4	B1	BX150N0.4	176	BC150N0.4	167
		0.6	C1	BX150N0.6	193	BC150N0.6	178
200	190-210	0.1	A1	BX200N0.1	$158	BC200N0.1	$147
		0.2	B1	BX200N0.2	176	BC200N0.2	167
		0.4	C1	BX200N0.4	193	BC200N0.4	178
		0.6*	D2	BX200N0.6	249	BC200N0.6	228
250	240-260	0.1	A1	BX250N0.1	$158	BC250N0.1	$147
		0.2	B1	BX250N0.2	176	BC250N0.2	167
		0.4*	C1	BX250N0.4	216	BC250N0.4	199
		0.6*	D1	BX250N0.6	249	BC250N0.6	228
300	290-310	0.1*	B1	BX300N0.1	$186	BC300N0.1	$170
		0.2*	C1	BX300N0.2	193	BC300N0.2	178
		0.4*	C1	BX300N0.4	216	BC300N0.4	199
		0.6*	E1	BX300N0.6	282	BC300N0.6	248
350	340-360	0.1*	B1	BX350N0.1	$186	BC350N0.1	$170
		0.2*	C1	BX350N0.2	193	BC350N0.2	178
		0.4*	D2	BX350N0.4	216	BC350N0.4	199
		0.6*	E1	BX350N0.6	282	BC350N0.6	248
400	390-410	0.1*	B1	BX400N0.1	$186	BC400N0.1	$170
		0.2*	C1	BX400N0.2	193	BC400N0.2	178
		0.4*	D2	BX400N0.4	216	BC400N0.4	199
		0.6*	E1	BX400N0.6	282	BC400N0.6	248

*D.C. Fused.



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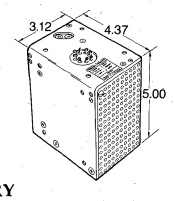
acdc electronics inc.

DUAL OUTPUT MODULES / OA SERIES / 0.01% REGULATION / ± 12 VDC & 15 VDC / 71°C OPERATING



STOCK DELIVERY

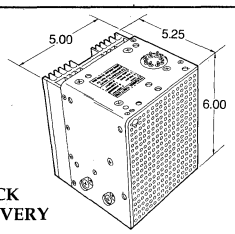
1.4A @ 40°C—$149.00
OR
1.2A @ 55°C,
1.0A @ 71°C

Case size: A1
Approx. weight: 5 lbs.
OVP: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
± 12	11-13	OA12D1.4
± 15	14-16	OA15D1.4

Note: On the dual supplies listed above the positive and negative outputs track each other by use of a common reference.



STOCK DELIVERY

3.7A @ 40°C—$195.00
OR
3.5A @ 55°C,
3.0A @ 71°C

Case size: C1
Approx. weight: 11 lbs.
OVP: $20.00

If overvoltage protection is desired, add -1 to model number to indicate this option.

VOLTS	VOLTAGE RANGE	MODEL NO.
± 12	11-13	OA12D3.7
± 15	14-16	OA15D3.7

Note: On the dual supplies listed above the positive and negative outputs track each other by use of a common reference.

DUAL OUTPUT MODULES BX & BC SERIES UP TO ± 50 VDC 71°C OPERATING

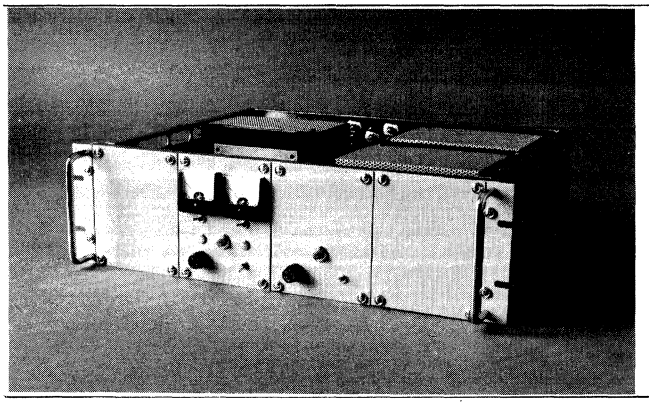
VOLTS	VOLTAGE RANGE	CURRENT AMPS	SIZE CODE	0.01% REG. MODEL NO.	0.01% REG. PRICE	0.5% REG. MODEL NO.	0.5% REG. PRICE
±2	0-3	0.3	A1	BX2D0.3	$154	BC2D0.3	$139
		0.6	A1	BX2D0.6	175	BC2D0.6	167
		1.2	C1	BX2D1.2	215	BC2D1.2	203
		2.5	C1	BX2D2.5	254	BC2D2.5	239
±4	3-5	0.3	A1	BX4D0.3	$154	BC4D0.3	$139
		0.6	A1	BX4D0.6	175	BC4D0.6	167
		1.2	C1	BX4D1.2	215	BC4D1.2	203
		2.5	C1	BX4D2.5	254	BC4D2.5	239
±5	4-6	0.3	A1	BX5D0.3	$154	BC5D0.3	$139
		0.6	A1	BX5D0.6	175	BC5D0.6	167
		1.2	C1	BX5D1.2	215	BC5D1.2	203
		2.5	C1	BX5D2.5	254	BC5D2.5	239
±6	5-7	0.3	A1	BX6D0.3	$154	BC6D0.3	$139
		0.6	A1	BX6D0.6	175	BC6D0.6	167
		1.2	C1	BX6D1.2	215	BC6D1.2	203
		2.5	C1	BX6D2.5	254	BC6D2.5	239
±8	7-9	0.3	A1	BX8D0.3	$154	BC8D0.3	$139
		0.6	A1	BX8D0.6	175	BC8D0.6	167
		1.2	C1	BX8D1.2	215	BC8D1.2	203
		2.5	C1	BX8D2.5	254	BC8D2.5	239
±10	9-11	0.3	A1	BX10D0.3	$154	BC10D0.3	$139
		0.6	A1	BX10D0.6	175	BC10D0.6	167
		1.2	C1	BX10D1.2	215	BC10D1.2	203
		2.5	C1	BX10D2.5	254	BC10D2.5	239
±12	11-13	See new OA Series of Dual Power Modules					
±14	13-15	0.3	A1	BX14D0.3	$154	BC14D0.3	$139
		0.6	A1	BX14D0.6	175	BC14D0.6	167
		1.2	C1	BX14D1.2	215	BC14D1.2	203
		2.5	C1	BX14D2.5	254	BC14D2.5	239
±15	14-16	See new OA Series of Dual Power Modules					
±16	15-17	0.3	A1	BX16D0.3	$154	BC16D0.3	$139
		0.6	A1	BX16D0.6	175	BC16D0.6	167
		1.2	C1	BX16D1.2	215	BC16D1.2	203
		2.5	C1	BX16D2.5	254	BC16D2.5	239
±18	17-19	0.3	A1	BX18D0.3	$154	BC18D0.3	$139
		0.6	A1	BX18D0.6	175	BC18D0.6	167
		1.2	C1	BX18D1.2	215	BC18D1.2	203
		2.5	C1	BX18D2.5	254	BC18D2.5	239
±20	19-21	0.3	A1	BX20D0.3	$154	BC20D0.3	$139
		0.6	A1	BX20D0.6	175	BC20D0.6	167
		1.2	C1	BX20D1.2	215	BC20D1.2	203
		2.5	D1	BX20D2.5	273	BC20D2.5	248
±22	21-23	0.3	A1	BX22D0.3	$154	BC22D0.3	$139
		0.6	A1	BX22D0.6	175	BC22D0.6	167
		1.2	C1	BX22D1.2	215	BC22D1.2	203
		2.5	D1	BX22D2.5	273	BC22D2.5	248
±24	23-25	0.3	A1	BX24D0.3	$154	BC24D0.3	$139
		0.6	A1	BX24D0.6	175	BC24D0.6	167
		1.2	C1	BX24D1.2	215	BC24D1.2	203
		2.5	D1	BX24D2.5	273	BC24D2.5	248

VOLTS	VOLTAGE RANGE	CURRENT AMPS	SIZE CODE	0.01% REG. MODEL NO.	0.01% REG. PRICE	0.5% REG. MODEL NO.	0.5% REG. PRICE
±26	25-27	0.3	A1	BX26D0.3	$154	BC26D0.3	$139
		0.6	A1	BX26D0.6	175	BC26D0.6	167
		1.2	C1	BX26D1.2	215	BC26D1.2	203
		2.5	D1	BX26D2.5	273	BC26D2.5	248
±28	27-29	0.3	A1	BX28D0.3	$154	BC28D0.3	$139
		0.6	A1	BX28D0.6	175	BC28D0.6	167
		1.2	C1	BX28D1.2	215	BC28D1.2	203
		2.5	D1	BX28D2.5	273	BC28D2.5	248
±30	29-31	0.3	A1	BX30D0.3	$154	BC30D0.3	$139
		0.6	A1	BX30D0.6	175	BC30D0.6	167
		1.2	C1	BX30D1.2	215	BC30D1.2	203
		2.5	E2	BX30D2.5	298	BC30D2.5	275
±32	31-33	0.3	A1	BX32D0.3	$154	BC32D0.3	$139
		0.6	A1	BX32D0.6	175	BC32D0.6	167
		1.2	C1	BX32D1.2	215	BC32D1.2	203
		2.5	E2	BX32D2.5	298	BC32D2.5	275
±34	33-35	0.3	A1	BX34D0.3	$154	BC34D0.3	$139
		0.6	B1	BX34D0.6	195	BC34D0.6	180
		1.2	C1	BX34D1.2	215	BC34D1.2	203
		2.5	E2	BX34D2.5	298	BC34D2.5	275
±36	35-37	0.3	A1	BX36D0.3	$154	BC36D0.3	$139
		0.6	B1	BX36D0.6	195	BC36D0.6	180
		1.2	C1	BX36D1.2	215	BC36D1.2	203
		2.5	E2	BX36D2.5	298	BC36D2.5	275
±38	37-39	0.3	A1	BX38D0.3	$154	BC38D0.3	$139
		0.6	B1	BX38D0.6	195	BC38D0.6	180
		1.2	C1	BX38D1.2	215	BC38D1.2	203
		2.5	E2	BX38D2.5	298	BC38D2.5	275
±40	39-41	0.3	A1	BX40D0.3	$154	BC40D0.3	$139
		0.6	B1	BX40D0.6	195	BC40D0.6	180
		1.2	C1	BX40D1.2	215	BC40D1.2	203
		2.5	E2	BX40D2.5	298	BC40D2.5	275
±42	41-43	0.3	A1	BX42D0.3	$154	BC42D0.3	$139
		0.6	B1	BX42D0.6	195	BC42D0.6	180
		1.2	C1	BX42D1.2	215	BC42D1.2	203
		2.5	E2	BX42D2.5	298	BC42D2.5	275
±44	43-45	0.3	A1	BX44D0.3	$154	BC44D0.3	$139
		0.6	B1	BX44D0.6	195	BC44D0.6	180
		1.2	C1	BX44D1.2	215	BC44D1.2	203
		2.5	E2	BX44D2.5	298	BC44D2.5	275
±46	45-47	0.3	A1	BX46D0.3	$154	BC46D0.3	$139
		0.6	B1	BX46D0.6	195	BC46D0.6	180
		1.2	C1	BX46D1.2	215	BC46D1.2	203
		2.5	E2	BX46D2.5	298	BC46D2.5	275
±48	47-49	0.3	A1	BX48D0.3	$154	BC48D0.3	$139
		0.6	B1	BX48D0.6	195	BC48D0.6	180
		1.2	C1	BX48D1.2	215	BC48D1.2	203
		2.5	E2	BX48D2.5	298	BC48D2.5	275
±50	49-51	0.3	A1	BX50D0.3	$154	BC50D0.3	$139
		0.6	B1	BX50D0.6	195	BC50D0.6	180
		1.2	C1	BX50D1.2	215	BC50D1.2	203
		2.5	E2	BX50D2.5	298	BC50D2.5	275

GUARANTEED FOREVER

acdc electronics inc. 2979 North Ontario Street, Burbank, California 91504, (213) 849-2414

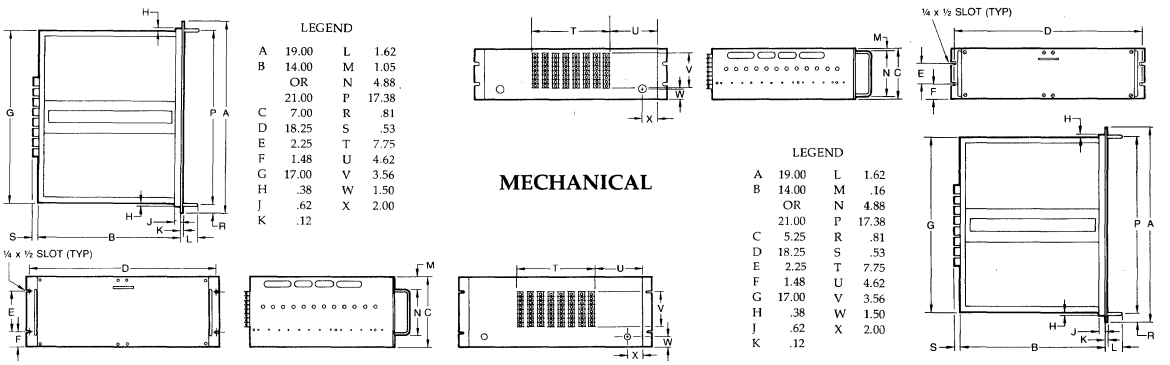
UNIVERSAL RACK ASSEMBLIES



FEATURES

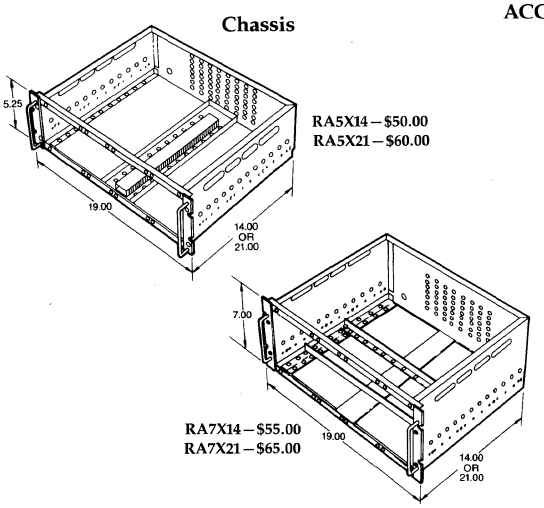
New from ACDC! Now, any ACDC power supply module can be mounted in either the 5¼" or 7" universal rack adapters shown below. Case sizes A1 thru D2 and case sizes J1, L1, M1, N1 and P1 can be mounted in the 5¼" rack. Any ACDC power supply module can be mounted in the 7" adapter. There are no holes to drill. Just assemble using the mounting hardware furnished with each rack. Front panels are finished in grey enamel and the chassis is finished in yellow cadmium. Panel options range from blank front panels to control consoles which are provided in metered or non-metered versions. Any two modules can be controlled and monitored from a single control console. Cabling is simplified in the 5¼" rack by the addition of an enclosed cable race which is located in the center of the chassis. Modules terminate to standard eight position barrier strips on the rear of the chassis. When ordering, specify the desired rack adapter, front panel and termination options, and mounting plates. Chassis slides are also available.

MECHANICAL



ACCESSORIES

Chassis

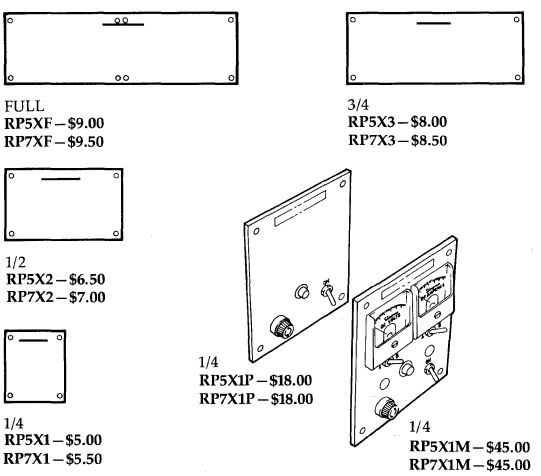


RA5X14—$50.00
RA5X21—$60.00

RA7X14—$55.00
RA7X21—$65.00

STOCK DELIVERY

Panels



FULL
RP5XF—$9.00
RP7XF—$9.50

3/4
RP5X3—$8.00
RP7X3—$8.50

1/2
RP5X2—$6.50
RP7X2—$7.00

1/4
RP5X1P—$18.00
RP7X1P—$18.00

1/4
RP5X1—$5.00
RP7X1—$5.50

1/4
RP5X1M—$45.00
RP7X1M—$45.00

STOCK DELIVERY

Module Mounting



RM2—$2.50
A1 (Horizontal) B1, B2, C1, C2, D1, D2

RM4—$2.50
K1, L1, N1, P1

RM1—$1.75
M1, A1 (Vertical)

RM3—$N/C
(included with RA7X14 & RA7X21)
E1, F1

G1, H1 mount directly in RA7X14 & RA7X21

STOCK DELIVERY

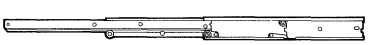
Barrier Strips



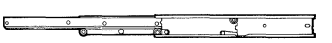
RH8—$1.90

STOCK DELIVERY

Chassis Slides



RS1X21 (pr)—$52.00



RS1X14 (pr)—$48.00

STOCK DELIVERY

acdc electronics inc.

ACDC SPECIAL POWER SUPPLIES

Digital Programmables

Continuing to explore new applications for wide range programmable power supplies, ACDC has designed and manufactured digital programmable modules with voltage ranges up to 100VDC and current ranges up to 0.5A. These units can be programmed for either voltage or current. Resolution is 10MV or 1μA. Programming is accomplished through the use of BCD input. The slewing rate is better than 10,000 volts/second. Common applications for these units are in digital systems requiring rapid and precise changes of voltage and current references such as found in integrated circuit testers.

Wide Range Programmables

ACDC manufactures a comprehensive line of wide range programmable power supply modules with voltages up to 50VDC and currents up to 2.5A. These modules have found broad customer acceptance in programmed equipment and laboratory applications where a stable DC voltage reference is required. Modules can be metered and operated in convective air ambients up to 71°C with no additional heatsinking. Units are completely encased to protect them from damage. Listed below is a selection of standard ACDC wide range programmable modules:

WIDE RANGE PROGRAMMABLE MODULES

VOLTAGE RANGE	CURRENT AMPS	SIZE CODE	0.01% REG. MODEL NO.	0.01% REG. PRICE	0.5% REG. MODEL NO.	0.5% REG. PRICE
0-25	0.1	M1	BX25P0.1	$126	BC25P0.1	$119
	0.4	A1	BX25P0.4	$159	BC25P0.4	$148
	1.2	A2	BX25P1.2	$186	BC25P1.2	$159
	2.5	B2	BX25P2.5	$216	BC25P2.5	$178
0-50	0.1	M1	BX50P0.1	$143	BC50P0.1	$136
	0.2	A1	BX50P0.2	$167	BC50P0.2	$150
	0.6	A2	BX50P0.6	$186	BC50P0.6	$159
	1.2	B2	BX50P1.2	$216	BC50P1.2	$178

Multiple Output Power Supplies

Often, a customer's need for more than one output can best be served with a multiple output power supply. ACDC has produced numerous devices of this type. ACDC also provides universal rack adapters for the consolidation of any of our power supply modules. Please call upon us to consult in the selection of the best solution to your applications problem.

Memory Power Supplies

With the ever increasing demand for computer logic in modern electronic circuitry, ACDC has specialized in providing DC power sources to be used in conjunction with memory applications. These supplies feature separate logic and memory drive outputs. The memory drive can be made temperature programmable and proper turn-on and turn-off sequencing between the various outputs can be provided as required.

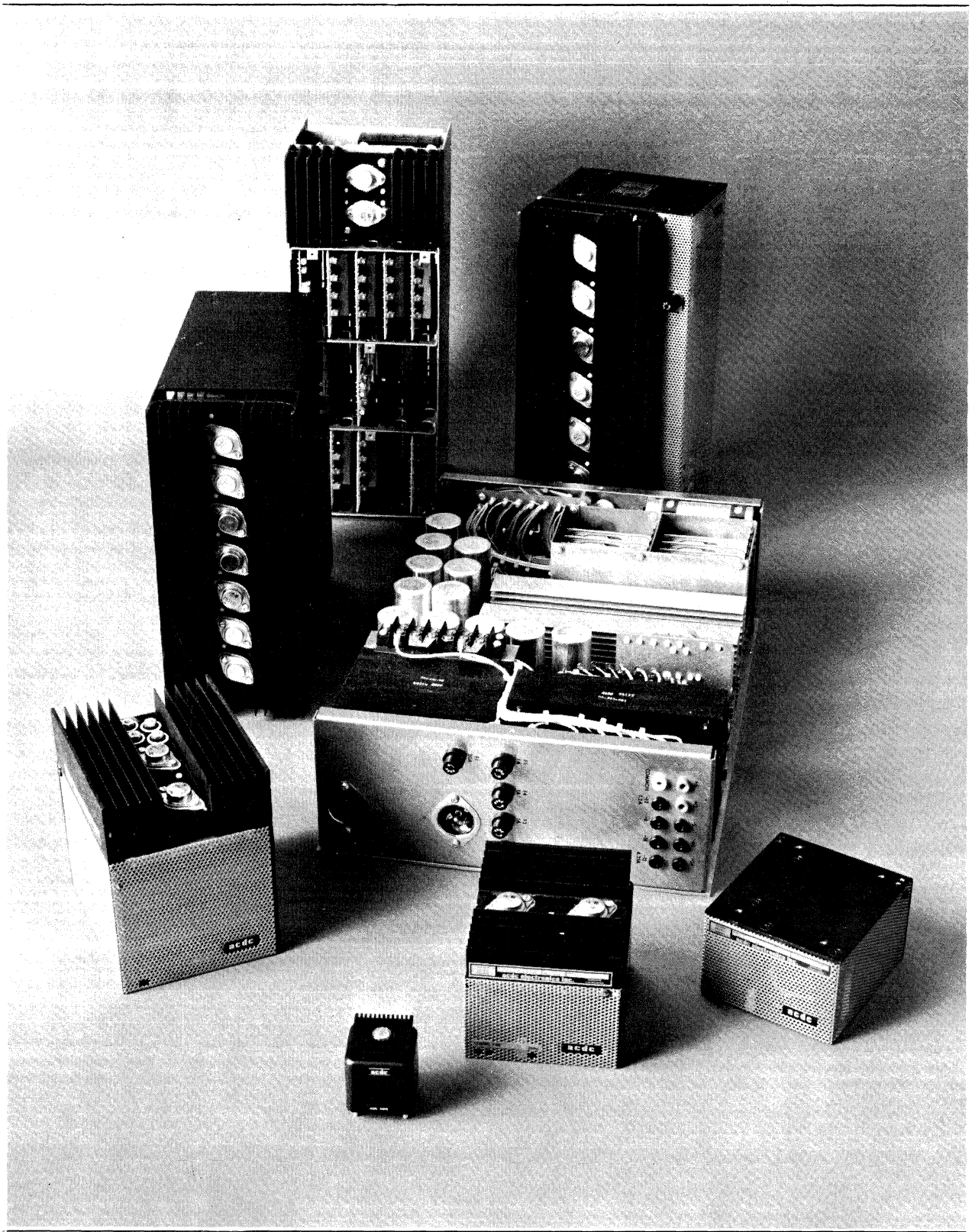
DC to DC Converters

ACDC combines its knowledge of Class A and switching regulators to assist industry in its ever increasing requirement for DC voltage transformation. To the user, this means smaller volumes, less weight and less power dissipation. Through the use of advanced circuit techniques, ACDC can provide 50% better power efficiencies in one fifth the volume of conventional approaches.

Digital Readout Power Supplies

With the advent of digital display equipment utilizing tube type readouts, requirements exist for DC power sources employing voltages of approximately 170 volts at current levels up to 40MA. A regulation of 2% is normally acceptable for these needs. As an example, the requirement outlined above can be accommodated in a volume measuring 1⅝"x1⅝"x2¼". More detailed information regarding this type of power supply may be obtained by discussing your particular requirements with our factory.

ACDC SPECIAL POWER SUPPLIES



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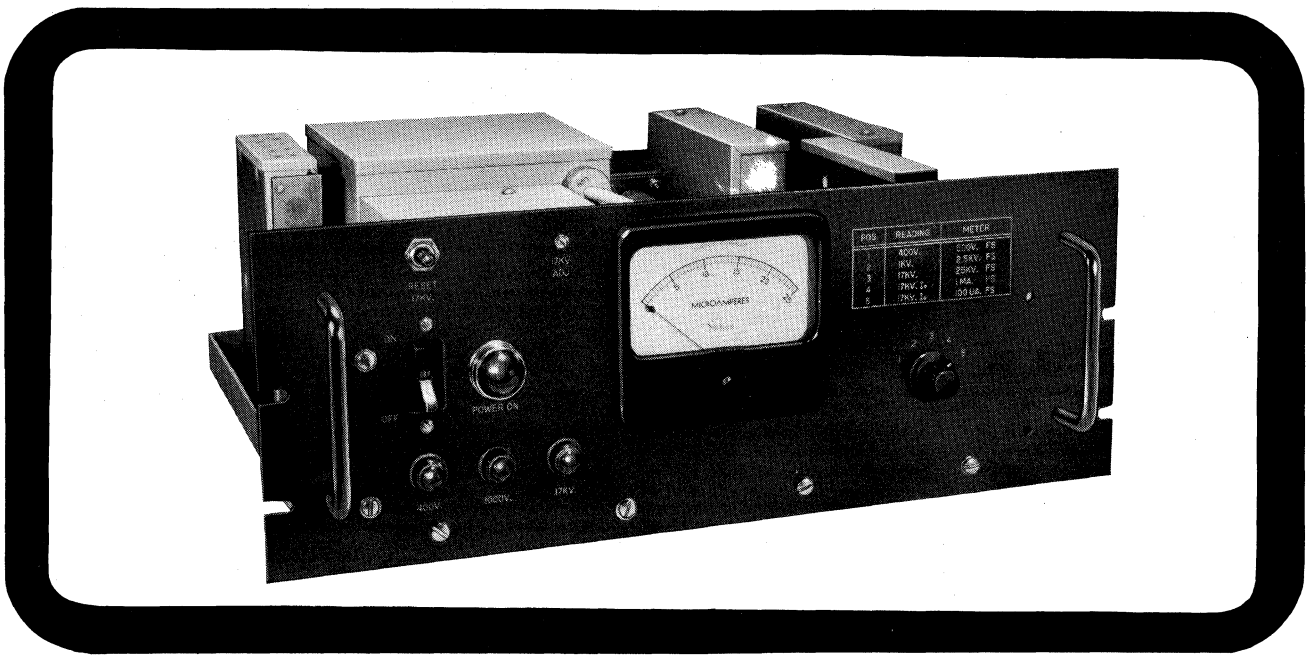
A-MP* SOLID STATE HIGH VOLTAGE POWER CONVERSION



The CAPITRON Division of AMP Incorporated has complete in-house facilities for designing and manufacturing power assemblies, including metal forming, printed circuit board fabrication, magnetics winding, encapsulating, and environmental testing. In addition, the use of AMPLIFILM* capacitor products enables CAPITRON engineers to design higher power into smaller packages for both military and commercial applications.

Solid state and conventional units are characterized by tight regulation, low ripple voltage, and dense, rugged construction. All are pre-engineered to specific customer requirements.

The rack and panel mounted multiple output supply shown is intended for use in normal office environments. All output voltages and current are read from a single panel meter. All voltages are short-circuit proof and a system malfunction will turn off the 17 KV output until it is reset.

A unique feature is the operation of the "power present" indicators: Low input line voltage turns off logic circuits, all supplies and indicators; high output voltage from any supply turns off logic, but not output power; overcurrent from any supply turns off its logic and its indicator.

SPECIFICATIONS:

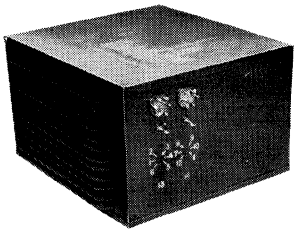
Adjustable outputs	17 KV, 1 KV
Fixed output	400 V
Current ranges	0.1 to 1 ma
Regulation	.01% to 1%
Ripple	.05%

Also available are special purpose power supplies for CRT, Energy Storage, Laser, Traveling Wave Tube and Programmable applications. The CAPITRON Division is equipped to satisfy special design requirements on short notice.

*Trademark of AMP Incorporated

MORE POWER TO

LOW VOLTAGE POWER SUPPLIES



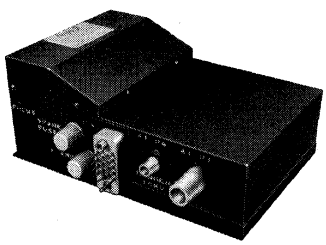
A typical multiple output type, this unit is not only short circuit proof between any output and ground, and between all outputs, but provides automatic over-voltage / undervoltage shutdown and output current limitation to 150% of rated value. All outputs are isolated with respect to the input, and the unit meets RFI requirements of MIL-I-6181.

Input: 20-29 VDC
Outputs:
300 VDC ±2% @ 70 ma.
250 VDC ±2% @ 150 ma.
55 VDC ±2% @ 220 ma.
22 VDC ±2% @ 800 ma.
6 VDC ±2% @ 10 ma.
−0.5 VDC nom. @ 10 ma.
(ext. adj. from +.0.2 to −1.4 VDC)
−20 VDC ±2% @ 25 ma.
−150 VDC ±2% @ 180 ma.

Regulation:
±1.0% line and load
Ripple: 0.017% pk-pk
Altitude:
10,000 ft. (operational)
Temperature:
−54° to +55° C
Shock Vibration:
MIL-E-5400
Size: 8″ x 8″ x 5″
Weight: 19 lb. max.

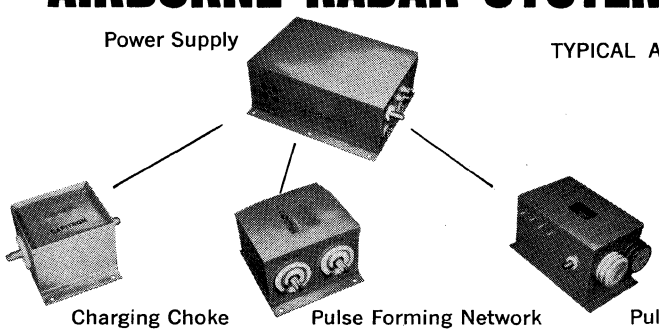
HEADS-UP CRT POWER SUPPLIES

Ripple: .05%
Regulation: ±0.1%
Volume: less than 50 cu. in.
Weight: 3¼ lbs.
Temperature:
−55°C to 110°C
MIL-E-5400



Input: 115 V, 400 cps MIL-STD-704
Outputs:
15 KVDC, 400 μa pk.
1.7 KV (adj. 1.4 to 2.0 KV), +30 μa to −30 μa
300 VDC, +15 μa to −15 μa

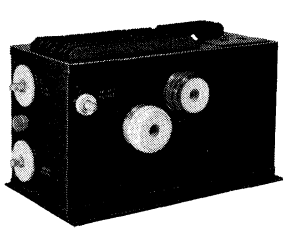
AIRBORNE RADAR SYSTEMS AND COMPONENTS



TYPICAL AIRBORNE RADAR POWER CONVERSION SYSTEM

A compact 4-module pulse system with extremely good heat sinking and klystron filament voltage regulation between 7.35 and 7.75 volts at 2 to 2½ amps. Maximum pulse ripple is only 1.0%. The largest unit is approximately ½ cu. ft. in size and weighs less than 12 lbs.

Pulse Modulator for Airborne Radar



This oil-filled pulse modulator is designed to drive the V-24 klystron family. Offering maximum power (300 KW peak) for minimum size, it has excellent square wave characteristics, providing pulses of long duration for the required repetition rate. A unique heat sinking technique effectively removes 400 watts of heat, permitting operation at 107°C ambient temperature. The package also supplies klystron input voltage variation tightly regulated to 9 +.5V/−0V with variations in temperature from −7 to 107°C, filament power from 107.5 to 119.5 volts, load current from 2 to 2.5 amps, and input frequency from 380 to 420 cps.

Performance Specifications
Input: 5 KVDC ±.25 KVDC @ 510 ma.
Output: 40 KV @ 7½ amps. 1800 pps for search followed by 2235 pps. for indefinite duration
Pulse: 2.1 μsec. read at 100% amplitude; 0.5 μsec. rise time; 0.9 μsec. fall time; 1.5% max. ripple; 10% max. backswing
Ambient Temperature: −7° C to +107° C (operational); −60° C to 121° C (storage)
Size: 10¼″ x 4¾″ x 5⅞″
Weight: 26 lbs. max.

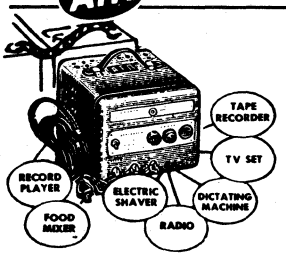
YOU, FROM →

CAPITRON DIVISION, AMP INCORPORATED
155 PARK STREET, ELIZABETHTOWN, PA. 17022.
TWX: 510-657-4561 • PHONE: 717-367-1105.

AMP
INCORPORATED

NOTE: See other CAPITRON High Voltage products under Catalog Sections 2100 and 1500.

ATR Inverters, Vibrators, "A" Eliminators, etc.



ATR DC TO AC UNIVERSAL INVERTERS

New, universal inverters for operating 110-v., 60 cycle AC equipment from DC voltages in autos, buses, trucks, boats, trains, planes and DC districts. Designed especially for standard 110-volt AC tape recorders, TV sets, radios, PA systems, electric razors, test equipment, etc. Units are carefully engineered and ruggedly constructed to provide long life operation. All feature complete RF interference suppression and exceptional frequency stability. Have operating efficiency in excess of 75%. Four-point voltage regulator corrects output voltage for minimum and maximum loads, and also helps compensate for input voltages lower or higher than normal. Inverters are recommended for use with loads having power factors in excess of 70%. Built-in toggle switch selects most efficient operation for use with TV sets or tape recorders. Inverters are not recommended for use with large motor driven appliances such as refrigerators, washing machines, etc. All have ON-Off switches. Housed in attractive brown hammerloid metal cabinet with convenient leather carrying strap. Sizes: Standard Model RSF, 8½x9⅛x5¼"; Heavy-Duty Model RHG 6⅛x11¼x8½", Extra-Heavy-Duty Model HSJ, 6½x12⅛x8½". With battery clips for instant connection to power source. Models with "P" suffix equipped with adapter cord for use in auto cigarette lighter receptacles. *Recommended for24 volt battery operation. **Before ordering, check wattage of equipment with which inverter will be used.**

Stock No.	Mfr's Type	Input D.C. Volts	A.C. Output 60 Cycles	Output Watt. Int.	Output Watt. Cont.	Shipping Weight	List Price	Net Price
	6U-RSF	6	110 Volts	100	80	22 lbs.	$ 99.00	$ 66.00
	6U-RSF-P	6	110	100	80	22	99.00	66.00
	6U-RHG	6	110	150	125	27	131.25	87.50
	6U-HSJ	6	110	175	150	37	155.25	103.50
	12U-RSF	12	110	150	125	22	89.75	59.22
	12U-RSF-P	12	110	150	125	22	89.75	59.22
	12U-RHG	12	110	200	175	27	119.50	79.66
	12U-HSJ	12	110	250	225	37	149.50	99.66
*	28U-RSF	28	110	125	100	22	109.50	73.00
*	28U-RHG	28	110	175	150	27	145.00	96.66
*	28U-HSJ	28	110	250	200	37	170.75	113.82
	32U-RSF	32	110	150	100	22	109.50	73.00
	32U-RHG	32	110	200	180	30	131.25	87.50
	32U-HSJ	32	110	325	225	37	170.75	113.82
	50U-RSF	50	110	150	100	22	109.50	73.00
	50U-RHG	50	110	225	200	27	145.00	96.66
	110U-RSF	110	110	250	150	22	89.75	59.82
	110AU-RHG	110	110	325	250	27	109.50	73.00
	110BU-RHG	110	110	450	350	30	145.00	87.50
	110U-HSJ	110	110	600	400	37	170.75	113.82
	220U-RSF	220	110	250	150	22	99.00	66.00
	220U-RHG	220	110	325	250	27	131.25	89.50
	220U-HSJ	220	110	500	300	37	170.75	113.82



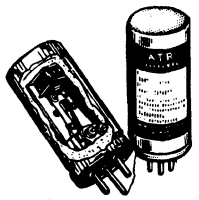
PORTABLE PLUG-IN TYPE INVERTERS

SPECIALLY DESIGNED FOR OPERATING STANDARD A. C. DICTATING MACHINES, RECORD PLAYERS, INCANDESCENT LAMPS, ELECTRIC RAZORS, ELECTRONIC TEST EQUIPMENT, AND OTHER SMALL ELECTRICAL AND ELECTRONIC DEVICES FROM D. C. VOLTAGES IN AUTOMOBILES, BUSES, TRUCKS, BOATS, PLANES, TRAINS, AND D. C. DISTRICTS.

Lightweight inverters for operating 110 v. AC equipment from DC voltage sources. Feature excellent frequency stability and high efficiency. 6 and 12-volt units plug into cigarette lighter receptacle of any vehicle; others are equipped with standard 2-prong plugs. All are designed especially for use with dictating machines; record players, electric razors, test equipment, etc. Not recommended for tape recorders and large motor driven appliances such as refrigerators, washing machines, etc. Brown Hammerloid case with leather carrying strap. Sizes: DME, 5¼x4¾x2¾"; RME and RMF, 8⅜x8x3¾". *Recommended for 24-volt operation. **Check wattage rating of equipment before ordering. RMF/RME Model Inverters equipped with voltage regulator.**

Stock No.	Mfr's Type	Input D.C. Volts	A.C. Output 60 Cycles	Output Watt. Int.	Output Watt. Cont.	Shipping Weight	List Price	Net Price
	6-DME (1)	6	110 Volts	40	30	5 lbs.	$33.50	$22.33
	6C-DME (1)	6/12	110	40	30	5	38.35	25.50
	6-RMF (2)	6	110	80	60	12	65.75	43.80
	6C-RMF (2)	6/12	110	80	60	12	72.45	48.30
	12-DME (1)	12	110	50	40	5	29.97	19.98
	12T-RME (1) (2) (3)	12	110	125	110	14	62.95	41.96
*	28-RME (2)	28	110	100	80	12	74.95	49.95
	32-RME (2)	32	110	100	80	12	74.95	49.95
	110-RME (2)	110	110	150	100	12	71.75	47.82
	220-RME	220	110	150	100	12	74.95	49.95

(1) These Inverters primarily recommended for Edison VP dictating machines. May also be used with Model 200 Sound-scriber (with engine of car not running).
(2) Primarily recommended for Dictaphone's Time Master, DeJur Stenorette, and Gray Audograph dictating machines or other similar types. Also recommended for use with Norelco tape recorder Model EL-3516 and Geloso Model G 255-S tape Recorder.
(3) **This Inverter specially designed and recommended also for use with RCA 8½" portable TV set or G.E. 9" portable TV set in an automobile.**



ATR VIBRATORS

FOR ALL AUTO RADIO SETS SINCE 1954 USE ONE OF THE ATR VIBRATORS LISTED BELOW ... ATR VIBRATORS FEATURE

Ceramic Stack Spacers with Two-Bolt Stack construction.

Instant Starting—as a result of highly efficient magnetic circuit with formed base for more uniform operation on both high and low voltages.

Large Oversize Tungsten Contacts having Full Wiping Action—for greater reliability and longer life.

Perforated Reed of Highest Quality Swedish Spring Steel.

Highest Precision Construction and Workmanship—Practically all parts used are held to within a tolerance of 0.0005 of inch.

Value Plus—as readily evidenced by the Larger Contacts, Ceramic Spacers and Precision Construction and Workmanship. Available in TEN-PAK.

ATR No. 1400 (Bulk), 4-Prong, 6-Volt For All 6-Volt Sets Since 1954

ATR No. 1843 (Bulk), 3-Prong, 12-Volt For All 12-Volt General Motors Since 1954

ATR No. 1843 also used in following automobiles: 1956 Ford (Philco), Lincoln (Bendix), and Mercury (Bendix); 1956 Chrysler (Philco); 1955-57 Packard; 1956-57 Plymouth (Philco); 1956 Studebaker (Philco) and 1957 Mercury (Philco)

ATR No. 1840 (Bulk), 4-Prong, 12-Volt For 12 Volt Cars other Than GM Since 1954

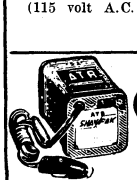


ATR ELECTRONIC TUBE PROTECTOR

A "MUST" FOR EVERY TV HOME! WILL DOUBLE OR TRIPLE THE LIFE OF ALL TYPES OF ELECTRONIC TUBES, INCLUDING TV PICTURE TUBE. Automatic in operation, for use with any electronic equipment having input wattage of 100 to 300 watts. Fuse protected; rugged construction; and enclosed in interior decorator's golden brown hammerloid-finish metal case. Wall Model 250 is 1 - 15/16" OD x 3⅛" in length and plugs directly into wall socket. Shipping weight is 1 lb.

—Wall Model 250

(115 volt A.C.) . . . . . **Net $2.95**

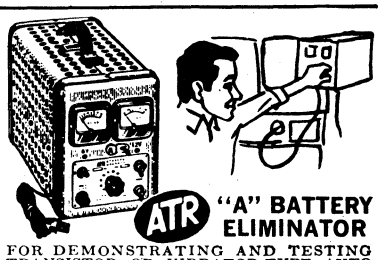


ATR SHAV-PAKS



Every man should have this lightweight ATR Inverter in his car for that "Keep Clean-Shaved Look." Will operate standard A.C. Electric Shavers from your CAR or Boat*. Complete with 3 ft. cord set. Plugs into cigarette lighter receptacle. Fuse protected, rugged construction, and attractively housed in grey hammerloid-finish steel case. Size 4"x2¾"x 2¾". Shipping weight 2½ lbs.

Model 6-SPB (6 volt) . . . . . **Net $14.75**
Model 12-SPB (12 volt) . . . . . **Net 12.95**



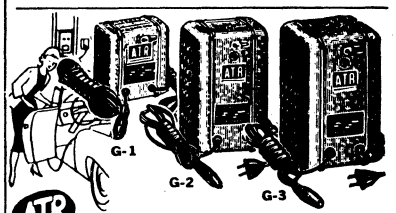
ATR "A" BATTERY ELIMINATOR

FOR DEMONSTRATING AND TESTING TRANSISTOR OR VIBRATOR-TYPE AUTO RADIOS. Designed for testing D.C. Electrical Apparatus on regular 110 volt A. C. lines . . . equipped with full-wave dry disc-type rectifier, assuring noiseless, interference-free operation. Fully Automatic and Fool-Proof; has voltmeter, ammeter, and 8-position voltage control. Fuse protected, and housed in heavy gauge brown hammerloid-finish metal case. 6 ft. cord set included. Size: Model 610C-ELIF, 6½"x9¼"x8½"—shipping weight 22 lbs.; Model 620C-ELIT, 6½"x12⅛"x8½"—shipping weight 33 lbs.

IDEAL AS A POWER SUPPLY FOR MODEL RAILROAD TRAINS, RADIO SETS, ELECTRO PLATING OUTFITS, AND OTHER 6 OR 12 VOLT, D.C. EQUIPMENT. MAY ALSO BE USED AS A BATTERY CHARGER.

—Model 610C-ELIF (6 volt at 10 amps. or 12 volt at 6 amps.) . . . . . **Net $59.82**

—Model 620C-ELIT (6 volt at 20 amps. or 12 volt at 10 amps.) . . . . . **Net $79.75**



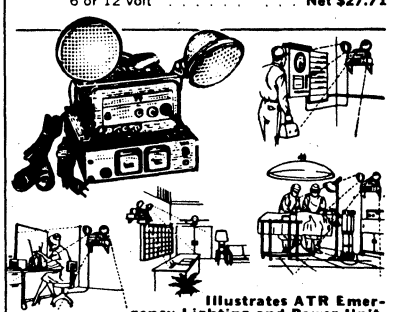
ATR AUTO PLUG-IN, HOME-TYPE PORTABLE BATTERY CHARGERS

No installation . . . just plug into cigarette lighter receptacle! Makes motor starting easy! Keeps your car battery fully charged in your own garage. Operates directly from standard 110 volt A.C. Household Current. Available in three portable sizes for both 6 or 12 volt cars. Light in weight, rugged in construction, economical, and built to last. Each battery charger is housed in grey hammerloid-finish metal case. Complete with cord sets. Size of G1 is 5¾"x4⅞"x2¾"—shipping weight is 6 lbs.; G2 is 8¼"x5½"x3⅞"—shipping weight is 8 lbs.; and G3 is 8½"x5½"x5¼"—shipping weight is 10 lbs.

(G-1) 6 or 12 volt **—Model 612CA4** (4 amp.) . . . . . **Net $19.46**

(G-2) 6 or 12 volt **—Model 612CA6** (6 amp.) . . . . . **Net $22.46**

(G-3) 6 or 12 volt **—Model 612CA10** (10 amp.) . . . . . **Net $27.71**



Illustrates ATR Emergency Lighting and Power Unit, Model ETS complete with lamps.

ATR EMERGENCY LIGHTING and POWER UNIT

Completely Automatic Standby-Power Units Specially Designed to Permit the Instantaneous Continued Operation of Critical Lighting Equipment, PA Systems, Amplifiers, Intercom Systems, Burglar Alarms, Fire Alarms, Synchronous Electric Clocks, Electric Time and Recording Clocks, Incubators, Gas Valves, Telephone and Test Equipment, and Similar Critical Devices in the Event of 115 Volt AC Commercial Power Line Failure. For Use: In Hospitals, Banks, Hotels, Theatres, Factories, Office Buildings, Schools, Homes, and Many Other Areas of Operation.

Type	*Storage Battery Input	A.C. Output 60 Cycles	Output Wattage Int.	Output Wattage Cont.	Net With Lamps
661-ETM	6-volts	110-volts	80	60	$231.75
662-ETS	6	110	100	80	253.50
663-ETH	6	110	150	125	275.50
1232-ETS	12	110	125	100	247.50
1233-ETH	12	110	175	150	267.00
1234-ETJ	12	110	250	200	287.25

For Units Without Lamps Deduct $37.50 Net.

Need custom power supplies?

Acme Electric can design and build to your specs.

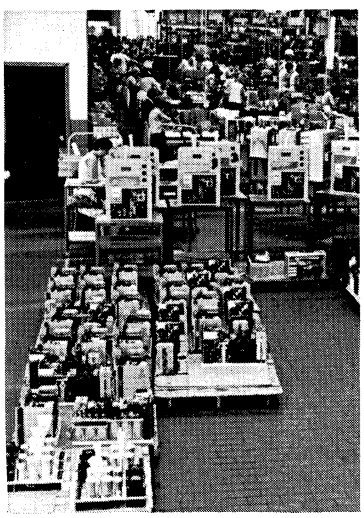
Acme Electric's engineering and experience have developed thousands of custom designed regulated DC power supplies for a variety of industrial markets. You'll find our power supplies in computers and data processing, communications, nuclear research, machine tools, photography, medical apparatus, to name but a few.

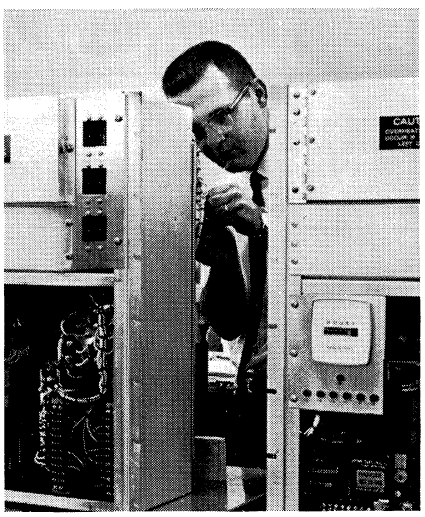
In these and other fields we have solved such knotty power supply problems as: dynamic load regulation of 3000 DC amps at .002%; economically achieved high efficiency at extremely low voltage and high current for IC's; tough packaging problems and programming requirements; many others. We're also specialists at designing and manufacturing CVT regulated power supplies.

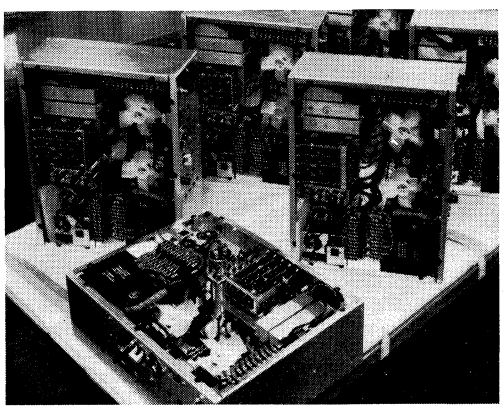
So, if you're looking for high quality, soundly engineered custom units, yet want them made with production line efficiency, why not draw on the engineering know-how of Acme Electric Corporation? Our business is to satisfy the functions of power control, conversion and/or regulation, whatever the industry or application.

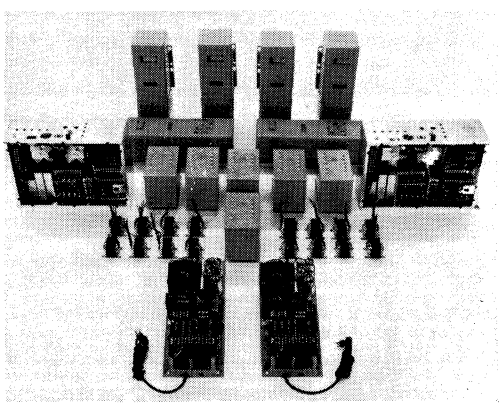
Acme Electric

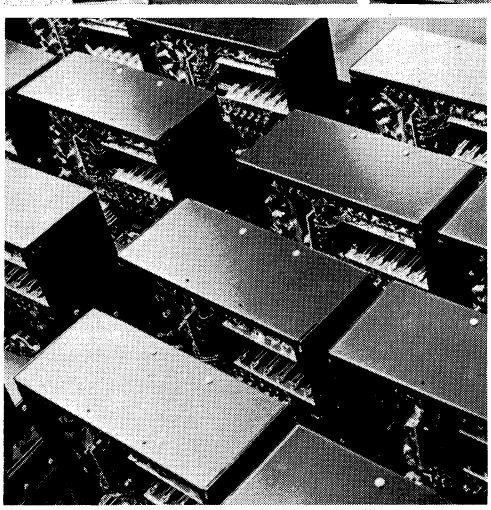
Acme Electric Corporation. Cuba, New York

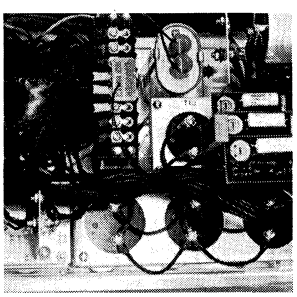


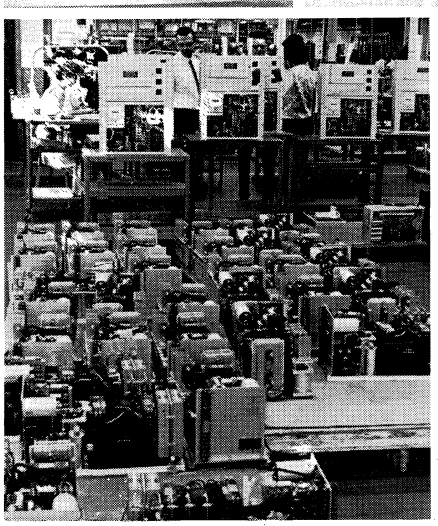


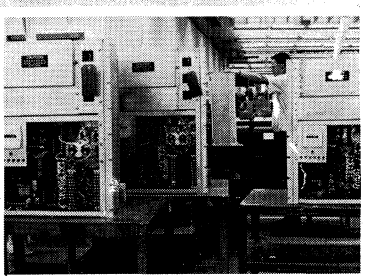


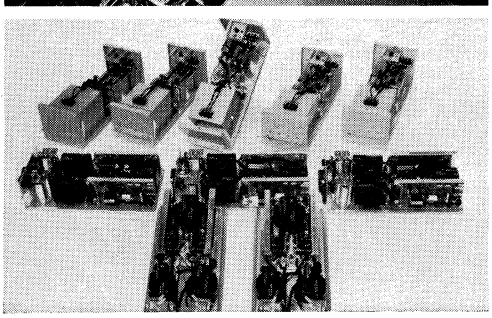


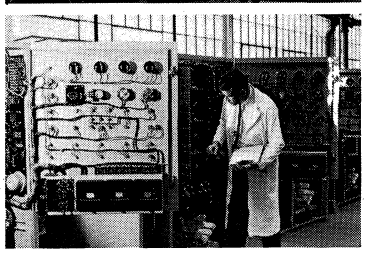












ABBOTT POWER MODULES

The Next 18 Pages List 2411 Regulated Modules with Specifications and Prices

The most complete line of small size MIL-SPEC type power modules available in the industry is fully described in the following 18 pages. The Abbott line of power modules include output voltages from 5.0 volts to 10,000 volts DC, output current from 2 milli-amperes to 20 amperes and output power from 2 watts to 240 watts. Sizes, weights, regulations and environments are shown for various input and output powers. A new line of 60 Hz to DC all silicon models for industrial as well as military applications is included. Optional features such as terminal pins on the mounting base, special connectors, re-mote output adjustment, etc., are described on the last page. Look through the next 18 pages and you may find the power supply you want is a standard Abbott model.

GENERAL PRICE REDUCTION

Over Half of the Models Reduced From 5% to 16%

It has always been our policy to promptly extend to our customers the benefits of our lower costs as well as our improved efficiencies. Recently, the costs of semi-conductors and other components used in our power modules have been reduced. We are pleased to announce a general price reduction this year. More than half of the prices listed in the next 18 pages reflect a 5 to 16% reduction over last year's prices, for the same models, shown in the 1968-69 edition of EEM.

abbott transistor
LABORATORIES, INCORPORATED

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60 Hz TO DC, REGULATED 1835, 1836, 1837
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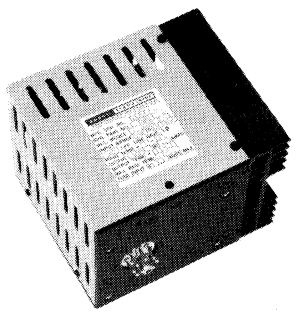
DC TO SINE WAVE, 1ϕ OR 3ϕ 1848
DC TO SINE WAVE, HI TEMP. 1849
DC TO 60 Hz, REGULATED 1850
OPTIONAL FEATURES 1851

abbott 60 ~ to DC (Regulated)



Model R50P1.2

POWER MODULES

features

- −4 to +160°F ambient
- 5 to 100 VDC
- 0.15 to 20 amps
- ±0.05% regulation
- All silicon
- High reliability
- Short circuit protection
- Voltage transient protection
- MIL-T-27B transformers used throughout
- For military and industrial applications

specifications

INPUT VOLTAGE RANGE
105-125 VRMS

INPUT FREQUENCY RANGE
50-420 Hertz, 1 phase

OUTPUT VOLTAGE AND CURRENT
See specific models listed in table below

LINE REGULATION
±0.05% or 10 mv (whichever is greater) for input change of 105-125 VRMS

LOAD REGULATION
±0.05% or 10 mv (whichever is greater) for change from no load to full load

RIPPLE
0.02% or 5 mv RMS (whichever is greater)

OUTPUT VOLTAGE ADJUSTMENT
Voltage is continuously adjustable between the limits shown in table by means of an externally accessible screwdriver adjustment potentiometer

ADJUSTMENT RESOLUTION
30 mv max. for outputs 5 thru 16 VDC; 50 mv max. for outputs 18 thru 50 VDC 70 mv mav for outputs 55 thru 95 VDC

ISOLATION VOLTAGE
300 VDC between output terminals and chassis ground

INSULATION RESISTANCE
50 megohms between output terminals and chassis ground when measured at 50 VDC

POLARITY
Inputs and outputs are isolated; either positive or negative side may be grounded

TEMPERATURE
Operating: −4°F (−20°C) to +160°F (+71°C) without derating, forced air, or heatsinking. Storage: −67 to +185°F

TEMPERATURE COEFFICIENT
0.03% per degree Centigrade

ALTITUDE
10,000 feet above sea level

SHORT CIRCUIT PROTECTION
Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed

INPUT TRANSIENT PROTECTION
180 VAC for 0.1 sec in accordance with MIL-STD-704A, figure 2, limit 1

LOAD TRANSIENT RECOVERY TIME
Output voltage returns to regulation limits within 75 microseconds after a 50% step change in load current

REMOTE ERROR SENSING
Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "sensing" leads. The resulting circuit action compensates for a DC voltage drop up to 0.5 volts in the load leads.

SERIES OPERATION
Two or more power supplies can be operated in series so that the output voltages of the supplies are additive. Total output voltage is not to exceed 200 VDC

OUTPUT IMPEDANCE
DC to 1K Hz — 0.003 R_L or 0.03 ohms max., whichever is greater.
1K Hz to 10K Hz — 0.008 R_L or 0.08 ohms max., whichever is greater.
10K Hz to 100K Hz — 0.015 R_L or 0.30 ohms max., whichever is greater.
R_L = rated load resistance.

RELIABILITY
The mean time between failure (MTBF) per MIL-HDBK-217 under worst case operating conditions of full output current, max. input voltage, and +160°F ambient is 22,026 hrs. for 20 amp models, increasing to 47,281 hrs. for 0.15 amp models. At +104°F ambient, the MTBF increases to 63,898 hrs. and 141,243 hrs., respectively (Consult factory for complete reports)

MOUNTING
Threaded inserts are provided on two surfaces for versatile mounting of cases A through F (see case drawings).

Output Voltage Adjustment Range	Output Current (Amps)	Size (See Dwg.)	Weight (Lbs)	Model Number	Price 1 Pc	Price 2-4 Pcs
4.5-5.5	0.15	A	3.0	R5S0.15	$ 94	$ 86
4.5-5.5	0.30	A	3.0	R5S0.3	111	101
4.5-5.5	0.6	B	6.0	R5S0.6	130	119
4.5-5.5	1.2	B	6.0	R5S1.2	149	136
4.5-5.5	2.5	C	8.0	R5S2.5	179	163
4.5-5.5	5.0	D	13.0	R5S5	247	225
4.5-5.5	10	F	22.0	R5S10	332	302
4.5-5.5	15	G	28.0	R5T15	424	386
4.5-5.5	20	J	33.0	R5T20	508	462
5.5-6.5	0.15	A	3.0	R6S0.15	94	86
5.5-6.5	0.3	A	3.0	R6S0.3	111	101
5.5-6.5	0.6	B	6.0	R6S0.6	130	119
5.5-6.5	1.2	B	6.0	R6S1.2	149	136
5.5-6.5	2.5	C	8.0	R6S2.5	179	163
5.5-6.5	5.0	D	13.0	R6S5	247	225
5.5-6.5	10	F	22.0	R6S10	332	302
5.5-6.5	15	G	28.0	R6T15	424	386
5.5-6.5	20	J	33.0	R6T20	508	462
6.5-7.5	0.15	A	3.0	R7S0.15	94	86
6.5-7.5	0.3	A	3.0	R7S0.3	111	101
6.5-7.5	0.6	B	6.0	R7S0.6	130	119
6.5-7.5	1.2	B	6.0	R7S1.2	149	136
6.5-7.5	2.5	C	8.0	R7S2.5	179	163
6.5-7.5	5.0	D	13.0	R7S5	247	225
6.5-7.5	10	F	22.0	R7S10	332	302
6.5-7.5	15	G	28.0	R7T15	424	386
6.5-7.5	20	J	33.0	R7T20	508	462
7.5-8.5	0.15	A	3.0	R8S0.15	94	86
7.5-8.5	0.3	A	3.0	R8S0.3	111	101
7.5-8.5	0.6	B	6.0	R8S0.6	130	119
7.5-8.5	1.2	B	6.0	R8S1.2	149	136
7.5-8.5	2.5	C	8.0	R8S2.5	179	163
7.5-8.5	5.0	D	13.0	R8S5	247	225
7.5-8.5	10	F	22.0	R8S10	332	302
7.5-8.5	15	G	28.0	R8T15	424	386
7.5-8.5	20	J	33.0	R8T20	508	462

Output Voltage Adjustment Range	Output Current (Amps)	Size (See Dwg.)	Weight (Lbs)	Model Number	Price 1 Pc	Price 2-4 Pcs
8.5-9.5	0.15	A	3.0	R9S0.15	$ 94	$ 86
8.5-9.5	0.3	A	3.0	R9S0.3	111	101
8.5-9.5	0.6	B	6.0	R9S0.6	130	119
8.5-9.5	1.2	B	6.0	R9S1.2	149	136
8.5-9.5	2.5	C	8.0	R9S2.5	179	163
8.5-9.5	5.0	D	13.0	R9S5	247	225
8.5-9.5	10	F	22.0	R9S10	332	302
8.5-9.5	15	H	31.0	R9T15	424	386
8.5-9.5	20	J	33.0	R9T20	508	462
9.5-10.5	0.15	A	3.0	R10S0.15	94	86
9.5-10.5	0.3	A	3.0	R10S0.3	111	101
9.5-10.5	0.6	B	6.0	R10S0.6	130	119
9.5-10.5	1.2	B	6.0	R10S1.2	149	136
9.5-10.5	2.5	C	8.0	R10S2.5	179	163
9.5-10.5	5.0	D	13.0	R10S5	247	225
9.5-10.5	10	F	22.0	R10S10	332	302
9.5-10.5	15	H	31.0	R10T15	436	397
9.5-10.5	20	J	33.0	R10T20	508	462
10.5-11.5	0.15	A	3.0	R11S0.15	94	86
10.5-11.5	0.3	A	3.0	R11S0.3	111	101
10.5-11.5	0.6	B	6.0	R11S0.6	130	119
10.5-11.5	1.2	B	6.0	R11S1.2	149	136
10.5-11.5	2.5	C	8.0	R11S2.5	179	163
10.5-11.5	5.0	D	13.0	R11S5	247	225
10.5-11.5	10	F	22.0	R11S10	332	302
10.5-11.5	15	H	31.0	R11T15	436	397
10.5-11.5	20	J	33.0	R11T20	508	462
11-13	0.15	A	3.0	R12S0.15	94	86
11-13	0.3	A	3.0	R12S0.3	111	101
11-13	0.6	B	6.0	R12S0.6	130	119
11-13	1.2	B	6.0	R12S1.2	149	136
11-13	2.5	C	8.0	R12S2.5	179	163
11-13	5.0	D	13.0	R12S5	247	225
11-13	10	F	22.0	R12S10	332	302
11-13	15	H	31.0	R12T15	436	397
11-13	20	J	33.0	R12T20	508	462

For more listings, please turn page →

60 HERTZ TO DC (Regulated)

Output Voltage Adjustment Range	Output Current (Amps)	Size (See Dwg.)	Weight (Lbs)	Model Number	Price 1 Pc	Price 2-4 Pcs
13-15	0.15	A	3.0	R14S0.15	$ 94	$ 86
13-15	0.3	A	3.0	R14S0.3	111	101
13-15	0.6	B	6.0	R14S0.6	130	119
13-15	1.2	B	6.0	R14S1.2	149	136
13-15	2.5	C	8.0	R14S2.5	179	163
13-15	5.0	D	13.0	R14S5	247	225
13-15	10	G	28.0	R14T10	342	311
13-15	15	H	31.0	R14T15	436	397
15-17	0.15	A	3.0	R16S0.15	94	86
15-17	0.3	A	3.0	R16S0.3	111	101
15-17	0.6	B	6.0	R16S0.6	130	119
15-17	1.2	B	6.0	R16S1.2	149	136
15-17	2.5	C	8.0	R16S2.5	179	163
15-17	5.0	D	13.0	R16S5	247	225
15-17	10	G	28.0	R16T10	342	311
15-17	15	H	31.0	R16T15	436	397
17-19	0.15	A	3.0	R18S0.15	94	86
17-19	0.3	A	3.0	R18S0.3	111	101
17-19	0.6	B	6.0	R18S0.6	130	119
17-19	1.2	B	6.0	R18S1.2	149	136
17-19	2.5	C	8.0	R18S2.5	179	163
17-19	5.0	D	13.0	R18S5	247	225
17-19	10	G	28.0	R18T10	342	311
19-21	0.15	A	3.0	R20S0.15	94	86
19-21	0.3	A	3.0	R20S0.3	111	101
19-21	0.6	B	6.0	R20S0.6	130	119
19-21	1.2	B	6.0	R20S1.2	149	136
19-21	2.5	C	8.0	R20S2.5	179	163
19-21	5.0	D	13.0	R20S5	247	225
19-21	10	G	28.0	R20T10	342	311
21-23	0.15	A	3.0	R22S0.15	94	86
21-23	0.3	A	3.0	R22S0.3	111	101
21-23	0.6	B	6.0	R22S0.6	130	119
21-23	1.2	B	6.0	R22S1.2	149	136
21-23	2.5	C	8.0	R22S2.5	179	163
21-23	5.0	D	13.0	R22S5	247	225
21-23	10	G	28.0	R22T10	342	311
23-25	0.15	A	3.0	R24S0.15	94	86
23-25	0.3	A	3.0	R24S0.3	111	101
23-25	0.6	B	6.0	R24S0.6	130	119
23-25	1.2	B	6.0	R24S1.2	149	136
23-25	2.5	C	8.0	R24S2.5	179	163
23-25	5.0	D	13.0	R24S5	247	225
23-25	10	G	28.0	R24T10	342	311
25-27	0.15	A	3.0	R26S0.15	94	86
25-27	0.3	B	6.0	R26S0.3	122	111
25-27	0.6	B	6.0	R26S0.6	130	119
25-27	1.2	C	8.0	R26S1.2	149	136
25-27	2.5	D	13.0	R26S2.5	201	183
25-27	5.0	E	20.0	R26S5	247	225
27-29	0.15	A	3.0	R28S0.15	94	86
27-29	0.3	B	6.0	R28S0.3	122	111
27-29	0.6	B	6.0	R28S0.6	130	119
27-29	1.2	C	8.0	R28S1.2	149	136
27-29	2.5	D	13.0	R28S2.5	201	183
27-29	5.0	E	20.0	R28S5	247	225
29-31	0.15	A	3.0	R30S0.15	94	86
29-31	0.3	B	6.0	R30S0.3	122	111
29-31	0.6	B	6.0	R30S0.6	130	119
29-31	1.2	C	8.0	R30S1.2	149	136
29-31	2.5	D	13.0	R30S2.5	201	183
29-31	5.0	E	20.0	R30S5	247	225
31-33	0.15	A	3.0	R32S0.15	94	86
31-33	0.3	B	6.0	R32S0.3	122	111
31-33	0.6	B	6.0	R32S0.6	130	119
31-33	1.2	C	8.0	R32S1.2	149	136
31-33	2.5	D	13.0	R32S2.5	201	183
31-33	5.0	E	20.0	R32S5	247	225
33-35	0.15	A	3.0	R34S0.15	94	86
33-35	0.3	B	6.0	R34S0.3	122	111
33-35	0.6	B	6.0	R34S0.6	130	119
33-35	1.2	C	8.0	R34S1.2	149	136
33-35	2.5	D	13.0	R34S2.5	201	183
33-35	5.0	E	20.0	R34S5	247	225
35-37	0.15	A	3.0	R36S0.15	94	86
35-37	0.3	B	6.0	R36S0.3	122	111
35-37	0.6	B	6.0	R36S0.6	130	119
35-37	1.2	C	8.0	R36S1.2	149	136
35-37	2.5	D	13.0	R36S2.5	201	183
35-37	5.0	E	20.0	R36S5	247	225
37-39	0.15	A	3.0	R38S0.15	94	86
37-39	0.3	B	6.0	R38S0.3	122	111
37-39	0.6	B	6.0	R38S0.6	130	119
37-39	1.2	C	8.0	R38S1.2	149	136
37-39	2.5	D	13.0	R38S2.5	201	183
37-39	5.0	E	20.0	R38S5	247	225
39-41	0.15	A	3.0	R40S0.15	94	86
39-41	0.3	B	6.0	R40S0.3	122	111
39-41	0.6	B	6.0	R40S0.6	130	119
39-41	1.2	C	8.0	R40S1.2	167	152
39-41	2.5	D	13.0	R40S2.5	201	183
39-41	5.0	F	22.0	R40S5	295	269
41-43	0.15	A	3.0	R42S0.15	94	86
41-43	0.3	B	6.0	R42S0.3	122	111
41-43	0.6	B	6.0	R42S0.6	130	119
41-43	1.2	C	8.0	R42S1.2	167	152
41-43	2.5	D	13.0	R42S2.5	201	183
41-43	5.0	F	22.0	R42S5	295	269
43-45	0.15	A	3.0	R44S0.15	94	86
43-45	0.3	B	6.0	R44S0.3	122	111
43-45	0.6	B	6.0	R44S0.6	130	119
43-45	1.2	C	8.0	R44S1.2	167	152
43-45	2.5	D	13.0	R44S2.5	201	183
43-45	5.0	F	22.0	R44S5	295	269
45-47	0.15	A	3.0	R46S0.15	94	86
45-47	0.3	B	6.0	R46S0.3	122	111
45-47	0.6	B	6.0	R46S0.6	130	119
45-47	1.2	C	8.0	R46S1.2	167	152
45-47	2.5	D	13.0	R46S2.5	$201	$183
45-47	5.0	F	22.0	R46S5	295	269
47-49	0.15	A	3.0	R48S0.15	94	86
47-49	0.3	B	6.0	R48S0.3	122	111
47-49	0.6	B	6.0	R48S0.6	130	119
47-49	1.2	C	8.0	R48S1.2	167	152
47-49	2.5	D	13.0	R48S2.5	201	183
47-49	5.0	F	22.0	R48S5	295	269
49-51	0.15	A	3.0	R50S0.15	94	86
49-51	0.3	B	6.0	R50S0.3	122	111
49-51	0.6	B	6.0	R50S0.6	130	119
49-51	1.2	C	8.0	R50S1.2	167	152
49-51	2.5	D	13.0	R50S2.5	201	183
49-51	5.0	F	22.0	R50S5	295	269
50-60	0.15	B	6.0	R55S0.15	112	102
50-60	0.3	B	6.0	R55S0.3	122	111
50-60	0.6	C	8.0	R55S0.6	169	154
50-60	1.2	D	13.0	R55S1.2	200	182
50-60	2.5	E	20.0	R55S2.5	234	213
60-70	0.15	B	6.0	R65S0.15	112	102
60-70	0.3	B	6.0	R65S0.3	122	111
60-70	0.6	C	8.0	R65S0.6	169	154
60-70	1.2	D	13.0	R65S1.2	200	182
60-70	2.5	E	20.0	R65S2.5	234	213
70-80	0.15	B	6.0	R75S0.15	112	102
70-80	0.3	B	6.0	R75S0.3	122	111
70-80	0.6	C	8.0	R75S0.6	169	154
70-80	1.2	D	13.0	R75S1.2	200	182
70-80	2.5	E	20.0	R75S2.5	234	213
80-90	0.15	B	6.0	R85S0.15	112	102
80-90	0.3	B	6.0	R85S0.3	122	111
80-90	0.6	C	8.0	R85S0.6	169	154
80-90	1.2	D	13.0	R85S1.2	200	182
80-90	2.5	E	20.0	R85S2.5	234	213
90-100	0.15	B	6.0	R95S0.15	112	102
90-100	0.3	B	6.0	R95S0.3	122	111
90-100	0.6	C	8.0	R95S0.6	169	154
90-100	1.2	D	13.0	R95S1.2	200	182
90-100	2.5	E	20.0	R95S2.5	234	213

MODEL DESIGNATION (For Model "R" series only)

For your assistance and understanding, we have included a complete explanation of our model designation for this series of units, using Model **R28S2.5-14** as an example.

R Designates the general series of the power supply.

28 Designates the nominal output voltage of the unit.

S Designates the output connector as follows:

S — 8 pin solder hook terminal. Standard on all units with case size A through F.

T — Terminal strip. Standard on all units with case size G through J.

P — Octal plug. Optional on case sizes A through F at $10 for one piece and $5 each for two to four pieces.

C — Cannon connector MS3112E-16-8P with mate. Optional on case sizes A through F at $30 for one piece and $20 for two to four pieces.

2.5 Designates the continuous full load output current.

14 Designates the inclusion of the desired optional features. For a list of the features available, and their numbers, please see the "Optional Features" section for Model R series, below. For example, R28S2.5-14 designates a 60 Hz to 28 VDC at 2.5 amps unit using an 8 pin solder hook terminal, having the optional features "overvoltage protection" and "remote voltage adjustment".

OPTIONAL FEATURES (For Model "R" series only)

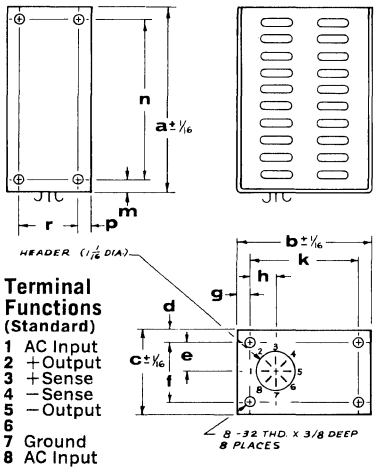
To include the optional features desired in the power supply, simply add a dash and the feature number to the end of the model number. (See "Model Designation" section above.)

Feature	Description	Feature Number	Price 1 pc.	Price 2-4 pcs.
Overvoltage Protection	If the output voltage rises 10% or 2V WIG above the nominal setting, the overvoltage protection circuitry reduces the voltage to approximately 1 volt within 15 microseconds. Under worst case conditions the output voltage could rise an additional 10% max during this 15 microsecond period.	1	$30	$20
Connector Location	The output connector can be supplied on the surface labeled "Optional Location" on the dimensional drawing for case size B through F.	2	10	5
230 VAC Operation	Units can be modified to operate with an input voltage of 210 to 250 VRMS, 50 to 420 Hz.	3	20	10
Remote Voltage Adjustment	Provision is made for locating an adjustment potentiometer in a remote location from the power supply.	4	20	10
Output Voltage Resolution	Provisions can be made to increase the output voltage adjustment resolution as follows:	5	20	10

Nominal Output Voltage	Resolution
5V through 16V	1.5 mv max.
18V through 50V	3.0 mv max.
55V through 95V	5.0 mv max.

NOTE: If parallel operation of these units is desired, please consult the factory.

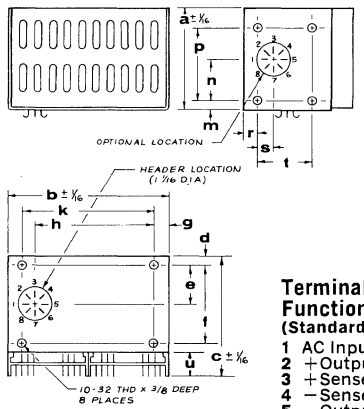
60 HERTZ TO DC (Regulated)
Case Size Drawings for Model "R" Series



Terminal Functions (Standard)
1 AC Input
2 +Output
3 +Sense
4 −Sense
5 −Output
6
7 Ground
8 AC Input

Case A

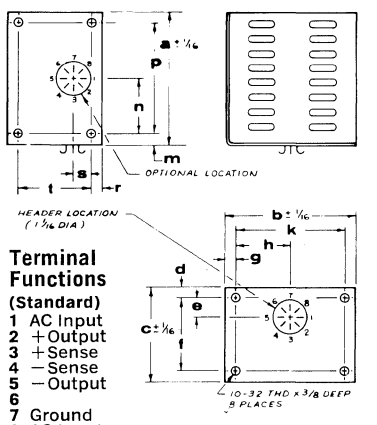
a	6½
b	4
c	1⅞
d	¼
e	1/16
f	1⅜
g	½
h	⅝
k	3
m	⅜
n	5¾
p	¼
r	1⅜



Terminal Functions (Standard)
1 AC Input
2 +Output
3 +Sense
4 −Sense
5 −Output
6
7 Ground
8 AC Input

Case E

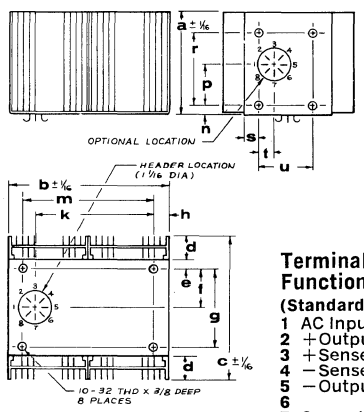
a	5
b	8
c	8⅜
d	½
e	2⅝
f	5¼
g	¾
h	5⅞
k	6½
m	⅝
n	1⅞
p	3 13/16
r	¾
s	½
t	4
u	2⅛



Terminal Functions (Standard)
1 AC Input
2 +Output
3 +Sense
4 −Sense
5 −Output
6
7 Ground
8 AC Input

Case B

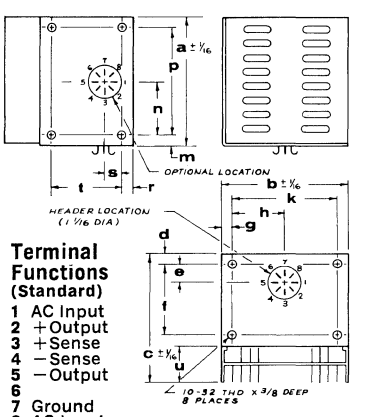
a	5
b	4½
c	4
d	⅜
e	⅞
f	3¾
g	5/16
h	1 1/16
k	3 1/16
m	5/16
n	1 15/16
p	4 1/16
r	⅜
s	1½
t	3¾



Terminal Functions (Standard)
1 AC Input
2 +Output
3 +Sense
4 −Sense
5 −Output
6
7 Ground
8 AC Input

Case F

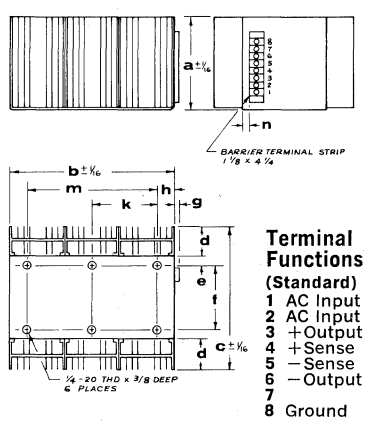
a	5
b	8
c	8¾
d	1¼
e	½
f	2⅝
g	5¼
h	¾
k	5⅞
m	6½
n	⅝
p	1⅞
r	3 13/16
s	¾
t	½
u	4



Terminal Functions (Standard)
1 AC Input
2 +Output
3 +Sense
4 −Sense
5 −Output
6
7 Ground
8 AC Input

Case C & D

	C	D
a	5	6½
b	4	4
c	5¾	7½
d	⅜	⅜
e	⅞	½
f	3 7/16	4⅜
g	5/16	½
h	1 7/16	1½
k	2 7/16	2½
m	5/16	½
n	1 15/16	2 7/16
p	4 1/16	5⅝
r	⅜	⅜
s	1 5/16	1⅛
t	3 7/16	4⅜
u	1¼	2⅛



Terminal Functions (Standard)
1 AC Input
2 AC Input
3 +Output
4 +Sense
5 −Sense
6 −Output
7
8 Ground

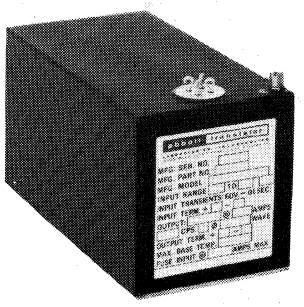
Case G, H, J

	G	H	J
a	5	6½	6½
b	12	12	12
c	8	8	9¾
d	1¼	1¼	2⅛
e	⅜	⅜	⅜
f	4¾	4¾	4¾
g	½	½	½
h	1¼	1¼	1¼
k	4¾	4¾	4¾
m	9½	9½	9½
n	⅜	⅜	⅜

DIMENSIONAL TOLERANCES: ±1/32 unless otherwise specified.

abbott transistor
LABORATORIES, INCORPORATED
5200 W. Jefferson Blvd. / Los Angeles 90016
(213) WEbster 6-8185 Cable: ABTLABS

abbott 60 ⏦ to DC (Reg.) Hermetically Sealed



POWER MODULES

features

- Close regulation
- 5 to 10,000 volts
- Hermetically sealed
- Compact
- Low ripple
- For aerospace application

specifications

Input Voltage Range
105-125 VAC

Input Frequency Range
55-65 Hertz, 1 phase

Line Regulation
±0.2% for input 105-125 VAC on Model V's, HA's, HAL's and HC's

±0.5% for input 105-125 VAC on Model HAK's, HCK's and HN's

Voltage Regulation
±0.5% — for input 105-125 VAC and from ½ load to full load on Model V's

±1.5% — for input 105-125 VAC and from ½ load to full load on Model HA's

±2.5% — for input 105-125 VAC and from ½ load to full load on Model HAK's, HAL's, HC's and HN's

Ripple
0.2% RMS — RMS Model V's
0.5% RMS — Model HA's
1% RMS—Model HAK's, HAL's & HC's
2% RMS — Model HN's

Voltage Adjustment Range
12% by screwdriver adjustment

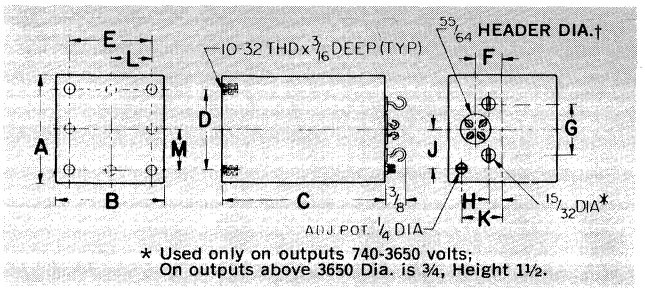
Environment
+160°F max. at mounting base, using adequate heat sink
−4°F (−20°C) min. at mounting surface
Altitude: to vacuum (true hermetic seal)
Vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, and explosion to MIL-E-5272C

Output Voltage and Current
See specific models listed in the following pages
(Outputs and inputs are isolated)

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
4.7-5.3	1.0	9B	4.0	V05D-5A	$190	$160
4.7-5.3	2.0	9A	4.2	V1D-5A	200	165
4.7-5.3	4.0	10A	6.1	V2D-5A	210	175
4.7-5.3	6.0	11C	8.3	V3D-5A	220	185
4.7-5.3	12.0	13A	16.1	V6D-5A	280	235
5.3-5.9	0.9	9B	4.0	V05D-5.6A	190	160
5.3-5.9	1.8	9A	4.2	V1D-5.6A	200	165
5.3-5.9	3.6	10A	6.1	V2D-5.6A	210	175
5.3-5.9	5.4	11C	8.3	V3D-5.6A	220	185
5.3-5.9	10.8	13A	16.1	V6D-5.6A	280	235
5.9-6.6	0.8	9B	4.0	V05D-6.3A	190	160
5.9-6.6	1.6	9A	4.2	V1D-6.3A	200	165
5.9-6.6	3.2	10A	6.1	V2D-6.3A	210	175
5.9-6.6	4.8	11C	8.3	V3D-6.3A	220	185
5.9-6.6	9.6	13A	16.1	V6D-6.3A	275	230
6.6-7.4	0.7	9B	4.0	V05-7A	190	160
6.6-7.4	1.4	9A	4.2	V1D-7A	200	165
6.6-7.4	2.8	10A	6.1	V2D-7A	210	175
6.6-7.4	4.2	11C	8.3	V3D-7A	220	185
6.6-7.4	8.4	13A	16.1	V6D-7A	275	230
7.4-8.3	0.63	9B	4.0	V05D-7.9A	185	155
7.4-8.3	1.26	9A	4.2	V1D-7.9A	190	160
7.4-8.3	2.52	10A	6.1	V2D-7.9A	205	170
7.4-8.3	3.78	11C	8.3	V3D-7.9A	215	180
7.4-8.3	7.56	12A	11.6	V6D-7.9A	275	230
8.3-9.3	0.57	9B	4.0	V05D-8.8A	185	155
8.3-9.3	1.14	9A	4.2	V1D-8.8A	190	160
8.3-9.3	2.28	10A	6.1	V2D-8.8A	205	170
8.3-9.3	3.42	11C	8.3	V3D-8.8A	215	180
8.3-9.3	6.84	12A	11.6	V6D-8.8A	275	230
9.3-10.4	0.50	9B	4.0	V05-9.9A	185	155
9.3-10.4	1.00	9A	4.2	V1D-9.9A	190	160
9.3-10.4	2.00	10A	6.1	V2D-9.9A	205	170
9.3-10.4	3.00	11C	8.3	V3D-9.9A	215	180
9.3-10.4	6.00	12A	11.6	V6D-9.9A	275	230
9.3-10.4	12.00	13A	16.1	V12D-9.9A	350	295
10.4-11.6	0.45	9B	4.0	V05D-11A	185	155
10.4-11.6	0.91	9A	4.2	V1D-11A	190	160
10.4-11.6	1.82	10A	6.1	V2D-11A	205	170
10.4-11.6	2.73	11C	8.3	V3D-11A	215	180
10.4-11.6	5.46	12A	11.6	V6D-11A	275	230
10.4-11.6	10.92	13A	16.1	V12D-11A	350	295
11.6-13.0	0.40	9B	4.0	V05D-12.3A	185	155
11.6-13.0	0.81	9A	4.2	V1D-12.3A	190	160
11.6-13.0	1.62	10A	6.1	V2D-12.3A	205	170
11.6-13.0	2.43	11C	8.3	V3D-12.3A	215	180
11.6-13.0	4.86	12A	11.6	V6D-12.3A	270	225
11.6-13.0	9.72	13A	16.1	V12D-12.3A	340	285
11.6-13.0	19.44	16A	16.3	V24D-12.3A	430	360
13.0-14.8	0.36	9B	4.0	V05D-13.8A	180	150
13.0-14.8	0.72	9A	4.2	V1D-13.8A	185	155
13.0-14.8	1.44	10A	6.1	V2D-13.8A	200	165
13.0-14.8	2.16	11C	8.3	V3D-13.8A	210	175
13.0-14.8	4.32	12A	11.6	V6D-13.8A	270	225
13.0-14.8	8.64	13A	16.1	V12D-13.8A	340	285
13.0-14.8	17.28	16A	16.3	V24D-13.8A	430	360
14.8-16.6	0.32	9B	4.0	V05D-15.7A	180	150
14.8-16.6	0.64	9A	4.2	V1D-15.7A	185	155
14.8-16.6	1.28	10A	6.1	V2D-15.7A	200	165
14.8-16.6	1.92	11C	8.3	V3D-15.7A	210	175
14.8-16.6	3.84	12A	11.6	V6D-15.7A	270	225
14.8-16.6	7.68	13A	16.1	V12D-15.7A	330	275
14.8-16.6	15.36	16A	16.3	V24D-15.7A	420	350
16.6-18.6	0.28	9B	4.0	V05D-17.6A	180	150
16.6-18.6	0.57	9A	4.2	V1D-17.6A	185	155
16.6-18.6	1.14	10A	6.1	V2D-17.6A	$200	$165
16.6-18.6	1.71	11C	8.3	V3D-17.6A	210	175
16.6-18.6	3.42	12A	11.6	V6D-17.6A	270	225
16.6-18.6	6.84	13A	16.1	V12D-17.6A	330	275
16.6-18.6	13.68	16A	16.3	V24D-17.6A	420	350
18.6-20.8	0.255	9B	4.0	V05D-19.7A	180	150
18.6-20.8	0.510	9A	4.2	V1D-19.7A	185	155
18.6-20.8	1.02	10A	6.1	V2D-19.7A	200	165
18.6-20.8	1.53	11C	8.3	V3D-19.7A	210	175
18.6-20.8	3.06	12A	11.6	V6D-19.7A	265	220
18.6-20.8	6.12	13A	16.1	V12D-19.7A	330	275
18.6-20.8	12.24	16A	16.3	V24D-19.7A	420	350
20.8-23.3	0.230	9B	4.0	V05D-22A	175	145
20.8-23.3	0.460	9A	4.2	V1D-22A	180	150
20.8-23.3	0.920	10A	6.1	V2D-22A	190	160
20.8-23.3	1.38	11C	8.3	V3D-22A	205	170
20.8-23.3	2.76	12A	11.6	V6D-22A	265	220
20.8-23.3	5.52	13A	16.1	V12D-22A	320	270
20.8-23.3	11.02	16A	16.3	V24D-22A	405	340
23.3-26.1	0.205	9B	4.0	V05D-24.7A	175	145
23.3-26.1	0.410	9A	4.2	V1D-24.7A	180	150
23.3-26.1	0.820	10A	6.1	V2D-24.7A	190	160
23.3-26.1	1.23	11C	8.3	V3D-24.7A	205	170
23.3-26.1	2.46	12A	11.6	V6D-24.7A	265	220
23.3-26.1	4.92	13A	16.1	V12D-24.7A	320	270
23.3-26.1	9.84	16A	16.3	V24D-24.7A	405	340
26.1-29.2	0.180	9B	4.0	V05D-27.6A	175	145
26.1-29.2	0.360	9A	4.2	V1D-27.6A	180	150
26.1-29.2	0.720	10A	6.1	V2D-27.6A	190	160
26.1-29.2	1.08	11C	8.3	V3D-27.6A	205	170
26.1-29.2	2.16	12A	11.6	V6D-27.6A	265	220
26.1-29.2	4.32	13A	16.1	V12D-27.6A	310	260
26.1-29.2	8.64	16A	16.3	V24D-27.6A	395	330
29.2-32.6	0.160	9B	4.0	V05D-31A	175	145
29.2-32.6	0.320	9A	4.2	V1D-31A	180	150
29.2-32.6	0.640	10A	6.1	V2D-31A	190	160
29.2-32.6	0.960	11C	8.3	V3D-31A	205	170
29.2-32.6	1.92	12A	11.6	V6D-31A	265	220
29.2-32.6	3.84	13A	16.1	V12D-31A	330	275
29.2-32.6	7.68	16A	16.3	V24D-31A	420	350
32.6-36.5	0.145	9B	4.0	V05D-34.6A	175	145
32.6-36.5	0.290	9A	4.2	V1D-34.6A	180	150
32.6-36.5	0.580	10A	6.1	V2D-34.6A	190	160
32.6-36.5	0.870	11C	8.3	V3D-34.6A	205	170
32.6-36.5	1.74	12A	11.6	V6D-34.6A	265	220
32.6-36.5	3.48	13A	16.1	V12D-34.6A	350	295
32.6-36.5	6.96	16A	16.3	V24D-34.6A	435	365
36.5-40.9	0.130	9B	4.0	V05D-38.7A	175	145
36.5-40.9	0.260	9A	4.2	V1D-38.7A	180	150
36.5-40.9	0.520	10A	6.1	V2D-38.7A	190	160
36.5-40.9	0.780	11C	8.3	V3D-38.7A	210	175
36.5-40.9	1.56	12A	11.6	V6D-38.7A	270	225
36.5-40.9	3.12	13A	16.1	V12D-38.7A	375	315
36.5-40.9	6.24	16A	16.3	V24D-38.7A	460	385
40.9-45.8	0.115	9B	4.0	V05D-43.3A	175	145
40.9-45.8	0.230	9A	4.2	V1D-43.3A	180	150
40.9-45.8	0.460	10A	6.1	V2D-43.3A	190	160
40.9-45.8	0.690	11C	8.3	V3D-43.3A	210	175
40.9-45.8	1.38	12A	11.6	V6D-43.3A	270	225
40.9-45.8	2.76	13A	16.1	V12D-43.3A	395	330
40.9-45.8	5.52	16A	16.3	V24D-43.3A	485	405
45.8-51.4	0.103	9B	4.0	V05D-48.6A	180	150
45.8-51.4	0.206	9A	4.2	V1D-48.6A	185	155
45.8-51.4	0.412	10A	6.1	V2D-48.6A	200	165
45.8-51.4	0.618	11C	8.3	V3D-48.6A	215	180
45.8-51.4	1.24	12A	11.6	V6D-48.6A	275	230
45.8-51.4	2.48	13A	16.1	V12D-48.6A	420	350
45.8-51.4	4.94	16A	16.3	V24D-48.6A	505	420
51.4-59.0	0.091	9B	4.0	V05D-55.2A	$200	$165
51.4-59.0	0.182	9A	4.2	V1D-55.2A	205	170
51.4-59.0	0.365	10A	6.1	V2D-55.2A	215	180
51.4-59.0	0.546	11C	8.3	V3D-55.2A	225	190
51.4-59.0	1.10	12A	11.6	V6D-55.2A	280	235
51.4-59.0	2.20	13A	16.1	V12D-55.2A	420	350
51.4-59.0	4.40	16A	16.3	V24D-55.2A	505	420
59.0-66.0	0.080	9B	4.0	HA05D-63A	260	215
59.0-66.0	0.160	9A	4.2	HA1D-63A	265	220
59.0-66.0	0.320	11A	6.9	HA2D-63A	275	230
59.0-66.0	0.480	12A	10.3	HA3D-63A	315	265
59.0-66.0	0.960	14	12.9	HAL6D-63A	370	300
59.0-66.0	1.900	17A	25.8	HAL12D-63A	430	360
59.0-66.0	3.800	18	44.5	HCL24D-63A	515	430
66.0-74.0	0.071	9B	4.0	HA05D-70A	260	215
66.0-74.0	0.143	9A	4.2	HA1D-70A	265	220
66.0-74.0	0.286	11A	6.9	HA2D-70A	275	230
66.0-74.0	0.429	12A	10.3	HA3D-70A	310	260
66.0-74.0	0.858	14	12.9	HAL6D-70A	365	295
66.0-74.0	1.72	17A	25.8	HAL12D-70A	430	360
66.0-74.0	3.44	18	44.5	HCL24D-70A	515	430
74.0-83.0	0.063	9B	4.0	HA05D-79A	260	215
74.0-83.0	0.127	9A	4.2	HA1D-79A	265	220
74.0-83.0	0.254	11A	6.9	HA2D-79A	275	230
74.0-83.0	0.381	12A	10.3	HA3D-79A	305	255
74.0-83.0	0.762	14	12.9	HAL6D-79A	340	285
74.0-83.0	1.52	17A	25.8	HAL12D-79A	430	360
74.0-83.0	3.04	18	44.5	HCL24D-79A	515	430
83.0-93.0	0.057	9B	4.0	HA05D-88A	260	215
83.0-93.0	0.114	9A	4.2	HA1D-88A	265	220
83.0-93.0	0.228	11A	6.9	HA2D-88A	275	230
83.0-93.0	0.342	12A	10.3	HA3D-88A	300	250
83.0-93.0	0.684	14	12.9	HAL6D-88A	330	275
83.0-93.0	1.38	17A	25.8	HAL12D-88A	430	360
83.0-93.0	2.76	18	44.5	HCL24D-88A	515	430
93.0-104	0.050	9B	4.0	HA05D-99A	260	215
93.0-104	0.100	9A	4.2	HA1D-99A	265	220
93.0-104	0.200	11A	6.9	HA2D99A	275	230
93.0-104	0.300	12A	10.3	HA3D-99A	290	245
93.0-104	0.600	14	12.9	HA6D-99A	315	265
93.0-104	1.20	17A	25.8	HAL12D-99A	430	360
93.0-104	2.40	18	44.5	HCL24D-99A	515	430
104-116	0.045	9B	4.0	HA05D-110A	260	215
104-116	0.091	9A	4.2	HA1D-110A	265	220
104-116	0.182	11A	6.9	HA2D-110A	275	230
104-116	0.273	12A	10.3	HA3D-110A	290	245
104-116	0.546	14	12.9	HA6D-110A	315	265
104-116	1.092	17A	25.8	HAL12D-110A	430	360
104-116	2.184	18	44.5	HCL24D-110A	515	430
116-130	0.040	9B	4.0	HA05D-123A	260	215
116-130	0.081	9A	4.2	HA1D-123A	265	220
116-130	0.162	11A	6.9	HA2D-123A	275	230
116-130	0.243	12A	10.3	HA3D-123A	290	245
116-130	0.486	14	12.9	HA6D-123A	315	265
116-130	0.972	17A	25.8	HAL12D-123A	430	360
116-130	1.944	18	44.5	HCL24D-123A	515	430
130-148	0.036	9B	4.0	HA05D-138A	260	215
130-148	0.072	9A	4.2	HA1D-138A	265	220
130-148	0.144	11A	6.9	HA2D-138A	275	230
130-148	0.216	12A	10.3	HA3D-138A	290	245
130-148	0.432	14	12.9	HA6D-138A	315	265
130-148	0.864	17A	25.8	HAL12D-138A	420	350
130-148	1.728	18	44.5	HCL24D-138A	505	420

Size	A	B	C	D	E	F	G	H	J	K	L	M
9A	2¾	4¾	3¾	2.25	4.25	0	2	0	1⅛	2⅛	—	—
9B	2¾	4¾	3½	2.25	4.25	0	2	0	1⅛	2⅛	—	—
10A	3	5	4	2.50	4.50	0	2	0	1¼	2¼	—	—
11A	4¼	4½	4	3.75	4.00	1⅝	2	1⅝	1⅞	2	—	—
11C	4¼	5¼	4	3.75	4.75	0	2	0	1⅞	2⅜	2.37	—
12A	4½	6	4	4.00	5.50	0	2	0	2	2¾	2.75	—
13A	5½	6½	4½	5.00	6.00	0	2	0	2½	3	3.00	2.50
14	6	6	4	5.50	5.50	2⅜	2	2⅜	2¾	2¾	2.75	2.75
15B	6	7½	4¼	5.50	7.00	2⅞	2	2⅞	2¾	3½	3.50	2.75
16A	6¾	7½	4¼	6.25	7.00	2¾	2	2¾	3⅛	3½	3.50	3.12
17A	7	8	4¼	6.50	7.50	3	2	3	3¼	3¾	3.75	3.25
17B	6½	11½	4½	6.00	11.00	2¼	2	4⅞	3	5½	5.50	3.00
18	8¾	9¾	5	8.25	9.25	2⅞	2	2⅞	4⅛	4⅝	4.62	4.12

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DECIMALS .XX ±0.015.



* Used only on outputs 740-3650 volts; On outputs above 3650 Dia. is ¾, Height 1½.

60 HERTZ TO DC (Regulated)

INPUT VOLTAGE: 115 VAC, 60 Hz, 1 PHASE

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
148-166	0.032	9B	4.0	HA05D-157A	$260	$215
148-166	0.064	9A	4.2	HA1D-157A	265	220
148-166	0.128	11A	6.9	HA2D-157A	275	230
148-166	0.192	12A	10.3	HA3D-157A	290	245
148-166	0.384	14	12.9	HA6D-157A	315	265
148-166	0.768	17A	25.8	HAL12D-157A	405	340
148-166	1.536	18	44.5	HCL24D-157A	490	410
166-186	0.028	9B	4.0	HA05D-176A	260	215
166-186	0.057	9A	4.2	HA1D-176A	265	220
166-186	0.114	11A	6.9	HA2D-176A	275	230
166-186	0.171	12A	10.3	HA3D-176A	290	245
166-186	0.342	14	12.9	HA6D-176A	315	265
166-186	0.648	17A	25.8	HAL12D-176A	395	330
166-186	1.368	18	44.5	HCL24D-176A	485	405
186-208	0.025	9B	4.0	HA05D-197A	260	215
186-208	0.051	9A	4.2	HA1D-197A	265	220
186-208	0.102	11A	6.9	HA2D-197A	275	230
186-208	0.153	12A	10.3	HA3D-197A	290	245
186-208	0.306	14	12.9	HA6D-197A	315	265
186-208	0.612	17A	25.8	HA12D-197A	385	320
186-208	1.224	18	44.5	HCL24D-197A	475	395
208-233	0.023	9B	4.0	HA05D-220A	260	215
208-233	0.046	9A	4.2	HA1D-220A	265	220
208-233	0.092	11A	6.9	HA2D-220A	275	230
208-233	0.138	12A	10.3	HA3D-220A	290	245
208-233	0.276	14	12.9	HA6D-220A	315	265
208-233	0.552	17A	25.8	HA12D-220A	375	315
208-233	1.104	18	44.5	HCL24D-220A	460	385
233-261	0.020	9B	4.0	HA05D-247A	260	215
233-261	0.041	9A	4.2	HA1D-247A	265	220
233-261	0.082	11A	6.9	HA2D-247A	275	230
233-261	0.123	12A	10.3	HA3D-247A	290	245
233-261	0.246	14	12.9	HA6D-247A	315	265
233-261	0.492	17A	25.8	HA12D-247A	375	315
233-261	0.984	18	44.5	HCL24D-247A	460	385
261-292	0.018	9B	4.0	HA05D-276A	260	215
261-292	0.036	9A	4.2	HA1D-276A	265	220
261-292	0.072	11A	6.9	HA2D-276A	275	230
261-292	0.108	12A	10.3	HA3D-276A	290	245
261-292	0.216	14	12.9	HA6D-276A	315	265
261-292	0.432	17A	25.8	HA12D-276A	385	320
261-292	0.864	18	44.5	HCL24D-276A	470	390
292-326	0.016	9B	4.0	HA05D-310A	260	215
292-326	0.032	9A	4.2	HA1D-310A	265	220
292-326	0.064	11A	6.9	HA2D-310A	275	230
292-326	0.096	12A	10.3	HA3D-310A	290	245
292-326	0.192	14	12.9	HA6D-310A	315	265
292-326	0.384	17A	24.8	HA12D-310A	385	320
292-326	0.768	18	44.5	HCL24D-310A	475	395
326-365	0.014	9B	4.0	HA05D-346A	265	220
326-365	0.029	9A	4.2	HA1D-346A	270	225
326-365	0.058	11A	6.9	HA2D-346A	280	235
326-365	0.087	12A	10.3	HA3D-346A	300	250
326-365	0.174	14	12.9	HA6D-346A	320	270
326-365	0.348	17A	25.8	HA12D-346A	390	325
326-365	0.696	18	44.5	HCL24D-346A	480	400
365-409	0.013	9B	4.0	HA05D-387A	265	220
365-409	0.026	9A	4.2	HA1D-387A	270	225
365-409	0.052	11A	6.9	HA2D-387A	280	235
365-409	0.078	12A	10.3	HA3D-387A	300	250
365-409	0.156	14	12.9	HA6D-387A	320	370
365-409	0.312	17A	25.8	HA12D-387A	395	330
365-409	0.624	18	44.5	HCL24D-387A	480	400
409-458	0.011	9B	4.0	HA05D-433A	265	220
409-458	0.023	9A	4.2	HA1D-433A	270	225
409-458	0.046	11A	6.9	HA2D-433A	280	235
409-458	0.069	12A	10.3	HA3D-433A	300	250
409-458	0.138	14	12.9	HA6D-433A	$330	$275
409-458	0.276	17A	25.8	HA12D-433A	400	335
409-458	0.552	18	44.5	HC24D-433A	485	405
458-514	0.010	9B	4.0	HA05D-486A	270	225
458-514	0.021	9A	4.2	HA1D-486A	275	230
458-514	0.041	11A	6.9	HA2D-486A	285	240
458-514	0.062	12A	10.3	HA3D-486A	305	255
458-514	0.124	14	12.9	HA6D-486A	330	275
458-514	0.248	17A	25.8	HA12D-486A	405	340
458-514	0.496	18	44.5	HC24D-486A	490	410
514-590	0.009	9B	4.0	HA05D-552A	270	225
514-590	0.018	9A	4.2	HA1D-552A	275	230
514-590	0.036	11A	6.9	HA2D-552A	285	240
514-590	0.055	12A	10.3	HA3D-552A	305	255
514-590	0.110	14	12.9	HA6D-552A	330	275
514-590	0.220	17A	25.8	HA12D-522A	420	350
514-590	0.440	18	44.5	HC24D-552A	495	415
590-660	0.008	9B	4.0	HA05D-630A	275	230
590-660	0.016	9A	4.2	HA1D-630A	280	235
590-660	0.032	11A	6.9	HA2D-630A	290	245
590-660	0.048	12A	10.3	HA3D-630A	310	260
590-660	0.096	14	12.9	HA6D-630A	335	280
590-660	0.190	17A	25.8	HA12D-630A	430	360
590-660	0.380	18	44.5	HC24D-630A	510	425
660-740	0.007	9B	4.0	HA05D-700A	275	230
660-740	0.014	9A	4.2	HA1D-700A	280	235
660-740	0.028	11A	6.9	HA2D-700A	290	245
660-740	0.043	12A	10.3	HA3D-700A	310	260
660-740	0.086	14	12.9	HA6D-700A	335	280
660-740	0.172	17A	25.8	HA12D-700A	435	365
660-740	0.344	18	44.5	HC24D-700A	515	430
740-830	0.006	9B	4.0	HA05D-790A	280	235
740-830	0.012	9A	4.2	HA1D-790A	285	240
740-830	0.025	11A	6.9	HA2D-790A	300	250
740-830	0.038	12A	10.3	HA3D-790A	315	265
740-830	0.076	14	12.9	HA6D-790A	340	295
740-830	0.152	17A	25.8	HA12D-790A	455	380
740-830	0.304	18	44.5	HC24D-790A	520	435
830-930	0.005	9B	4.0	HA05D-880A	285	240
830-930	0.011	9A	4.2	HA1D-880A	290	245
830-930	0.022	11A	6.9	HA2D-880A	305	255
830-930	0.034	12A	10.3	HA3D-880A	320	270
830-930	0.068	14	12.9	HA6D-880A	345	290
830-930	0.138	17A	25.8	HA12D-880A	470	390
830-930	0.276	18	44.5	HC24D-880A	530	440
930-1040	0.005	9B	4.0	HA05D-990A	290	245
930-1040	0.010	9A	4.2	HA1D-990A	300	250
930-1040	0.020	11A	6.9	HA2D-990	310	260
930-1040	0.030	12A	10.3	HA3D-990A	330	275
930-1040	0.060	14	12.9	HA6D-990A	350	295
930-1040	0.120	17A	25.8	HA12D-990A	470	390
930-1040	0.240	18	44.5	HC24D-990A	540	450
1040-1160	0.004	9B	4.0	HAK05D-1100A	300	250
1040-1160	0.009	9A	4.2	HAK1D-1100A	305	255
1040-1160	0.018	11A	6.9	HAK2D-1100A	315	265
1040-1160	0.027	12A	10.3	HAK3D-1100A	335	280
1040-1160	0.054	14	12.9	HAK6D-1100A	360	300
1040-1160	0.109	17A	25.8	HAK12D-1100A	475	395
1040-1160	0.218	18	44.5	HCK24D-1100A	545	455
1160-1300	0.004	9B	4.0	HAK05D-1230A	305	255
1160-1300	0.008	9A	4.2	HAK1D-1230A	310	260
1160-1300	0.016	11A	6.9	HAK2D-1230A	320	270
1160-1300	0.024	12A	10.3	HAK3D-1230A	340	285
1160-1300	0.048	14	12.9	HAK6D-1230A	365	305
1160-1300	0.097	17A	25.8	HAK12D-1230A	480	400
1160-1300	0.194	18	44.5	HCK24D-1230A	550	460
1300-1480	0.003	9B	4.0	HAK05D-1380A	$310	$260
1300-1480	0.007	9A	4.2	HAK1D-1380A	315	265
1300-1480	0.014	11A	6.9	HAK2D-1380A	330	275
1300-1480	0.021	12A	10.3	HAK3D-1380A	345	290
1300-1480	0.043	14	12.9	HAK6D-1380A	370	310
1300-1480	0.086	17A	25.8	HAK12D-1380A	485	405
1300-1480	0.172	18	44.5	HCK24D-1380A	565	470
1480-1660	0.003	9B	4.0	HAK05D-1570A	315	265
1480-1660	0.006	9A	4.2	HAK1D-1570A	320	270
1480-1660	0.013	11A	6.9	HAK2D-1570A	335	280
1480-1660	0.019	12A	10.3	HAK3D-1570A	350	295
1480-1660	0.038	14	12.9	HAK6D-1570A	375	315
1480-1660	0.076	17A	25.8	HAK12D-1570A	490	410
1480-1660	0.152	18	44.5	HCK24D-1570A	580	485
1660-1860	0.002	9B	4.0	HAK05D-1760A	330	275
1660-1860	0.005	9A	4.2	HAK1D-1760A	335	280
1660-1860	0.010	11A	6.9	HAK2D-1760A	345	290
1660-1860	0.017	12A	10.3	HAK3D-1760A	365	305
1660-1860	0.034	14	12.9	HAK6D-1760A	390	325
1660-1860	0.068	17A	25.8	HAK12D-1760A	495	415
1660-1860	0.136	18	44.5	HCK24D-1760A	590	495
1860-2080	0.002	9B	4.0	HAK05D-1970A	340	285
1860-2080	0.005	9A	4.2	HAK1D-1970A	345	290
1860-2080	0.010	11A	6.9	HAK2D-1970A	360	300
1860-2080	0.015	12A	10.3	HAK3D-1970A	375	315
1860-2080	0.030	14	12.9	HAK6D-1970A	400	335
1860-2080	0.061	17A	25.8	HAK12D-1970A	510	425
1860-2080	0.122	18	44.5	HCK-24D-1970A	610	510
2080-2330	0.027	14	13.9	HAK6D-2200A	410	345
2080-2330	0.055	17A	25.8	HAK12D-2200A	520	435
2080-2330	0.110	18	44.5	HCK24D-2200A	635	530
2330-2610	0.024	14	13.9	HAK6D-2470A	435	365
2330-2610	0.049	17A	25.8	HAK12D-2470A	530	445
2330-2610	0.098	18	44.5	HCK24D-2470A	650	545
2610-2920	0.024	14	13.9	HAK6D-2760A	440	370
2610-2920	0.043	17A	25.8	HAK12D-2760A	540	450
2610-2920	0.086	18	44.5	HCK24D-2760A	675	565
2920-3260	0.019	14	13.9	HAK6D-3100A	460	385
2920-3260	0.038	17A	25.8	HAK12D-3100A	545	455
2920-3260	0.076	18	44.5	HCK24D-3100A	700	585
3260-3650	0.017	14	13.9	HAK6D-3460A	475	395
3260-3650	0.034	17A	25.8	HAK12D-3460A	570	475
3260-3650	0.068	18	44.5	HCK24D-3460A	735	615
3650-4090	0.005	15B	16.5	HN2D-3870A	495	415
3650-4090	0.010	17B	24.6	HN4D-3870A	695	580
4090-4580	0.004	15B	16.5	HN2D-4330A	545	455
4090-4580	0.009	17B	24.6	HN4D-4330A	735	615
4580-5140	0.004	15B	16.5	HN2D-4860A	590	495
4580-5140	0.008	17B	24.6	HN4D-4860A	785	655
5140-5900	0.003	15B	16.5	HN2D-5520A	645	540
5140-5900	0.007	17B	24.6	HN4D-5520A	825	690
5900-6600	0.003	15B	16.5	HN2D-6300A	690	575
5900-6600	0.006	17B	24.6	HN4D-6300A	875	730
6600-7400	0.002	15B	16.5	HN2D-7000A	740	620
6600-7400	0.005	17B	24.6	HN4D-7000A	915	765
7400-8300	0.002	15B	16.5	HN2D-7900A	780	650
7400-8300	0.005	17B	24.6	HN4D-7900A	965	805
8300-9300	0.002	15B	16.5	HN2D-8800A	840	700
8300-9300	0.004	17B	24.6	HN4D-8800A	1005	840
9300-10400	0.002	15B	16.5	HN2D-9900A	890	745
9300-10400	0.004	17B	24.6	HN4D-9900A	1060	885

† To have the header located on the mounting base, change the model number character preceding the first dash of Model Number to "B". (Example: V05B-5A indicates a header out the base.) See page 1851. No increase in price for this service.

Send us your special requirements for a comprehensive proposal with price and delivery

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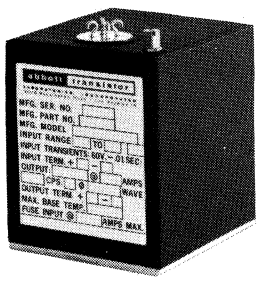
5200 W. Jefferson Blvd. / Los Angeles 90016
(213) WEbster 6-8185 Cable: ABTLABS

abbott 400 ~ to DC (Regulated)



POWER MODULES

features

- Close regulation
- 5 to 10,000 volts
- Hermetically sealed
- Compact, low cost
- Low ripple
- For aerospace application

specifications

Input Voltage Range
105-125 VAC

Input Frequency Range
380-420 Hertz, 1 phase

Line Regulation
±0.2% for input 105-125 VAC on Model T's, GA's, GAL's, and GC's
±0.5% for input 105 - 125 VAC on Model GAK's, GCK's and GN's

Voltage Regulation
±0.5% — for input 105-125 VAC and from ½ load to full load on Model T's
±1.5% — for input 105-125 VAC and from ½ load to full load on Model GA's
±2.5% — for input 105-125 VAC and from ½ load to full load on Model GAK's, GAL's, GC's and GN's

Ripple
0.2% RMS — Model T's
0.5% RMS — Model GA's
1% RMS — Model GAK's, GAL's & GC's
2% RMS — Model GN's

Voltage Adjustment Range
12% by screwdriver adjustment

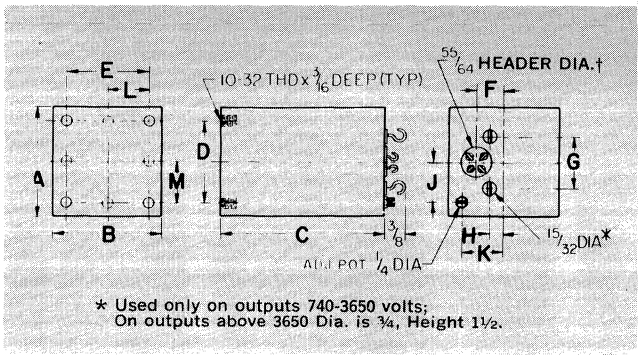
Environment
+160°F max. at mounting base using adequate heat sink
−65°F min. at mounting surface
Altitude: To vacuum (true hermetic seal)
Vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, and explosion to MIL-E-5272C

Output Voltage & Current
See specific models listed in the following pages
(Outputs and inputs are isolated)

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
4.7-5.3	0.400	2C	0.8	T02D-5A	$185	$155
4.7-5.3	1.0	3A	1.7	T05D-5A	190	160
4.7-5.3	2.0	3	1.8	T1D-5A	200	165
4.7-5.3	4.0	5	2.0	T2D-5A	210	175
4.7-5.3	6.0	6	2.3	T3D-5A	220	185
4.7-5.3	12.0	11	5.7	T6D-5A	280	235
5.3-5.9	0.357	2C	0.8	T02D-5.6A	185	155
5.3-5.9	0.9	3A	1.7	T05D-5.6A	190	160
5.3-5.9	1.8	3	1.8	T1D-5.6A	200	165
5.3-5.9	3.6	5	2.0	T2D-5.6A	210	175
5.3-5.9	5.4	6	2.3	T3D-5.6A	220	185
5.3-5.9	10.8	11	5.7	T6D-5.6A	280	235
5.9-6.6	0.318	2C	0.8	T02D-6.3A	185	155
5.9-6.6	0.8	3A	1.7	T05D-6.3A	190	160
5.9-6.6	1.6	3	1.8	T1D-6.3A	200	165
5.9-6.6	3.2	5	2.0	T2D-6.3A	210	175
5.9-6.6	4.8	6	2.3	T3D-6.3A	220	185
5.9-6.6	9.6	11	5.7	T6D-6.3A	275	230
6.6-7.4	0.286	2C	0.8	T02D-7A	185	155
6.6-7.4	0.7	3A	1.7	T05D-7A	190	160
6.6-7.4	1.4	3	1.8	T1D-7A	200	165
6.6-7.4	2.8	5	2.0	T2D-7A	210	175
6.6-7.4	4.2	6	2.3	T3D-7A	220	185
6.6-7.4	8.4	11	5.7	T6D-7A	275	230
7.4-8.3	0.253	2C	0.8	T02D-7.9A	185	155
7.4-8.3	0.63	3A	1.7	T05D-7.9A	190	160
7.4-8.3	1.26	3	1.8	T1D-7.9A	200	165
7.4-8.3	2.52	5	2.0	T2D-7.9A	210	175
7.4-8.3	3.78	6	2.3	T3D-7.9A	220	185
7.4-8.3	7.56	7	2.8	T6D-7.9A	275	230
8.3-9.3	0.227	2C	0.8	T02D-8.8A	180	150
8.3-9.3	0.57	3A	1.7	T05D-8.8A	185	155
8.3-9.3	1.14	3	1.8	T1D-8.8A	190	160
8.3-9.3	2.28	5	2.0	T2D-8.8A	205	170
8.3-9.3	3.42	6	2.3	T3D-8.8A	215	180
8.3-9.3	6.84	7	2.8	T6D-8.8A	275	230
9.3-10.4	0.202	2C	0.8	T02D-9.9A	180	150
9.3-10.4	0.50	3A	1.7	T05D-9.9A	185	155
9.3-10.4	1.00	3	1.8	T1D-9.9A	190	160
9.3-10.4	2.00	5	2.0	T2D-9.9A	205	170
9.3-10.4	3.00	6	2.3	T3D-9.9A	215	180
9.3-10.4	6.00	7	2.8	T6D-9.9A	275	230
9.3-10.4	12.00	11	5.7	T12D-9.9A	350	295
10.4-11.6	0.182	2C	0.8	T02D-11A	180	150
10.4-11.6	0.45	3A	1.7	T05D-11A	185	155
10.4-11.6	0.91	3	1.8	T1D-11A	190	160
10.4-11.6	1.82	5	2.0	T2D-11A	205	170
10.4-11.6	2.73	6	2.3	T3D-11A	215	180
10.4-11.6	5.46	7	2.5	T6D-11A	275	230
10.4-11.6	10.92	11	5.7	T12D-11A	350	295
11.6-13.0	0.163	2C	0.8	T02D-12.3A	180	150
11.6-13.0	0.40	3A	1.7	T05D-12.3A	185	155
11.6-13.0	0.81	3	1.8	T1D-12.3A	190	160
11.6-13.0	1.62	5	2.0	T2D-12.3A	205	170
11.6-13.0	2.43	6	2.3	T3D-12.3A	215	180
11.6-13.0	4.86	7	2.8	T6D-12.3A	270	225
11.6-13.0	9.72	11	5.7	T12D-12.3A	340	285
11.6-13.0	19.44	14	12.3	T24D-12.3A	430	360
13.0-14.8	0.145	2C	0.8	T02D-13.8A	175	145
13.0-14.8	0.36	3A	1.7	T05D-13.8A	180	150
13.0-14.8	0.72	3	1.8	T1D-13.8A	185	155
13.0-14.8	1.44	5	2.0	T2D-13.8A	200	165
13.0-14.8	2.16	6	2.3	T3D-13.8A	210	175
13.0-14.8	4.32	7	2.8	T6D-13.8A	270	225
13.0-14.8	8.64	11	5.7	T12D-13.8A	340	285
13.0-14.8	17.28	14	12.3	T24D-13.8A	430	360
14.8-16.6	0.127	2C	0.8	T02D-15.7A	175	145
14.8-16.6	0.32	3A	1.7	T05D-15.7A	180	150
14.8-16.6	0.64	3	1.8	T1D-15.7A	185	155
14.8-16.6	1.28	5	2.0	T2D-15.7A	200	165
14.8-16.6	1.92	6	2.3	T3D-15.7A	210	175
14.8-16.6	3.84	7	2.8	T6D-15.7A	270	225
14.8-16.6	7.68	11	5.7	T12D-15.7A	330	275
14.8-16.6	15.36	14	12.3	T24D-15.7A	420	350
16.6-18.6	0.114	2C	0.8	T02D-17.6A	$175	$145
16.6-18.6	0.28	3A	1.7	T05D-17.6A	180	150
16.6-18.6	0.57	3	1.8	T1D-17.6A	185	155
16.6-18.6	1.14	5	2.0	T2D-17.6A	200	165
16.6-18.6	1.71	6	2.3	T3D-17.6A	210	175
16.6-18.6	3.42	7	2.8	T6D-17.6A	270	225
16.6-18.6	6.84	11	5.7	T12D-17.6A	330	275
16.6-18.6	13.68	14	12.3	T24D-17.6A	420	350
18.6-20.8	0.101	2C	0.8	T02D-19.7A	175	145
18.6-20.8	0.255	3A	1.7	T05D-19.7A	180	150
18.6-20.8	0.510	3	1.8	T1D-19.7A	185	155
18.6-20.8	1.02	5	2.0	T2D-19.7A	200	165
18.6-20.8	1.53	6	2.3	T3D-19.7A	210	175
18.6-20.8	3.06	7	2.8	T6D-19.7A	265	220
18.6-20.8	6.12	11	5.7	T12D-19.7A	330	275
18.6-20.8	12.24	14	12.3	T24D-19.7A	420	350
20.8-23.3	0.098	2C	0.8	T02D-22A	170	140
20.8-23.3	0.230	3A	1.7	T05D-22A	175	145
20.8-23.3	0.460	3	1.8	T1D-22A	180	150
20.8-23.3	0.920	5	2.0	T2D-22A	190	160
20.8-23.3	1.38	6	2.3	T3D-22A	205	170
20.8-23.3	2.76	7	2.8	T6D-22A	265	220
20.8-23.3	5.52	11	5.7	T12D-22A	320	270
20.8-23.3	11.02	14	12.3	T24D-22A	405	340
23.3-26.1	0.081	2C	0.8	T02D-24.7A	170	140
23.3-26.1	0.205	3A	1.7	T05D-24.7A	175	145
23.3-26.1	0.410	3	1.8	T1D-24.7A	180	150
23.3-26.1	0.820	5	2.0	T2D-24.7A	190	160
23.3-26.1	1.23	6	2.3	T3D-24.7A	205	170
23.3-26.1	2.46	7	2.8	T6D-24.7A	265	220
23.3-26.1	4.92	11	5.7	T12D-24.7A	320	270
23.3-26.1	9.84	14	12.3	T24D-24.7A	405	340
26.1-29.2	0.073	2C	0.8	T02D-27.6A	170	140
26.1-29.2	0.180	3A	1.7	T05D-27.6A	175	145
26.1-29.2	0.360	3	1.8	T1D-27.6A	180	150
26.1-29.2	0.720	5	2.0	T2D-27.6A	190	160
26.1-29.2	1.08	6	2.3	T3D-27.6A	205	170
26.1-29.2	2.16	7	2.8	T6D-27.6A	265	220
26.1-29.2	4.32	11	5.7	T12D-27.6A	310	260
26.1-29.2	8.64	14	12.3	T24D-27.6A	395	330
29.2-32.6	0.065	2C	0.8	T02D-31A	170	140
29.2-32.6	0.160	3A	1.7	T05D-31A	175	145
29.2-32.6	0.320	3	1.8	T1D-31A	180	150
29.2-32.6	0.640	5	2.0	T2D-31A	190	160
29.2-32.6	0.960	6	2.3	T3D-31A	205	170
29.2-32.6	1.92	7	2.8	T6D-31A	265	220
29.2-32.6	3.84	11	5.7	T12D-31A	320	275
29.2-32.6	7.68	14	12.3	T24D-31A	420	350
32.6-36.5	0.058	2C	0.8	T02D-34.6A	170	140
32.6-36.5	0.145	3A	1.7	T05D-34.6A	175	145
32.6-36.5	0.290	3	1.8	T1D-34.6A	180	150
32.6-36.5	0.580	5	2.0	T2D-34.6A	190	160
32.6-36.5	0.870	6	2.3	T3D-34.6A	205	170
32.6-36.5	1.75	7	2.8	T6D-34.6A	265	220
32.6-36.5	3.48	11	5.7	T12D-34.6A	350	295
32.6-36.5	6.96	14	12.3	T24D-34.6A	435	365
36.5-40.9	0.052	2C	0.8	T02D-38.7A	170	140
36.5-40.9	0.130	3A	1.7	T05D-38.7A	175	145
36.5-40.9	0.260	3	1.8	T1D-38.7A	180	150
36.5-40.9	0.520	5	2.0	T2D-38.7A	190	160
36.5-40.9	0.780	6	2.3	T3D-38.7A	210	175
36.5-40.9	1.56	7	2.8	T6D-38.7A	270	225
36.5-40.9	3.12	11	5.7	T12D-38.7A	375	315
36.5-40.9	6.24	14	12.3	T24D-38.7A	460	385
40.9-45.8	0.046	2C	0.8	T02D-43.3A	170	140
40.9-45.8	0.115	3A	1.7	T05D-43.3A	175	145
40.9-45.8	0.230	3	1.8	T1D-43.3A	180	150
40.9-45.8	0.460	5	2.0	T2D-43.3A	190	160
40.9-45.8	0.690	6	2.3	T3D-43.3A	210	175
40.9-45.8	1.38	7	2.8	T6D-43.3A	270	225
40.9-45.8	2.76	11	5.7	T12D-43.3A	395	330
40.9-45.8	5.52	14	12.3	T24D-43.3A	485	405
45.8-51.4	0.041	2C	0.8	T02D-48.6A	175	145
45.8-51.4	0.103	3A	1.7	T05D-48.6A	180	150
45.8-51.4	0.206	3	1.8	T1D-48.6A	185	155
45.8-51.4	0.412	5	2.0	T2D-48.6A	200	165
45.8-51.4	0.618	6	2.3	T3D-48.6A	215	180
45.8-51.4	1.24	7	2.8	T6D-48.6A	$275	$230
45.8-51.4	2.47	11	5.7	T12D-48.6A	420	350
45.8-51.4	4.94	14	12.3	T24D-48.6A	505	420
51.4-59.0	0.036	2C	0.8	T02D-55.2A	195	160
51.4-59.0	0.091	3A	1.7	T05D-55.2A	200	165
51.4-59.0	0.182	3	1.8	T1D-55.2A	205	170
51.4-59.0	0.364	5	2.0	T2D-55.2A	215	180
51.4-59.0	0.546	6	2.3	T3D-55.2A	225	190
51.4-59.0	1.10	7	2.8	T6D-55.2A	280	235
51.4-59.0	2.20	11	5.7	T12D-55.2A	420	350
51.4-59.0	4.40	14	12.3	T24D-55.2A	505	420
59.0-66.0	0.032	2C	0.8	GA02D-63A	255	210
59.0-66.0	0.08	8A	2.2	GA05D-63A	260	215
59.0-66.0	0.16	8	2.5	GA1D-63A	265	220
59.0-66.0	0.32	9	3.0	GA2D-63A	275	230
59.0-66.0	0.48	10	3.9	GA3D-63A	315	265
59.0-66.0	0.96	12	5.8	GAL6D-63A	370	300
59.0-66.0	1.9	13	8.8	GAL12D-63A	430	360
59.0-66.0	3.8	17	25.5	GCL24D-63A	515	430
66.0-74.0	0.029	2C	0.8	GA02D-70A	255	210
66.0-74.0	0.071	8A	2.2	GA05D-70A	260	215
66.0-74.0	0.143	8	2.5	GA1D-70A	265	220
66.0-74.0	0.286	9	3.0	GA2D-70A	275	230
66.0-74.0	0.429	10	3.9	GA3D-70A	310	260
66.0-74.0	0.858	12	5.8	GAL6D-70A	365	295
66.0-74.0	1.72	13	8.8	GAL12D-70A	430	360
66.0-74.0	3.44	17	25.5	GCL24D-70A	515	430
74.0-83.0	0.025	2C	0.8	GA02D-79A	255	210
74.0-83.0	0.063	8A	2.2	GA05D-79A	260	215
74.0-83.0	0.127	8	2.5	GA1D-79A	265	220
74.0-83.0	0.254	9	3.0	GA2D-79A	275	230
74.0-83.0	0.381	10	3.9	GA3D-79A	305	255
74.0-83.0	0.762	12	5.8	GAL6D-79A	340	285
74.0-83.0	1.52	13	8.8	GAL12D-79A	430	360
74.0-83.0	3.04	17	25.5	GCL24D-79A	515	430
83.0-93.0	0.023	2C	0.8	GA02D-88A	255	210
83.0-93.0	0.057	8A	2.2	GA05D-88A	260	215
83.0-93.0	0.114	8	2.5	GA1D-88A	265	220
83.0-93.0	0.228	9	3.0	GA2D-88A	275	230
83.0-93.0	0.342	10	3.9	GA3D-88A	300	250
83.0-93.0	0.684	12	5.8	GAL6D-88A	330	275
83.0-93.0	1.38	13	8.8	GAL12D-88A	430	360
83.0-93.0	2.76	17	25.5	GCL24D-88A	515	430
93.0-104	0.020	2C	0.8	GA02D-99A	255	210
93.0-104	0.050	8A	2.2	GA05D-99A	260	215
93.0-104	0.100	8	2.5	GA1D-99A	265	220
93.0-104	0.200	9	3.0	GA2D-99A	275	230
93.0-104	0.300	10	3.9	GA3D-99A	290	245
93.0-104	0.600	12	5.8	GA6D-99A	315	265
93.0-104	1.20	13	8.8	GAL12D-99A	430	360
93.0-104	2.40	17	25.5	GCL24D-99A	515	430
104-116	0.018	2C	0.8	GA02D-110A	255	210
104-116	0.045	8A	2.2	GA05D-110A	260	215
104-116	0.091	8	2.5	GA1D-110A	265	220
104-116	0.182	9	3.0	GA2D-110A	275	230
104-116	0.273	10	3.9	GA3D-110A	290	245
104-116	0.546	12	5.8	GA6D-110A	315	265
104-116	1.092	13	8.8	GAL12D-110A	430	360
104-116	2.184	17	25.5	GCL24D-110A	515	430
116-130	0.016	2C	0.8	GA02D-123A	255	210
116-130	0.040	8A	2.2	GA05D-123A	260	215
116-130	0.081	8	2.5	GA1D-123A	265	220
116-130	0.162	9	3.0	GA2D-123A	275	230
116-130	0.243	10	3.9	GA3D-123A	290	245
116-130	0.486	12	5.8	GA6D-123A	315	265
116-130	0.972	13	8.8	GAL12D-123A	430	360
116-130	1.944	17	25.5	GCL24D-123A	515	430
130-148	0.014	2C	0.8	GA02D-138A	255	210
130-148	0.036	8A	2.2	GA05D-138A	260	215
130-148	0.072	8	2.5	GA1D-138A	265	220
130-148	0.144	9	3.0	GA2D-138A	275	230
130-148	0.216	10	3.9	GA3D-138A	290	245
130-148	0.432	12	5.8	GA6D-138A	315	265
130-148	0.864	13	8.8	GAL12D-138A	420	350
130-148	1.728	17	25.5	GCL24D-138A	505	420

Size	A	B	C	D	E	F	G	H	J	K	L	M
3	2¾	2¾	3	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
3A	2¾	2¾	2¾	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
5	2¾	2¾	3¼	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
6	2¾	3	3¼	2.25	2.50	¾	2	½	1⅛	1¼	—	—
7	2¾	2¾	4	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
8	2¾	4¼	3	2.25	3.75	0	2	0	1⅛	1⅞	—	—
8A	2¾	4¼	2¾	2.25	3.75	0	2	0	1⅛	1⅞	—	—
9	2¾	4⅝	3¼	2.25	4.12	0	2	0	1⅛	2 1/16	—	—
10	2¾	5¼	3¼	2.25	4.75	0	2	0	1⅛	2⅜	2.37	—
11	3	5½	3¼	2.50	5.00	2⅛	2	1⅞	1¼	2½	2.50	—
12	3	5½	4	2.50	5.00	2⅛	2	1⅞	1¼	2½	2.50	—
12B	3	8¼	4	2.50	7.75	2¼	2	½	1¼	3⅞	3.87	—
13	6	6	3¼	5.50	5.50	2⅜	2	2⅜	2¾	2¾	2.75	2.75
14	6	6	4	5.50	5.50	2⅜	2	2⅜	2¾	2¾	2.75	2.75
16	6	9	4	5.50	8.50	3⅞	2	3⅞	2¾	4¼	4.25	2.75
17	6	12	4	5.50	11.50	4¾	2	4¾	2¾	5¾	5.75	2.75

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DECIMALS .XX ±0.015.



* Used only on outputs 740-3650 volts;
On outputs above 3650 Dia. is ¾, Height 1½.

400 HERTZ TO DC (Regulated)

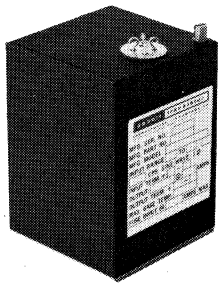
INPUT VOLTAGE: 115 VAC, 400 Hz, 1 PHASE

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
148-166	0.013	2C	0.8	GA02D-157A	$255	$210
148-166	0.032	8A	2.2	GA05D-157A	260	215
148-166	0.064	8	2.5	GA1D-157A	265	220
148-166	0.128	9	3.0	GA2D-157A	275	230
148-166	0.192	10	3.9	GA3D-157A	290	245
148-166	0.384	12	5.8	GA6D-157A	315	265
148-166	0.768	13	8.8	GAL12D-157A	405	340
148-166	1.536	17	25.5	GCL24D-157A	490	410
166-186	0.011	2C	0.8	GA02D-176A	255	210
166-186	0.028	8A	2.2	GA05D-176A	260	215
166-186	0.057	8	2.5	GA1D-176A	265	220
166-186	0.114	9	3.0	GA2D-176A	275	230
166-186	0.171	10	3.9	GA3D-176A	290	245
166-186	0.342	12	5.8	GA6D-176A	315	265
166-186	0.684	13	8.8	GAL12D-176A	395	330
166-186	1.368	17	25.5	GCL24D-176A	485	405
186-208	0.010	2C	0.8	GA02D-197A	255	210
186-208	0.025	8A	2.2	GA05D-197A	260	215
186-208	0.051	8	2.5	GA1D-197A	265	220
186-208	0.102	9	3.0	GA2D-197A	275	230
186-208	0.153	10	3.9	GA3D-197A	290	245
186-208	0.306	12	5.8	GA6D-197A	315	265
186-208	0.612	13	8.8	GA12D-197A	385	320
186-208	1.224	17	25.5	GCL24D-197A	475	395
208-233	0.009	2C	0.8	GA02D-220A	255	210
208-233	0.023	8A	2.2	GA05D-220A	260	215
208-233	0.046	8	2.5	GA1D-220A	265	220
208-233	0.092	9	3.0	GA2D-220A	275	230
208-233	0.138	10	3.9	GA3D-220A	290	245
208-233	0.276	12	5.8	GA6D-220A	315	265
208-233	0.552	13	8.8	GA12D-220A	375	315
208-233	1.104	17	25.5	GCL24D-220A	460	385
233-261	0.003	2C	0.8	GA02D-247A	255	210
233-261	0.020	8A	2.2	GA05D-247A	260	215
233-261	0.041	8	2.5	GA1D-247A	265	220
233-261	0.082	9	3.0	GA2D-247A	275	230
233-261	0.123	10	3.9	GA3D-247A	290	245
233-261	0.246	12	5.8	GA6D-247A	315	265
233-261	0.492	13	8.8	GA12D-247A	375	315
233-261	0.984	17	25.5	GCL24D-247A	460	385
261-292	0.007	2C	0.8	GA02D-276A	255	210
261-292	0.018	8A	2.2	GA05D-276A	260	215
261-292	0.036	8	2.5	GA1D-276A	265	220
261-292	0.072	9	3.0	GA2D-276A	275	230
261-292	0.108	10	3.9	GA3D-276A	290	245
261-292	0.216	12	5.8	GA6D-276A	315	265
261-292	0.432	13	8.8	GA12D-276A	385	320
261-292	0.864	17	25.5	GCL24D-276A	470	390
292-326	0.006	2C	0.8	GA02D-310A	255	210
292-326	0.016	8A	2.2	GA05D-310A	260	215
292-326	0.032	8	2.5	GA1D-310A	265	220
292-326	0.064	9	3.0	GA2D-310A	275	230
292-326	0.096	10	3.9	GA3D-310A	290	245
292-326	0.192	12	5.8	GA6D-310A	315	265
292-326	0.384	13	8.8	GA12D-310A	385	320
292-326	0.768	17	25.5	GCL24D-310A	475	395
326-365	0.006	2C	0.8	GA02D-346A	260	215
326-365	0.014	8A	2.2	GA05D-346A	265	220
326-365	0.029	8	2.5	GA1D-346A	270	225
326-365	0.058	9	3.0	GA2D-346A	280	235
326-365	0.087	10	3.9	GA3D-346A	300	250
326-365	0.174	12	5.8	GA6D-346A	320	270
326-365	0.348	13	8.8	GA12D-346A	390	325
326-365	0.696	17	25.5	GCL24D-346A	480	400
365-409	0.005	2C	0.8	GA02D-387A	260	215
365-409	0.013	8A	2.2	GA05D-387A	265	220
365-409	0.026	8	2.5	GA1D-387A	270	225
365-409	0.052	9	3.0	GA2D-387A	280	235
365-409	0.078	10	3.9	GA3D-387A	300	250
365-409	0.156	12	5.8	GA6D-387A	$320	$270
365-409	0.312	13	8.8	GA12D-387A	395	330
365-409	0.624	17	25.5	GCL24D-387A	480	400
409-458	0.005	2C	0.8	GA02D-433A	260	215
409-458	0.011	8A	2.2	GA05D-433A	265	220
409-458	0.023	8	2.5	GA1D-433A	270	225
409-458	0.046	9	3.0	GA2D-433A	280	235
409-458	0.069	10	3.9	GA3D-433A	300	250
409-458	0.138	12	5.8	GA6D-433A	330	275
409-458	0.276	13	8.8	GA12D-433A	400	335
409-458	0.552	17	25.5	GC24D-433A	485	405
458-514	0.004	2C	0.8	GA02D-486A	265	220
458-514	0.010	8A	2.2	GA05D-486A	270	225
458-514	0.021	8	2.5	GA1D-486A	275	230
458-514	0.041	9	3.0	GA2D-486A	285	240
458-514	0.062	10	3.9	GA3D-486A	305	255
458-514	0.124	12	5.8	GA6D-486A	330	275
458-514	0.248	13	8.8	GA12D-486A	405	340
458-514	0.496	17	25.5	GC24D-486A	490	410
514-590	0.004	2C	0.8	GA02D-552A	265	220
514-590	0.009	8A	2.2	GA05D-552A	270	225
514-590	0.018	8	2.5	GA1D-552A	275	230
514-590	0.036	9	3.0	GA2D-552A	285	240
514-590	0.055	10	3.9	GA3D-552A	305	255
514-590	0.110	12	5.8	GA6D-552A	330	275
514-590	0.220	13	8.8	GA12D-552A	420	350
514-590	0.440	17	25.5	GC24D-552A	495	415
590-660	0.008	8A	2.2	GA05D-630A	275	230
590-660	0.016	8	2.5	GA1D-630A	280	235
590-660	0.032	9	3.0	GA2D-630A	290	245
590-660	0.048	10	3.9	GA3D-630A	310	260
590-660	0.096	12	5.8	GA6D-630A	335	280
590-660	0.190	13	8.8	GA12D-630A	430	360
590-660	0.380	17	25.5	GC24D-630A	510	425
660-740	0.007	8A	2.2	GA05D-700A	275	230
660-740	0.014	8	2.5	GA1D-700A	280	235
660-740	0.028	9	3.0	GA2D-700A	290	245
660-740	0.043	10	3.9	GA3D-700A	310	260
660-740	0.086	12	5.8	GA6D-700A	335	280
660-740	0.172	13	8.8	GA12D-700A	435	365
660-740	0.344	17	25.5	GC24D-700A	515	430
740-830	0.006	8A	2.2	GA05D-790A	280	235
740-830	0.012	8	2.5	GA1D-790A	285	240
740-830	0.025	9	3.0	GA2D-790A	300	250
740-830	0.038	10	3.9	GA3D-790A	315	265
740-830	0.076	12	5.8	GA6D-790A	340	285
740-830	0.152	13	8.8	GA12D-790A	455	380
740-830	0.304	17	25.5	GC24D-790A	520	435
830-930	0.005	8A	2.2	GA05D-880A	285	240
830-930	0.011	8	2.5	GA1D-880A	290	245
830-930	0.022	9	3.0	GA2D-880A	305	255
830-930	0.034	10	3.9	GA3D-880A	320	270
830-930	0.068	12	5.8	GA6D-880A	345	290
830-930	0.138	13	8.8	GA12D-880A	470	390
830-930	0.276	17	25.5	GC24D-880A	530	440
930-1040	0.005	8A	2.2	GA05D-990A	290	245
930-1040	0.010	8	2.5	GA1D-990A	300	250
930-1040	0.020	9	3.0	GA2D-990A	310	260
930-1040	0.030	10	3.9	GA3D-990A	330	275
930-1040	0.060	12	5.8	GA6D-990A	350	295
930-1040	0.120	13	8.8	GA12D-990A	470	390
930-1040	0.240	17	25.5	GC24D-990A	540	450
1040-1160	0.004	8A	2.2	GAK05D-1100A	300	250
1040-1160	0.009	8	2.5	GAK1D-1100A	305	255
1040-1160	0.018	9	3.0	GAK2D-1100A	315	265
1040-1160	0.027	10	3.9	GAK3D-1100A	335	280
1040-1160	0.054	12	5.8	GAK6D-1100A	360	300
1040-1160	0.109	14	9.9	GAK12D-1100A	475	395
1040-1160	0.218	17	25.5	GCK24D-1100A	545	455
1160-1300	0.004	8A	2.2	GAK05D-1230A	$305	$255
1160-1300	0.008	8	2.5	GAK1D-1230A	310	260
1160-1300	0.016	9	3.0	GAK2D-1230A	320	270
1160-1300	0.024	10	3.9	GAK3D-1230A	340	285
1160-1300	0.048	12	5.8	GAK6D-1230A	365	305
1160-1300	0.091	14	9.9	GAK12D-1230A	480	400
1160-1300	0.194	17	25.5	GCK24D-1230A	550	460
1300-1480	0.003	8A	2.2	GAK05D-1380A	310	260
1300-1480	0.007	8	2.5	GAK1D-1380A	315	265
1300-1480	0.014	9	3.0	GAK2D-1380A	330	275
1300-1480	0.021	10	3.9	GAK3D-1380A	345	290
1300-1480	0.043	12	5.8	GAK6D-1380A	370	310
1300-1480	0.086	14	9.9	GAK12D-1380A	485	405
1300-1480	0.172	17	25.5	GCK24D-1380A	565	470
1480-1660	0.003	8A	2.2	GAK05D-1570A	315	265
1480-1660	0.006	8	2.5	GAK1D-1570A	320	270
1480-1660	0.013	9	3.0	GAK2D-1570A	335	280
1480-1660	0.019	10	3.9	GAK3D-1570A	350	295
1480-1660	0.038	12	5.8	GAK6D-1570A	375	315
1480-1660	0.076	14	9.9	GAK12D-1570A	490	410
1480-1660	0.152	17	25.5	GCK24D-1570A	580	485
1660-1860	0.002	8A	2.2	GAK05D-1760A	330	275
1660-1860	0.005	8	2.5	GAK1D-1760A	335	280
1660-1860	0.010	9	3.0	GAK2D-1760A	345	290
1660-1860	0.017	10	3.9	GAK3D-1760A	365	305
1660-1860	0.034	12	5.8	GAK6D-1760A	390	325
1660-1860	0.068	14	9.9	GAK12D-1760A	495	415
1660-1860	0.136	17	25.5	GCK24D-1760A	590	495
1860-2080	0.002	8A	2.2	GAK05D-1970A	340	285
1860-2080	0.005	8	2.5	GAK1D-1970A	345	290
1860-2080	0.010	9	3.0	GAK2D-1970A	360	300
1860-2080	0.015	10	3.9	GAK3D-1970A	375	315
1860-2080	0.030	12	5.8	GAK6D-1970A	400	335
1860-2080	0.061	14	9.9	GAK12D-1970A	510	425
1860-2080	0.122	17	25.5	GCK24D-1970A	610	510
2080-2330	0.027	12	5.8	GAK6D-2200A	410	345
2080-2330	0.055	14	9.9	GAK12D-2200A	520	435
2080-2330	0.110	17	25.5	GCK24D-2200A	635	530
2330-2610	0.024	12	5.8	GAK6D-2470A	435	365
2330-2610	0.049	14	9.9	GAK12D-2470A	530	445
2330-2610	0.098	17	25.5	GCK24D-2470A	650	545
2610-2920	0.021	12	5.8	GAK6D-2760A	440	370
2610-2920	0.043	14	9.9	GAK12D-2760A	540	450
2610-2920	0.086	17	25.5	GCK24D-2760A	675	565
2920-3260	0.019	12	5.8	GAK6D-3100A	460	385
2920-3260	0.038	14	9.9	GAK12D-3100A	545	455
2920-3260	0.076	17	25.5	GCK24D-3100A	700	585
3260-3650	0.017	12	5.8	GAK6D-3460A	475	395
3260-3650	0.034	14	9.9	GAK12D-3460A	570	475
3260-3650	0.068	17	25.5	GCK24D-3460A	735	615
3650-4090	0.005	12B	6.7	GN2D-3870A	495	415
3650-4090	0.010	16	14.1	GN4D-3870A	695	580
4090-4580	0.004	12B	6.7	GN2D-4330A	545	455
4090-4580	0.008	16	14.1	GN4D-4330A	735	615
4580-5140	0.004	12B	6.7	GN2D-4860A	590	495
4580-5140	0.008	16	14.1	GN4D-4860A	785	655
5140-5900	0.003	12B	6.7	GN2D-5520A	645	540
5140-5900	0.006	16	14.1	GN4D-5520A	825	690
5900-6600	0.003	12B	6.7	GN2D-6300A	690	575
5900-6600	0.006	16	14.1	GN4D-6300A	875	730
6600-7400	0.002	12B	6.7	GN2D-7000A	740	620
6600-7400	0.004	16	14.1	GN4D-7000A	915	765
7400-8300	0.002	12B	6.7	GN2D-7900A	780	650
7400-8300	0.004	16	14.1	GN4D-7900A	965	805
8300-9300	0.002	12B	6.7	GN2D-8800A	840	700
8300-9300	0.004	16	14.1	GN4D-8800A	1005	840
9300-10400	0.002	12B	6.7	GN2D-9900A	890	745
9300-10400	0.004	16	14.1	GN4D-9900A	1060	885

† To have the header located on the mounting base, change the model number character preceding the first dash of Model Number to "B". (Example: T05**B**-5A indicates a header out the base.) See page 1851. No increase in price for this service.

abbott transistor
LABORATORIES, INCORPORATED
5200 W. Jefferson Blvd. / Los Angeles 90016
(213) WEbster 6-8185 Cable: ABTLABS

abbott 400~ to DC (Reg.) Hi-Temp.



POWER MODULES

features

- Hi-temp. +212°F.
- 5 to 3500 volts
- Hermetically sealed
- Compact, low cost
- Low ripple
- For aerospace application

specifications

Input Voltage Range
105-125 VAC

Input Frequency Range
380-420 Hertz, 1 phase

Line Regulation
±0.2% for input 105-125 VAC on Model U's and GB's
±0.5% for input 105-125 VAC on Model GBK's

Voltage Regulation
±0.5%—for input 105-125 VAC and from ½ load to full load on Model U's
±1.5%—for input 105-125 VAC and from ½ load to full load on Model GB's
±2.5%—for input 105-125 VAC and from ½ load to full load on Model GBK's

Ripple
0.2% RMS—Model U's
0.5% RMS—Model GB's
1% RMS—Model GBK's

Voltage Adjustment Range
12% by screwdriver adjustment

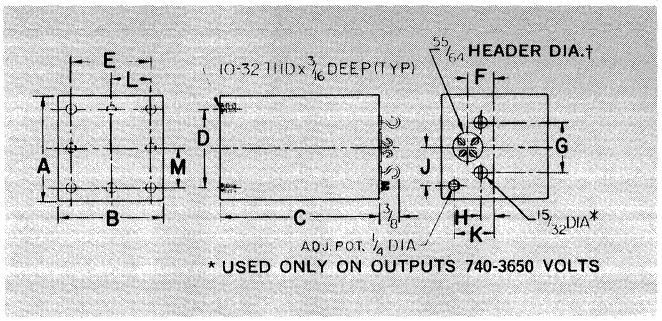
Environment
+212°F max. at mounting base using adequate heat sink
−65°F min. at mounting surface
Altitude: To vacuum (true hermetic seal).
Vibration, shock, sand, dust, humidity, salt-spray, fungus, sunshine, rain, and explosion to MIL-E-5272C

Output Voltage & Current
See specific models listed
(Outputs and inputs are isolated)

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
4.7-5.3	0.400	2C	0.8	U02D-5A	$233	$194
4.7-5.3	1.0	3A	1.7	U05D-5A	240	200
4.7-5.3	2.0	3	1.8	U1D-5A	247	206
4.7-5.3	4.0	5	2.0	U2D-5A	261	218
4.7-5.3	6.0	6	2.3	U3D-5A	277	231
4.7-5.3	10.0	11	5.5	U5D-5A	351	293
5.3-5.9	0.357	2C	0.8	U02D-5.6A	233	194
5.3-5.9	0.9	3A	1.7	U05D-5.6A	240	200
5.3-5.9	1.8	3	1.8	U1D-5.6A	247	206
5.3-5.9	3.6	5	2.0	U2D-5.6A	261	218
5.3-5.9	5.4	6	2.3	U3D-5.6A	277	231
5.3-5.9	8.91	11	5.5	U5D-5.6A	351	293
5.9-6.6	0.318	2C	0.8	U02D-6.3A	233	194
5.9-6.6	0.8	3A	1.7	U05D-6.3A	240	200
5.9-6.6	1.6	3	1.8	U1D-6.3A	247	206
5.9-6.6	3.2	5	2.0	U2D-6.3A	261	218
5.9-6.6	4.8	6	2.3	U3D-6.3A	277	231
5.9-6.6	7.92	11	5.5	U5D-6.3A	344	287
6.6-7.4	0.286	2C	0.8	U02D-7A	233	194
6.6-7.4	0.7	3A	1.7	U05D-7A	240	200
6.6-7.4	1.4	3	1.8	U1D-7A	247	206
6.6-7.4	2.8	5	2.0	U2D-7A	261	218
6.6-7.4	4.2	6	2.3	U3D-7A	277	231
6.6-7.4	7.15	11	5.5	U5D-7A	344	287
7.4-8.3	0.253	2C	0.8	U02D-7.9A	224	187
7.4-8.3	0.63	3A	1.7	U05D-7.9A	231	193
7.4-8.3	1.26	3	1.8	U1D-7.9A	240	200
7.4-8.3	2.52	5	2.0	U2D-7.9A	254	212
7.4-8.3	3.78	6	2.3	U3D-7.9A	277	231
7.4-8.3	6.32	7	3.0	U5D-7.9A	344	287
8.3-9.3	0.227	2C	0.8	U02D-8.8A	224	187
8.3-9.3	0.57	3A	1.7	U05D-8.8A	231	193
8.3-9.3	1.14	3	1.8	U1D-8.8A	240	200
8.3-9.3	2.28	5	2.0	U2D-8.8A	254	212
8.3-9.3	3.42	6	2.3	U3D-8.8A	277	231
8.3-9.3	5.68	7	3.0	U5D-8.8A	344	287
9.3-10.4	0.202	2C	0.8	U02D-9.9A	224	187
9.3-10.4	0.50	3A	1.7	U05D-9.9A	231	193
9.3-10.4	1.00	3	1.8	U1D-9.9A	240	200
9.3-10.4	2.00	5	2.0	U2D-9.9A	254	212
9.3-10.4	3.00	6	2.3	U3D-9.9A	270	225
9.3-10.4	5.05	7	3.0	U5D-9.9A	344	287
9.3-10.4	10.10	11	5.5	U10D-9.9A	441	368
10.4-11.6	0.182	2C	0.8	U02D-11A	224	187
10.4-11.6	0.45	3A	1.7	U05D-11.A	231	193
10.4-11.6	0.91	3	1.8	U1D-11A	240	200
10.4-11.6	1.82	5	2.0	U2D-11A	254	212
10.4-11.6	2.73	6	2.3	U3D-11A	270	225
10.4-11.6	4.55	7	3.0	U5D-11A	344	287
10.4-11.6	9.10	11	5.5	U10D-11A	441	368
11.6-13.0	0.163	2C	0.8	U02D-12.3A	224	187
11.6-13.0	0.40	3A	1.7	U05D-12.3A	231	193
11.6-13.0	0.81	3	1.8	U1D-12.3A	240	200
11.6-13.0	1.62	5	2.0	U2D-12.3A	254	212
11.6-13.0	2.43	6	2.3	U3D-12.3A	270	225
11.6-13.0	4.06	7	3.0	U5D-12.3A	337	281
11.6-13.0	8.12	11	5.5	U10D-12.3A	427	356
11.6-13.0	13.83	14	14.5	U17D-12.3A	505	421
13.0-14.8	0.145	2C	0.8	U02D-13.8A	217	181
13.0-14.8	0.36	3A	1.7	U05D-13.8A	224	187
13.0-14.8	0.72	3	1.8	U1D-13.8A	231	193
13.0-14.8	1.44	5	2.0	U2D-13.8A	247	206
13.0-14.8	2.16	6	2.3	U3D-13.8A	261	218
13.0-14.8	3.62	7	3.0	U5D-13.8A	337	281
13.0-14.8	7.24	11	5.5	U10D-13.8A	427	356
13.0-14.8	12.31	14	14.5	U17D-13.8A	505	421
14.8-16.6	0.127	2C	0.8	U02D-15.7A	217	181
14.8-16.6	0.32	3A	1.7	U05D-15.7A	224	187
14.8-16.6	0.64	3	1.8	U1D-15.7A	231	193
14.8-16.6	1.28	5	2.0	U2D-15.7A	247	206
14.8-16.6	1.92	6	2.3	U3D-15.7A	261	218
14.8-16.6	3.18	7	3.0	U5D-15.7A	$337	$281
14.8-16.6	6.36	11	5.5	U10D-15.7A	411	343
14.8-16.6	10.81	14	14.5	U17D-15.7A	490	409
16.6-18.6	0.114	2C	0.8	U02D-17.6A	217	181
16.6-18.6	0.28	3A	1.7	U05D-17.6A	224	187
16.6-18.6	0.57	3	1.8	U1D-17.6A	231	193
16.6-18.6	1.14	5	2.0	U2D-17.6A	247	206
16.6-18.6	1.71	6	2.3	U3D-17.6A	261	218
16.6-18.6	2.84	7	3.0	U5D-17.6A	337	281
16.6-18.6	5.68	11	5.5	U10D-17.6A	411	343
16.6-18.6	9.65	14	14.5	U17D-17.6A	490	409
18.6-20.8	0.101	2C	0.8	U02D-19.7A	217	181
18.6-20.8	0.255	3A	1.7	U05D-19.7A	224	187
18.6-20.8	0.510	3	1.8	U1D-19.7A	231	193
18.6-20.8	1.02	5	2.0	U2D-19.7A	247	206
18.6-20.8	1.53	6	2.3	U3D-19.7A	261	218
18.6-20.8	2.54	7	3.0	U5D-19.7A	330	275
18.6-20.8	5.08	11	5.5	U10D-19.7A	411	343
18.6-20.8	8.62	14	14.5	U17D-19.7A	490	409
20.8-23.3	0.098	2C	0.8	U02D-22A	210	175
20.8-23.3	0.230	3A	1.7	U05D-22A	217	181
20.8-23.3	0.460	3	1.8	U1D-22A	224	187
20.8-23.3	0.920	5	2.0	U2D-22A	240	200
20.8-23.3	1.38	6	2.3	U3D-22A	254	212
20.8-23.3	2.27	7	3.0	U5D-22A	330	275
20.8-23.3	4.54	11	5.5	U10D-22A	404	337
20.8-23.3	7.72	14	14.5	U17D-22A	477	398
23.3-26.1	0.081	2C	0.8	U02D-24.7A	210	175
23.3-26.1	0.205	3A	1.7	U05D-24.7A	217	181
23.3-26.1	0.410	3	1.8	U1D-24.7A	224	187
23.3-26.1	0.820	5	2.0	U2D-24.7A	240	200
23.3-26.1	1.23	6	2.3	U3D-24.7A	254	212
23.3-26.1	2.02	7	3.0	U5D-24.7A	330	275
23.3-26.1	4.04	11	5.5	U10D-24.7A	404	337
23.3-26.1	6.88	14	14.5	U17D-24.7A	477	398
26.1-29.2	0.073	2C	0.8	U02D-27.6A	210	175
26.1-29.2	0.180	3A	1.7	U05D-27.6A	217	181
26.1-29.2	0.360	3	1.8	U1D-27.6A	224	187
26.1-29.2	0.720	5	2.0	U2D-27.6A	240	200
26.1-29.2	1.08	6	2.3	U3D-27.6A	254	212
26.1-29.2	1.81	7	3.0	U5D-27.6A	330	275
26.1-29.2	3.62	11	5.5	U10D-27.6A	390	325
26.1-29.2	6.16	14	14.5	U17D-27.6A	463	386
29.2-32.6	0.065	2C	0.8	U02D-31A	210	175
29.2-32.6	0.160	3A	1.7	U05D-31A	217	181
29.2-32.6	0.320	3	1.8	U1D-31A	224	187
29.2-32.6	0.640	5	2.0	U2D-31A	240	200
29.2-32.6	0.960	6	2.3	U3D-31A	254	212
29.2-32.6	1.61	7	3.0	U5D-31A	330	275
29.2-32.6	3.22	11	5.5	U10D-31A	411	343
29.2-32.6	5.48	14	14.5	U17D-31A	490	409
32.6-36.5	0.058	2C	0.8	U02D-34.6A	210	175
32.6-36.5	0.145	3A	1.7	U05D-34.6A	217	181
32.6-36.5	0.290	3	1.8	U1D-34.6A	224	187
32.6-36.5	0.580	5	2.0	U2D-34.6A	240	200
32.6-36.5	0.870	6	2.3	U3D-34.6A	254	212
32.6-36.5	1.44	7	3.0	U5D-34.6A	330	275
32.6-36.5	2.88	11	5.5	U10D-34.6A	441	368
32.6-36.5	4.91	14	14.5	U17D-34.6A	514	429
36.5-40.9	0.052	2C	0.8	U02D-38.7A	210	175
36.5-40.9	0.130	3A	1.7	U05D-38.7A	217	181
36.5-40.9	0.260	3	1.8	U1D-38.7A	224	187
36.5-40.9	0.520	5	2.0	U2D-38.7A	240	200
36.5-40.9	0.780	6	2.3	U3D-38.7A	261	218
36.5-40.9	1.29	7	3.0	U5D-38.7A	337	281
36.5-40.9	2.58	11	5.5	U10D-38.7A	471	393
36.5-40.9	4.39	14	14.5	U17D-38.7A	544	454
40.9-45.8	0.046	2C	0.8	U02D-43.3A	210	175
40.9-45.8	0.115	3A	1.7	U05D-43.3A	217	181
40.9-45.8	0.230	3	1.8	U1D-43.3A	224	187
40.9-45.8	0.460	5	2.0	U2D-43.3A	$240	$200
40.9-45.8	0.690	6	2.3	U3D-43.3A	261	218
40.9-45.8	1.15	7	3.0	U5D-43.3A	337	281
40.9-45.8	2.30	11	5.5	U10D-43.3A	494	412
40.9-45.8	3.92	14	14.5	U17D-43.3A	572	477
45.8-51.4	0.041	2C	0.8	U02D-48.6A	217	181
45.8-51.4	0.103	3A	1.7	U05D-48.6A	224	187
45.8-51.4	0.206	3	1.8	U1D-48.6A	231	193
45.8-51.4	0.412	5	2.0	U2D-48.6A	247	206
45.8-51.4	0.618	6	2.3	U3D-48.6A	270	225
45.8-51.4	1.03	7	3.0	U5D-48.6A	344	287
45.8-51.4	2.06	11	5.5	U10D-48.6A	524	437
45.8-51.4	3.49	14	14.5	U17D-48.6A	597	498
51.4-59.0	0.036	2C	0.8	U02D-55.2A	240	200
51.4-59.0	0.091	3A	1.7	U05D-55.2A	247	206
51.4-59.0	0.182	3	1.8	U1D-55.2A	254	212
51.4-59.0	0.364	5	2.0	U2D-55.2A	270	225
51.4-59.0	0.546	6	2.3	U3D-55.2A	284	237
51.4-59.0	0.905	7	3.0	U5D-55.2A	351	293
51.4-59.0	1.81	11	5.5	U10D-55.2A	524	437
51.4-59.0	3.07	14	14.5	U17D-55.2A	597	498
59.0-66.0	0.032	2C	0.8	GB02D-63A	314	262
59.0-66.0	0.080	8A	2.2	GB05D-63A	321	268
59.0-66.0	0.160	8	2.8	GB1D-63A	330	275
59.0-66.0	0.320	9	3.0	GB2D-63A	344	287
59.0-66.0	0.480	10	3.8	GB3D-63A	397	331
59.0-66.0	0.792	12	5.8	GBL5D-63A	450	375
59.0-66.0	1.590	13	8.8	GBL10D-63A	540	450
59.0-66.0	2.69	17	25.5	GBL17D-63A	613	511
66.0-74.0	0.029	2C	0.8	GB02D-70A	314	262
66.0-74.0	0.071	8A	2.2	GB05D-70A	321	268
66.0-74.0	0.143	8	2.8	GB1D-70A	330	275
66.0-74.0	0.286	9	3.0	GB2D-70A	344	287
66.0-74.0	0.429	10	3.8	GB3D-70A	390	325
66.0-74.0	0.715	12	5.8	GBL5D-70A	441	368
66.0-74.0	1.43	13	8.8	GBL10D-70A	540	450
66.0-74.0	2.42	17	25.5	GBL17D-70A	613	511
74.0-83.0	0.025	2C	0.8	GB02D-79A	314	262
74.0-83.0	0.063	8A	2.2	GB05D-79A	321	268
74.0-83.0	0.127	8	2.8	GB1D-79A	330	275
74.0-83.0	0.254	9	3.0	GB2D-79A	344	287
74.0-83.0	0.381	10	3.8	GB3D-79A	381	318
74.0-83.0	0.634	12	5.8	GBL5D-79A	427	356
74.0-83.0	1.27	13	8.8	GBL10D-79A	540	450
74.0-83.0	2.15	17	25.5	GBL17D-79A	613	511
83.0-93.0	0.023	2C	0.8	GB02D-88A	314	262
83.0-93.0	0.057	8A	2.2	GB05D-88A	321	268
83.0-93.0	0.114	8	2.8	GB1D-88A	330	275
83.0-93.0	0.228	9	3.0	GB2D-88A	344	287
83.0-93.0	0.342	10	3.8	GB3D-88A	374	312
83.0-93.0	0.568	12	5.8	GBL5D-88A	411	343
83.0-93.0	1.14	13	8.8	GBL10D-88A	540	450
83.0-93.0	1.93	17	25.5	GBL17D-88A	613	511
93.0-104	0.020	2C	0.8	GB02D-99A	314	262
93.0-104	0.050	8A	2.2	GB05D-99A	321	268
93.0-104	0.100	8	2.8	GB1D-99A	330	275
93.0-104	0.200	9	3.0	GB2D-99A	344	287
93.0-104	0.300	10	3.8	GB3D-99A	367	306
93.0-104	0.510	12	5.8	GBL5D-99A	397	331
93.0-104	1.02	13	8.8	GBL10D-99A	540	450
93.0-104	1.71	17	25.5	GBL17D-99A	613	511
104-116	0.018	2C	0.8	GB02D-110A	314	262
104-116	0.045	8A	2.2	GB05D-110A	321	268
104-116	0.091	8	2.8	GB1D-110A	330	275
104-116	0.182	9	3.0	GB2D-110A	344	287
104-116	0.273	10	3.8	GB3D-110A	367	306
104-116	0.455	12	5.8	GBL5D-110A	397	331
104-116	0.910	13	8.8	GBL10D-110A	540	450
104-116	1.545	17	25.5	GBL17D-110A	613	511

Size	A	B	C	D	E	F	G	H	J	K	L	M
3	2¾	2¾	3	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
3A	2¾	2¾	2¾	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
5	2¾	2¾	3¼	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
6	2¾	3	3¼	2.25	2.50	¾	2	½	1⅛	1¼	—	—
7	2¾	2¾	4	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
8	2¾	4¼	3	2.25	3.75	0	2	0	1⅛	1⅞	—	—
8A	2¾	4½	2¾	2.25	3.75	0	2	0	1⅛	1⅞	—	—
9	2¾	4⅝	3¼	2.25	4.12	0	2	0	1⅛	2⅛	—	—
10	2¾	5¼	3¼	2.25	4.75	0	2	0	1⅛	2⅜	2.37	—
11	3	5½	3¼	2.50	5.00	2⅛	2	1⅞	1¼	2½	2.50	—
12	3	5½	4	2.50	5.00	2⅛	2	1⅞	1¼	2½	2.50	—
13	6	6	3¼	5.50	5.50	2⅜	2	2⅜	2¾	2¾	2.75	2.75
14	6	6	4	5.50	5.50	2⅜	2	2⅜	2¾	2¾	2.75	2.75
17	6	12	4	5.50	11.50	4¾	2	4¾	2¾	5¾	5.75	2.75

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DECIMALS .XX ±0.015.



400 HERTZ TO DC (Reg.) HI-TEMP.

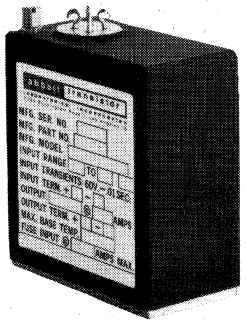
INPUT VOLTAGE: 115 VAC (Nominal), 380-420 Hz, 1 PHASE

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
116-130	0.016	2C	0.8	GB02D-123A	$314	$262
116-130	0.040	8A	2.2	GB05D-123A	321	268
116-130	0.081	8	2.8	GB1D-123A	330	275
116-130	0.162	9	3.0	GB2D-123A	344	287
116-130	0.243	10	3.8	GB3D-123A	367	306
116-130	0.406	12	5.8	GBL5D-123A	397	331
116-130	0.812	13	8.8	GBL10D-123A	540	450
116-130	1.381	17	25.5	GBL17D-123A	613	511
130-148	0.014	2C	0.8	GB02D-138A	314	262
130-148	0.036	8A	2.2	GB05D-138A	321	268
130-148	0.072	8	2.8	GB1D-138A	330	275
130-148	0.144	9	3.0	GB2D-138A	344	287
130-148	0.216	10	3.8	GB3D-138A	367	306
130-148	0.362	12	5.8	GBL5D-138A	397	331
130-148	0.724	13	8.8	GBL10D-138A	524	437
130-148	1.231	17	25.5	GBL17D-138A	597	498
148-166	0.013	2C	0.8	GB02D-157A	314	262
148-166	0.032	8A	2.2	GB05D-157A	321	268
148-166	0.064	8	2.8	GB1D-157A	330	275
148-166	0.128	9	3.0	GB2D-157A	344	287
148-166	0.192	10	3.8	GB3D-157A	367	306
148-166	0.318	12	5.8	GB5D-157A	397	331
148-166	0.636	13	8.8	GBL10D-157A	510	425
148-166	1.082	17	25.5	GBL17D-157A	583	486
166-186	0.011	2C	0.8	GB02D-176A	314	262
166-186	0.028	8A	2.2	GB05D-176A	321	268
166-186	0.057	8	2.8	GB1D-176A	330	275
166-186	0.114	9	3.0	GB2D-176A	344	287
166-186	0.171	10	3.8	GB3D-176A	367	306
166-186	0.284	12	5.8	GB5D-176A	397	331
166-186	0.568	13	8.8	GBL10D-176A	494	412
166-186	0.965	17	25.5	GBL17D-176A	572	477
186-208	0.010	2C	0.8	GB02D-197A	314	262
186-208	0.025	8A	2.2	GB05D-197A	321	268
186-208	0.051	8	2.8	GB1D-197A	330	275
186-208	0.102	9	3.0	GB2D-197A	344	287
186-208	0.153	10	3.8	GB3D-197A	367	306
186-208	0.254	12	5.8	GB5D-197A	397	331
186-208	0.508	13	8.8	GBL10D-197A	480	400
186-208	0.862	17	25.5	GBL17D-197A	558	465
208-233	0.009	2C	0.8	GB02D-220A	314	262
208-233	0.023	8A	2.2	GB05D-220A	321	268
208-233	0.046	8	2.8	GB1D-220A	330	275
208-233	0.092	9	3.0	GB2D-220A	344	287
208-233	0.138	10	3.8	GB3D-220A	367	306
208-233	0.228	12	5.8	GB5D-220A	397	331
208-233	0.456	13	8.8	GBL10D-220A	471	393
208-233	0.772	17	25.5	GBL17D-220A	544	454
233-261	0.008	2C	0.8	GB02D-247A	314	262
233-261	0.020	8A	2.2	GB05D-247A	321	268
233-261	0.041	8	2.8	GB1D-247A	330	275
233-261	0.082	9	3.0	GB2D-247A	344	287
233-261	0.123	10	3.8	GB3D-247A	367	306
233-261	0.203	12	5.8	GB5D-247A	397	331
233-261	0.406	13	8.8	GBL10D-247A	471	393
233-261	0.688	17	25.5	GBL17D-247A	544	454
261-292	0.007	2C	0.8	GB02D-276A	314	262
261-292	0.018	8A	2.2	GB05D-276A	321	268
261-292	0.036	8	2.8	GB1D-276A	330	275
261-292	0.072	9	3.0	GB2D-276A	344	287
261-292	0.108	10	3.8	GB3D-276A	367	306
261-292	0.181	12	5.8	GB5D-276A	397	331
261-292	0.362	13	8.8	GBL10D-276A	480	400
261-292	0.615	17	25.5	GBL17D-276A	553	461
292-326	0.006	2C	0.8	GB02D-310A	$314	$262
292-326	0.016	8A	2.2	GB05D-310A	321	268
292-326	0.032	8	2.8	GB1D-310A	330	275
292-326	0.064	9	3.0	GB2D-310A	344	287
292-326	0.096	10	3.8	GB3D-310A	367	306
292-326	0.161	12	5.8	GB5D-310A	397	331
292-326	0.322	13	8.8	GB10D-310A	480	400
292-326	0.548	17	25.5	GBL17D-310A	558	465
326-365	0.006	2C	0.8	GB02D-346A	323	269
326-365	0.014	8A	2.2	GB05D-346A	330	275
326-365	0.029	8	2.8	GB1D-346A	337	281
326-365	0.058	9	3.0	GB2D-346A	351	293
326-365	0.087	10	3.8	GB3D-346A	374	312
326-365	0.145	12	5.8	GB5D-346A	404	337
326-365	0.290	13	8.8	GB10D-346A	487	406
326-365	0.491	17	25.5	GBL17D-346A	565	471
365-409	0.005	2C	0.8	GB02D-387A	323	269
365-409	0.013	8A	2.2	GB05D-387A	330	275
365-409	0.026	8	2.8	GB1D-387A	337	281
365-409	0.052	9	3.0	GB2D-387A	351	293
365-409	0.078	10	3.8	GB3D-387A	374	312
365-409	0.129	12	5.8	GB5D-387A	404	337
365-409	0.258	13	8.8	GB10D-387A	494	412
365-409	0.439	17	25.5	GBL17D-387A	567	473
409-458	0.005	2C	0.8	GB02D-433A	323	269
409-458	0.011	8A	2.2	GB05D-433A	330	275
409-458	0.023	8	2.8	GB1D-433A	337	281
409-458	0.046	9	3.0	GB2D-433A	351	293
409-458	0.069	10	3.8	GB3D-433A	374	312
409-458	0.166	12	5.8	GB5D-433A	411	343
409-458	0.232	13	8.8	GB10D-433A	501	418
409-458	0.392	17	25.5	GB17D-433A	574	479
458-514	0.004	2C	0.8	GB02D-486A	330	275
458-514	0.010	8A	2.2	GB05D-486A	337	281
458-514	0.021	8	2.8	GB1D-486A	344	287
458-514	0.041	9	3.0	GB2D-486A	360	300
458-514	0.062	10	3.8	GB3D-486A	381	318
458-514	0.103	12	5.8	GB5D-486A	411	343
458-514	0.206	13	8.8	GB10D-486A	510	425
458-514	0.349	17	25.5	GB17D-486A	583	486
514-590	0.004	2C	0.8	GB02D-552A	330	275
514-590	0.009	8A	2.2	GB05D-552A	337	281
514-590	0.018	8	2.8	GB1D-552A	344	287
514-590	0.036	9	3.0	GB2D-552A	360	300
514-590	0.055	10	3.8	GB3D-552A	381	318
514-590	0.090	12	5.8	GB5D-552A	411	343
514-590	0.180	13	8.8	GB10D-552A	524	437
514-590	0.307	17	25.5	GB17D-552A	592	494
590-660	0.008	8A	2.2	GB05D-630A	344	287
590-660	0.016	8	2.8	GB1D-630A	351	293
590-660	0.032	9	3.0	GB2D-630A	367	306
590-660	0.048	10	3.8	GB3D-630A	390	325
590-660	0.079	12	5.8	GB5D-630A	420	350
590-660	0.158	13	8.8	GB10D-630A	540	450
590-660	0.269	17	25.5	GB17D-630A	600	500
660-740	0.007	8A	2.2	GB05D-700A	344	287
660-740	0.014	8	2.8	GB1D-700A	351	293
660-740	0.028	9	3.0	GB2D-700A	367	306
660-740	0.043	10	3.8	GB3D-700A	390	325
660-740	0.071	12	5.8	GB5D-700A	420	350
660-740	0.142	13	8.8	GB10D-700A	547	456
660-740	0.242	17	25.5	GB17D-700A	615	513
740-830	0.006	8A	2.2	GB05D-790A	351	293
740-830	0.012	8	2.8	GB1D-790A	360	300
740-830	0.025	9	3.0	GB2D-790A	374	312
740-830	0.038	10	3.8	GB3D-790A	$397	$331
740-830	0.063	12	5.8	GB5D-790A	427	356
740-830	0.126	13	8.8	GB10D-790A	370	475
740-830	0.215	17	25.5	GB17D-790A	627	523
830-930	0.005	8A	2.2	GB05D-880A	360	300
830-930	0.011	8	2.8	GB1D-880A	367	306
830-930	0.022	9	3.0	GB2D-880A	381	318
830-930	0.034	10	3.8	GB3D-880A	404	337
830-930	0.057	12	5.8	GB5D-880A	434	362
830-930	0.014	13	8.8	GB10D-880A	584	487
830-930	0.193	17	25.5	GB17D-880A	637	531
930-1040	0.005	8A	2.2	GB05D-990A	367	306
930-1040	0.010	8	2.8	GB1D-990A	374	312
930-1040	0.020	9	3.0	GB2D-990A	390	325
930-1040	0.030	10	3.8	GB3D-990A	411	343
930-1040	0.051	12	5.8	GB5D-990A	441	368
930-1040	0.102	13	8.8	GB10D-990A	584	487
930-1040	0.171	17	25.5	GB17D-990A	646	539
1040-1160	0.018	9	3.0	**GBK2D-1100A**	397	331
1040-1160	0.027	10	3.8	GBK3D-1100A	420	350
1040-1160	0.045	12	5.8	GBK5D-1100A	450	375
1040-1160	0.090	14	8.9	GBK10D-1100A	591	493
1040-1160	0.154	17	25.5	GBK17D-1100A	655	546
1160-1300	0.016	9	3.0	GBK2D-1230A	404	337
1160-1300	0.024	10	3.8	GBK3D-1230A	427	356
1160-1300	0.041	12	5.8	GBK5D-1230A	457	381
1160-1300	0.082	14	8.9	GBK10D-1230A	600	500
1160-1300	0.138	17	25.5	GBK17D-1230A	662	552
1300-1480	0.014	9	3.0	GBK2D-1380A	411	343
1300-1480	0.021	10	3.8	GBK3D-1380A	434	362
1300-1480	0.036	12	5.8	GBK5D-1380A	464	387
1300-1480	0.072	14	8.9	GBK10D-1380A	607	506
1300-1480	0.123	17	25.5	GBK17D-1380A	675	563
1480-1660	0.013	9	3.0	GBK2D-1570A	420	350
1480-1660	0.019	10	3.8	GBK3D-1570A	441	368
1480-1660	0.032	12	5.8	GBK5D-1570A	471	393
1480-1660	0.064	14	8.9	GBK10D-1570A	614	512
1480-1660	0.108	17	25.5	GBK17D-1570A	692	577
1660-1860	0.010	9	3.0	GBK2D-1760A	434	362
1660-1860	0.017	10	3.8	GBK3D-1760A	457	381
1660-1860	0.028	12	5.8	GBK5D-1760A	487	406
1660-1860	0.056	14	8.9	GBK10D-1760A	621	518
1660-1860	0.096	17	25.5	GBK17D-1760A	705	588
1860-2080	0.010	9	3.0	GBK2D-1970A	450	375
1860-2080	0.015	10	3.8	GBK3D-1970A	471	393
1860-2080	0.025	12	5.8	GBK5D-1970A	501	418
1860-2080	0.051	14	8.8	GBK10D-1970A	637	531
1860-2080	0.086	17	25.5	GBK17D-1970A	726	605
2080-2330	0.023	12	5.8	GBK5D-2200A	517	431
2080-2330	0.045	14	8.9	GBK10D-2200A	651	543
2080-2330	0.077	17	25.5	GBK17D-2200A	751	626
2330-2610	0.020	12	5.8	GBK5D-2470A	547	456
2330-2610	0.040	14	8.9	GBK10D-2470A	667	556
2330-2610	0.068	17	25.5	GBK17D-2470A	771	643
2610-2920	0.018	12	5.8	GBK5D-2760A	554	462
2610-2920	0.036	14	8.9	GBK10D-2760A	674	562
2610-2920	0.061	17	25.5	GBK17D-2760A	794	662
2920-3260	0.016	12	5.8	GBK5D-3100A	577	481
2920-3260	0.032	14	8.9	GBK10D-3100A	681	568
2920-3260	0.054	17	25.5	GBK17D-3100A	818	682
3260-3650	0.014	12	5.8	GBK5D-3460A	591	498
3260-3650	0.029	14	8.9	GBK10D-3460A	711	593
3260-3650	0.049	17	25.5	GBK17D-3460A	859	716

† To have the header located on the mounting base, change the model number character preceding the first dash of Model Number to "B". (Example: U5**B**-5A indicates a header out the base.) See page 1851. No increase in price for this service.

abbott transistor
LABORATORIES, INCORPORATED
5200 W. Jefferson Blvd. / Los Angeles 90016
(213) WEbster 6-8185 Cable: ABTLABS

abbott 28 VDC to DC (Regulated)



POWER MODULES

features

- Close regulation
- 5 to 10,000 volts
- Hermetically sealed
- Short circuit protection
- Compact, low cost
- Input spike protection

specifications

Input Voltage Range
24 to 30 volts DC

Line Regulation
±0.2% for input 24 to 30 VDC on Model A's, AL's and C's
±0.5% for input 24 to 30 VDC on Model AK's, AN's and CK's

Voltage Regulation
±1.5% for input 24 to 30 VDC and from ½ load to full load on Model A's
±2.5% for input 24 to 30 VDC and from ½ load to full load on Model AK's, AL's, AN's and C's

Ripple
0.5% RMS — Model A's
1.0% RMS—Model AK's, AL's and C's
2% RMS — Model AN's

Voltage Adjustment Range
12% by screwdriver adjustment

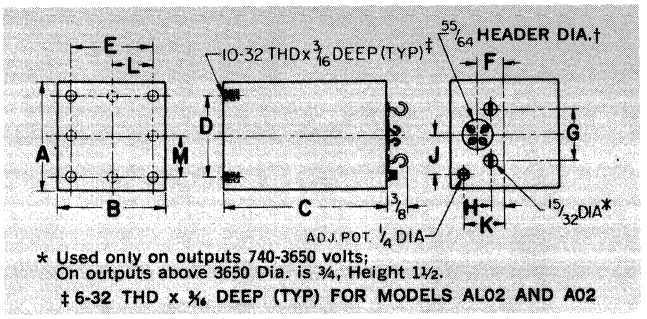
Environment
+160°F max. at mounting base, using adequate heat sink
−65°F min. at mounting surface
Altitude: to vacuum (true hermetic seal)
Vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, and explosion to MIL-E-5272C

Output Voltage and Current
See specific models listed in the following pages
(Outputs and inputs are isolated)

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
4.7-5.3	0.400	1B	0.5	AL02D-5A	$210	$175
4.7-5.3	1.0	1A	0.9	AL05D-5A	220	185
4.7-5.3	2.0	1	1.0	AL1D-5A	235	195
4.7-5.3	4.0	2	1.2	AL2D-5A	250	210
4.7-5.3	6.0	4	1.4	AL3D-5A	275	230
4.7-5.3	12.0	7	2.5	AL6D-5A	315	265
5.3-5.9	0.357	1B	0.5	AL02D-5.6A	205	170
5.3-5.9	0.9	1A	0.9	AL05D-5.6A	215	180
5.3-5.9	1.8	1	1.0	AL1D-5.6A	225	190
5.3-5.9	3.6	2	1.2	AL2D-5.6A	245	205
5.3-5.9	5.4	4	1.4	AL3D-5.6A	270	225
5.3-5.9	10.8	7	2.5	AL6D-5.6A	310	260
5.9-6.6	0.318	1B	0.5	AL02D-6.3A	205	170
5.9-6.6	0.8	1A	0.9	AL05D-6.3A	215	180
5.9-6.6	1.6	1	1.0	AL1D-6.3A	225	190
5.9-6.6	3.2	2	1.2	AL2D-6.3A	245	205
5.9-6.6	4.8	4	1.4	AL3D-6.3A	270	225
5.9-6.6	9.6	5	1.9	AL6D-6.3A	310	260
6.6-7.4	0.286	1B	0.5	AL02D-7A	205	170
6.6-7.4	0.7	1A	0.9	AL05D-7A	215	180
6.6-7.4	1.4	1	1.0	AL1D-7A	225	190
6.6-7.4	2.8	2	1.2	AL2D-7A	245	205
6.6-7.4	4.2	4	1.4	AL3D-7A	260	220
6.6-7.4	8.4	5	1.9	AL6D-7A	305	255
7.4-8.3	0.253	1B	0.5	AL02D-7.9A	205	170
7.4-8.3	0.63	1A	0.9	AL05D-7.9A	215	180
7.4-8.3	1.26	1	1.0	AL1D-7.9A	225	190
7.4-8.3	2.52	2	1.2	AL2D-7.9A	245	205
7.4-8.3	3.78	4	1.4	AL3D-7.9A	260	220
7.4-8.3	7.56	5	1.9	AL6D-7.9A	305	255
8.3-9.3	0.227	1B	0.5	AL02D-8.8A	205	170
8.3-9.3	0.57	1A	0.9	AL05D-8.8A	215	180
8.3-9.3	1.14	1	1.0	AL1D-8.8A	220	185
8.3-9.3	2.28	2	1.2	AL2D-8.8A	240	200
8.3-9.3	3.42	4	1.4	AL3D-8.8A	255	215
8.3-9.3	6.82	5	1.9	AL6D-8.8A	300	250
9.3-10.4	0.202	1B	0.5	A02D-9.9A	200	165
9.3-10.4	0.50	1A	0.9	A05D-9.9A	210	175
9.3-10.4	1.00	1	1.0	AL1D-9.9A	220	185
9.3-10.4	2.00	2	1.2	AL2D-9.9A	235	195
9.3-10.4	3.00	4	1.4	AL3D-9.9A	250	210
9.3-10.4	6.00	5	1.9	AL6D-9.9A	300	250
9.3-10.4	12.00	11	3.9	AL12D-9.9A	350	295
10.4-11.6	0.182	1B	0.5	A02D-11A	200	165
10.4-11.6	0.45	1A	0.9	A05D-11A	210	175
10.4-11.6	0.91	1	1.0	AL1D-11A	215	180
10.4-11.6	1.82	2	1.2	AL2D-11A	225	190
10.4-11.6	2.73	4	1.4	AL3D-11A	250	210
10.4-11.6	5.46	5	1.9	AL6D-11A	295	245
10.4-11.6	10.92	11	3.9	AL12D-11A	345	290
11.6-13.0	0.163	1B	0.5	A02D-12.3A	200	165
11.6-13.0	0.40	1A	0.9	A05D-12.3A	210	175
11.6-13.0	0.81	1	1.0	AL1D-12.3A	215	180
11.6-13.0	1.62	2	1.2	AL2D-12.3A	235	195
11.6-13.0	2.43	4	1.4	AL3D-12.3A	250	210
11.6-13.0	4.86	5	1.9	AL6D-12.3A	285	240
11.6-13.0	9.72	11	3.9	AL12D-12.3A	335	280
11.6-13.0	19.44	14	11.9	CL24D-12.3A	425	355
13.0-14.8	0.145	1B	0.5	A02D-13.8A	200	165
13.0-14.8	0.36	1A	0.9	A05D-13.8A	210	175
13.0-14.8	0.72	1	1.0	AL1D-13.8A	215	180
13.0-14.8	1.44	2	1.2	AL2D-13.8A	245	205
13.0-14.8	2.16	4	1.4	AL3D-13.8A	255	215
13.0-14.8	4.32	5	1.9	AL6D-13.8A	280	235
13.0-14.8	8.64	11	3.9	AL12D-13.8A	330	275
13.0-14.8	17.28	14	11.9	CL24D-13.8A	420	350
14.8-16.6	0.127	1B	0.5	A02D-15.7A	200	165
14.8-16.6	0.32	1A	0.9	A05D-15.7A	210	175
14.8-16.6	0.64	1	1.0	AL1D-15.7A	215	180
14.8-16.6	1.28	2	1.2	AL2D-15.7A	245	205
14.8-16.6	1.92	4	1.4	AL3D-15.7A	255	215
14.8-16.6	3.84	5	1.9	AL6D-15.7A	280	235
14.8-16.6	7.68	11	3.9	AL12D-15.7A	320	270
14.8-16.6	15.36	14	11.9	CL24D-15.7A	405	340
16.6-18.6	0.114	1B	0.5	A02D-17.6A	190	160
16.6-18.6	0.28	1A	0.9	A05D-17.6A	205	170
16.6-18.6	0.57	1	1.0	A1D-17.6A	$210	$175
16.6-18.6	1.14	2	1.2	AL2D-17.6A	240	200
16.6-18.6	1.71	4	1.4	AL3D-17.6A	255	215
16.6-18.6	3.42	5	1.9	AL6D-17.6A	275	230
16.6-18.6	6.84	11	3.9	AL12D-17.6A	315	265
16.6-18.6	13.68	14	11.9	CL24D-17.6A	400	335
18.6-20.8	0.101	1B	0.5	A02D19.7A	190	160
18.6-20.8	0.255	1A	0.9	A05D-19.7A	205	170
18.6-20.8	0.510	1	1.0	A1D-19.7A	210	175
18.6-20.8	1.02	2	1.2	AL2D-19.7A	240	200
18.6-20.8	1.53	4	1.4	AL3D-19.7A	250	210
18.6-20.8	3.06	5	1.9	AL6D-19.7A	265	220
18.6-20.8	6.12	11	3.9	AL12D-19.7A	315	265
18.6-20.8	12.24	14	11.9	CL24D-19.7A	400	335
20.8-23.3	0.091	1B	0.5	A02D-22A	185	155
20.8-23.3	0.230	1A	0.9	A05D-22A	200	165
20.8-23.3	0.460	1	1.0	A1D-22A	205	170
20.8-23.3	0.920	2	1.2	AL2D-22A	235	195
20.8-23.3	1.38	4	1.4	AL3D-22A	240	200
20.8-23.3	2.76	5	1.9	AL6D-22A	265	220
20.8-23.3	5.52	11	3.9	AL12D-22A	315	265
20.8-23.3	11.00	14	11.9	CL24D-22A	400	335
23.3-26.1	0.081	1B	0.5	A02D-24.7A	185	155
23.3-26.1	0.205	1A	0.9	A05D-24.7A	200	165
23.3-26.1	0.410	1	1.0	A1D-24.7A	205	170
23.3-26.1	0.820	2	1.2	AL2D-24.7A	225	195
23.3-26.1	1.23	4	1.4	AL3D-24.7A	240	200
23.3-26.1	2.46	5	1.9	AL6D-24.7A	265	220
23.3-26.1	4.92	11	3.9	AL12D-24.7A	315	265
23.3-26.1	9.84	14	11.9	CL24D-24.7A	400	335
26.1-29.2	0.073	1B	0.5	A02D-27.6A	185	155
26.1-29.2	0.180	1A	0.9	A05D-27.6A	200	165
26.1-29.2	0.360	1	1.0	A1D-27.6A	205	170
26.1-29.2	0.720	2	1.2	AL2D-27.6A	225	190
26.1-29.2	1.08	4	1.4	AL3D-27.6A	240	200
26.1-29.2	2.16	5	1.9	AL6D-27.6A	265	220
26.1-29.2	4.32	11	3.9	AL12D-27.6A	315	265
26.1-29.2	8.64	14	11.9	CL24D-27.6A	400	335
29.2-32.6	0.065	1B	0.5	A02D-31A	185	155
29.2-32.6	0.160	1A	0.9	A05D-31A	200	165
29.2-32.6	0.320	1	1.0	A1D-31A	205	170
29.2-32.6	0.640	2	1.2	A2D-31A	220	185
29.2-32.6	0.960	4	1.4	AL3D-31A	240	200
29.2-32.6	1.92	5	1.9	AL6D-31A	265	220
29.2-32.6	3.84	11	3.9	AL12D-31A	315	265
29.2-32.6	7.68	14	11.9	CL24D-31A	400	335
32.6-36.5	0.058	1B	0.5	A02D-34.6A	185	155
32.6-36.5	0.145	1A	0.9	A05D-34.6A	200	165
32.6-36.5	0.290	1	1.0	A1D-34.6A	205	170
32.6-36.5	0.580	2	1.2	A2D-34.6A	210	175
32.6-36.5	0.870	4	1.4	AL3D-34.6A	240	200
32.6-36.5	1.74	5	1.9	AL6D-34.6	265	220
32.6-36.5	3.48	11	3.9	AL12D-34.6A	315	265
32.6-36.5	6.96	14	11.9	CL24D-34.6A	400	335
36.5-40.9	0.052	1B	0.5	A02D-38.7A	185	155
36.5-40.9	0.130	1A	0.9	A05D-38.7A	200	165
36.5-40.9	0.260	1	1.0	A1D-38.7A	205	170
36.5-40.9	0.520	2	1.2	A2D-38.7A	210	175
36.5-40.9	0.780	4	1.4	AL3D-38.7A	240	200
36.5-40.9	1.56	5	1.9	AL6D-38.7A	265	220
36.5-40.9	3.12	11	3.9	AL12D-38.7A	315	265
36.5-40.9	6.24	14	11.9	CL24D-38.7A	400	335
40.9-45.8	0.046	1B	0.5	A02D-43.3A	185	155
40.9-45.8	0.115	1A	0.9	A05D-43.3A	200	165
40.9-45.8	0.230	1	1.0	A1D-43.3A	205	170
40.9-45.8	0.460	2	1.2	A2D-43.3A	210	175
40.9-45.8	0.690	4	1.4	AL3D-43.3A	240	200
40.9-45.8	1.38	5	1.9	AL6D-43.3A	265	220
40.9-45.8	2.76	11	3.9	AL12D-43.3A	315	265
40.9-45.8	5.52	14	11.9	CL24D-43.3A	400	335
45.8-51.4	0.041	1B	0.5	A02D-48.6A	185	155
45.8-51.4	0.103	1A	0.9	A05D-48.6A	200	165
45.8-51.4	0.206	1	1.0	A1D-48.6A	205	170
45.8-51.4	0.412	2	1.2	A2D-48.6A	210	175
45.8-51.4	0.618	4	1.4	A3D-48.6A	240	200
45.8-51.4	1.24	5	1.9	AL6D-48.6A	$265	$220
45.8-51.4	2.48	11	3.9	AL12D-48.6A	315	265
45.8-51.4	4.96	14	11.9	CL24D-48.6A	400	335
51.4-59.0	0.036	1B	0.5	A02D-55.2A	185	155
51.4-59.0	0.091	1A	0.9	A05D-55.2A	200	165
51.4-59.0	0.182	1	1.0	A1D-55.2A	205	170
51.4-59.0	0.364	2	1.2	A2D-55.2A	210	175
51.4-59.0	0.546	4	1.4	A3D-55.2A	240	200
51.4-59.0	1.10	5	1.9	AL6D-55.2A	265	220
51.4-59.0	2.20	11	3.9	AL12D-55.2A	315	265
51.4-59.0	4.40	14	11.9	CL24D-55.2A	400	335
59.0-66.0	0.032	1B	0.5	A02D-63A	185	155
59.0-66.0	0.080	1A	0.9	A05D-63A	200	165
59.0-66.0	0.160	1	1.0	A1D-63A	205	170
59.0-66.0	0.320	2	1.2	A2D-63A	210	175
59.0-66.0	0.480	4	1.4	A3D-63A	240	200
59.0-66.0	0.960	5	1.9	AL6D-63A	265	220
59.0-66.0	1.90	11	3.9	AL12D-63A	315	265
59.0-66.0	3.80	14	11.9	CL24D-63A	400	335
66.0-74.0	0.029	1B	0.5	A02D-70A	185	155
66.0-74.0	0.071	1A	0.9	A05D-70A	200	165
66.0-74.0	0.143	1	1.0	A1D-70A	205	170
66.0-74.0	0.286	2	1.2	A2D-70A	210	175
66.0-74.0	0.429	4	1.4	A3D-70A	235	195
66.0-74.0	0.858	5	1.9	AL6D-70A	255	215
66.0-74.0	1.72	11	3.9	AL12D-70A	315	265
66.0-74.0	3.44	14	11.9	CL24D-70A	400	335
74.0-83.0	0.025	1B	0.5	A02D-79A	185	155
74.0-83.0	0.063	1A	0.9	A05D-79A	200	165
74.0-83.0	0.127	1	1.0	A1D-79A	205	170
74.0-83.0	0.254	2	1.2	A2D-79A	210	175
74.0-83.0	0.381	4	1.4	A3D-79A	235	195
74.0-83.0	0.762	5	1.9	AL6D-79A	245	205
74.0-83.0	1.52	11	3.9	AL12D-79A	315	265
74.0-83.0	3.04	14	11.9	CL24D-79A	400	335
83.0-93.0	0.023	1B	0.5	A02D-88A	185	155
83.0-93.0	0.057	1A	0.9	A05D-88A	200	165
83.0-93.0	0.114	1	1.0	A1D-88A	205	170
83.0-93.0	0.228	2	1.2	A2D-88A	210	175
83.0-93.0	0.342	4	1.4	A3D-88A	220	185
83.0-93.0	0.684	5	1.9	AL6D-88A	235	195
83.0-93.0	1.38	11	3.9	AL12D-88A	315	265
83.0-93.0	2.76	14	11.9	CL24D-88A	400	335
93.0-104	0.020	1B	0.5	A02D-99A	185	155
93.0-104	0.050	1A	0.9	A05D-99A	200	165
93.0-104	0.100	1	1.0	A1D-99A	205	170
93.0-104	0.200	2	1.2	A2D-99A	210	175
93.0-104	0.300	4	1.4	A3D-99A	215	180
93.0-104	0.600	5	1.9	A6D-99A	220	185
93.0-104	1.20	11	3.9	AL12D-99A	315	265
93.0-104	2.40	14	11.9	CL24D-99A	400	335
104-116	0.018	1B	0.5	A02D-110A	185	155
104-116	0.045	1A	0.9	A05D-110A	200	165
104-116	0.091	1	1.0	A1D-110A	205	170
104-116	0.182	2	1.2	A2D-110A	210	175
104-116	0.273	4	1.4	A3D-110A	215	180
104-116	0.546	5	1.9	A6D-110A	220	185
104-116	1.092	11	3.9	AL12D-110A	315	265
104-116	2.184	14	11.9	CL24D-110A	400	335
116-130	0.016	1B	0.5	A02D-123A	185	155
116-130	0.040	1A	0.9	A05D-123A	200	165
116-130	0.081	1	1.0	A1D-123A	205	170
116-130	0.162	2	1.2	A2D-123A	210	175
116-130	0.243	4	1.4	A3D-123A	215	180
116-130	0.486	5	1.9	A6D-123A	220	185
116-130	0.972	11	3.9	AL12D-123A	315	265
116-130	1.944	14	11.9	CL24D-123A	400	335
130-148	0.014	1B	0.5	A02D-138A	185	155
130-148	0.036	1A	0.9	A05D-138A	200	165
130-148	0.072	1	1.0	A1D-138A	205	170
130-148	0.144	2	1.2	A2D-138A	210	175
130-148	0.216	4	1.4	A3D-138A	215	180
130-148	0.432	5	1.9	A6D-138A	220	185
130-148	0.864	11	3.9	AL12D-138A	305	255
130-148	1.728	14	11.9	CL24D-138A	390	325

Size	A	B	C	D	E	F	G	H	J	K	L	M
1	1½	2¾	3	1.00	2.25	5/16	15/16	1/16	½	1⅛	—	—
1A	1½	2¾	2¾	1.00	2.25	5/16	15/16	1/16	½	1⅛	—	—
1B	1½	2	2	1.00	1.50	0			½	¾	—	—
2	1⅞	2¾	3¼	1.37	2.25	¾	1⅜	½	1 1/16	1⅛	—	—
4	2¼	2¾	3¼	1.75	2.25	¾	1⅝	½	⅞	1⅛	—	—
5	2¾	2¾	3¼	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
7	2¾	2¾	4	2.25	2.25	¾	2	½	1⅛	1⅛	—	—
11	3	5½	3¼	2.50	5.00	2⅛	2	1⅞	1¼	2½	2.50	—
12	3	5½	4	2.50	5.00	2⅛	2	1⅞	1¼	2½	2.50	—
14	6	6	4	5.50	5.50	2⅜	2	2⅜	2¾	2¾	2.75	2.75

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DECIMALS .XX ±0.015.



* Used only on outputs 740-3650 volts; On outputs above 3650 Dia. is ¾, Height 1½.

‡ 6-32 THD x 3/16 DEEP (TYP) FOR MODELS AL02 AND A02

DC TO DC

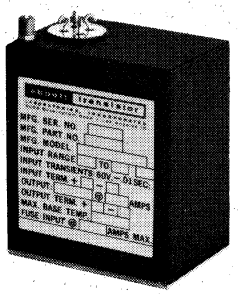
INPUT VOLTAGE RANGE: 24 TO 30 VOLTS, DC

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
148-166	0.013	1B	0.5	A02D-157A	$185	$155
148-166	0.032	1A	0.9	A05D-157A	200	165
148-166	0.064	1	1.0	A1D-157A	205	170
148-166	0.128	2	1.2	A2D-157A	210	175
148-166	0.192	4	1.4	A3D-157A	215	180
148-166	0.384	5	1.9	A6D-157A	220	185
148-166	0.768	11	3.9	AL12D-157A	290	245
148-166	1.536	14	11.9	CL24D-157A	375	315
166-186	0.011	1B	0.5	A02D-176A	185	155
166-186	0.028	1A	0.9	A05D-176A	200	165
166-186	0.057	1	1.0	A1D-176A	205	170
166-186	0.114	2	1.2	A2D-176A	210	175
166-186	0.171	4	1.4	A3D-176A	215	180
166-186	0.342	5	1.9	A6D-176A	220	185
166-186	0.684	11	3.9	AL12D-176A	280	235
166-186	1.368	14	11.9	CL24D-176A	370	310
186-208	0.010	1B	0.5	A02D-197A	185	155
186-208	0.025	1A	0.9	A05D-197A	200	165
186-208	0.051	1	1.0	A1D-197A	205	170
186-208	0.102	2	1.2	A2D-197A	210	175
186-208	0.153	4	1.4	A3D-197A	215	180
186-208	0.306	5	1.9	A6D-197A	220	185
186-208	0.684	11	3.9	AL12D-197A	270	225
186-208	1.368	14	11.9	CL24D-197A	360	300
208-233	0.009	1B	0.5	A02D-220A	185	155
208-233	0.023	1A	0.9	A05D-220A	200	165
208-233	0.046	1	1.0	A1D-220A	205	170
208-233	0.092	2	1.2	A2D-220A	210	175
208-233	0.138	4	1.4	A3D-220A	215	180
208-233	0.276	5	1.9	A6D-220A	220	185
208-233	0.552	11	3.9	A12D-220A	260	220
208-233	1.104	14	11.9	CL24D-220A	345	290
233-261	0.008	1B	0.5	A02D-247A	185	155
233-261	0.020	1A	0.9	A05D-247A	200	165
233-261	0.041	1	1.0	A1D-247A	205	170
233-261	0.082	2	1.2	A2D-247A	210	175
233-261	0.123	4	1.4	A3D-247A	215	180
233-261	0.246	5	1.9	A6D-247A	220	185
233-261	0.492	11	3.9	A12D-247A	260	220
233-261	0.984	14	11.9	CL24D-247A	345	290
261-292	0.007	1B	0.5	A02D-276A	185	155
261-292	0.018	1A	0.9	A05D-276A	200	165
261-292	0.036	1	1.0	A1D-276A	205	170
261-292	0.072	2	1.2	A2D-276A	210	175
261-292	0.108	4	1.4	A3D-276A	215	180
261-292	0.216	5	1.9	A6D-276A	220	185
261-292	0.432	11	3.9	A12D-276A	270	225
261-292	0.864	14	11.9	CL24D-276A	350	295
292-326	0.006	1B	0.5	A02D-310A	185	155
292-326	0.016	1A	0.9	A05D-310A	200	165
292-326	0.032	1	1.0	A1D-310A	205	170
292-326	0.064	2	1.2	A2D-310A	210	175
292-326	0.096	4	1.4	A3D-310A	215	180
292-326	0.192	5	1.9	A6D-310A	220	185
292-326	0.348	11	3.9	A12D-310A	270	225
292-326	0.768	14	11.9	CL24D-310A	360	300
326-365	0.006	1B	0.5	A02D-346A	190	160
326-365	0.014	1A	0.9	A05D-346A	205	170
326-365	0.029	1	1.0	A1D-346A	210	175
326-365	0.058	2	1.2	A2D-346A	215	180
326-365	0.087	4	1.4	A3D-346A	220	185
326-365	0.174	5	1.9	A6D-346A	225	190
326-365	0.348	11	3.9	A12D-346A	275	230
326-365	0.768	14	11.9	CL24D-346A	365	305
365-409	0.005	1B	0.5	A02D-387A	190	160
365-409	0.013	1A	0.9	A05D-387A	205	170
365-409	0.026	1	1.0	A1D-387A	210	175
365-409	0.052	2	1.2	A2D-387A	215	180
365-409	0.078	4	1.4	A3D-387A	220	185
365-409	0.156	5	1.9	A6D-387A	225	190
365-409	0.312	11	3.9	A12D-387A	280	235
365-409	0.624	14	11.9	CL24D-387A	365	305
409-458	0.005	1B	0.5	A02D-433A	$190	$160
409-458	0.012	1A	0.9	A05D-433A	205	170
409-458	0.023	1	1.0	A1D-433A	210	175
409-458	0.046	2	1.2	A2D-433A	215	180
409-458	0.069	4	1.4	A3D-433A	220	185
409-458	0.138	5	1.9	A6D-433A	235	195
409-458	0.276	11	3.9	A12D-433A	285	240
409-458	0.552	14	11.9	C24D-433A	370	310
458-514	0.004	1B	0.5	A02D-486A	200	165
458-514	0.010	1A	0.9	A05D-486A	210	175
458-514	0.021	1	1.0	A1D-486A	215	180
458-514	0.041	2	1.2	A2D-486A	220	185
458-514	0.062	4	1.4	A3D-486A	225	190
458-514	0.124	5	1.9	A6D-486A	235	195
458-514	0.248	11	3.9	A12D-486A	290	245
458-514	0.496	14	11.9	C24D-486A	375	315
514-590	0.004	1B	0.5	A02D-552A	200	165
514-590	0.009	1A	0.9	A05D-552A	210	175
514-590	0.018	1	1.0	A1D-552A	215	180
514-590	0.036	2	1.2	A2D-552A	220	185
514-590	0.055	4	1.4	A3D-552A	225	190
514-590	0.110	5	1.9	A6D-552A	235	195
514-590	0.220	11	3.9	A12D-552A	305	255
514-590	0.440	14	11.9	C24D-552A	380	320
590-660	0.008	1A	0.9	A05D-630A	215	180
590-660	0.016	1	1.0	A1D-630A	220	185
590-660	0.032	2	1.2	A2D-630A	225	190
590-660	0.048	4	1.4	A3D-630A	235	195
590-660	0.096	5	1.9	A6D-630A	240	200
590-660	0.192	11	3.9	A12D-630A	315	265
590-660	0.384	14	11.9	C24D-630A	395	330
660-740	0.007	1A	0.9	A05D-700A	215	180
660-740	0.014	1	1.0	A1D-700A	220	185
660-740	0.028	2	1.2	A2D-700A	225	190
660-740	0.043	4	1.4	A3D-700A	235	195
660-740	0.086	5	1.9	A6D-700A	240	200
660-740	0.172	11	3.9	A12D-700A	320	270
660-740	0.344	14	11.9	C24D-700A	400	335
740-830	0.006	1A	0.9	A05D-790A	220	185
740-830	0.012	1	1.0	A1D-790A	225	190
740-830	0.025	2	1.2	A2D-790A	235	195
740-830	0.038	4	1.4	A3D-790A	240	200
740-830	0.076	5	1.9	A6D-790A	245	205
740-830	0.152	11	3.9	A12D-790A	340	285
740-830	0.304	14	11.9	C24D-790A	405	340
830-930	0.005	1A	0.9	A05D-880A	225	190
830-930	0.011	1	1.0	A1D-880A	235	195
830-930	0.022	2	1.2	A2D-880A	240	200
830-930	0.034	4	1.4	A3D-880A	245	205
830-930	0.068	5	1.9	A6D-880A	250	210
830-930	0.138	11	3.9	A12D-880A	350	295
830-930	0.276	14	11.9	C24D-880A	410	345
930-1040	0.005	1A	0.9	A05D-990A	235	195
930-1040	0.010	1	1.0	A1D-990A	240	200
930-1040	0.020	2	1.2	A2D-990A	245	205
930-1040	0.030	4	1.4	A3D-990A	250	210
930-1040	0.060	5	1.9	A6D-990A	255	215
930-1040	0.120	11	3.9	A12D-990A	350	295
930-1040	0.240	14	11.9	C24D-990A	425	355
1040-1160	0.004	1A	0.9	AK05D-1100A	240	200
1040-1160	0.009	1	1.0	AK1D-1100A	245	205
1040-1160	0.018	2	1.2	AK2D-1100A	250	210
1040-1160	0.027	4	1.4	AK3D-1100A	255	215
1040-1160	0.054	7	1.9	AK6D-1100A	260	220
1040-1160	0.109	12	3.9	AK12D-1100A	360	300
1040-1160	0.218	14	11.9	CK24D-1100A	430	360
1160-1300	0.004	1A	0.9	AK05D-1230A	245	205
1160-1300	0.008	1	1.0	AK1D-1230A	250	210
1160-1300	0.016	2	1.2	AK2D-1230A	255	215
1160-1300	0.024	4	1.4	AK3D-1230A	260	220
1160-1300	0.048	7	1.9	AK6D-1230A	270	225
1160-1300	0.097	12	3.9	AK12D-1230A	365	305
1160-1300	0.194	14	11.9	CK24D-1230A	435	365
1300-1480	0.003	1A	0.9	AK05D-1380A	$250	$210
1300-1480	0.007	1	1.0	AK1D-1380A	255	215
1300-1480	0.014	2	1.2	AK2D-1380A	260	220
1300-1480	0.021	4	1.4	AK3D-1380A	270	225
1300-1480	0.043	7	1.9	AK6D-1380A	275	230
1300-1480	0.086	12	3.9	AK12D-1380A	370	310
1300-1480	0.172	14	11.9	CK24D-1380A	450	375
1480-1660	0.003	1A	0.9	AK05D-157A	255	215
1480-1660	0.006	1	1.0	AK1D-1570A	260	220
1480-1660	0.013	2	1.2	AK2D-1570A	270	225
1480-1660	0.019	4	1.4	AK3D-1570A	275	230
1480-1660	0.038	7	1.9	AK6D-1570A	280	235
1480-1660	0.076	12	3.9	AK12D-1570A	375	315
1480-1660	0.152	14	11.9	CK24D-1570A	465	390
1660-1860	0.002	1A	0.9	AK05D-1760A	270	225
1660-1860	0.005	1	1.0	AK1D-1760A	275	230
1660-1860	0.010	2	1.2	AK2D-1760A	280	235
1660-1860	0.017	4	1.4	AK3D-1760A	285	240
1660-1860	0.034	7	1.9	AK6D-1760A	290	245
1660-1860	0.068	12	3.9	AK12D-1760A	380	320
1660-1860	0.136	14	11.9	CK24D-1760A	480	400
1860-2080	0.002	1A	0.9	AK05D-1970A	280	235
1860-2080	0.005	1	1.0	AK1D-1970A	285	240
1860-2080	0.010	2	1.2	AK2D-1970A	290	245
1860-2080	0.015	4	1.4	AK3D-1970A	300	250
1860-2080	0.030	7	1.9	AK6D-1970A	305	255
1860-2080	0.061	12	3.9	AK12D-1970A	395	330
1860-2080	0.122	14	11.9	CK24D-1970A	495	415
2080-2330	0.027	7	1.9	AK6D-2200A	315	265
2080-2330	0.055	12	3.9	AK12D-2200A	405	340
2080-2330	0.110	14	11.9	CK24D-2200A	520	435
2330-2610	0.024	7	1.9	AK6D-2470A	340	285
2330-2610	0.049	12	3.9	AK12D-2470A	420	350
2330-2610	0.098	14	11.9	CK24D-2760A	540	450
2610-2920	0.021	7	1.9	AK6D-2760A	345	290
2610-2920	0.043	12	3.9	AK12D-2760A	425	355
2610-2920	0.086	14	11.9	CK24D-276A	560	470
2920-3260	0.019	7	1.9	AK6D-3100A	365	305
2920-3260	0.038	12	3.9	AK12D-3100A	430	360
2920-3260	0.076	14	11.9	CK24D-3100A	585	490
3260-3650	0.017	7	1.9	AK6D-3460A	375	315
3260-3650	0.034	12	3.9	AK12D-3460A	455	380
3260-3650	0.068	14	11.9	CK24D-3460A	620	520
3650-4090	0.005	12	6.0	AN2D-3870A	420	350
3650-4090	0.010	14	7.9	AN4D-3870A	635	530
4090-4580	0.004	12	6.0	AN2D-4330A	460	385
4090-4580	0.009	14	7.9	AN4D-4330A	635	530
4580-5140	0.004	12	6.0	AN2D-4860A	500	420
4580-5140	0.008	14	7.9	AN4D-4860A	675	565
5140-5900	0.003	12	6.0	AN2D-5520A	550	460
5140-5900	0.007	14	7.9	AN4D-5520A	705	590
5900-6600	0.003	12	6.0	AN2D-6300A	600	500
5900-6600	0.006	14	7.9	AN4D-6300A	765	640
6600-7400	0.002	12	6.0	AN2D-7000A	645	540
6600-7400	0.005	14	7.9	AN4D-7000A	815	680
7400-8300	0.002	12	6.0	AN2D-7900A	700	585
7400-8300	0.005	14	7.9	AN4D-7900A	860	720
8300-9300	0.002	12	6.0	AN2D-8800A	750	625
8300-9300	0.004	14	7.9	AN4D-8800A	915	765
9300-10400	0.002	12	6.0	AN2D-9900A	795	665
9300-10400	0.004	14	7.9	AN4D-9900A	965	805

† To have the header located on the mounting base, change the model number character preceding the first dash of Model Number to "B". (Example: AL05**B**-5A indicates a header out the base.) See page 1851. No increase in price for this service. Not available on Model A02 series.

abbott transistor
LABORATORIES, INCORPORATED
5200 W. Jefferson Blvd. / Los Angeles 90016
(213) WEbster 6-8185 Cable: ABTLABS

abbott 28 VDC to DC (Reg.) Hi-Temp.



POWER MODULES

features

- Hi-temp. +212°F.
- 5 to 3500 volts
- Hermetically sealed
- Short circuit protection
- Input spike protection

specifications

Input Voltage Range
24 to 30 volts DC

Line Regulation
±0.2% for input 24 to 30 VDC on Model B's and BL's
±0.5% for input 24 to 30 VDC on Model BK's

Voltage Regulation
±1.5% for input 24 to 30 VDC and from ½ load to full load on Model B's
±2.5% for input 24 to 30 VDC and from ½ load to full load on Model BK's and BL's

Ripple
0.5% RMS — Model B's
1.0% RMS — Model BK's and BL's

Voltage Adjustment Range
12% by screwdriver adjustment

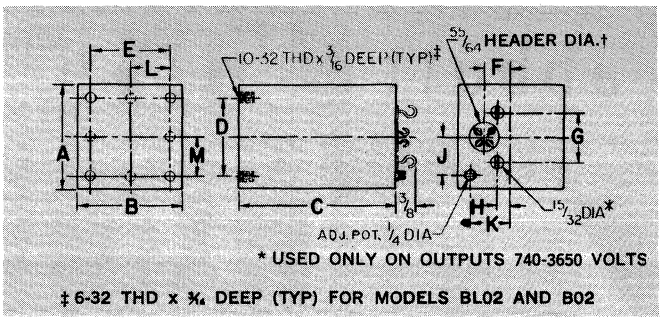
Environment
+212°F max. at mounting base using adequate heat sink
−65°F min. at mounting surface
Altitude: To vacuum (true hermetic seal). Vibration, shock, sand, dust, humidity, salt-spray, fungus, sunshine, rain, and explosion to MIL-E-5272C

Output Voltage & Current
See specific models listed
(Outputs and inputs are isolated)

Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
4.7-5.3	0.400	1B	0.5	BL02D-5A	$261	$218
4.7-5.3	1.0	1A	0.9	BL05D-5A	277	231
4.7-5.3	2.0	1	1.0	BL1D-5A	291	243
4.7-5.3	4.0	2	1.1	BL2D-5A	321	268
4.7-5.3	6.0	4	1.3	BL3D-5A	344	287
4.7-5.3	10.0	6A	2.5	BL5D-5A	397	331
5.3-5.9	0.357	1B	0.5	BL02D-5.6A	254	212
5.3-5.9	0.9	1A	0.9	BL05D-5.6A	270	225
5.3-5.9	1.8	1	1.0	BL1D-5.6A	284	237
5.3-5.9	3.6	2	1.1	BL2D-5.6A	307	256
5.3-5.9	5.4	4	1.3	BL3D-5.6A	337	281
5.3-5.9	8.91	6A	2.5	BL5D-5.6A	390	325
5.9-6.6	0.318	1B	0.5	BL02D-6.3A	254	212
5.9-6.6	0.8	1A	0.9	BL05D-6.3A	270	225
5.9-6.6	1.6	1	1.0	BL1D-6.3A	284	237
5.9-6.6	3.2	2	1.1	BL2D-6.3A	307	256
5.9-6.6	4.8	4	1.3	BL3D-6.3A	337	281
5.9-6.6	7.92	6	1.9	BL5D-6.3A	390	325
6.6-7.4	0.286	1B	0.5	BL02D-7A	254	212
6.6-7.4	0.7	1A	0.9	BL05D-7A	270	225
6.6-7.4	1.4	1	1.0	BL1D-7A	284	237
6.6-7.4	2.8	2	1.1	BL2D-7A	307	256
6.6-7.4	4.2	4	1.3	BL3D-7A	330	275
6.6-7.4	7.15	6	1.9	BL5D-7A	381	318
7.4-8.3	0.253	1B	0.5	BL02D-7.9A	254	212
7.4-8.3	0.63	1A	0.9	B05D-7.9A	270	225
7.4-8.3	1.26	1	1.0	BL1D-7.9A	284	237
7.4-8.3	2.52	2	1.1	BL2D-7.9A	307	256
7.4-8.3	3.78	4	1.3	BL3D-7.9A	330	275
7.4-8.3	6.32	6	1.9	BL5D-7.9A	381	318
8.3-9.3	0.227	1B	0.5	BL02D-8.8A	254	212
8.3-9.3	0.57	1A	0.9	B05D-8.8A	270	225
8.3-9.3	1.14	1	1.0	BL1D-8.8A	277	231
8.3-9.3	2.28	2	1.1	BL2D-8.8A	300	250
8.3-9.3	3.42	4	1.3	BL3D-8.8A	321	268
8.3-9.3	5.68	6	1.9	BL5D-8.8A	374	312
9.3-10.4	0.202	1B	0.5	B02D-9.9A	247	206
9.3-10.4	0.50	1A	0.9	B05D-9.9A	261	218
9.3-10.4	1.00	1	1.0	BL1D-9.9A	277	231
9.3-10.4	2.00	2	1.1	BL2D-9.9A	291	243
9.3-10.4	3.00	4	1.3	BL3D-9.9A	314	262
9.3-10.4	5.05	6	1.9	BL5D-9.9A	374	312
9.3-10.4	10.10	11	3.7	BL10D-9.9A	441	365
10.4-11.6	0.182	1B	0.5	B02D-11A	247	206
10.4-11.6	0.45	1A	0.9	B05D-11A	261	218
10.4-11.6	0.91	1	1.0	BL1D-11A	270	225
10.4-11.6	1.82	2	1.1	BL2D-11A	284	237
10.4-11.6	2.73	4	1.3	BL3D-11A	314	262
10.4-11.6	4.55	6	1.9	BL5D-11A	367	306
10.4-11.6	9.10	11	3.7	BL10D-11A	434	362
11.6-13.0	0.163	1B	0.5	B02D-12.3A	247	206
11.6-13.0	0.40	1A	0.9	B05D-12.3A	261	218
11.6-13.0	0.81	1	1.0	BL1D-12.3A	270	225
11.6-13.0	1.62	2	1.1	BL2D-12.3A	291	243
11.6-13.0	2.43	4	1.3	BL3D-12.3A	314	262
11.6-13.0	4.06	6	1.9	BL5D-12.3A	360	300
11.6-13.0	8.12	11	3.7	BL10D-12.3A	420	350
11.6-13.0	13.83	14	10.3	BL17D-12.3A	498	465
13.0-14.8	0.145	1B	0.5	B02D-13.8A	247	206
13.0-14.8	0.36	1A	0.9	B05D-13.8A	261	218
13.0-14.8	0.72	1	1.0	BL1D-13.8A	270	225
13.0-14.8	1.44	2	1.1	BL2D-13.8A	307	256
13.0-14.8	2.16	4	1.3	BL3D-13.8A	321	268
13.0-14.8	3.62	6	1.9	BL5D-13.8A	351	293
13.0-14.8	7.24	11	3.7	BL10D-13.8A	411	343
13.0-14.8	12.31	14	10.3	BL17D-13.8A	490	409
14.8-16.6	0.127	1B	0.5	B02D-15.7A	247	206
14.8-16.6	0.32	1A	0.9	B05D-15.7A	261	218
14.8-16.6	0.64	1	1.0	BL1D-15.7A	270	225
14.8-16.6	1.28	2	1.1	BL2D-15.7A	307	256
14.8-16.6	1.92	4	1.3	BL3D-15.7A	321	268
14.8-16.6	3.18	6	1.9	BL5D-15.7A	351	293
14.8-16.6	6.36	11	3.7	BL10D-15.7A	404	337
14.8-16.6	10.81	14	10.3	BL17D-15.7A	477	398
16.6-18.6	0.114	1B	0.5	B02D-17.6A	240	200
16.6-18.6	0.28	1A	0.9	B05D-17.6A	254	212
16.6-18.5	0.57	1	1.0	BL1D-17.6A	261	218
16.6-18.6	1.14	2	1.1	BL2D-17.6A	$300	$250
16.6-18.6	1.71	4	1.3	BL3D-17.6A	307	256
16.6-18.6	2.84	6	1.9	BL5D-17.6A	344	287
16.6-18.6	5.68	11	3.7	BL10D-17.6A	397	331
16.6-18.6	9.65	14	10.3	BL17D-17.6A	470	392
18.6-20.8	0.101	1B	0.5	B02D-19.7A	240	200
18.6-20.8	0.255	1A	0.9	B05D-19.7A	254	212
18.6-20.8	0.510	1	1.0	BL1D-19.7A	261	218
18.6-20.8	1.02	2	1.1	BL2D-19.7A	300	250
18.6-20.8	1.63	4	1.3	BL3D-19.7A	307	256
18.6-20.8	2.54	6	1.9	BL5D-19.7A	330	275
18.6-20.8	5.08	11	3.7	BL10D-19.7A	397	331
18.6-20.8	8.62	14	10.3	BL17D-19.7A	470	392
20.8-23.3	0.091	1B	0.5	B02D-22A	231	193
20.8-23.3	0.230	1A	0.9	B05D-22A	247	206
20.8-23.3	0.460	1	1.0	BL10D-22A	254	212
20.8-23.3	0.920	2	1.1	BL2D-22A	291	243
20.8-23.3	1.38	4	1.3	BL3D-22A	300	250
20.8-23.3	2.27	6	1.9	BL5D-22A	330	275
20.8-23.3	4.54	11	3.7	BL10D-22A	397	331
20.8-23.3	7.72	14	10.3	BL17D-22A	476	392
23.3-26.1	0.081	1B	0.5	B02D-24.7A	231	193
23.3-26.1	0.205	1A	0.9	B05D-24.7A	247	206
23.3-26.1	0.410	1	1.0	BL10D-24.7A	254	212
23.3-26.1	0.820	2	1.1	BL2D-24.7A	291	243
23.3-26.1	1.23	4	1.3	BL3D-24.7A	300	250
23.3-26.1	2.02	6	1.9	BL5D-24.7A	330	275
23.3-26.1	4.04	11	3.7	BL10D-24.7A	397	331
23.3-26.1	6.88	14	10.3	BL17D-24.7A	470	392
26.1-29.2	0.073	1B	0.5	B02D-27.6A	231	193
26.1-29.2	0.180	1A	0.9	B05D-27.6A	247	206
26.1-29.2	0.360	1	1.0	BL1D-27.6A	254	212
26.1-29.2	0.720	2	1.1	BL2D-27.6A	284	237
26.1-29.2	1.08	4	1.3	BL3D-27.6A	300	250
26.1-29.2	1.81	6	1.9	BL5D-27.6A	330	275
26.1-29.2	3.62	11	3.7	BL10D-27.6A	397	331
26.1-29.2	6.16	14	10.3	BL17D-27.6A	470	392
29.2-32.6	0.065	1B	0.5	B02D-31A	231	193
29.2-32.6	0.160	1A	0.9	B05D-31A	247	206
29.2-32.6	0.320	1	1.0	B1D-31A	254	212
29.2-32.6	0.640	2	1.1	B2D-31A	261	231
29.2-32.6	0.960	4	1.3	BL3D-31A	300	250
29.2-32.6	1.61	6	1.9	BL5D-31A	330	275
29.2-32.6	3.22	11	3.7	BL10D-31A	397	331
29.2-32.6	5.48	14	10.3	BL17D-31A	470	392
32.6-36.5	0.058	1B	0.5	B02D-34.6A	231	193
32.6-36.5	0.145	1A	0.9	B05-34.6A	247	206
32.6-36.5	0.290	1	1.0	B1D-34.6A	254	212
32.6-36.5	0.580	2	1.1	B2D-34.6A	261	218
32.6-36.5	0.870	4	1.3	BL3D-34.6A	300	250
32.6-36.5	1.44	6	1.9	BL5D-34.6A	330	275
32.6-36.5	2.88	11	3.7	BL10D-34.6A	397	331
32.6-36.5	4.91	14	10.3	BL17D-34.6A	470	392
36.5-40.9	0.052	1B	0.5	B02D-38.7A	231	193
36.5-40.9	0.130	1A	0.9	B05D-38.7A	247	206
36.5-40.9	0.260	1	1.0	B1D-38.7A	254	212
36.5-40.9	0.520	2	1.1	B2D-38.7A	261	218
36.5-40.9	0.780	4	1.3	BL3D-38.7A	300	250
36.5-40.9	1.29	6	1.9	BL5D-38.7A	330	275
36.5-40.9	2.58	11	3.7	BL10D-38.7A	397	331
36.5-40.9	4.39	14	10.3	BL17D-38.7A	470	392
40.9-45.8	0.046	1B	0.5	B02D-43.3A	231	193
40.9-45.8	0.155	1A	0.9	B05D-43.3A	247	206
40.9-45.8	0.230	1	1.0	B1D-43.3A	254	212
40.9-45.8	0.460	2	1.1	B2D-43.3A	261	218
40.9-45.8	0.690	4	1.3	BL3D-43.3A	300	250
40.9-45.8	1.15	6	1.9	BL5D-43.3A	330	275
40.9-45.8	2.30	11	3.7	BL10D-43.3A	397	331
40.9-45.8	3.92	14	10.3	BL17D-43.3A	470	392
45.8-51.4	0.041	1B	0.5	B02D-48.6A	231	193
45.8-51.4	0.103	1A	0.9	B05D-48.6A	247	206
45.8-51.4	0.206	1	1.0	B1D-48.6A	254	212
45.8-51.4	0.412	2	1.1	B2D-48.6A	261	218
45.8-51.4	0.618	4	1.3	B3D-48.6A	300	250
45.8-51.4	1.03	6	1.9	BL5D-48.6A	$330	$275
45.8-51.4	2.06	11	3.7	BL10D-48.6A	397	331
45.8-51.4	3.49	14	10.3	BL17D-48.6A	470	392
51.4-59.0	0.036	1B	0.5	B02D-55.2A	231	193
51.4-59.0	0.091	1A	0.9	B05D-55.2A	247	206
51.4-59.0	0.182	1	1.0	B1D-55.2A	254	212
51.4-59.0	0.364	2	1.1	B2D-55.2A	261	218
51.4-59.0	0.546	4	1.3	B3D-55.2A	300	250
51.4-59.0	0.905	6	1.9	BL5D-55.2A	330	275
51.4-59.0	1.81	11	3.7	BL10D-55.2A	397	331
51.4-59.0	3.07	14	10.3	BL17D-55.2A	470	392
59.0-66.0	0.032	1B	0.5	B02D-63A	231	193
59.0-66.0	0.080	1A	0.9	B05D-63A	247	206
59.0-66.0	0.160	1	1.0	B1D-63A	254	212
59.0-66.0	0.320	2	1.1	B2D-63A	261	218
59.0-66.0	0.480	4	1.3	B3D-63A	300	250
59.0-66.0	0.795	6	1.9	BL5D-63A	330	275
59.0-66.0	1.59	11	3.7	BL10D-63A	397	331
59.0-66.0	2.69	14	10.3	BL17D-63A	470	392
66.0-74.0	0.029	1B	0.5	B02D-70A	231	193
66.0-74.0	0.071	1A	0.9	B05D-70A	247	206
66.0-74.0	0.143	1	1.0	B1D-70A	254	212
66.0-74.0	0.286	2	1.1	B2D-70A	261	218
66.8-74.0	0.429	4	1.3	B3D-70A	291	243
66.8-74.0	0.715	6	1.9	BL5D-70A	321	268
66.0-74.0	1.43	11	3.7	BL10D-70A	397	331
66.0-74.0	2.42	14	10.3	BL17D-70A	470	392
74.0-83.0	0.025	1B	0.5	B02D-79A	231	193
74.0-83.0	0.063	1A	0.9	B05D-79A	247	206
74.0-83.0	0.127	1	1.0	B1D-79A	254	212
74.0-83.0	0.254	2	1.1	B2D-79A	261	218
74.0-83.0	0.381	4	1.3	B3D-79A	291	243
74.0-83.0	0.634	6	1.9	BL55-79A	307	256
74.0-83.0	1.27	11	3.7	BL10D-79A	397	331
74.0-83.0	2.15	14	10.3	BL17D-79A	470	392
83.0-93.0	0.023	1B	0.5	B02D-88A	231	193
83.0-93.0	0.057	1A	0.9	B05D-88A	247	206
83.0-93.0	0.114	1	1.0	B1D-88A	254	212
83.0-93.0	0.228	2	1.1	B2D-88A	261	218
83.0-93.0	0.342	4	1.3	B3D-88A	277	231
83.0-93.0	0.568	6	1.9	BL5D-88A	291	243
83.0-93.0	1.14	11	3.7	BL10D-88A	397	331
83.0-93.0	1.93	14	10.3	BL17D-88A	470	392
93.0-104	0.020	1B	0.5	B02D-99A	231	193
93.0-104	0.050	1A	0.9	B05D-99A	247	206
93.0-104	0.100	1	1.0	B1D-99A	254	212
93.0-104	0.200	2	1.1	B2D-99A	261	218
93.0-104	0.300	4	1.3	B3D-99A	270	225
93.4-104	0.510	6	1.9	BL5D-99A	277	231
93.0-104	1.02	11	3.7	BL10D-99A	397	331
93.0-104	1.71	14	10.3	BL17D-99A	470	392
104-116	0.018	1B	0.5	B02D-110A	231	193
104-116	0.045	1A	0.9	B05D-110A	247	206
104-116	0.091	1	1.0	B1D-110A	254	212
104-116	0.182	2	1.1	B2D-110A	261	218
104-116	0.273	4	1.3	B3D-110A	270	225
104-116	0.455	6	1.9	BL5D-110A	277	231
104-116	0.910	11	3.7	BL10D-110A	397	331
104-116	1.545	14	10.3	BL17D-110A	470	392
116-130	0.016	1B	0.5	B02D-123A	231	193
116-130	0.040	1A	0.9	B05D-123A	247	206
116-130	0.081	1	1.0	B1D-123A	254	212
116-130	0.162	2	1.1	B2D-123A	261	218
116-130	0.243	4	1.3	B3D-123A	270	225
116-130	0.406	6	1.9	BL5D-123A	277	231
116-130	0.812	11	3.7	BL10D-123A	397	331
116-130	1.381	14	10.3	BL17D-123A	470	392
130-148	0.014	1B	0.5	B02D-138A	231	193
130-148	0.036	1A	0.9	B05D-138A	247	206
130-148	0.072	1	1.0	B1D-138A	254	212
130-148	0.144	2	1.1	B2D-138A	261	218
130-148	0.216	4	1.3	B3D-138A	270	225
130-148	0.362	6	1.9	BL5D-138A	277	231
130-148	0.724	11	3.7	BL10D-138A	381	318
130-148	1.231	14	10.3	BL17D-138A	454	379

Size	A	B	C	D	E	F	G	H	J	K	L	M
1	1½	2¾	3	1.00	2.25	5/16	15/16	1/16	½	1⅛	—	—
1A	1½	2¾	2¾	1.00	2.25	5/16	15/16	1 1/16	½	1⅛	—	—
1B	1½	2	2	1.00	1.50	0	—	—	½	¾	—	—
2	1⅞	2¾	3¼	1.37	2.25	¾	1⅜	½	11/16	1⅛	—	—
4	2¼	2¾	3¼	1.75	2.25	¾	1⅝	½	⅞	1⅛	—	—
6	2¾	3	3¼	2.25	2.50	¾	2	½	1⅛	1¼	—	—
6A	2¾	3	4	2.25	2.50	¾	2	½	1⅛	1¼	—	—
11	3	5½	3¼	2.50	5.00	2⅛	2	1⅞	1¼	2½	2.50	—
12	3	5½	4	2.50	5.00	2⅛	2	1⅞	1¼	2½	2.50	—
14	6	6	4	5.50	5.50	2⅜	2	2⅜	2¾	2¾	2.75	2.75

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DECIMALS .XX ±0.015.



* USED ONLY ON OUTPUTS 740-3650 VOLTS

‡ 6-32 THD x ¾ DEEP (TYP) FOR MODELS BL02 AND B02

28 VDC TO DC (Reg.) HI-TEMP.

INPUT VOLTAGE RANGE: 24 TO 30 VOLTS, DC

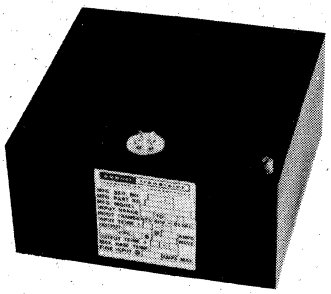
Output Voltage Range	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
148-166	0.013	1B	0.5	B02D-157A	$231	$193
148-166	0.032	1A	0.9	B05D-157A	247	206
148-166	0.064	1	1.0	B1D-157A	254	212
148-166	0.128	2	1.1	B2D-157A	261	218
148-166	0.192	4	1.3	B3D-157A	270	225
148-166	0.318	6	1.9	B5D-157A	277	231
148-166	0.636	11	3.7	BL10D-157A	367	306
148-166	1.082	14	10.3	BL17D-157A	440	367
166-186	0.011	1B	0.5	B02D-176A	231	193
166-186	0.028	1A	0.9	B05D-176A	247	206
166-186	0.057	1	1.0	B1D-176A	254	212
166-186	0.114	2	1.1	B2D-176A	261	218
166-186	0.171	4	1.3	B3D-176A	270	225
166-186	0.284	6	1.9	B5D-176A	277	231
166-186	0.568	11	3.7	BL10D-176A	351	293
166-186	0.965	14	10.3	BL17D-176A	430	359
186-208	0.010	1B	0.5	B02D-197A	231	193
186-208	0.025	1A	0.9	B05D-197A	247	206
186-208	0.051	1	1.0	B1D-197A	254	212
186-208	0.102	2	1.1	B2D-197A	261	218
186-208	0.153	4	1.3	B3D-197A	270	225
186-208	0.254	6	1.9	B5D-197A	277	231
186-208	0.508	11	3.7	BL10D-197A	337	281
186-208	0.862	14	10.3	BL17D-197A	415	346
208-233	0.009	1B	0.5	B02D-220A	231	193
208-233	0.023	1A	0.9	B05D-220A	247	206
208-233	0.046	1	1.0	B1D-220A	254	212
208-233	0.092	2	1.1	B2D-220A	261	218
208-233	0.138	4	1.3	B3D-220A	270	225
208-233	0.228	6	1.9	B5D-220A	277	231
208-233	0.456	11	3.7	BL10D-220A	330	275
208-233	0.772	14	10.3	BL17D-220A	403	336
233-261	0.008	1B	0.5	B02D-247A	231	193
233-261	0.020	1A	0.9	B05-247A	247	206
233-261	0.041	1	1.0	B1D-247A	254	212
233-261	0.082	2	1.1	B2D-247A	261	218
233-261	0.123	4	1.3	B3D-247A	270	225
233-261	0.203	6	1.9	B5D-247A	277	231
233-261	0.406	11	3.7	BL10D-247A	330	275
233-261	0.688	14	10.3	BL17D-247A	403	336
261-292	0.007	1B	0.5	B02D-276A	231	193
261-292	0.018	1A	0.9	B05D-276A	247	206
261-292	0.036	1	1.0	B1D-276A	254	212
261-292	0.072	2	1.1	B2D-276A	261	218
261-292	0.108	4	1.3	B3D-276A	270	225
261-292	0.181	6	1.9	B5D-276A	277	231
261-292	0.362	11	3.7	BL10D-276A	337	281
261-292	0.615	14	10.3	BL17D-276A	410	342
292-326	0.006	1B	0.5	B02D-310A	231	193
292-326	0.016	1A	0.9	B05D-310A	247	206
292-326	0.032	1	1.0	B1D-310A	254	212
292-326	0.064	2	1.1	B2D-310A	261	218
292-326	0.096	4	1.3	B3D-310A	270	225
292-326	0.161	6	1.9	B5D-310A	277	231
292-326	0.322	11	3.7	B10D-310A	337	281
292-326	0.548	14	10.3	BL17D-310A	415	346
326-365	0.006	1B	0.5	B02D-346A	240	200
326-365	0.014	1A	0.9	B05D-346A	254	212
326-365	0.029	1	1.0	B1D-346A	261	218
326-365	0.058	2	1.1	B2D-346A	270	225
326-365	0.087	4	1.3	B3D-346A	277	231
326-365	0.145	6	1.9	B5D-346A	284	237
326-365	0.290	11	3.7	B10D-346A	344	287
326-365	0.491	14	10.3	BL17D-346A	422	352
365-409	0.005	1B	0.5	B02D-387A	$240	$200
365-409	0.013	1A	0.9	B05D-387A	254	212
365-409	0.026	1	1.0	B1D-387A	261	218
365-409	0.052	2	1.1	B2D-387A	270	225
365-409	0.078	4	1.3	B3D-387A	277	231
365-409	0.129	6	1.9	B5D-387A	284	237
365-409	0.258	11	3.7	B10D-387A	351	293
365-409	0.439	14	10.3	BL17D-387A	424	354
409-458	0.005	1B	0.5	B02D-433A	240	200
409-458	0.012	1A	0.9	B05D-433A	254	212
409-458	0.023	1	1.0	B1D-433A	261	218
409-458	0.046	2	1.1	B2D-433A	270	225
409-458	0.069	4	1.3	B3D-433A	277	231
409-458	0.116	6	1.9	B5D-433A	284	237
409-458	0.232	11	3.7	B10D-433A	360	300
409-458	0.392	14	10.3	BL17D-433A	433	361
458-514	0.004	1B	0.5	B02D-486A	247	206
458-514	0.010	1A	0.9	B05D-486A	261	218
458-514	0.021	1	1.0	B1D-486A	270	225
458-514	0.041	2	1.1	B2D-486A	277	231
458-514	0.062	4	1.3	B3D-486A	284	237
458-514	0.103	6	1.9	B5D-486A	291	243
458-514	0.206	11	3.7	B10D-486A	367	306
458-514	0.349	14	10.3	BL17D-486A	440	367
514-590	0.004	1B	0.5	B02D-552A	247	206
514-590	0.009	1A	0.9	B05D-552A	261	218
514-590	0.018	1	1.0	B1D-552A	270	225
514-590	0.036	2	1.1	B2D-552A	277	231
514-590	0.055	4	1.3	B3D-552A	284	237
514-590	0.090	6	1.9	B5D-552A	291	248
514-590	0.180	11	3.7	B10D-552A	381	318
514-590	0.307	14	10.3	BL17D-552A	450	375
590-660	0.008	1A	0.9	B05D-630A	270	225
590-660	0.016	1	1.0	B1D-630A	277	231
590-660	0.032	2	1.1	B2D-630A	284	237
590-660	0.048	4	1.3	B3D-630A	291	243
590-660	0.079	6	1.9	B5D-630A	300	250
590-660	0.158	11	3.7	B10D-630A	397	331
590-660	0.269	14	10.3	BL17D-630A	465	388
660-740	0.007	1A	0.9	B05D-700A	270	225
660-740	0.014	1	1.0	B1D-700A	277	231
660-740	0.028	2	1.1	B2D-700A	284	237
660-740	0.043	4	1.3	B3D-700A	291	243
660-740	0.071	6	1.9	B5D-700A	300	250
660-740	0.142	11	3.7	B10D-700A	404	337
660-740	0.242	14	10.3	BL17D-700A	472	394
740-830	0.006	1A	0.9	B05D-790A	277	231
740-830	0.012	1	1.0	B1D-790A	284	237
740-830	0.025	2	1.1	B2D-790A	291	243
740-830	0.038	4	1.3	B3D-790A	300	250
740-830	0.063	6	1.9	B5D-790A	307	256
740-830	0.126	11	3.7	B10D-790A	427	356
740-830	0.215	14	10.3	BL17D-790A	484	404
830-930	0.005	1A	0.9	B05D-880A	284	237
830-930	0.011	1	1.0	B1D-880A	291	243
830-930	0.002	2	1.1	B2D-880A	300	250
830-930	0.034	4	1.3	B3D-880A	307	256
830-930	0.057	6	1.9	B5D-880A	$314	$262
830-930	0.114	11	3.7	B10D-880A	441	368
830-930	0.193	14	10.3	BL17D-880A	494	412
930-1040	0.005	1A	0.9	B05D-990A	291	243
930-1040	0.010	1	1.0	B1D-990A	300	250
930-1040	0.020	2	1.1	B2D-990A	307	256
930-1040	0.030	4	1.3	B3D-990A	314	262
930-1040	0.051	6	1.9	B5D-990A	321	268
930-1040	0.102	11	3.7	B10D-990A	441	368
930-1040	0.171	14	10.3	BL17D-990A	505	421
1040-1160	0.018	2	1.1	BK2D-1100A	314	262
1040-1160	0.027	4	1.3	BK3D-1100A	321	268
1040-1160	0.045	6A	2.3	BK5D-1100A	330	275
1040-1160	0.090	12	4.4	BK10D-1100A	450	375
1040-1160	0.154	14	11.2	BK17D-1100A	512	427
1160-1300	0.016	2	1.1	BK2D-1230A	321	268
1160-1300	0.024	4	1.3	BK3D-1230A	300	275
1160-1300	0.041	6A	2.3	BK5D-1230A	337	281
1160-1300	0.082	12	4.4	BK10D-1230A	457	381
1160-1300	0.138	14	11.2	BK17D-1230A	519	433
1300-1480	0.014	2	1.1	BK2D-1380A	330	275
1300-1480	0.021	4	1.3	BK3D-1380A	337	281
1300-1480	0.036	6A	2.3	BK5D-1380A	344	287
1300-1480	0.072	12	4.4	BK10D-138A	464	387
1300-1480	0.123	14	11.2	BK17D-1380A	532	444
1480-1660	0.013	2	1.1	BK2D-1570A	337	281
1480-1660	0.019	4	1.3	BK3D-1570A	344	287
1480-1660	0.032	6A	2.3	BK5D-1570A	351	293
1480-1660	0.064	12	4.4	BK10D-1570A	471	393
1480-1660	0.108	14	11.2	BK17D-1570A	550	459
1660-1860	0.010	2	1.1	BK2D-1760A	351	293
1660-1860	0.017	4	1.3	BK3D-1760A	360	300
1660-1860	0.028	6A	2.3	BK5D-1760A	367	306
1660-1860	0.056	12	4.4	BK10D-1760A	480	400
1660-1860	0.096	14	11.2	BK17D-1760A	564	470
1860-2080	0.010	2	1.1	BK2D-1970A	367	306
1860-2080	0.015	4	1.3	BK3D-1970A	374	312
1860-2080	0.025	6A	2.3	BK5D-1970A	381	318
1860-2080	0.051	12	4.4	BK10D-1970A	494	412
1860-2080	0.086	14	11.2	BK17D-1970A	583	486
2080-2330	0.023	6A	2.3	BK5D-2200A	397	331
2080-2330	0.045	12	4.4	BK10D-2200A	510	425
2080-2330	0.077	14	11.2	BK17D-2200A	609	508
2330-2610	0.020	6A	2.3	BK5D-2470A	427	356
2330-2610	0.040	12	4.4	BK10D-2470A	524	437
2330-2610	0.068	14	11.2	BK17D-2470A	628	524
2610-2920	0.018	6A	2.3	BK5D-2760A	434	362
2610-2920	0.036	12	4.4	BK10D-2760A	531	443
2610-2920	0.610	14	11.2	BK17D-2760A	652	544
2920-3260	0.016	6A	2.3	BK5D-3100A	457	381
2920-3260	0.032	12	4.4	BK10D-3100A	540	450
2920-3260	0.054	14	11.2	BK17D-3100A	675	563
3260-3650	0.014	6A	2.3	BK5D-3460A	471	393
3260-3650	0.029	12	4.4	BK10D-3460A	570	475
3260-3650	0.049	14	11.2	BK17D-3460A	716	597

† To have the header located on the mounting base, change the model number character preceding the first dash of Model Number to "B". (Example: BL5B-5A indicates a header out the base.) See page 1851. No increase in price for this service. Not available on Model B02 series.

abbott transistor
LABORATORIES, INCORPORATED
5200 W. Jefferson Blvd. / Los Angeles 90016
(213) WEbster 6-8185 Cable: ABTLABS

abbott DC to Sine Wave 1φ or 3φ

POWER MODULES



features

- Close regulation
- 400 or 800 Hertz
- Hermetically sealed
- No moving parts
- Compact
- For aerospace application

specifications

Input Voltage Range
24 to 30 volts DC

Line Regulation
±0.2% for input 24 to 30 VDC

Voltage Regulation
±1% for input 24 to 30 VDC and from ½ load to full load

Frequency Stability ±1%

Phase Displacement (3 φ only)
120° ±5° from ½ to full load and P.F. 0.7 lag or lead

Voltage Adjustment Range
12% by screwdriver adj.

Short Circuit Protection
on all models except N3, N6, and N12

Environment
+160°F max. at mtg. base (1 φ only) using adequate heat sink
+212°F max. at mtg. base (3 φ only) using adequate heat sink
−65°F min. at mounting surface
Altitude: To vacuum (true hermetic seal)
Vibration, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, and explosion to MIL-E-5272C

Output Voltage, Current and Frequency
See specific models listed (Outputs and inputs are isolated)

DC TO SINE WAVE (1 φ or 3 φ)
INPUT VOLTAGE RANGE: 24 TO 30 VOLTS DC

Output No. of Phases	Output Frequency Hertz	Output Voltage Range Per Phase	Output Power Volt-Amps	Distortion Harmonic %	Size (See Dwg.)	Weight Lbs.	Model Number	Price 1 Piece	Price 2-4 Pieces
1	400	25.4-28.6	5	3	4	1.4	N05D-27A-400	$239	$199
1	400	25.4-28.6	10	3	4C	1.5	N1D-27A-400	241	201
1	400	25.4-28.6	20	3	4A	2.1	N2D-27A-400	243	203
1	400	25.4-28.6	30	3	6	2.2	N3D-27A-400	245	205
1	400	25.4-28.6	60	4	11	4.5	N6D-27A-400	395	335
1	400	25.4-28.6	120	5	13	9.1	N12D-27A-400	735	615
1	400	108-122	5	3	4	1.4	N05D-115A-400	214	179
1	400	108-122	10	3	4C	1.5	N1D-115A-400	216	181
1	400	108-122	20	3	4A	2.1	N2D-115A-400	218	183
1	400	108-122	30	3	6	2.2	N3D-115A-400	220	185
1	400	108-122	60	4	11	4.5	N6D-115A-400	375	315
1	400	108-122	120	5	13	9.1	N12D-115A-400	715	595
1	800	25.4-28.6	5	3	4	1.4	N05D-27A-800	264	219
1	800	25.4-28.6	10	3	4C	1.5	N1D-27A-800	266	221
1	800	25.4-28.6	20	3	4A	2.1	N2D-27A-800	268	223
1	800	25.4-28.6	30	3	6	2.2	N3D-27A-800	270	225
1	800	25.4-28.6	60	4	11	4.5	N6D-27A-800	425	355
1	800	25.4-28.6	120	5	13	9.1	N12D-27A-800	760	635
1	800	108-122	5	3	4	1.4	N05D-115A-800	239	199
1	800	108-122	10	3	4C	1.5	N1D-115A-800	241	201
1	800	108-122	20	3	4A	2.1	N2D-115A-800	243	203
1	800	108-122	30	3	6	2.2	N3D-115A-800	245	205
1	800	108-122	60	4	11	4.5	N6D-115A-800	395	335
1	800	198-122	120	5	13	9.1	N12D-115A-800	735	615
3*	400	108-122	33	4	13	8.3	Q3D-115A-400Y	1905	1587
3	400	108-122	66	4	14	9.2	Q6D-115A-400Y	1975	1658
3	400	108-122	100	5	14	9.2	Q10D-115A-400Y	2081	1728
3	400	25.4-28.6	33	4	13	8.3	Q3D-27A-400Y	1940	1622
3	400	25.4-28.6	66	4	14	9.2	Q6D-27A-400Y	2046	1693
3	400	25.4-28.6	100	5	14	9.2	Q10D-27A-400Y	2142	1764
3	800	108-122	33	4	13	8.3	Q3D-115A-800Y	1940	1622
3	800	108-122	66	4	14	9.2	Q6D-115A-800Y	2046	1693
3	800	108-122	100	5	14	9.2	Q10-115A-800Y	2142	1764
3	800	25.4-28.6	33	4	13	8.3	Q3D-27A-800Y	1975	1658
3	800	25.4-28.6	66	4	14	9.2	Q6D-27A-800Y	2081	1728
3	800	25.4-28.6	100	5	14	9.2	Q10D-27A-800Y	2152	1799

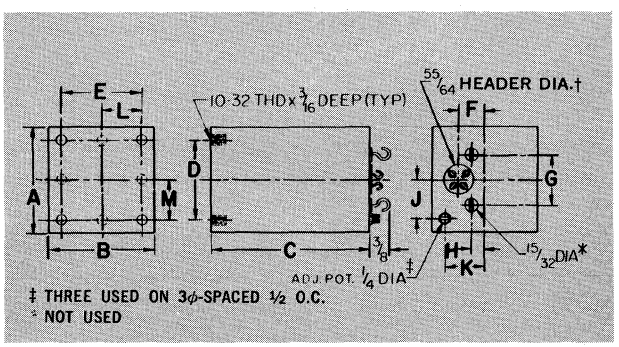
* The output of the three phase models is normally four wire "WYE" connected. To obtain "Delta" instead of "WYE" change last letter of model number to "D." (Example: Q3D-115A-400**D**.)

† To have the header located on the mounting base, change the model number character preceding the first dash of Model Number to "B". (Example: N3**B**-115A-400 indicates a header out the base.) See page 1851. No increase in price for this service.

Size	A	B	C	D	E	F	G	H	J	K	L	M
4	2¼	2¾	3¼	1.75	2.25	¾	—	—	⅞	1⅛	—	—
4C	2¼	2¾	3½	1.75	2.25	¾	—	—	⅞	1⅛	—	—
4A	2½	3	3¼	2.00	2.50	¾	—	—	1	1¼	—	—
6	2¾	3	3¼	2.25	2.50	¾	—	—	1⅛	1¼	—	—
11	3	5½	3¼	2.50	5.00	2⅛	—	—	1¼	2½	2.50	—
13	6	6	3¼	5.50	5.50	2⅜	—	—	2¾	2¾	2.75	2.75
14	6	6	4	5.50	5.50	2⅜	—	—	2¾	2¾	2.75	2.75
15	6	9	3⅜	5.50	8.50	3⅞	—	—	2¾	4¼	4.25	2.75

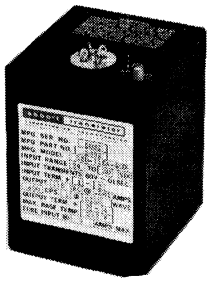
DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DECIMALS .XX ±0.015.

Other voltages and frequencies available on request.



For quantity discount or for any special design, please send us your requirement.

abbott DC to Sine Wave 1φ Hi-Temp.



POWER MODULES *specifications* FOR SINGLE PHASE OUTPUTS

features

- Close regulation
- 400 to 1600 Hertz
- Hermetically sealed
- High Reliability
- Compact
- For aerospace
- Short circuit protected

Input Voltage Range
24 to 30 volts DC

Line Regulation
±0.2% change of output voltage for input 24-30 VDC

Load Regulation
±0.5% from ½ load to full load

Frequency Stability
±1%

Voltage Adjustment Range
12% by screwdriver adjustment

Environment
+212F° max. at mounting base, using adequate heat sink
−65°F min. at mounting surface
Altitude: to vacuum (true hermetic seal)
Vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, and explosion to MIL-E-5272C

Output Voltage, Current and Frequency
See specific models listed below
(Outputs and inputs are isolated)

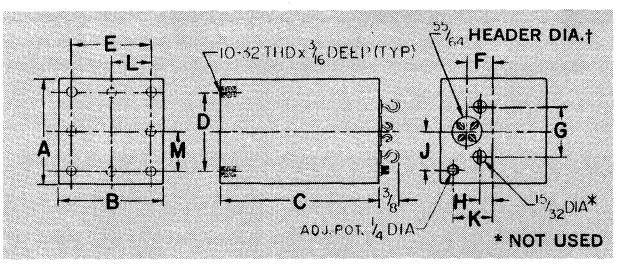
DC TO SINE WAVE (1φ) HI-TEMP.
INPUT VOLTAGE RANGE: 24 TO 30 VOLTS DC

Output Frequency Hertz	Output Voltage Range	Output Power Volt-Amps	Distortion Harmonic %	Size (See Dwg.)	Weight Lbs.	Model Number†	Price 1 Pc.	Price 2-4 Pcs.
400	25.4-28.6	5	2.0	4	1.6	S05D-27A-400	$297	$248
400	25.4-28.6	10	2.5	4C	1.7	S1D-27A-400	301	251
400	25.4-28.6	20	2.5	4B	2.3	S2D-27A-400	303	253
400	25.4-28.6	30	2.5	6A	2.4	S3D-27A-400	307	256
400	25.4-28.6	60	3.0	12	4.8	S6D-27A-400	501	418
400	25.4-28.6	120	4.0	14	8.5	S12D-27A-400	921	768
400	108-122	5	2.0	4	1.6	S05D-115A-400	267	223
400	108-122	10	2.5	4C	1.7	S1D-115A-400	271	226
400	108-122	20	2.5	4B	2.3	S2D-115A-440	273	228
400	108-122	30	2.5	6A	2.4	S3D-115A-400	277	231
400	108-122	60	3.0	12	4.8	S6D-115A-400	471	393
400	108-122	120	4.0	14	8.5	S12D-115A-400	891	743
800	25.4-28.6	5	2.0	4	1.6	S05D-27A-800	327	273
800	25.4-28.6	10	2.5	4C	1.7	S1D-27A-800	331	276
800	25.4-28.6	20	2.5	4B	2.3	S2D-27A-800	333	278
800	25.4-28.6	30	2.5	6A	2.4	S3D-27A-800	337	281
800	25.4-28.6	60	3.0	12	4.8	S6D-27A-800	501	418
800	25.4-28.6	120	4.0	14	8.5	S12D-27A-800	951	793
800	108-122	5	2.0	4	1.6	S05D-115A-800	297	248
800	108-122	10	2.5	4C	1.7	S1D-115A-800	301	251
800	108-122	20	2.5	4B	2.3	S2D-115A-800	303	253
800	108-122	30	2.5	6A	2.4	S3D-115A-800	307	256
800	108-122	60	3.0	12	4.8	S6D-115A-800	501	418
800	108-122	120	4.0	14	8.5	S12D-115A-800	921	768
1200	25.4-28.6	5	2.0	4	1.6	S05D-27A-1200	327	273
1200	25.4-28.6	10	2.5	4C	1.7	S1D-27A-1200	331	276
1200	25.4-28.6	20	2.5	4B	2.3	S2D-27A-1200	333	278
1200	25.4-28.6	30	2.5	6A	2.4	S3D-27A-1200	337	281
1200	25.4-28.6	60	3.0	12	4.8	S6D-27A-1200	501	418
1200	25.4-28.6	120	4.0	14	8.5	S12D-27A-1200	951	793
1200	108-122	5	2.0	4	1.6	S05D-115A-1200	297	248
1200	108-122	10	2.5	4C	1.7	S1D-115A-1200	301	251
1200	108-122	20	2.5	4B	2.3	S2D-115A-1200	303	253
1200	108-122	30	2.5	6A	2.4	S3D-115A-1200	307	256
1200	108-122	60	3.0	12	4.8	S6D-115A-1200	501	418
1200	108-122	120	4.0	14	8.5	S12D-115A-1200	921	768
1600	25.4-28.6	5	2.0	4	1.6	S05D-27A-1600	327	273
1600	25.4-28.6	10	2.5	4C	1.7	S1D-27A-1600	331	276
1600	25.4-28.6	20	2.5	4B	2.3	S2D-27A-1600	333	278
1600	25.4-28.6	30	2.5	6A	2.4	S3D-27A-1600	337	281
1600	25.4-28.6	60	3.0	12	4.8	S6D-27A-1600	501	418
1600	25.4-28.6	120	4.0	14	8.5	S12D-27A-1600	951	793
1600	108-122	5	2.0	4	1.6	S05D-115A-1600	297	248
1600	108-122	10	2.5	4C	1.7	S1D-115A-1600	301	251
1600	108-122	20	2.5	4B	2.3	S2D-115A-1600	303	253
1600	108-122	30	2.5	6A	2.4	S3D-115A-1600	307	256
1600	108-122	60	3.0	12	4.8	S6D-115A-1600	501	418
1600	108-122	120	4.0	14	8.5	S12D-115A-1600	921	768

† To have the header located on the mounting base, change the model number character preceding the first dash of Model Number to "B". (Example: S3B-27A-400 indicates a header out the base.) See page 1851. No increase in price for this service.

Size	A	B	C	D	E	F	G	H	J	K	L	M
4	2¼	2¾	3¼	1.75	2.25	¾	—	—	⅞	1⅛	—	—
4C	2¼	2¾	3½	1.75	2.25	¾	—	—	⅞	1⅛	—	—
4B	2½	3	3¾	2.00	2.50	¾	—	—	1	1¼	—	—
6A	2¾	3	4	2.25	2.50	¾	—	—	1⅛	1¼	—	—
12	3	5½	4	2.50	5.00	2⅛	—	—	1¼	2½	2.50	—
14	6	6	4	5.50	5.50	2⅜	—	—	2¾	2¾	2.75	2.75

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DECIMALS .XX ±0.015.



abbott transistor
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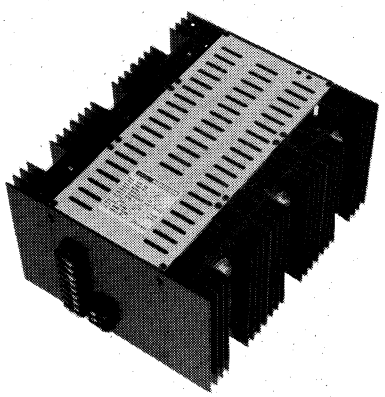
(213) WEbster 6-8185 Cable: ABTLABS

abbott DC to 60 ∿ (Regulated)



POWER MODULES

features

- −4° to +160°F ambient
- 115, 220 and 440 VRMS Models
- 30 to 240 VA
- All Silicon
- High Reliability
- Short Circuit Protection
- Reverse Polarity Protection
- Close Regulation

specifications

Input Voltage Range
11-13 VDC on 'K' Models
22-26 VDC on 'P' Models

Load Regulation
±1% for load change of ½ load to full load

Line Regulation
±0.2% for specified input voltage range

Output Frequency
Adjustable between 55 and 65 Hz by screwdriver adjustment

Frequency Stability
±1% from −4°F to +160°F
±1% over eight hour period at constant temperature

Wave Form
Sinusoidal, with maximum distortion into a resistive load as shown in table below.

Synchronization
Terminals are provided for external synchronization. Input of 6.3 vrms ±20%, 55 to 65 Hz required

Load Power Factor
Full rated output VA from unity to 0.7 PF lagging or leading

Efficiency
45% minimum on 'K' Models at nominal input voltage. 50% minimum on 'P' Models at nominal input voltage

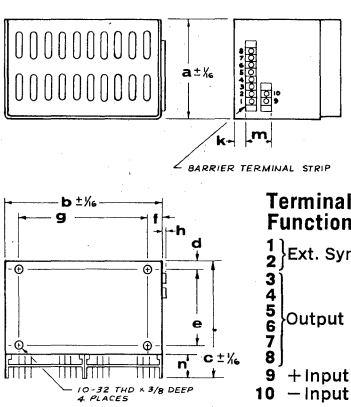
Operating Temperature
−4°F to +160°F ambient without derating, forced air, or heatsinking

Input Transient Protection
45 VDC for 0.1 seconds

Output Voltage and Power
See specific Models listed in the table below

Input Voltage Range (VDC)	Output Voltage Range* (V RMS)	Output Power (VA)	Harmonic Distortion (%)	Size (See Dwg.)	Weight (Lbs.)	Model Number	Price 1 Pc.	Price 2 - 4 Pcs.
11-13	105-125	30	4	KI	20	K3T-115-60	$430	$395
11-13	105-125	60	4	FI	22	K6T-115-60	625	570
11-13	105-125	120	5	JI	30	K12T-115-60	790	720
11-13	200-240	30	4	KI	20	K3T-220-60	455	415
11-13	200-240	60	4	FI	22	K6T-220-60	645	590
11-13	200-240	120	5	JI	30	K12T-220-60	810	740
11-13	400-480	30	4	KI	20	K3T-440-60	465	425
11-13	400-480	60	4	FI	22	K6T-440-60	660	600
11-13	400-480	120	5	JI	30	K12T-440-60	825	750
22-26	105-125	60	4	KI	20	P6T-115-60	430	395
22-26	105-125	120	4	FI	22	P12T-115-60	625	570
22-26	105-125	240	5	JI	30	P24T-115-60	790	720
22-26	200-240	60	4	KI	20	P6T-220-60	455	415
22-26	200-240	120	4	FI	22	P12T-220-60	645	590
22-26	200-240	240	5	JI	30	P24T-220-60	810	740
22-26	400-480	60	4	KI	20	P6T-440-60	465	425
22-26	400-480	120	4	FI	22	P12T-440-60	660	600
22-26	400-480	240	5	JI	30	P24T-440-60	825	750

* Adjustable between limits shown.

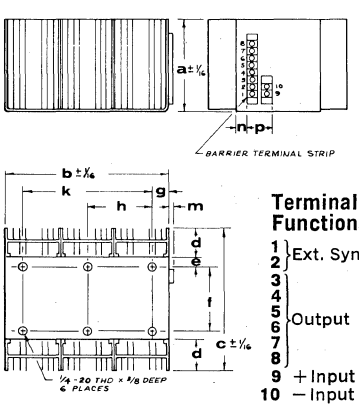


Case K1

a	5
b	8
c	7½
d	½
e	5¼
f	¾
g	6½
h	¾
k	⅜
m	3
n	1¼

Terminal Functions

1, 2	Ext. Sync.
3, 4, 5, 6, 7, 8	Output
9	+Input
10	−Input



Terminal Functions

1, 2	Ext. Sync.
3, 4, 5, 6, 7, 8	Output
9	+Input
10	−Input

Case F1, J1

	F1	J1
a	5	6½
b	8	12
c	8¾	9¾
d	1¼	2⅛
e	½	⅜
f	5¼	4¾
g	¾	1¼
h	—	4¾
k	6½	9½
m	¾	¾
n	⅜	⅜
p	3	3

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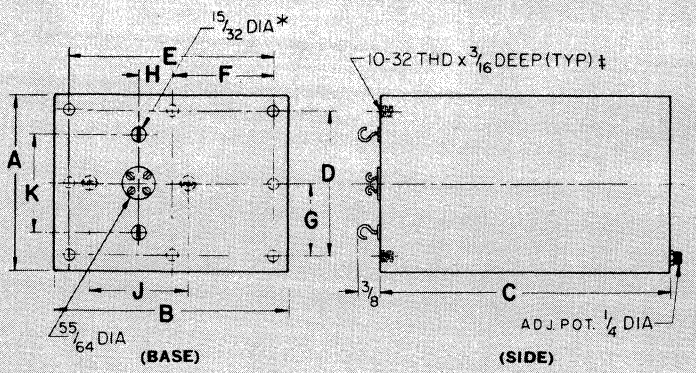
OPTIONAL FEATURES

for all Models except "R", "P", & "K"

TERMINALS ON MOUNTING BASE

The electrical terminals extending through a glass sealed header may be located on the mounting base of any Abbott power module, at no increase in price. Simply change the model number character preceding the first dash to "B". The drawing below lists dimensions for all case sizes.



Case Size	A	B	C	D	E	F	G	H	J	K
1	1½	2¾	3	1.00	2.25	—	—	0	1½	—
1A	1½	2¾	2¾	1.00	2.25	—	—	0	1½	—
1B	1½	2	2	1.00	1.50	—	—	0	—	—
2	1⅞	2¾	3¼	1.37	2.25	—	—	0	1½	—
3	2¾	2¾	3	2.25	2.25	—	—	0	2	—
3A	2¾	2¾	2¾	2.25	2.25	—	—	0	—	2
4	2¼	2¾	3¼	1.75	2.25	—	—	0	1½	—
4A	2½	3	3¼	2.00	2.50	—	—	0	—	—
4B	2½	3	3¾	2.00	2.50	—	—	0	—	—
4C	2¼	2¾	3½	1.75	2.25	—	—	0	1½	—
5	2¾	2¾	3¼	2.25	2.25	—	—	0	—	2
6	2¾	3	3¼	2.25	2.50	—	—	0	2	—
6A	2¾	3	4	2.25	2.50	—	—	0	2	—
7	2¾	2¾	4	2.25	2.25	—	—	0	2	—
8	2¾	4¼	3	2.25	3.75	—	—	1¼	—	1½
8A	2¾	4¼	2¾	2.25	3.75	—	—	¾	—	2
9	2¾	4⅝	3¼	2.25	4.12	—	—	1⅝	—	1½
9A	2¾	4¾	3¾	2.25	4.25	—	—	½	—	2
9B	2¾	4¾	3½	2.25	4.25	—	—	⅝	—	2
10	2¾	5¼	3¼	2.25	4.75	2.37	—	1½	—	1½
10A	3	5	4	2.50	4.50	—	—	½	—	2
11	3	5½	3¼	2.50	5.00	2.50	—	0#	—	1½
11A	4¼	4½	4	3.75	4.00	—	—	1⅝	—	1½
11C	4¼	5¼	4	3.75	4.75	2.37	—	0	1½	—
12	3	5½	4	2.50	5.00	2.50	—	1⅜	—	2
12A	4½	6	4	4.00	5.50	2.75	—	0†	—	2
13	6	6	3¼	5.50	5.50	2.75	2.75	1½	1½	—
13A	5½	6½	4½	5.00	6.00	3.00	2.50	0	—	1½
14	6	6	4	5.50	5.00	2.75	2.75	1½	1½	—
14A	5½	7	5	5.00	6.50	3.25	2.50	0	—	2
15	6	9	3⅜	5.50	8.50	4.25	2.75	3½	—	2
15A	6¼	7¾	6	5.75	7.25	3.62	2.87	0	—	2
16A	6¾	7½	4¼	6.25	7.00	3.50	3.12	1½	1½	—
17	6	12	4	5.50	11.50	5.75	2.75	2¾	—	2
17A	7	8	4¼	6.50	7.50	3.75	3.25	1	—	2
18	8¾	9¾	5	8.25	9.25	4.62	4.12	2⅞	—	2

* Used on outputs 740-3650 volts; not available on mounting base above 3650 volts.

‡ 6-32 THD x 3/16 DEEP (TYP) FOR MODELS AL02, A02, BL02 AND B02.

† 2 7/16 on Models HA3B and HAK3B

⅞ on Models T12B, U10B, T6B-5A thru T6B-7A and U5B-5A thru U5B-7A

DIMENSIONAL TOLERANCES: FRACTION ±1/32; DECIMAL .XX ±0.015.

SPECIAL CONNECTORS

The following military type hermetically sealed connectors are available on all Abbott power modules with output voltages up to 740 volts. A special high voltage ceramic connector (manufactured by AMP, Inc.) is available on power modules with output voltages above 3650 volts DC. The additional costs for various connectors, together with their mating part are listed. Simply change the model number character preceding the first dash to "A" to have a connector extend out the top surface (opposite the mounting base). **Example:** V05A-5A indicates a connector out the top surface. V05C-5A indicates a connector out the mounting base.

MILITARY CONNECTORS

CONNECTOR	MFGR.	MATING PART	MODIFY MODEL NO.	PRICE 1 PC.	PRICE 2-4 PCS.
MS3113H-12-10P	BENDIX or CANNON	MS3116F-12-10S	See Above	add $30	add $20
833589	AMP. INC.	832692-2 (2 ft. leads)	Add "AMP" and see above	add $60*	add $40

*Price includes two each high voltage connectors and their mates, one for each polarity.

OTHER OPTIONAL FEATURES are available at additional cost:

SHORT CIRCUIT PROTECTION — All regulated modules listed in this catalog have built-in electronic short circuit protection (a short circuit across the output terminals will not damage the unit) except Model T's, U's, and V's. Special short circuit protection is available on these models at an additional cost of $25 for its inclusion in one unit, and $20 in 2-4 units. Simply add an "S" after the character preceeding the first dash of the model number. Example: V05DS-5A indicates short circuit protection has been included.

REMOTE OUTPUT ADJUSTMENT — Provision for locating an adjustment potentiometer in a remote location from the power supply can be made at an additional cost of $30 for its inclusion in one unit and $20 in 2-4 units. Simply add an "R" after the character preceeding the first dash of the model number. Example: V05DR-5A indicates the remote output adjustment feature has been included. (Special terminal arrangement includes two additional terminals for connection to a remote potentiometer.)

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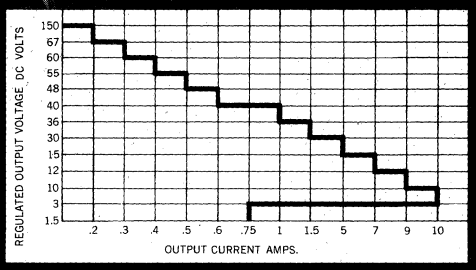


ACOPIAN SINGLE OUTPUT POWER SUPPLIES

Output voltages from 1 to 150 volts available in 1-volt increments. Graph shows range of maximum current ratings. Most models have ±1-volt adjustments.

Input voltage: 105-125 volts AC, 50 to 400 Hz, single phase.

Line regulation: Choice of ±0.05% or ±0.5%

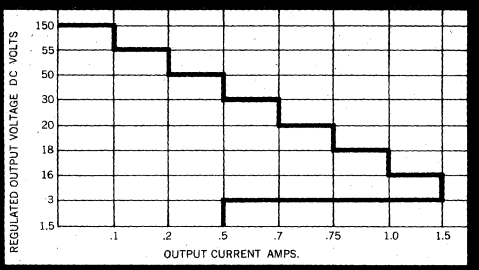
Load regulation: ±0.05% to ±0.5% depending on model.

Polarity: Output is floating, either positive or negative side may be grounded.

Size: Housing size varies according to voltage and current rating. Sizes begin at 3⅜ x 3¼ x 4-11/16 inches high.

Features: Short circuit protection. No additional heat sinking required.

Prices: From $45. to $175.



ACOPIAN DUAL OUTPUT POWER SUPPLIES

In addition to the common dual voltages used for powering operational amplifiers, a broad range of identical or different dual power supplies are available in 1-volt increments. Graph shows the voltages and maximum current rating per section. Consult factory for compatible section ratings, model number and price.

Input voltage: 105-125 volts AC, 50 to 400 Hz, single phase.

Line regulation: 0.05%

Load regulation: 0.05% (most models)

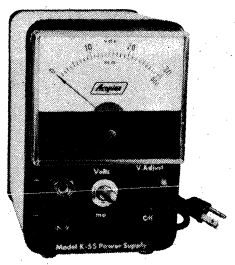
Ripple: 1 to 5 mv, depending on model

Polarity: Outputs are floating. Each power supply may be connected as a separate supply with floating output. Either the negative or positive side of one power supply may be grounded irrespective of the other supply.

Size: Housing size varies according to voltage and current rating. Sizes begin at 3⅜ x 3¼ x 4-9/32 inches high.

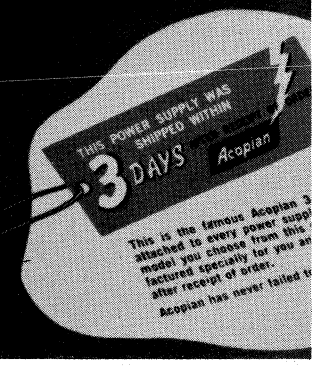
Features: Short circuit protection. No additional heat sinking required.

Prices: From $88. to $230.



VOLTAGE REGULATED LABORATORY POWER SUPPLY FOR ONLY $98.

Acopian's compact K55 laboratory power supply delivers 300 ma over an adjustable range of 1.25 to 30 volts. Load regulation is ±0.5% or 50 mv, whichever is greater. Ripple is 1 mv rms. The K55 contains all-silicon semiconductors and is short-circuit proof. It stands only 5¾ inches high, weighs only 3 pounds, and costs only $98. Availability . . . only 3 days.



Do you have Acopian's newest catalog? It contains complete information about 82,000 different power supplies, all available for shipment in only 3 days. Included are single and dual regulated supplies, unregulated supplies for operating lamps and relays, and chassis assemblies for rack mounting. Write or call for your copy.

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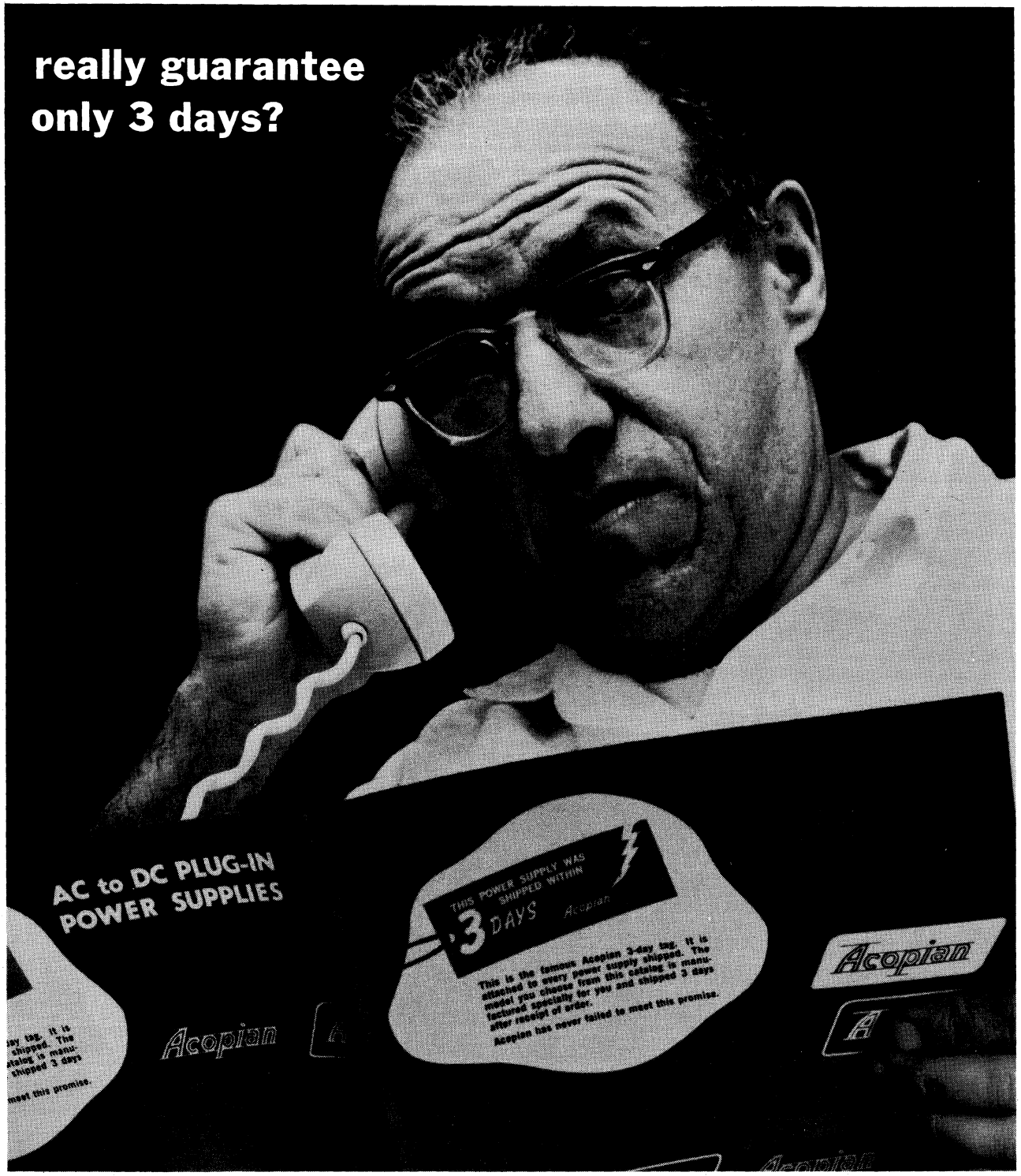

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INVERTERS
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for undersea, airborne and other space-limited applications

NEW CREATIVE APPROACHES TO ENERGY CONVERSION YIELD SUPERVERTERS* and MULTIPLE INVERTER SYSTEMS

Continuing, long range energy conversion studies by Aerospace Avionics, Inc. have provided a firm engineering base for the development of a wide spectrum of energy conversion devices for the maximum utilization of available power. Many of these products are now operational aboard aircraft, undersea vessels, nuclear-powered craft and in the field. *Superverters* and *Multiple Inverter Systems* are two current examples of this Aerospace capability.

Now replacing rotary inverters in single-phase applications, *Superverters* offer significant advantages in terms of performance, reduced size and maintenance. These units incorporate state-of-the-art waveform synthesis techniques, provide excellent voltage regulation and sustained overload capability.

Multiple Inverter Systems achieve utmost efficiency in utilization of minimal space. They consist of three electrically independent, all-silicon, solid state inverters providing 600 VA, single-phase, 400 Hz; 400 VA, single-phase, 60 Hz; and 100 VA, 3-phase 400 Hz from a single 28 VDC source. In addition they afford significant economies in terms of spares provisioning, common documentation and continuity of maintenance.

Both inverter lines are readily available in the models specified herein or modified to meet your particular project requirements.

* Trademark

INVERTERS, POWER AND FREQUENCY CONVERTERS 5 VA TO 10 KVA

- **Single and 3-phase sine and square wave outputs**
- **Voltage and current regulated, short circuit protected**
- **Efficiencies to 95%**
- **Packaging variations in accordance with most military and commercial specifications including:**

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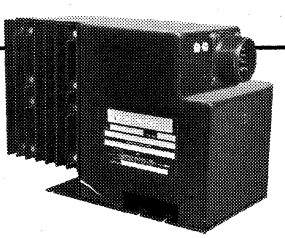
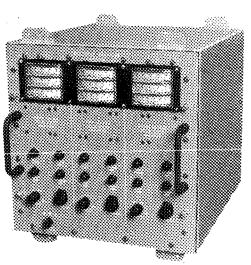


MODEL SV250,
250 VA
Static Inverters

FEATURES:

- *Delivers up to 250% of rated current*
- *Continuous duty operation*
- *Altitude to 70,000'; Temp. —54° to +71°C*
- *Overload, transient and short circuit protected*
- *Convection cooled*
- *Replaces MS rotary inverters*



MODEL NO. SV1500
Multiple Inverter System

FEATURES:

- *Automatic shutdown with front panel indication for: (1) Voltage deviation greater than ± 10%, (2) Frequency deviation greater than ± 10%, (3) Heat sink temperature greater than 120 C.*
- *Overload current limiting*
- *Continuous duty operation*
- *Plug-in circuit cards*
- *Internally illuminated meters with dimmer*
- *Off ground input and output operation*
- *Small size (14"x14"x16")*

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ARNOLD MAGNETICS

POWER CONVERSION EQUIPMENT

SMALL SIZE • LIGHT WEIGHT • SOLID-STATE RELIABILITY
Arnold's complete line of miniature modularized converters and power supplies features an extremely high power-to-volume ratio . . . exceptionally light weight . . . and solid-state reliability in the smallest power packages available anywhere.

WIDE RANGE OF INPUTS and OUTPUTS
The Arnold line of power modules includes output voltages from 2 volts to 20,000 volts DC, output current from 100 micro amperes to 15 amperes.

BROAD RANGE OF APPLICATIONS
Applications cover the entire spectrum of industry power requirements from the smallest to the largest, from 3 watts in 3 cubic inches to 400 watts in 190 cubic inches — available, in most instances, as standard off-the-shelf equipment.

SPECIAL LOW PRICE ON SMALL QUANTITIES
Arnold's present pricing formula incorporates a sharp price drop in the 2 - 4 unit range as well as in the larger quantities. The delivery is from stock to two weeks.

PERSONAL SERVICE
Regardless of the size of the order, Arnold's policy is one of personal service through our Project Manager - Technician team concept. This concept is based upon personal monetary gain for the team unit . . the faster the delivery in an efficient, quality controlled effort, the greater the personal gain for the individual members of the team through participation in a percentage of the gross sale **after delivery.** During the past 14 years, the participation by the product team involved in the order has produced an unparalleled ability to deliver quality products per customer requirements, and has developed a tremendous bank of personal and company knowledge to solve the most exacting power problems.

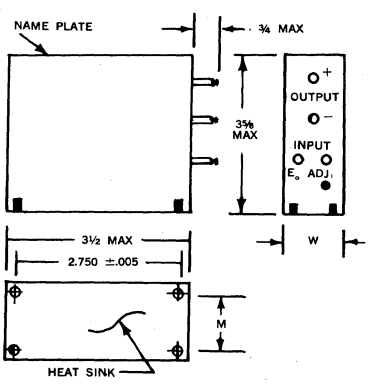
NEW FACILITIES
In 1968, Arnold moved into new facilities, especially designed to meet their individual needs for some years to come. Located in the heart of the Southern California electronics industry, the additional space will be devoted to development, display and manufacture of an expanding number of state-of-the-art products. In addition, both the progressive increase in production and the new space available now make it possible for Arnold to again seek men with backgrounds in either the technical or sales engineering areas to form new Project Manager - Technician Teams. Inquiries are invited.

THE ARNOLD TOROIDAL WINDING MACHINE

Arnold's Toroidal Winding Machine has been a production and laboratory "standard" for more than 14 years. Virtually unchanged since its introduction, it sets up quickly . . . is easy to operate . . . accommodates a wide range of wire sizes . . . winds at high speeds . . . and is portable. The Arnold Toroidal Winder offers a single compact design, equally suitable for winding toroidal coils for both laboratory and production requirements. And, it is priced low enough to permit only occasional use . . . ready to wind any quantity from a single coil into the thousands.

AC-DC CONVERTER MINIATURE, SOLID-STATE





FEATURES
- MINIATURE SIZE (21 CU IN)
- ANY VOLTAGE, SINGLE OR DUAL OUTPUT
- HIGH RELIABILITY
- SHORT CIRCUIT AND TRANSIENT PROTECTED
- FULLY ENCAPSULATED
- ADJUSTABLE OUTPUT
- MEETS MIL-E-5272C
- OUTPUTS ARE ISOLATED
- RFI **QUALIFIED** (MOD "I")

SPECIFICATIONS
INPUT VOLTAGE: 108 - 130 VRMS, 50 to 500 Hz
OUTPUT CURRENT: 5A MAX (OR 40 WATTS)
VOLTAGE ADJUST: +5%, −25%
LINE REGULATION: 0.1% TYP.
LOAD REGULATION: (½-FL): 0.9% TYP.
RIPPLE (RMS): 0.1% TYP.
TEMP. COEF: .05%/°C MAX.
TEMP. RANGE: −10° to +71°C AT CASE
ENVIRONMENTAL: PER MIL-E-5272C
ALTITUDE: 60,000 FT.

MODIFICATIONS
A — REMOTE ADJUST
(CT) — CENTER TAP
E — INPUT VOLTAGE ALTERATION
F — ADDITIONAL AC OUTPUT
G — FLEXIBLE LEADS
I — RFI QUALIFIED (MIL-I-6181D CERTIFICATION SUPPLIED)
L — TIGHTER LOAD REGULATION
R — TIGHTER LINE REGULATION
S — SHORT TERMINALS

Model No.	W (In)	M (In)	Weight (Oz)
PHU	1⅝	1.125	26
PHR	3¼	2.625	52
PHS	4⅞	4.125	78

Nominal Output Voltage (VDC)	Output Current (AMPS)	Model	Price 1 Pc.	Price 2-4 Pcs.
3	5.0	PHU-3	$220	$187
5	5	PHU-5	220	187
5	10.0	PHR-5	398	338
5	15.0	PHS-5	576	489
6	5.0	PHU-6	220	187
6	10.0	PHR-6	398	338
6.3	5.0	PHU-6.3	235	199
10	4.0	PHU-10	235	199
10	8.0	PHR-10	398	338
12	3.3	PHU-12	235	199
12	6.6	PHR-12	398	338
15	2.6	PHU-15	235	199
24	1.6	PHU-24	235	199
24	3.2	PHR-24	398	338
28	1.4	PHU-28	235	199
28	2.8	PHR-28	398	338
30	1.3	PHU-30	235	199
300	.13	PHU-300	225	191
500	.080	PHU-500	235	199
750	.053	PHU-750	235	199
1000	.030	PHU-1000	245	208
2000	.010	PHU-2000	350	297
±5	±4	PHU-10(CT)	291	247
±5	±8	PHR-10(CT)	428	363
±12	±1.6	PHU-24(CT)	291	247
±15	±1.3	PHU-30(CT)	291	247

HOW TO ORDER STANDARD UNITS:
Specify model "PHU" followed by output voltage (any voltage, 2 - 2000 is STANDARD) EXAMPLE: PHU-4.7. Output voltage is 4.7 VDC at 5 AMPS.

HOW TO ORDER SPECIAL UNITS:
Specify model "PHU" followed by "output voltage/output current (AMP)". EXAMPLE: PHU-30(CT)/.5-5/2 delivers ±15 VDC @ ±500 MA and 5 VDC @ 2 AMP. (isolated).

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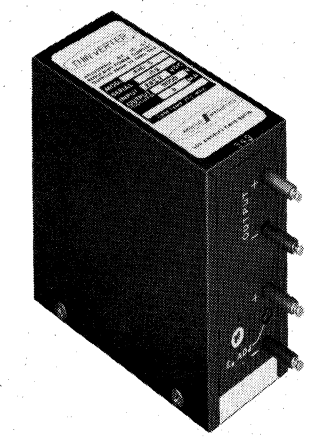
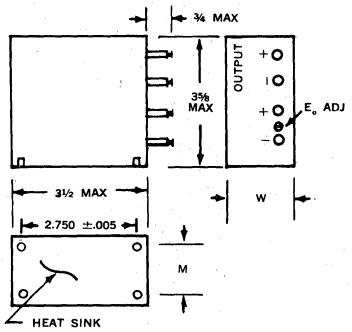
DC-DC CONVERTER MINIATURE, SOLID-STATE





FEATURES
- MINIATURE SIZE — 40 WATTS (21 CU. IN.)
- ADJUSTABLE OUTPUT
- SHORT CIRCUIT & POLARITY REVERSAL PROTECTION
- HIGH RELIABILITY — HERMETICALLY SEALED
- 15 STANDARD MODIFICATIONS AVAILABLE
- FLOATING OUTPUT
- CLOSELY REGULATED
- MEETS MIL-E-5272C
- DELIVERY STOCK TO 4 WEEKS

SPECIFICATIONS

LINE REGULATION (26 - 30 VDC) .24%
LOAD REGULATION (½-FULL LOAD) 1% TYPICAL
RIPPLE .1% TYPICAL
TEMPERATURE −55°C TO +100°C
VIBRATION 25G MAX 0-2000 CPS
SHOCK 100G
ALTITUDE TO 60,000 FT.
WEIGHT — 26 OZ. APPROX.

MODIFICATIONS (SPECIFY MOD LETTER)

A — REMOTE E_{out} ADJUST
CT — CENTER TAPPED OUTPUTS
E — INPUT VOLTAGE ALTERATION
EE — 12V INPUT
F — ADDITIONAL AC OUTPUT
G — FLEXIBLE LEADS
I — RFI QUALIFIED
L — TIGHTER LOAD REGULATION
P — PROGRAMMABLE OUTPUT
R — TIGHTER LINE REGULATION
W — 60 WATT OUTPUT
WW — 8 AMP OUTPUT

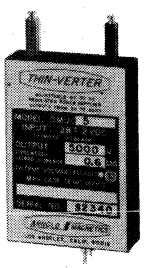
Model No.	W (In)	M (In)	Weight (Oz)
SHU	1⅝	1.125	26
SHR	3¼	2.75	52
SHS	4⅞	4.375	78

Model and Part No.	Output Voltage	Current Amps	Price Each 1 Pc.	Price Each 2-4 Pcs.
SHU-3	3	5.0	$195	$166
SHU-5	5	5.0	195	166
SHU-6.3	6.3	5.0	195	166
SHU-10	10	4.0	195	166
SHR-10	10	8.0	398	338
SHS-10	10	12.0	576	490
SHU-24	24	1.6	195	166
SHR-24	24	3.2	398	338
SHS-24	24	4.8	576	490
SHU-30	30	1.3	195	166
SHU-50	50	0.8	195	166
SHU-100	100	0.4	200	170
SHU-250	250	0.16	200	170
SHU-300	300	0.13	200	170
SHU-500	500	0.080	215	183
SHU-750	750	0.053	215	183
SHU-1000	1000	0.040	230	195
SHU-1500	1500	0.026	260	221
SHU-2000	2000	0.020	305	259
SHU-2500	2500	0.016	330	280
SHU-3000	3000	0.013	345	293
SHU-3500	3500	0.011	360	306
SHU-4000	4000	0.010	375	319
SHU-5000	5000	0.008	390	331

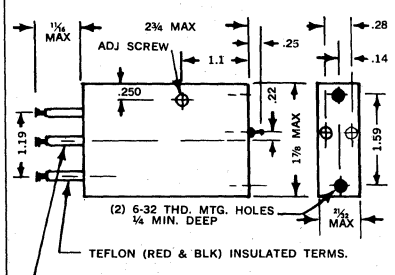
NOTES
1. ANY VOLTAGE IN THE RANGE FROM 3-5000 AVAILABLE; SOME MULTIPLE OUTPUT UNITS AVAILABLE ON SPECIAL ORDER (SEE MODS F & CT)
2. UNITS FOR 12VDC OPERATION SPECIFY MOD EE (10 - 14 VDC INPUT)
3. FOR INPUTS FROM 18 - 135 VDC SPECIFY MOD. LETTER "E" AND INPUT VOLTAGE (MIN. - MAX.)

HOW TO ORDER: Specify Model No. — Nominal Output Voltage (VDC). Example: SHU-30 CT will deliver +15 & −15 VDC at 1.3A each.

DC-DC CONVERTER-3 WATT SUBMINIATURE (3.8 OZ., 3.3 CU. IN.)



ONE-HALF
ACTUAL SIZE



FEATURES

SUB-MINIATURE SIZE & WEIGHT (3 WATTS IN 3.3 CU IN)
ADJUSTABLE OUTPUT
SHORT CIRCUIT, TRANSIENT & POLARITY REVERSAL
HIGH RELIABILITY — HERMETICALLY SEALED
15 STANDARD MODIFICATIONS AVAILABLE
FLOATING OUTPUT
CLOSELY REGULATED
MEETS MIL-E-5272C
DELIVERY STOCK TO 4 WEEKS

SPECIFICATIONS

INPUT 26-30 VDC
LINE REGULATION .3% (26-30 VDC E_{in})
LOAD REGULATION 1 - 4% (½ TO F.L.) DEPENDS ON OUTPUT VOLTAGE
OUTPUT ADJUSTMENT RANGE +5 −10%
RIPPLE 0.3% (RMS)
TEMPERATURE −55°C TO +100°C AT SURFACE OF UNIT
VIBRATION 25G 0 - 2000 CPS
SHOCK 100G
ENVIRONMENT — DESIGNED TO MEET MIL-5272C
ALTITUDE 60,000 FT.

MODIFICATIONS

A — REMOTE E_{out} ADJUST
CT — CENTER TAPPED OUTPUTS
D — ADJUST POT ON SIDE
E — INPUT VOLTAGE ALTERATION
F — ADDITIONAL AC OUTPUTS
I — RFI QUALIFIED
P — PROGRAMMABLE OUTPUT
Z — BROADER ADJUSTMENT RANGE

Model No.	Output[3, 4] VDC	Output[3, 4] MA	Price 1 Pc.	Price 2-4 Pcs.
SMU-.002	2	750	$200	$170
SMU-.003	3	750	200	170
SMU-.006	6	500	190	161
SMU-.012	12	250	185	157
SMU-.028	28	108	180	153
SMU-.028CT	−14, +14	108	210	179
SMU-.1	100	30	180	153
SMU-.15	150	20	180	153
SMU-.3	300	10	190	161
SMU-.5	500	6.0	195	166
SMU-.75	750	4.0	200	170
SMU-1	1000	3.0	245	208
SMU-1.5	1500	2.0	250	213
SMU-2	2000	1.5	260	221
SMU-2.5	2500	1.2	270	229
SMU-3	3000	1.0	330	270
SMU-4	4000	0.75	370	310
SMU-5	5000	0.6	420	360
SMV-.0063	6.3 VRMS	500	190	161
SMU-1F	1000 6.3 AC	1.5 200	270	229
SMU-2F	2000 6.3 AC	0.7 200	285	242
SMU-1P	1000 (Electrically Programmable)	3	280	238
SMV-.006P	4-6 VRMS 4-6 KC	300	225	191

HOW TO ORDER: Specify Model No. — Nominal Output Voltage in KVDC. Example: SMU-1.5D will deliver 1500 VDC at 2 ma with adjust pot on side of unit.

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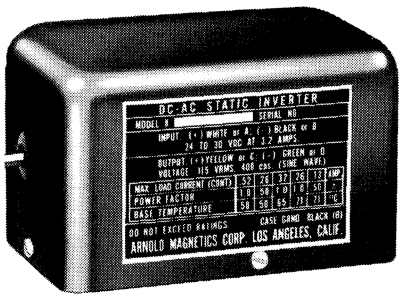
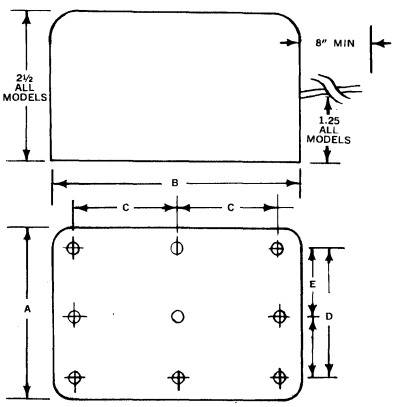
DC SINE WAVE INVERTER 400 CYCLE, SOLID-STATE, MINIATURE, 2 WATTS PER CU. IN.



Input (VDC)	Output (VRMS)	Output Power (VA)	Model No. Model-E_{in}-E_{out}-Freq.-P_{out}	*Price 1 Pc.	*Price 2 - 4 Pcs.
10-14	115	20	SKB-12-115-400 -20	$270	$229
10-14	115	40	SKD-12-115-400 -40	479	407
10-14	28	20	SKB-12-28 -400 -20	270	229
10-14	28	40	SKD-12-28 -400 -40	479	407
24-30	115	50	SKB-28-115-400 -50	270	229
24-30	115	50	SKB-28-115-10K -50	335	284
24-30	115	100	SKD-28-115-400 -100	479	407
24-30	115	200	SKF-28-115-400 -200	937	796
24-30	115	300	SKG-28-115-400 -300	1349	1146
24-30	28	50	SKB-28-28 -400 -50	270	229
24-30	28	100	SKD-28-28 -400 -100	479	407
24-30	28	200	SKF-28-28 -400 -200	937	796

AVAILABLE VOLTAGES: 6-440 VRMS
AVAILABLE FREQUENCIES: 360-10,000 Hz



Model	A (In)	B (In)	C (In)	D	E	Size Mtg. Holes	Wt. Oz.
SKB	2.5	4	1.75	2.00		6-32 x ¼	28
SKD	4	5	2.21	3.42		6-32 x ¼	56
SKF	5	8	3.70	4.40		8-32 x 5/16	112
SKG	8	8	3.56	7.124	3.56	10-32 x 5/16	168

FEATURES
MINIATURE SIZE
LOW HARMONIC DISTORTION
CLOSELY REGULATED OUTPUT
SHORT CIRCUIT PROTECTED
12 OR 24 V INPUT
HERMETICALLY SEALED
RFI PER MIL I-6181
MEETS MIL-E-5272 & 7894
FAST DELIVERY
FULLY ENCAPSULATED
FIRST UNIT BUILT 10 YEARS AGO

SPECIFICATIONS
VOLTAGE REGULATION ±1%
FREQUENCY REGULATION ±.3%
VOLTAGE ADJUSTMENT ±5%
TEMPERATURE −55° to +70°C
ENVIRONMENT MIL-E-5272
TOTAL HARMONIC DISTORTION 3% MAX.

HOW TO ORDER
FOR STANDARD UNITS
Specify simply: Model "SKB" static inverter (This standard unit will have an input of 28 VDC and an output of 115V 400 cps).

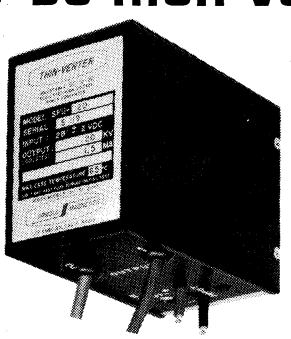
FOR SPECIAL UNITS:
Specify Model "SK" followed by termination desired, nominal input voltage, output voltage and output frequency.

EXAMPLE
SKA-28-115-400-40

SK Model	A Termination	—	28 Nominal Input Voltage	—	115 Output Voltage	—	400 Output Frequency	—	40 Output Power

TERMINATION DESIGNATION:
Wire leads out end "B" (standard configuration)
A/N connector: "A" (Add $25.00)
Wire leads out bottom: "C" (Add $15.00)

DC-DC HIGH VOLTAGE MINIATURE, SOLID-STATE, REGULATED 5KV-20KV

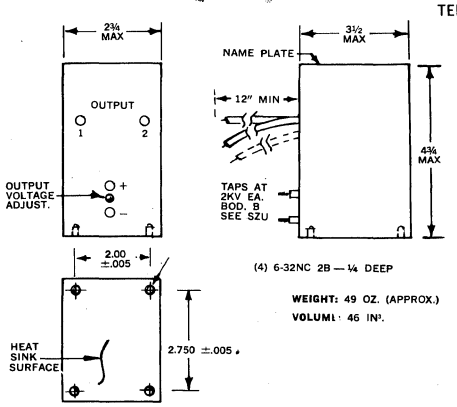


FEATURES
- MINIATURE SIZE (46 CU. IN.)
- RELIABLE — TOTALLY ENCAPSULATED
- OVERVOLTAGE, OVERLOAD AND POLARITY REVERSE PROTECTION
- ADJUSTABLE OUTPUT: (40% TO 105% E_o)
- INTERNAL CORONA CONTROL
- DELIVERY — STOCK TO 6 WEEKS

SPECIFICATIONS
INPUT VOLTAGE: 26 to 30 VDC AT 2.5A MAX.
LOAD REGULATION: ½ TO FULL LOAD 0.2% — NO LOAD TO FULL LOAD 0.5%
LINE REGULATION: FOR VARIATIONS OF INPUT FROM 26 TO 30 VDC LESS THAN 0.24%
TEMPERATURE: 0° TO 50°C LESS THAN .05% 1°C

Model	KVDC	MA (FL)	1 Pc.	2-4 Pcs.
SFU-6	6	5	$550	$467
SFU-8	8	3.7	580	493
SFU-10	10	3	620	526
SFU-12	12	2.5	655	556
SFU-14	14	2.1	680	578
SFU-16	16	1.8	725	616
SFU-18	18	1.6	760	646
SFU-20	20	1.5	795	676

MODIFICATIONS
B — Taps in 2KV steps
T — Built in time delay



HOW TO ORDER
Specify Model Number, Output Voltage in K.V.D.C. Example: SFU-20T will deliver 20,000 VDC at 1.5 MA with built in time delay.

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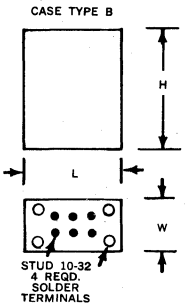
POWER CONVERSION EQUIPMENT

MINIATURE POWER TRANSFORMERS

Series	Max. Power Watts	Size H	Size W	Size L	Max. Output Voltage	Max. No. of Terminals	Weight (Oz)	Case Type
TTA	1.0	1 1/16 Dia.		x½	100	8	.5	A
TTH	20	1⅝ Dia.		x1⅛	1000	8	4	A
TNA	50	2 3/16	x1	x2⅞	1000	10	13	B
TNB	120	2¼	x1¼	x3	1750	10	15	B
TND	235	2½	x1½	x3⅛	1750	10	23	B
TNE	335	3	x1½	x4	1750	10	38	B
TEA	160	2.4	x2	x2	3000	14	22	C
TEB	100	2.4	x1.7	x1.7	2500	14	11	C
TEF	32	1.8	x1.4	x1.4	2000	10	8	C
TEH	21	1.5	x1.3	x1.2	2000	10	4.5	C
TEM	8	1.1	x1.2	x.9	850	8	2.0	C
TEO	4.6	1.1	x.9	x.9	370	8	1.2	C



Input — 115V 400 cycles 1 phase
Temp. — −55°C to 100°C
Environment — Encapsulated to meet MIL E 5272D or MIL T 27A
Output — Up to three windings

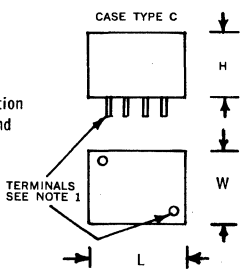
HOW TO ORDER

EXAMPLE: TNB — 500 CT/20 — 26/3.8 — 6.3/3.2 — HE

Series No.	Primary VRMS	Secondary VRMS/AMPS	Secondary VRMS/AMPS	Termination Hook end

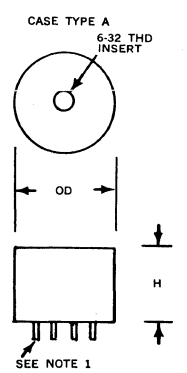
NOTES: 1. Specify HS for hooked pins outside
Specify HE for hooked pins out end
Specify SE for straight pins out end
Specify LS for flexible leads outside

2. For additional information and quotation send us your requirements.



MINIATURE INDUCTORS

Series	Inductance MH	Max. "Q"	Max. "Q" Freq. KC	Size (Case Type A)
ITV	1 to 17000	175 to 52	15 to 1.7	1.44 dia x .75
ITW	1 to 17000	240 to 50	40 to 2.5	1.44 dia x .75
ITR	1 to 7000	145 to 55	19 to 3	1.06 dia x .47
ITS	1 to 500	168 to 50	100 to 13	1.06 dia x .47
ITU	1 to 3000	190 to 50	40 to 5	1.06 dia x .47



HOW TO ORDER

EXAMPLE: ITV — 15 — HS

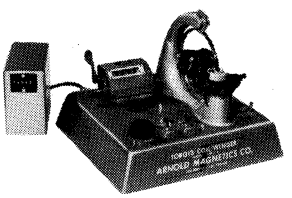
Series No.	Inductance (MH)	Termination (See note 1)

TOROIDAL COIL WINDER

Sets up quickly . . . easy to operate . . . takes wide range of wire sizes

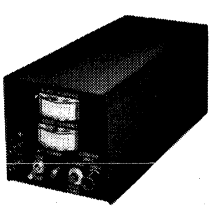
• Min. finished hole size: .18 in. • Max. finished toroid O.D.: 4.0 in. • Winding speed: 1500 turns/min. • Wire range: AWG 44 to AWG 26 • Dual, self-checking turns counting system • Loading (wire length) counter • Core range: 3/32" I.D. to 4" O.D. to 1½" high.

LABORATORY USE — Change wire and core size in 45 sec. • **PRODUCTION USE** — 1500 turns per minute • Insert core and load in 20 sec. • **Model WTA — $890.00** includes all rings, counters and accessories • **Model WTB — $750.00** without electronic counter or extra rings.



ELECTRONIC LOADS (OR CURRENT LIMITERS) MODEL LGA

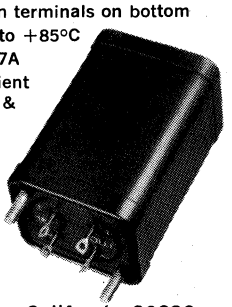
GENERAL SPECIFICATIONS • Load Voltage Range: 2-50 Volts DC • Load Current Range: 0-30 Amps DC • Load Power: Continuous 200 Watts, 50% more power for short periods • Excitation Source: 120V 50-500 Hz, 50 Watts • FEATURES • Used in place of load resistors for testing power supplies, batteries & amplifiers • Maintains constant current at value selected (will, therefore, limit the maximum current delivered to another load (connected in series) 0 to ½, to full current setting • May be switched from 0 to ½, to full current setting • No switching — continuous current adjustment with near infinite resolution • May be paralled for increased current rating • USES • Power resistor substitute • Load bank substitute • Constant current load • PRICE: From $350.00 (in single piece quantity) • DELIVERY: 4-6 weeks ARO.



LINE SPIKE FILTER MODEL FLD

Missile and aircraft applications
VOLTAGE: to 35 VDC
CURRENT: to 4 AMPS
CONSTRUCTION: Steel can with mounting studs and pin terminals on bottom
TEMPERATURE: −25°C to +85°C
ENVIRONMENT: MIL-T-27A
ATTENUATION: Of transient currents & voltages

0 - 1.2 KC: 3 db min.
1.2 - 2.4 KC: 10 db min.
2.4 KC - UP: 27 db min.
WEIGHT: 8 Oz.
PRICE: 1 pc. $45.00



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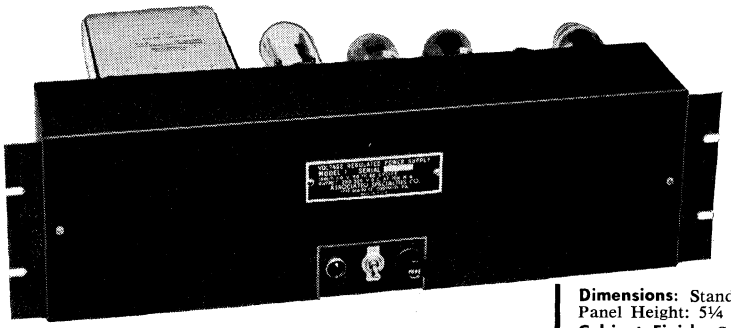
Associated Specialties Co.

1751 MAIN STREET, OREFIELD, PENNSYLVANIA



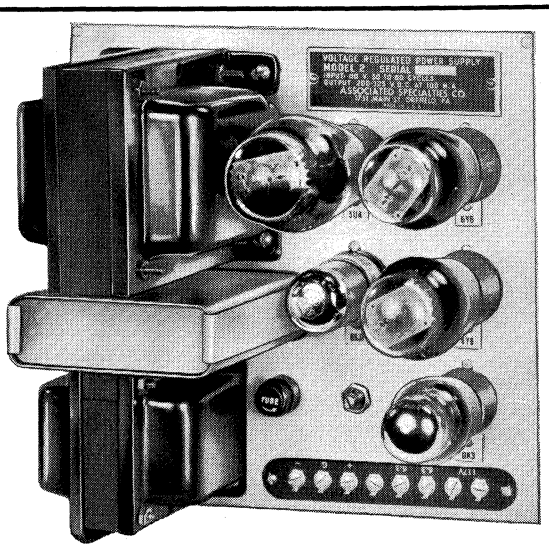
ELECTRONICALLY REGULATED D.C. CONSTANT VOLTAGE POWER SUPPLIES

RELAY RACK MOUNTING TYPES
—BK (BLACK RIPPLE FRONT PANEL)
—GR (GRAY RIPPLE FRONT PANEL)

Input: 105-125 volts AC. 50-60 cycles.
Regulation of DC Voltage: Better than 1% for loads of 0 to 100 ma. and line voltage variations from 105 to 125 volts.
Isolated Output: Both positive and negative sides of the output are isolated from ground. Either side may be grounded or the output may be left floating.
AC Output for Filaments: An isolated AC voltage of 6.3 volts AC at 3 amperes is available at the output terminal connections.
Overload Protection: A fuse mounted on the front panel protects supply against external overloads or internal failure.
Input and Output Connections: All input and output connections are made to a single terminal strip conveniently located on the rear of the chassis.

Dimensions: Standard 19" relay rack mounting. Panel width: 19 inches, Panel Height: 5¼ inches; Depth Behind Panel: 7¼ inches.
Cabinet Finish: Standard Black ripple enamel.
Controls: Rear Chassis—DC output voltage control. Front Panel—Pilot light, input power switch, and fuse.
High Quality Components: Only components of the highest quality are used in this equipment insuring you years of trouble-free dependable operation.
Accessibility: By removing two small screws, the front panel may be removed while the supply stays mounted on a relay track or cabinet. This allows quick and easy inspection.

MODEL	OUTPUT VOLTAGE	RIPPLE
1	200-325 V.D.C.	10 M.V. MAX.
11	75-200 V.D.C.	5 M.V. MAX.



SUB-CHASSIS MOUNTING

Sub-chassis mounting type regulated power supplies are designed to save space and money. They can be mounted on a chassis along with other components and thereby save space which would be used by a relay rack mounting supply. Savings are made in the size and cost of the cabinet required for a job along with the lower cost of the sub-chassis mounting supplies.

SAME AS MODEL 1 AND 11 EXCEPT

Dimensions: 9" wide, 8¾" long, 4¾" high above chassis, 1¾" clearance required below chassis. Size of cut-out required, 8¼" wide x 8" high. Location of four mounting holes: 8⅝" wide x 8 11/32" high.
Chassis Finish: Aluminum.
Controls: DC output voltage control adjustable from the top side of the chassis.

MODEL	OUTPUT VOLTAGE	RIPPLE
2	200-325 V.D.C.	10 M.V. MAX.
12	75-200 V.D.C.	5 M.V. MAX.



CABINET MOUNTING

An ideal unit for bench work or assembly into equipment.

SAME AS MODEL 1 AND 11 EXCEPT

Input Connections: A line cord at rear of cabinet.
Output Connections: 5 way binding posts.
Dimensions: 5" wide, 7" high, 16" deep.
Panel Finish: Aluminum.
Cabinet Finish: Gray enamel.
Controls: D.C. output voltage on front panel.
Meters: Output voltage.

MODEL	OUTPUT VOLTAGE	RIPPLE
3	200-325 V.D.C.	10 M.V. MAX.
13	75-200 V.D.C.	5 M.V. MAX.

MODEL P2 PANEL $9.00

Mounts two Model 2 or 12 power supplies side by side in a 19 inch relay rack space 8¾" high.

OUTPUT	MOUNTING	SIZE	WEIGHT	COLOR	MODEL	PRICE
200-325 V.D.C., 0-100 M.A. REGULATION LINE BETTER THAN 1% LOAD BETTER THAN 1% RIPPLE 10 MV R.M.S. MAX.	RACK MOUNTED	SEE ABOVE	20 POUNDS	GRAY COVER	1-GR	$69.50
	RACK MOUNTED	SEE ABOVE	20 POUNDS	BLACK COVER	1-BK	$69.50
	SUB-CHASSIS MOUNTING	SEE ABOVE	15 POUNDS	ALUMINUM CHASSIS	2	$64.50
	CABINET	SEE ABOVE	20 POUNDS	GRAY	3	$79.50
75-200 V.D.C., 0-100 M.A. REGULATION LINE BETTER THAN 1% LOAD BETTER THAN 1% RIPPLE 5 MV R.M.S. MAX.	RACK MOUNTED	SAME AS 1-GR	20 POUNDS	GRAY COVER	11-GR	$79.50
	RACK MOUNTED	SAME AS 1-BK	20 POUNDS	BLACK COVER	11-BK	$79.50
	SUB-CHASSIS MOUNTING	SAME AS 2	15 POUNDS	ALUMINUM CHASSIS	12	$74.50
	CABINET	SAME AS 3	20 POUNDS	GRAY	13	$89.50

astro-metrix corporation

125 WEST PROVIDENCIA AVENUE, BURBANK, CALIFORNIA 91502
TELEPHONES (213) 849-4759, 842-0933

CUSTOM POWER SUPPLIES DESIGNED & BUILT TO YOUR SPECIFICATIONS

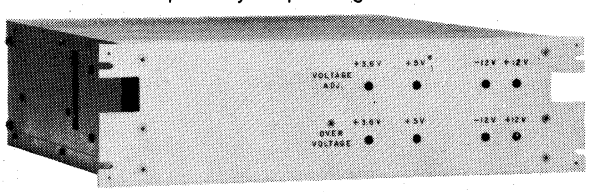
Astro-Metrix Corporation, division of J.K.F. Industries, has the complete in-house capabilities for design and production of custom and O.E.M. system power supplies. Our entire DC power supply capability is directed toward filling the **volume** requirements of the original equipment manufacturer. We are currently manufacturing computer power supplies based on **constant voltage transformer** pre-regulators, **high frequency switching** pre-regulators, **phase controlled SCR regulators** as well as standard transformer input. Extensive use of integrated circuits reduce circuit complexity. With the in depth experience available at Astro-Metrix Corporation the **most ideal** fundamental design can be applied in manufacturing, resulting in low cost and high reliability.

Typical multiple output O.E.M. power supplies:

MODEL AMC-M-338

SPECIFICATIONS

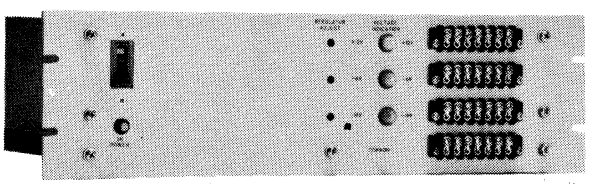
Input: 105-125 VAC 47-65 CPS
Output: 5v - 13a
+12v - 6a
−12v - 4a
+ 6v - 2a
+12 volt sequence by computer logic
Regulation: .1%
Ripple: 10mV
Size: 5″ x 19″ x 20″
Price: $530.00 - 100 up



MODEL AMC-M-270

SPECIFICATIONS

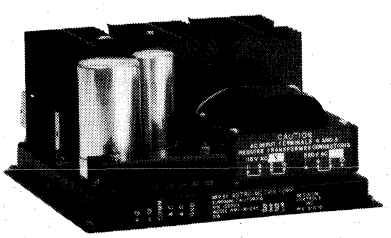
Input: 105-125 VAC 47-470 CPS
Output: +18V @ 3.5a
+12V @ 1a
− 6V @ 1.5a
Regulation line and load: .1%
Ripple: 10mV P-P
Price: $175.00 Production Quantities



MODEL S-1070

SPECIFICATIONS

Input: 105-125 VAC 47-470 CPS
Output: +12V @ 6 amp
Regulation line and load: .1%
Ripple: 10mV P-P
Price: $165.00 Production Quantities



MODEL AMC-VA-125-30

SPECIFICATIONS

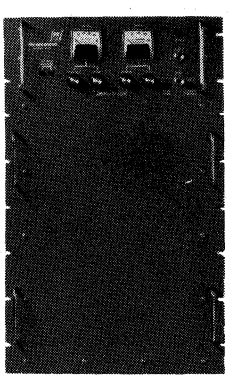
Input: 0-125V dc
Regulation: ±10%
Ripple: 1%
Current: 0-30 Amps dc
Price: $725.00 ea



MODEL AMCRC-36-200

SPECIFICATIONS

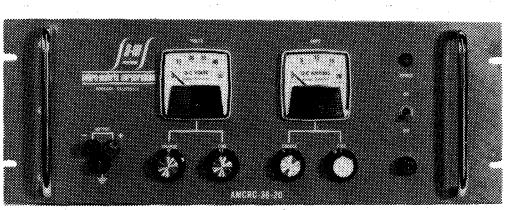
Input: 220/440 VAC
Output: 0-36V dc
0-200 Amps
Regulation line and load: .1%
Ripple: .1%
Output impedance: .005 ohms
Price: $3,950.00 ea



MODEL AMCRC-36-20

SPECIFICATIONS

Input: 105-125V dc
Output: (Volts) 0-36V dc
(Amps) 0-30
Regulation: .005% line
.005% load
Ripple: 1mV RMS
Output Impedance: .005 ohms
Programmable: 1,000 ohm/volt
Ambient: 0-70°C



SOLID STATE SINE-WAVE OUTPUT FREQUENCY CONVERTERS / 400 CPS and 60 CPS

- **All Silicon • Short-Circuit Proof • MIL-Type Construction**
- **High Efficiency • Low Cost • Compact • Light Weight**
- **3 ϕ Models Have Independent Voltage Regulation/Phase.**

This NEW type of frequency converter was researched and developed by ASTRO-METRIX CORPORATION to meet the ever growing market for smaller, lower cost A.C. power supplies. The industry-praised design employs a high-efficiency switching regulator coupled with an equally high-efficiency filter network. By providing transformer isolation in the higher frequency output end of the power supply, the need for a heavy weight and bulky (50-60 cps) input power transformer has been eliminated, which also reduces much of the heat generated inside the unit. The magnetics are also "Class F" for reliability and overload capability, and can be ordered to meet MIL-T-27 if desired.

The standard Models come with input circuit-breaker, pilot lamp and output terminals on the front 19" Relay panel; the rear panel is blank except for 6 ft. line cord. The list of OPTIONS (below) enables you to CUSTOMIZE a unit to your individual needs simply by adding the appropriate suffix letters after the Model Number.

SPECIFICATIONS COMMON TO ALL STANDARD MODEL FREQUENCY CONVERTERS

Input: 105 to 125 VAC, 47 to 65 CPS
Voltage Regulation: Less than ±1.0%
Voltage Modulation: Less than ±0.5%
Frequency Stability: ±0.25% (See Options)
Recovery Time: 25 msec
Output: 105 to 125 VAC, 400 CPS (see Option)
Distortion: Less than 3.0%
Ambient Temperature: 0°C to +55°C (see Option)
Semiconductors: Silicon
Power Factor: ±0.7%

AVAILABLE OPTIONS

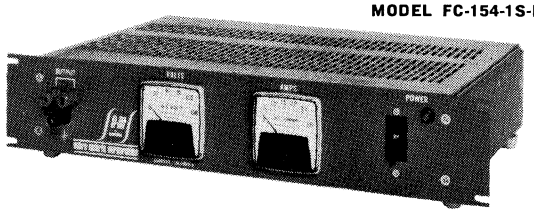
Select from the chart below the desired Model Number to meet your needs by Phase and VA rating. Then select from the list of OPTIONS the suffix letter(s) that corresponds to the option(s) needed to customize the standard model to your requirements and add them to the Model Number. EXAMPLE: FC-104-1S-V-H would be a 100 VA, 1ϕ unit with a volt meter and handles added.

Add SUFFIX

A Adjustable output voltage — 0 to 130 VAC at full-rating. Not available on 3 ϕ or low distortion models.
C Current Meter ±3% accuracy.
D Distortion less than 0.5%.
F Frequency stability of 0.01%.
H Handles on front panel.
J Voltage adjust ±10% control on rear panel.
K Frequency adjust ±5% control on rear panel.
M Frequency meter 400 CPS ±20, Accuracy ±0.1%.
P 47 to 480 CPS operation.
R Rear panel terminals for Output.
S Synchronization terminals on rear panel to sync two identical units.
T Temperature range from −55°C to +71°C.
V Voltmeter ±3% accuracy.

Other output frequencies and voltages are available on request. Please contact the factory or our representatives to obtain other modifications not listed above.

MODEL FC-154-1S-M



Model Number	Output VA	Width	Height (Inches)	Depth	Appr. Weight
1-Phase					
FC-104-1S	100	19	5¼	18	25
FC-154-1S	150	19	5¼	18	25
FC-254-1S	250	19	5¼	18	30
FC-454-1S	450	19	10½	22	45
3-Phase					
FC-204-3S	200	19	7	18	50
FC-304-3S	300	19	7	18	50
FC-454-3S	450	19	10½	22	60
FC-754-3S	750	19	15¾	22	90

SOLID STATE SINE-WAVE OUTPUT FREQUENCY CONVERTERS / 60 CPS

SPECIFICATIONS COMMON TO ALL STANDARD MODEL FREQUENCY CONVERTERS

Input: 115/200 VAC, 400 CPS, 3 Phase, Steady State per MIL-STD-704.
Voltage Regulation: ±2%.
Frequency Stability: ±0.5%.
Protection: Short Circuit, Overvoltage, Undervoltage.
Efficiency: 85%.
Output: 105/125 VAC, 60 CPS.
Distortion: 5%.
Ambient Temperature: 0°C to 55°C.
Semiconductors: Silicon.
Power Factor: ±0.7.
RFI: Designed to MIL-I-6181D.

Model Number	Output VA	W	H	D	Appr. Weight
1-PHASE					
CC-506-1S	500 VA	19″	5¼″	18″	30
CC-1006-1S	1 KVA	19″	5¼″	18″	40
CC-2006-1S	2 KVA	19″	7″	18″	50
CC-5006-1S	5 KVA	19″	12½″	18″	90
3-PHASE					
CC-1006-3S	1 KVA	19″	7″	14″	60
CC-2006-3S	2 KVA	19″	10¼″	16″	80
CC-5006-3S	5 KVA	19″	12¼″	18″	100
CC-10006-3S	10 KVA	19″	21″	20″	180

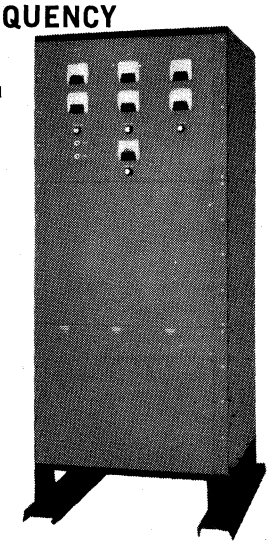
ALL SILICON SINE-WAVE OUTPUT FREQUENCY CONVERTERS / 400 CPS

SPECIFICATIONS COMMON TO ALL STANDARD MODEL FREQUENCY CONVERTERS

Input: 220/440 ±10% VAC, 60 CPS.
Voltage Regulation: Less than ±1.0%.
Voltage Modulation: Less than ±0.5%.
Frequency Stability: ±0.25% (See Options).
Recovery Time: 25 msec.
Output: 105 to 125 VAC, 400 CPS (See Option).
Distortion: Less than 3.0%.
Ambient Temperature: 0°C to +55°C Forced Air Cooled.
Semiconductors: Silicon.
Power Factor: ±0.7%.

Model Number	Output VA	W	H	D	Appr. Weight
1-PHASE					
FC-1004-1S	1 KVA	19	14	22	120
FC-2004-1S	2 KVA	19	21	22	225
FC-5004-1S	5 KVA	19	31	22	400
FC-10004-1S	10 KVA	30	48	30	600
FC-20004-1S	20 KVA	36	68	32	900
3-PHASE					
FC-1004-3S	1 KVA	19	14	22	150
FC-2004-3S	2 KVA	19	21	22	300
FC-5004-3S	5 KVA	19	48	24	500
FC-10004-3S	10 KVA	30	48	30	750
FC-20004-3S	20 KVA	36	68	32	1000

POWER CONVERSION using (Silicon Controlled Rectifier)



MILITARIZED FREQUENCY CHANGERS — Astro-Metrix Corporation Frequency Converters are designed to convert Mil 400 CPS 3 phase power to 60 CPS single phase at high efficiency thru the use of silicon semiconductors operating in switching mode.

The converters provide power for **teletypewriters, test equipment, communication equipment** and various other ground support equipment.

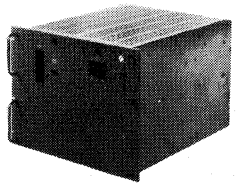
SPECIFICATIONS:

Input Voltage: 115/200 VAC ±13%.
Input Configuration: Three Phase, 4 Wire Wye.
Input Frequency: 360 CPS, 440 CPS.
Ouptut Voltage: 115 Volts RMS.
Output Frequency: 60 CPS ±1%.
Voltage Regulation: ±3 Volts for 0 to 100%. Change in load and for ±13% change in Input Line Voltage.
Power Factor: 0.75 Lagging to Unity. No Load to Full Load.
Distortion: 5% Maximum Distortion for All Conditions of Line, Load and Temperature.
Starting Time: 3 Seconds Maximum.
Common Connection: Input and Output Completely Isolated.
Overload: Overcurrent protection in Both Input and Output Lines.
Efficiency: 82% Minimum at Rated Load.
RFI: Radiated MIL-STD-826 Class G. Conducted MIL-STD-826 Class G.
Circuit Breaker: Self Contained Magnetic Circuit Breaker in Input Lines.
Temperature Range: STD −30°C to +71°C. OPT −50°C to +71°C.
Time Indicator (Optional): Elapsed Time Indicator Non-Resetting 9999.9 Hours Numerical Form.

INDIVIDUAL MODEL SPECIFICATION

	MC-400-1S	MC-750-1S	MC-1500-1S	MC-3500-1S	MC-8000-1S
Output Power	400VA	750VA	1.5 KVA	3.5 KVA	8.0 KVA
Weight	25 lbs	60 lbs	70 lbs	87 lbs	225 lbs
Size	7.796 W x 4.965 H x 19.398 D	10.125 W x 7.625 H x 19.5625 D	19.00 W x 10.50 H x 12.00 D	8.99 W x 12.12 H x 21.89 D	20.00 W x 12.12 H x 23.50 D

Other sizes available upon request.

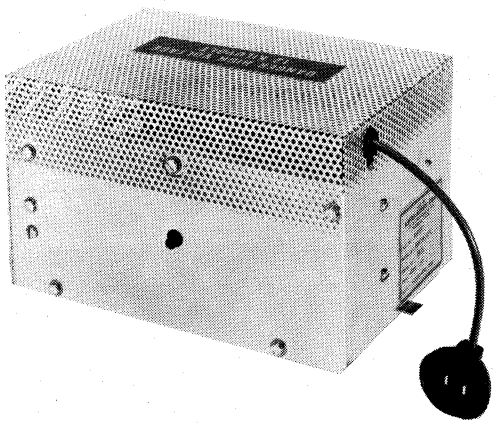


astro-metrix corporation

125 WEST PROVIDENCIA AVENUE, BURBANK, CALIFORNIA 91502
TELEPHONES (213) 849-4759, 842-0933

HIGH VOLTAGE - SOLID STATE - POWER CONVERSION

Astro-Metrix Corporation has developed unique high frequency switching circuitry which combined with our in-house high voltage transformer capability results in truly outstanding high voltage power supplies for **CRTs** display and monoscope character generator display tubes. The power supplies can withstand repeated HV arcing and short circuiting without damage. We have produced thousands of regulated HV dc power supplies for the industry in the last two years resulting in over 1,000,000 operating hours. These proven designs can be adapted to your requirement usually with a minimum of change.



SPECIFICATIONS

Typical Unit: HIGH VOLTAGE

Input: 25V dc
Output #1: −1800V 1.5mA
Regulation Line and Load: .1%
Ripple: .01%

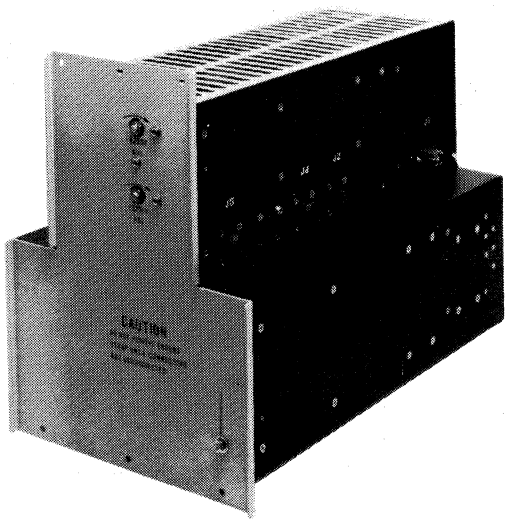
Output #2: +12 KV
Regulation Line and Load: .5%
Ripple: .1%

Output #3: +400V 5mA
Regulation: .1%
Ripple: .1%

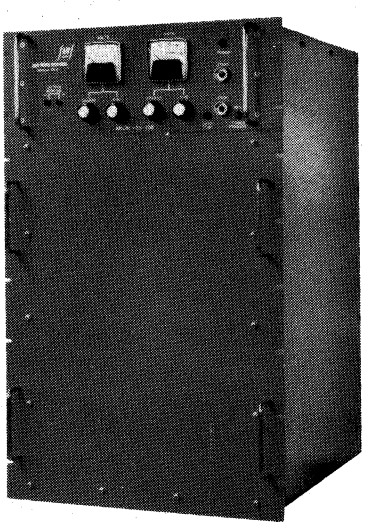
Output #4: +1500 to 2000V dc
Adjustable for focus
10uA output

Price: 500 up less than $150.00

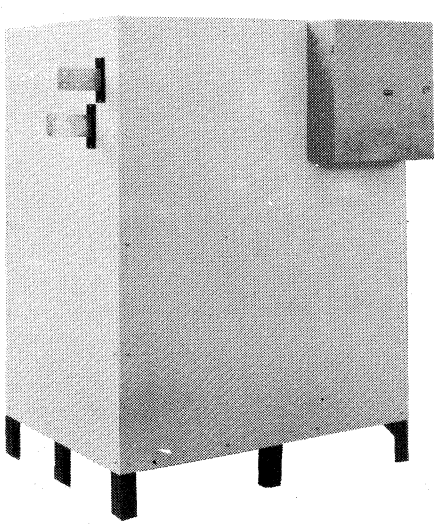
Similar circuitry is being applied to airborne HC power supplies to be used in radar display for both commercial and military aircraft.



SPECIAL HIGH CURRENT POWER SUPPLIES

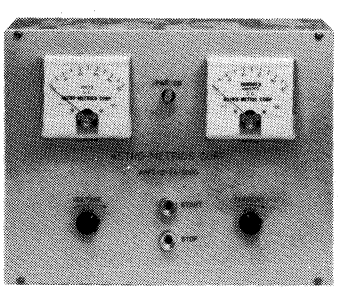


MODEL AMCRC 36-200B



MODEL ARPS 12-24-5000

30,000 Amps up to 36Vdc. Astro-Metrix Corporation is currently producing commercial and industrial regulated power conversion units with output to 30,000 Amps at up to 36V dc. This equipment is used in anodizing, precious metal plating, chemical milling, and hard chrome plating. All units are available both current and voltage regulated to ±1%. Regulation is by either saturable reactor magnetic amplifier or silicon controlled rectifier.



CONTROL UNIT

65 MODELS . . . IN 3 BASIC SIZES

For 10 to 42-Cell Nickel-Iron Alkaline Batteries and 6 to 24-Cell Lead Acid Batteries
Ratings 300 to 2,000 Ampere Hours

COMPLETE RECHARGING IN 8 HOURS OR LESS

SPECIFICATIONS — NICKEL-IRON CHARGERS**

Model Number	Number of Cells	AC Input Phases	Bat. Cap. A. H.	Cabinet Size	Shipping Wt. (lbs.)	Price	Model Number	Number of Cells	AC Input Phases	Bat. Cap. A. H.	Cabinet Size	Shipping Wt. (lbs)	Price
AMC 10-1-300E	10	1	300	E2		$ 475	AMC 24/25-3-300E	24/25	3▲	300	E4	405	$ 710
AMC 10-1-400E	10	1	400	E2	245	480	AMC 24/25-3-500E	24/25	3▲	500	E4	455	780
AMC 10-1-500E	10	1	500	E2	295	495	AMC 24/25-3-800E	24/25	3▲	800	E4		890
AMC 10-1-640E	10	1	640	E2	320	520	AMC 24/25-3-1000E	24/25	3▲	1000	E4		1,015
AMC 10-3-800E	10	3▲	800	E4	330	630	AMC 28/30-3-400E	28/30	3▲	400	E4		715
AMC 20-1-300E	20	1	300	E2	320	680	AMC 28/30-3-500E	28/30	3▲	500	E4		780
AMC 20-3 640E	20	3▲	640	E4		770	AMC 28/30-3-640E	28/30	3▲	640	E5		835
AMC 20-3-800E	20	3▲	800	E4		840	AMC 28/30-3-900E	28/30	3▲	900	E5		985
							AMC 40/42-3-500E	40/42	3▲	500	E5		1,090
							AMC 40/42-3-800E	40/42	3▲	800	E5	850	1,190

SPECIFICATIONS — LEAD-ACID CHARGERS

Model Number	Number of Cells	AC Input Phases	Bat. Cap. A. H.	Cabinet Size	Shipping Wt. (lbs.)	Price	Model Number	Number of Cells	AC Input Phases	Bat. Cap. A. H.	Cabinet Size	Shipping Wt. (lbs.)	Price
AMC 6-1-360***	6	1*	360	E2	245	$ 395	AMC 15-3-1500	15	3▲	1500			$1,385
AMC 6-1-500	6	1†	500	E2	295	540	AMC 16-1-250	16	1†	250	E2	345	550
AMC 6-1-720	6	1†	720	E2	320	685	AMC 16-3-360	16	3▲	360	E4	405	625
AMC 6-3-1000	6	3▲	1000	E4	455	705	AMC 16-3-500	16	3▲	500	E4	455	765
AMC 6-3-1250	6	3▲	1250	E5		880	AMC 16-3-720	16	3▲	720	E4	555	890
AMC 6-3-1500	6	3▲	1500	E5		1,190	AMC 16-3-1000	16	3▲	1000	E4	680	1,075
AMC 8-1-250	8	1	250	E2		385	AMC 16-3-1250	16	3▲	1250	E5		1,295
AMC 8-1-360	8	1	360	E2		395	AMC 16-3-1500	16	3▲	1500	E5		1,450
AMC 9-1-360	9	1†	360	E2	295	425	AMC 18-1-250	18	1†	250	E2	345	595
AMC 9-1-500	9	1†	500	E2	320	550	AMC 18-3-360	18	3▲	360	E4	430	635
AMC 9-3-720	9	3▲	720	E4	455	820	AMC 18-3-500	18	3▲	500	E4	480	795
AMC 9-3-1000	9	3▲	1000	E4	530	920	AMC 18-3-720	18	3▲	720	E4	605	845
AMC 12-1-250	12	1†	250	E2	295	395	AMC 18-3-1000	18	3▲	1000	E4	730	1,190
AMC 12-1-360	12	1†	250	E2	320	680	AMC 18-3-1250	18	3▲	1250	E5		1,270
AMC 12-3-500	12	3▲	500	E4	430	570	AMC 18-3-1500	18	3▲	1500	E5		1,445
AMC 12-3-720	12	3▲	720	E4	505	767	AMC 18-3-1750	18	3▲	1750	E5		1,710
AMC 12-3-1000	12	3▲	1000	E4	605	1,045	AMC 18-3-2000	18	3▲	2000	E5		1,820
AMC 12-3-1250	12	3▲	1250	E5		1,190	AMC 24-3-360	18	3▲	360	E4		765
AMC 12-3-1500	12	3▲	1500	E5		1,260	AMC 24-3-500	18	3▲	500	E4		798
AMC 15-1-250	15	1†	250	E2	320	495	AMC 24-3-720	18	3▲	720	E4		910
AMC 15-3-360	15	3▲	360	E4	405	550	AMC 24-3-1000	18	3▲	1000	E5		1,420
AMC 15-3-500	15	3▲	500	E4	455	585	AMC 24-3-1250	18	3▲	1250	E5		1,645
AMC 15-3-720	15	3▲	720	E4	530	875							
AMC 15-3-1000	15	3▲	1000	E4	630	1,110							
AMC 15-3-1250	15	3▲	1250	E5		1,280							

** Complete with control circuit.

*** Available in Two non-interchangeable Models. (1) 104/110/120 Single Phase Input. (2) 208/220/240 or 416/440/480 Single Phase Input. When ordering specify AC Input required.

All units operate from 60 cycle sources. AC input standard voltage taps are as follows:

▲ All Three-Phase Inputs: 208/220/240 or 416/440/480.
For other AC Inputs, consult nearest AMC Sales Representative.

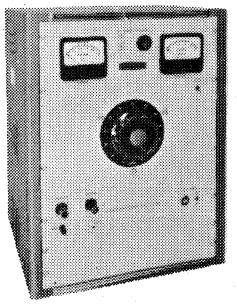
* Single Phase Inputs: 104/110/120.
† Single Phase Inputs: 208/220/240 or 416/440/480.

STANDARD EQUIPMENT: Extra-flexible 10 ft. cable, ammeter, a-c and d-c fuses. Charger is terminated by timer which is activated by AMC control circuit.

Beckman®

HIGH VOLTAGE POWER SUPPLIES

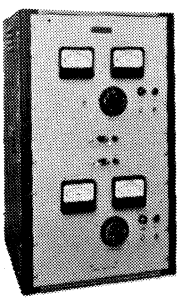
HEAVY DUTY POWER SUPPLIES



These industrial type power supplies are built for service and efficiency. All are of the transformer type and employ husky components that have been selected for their power handling capacity. Controls are arranged so that operation is simple and the units contain a number of safety features for protection of personnel and equipment. Output is continuously variable from zero to full rated values. These supplies are unregulated and standard ripple is 5% or less. Ripple of from 0.01% to 1%, and regulated supplies are available on special order. All power supplies have automatic overload cutout control circuits.

MODEL	VOLTAGE	CURRENT	MODEL	VOLTAGE	CURRENT
F-6001	0-1000	2 Amp.	F-6005-AV	0-5000	500 MA.
F-6002	0-2000	1 Amp.	F-6005-A1K	0-5000	1 Amp.
F-6003-A1	0-3000	100 MA.	F-6010-A1	0-10,000	100 MA.
F-6003-AV	0-3000	500 MA.	F-6010-AV	0-10,000	500 MA.
F-6003-AK	0-3000	1 Amp.	F-6020-A05	0-20,000	50 MA.
F-6005-A1-H	0-5000	100 MA.	F-6030-A3	0-30,000	300 MA.

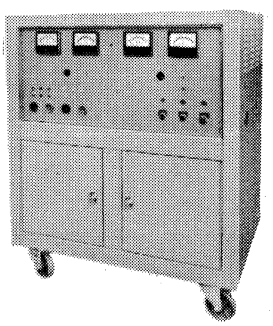
CONSTANT CURRENT POWER SUPPLIES



Designed for application where output current must remain constant regardless of loading resistance changes. Used for magnet fields, plating applications, gaseous lamps. Dependable magnetic current stabilizer has no moving parts, no tubes, no transistors to replace. Simply set current to desired level, no balancing or other adjustments needed. Ideal for lamp operation since operating state ionizing voltage in no way affects lamp current. Standard hum level 5%. Lower hum levels available on order.

MODEL	MAX. VOLTAGE	CURRENT	MODEL	MAX. VOLTAGE	CURRENT
C-25-100	25 V.	100 Amp.	C-1000-5	1000 V.	5 Amp.
C-70-70	70 V.	70 Amp.	C-3000-1	3000 V.	1 Amp.
C-150-250	150 V.	250 Amp.	C-5000-1	5000 V.	1 Amp.
C-500-10	500 V.	10 Amp.	C-10K-5H	10 KV	500 MA.
C-Dual-500-10	500 or 1000 V.	10 or 20 Amp.			

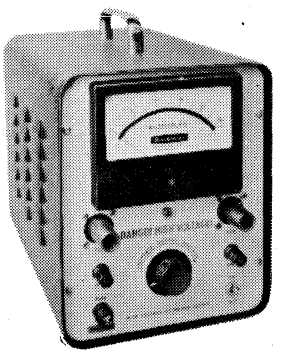
3 PHASE HEAVY DUTY POWER SUPPLIES



For use in applications where high voltages at extra high currents are required. Either fixed or fully variable types are available. Automatic circuits protect against over-current conditions, turning off main power in a split second. Used for plasma research, electron beam furnaces, plate power and condenser charging. Voltage or current regulated types available. Input power requirement is 220 or 440 volts, 3 phase 60 cps. Standard ripple is 5% and regulation is approximately 10%.

MODEL	VOLTAGE	CURRENT AMPS	MODEL	VOLTAGE	CURRENT AMPS
A 1-A	0 to 100	100	A 50	0 to 5,000	5
A 1-B	0 to 100	1000	A 51	0 to 5,000	10
A 10A	0 to 1,000	5	A 72	0 to 7,500	10
A 10B	0 to 1,000	10	A 100	0 to 10,000	5
A 30A	0 to 3,000	5	A 110	0 to 10,000	10
A 31	0 to 3,000	10	A 200	0 to 20,000	5
A 32	0 to 3,000	20	A 300	0 to 30,000	5
			A 500	0 to 50,000	5

PORTABLE HIGH VOLTAGE DC POWER SUPPLIES



These general purpose supplies are particularly suited for laboratory or production line use to provide a convenient source of high voltage, low current dc power. Widely used for such applications as powering photomultiplier tubes, image intensifiers, condenser chargng, and routine insulation breakdown testing.
Voltage readings are indicated by a 6" precision mirror scale kilovoltmeter of 1% accuracy. Polarity is reversible from the front panel (patent applied for). An ac input protection fuse is included as well as a built-in limiting ballast lamp restricting maximum current output levels. These levels may be adjusted by changing ballast. A single control allows continuous adjustment of output voltage from zero to maximum rated voltage.
The output is unregulated (regulation is 20% for 10 to 100% loading). Current rating is 5 milliamperes. The ripple is 5% (rms) at full voltage and current load.

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	DIMENSIONS H x W x D	NET WGT. (Pounds)	INPUT POWER REQUIREMENTS
6000-1MA-MS	0-1000	5 MA	11" x 9" x 13"	17	115 V, 60 Hz, 100 watts
6000-5MA-MS	0-2500	5 MA	11" x 9" x 13"	17	115 V, 60 Hz, 100 watts
6005-5MA-MS	0-5KV	5 MA	11" x 9" x 13"	17	115 V, 60 Hz, 100 watts
6010-5MA-MS	0-10 KV	5 MA	11" x 9" x 13"	23	115 V, 60 Hz, 100 watts
6015-5MA-MS	0-15 KV	5 MA	11" x 9" x 13"	23	115 V, 60 Hz, 150 watts
6025-5MA-MS	0-25 KV	5 MA	11" x 9" x 13"	34	115 V, 60 Hz, 150 watts

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CEDAR GROVE OPERATIONS
89 COMMERCE ROAD
CEDAR GROVE, NEW JERSEY • 07009

INTERNATIONAL SUBSIDIARIES: Geneva; Munich; Glenrothes, Scotland; Tokyo; Paris; Capetown; London; Mexico City.

Additional Beckman Instrumentation in Section 2900

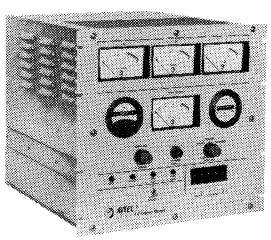
AVTEL SOLID STATE POWER CONVERSION EQUIPMENT

AVTEL

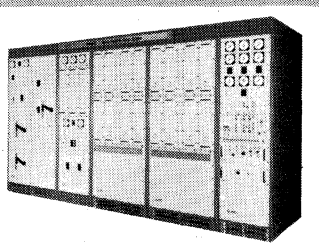
Avtel offers total capability in power conversion systems and components...

- Commercial, industrial, and military applications
- Experience ranges from milliwatts to hundreds of kilowatts
- Proven reliability with unsurpassed performance
- Convert AC-DC, DC-DC, DC-AC, AC-AC

TYPICAL AVTEL PRODUCTS



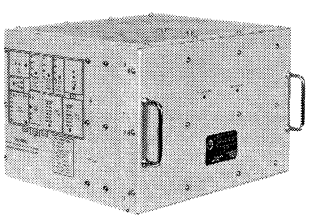
FREQUENCY CHANGER
7.5 KVA, 60 Hz to 400 Hz.



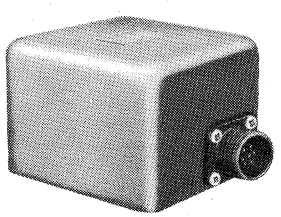
UNINTERRUPTIBLE POWER SYSTEM
50/60 Hz, 250 KVA, 3 Phase.

- AC Regulators
- DC-DC Converters
- DC Regulators
- Frequency Changers
- High Voltage Power Supplies
- Inverters
- Modular Power Supplies
- Motor Speed Controls
- Multi-Output Power Supplies
- Uninterruptible Power Systems

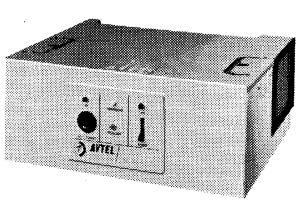
For details, see following pages



MILITARY POWER SOURCE
50-400 Hz input, 28 VDC, 5A and 1 KVA, 400 Hz, 3 phase output.

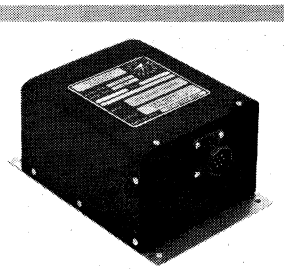


3 PHASE AC LINE REGULATOR
400 Hz input, 1,000 watt output



STATIC INVERTER
500 VA, 25 VDC to 115 VAC, 60 Hz.

Technological leadership, production know-how, and stringent quality assurance are Avtel's hallmark. Every product is system-engineered to ensure performance, reliability and maintainability commensurate with application requirements.



PRECISION GYRO POWER SOURCE
1 phase input, 50 VA, 400 Hz, 3 phase output.

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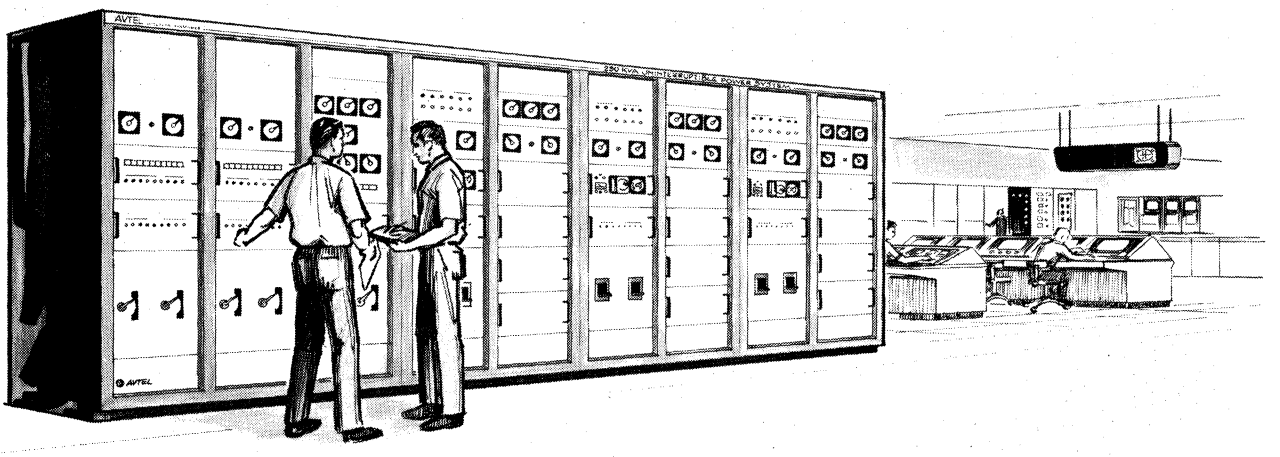
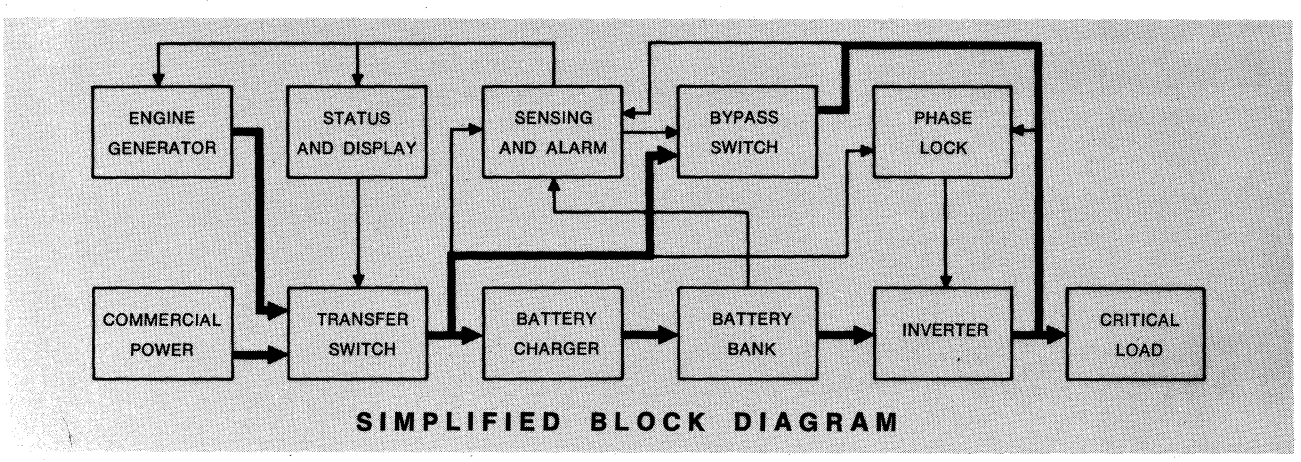
UPS UNINTERRUPTIBLE POWER SYSTEMS



Avtel's Uninterruptible Power Systems (UPS) offer the maximum in reliability and efficiency for applications where even a momentary power failure or disturbance cannot be tolerated. High mean-time-between-failure (MTBF) coupled with modular construction for low mean-time-to-repair (MTTR) make Avtel UPS the most practical systems for continuous on-line operation. Specifically designed to power very critical loads, these systems are offered in power capabilities from 250 VA to 1 MEGA-VA. The specific model availability for power levels up to 50 KVA is detailed in the CR and TR series pages which follow. Larger system requirements are achieved through a building block format utilizing appropriate combinations of 62.5, 125, 250 or 500 KVA modules. Ultra-reliable systems for the most critical applications are achieved by paralleling three units of appropriate capacity such that any two are capable of supporting the full load. Should any section of the system fail, it will automatically clear without causing an interruption of power to the critical load. Alarm and status indicating provisions alert operating personnel and substantially assist in the isolation of the fault. The modular construction of these systems makes possible a MTTR of approximately 30 minutes, exclusive of heavy (input and output) magnetics. Any section of the system can be shut down for maintenance purposes without risking interruption of power to the critical loads or injury to personnel. Following the maintenance functions, sections are brought back into service automatically by the operation of a single switch without causing any disturbance of the power supplied the critical load. In order to further assure reliability, all systems are extensively "burned-in" to ensure that any components containing latent defects of manufacture are replaced prior to shipment of any UPS.



SIMPLIFIED BLOCK DIAGRAM

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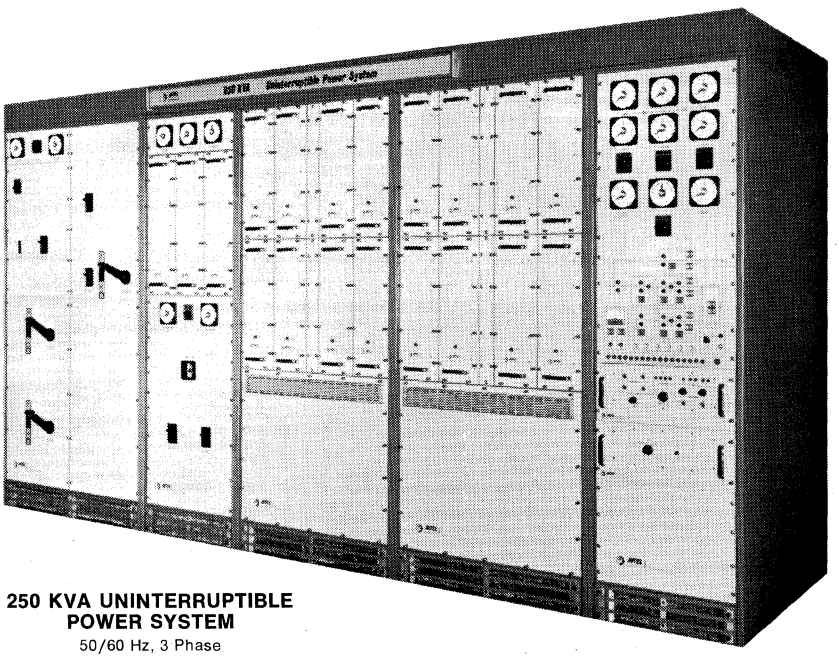
SOLID STATE AC POWER FOR CRITICAL APPLICATIONS

AVTEL



250 KVA UNINTERRUPTIBLE POWER SYSTEM
50/60 Hz, 3 Phase

AVTEL UPS are designed to provide these outstanding advantages:

TRUE SINEWAVE OUTPUT: The maximum harmonic distortion under the worst combination of conditions is less than 2%. Under normal operating conditions, less than 1.5% is typical.

TIGHT FREQUENCY CONTROL: The output frequency is completely unaffected by load and line variations. If desired, the output frequency can be phase-locked to the commercial line or other reference source.

MINIMUM MAINTENANCE: Modular construction throughout permits quick access to and exchange of any component. A MTTR of less than 30 minutes is typical. Cleaning the air filter is the only required preventive maintenance, other than battery watering. In non-redundant systems, the by-pass switch is used to supply power to the critical load directly from the commercial lines during maintenance.

LOW COST OF OWNERSHIP: Avtel's low maintenance, high efficiency, and trouble-free operation yield substantial savings over other approaches to uninterruptible power. This advantage becomes increasingly significant with time, and savings of over 50 percent overall in ten years ownership are not improbable.

SILENT OPERATION: Unlike rotary systems which produce substantial noise and vibration, these compact and silent units can be installed in close proximity to the load with which they are associated thereby avoiding expensive installations.

OPERATING SIMPLICITY: This equipment can be operated safely by non-technical personnel. Logically grouped meters, controls and status-indicating lamps make the operation of this equipment virtually self-explanatory. Fully automatic, instrument free systems are also offered.

HIGH POWER DENSITY: These systems are the smallest and lightest yet offered in these power ranges. For example, a 125 KVA system occupies only 35 square feet of floor space, exclusive of batteries.

UNPRECEDENTED EFFICIENCY: Operating efficiencies normally exceed 85%. This low dissipation allows laboratory operation without special cooling considerations.

COMPLETE INSTRUMENTATION: Meters, status indicators, and other instruments necessary for the measurement of all critical parameters are provided.

PHASE BALANCE: Poly-phase systems supply essentially balanced outputs despite substantial unbalance in phase loading.

IMPERVIOUS TO OVERLOADS: These units cannot be damaged by overloads or short circuits. Normal output is automatically reinstated upon removal of the overload.

RFI SUPPRESSION: Careful and effective filtration of both the input and output lines, together with ample shielding afford RFI attenuation far superior to other uninterruptible systems.

ALARM CIRCUITRY: Visual and audible alarms are provided to indicate loss of incoming power and switchover to secondary sources. Additional alarms pinpoint failures in the UPS itself in the remote possibility that they might occur. A separate alarm system indicates battery bank status including conditions of the atmosphere in the battery room.

CHOICE OF OUTPUTS: Avtel UPS can be ordered in standard 460 V, 60 Hz models or 50 Hz versions at voltage levels found in overseas installations. A complete line of 400 Hz models is also available.

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UPS SPECIFICATIONS

AVTEL'S Uninterruptible Power Systems are tailored to meet application requirements. Typical operating characteristics are:

INPUT

VOLTAGE: 460, 380, 208, ±15% as desired, 50, 60, 400 Hz ±20%, 3 or 4 wire.

INRUSH SURGE: Upon application of prime power to the uninterruptible power system, the input current shall not exceed 100% of the normal operating current with a 100% rating resistive load applied prior to turn-on.

EFFICIENCY:

A. Battery Charging System—94% nominal

B. Inverting System—88% nominal

C. Overall System Worse Case—80%

OUTPUT

VOLTAGE: Value as desired. The voltage regulation shall be ±1% relative to the set voltage for the combined effects of line, load and temperature.

FREQUENCY: The output frequency shall be 50, 60, or 400 Hz ±0.5% for the combined effects of line, load and temperature unless tracking the input line.

PHASE BALANCE: Under balanced load conditions, the phase voltages shall be equal within ±½%. Under any combination of phase load unbalance up to 50%, the phase voltages shall be within ±5% of the average of the 3 phases.

LOAD POWER FACTOR: The system shall be capable of producing full-rated power continuously at a load power factor of 0.7 lead to 0.7 lag. All regulation specifications shall be as stated above under the load power factor variation as set forth.

HARMONIC DISTORTION: 2% THD, maximum.

REGULATION RESPONSE TIME: The maximum regulation response time shall be 32 milliseconds under the following conditions: A 100% step function change in load from no-load to full-load, or full-load to no-load, and a step function change in line voltage from low-line to high-line, or high-line to low-line.

TRANSIENT AMPLITUDE: 100% step function variations in line and load shall not cause transients which depart more than ±7½% from the steady-state values existing prior to the initiation of the transient condition. Loss of prime power will cause a maximum transient of +0, −7½% with no output transient when prime AC power is restored.

RECOVERY TIME: The maximum recovery time to within ±2% of initial steady state value shall be 32 milliseconds under a 100% step function variation or loss of prime AC input power.

LOAD RATE: Upon application of AC input power, the battery charging system shall apply load to the AC source at a rate not exceeding 30% per second.

OUTPUT FREQUENCY CONTROL: ±0.5% or by an external synch signal from the input line. The design of the reference oscillators and the common synchronization line shall be so conceived that the failure of an oscillator shall not cause an interruption in power supplied to the critical loads.

PHASE LOCK AND BY-PASS: Manual and automatic systems tailored to applicable requirements are available.

PROTECTION PROVISIONS

INPUT CURRENT – Suitable circuit breakers will be provided on the input circuits to prevent consequential damage to the system in the event of internal fault.

OVERLOAD AND SHORT CIRCUIT: The equipment will contain internal protection against overloads and short circuits. In the event of overload conditions, auxiliary contact closures will provide visual alarms.

OVERHEAT PROTECTION: Each module shall incorporate temperature sensors to monitor the temperature of the components which will experience the greatest immediate temperature rise in the event of cooling system degradation or failure. The temperature sensors shall be so arranged as to provide visual alarms of an impending over-temperature condition. Should the temperature continue to rise to such levels as may result in component failures, the system shall revert to a fail-safe mode and this condition shall be indicated by illuminating an appropriately marked status indicating lamp.

POWER TRANSFER ALARM: In the event that prime power is lost, alarms will be provided to indicate this condition. The alarm shall continue until such time as the diesel standby generator successfully picks up the entire critical load and the battery ceases to discharge. At such time as battery discharge stops and the system is operating from standby power, a status indicating lamp shall illuminate to indicate this condition.

INSTRUMENTATION

QUALITY: All instruments will be 2% accuracy, taut band, ruggedized type.

AC INPUT POWER CIRCUITS: The AC input power shall be monitored by a voltmeter and ammeter with a line selector switch associated with each meter. Also, a frequency meter will be provided to monitor input frequency.

BATTERY DC BUS: The battery bus will be monitored by a DC voltmeter. Also, a center zero scale DC ammeter to indicate charge or discharge of the battery will be provided.

AC OUTPUT CIRCUITS: The AC output circuits shall be monitored by three ammeters and one voltmeter for the output lines. A frequency meter and input/output synchroscope will also be provided.

GENERAL PROVISIONS

BATTERY MOUNTING: The battery shall be mounted on open metal racks of corrosion-resistant material, or suitably protected against corrosion. The battery bank shall be fitted with a locking manual disconnect, and suitable fuses or breakers to prevent serious system and facility damage in the event of fault loads imposed on the bank.

BATTERY CAPACITY: The battery charger shall have sufficient continuous duty power handling capacity to support a full load at the system output and simultaneously recharge the battery from a minimum useful charge condition in a period of 8 hours. The charger shall be capable of supporting a 50% overload for 15 minutes without damage or degradation.

BATTERY EQUALIZATION MODE: The battery charger shall be equipped with an adjustable, automatically regulated circuit which shall raise the charger crossover voltage to equalize potential for the period recommended by the battery manufacturer.

BATTERY CONSIDERATIONS: Considerations relative to the batteries shall be in accordance with Federal Standard PPP-B-140 and W-B-134.

ENVIRONMENTAL CONSIDERATIONS

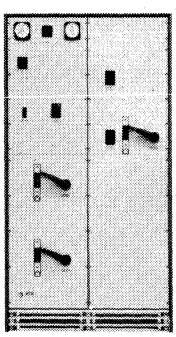
TEMPERATURE: The equipment shall meet all requirements of the specifications over the temperature range of 10-50°C.

HUMIDITY: The equipment shall suffer no degradation in performance in atmospheres containing 95% relative humidity.

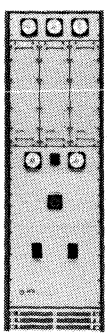
FUNGUS RESISTANCE: The equipment shall not incorporate any materials that are fungus nutrients and shall be thoroughly treated with a fungus-resistant varnish per MIL-V-173.

SHOCK AND VIBRATION: The equipment shall not suffer any damage or degradation of performance when subjected to shock and vibration as encountered in normal transportation and handling.

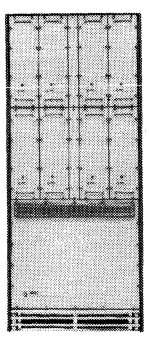
TYPICAL UPS BUILDING BLOCKS



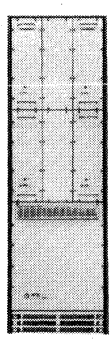
INPUT/OUTPUT/BYPASS MODULE (includes 175 KVA input transformer)



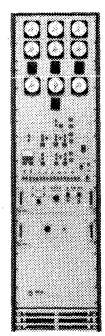
BATTERY CHARGER MODULE (power levels to 150 KVA)



125 KVA INVERTER MODULE



62.5 KVA INVERTER MODULE



STATUS AND CONTROL MODULE (typical for redundant systems)

Avtel offers its experience in the analysis of your requirements and will submit a proposal based on the lowest cost system consistent with these requirements. In addition to supplying the UPS, Avtel is capable of assuming overall installation responsibility providing all necessary standby power engine generator sets, battery banks, switchgear and system installation. Our extensive experience and capabilities are your assurance of a system and installation most ideally suited to your requirements. Contact your area representative or the factory for additional information.

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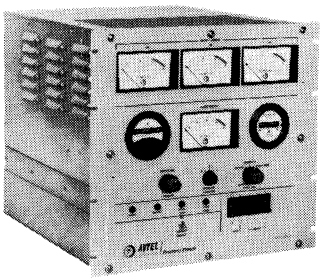
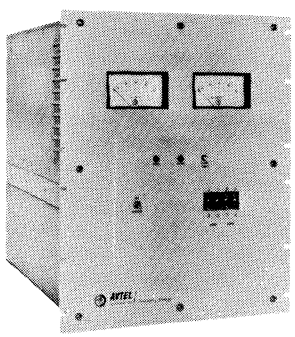
HIGH POWER SOLID STATE FREQUENCY CHANGERS

AVTEL

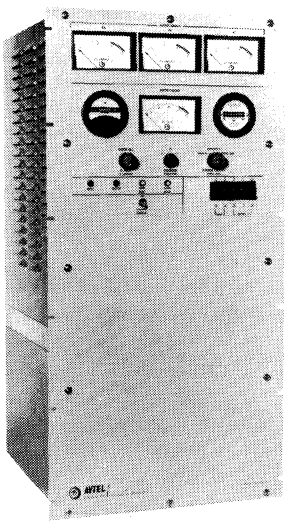


CR 074-3
7.5 KVA, 400 Hz, 3 Phase

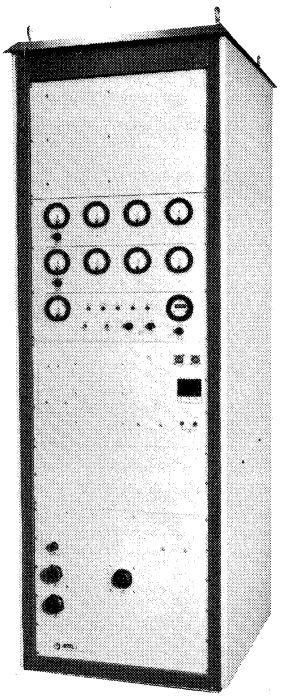
CR SERIES 2.5 TO 50 KVA—45-65 AND 400 Hz INPUT. 45-65, 350-450, OR 700-900 Hz OUTPUT WITH UNINTERRUPTIBLE POWER OPTION AVAILABLE ON MOST MODELS



CR 056-1
5 KVA, 60 Hz, 1 Phase



CR 204-3
20 KVA, 400 Hz, 3 Phase



CR 504-3
50 KVA, 400 Hz, 3 Phase

Efficient, reliable and silent in operation, these completely solid-state electronic systems are ideal for any application requiring AC power in the KVA ranges. In this series, there are 26 standard models in seven power ratings from 2.5 KVA to 50 KVA. Three output frequency bands are available from 45 to 65, 350 to 450, and 700 to 900 Hz. Most frequency and power ratings are available with either single or polyphase output. Unique electronic circuitry provides complete protection from overloads or short circuits.

These highly versatile and rugged units are capable of fulfilling the majority of AC power source requirements. Twenty-nine standard options are offered to meet virtually any special or unusual requirement for AC power.

The CR Series utilize many advanced techniques developed and proved by Avtel for highly critical military and aerospace applications. The unique design of these units, coupled with Avtel's rigid quality assurance and reliability program, ensures uncompromising adherence to published performance criteria.

Constructed with silicon semiconductors exclusively, these units are small, rugged and efficient. Most of the models are available with an uninterruptable power option providing the most reliable, transient free continuous source of AC power obtainable. Many other options are available and are tabulated at the top of the third following page.

The unique design of this equipment results in an AC source which is a direct replacement for motor alternator sets, but with the following superior characteristics:

- **Output frequency unaffected by load.**
- **Low accoustical noise.**
- **Efficiencies over 90%.**
- **Instant starting.**
- **Sinewave output with less than 2% total harmonic distortion.**
- **Ease of frequency variation.**
- **No maintenance required.**
- **Light weight.**
- **Impervious to overloads.**
- **Remote sensing.**
- **Remote programming.**

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CR SERIES SPECIFICATIONS FOR STANDARD UNITS (LESS OPTIONS)

OUTPUT KVA	OUTPUT VOLTS	OUTPUT PHASES	INPUT VOLTS	RACK MOUNT DIMENSIONS HEIGHT	RACK MOUNT DIMENSIONS WIDTH	RACK MOUNT DIMENSIONS DEPTH	UNITIZED DIMENSIONS HEIGHT	UNITIZED DIMENSIONS WIDTH	UNITIZED DIMENSIONS DEPTH	WEIGHT †	MODEL NO.
350-450 or 700-900 Hz Output with 45-65 Hz, 3-Phase Input											
2.5	120/208	3	115/200	17.5	19	21	17.25	17	21	175	CR 024-3*
2.5	120	1	115/200	17.5	19	21	17.25	17	21	185	CR 024-1*
5	120/208	3	115/200	17.5	19	21	17.25	17	21	190	CR 054-3*
5	120	1	115/200	17.5	19	21	17.25	17	21	205	CR 054-1*
7.5	120/208	3	115/200	17.5	19	21	17.25	17	21	220	CR 074-3*
7.5	120	1	115/200	17.5	19	21	17.25	17	21	240	CR 074-1*
10	120/208	3	115/200	31.5	19	21	31.25	17	21	315	CR 104-3*
10	120	1	115/200	31.5	19	21	31.25	17	21	315	CR 104-1*
15	120/208	3	115/200	31.5	19	21	31.25	17	21	315	CR 154-3*
20	120/208	3	115/200	47	19	24	60	24	30	430	CR 204-3*
37.5	120/208	3	460	—	—	—	80	24	30	1900	CR 374-3*
50	120/208	3	460	—	—	—	80	24	30	2200	CR 504-3*
45-65 Hz Output with 45-65 Hz, 3-Phase Input											
2.5	120/208	3	115/200	17.5	19	21	17.25	17	21	225	CR 026-3
2.5	120	1	115/200	17.5	19	21	17.25	17	21	245	CR 026-1
5	120/208	3	115/200	24.5	19	24	24.25	17	24	310	CR 056-3
5	120	1	115/200	24.5	19	24	24.25	17	24	355	CR 056-1
7.5	120/208	3	115/200	24.5	19	24	24.25	17	24	390	CR 076-3
7.5	120	1	115/200	24.5	19	24	24.25	17	24	435	CR 076-1
10	120/208	3	115/200	47	19	24	60	24	30	1100	CR 106-3
10	120	1	115/200	47	19	24	60	24	30	1175	CR 106-1
15	120/208	3	115/200	47	19	24	60	24	30	1100	CR 156-3
15	120	1	115/200	47	19	24	60	24	30	1175	CR 156-1
20	120/208	3	460	—	—	—	72	24	30	1300	CR 206-3
20	240	1	460	—	—	—	72	24	30	1400	CR 206-1
37.5	440	3	460	—	—	—	84	24	30	2400	CR 376-3
50	440	3	460	—	—	—	84	24	30	2700	CR 506-3

*Third digit specifies frequency, for example: CR 024-3 = 400 Hz; CR 028-3 = 800 Hz.

Specifications subject to change without notice

†Weights given are for unitized versions.

INPUT

VOLTAGE: 187 to 242 for nominally 115/200 volt input units. Allows connection to 230 three wire without modification.
±10% of nominal for all other AC inputs. See Options A thru G.

POWER:

Output Frequency Band:	Percent of Full Load Rating:
45-65 Hz	110
350-450 Hz	120
700-900 Hz	135

FREQUENCY: 45-65 Hz. See Options A, B, C & H.

OUTPUT

VOLTAGE: Adjustable. See Options I & K.

CURRENT: Adjustable. See Options J & L.

POWER RATING: Based on continuous duty.

FREQUENCY: Continuously adjustable over the entire operating band. See Options M thru R.

BANDS: 45-65, 350-450, 700-900 Hz.

REGULATION:
Voltage: ±1% or 0.5 V.
Current: ±1% or 1 ampere.
Frequency: ±0.50% for variable frequency operation. ±0.010% for fixed frequency operation.

DISTORTION: For linear loads, the output sine-wave contains less than 2% total harmonic distortion. See Option U.

POWER FACTOR: 0.7 lead to 0.7 lag for full rated power. Power factor loads to 0.2 are permissible with load ratings of 50%.

PHASE BALANCE: 2% typical deviation for 100% load unbalance in any combination. 0.25% for any balanced load.

TRANSIENT RESPONSE: Typically 20 ms but may vary from 4 to 75 ms depending on model and options.

INCIDENTAL MODULATION:
Amplitude: Varies 0.1 to 1% peak to peak depending on model and options.
Frequency: Less than 0.05% for variable frequency operation and negligible for fixed frequency operation.

PROTECTION CIRCUITS

LOAD: Widely adjustable current limiting capability can be set to the maximum normal requirements of the load. In the event of load malfunction, the unit will become a constant current source at the set limit.

OVERLOAD: The unit cannot be damaged by any overload or short circuit of transient or indefinite duration. Finite overloads are permitted for periods inversely proportional to the magnitude of the overload. When the permissible overload limitations are exceeded, the output voltage will reduce to such value as necessary to produce the load current limit set by the current adjust control. If the load exceeds 300% of ratings, the output voltage will reduce to zero instantaneously. Reduction of the load to specification limits or current control setting will automatically reinstate normal operation.

OVERHEAT: The output is interrupted by thermoswitches in the event of excessive internal temperatures. In such event, the cooling fan continues to operate and upon reduction of internal temperatures to specification limits, normal operation is automatically reinstated.

BACKUP PROTECTION: Both input and output power lines are protected by toggle-operated magnetic circuit breakers which double as the primary input and output power switches. In the event of electronic protection circuitry malfunction or component failure in the power system, these breakers will prevent consequential damage to the unit, its load or the input power source.

CONTROLS

INPUT: Toggle-operated circuit breakers.

OUTPUT: Toggle-operated circuit breakers through 15 KVA.

STANDBY: Toggle switch drives regulator to zero output condition in standby position.

VOLTAGE CONTROL: Adjusts output voltage.

CURRENT CONTROL: Adjusts output current limit.

FREQUENCY CONTROL: Adjusts output frequency.

FREQUENCY SELECTOR: Selects discrete frequencies. Options P & R only.

VOLTMETER SWITCH: Selects voltmeter circuit.

FUNCTION SWITCH: Selects operating mode. Options M thru O only.

METERS & INDICATORS

METER ACCURACY: 2% of full scale.

TYPE: Knife-edged, mirrored scale, taut-band construction.

METER FUNCTIONS: Input/Output voltmeter, Independent ammeter for each output phase.

INDICATORS:
Input power • Output power • Overload • Overheat • Phase sequence (3 phase units)

ENVIRONMENTAL

OPERATING TEMPERATURE: 0 to 50°C.

STORAGE TEMPERATURE: −20 to +71°C.

HUMIDITY: 0 to 95% R.H., non-condensing.

SHOCK & VIBRATION: Normal transportation and handling.

ELECTROMAGNETIC INTERFERENCE

Constructed in accordance with Military EMI/RFI requirements.

CONSTRUCTION

Welded frame covered with easily removable non-structural dust covers.
See Options X and Y.

OPTIONS

See the top of second following page.

PRICE

For price quotations, specify model number and options.

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LOW POWER SOLID STATE FREQUENCY CHANGERS

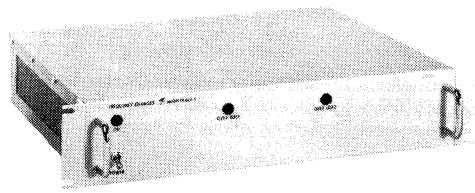
AVTEL

TR SERIES 250 TO 2000 VA — 45-450 Hz

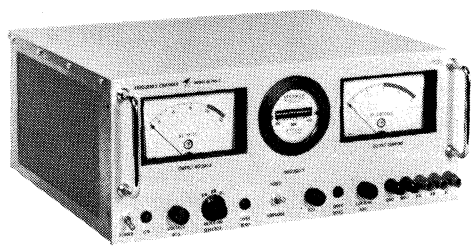
INPUT. 50/60, 400, 800, OR 1600 Hz OUTPUT
WITH UNINTERRUPTABLE POWER OPTION
AVAILABLE ON MOST MODELS

The low power Avtel TR Series Frequency Changers have all the advantages of the larger CR equipment illustrated on the preceding pages. Available in 20 standard models from 250 VA to 2000 VA, the TR Series supplies output frequencies in four different bands: 45-65 Hz, 350-450 Hz, 700-900 Hz, and 1500-1700 Hz.

As in the CR Series, the unique design of TR Frequency Changers ensures that output waveform and frequency are unaffected by changes in the load. The unit is quiet, maintenance free, and impervious to overloads and short circuits. Avtel's TR Series Frequency Changers are the ultimate solution to smaller load applications where well-regulated AC power is essential.



TR 054-3 (System)
500 VA, 400 Hz, 3 PHASE



TR 104-3 (Lab)
1000 VA, 400 Hz, 3 PHASE

SPECIFICATIONS FOR STANDARD UNITS (LESS OPTIONS)

OUTPUT			19 IN. RACK MOUNT		WEIGHT	MODEL NO.
VA	VOLTS	PHASES	HEIGHT	DEPTH		
350-450, 700-900, or 1500-1700 Hz Output with 115 V, 45-65 Hz, 1-Phase Input						
250	120/208	3	3.5	17	40	TR 024-3 *
250	120	1	3.5	17	45	TR 024-1 *
500	120/208	3	3.5	17	55	TR 054-3 *
500	120	1	3.5	17	55	TR 054-1 *
1000	120/208	3	7.0	17	95	TR 104-3 *
1000	120	1	7.0	17	95	TR 104-1 *
1500	120/208	3	8.75	17	115	TR 154-3 *
1500	120	1	8.75	17	125	TR 154-1 *
2000	120/208	3	10.5	17	150	TR 204-3 *
2000	120	1	10.5	17	160	TR 204-1 *
45-65 Hz Output with 115 V, 45-65 Hz, 1-Phase Input						
250	120/208	3	5.25	17	45	TR 026-3
250	120	1	5.25	17	60	TR 026-1
500	120/208	3	7.0	17	75	TR 056-3
500	120	1	7.0	17	85	TR 056-1
1000	120/208	3	8.75	22	125	TR 106-3
1000	120	1	8.75	22	140	TR 106-1
1500	120/208	3	10.5	22	150	TR 156-3
1500	120	1	10.5	22	160	TR 156-1
2000	120/208	3	12.25	22	175	TR 206-3
2000	120	1	12.25	22	190	TR 206-1

*Third (and fourth) digit specifies frequency, for example: TR 024-3 = 400 Hz; TR 028-3 = 800 Hz; TR 0216-3 = 1600 Hz.

The TR Series systems version is designed for continuous operation. It has limited controls on the front panel (status indicators, breaker, and standby switch) with adjustments located on the rear of the unit. The laboratory version is fully metered, with frequency, voltage, and current adjustments on the front panel. This model is ideally suited for use as precision test equipment.

Specifications subject to change without notice

INPUT

VOLTAGE: 115 volts ±10% is standard. ±10% is allowed for Options A, E, F, G and H.

FREQUENCY: 45-65 Hz. See Options A and H. 45 to 1200 Hz also available upon request.

OUTPUT

VOLTAGE: 120 VRMS. Lab models, 95-130 VRMS.

CURRENT: 75-120% of full rating with automatic voltage-current crossover, adjustable on lab models.

FREQUENCY: ±0.5% fixed frequency is standard on system models. Crystal controlled output with 0.01% regulation at 50, 60, 400, 800, or 1600 Hz available. Continuously adjustable frequency over the respective band on lab models.

BANDS: 45-65, 350-450, 700-900, 1500-1700 Hz.

REGULATION:
Voltage: ±1%.
Current: ±2%.
Frequency: ±0.5% for variable frequency, +0.01% for fixed frequency, option Q.

DISTORTION: ±2% THD maximum for linear loads.

POWER FACTOR: 0.7 lead to 0.7 lag.

PROTECTION

Automatic protection and recovery from overloads, short circuits and over heating.

SYSTEM VERSION — CONTROLS AND INDICATORS

INPUT: Circuit breaker.

STANDBY: "Standby" toggle switch.

VOLTAGE CONTROL: Rear mounted screwdriver adjustment for output voltage.

CURRENT CONTROL: Rear mounted screwdriver adjustment for current limit.

FREQUENCY CONTROL: On variable frequency units only, option AE.

INDICATORS: Front panel indicators for input power, output power, overload and overheat.

LAB VERSION — CONTROLS AND INDICATORS

INPUT AND STANDBY: Identical to system version.

INDICATORS: Same as system version.

VOLTAGE, FREQUENCY AND CURRENT CONTROLS: Front panel knobs provided.

VOLTMETER: Input/Output voltmeter.

AMMETER: Output Ammeter.

FREQUENCY METER: On variable frequency models only, option S and T.

VOLTMETER-AMMETER SWITCH: Used to select input or output phase.

ENVIRONMENTAL

OPERATING TEMPERATURE: 0 to 50°C.

STORAGE TEMPERATURE: −20 to +71°C.

HUMIDITY: 0 to 95% R.H., non-condensing.

SHOCK AND VIBRATION: Normal transportation and handling.

ELECTROMAGNETIC INTERFERENCE

Constructed in accordance with Military EMI/RFI requirements.

CONSTRUCTION

Rack mount packaging is standard.
Connectors are rear-mounted with mating connectors provided.

OPTIONS

See top of following page for available options.

PRICE

For price quotations, specify model number, options and system or lab version.

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CR AND TR SERIES OPTIONS

Options A through G, and AB, AC, AD available on models indicated in table. Options H through AA available on all models.

OPTION	DESCRIPTION
A	Uninterruptible, on-line, AC/DC input power system. Output remains constant despite commercial line power failure without output transients at time of input power switchover. This option utilizes DC input from a battery bank and includes battery charging circuitry. Charge is controlled at an adjustable constant current to an adjustable voltage crossover and then is automatically reduced to a value sufficient to maintain the battery at full charge. See details on page 2.
B	Same as A with the addition of a manual, make-before-break, by-pass switch for taking UPS off-line for maintenance or other purposes.
C	Same as A with automatic bypass operation which switches the critical bus to the input line in the event of UPS output exceeding specification limits.
D	115 V, single-phase input.
E	230 V, single-phase input.
F	115/200, three-phase input.
G	460 V, three-phase input.
H	115/200, 45-450 Hz three-phase input. (460 V for 20 and 50 KVA units.)
I	Output voltage adjustable from 0 to 135 Vrms via front panel control for CR, 10 to 130 Vrms for TR.
J	Output current limit adiustable from 10-125% of rated output via front panel control.
K	Output voltage adjustable from 95 to 135 Vrms via front panel control for CR, 95 to 130 Vrms for TR.
L	Output current limit adjustable from 75-125% of rated current via front panel control.
M	External synchronization from pulse, sine or complex waveform sources.
N	Output phase lock for parallel on-line operation.
O	Phase lock and load coupler for parallel operation of 2 or more units. This option has provisions for alarm and automatic shut-down of a malfunctioning unit.
P	Fixed frequency operation in addition to standard variable frequency selectable by front panel switch. The fixed frequency has a tolerance of .01% for the combined effects of line, load and environmental extremes and can be supplied at any frequency within the band.
Q	Single fixed frequency operation in lieu of variable frequency. (0.01% tolerance).
R	Multiple fixed frequency operation, switch-selected. No variable frequency. (±0.01% tolerance).
S	Frequency meter, dial and pointer type. Covers full range of unit.
T	Frequency meter, Reed type. Covers full range of unit.
U	Output waveform—1% THD max.
V	Qualified to MIL-I-6181 or MIL-STD-826 as desired.
W	Running time meter, 0-9999 hours. Recycles at 10,000 hrs.
X	Unitized construction for application where rack mounting is not intended.
Y	Unitized construction, mounted on rubber-tired, full castering wheels. (CR models only).
Z	120V Delta Output. (3 phase models only).
AA	Switchable delta/wye output with dual-range meter scales and front-panel mode indicator.
AB	120/240 dual range output voltage for models with single phase output.
AC	120 VDC +15%, −20% input.
AD	240 VDC +15%, −20% input.
AE	Variable frequency operation (TR systems model only).

NOTE

Certain options effect equipment size and weight. When specifying options, please check with the factory on equipment physical characteristics.

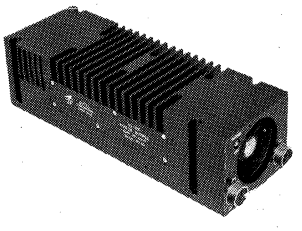
MODEL NO.	OPTION									
	A	B	C	D	E	F	G	AB	AC	AD
TR 024-3	X				X	X	X		X	
TR 024-1	X				X	X	X	X	X	
TR 054-3	X				X	X	X		X	
TR 054-1	X				X	X	X	X	X	
TR 104-3	X				X	X	X		X	
TR 104-1	X				X	X	X	X	X	
TR 154-3	X				X	X	X		X	
TR 154-1	X				X	X	X	X	X	
TR 204-3	X				X	X	X		X	
TR 204-1	X				X	X	X	X	X	
TR 026-3	X	*	*		X	X	X		X	
TR 026-1	X	X	X		X	X	X	X	X	
TR 056-3	X	*	*		X	X	X		X	
TR 056-1	X	X	X		X	X	X	X	X	
TR 106-3	X	*	*		X	X	X		X	
TR 106-1	X	X	X		X	X	X	X	X	
TR 156-3	X	*	*		X	X	X		X	
TR 156-1	X	X	X		X	X	X	X	X	
TR 206-3	X	*	*		X	X	X		X	
TR 206-1	X	X	X		X	X	X	X	X	
CR 024-3	X			X	X		X			X
CR 024-1	X			X	X		X	X		X
CR 054-3	X			X	X		X			X
CR 054-1	X			X	X		X	X		X
CR 074-3	X				X		X			X
CR 074-1	X				X		X	X		X
CR 104-3	X						X			X
CR 104-1	X						X	X		X
CR 154-3	X						X			X
CR 204-3	X						X			
CR 374-3	X					X				
CR 504-3	X					X				
CR 026-3	X	X	X	X	X		X			X
CR 026-1	X	X	X	X	X		X	X		X
CR 056-3	X	X	X	X	X		X			X
CR 056-1	X	X	X	X	X		X	X		X
CR 076-3	X	X	X		X		X			X
CR 076-1	X	X	X		X		X	X		X
CR 106-3	X	X	X				X			X
CR 106-1	X	X	X				X	X		X
CR 156-3	X	X	X				X			X
CR 156-1	X	X	X				X	X		X
CR 206-3	X	X	X			X				
CR 206-1	X	X	X			X		X		
CR 376-3	X	X	X			X				
CR 506-3	X	X	X			X				

*When combined with option F.

Eleven years ago, Avtel specialized in solid-state power conversion equipment and has concentrated its efforts in this area ever since. Whatever your individual power conversion requirements may be, you are assured that our technical staff will give them prompt and skillful analysis. With over 200 custom designs and years of systems experience, these power conversion specialists appreciate the value of timely recognition and consideration of potential problem areas associated with integrating power sources into complex systems. In the interest of precluding systems interface problems, Avtel offers the assistance of its applications engineers to study your requirements and formulate suitable specifications.

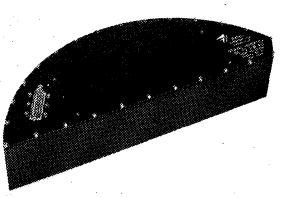
STRAIN GAUGE POWER SUPPLY

This unit, developed for a research rocket aircraft, is one-third the size and weight of the equipment it replaces.
INPUT—115 Volts ac, 400 Hz, 3-phase
OUTPUT—12 Volts dc at 10 amperes
VOLTAGE REGULATION—0.1% for combined effects of line, load and temperature variations.



GUIDANCE SYSTEM POWER SUPPLY

A split phase static inverter, this unit supplies two outputs of 125 VA at 90° ±0.5° phase angle displacement. Output frequency is held to 0.001% and the true rms value of the output voltage is maintained within 0.1%.



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BATTERY CHARGERS

Berkleonics, Inc.
1221 So. Shamrock Ave., Monrovia, California 91016 Phone 213-359-9261

NEW EXPANDED LINE

COMPACT BATTERY CHARGERS FOR NI-CAD CELLS

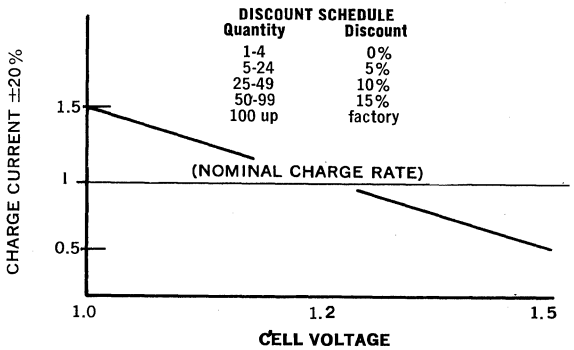
- MIL T 27 Size AJ—1⅝x1⅝x2⅜ Commercial Size—1.52Hx1.32Dia
- MIL T 27 Size EB—1$^{15}/_{16}$x1$^{13}/_{16}$x2$^{7}/_{16}$ Commercial Size—1.77H x 1.82Dia
- MIL T 27 Size FB—2$^{5}/_{16}$x2$^{1}/_{16}$x2½ Commercial Size—2.58Hx2.05Dia
- MIL T 27 Size HB—3$^{1}/_{16}$x2⅝x3$^{3}/_{16}$ Commercial Size—3$^{1}/_{16}$x2⅝x3$^{3}/_{16}$

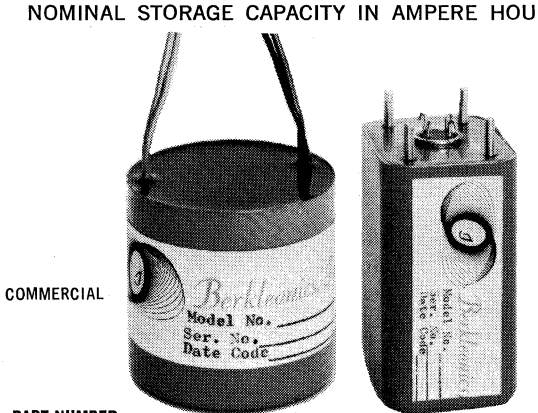
NOTE:
Prices shown in chart are for Type "C" chargers (Commercial Grade). When ordering Type "M" chargers (Military Grade), increase above prices by 100%.

NOMINAL CHARGE RATE IN MA

NOMINAL BATTERY VOLTAGE (NUMBER OF CELLS @ 1.2 VOLTS CELL)	22	50	90	120	160	230	300	400	600	800	1100
1.2	$10.	$10.	$10.	$10.	$12.	$12.	$15.	$15.	$15.	$15.	$23.
2.4	$10.	$10.	$10.	$12.	$12.	$15.	$15.	$15.	$15.	$15.	$23.
3.6	$10.	$10.	$12.	$12.	$15.	$15.	$15.	$18.	$23.	$23.	$23.
4.8	$10.	$10.	$12.	$15.	$15.	$15.	$18.	$18.	$23.	$23.	$23.
6.0	$10.	$12.	$15.	$15.	$15.	$18.	$18.	$23.	$23.	$23.	$28.
7.2	$10.	$12.	$15.	$15.	$18.	$18.	$23.	$23.	$23.	$28.	$28.
8.4	$12.	$12.	$15.	$15.	$18.	$18.	$23.	$23.	$28.	$28.	$28.
9.6	$12.	$12.	$15.	$18.	$18.	$23.	$23.	$23.	$28.	$28.	$33.
10.8	$12.	$15.	$15.	$18.	$18.	$23.	$23.	$28.	$28.	$28.	$33.
12.0	$12.	$15.	$15.	$18.	$18.	$23.	$23.	$28.	$28.	$28.	$33.
13.2	$12.	$15.	$15.	$18.	$23.	$23.	$23.	$28.	$28.	$33.	$33.
14.4	$12.	$15.	$18.	$18.	$23.	$23.	$28.	$28.	$28.	$33.	$33.
15.6	$12.	$15.	$18.	$18.	$23.	$23.	$28.	$28.	$28.	$33.	$33.
16.8	$12.	$15.	$18.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$33.
18.0	$12.	$15.	$18.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$33.
19.2	$12.	$15.	$18.	$18.	$23.	$28.	$28.	$28.	$33.	$33.	$33.
20.4	$12.	$15.	$18.	$18.	$23.	$28.	$28.	$28.	$33.	$33.	$38.
21.6	$12.	$15.	$18.	$18.	$23.	$28.	$28.	$28.	$33.	$33.	$38.
22.8	$12.	$15.	$18.	$23.	$23.	$28.	$28.	$28.	$33.	$33.	$38.
24.0	$15.	$15.	$18.	$23.	$23.	$28.	$28.	$28.	$33.	$38.	$38.
25.2	$15.	$15.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$38.	$38.
26.4	$15.	$15.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$38.	$38.
27.6	$15.	$15.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$38.	$38.
28.8	$15.	$15.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$38.	$38.
30.0	$15.	$15.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$38.	$38.
31.2	$15.	$15.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$38.	$38.
32.4	$15.	$15.	$18.	$23.	$23.	$28.	$28.	$33.	$33.	$38.	$38.
33.6	$15.	$15.	$18.	$23.	$23.	$28.	$33.	$33.	$33.	$38.	$38.
34.8	$15.	$15.	$18.	$23.	$23.	$28.	$33.	$33.	$33.	$38.	$38.
36.0	$15.	$15.	$18.	$23.	$23.	$28.	$33.	$33.	$33.	$38.	$38.
	0.22	0.5	0.9	1.2	1.6	2.3	3	4	6	8	11

NOMINAL STORAGE CAPACITY IN AMPERE HOURS





These 115V, 60 Hz battery chargers are designed specifically for nickel cadmium and similar rechargeable cells. Average charge time for these chargers is 14 to 16 hours with no damage to cells or charger if the charger is left on indefinitely (See Fig. 1).

Variations of mechanical sizes and electrical specifications for every need are available on special request.

PART NUMBER
C - 12 - -400
- C — PACKAGE TYPE—**LETTER CODE**
- 12 — NOMINAL BATTERY VOLTAGE @ 1.2 VOLTS/CELL
- 400 — CELL DISCHARGE CURRENT IN MA @ 10 HOUR RATE

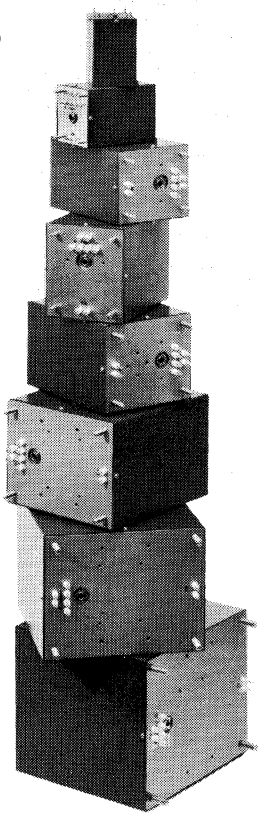
MTG. INSERTS

"C"—COMMERCIAL GRADE (METAL ENCASED & POTTED WITH EPOXY) UNIT HAS 2 THREADED HOLES IN END OPPOSITE LEAD EXIT.
"M"—MILITARY (DESIGNED TO SATISFY MIL-T-27 / TF4RX02)
- TRANSFORMER
- METAL ENCASED & HERMETICALLY SEALED
- 105°C
- 10,000 HOUR LIFE
- POWER TRANSFORMER SUPPLYING RECTIFIED LOAD

CEA, *a division of Berkleonics, Inc.*
1221 S. SHAMROCK AVENUE, MONROVIA, CALIFORNIA 91016
TELEPHONE: (213) 359-9261

MODULAR DC SUPPLIES

THE BEST MODULAR DC SUPPLIES ON THE MARKET... *CHECK THE SPECS!*



Power Supply Index

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IF YOU DON'T FIND IT — CONTACT THE NEAREST CEA REPRESENTATIVE AS LISTED IN EEM. WRITE FOR LATEST CATALOGUES.

HOW TO SELECT AND SPECIFY A CEA POWER SUPPLY OR VOLTAGE REFERENCE

To select and specify a CEA Power Supply or Voltage Reference, enter the Charts for either the CEA6 Series (80°C) or the CEA5 Series (65°C) according to the required center voltage. The first column of the chart gives the center voltage ranges. The required output current determines the line within the selected center voltage range. The model number and price are found in the column of the required regulation class. The desired center voltage should be inserted in the boxes in the model number.

For example, to select and specify a CEA6 Series (80°C) Module with a center voltage of 16.5 volts and a rated current of 1.00 amps with Regulation Class B the charts should be entered where the first column states, "Choose any center voltage from 12.5-27.4." On the line for 1.00 amps, proceed to the column titled Regulation Class B. The model number as given in the charts should then have the desired center voltage, 16.5 volts, inserted in the boxes. The model number for this unit is then CEA6B165Y102 and the unit price is $130.

If options are required the option designation should be added to the model number. For example, should 100 db shielding with 10,000 megohms insulation resistance be required option designation T1 should be added to the model number producing the model number of CEA6B165Y102T1. Added charges and delivery time along with descriptions of the options are given on the options price list.

CEAO 0 000 0 000 00...0

Series
CEA6 for maximum base temperature of 80°C
CEA5 for maximum base temperature of 65°C

Regulation Class
A — Line plus Load ±0.05%
B — Line plus Load ±0.01%
C — Line plus Load ±0.0025%
D — Line plus Load ±0.0005%

Output Voltage
Purchaser fills in the desired center voltage.
2 digits — 3.5 thru 9.9 V
3 digits — 10.0 thru 500 V

Output Voltage Decimal Location
X — 3.5 thru 9.9 volts
Y — 10.0 thru 99.9 volts
Z — 100 thru 500 volts

Output Current
500 — 50 milliamps
101 — 100 milliamps
251 — 250 milliamps
501 — 500 milliamps
102 — 1.00 amps
252 — 2.50 amps
502 — 5.00 amps
103 — 10.0 amps
253 — 25.0 amps

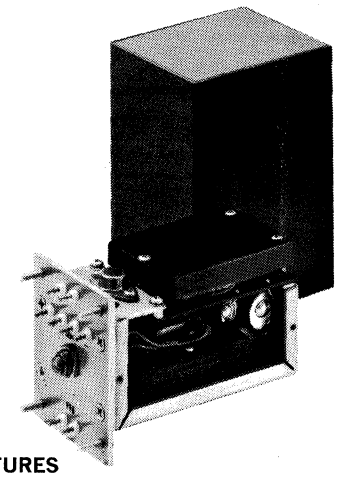
Options
Purchaser adds the option designations for all desired options.

CEA, a division of Berkleonics, Inc.
1221 S. SHAMROCK AVENUE, MONROVIA, CALIFORNIA 91016
TELEPHONE: (213) 359-9261

SINGLE OUTPUT MODULES

• CEA6 SERIES AND CEA5 SERIES •

MODULAR DC POWER SUPPLIES AND VOLTAGE REFERENCES



The CEA6 Series and CEA5 Series represent a new concept in power supply design. No other commercially available line offers total regulation including stability, temperature coefficient and ripple that permit use as a voltage reference, no other commercially available line offers standard features such as: regulation to 0.0005%; choice of exact center voltage; 20 db isolation (up to 100 db available optionally); and temperature coefficient to 0.0005%.

OUTPUT VOLTAGE AND CURRENT

Any center voltage from 3.5 to 500 volts may be selected at rated currents of 50 milliamps to 25 amps. The ability to select any center voltage always provides the desired center voltage, eliminating compromise.

REGULATION

CEA offers four classes of regulation to meet the varied requirements for Modular DC Power Supplies and Voltage References. All specifications are GUARANTEED—not typical.

The GUARANTEED stability for forty hours at constant temperature is better than the line plus load regulation specification. For example, the forty hour stability of a Class D regulation unit is better than ±0.0005% of the output voltage. The long term (two months) stability is better than twice the line plus load regulation specification.

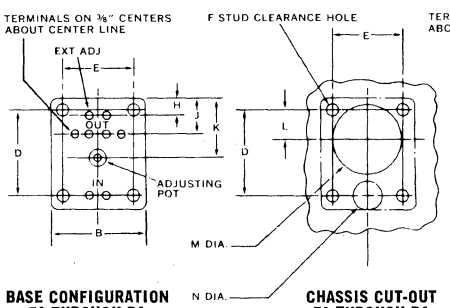
For systems which require an absolute minimum ripple, CEA provides modules with RMS readings as low as 0.0003% to satisfy laboratory and standards requirements.

All modules are tested with performance recorded to ensure compliance with specifications.

Class of Regulation	Guaranteed Line Regulation for 10% Line Change	Guaranteed Load Regulation for No Load to Full Load	Guaranteed Temperature Coefficient per Degree C	Guaranteed Stability for 40 Hours	Guaranteed RMS Ripple
A	±0.01%	±0.04%	±0.01%	±0.05%	0.01%
B	±0.002%	±0.008%	±0.005%	±0.01%	0.001%
C	±0.0005%	±0.002%	±0.001%	±0.0025%	0.0005%
D	±0.0001%	±0.0004%	±0.0005%	±0.0005%	0.0003%

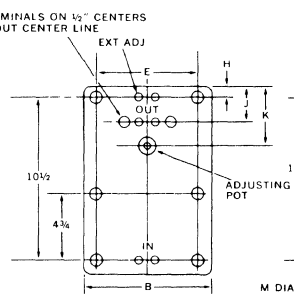
FEATURES

- Regulation from 0.05% to 0.0005%
- Temperature Coefficient from 0.01% to 0.0005% per Degree C
- Isolation 20 db Standard, 100 db Optional
- Any Center Voltage from 3.5 to 500 VDC
- Rated Currents to 25 Amps
- Output Voltage Adjustment ±5% Standard, ±50% Optional
- Input 105-125V, 50-420 Hz
- All Silicon and Repairable
- No Turn-On Overshoot
- Series Starting Standard
- Remote Sensing Standard
- Output Floats to ±500 Volts

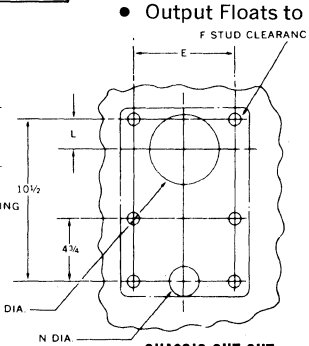


BASE CONFIGURATION FA THROUGH RA

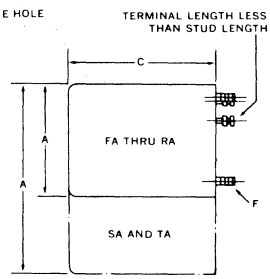
CHASSIS CUT-OUT FA THROUGH RA



BASE CONFIGURATION SA AND TA



CHASSIS CUT-OUT SA AND TA



SIDE VIEW

MODULE DIMENSIONS:

MIL-T 27A SIZE	A	B	C	D	E	F	H	J	K	L	CHASSIS CLEARANCE HOLES M	N	WT. LBS.
FA	2 5/16	2 1/16	3 1/8	1 11/16	1 7/16	6-32x3/8	5/16	1 3/16	1 7/16	1 1/16	1 11/16	3/4	1
GA	2 3/4	2 3/8	3 13/16	2 1/8	1 3/4	6-32x3/8	5/16	1 3/16	1 7/16	1 1/16	1 11/16	3/4	1 3/4
HA	3 1/16	2 5/8	4 1/4	2 13/64	1 55/64	6-32x3/8	3/8	7/8	1 1/2	1 1/16	1 11/16	3/4	2 1/2
JA	3 9/16	3 1/16	4 7/8	2 5/8	2 1/8	8-32x3/8	1/2	1	1 5/8	1 1/16	1 11/16	3/4	3 1/2
KA	3 15/16	3 3/8	5 1/4	3	2 7/16	10-32x1/2	1/2	1	1 5/8	1 1/16	1 11/16	3/4	4 1/4
LA	4 5/16	3 11/16	5 9/16	3 5/16	2 11/16	10-32x1/2	1/2	1	1 5/8	1 1/16	1 11/16	3/4	5 1/2
MA	4 11/16	4	6	3 11/16	3	1/4-20x5/8	1/2	1	1 5/8	1 1/16	1 11/16	3/4	7
NA	5 1/16	4 5/16	6 13/16	4 1/16	3 5/16	1/4-20x5/8	1/2	1	1 5/8	1 1/16	1 11/16	3/4	9
PA	6 1/16	4 13/16	6 13/16	5 1/16	3 13/16	1/4-20x5/8	1/2	1	1 5/8	1 1/16	1 11/16	3/4	12
QA	7 1/16	5 9/16	7 1/16	6 1/16	4 9/16	5/16-18x2 1/32	1/2	1	1 5/8	1 1/16	1 11/16	3/4	17
RA	8 1/16	6 1/16	7 1/16	7 1/16	5 1/16	5/16-18x2 1/32	1/2	1	1 5/8	1 1/16	1 11/16	3/4	30
SA	11 1 1/16	5 9/16	7 1/16	—	4 7/16	5/16-18x7/8	1/2	1	1 5/8	1 1/16	2 1/4	3/4	35
TA	11 1 1/16	6 1/16	8 1/16	—	5 9/16	5/16-18x7/8	1/2	1	1 5/8	1 1/16	2 1/4	3/4	50

CEA, a division of Berkleonics, Inc.
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TELEPHONE: (213) 359-9261

CEA5 SERIES TO 65° C

	OUTPUT CURRENT (AMPS)	CLASS "D" REGULATION LINE PLUS LOAD ±0.0005% MODEL	PRICE	CLASS "C" REGULATION LINE PLUS LOAD ±0.0025% MODEL	PRICE	CLASS "B" REGULATION LINE PLUS LOAD ±0.01% MODEL	PRICE	CLASS "A" REGULATION LINE PLUS LOAD ±0.05% MODEL	PRICE	THERMAL CURVE	SIZE
CHOOSE ANY CENTER VOLTAGE FROM 3.5 — 9.9	0.10	CEA5D□□X101R	$210	CEA5C□□X101R	$140	CEA5B□□X101	$ 90	CEA5A□□X101	$ 80	1	FA
	0.25	CEA5D□□X251R	210	CEA5C□□X251R	140	CEA5B□□X251	90	CEA5A□□X251	80	2	GA
	0.50	CEA5D□□X501R	225	CEA5C□□X501R	155	CEA5B□□X501	105	CEA5A□□X501	95	3	HA
	1.00	CEA5D□□X102R	225	CEA5C□□X102R	155	CEA5B□□X102	105	CEA5A□□X102	95	4	JA
	2.50			CEA5C□□X252R	205	CEA5B□□X252	155	CEA5A□□X252	145	5	MA
	5.00			CEA5C□□X502R	225	CEA5B□□X502	175	CEA5A□□X502	165	6	NA
	10.0					CEA5B□□X103	265	CEA5A□□X103	255	7	QA
	25.0					CEA5B□□X253	350	CEA5A□□X253	340	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 10.0 — 12.4	0.10	CEA5D□□□Y101R	$210	CEA5C□□□Y101R	$140	CEA5B□□□Y101	$ 90	CEA5A□□□Y101	$ 80	1	FA
	0.25	CEA5D□□□Y251R	220	CEA5C□□□Y251R	150	CEA5B□□□Y251	100	CEA5A□□□Y251	80	2	GA
	0.50	CEA5D□□□Y501R	225	CEA5C□□□Y501R	155	CEA5B□□□Y501	105	CEA5A□□□Y501	95	3	HA
	1.00	CEA5D□□□Y102R	245	CEA5C□□□Y102R	175	CEA5B□□□Y102	125	CEA5A□□□Y102	95	4	JA
	2.50			CEA5C□□□Y252R	225	CEA5B□□□Y252	175	CEA5A□□□Y252	145	5	MA
	5.00			CEA5C□□□Y502R	270	CEA5B□□□Y502	220	CEA5A□□□Y502	165	6	NA
	10.0					CEA5B□□□Y103	330	CEA5A□□□Y103	255	7	QA
	25.0					CEA5B□□□Y253	365	CEA5A□□□Y253	340	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 12.5 — 27.4	0.10	CEA5D□□□Y101R	$210	CEA5C□□□Y101R	$140	CEA5B□□□Y101	$ 90	CEA5A□□□Y101	$ 80	1	GA
	0.25	CEA5D□□□Y251R	220	CEA5C□□□Y251R	150	CEA5B□□□Y251	100	CEA5A□□□Y251	90	2	HA
	0.50	CEA5D□□□Y501R	225	CEA5C□□□Y501R	155	CEA5B□□□Y501	105	CEA5A□□□Y501	95	3	JA
	1.00	CEA5D□□□Y102R	245	CEA5C□□□Y102R	175	CEA5B□□□Y102	125	CEA5A□□□Y102	115	4	KA
	2.50			CEA5C□□□Y252R	225	CEA5B□□□Y252	175	CEA5A□□□Y252	165	5	NA
	5.00			CEA5C□□□Y502R	270	CEA5B□□□Y502	220	CEA5A□□□Y502	210	6	PA
	10.0					CEA5B□□□Y103	330	CEA5A□□□Y103	320	7	RA
	25.0					CEA5B□□□Y253	365	CEA5A□□□Y253	355	8	TA
CHOOSE ANY CENTER VOLTAGE FROM 27.5 — 29.9	0.10	CEA5D□□□Y101R	$210	CEA5C□□□Y101R	$140	CEA5B□□□Y101	$ 90	CEA5A□□□Y101	$80	2	GA
	0.25	CEA5D□□□Y251R	220	CEA5C□□□Y251R	150	CEA5B□□□Y251	100	CEA5A□□□Y251	90	3	HA
	0.50	CEA5D□□□Y501R	245	CEA5C□□□Y501R	175	CEA5B□□□Y501	125	CEA5A□□□Y501	115	4	KA
	1.00	CEA5D□□□Y102R	250	CEA5C□□□Y102R	180	CEA5B□□□Y102	130	CEA5A□□□Y102	120	5	LA
	2.50			CEA5C□□□Y252R	225	CEA5B□□□Y252	175	CEA5A□□□Y252	165	6	NA
	5.00			CEA5C□□□Y502R	270	CEA5B□□□Y502	220	CEA5A□□□Y502	210	7	PA
	10.0					CEA5B□□□Y103	330	CEA5A□□□Y103	320	8	RA
	25.0					CEA5B□□□Y253	365	CEA5A□□□Y253	355	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 30.0 — 39.9	0.10	CEA5D□□□Y101R	$210	CEA5C□□□Y101R	$140	CEA5B□□□Y101	$ 90	CEA5A□□□Y101	$80	2	GA
	0.25	CEA5D□□□Y251R	225	CEA5C□□□Y251R	155	CEA5B□□□Y251	105	CEA5A□□□Y251	95	3	JA
	0.50	CEA5D□□□Y501R	250	CEA5C□□□Y501R	180	CEA5B□□□Y501	130	CEA5A□□□Y501	120	4	LA
	1.00	CEA5D□□□Y102R	295	CEA5C□□□Y102R	225	CEA5B□□□Y102	175	CEA5A□□□Y102	165	5	NA
	2.50			CEA5C□□□Y252R	270	CEA5B□□□Y252	220	CEA5A□□□Y252	210	6	PA
	5.00			CEA5C□□□Y502R	315	CEA5B□□□Y502	265	CEA5A□□□Y502	255	7	QA
	10.0					CEA5B□□□Y103	350	CEA5A□□□Y103	340	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 40.0 — 49.9	0.10	CEA5D□□□Y101R	$225	CEA5C□□□Y101R	$155	CEA5B□□□Y101	$105	CEA5A□□□Y101	$ 95	2	HA
	0.25	CEA5D□□□Y251R	225	CEA5C□□□Y251R	155	CEA5B□□□Y251	105	CEA5A□□□Y251	95	3	JA
	0.50	CEA5D□□□Y501R	250	CEA5C□□□Y501R	180	CEA5B□□□Y501	130	CEA5A□□□Y501	120	4	LA
	1.00	CEA5D□□□Y102R	295	CEA5C□□□Y102R	225	CEA5B□□□Y102	175	CEA5A□□□Y102	165	5	NA
	2.50			CEA5C□□□Y252R	270	CEA5B□□□Y252	220	CEA5A□□□Y252	210	6	PA
	5.00			CEA5C□□□Y502R	315	CEA5B□□□Y502	265	CEA5A□□□Y502	255	7	QA
	10.0					CEA5B□□□Y103	350	CEA5A□□□Y103	340	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 50.0 — 59.9	0.05	CEA5D□□□Y500R	$225	CEA5C□□□Y500R	$155	CEA5B□□□Y500	$105	CEA5A□□□Y500	$ 95	2	HA
	0.10	CEA5D□□□Y101R	225	CEA5C□□□Y101R	155	CEA5B□□□Y101	105	CEA5A□□□Y101	95	3	JA
	0.25	CEA5D□□□Y251R	245	CEA5C□□□Y251R	175	CEA5B□□□Y251	125	CEA5A□□□Y251	115	4	KA
	0.50	CEA5D□□□Y501R	275	CEA5C□□□Y501R	205	CEA5B□□□Y501	155	CEA5A□□□Y501	145	5	MA
	1.00	CEA5D□□□Y102R	340	CEA5C□□□Y102R	270	CEA5B□□□Y102	220	CEA5A□□□Y102	210	6	PA
	2.50			CEA5C□□□Y252R	315	CEA5B□□□Y252	265	CEA5A□□□Y252	255	7	QA
	5.00			CEA5C□□□Y502R	380	CEA5B□□□Y502	330	CEA5A□□□Y502	320	8	RA
	10.0					CEA5B□□□Y103	365	CEA5A□□□Y103	355	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 60.0 — 79.9	0.05	CEA5D□□□Y500R	$250	CEA5C□□□Y500R	$180	CEA5B□□□Y500	$130	CEA5A□□□Y500	$120	2	JA
	0.10	CEA5D□□□Y101R	270	CEA5C□□□Y101R	200	CEA5B□□□Y101	150	CEA5A□□□Y101	140	3	KA
	0.25	CEA5D□□□Y251R	275	CEA5C□□□Y251R	205	CEA5B□□□Y251	155	CEA5A□□□Y251	145	4	LA
	0.50	CEA5D□□□Y501R	300	CEA5C□□□Y501R	230	CEA5B□□□Y501	180	CEA5A□□□Y501	170	5	MA
	1.00	CEA5D□□□Y102R	380	CEA5C□□□Y102R	310	CEA5B□□□Y102	260	CEA5A□□□Y102	250	6	PA
	2.50			CEA5C□□□Y252R	365	CEA5B□□□Y252	315	CEA5A□□□Y252	305	7	QA
	5.00			CEA5C□□□Y502R	480	CEA5B□□□Y502	430	CEA5A□□□Y502	420	8	SA
	10.0					CEA5B□□□Y103	460	CEA5A□□□Y103	450	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 80.0 — 89.9	0.05	CEA5D□□□Y500R	$250	CEA5C□□□Y500R	$180	CEA5B□□□Y500	$130	CEA5A□□□Y500	$120	2	JA
	0.10	CEA5D□□□Y101R	270	CEA5C□□□Y101R	200	CEA5B□□□Y101	150	CEA5A□□□Y101	140	3	KA
	0.25	CEA5D□□□Y251R	275	CEA5C□□□Y251R	205	CEA5B□□□Y251	155	CEA5A□□□Y251	145	4	LA
	0.50	CEA5D□□□Y501R	300	CEA5C□□□Y501R	230	CEA5B□□□Y501	180	CEA5A□□□Y501	170	5	MA
	1.00	CEA5D□□□Y102R	380	CEA5C□□□Y102R	310	CEA5B□□□Y102	260	CEA5A□□□Y101	250	6	PA
	2.50			CEA5C□□□Y252R	460	CEA5B□□□Y252	410	CEA5A□□□Y252	400	7	RA
	5.00			CEA5C□□□Y502R	480	CEA5B□□□Y502	430	CEA5A□□□Y502	420	8	SA

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CEA5 SERIES TO 65° C

	OUTPUT CURRENT (AMPS)	CLASS "D" REGULATION LINE PLUS LOAD ±0.0005% MODEL	PRICE	CLASS "C" REGULATION LINE PLUS LOAD ±0.0025% MODEL	PRICE	CLASS "B" REGULATION LINE PLUS LOAD ±0.01% MODEL	PRICE	CLASS "A" REGULATION LINE PLUS LOAD ±0.05% MODEL	PRICE	THERMAL CURVE	SIZE
CHOOSE ANY CENTER VOLTAGE FROM 90.0 — 99.9	0.05	CEA5D□□□Y500R	$250	CEA5C□□□Y500R	$180	CEA5B□□□Y500	$130	CEA5A□□□Y500	$120	2	JA
	0.10	CEA5D□□□Y101R	270	CEA5C□□□Y101R	200	CEA5B□□□Y101	150	CEA5A□□□Y101	140	3	KA
	0.25	CEA5D□□□Y251R	275	CEA5C□□□Y251R	205	CEA5B□□□Y251	155	CEA5A□□□Y251	145	4	LA
	0.50	CEA5D□□□Y501R	300	CEA5C□□□Y501R	230	CEA5B□□□Y501	180	CEA5A□□□Y501	170	5	MA
	1.00	CEA5D□□□Y102R	435	CEA5C□□□Y102R	365	CEA5B□□□Y102	315	CEA5A□□□Y102	305	6	QA
	2.50			CEA5C□□□Y252R	460	CEA5B□□□Y252	410	CEA5A□□□Y252	400	7	RA
	5.00			CEA5C□□□Y502R	480	CEA5B□□□Y502	430	CEA5A□□□Y502	420	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 100 — 119	0.05	CEA5D□□□Z500R	$270	CEA5C□□□Z500R	$200	CEA5B□□□Z500	$150	CEA5A□□□Z500	$140	2	KA
	0.10	CEA5D□□□Z101R	275	CEA5C□□□Z101R	205	CEA5B□□□Z101	155	CEA5A□□□Z101	145	3	LA
	0.25	CEA5D□□□Z251R	300	CEA5C□□□Z251R	230	CEA5B□□□Z251	180	CEA5A□□□Z251	170	5	MA
	0.50	CEA5D□□□Z501R	325	CEA5C□□□Z501R	255	CEA5B□□□Z501	205	CEA5A□□□Z501	195	6	NA
	1.00	CEA5D□□□Z102R	435	CEA5C□□□Z102R	365	CEA5B□□□Z102	315	CEA5A□□□Z102	305	7	QA
	2.50			CEA5C□□□Z252R	440	CEA5B□□□Z252	390	CEA5A□□□Z252	380	8	RA
	5.00			CEA5C□□□Z502R	510	CEA5B□□□Z502	460	CEA5A□□□Z502	450	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 120 — 139	0.05	CEA5D□□□Z500R	$270	CEA5C□□□Z500R	$200	CEA5B□□□Z500	$150	CEA5A□□□Z500	$140	3	KA
	0.10	CEA5D□□□Z101R	275	CEA5C□□□Z101R	205	CEA5B□□□Z101	155	CEA5A□□□Z101	145	4	LA
	0.25	CEA5D□□□Z251R	310	CEA5C□□□Z251R	240	CEA5B□□□Z251	190	CEA5A□□□Z251	180	5	MA
	0.50	CEA5D□□□Z501R	345	CEA5C□□□Z501R	275	CEA5B□□□Z501	225	CEA5A□□□Z501	215	6	NA
	1.00	CEA5D□□□Z102R	465	CEA5C□□□Z102R	395	CEA5B□□□Z102	345	CEA5A□□□Z102	335	7	QA
	2.50			CEA5C□□□Z252R	535	CEA5B□□□Z252	485	CEA5A□□□Z252	475	8	SA
	5.00			CEA5C□□□Z502R	585	CEA5B□□□Z502	535	CEA5A□□□Z502	525	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 140 — 159	0.05	CEA5D□□□Z500R	$270	CEA5C□□□Z500R	$200	CEA5B□□□Z500	$150	CEA5A□□□Z500	$140	3	KA
	0.10	CEA5D□□□Z101R	275	CEA5C□□□Z101R	205	CEA5B□□□Z101	155	CEA5A□□□Z101	145	4	LA
	0.25	CEA5D□□□Z251R	310	CEA5C□□□Z251R	240	CEA5B□□□Z251	190	CEA5A□□□Z251	180	5	MA
	0.50	CEA5D□□□Z501R	345	CEA5C□□□Z501R	275	CEA5B□□□Z501	225	CEA5A□□□Z501	215	6	NA
	1.00	CEA5D□□□Z102R	560	CEA5C□□□Z102R	490	CEA5B□□□Z102	440	CEA5A□□□Z102	430	7	RA
	2.50			CEA5C□□□Z252R	535	CEA5B□□□Z252	485	CEA5A□□□Z252	475	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 160 — 199	0.05	CEA5D□□□Z500R	$275	CEA5C□□□Z500R	$205	CEA5B□□□Z500	$155	CEA5A□□□Z500	$145	3	LA
	0.10	CEA5D□□□Z101R	310	CEA5C□□□Z101R	240	CEA5B□□□Z101	190	CEA5A□□□Z101	180	4	MA
	0.25	CEA5D□□□Z251R	345	CEA5C□□□Z251R	275	CEA5B□□□Z251	225	CEA5A□□□Z251	215	5	NA
	0.50	CEA5D□□□Z501R	400	CEA5C□□□Z501R	330	CEA5B□□□Z501	280	CEA5A□□□Z501	270	6	PA
	1.00	CEA5D□□□Z102R	560	CEA5C□□□Z102R	490	CEA5B□□□Z102	440	CEA5A□□□Z102	430	7	RA
	2.50			CEA5C□□□Z252R	535	CEA5B□□□Z252	485	CEA5A□□□Z252	475	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 200 — 219	0.05	CEA5D□□□Z500R	$275	CEA5C□□□Z500R	$205	CEA5B□□□Z500	$155	CEA5A□□□Z500	$145	3	LA
	0.10	CEA5D□□□Z101R	310	CEA5C□□□Z101R	240	CEA5B□□□Z101	190	CEA5A□□□Z101	180	4	MA
	0.25	CEA5D□□□Z251R	345	CEA5C□□□Z251R	275	CEA5B□□□Z251	225	CEA5A□□□Z251	215	5	NA
	0.50	CEA5D□□□Z501R	400	CEA5C□□□Z501R	330	CEA5B□□□Z501	280	CEA5A□□□Z501	270	6	PA
	1.00	CEA5D□□□Z102R	560	CEA5C□□□Z102R	490	CEA5B□□□Z102	440	CEA5A□□□Z102	430	7	RA
	2.50			CEA5C□□□Z252R	585	CEA5B□□□Z252	535	CEA5A□□□Z252	525	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 220 — 259	0.05	CEA5D□□□Z500R	$320	CEA5C□□□Z500R	$250	CEA5B□□□Z500	$200	CEA5A□□□Z500	$190	3	MA
	0.10	CEA5D□□□Z101k	365	CEA5C□□□Z101R	295	CEA5B□□□Z101	245	CEA5A□□□Z101	235	4	NA
	0.25	CEA5D□□□Z251R	420	CEA5C□□□Z251R	350	CEA5B□□□Z251	300	CEA5A□□□Z251	290	5	PA
	0.50	CEA5D□□□Z501R	490	CEA5C□□□Z501R	420	CEA5B□□□Z501	370	CEA5A□□□Z501	360	6	QA
	1.00	CEA5D□□□Z102R	660	CEA5C□□□Z102R	590	CEA5B□□□Z102	540	CEA5A□□□Z102	530	7	SA
	2.50			CEA5C□□□Z252R	665	CEA5B□□□Z252	615	CEA5A□□□Z252	605	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 260 — 279	0.05	CEA5D□□□Z500R	$320	CEA5C□□□Z500R	$250	CEA5B□□□Z500	$200	CEA5A□□□Z500	$190	4	MA
	0.10	CEA5D□□□Z101R	365	CEA5C□□□Z101R	295	CEA5B□□□Z101	245	CEA5A□□□Z101	235	5	NA
	0.25	CEA5D□□□Z251R	420	CEA5C□□□Z251R	350	CEA5B□□□Z251	300	CEA5A□□□Z251	290	6	PA
	0.50	CEA5D□□□Z501R	490	CEA5C□□□Z501R	420	CEA5B□□□Z501	370	CEA5A□□□Z501	360	7	QA
	1.00	CEA5D□□□Z102R	660	CEA5C□□□Z102R	590	CEA5B□□□Z102	540	CEA5A□□□Z102	530	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 280 — 339	0.05	CEA5D□□□Z500R	$375	CEA5C□□□Z500R	$305	CEA5B□□□Z500	$255	CEA5A□□□Z500	$245	4	NA
	0.10	CEA5D□□□Z101R	430	CEA5C□□□Z101R	360	CEA5B□□□Z101	310	CEA5A□□□Z101	300	5	PA
	0.25	CEA5D□□□Z251R	510	CEA5C□□□Z251R	440	CEA5B□□□Z251	390	CEA5A□□□Z251	380	6	QA
	0.50	CEA5D□□□Z501R	635	CEA5C□□□Z501R	565	CEA5B□□□Z501	515	CEA5A□□□Z501	505	7	RA
	1.00	CEA5D□□□Z102R	695	CEA5C□□□Z102R	625	CEA5B□□□Z102	575	CEA5A□□□Z102	565	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 340 — 379	0.05	CEA5D□□□Z500R	$375	CEA5C□□□Z500R	$305	CEA5B□□□Z500	$255	CEA5A□□□Z500	$245	4	NA
	0.10	CEA5D□□□Z101R	430	CEA5C□□□Z101R	360	CEA5B□□□Z101	310	CEA5A□□□Z105	300	5	PA
	0.25	CEA5D□□□Z251R	510	CEA5C□□□Z251R	440	CEA5B□□□Z251	390	CEA5A□□□Z251	380	6	QA
	0.50	CEA5D□□□Z501R	635	CEA5C□□□Z501R	565	CEA5B□□□Z501	515	CEA5A□□□Z501	505	7	RA
	1.00	CEA5D□□□Z102R	770	CEA5C□□□Z102R	700	CEA5B□□□Z102	650	CEA5A□□□Z102	640	8	TA
CHOOSE ANY CENTER VOLTAGE FROM 380 — 500	0.05	CEA5D□□□Z500R	$430	CEA5C□□□Z500R	$360	CEA5B□□□Z500	$310	CEA5A□□□Z500	$300	4	PA
	0.10	CEA5D□□□Z101R	510	CEA5C□□□Z101R	440	CEA5B□□□Z101	390	CEA5A□□□Z101	380	5	QA
	0.25	CEA5D□□□Z251R	635	CEA5C□□□Z251R	565	CEA5B□□□Z251	515	CEA5A□□□Z251	505	6	RA
	0.50	CEA5D□□□Z501R	695	CEA5C□□□Z501R	625	CEA5B□□□Z501	575	CEA5A□□□Z501	565	7	SA
	1.00	CEA5D□□□Z102R	770	CEA5C□□□Z102R	700	CEA5B□□□Z102	650	CEA5A□□□Z102	640	8	TA

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CEA6 SERIES TO 80° C

	OUTPUT CURRENT (AMPS)	CLASS "D" REGULATION LINE PLUS LOAD ±0.0005% MODEL	PRICE	CLASS "C" REGULATION LINE PLUS LOAD ±0.0025% MODEL	PRICE	CLASS "B" REGULATION LINE PLUS LOAD ±0.01% MODEL	PRICE	CLASS "A" REGULATION LINE PLUS LOAD ±0.05% MODEL	PRICE	THERMAL CURVE	SIZE
CHOOSE ANY CENTER VOLTAGE FROM 3.5 — 9.9	0.10	CEA6D□□X101R	215	CEA6C□□X101R	$145	CEA6B□□X101	$ 95	CEA6A□□X101	$ 85	1	FA
	0.25	CEA6D□□X251R	215	CEA6C□□X251R	145	CEA6B□□X251	95	CEA6A□□X251	85	2	GA
	0.50	CEA6D□□X501R	230	CEA6C□□X501R	160	CEA6B□□X501	110	CEA6A□□X501	100	3	HA
	1.00	CEA6D□□X102R	230	CEA6C□□X102R	160	CEA6B□□X102	110	CEA6A□□X102	100	4	JA
	2.50			CEA6C□□X252R	210	CEA6B□□X252	160	CEA6A□□X252	150	5	MA
	5.00			CEA6C□□X502R	235	CEA6B□□X502	185	CEA6A□□X502	175	6	NA
	10.0					CEA6B□□X103	280	CEA6A□□X103	270	7	QA
	25.0					CEA6B□□X253	370	CEA6A□□X253	360	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 10.0 — 12.4	0.10	CEA6D□□Y101R	215	CEA6C□□Y101R	$145	CEA6B□□□Y101	$ 95	CEA6A□□Y101	$ 85	1	FA
	0.25	CEA6D□□Y251R	215	CEA6C□□Y251R	145	CEA6B□□□Y251	95	CEA6A□□Y251	85	2	GA
	0.50	CEA6D□□Y501R	230	CEA6C□□Y501R	160	CEA6B□□□Y501	110	CEA6A□□Y501	100	3	HA
	1.00	CEA6D□□Y102R	230	CEA6C□□Y102R	160	CEA6B□□□Y102	110	CEA6A□□Y102	100	4	JA
	2.50			CEA6C□□Y252R	210	CEA6B□□□Y252	160	CEA6A□□Y252	150	5	MA
	5.00			CEA6C□□Y502R	235	CEA6B□□□Y502	185	CEA6A□□Y502	175	6	NA
	10.0					CEA6B□□□Y103	280	CEA6A□□Y103	270	7	QA
	25.0					CEA6B□□□Y253	370	CEA6A□□Y253	360	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 12.5 — 27.4	0.10	CEA6D□□□Y101R	$215	CEA6C□□□Y101R	$145	CEA6B□□□Y101	$ 95	CEA6A□□□Y101	$ 85	1	GA
	0.25	CEA6D□□□Y251R	225	CEA6C□□□Y251R	155	CEA6B□□□Y251	105	CEA6A□□□Y251	95	2	HA
	0.50	CEA6D□□□Y501R	230	CEA6C□□□Y501R	160	CEA6B□□□Y501	110	CEA6A□□□Y501	100	3	JA
	1.00	CEA6D□□□Y102R	250	CEA6C□□□Y102R	180	CEA6B□□□Y102	130	CEA6A□□□Y102	120	4	KA
	2.50			CEA6C□□□Y252R	235	CEA6B□□□Y252	185	CEA6A□□□Y252	175	5	NA
	5.00			CEA6C□□□Y502R	280	CEA6B□□□Y502	230	CEA6A□□□Y502	220	6	PA
	10.0					CEA6B□□□Y103	345	CEA6A□□□Y103	335	7	RA
	25.0					CEA6B□□□Y253	385	CEA6A□□□Y253	375	8	TA
CHOOSE ANY CENTER VOLTAGE FROM 27.5 — 29.9	0.10	CEA6D□□□Y101R	$215	CEA6C□□□Y101R	$145	CEA6B□□□Y101	$ 95	CEA6A□□□Y101	$ 85	2	GA
	0.25	CEA6D□□□Y251R	225	CEA6C□□□Y251R	155	CEA6B□□□Y251	105	CEA6A□□□Y251	95	3	HA
	0.50	CEA6D□□□Y501R	250	CEA6C□□□Y501R	180	CEA6B□□□Y501	130	CEA6A□□□Y501	120	4	KA
	1.00	CEA6D□□□Y102R	255	CEA6C□□□Y102R	185	CEA6B□□□Y102	135	CEA6A□□□Y102	125	5	LA
	2.50			CEA6C□□□Y252R	235	CEA6B□□□Y252	185	CEA6A□□□Y252	175	6	NA
	5.00			CEA6C□□□Y502R	280	CEA6B□□□Y502	230	CEA6A□□□Y502	220	7	PA
	10.0					CEA6B□□□Y103	345	CEA6A□□□Y103	335	8	RA
	25.0					CEA6B□□□Y253	385	CEA6A□□□Y253	375	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 30.0 — 39.9	0.10	CEA6D□□□Y101R	$ 215	CEA6C□□□Y101R	$145	CEA6B□□□Y101	$ 95	CEA6A□□□Y101	$ 85	2	GA
	0.25	CEA6D□□□Y251R	230	CEA6C□□□Y251R	160	CEA6B□□□Y251	110	CEA6A□□□Y251	100	3	JA
	0.50	CEA6D□□□Y501R	255	CEA6C□□□Y501R	185	CEA6B□□□Y501	135	CEA6A□□□Y501	125	4	LA
	1.00	CEA6D□□□Y102R	305	CEA6C□□□Y102R	235	CEA6B□□□Y102	185	CEA6A□□□Y102	175	5	NA
	2.50			CEA6C□□□Y252R	280	CEA6B□□□Y252	230	CEA6A□□□Y252	220	6	PA
	5.00			CEA6C□□□Y502R	330	CEA6B□□□Y502	280	CEA6A□□□Y502	270	7	QA
	10.0					CEA6B□□□Y103	370	CEA6A□□□Y103	360	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 40.0 — 49.9	0.10	CEA6D□□□Y101R	$230	CEA6C□□□Y101R	$ 160	CEA6B□□□Y101	$110	CEA6A□□□Y101	$100	2	HA
	0.25	CEA6D□□□Y251R	230	CEA6C□□□Y251R	160	CEA6B□□□Y251	110	CEA6A□□□Y251	100	3	JA
	0.50	CEA6D□□□Y501R	255	CEA6C□□□Y501R	185	CEA6B□□□Y501	135	CEA6A□□□Y501	125	4	LA
	1.00	CEA6D□□□Y102R	305	CEA6C□□□Y102R	235	CEA6B□□□Y102	185	CEA6A□□□Y102	175	5	NA
	2.50			CEA6C□□□Y252R	280	CEA6B□□□Y252	230	CEA6A□□□Y252	220	6	PA
	5.00			CEA6C□□□Y502R	330	CEA6B□□□Y502	280	CEA6A□□□Y502	270	7	QA
	10.0					CEA6B□□□Y103	370	CEA6A□□□Y103	360	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 50.0 — 59.9	0.05	CEA6D□□□Y500R	$230	CEA6C□□□Y500R	$160	CEA6B□□□Y500	$110	CEA6A□□□Y500	$ 100	2	HA
	0.10	CEA6D□□□Y101R	230	CEA6C□□□Y101R	160	CEA6B□□□Y101	110	CEA6A□□□Y101	100	3	JA
	0.25	CEA6D□□□Y251R	250	CEA6C□□□Y251R	180	CEA6B□□□Y251	130	CEA6A□□□Y251	120	4	KA
	0.50	CEA6D□□□Y501R	280	CEA6C□□□Y501R	210	CEA6B□□□Y501	160	CEA6A□□□Y501	150	5	MA
	1.00	CEA6D□□□Y102R	350	CEA6C□□□Y102R	280	CEA6B□□□Y102	230	CEA6A□□□Y102	220	6	PA
	2.50			CEA6C□□□Y252R	330	CEA6B□□□Y252	280	CEA6A□□□Y252	270	7	QA
	5.00			CEA6C□□□Y502R	395	CEA6B□□□Y502	345	CEA6A□□□Y502	335	8	RA
	10.0					CEA6B□□□Y103	385	CEA6A□□□Y103	375	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 60.0 — 79.9	0.05	CEA6D□□□Y500R	$255	CEA6C□□□Y500R	$185	CEA6B□□□Y500	$135	CEA6A□□□Y500	$125	2	JA
	0.10	CEA6D□□□Y101R	275	CEA6C□□□Y101R	205	CEA6B□□□Y101	155	CEA6A□□□Y101	145	3	KA
	0.25	CEA6D□□□Y251R	280	CEA6C□□□Y501R	210	CEA6B□□□Y251	160	CEA6A□□□Y251	150	4	LA
	0.50	CEA6D□□□Y501R	310	CEA6C□□□Y501R	240	CEA6B□□□Y501	190	CEA6A□□□Y501	180	5	MA
	1.00	CEA6D□□□Y102R	395	CEA6C□□□Y102R	325	CEA6B□□□Y102	275	CEA6A□□□Y102	265	6	PA
	2.50			CEA6C□□□Y252R	380	CEA6B□□□Y252	330	CEA6A□□□Y252	320	7	QA
	5.00			CEA6C□□□Y502R	500	CEA6B□□□Y502	450	CEA6A□□□Y502	440	8	SA
	10.0					CEA6B□□□Y103	485	CEA6A□□□Y103	475	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 80.0 — 89.9	0.05	CEA6D□□□Y500R	$255	CEA6C□□□Y500R	$185	CEA6B□□□Y500	$135	CEA6A□□□Y500	$125	2	JA
	0.10	CEA6D□□□Y101R	275	CEA6C□□□Y101R	205	CEA6B□□□Y101	155	CEA6A□□□Y101	145	3	KA
	0.25	CEA6D□□□Y251R	280	CEA6C□□□Y251R	210	CEA6B□□□Y251	160	CEA6A□□□Y251	150	4	LA
	0.50	CEA6D□□□Y501R	310	CEA6C□□□Y501R	240	CEA6B□□□Y501	190	CEA6A□□□Y501	180	5	MA
	1.00	CEA6D□□□Y102R	395	CEA6C□□□Y102R	325	CEA6B□□□Y102	275	CEA6A□□□Y101	265	6	PA
	2.50			CEA6C□□□Y252R	480	CEA6B□□□Y252	430	CEA6A□□□Y252	420	7	RA
	5.00			CEA6C□□□Y502R	500	CEA6B□□□Y502	450	CEA6A□□□Y502	440	8	SA

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CEA6 SERIES TO 80° C

	OUTPUT CURRENT (AMPS)	CLASS "D" REGULATION LINE PLUS LOAD ±0.0005% MODEL	PRICE	CLASS "C" REGULATION LINE PLUS LOAD ±0.0025% MODEL	PRICE	CLASS "B" REGULATION LINE PLUS LOAD ±0.01% MODEL	PRICE	CLASS "A" REGULATION LINE PLUS LOAD ±0.05% MODEL	PRICE	THERMAL CURVE	SIZE
CHOOSE ANY CENTER VOLTAGE FROM 90.0 — 99.9	0.05	CEA6D□□□Y500R	$255	CEA6C□□□Y500R	$185	CEA6B□□□Y500	$135	CEA6A□□□Y500	$125	2	JA
	0.10	CEA6D□□□Y101R	275	CEA6C□□□Y101R	205	CEA6B□□□Y101	155	CEA6A□□□Y101	145	3	KA
	0.25	CEA6D□□□Y251R	280	CEA6C□□□Y251R	210	CEA6B□□□Y251	160	CEA6A□□□Y251	150	4	LA
	0.50	CEA6D□□□Y501R	310	CEA6C□□□Y501R	240	CEA6B□□□Y501	190	CEA6A□□□Y501	180	5	MA
	1.00	CEA6D□□□Y102R	450	CEA6C□□□Y102R	380	CEA6B□□□Y102	330	CEA6A□□□Y102	320	6	QA
	2.50			CEA6C□□□Y252R	480	CEA6B□□□Y252	430	CEA6A□□□Y252	420	7	RA
	5.00			CEA6C□□□Y502R	500	CEA6B□□□Y502	450	CEA6A□□□Y502	440	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 100 — 119	0.05	CEA6D□□□Z500R	$275	CEA6C□□□Z500R	$205	CEA6B□□□Z500	$155	CEA6A□□□Z500	$145	2	KA
	0.10	CEA6D□□□Z101R	280	CEA6C□□□Z101R	210	CEA6B□□□Z101	160	CEA6A□□□Z101	150	3	LA
	0.25	CEA6D□□□Z251R	310	CEA6C□□□Z251R	240	CEA6B□□□Z251	190	CEA6A□□□Z251	180	5	MA
	0.50	CEA6D□□□Z501R	335	CEA6C□□□Z501R	265	CEA6B□□□Z501	215	CEA6A□□□Z501	205	6	NA
	1.00	CEA6D□□□Z102R	450	CEA6C□□□Z102R	380	CEA6B□□□Z102	330	CEA6A□□□Z102	320	7	QA
	2.50			CEA6C□□□Z252R	460	CEA6B□□□Z252	410	CEA6A□□□Z252	400	8	RA
	5.00			CEA6C□□□Z502R	535	CEA6B□□□Z202	485	CEA6A□□□Z502	475	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 120 — 139	0.05	CEA6D□□□Z500R	$275	CEA6C□□□Z500R	$205	CEA6B□□□Z500	$155	CEA6A□□□Z500	$145	3	KA
	0.10	CEA6D□□□Z101R	280	CEA6C□□□Z101R	210	CEA6B□□□Z101	160	CEA6A□□□Z101	150	4	LA
	0.25	CEA6D□□□Z251R	320	CEA6C□□□Z251R	250	CEA6B□□□Z251	200	CEA6A□□□Z251	190	5	MA
	0.50	CEA6D□□□Z501R	355	CEA6C□□□Z501R	285	CEA6B□□□Z501	235	CEA6A□□□Z501	225	6	NA
	1.00	CEA6D□□□Z102R	480	CEA6C□□□Z102R	410	CEA6B□□□Z102	360	CEA6A□□□Z102	350	7	QA
	2.50			CEA6C□□□Z252R	560	CEA6B□□□Z252	510	CEA6A□□□Z252	500	8	SA
	5.00			CEA6C□□□Z502R	615	CEA6B□□□Z502	565	CEA6A□□□Z502	555	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 140 — 159	0.05	CEA6D□□□Z500R	$275	CEA6C□□□Z500R	$205	CEA6B□□□Z500	$155	CEA6A□□□Z500	$145	3	KA
	0.10	CEA6D□□□Z101R	280	CEA6C□□□Z101R	210	CEA6B□□□Z101	160	CEA6A□□□Z101	150	4	LA
	0.25	CEA6D□□□Z251R	320	CEA6C□□□Z251R	250	CEA6B□□□Z251	200	CEA6A□□□Z251	190	5	MA
	0.50	CEA6D□□□Z501R	355	CEA6C□□□Z501R	285	CEA6B□□□Z501	235	CEA6A□□□Z501	225	6	NA
	1.00	CEA6D□□□Z102R	580	CEA6C□□□Z102R	510	CEA6B□□□Z102	460	CEA6A□□□Z102	450	7	RA
	2.50			CEA6C□□□Z252R	560	CEA6B□□□Z252	510	CEA6A□□□Z252	500	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 160 — 199	0.05	CEA6D□□□Z500R	$280	CEA6C□□□Z500R	$210	CEA6B□□□Z500	$160	CEA6A□□□Z500	$150	3	LA
	0.10	CEA6D□□□Z101R	310	CEA6C□□□Z101R	240	CEA6B□□□Z101	190	CEA6A□□□Z101	180	4	MA
	0.25	CEA6D□□□Z251R	355	CEA6C□□□Z251R	285	CEA6B□□□Z251	235	CEA6A□□□Z251	225	5	NA
	0.50	CEA6D□□□Z501R	415	CEA6C□□□Z501R	345	CEA6B□□□Z501	295	CEA6A□□□Z501	285	6	PA
	1.00	CEA6D□□□Z102R	580	CEA6C□□□Z102R	510	CEA6B□□□Z102	460	CEA6A□□□Z102	450	7	RA
	2.50			CEA6C□□□Z252R	560	CEA6B□□□Z252	510	CEA6A□□□Z252	500	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 200 — 219	0.05	CEA6D□□□Z500R	$280	CEA6C□□□Z500R	$210	CEA6B□□□Z500	$160	CEA6A□□□Z500	$150	3	LA
	0.10	CEA6D□□□Z101R	320	CEA6C□□□Z101R	250	CEA6B□□□Z101	200	CEA6A□□□Z101	190	4	MA
	0.25	CEA6D□□□Z251R	355	CEA6C□□□Z251R	285	CEA6B□□□Z251	235	CEA6A□□□Z251	225	5	NA
	0.50	CEA6D□□□Z501R	415	CEA6C□□□Z501R	345	CEA6B□□□Z501	295	CEA6A□□□Z501	285	6	PA
	1.00	CEA6D□□□Z102R	580	CEA6C□□□Z102R	510	CEA6B□□□Z102	460	CEA6A□□□Z102	450	7	RA
	2.50			CEA6C□□□Z252R	615	CEA6B□□□Z252	565	CEA6A□□□Z252	555	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 220 — 259	0.05	CEA6D□□□Z500R	$330	CEA6C□□□Z500R	$260	CEA6B□□□Z500	$210	CEA6A□□□Z500	$200	3	MA
	0.10	CEA6D□□□Z101R	375	CEA6C□□□Z101R	305	CEA6B□□□Z101	255	CEA6A□□□Z101	245	4	NA
	0.25	CEA6D□□□Z251R	435	CEA6C□□□Z251R	365	CEA6B□□□Z251	315	CEA6A□□□Z251	305	5	PA
	0.50	CEA6D□□□Z501R	510	CEA6C□□□Z501R	440	CEA6B□□□Z501	390	CEA6A□□□Z501	380	6	QA
	1.00	CEA6D□□□Z102R	690	CEA6C□□□Z102R	620	CEA6B□□□Z102	570	CEA6A□□□Z102	560	7	SA
	2.50			CEA6C□□□Z252R	695	CEA6B□□□Z252	645	CEA6A□□□Z252	635	9	TA
CHOOSE ANY CENTER VOLTAGE FROM 260 — 279	0.05	CEA6D□□□Z500R	$330	CEA6C□□□Z500R	$260	CEA6B□□□Z500	$210	CEA6A□□□Z500	$200	4	MA
	0.10	CEA6D□□□Z101R	375	CEA6C□□□Z101R	305	CEA6B□□□Z101	255	CEA6A□□□Z101	245	5	NA
	0.25	CEA6D□□□Z251R	435	CEA6C□□□Z251R	365	CEA6B□□□Z251	315	CEA6A□□□Z251	305	6	PA
	0.50	CEA6D□□□Z501R	510	CEA6C□□□Z501R	440	CEA6B□□□Z501	390	CEA6A□□□Z501	380	7	QA
	1.00	CEA6D□□□Z102R	690	CEA6C□□□Z102R	620	CEA6B□□□Z102	570	CEA6A□□□Z102	560	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 280 — 339	0.05	CEA6D□□□Z500R	$385	CEA6C□□□Z500R	$315	CEA6B□□□Z500	$265	CEA6A□□□Z500	$255	4	NA
	0.10	CEA6D□□□Z101R	445	CEA6C□□□Z101R	375	CEA6B□□□Z101	325	CEA6A□□□Z101	315	5	PA
	0.25	CEA6D□□□Z251R	530	CEA6C□□□Z251R	460	CEA6B□□□Z251	410	CEA6A□□□Z251	400	6	QA
	0.50	CEA6D□□□Z501R	660	CEA6C□□□Z501R	590	CEA6B□□□Z501	540	CEA6A□□□Z501	530	7	RA
	1.00	CEA6D□□□Z102R	725	CEA6C□□□Z102R	655	CEA6B□□□Z102	605	CEA6A□□□Z102	595	8	SA
CHOOSE ANY CENTER VOLTAGE FROM 340 — 379	0.05	CEA6D□□□Z500R	$385	CEA6C□□□Z500R	$315	CEA6B□□□Z500	$265	CEA6A□□□Z500	$255	4	NA
	0.10	CEA6D□□□Z101R	445	CEA6C□□□Z101R	375	CEA6B□□□Z101	325	CEA6A□□□Z101	315	5	PA
	0.25	CEA6D□□□Z251R	530	CEA6C□□□Z251R	460	CEA6B□□□Z251	410	CEA6A□□□Z251	400	6	QA
	0.50	CEA6D□□□Z501R	660	CEA6C□□□Z501R	590	CEA6B□□□Z501	540	CEA6A□□□Z501	530	7	RA
	1.00	CEA6D□□□Z102R	805	CEA6C□□□Z102R	735	CEA6B□□□Z102	685	CEA6A□□□Z102	675	8	TA
CHOOSE ANY CENTER VOLTAGE FROM 380 — 500	0.05	CEA6D□□□Z500R	$445	CEA6C□□□Z500R	$375	CEA6B□□□Z500	$325	CEA6A□□□Z500	$315	4	PA
	0.10	CEA6D□□□Z101R	530	CEA6C□□□Z101R	460	CEA6B□□□Z101	410	CEA6A□□□Z101	400	5	QA
	0.25	CEA6D□□□Z251R	660	CEA6C□□□Z251R	590	CEA6B□□□Z251	540	CEA6A□□□Z251	530	6	RA
	0.50	CEA6D□□□Z501R	725	CEA6C□□□Z501R	655	CEA6B□□□Z501	605	CEA6A□□□Z501	595	7	SA
	1.00	CEA6D□□□Z102R	805	CEA6C□□□Z102R	735	CEA6B□□□Z102	685	CEA6A□□□Z102	675	8	TA

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THERMAL DATA
THERMAL RADIATORS

THERMAL DATA

SIZE	AREA sq. in.
FA	10
GA	13
HA	16
JA	22
KA	27
LA	31
MA	38
NA	44
PA	58
QA	79
RA	108
SA	130
TA	156

TABLE W—Heat dissipation area of standard power supply without heat dissipation radiators.

The information presented in this section will enable the designer to determine if cooling is required and if so to select the most optimum method of cooling.

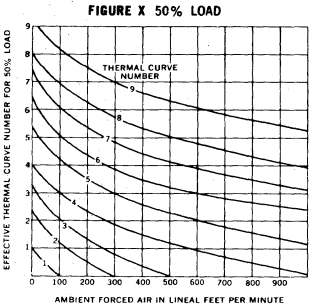
For modules with Thermal Curve Nos. 1, 2 and 3, heat dissipation area in addition to that provided by the standard module is not usually required for operation up to full load. For modules with Thermal Curve Nos. 4 and 5, additional heat dissipation area such as the instrument chassis or heat dissipation radiators will usually be required for operation at full load.

The base (terminal end) is thermally connected to the power output transistor; therefore, the base must make positive mechanical and thermal bond to the mounting body. Silicone grease should be applied to the base of the power supply and the mounting body must be a smooth metallic surface.

The maximum temperature the base will achieve, the heat dissipation area required, the airflow velocity in lineal feet per minute required or the maximum allowable ambient temperature may be determined by following the appropriate procedure given below.

The total heat dissipation area may be determined by totaling the area given for the appropriate case size from Table W, the effective surface area of the mounting body which may be considered as heat dissipation area, and the area of any selected CEA Thermal Radiators.

FIGURE X 50% LOAD



CASE 1

To be determined: MAXIMUM TEMPERATURE BASE WILL ACHIEVE.

Known: 1. Ambient temperature in °C. 2. Airflow velocity in feet per minute. 3. Heat dissipation area provided in square inches.

Procedure: 1. Choose the required Power Supply/Voltage Reference (voltage and current) from the tables. The Thermal Curve Number for the selected unit is given in the next to last column on the chart. 2. Determine the Effective Thermal Curve Number by entering Figure X or Y (according to the intended operation of approximately 50% or 100% of load) along the X-axis at the known velocity of the air which will pass over the Power Supply/Voltage Reference. Proceed up the line representing this airflow velocity to the Thermal Curve Number selected in Step 1. Then proceed to the left to the Y-axis to determine the Effective Thermal Curve Number. 3. Enter Figure Z along the X-axis at the known Heat Dissipation Area. Proceed up the line representing this Heat Dissipation Area to the Effective Thermal Curve Number. Proceed to the left to the Y-axis to determine the Base Temperature Rise above ambient in °C. 4. Add the Base Temperature Rise above ambient determined in Step 3 to the known Ambient Temperature to determine the Maximum Temperature the base will achieve.

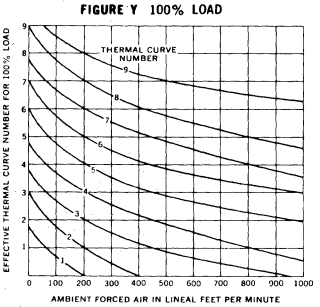
CASE 2

To be determined: HEAT DISSIPATION AREA REQUIRED.

Known: 1. Ambient temperature in °C. 2. Airflow velocity in lineal feet per minute. 3. Maximum base temperature rating (65°C for CEA5 Series or 80°C for CEA6 Series).

Procedure: 1. See Procedure No. 1 of Case 1. 2. See Procedure No. 2 of Case 1. 3. Enter Figure Z along the Y-axis at the known Maximum Base Temperature Rating. Proceed across the line representing the Maximum Base Temperature rating to the Effective Thermal Curve Number determined in Step 2 and then proceed down to the X-axis to determine the total Heat Dissipation Area required. 4. Subtract from the total Heat Dissipation Area required determined in Step 3, the Heat Dissipation Area of the Standard unit without Heat Dissipation Radiators to determine the additional Heat Dissipation Area required. Table W gives the Heat Dissipation Area of the Standard units without Heat Dissipation Radiators. 5. This additional Heat Dissipation Area may be supplied either by the chassis to which the Power Supply/Voltage Reference is mounted or by adding Heat Dissipation Radiators to the base of the Power Supply/Voltage Reference. The correct Heat Dissipation Radiator may be chosen from the table.

FIGURE Y 100% LOAD



CASE 3

To be determined: AIRFLOW VELOCITY IN LINEAL FEET PER MINUTE.

Known: 1. Ambient temperature in °C. 2. Maximum base temperature rating (65°C for CEA5 Series or 80°C for CEA6 Series). 3. Heat dissipation area provided in square inches.

Procedure: 1. See Procedure No. 1 of Case 1. 2. By subtracting the Ambient Temperature from the Maximum Base Temperature Rating, the maximum allowable Base Temperature Rise Above Ambient is determined. 3. Enter Figure Z along the Y-axis at this value of Maximum Base Temperature Rise Above Ambient and proceed to the right to the vertical line representing the Heat Dissipation Area provided. The intersection of these two lines defines the Effective Thermal Curve Number. 4. Enter either Figure X or Y along the Y-axis at the Effective Thermal Curve Number determined in Step 3 and proceed to the right to the intersection of that line and the Thermal Curve Number determined in Step 1. Proceed down from the intersection to the X-axis to determine the required Ambient Forced-Air in lineal feet per minute.

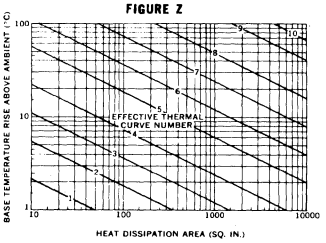
CASE 4

To be determined: MAXIMUM AMBIENT TEMPERATURE ALLOWABLE IN °C.

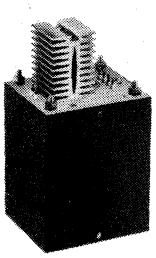
Known: 1. Airflow velocity in lineal feet per minute. 2. Maximum base temperature rating (65°C for CEA5 Series or 80°C for CEA6 Series). 3. Heat dissipation area provided in square inches.

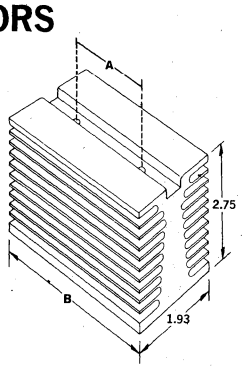
Procedure: 1. See Procedure No. 1 of Case 1. 2. See Procedure No. 2 of Case 1. 3. See Procedure No. 3 of Case 1. 4. The Maximum Temperature allowable is then determined by subtracting the Base Temperature Rise Above Ambient from the Maximum Base Temperature Rating.

FIGURE Z



THERMAL RADIATORS





Models CEATR1 and CEATR2 Thermal Radiators are designed for use with all CEA6 Series and CEA5 Series Modular DC Power Supplies and Voltage References. CEA Thermal Radiators may be mounted directly onto the module base or on the opposite side of the mounting body. The mounting hole configuration in the Thermal Radiators and the base of each Module are symmetrical so that the radiators may be mounted for airflow in either direction across the base of the Module.

Under some operating conditions it may be necessary to employ Thermal Radiators to provide the heat dissipation area required. Procedures to determine the required heat dissipation area are described above.

A coating of silicon grease should be applied on each mating surface of the Module, mounting body and Thermal Radiator. The mounting body must be a smooth metallic surface.

Case sizes MA through NA are designed for mounting one Model CEATR1 Thermal Radiator. Case sizes PA through TA are designed to accept multiple Thermal Radiators according to the requirements of the operating conditions.

Thermal Radiator Model No.	Radiation Area (Sq. In.)	Dimensions A	Dimensions B	Weight (Pounds)	Price Each
CEATR1	75	1.000	1.93	0.75	$10.00
CEATR2	150	2.000	3.93	1.50	$15.00

CASE SIZE		MA	NA	PA	QA	RA	SA	TA
THERMAL RADIATOR	MODEL No.	CEATR1	CEATR1	CEATR1	CEATR2	CEATR2	CEATR2	CEATR2
	QUANTITY	1	1	2	2	2	4	4

GENERAL INFORMATION

CEA RESERVES ALL RIGHTS TO CHANGE SPECIFICATIONS AND/OR PRICE, OR DISCONTINUE INSTRUMENTS WITHOUT NOTICE AND IS NOT OBLIGATED TO MAKE CHANGES TO ANY PREVIOUSLY SOLD INSTRUMENTS.

CEA: 1221 S. SHAMROCK AVE., MONROVIA, CAL. 91016
TELEPHONE: (213) 359-9261

DISCOUNT SCHEDULE:

Quantity	Discount	Quantity	Discount
1-4	NET	10-24	LESS 10%
5-9	LESS 5%	OVER 24	CONSULT FACTORY

TERMS: NET 30 DAYS
FROM DATE OF INVOICE TO APPROVED CUSTOMERS
F.O.B.: MONROVIA, CALIFORNIA

DELIVERY: CLASS "A" AND "B" UNITS—2 WEEKS
CLASS "C" UNITS—3 WEEKS
CLASS "D" UNITS—4 WEEKS
SOME OPTIONS EXTEND DELIVERY

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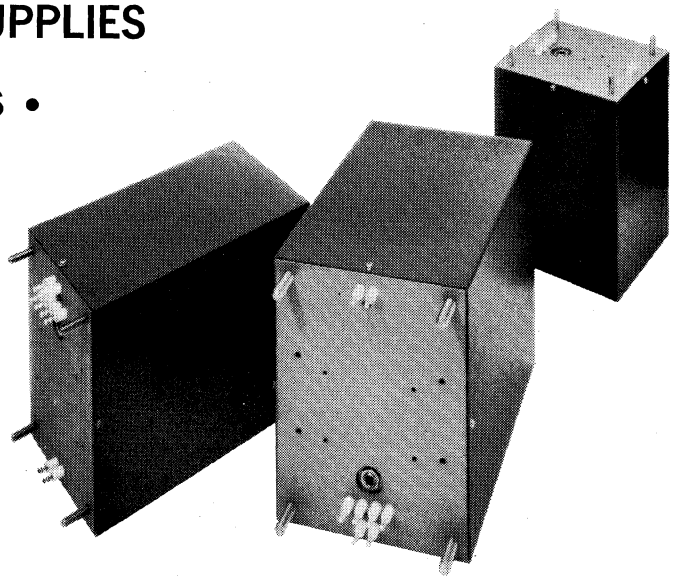
DUAL SUPPLIES

TRACKING MODULAR DUAL SUPPLIES

• CEAD5 AND CEAD6 SERIES •



FEATURES

- Regulation from 0.05% to 0.0005%
- Tracking from 0.1% to 0.001%
- Temperature Coefficient from 0.01% to 0.0005% per Degree C
- Isolation 20 db standard, 100 db optional
- Any Center Voltage from 3.5 to 500 VDC
- Rated Currents to 25 Amps
- Output Voltage Adjustment to ±50% Optional
- Input 105-125V, 50-400 Hz
- All Silicon and Repairable
- No Turn-On Overshoot
- Series Starting Standard
- Remote Sensing Standard
- Output Floats to ±500 Volts

Now get 2 of CEA's high performance modular supplies in one package at less cost. The CEA duals have the same guaranteed specifications as the CEA6 Series, and, in addition, tracking between the units equal to two times the regulation class of the unit. For example, a dual power supply with Class C regulation (.0025%) will have tracking to .005%. The dual outputs can be independent and isolated from each other if specified by option K. Standard duals have fixed output voltages within 1% of specified voltages. Externally adjustable units are available optionally.

Class of Regulation	Guaranteed Line Regulation for 10% Line Change	Guaranteed Load Regulation for No Load to Full Load	Guaranteed Temperature Coefficient per Degree C	Guaranteed Stability for 40 Hours	Guaranteed RMS Ripple	Guaranteed Tracking
A	±0.01%	±0.04%	±0.01%	±0.05%	0.01%	±0.05%
B	±0.002%	±0.008%	±0.005%	±0.01%	0.001%	±0.01%
C	±0.0005%	±0.002%	±0.001%	±0.0025%	0.0005%	±0.0025%
D	±0.0001%	±0.0004%	±0.0005%	±0.0005%	0.0003%	±0.0005%

SELECTING A MODEL NUMBER

The model number of the desired dual supply is obtained by choosing the model number of the single output supply of the CEA5 or CEA6 Series having the desired characteristics and then inserting a D in the model number after the CEA. For example, a dual 15 volt, 100ma, Class B regulation, 80°C unit would be designated as CEAD6B150Y101.

SPECIFICATIONS

The physical size of the dual supply is exactly two case sizes larger than that required for the single output supply. In the example above, the case size would be JA, which is two sizes larger than the GA required for a CEA6B150Y101. The maximum size dual package is limited to size TA, therefore, the choice of single output supplies that can be made into duals is limited to those with case size RA or smaller. There are no other restrictions as to the currents and voltages available in duals from the standard CEA5 and CEA6 Series except that the two outputs will have identical voltages and current ratings. All other specifications are identical to the CEA5 or CEA6 Series, except that standard duals have fixed output voltages within 1%.

PRICE

The price of the dual supply is obtained by taking the price of the single output CEA5 or CEA6 Series equivalent, multiplying by a factor of 2 and then reducing by 10%. For example, if a particular single output CEA6 Series supply cost $100 the dual version would cost $180 (2 x $100 = $200, less 10% = $180).

DELIVERY

3 weeks for Class A & B, 4 weeks for Class C & D.

OPTIONS

Many outstanding features are available optionally, such as isolated dual outputs, shielded transformers to 100db, voltage and current limiting, wide adjustment ranges (to ±50%), etc. Applicable options are shown on the option price list.

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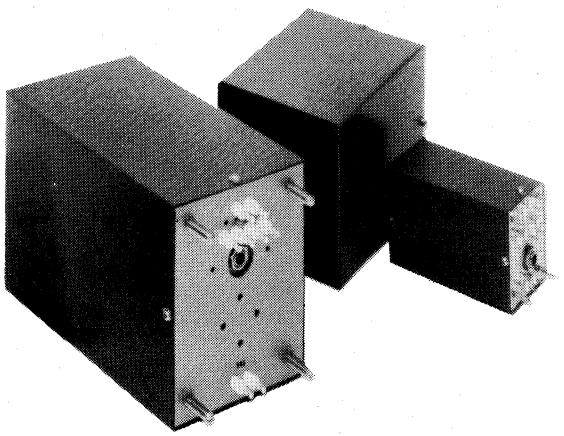
CONSTANT CURRENT SUPPLIES

CONSTANT CURRENT MODULAR SUPPLIES



• CEAC5 AND CEAC6 SERIES •

FEATURES

- Current regulations from .5% to .005%
- Temperature coefficients from .1% to .005%/°C
- Isolation 20 db standard, 100 db optional
- Rated currents to 5 amps
- Compliance voltages to 200 Volts
- Output current adjustment to ±50%
- Repairable
- All Silicon
- Output Floats to ±500 Volts

CEA now introduces a constant current version of the CEA5 and CEA6 Series of constant voltage supplies. The constant current units have four regulation classes where all important specs are combined in the proper ratios with each other:

Class of Regulation	Guaranteed Line Regulation for 10% Line Change	Guaranteed 0 to 100% Rated Voltage Change	Guaranteed Temp. Coefficient per Degree C	Guaranteed Stability for 40 Hrs.	Guaranteed RMS Ripple
A	±.1%	±.4%	±.1%	±.5%	.1%
B	±.02%	±.08%	±.05%	±.1%	.01%
C	±.005%	±.02%	±.01%	±.025%	.005%
D	±.001%	±.004%	±.005%	±.005%	.003%

These units operate within specifications into impedances ranging from a short circuit to whatever value gives rated voltage.

HOW TO SELECT THE MODEL NUMBER

1. Multiply the desired rated current (limited to 5 amps) by 5.
2. Determine the maximum compliance voltage desired (limited to 200 volts).
3. Determine the class of regulation desired by letter, A, B, C or D.
4. Determine the base temperature for your application (65°C or 80°C).
5. Using the above four basic specifications, **choose** from the CEA5 (65°C) **or** the CEA6 (80°C) charts the Model number of the equivalent constant voltage supply. This will also give the price, size, weight and thermal curve. **Insert** the letter C after the CEA and before the first number in the Model number.

Example: A constant current supply having a rated current of 100ma and a compliance voltage of 50 volts is desired with Class B current regulation in an 80°C unit. By multiplying the desired current by 5 (500ma) and looking at the CEA6 Model number charts for 50 volts, 500ma, & "B" regulation, we find the equivalent constant voltage Model number to be CEA6B500Y501, priced at $160, case size MA, and thermal curve #5. Convert this model number to the desired constant current supply by inserting a C as shown: CEAC6B500Y501.

In a nutshell, by derating a CEA constant voltage supply to 20% of rated current, it can be converted to a constant current supply with wide output voltage characteristics (zero to rated volts).

PRICE AND DELIVERY: Same as equivalent CEA5 or CEA6 Series.

SPECIFICATIONS: Other than the regulation classes specified above, all other specs are identical to those for the equivalent CEA5 or CEA6 Model, including size, weight, and thermal curve. There is however, a maximum limit of compliance voltage at 200 volts, and a maximum limit on regulated current at 5 amps in the standard line. CEA invites your inquiry for both higher currents and higher voltages.

OPTIONS: As shown in the option price list, constant current supplies can be supplied with a multitude of features, such as 100DB shielded transformers (ideal for strain gage supplies), voltage limiting, wide adjustment range (to ±50%), etc.

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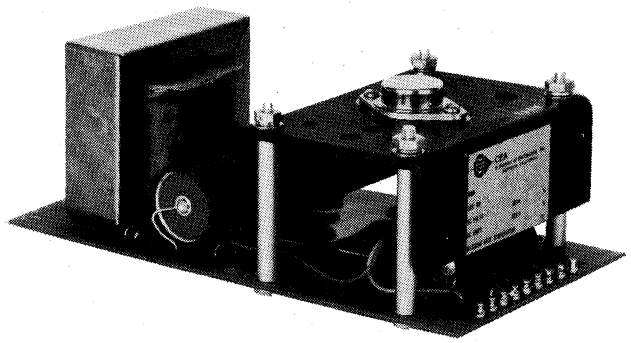
CARD SUPPLIES

CARD TYPE MODULAR SUPPLIES

• CEA7 SERIES •

Precision Voltage on a Card
At The Lowest Price

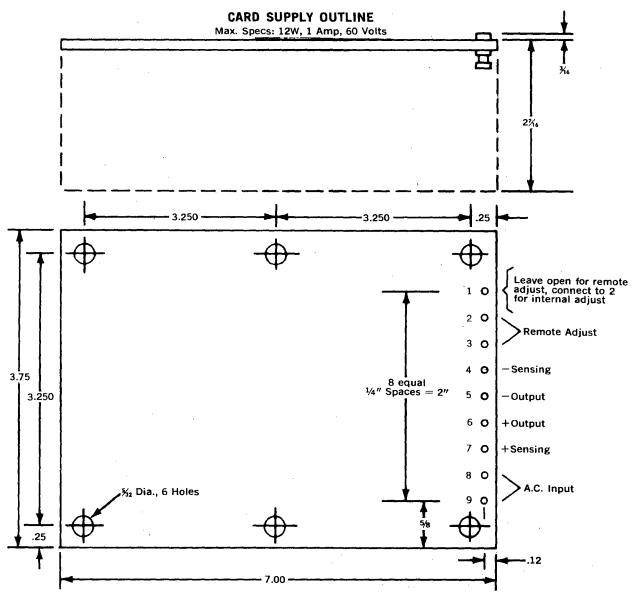


FEATURES

- Regulation from 0.05% to 0.0005%
- Temperature Coefficients from 0.01% to .0005%/°C
- Isolation 20 db standard, 100 db optional
- Rated Voltages to 60 Volts, Currents to 1 Amp
- Input 105-125V, 50-400 Hz
- All Silicon
- No Turn-On Overshoot
- Series Starting Standard
- Remote Sensing Standard
- Output Voltage Adjustment to ±5% Standard, up to ±50% Optional
- Output Floats to ±500 Volts

NOW — CEA's precision power supplies on a card — at less cost! The new CEA7 Series card supplies have identical electrical specifications to the CEA6 Series, including the availability of four classes of regulation. The wide variety of voltages and currents modules are all on one size printed circuit board and adaptable to any plug-in card or mounted In any chassis with four screws and six connections. The CEA7 Series with Class C & D regulation make ideal reference units for many applications in computers and instrumentation systems.

Class of Regulation	Guaranteed Line Regulation for 10% Line Change	Guaranteed Load Regulation for No Load to Full Load	Guaranteed Temperature Coefficient Per Degree C	Guaranteed Stability for 40 Hours	Guaranteed RMS Ripple
A	±0.01%	±0.04%	±0.01%	±0.05%	0.01%
B	±0.002%	±0.008%	±0.005%	±0.01%	0.001%
C	±0.0005%	±0.002%	±0.001%	±0.0025%	0.0005%
D	±0.0001%	±0.0004%	±0.0005%	±0.0005%	0.0003%



SELECTING A MODEL NUMBER

Select the model number from the CEA6 Series charts by using the voltage, current, and regulation desired. Then, after the letters CEA in the model number, merely replace the 6 with a 7. For example, suppose the characteristics of a Model CEA6C100Y101R (10 volt, 100ma, Class C regulation) are desired in the card series; the correct card type model number would be CEA7C100Y101R.

SPECIFICATIONS

The maximum current obtainable in the CEA7 Series is 1.0 amps, the maximum voltage is 60 volts, and the maximum output power is 12 watts. All of these conditions must be met in selecting a card type supply.

The maximum dimensions of the card are 2¾ thick by 3¾ by 7 inches. The card fits wherever it is needed and connections are as shown in the outline drawing.

PRICE AND DELIVERY

Base price of a CEA7 Series supply is calculated from CEA6 Series prices by subtracting $20 from the equivalent CEA6 Series price.

Delivery is 2-3 weeks on Class A & B, and 4 weeks on Class C & D.

OPTIONS

A multitude of features are available optionally as shown on the options price list. Included are shielded transformers (100db), current and voltage limiting, wide adjustment ranges, etc.

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OPTIONS

OPTION PRICES

(Add Whichever Price is Greater to Base Price of Power Supply. Add the Option Symbol to the End of the Model No.)

Symbol Option	Option Description		Power Supply Series: Single Output CEA5, CEA6	Dual Output CEAD5, CEAD6	Constant Current CEAC5, CEAC6	Card Type CEA7	Week(s) Added To Delivery
FIXED OUTPUTS							
F	Fixed Output ±1%		No Charge	No Charge, Std.	No Charge	No Charge	None
F1	Fixed Output ±.1%		$15	$30	$20	$15	1
F2	Fixed Output ±.01%		$50	$100	$60	$50	1
ADJUSTABLE OUTPUTS				External Adj. Only			
G	Output Adjust Range ±1%		$5	$5 (1 output)	$5	$5	None
GG	Output Adjust Range ±1%		—	$15 (2 outputs)			1
G1	Output Adjust Range ±10%		$5 or 5%	$5 or 3% (1 output)	$5 or 5%	$5 or 5%	1
G11	Output Adjust Range ±10%		—	$15 or 5% (2 outputs)			1
G2	Output Adjust Range ±20%		$10 or 10%	$10 or 5% (1 output)	$10 or 10%	$10 or 10%	1
G22	Output Adjust Range ±20%		—	$25 or 10% (2 outputs)			1
G3	Output Adjust Range ±30%		$15 or 15%	$15 or 10% (1 output)	$15 or 15%	$15 or 15%	1
G33	Output Adjust Range ±30%		—	$35 or 15% (2 outputs)			1
G4	Output Adjust Range ±40%		$20 or 20%	$20 or 10% (1 output)	$20 or 20%	$20 or 20%	1
G44	Output Adjust Range ±40%		—	$45 or 20% (2 outputs)			1
G5	Output Adjust Range ±50%		$25 or 25%	$25 or 15% (1 output)	$25 or 25%	$25 or 25%	1
G55	Output Adjust Range ±50%		—	$55 or 25% (2 outputs)			1
EXTENDED TEMP. RANGE							
H	Temp. Range −20°C to +80°C		$15 or 10%	$30 or 10%	$15 or 10%	$15 or 10%	1
H1	Temp. Range −55°C to +80°C		$100 or 100%	$200 or 100%	$100 or 100%	$100 or 100%	4
H2	Temp. Range −40°C to +80°C		$20 or 20%	$40 or 20%	$20 or 20%	$20 or 20%	2
H3	Temp. Range −55°C to +115°C		$200 or 200%	$400 or 200%	$200 or 200%	$200 or 200%	6
FAST RESPONSE INTO LARGE CAPACITY LOADS							
J	Voltage Pull Down Ckt; Equiv. Load $R = .1 \frac{V\ Rated}{I\ Rated}$		$30 or 25%	$60 or 50%	$30 or 25%	$30 or 25%	2
DUAL OUTPUT ISOLATION							
K	Isolated Outputs		—	$20 or 10%	—	—	1
INPUT VOLTAGE AND FREQUENCY OPTIONS							
L	Input 95-135V, 50-420cps		$10 or 10%	$20 or 20%	$10 or 10%	$10 or 10%	1
L1	Input 208 ±10%, 50-420cps		$15 or 10%	$25 or 10%	$15 or 10%	$15 or 10%	1
L2	Input 230 ±10%, 50-420cps		$15 or 10%	$25 or 10%	$15 or 10%	$15 or 10%	1
L3	Input 400 ±10%, 50-420cps		**$25 or 15%**	$40 or 15%	$25 or 15%	$25 or 15%	1
L4	Input 400 ±20cps, 105-125V		**$15 or 10%**	$25 or 10%	$15 or 10%	$15 or 10%	1
L5	Input 115/230, 50-420cps		$30 or 20%	$50 or 20%	$30 or 20%	$30 or 20%	1
L6	115/208, 50-420cps		$30 or 20%	$50 or 20%	$30 or 20%	$30 or 20%	1
SPECIAL CONNECTIONS							
N	Octal Plug (replaces solder term.)		$15	$15	$15	Not Applicable	3
PROTECTION CIRCUITS							
P	Voltage Limiting (110%)		$25 or 10%	$50 or 10% (both outputs)	$25 or 10%	$25 or 10%	1
P1	Current Limiting (130%)		$30 or 20%	$60 or 20% (both outputs)	Not Applicable	$30 or 20%	1
P2	Over Temp. Cutout (105%)		$20	$20	$20	$20	1
P3	Crowbar Voltage Limit (110%)		$40 or 20%	$80 or 20% (both outputs)	$40 or 20%	$40 or 20%	1
REMOTE PROGRAMMING							
R	Remote Adjust (No pot provided)		No Charge	No Charge	No Charge	No Charge	None
R1	Remote Adjust with 1% linearity (No pot provided)		$20 or 10%	$40 or 10%	$20 or 10%	$20 or 10%	1
R2	Remote Adjust Plus Internal Pot (A&B only)		$5	$10	$5	$5	None
R3	Remote Adjust with pot provided (A&B only)		$5	$10	$5	$5	None
START INTO HIGH CAPACITY LOADS							
S1	Start into 30,000 MFD/AMP		$10 or 15%	$20 or 10%	$10 or 10%	$10 or 10%	1
HIGH ISOLATION							
T	40DB Transformer Shielding		$25 or 15%	$40 or 15%	$25 or 15%	$25 or 15%	1
T1	100DB Transformer Shielding		$50 or 25%	$80 or 25%	$50 or 25%	$50 or 25%	1
HIGH FLOAT VOLTAGE							
U	Output Float up to ±1000V		$10 or 10%	$20 or 10%	$10 or 10%	$10 or 10%	1
RUGGEDIZED							
W	Potted for Ruggedization with no internal pot, by case size:	FA, GA, HA, JA	$5	$5	$5	$10	1
		KA, LA	$10	$10	$10		1
		MA, NA	$15	$15	$15		1
		PA,	$20	$20	$20	(Only	1
		QA,	$25	$25	$25	one	1
		RA,	$30	$30	$30	card	1
		SA,	$35	$35	$35	size)	1
		TA,	$40	$40	$40		1
W1	Potted for Ruggedization with hermetically sealed internal pot, by case size:	FA, GA, HA, JA	$20	$20	$20	$25	1
		KA, LA	$25	$25	$25		1
		MA, NA	$30	$30	$30		1
		PA,	$35	$35	$35	(Only	1
		QA,	$40	$40	$40	one	1
		RA,	$45	$45	$45	card	1
		SA,	$50	$50	$50	size)	1
		TA,	$55	$55	$55		1

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TELEPHONE: (213) 359-9261

LINE ISOLATORS

HIGHLY SHIELDED LINE ISOLATORS



FEATURES

- Stops High-Frequency Line Transients
- Stops 60 cps Leakage Current
- Breaks AC Power Ground Loops
- Portable — Ready to Plug In and Use Anywhere
- 0.1 to 2 KVA Units Available From Stock to Two Weeks

DESCRIPTION

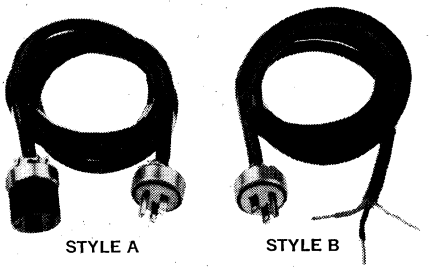
This new series of highly-shielded power Line Isolators offers the systems and laboratory engineers an opportunity to fully isolate electronic test equipment such as oscilloscopes, DVM's, power supplies, oscillators, amplifiers, counters, VTVM's and signal conditioning equipment. For example, with a Line Isolator connected between the power source and an oscilloscope, electrical measurements may be made without fear of tripping circuit breakers or blowing fuses because of power ground loops. Most high-frequency line transients are capacitance-coupled through standard power transformers (500 to 5000 pfd), and cause considerable unexplained interference. Reduction of such coupling capacity is the CEA secret to interference-free performance and high common mode rejection. CEA offers three choices of Line Isolators with reduced coupling capacity; 0.01 pfd, 0.001 pfd, and 0.0005 pfd. The effect of input-to-output coupling capacity is illustrated by the impedance of that capacity at various frequencies (5000 pfd for an unshielded transformer).

Frequency	Impedance of Capacity in Megohms			
	5000 pfd	0.01 pfd	0.001 pfd	0.0005 pfd
60 Hz	0.53	265,000	2,650,000	5,300,000
100 Hz	0.32	160,000	1,600,000	3,200,000
1 KHz	0.032	16,000	160,000	320,000
10 KHz	0.0032	1,600	16,000	32,000
100 KHz	0.00032	160	1,600	3,200
1 MHz	0.000032	16	160	320
10 MHz	0.0000032 (3.2Ω)	1.6	16	32

STANDARD LINE ISOLATORS

VA Rating	Max. Output (Amps)	Overall Size (Inches) W	D	H	Wt. Lbs.	COUPLING CAPACITY 0.01 pfd Model	Price	0.001 pfd Model	Price	0.0005 pfd Model	Price
100	0.85	5⅜	5⅛	7	9	CEA10	$ 70.00	CEA20	$ 95.00	CEA30	$130.00
250	2.2	5⅜	5⅛	7	12	CEA11	85.00	CEA21	115.00	CEA31	155.00
500	4.3	9⅜	6⅛	8	27	CEA12	100.00	CEA22	135.00	CEA32	185.00
1000	8.6	9⅜	6⅛	8	33	CEA13	125.00	CEA23	170.00	CEA33	230.00
1500	13.0	9⅛	7¼	9	38	CEA14	150.00	CEA24	210.00	CEA34	275.00
2000	17.3	9	9	9	55	CEA15	200.00	CEA25	275.00	CEA35	370.00

Aside from the standard models listed, CEA manufactures custom isolators up to 10 KVA and to meet particular requirements such as special shapes, sizes, output and input voltages and environmental conditions. CEA also makes custom shielded power and audio transformers, as well as a standard line of shielded modular DC supplies. Custom item deliveries average 4 weeks ARO.



STYLE A STYLE B

STANDARD SHIELDED LINE CORDS

Model	Max. Current In Amps.	Length In Feet	Style	Price (Each)
CEA8A6	5	6	A	$14.00
CEA8B6	5	6	B	11.00
CEA8A10	5	10	A	15.00
CEA8B10	5	10	B	12.00
CEA8A15	5	15	A	17.00
CEA8B15	5	15	B	14.00
CEA8A20	5	20	A	19.00
CEA8B20	5	20	B	16.00
CEA9A6	15	6	A	17.00
CEA9B6	15	6	B	14.00
CEA9A10	15	10	A	21.00
CEA9B10	15	10	B	18.00
CEA9A15	15	15	A	26.00
CEA9B15	15	15	B	23.00
CEA9A20	15	20	A	31.00
CEA9B20	15	20	B	28.00

TECHNICAL SPECIFICATIONS

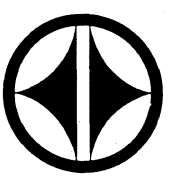
Isolation:	Input-to-output coupling capacity; less than 0.01, 0.001, or 0.0005 pfd. Input-to-output DC resistance; greater than 10,000 megohms.
Input:	95-135 VAC, 50-65 cps.
Output Voltage:	Within 2% of the input voltage, from no load to full load.
Output Current:	See model chart.
Efficiency:	Better than 95%.
Mechanical:	Unit has chrome handle, deep drawn case with grey baked enamel finish, 6 ft. shielded line cord, and non-scuff feet.

The new CEA Isolators are easily rack-mounted by removing the four mounting feet and using the #8-32 inserts for bolt mounting.

SHIELDED LINE CORDS FOR ISOLATOR OUTPUTS

To make optimum use of CEA Line Isolators, CEA offers specially designed shielded line cords in two styles and several lengths. Style A can be used as an extension cord for equipment that has a line receptacle mounted at the chassis (such as Tektronix scopes). Style B has stripped and tinned leads on one end and can be installed into equipment as a direct replacement for unshielded line cords (such as Hewlett-Packard equipment). The plugs on these cords, as well as the cable, are shielded and are constructed of the finest materials available. Other lengths, current ratings, and connectors are available on request.

Look in the Green Section for Products and their Manufacturers



Tell them you found them in **eem**

BULOVA AC POWER SUPPLIES

Features

All new . . . with more VA per output per dollar . . . Bulova AC Power features—Fully Regulated Sine Wave—All Solid-State Design—Up to 1000-VA Output—Protected Input/Output

Performance Specifications:

OUTPUT:

Frequency Output: 50 or 60 Hz (standard)—any other specific frequency custom

Frequency Accuracy: ±1%, ±.015% or ±.005%

Temperature Range: 0°C to +50°C

Wave Shape: Sine Wave, 3% Distortion max.

Output Voltage: 115 or 230 V AC nominal

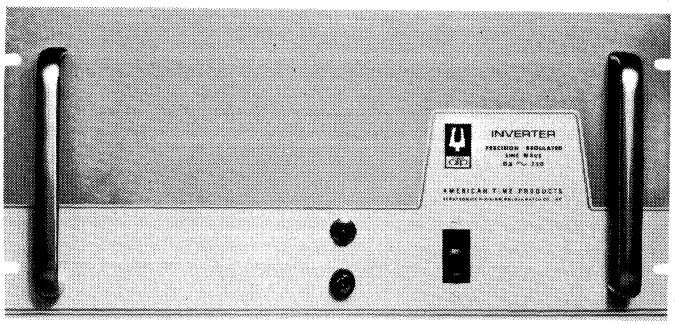
Voltage Regulation: ±1% any combination of full line and load change

INPUT:

115V AC or 230V AC, ±10%; 22 to 30V DC Normal (11 to 15V DC, and 45 to 56V DC available)

Some models available from stock . . . custom designs to meet special needs for systems, equipment or laboratory use, up to 2000 VA and ±.005% frequency accuracy. Meters are optional.

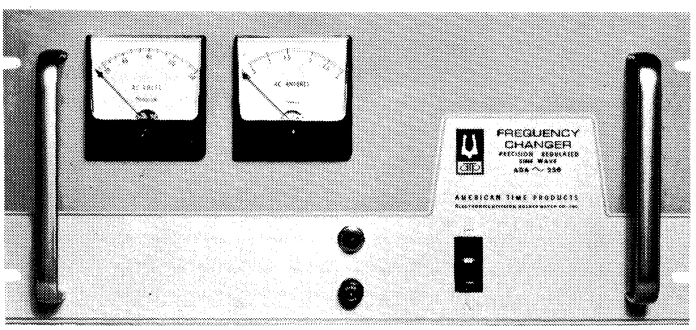
INVERTERS (Standard)



Type	Input VDC	Output VA	Output Freq.	Output Volt	Wt. Lbs. (2)	Ht. In.
DA-250S	22-30	250	50 or 60	115(1)	70	8 3/4
DA-500S	22-30	500	50 or 60	115(1)	130	10 1/2

(1) 230 Volt Available (2) For 50Hz, add about 5 lbs.

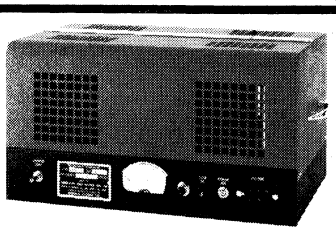
FREQUENCY CHANGERS (Standard)



Type	Input VAC + 10%	Input Freq. Hz	Output VA	Output Freq.	Output Volt	Wt. Lbs. (2)	Ht. In.
ADA-250S	115/230	47-65	250	50 or 60	115(1)	80	8 3/4
ADA-500S	115/230	47-65	500	50 or 60	115	130	10 1/2

(1) 230 Volt Available (2) For 50Hz, add about 5 lbs.

AC POWER SUPPLY Type 211C-75 Watt

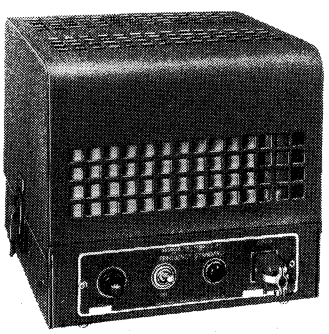


Input Voltage—110-125V, 50 to 400 cycles
Input Wattage—250 at 75 watts out, 125 at 0 watts out
Output Voltage—0 to 125 volts
Output Load—180 ohms and up
Distortion—8% maximum
Source Impedance—Approximately 25 ohms
Output Frequency—As specified on nameplate (50, 60, 100, 400 and 500 cycles are standard, others on special order)
Frequency Accuracy—±20 parts per million .002% from 15°to 35°C.
Size—211C—17" wide, 10" deep, 9" high; 211CP—Rack mounting type, 19" wide, 10" deep, 8 3/4" high.
Weight—211C—25 lbs., 211CP—30 lbs.

AC POWER SUPPLY, 10 and 20 WATTS—MODELS 2005A & 2005A-2

This unit is ideally suited for synchronous motor drives, chronographs, stroboscopes, generator frequency control, running timers and general laboratory use. Five external clocks can be driven from this unit.

SPECIFICATIONS—FREQUENCY: 50 cps to 2000cps. Any fixed frequency; OUTPUT: 10 watts at 115 volts (Model 2005A); ACCURACY: Up to ±.001% from 15°C to 35°C; INPUT: 115V AC, 50cps to 400cps, 75 watts. 220V AC unit available; WAVE SHAPE: Sine wave; TEMPERATURE: As low as −55°C to as high as 85°C.



Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

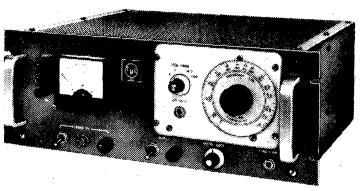
BULOVA AMERICAN TIME PRODUCTS

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.

61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

single phase AC power supplies

NS series
70VA to 350VA



MODEL NS175-7A-V

- **Fixed and adjustable output frequencies between 45 and 6000 cycles.**
- **Interchangeable Oscillators** . . . Oscillators are interchangeable via quick disconnect; frequency range and/or frequency stability may be changed at any time merely by replacing oscillator module.
- **Excellent frequency stability** . . . Fixed frequency models stable to ±0.001%. Variable frequency models stable to ±0.1%.
- **Low distortion sine wave output** . . . less than 1% total harmonic distortion between 300 and 1000 cycles, less than 3% between 45 and 6000 cycles.
- **Each model can be operated either as a precision AC power supply or as a wide band audio power amplifier.**
- **Constant voltage output** . . . 0.5% regulation for no load to full load change. Response time less than 50 microseconds.

REGULATED POWER AMPLIFIERS

MODEL	OUTPUT POWER VOLT-AMPERES	*DIMENSIONS H x W x D	WEIGHT (APPROX.) LBS.
NS70	70	7″ x 19″ x 14″	53
NS120	120	7″ x 19″ x 14″	57
NS175	175	7″ x 19″ x 14″	60
NS350	350	8¾″ x 19″ x 20¾″	115

*Dimensions apply to standard rack mount models. Add ¾″ to height if bench adapters are included.

STANDARD OSCILLATORS**

OUTPUT FREQUENCY	FREQUENCY STABILITY ±0.25%	±0.1%	±0.01%	±0.001%
	SUFFIX #			
Fixed 400 cps	—4A	—4B	—4E	—4G
Fixed 800 cps	—8A	—8B	—8E	—8G
Fixed 50 cps	—1A	—1B	—1E	Special Order
Fixed 60 cps	—2A	—2B	—2E	
Adjust. 350-450 cps	—5A	—5B	X	X
Adjust. 45-70 cps	—3A	—3B	X	X
Adjust. 300-2000 cps	—6A	—6B	X	X
Adjust. 45-6000 cps	—7A	X	X	X

****AUDIO AMPLIFIER ONLY:** Each model is also available as an audio power amplifier only (without a built-in oscillator) with a full power range of 45-6000 cps. All standard models (with or without oscillator) include an input signal jack for use with external signal source. Specify the Basic Power Supply Model and Suffix # (—JA) if oscillator is not required.

SPECIFICATIONS

INPUT SERVICE: 115V ±5%, 1ø, 47-65 cps.
OUTPUT CONFIGURATION: Single phase, 2 wire floating.
OUTPUT VOLTAGE: Adjustable 0-125 volts rms-by front panel gain control; full power available at 110-125 volts.
DUTY CYCLE: Continuous duty at rated output.
VOLTAGE REGULATION: Less than 0.5% for no load to full load change; ±0.5% for ±5% input voltage change (from 115V.) .
LOAD POWER FACTOR: 0.7 lead or lag to unity at rated output; wider power factor range at derated output.
OUTPUT WAVE SHAPE: Sine wave with less than 3% total harmonic distortion over the 45-6000 cps frequency range; less than 1% 300-1000 cps.
RESPONSE TIME: Less than 50 microseconds.
HUM and Noise: 60 db below maximum output voltage.
FREQUENCY RANGE: Each model can be driven at full power from an external signal source over a 45-6000 cycle frequency range. Output frequencies of built-in oscillators are tabulated above.
EXTERNAL SIGNAL: 5 volts rms required for rated output. Signal input impedance 600 ohms single ended.

METERS: Output voltmeter is furnished as standard equipment on model **NS350.** Voltmeter is available as accessory for models **NS70, NS120 & NS-175;** specify suffix (—V).
TERMINATIONS: Output terminals are furnished both front and rear, five way binding posts on front and barrier strip on rear. Input power termination is rear mounted barrier strip. Signal input is via jack mounted on front panel.
PROTECTION: Models rated at 175VA or less are protected against overload and short circuit by output fuse. Model **NS350** features output overload relay protection and front panel reset. Internal component failure will remove the power into the system by means of a blown line fuse.
CONSTRUCTION: Standard 19″ rack mount construction with full dust covers. Bench adapters available as accessory, specify suffix (—C).
FINISH: Front panels finished in satin green enamel. Panel marking is white. Chassis surfaces are protected with yellow iridite.

HOW TO ORDER

Standard NS series power supplies may be ordered directly from the catalog by specifying both the Basic Power Supply Model and the Suffix # for the particular oscillator which is required. Thus, the model **NS175-5B** describes a 175VA power supply having an adjustable 350-450 cycle frequency range and a frequency stability of ±0.1%. The same basic unit, but without a built in oscillator, is identified as the model **NS175-JA** Audio Amplifier. If an output voltmeter and bench adapters are required, the same audio amplifier is then identified as the model **NS175-JA-C-V.**

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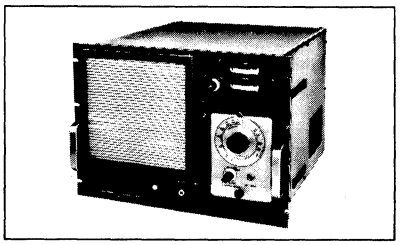
single phase AC power supplies

NA series
500VA to 15KVA



MODEL N1000A
With SG-17A Plug-in Oscillator

The NA SERIES of AC POWER SUPPLIES are exceptionally flexible sources of audio power. Each power supply consists of a **REGULATED AUDIO POWER AMPLIFIER** with interchangeable fixed or variable **PLUG-IN OSCILLATORS** for a wide range of precision AC power applications. The Amplifier has a full power range of 45-6,000 cycles. With the incorporation of a **CML** Plug-in Oscillator precise fixed or adjustable output frequencies are available anywhere within this range. Plug-in Oscillators are Wein Bridge or Tuning Fork controlled.

Regulated Power Amplifiers with Precision Plug-in Oscillators

- **Each Model can be operated either as a precision AC Power Supply or as an Audio Power Amplifier.**
- **INTERCHANGEABLE PLUG-IN OSCILLATORS** . . . 21 standard oscillators are available — to provide fixed or adjustable output frequencies between 45 and 6,000 cps and stabilities to ±0.001%.
- **INSTANTANEOUS OVERLOAD PROTECTION**
- **MINIMUM PACKAGE SIZE** . . . 2000VA in 14" rack height; 750VA in 8¾" rack height.
- **CONSTANT VOLTAGE OUTPUT** . . . 0.5% regulation for no load to full load change — response time less than 50 microseconds.

Frequency stabilities range between ±0.25% and ±0.001%. Plug-in Oscillators include gain control as well as front panel jack for external signal drive. Each Power Amplifier model may also be operated without a plug-in oscillator; however, in that case, the Model SA-2 External Signal Adapter is required.
Precise amplitude stability and low harmonic content are provided by a combination of positive current feedback and inverse voltage feedback.

REGULATED POWER AMPLIFIERS

MODEL	OUTPUT POWER—VA	INPUT	*DIMENSIONS H x W x D			WT. APPROX. LBS.
N500A	500	115V, 1ø, 47-65CPS	8¾	19	21	175
N750B	750	115V, 1ø, 47-65	8¾	19	21	180
N750A	750	208/230V, 3ø, 47-65	14	19	20½	260
N1000A	1,000	208/230V, 3ø, 47-65	14	19	20½	270
N1500A	1,500	208/230V, 3ø, 47-65	14	19	20½	315
N2000A	2,000	208/230V, 3ø, 47-65	14	19	20½	325
N5000A	5,000	208/230V, 3ø, 57-65	51	24	24	850
N15000A	15,000	208/230V, 3ø, 57-65	47	34	24	1600

*500VA to 2000VA units are standard rack mount models. Add ¾" to height if bench adapters are included. 5000VA and 15000VA units are cabinet models. Model N5000A includes casters.

PLUG-IN OSCILLATORS**

OUTPUT FREQUENCY	FREQUENCY STABILITY ±0.25%	±0.1%	±0.01%	±0.001%
	MODEL #			
Fixed 400 cps	SG-14A	SG-14B	SG-14E	SG-14G
Fixed 800 cps	SG-18A	SG-18B	SG-18E	SG-18G
Fixed 60 cps	SG-12A	SG-12B	SG-12E	Special
Fixed 50 cps	SG-11A	SG-11B	SG-11E	Order
Adjustable 350-450 cps	SG-15A	SG-15B	X	X
Adjustable 45-70 cps	SG-13A	SG-13B	X	X
Adjustable 300-2,000 cps	SG-16A	SG-16B	X	X
Adjustable 45-6,000 cps	SG-17A	X	X	X
45-6,000 cps	EXTERNAL SIGNAL ADAPTER Model SA-2			

**All Plug-in Oscillators are provided with a jack for external signal drive.

SPECIFICATIONS

OUTPUT CONFIGURATION: Single Phase, 2 wire floating.
OUTPUT VOLTAGE: Adjustable 0-125 Volts; full power available at output of 110-125 Volts.
DUTY CYCLE: Continuous duty at full rated output.
OUTPUT POWER: Rated output power for each model is shown in chart above.
VOLTAGE REGULATION: Less than 0.5% for no load to full load change. ±0.5% for ±5% input voltage change.
LOAD POWER FACTOR: 0.7 lead or lag to unity at rated output; wider power factor range with slight derating.
OUTPUT WAVE SHAPE: Sine wave. Less than 3% total harmonic distortion over the 45-6,000 cycle frequency range. Less than 1% 300 to 1000 cycles.
RESPONSE TIME: Less than 50 microseconds.
HUM and NOISE: 60 db below maximum output voltage.
PROTECTIVE CIRCUITS: All models are equipped wtih instantaneous overload protection and front panel reset.
METERS: All standard models are furnished with front panel meters to monitor output voltage and plate currents of final amplifier tubes.
FREQUENCY RANGE: Each amplifier model is rated at full power 45-6,000 cps with the exception of the Model N15000A which is rated at full power 200-6,000 cps. Each model may be driven from an external signal source over the rated frequency range. When driven by a PLUG-IN OSCILLATOR the output frequency range is determined by the particular plug-in which is selected. Standard oscillator frequencies are tabulated above.
FREQUENCY STABILITY: Determined by the plug-in oscillator or external signal source which is utilized. Stabilities of standard plug-in oscillators are tabulated above.
EXTERNAL SIGNAL: Signal input voltage of 5 volts rms required for full rated output. Signal input impedance 600 ohms, single ended.
OUTPUT & INPUT TERMINATIONS: Units rated at 500VA to 2000VA include output terminals on front and rear, five way binding posts on front and barrier strip on rear; input power termination is rear mounted barrier strip. Models N5000A and N15000A have input and output terminals accessible via knockouts at cabinet rear.
CONSTRUCTION: Models rated 500VA to 2,000VA are standard 19" rack mount units with full dust covers. Bench adapters available as accessory for these models; specify suffix (—C). Side support is recommended for rack mount models. Slides available as optional accessories; specify suffix (—S). 5 KVA and 15 KVA models are furnished complete in cabinet enclosure. 5 KVA model includes casters.
FINISH: Front panels finished in satin green enamel. Panel marking is white. Cabinets are green armorhide. Chassis surfaces are protected with yellow iridite.

HOW TO ORDER

Standard NA series power supplies may be ordered directly from the catalog by specifying both the regulated power amplifier model and the model number of the plug-in oscillator (or external signal adapter if no oscillator is ordered). Thus, the model **N1000A** with model **SG-15A** describes a 1000VA power supply having an adjustable 350-450 cycle frequency range and a frequency stability of ±0.25%. The model **N1000A-C** with **SG-15A** describes a similar unit with bench adapters and the model **N1000A-S** with **SG-15A** describes a similar basic unit with slides.

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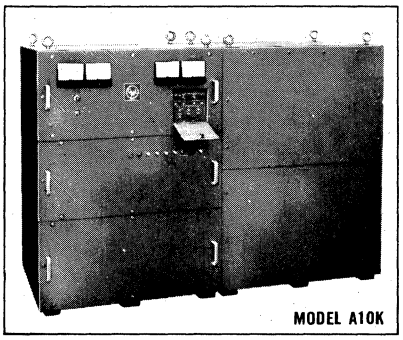
wide band power amplifiers for audio and ultrasonic testing

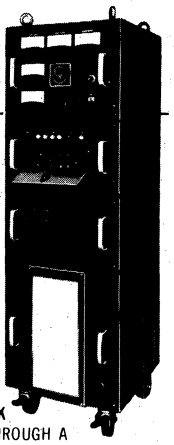
SPG series
1KVA to 200KVA



MODEL A10K

- Full power into reactive loads.
- Low distortion.
- ±0.5 db frequency response.
- Ideal for CW and PULSED duty.
- Selectable output taps for matching wide range of load impedances.
- Rugged construction for marine or airborne installations.

APPLICATIONS
SONAR TESTING
VIBRATION TESTING
INDUSTRIAL PROCESS CONTROL
HIGH INTENSITY ACOUSTIC SYSTEMS



MODEL S5K
PASSES THROUGH A STANDARD SUBMARINE HATCH



MODEL B5K

** MODEL	OUTPUT POWER KVA	LOAD POWER FACTOR RANGE AT RATED KVA	STANDARD OUTPUT IMPEDANCE TAPS OHMS	DIMENSIONS* H x W x D (APPROX.) INCHES	WEIGHT (APPROX.) LBS.	TYPE OF COOLING
A1K	1KVA	±0.4 to Unity	4/16/36/64/144/576	22¾ x 19 x 20½	345	FORCED AIR
A2K	2	±0.4 to Unity	4/16/36/64/144/576	22¾ x 19 x 20½	400	
A3K	3	±0.1 to Unity	4/16/36/64/144/576	53 x 27 x 26	750	
S5K	5	±0.4 to Unity	16/64/256	62 x 17 x 17	800	
B5K	5	±0.1 to Unity	8/32/72/128/288/1152	45 x 24 x 24	850	
A10K	10	±0.1 to Unity	16/64/144/256/576/2304	47 x 68 x 24	1,700	
A20K	20	±0.3 to Unity	16/64/144/256/576	47 x 68 x 24	2,100	
VA30K	30	±0.1 to Unity	16/64/144/256/576	72 x 72 x 36	3,000	VAPOR COOLED
VA50K	50	±0.4 to Unity	16/64/144/256/576	72 x 72 x 36	4,200	
VA100K	100	±0.1 to Unity	16/64/144/256	2 sections, ea.: 90 x 72 x 57	9,400	
VA200K	200	±0.1 to Unity	16/64/144/256	3 sections, ea.: 90 x 72 x 57	14,100	

*Models A1K and A2K are standard 19" rack mount units; bench adapters available on special order. All other models are furnished complete in cabinet enclosures. Models A3K, S5K and B5K include casters.

**Refer to pages 2 and 3 for lower powered amplifiers.

SPECIFICATIONS

OUTPUT FREQUENCY: Standard full power frequency range is 100-10,000 cps except for Model A3K which has a 200-15,000 cps range. **Other frequency ranges** between 5 cps and 200KC are available on a custom basis.

OUTPUT CONFIGURATION: 2 wire floating.

DUTY CYCLE: Continuous duty at full rated output power. Please consult CML for pulsed or intermittent duty ratings.

FREQUENCY RESPONSE: ±0.5 db, 100-10,000 cps. Model A3K ±0.5 db 200-15,000 cps.

HARMONIC DISTORTION: Less than 3%, 100-10,000 cps; less than 1.5% mid-band.

HUM AND NOISE: At least 60 db below rated output tap voltage.

OUTPUT IMPEDANCE SELECTION: Taps are selected by link change. Front panel tap select switches are available at additional charge.

INPUT SERVICE: Models rated 1KVA to 20KVA require 208/230 volts ±5%, 3 phase, 57-65 cycles. However, the Model S5K is also available with input of 440/460/480 volts, ±5%, 3 phase, 57-65 cycles – specify Model S5KM5963. Models rated at 30KVA output and higher require 440/460/480 volts ±5%, 3 phase, 57-65 cycles.

SIGNAL INPUT VOLTAGE: 1.0 volt RMS for rated output.

SIGNAL INPUT IMPEDANCE: 600 ohms, single ended.

KEYED OPERATION: All models are suitable for operation with keyed input signals.

METERING: All models include complete front panel metering. In addition, models rated at 3KVA to 200KVA have recessed front panel section with test points for critical circuit parameters — to keep down-time to a minimum.

PROTECTIVE CIRCUITS: CML instantaneous overload circuitry protects both amplifier and load. Rapid front panel reset permits return to normal operation with minimum down-time.

FINISH: Panels are satin green enamel; cabinets are green armorhide. Special colors are available on a custom basis.

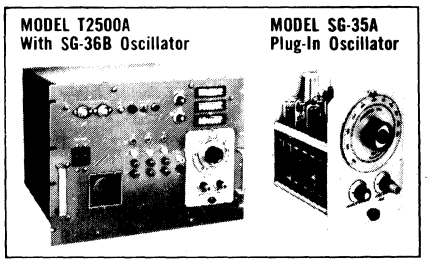
VAPOR COOLING

All CML models rated at 30KVA output or higher feature modern vapor cooling systems to dissipate heat generated in the "final" amplifier. Use of this method, with its high efficiency heat transfer, reduces "raw water" requirements appreciably when compared with older "water cooled systems." In addition, it eliminates the need for a pump in the closed loop cooling system and greatly reduces contamination of distilled water in the closed system — thus greatly reducing maintenance.

CML, Inc.
A Subsidiary of Tenney Engineering, Inc.
350 Leland Ave. • Plainfield, New Jersey 07062
Telephone (201) 754-5502 • TWX: 710-997-9529

three phase frequency converters

TA series
150VA to 20KVA



The new TA Series of Three Phase Frequency Converters are exceptionally versatile sources of AC power. Each converter consists of a regulated **THREE PHASE AMPLIFIER** with interchangeable fixed or variable frequency **PLUG-IN OSCILLATORS** for a wide range of precision AC power applications. The amplifier has a full power range of 45-6,000 cps. With the incorporation of a CML plug-in oscillator (which includes 120° phase shift network) precise fixed or adjustable frequencies are available anywhere within this range.

- **MINIMUM PACKAGE SIZES** . . . 2500VA in 14" rack height.
- **INTERCHANGEABLE PLUG-IN OSCILLATORS** . . . 21 standard oscillators are available — to provide fixed or adjustable output frequencies between 45 and 6,000 cps and stabilities to ±0.001%.
- **INSTANTANEOUS OVERLOAD PROTECTION** . . . An overload of any one phase causes complete output shutdown, protecting 3 phase load.
- **DUAL OUTPUT VOLTAGE FOR △ OR Y LOADS** . . . Adjustable voltages 0-125 volts line-to-line as well as 0-217 volts line-to-line are presented at output terminals; output is isolated for maximum versatility.
- **CONSTANT VOLTAGE OUTPUT** . . . 0.5% regulation for no load to full load change — response time less than 50 microseconds.
- **OUTPUT VOLTAGE UNAFFECTED BY UNBALANCED LOADS.**

Plug-in oscillators are Wein bridge or tuning-fork controlled for frequency stabilities ranging between ±0.25% and ±0.001%. Dual output taps are standard for matching either Delta or Wye loads (output may be connected either 120 volts line-to-line or 208 volts line-to-line). Precise amplitude stability and low harmonic content are provided by a combination of positive current feedback and inverse voltage feedback.

THREE PHASE AMPLIFIERS

MODEL	3∅ OUTPUT POWER — VA	INPUT	*DIMENSIONS H x W x D			WT. (APPROX.) LBS.
T150A	150	115V, 1∅, 47-65	7	19	17	105
T300B	300	115V, 1∅, 47-65	12¼	19	20	180
T500B	500	115V, 1∅, 47-65	12¼	19	20	190
T750A	750	208/230V, 3∅, 47-65	14	19	20½	275
T1200A	1,200	208/230V, 3∅, 47-65	14	19	20½	285
T1750A	1,750	208/230V, 3∅, 47-65	14	19	20½	355
T2500A	2,500	208/230V, 3∅, 47-65	14	19	20½	365
T5000A	5,000	208/230V, 3∅, 47-65	45	24	24	950
T15000A	15,000	208/230V, 3∅, 57-65	78	35	36	1700
T20000A	20,000	208/230V, 3∅, 57-65	78	35	36	1900

*150VA to 2500VA units are rack mount models with dimensions as shown above. Add ¾" to height if bench adapters are included.

PLUG-IN OSCILLATORS

3∅ OUTPUT FREQUENCY	FREQUENCY STABILITY ±0.25%	±0.1%	±0.01%	±0.001%
	MODEL #			
Fixed 400 cps	SG-34A	SG-34B	SG-34E	SG-34G
Fixed 800 cps	SG-38A	SG-38B	SG-38E	SG-38G
Fixed 60 cps	SG-32A	SG-32B	SG-32E	Special Order
Fixed 50 cps	SG-31A	SG-31B	SG-31E	Special Order
Adjustable 350-450 cps	SG-35A	SG-35B	X	X
Adjustable 45-70 cps	SG-33A	SG-33B	X	X
Adjustable 300-2,000 cps	SG-36A	SG-36B	X	X
Adjustable 45-6,000 cps	SG-37A	X	X	X

5000VA-20,000VA units are cabinet models. Model T5000A includes casters.

SPECIFICATIONS—Standard Frequency Converter Models

OUTPUT CONFIGURATION: Three Phase, 4 wire wye, neutral floating.
OUTPUT VOLTAGE: 0-125 Volts line-to-line and 0-217 Volts line-to-line; both sets of terminals are presented at output. Full power available at output of 110-125 volts and 190-217 volts. Master gain control and phase 2 and 3 trim controls provided on front panel.
DUTY CYCLE: Continuous duty at full rated output.
OUTPUT POWER: Rated output power for each model is shown in chart above. Maximum power per phase is 1/3 of 3∅ output.
VOLTAGE REGULATION: Less than 0.5% for no load to full load change. ±0.5% for ±5% input voltage change.
LOAD POWER FACTOR: 0.7 lead or lag to unity at rated output; wider power factor range with slight derating.
UNBALANCED PHASE LOADING: Separate power amplifiers and regulation circuits are provided for each output phase. Therefore unbalanced phase loading has negligible effect as long as the rated output power per phase is not exceeded.
PROTECTIVE CIRCUITS: All models are equipped with instantaneous overload protection and front panel reset. An overload in any phase causes all phases to shut down, thus protecting 3∅ loads. Front panel lamps also indicate which phase has been overloaded.
OUTPUT & INPUT TERMINATIONS: Output terminals are furnished both front and rear, five way binding posts on front, barrier strip on rear. Input is via rear mounted barrier strip.
FREQUENCY RANGE: Each amplifier model is rated at full power 45-6,000 cps except for the models T15000A and T20000A which have a 300-500 cycle full power range. The operating output frequency range is determined by the particular plug-in oscillator which is used.
FREQUENCY STABILITY: Determined by the particular plug-in oscillator which is selected. Stabilities of standard oscillators are tabulated above.
RESPONSE TIME: Less than 50 microseconds.
WAVE SHAPE: Sine Wave.
HARMONIC DISTORTION: Less than 3% over the entire 45-6,000 cycle amplifier range; less than 1%, 300-1000 cps.
HUM AND NOISE: 60 db below maximum output voltage.
OUTPUT PHASE SEPARATION: 120 ±1° for fixed frequency models as well as 350-450 cycle models. 120 ±2° for 45-70 and 300-2,000 cycle models. 120 ±3° for 45-6,000 cycle models.
METERS: Models rated 150VA to 500VA are furnished with output voltmeter and selector switch to monitor any line-to-line and line-to-neutral voltage. Models rated 750VA to 20KVA have three (3) combination output voltmeter/plate current ammeters with selector switch to monitor any line-to-line and line-to-neutral output voltage as well as plate current of 3∅ amplifier.
CONSTRUCTION: Models rated 150VA to 2500VA are standard 19" rack mount units with full dust covers. Bench adapters available as accessories for these models; specify suffix (—C). Side support is recommended for rack mount models. Slides are available as optional accessories; specify suffix (—S). 5KVA-20KVA models are furnished complete in cabinet enclosure. 5KVA model includes casters.
FINISH: Front panels finished in satin green enamel. Panel marking is white. Cabinets are green armorhide. Chassis surfaces are protected with yellow iridite.

HOW TO ORDER

Standard TA series frequency converters may be ordered directly from the catlog by specifying both the three phase amplifier model and the model number of the plug-in oscillator. Thus, the model **T750A** with model **SG-34B** describes a 750VA frequency converter having a fixed 400 cycle output frequency and a frequency stability of ±0.1%. The same unit, except for the addition of bench adapters, is designated as the model **T750A-C** with **SG-34B**, whereas model **T750A-S** with **SG-34B** describes a similar unit with slides.

SINGLE PHASE & TWO PHASE OUTPUT

Standard 3 phase amplifiers may be used to provide a 2 phase output at 2/3 of rated output power. Special plug-in oscillators are available with selectable 90° or 120° phase separation for 2 phase or 3 phase operation respectively.

Standard 3 phase amplifiers may be used to provide a single phase output at 57% of rated output power over an adjustable voltage range of 110-125 volts.

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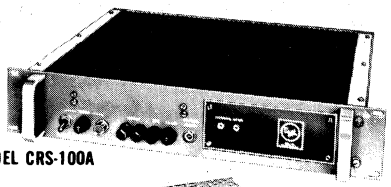
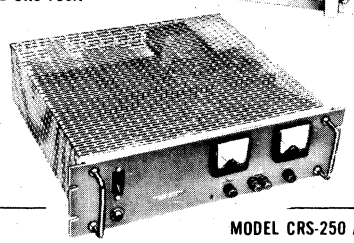
solid state frequency converters CML

LRS series
60 or 400 cycles to 60 cycles

CRS series
50/60 cycles to 400 cycles



MODEL CRS-100A



MODEL CRS-250 A

- 50VA to 2KVA output.
- Low distortion sine wave output.
- Rugged construction for airborne, marine and ground support installations.
- 0.5% frequency regulation & 1% voltage regulation.
- Full output power into both leading & lagging power factor loads.
- High efficiency switched mode operation.
- TRANSISTORIZED POWER STAGES rather than Silicon Controlled Rectifiers — thus insuring positive, controlled turn-off & turn-on characteristics for reliable, continuous operation.
- SILICON SEMI-CONDUCTORS used throughout.

LRS series
60 OR 400 CYCLE TO 60 CYCLE CONVERTERS

MODEL	OUTPUT VA	**45-65 CYCLE INPUT SINGLE ø VOLTS	DIMENSIONS H x W x D	WEIGHT (APPROX.) LBS.
LRS-250A	250	105-125	5¼ x 19 x 15	80
LRS-500A	500	105-125	10½ x 19 x 16	100
LRS-1000A	1000	105-125	21 x 19 x 16½	220

**350-450 Cycle input also available.
Specify suffix -H (example: Model LRS-250A-H)

CRS series
50/60 CYCLE TO 400 CYCLE CONVERTERS

MODEL	OUTPUT VA	*45-65 CYCLE INPUT SINGLE ø VOLTS	DIMENSIONS H x W x D	WEIGHT (APPROX.) LBS.
CRS-50A	50	105-125	3½ x 19 x 14	24
CRS-100A	100	105-125	3½ x 19 x 14	26
CRS-150A	150	105-125	5¼ x 19 x 10	30
CRS-250A	250	105-125	5¼ x 19 x 15	65
CRS-500A	500	105-125	10½ x 19 x 16	88
CRS-1000A	1000	105-125	15¾ x 19 x 16	135
CRS-2000A	2000	200-240V ⏦, 3ø	26¼ x 19 x 20	260

*350-450 Cycle input also available on a special basis.

SPECIFICATIONS

OUTPUT CONFIGURATION: Single phase, two wire, isolated.
INPUT CONFIGURATION: Single phase, two wire, isolated except for model **CRS-2000A** which has 3 phase input.
OUTPUT VOLTAGE: Adjustable 105-125 Volts RMS.
VOLTAGE REGULATION: ±1% for combined no load to full load change and rated input voltage variation.
FREQUENCY REGULATION: ±0.5% for combined no load to full load change and rated input voltage variation.
HARMONIC DISTORTION: 1% for 400 cycle models, 3% for 60 cycle models when powering linear (resistive or reactive) loads; slightly higher into switching type loads.
LOAD POWER FACTOR: 0.7 lead or lag to unity at rated output; wider power factor range with slight derating.
AMBIENT TEMPERATURE: Operating: —20°C to +50°C
Storage: —40°C to +85°C
COOLING: CML frequency converters require no auxiliary cooling. There is no need for special base plate heat sinks. Units rated at 500VA to 2000VA include quiet built-in fan.
TEMPERATURE STABILITY: Frequency: Max. 0.05%/degree C. Voltage: Max. 0.01%/degree C.

TERMINATIONS: Output terminals are furnished both front and rear, five way binding posts on front & barrier strips on rear. Input is via rear mounted barrier strip.

CONSTRUCTION: Standard models furnished as rack mount equipment with full dust covers. Modified rack mount or modular supplies packaged in accordance with customer specification are also available.
Slides available on special order.

CONTROLS AND METERS: All models include front panel voltage adjust. Models rated at **250** to 2000VA include input circuit breaker. Lower power models have "power-on" switch. Models rated at **250** to 2000VA include output voltmeter and output ammeter. Meters are available for lower powered units on special order.

PROTECTION: All models rated **250** to 2000VA are protected against overload, short circuit, and internal faults by input circuit breaker. Units rated 50 to 150VA include input and output fuses.

FINISH: Front panels finished in satin green enamel. Panel marking is white.

CUSTOM REQUIREMENTS

We invite your inquiries for modified or custom frequency converters designed and manufactured in accordance with applicable military or commercial specifications. We would be happy to submit our proposal for converters having the following features:

- Special lightweight designs.
- Three phase outputs.
- Square wave outputs.
- Multiple output voltages.
- Adjustable output frequencies.
- Modular construction.
- Frequency stabilities to .001%
- Frequency synchronized with external signal.

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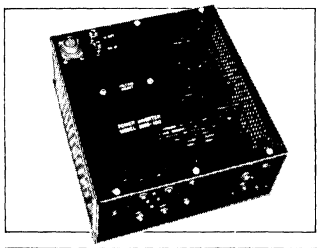
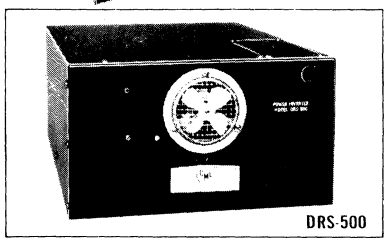
transistorized DC to AC power inverters

MNS series
MRS series
60 cycles output

DRS series
400 cycles output



MNS-100



DRS-500

- 50 to 2000VA output.
- Low distortion sine wave
- Highly regulated.
- Reliable.
- Quiet operation.
- Overload & short circuit protection.
- Protected against input polarity reversal.
- High efficiency.
- Input to output isolation.
- No auxiliary cooling required.

MNS series — 60 CPS

Output: 105/115/125 Volts rms, Single Phase.
Input: 22-30 Volts D. C.
Frequency Regulation: 0.5%.

MODEL	OUTPUT VA	DIMENSIONS H x W x D	NET WT. LBS. (APPROX.)
MNS-50	50	5 x 11 x 11	28
MNS-100	100	5 x 11 x 11	28
MNS-500	500	8 x 14 x 14	80
MNS-1000	1000	14 x 17 x 19	162

MRS series — 60 CPS

Output: 115 Volts rms, Single Phase.
Input: 22-30 Volts D. C.
Voltage & Frequency Regulation: 0.5%

MODEL	OUTPUT VA	DIMENSIONS H x W x D	NET WT. LBS. (APPROX.)
MRS-500	500	12 x 14 x 14	150
MRS-1000	1000	14 x 17 x 19	175
MRS-2000	2000	17 x 17 x 22	300

DRS series — 400 CPS

Output: 115 Volts rms, Single Phase.
Input: 22-30 Volts D. C.
Voltage & Frequency Regulation: 0.5%.

MODEL	OUTPUT VA	DIMENSIONS H x W x D	NET WT. LBS. (APPROX.)
DRS-50	50	5 x 11 x 8	25
DRS-100	100	5 x 11 x 8	26
DRS-500	500	8 x 14 x 16	70
DRS-1000	1000	14 x 17 x 18	160

SPECIFICATIONS

INPUT CONFIGURATION: Two wire, isolated.
OUTPUT CONFIGURATION: Single phase, two wire isolated.
OUTPUT VOLTAGE: MRS & DRS Models are preset at 115 volts rms. MNS Models have taps available at 105/115/125 volts rms — These values measured at nominal input voltage with half load.
DUTY CYCLE: Continuous duty at full rated output.
HARMONIC DISTORTION: 1% for 400 cycle models, 3% for 60 cycle models when powering linear (resistive or reactive) loads; slightly higher into switching type loads.
LOAD POWER FACTOR: 0.7 lead or lag to unity at rated output; wider power factor range with slight derating.
FREQUENCY REGULATION: Load: 0.5% for no load to full load change. Line: 0.5% for rated input line change.
Units providing frequency regulation and stability to ±0.001% available on special order. Units in which the frequency may be synchronized with an external source available at slight additional charge.
VOLTAGE REGULATION: MRS & DRS Series: Load: 0.5% for no load to full load change. Line: 0.5% for rated input line change.
MNS Series: Load: Approximately 6% for half load to full load change. Line: Approximately proportional to input line change.
EFFICIENCY: MNS series typically 72% at full load. MRS & DRS series typically 67% at full load.
AMBIENT TEMPERATURE: Operating: —20°C to +50°C. Storage: —40°C to +85°C.
TEMPERATURE STABILITY: Frequency: Max. 0.05%/degree C. Voltage: MRS & DRS Series max. 0.01%/degree C. MNS Series max. 0.03%/degree C.
PROTECTIVE CIRCUITS: 50 & 100 VA models have input and output fuses. Input fuse will blow on application of input polarity reversal. 500 to 2000VA models have circuit breaker protection against overload, shorted output, DC overvoltage and overtemperature. Protection is also provided for DC polarity reversal.
COOLING: CML Inverters require no auxiliary cooling. There is no need to provide special base plate heat sinks. Units rated at 500 to 2000VA include quiet built-in fan.
HOUSING: Two part modular housings with heat radiating finish.
MOUNTING: Tapped inserts are provided for base mount.
INPUT-OUTPUT TERMINATION: 50 & 100VA models have quick disconnect on top surface. Mating connector is furnished with inverter (dimensions listed do not include connector). 500 to 2000VA units have terminals accessible via removable top cover plate.

CUSTOM REQUIREMENTS

Modified or custom supplies which embody many techniques incorporated in the fine catalog units described above are also available on a relatively short term delivery basis. We invite your inquiries regarding **completely militarized** power supplies and those requiring special frequency/voltage configurations, as well as those requiring minimum size and weight.

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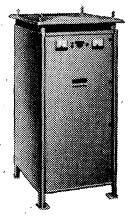
CHRISTIE SINCE 1929®

GENERAL PURPOSE HIGH CURRENT D-C POWER SUPPLIES

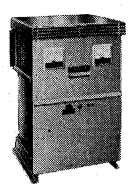
Send for "AC" Bulletin

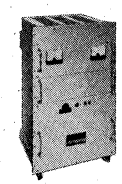
MAGAMP "K & KK" SERIES, 3-PHASE

- 0.25% Static Reg.
- 1% rms Ripple
- 50 msec Response Time
- 6 v Dynamic Reg. NL ⇕ FL



VOLTS	AMPS	MODEL
5½-8	0-50	MH8-50K2S
	-100	-100K2S
	-200	-200K2S
	-300	-300K2S
11-16	0-50	MH16-50K2S
	-100	-100K2S
	-200	-200K2S
	-300	-300K2S
22-32	0-50	MH32-50K2S
	-100	-100K24S
	-200	-200K24S
	-300	-300K24S
15-36	0-50	MH36-50KK2S
	-100	-100KK2S
	-200	-200KK2S
	-400	IC36-400KK4S
26-36	0-400	IC36-400K4S
	-500	-500K4S
	-600	-600K4S
	-800	2C36-800K4S
	-1000	-1000K4S
	-1200	-1200K4S
26-32	0-1500	2C32-1500K4S
44-64	0-100	MH64-100K2S
	-200	IC64-200K4S
	-300	-300K4S
110-135	0-40	MH135-40K2S
	-60	-60K2S
	-100	IC135-100K4S
	-200	-200K4S
	-300	2C135-300K4S
220-280	0-100	2C280-100K4S





SCR "SCO" SERIES, 1-PHASE

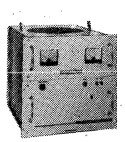
- 0.25% Static Reg.
- 1% rms Ripple
- 25 msec Response Time
- 5 v Dynamic Reg. NL ⇕ FL



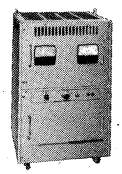
2-15	0-100	SCO15-100-12S
2-37	-50	SCO36-50-12S
2-48	-40	SCO48-40-12S

SCR "E" SERIES, 3-PHASE

- 0.1% Voltage Reg.
- 30 mv rms Ripple
- 1% Current Reg.
- 3 v Dynamic Reg. NL ⇕ FL



0-40	0-150	IRO40-150E24S
	-300	2RO40-300E24S
	-600	ICO40-600E24S
0-135	0-150	2CO135-150E4S
	-300	2CO135-300E4S



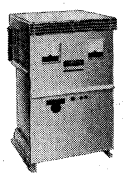
TRANSISTOR "KKGG" SERIES, 3-PHASE

- 0.01% Static Reg.
- 1 mv rms Ripple
- 50 microsec Response Time
- 0.5 v Dynamic Reg. NL ⇕ FL

VOLTS	AMPS	MODEL
15-36	0-50	MH36-50KKGG24L
	-100	-100KKGG24L
	-200	-200KKGG24L
26-36	0-400	2C36-400KGG24S
	-600	-600KGG24S

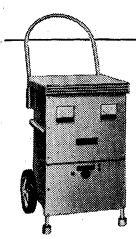
SEMI-REGULATED SERIES, 3-PHASE

- "R & T" Load Regulated Only
- 1% rms Ripple
- "A" Unregulated





0-30	0-100	MH28-100AN2S
	-200	-200AN2S
	-600	IC28-600AN2S
0-56	0-50	MH56-50AN2S
28/14	0-100/200	MH28-100DT2S
28	0-100	MH28-100A2S
	-100	-100R2S
	-200	-200A2S
	-200	-200R2S
	-300	-300R2S
	-400	-400R2S
	-600	-600R2S
	-1000	A28-1000T4S
120	0-20	MH120-20A2S
	-40	-40A2S
	-60	-60A2S
	-80	-80A2S
	-125	-125A2S
	-200	H120-200A4S
	-400	IC120-400A4S
120/240	0-200	IC240-200A4S

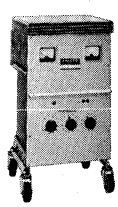


AIRCRAFT STARTING "RA" SERIES

Send for "RA" Bulletin

- 2% Static Reg.
- 1% rms Ripple
- 600% Intermittent Current Rating
- Mobile

12/24	0-50	QRA24-50
28	0-100	MH28-100RA2M
	-200	-200RA2M
	-300	-300RA2M
	-400	-400RA2M
	-600	-600RA2M
	-1000	-1000TJA2M



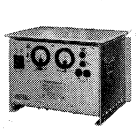
UNREGULATED LOW VOLTAGE SERIES, 3-PHASE

- Unregulated
- 6% rms Ripple

2-14/1-7	0-100/200	MH6-200PD2S
	-150/300	-300PD2S
	-200/400	-400PD2S
	-250/500	-500PD2S
	-300/600	-600PD2S
	-375/750	-750PD2S
	-500/1000	H6-1000PD2S
	-600/1200	-1200PD2S
	-750/1500	-1500PD2S
4-28/2-14	0-100/200	MH12-200PD2S

All specifications are typical only

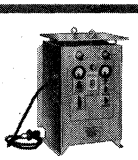
Typical Special Army, Navy, Air Force, A.E.C. and NASA Units



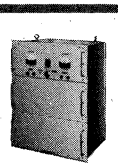
30 AMP AUTOMATIC BATTERY CHARGER



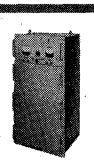
50 AMP RADIO POWER



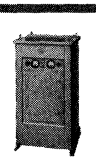
75 AMP MISSILE TESTING SUPPLY



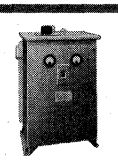
250 AMP MISSILE GROUND POWER



500 AMP MISSILE GROUND POWER



HELICOPTER STARTING POWER SUPPLY



175 AMP FORKLIFT TRUCK CHARGER

CHRISTIE SINCE 1929® **CHRISTIE ELECTRIC CORP.**

D.C. POWER SUPPLIES
BATTERY CHARGERS & TESTERS
ELECTRO-OPTICAL SYSTEMS

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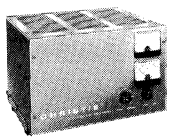
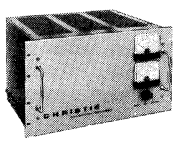
AUTOMATIC BATTERY CHARGERS

LEAD-ACID • NICKEL-CADMIUM • SILVER-ZINC

Send for "BC" Bulletin

- Emergency Standby Float Service
- 0.5% & 1% Voltage Regulation
- General Purpose Chargers and Battery Eliminators





NOM. D-C VOLTS	RATED D-C AMPS	BASIC MODEL NO.	1-PH OR 3-PH
6/12	12	BCA14-12-01-S	1-Ph
	25	BCA14-25-01-S	1-Ph
	50	BCA14-50-12-S	1-Ph
6/12/24	12	BCA30-12-01-S	1-Ph
	25	BCA30-25-01-S	1-Ph
	50	BCA30-50-12-S	1-Ph
	150	1FCB30-150-02-S	3-Ph
36/40	20	BCA40-20-01-S	1-Ph
	40	BCA40-40-12-S	1-Ph
	130	1FCB40-130-02-S	3-Ph
	150	1FCB36-150-02-S	3-Ph
48	6	BCA50-6-01-S	1-Ph
	12	BCA50-12-01-S	1-Ph
	25	BCA50-25-12-S	1-Ph
	50	FCA50-50-02-S	1-Ph
	60	1FCB50-60-02-S	3-Ph
	130	1FCB50-130-02-S	3-Ph
120	6	BCA126-6-01-S	1-Ph
	12	BCA126-12-12-S	1-Ph
	25	FCA126-25-02-S	1-Ph
	30	1FCB126-30-02-S	3-Ph
	50	1FCA126-50-02-S	1-Ph
	60	1FCB126-60-02-S	3-Ph
	100	1FCB126-100-02-S	3-Ph

BATTERY TESTER

NICKEL-CADMIUM

Send for Tester Bulletin



- Available with Companion Charger
- Also for Lead-Acid Batteries
- Fully Automatic
- 12 & 24 Volts
- 3 to 100 Ampere-hours

Determines whether a given battery is capable of delivering all or most of its rated capacity. Designed to operate with companion charger to provide fully automatic charger-tester system.

TESTER MODEL	BATTERY VOLTS	TEST AMPS	COMPANION 115 V., 1-PH., 60 Hz CHARGER MODEL	COMPANION 220 V., 1-PH., 50 Hz CHARGER MODEL
TN1224AA	12/24	5/25	BCA30-25-01AADU-S	BCA30-25-02AADUZ-S
TN12AA	12	45	BCA14-50-12AAU-S	BCA14-50-02AAUZ-S



BF LAMPHOUSE

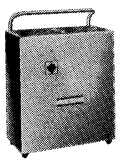
CHRISTIE SINCE 1929

XENOLITE®

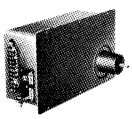
- LAMPHOUSES
- OPTICS
- POWER SUPPLIES
- IGNITERS
- LAMPS
- PROJECTORS

Send for XENOLITE Bulletins

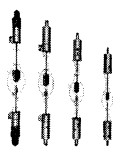
XENON AND MERCURY ARC LAMP SYSTEMS



XM POWER SUPPLY



IGA IGNITER

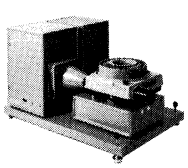


XENON LAMPS

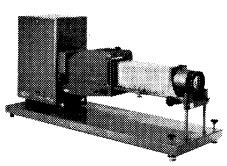
LAMP				IGNITER	LAMPHOUSE incl. Igniter			POWER SUPPLY		
NOM. WATTS	TYPE*	STD.	OZONE-FREE	MANUAL/ AUTOMATIC IGNITION	UF (ADJ. FOCUS)	BF (BRIGHT FIELD)	BSF (EXTRA BRIGHT)	CLASS I (REGULATED)	CLASS II	CLASS III (MOST ECONOMICAL)
150	X	CXL-155	—	IGM-2***	UF5	BF5	—	SCX1200-12	BXM450-1	—
200	H	CSH-200D	—	IGM-2***	UF2J-B2	—	—	—	—	Inside Lamphouse
300	X	CXL-305	—	IGA-7	UF5	BF5	—	SCX1200-12	BXM450-1	—
450	X	CXL-451	CXL-451-0	IGA-7	UF5	BF5	—	SCX1200-12**	BXM450-1	XM450-1
500	H	CSH-500D	—	IGA-7	UF5J	BF5J	—	SCX1200-12J	BXM500B-1	—
900	X	CXL-900	CXL-900-0	IGA-7	UF10	BF10	—	SCX1200-12**	—	XM900-1
1000	XH	—	—	IGA-7	UF10	BF10	—	SCX1200-12	—	—
1600	X	CXL-1600	CXL-1600-0	IGA-7	UF16	BF16	BSF30	1FX1600-02S	—	XM1600-2S
2000	X	CXL-2000K	—	IGA-7	UF16	BF16	BSF30	1FX1600-02S	—	XM1600-2NS
2500	XH	—	—	IGA-20	UF30J	BF30J	BSF30J	1FX2500B-02S	—	—
3000	X	CXL-3000K	—	IGA-20	UF30	BF30	BSF30	1FX2500-02S	—	1FXM2500-2S
4200	X	CXL-4200K	—	IGA-20	—	—	BSF50	2FX6500-02S	—	3FXM6500-2S
5000	XH	—	—	IGA-20	—	—	BSF50	2FX6500B-02S	—	—
6500	X	—	—	IGA-20	—	—	—	2FX6500-02S	—	3FXM6500-2S
12000	X	—	—	IGA-35	—	—	—	CX12000-24S	—	—
25000	X	—	—	IGA-60	—	—	—	CX25000-4S	—	—

X = Xenon XH = Xenon Mercury H = Mercury **or SCX1000-12 ***Manual ignition only.

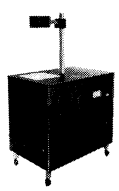
XENON ILLUMINATED PROJECTORS UP TO 6 TIMES BRIGHTER FOR FRONT OR REAR PROJECTION



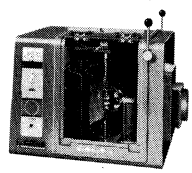
XENOLITE with 35mm & 2"x2" SLIDE PROJECTOR



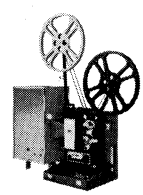
XENOLITE with 3¼"x4" SLIDE PROJECTOR



XENOLITE OVERHEAD PROJECTOR



XENOLITE for 35 & 70mm MOVIE PROJECTORS



XENOLITE with 16mm MOVIE PROJECTOR

CHRISTIE SINCE 1929

CHRISTIE ELECTRIC CORP.

D.C. POWER SUPPLIES
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ELECTRO-OPTICAL SYSTEMS

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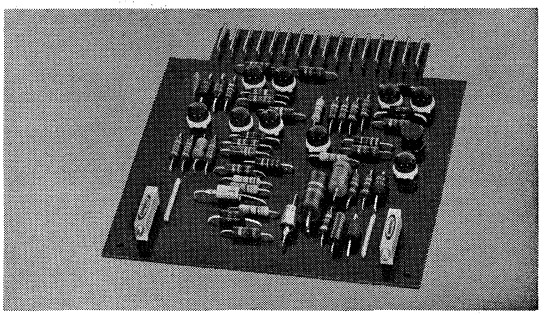
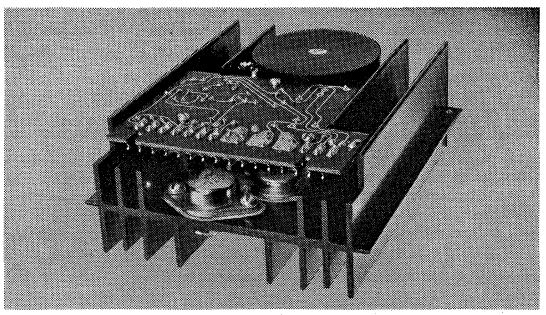
SYSTEM POWER SUPPLIES



Omnimod Control Amplifier



Omnimod Power Control Module

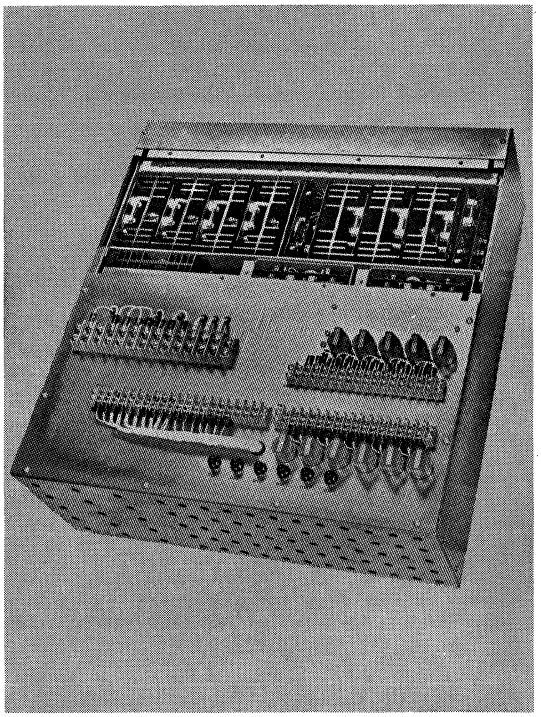
Build your own Custom Power Supplies

. . . as easy as 1, 2, 3 . . .

To design your own custom power supply using Contemporary Electronics components, simply:

1. Design one input power converter to change unregulated line ac power to unregulated dc power. We can supply power transformers, filter chokes and other items or they can be purchased from another source.
2. Select the proper number of the right dc to dc regulator module types for each output.
3. Package these modules with the correct output filter components in the space available.

Write for Application Note #600 which will help you design a successful custom power supply with our dc to dc regulator modules. Contemporary Electronics' engineers are available to help you develop the best design for your need.



Custom System Power Supplies Designed and Produced to your Specification

. . . using Contemporary Electronics' award winning OMNIMOD concept.

Our application engineers will help you to develop a specification that will assure delivery of a custom power supply adequate for your need, at lowest cost.

Contemporary Electronics will design a power supply and produce it to meet this specification.

Designs will utilize available OMNIMOD modules wherever possible to provide plug-in interchangeability of most components, add-on capability and the high efficiency, ruggedness and small size of the OMNIMOD switching technique.

Write for Data Sheet #101 describing the OMNIMOD concept

CONTEMPORARY ELECTRONICS

EXTRA SERVICE TO THE DATA PROCESSING INDUSTRY

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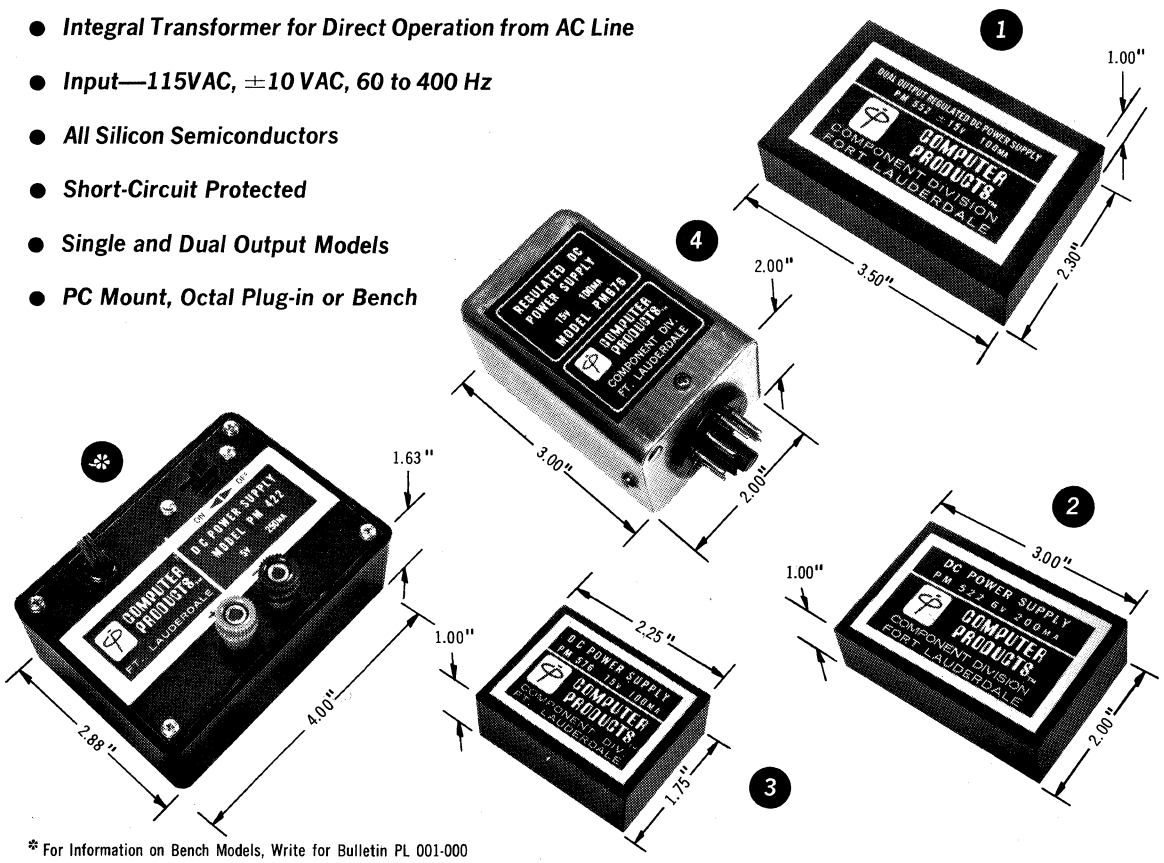
SMALL—LOW COST—REGULATED DC POWER MODULES

- *Integral Transformer for Direct Operation from AC Line*
- *Input—115VAC, ±10 VAC, 60 to 400 Hz*
- *All Silicon Semiconductors*
- *Short-Circuit Protected*
- *Single and Dual Output Models*
- *PC Mount, Octal Plug-in or Bench*



* For Information on Bench Models, Write for Bulletin PL 001-000

Output Voltage	Output Current	Regulation		Temperature Coefficient	Noise and Ripple (RMS)	Output Impedance @ 10KHz	Printed Circuit Mount				Octal Plug-In			
		Line ± 10VAC	Load NL-FL				Model Number	Unit Price		Fig.	Model Number	Unit Price		Fig.
								Single	100			Single	100	
3.6V	250MA	±0.05%	±0.05%	0.05%/°C	0.5MV	0.2 ohms	PM544	$36.15	$28.05	2	PM644	$40.75	$31.25	4
5V	250MA	±0.05%	±0.05%	0.05%/°C	0.5MV	0.2 ohms	PM529	36.15	28.05	2	PM629	40.75	31.25	4
6V	200MA	±0.05%	±0.05%	0.05%/°C	0.5MV	0.2 ohms	PM522	36.15	28.05	2	PM622	40.75	31.25	4
10V	120MA	±0.02%	±0.02%	0.02%/°C	0.5MV	0.2 ohms	PM587	24.95	17.95	3	PM687	29.95	21.20	4
12V	100MA	±0.02%	±0.02%	0.02%/°C	0.5MV	0.2 ohms	PM563	24.95	17.95	3	PM663	29.95	21.20	4
15V	100MA	±0.02%	±0.02%	0.02%/°C	0.5MV	0.2 ohms	PM576	24.95	17.95	3	PM676	29.95	21.20	4
Dual 15V	100MA	±0.02%	±0.02%	0.02%/°C	0.5MV	0.2 ohms	PM552	42.95	33.95	1	PM652	64.90	47.40	4
18V	65MA	±0.02%	±0.02%	0.02%/°C	1.0MV	0.2 ohms	PM560	24.95	17.95	3	PM660	29.95	21.20	4
20V	60MA	±0.02%	±0.02%	0.02%/°C	1.0MV	0.2 ohms	PM574	27.95	20.70	3	PM674	32.95	24.30	4
Dual 20V	60MA	±0.02%	±0.02%	0.02%/°C	1.0MV	0.2 ohms	PM548	55.90	41.40	1	PM648	70.90	53.60	4
22V	55MA	±0.02%	±0.02%	0.02%/°C	1.0MV	0.2 ohms	PM556	27.95	20.70	3	PM656	32.95	24.30	4
24V	50MA	±0.02%	±0.02%	0.02%/°C	1.0MV	0.2 ohms	PM585	27.95	20.70	3	PM685	32.95	24.30	4
28V	40MA	±0.02%	±0.02%	0.02%/°C	1.0MV	0.2 ohms	PM562	27.95	20.70	3	PM662	32.95	24.30	4
170V	10MA	±0.05%	±0.05%	0.05%/°C	15MV	5 ohms	PM538	36.15	28.05	2	PM638	40.75	31.25	4
180V	10MA	±0.05%	±0.05%	0.05%/°C	15MV	5 ohms	PM539	36.15	28.05	2	PM639	$40.75	$31.25	4
5V	3AMP	±0.05%	±0.05%	0.05%/°C	1.0MV	0.1 ohms	PM728	$98.80	$76.10	← SEE BULLETIN PL 001-728				

COMPUTER PRODUCTS™
2801 East Oakland Park Blvd.
Fort Lauderdale, Florida 33306
Telephone (305) 565-9565

Shipment Within Three Days ARO

POWER SUPPLIES

CONTROL CIRCUITS, INC., 66 TUTTLE RD., MIDDLETOWN, CONN., PHONE (203) 347-7223

AC - DC MODULAR SUPPLIES:

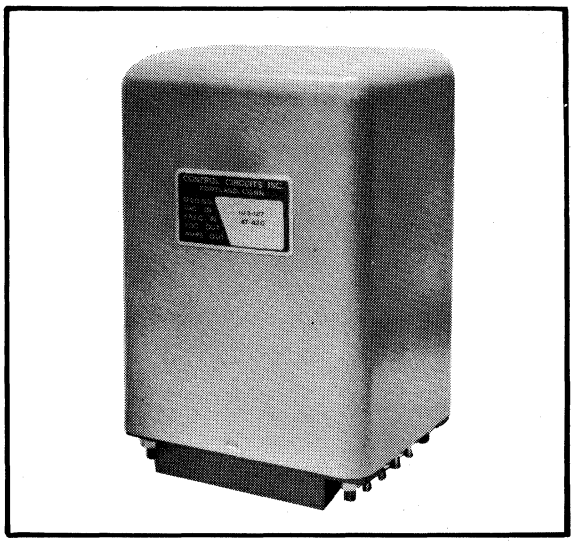
Single, Dual, and Multi-Outputs

FEATURES:

Industrial, Computer, Ground Support Models
Fully Repairable — removable case
Instant Short Circuit Protection
Rugged Design — all units meet highest MIL-Shock and vibration tests

SPECIFICATION RANGES:

Output Voltage ..... 4.5 VDC - 1,000 VDC
Output Current ..... 0-30 Amps
Regulation ..... .5% - .05% - .02%
Base Temperature ..... 75°C to 115°C



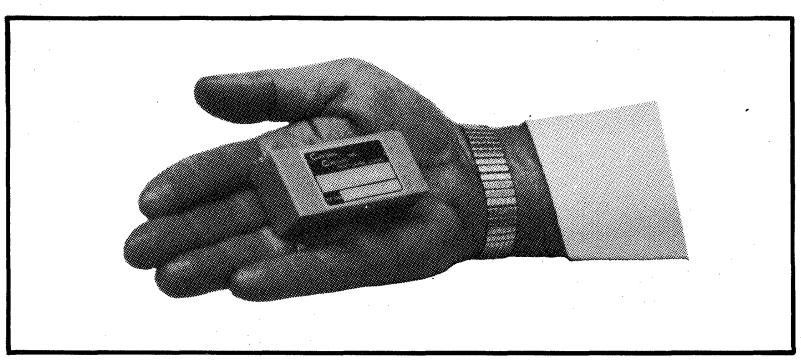
FULL MILITARY SPECIFIATION LINE DESIGNED TO COMPLY WITH:

MIL-T-27A	Transformers
MIL-Std-701, MIL-S-19500	Semiconductors
MIL-C-3965	Capacitors
MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200	Workmanship and Environmental

CERTIFIED TEST DATA ON MILITARY COMPLIANCE

CUSTOM - SPECIALS

- Integrated Circuit Types
- Open Frame
- Micro-Miniature Versions
- Commercial Types



CONTROL CIRCUITS, INC.

66 TUTTLE ROAD, MIDDLETOWN, CONNECTICUT, PHONE (203) 347-7223

POWER SUPPLIES

CONTROL CIRCUITS, INC., 66 TUTTLE RD., MIDDLETOWN, CONN., PHONE (203) 347-7223

DC to DC CONVERTERS — MODULAR

FEATURES:

Rugged Design

Spike Protection

SPECIFICATION RANGES:

Input Voltage ..... 24 VDC - 30 VDC

Output Voltage ..... 5.0 VDC - 5,000 VDC

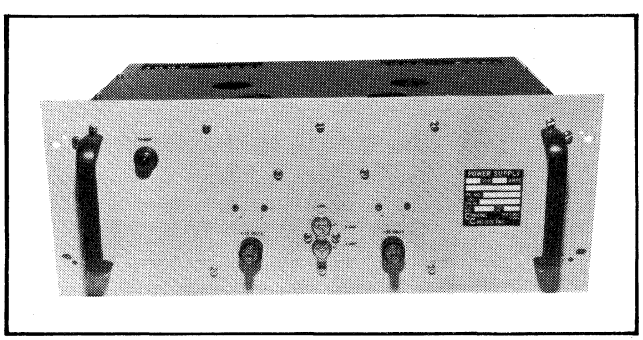
Base Temperature ..... 75°C to 115°C

FULL MILITARY VERSION AVAILABLE



RACK MOUNTS —

AC to DC — MODULAR — OPEN FRAME



FEATURES:

Overvoltage Protection

Close Tracking

Full Metering

Fused and Short Circuit Protection

Full Military Version Available

SPECIFICATION RANGES:

Output Voltage ..... 1.5 VDC to 2,000 VDC

Output Current ..... 0 to 50 Amps

Operating Temperature ..... 75°C to 115°C

CONTROL CIRCUITS, INC.
66 TUTTLE ROAD, MIDDLETOWN, CONNECTICUT, PHONE (203) 347-7223

HIGH VOLTAGE EQUIPMENT

HIGHLY REGULATED ADJUSTABLE HIGH VOLTAGE MODULES SERIES "HRM"



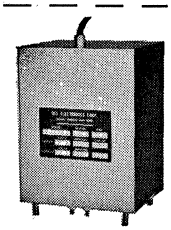
SPECIFICATIONS

Input: 115V ±10% 60 cps
Output: Regulation for 10% line change .03% max. Regulation for NL to FL .03% max
Ripple: .03% RMS max
Temp. Range: −54°C to +65°C operating
Temp. Coefficient: 0.02%/°C

- No voltage overshoot
- Adjustable output
- Short circuit proof (no fuses)
- Meet environmental and transient requirements of MIL-E-16400

Model No. Pos. Output	Model No. Neg. Output	Output Voltage	Max. Current	Dimensions Inches	Net Wt. (Lbs.)
.6HRM5P1	.6HRM5N1	300-600V	5MA	4⅜ x 3⅜ x 4¾	7
1.2HRM5P1	1.2HRM5N1	600-1.2KV	5MA	4⅜ x 3¾ x 4¾	7½
1.7HRM5P1	1.7HRM5N1	900-1.7KV	5MA	4⅜ x 3¾ x 4¾	9
2.5HRM4P1	2.5HRM4N1	1.3-2.5KV	4MA	4⅜ x 3¾ x 4¾	9
3.5HRM3P1	3.5HRM3N1	1.7-3.5KV	3MA	4⅜ x 3¾ x 4¾	9
5HRM2P1	5HRM2N1	2.5-5.0KV	2MA	4 1/16 x 4 x 4 15/16	10
7HRM1.5P1	7HRM1.5N1	3.5-7.0KV	1.5MA	4 1/16 x 4 x 4 15/16	10
10HRM1P1	10HRM1N1	5.0-10KV	1MA	5½ x 4½ x 6	15
15HRM1.5P1	15HRM1.5N1	7.5-15KV	1.5MA	5½ x 4½ x 6	15
20HRM1P1	20HRM1N1	10-20KV	1MA	7¼ x 4 5/16 x 8	20
25HRM2P1	25HRM2N1	12-25KV	2MA	7¼ x 4 5/16 x 8	20
30HRM.75P1	30HRM.75N1	15-30KV	0.75MA	9¼ x 5½ x 9 5/8	35
40HRM.5P1	40HRM.5N1	20-40KV	0.5MA	8¼ x 5 5/16 x 7 7/8	37
50HRM.5P1	50HRM.5N1	25-50KV	0.5MA	8¼ x 8¼ x 8	42
				10 x 8 x 10	60

REGULATED MODULES TRANSISTORIZED SERIES "TRHV"

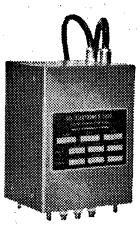


The TRHV series of regulated power supplies are all solid state units. Reference and regulating circuitry is accomplished at low voltage. The units are completely self-contained and require only 115 Volt AC 60/400 cycle excitation to be operative. These supplies are rugged and feature good line, load and thermal stability. The operating temperature range is −20°C to +55°C. Regulation better than 0.25% for 10% line change & NL to FL. Ripple 0.5% RMS at max current.

Model No. Positive Output	Model No. Negative Output	Voltage Output	Max. Current	Dimensions (Inches)	Net Weight (Lbs.)
1RP5-1	1RN5-1	1 KV	5 MA	4¼x3¾x5½	8½
2.5RP4-1	2.5RN4-1	2.5 KV	4 MA	4¼x3¾x5½	8½
5RP2-1	5RN2-1	5 KV	2 MA	4¼x3¾x5½	8½
7.5RP1.5-1	7.5RN1.5-1	7.5 KV	1.5 MA	4¾x4x6	10
10RP1-1	10RN1-1	10 KV	1 MA	4¾x4x6	10½
10RP2-1	10RN2-1	10 KV	2 MA	6¾x4¼x7½	18½
15RP1.5-1	15RN1.5-1	15 KV	1.5 MA	6¾x4¼x7½	18
20RP1-1	20RN1-1	20 KV	1 MA	7¼x4¼x7½	19

UNREGULATED MODULES COMPACT HIGH VOLTAGE

SERIES "S"



These power supplies are designed for operation from either a 0-115 volt or 0-125 volt line at 60/400 cycles. Three input terminals are provided to permit proper line connection. The output is available from shielded polyethylene cables and may be varied over the full range by varying the input AC line. The two output cables are insulated for the full output voltage, so that either the positive or negative terminal may be grounded.* All units have selenium rectifiers and are hermetically sealed in an epoxy, vacuum filled, metal case.

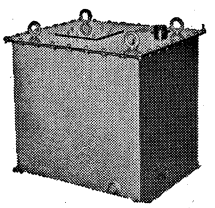
Units for 50 cycle operation at various line voltages are available on request.

*Model 40-2-4 is designed with one output cable for single polarity operation. When ordering, please specify polarity.

Model No.	Max. Output Voltage	Max. Rated Current	*Ripple at Full Load %RMS/MA at 60 CPS	Dimensions (Inches)	Net Weight (Lbs.)
2.5-2-6	0-2.5 KV	2 MA	0.25	3 x 2⅝ x 4¼	3¼
5-2-4	0-5.0 KV	2 MA	0.25	3 x 3½ x 3⅞	4¼
10-1-12	0-10 KV	1.25 MA	0.30	3 x 3½ x 4⅞	5½
15-1-8	0-15 KV	1.25 MA	0.25	4¼ x 5 x 5¾	11½
20-1-4	0-20 KV	1.25 MA	0.25	4¼ x 5⅛ x 6¾	14
25-1-3	0-25 KV	1.25 MA	0.30	4¾ x 6 x 7¼	20¼
30-1-5	0-30 KV	1.25 MA	0.20	5 x 6½ x 8	24½
40-1-1	0-40 KV	1 MA	0.25	6¼ x 8¼ x 7	26
40-2-4	0-40 KV	2 MA	0.30	6¼ x 8¼ x 7	30
50-1-5	0-50 KV	1 MA	0.25	9⅞ x 7¾ x 9⅜	52
60-1.5-1	0-60 KV	1.5 MA	0.35	12¼x9¼x11¼	87
1-5-2	1 KV	5 MA	.20	3 x 2¾ x 4¼	3½
2.5-5-3	2.5 KV	5 MA	.20	3½ x 3 x 5	5
5-5-4	5 KV	5 MA	.25	4 x 3⅜ x 5¼	7½
7.5-5-1	7.5 KV	5 MA	.20	4⅜ x 3¾ x 5½	8½
10-5-1	10 KV	5 MA	.25	4⅜ x 3¾ x 5½	10
15-5-1	15 KV	5 MA	.30	5¾ x 5 x 6¾	19½
20-5-3	20 KV	5 MA	.25	6⅛ x 6⅛ x 6½	21
25-5-1	25 KV	5 MA	.25	6¾ x 6¼ x 7¼	27¼
30-5-8	30 KV	5 MA	.30	7¼ x 6½ x 7¾	38
1-10-1	1 KV	10 MA	.10	3½ x 3 x 5	5
2.5-10-1	2.5 KV	10 MA	.10	4 x 3⅜ x 5¼	6½
5-10-2	5 KV	10 MA	.12	4⅜ x 3¾ x 5½	9
7.5-10-1	7.5 KV	10 MA	.10	4¾ x 4 x 7¼	13½
10-10-3	10 KV	10 MA	.10	5 x 4⅜ x 6¾	14½
15-10-2	15 KV	10 MA	.15	6⅛ x 6⅛ x 6½	22½
20-10-3	20 KV	10 MA	.15	6¾ x 6¼ x 7¼	27½
25-10-2	25 KV	10 MA	.10	7½ x 6½ x 8½	38
30-10-3	30 KV	10 MA	.15	8 x 7¾ x 8¾	50

*Ripple at 400 cycles is 15% of ripple at 60 cycles, shown above.

SERIES "O" OIL INSULATED TANK UNITS



DEL SERIES "O", oil insulated, High Voltage Power Supplies offers one of the most comprehensive lines of basic high voltage units available to industry and laboratories. These D.C. supplies are designed to provide long, reliable service in such applications as dielectric testing, capacitor chargers, electrostatic precipitators, electron microscopes, image intensifiers, plasma research and accelerators. Series "O" supplies feature reversible polarity on most units, shielded polyethylene output cables, high quality insulating oil in dust free tank, quiet, long life operation with low corona.

STANDARD MODELS

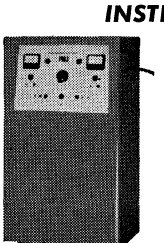
Model No.	Output Voltage (kv)	Output Current (ma)	Model No.	Output Voltage (kv)	Output Current (ma)	Model No.	Output Voltage (kv)	Output Current (ma)
PSO20-200-3	20	200	PSO50-50-8	50	50	PSO100-300-1	100	300
PSO20-300-2	20	300	PSO50-75-1	50	75	PSO100-500-1	100	500
PSO25-50-2	25	50	PSO50-100-4	50	100	PSO120-5-3	120	5
PSO25-200-11	25	200	PSO50-200-5	50	200	PSO120-10-1	120	10
PSO25-400-1	25	400	PSO50-220-2	50	220	PSO120-30-1	120	30
PSO25-500-6	25	500	PSO50-300-1	50	300	PSO130-2-3	130	2
PSO30-3-2	30	3	PSO50-500-3	50	500	PSO150-5-5	150	5
PSO30-5-4	30	5	PSO60-1-1A†	60	1	PSO150-10-1	150	10
PSO30-5-16	30	5	PSO60-5-2	60	5	PSO150-20-1	150	20
PSO30-20-9	30	20	PSO60-10-1	60	10	PSO150-50-3	150	50
PSO30-30-5	30	30	PSO60-100-2	60	100	PSO150-100-1	150	100
PSO30-75-1	30	75	PSO70-5-1	70	5	PSO150-150-1	150	150
PSO30-150-4	30	150	PSO70-5-3	70	5	PSO150-200-1	150	200
PSO30-200-2	30	200	PSO75-30-1	75	30	PSO150-300-1	150	300
PSO30-500-1	30	500	PSO75-60-1	75	60	PSO160-2-1	160	2
PSO40-5-6	40	5	PSO80-5-1	80	5	PSO200-10-1	200	10
PSO40-10-4	40	10	PSO80-5-4	80	5	PSO200-150-1	200	150
PSO40-20-1	40	20	PSO80-10-1B	80	10	PSO200-250-1	200	250
PSO40-220-1	40	220	PSO80-60-1	80	60	PSO250-1-2	250	1
PSO50-1-2†	50	1	PSO100-2-1	100	2	PSO250-3-2	250	3
PSO50-5-6	50	5	PSO100-30-6	100	30	PSO250-10-2	250	10
PSO50-5-9	50	5	PSO100-50-1	100	50	PSO300-10-1	300	10
PSO50-10-2	50	10	PSO100-100-1	100	100	PSO300-50-2	300	50
PSO50-20-2	50	20	PSO100-150-1	100	150			
PSO50-30-4	50	30	PSO100-200-3	100	200			

† Polarity — All units feature reversible polarity except Models PSO 40-2-3, PSO 50-1-2, and PSO 60-1-1A which supply positive outputs only.

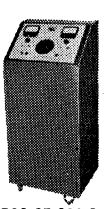
NOTE: Larger units are shipped without oil to reduce transportation costs. See notations on price list.

COMPLETE LINE OF CONTROL PANELS AND REGULATED CONTROLS AVAILABLE FOR ALL SERIES "O" POWER SUPPLIES.

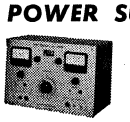
INSTRUMENTED POWER SUPPLIES



PSC 120-5-2



PSC 25-200-2



PSC 30-5-1

DEL Series "PSC" Instrumented, High Voltage Power Supplies provides a broad selection of units designed for reliable and dependable use in research and industry.

All units: Input 115V, 60 cps unless noted otherwise.
All units up to 20KV are air insulated and utilize epoxy components.
All other units have high voltage section immersed in high grade insulating oil to insure freedom from electrical noise.

STANDARD MODELS

Model No.	Output Voltage Range (kv)	Max. Output Current (ma)	Model No.	Output Voltage Range (kv)	Max. Output Current (ma)	Model No.	Output Voltage Range (kv)	Max. Output Current (ma)
PSC.5-1000-1	0-0.5	1000	PSC20-25-1	0-20	25	PSC80-10-1B	0-80	10
PSC1-150-1	0-1 5	150	PSC20-150-1	0-20	150	PSC100-30-2	0-100	30
PSC1-5000-1	0-1	5000	PSC20-300-1	0-20	300	PSC100-50-1	0-100	50
PSC2-100-1	0-2	100	PSC25-200-2	0-25	200	PSC100-100-1	0-100	100
PSC2.5-750-1	0-2.5	750	PSC25-400-1	0-25	400	PSC120-5-2A	0-120	5
PSC2.5-1000-1	0-2.5	1000	PSC30-5-1	0-30	5	PSC120-10-1	0-120	10
PSC2.5-2000-1	0-2.5	2000		0-35	1	PSC120-30-1	0-120	30
PSC5-50-1	0-5	50	PSC30-5-7	0-30	5	PSC150-5-1	0-150	5
PSC5-500-1	0-5	500	PSC30-75-1	0-30	75	PSC150-10-1	0-150	10
PSC5-1000-3	0-5	1000	PSC30-150-1	0-30	150	PSC150-20-1	0-150	20
PSC10-10-8	0-10	10	PSC30-200-1	0-30	200	PSC150-50-1	0-150	50
PSC10-250-1	0-10	250	PSC50-30-3	0-50	30	PSC200-10-1	0-200	10
PSC10-500-10	0-10	500	PSC50-50-1	0-50	50	PSC250-1-1A	0-250	1
PSC10-750-1	0-10	750	PSC50-75-3	0-50	75	PSC250-3-1	0-250	3
PSC15-10-1	0-15	10	PSC50-100-2	0-50	100	PSC250-10-1	0-250	10
PSC15-200-1	0-15	200	PSC50-200-3	0-50	200	PSC300-10-1	0-300	10
PSC15-300-1	0-15	300	PSC75-30-1	0-75	30			
PSC20-10-1	0-20	10	PSC75-60-1	0-75	60			

NOTE: Some units are shipped without oil to reduce transportation charges. See notations on price lists.

Standard Power Supplies and Transformers are available from stock. Others can be built to your specific requirements with output up to 350 KV and 250 KVA.

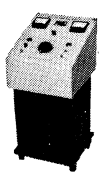
SEND FOR NEW COMPLETE CATALOG COVERING ALL HIGH VOLTAGE EQUIPMENT.

HIGH VOLTAGE EQUIPMENT

RACK MOUNT POWER SUPPLIES
"RHPT" SERIES HIGH POT TESTER

The Del RHPT series of rack mounted Hi Pot Testers are general-purpose power supplies which are fully instrumented, completely enclosed, and fully protected. These units are designed for standard 19-inch racks and have light gray panels. They are recommended for all cmmercial, industrial, and laboratory uses where reliable dc high-voltage sources are required.

Model No.	Output Voltage Range (kv)	Max. Current (ma)	Model No.	Output Voltage Range (kv)	Max. Current (ma)
1RHPT-5-1	0-1	5	10RHPT-1.25-1	0-10	1.25
1RHPT-10-1	0-1	10	10RHPT-5-1	0-10	5
1RHPT-25-1	0-1	25	10RHPT-10-1	0-10	10
1RHPT-50-1	0-1	50	10RHPT-25-1	0-10	25
1RHPT-100-1	0-1	100	10RHPT-50-1	0-10	50
1RHPT-500-1	0-1	500	10RHPT-100-1	0-10	100
1RHPT-1000-1	0-1	1000	10RHPT-150-1	0-10	150
1RHPT-1500-1	0-1	1500	15RHPT-1.25-1	0-15	1.25
2.5RHPT-2-1	0-2.5	2	15RHPT-5-1	0-15	5
2.5RHPT-5-1	0-2.5	5	15RHPT-10-1	0-15	10
2.5RHPT-10-1	0-2.5	10	15RHPT-25-1	0-15	25
2.5RHPT-25-1	0-2.5	25	15RHPT-50-1	0-15	50
2.5RHPT-50-1	0-2.5	50	15RHPT-75-1	0-15	75
2.5RHPT-100-1	0-2.5	100	20RHPT-1.25-1	0-20	1.25
2.5RHPT-200-1	0-2.5	200	20RHPT-5-1	0-20	5
2.5RHPT-400-1	0-2.5	400	20RHPT-10-1	0-20	10
2.5RHPT-600-1	0-2.5	600	20RHPT-25-1	0-20	25
5RHPT-2-1	0-5	2	20RHPT-50-1	0-20	50
5RHPT-5-1	0-5	5	20RHPT-75-1	0-20	75
5RHPT-10-1	0-5	10	25RHPT-1.25-1	0-25	1.25
5RHPT-25-1	0-5	25	25RHPT-5-1	0-25	5
5RHPT-50-1	0-5	50	25RHPT-10-1	0-25	10
5RHPT-100-1	0-5	100	25RHPT-25-1	0-25	25
5RHPT-200-1	0-5	200	30RHPT-1.25-1	0-30	1.25
5RHPT-300-1	0-5	300	30RHPT-5-1	0-30	5
7.5RHPT-5-1	0-7.5	5	30RHPT-10-1	0-30	10
7.5RHPT-10-1	0-7.5	10	30RHPT-25-1	0-30	25
7.5RHPT-25-1	0-7.5	25	40RHPT-2-1†	0-40	2
7.5RHPT-50-1	0-7.5	50	50RHPT-1-1	0-50	1
7.5RHPT-100-1	0-7.5	100	60RHPT-1-1	0-60	1



"HIGH POT" TESTERS
"TC" SERIES POWER SUPPLIES

DEL TC Series multi-purpose D.C. Power Supplies are compact, fully instrumented and fully protected units providing ratings up to 80,000 volts D.C. continuously variable.

Seleninum Rectifiers used throughout to provide long life and instantaneous operation. No filament warm up time required.

All high voltage components immersed in special high grade insulating oil. This assures LONG trouble-free LIFE.

STANDARD MODELS

Model No.	Full Load Voltage Range (kv)	Current Range (ma)	Ripple* (% rms/ma at 60 Hz)	Dimensions** Complete Unit (in., w x d x h)	Dimensions** Tank Only (in., w x d x h)
30TC-5-1	0-30	0-5	0.4		
40TC-5-1	0-40	0-5	0.5	14½ x 13½ x 25¾	14 x 13 x 16½
50TC-5-1	0-50	0-5	0.4		
60TC-5-1	0-60	0-5	0.4		
30TC-20-1	0-30	0-20	0.4		
40TC-20-1	0-40	0-20	0.4		
50TC-10-1	0-50	0-10	0.4	17 x 17 x 32	16½ x 16½ x 21½
60TC-10-1	0-60	0-10	0.4		
70TC-5-1	0-70	0-5	0.4		
80TC-5-1	0-80	0-5	0.4		

*%/ma is specified at maximum voltage and current. Percentage shown is also accurate for lower currents down to less than 15% of the maximum ma rating.

**Dimensions are nominal. Outline drawings available on request.

ALSO AVAILABLE FOR OTHER INPUT AND OUTPUT VOLTAGES

LHRM SERIES



The Del LHRM Series of High Voltage Power Supplies offer the HRM module power supply with its high regulation, low ripple, short circuit protection and other desirable features in a lab. type rack mountable supply.

Full voltage control by ten-turn potentiometer, ammeter and voltmeter, line switch, etc., make this unit essential in lab. development and testing of high voltage equipment such as high resolution CRT displays, and other applications requiring a precision high voltage power supply. It offers the great advantage in that the characteristics are identical to the HRM modules which can be then utilized in the final equipment.

FEATURES

- Short Circuit Proof
- Full Adjustable Output
- Excellent Thermal Stability
- No Voltage Overshoot on Turn On or Turn Off
- Single Shielded Output Cable
- Fast Response
- No Warm-up Required
- All Silicon Transistors
- No r.f.i., Chopper or Hhigh Frequency Oscillator
- Automatic Resetting Thermal Cutout

Enhances selection of final power supply module.
Ten Turn Potentiometer with 0.15% Linearity.

SPECIFICATIONS — ALL MODELS

INPUT: 115V ±10% 60 to 400 Hz. single phase for units up to 10 KV.
115V ±10% 60 or 400 Hz. for units 15 KV and above.

OUTPUT: See table

REGULATION:

LINE: Less than 0.03% from 50% to 100% of max. rated output voltage increasing to 0.5% at 10% of max. rated output voltage for a ±10% line votlage change.

LOAD: Same as line regulation above from no load to full load.

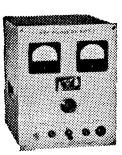
RIPPLE: Less than 0.03% rms of max. rated output voltage.

LINEARITY: Better than 0.15" with a ten turn potentiometer. Models marked (*) 0.7%.

MODEL NUMBER Pos. Output	MODEL NUMBER Neg. Output	Output Voltage KV	Output Current MA	19" Rack Panel Mount (W.x D.x H.)	(Lbs.) Approx. Wgt.
1.2LHRM5P1	1.2LHRM5N1	0-1.2	5		10
1.7LHRM5P1	1.7LHRM5N1	0-1.7	5		10
2.5LHRM4P1	2.5LHRM4N1	0-2.5	4		10
3.5LHRM3P1	3.5LHRM3N1	0-3.5	3	21¾x15¼x10½	11
5LHRM2P1	5LHRM2N1	0-5	2		11
7LHRM1.5P1	7LHRM1.5N1	0-7	1.5		18
10LHRM1P1	10LHRM1N1	0-10	1		18
12LHRM5P1*	12LHRM5N1*	0-12	5		23
15LHRM1.5P1	15LHRM1.5N1	0-15	1.5		23
15LHRM5P1*	15LHRM5N1*	0-15	5		23
20LHRM1P1	20LHRM1N1	0-20	1		23
20LHRM5P1*	20LHRM5N1*	0-20	5	21¾x15¼x12¼	23
25LHRM5P1*	25LHRM5N1*	0-25	5		23
25LHRM10P1*	25LHRM10N1*	0-25	10		23
30LHRM.75P1	30LHRM.75N1	0-30	.75		42
30LHRM5P1	30LHRM5N1*	0-30	5		47
40LHRM.5P1	40LHRM.5N1	0-30	.5	21¾x15¼x14	47
50LHRM.5P1	50LHRM.5P1	0-50	.5		66

NOTE: All Models Available with Digital Voltmeter Readout, Grounding Switches, Ripple Reducers Upon Special Request.

"HI-POT" TESTERS



Del D.C. "HI-POT" supplies are fully instrumented and fully protected units providing output voltages up to 160,000 volts D.C. Supplies are well designed to provide conservative ratings.

Thirteen models offer a wide selection to meet all applications. Portable units as well as floor type with rack mountable control panels* are available

Input 115 VAC - 60 cycle.

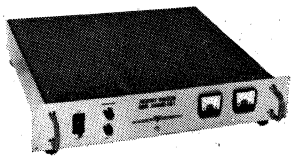
Model No.	Voltage Range Full Load	Current Range MA	Ripple at Full Load % RMS/MA	Size	Polarity
2.5 HPT-2-1	0-2,500	2	0.30	9½" x 11" x 12"	Reversible
5 HPT-2-1	0-5,000	2	0.20	9½" x 11" x 12"	Reversible
10 HPT-1-1	0-10,000	1.25	0.45	9½" x 11" x 12"	Reversible
15 HPT-1-1	0-15,000	1.25	0.30	9½" x 11" x 12"	Reversible
20 HPT-1-1	0-20,000	1.25	0.30	9½" x 11" x 12"	Reversible
20 HPT-5-1	0-20,000	5	0.50	9½" x 11" x 12"	Reversible
30 HPT-3-1	0-30,000	3	0.50	9½" x 11" x 12"	Reversible
40 HPT-1-1	0-40,000	1	0.30	9½" x 11" x 12"	Reversible
40 HPT-2-1	0-40,000	2	0.30	20" x 12" x 14"	Positive
50 HPT-1-1	0-50,000	1	0.50	20" x 12" x 14"	Positive
60 HPT-1-1	0-60,000	1	0.50	20" x 12" x 14"	Positive
*100 HPT-2-1	0-100,000	2	0.50	20¾" x 17½" x 25½" Tank Only	Reversible
*130 HPT-2-1	0-130,000	2	0.50	29¼" x 19" x 27" Tank Only	Reversible
*160 HPT-2-1	0-160,000	2	0.50	29¼" x 19" x 33½" Tank Only	Reversible

Rack Mountable Hi-Pot Testers also available from stock.

DEL ELECTRONICS CORP. MOUNT VERNON, N.Y.
250 E. Sandford Blvd. 914 - 699-2000 TWX: 710-562-0130

AUXILIARY EQUIPMENT DEL TRANSFORMERS

TRANSISTORIZED FREQUENCY CONVERTERS



ATA SERIES

The ATA Series of frequency converters is a source of stable 400 cycle power which operates directly from a standard 50 to 60 cycle line. These units feature excellent frequency characteristics, waveform purity, voltage regulation and low dynamic impedance.

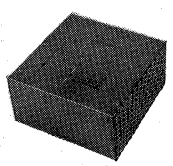
SPECIFICATIONS

INPUT VOLTAGE	105-125 VAC, 50-70 cps
OUTPUT VOLTAGE	Adj. 105-125 VAC
OUTPUT FREQ.	400 cps, adjustable, 398 to 402 cps.
DISTORTION	0.8%, Max.
POWER FACTOR	±0.7 to Unity
VOLTAGE REG.	
LOAD	Within 0.5% for no load to full load.
LINE	±0.5% for 105-125 V
METERS	Output voltage and current.
CONSTRUCTION	Designed for rack mounting.

MODEL	OUTPUT V.A.	SIZE W x D x H (in.)	TYPE
ATA 400RS-100	100	19 x 16 x 3½	Regulated
ATA 400RS-500	500	19 x 16 x 8¾	Regulated
ATA 400RS-1000	1000	19 x 16 x 14	Regulated

TRANSISTORIED DC/AC INVERTERS

DTA 60 SERIES



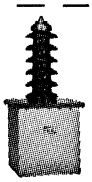
The DTA 60 Series of DC to 60 cycle AC and the DTA 400 Series of DC to 400 cycle AC inverters include regulated units, for those applications requiring precise output voltage, and unregulated units where the output voltage is not critical. All units operate from a 22 to 30 volt DC source, are capable of frequency synchronization to an external source, and are protected against overvoltage, reverse polarity, overload and over-temperature.

SPECIFICATIONS

INPUT VOLTAGE: 22-30 VDC
OUTPUT VOLTAGE: 115 VAC for regulated units; 115 VAC Nom. with ±10% taps for unregulated units.
POWER FACTOR: ±0.7 to unity.
DISTORTION: 2½% for DTA 60 Series 0.8% for DTA 400 Series.
VOLTAGE REG. LOAD: Approx. 6% for 50% load change, unregualted units. 0.5% no load to full load for regulated units.
LINE: Output proportional to input for unregulated units. 0.5% for 22 to 30 VDC for regulated units.
FREQUENCY REG. 60 SERIES: 0.5% for 22 to 30 VDC 0.5% for no load to full load.
400 SERIES: 0.2% for 22 to 30 VDC. 0.2% for no load to full load.
ISOLATION: Between input, output, gnd.
HOUSING: Modular, with heat radiating finish.
MOUNTING: Tapped inserts in base.
TERMINATIONS: Input, output, ground and synchronization signal, all available under removable access plate.

UNREGULATED MODEL	OUTPUT V.A.	SIZE W x D x H (in.)	WEIGHT LBS.	TYPE
DTA 60RS_100	100	10 x 10 x 5	25	Regulated
DTA 60RS-500	500	12 x 14 x 12	95	Regulated
DTA 60RS-1000	1000	17 x 18 x 14	180	Regulated
DTA 60RS-2500	2500	17 x 17 x 19	280	Regulated
DTA 60S-100	100	10 x 10 x 5	30	Unregulated
DTA 60S-500	500	12 x 14 x 12	85	Unregulated
DTA 60S-1000	1000	14 x 14 x 14	165	Unregulated
DTA 60S-2500	2500	17 x 17 x 19	275	Unregulated
REGULATED MODEL	**OUTPUT V.A.**	**SIZE W x D x H (in.)**	**WEIGHT LBS.**	**TYPE**
DTA 400RS-100	100	10 x 10 x 5	21	Regulated
DTA 400RS-500	500	12 x 14 x 12	65	Regulated
DTA 400RS-1000	1000	17 x 18 x 4	145	Regulated
DTA 400S-100	100	10 x 10 x 5	25	Unregulated
DTA 400S-500	500	12 x 14 x 12	75	Unregulated
DTA 400S-1000	1000	14 x 14 x 14	165	Unregulated

METER MULTIPLIERS

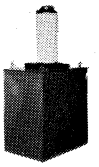


Del Electronics' line of multipliers is designed and built to provide high voltage DC measurements with safety and minimum corona at reasonable cost. Each unit consists of resistors immersed in high grade insulating oil and hermetically sealed grounded case. All units are designed for use with 100 ua full scale meter. Can be furnished with panel type 4½" rectangular 100 ua meter (2% accuracy), with KV scale to match.

Type	Maximum Kilivolts	Case Dimension (Max.) W	D	H	Insulator Height
M-5	5	2 5/16"	2 1/16"	2½"	1"
M-10	10	2 5/16"	2 1/16"	2½"	1¾"
M-15	15	2 5/16"	2 1/16"	3⅛"	1¾"
M-20	20	2¾"	2½"	4"	2½"
M-30	30	4¼"	3¾"	5½"	3"
M-50	50	4¾"	4"	8"	8⅛"
M-100	100	9½"	9½"	9½"	14"
M-150	150	11"	11"	12"	20"
M-250	250	16½"	16½"	22"	28¾"

ALSO AVAILABLE FOR OTHER INPUT AND OUTPUT VOLTAGES

ISOLATION TRANSFORMERS

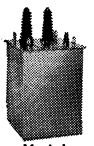


Model 2-TR-250-21

DEL ELECTRONICS' line of High Voltage Isolation Transformers are designed and manufactured for use in industry and in research and development laboratories.

These DEL High Quality Transformers have the following features:

- Complete vacuum varnish impregnation
- Immersed in high grade insulating oil
- Electrostatic shield between primary and secondary
- Good regulation



Model 3-TR-60-22

STANDARD 60 HZ TYPE ISOLATION TRANSFORMERS

Model No.	Max Kva	Kvdc Insulation	Tank Size (in., w x d x h)	Insulator Height (in.) ††
1-TR-30-XX†	1	30	10 x 12 x 11	6
1.5-TR-30-XX†	1.5	30	10 x 12 x 11	6
1-TR-50-XX†	1	50	13 x 13⅞ x 16⅜	8½
3-TR-50-XX†	3	50		
1-TR-60-XX†	1	60	9¾ x 12⅜ x 13⅜	11
2-TR-60-XX†	2	60	9¾ x 12⅜ x 13⅜	11
3-TR-60-XX†	3	60	16½ x 16½ x 21⅜	11
5-TR-60-XX†	5	60		
3-TR-75-XX†	3	75	16½ x 16½ x 22	11
1-TR-100-XX†	1	100	20¾ x 17½ x 17 3/16	14
3-TR-100-XX†	3	100		
3-TR-150-XX†	3	150	29¼ x 19 x 27	19½
5-TR-150-XX†	5	150		
2-TR-250-XX†	2	250	25 x 33 x 37 5/16	28¾
3-TR-250-XX†	3	250	29¾ x 29¾ x 36⅜	28¾
5-TR-250-XX†	5	250	25 x 33 x 37¼	28¾
4-TR-300-XX†	4	300	39½ x 47½ x 50½	35

* Dimensions are nominal. Outline drawings available on request.

† NOTE — Add the following suffix in place of XX.

FOR	SUFFIX	FOR	SUFFIX
120/120	11	240/120	21
120/240	12	240/240	22

†† If shielded polyethylene output cables are desired in place of porcelain insulator, designate by a C prefix; e.g., 1-CTR-30-XX.

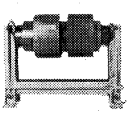
HIGH VOLTAGE ISOLATION TRANSFORMERS

OPEN TYPE CONSTRUCTION — EPOXY COATED

Primaries: 115 V, 230 V — 60 cps • Secondaries: 115 V

Type	KVA	Insulation KVDC Working	Size
AD 1640	.200	10	6⅛ x 4 x 5⅛
AD 1641	.500	10	7⅝ x 5⅞ x 7¾
AD 1642	.750	10	9½ x 6 5/16 x 8¼
AD 1643	1.000	10	8½ x 8 x 9¾
AD 1644	.200	20	8½ x 4 x 5⅝
AD 1645	.500	20	10¼ x 5⅝ x 7½
AD 1646	.750	20	9¾ x 6¾ x 8
AD 1647	1.000	20	11¼ x 6⅝ x 8¾
AD 3060	.250	30	8½ x 7¼ x 6½
AD 3061	.500	30	9¾ x 7 x 8¾
AD 3062	.750	30	10½ x 7½ x 9½
AD 3063	1.000	30	11 x 9 x 9½
AD 3064	.250	40	10 x 7 x 6½
AD 3065	.500	40	11¼ x 7¼ x 8¾
AD 3066	.750	40	12½ x 7½ x 9½
AD 3067	1.000	40	12¾ x 9 x 9½
AD 3068	.250	50	13¼ x 7¼ x 6½
AD 3069	.500	50	13¼ x 7¼ x 8¾
AD 3070	.750	50	14½ x 7½ x 9½
AD 3071	1.000	50	14¾ x 9 x 9½

TRANSFORMER REACTORS







SPECIAL PURPOSE TRANSFORMERS

We design and manufacture to customers specifications a wide variety of High Voltage, Low Capacity Filament Transformers, and Hermetically Sealed units.

OVER 3500 PROVEN AND TESTED TRANSFORMER DESIGNS AVAILABLE

SEND FOR DEL ELECTRONICS NEW CATALOG ON

CAPACITORS

SILVERCAP® • HERMETIC SEALED • PRECISION CERAMIC & BAKELITE CASED • ENERGY STORAGE • POWER CONVERSION

MULTISYN® — INDUCTOSYN®

PRECISION ANGLE SENSING, CONTROL, AND DIGITIZING COMPONENTS. ACCURACIES TO 0.5 SECOND OF ARC.

DEL ELECTRONICS CORP. DEL MOUNT VERNON, N.Y.
250 E. Sandford Blvd. 914 - 699-2000 TWX: 710-562-0130

DC to DC Converters

BASIC PART NUMBERS — REGULATED

Model No.	INPUT Voltage	Case Size	Conv. Freq.	Output Power +65°C	+100°C
PS 101	26-30	1.5x1.2x3	30KHz	3W	2W
PS 107	22-32	1.5x1.2x3	30KHz	2W	1W
PS 142	26-30	1.5x2x3	20KHz	6W	4W
PS 143	22-32	1.5x2x3	20KHz	4W	3W
PS 136	26-30	2x2x4	20KHz	15W	10W
PS 121	22-32	2x2x4	20KHz	10W	7W
PS 122	26-30	2x3x4	20KHz	30W	20W
PS 137	22-32	2x3x4	20KHz	20W	15W
PS 148	26-30	2x4x4	20KHz	60W	40W
PS 149	22-32	2x4x4	20KHz	40W	30W

All regulated supplies are adjustable to +5% and −30%

BASIC PART NUMBERS — UNREGULATED

Model No.	INPUT Voltage	Case Size	Conv. Freq.	Max. Input Current +65°C	+100°C
PS 115	0-35	1.5x1.2x3	20KHz	.3A	.2A
PS 144	0-35	1.5x2x3	20KHz	.6A	.4A
PS 109	0-35	2x2x4	20KHz	2A	1.3A
PS 138	0-35	2x3x4	20KHz	3A	2A
PS 150	0-35	2x4x4	20KHz	4A	2.5A

OUTPUT POWER = .7 $I_{IN\ MAX.}$ E_{IN}.
OUTPUT VOLTAGE is directly proportional to input voltage.
Specify input voltage in part number — PS 115-25-250-B-F.
Conversion frequency is directly proportional to input voltage, and will be approximately 20KHz at specified input voltage.

UNIT PRICE SCHEDULE

	Rectifier	OUTPUT VOLTAGE 2-30	31-500	501-1500	1501-2500	2501-6000
	FW	200.00	.....	.....	.....	.....
PS 101	B	205.00	190.00	210.00	220.00	.....
PS 107	BCT	220.00	200.00	220.00	240.00	.....
	VD	.....	.....	200.00	210.00	225.00
	VQ	.....	.....	.....	.....	230.00
	BVD	.....	.....	.....	.....	250.00
	FW	145.00	.....	.....	.....	.....
	B	150.00	140.00	150.00	155.00	.....
PS 115	BCT	160.00	150.00	155.00	165.00	.....
	VD	.....	.....	145.00	150.00	160.00
	VQ	.....	.....	.....	.....	170.00
	BVD	.....	.....	.....	.....	190.00
	FW	220.00	.....	.....	.....	.....
	B	225.00	210.00	230.00	240.00	.....
PS 142	BCT	240.00	220.00	240.00	265.00	.....
PS 143	VD	.....	.....	220.00	230.00	247.00
	VQ	.....	.....	.....	.....	253.00
	BVD	.....	.....	.....	.....	275.00
	FW	160.00	.....	.....	.....	.....
	B	165.00	155.00	165.00	170.00	.....
PS 144	BCT	175.00	165.00	170.00	180.00	.....
	VD	.....	.....	160.00	165.00	175.00
	VQ	.....	.....	.....	.....	187.00
	BVD	.....	.....	.....	.....	210.00
	FW	240.00	.....	.....	.....	.....
	B	246.00	228.00	252.00	265.00	.....
PS 109	BCT	265.00	240.00	265.00	288.00	.....
PS 121	VD	.....	.....	240.00	252.00	270.00
	VQ	.....	.....	.....	.....	276.00
	BVD	.....	.....	.....	.....	300.00
	FW	174.00	.....	.....	.....	.....
	B	180.00	168.00	180.00	186.00	.....
PS 136	BCT	192.00	180.00	186.00	198.00	.....
	VD	.....	.....	174.00	180.00	192.00
	VQ	.....	.....	.....	.....	204.00
	BVD	.....	.....	.....	.....	228.00
	FW	260.00	.....	.....	.....	.....
	B	266.00	247.00	273.00	286.00	.....
PS 122	BCT	286.00	260.00	286.00	312.00	.....
PS 137	VD	.....	.....	260.00	273.00	292.00
	VQ	.....	.....	.....	.....	300.00
	BVD	.....	.....	.....	.....	325.00
	FW	188.00	.....	.....	.....	.....
	B	195.00	182.00	195.00	202.00	.....
PS 138	BCT	208.00	195.00	202.00	215.00	.....
	VD	.....	.....	188.00	195.00	208.00
	VQ	.....	.....	.....	.....	221.00
	BVD	.....	.....	.....	.....	247.00
	FW	280.00	.....	.....	.....	.....
	B	288.00	267.00	295.00	308.00	.....
PS 148	BCT	308.00	280.00	308.00	337.00	.....
PS 149	VD	.....	.....	280.00	295.00	315.00
	VQ	.....	.....	.....	.....	323.00
	BVD	.....	.....	.....	.....	350.00
	FW	203.00	.....	.....	.....	.....
	B	210.00	197.00	210.00	218.00	.....
PS 150	BCT	225.00	210.00	218.00	232.00	.....
	VD	.....	.....	203.00	210.00	225.00
	VQ	.....	.....	.....	.....	238.00
	BVD	.....	.....	.....	.....	266.00

NOTES
1 For filters add 5% to Basic price
2 For filters on BCT add 10% to basic price
3 For program add 5% to basic price
4 Prices subject to change without notice

Reliability

Short Circuit Protected

Filtered Input



Crestronics DC to DC Converters are designed as a power supply for electronic circuits with a minimum of interference in the audio and rf ranges. The 20 KHz & 30 KHz conversion employed eliminates all audio range problems and an internal input filter reduces the rfi conductance noise to a level of less than 30 mv P-P across a one ohm resistor in series with the input.

REGULATION:

Regulated Units
- Line ..... .01 % /V
- Temperature ..... .02 % /°C
- Load 10 % to Full load.
  - 2 to 9 VDC ..... 6 %
  - 10 to 24 VDC ..... 4 %
  - 25 to 6000 VDC ..... 3 %

Unregulated Units
- Line ..... Proportional to input
- Load 10 % to full load
  - 2 to 9 VDC ..... 10 %
  - 10 to 24 VDC ..... 5 %
  - 25 to 6000 VDC ..... 4 %

No permanent damage will result if CRESTRONICS Power Supplies are operated without a load.

The conversion frequency of all units will vary in proportion to the output voltage.

RECTIFIER SYSTEMS — RIPPLE

Rectifier	Without Filter RMS	Without Filter P-P	With Filter RMS	With Filter P-P*
FW	.2 %	1 %	.05 %	.2 %
B	.2 %	1 %	.05 %	.2 %
BCT	.2 %	1 %	.05 %	.2 %
VD	.3 %	.6 %	.1 %	.3 %
VQ	.3 %	.6 %	.1 %	.3 %
BVD	.2 %	.3 %	.05 %	.15 %

*1—An external filter is required to further reduce switching spikes.
2—Because of common mode ripple it is necessary to know the ground polarity when filter is ordered.

Plasma-power Gas Laser Power Supplies

PS 177/2-A input $132.00—PS 178/4-A input $156.00

Input: 10-35 VDC Current regulated

ORDERING INFORMATION

PS 101 — 5000 — VQ+F

Basic part number — Output Voltage — Rectifier System

1. **Basic Part Number determines: Size, Wattage, Regulator, Conversion frequency, and input voltage.**
2. **Output Voltage: May be any voltage between 2 and 6000VDC**
3. **Rectifier System: Select rectifier system for desired output voltage and ripple.**
   If filter is required designate positive or negative ground. (Sample is for positive ground.)

QUANTITY DISCOUNTS: 1 to 4, Unit Price — 5 to 19, 10 % — 20 to 49, 20 % — 50 to 99, 30 %.



Crestronics Engineering staff will design to your mechanical and/or electrical specifications

Crestronics

P. O. BOX S
CRESTLINE, CALIF. 92325

744 ROCKY LOOP
PHONE (714) 338-1722

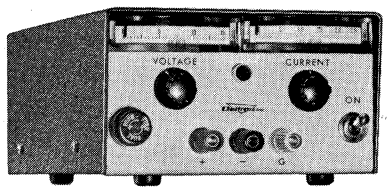
With Our Head in the Clouds . . . and Our Feet on the Ground

Deltron inc.

REGULATED POWER SUPPLIES

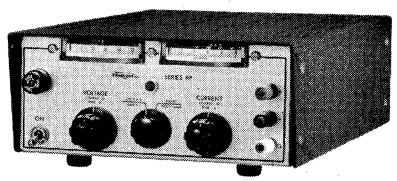
LABORATORY TYPES

SERIES ED/EA — Bulletin 109
0.01% Regulation



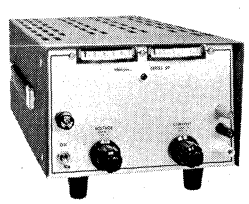
25 MODELS . . . to 100V . . . to 2A . . . 24W.
Silicon metered supplies in 1/3 rack size, current limit and automatic crossover models. One twin range dual supply in the series.
Prices . . . $129. to $159.

SERIES RP — Bulletin 101
0.01% Regulation



26 MODELS . . . to 100V . . . to 5A . . . 200 W.
Silicon metered supplies in 1/2 rack size, with automatic crossover. Six twin range supplies in the series.
Prices . . . $159. to $325.

SERIES SP — Bulletin 105
0.01% Regulation



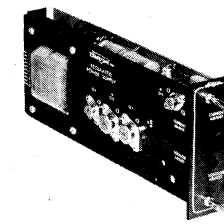
36 MODELS . . . to 100V . . . to 50A . . . 1200W.
Silicon metered supplies in 1/2 and full rack sizes, with automatic crossover and SCR pre-regulator for high efficiency.
Prices . . . $195. to $925.

FEATURES — ALL LAB MODELS

Remote programming and sensing.
Series and parallel operation.
Rack adapters for up to 3 units.

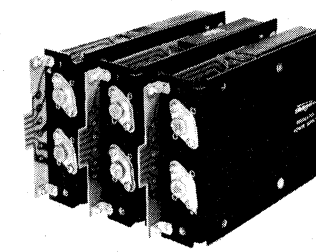
CARD MODULE TYPES

SERIES CD/CA — Bulletin 106
0.01% Regulation



24 MODELS . . . to 100V . . . to 2A . . . 24 W.
Silicon full range supplies in 1/8th rack size, current limit and automatic crossover models. Accessory front panel. Universal mounting also fits card cage.
Prices . . . $86. to $119.

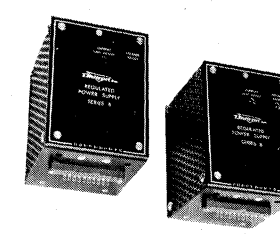
SERIES OS/PS — Bulletin 406
0.05% Regulation



2 MODELS . . . to 15V . . . to .3A . . . 9W.
Silicon dual output tracking supplies in 1/8th rack size, especially for operational amplifiers. Universal mounting and also fits card cage.
Prices . . . $69. to $89.

MODULAR TYPES

SERIES B — Bulletin 110
0.05% Regulation



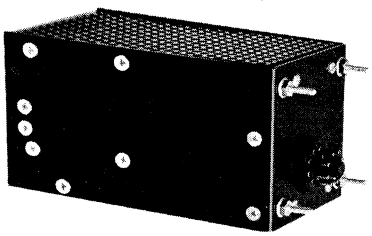
6 MODELS . . . to 40V . . . to 1.2A . . . 16W.
Silicon full range supplies in compact box type construction. Use for powering integrated circuits, digital logic, etc. Accessory crowbar ($15.) protects IC's.
Prices . . . $59. to $69.

Deltron inc. WISSAHICKON AVE. • NORTH WALES, PENNA. 19454 • PHONE: (215) 699-9261 • TWX: (510) 661-8061

Deltron inc.

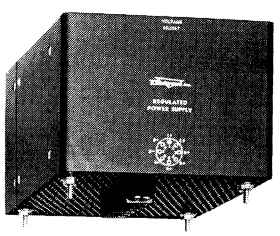
MODULAR TYPES

SERIES D — Bulletin 406
0.05% Regulation



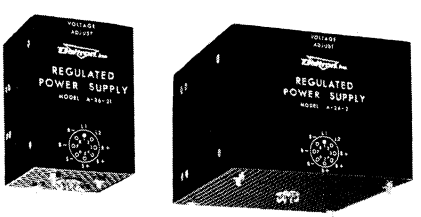
12 MODELS . . . to 15V . . . to 1.5A . . . 45W. Silicon dual independent output supplies in compact box type construction. Ideal for operational amplifiers and integrated circuits.
Prices . . . $118. to $179.

SERIES C — Bulletin 111
0.02% Regulation



300 MODELS . . . to 262V . . . to 36A . . . 700W. Silicon slot adjustable box type supplies designed to meet MIL environmental specs. Units feature most power at lowest cost and smallest size in the industry.
Prices . . . $65. to $470.

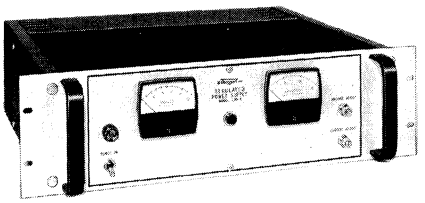
SERIES A — Bulletin 103
0.01% Regulation



261 MODELS . . . to 264V . . . to 37A . . . 800W. Silicon slot adjustable box type supplies offering premium specs, but otherwise similar to series C units.
Prices . . . $95. to $773.

SYSTEM RACK TYPES

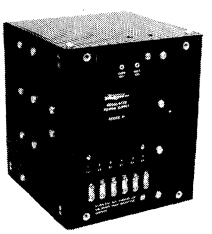
SERIES L — Bulletin 107
0.01% Regulation



720 MODELS . . . to 200V . . . to 86A . . . 1.2KW. Silicon slot adjustable rack mounted supplies well suited for digital and analog systems. Conservative design insures uninterrupted service in exacting applications. Adjustable current cutback limiting.
Prices . . . $190. to $924.

SERIES N — Bulletin 112
0.005% Regulation

Integrated Circuit Regulation System



112 MODELS . . . to 50V . . . to 36A . . . 650W. Silicon slot adjustable supplies featuring integrated circuit regulation system for unprecedented performance. Units are designed for automated manufacture resulting in low cost. Metered control panels fully pre-wired, rack adapters, crowbars available for economical system assembly.
Prices . . . $85. to $330.

CUSTOM SUPPLIES



Modern air conditioned plant houses an outstanding power supply design and manufacturing facility including a well staffed engineering department, an in—plant transformer department, printed circuit department, and sheet metal department to insure prompt service on custom units. Call or write for your special requirements.

Deltron inc. WISSAHICKON AVE. • NORTH WALES, PENNA. 19454 • PHONE: (215) 699-9261 • TWX: (510) 661-8061

FIRST IN DC POWER

DRESSEN-BARNES ELECTRONICS CORPORATION SHORT FORM CATALOG

5 YEAR WARRANTY

5 YEAR WARRANTY

Dressen-Barnes Electronics Corporation warrants each power supply manufactured by them to be free from defects in material and workmanship, for a period of five years from the date of delivery to the original purchaser, except for vacuum tubes which are warranted for one year.

Dressen-Barnes obligation under this warranty is limited to servicing or adjusting any power supply returned to the factory for that purpose, and replacing any defective parts thereof. If the failure has been caused by misuse, operation in excess of specification guarantees or modification by the customer, repairs will be billed at cost.

Permission must be obtained from Dressen-Barnes before a supply may be returned for warranty examination. Transportation charges are to be prepaid. Warranty is transferable by the original purchaser as long as it is sold for use in original equipment.

This warranty is expressly in lieu of all other obligations or liabilities on the part of Dressen-Barnes Electronics Corporation and Dressen-Barnes Electronics Corporation neither assumes nor authorizes any other person to assume for them, any liability in connection with the sale of Dressen-Barnes power supplies.

IMPORTANT ANNOUNCEMENT: The Ferrodyne Corporation, a wholly owned subsidiary of Dressen-Barnes Electronics Corporation, has considerably expanded its line of transformers. Long recognized as a leader in the design of custom transformers, particularly miniature, toroidal, inverter and box shielded transformers, Ferrodyne now offers a line of standard transformers. Contact your local Ferrodyne Representative or write direct for a product, engineering and production capability brochure. Ferrodyne Corporation, 4240 Glencoe Avenue, Venice, California 90291, (213) 870-9891.

NEW ULTRA-HIGH PERFORMANCE, LOW PROFILE, FIXED VOLTAGE ALL SILICON DC POWER SUPPLIES

Modular and Rack Mounted

SPECIFICATIONS FOR SUPPLIES MODEL 301 THROUGH 901

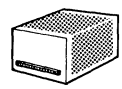
Regulation: Line: .01% +1 mv for line variation from 105 to 132 VAC. Load: .02% +1 mv from zero to full rated load.
Ripple: ½ millivolt RMS with plus or minus output terminal grounded at 60 Hz and 115 VAC line input.
Temperature Range, Operating: —20°C to +71°C.
Temperature Range, Storage: —55°C to 85°C.
Input Voltage: 105 to 132 VAC or 210 to 264 VAC at no extra cost.
Transient Recovery: Less than 100 microseconds.
Temperature Coefficient: .01% per degree centigrade.
Overload Protection: Automatic current limiting at 110% to 130% of rated current. Automatic recovery on removal of overload.
Remote Sensing: Standard feature.
Remote Voltage Adjustment: Standard feature.
Remote Programming: 100 ohms per volt.
Thermal Protection: Built in Thermostat on Heat Sink.
Overvoltage Protection: Optional at extra charge; internal or external mounting. 75% relative humidity on standard units, 95% relative humidity and fungus proofing optional at extra charge.

VOLTAGE AND CURRENT TABLE

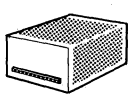
OUTPUT** VOLTAGE →		3	5	6	10	12	15	18	20	24	28	32	36	48	100	120	150
*SERIES	TEMP.	OUTPUT AMPERES															
301		3.8	3.7	3.2	2.7	2.5	2.2	2.0	1.8	1.4	1.3	1.2	1.1	0.9	0.37	0.3	0.25
401		5.3	5.1	4.8	4.2	4.0	3.5	3.2	3.1	2.5	2.3	2.1	2.0	1.6	0.55	0.49	0.39
501		11.0	10.5	9.0	7.5	7.3	6.0	5.5	5.0	4.0	3.5	3.2	3.0	2.5	1.0	0.9	0.7
601	40°C	13.1	12.6	12.4	10.8	10.0	9.0	7.9	7.4	6.7	6.0	5.7	5.4	4.1	1.7	1.5	1.1
701		22.0	20.0	19.0	16.0	15.0	14.0	13.0	12.0	11.0	10.0	9.0	8.0	6.0	2.0	1.7	1.4
801		33.0	31.0	30.0	24.0	21.0	19.0	16.5	15.2	14.0	13.0	11.7	10.4	7.7	3.3	3.0	2.2
901		48.0	48.0	47.0	38.0	33.0	25.0	25.0	23.0	20.0	19.0	16.0	13.0	10.0	4.3	3.7	3.1
301		3.3	3.2	2.9	2.5	2.3	2.0	1.8	1.6	1.3	1.2	1.1	1.0	0.85	0.34	0.28	0.23
401		4.6	4.3	4.1	3.6	3.5	3.2	3.0	2.9	2.4	2.1	2.0	1.8	1.4	0.51	0.45	0.36
501		9.4	9.0	8.4	7.0	6.8	5.6	5.1	4.6	3.7	3.4	3.1	2.9	2.4	0.96	0.86	0.67
601	50°C	11.3	10.8	10.6	9.7	9.2	8.4	7.4	6.9	6.3	5.6	5.3	5.0	3.9	1.5	1.3	1.0
701		20.0	18.0	17.3	14.5	13.6	12.7	11.8	10.9	10.0	9.0	8.2	7.3	5.4	1.7	1.5	1.3
801		29.0	24.6	24.6	20.4	19.0	18.0	14.8	13.7	12.5	11.5	10.6	9.8	7.1	3.0	2.7	2.0
901		42.0	41.0	40.0	33.0	28.0	22.0	22.0	20.0	17.0	16.0	13.5	11.0	9.0	3.6	3.1	2.6
301		2.6	2.5	2.4	2.2	2.1	1.8	1.7	1.5	1.2	1.1	1.0	0.9	0.8	0.3	0.25	0.2
401		3.7	3.4	3.3	3.0	2.9	2.8	2.7	2.6	2.2	2.0	1.8	1.7	1.3	0.47	0.42	0.33
501		8.2	8.0	7.7	6.3	5.9	5.1	4.7	4.2	3.4	3.1	2.9	2.7	2.2	0.9	0.8	0.62
601	60°C	9.2	9.2	8.9	8.5	8.3	7.9	6.9	6.5	5.8	5.2	4.9	4.7	3.6	1.3	1.1	0.9
701		16.5	16.5	15.6	13.0	12.3	11.5	10.6	9.8	9.0	8.0	7.3	6.5	4.9	1.6	1.4	1.2
801		25.0	20.8	20.8	16.8	16.1	15.5	12.4	11.8	10.8	9.8	9.2	8.6	6.5	2.5	2.2	1.75
901		34.0	33.0	32.0	27.0	22.0	18.0	18.0	17.0	14.0	13.0	11.5	10.0	7.5	3.0	2.6	2.1
301		1.6	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.1	1.0	.96	0.85	0.75	0.28	0.23	0.19
401		2.5	2.4	2.4	2.0	1.9	1.9	1.9	1.8	1.5	1.4	1.35	1.3	1.0	0.42	0.38	0.3
501		5.5	5.5	5.5	5.0	4.7	4.3	4.1	3.6	3.0	2.8	2.6	2.4	1.9	0.8	0.7	0.55
601	71°C	6.2	6.1	6.0	5.7	5.7	5.3	5.0	4.9	4.8	4.7	4.5	4.3	3.1	1.1	1.0	0.8
701		10.0	10.0	10.0	9.5	9.5	8.6	8.6	8.5	7.6	7.1	6.4	5.7	4.3	1.5	1.2	1.0
801		20.5	17.3	17.3	13.8	13.2	12.7	10.1	9.7	9.0	8.2	7.6	7.1	5.4	2.1	1.9	1.5
901		25.0	25.0	24.0	21.0	17.0	14.0	14.0	13.0	11.0	10.0	8.8	7.5	6.0	2.3	1.9	1.6

*The model number consists of the series indicated plus a dash number to indicate voltage. Examples: The model number 301-5 is a 5 VDC, 3.7 AMP at 40°C unit; the 501-28 is a 28 VDC, 3.5 AMP at 40°C unit. Note that current varies with temperature.

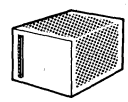
**Output voltage is adjustable to ±5%. Higher currents available on special order. Built-in ±10% adjustment usable up to 85% of rated current. Price and delivery information available from the factory.



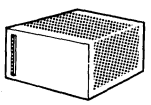
301 SERIES
3-3/16" x 4-15/16" x 6-1/2"



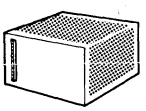
401 SERIES
3-3/16" x 4-15/16" x 9-3/8"



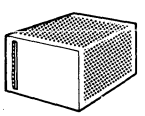
501 SERIES
4-15/16" x 4-15/16" x 9-3/8"



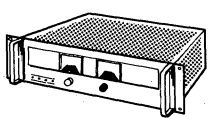
601 SERIES
4-15/16" x 7-1/2" x 9-3/8"



701 SERIES
4-15/16" x 7-1/2" x 11-7/8"



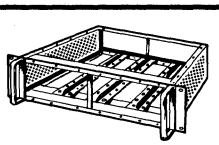
801 SERIES
4-15/16" x 7-1/2" x 17"

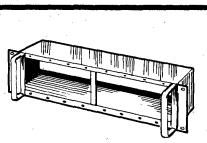


901 SERIES
3-1/2" x 19" x 17-1/2" max.

RACK ADAPTERS FOR 301 THROUGH 801 SERIES DC POWER SUPPLIES

Dressen-Barnes Electronics offers a variety of rack adapters for mounting combinations of power supplies. Consult the factory for the correct rack for your particular requirement.





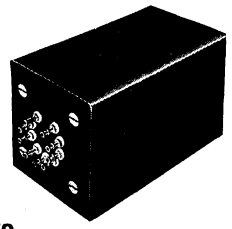
Prices and specifications subject to change without notice. Minor modifications can be made on all units to meet customer requirements. Quantity discounts on 10 units or more, depending on the model, available from the factory.

DRESSEN-BARNES ELECTRONICS CORPORATION / 250 N. VINEDO AVENUE / PASADENA, CALIFORNIA 91107
TELEPHONE: (213) 681-0643 / TWX: 213-449-2556 / CABLE ADDRESS: DREBAR—PASADENA, CALIFORNIA

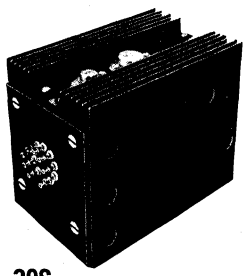
REGULATED HIGH-DENSITY, CONVECTION COOLED, ULTRA-HIGH PERFORMANCE, ALL SILICON DC POWER MODULES — IN STOCK

SPECIFICATIONS

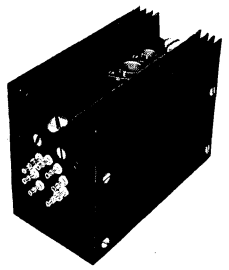
Regulation: Line: 105-125 VAC: 0.01% or 5 MV (whichever is greater)
Load: NL to FL: 0.01% or 5 MV (whichever is greater)
Ripple: 1 MV RMS max. (2 MV RMS max. above 100V)
Ambient Temperature Range: 0 to 71°C
Storage Temperature Range: —55°C to 85°C
Input: 105-125V; 50-400 CPS, single phase, 0.2 amperes
Transient Recovery Time: Less than 100 microseconds
Temperature Coefficient (Typical):
0.03%/°C for Voltages below 45V
0.01%/°C for Voltages 45V and above
Stability (Typical):
0.5%/8 hrs. for Voltages below 45V
0.1%/8 hrs. for Voltages 45V and above
Output Impedance: Less than 1 ohm @ 500 KC
Overload Protection: Resistor-fuse protection above 40 volts output. Automatic current limiting up to 40 volts set between 110 and 130% of full load.
Remote Sensing: Standard feature.
Remote Voltage Adjust: Standard feature.
Remote Fuse: Standard feature.



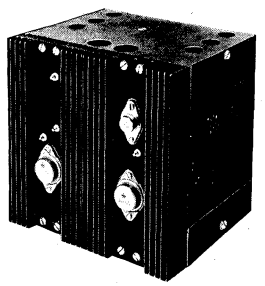
15S 4-7/8 x 2-5/8 x 3-3/32



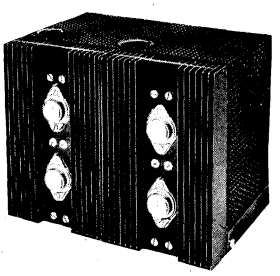
30S 6 x 3-3/4 x 4-7/8



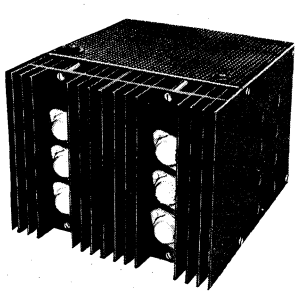
20S 5-1/4 x 2-7/8 x 4



41S 5-3/16 x 6-1/16 x 6-3/16



51S 5-3/16 x 6-3/16 x 7-11/16



61S 8-5/8 x 6-1/8 x 8-3/16

VOLTAGE AND CURRENT TABLE

OUTPUT ALL SERIES **	CURRENT RATING (50°C)† (65°C & 71°C)‡											
	15S	PRICE	20S	PRICE	30S	PRICE	41S	PRICE	51S	PRICE	61S	PRICE
VOLTS	← MILLIAMPERES →				← AMPERES →							
3	750	69.50	1400	85.00	3.10	117.50	6.0	137.50	12.9	*	24.0	*
5	750	69.50	1400	85.00	3.10	117.50	6.0	137.50	11.0	197.50	21.0	265.00
6	735	69.50	1400	85.00	2.95	117.50	5.8	137.50	10.5	197.50	21.0	265.00
10	580	69.50	1100	85.00	2.34	117.50	4.8	137.50	8.6	197.50	16.0	265.00
12	535	69.50	1000	85.00	2.16	117.50	4.5	137.50	7.8	197.50	14.5	265.00
15	430	69.50	800	85.00	1.75	117.50	4.0	137.50	7.1	197.50	14.5	265.00
20	375	69.50	700	85.00	1.50	117.50	3.4	137.50	6.1	197.50	12.5	265.00
24	325	69.50	600	85.00	1.30	117.50	3.1	137.50	5.4	197.50	10.5	265.00
26	285	*	550	*	1.13	*	2.9	*	5.0	*	10.0	*
28	285	69.50	550	85.00	1.13	117.50	2.8	137.50	4.9	197.50	9.5	265.00
32	250	*	500	*	1.00	*	2.6	*	4.6	*	9.0	*
50	165	*	300	*	0.660	*	1.6	*	2.8	*	5.5	*
120	—	*	110	*	0.29	*	0.7	*	1.0	*	2.0	*
150	—	—	60	*	0.215	*	0.6	*	0.85	*	1.8	*
200	—	—	35	*	0.165	*	0.4	*	0.7	*	1.0	*
Input Current (Amps) (105-125 VAC, 50-400 CPS)	0.2		0.3		0.75		1.5		2.5		5.0	

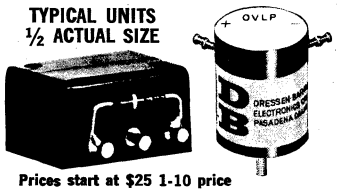
*Price and delivery information for these models and other models, from 1-200V, available from the factory.
**The model number consists of the series indicated, plus a dash number to indicate voltage. Examples: The model number 15-3S is a 3 VDC, 750 MA unit; the 30-28S is a 28 VDC, 1.13 AMP unit.
†Any supply can be adjusted 10% in voltage by a screw adjustment on the supply. Slight current derating will result. Contact factory for exact values.
‡Lineal Feet per Minute over the surfaces of the power supply. Temperature is of the air, measured 2 inches up stream.

Many modifications can be made to fit individual customer requirements. For example: different input voltages, parallel operation and wider output voltage swings. Consult the factory for your specific modification requirements.

OVERVOLTAGE LOAD PROTECTOR (OVLP) for overload detection

For use with DB Electronics power supplies and other equipment requiring overload protection. Primarily designed for protecting IC circuitry from line transients but can also be used to protect any load sensitive to momentary or continuous overvoltage conditions. Features high speed overvoltage detectors in conjunction with "Crowbar" SCR. Units available in fixed trip voltages. SCR's are sized for current loads.

TYPICAL UNITS
½ ACTUAL SIZE



Prices start at $25 1-10 price

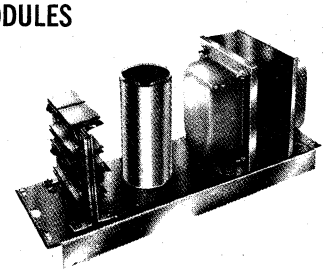
Prices and specifications subject to change without notice. Minor modifications can be made on all units to meet customer requirements. Quantity discounts on 10 units or more, depending on the model, available from the factory.

DB
DRESSEN-BARNES ELECTRONICS CORPORATION / 250 N. VINEDO AVENUE / PASADENA, CALIFORNIA 91107
TELEPHONE: (213) 681-0643 / TWX: 213-449-2556 / CABLE ADDRESS: DREBAR—PASADENA, CALIFORNIA

UNREGULATED DC POWER MODULES

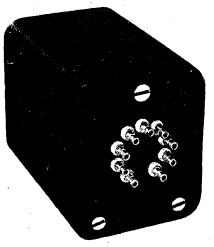
21 SERIES

MODEL NO.	OUTPUT (115 VAC, 60 CPS Input) VOLTS	AMPS	UNIT PRICE
21-101B	28	2	39.50
21-102B	28	5	54.50
21-103B	28	10	85.00
21-112	5-32	5	75.00
21-113	5-32	10	99.00
21-114	5-32	15	140.00



Silicon Rectifier, Repairable, Output Adj. in 1.5V Steps at Barrier Strip
Input: 105-125V, 50-400 CPS.
Polarity: Floating Output, low ripple with D/B filter (request data)

121 SERIES

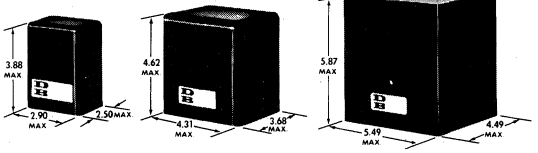


MODEL NO.	OUTPUT (115 VAC, 60 CPS Input) VOLTS	AMPS	UNIT PRICE
121-6	6	1500	42.50
121-12	12	1150	42.50
121-24	24	550	42.50
121-28	28	500	42.50
121-48	48	300	42.50
121-90	90	150	42.50
121-150	150	90	57.50

Silicon Rectifier, Repairable, Computer Grade Capacitors, Small Size
Input: 105-125V, 50-400 CPS. Max. Operating Temperature: 50°C.
Polarity: Floating Output, low ripple. Voltage Tolerance: ±10% ±1V

Silicon Rectifier, Non-repairable, Computer Grade Capacitors, Small Size, Completed Potted.
INPUT: 105-125V, 50-400 CPS; .25 ampere (221 series), .6 ampere (321 series), 1.5 amperes (421 series)
OPERATING TEMPERATURE: −40°C to +50°C
STORAGE TEMPERATURE: −40°C to +85°C
RELATIVE HUMIDITY: 95%
RIPPLE: 1V RMS max. (Note: Ripple decreases in direct proportion to decrease in load current; ripple can be further reduced by using external capacitor across the output.) 1.5V RMS max. on 421 series above 50V.
VOLTAGE TOLERANCE: ±10% ±1V
POLARITY: Floating output.

221, 321, 421 SERIES



221 SERIES — **$32.50 each in voltages listed**

321 SERIES — **$45.50 each in voltages listed**

421 SERIES — **$57.50 each in voltages listed**

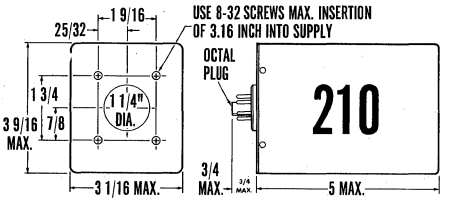
CURRENT AND VOLTAGE AT 115 VAC, 60 Hz INPUT, 25°C AMBIENT.

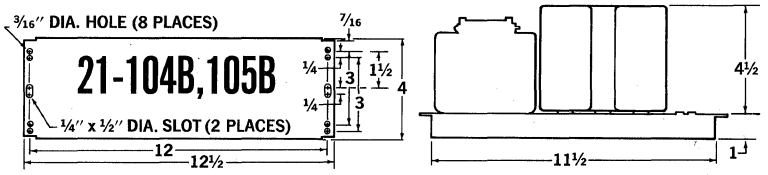
OUTPUT VOLTS	221 SERIES	321 SERIES	421 SERIES
	MILLIAMPERES		
6	2000	3000	6000
12	1400	2900	6000
24	750	1800	4400
28	750	1500	3500
48	300	900	2200
90	170	500	1200
180	80	200	600

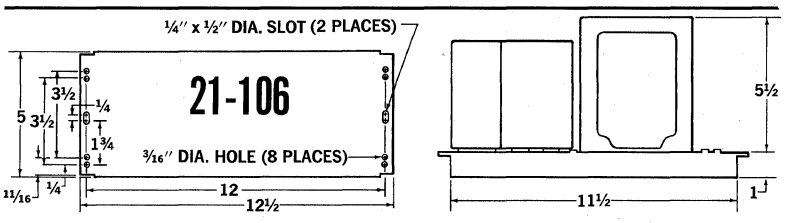
*The model number consists of the series indicated plus a dash number to indicate voltage. Example: The model number 321-12 is a 12 VDC, 2900 MA unit.

FILTERS

Designed for use with the DB Electronics power supplies listed below, other unregulated power supplies, and as independent filtering sources for other equipment.







FILTER MODEL NOS. CORRESPONDING TO UNREGULATED POWER SUPPLY MODEL NOS.

Unregulated Power Supply Voltage Range	221 Series	321 Series	421 Series	21-101B	21-102B 21-112	21-103B 21-113	21-114
6 to 18V	210-1	210-1	210-2	210-1	210-2 or 21-104B	21-105B	21-106
19 to 23V	210-1	210-1	210-1	210-1	210-2	21-105B	21-106
24 to 36V	210-1	210-1	210-1	210-1	21-104B	21-105B	21-106
37 to 75V	210-3	201-3	210-3	—	—	—	—
76 to 105V	210-4	210-4	210-4	—	—	—	—

FILTER OUTPUT RIPPLE: (25°C, Full Load, 120 Hz)

D/B Filter Model No.	Ripple Fraction	Unit Price
210-1	1/10th	30.00
210-2		40.00
210-3		45.00
210-4		55.00
21-104B	1/200th	45.00
21-105B	1/50th	52.50
21-106	1/40th	85.00

SPECIFICATIONS

Filter Output Voltage: DC output voltage is typically less than 2V below the input voltage.

Temperature: Operating: −40°C to +50°C.
Storage: −40°C to +85°C.

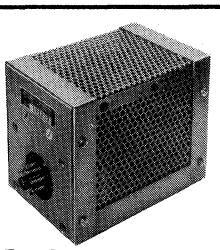
Relative Humidity: 210 Series: 95%
21-104B, 21-105B, 21-106: 75%

RUGGEDIZED DUAL OUTPUT UNITS TYPE 27949
ISOLATED AND FLOATING OUTPUTS

Qualified to: Vibration: Mil-Std-810B
5-15 Hz at .06 in. double amplitude
16-25 Hz at .04 in. double amplitude
26-33 Hz at .02 in. double amplitude

Shock: 50G peak for 9.0 ±0.9 ms duration.

Humidity: 10% to 95% RH, 60°F to 130°F.



Input: 105 to 125 VRMS, 50 to 400 HZ single phase
Output: See table
Voltage Adjust: ±5%
Regulation, Line: 1MV MAX. **Load:** 10MV MAX.
Ripple: 1MV RMS MAX.
Temperature, Operating: 0-50°C.
Shock/Vibration Qualified: Mil-Std-810B, Mil-Std-167 Type 1.
Temperature Coefficient: .03%/°C
Short Circuit Protected.

OUTPUTS AVAILABLE

OUTPUT VOLTAGE	CURRENT MA
±2	800
±5	700
±10	550
±12	500
±15	440
±20	370
±25	325
±30	260
±40	230
±50	190

Prices and specifications subject to change without notice. Minor modifications can be made on all units to meet customer requirements. Quantity discounts on 10 units or more, depending on the model, available from the factory.

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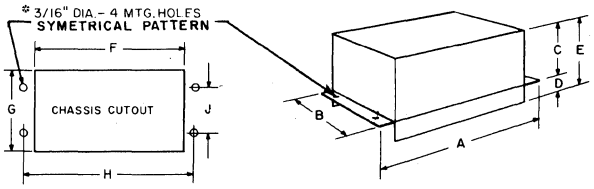
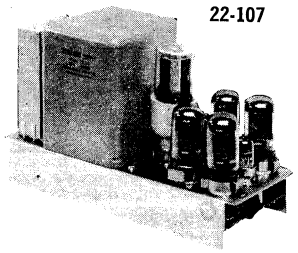
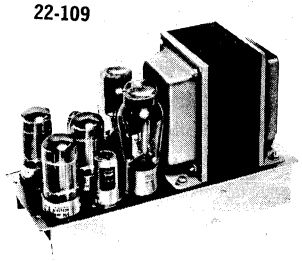
22 SERIES HIGH PERFORMANCE, LOW COST VACUUM TUBE MODULES



22-107



22-109



*Except: Models 22-102A through 22-104B = 5/32" dia.

Model No.	AC INPUT* (105-125V) CPS	Amps	Nominal Volts**	DC OUTPUT Adj.† Range (Volts)	Chassis Pot Adj.	Amps	UNREGULATED OUTPUT AC Volts	Amps	REGULATION—LINE (105-125V) MV	%	REGULATION—LOAD (NL-FL) (115V AC) MV	%	RIPPLE MV RMS Max (115V Line)	DIMENSIONS IN INCHES A	B	C	D	E	F	G	H	J	UNIT PRICE
22-102A	50-60	0.75	150	150-200	NO	0-.070	6.3	3	600	0.4 @ 150V	450	0.3 @ 150V	5	4 1/8	5	4 1/4	1 3/4	6	3 7/16	5 1/16	3 13/16	4 1/8	75.50
22-102B	50-400	0.85	150	150-200	YES	0-.070	6.3	3	300	0.2 @ 150V	150	0.1 @ 150V	2	4 1/8	5	4 1/4	2	6 1/4	3 7/16	5 1/16	3 13/16	4 1/8	99.50
22-103A	50-60	0.9	250	210-310	NO	0-.070	6.3	3	600	0.24 @ 250V	450	0.18 @ 250V	5	4 1/8	5	4 1/4	1 3/4	6	3 7/16	5 1/16	3 13/16	4 1/8	75.50
22-103B	50-400	0.9	250	210-260	YES	0-.070	6.3	3	300	0.1 @ 300V	150	0.05 @ 300V	2	4 1/8	5	4 1/4	2	6 1/4	3 7/16	5 1/16	3 13/16	4 1/8	99.50
22-104A	50-60	1	300	240-350	NO	0-.070††	6.3	3	600	0.2 @ 300V	450	0.15 @ 300V	5	4 1/8	5	4 1/4	1 3/4	6	3 7/16	5 1/16	3 13/16	4 1/8	75.50
22-104B	50-400	0.9	300	280-320	YES	0-.070	6.3	3	300	0.1 @ 300V	150	0.05 @ 300V	2	4 1/8	5	4 1/4	2	6 1/4	3 7/16	5 1/16	3 13/16	4 1/8	99.50
22-106A	50-60	2	300	270-325	YES	0-.150	6.3	6	600	0.2 @ 300V	300	0.1 @ 300V	5	10 1/2	4	4 5/8	2	6 5/8	9 9/16	4 1/16	10	2 1/4	96.00
22-106B	50-400	2	300	270-325	YES	0-.150	6.3	6	300	0.1 @ 300V	150	0.05 @ 300V	2	10 1/2	4	4 5/8	2	6 5/8	9 9/16	4 1/16	10	2 1/4	97.00
22-108A	50-400	3	400	250-400	YES	0-.200	6.3	6	200	0.05 @ 400V	200	0.05 @ 400V	2	12 1/2	5	4 7/8	2	6 7/8	11 9/16	5 1/16	12	3	129.00
22-109	50-400	4.5	450	250-500	YES	0-.300	6.3	6	225	0.05 @ 450V	225	0.05 @ 450V	2	12 1/2	5	5 3/8	2	7 3/8	11 9/16	5 1/16	12	3	156.00
22-110	50-60	2	150	80-260	YES	0-.150	6.3	6	600	0.4 @ 150V	375	0.25 @ 150V	5	10 1/2	4	4 5/8	2	6 5/8	9 9/16	4 1/16	10	2 1/4	96.00
22-110A	50-400	2	150	80-260	YES	0-.150	6.3	6	300	0.2 @ 150V	150	0.1 @ 150V	2	10 1/2	4	4 5/8	2	6 5/8	9 9/16	4 1/16	10	2 1/4	109.00
22-118	50-400	4	150	110-165	YES	0-.500	6.3	6	300	0.2 @ 150V	150	0.1 @ 150V	2	12 1/2	5 9/16	5 3/8	2	7 3/8	11 9/16	5 5/8	12	3 9/16	181.50
22-119	50-400	4	300	275-325	YES	0-.500	6.3	6	300	0.1 @ 300V	150	0.05 @ 300V	2	12 1/2	5 9/16	5 3/8	2	7 3/8	11 9/16	5 5/8	12	3 9/16	199.00
22-120	50-400	2.5	150	115-165	YES	0-.200	6.3	6	300	0.2 @ 150V	150	0.1 @ 150V	2	12 1/2	5	4 7/8	2	6 7/8	11 9/16	5 1/16	12	3	143.00

NOTES

* Models available with higher input voltages upon request.

** Unit set at factory for nominal value ±2%. Unit may be adjusted within range indicated.

† Information necessary to adjust the unit to any output within the range specified furnished with each unit.

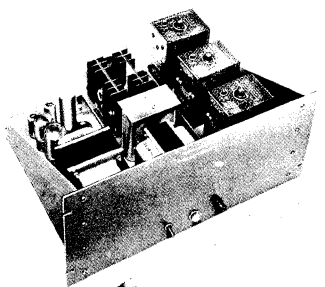
†† Above 320 volts, maximum current is from 55MA at 340V to 50MA at 350V.

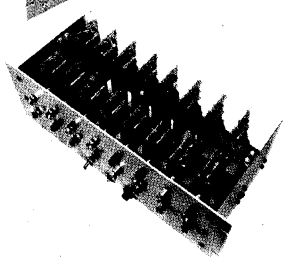
CUSTOMIZED POWER SUPPLIES

Dressen-Barnes makes many modifications to its standard lines of power supplies to meet special or custom supply requirements of its customers. These fall into three general types of modifications:

Type I

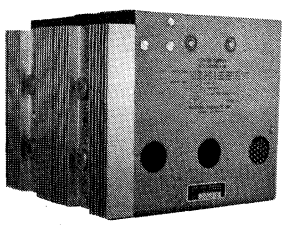
Multiple output packages made from assemblies of standard modules

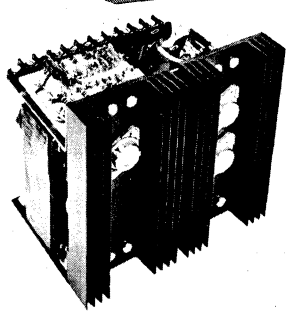




Type II

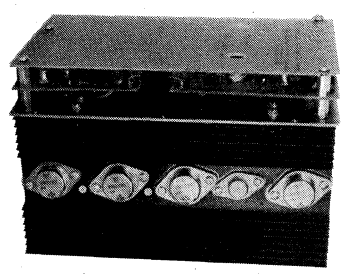
Modification of Standard units to meet special customer requirements.

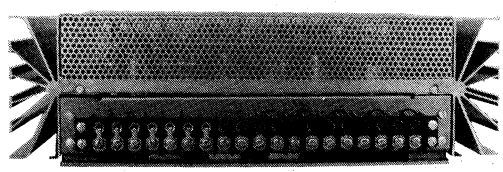




Type III

Standard Circuitry in special packages for volume requirements to meet customer specifications.





With this broad capability and with our modern Quick Reaction Facilities, Dressen-Barnes over the past 22 years has delivered nearly 4,000 different models of custom power supplies.

Prices and specifications subject to change without notice. Minor modifications can be made on all units to meet customer requirements. Quantity discounts on 10 units or more, depending on the model, available from the factory.

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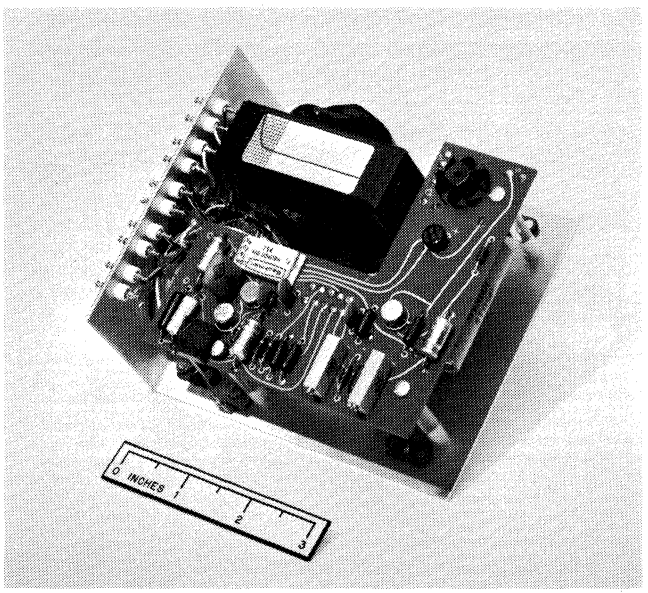
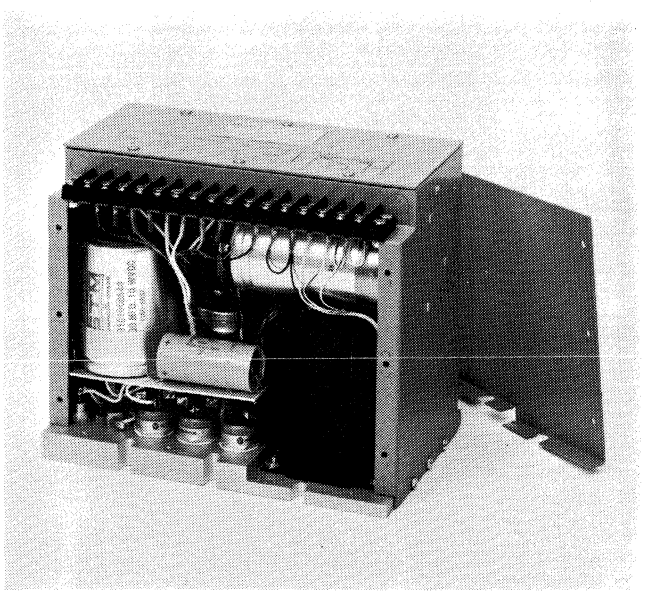
Now... from Diversified Electronics

Low Cost—Custom Engineered POWER SUPPLIES





OFF-THE-SHELF COST WITH CUSTOM ENGINEERED RELIABILITY

Our pre-designed circuits are combined to achieve the electrical performance you require giving you flexibility of package configuration. Our modular techniques approach cost and delivery advantages of catalog, off-the-shelf units while the performance, size, and reliability is custom engineered to your particular power supply requirements.

DIVERSIFIED EXPERIENCE

Diversified system engineered supplies for —

- BWO-VTM-TWT
- Photomultipliers
- Storage and Display Cathode Ray Tubes
- Discrete and Integrated Solid State Devices
- Swept Power Supplies
- Solid State Pulse Modulators

TYPICAL PRODUCT DESIGNS

A high-current 5,000-Hz duty-cycle regulator typifies our design and packaging concept. This high-current regulator is compactly packaged in a 4 x 4 x 3 inch enclosure. The series transistor is recess-mounted on the base plate which forms a heat sink for efficient heat transfer to the chassis on which it is mounted. The unit is ruggedized for shock and vibration resistance and will withstand other extreme environmental exposures. This unit, and any DIVERSIFIED power supply or module, can be qualified to MIL-E-5400 or other military specifications. It has the following electrical characteristics:

Input Voltage	24 to 40 VDC, Unreg.
Output Voltage	10 to 20 VDC, Adj.
Output Current	1 to 8 Amps
Output Power	160 watts Max.
Efficiency	85%
Built-in overload protection	

FACILITIES TO MEET YOUR REQUIREMENTS

OUR experience in CUSTOM ENGINEERED Power Supply units is backed by the latest equipment for custom prototype fabrication and volume production. A complete machine shop, etched circuit board facility, encapsulation pressure-vacuum chamber, and soldering-assembly section support our fully equipped electronic test-calibration lab.

At your service, is our capability from custom design through production to meet your special power supply requirements with quality controlled reliability and repeatability.

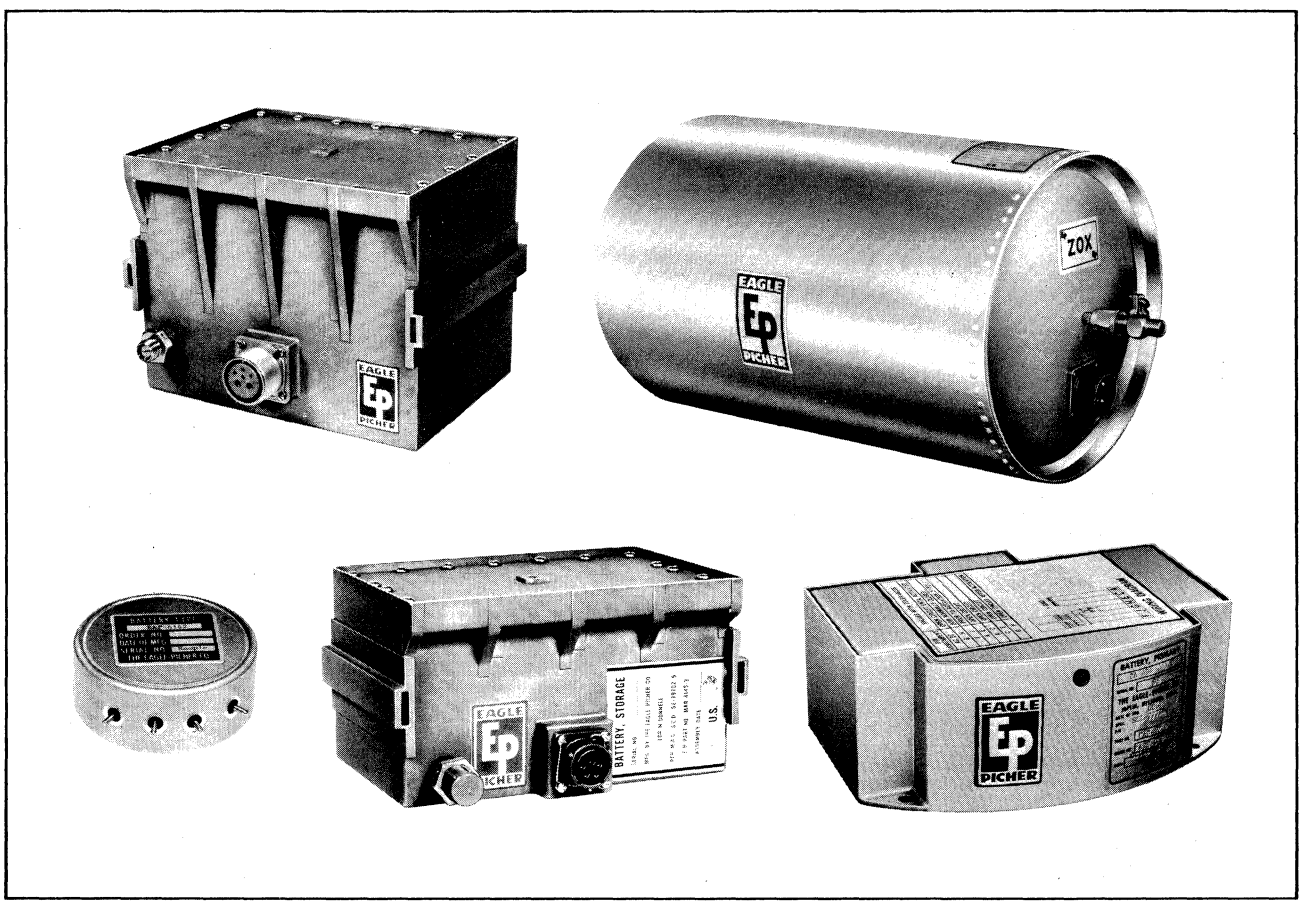
For answers to all your power conversion requirements, call or write:

DIVERSIFIED ELECTRONICS CO. INC.

SALES MANAGER
154 San Lazaro Avenue
Sunnyvale, California 94086
(408) 738-3911

EAGLE EP PICHER CUSTOMIZED BATTERIES

SILVER ZINC • SILVER CADMIUM • THERMAL
NICKEL CADMIUM • WATER ACTIVATED



A complete line of PRIMARY and RECHARGEABLE batteries for consumer, industrial and military applications. The major objective of all Eagle-Picher electrochemical research, dating back to 1922, is the development of reliable power units of the greatest energy per unit weight and volume.

If you need BIG power... from SMALL batteries, count on Eagle-Picher to meet your most demanding requirements. Eagle-Picher has supplied batteries for virtually every major weapon and space system from Agena to Gemini to Zeus.

Eagle-Picher can supply a variety of *shapes*, to meet your most demanding system requirements.

For full technical information and design assistance based on 50 years battery experience and research, contact:

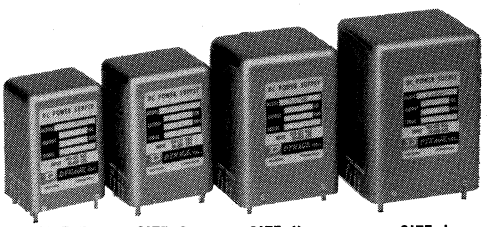
EAGLE-PICHER INDUSTRIES, INC. • ELECTRONICS DIVISION
Department EEM-3 • American Building • Cincinnati, Ohio 45202

D Series Modular DC Regulated Power Supplies 72-Hour Delivery, Fully Accessible, Fully Repairable, All Silicon

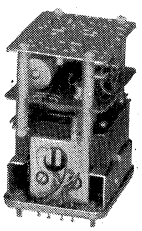
Specifications

Input: 105 — 125 vac, 47 — 420 Hz.
Output (floating): Volts and current: See Table of Models.
Regulation combined:
"A" MODEL — ±0.05% or 1.5 mv, whichever is greater, for a combined ±10 vac input change and 0 to full load change.
STD. MODEL — ±0.5% or 25 mv, whichever is greater, for a combined ±10 vac input change and 0 to full load change.
Ripple:
"A" MODEL — 0.002% or 1 mv, rms, whichever is greater.
STD. MODEL — 0.01% or 5 mv, rms, whichever is greater.
Temperature Coefficient:
"A" MODEL — ±0.01%/°C or 1.2 mv/°C, whichever is greater, over the range of −20°C to +60°C.
STD. MODEL — ±0.04%/°C or 4.8 mv/°C, whichever is greater, over range −20°C to +60°C.
Voltage Adjustment: ±5% @ rated load.
±10% @ 90% load.
Resolution of Adjustment:
"A" MODEL — 0.4% or 30 mv, whichever is greater.
STD. MODEL — 0.7% or 70 mv, whichever is greater.
Temperature, operating: −20° to +71°C ambient (Base of supply must be held at 80°C or less by heat sinking).
Temperature storage: −62°C to +85°C.
Electronic Short Circuit Protection: Set for approx. 150% rated load.
Overtemperature protection: Provided on all models.

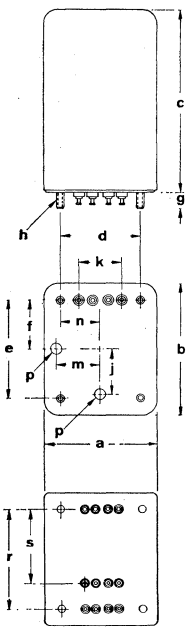
Optional Features — See page 1918



SIZE F 1.9 lbs. SIZE G 2.2 lbs. SIZE H 3.0 lbs. SIZE J 3.9 lbs.



SIZE H (open)



CASE SIZE	DIMENSIONS a	b	c	d	e	f	g	h	j	k	m	n	p	r	s	TOLERANCES a & b	c	d. e. f, j, m, n, p, r & s	TERMINALS CUTOUTS (2)
F	2 3/8	2 3/4	3 7/8	1 3/4	2 1/8	1 1/16	3/8	6-32	1	1	—	7/8	1/4	—	1 5/8	1/32	1/32	1/64	3/8 x 1 3/8
G	2 5/8	3 1/16	4 5/16	1 55/64	2 13/64	1 19/128	3/8	8-32	1 7/64	1	—	19/128	1/4	—	1 5/8	1/32	1/32	1/64	3/8 x 1 3/8
H	3 1/16	3 9/16	4 15/16	2 1/8	2 5/8	1 5/16	3/8	8-32	—	1	1 7/32	1 1/16	1/4	2 5/8	—	1/32	1/32	1/64	3/8 x 1 3/8
J	3 3/8	3 15/16	5 5/16	2 1/16	3	1 1/2	1/2	10-32	—	1	1 23/64	1 7/32	1/4	3	—	1/32	1/32	1/64	3/8 x 1 3/8

Ordering Information

Output Voltage ±5.0% Range	Output Current Amps	Case Size	Thermal Curve No.	A Model 0.05% Regulation Model	Price
0.5-1.2	0.200	F	1	D—0.9-0.200A	$69.00
0.5-1.2	0.300	G	2	D—0.9-0.300A	77.00
0.5-1.2	0.750	H	3	D—0.9-0.750A	89.00
0.5-1.2	1.0	J	4	D—0.9-1.0A	105.00
1.2-1.8	0.200	F	1	D—1.5-0.200A	69.00
1.2-1.8	0.300	G	2	D—1.5-0.300A	77.00
1.2-1.8	0.750	H	3	D—1.5-0.750A	89.00
1.2-1.8	1.0	J	4	D—1.5-1.0A	105.00
1.8-2.3	0.200	F	1	D—2.1-0.200A	69.00
1.8-2.3	0.300	G	2	D—2.1-0.300A	77.00
1.8-2.3	0.750	H	3	D—2.1-0.750A	89.00
1.8-2.3	1.0	J	4	D—2.1-1.0A	105.00
2.3-2.7	0.200	F	1	D—2.5-0.200A	69.00
2.3-2.7	0.300	G	2	D—2.5-0.300A	77.00
2.3-2.7	0.750	H	3	D—2.5-0.750A	89.00
2.3-2.7	1.0	J	4	D—2.5-1.0A	105.00
2.7-3.1	0.200	F	1	D—2.9-0.200A	69.00
2.7-3.1	0.300	G	2	D—2.9-0.300A	77.00
2.7-3.1	0.750	H	3	D—2.9-0.750A	89.00
2.7-3.1	1.0	J	4	D—2.9-1.0A	105.00
3.1-3.5	0.200	F	1	D—3.3-0.200A	69.00
3.1-3.5	0.300	G	2	D—3.3-0.300A	77.00
3.1-3.5	0.750	H	3	D—3.3-0.750A	89.00
3.1-3.5	1.0	J	4	D—3.3-1.0A	105.00
3.5-3.9	0.200	F	1	D—3.7-0.200A	69.00
3.5-3.9	0.300	G	2	D—3.7-0.300A	77.00
3.5-3.9	0.750	H	3	D—3.7-0.750A	89.00
3.5-3.9	1.0	J	4	D—3.7-1.0A	105.00
3.9-4.3	0.200	F	1	D—4.1-0.200A	$69.00
3.9-4.3	0.300	G	2	D—4.1-0.300A	77.00
3.9-4.3	0.750	H	3	D—4.1-0.750A	89.00
3.9-4.3	1.0	J	4	D—4.1-1.0A	105.00
4.3-4.7	0.200	F	1	D—4.5-0.200A	69.00
4.3-4.7	0.300	G	2	D—4.5-0.300A	77.00
4.3-4.7	0.750	H	4	D—4.5-0.750A	89.00
4.3-4.7	1.0	J	4	D—4.5-1.0A	105.00
4.7-5.2	0.200	F	1	D—5.0-0.200A	69.00
4.7-5.2	0.300	G	2	D—5.0-0.300A	77.00
4.7-5.2	0.500	H	3	D—5.0-0.500A	89.00
4.7-5.2	0.750	H	4	D—5.0-0.750A	92.00
4.7-5.2	1.0	J	5	D—5.0-1.0A	105.00
5.2-5.8	0.200	F	1	D—5.5-0.200A	69.00
5.2-5.8	0.300	G	2	D—5.5-0.300A	77.00
5.2-5.8	0.500	H	3	D—5.5-0.500A	89.00
5.2-5.8	0.750	H	4	D—5.5-0.750A	92.00
5.2-5.8	1.0	J	5	D—5.5-1.0A	105.00
5.8-6.4	0.200	F	2	D—6.1-0.200A	69.00
5.8-6.4	0.300	G	2	D—6.1-0.300A	77.00
5.8-6.4	0.500	H	3	D—6.1-0.500A	89.00
5.8-6.4	0.750	H	4	D—6.1-0.750A	92.00
5.8-6.4	1.0	J	5	D—6.1-1.0A	105.00
6.4-7.0	0.200	F	2	D—6.7-0.200A	69.00
6.4-7.0	0.300	G	2	D—6.7-0.300A	77.00
6.4-7.0	0.500	H	3	D—6.7-0.500A	89.00
6.4-7.0	0.750	H	4	D—6.7-0.750A	92.00
6.4-7.0	1.0	J	5	D—6.7-1.0A	105.00

Ordering Information

Output Voltage ±5.0% Range	Output Current Amps	Case Size	Thermal Curve No.	A Model 0.05% Regulation Model	A Model 0.05% Regulation Price	Standard Model 0.5% Regulation Model	Standard Model 0.5% Regulation Price
7.0- 7.7	0.150	F	1	D— 7.3-0.150A	$69.00	—	—
7.0- 7.7	0.300	G	2	D— 7.3-0.300A	77.00	—	—
7.0- 7.7	0.500	H	3	D— 7.3-0.500A	89.00	—	—
7.0- 7.7	0.750	H	4	D— 7.3-0.750A	92.00	—	—
7.0- 7.7	1.0	J	5	D— 7.3-1.0A	105.00	—	—
7.7- 8.5	0.150	F	1	D— 8.1-0.150A	69.00	—	—
7.7- 8.5	0.300	G	2	D— 8.1-0.300A	77.00	—	—
7.7- 8.5	0.500	H	3	D— 8.1-0.500A	89.00	—	—
7.7- 8.5	0.750	H	4	D— 8.1-0.750A	92.00	—	—
7.7- 8.5	1.0	J	5	D— 8.1-1.0A	105.00	—	—
8.5- 9.4	0.150	F	1	D— 8.9-0.150A	69.00	—	—
8.5- 9.4	0.300	G	2	D— 8.9-0.300A	77.00	—	—
8.5- 9.4	0.500	H	3	D— 8.9-0.500A	89.00	—	—
8.5- 9.4	0.750	H	4	D— 8.9-0.750A	92.00	—	—
8.5- 9.4	1.0	J	5	D— 8.9-1.0A	105.00	—	—
9.4-10.3	0.150	F	1	D— 9.8-0.150A	69.00	D— 9.8-0.150	$56.00
9.4-10.3	0.300	G	2	D— 9.8-0.300A	77.00	D— 9.8-0.300	65.00
9.4-10.3	0.500	H	3	D— 9.8-0.500A	89.00	D— 9.8-0.500	77.00
9.4-10.3	0.750	J	5	D— 9.8-0.750A	105.00	D— 9.8-0.750	92.00
10.3-11.4	0.100	F	1	D—10.8-0.100A	69.00	D—10.8-0.100	56.00
10.3-11.4	0.200	F	2	D—10.8-0.200A	70.00	D—10.8-0.200	57.00
10.3-11.4	0.300	G	3	D—10.8-0.300A	77.00	D—10.8-0.300	65.00
10.3-11.4	0.500	H	4	D—10.8-0.500A	89.00	D—10.8-0.500	77.00
10.3-11.4	0.750	J	5	D—10.8-0.750A	105.00	D—10.8-0.750	92.00
11.4-12.6	0.100	F	1	D—12.0-0.100A	64.00	D—12.0-0.100	56.00
11.4-12.6	0.200	G	2	D—12.0-0.200A	73.00	D—12.0-0.200	65.00
11.4-12.6	0.300	G	2	D—12.0-0.300A	74.00	D—12.0-0.300	66.00
11.4-12.6	0.500	H	4	D—12.0-0.500A	85.00	D—12.0-0.500	77.00
11.4-12.6	0.750	J	5	D—12.0-0.750A	100.00	D—12.0-0.750	92.00
12.6-13.9	0.075	F	1	D—13.2-0.075A	64.00	D—13.2-0.075	56.00
12.6-13.9	0.150	F	2	D—13.2-0.150A	65.00	D—13.2-0.150	57.00
12.6-13.9	0.200	G	2	D—13.2-0.200A	73.00	D—13.2-0.200	65.00
12.6-13.9	0.300	H	3	D—13.2-0.300A	85.00	D—13.2-0.300	77.00
12.6-13.9	0.500	H	4	D—13.2-0.500A	88.00	D—13.2-0.500	80.00
12.6-13.9	0.750	J	5	D—13.2-0.750A	100.00	D—13.2-0.750	92.00
13.9-15.3	0.075	F	1	D—14.6-0.075A	64.00	D—14.6-0.075	56.00
13.9-15.3	0.150	F	2	D—14.6-0.150A	65.00	D—14.6-0.150	57.00
13.9-15.3	0.200	G	2	D—14.6-0.200A	73.00	D—14.6-0.200	65.00
13.9-15.3	0.300	H	3	D—14.6-0.300A	85.00	D—14.6-0.300	77.00
13.9-15.3	0.500	H	4	D—14.6-0.500A	88.00	D—14.6-0.500	80.00
13.9-15.3	0.750	J	5	D—14.6-0.750A	100.00	D—14.6-0.750	92.00
15.3-16.9	0.075	F	1	D—16.1-0.075A	64.00	D—16.1-0.075	56.00
15.3-16.9	0.150	F	2	D—16.1-0.150A	65.00	D—16.1-0.150	57.00
15.3-16.9	0.200	G	2	D—16.1-0.200A	73.00	D—16.1-0.200	65.00
15.3-16.9	0.300	H	3	D—16.1-0.300A	85.00	D—16.1-0.300	77.00
15.3-16.9	0.500	H	4	D—16.1-0.500A	88.00	D—16.1-0.500	80.00
15.3-16.9	0.750	J	5	D—16.1-0.750A	100.00	D—16.1-0.750	92.00
16.9-18.7	0.075	F	1	D—17.8-0.075A	65.00	D—17.8-0.075	56.00
16.9-18.7	0.150	F	2	D—17.8-0.150A	66.00	D—17.8-0.150	57.00
16.9-18.7	0.200	G	2	D—17.8-0.200A	73.00	D—17.8-0.200	65.00
16.9-18.7	0.300	H	3	D—17.8-0.300A	85.00	D—17.8-0.300	77.00
16.9-18.7	0.500	J	4	D—17.8-0.500A	100.00	D—17.8-0.500	92.00
16.9-18.7	0.750	J	6	D—17.8-0.750A	104.00	D—17.8-0.750	96.00
18.7-20.6	0.075	F	1	D—19.6-0.075A	65.00	D—17.8-0.075	56.00
18.7-20.6	0.150	F	2	D—19.6-0.150A	66.00	D—19.6-0.150	57.00
18.7-20.6	0.200	G	2	D—19.6-0.200A	73.00	D—19.6-0.200	65.00
18.7-20.6	0.300	H	3	D—19.6-0.300A	85.00	D—19.6-0.300	77.00
18.7-20.6	0.500	J	5	D—19.6-0.500A	100.00	D—19.6-0.500	92.00
18.7-20.6	0.750	J	6	D—19.6-0.750A	104.00	D—19.6-0.750	96.00
20.6-22.7	0.050	F	1	D—21.6-0.050A	65.00	D—21.6-0.050	56.00
20.6-22.7	0.100	F	2	D—21.6-0.100A	66.00	D—21.6-0-100	57.00
20.6-22.7	0.150	G	2	D—21.6-0.150A	73.00	D—21.6-0.150	65.00
20.6-22.7	0.200	G	2	D—21.6-0.200A	74.00	D—21.6-0.200	66.00
20.6-22.7	0.300	H	3	D—21.6-0.300A	85.00	D—21.6-0.300	77.00
20.6-22.7	0.500	J	5	D—21.6-0.500A	100.00	D—21.6-0.500	92.00
20.6-22.7	0.750	J	6	D—21.6-0.750A	104.00	D—21.6-0.750	96.00
22.7-25.0	0.050	F	1	D—23.8-0.050A	65.00	D—23.8-0.050	56.00
22.7-25.0	0.100	F	2	D—23.8-0.100A	66.00	D—23.8-0.100	57.00
22.7-25.0	0.150	G	2	D—23.8-0.150A	73.00	D—23.8-0.150	65.00
22.7-25.0	0.200	G	2	D—23.8-0.200A	74.00	D—23.8-0.200	66.00
22.7-25.0	0.300	H	4	D—23.8-0.300A	85.00	D—23.8-0.300	77.00
22.7-25.0	0.500	J	5	D—23.8-0.500A	100.00	D—23.8-0.500	92.00
25.0-27.6	0.050	F	1	D—26.2-0.050A	65.00	D—26.2-0.050	56.00
25.0-27.6	0.100	F	2	D—26.2-0.100A	66.00	D—26.2-0.100	57.00
25.0-27.6	0.150	G	2	D—26.2-0.150A	73.00	D—26.2-0.150	65.00
25.0-27.6	0.200	G	3	D—26.2-0.200A	74.00	D—26.2-0.200	66.00
25.0-27.6	0.300	H	4	D—26.2-0.300A	85.00	D—26.2-0.300	77.00
25.0-27.6	0.500	J	5	D—26.2-0.500A	100.00	D—26.2-0.500	92.00
27.6-30.4	0.050	F	1	D—29.0-0.050A	66.00	D—29.9-0.050	58.00
27.6-30.4	0.100	F	2	D—29.0-0.100A	67.00	D—29.0-0.100	59.00
27.6-30.4	0.150	G	2	D—29.0-0.150A	74.00	D—29.0-0.150	66.00
27.6-30.4	0.200	G	3	D—29.0-0.200A	75.00	D—29.0-0.200	67.00
27.6-30.4	0.300	H	4	D—29.0-0.300A	85.00	D—29.0-0.300	77.00
27.6-30.4	0.500	J	6	D—29.0-0.500A	100.00	D—29.0-0.500	92.00
30.4-33.6	0.050	F	1	D—32.0-0.050A	66.00	D—32.0-0.050	$58.00
30.4-33.6	0.100	F	2	D—32.0-0.100A	67.00	D—32.0-0.100	59.00
30.4-33.6	0.150	G	2	D—32.0-0.150A	74.00	D—32.0-0.150	66.00
30.4-33.6	0.200	G	3	D—32.0-0.200A	75.00	D—32.0-0.200	67.00
30.4-33.6	0.300	H	4	D—32.0-0.300A	85.00	D—32.0-0.300	77.00
30.4-33.6	0.500	J	6	D—32.0-0.500A	100.00	D—32.0-0.500	92.00
33.6-37.0	0.050	F	1	D—35.2-0.050A	66.00	D—35.2-0.050	58.00
33.6-37.0	0.100	F	2	D—35.2-0.100A	67.00	D—35.2-0.100	59.00
33.6-37.0	0.150	G	3	D—35.2-0.150A	74.00	D—35.2-0.150	66.00
33.6-37.0	0.200	G	3	D—35.2-0.200A	75.00	D—35.2-0.200	67.00
33.6-37.0	0.300	H	4	D—35.2-0.300A	85.00	D—35.2-0.300	77.00
33.6-37.0	0.500	J	6	D—35.2-0.500A	100.00	D—35.2-0.500	92.00
37.0-40.8	0.050	F	1	D—38.8-0.050A	66.00	D—38.8-0.050	58.00
37.0-40.8	0.100	F	2	D—38.8-0.100A	67.00	D—38.8-0.100	59.00
37.0-40.8	0.150	G	3	D—38.8-0.150A	74.00	D—38.8-0.150	66.00
37.0-40.8	0.200	G	4	D—38.8-0.200A	75.00	D—38.8-0.200	67.00
37.0-40.8	0.300	J	5	D—38.8-0.300A	100.00	D—38.8-0.300	92.00
40.8-45.0	0.050	F	1	D—42.8-0.050A	67.00	D—42.8-0.050	59.00
40.8-45.0	0.075	F	2	D—42.8-0.075A	71.00	D—42.8-0.075	63.00
40.8-45.0	0.100	G	2	D—42.8-0.100A	74.00	D—42.8-0.100	66.00
40.8-45.0	0.150	G	3	D—42.8-0.150A	75.00	D—42.8-0.150	67.00
40.8-45.0	0.200	H	4	D—42.8-0.200A	85.00	D—42.8-0.200	77.00
40.8-45.0	0.300	J	5	D—42.8-0.300A	100.00	D—42.8-0.300	92.00
45.0-49.5	0.050	F	1	D—47.2-0.050A	67.00	D—47.2-0.050	59.00
45.0-49.5	0.075	F	2	D—47.2-0.075A	71.00	D—47.2-0.075	63.00
45.0-49.5	0.100	G	2	D—47.2-0.100A	74.00	D—47.2-0.100	66.00
45.0-49.5	0.150	G	3	D—47.2-0.150A	75.00	D—47.2-0.150	67.00
45.0-49.5	0.200	H	4	D—47.2-0.200A	85.00	D—47.2-0.200	77.00
45.0-49.5	0.300	J	5	D—47.2-0.300A	100.00	D—47.2-0.300	92.00
49.5-54.5	0.050	F	1	D—52.0-0.050A	67.00	D—52.0-0.050	59.00
49.5-54.5	0.075	F	2	D—52.0-0.075A	71.00	D—52.0-0.075	63.00
49.5-54.5	0.100	G	2	D—52.0-0.100A	74.00	D—52.0-0.100	66.00
49.5-54.5	0.150	H	3	D—52.0-0.150A	85.00	D—52.0-0.150	77.00
49.5-54.5	0.200	H	4	D—52.0-0.200A	88.00	D—52.0-0.200	80.00
49.5-54.5	0.300	J	6	D—52.0-0.300A	100.00	D—52.0-0.300	92.00
54.5-60.0	0.050	F	1	D—57.2-0.050A	68.00	D—57.2-0.050	60.00
54.5-60.0	0.075	F	2	D—57.2-0.075A	74.00	D—57.2-0.075	66.00
54.5-60.0	0.100	G	2	D—57.2-0.100A	85.00	D—57.2-0.100	77.00
54.5-60.0	0.150	H	3	D—57.2-0.150A	88.00	D—57.2-0.150	80.00
54.5-60.0	0.200	H	4	D—57.2-0.200A	100.00	D—57.2-0.200	92.00
60.0-66.1	0.075	F	2	D—63.0-0.075A	85.00	D—63.0-0.075	77.00
60.0-66.1	0.100	G	2	D—63.0-0.100A	95.00	D—63.0-0.100	87.00
60.0-66.1	0.200	H	4	D—63.0-0.200A	115.00	D—63.0-0.200	107.00
66.1-72.8	0.050	F	2	D—69.5-0.050A	85.00	D—69.5-0.050	77.00
66.1-72.8	0.100	G	2	D—69.5-0.100A	105.00	D—69.5-0.100	97.00
66.1-72-8	0.200	H	4	D—69.5-0.200A	120.00	D—69.5-0.200	112.00
72.8-80.1	0.050	F	2	D—76.5-0.050A	90.00	D—76.5-0.050	82.00
72.8-80.1	0.100	G	3	D—76.5-0.100A	110.00	D—76.5-0.100	102.00
72.8-80.1	0.150	H	4	D—76.5-0.150A	125.00	D—76.5-0.150	117.00
80.1-88.2	0.050	F	2	D—84.2-0.050A	95.00	D—84.2-0.050	87.00
80.1-88.2	0.100	G	3	D—84.2-0.100A	115.00	D—84.2-0.100	107.00
80.1-88.2	0.150	H	4	D—84.2-0.150A	130.00	D—84.2-0.150	122.00
88.2-97.1	0.050	F	2	D—92.6-0.050A	100.00	D—92.6-0.050	92.00
88.2-97.1	0.100	G	3	D—92.6-0.100A	120.00	D—92.6-0.100	112.00
88.2-97.1	0.150	H	4	D—92.6-0.150A	135.00	D—92.6-0.150	127.00
97.1-106.8	0.025	F	1	D—102-0.025A	100.00	D—102-0.025	92.00
97.1-106.8	0.050	G	2	D—102-0.050A	105.00	D—102-0.050	97.00
97.1-106.8	0.100	H	3	D—102-0.100A	125.00	D—102-0.100	117.00
106.8-117.2	0.025	F	1	D—112-0.025A	102.00	D—112-0.025	94.00
106.8-117.2	0.050	G	2	D—112-0.050A	105.00	D—112-0.050	97.00
106.8-117.2	0.100	H	4	D—112-0.100A	125.00	D—112-0.100	117.00
117.2-128.7	0.025	F	1	D—123-0.025A	105.00	D—123-0.025	97.00
117.2-128.7	0.050	G	2	D—123-0.050A	110.00	D—123-0.050	102.00
117.2-128.7	0.100	H	4	D—123-0.100A	130.00	D—123-0.100	122.00
128.7-141.6	0.050	G	2	D—135-0.050A	115.00	D—135-0.050	107.00
128.7-141.6	0.100	H	4	D—135-0.100A	140.00	D—135-0.100	132.00
141.6-156.1	0.050	G	2	D—149-0.050A	115.00	D—149-0.050	107.00
141.6-156.1	0.075	H	3	D—149-0.075A	140.00	D—149-0.075	132.00
156.1-172.1	0.050	G	3	D—164-0.050A	120.00	D—164-0.050	112.00
156.1-172.1	0.075	H	4	D—164-0.075A	145.00	D—164-0.075	137.00
172.1-189.6	0.025	G	2	D—181-0.025A	120.00	D—181-0.025	112.00
172.1-189.6	0.075	H	4	D—181-0.075A	145.00	D—181.0.075	137.00
189.6-208	0.025	G	2	D—199-0.025A	125.00	D—199.0-0.025	117.00
189.6-208	0.050	G	3	D—199-0.025A	150.00	D—199.0-0.050	142.00
208-228.5	0.025	G	2	D—218-0.025A	125.00	D—218-0.025	117.00
208-228.5	0.050	H	3	D—218-0.050A	150.00	D—218-0.050	142.00
228.5-252	0.025	G	2	D—240-0.025A	130.00	D—240-0.025	122.00
228.5-252	0.050	H	4	D—240-0.050A	155.00	D—240-0.050	147.00

1-9 Net • 10-24 Less 5% • 25 and Above Consult Factory or Area Representative

DYNAGE inc. • BLOOMFIELD, CONN. 06002 • (203) 243-0315 • TWX 710-425-6063

H Series Modular DC Power Supplies 72-Hr Delivery Four-Way Mounting, Optional, Built-In O.V. Protector

Specifications

Input: 105 — 125 vac, 47 — 420 Hz.

Output (floating): Volts and current: See Table of Models.

Regulation Combined: ±0.05% or 1.5 mv, whichever is greater for a combined ±10 vac input change and 0 to full load change.

Ripple: 0.002% or 1 mv, rms, whichever is greater.

Temperature Coefficient: ±0.01%/°C or 1.2 mv/°C, whichever is greater, over the range of −20°C to +60°C.

Voltage Adjustment: ±5 % at rated load. ±10% at 90% load.

Resolution of Adjustment: 0.4% or 30 mv, whichever is greater.

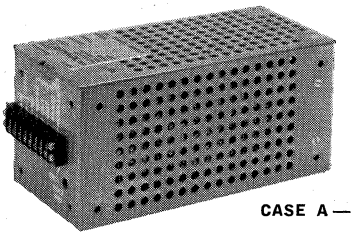
Temperature Operating: −20° to +71°C ambient (See current ratings at 3 temperature).

Temperature Storage: −62°C to +85°C.

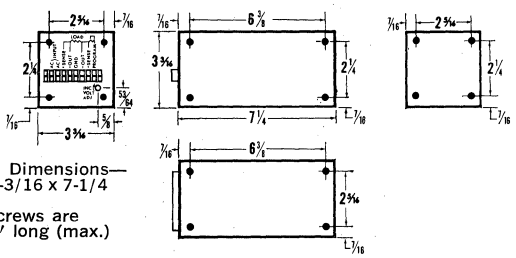
Remote Sensing, Remote Programming, Over Temperature Protection: Provided on all models.

Electronic Short Circuit Protection: Set for approx. 125% rated load.

Optional Features — See page 1918.

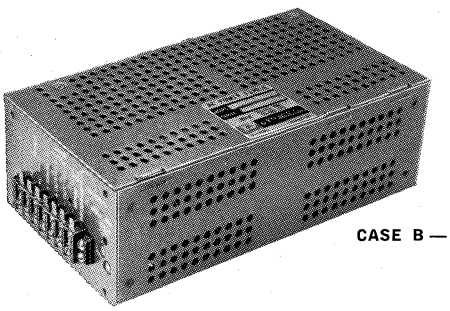


CASE A — 4 lbs.

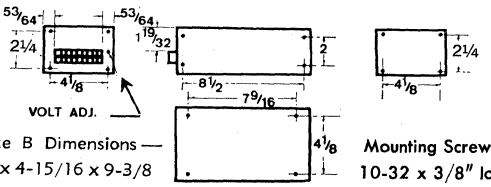


Case size A Dimensions— 3-3/16 x 3-3/16 x 7-1/4

Mounting screws are 10-32 x 3/8″ long (max.)



CASE B — 10 lbs.



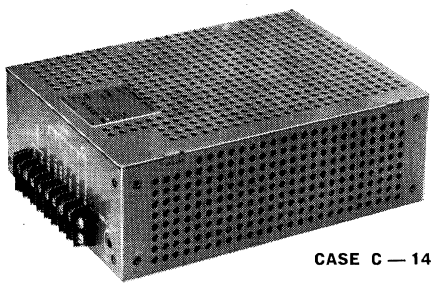
Case size B Dimensions — 3-3/16 x 4-15/16 x 9-3/8

Mounting Screws are 10-32 x 3/8″ long (max.)

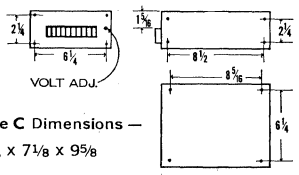
Ordering Information

Output Voltage ±5.0% Range	Output Current (Amps) at 50°C	at 60°C	at 71°C	Size	Model	Price .05% Regulation
0.5—1.2	3.3	2.7	2.2	A	H-0.9-3.3A	$117.00
1.2—1.8	3.3	2.7	2.2	A	H-1.5-3.3A	117.00
1.8—2.3	3.3	2.7	2.2	A	H-2.1-3.3A	117.00
2.3—2.7	3.3	2.7	2.2	A	H-2.5-3.3A	117.00
2.7—3.1	3.3	2.7	2.2	A	H-2.9-3.3A	117.00
3.1—3.5	3.3	2.7	2.2	A	H-3.3-3.3A	117.00
3.5—3.9	3.3	2.7	2.2	A	H-3.7-3.3A	117.00
3.9—4.3	3.3	2.7	2.2	A	H-4.1-3.3A	117.00
4.3—4.7	3.2	2.7	2.2	A	H-4.5-3.2A	117.00
4.7—5.3	3.2	2.7	2.2	A	H-5.0-3.2A	117.00
5.3—5.8	3.1	2.6	2.1	A	H-5.5-3.1A	117.00
5.8—6.4	2.9	2.4	2.0	A	H-6.1-2.9A	117.00
6.4—7.0	2.8	2.3	1.9	A	H-6.7-2.8A	117.00
7.0—7.7	2.7	2.3	1.8	A	H-7.3-2.7A	117.00
7.7—8.5	2.5	2.1	1.7	A	H-8.1-2.5A	117.00
8.5—9.4	2.4	2.0	1.6	A	H-8.9-2.4A	117.00
9.4—10.3	2.2	1.9	1.5	A	H-9.8-2.2A	117.00
10.3—11.4	2.1	1.8	1.4	A	H-10.8-2.1A	117.00
11.4—12.6	1.9	1.6	1.3	A	H-12.0-1.9A	117.00
12.6—13.9	1.8	1.6	1.3	A	H-13.2-1.8A	117.00
13.9—15.3	1.6	1.4	1.2	A	H-14.6-1.6A	117.00
15.3—16.9	1.5	1.3	1.1	A	H-16.1-1.5A	117.00
16.9—18.7	1.4	1.3	1.0	A	H-17.8-1.4A	117.00
18.7—20.6	1.3	1.2	.95	A	H-19.6-1.3A	117.00
20.6—22.7	1.2	1.1	.85	A	H-21.6-1.2A	117.00
22.7—25.0	1.1	1.0	.80	A	H-23.8-1.1A	117.00
25.0—27.6	1.0	.90	.75	A	H-26.2-1.0A	117.00
27.6—30.4	0.95	.85	.70	A	H-29.0-0.95A	117.00
30.4—33.6	0.85	.80	.65	A	H-32.0-0.85A	117.00
33.6—37.0	0.80	.75	.60	A	H-35.2-0.80A	117.00
37.0—40.8	0.70	.65	.55	A	H-38.8-0.70A	117.00
40.8—45.0	0.65	.60	.50	A	H-42.8-0.65A	117.00
45.0—49.5	0.60	.55	.45	A	H-47.2-0.60A	117.00
49.5—54.5	0.55	.50	.43	A	H-52.0-0.55A	117.00
54.5—60.0	0.50	.45	.38	A	H-57.2-0.50A	117.00
60.0—66.1	0.50	.44	.38	A	H-63.1-0.50A	129.00
66.1—72.8	0.48	.41	.35	A	H-69.5-0.48A	139.00
72.8—80.1	0.45	.39	.33	A	H-76.5-0.45A	139.00
80.1—88.2	0.40	.35	.30	A	H-84.2-0.40A	139.00
88.2—97.1	0.38	.33	.28	A	H-92.6-0.38A	139.00
97.1—106.8	0.33	.29	.25	A	H-102-0.33A	139.00
106.8—117.2	0.30	.26	.23	A	H-112-0.30A	139.00
117.2—128.7	0.28	.24	.20	A	H-123-0.28A	139.00
128.7—141.6	0.25	.21	.18	A	H-135-0.25A	139.00
141.6—156.1	0.20	.18	.15	A	H-149-0.20A	153.00
156.1—172.1	0.20	.18	.15	A	H-164-0.20A	153.00
172.1—189.6	0.18	.15	.13	A	H-181-0.18A	161.00
189.6—208	0.15	.14	.13	A	H-199-0.15A	168.00
208.0—228.5	0.15	.13	.10	A	H-218-0.15A	175.00
228.5—252	0.13	.11	.10	A	H-240-0.13A	182.00

Output Voltage ±5.0% Range	Output Current (Amps) at 50°C	at 60°C	at 71°C	Size	Model	Price .05% Regulation
0.5—1.2	6.4	5.3	4.3	B	H-0.9-6.4A	$135.00
1.2—1.8	6.4	5.3	4.3	B	H-1.5-6.4A	135.00
1.8—2.3	6.4	5.3	4.3	B	H-2.1-6.4A	135.00
2.3—2.7	6.4	5.3	4.3	B	H-2.5-6.4A	135.00
2.7—3.1	6.4	5.3	4.3	B	H-2.9-6.4A	135.00
3.1—3.5	6.4	5.3	4.3	B	H-3.3-6.4A	135.00
3.5—3.9	6.4	5.3	4.3	B	H-3.7-6.4A	135.00
3.9—4.3	6.4	5.3	4.3	B	H-4.1-6.4A	135.00
4.3—4.7	6.4	5.3	4.3	B	H-4.5-6.4A	135.00
4.7—5.3	6.4	5.3	4.3	B	H-5.0-6.4A	135.00
5.3—5.8	6.1	5.1	4.1	B	H-5.5-6.1A	135.00
5.8—6.4	5.8	4.8	3.9	B	H-6.1-5.8A	135.00
6.4—7.0	5.5	4.6	3.7	B	H-6.7-5.5A	135.00
7.0—7.7	5.4	4.5	3.6	B	H-7.3-5.4A	135.00
7.7—8.5	4.9	4.1	3.3	B	H-8.1-4.9A	135.00
8.5—9.4	4.7	4.0	3.2	B	H-8.9-4.7A	135.00
9.4—10.3	4.4	3.7	3.0	B	H-9.8-4.4A	135.00
10.3—11.4	4.1	3.5	2.8	B	H-10.8-4.1A	135.00
11.4—12.6	3.8	3.2	2.6	B	H-12.0-3.8A	135.00
12.6—13.9	3.5	3.1	2.5	B	H-13.2-3.5A	135.00
13.9—15.3	3.2	2.8	2.3	B	H-14.6-3.2A	135.00
15.3—16.9	3.0	2.6	2.1	B	H-16.1-3.0A	135.00
16.9—18.7	2.7	2.5	2.0	B	H-17.8-2.7A	135.00
18.7—20.6	2.5	2.3	1.9	B	H-19.6-2.5A	135.00
20.6—22.7	2.3	2.1	1.7	B	H-21.6-2.3A	135.00
22.7—25.0	2.2	2.0	1.6	B	H-23.8-2.2A	135.00
25.0—27.6	2.0	1.8	1.5	B	H-26.2-2.0A	135.00
27.6—30.4	1.9	1.7	1.4	B	H-29.0-1.9A	135.00
30.4—33.6	1.7	1.6	1.3	B	H-32.0-1.7A	135.00
33.6—37.0	1.6	1.5	1.2	B	H-35.2-1.6A	135.00
37.0—40.8	1.4	1.3	1.1	B	H-38.8-1.4A	135.00
40.8—45.0	1.3	1.2	1.0	B	H-42.8-1.3A	135.00
45.0—49.5	1.2	1.1	.90	B	H-47.2-1.2A	135.00
49.5—54.5	1.1	1.0	.85	B	H-52.0-1.1A	135.00
54.5—60.0	1.0	.90	.75	B	H-57.2-1.0A	135.00
60.0—66.1	1.0	.87	.75	B	H-63-1.0A	148.00
66.1—72.8	.95	.82	.70	B	H-69.5-0.95A	163.00
72.8—80.1	.90	.77	.65	B	H-76.5-0.90A	163.00
80.1—88.2	.80	.70	.60	B	H-84.2-0.80A	163.00
88.2—97.1	.75	.65	.55	B	H-92.6-0.75A	163.00
97.1—106.8	.65	.57	.50	B	H-102-0.65A	163.00
106.8—117.2	.60	.52	.45	B	H-112-0.60A	163.00
117.2—128.7	.55	.47	.40	B	H-123-0.55A	163.00
128.7—141.6	.50	.42	.35	B	H-135-0.50A	163.00
141.6—156.1	.45	.40	.35	B	H-149-0.45A	168.00
156.1—172.1	.40	.35	.30	B	H-164-0.40A	176.00
172.1—189.6	.35	.30	.25	B	H-181-0.35A	185.00
189.6—208.0	.30	.27	.25	B	H-199-0.30A	193.00
208.0—228.5	.30	.25	.20	B	H-218-0.30A	202.00
228.5—252.0	.25	.22	.20	B	H-240-0.25A	210.00



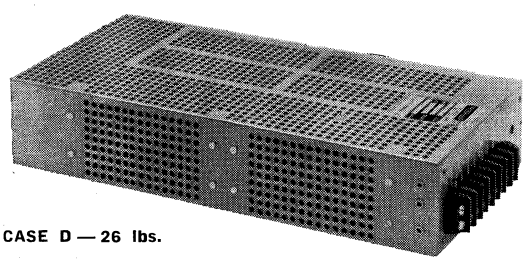
CASE C — 14 lbs.



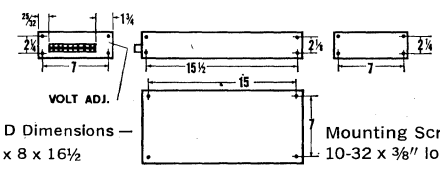
Case size C Dimensions — 3 3/16 x 7⅛ x 9 5/8

Mounting Screws are 10-32 x ⅜" long (max.)

Output Voltage ±5.0% Range	Output Current (Amps) at 50°C	at 60°C	at 71°C	Size	Model	Price .05% Regulation
0.5—1.2	11.3	9.9	8.5	C	H-0.9-11.3A	$195.00
1.2—1.8	11.3	9.9	8.5	C	H-1.5-11.3A	195.00
1.8—2.3	11.3	9.9	8.5	C	H-2.1-11.3A	195.00
2.3—2.7	11.3	9.9	8.5	C	H-2.5-11.3A	195.00
2.7—3.1	11.3	9.9	8.5	C	H-2.9-11.3A	195.00
3.1—3.5	11.3	9.9	8.5	C	H-3.3-11.3A	195.00
3.5—3.9	11.3	9.9	8.5	C	H-3.7-11.3A	195.00
3.9—4.3	10.8	9.4	8.1	C	H-4.1-10.8A	195.00
4.3—4.7	10.8	9.4	8.1	C	H-4.5-10.8A	195.00
4.7—5.3	10.8	9.4	8.1	C	H-5.0-10.8A	195.00
5.3—5.8	9.9	8.6	7.4	C	H-5.5-9.9A	195.00
5.8—6.4	9.8	8.5	7.3	C	H-6.1-9.8A	195.00
6.4—7.0	9.6	8.4	7.2	C	H-6.7-9.6A	195.00
7.0—7.7	9.3	8.1	7.0	C	H-7.3-9.3A	195.00
7.7—8.5	9.0	7.9	6.7	C	H-8.1-9.0A	195.00
8.5—9.4	8.5	7.4	6.3	C	H-8.9-8.5A	195.00
9.4—10.3	8.0	7.0	6.0	C	H-9.8-8.0A	195.00
10.3—11.4	7.7	6.7	5.7	C	H-10.8-7.7A	195.00
11.4—12.6	7.4	6.5	5.4	C	H-12.0-7.4A	195.00
12.6—13.9	7.0	6.1	5.2	C	H-13.2-7.0A	195.00
13.9—15.3	6.7	5.8	5.0	C	H-14.6-6.7A	195.00
15.3—16.9	6.3	5.5	4.7	C	H-16.1-6.3A	195.00
16.9—18.7	6.0	5.2	4.5	C	H-17.8-6.0A	195.00
18.7—20.6	5.5	4.8	4.1	C	H-19.6-5.5A	195.00
20.6—22.7	5.2	4.5	3.9	C	H-21.6-5.2A	195.00
22.7—25.0	4.8	4.2	3.6	C	H-23.8-4.8A	195.00
25.0—27.6	4.6	4.0	3.4	C	H-26.2-4.6A	195.00
27.6—30.4	4.3	3.7	3.2	C	H-29.0-4.3A	195.00
30.4—33.6	4.0	3.5	3.0	C	H-32.0-4.0A	195.00
33.6—37.0	3.8	3.3	2.8	C	H-35.2-3.8A	195.00
37.0—40.8	3.6	3.1	2.7	C	H-38.8-3.6A	195.00
40.8—45.0	3.4	3.0	2.5	C	H-42.8-3.4A	195.00
45.0—50.0	3.1	2.7	2.3	C	H-47.2-3.1A	195.00



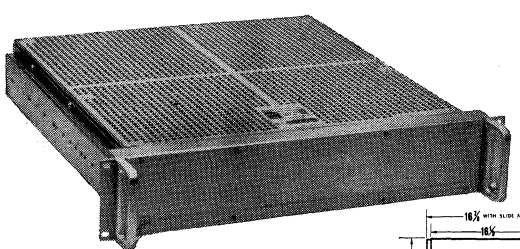
CASE D — 26 lbs.



Case size D Dimensions — 3 3/16 x 8 x 16½

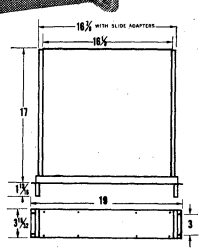
Mounting Screws are 10-32 x ⅜" long (max.)

Output Voltage ±5.0% Range	Output Current (Amps) at 50°C	at 60°C	at 71°C	Size	Model	Price .05% Regulation
0.5—1.2	23.0	20.1	17.2	D	H-0.9-23.0A	$265.00
1.2—1.8	23.0	20.1	17.2	D	H-1.5-23.0A	265.00
1.8—2.3	23.0	20.1	17.2	D	H-2.1-23.0A	265.00
2.3—2.7	23.0	20.1	17.2	D	H-2.5-23.0A	265.00
2.7—3.1	23.0	20.1	17.2	D	H-2.9-23.0A	265.00
3.1—3.5	23.0	20.1	17.2	D	H-3.3-23.0A	265.00
3.5—3.9	23.0	20.1	17.2	D	H-3.7-23.0A	265.00
3.9—4.3	21.1	18.5	15.8	D	H-4.1-21.1A	265.00
4.3—4.7	21.1	18.5	15.8	D	H-4.5-21.1A	265.00
4.7—5.3	21.1	18.5	15.8	D	H-5.0-21.1A	265.00
5.3—5.8	20.0	17.5	15.0	D	H-5.5-20.0A	265.00
5.8—6.4	19.5	17.1	14.6	D	H-6.1-19.5A	265.00
6.4—7.0	19.0	16.6	14.2	D	H-6.7-19.0A	265.00
7.0—7.7	18.0	15.7	13.5	D	H-7.3-18.0A	265.00
7.7—8.5	17.4	15.2	13.0	D	H-8.1-17.4A	265.00
8.5—9.4	16.4	14.3	12.3	D	H-8.9-16.4A	265.00
9.4—10.3	15.6	13.6	11.7	D	H-9.8-15.6A	265.00
10.3—11.4	14.8	12.9	11.1	D	H-10.8-14.8A	265.00
11.4—12.6	14.3	12.5	10.7	D	H-12.0-14.3A	265.00
12.6—13.9	13.7	12.0	10.3	D	H-13.2-13.7A	265.00
13.9—15.3	13.3	11.6	10.0	D	H-14.6-13.3A	265.00
15.3—16.9	12.4	10.8	9.3	D	H-16.1-12.4A	265.00
16.9—18.7	11.8	10.3	8.8	D	H-17.8-11.8A	265.00
18.7—20.6	11.0	9.6	8.2	D	H-19.6-11.0A	265.00
20.6—22.7	10.5	9.2	7.9	D	H-21.6-10.5A	265.00
22.7—25.0	9.5	8.3	7.1	D	H-23.8-9.5A	265.00
25.0—27.6	9.0	7.9	6.7	D	H-26.2-9.0A	265.00
27.6—30.4	8.5	7.4	6.4	D	H-29.0-8.5A	265.00
30.4—33.6	7.7	6.7	5.8	D	H-32.0-7.7A	265.00
33.6—37.0	7.3	6.4	5.5	D	H-35.2-7.3A	265.00
37.0—40.8	7.0	6.1	5.2	D	H-38.8-7.0A	265.00
40.8—45.0	6.6	5.7	4.9	D	H-42.8-6.6A	265.00
45.0—50.0	6.0	5.2	4.5	D	H-47.2-6.0A	265.00



CASE E — 52 lbs.

Case Size E Dimensions
16 7/8" wide x 17" deep x 3 15/32" high
Standard 19" panel front mounting



Meter panel optional (includes voltmeter, ammeter shunt, voltage adjust, switch, pilot light and fuse). Price: $35.00. Add suffix "M".

Output Voltage ±5.0% Range	Output Current (Amps) at 50°C	at 60°C	at 71°C	Size	Model	Price .05% Regulation
0.5—1.2	46.0	40.2	34.4	E	H-0.9-46.0A	$435.00
1.2—1.8	46.0	40.2	34.4	E	H-1.5-46.0A	435.00
1.8—2.3	46.0	40.2	34.4	E	H-2.1-46.0A	435.00
2.3—2.7	46.0	40.2	34.4	E	H-2.5-46.0A	435.00
2.7—3.1	46.0	40.2	34.4	E	H-2.9-46.0A	435.00
3.1—3.5	46.0	40.2	34.4	E	H-3.3-46.0A	435.00
3.5—3.9	46.0	40.2	34.4	E	H-3.7-46.0A	435.00
3.9—4.3	42.2	37.0	31.6	E	H-4.1-42.2A	435.00
4.3—4.7	42.2	37.0	31.6	E	H-4.5-42.2A	435.00
4.7—5.3	42.2	37.0	31.6	E	H-5.0-42.2A	435.00
5.3—5.8	40.0	35.0	30.0	E	H-5.5-40.0A	435.00
5.8—6.4	39.0	34.2	29.2	E	H-6.1-39.0A	435.00
6.4—7.0	38.0	33.2	28.4	E	H-6.7-38.0A	435.00
7.0—7.7	36.0	31.4	27.0	E	H-7.3-36.0A	435.00
7.7—8.5	34.8	30.4	26.0	E	H-8.1-34.8A	435.00
8.5—9.4	32.8	28.6	24.6	E	H-8.9-32.8A	435.00
9.4—10.3	31.2	27.2	23.4	E	H-9.8-31.2A	435.00
10.3—11.4	29.6	25.8	22.2	E	H-10.8-29.6A	435.00
11.4—12.6	28.6	25.0	21.4	E	H-12.0-28.6A	435.00
12.6—13.9	27.4	24.0	20.6	E	H-13.2-27.4A	435.00
13.9—15.3	26.6	23.2	20.0	E	H-14.6-26.6A	435.00
15.3—16.9	24.8	21.6	18.6	E	H-16.1-24.8A	435.00
16.9—18.7	23.6	20.6	17.6	E	H-17.8-23.6A	435.00
18.7—20.6	22.0	19.2	16.4	E	H-19.6-22.0A	435.00
20.6—22.7	21.0	18.4	15.8	E	H-21.6-21.0A	435.00
22.7—25.0	19.0	16.6	14.2	E	H-23.8-19.0A	435.00
25.0—27.6	18.0	15.8	13.4	E	H-26.2-18.0A	435.00
27.6—30.4	17.0	14.8	12.8	E	H-29.0-17.0A	435.00
30.4—33.6	15.4	13.4	11.6	E	H-32.0-15.4A	435.00
33.6—37.0	14.6	12.8	11.0	E	H-35.2-14.6A	435.00
37.0—40.8	14.0	12.2	10.4	E	H-38.8-14.0A	435.00
40.8—45.0	13.2	11.4	9.8	E	H-42.8-13.2A	435.00
45.0—50.0	12.0	10.4	9.0	E	H-47.2-12.0A	435.00

Standard voltages up to 250 vdc can be furnished upon request, in cases, C, D and E of the "H" Series.

1-9 Net • 10-24 Less 5% • 25 and Above Consult Factory or Area Representative

DYNAGE inc. • BLOOMFIELD, CONN. 06002 • (203) 243-0315 • TWX 710-425-6063

K & KH Series Dual Output Modular DC Power Supplies 72-Hour Delivery, Fully Repairable

Specifications

Input: 105-125 VAC, 47-420 Hz.

Output (floating): Volts and current: See model description. Master output (positive voltage) adjustable. Slave output (negative voltage) set within ±1% of master output and common to master output.

Regulation, combined: ±0.1% for a combined ±10 VAC input change and 0 to full load change.

Ripple: 2 mv, rms.

Tracking: Negative output will track with positive output to within ±0.02%/°C.

Temperature Coefficient: ±0.03%/°C, over the range of −20°C to +60°C.

Voltage adjustment: ±1 VDC.

Temperature, operating: −20°C to +71°C (Base of K series enclosures must be held at 80°C or less by heat sinking).

Temperature storage: −62°C to +85°C.

Electronic Short Circuit Protection: Set for approximately 150% rated load.

Overtemperature protection: Provided on all models.

Remote Programming: On KH series only. Optional on K series.

Resolution of Adjustment: 70 MV.

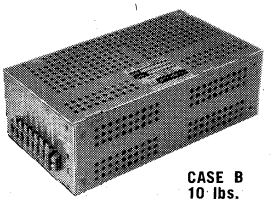
Optional Features — See page 1918



SIZE G
2.2 lbs.



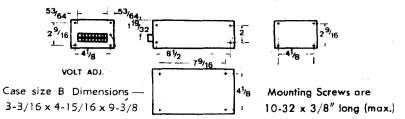
SIZE G (open)



CASE B
10 lbs.

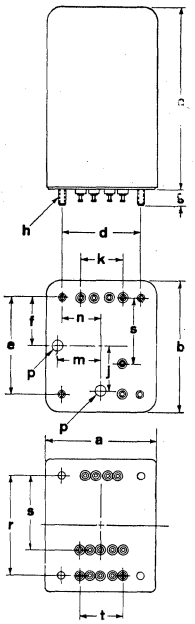


SIZE J
3.9 lbs.



Case size B Dimensions — 3-3/16 x 4-15/16 x 9-3/8

Mounting Screws are 10-32 x 3/8" long (max.)



Case Size	a	b	c	d	e	f	g	h	j	k	m	n	p	r	s	t	TOLERANCES a & b	TOLERANCES c	TOLERANCES d, e, f, j, m, n, p, r & s	TERMINAL CUTOUT (2)	TERMINAL CUTOUT PROG. & SENS.
G	2⅝	3 1/16	4 5/16	1 55/64	2 19/64	1 19/128	⅜	8-32	1 7/64	1	—	119/128	¼	—	1 5/8	1 5/16	1/32	1/32	1/64	⅜ x 1⅜	⅜ x 1 11/16
J	3⅜	3 15/16	5 5/16	2 7/16	3	1½	½	10-32	—	1	1 23/64	1 7/32	¼	3	—	1 5/16	1/32	1/32	1/64	⅜ x 1⅜	⅜ x 1 11/16

K Series Model	Output Voltage Range	Output Current Amps.	Case Size	Thermal Curve No.	Price
K-10/10 — 0.175/0.175	9.0 — 11.0	0.175	G	2	$117.00
K-10/10 — 0.60/0.60	9.0 — 11.0	0.600	J	6	155.00
K-12/12 — 0.15/0.15	11.0 — 13.0	0.150	G	2	117.00
K-12/12 — 0.50/0.50	11.0 — 13.0	0.500	J	6	155.00
K-15/15 — 0.15/0.15	14.0 — 16.0	0.150	G	2	117.00
K-15/15 — 0.50/0.50	14.0 — 16.0	0.500	J	6	155.00

KH Series Model	Output Voltage Range	Output Current (Amps.) At 50°C	At 60°C	At 71°C	Case Size	Price
KH — 10/10	9.0 — 11.0	2.0	1.7	1.4	B	$225.00
KH — 12/12	11.0 — 13.0	1.8	1.5	1.3	B	225.00
KH — 15/15	14.0 — 16.0	1.6	1.4	1.2	B	225.00

FOR OTHER VOLTAGES; CURRENT OR CASE SIZES CONSULT FACTORY

Mounting Accessories (All Series)

Rack Adapters

H R 1-A — 3½" height by 17⅝" depth (can use with chassis slides). Price $60.00. Available power supply mounting combinations by case size are as follows:

2C and 1B	4B
2C and 1A	3B and 1A
1C, 2B and 1A	2B and 2A
1C, 1B and 2A	*1B and 4A
1C and 3A	*5A

With suffix (-1) option (with no meter panels):

1C and 4A	8A

Added cost $10.00

* Only four meter panels can be provided on front panel.

H R 1-B — 3½" height by 17⅝" depth (can use with chassis slides). Price $60.00. Available power supply mounting combinations by case size are as follows:

1D and 1C 1D and 1B 1D and 2A

Note: Only 2 meter panels can be mounted on rack front.

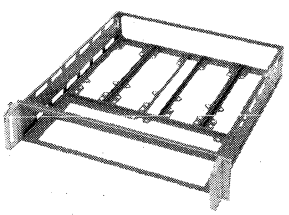
With suffix (-1) option (with no meter panels): 1D and 4A

H R 1-C—3½" height by 17⅝" depth (can use with chassis slides). Picture not shown. Mounts 2D case power supplies. Price $60.00.

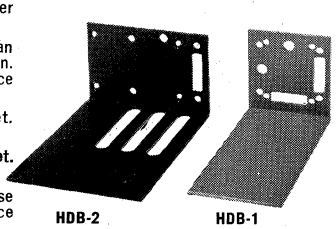
H D B-1 — D Series mounting bracket. F and G case size. Price $10.00.

H D B-2 — D Series mounting bracket. H case size. Price $10.00.

Note: Consult factory for special case mounting configurations and price quantity discount schedule.



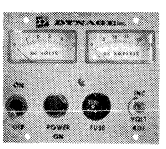
HR1-A
Rack adapter accepts Grant, Jonathan, Chassis Trak and Zero Manufacturing Slides.



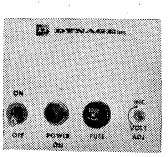
HDB-2 HDB-1

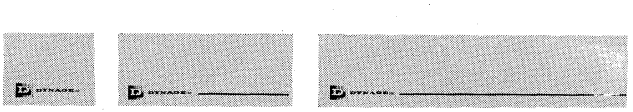
Panels

H M P-1 — ¼ Rack metered panel. 3½" height, for use with rack adapters (includes voltmeter, ammeter, shunt, screwdriver voltage adjust, switch, pilot light and fuse. Price $50.00.



H C P-1 — ¼ Rack control panel. 3½" height, for use with rack adapters (includes screwdriver voltage adjust, switch, pilot light and fuse. Price $25.00.



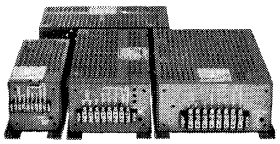


H B P-1 — Blank panel. 3½" height, ¼ rack. Price $5.00.

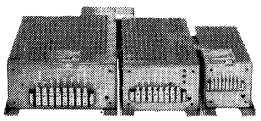
H B P-2 — Blank panel. 3½" height, ½ rack. Price $10.00.

H B P-3 — Blank panel. 3½" height, full rack. Price $10.00.

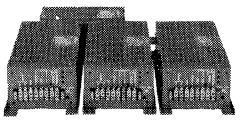
Build Your Power Supply System...



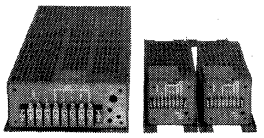
HR 1-A
1 H Series C case, 2 B cases, 1 A case
Variations:
1 H Series C case, 1 B case, 2 A case;
1 H Series C case, 3 D or K Series modules



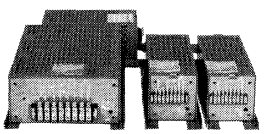
HR 1-A
1 H Series C case, 1 B case, 1 A case, 1 D or K Series module
Variations:
1 H Series C case, 2 B cases, 1 A case;
1 H Series C case, 1 B case, 2 A cases



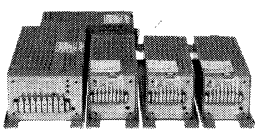
HR 1-A
3 H Series B cases, 1 A case
Variation:
2 H Series B cases, 2 A cases



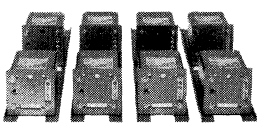
HR 1-B
1 H Series D case, 2 A cases
Variation:
1 H Series C case, 4 D or K Series Modules



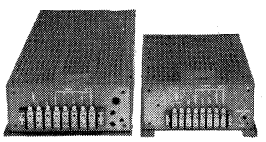
HR 1-A
1 H Series C case, 3 A cases
Variation:
1 H Series C case, 3 D or K Series modules



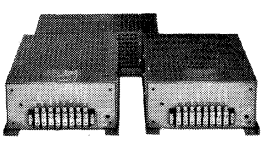
HR 1-A
1 H Series B case, 4 A cases
Variations:
5 H Series A cases
5 D or K Series modules



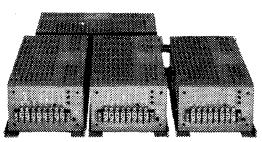
HR 1-A-1
8 D or K Series modules
Variations:
8 H Series A cases
4 H Series A cases, 1 C case



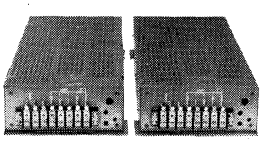
HR 1-B
1 H Series D case, 1 B case
Variation:
1 H Series D case, 1 B case
Special Variation:
1 H Series D case, 1 C case, 1 A case



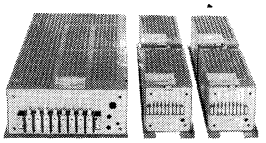
HR 1-A
2 H Series C cases, 1 B case
Variations:
2 H Series C cases, 1 A case;
2 H Series C cases, 1 D or K Series module



HR 1-A
4 H Series B cases
Variation:
4 D or K Series modules

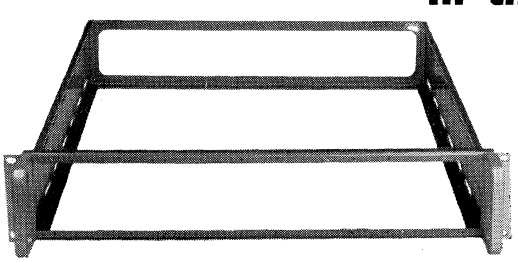


HR 1-C
2 H Series D cases



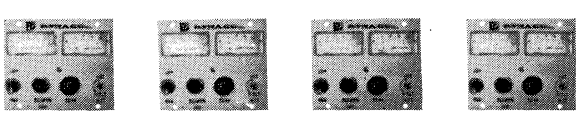
HR 1-B-1
1 H Series D case, 4 A cases
Variation:
1 H Series D case, 4 D or K Series modules

In this 3½" Rack...



3½" high by 17⅝" deep.
Slides available. Mounts in 18" or deeper cabinets.

With These Panels...

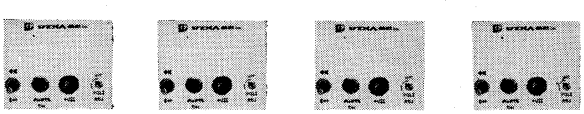


HMP-1 — Mounts up to 4 in a rack

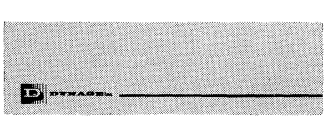


HBP-1
Mounts up to 4 in a rack

HBP-2
Mounts up to 2 in a rack



HCP-1 — Mounts up to 4 in a rack



HBP-3 — Mounts 1 in a rack

Send for your free system designer's manual. This manual includes detailed outline drawings printed on reproducible stock for your designing convenience.

DYNAGE inc. • BLOOMFIELD, CONN. 06002 • (203) 243-0315 • TWX 710-425-6063

Optional Features

Improved Combined Voltage Regulation, Suffixes "A", "AA" and "AAA"

K & KH SERIES ONLY

Suffix "A" — Added Cost $10.00

Combined voltage regulation of ±0.05%. To order add a suffix "A" to the model number

D & H SERIES ONLY

Suffix "AA" — Added Cost $10.00 or 5% whichever is greater

Combined voltage regulation of ±0.025% or ±0.75 mv, whichever is greater.

Suffix "AAA" — Added Cost $30.00 or 15% whichever is greater

Combined voltage regulation of ±0.01% or ±0.5 mv, whichever is greater. This feature should only be ordered in conjunction with suffixes "F" or "FF" or "R" or "P" and "T".

Fixed Output, Suffixes "F" and "FF"

Suffix "F" — No Added Cost

Output fixed as specified within model range to ±1% or ±50 mv, whichever is greater.

Suffix "FF" — Added Cost $5.00 or 3% whichever is greater

Output fixed as specified within Model range to ±0.25% or ±15 mv, whichever is greater.

Remote Sensing, Suffix "S" — Added Cost $5.00

D SERIES

Two (2) additional terminals are provided in the base of the supply for connection to the remotely located load. Voltage drops in the load lines should not be allowed to exceed 0.5 vdc. Remote sensing leads should be shielded on long runs to prevent pickup into the amplifier circuitry of the supply.

K SERIES

Three (3) additional terminals are provided in the base of the supply for connection to the remotely located load. Voltage drops in the load lines should not be allowed to exceed 0.5 VDC. Remote sensing leads should be shielded on long runs to prevent pickup into the amplifier circuitry of the supply.

KH SERIES

Three (3) extra terminals are provided above the connection for connection to the remotely located load. Voltage drops in the load lines should not be allowed to exceed 0.5 VDC. Remote sensing leads should be shielded on long runs to prevent pick-up into the amplifier circuitry of the supply.

Remote Programming, Suffix "P" — Added Cost $5.00 (D Series only; Standard on H Series)

Two (2) extra terminals are provided in the base of the supply for connection of the remotely located trimpot. The standard internal trimpot will be shipped as a separate item with the supply. Use shielded leads on long runs to prevent pick-up into the amplifier circuitry of the supply. Programming resistance is as follows:

Output Voltage Model Group	Programming Resistance, ohms/volt	
	"A" Models	Std. Models
0.9 to 10.8	180 to 200	—
12.0 to 57.2	180 to 200	84 to 102
63.0 to 240	300 to 333	260 to 340

Add Suffix "P" to the model number when ordering

Remote Programming, Master Output Only, K Series Only, Suffix "P" Added Cost $5.00

One (1) extra terminal is provided in the base of the supply for connection to the remotely located trimpot. The standard internal potentiometer will be shipped as a separate item with the supply. Programming resistance is 84 to 102 ohms/volt. Use shielded leads on long runs to prevent pickup into the amplifier circuitry of the supply. Add suffix "P" to the model number.

Built-in Overvoltage Protection, Suffix "D" (H Series and J size of D Series). Added Cost $30.00 or 15% whichever is greater.

This feature will drive the output voltage towards zero by electronically shorting the output, if the output increases above the preset level of 125% to 135% of the nominal output voltage. Protection level can be set to other values within a setting accuracy of ±5%. The supply must be turned "off" and then "on" to restore the output after the protection circuit has operated. This feature is available on the J Size and all H series modules only. Minimum voltage set point 5.5 vdc.

230 VAC Input — Suffix "N". H Series Only

Add $5.00 when ordered in A and B case sizes. No additional charge when ordered in C, D and E case sizes.

Wide Input Range — Suffix "W" — Added Cost $10.00 or 8% whichever is greater.

This feature will allow an expanded input voltage range of 95 vac to 132 vac at 57-63 Hz. Derate output current by 25% on all models.

Series connection, Suffix "B" — Added Cost $1.00 or 2% whichever is greater (D & H Series only)

The supplies will operate into either conventional or complex loads with series connection, but should have a silicon rectifier connected externally across each of the two (2) outputs with the cathode of the rectifier being connected to the + output terminal of the supply. The rectifier will protect the pass transistor sections of each supply from being overvoltaged when the supply is driven to cut back by short circuiting the output. Modifications are made internally to the H series supplies only. Added cost: $1.00 or 2% whichever is greater.

Fungus Proofing, Suffix "V" — Added Cost $10.00 or 3% whichever is greater

MIL-V-173 varnish is used for fungi nutrient components.

Improved Resolution of Adjustment, Suffix "R"
Added Cost $10.00 or 5% whichever is greater

Improved resolution of output voltage adjustment can be obtained on the "A" models only by adding suffix "R" to the model number. The resolution and adjust span are listed opposite the range of nominal output voltages of the supplies. Specify the nominal output required when ordering. Available on "A" models only.

D & H SERIES

Output Voltage Model Group	Adjust Span, mv	Resolution (whichever is greater)
0.9 to 4.1 vdc	± 50	1 mv
4.5 to 6.7 vdc	± 75	1 mv
7.3 to 10.8 vdc	± 100	0.01% or 1 mv
12.0 to 19.6	± 200	10 mv
21.6 to 38.8	± 400	0.05% or 16 mv
42.8 to 92.6	± 1000	31 mv
102 to 199	± 2000	39 mv
218 to 240	± 4000	67 mv

K & KH SERIES

±10	±250	12 MV
±12	±250	12 MV
±15	±250	12 MV

Improved Tracking, Suffix "K" Added Cost $20.00

Tracking of the −15 vdc output to the +15 VDC output within ±0.005%/°C. To order add a suffix "K" to the model number.

Lower Temperature Coefficient, Suffix "T" Added Cost $10.00

Temperature coefficient of ±0.015%/°C over the range of −20°C to +60°C. To order add a suffix "T" to the model number.

Lower Temperature Coefficient, Suffixes "T", "TT" and "TTT"

D & H SERIES ONLY

Suffix	Temperature Coefficient (whichever is greater)	Range, °C	Added Cost
"T"	±0.005%/°C or ±0.6 mv/°C	−20 to 60	$20.00 or 10%
*"TT"	±0.002%/°C or ±0.24 mv/°C	0 to 50	25.00 or 15%
*"TTT"	±0.001%/°C or ±0.12 mv/°C	0 to 50	50.00 or 50%

*Suffixes "TT" and "TTT" are only available in conjunction with the following other optional features. Suffix "F" or "FF" or "R" or "P".

Long Term Stability, Suffixes "H", "HH" and "HHH"

D & H SERIES ONLY

Suffix	Long Term Stability (whichever is greater)	Short Term Stability (whichever is greater)	Added Cost
*"H"	±0.05% or ±6 mv/month	±0.01% is ±1.2 mv/8 hrs.	$30.00 or 20%
*"HH"	±0.02% or ±2.4 mv/month	±0.004% or ±0.5 mv/8 hrs.	50.00 or 50%
**"HHH"	±0.005% or ±0.6 mv/month	±0.001% or ±0.12 mv/8 hrs.	90.00 or 100%

*Suffixes "H" and "HH" are only available in conjunction with Suffix "TT" (and other required Suffixes).

**Suffix "HHH" is only available in conjunction with Suffix "TTT" (and other required Suffixes).

Ordering Information

To Order

Specify power supply by model number along with suffixes for any optional features required. As an example, to order Model D-14.6 — 0.200A with improved 0.01% regulation (Suffix "AAA"), with fixed output, (Suffix "F"), and with 0.002% temperature coefficient (Suffix "TT"); the complete model number would be D-14.6 - 0.200AAAFTT.

Cost additions to the base cost of $73.00 for 1-9 quantity are $30.00 for Suffix "AAA", none for Suffix "F", and $25.00 for Suffix "TT" for a total cost of $128.00.

Seventy-two (72) hour delivery can be made on quantities of 2 pieces or less of each model ordered, except those with optional features.
Outline drawings and parts lists only furnished when requested.

* For mixed models and optional feature discounts, consult local rep or Dynage directly.

Terms

Terms are net 30 days, F.O.B. Bloomfield, Conn. Prices and specifications subject to change without notice. Blanket purchase agreements with releases over one (1) year are easily arranged.

Warranty

Dynage, Inc., warrants each product manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing, adjusting or replacing any product returned to the factory for that purpose within two (2) years after date of shipment. We assume no liability for consequential damages of any kind, and the purchaser, by acceptance of each product will assume all liability for the consequence of its use or misuse by the purchaser, his employees, or others.

Elcor HIGH ISOLATION* OUTPUT

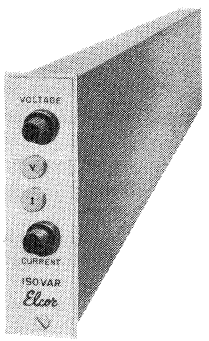
Low Noise DC Power and Transformer Modules

NEW

ISOVAR: Automatic Voltage-to-Current Regulation

- Voltage monitoring in constant current mode
- No compromise of current regulation through load

It's the versatile isolated power supply; two operating modes—voltage and current regulation; 0.002% current and voltage regulation; 0 to 40 V, 175 MA output; 1.4″ width allows 12 channels in standard 19″ rack; 10-turn pots set precise maximum and operating values for current and voltage; guarded remote sensing leads; 0.005%/°C T.C. for both current and voltage; state-of-the-art integrated circuits design. Write for complete details and pricing information. (Tentative Specifications)

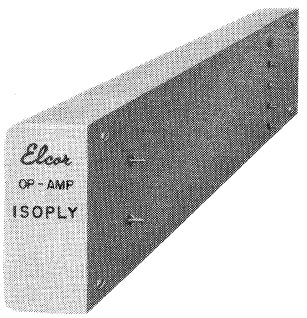


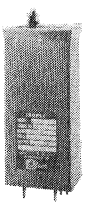
NEW

DUAL POWER ISOPLY

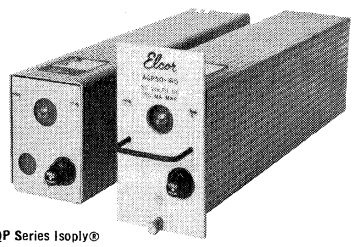
- Isolated power for operational amplifier
- Precise regulation and tracking

Compact power for printed circuit board mounting; ±15 VDC, 200 MA; —15 V output tracks +15 V output; current limiting; 0.005% voltage regulation; 0.005%/°C T.C.; 3″H x 1″W x 8″D. Write for complete details and pricing information. (Tentative Specifications)





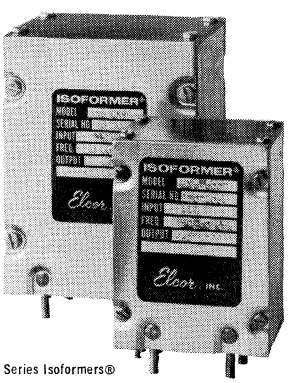
QM Series Isoply®



4QC and 4QP Series Isoply®

ISOPLYS: Isolated-output DC power supplies for bridge circuits. Less than 5 μV p-p noise to ground, when used with a 350-ohm transducer. All silicon transistor regulated power supplies. Output voltage adjustable about ±10% from nominal voltage. Available as chassis mounted with solder terminals (QC series) and as plug-in modules (QP series), 6 per 19-inch rack. Outputs from 1 V, 200 MA to 100 V, 1¢ MA. Adjustable models, 4 to 16 V, 75 MA output (QM series), 15 silicon devices, wire-wound resistors, 10-turn potentiometer stability of 0.05%/8 hours. Current limiting. Regulation, 0.02%; T.C. 0.01%/°F. Ripple: Less than 0.005%. Remote sensing.

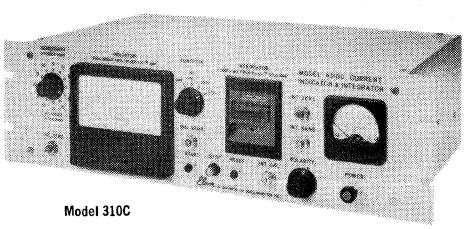
APPLICATIONS: Power modules for use with: bridge circuits, ungrounded amplifiers, traveling wave tubes, screen rooms; for use as: servo references, floating bias, direct coupling, ground loop decoupling, slide wire power supply, battery substitutes.



4X and 25X Series Isoformers®

ISOLATED REFERENCE SUPPLIES: DC outputs of 6.2 V, 8.4 V, 9.0 V, and 11.7 V, currents from less than 1 MA to 20 MA (fixed load). For floating potentiometers, retransmitting slide wires, wide range zero controls, bias, and many other voltage reference applications. Available in mumetal cans for reduced magnetic disturbance.

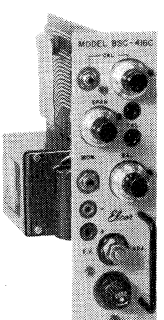
ISOFORMERS: Isolation transformers: 4 W and 25 W; secondary winding and shield have high conductive and capacitive isolation from primary and case (ground or primary common). Line isolation .05pf and ground isolation 15pf. Output voltages from 6.3V to 150V for 4 W models and to 600V for 25 W models. Standard input 117 VAC 50-60 Hz; other inputs from 6.3 VAC to 234 VAC available. Available up to 6 KVA output.



Model 310C

CURRENT INDICATOR AND INTEGRATORS: New solid state instruments; push button start-stop control and/or remote reset. APPLICATIONS: Nuclear experiments, spectroscopic and chromatographic analysis, flow totalizing, stress-strain testing, densitometry, illumination testing. Gives continuous indication of chemical reaction progress in coulombmetric experiments. Sensitivities to 3 x 10^{-10} amperes. Specifications: 0.02% per hour drift, 0.2% reproducibility, 1% accuracy. Digital readout and electrical recorder output.

BRIDGE SIGNAL CONDITIONING UNITS: Conditions and prepares electrical signals from various strain sensitive resistance transducers. Incorporates Elcor 4 to 16V, 75 MA highly isolated low noise power supply. Variable controls—balance, voltage, span, and calibration—are 10-turn, high resolution, low T.C. potentiometers. For 4, 6, or 8 wire systems. Convenient test and remote control features.



Model BSC-416C

*Power supplies with entire output circuitry highly isolated conductively and capacitively from ground (case) and ac input; used without causing a ground loop or adding to the existing noise level. True battery equivalent.

For complete information on all Elcor high isolation products, see your representative or write Elcor.

Elcor 2431 Linden Lane, P.O. Box 986, Silver Spring, Maryland 20910 / (301) 589-6614
Products by Welex Electronics, a division of Halliburton Services

E-TRONICS

MODULAR D.C. POWER SUPPLIES

SELECTED RANGE MODULES & PROGRAMMABLE RANGE MODULES

INTEGRATED CIRCUIT DESIGN

GENERAL SPECIFICATIONS FOR .01% SUPPLIES

INPUT 105-125 volts AC, 50-400 cycles per second

LINE REGULATION Less than 0.01% or 1 mv

LOAD REGULATION Less than 0.01% or 1 mv

RIPPLE NOISE Less than 500 microvolts

STABILITY Less than 0.01% or 5 mv/8 hrs.

RECOVERY TIME Less than 50 microseconds for instantaneous load changes

OUTPUT IMPEDANCE Less than KE/1 ohms

Frequency Range	DC-1KC	1KC-100KC	100KC-1MC
K	0.0004	0.004	0.04

OVERLOAD & SHORT CIRCUIT Circuit reduces voltage current simultaneously for overload or short circuit with automatic recovery after overload is removed.

TEMPERATURE COEFFICIENT Less than 0.01% or 1 mv/°C

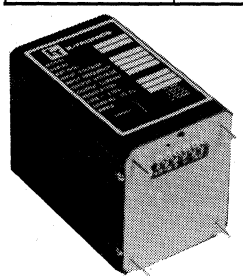
OPERATING TEMPERATURE 71°C max.

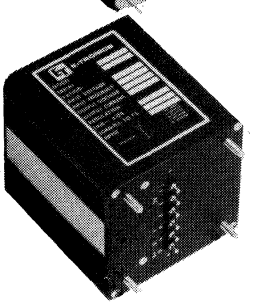
RESOLUTION Less than 0.05%

REMOTE PROGRAMMING Nominally 200 ohms per volt

CONTROLS Voltage adjust, screwdriver control, self-locking pot on modules.

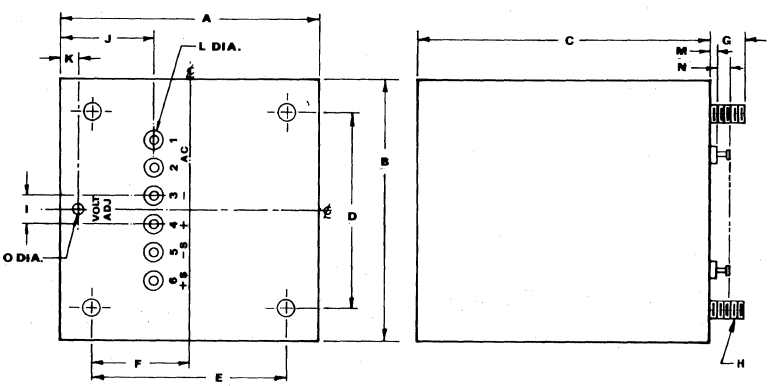
TERMINALS Input, output and remote sensing, solder terminals

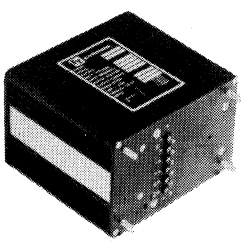


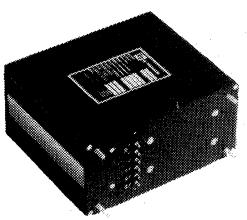


CASE DIMENSIONS

(Barrie strip terminals available)







MODULE DIMENSIONS

CASE SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	APPROX. NET LBS.	WEIGHT SHPG. LBS.
1	3 17/32	3 1/32	3 13/16	2 13/16	2 23/32	1 23/64	1/2	8-32	1/4	9/16	3/16	1/8	1/16	1/4	3/16	2 1/2	5
2	3 17/32	3 1/32	4 13/16	2 13/16	2 23/32	1 23/64	1/2	8-32	1/4	9/16	3/16	1/8	1/16	1/4	3/16	3 1/2	5 1/2
3	4	4	4 1/2	3	3	1 1/2	17/32	10-32	7/16	1 13/16	13/32	5/16	3/32	3/16	3/16	8	11
4	6	4	5 5/8	3	5	2 1/2	17/32	10-32	7/16	1 5/8	13/32	5/16	3/32	3/16	3/16	12	15
5	8	4	6 7/8	3	6 7/8	3 7/16	17/32	10-32	7/16	2 1/2	13/32	5/16	3/32	3/16	3/16	17	20

OPTIONS AVAILABLE:

		Price
A	Overvoltage Protection	$15.00
B	210-250 Volt Input	$10.00
C	110-220 Volt Input	$15.00

Add Suffix to end of Part Number

Consult the

MANUFACTURERS & SALES OFFICES DIRECTORY

in the eem yellow pages

for your local representative

E-TRONICS • 5901 Noble Avenue, Van Nuys, Calif. 91401 • Phone (213) 787-5581

E-TRONICS

SELECTED RANGE MODULES

TWO ACCURACY MODELS .1% — .01%

Output Voltage ± Adj. Range	Amps	Case	.1% Model	Price	.01% Model	Price
3 Volts ±.5 V. ADJ.	.25	1	EA3-.25	55	E3-.25	70
	.5	1	EA3-.5	60	E3-.5	75
	1	1	EA3-1	65	E3-1	80
	2	2	EA3-2	70	E3-2	90
	3	3	EA3-3	90	E3-3	110
	4	4	EA3-4	130	E3-4	160
	5	4	EA3-5	140	E3-5	170
	6	5	EA3-6	150	E3-6	185
	10	5	EA3-10	190	E3-10	235
4 Volts ±.5 V. ADJ.	.25	1	EA4-.25	55	E4-.25	70
	.5	1	EA4-.5	60	E4-.5	75
	1	1	EA4-1	65	E4-1	80
	2	2	EA4-2	70	E4-2	90
	3	3	EA4-3	90	E4-3	110
	4	4	EA4-4	130	E4-4	160
	5	4	EA4-5	140	E4-5	170
	6	5	EA4-6	150	E4-6	185
	10	5	EA4-10	190	E4-10	235
5 Volts ±.5 V. ADJ.	.25	1	EA5-.25	55	E5-.25	70
	.5	1	EA5-.5	60	E5-.5	75
	1	2	EA5-1	65	E5-1	80
	2	2	EA5-2	70	E5-2	90
	3	3	EA5-3	90	E5-3	110
	4	4	EA5-4	130	E5-4	160
	5	4	EA5-5	140	E5-5	170
	6	5	EA5-6	145	E5-6	180
	10	5	EA5-10	185	E5-10	230
6 Volts ±.5 V. ADJ.	.25	1	EA6-.25	55	E6-.25	70
	.5	1	EA6-.5	60	E6-.5	75
	1	2	EA6-1	65	E6-1	80
	2	3	EA6-2	75	E6-2	95
	3	3	EA6-3	85	E6-3	105
	4	4	EA6-4	125	E6-4	155
	5	4	EA6-5	135	E6-5	165
	6	5	EA6-6	150	E6-6	185
	10	5	EA6-10	185	E6-10	230
7 Volts ±.5 V. ADJ.	.25	1	EA7-.25	55	E7-.25	70
	.5	1	EA7-.5	60	E7-.5	75
	1	2	EA7-1	65	E7-1	80
	2	3	EA7-2	80	E7-2	100
	3	3	EA7-3	90	E7-3	110
	4	4	EA7-4	140	E7-4	170
	5	4	EA7-5	160	E7-5	200
	6	5	EA7-6	180	E7-6	225
	10	5	EA7-10	200	E7-10	245
8 Volts ±.5 V. ADJ.	.25	1	EA8-.25	55	E8-.25	70
	.5	1	EA8-.5	60	E8-.5	75
	1	2	EA8-1	65	E8-1	80
	2	3	EA8-2	80	E8-2	100
	3	4	EA8-3	135	E8-3	150
	4	4	EA8-4	145	E8-4	175
	5	4	EA8-5	160	E8-5	200
	6	5	EA8-6	180	E8-6	225
	10	5	EA8-10	200	E8-10	245
9 Volts ±.5 V. ADJ.	.25	1	EA9-.25	55	E9-.25	70
	.5	1	EA9-.5	60	E9-.5	75
	1	2	EA9-1	65	E9-1	80
	2	3	EA9-2	80	E9-2	100
	3	4	EA9-3	125	E9-3	150
	4	4	EA9-4	140	E9-4	175
	5	4	EA9-5	160	E9-5	200
	6	5	EA9-6	180	E9-6	225
	9	5	EA9-9	200	E9-9	245
10 Volts ±.5 V. ADJ.	.25	1	EA10-.25	55	E10-.25	70
	.5	1	EA10-.5	60	E10-.5	80
	1	2	EA10-1	70	E10-1	90
	2	3	EA10-2	80	E10-2	100
	3	4	EA10-3	125	E10-3	150
	4	4	EA10-4	135	E10-4	165
	5	5	EA10-5	160	E10-5	200
	6	5	EA10-6	180	E10-6	225
	8	5	EA10-8	200	E10-8	245

Output Voltage ± Adj. Range	Amps	Case	.1% Model	Price	.01% Model	Price
12 Volts ±.5 V. ADJ.	.25	1	EA12-.25	55	E12-.25	70
	.5	1	EA12-.5	60	E12-.5	80
	1	2	EA12-1	70	E12-1	90
	2	3	EA12-2	80	E12-3	100
	3	4	EA12-3	125	E12-3	150
	4	4	EA12-4	135	E12-4	165
	5	5	EA12-5	160	E12-5	200
	6	5	EA12-6	180	E12-6	225
	7	5	EP12-7	190	E12-7	235
14 Volts ±.5 V. ADJ.	.25	1	EA14-.25	55	E14-.25	70
	.5	2	EA14-.5	65	E14-.5	80
	1	3	EA14-1	80	E14-1	100
	2	4	EA14-2	125	E14-2	150
	3	4	EA14-3	130	E14-3	160
	4	4	EA14-4	140	E14-4	170
	5	5	EA14-5	160	E14-5	200
	6	5	EA14-6	180	E14-6	225
	7	5	EA14-7	190	E14-7	235
15 Volts ±.5 V. ADJ.	.25	1	EA15-.25	55	E15-.25	70
	.5	2	EA15-.5	65	E15-.5	80
	1	3	EA15-1	80	E15-1	100
	2	4	EA15-2	125	E15-2	150
	3	4	EA15-3	130	E15-3	160
	4	4	EA15-4	140	E15-4	170
	5	5	EA15-5	160	E15-5	200
	6	5	EA15-6	180	E15-6	225
	7	5	EA15-7	190	E15-7	235
16 Volts ±.5 V. ADJ.	.25	1	EA16-.25	55	E16-.25	70
	.5	2	EA16-.5	65	E16-.5	80
	1	3	EA16-1	80	E16-1	100
	2	4	EA16-2	125	E16-2	150
	3	4	EA16-3	130	E16-3	160
	4	5	EA16-4	140	E16-4	175
	5	5	EA16-5	160	E16-5	200
	6	5	EA16-6	180	E16-6	225
	7	5	EA16-7	190	E16-7	235
18 Volts ±.5 V. ADJ.	.25	1	EA18-.25	55	E18-.25	70
	.5	2	EA18-.5	65	E18-.5	80
	1	3	EA18-1	80	E18-1	100
	2	4	EA18-2	125	E18-2	150
	3	4	EA18-3	130	E18-3	160
	4	5	EA18-4	140	E18-4	175
	5	5	EA18-5	160	E18-5	200
	6	5	EA18-6	180	E18-6	225
	7	5	EA18-7	190	E18-7	235
19 Volts ±.5 V. ADJ.	.25	1	EA19-.25	55	E19-.25	70
	.5	2	EA19-.5	65	E19-.5	80
	1	3	EA19-1	80	E19-1	100
	2	4	EA19-2	125	E19-2	150
	3	4	EA19-3	130	E19-3	160
	4	5	EA19-4	140	E19-4	175
	5	5	EA19-5	160	E19-5	200
	6	5	EA19-6	180	E19-6	225
	7	5	EA19-7	190	E19-7	235
20 Volts ±1 V. ADJ.	.25	1	EA20-.25	55	E20-.25	70
	.5	2	EA20-.5	65	E20-.5	80
	1	3	EA20-1	80	E20-1	100
	2	4	EA20-2	125	E20-2	150
	3	4	EA20-3	130	E20-3	160
	4	5	EA20-4	140	E20-4	175
	5	5	EA20-5	160	E20-5	200
	6	5	EA20-6	180	E20-6	225
22 Volts ±1 V. ADJ.	.25	1	EA22-2.5	55	E22-.25	70
	.5	2	EA22-.5	65	E22-.5	80
	1	3	EA22-1	80	E22-1	100
	2	4	EA22-2	125	E22-2	150
	3	4	EA22-3	130	E22-3	160
	4	5	EA22-4	140	E22-4	175
	5	5	EA22-5	160	E22-5	200
	6	5	EA22-6	180	E22-6	225

Output Voltage ± Adj. Range	Amps	Case	.1% Model	Price	.01% Model	Price
24 Volts ±2 V. ADJ.	.25	1	EA24-.25	55	E24-.25	70
	.5	2	EA24-.5	65	E24-.5	80
	1	3	EA24-1	80	E24-1	100
	2	4	EA24-2	125	E24-2	150
	3	5	EA24-3	140	E24-3	175
	4	5	EA24-4	160	E24-4	200
	5	5	EA24-5	180	E24-5	225
28 Volts ±2 V. ADJ.	.25	1	EA28-.25	55	E28-.25	70
	.5	2	EA28-.5	65	E28-.5	80
	1	3	EA28-1	80	E28-1	100
	2	4	EA28-2	125	E28-2	150
	3	5	EA28-3	140	E28-3	175
	4	5	EA28-4	160	E28-4	200
	5	5	EA28-5	180	E28-5	225
32 Volts ±2 V. ADJ.	.25	1	EA32-.25	55	E32-.25	70
	.5	2	EA32-.5	65	E32-.5	80
	1	3	EA32-1	80	E32-1	100
	2	4	EA32-2	125	E32-2	150
	3	5	EA32-3	160	E32-3	200
	4	5	EA32-4	180	E32-4	225
36 Volts ±2 V. ADJ.	.1	1	EA36-.1	65	E36-.1	80
	.25	2	EA36-.25	70	E36-.25	85
	.5	2	EA36-.5	75	E36-.5	95
	1	3	EA36-1	125	E36-1	150
	2	4	EA36-2	155	E36-2	190
	3	5	EA36-3	190	E36-3	235
	4	5	EA36-4	200	E36-4	245
40 Volts ±2 V. ADJ.	.1	1	EA40-.1	65	E40-.1	80
	.25	2	EA40-.25	70	E40-.25	85
	.5	3	EA40-.5	95	E40-.5	115
	1	3	EA40-1	125	E40-1	150
	2	4	EA40-2	155	E40-2	190
	3	5	EA40-3	190	E40-3	235
	4	5	EA40-4	200	E40-4	245
44 Volts ±2 V. ADJ.	.1	1	EA44-.1	65	E44-.1	80
	.25	2	EA44-.25	70	E44-.25	85
	.5	3	EA44-.5	95	E44-.5	115
	1	3	EA44-1	125	E44-1	150
	2	4	EA44-2	155	E44-2	190
	3	5	EA44-3	190	E44-3	235
	4	5	EA44-4	200	E44-4	245
48 Volts ±2 V. ADJ.	.1	1	EA48-.1	65	E48-.1	80
	.25	2	EA48-.25	70	E48-.25	85
	.5	3	EA48-.5	95	E48-.5	115
	1	3	EA48-1	125	E48-1	150
	2	4	EA48-2	155	E48-2	190
	3	5	EA48-3	190	E48-3	235
	4	5	EA48-4	200	E48-4	245
52 Volts ±2 V. ADJ.	.05	1	EA52-.05	65	E52-.05	80
	.1	1	EA52-.1		E52-.1	90
	.25	2	EA52-.25		E52-.25	95
	.5	3	EA52-.5		E52-.5	125
	1	3	EA52-1		E52-1	160
	2	4	EA52-2		E52-2	200
	3	5	EA52-3		E52-3	245

For higher voltage ranges contact factory for bulletin covering modules up to 300 volts output.

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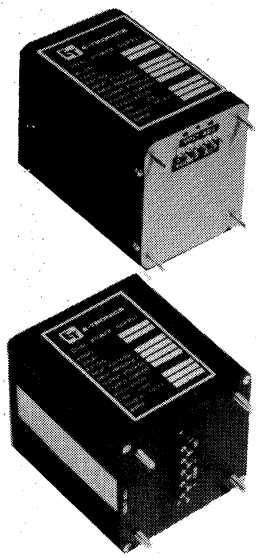
E-TRONICS

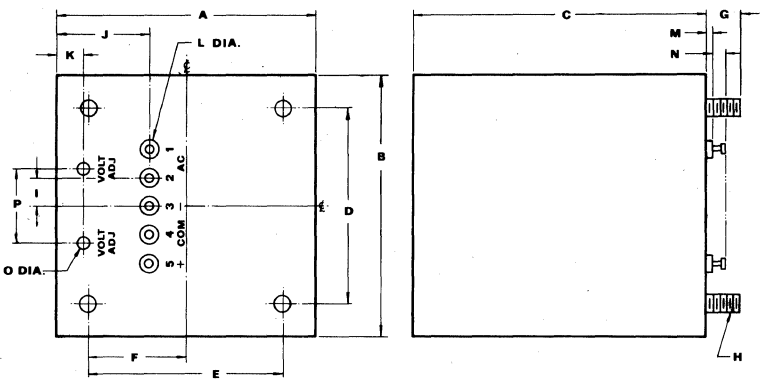
MODULAR D.C. POWER SUPPLIES
DUAL OUTPUT MODULES

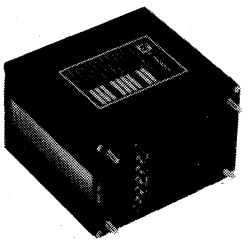
INTEGRATED CIRCUIT DESIGN

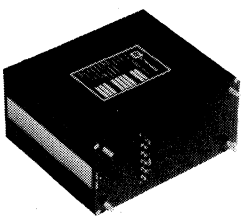


CASE DIMENSIONS

(Barrier strip terminals available)







DUAL OUTPUT SUPPLIES

Output Voltage ± Adjust Range	Current Amps Ea. Output	*Case Size See Dwg.	Standard Model ±.1% Accuracy	Price	Precision Model ±.01% Accuracy	Price
5 Volts ±.5 V ADJ.	.100	1	EDA5-.1	$ 90	ED5-.1	$105
	.250	1	EDA5-.25	95	ED5-.25	110
	.500	2	EDA5-.5	105	ED5-.5	120
	1.0	2	EDA5-1	120	ED5-1	135
	1.5	3	EDA5-1.5	140	ED5-1.5	165
	2.0	4	EDA5-2	190	ED5-2	215
	3.0	5	EDA5-3	225	ED5-3	245
6 Volts ±.5 V ADJ.	.100	1	EDA7-.1	$ 90	ED7-.1	$105
	.250	1	EDA7-.25	95	ED7-.25	110
	.500	2	EDA7-.5	105	ED7-.5	120
	1.0	3	EDA7-1	130	ED7-1	145
	1.5	4	EDA7-1.5	140	ED7-1.5	170
	2.0	4	EDA7-2	195	ED7-2	215
	3.0	5	EDA7-3	225	ED7-3	245
10 Volts ±.5 V ADJ.	.100	1	EDA10-.1	$ 90	ED10-.1	$105
	.250	1	EDA10-.25	100	ED10-.25	110
	.500	2	EDA10-.5	120	ED10-.5	135
	1.0	3	EDA10-1	135	ED10-1	150
	1.5	4	EDA10-1.5	155	ED10-1.5	175
	2.0	4	EDA10-2	190	ED10-2	215
	3.0	5	EDA10-3	225	ED10-3	245
12 Volts ±.5 V ADJ.	.100	1	EDA12-.1	90	ED12-.1	105
	.250	1	EDA12-.25	100	ED12-.25	110
	.500	2	EDA12-.5	120	ED12-.5	135
	1.0	3	EDA12-1	135	ER12-1	155
	2.0	4	EDA12-2	190	ED12-2	215
	3.0	5	EDA12-3	225	ED12-3	245
15 Volts ±.5 V ADJ.	.100	1	EDA15-.1	90	ED15-.1	105
	.250	2	EDA15-.25	100	ED15-.25	115
	.500	3	EDA15-.5	120	ED15-.5	135
	1.0	3	EDA15-1	125	ED15-1	140
	2.0	4	EDA15-2	185	ED15-2	210
	3.0	5	EDA15-3	225	ED15-3	245
18 Volts ±.5 V ADJ.	.100	1	EDA18-.1	90	ED18-.1	105
	.250	2	EDA18-.25	100	ED18-.25	115
	.500	3	EDA18-.5	120	ED18-.5	135
	1.0	4	EDA18-1	165	ED18-1	185
	2.0	5	EDA18-2	190	ED18-2	215
	3.0	5	EDA18-3	225	ED18-3	245

DUAL OUTPUT SUPPLIES

Output Voltage ± Adjust Range	Current Amps Ea. Output	*Case Size See Dwg.	Standard Model ±.1% Accuracy	Price	Precision Model ±.01% Accuracy	Price
20 Volts ±1 V ADJ.	.100	1	EDA20-.1	90	ED20-.1	105
	.250	2	EDA20-.25	100	ED20-.25	115
	.500	3	EDA20-.5	120	ED20-.5	135
	1.0	4	EDA20-1	165	ED20-1	185
	2.0	5	EDA20-2	190	ED20-2	215
	3.0	5	EDA20-3	225	ED20-3	245
24 Volts ±2 V. ADJ.	.100	1	EDA24-.1	90	ED24-.1	105
	.250	2	EDA24-.25	105	ED24-.25	115
	.500	3	EDA24-.5	125	ED24-.5	140
	1.0	4	EDA24-1	165	ED24-1	185
	2.0	5	EDA24-2	190	ED24-2	215
	2.5	5	EDA24-2.5	225	ED24-2.5	245
28 Volts ±2 V. ADJ.	.100	1	EDA28-.1	90	ED28-.1	105
	.250	2	ERA28-.25	100	ED28-.25	115
	.500	3	EDA28-.5	125	ED28-.5	140
	1.0	4	EDA28-1	165	ED28-1	185
	2.0	5	EDA28-2	190	ED28-2	215
	2.5	5	EDA28-2.5	225	ED28-2.5	245
35 Volts ±2 V. ADJ.	.100	1	EDA35-.1	90	ED35-.1	105
	.250	2	EDA35-.25	100	ED35-.25	115
	.500	3	EDA35-.5	125	ED35-.5	140
	1.0	4	EDA35-1	165	ED35-1	185
	2.0	5	EDA35-2	190	ED35-2	215

MODULE DIMENSIONS

Case Size	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Approx. Wt. Net Lbs.	Approx. Wt. Shpg. Lbs.
1	3 17/32	3 1/32	3 13/16	2 13/16	2 23/32	1 23/64	1/2	8-32	1/4	9/16	3/16	1/8	1/16	1/4	3/16	1 1/16	2 1/2	5
2	3 17/32	3 1/32	4 13/16	2 13/16	2 23/32	1 23/64	1/2	8-32	1/4	9/16	3/16	1/8	1/16	1/4	3/16	1 1/16	3 1/2	5 1/2
3	4	4	4 1/2	3	3	1 1/2	1 7/32	10-32	7/16	1 13/16	1 3/32	5/16	3/32	3/16	3/16	1 1/8	8	11
4	6	4	5 5/8	3	5	2 1/2	1 7/32	10-32	7/16	1 5/8	1 3/32	5/16	3/32	3/16	3/16	1 1/8	12	15
5	8	4	6 7/8	3	6 7/8	3 7/16	1 7/32	10-32	7/16	2 1/2	1 3/32	5/16	3/32	3/16	3/16	1 1/8	17	20

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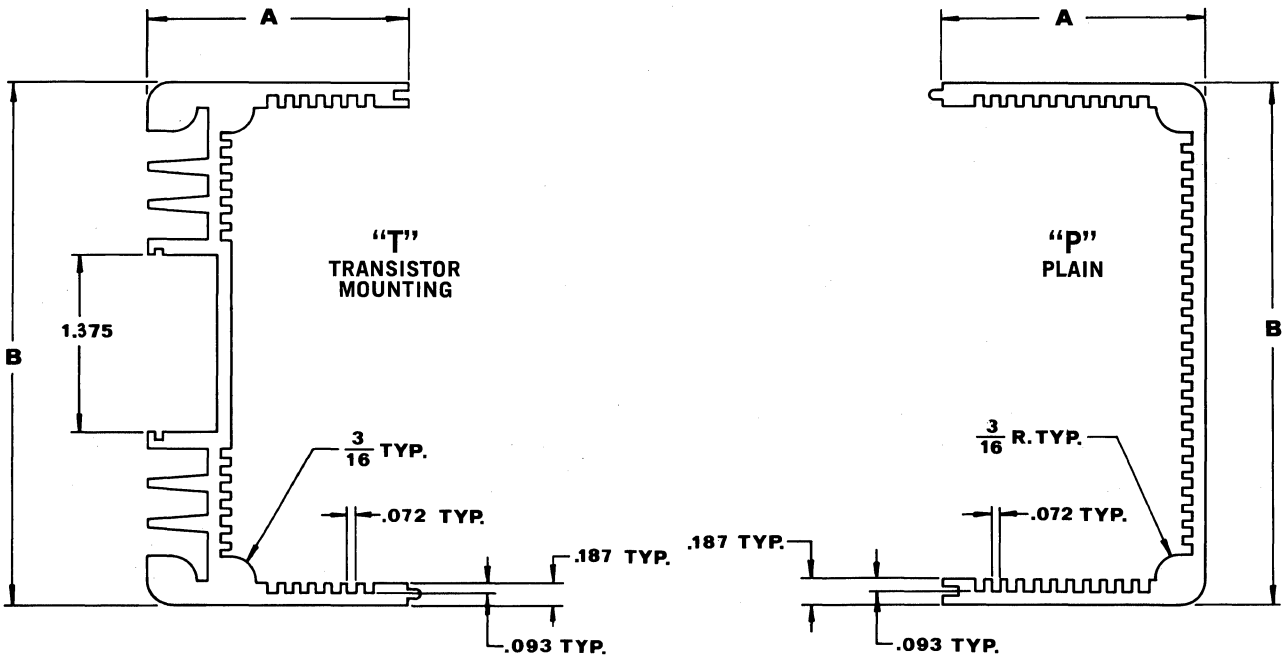
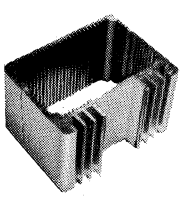
HEAT SINK EXTRUSION

TRANSISTOR PLATE

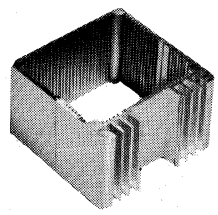


Part Number	Dimension A	Dimension B	Standard Length	Price Per Foot
T2X4X	2″	4″	72″	$5.50
T4X4X	4″	4″	72″	$6.50
P2X4X	2″	4″	72″	$3.30
P1X4X	1″	4″	72″	$3.00

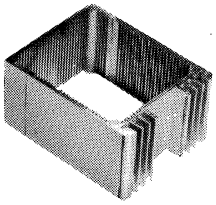
MATING TONGUE & GROOVE ASSEMBLIES MAKE FOLLOWING HOUSING SIZES (see photos below):



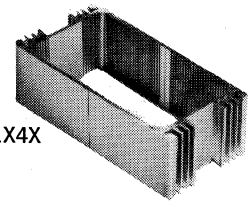
Width: 3″
Depth: 4″
Use: T2X4X & P1X4X



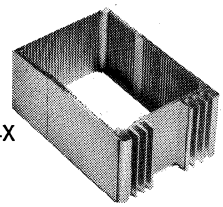
Width: 4″
Depth: 4″
Use: T2X4X & P2X4X



Width: 4″
Depth: 5″
Use: T4X4X & P1X4X



Width: 4″
Depth: 8″
Use: T4X4X & P4X4X



Width: 4″
Depth: 6″
Use: T4X4X & P2X4X

Length for above assemblies cut to size. Minimum cutting charge $0.25 per cut.

End plates also available: $1.00 each.

Minimum order: $25.00.

Discount schedule: Mixed types may be combined for quantity discount.

1-24 ft. 0%, 25-49 ft. 5%, 50-99 ft. 15%, 100-249 ft. 20%.

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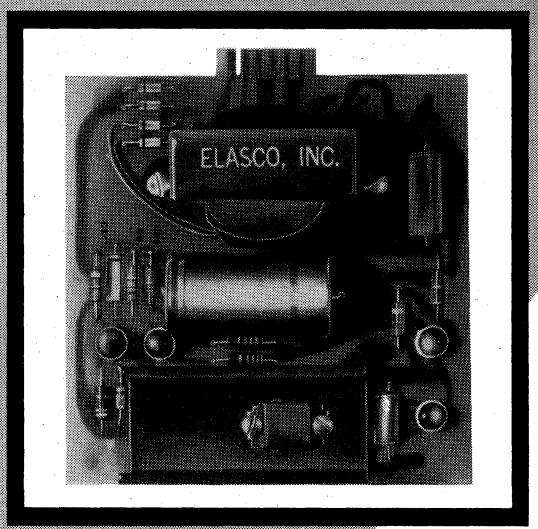
elasco inc.

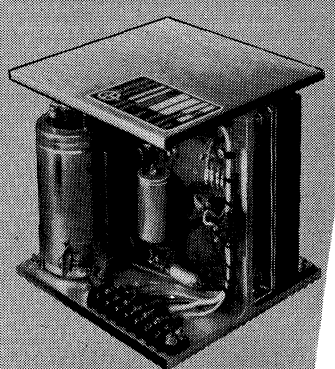
A COMPLETE SERIES OF SOLID STATE POWER SUPPLIES.



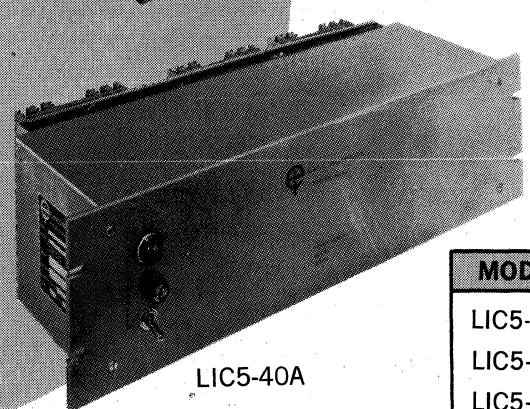
LIC5-1A

New LOW COST POWER SUPPLY SERIES FOR IC'S

ELASCO'S new LIC Series of low-cost high quality power supplies is designed expressly for the IC market. This series delivers 5 Volts D.C. at the power levels indicated in the chart shown below. Ripple and regulation specifications are commensurate with integrated circuit requirements. All units are short-circuit proof and an over-voltage protection option is available.



LIC5-7A
LIC5-20A



LIC5-40A

SPECIFICATIONS

Input:	105-125VAC, 60 to 400Hz
Output Voltage:	5VDC
Line Regulation:	0.5% Max.
Load Regulation:	0.5% Max.
Ripple & Noise:	10MV. RMS Max.
Stability:	±0.1% After warm up
Temperature Coefficient:	Better than .05%/°C
Operating Temperature:	−20°C to +71°C
Storage Temperature:	−20°C to +85°C
Short Circuit Proof	
Overvoltage option available	

MODEL	VOLTAGE	CURRENT	SIZE	PRICE
LIC5-1A	5VDC	1 Ampere	4½ x 4½ x 1¾	$ 24.00
LIC5-7A	5VDC	7 Amperes	5 x 6 x 6	49.00
LIC5-20A	5VDC	20 Amperes	6 x 6 x 6	89.00
LIC5-40A	5VDC	40 Amperes	5¼ x 19 x 8	149.00

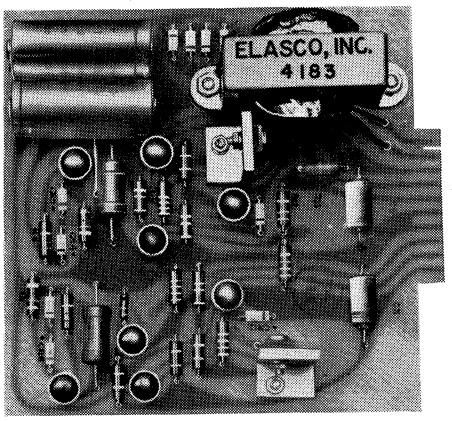
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

elasco incorporated

5 NORTHWOOD ROAD, BLOOMFIELD, CONN. 06002
(203) 242-0708

elasco inc.

A COMPLETE SERIES OF SOLID STATE POWER SUPPLIES.



2Q15-100PC

new DUAL-OUTPUT POWER SUPPLIES

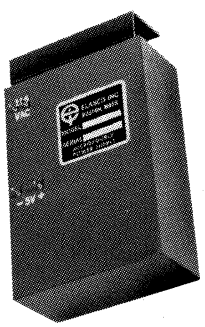
ELASCO'S new 2Q series of low-cost high quality power supplies is primarily designed for use with operational amplifiers. Two power levels are presently available, both mounted on the same size printed circuit card. As many as ten units can be mounted in a standard 5¼ inch basket.

SPECIFICATIONS

Input:	105-125VAC, 60 to 400Hz	Temperature coefficient:	Better than .02%/°C
Output Voltage:	±15VDC, Dual Output	Operating Temperature:	−25°C to +71°C
Line Regulation:	0.1% Max.	Storage Temperature:	−55°C to +85°C
Load Regulation:	0.1% Max.	Short Circuit Proof	
Ripple & Noise:	2MV. RMS Max.	Tracking Outputs	
Stability:	±0.1% after warm up	Size: 4½ x 4½ x 1½"	

MODEL	VOLTAGE	CURRENT	PRICE
2Q15-100PC	±15VDC	.1 Amp. each side	$31.50
2Q15-250PC	±15VDC	.25 Amp. each side	42.00

IC5-5A MICROSOURCE POWER SUPPLY



IC5-5A

The new ELASCO Model IC5-5A power supply represents a real breakthrough in both technology and pricing. The use of a patented input regulator and new low cost silicon semiconductor devices has yielded an ideal source for powering your IC circuits and systems. The IC5-5A is small enough to mount on a P.C. card as an integral part of your system, yet it is completely self-contained and will operate from any input frequency, 50 hertz and up. The input regulator is not frequency sensitive and because of its low dissipation characteristics allows us to attain a power density of better than one watt per cubic inch.

SPECIFICATIONS

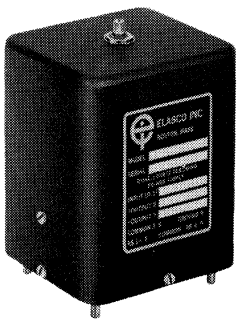
Input:	105-125VAC, 50 to 1000Hz	Temperature Coefficient:	Better than 0.05%
Output:	5VDC @ 5 Amperes, (±0.25V adjust)	Operating Temperature:	−25°C to +65°C
Line Regulation:	0.1%	Storage Temperature:	−55°C to +85°C
Load Regulation:	0.1%	Short Circuit Proof	
Ripple & Noise:	0.1%	Protected Against Over-voltage Conditions	
Stability:	±0.1%, after warm-up	Size: 3⅛ x 4⅝ x 1⅜"	

PRICING SCHEDULE 1-4 $185.00 5-9 $175.00 10-24 $160.00 25-UP CONSULT FACTORY

elasco inc.

A COMPLETE SERIES OF SOLID STATE POWER SUPPLIES.

"2MS" SERIES dual-source power supplies



DESCRIPTION

The 2MS Series of Dual-Source power supplies is used for laboratory and system applications where balanced or tracking output voltages are desired. Designed for use with operational amplifiers as well, these units feature twin outputs. The 2MS Series incorporates two separate power sources in a single compact case, typically 3⅝ x 3⅞ x 4½ inches. Special models with wider range of adjustments are available.

• All Silicon • Tracking Outputs • Available in "Z" Option
• Short Circuit Proof • Remote Sensing
• Twin Outputs • 0 to 71°C

PRICING DATA

Series	Nominal Voltage from	to	Current (ma)	Case	Price ($)
2MS	5v	30v	50	A	95
2MS	33v	50v	50	B	105
2MS	5v	30v	100	B	105
2MS	33v	50v	100	C	115
2MS	5v	15v	250	B2	115
2MS	18v	30v	250	C	115
2MS	33v	50v	250	C2	125
2MS	5v	30v	500	C2	125
2MS	33v	50v	500	E2	145

"MS" SERIES minisource power supplies



DESCRIPTION

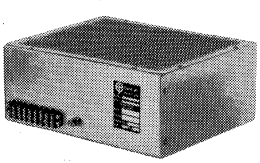
The "MS" Power Supply series delivers essentially fixed output voltage which may be fine adjusted ±1V. This series is designed to deliver full rated power under worst case conditions of line voltage, load current and ambient temperature of 71°C without the use of complex heat sinking and/or referral to thermal design curves. Each and every Elasco power supply is designed to perform under worst case conditions on its own — WITHOUT THE USE OF EXTERNAL THERMAL CRUTCHES. This is why ELASCO can warranty all its catalog items unconditionally for 10 YEARS.

The "MS" series is completely serviceable. All components are accessible for checking and replacement should there be a degradation in performance. The "MS" series is overload and short circuit proof and will recover automatically upon removal of the overload condition.

PRICING DATA

Series	Nominal Voltage from	to	Current (ma)	Case	Price ($)
MS	3v	22v	100	A	70
MS	3v	38v	250	B	75
MS	3v	28v	500	B	90
MS	24v	44v	100	B	70
MS	30v	38v	500	C	90
MS	40v	48v	500	D	100
MS	46v	52v	100	B	80
MS	46v	70v	250	C	85
MS	52v	68v	50	B	75
MS	72v	74v	250	D	85
MS	70v	74v	50	C	75
MS	76v	98v	50	C	80
MS	78v	98v	100	D	85
MS	100v	145v	100	D	110
MS	150v	200v	100	D	135

"SVS" SERIES transistorized power supplies



DESCRIPTION

The "SVS" Power Supply series delivers essentially fixed output voltage which may be fine adjusted ±1V. This series is designed to deliver full rated power under worst case conditions of line voltage, load current and ambient temperature of 71°C without the use of complex heat sinking and/or referral to thermal design curves. Each and every Elasco power supply is designed to perform under worst case conditions on its own — WITHOUT THE USE OF EXTERNAL THERMAL CRUTCHES. This is why ELASCO can warranty all its catalog items unconditionally for 10 YEARS.

The "SVS" series is completely serviceable. All components are accessible for checking and replacement should there be a degradation in performance. The "SVS" series is overload and short circuit proof and will recover automatically upon removal of the overload condition. Options for either panel or chassis mounting have been automatically built into this series.

PRICING DATA

Series	Nominal Voltage from	to	Current (ma)	Case	Price ($)
SVS	4v	30v	1A	E	105
SVS	32v	44v	1A	F	135
SVS	46v	50v	1A	F	140
SVS	4v	16v	2A	F	135
SVS	18v	28v	2A	G	140
SVS	30v	32v	2A	G	160
SVS	34v	50v	2A	G	165
SVS	4v	22v	3.5A	G	145
SVS	24v	40v	3.5A	H	170
SVS	42v	50v	3.5A	J	210
SVS	4v	8v	5A	G	185
SVS	10v	16v	5A	H	210
SVS	18v	32v	5A	J	225
SVS	34v	38v	5A	J	275
SVS	40v	50v	5A	J	290
SVS	4v	32v	10A	J	300

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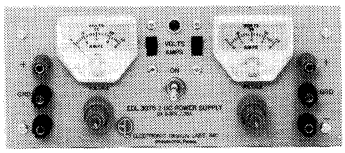
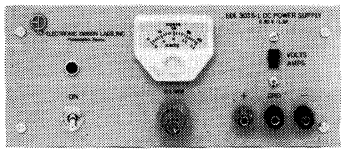
SEND FOR 24-PAGE CATALOG A1167 FOR COMPLETE DETAILS ON ALL ELASCO SERIES.

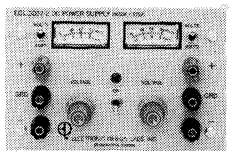
EDL SERIES — ALL-SILICON ½ AND ⅓ RACK POWER SUPPLIES FOR BENCH OR RACK USE

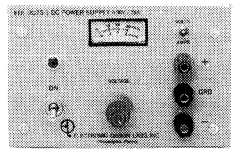
FULL OUTPUT RATING TO 51°C AMBIENT COOL OPERATION LESS THAN 20°C TEMP. RISE





3½H x 8½W x 11D





3½H x 5⅝W x 8D

	DUAL OUTPUT		SINGLE OUTPUT		DUAL OUTPUT		SINGLE OUTPUT	
MODEL	EDL 3075-2	EDL 1515-2	EDL 3015-1	EDL 1530-1	EDL 3037-2	EDL 1575-2	EDL 3075-1	EDL 1515-1
VOLTS	2 x 0 to 30V	2 x 0 to 15V	0 to 30V	0 to 15V	2 x 0 to 30V	2 x 0 to 15V	0 to 30V	0 to 15V
AMPS	.75A	1.5A	1.5A	3A	.375A	.75A	.75A	1.5A
*** PRICE**	198.00		158.00		148.00		138.00	

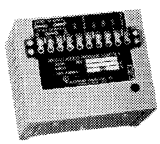
*ALL PRICES FOB PHILADELPHIA.

SLOT VOLTAGE MODULAR POWER SUPPLIES ARE AVAILABLE AS **OEM** MODELS (OPEN CHASSIS CONSTRUCTION, LESS THE ENCLOSURE) FOR HIGH VOLUME USE.

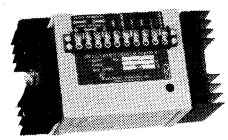
ALSO THESE OEM MODELS ARE AVAILABLE WITH OUTPUT VOLTAGE STABILITY OF UP TO ±4 PPM/°C @ FULL OUTPUT CURRENTS, OR THEY CAN BE CUSTOMIZED TO YOUR SPECIFIC NEEDS. FOR DETAILED INFORMATION CONTACT FACTORY.

SLOT VOLTAGE MODULAR POWER SUPPLIES

'A' PACKAGE
4H x 5W x 3D



'B' PACKAGE
4H x 7⅝W x 3D



	SINGLE OUTPUT MODELS						DUAL OUTPUT MODELS						
	'A' PACKAGE			'B' PACKAGE			'A' PACKAGE			'B' PACKAGE			
VOLTS RANGE	AMPS	MODEL MV—	PRICE	AMPS	MODEL MV—	PRICE	AMPS (EACH)	MODEL MV—	PRICE	AMPS (EACH)	MODEL MV—	PRICE	VOLTS RANGE
0-6	0.6	A1060		1.5	B1060		0.3	A2060		0.75	B2060		0-6
0-12	0.35	A1012		1.0	B1012		0.18	A2012		0.50	B2012		0-12
0-18	0.25	A1018		0.75	B1018		0.12	A2018		0.40	B2018		0-18
0-24	0.20	A1024		0.60	B1024		0.10	A2024		0.30	B2024		0-24
0-30	0.15	A1030		0.50	B1030		0.08	A2030		0.25	B2030		0-30
4.5-6	1.00	A1456		2.20	B1456		0.50	A2456		1.10	B2456		4.5-6
6-7.5	1.00	A1675	69	2.20	B1675	79	0.50	A2675	85	1.10	B2675	95	6-7.5
7.5-9	1.00	A1759		1.60	B1759		0.50	A2759		0.80	B2759		7.5-9
9-12	0.75	A1912		1.50	B1912		0.40	A2912		0.75	B2912		9-12
12-15	0.75	A1125		1.00	B1125		0.35	A2125		0.50	B2125		12-15
15-18	0.75	A1158		—	—		0.35	A2158		—	—		15-18
18-21	0.75	A1181		—	—		0.35	A2181		—	—		18-21
21-26	0.50	A1216		—	—		0.25	A2216		—	—		21-26
26-30	0.30	A1260		—	—		0.15	A2260		—	—		26-30

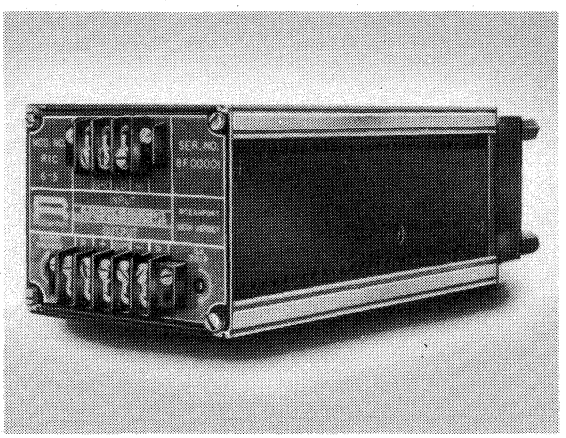
SPECIFICATIONS ON ALL LISTED SUPPLIES

	STANDARD MODELS	HI PERFORMANCE MODELS**
INPUT VOLTAGE	105-125/210-250 VAC, 44-440 Hz	
LINE REGULATION	0.25%	0.01%
LOAD REGULATION, NL TO FL	0.1%	0.01%
RIPPLE AND NOISE	4 MV	1 MV
TRANSIENT RESPONSE	50 U SEC.	50 U SEC.
TEMPERATURE COEFFICIENT	0.05%/°C	0.005%/°C
OPERATING TEMPERATURE	0 TO 71°C	
CASE TEMPERATURE RISE	20°C MAX.	
SHORT CIRCUIT PROOF	ELECTRONIC CURRENT LIMITING, AUTO RESET	
REMOTE SENSE	YES	
CURRENT DERATING	FULL OUTPUT TO 51°C, LINEARLY DERATE TO 0 @ 71°C	

** HIGH PERFORMANCE MODELS — ADD SUFFIX 'H' TO MODEL NUMBER — ADD $20 to PRICE.

ELECTRONIC DESIGN LABS, INC.
P.O. BOX 7837, PHILADELPHIA, PENNA. 19101 • TEL: (215) 925-9500

Power Supplies For IC Applications



RIC SERIES

The RIC Series consist of modular power supplies designed specifically for OEM applications requiring power for discrete or integrated circuit logic.

Mechanical Features

- Modular construction
- Separate AC & DC barrier strip
- Transformer has electrostatic shielding

Electrical Features

- ± 0.5% O/A regulation
- Maximum ripple & noise 15MV pk/pk
- Electronic current limiting
- Built-in adjustable overvoltage protection
- Automatic thermal overload protection
- ± 10% output voltage adjustment
- High efficiency
- Remote sensing/programming

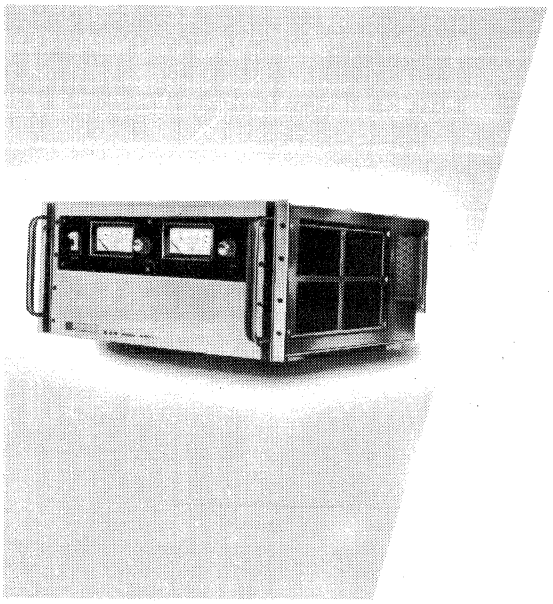
RATINGS

Size 1				Size 2				Size 3				Size 4			
Model	Output V	Output A	Price	Model	Output V	Output A	Price	Model	Output V	Output A	Price	Model	Output V	Output A	Price
RIC 2-5	2	5	$100	RIC 2-10	2	10	$125	RIC 2-25	2	25	$295	RIC 2-50	2	50	$395
RIC 3-5	3.5	5	100	RIC 3-10	3.5	10	125	RIC 3-25	3.5	25	295	RIC 3-50	3.5	50	395
RIC 4-5	4	5	100	RIC 4-10	4	10	125	RIC 4-25	4	25	295	RIC 4-50	4	50	395
RIC 5-5	5	5	100	RIC 5-10	5	10	125	RIC 5-25	5	25	295	RIC 5-50	5	50	395
RIC 6-5	6	5	100	RIC 6-10	6	10	125	RIC 6-25	6	25	295	RIC 6-50	6	50	395
RIC 10-2.5	10	2.5	100	RIC 10-5	10	5	125	RIC 10-12	10	12	295	RIC 10-25	10	25	395
RIC 12-2.5	12	2.5	100	RIC 12-5	12	5	125	RIC 12-12	12	12	295	RIC 12-25	12	25	395
RIC 15-2.5	15	2.5	100	RIC 15-5	15	5	125	RIC 15-12	15	12	295	RIC 15-25	15	25	395
RIC 19-2.5	19	2.5	100	RIC 19-5	19	5	125	RIC 19-12	19	12	295	RIC 19-25	19	25	395
RIC 26-1.5	26	1.5	100	RIC 26-2.5	26	2.5	125	RIC 26- 6	26	6	225	RIC 26-12	26	12	325
RIC 48-0.5	48	0.5	100	RIC 48-1	48	1	125	RIC 48- 3	48	3	225	RIC 48- 6	48	6	325
RIC 212-1	±12	1.0	150	212-2	±12	2	175								
RIC 215-1	±15	1.0	150	215-2	±15	2	175								

All units — input 100-130V RMS 47-63 Hz; output adjustable ± 10%, RIC 26 series 26V ± 4V.
Size 1 — 3¼ H x 4⅛ W x 11½ L 10 lbs.
Size 2 — 5H x 4⅛ W x 12L 14 lbs.
Size 3 — 3¼ H x 8¼ W x 12L 35 lbs.
Size 4 — 5H x 8¼ W x 12L 45 lbs.
Prices and specifications subject to change without notice. U.S. patents applied for.

Specialists in Power Conversion Equipment
ELECTRONIC MEASUREMENTS
Division of Rowan Industries
2 Crescent Place • Oceanport, N. J. 07757 • 201 — 229-5000 • TWX: 710-722-6592

Power Supplies- High Wattage



Electrical Features

- 0.1% regulation constant voltage or constant current mode
- 10 MV RMS ripple maximum either voltage or current
- Remote sensing/programming
- Efficiency up to 85%
- Automatic E/I crossover
- Thermal overload protection

Mechanical Features

- Forced air cooling
- Plug-in circuit boards

SCR SERIES

The SCR Series are high current power supplies designed for a wide variety of applications, particularly where operation in both the constant current mode and in the constant voltage mode is required. Use of active components in the filter section reduces ripple in either mode by factors as high as 100 to 1 over competitive designs. The unique filter design coupled with efficient cooling results in the smallest package size per watt possible.

Ratings

Size 1				Size 2				Size 3			
Output				Output				Output			
Model #	E	I	Price	Model #	E	I	Price	Model #	E	I	Price
SCR 10-250	0-10	250	$1300	SCR 10-500	0-10	500	$1700	SCR 40-250	0-40	250	$2500
SCR 20-125	0-20	125	1150	SCR 20-250	0-20	250	1500	SCR 50-200	0-50	200	2500
SCR 30-100	0-30	100	1250	SCR 30-200	0-30	200	1600	SCR 100-100	0-100	100	2500
SCR 40-60	0-40	60	925	SCR 40-125	0-40	125	1375	—	—	—	—
SCR 80-30	0-80	30	900	SCR 80-60	0-80	60	1500	—	—	—	—
SCR 120-20	0-120	20	900	SCR 120-40	0-120	40	1500	—	—	—	—
SCR 160-15	0-160	15	900	SCR 160-30	0-160	30	1500	—	—	—	—
SCR 250-10	0-250	10	900	SCR 250-20	0-250	20	1500	—	—	—	—
SCR 500-5	25-500	5	1300	SCR 500-10	25-500	10	1700	—	—	—	—

All units — input 188-242V 3 PH Y or delta 50-60Hz; For 480V nominal ± 10% input add suffix 0075 and add $150.00 to price.
Size 1 — 7H x 19W x 20D
Size 2 — 8¾H x 19W x 20D
Size 3 — 12¼H x 19W x 20D
U.S. patent applied for. Prices and specifications subject to change without notice.

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Division of Rowan Industries
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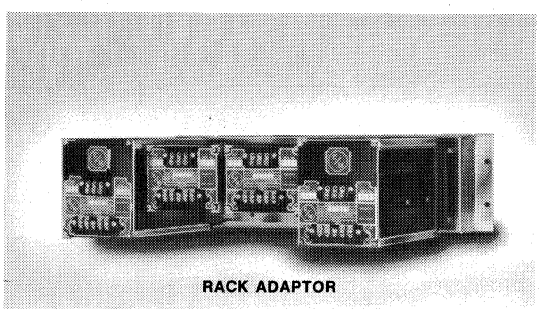
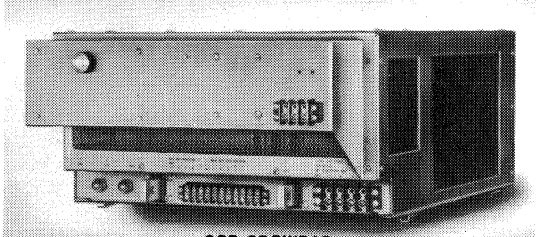
Power Supply Accessories



RACK ADAPTOR



SCR CROWBAR

RIC Accessories

Rack Adapters

Model #	Size	Type	Price
RA 4001-1	3½	w/handles	$35.00
RA 4001-2	3½	w/o handles	25.00
RA 4002-1	5¼	w/handles	35.00
RA 4002-2	5¼	w/o handles	25.00

Accommodate up to 4 quarter-rack supplies or 2 half-rack. 5¼ rack adapters accommodate any combination of 3½ of 5¼ models. Price includes one full size blank panel.

Panel Options

Model	Description	Price
P 4001 F	Blank 3½ full panel	$10.00
P 4001 H	Blank 3½ half panel	10.00
P 4001 Q	Blank 3½ quarter panel	10.00
P 4002 F	Blank 5¼ full panel	10.00
P 4002 H	Blank 5¼ half panel	10.00
P 4002 Q	Blank 5¼ quarter panel	10.00

Other Options

	Price*
Control set, including voltage adj. pot, switch, fuse, pilot light add suffix C to panel option Model #	$15.00
Meter set, including voltmeter and ammeter add suffix M to panel option Model #	25.00
Combination control and meter set add suffix CM to panel option Model #	40.00

* Add to basic panel option price

SCR Accessories

SCR CROWBAR CIRCUIT PROTECTION					
Part No.	Model	Range Adjustment	Response	Size W D	Price
3003	SCR 10-250	4-12V	10, usec	17 x 5″	$300.00
3004	SCR 10-500	4-12V	10, usec	17 x 5″	$400.00
3005	SCR 20-125	8-24V	10, usec	17 x 5″	$250.00
3006	SCR 20-250	8-24V	10, usec	17 x 5″	$300.00
3007	SCR 40- 60	16-48V	10, usec	17 x 5″	$200.00
3008	SCR 40-125	16-48V	10, usec	17 x 5″	$250.00

Factory installed Crowbar type. SCR Crowbar is shorted across load within 10 usec after which power supply is disconnected from line within approximately 10 ms.

Prices and specifications subject to change without notice.

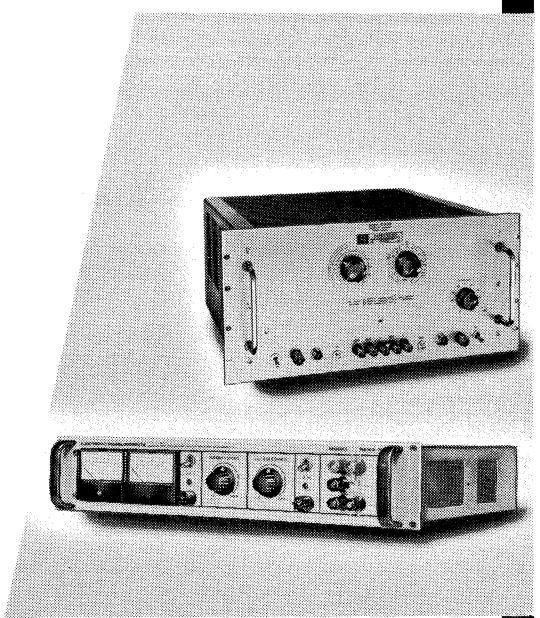
Specialists in Power Conversion Equipment

ELECTRONIC MEASUREMENTS

Division of Rowan Industries

2 Crescent Place • Oceanport, N. J. 07757 • 201 — 229-5000 • TWX: 710-722-6592

Power Supplies For Lab/Systems



RE Series

The RE Series is designed for both precise laboratory and systems use and features automatic cross-over to either constant voltage or constant current modes of operation.

Features

- .01% regulation
- Remote sensing/programming
- Automatic E/I crossover
- 0.5 MV RMS ripple
- 1000 Ohms/volt programming constant

Ratings

Model #	Output E	Output I	Size	Price
RE 40-5	0-40	5	1	$290.00
RE 40-10	0-40	10	2	370.00
RE 60-2.5	0-60	2.5	1	290.00
RE 60-5	0-60	5	2	415.00

NOTES: All units input: 105-125 VAC 50-63Hz.
For meters add suffix M to Model and $25.00 to price
For meters and front terminals add suffix ML to model and $30.00 to price.
Size 1 — 3½H x 19W x 17¼D.
Size 2 — 5¼H x 19W x 16¼D.

HV Series

The HV Series is a completely solid state medium voltage power supply.

Features

- .02% regulation
- 1MV RMS ripple
- Automatic E/I crossover
- Remote sensing/programming

Ratings

Model #	E	I	Size	Price
HV 150-2M	0-150	2	3½H x 19W x 15¾D	$735.00
HV 330-1M	0-330	1	3½H x 19W x 15¾D	735.00

All units 105-125V AC 50-63Hz

C 600 Series

The C 600 Series is designed for applications where precise constant current operation down to currents as low as 0.5 microamps is required.

Ratings

Model #	Output Compliance Full I	Output Compliance Derated I	Output Current	Regulation Line	Regulation Load	Ripple 0.4% of setting + Neg.	Ripple 0.4% of setting + Pos.	Size	Price
C 612 AM	0-100	100-260	1 ua-100ma	0.15%	0.1%	0.5 ua	0.1 ua	3¼ x 19 x 9¼	$320.00
C 630 CM	0-200	200-280	10 ua-1A	0.15%	0.1%	4 ua	4 ua	8¾ x 19 x 15	962.00
C 633 CM	0-300	300-420	2.2 ua-300ma	0.15%	0.1%	0.5 ua	0.1 ua	5¼ x 19 x 15	500.00
C 636 CM	0-600	600-730	2.2 ua-220ma	0.15%	0.1%	1 ua	0.2 ua	8¾ x 19 x 15	700.00

All units input 105-125Vac 50-63Hz; All units except 612A have a voltage limiter.
For voltage limiting on C 612A add suffix L and $50.00 to price, delete either voltmeter or front terminals.
Chopper stabilization improves stability to 0.2%; add suffix K and $95.00 to price.

Specialists in Power Conversion Equipment

ELECTRONIC MEASUREMENTS

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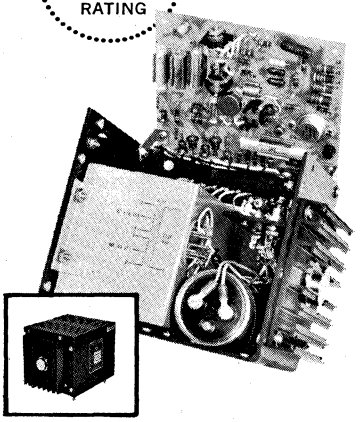
TRANSPAC® Power Modules
MAGITRAN® Power Supplies

MIL SPEC SILICON, REPAIRABLE POWER MODULES

Fully Meets MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200

75°C FREE AIR RATING



0 through 310 VDC, 50 MA through 8 Amps

Transpac **CERTIFIED*** *Militarized Line*

Input: 103.5-126.5 VAC (standard) or 108-132 VAC (specify) 50-440 cps
Ripple: Less than 800 μv RMS except 50 through 310 VDC where ripple is less than 0.005% RMS
Line Regulation: Less than ±0.01% or 5 mv, whichever is greater, for full input change
Load Regulation: Less than 0.05% or 8 mv for 0-100% load change
Transient Response: Less than 50 μsec for step line or load change
Maximum Case Temperature: 115°C
Free Air Operating Temperature: —55°C to +75°C (full tantalum type up to 1 ampere most models) —40°C to +75°C (semi-tantalum type above 1 ampere) full ratings, no external heat sinking
Temperature Coefficient: Less than 0.01% per degree C or 3 mv
Long Term Stability: Within 5 mv for 8 hours after 20 minute warm-up (line, load, temperature constant)
Interconnection: Series or parallel operation
Voltage Adjustment: External screwdriver voltage control
Remote Voltage Control: Provision for external control of output voltage
Remote Sensing: Remote sensing facilities provided
Short Circuit Protection: Automatic short circuit protection and automatic recovery
Output Connection: Ungrounded outputs, either positive or negative terminals may be grounded
Transistor Types: MIL-STD-701 and MIL-S-19500
Military Specs: MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200 where applicable

*Certificate of Conformity by independent laboratory supplied on request.

OUTPUT VOLTAGE (DC)	CURRENT	SIZE W x D x H (INCHES)	MODEL	PRICE
0-7 VDC	0-500MA	3-5/16 x 4-3/16 x 5-1/2	MS07P5	$315.00
0-7 VDC	0-1 AMP	4 x 4-3/4 x 5-15/16	MS071	$355.00
0-7 VDC	0-2 AMP	5-3/4 x 7-3/16 x 5-1/4	MS072	$395.00
0-7 VDC	0-4 AMP	6 x 8-15/16 x 6-5/16	MS074	$455.00
0-7 VDC	0-6 AMP	6 x 9-5/8 x 6-5/16	MS076	$535.00
0-7 VDC	0-8 AMP	6 x 10-5/16 x 6-5/16	MS078	$595.00
0-10 VDC	0-50MA	3 x 3 x 3-1/4	MS01P05	$220.00
0-10 VDC	0-250MA	3-1/4 x 3-1/4 x 4-31/32	MS01P3	$285.00
10-20 VDC	0-50MA	3 x 3 x 3-1/4	MS10P05	$220.00
10-20 VDC	0-250MA	3-1/4 x 3-1/4 x 4-31/32	MS10P3	$285.00
11-12 VDC	0-4 AMP	6 x 8-15/16 x 6-5/16	MS124	$455.00
11-12 VDC	0-6 AMP	6 x 9-5/8 x 6-5/16	MS126	$535.00
11-12 VDC	0-8 AMP	6 x 10-5/16 x 6-5/16	MS128	$595.00
11-13 VDC	0-500MA	3-5/16 x 4-3/16 x 5-1/2	MS12P5	$315.00
11-13 VDC	0-1 AMP	4 x 4-3/4 x 5-15/16	MS121	$355.00
11-13 VDC	0-2 AMP	5-3/4 x 7-3/16 x 5-1/4	MS122	$395.00
17-18 VDC	0-4 AMP	6 x 8-15/16 x 6-5/16	MS184	$455.00
17-18 VDC	0-6 AMP	6-15/16 x 9-15/16 x 6-5/16	MS186	$535.00
17-18 VDC	0-8 AMP	6-15/16 x 10-5/8 x 6-5/16	MS188	$595.00
17-19 VDC	0-500MA	3-5/16 x 4-3/16 x 5-1/2	MS18P5	$315.00
17-19 VDC	0-1 AMP	4 x 4-3/4 x 5-15/16	MS181	$355.00
17-19 VDC	0-2 AMP	5-3/4 x 7-3/16 x 5-1/4	MS182	$395.00
20-30 VDC	0-50MA	3 x 3 x 3-1/4	MS20P05	$220.00
20-30 VDC	0-250MA	3-1/4 x 3-1/4 x 4-31/32	MS20P3	$285.00
23-24 VDC	0-4 AMP	6 x 8-15/16 x 6-5/16	MS244	$455.00
23-24 VDC	0-6 AMP	6-15/16 x 9-15/16 x 6-5/16	MS246	$535.00
23-24 VDC	0-8 AMP	6-15/16 x 10-5/8 x 6-5/16	MS248	$595.00
23-25 VDC	0-500MA	3-5/16 x 4-3/16 x 5-1/2	MS24P5	$315.00
23-25 VDC	0-1 AMP	4 x 4-3/4 x 5-15/16	MS241	$355.00
23-25 VDC	0-2 AMP	5-3/4 x 7-3/16 x 5-1/4	MS242	$395.00
27-28 VDC	0-4 AMP	6 x 8-15/16 x 6-5/16	MS284	$455.00
27-28 VDC	0-6 AMP	6-15/16 x 9-15/16 x 6-5/16	MS286	$535.00
27-28 VDC	0-8 AMP	6-15/16 x 10-5/8 x 6-5/16	MS288	$595.00



OUTPUT VOLTAGE (DC)	CURRENT	SIZE W x D x H (INCHES)	MODEL	PRICE
27-29 VDC	0-500MA	3-5/16 x 4-3/16 x 5-1/2	MS28P5	$315.00
27-29 VDC	0-1 AMP	4 x 4-3/4 x 5-15/16	MS281	$355.00
27-29 VDC	0-2 AMP	5-3/4 x 7-3/16 x 5-1/4	MS282	$395.00
30-40 VDC	0-50MA	3 x 3 x 3-1/4	MS30P05	$235.00
30-40 VDC	0-250MA	3-5/16 x 4-3/16 x 5-1/2	MS30P3	$295.00
31-32 VDC	0-4 AMP	6-15/16 x 9-1/4 x 6-5/16	MS324	$455.00
31-33 VDC	0-500MA	3-5/16 x 4-3/16 x 5-1/2	MS32P5	$315.00
31 33 VDC	0-1 AMP	4 x 4-3/4 x 5-15/16	MS321	$355.00
31-33 VDC	0-2 AMP	5-3/4 x 7-3/16 x 5-1/4	MS322	$395.00
40-50 VDC	0-50MA	3-1/4 x 3-1/4 x 4-31/32	MS40P05	$235.00
40-50 VDC	0-250MA	3-5/16 x 4-3/16 x 5-1/2	MS40P3	$295.00
44-45 VDC	0-4 AMP	6-15/16 x 9-1/4 x 6-5/16	MS454	$575.00
44-46 VDC	0-500MA	4 x 4-3/4 x 5-15/16	MS45P5	$390.00
44-46 VDC	0-1 AMP	5-3/4 x 7-3/16 x 5-1/4	MS451	$405.00
44-46 VDC	0-2 AMP	6 x 8-15/16 x 6-5/16	MS452	$430.00
50-60 VDC	0-50MA	3-1/4 x 3-1/4 x 4-31/32	MS50P05	$235.00
50-60 VDC	0-250MA	3-5/16 x 4-3/16 x 5-1/2	MS50P3	$350.00
58-60 VDC	0-4 AMP	6-15/16 x 9-1/4 x 6-5/16	MS604	$575.00
59-61 VDC	0-1 AMP	5-3/4 x 7-3/16 x 5-1/4	MS601	$405.00
59-61 VDC	0-2 AMP	6 x 8-15/16 x 6-5/16	MS602	$430.00
60-70 VDC	0-100MA	3-1/4 x 3-1/4 x 4-31/32	MS60P1	$315.00
70-80 VDC	0-100MA	3-1/4 x 3-1/4 x 4-31/32	MS70P1	$315.00
80-90 VDC	0-100MA	3-1/4 x 3-1/4 x 4-31/32	MS80P1	$315.00
90-100 VDC	0-100MA	3-1/4 x 3-1/4 x 4-31/32	MS90P1	$315.00
100-110 VDC	0-100MA	3-1/4 x 3-1/4 x 4-31/32	MS100P1	$315.00
150-160 VDC	0-100MA	5 x 5-3/4 x 6	MS150P1	$395.00
200-210 VDC	0-100MA	5 x 5-3/4 x 6	MS200P1	$395.00
250-260 VDC	0-100MA	5 x 5-3/4 x 6	MS250P1	$395.00
300-310 VDC	0-100MA	5 x 5-3/4 x 6	MS300P1	$395.00

ELECTRONIC RESEARCH ASSOCIATES, INC.
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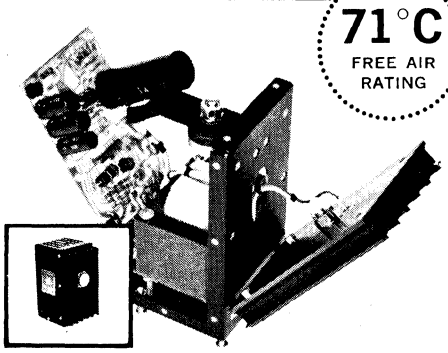
TRANSPAC® SILICON, REPAIRABLE POWER MODULES



71°C FREE AIR RATING

0 through 310 VDC, 50 MA through 40 Amps

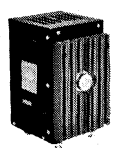
Ultra-Compact Standard Silicon Line

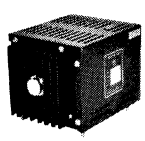
Input: 105-125 VAC, 50-400 cps
Ripple: Less than 800 microvolts RMS except 150 through 310 VDC which is .005% RMS
Line regulation: Less than ±0.01% or 5 mv for full input change
Load regulation: Less than 0.05% or 8 millivolts for 0-100% load change
Voltage adjustment: External screwdriver voltage control
Output connection: Ungrounded outputs, either positive or negative terminals may be grounded
Transient response: Less than 50 microseconds
Free air operating temperature: −20°C to +71°C, full ratings, no external heat sinking
Maximum case temperature: 110°C (15 to 40 Amps 125°C)
Temperature coefficient: Less than 0.01% per °C or 3 millivolts
Long-term stability: Within 5 millivolts for 8 hours
Heat sinking: Internal, convection cooled

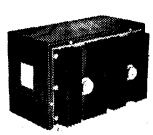
REPRESENTATIVE MODELS

OUTPUT VOLTAGE (DC)	CURRENT	SIZE W x D x H (INCHES)	MODEL	PRICE
0-5 VDC	0-200MA	2-5/8 x 3-1/16 x 4-1/4	SR05P2	$175.00
0-5 VDC	0-500MA	3-1/4 x 3-1/4 x 4-31/32	SR05P5	$195.00
0-5 VDC	0-1 AMP	3-1/4 x 4 x 5-15/16	SR051	$215.00
0-5 VDC	0-2 AMP	4 x 4-11/16 x 5-15/16	SR052	$240.00
0-5 VDC	0-4 AMP	5-9/16 x 7-1/4 x 5-3/4	SR054	$325.00
0-5 VDC	0-8 AMP	8-3/4 x 7-5/8 x 6-11/16	SR058	$390.00
1-3 VDC	15 AMP	9-1/16 x 11-13/16 x 7-1/2	SR0215	$430.00
1-3 VDC	25 AMP	9-7/8 x 12-1/2 x 7-1/2	SR0225	$515.00
1-3 VDC	40 AMP	13 x 15 x 7-1/2	SR0240	$635.00
3-5 VDC	15 AMP	9-1/16 x 11-13/16 x 7-1/2	SR0415	$430.00
3-5 VDC	25 AMP	9-7/8 x 12-1/2 x 7-1/2	SR0425	$515.00
3-5 VDC	40 AMP	13 x 15 x 7-1/2	SR0440	$635.00
5-7 VDC	0-500MA	3-1/4 x 3-1/4 x 4-31/32	SR6P5	$115.00
5-7 VDC	0-1 AMP	3-1/4 x 4 x 5-15/16	SR61	$165.00
5-7 VDC	0-2 AMP	4 x 4-11/16 x 5-15/16	SR62	$195.00
5-6 VDC	0-4 AMP	5-9/16 x 7-1/4 x 5-3/4	SR64	$295.00
5-6 VDC	0-8 AMP	8-3/4 x 7-5/8 x 6-11/16	SR68	$390.00
5-7 VDC	15 AMP	9-1/16 x 11-13/16 x 7-1/2	SR0615	$430.00
5-7 VDC	25 AMP	9-7/8 x 12-1/2 x 7-1/2	SR0625	$515.00
5-7 VDC	40 AMP	13 x 15 x 7-1/2	SR0640	$645.00
11-13 VDC	0-500MA	3-1/4 x 3-1/4 x 4-31/32	SR12P5	$115.00
11-13 VDC	0-1 AMP	3-1/4 x 4 x 5-15/16	SR121	$165.00
11-13 VDC	0-2 AMP	4 x 4-11/16 x 5-15/16	SR122	$195.00
11-12 VDC	0-4 AMP	5-9/16 x 7-1/4 x 5-3/4	SR124	$295.00
11-12 VDC	0-8 AMP	8-3/4 x 7-5/8 x 6-11/16	SR128	$390.00
11-13 VDC	15 AMP	9-1/16 x 12-1/2 x 7-1/2	SR1215	$445.00
11-13 VDC	25 AMP	9-7/8 x 12-1/2 x 7-1/2	SR1225	$515.00
11-13 VDC	40 AMP	16-1/2 x 15-1/4 x 7-1/2	SR1240	$660.00
13-15 VDC	0-500MA	3-1/4 x 3-1/4 x 4-31/32	SR14P5	$155.00
13-15 VDC	0-1 AMP	3-1/4 x 4 x 5-15/16	SR141	$190.00
13-15 VDC	0-2 AMP	4-1/4 x 5 x 6-15/16	SR142	$215.00
14-15 VDC	0-4 AMP	6-1/4 x 7-5/8 x 6-1/8	SR154	$315.00
14-15 VDC	0-8 AMP	10-1/2 x 7-1/2 x 6-5/8	SR158	$410.00
13-15 VDC	15 AMP	9-1/16 x 12-1/2 x 7-1/2	SR1415	$445.00
13-15 VDC	25 AMP	13 x 15 x 7-1/2	SR1425	$515.00
13-15 VDC	40 AMP	16-1/2 x 16 x 7-1/2	SR1440	$675.00









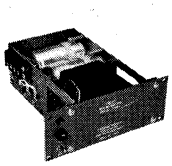
REPRESENTATIVE MODELS

OUTPUT VOLTAGE (DC)	CURRENT	SIZE W x D x H (INCHES)	MODEL	PRICE
17-19 VDC	0-500MA	3-1/4 x 3-1/4 x 4-31/32	SR18P5	$155.00
17-19 VDC	0-1 AMP	3-1/4 x 4 x 5-15/16	SR181	$190.00
17-19 VDC	0-2 AMP	4-1/4 x 5 x 6-15/16	SR182	$215.00
17-18 VDC	0-4 AMP	6-1/4 x 7-5/8 x 6-1/8	SR184	$325.00
17-18 VDC	0-8 AMP	10-1/2 x 7-1/2 x 6-5/8	SR188	$410.00
17-19 VDC	15 AMP	9-1/16 x 12-1/2 x 7-1/2	SR1815	$430.00
17-19 VDC	25 AMP	13 x 15 x 7-1/2	SR1825	$515.00
17-19 VDC	40 AMP	16-1/2 x 16 x 7-1/2	SR1840	$675.00
23-25 VDC	0-500MA	3-1/4 x 3-1/4 x 4-31/32	SR24P5	$135.00
23-25 VDC	0-1 AMP	3-1/4 x 4 x 5-15/16	SR241	$195.00
23-25 VDC	0-2 AMP	4-1/4 x 5 x 6-15/16	SR242	$200.00
23-24 VDC	0-4 AMP	6-1/4 x 7-5/8 x 6-1/8	SR244	$330.00
23-24 VDC	0-8 AMP	10-1/2 x 7-1/2 x 6-5/8	SR248	$410.00
23-25 VDC	15 AMP	9-1/16 x 12-1/2 x 7-1/2	SR2415	$445.00
23-25 VDC	25 AMP	13 x 15 x 7-1/2	SR2425	$525.00
23-25 VDC	40 AMP	16-1/2 x 16 x 7-1/2	SR2440	$685.00
27-29 VDC	0-500MA	3-1/4 x 3-1/4 x 4-31/32	SR28P5	$155.00
27-29 VDC	0-1 AMP	3-1/4 x 4 x 5-15/16	SR281	$175.00
27-29 VDC	0-2 AMP	4-1/4 x 5 x 6-15/16	SR282	$205.00
27-28 VDC	0-4 AMP	6-1/4 x 7-5/8 x 6-1/8	SR284	$335.00
27-28 VDC	0-8 AMP	10-1/2 x 7-1/2 x 6-5/8	SR288	$395.00
27-29 VDC	15 AMP	9-1/16 x 12-1/2 x 7-1/2	SR2815	$445.00
27-29 VDC	25 AMP	13 x 15 x 7-1/2	SR2825	$525.00
27-29 VDC	40 AMP	16-1/2 x 16 x 7-1/2	SR2840	$685.00
31-33 VDC	0-500MA	3-1/4 x 3-1/4 x 4-31/32	SR32P5	$165.00
31-33 VDC	0-1 AMP	3-1/4 x 4 x 5-15/16	SR321	$195.00
31-33 VDC	0-2 AMP	4-1/4 x 5 x 6-15/16	SR322	$225.00
31-32 VDC	0-4 AMP	6-1/4 x 7-5/8 x 6-1/8	SR324	$335.00
31-32 VDC	0-8 AMP	10-1/2 x 7-1/2 x 6-5/8	SR328	$410.00
150-160 VDC	0-100MA	3-11/32 x 3-9/16 x 6	SR150P1	$175.00
200-210 VDC	0-100MA	3-11/32 x 3-9/16 x 6	SR200P1	$195.00
250-260 VDC	0-100MA	4 x 4-11/16 x 5-15/16	SR250P1	$225.00
300-310 VDC	0-100MA	4 x 4-11/16 x 5-15/16	SR300P1	$235.00

OTHER DC MODULE TYPES

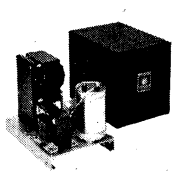
Wide choice of additional stock DC modules covering voltage ranges from 5 VDC through 20 KVDC at low, intermediate, and high current ratings. Military and industrial regulated, unregulated and high voltage types. Write for full catalog data.

NON-REGULATED SILICON HIGH CURRENT POWER SUPPLIES



Non-regulated silicon rectifier designs with all components fully accessible. All units in one-half relay rack dimensions. Two units may be mounted side-by-side for 19" relay rack mounting. Front panel switch and pilot light; rear terminals. Ripple less than 1 volt, 5 models, 28 VDC, 5 to 40 amp ratings. Prices $105 to $260.

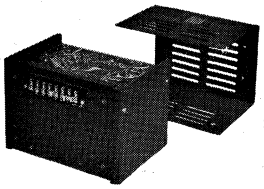
SOLID-STATE AC to AC FREQUENCY CHANGERS



Stock units for conversion of 50-1000 cps input to 60 or 400 cps output. Power ratings up to 500 VA. Regulated, unregulated square wave and regulated sinusoidal output types. Prices from $175 through $510 each.

Send for complete ERA Catalog

ELECTRONIC RESEARCH ASSOCIATES, INC.
67 SAND PARK ROAD, CEDAR GROVE, NEW JERSEY 07009 (201)239-3000
SUBSIDIARIES: ERA Acoustics Corp. • ERA Dynamics Corp. • Astrocom Inc. • The Magitran Company



71°C FREE AIR RATING

WIDE RANGE LOW COST DC POWER MODULE

4 through 60 VDC, 750 MA through 10 Amps

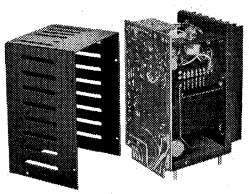
Input: 105-125 VAC, 50-400 cps
DC Output: 4-32 VDC or 30-60 VDC (see table)
Regulator Type: Solid-state, all silicon semi-conductors
Ripple: Less than 800 microvolts RMS or .005%, whichever is greater
Line Regulation: Better than ±0.01% or 5 mv for full input change
Load Regulation: Better than 0.05% or 8 mv for 0-100% load change
Transient Response: Less than 50 microseconds
Operating Temperature: —20°C to +71°C free air, full ratings
Temperature Coefficient: Less than 0.01% per degrees C or 3 millivolts
Long-Term Stability: Within 8 millivolts (8 hours reference)

Features of all ERA Wide Range Modules

- Wide range output voltage flexibility
- Low and high current models
- Single model serves all voltage requirements
- All silicon
- No heat sinking or air blow required
- Compact, fully repairable
- Automatic over-current protection
- Excellent long-term stability
- Minimal temperature coefficient
- Wide input range
- Remote sensing
- Series or parallel operation
- Ungrounded outputs
- Short circuit and transient protected
- Optional accessories

Output Voltage (DC)	Current	Size WxDxH (inches)	Weight (lbs.)	Model	Price
4-32	0-750 MA	4 x 4 x 6½	6.2	LC32P7	$ 95.00
4-32	0-2 amps	5 x 5 x 7	8.5	LC322	$120.00
4-32	0-5 amps	6¾ x 8½ x 7¼	16.8	LC325	$189.00
4-32	0-10 amps	8¾ x 9½ x 7½	29.0	LC3210	$225.00
30-60	0-1 amp	5 x 5 x 7	8.5	LC601	$145.00

Over-Voltage Protector Option: Add $35.00 to above prices and Suffix V to Model No. (i.e. LC325V, etc.)



71°C FREE AIR RATING

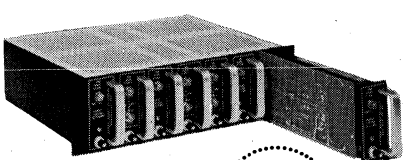
WIDE RANGE ULTRA COMPACT DC POWER COMPACTS

1 through 33 VDC, 500 MA through 8 Amps

The WR Series of DC Compacts features the same high quality engineering and construction as the LC Series above. This series has been designed for applications with minimum space requirements.

Input: 105-125 VAC, 50-400 cps
DC Output: 1-33 VDC or 1-18 VDC (see table)
Regulator type: Solid-state, all-silicon semi-conductors
Ripple: Less than 800 microvolts RMS or 0.005% whichever is greater
Line regulation: Better than ±0.01% or 5 millivolts for full input change
Load regulation: Better than 0.05% or 8 millivolts for 0-100% load change
Vernier voltage: Provision for external adjustment
Transient response: Less than 50 micro-seconds
Operating temperature: —20°C to +71°C free air, full ratings
Temperature coefficient: 0.01% or 3 millivolts per degrees C
Long term stability: Within 5 millivolts or 0.02% (8 hours reference: line, load temperature constant)
Heat sinking: Internal, convection cooled

Output Voltage (DC)	Current (71°C)	Size WxDxH (inches)	Weight (lbs.)	Model	Price
1-33	0-500 MA	3¼ x 3¼ x 5¼	3.5	WR33P5	$130.00
1-33	0-1 amp	3¼ x 4 x 5 15/16	5.1	WR331	$155.00
1-18	0-2 amps	4 x 4 1/16 x 5 15/16	6.5	WR182	$170.00
1-33	0-2 amps	4¼ x 5 x 6⅞	7.8	WR332	$185.00
1-33	0-4 amps	5 5/16 x 7¼ x 6¼	13.3	WR334	$255.00
1-33	0-8 amps	8¾ x 7⅝ x 6 15/16	22.5	WR338	$305.00



71°C FREE AIR RATING

WIDE RANGE SLIM TRAN DC POWER MODULES

1 through 63 VDC, 1 through 2 Amps

Input: 105-125 VDC, 50-400 cps
DC Output: 1-33 VDC or 1-63 VDC depending on model
Regulator Type: Solid-state, all silicon semi-conductors
Ripple: Less than 800 microvolts RMS or 0.005% whichever is greater
Line Regulation: Less than ±0.01% or 5 MV for full input change
Load Regulation: Less than 0.05% or 8 MV for 0-100% load change
Transient Response: Less than 50 microseconds
Operating Temperature: —20°C to +71°C free air, full ratings
Temperature Coefficient: Less than 0.01% or 3 MV per degrees C
Long Term Stability: Within 5 MV or 0.02% for 8 hours (line, load, temperature constant)

The versatile design of these modules permits the use of as many as 7 units to occupy a standard 5½" panel and 19" relay rack assembly.

Due to the wide range characteristics, a single model can serve many voltage requirements. ST series units are available in either single or dual output models.

Output* Voltage (DC)	Current* (71°C)	Size WxDxH (inches)	Weight (lbs.)	Model	Price
1-63	0-1 amp	2⅜ x 16½ x 5¼	7.5	ST 1000	$165.00
1-33 Dual	0-1 amp Dual	2⅜ x 16½ x 5¼	7.8	ST 1000-2	$195.00
1-33	0-2 amps	2⅜ x 16½ x 5¼	7.5	ST 2000	$175.00

*For higher current or voltage ratings two or more units may be connected in series or parallel

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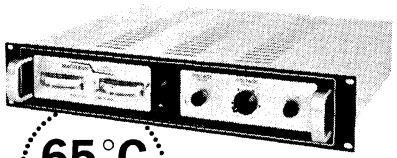
SILICON MAGITRAN® VARIABLE POWER SUPPLIES

0 to 36 VDC, 2 Amps through 25 Amps



65°C FREE AIR RATING

Model SL36-4M Shown

- All-Silicon Design
- Continuously Adjustable 0 to 36 VDC
- Operating Temperature to +65°C
- Automatic Short Circuit Protection
- Remote Sensing
- Convection Cooled
- Relay Rack or Bench Mounting

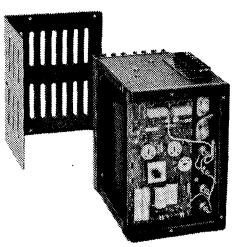
Input: 105-125 VAC, 50-400 cps
Regulation Line: ±0.01% or 5 mv
Regulation Load: 0.05% or 8 mv
Long Term Stability: Less than 8 mv, constant line, load and temperature
Ripple: Less than 1 mv, RMS
Transient Response: Less than 50 μsec
Operating Temperature: —20°C to +65°C
Temperature Coefficient: 0.01%/°C or 3 mv
Short Circuit Protection with automatic recovery
Remote Sensing
Parallel and Series Operation
Vernier Voltage Control
Output Terminals (Ungrounded)
Reverse Voltage Protection
Cooling: Convection
Metering: Separate Current and Voltage Meters

Model	Voltage	Current	Size* HxWxD	Price
SL36-2M	0-36 VDC	0-2 amps	3-1/2 x 7-1/2 x 15-7/8	$235.00
SL36-2/2M	0-36 VDC Dual	0-2 amps Dual	3-1/2 x 17 x 15-7/8	$465.00
SL36-4M	0-36 VDC	0-4 amps	3-1/2 x 17 x 15-7/8	$290.00
SL36-8M	0-36 VDC	0-8 amps	5-1/4 x 17 x 15-7/8	$355.00
SL36-12M	0-36 VDC	0-12 amps	7 x 17 x 15-7/8	$455.00
SL36-25M	0-36 VDC	0-25 amps	10-1/2 x 17 x 15-7/8	$650.00

*Relay rack mounting kit no charge. Provides for 19" rack mounting.

OTHER MODELS: Model TRO 40M, 0 to 40 VDC @ 0 to 500 MA $130.00 / Model THK5-15LM, 0 to 5000 VDC @ 0 to 15 MA $345.00

SOLID STATE AC REGULATOR Sinusoidal Output, Modular Design



Model RT 250

FEATURES

- Sinusoidal output
- Precision RMS regulation
- Compact, modular design
- Minimum magnetic field or RFI
- Wide input range 47-440 cps
- Wide load power factor range
- Remote sensing
- Overload and short-circuit protected
- 71°C Free air rating
- Fully repairable

Model	Rating	Weight	Price
RT 250	250 VA	13 lbs.	$130.
RT 500	500 VA	17 lbs.	$175.
RT 1000	1000 VA	22 lbs.	$235.

Input: 105-130 VAC, 47-440 cps.
Line Regulation (RMS): Within ± 0.1% for full input change, resistive load or within ± 0.2% for +0.7 to —0.7 PF load.
Load Regulation (RMS): Within 0.2% for full load change, resistive, or within 0.5% for +0.7 to —0.7 load PF change.
Wave Form Distortion: Less than 5% (115 VAC input, unity through 0.7 load PF.)
Efficiency: Better than 75% rated load, 115 VAC input.
Load Power Factors Range: +0.7 PF through —0.7 PF.
Response Time: Less than 16 millisec.
Operating Temperature: —20°C to 71°C free air, full ratings.
Heat Sinking: Internal, convection cooled.

TRANSPAC® SOLID-STATE DC to AC INVERTERS

UNREGULATED (Square Wave) IT-B TYPES

Wave form approximately square wave
Self-excited designs with isolating feed-back transformers
Output voltage, RMS value at nominal input with taps provided for 105, 115, 125 VAC
Output voltage and frequency vary proportionately with input voltage change
Voltage regulation is within approximately 6% and frequency regulation within approximately ±2% for 50-100% load change
Unit can be synchronized externally

	POWER OUTPUT	INPUT VDC	OUTPUT (NOM.)	SIZE W x D x H (INCHES)	MODEL	PRICE
60 CPS OUTPUT	15 VA	5-7	115 VAC	2-5/8 x 3-1/16 x 4-1/2	IT616B	$ 80.00
	25 VA	10-14	115 VAC	3-1/16 x 3-9/16 x 4-7/8	IT126B	$ 90.00
	50 VA	19-29	115 VAC	3-7/8 x 3-7/8 x 4-3/4	IT256B	$105.00
	100 VA	19-29	115 VAC	3-1/4 x 4 x 5-15/16	IT2106B	$115.00
400 CPS OUTPUT	15 VA	5-7	115 VAC	2-3/8 x 2-3/4 x 3-13/16	IT614B	$ 80.00
	25 VA	10-14	115 VAC	2-5/8 x 3-1/16 x 4-1/2	IT124B	$ 90.00
	50 VA	19-29	115 VAC	3-1/16 x 3-9/16 x 4-7/8	IT254B	$105.00
	100 VA	19-29	115 VAC	3-1/4 x 4 x 5-15/16	IT2104B	$125.00

REGULATED (Square Wave) SB TYPES

Wave form approximately square wave
MOPA designs, regulated oscillator-driver and isolating power amplifier
Output voltage, RMS value at nominal input with taps provided for 105, 115, 125 VAC
Output voltage varies proportionately with input voltage change
Output voltage regulation within approximately 5% for a 50-100% load change
Frequency regulation within approximately ±1% for ±10% input change or 0-100% load change
Unit can be synchronized externally

60 CPS OUTPUT	50 VA	20-29	115 VAC	5-1/2 x 6-1/16 x 6-5/32	IT256SB	$195.00
	100 VA	20-29	115 VAC	5-1/2 x 6-1/16 x 6-5/32	IT2106SB	$245.00
	250 VA	10-14	115 VAC	6-1/8 x 5-15/16 x 6-1/2	IT2256SB(12)	$255.00
	250 VA	19-29	115 VAC	6-1/8 x 5-15/16 x 6-1/2	IT2256SB(24)	$265.00
	500 VA	10-14	115 VAC	7-13/32 x 9 x 6-3/16	IT2506SB(12)	$280.00
	500 VA	19-29	115 VAC	7-13/32 x 9 x 6-3/16	IT2506SB(24)	$290.00
400 CPS OUTPUT	50 VA	20-29	115 VAC	6-1/8 x 5-15/16 x 6-1/2	IT254SB	$205.00
	100 VA	20-29	115 VAC	6-1/8 x 5-15/16 x 6-1/2	IT2104SB	$230.00
	250 VA	20-29	115 VAC	6-1/8 x 5-15/16 x 6-1/2	IT2254SB	$270.00
	500 VA	20-29	115 VAC	7-13/32 x 9 x 6-3/16	IT2504SB	$335.00

REGULATED (Sine Wave) RS TYPES

Sinusoidal wave form, approximately 7% RMS distortion
MOPA designs, stabilized oscillator and isolating power amplifier
Output taps provided for 105, 115, 125 VAC
Voltage variation less than ±1% for full input load change
Load voltage variation with 0-100% change is less than 6%
Frequency regulation within ±1% for either 10% input change or 0-100% load change
Magnetic regulator provides voltage regulation
Unit can be synchronized externally

60 CPS OUTPUT	50 VA	26-29	115 VAC	6-1/8 x 5-15/16 x 6-1/2	IT256RS	$235.00
	100 VA	26-29	115 VAC	7-13/32 x 9 x 6-3/16	IT2106RS	$260.00
	250 VA	26-29	115 VAC	12 x 9 x 8	IT2256RS	$340.00
400 CPS OUTPUT	50 VA	26-29	115 VAC	6-1/8 x 5-15/16 x 6-1/2	IT254RS	$240.00
	100 VA	26-29	115 VAC	7-13/32 x 9 x 6-3/16	IT2104RS	$275.00
	250 VA	26-29	115 VAC	12 x 9 x 8	IT2254RS	$365.00

Note: All prices F.O.B. Cedar Grove, New Jersey
Subject to change without notice

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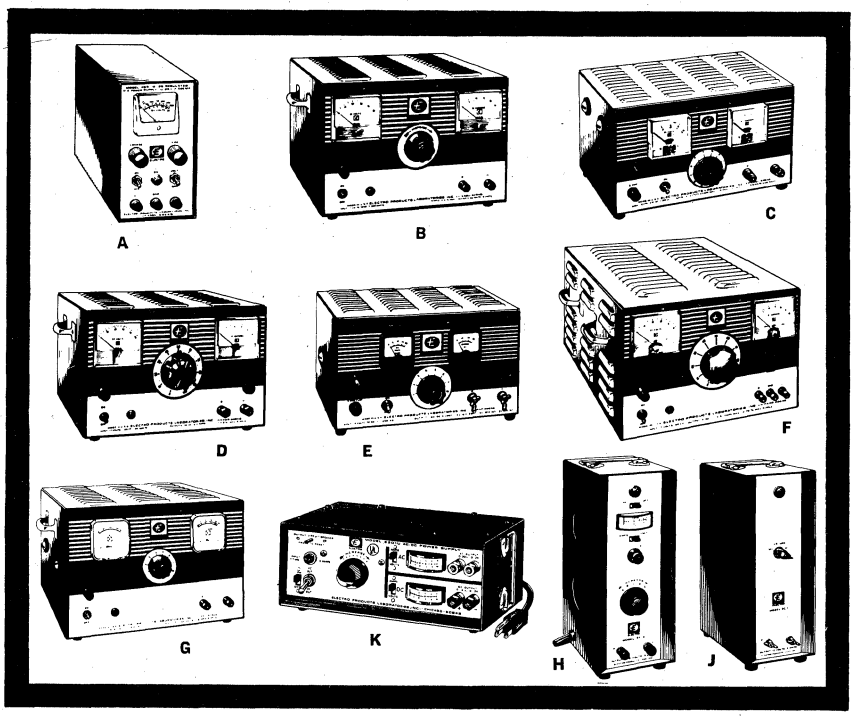
ELECTRO

REGULATED & SEMI-REGULATED POWER SUPPLIES

Electro offers a wide selection of ruggedly-constructed, low voltage dc power supplies for use in design, development and testing of transistor circuitry . . . for servicing and operating auto, aircraft, marinecraft radio and electronic equipment . . . and for production line testing, industrial and educational laboratory work and many other applications.

Each model is precision made and engineered to give unequalled performance life per dollar. Features include: Voltage regulation, ac ripple filtering, adjustable output voltage, large easy-to-read meters, isolated output terminals, 1-year warranty.

INPUT — *Regulated Models*: 105-125 vac. 60 Hz *Industrial* and *General Purpose Models*: 117 vac 50/60 Hz. Models available to fit W.E. and EIA racks. Custom-design or modification of standard units to your specifications.



Selection Guide — Power Supplies for every need

Model	Figure	Output Volts	Output Current	Line Reg.**	Load Reg.*	Max. Ripple, RMS	Meters††	DC Imp. Ohms*	Size (HxWxD)	Shpg. Wt. Lbs.	Price (net)
REGULATED											
PSR-12-25	A	0-25	0-500mA	0.01%+2mV	0.01%	100uV	0-30V/600mA	.006	5-1/4x3-1/8x10	7	$110.00
PSR-12-50	A	0-50	0-250mA	0.01%+2mV	0.01%	100uV	0-60V/300mA	.02	5-1/4x3-1/8x10	7	110.00
PSR-500-32	B	2-32	0-15A	0.1%	1.0%	0.5%	0-50V, 0-25A	.02	9-3/4x14-1/4x14-1/4	89	395.00
PSR-500-55	B	2-55	0-10A	0.1%	1.0%	0.5%	0-75V, 0-15A	.06	9-3/4x14-1/4x14-1/4	88	395.00
PSR-500-125	B	2-125	0-5A	0.1%	1.0%	0.5%	0-150V, 0-5A	.25	9-3/4x14-1/4x14-1/4	93	425.00

Model	Figure	Voltage Output	Amps. Output	Load Regulation* (V/A)†	Max. Ripple %	Meters††	DC Impedance (ohms)*	Size (HxWxD) inches	Weight lbs. (net)	Price (net)
INDUSTRIAL										
EF	C	0-28 0-14	0-5 0-5	0.9 (1-5A) 0.6 (1-5A)	1.0 1.0	0-50V, 0-6A	0.9 (1-5A) 0.6 (1-5A)	7x12x8-1/2	25	$125.00
EFB	C	0-32 0-16	0-4 0-8	1.25 1.0	0.1 0.1	0-40/20V, 0-10A	1.25 1.0	7x12x8-1/2	36	165.00
EFBR*		0-32 0-16	0-4 0-8	1.25 1.0	0.1 0.1	0-40/20V, 0-10A	1.25 1.0	8-3/4x19x8-1/2	47	185.00
GFL	D	0-125	0-5	1.5	0.5	0-150V, 0-5A	1.5	9-3/4x14-1/4x14-1/4	88	325.00
GFLR*		0-125	0-5	1.5	0.5	0-150V, 0-5A	1.5	10-1/2x19x14-1/4	100	345.00
NFB	D	0-32	0-15	0.4	0.75	0-50V, 0-25VA	0.4	9-3/4x14-1/4x14-1/4	84	300.00
NFBR*		0-32	0-15	0.4	0.75	0-50V, 0-25A	0.4	10-1/2x19x14-1/4	97	320.00
PS-5	D	0-55	0-10	0.8	0.5	0-75V, 0-15A	0.8	9-3/4x14-1/4x14-1/4	70	325.00
PS-5R*		0-55	0-10	0.8	0.5	0-75V, 0-15A	0.8	10-1/2x19x14-1/4	89	345.00
PS-1000-32	F	0-32	0-30	0.2	0.75	0-50V, 0-30A	0.2	9-3/4x14-1/4x19-1/4	103	398.00
PS-1000-55	F	0-55	0-20	0.5	0.5	0-75V, 0-30A	0.5	9-3/4x14-1/4x19-1/4	113	398.00
PS-1000-125	F	0-125	0-8A	1.0	Less than 1%	0-150V, 0-10A	1.0	9-3/4x14-1/4x19-1/4	120	425.00
GENERAL PURPOSE										
D-612T	E	0-16 0-8	0-10 0-10	0.44 (3-10A) 0.3 (3-10A)	0.5@5A 2@10A	0-20V, 0-10A	0.44 (3-10A) 0.3 (3-10A)	7x12x8-1/2	22	$79.50
H	E	12 (adj.) 6 (adj.)	0-10 0-20	0.23 (3-10A) 0.15 (3-20A)	5 5	0-20V, 0-30A	0.23 (3-10A) 0.15 (3-20A)	7x12x8-1/2	30	99.50
EC-1	J	12 (adj.)	0-5	1.4	0.5	None	1.4	10-3/4x4-3/8x6-1/2	12	39.50
EC-2	H	0-16	0-5	1.8	0.5	0-20V/10A	1.8	10-3/4x4-3/8x6-1/2	11	49.50
PS-30	G	12 (adj.)	0-30	0.12 (6-30A)	1	0-20V, 0-50A	0.27	9-3/4x14-1/4x14-1/4	68	198.00
PS-50	G	12 (adj.)	0-50	0.17	1	0-20V, 0-50A	0.17	9-3/4x14-1/4x19-1/4	87	298.00
3301-U	K	0-16 DC 0-20 AC	0-3 0-3	1.6 (1-3 Amps)	.5	0-20V, 0-5A DC 0-20V, 0-5A AC	2.4 DC 0.5 AC	4-3/4x10-3/4x6-1/2	10	89.50

*Rack mounted version.

†Output voltage change for each ampere of output current change, except on regulated units % applies for either line or load.

*No-load to full-load unless otherwise specified.

††All 2% accuracy except 5% for general purpose units.

**From 105-125VAC.

Rectifiers: Selenium and Silicon ("avalanche" characteristics on Industrial units).

Stocked at your electronic distributor. Write for full-line catalog. Prices subject to change without notice.

ELECTRO PRODUCTS LABORATORIES, INC.

Since 1936—Pioneers in Low Voltage Power Supplies

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ELGAR
AC Power Sources

ELGAR
Model 201
Single Phase 200 VA
Solid-State
Power Source

Elgar AC power sources are designed for continuous-duty operation and utilizes all-silicon solid-state circuitry as well as the highest-grade components. The basic power amplifier consists of two DC supplies and a multiple-stage amplifier with an adjustable power output transformer.

Control circuitry is mounted on a circuit board with test points, and all adjustment controls are available from the top of the unit.

Standard output voltages of 28 V, 115 V, or 230 V are available at the rear-panel terminal strip and at the front-panel connectors.

The instruments are contained in rack-mount enclosures with a meter for output voltage monitoring, a power-ON indicator, an output voltage amplitude control, and a power switch circuit breaker located on the front panel.

The output power frequency is established by a plug-in oscillator. Output frequency is 45 Hz to 10 KHz depending on the power amplifier selected. A variety of plug-in oscillators are available with frequency accuracies up to 0.0001%.

Single-Phase Power Amplifiers

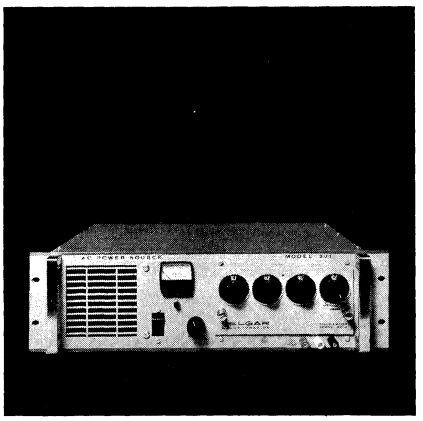
Model	Output Power
201	200 VA
501	500 VA
1001	1,000 VA
1000-1	1,000 VA (2 pieces Model 501 in tandem)
C-1000-1	Model 1000-1 in rack mount enclosure
2000-1	2,000 VA (2 pieces Model 1001 in tandem)
C-2000-1	Model 2000-1 in rack mount enclosure

Two-Phase Power Amplifiers

Model	Output Power (Total)
153	150 VA
400-2	400 VA (2 pieces Model 201 interconnected for 2ϕ)
C-400-2	Model 400-2 in rack mount enclosure
1000-2	1,000 VA (2 pieces Model 501 interconnected for 2ϕ)
C-1000-2	Model 1000-2 in rack mount enclosure
2000-2	2,000 VA (2 pieces Model 1001 interconnected for 2ϕ)
C-2000-2	Model 2000-2 in rack mount enclosure
4000-2	4,000 VA (2 pieces Model 2000-1 interconnected for 2ϕ)
C-4000-2	Model 4000-2 in rack mount enclosure

Three-Phase Power Amplifiers

Model	Output Power (Total)
153	150 VA
400-3D	400 VA (2 pieces Model 201 in 3ϕ delta configuration)
C-400-3D	Model 400-3D in rack mount enclosure
400-3Y	400 VA (2 pieces Model 201 in 3ϕ, 4 wire wye configuration)
C-400-3Y	Model 400-3Y in rack mount enclosure
600-3	600 VA (3 pieces Model 201 in 3ϕ, 4 wire wye configuration)
C-600-3	Model 600-3 in rack mount enclosure
1000-3D	1,000 VA 2 pieces Model 501 in 3ϕ delta configuration)
C-1000-3D	Model 1000-3D in rack mount enclosure
1000-3Y	1,000 VA (2 pieces Model 501 in 3ϕ, 4 wire wye configuration)
C-1000-3Y	Model 1000-3Y in rack mount enclosure
1503	1,500 VA
1500-3	1,500 VA (3 pieces Model 501 in 3ϕ, 4 wire wye configuration)
C-1500-3	Model 1500-3 in rack mount enclosure
2000-3D	2,000 VA (2 pieces Model 1001 in 3ϕ delta configuration)
C-2000-3D	Model 2000-3D in rack mount enclosure
2000-3Y	2,000 VA (2 pieces Model 1001 in 3ϕ, 4 wire wye configuration)
C-2000-3Y	Model 2000-3Y in rack mount enclosure
3000-3	3,000 VA (3 pieces Model 1001 in 3ϕ, 4 wire wye configuration)
C-3000-3	Model 3000-3 in rack mount enclosure
6000-3	6,000 VA (3 pieces Model 2000-1 in 3ϕ, 4 wire wye configuration)
C-6000-3	Model 6000-3 in rack mount enclosure



Output Power: 0-200 VA, 1ϕ, (1 unit); 0-400 VA, 2ϕ, (2 units); 0-400 VA, 3ϕ, (2 units)*; 0-600 VA, 3ϕ, (3 units); continuous duty.

Power Factor: Full current rating into 0.7 lagging to 0.7 leading power factor loads.

Output Voltage: Adjustable 0-32 VAC, 0-130 VAC, or 0-260 VAC.** Full output power range 27-32 VAC, 110-130 VAC, or 220-260 VAC.

Output Configuration: 2-wire isolated from ground; either output can be grounded.

Output Frequency Range: 45 Hz to 5000 Hz at full power output; 5 KHz to 10 KHz at one-half power output.

Wave Shape: Sine wave.

Distortion: Less than 0.9% over 45 Hz to 5000 Hz range at full output power. Less than 0.5% at mid band (100 Hz to 1000 Hz) at full output power. Less than 2% 5 KHz to 10 KHz at one-half output power.

Load Regulation: ±1% no load to full load, 45 Hz to 5000 Hz, adjustable through zero for specific load conditions. ±2% no load to one-half load, 5 KHz to 10 KHz.

Response Time: Less than 50 μsec.

Line Regulation: ±0.25% at full load vesus ±10 VAC change at 115 VAC input. ±0.25% at full load versus ±20 VAC change at 230 VAC input.

Short Circuit Protection: Automatic curcurent limiting protects against overload or short circuit; amplifier recovers immediately when overload or short circuit is removed.

Output Noise: 60 db below full output voltage.

Input Power: 115 VAC ±10 VAC or 230 VAC ±20 VAC***, 47 Hz to 63 Hz, single phase. (50 Hz to 425 Hz optional).

Temperature Range: 0°C to 50°C operational, −20°C to +85°C non-operational.

Weight: Net approx. 60 lbs., shipping approx. 65 lbs.

*For 2 amplifier wye only: frequency range 45 Hz to 2000 Hz at full power; ±1% regulation for balanced load.

**Output voltage range selected by jumper change on rear panel terminal block.

***Input voltage range selected by jumper change on inside terminal block.

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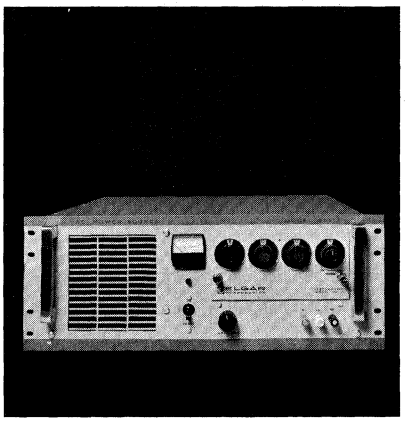
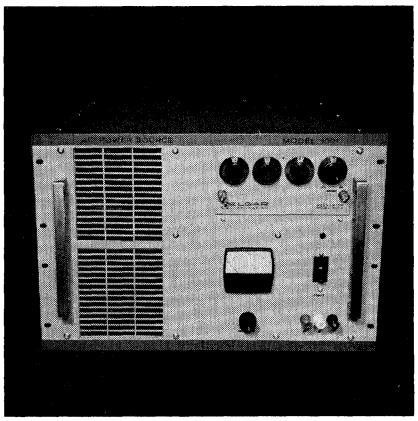
ELGAR
Model 501
Single Phase 500 VA
Solid-State
Power Source



Output Power: 0-500 VA, 1ϕ, (1 unit); 0-1000 VA, 2ϕ, (2 units); 0-1000 VA, 3ϕ, (2 units)*; 0-1500 VA, 3ϕ, (3 units); continuous duty.
Power Factor: Full current rating into 0 lagging to 0.7 leading power factor loads.
Output Voltage: Adjustable 0-32 VAC, 0-130 VAC, or 0-260 VAC**. Full power range 27-32 V, 110-130 V, or 220-260 V.
Output Configuration: 2-wire isolated from ground; either output can be grounded.
Output Frequency Range: 45 Hz to 5000 Hz at full power output.
Wave Shape: Sine Wave.
Distortion: Less than 0.9% over 45 Hz to 5000 Hz range at full output power. Less than 0.5% mid band (100 Hz to 1000 Hz) at full output power.
Load Regulation: ±1% no load to full load, 45 Hz to 5000 Hz, adjustable through zero for specific load conditions.
Response Time: Less than 50 μsec.
Line Regulation: ±0.25% at full load versus ±10 VAC, change at 115 VAC input. ±0.25% at full load versus ±20 VAC change at 230 VAC input.
Short Circuit Protection: Automatic current limiting protects against overload or short circuit, amplifier recovers immediately when overload or short circuit is removed.
Output Noise: 60 db below full output voltage.
Input Power: 115 VAC ±10 VAC or 230 VAC ±20 VAC***, 47 Hz to 63 Hz, single phase. (375 Hz to 425 Hz optional).
Temperature Range: 0°C to 50°C operational, −20°C to +85°C non-operational.
Weight: Net approx. 105 lbs., shipping approx. 115 lbs.

*For 2 amplifier wye only: frequency range 45 Hz to 2000 Hz at full power; ±1% regulation for balanced load.
**Output voltage range selected by jumper change on rear panel terminal block.
***Input voltage range selected by jumper change on inside terminal block.

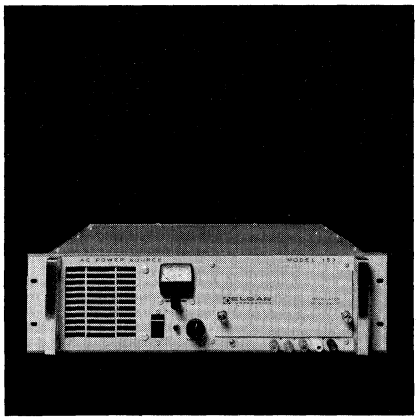
ELGAR
Model 1001
Single Phase 1000 VA
Solid-State
Power Source



Output Power: 0-1000 VA, 1ϕ, (1 unit); 0-2000 VA, 2ϕ, (2 units); 0-2000 VA, 3ϕ, (2 units)*; 0-3000 VA, 3ϕ (3 units); continuous duty.
Power Factor: Full current rating into 0 lagging to 0.7 leading power factor loads.
Output Voltage: Adjustable 0-32 VAC, 0-130 VAC, or 0-260 VAC.** Full power range 27-32 VAC, 110-130 VAC, or 220-260 VAC.
Output Configuration: 2-wire isolated from ground; either output can be grounded.
Output Frequency Range: 45 Hz to 5000 Hz at full power output.
Wave Shape: Sine Wave.
Distortion: Less than 0.9% over 45 Hz to range at full output power. Less than 0.5% mid band (100 Hz to 1000 Hz) at full output power.
Load Regulation: ±1% no load to full load, 45 Hz to 5000 Hz, adjustable through zero for specific load conditions.
Response Time: Less than 50 μsec.
Line Regulation: ±0.25% at full load versus ±10 VAC change at 115 VAC input. ±0.25% at full load versus ±20 VAC change at 230 VAC input.
Short Circuit Protection: Automatic current limiting protects against overload or short circuit; amplifier recovers immediately when overload or short circuit is removed.
Output Noise: 60 db below full output voltage.
Input Power: 115 VAC ±10 VAC, 208 VAC or 230 VA C±20 VAC***, 47 Hz to 63 Hz, single phase. (375 Hz to 425 Hz optional).
Temperature Range: 0°C to 50°C operational, −20°C to +85°C non-operational.
Weight: Net approx. 210 lbs., shipping approx. 220 lbs.

*For 2 amplifier wye only: frequency range 45 Hz to 2000 Hz at full power; ±1% load regulation for balanced load.
**Output voltage range selected by jumper change on rear panel terminal block.
***Input voltage range selected by jumper change on inside terminal block.

ELGAR
Model 153
Three Phase 150 VA
Solid-State
Power Source



Output Power: 0-150 VA per phase, 1ϕ; 0-75 VA per phase, 2ϕ; 0-50 VA per phase, 3ϕ; continuous duty.
Power Factor: Full current rating into 0.7 lagging to 0.7 leading power factor loads.
Output Voltage: 0-130 VAC or 0-260 VAC, 2 wire 1 phase. 0-32 VAC, 0-130 VAC, or 0-260 VAC, 3 wire, 2 phase. 0-32 VAC, 0-130 VAC, or 0-260 VAC line to line, 3 wire open delta, 3 phase. 0-32 VAC, 0-130 VAC line to neutral, 4 wire wye, 3 phase.
Output Configuration: All outputs isolated from ground, any one phase or the neutral can be grounded. Voltage ranges are selected by strapping on rear panel connector.
Output Frequency Range: 350 Hz to 10 KHz at full power output.
Wave Shape: Sine Wave.
Distortion: Less than 0.5% over 350 Hz to 1000 Hz range at full power output. Less than 0.9% over 1000 Hz to 5000 Hz range at full power output. Less than 2% over 5 Hz to 10 KHz range at full power output.
Load Regulation: ±1% no load to full load, 350 Hz to 5000 Hz; ±2% no load to full load, 5 KHz to 10 KHz; adjustable through zero for specific load conditions.
Response Time: Less than 50 μsec.
Line Regulation: ±0.25% at full load versus ±10 VAC change at 115 VAC input. ±0.25% at full load versus ±20 VAC change at 230 VAC input.
Short Circuit Protection: Automatic current limiting protects against overload or short circuits, amplifier recovers immediately when overload or short circuit is removed.
Output Noise: 60 db below full output voltage.
Input Power: 115 VAC ±10 VAC or 230 VAC ±20 VAC*, 47 Hz to 63 Hz, single phase. (375 Hz to 425 Hz optional).
Temperature Range: 0°C to 50°C operational, −20°C to +85°C non-operational.

*Input voltage selected by strapping on internal terminal block.

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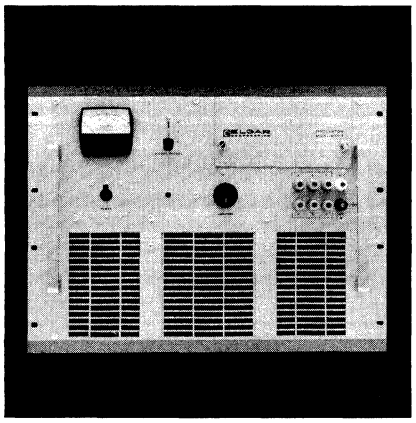
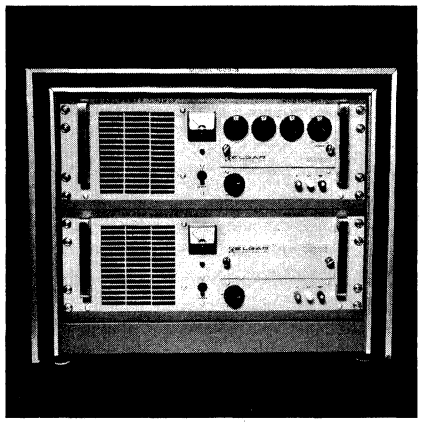
ELGAR
Model 1503
Three Phase 1500 VA
Solid-State
Power Source



Output Power: 1500 VA total, 500 VA per phase, continuous duty.
Power Factor: Full current rating into zero lagging to 0.7 leading power factor loads.
Output Voltage: 0-130 VAC line to neutral and 0-130 VAC line to line available simultaneously.
Output Configuration: 3-phase, 4-wire wye; all outputs isolated from ground, any one phase or the neutral can be grounded.
Output Frequency Range: 45 Hz to 5000 Hz at full power output.
Wave Shape: Sine Wave.
Distortion: Less than 0.9% over 45 Hz to 5000 Hz range at full output power. Less than 0.5% mid band (100 Hz to 1000 Hz) at full output power.
Line Regulation: ±0.25% at full load versus ±10 VAC change at 115 VAC input. ±0.25% at full load versus ±20 VAC change at 230 VAC input.
Load Regulation: ±1% no load to full load, 45 Hz to 5000 Hz, adjustable through zero for specific load conditions.
Response Time: Less than 50 μsec.
Short Circuit Protection: Automatic curcurent limiting protects against overload or short circuit; amplifier recovers immediately when overload or short circuit is removed.
Output Noise: 60 db below full output voltage.
Input Power: 115 VAC ±10 VAC or 208 or 230 VAC ±20 VAC, 47 Hz to 63 Hz three phase. (375 Hz to 425 Hz optional).
Temperature Range: 0°C to 50°C operational, −20° to +85°C non-operational.
Weight: Net approx. 230 lbs., shipping approx. 240 lbs.

ELGAR
Model 1000
Single, Two or Three Phase
1000 VA Solid-State
Power Source



The Elgar Model 1000 AC power source is an all-silicon, solid-state power source designed for maximum flexibility and reliability.

It utilizes two pieces of our industry-proven Model 501 housed in a single rack mount enclosure. These units can be interconnected to provide the following ouput power configurations:
1000 VA, single phase,
1000 VA, 2 phase,
1000 VA, 3 phase, 3 wire delta, or
1000 VA, 3 phase, 4 wire wye.

Either amplifier will accept any of 40 interchangeable single or multiphase plug-in oscillators covering the range of 45 Hz to 5000 Hz, with accuracies from 1% to 0.0001%. Special oscillator modules are available providing ±0.01% amplitude and phase regulation, or amplitude and frequency BCD programming capability.

The Model 1000 is ideally suited for automated and laboratory testing of gyro, aircraft and missile and space equipment, and for operation of 60 Hz power equipment overseas.

Output Power:
Model 1000-1*, 1φ.
Model 1000-2, 2φ (500 VA/phase).
Model 1000-3D, 3φ, 3 wire delta (333 VA/phase).
Model 1000-3Y, 3φ, 4 wire wye, (333 VA/phase) continuous duty.

Power Factor: Full current rating into zero lagging to 0.7 leading for 1000-1 and 1000-2; 0.7 lagging to 0.7 leading for 1000-3D and 1000-3Y.

Output Voltage:
Model 1000-1, 0-130 VAC or 0-260 VAC, 2 wire.
Model 1000-2, 0-32 VAC, 0-130 VAC, or 0-260 VAC, 3 wire.
Model 1000-3D, 0-32 VAC, 0-130 VAC, or 0-260 VAC line to line, 3 wire open delta.
Model 1000-3Y, 0-32 VAC or 0-130 VAC line to neutral (120/208), 4 wire wye.

Output Configuration: All outputs isolated from ground; any one phase or neutral can be grounded. Voltage ranges are selected by strapping changes on rear panel terminal block.
Output Frequency Range: 1000-1 & 1000-2, 45 Hz to 5000 Hz at full power output. 1000-3D & 1000-3Y, 45 Hz to 2000 Hz at full power output.
Wave Shape: Sine wave.
Distortion: Less than 0.9% full frequency range at full output power. Less than 0.5% mid range (100 Hz to 1000 Hz) at full output power.
Load Regulation: ±1% no load to full load over rated frequency range (1000-3Y with balanced load), adjustable through zero for specific load conditions.
Response Time: Less than 50 μsec.
Line Regulation: ±0.25% at full load versus ±10 VAC change at 115 VAC input. ±0.25% at full load versus ±20 VAC change at 230 VAC input.
Short Circuit Protection: Automatic current limiting protects against overload or short circuit, amplifier recovers immediately when overload or short circuit removed.
Output Noise: 60 db below full output voltage.
Input Power: 115 VAC ±10 VAC or 230 VAC ±20 VAC**, single phase, 47 Hz to 63 Hz. (375 Hz to 425 Hz optional).
Temperature Range: 0°C to 50°C operational, −20°C to +85°C non-operational.
Weight: Net approx. 210 lbs., shipping approx. 230 lbs., with cabinet approx. 280 lbs.

*Model dash numbers are for initial use ordering; units are field changeable for any configuration with appropriate oscillator change.
**Input voltage range selected by jumper change on terminal block.

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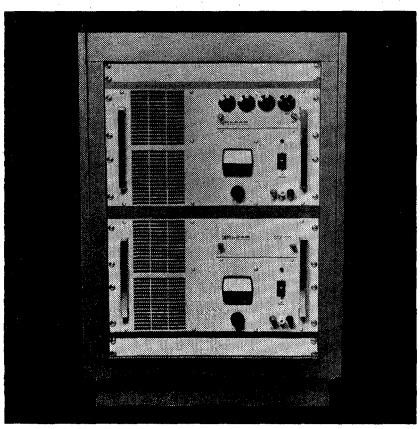
ELGAR
Model 2000
Single, Two or Three Phase
2000 VA Solid-State
Power Source



The Elgar Model 2000 AC power source is an all-silicon, solid state power source designed for maximum flexibility and reliability.

It utilizes two pieces of our industry-proven Model 1001 housed in a single rack mount enclosure. These units can be interconnected to provide the following output power configurations:
2000 VA, single phase,
2000 VA, 2 phase,
2000 VA, 3 phase, 3 wire delta, or
2000 VA, 3 phase, 4 wire wye.

Either amplifier will accept any of 40 interchangeable single or multiphase plug-in oscillators covering the range of 45 Hz to 5000 Hz, with accuracies from 1% to 0.0001%. Special oscillator modules are available providing ±0.01% amplitude and phase regulation, or amplitude and frequency BCD programming capability.

The Model 2000 is ideally suited for automated and laboratory testing of gyro, aircraft and missile and space equipment, and for operation of 60 Hz power equipment overseas.

Output Power:
Model 2000-1, 1ϕ.
Model 2000-2, 2ϕ (1 KVA/phase).
Model 2000-3D, 3ϕ, 3 wire delta, (667 VA/phase).
Model 2000-3Y, 3ϕ, 4 wire wye (667 VA/phase).

Power Factor: Full current rating into zero lagging to 0.7 leading for 2000-1 and 2000-2; 0.7 lagging to 0.7 leading for 2000-3D and 2000-3Y.

Output Voltage:
Model 2000-1*, 0-130 VAC or 0-260 VAC, 2 wire.
Model 2000-2, 0-32 VAC, 0-130 VAC, or 0-260 VAC, 3 wire.
Model 2000-3D, 0-32 VAC, 0-130 VAC, or 0-260 VAC line to line, 3 wire delta.
Model 2000-3Y, 0-32 VAC or 0-130 VAC line to neutral (120/208), 4 wire wye.

Output Configuration: All outputs isolated from ground; any one phase or neutral can be grounded. Voltage ranges are selected by strapping changes on rear panel terminal block.

Output Frequency Range: Model 2000-1 & Model 2000-2, 45 Hz to 5000 Hz at full power output. Model 2000-3D & Model 2000-3Y, 45 Hz to 2000 Hz at full power output.

Wave Shape: Sine wave.

Distortion: Less than 0.9% full frequency range at full output power. Less than 0.5% mid range (100 Hz to 1000 Hz) at full output power.

Load Regulation: ±1% no load to full load over rated frequency range (Model 2000-3Y with balanced load), adjustable through zero for specific load conditions.

Response Time: Less than 50 μsec.

Line Regulation: ±0.25% at full load versus ±10 VAC change at 115 VAC input. ±0.25% at full load versus ±20 VAC change at 230 VAC input.

Short Circuit Protection: Automatic current limiting protects against overload or short circuit, amplifier recovers immediately when overload or short circuit removed.

Output Noise: 60 db below full output voltage.

Input Power: 115 VAC ±10 VAC or 230 VAC ±20 VAC**, single phase, 47 Hz to 63 Hz. (375 Hz to 425 Hz optional).

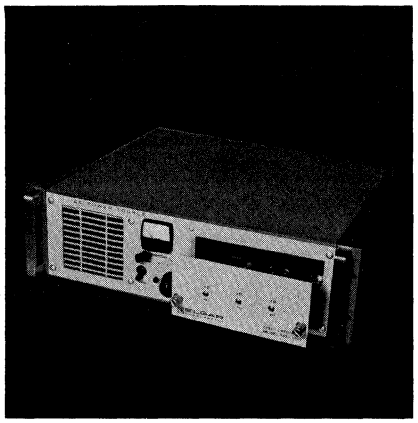
Temperature Range: 0°C to 50°C operational, −20°Cto + 85°C non-operational.

Weight: Net approx. 420 lbs., shipping approx. 440 lbs., with cabinet approx. 500 lbs.

*Model dash numbers are for initial use ordering; units are field changeable for any configuration with appropriate oscillator change.

**Input voltage range selected by jumper change on terminal block.

ELGAR
Super-Stable
Solid-State
Plug-In Oscillator
Modules



For gyro drift and life testing, Elgar Super-Stable (SS) plug-in oscillator modules provide a stable-frequency, low-distortion signal for any of the Elgar AC power amplifiers. The plug-in oscillators are designed for one, two, or three-phase operation depending on the amplifier or combination of amplifiers selected. The Super-Stable oscillators are unique in that they use electronic servo techniques with remote sensing for amplitude and phase regulation. Output frequencies are available from 45 Hz to 9,600 Hz at 0.01% accuracy. The nominal output voltage must be specified along with the frequency when ordering any of the Super-Stable oscillators.

Output Voltages (Typical): 28 VAC, 34 VAC, 115 VAC.

Output Configuration: 1ϕ, 2ϕ or 3ϕ; 3ϕ is 3-wire, open delta (floating).

Output Power: Depends on power amplifier selected.

Power Factor: ±.7 (other power factor optional).

Fixed Frequency (Typical): 400 Hz, 800 Hz, 1,200 Hz, 9,600 Hz; other frequencies optional.

Distortion: Less than 0.35% total.

Amplitude Stability: Load ±0.01% no load to full load; Line ±0.01% for 115 V ±10 V; Time ±0.1% for 1,000 hours under constant conditions; Specifications refer to full wave average value of wave form.

Temperature Coefficient: ±0.005%/°C.

Phase Accuracy: Adjustable to ±0.01%.

Phase Stability: ±0.1° for 1000 hours.

NOTE: Above specifications apply when used with any Elgar AC power amplifier.

Model	Frequency	Accuracy	Phase
441 - .01SS	400 Hz	0.01%	1
442 - .01SS	400 Hz	0.01%	2
443 - .01SS	400 HZ	0.01%	3
481 - .01SS	800 Hz	0.01%	1
482 - .01SS	800 Hz	0.01%	2
483 - .01SS	800 Hz	0.01%	3
41201 - .01SS	1,200 Hz	0.01%	1
41202 - .01SS	1,200 Hz	0.01%	2
41203 - .01SS	1,200 Hz	0.01%	3

Oscillator modules are available for any frequency from 400 Hz to 9.6 KHz and accuracies to 0.01%.

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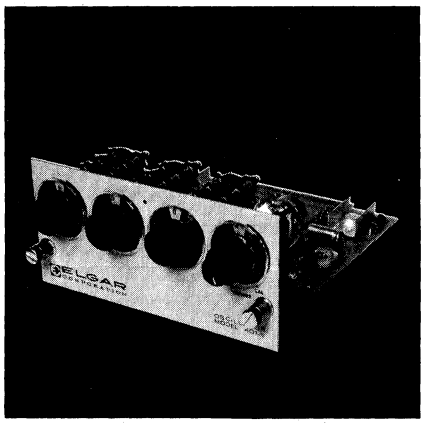
ELGAR Solid-State Plug-In Oscillator Modules



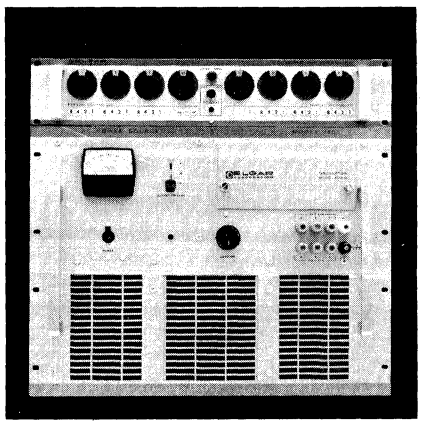
The Elgar oscillators are contained in a plug-in enclosure which can be inserted into the front panel opening of an Elgar power source. The plug-in enclosure contains a horizontally-mounted printed circuit board, and a terminal connector which mates with a similar connector in the power source. The 0.1% model is provided with a front panel access hole for a screwdriver frequency adjustment. The oscillators are available in 50, 60, 400, 800, 3,200 and 4,800 Hz output frequencies, or any frequency from 45 Hz to 10 KHz on special order.

Model	Frequency	Accuracy	Phase
400-A	External Osc. Adapter		
400-B	Blank Osc. Module		
401-V	Variable (45 Hz to 10 KHZ)	±1%	1
402-V	" "	"	2
403-V	" "	"	3
451-.1	Fixed 50 Hz	±.1%	1
452-.1	"	"	2
453-.1	"	"	3
451-.01	"	±.01%	1
452-.01	"	"	2
453-.01	"	"	3
451-.0001	"	±.0001%	1
452-.0001	"	"	2
453-.0001	"	"	3
461-.1	Fixed 60 Hz	±.1%	1
462-.1	"	"	2
463-.1	"	"	3
461-.01	"	±.01%	1
462-.01	"	"	2
463-.01	"	"	3
461-.0001	"	±.0001%	1
461-.0001	"	"	2
463-.0001	"	"	3
441-.1	Fixed 400 Hz	±.1%	1
442-.1	"	"	2
443-.1	"	"	3
441-.01	"	±.01%	1
442-.01	"	"	2
443-.01	"	"	3
441-.0001	"	±.0001%	1
442-.0001	"	"	2
443-.0001	"	"	3

Special Plug-in Oscillator Modules are available for:

- Any frequency and accuracy (to .0001%) from 45 Hz to 5,000 Hz.
- Dual frequency (switchable).
- Special purpose functions (programmable).

ELGAR Decoder Programmer Solid-State Programmable Oscillators



The Elgar DP Series of decoder programmers are precision programmable oscillators which operate in conjunction with Elgar's wide range of AC power sources. The standard output voltage is 0-3 V rms, however, options are available to adapt to power amplifiers requiring other drive levels and, in particular, Option No. 6 which provides 0-150 V rms at 25 milliwatts as a stimulus source.

They are designed for automatic programmed frequency selection, automatic programmed amplitude selection, automatic programmed phase angle selection, and combinations of frequency and amplitude and amplitude and phase angle.

The DP Series is available in 1, 2 or 3 phase configurations, 45 Hz to 10,000 Hz frequency range, and with the appropriate Elgar power amplifier, up to 6 KVA of output power.

Salient Features

Automatic frequency selection
Automatic amplitude selection
Automatic phase angle selection
Continuous waveform amplitude programming
Standard 8421 binary coded decimal system
Frequency response: ±0.1%.
System amplitude stability: ±0.01% versus 100% load change; ±0.01% versus ±10 V line change; ±0.1% for 1000 hours under constant conditions.

Frequency: Frequency Accuracy: ±1% of programmed value; Frequency Stability: 0.02%°C; Frequency Programming Range: 45 Hz to 10 KHz; Frequency Resolution: 3 decades with 3 ranges
Range 1: 45 Hz to 109.9....0.1 Hz steps
Range 2: 100 Hz to 1.099 KHz 1 Hz steps
Range 3: 1 KHz to 10.99 KHz 10 Hz steps
Frequency Response of Amplitude: ±0.1% of full output over frequency range.

Amplitude: Amplitude Programming Range: 0-130 V (0-32 and 0-260 optional); Output Signal to Power Amplifier: 0-3 V RMS (0-150 V at 25 milliwatts optional); Amplitude Resolution: 100 MV from 1-130 V; Amplitude Programming Accuracy: ±0.25% FS of range (half-wave average); Amplitude Stability: ±0.1% for 1000 hours at constant temperature, load and line; Temperature Coefficient: ±0.005%/°C; Distortion: Less than 0.5%, less than 0.2% mid band 200-1000 Hz; System Settling Time: 100ms, includes power amplifier.

Phase (Applicable to 2 phase systems): Phase Programming Range: 0-360° in 1° steps); Phase Programming Accuracy: ±1°.

Programming: BCD 8421 (parallel entry); Option 1: Logic level "O" = 0 to +0.5 V, "I" = +3.5 V to +15 V; Option 2: Contact closures; Option 3: Program storage; storage set time is 5ms; Option 4: External amplitude modulation; Option 5: ±0.1% amplitude programming accuracy; Option 6: Output voltage 0-150 VAC at 25 milliwatts. For two or three phase outputs, phase accuracies will be ±1° 45 Hz to 2 KHz, ±2° 2 KHz to 6 KHz (programmed F and/or A).

Programming Connectors: MS type (mating connectors supplied).

Input Power: 105-125 V or 210-250 V single phase, 47 to 425 Hz 100 watts maximum.

Size: 3½" h x 14" d x 19" wide, standard rack mounting.

Actual output voltage range and output power is dependent on Elgar power amplier selected. Phase programming is not available with frequency programming.

Model DPI-A: Amplitude programming only (fixed frequency .01%).

Model DPI-F: Frequency programming only (fixed amplitude).

Model DP2-P: Phase programming only (fixed frequency .01% and fixed amplitude).

Model DPI-AF: Amplitude and Frequency only (fixed phase).

Model DP2-AP: Amplitude and Phase only (fixed frequency .01%).

Example: DPI-AF-13 would be amplitude and frequency programming with storage, 8421 "IC" logic levels.

Model DP2-XX-XX For two phase.

Model DP3-XX-XX For three phase.

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ELGAR
AC Line Conditioners

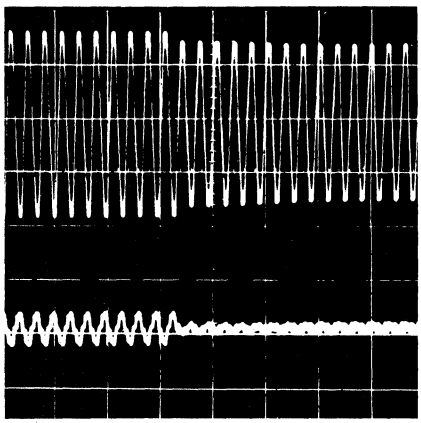
ELGAR
Series 6000
High-Speed
Solid-State
AC Line Conditioners

Elgar AC line conditioners provide pure AC power by eliminating high-speed line and load transients as well as all other forms of power line disturbance. These versatile instruments feature response times 1,000 times faster (typically 50 microseconds) than the fastest AC line regulator. All Elgar units are designed for continuous operation and are contained in rack-mount enclosures. The front panel has meters to monitor input and output voltages and load current, an overload indicator, and power circuit breaker. Cooling air is drawn in at the front panel and exhausted at the rear. Anyone using voltage-sensitive equipment needs isolation from high-speed line transients. Unconditioned power sources are subject to fluctuating high-speed voltage changes which can cause erratic operation, component failures, and a reduction in equipment life. In the case of sensitive measuring and data handling equipment, high-speed line transients often are the cause of erroneous information. These unwanted transients, which occur on power lines, are voltage surges, high-voltage spikes, voltage dips, and low-voltage spikes. Frequencies are often in the megacycle range, with pulse durations ranging from one millisecond to just a few nanoseconds. High-frequency transients are most frequently caused by the operation of: arc welders, fluorescent lights, heaters cycling on and off, elevators, environmental chambers, shake tables, air conditioners, tape punches, thermal baths, etc. High voltage spikes appear on the power line each time the current is interrupted through an inductive load. Local user conditions such as intermittent heavy loads, long feeder lines, or multiple-customer use of common power sources cause low-voltage dips and low-voltage spikes. The speed and reliability of Elgar line conditioners completely eliminate unwanted transients, providing pure AC power.

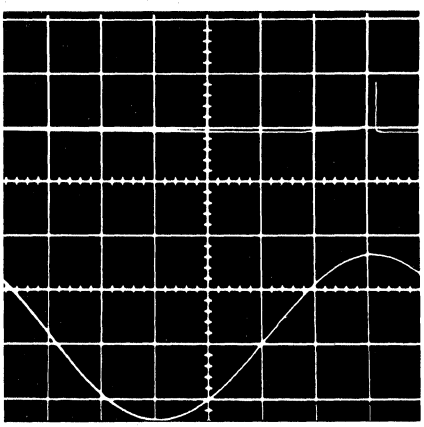
Line Conditioner Selection Guide

Output Power (KVA)	Output Voltage (VAC)	Input Voltage (VAC)	Input Freq. (Hz)	Model
0.5	115	95-135	60	7006
1	115	95-135	50	6005
1	115	95-135	60	6006
1	115	95-135	400	6004
1	230	190-270	50	6235
1	230	190-270	60	6236
2.5	115	95-135	50	3005
2.5	115	95-135	60	3006
2.5	115	95-135	400	3004
2.5	230	190-270	50	3235
2.5	230	190-270	60	3236
5	115	95-135	50	5005
5	115	95-135	60	5006
5	230	190-270	50	5235
5	230	190-270	60	5236

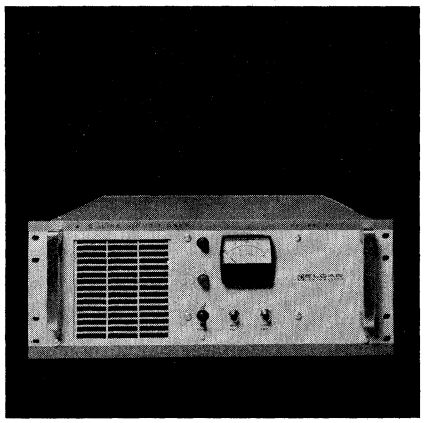
NOTES
1. Step-up or step-down combinations available such as 230 V input & 115 V output.
2. See text for detailed specifications.



The top trace shows a sudden decrease in input line voltage. The bottom trace is the AC Line Conditioner output, showing the instrument's fast response time by lack of variation in sine wave output.



The top trace is a distorted power input to the Line Conditioner. Output of the Line Conditioner shown on the bottom trace, is a pure, distortion-free sine wave.



There are four models in this series: 6005A, 6006A, 6235A, and 6236A. Except where noted, specifications are the same for all models.

INPUT:

Voltage: 95-115 V rms, 105-125 V rms, 115-135 V rms, selectable by tap switch (6005A & 6006A); 190-230 V rms, 210-250 V rms, 230-270 V rms, selectable by tap switch (Models 6235A & 6236A).

Frequency: 47 to 53 Hz (Models 6005A & 6235A); 57 to 63 Hz (Models 6006A & 6236A).

Power: 1,600 watts max.

Harmonic Distortion: 10% max.

Isolation: 100 db common mode isolation; 1 pf power transformer primary to secondary coupling capacitance. Low side of input normally strapped to chassis but may be floated to 300 V rms.

OUTPUT:

Voltage: 115 V rms setable to 0.1% (Models 6005A & 6006A); 230 V rms, setable to 0.1%, with 115 V rms optional (Models 6235A & 6236A).

Voltage Instability: ±0.05% for 24 hours under constant line, load, and ambient temperature conditions.

Power: 1,000 VA from unity to ±0.7 power factor, 4,500 VA max. peak instantaneous power.

Harmonic Distortion: 0.2% max.

Line Regulation: ±0.025% for a ±10 V line change (Models 6005A & 6006A); ±0.025% for a ±20 V line change (Models 6235A & 6236A).

Load Regulation: 0.025% for a zero to full resistive load change; 0.05% for a zero to full load change at ±0.7 power factor.

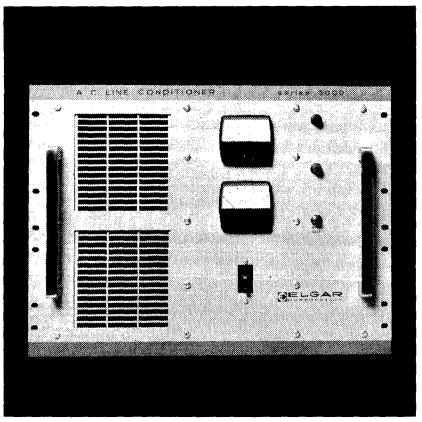
Amplitude Temperature Coefficient: 0.005% per degree C max.

Peak Amplitude Instability: ±0.01% cycle to cycle.

Maximum Crest Factor: (for rated power output) 2.5 times.

8159 Engineer Road, San Diego, California 92111, Phone (714) 279-0800

ELGAR
Series 3000 & 5000
High-Speed Solid-State
AC Line Conditioners



There are eight models in this series: Models 3005A, 3006A, 3235A, 3236A, 5005A, 5006A, 5235A and 5236A. Except where noted, specifications are the same for all models.

INPUT:

Voltage: 95-115 V rms, 105-125 V rms, 115-135 V rms, selectable by tap switch (Models 3005A, 3006A, 5005A & 5006A); 190-230 V rms, 210-250 V rms, 230-270 V rms, selectable by tap switch (Models 3235A, 3236A, 5235A & 5236A).

Frequency: 47 to 53 Hz (Models 3005A 3235A, 5005A & 5235A); 57 to 63 Hz (Models 3006A, 3236A, 5006A & 5236A).

Input Power: 4,000 watts max. (Series 3000). 8,000 watts max. (Series 5000).

Harmonic Distortion: 10% max.

Isolation: 100 db common mode isolation; 1 pf power transformer primary to secondary coupling capacitance; low side of input normally strapped to chassis but may be floated to 300 V rms.

OUTPUT:

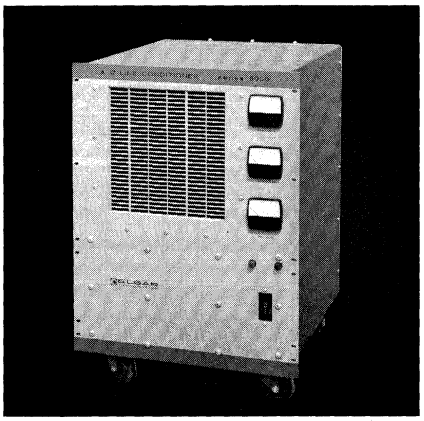
Voltage: 115 V rms, setable to 0.1% (Models 3005A, 3006A, 5005A & 5006A); 230 V rms, setable to 0.1%, with 115 V optional (Models 3235A, 3236A, 5235A & 5236A).

Voltage Instability: ±0.05% for 24 hours under constant line, load and ambient temperature conditions.

Output Power: (3000 Series) 2,500 VA from unity to ±0.7 power factor, 11,250 VA max. peak instantaneous power. (5000 Series) 5,000 VA from unity to ±0.7 power factor, 22,500 VA max. peak instantaneous power.

Harmonic Distortion: 0.2% max.

Line & Load Regulation: ±0.05% for a ±10 V line change and for zero to full load change (Models 3005A, 3006A, 5005A & 5006A); ±0.05% for a ±20 V line change and for zero to full load change (Models 3235A, 3236A, 5235A & 5236A).



Peak Amplitude Instability: ±0.01% cycle to cycle.

Maximum Crest Factor: 2.5 times (for rated power output).

Shunt Capacitance: Unit will operate with up to 100 μf of shunt capacitance.

TRANSIENT CHARACTERISTICS:

Line (10% step change): Output transient will not exceed 0.5% peak amplitude.

Impulse Settling Time: 50 μsec or less.

Overload Indication: Front panel lamp illuminates when load exceeds KVA rating. Raw AC power is applied to load during period of illumination.

Overload Protection: Excessive overload condition actuates front panel circuit breaker.

GENERAL

Metered Input/Output: Switchable input/output AC voltmeter and output current meter. Meter accuracies ±3% full scale.

Ambient Temperature: 0 to 55°C.

Storage Temperature: −20°C to 85°C.

Cooling: A blower provides internal forced air circulation; reversible air flow through front panel.

Dimensions: 3000 Series 19″ w x 14″ h x 19″ d, for standard rack mounting.
5000 Series 19″ w x 24½″ h x 20″ d, for standard rack mounting.

Net Weight: 3000 Series 175 lb.
5000 Series 400 lb.

Shipping Weight: 3000 Series 180 lb.
5000 Series 425 lb.

Shunt Capacitance: Unit will operate with up to 100 μf of shunt capacitance.

Transient Characteristics

Line (10% step change): Output transient will not exceed 0.5% peak amplitude.

Impise Settling Time: 50 μsec or less.

Overload Indication: Front panel lamp illuminates when load exceeds 1 KVA. Raw AC power is applied to load during period of illumination.

Overload Protection: Excessive overload condition actuates front panel circuit breaker.

GENERAL:

Metered Input/Output: Switchable input/output and output current monitoring on AC voltmeter. Meter accuracy ±3% full scale.

Ambient Temperature: 0 to 55°C.

Storage Temperature: −20°C to +85°C.

Cooling: A blower provides internal forced air circulation; reversible air flow through front panel.

Dimensions: 19″ w x 7″ h x 17½″ d, for standard rack mounting.

Net Weight: 105 lb.

Shipping Weight: 115 lb.

ELGAR
Model 7006
High-Speed
Solid-State
Line Conditioner

Output Power: 500 VA.

Response Time: Less than 50 μsec.

Regulation: ±0.05% (line and load).

Output Harmonics: Less than 0.25% for up to 10% input harmonics.

Input Voltage Ranges: 95-115 VAC, 105-125 VAC, 115-135 VAC, selected by tap switch.

Input Frequency: 59 to 61 Hz.

Output Voltage: 115 VAC.

Power Factor: Full current rating up to 0.7 leading or lagging, half current rating to 0 leading or lagging.

Operating Temperature: 0-50°C.

Input Current: 7.5 amps max.

Weight: Less than 35 lb.

Size: 3½″ h x 14″ d x 19″ w, standard rack mounting.

8159 Engineer Road, San Diego, California 92111, Phone (714) 279-0800

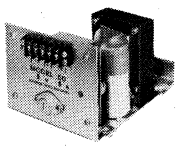
LOW COST DC POWER SUPPLIES

50 WATT-ONE VOLTAGE—$59 200 WATT-ONE VOLTAGE—$99

50 WATT-THREE VOLTAGES—$125

100% SILICON LOW RIPPLE GOOD REGULATION

50 WATT—ONE VOLTAGE



SIZE: **5" x 4.13" H x 7" L**
WEIGHT: **5.5 LBS.**

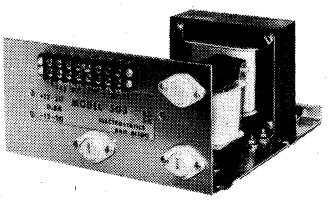
MODEL	VOLTS	AMPS
50 - 3	2.5 - 3.5	5.0
50 - 4	3.5 - 4.5	5.0
50 - 5	4.5 - 5.5	5.0
50 - 6	5.5 - 6.5	4.5
50 - 7	6.5 - 7.5	4.5
50 - 8	7.5 - 8.5	4.5
50 - 9	8.5 - 9.5	4.0
50 - 10	9.5 - 10.5	4.0
50 - 11	10.5 - 11.5	4.0
50 - 12	11.0 - 13.0	3.0
50 - 14	13.0 - 15.0	3.0
50 - 16	15.0 - 17.0	3.0
50 - 18	17.0 - 19.0	3.0
50 - 20	18.0 - 22.0	2.0
50 - 24	22.0 - 26.0	2.0
50 - 28	26.0 - 30.0	2.0
50 - 34	30.0 - 38.0	1.5
50 - 44	38.0 - 50.0	1.0

PRICE

1 - 9 ..... **$59.00** each
For overvoltage add $10.00

10 - 24 ..... **$56.00** each
For overvoltage add $9.00

50 WATT—THREE VOLTAGES



SIZE: **8" W x 4" H 8" L**
WEIGHT: **8.0 LBS.**

MODEL	VOLTS	AMPS
503	4.5 - 6.5	5.0
	+12 TO 20	0.5
	−12 TO 20	0.5

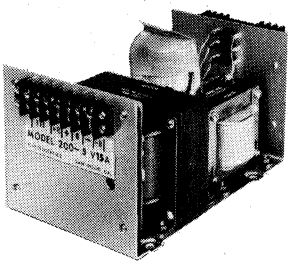
5 AMP OUTPUT MAY BE CONNECTED FOR + OR − OUTPUT.

PRICE

1 - 9 ..... **$125.00** each
For overvoltage add $25.00

10 - 24 ..... **$115.00** each
For overvoltage add $21.00

200 WATT—ONE VOLTAGE



SIZE: **5.5" W x 5" H x 10.5" L**
WEIGHT: **11.0 LBS.**

MODEL	VOLTS	AMPS
200 - 5	4.5 - 5.5	15.0
200 - 6	5.5 - 6.5	15.0
200 - 12	11.5 - 12.5	10.0
200 - 15	14.5 - 15.5	9.0
200 - 24	23.5 - 24.5	7.5
200 - 28	27.5 - 28.5	7.0
200 - 48	47.5 - 48.5	4.0

Remote sensing standard on all models.

PRICE

1 - 9 ..... **$99.00** each
For overvoltage add $15.00

10 - 24 ..... **$94.00** each
For overvoltage add $13.00

Any voltage, 3 to 50, not listed above

1 - 9 ..... **$109.00** each
For overvoltage add $15.00

ELECTRICAL SPECIFICATIONS FOR ALL MODELS

INPUT: 105 - 125 VAC, 50 - 420 Hz

REGULATION: LINE — 0.01% OR 5 MV (10 VOLT CHANGE)
LOAD — 0.10% OR 15 MV (FULL LOAD CHANGE)

RIPPLE: 5 TO 15 A — LESS THAN 500 MICROVOLTS RMS
0.5 TO 5 A — LESS THAN 250 MICROVOLTS RMS

IMPEDANCE: 100 Hz — .001 OHMS
1 KHz — .005 OHMS
10 KHz — .01 OHMS
100 KHz — .1 OHMS

TRANSIENT RESPONSE: FOR 50% LOAD CHANGE
10 MICROSECONDS WIDE AND
5 MILLIVOLTS PEAK

OVERSHOOT: NONE ON TURN ON OR OFF

TEMPERATURE: OPERATING - −20 TO +71°C
STORAGE - −65 TO +85°C
COEFFICIENT - 0.01%/°C MAX

CURRENT LIMITING: FIXED — AUTOMATIC RECOVERY

OVERVOLTAGE: ADJUSTABLE CROWBAR — OPTIONAL

ADJUSTMENT: SCREWDRIVER

OUTPUT: FLOATING — TERMINAL STRIP

CAPACITORS: COMPUTER GRADE — 10 YEAR LIFE

ONE YEAR WARRANTY—SATISFACTION GUARANTEED
WRITE FOR QUANTITY DISCOUNTS

DELIVERY — STOCK TO 2 WEEKS **F.O.B. — SAN DIEGO, CALIFORNIA**

ELECTROSTATICS

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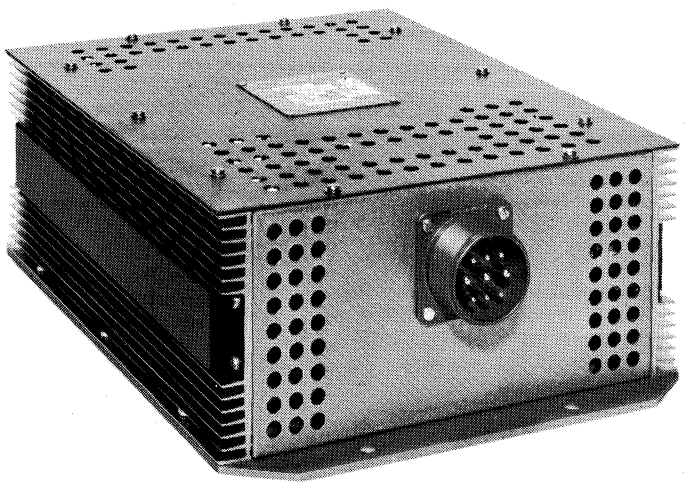
FLITE-TRONICS

60 Hz 400 Hz STATIC INVERTERS



Other Inverters Available:

- **Model PC-14A 60 VA**
- **Model PC-14 100 VA**
- **Model PC-15A 250 VA**
  Specifications same as PC-17
- **12V to 24V Converters**
- **24V to 12V Converters**

For applications requiring greater than 600 VA of continuous power, the Flite-Tronics' Model PC-17 Inverter can be paralleled as necessary to double, triple, or quadruple the output power of a single unit. This is simply done by phase locking the oscillator in the PC-17. Malfunction of a single unit when connected in this manner will not damage the other units in parallel. Each unit has its own overload protection. Each device is capable of self-preservation.

SPECIFICATIONS MODEL PC-17 (600 VA) STATIC INVERTER

INPUT VOLTAGE:
28 VDC ±2.0 VDC

INPUT CURRENT:
31A — full load
1.0A — no load

OUTPUT VOLTAGES:
115 VAC +5% −7%
26 VAC +5% −7%

OUTPUT FREQUENCY:
400 Hz ±1%

OUTPUT POWER:
600 VA continuous for 115 VAC output
125 VA continuous for 26 VAC output
NOTE: Total continuous output power 600 VA.

OUTPUT WAVEFORM:
Sine Wave, Single Phase

HARMONIC DISTORTION:
7% maximum (Typically 3%)

POWER FACTOR:
.8 to 1.0

ALTITUDE:
45,000 feet

EFFICIENCY:
70% typical

TEMPERATURE:
−65°F to 160°F

WEIGHT:
14 lbs.

SIZE:
Width 8½″
Length 12″
Height 4 1/16″

INPUT OVERVOLTAGE:
Withstands 130% overvoltage (37 VDC) for five minutes minimum while delivering full rated 600 VA output power. Output voltage under this condition 115 VAC +5% −7%.

EMISSION RFI:
Radiated & Conducted . . . 90KC to 1000MC.
Far below levels specified in Appendix A of RTCA Paper 120-61/DO-108 Category "A".

HUMIDITY:
Greater than 95% for ten days, temperature cycled between 75°F to 160°F.

VIBRATION:
To withstand at least 10 G's from 10 to 500 cycles per second in three directions for 90 minutes each direction.

SHOCK:
To withstand at least 10 G's for 11 milliseconds in three directions.

OVERLOAD CAPABILITY:
Deliver 150% of rated output current at rated output voltage for a duration of not less than 5 minutes (i.e., 900 volt amp load).

INPUT VOLTAGE PROTECTION:
Unit withstands transients of 88 volts lasting 1 millisecond on the 28.0 VDC input line.

EXCESSIVE OVERLOAD & OUTPUT SHORT CIRCUIT:
Withstands without damage or degradation loads exceeding 150% nominal to an output short circuit. Unit delivers rated output on removal of above condition.

SPECIFICATIONS MODEL PC-16 STATIC INVERTER

POWER OUTPUT:
250 VA Continuous
150% Overload 5 minutes
pf — .8 to 1.0

VOLTAGE INPUT:
1. 28 VDC ±2 Volts
2. Withstands 88 Volt Transient for 1 Millisecond

INPUT CURRENT:
14 Amp — full load
1 Amp — no load

FREQUENCY:
60 HZ ±1 Hz

VOLTAGE OUTPUT:
115 VAC RMS +5% −7%

AMPLITUDE DISTORTION:
Less than 7%

WAVE FORM:
Sine Wave

PHASE:
Single

SHORT CIRCUIT
Withstand for 1 minute or longer

TEMPERATURE:
−10°F to +160°F

ALTITUDE:
45,000 Ft.

WEIGHT:
16 lbs.

SIZE:
7½″ x 12″ x 4″ overall dimensions

For application requiring greater than 250 VA of continuous power Model PC-16 can be paralleled to double or triple the output power of a single unit.

FLITE-TRONICS, co., inc. 3312 Burton Avenue., Burbank, Calif. 91502 U.S.A.
Phone: (213) 849-1552

FERROTRAN

POWERTRAN SOLID STATE POWER SUPPLY MODULES

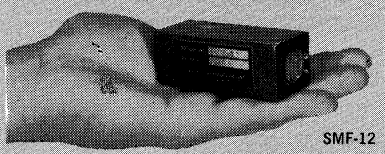
GUARANTEED FOR 3 YEARS!

Miniature Regulated D.C. Output • All Silicon • Long-Life Semi-Conductor Units

SINGLE OUTPUT VOLTAGE UNITS

INPUT VOLTAGE — 115 volts A.C.

SUBMINIATURE MODULES



SMF-12

Case; 3"x1 3/16"x1 1/4"; Mounts on a chassis with 2 ea. 4-40 blind inserts; no projecting studs; ideal for printed circuit boards; fixed voltage.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
SMF-5	5	40ma.	2.0	.20	$42
SMF-6	6	40	1.3	.15	42
SMF-10	10	40	1.0	.15	42
SMF-12	12	40	1.0	.15	42
SMF-15	15	40	1.0	.10	42
SMF-20	20	30	1.2	.25	43
SMF-24	24	30	1.2	.20	43
SMF-28	28	25	1.2	.30	43
SMF-30	30	20	1.5	.3	45
SMF-40	40	15	1.5	.2	45
SMF-50	50	15	1.5	.2	45
SMF-60	60	10	1.5	.1	45
SMF-70	70	10	1.2	.1	45
DUAL OUTPUT					
SMA-6	6, 6	20ma.	1.0	.3	52
SMA-10	10, 10	20	1.0	.1	52
SMA-12	12, 12	20	1.0	.1	52
SMA-15	15, 15	20	1.5	.1	52

Case; 1 5/8"x1 7/8"x1 5/8"; Mounts on a chassis with 4 ea. 6-32 studs. 5/8" diam. connector in cover.

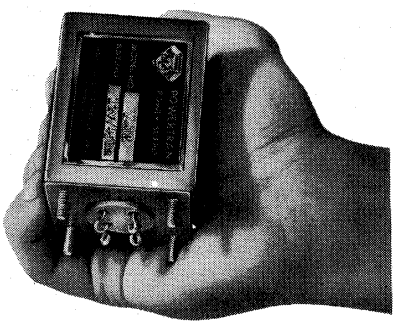
Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
SM-5	5	40ma.	2.0	.2	$42
SM-6	6	40	1.3	.15	42
SM-10	10	40	1.0	.15	42
SM-12	12	40	1.0	.15	42
SM-15	15	40	1.0	.10	42
SM-20	20	30	1.2	.25	43
SM-24	24	30	1.2	.20	43
SM-28	28	25	1.2	.30	43
DUAL OUTPUT					
SMAC-6	6, 6	20ma.	1.0	.3	52
SMAC-10	10, 10	20	1.0	.1	52
SMAC-12	12, 12	20	1.0	.1	52
SMAC-15	15, 15	20	1.5	.1	52

PRINTED CIRCUIT MODULES

Epoxy encapsulated power modules in an epoxy shell; incorporates pins for direct soldering to printed circuit boards 1 5/8"x1 7/8"x1 1/2".

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
SMP-5	5	40ma.	2.0	.30	$42
SMP-6	6	40	1.3	.15	42
SMP-10	10	40	1.0	.15	42
SMP-12	12	40	1.0	.15	42
SMP-15	15	40	1.0	.10	42
SMP-20	20	30	1.2	.25	43
SMP-24	24	30	1.2	.20	43
SMP-28	28	25	1.2	.30	43

MIDGET MODULES



M-12 MIDGET MODULE

All silicon; 70°C operation. Fixed voltage.

EB Case: 1 3/4"x1 7/8"x2 3/8". Wt. Ea., 3/4 lb.

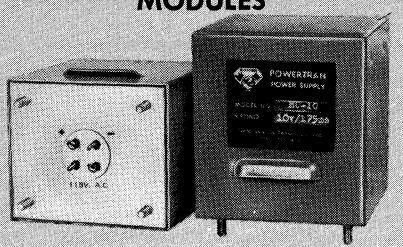
Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
M- .5	.5	30ma.	4.0	.90	$36
M-1.0	1.0	30	4.0	.90	36
M-1.5	1.5	30	4.0	.90	36
M-2.0	2.0	30	4.0	.45	36
M-2.5	2.5	30	4.0	.50	36
M-3.0	3.0	30	6.0	.60	37
M-4.0	4.0	30	5.0	.50	37
M-5	5	50	3.0	.30	37
M-6	6	50	1.8	.18	37
M-8	8	50	2.0	.15	37
M-9	9	50	1.6	.20	37
M-10	10	50	1.4	.12	37
M-12	12	45	1.3	.12	37
M-15	15	45	1.5	.13	38
M-18	18	45	1.5	.18	39
M-20	20	45	1.5	.15	39
M-22	22	45	1.5	.15	39
M-24	24	40	1.5	.15	40
M-25	25	40	1.5	.15	40
M-27	27	40	1.5	.15	40
M-28	28	40	1.5	.15	40
M-30	30	40	1.5	.15	41
M-35	35	40	1.5	.15	41
M-40	40	40	1.5	.22	40
M-45	45	35	1.5	.20	42
M-50	50	30	1.5	.20	42

Extremely low ripple units in slightly larger case than above. IDEAL FOR OPERATIONAL AMPLIFIERS.

FB Case: 2 1/8"x2"x2 1/2". Wt. ea., 3/4 lb.

HM-5	5	50ma.	2.0	.08	43
HM-6	6	50	1.5	.06	43
HM-10	10	50	1.0	.03	43
HM-12	12	50	1.0	.03	43
HM-15	15	50	1.0	.05	44
HM-20	20	50	1.0	.05	44
HM-24	24	45	1.2	.02	44
HM-28	28	45	1.5	.05	44

HIGH TEMPERATURE MODULES



Low priced; all silicon; very small, fixed voltage modules, will operate to 80° C. without derating.

HB Case; 2 1/2"x3"x3 1/8". Wt. ea. 1 3/4 lbs.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
MC-7*	7	175ma.	1.3	.10	$51
MC-10	10	175	1.3	.08	51
MC-12	12	150	1.3	.08	51
MC-15	15	140	1.3	.10	51
MC-18	18	140	1.5	.10	51
MC-20	20	140	1.3	.05	51
MC-22	22	130	1.3	.08	51
MC-23	23	130	1.3	.05	50
MC-24	24	125	1.3	.05	51
MC-25	25	125	1.3	.05	51
MC-26	26	125	1.3	.05	50
MC-27	27	125	1.3	.05	50
MC-28	28	125	1.3	.05	51
MC-30	30	110	1.5	.10	51
MC-45	45	100	1.5	.10	51

*MC-7 in GB Case

JB Case; 3 1/2"x3"x3 7/8". Wt. ea., 3 3/4 lbs.

MCH-7*	7	280ma.	1.7	.3	$56
MCH-10	10	280	1.3	.3	56
MCH-12	12	250	1.3	.1	56
MCH-15	15	250	1.3	.1	56
MCH-18	18	225	1.3	.1	56
MCH-20	20	225	1.5	.1	56
MCH-22	22	225	1.5	.1	56
MCH-24	24	200	1.8	.1	56
MCH-26	26	200	1.8	.1	55
MCH-27	27	180	1.8	.1	55
MCH-28	28	180	1.8	.1	56
MCH-30	30	160	1.8	.1	56
MCH-45	45	140	1.8	.1	56

*MCH-7 and MCH-10 in HB Case

MIL-SPEC MODULES

Meets MIL-E-5272C as follows:
Acceleration—Non-op; Proc III; 10g along each axis for 10 minutes.
Shock—Non-op; Proc V; 30g for 6 ms each axis.
Vibration—Proc XII; 5-20cps double amp. of .25 in.; 20-400cps—5g; 400—3KC—7.5g.
Temp. (operating)——65° C to +75°C
All power supplies described on these pages may be militarized. Below are representative units and prices.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Case	Price
MSM-4.8	4.8	15ma.	3.0	0.1	AJ	$75
MSM-12	12	50	.8	0.5	EB	60
MAS-15	15, 15	15ma.	.6	0.1	GB	80

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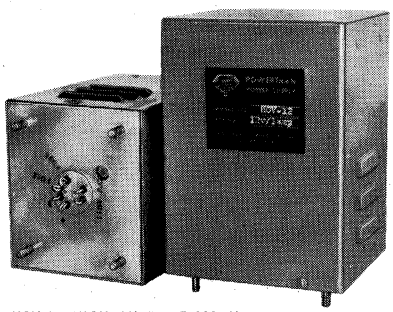
Miniature Regulated D.C. Output • All Silicon • Long-Life Semi-Conductor Units

SINGLE OUTPUT VOLTAGE UNITS

INPUT VOLTAGE — 115 volts A.C.

ADJUSTABLE OUTPUT MODULES



HCV-12 HIGH CURRENT MODULE

Variable D.C. output; repairable; output voltage adjustable thru screwdriver control on stud side of case. Compact series regulated modules with short circuit protection; all silicon.

HA Case; 3"x2⅝"x3½". Wt. ea., 2½ lbs.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
MV-6	5.8- 7	200ma.	.6	.20	$58
MV-10	9 -12	200	.4	.03	58
MV-12	11.0-13	200	.2	.025	58
MV-15	14 -16	200	.5	.03	58
MV-20	19 -22	180	.5	.03	59
MV-24	23 -26	180	.5	.04	60
MV-28	27 -29	150	.5	.04	60

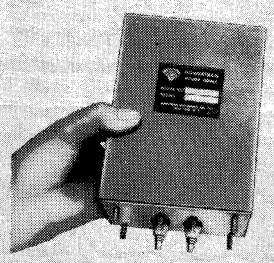
JB Case; 3½"x3"x3⅞"

MCS-6	5.8- 7	450ma.	0.8	.3	$70
MCS-10	9 -11	450	0.5	.1	70
MCS-12	11 -13	400	0.5	.05	70
MCS-15	14 -16	400	0.5	.05	70
MCS-20	19 -22	350	0.5	.05	70
MCS-24	23 -26	350	0.5	.05	75
MCS-28	27 -29	300	0.4	.04	75

JA Case; 3¾"x3"x4⅞". Wt. ea., 4 lbs.

HCV-6	4.9- 6.8	1.0amp	.40	.20	$84
HCV-10	8.5-11.8	1.0	.40	.10	84
HCV-12	11.0-14.5	1.0	.40	.05	84
HCV-15	14.0-18.0	.8	.40	.10	84
HCV-20	18.0-24.0	.7	.40	.30	85
HCV-28	26.5-29.0	.6	.25	.30	85

HIGH VOLTAGE MODULES



HV-1000

All silicon components; solid state regulator; floating outputs; ideal for photomultipliers.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Case	Price
HM-100	100	6ma.	1.0	.05	HB	$55
HM-200	200	5	.5	.05	HB	60
HM-300	300	3	1.0	.05	JB	70
HM-500	500	1.8	1.0	.05	JB	75
HM-750	750	1.2	1.0	.1	LB	85
HM-1000	1000	1	1.0	.1	LB	85
HV-45	45	40	1.5	.15	GA	55
HV-48	48	60	1.5	.15	GA	65
HV-50	50	40	1.5	.15	GA	55
HV-55	55	40	1.5	.15	GA	55
HV-60	60	40	1.5	.15	GA	55
HV-67	67	40	1.5	.15	GA	55
HV-70	70	40	1.5	.15	GA	55
HV-75	75	60	1.3	.10	GA	65
HV-90	90	60	1.2	.10	GA	65
HV-100	100	60	1.5	.10	GA	65
HV-120	120	55	1.3	.12	HA	70
HV-150	150	45	1.0	.10	HA	75
HV-175	175	40	1.2	.12	HA	75
HV-200	200	40	1.3	.12	HA	75
HV-250	250	40	1.5	.05	JA	80
HV-300	300	35	1.5	.10	JA	80
HV-400	400	20	1.5	.20	JA	90
HV-500	500	15	1.5	.20	JA	90
HV-750	750	8.5	1.2	.30	LA	140
HV-1000	1000	5	1.3	.30	LA	150

HIGH CURRENT, HIGH VOLTAGE MODULES

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Case	Price
HVA-60	60	90ma.	1.5	.20	LA	80
HVA-100	100	90	1.5	.20	LA	95
HVA-150	150	90	1.5	.20	LA	110

All power supplies with output volts of 750 or higher have special ceramic high voltage terminals.

UNREGULATED MODULES

Ideal raw D.C. supplies containing transformer, rectifiers and capacitor filter. Simply attach series regulator or zener diode to convert to a regulated power supply; all solid state.

LOW VOLTAGE UNREGULATED MODULES

Model	D.C. Volts	D.C. Current	Case	Price
SU-5	5	2amp	HA	$42
SU-6A	6	1	GB	40
SU-6B	6	2	HA	42
SU-10A	10	1.5	HA	42
SU-10B	10	.5	GB	40
SU-12A	12	1.5	HA	44
SU-12B	12	.5	HA	42
SU-12C	12	.25	HA	40
SU-15A	15	1.0	HA	44
SU-15B	15	.5	GB	40
SU-15C	15	.25	FB	35
SU-20A	20	.8	HA	44
SU-20B	20	.3	GA	40
SU-20C	20	1.2	HA	44
SU-25A	25	.8	HA	44
SU-25B	25	.3	HA	42
SU-28A	28	.8	HA	44
SU-28B	28	.3	GB	40
SU-30A	30	.7	HA	44
SU-30B	30	.3	GB	40

HIGH VOLTAGE UNREGULATED MODULES

SU-40A	40	.5	HA	$42
SU-40B	40	.2	GB	40
SU-48	48	.4	HA	44
SU-50A	50	.4	HA	42
SU-50B	50	.2	GA	40
SU-60	60	.38	HA	42
SU-75	75	.3	HA	42
SU-90A	90	.25	HA	42
SU-90B	90	.10	HA	40
SU-100	100	.2	HA	42
SU-120A	120	.2	HA	42
SU-120C	120	.5	JA	55
SU-150	150	.10	HA	38
SU-200A	200	.09	HA	42
SU-250	250	.065	HA	44
SU-300	300	.06	HA	50
SU-400	400	.06	HA	50
SU-500	500	.05	LB	60
SU-750	750	.03	LB	70
SU-900	900	.025	LB	70
SU-1000	1000	.02	LB	70
SU-1250	1250	10ma.	LB	70
SU-1400	1400	5ma.	LB	70

Unregulated	Miniature	Power	Supply	Modules.
SUM-10	10	150	EB	$32
SUM-15	15	100	EB	32
SUM-20	20	75	EB	32
SUM-25	25	60	EB	32
SUM-30	30	50	EB	33
SUM-40	40	35	EB	34

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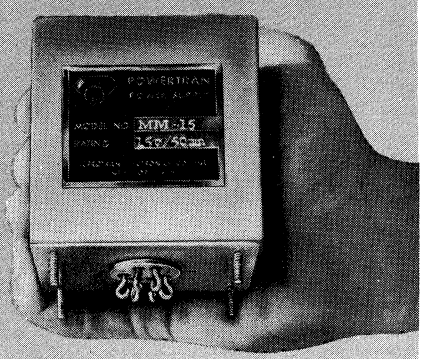
DUAL OUTPUT VOLTAGE UNITS

INPUT VOLTAGE — 115 volts A.C.



MM-15 DUAL OUTPUT MODULE

Ideal for Operational Amplifiers of All Manufacture.

Voltage Stability— ±.01V max. change/ 8 hrs. (room temp.)

Temp. Stability— .006V/°C rise in temp.

LOW CURRENT MODULES

These precision engineered modules furnish two matched output voltages from independent power supply units. The current shown is available from each tap.

GB Case; 2¾"x2⅜"x2¾". Wt. ea., 1¼ lbs.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Case	Price
MM-3	3, 3	45ma.	3.0	.40	GB	$58
MM-5	5, 5	50	1.7	.08	GB	58
MM-6	6, 6	50	1.6	.05	GB	58
MM-7	7, 7	55	1.4	.05	GB	58
MM-10	10, 10	60	1.2	.005	GB	58
MM-12	12, 12	60	1.2	.005	GB	58
MM-15	15, 15	55	1.0	.006	GB	59
MM-18	18, 18	50	1.0	.01	GB	59
MM-20	20, 20	50	1.0	.01	GB	59
MM-24	24, 24	45	1.0	.01	GB	60
MM-25	25, 25	45	1.0	.01	GB	60
MM-27*	27, 27	45	1.0	.01	HB	62
MM-28*	28, 28	45	1.0	.01	HB	62
MM-30*	30, 20	45	1.0	.01	HB	62

*Case Height is 2½"

HIGH CURRENT MODULES

These modules contain two independent power supply units which furnish two similar voltages with rated current available from each tap.

JB Case; 3½"x3"x3⅞". Wt. ea., 2½ lbs.

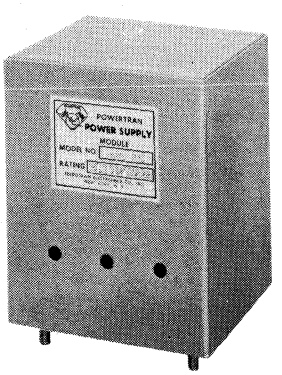
Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
HMC-7	7, 7	150	1.5	.15	$80
HMC-10	10, 10	150	1.2	.05	80
HMC-12	12, 12	150	1.5	.02	80
HMC-15	15, 15	150	1.5	.02	80
HMC-20	20, 20	120	1.2	.04	80
HMC-24	24, 24	110	1.3	.04	80
HMC-28	28, 28	110	1.4	.05	80

HIGH VOLTAGE DUAL OUTPUT MODULES

JA Case; 3½"x3"x4⅝". Wt. ea., 3¾ lbs..

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
HHV-45	45, 45	40ma.	1.0	.20	$70
HHV-50	50, 50	40	1.0	.20	70
HHV-55	55, 55	40	1.0	.20	70
HHV-60	60, 60	40	1.0	.20	70
HHV-65	65, 65	40	1.0	.20	70
HHV-67	67, 67	40	1.0	.20	70
HHV-70	70, 70	40	1.0	.20	70
HHV-90	90, 90	35	1.0	.10	85
HHV-100*	100, 100	30	1.0	.08	85
HHV-120*	120, 120	25	1.0	.05	90

*Case Height is 4⅞"



HMC-15 DUAL OUTPUT HIGH CURRENT MODULE

Since the dual supplies shown on this page are not connected to the case nor to each other, electrically, they can supply two positive voltages, two negative voltages, or a negative and a positive voltage. The current listed is available from each tap.

UNSYMMETRICAL DUAL OUTPUT MODULES

These modules contain two independent power supply units which furnish two different voltages as shown. The current listed is available from each tap.

GB Case; 2¾"x2⅜"x2¾". Wt. ea., 1¼ lbs.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
MA-408	4, 8	40	3.0	.2	$60
MA-410	4, 10	40	3.0	.2	60
MA-412	4, 12	40	3.0	.2	60
MA-415	4, 15	40	3.0	.2	62
MA-506	5, 6	50	1.7	.1	60
MA-510	5, 10	50	1.7	.1	60
MA-512	5, 12	50	1.7	.1	60
MA-515	5, 15	50	1.7	.1	62
MA-610	6, 10	50	1.6	.05	60
MA-612	6, 12	50	1.6	.1	60
MA-615	6, 15	50	1.6	.1	62
MA-810	8, 10	50	1.2	.05	60
MA-812	8, 12	50	1.2	.005	60
MA-815	8, 15	50	1.2	.005	62
MA-910	9, 10	50	1.2	.05	60
MA-912	9, 12	50	1.2	.005	60
MA-915	9, 15	50	1.2	.005	62
MA-1012	10, 12	50	1.2	.005	60
MA-1015	10, 15	50	1.2	.005	62
MA-1215	12, 15	50	1.2	.005	62

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Case	Price
B-224	12, 24	50	1.5	.20	HB	$70
B-456	45, 67	40	1.5	.20	HA	70

The modules shown below contain two independent power supply units which furnish two similar voltages. Two dissimilar currents are available as shown.

JB Case; 3½"x3"x3⅞". Wt. ea., 3¾ lbs.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
HMJ-10	10	50ma.	1.5	.10	$80
	10	250	2.0	.20	
HMJ-12	12	50	1.5	.15	80
	12	250	2.0	.20	
HMJ-15	15	50	1.5	.15	80
	15	250	2.0	.20	
HMJ-20	20	45	1.5	.15	80
	20	225	2.0	.20	
HMJ-24	24	40	1.5	.15	80
	24	200	2.0	.20	
HMJ-28	28	40	1.5	.15	80
	28	180	2.0	.20	

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FERROTRAN

POWER SUPPLY DESIGN INFORMATION

220 V.A.C. INPUT POWER MODULES

ELECTRICAL FEATURES

NOMINAL INPUT VOLTAGE — 115 volts.

INPUT VOLTAGE RANGE — Regulated from 105 to 130 volts ac input; max is 140 v.

220 V. AC INPUT—All modules available with 220 v. ac input in a case slightly larger than specified; 220 v. ac input units may be tapped at 115 v. additionally.

INPUT FREQUENCY RANGE — 55 to 450 cycles; 55 to 2 kc at small additional charge.

REGULATION — Load regulation is specified in tables. Line voltage regulation is approximately 3% (105-130 v.a.c.)

RIPPLE — RMS value specified in tables at 60 cycles input and at currents indicated; will be reduced at lower currents; For approximate ripple at 400c divide 60 c. ripple by 6.

OUTPUT VOLTAGE — Fixed voltage units have an output voltage within 5% of values shown; Customers may specify exact output voltage required at no extra charge.

COMPONENTS — All components rated for minimum of 85 degrees C. and are of domestic manufacture. All semi-conductors are silicon.

POLARITY — Outputs are floating off case with 1000 v. d.c. test voltage; may be used positively or negatively.

STABILITY — Fully operable on turn-on; voltage varies within a few percent during first five minutes; after half-hour of operation, voltage remains stable within a small fraction of 1%.

TEMP. (STORAGE) — —54°C to +85°C.

TEMP. (OPERATING)— —30°C to +70°C exc. where specified.

MECHANICAL FEATURES

SHOCK — 70G.

VIBRATION — 2G from 12 cps to 250 cps, in 3 planes.

CASE — Will meet MIL-T-27 specifications.

CONNECTOR — Compression type multi-lead glass headers, 0.900" dia. for all units. Hook type solder pins are standard. Hooks are ¼-inch high. (Transformer type terminals or octal plug-in types may be specified. Transformer terminals are 7/16" high x 3/16" in dia. Octal plug-in terminals fit standard 8-pin sockets.

CONNECTOR MOUNTING — All connectors are mounted dead-center in stud side of case. Clearance hole for standard hook connector is 1 1/16".

BLIND INSERTS — 4/40 and 6/32, blind inserts may be mounted on case in addition to or instead of mounting studs. Case height is necessarily increased thereby.

FINISH — Light grey Alkyd base enamel; high gloss.

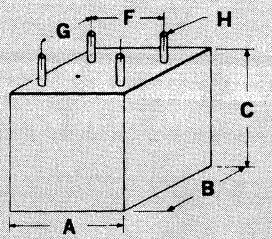
NAMEPLATE — Metal foil decal. Completely identifies model and rating.

HEATSINKS — Internal, for all units. No transistors or zeners mounted externally; no fins mounted externally.

CASE MOUNTING — Chassis mounted with four threaded studs.

MARKING — All terminals marked with pin numbers and identification.

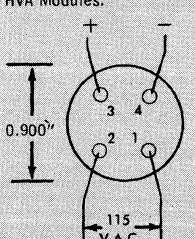
DIMENSIONS PER MIL-T-27A



Case	A	B	C	F	G	H
AH	1 5/16	1 5/16	1 3/4	1 1/4	—	6-32x3/8
AJ	1 5/8	1 5/8	2 3/8	1 3/16	1 3/16	6-32x3/8
EB	1 15/16	1 13/16	2 7/16	1 3/8	1 1/4	6-32x3/8
FB	2 5/16	2 1/16	2 1/2	1 11/16	1 7/16	6-32x3/8
GA	2 3/4	2 3/8	3 13/16	2 1/8	1 3/4	6-32x3/8
GB	2 3/4	2 3/8	2 13/16	2 1/8	1 3/4	6-32x3/8
HA	3 1/16	2 5/8	4 1/4	2 19/64	1 55/64	8-32x3/8
HB	3 1/16	2 5/8	3 3/16	2 19/64	1 55/64	8-32x3/8
JA	3 9/16	3 1/16	4 7/8	2 5/8	2 1/8	8-32x3/8
JB	3 9/16	3 1/16	3 7/8	2 5/8	2 1/8	8-32x3/8
LA	4 5/16	3 11/16	5	3 5/16	2 11/16	10-32x1/2
LB	4 5/16	3 11/16	4 1/2	3 5/16	2 11/16	10-32x1/2

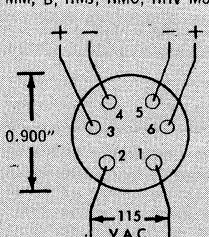
CONNECTIONS

Single D.C. Output Voltage Connections for M, HM, MC, MCH, HV, SMF, SM, SU, SUM, MCS, MV, HVA Modules.



pins 1 & 2 parallel to wide side of case

Dual D.C. Output Voltage Connections for MA, MM, B, HMJ, HMC, HHV Modules.



pins 3 & 4 power supply #1

pins 5 & 6 power supply #2

pins 1 & 2 input

HCV module, as per above sketch. Pins 1 & 2 115 AC input. Pins 3 & 4 DC output. Connect a fuse between Pins 5 & 6 equal to d.c. rated current of module.

These all-silicon, solid state modules operate from either 115 v. a.c. or 220 v. a.c. line voltage to furnish the d.c. outputs shown below. They will operate to 70° C. without derating.

EB Case: 1¾"x1⅞"x2⅜". Wt. Ea., ¾ lb.

Model	D.C. Volts	D.C. Current	% Reg.	% Ripple	Price
M-5-2	5	50	3.0	.30	$44
M-6-2	6	50	1.8	.18	44
M-10-2	10	50	1.4	.12	44
M-12-2	12	45	1.3	.12	44
M-15-2	15	45	1.5	.13	44
M-20-2	20	45	1.5	.15	44
M-24-2	24	40	1.5	.15	45
M-27-2	27	40	1.5	.15	46
M-28-2	28	40	1.5	.15	46
M-30-2	30	40	1.5	.15	46

CONNECTIONS — 5 pin connector dead center on stud side of the case.
Pins 1 & 2 — 115 v. a.c. input. or
Pins 1 & 3 — 220 v. a.c. input.
Pin 4 — positive d.c. output. Pin 5 — negative.

SPECIAL COMPONENTS

In addition to its off-the-shelf products, FERROTRAN designs all types of power supplies and transformers to meet special requirements. This is done at no extra cost to the customer.

AUDIO AMPLIFIER MODULES

These are compact, transistorized units designed to plug into standard 7 or 8-pin tube sockets. Completely tubeless and self-contained, they require no more than a single D.C. applied voltage for complete operation. Component parts are sturdily mounted to withstand shock and vibration conditions.

APPLICATIONS: Public Address, telephone and intercommunication systems, recorder or data amplifiers.

POWER AMPLIFIER SPECIFICATIONS

Model	Pwr. Outp.	Inp. Res.	Outp. Res. (ohms)	DB Pwr. Gain	DV Volts Appl.	Price
AA-1	150mw	600	6	55	+12	$80
AA-2L	135mw	1000	600	50	+12	80
AA-3-3	2W	600	3.2	38	—15	80
AA-3-8	2W	600	8.0	37	—15	80
AA-4-3	2W	600	3.2	65	—15	130
AA-4-8	2W	800	8	66	—15	130
AA-4L	2W	820	600	67	—15	130
AA-5	2W	800	3.2	62	+15	130

Case Sizes: AA-1 & AA-2 FB case
All others HA Case

FERROTRAN ELECTRONICS COMPANY, INC.
683 BROADWAY • NEW YORK, N.Y. 10012 • PHONE: (212) AL 4-5810

GATES

A single source for all possible types of "brute force" and regulated power supplies that can fill 90% of your design and application needs. Gates Power Supplies give you absolutely lowest cost and long life. The units are excellently constructed of high rated components for trouble free, years of service.

Silicon or Selenium. Single and three-phase units. 1 to 1000 volts, 1 to 1000 Amps. Metered and unmetered Static or variable outputs. Rack, cabinet or chassis mounts. Unit or hundred quantities 48 hour delivery. Two year guarantees. Power supplies for OEM Application, Testing, Prototype, Lab type units, Plating, Motor Control, Cathodic Protection, Transistor power, Anodizing, Battery Charging, Battery Conversions, Marine types, Aircraft Starting.

ECONOMY RANGE DC POWER SUPPLIES — Less Than 1% Ripple - Good Regulation - Rack Mount Type - Heavy Duty Construction - Powerstat - Fused 2% Meters - 115 Vac Input

MODEL GT 12-5:	Output 0.12V,	5A	.....$	85.
MODEL GT 12-10:	Output 0-12V,	10A	.....$	130.
MODEL GT 12-15:	Output 0-12V,	15A	.....$	145.
MODEL GT 12-25:	Output 0-12V,	25A	.....$	154.
MODEL GT 12-100:	Output 0-12V,	100A	.....$	395.
MODEL GT 14-5:	Output 0-14V,	5A	.....$	120.
MODEL GT 14-15:	Output 0-14V,	15A	.....$	135.
MODEL GT 14-20:	Output 0-14V,	20A	.....$	145.
MODEL GT 14-30:	Output 0-14V,	30A	.....$	276.
MODEL GT 14-40:	Output 0-14V,	40A	.....$	285.
MODEL GT 14-50:	Output 0-14V,	50A	.....$	350.
MODEL GT 14-75:	Output 0-14V,	75A	.....$	375.
MODEL GT 14-100:	Output 0-14V,	100A	.....$	425.
MODEL GT 16-5:	Output 0-16V,	5A	.....$	85.
MODEL GT 16-10:	Output 0-16V,	10A	.....$	90.
MODEL GT 16-25:	Output 0-16V,	25A	.....$	155.
MODEL GT 16-30:	Output 0-16V,	30A	.....$	195.
MODEL GT 16-40:	Output 0-16V,	40A	.....$	260.
MODEL GT 16-50:	Output 0-16V,	50A	.....$	370.
MODEL GT 16-70:	Output 0-16V,	70A	.....$	390.
MODEL GT 16-80:	Output 0-16V,	80A	.....$	405.
MODEL GT 28-5:	Output 0-28V,	5A	.....$	90.
MODEL GT 28-12:	Output 0-28V,	12A	.....$	169.
MODEL GT 28-24:	Output 0-28V,	24A	.....$	275.
MODEL GT 32-5:	Output 0-32V,	5A	.....$	114.
MODEL GT 32-8:	Output 0-32V,	8A	.....$	149.
MODEL GT 32-12:	Output 0-32V,	12A	.....$	179.
MODEL GT 32-15:	Output 0-32V,	15A	.....$	219.
MODEL GT 32-24:	Output 0-32V,	24A	.....$	295.
MODEL GT 32-30:	Output 0-32V,	30A	.....$	325.
MODEL GT 32-50:	Output 0-32V,	50A	.....$	425.
MODEL GT 32-60:	Output 0-32V,	60A	.....$	561.
MODEL GT 48-5:	Output 0-48V,	5A	.....$	138.
MODEL GT 48-10:	Output 0-48V,	10A	.....$	164.
MODEL GT 48-15:	Output 0-48V,	15A	.....$	170.
MODEL GT 48-25:	Output 0-48V,	25A	.....$	250.
MODEL GT 48-35:	Output 0-48V,	35A	.....$	300.
MODEL GT 48-50:	Output 0-48V,	50A	.....$	350.
MODEL GT 48-60:	Output 0-48V,	60A	.....$	425.
MODEL GT 48-80:	Output 0-48V,	80A	.....$	500.
MODEL GT 48-100:	Output 0-48V,	100A	.....$	550.
MODEL GT 80-5:	Output 0-80V,	5A	.....$	220.
MODEL GT 80-10:	Output 0-80V,	10A	.....$	275.
MODEL GT 80-20:	Output 0-80V,	20A	.....$	450.
MODEL GT 115-5:	Output 0-115V,	5A	.....$	240.
MODEL GT 115-10:	Output 0-115V,	10A	.....$	260.
MODEL GT 115-15:	Output 0-115V,	15A	.....$	280.
MODEL GT 115-20:	Output 0-115V,	20A	.....$	310.
MODEL GT 115-25:	Output 0-115V,	25A	.....$	350.
MODEL GT 115-30:	Output 0-115V,	30A	.....$	390.
MODEL GT 115-40:	Output 0-115V,	40A	.....$	490.
MODEL GT 115-50:	Output 0-115V,	50A	.....$	560.
MODEL GT 115-60:	Output 0-115V,	60A	.....$	660.
MODEL GT 115-70:	Output 0-115V,	70A	.....$	700.
MODEL GT 130-2:	Output 0-130V,	2A	.....$	124.
MODEL GT 120-5:	Output 0-120V,	5A	.....$	277.
MODEL GT 130-5:	Output 0-130V,	5A	.....$	223.
MODEL GT 130-10:	Output 0-130V,	10A	.....$	386.
MODEL GT 200-10:	Output 0-220V,	10A	.....$	482.
MODEL GT 80-50:	Output 0-80V,	50A	.....	Inquire
MODEL GT 80-100:	Output 0-80V,	100A	.....	Inquire

3 PHASE MODEL POWERSTAT METERS

MODEL GP 125-40:	Output	40A, 0-125V ..	$	Inquire
MODEL GP 125-80:	Output	80A, 0-125V ..	$	Inquire
MODEL GP 125-125:	Output	125A, 0-125V ..	$	Inquire
MODEL GP 250-15:	Output	15A, 0-250V ..	$	Inquire
MODEL GP 250-25:	Output	25A, 0-250V ..	$	Inquire
MODEL GP 250-40:	Output	40A, 0-250V	$	Inquire
MODEL GP 250-75:	Output	75A, 0-250V ..	$	Inquire
MODEL GP 500-5:	Output	5A, 0-500V ..	$	Inquire
MODEL GP 500-10:	Output	10A, 0-500V ..	$	Inquire
MODEL GP 500-25:	Output	25A, 0-500V ..	$	Inquire
MODEL GP 500-35:	Output	35A, 0-500V ..	$	Inquire

LOW-COST BASIC/OEM SUPPLIES

MODEL L6.3-30	6.3VDC @	30A/1%	$	125.
MODEL L12-12	12VDC @	12A/Rip., 1Mv/.01%	$	180.
MODEL L12-15	12VDC @	15A/1%	$	170.
MODEL L12-24	12VDC @	24Amp.	$	100.
MODEL L12-24	12VDC @	24A/1%	$	144.
MODEL L12-50	12VDC @	50Amp.	$	133.
MODEL L12-50	12VDC @	50A/Rip. 1%	$	223.
MODEL L24-30	24VDC @	30A/Rip.1%	$	313.
MODEL L28-1	28VDC @	1A/0.5%	$	55.
MODEL L28-2	28VDC @	1A/Rip. .05%....	$	65.
MODEL L28-5	28VDC @	5Amp.	$	85.
MODEL L28-8	28VDC @	8Amp.	$	110.
MODEL L28-12	28VDC @	12Amp.	$	120.
MODEL L28-24	28VDC @	24Amp. (N.F.)....	$	115.
MODEL L28-24	28VDC @	24Amp.	$	180.
MODEL L28-30	28VDC @	30Amp.	$	313.
MODEL L28-50	28VDC @	50Amp. (N.F.)....	$	205.
MODEL L28-50	28VDC @	50Amp.	$	285.
MODEL L28-50	28VDC @	50Amp. —1% R.	$	403.

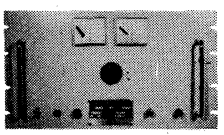
(N.F.) means not filtered

MAGNETICALLY REGULATED D.C. POWER SUPPLIES

REGULATION: Line ±1% for ±15% line voltage change load ±2% for any load change between ½ load and full load. Ripple 1% RMS Maximum. Rack or cabinet types.

VOLTS	D.C. OUTPUT AMPS	VA	CATALOG NUMBER	LOAD REGULATIFON 20% F.L.	50% F.L.	PRICE
6	10	60	6GDCV10	9	7	$130.00
6	15	90	6GDCV15	9	7	140.00
12	5	60	12GDCV5	7	5	92.00
12	10	120	12GDCV10	7	5	120.00
12	15	180	12GDCV15	7	5	155.00
18	5	90	18GDCV5	5	4	96.00
18	10	180	18GDCV10	7	5	141.00
24	6	144	24GDCV6	5	4	116.00
24	10	240	24GDCV10	6	4	144.00
24	15	360	24GDCV15	5	4	200.00
24	25	600	24GDCV25	6	4	275.00
28	8	224	28GDCV8	6	4	144.00
28	15	420	28GDCV15	7	5	200.00
48	4	192	48GDCV4	3.5	2.5	109.00
48	4	480	48GDCV4	4	2	149.00
48	20	960	48GDCV20	3	2	223.00
125	2	250	125GDCV2	2.5	1.5	117.00
150	2	300	150GDCV2	2	1.5	117.00
150	1	200	200GDCV1	3	2	112.00
250	1	250	250GDCV1	3	2	120.00

NEW SCR REGULATED POWER SUPPLIES



GCR32-30 115VAC 24-32 @ 30A 1% Rip. ±1% Req. Meters 19″Wx17″Dx12¼″H

GCR32-25 115VAC 24-32 @ 25A 1% ±1% Meters 19″Wx17″Dx12¼″H

GCR32-20 115VAC 24-32 @ 20A 1% ±1% Meters 19″Wx17″Dx10¼″H

MODEL L28-100	28VDC @	100Amp.	$	418.
MODEL L115-2.5	115VDC @	2.5A	$	85.
MODEL L115-5	115VDC @	5A	$	124.
MODEL L115-10	115VDC @	10A (N.F.)	$	188.
MODEL L115-10	115VDC @	10A	$	340.
MODEL L220-5	220VDC @	5A	$	223.
MODEL L220-10	220VDC @	10A	$	340.
MODEL L440-5	440VDC @	5A	$	349.

(N.F.) means not filtered

12 VOLT POWER SUPPLIES — 1% Ripple

MODEL GS 12-1,	Output	1A, 12V	$	35.00
MODEL GS 12-3,	Output	3A, 12V	$	55.00
MODEL GS 12-5,	Output	5A, 12V	$	65.00
MODEL GS 12-10,	Output	10A, 12V	$	85.00
MODEL GS 12-15,	Output	15A, 12V	$	130.00
MODEL GS 12-20,	Output	20A, 12V	$	150.00
MODEL GS 12-25,	Output	25A, 12V	$	170.00
MODEL GS 12-30,	Output	30A, 12V	$	190.00

3 PHASE BENCH MODEL PLATING SUPPLIES

MODEL GL 6-50	6V	50A	$	204.00
MODEL GL 9-50	9V	50A	$	212.00
MODEL GL 12-50	12V	50A	$	220.00
MODEL GL 18-50	18V	50A	$	236.00
MODEL GL 6-75	6V	75A	$	256.00
MODEL GL 9-75	9V	75A	$	264.00
MODEL GL 12-75	12V	75A	$	276.00
MODEL GL 18-75	18V	75A	$	292.00
MODEL GL 6-100	6V	100A	$	268.00
MODEL GL 9-100	9V	100A	$	284.00
MODEL GL 12-100	12V	100A	$	300.00
MODEL GL 18-100	18V	100A	$	316.00
MODEL GL 6-150	6V	150A	$	300.00
MODEL GL 9-150	9V	150A	$	328.00
MODEL GL 12-150	12V	150A	$	352.00
MODEL GL 18-150	18V	150A	$	372.00
MODEL GL 6-200	6V	200A	$	330.00
MODEL GL 9-200	9V	200A	$	352.00
MODEL GL 12-200	12V	200A	$	372.00
MODEL GL 6-250	6V	250A	$	372.00
MODEL GL 9-250	9V	250A	$	396.00
MODEL GL 12-250	12V	250A	$	460.00

24 VOLT POWER SUPPLIES Rack Type — 1% Ripple

MODEL G 24-6R	24VDC	6A	$	95.00
MODEL G 24-15R	24VDC	15A	$	105.00
MODEL G 24-25R	24VDC	25A	$	125.00
MODEL G 24-50R	24VDC	50A	$	210.00

GR LINE REGULATED POWER SUPPLIES — 2% Meters - 1% Ripple

MODEL GR 12-5	0-12V	5A	$	120.00
MODEL GR 12-10	0-12V	10A	$	155.00
MODEL GR 12-20	0-12V	20A		Inquire
MODEL GR 12-30	0-12V	30A	$	175.00
MODEL GR 16-5	0-16V	5A	$	175.00
MODEL GR 16-10	0-16V	10A	$	125.00
MODEL GR 8-10	0-8V	10A	$	155.00
MODEL GR 28-5	0-28V	5A	$	95.00
MODEL GR 14-5	0-14V	5A	$	125.00
MODEL GR 32-4	0-32V	4A	$	79.00
MODEL GR 16-8	0-16V	8A	$	135.00
MODEL GR 32-15	0-32V	15A	$	225.00
MODEL GR 55-10	0-55V	10A	$	210.00
MODEL GR 125-1	0-125V	1A	$	375.00
MODEL GR 125-5	0-125V	5A	$	215.00
MODEL GR 125-10	0-125V	10A	$	485.00

INDUSTRIAL POWER UNITS — SINGLE PHASE

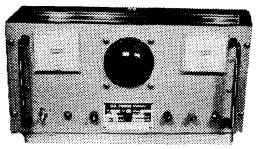
MODEL GK 115-125A	Output 115V	125W....	$	63.00
MODEL GK 115-125B	Output 115V	125W....	$	63.00
MODEL GK 115-125C	Output 115V	125W....	$	63.00
MODEL GK 115-250A	Output 115V	250W....	$	72.50
MODEL GK 115-250B	Output 115V	250W....	$	72.50
MODEL GK 115-250C	Output 115V	250W....	$	72.50
MODEL GK 115-375A	Output 115V	375W....	$	89.00
MODEL GK 115-375B	Output 115V	375W....	$	89.00

PRICES SUBJECT TO CHANGE — SEE AD IN SECTION 4800

GATES

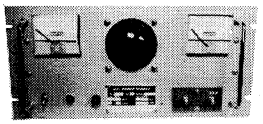
GATES ELECTRONIC COMPANY, INC. • 256 Van Nest Avenue, Bronx, N.Y. 10460 • Telephone: Tulip 1-5900

MODEL GT125-5F



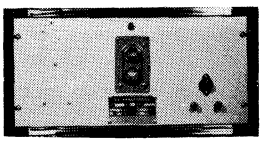
INPUT: 115VAC
OUTPUT: 0-125 @ 5A
RIPPLE: 0.5%
REGULATION: UNREGULATED
METERS: YES
DIMENSIONS: 21″ W x 15″ D x 10½″ H
PRICE: $325.00

MODEL GT14-40



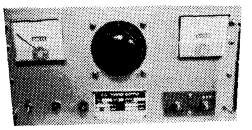
INPUT: 115VAC
OUTPUT: 0-14 @ 40A
RIPPLE: 0.1%
REGULATION: UNREGULATED
METERS: YES
DIMENSIONS: 19″ W x 13½″ D x 8-3/6″ H
PRICE: $275.00 — RACK MOUNTED

MODEL G220-10



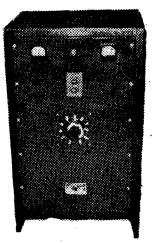
INPUT: 115VAC
OUTPUT: 220VDC @ 10A
RIPPLE: 48%
METERS: NONE
DIMENSIONS: 21″ W x 15″ D x 10″ H
PRICE: $425.00
METERS $50.00 EXTRA

SILICON INDUSTRIAL POWER UNIT
MODEL G30-40F



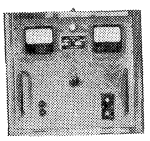
INPUT: 115 Volts AC, 60 cycles, single phase.
OUTPUT: 0-32 Volts DC, 0-40 Amperes DC, continuous duty
RIPPLE: 1% RMS
DIMENSIONS: 12¼″H x 19″W x 13″D
REGULATION: D.C.V. at full load: 32 minimum D.C.V. at 1/10 load: 35 maximum
PRICE: $425.00

SILICON AIRCRAFT BATTERY ELIMINATOR
Model G30-200



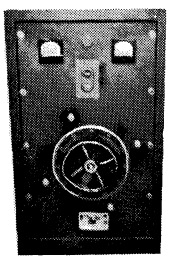
INPUT: 220 Volts AC, 60 cycles, 3 phase
OUTPUT: 0-32 Volts DC, 0-200 amperes continuous duty also avail. 300A
RIPPLE .5% RMS
REGULATION: 5-8% 1/10th load to full load with constant input and maximum output voltage setting
METERS: 2% Accuracy
DIMENSIONS: 25″ x 25″ x 43″

SILICON REGULATED POWER SUPPLY
Model G530-40M



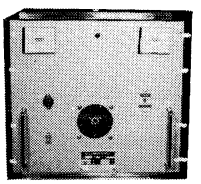
INPUT: 115 Volts AC, 60 cycles, 1 phase
OUTPUT: 5-30 Volts DC, 0-40 amperes
RIPPLE: 1% RMS
REGULATION: ±1% from no load to full load
METERS: 2% Accuracy
DIMENSIONS: 21″ x 15″ 19″

MODEL GT20-200



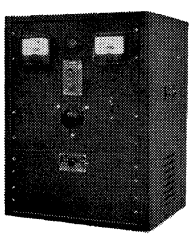
INPUT: 220 VAC 60 cy. 1 Phase
OUTPUT: 0-22 VDC @ 200A
RIPPLE: 1%
CABINET: 35″ x 20″ x 20″
METERS: VOLT & AMP.
PRICE $625.00

SILICON GENERAL PURPOSE RECTIFIER
MODEL G-115



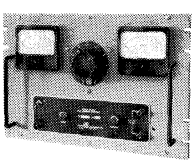
INPUT: 115 Volts AC 60 cycles, 1 Phase
OUTPUT: 0-32 Volts DC, 0-50 Amperes DC, Continuous duty variable over entire range
RIPPLE: 1% RMS
DIMENSIONS: 22″H x 19″W x 15″D
PRICE: $522.00 NET

SILICON POWER RECTIFIER
Model G50-50R



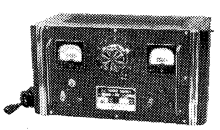
INPUT: 220 Volts AC, 60 cycles, 3 phase
OUTPUT: 0-50 volts DC, 0-50 amperes continuous duty
RIPPLE: 3% RMS
REGULATION: No Load to Full Load 8%
METERS: 2% Accuracy
DIMENSIONS: 21″ x 15″ x 19″

AIRCRAFT BATTERY ELIMINATOR
MODEL G101F



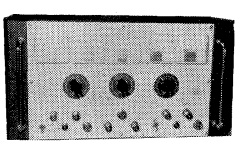
INPUT: 115 Volts AC 60 cycles, single phase
OUTPUT: 0-32 Volts DC, 0-20 Amperes, continuous duty
RIPPLE: 0.5% RMS
Unique overload device prevents needle slam and shows overload condition
REGULATION: D.C.V. at full load: 30
D.C.V. at 1/10 load: 35
METERS: 2% Accuracy
DIMENSIONS: 19″ x 14¼″ x 12¼″
PRICE: $302.50 NET
May be used for Rack or Bench

SILICON POWER RECTIFIER
For transistor circuits electronic equipment
MODEL G92F



INPUT: 115 volts AC 60 cycles, 1 phase
OUTPUT: 0-32 Volts DC, 0-10 Amperes D.C. continuous duty
REGULATION: No load to full load 15%
RIPPLE: Less than 0.3% RMS
METERS: 2% Accuracy
DIMENSIONS: 17″ x 9″ x 9″
PRICE: $169.50 NET
*Also available in 5 Amperes
PRICE: $114.50 NET

VARIABLE AC AND DC POWER SUPPLY



INPUT: 115 Volts AC, 60 HZ, 1 Phase
OUTPUT: (1) 0-22 Volts DC at 4 amperes. (2) 0-22 VAC at 4 amperes. (3) 0-350 Volts DC at 200 MA. All very low filtered.
DIMENSION: 17″ x 9″ x 9″
WEIGHT: 36 Lbs. Approx.

INDUSTRIAL POWER UNITS — SINGLE PHASE Continued

MODEL GK 115-375C	Output 115V	375W....	**$ 89.00**
MODEL GK 115-500A	Output 115V	500W....	**$105.00**
MODEL GK 115-500B	Output 115V	500W....	**$105.00**
MODEL GK 115-500C	Output 115V	500W....	**$105.00**
MODEL GK 115-750A	Output 115V	750W....	**$130.00**
MODEL GK 115-750B	Output 115V	750W....	**$130.00**
MODEL GK 115-750C	Output 115V	750W....	**$130.00**
MODEL GK 115-1000A	Output 115V	1000W....	**$150.00**
MODEL GK 115-1000B	Output 115V	1000W....	**$150.00**
MODEL GK 115-1000C	Output 115V	1000W....	**$150.00**
MODEL GK 230-125A	Output 230V	125W....	**$ 67.00**
MODEL GK 230-125A	Output 230V	125W....	**$ 67.00**

PRICES SUBJECT TO CHANGE

HIGH VOLTAGE DC POWER SUPPLIES — 1% Ripple - Good Regulation - Cabinets - Meters - Heavy Duty Construction - Powerstat - Fused 1% Meters - 115 Vac Input Heavy Duty Line Cord.

MODEL GP 32-20	115V, Out 0-32V	@ 20A..	**$ Inquire**
MODEL GP 32-40	115V, Out 0-32V	@ 40A..	**$ Inquire**
MODEL GP 32-100	220V, Out 0-32V	@ 100A	**$ Inquire**
MODEL GP 32-150	220V, Out 0-32V	@ 150A	**$ Inquire**
MODEL GP 60-6	115V, Out 0-60V	@ 60A..	**$ Inquire**
MODEL GP 60-10	115V, Out 0-60V	@ 10A..	**$ Inquire**
MODEL GP 60-12	115V, Out 0-60V	@ 12A..	**$ Inquire**
MODEL GP 60-20	115V, Out 0-60V	@ 20A..	**$ Inquire**
MODEL GP 60-50	220V, Out 0-60V	@ 50A..	**$ Inquire**
MODEL GP 60-80	220V, Out 0-60V	@ 80A..	**$ Inquire**
MODEL GP 60-250	220V, Out 0-60V	@ 250A	**$ Inquire**
MODEL GP 125-3	117V, Out 0-125V	@ 3A....	**$ Inquire**
MODEL GP 125-5	117V, Out 0-125V	@ 5A....	**$ Inquire**
MODEL GP 125-10	117V, Out 0-125V	@ 10A..	**$ Inquire**
MODEL GP 125-20	117V, Out 0-125V	@ 20A..	**$ Inquire**
MODEL GP 125-24	220V, Out 0-125V	@ 24A..	**$ Inquire**
MODEL GP 125-40	220V, Out 0-125V	@ 40A..	**$ Inquire**
MODEL GP 125-80	220V, Out 0-125V	@ 80A..	**$ Inquire**
MODEL GP 125-120	220V, Out 0-125V	@ 120A	**$ Inquire**
MODEL GP 250-5	117V, Out 0-250V	@ 5A ..	**$ Inquire**
MODEL GP 250-10	117V, Out 0-250V	@ 10A..	**$ Inquire**
MODEL GP 250-12	220V, Out 0-250V	@ 12A..	**$ Inquire**
MODEL GP 250-20	220V, Out 0-250V	@ 20A	**$ Inquire**
MODEL GP 250-40	220V, Out 0-250V	@ 40A	**$ Inquire**
MODEL GP 250-60	220V, Out 0-250V	@ 60A	**$ Inquire**
MODEL GP 300-1	220V, Out 0-250V	@ 1A....	**$ Inquire**
MODEL GP 300-2	220V, Out 0-250V	@ 2A....	**$ Inquire**
MODEL GP 300-3	220V, Out 0-250V	@ 3A	**$ Inquire**
MODEL GP 300-5	220V, Out 0-250V	@ 5A....	**$ Inquire**
MODEL GP 500-1	220V, Out 0-500V	@ 1A....	**$ Inquire**
MODEL GP 500-2	220V, Out 0-500V	@ 2A....	**$ Inquire**
MODEL GP 500-3	220V, Out 0-500V	@ 3A....	**$ Inquire**
MODEL GP 500-5	220V, Out 0-500V	@ 5A....	**$ Inquire**
MODEL GP 500-5	220V, Out 0-500V	@ 5A....	**$ Inquire**
MODEL GP 500-10	220V, Out 0-500V	@ 10A..	**$ Inquire**
MODEL GP 500-20	220V, Out 0-500V	@ 20A..	**$ Inquire**
MODEL GP 500-30	220V, Out 0-500V	@ 30A..	**$ Inquire**

GATES

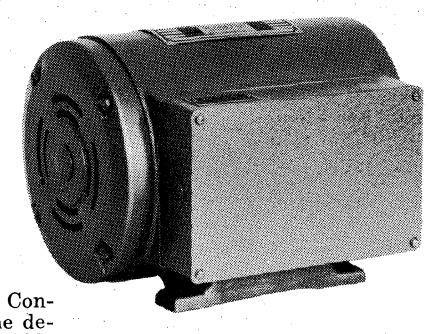
GATES ELECTRONIC COMPANY, INC. • 256 Van Nest Avenue, Bronx, N.Y. 10460 • Telephone: Tulip 1-5900

NOBRUSH® FREQUENCY CONVERTERS & GENERATORS

The heart of each "NoBrush" Frequency Converter is a "NoBrush" permanent magnet generator—a revolutionary development in its own right. The "NoBrush" permanent magnet generator features a cast aluminum rotor designed to give amazing voltage stability. It eliminates brushes, commutators, slip rings, resulting in absolute minimum maintenance. Elimination of excitation losses gives amazingly high efficiency, with consequent low heating. Other "NoBrush" advantages are excellent wave form, and immunity to damage by repeated overload or short circuit.

FREQUENCY CONVERTER SERIES 30 UNIT SHELL DESIGN

FOR CONVERSION OF 60 TO 400 CYCLES



FEATURES:

Maximum Dependability
Cool Operation
Very Low Audible Noise
Extremely Low R.F. Noise (zero for most applications)
Compact Construction
Light Weight
High Overload Capacity
Minimum Maintenance
Withstands Short Circuit
Stable Output Voltage
Low Internal Impedance (favorable for pulse loads)
Operates in Adverse Environments

The "NoBrush" Unit Shell Frequency Converter was developed in response to the demand for an efficient, compact, dependable quiet unit, for powering electronic and other high frequency equipment. A "NoBrush" generator is mounted with a high quality induction motor within a single shell. Oversize pre-lubricated ball bearings, sealed for life, insure long term maintenance-free operation. Magnetism is permanently "locked in" at a high level. Problems of radio interference, sparking, fouling, etc., have been eliminated. Because of its simple design and rugged construction, the unit withstands extremes of mechanical and electrical operating conditions, resulting in continuous long-life service.

FUNCTION. The Series 30 Converter is a highly compact motor generator set for conversion of 60 cycle to 400 cycle power. **CONSTRUCTION.** Generator and motor stators contained within aluminum alloy unit shell. Generator and motor rotors pressed on unit shaft, with ball bearings at ends of shaft. Two-bearing construction is utilized, without any projecting shafts, couplings or belts. Single phase input models are provided with starting capacitor and relay, easily accessible in a generous-sized terminal box. **APPLICATION.** Wherever a dependable, trouble-free source of 400 cycle power within the range of 150 VA to 2.5 KVA is required, where 60 cycles (and in some cases, 50 cycles) is available for primary energy. **SPECIFIC APPLICATIONS.** As a source of high frequency power for electronic apparatus; for test and research work; for the servicing of aircraft electrical equipment; for portable radio and military electronic devices; for high frequency motors; for isolated power in computers.

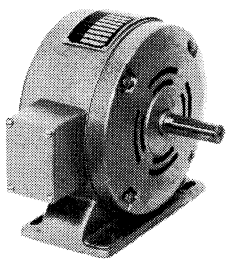
SPECIFICATIONS: INPUT. Low-slip induction motors utilized for drive, available in single and three-phase models. Single phase units are reconnectable for 115 or 230 volts and are capacitor start, induction run. Three phase units normally supplied reconnectable for 208 or 220 or 440 volts. **DUTY.** Continuous. **MOTOR SPEED.** 3500 RPM for ratings up to ¾ KVA. 1750 RPM for ratings from 1 KVA to 2½ KVA. **BEARING TYPE.** Ball bearings, sealed, lubricated-for-life. **ACCESS.** In single phase models—to starting capacitor and relay by removal of external terminal box cover. **OUTPUT VOLTAGE STABILITY.** Within 1% for constant load and constant input frequency. **EFFECT OF INPUT VOLTAGE CHANGE ON OUTPUT VOLTAGE.** Output voltage will change less than 1% for input changes of plus or minus 10%, or for short period input disturbances as great as 30%. **OUTPUT FREQUENCY.** See Chart. **OUTPUT FREQUENCY STABILITY.** Within plus or minus ½% at constant load and constant input frequency. **TEMPERATURE RISE.** 40 degrees, C. (72 degrees F.) **R. F. NOISE.** Extremely low; may be considered zero for most applications. **EXCITATION.** Internal, permanent magnet. **REGULATION.** See typical curves. **DIRECTION OF ROTATION.** Operates equally well in clockwise or counter-clockwise direction. **WAVE FORM.** No sharp peaks or spikes. Total harmonics, single or three phase, within 4% for ratings 1 KVA or over; 5%-8% for ratings under 1 KVA, depending on model. Improved wave form on special order. **OPERATING POSITION.** May be operated with shaft horizontal, vertical or at any angle. **COOLING.** By internally mounted fan. **AUDIBLE NOISE.** Approximately 70 db. (Measurement on "B" scale, at 3 feet distance from unit, in accordance with ASA Standard No. Z 24.7-1950.) **AVAILABLE VARIATIONS.** The following variations are available on special order, in most cases at only a modest addition in price. (Not all variations are available in all ratings.) • Re-lubricable bearings • Militarized construction • Other standard single or three phase input voltages • 50 cycle input • Synchronous motor drive • Other output frequencies—180, 280, 360, 840 cycles • Other standard or non-standard output voltages • Reconnectable output windings for full power at either of two voltages • Low voltage taps • Auxiliary D.C. output at low or high voltage • Two phase output • Class "B" insulation for high ambient temperature operation • Carrying handles for easy portability • Screened openings for unfavorable environments.

	OUTPUT					INPUT					DIMENSIONS			WEIGHT
Model No.	KVA Rating	Phase	Nominal Voltages No Load	Nominal Voltages Full Load	Nom. Freq Full Load	H.P.	Speed	Phase	Voltage	Current Full Load	Height	Length	Width	Net Wt. lbs.
30-021	0.15	1	124	115	410	¼	3500	1	115/230 Reconnectable	3.0/1.5	8	11	9¾	40
30-004	0.25	3	124/214	115/200	410	½	3500	1		6.6/3.3	8	11	9¾	43
30-002	0.5	1	124	115	410	¾	3500	1		11.7/5.6	8	11	9¾	51
30-025	1.0	3	124/214	115/200	410	1½	1750	1		24.0/12.0	11¾	16	14	103
30-026	1.5	3	124/214	115/200	410	2¼	1750	1		30.0/15.0	11¾	16	14	121
30-007	2.0	3	124/214	115/200	410	3	1750	1		34.0/17.0	11¾	16	14	130
30-011	0.50	1	124	115	410	¾	3500	3	208 — 220/440 Reconnectable	3.2/1.6	8	11	9¾	51
30-006	0.75	3	124/214	115/200	410	1.1	3500	3		5.2/2.6	8	11	9¾	51
30-020	2.0	3	124/214	115/200	410	3	1750	3		9.0/4.5	11¾	16	14	112
30-029	2.5	3	124/214	115/200	410	4½	1750	3		12.6/6.3	11¾	16	14	145

OTHER 400 CYCLE CONVERTERS & GENERATORS

NOBRUSH®

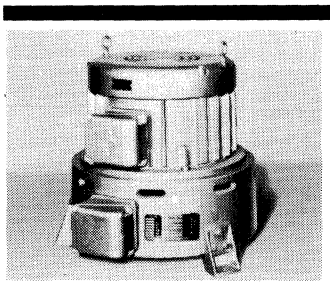
"NoBrush" machines employ permanent magnet excitation — the oldest principle in generator construction — applied in the newest way. By modern principles of engineering design, performance and capabilities previously unheard of in rotating generators are made available — fitting the machine to applications where previously unsuitable. Outstanding advantages exist over other methods of power generation and frequency conversion. Quality has been tested repeatedly in actual military and industrial applications, under most exacting conditions that would have disabled machines of other types.



ALTERNATORS

The original, revolutionary, "No-Brush" generator. Permanent magnets yield stability, reproducibility, ruggedness and virtually zero R.F. noise. Available in large variety of ratings, frequencies and voltages. Supplementary windings with rectifiers available for D.C. output.

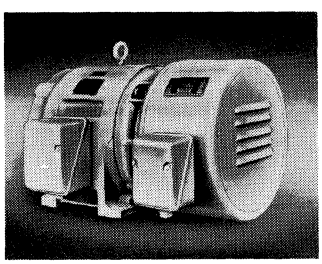
Cat. No.	Rating KVA	Phase	Speed RPM	Height	Length	Width	Weight Lbs.
36-001	.25	1	3428	8⅛"	7 1/16"	9 7/16"	17
36-003	.50	1	3428	8⅛"	7 1/16"	9 7/16"	22
36-030	.50	3	3428	8⅛"	7 1/16"	9 7/16"	21½
36-005	.75	3	3428	8⅛"	7 1/16"	9 7/16"	21½
36-007	1	3	1714	12 3/16	8⅜"	13⅜"	35½
36-008	2	3	1714	12 3/16	8⅜"	13⅜"	45
36-011	5	3	1714	17¼"	11 13/16"	18⅜"	103½
36-012	7½	3	1714	17¼"	11 13/16"	18⅜"	120
36-013	10	3	1714	17¼"	11 13/16"	18⅜"	135



VERTICAL CONVERTER

A rugged 60-400 CPS frequency converter for power output ratings from 2.5 KVA to 10.0 KVA. High quality induction motor is close coupled to a famous "NoBrush" generator for a really outstanding unit. Sealed bearings and totally enclosed motor result in greatly minimized maintenance. Very compact, with high power to weight and size ratio. Available variations include 50 CPS input and other output frequencies.

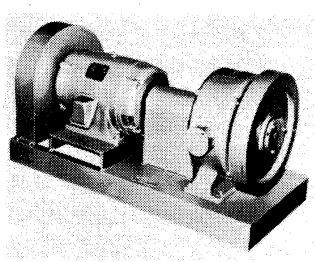
Cat. No.	Rating KVA	Phase	Dimensions Diameter	Dimensions Height	Weight Lbs.
33-001	2.5	1	19.4"	16.1"	173
33-002	3.5	1	19.4"	16.1"	215
33-003	5.0	1	21.9"	18.1"	277
33-004	5.0	3	21.9"	18.1"	248
33-005	7.5	3	21.9"	18.1"	262
33-006	10.0	3	21.9"	18.8"	334
33-009	3.0	3	19.4"	16.1"	177



SYNC. DRIVEN CONVERTER

The ultimate in frequency converter quality. Drive from 1200 R.P.M. brushless synchronous motor. Direct mounted 40-pole "NoBrush" generator delivers stable, almost pure sine-wave voltage. Immune to voltage disturbances on input line. Militarized versions available. Ratings from 2.5 KVA to 10 KVA.

Cat. No.	Rating KVA	Phase	Length	Width	Height	Weight Lbs.
35-001	2.5	1	26"	22"	16½"	470
35-002	5	1	30"	22"	16½"	650
35-003	3	3	26"	22"	16½"	475
35-004	5	3	28"	22"	16½"	590
35-005	10	3	30"	22"	16½"	660



MOTOR GENERATOR SETS

"NoBrush" Motor Generator sets give maximum flexibility. In-line coupling used for identical shaft speeds. Other units—V-belt or timing belt coupling. Components rigidly mounted on rust-proofed steel base. Frequencies from 50 to 400 cycles.

3 PHASE INPUT AND 1 PHASE OUTPUT BELT DRIVEN

Cat. No.	Rating KVA	Overall Length	Base Length	Height	Width	Weight Lbs.
37-004	1 KVA	32½"	30"	15½"	15"	225
37-024	3 KVA	36"	34"	21½"	18"	370
37-025	5 KVA	41½"	40"	21½"	21"	430
3 PHASE IN AND 3 PHASE OUT						
37-026	3 KVA	36"	34"	17½"	18"	350
37-027	5 KVA	41½"	40"	21½"	22"	400
37-028	10 KVA	45"	42"	21½"	25"	500

Note: Single phase input available in some ratings on special order.

Specifications subject to change without notice.

GEORATOR CORPORATION • MANASSAS, VIRGINIA 22110 • TELEPHONE: (703) EMPIRE 8-2102

brandenburg
STABILISED HIGH VOLTAGE

STABILIZED HIGH VOLTAGE

BETA RANGE

- **Model 500 — 0.5 to 5 kV .....5 mA.**
- **Model 705 — 1.5 to 15 kV .....2 mA.**
- **Model 800 — 3.0 to 30 kV .....1 mA.**
- **Model 905/906 — 6.0 to 60 kV ..400 μA.**

The BETA range consists of four models of high frequency, high voltage regulated D.C. supplies carefully designed for high reliability and stability. Extremely high standards of engineering and wiring together with extensive use of specially molded polyethylene components combine to provide compact, lightweight units. The front panels are designed for 19 inch rack mounting, but the clean styling of the PVC covered cabinet and the runners make the units equally suitable for bench use. Case and frame are made entirely of aluminum.

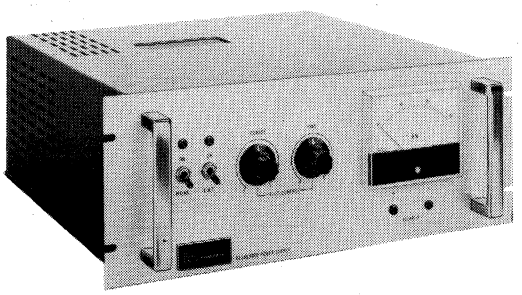
All models except 905/906 (905 negative — 906 positive output) feature extremely simple polarity reversal by means of a specially molded plug and socket on the back panel. This allows the high voltage polarity to be reversed directly; automatically switching the amplifier phase and meter connections with remote relays. Operation of the plug is interlocked for safety to suppress the high voltage during changeover.

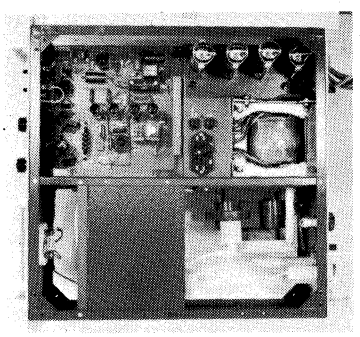
Protection: Both line and high voltage are fused, and in addition an electromagnetic cutout is provided.

Continuously variable output is provided by coarse and fine potentiometers on the front panel. Output is monitored by a 100 μA moving coil meter in series with a high stability resistor chain which also provides feedback to the comparator amplifier. A current metering jack is provided on the back panel.

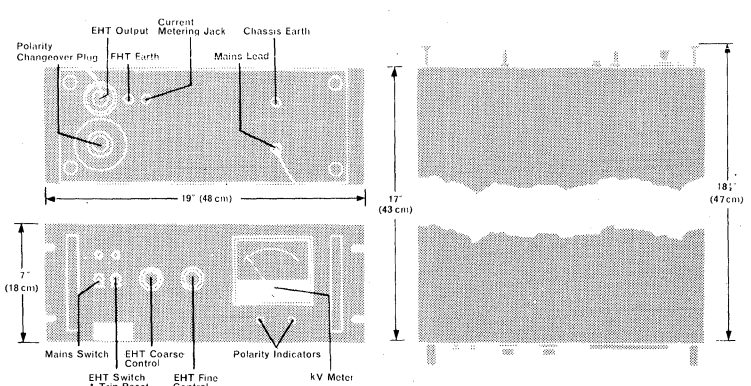
Amplifier: The comparator amplifier and reference are built as a printed circuit board coupled by an edge connector and can be quickly replaced as a unit should it ever become necessary.

Output Ripple is better than 0.1% at full voltage. Stability is better than 0.1% for a line voltage change of +10% to −7½%. Can be supplied for 110 or 220 volt 50/60 cycle operation.





DIMENSIONS AND CONTROLS



Weight: 36 lb (16 kg)

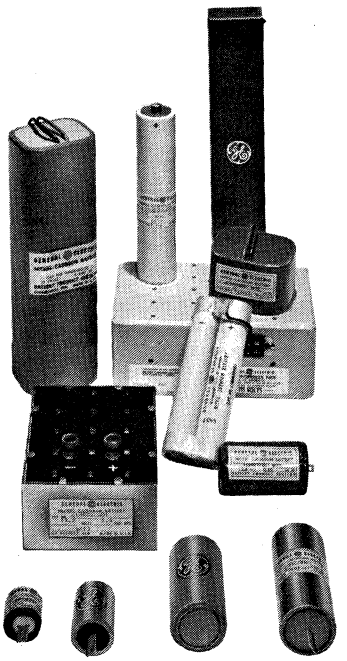
Typical Applications are:

- Cathode Ray Tube Supplies
- Cathode Ray Tube Testing
- Flying Spot Scanners
- Electron Microscopes
- Electron Diffraction Cameras
- High Voltage Testing of Cables Components, Insulation etc.
- Electron MicroProbes
- Electrostatic Deposition Processes
- Chemical Precipitation
- Electrostatic Dust Precipitation
- Testing for Mechanical Defects

GENCOM DIVISION
Whittaker CORPORATION
80 Express Street, Plainview, L.I., N.Y. 11803
Telephone: 433-5900 / Area Code 516

RECHARGEABLE NICKEL-CADMIUM BATTERIES

- **Operate over a wide temperature range**
- **High discharge rate capability with constant voltage output**
- **Long cycle life**
- **Meet severe environmental requirements**
- **Customized battery designs available**



Typical sealed-cell battery designs.

General Electric rechargeable nickel-cadmium batteries are suitable for a wide variety of commercial, military, and aerospace applications. Available battery types include sealed, pressure relieved, and vented cells nominally rated from 0.08 ampere-hours to 160 ampere-hours (at the one-hour rate).

The cells utilize sintered-plate electrode construction to provide the following excellent operating characteristics:

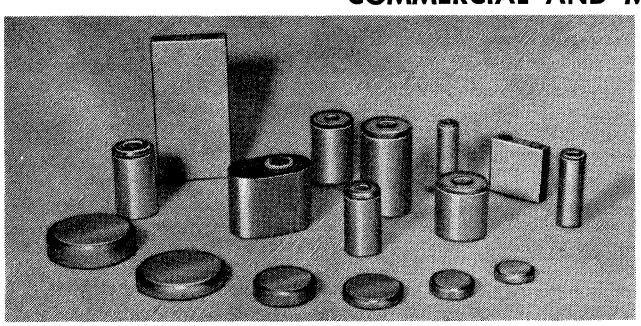
Temperature — the batteries will operate in temperatures ranging from −40°C to +60°C with an optimum range of +15°C to +30°C.

Discharge rates several times rated call capacity are possible up to: 10 times for sealed cells, 20 times for pressure relieved cells, and 30 times for vented cells. Output voltage remains relatively constant over 90 percent of the discharge period.

Cycle life — under specified rated conditions, the number of charge/discharge cycles is normally in excess of 1000. A life in excess of 5,000 cycles is possible at discharge rates not exceeding 25 percent of rated cell capacity.

Shock resistance — the cells exhibit great resistance to shock, vibration, and physical damage. Tests up to 5,000 G's have been performed without causing cell damage.

COMMERCIAL AND MILITARY APPLICATIONS



Sealed cells are available in a wide variety of shapes and ampere-hour ratings to obtain batteries of any needed voltage or size.

SEALED CELLS — Sealed cells are available in three basic shapes: button, cylindrical, and rectangular. No maintenance is required and these cells will operate in any position. In addition, all cylindrical and rectangular cells in this classification feature a resealable vent mechanism that permits maximum cell life, even under infrequent abnormal operation.

Button cells are particularly suited for portable radios, flashlights, photo flash equipment, burglar alarms, and other low-drain high-capacity applications. Available ratings run from 0.08 to 1.60 ampere-hours at the one-hour rate.

Cylindrical and rectangular sealed cells provide maximum discharge rates and capacity. The special resealing vent mechanism on these cells provides added safety and reliability, making them especially suited for portable, cordless, rechargeable consumer products such as TV sets, radio receivers, and transceivers; appliances; and starting small gas engines. Available ratings run from 0.08 to 4.0 ampere-hours at the one-hour rate.

VENTED CELLS — Vented cells provide outstanding performance where large peaks of power and fast recharging are required. Typical applications include aircraft, turbine, and diesel engine starting. Available ratings run from 11.0 to 160.0 ampere-hours at the one-hour rate.

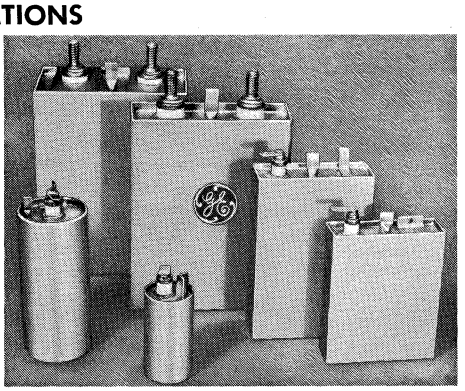
SPECIAL DESIGNS — All of these battery cell types can be customized, through use of special battery design and packaging techniques, to meet individual power and size requirements.

AEROSPACE APPLICATIONS

General Electric nickel-cadmium aerospace batteries are designed to operate for extended periods in an outer space environment. The battery cells employ a hermetic ceramic-to-metal seal (leakage rate less than 1×10^{-8} cc/second of helium per year) construction that effectively insulates the positive terminal or both terminals. The cells are also designed to withstand constant overcharging at specified rates.

Specialized cell and battery designs will be built to meet unusual requirements. This includes special cell terminal arrangements, deep drawn cases, cell case design, and third electrode control circuit to permit faster charging. Available ratings run from 0.75 to 100.0 ampere-hours at the one-hour rate.

WRITE FOR BULLETIN GEA-7287



Hermetically-sealed aerospace cells are available in stainless-steel cylindrical or rectangular case designs.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

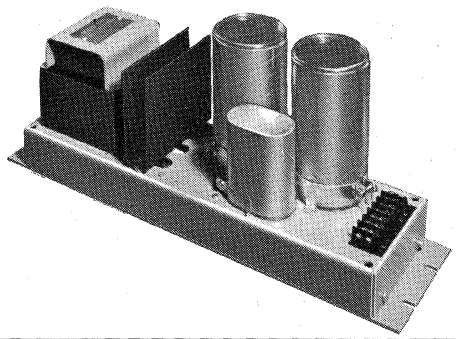
GENERAL ELECTRIC

REGULATED DC POWER SUPPLIES

Improve Performance of Computers and Other Electronic Equipment

These component power supplies can be used in a wide variety of applications where relatively constant d-c voltage is required despite fluctuating line voltages. Computers, process control equipment, and electronic measuring devices are typical applications where demands for accuracy require constant regulation of voltage.

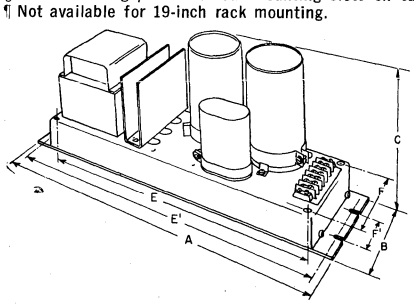
Performance-proved GE d-c power supplies can be designed to suit your needs for either 50- or 60-Hertz power sources.



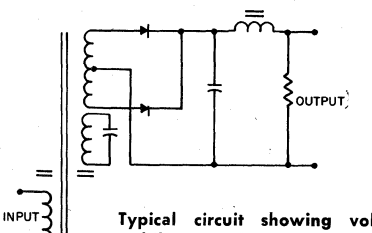
97- TO 130-VOLT INPUT RANGE, 40C AMBIENT

DC OUTPUT†				LOAD REGULATION‡		Dimensions in Inches (See sketch below)							NET
						OVER-ALL			MOUNTING				
									Chassis		Rack		
Volts	Amps	MODEL NO.	List Price	100% to 50% load	100% to 20% load	A	B	C	F	E	F′	E′	WGT. LBS.
60 HERTZ													
10.0	16.0	9T66Y8	**$165.00**	5%	8%	19	7	6⅝	6¼	16¼	4	18⅜	25
12.0	5.0	9T66Y51	**140.00**	5%	6%	19	3½	7⅝	2¾	16¼	3	18⅜	16
12.0	15.0	9T66Y53	**170.00**	5%	7%	19	5¼	8	4½	16¼	2¼	18⅜	25
12.0	20.0	9T66Y978	**185.00**	5%	7%	19	7	8	6¼	16¼	4	18⅜	35
18.0	5.0	9T66Y61	**128.00**	4%	5%	19	3½	7⅝	2¾	16¼	3	18⅜	19
18.5	6.0	9T66Y966	**133.00**	4%	5%	19	5¼	7	4½	16¼	2¼	18⅜	20
18.5	12.0	9T66Y967	**158.00**	5%	7%	19	5¼	7¾	4½	16¼	2¼	18⅜	20
±18.5	24.0	9T66Y965	**373.00**	5%	8%	19	8¾	7	8	16¼	5¾	18⅜	45
24.0	2.5	9T66Y987	**121.00**	4%	6%	19	3½	6⅛	2¾	16¼	3	18⅜	16
24.0	6.0	9T66Y988	**143.00**	3%	5%	19	5¼	6½	4½	16¼	2¼	18⅜	25
24.0	10.0	9T66Y989	**166.00**	3%	5%	19	5¼	8	4½	16¼	2¼	18⅜	28
24.0	20.0	9T66Y990	**217.00**	3%	5%	19	7	9⅜	6¼	16¼	4	18⅜	45
24.0	50.0	9T66Y991	**383.00**	3%	5%	19	10½	11⅜	9¾	16¼	§	18⅜	105
28.0	8.0	9T66Y83	**159.00**	3%	5%	19	5¼	8	4½	16¼	2¼	18⅜	25
28.0	20.0	9T66Y85	**236.00**	3%	5%	19	7	9⅜	6¼	16¼	4	18⅜	50
28.0	50.0	9T66Y6	**429.00**	3%	5%	19	10½	12⅛	10½	17½	10½	18⅜	105
48.0	4.0	9T66Y93	**133.00**	3%	5%	19	5¼	8	4½	16¼	2¼	18⅜	25
48.0	10.0	9T66Y94	**182.00**	2%	4%	19	5¼	8	4½	16¼	2¼	18⅜	35
90.0	1.0	9T66Y69	**115.00**	2%	3%	19	3½	7⅛	2⅝	16¼	3	18⅜	19
90.0	10.0	9T66Y985	**253.00**	3%	4%	20⅞	7⅜	7	6⅛	20	¶	¶	100
125.0	2.0	9T66Y980	**143.00**	2%	3%	19	5¼	6½	4½	16¼	2¼	18⅜	26
125.0	4.0	9T66Y970	**185.00**	2%	3%	19	7	7⅝	6½	16¼	4	18⅜	48
150.0	2.0	9T66Y981	**151.00**	2%	3%	19	5¼	6½	4½	16¼	2¼	18⅜	28
200.0	1.0	9T66Y982	**134.00**	2%	3%	19	5¼	6½	4½	16¼	2¼	18⅜	24
50 HERTZ													
12.0	15.0	9T66Y53G5	**$179.00**	5%	7%	19	5¼	6½	4½	16¼	2¼	18⅜	27
24.0	10.0	9T66Y989G5	**174.00**	3%	5%	19	5¼	8	4½	16¼	2¼	18⅜	30
24.0	20.0	9T66Y990G5	**228.00**	3%	5%	19	7	8½	6½	16¼	4	18⅜	50
28.0	8.0	9T66Y83G5	**167.00**	2%	5%	19	5¼	8	4½	16¼	2¼	18⅜	25
48.0	4.0	9T66Y93G5	**140.00**	3%	5%	19	4¼	8	4½	16¼	2¼	18⅜	30
48.0	10.0	9T66Y94G5	**191.00**	2%	4%	19	5½	9	4½	16¼	2¼	18⅜	38
125.0	2.0	9T66Y980G5	**150.00**	2%	3%	19	5¼	7⅜	4½	16¼	2¼	18⅜	28

† May vary ±1%. All standard units come equipped with a plate for 19-inch rack mounting.
‡ Indicates approximate percent increase in output voltage due to decrease of load current from full load.
§ Rack mounting plate has four mounting slots on each end. Distance between centers of two outer slots is 7½ In., between two inner slots 3 In.
¶ Not available for 19-inch rack mounting.



Mounting holes suitable for ¼-20 screws. Length of screw may vary with chassis height.



Typical circuit showing voltage stabilizers and filter components.

EFFECT OF INPUT VOLTAGE VARIATION

D-c power supplies can be designed for various input voltages and ranges. With all other variables constant, the output voltage will not vary more than ±1 percent for a change in input voltage over the rated range of 97 to 130 volts input.

EFFECT OF TEMPERATURE CHANGE

For every 40C change in the ambient temperature, the output voltage level will change approximately one percent.

EFFECT OF FREQUENCY

A change of one percent in frequency will change output voltage level approximately one and one-half percent.

ISOLATION

All d-c power supplies provide electrical isolation between the a-c power source and the d-c load.

POLARITY

GE d-c power supplies can be designed with the polarity you require. All standard units listed can be installed with either plus or minus grounded.

RIPPLE

Ripple levels of one percent RMS meet most requirements. However, other levels of ripple content can be designed into GE power supplies.

EFFICIENCY

Efficiency ranges from 70 to 85 percent for normal output voltage levels. For unusually low output voltages or low power ratings, some decrease in efficiency may occur.

REGULATION

Load regulation characteristics depend on the rated output voltage and rated power level of the power supply.

Prices subject to change without notice.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

AC VOLTAGE STABILIZERS

For Electronic and Electric Equipment

General Electric a-c voltage stabilizers are static-magnetic transformer-type products which provide voltage maintained within ±1% variation while input line voltage fluctuates ±15%. They are offered in the following variations:

Unfiltered output: output voltage waveform is relatively flat-topped, with harmonic content from 15 to 20%.

Harmonic filtered output: output voltage is filtered to near sinusoidal waveshape, with a maximum of 3% harmonic content.

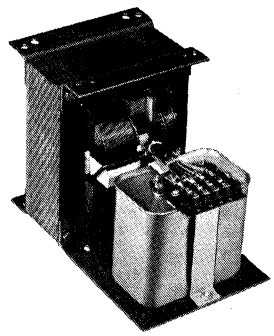
Enclosed construction: completely metal enclosed for safe external mounting.

Open construction: for installation within electronic or electric equipment.

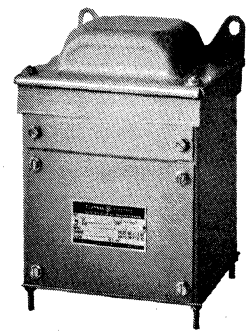
Cord/Receptacle units: for convenient temporary connections.

SINGLE PHASE — Magnetic-capacitor circuitry is frequency sensitive. Stabilizers designed for one frequency are not suitable for use on another.

THREE PHASE — Standard single-phase a-c voltage stabilizers can be connected for 3-phase, 4-wire loads with input connected delta. However, single-phase models cannot be connected for 3-phase, 3-wire loads: select from 3-phase delta-delta models.



Open — small ratings



Enclosed — small ratings

Single Phase

Volt-amp Output Capacity	Input Voltage Range	Stabilized Output Voltage	Unfiltered Output		Harmonic Filtered Output	
			Model Number	List Price	Model Number	List Price
ENCLOSED — FOR 60 HERTZ						
15	95-130	118	9T91Y4070	$31.70	.....	.....
30	95-130	118	9T91Y4090	36.30	.....	.....
60	95-130	118	9T91Y4110	47.90	.....	.....
120	95-130	118	9T91Y4130	65.90	.....	.....
250	95-130	118	9T91Y4140‡	110.00	9T91Y7140‡	$114.00
250	190-260	118	9T91Y4142‡	110.00	.....	.....
250	190-260X380-520	118/236	9T91Y4144‡	122.00	.....	.....
250	380-520	118	9T91Y4145‡	110.00	.....	.....
500	95-130	118	9T91Y4150‡	173.00	9T91Y7150‡	178.00
500	190-260	118	9T91Y4152‡	173.00	.....	.....
500	380-520	118	9T91Y4155‡	173.00	.....	.....
1000	95-130	118	9T91Y4170	265.00	9T91L7170	273.00
1000	95-130X175-235X190-260	118/236	.....	.....	9T91Y7173	307.00
1000	190-260	118	9T91Y4172	265.00	9T91Y7172	273.00
1000	190-260X380-520	118/236	.....	.....	9T91Y7174	302.00
1000	380-520	118	9T91Y4175	265.00	.....	.....
2000	95-130X175-235X190-260	118/236	9T91Y4183	531.00	9T91Y7183	557.00
2000	190-260X380-520	118/236	9T91Y4184	523.00	9T91Y7184	543.00
2000	380-520	236/472	9T91Y4186	503.00	.....	.....
3000	95-130X175-235X190-260	118/236	9T91Y4193	714.00	9T91Y7193	750.00
3000	190-260X380-520	118/236	9T91Y4194	699.00	.....	.....
3000	380-520	236/472	9T91Y4196	680.00	.....	.....
5000	190-260X380-520	118/236	9T91Y4204	1077.00	9T91Y7204	1136.00
5000	95-130X175-235X190-260	118/236	9T91Y4203	1094.00	9T91Y7203	1157.00
5000	380-520	236-472	9T91Y4206	1044.00	.....	.....
7500	95-130X175-235X190-260	118/236	9T91Y4213	1632.00	.....	.....
7500	190-260X380-520	118/236	9T91Y4214	1600.00	9T91Y7214	1764.00
10000	95-130X175-235X190-260	118/236	.....	.....	9T91Y7223	2339.00
10000	190-260X380-520	118/236	9T91Y4224	2090.00	9T91Y7224	2295.00
15000	190-260X380-520	118/236	9T91Y4244	3068.00	9T91Y7244	3385.00
OPEN — FOR 60 HERTZ						
15	95-130	118	9T91Y5070	$30.00	.....	.....
30	95-130	118	9T91Y5090	34.20	.....	.....
60	95-130	118	9T91Y5110	44.70	.....	.....
120	95-130	118	9T91Y5130	62.00	.....	.....
250	95-130	118	9T91Y5140	104.00	9T91Y8140	$107.00
250	190-260	118	9T91Y5142	104.00	.....	.....
500	95-130	118	9T91Y5150	163.00	9T91Y8150	166.00
500	190-260	118	9T91Y5152	163.00	.....	.....
750	95-130	118	9T91Y5160	205.00	9T91Y8160	212.00
1000	95-130	118	9T91Y5170	248.00	9T91Y8170	256.00
1000	190-260	118	9T91Y5172	248.00	9T91Y8172	256.00
1500	95-130	118	9T91Y5010	344.00	9T91Y8010	361.00
2000	95-130X175-235X190-260	118/236	9T91Y5183	498.00	9T91Y8183	523.00
ENCLOSED — FOR 50 HERTZ						
250	95-130	118	9T91Y4147‡	$127.00	9T91Y7147‡	$131.00
250	95-130X175-235X190-260	118/236	9791Y4148‡	143.00	9T91Y7148‡	148.00
500	95-130X175-235X190-260	118/236	9T91Y4158	225.00	9T91Y7158	231.00
500	190-260X380-520	118/236	9T91Y4159	220.00	9T91Y7159	227.00
1000	95-130X175-235X190-260	118/236	9T91Y4178	344.00	9T91Y7178	355.00
2000	95-130X175-235X190-260	118/236	9T91Y4188	611.00	9T91Y7188	641.00
3000	95-130X175-235X190-260	118/236	9T91Y4198	821.00	9T91Y7198	861.00
5000	95-130X175-235X190-260	118/236	9T91Y4208	1260.00	9T91Y7208	1323.00
7500	95-130X175-235X190-260	118/236	9T91Y4218	1873.00	9T91Y7218	2060.00
7500	190-260X380-520	118/236	9T91Y4219	1842.00	9T91Y7219	2027.00

‡ Can be used with adapter kit for quick conversion to a cord and receptacle unit.

3 Phase Delta Delta

Freq.	VA	Input Voltage Range	Stabilized Output Voltage	Model Number	List Price
ENCLOSED					
60	6000*	190 to 260/380 to 520 delta	230/236 delta	9T91Y3506	$2306.00
60	10000*	190 to 260 delta	236 delta	9T91Y3501G2	3324.00
50	10000*	190 to 260 delta	236 delta	9T91Y3510	3633.00

*Minimum recommended load 20% of rated; maximum harmonic content 5%.

Cord/Receptacle Units

Integral single-phase units with a 2-prong cord set and female receptacle in the case.

Volt-amp Output Capacity	Input Voltage Range	Stabilized Output Voltage	Model Number	List Price
ENCLOSED — UNFILTERED OUTPUT — FOR 60 HERTZ				
15	95-130	118	9T91Y4070G19	$36.30
30	95-130	118	9T91Y4090G19	40.90
60	95-130	118	9T91Y4110G19	52.30
120	95-130	118	9T91Y4130G19	70.60

Adapter kits are available for use with 250 and 500 volt-amp stabilizers to provide quick conversion to a cord and receptacle unit.

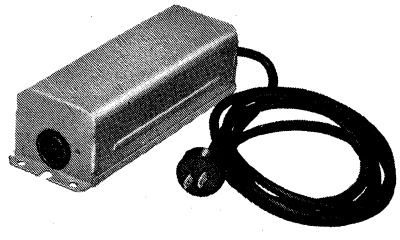
For Use With Stabilizer Model Number	Order Adapter Kit Model Number		List Price
	2-prong	3-prong	
9T91Y4140	9T91Y4140G55	9T91Y4140G75	
9T91Y4142	9T91Y4140G55	9T91Y4140G75	
9T91Y4144	9T91Y4140G55	9T91Y4140G75	2-prong
9T91Y4145	9T91Y4140G55	9T91Y4140G75	Kits
9T91Y4147	9T91Y4140G55	9T91Y4140G75	$4.60
9T91Y4148	9T91Y4140G55	9T91Y4140G75	
9T91Y4150	9T91Y4140G55	9T91Y4140G75	
9T91Y4152	9T91Y4140G55	9T91Y4140G75	
9T91Y4155	9T91Y4140G55	9T91Y4140G75	
9T91Y7140	9T91Y7140G55	9T91Y7140G75	3-prong
9T91Y7150	9T91Y7150G55	9T91Y7150G75	Kits
9T91Y7147	9T91Y7147G55	9T91Y7147G75	$5.70
9T91Y7148	9T91Y7147G55	9T91Y7147G75	

Filament Ratings—Single Phase—60 Hertz

For stabilized power for 6-volt nominal filaments, these stabilizers are suitable for operation with other 6-volt loads of rated or lower output current requirements. Current-limiting characteristic protects cold filaments from high current surges.

Volt-amp Output Capacity	Input Voltage Range	Output		Model Number	List Price
		Volts	Amps		
OPEN					
15	95-130	6	2.5	9T91Y365	$30.00
15	95-130	6.3	2.4	9T91Y367	30.00
31.5	95-130/190-260	6.3	5.0	9T91Y369	34.20
63	95-130/190-260	6.3	10.0	9T91Y370	44.70
94.5	95-130/190-260	6.3	15.0	9T91Y371	51.20
157.5	95-130/190-260	6.3	25.0	9T91Y372	75.00

Typical cord/receptacle unit



Prices subject to change without notice.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

STABILTRON* AC VOLTAGE STABILIZERS

For Electronic and Electric Equipment Requiring PRECISE Voltage Control

General Electric Stabiltron a-c voltage stabilizers can be used in a wide variety of electronic equipment applications where precise control of voltage is required. The Stabiltron consists entirely of static components — there are no tubes to burn out or moving parts to replace or maintain.

The Stabiltron senses deviations from a predetermined output voltage level by an error detector. The error signal, through the silicon-controlled rectifier circuit, augments the voltage stabilizer action and provides almost instantaneous correction of output voltage.

Typical applications include computers, radar and communications equipment, industrial process control, and X-ray equipment.

Input Voltage — The most common power source voltages can be handled by the standard models listed. Stabiltron units can be provided for special voltage levels on request.

Output Voltage — Stabiltron voltage stabilizers maintain extremely precise voltage output in spite of wide fluctuations of line voltage, frequency, load, load power factor, and ambient temperatures.

The table below illustrates the effect on the output of the maximum steady state excursions, within rated limits of some of these variables.

TABLE 1 — TYPICAL OUTPUT VOLTAGE CHARACTERISTICS

Variable	Excursion	Output Voltage Bandwidth¶
Line voltage†	95 to 130	0.02 to 0.2%
Frequency	57 to 63 Hertz	0.15 to 0.4%
Load	0 to 100% rated load	0.02 to 0.1%
Load power factor	0.4 lagging to unity	0.01 to 0.1%
Ambient temperature	−25C to 40C	0.01%/degree C

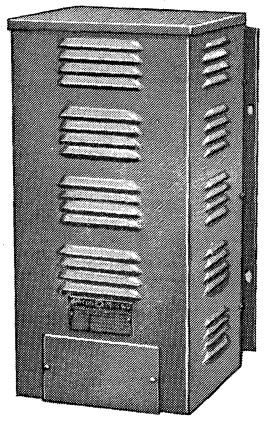
¶ A range is indicated because exact amounts are dependent on the static level of other variables.

† When the Stabiltron unit is operated at less than rated load, the line voltage can be reduced considerably below 95 volts without serious deterioration of the output voltage.

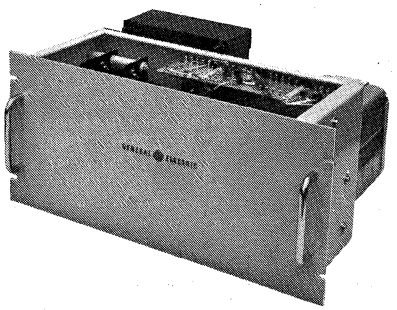
Response — Under transient line or load conditions, elapsed time for correction of output voltage and transient excursion from the normal bandwidth are key considerations to equipment operation.

The Stabiltron provides fast response and small transient excursion through its unique combination of solid state and magnetic circuitry.

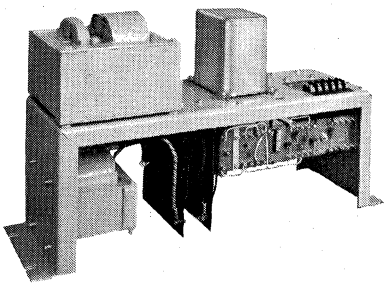
* Trade-name of General Electric Co.



ENCLOSED CONSTRUCTION - 2-kva units are suitable for either wall or floor mounting. 5- and 10-kva units can be floor mounted only.



PANEL CONSTRUCTION is suitable for standard 19-inch rack mounting.



OPEN CONSTRUCTION is suitable for horizontal or vertical mounting surfaces in equipment enclosures.

57-63CPS; 3% HARMONIC: 0.4 LAG TO UNITY LOAD PF

Kva	Model Number	List Price	Input Voltage Range	Output Voltage (Adjustable ±4%)	Approx. Net Weight (Pounds)	Construction Type	Approx. Dim. (in.) H	W	D
0.5	9T91Y3021	$422	95-130/190-260	118	70	Panel	7	19	14¾
0.5	9T91Y3021G2	414	95-130/190-260	118	70	Open	7	19	13¼
1.0	9T91Y3022	497	95-130/190-260	118	125	Panel	8¾	19	15½
1.0	9T91Y3022G2	490	95-130/190-260	118	125	Open	8¾	19	14
2.0	9T91Y3023	665	95-130/190-260	118/236	185	Enclosed	25	14½	11¼
2.0	9T91Y3023G2	654	95-130/190-260	118/236	180	Open	23½	14½	10¼
5.0	9T91Y3027	1428	95-130/175-235/190-260	118/236	570	Enclosed	26½	28	14
10.0	9T91Y3030	2205	190-260/380-520	118/236	975	Enclosed	28	39	17

TABLE 2 — TYPICAL TRANSIENT RESPONSE CHARACTERISTICS

Transient Change	Percent Peak Output Voltage Excursion	Response‡ Time	Total Recovery§ Time
0 to 115V input	14%	4 Hertz	13 Hertz
95 to 130V input	14%	3 Hertz	8 Herzt
130 to 95V input	9%	5 Hertz	9 Hertz
0 to 100% rated load	24%	1 Hertz	2 Hertz
20% to 100% rated load	21%	1 Hertz	2 Hertz
100% to 20% rated load	34%	1 Hertz	10 Hertz

‡ The time required for the output to recover 63.3% from its maximum excursion.

§ The time required for the output to recover to normal bandwidth limits.

Harmonic Content — Under all rated ranges of line variation and most load conditions, the total harmonic content of the output wave form will not exceed three percent for a sine wave power source. Even under adverse conditions, when the power source is not a sine wave, the Stabiltron voltage stabilizer will correct the wave form to the load to approximately three percent harmonic content.

Rectifier-filter Loading — Since the output wave form is low in harmonic content, the Stabiltron voltage stabilizer can be connected successfully to a rectifier (capacitor input) filter load to the input of a d-c power supply having capacitor input filters.

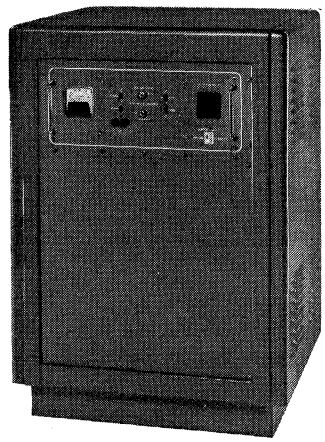
Prices subject to change without notice.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

volt-pac® VOLTAGE REGULATORS

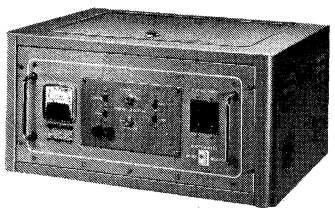
- **New solid-state control**
- **Precise output voltage control**
- **Fast voltage-correction rate**
- **Cabinet or rack-mounted models**
- **Magnetic circuit-breaker protection**



Three-Phase

General Electric's new automatic voltage regulator line provides closely regulated output voltages from varying input voltages. They normally include a motor-operated Volt-Pac variable transformer, associated buck-boost transformers which handle a wide range of input-voltage variation, and a new solid-state SCR control.

These automatic regulators maintain a preselected output voltage level within 1 percent bandwidth, and are temperature compensated from −20 to +40C. They can be bench or floor mounted, or in smaller sizes, mounted in standard relay racks.



Single-Phase

Input Voltage Range		Nom. Output Volt-	Adjustable Output Voltage†		Correc-tion Rate Volts/	Load		Rack-mounted						Cabinet-mounted					
										Approximate Dimensions (In.)						Approximate Dimensions (In.)			
Min.	Max.	age	Min.	Max.	Sec.	Max. Amps	KVA ‡	Model No.	List Price	Width	Height	Depth	Net Wt.	Model No.	List Price	Width	Height	Depth	Net Wt.
115 VOLTS — SINGLE-PHASE																			
95	135	115	110	120	10.4	10	1.15	9T92Y130G3	$430	19	6¾	12¼	50	9T92Y130G1	$460	22½	9⅛	17	70
95	135	115	110	120	10.4	25	2.9	9T92Y131G3	460	19	8¾	15¼	70	9T92Y131G1	490	22½	10⅞	17	95
95	135	115	110	120	10.4	50	5.75	9T92Y132G3	515	19	8¾	15¼	100	9T92Y132G1	545	22½	10⅞	17	125
95	135	115	110	120	10.4	100	11.5	9T92Y133G3	625	19	12¼	19⅛	120	9T92Y133G1	655	22½	14	19⅝	150
95	135	115	110	120	10.4	150	17.2	.....	.....	....	.....	.....	.....	9T92Y134G1	700	21½	20	18¼	170
230 VOLTS — SINGLE-PHASE																			
200	260	230*	220	240	17.2	13	3.0	9T92Y135G3	$515	19	8¾	15¼	70	9T92Y135G1	$545	22½	10⅞	17	95
200	260	230*	220	240	17.2	32.5	7.5	9T92Y136G3	570	19	8¾	15¼	100	9T92Y136G1	600	22½	10⅞	17	125
200	260	230*	220	240	17.2	52	12.0	9T92Y137G3	660	19	12¼	19⅛	120	9T92Y137G1	690	22½	14	19⅝	150
200	260	230*	220	240	17.2	130	30.0	.....	.....	....	.....	.....	.....	9T92Y138G1	800	22½	20	18¼	170
460 VOLTS — SINGLE-PHASE																			
400	520	460	440	480	34.4	13	6.0	9T92Y139G3	$675	19	8¾	18⅝	85	9T92Y139G1	$705	22½	10½	19¾	110
400	520	460	440	480	34.4	32.5	15.0	9T92Y140G3	745	19	8¾	18⅝	115	9T92Y140G1	775	22½	10½	19¾	140
400	520	460	440	480	34.4	52	24.0	.....	.....	....	.....	.....	.....	9T92Y141G1	890	21¾	20	18¼	220
400	520	460	440	480	34.4	130	60.0	.....	.....	....	.....	.....	.....	9T92Y142G1	1110	25¾	30⅝	18½	350
230 VOLTS — THREE-PHASE																			
200	260	230*	220	240	17.2	12.5	5.0	9T92Y143G3	$995	19	8¾	18⅝	75	9T92Y143G1	$985	22½	10½	19¾	100
200	260	230*	220	240	17.2	34	13.5	.....	.....	....	.....	.....	.....	9T92Y144G1	1095	25¾	13⅝	17¼	140
200	260	230*	220	240	17.2	68	27.0	.....	.....	....	.....	.....	.....	9T92Y145G1	1325	25¾	13⅝	17¼	200
200	260	230*	220	240	17.2	136	54.0	.....	.....	....	.....	.....	.....	9T92Y146G1	1755	20¾	30⅜	18½	300
200	260	230*	220	240	7.5	170	67.5	.....	.....	....	.....	.....	.....	9T92Y147G1	1950	25¾	30⅝	18½	500
460 VOLTS — THREE-PHASE																			
400	520	460	440	480	34.4	13	10.4	.....	.....	....	.....	.....	.....	9T92Y148G1	$1115	25¾	13⅝	17¼	140
400	520	460	440	480	34.4	32.5	26.0	.....	.....	....	.....	.....	.....	9T92Y149G1	1245	25¾	13⅝	17¼	200
400	520	460	440	480	34.4	52	41.5	.....	.....	....	.....	.....	.....	9T92Y150G1	1600	20¾	30⅜	18½	300
400	520	460	440	480	34.4	100	80.0	.....	.....	....	.....	.....	.....	9T92Y151G1	1900	25¾	30⅝	18½	500
400	520	460	440	480	15.0	130	104.0	.....	.....	....	.....	.....	.....	9T92Y152G1	2000	28⅜	30⅜	18½	600

* 208-volt nominal output voltage operation requires no change in power connection, but does require selecting correct control transformer ratio. When operated at a nominal 208 volts output, the regulator will correct for an input range of 181 to 236 volts, with the output voltage adjustable from 199 to 217 volts.

† The specified input voltage range is applicable for nominal output voltage. When operating at any other output voltage within specified range, the input voltage range will change proportionately with the change in output voltage level selected.

‡ Load kva based on nominal output voltage.

No Waveform Distortion

No harmonic waveform distortion is introduced at any load or with any input voltage. The output voltage waveform is a precise reproduction of applied input waveform.

Adjustable Output Voltage

Output voltage for units nominally rated 115 volts is adjustable from 110 to 120 volts. Output voltage also is adjustable from 220 to 240 volts for units rated 230 volts; from 440 to 480 volts for nominally ratetd units of 460 volts. Please note that the specified input-voltage range is applicable for nominal output voltage. When operating at any other output voltage within specified range, the input voltage range shifts in proportion with the selected output voltage.

Accurate Static-sensing Control

Solid-state control combined with the new Sylvan-Kettler static-sensing device achieve the optimum in automatic accuracy. The voltage regulator is governed automatically by a dead-band-type voltage-sensitive control utilizing either lamp or zener bridges. The circuit includes magnetic input circuit breakers and an output voltmeter.

TYPICAL SPECIFICATIONS

Regulation Accuracy	±1.0%
Speed of correction	10.4 volt/sec
Output voltage	Adjustable from 110-120 volts
Input voltage	95 to 135, single-phase
Frequency	60-Hertz
Load Range	Zero to full load
Efficiency	Up to 99%
Power Factor Range	0 to 100%
Wave Form Distortion	None
Output Meter	0-150 Volts AC
Ambient Temperature Operating Range	−20C to +40C
Protection	Magnetic Circuit Breaker in Power Input Line—Control Circuitry Fused

Prices subject to change without notice.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

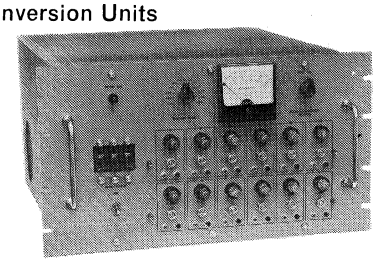
GENERAL ELECTRIC

GLENTRONICS INC. Gt: 748 East Alosta (U.S. Highway 66), Glendora, California 91740, (213) 963-1676

SOLID STATE POWER CONVERSION EQUIPMENT

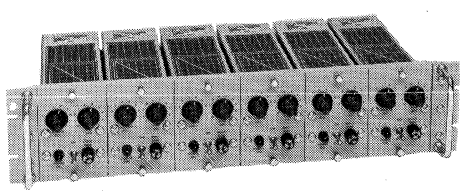
Spaceborne/Airborne/Ground Support/Computer Subsystems/Laboratory Instrumentation/Control Devices

Representative Glentronics Power Conversion Units



Remote Programmed Marginal Testing Unit

Input: 208 VAC + 8 VAC 375-425 CPS 3 Ø 4 wire
Outputs: 12, ranging from + 24 @ 600 MA to − 24 @ 250 MA
Regulation: .5% line and load, all outputs
Ripple: 25 MV to 5 MV max., depending on outputs



Stable Constant Current for Resistance Bridge Measurements

Input: 115 VAC + 10% @ 60 CPS I Ø
Output: Constant current .2 to 2 MA
Load Impedance: 0-5000 ohms
Regulation: ± .005% line
± .005% load
± .01% temperature
Ripple: .005% RMS maximum
Temperature: + 40°F. to 100°F.

AC Regulators
DC-DC Converters
Modular Power Supplies
Multi-output Power Supplies
Inverters

Glentronics offers complete in-house capabilities for the design and development of electronic equipment, including production test and prototype development laboratories, and manufacturing facilities for the production of transformers and chokes, printed circuit boards, mechanical assemblies, heat dissipators and component ovens.

Facilities have been approved by Government agencies and aerospace manufacturers. Glentronics' reputation is built on quality commensurate with application requirements, performance, comparable pricing, and delivery on schedule. A proven record of achievement is exemplified by the nearly 200 customer facilities served by Glentronics, Inc.

GLENTRONICS INC. Gt: 748 East Alosta (U.S. Highway 66), Glendora, California 91740, (213) 963-1676

HEWLETT hp PACKARD

0 - 4 VOLTS	@	0 - 2000 AMPS.
0 - 15 VOLTS	@	0 - 200 AMPS.
0 - 20 VOLTS	@	0 - 3 AMPS.
0 - 60 VOLTS	@	0 - 15 AMPS.
0 - 100 VOLTS	@	0 - 0.2 AMPS.
0 - 110 VOLTS	@	0 - 50 AMPS.
0 - 320 VOLTS	@	0 - 1.5 AMPS.
0 - 1000 VOLTS	@	0 - 0.2 AMPS.
0 - 4000 VOLTS	@	0 - 0.05 AMPS.

how to select a Hewlett-Packard DC Power Supply for your application

DC Power Supplies — you might think of them in other terms. Such as battery substitutes, rectifiers, AC-DC converters, power amplifiers, operational amplifiers or maybe even as SCR's.

No matter what you call them, Hewlett-Packard offers more than 100 models of DC power supplies. These offer a wide range of voltages and currents, a sophisticated variety of control versatility and solid-state reliability. One of them may prove suitable for your application — whether it be for OEM use, a special system, the production table, or the research bench.

To this end, we offer the following guidelines for helping you select the right power supply. See the next three pages for a condensed listing of DC power supplies from Hewlett-Packard.

power supplies

Voltage Output: A power supply with a voltage rating about 10% higher than that required is recommended. This provides the necessary flexibility for testing and adjusting analytical and other systems.

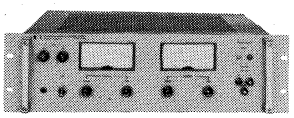
Current Output: For optimum performance, the current rating of the selected power supply should equal or exceed the maximum instantaneous (not average) output demanded by the load. Built-in fast-acting protection circuits of Hewlett-Packard instruments limit the output current to a preselected value; this protects both the power supply and the load from damage.

Output Mode: Most hp power supplies are designed to provide either a constant voltage or a constant current output. However, many hp power supplies are designed to operate in either mode and to automatically switch (cross over) from one mode to the other at any preselected point in the output range. If flexibility in operating mode is desired, these versatile hp power supplies are recommended.

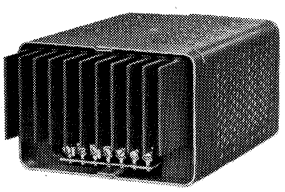
Specifications: Most applications will call for well regulated power supplies. These: fluctuate less than 0.01% for a maximum change in input AC line voltage or output load resistance. With no change in load or line conditions, a well regulated supply will drift less than 0.03% in eight hours and experience an output change of less than 0.01%/°C change in room temperature. Ripple and noise are functions of internal filtering and isolation; 200uv RMS is typical of well regulated hp supplies (for a 24V output, this is less than 10 parts per million). Performance specifications a factor of 10 times better are available from more precise units — while moderate regulation of .5 to .1% is typical of units with output ratings above 2 kW.

DC power supplies

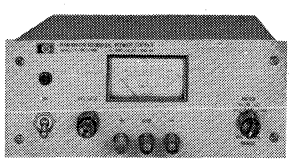
arranged by order of increasing voltage output



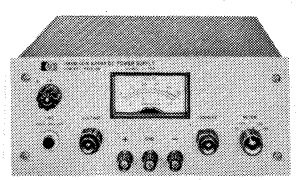
LVR



SLOT



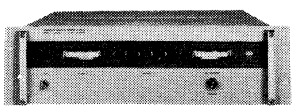
LAB



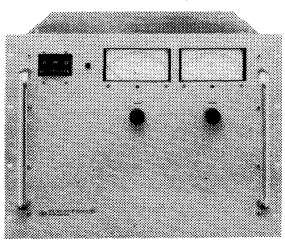
MPB

Output (volts)	Output (amperes)	Model	Series	Load regulation (mV)	Line regulation (mV)	RMS ripple & noise (mV)	Input line voltage (Vac)	Remote programming	CV/CC*	Price
0-4	0-2000	6463A	SCR-10	50 mV combined		280	3φ 208/230/460 ±10%	✓	✓	$3500
4-5.5	0-8	6384A	ICS	1 mV	1 mV	1 mV	115±10%			220
5.8±20%	0-15	60063A	SLOT	0.05%	0.05%	1 mV	115±10%			†
5.8±20%	0-3	60065A	SLOT	0.05%	0.05%	1 mV	115±10%			†
5.8±20%	0-8	60066A	SLOT	0.05%	0.05%	1 mV	115±10%			†
0-7.5	0-3	6203B	LAB	5 mV	3 mV	0.2	115±10%	✓	✓	169
0-7.5	0-5	6281A	MPB-3	5 mV	2 mV+0.01%	0.2	115±10%	✓	✓	210
0-7.5	0-15	6385A	ICS	1 mV	1 mV	1 mV	115±10%	✓	✓	500
0-7.5	0-30	6386A	ICS	1 mV	1 mV	1 mV	115±10%	✓	✓	700
0-7.5	0-60	6387A	ICS	1 mV	1 mV	1 mV	230±10%	✓	✓	900
0-7.5	0-120	6388A	ICS	1 mV	1 mV	1 mV	230±10%	✓	✓	1125
0-8	0-1000	6464A	SCR-10	25 mV combined		80	3φ 208/230/460 ±10%	✓	✓	3300
0-10	0-1	6213A	BENCH	.01%+4mV	.01%+4mV	0.2	115±10%			90
0-10	0-1	6214A	BENCH	.01%+4mV	.01%+4mV	0.2	115±10%		✓	115
0-10	0-2	6113A	STB	0.001%+1.1 mV	0.001%	0.04	115±10%	✓		375
0-10	0-10	6282A	MPB-5	1 mV+0.01%	1 mV+0.01%	0.5	115±10%	✓	✓	350
0-10	0-20	6256B	LVR	.01%+200μV	.01%+200μV	0.2	115±10%	✓	✓	450
0-10	0-50	6259B	LVR	200μV+0.01%	200μV+0.01%	0.1	230±10%			650
0-10	0-100	6260A	LVR	200μV+0.01%	200μV+0.01%	1.0	230±10%	✓	✓	775
13±20%	0-0.5	60122B	SLOT	0.05%	0.05%	1 mV	115±10%			†
13±20%	0-1	60123B	SLOT	0.05%	0.05%	1 mV	115±10%			†
13±20%	0-2.2	60125B	SLOT	0.05%	0.05%	1 mV	115±10%			†
13±20%	0-6	60126B	SLOT	0.05%	0.05%	1 mV	115±10%			†
±15±20%	0-0.2A	60153D	SLOT	0.03%	0.03%	0.3	115±10%			†
±15±20%	0-0.75	60155C	SLOT	0.03%	0.01%	0.3	115±10%			†
0-15	0-200	6453A	SCR-3	10 mV+0.2% combined		150	3φ 208/230/460 ±10%	✓	✓	1375
0-16 or 0-18	0-600 or 0-500	6466A	SCR-10	10 mV+0.2% combined		160 or 180	3φ 208/230/460 ±10%	✓	✓	2600
0-18	0-0.3	6343A	MOD	3 mV or 0.03%	3 mV or 0.03%	1.0	115±10%	✓		120
0-18	0-1	6344A	MOD	3 mV or 0.03%	3 mV or 0.03%	1.0	115±10%	✓		165
−20 to +20	0-0.5	6823A	PS/A	5 mV+0.02%	5 mV+0.02%	2	115±10%	✓	✓	194
0-20	0-0.6	6204B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓		144
0-20 and 0-40	0-0.6 and 0-0.3	6205B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓		235
0-20	0-1	6101A	STB	600μV+0.001%	0.001%	0.04	115±10%	✓		265
0-20	0-1	6111A	STB	600μV+0.001%	0.001%	0.04	115±10%	✓		375
0-20	0-1.5	6200B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓	✓	189
0-20	0-1.5	6201B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓	✓	169
0-20 Dual	0-3	6253A	DPR	4 mV+0.01%	2 mV+0.01%	0.2	115±10%	✓	✓	445
0-20	0-3	6284A	MPB-3	4 mV+0.01%	2 mV+0.01%	0.2	115±10%	✓	✓	210
0-20	0-5	6285A	MPB-5	1 mV+0.01%	1 mV+0.01%	0.5	115±10%	✓	✓	350
0-20	0-10	6263B	LVR	200μV+0.01%	200μV+0.01%	0.2	115 Vac±10%	✓	✓	435
0-20	0-10	6286A	MPB-5	1 mV+0.01%	1 mV+0.01%	0.5	115±10%	✓	✓	395
0-20	0-15	6427B	SCR-1P	20 mV	10 mV	40	115±10%	✓	✓	380
0-20	0-20	6264B	LVR	200μV+0.01%	200μV+0.01%	0.2	115 Vac±10%	✓	✓	525
0-20	0-45	6428B	SCR-1P	40 mV	20 mV	40	115±10%	✓	✓	550
0-24	0-3	6224B	MPM	.01%+4 mV	.01%+2 mV	0.2	115±10%	✓	✓	325
0-25	0-0.2	801C	—	2 mV	2 mV	0.1	105-125			175
0-25	0-0.4	6215A	BENCH	.01%+4 mV	.01%+4 mV	0.2	115±10%			90
0-25	0-0.4	6216A	BENCH	.01%+4 mV	.01%+4 mV	0.2	115±10%		✓	115
0-25	0-1	6220B	MPM	.01%+2 mV	.01%+2 mV	0.2	115±10%	✓	✓	250
26±20%	0-0.25	60242A	SLOT	0.05%	0.05%	1 mV	115±10%			†
26±20%	0-0.5	60243B	SLOT	0.05%	0.05%	1 mV	115±10%			†
26±20%	0-1	60244B	SLOT	0.05%	0.05%	1 mV	115±10%			†
26±20%	0-1.5	60245B	SLOT	0.05%	0.05%	1 mV	115±10%			†
26±20%	0-3.5	60246B	SLOT	0.05%	0.05%	1 mV	115±10%			†

HEWLETT hp PACKARD



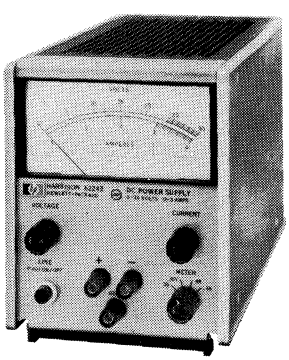
HVR



SCR



BENCH



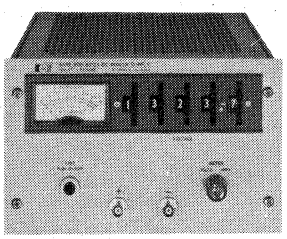
MPM

Output (volts)	Output (amperes)	Model	Series	Load regulation (mV)	Line regulation (mV)	RMS ripple & noise (mV)	Input line voltage (Vac)	Remote programming	CV/CC*	Price
0-30	0-0.15	721A	—	30 mV	±15 mV	0.15	115±10%			$145
0-30	0-1	6206B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓		169
0-36	0-0.15	6346A	MOD	3 mV or 0.02%	3 mV or 0.02%	1.0	115±10%	✓		120
0-36	0-0.5	6347A	MOD	3 mV or 0.02%	3 mV or 0.02%	1.0	115±10%	✓		165
0-36	0-10	6433B	SCR-1P	36 mV	18 mV	36	115±10%	✓	✓	370
0-36	0-100	6456B	SCR-3	10 mV+0.2% combined		160	3φ 208/230/460 ±10%	✓	✓	1275
0-36	0-300	6469A	SCR-10	10 mV+0.2% combined		180	3φ 208/230/460 ±10%	✓	✓	2300
0-40	0-0.3	6204B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓		144
0-40 and 0-20	0-0.3 and 0-0.6	6205B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓		235
0-40	0-0.5	6102A	STB	350μV+0.001%	0.001%	0.04	115±10%	✓		265
0-40	0-0.5	6112A	STB	350μV+0.001%	0.001%	0.04	115±10%	✓		375
0-40	0-0.75	6200B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓	✓	189
0-40	0-0.75	6202B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓	✓	169
0-40 Dual	0-1.5	6255A	DPR	2 mV+0.01%	2 mV+0.01%	0.2	115±10%	✓	✓	445
0-40	0-1.5	6289A	MPB-3	2 mV+0.01%	2 mV+0.01%	0.2	115±10%	✓	✓	210
0-40	0-3	6265B	LVR	200μV+0.01%	200μV+0.01%	0.2	115 Vac±10%	✓	✓	350
0-40	0-3	6290A	MPB-5	1 mV+0.01%	1 mV+0.01%	0.5	115 Vac±10%	✓	✓	350
0-40	0-5	6266B	LVR	200μV+0.01%	200μV+0.01%	0.2	115 Vac±10%	✓	✓	435
0-40	0-5	6291A	MPB-5	1 mV+0.01%	1 mV+0.01%	0.5	115±10%	✓	✓	395
0-40	0-10	6267B	LVR	200μV+0.01%	200μV+0.01%	0.2	115 Vac±10%	✓	✓	525
0-40	0-25	6434B	SCR-1P	40 mV	18 mV	40	115±10%	✓	✓	550
0-40	0-30	6268A	LVR	200μV+0.01%	200μV+0.01%	1	230±10%	✓	✓	695
0-40	0-50	6269A	LVR	200μV+0.01%	200μV+0.01%	1 mV	230±10%	✓	✓	875
−50 to +50	0-1	6824A	PS/A	5 mV+0.02%	5 mV+0.02%	10	115±10%	✓	✓	350
0-±50	0-1	6130A	DVS	2 mV	2 mV	1 mV	115±10%	✓		1500
0-50	0-0.2	6217A	BENCH	.01%+1 mV	.01%+4 mV	0.2	115±10%			90
0-50	0-0.2	6218A	BENCH	.01%+1 mV	.01%+4 mV	0.2	115±10%		✓	115
0-50	0-0.5	6177B	CCB	25 PPM	25 PPM	50PPM	115±10%	✓		425
0-50	0-0.5	6220B	MPM	2 mV+.01%	2 mV+.01%	0.2	115±10%	✓	✓	250
0-50	0-1.5	6226B	MPM	2 mV+0.01%	0.2 mV+0.01%	0.2	115±10%	✓	✓	325
0-60	0-0.5	6206B	LAB	4 mV+0.01%	4 mV+0.01%	0.2	115±10%	✓		169
0-60	0-1	6294A	MPB-3	2 mV+0.01%	2 mV+0.01%	0.2	115±10%	✓	✓	210
0-60	0-3	6296A	MPB-5	1 mV+0.01%	1 mV+0.01%	0.5	115±10%	✓	✓	395
0-60	0-3	6271B	LVR	200μV+0.01%	200μV+0.01%	0.2	115 Vac±10%	✓	✓	435
0-60	0-5	6438B	SCR-1P	60 mV	30 mV	120	115±10%	✓	✓	360
0-60	0-15	6439B	SCR-1P	120 mV	60 mV	60	115±10%	✓	✓	550
0-60	0-15	6274A	LVR	0.2 mV+0.01%	2 mV+.01%	0.5	115±10%	✓	✓	695
0-64	0-50	6459A	SCR-3	10 mV+0.2% combined		160	3φ 208/230/460 ±10%	✓	✓	1275
0-64	0-150	6472A	SCR-10	100 mV+0.2% combined		160	3φ 208/230/460 ±10%	✓	✓	2600
0-100	0-0.2	6106A	STB	200μV+0.001%	0.001%	0.04	115±10%	✓		265
0-100	0-0.2	6116A	STB	200μV+0.001%	0.001%	0.04	115±10%	✓		375
0-100	0-0.25	6181B	CCB	25 PPM	25 PPM	50PPM	115 Vac±10%	✓		425
0-100	0-0.5	6131A	DVS	2 mV	2 mV	5.0	115±10%	✓		1500
0-100	0-0.75	6299A	MPB-3	2 mV+0.01%	2 mV+0.01%	0.2	115±10%	✓	✓	225
0-110	0-100	6475A	SCR-10	100 mV+0.2% combined		220	3φ 208/230/460 ±10%	✓	✓	2600
0-120	0-2.5	6443B	SCR-1P	120 mV	60 mV	240	115±10%	✓	✓	360
0-160	0-0.2	6207B	LAB	2 mV+0.02%	2 mV+0.02%	0.5	115±10%	✓	✓	235
0-160	0-0.4	6354A	MOD	2 mV+0.005%	1 mV+0.005%	1.0	115±10%	✓	✓	259
0-220	0-50	6477A	SCR-10	100 mV+0.2% combined		330	3φ 208/230/460 ±10%	✓	✓	2600
0-300	0-35	6479A	SCR-10	100 mV+0.2% combined		300	3φ 208/230/460 ±10%	✓	✓	2600

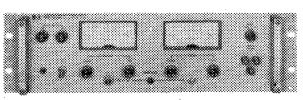
Note: Virtually all hp units can be rack mounted in accordance with standard RETMA 19″ systems: Some may require rack kits.
*Automatic crossover between constant voltage (CV) and constant current (CC) operation.
†Check with local hp sales offices for quantity price.

additional listing on next page

DC power supplies



STB



ICS

Output (volts)	Output (amperes)	Model	Series	Load regulation (mV)	Line regulation (mV)	RMS ripple & noise (mV)	Input line voltage (Vac)	Remote programming	CV/CC*	Price
0-320	0-0.1	6209B	LAB	2 mV+0.02%	2 mV+0.02%	1.0	115±10%	√	√	235
0-320	0-0.2	6357A	MOD	2 mV+0.005%	1 mV+0.005%	1.0	115±10%	√	√	259
0-320	0-0.6	890A	MVR	10 mV or 0.007%	10 mV or 0.007%	1.0	115±10%	√		445
0-320	0-1.5	895A	MVR	10 mV or 0.007%	10 mV or 0.007%	1.0	115±10%	√		625
−250 to −400 0 to−900	.03-.05 0-10 μA	715A‡	—	1% 1%	1% 1%	7 10	115/230±10%			365
0-500	0-0.1	711A‡	—	1000 or 0.5%	1000 or 0.5%	1	115/230±10%			275
0 to 500 −300 0 to 150	0-0.2 0-0.05 0-0.005	712C‡	—	0.01% +5 mV 50 mV 50 mV	0.01% +50 mV 50 mV 50 mV	0.5 30 15	115±10%	√	√	490
0-440 or 0-500 or 0-600	0-25 or 0-20 or 0-15	6483B	SCR-10	100 mV+0.5% combined		440 500 600	3φ208/230/460 ±10%	√	√	2600
1-600	0-1.5	6448B	SCR-1P	600 mV	600 mV	600 mV	115 V ac±10%	√	√	550
−250 to−800 0 to−800 6.3 V (ADJ)	0-2.0	716B‡	—	0.05% — —	0.05% 0.05% 1%	1 0.5 2	115/230±10%			875
0-1000	0-0.2	6521A	HVR	20 mV or 0.005%	20 mV or 0.005%	1.0	115±10%		√	750
0-1600	0-0.005	6515A	HVB	16 mV or 0.01%	16 mV or 0.01%	2.0	115±10%			235
0-2000	0-0.1	6522A	HVR	20 mV or 0.002%	20 mV or 0.005%	1.0	115±10%		√	750
0-3000	0-0.006	6110A	STB	100μV+0.001%	0.001%	0.4	115±10%			495
0-3000	0-0.006	6516A	HVB	16 mV or 0.01%	16 mV or 0.01%	2.0	115±10%			295
0-4000	0-0.05	6525A	HVR	20 mV or 0.001%	20 mV or 0.005%	1.0	115±10%		√	750

All Supplies: 50°C maximum ambient temperature rating. Floating output (ground either side), continuously variable output, low output impedance at all frequencies, 3-wire input, computer-quality electrolytics, 1 year warranty. No turn-on, turn-off overshoot; short-circuit-proof, all semiconductor except as noted by‡.

Transistor Supplies: Glass-epoxy printed circuit board construction, fully automatic overload protection — short-circuit-proof.

Our 1969 Catalog/Handbook

In it you will find more guidelines for selecting the right power supply for your specific application. It contains AN-90, our application note which gives specifications, definitions, explanations, illustrations, and applications for the complete hp line of DC power supplies. You need only ask your local hp sales office for assistance, or write Hewlett-Packard Company, 110 Locust Avenue, Berkeley Heights, New Jersey 07922. Europe: 1217 Meyrin, Geneva.

Applications Service

Hewlett-Packard staff engineers are available for additional technical assistance, for applications information, and technical data on DC power supplies. He's as near as your telephone. Moreover, the field office engineer is backed by factory specialists. Many times the problem is directed there: at New Jersey Division, 110 Locust Avenue, Berkeley Heights, New Jersey 07922. Telephone: (201) 464-1234.

Additional Literature

Additional literature on applications are available. Besides the 1969 DC Power Supply Handbook described here, there is other applications information available. These are described below by title:

AN-82 — Power Supply Amplifier: Concepts and Modes of Operation

TL-2 — Constant Voltage/Constant Current Regulated Power Supplies

TL-5 — Method of Achieving Constant Current Operation Utilizing a Constant Voltage Power Supply

TL-7 — Notes on DC Power Supply Isolation Measurement

HEWLETT hp PACKARD

POWER SUPPLIES

Hewlett-Packard, N.J. Division • 110 Locust Avenue
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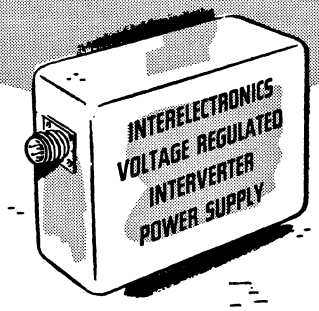
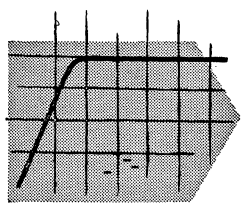
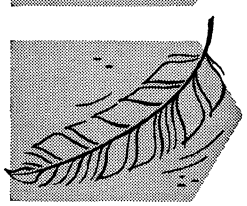
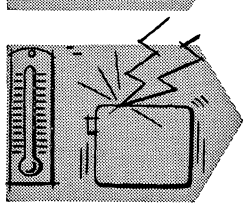
In Europe: 1217 Meyrin, Geneva

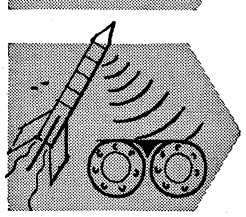
PROVEN RELIABILITY—
DC-DC, DC-AC, SOLID-STATE POWER INVERTERS
over 260,000 logged hours— voltage-regulated, frequency-controlled, for missile, telemeter, ground-support, 135°C all-silicon units available now—

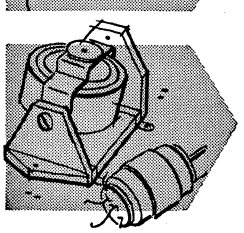












Interelectronics all-silicon thyratron-like gating elements and cubic-grain toroidal magnetic components convert DC to any desired number of AC or DC outputs from 1 to 10,000 watts.

Ultra-reliable in operation (over 260,000 logged hours), no moving parts, unharmed by shorting output or reversing input polarity. High conversion efficiency (to 92%, including voltage regulation by Interelectronics patented reflex high-efficiency magnetic amplifier circuitry).

Wide input voltage range (1 to 250 volts DC). Wide input voltage regulation (output voltage maintained with variations up to 50% in input voltage).

Light weight (to 6 watts/oz.), compact (to 8 watts/cu. in.), low ripple (to 0.01 mv. p-p), excellent voltage regulation (to 0.1%), precise frequency control (to 0.2%) with Interelectronics extreme environment magnetostrictive standards or to 0.0001% with fork or piezoelectric standards.

Complies with MIL specs. for shock (100G 11 misc.), acceleration (100G 15 min.), vibration (100G 5 to 5,000 cps.), temperature (to 150 degrees C), RF noise (I-26600).

AC single and polyphase units supply sine waveform output (to 2% harmonics), will deliver up to ten times rated line current into a short circuit to actuate MIL type magnetic circuit breakers or fuses, will start gyros and motors with starting current surges up to ten times normal operating line current.

Now in use in major missiles, powering telemeter transmitters, radar beacons, electronic equipment. Single and polyphase units now power airborne and marine missile gyros, synchros, servos, magnetic amplifiers.

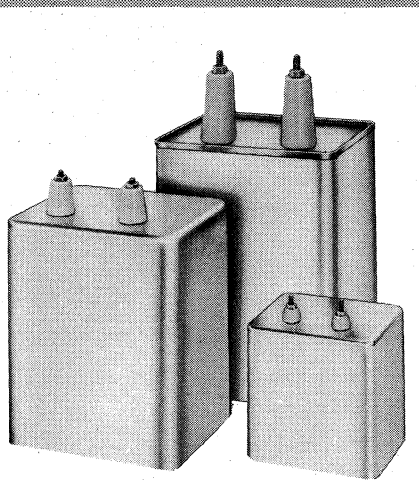
Interelectronics—first and most experienced in the solid-state power supply field produces its own all-silicon solid-state gating elements, all high flux density magnetic components, high temperature ultra-reliable film capacitors and components, has complete facilities and know how—has designed and delivered more working KVA than any other firm!

For complete engineering data, write Interelectronics today, or call (914) EL 8-8000 in Congers.

INTERELECTRONICS CORPORATION
550 U.S. Route 303, Congers, New York 10920

HIPOTRONICS INC.

HIGH VOLTAGE POWER PACKS



The Hipotronics wide range of compact miniaturized power packs with output voltages from 2 to 100 KV and current ratings of 2, 5 or 10 milliamperes are designed for long life and trouble free operation. Advanced high voltage techniques developed by Hipotronics permit greater size and weight reduction than previously possible.

All units are housed in a hermetically sealed MIL-T-27A can and vacuum filled with mineral type transformer oil or epoxy. The insulating medium insures corona-free operation and allows for running the supply at 3 or 4 times normal current rating for long periods of time. The corona free operation precludes component failure caused by long term corona degradation of insulation and guarantees a pure DC output free of any interfering high frequency signals which might possibly influence or affect the system which it is powering.

Every component in the supply is operated at well below its design rating and pre-assembly hipotted at one and one half times its operating voltage.

The output connections are high voltage ceramic type on models 30 KV and below and through plug in re-entrant receptacles for coaxial cables on greater than 30 KV units. Three foot cable assemblies are supplied with each re-entrant bushing type and longer ones are easily assembled if required.

Output Voltage Kilovolts	Current Milliamperes	Model	Height	Width	Depth	Price
2.5 KV	2 ma.	2.5A	3½″	3¾″	2¾″	$ 50
2.5 KV	5 ma.	2.5B	3½″	3¾″	2¾″	60
2.5 KV	10 ma.	2.5C	4¼″	3⅞″	3⅜″	70
5 KV	2 ma.	5A	4¼″	3⅞″	3⅜″	65
5 KV	5 ma.	5B	4¼″	3⅞″	3⅜″	75
5 KV	10 ma.	5C	5¼″	3⅞″	3⅜″	90
7.5 KV	10 ma.	7.5C	5¼″	3⅞″	3⅜″	110
10 KV	2 ma.	10A	5¼″	3⅞″	3⅜″	75
10 KV	5 ma.	10B	5¼″	3⅞″	3⅜″	95
10 KV	10 ma.	10C	6⅛″	4⅝″	4″	125
15 KV	5 ma.	15B	6⅛″	4⅝″	4″	125
15 KV	10 ma.	15C	6⅛″	4⅝″	4″	150
20 KV	2 ma.	20A	6⅛″	4⅝″	4″	135
20 KV	5 ma.	20B	6⅛″	4⅝″	4″	180
25 KV	10 ma.	25C	10″	6″	5″	350
30 KV	2 ma.	30A	10″	6″	5″	190
30 KV	5 ma.	30B	10″	6″	5″	250
40 KV	2 ma.	40A	12″	6″	5″	270
50 KV	5 ma.	50B	10″	6″	8″	390
60 KV	2 ma.	60A	10″	6″	8″	325
100 KV	2 ma.	100A	15½″	8⅛″	9¼″	625

FEATURES

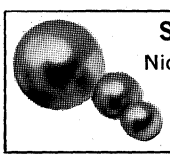
- **Hermetically sealed, oil or epoxy filled**
- **Solid state rectifiers**
- **10 year life**
- **Low ripple**
- **Good regulation**
- **Compact, highly miniaturized**
- **Reversible polarity**

Inquiries are invited for units with outputs different than our standards, with built in line regulation, short circuit current limited units, lower output ripple, with 220V, 50/60 cycle inputs or with center tapped output etc.

SPECIFICATIONS FOR ALL MODELS

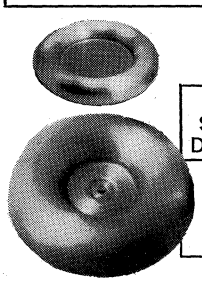
Input	0-125 volts, output voltages and currents stated for nominal 117 volt input.
Regulation	10 to 15% no load to full load
Ripple	1/2% rms per milliampere output
Life	10 years at 25°C ambient with rated output voltage and current
Terminations	Ceramic bushings on 30 KV and below models Re-entrant receptacles with 3 foot mating coaxial cables on 40 KV and up models

HV TERMINATIONS



SPHERES
Nickel plated with threaded insert

Diameter		Diameter	
1″	$2.00	6″	$10.00
2″	3.00	8″	20.00
3″	4.00	10″	40.00
4″	5.00	12″	50.00



TOROIDS

Cross Section Diameter	Outside Diameter	Inside Diameter	Price
2″	10″	6″	$ 30.00
5″	20″	10″	$200.00

SEND FOR CATALOG

HIPOTRONICS INC.

High-Potential Electronics

BREWSTER, N. Y. 10509 / (914) 279-8091

HIPOTRONICS INC.

HIGH VOLTAGE POWER SUPPLIES AND POWER PACKS

Hipotronics has a complete line of unregulated high voltage power supplies with output voltages ranging from 1 to 600 KV and with current outputs from 2.5 ma to 10 amperes.

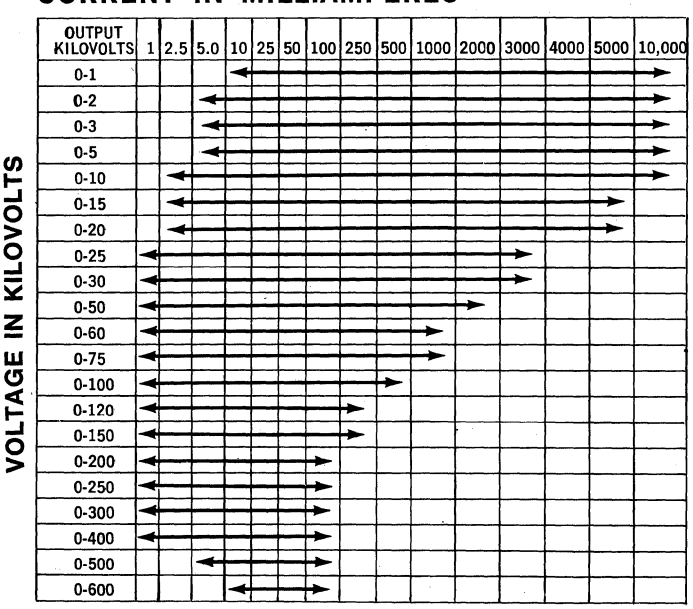
All units are conservatively designed for continuous use and are available with fully instrumented control consoles or less controls for use in OEM equipment or with existing controllers.

They are designed for maximum equipment and operator protection. The surge devices preclude injury to any component from repeated short circuits at full output and the many safety devices insure operator protection.

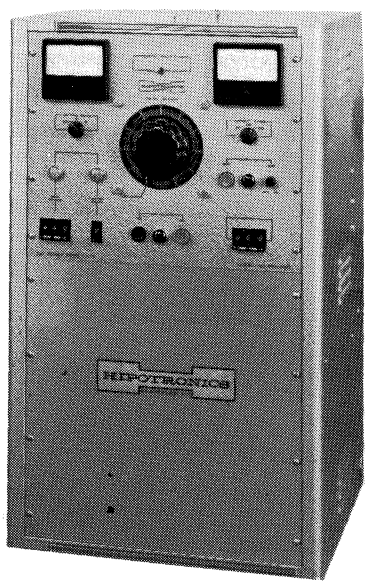
FEATURES

- **Reversible polarity**
- **Output shorting relay with discharge resistor**
- **Surge limiting resistor in output lead**
- **Continuously variable output control**
- **Continuously variable overvoltage control (optional extra)**
- **Continuously variable overcurrent control**
- **Zero start interlock**
- **External interlock provision**
- **Door interlocks**
- **HV on and off push buttons**
- **Circuit breaker input**
- **Functional pilot lights**
- **Triple range KV meter, 2% accuracy**
- **Triple range current meter, 2% accuracy**
- **Surge protection on meters, relays, transformers**
- **Vernier output (optional extra)**

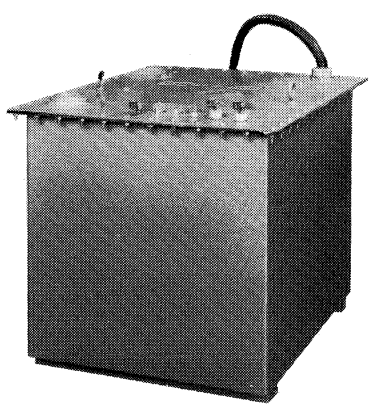
CURRENT IN MILLIAMPERES



MODEL NUMBER FORMED BY PREFIXING 8 to KV and hyphenating current i.e. 60KV, 50ma is Model No. 860-50; 1KV at 1000 ma. is Model 81-1000. WRITE FACTORY for size, weights, prices, specifications etc. of any model in arrowed area. If your requirement can not be satisfied with one of our standard models listed above, send us specifications for prompt proposal.



Model 810-500



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HIPOTRONICS, INC. / BREWSTER, N. Y. 10509 / (914) 279-8091

200 SERIES

AC INPUT

GUARDED AND UNGUARDED D.C. CURRENT SUPPLIES FOR PRECISION POTENTIOMETERS



GUARDED UNIT (CASE-19)



GUARDED UNIT CASE-05)

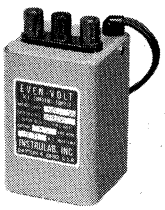
PERFORMANCE:

TYPE UNIT		UNGUARDED UNITS					GUARDED UNITS	
Letter Designation		NONE	-NW-	-ND-	-NWS-	-NDS-	G-NW-	G-ND-
Line Regulation in percent continuous or instantaneous output change per 10 Volt line change. (Long Term & Short Term)		0.005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Temperature Coefficient in percent per °C referred to 25°C over 0 to 65°C ambient		±0.0005	±0.0005	±0.0005	±0.0005	±0.0005	±0.0005	±0.0005
Time Stability (Max. Drift Non-Cumulative)	PPM/hr	—	10	4	10	4	5	2
	PPM/24hr	100	25	10	25	10	25	5
	PPM/100 hr	—	100	50	100	50	100	30
Minimum **AC ISOLATION** in equivalent capacitance (picofarads) (1)	OUTPUT TO INPUT	1	1	1	0.05[1]	0.05[1]	0.01	0.01
	OUTPUT TO GUARD	—	—	—	—	—	20	20
	OUTPUT TO GROUND	100	100	100	100	100	30	30
	OUTPUT TO GROUND	—	—	—	—	—	20	20
Minimum **DC ISOLATION** in resistance (Ohms at 50% RH)	OUTPUT TO INPUT	10^{10}	10^{10}	10^{10}	10^{11}	10^{11}	10^{12}	10^{12}
	OUTPUT TO GUARD	—	—	—	—	—	10^{9}	10^{9}
	OUTPUT TO GROUND	10^{10}	10^{10}	10^{10}	10^{10}	10^{11}	10^{12}	10^{12}
	OUTPUT TO GROUND	—	—	—	—	—	10^{12}	10^{12}
RIPPLE (% RMS)		0.003	0.003				0.001	
RANDOM NOISE (0.6 to 2KC/P-P)		100μV	0.0003% or output					

[1] 0.05 picofarads will produce a leakage current of about 4 nanoamps peak to peak through 1 megohm with 117 volts 60 cycle line voltage input.

500 SERIES

AC INPUT



REGULATED D.C. POWER SUPPLY

SELECTION CHART

Model No.	OUTPUT Volts D.C. (Specify a Voltage)	Current Ma.	Nominal Output Voltage Tolerance
501-**	1 to 10.0 in ½ V Steps	0 - 50	0.5%
502-**	1 to 10.0 in ½ V Steps	0 - 50	0.1%

** When ordering select case number from case illustrations.
Other voltages, currents and specifications available. Please contact factory or representative for additional information.

SPECIFICATIONS:

UNIT CHARACTERISTICS

INPUT: 117 V A.C. ±17 V — 50-60 C 8 Watts (other line voltages and frequencies available).
OUTPUT: Volts: Available in any one nominal voltage ½ V steps from 1.0 through 10.0 V D.C.
Current: 0 - 50 Ma.
Output Impedance: Maximum .01 ohm.
Regulation: Line Voltage Changes: 0.5% Maximum for ±17 V A.C. Load Changes: .05% Maximum for 0 to 50 Ma. Load.
Temperature Coefficient: Maximum ±.003%/°F.
Overall Accuracy: ±0.15%.
Ambient Temperature Range: 0 to 120°F.
Ripple: Maximum 0.01%.
Isolation: Output to A.C. input line — less than equivalent of 2 picofarads.
Cases: Available in Case Nos. 03, 05, 09 and 11. See outline drawings. Specify case number on your order.
Shipping Weight: 2½ lbs.

900 SERIES

RESISTANCE TO CURRENT CONVERTERS

SPECIFICATIONS:

INPUT:
Signal: 3-Wire or 2-Wire Potentiometer-Type Resistive Element with standard nominal spans of 100, 200, 500 and 1,000 ohms as specified. 1.0 Volt D.C. will be impressed across resistive element unless otherwise specified. Input lead resistance unbalance of 2% of span allowable.



Power: 117 Volts, 50-60 CPS ±15 Volts, 7 Watts.
CONTROLS:
Zero: Live zero, adjustable ±2% of total span.
Span: Adjustable ±5% over specified input span of 100, 200, 500, or 1,000 ohms.

900 SERIES (Continued)

OUTPUT:

	D.C. CURRENT	(Nominal Load (ohms) Includes Lead Resistance MINIMUM	MAXIMUM
Model 903	−2.5 to 0 to +2.5 Ma.	0	1,000
Model 905	0 to 5 Ma. basic with 1-5, 0-4 to 2.0 Ma. as specified.	0	5,000
Model 920	4 to 20 Ma.	0	1,500
Model 950	10 to 50 Ma.	0	—

Outputs are easily changed. -Other output currents from spans of 100 μa. minimum to 40 Ma. maximum can be provided on special order.

CASE:
No. 18: For surface mounting 6″ L x 3 1/16″ W x 3⅝″ H
No. 61: For panel mounting 3 7/16″ W x 7″ H x 12¼″ D
No. 91: Plug-in rack mounting 3 7/16″ W x 7″ H x 12¼″ D
May be used in 91 A rack adapter for multiple unit mounting. (Maximum 5 units/rack)
Above cases for non-hazardous locations. Other cases available on request.

PERFORMANCE:
Interference Rejection: Output effect less than 1% full scale when 100 V (rms) at 60 CPS is applied as interference signal.
Frequency Response: ½ second (speeds to ½ millisecond available).
Ripple: 0.02% RMS or 1 microamp pk to pk whichever is greater.
Output to Input Isolation: None. Either positive or negative ground can be used.
Output or Input to Line Isolation: Less than 5 picofarads equivalent capacitance.
Operating Temperature Range: 0 to 125°F.
Accuracy: ±0.5% or ±5 microamps, whichever is greater.
Repeatability: ±0.1% or ±5 microamps, whichever is greater.

930 SERIES

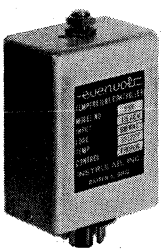
PROGRAMMABLE CONSTANT CURRENT SUPPLY



SPECIFICATIONS

Type: Solid state current regulated power supply.
Range: As specified continuously adjustable or step-selected from 0.1 thru 50 Ma.
Compliance Voltage: 15 volts D.C. maximum.
Line Regulation: 0.005% or 0.5 μa (whichever is greater) for 10% line change. Long and short term.
Load Regulation: 0.005% or 1.0 μa (whichever is greater) for 0 to 100% load change.
Temperature Coefficient: ±0.002% per °C. (0.0005% per °C available).
Time Stability: 0.005%/24 hrs., non-cumulative.
Output Impedance: Greater than 0.5 megohms.
Ripple & Random Noise: 0.01 μa RMS maximum.
Output Selector: Front panel mounted.
Terminal Connections: Rear mounted terminal board for output, meter and ground.
Power Supply: 100 to 135 volts, 60 cycles, 6 watts with 3 conductor line cord and fuse.
Case: 19″ rack, 3½″ H x 8⅞″ deep with handles.

9511 SERIES



TEMPERATURE CONTROLLER

SPECIFICATIONS FOR A MINIATURIZED TEMPERATURE CONTROL SYSTEM

INPUT: 115 V AC ±15% 60 Hz.
LOAD: Power handling capabilities up to 500 watts* (non-inductive) without relays.
OFF CURRENT: 20 Ma. Maximum.
CONTROL ACTION: Proportioning; Adjust internal potentiometer (accessible through side of case) to adjust proportioning band sensitivity. (Range of proportional band sensitivity can be varied for the applications.)
AMBIENT TEMPERATURE: 80 - 120°F.
SIZE: 4.0 H x 2.5 x 1.6 inches (Space Saver Size).
TEMPERATURE RANGE ADJUSTMENT: Adjust potentiometer on top of case for temperature set.
RANGES AVAILABLE: 210 to 300, 280 to 400, 350 to 500, 420 to 600°F. Other ranges and wattages and case configurations available.
***1 KW @ 220 VOLTS** — specify Model 9521.
Other temperature controllers are available with readout, manual reset for high limit, and adjustable set point.

9519 SERIES



TEMPERATURE CONTROLLER

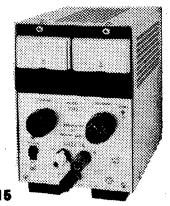
SPECIFICATIONS:

INPUT: 115 VAC ±15%, 50-60 Hz, 1.5 kw max. load @ 65°C; or 200 VAC ±15%, 50-60 Hz, 3.0 kw max. load @ 65°C. — Specify Model 9529.
TEMPERATURE RANGES: See chart.
SENSOR: Thermistor, 5% interchangeability (approx. ½°C).
ADJUSTABLE SET POINT: External.
CONTROL ACTION: Close proportioning control is provided by varying the off time to control output power according to load requirements.
CONTROL SENSITIVITY: Internally adjustable. See chart below for specific models.
AMBIENT OPERATING TEMPERATURE: 32°F to 175°F (0°C to 80°C). Load de-rates linearly from rated power at 65°C to "0" watts at 85°C.
RADIO FREQUENCY INTERFERENCE: Exceptionally low because of zero angle electronic switching.
HOUSING: Black Anodized Aluminum case provides ample cooling.

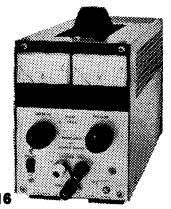
REGULATED DC POWER SUPPLIES

TRANSISTORIZED MODELS "ECONOMY SERIES"

MODEL	DC OUTPUT		RIPPLE (mVp-p)	REGULATION (mV)	
	VOLTS	AMPS		LINE (±10%)	LOAD
7314A	1～15	0.5	3	20	30
7315		1	2	10	10
7316		2	2	10	10
7315A	0.5～20	1	2	10	10
7324	1～30	0.5	2	10	10
7325		1	2	10	10
7326		2	2	10	10
7334	1～60	0.5	3	10	10
7335		1	3	10	10
7353	2～100	0.3	2mVrms	20	30
7372	5～300	0.15	3mVrms	40	60



MODEL 7315

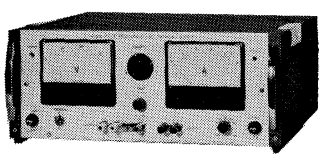


MODEL 7316

* Compact, light weight and rich variety as below:
* In the event of overload or output short-circuit trouble, an output current limiting circuit of accurate performance works accordingly.
* Limiting current can be set continuously within the range of 10%～100% of the maximum range. Also can be used as the constant-current power supply.
  (However except model 7314A・7315A)
* By using same types more than 2 sets, the operation can be made either in series connection or in parallel connection (However except model 7314A)
* The panel size is 1/4 rack, and these types can be set four models in 19-inch rack or 500mm standard rack.
* Dimensions of these series-types have two divisions as follows;
  "A type" 7314A, 7315, 7315A, and 7324 types:.....
  .....111W×158H×205Dmm Net Weight: 3Kg approx.
  "B type" Except the above types:.....
  .....111W×158H×345Dmm Net Weight: 5.7Kg approx.

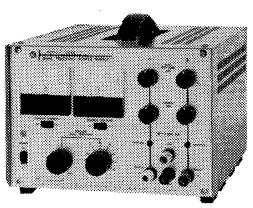
TRANSISTORIZED MODELS "SERIES-TYPES"

MODEL	DC OUTPUT		RIPPLE (mVp-p)	REGULATION (mV)	
	VOLTS	AMPS		LINE (±10%)	LOAD
713C	0～35	0.35 (0.5)	3	30	30
717C		1.5	2	20	20
719B		3 (3.5)	3	30	30
7124		5	2	2.5	5
716B		10	3	10	10
7329		20	3mVrms	10	10
7337A	0～50	5	1mVrms	0.01% +1mV	0.01% +2mV
7339		15	3mVrms	10	10
733	0～70	1	2	30	30
7133		2.5	2	5	10
7355	0～110	1	5 (0.05% +0.1mA)	(0.01% +2mV) (0.2% +0.1mA)	(0.01% +2mV) (0.2% +0.1mA)
7375	0～300	1	10 (0.1% +0.1mA)	(0.01% +10mV) (0.2% +0.1mA)	(0.02% +10mV) (0.5% +0.1mA)
7025	0～±30	1	0.5mVrms	10	10
7034	0～±60	0.5	0.5mVrms	10	10

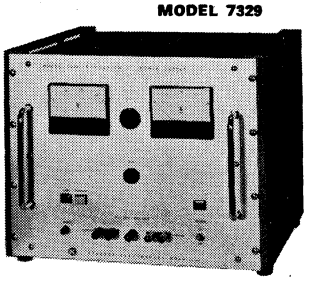


MODEL 7124

MODEL 7329



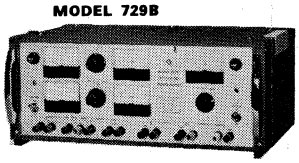
MODEL 7025



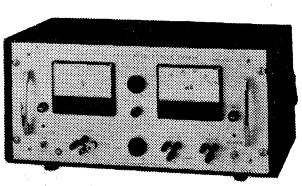
* These types have larger voltmeter and ammeter compared with the regulated DC power supply "ECONOMY SERIES"
* Model 7375 utilizes some vacuum tubes together with transistors, and cross-over type for constant voltage and current.

VACUUM TUBE MODELS "SERIES-TYPES"

MODEL	DC OUTPUT		RIPPLE (mVp-p)	REGULATION (mV)	
	VOLTS	AMPS		LINE (±10%)	LOAD
729	0～300	0.15	50	(1% +0.5V)	(±1% ±0.5V)
729B		0.15	50	(1% +0.5V)	(±1% ±0.5V)
722C	0～500	0.2	10	(0.3% +0.3V)	(±0.3% ±0.3V)
725C		0.5	10	(0.3% +0.3V)	(±0.3% ±0.3V)



MODEL 729B



MODEL 722C

* Model 729 is equipped with a variable negative voltage for C bias and unregulated AC voltage for heaters of tubes. Model 729B is the variation of model 729, having the same ratings plus a voltmeter and an ammeter for the output, +B1, +B2, another voltmeter for the C bias output.
* Model 722C and model 725C are also equipped with a variable negative voltage for C bias and unregulated AC voltage for heaters of tubes, besides the overload protector.

kikusui
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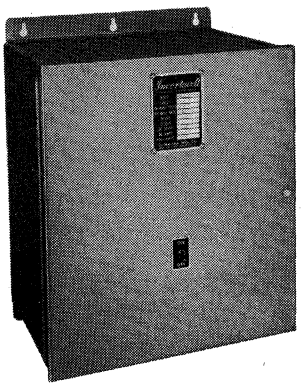
SOLE AGENT DATA INSTRUMENTS DIVISION
7300 CRESCENT BLVD. PENNSAUKEN, N.J. 08110
PHONE: (609) 662-3031 TWX: 710892-0786

LA MARCHE

INVERTERS POWER SUPPLIES



DC to AC Power Source with Regulated Sine Wave Output

DESCRIPTION

The La Marche MODEL A-51 is a completely solid state SCR inverter which provides a regulated, sine wave output for such applications as:

- Boiler Controls
- Telephone and Microwave Communications
- Burglar Alarms
- Supervisory Control Equipment
- Data Processing and Telemetering Equipment
- Nuclear and Missile Installations
- P.A. Systems
- Fire Alarms

SPECIFICATIONS

AC OUTPUT VOLTAGE .....120 Volts Nominal
LINE REGULATION .....±1% for ±15% DC Change
LOAD REGULATION .....±2% No Load to Full Load
FREQUENCY .....60 Cycle Nominal
FREQUENCY STABILITY .....±1% for Load, Input Voltage and Temperature Variations
WAVE SHAPE .....Sine Wave
DISTORTION .....Approximately 7%
OVERALL EFFICIENCY .....Approximately 65%
AMBIENT TEMPERATURE .....−20° to 60°C (0° to 140°F)

MODEL A-51-120 VOLT A.C. — 60 HZ SINE WAVE OUTPUT

Model No.	D.C. Input Voltage volts	D.C. Current Full Load amps	D.C. Current No Load amps	Continuous A.C. Current Load Rating Continuous V.A.	Continuous A.C. Current Load Rating Continuous amps	Price
A51-250-24V	24V	20.0	5.0	250	2.1	$ 990.
A51-250-48V	48V	9.0	3.0	250	2.1	1040.
A51-250-120V	120V	4.0	1.5	250	2.1	1100.
A51-500-24V	24V	40.0	10.5	500	4.2	1240.
A51-500-48V	48V	18.0	6.0	500	4.2	1450.
A51-500-120V	120V	8.0	3.0	500	4.2	1725.
A51-1K-24V	24V	80.0	18.0	1K	8.3	1850.
A51-1K-48V	48V	36.0	10.0	1K	8.3	1950.
A51-1K-120V	120V	15.0	5.5	1K	8.3	2100.
A51-2K-48V	48V	70.0	11.0	2K	16.6	2490.
A51-2K-120V	120V	28.0	6.0	2K	16.6	2740.
A51-3K-120V	120V	45.0	6.5	3K	24.9	3090.
A51-5K-120V	120V	75.0	7.0	5K	41.9	4400.

INVERTER ACCESSORIES

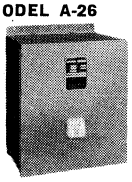
1. A.C. or D.C. Voltmeter $25.
2. A.C. or D.C. Ammeter $25.
3. Frequency meter $95.
4. A.C. Power Failure Relay $25.
5. Low D.C. Voltage Alarm Relay $38.
6. D.C. Circuit Breaker $35.
7. A.C. Circuit Breaker $25.
8. Ground Detection Relay $50.
9. Automatic Demand Panel $95.

ORDERING SPECIFICATIONS

1. La Marche model number.
2. Number and type of battery cells.
3. Ampere hour capacity of batteries.
4. AC loads.
5. Application.
6. Type and capacity of charging equipment.
7. Type of mounting, wall or rack mount.
8. Optional accessories.

FILTERED D.C. POWER SUPPLIES

MODEL A-26



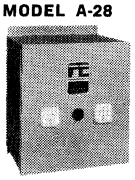
DESIGN FEATURES

1. Automatic in operation and self-regulating.
2. No moving parts. Nothing to arc or wear out.
3. No external controls. Cannot be tampered with.

The La Marche A-26 power supply features automatic load regulation and semi-automatic current limiting. The model A-26 is filtered to 10% ripple. There are no controls to be set for different applications because the amount of loading determines the current output.

The La Marche model A-26, like all La Marche units, is a solid state device employing a balanced isolation power transformer, a magnetic amplifier and sealed silicon diode rectifiers. These power supplies have no contacts, relays, switches, fans, tubes, time clocks or other moving parts.

MODEL A-28



DESIGN FEATURES

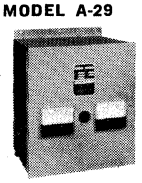
- Silicon diode rectifiers.
- Current limiting circuit.
- Automatic A.C. voltage compensation.
- D.C. voltage regulation.
- Output ammeter and voltmeter.

The model (A-28) is a solid state, fully automatic, constant voltage D.C. power supply designed for all regulated applications.

Standard features include automatic A.C. line compensation, D.C. voltage regulation and current limiting. The La Marche transistor controlled magnetic amplifier circuit is designed to automatically provide a D.C. output regulation of ±5" from no load to full rated output. Accurate output regulation is maintained with A.C. line variations of ±10%. The A-28 is offered in a wide range of sizes and voltages.

The reliability of the La Marche circuit has led to its selection for critical communication and control systems, nuclear powered ships, missile firing stations, and utility power standby systems.

MODEL A-29



ORDER SPECIFICATIONS

1. La Marche model number
2. A.C. input voltage, cycles, phase
3. Intermittent D.C. loads and duration
4. Continuous D.C. load
5. Amount of filtering — measured how?

The model (A-29) is a solid state, fully automatic, constant voltage D.C. power supply designed for all regulated applications.

Standard features include automatic A.C. line compensation, D.C. voltage regulation and current limiting. The La Marche transistor controlled magnetic amplifier circuit is designed to automatically provide a D.C. output regulation of ±1% from no load to full rated output. Accurate outputs regulation is maintained with A.C. line variations of ±10%. The A-29 is offered in a wide range of sizes and voltages.

The reliability of the La Marche circuit has led to its selection for critical communication and control systems, nuclear powered ships, missile firing stations, and utility power standby systems.

D.C. AMPS	12 VOLT A-26	12 VOLT A-28	12 VOLT A-29	24 VOLT A-26	24 VOLT A-28	24 VOLT A-29	32-36 VOLT A-26	32-36 VOLT A-28	32-36 VOLT A-29	48 VOLT A-26	48 VOLT A-28	48 VOLT A-29	130 VOLT A-26	130 VOLT A-28	130 VOLT A-29	260 VOLT A-26	260 VOLT A-28	260 VOLT A-29
3	$ 85.	$130.	$260.	$ 92.	$140.	$260.	—	—	—	—	$145.	$295.	—	—	$475.	$480.	$550.	$685.
6	94.	145.	290.	105.	156.	290.	—	—	—	$247.	350.	450.	$325.	425.	640.	655.	740.	840.
10	114.	177.	350.	150.	232.	430.	$160.	$246.	$490.	305.	425.	510.	395.	564.	850.	790.	850.	970.
15	130.	197.	425.	172.	265.	490.	—	—	—	235.	485.	720.	520.	650.	980.	970.	1175.	1580.
20	153.	226.	510.	193.	298.	510.	250.	318.	640.	350.	590.	815.	655.	780.	1185.	1180.	1490.	1870.
25	—	—	—	—	—	—	—	—	—	—	—	—	760.	895.	1250.	1390.	1690.	2040.
30	182.	265.	530.	224.	347.	530.	280.	354.	715.	420.	612.	930.	820.	1146.	1565.	1660.	1950.	2250.
35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1910.	2200.	2590.
40	205.	298.	745.	250.	384.	745.	340.	450.	990.	545.	781.	1020.	1120.	1330.	1750.	2100.	2450.	2860.
50	263.	375.	890.	295.	460.	890.	460.	612.	1360.	570.	820.	1260.	1260.	1550.	1970.	2350.	2950.	3340.
60	295.	425.	1050.	360.	510.	910.	540.	672.	1500.	710.	948.	1425.	1360.	2052.	2580.	2650.	3564.	3850.
75	326.	468.	1140.	455.	568.	1140.	655.	900.	2000.	765.	996.	1550.	1670.	2220.	3160.	—	—	—
85	—	—	—	—	—	—	—	—	—	—	—	—	1800.	2340.	3475.	—	—	—
100	394.	568.	1330.	582.	858.	1330.	—	—	—	860.	1140.	1750.	1990.	2460.	3840.	—	—	—
125	510.	702.	—	650.	995.	1540.	—	—	—	950.	1360.	2080.	—	—	—	—	—	—
130	626.	860.	—	695.	10.80	1660.	750.	960.	2150.	—	—	—	2400.	2868.	4550.	—	—	—
150	685.	950.	—	780.	1140.	1750.	820.	1194.	2650.	1050.	1420.	2180.	—	—	—	—	—	—
160	784.	1096.	—	860.	1252.	1790.	—	—	—	1110.	1548.	2250.	—	—	—	—	—	—
175	—	—	—	—	—	—	—	—	—	1190.	1620.	2490.	—	—	—	—	—	—
200	—	—	—	935.	1374.	1860.	1130.	1612.	3580.	1275.	1780.	2750.	—	—	—	—	—	—
250	—	—	—	—	1660.	2250.	—	—	—	1750.	2250.	3450.	—	—	—	—	—	—
300	—	—	—	—	2010.	2840.	—	—	—	2090.	2580.	3990.	—	—	—	—	—	—
400	—	—	—	—	2800.	3800.	—	—	—	2850.	3350.	5200.	—	—	—	—	—	—

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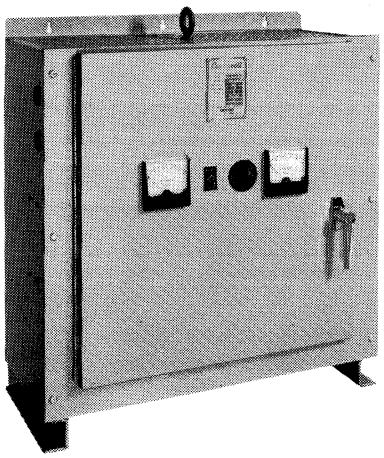

FLOAT BATTERY CHARGERS

LaMARCHE

GENERAL DESCRIPTION

The model A-11 Float Battery Charger is a completely automatic, solid state, constant voltage device having:

A.C. VOLTAGE COMPENSATION — D.C. VOLTAGE REGULATION — CURRENT LIMITING

The model (A-11) charger is designed and built to carry continuous and intermittent loads up to its maximum rated output. The A-11 is current limited at 140% of rated output. Each unit is designed and built to charge a specific type of battery containing a specific number of cells.

The La Marche Transistor Controlled magnetic-amplifier circuits provide continuous taper charging. Maintains rated output voltage within ±1% from no load to full load with A.C. input variations of ±10%. Silicon diodes are used for rectification.

The model A-11 charger floats lead-acid batteries at 2.17 volts per cell and by means of a front panel switch equalizes at 2.33 volts per cell. Both float and equalize voltages are adjustable to meet battery manufacturers recommendations. This type of charging imparts the longest battery life and is the accepted method for charging batteries used in standby service.

DESIGN FEATURES

1. Quality parts throughout. Silicon diode rectifiers and transistor magnetic amplifiers used exclusively.
2. A.C. power loss relay, output voltmeter/ammeter and fused input-output are standard on all models.
3. Eighty sizes available in five input voltages.
3. Eighty sizes available in five input voltages.
4. Adjustable equalize and float levels; float/equalize controls located on face panel for easy operation.
5. Design and operation tested and approved by battery manufacturers, utilities, railroads and military.

SPECIFICATIONS

STANDARD ACCESSORIES SUPPLIED:

1. Potentiometer for desired float and equalize charge voltage adjustments.
2. Quality D.C. ammeter and voltmeter with 50 millivolt movement, 2% accuracy.
3. Power failure relay with terminals for connections to a remote alarm system.
4. Fused A.C. input and D.C. output for complete protection.
5. Convenient switch to transfer from float charge to high rate equalize charge.
6. Internal terminal board for easy connection of A.C. input, D.C. output and power failure equipment.

OPTIONAL ACCESSORIES:

1. A.C. circuit breaker replacing fuse.
2. 0-24 hour equalizing timer.
3. Ground detection switch.
4. Low D.C. voltage alarm relay.
5. High D.C. voltage alarm relay.
6. Special paint.
7. Export packing add 5%.
8. Individual float/equalize adjustments, specify model A-11B.
9. Filtered units available, see model A-12.
10. Dual fusing for A.C. input and D.C. output replacing single input and output fusing.
11. Dual voltage A.C. input.
12. 1% taut band meters replacing 2% meters.
13. Relay rack mounting.

La Marche Model No. and Amperage Output	6 and 12 Volt Systems†	24 Volt Systems†	32 and 36 Volt Systems†	48 Volt Systems†	130 Volt Systems†	260 Volt Systems†
	Price	Price	Price	Price	Price	Price
A-11- 3-	$198.§	$240.§	$250.§	$260.§	$325.§	$580.§
A-11- 6-	230.§	265.§	310.§	310.§	496.§	750.§
A-11- 10-	245.§	350.§	390.§	414.§	576.§	890.§
A-11- 15-	300.§	395.§	460.§	580.§	694.§	1288.§
A-11- 20-	398.§	450.§	595.§	725.§	780.§	1645§*
A-11- 25-	—	—	—	755.§	970.§	1890.§*
A-11- 30-	480.§	500.§	730.§	845.§	1190.§	2070.§*
A-11- 35-	—	—	—	—	1250.§	—
A-11- 40-	560.§	575.§	795.§	980.§	1385.§*	2640.§*
A-11- 50-	698.§	740.§	980.§	1190.§*	1590.§*	2965.§*
A-11- 60-	890.§	910.§	1175.§	1310.§*	1950.*	3280.*
A-11- 75-	980.§	995.§	1250.§*	1495.§*	2650.§*	3875.*
A-11-100-	1100.*	1160.*	1350.§*	1655.§*	3375.§*	4550.*
A-11-125-	—	1340.*	1550.*	1890.*	3850.§*	5540.*
A-11-150-	—	1550.*	1870.*	2140.*	4380.*	6910.*
A-11-175-	—	—	—	—	4975.*	—
A-11-200-	—	1650.*	1980.*	2375.*	5460.*	7940.*
A-11-250-	—	1980.*	2685.*	3160.*	5980.*	—
A-11-300-	—	2495.*	—	3675.*	6450.*	—
A-11-350-	—	—	—	—	6920.*	—
A-11-400-	—	3550.*	—	4590.*	7290.*	—

NOTES:

*** A.C. INPUT**

Standard models are available in nominal A.C. line voltage of 120 208, 240, 480 and 550, single phase, 50/60 cycle. Models marked * are available in three phase only.

§ Underwriters Listed.

† BATTERY TYPES

The model A-11 chargers are available in the listed ampere capacities and **nominal D.C. voltages** for lead-acid, nickel-cadmium, nickel-iron alkaline and other types of batteries. **Specify number and type of battery cells.**

CALL FOR COMPLETE INFORMATION ON OUR VOLTAGE SENSING RELAYS & D.C. TO D.C. CONVERTERS

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KEPCO DESIGN FEATURES CHART

DESIGN GROUPS	PAGE INDEX	MODULAR GROUP	AUTOCROSSOVER GROUP	HIGH SPEED	HIGH VOLTAGE	GENERAL PURPOSE	SPECIAL PURPOSE	SOLID STATE	VACUUM TUBE	HYBRID	SCR	RESONANT TRANSFORMER	CONVECTION COOLED	FORCED-AIR COOLED	DESCRIPTION
ABC® TRANSISTORIZED	1994					*		*					*		2V–100V; 10W–20W; 1/2 rack
ABC® HYBRID	1988				*					*			*		200V–2500V; 20W; 1/2 rack
BHK	1989		●	●	*					*			*		500V–2000V; 200W; full rack
BOP	1985	●		*			●	*						*	Bipolar ±36V, ±5A; 1/2 rack
CC	1997			●			*	*					*		0.2–2A; 20W; I-C regulated, fast current regulation; 1/6 rack plug-in
CDT	1998						*	*					*		±15V, ±40V, ±100V; 20W; dual tracking
CK	1982		*			●		*						*	2V–60V; 40W; 1/2 rack
CK-HS	1986		●	*				*						*	2V–60V; 40W; 1/2 rack, high speed
CPS	1999	●					*	*						*	For integrated circuits, I-C regulated; 6V–15V; 60W–750W; 1/4, 1/2, full rack
HB	1990				*					*			*		325V–525V; 250W; full rack
JQE (HS)	1992	●		●		*		*						*	I-C regulated; 6V–100V; 60W–750W; 1/4, 1/2, full rack
KG	2000						*	*					*		Isolated for transducers; 25V–100V; 5W; 1/8 rack plug-in
KO	1983		*			●		*			*			*	12V–70V;1400W; full rack
KS	1984		*			●		*			*			*	8V–120V; 120W–1200W; full rack
OPS-B (TA)	1987	●	●	*	●		●	*					*		Power amplifier, I-C controlled; 7V-100V; 20W; "TA" – 1/6 rack plug-in
PAR	1975	*						*					*		Slot adjustable; 4V–60V; 100W module
PAT	1976	*						*					*		I-C regulated; 7V–100V; 20W module
PAX (HS)	1977	*		●				*					*		7V–100V; 10W module; 1/6 rack plug-in
PCX (MAT)	1978	*				●		*					*		I-C regulated; 7V–100V; 20W; "MAT"; 1/6 rack plug-in
PR	1995				●	*						*		*	15V–310V; 150W–600W; full rack
PRM	1980	*										*	*		5V–120V (fixed); 120W–180W module
PVS	2001						*	*	●				*		Precision voltage source, 100.00V; 100W; digital readout; 1/2 rack
PWR	1979	*						*				*	*		Slot adjustable; 4V–60V; 100W module
SM-A	1996				●	*		*				*		*	14V–325V; 100W–650W; full rack
WR	1991				*	●			*				*		400V–2500V; 60W–1000W; full rack

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* PRIMARY LISTING ● CROSS REFERENCE

KEPCO POWER SUPPLIES

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HOW TO USE THIS CATALOG

This edition of Kepco's annual product catalog is laid out in a significantly changed way from previous versions. Products are grouped by a shared major characteristic rather than an alphabetical listing.

A cross reference in each group will direct you to other models that also share the characteristic but which are described elsewhere—in another category.
Prices and shipping weights are imprinted directly on each spec page, eliminating the requirement for a separate price list.

You may enter the catalog in a number of ways. If you know the model designation, you'll find its group classification in the Design Features Chart on the facing page. Example: the data on CC models will be found in the section entitled Special Purpose powed supplies—and it will be cross referenced in the High Speed Section. Turn to Page 1997 to find the Special Purpose section.

If you are looking for modular supplies—and have no specific model type in mind, the index will refer you to Page 1975, the start of the Modular, section in which six separate groups are listed and three are cross referenced.

KEPCO POWER SUPPLIES

ORDERING INFORMATION:

All Kepco products are marketed on a direct-factory basis. There are no mark-ups or discounts (other than for quantity buyers) so that there is but one price for our products throughout the United States. Kepco maintains independent sales representatives in most states—and overseas. These factory-trained men will be most pleased to give you any required assistance in procuring and applying these products.

Power supplies are identified by a multipart model number, usually comprising a letter group prefix (identifying the design) followed by a series of numbers that specify the model (usually in rated volts and amperes.) Options will be identified by letter suffix specifying meters, cases, special controls, etc.

It is important for the expeditious handling of inquiries, orders, etc., that the full Kepco model number be used for identification, even if local specification control numbers have been assigned by your organization.

DISCOUNTS:

Discounts are available to quantity buyers. For details please consult with the Kepco Sales Department.

SHIPMENT:

Prices shown in this catalog are f.o.b. Flushing, New York. Please contact our sales office in Flushing for f.o.b. destination (delivered) prices. Our usual means of shipment is by insured motor freight or, location permitting, UPS. Air shipments or special routing available on request.

WARRANTY:

All Kepco products are backed by a firm one (1) year warranty, covering all parts and labor. The warranty is honored at our factory Service Department, Flushing, New York, and at field service depots maintained at strategic cities. Consult your local sales representative concerning the availability of local service.

PARTS:

Maintenance parts may be obtained through the field representative or from Kepco directly. When ordering parts, please use the identifying Kepco part number, and give the model and serial number of the instrument for which they are intended. Do *not* return any parts to Kepco unless authorization tags and instructions are provided.

TM

COMMUNICATIONS:

Address all mail to:
Kepco, Inc., 131-38 Sanford Avenue, Flushing, N.Y. 11352
Telephone: 212-461-7000
TWX Number: 710-582-2631
Telex: 12-6055
Cable Address: KEPCOPOWER NEWYORK

APPLICATIONS ASSISTANCE:

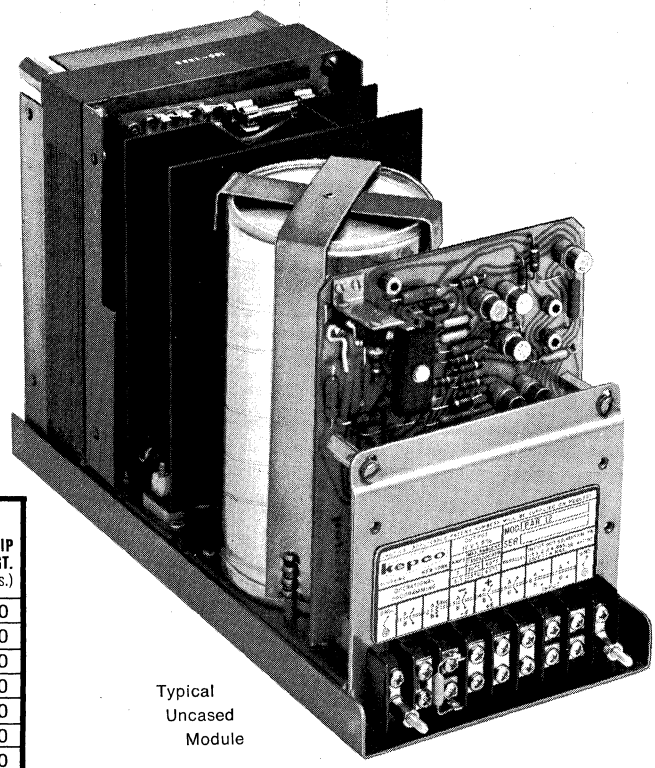
Questions concerning the facilities, features, behavior, and characteristics of any product may be directed to the Kepco Applications Engineering Department. A staff of specialists is happy to provide any assistance in the application of Kepco's Power Supplies to your requirements.

PUBLICATIONS:

From time to time Kepco publishes papers, articles, handbooks and supplements designed to further the state of utilization of modern power supply technology. The Kepco Power Supply News is a regularly published compendium of timely news articles. For a subscription to the Power Supply News—or copies of available publications, use the enclosed business reply card to order your personal copy. Copies of Kepco's publications are also available through Kepco's field representatives.

KEPCO PAR MODULAR POWER SUPPLIES

The PAR modules couple a high gain d-c feedback regulator with convection cooled NPN pass transistors to a conventional power transformer for 50–440 Hz power frequency accommodation. The PAR modules produce a fixed voltage with a ±5% adjustment range at a current rating which depends upon the ambient temperature (see table). PAR models may be programmed to a lesser nominal voltage (with current derating) by substituting for the resistor wired across the control terminals. (See *Operating Region Graph.*) When operating with external current feedback—as a current regulator—the compliance voltage must lie within the shaded region of the graph.



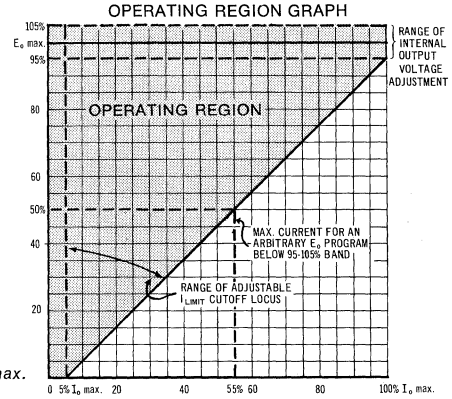
Typical Uncased Module

MODEL	OUTPUT VOLTS	OUTPUT CURRENT at ambient temp 65°C† 55°C††	40°C† 30°C††	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	PRICE ♦	SHIP WGT. (lbs.)
PAR–4	4±5%	0–9.0	0–11.0	0.0001	0.005	0.1+0.5	$205.00	20
PAR–7	7±5%	0–8.0	0–10.0	0.0001	0.005	0.1+0.5	205.00	20
PAR–12	12±5%	0–5.5	0–7.0	0.0002	0.005	0.1+0.5	205.00	20
PAR–15	15±5%	0–4.6	0–6.0	0.0003	0.005	0.1+0.5	205.00	20
PAR–24	24±5%	0–3.4	0–4.0	0.0006	0.005	0.1+0.5	205.00	20
PAR–28	28±5%	0–3.1	0–3.7	0.0008	0.005	0.1+0.5	205.00	20
PAR–36	36±5%	0–2.3	0–2.8	0.0015	0.005	0.1+0.5	205.00	20
PAR–48	48±5%	0–1.8	0–2.3	0.0022	0.005	0.1+0.5	205.00	20
PAR–60	60±5%	0–1.5	0–2.0	0.003	0.005	0.1+0.5	205.00	20

†Uncased: ††Cased ♦ For case, add Suffix "C" to model number and $11.00 to price.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE** (External Sensing)
OUTPUT RANGE	±5% †	1 mA to I_{limit} cutoff locus
REGULATION, LINE	<0.005%	<0.005% at rated sample**
REGULATION, LOAD	<0.01% or 0.5 mV*	<0.01% at rated sample** ‡
STABILITY (8 HR.)	<0.02% or 2 mV*	<0.02% or 1 mA*
TEMP. COEFFICIENT	<0.02% per °C	<0.02% per °C at rated sample**
RIPPLE, rms	<0.25 mV	<0.01% of I_O max.

OPERATING REGION GRAPH



*whichever is greater
**Rated sample is 1 volt across external current sensing resistor with external current control.
†Adjustable to zero with corresponding current derating (see operating region graph).
‡The compliance voltage range lies within shaded operating region from the I_{limit} locus to 105% E_O max.

INPUT: 105-125V a-c or 210-250V a-c, (selected), 50-440 Hz, single phase; approximately 2 amperes, 200 watts.

TEMPERATURE, AMBIENT OPERATING: *Uncased:* –20°C to + 65°C maximum (see rating chart). *Cased:* –20°C to +55°C maximum (see rating chart).

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Convection.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROL/PROGRAMMING: ±5% internal trimmer (voltage or current). External resistance programming ratio is 1000 ohms per volt. A 1% fixed resistor is supplied to program the tabulated nominal voltage. When programmed below the ±5% output band, derate current per operating region graph.

VOLTAGE RECOVERY, (for step load current): <50 μseconds.

OVERLOAD CURRENT CUTOFF: Adjustable cutoff locus pivots about the $E_O \approx 0$, $I_O \approx 5\%$ point, reducing the output current into an overload. *Note:* Nonlinear loads drawing a high starting current may be locked out by the cutoff locus, and require a starting resistance to be contained within the shaded regions of the operating region graph.

REMOTE ERROR SENSING: Compensates for up to 0.5 volt drop per output lead.

OVERSHOOT: (Turn-on/off): None in ±5% operating band. When output is set below 25%, load to approximately 10% to maintain negligible overshoot.

SERIES/PARALLEL: Connections are provided for parallel operation of identical units. Series operation to rated isolation.

OVERVOLTAGE PROTECTOR: Provision is made for attachment of an optional crowbar overvoltage protector, type VP-PAR. See Crowbar section for detailed description of the protector.

TERMINALS: All input, output, sense and control connections are made via a single multiterminal barrier strip.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Case:* Royal Blue, epoxy.

MOUNTING: A cased model is ordered by appending suffix "C" to the model number. If ordered separately, specify Case CA-200. Rack mount with adapters RA 25-1, RA 8-2 or RA 9-3. *See hardware section.*

All terms used in the specifications are defined in the Kepco Glossary

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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(212) 461-7000 • TWX # 710-582-2631
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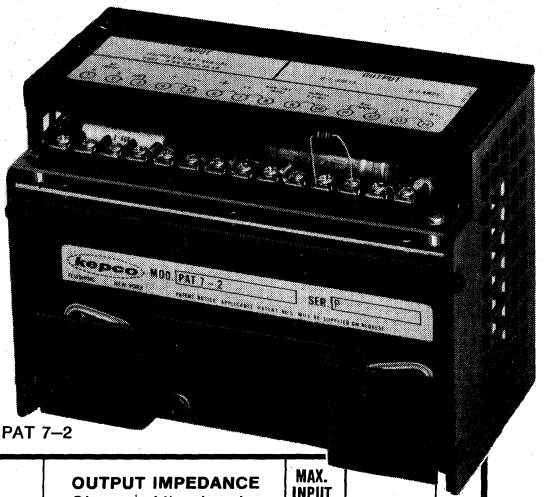
KEPCO PAT MODULAR POWER SUPPLIES

The Kepco PAT series of voltage regulated modular power supplies features compact repairable construction of a precision programmable regulator. The output is a self-cooled series NPN transistor driven by a monolithic linear I-C amplifier and protected by adjustable current limiting. The regulator will control current when equipped with an external pair of sensing and feedback resistors.

voltage/current regulation

full range operationally programmable

all silicon design



Model PAT 7–2

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μh	MAX. INPUT AMPS at 125 V a-c	PRICE◆	SHIP WGT. (lbs.)
PAT 7–2	0–7	0–2	0.2×10^{-3}	0.02	0.1 + 1	0.50	$121.00	6
PAT 15–1.5	0–15	0–1.5	0.5×10^{-3}	0.02	0.1 + 1	0.65	121.00	6
PAT 21–1	0–21	0–1	1×10^{-3}	0.02	0.1 + 1	0.45	121.00	6
PAT 40–0.5	0–40	0–0.5	4×10^{-3}	0.02	0.1 + 1	0.40	121.00	6
PAT 72–0.3	0–72	0–0.3	12×10^{-3}	0.02	0.1 + 1	0.45	121.00	6
PAT 100–0.2	0–100	0–0.2	25×10^{-3}	0.02	0.1 + 1	0.45	121.00	6

◆ Option "–R": add $10.00. Option "–T": add $30.00. Option "–E": add $10.00

SPECIFICATION	VOLTAGE MODE	CURRENT MODE**	VOLTAGE AMPLIFIER OFFSETS*** OFFSET VOLTAGE ΔE_{io}	OFFSET CURRENT ΔI_{io}	VOLTAGE REFERENCE (INTERNAL)***
OUTPUT RANGE	0–100% E_o max.	1 mA–100% I_o max.	——	——	Fixed 6.2V±5%
LINE: 105–125/210–250V a-c	<0.0005%	<0.005%**	<10 μV	<2 nA	0.0001%
LOAD: No Load/Full Load	<0.005% or 0.2 mV*	<0.01%**	<200 μV	<5 nA	——
TIME: 8 Hours. Stability	<0.01% or 1 mV*	<0.02**	<20 μV	<2 nA	0.005%
TEMP.: Coefficient per °C	<0.01%†	<0.02**†	<20 μV	<5 nA	0.005%
RIPPLE: (rms)	<0.1 mV	<0.02% of I_o max.	——	——	——

*whichever is greater.

**External sensing, using a 1V sample. Specs are measured at rated sample voltage with 20 PPM external current feedback control.

***Offsets and the reference contribute to output change ΔE_O, by the equation $\Delta E_O = \pm\Delta E_{ref}(R_f/R_i) \pm\Delta E_{io}(1+R_f/R_i) \pm\Delta I_{io}(R_f)$ where R_f is the feedback resistor and R_i is the input resistor from the signal reference. Use the offsets to calculate output variations when external input/feedback elements are substituted for the internal reference and voltage control in special applications.

†See OPTIONS for 0.005% per °C voltage mode – 0.01% per °C current mode temperature coefficient.

INPUT: 105-125V a-c or 210-250V a-c (selected), 50-440 Hz, single phase.

TEMPERATURE, AMBIENT OPERATING: Cased: –20°C to +71°C.

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Convection.

ISOLATION VOLTAGE: 500 volts to chassis.

PROGRAMMING: Approximately 1 mA control current, externally adjustable by resistance at ≅1000 ohms per volt. May be operationally controlled as an amplifier using voltage or current signals; common positive.

OPEN LOOP d-c GAIN: $>0.5\times10^6$ volts per volt.

VOLTAGE RECOVERY (for step load current): <50 μseconds for recovery to within 0.005% or 2 mV of setting.

CURRENT LIMITING: Adjustable from 10% to 105% of rated full current with provision for remote control.

REMOTE ERROR SENSING: Compensates up to 0.5 volt drop per output lead.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

SERIES/PARALLEL: Series operation to rated isolation; also master/slave capability. Current limiting design permits self-determined parallel load sharing.

TERMINALS: All input, output and control connections are made via a multi-terminal barrier strip.

DIMENSIONS: See Page 2005 for listings.

FINISH: Black anodized aluminum.

MOUNTING: Rack mount with adapters RA 26-1, RA 27-2 or RA 28-4. *See Hardware section.*

OPTIONS: (add designator as a suffix to the model number).

"–R" ADJUSTMENT OF CONTROL CURRENT: A ±10% trimmer is installed to allow precision programming calibration.

"–T" LOW TC OPTION: A special reference provides 0.005% per °C temperature coefficient in voltage mode, 0.01% per °C in current mode.

"–E" OFFSET VOLTAGE NULLING CONTROL: To zero the fixed part of E_{io}, the voltage amplifier's voltage offset.

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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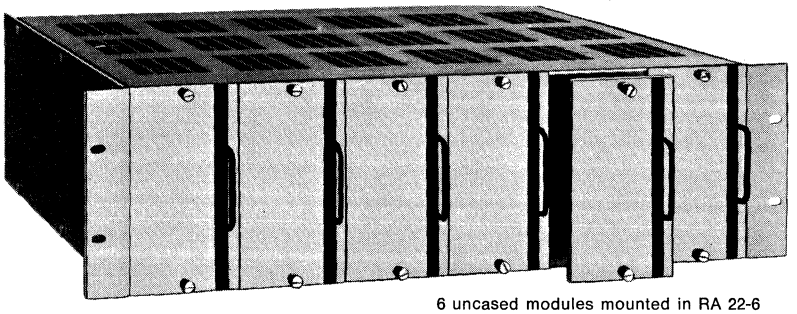
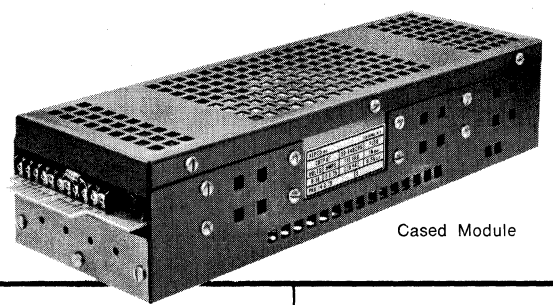
KEPCO PAX MODULAR POWER SUPPLIES



6 uncased modules mounted in RA 22-6 housing using BPA-22 slide adapters

PAX modules are low cost, single-amplifier power supplies that can be used with voltage or current feedback. The HS models (high speed) are especially recommended for current control because of their fast-recovery characteristics. In the PAX design, a convection-cooled PNP series pass transistor is used, the negative output terminal is common to the signal input. The PAX models are thus the signal-complement of the PCX and OPS designs.



Cased Module

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1 1kHz to 100kHz + μH	MAX. INPUT AMPS at 125 V a-c	PRICE ♦	SHIP WGT. (lbs.)
PAX 7–1	0–7	0–1	0.004	0.02	0.1+1	0.3	$ 94.00	4
PAX 7–1HS	0–7	0–1	0.004	0.2	0.2+15	0.3	104.00	4
PAX 15–0.75	0–15	0–0.75	0.010	0.02	0.1+1	0.3	94.00	4
PAX 15–0.75HS	0–15	0–0.75	0.010	0.2	0.2+15	0.3	104.00	4
PAX 21–0.5	0–21	0–0.5	0.025	0.02	0.1+1	0.3	94.00	4
PAX 21–0.5HS	0–21	0–0.5	0.025	0.2	0.2+15	0.3	104.00	4
PAX 36–0.3	0–36	0–0.3	0.06	0.02	0.1+1	0.3	94.00	4
PAX 36–0.3HS	0–36	0–0.3	0.06	0.2	0.2+15	0.3	104.00	4
PAX 72–0.15	0–72	0–0.15	0.25	0.02	0.1+1	0.3	94.00	4
PAX 72–0.15HS	0–72	0–0.15	0.25	0.2	0.2+15	0.3	104.00	4
PAX 100–0.1	0–100	0–0.1	0.5	0.02	0.1+1	0.3	94.00	4
PAX 100–0.1HS	0–100	0–0.1	0.5	0.2	0.2+15	0.3	104.00	4

♦ For Case–add suffix "C" to model number and $11.00 to price.
Calibration Control–add suffix "R" to model and $10.00 to price.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE** (External Sensing)
OUTPUT RANGE	0–100% E_O max.	1 mA to 100% I_O
REGULATION, LINE	<0.05% or 1 mV*	<0.1% at rated sample**
REGULATION, LOAD	<0.05% or 1 mV*	<0.1% at rated sample**
STABILITY (8 HR.)	<0.05% or 3 mV*	<0.1% or 1 mA*
TEMP. COEFFICIENT	<0.05% per °C	<0.1% per °C at rated sample**
RIPPLE, (Standard Speed)	<0.25 mV, rms.	<0.1% I_O max.
RIPPLE, (High Speed)	<0.1% of maximum output (grounded)	<0.1% of maximum output (grounded)

*whichever is greater

**Rated sample is 1V d-c across external current sampling resistor, with external current control.

INPUT: 105-125V a-c or 210-250V a-c (selected), 50-440 Hz, single phase.

TEMPERATURE, AMBIENT OPERATING: –20°C to + 50°C

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Convection.

ISOLATION VOLTAGE: 500 volts to chassis.

PROGRAMMING: Approximately 1mA control current. Externally adjustable, by resistance at ≈1000 ohms per volt. Specify suffix "R" to obtain model with integral ±10% control current adjustment. May be operationally controlled as an amplifer using voltage or current signals; common negative.

VOLTAGE RECOVERY: (for step load current): <50 microseconds.

CURRENT LIMITING: Adjustable from 25% to 150% of rated full current.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

HIGH SPEED MODELS, (Suffix HS):

Slewing: >50,000 volts per second, measured as the chord to the first time constant on the exponential response.

Sinusoidal Frequency Response: $f_{max} = \frac{16}{E_{pp}}$ kHz

(E_{pp} is the peak-to-peak voltage excursion.)

Maximum Capacitive Loading: 0.001 microfarad.

Transient Response:

Voltage Mode: Recovery is an exponential with a 50 microsecond time constant.

Current Mode: To a step load voltage, recovery is at the rate of 0.05 millisecond per volt.

SERIES/PARALLEL: Series operation to rated isolation; also master/slave capability. Current limiting design permits self-determined parallel load sharing.

TERMINALS: All input, output and control connections are made via a multi-terminal barrier strip and printed circuit connector.

FINISH: Blue anodized aluminum.

DIMENSIONS: See Page 2005 for listings.

MOUNTING: The uncased model can be mounted to a BPA-22 slide adapter for use with the RA 22-6, CA-3, CA-4 and CA-5. *See hardware section.* The cased model can be rack-mounted on adapters RA 12-1, RA 13-4 or RA 11-6.

All terms used in the specifications are defined in the Kepco Glossary

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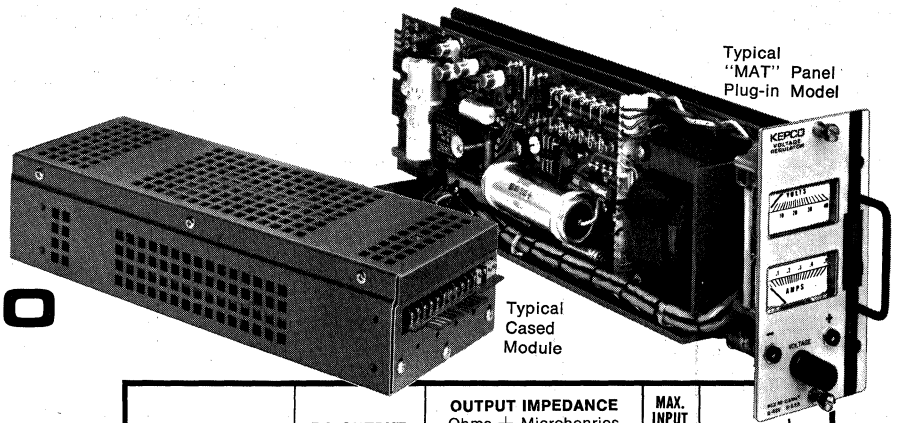

KEPCO PCX MODULAR POWER SUPPLIES

The PCX group of voltage regulators are available in two forms—as programmable modules for OEM's or (with the suffix "MAT") as metered plug-ins with a built-in, 10-turn voltage control. The regulator is a self-cooled series NPN transistor driven by Kepco's monolithic linear I-C amplifier and protected by adjustable current limiting. The regulator will control current when equipped with an external pair of sensing and feedback resistors. The PCX series, with its I-C regulator replaces Kepco's PBX design group.

◆ Options: "–R" add $10.00 "–T" add $30.00 "–E" add $10.00
For Case–add suffix "C" to model number and $11.00 to price. Do not use case with "MAT" models.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	MAX. INPUT AMPS at 125 V a-c	PRICE◆	SHIP WGT. (lbs.)
PCX 7–2	0–7	0–2	0.2×10^{-3}	0.02	0.1+1	0.50	$111.00	4
PCX 7–2MAT	0–7	0–2	0.2×10^{-3}	0.02	0.1+1	0.50	168.00	6
PCX 15–1.5	0–15	0–1.5	0.5×10^{-3}	0.02	0.1+1	0.65	111.00	4
PCX 15–1.5MAT	0–15	0–1.5	0.5×10^{-3}	0.02	0.1+1	0.65	168.00	6
PCX 21–1	0–21	0–1	1×10^{-3}	0.02	0.1+1	0.45	111.00	4
PCX 21–1MAT	0–21	0–1	1×10^{-3}	0.02	0.1+1	0.45	168.00	6
PCX 40–0.5	0–40	0–0.5	4×10^{-3}	0.02	0.1+1	0.40	111.00	4
PCX 40–0.5MAT	0–40	0–0.5	4×10^{-3}	0.02	0.1+1	0.40	168.00	6
PCX 72–0.3	0–72	0–0.3	12×10^{-3}	0.02	0.1+1	0.45	111.00	4
PCX 72–0.3MAT	0–72	0–0.3	12×10^{-3}	0.02	0.1+1	0.45	168.00	6
PCX 100–0.2	0–100	0–0.2	25×10^{-3}	0.02	0.1+1	0.45	111.00	4
PCX 100–0.2MAT	0–100	0–0.2	25×10^{-3}	0.02	0.1+1	0.45	168.00	6

SPECIFICATION	VOLTAGE MODE	CURRENT MODE**	VOLTAGE AMPLIFIER OFFSETS*** OFFSET VOLTAGE ΔE_{io}	OFFSET CURRENT ΔI_{io}	VOLTAGE REFERENCE (INTERNAL)***
OUTPUT RANGE	0–100% E_o max.	1 mA–100% I_o max.	——	——	Fixed 6.2V±5%
LINE: 105–125/210–250V a-c	<0.0005%	<0.005%**	<10 μV	<2 nA	0.0001%
LOAD: No Load/Full Load	<0.005% or 0.2 mV*	<0.01%**	<200 μV	<5 nA	——
TIME: 8 Hours. Stability	<0.01% or 1 mV*	<0.02**	<20 μV	<2 nA	0.005%
TEMP.: Coefficient per °C	<0.01%/°†	<0.02**†	<20 μV	<5 nA	0.005%
RIPPLE: (rms)	<0.1 mV	<0.02% of I_o max.	——	——	——

*whichever is greater.

**External sensing, using a 1V sample. Specs are measured at rated sample voltage with 20 PPM external current feedback control.

***Offsets and the reference contribute to output change ΔE_O, by the equation $\Delta E_O = \pm\Delta E_{ref}(R_f/R_i) \pm\Delta E_{io}(1+R_f/R_i) \pm\Delta I_{io}(R_f)$ where R_f is the feedback resistor and R_i is the input resistor from the signal reference. Use the offsets to calculate output variations when external input/feedback elements are substituted for the internal reference and voltage control in special applications.

†See OPTIONS for 0.005% per °C voltage mode – 0.01% per °C current mode temperature coefficient.

INPUT: 105-125V a-c or 210-250V a-c (selected) 50-440 Hz, 1Ø.

TEMPERATURE, AMBIENT OPERATING: Cased: –20°C to +65°C. Uncased: –20°C to +71°C.

TEMPERATURE: STORAGE: –40°C to +85°C.

ISOLATION VOLTAGE: 500 volts to chassis.

PROGRAMMING: Approximately 1mA control current. Externally adjustable, by resistance at ≈1000 ohms per volt. Specify suffix "R" to obtain model with integral ±10% control current adjustment. May be operationally controlled as an amplifier using voltage or current signals; common positive.

OPEN LOOP d-c GAIN: $>0.5\times10^6$ volts per volt.

VOLTAGE RECOVERY (for step load current): <50 μseconds for recovery to within 0.005% or 2 mV of setting.

CURRENT LIMITING: Adjustable from 10% to 105% of the rated full current.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

SERIES/PARALLEL: Series operation to rated isolation; also master/slave capability. Current limiting design permits self-determined parallel load sharing.

COOLING: Convection.

TERMINALS: All input, output and control connections are made via a multi-terminal barrier strip and printed circuit connector.

DIMENSIONS: See Page 2005 for listings.

FINISH: Blue anodized aluminum.

CASES/MOUNTING: Model number without suffix specifies an uncased open model. Add suffix "C" for wraparound case – or order Case CA-1 separately. Cased models can be rack mounted on adapters RA 12-1, RA 13-4 or RA 11-6. Uncased models can be used with BPA-22 slide adapter for plug-in mounting. These fit interchangeably with metered "MAT" – option models in cases CA-3, CA-4, CA-5 or RA 22-6. *See Hardware section.*

OPTIONS: (add designator as a suffix to the model numbers).

"–MAT" Metered: This option specifies a plug-in style metered panel with voltage control (10-turn). The uncased unit must be plugged into accessory case. *See CASES/MOUNTING.*

"–R" ADJUSTMENT OF CONTROL CURRENT: A ±10% trimmer is installed to allow precision programming calibration.

"–T" LOW TC OPTION: A special reference provides 0.005% per °C temperature coefficient in voltage mode, 0.01% per °C in current mode.

"–E" OFFSET VOLTAGE NULLING CONTROL: To zero the fixed part of E_{io}, the voltage amplifier's voltage offset.

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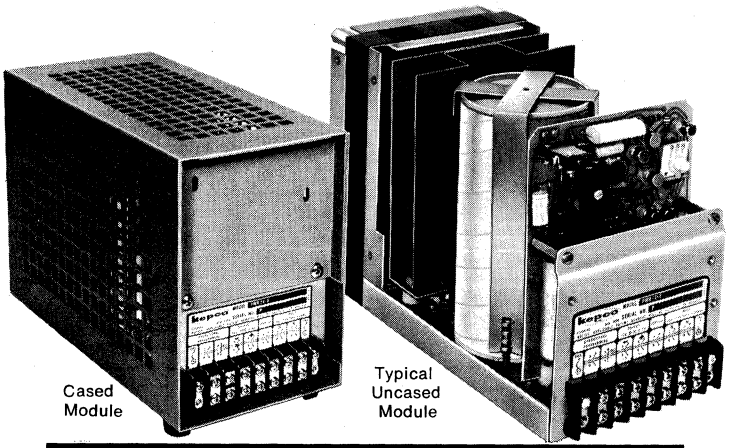
All terms used in the specifications are defined in the Kepco Glossary

KEPCO PWR MODULAR POWER SUPPLIES



The PWR modules couple a high-gain, d-c feedback regulator and convection-cooled NPN series pass transistors to a ferroresonant Flux-O-Tran® power transformer to provide well regulated voltage with a ±5% adjustment range around the nominal level. The nominal voltage for each model is set by a fixed resistor wired externally across the connection barrier strip. This resistor may be changed, or a variable resistor substituted, to alter the nominal setting. The output current derates when the nominal setting is reduced (See *Operating Region Graph*) when operating with external current feedback—as a current regulator, the compliance voltage must lie within the shaded region of the graph.

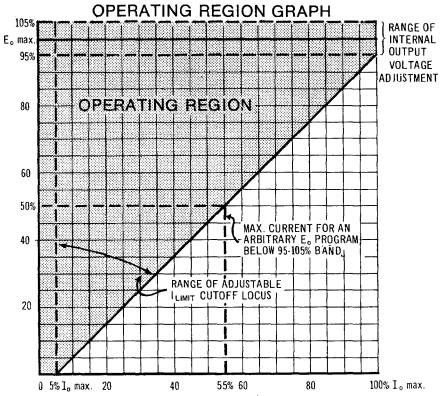
MODEL	DC OUTPUT RANGE VOLTS	AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	PRICE◆	SHIP WGT. (lbs.)
PWR 4–14	4±5%	0–14	0.0002	0.005	0.1+0.5	$220.00	21
PWR 7–11	7±5%	0–11	0.0003	0.005	0.1+0.5	220.00	21
PWR 12–7	12±5%	0–7	0.001	0.005	0.1+0.5	220.00	21
PWR 15–6	15±5%	0–6	0.002	0.005	0.1+0.5	220.00	21
PWR 24–4	24±5%	0–4	0.003	0.005	0.1+0.5	220.00	21
PWR 28–3.3	28±5%	0–3.3	0.004	0.005	0.1+0.5	220.00	21
PWR 36–3	36±5%	0–3	0.006	0.005	0.1+0.5	220.00	21
PWR 48–2	48±5%	0–2	0.015	0.005	0.1+0.5	220.00	21
PWR 60–1.5	60±5%	0–1.5	0.02	0.005	0.1+0.5	220.00	21

◆ For case, add Suffix "C" to model number and $11.00 to price.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE** (External Sensing)
OUTPUT RANGE	±5% E_O†	1mA to I_{limit} cutoff locus
REGULATION, LINE	<0.005%	<0.05% at rated sample**‡
REGULATION, LOAD	<0.05% or 1 mV*	<0.1% at rated sample**
STABILITY (8 HR.)	<0.05% or 3 mV*	<0.1% or 1 mA
TEMP. COEFFICIENT	<0.05% per °C	<0.1% per °C at rated sample**
RIPPLE, rms.	<0.25 mV	<0.1% of I_O max.

whichever is greater
***Rated sample is 1 volt across external current sampling resistor with external current control.*
†Adjustable to zero with corresponding current derating (see operating region graph).
‡Compliance voltage range lies within shaded operating region from limit locus to 105% E_O max.

OPERATING REGION GRAPH



INPUT: 100-130V a-c, 60 Hz ±1 Hz single phase; approximately 2 amperes, 200 watts.

Overseas Units: Specify suffix "–50" for selectable 104 ±13.5V a-c, 115 ±15V a-c, 208 ±27V a-c, or 230 ±30 V a-c, 50 Hz ±1 Hz. Derate *output current* by 20% when ordering with "–50" option. Add $15.00 to unit price

TEMPERATURE AMBIENT OPERATING: *Uncased:* –20°C to +65°C. *Cased:* –20° to +55°C.

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Convection.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROL/PROGRAMMING: ±5% by internal trimmer for voltage or current. External resistance programming ratio is 1000 ohms per volt, 1 mA control current. A 1% fixed resistor is supplied to program the tabulated nominal voltage. When programmed below ±5% output band, derate current per operating region graph.

VOLTAGE RECOVERY: (for step load current): <50 microseconds.

REMOTE ERROR SENSING: Compensates for up to 0.5 volt drop per output lead.

OVERLOAD CURRENT CUTOFF: Adjustable cutoff locus pivots about the $E_O \approx 0$, $I_O \approx 5\%$ point, reduces current into an overload. *Note:* Non-linear loads drawing a high starting current may be locked out by the cutoff locus, and require a starting resistance to be contained within the shaded regions of the operating region graph.

OVERSHOOT: (Turn-on/off): None in ±5% operating band. When output is set below 25%, load to approximately 10% to maintain negligible overshoot.

SERIES/PARALLEL: Connections are provided for parallel operation of identical units. Series operation to rated isolation.

TERMINALS: All input, output, sense and control connections are made via a single multiterminal barrier strip.

FINISH: *Case:* Royal Blue, epoxy.

DIMENSIONS: See Page 2005 for listings.

MOUNTING: A cased model is ordered by appending suffix "C" to the model number. If ordered separately, specify Case CA-200. Rack mount with adapters RA 23-1, RA 8-2 or RA 9-3. *See hardware section.*

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KEPCO PRM MODULAR POWER SUPPLIES

The Kepco PRM voltage regulated modules are simple, reliable, efficient, fixed output sources. The design is based on a ferroresonant power transformer called Flux-O-Tran® which provides both regulating and overload current limiting. The extra-filtered models (suffix F) have a Pi section LC filter, reducing their ripple to about a tenth that of the single section capacitor-filtered models. The *dual* output models have two independent d-c circuits that may be used in series or in parallel or separately.

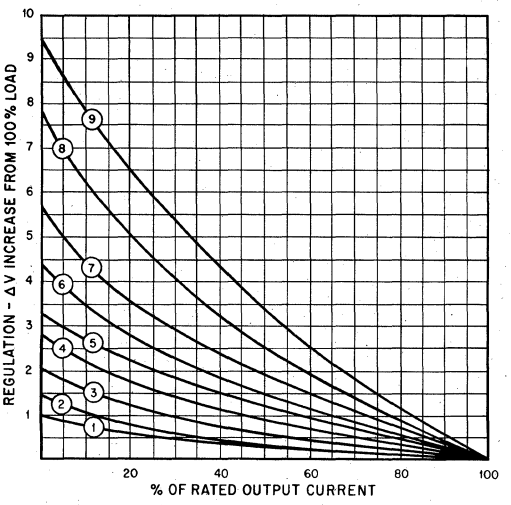

FIGURE 1: TYPICAL LOAD REGULATION FOR ALL PRM MODELS

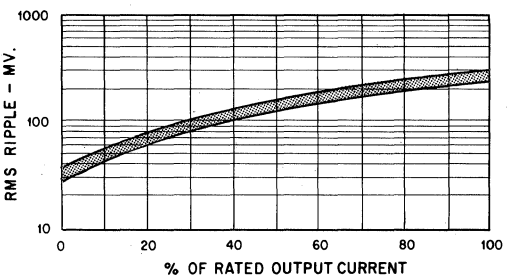

FIGURE 2: TYPICAL RIPPLE AS A FUNCTION OF LOAD FOR ALL PRM MODELS EXCEPT EXTRA FILTERED MODELS

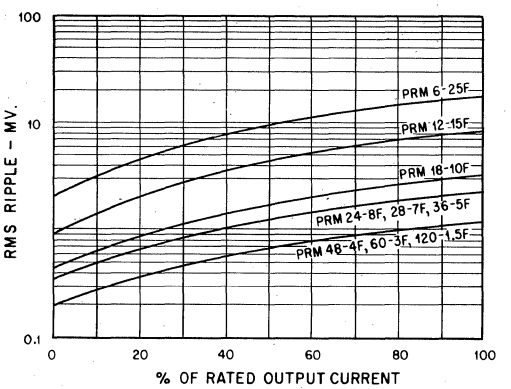

FIGURE 3: TYPICAL RIPPLE AS A FUNCTION OF LOAD FOR ALL EXTRA FILTERED MODELS

SPECIFICATION	SIZE A 180 SERIES	SIZE B 120 SERIES	SIZE C 180F (EXTRA FILTERED SERIES)	SIZE C 300 (DUAL 150 SERIES)
ACCURACY*	± 2%	± 2%	±2%**	2%†
REGULATION, LINE	±1%‡	±1%‡	±1%‡	±1%▼
STABILITY (8 hr.)	1% or 0.1V•	1% or 0.1V•	1% or 0.1V•	1% or 0.1V•
TEMP. COEFFICIENT	0.05% per °C	0.05% per °C	0.05% per °C	0.05% per °C
INPUT (115Va-c, 60 Hz)	3A (280w)	2A (190w)	3A (280w)	5A (465w)

**At 115V a-c, full load, 30°C. Initial (cold) output is 1% higher. •whichever is greater*
***The filter introduces an added 2% drop, a 10% reduction in load current will compensate for the loss.*
†Interaction is less than 2% as the other supply in the dual package is loaded from zero to maximum.
‡For ±15V a-c line variation, at 25-100% load. For loads below 25%, line regulation is ±1.5% output change.
▼For ±15V a-c line variation, at 50-100% load. For loads below 50%, line regulation is ±1.5% output change.

INPUT: 115V a-c, ± 15 V a-c, 60 Hz ±5% single phase.
Overseas Models: for 50 Hz ±5% specify suffix "–50". Inputs: (selectable) 104 ±13.5V a-c, 115 ±15V a-c, 208 ±27V a-c or 230 ±30V a-c. Output *current* rating is derated 20% in the 50 Hz version. Add $15.00 to unit price.
NOTE: Input frequency variations produces an approximate equal percentage output voltage change.
TEMPERATURE, AMBIENT OPERATING: –20°C to +55°C
TEMPERATURE STORAGE: –40°C to +85°C
COOLING: Convection.
OUTPUT IMPEDANCE: 1 kHz–10 kHz: 0.05 ohms, 10 kHz–100kHz: 0.05 ohms + 0.5 microhenries. Below 1000 Hz impedance is a function of a load current and may be derived from the slope of load regulation curve ΔE/ΔI.
VOLTAGE RECOVERY: (50-100% current): <400 milliseconds.
OVERLOAD PROTECTION: Current limiting transformer restricts short circuit current to safe value. A thermal circuit breaker is employed in *dual* models.
ISOLATION VOLTAGE: 600 volts to chassis (or between the outputs of dual models.
SERIES/PARALLEL OPERATION: Identical models, or halves of a dual supply can be paralled for approximately double current (allow for 10% imbalance). Series operation to rated isolation.
ACCESSORIES: Various rack adapters available, *See Hardware Section.* *Cases:* Size A uses CA-200
Size C uses CA-300
Size B has non-removable integral enclosure.
Add suffix "C" for cased Size A & C models.
FINISH: *Cases:* royal blue.

All terms used in the specifications are defined in the Kepco Glossary.

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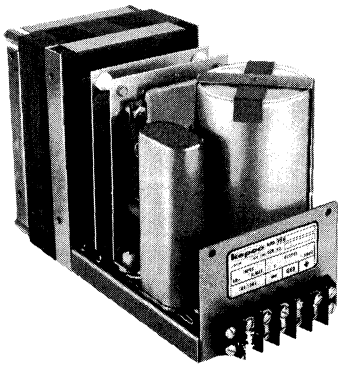
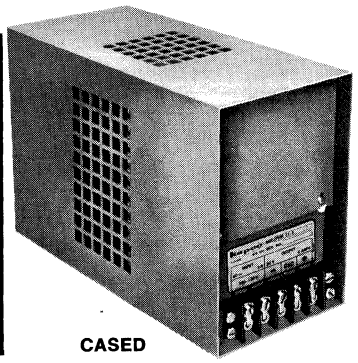
SIZE "A" - 180 SERIES



UNCASED
6¾" x 4¾" x 10⅜"

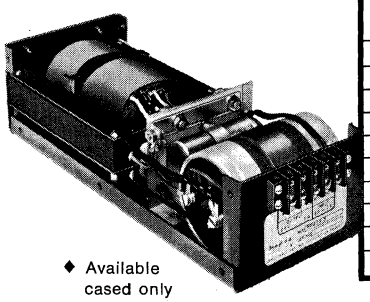
MODEL	DC OUTPUT VOLTS	DC OUTPUT AMPS	LOAD REGULATION* ΔV INCREASE 100%-50% LOAD	LOAD REGULATION* ΔV INCREASE 100%-25% LOAD	LOAD REG. CURVE (Fig. 1)	RIPPLE (max) RMS VOLTS	PRICE ♦	SHIP WGT. (lbs.)
PRM 5–25	5.2	0–25	0.5	0.8	1	0.4	$125.00	22
PRM 6–25	6.3	0–25	0.5	0.8	1	0.4	125.00	22
PRM 12–15	12	0–15	0.6	1.0	1	0.4	125.00	22
PRM 18–10	18	0–10	0.6	1.0	2	0.3	125.00	22
PRM 24–8	24	0–8	0.7	1.2	2	0.3	125.00	22
PRM 28–7	28	0–7	0.7	1.2	2	0.4	125.00	22
PRM 36–5	36	0–5	0.8	1.3	3	0.4	125.00	22
PRM 48–4	48	0–4	1.0	1.8	4	0.3	125.00	22
PRM 60–3	60	0–3	1.1	1.9	5	0.3	125.00	22
PRM 120–1.5	120	0–1.5	2.2	3.6	7	0.3	125.00	22

*Measured at 115V AC Line



CASED
6¹⁵⁄₁₆" x 5" x 10⁷⁄₁₆"
♦ For case, add Suffix "C" to model number and $11.00 to price.

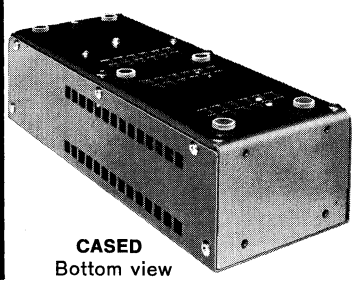
SIZE "B" - 120 SERIES



♦ Available cased only (cover removed to show interior)

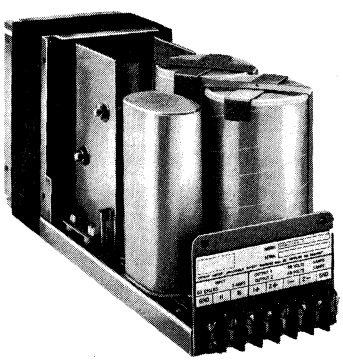
MODEL	DC OUTPUT VOLTS	DC OUTPUT AMPS	LOAD REGULATION* ΔV INCREASE 100%-50% LOAD	LOAD REGULATION* ΔV INCREASE 100%-25% LOAD	LOAD REG. CURVE (Fig. 1)	RIPPLE (max) RMS VOLTS	PRICE ♦	SHIP WGT. (lbs.)
PRM 5–15	5.2	0–15	0.5	0.8	1	0.4	$104.00	17
PRM 6–15	6.3	0–15	0.5	0.8	1	0.4	104.00	17
PRM 12–10	12	0–10	0.6	1.0	2	0.4	104.00	17
PRM 18–6.7	18	0–6.7	0.8	1.3	3	0.3	104.00	17
PRM 24–5	24	0–5	1.0	1.7	3	0.3	104.00	17
PRM 28–4.3	28	0–4.3	1.2	2.0	4	0.3	104.00	17
PRM 36–3.3	36	0–3.3	1.5	2.4	5	0.3	104.00	17
PRM 48–2.5	48	0–2.5	2.0	3.4	6	0.3	104.00	17
PRM 60–2	60	0–2	2.3	3.8	7	0.3	104.00	17
PRM 120–1	120	0–1	4.6	7.6	9	0.3	104.00	17

*Measured at 115V AC Line



CASED
Bottom view
3¹³⁄₃₂" x 5" x 13¹³⁄₁₆"
♦ Available cased only Price includes case.

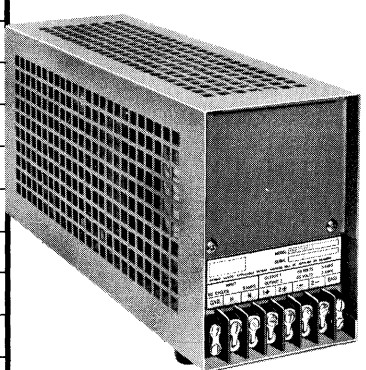
SIZE "C" - 300 SERIES DUAL OUTPUT



UNCASED
6¾" x 4¾" x 14⅜"

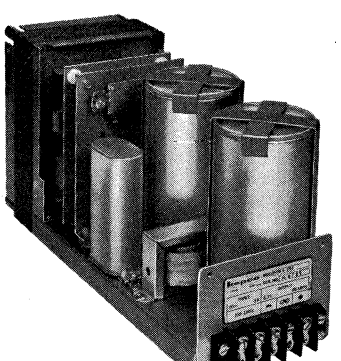
MODEL	DC OUTPUT VOLTS	DC OUTPUT AMPS	LOAD REGULATION* ΔV INCREASE 100%-50% LOAD	LOAD REGULATION* ΔV INCREASE 100%-25% LOAD	LOAD REG. CURVE (Fig. 1)	RIPPLE (max) RMS VOLTS	PRICE ♦	SHIP WGT. (lbs.)
PRM 2X4.5–20	4.5 4.5	0–20 0–20	0.5	0.7	1	0.3	$197.00	38
PRM 2X5–20	5.2 5.2	0–20 0–20	0.5	0.7	1	0.3	197.00	38
PRM 2X6–20	6.3 6.3	0–20 0–20	0.5	0.7	1	0.3	197.00	38
PRM 2X12–12	12 12	0–12 0–12	0.5	0.7	1	0.3	197.00	38
PRM 2X15–10	15 15	0–10 0–10	0.5	1.0	1	0.3	197.00	38
PRM 2X18–8	18 18	0–8 0–8	0.6	1.6	1	0.3	197.00	38
PRM 2X24–6	24 24	0–6 0–6	0.6	1.0	2	0.3	197.00	38
PRM 2X28–5	28 28	0–5 0–5	0.7	1.2	2	0.3	197.00	38
PRM 2X36–4	36 36	0–4 0–4	0.7	1.2	3	0.3	197.00	38
PRM 2X48–3	48 48	0–3 0–3	0.8	1.4	3	0.3	197.00	38
PRM 2X60–2.5	60 60	0–2.5 0–2.5	1.0	1.7	3	0.3	197.00	38

*Measured at 115V AC Line



CASED
6¹⁵⁄₁₆" x 5" x 14⁷⁄₁₆"
♦ For case, add Suffix "C" to model number and $11.00 to price.

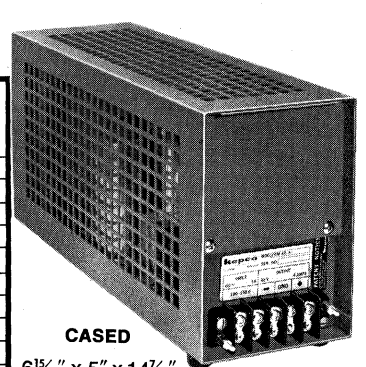
SIZE "C" - 180F SERIES EXTRA-FILTERED



UNCASED
6¾" x 4¾" x 14⅜"

MODEL	DC OUTPUT** VOLTS	DC OUTPUT** AMPS	LOAD REGULATION* ΔV INCREASE 100%-50% LOAD	LOAD REGULATION* ΔV INCREASE 100%-25% LOAD	LOAD REG. CURVE (Fig. 1)	RIPPLE (max) RMS VOLTS	PRICE ♦	SHIP WGT. (lbs.)
PRM 5–25F	5.2	0–25	0.7	1.2	1	0.04	$178.00	28
PRM 6–25F	6.3	0–25	0.7	1.2	1	0.04	178.00	28
PRM 12–15F	12	0–15	0.9	1.4	2	0.02	178.00	28
PRM 18–10F	18	0–10	0.9	1.5	3	0.01	178.00	28
PRM 24–8F	24	0–8	1.2	2.0	3	0.005	178.00	28
PRM 28–7F	28	0–7	1.3	2.1	3	0.005	178.00	28
PRM 36–5F	36	0–5	1.5	2.4	4	0.005	178.00	28
PRM 48–4F	48	0–4	1.7	2.9	5	0.003	178.00	28
PRM 60–3F	60	0–3	2.3	3.6	6	0.003	178.00	28
PRM 120–1.5F	120	0–1.5	3.8	6.8	8	0.003	178.00	28

*Measured at 115V AC Line **Less 2% filter drop (See ACCURACY)



CASED
6¹⁵⁄₁₆" x 5" x 14⁷⁄₁₆"
♦ For case, add Suffix "C" to model number and $11.00 to price.

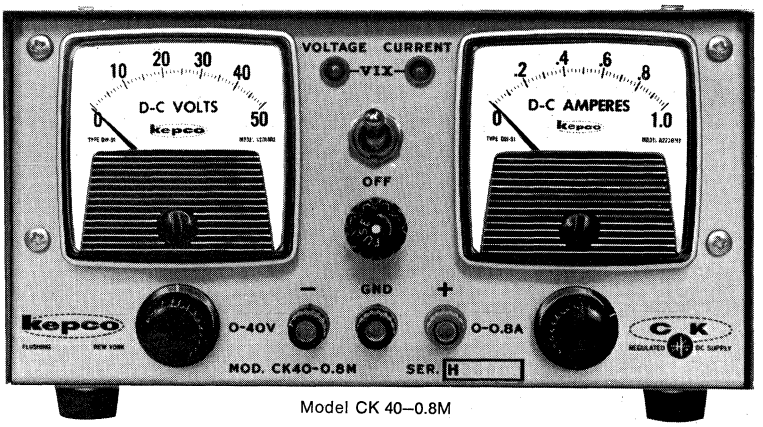
KEPCO CK

AUTOMATIC CROSSOVER

POWER SUPPLIES

The CK Power Supplies are twin-amplifier voltage and current autocrossover power supplies with VIX® mode indicators. The amplifiers drive a forced-cooled PNP pass transistor series regulator. The CK models are equipped with a 16-terminal access barrier strip for programming connections to externally control voltage and current. The panel controls for both voltage and current are precision 10-turn, 20 PPM TC wirewound rheostats.

- *VIX® indicators, automatic crossover*
- *10-turn voltage and current controls*
- *programmable*



Model CK 40–0.8M

MODEL	DC OUTPUT RANGE VOLTS	AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	MAX. INPUT AMPS at 125 V a-c	PRICE◆	SHIP WGT. (lbs.)
CK 2–8M	0–2	0–8	$0.065X10^{-3}$	0.01	0.05+0.5	1	$363.00	21
CK 8–5M	0–8	0–5	$0.16X10^{-3}$	0.01	0.05+0.5	1.2	363.00	21
CK 18–3M	0–18	0–3	$0.6X10^{-3}$	0.01	0.05+0.5	1.3	321.00	21
CK 36–1.5M	0–36	0–1.5	$2.4X10^{-3}$	0.02	0.08+0.8	1.5	321.00	21
CK 40–0.8M	0–40	0–0.8	$5X10^{-3}$	0.02	0.08+0.8	1	281.00	21
CK 60–0.5M	0–60	0–0.5	$12X10^{-3}$	0.02	0.08+0.8	1	321.00	21

◆ Price includes meters, for unmetered models, delete suffix "M". In quantities of 12 or more units deduct $30.00 from price.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE (Internal Sensing)	CURRENT MODE ** (External Sensing)
OUTPUT RANGE	0–100% E_O max.	0.2%–100% I_O max.	1 mA–100% I_O max.
REGULATION, LINE	<0.005% or 0.1 mV*	<0.01% or 0.2 mA*	<0.01% at rated sample**
REGULATION, LOAD	<0.01% or 0.5 mV*	<0.01% or 0.2 mA*	<0.01% at rated sample**
STABILITY (8 HR.)	<0.01% or 2.0 mV*	<0.05% or 1 mA*	<0.05% or 1 mA*
TEMP. COEFFICIENT	<0.01% per °C	<0.05% of I_O max. per °C	<0.05% per °C at rated sample**
RIPPLE, rms	<0.5 mV	<0.05% of output setting or 0.01% of I_O max.*	

**whichever is greater*
***Rated Sample is 1.0V d-c across external current sampling resistor with external current control*

INPUT: 105-125V a-c or 210-250V a-c (selected), 50–65 Hz, single phase.

TEMPERATURE, AMBIENT OPERATING: –20°C to +50°C
TEMPERATURE, STORAGE: –40°C to +85°C

COOLING: Forced air lateral circulation. Built-in blower.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROLS: Independent 10-turn controls for voltage and current. **Resolution:** 0.05%.

PROGRAMMING: 1 mA control current, by resistance at 1000 ohms per volt. May be operationally controlled as an amplifier, using voltage or current signals; common negative. Voltage and current regulators may be independently programmed.

VOLTAGE RECOVERY, (for step load current): 50 microseconds.

AUTOMATIC CROSSOVER: Selects voltage regulation or current regulation operating mode automatically.

VIX CIRCUIT: Mode indicators display operating condition, a ±8V, ±1 mA control signal is provided at rear terminals.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

SERIES/PARALLEL: Automatic crossover design permits self-determined paralellel load-sharing; also master/slave capability. Series operation to rated isolation.

METERS: Suffix "M" designates a pair of 2½ inch, 2% meters. Delete suffix for unmetered unit.

TERMINALS: Binding posts on front panel, plus, minus, and ground. Sixteen (16) terminal barrier strip on rear contains output, sensing and control terminals.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Brushed aluminum. *Case:* Charcoal gray texture.

MOUNTING: Mount single unit in rack adapter RA-5, two abreast in rack adapter RA-4. *See Hardware section.*

All terms used in the specifications are defined in the Kepco Glossary

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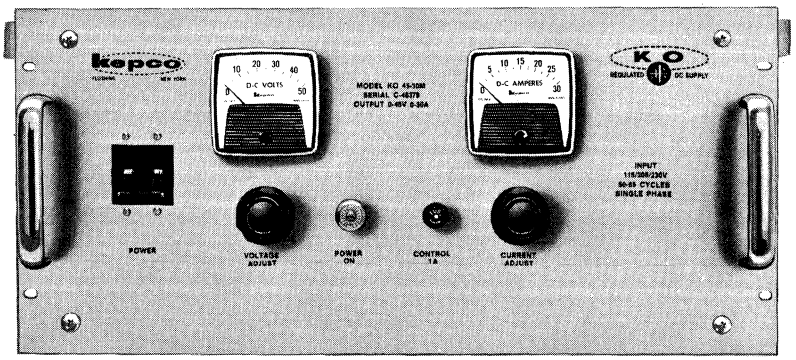
Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.



Model KO 45-30M

KEPCO

KO

SCR

POWER SUPPLIES

KO Power Supplies are heavy-duty SCR regulators employing two control amplifiers for automatic crossover voltage and current operation. Voltage and current are both programmable or may be controlled by the panel-mounted, precision 10-turn, 20 PPM TC wirewound rheostats.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	RIPPLE RMS % MV.	OUTPUT IMPEDANCE Ohms + μH 1kHz to 10 kHz	OUTPUT IMPEDANCE Ohms + μH 10 kHz to 100kHz	MAX. INPUT AMPS at 125V a-c AMPS	MAX. INPUT AMPS at 125V a-c WATTS	PRICE◆	SHIP WGT. (lbs.)
KO 12–100M	0–12	0–100	0.5 or 30	0.02	0.04+0.5	24	1800	$1,095.00	178
KO 25–50M	0–25	0–50	0.5 or 40	0.02	0.04+0.5	24	1800	995.00	165
KO 45–30M	0–45	0–30	0.3 or 20	0.02	0.04+0.5	24	1800	895.00	165
KO 70–20M	0–70	0–20	0.3 or 30	0.02	0.04+0.5	24	1800	995.00	169

◆ Price includes meters, for unmetered models, delete suffix "M". In quantities of 12 or more units deduct $30.00 from price.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE** (Internal Sensing)
OUTPUT RANGE	0–100% E_O max.	10%–100% I_O max.
REGULATION, LINE	<1%	<2% or 200 mA*
REGULATION, LOAD	<1% or 20 mV*	<2% or 200 mA* **
STABILITY (8 HR.)	<1% or 50 mV*	<2% or 200 mA*
TEMP. COEFFICIENT	<0.1% per °C	<0.5% of I_O max. per °C
RIPPLE, rms	See Table	<0.5% of I_O max.

**whichever is greater*
***compliance range: 0.25V to 100% E_O max.*

INPUT: 105-125V a-c or 210-250V a-c, (selected), 50-65 Hz, single phase.

TEMPERATURE, AMBIENT OPERATING: –20°C to +50°C

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Forced air lateral circulation, built-in blowers.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROL RESOLUTION: 0.05%, independent 10-turn controls for voltage and current.

PROGRAMMING: Voltage control approximately 100 ohms per volt, (10 mA control current) Current control approximately 1000 ohms per volt, (1 mA control current).

VOLTAGE RECOVERY: (for step load current, 0-100% and 100%-10%): <500 milliseconds.

All terms used in the specifications are defined in the Kepco Glossary.

AUTOMATIC CROSSOVER: Selects voltage regulation or current regulation operating mode automatically.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

SERIES/PARALLEL: Automatic crossover design permits self-determined parallel load sharing; also master/slave capability. Series operation to rated isolation.

METERS: Suffix "M" designates a pair of 2½" 2% meters. Delete suffix "M" for unmetered unit.

TERMINALS: Heavy duty output connectors at rear. A multi-terminal barrier strip contains sensing and control functions.

DIMENSIONS: See Page 2005 for listings.

FINISH: Light gray, Color 26440 per Fed Std. 595.

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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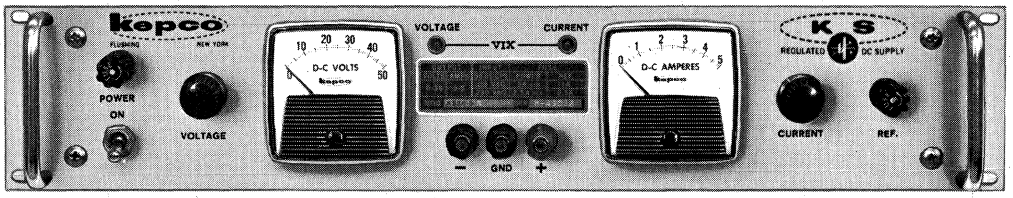

Model KS 36–5M

KEPCO KS

AUTOMATIC CROSSOVER

POWER SUPPLIES

The KS Power Supplies are twin-amplifier voltage and current autocrossover power supplies with VIX® mode indicators. The amplifiers drive a PNP pass transistor output stage whose drop is tracked by an SCR preregulator for minimum dissipation. Cooling is by self-contained forced air blowers. A 16-terminal access barrier strip allows for the external programming of voltage and current. The panel controls for both voltage and current are precision 10-turn, 20 PPM TC wirewound rheostats.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+ μH	SIZE	MAX. INPUT AMPS at 125V a-c AMPS	MAX. INPUT AMPS at 125V a-c WATTS	PRICE♦	SHIP WGT. (lbs.)
KS 8–15M	0–8	0–15	$0.05X10^{-3}$	0.01	0.04+0.4	A	4.4	320	$ 657.00	45
KS 8–25M	0–8	0–25	$0.03X10^{-3}$	0.01	0.04+0.4	B	8.5	565	798.00	65
KS 8–50M	0–8	0–50	$0.016X10^{-3}$	0.005	0.02+0.4	C	15.5	1000	1,103.00	95
KS 8–100M	0–8	0–100	$0.008X10^{-3}$	0.005	0.02+0.4	D	34.0	2100	1,523.00	170
KS 18–10M	0–18	0–10	$0.18X10^{-3}$	0.01	0.04+0.5	A	6.7	345	604.00	45
KS I8–15M	0–18	0–15	$0.12X10^{-3}$	0.01	0.04+0.5	B	8.0	510	762.00	65
KS 18–25M	0–18	0–25	$0.07X10^{-3}$	0.005	0.04+0.5	C	14.0	900	1,018.00	95
KS 18–50M	0–18	0–50	$0.035X10^{-3}$	0.005	0.02+0.2	D	26.0	1800	1,428.00	170
KS 36–5M	0–36	0–5	$0.7X10^{-3}$	0.02	0.1 +1.0	A	4.8	290	552.00	45
KS 36–10M	0–36	0–10	$0.4X10^{-3}$	0.01	0.1 +1.0	B	8.9	580	657.00	65
KS 36–15M	0–36	0–15	$0.25X10^{-3}$	0.01	0.1 +0.6	C	12.2	860	767.00	95
KS 36–30M	0–36	0–30	$0.1X10^{-3}$	0.005	0.04+0.4	D	25.0	1600	1,208.00	170
KS 60–2M	0–60	0–2	$3X10^{-3}$	0.02	0.1 +1.0	A	3.0	250	552.00	45
KS 60–5M	0–60	0–5	$1X10^{-3}$	0.02	0.1 +1.0	B	7.0	500	678.00	65
KS 60–10M	0–60	0–10	$0.6X10^{-3}$	0.01	0.1 +1.0	C	13.0	1000	940.00	95
KS 60–20M	0–60	0–20	$0.3X10^{-3}$	0.01	0.1 +0.8	D	24.0	1700	1,418.00	170
KS 120–1M	0–120	0–1	$10X10^{-3}$	0.02	0.1 +1.0	A	3.0	250	578.00	45
KS 120–2.5M	0–120	0–2.5	$5X10^{-3}$	0.02	0.1 +1.0	B	7.0	500	730.00	65
KS 120–5M	0–120	0–5	$3X10^{-3}$	0.01	0.1 +1.0	C	13.0	1000	1,019.00	95
KS 120–10M	0–120	0–10	$1X10^{-3}$	0.01	0.1 +1.0	D	25.0	1700	1,523.00	170

♦ Price includes meters, for unmetered models, delete suffix "M". In quantities of 12 or more units deduct $30.00 from price.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE (Internal Sensing)	CURRENT MODE** (External Sensing)
OUTPUT RANGE	0–100% E_O max.	<0.5%–100% I_O max.	10 mA–100% I_O max.
REGULATION, LINE	<0.005%	<0.01% or 1 mA*	<0.01% at rated sample**
REGULATION, LOAD	<0.01% or 0.5 mV*	<0.01% or 1 mA*	<0.01% at rated sample**
STABILITY (8 HR.)	<0.01% or 3 mV*	<0.05% or 5mA*	<0.05% at rated sample**
TEMP. COEFFICIENT	<0.01% per °C	<0.05% of I_O max. per °C	<0.05% per °C at rated sample**
RIPPLE, rms.	<1 mV	<0.1% of setting or 0.05% of I maximum.*	

*whichever is greater
**Rated sample is 1V d-c across external current sampling resistor, with external current control.

INPUT: 115±10V a-c or 230±15V a-c (selected) 50-65 Hz, 1Ø. Size D has additional 104±9V a-c and 208±18V a-c inputs.
TEMPERATURE, AMBIENT OPERATING: –20°C to +50°C
TEMPERATURE, STORAGE: –40°C to +85°C
COOLING: Forced air, lateral circulation. Built-in blower.
ISOLATION VOLTAGE: 500 volts to chassis.
CONTROLS: Independent 10-turn controls for voltage and current. **Resolution:** 0.05%.
PROGRAMMING: 10 milliamperes control current, by resistance at 100 ohms per volt. May be operationally controlled as an amplifier, using voltage or current signals; common negative.
VOLTAGE RECOVERY, (for step load current): <50 microseconds.
AUTOMATIC CROSSOVER: Selects voltage regulation or current regulation operating mode automatically.
VIX® CIRCUIT: Mode indicators display operating condition, a ±8V, ±1 mA control signal is provided at rear terminals.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

SERIES/PARALLEL: Automatic crossover design permits self-determined parallel load sharing; also master/slave capability. Series operation to rated isolation.

METERS: Suffix "M" designates a pair of 2½" 2% meters. Delete suffix for unmetered unit.

TERMINALS: Binding posts on front panel, plus, minus and ground (except D size models). Sixteen (16) terminal barrier strip on rear contains output, sensing and control terminals. Separate heavy duty output terminals at the rear.

DIMENSIONS: See Page 2005 for listings.

FINISH: Light gray, color 26440, per Fed. Std. 595.

All terms used in the specifications are defined in the Kepco Glossary.

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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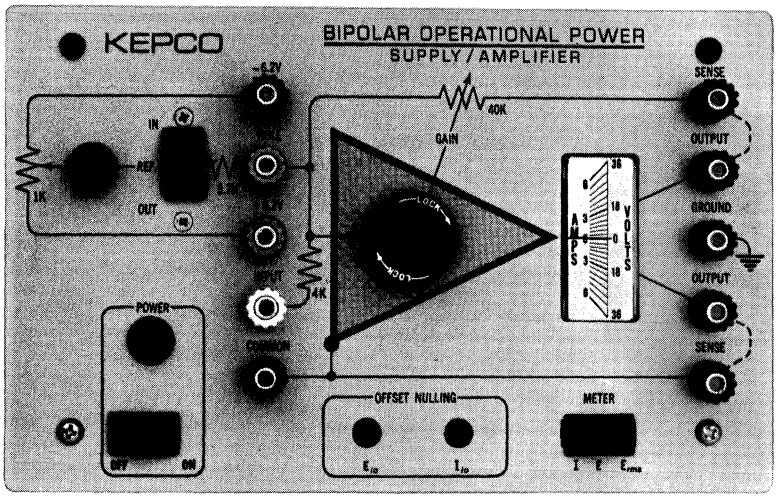
KEPCO BOP

BIPOLAR OPERATIONAL POWER SUPPLIES



Model BOP 36–5M

The Bipolar Operational Power Supply is a distinctly different sort of instrument, capable of responding to programming commands in either direction from zero. The BOP employs a d-c coupled NPN/PNP complementary-symmetry output stage, force-cooled for efficient dissipation.

The standard laboratory BOP is equipped with a patch board panel containing input/output reference and feedback elements. The unmetered instrument has a blank panel for OEM's. Barrier strip access to all control points is provided on both styles.

MODEL	DC OUTPUT RANGE VOLTS	AMPS	CURRENT SINK	PRICE ♦	SHIP WGT. (lbs.)
BOP 36–5M	+36 to –36	+5 to –5	±1A	$585.00	42
BOP 36–5	+36 to –36	+5 to –5	±1A	515.00	40

SPECIFICATION	VOLTAGE AMPLIFIER OFFSETS** ΔE_{io}	ΔI_{io}	6.2V REFERENCES
LINE: 105-125/210-250V a-c	<0.1 mV	<10 nA	<0.0005%
LOAD: No Load/Full Load	<1.0 mV	<10 nA	——
TIME: 8 Hours. (Stability)	<0.1 mV	<50 nA	<0.005%
TEMP: Per °C (Coefficient)	<0.05 mV	<50 nA	<0.005%

***E_{io} is the offset voltage and I_{io} is the offset current referred to the input of the voltage comparison amplifier.*

****Offsets and the reference contribute to output change ΔE_o, by the equation $\Delta E_o = \pm\Delta E_{ref}(R_f/R_i) \pm\Delta E_{io}(1+R_f/R_i) \pm\Delta I_{io}(R_f)$ where R_f is the feedback resistor and R_i is the input resistor from the signal reference. Use the offsets to calculate output variations*

OPEN LOOP d-c GAIN: 35,000 volts per volt.

OUTPUT SLEWING RATE: *Fast:* 4 volts per microsecond
Slow: 0.36 volts per microsecond
(Measured as the chord to the first time constant.)

SINUSOIDAL FREQUENCY RESPONSE (with gain–feedback set to 20db): *Fast:*—3db at 20 kHz. *Slow:*—3db at 1.8 kHz
Model BOP 36-5M is unconditionally stable for any feedback to 100% and any load reactance in its "slow" mode. The instrument is stable in its "fast" mode for any feedback to 100% and load capacitance up to 0.001 microfarad.

DISTORTION: *Harmonic:* 0.5% @ -3db point.
Intermodulation: <0.1% (60 Hz and 7 kHz, 4:1 in *Fast* mode).

TRANSIENT RESPONSE (measured to first time constant on the exponential response):

Fast Mode: *Voltage:* 50 microseconds for step current.
Current: 0.25 microsecond/volt for step voltage.

Slow Mode: *Voltage:* 500 microseconds for step current
Current: 2.8 microseconds/volt for step voltage.

RIPPLE: Less than 0.01% of maximum output or 3 mV rms, whichever is greater.

OUTPUT IMPEDANCE: d-c $< 1.5 \times 10^{-3}$ ohms.
Source inductance 100μh max.

OFFSET NULLING: The fixed parts of the offset voltage and offset current can be nulled using recessed front panel controls.

REFERENCES: Two at +6.2V and –6.2V (nominal); maximum loading (each) 1 milliampere.

PROGRAMMING: A built-in input control spans the ±6.2V reference and provides plus and minus output control with approximately 10% linearity (because of the 1 mA input current). A built-in vernier type rheostat acts as a variable gain control. (with the internal input resistor, its range is 0–10). All nodes and terminals are accessible at the panel for control as a high powered operational amplier (summing, scaling, integrating, etc.)

INPUT: 105-125/210-250V a-c. 50-65 Hz.

TEMPERATURE, AMBIENT OPERATING: –20°C to +65°C.

TEMPERATURE, STORAGE: –40°C to +85°C

COOLING: Forced air; built-in blower.

ISOLATION 500 volts to chassis.

CURRENT LIMITING: Fixed, factory-set to 5.5 amperes (plus and minus).

TERMINALS: Ten-terminal front panel patch board. Ten-terminal rear mounted barrier strip duplicates functions. Unmetered model has rear barrier strip terminals only.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Light gray, Color 26440 per Fed. Std. 595.
Case: Charcoal gray texture.

MOUNTING: Rack adapter RA-24. *See Hardware section.*

All terms used in the specifications are defined in the Kepco Glossary.

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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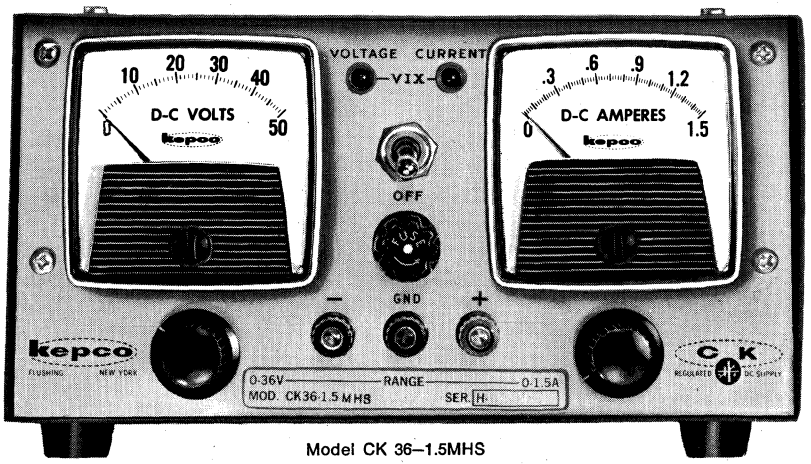
KEPCO
CK-HS
AUTOMATIC CROSSOVER
POWER SUPPLIES

This is a high speed (fast programming) version of the Kepco CK design. The high speed is achieved by removing output and feedback capacitances, reducing the stability margin. For this reason, CK-HS models should not be used in place of a voltage source in applications where its fast-programming voltage agility is not required. It is ideal as a current source because of the quick recovery characteristic. Offset nulling controls are built-in. The series pass transistor is a PNP element, making the negative output terminal signal-common.



Model CK 36–1.5MHS

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	MAX. INPUT AMPS at 125V a-c	PRICE ♦	SHIP WGT. (lbs.)
CK 8–5MHS	0–8	0–5	1.2	$410.00	21
CK 18–3MHS	0–18	0–3	1.3	368.00	21
CK 36–1.5MHS	0–36	0–1.5	1.5	368.00	21
CK 40–0.8MHS	0–40	0–0.8	1.0	328.00	21
CK 60–0.5MHS	0–60	0–0.5	1.0	368.00	21

♦ Price includes meters, for unmetered models, delete suffix "M". In quantities of 12 or more units deduct $30.00 from price.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE**	VOLTAGE AMPLIFIER OFFSETS*** E_{io}	VOLTAGE AMPLIFIER OFFSETS*** I_{io}
OUTPUT RANGE	0–100% E^o max.	0.2%–100% I^o max.	——	——
LINE: 105–125/210–250V a-c	<0.005% or 0.1 mV*	<0.005%* or 0.2 mA*	<0.1 mV	<10 nA
LOAD: No Load/Full Load	<0.01% or 0.5 mV*	<0.01%** or 0.2 mA*	<0.5 mV	<10 nA
TIME: 8 Hours. Stability	<0.01% or 2.0 mV*	<0.02% or 1 mA*	<0.1 mV	<50 nA
TEMP.: Coefficient per °C	<0.01%	<0.05% of I^o max.	<0.5 mV	<100 nA

**whichever is greater.*

***Rated sample is 1 volt across external current sensing resistor with external current control.*

****Offsets and the reference contribute to output change ΔE_O, by the equation $\Delta E_O = \pm\Delta E_{ref}(R_f/R_i) \pm\Delta E_{io}(1+R_f/R_i) \pm\Delta I_{io}(R_f)$ where R_f is the feedback resistor and R_i is the input resistor from the signal reference. Use the offsets to calculate output variations*

DC VOLTAGE GAIN: 35,000 volts per volt.

OUTPUT SLEWING RATE: 100,000 volts per second (0.1V/μsec.) measured as the slope of the chord to the first time constant on the exponential response.

SINUSOIDAL FREQUENCY RESPONSE: $f_{max.} = \frac{32}{E_{pp}}$ kHz. (E_{pp} is the peak-to-peak voltage excursion.)

MAXIMUM CAPACITANCE LOADING: 0.001 microfards. Excess capacitance slows response and causes peaking of response and instability. Adjustable lag networks provide for small range of load reductance.

RIPPLE: (rms) Voltage Mode: <0.1% of maximum output (grounded) **Current Mode:** <0.5% of maximum output

TRANSIENT RESPONSE: Voltage mode *(for step load current)* recovery is an exponential with a 50 microsecond time constant. **Current Mode** *(for step load voltage)* recovery is at the rate of 10 μsec. per volt.

OUTPUT IMPEDANCE: At d-c $Z_O = \Delta E_O/I_O$; dynamically, add the reactive impedance of 5 millihenries.

OFFSET NULLING: The initial part of the input offset voltage and input offset current can be nulled with internal controls.

REFERENCES: Two; +6.2V and –6.2V; maximum current 1 mA.

AUTOMATIC CROSSOVER: Selects voltage regulation or current regulation operating mode automatically.

VIX® CIRCUIT: Mode indicators display operating conditions, also produce a ±8V, ±1 mA control signal.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

PROGRAMMING: 1 mA control current, by resistance at 1000 ohms per volt. May be operationally controlled as an amplifier, using external voltage or current signals; common negative.

INPUT: 105-125V a-c or 210-250V a-c (selectable), 50-65 Hz single phase.

TEMPERATURE, AMBIENT OPERATING: –20°C to +50°C.

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Forced lateral circulation, built-in blower.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROLS: 10-turn voltage and current controls, 0.05% resolution.

METERS: Suffix "M" designates a pair of 2½", 2% meters.

TERMINALS: Binding posts on front panel, plus, minus, and ground. Sixteen (16) terminal barrier strip on the rear contains output, sensing, and control terminals.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Brushed aluminum. *Case:* Charcoal gray texture.

MOUNTING: Mount single unit in rack adapter RA-5, two abreast in rack adapter RA-4. *See Hardware section.*

All terms used in the specifications are defined in the Kepco Glossary

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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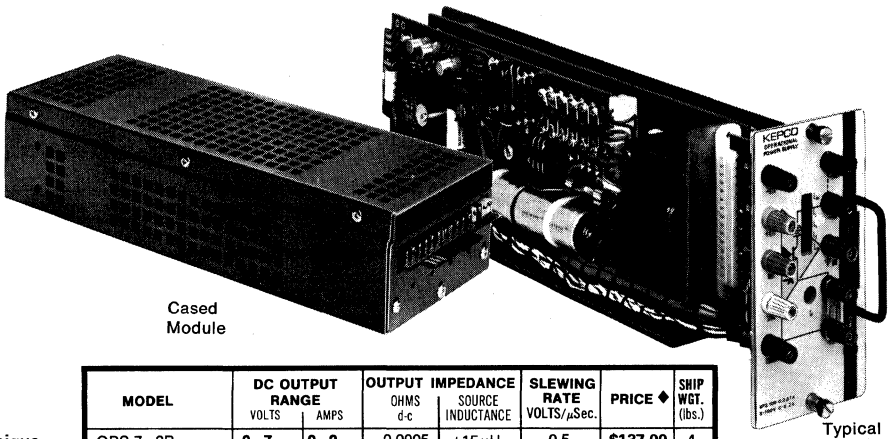
KEPCO OPS-B

PLUG-IN MODULAR POWER SUPPLIES



Cased Module

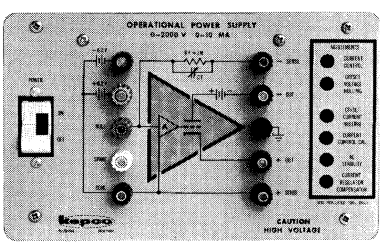
Typical "BTA" Panel Plug-in Model

The Kepco Operational Power Supply is a unique instrument; a combination self-powered operational power amplifier and d-c power supply. The OPS group is suitable for a wide variety of signal processing chores: scaling, summing, integrating and impedance transformation. The "B" models, incorporating a linear I-C input amplifier, are in modular form for OEM's; the "BTA" versions are plug-in modules which offer a 10-terminal patch panel for bench-type operational manipulations. Model OPS 2000 is a hybrid type utilizing a high voltage vacuum tube. Their fast output slewing enables the OPS models to be fast-recovery, programmable, current controllers or audio spectrum voltage amplifiers.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE OHMS d-c	OUTPUT IMPEDANCE SOURCE INDUCTANCE	SLEWING RATE VOLTS/μSec.	PRICE ◆	SHIP WGT. (lbs.)
OPS 7–2B	0–7	0–2	0.0005	+15μH	0.5	$137.00	4
OPS 7–2BTA	0–7	0–2	0.0005	+150μH	0.25	179.00	6
OPS 15–1.5B	0–15	0–1.5	0.001	+15μH	1.0	137.00	4
OPS 15–1.5BTA	0–15	0–1.5	0.001	+150μH	0.25	179.00	6
OPS 21–1B	0–21	0–1	0.0025	+15μH	1.0	137.00	4
OPS 21–1BTA	0–21	0–1	0.0025	+150μH	0.5	179.00	6
OPS 40–0.5B	0–40	0–0.5	0.008	+15μH	1.5	137.00	4
OPS 40–0.5BTA	0–40	0–0.5	0.008	+150μH	1.0	179.00	6
OPS 72–0.3B	0–72	0–0.3	0.025	+15μH	1.5	137.00	4
OPS 72–0.3BTA	0–72	0–0.3	0.025	+150μH	1.0	179.00	6
OPS 100–0.2B	0–100	0–0.2	0.050	+15μH	2.0	137.00	4
OPS 100–0.2BTA	0–100	0–0.2	0.050	+150μH	1.5	179.00	6
OPS 20	0–20	0–0.05	0.04	+150μH	1.0	200.00	7
OPS 2000	0–2000	0–0.01	20.0	+15μH	1.0	368.00	16

◆ For Case—add suffix "C" to model number and $11.00 to price. Do not use case with "BTA" models.

SPECIFICATION	VOLTAGE AMPLIFIER OFFSETS* (referred to the input of the control amplifier) ALL OPS MODELS EXCEPT OPS 2000 OFFSET VOLTAGE ΔE_{io}	ALL OPS MODELS EXCEPT OPS 2000 OFFSET CURRENT ΔI_{io}	OPS 2000 VOLTAGE AMPLIFIER OFFSET VOLTAGE ΔE_{io}	OPS 2000 VOLTAGE AMPLIFIER OFFSET CURRENT ΔI_{io}	OPS-2000 CURRENT MODE REGULATION AUTO-CROSSOVER (Internal Sensing)	REFERENCES* ±6.2V (All Models)
LINE: 105-125/210-250V a-c	<10 μV	<2 nA	<0.1 mV	<10 nA	<10 μA	<0.0001%
LOAD: No load/full load	<200 μV	<5 nA	<1.0 mV	<10 nA	<10 μA	———
TIME: 8 hrs. (Stability)	<20 μV	<2 nA	<0.1 mV	<100 nA	<0.01%	<0.005%
TEMP.: Per°C (Coefficient)	<20 μV	<5 nA	<0.5 mV	<100 nA	<0.01%	<0.005%



Bench Style Model OPS 2000

Offsets and the reference contribute to output change ΔE_O, by the equation $\Delta E_O = \pm\Delta E_{ref}(R_f/R_i) \pm \Delta E_{io}(1+R_f/R_i) \pm \Delta I_{io}(R_f)$ where R_f is the feedback resistor and R_i is the input resistor from the signal reference. Use the offsets to calculate output variations.

OPEN LOOP d-c GAIN: $>0.5\times10^6$ volts per volt.

OUTPUT SLEWING RATE: See chart. (measured as the chord to the first time constant on the exponential response).

SINUSOIDAL FREQUENCY RESPONSE: $f_{max.} = \frac{\text{Slew Rate}}{\pi E_{pp}}$ (E_{pp} is the peak-to-peak voltage excursion.)

RIPPLE: <0.01% of max. output, or 3mV whichever is greater.

MAXIMUM CAPACITIVE LOADING: 0.001 microfarads. Excess capacitance slows response and causes peaking of response and instability. Adjustable lag networks provide for small range of load reactance.

TRANSIENT RESPONSE Voltage Mode (for step load current): recovery is an exponential with 50 microsecond time constant. **Current Mode (for step load voltage):** recovery is the reciprocal of the slew rate.

OFFSET NULLING: Fixed part of input-offset voltage and input offset currents can be nulled. OPS-BTA models feature front panel nulling, modules have internal trimmers.

REFERENCES: Two at +6.2V and −6.2V; 1 mA max.

PROGRAMMING: May be controlled by external voltage or current signals, common positive.

INPUT: 105-125V a-c or 210-250V a-c (selected), 50-440 Hz single phase. Model OPS 2000: 50-65 Hz single phase.

TEMPERATURE, AMBIENT OPERATING: −20°C to +65°C.

TEMPERATURE, STORAGE: −40°C to +85° C.

COOLING: Convection.

ISOLATION VOLTAGE: 500 volts to chassis. (OPS 2000: 1000V).

CURRENT LIMITING: Adjustable from 10% to 110% of rated current. Model OPS 2000 is an automatic-crossover current regulator, see table for performance specifications.

TERMINALS: Connections via a rear mounted barrier strip. Modules and OPS-BTA include a PC connector. Bench models have front panel terminal pattern.

DIMENSIONS: See Page 2005 for listings. Models OPS-20 and OPS-2000 are available in a bench style case only. OPS 7-2 to OPS 100-0.2 are available uncased, with CA-1 case (-C), or as plug-in patch board units (-TA).

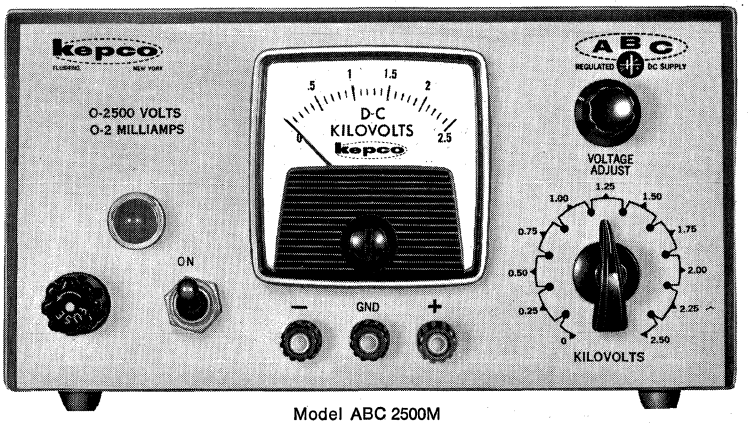
FINISH: *Modules:* Blue anodized aluminum.
Panels: Light gray, color 26440 per Fed. Std. 595.
Bench style Cases: Charcoal gray texture.

MOUNTING: Cased modules may be racked with adapters RA 12-1, RA 13-4 or RA 11-6. Uncased modules with BPA-22 adapter and the (-TA) plug-in units, mount in housings CA-3, CA-4, CA-5 or RA 22-6. Bench style units may be rack mounted with RA-24. *See Hardware Section.*

Data subject to change without notice

All terms used in the specifications are defined in the Kepco Glossary on Page 33.

KEPCO ABC HYBRID POWER SUPPLIES



Model ABC 2500M

The ABC group of bench-style programmable voltage regulators span a wide range of voltages. The transistor group covers 0–2V to 0–100V; the hybrid group 0–200V to 0–2500V. Hybrid models employ a high voltage vacuum tube series regulator, convection cooled, driven by a high gain transistor amplifier. The 0–200 and 0–425 volt models employ a continuous 10-turn wirewound, 20 PPM TC voltage control. The 0–1000 volt, 0–1500 volt and 0–2500 volt models employ a 10-step voltage selector with 10-turn vernier. They may be programmed, however, continuously from zero to their rated voltage.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	RIPPLE (max) RMS MV.	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	MAX. INPUT AMPS at 125 V a-c	PRICE ♦	SHIP WGT. (lbs.)
ABC 200M	0–200	0–0.1	0.5	1	0.5	2.0+ 2.0	0.5	$220.00	14
ABC 425M	0–425	0–0.05	0.5	4	0.5	2.0+ 2.0	0.5	220.00	15
ABC 1000M	0–1000	0–0.02	1.0	25	1.0	2.0+10.0	0.5	309.00	15
ABC 1500M	0–1500	0–0.01	1.0	75	1.0	2.0+10.0	0.3	309.00	15
ABC 2500M	0–2500	0–0.002	1.0	625	1.0	2.0+10.0	0.3	383.00	18

♦ Price includes meter, for unmetered model, delete suffix "M" and deduct $20.00 for models ABC 200 and ABC 425. Deduct $15.00 for models ABC 1000, 1500 and 2500 (any quantity order).

	VOLTAGE MODE	CURRENT MODE** (External Sensing)
OUTPUT RANGE	0–100% E_O max.	1 mA–100% I_O max.
REGULATION, LINE	<0.05% or 5 mV*	<0.1% at rated sample**
REGULATION, LOAD	<0.05% or 5 mV*	<0.1% at rated sample**
STABILITY (8 HR.)	<0.05% or 50 mV*	<0.1% or 10 μA*
TEMP. COEFFICIENT	<0.05% per °C	<0.1% per °C at rated sample**
RIPPLE, rms.	See Table above	<0.1% I_O max.

*whichever is greater
**Rated sample is 10V d-c across external current sampling resistor, with external current control.

INPUT: 105-125V a-c or 210-250V a-c (selected) 50-440 Hz single phase.

TEMPERATURE, AMBIENT OPERATING: –20°C to +55°C.

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Convection.

ISOLATION VOLTAGE: 1000 volts to chassis.

AC OUTPUT: 6.5V AC, 2A unregulated, available at the rear terminals of Models ABC 200M and ABC 425M.

CONTROL RESOLUTION: 0.05%, 10-turn voltage control on Models ABC 200M and ABC 425M. Resolution is 0.005% with 10-position selector and 10-turn vernier voltage control on Models ABC 1000M, ABC 1500M and ABC 2500M.

PROGRAMMING: 1 mA control current, by resistance at 1000 ohms per volt. May be operationally controlled as an amplifier using voltage or current signals; common positive.
Model ABC 2500M is restricted to the upper ⅔ of its output range in operational control. Fast slewing models available on special order.

VOLTAGE RECOVERY (for step load current): <50 μseconds.

CURRENT LIMITING: Single turn panel adjustment sets limit from 25% to 150% of rated full current on Models ABC 200M and ABC 425M. A fixed limit set to approximately 150% is provided on Models ABC 1000M, ABC 1500M and ABC 2500M.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

SERIES/PARALLEL: Series operation to rated isolation; also master/slave capability. Current limiting design permits self-determined parallel load sharing.

METERS: Suffix "M" designates a single dual scale 2½", 2% volt-ammeter with selector switch, for models ABC 200M and ABC 425M. Voltmeter only for Models ABC 1000M, ABC 1500M and ABC 2500M.
Delete suffix "M" for unmetered unit.

TERMINALS: Binding posts on front panel, plus, minus and ground. Multi-terminal barrier strip at the rear contains output and control terminals.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Brushed aluminum. *Case:* Charcoal gray texture.

MOUNTING: Mount single unit in rack adapter RA-5, two abreast in rack adapter RA-4. *See Hardware section.*

All terms used in the specifications are defined in the Kepco Glossary

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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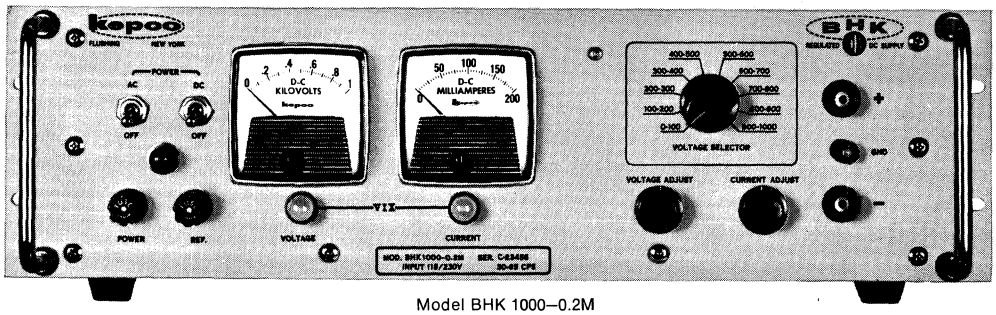


Model BHK 1000–0.2M

KEPCO
BHK
HIGH VOLTAGE
POWER SUPPLIES

The high voltage hybrid BHK models employ twin-transistor amplifiers (one for voltage, the other for current) to drive a series pass tube regulator in either voltage or current mode, with automatic crossover and VIX® mode indicators. By restrapping for high speed, the same model is also a fast programmable voltage or quick recovery current source. Built-in offset nulling controls allow precision operational programming. Panel controls are 10-turn, 20 PPM TC wirewound, with a 10-position selector for additional voltage resolution.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c-100Hz	0-1-1kHz	1-100kHz+μH	PRICE◆	SHIP WGT. (lbs.)
BHK 500–0.4M	0–500	0–0.4	0.13	0.1	0.2 + 0.5	$825.00	40
BHK 1000–0.2M	0–1000	0–0.2	0.5	0.1	0.2 + 0.5	825.00	41
BHK 2000–0.1M	0–2000	0–0.1	2.0	0.2	0.5 + 2.0	850.00	43

◆ Price includes meters, for unmetered models, delete suffix "M". In quantities of 12 or more units deduct $30.00 from price.

SPECIFICATIONS	VOLTAGE REGULATION	CURRENT REGULATION (Internal Sensing)	VOLTAGE AMPLIFIER OFFSETS** ΔE_{io}	VOLTAGE AMPLIFIER OFFSETS** ΔI_{io}	VOLTAGE REFERENCE (INTERNAL)**
OUTPUT RANGE:	0-100% E_O max.	0.2%-100% I_O max.	——	——	Fixed 6.2V±5%
LINE: 105-125/210-250V a-c	<0.005% or 1 mV*	<100 μA	<1 mV	<10 nA	0.0001%
LOAD: No Load/Full Load	<0.01% or 1 mV*	<100 μA	<1 mV	<10 nA	——
TIME: 8 hours (Stability)	<0.01% or 2.0 mV*	<0.01% or 20μA*	<50 μV	<50 nA	0.005%
TEMP: Per °C (Coefficient)	<0.01%	<0.05% of I_O max.	<100 μV	<50 nA	0.005%
RIPPLE: rms (Normal Speed)	<1 mV	<100 μA	——	——	——

**whichever is greater.*

***Offsets and the reference contribute to output change ΔE_O, by the equation $\Delta E_O = \pm\Delta E_{ref}(R_f/R_i) \pm\Delta E_{io}(1+R_f/R_i) \pm\Delta I_{io}(R_f)$ where R_f is the feedback resistor and R_i is the input resistor from the signal reference. Use the offsets to calculate output variations.*

OPEN LOOP d-c GAIN: $>0.5\times10^6$ volts per volt.

OUTPUT SLEWING RATE: *(Fast slewing connection):* Greater than 500,000 volts per second, measured as the chord to the first time constant on the exponential response.

SINUSOIDAL FREQUENCY RESPONSE:

Fast Slewing Connection: $f_{max} = \frac{160}{E_{pp}}$ kHz.

(E_{pp} is the peak-to-peak excursion).

RIPPLE, Fast Slewing Connection:

Ungrounded: <0.1% E_o max.

Grounded: <0.001% E_o max.

TRANSIENT RESPONSE:

Voltage Mode, Fast Slewing: For step load current, recovery is an exponential with a 50 microsecond time constant.

Current Mode, Fast Slewing: For step load voltage, recovery is at the rate of 2 μsec. per volt.

Voltage Mode, Normal Speed: For step load current, recovery to regulation band within 50 microseconds.

OUTPUT IMPEDANCE:

Voltage Mode, Normal Speed: See table.

Voltage Mode, Fast Slewing: Above 1kHz, add the reactive impedance of 500 microhenries.

OFFSET NULLING: The initial part of the input offset voltage and input offset current can be nulled with internal controls.

REFERENCES: Two: +6.2 volts and –6.2 volts; maximum current 1 milliampere.

PROGRAMMING: 1 mA control current, by resistance at 1000 ohms per volt. May be operationally controlled as an amplifier using voltage or current signals. Common positive.

AUTOMATIC CROSSOVER: Selects voltage regulation or current regulation operating mode automatically.

VIX® CIRCUIT: Voltage/Current mode indicators display operating conditions; also 115V a-c control signal (0.5A max.)

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

TEMPERATURE, AMBIENT OPERATING: –20°C to +55°C.

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Convection.

INPUT: 105-125 V a-c or 210-250V a-c (selected), 50-65 Hz single phase. Approximately 4 amperes at 125V a-c.

ISOLATION VOLTAGE: 1000 volts to chassis.

CONTROL RESOLUTION: Voltage: 0.01% 10-turn vernier control and 10 position selector. *Current:* 0.05% 10-turn control.

OVERSHOOT: (Turn-on/off): None above 10% voltage setting; negligible below 10% when preloaded to 10% minimum.

SERIES/PARALLEL: Automatic crossover design permits self-determined parallel load sharing, or use of master/slave connection. Series operation to rated isolation.

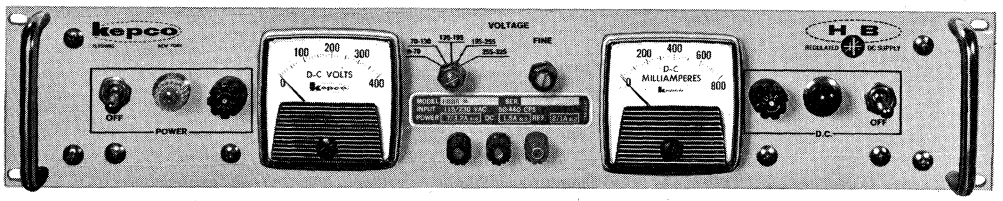
METERS: Suffix "M" designates a pair of 2½", 2% meters. Delete suffix "M" for unmetered unit.

TERMINALS: Safety (recessed) output connections on front panel; two multi-terminal barrier strips at the rear contain output, sensing and control functions. Fast slewing/normal strapping is internal.

DIMENSIONS: See Page 2005 for listings.

FINISH: Light gray, color 26440, per Fed. Std. 595.

All terms used in the specifications are defined in the Kepco Glossary.



Model HB 8AM

KEPCO

HB

HYBRID

POWER SUPPLIES

The high voltage hybrid HB power supplies use a high gain transistor comparison amplifier to drive the series pass tube regulator. Voltage feedback is by means of a 5-position range switch and 10-turn, 20 PPM TC wire-wound vernier control with remote programming within the span of any one range (to zero with derating). Current may be regulated with external sensing and feedback using the rating chart to determine the allowable compliance range.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	AUXILIARY OUTPUT 6.5V a-c Unregulated	MAX. INPUT AMPS at 125 V a-c	PRICE ◆	SHIP WGT. (lbs.)
HB 2AM	0–325	0–0.2	0.2	0.08	0.2+0.5	EACH SUPPLY HAS TWO 6 AMPERE OUTPUTS	2.0	$325.00	35
HB 4AM	0–325	0–0.4	0.1	0.08	0.2+0.5		3.0	365.00	35
HB 6AM	0–325	0–0.6	0.06	0.08	0.2+0.5		5.0	395.00	43
HB 8AM	0–325	0–0.8	0.05	0.08	0.2+1.0		5.5	435.00	43
HB 250M	0–250	0–1	0.025	0.08	0.2+0.5		8.0	595.00	43
HB 525M	0–525	0–0.5	0.1	0.08	0.2+0.5		8.0	550.00	43

◆ Price includes meters, for unmetered models, delete suffix "M". In quantities of 12 or more units deduct $30.00 from price.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE (External Sensing)
OUTPUT RANGE	0–100% E_O max.	10 mA–100% I_O max.
REGULATION, LINE	<0.01%	<0.01% at rated sample**
REGULATION, LOAD	<0.01% or 2 mV*	<0.01% at rated sample**
STABILITY (8 HR.)	<0.01% or 2 mV*	<0.05% or 0.2 mA*
TEMP. COEFFICIENT	<0.01% per °C	<0.05% per °C at rated sample**
RIPPLE, rms.	<1 mV	<0.01% of I_O max.

**whichever is greater*

***Rated sample is 10V d-c across external current sampling resistor, with external current control.*

INPUT: 105-125 V or 210-250V a-c (selected), 50–440 Hz, single phase.

TEMPERATURE, AMBIENT OPERATING: −20°C to +55°C.

TEMPERATURE STORAGE: −40°C to +85°C.

COOLING: Convection.

ISOLATION VOLTAGE: 600 volts to chassis.

AC OUTPUTS: Two unregulated, 6.5V a-c, 6A outputs.

CONTROL RESOLUTION: 0.02%, 5 step range selector, 10-turn vernier.

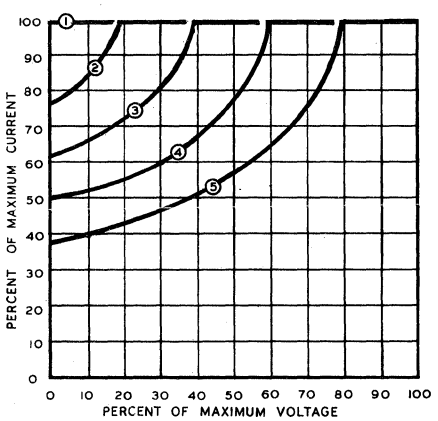
PROGRAMMING: 10 mA control current, by resistance at 100 ohms per volt. May be operationally controlled as an amplifier using voltage or current signals; common positive.

VOLTAGE RECOVERY (for step load current): < 50 microseconds.

REMOTE ERROR SENSING: (Models HB 250M and HB 525M only) compensate up to 0.5 volt drop per output lead.

OVERSHOOT (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded 10% minimum.

RATING CURVES: Output is designed to deliver 100% of rated current within the span of any one range. When operating outside the selected range, either by remote programming, or as the compliance voltage in current mode, use the graph to determine the maximum current that can be drawn at reduced voltage.



RATING CURVES

Curves represent the volt-ampere rating for range switch positions 1–5. To use, determine which position covers the desired voltage. Read the maximum current for each voltage on the left scale.

METERS: Suffix "M" designates a pair of 2½", 2% meters. Delete suffix for unmetered unit.

TERMINALS: Binding posts on front panel, plus, minus and ground. Multi-terminal barrier strip at the rear contains output, sensing and control terminals.

DIMENSIONS: See Page 2005 for listings.

FINISH: Light gray, color 26440, per Fed. Std. 595.

All terms used in the specifications are defined in the Kepco Glossary

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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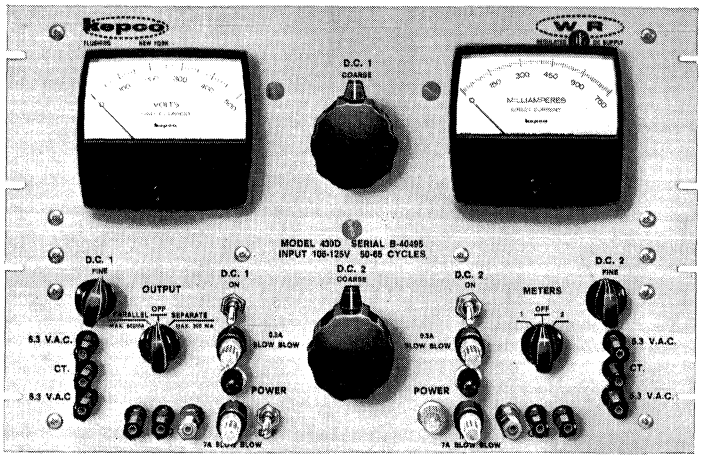
KEPCO™
WR
VACUUM TUBE
POWER SUPPLIES

The Kepco WR group is comprised of a variety of high voltage, vacuum tube-regulated power supplies. Many are multioutput units delivering bias and filament power in addition to regulated B+.



Model 430D

- *time tested vacuum tube design*
- *multi-output laboratory units*

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE mA	REGULATION LOAD 0—MAX. %	REGULATION LOAD 0—MAX. ΔV	REGULATION LINE %	REGULATION LINE ΔV	RIPPLE RMS mV	OUTPUT IMPEDANCE Ohms + μH d-c to 100Hz	100Hz to 1kHz	1kHz to 100kHz +μH	AUX. OUTPUT 6.3V a-c Unreg	DIMENSIONS H	W	D	MAX. INPUT AMPS at 125 V a-c	PRICE◆	SHIP WGT. (lbs.)
2400 B—#1	**Bias**																
	0—150	**0—5**	*	*	*	*	1	*	*	*		10½	19	17⅞	5.0	**$ 625.00**	111
#2	**0—400**	**0—150**	0.025	0.1	0.1	0.4	3	0.7	0.05	0.2+2	10 AMP						
#3	**0—400**	**0—150**	0.025	0.1	0.1	0.4	3	0.7	0.05	0.2+2	10 AMP						
Parallel #2 & #3	**0—400**	**0—300**	0.025	0.1	0.1	0.4	3	0.35	0.05	0.2+2							
Series #2 & #3	**0—800**	**0—150**	0.025	0.2	0.1	0.8	6	1.4	0.1	0.4+4							
400 B	**0—400**	**0—150**	0.025	0.1	0.1	0.4	3	0.7	0.05	0.2+2	10 AMP	7	19	11⅞	3.0	**310.00**	48
	Bias																
	0—150	**0—5**	*	*	*	*	1	*	*	*							
430 D—#1	**0—450**	**0—300**	0.025	0.1	0.1	0.4	3	0.38	0.05	0.2+2	10 AMP	12¼	19"	17⅞	8.0	**762.00**	140
#2	**0—450**	**0—300**	0.025	0.1	0.1	0.4	3	0.38	0.05	0.2+2	10 AMP						
Parallel #1 & #2	**0—450**	**0—600**	0.025	0.1	0.1	0.4	3	0.19	0.05	0.2+2							
Series #1 & #2	**0—900**	**0—300**	0.025	0.2	0.1	0.8	6	0.76	0.1	0.4+4							
800 B—#1	**0—600**	**0—200**	0.02	0.1	0.1	0.4	3	0.6	0.05	0.2+2	10 AMP	12¼	19	17⅞	7.5	**657.00**	141
#2	**0—600**	**0—200**	0.02	0.1	0.1	0.4	3	0.6	0.05	0.2+2	10 AMP						
Parallel #1 & #2	**0—600**	**0—400**	0.02	0.1	0.1	0.4	3	0.3	0.05	0.2+2							
Series #1 & #2	**0—1200**	**0—200**	0.02	0.2	0.1	0.8	6	1.2	0.1	0.4+4							
605	**0—600**	**0—500**	0.02	0.1	0.1	0.4	3	0.24	0.05	0.2+2	20 AMP	10½	19	17⅞	8.0	**473.00**	119
	Bias																
	0—150	**0—5**	*	*	*	*	1	*	*	*							
615B	**0—600**	**0—300**	0.02	0.1	0.1	0.4	3	0.4	0.05	0.2+2	10 AMP	10½	19	13⅞	6.0	**394.00**	74
	Bias																
	0—150	**0—5**	*	*	*	*	1	*	*	*							
103—#1	**0—300**	**0—75**	Common B- Isolated from #1 and #2 Unreg				30	—	—	—	5 AMP	8	16"	8"	1.5	**139.00**	30
#2	**0—300**	**0—75**					30	—	—	—							
#3	**−50 to +50**	**0—5**					10	—	—	—		Rack Adapter RA-1 Available, See Accessory Page					
Parallel #1 & #2	**0—300**	**0—150**					30	—	—	—							
1250 B ◇	**0—1000**	**0—500**	0.01	0.1	0.05	0.4	3	0.2	0.1	1.0+2		28	22	15½	12.5	**730.00**	203
1520 B ◇	**0—1500**	**0—200**	0.01	0.1	0.05	0.4	3	0.75	0.3	1.0+5		23	22	15½	7.0	**788.00**	204
HB 2050 ◇	**0—2000**	**0—500**	0.005	0.1	0.02	0.4	3	0.2	0.5	2.0+5		33½	22	18	24.0	**1,733.00**	312
HB 2500 ◇	**0—2500**	**0—50**	0.005	0.1	0.02	0.4	5	2.5	0.5	2.0+5		8¾	19	14	5.0	**1,024.00**	85

◆ Available metered only.

All terms used in the specifications are defined in the Kepco Glossary on Page 33.

INPUT:
105-125V a-c, 50-65 Hz, single phase, 400 Hz, input available on special order.

TEMPERATURE, AMBIENT OPERATING:
−20°C to +55°C

TEMPERATURE, STORAGE:
−40°C to 85°C

COOLING: Convection.

ISOLATION VOLTAGE:
400 volts to chassis.

CONTROL RESOLUTION:
0.5% single turn controls on all models except 2400B, 430D, 800B and HB 2500, which employ a coarse and fine adjustment. The "fine" control covers a 1% voltage range with 0.005% resolution.

VOLTAGE RECOVERY, (for step load current):
< 50 microseconds.

TERMINALS:
Output and ground terminals are on the front panel, except Models 2400B, HB 2050 and HB 2500, which have the terminals at the rear.

DIMENSIONS:
The dimensions for each model are tabulated, models with the ✧ symbol are supplied in a rack cabinet. They may be removed for mounting in any standard 19" equipment rack.

The equipment rack dimensions are:

MODEL	H	W	D
1250 B	26¼"	19"	13⅞"
1520 B	21"	19"	13⅞"
HB 2050	31½"	19"	17⅞"
103	(Use with Rack Adapter RA-1)		

FINISH:
Panel: Light gray Color 26440 per Fed. Std. 595.
Cabinet: Charcoal gray texture.

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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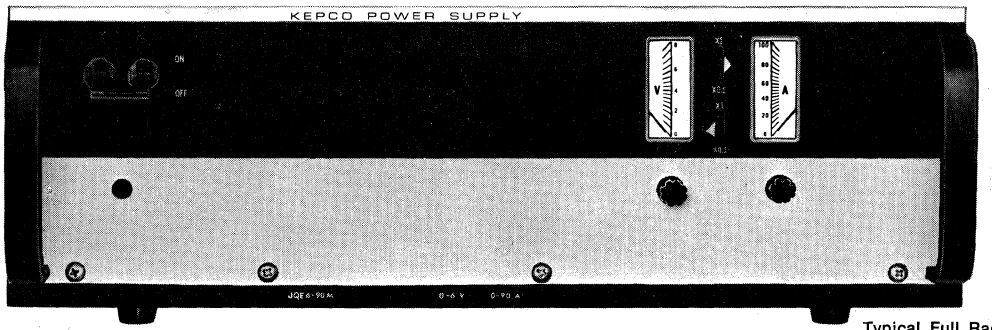
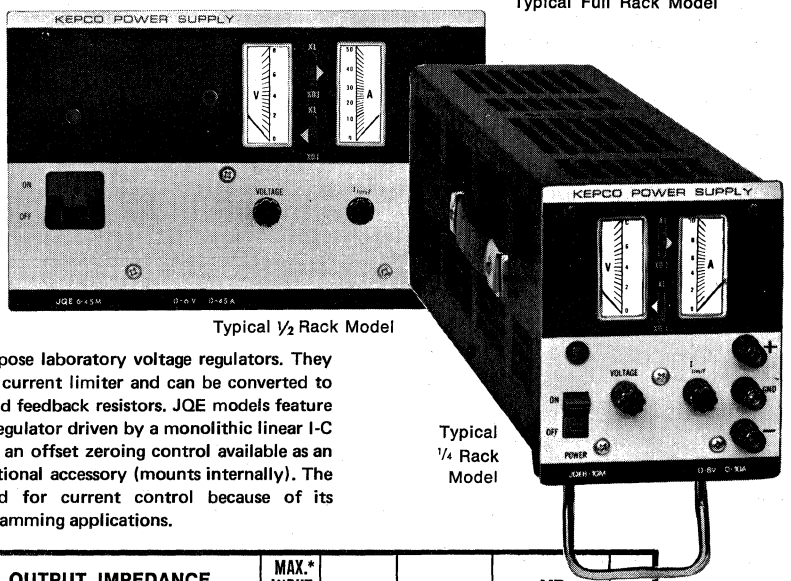


Typical Full Rack Model

KEPCO
JQE
COMPACT
POWER SUPPLIES



Typical ½ Rack Model

Typical ¼ Rack Model

JQE power supplies are compact general-purpose laboratory voltage regulators. They are equipped with a panel-adjusted overload current limiter and can be converted to current regulation by using external sensing and feedback resistors. JQE models feature a linear full-dissipation series NPN transistor-regulator driven by a monolithic linear I-C amplifier. Output is fully programmable with an offset zeroing control available as an option. An overvoltage crowbar is also an optional accessory (mounts internally). The JQE-HS high-speed option is recommended for current control because of its fast-recovery characteristics, and for fast programming applications.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1 1kHz to 100kHz+μH	MAX.* INPUT AMPS at 125 V a-c	RACK SIZE	PRICE◆	VP OPTION	SHIP WGT. (lbs.)
JQE 6–10M	0–6	0–10	30 μΩ	0.01	0.02 +1	2.3	¼	$289.00	$ 75.00	21
JQE 6–22M	0–6	0–22	14 μΩ	0.005	0.01 +0.5	4.6	½	520.00	95.00	34
JQE 6–45M	0–6	0–45	7 μΩ	0.005	0.01 +0.5	8.7	½	625.00	95.00	48
JQE 6–90M	0–6	0–90	3.5 μΩ	0.001	0.005+0.5	18.0	Full	977.00	115.00	95
JQE 15–6M	0–15	0–6	125 μΩ	0.01	0.02 +1	2.3	¼	289.00	75.00	21
JQE 15–12M	0–15	0–12	63 μΩ	0.005	0.01 +0.5	4.6	½	520.00	95.00	34
JQE 15–25M	0–15	0–25	30 μΩ	0.005	0.01 +0.5	8.7	½	625.00	95.00	48
JQE 15–50M	0–15	0–50	15 μΩ	0.001	0.005+0.5	18.0	Full	977.00	115.00	95
JQE 25–4M	0–25	0–4	300 μΩ	0.01	0.02 +1	2.3	¼	289.00	75.00	21
JQE 25–9M	0–25	0–9	140 μΩ	0.005	0.01 +0.5	4.6	½	520.00	95.00	34
JQE 25–18M	0–25	0–18	70 μΩ	0.005	0.01 +0.5	8.7	½	625.00	95.00	48
JQE 25–36M	0–25	0–36	35 μΩ	0.001	0.005+0.5	18.0	Full	977.00	115.00	95
JQE 36–3M	0–36	0–3	600 μΩ	0.01	0.02 +1	2.3	¼	289.00	75.00	21
JQE 36–6M	0–36	0–6	300 μΩ	0.005	0.01 +0.5	4.6	½	520.00	95.00	34
JQE 36–13M	0–36	0–13	140 μΩ	0.005	0.01 +0.5	8.7	½	625.00	95.00	48
JQE 36–25M	0–36	0–25	70 μΩ	0.001	0.005+0.5	18.0	Full	977.00	115.00	95
JQE 55–2M	0–55	0–2	1.4 mΩ	0.01	0.02 +1	2.3	¼	300.00	75.00	21
JQE 55–4.5M	0–55	0–4.5	600 μΩ	0.005	0.01 +0.5	4.6	½	520.00	95.00	34
JQE 55–9M	0–55	0–9	300 μΩ	0.005	0.01 +0.5	8.7	½	625.00	95.00	48
JQE 55–18M	0–55	0–18	150 μΩ	0.001	0.005+0.5	18.0	Full	977.00	115.00	95
JQE 75–1.5M	0–75	0–1.5	2.5 mΩ	0.01	0.02 +1	2.3	¼	300.00	75.00	21
JQE 75–3M	0–75	0–3	1.25 mΩ	0.005	0.01 +0.5	4.6	½	520.00	95.00	34
JQE 75–6.5M	0–75	0–6.5	570 μΩ	0.005	0.01 +0.5	8.7	½	625.00	95.00	48
JQE 75–13M	0–75	0–13	285 μΩ	0.001	0.005+0.5	18.0	Full	977.00	115.00	95
JQE 100–1M	0–100	0–1	5 mΩ	0.01	0.05 +2	2.3	¼	300.00	75.00	21
JQE 100–2.5M	0–100	0–2.5	2 mΩ	0.005	0.02 +1	4.6	½	520.00	95.00	34
JQE 100–5M	0–100	0–5	1.25 mΩ	0.005	0.02 +1	8.7	½	625.00	95.00	48
JQE 100–10M	0–100	0–10	0.62 mΩ	0.001	0.01 +1	18.0	Full	977.00	115.00	95

◆ Options: "–HS" add $50.00 "–T" add $30.00, "–E" add $10.00

*at 125V a-c, Pf. typical 0.7

SPECIFICATION	VOLTAGE MODE	CURRENT MODE**	VOLTAGE AMPLIFIER OFFSETS***		VOLTAGE REFERENCE (INTERNAL)***
			OFFSET VOLTAGE ΔE_{io}	OFFSET CURRENT ΔI_{io}	
OUTPUT RANGE	0–100% E_o max.	1 mA–100% I_o max.	———	———	Fixed 6.2V±5%
LINE: 105–125/210–250V a-c	<0.0005%	<0.005%**	<10 μV	<2 nA	0.0001%
LOAD: No Load/Full Load	<0.005% or 0.2 mV*	<0.01%**	<200 μV	<5 nA	———
TIME: 8 Hours. Stability	<0.01% or 1 mV*	<0.02**	<20 μV	<2 nA	0.005%
TEMP.: Coefficient per °C	<0.01%†	<0.02**†	<20 μV	<5 nA	0.005%
RIPPLE: (rms)	<0.2 mV	<0.02% of I_o max.	———	———	———

*whichever is greater.

**External sensing, using a 1V sample. Specs are measured at rated sample voltage with 20 PPM external current feedback control.

***Offsets and the reference contribute to output change ΔE_O, by the equation $\Delta E_O = \pm\Delta E_{ref}(R_f/R_i) \pm\Delta E_{io}(1+R_f/R_i) \pm\Delta I_{io}(R_f)$ where R_f is the feedback resistor and R_i is the input resistor from the signal reference. Use the offsets to calculate output variations when external input/feedback elements are substituted for the internal reference and voltage control in special applications.

†See OPTIONS for 0.005% per °C voltage mode — 0.01% per °C current mode temperature coefficient.

INPUT: 105-125V a-c or 210-250V a-c (selected) 50-65 Hz, 1Ø

TEMPERATURE, AMBIENT OPERATING: –20°C to + 71°C

TEMPERATURE, STORAGE: –50°C to + 85°C

COOLING: Forced air, built-in blower.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROLS: *Voltage:* 10-turn, 20 PPM TC, wirewound rheostat, ±0.25% linearity
Current: Multiturn vernier potentiometer.

PROGRAMMING: 1 mA control current (built-in reference) resistance program at 1000 ohms per volt with built-in calibration control. Program by voltage or current operationally as an amplifier, positive output terminal common. See OPTIONS for wide band "high speed" models and offset (E_{io}) nulling control.

OPEN LOOP d-c GAIN: $>0.5\times10^6$ volts per volt.

VOLTAGE RECOVERY (for step load current): <50 μseconds for recovery to within 0.005% or 2 mV of setting.

OVERSHOOT (Turn on/off): Conventional speed models exhibit no overshoot when set above 25% of rated voltage or at any voltage setting when loaded to 10% of rated current (not applicable to HS models).

CURRENT LIMITING: Adjustable from 10% to 105% of the rated full current.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

SERIES/PARALLEL: Series operation to the rated isolation voltage. Units may be paralleled by employing their current limiters.

METERS: Two dual range, 2-inch, 2% taut band recessed meters, monitor output voltage and current. 10:1 range switching. Unmetered versions available as modules, delete suffix "M" and deduct $30.00 from listed price (any quantity).

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Light gray, Color 26440, per Fed. Std. 595.
Case: Charcoal gray texture.

MOUNTING: JQE 1/4 rack and 1/2 rack size models fit the RA-24 hardware system (*see hardware section*). Full rack sized models have accessory flanges for direct installation in standard 19" racks. Unmetered JQE models are in modular form for chassis mounting — or may be mounted in RA-24 by use of an adapter plate RAP 24 -1J for 1/4 rack size; RAP 24-2J for 1/2 rack size.

OPTIONS: (add designator as a suffix to the model number, e.g.: JQE6-10MHS for high speed option).

"–HS" HIGH SPEED OPTION for fast programming.
Programming speed: 100,000V/sec. models up to 25 amperes, 50,000V/sec. models over 25 amperes. Programming speed measured as the chord of the exponential to its first time constant. **Offset voltage nulling control** included with HS option.
Ripple: <0.01% of E_o max. — or 3 mV, rms, whichever is greater.

"–VP" OVERVOLTAGE CROWBAR: Shorts output terminals through an SCR if voltage attempts to exceed preset limit. Not available with HS option.
Limit level range: 3V d-c to 110V d-c.
Trigger time: 5-10 μsec., adjustable delay to minimize false alarms.
Threshold: 5% of output level — or 0.25 volts, whichever is greater.

"–T" LOW TC OPTION: A special reference provides 0.005% °C TC in voltage mode, 0.01% per °C TC in current mode.

"–E" OFFSET VOLTAGE NULLING CONTROL: To zero the fixed part of E_{io}, the voltage amplifier's voltage offset.

All terms used in the specifications are defined in the Kepco Glossary

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

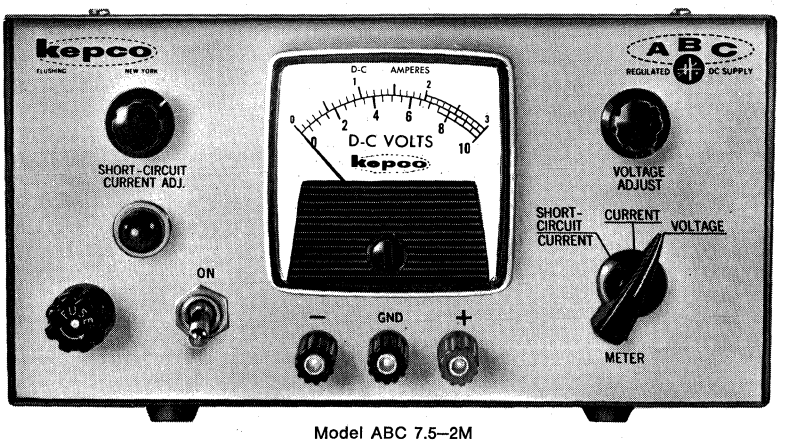
KEPCO ABC®

ALL-TRANSISTOR

POWER SUPPLIES

The ABC group of bench-style programmable voltage regulators span a wide range of voltages. The transistor group covers 0–2V to 0–100V; the hybrid group 0–200V to 0–2500V. All-transistor models employ a PNP series regulator, convection cooled, driven by a high gain transistor amplifier. These models feature 10-turn wirewound, 20 PPM TC voltage controls and panel-adjustable current limiting.

- *voltage and current regulation*
- *10-turn voltage control*
- *programmable*



Model ABC 7.5–2M

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	RIPPLE (max) RMS MV.	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	MAX. INPUT AMPS at 125 V a-c	PRICE ◆	SHIP WGT. (lbs.)
ABC 2–1M	0–2	0–1	0.25	0.001	0.01	0.1 +0.5	0.3	$131.00	10
ABC 7.5–2M	0–7.5	0–2	0.25	0.002	0.01	0.05+0.5	0.5	175.00	14
ABC 10–0.75M	0–10	0–0.75	0.25	0.007	0.02	0.1 +1	0.3	131.00	10
ABC 15–1M	0–15	0–1	0.25	0.008	0.01	0.05+0.5	0.5	175.00	13
ABC 18–0.5M	0–18	0–0.5	0.25	0.02	0.02	0.1 +1	0.3	131.00	10
ABC 30–0.3M	0–30	0–0.3	0.25	0.05	0.02	0.1 +1	0.3	131.00	10
ABC 40–0.5M	0–40	0–0.5	0.25	0.04	0.02	0.05+0.5	0.5	175.00	14
ABC 100–0.2M	0–100	0–0.2	0.25	0.25	0.05	0.05+1	0.5	197.00	14

◆ Price includes volt/ammeter, for unmetered models, delete suffix "M" and deduct $20 from price (any quantity order).

SPECIFICATION	VOLTAGE MODE	CURRENT MODE** (External Sensing)
OUTPUT RANGE	0–100 % E_0 max.	1 mA to 100% I_0
REGULATION, LINE	<0.05% or 1 mV*	<0.1% at rated sample**
REGULATION, LOAD	<0.05% or 1 mV*	<0.5% at rated sample**
STABILITY (8 HR.)	<0.05% or 3 mV*	<0.1% or 1 mA*
TEMP. COEFFICIENT	<0.05% per °C	<0.1% per °C at rated sample**
RIPPLE, rms	<0.25 mV	<0.1% of I_0 max.

**whichever is greater*
***Rated sample is 1V d-c across external current sampling resistor, with external current control.*

INPUT: 105-125V a-c or 210-250V a-c (selected), 50-440 Hz, single phase

TEMPERATURE, AMBIENT OPERATING: –20°C to +50°C.

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Convection.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROL RESOLUTION: 0.05%, 10-turn voltage control.

PROGRAMMING: 1 mA control current, by resistance at 1000 ohms per volt. May be controlled operationally as an amplifier using voltage or current signals; common negative.

VOLTAGE RECOVERY: (for step load current): <50 microseconds.

CURRENT LIMITING: Single turn panel adjustment sets limit from 25% to 150% of rated full current.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting. Negligible below 25% when preloaded to 10% minimum.

SERIES/PARALLEL: Series operation to rated isolation; also master/slave capability. Current limiting design permits self-determined parallel load sharing.

METERS: The suffix "M" designates a single dual scale volt-ammeter, 2½", 2%, with selector switch. Delete suffix for unmetered unit.

TERMINALS: Binding posts on front panel, plus, minus and ground. Multi-terminal barrier strip at rear contains output, sensing and control terminals.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Brushed aluminum
Case: Charcoal gray texture.

MOUNTING: Mount single unit in rack adapter RA-5, two abreast in rack adapter RA-4. *See Hardware section.*

All terms used in the specifications are defined in the Kepco Glossary

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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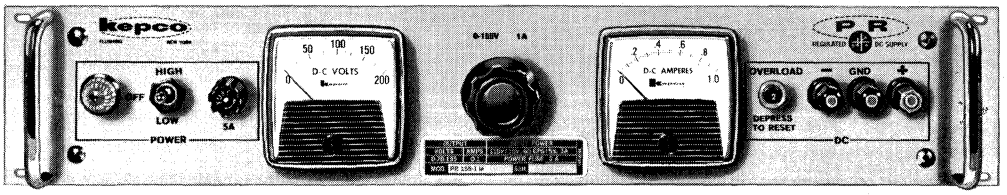

Model PR 155–1M

KEPCO PR

RESONANT TRANSFORMER

POWER SUPPLIES

The Kepco PR design consists of a ferroresonant power transformer (Flux-O-Tran®) coupled to a variable autotransformer for adjustable output. The regulating transformer provides line stabilization and current limiting. The husky silicon rectifiers and capacitive filter provide large amounts of d-c in a simple, reliable package.

GROUP I

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	RIPPLE (MAX.) RMS %	OUTPUT IMPEDANCE Ohms + μH 1Hz to 10Hz	OUTPUT IMPEDANCE Ohms + μH 10Hz to 100Hz + μH	SIZE	MAX. INPUT AMPS at 125 V a-c	PRICE ◆	SHIP WGT. (lbs.)
PR 15–10M	0-7.5 -15	0–10	2	0.02	0.04+0.1	A	3.5	$378.00	48
PR 15–30M	0 -15	0–30	2	0.02	0.04+0.1	B	7.0	552.00	103
PR 38–5M	0–19 -38	0–5	1	0.03	0.04+0.1	A	4.0	357.00	47
PR 38–15M	0 -38	0–15	1	0.03	0.04+0.2	B	9.0	520.00	92
PR 80–2.5M	0–40 -80	0–2.5	0.7	0.04	0.04+0.1	A	4.0	357.00	45
PR 80–8M	0 -80	0–8	0.7	0.05	0.07+0.5	B	9.5	499.00	90
PR 155–1M	0–78 -155	0–1	0.6	0.1	0.1 +0.1	A	3.0	357.00	40
PR 155–4M	0 -155	0–4	0.6	0.1	0.1 +0.5	B	9.0	473.00	80
PR 220–3M	0 -220	0–3	0.5	0.2	0.1 +0.5	B	9.0	473.00	80
PR 310–0.6M	0-165-310	0–0.6	0.5	0.3	0.1 +0.1	A	3.0	378.00	40
PR 310–2M	0 -310	0–2	0.5	0.3	0.1 +0.5	B	9.0	473.00	80

GROUP II

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	RIPPLE (MAX.) RMS %	OUTPUT IMPEDANCE Ohms + μH 1Hz to 10Hz	OUTPUT IMPEDANCE Ohms + μH 10Hz to 100Hz + μH	SIZE	MAX. INPUT AMPS at 125 V a-c	PRICE ◆	SHIP WGT. (lbs.)
PR 20–100AM	0–20	0–100	3	0.05	0.06+0.1	C	9.0/φ	$1,103.00	250
PR 40–50AM	0–40	0–50	2	0.05	0.06+0.1	C	8.5/φ	940.00	250
PR 50–40AM	0–50	0–40	1.5	0.05	0.06+0.1	C	8.5/φ	940.00	250

◆ Price includes meters, for unmetered models, delete suffix "M". In quantities of 12 or more units deduct $30.00 from price.

LINE REGULATION: ±1% for 115V a-c ±10V *Group I* ±2% for 230V a-c ±20V *Group II* *(See Figure 4)*

LOAD REGULATION: 2% for half to full load except 5% for 15V and 20V models. 4% for quarter to full load except 8% for 15V and 20V models. *(See Figure 3)*

STABILITY: (8 HRS.): 1% or 0.1V, whichever is greater.

TEMPERATURE COEFFICIENT: 0.05% per °C

AMBIENT OPERATING TEMPERATURE: −20°C to +55°C.

STORAGE TEMPERATURE: −40°C to +85°C.

COOLING: Forced air lateral circulation; built-in blower.

INPUT: *Group I:* 115 ±10V a-c, 60 Hz ±5% single phase. *Group II:* 208 or 230V a-c, (selectable) ±10%, 60 Hz, ±5% three phase.

Overseas Units: Specify suffix "–50" for selectable 104 ±9V a-c; 115 ±10V a-c 208 ±18V a-c; 230 ±20V a-c, 50 Hz ±5%. Group II models with –50 suffix have 208 or 230V a-c input options only. Derate *output voltage* range by 20% when ordering with –50 option. Add $30.00 to price of Group I models and $90.00 to price of Group II models. *NOTE:* A 1% line frequency change will produce approximately 1% output voltage change.

ISOLATION VOLTAGE: 600 volts to chassis.

CONTROL RESOLUTION: Approximately 1%. *Range:* 0.2% to 100% E_O max. (in two ranges on 3½" high models of Group I).

VOLTAGE RECOVERY (50-100% current): <400 milliseconds.

SERIES/PARALLEL: Units can be paralleled by adjusting their outputs to share the load. Series operation to rated isolation.

OVERLOAD PROTECTION: Constant voltage transformer limits current at maximum voltage setting; circuit breaker protection at lower settings.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded 10% minimum.

METERS: Suffix "M" designates a pair of 2½", 2% meters. Delete suffix for unmetered unit.

TERMINALS: Binding posts on front panel, plus, minus and ground (except Group II models which have a heavy duty output connector at the rear.

DIMENSIONS: See Page 2005 for listings.

FINISH: Light gray, color 26440, per Fed. Std. 595.

FIGURE 1

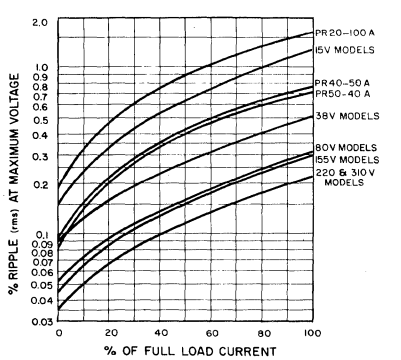

FIGURE 2: TYPICAL RIPPLE CHARACTERISTICS AS A FUNCTION OF LOAD CURRENT

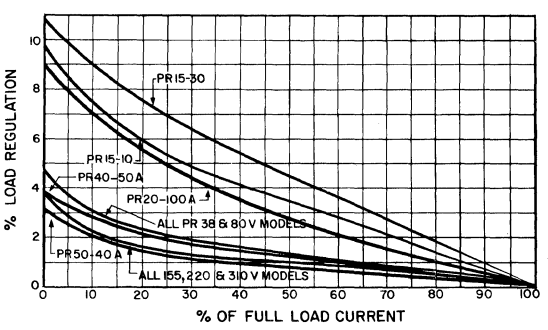

FIGURE 3: TYPICAL LOAD REGULATION MEASURED AT MAXIMUM RATED OUTPUT VOLTAGE; NORMAL LINE

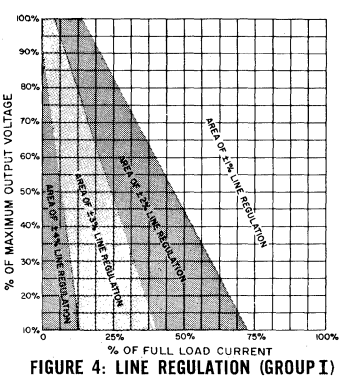

FIGURE 4: LINE REGULATION (GROUP I) AS A FUNCTION OF OUTPUT VOLTAGE AND LINE CURRENT

All terms used in the specifications are defined in the Kepco Glossary.

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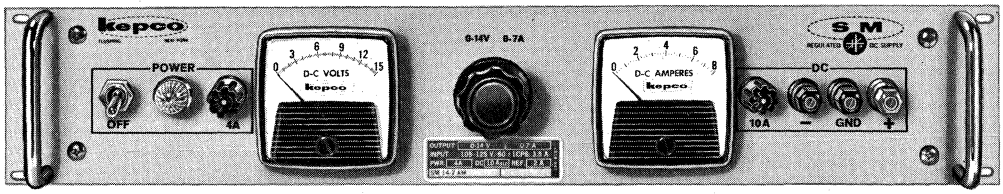

Model SM 14-7AM

KEPCO SM-A TRANSISTORIZED POWER SUPPLIES

SM Power supplies combine the line stabilization of Kepco's PR design with a feedback-controlled, high gain d-c amplifier—using series PNP power transistors. The Kepco Flux-O-Tran®, a ferroresonant power transformer, drives a variable autotransformer mechanically coupled to the feedback amplifier's voltage control permitting the SM design to offer all-transistor regulation up to 0—325 volts at 2 amperes.

MODEL	DC OUTPUT RANGE VOLTS	DC OUTPUT RANGE AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	MAX. INPUT AMPS at 125 V a-c	SIZE	PRICE ♦	SHIP WGT. (lbs.)
SM 14–7AM	0–14	0–7	0.001	0.005	0.1 +0.4	3.5	A	$426.00	46
SM 14–15AM	0–14	0–15	0.0005	0.005	0.02+0.4	5.5	B	552.00	65
SM 14–30AM	0–14	0–30	0.0003	0.005	0.02+0.1	10.5	C	762.00	107
SM 36–5AM	0–36	0–5	0.005	0.005	0.03+0.4	4.0	A	415.00	46
SM 36–10AM	0–36	0–10	0.003	0.005	0.03+0.4	6.5	B	552.00	66
SM 36–15AM	0–36	0–15	0.002	0.005	0.03+0.4	10.5	C	657.00	99
SM 75–2AM	0–75	0–2	0.02	0.005	0.04+0.4	4.0	A	447.00	46
SM 75–5AM	0–75	0–5	0.01	0.005	0.02+0.4	6.5	B	552.00	70
SM 75–8AM	0–75	0–8	0.005	0.005	0.06+0.5	10.0	C	657.00	100
SM 160–1AM	0–160	0–1	0.1	0.005	0.04+0.5	3.5	A	447.00	45
SM 160–2AM	0–160	0–2	0.05	0.005	0.04+0.4	5.5	B	552.00	70
SM 160–4AM	0–160	0–4	0.02	0.005	0.06+1.0	10.5	C	657.00	96
SM 325–0.5AM	0–165–325	0–0.5	0.4	0.005	0.1 +1.0	3.5	A	462.00	46
SM 325–1AM	0–325	0–1	0.2	0.005	0.1 +1.0	5.0	B	583.00	70
SM 325–2AM	0–325	0–2	0.1	0.005	0.1 +1.0	11.0	C	709.00	96

♦ Price includes meters, for unmetered models, delete suffix "M". In quantities of 12 or more units deduct $30.00 from price.

SPECIFICATION	VOLTAGE MODE
OUTPUT RANGE	0–100% E_O max.
REGULATION, LINE	<0.01%
REGULATION, LOAD	<0.05% or 1 mV*
STABILITY (8 HR).	<0.05% or 3 mV*
TEMP. COEFFICIENT	<0.05% per °C
RIPPLE, rms.	<1 mV

whichever is greater

INPUT: 105-125V a-c, 60 ±1 Hz, single phase.

Overseas Models: Specify suffix "–50" for selectable 104 ±9V, a-c; 115 ±10V a-c; 208 ±18V a-c; 230 ±20V a-c, 50 Hz ±1 Hz. Derate *output voltage* range by 20% when ordering with "50" option, add $40.00 to unit price.

TEMPERATURE, AMBIENT OPERATING: –20°C to +50°C.

TEMPERATURE, STORAGE: –40°C to +85°C.

COOLING: Forced air, lateral circulation. Built-in blower.

ISOLATION VOLTAGE: 400 volts to chassis.

CONTROL RESOLUTION: 0.1%, 10-turn voltage control.

VOLTAGE RECOVERY: (for step load current): 50 microseconds.

REMOTE ERROR SENSING: Compensates up to 0.5 volt drop per output lead.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

METERS: Suffix "M" designates a pair of 2½", 2% meters. Delete suffix for unmetered unit.

SERIES OPERATION: To rated isolation.

TERMINALS: Binding posts front and rear for plus, minus and ground.

DIMENSIONS: See Page 2005 for listings.

FINISH: Light gray, Color 26440 per Fed Std. 595.

All terms used in the specifications are defined in the Kepco Glossary.

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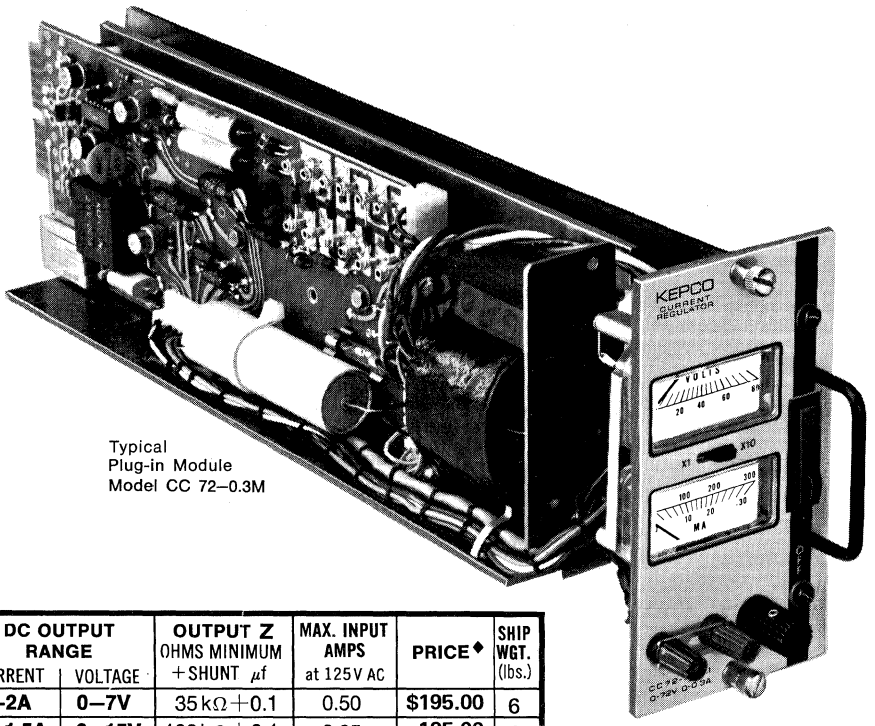
KEPCO CC CONSTANT CURRENT POWER SUPPLIES

The CC plug-in modules are current controllers with built-in dual-range, current-sensing resistors and 10-turn control. They employ Kepco's monolithic linear I-C amplifier driving a self-cooled NPN series transistor-regulator. Capacitorless output filtering ensures rapid recovery from switching or load transients. Output current ranges from true zero (no minimum) to the selected range (10% or 100% of the current rating) with 10-turn resolution. Metering is isolated by means of an I-C voltage follower.



Typical
Plug-in Module
Model CC 72–0.3M

MODEL	DC OUTPUT RANGE CURRENT	DC OUTPUT RANGE VOLTAGE	OUTPUT Z OHMS MINIMUM +SHUNT μf	MAX. INPUT AMPS at 125 V AC	PRICE◆	SHIP WGT. (lbs.)
CC 7–2M	**0–2A**	**0–7V**	35kΩ+0.1	0.50	**$195.00**	6
CC 15–1.5M	**0–1.5A**	**0–15V**	100kΩ+0.1	0.65	**195.00**	6
CC 21–1M	**0–1A**	**0–21V**	200kΩ+0.1	0.45	**195.00**	6
CC 40–0.5M	**0–0.5A**	**0–40V**	800kΩ+0.1	0.40	**195.00**	6
CC 72–0.3M	**0–0.3A**	**0–72V**	2.4MΩ+0.1	0.45	**195.00**	6
CC 100–0.2M	**0–0.2A**	**0–100V**	10MΩ+0.1	0.45	**195.00**	6

◆ Uncased, available metered only.

SPECIFICATION	CURRENT MODE
OUTPUT RANGE	0–100% or 0–10%, switched
REGULATION, LINE	<0.0005% or 0.2 μA* (105–125/210–250V a-c)
REGULATION, LOAD	<0.005% or 2 μA* (no load–full load)
STABILITY (8 HR.)	<0.02% or 2 μA*
TEMP. COEFFICIENT	<0.01% per °C
RIPPLE, rms.	<0.02% of selected scale

whichever is greater

INPUT: 105-125V a-c or 210-250V a-c (selected)

TEMPERATURE, AMBIENT OPERATING: −20°C to +65°C.

TEMPERATURE, STORAGE: −40°C to +85°C.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROLS: A panel mounted output range selector switches the output either 0–100% I_o max. or 0–10% I_o max. A 10-turn precision current control operates full span through either range. Resolution: 0.05% of the full scale value. A combination on-off slide switch and pilot light provides primary power control.

PROGRAMMING: Control loop uses 0.1 milliampere, current sample is approximately 1V d-c. Supply may be programmed through either current range by a 0-10,000 ohm rheostat. (range switch is not programmable).

MAXIMUM CAPACITIVE LOADING: 0.001 microfarads.

CURRENT RECOVERY (for step load voltage): <2 μsec/volt, except Model CC 7-2M: 4 μsec/volt, measured to the first time constant on the exponential response.

VOLTAGE LIMITING: Fixed at approximately 150-200% of the rated compliance voltage.

SERIES/PARALLEL: Parallel operation of current sources may be made without restriction. Series operation through the use of master-slave interconnection.

COOLING: Convection.

METERS: Two 2% taut-band recessed meters monitor output current and compliance voltage. Current is displayed on a dual-scale meter whose range is switched with the range switch. The compliance voltmeter is a high impedance TVM to minimize the loading error.

TERMINALS: Output terminals (shorted) are located on the front panel, a-c input, output and control terminals are via a rear PC connection which mates with the connector mounted in the various housings and rack cabinets. These connectors are, in turn, wired to barrier strips for easy access.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Light gray, color 26440, per Fed. Std. 595.
Housings: Charcoal gray texture.

MOUNTING: Power supplies are uncased, must be plugged into one of the following available housings: CA-3, CA-4, CA-5 or RA 22-6. *See Hardware section.*

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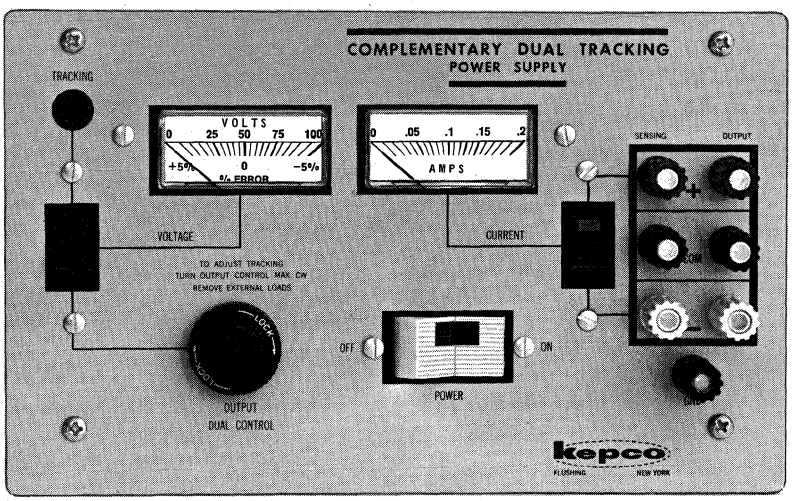
KEPCO CDT

DUAL TRACKING

POWER SUPPLIES

The complementary dual-tracking power supplies consist of two regulators coupled together in a complementary manner using a common reference and a single output voltage control. They may be used to drive independent plus (+) and minus (—) loads or may be used in series for double voltage to a single load.



Model CDT 100—0.2 M

MODEL	TWIN OUTPUTS* COMPLEMENTARY VOLTS	COMPLEMENTARY AMPS	SERIES VOLTS	SERIES AMPS	INDIVIDUAL SUPPLIES OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	MAX. INPUT AMPS at 125 V a-c	PRICE ♦	SHIP WGT. (lbs.)
CDT 15—1.5M	0—±15	0—±1.5	0—30	0—1.5	0.001	0.02	0.1+1	1.3	$399.00	19
CDT 40—0.5M	0—±40	0—±0.5	0—80	0—0.5	0.008	0.02	0.1+1	0.8	399.00	19
CDT 100—0.2M	0—±100	0—±0.2	0—200	0—0.2	0.05	0.02	0.1+1	0.9	399.00	19

**Each Power Supply contains two sources with a common voltage control, may be used as complementary (plus and minus) supplies or in series for double voltage.*

♦ Available metered only.

SPECIFICATION	VOLTAGE MODE COMPLEMENTARY**	SERIES
OUTPUT RANGE	0 to $+E_O$ and 0 to $-E_O$	0 to twice E_O
REGULATION, LINE	<0.005%	<0.005%
REGULATION, LOAD	<0.01% or 1mV*	<0.01% or 2mV*
STABILITY (8 hr)	<0.01% or 2mV*	<0.01% or 4mV*
TEMP. COEFFICIENT	<0.01% per °C	<0.01% per °C
RIPPLE, rms	<0.25mV	<0.5mV

**whichever is greater*

***Specifications are for the individual supplies, changes in the master supply (plus output) are repeated 1:1 in the slave supply.*

INPUT: 105-125V a-c or 210-250V a-c (selected) 50-440 Hz.

TEMPERATURE, AMBIENT OPERATING: —20°C to +65°C.

TEMPERATURE, STORAGE: —40°C to +85°C.

COOLING: Convection.

ISOLATION VOLTAGE: 500 volts to chassis.

OUTPUT: The individual power supplies are wired in series, controlled with a single voltage control. They may be loaded in series or separately.

CONTROL RESOLUTION: <0.05%, 10 turn voltage control adjusts the output of the positive supply, designated "master", this voltage in turn controls the negative supply or "slave" in a 1:1 ratio. The two power supplies are connected in series.

TRACKING: ±5% range of adjustment is controlled by a recessed front panel control. Units can be adjusted to within ±0.5% using panel meter. Closer adjustment with external instrumentation.

PROGRAMMING: 1 milliampere control current, or resistance: 1000 ohms per volt. Common positive.

VOLTAGE RECOVERY, (for step load current): <50 μseconds.

CURRENT LIMITING: Each supply is individually limited with a 10 to 105% range of adjustment.

REMOTE ERROR SENSING: Compensates for up to 0.5 volt drop per output lead.

OVERSHOOT: (Turn-on/off): None above 25% voltage setting. Negligible below 25% when preloaded to 10% minimum.

METERS: Voltmeter monitors output of MASTER, or the difference between MASTER and SLAVE, displayed as a percentage error (range ±5%). Ammeter monitors current from either supply (selectable).

TERMINALS: Binding posts on the front panel for plus, common and minus outputs, also sensing terminals and separate ground. Barrier strip at the rear has duplicate output, sensing and control terminals.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Light gray Color 26440 per Fed. Std. 595.
Case: Charcoal gray texture.

MOUNTING: Rack adapter RA-24. *See Hardware section.*

All terms used in the specifications are defined in the Kepco Glossary

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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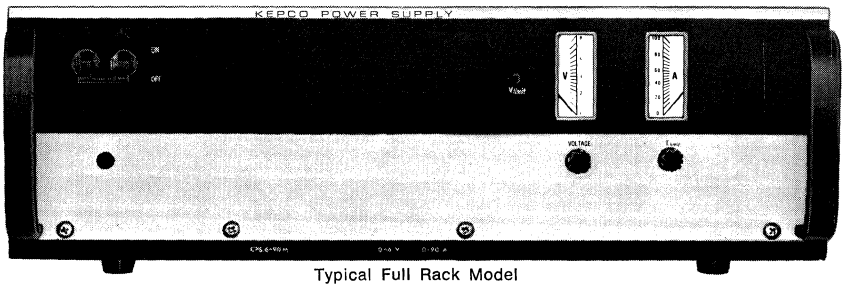
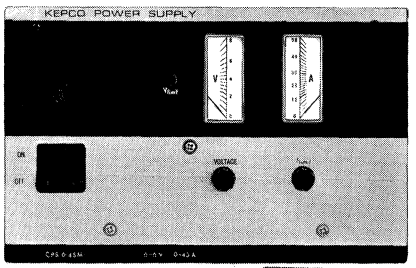
KEPCO CPS
COMPUTER I-C
POWER SUPPLIES



Typical Full Rack Model

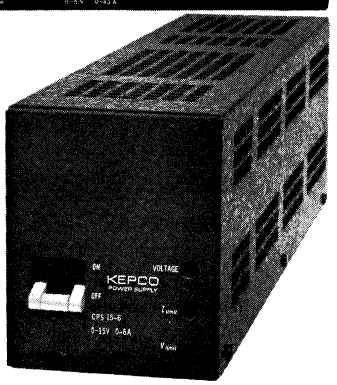
CPS Power Supplies are especially designed for driving digital I-C's. They feature an integral overvoltage crowbar and a linear full-dissipation series NPN transistor-regulator driven by a monolithic linear amplifier. On/off switching and crowbar reset is accomplished by a panel-mounted circuit breaker. The metered models feature panel-mounted, 10-turn voltage controls and dual meters. The CPS Power Supplies are also available unmetered, in modular form for OEM's with controls recessed.



Typical ½ Rack Model

SPECIFICATION	VOLTAGE MODE	CURRENT MODE**	VOLTAGE AMPLIFIER OFFSETS*** OFFSET VOLTAGE ΔE_{io}	OFFSET CURRENT ΔI_{io}	VOLTAGE REFERENCE (INTERNAL)***
OUTPUT RANGE	0–100% E_o max.	1 mA–100% I^o max.	——	——	Fixed 6.2V±5%
LINE: 105–125/210–250V a-c	<0.0005%	<0.005%**	<10 μV	<2 nA	0.0001%
LOAD: No Load/Full Load	<0.005% or 0.2 mV*	<0.01%**	<200 μV	<5 nA	——
TIME: 8 Hours. Stability	<0.01% or 1 mV*	<0.02**	<20 μV	<2 nA	0.005%
TEMP.: Coefficient per °C	<0.01%†	<0.02**†	<20 μV	<5 nA	0.005%
RIPPLE: (rms)	<0.2 mV	<0.02% of I_o max.	——	——	——

*whichever is greater.
**External sensing, using a 1V sample. Specs are measured at rated sample voltage with 20 PPM external current feedback control.
***Offsets and the reference contribute to output change ΔE_o, by the equation $\Delta E_o = \pm\Delta E_{ref}(R_f/R_i) \pm\Delta E_{io}(1+R_f/R_i) \pm\Delta I_{io}(R_f)$ where R_f is the feedback resistor and R_i is the input resistor from the signal reference. Use the offsets to calculate output variations when external input/feedback elements are substituted for the internal reference and voltage control in special applications.
†See OPTIONS for 0.005% per °C voltage mode — 0.01% per °C current mode temperature coefficient.



Typical ¼ Rack Unmetered Module

MODEL	DC OUTPUT RANGE VOLTS	AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	RACK SIZE	PRICE ◆	SHIP WGT. (lbs.)
CPS 6–10M	0–6	0–10	30×10⁻⁶	0.02	0.05 + 1	¼	$366.00	21
CPS 6–10							336.00	21
CPS 6–22M	0–6	0–22	14×10⁻⁶	0.02	0.05 + 1	½	585.00	34
CPS 6–22							555.00	34
CPS 6–45M	0–6	0–45	7×10⁻⁶	0.02	0.05 + 1	½	660.00	48
CPS 6–45							630.00	48
CPS 6–90M	0–6	0–90	3.5×10⁻⁶	0.02	0.05 + 1	Full	995.00	95
CPS 6–90							965.00	95
CPS 15–6M	0–15	0–6	125×10⁻⁶	0.02	0.05 + 1	¼	366.00	21
CPS 15–6							336.00	21
CPS 15–12M	0–15	0–12	63×10⁻⁶	0.02	0.05 + 1	½	585.00	34
CPS 15–12							555.00	34
CPS 15–25M	0–15	0–25	30×10⁻⁶	0.02	0.05 + 1	½	660.00	48
CPS 15–25							630.00	48
CPS 15–50M	0–15	0–50	15×10⁻⁶	0.02	0.05 + 1	Full	995.00	95
CPS 15–50							965.00	95

Option "–E": add $10.00, Option "–T": add $30.00

INPUT: 105-125V a-c or 210-250V a-c (selected) 50-65 Hz, 1Ø.

TEMPERATURE: AMBIENT OPERATING: –20°C to +71°C

TEMPERATURE, STORAGE: –50°C to + 85°C

COOLING: Forced air, built-in blower.

CONTROLS: *Voltage:* 10-turn, 20 PPM TC wirewound rheostat.
Current: Multiturn vernier potentiometer.

Unmetered models (without suffix M) are designed for chassis mounting as modules and have their voltage control and current limit control recessed.

PROGRAMMING: Control loop uses 1 milliampere. Supply may be programmed by resistance at 1000 ohms per volt, or may be operationally controlled as an amplifier (common positive) using voltage or current signals.

VOLTAGE RECOVERY (for step load current): <50 μseconds for recovery to within 2 mV of setting.

OVERSHOOT (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

CURRENT LIMITING: Adjustable from 10% to 105% of the rated full current.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead.

SERIES/PARALLEL: Series operation to the rated isolation voltage. Units may be paralleled by employing their current limiters.

ISOLATION VOLTAGE: 500 volts to chassis.

METERS: Units with the suffix "M" contain a pair of taut band 2-inch, 2% meters to monitor voltage and current. The unmetered CPS power supplies are in modular form, suitable for chassis mounting.

DIMENSIONS: See Page 2005 for listings.

FINISH: (Metered models only have a panel).
Panel: Light gray, Color 26440 per Fed. Std. 595.
Case: Charcoal gray texture.

MOUNTING: Fits the RA-24 system of rack housings. Unmetered units mount on a chassis or in the RA-24 with use of an adapter plate. Full rack units are pre-drilled for Jonathan slides 110 QD20-1, 22-1, 24-1.

OPTIONS: (add designator as a suffix to the model number).

"–T" LOW TC OPTION: A special reference provides 0.005% per °C temperature coefficient in voltage mode, 0.01% per °C in current mode.

"–E" OFFSET VOLTAGE NULLING CONTROL: To zero the fixed part of E_{io}, the voltage amplifier's voltage offset.

OVERVOLTAGE PROTECTOR: (built-in) An integral overvoltage crowbar is set by means of a recessed multiturn panel control. Range is from 3V d-c to the maximum voltage rating plus 10%.

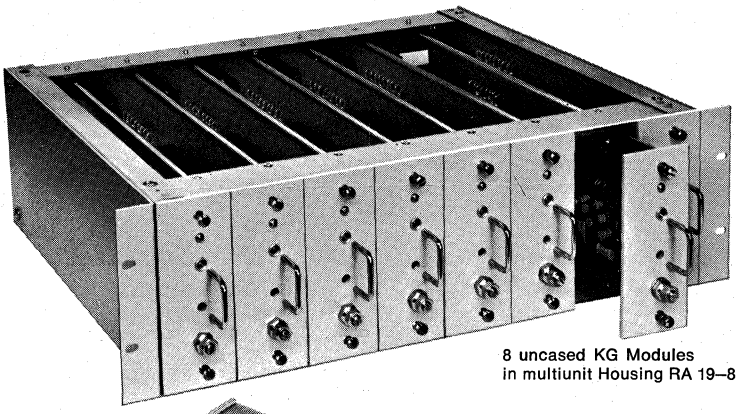
Triggering Time: 5-10 microseconds with an adjustable delay to minimize the false alarm rate.

Threshold: May be set to within 5% or 0.25 volts (whichever is greater) of the power supply's output voltage.

Data subject to change without notice

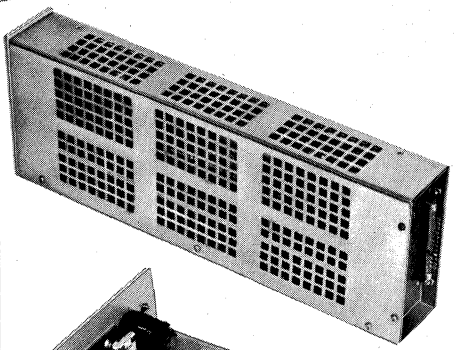
All terms used in the specifications are defined in the Kepco Glossary. Refer to Kepco's Catalog or Handbook.

KEPCO KG ISOLATED POWER SUPPLIES

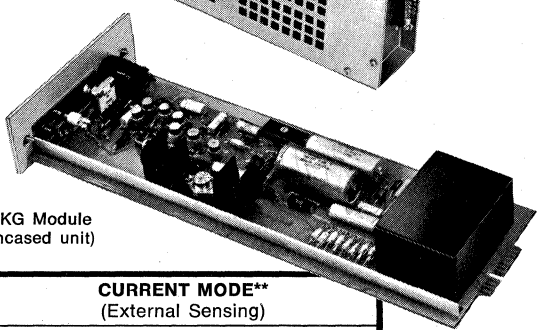


8 uncased KG Modules in multiunit Housing RA 19–8

The KG isolated module is designed for driving balanced electronic circuits and bridges - often used with electromechanical transducers. The KG module offers minimal common mode line-coupled current, achieved by stringent isolation of the power transformer and line-related components, and nonmetallic, low-capacitance mounting. The modules are designed for plug-in mounting 8-abreast in a 19-inch rack or in an individual plug-in case.



KG Module in single unit Case



KG Module (uncased unit)

MODEL	DC OUTPUT RANGE VOLTS	AMPS	OUTPUT IMPEDANCE Ohms + Microhenries d-c to 100Hz	100 Hz to 1kHz	1kHz to 100kHz+μH	MAX. INPUT AMPS at 125 V a-c	PRICE ◆	SHIP WGT. (lbs.)
KG 25–0.2	0–25	0–0.2	0.006	0.01	0.1+1	0.2	$175.00	4
KG 100–0.05	0–100	0–0.05	0.1	0.01	0.1+1	0.2	175.00	4

KG Modules have been especially isolated for minimum common mode signal and least ground coupling to the power line.

◆ Uncased, order plug-in enclosure CA-2 separately. Option "–R": add $10.00, Option "–E" add $10.00.

SPECIFICATION	VOLTAGE MODE	CURRENT MODE** (External Sensing)
OUTPUT RANGE	0–100% E_O max.	1 mA–100% I_O max.
REGULATION, LINE	<0.001%	<0.001% at rated sample**
REGULATION LOAD	<0.005% or 0.5 mV*	<0.01% at rated sample**
STABILITY (8 HR.)	<0.005% or 1 mV*	<0.01% at rated sample**
TEMP. COEFFICIENT	<0.005% per °C	<0.01% per °C at rated sample**
RIPPLE, rms.	<0.1 mV	<0.01% of I_O max.

**whichever is greater*
***Rated sample is 1Vd-c across external current sampling resistor, with external current control.*

INPUT: 105-125V a-c, 50-65 Hz, single phase.
TEMPERATURE, AMBIENT OPERATING: –20°C to +50°C.
TEMPERATURE, STORAGE: –40°C to +85°C.
COOLING: Convection.
ISOLATION: Volts: 500 volts to ground, maximum.
Ohms: 10 K megohms to ground, minimum.
Capacitance: 200 picofarads to ground, max.
Leakage: 50 nA to ground, maximum.
Input to output: 1 picofarad, maximum.
CONTROL RESOLUTION: 0.05%, 10-turn voltage control, screwdriver adjustment, with lock.
PROGRAMMING: 1 mA control current, by resistance at 1000 ohms per volt.
VOLTAGE RECOVERY (for step load current): <50 microseconds for recovery to within 0.005% or 2 mV of setting.
CURRENT LIMITING: Recessed panel adjustment from 5% to 110% of rated current.
OVERSHOOT (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.
SERIES/PARALLEL: Current limiting design permits self-determined parallel load-sharing. Series operation to rated isolation.
TERMINALS: All connections are made through printed circuit connector in housing, a-c input, d-c output, sensing and control. A blank terminal is provided which can be wired for operational control using voltage or current signals.
FINISH: Light gray, Color 26440 per Fed Std. 595.
DIMENSIONS: See Page 2005 for listings.
MOUNTING: The uncased KG module must be plugged into either a single unit case, CA-2 or the 8-unit rack adapter, RA 19-8. Both housings contain integral plug-in connectors. *See hardware section.*
OPTIONS: (add designator as a suffix to the model number).
"–R" ADJUSTMENT OF CONTROL CURRENT: A ±10% trimmer is installed to allow precision programming calibration.
"–E" OFFSET VOLTAGE NULLING CONTROL: To zero the voltage amplifier's voltage offset.

All terms used in the specifications are defined in the Kepco Glossary

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PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

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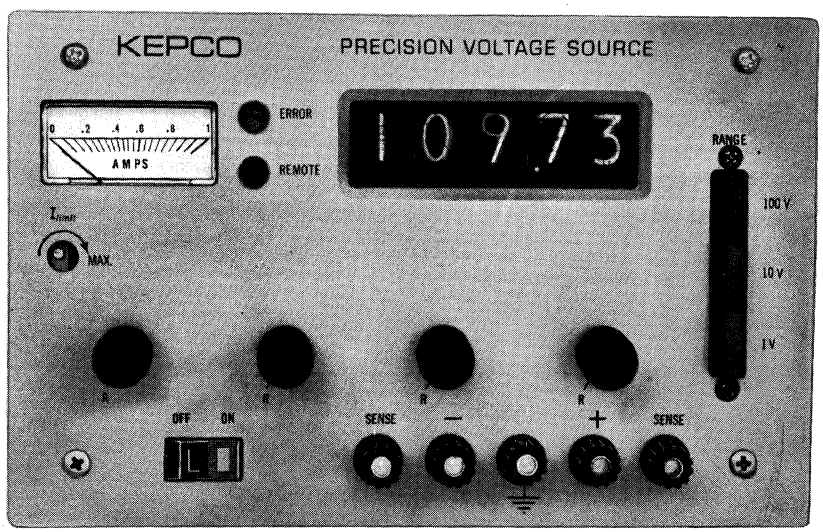
KEPCO PVS
PRECISION VOLTAGE SOURCE
POWER SUPPLIES

- *4 digit output selection*
- *3 decimal range selection*
- *BCD programming (switch closures)*
- *digital display*
- *current limiting*



Model PVS 100–1M — Price: $875.00 — Ship Wgt.: 28 lbs.
Model PVS 100–1MG — Price: $815.00 — Ship Wgt.: 28 lbs.

The PVS Precision Voltage Source features an extremely low drift linear amplifier driving a self-cooled NPN power transistor stage. Voltage control is by means of digitally selected (1–2–4–8 BCD) precision —low TC, high stability feedback resistors with a 3-decade oven-controlled reference. Output is displayed on a 4½ digit readout with a built-in error-detecting system to prevent false indication. Output current is metered and the limit is adjustable. A remote digital programming connector is fitted to the voltage control (BCD switch closures) and to the display (decimal switch closures). Model with suffix "G" omits the remote digital control feature. The 0.02% overall accuracy qualifies the Precision Voltage Source as an instrument calibrator.

OUTPUT:	0.0000–100.00 volts
CURRENT:	0–1 ampere
REGULATION, LINE:	<0.0005%
REGULATION, LOAD:	<0.001% or 0.1 mV*
STABILITY, (8 HR):	<0.005% or 1 mV*
TEMP. COEFFICIENT:	<0.005% per °C
READOUT ACCURACY:	0.02% of full scale
RESOLUTION:	100 microvolts
RIPPLE:	<100μV rms
OUTPUT IMPEDANCE:	d-c –1kHz : $10^{-3}\Omega$ 1kHz–100kHz : $10^{-2}\Omega + 1\mu h$

**whichever is greater*

INPUT: 105-125V a-c or 210-250V a-c (selected) 50-440 Hz, 1Ø.

TEMPERATURE, AMBIENT OPERATING: –20°C to +55°C

TEMPERATURE, STORAGE: –40°C to +85°C

COOLING: Convection.

ISOLATION VOLTAGE: 500 volts to chassis.

CONTROLS: Four (4) 10-position rotary switches select voltage in conjunction with three push button decimal range selectors. A recessed current limit control is accessible through the front panel.

OVERRANGE: 10% overrange on each range; e.g., 1.099V, 10.999V and 109.99 volts (derate current to 0.6 amperes at 109.99 volts).

PROGRAMMING: External switch closures will program the output in a 1-2-4-8 BCD code. A separate programming connector is provided for the digital display. This connector is omitted in the model with suffix "G".

CURRENT LIMITING: Recessed multiturn trimmer adjusts the current limiting from 10% to 105% Io max.

VOLTAGE RECOVERY (for step load current): <50 μseconds for recovery to within 0.005% or 2 mV of setting.

REMOTE ERROR SENSING: Compensates up to 0.5V drop per output lead. Error sensing terminals located on the front panel.

OVERSHOOT (Turn-on/off): None above 25% voltage setting; negligible below 25% when preloaded to 10% minimum.

METERS: Voltage is indicated on a four-digit numerical display with a fifth-digit overrange. Current on a 2-inch, 2% recessed taut-band ammeter.

TERMINALS: Binding posts on the front panel, plus/minus, ground and error sensing. Connections at the rear for output, error sensing and programming functions.

DIMENSIONS: See Page 2005 for listings.

FINISH: *Panel:* Light gray, Color 26440 per Fed. Std. 595.
Case: Charcoal gray texture.

MOUNTING: Fits RA-24 rack adapter. *See hardware section.*

All terms used in the specifications are defined in the Kepco Glossary.

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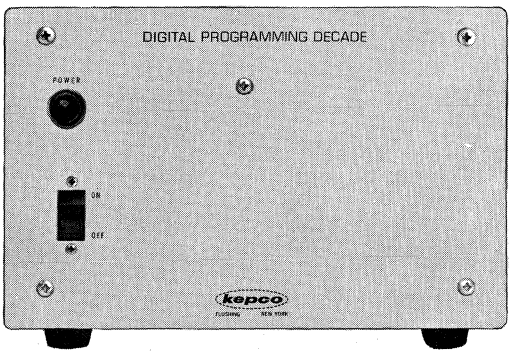
KEPCO DIGITAL PROGRAMMING SYSTEM

DIGITAL PROGRAMMING DECADE



MODEL	DESCRIPTION		COMPANION REGISTER	CABLE TO DPR
DPD—1	4 digit	0—1000.0V	DPR—4	Cable A
DPD—2	4 digit	0—100.00V	DPR—4	Cable B
DPD—3	5 digit	0—1000.00V	DPR—5	Cable A
DPD—4	3 digit	0—1000V	DPR—3	Cable A
DPD—5	3 digit	0—100.0V	DPR—3	Cable B
DPD—6	3 digit	0—10.00V	DPR—3	Cable B
DPD—7	3 digit	Current	DPR—3	Cable B

FUNCTION:
To control the output level (voltage or current) of a d-c Power Supply by means of digitally encoded commands.

OUTPUT RANGE: Each DPD will program 10% overrange and when using the voltage control board has three selectable decimal levels. The largest is shown in the chart; e.g., Model DPD—1, a 4 digit overranging instrument will program: 0—10.999 volts, 0—109.99 volts and 0—1099.9 volts. The DPD—7, a three-digit instrument for the control of current has two selectable decimal levels. A current code board, compatible with the *current rating* of the power supply being controlled, is needed with the DPD—7. Specify the *current code board* when ordering by appending a suffix number to the model equal to the *ampere* rating of the supply being controlled. Specify Model DPD—7—22A for an instrument to control a 22 ampere power supply. The *current code board* in Model DPD—7 causes the programmed current to correspond to the numerical display of the companion DPR—3 Register.

DESCRIPTION: The DPD's use transistor-driven reed relays to actuate resistors in a 1—2—4—8 BCD code. The input is parallel (RTL) logic levels or switch closures; the output a four-wire resistance and control current command capable of programming any Kepco Operationally Programmable Power Supplies. The DPD's may be driven by the suitable companion DPR which provides serial-parallel conversion, data storage and display.

TIMING: Commands to the DPD are sequenced: hold—execute —program, requiring a 10 millisecond sequence time. This sequencing is provided by the DPR when used together.

INPUT: logic "0" is 0 to 0.3V d-c
logic "1" is 1 to 3V d-c
input impedance: 3K ohms

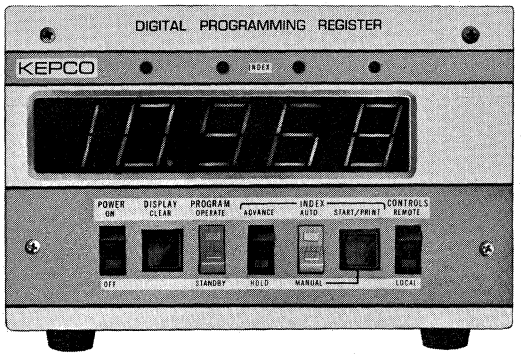
POWER REQUIREMENTS:
115V ±10V a-c or 230V ±20V a-c, 50-440 Hz single phase

SIZE: Half-rack: 5¼" H x 8-11/32" W x 13⅜" D
Rack adapter (Model RA-24) is available)

CABLES: Connect DPK—1 to any DPR via a cable "A"

TYPE	10' length	3' length	CONNECTS DPR—3—4—5 TO
A	A—10	A—3	DPK—1, DPD—1—3—4
B	B—10	B—3	DPD—2—5—6—7

DIGITAL PROGRAMMING REGISTER



MODEL	NUMBER OF DISPLAY REGISTERS
DPR—3	3 + Overrange
DPR—4	4 + Overrange
DPR—5	5 + Overrange

FUNCTION:
The DPR accepts serial BCD or decimal coded programming signals, stores them and provides a parallel output signal to the DPD decade.

DESCRIPTION:
DPR processes incoming serial data into storage/display registers including a segmented numeric readout. The data is presented in parallel, continuous form to a DPD Programmer. The DPR also processes index and decimal point commands from a keyboard or machine input.

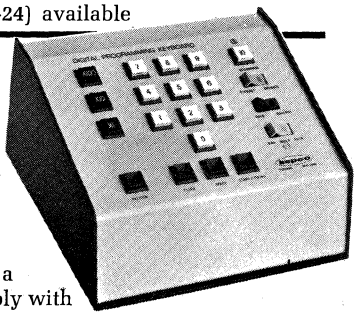
INPUT: Decimal — 10 lines
BCD — 5 lines including data pulse
Range selection (decimal point) — 3 lines;
Function command — 5 lines
Logic levels: "0" is 0 to 0.3V d-c; "1" is 1 to 3V d-c.

OUTPUTS: To DPD: parallel data.
To Printer (optional): parallel logic levels.
Print signal: 150 ohms output impedance.
Print complete signal: 1000 ohms input impedance.

POWER REQUIREMENTS:
115V ±10V ac or 230 ±20V ac, 50-440 Hz single phase.

SIZE: Half-rack 5¼" H x 8-11/32" W x 17⅜" D
Rack Adapter (RA-24) available

Model DPK-1 DIGITAL PROGRAMMING KEYBOARD



FUNCTION:
To control the output of a regulated d-c Power Supply with an adding machine keyboard, through a DPR logic and DPD analog converter. DPK-1 is a manual input — in serial form — for the DPR registers.

DESCRIPTION:
The DPK-1 uses SPDT keys to generate decimal code and register control signals, which are shaped and processed for delivery to the DPR storage register. Model DPK-1 will program registers DPR-3, DPR-4 and DPR-5

COMMANDS:
10 digit decimal signals, 3 ranges, Space, Clear, Start/Print, Index, Hold/Advance, Standby/Operate, Preview, Polarity.

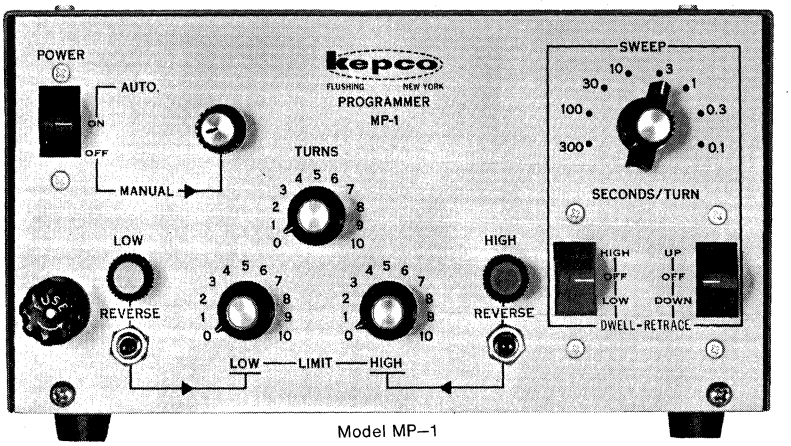
POWER: Supplied from DPR.
Rack adapter (Model RA 19-1) available.

KEPCO

MOTORIZED PROGRAMMERS

MECHANICAL FUNCTION GENERATOR

Models MP-1 and MP-10 are mechanical drives for a 10-turn servo-mount potentiometer installed within. A synochronous motor drives the shaft through an 8-speed gear-box with adjustable limits.



Model MP–1

MODELS	SECONDS PER REVOLUTION (MAXIMUM: 10 REVOLUTIONS, 3600°)								PRICE	SHIP WGT.
MP–1	0.1	0.3	1.0	3.0	10.0	30.0	100.0	300.0	$595.00	11
MP–10	1.0	3.0	10.0	30.0	100.0	300.0	1000.0	3000.0	595.00	11

TIMING ACCURACY: ±5% referenced to 60 Hz line frequency.

LIMITS, (Mechanically Adjustable):

Low Limit: Range from 0-9⅔ turns.

High Limit: Range from ⅓ to 10-turns.

Minimum Sweep Range: ⅓ turn (120°)

OVERIDE: Manual override buttons reverse the sweep at any desired point—or manually stop the programmer.

DIRECTION SIGNALS: Pilot lights signal the direction of sweep up and down. With dwell and retrace off, sweep cycles symmetrically between limits.

DWELL: 20 Milliseconds, plus a delay equal to 2% of the single rotation sweep time.

DWELL SWITCH: Stops the sweep at either the high or low limit (selectable).

RETRACE: Selector causes the sweep to retrace up or down at maximum speed—no matter what the speed selected.

AVAILABLE POTENTIOMETERS: Any ⅛" shaft, ⅜" servo-mount potentiometer. *Standard values:* 10, 25, 50, 100 and 500 ohms; 1, 2, 5, 10, 30, 50, 75, 90, 100 and 125 kilohms. Other resistance values on special order.

TERMINALS: Rear mounted barrier strip contains speed changing connections: high and low limit contacts, dwell and retrace and the output of the linear potentiometer.

DIMENSIONS: 4¼"H x 9$\frac{5}{32}$"W x 9⅝"D.

FINISH: *Panel:* Light gray, Color 26440, per Fed. Std. 595.
Case: Charcoal gray texture.

MOUNTING: Mount single unit in rack adapter RA-5, two abreast in rack adapter RA-4. *See Hardware section.*

DIGITAL PROGRAMMING SYSTEM

MODEL	DESCRIPTION	PRICE	SHIP WGT. (LBS.)
DPK–1	Keyboard	$230.00	7
DPR–3	3-Digit Register	$ 980.00	24
DPR–4	4-Digit Register	1,090.00	24
DPR–5	5-Digit Register	1,200.00	24
DPD–1	0–1000.0V Decade	$790.00	17
DPD–2	0–100.00V Decade	735.00	17
DPD–3	0–1000.00V Decade	840.00	17
DPD–4	0–1000V Decade	710.00	17
DPD–5	0–100.0 Decade	660.00	17
DPD–6	0–10.00 Decade	660.00	17
DPD–7	Current Decade	630.00	17
A–3	Cable, 3'	$30.00	2
A–10	Cable, 10'	35.00	4
B–3	Cable, 3'	30.00	2
B–10	Cable, 10'	35.00	4

SYSTEM OPTIONS and ACCESSORIES

PROGRAM BOARDS		SUPPLIED IN DPD MODELS:						
MODEL	PRICE	–1	–2	–3	–4	–5	–6	–7
PB–10K	$100.00	*		*	*			
PB–1K	75.00	*	*	*	*	*		
PB–100	50.00	*	*	*	*	*	*	*
PB–10	50.00	*	*	*		*	*	*
PB–1	50.00		*	*			*	*

CURRENT CODE BOARDS: Plug into DPD–7 to control current. Board of choice is supplied with DPD–7, specified by appending suffix equal to current rating of supply being programmed, e.g.: DPD–7–15 for 15 amp code board. Additional code boards. **PRICE: $50.00 each**

OPTIONAL OFFSET CONTROL: Add suffix "E" to model number, e.g.: DPD–2E for an optional E_{io} (voltage offset) zeroing control. Used to control power supplies that lack zeroing facilities. **PRICE: $50.00**

MOTORIZED PROGRAMMERS

MODEL	PRICE	SHIP. WGT. (LBS.)
MP–1	$595.00	11
MP–10	595.00	11

PROGRAMMER FUNCTION GENERATOR

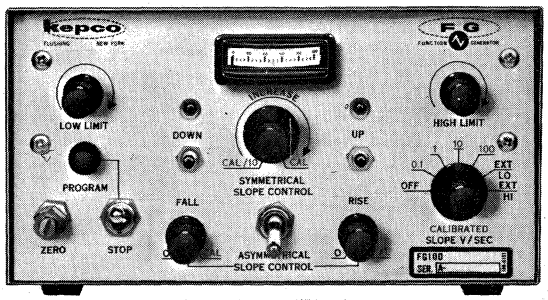
MODEL	PRICE	SHIP WGT. (LBS.)
Model FG–100	$575.00	12

DIGITAL PROGRAMMING PANELS

MODEL	RATIO Ω/V	PRICE	SHIP. WGT. (LBS.)
KP 1	1000	$273.00	10
KP 10	100	310.00	16

KEPCO

PROGRAMMER, FUNCTION GENERATOR
MODEL FG-100



Model FG-100 is a precision, slow speed, triangular waveform generator capable of generating any repetitive ramp function. Separately adjustable, high and low limits, are provided which periodically reverse the direction of the integration. The rising rate and falling rate are separately adjustable or can be controlled symmetrically with a single control.

OUTPUTS: All outputs available simultaneously.

#1 — 0-20V d-c, 0-20 ma.

#2 — 0-10 ma to program 100 ohm/volt power supply.

#3 — 0-1 ma to program 1000 ohm/volt power supply.

INPUT: 105-125V or 210-250V a-c, 50-440 Hz

TIMING: 4 ranges: 0.1V/sec., 1.0V/sec., 10V/sec., 100V/sec. Rising and falling slopes continuously adjustable between ranges either separately or symmetrically. For outputs #2 and #3, divide the above timing by 2000 and 20,000 respectively to obtain milliamperes per second.

LIMITS: Separately adjustable high limit and low limit permits operation between any two pre-set voltages or currents.

REVERSING SWITCHES: Programming direction is automatically reversed at the high and low limits. In addition, a pair of push buttons are provided which permit the direction to be reversed at any point in the operating span. A pair of directional lamps are provided to show the direction of the ramp.

METER: 2½" edgewise meter monitors output in volts (0-20V a-c) and in percent of maximum output, 0-100%.

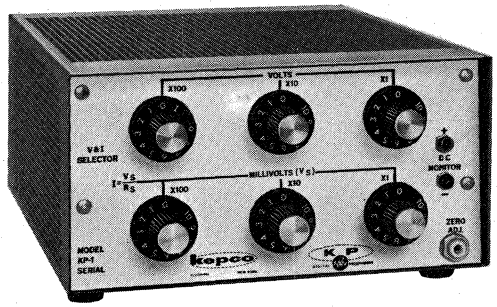
PROGRAMMING: Model FG-100 may be used by itself to generate a wide variety of very low speed triangular or sawtooth functions, or it can be used directly with any programmable d-c power supply. When connected to a programmable power supply, the Model FG-100 Function Generator programs the power supply throughout all or part of its rated voltage or current range as set by the power supply's controls and the function generator's limit settings. NOTE: function speed is converted to programming speed by multiplying the driving current rate (ma/sec.) by the resistance setting of the voltage control of the power supply being programmed. This gives the programming speed of the power supply's output in volts per second.

REMOTE CONTROLS: Timing and limit setting controls are brought to a multi-terminal barrier strip at the rear of the unit for remote operation. A sync output is also provided as is provision for remote directional signals.

DIMENSIONS: 4¼" H x 8$\frac{5}{32}$" W x 13" D (13⅜" D overall)

MOUNTING: Mount single unit in rack adapter RA-5, two abreast in rack adapter RA-4. *See Hardware Section.*

PROGRAMMING PANELS



MODEL KP-1 for use with any Kepco programmable power supply using a 1mA control current.

SPECIFICATIONS: MODEL KP-1

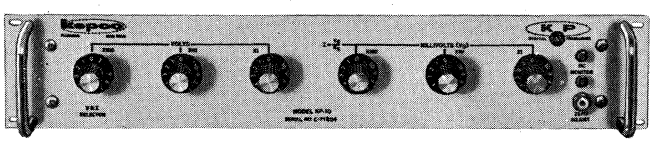
DECADES: 6-digit voltage programming. 3-digit current programming.

RANGE: 0-1,011.110 ohms in 1 ohm steps (0 to 1,011.110V in 1 millivolt steps at 1000Ω/V).

ACCURACY: Decades contain 0.1% resistor except units decade (millivolts) which contain 1% resistors.

DIMENSIONS: Half-rack, 4¼"H x 8$\frac{5}{32}$"W x 9⅝"D.

MOUNTING: Mount single unit in rack adapter RA-5, two abreast in rack adapter RA-4. *See Hardware Section.*



MODEL KP-10 for use with any Kepco programmable power supply using a 10 mA control current.

SPECIFICATIONS: MODEL KP-10

DECADES: 6-digit voltage programming. 3-digit current programming.

RANGE: 0-101,111.0 ohms in 0.1 ohm steps (0-1,011.110V in 1 millivolt steps at 100Ω/V.)

ACCURACY: All decades contain 0.1% resistors.

DIMENSIONS: 3½" high x 19" wide x 11" deep.

FINISH: Light gray, color 26440, per Fed. Std. 595

Both decade programmers contain provision for current programming using the first three digits. This assumes a 1 volt sensing drop (internal or external). If the recommended 10 volt sample is employed for HB and ABC high voltage hybrids, then a fourth digit can be used for higher resolution.

When substituted in place of a power supply's normal voltage control and calibrated, the KP-1/KP-10 digital decade programmer converts that supply to a highly accurate voltage or current source.

Both programmers contain zero trimming controls which, in conjunction with the power supplies own bridge current adjustment, allow precise calibration of the output at minimum and maximum output. The programming function of the Kepco bridge is inherently linear to an accuracy determined by the load/line regulation of the power supply. This means that the circuit accuracy is, for all intents and purposes, limited solely by the resistors used in the programmer.

KEPCO POWER SUPPLY DIMENSIONS

DIMENSIONS FOR EACH KEPCO POWER SUPPLY GROUP

The dimensions listed on this page are overall outline dimensions, except depth, which is given as the measurement behind panel, ie: clearance required. Dimensions do not include allowance for cables or connections. Outline drawings for each group of power supplies are available upon request.

ABC(Transistor) Group Page 1994

4¼"H x 8$\frac{5}{32}$"W x 9⅜"D for Models ABC 7.5-2M, ABC 15-1M, ABC 40-0.5M and ABC 100-0.2M; 4¼"H x 8$\frac{5}{32}$"W x 5⅝"D for Models ABC 2-1M, ABC 10-0.75M, ABC 18-0.5M and ABC 30-0.3M.

ABC(Hybrid) Group Page 1988

4¼"H x 8$\frac{5}{32}$"W x 9⅝"D for all models except 13⅜"D for Model ABC 2500M.

BHK Group Page 1989

5$\frac{7}{32}$"H x 19"W x 16½"D (behind panel)

BOP Group Page 1985

5$\frac{7}{32}$" H x 8$\frac{11}{32}$" W x 17⅞" D (behind panel)

CC Group Page 1997

5$\frac{7}{32}$" H x 2$\frac{25}{32}$" W x 15" D (behind panel)

CDT Group Page 1998

5$\frac{7}{32}$"H x 8$\frac{11}{32}$"W x 17⅜"D (behind panel)

CK Group Page 1982

4¼"H x 8$\frac{5}{32}$"W x 13⅜"D.

CK-HS Group Page 1986

4¼"H x 8$\frac{5}{32}$"W x 13⅜"D.

CPS Group Page 1999

Metered models:
¼ Rack:
5$\frac{7}{32}$" H x 4$\frac{5}{32}$" W x 17⅞" D. (behind panel).
½ Rack:
5$\frac{7}{32}$" H x 8$\frac{11}{32}$ W x 18½" D. (behind panel).
Full Rack:
5$\frac{7}{32}$" H x 16½" W x 18½" D. (behind panel).
Unmetered (modular) models:
¼ Rack: 5" H x 4$\frac{1}{32}$" W x 17⅞" D.
½ Rack: 5" H x 8$\frac{3}{32}$" W x 18½" D.
Full Rack: 5" H x 16½" W x 18½" D.

HB Group Page 1990

3$\frac{15}{32}$"H x 19"W x 14⅜"D (behind panel).

JQE Group Page 1992

Metered models:
¼ Rack:
5$\frac{7}{32}$" H x 4$\frac{5}{32}$" W x 17⅞" D. (behind panel).
½ Rack:
5$\frac{7}{32}$" H x 8$\frac{11}{32}$ W x 18½" D. (behind panel).
Full Rack:
5$\frac{7}{32}$" H x 16½" W x 18½" D. (behind panel).
Unmetered (modular) models:
¼ Rack: 5" H x 4$\frac{1}{32}$" W x 17⅞" D.
½ Rack: 5" H x 8$\frac{3}{32}$" W x 18½" D.
Full Rack: 5" H x 16½" W x 18½" D.

KG Group Page 2000

Panel: 2$\frac{3}{32}$" x 5$\frac{7}{32}$";
PC connector 13$\frac{19}{32}$" behind panel.

KO Group Page 1983

8$\frac{23}{32}$"H x 19"W x 20"D (behind panel). Side handles and skids removable for rack mounting.

KS Group Page 1984

Size "A": 3$\frac{15}{32}$"H x 19"W x 14⅜"D (behind panel)
Size "B": 5$\frac{7}{32}$"H x 19"W x 16$\frac{1}{16}$"D (behind panel)
Size "C": 6$\frac{3}{32}$"H x 19"W x 16$\frac{1}{16}$"D (behind panel)
Size "D": 8$\frac{23}{32}$"H x 19"W x 20"D (behind panel)
Size "D" has removable side handles and skids.

OPS-B Broup Page 1987

Uncased: 2½" H x 3$\frac{13}{16}$" W x 12$\frac{13}{16}$" D.
Cased: (Suffix C) 2$\frac{1}{16}$" H x 4⅛" W x 13$\frac{3}{16}$" D.
OPS 20: 5$\frac{7}{32}$"H x 8$\frac{11}{32}$"W x 3⅞"D. (behind panel)
OPS 2000: 5$\frac{7}{32}$" H x 8$\frac{11}{32}$"W x 13⅞"D. "
OPS-BTA: 5$\frac{7}{32}$" H x 2$\frac{25}{32}$" W x 15" D. "

PAR Group Page 1975

Uncased: 6¾"H x 4¾" W x 10¾"D.
Cased: 6$\frac{15}{16}$"H x 5"W x 10¾"D.

PAT Group Page 1976

3$\frac{15}{32}$"H x 6⅝"W x 4$\frac{29}{32}$"D.

PAX (HS) Group Page 1977

Uncased: 2½"H x 3$\frac{13}{16}$"W x 12$\frac{13}{16}$"D.
Cased: (Suffix C) 2$\frac{1}{16}$"H x 4⅛"W x 13$\frac{3}{16}$"D.

PCX Group Page 1978

Uncased: 2½"H x 3$\frac{13}{16}$"W x 12$\frac{13}{16}$"D.
Cased: (Suffix C) 2$\frac{1}{16}$"H x 4⅛"W x 13$\frac{3}{16}$"D.
PCX-MAT: 5$\frac{7}{32}$"H x 2$\frac{25}{32}$" W x 15" D

PR Group Page 1995

Size "A": 3$\frac{15}{32}$"H x 19"W x 13$\frac{15}{16}$"D (behind panel)
Size "B": 5$\frac{7}{32}$" H x 19"W x 13$\frac{15}{16}$"D (behind panel)
Size "C": 8$\frac{23}{32}$"H x 19"W x 20" D (behind panel)
Size "C" has removable side handles and skids.

PVS Group Page 2001

5$\frac{7}{32}$" H x 8$\frac{11}{32}$" W x 17⅞" D (behind panel).

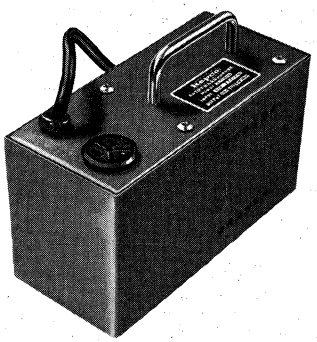
PWR Group Page 1979

Uncased: 6¾"H x 4¾" W x 10¾"D.
Cased: 6$\frac{15}{16}$"H x 5"W x 10¾"D.

SM-A Group Page 1996

Size "A": 3$\frac{15}{32}$"H x 19"W x 13$\frac{15}{16}$"D (behind panel)
Size "B": 5$\frac{7}{32}$" H x 19"W x 13$\frac{15}{16}$"D (behind panel)
Size "C": 8$\frac{23}{32}$"H x 19"W x 13$\frac{15}{16}$"D (behind panel)

KEPCO
AUTOTRANSFORMERS



Compact step-down Transformers provide 115V a-c output from 220/230/240V a-c (tap selected) 48–440 Hz.

MODEL	POWER	SIZE* L	W	D	PRICE	SHIP WGT. (LBS.)
AT–100	100 VA	5½"	2⅞"	2¾"	**$ 27.00**	5
AT–250	250 VA	6"	3½"	3½"	**37.00**	8
AT–500	500 VA	7½"	3½"	4½"	**53.00**	14
AT–1000	1000 VA	8"	5¼"	5¼"	**79.00**	23
AT–1500	1500 VA	9¼"	5¼"	6½"	**105.00**	30

*Overall case dimensions (not including handle and feet)

KEPCO
ACCESSORY EQUIPMENT

MODEL	PRICE	SHIP. WGT. (LBS.)
VIX–1 (uncased)	**$73.00**	12
VIX–1C (cased)	**83.00**	13
KT 6212	**$578.00**	50

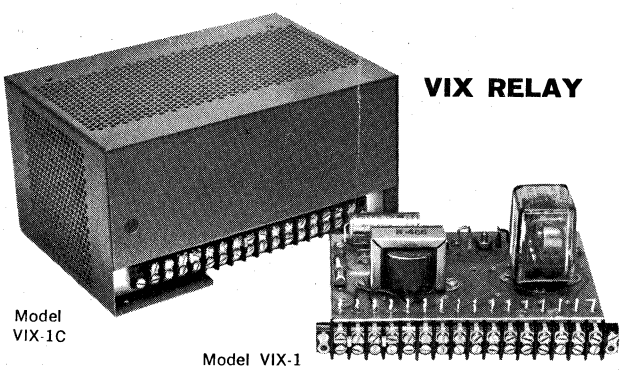
PRIMARY LISTING:

AT

KT

VIX

VIX RELAY



Model VIX-1C

Model VIX-1

Model VIX-1C translates the VIX REMOTE SIGNAL available on all CK and KS VIX-equipped power supplies into a heavy duty relay closure for external control or signal applications.

SPECIFICATIONS

INPUT: ±8V d-c at 1 ma (from VIX signal).

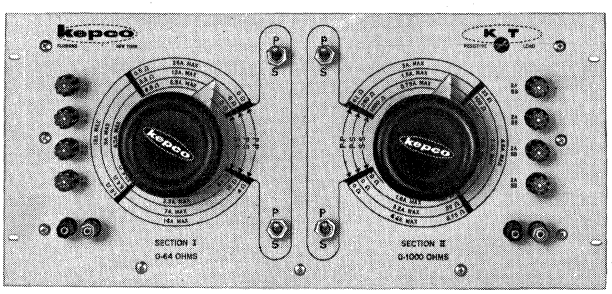
OUTPUT: Three pole, double throw relay contacts; each rated to carry 10 amperes at 115V a-c or 5 amperes at 230V a-c.

POWER REQUIREMENTS: 105-125V or 210-250V a-c

SIZE: 4¼" H x 8$\frac{5}{32}$" W x 5" D (5⅝" D overall) Standard half-rack configuration).

MOUNTING: In the half-rack enclosure VIX-1C can be mounted in either RA-4 or RA-5 rack adapters.
The enclosure is removable so that the circuit board, which is complete by itself, can be mounted within other equipment, or chassis. To designate model without enclosure, delete the suffix "C", e.g., Model VIX-1, for unenclosed circuit board for "built-in" mounting.

VARIABLE RESISTIVE LOAD



The Model KT 6212 is a multiganged, eight-section group of dual-wound power rheostats used in the testing of regulated power supplies.

Model KT 6212 consists of two independent gangs of four rheostats apiece, 0-64 ohms and 0-1000 ohms. The rheostats can be switched for parallel, series parallel and series operation. Each rheostat has heavy and light windings so that the maximum load current changes at approximately each third rotation point around the dial.

CONTROLS:
Switches select series and parallel combinations of the four ganged rheostats with the corresponding resistance and current rating designated by concentric bands.

Each band defines the resistance range for its particular connection with zero ohms (maximum current) in the clockwise position. The bands are divided into three sections that correspond to the position of the heavy and light windings, respectively. The maximum current in each section is shown on the corresponding portion of the band.

FUSING:
Each rheostat in the 0-64 ohm gang is fused at 7 amperes. Each rheostat of the 0-1000 ohm gang is fused for 2 amperes.

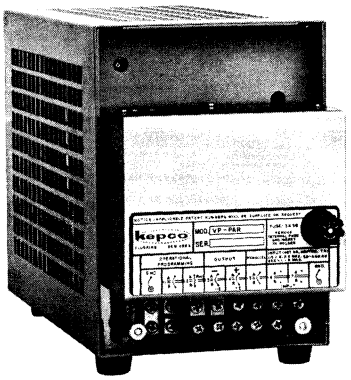
TERMINALS:
A pair of 5-way binding posts is provided at each gang for connection to the power source under test. These connections are duplicated at the rear.

EXTERNAL POWER REQUIREMENTS:
None. The Model KT 6212 is a passive device.

DIMENSIONS:
8¾"H x 19"W x 13⅝"D. The Model KT 6212 resistive load is designed for mounting in standard 19" equipment racks.

PRIMARY LISTING:
VP
VIP
CROSS REFERENCE
CPS
JQE

KEPCO OVERVOLTAGE CROWBARS



Model VP-PAR with cased PAR Module

MODEL	VOLTS	AMPS	FOR USE WITH	DIMENSIONS H	W	D	PRICE	SHIP WGT. (LBS.)
VP—PAR	3—80V	12A	All PAR Models	4 13/16"	4½"	2¼"	$75.00	3
VP—PWR	3—80V	15A	All PWR Models	4 13/16"	4½"	2¼" + Fuse	75.00	3
VP—PX	3—110V	3A	All PAX and PCX Models	2 19/32"	5 3/32"	3 1/16"	80.00	3
VP—KCA	3—160V	25A	All ABC Transistorized, CK and KS Models (except those listed below)	2⅜"	8⅛"	3 7/16" + Terminals	110.00	3
VP—KS—1	3—160V	30A	KS 36-30M, 60-20M & 120-10M	4"	10¾"	3⅛" + Terminals	125.00	6
VP—KS—2	3—30V	100A	KS 8-50M, 8-100M & 18-50M	4"	10¾"	3⅛" + Terminals	155.00	6

OPERATING LEVEL:
The trigger point may be set to within 5% or 0.25V (whichever is greater) of power supply setting.

TEMPERATURE COEFFICIENT:
0.1% or 0.1V (whichever is greater) per °C.

REMOTE ERROR SENSING:
Compensates up to 1 volt per output lead.

TRIGGERING TIME, (adjustable delay):
5 to 10 microseconds with an adjustable delay to minimize the false alarm rate.

Power Supplies may be ordered with the overvoltage protector factory-installed.
Installation charges 1-11: $25.00 ea.
12-23: $10.00 ea.
24 or more $3.00 ea.

KEPCO
OVER-VOLTAGE / OVER-CURRENT PROTECTORS

MODEL	DESCRIPTION	PRICE	SHIP. WGT. (LBS.)
VIP—1	Overvoltage/Overcurrent	$132.00	21
VIP—3	Over and Undervoltage/ Over and Undercurrent	237.00	21
VIP—4	200 ampere Overvoltage crowbar (5—50V)	310.00	21

The VIP consists of a sensing circuit capable of detecting a voltage 1% or 0.1 volts different than any preset voltage limit in the range 5—200*volts. Should such an over or under-voltage occur, a fast-acting silicon controlled rectifier (SCR) "crowbar" short circuits the power supply's output within 50 microseconds. Simultaneously a power interlock relay is tripped which removes the primary a-c power within approximately 50 milliseconds. The SCR discharges the power supply's output filter capacitor and the voltage is reduced to zero.

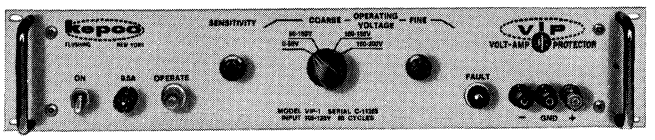
Operation in the internal reference mode allows the operator to pre-set any voltage as a limit above or below which crowbar/turn-off action is precipitated. In its tracking mode, the VIP is interconnected with the voltage control circuit of the power supply with which it is used and will sense a voltage differential between the output of the supply and the programmed voltage.

Terminals are provided for the addition of a sensing resistor to convert VIP into an over-current or under-current protector depending on model. The current sensing resistor is chosen to drop 1 volt at the operating current. The sensitivity control then adjusts the firing threshold from 0 to the operating current, maximum 30 amperes.

*Model VIP-4 voltage range is 5-50V.

All terms used in the specifications are defined in the Kepco Glossary.

Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.



SPECIFICATIONS:

VOLTAGE
SENSITIVITY: Minimum threshold 1% of operating voltage or 0.1 volts whichever is greater (adjustable).
RANGE: 0—50V*, 50—100V, 100—150V, 150—200V.
*Minimum voltage required for proper operation is 5V.

CURRENT
SENSITIVITY: 5% of operating current producing a 1 volt drop across external sensing resistor.
RANGE: 0-30 amperes. Model VIP 4 has a 0-200 ampere crowbar range.

POWER INTERLOCK RELAY
CONTACT RATING: 10 amperes at 115V a-c.
Operation of the VIP is in two stages. The output crowbar is immediately followed by an a-c power interruption to the crowbarred power supply. High power supplies (such as might require a VIP 4) may require either an auxiliary contactor to turn them off, or, in the case of the large KS and KO models, a connection may be made to the trip coil of the power supply's circuit breaker to accomplish the turn-off action.

DIMENSIONS
3½" high x 19" wide x 8" deep.
Standard EIA rack dimensions.

FINISH: Light gray, color 26440, per Fed. Std. 595

NOTE: When a VIP is to be used in its "Tracking Mode" be sure to specify (when ordering) whether it is to be used with a *plus* common or *minus* common power supply.

KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352
(212) 461-7000 • TWX #710-582-2631
Telex: 12-6055 • Cable: KEPCOPOWER NEWYORK

kepco®

HARDWARE AND MOUNTING EQUIPMENT

HARDWARE FOR PLUG-IN MODELS OPS-BTA, PCX-MAT AND CC POWER SUPPLIES.
OPS-B, PAX and PCX models can also be mounted using BPA—22 Adapter.

MODEL	DESCRIPTION	SIZE	PRICE	SHIP. WGT. (LBS.)
RA 22—6	Six-slot rack housing w/o plug boards*	5 7/32" H x 19" W x 16 3/8"D	$32.00	11
BPA—22	Blank panel assembly w/slide plate	5 7/32" H x 2 25/32"W x 14 5/8" D	11.00	2
RFP 22—1	Single filler panel	5 7/32" H x 2 25/32"W —	6.00	1/2
RFP 22—2	Double filler panel	5 7/32" H x 5 9/16"W —	6.00	1/2
RFP 22—3	Triple filler panel	5 7/32" H x 8 3/8" W —	6.00	1/2
CA—3	Single-slot housing w/plug board	5 7/32" H x 2 25/32"W x 16" D	20.00	6
CA—4	Double-slot housing w/plug board	5 7/32" H x 5 9/16"W x 16" D	30.00	7
CA—5	Triple-slot housing w/plug board	5 7/32" H x 8 3/8" W x 16" D	40.00	8
PC—2	Plug-in adapter*	5 7/32" H x 2 21/32"W —	9.00	1
8282	Plug-in Kit for BPA—22	— — —	6.00	1/2

*For plug-in convenience in the RA 22—6, use (1) PC—2 per slot.

CHASSIS MOUNTING TYPES OPS-B, PAX, PCX MODELS CAN BE ENCASED WITH CASE CA—1, FITTED WITH PLUG PC—1 FOR QUICK-DISCONNECT AND RACK MOUNTED IF DESIRED.

CA—1	Chassis mounting case (single)	2 11/16"H x 4 1/8" W x 13 3/16"D	11.00	2
PC—1	Connector	— — —	6.00	1/2
RA 12—1	1 cased unit Rack Adapter	3 15/32"H x 19" W —	11.00	3
RA 13—4	4 cased unit Rack Adapter	3 15/32"H x 19" W —	11.00	3
RA 11—6	6 cased unit Rack Adapter	5 7/32" H x 19" W —	11.00	3

The CC, PCX-MAT and OPS-BTA plug-in systems permit a wide variety of options. The assemblies CC, PCX-MAT or OPS-BTA having a panel, are equipped with a slide plate which enables them to slip into either Models CA—3 (single unit), CA—4 (dual), CA—5 (triple) or the Model RA 22—6. The Models CA—3, 4 and 5 are complete cases with integral PC connector, line cord, and barrier strip(s) for access to the control functions. The Model RA 22—6 requires the use of from one to six of Model PC—2 connectors (depending on how many instruments are to be plugged in) which must be ordered separately and installed. The RA 22—6 is equipped with a line cord.

The Blank Panel Adapter (Model BPA—22) permits the mounting of regular PAX, PCX and OPS-B modules (uncased style) in any of the above cases or rack adapters. The panel is, of course, blank. Filler panels, Model RFP 22—1, —2 and —3 are available to fill in blank slots in any of the cases Model CA—3, 4, 5 and RA 22—6.

Adapters, Models RA 12—1, RA 13—4 and RA 11—6, will mount one, four or six *cased* PAX, PCX or OPS-B modules in a 19-inch panel without any of the panel control features or metering. Connector PC—1 may be used to connect to such modules or their barrier strips may be utilized for wiring.

RACK ADAPTERS

Adapt bench style, modular and half-rack Power Supplies to the standard 19" wide equipment rack or cabinet. Panels and Rack Adapters are finished light gray Color 26440 per Fed. Std. 595.

RACK ADAPTERS for ABC, CK, FG—100, KP—1, MP—1, MP—10 and VIX 1—C.

MODEL	FOR USE WITH	DIMENSIONS H	DIMENSIONS W	PRICE	SHIP. WGT. (LBS.)
RA 1 *(Single)*	Model 103 only	10 1/2"	19"	$16.00	5
RA 4 *(Dual)*	Above Listed Models	5 7/32"	19"	16.00	4
RA 5 *(Single)*	Above Listed Models	5 7/32"	19"	16.00	4
FP1	Filler Panel for RA 4	4 1/4"	8 5/32"	5.00	1/2

HARDWARE, ADAPTERS and ACCESSORY ITEMS

PRM Size "A" — 180 Series and PWR GROUPS

MODEL	DESCRIPTION	DIMENSIONS H	DIMENSIONS W	DIMENSIONS D	PRICE	SHIP. WGT. (LBS.)
CA—200	Case	6 15/16"	5"	10 7/16"	$11.00	4
RA 8—2	2 Unit Rack Adapter	5 7/32"	19"	—	11.00	4
RA 9—3	3 Unit Rack Adapter	6 31/32"	19"	—	11.00	4
RA 10—1	1 PRM Unit Adapter	5 7/32"	19"	—	11.00	4
RA 23—1	1 PWR Unit Adapter	5 7/32"	19"	—	11.00	4
RA 25—1	1 PAR Unit Adapter	5 7/32"	19"	—	11.00	4

PRM Size "B" — 120 Series Group

RA 14—3	3 Unit Rack Adapter	3 15/32"	19"	—	$11.00	3
RA 15—1	1 Unit Rack Adapter	3 15/32"	19"	—	11.00	3
RA 16—4	4 Unit Rack Adapter	5 7/32"	19"	—	11.00	3
RA 17—5	5 Unit Rack Adapter	5 7/32"	19"	—	11.00	3

PRM Size "C" — Dual Output and Extra-Filtered GROUPS

MODEL	DESCRIPTION	DIMENSIONS H	DIMENSIONS W	DIMENSIONS D	PRICE	SHIP. WGT. (LBS.)
CA—300	Case	6 15/16"	5"	14 7/16"	$11.00	4
RA 8—2	2 Unit Rack Adapter	5 7/32"	19"	—	11.00	3
RA 9—3	3 Unit Rack Adapter	6 31/32"	19"	—	11.00	3
RA 18—1	1 Unit Rack Adapter	5 7/32"	19"	—	11.00	3

PLUG-IN CABINETS for PRM Size "A" & "C"

RA 20—3	3 Unit Housing	8 25/32"	19"	18"	100.00	12
RAP 20—1	1 Unit Panel Adapter	8 25/32"	5 1/2"	—	6.00	1/2
RFP 20—1	Rack Filler Panel	8 25/32"	5 1/2"	—	6.00	1/2

PLUG-IN CABINETS for PAR and PWR GROUPS

RA 21—3	3 Unit Housing	8 25/32"	19"	13"	100.00	12
RAP 21—1	1 Unit Panel Adapter	8 25/32"	5 1/2"	—	6.00	1/2
RFP 21—1	Rack Filler Panel	8 25/32"	5 1/2"	—	6.00	1/2

KG GROUP

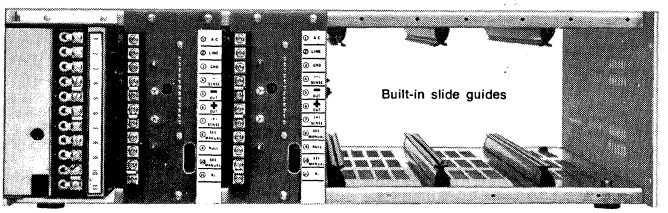
CA—2	Single Unit Housing	5 1/2"	2 3/16"	14"	$16.00	2
RA 19—8	Multi Unit Housing (8)	5 1/4"	19"	14"	79.00	11
RFP 19—1	Single filler panel	5 7/32"	2 3/16"	—	6.00	1/2
RFP 19—2	Double filler panel	5 7/32"	4 3/16"	—	6.00	1/2
RFP 19—3	Triple filler panel	5 7/32"	6 5/16"	—	6.00	1/2

PAT GROUP

RA 26—1	1 Unit Rack Adapter	3 15/32"	19"	—	$ 11.00	3
RA 27—2	2 Unit Rack Adapter	3 15/32"	19"	—	11.00	3
RA 28—4	4 Unit Rack Adapter	6 31/32"	19"	—	11.00	3

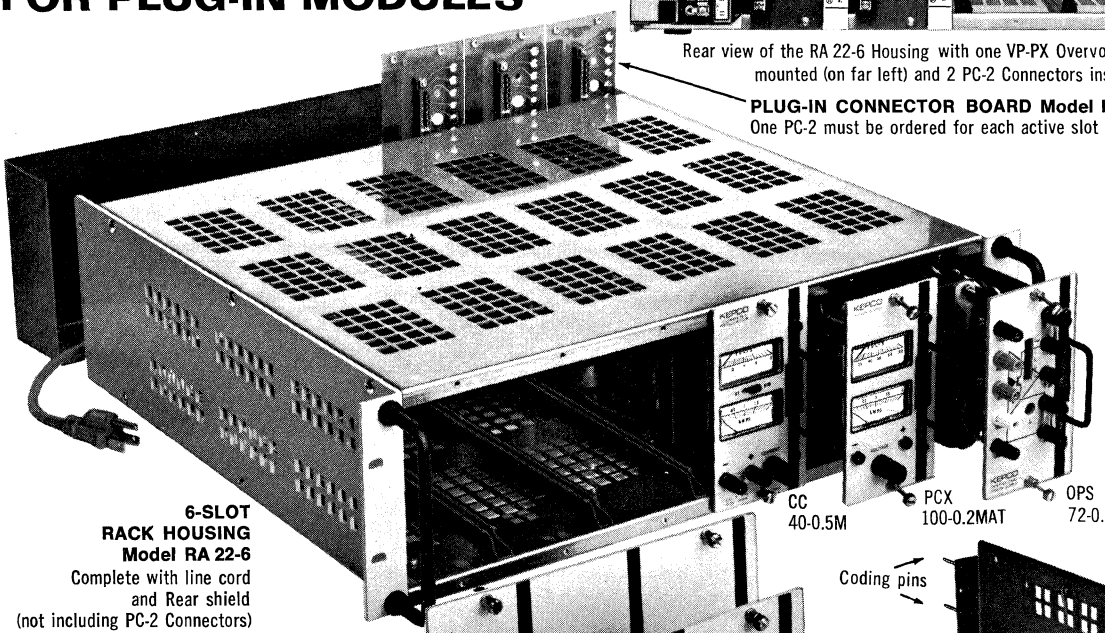
PANEL MOUNTING HOLES ARE PRE-DRILLED IN STANDARD E.I.A. PATTERN

KEPCO
ENCLOSURES AND HARDWARE SYSTEMS FOR PLUG-IN MODULES

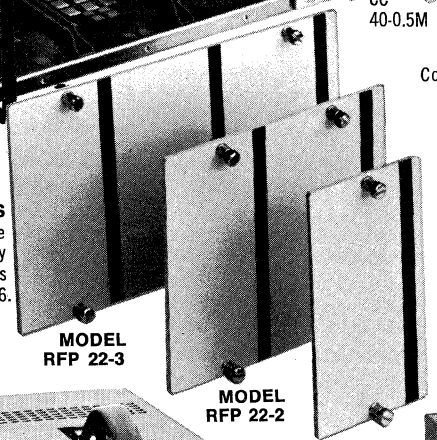


Rear view of the RA 22-6 Housing with one VP-PX Overvoltage Protector mounted (on far left) and 2 PC-2 Connectors installed

PLUG-IN CONNECTOR BOARD Model PC-2
One PC-2 must be ordered for each active slot in the RA 22-6.



6-SLOT RACK HOUSING Model RA 22-6
Complete with line cord and Rear shield (not including PC-2 Connectors)

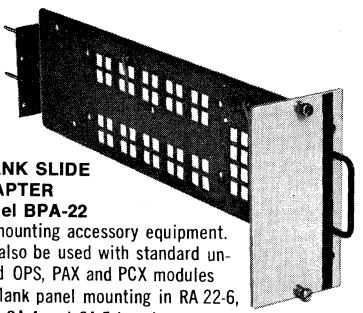


FILLER PANELS
(supplied without slide assembly and handle), may be used to fill unused slots in CA-3, CA-4, CA-5 and RA 22-6.

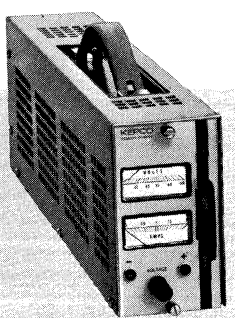
MODEL RFP 22-3

MODEL RFP 22-2

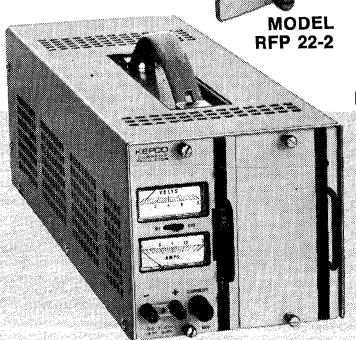
MODEL RFP 22-1



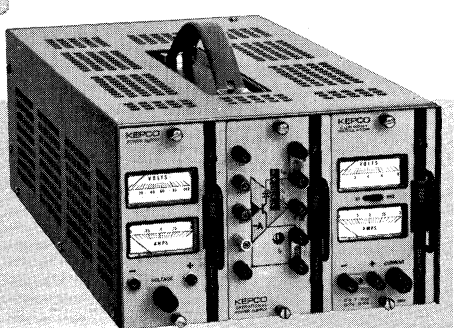
BLANK SLIDE ADAPTER Model BPA-22
For mounting accessory equipment. May also be used with standard uncased OPS, PAX and PCX modules for blank panel mounting in RA 22-6, CA-3, CA-4 and CA-5 housings.



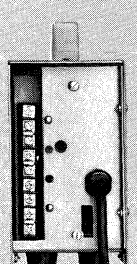
SINGLE UNIT HOUSING Model CA-3
Supplied complete with a built-in PC-2 connector. (shown with a PCX 100-0.2MAT plugged-in)



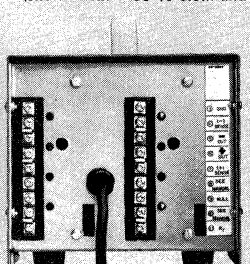
DOUBLE UNIT HOUSING Model CA-4
Supplied complete with a built-in dual PC-2 connector. (shown with a CC 40-0.5M and a BPA-22 plugged-in)



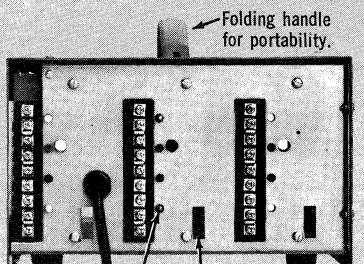
TRIPLE UNIT HOUSING Model CA-5
Supplied complete with a triple PC-2 connector.



Typical rear view of CA-3, showing access terminals and connector.



Typical rear view of CA-4, showing integral connector (Double PC-2) supplied.



Typical rear view of CA-5, showing coding pins, connectors and line cord. | Slot provides access to internal adjustments in mounted supplies.

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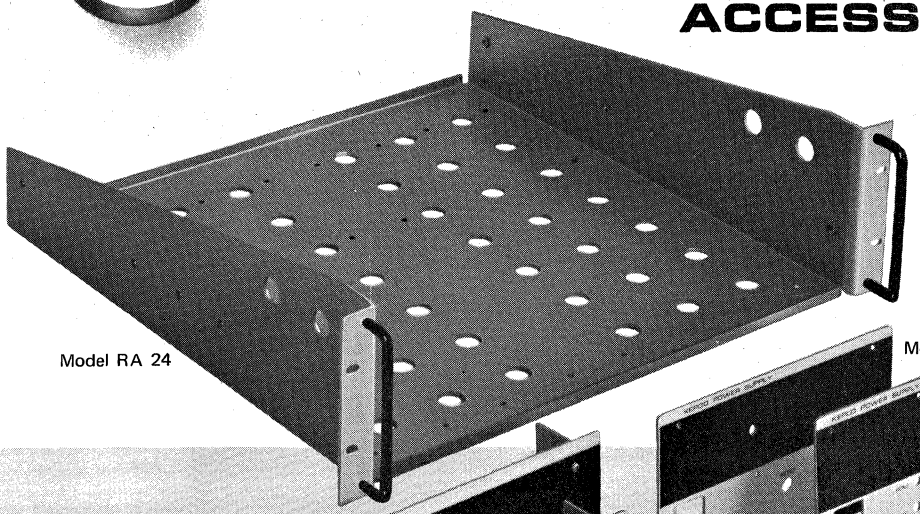


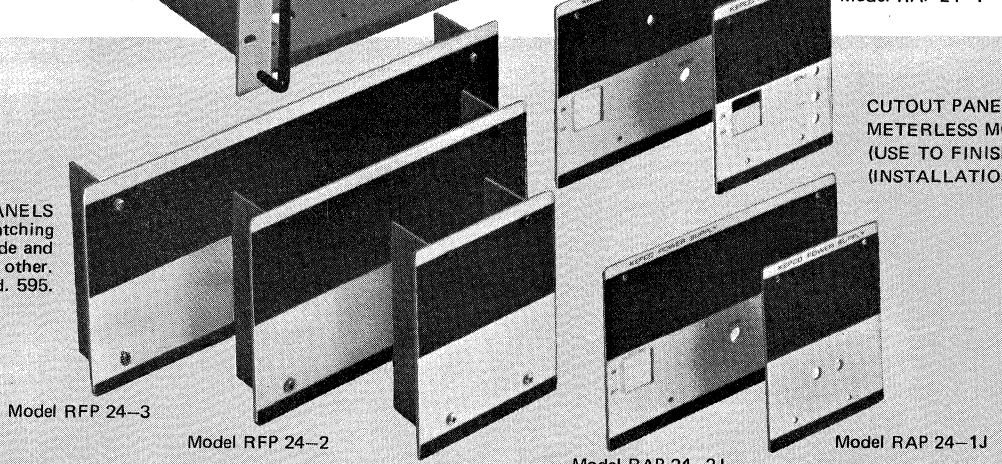
Model RA 24

Model RAP 24–2

Model RAP 24–1

CUTOUT PANELS FOR METERLESS MODULES (USE TO FINISH RA–24 (INSTALLATION).

BLANK FILLER PANELS are finished with a matching stripe on one side and solid gray on the other. Color 26440 per Fed. Std. 595.



Model RFP 24–3

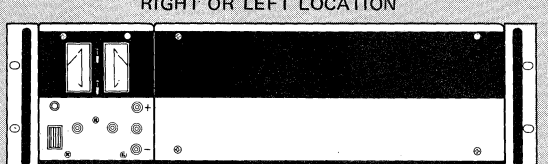
Model RFP 24–2

Model RFP 24–1

Model RAP 24–2J

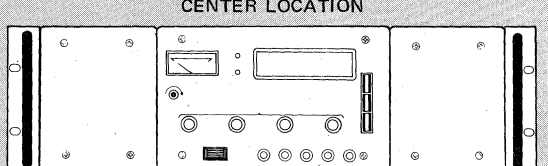
Model RAP 24–1J

RIGHT OR LEFT LOCATION



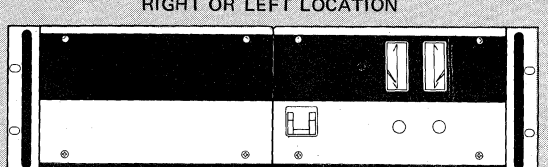
JQE 6–10M RFP 24–3

CENTER LOCATION



RFP 24–1 PVS 100–1M RFP 24–1

RIGHT OR LEFT LOCATION



RFP 24–2 CPS 6–22M

RA 24 RACK SYSTEM

THE RA 24 WILL HOUSE ¼ & ½ RACK SIZED MODELS IN THE FOLLOWING GROUPS:

BOP, CDT, CPS, DPD, DPR, JQE, OPS 20, OPS 2000 & PVS

MODEL	DESCRIPTION	DIMENSIONS H	W	D	PRICE	SHIP. WGT. (LBS.)
RA–24	Rack Adapter for (2) ½ or (4) ¼ Rack Models	5 7/32"	19"	17 7/8"	$21.00	10
RAP 24–1	Adapter for unmetered ¼ Rack CPS Models	5 7/32"	4 5/32"	—	6.00	½
RAP 24–2	Adapter for unmetered ½ Rack CPS Models	5 7/32"	8 13/32"	—	6.00	½
RAP 24–1J	Adapter for unmetered ¼ Rack JQE Models	5 7/32"	4 5/32"	—	6.00	½
RAP 24–2J	Adapter for unmetered ½ Rack JQE Models	5 7/32"	8 13/32"	—	6.00	½
RAP 24–45	Rack Adapter for ABC, CK, KP–1, MP, FG & VIX	—	—	—	11.00	½
RFP 24–1	¼ Filler Panel for RA–24	5 7/32"	4 5/32"	1 5/8	6.00	½
RFP 24–2	½ Filler Panel for RA–24	5 7/32"	8 13/32"	1 5/8	6.00	½
RFP 24–3	¾ Filler Panel for RA–24	5 7/32"	11 3/16"	1 5/8	6.00	½

½ & ¼ RACK POWER SUPPLIES AND PROGRAMMERS CAN BE MOUNTED TOGETHER OR WITH FILLER PANELS IN RA 24.

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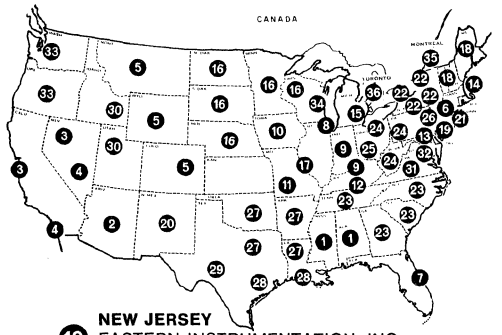

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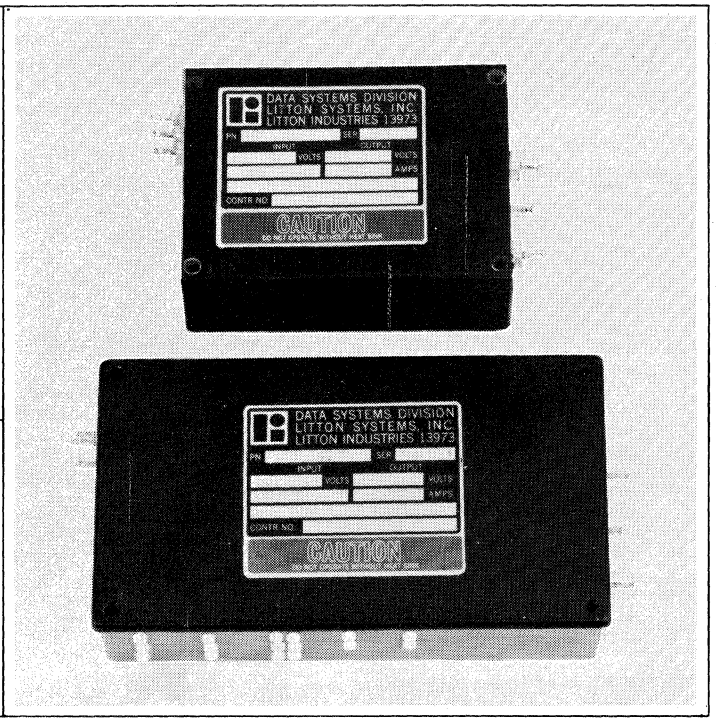
DATA SYSTEMS DIVISION • LITTON INDUSTRIES

TECHNICAL DATA SHEET



FEATURES:

- Dual outputs (200 series)
- Small size 8.1 to 24 cubic inches (200/250 series) 13 to 108 cubic inches (400 series)
- MIL Spec conformance (MIL-E-5400, Class 2; MIL-I-6181D; MIL-P-81279; MIL-STD-704 CAT B)
- High Efficiency — up to 65% (200/250 series) up to 80% (400 series)
- High Voltage — 3 to 40 VDC with power rating to 300 watts
- Reliability ranging up to 162,000 hours MTBF (200/250 series); up to 66,000 hours MTBF (400 series)
- Automatic overcurrent and overvoltage protection (power supply off until overvoltage condition removed and input power recycled)
- High current — 6 to 30 amperes at power ratings up to 300 watts (400 series)
- Modular packaging for full maintainability
- Latest Litton-developed switching regulator techniques

APPLICATION:

Here are the third-generation Litton power supplies, direct descendants of the original micro-miniature modules developed in U. S. Navy- and Litton-sponsored programs. These solid-state, conduction-cooled power supplies were refined in cooperation with a wide range of government agencies. They represent a breakthrough in achieving high packaging density coupled with optimum performance and reliability, and automatic protection features. These units are capable of fulfilling up to 90% of military power supply needs for microelectronic systems in airborne, shipboard, field, and space environments.

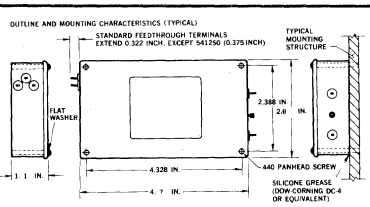
200/250 + 400 SERIES MICROMINIATURE POWER SUPPLIES

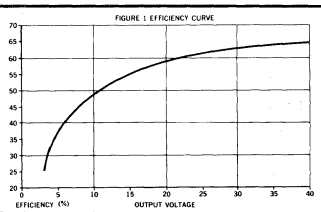
PERFORMANCE	UNITS OF MEASURE	MODEL 541200	MODEL 541210	MODEL 541220	MODEL 541250	MODEL 541400	MODEL 541410	MODEL 541420	MODEL 541430	MODEL 541440
INPUTS		115/200 VOLTS RMS, 400 HZ, 3 PHASE				115/200 VOLTS RMS, 400 HZ, 3 PHASE				
OUTPUTS AVAILABLE		1 OR 2	1 OR 2	1 OR 2	1	1	1	1	1	1
OUTPUT VOLTAGES AVAILABLE	VOLTS	3 TO 40	3 TO 40	3 TO 40	3 TO 40	3 TO 40	3 TO 40	3 TO 40	3 TO 40	3 TO 40
OUTPUT VOLTAGE ADJUSTMENT	VOLTS	±0.2	±0.2	±0.2	±0.2	±0.3	±0.3	±0.3	±0.3	±0.3
OUTPUT CURRENT, MAXIMUM	AMPERES	2	2	2	2	6	6	5	15	30
OUTPUT POWER, MAXIMUM	WATTS	30	60	90	25	30	75	120	90	300
STATIC REGULATION (LINE AND LOAD)	%	±1	±1	±1	±1	±0.25	±0.25	±0.25	±0.25	±0.25
DYNAMIC REGULATION, MAXIMUM (FULL to ¾ LOAD)	MILLIVOLTS	200	200	200	300	200	200	200	300	300
RECOVERY TIME MAXIMUM (FULL TO ¾ LOAD)	μSECONDS	150	175	150	250	150	175	150	250	300
RIPPLE (PEAK-TO-PEAK), MAXIMUM	MILLIVOLTS	100	100	100	100	50	50	50	75	100
RIPPLE AND SWITCHING SPIKE ENVELOPE MAXIMUM	MILLIVOLTS	100	100	100	100	60	80	100	150	300
TEMPERATURE COEFFICIENT, MAXIMUM	% PER °C	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
EFFICIENCY, MINIMUM	%	SEE FIGURE 1				SEE FIGURE 2				
DIMENSIONS, MAXIMUM (PLUS TERMINALS)	INCHES	4.7 x 2.8 x 1.1	5.6 x 3.2 x 1.1	6.0 x 3.3 x 1.3	3.2 x 2.4 x 1.1	4.7 x 2.8 x 1.1	5.6 x 3.2 x 1.1	6.0 x 3.3 x 1.3	7.9 x 4.0 x 1.2	6.1 x 9.3 x 2.1
VOLUME, APPROXIMATE	INCHES³	13	17	24	8	13	17	24	35	108
WEIGHT, MAXIMUM	POUNDS	1.0	1.5	2.0	0.75	1.0	1.5	2.0	3.3	7.0
RELIABILITY DEMONSTRATED		The 200 and 250 and 400 series were designed with the same philosophy and techniques at Litton DSD's original microminiature power supplies, which considerably exceeded the calculated reliability by operating 90,000 hours without a failure (63% confidence level; 10,000 hours MTBF at 99.97% confidence level).								
CALCULATED (AT 60°C)	HOURS MTBF	81,000 (DUAL 6V, 2A)	69,000 (DUAL 12V, 2A)	36,000 (28V, 2A)	162,000 (6V, 2A) 149,000 (12V, 2A)	66,000 (5V, 6A)	54,000 (12V, 6A)	28,500 (28V, 4A)	50,000 (5V, 15A)	40,000 (5V, 30A)
OPERATING TEMPERATURE CONDUCTIVE BASE, MAXIMUM	°C	+80	+80	+80	+80	+80	+80	+80	+80	+80
PROTECTION AUTOMATIC OVERCURRENT SHUTDOWN LEVEL	% OF RATED LOAD	110-150	110-150	110-150	105-150	110-140	110-140	110-140	110-140	110-140
AUTOMATIC OVERVOLTAGE SHUTDOWN LEVEL		PER CUSTOMER REQUIREMENTS				PER CUSTOMER REQUIREMENTS				
TURN-ON TIME (OUTPUT VOLTAGE WITHIN REGULATION BAND AFTER APPLICATION OF INPUT POWER)	MILLISECONDS	10	10	10	10	10	10	10	10	10

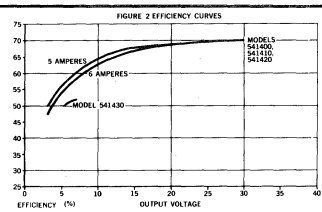
FOR PRICE, DELIVERY, AND ADDITIONAL TECHNICAL INFORMATION

CONTACT

MARKETING MANAGER,
SPECIAL PRODUCTS
LITTON DATA SYSTEMS DIVISION
8000 WOODLEY
VAN NUYS, CALIFORNIA 91406
PHONE: 213 781-8211
TWX: (910 495-1708)







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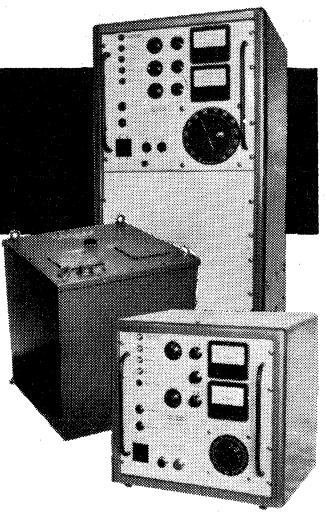
	CENTRAL REGION 379 WEST 1ST STREET, SUITE 102 DAYTON, OHIO 45402 PHONE: 513 223-3285	NORTHEASTERN REGION 395 TOTTEN POND ROAD WALTHAM, MASSACHUSETTS 02154 PHONE: 617-891-7685	WASHINGTON, D.C. 1875 CONNECTICUT AVENUE N. W. WASHINGTON, D.C. 20009 PHONE: 202 462-7082

KILOVOLT CORPORATION

HIGH VOLTAGE POWER SUPPLIES

PULSE MODULATORS INSULATION TESTERS



HIGH VOLTAGE POWER SUPPLIES FOR INDUSTRY

Soundly engineered — ruggedly constructed — conservatively rated. Custom designed for operation of electrostatic deposition and separation systems, for dielectric testing, for industrial processing and experimental laboratory work. Kilovolt Corporation power supplies represent concentrated experience in the field of high voltage techniques.

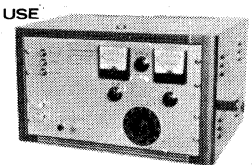
- Reversible Polarity Output
- Continuously Variable Output Control
- Adjustable Overload Shut-off
- Adjustable Overvoltage Shut-off
- Provisions for External Interlock
- Safety Interlock on H V Cabinet Door
- Zero-start Interlock
- Dual Range Voltage and Current Meters
- Fail-safe Output Shorting Mechanism
- Functional Pilot Lamps
- Circuit Breaker Operation

KV	MA	Model	KV	MA	Model	KV	MA	Model	KV	MA	Model	KV	MA	Model
0-1	500	KV 1-500	0-5	1,000	KV 5-1,000	0-20	300	KV 20-300	0-50	300	KV 50-300	0-200	5	KV 200-5
0-1	3,000	KV 1-3,000	0-5	3,000	KV 5-3,000	0-20	800	KV 20-800	0-60	10	KV 60-10	0-200	10	KV 200-10
0-1	5,000	KV 1-5,000	0-10	5	KV 10-5	0-25	200	KV 25-200	0-120	5	KV 120-5	0-250	2	KV 250-2
0-1	15,000	KV 1-15,000	0-10	50	KV 10-50	0-30	20	KV 30-20	0-120	10	KV 120-10	0-250	5	KV 250-5
0-3	200	KV 3-200	0-10	250	KV 10-250	0-30	50	KV 30-50	0-120	30	KV 120-30	0-250	10	KV 250-10
0-3	1,000	KV 3-1,000	0-10	500	KV 10-500	0-30	100	KV 30-100	0-120	100	KV 120-100	0-350	2	KV 350-2
0-3	2,000	KV 3-2,000	0-10	1,500	KV 10-1500	0-30	200	KV 30-200	0-150	5	KV 150-5	0-350	5	KV 350-5
0-3	5,000	KV 3-5,000	0-20	10	KV 20-10	0-30	500	KV 30-500	0-150	10	KV 150-10	0-600	2	KV 600-2
0-5	100	KV 5-100	0-20	50	KV 20-50	0-50	50	KV 50-50	0-150	30	KV 150-30	0-600	5	KV 600-5
0-5	500	KV 5-500	0-20	150	KV 20-150	0-50	100	KV 50-100	0-150	100	KV 150-100	0-1,000	5	KV 1,000-5

ECONOMICALLY PRICED HIGH VOLTAGE POWER SUPPLY

FOR LABORATORY AND INDUSTRIAL USE

- Reversible Polarity Output
- Continously Variable Output
- Automatic Overload Shut-off
- Dual Range Meters
- Provisions for External Interlock
- Operational Pilot Lamps
- Selenium Rectification



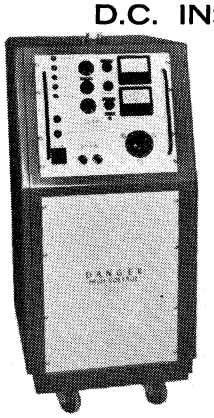
Model KV30-5
30,000 volts D.C. — 5 milliamperes

HIGHLY REGULATED VOLTAGE POWER SUPPLIES

Highly regulated against line variations or changes in load. Fast-acting electronic regulation. Out-put variable from zero. Negative polarity. Positive or Reversible Polarity on special order.

Effective Regulated Range KV	MA	Model	KV	MA	Model
0.4-2.5	200	KVR 2.5-200	1-24	80	KVR 24-80
0.4-2.5	500	KVR 2.5-500	1-40	40	KVR 40-40
0.4-2.5	1000	KVR 2.5-1000	1-40	80	KVR 40-80
0.6-4	500	KVR 4-500	1-50	5	KVR 50-5
0.6-4	1000	KVR 4-1000	5-100	5	KVR 100-5
0.6-8	500	KVR 8-500	5-120	5	KVR 120-5
1-16	8	KVR 16-8	5-150	5	KVR 150-5
1-16	120	KVR 16-120	10-200	2	KVR 200-2
1-24	8	KVR 24-8	10-250	2	KVR 250-2
1-24	40	KVR 24-40	10-300	2	KVR 300-2

HIGH VOLTAGE D.C. INSULATION TESTERS



- Reversible Polarity Output
- Continously Variable Output Control with Vernier Adjust
- Adjustable Overload Shut-off
- Adjustable Overvoltage Shut-off
- Provisions for External Interlock
- Safety Interlock on High Voltage Cabinet Door
- Zero-start Interlock
- Triple Range Current Meter
- Triple Range Voltage Meter
- High Voltage Surge-on Provisions, Optional
- Fail-safe Output Shorting Mechanism
- Functional Pilot Lamps
- Circuit Breaker Operation
- Selenium Rectification
- Memory Meter, Optional
- Automatic Rate-Of-Rise, Optional

KV	MA	Model	KV	MA	Model
0-30	5	DC 30-5	0-250	5	DC 250-5
0-60	5	DC 60-5	0-350	5	DC 350-5
0-120	5	DC 120-5	0-600	5	DC 600-5
0-150	5	DC 150-5	0-1,000	5	DC 1,000-5

Write for NEW Catalog

HIGH VOLTAGE INSULATION TESTERS

A.C. For dielectric testing under ASTM, MIL and Federal specs. Motor driven output control with adjustable speeds permits selection of proper rate-of-rise for various specification testing.

A.C.

KV	MA	Model
0-15	350	AC 15-5
0-25	200	AC 25-5
0-25	100	AC 25-2.5
0-60	40	AC 60-2.5
0-100	50	AC 100-5

A.C./D.C.

KV AC Peak	KV DC	MA AC	MA DC	Model
15	30	20	5	DAC 15/30-20/5
30	60	20	5	DAC 30/60-20/5
75	150	20	5	DAC 75/150-20/5
125	250	20	5	DAC 125/250-20/5

HIGH VOLTAGE D.C. POWER PACKS

2 to 30 KV (solid encapsulated) for O.E.M. applications.
50 to 150 KV (oil insulated). Construction as required by customer.

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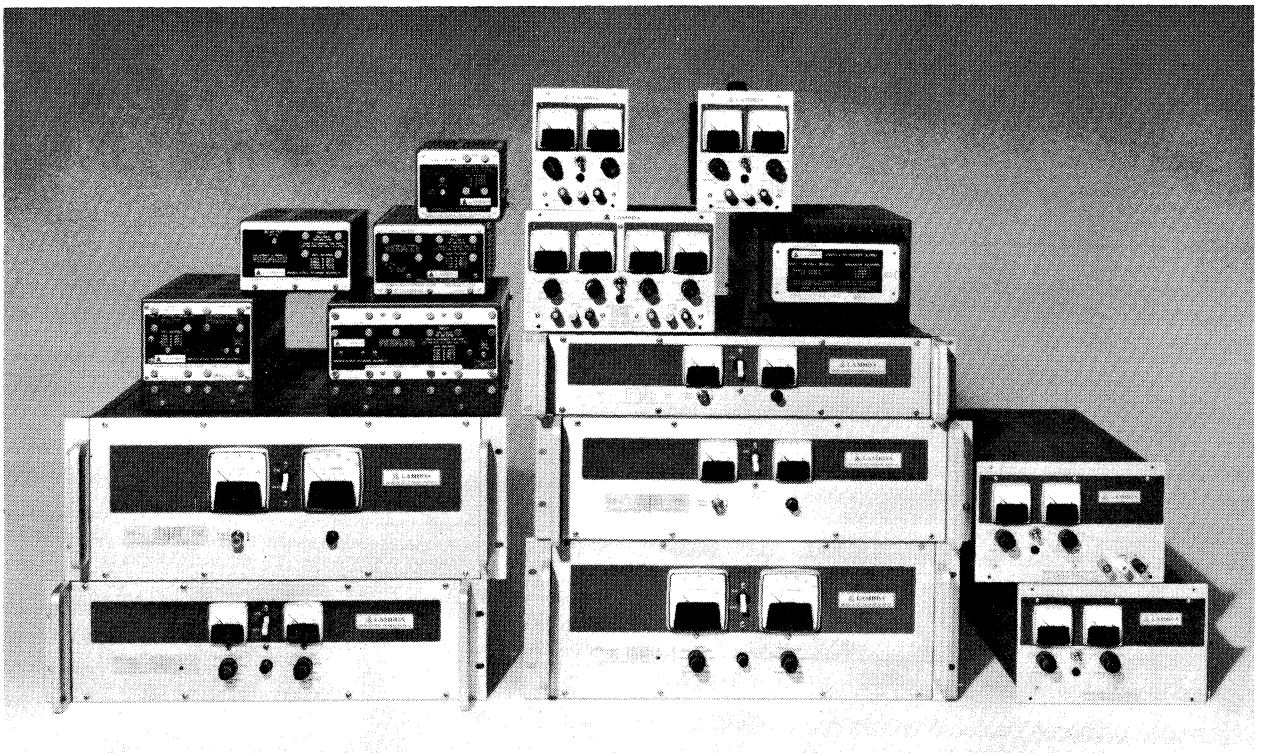
All Silicon Convection Cooled Power Supplies For Systems/Laboratory Use/Test Equipment/OEM

Up to 500 volts • Up to 300 amps

See Section 5600 for Lambda Transformers



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Phone Waterlooville 51577 & 51578
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1000 Berlin 41, Postfach 360, W. Germany
Tel. 0311-793371 Telex 0184307

Veeco GmbH, 8 Munich/45, Knorrstrasse 142
W. Germany, Phone 311-77-60
Cable: Veecovac, Munich

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Lambda Electronique, S.A.
64 a 70 rue des Chantiers, 78 Versailles, France
Tel. 951 03-34 or 951 11-36

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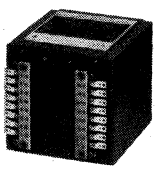
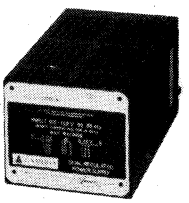
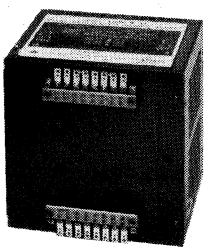
COM-PAK MARK II T.M. LC Series

IC Regulated Power Supplies in 4 different packages


LCS-1


LCS-2, LCD-2


LCD-A


LCS-4, LCD-4

Only the Lambda LC series offers all these high performance features

5 Year Guarantee

- **All-silicon DC Power Supply using integrated circuits to provide regulation system** except for input and output capacitors, rectifiers and series regulation transistors.
- **3 5/32" x 3 3/32" x 1 11/16" with single output models** (LCS-1)
- **3 5/32" x 3 3/32" x 3 5/16" with single and dual output models** (LCS-2 & LCD-2)
- **3 3/16" x 3 3/4" x 6 1/2" with dual output models** (LCD-A)
- **4 29/32" x 4 29/32" x 5 1/4" with single and dual output models** (LCS-4 & LCD-4)
- **More current** per cubic inch.
- **Guaranteed for five years material and labor.**
- **Increased reliability** through use of Integrated Circuit which replaces 32 discrete components from conventional designs.
- **Convection cooled**—no external heat sinking required.
- **Regulation,** Line or Load.. .01% + 1mV.
- **Ripple and Noise**... 250 μV rms; 1mV p-to-p.
- **Wide Input Voltage and Frequency Range**...105-132 VAC, 57-63Hz.
- **Wide Temperature Range**... −20°C to +71°C.
- **Temp. Coeff.**.... .01% + 300μV/°C External Programing Resistor. .015% + 300μV/°C Internal Resistor.
- **Lightweight**—Only 1 lb. for 1¾" size; 2¼ lbs. for 3 5/16" size; 5 lbs. for 6½" size; 8½ lbs. for 5" size.
- **Mounting flexibility**—five mounting surfaces (LCS-1); four mounting surfaces (LCS-2 & LCD-2, LCS-4 & LCD-4). LCD-A can be mounted in any of three mutually perpendicular planes.
- **Overvoltage Protection**—available as accessory up to 70 VDC.
- **Multi-Current-Rated**
- **Complete Serviceability**.....all components replaceable.
- **Remote sensing.**
- **No overshoot** on turn-on, turn-off or power failure.
- **Remote Programing**.....1000 ohm/V nominal or Volt/Volt.
- **Series/Parallel operation** with similar single or dual units.
- **Completely Protected**—automatic current limiting.

Features of Dual Output Models

- **Independent Operation**
- **Independent Remote Sensing**
- **Independent Remote Programing**
- **Series Parallel Operation** (Master/Slave)
- **Each Supply Electrically Isolated** and Floating with Respect to Ground.

Additional Data

- **DC OUTPUT: Voltage Range:** For voltage ranges see tables.
- **AC INPUT:** 105-132 VAC; 57-63 Hz. For operation at other than 57-63 Hz, consult factory for ratings and specifications.
- **INPUT POWER:** LCS-1 ..... 10 watts
  LCS-2, LCD-2 .... 20 watts
  LCD-A ..... 55 watts
  LCS-4, LCD-4 ....125 watts
- **OVERLOAD PROTECTION: Thermal:** Thermostat; automatic reset when overtemperature condition is eliminated. (Not applicable to LCS-1 & LCD-A Models.) **Electrical: External Overload Protection:** Automatic electronic current limiting circuit limits the output current to a preset value, thereby providing protection for the load as well as the power supply.
- **CURRENT LIMIT:** 140% 40°C Rating Max. for LCS-1, LCS-2, LCD-2, LCD-A. 110% of 40°C Rating for LCS-4, LCD-4.
- **PHYSICAL DATA: Weight:** LCS-1 1 lb net; 1⅞ lbs ship; LCS-2, LCD-2 2¼ lbs net; 3⅛ lbs ship; LCD-A 5 lbs net; 6 lbs ship; LCS-4, LCD-4 8½ lbs net; 9½ lbs ship.

Specifications subject to change without notice.

LC series voltage and current ratings

LCS-1 SINGLE OUTPUT MODELS 3 5/32" x 3 9/32" x 1 11/16"

Model	ADJ. VOLT. RANGE VDC	MAX. MA. AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LCS-1-01	0-7	200	200	150	100	$85
LCS-1-02	0-18	95	95	95	80	85
LCS-1-03	0-32	65	65	65	40	85
LCS-1-04	0-60	35	35	35	25	95
LCS-1-05	0-120	12	12	12	12	95

LCS-2 SINGLE OUTPUT MODELS 3 5/32" x 3 9/32" x 3 5/16"

Model	ADJ. VOLT. RANGE VDC	MAX. MA. AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LCS-2-01	0-7	550	455	350	240	$ 90
LCS-2-02	0-18	330	275	210	140	90
LCS-2-03	0-32	240	205	155	95	90
LCS-2-04	0-60	145	115	87	57	100
LCS-2-05	0-120	50	50	45	30	100

LCS-4 SINGLE OUTPUT MODELS 4 29/32" x 4 29/32" x 5 1/4"

Model	FIXED VOLT. RANGE VDC	MAX. AMPS. AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LCS-4-3	3±5%	4.5	3.9	3.1	2.0	$130
LCS-4-3P6	3.6±5%	4.5	3.9	3.1	2.0	130
LCS-4-4	4±5%	4.5	3.9	3.1	2.0	130
LCS-4-4P5	4.5±5%	4.4	3.7	2.9	1.8	130
LCS-4-5	5±5%	4.4	3.7	2.9	1.8	130
LCS-4-6	6±5%	4.0	3.4	2.6	1.5	130
LCS-4-8	8±5%	4.0	3.4	2.6	1.5	130
LCS-4-10	10±5%	3.2	2.8	2.2	1.3	130
LCS-4-12	12±5%	3.1	2.8	2.2	1.3	130
LCS-4-15	15±5%	2.8	2.6	2.1	1.3	130
LCS-4-18	18±5%	2.6	2.4	2.0	1.2	130
LCS-4-20	20±5%	2.4	2.2	1.9	1.1	130
LCS-4-24	24±5%	2.2	1.8	1.5	0.95	130
LCS-4-28	28±5%	2.0	1.6	1.4	0.85	130
LCS-4-36	36±5%	1.8	1.5	1.3	0.85	140
LCS-4-48	48±5%	1.2	1.1	0.9	0.75	140
LCS-4-100	100±5%	0.46	0.46	0.46	0.34	140
LCS-4-120	120±5%	0.40	0.40	0.40	0.30	140
LCS-4-150	150±5%	0.32	0.32	0.32	0.25	180

LCS-4 SINGLE OUTPUT MODELS (Wide Range) 4 29/32" x 4 29/32" x 5 1/4"

Model	ADJ. VOLT. RANGE VDC	MAX. AMPS. AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LCS-4-01	0-7	3.3	3.0	2.3	1.5	$130
LCS-4-02	0-18	1.8	1.6	1.2	0.8	130
LCS-4-03	0-32	1.0	0.9	0.7	0.5	130
LCS-4-04	0-60	0.55	0.5	0.43	0.3	140
LCS-4-05	0-120	0.25	0.25	0.22	0.16	140

NOTES:
(1) For operation at other than 57-63 Hz, consult factory for ratings and specifications.
(2) All prices FOB Melville, N. Y. All prices and specifications subject to change without notice.

LCD-2 DUAL OUTPUT MODELS 3 5/32" x 3 9/32" x 3 5/16"

Model	ADJ. VOLT. RANGE VDC (EACH SIDE)	MAX. MA. AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LCD-2-11	0-7 0-7	300 300	240 240	175 175	115 115	$155
LCD-2-12	0-18 0-7	160 300	130 240	100 175	65 115	155
LCD-2-13	0-32 0-7	120 300	95 240	70 175	45 115	155
LCD-2-22	0-18 0-18	160 160	130 130	100 100	65 65	155
LCD-2-23	0-32 0-18	120 160	95 130	70 100	45 65	155
LCD-2-33	0-32 0-32	120 120	95 95	70 70	45 45	155
LCD-2-44	0-60 0-60	65 65	52 52	37 37	23 23	170
LCD-2-55	0-120 0-120	30 30	30 30	22 22	14 14	170

LCD-A DUAL OUTPUT MODELS 3 3/16" x 3 3/4" x 6 1/2"

Model	ADJ. VOLT. RANGE VDC	MAX. AMPS. AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LCD-A-11	0-7 0-7	1.0 1.0	0.9 0.9	0.7 0.7	0.5 0.5	$170
LCD-A-12	0-18 0-7	0.5 1.0	0.45 0.9	0.4 0.7	0.3 0.5	170
LCD-A-13	0-32 0-7	0.35 1.0	0.3 0.9	0.25 0.7	0.2 0.5	170
LCD-A-22	0-18 0-18	0.5 0.5	0.45 0.45	0.4 0.4	0.3 0.3	170
LCD-A-23	0-32 0-18	0.35 0.5	0.3 0.45	0.25 0.4	0.2 0.3	170
LCD-A-33	0-32 0-32	0.35 0.35	0.3 0.3	0.25 0.25	0.2 0.2	170
LCD-A-44	0-60 0-60	0.2 0.2	0.18 0.18	0.14 0.14	0.12 0.12	180
LCD-A-55	0-120 0-120	75 ma 75 ma	75 ma 75 ma	75ma 75ma	60 ma 60 ma	200

LCD-4 DUAL OUTPUT MODELS 4 29/32" x 4 29/32" x 5 1/4"

Model	ADJ. VOLT. RANGE VDC	MAX. AMPS. AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LCD-4-11	0-7 0-7	1.8 1.8	1.5 1.5	1.2 1.2	0.7 0.7	$240
LCD-4-12	0-18 0-7	1.0 1.8	0.8 1.5	0.65 1.2	0.4 0.7	240
LCD-4-13	0-32 0-7	0.6 1.8	0.53 1.5	0.4 1.2	0.24 0.7	240
LCD-4-22	0-18 0-18	1.0 1.0	0.8 0.8	0.65 0.65	0.4 0.4	220
LCD-4-23	0-32 0-18	0.6 1.0	0.53 0.8	0.4 0.65	0.24 0.4	220
LCD-4-33	0-32 0-32	0.6 0.6	0.53 0.53	0.4 0.4	0.24 0.24	220
LCD-4-44	0-60 0-60	0.33 0.33	0.3 0.3	0.24 0.24	0.15 0.15	240
LCD-4-55	0-120 0-120	0.12 0.12	0.12 0.12	0.12 0.12	0.075 0.075	240
LCD-4-152 Fixed	15±5% 15±5%	1.5 1.5	1.3 1.3	1.0 1.0	0.6 0.6	220

OVERVOLTAGE PROTECTION
(Separate OV required for each output)

Model	ADJ. VOLT. RANGE VDC	FOR USE WITH	Price [2]
LC-OV-10	3-24	LCS-1, LCS-2, LCD-2	$20
LC-OV-11	3-47		20
LC-OV-12	3-70		25
LM-OV- 1	3- 8	Fixed Voltage LCS-4, LCD-4	30
LM-OV- 2	6-20		30
LM-OV- 3	18-70		30
LH-OV- 4	3-24	LCD-A & wide range LCD-4	35
LH-OV- 5	3-47		35
LH-OV- 6	3-70		35

LAMBDA PAGE 3

LAMBDA ELECTRONICS CORP.
A Veeco SUBSIDIARY
515 BROAD HOLLOW ROAD, MELVILLE, L.I., NEW YORK 11746 TEL. 516-694-4200,TWX: 510-224-6484 CABLE: VEECOVAC PLAINVIEW NY

Military COM-PAK MARK II™ IC Regulated Power Supplies

The only MIL supply available with a 5 year guarantee.

All models designed and tested to meet performance specifications of MIL-STD-810 B,-454,-461,-462,-463, MIL-E-5272-C, MIL-E-16400 F, MIL-E-4158 D and MIL-E-5400 K.

*See page 6 for details for Altitude, High Temperature, Low Temperature, Temperature Shock, Temperature Altitude, Humidity, Fungus, Salt Fog, Dust, Explosive Atmosphere, Acceleration, Vibration, Shock, EMI.

- **All-silicon DC Power Supply using integrated circuits to provide regulation system** except for input and output capacitors, rectifiers and series regulation transistors.
- **Increased reliability** through use of integrated circuit which replaces 32 discrete components from conventional designs.
- **3 5/32" x 3 9/32" x 3 5/16" with single or dual output models**
- **3 5/32" x 3 9/32" x 1 11/16" with single output models**
- **More current** per cubic inch.
- **Guaranteed for five years, material and labor,** when returned to factory for service.
- **Convection cooled**—no external heat sinking required.
- **Regulation,** Line or Load . . . 0.01% + 1mV.
- **Ripple and Noise** . . . 1 mVrms
- **Wide Input Voltage and Frequency Range**. . . .MIL-E models 102-124 VAC, 360-440 Hz as per MIL-STD-704A, Class B. MIL-S models 105-132 VAC, 57-63 Hz
- **Wide Storage Temp. Range**. . . . . −62°C to +85°C
- **Temp Coeff.** . . .01% + 300 μV/°C External Programing Resistor.
  .015% + 300 μV/°C Internal Resistor.
- **Lightweight** — Only 1 lb. for 1¾" size; 2¼ lbs. for 3" size.
- **Rugged die-cast aluminum construction.**
- **Mounting Flexibility** — five mounting surfaces (MIL-E-CS-1 & MIL-SCS-1); four mounting surfaces (MIL-E-CS-2 & CD-2; MIL-SCS-2 & CD-2).
- **Overvoltage Protection** — available as accessory up to 70 VDC.
- **Multi-Current-Rated** (MIL-S units only)
- **Remote sensing.**
- **No overshoot** on turn-on, turn-off or power failure.
- **Remote Programing**. . . . . 1000 ohm/V nominal or Volt/Volt.
- **Series/Parallel operation** with similar single or dual units.
- **Completely Protected** — automatic current limiting.

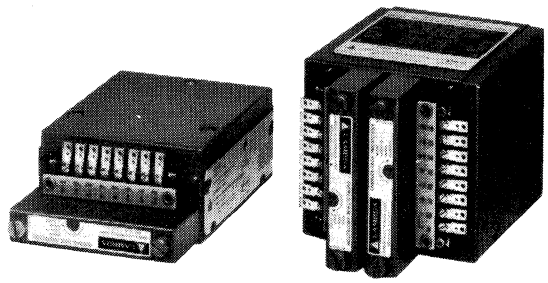
Features of Dual Output Models

- **Independent Operation**
- **Independent Remote Sensing**
- **Independent Remote Programing**
- **Series/Parallel Operation** (Master/Slave)
- **Each Supply Electrically Isolated** and Floating with Respect to Ground.

Additional Data

- **DC OUTPUT: Voltage Range:** For voltage ranges see tables.
- **AC INPUT:** MIL-E Models — 102V to 124V rms, 360 to 440 Hz as per MIL-STD-704A, Class B.
  MIL-S Models — 105V to 132V rms, 57 to 63 Hz.
- **INPUT POWER:** (with Input 124V, 400 Hz and Output fully loaded)
  MIL-E-CS-2, MIL-E-CD-2 13 watts
  MIL-E-CS-1 9 watts
  (with Input 132V, 60 Hz and Output loaded to 40°C rating)
  MIL-S-CS-2, MIL-S-CD-2 20 watts
  MIL-S-CS-1 10 watts
- **AMBIENT OPERATING TEMPERATURE:** −54°C to +71°C
- **OVERLOAD PROTECTION: Thermal:** Thermostat; automatic reset when overtemperature condition is eliminated. (Not applicable to MIL-E-CS-1 or MIL-S-CS-1 Models.) **Electrical: External Overload Protection:** Automatic electronic current limiting circuit limits the output current to a preset value, thereby providing protection for the load as well as the power supply.
- **CURRENT LIMIT:**
  MIL-E Models — 130% of Rated Current.
  MIL-S Models — 140% of Rated Current.
- **PHYSICAL DATA: Weight:** MIL-E-CS-2, MIL-E-CD-2, MIL-S-CS-2, MIL-S-CD-2, 2¼ lbs. net, 3⅛ lbs. ship. MIL-E-CS-1, MIL-S-CS-1, 1 lb. net, 1⅞ lbs. ship.
- **FINISH:** Gray, FED STD 595 No. 36231

Military COMPAK MARK II Power Supplies



NOTE: 1. All testing performed by an independent testing laboratory — New York Testing Laboratories, Inc., Westbury, New York.
2. Test reports are available for each qualification test.
* MIL-S- units are identical to MIL-E units except for AC input frequency.

MIL-E RATINGS: 400 Hz operation

MIL-E-CS1 SINGLE OUTPUT MODELS

3 5/32" x 3 9/32" x 1 11/16"

Model	VOLTAGE RANGE	MAX. CONTINUOUS CURRENT OVER ENTIRE OPERATING TEMPERATURE RANGE (MA)*	Price[2]
MIL-E-CS1-01	0-7	200	$115
MIL-E-CS1-02	0-18	95	115
MIL-E-CS1-03	0-32	65	115
MIL-E-CS1-04	0-60	35	125
MIL-E-CS1-05	0-120	10	125

* Ratings based upon Class I operation per MIL-E-5400K.

MIL-E-CS2 SINGLE OUTPUT MODELS

3 5/32" x 3 9/32" x 3 5/16"

Model	VOLTAGE RANGE	MAX. CONTINUOUS CURRENT OVER ENTIRE OPERATING TEMPERATURE RANGE (MA)*	Price[2]
MIL-E-CS2-01	0-7	450	$130
MIL-E-CS2-02	0-18	270	130
MIL-E-CS2-03	0-32	180	130
MIL-E-CS2-04	0-60	110	140
MIL-E-CS2-05	0-120	30	140

* Ratings based upon Class I operation per MIL-E-5400K.

MIL-E-CD2 DUAL OUTPUT MODELS

3 5/32" x 3 9/32" x 3 5/16"

Model	VOLTAGE RANGE	MAX. CONTINUOUS CURRENT OVER ENTIRE OPERATING TEMPERATURE RANGE (MA)*	Price[2]
MIL-E-CD2-11	0-7 0-7	250 250	$230
MIL-E-CD2-12	0-18 0-7	135 250	230
MIL-E-CD2-13	0-32 0-7	95 250	230
MIL-E-CD2-22	0-18 0-18	135 135	230
MIL-E-CD2-23	0-32 0-18	95 135	230
MIL-E-CD2-33	0-32 0-32	95 95	230
MIL-E-CD2-44	0-60 0-60	50 50	245
MIL-E-CD2-55	0-120 0-120	25 25	245

* Ratings based upon Class I operation per MIL-E-5400K.

MIL-S RATINGS: 60 Hz operation[1]

MIL-S-CS1 SINGLE OUTPUT MODELS

3 5/32" x 3 9/32" x 1 11/16"

Model	VOLTAGE RANGE	MAXIMUM CURRENT (MA) AT AMBIENT TEMPERATURE 40°C	50°C	60°C	71°C	Price[2]
MIL-S-CS1-01	0-7	200	200	150	100	$115
MIL-S-CS1-02	0-18	95	95	95	80	115
MIL-S-CS1-03	0-32	65	65	65	40	115
MIL-S-CS1-04	0-60	35	35	35	25	125
MIL-S-CS1-05	0-120	12	12	12	12	125

MIL-S-CS2 SINGLE OUTPUT MODELS

3 5/32" x 3 9/32" x 3 5/16"

Model	VOLTAGE RANGE	MAXIMUM CURRENT (MA) AT AMBIENT TEMPERATURE 40°C	50°C	60°C	71°C	Price[2]
MIL-S-CS2-01	0-7	550	455	350	240	$130
MIL-S-CS2-02	0-18	330	275	210	140	130
MIL-S-CS2-03	0-32	240	205	155	95	130
MIL-S-CS2-04	0-60	145	115	87	57	140
MIL-S-CS2-05	0-120	50	50	45	30	140

MIL-S-CD2 DUAL OUTPUT MODELS

3 5/32" x 3 9/32" x 3 5/16"

Model	VOLTAGE RANGE	MAXIMUM CURRENT (MA) AT AMBIENT TEMPERATURE 40°C	50°C	60°C	71°C	Price[2]
MIL-S-CD2-11	0-7 0-7	300 300	240 240	175 175	115 115	$230
MIL-S-CD2-12	0-18 0-7	160 300	130 240	100 175	65 115	230
MIL-S-CD2-13	0-32 0-7	120 300	95 240	70 175	45 115	230
MIL-S-CD2-22	0-18 0-18	160 160	130 130	100 100	65 65	230
MIL-S-CD2-23	0-32 0-18	120 160	95 130	70 100	45 65	230
MIL-S-CD2-33	0-32 0-32	120 120	95 95	70 70	45 45	230
MIL-S-CD2-44	0-60 0-60	65 65	52 52	37 37	23 23	245
MIL-S-CD2-55	0-120 0-120	30 30	30 30	22 22	14 14	245

NOTES:

(1) MIL-S modules will meet all the environmental specifications of the MIL-E models except the ratings will be based upon max. ambient temperatures as indicated.

(2) All prices FOB Melville, N. Y. All prices and specifications subject to change without notice.

OVERVOLTAGE PROTECTION MIL-E and MIL-S units (Separate OV required for each output)

Model	ADJ. VOLT. RANGE	Price[2]
MIL-C-OV-10	3-24 VDC	$30
MIL-C-OV-11	3-47 VDC	30
MIL-C-OV-12	3-70 VDC	35

LAMBDA ELECTRONICS CORP.
A Veeco SUBSIDIARY
515 BROAD HOLLOW ROAD, MELVILLE, L.I., NEW YORK 11746 TEL. 516-694-4200,TWX: 510-224-6484 CABLE: VEECOVAC PLAINVIEW NY

LM Series Modular Power Supplies

All silicon, programable, convection-cooled modules up to 150 volts, up to 33 amps.

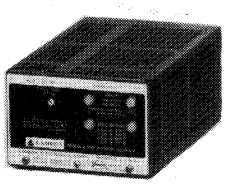
7 VERSATILE MODULES WITH 5 YEAR GUARANTEE

- **MEET MIL. ENVIRONMENT SPECS**
  Specify Lambda with assurance of meeting military requirements
  - RFI—MIL-I-16910
  - Vibration: MIL-T-4807A
  - Shock: MIL-E-4970A Proc. 1 & 2
  - Humidity: MIL-STD-810 Meth. 507
  - Temp. Shock: MIL-E-5272C (ASG) Proc. 1
  - Altitude: MIL-E-4970A (ASG) Proc. 1
  - Marking: MIL-STD-130
  - Quality: MIL-Q-9858
  - Fungus Proofing (optional): all models available with MIL-V-173 varnish for all fungi nutrient components.
- **CONVECTION-COOLED**
  No heat sinking or forced air required. Avoids heat sinking and reliability problems, and gives complete mounting freedom.
- **HIGHER RATINGS WITH FORCED AIR COOLING**
  Convection-cooled design offers greatest opportunity for increased ratings with forced air. Ventilated construction affords substantial increases in rating with small amounts of air flowing through the power supply. Consult Factory for details.
- **THERMALLY PROTECTED AND SHORT-CIRCUIT PROOF**
  Self-restoring current limiting and self-resetting thermostats protect supplies.
- **NO VOLTAGE SPIKES OR OVERSHOOT**
  on turn-on, turn-off, or power failure—for maximum load protection.
- **WIDE INPUT VOLTAGE AND FREQUENCY RANGE**
  Makes Lambda power supplies suitable for field gear and worst-case conditions so you need fewer special provisions. VAC, 105-132 55-65 Hz. Delete 40°C rating for operation at 47-55 Hz. For operation at 360-440 Hz consult factory for ratings. (205-265 VAC, optional at no extra charge).
- **OVERVOLTAGE PROTECTION**
  Available for all models up to 70 VDC, starting at $30. Positive safety for voltage-sensitive devices in your load circuitry—and in a compact, low-cost accessory.
- **HIGH PERFORMANCE OPTION**
  Better regulation, ripple, and temperature coefficient for extra performance and safety margin in your system. All models available with these specifications at $15.00 surcharge:

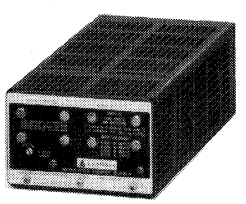
  LINE REGULATION: .01% + 1mV
  LOAD REGULATION: .02% + 2mV
  RIPPLE AND NOISE: 0.5mV rms; 1.5mVp-to-p with 60 Hz input
  TEMP. COEFF.: .01%/°C



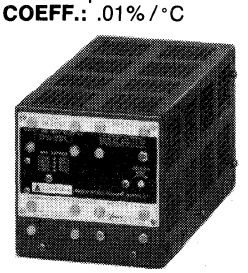
A MODULE
up to 120 volts
up to 2.0 amps



B MODULE
up to 150 volts
up to 3.8 amps

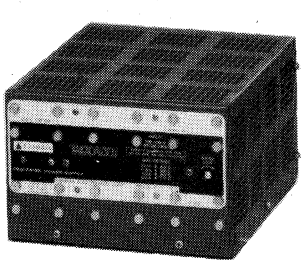


C MODULE
up to 150 volts
up to 5.3 amps

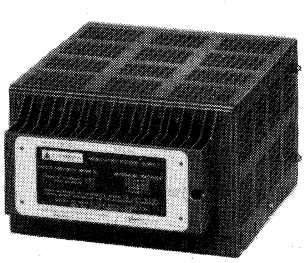


CC MODULE
up to 150 volts
up to 11.0 amps

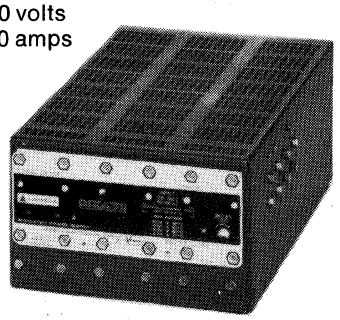




D MODULE
up to 150 volts • up to 13.1 amps



E MODULE
up to 150 volts • up to 22.0 amps



EE MODULE
up to 150 volts • up to 33 amps

LAMBDA PAGE 6

LM series modular power supplies wide range models

Here's a quick way to check which LM zero and wide voltage range packages fit your needs

Be sure to see page 10 for Fixed Voltage Range LM Series models from 3 to 150 volts.

VOLTAGE RANGE	PACKAGE SIZE								
	A	B	C	D	E	EE	F	G	H
0 - 7	✓	✓	✓	✓	✓	✓	✓	✓	✓
0 - 14	✓	✓	✓	✓	✓	✓			
0 - 24	✓								
0 - 32	✓	✓	✓	✓	✓	✓			
0 - 60	✓	✓	✓	✓	✓	✓			
0 -120	✓								
8.5- 14		✓	✓	✓					
13 - 23		✓	✓	✓					
22 - 32		✓	✓	✓					
30 - 60		✓	✓	✓					

Package A 3 3/16" x 3 3/4" x 6 1/2"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-251	0–7	0.35	0.31	0.29	0.27	$69
LM-201	0–7	0.85	0.75	0.70	0.55	79
LM-202	0–7	1.7	1.5	1.4	1.1	89
LM-252	0–7	2.0	1.8	1.4	1.1	99
LM-257	0—15	0.27	0.24	0.23	0.22	69
LM-203	0—15	0.45	0.40	0.38	0.28	79
LM-204	0—15	0.90	0.80	0.75	0.55	89
LM-258	0—15	1.2	1.1	1.0	0.80	99
LM-259	0–24	0.18	0.16	0.15	0.14	69
LM-260	0–24	0.35	0.30	0.25	0.20	79
LM-261	0–24	0.70	0.65	0.60	0.45	89
LM-262	0–24	0.80	0.75	0.70	0.60	99
LM-263	0–32	0.14	0.12	0.11	0.10	69
LM-205	0–32	0.25	0.23	0.20	0.15	79
LM-206	0–32	0.50	0.45	0.40	0.30	89
LM-264	0–32	0.66	0.60	0.50	0.32	99
LM-265	0–60	0.08	0.07	0.07	0.06	79
LM-207	0–60	0.13	0.12	0.11	0.08	89
LM-208	0–60	0.25	0.23	0.21	0.16	99
LM-266	0–60	0.35	0.31	0.28	0.25	109
LM-267	0–120	0.10	0.09	0.08	0.07	109
LM-268	0–120	0.15	0.14	0.12	0.11	119

Package B 3 3/16" x 4 15/16" x 6 1/2"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-B-0-7	0–7	2.8	2.6	2.3	1.5	$109
LM-B-0-14	0–14	1.6	1.5	1.3	1.2	109
LM-B-0-32	0–32	0.8	0.7	0.6	0.5	109
LM-B-0-60	0–60	0.45	0.4	0.35	0.3	109
LM-217	8.5–14	2.1	1.9	1.7	1.3	119
LM-218	13–23	1.5	1.3	1.2	1.0	119
LM-219	22–32	1.2	1.1	1.0	0.8	119
LM-220	30–60	0.70	0.65	0.60	0.45	129

Package C 3 3/16" x 4 15/16" x 9 3/8"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-225	0–7	4.0	3.6	3.0	2.4	$139
LM-C-0-14	0–14	2.2	2.0	1.8	1.5	139
LM-C-0-32	0–32	1.1	1.0	0.90	0.80	139
LM-C-0-60	0–60	0.60	0.55	0.50	0.45	139
LM-226	8.5–14	3.3	3.0	2.5	2.0	139
LM-227	13–23	2.3	2.1	1.7	1.4	139
LM-228	22–32	2.0	1.8	1.5	1.2	139
LM-229	30–60	1.1	1.0	0.80	0.60	149

Package D 4 15/16" x 7 1/2" x 9 3/8"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-234	0–7	8.3	7.3	6.5	5.5	$199
LM-D-0-14	0–14	4.9	4.2	3.4	2.7	199
LM-D-0-32	0–32	2.5	2.1	1.7	1.3	180
LM-D-0-60	0–60	1.3	1.1	0.95	0.75	239
LM-235	8.5–14	7.7	6.8	6.0	4.8	199
LM-236	13–23	5.8	5.1	4.5	3.6	209
LM-237	22–32	5.0	4.4	3.9	3.1	219
LM-238	30–60	2.6	2.3	2.0	1.6	239

Package E 4 15/16" x 7 1/2" x 11 7/8"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-E-0-7	0–7	12.0	10.5	8.5	6.8	$249
LM-E-0-14	0–14	7.4	6.4	5.2	4.1	249
LM-E-0-32	0–32	3.7	3.2	2.6	2.1	249
LM-E-0-60	0–60	2.1	1.7	1.4	1.1	249

Package EE 4 15/16" x 7 1/2" x 17"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°	50°	60°	71°	Price
LM-EE-0-7	0—7	16	13.5	11.2	9.2	$320
LM-EE-0-14	0—14	10.2	8.6	7.3	6.1	320
LM-EE-0-32	0—32	5.2	4.4	3.8	3.2	320
LM-EE-0-60	0—60	2.7	2.45	2.15	1.85	320

NOTES:

[1] CURRENT RATING IS FROM ZERO TO 1 MAX. CURRENT RATING APPLIES OVER ENTIRE OUTPUT VOLTAGE RANGE. CURRENT RATING APPLIES FOR INPUT VOLTAGE 105-132 VAC 55-65 HZ. FOR OPERATION AT 47-55 HZ DELETE 40°C RATING. FOR OPERATION AT 360-440 HZ CONSULT FACTORY FOR RATINGS AND SPECIFICATIONS.

[2] PRICES F.O.B. FACTORY, MELVILLE, N. Y. ALL SPECIFICATIONS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

Overvoltage Protectors

Model	Adj. Volt Range	Price
LM-OV-1	3-8V	$30
LM-OV-2	6-20V	30
LM-OV-3	18-70V	30
LM-OV-7 (for EE pkg.)	3-8V	75
LM-OV-8 (for EE pkg.)	6-20V	75
LM-OV-9 (for EE pkg.)	18-70V	75

LAMBDA ELECTRONICS CORP.
A Veeco SUBSIDIARY
515 BROAD HOLLOW ROAD, MELVILLE, L.I., NEW YORK 11746 TEL. 516-694-4200,TWX: 510-224-6484 CABLE: VEECOVAC PLAINVIEW NY

LM series modular power supplies—fixed voltage models

SEE NOTES 1 AND 2 ON PAGE 9

Package B 3 3/16" x 4 15/16" x 6 1/2"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-B-3	3 ±5%	3.8	3.3	2.6	1.6	$119
LM-B-3-P-6	3.6±5%	3.8	3.3	2.6	1.6	119
LM-B-4	4 ±5%	3.8	3.3	2.6	1.6	119
LM-B-4-P-5	4.5±5%	3.7	3.2	2.5	1.5	119
LM-B-5	5 ±5%	3.7	3.2	2.5	1.5	119
LM-B-6	6 ±5%	3.2	2.9	2.4	1.4	119
LM-B-8	8 ±5%	3.2	2.9	2.4	1.4	119
LM-B-10	10 ±5%	2.7	2.5	2.2	1.4	119
LM-B-12	12 ±5%	2.5	2.3	2.1	1.3	119
LM-B-15	15 ±5%	2.2	2.0	1.8	1.3	119
LM-B-18	18 ±5%	2.0	1.8	1.7	1.3	119
LM-B-20	20 ±5%	1.8	1.6	1.5	1.2	119
LM-B-24	24 ±5%	1.4	1.3	1.2	1.1	119
LM-B-28	28 ±5%	1.3	1.2	1.1	1.0	119
LM-B-36	36 ±5%	1.1	1.0	0.90	0.85	119
LM-B-48	48 ±5%	0.9	0.85	0.80	0.75	119
LM-B-100	100 ±5%	0.37	0.34	0.30	0.28	139
LM-B-120	120 ±5%	0.30	0.28	0.25	0.23	139
LM-B-150	150 ±5%	0.25	0.23	0.20	0.19	139

Package C 3 3/16" x 4 15/16" x 9 3/8"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-C-3	3 ±5%	5.3	4.6	3.7	2.5	$139
LM-C-3-P-6	3.6±5%	5.2	4.5	3.6	2.5	139
LM-C-4	4 ±5%	5.2	4.5	3.6	2.5	139
LM-C-4-P-5	4.5±5%	5.1	4.4	3.5	2.4	139
LM-C-5	5 ±5%	5.1	4.3	3.4	2.4	139
LM-C-6	6 ±5%	4.8	4.1	3.3	2.4	139
LM-C-8	8 ±5%	4.6	3.9	3.2	2.1	139
LM-C-10	10 ±5%	4.2	3.6	3.0	2.0	139
LM-C-12	12 ±5%	4.0	3.5	2.9	1.9	139
LM-C-15	15 ±5%	3.5	3.2	2.8	1.9	139
LM-C-18	18 ±5%	3.2	3.0	2.7	1.9	139
LM-C-20	20 ±5%	3.1	2.9	2.6	1.8	139
LM-C-24	24 ±5%	2.5	2.4	2.2	1.5	139
LM-C-28	28 ±5%	2.3	2.1	2.0	1.4	139
LM-C-36	36 ±5%	2.0	1.8	1.7	1.3	159
LM-C-48	48 ±5%	1.6	1.4	1.3	1.0	159
LM-C-100	100 ±5%	0.55	0.51	0.47	0.42	159
LM-C-120	120 ±5%	0.49	0.45	0.42	0.38	159
LM-C-150	150 ±5%	0.39	0.36	0.33	0.30	159

Package CC 4 15/16" x 4 15/16" x 9 3/8"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-CC-3	3 ±5%	11.0	9.4	8.2	5.5	$179
LM-CC-3-P-6	3.6±5%	11.0	9.4	8.2	5.5	179
LM-CC-4	4 ±5%	11.0	9.4	8.2	5.5	179
LM-CC-4-P-5	4.5±5%	10.5	9.0	8.0	5.5	179
LM-CC-5	5 ±5%	10.5	9.0	8.0	5.5	179
LM-CC-6	6 ±5%	9.0	8.4	7.7	5.5	179
LM-CC-8	8 ±5%	8.5	7.9	7.2	5.5	179
LM-CC-10	10 ±5%	7.5	7.0	6.3	5.0	179
LM-CC-12	12 ±5%	7.3	6.8	5.9	4.7	179
LM-CC-15	15 ±5%	6.0	5.6	5.1	4.3	179
LM-CC-18	18 ±5%	5.5	5.1	4.7	4.1	179
LM-CC-20	20 ±5%	5.0	4.6	4.2	3.6	179
LM-CC-24	24 ±5%	4.0	3.7	3.4	3.0	179
LM-CC-28	28 ±5%	3.5	3.4	3.1	2.8	179
LM-CC-36	36 ±5%	3.0	2.9	2.7	2.4	199
LM-CC-48	48 ±5%	2.5	2.4	2.2	1.9	199
LM-CC-100	100 ±5%	1.0	0.96	0.90	0.80	199
LM-CC-120	120 ±5%	0.9	0.86	0.80	0.70	199
LM-CC-150	150 ±5%	0.7	0.67	0.62	0.55	199

Package D 4 15/16" x 7 1/2" x 9 3/8"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-D-3	3 ±5%	13.1	11.3	9.2	6.2	$209
LM-D-3-P-6	3.6±5%	13.1	11.3	9.2	6.2	209
LM-D-4	4 ±5%	13.1	11.3	9.2	6.2	209
LM-D-4-P-5	4.5±5%	13.1	11.3	9.2	6.2	209
LM-D-5	5 ±5%	12.6	10.8	9.2	6.1	209
LM-D-6	6 ±5%	12.4	10.6	8.9	6.0	209
LM-D-8	8 ±5%	12.2	10.3	8.8	5.9	209
LM-D-10	10 ±5%	10.8	9.7	8.5	5.7	209
LM-D-12	12 ±5%	10.0	9.2	8.3	5.7	209
LM-D-15	15 ±5%	9.0	8.4	7.9	5.3	219
LM-D-18	18 ±5%	7.9	7.4	6.9	5.0	219
LM-D-20	20 ±5%	7.4	6.9	6.5	4.9	219
LM-D-24	24 ±5%	6.7	6.3	5.8	4.8	219
LM-D-28	28 ±5%	6.0	5.6	5.2	4.7	219
LM-D-36	36 ±5%	5.4	5.0	4.7	4.3	239
LM-D-48	48 ±5%	4.1	3.9	3.6	3.1	239
LM-D-100	100 ±5%	1.7	1.5	1.3	1.1	239
LM-D-120	120 ±5%	1.5	1.3	1.1	1.0	239
LM-D-150	150 ±5%	1.1	1.0	0.90	0.80	239

Package E 4 15/16" x 7 1/2" x 11 7/8"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-E-3	3 ±5%	22.0	20.0	16.5	10.0	$269
LM-E-3-P-6	3.6±5%	21.0	19.0	16.5	10.0	269
LM-E-4	4 ±5%	21.0	19.0	16.5	10.0	269
LM-E-4-P-5	4.5±5%	20.0	18.0	16.4	10.0	269
LM-E-5	5 ±5%	20.0	18.0	16.4	10.0	269
LM-E-6	6 ±5%	19.0	17.3	15.6	10.0	269
LM-E-8	8 ±5%	18.0	16.4	14.7	10.0	269
LM-E-10	10 ±5%	16.0	14.5	13.0	9.5	269
LM-E-12	12 ±5%	15.0	13.6	12.3	9.5	269
LM-E-15	15 ±5%	14.0	12.7	11.5	8.6	269
LM-E-18	18 ±5%	13.0	11.8	10.6	8.6	269
LM-E-20	20 ±5%	12.0	10.9	9.8	8.5	269
LM-E-24	24 ±5%	11.0	10.0	9.0	7.6	269
LM-E-28	28 ±5%	10.0	9.0	8.0	7.1	269
LM-E-36	36 ±5%	8.0	7.3	6.5	5.7	269
LM-E-48	48 ±5%	6.0	5.4	4.9	4.3	299
LM-E-100	100 ±5%	2.0	1.7	1.6	1.5	299
LM-E-120	120 ±5%	1.7	1.5	1.4	1.2	299
LM-E-150	150 ±5%	1.4	1.3	1.2	1.0	299

Package EE 4 15/16" x 7 1/2" x 17"

Model	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF: [1] 40°C	50°C	60°C	71°C	Price [2]
LM-EE-3	3 ±5%	33.0	29.0	25.0	20.5	$320
LM-EE-3-P-6	3.6±5%	32.0	26.0	22.0	18.3	320
LM-EE-4	4 ±5%	32.0	26.0	22.0	18.3	320
LM-EE-4-P-5	4.5±5%	31.0	24.6	20.8	17.3	320
LM-EE-5	5 ±5%	31.0	24.6	20.8	17.3	320
LM-EE-6	6 ±5%	30.0	24.6	20.8	17.3	320
LM-EE-8	8 ±5%	28.0	23.5	19.7	16.5	320
LM-EE-10	10 ±5%	24.0	20.4	16.8	13.8	320
LM-EE-12	12 ±5%	21.0	19.0	16.1	13.2	320
LM-EE-15	15 ±5%	19.0	18.0	15.5	12.7	320
LM-EE-18	18 ±5%	16.5	14.8	12.4	10.1	320
LM-EE-20	20 ±5%	15.2	13.7	11.8	9.7	320
LM-EE-24	24 ±5%	14.0	12.5	10.8	9.0	320
LM-EE-28	28 ±5%	13.0	11.5	9.8	8.2	320
LM-EE-36	36 ±5%	10.4	9.8	8.6	7.1	320
LM-EE-48	48 ±5%	7.7	7.1	6.5	5.4	320
LM-EE-100	100 ±5%	3.3	3.0	2.5	2.1	350
LM-EE-120	120 ±5%	3.0	2.7	2.2	1.9	350
LM-EE-150	150 ±5%	2.2	2.0	1.75	1.50	350

LM series power modules A-EE performance data

GUARANTEED FOR 5 YEARS

DC OUTPUT:

Voltage Range — For voltage ranges see pages 9 and 10.

Regulated Voltage.

Regulation (line) — 0.05% plus 4 mV for line variations from 105-132 VAC. 0.01% plus 1.0 mV for line variations from 105-132 VAC. (Y option)

(load) — 0.03% plus 3 mV load variations from 0 to full load. 0.02% plus 2 mV for load variations from 0 to full load. (Y option)

Remote Programing

Resistance ..... 200 ohms/volt, nominal

Voltage ..... Volt per volt

Ripple and Noise .. 1 mV RMS, 3 mV p to p with either pos. or neg. terminal grounded. 0.5 mV RMS, 1.5 mV p to p with 60 Hz input. (Y option)

Temperature coefficient ..... 0.03%/°C. 0.01%/°C (Y option)

AC INPUT: Line .... 105-132 VAC: 47-440 Hz. 40°C rating not applicable for 50 Hz. operation.

Power:

LM 251, 257, 259, 263, 265	20 watts(1)
LM 201, 203, 260, 205, 207, 267	30 watts(1)
LM 202, 204, 261, 206, 208, 268	60 watts(1)
LM 252, 258, 262, 264, 266	70 watts(1)
Package B Models	80 watts(1)
Package C Models	140 watts(1)
Package CC Models	220 watts(1)
Package D Models	300 watts(1)
Package E Models	450 watts(1)
Package EE Models	750 watts(1)

(1)With output loaded to 40°C rating, input 132 VAC and 55-65 Hz

AMBIENT OPERATING TEMPERATURE: Continuous duty from −20°C to +71°C ambient with corresponding load current ratings for all modes of positions.

STORAGE TEMPERATURE: −55°C to +85°C.

OVERLOAD PROTECTION:

Thermal ..... Thermostat; automatic reset when over-temp condition is eliminated.

Electrical:

External Overload

Protection ..... Fixed, automatic electronic current limiting circuit limits the output current upon external overloads, including short circuit, thereby providing protection for load as well as power supply.

INPUT & OUTPUT CONNECTIONS:

Heavy duty terminal block on rear of chassis.

CONTROLS:

DC output

control ..... Simple screwdriver voltage adjustment over entire voltage range.

Remote Sensing .. Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

PHYSICAL DATA:

Weight ..... A Package Models
5 lbs. net; .....6 lbs. ship.
B Package Models
6 lbs. net; .....7 lbs. ship.
C Package Models
9 lbs. net; .....10 lbs. ship.
CC Package Models
15 lbs. net; ....17 lbs. ship.
D Package Models
20 lbs. net; ....23 lbs. ship.
E Package Models
28 lbs. net; ....31 lbs. ship.
EE Package Models
37 lbs. net; ....47 lbs. ship.

Finish ..... A, B, C, CC, D, E and EE Packages—Grey, FED. STD. 595 No. 26081.

Mounting ..... Three surfaces, each with tapped mounting holes, can be utilized for mounting A, B, C, CC, and D Package Models.

High Performance Option

Add Suffix "-Y"—All models available with these specifications for $15.00 extra: Line regulation .01% + 1 mV; Load regulation .02% + 2 mV; Ripple and Noise—with 60 Hz input: ½ mV rms; 1½ mV p to p; Temp. Coeff. .01%/°C

AC Input Option

Add Suffix "-V"—All units are available with 205-265 VAC, 47-440 Hz at no extra charge. (40°C rating not applicable.)

Fungus Proofing Option

Add Suffix "-R"—All models can be obtained with MIL-V-173 varnish for all fungi nutrient components at $10.00 surcharge.

LAMBDA ELECTRONICS CORP.
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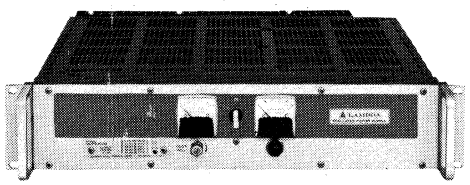
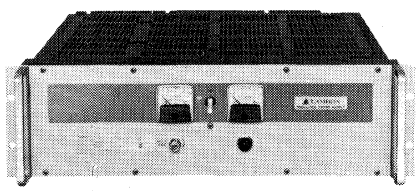
LM SERIES FULL RACK POWER SUPPLIES

Deliver Up To 150 Volts, Up To 150 Amps
In Compact Convection-Cooled Packages

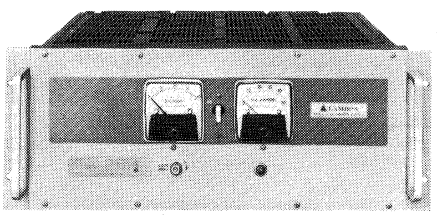
LM Series Full Rack Power Supplies are available with voltages up to 150 VDC, currents up to 150 amps. They are offered in three package sizes all of which fit into a standard 19″ rack. There are 46 fixed voltage range models and 3 wide range models, available metered or non-metered with optional built-in overvoltage protection. Meters and overvoltage protection are standard equipment on H packages and are available as options on F and G packages.



Package F
up to 150 volts/up to 48 amps

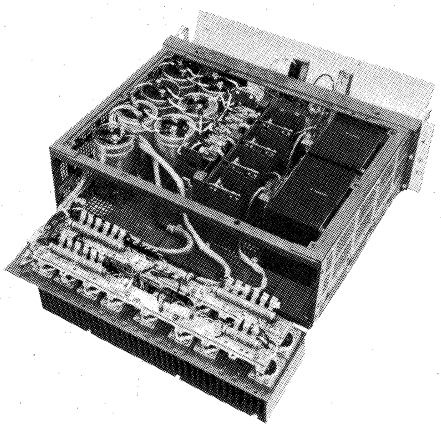


Package G
up to 150 volts/up to 95 amps



Package H
up to 12 volts/up to 150 amps

QUALITY COMPONENTS



Computer grade hermetically sealed 10-year life electrolytic capacitors

Drop-down front panel exposes meters, controls and front electrical connections for servicing

MIL-R-26 type wire wound resistors and MIL-R-22684 type film resistors mounted on circuit boards behind front panels

Line input fuse easily accessible from the front

Top completely removable

MIL-T-27 Grade 6 transformers

MIL-W-16878 wire

All-silicon hermetically sealed, internally mounted semiconductors

Hinged back exposes all rear connections for servicing

Convection-cooled heat-sink fins

G PACKAGE SHOWN
CONVECTION-COOLED

OTHER FEATURES

- **CONVECTION-COOLED DESIGN**
  offers greatest opportunity for increased ratings with forced air. Ventilated construction affords substantial increases in rating with small amounts of air flowing through the power supply. Consult Factory.

- **WIDE INPUT VOLTAGE AND FREQUENCY RANGE**
  Makes Lambda power supplies suitable for field gear and worst-case conditions so you need fewer special provisions. 105-132 VAC, 45-440 Hz with 10% derating for 50 Hz (205-265 optional at no extra charge).

- **OVERVOLTAGE PROTECTION**
  Built-in overvoltage protection is standard on all package H models and available as an option on all package F and G models up to 70 VDC. To order for F and G packages, add suffix "—OV" to model number and add $90. to price. Price of package H models includes overvoltage protection.

- **THERMALLY PROTECTED AND SHORT-CIRCUIT PROOF**
  Self-restoring current limiting and self-resetting thermostats protect supplies.

- **NO VOLTAGE SPIKES OR OVERSHOOT**
  on turn-on, turn-off, or power failure—for maximum load protection.

- **HIGH PERFORMANCE SPECIFICATIONS**
  Better regulation, ripple, and temperature coefficient for extra performance and safety margin in your system.
  The following specifications are standard for all package H models and are included in the price. All package F and G units are available with these specifications at a $15. surcharge.
  LINE REGULATION: .01% +1mV
  LOAD REGULATION: .02% +2mV
  RIPPLE AND NOISE: with 60 Hz input; 0.5mV rms; 1.5mV p-To-p
  TEMPERATURE COEFFICIENT: .01%/°C
  Add suffix "-Y" to package F and G model numbers.

LAMBDA PAGE 10

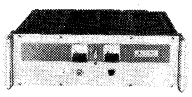
LM SERIES FULL RACK FIXED VOLTAGE MODELS

Package F 3½" x 19" x 16½"



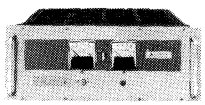
Model	Adj. Volt. Range VDC	MAX. AMPS AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LM-F-3	3 ±5%	48.0	42.0	34.0	25.0	$450
LM-F-3-P-6	3.6±5%	48.0	42.0	34.0	25.0	450
LM-F-4	4 ±5%	48.0	42.0	34.0	25.0	450
LM-F-4-P-5	4.5±5%	48.0	42.0	34.0	25.0	450
LM-F-5	5 ±5%	48.0	41.0	33.0	25.0	450
LM-F-6	6 ±5%	47.0	40.0	32.0	24.0	450
LM-F-8	8 ±5%	44.0	37.0	30.0	23.0	450
LM-F-10	10 ±5%	38.0	33.0	27.0	21.0	450
LM-F-12	12 ±5%	33.0	28.0	22.0	17.0	450
LM-F-15	15 ±5%	25.0	22.0	18.0	14.0	450
LM-F-18	18 ±5%	25.0	22.0	18.0	14.0	450
LM-F-20	20 ±5%	23.0	20.0	17.0	13.0	450
LM-F-24	24 ±5%	20.0	17.0	14.0	11.0	450
LM-F-28	28 ±5%	19.0	16.0	13.0	10.0	450
LM-F-36	36 ±5%	13.0	11.0	10.0	7.5	500
LM-F-48	48 ±5%	10.0	9.0	7.5	6.0	500
LM-F-100-M	100 ±5%	4.3	3.6	3.0	2.3	530
LM-F-120-M	120 ±5%	3.7	3.1	2.6	1.9	530
LM-F-150-M	150 ±5%	3.1	2.6	2.1	1.6	530

Package G 5¼" x 19" x 16½"



Model	Adj. Volt. Range VDC	MAX. AMPS AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LM-G-3	3 ±5%	95.0	80.0	62.0	45.0	$575
LM-G-3-P-6	3.6±5%	85.0	80.0	62.0	45.0	575
LM-G-4	4 ±5%	85.0	80.0	62.0	45.0	575
LM-G-4-P-5	4.5±5%	85.0	80.0	62.0	45.0	575
LM-G-5	5 ±5%	80.0	75.0	62.0	45.0	575
LM-G-6	6 ±5%	80.0	75.0	62.0	45.0	575
LM-G-8	8 ±5%	68.0	62.0	53.0	41.0	575
LM-G-10	10 ±5%	64.0	53.0	44.0	35.0	575
LM-G-12	12 ±5%	56.0	46.0	37.0	29.0	525
LM-G-15	15 ±5%	45.0	42.0	36.0	28.0	525
LM-G-18	18 ±5%	38.0	34.0	28.0	21.0	525
LM-G-20	20 ±5%	35.0	32.0	28.0	21.0	525
LM-G-24	24 ±5%	32.0	26.0	21.0	16.0	525
LM-G-28	28 ±5%	28.0	25.0	21.0	16.0	525
LM-G-36	36 ±5%	22.0	20.0	16.0	13.0	575
LM-G-48	48 ±5%	17.0	14.0	12.0	9.0	600
LM-G-100-M	100 ±5%	7.5	7.0	6.0	5.0	680
LM-G-120-M	120 ±5%	6.5	6.0	5.4	4.4	680
LM-G-150-M	150 ±5%	5.5	5.2	4.5	3.7	680

Package H 7" x 19" x 18½"



Model	Adj. Volt. Range VDC	MAX. AMPS AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LM-H-3-0V-Y-M	3 ±5%	150	140	125	91	$995
LM-H-3-P-6-0V-Y-M	3.6±5%	130	109	90	69	995
LM-H-4-0V-Y-M	4 ±5%	135	118	100	74	995
LM-H-4-P-5-0V-Y-M	4.5±5%	120	104	84	66	995
LM-H-5-0V-Y-M	5 ±5%	130	110	90	70	995
LM-H-6-0V-Y-M	6 ±5%	117	100	84	66	995
LM-H-10-0V-Y-M	10 ±5%	95	83	69	56	995
LM-H-12-0V-Y-M	12 ±5%	90	77	63	50	995

Wide Voltage Models

Package F 3½" x 19" x 16½"

Model	Adj. Volt. Range VDC	MAX. AMPS AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LM-F-0-7	0—7	25.0	21.0	17.0	14.0	$450

Package G 5¼" x 19" x 16½"

Model	Adj. Volt. Range VDC	MAX. AMPS AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LM-G-0-7	0—7	35.0	29.0	24.0	20.0	$575

Package H 7" x 19" x 18½"

Model	Adj. Volt. Range VDC	MAX. AMPS AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LM-H-0-7-0V-Y-M	0—7	52	46	37	30	$875

NOTES:

[1] CURRENT RATING IS FROM ZERO TO I MAX.

CURRENT RATING APPLIES OVER ENTIRE OUTPUT VOLTAGE RANGE.

CURRENT RATING APPLIES FOR INPUT VOLTAGE 105-132 VAC 55-65 HZ.

FOR OPERATION AT 45-55 HZ DELETE 40°C RATING.

FOR OPERATION AT 360-440 HZ CONSULT FACTORY FOR RATINGS AND SPECIFICATIONS.

[2] PRICES OF F AND G PACKAGES ARE NON-METERED MODELS, EXCEPT FOR MODEL NUMBERS FOLLOWED BY SUFFIX "-M". FOR METERED MODELS ADD SUFFIX "-M" TO MODEL NUMBER AND $30.00 TO PRICE.

PACKAGE H MODELS ARE AVAILABLE ONLY WITH OVERVOLTAGE PROTECTION, HIGH-PERFORMANCE OPTION, AND METERS, ALL OF WHICH ARE INCLUDED IN THE PRICE.

PRICES F.O.B. FACTORY, MELVILLE, N. Y. ALL SPECIFICATIONS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

ACCESSORIES AND PERFORMANCE OPTIONS FOR LM SERIES POWER SUPPLIES

Meters — LM-F and LM-G packages are full rack power supplies available metered or non-metered. For metered models, add new suffix "-M" to the model number and add $30. to the non-metered price. Meters are standard equipment on all LH packages and are included in the price.

Overvoltage Protection — F and G packages are available with built-in crowbar type overvoltage protection up to 70 VDC. To order overvoltage protection for F and G packages, add suffix "-OV" to the model number and add $90. to the price. Overvoltage protection is standard equipment on package H models and is included in the price.

To order F, G and H packages with both overvoltage and meters specify by adding suffix "-OV-M" to model number.

Examples LM-G-3-OV-M LM-F-4-OV-M

Chassis Slides
F, G and H packages are available with mounted chassis slides. Add suffix "-CS" to model number, and add $60. to the price of F and G models, $100. to the price of H models.

High Performance Specifications
All models available with these specifications:
Line regulation: .01% +1mV
Load regulation: .02% +2mV
Ripple and Noise: 0.5mV rms; 1.5mV p-to-p with 60 Hz input
Temperature Coefficient: .01%/°C

These high performance specifications are standard for all package H models and are included in the price. To order as an option on F and G packages, add suffix "-Y" to the model number and add $15.00 to the price.

AC Input Option
All models are available with 205--265 VAC input voltage at no extra cost. Add suffix "-V" to model number. (40°C rating not applicable.)

Fungus Proofing Option
All models available with fungus proofing with MIL-V-173 varnish for all fungi nutrient components.
To order add suffix "-R" to model number and add $15. to the price of F, G and H package models.

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LM SERIES FULL RACK POWER SUPPLIES — F, G, H
PERFORMANCE DATA

Voltage Range — For voltage ranges see pages 28,29

Regulated Voltage.

Regulation (line) — 0.05% plus 4mV for line variations from 105-132 VAC. 0.01% plus 1.0 mV for line variations from 105-132 VAC. (Y option) *

(load) — 0.03% plus 3 mV load variations from 0 to full load. 0.02% plus 2 mV for load variations from 0 to full load. (Y option) *

Remote Programing
- Resistance ..... 200 ohms/volt; nominal
- Voltage ..... Volt per volt

Ripple and Noise .. 1 mV RMS, 3 mV p to p with either pos. or neg. terminal grounded. 0.5 mV RMS, 1.5 mV p to p with 60 Hz input. (Y option)*

Temperature coefficient ..... 0.03%/°C. 0.01%/°C. (Y option) *

Line .. 105-132 VAC: 45-440 Hz with 10% derating for 50 Hz operation.

Power:
Package F Models.... 900 watts(1)
Package G Models....1300 watts(1)
Package H Models....2200 watts(1)
(1)With output loaded to 40°C rating, input 132 VAC and 55-65 Hz

Continuous duty from −20°C to +71°C ambient with corresponding load current ratings for all modes of operation, and all mounting positions.

−55°C to +85°C.

Thermal ..... Thermostat; automatic reset when over-temp condition is eliminated.

Electrical:
External Overload Protection ..... Fixed, automatic electronic current limiting circuit limits the output current upon external overloads, including short circuit, thereby providing protection for load as well as power supply.

Heavy duty terminal block on rear of chassis.

DC output control ..... Simple screwdriver voltage adjustment over entire voltage range.

Remote Sensing .. Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Voltmeter and ammeter on metered models of packages F, G and H.

Weight ..... F Package Models
54 lbs. net; ....64 lbs. ship.
G Package Models
72 lbs. net; ....84 lbs. ship.
H Package Models
110 lbs. net; ..145 lbs. ship.

Finish ..... F, G and H Package Front Panels—Brushed aluminum clear anodized panels with grey inlay (standard).

Add Suffix "-Y", All F and G models available with these specifications for $15.00 extra: Line regulation .01 + 1 mV; Load regulation .02% + 2 mV; Ripple and Noise—with 60 Hz input: ½ mV rms; 1½ mV p to p; Temp. Coeff. .01%°C. These specifications are standard on all H packages and are included in the price.

Add Suffix "-V"—All units are available with 205-265 VAC, 45-440 Hz at no extra charge. (40°C rating not applicable.)

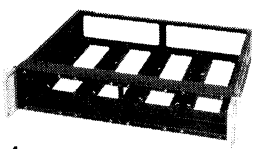
Add Suffix "-R"—All models can be obtained with MIL-V-173 varnish for all fungi nutrient components at $15.00 surcharge.

Accessories for use with Lambda LM Series A, B, C, CC, D and E Packages.

RACK ADAPTERS

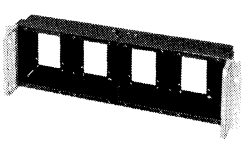


LRA-5
3½" height by 2 7/16" depth. Price $35.00

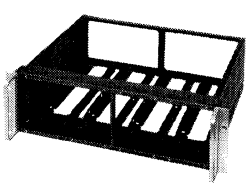


LRA-4
3½" height by 14" depth. (For use with chassis slides) Price $60.00

LRA-5 and LRA-4 mount the following combinations of LM models:
- up to 4 A package sizes
- 3 B or 3 C package sizes
- 2 A and 1 B or 1 C package sizes



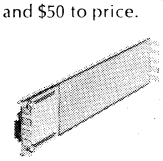
LRA-3
5¼" height by 2 7/16" depth. Price $35.00



LRA-6
5¼" height by 14" depth. (For use with chassis slides) Price $60.00

LRA-3 and LRA-6 mount the following combinations of LM models:
- up to 4 A, B or C package sizes
- 3CC package sizes (only in LRA-6)
- 2D or 2E package sizes
- 2A, B or C and 1CC or 1D or 1E package sizes
- 1 CC and 1 D or 1 E package sizes
- 1 D and 1 E package sizes

CHASSIS SLIDES FOR RACK ADAPTERS
Rack adapters LRA-4 and LRA-6 are available with chassis slides mounted (LAMBDA No. KHT-34-003)
Add suffix "-CS" to rack adapter model number and $50 to price.



OVERVOLTAGE PROTECTION ACCESSORY
ADJUSTABLE CROWBAR TYPE—$30

Mounting provisions provided . . . 2-terminal connection



Model	Adj. Volt. Range	Size: H x W x D	Price
LM-OV-1	3- 8 v	1¼" x 3⅜" x ⅝"	$30
LM-OV-2	6-20 v	1¼" x 3⅜" x ⅝"	$30
LM-OV-3	18-70 v	1¼" x 3⅜" x ⅝"	$30

For use with A, B, C, CC, D and E Package LM power supplies with adjustable voltage ranges up to 70 VDC.

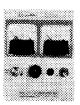
Packages F, G and H are available with overvoltage protection *built-in* ... see page 9.

¼ RACK METERED PANELS for use with rack adapters

(Include voltmeter, ammeter, screwdriver voltage adjust, switch, pilot light, fuse, fanning strip and cabling for connection to the module, and an auxiliary terminal board for customers' external connections)



Model MP-3 . . . 3½" height . . . for use with LM Packages A, B and C . . . Price $45.00



Model MP-5 . . . 5¼" height . . . for use with LM Packages A, B, C, CC, D and E . . . Price $45.00

¼ RACK NON-METERED PANELS for use with rack adapters

(Include screwdriver voltage adjust, switch, pilot light, fuse, fanning strip and cabling for connection to the module, and an auxiliary terminal board for customers' external connections)

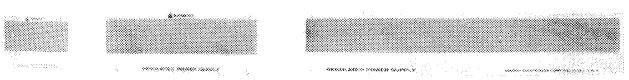


Model P-3 . . . 3½" height . . . for use with LM Packages A, B and C . . . Price $25.00



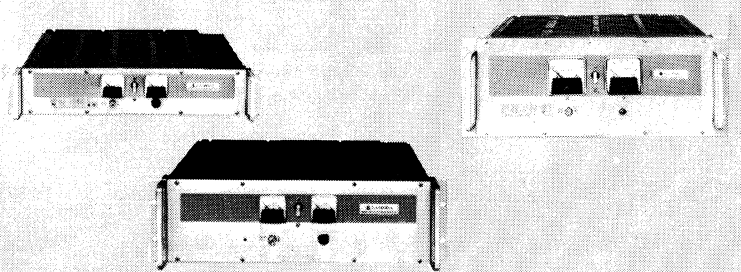
Model P-5 . . . 5¼" height . . . for use with LM Packages A, B, C, CC, D and E . . . Price $25.00

BLANK PANELS



Model LBP-60	3½" height, ¼ rack	Price $5.00	(For use with
Model LBP-50	3½" height, ½ rack	Price 10.00	rack adapters
Model LBP-30	3½" height, full rack	Price 10.00	LRA-4 and LRA-5)
Model LBP-10	5¼" height, ¼ rack	Price $5.00	(For use with
Model LBP-20	5¼" height, ½ rack	Price 10.00	rack adapters
Model LBP-40	5¼" height, full rack	Price 10.00	LRA-3 and LRA-6)

F, G and H PACKAGES



These are full rack power supplies available metered or non-metered. Overvoltage protection and mounted chassis slides are available as options.

Consult factory for additional accessories. Prices subject to change without notice.

LAMBDA PAGE 13

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LC/LM SERIES COMPLETE POWER SUPPLY ASSEMBLY SYSTEMS OBSOLETE CUSTOM DESIGNED POWER SUPPLIES

- Lambda's dramatically new Power Supply Systems Concept eliminates the need for costly custom assembly designed multiple-output power supply systems. Select from the component power supplies described on pages 2-10 and assemble your system with these standard accessories:
- Overvoltage protectors
- Rack adapters
- Systems power control panels
- Systems metering panels
- Standard systems cables
- Chassis slides
- Assemble the system yourself or if you prefer, Lambda will assemble your power system for you.

YOU CAN OBTAIN:

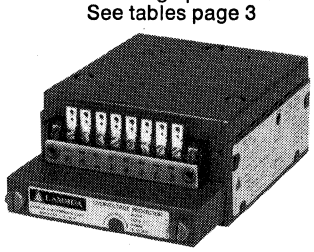
- Up to 8 separate outputs in a 1¾" high rack adapter.
- Up to 16 separate outputs in 3½" rack adapter.
- Up to 16 separate outputs in a 5¼" rack adapter.
- Use of standard mass-produced power supplies and accessories gives lower unit costs.
- Fast delivery. No waiting for custom design.
- Maximum flexibility for later design changes.
- Substantial discounts are available to Original Equipment Manufacturers under the Lambda Commercial Purchase Plan.
- Guaranteed 5 years whether you assemble or Lambda assembles.

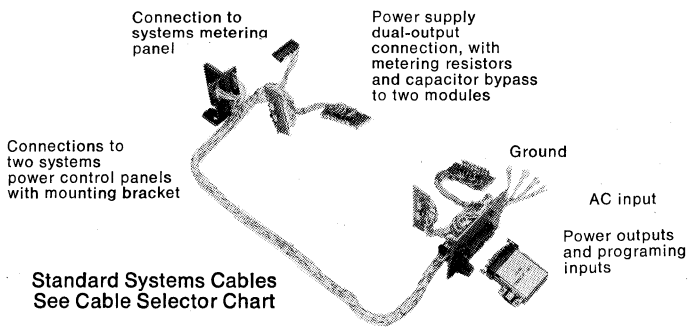
How to take advantage of LAMBDA's new "Select-don't-design" Power Supply Assembly Systems Concept.

1. List your power supply requirements.
2. Select the modules you need for proper voltages and currents . . . remember, you can series/parallel units.
3. Select the smallest rack adapter that will house your modules.
4. Select the necessary power control panels and metering panel.
5. Select the overvoltage protection units if required.
6. Select the cables you need.
7. Order the units or ask LAMBDA to assemble your system. Add 5% if LAMBDA assembles.

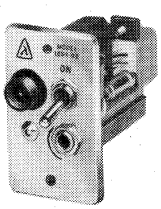
LC SERIES POWER SUPPLY ASSEMBLY SYSTEM WITH UP TO 8 OUTPUTS IN A 1¾" RACK

$3\frac{5}{32}$" x $3\frac{9}{32}$" x $1\frac{11}{16}$"
LC module with overvoltage protector
See tables page 3

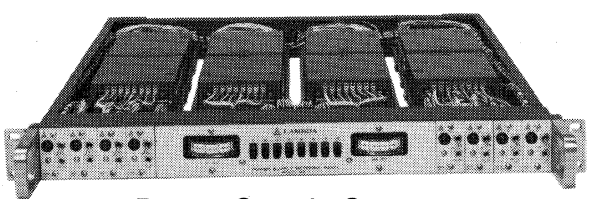




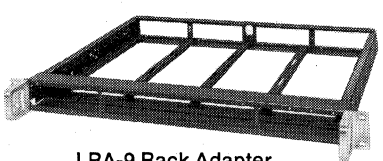
Standard Systems Cables
See Cable Selector Chart



SP-1 Systems
Power Control Panel,
Price: **$20**

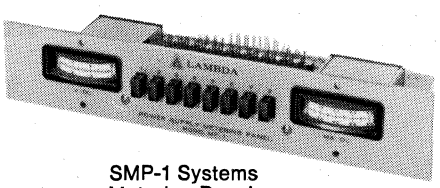


Power Supply System
1¾"x19"x14"

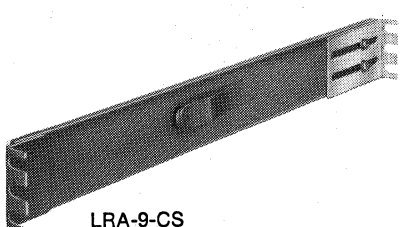


LRA-9 Rack Adapter,
Price: **$60**

5 Year Guarantee



SMP-1 Systems
Metering Panel,
Price: **$90**



LRA-9-CS
Chassis Slide,
Price: **$50** (pr.)

LAMBDA PAGE 14

Follow these simple steps to "Select-don't-Design" your own multiple-output power supply systems.

1. SELECT RACK ADAPTER

LRA-9 Rack Adapter—1¾" high x 14" deep .. Price: **$60**
To order chassis slide for use with a rack adapter, add suffix—CS to rack adapter model number (Example: LRA-9-CS). ..... Additional Price: **$50**

2. SELECT POWER SUPPLY MODULES

- Select any of the LCS-1 power supply modules listed on page 3.
- Utilize up to 8 units and obtain up to 8 different outputs.
- Connect these units in series or in parallel to get the voltages and currents you need.

3. SELECT OVERVOLTAGE PROTECTION (Optional)

- See table on page 3 for models and prices.

4. SELECT POWER CONTROL PANELS AND METERING PANEL

Systems Power Control Panels. For each power supply there should be a control panel which provides an ON-OFF switch, pilot light, and voltage output control. The control panel mounts on the front of the rack adapter—up to 8 panels may be used. Specify exact power supply module to be controlled by Systems Power Control Panel by adding model number of power supply module as suffix to model number of control panel (Example: SP-1-LCS-1-01).

SP-1 Systems Power Control Panel. For use with 1¾" Rack Adapter LRA-9 ..... Price: **$20**

Systems Metering Panels. Metering panels are available for use with rack adapters. The metering panel is optional.

Each Systems Metering Panel contains a voltmeter and an ammeter, each with three ranges, and a pushbutton selector switch. The selector switch allows monitoring of the voltage and current of any of up to 8 outputs. A barrier strip assembly is provided with each metering panel ordered. This barrier strip assembly mounts at the rear of the rack adapter for application of AC input power for the entire assembly.

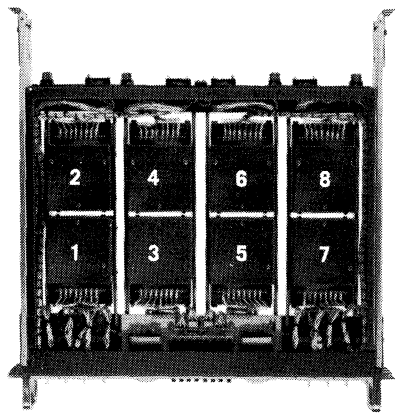
SMP-1 Systems Metering Panel. For use with 1¾" Rack Adapter LRA-9 ..... Price: **$90**

5. SELECT SYSTEMS OR AUXILIARY CABLES

Systems Cables. The standard systems cables provide interconnection between the power supplies, control panels and metering panel and provide all power supply outputs through a connector which mounts on the rear of the rack adapter. Each output connector is provided with a mate for customer use. Each cable has its own input line fuse.

Auxiliary Cables. When systems cables and metering panel are not used, auxiliary cables can be supplied for direct connection between any power module and a power control panel. In this instance the customer will supply his own input/output wiring.

POWER SUPPLY LOCATIONS • TOP VIEW



To Order Cables. When ordering cables it is necessary to refer to both the Cable Selector Chart and the power supply location diagram.

Step 1. Select the Systems Cables to connect the power supply modules which will be in the rack locations indicated in the table.

Step 2. If you decide not to use a metering panel, select the auxiliary cables you need from the Cable Selector Chart and the location diagram.

Cables for use with 1¾" Rack Adapter LRA-9

Systems Cables

SC-1 ..... Price: **$60**
SC-2 ..... Price: **$60**

Auxiliary Cables

SC-3 ..... Price: **$15**
SC-4 ..... Price: **$15**

6. SELECT BLANK PANELS

If you use fewer than 8 power supply modules in your design, or if you decide you want to control the power supply system remotely, you may order blank panels for the front of the LRA-9 Rack Adapter.

Blank Panel Model	Replaces	Prices
SB-1	1 SP panel	$ 2.50
SB-2	2 SP panels	5.00
SB-3	4 SP panels	10.00
SB-4	1 SMP panel	10.00
SB-5	All panels	10.00

CABLE SELECTOR CHART LRA-9 Rack Adapter

Rack Adapter	Systems Metering Panel	Power Control Panel	Blank Panels	Power Supply Components	Current Range	CABLES				Unit Locations in Rack
						Systems	Auxiliary	Modules per cable	Outputs per cable	
LRA-9 1¾" High X 14" Deep	SMP-1	SP-1	SB-1 SB-2 SB-3 SB-4 SB-5	LCS-1	All	SC-1	—	2	2	1 & 2 or 7 & 8
						SC-2	—	2	2	3 & 4 or 5 & 6
						—	SC-3	1	—	1, 3, 5 or 7
						—	SC-4	1	—	2, 4, 6, or 8

LC/LM Series Power Supply Assembly System

LC/LM Modules with overvoltage protectors. See tables pages 3, 9 and 10.


LC-1 Module

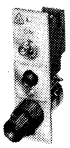

LC-2 Module

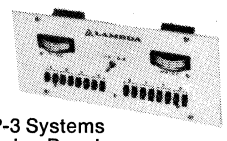

LC-A Module

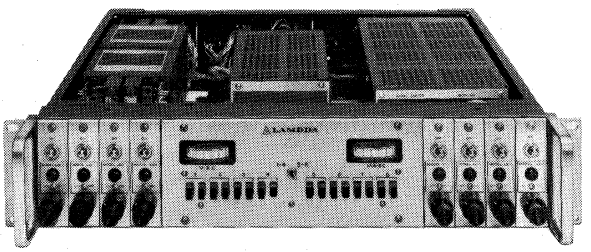

LM-A Module

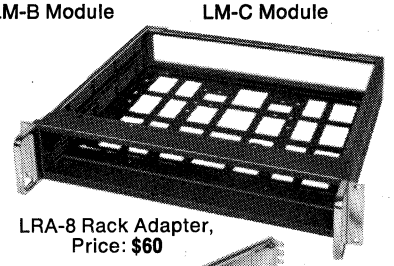

LM-B Module

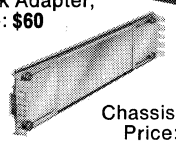

LM-C Module


SP-3 Systems Power Control Panel, Price: **$20**


SMP-3 Systems Metering Panel, Price: **$100**


Power Supply System
3½" x 19" x 14"


LRA-8 Rack Adapter, Price: **$60**


Chassis Slide, Price: **$50**

Follow these simple steps to "Select-don't-Design" your own multiple-output power supply systems.

1. SELECT RACK ADAPTER

LRA-8 Rack Adapter—3½" high x 14" deep Price: **$60**
To order chassis slide for use with a rack adapter, add suffix -CS to rack adapter model number (Example: LRA-8-CS). Additional Price: **$50**

2. SELECT POWER SUPPLY MODULES

- Select any of the LCS-1, LCS-2 or LCD-2 power supply modules.
- Utilize up to 8 units per rack and obtain up to 16 different outputs by using 8 dual LC units.
- Utilize up to 4 LCD-A or 4 LM-A units per rack, to obtain a wider selection of current ratings.
- Utilize up to 3 LM-B units or 3 LM-C units to obtain more power, though fewer different outputs.
- Mix any of the above power supply modules to obtain the outputs needed. Suggestions are illustrated in the drawings on page 15.

Note: The lengths of the LCD-A, LM-A, LM-B or LM-C units are such that no other power supplies will fit with them in the front-to-back dimension of the LRA-8 rack.

3. SELECT OVERVOLTAGE PROTECTION (Optional)

See tables on pages 3 and 9 for models and prices.

4. SELECT POWER CONTROL PANELS AND METERING PANEL

Systems Power Control Panels. For each power supply there should be a control panel which provides an ON-OFF switch, pilot light, and voltage output control. The control panel mounts on the front of the rack adapter—up to 8 panels may be used. For dual output modules, a single control panel controls both outputs independently. Specify exact power supply module to be controlled by Systems Power Control Panel by adding model number of power supply module as suffix to model number of control panel (Example: SP-3-LCS-2-11).

SP-3 Systems Power Control Panel. For use with 3½" Rack Adapter LRA-8. Price: **$20**

Systems Metering Panels. Metering panels are available for use with rack adapters. The metering panel is optional.

Each Systems Metering Panel contains a voltmeter and an ammeter, each with three ranges, and a pushbutton selector switch. The selector switch allows monitoring of the voltage and current of any of up to 16 outputs. A barrier strip assembly is provided with each metering panel ordered. This barrier strip assembly mounts at the rear of the rack adapter for application of AC input power for the entire assembly.

SMP-3 Systems Metering Panel. For use with 3½" Rack Adapter LRA-8. Price: **$100**

5. SELECT SYSTEMS OR AUXILIARY CABLES

Systems Cables. The standard systems cables provide interconnection between the power supplies, control panels and metering panel as well as providing all power supply outputs through a connector which mounts on the rear of the rack adapter. Each output connector is provided with a mate for customer use. Each cable has its own input line fuse.

Auxiliary Cables. When systems cables and metering panel are not used, auxiliary cables can be supplied for direct connection between any power module and a power control panel. In this instance the customer will supply his own input/output wiring.

To Order Cables

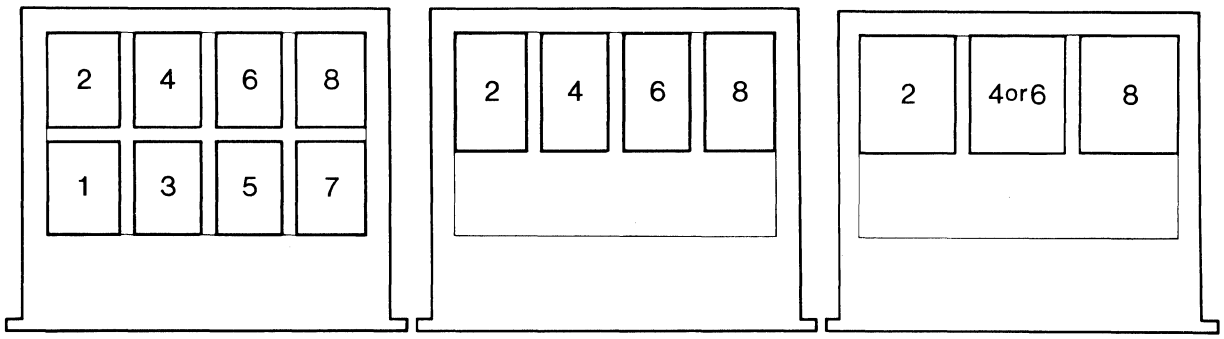
When ordering cables it is necessary to refer to both the Cable Selector Chart and the power supply location diagram.

Step 1. Select the Systems cables to connect the power supply modules which will be in the rack locations indicated in the table.

Step 2. If you decide not to use a metering panel, select the auxiliary cables you need from the Cable Selector Chart and the location diagram.

with up to 16 outputs in a 3½" rack

POWER SUPPLY LOCATIONS • TOP VIEW



LCS-1
LCS-2
LCD-2

LCD-A
LM-A

LM-B
LM-C

5 Year Guarantee

6. SELECT BLANK PANELS

If you use fewer than 8 power supply modules in your design, or if you decide you want to control the power supply system remotely, you may order blank panels for the front of the LRA-8 Rack Adapter.

Blank panel Model	Replaces	Price
SB-6	1 SP panel	$ 2.50
SB-7	2 SP panels	5.00
SB-8	4 SP panels	10.00
SB-9	1-SMP panel	10.00
SB-10	All panels	10.00

Cables for use with 3½" Rack Adapter LRA-8

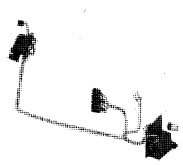
Systems Cables		Auxiliary Cables	
Model	Price	Model	Price
SC5	$ 50	SC3	$15
SC6	100	SC4	15
SC7	100	SC11	20
SC8	60	SC13	20
SC9	60	SC18	15
SC14	60		
SC15	60		
SC16	50		
SC17	50		

LIST ALL POWER SUPPLIES AND ACCESSORIES

Order all the power supplies and accessories needed to assemble your system. If you prefer, Lambda will assemble the system for you. Add 5% to the total cost of all power supplies and accessories to determine the price of the completed assembly.

CABLE SELECTOR CHART • LRA-8 RACK ADAPTER

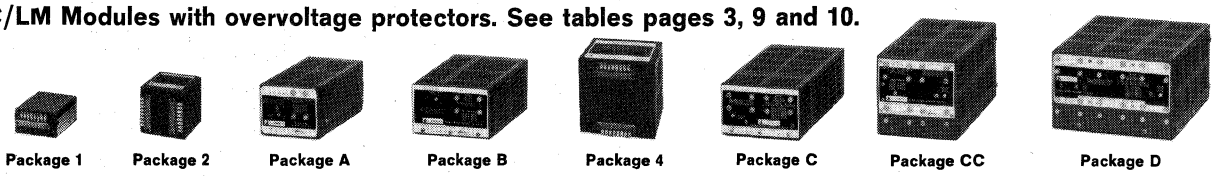
Rack Adapter	Systems Metering Panel	Power Control Panel	Blank Panels	Power Supply Components	Current Range	CABLES Systems	CABLES Auxiliary	CABLES Modules per cable	CABLES Outputs per cable	Unit Locations in Rack
LRA-8	SMP-3	SP-3	SB-6	LCS-1	All	SC-8		2	2	1 & 2 or 7 & 8
3½" High			SB-7	LCS-2		SC-9		2	2	3 & 4 or 5 & 6
X			SB-8				SC-3	1		1, 3, 5 or 7
14" Deep			SB-9				SC-4	1		2, 4, 6 or 8
			SB-10	LCD-2	All	SC-6		2	4	1 & 2 or 7 & 8
						SC-7		2	4	3 & 4 or 5 & 6
							SC-11			1, 3, 5 or 7
				LCD-2	All	SC-14		1	2	2 or 8
				LCD-A		SC-15		1	2	4 or 6
							SC-13	1		2, 4, 6 or 8
				LM-A LM-B LM-C	5 Amp. Max.	SC-16		1	1	2, 4, 6 or 8
							SC-18	1		2, 4, 6 or 8
				LCS-1 LCS-2	All	SC-5		1	1	2, 4, 6 or 8
				LM-C	Above 5 Amp.	SC-17		1	1	2, 4, 6 or 8

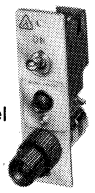


LC Systems Cable

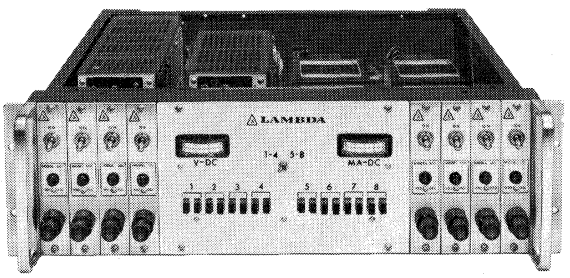
LC/LM Series Power Supply Assembly Systems

LC/LM Modules with overvoltage protectors. See tables pages 3, 9 and 10.

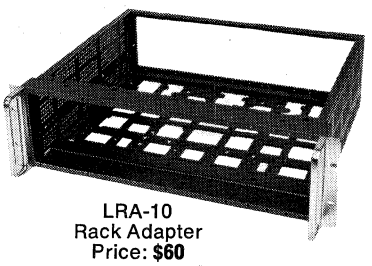




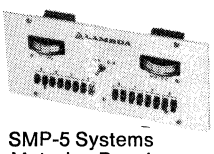
SP-5 Systems
Power Control Panel
Price: **$30**



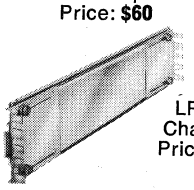
Power Supply System
5¼" x 19" x 14"



LRA-10
Rack Adapter
Price: **$60**



SMP-5 Systems
Metering Panel
Price: **$100**



LRA-10-CS
Chassis Slide
Price: **$50** (pr.)

Follow these simple steps to "Select-don't-Design" your own multiple-output power supply systems.

1. SELECT RACK ADAPTER

LRA-10 Rack Adapter—5½" high x 14" deep. Price: **$70**
To order chassis slide for use with a rack adapter, add suffix -CS to rack adapter model number (Example: LRA-10-CS). Additional Price: **$50.**

2. SELECT POWER SUPPLY MODULES

- Utilize up to 8 LCS-1, 8 LCS-2 or LCD-2 units per rack and obtain up to 16 different outputs.
- Utilize up to 4 LCD-A, 3 LC-4, 4 LM-A, 4 LM-B, 4 LM-C, 3 LM-CC or 2 LM-D power supply packages per rack.
- Utilize a wide combination of these units in any LRA-10 rack.
- Mix any of the above power supply modules to obtain the outputs needed. Suggestions are illustrated in the drawings on page 15.

Note: The lengths of the LCD-A, LM-A, LM-B, LM-C and LC-4 units are such that no other power supplies will fit in the front-to-back dimension of the LRA-10 rack.

3. SELECT OVERVOLTAGE PROTECTION (Optional)

See tables on pages 3 and 9 for models and prices.

4. SELECT POWER CONTROL PANELS AND METERING PANEL

Systems Power Control Panels. For each power supply there must be a control panel which provides an ON-OFF switch, pilot light, and voltage output control. The control panel mounts on the front of the rack adapter—up to 8 panels may be used. For dual output models, a single control panel controls both outputs simultaneously. Specify exact power supply module to be controlled by Systems Power Control Panel by adding model number of power supply module as suffix to model number of control panel (Example: SP-5-LM-D-4).

SP-5 Systems Power Control Panel. For use with 5¼" Rack Adapter LRA-10 Price: **$30**

Systems Metering Panels. Metering panels are available for use with rack adapters. The metering panel is optional.

Each Systems Metering Panel contains a voltmeter and an ammeter, each with three ranges, and a pushbutton selector switch. The selector switch allows monitoring of the voltage and current of any of up to 16 outputs. A barrier strip assembly is provided with each metering panel ordered. This barrier strip assembly mounts at the rear of the rack adapter for application of AC input power for the entire assembly.

SMP-5 Systems Metering Panel. For use with 5¼" Rack Adapter LRA-10 Price: **$100**

5. SELECT SYSTEMS OR AUXILIARY CABLES

Systems Cables. The standard systems cables provide interconnection between the power supplies, control panels and metering panel as well as providing all power supply outputs through a connector which mounts on the rear of the rack adapter. Each output connector is provided with a mate for customer use. Each cable has its own input line fuse.

Auxiliary Cables. When systems cabling and metering are not used, auxiliary cables can be supplied for direct connection between any power module and a power control panel. In this instance the customer will supply his own input/output wiring.

To Order Cables

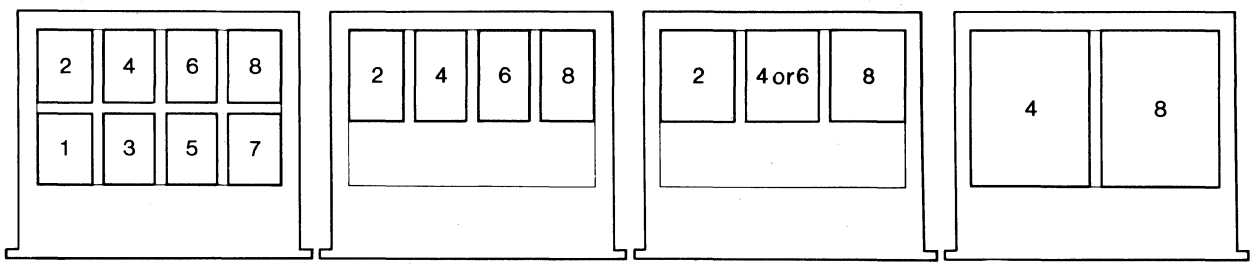
When ordering cables it is necessary to refer to both the Cable Selector Chart and the power supply location diagram.

Step 1. Select the systems cables to connect the power supply modules which will be in the rack locations indicated in the table.

Step 2. If you decide not to use a metering panel, select the auxiliary cables you need from the Cable Selector Chart and the the location diagram.

with up to 16 outputs in a 5¼"x 14" rack

POWER SUPPLY LOCATIONS • TOP VIEW



LCS-1
LCS-2
LCD-2

LCD-A
LM-A

LCS-4
LCD-4
LM-CC

LM-D

5 Year Guarantee

Cables for use with 5¼"x 14" Rack Adapter LRA-10

Systems Cables		Auxiliary Cables	
Model	Price	Model	Price
SC-20	$ 60	SC-3	$15
SC-21	60	SC-4	15
SC-22	50	SC-11	20
SC-26	100	SC-13	20
SC-27	100	SC-18	15
SC-28	60		
SC-29	60		
SC-32	50		
SC-33	50		
SC-35	50		

6. SELECT BLANK PANELS

If you use fewer than 8 power supply modules in your design, or if you decide you want to control the power supply system remotely, you may order blank panels for the front of the LRA-10 Rack Adapter.

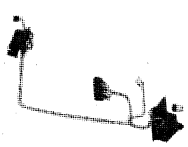
Blank Panel Model	Replaces	Price
SB-11	1 SP panel	$ 2.50
SB-12	2 SP panels	5.00
SB-13	4 SP panels	10.00
SB-14	1-SMP panel	10.00
SB-15	All panels	10.00

LIST ALL POWER SUPPLIES AND ACCESSORIES

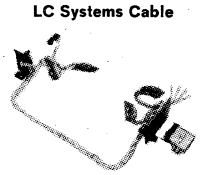
Order all the power supplies and accessories needed to assemble your system. If you prefer, Lambda will assemble the system for you. Add 5% to the total cost of all power supplies and accessories to determine the price of the completed assembly.

CABLE SELECTOR CHART FOR LRA-10 RACK ADAPTER

Rack Adapter	Systems Metering Panel	Power Control Panel	Blank Panels	Power Supply Components	Current Range	CABLES				Unit Locations in Rack
						Systems	Auxiliary	Modules per Cable	Outputs per Cable	
LRA-10 5¼" High x 14" Deep	SMP-5	SP-5	SB-11 SB-12 SB-13 SB-14 SB-15	LCS-1 LCS-2	All	SC-20		2	2	1 & 2 or 7 & 8
						SC-21		2	2	3 & 4 or 5 & 6
				LCS-1 LCS-2 LCS-4	All	SC-22		1	1	2, 4, 6 or 8
							SC-3	1		1, 3, 5 or 7
							SC-4	1		2, 4, 6 or 8
				LCD-2	All	SC-26		2	4	1 & 2 or 7 & 8
						SC-27		2	4	3 & 4 or 5 & 6
							SC-11	1		1, 3, 5 or 7
				LCD-2 LCD-4 LCD-A	All	SC-28		1	2	2 or 8
						SC-29		1	2	4 or 6
							SC-13	1		2, 4, 6 or 8
				LM-A LM-B	5A Max.	SC-32		1	1	2, 4, 6 or 8
				LM-C LM-CC LM-D	5A to 10A	SC-33		1	1	2, 4, 6 or 8
							SC-18	1		2, 4, 6 or 8
				LM-CC LM-D	Above 10A	SC-35		1	1	2, 4. 6 or 8
							SC-18	1		2, 4, 6 or 8



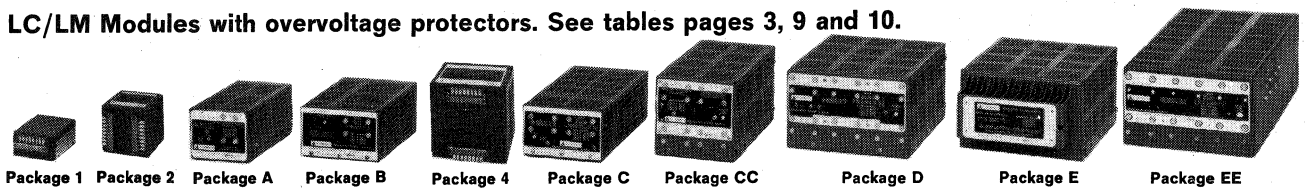
LC Systems Cable

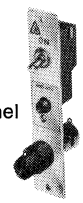


LM Systems Cable

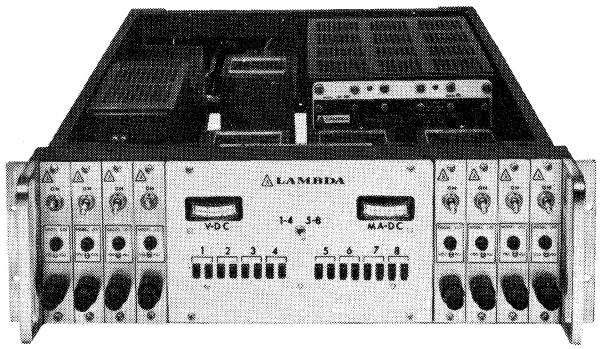
LC/LM Series Power Supply Assembly Systems

LC/LM Modules with overvoltage protectors. See tables pages 3, 9 and 10.

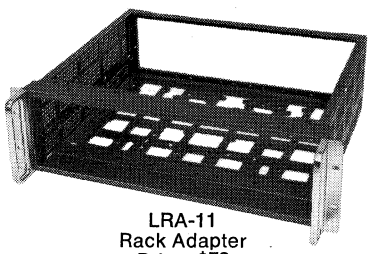




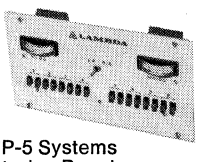
SP-5 Systems
Power Control Panel
Price: **$30**



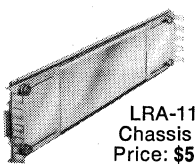
Power Supply System
5¼"x19"x21"



LRA-11
Rack Adapter
Price: **$70**



SMP-5 Systems
Metering Panel
Price: **$100**



LRA-11-CS
Chassis Slide
Price: **$50** (pr.)

5 Year Guarantee

Follow these simple steps to "Select-don't-Design" your own multiple-output power supply systems.

1. SELECT RACK ADAPTER

LRA-11 Rack Adapter—5¼" high x 21" deep Price: **$70**
To order chassis slide for use with a rack adapter, add suffix -CS to rack adapter model number (Example: LRA-11-CS). Additional Price: **$50**

2. SELECT POWER SUPPLY MODULES

- Utilize up to 8 LCS-1, 8 LCS-2, 8 LCD-2, 8 LCD-A or 6 LC-4 units per rack and obtain up to 16 different outputs.
- Utilize up to 8 LM-A or 8 LM-B units per rack and obtain up to 8 different outputs.
- Utilize up to 4 LM-C, 3 LM-CC, 2 LM-D, 2 LM-E or 2 LM-EE units in the LRA-11 rack adapter.
- Mix any of the above power supply modules to obtain the outputs needed. Suggestions are illustrated in the drawings on page 15.

3. SELECT OVERVOLTAGE PROTECTION (Optional)

See tables on pages 3 and 9 for models and prices.

4. SELECT POWER CONTROL PANELS AND METERING PANEL

Systems Power Control Panels. For each power supply there should be a control panel which provides an ON-OFF switch, pilot light, and voltage output control. The control panel mounts on the front of the rack adapter—up to 8 panels may be used. For dual output models, a single control panel controls both outputs simultaneously. Specify exact power supply module to be controlled by Systems Power Control Panel by adding model number of power supply module as suffix to model number of control panel (Example: SP-5-LM-E-8).

SP-5 Systems Power Control Panel. For use with 5¼" Rack Adapter LRA-11. Price: **$30**

SP-50 Systems Power Control Panel. For use with LM-EE models. Price: **$30**

Systems Metering Panels. Metering panels are available for use with rack adapters. The metering panel is optional.

Each Systems Metering Panel contains a voltmeter and an ammeter, each with three ranges, and a pushbutton selector switch. The selector switch allows monitoring of the voltage and current of any of up to 16 outputs. A barrier strip assembly is provided with each metering panel ordered. This barrier strip assembly mounts at the rear of the rack adapter for application of AC input power for the entire assembly. SMP-5 or SMP-50. Price: **$100**

5. SELECT SYSTEMS OR AUXILIARY CABLES

Systems Cables. The standard systems cables provide interconnection between the power supplies, control panels and metering panel as well as providing all power supply outputs through a connector which mounts on the rear of the rack adapter. Each output connector is provided with a mate for customer use. Each cable has its own input line fuse.

Auxiliary Cables. When systems cables and metering panel are not used, auxiliary cables can be supplied for direct connection between any power module and a power control panel. In this instance the customer will supply his own input/output wiring.

To Order Cables

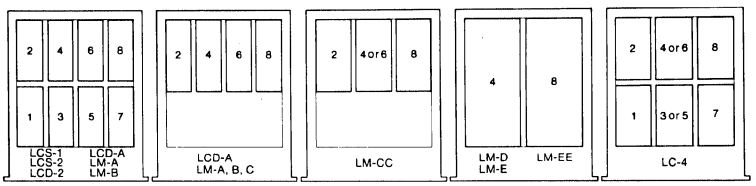
When ordering cables it is necessary to refer to both the Cable Selector Chart and the power supply location diagram.

Step 1. Select the systems cables to connect the power supply modules which will be in the rack locations indicated in the table.

Step 2. If you decide not to use a metering panel, select the auxiliary cables you need from the Cable Selector Chart and the location diagram.

with up to 16 outputs in a 5¼" x 21" rack

POWER SUPPLY LOCATIONS • TOP VIEW



Cables for use with 5¼" x 21" Rack Adapter LRA-11

Systems Cables				Auxiliary Cables	
Model	Price	Model	Price	Model	Prices
SC-40	$ 60	SC-71	$60	SC-3	$15
SC-41	60	SC-72	60	SC-11	20
SC-44	100	SC-73	60	SC-43	15
SC-45	100	SC-74	60	SC-46	20
SC-50	60	SC-80	60	SC-52	15
SC-51	60	SC-81	60	SC-53	15
SC-58	50	SC-83	75	SC-68	15
SC-59	50	SC-84	75		
SC-60	50				
SC-61	50				
SC-64	50				
SC-65	50				
SC-66	50				
SC-67	50				
SC-70	50				

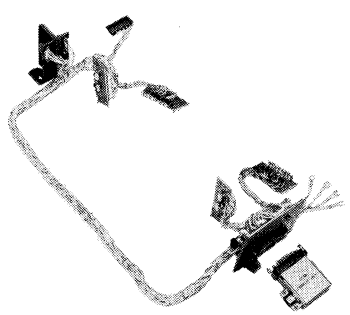
6. SELECT BLANK PANELS

If you use fewer than 8 power supply modules in your design, or if you decide you want to control the power supply system remotely, you may order blank panels for the front of the LRA-11 Rack Adapter.

Blank Panel Model	Replaces	Price
SB-11	1 SP panel	$ 2.50
SB-12	2 SP panels	5.00
SB-13	4 SP panels	10.00
SB-14	1-SMP panel	10.00
SB-15	All panels	10.00

CABLE SELECTOR CHART FOR LRA-11 RACK ADAPTER

Rack Adapter	Systems Metering Panel	Power Control Panel	Blank Panels	Power Supply Components	Current Range	CABLES Systems	CABLES Auxiliary	Modules per Cable	Outputs per Cable	Unit Locations in Rack
LRA 11	SMP-5	SP-5	SB-11	**LCS-1**	All	SC-40		2	2	1 & 2 or 7 & 8
	or		SB-12	**LCS-2**		SC-41		2	2	3 & 4 or 5 & 6
5¼" High	SMP-50	SP-50	SB-13	**LCS-4**			SC-3	1		1, 3, 5 or 7
X	for	for					SC-43	1		2, 4, 6 or 8
21" Deep	EE	EE	SB-14	**LCD-2**		SC-44		2	4	1 & 2 or 7 & 8
			SB-15	**LCD-4**		SC-45		2	4	3 & 4 or 5 & 6
				LCD-A			SC-11	1		1, 3, 5 or 7
							SC-46	1		2, 4, 6 or 8
				LM-A	All	SC-50		2	2	1 & 2 or 7 & 8
				LM-B		SC-51		2	2	3 & 4 or 5 & 6
							SC-52	1		1, 3, 5 or 7
							SC-53	1		2, 4, 6 or 8
				LM-A	5A max.	SC-58		1	1	2, 4, 6 or 8
				LM-B	5A-10A	SC-59		1	1	2, 4, 6 or 8
				LM-C	10A-20A	SC-60		1	1	2, 4, 6 or 8
				LM-CC						
				LM-D	20A-50A	SC-61		1	1	4 or 8
				LM-E	(LM-E)					
					All		SC-53	1		2, 4, 6 or 8
				LM-EE	5A max.	SC-64		1	1	4 or 8
					5A-10A	SC-65		1	1	4 or 8
					10A-20A	SC-66		1	1	4 or 8
					Above 20A	SC-67		1	1	4 or 8
					All		SC-68	1		4 or 8
				LCS-1	All	SC-70		1	1	1, 3, 5 or 7
				LCS-2						
				LCS-4						
				LCD-2	All	SC-71		1	2	1 or 7
				LCD-4		SC-72		1	2	3 or 5
				LCS-1	All	SC-73		2	2	1 & 3
				LCS-2						
				LCS-4		SC-74		2	2	5 & 7
				LM-A, B, C or D with LCS-1, 2, or 4	5A max.	SC-80		2	2	1 & 2 or 7 & 8
						SC-81		2	2	3 & 4 or 5 & 6
				LM-A, B, C or D with LCD-2 or 4	5A max.	SC-83		2	3	1 & 2 or 7 & 8
						SC-84		2	3	3 & 4 or 5 & 6
				LM-A or B with LCD-A	All	SC-83		2	3	1 & 2 or 7 & 8
						SC-84		2	3	3 & 4 or 5 & 6

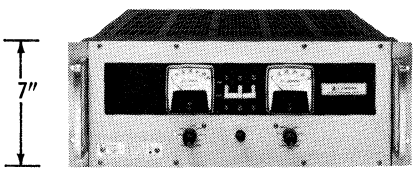


Systems Cable

LAMBDA ELECTRONICS CORP.
A Veeco SUBSIDIARY
515 BROAD HOLLOW ROAD, MELVILLE, L.I., NEW YORK 11746 TEL. 516-694-4200,TWX: 510-224-6484 CABLE: VEECOVAC PLAINVIEW NY

LAMBDA POWER INSTRUMENTS

NEW LB SERIES HIGH-EFFICIENCY, HIGH-CURRENT POWER SUPPLIES



Built-in overvoltage protection is standard on all models up to 70 VDC

Electronic ripple reducer provides 6 mV ripple max.

- **Up to 125 volts; up to 300 amps.**
- **Convection cooled — no internal blowers.**

FEATURES

- **Up to 80% Efficiency**
- **Low Ripple** — 6 mV rms max.
- **All Silicon** design for maximum reliability
- **Convection Cooled** — no blowers, no external heat sinks
- **Overvoltage Protection** — standard on all models up to 70 VDC
- **Remotely programmable**
- **Remote sensing**
- **Transformer** — designed to MIL-T-27C Grade 6

LB SERIES, METERED, FULL-RACK — SIZE: 7" x 19" x 18¾"

Model	Voltage Range	MAX. CURRENT (Amps) AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LB-701-FM-OV	0-7.5	300	270	235	200	$1,450
LB-702-FM-OV	0-15	180	170	160	150	1,450
LB-703-FM-OV	0-36	80	75	70	65	1,200
LB-704-FM-OV	0-60	50	47	44	40	1,300
LB-705-FM	0-125	25	22	19	16	1,100

- **Completely Protected** — Short circuit proof — Continuously adjustable automatic current limiting.
- **Constant I./Constant V.** by automatic crossover
- **Series/Parallel Operation**
- **AC Input:** 208 ±10% — VAC: 57-63 Hz, 3 phase 4 wire
- **Temperature Coefficient:** 0.03% +0.5 mV/°C
- **Guaranteed for 5 years:** The only 5-year guarantee that includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.
- **Multi-Current-Rated** for 40°C, 50°C, 60°C, 71°C

NOTES:

[1] Current rating applies over entire voltage range.

[2] Prices include meters. LB Series models are not available without meters. Prices for all models up to and including 60VDC include built-in overvoltage protection. Prices and specifications are subject to change without notice.

[3] Chassis Slides: Add suffix (-CS) to model number and add $100.00 to price.

LB SERIES UNIQUE SCR CIRCUITRY PROVIDES UP TO 80% EFFICIENCY IN A CONVECTION COOLED 7" PANEL HEIGHT PACKAGE

LB SERIES PERFORMANCE DATA

CONSTANT VOLTAGE:
DC OUTPUT
Regulated Voltage.
Regulation
(line): 0.05% +6 mV for line variations from 187 - 229 VAC or from 229 - 187 VAC.
(load): 0.1% +10 mV for load variations from 0 to full load.
Remote Programming
Resistance: 200 ohms/Volt.
Voltage: Volt per Volt.
Ripple and Noise: 6 mV RMS. max.
Temp. Coef.: .03% +.5 mV/°C.

CONSTANT CURRENT: (Current regulated line and load):
Automatic Crossover.
Voltage Range: As shown in tables.
Current Range: Zero to max. current as shown in tables.
Regulation (line and load combined): Less than 1% for Input Variations from 187 - 299 VAC or from 229 - 187 VAC and from 0 to 95% Eo load voltage change.
Ripple and Noise: Less than 0.1% RMS of load current either pos. or neg. terminal grounded.

AC INPUT: 208 ±10% VAC: 57 - 63 Hz, 3 phase ±10% max. phase unbalance, 4 wire. For operation at other than 57 - 63 Hz consult factory for ratings and specifications. (For 230 ±10% VAC operation, specify V option.)

EFFICIENCY: 70% for LB-701; 80% for LB-703.

AMBIENT OPERATING TEMPERATURE: Continuous duty from 0° to +71°C with load current rating shown in tables.

STORAGE TEMPERATURE: −55°C to +85°C.

LOAD TRANSIENT RESPONSE: 50 msec. to within 1% of Eo max. with load variations from 50% to 100% and 100% to 50% of load.

OVERLOAD PROTECTION
Thermal: Thermostat; requires resetting of circuit breaker to reenergize.
Electrical:
External Overload Protection: Adjustable, automatic electronic current limiting circuit limits the output current to the preset value, thereby providing protection for load as well as power supply. Current limiting settability too 110% of rated current.
Internal Failure Protection: Provided by primary circuit breaker.

INPUT CONNECTIONS: Terminal block on rear of chassis.

OUTPUT CONNECTIONS: Heavy duty studs on rear of chassis.

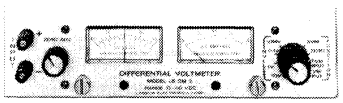
METERS: Independent Voltmeter and Ammeter with ±2% accuracy.

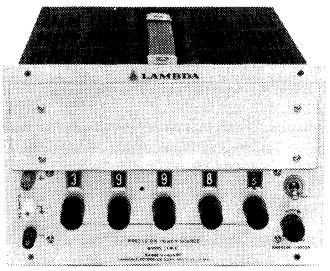
CONTROLS: (Consult Instruction Manual for specific instructions.)
DC output controls: Coarse and fine voltage adjust and coarse and fine current adjust on front panel.
Remote sensing: Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation up to 5 volts in each leg.
Power: Circuit breaker to protect against internal failure and to provide an on-off control on front panel. Pilot lamp on front panel energizes when circuit breaker is "on".

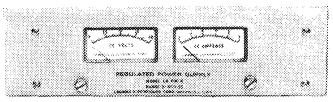
PHYSICAL DATA:
Weight: 185 lbs. net, 225 lbs. ship.
Panel Finish: Brushed aluminum clear anodized panels with grey inlay.
Chassis Finish: Grey, FED. STD. 595 No. 26081.
Size: 7" x 19" x 18¾".

LAMBDA PAGE 22

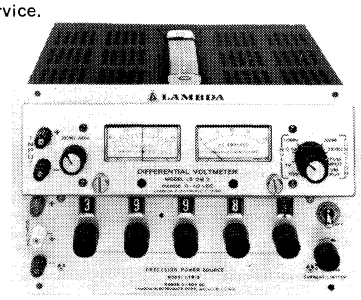
BASIC LS SERIES HIGH PRECISION POWER SOURCE



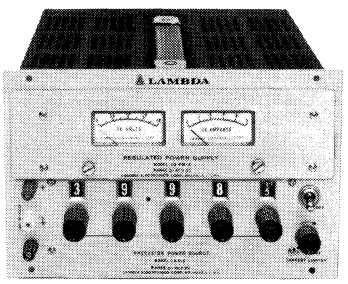




With this plug-in accessory it becomes a High Precision Power Differential Voltmeter that obsoletes any instrument now offered for this service.



With this plug-in accessory it becomes a Metered High Precision Power Supply that offers all these features:



LS Series High Precision Power Differential Voltmeter Data

Basic Non-Metered Model	Voltage Range	MAX. AMSP AT AMBIENT OF[1]				Price[2]	METERED ACCESSORY	
		30°C	40°C	50°C	60°C		Model	Price
LS-511	0-10VDC	2.8A	2.5A	2.1A	1.7A	$375	LS-DM1	$85
LS-512	0-20VDC	1.8A	1.6A	1.3A	1.1A	375	LS-DM2	85
LS-513	0-40VDC	1.0A	0.9A	0.75A	0.6A	375	LS-DM3	85
LS-515	0-120VDC	0.33A	0.29A	0.25A	0.21A	375	LS-DM5	85
LS-516	0-250VDC	0.1A	0.09A	0.08A	0.07A	380	LS-DM6	85

[1] Current rating applies over entire voltage range. Ratings based on 55-65 Hz operation. Derate current 10% for 50 Hz input.

[2] This price is for Precision Power Source only. Addition of Differential Voltmeter Accessory Plug-In (next two columns) is necessary for unit to function as High Precision Power Differential Voltmeter.

LS Series High Precision Power Supply Data

Basic Non-Metered Model	Voltage Range	MAX. AMSP AT AMBIENT OF[1]				Price[2]	METERED ACCESSORY	
		30°C	40°C	50°C	60°C		Model	Price
LS-511	0-10VDC	2.8A	2.5A	2.1A	1.7A	$375	LS-FM1	$55
LS-512	0-20VDC	1.8A	1.6A	1.3A	1.1A	375	LS-FM2	55
LS-513	0-40VDC	1.0A	0.9A	0.75A	0.6A	375	LS-FM3	55
LS-515	0-120VDC	0.33A	0.29A	0.25A	0.21A	375	LS-FM5	55
LS-516	0-250VDC	0.1A	0.09A	0.08A	0.07A	380	LS-FM6	55

[1] Current rating applies over entire voltage range. Ratings based on 55-65 Hz operating. Derate current 10% for 50 Hz input.

[2] This price is for non-metered Precision Power Source. Addition of Metered Accessory Plug-In (next two columns) is necessary to have Metered High Precision Power Supply.

OVERVOLTAGE PROTECTION

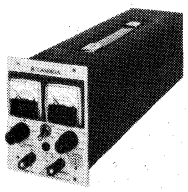
For Use With	Model	Adj. Volt. Range	Price
LS-511	LHOV-4	3-24 V	$35
LS-512	LHOV-4	3-24 V	$35
LS-513	LHOV-5	3-47 V	$35

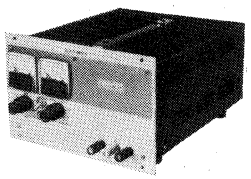
- **Draw power as you measure voltage** — The first and only differential voltmeter to furnish high stability power output while being used as a voltmeter . . . no need for a separate power supply.
- **0.0005% plus 100 μV regulation** — Best of any high stability power supply in this price range.
- **Ripple** — 35 μV rms; 100 μV p-p.
- **0.01% +1mV accuracy**
- **Illuminated Digital Readout Millimatic (TM) gang dialing** — 5 digital voltage dials with automatic decade switching provides convenient precise adjustment (200 μV resolution over entire range).
- **2 meters** — Monitor both voltage and current simultaneously and continuously.
- **Guaranteed for 5 years** — The only 5-year guarantee that includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.
- **Multi-Current-Rated** for 30°C, 40°C, 50°C, 60°C — Covers temperatures most often encountered in laboratory work.
- **5 Models** — With ranges of 0-10, 0-20, 0-40, 0-120, 0-250VDC — Wide selection of ranges to suit your specific needs.
- **Only 5¼" high** — Convenient half rack size for rack or bench use.
- **Stability** 0.001% +100 μV for 8 hours.
- **All-silicon design** for maximum reliability.
- **Convection-cooled** for convenience and reliability . . . no blowers or heat sinks.
- **Remote programming** by changes in voltage or resistance for convenience in systems, test equipment and automatic equipment applications.
- **Auto Series/Auto Parallel** with Master-Slave tracking
- **Constant I/Constant V** by automatic crossover.
- **Completely protected:** short-circuit proof; continuously adjustable automatic current limiting.
- **Overvoltage protection** available as low cost add-on accessory (see page 44).
- **Rubber Feet** provided for bench use.
- **Mount in Rack Adapters** — LRA-1 ($60.00) or LRA-2 ($35.00). Rack adapter LRA-1 only is available with chassis slides mounted. Add suffix "CS" to rack adapter model number and $50 to price.

LAMBDA ELECTRONICS CORP.
A Veeco SUBSIDIARY
515 BROAD HOLLOW ROAD, MELVILLE, L.I., NEW YORK 11746 TEL. 516-694-4200,TWX: 510-224-6484 CABLE: VEECOVAC PLAINVIEW NY

LR SERIES HIGH PERFORMANCE POWER SUPPLIES (0.0005% +100 μV Regulation)

New ¼-rack size as well as ½-rack size provides even more versatility at low cost.





Four ¼-rack Models

Model	Voltage Range	MAX. AMPS AT AMBIENT OF[1] 30°C	40°C	50°C	60°C	Price[2]
LR-602-FM	0-20VDC	1.1A	0.95A	0.80A	0.64A	$265
LR-603-FM	0-40VDC	0.60A	0.50A	0.42A	0.33A	265
LR-605-FM	0-120VDC	0.23A	0.20A	0.17A	0.14A	295
LR-606-FM	0-250VDC	80ma	72ma	65ma	60ma	310

Four ½-rack Models

Model	Voltage Range	MAX. AMPS AT AMBIENT OF[1] 30°C	40°C	50°C	60°C	Price[2]
LR-612-FM	0-20VDC	1.8A	1.6A	1.3A	1.1A	$305
LR-613-FM	0-40VDC	1.0A	0.9A	0.75A	0.6A	305
LR-615-FM	0-120VDC	0.33A	0.29A	0.25A	0.21A	320
LR-616-FM	0-250VDC	100ma	90ma	80ma	70ma	340

[1] Current rating applies over entire voltage range. Ratings based on 55-65 Hz operation. Derate current 10% for 50 Hz input.
[2] Prices are for metered models. LR Series models are **not** available without meters. Prices F.O.B. factory, Melville, N. Y. All specifications and prices subject to change without notice.

Overvoltage Protection

For Use With	Model	Adj. Volt. Range	Price
LR-602-FM, LR-612-FM	LH-OV-4	3-24 V	$35
LR-603-FM, LR-613-FM	LH-OV-5	3-47 V	35

- **0.0005% plus 100 μV regulation.**
- **35 μV rms ripple.**
- **AC Input:** 105-132 VAC, 47-440 Hz (derate dc output current 10% at 50 Hz). 205-265 VAC at no extra charge. ("-V" option).
- **2 meters** monitor both voltage and current simultaneously and continuously.
- **With Remote Programming**
  Accuracy — 0.01% plus 1mV
  Stability — 0.001% plus 100 μV for 8 hours
  Temp. Coeff. — 0.001% plus 10 μV/°C
- **Guaranteed for 5 years.** The only 5-year guarantee that includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.
- **Multi-Current-Rated.**
- **Only 5¼" high.** Convenient ¼ and ½ rack sizes for rack or bench use.
- **All-silicon** design for maximum reliability.
- **Convection cooled** for convenience and reliability . . . no blowers or heat sinks.
- **Remote programming** by changes in voltage or resistance for convenience in systems, test equipment and automatic equipment applications.
- **Auto Series/Auto Parallel** with Master-Slave tracking.
- **Constant I/Constant V** by automatic cross-over.
- **Completely protected:** short-circuit proof; continuously adjustable automatic current limiting.
- **Overvoltage protection** available as low cost add-on accessory.

LR Series

DC OUTPUT:

Regulated Voltage

Regulation (line) ..... 0.0005% plus 100 μV for line variations from 105-132 VAC.
(load) ..... 0.0005% plus 100 μV for load variations from 0 to full load.
Remote Programming
Resistance ..... 1000 ohms/volt. nominal
Voltage ..... volt per volt.
Ripple and Noise ..... 35 μV RMS, 100 μV p to p with either pos. or neg. terminal grounded, with 60 Hz input.
Temp. coef.* ..... 0.001% plus 10 μV/°C

CONSTANT CURRENT: (Current regulated line or load):

Automatic Crossover:

Voltage Range ..... As shown in Tables.
Current Range ..... Continuously adjustable from 1% to 100% of 30° rating.
Regulation (line or load) Less than 2.0ma for input variations of 105-132 VAC and from 0 to rated VDC load voltage change.
Ripple and Noise ..... Less than 500 μa with either pos. or neg. terminal grounded.

OVERLOAD PROTECTION:

Thermal ..... Thermostat; automatic reset when over-temperature condition is removed.
Electrical: External
Overload Protection ..... Adjustable automatic electronic current limiting circuit limits the output current to the preset value, thereby providing protection for load as well as power supply. Current limiting settability to 105% of rated current.
Internal Failure
Protection ..... Provided by fuse.

* Remote programming mode only.

ACCURACY:* 0.01% plus 1mv at 25°C.

STABILITY:* 0.001% plus 100 μV over any 8-hour period after 30-minute warmup.

AMBIENT OPERATING TEMPERATURE: Continuous duty from 0° to +60°C with load current ratings shown in table.

STORAGE TEMPERATURE: −55°C to +85°C.

INPUT & OUTPUT CONNECTIONS: Covered DC output and AC input terminal blocks on rear of chassis.

CONTROLS: (Consult Instruction Manual for specific instructions.)

DC output control ..... Coarse and fine front panel concentric controls.
Current limiter ..... Coarse and fine front panel concentric controls.
Remote Sensing ..... Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation, rear panel.
Power ..... ON-OFF toggle switch, front panel.

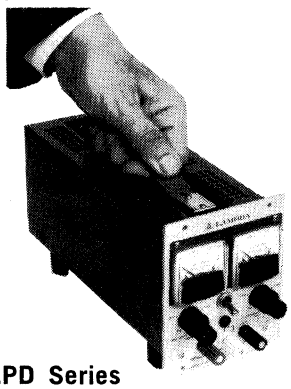
AC INPUT: 105-132 VAC, 47-440 Hz (derate dc output current 10% at 50 Hz). 205-265 VAC at no extra charge. ("-V" option).

PHYSICAL DATA:

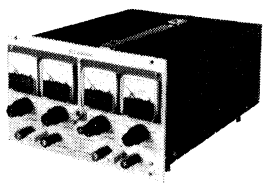
Size ..... LR-602-FM—606 FM
5 3/16"H x 4 3/16"W x 15½"D
LR-612-FM—616 FM
5 3/16"H x 8 3/8"W x 10⅝"D
Weight ..... LR-602-FM—606 FM
11 lbs. net; 14 lbs. ship.
LR-612-FM—16 FM
14 lbs. net; 17 lbs. ship.
Panel Finish ..... Brushed aluminum clear anodized panels with grey inlay (standard).

All specifications subject to change without notice.

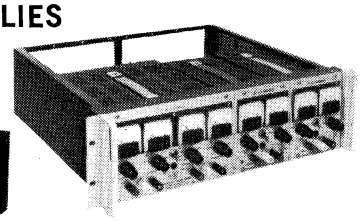
LP SERIES GENERAL PURPOSE/SINGLE OUTPUT
LPD SERIES GENERAL PURPOSE/DUAL OUTPUT POWER SUPPLIES



LP-414-FM



Two Single Output LP Models and one Dual Output LPD Models in a single rack.



Twice the voltage (up to 500 VDC) with outputs in series.
Twice the current (up to 3.4 amps) with outputs in parallel.

Features of LPD Series Dual Output Power Supply

- **5 Models with two independent DC outputs offer widest choice** — Up to ±250 VDC, up to 1.7 amps. Either output may be + or −, or both outputs may be + or −.
- **Series/Parallel operation** of both outputs yields two times the voltage or two times the current — up to 500 volts or up to 3.4 amps
- **Auto Series/Auto Parallel (master-slave)** permits tracking to a common reference
- **4 Meters** provide simultaneous monitoring of both voltage and current.
- **Most power** in a half-rack package
- **Most Amps per dollar**
- **Overvoltage Protection** as an accessory
- **Compatible** with LP, LH and LK Series rack adapters and other accessories
- **Multi-Current-Rated** — Only dual power supplies on market with this advanced design feature
- **Regulation** — .01% +1mV
- **Ripple** — 500 μV RMS (1.5 mV p-p)

Additional Features of LP and LPD Series

- **Guaranteed for 5 years.** Lambda is the only power supply manufacturer who provides a 5-year guarantee on materials and labor.
- **Regulation** (line or load) — .01% +1mV.
- **Ripple** — 500 μV RMS, 1.5mV p-p. Models LP-415 and LP-425-FM only: 1mV RMS, 3mV p-p.
- **Temperature Coefficient** — .015% +.5mV/°C.
- **A-C Input** — 105-132 VAC 47-440 Hz (ratings based on 57-63 Hz operation). For operation at 205-265 VAC, add suffix "-V" to model numbers. No change in price.
- **Multi-Current-Rated** at 30°C, 40°C, 50°C and 60°C.
- **Designed for bench and rack use.**
- **All silicon transistors.**
- **Series/parallel operation.**
- **Continuously variable.**
- **Remotely programmable.**
- **Constant voltage/constant current.**
- **Designed to meet RFI** per MIL STD 826A.
- **Remote sensing.**
- **Fungus Proofing Option** — Add suffix "R" to model number and add $15.00 to price.

LPD SERIES — Size 5 1/16" x 8 1/8" x 10 5/8"

Model	Voltage Range Per Output/ Outputs In Series - VDC	I MAX. AMPS AT AMBIENT OF[1] Per Output/Outputs in Parallel				Price (2)
		30°C	40°C	50°C	60°C	
*LPD-421-FM	0±20/0-40	1.7A/3.4A	1.5A/3.0A	1.3A/2.6A	0.9A/1.8A	$325
*LPD-422-FM	0±40/0-80	1.0A/2.0A	0.85A/1.7A	0.7A/1.4A	0.55A/1.1A	260
*LPD-423-FM	0±60/0-120	0.7A/1.4A	0.6A/1.2A	0.5A/1.0A	0.4A/0.8A	325
LPD-424-FM	0±120/0-240	0.38A/0.76A	0.32A/0.64A	0.26A/0.52A	0.20A/0.40A	325
LPD-425-FM	0±250/0-500	0.13A/0.26A	0.12A/0.24A	0.11A/0.22A	0.10A/0.20A	350

LPD NOTES:
* Overvoltage Protection available as an accessory. Each output requires separate OV accessory — add $35.00 for each output.
[1] Current rating applies over entire voltage range. Ratings based on 57-63 Hz operation.
[2] Prices are for metered models. LPD Series models are not available without meters.

LP SERIES — Size 5 3/16" x 4 3/16" x 10"

Model	Voltage Range	CURRENT RANGE AT AMBIENT OF[1]				Price[2] U.S. and Canada
		30°C	40°C	50°C	60°C	
LP-410	0-10 VDC*	0-2A	0-1.8A	0-1.6A	0-1.4A	$129
LP-411	0-20 VDC*	0-1.2A	0-1.1A	0-1.0A	0-0.8A	119
LP-412	0-40 VDC*	0-0.70A	0-0.65A	0-0.60A	0-0.50A	114
LP-413	0-60 VDC*	0-0.45A	0-0.41A	0-0.37A	0-0.33A	129
LP-414	0-120 VDC	0-0.20A	0-0.18A	0-0.16A	0-0.12A	149
LP-415	0-250 VDC	0-80mA	0-72mA	0-65mA	0-60mA	164

LP NOTES:
* Overvoltage Protection available as an accessory — $35.00 each.
[1] Current rating applies over entire voltage range.
[2] Prices are for non-metered models. For metered models, add suffix (-FM) and Add $10.00 to price.

OVERVOLTAGE PROTECTION

For Use With	Model	Adj. Volt Range	Price*
LP-410; (0-10VDC)	LH-OV-4	3-24V	$35
LP-411; LPD-421-FM (0-20VDC)	LH-OV-4	3-24V	35
LP-412; LPD-422-FM (0-40VDC)	LH-OV-5	3-47V	35
LP-413; LPD-423-FM (0-60VDC)	LH-OV-6	3-70V	35

* Price is for a single overvoltage accessory. LPD Series models require one LHOV for each output.

LP AND LPD SERIES DATA

DC OUTPUT:
Regulated Voltage
Regulation (line or load) .....0.01% +1mV.
Current Range .....As shown in table.
Remote Programming
Resistance .....200 ohms/volt.
Voltage .....Volt per volt.
Ripple and noise .....500 μV RMS, 1.5mV p to p (either + or − terminal grounded). LP-415 and LP-425-FM models only — 1mV RMS, 3mV, p-p.
Temperature coefficient .....0.015% +0.5mV/°C.

CONSTANST CURRENT: **(Current regulated line and load)**
Automatic Crossover
Voltage Range .....As shown in table.
Current Range .....Min: 5mA or 1% whichever is greater. Max: as shown in table.
Regulation (line or load) .....Less than 0.2% or 5mA.

AC INPUT 105-132 VAC; 45-440 Hz.

OVERLOAD PROTECTION:
Thermal .....Thermostat, automatic reset.
Electrical: External Overload Protection Adjustable, automatic electronic current limiting, settable to 105% of rated current.
Internal Failure Protection .....Provided by fuse.

AMBIENT OPERATING TEMPERATURE Continuous duty from 0° to +60°C.

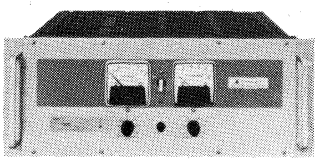
STORAGE TEMPERATURE −55°C to +85°C.

INPUT & OUTPUT CONNECTIONS: Covered terminal block on rear of chassis; five-way binding posts on front panel. On LPD models one set of five-way binding posts is provided for each output.

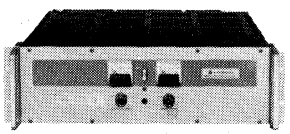
METERS: Voltmeter and ammeter. For LPD Models a voltmeter and ammeter is provided for each separate output.

LAMBDA ELECTRONICS CORP.
A Veeco SUBSIDIARY
515 BROAD HOLLOW ROAD, MELVILLE, L.I., NEW YORK 11746 TEL. 516-694-4200,TWX: 510-224-6484 CABLE: VEECOVAC PLAINVIEW NY

LK SERIES HIGH CURRENT POWER SUPPLIES
LH SERIES GENERAL PURPOSE POWER SUPPLIES



7" metered full-rack



5¼" metered full-rack

3 FULL-RACK MODELS — Size 7" x 19" x 18½"

Model[2]	Adj. Volt. Range VDC	CURRENT RANGE AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LK-360 FM	0-20	0-66A	0-59A	0-50A	0-40A	$995
LK-361 FM	0-36	0-48A	0-43A	0-36A	0-30A	950
LK-362 FM	0-60	0-25A	0-24A	0-22A	0-19A	995

3 FULL-RACK MODELS — Size 5¾6" x 19" x 16½"

Model[2]	Adj. Volt. Range VDC	CURRENT RANGE AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LK-350	0-20	0-35A	0-31A	0-26A	0-20A	$675
LK-351	0-36	0-25A	0-23A	0-20A	0-15A	640
LK-352	0-60	0-15A	0-14A	0-12.5A	0-10A	650

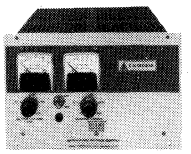
6 HALF-RACK MODELS — Size 5¾6" x 8⅜" x 16½"

Model[2]	Adj. Volt. Range VDC	CURRENT RANGE AT AMBIENT OF[1] 40°C	50°C	60°C	71°C	Price[2]
LK-340 A	0-20	0-8.0A	0-7.0A	0-6.1A	0-4.9A	$330
LK-341 A	0-20	0-13.5A	0-11.0A	0-10.0A	0-7.7A	385
LK-342 A	0-36	0-5.2A	0-5.0A	0-4.5A	0-3.7A	335
LK-343 A	0-36	0-9.0A	0-8.5A	0-7.6A	0-6.1A	395
LK-344 A	0-60	0-4.0A	0-3.5A	0-3.0A	0-2.5A	340
LK-345 A	0-60	0-6.0A	0-5.2A	0-4.5A	0-4.0A	395

ACCESSORY OVERVOLTAGE PROTECTION

For Use With	Model	Adj. Volt. Range	Price
LK-340A, 341A	LH-OV-4	3-24VDC	$35
LK-342A, 343A	LH-OV-5	3-47VDC	35
LK-344A, 345A	LH-OV-6	3-70VDC	35
LK-350-352 LK-360 FM-362 FM	Overvoltage Protection up to 70 VDC as a built-in option for full-rack models. To order, add suffix (-OV) and add $90.00 to price of models LK-350-352, add $120.00 for models LK-360-FM-362-FM.		

½ RACK model (metered)

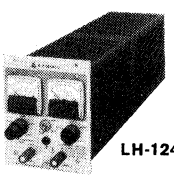


LH-125-FM

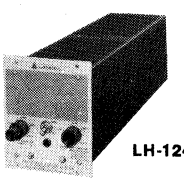
SIZE 5¾6" x 8⅜" x 15⅝" PATENTS PENDING

Model[2]	Adj. Volt. Range VDC	CURRENT RANGE AT AMBIENT OF[1] 30°C	50°C	60°C	71°C	Price[2]
LH-119A	0-10	0-9.0A	0-8.0A	0-6.9A	0-5.8A	$289
LH-122A	0-20	0-5.7A	0-4.7A	0-4.0A	0-3.3A	260
LH-125A	0-40	0-3.0A	0-2.7A	0-2.3A	0-1.9A	269
LH-128A	0-60	0-2.4A	0-2.1A	0-1.8A	0-1.5A	315
LH-131	0-120	0-1.2A	0-0.9A	0-0.8A	0-0.6A	320

¼ RACK metered and non-metered



LH-124-A-FM



LH-124-A

SIZE: 5¾6" x 4¾6" x 15½"

Model[2]	Adj. Volt. Range VDC	CURRENT RANGE AT AMBIENT OF[1] 30°C	50°C	60°C	71°C	Price[2]
LH-118A	0-10	0-4.0A	0-3.5A	0-2.9A	0-2.3A	$180
LH-121A	0-20	0-2.4A	0-2.2A	0-1.8A	0-1.5A	170
LH-124A	0-40	0-1.3A	0-1.1A	0-0.9A	0-0.7A	170
LH-127A	0-60	0-0.9A	0-0.7A	0-0.6A	0-0.5A	185
LH-130	0-120	0-0.5A	0-0.4A	0-0.35A	0-0.25A	240

ACCESSORY OVERVOLTAGE PROTECTION

For Use With	Model	Adj. Volt. Range	Price
LH-118A—122A	LH-OV-4	3-24VDC	$35
LH-124A—125A	LH-OV-5	3-47VDC	35
LH-127A—128A	LH-OV-6	3-70VDC	35

NOTES: LK & LH Series

[1] Current rating applies over entire voltage range.

[2] Prices are for non-metered models (except for models LK-360-FM, LK-361-FM, and LK-362-FM which are metered models not available without meters). For metered models, add suffix (-FM) and add $30.00 to price.

[3] Overvoltage Protection up to 70 VDC is available as a bolt-on accessory for models with suffix (A). To order, see chart. For full-rack models, overvoltage protection up to 70 VDC is available as a built-in option. To order add suffix (-OV) and add $90.00 to price of models LK-350-352; add $120.00 for models LK-360-FM-362-FM.

[4] Chassis Slides for full rack models: Add suffix (-CS) to model number and add $60.00 to the price, except for models LK-360-FM-LK-362-FM, for which add $100.00

FEATURES AND DATA

- **All Silicon**
- **Convection Cooled — no blowers, no external heat sinks**
- **Overvoltage Protection** — Available for all models up to 70 VDC
- **Remotely Programmable**
- **Remote Sensing**
- **Temperature Coefficient** .015%/°C +.5mV/°C
- **Transformer** — designed to MIL-T-27 Grade 6
- **Completely Protected** — Short circuit proof — Continuously adjustable automatic current limiting
- **Constant I./Constant V.** by automatic crossover
- **Meet Mil. Environment Specs.**
  Vibration: MIL-T-4807A
  Shock: MIL-E-4970A Proc. 1 & 2
  Humidity: MIL-STD-810 Meth. 507
  Temp. Shock: MIL-E-5272C (ASG) Proc. 1
  Altitude: MIL-E-4970A (ASG) Proc. 1
  Marking: MIL-STD-130
  Quality: MIL-Q-9858
- **Series/Parallel Operation**
- **No Voltage Spikes or Overshoot** on "turn on", "turn off" or power failure
- **Wide Input Voltage and Frequency Range** —
  Models LK 360 FM, LK 361 FM, 362 FM — 188-238 VAC, 57-63 Hz
  Other LK models — 105-132 VAC, 57-63 Hz
  LH models — 105-135 VAC, 45-480 Hz
- **LH models meet RFI Spec.** — Mil-I-16910
- **AC Input Option** — For operation at 205-265 VAC, add suffix "-V" to model numbers. No change in price.
- **Fungus Proofing Option** — Add suffix "R" to model number and add $20.00 to price.

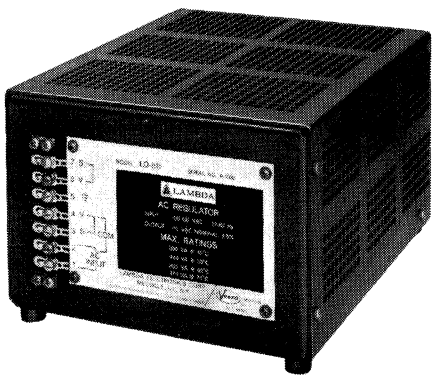
LAMBDA PAGE 26

LAMBDA

NEW solid state ac power conditioner

LD series

• less than 1% regulation, line or load • less than 3% distortion



Lambda LD Series AC Power Conditioner

FEATURES

- **Regulation**, Line or load: less than 1%
- **Response Time:** Less than 50 msec.
- **All Silicon Semiconductors**
- **Convection Cooled**—No external heat sinks
- **Sinusolidal Output**—Less than 3% distortion
- **High Efficiency**—Greater than 80%
- **Wide Power Factor Range:** +0.7 PF leading to 0 PF lagging
- **Remote Sensing**
- **Adjustable Output Voltage**
- **Multi-Current-Rated:** 40°, 50°, 60°, 71°
- **Wide Frequency Range:** 57-63 Hz
- **Wide Temperature Range:** 0 to 71°C
- **Automatic Current Limiting**: Protects load as well as power supply
- **Completely Repairable**—All components replaceable
- **Guaranteeed For 5 Years**—Material *and* labor
- **Mounting Flexibility**—Can be mounted on any of three mutually perpendicular planes, and in any position... mounting not influenced by heat sink or air flow considerations.

DESCRIPTION

Lambda, the world's largest unit producer of DC power supplies, now offers a new line of solid state AC Power Line Conditioners for use with electronic test equipment, electronic systems, lighting and heating equipment, motor starting controls, measurement instrumentation and other applications where AC line conditioning is required.

The new Lambda Power Conditioners, LD Series, feature a unique circuitry design that provides fast acting RMS regulation independent of power factor and input frequency. Efficiency is greater than 80%.

The LD Series has current limiting with time delay for starting lamps and small motors with minimum voltage dip. The automatic current limiting circuit limits the output current to within 140% of the 40°C current rating at short circuit, providing protection for the load as well as the power supply.

The new LD Series has a wide power factor range from 0.7 PF leading to 0 PF lagging, and is multi-current-rated to 71°C, with no external heat sinks.

The LD Series is all silicon and convection cooled and is designed to meet conducted portions of MIL-STD-461 for RFI/EMI.

Other features include automatic overload resetting, thermostat protection and remote sensing. The unit is fully repairable and is fully guaranteed for 5 years to rated specifications for *both* material and labor.

LD SERIES

Size: 4 15/16" x 7½" x 9⅜"

MODEL	MAXIMUM VA AT AMBIENT TEMPERATURE				
	40°	50°	60°	71°	PRICE
LD-811	500 VA	440 VA	300 VA	170 VA	$150

NOTE 1: PRICE IS FOB MELVILLE, NEW YORK. ALL PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

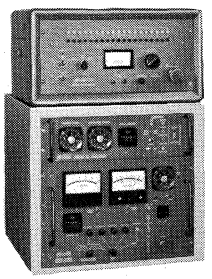
MACARR, INC.

Specialists in Reliable State-of-the-Art Static Power & Control Equipment

BATTERY SERVICE AND ANALYSIS EQUIPMENT

Complete line of units for testing, evaluation, and maintenance of all types of batteries (nickel cadmium, silver zinc, lead acid, silver cadmium, etc.), in all ratings.

Standard and Custom Units for Industrial and Military Applications.



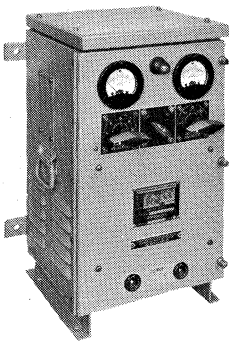
Model 50 Cell-Scanner Individual Cell Performance Tested Automatically. 19 Cells — Adjustable Failure Voltage 0.5 to 2.0 Volts. Model 50 A — 23 Cells.

ANDAC Battery Charger, Discharger, Analyzer. Model 12-30. 1-101 0-30 V, 0-30 A.

COMPLETE LINE OF BATTERY CHARGING EQUIPMENT

High performance chargers for use with aircraft batteries, all types of Alkaline batteries, fork lift truck batteries, central station and microwave station batteries, etc.

Standard and Custom/ Commercial & Military Units.

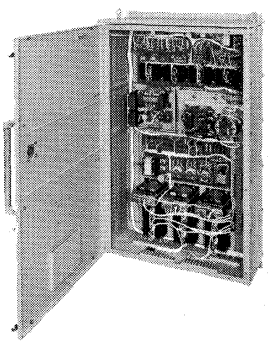


40 — 30 BCN Multi-Purpose Portable Charger 6, 8, 12, 24, 36 Volts up to 30 A Mil-B-24095

MOTOR GENERATOR CONTROL EQUIPMENT

Standard and Custom Units for Naval Shipboard and other applications. Ratings to 200 KW, DC & AC.

A.C. Variable Speed Drive Systems. Ratings from 10-200 HP. For centrifugal pumping applications of all fluids. Standard and Custom Designs.

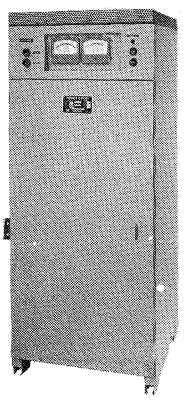


Control Panel 5 KW 60 to 400 Cycle. Precise Frequency Voltage Regulated Naval Shipboard Motor Generator System.

INDUSTRIAL POWER SUPPLIES FOR ELECTROPLATING AND OTHER APPLICATIONS

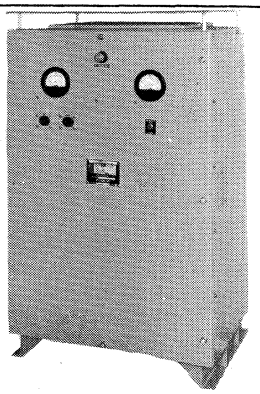
Unregulated and regulated units utilizing Solid State and Magnetic Power Control.

Standard and Custom Units to 500 Volts and 20,000 Amperes.



D.C. POWER SUPPLIES

Unregulated and regulated types. For ground power, industrial, computer, general purpose and special purpose applications. Complete line of Zenon lamp Supplies and igniters to 25 KW. Regulated units utilize magnetic, controlled rectifiers, transistors for power control. Standard and custom units for commercial and military applications. To 1000 Volts and 20,000 Amperes.



Precisely Regulated Power Supply for Naval Shipboard Helicopter Starting and Servicing. 28 V 450 A

Solid State Inverters, Converters and Frequency Changers. Complete uninterrupted power supplies from 1 to 15 KVA. Standard and Custom Units for Commercial and Military Applications.

Complete "In House" design and manufacturing facility. Quality Assurance under Mil-Q-9858 and Mil-I-45208. Call or write regarding your power problems.

MACARR, INC.

subsidiary of Tenney *Engineering, Inc.*

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(212) 325-5510 TWX 710-593-3437

MALLORY BATTERIES

DURACELL® Alkaline Batteries

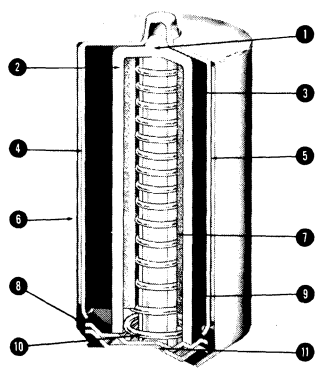
Construction

Improved alkaline manganese construction — A new internal construction increases the surface area of the anode in relation to cell volume. Conductivity of Mallory Alkaline Manganese batteries is thus improved and impedance is lowered. The result — more hours of service at heavier loads and lower temperatures. The case and case seal also have been redesigned to give improved protection at both the top and bottom, producing additional compression points in the joints to provide physical stability even under severe vibration.

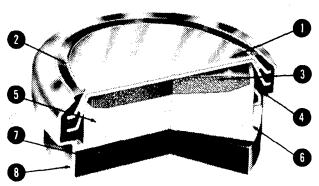
New flat configuration — Mallory Alkaline Manganese batteries, available in all standard sizes in the cylindrical configuration, are now also available in some special sizes in a flat configuration.

Designation and Characteristics

Cell Designation	Std. Size	Nom. Volts	Diam. In.	Ht./In.	Approx. Wt./Oz.
Mn-1300	D	1.5	1.31	2.37	5.03
Mn-1400	C	1.5	1.02	1.94	2.34
Mn-1500	AA	1.5	0.55	1.96	.82
Mn-2400	AAA	1.5	0.40	1.74	.40
Mn-9100	N	1.5	0.46	1.12	.34
Px-825	—	1.5	0.90	0.22	.25



1. INSULATOR
2. ABSORBENT AND ALKALINE ELECTROLYTE
3. MANGANESE DIOXIDE DEPOLARIZER
4. INNER CAN
5. ADAPTER SLEEVE
6. OUTER CAN
7. ZINC ANODE
8. CELL SEAL (GROMMET)
9. BARRIER
10. CONTACT SPRING
11. DOUBLE CELL TOP



FLAT PELLET STRUCTURE

1. DOUBLE CELL TOP
2. CELL SEAL (GROMMET)
3. ZINC ANODE
4. INSULATING RING
5. ABSORBENT AND ALKALINE ELECTROLYTE
6. BARRIER
7. MANGANESE DIOXIDE DEPOLARIZER
8. CELL CONTAINER

Other Mallory High-Energy Battery Systems

Mallory manufactures many other basic battery systems • Among these are **low voltage systems** — either 0.9 or 0.5 volts nominal rated output • **Silver oxide types** — 1.50 volts for use in hearing aids •

Mallory Battery Engineering Service

The Mallory Battery Company has a staff of battery applications engineers available as a service to designers. This group has extensive experience with product design problems involving electrochemical power sources of all types. To take advantage of their services including battery design consulting service, drawings, specifications and prototype samples, please write to the Technical Sales Department, Mallory Battery Company, a division of P. R. Mallory & Co., Inc., South Broadway, Tarrytown, New York 10591. Or telephone 914 - 591-7000.

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Standard Mallory components are available from authorized Mallory distributors throughout the United States.

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a division of P. R. MALLORY & CO. INC.
S. Broadway, Tarrytown, New York, 10591; Telephone: 914-591-7000

MALLORY BATTERIES

DURACELL® Reserve Alkaline Batteries

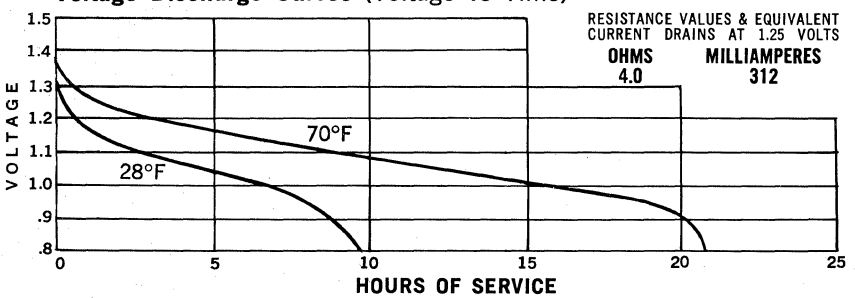


In this battery the electrolyte is stored separately from the active electrochemical components, resulting in extraordinarily long shelf life. The battery may be activated upon demand by twisting the top terminal cap which puts the battery into service by releasing the electrolyte into the cell. This alkaline managanese cell utilizes a new concept in anode design which exhibits high efficiency over a wide temperature range. Momentary high current pulses in the range of 12 to 15 amperes are possible. Activation time is approximately 2 seconds when the cell is not under load. When under a 4 ohm load, the activation time to a 1.35 volt level is less than 19 seconds at 70°F and less than 30 seconds at 30°F. Suggested applications are emergency lighting and communications equipment, military ordnance devices and in any use where long shelf life is of prime importance.

Specifications:

Nominal Voltage:	1.50
Rated Capacity:	6000 mah
Rated Capacity At:	0 to 500 ma
Diameter:	1.285 ±.005
Height:	2.367 ±.015
Volume:	4.1 cu. in.
Weight:	4.25 oz.

Voltage Discharge Curves (Voltage vs Time)



DURACELL® Rechargeable Alkaline Batteries

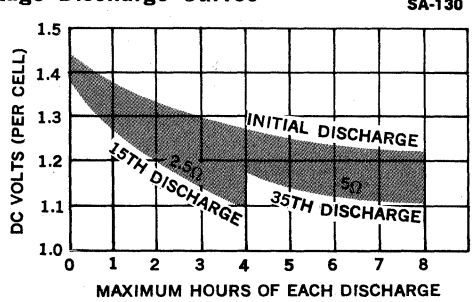


Mallory Duracell® Rechargeable Alkaline Batteries, properly used and charged, provide a practical rechargeable battery system at a fraction of the cost of other rechargeable systems. Electrically and dimensionally interchangeable with standard "D", "C" and "AA" zinc carbon and managanese alkaline primary batteries, they may be directly substituted for these battery types in many consumer and industrial equipments where low initial and operation costs are required, such as: portable battery operated television receivers, radios, phonographs, tape recorders, cameras, flashlights, lanterns, toys, cordless small appliances, etc. They should not be used as replacements in equipment, such as certain power tools, razors, toothbrushes, carving knives, etc., in which nickel cadmium batteries were originally used.

CHARGE RATINGS

Mallory Battery Type	Size	Re-able charge-Capac-ity In Ampere Hours	Maximum Recommended Discharge Current and Load Resistance Per Cell for Up To: 16 hours	Ohms	8 hours	Ohms	4 hours	Ohms
SA-13D	D	2.0	125 ma	10	250 ma	5	500 ma	2.5
SA-14C	C	1.0	62.5 ma	20	125 ma	10	250 ma	5
SA-15AA	AA	.3	18¾ ma	70	37.5 ma	35	75 ma	17.5

Voltage Discharge Curves (DC VOLTAGE VS. TIME AT 72°F) SA-130



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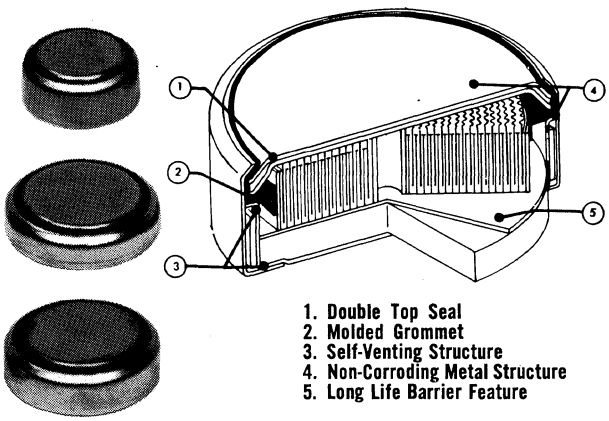
MALLORY

MALLORY BATTERIES

Mercury Cells — Medium to Low Temperature



1. Double Top Seal
2. Molded Grommet
3. Self-Venting Structure
4. Non-Corroding Metal Structure
5. Long Life Barrier Feature

Applications

This cell packages up to 45 watt hours per pound, with numerous applications in the field of air-sea-rescue transceivers, emergency beacons, etc.

The long shelf life allows storage of battery packages in bunkers of rescue boats, life rafts, survival kits, and depots and caches. The Sonobuoy development program will benefit greatly from this unit. The cell is electrically quiet, and is capable of being checked prior to target missions and subsequent use. Recommended uses are in navigational buoys, subsea countermeasures, oceanographic devices, etc., especially where service requirements are greater than 72 hours of duty. The cells can be turned off without interim internal capacity losses. The economies in operation which are effected are significant due to the high efficiency of these cells.

Marker lights, intermittent stroboscopic flash devices, fuses, telemetry devices, remotely operated unattended stations requiring small blocks of power for warning devices, relay trips, etc.

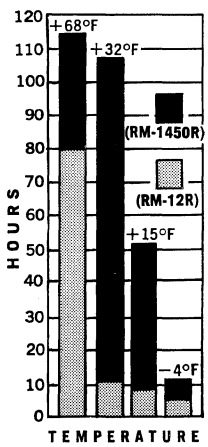
As a consequence of the extended temperature range, moon missiles and satellites which have radiation controlled temperatures in the area of 0°F. to 160°F. will provide greater data transmission time during flight. No pressure containers are required since cells will operate in complete vacuum. Ground testing prior to shots will indicate flight performance.

Cell Specifications

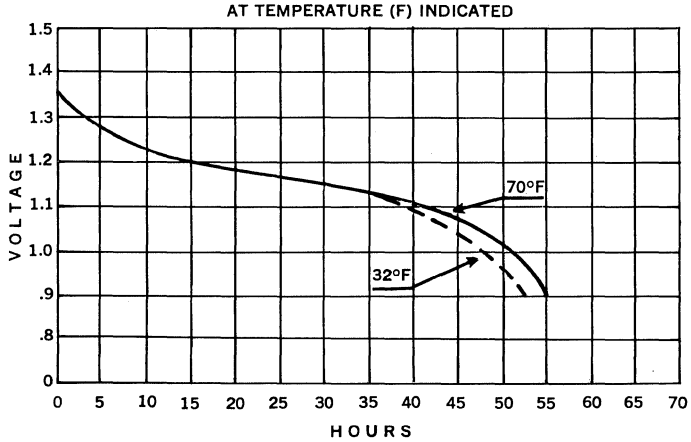
Cell Type Number	Max. Diam. Ins.	Ht. Ins.	Wt. Ozs.	No Load Voltage	Rated Capacity Milliamp.-Hrs.
RM-640WA	.625	.380	.23	1.35 V	360
RM- 3WA	.980	.465	.77	1.35 V	1,500
RM-1438R	1.462	0.390	1.40	1.35 V	2,700
RM-1450R	1.462	0.520	1.85	1.35 V	4,500
RM-2550R	2.553	0.545	6.23	1.35 V	13,000

Typical Service Life For RM-1450R

Temp. F	25 Ohm Load	12 Ohm Load
70°F	90 hrs.	48 hrs.
32°F	85 hrs.	27 hrs.
0°F	20 hrs.	8 hrs.
−20°F	6.5 hrs.	1.75 hrs.



RM-1438R DISCHARGED THRU 25Ω CONTINUOUS AT TEMPERATURE (F) INDICATED



Mercury Sizes and Configurations

TYPE	RM-212	RM-312	RM-13	RM-400R	RM-575	RM-41	RM-675
CAPACITY MAH	16	45	65	70	100	105	180
RATED DRAIN MA	.75	2	1	2	3	2	5
DIAMETER (INCHES)	.220	.305	.300	.450	.450	.450	.450
HEIGHT (INCHES)	.130	.135	.205	.130	.130	.155	.200
WEIGHT (OUNCES)	.01	.02	.03	.04	.05	.07	.09
TYPE	RM-625R	RM-630	RM-450R	RM-640WA	RM-640R	RM-660	RM-822
CAPACITY MAH	250	350	350	360	500	600	750
RATED DRAIN MA	5	5	5	15	15	15	15
DIAMETER (INCHES)	.610	.610	.450	.625	.620	.680	.900
HEIGHT (INCHES)	.233	.233	.565	.380	.435	.295	.222
WEIGHT (OUNCES)	.15	.17	.18	.36	.28	.27	.38
TYPE	RM-401R	RM-24	RM-828	RM-1R	RM-3WA	RM-601R	RM-3R
CAPACITY MAH	800	900	1000	1000	1200	1800	2200
RATED DRAIN MA	25	25	25	30	25	30	42
DIAMETER (INCHES)	.450	.400	.900	.622	.980	.622	.980
HEIGHT (INCHES)	1.120	1.735	.280	.645	.460	1.125	.650
WEIGHT (OUNCES)	.40	.50	.41	.43	.77	1.22	1.0
TYPE	RM-502R	RM-1438R	RM-4R	RM-12R	RM-1450R	RM-2550R	RM-42R
CAPACITY MAH	2400	2700	3400	3600	4500	13000	14000
RATED DRAIN MA	50	100	63	83	100	250	250
DIAMETER (INCHES)	.535	1.462	1.190	.622	1.462	2.550	1.190
HEIGHT (INCHES)	1.953	.385	.650	1.953	.510	.531	2.375
WEIGHT (OUNCES)	1.05	1.4	1.60	1.40	1.85	6.3	5.85

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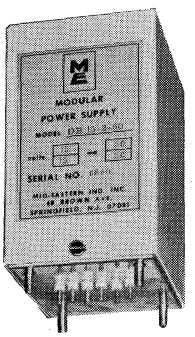
A Division of Eanco, Inc.
660 Jerusalem Road • Scotch Plains, New Jersey 07076 • (201) 233-5900.

DB Dual Output Regulated Power Modules

■ Features

All Silicon Semiconductors
Low Ripple
Tight Regulation
Dust Tight
Fully Repairable
For Operational Amplifiers
Dual Isolated Outputs Available
Hermetic Sealing Available



Model	Output		Voltage Regulation			Price
	Voltage	Current Amps	Line	Load	Size	
DB 6-2-50	± 6	50 ma	0.02%	0.1%	1	$79.00
DB 10-2-50	± 10	50 ma	0.02%	0.1%	1	69.00
DB 15-2-50	± 15	50 ma	0.02%	0.1%	1	69.00
DB 20-2-50	± 20	50 ma	0.02%	0.1%	1	69.00
DB 6-2-75	± 6	75 ma	0.02%	0.1%	2	85.00
DB 10-2-75	± 10	75 ma	0.02%	0.1%	2	75.00
DB 15-2-75	± 15	75 ma	0.02%	0.1%	2	75.00
DB 20-2-75	± 20	75 ma	0.02%	0.1%	2	75.00

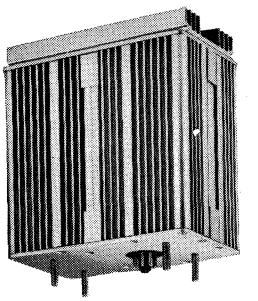
Size 1: 3-1/16" x 2⅝" x 4¼" — 8-32 studs —
Mounting dimensions: 1⅞" x 1¾"

Size: 2: 3-9/16" x 3-1/16" x 4⅞" — 8-32 studs —
Mounting dimensions: 2⅛" x 2⅝"

HT-HTA Transistorized Power Supply Modules

■ Features

Remote Sensing
High Power — Small Package
No Forced Air Cooling Required
Solid State Short Circuit Protection
60°C Ambient Operation
No Heat Sinking
Fully Maintainable
Stock Delivery
All Silicon Semiconductors
High Reliability



Model Number	Price	Model Number	Price
HT 6-4	$169.00	HTA 6-3	$169.00
HT 12-4	169.00	HTA 12-3	169.00
HT 18-2.9	169.00	HTA 18-2.1	169.00
HT 24-2.3	169.00	HTA 24-1.9	169.00
HT 28-2.1	169.00	HTA 28-1.5	169.00
HT 36-1.7	169.00	HTA 36-1.3	169.00
HT 40-1.9	169.00	HTA 40-1.1	169.00
HT 60-1	169.00	HTA 60- .75	169.00
HT 100-1	169.00	HTA 100- .75	169.00

NOTE: The digits of the Model Number indicate the output voltage and current in amps. Example: HT 6-4 has an output voltage of 6 and current of 4 amps. HT 12-4 has an output of 12 volts at 4 amps.

■ About Mid-Eastern Industries

Mid-Eastern's engineering experience in the design and manufacture of standard and custom power supplies covers a span of 10 years. Over this period Mid-Eastern power supplies have proven their performance in computers, data processing, communications, nuclear research, machine tools; medical apparatus, ground support equipment, process controls and many other special applications.

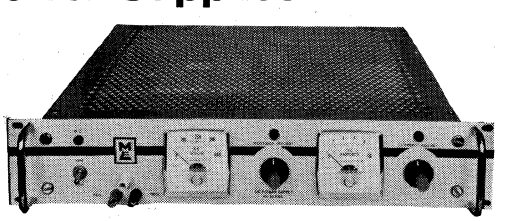
Mid-Eastern engineers have to their credit the solution of many difficult engineering problems. Superior engineering has been applied to all Mid-Eastern power supplies with the result that every unit meets the high standards of reliability and quality of the most exacting customer. Ease of checkout, calibration, and maintenance is maintained in each model by the use of interchangeable plug-ins and modular design. Complete step-by-step trouble shooting and adjustment procedures, schematics, and comprehensive parts data are provided with all standard power supplies.

Along with technical competence, Mid-Eastern offers you the advantages of doing business with a customer-oriented organization. Not only do we want you to buy our equipment, but we want you to be secure in the knowledge that we stand behind it with an integrity and reliability that goes beyond the legal terms of our warranty. We have earned the confidence our customers have in us.

HV Constant High Voltage Power Supplies

■ Features

0.01% Regulation
All Solid State
10-Turn Voltage Adjustments
Adjustable Current Limit
Remote Programming
1 Millivolt Ripple
Remote Sensing



Model Number	Output		RMS Ripple	Regulation		Size	Price
	Volts	Amps		Line	Load		
HV 350-1	0-350	1	< 1mv	0.005%	0.01%	3½ x 19 x 16½	$605.00
HV 350-2	0-350	2	< 1mv	0.005%	0.01%	5¼ x 19 x 16½	725.00
HV 350-3	0-350	3	< 1mv	0.005%	0.01%	7 x 19 x 16½	905.00

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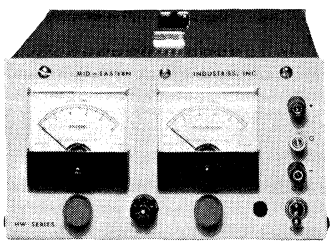
HW Constant Voltage/Constant Current Power Supplies

■ Features



- Models up to 100 Volts
- Remotely Programmable
- Remote Sensing
- Series and Parallel Operation
- 500μ Volts Ripple
- .01% Load Regulation
- Half Rack Size
- Separate Voltmeter and Ammeter
- Rack or Bench mounted
- 005% Line Regulation

Model Number	Output		Regulation				Price
	Voltage	Current Amps	Line		Load		
			CV	CC	CV	CC	
HW 10-8	0-10	0-8	0.01%	0.1%	0.01% or 1 mv	0.5%	$225.00
HW 10-15	0-10	0-15	0.01%	0.1%	0.01% or 1 mv	0.5%	310.00
HW 20-4	0-20	0-4	0.01%	0.1%	0.01% or 1 mv	0.5%	225.00
HW 20-10	0-40	0-10	0.01%	0.1%	0.01% or 1 mv	0.5%	310.00
HW 40-2	0-40	0-2	0.01%	0.1%	0.01% or 1 mv	0.5%	225.00
HW 40-5	0-40	0-5	0.01%	0.1%	0.01% or 1 mv	0.5%	295.00
HW 60-1.5	0-60	0-1.5	0.01%	0.1%	0.01% or 1 mv	0.5%	225.00
HW 60-3	0-60	0-3	0.01%	0.1%	0.01% or 1 mv	0.5%	310.00
HW 100-2	0-100	0-2	0.01%	0.1%	0.01% or 1 mv	0.5%	360.00
HW 200-1	0-200	0-1	0.01%	0.1%	0.01% or 1 mv	0.5%	395.00

Prices include: meters, case, carry handle, and rubber feet. Options: overvoltage, 10-turn potentiometers, and special input voltage.

■ How to Order

The power supplies in this catalog are all standard production units and are delivered from stock (normally within 7 days). Call your local Mid-Eastern representative for complete information on price and delivery schedules. A list of representatives is included for your convenience.
In order to avoid delay, use the full model number when ordering your supply. Unless otherwise specified, orders are shipped via motor freight or UPS.

■ Warranty

Mid-Eastern power supplies are backed by an unconditional repair or replacement warranty for one year after date of sale.

■ Applications Assistance

If you are uncertain as to which ME power supply best meets your existing or anticipated need, please consult the factory or your nearest representative. Mid-Eastern power supply experts will welcome the opportunity to assist you and to recommend the best supply for your use.

■ Other Mid-Eastern Products

In addition to standard power supplies, Mid-Eastern manufactures custom-made power supplies and standard and custom diversity combiners. Detailed information on this other equipment is available upon request.

LA Silicon Modular Power Supplies

■ Features



- <1 millivolt Ripple RMS
- Remote Sensing
- .02% Load Regulation
- Fully Repairable
- .01% Line Regulation
- No Cooling Required
- All Silicon Semiconductors
- Remotely Programmable
- Models to 200 Volts Output
- Plug-in Regulator Card

Model Number	Output		Price	Model Number	Output		Price
	Volts	Amps			Volts	Amps	
LA 5-3	5-6	3.0	$135.00	LA 40-.75	38-42	0.75	$135.00
LA 7-2.5	7-9	2.5	130.00	LA 45-.75	42-45	0.75	135.00
LA 10-2.5	9-10	2.5	130.00	LA 48-.5	46-50	0.50	135.00
LA 12-2	10-12	2.0	130.00	LA 55-.5	50-58	0.50	135.00
LA 14-2	12-14	2.0	130.00	LA 60-.5	58-65	0.50	135.00
LA 15-1.5	14-16	1.5	130.00	LA 75-.375	70-80	0.375	145.00
LA 18-1.5	16-18	1.5	130.00	LA 90-.375	80-90	0.375	155.00
LA 20-1.5	18-20	1.5	130.00	LA 100-.25	90-110	0.25	155.00
LA 24-1.25	20-25	1.25	135.00	LA 125-.25	110-130	0.25	165.00
LA 28-1	26-30	1.0	135.00	LA 150-.20	130-170	0.20	175.00
LA 32-1	30-33	1.0	135.00	LA 200-.20	170-220	0.20	190.00
LA 36- .75	35-38	0.75	135.00	LA 225-.20	220-240	0.20	225.00

*Special voltage and current ranges available. Inquire of factory.

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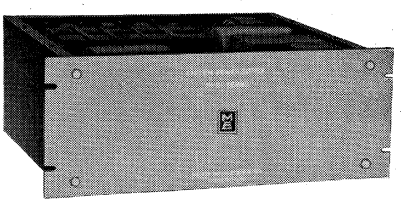
MS High Power System Component Power Supplies

■ Features

Most Complete Coverage
Up to 600 Volts
Up to 1200 Amperes
139 Standard Models

Low Cost
All Solid State
Extreme Reliability
10 Year Guarantee



Model Number	Inches in Height	Model Number	Inches in Height	Model Number	Inches in Height	Model Number	Inches in Height	Model Number	Inches in Height	Model Number	Inches in Height
MS9-600	48⅝	MS20-10	3½	MS34-6	3½	MS65-3	3½	MS128-2	3½	MS350-1.5	5¼
MS9-1200	67⅞	MS20-30	5¼	MS34-20	5¼	MS65-10	5¼	MS128-6	5¼	MS350-3	8¾
		MS20-45	8¾	MS34-30	8¾	MS65-15	8¾	MS128-10	8¾	MS350-5	12¼
MS12-12	3¼	MS20-80	12¼	MS34-50	12¼	MS65-25	12¼	MS128-15	12¼	MS350-7	17½
MS12-40	5¼	MS20-120	17½	MS34-75	17½	MS65-35	17½	MS128-24	17½	MS350-10	24
MS12-60	8¾	MS20-180	24	MS34-125	24	MS65-50	24	MS128-35	24	MS350-30	67⅞
MS12-100	12¼	MS20-400	67⅞	MS34-300	67⅞	MS65-75	48⅝	MS128-45	48⅝		
MS12-150	17½					MS65-150	67⅞	MS128-90	67⅞	MS410-1.5	5¼
MS12-225	24	MS25-8	3½	MS38-6	3½					MS410-3	8¾
MS12-400	67⅞	MS25-25	5¼	MS38-20	5¼	MS77-3	3½			MS410-5	12¼
		MS25-37	8¾	MS38-30	8¾	MS77-10	5¼	MS240-.75	3½	MS410-7	17½
MS13.5-12	3½	MS25-60	12¼	MS38-50	12¼	MS77-15	8¾	MS240-3	5¼	MS410-10	24
MS13.5-40	5¼	MS25-90	17½	MS38-75	17½	MS77-25	12¼	MS240-5	8¾	MS410-30	67⅞
MS13.5-60	8¾	MS25-140	24	MS38-125	24	MS77-35	17½	MS240-7	12¼		
MS13.5-100	12¼	MS25-200	48⅝	MS38-300	67⅞	MS77-50	24	MS240-10	17½	MS470-2	8¾
MS13.5-150	17½	MS25-400	67⅞			MS77-75	48⅝	MS240-15	24	MS470-3	12¼
MS13.5-225	24					MS77-150	67⅞	MS240-40	67⅞	MS470-5	17½
MS13.5-400	67⅞	MS29-8	3½	MS46-5	3½					MS470-7	24
		MS29-25	5¼	MS46-15	5¼	MS109-2	3½			MS470-10	48⅝
MS17-10	3½	MS29-37	8¾	MS46-22	8¾	MS109-6	5¼	MS273-.75	3½	MS470-20	67⅞
MS17-30	5¼	MS29-60	12¼	MS46-40	12¼	MS109-10	8¾	MS273-3	5¼		
MS17-45	8¾	MS29-90	17½	MS46-60	17½	MS109-15	12¼	MS273-5	8¾	MS545-2	8¾
MS17-80	12¼	MS29-140	24	MS46-90	24	MS109-24	17½	MS273-7	12¼	MS545-3	12¼
MS17-120	17½	MS29-200	48⅝	MS46-120	48⅝	MS109-35	24	MS273-10	17½	MS545-5	17½
MS17-180	24	MS29-400	67⅞	MS46-240	67⅞	MS109-45	48⅝	MS273-15	24	MS545-7	24
MS17-400	67⅞					MS109-90	67⅞	MS273-40	67⅞	MS545-10	48⅝
										MS545-20	67⅞

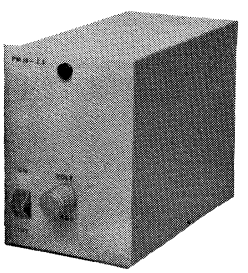
NOTE: The digits of the Model Number indicate the output voltage and current in amps. Example: MS9-600 has an output of 9 volts, current of 600 amps. MS9-1200 has an output of 9 volts at 1200 amps. **Consult factory for prices.**

PM Miniature Silicon Power Supplies

■ Features

.02% Load Regulation
.01% Line Regulation
<1 millivolt Ripple RMS
Remote Sensing

Fully Repairable
All Silicon Semiconductors
Remotely Programmable
Models to 240 Volts Output
Plug-in Regulator Card



Model Number	Output		Price	Model Number	Output		Price
	Volts	Amps			Volts	Amps	
PM 5-3	5-6	3	$135.00	PM 40-.75	38-45	.75	$135.00
PM 7-2.5	7-9	2.5	130.00	PM 45-.75	42-45	.75	135.00
PM 10-2.5	9-10	2.5	130.00	PM 48-.5	46-50	.5	135.00
PM 12-2	10-12	2	130.00	PM 55-.5	50-58	.5	135.00
PM 14-2	12-14	2	130.00	PM 60-.5	58-65	.5	135.00
PM 16-1.5	14-16	1.5	130.00	PM 75-.375	70-80	.375	145.00
PM 18-1.5	16-18	1.5	130.00	PM 90-.375	80-90	.375	155.00
PM 20-1.5	18-20	1.5	130.00	PM 100-.25	90-110	.25	155.00
PM 24-1.25	20-25	1.25	135.00	PM 125-.25	110-130	.25	165.00
PM 28-1	26-30	1	135.00	PM 150-.20	130-170	.20	175.00
PM 32-1	30-33	1	135.00	PM 200-.20	170-220	.20	190.00
PM 36-.75	35-38	.75	135.00	PM 225-.20	220-240	.20	225.00

*Special voltage and current ranges available. Inquire of factory.

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A Division of Eanco, Inc.
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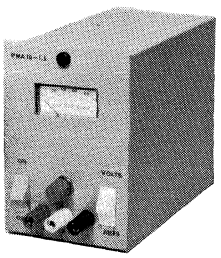
PMA Miniature Silicon Power Supplies



■ Features

.02% Load Regulation
.01% Line Regulation
< 1 millivolt Ripple RMS
Remote Sensing
Fully Repairable
All Silicon Semiconductors
Remotely Programmable
Models to 100 Volts Output
Plug-in Regulator Card

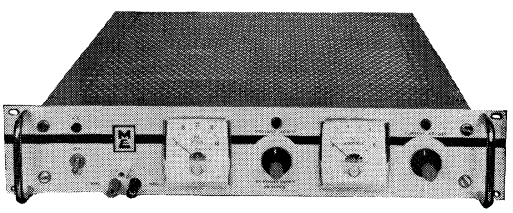
Model Number	Output		RMS Ripple	% Regulation		Size	Price
	Volts	Amps		Line	Load		
PMA 10-1.5	10	1.5	< 1mv	< 0.01	< 0.02	8 x 3 3/16 x 5 3/16	$165.00
PMA 20-1.0	20	1.0	< 1mv	< 0.01	< 0.02	8 x 3 3/16 x 5 3/16	165.00
PMA 40-.5	40	.5	< 1mv	< 0.01	< 0.02	8 x 3 3/16 x 5 3/16	175.00
PMA 60-.35	60	.35	< 1mv	< 0.01	< 0.02	8 x 3 3/16 x 5 3/16	175.00
PMA 100-.2	100	.2	< 1mv	< 0.01	< 0.02	8 x 3 3/16 x 5 3/16	190.00

*Special voltage and current ranges available. Inquire of factory.

PR Constant Voltage/Current Silicon Power Supplies

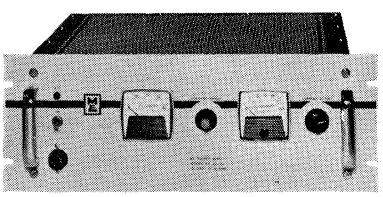
■ Features

High Power — Small Size
Remotely Programmable
All Silicon Semiconductors
Mode Lites
.01% Regulation
Low Ripple
Constant Voltage/Constant Current
Parallel Operation



Model Number	Output		Regulation				Panel Height	Price
			Line		Load			
	Volts	Current Amps	CV	CC	CV	CC		
PR 20-15	0-20	0-15	0.01%	0.01%	0.01%	0.25%	3½"	$495.00
PR 40-10	0-40	0-10	0.01%	0.01%	0.01%	0.25%	3½"	485.00
PR 60-7	0-60	0-7	0.01%	0.01%	0.01%	0.25%	3½"	500.00
PR 125-3.2	0-125	0-3.2	0.01%	0.01%	0.01%	0.25%	3½"	575.00
PR 20-30	0-20	0-30	0.01%	0.01%	0.01%	0.25%	5¼"	670.00
PR 40-20	0-40	0-20	0.01%	0.01%	0.01%	0.25%	5¼"	675.00
PR 60-14	0-60	0-14	0.01%	0.01%	0.01%	0.25%	5¼"	670.00
PR 125-6.5	0-125	0-6.5	0.01%	0.01%	0.01%	0.25%	5¼"	875.00

RA Constant Voltage Silicon Supplies



■ Features

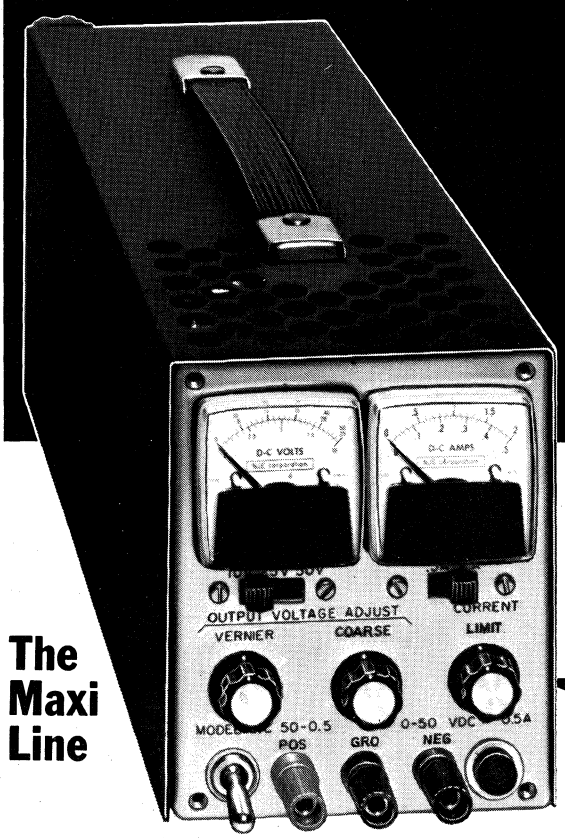
High Power — Small Size
Remotely Programmable
All Silicon Semiconductors
.01% Regulation
Low Ripple
Parallel Operation

Model Number	Output		Voltage Regulation		Panel Height	Price
	Voltage	Current Amps	Line	Load		
RA 20-15	0-20	0-15	0.01%	0.01%	3½"	$415.00
RA 40-10	0-40	0-10	0.01%	0.01%	3½"	415.00
RA 60-7	0-60	0-7	0.01%	0.01%	3½"	425.00
RA 125-3.2	0-125	0-3.2	0.01%	0.01%	3½"	425.00
RA 20-25	0-20	0-25	0.01%	0.01%	5½"	465.00
RA 40-20	0-40	0-20	0.01%	0.01%	5½"	440.00
RA 60-14	0-60	0-14	0.01%	0.01%	5½"	510.00
RA 125-6.5	0-125	0-6.5	0.01%	0.01%	5½"	560.00
RA 40-30	0-40	0-30	0.01%	0.01%	7"	665.00
RA 60-20	0-60	0-20	0.01%	0.01%	7"	675.00
RA 125-10	0-125	0-10	0.01%	0.01%	7"	725.00

Options include: meters, overvoltage, 10-turn potentiometers, and special input voltages.

LAB POWER

New PVC Power Supply



The Maxi Line

Voltage	Current	
0-10V DC	2A	4A
0-20V DC	1A	2A
0-50V DC	0.5A	1.0A

with these features

- Voltage / Current Crossover
- Three (3) Range Voltmeter
- Three (3) Range Ammeter
- Plug-in Amplifiers with I. C.
- Precision Current Regulation
- Mil-T-27A Transformer
- Remote Voltage or Resistance Programming
- Master Slave Series / Parallel
- Available in Singles & Duals

NJE CORPORATION
Electronic Development & Manufacturing
Kenilworth, New Jersey 07033 / (201) 272-6000
TELEFAX: FFP • TWX: (710) 996-5967

380A

A subsidiary of ***CONDEC*** *Corporation*

The "MINI" power supply with the "MINI" price. $124

SINGLE OUTPUT, 1/4 RACK

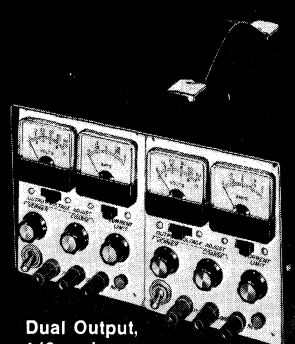


3 Models with ranges up to 0-50V plus:

- Three-range voltmeter
- Dual-range ammeter
- Coarse/fine voltage adjust (3, 5, 7 mv resolution)
- Master slave series/parallel
- Adjustable current regulation
- Mil-T-27A grade transformers
- All-silicon construction
- Dual-tracking outputs

Model	Voltage	Current	Resolution	Weight	Size (Inches)	Price (4)
LVC10-2	0-10V	0-2A	3 mv	11 lbs.	4¾ (H) 4 (W) 12 (D)	$124.00
LVC20-1	0-20V	0-1A	5 mv			
LVC50-.5	0-50V	0-.5A	7 mv			
2LVC10-2	0-10V Dual (1)	0-2A Dual	3 mv	22 lbs.	4¾ (H) 8¼ (W) 12 (D)	$248.00
	0-20V (2)	0-2A				
	0-10V (3)	0-4A				
2LVC20-1	0-20V Dual (1)	0-1A Dual	5 mv	22 lbs.	4¾ (H) 8¼ (W) 12 (D)	$248.00
	0-40V (2)	0-1A				
	0-20V (3)	0-2A				
2LVC50-.5	0-50V Dual (1)	0-.5A Dual	7 mv	22 lbs.	4¾ (H) 8¼ (W) 12 (D)	$248.00
	0-100V (2)	0-.5A				
	0-50V (3)	0-1A				

(1) Dual outputs consist of (2) separate isolated power supplies.
(2) Series outputs by connecting units in series.
(3) Parallel outputs by connecting outputs and single master unit.
(4) Effective Sept. 1, 1968.



Dual Output, 1/2 rack, $248.

IMMEDIATE DELIVERY • 10 YEAR WARRANTY

Write for new catalog.

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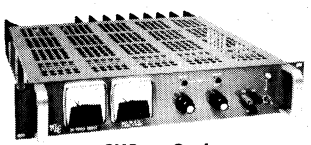
POWER SUPPLIES



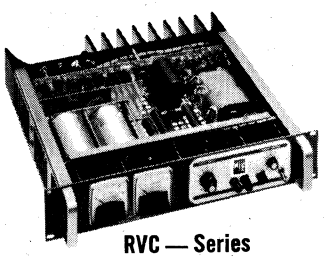
LVC — Series

- Three-Range Voltmeter
- Dual-Range Ammeter
- Coarse/Fine Voltage Adjust
- Master Slave Series/Parallel
- Adjustable Current Limiting
- Mil-T-27 Grade Transformers
- All-Silicon Construction
- Dual-Tracking Outputs



SVC — Series

- All Silicon Design
- Regulated Voltage and / or Current
- Mode Indicator Lamps
- 0-71°C Operating
- 0-20V, 0-40V, 0-60V, 0-125V units

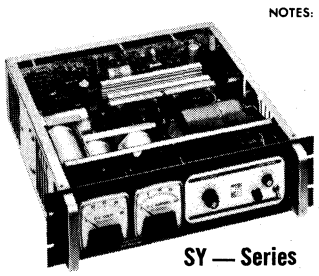


RVC — Series

- Regulated Voltage and/or Current
- 0-36 Volt Supplies
- 0-50°C Operating
- 50 microsecond response

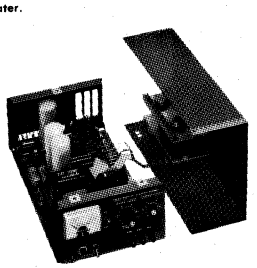
Voltage Range	Current 50°C	Current 75°C	Regulation Load ±	Regulation Line ±	Ripple (RMS)	Design Code	Size	Model	Price	Catalog Code
0-5.5V	14A	11A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-5-14.0	$ 299.	S
0-5.5V	20.5A	20.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-5-20.5	380.	S
0-5.5V	40.0A	40.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-5-40.0	555.	S
5.5-6.5V	15.0A	11.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-6-15	268.	S
5.5-6.5V	24.5A	18.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-6-24.5	340.	S
5.5-6.5V	46.0A	38.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-6-46	515.	S
7.0-9.0V	14.5A	10.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-8-14.5	268.	S
7.0-9.0V	22.5A	17.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-8-22.5	340.	S
7.0-9.0V	43.0A	36.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-8-43.0	515.	S
0-10V	2A (60°C)		.01%	.01%	.250mv	VCC	4¾ x 4 x 12	LVC-10-2	113.	L
0-10V	10A		.01%	.01%	1mv	VCL	3½ x 19 x 16⅝	QR-10-10	410.	L
9.0-11.0V	14.0A	10.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-10-14	268.	S
9.0-11.0V	21.0A	16.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-10-21	340.	S
9.0-11.0V	41.0A	35.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-10-41	515.	S
11.0-13.0V	14.0A	10.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-12-14	268.	S
11.0-13.0V	20.5A	16.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-12-20.5	340.	S
11.0-13.0V	40.0A	33.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-12-40	515.	S
5-14V	15A		.5%	.5%	1%	VCP	3½ x 19 x 14⅝	TC-14-15	365.	L
5-14V	30A		.5%	.5%	1%	VCP	5¼ x 19 x 16⅝	TC-14-30	500.	L
5-14V	200A		.5%	.5%	1%	VCP	21 x 19 x 16⅝	TC-14-200	1550.	L
0-15V	20A		.01%	.01%	1mv	VCL	5½ x 19 x 16⅝	QR-15-20	510.	L
14-16V	13.0A	10.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-15-13	268.	S
14-16V	17.5A	13.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-15-17.5	340.	S
14-16V	35.0A	30.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16⅝	FS-15-35	515.	S
0-18V	3A		.02%	.03%	1mv	VCL	4½ x 8 x 14	TR-18-3	195.	L
0-18V	3A		.01%	.01%	.250mv	VCC	4½ x 8 x 14	RB-18-3-M	225.	L
0-18V	6A		.005%	.02%	1mv	VCL	3½ x 19 x 16⅝	QR-18-6	410.	L
0-18V	30A		.01%	.02%	1mv	VCL	7 x 19 x 16⅝	CR-18-30	600.	L
5-18V	30A		.01%	.01%	1mv	VCL	5¼ x 19 x 16⅝	SY-18-30-M	580.	L
17-19V	11.0A	9.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-18-11	268.	S
17-19V	16.5A	12.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-18-16.5	340.	S
17-19V	32.0A	29.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-18-32	515.	S
0-20V	1A (60°C)		.01%	.01%	.250mv	VCC	4½ x 4 x 12	LVC-20-1	113.	L
0-20V	7.5A (60°C)		.01%	.01%	1mv	VCC	8 x 5 x 14	SVC-20-7.5-M	375.	L
0-20V	15A (60°C)		.01%	.01%	1mv	VCC	3½ x 19 x 16⅝	SVC-20-15-M	490.	L
0-20V	30A (60°C)		.01%	.01%	1mv	VCC	5¼ x 19 x 16⅝	SVC-20-30-M	690.	L
19-21V	10.0A	8.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-20-10	268.	S
19-21V	15.5A	12.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-20-15.5	340.	S
19-21V	30.0A	28.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-20-30	515.	S
22-26V	9.0A	8.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-24-9	268.	S
22-26V	13.5A	11.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-24-13.5	340.	S
22-26V	25.0A	21.5A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-24-25	480.	S
27-31V	8.0A	7.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-29-8.0	268.	S
27-31V	12.0A	10.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-29-12	340.	S
27-31V	23.0A	20.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-29-23	480.	S
0-32V	10A		5.5%	.5%	1%	VCP	14 x 19 x 14⅝	ELB-32-10	500.	L
0-32V	10A		2.5%	.5%	1%	VCP	14 x 19 x 14⅝	ELA-32-10	550.	L
10-32V	10A		.5%	.5%	1%	VCP	3½ x 19 x 14⅝	TC-32-10	320.	L
0-32V	20A		5.5%	.5%	1%	VCP	26¼ x 19 x 16⅝	ELB-32-20	610.	L
0-32V	20A		2.5%	.5%	1%	VCP	26¼ x 19 x 16⅝	ELA-32-20	720.	L
10-32V	20A		100mv	50mv	35mv	VCL	5¼ x 19 x 16	SP-32-20	525.	S
10-32V	20A		.5%	.5%	1%	VCP	5¼ x 19 x 16⅝	TC-32-20	445.	L
0-32V	30A		5.5%	.5%	1%	VCP	26¼ x 19 x 16⅝	ELA-32-30	1010.	L
0-32V	30A		2.5%	.5%	1%	VCP	26¼ x 19 x 16⅝	ELB-32-30	850.	L
10-32V	30A		100mv	50mv	35mv	VCL	7 x 19 x 16	SP-32-30	562.	S
10-32V	30A		.5%	.5%	1%	VCP	7 x 19 x 16⅝	TC-32-30	585.	L
10-32V	50A		100mv	50mv	35mv	VCL	10½ x 19 x 16	SP-32-50	735.	S
10-32V	50A		.5%	±.5%	1%	VCP	10½ x 19 x 16⅝	TC-32-50	865.	L
10-32V	100A		100mv	50mv	35mv	VCL	17½ x 19 x 16	SP-32-100	1450.	S
10-32V	120A		.5%	.5%	120mv	VCL	21 x 19 x 16⅝	TC-32-120	1570.	L
31-35V	7.0A	7.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-33-7.0	268.	S
31-35V	11.0A	9.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 11/16	HS-33-11	340.	S
31-35V	21.0A	18.5A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-33-21	515.	S
0-36V	2A		.02%	.03%	1mv	VCL	4½ x 8 x 14	TR-36-2	195.	L

NOTES: All HS, FS, SP Models Priced Without Meters.
Line and Load Regulations all have ±2mv, Whichever is Greater. Lower Specs.



SY — Series

- Wide Slot Voltage Adjustable (5-18V) (10-36V) (10-60V)
- 0-50°C Operating
- 75 Microsecond response



RB — Series

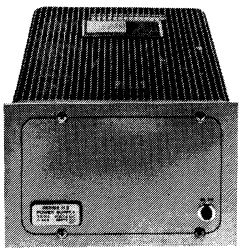
- Regulated Voltage and/or Current
- Half Rack Bench Supply (Rack Adaptable)
- 0-50°C operating
- 50 Microsec Response

UNLIMITED from NJE!

Voltage Range	Current 50°C	Current 75°C	Regulation Load ±	Regulation Line ±	Ripple (RMS)	Design Code	Size	Model	Price	Catalog Code
0-36V	2A		.01%	.01%	.250mv	VCC	4½ x 8 x 14	RB-36-2-M	$225.	L
0-36V	4A		.005%	.02%	1mv	VCL	3½ x 19 x 16⅝	QR-36-4	430.	L
0-36V	5A		.01%	.01%	1mv	VCC	3½ x 19 x 16⅝	RVC-36-5-M	375.	L
0-36V	8A		.01%	.02%	1mv	VCL	3½ x 19 x 16⅝	CR-36-8	475.	L
0-36V	10A		.01%	.02%	1mv	VCL	5¼ x 19 x 16⅝	QR-36-10	490.	L
10-36V	10A		.01%	.01%	1mv	VCL	3½ x 19 x 16⅝	SY-36-10-M	390.	L
0-36V	15A		.01%	.02%	1mv	VCL	5¼ x 19 x 16⅝	CR-36-15	520.	L
0-36V	15A		.01%	.01%	1mv	VCC	5¼ x 19 x 16⅝	RVC-36-15-M	545.	L
0-36V	20A		.01%	.02%	1mv	VCL	7 x 19 x 16⅝	CR-36-20	620.	L
10-36V	20A		.01%	.01%	1mv	VCL	5¼ x 19 x 16⅝	SY-36-20-M	485.	L
0-36V	25A		.01%	.01%	1mv	VCC	7 x 19 x 16⅝	RVC-36-25-M	690.	L
0-36V	30A		.01%	.02%	1mv	VCL	8¾ x 19 x 16⅝	CR-36-30	745.	L
10-36V	30A		.01%	.01%	1mv	VCL	7 x 19 x 16⅝	SY-36-30-M	645.	L
0-36V	50A		.01%	.02%	1mv	VCL	17½ x 19 x 16⅝	CR-36-50	1475.	L
35-39V	6.5A	6.0A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 1/16	HS-37-6.5	268.	S
35-39V	10.A	8.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 1/16	HS-37-10	340.	S
35-39V	19.0A	16.5A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-37-19	515.	S
0-40V	5A (60°C)		.01%	.01%	1mv	VCC	8 x 5 x 14	SVC-40-5-M	345.	L
0-40V	10A (60°C)		.01%	.01%	1mv	VCC	3½ x 19 x 16⅝	SVC-40-10-M	475.	L
0-40V	20A (60°C)		.01%	.01%	1mv	VCC	5¼ x 19 x 16⅝	SVC-40-20-M	670.	L
0-40V	50A		5%	N/A	1%	VCP	17½ x 19 x 16⅞	EB-40-50	1080.	L
0-40V	50A		2%	N/A	1%	VCP	17½ x 19 x 16⅞	EA-40-50	1100.	L
0-40V	100A		5%	N/A	1%	VCP	35 x 19 x 16⅞	EB-40-100	1610.	L
0-40V	100A		2%	N/A	1%	VCP	35 x 19 x 16⅞	EA-40-100	1660.	L
41-45A	5.5A	5.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 1/16	HS-43-5.5	268.	S
41-45A	9.0A	7.5A	.05%	.05%	1mv	VCL	5¼ x 8½ x 15 1/16	HS-43-9.0	340.	S
41-45A	17.0A	15.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-43-17	515.	S
0-50V	.5A (60°C)		.01%	.01%	.250mv	VCC	4¾ x 4 x 12	LVC-50-.5	113.	L
0-50V	1.5A		.01%	.01%	.250mv	VCC	4½ x 8 x 14	RB-50-1.5-M	245.	L
45-51V	5.0A	5.0A	.05%	.05%	1mv	VCL	5¼ x 8¾ x 16½	HS-48-5	299.	S
45-51V	8.0A	7.0A	.05%	.05%	1mv	VCL	5¼ x 8¾ x 16½	HS-48-8	365.	S
45-51V	16.0A	14.0A	.05%	.05%	1mv	VCL	5¼ x 19 x 16½	FS-48-16	565.	S
20-52V	6A		.5%	.5%	1%	VCP	3½ x 19 x 14⅝	TC-52-6	420.	L
20-52V	12A		.5%	.5%	1%	VCP	5¼ x 19 x 16⅝	TC-52-12	465.	L
30-52V	20A		100mv	50mv	35mv	VCL	7 x 19 x 16	SP-41-20	800.	S
20-52V	30A		.5%	.5%	1%	VCP	10½ x 19 x 16⅝	TC-52-30	850.	L
30-52V	30A		100mv	50mv	35mv	VCL	10½ x 19 x 16	SP-41-30	940.	S
30-52V	50A		100mv	50mv	35mv	VCL	14 x 19 x 16	SP-41-50	1310.	S
0-60V	2.5A		.005%	.02%	1mv	VCL	3½ x 19 x 16⅝	QR-60-2.5	420.	L
0-60V	3.5A (60°C)		.01%	.01%	1mv	VCC	8 x 5 x 14	SVC-60-3.5-M	365.	L
0-60V	6A		.005%	.02%	1mv	VCL	5¼ x 19 x 16⅝	QR-60-6	550.	L
10-60V	6A		.01%	.01%	1mv	VCL	3½ x 19 x 16⅝	SY-60-6-M	420.	L
0-60V	7A		.01%	.01%	1mv	VCC	3½ x 19 x 16⅝	SVC-60-7-M	595.	L
0-60V	9A		.01%	.01%	1mv	VCL	5¼ x 19 x 16⅝	CR-60-9	620.	L
10-60V	12A		.01%	.01%	1mv	VCL	5¼ x 19 x 16⅝	SY-60-12-M	515.	L
0-60V	14A (60°C)		.01%	.01%	1mv	VCC	5¼ x 19 x 16⅝	SVC-60-14-M	690.	L
0-60V	18A		.01%	.01%	1mv	VCL	8¾ x 19 x 16⅝	CR-60-18	900.	L
10-60V	18A		.01%	.01%	1mv	VCL	7 x 19 x 16⅝	SY-60-18-M	665.	L
0-80V	4A		5.5%	.5%	1%	VCP	14 x 19 x 14⅝	ELB-80-4	500.	L
0-80V	4A		2.5%	.5%	1%	VCP	14 x 19 x 14⅝	ELA-80-4	530.	L
25-80V	4A		.5%	.5%	1%	VCP	3½ x 19 x 16⅝	TC-80-4	320.	L
0-80V	8A		5.5%	.5%	1%	VCP	26¼ x 19 x 16⅝	ELB-80-8	590.	L
0-80V	8A		2.5%	.5%	1%	VCP	26¼ x 19 x 16⅝	ELA-80-8	640.	L
25-80V	8A		.5%	.5%	1%	VCP	5¼ x 19 x 16⅝	TC-80-8	545.	L
0-80V	15A		5.5%	.5%	1%	VCP	29¾ x 19 x 16⅝	ELB-80-15	940.	L
0-80V	15A		2.5%	.5%	1%	VCP	29¾ x 19 x 16⅝	ELA-80-15	1030.	L
25-80V	20A		.5%	.5%	1%	VCP	10½ x 19 x 16⅝	TC-80-20	850.	L
0-80V	30A		5.0%	N/A	1%	VCP	17½ x 19 x 16⅝	EB-80-30	1150.	L
0-80V	30A		2.0%	N/A	1%	VCP	17½ x 19 x 16⅝	EA-80-30	1170.	L
0-80V	50A		5.0%	N/A	1%	VCP	35 x 19 x 16⅝	EB-80-50	1550.	L
0-80V	50A		2.0%	N/A	1%	VCP	35 x 19 x 16⅝	EA-80-50	1600.	L
0-80V	100A		5.0%	N/A	1%	VCP	35 x 19 x 16⅝	EB-80-100	1750.	L
0-80V	100A		2.0%	N/A	1%	VCP	35 x 19 x 16⅝	EA-80-100	2030.	L
0-120V	10A		5.5%	.5%	1%	VCP	29¾ x 19 x 16⅝	ELB-120-10	930.	L
0-120V	10A		2.5%	.5%	1%	VCP	29¾ x 19 x 16⅝	ELA-120-10	1000.	L
0-125V	1.6A		.01%	.01%	1mv	VCC	8 x 5 x 14	SVC-125-1.6-M	515.	L
0-125V	3.2A		.01%	.01%	1mv	VCC	3½ x 19 x 16⅝	SVC-125-3.2-M	765.	L
0-125V	6.5A		.01%	.01%	1mv	VCC	5¼ x 19 x 16⅝	SVC-125-6.5-M	1110.	L

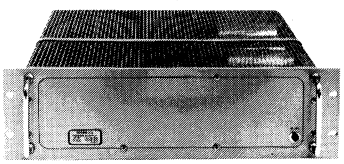
CODES:
"S" Systems Catalog (old Con Avionics products)
"L" Lab. Catalog (old NJE)

"VCL" Voltage Regulated with current limit
"VCC" Voltage Regulated with current regulation
"VCP" Voltage Regulated with current protection (other than electronic)



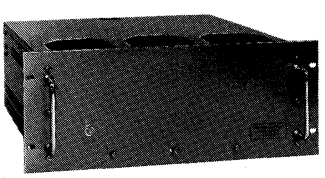
HS — Series

- Self-Cooled — No External Heat Sink Needed
- Series Operation Capability
- Fully Repairable
- Current Limiting Automatic Short Circuit Protection
- All Silicon Transistors
- Remote Sensing



FS — Series

- Self-Cooled — No External Heat Sink Needed
- Series Operation Capability
- Fully Repairable
- Current Limiting Automatic Short Circuit Protection
- All Silicon Transistors
- Remote Sensing



SP — Series

- Wide Slot Voltage Adjustment (10-32) (30-52)
- 0-50°C Operating
- 50mv Line Reg.
- 100mv Load Reg.
- 35mv RMS

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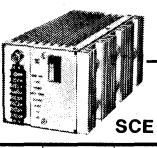
Modular power. Popular price.


SCA


SCB


SCC


SCE

Volt	Amps	Price	Volt	Amps	Price	Volt	Amps	Price	Volt	Amps	Price
3	0.75	$77.	3	2.5	$107.	3	5.0	$137.	3	12.0	$197.
4	0.75	77.	4	2.5	107.	4	5.0	137.	4	12.0	197.
5	0.75	77.	5	2.5	107.	5	4.5	137.	5	12.0	197.
6	0.75	77.	6	2.5	107.	6	4.5	137.	6	12.0	197.
7	0.75	77.	7	2.5	107.	7	4.5	137.	7	12.0	197.
8	0.75	77.	8	2.4	107.	8	4.5	137.	8	12.0	197.
9	0.75	77.	9	2.3	107.	9	4.5	137.	9	12.0	197.
10	0.65	77.	10	2.2	107.	10	4.3	137.	10	11.0	197.
12	0.5	77.	12	2.0	107.	12	4.0	137.	12	10.0	197.
15	0.45	77.	15	1.5	107.	15	3.5	137.	15	9.0	207.
18	0.42	77.	18	1.5	107.	18	3.2	137.	18	8.0	207.
20	0.40	77.	20	1.4	107.	20	3.0	137.	20	7.5	207.
22	0.37	77.	22	1.3	107.	22	2.8	137.	22	7.1	207.
24	0.35	77.	24	1.2	107.	24	2.6	137.	24	6.7	217.
28	0.3	77.	28	1.0	107.	28	2.3	137.	28	6.0	217.
32	0.29	87.	32	0.9	117.	32	2.0	147.	32	5.5	237.
36	0.28	87.	36	0.8	117.	36	1.8	147.	36	5.0	237.
40	0.25	87.	40	0.75	117.	40	1.7	147.	40	4.7	237.
44	0.23	87.	44	0.7	117.	44	1.6	147.	44	4.4	237.
48	0.21	87.	48	0.63	117.	48	1.5	147.	48	4.1	237.
52.5	0.19	87.	52.5	0.58	117.	52.5	1.3	147.	52.5	3.5	237.
57.5	0.17	87.	57.5	0.53	117.	57.5	1.2	147.	57.5	3.0	237.

All voltages adjustable ± 10%. All current ratings at 50°C.

New NJE SC series power supplies

For years we've been selling reliable laboratory power supplies at popular prices. Now you can also get these modular power supplies at our popular prices.

SC series sub-rack power supplies

- 4 basic package sizes (SCA, SCB, SCC, SCE).
- 3 different mounting surfaces (each module).
- Convection cooled – no external heat sinking required.
- Fit into racks as small as 3½" high.
- Current limiting automatic short circuit protection.
- Remote voltage adjustment, remote sensing – both standard.
- Five-year unconditional guarantee.
- All-silicon semi-conductors.
- Over voltage option available.

Specifications
Input: 105-125V AC, 47-440 cps
Regulation (Line and Load Combined): ±0.05% or 2mv, whichever is greater.
Ripple: 1 mv rms
Response Time: 20 μsecs.
Temperature Coefficient: 0.015%/°C or 1.8mv/°C, whichever is greater.
Temperature: 75°C max

Remote voltage adjustment and remote sensing are standard. Overvoltage protection and metered panels available as options. Series start is standard on SCB, SCC and SCE and available as an option on SCA models.

5 YEAR WARRANTY!

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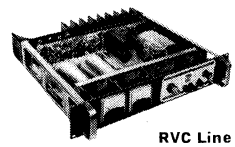
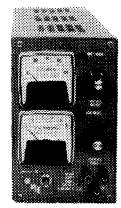
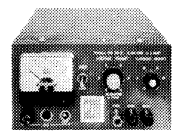
Laboratory power. Popular price.


LVC Line


RVC Line


SVC Line


RB Line

Now covered under our new 10 year warranty

LVC Line

Model No.	Voltage	Current	Line (1) (3)	Load (2) (3)	Ripple	Size H x W x D	Price
LVC-10-2	0-10V	0-2A	.01%	±.01%	250 μv	4¾x4x12	$124
LVC-20-1	0-20V	0-1A	.01%	±.01%	250 μv	4¾x4x12	$124
LVC-50-0.5	0-50V	0-0.5A	.01%	±.01%	250 μv	4¾x4x12	$124
2LVC-10-2	Dual 0-10V	0-2A	.01%	±.01%	250 μv	4¾x8x12	248
	0-10V	0-4A					
	0-20V	0-2A					
2LVC-20-1	Dual 0-20V	0-1A	.01%	±.01%	250 μv	4¾x8x12	248
	0-20V	0-2A					
	0-40V	0-1A					
2LVC-50-0.5	Dual 0-50V	0-0.5A	.01%	±.01%	250 μv	4¾x8x12	248
	0-50V	0-1A					
	0-100V	0-0.5A					

(1) 105-125VAC (47-420 cps) (2) Measured NL-FL, FL-NL (3) or 2 mv whichever is greater.

SVC Line

Model No.	Volts	Amps	Load	Line	Dimension H x W x D	Price
SVC-20-7.5 (Lab-Rak)	0-20	0-7.5	*0.01% or 1mv	*0.01% or 1mv	8 x 5 x 14	$355
SVC-20-15	0-20	0-15	*0.01% or 1mv	*0.01% or 1mv	3½ x 19 x 16⅝	470
SVC-20-30	0-20	0-30	*0.01% or 1mv	*0.01% or 1mv	5¼ x 19 x 16⅝	670
SVC-40-5 (Lab-Rak)	0-40	0-5	*0.01% or 1mv	*0.01% or 1mv	8 x 5 x 14	325
SVC-40-10	0-40	0-10	*0.01% or 1mv	*0.01% or 1mv	3½ x 19 x 16⅝	455
SVC-40-20	0-40	0-20	*0.01% or 1mv	*0.01% or 1mv	5¼ x 19 x 16⅝	650
SVC-60-3.5 (Lab-Rak)	0-60	0-3.5	*0.01% or 1mv	*0.01% or 1mv	8 x 5 x 14	345
SVC-60-7	0-60	0-7	*0.01% or 1mv	*0.01% or 1mv	3½ x 19 x 16⅝	575
SVC-60-14	0-60	0-14	*0.01% or 1mv	*0.01% or 1mv	5¼ x 19 x 16⅝	670
SVC-125-1.6 (Lab-Rak)	0-125	0-1.6	*0.01% or 1mv	*0.01% or 1mv	8 x 5 x 14	495
SVC-125-3.2	0-125	0-3.2	*0.01% or 1mv	*0.01% or 1mv	3½ x 19 x 16⅝	765
SVC-125-6.5	0-125	0-6.5	*0.01% or 1mv	*0.01% or 1mv	5¼ x 19 x 16⅝	1110

RVC Line

Model No.	Volts	Amps	Load	Line	Dimensions H x W x D	Price
RVC-36-5	0-36	0-5	0.005% or 0.5mv	0.01% or 1.0 mv	3½ x 19 x 16⅝	$355
			1 ma/v change in output	1 ma		
RVC-36-15	0-36	0-15	0.01% or 1.0 mv	0.01% or 1.0 mv	5¼ x 19 x 16⅝	525
			3 ma/v change in output	3 ma		
RVC-36-25	0-36	0-25	0.01% or 1.0 mv	0.01% or 1.0 mv	7 x 19 x 16⅝	670
			5 ma/v change in output	5 ma		

RB Line

Model No.	Volts	Amps	Load	Line	Dimensions H x W x D	Price
RB-18-3-M	0-18	0-3	0.01% or 1 mv	0.01% or 1 mv	4½ x 8 x 14⅜	$225
			2 ma/V change in output	0.5 ma		
RB-36-2-M	0-36	0-2	0.01% or 1 mv	0.01% or 1 mv	4½ x 8 x 14⅜	225
			1 ma/V change in output	0.5 ma		
RB-50-1.5-M	0-50	0-1.5	0.01% or 1 mv	0.01% or 1 mv	4½ x 8 x 14⅜	245
			0.75 ma/V change in output	0.5 ma		

Immediate Delivery!

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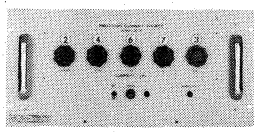
PRECISION POWER SOURCES

AC and DC constant current — constant voltage

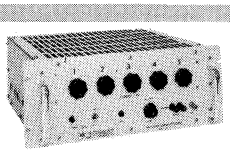


GENERAL PURPOSE DC CONSTANT CURRENT SOURCES — For Transistor, Zener, Rectifier PIV Tests. Magnetic Field Control.

Programmable constant current sources with stability as good as 0.05%. All solid state except the CS-120 which is hybrid. Major applications: C-1, compact electromagnet field supply; CS-111, transistor and zener testing; CS-120, rectifier PIV and high voltage transistor measurements. The CS-111 and CS-120 may be modulated.

Other applications include testing of relays, solenoids, magnetic, resistive and other current sensitive components.

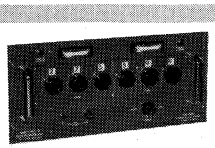
Model No.	Current Range mA	Voltage Range V	Readout Digits	Regulation %
C -1	0 - 2000	0 - 100	Pot.	0.1
CS - 111	0 - 500	0 - 250	6	0.01
CS - 120	0 - 10	0 - 2000	5	0.07



PRECISION DC CONSTANT CURRENT SOURCES — For Gyro Torquing, Semiconductor Tests, Calibration.

Programmable constant current sources in the 0.005% stability class. Digital current readout with 1 μA resolution, superior performance at low currents with zero current adjustment. Modulation capability with scale factor of 1 V/10% of current setting. Internal reference and sensitive control circuitry housed in temperature-regulated enclosure. Low temperature coefficient wirewound current sensing resistors. 0.02% absolute accuracy. 20 ppm current regulation from short-circuit to maximum output voltage. All solid state.

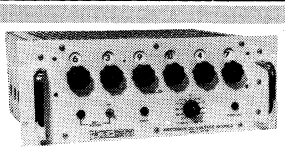
Model No.	Current Range mA	Voltage Range V	No. of Decades
CS - 11	0 - 100	0 - 100	5
CS - 12	0 - 1000	0 - 12.5	6



DC HIGH CURRENT-HIGH VOLTAGE SOURCES — For Capacitor Forming.

Solid state units are employed in the forming and testing of tantalum and other electrolytic capacitors, for plasma measurements, and as magnetic and power bridge supplies. Automatic switchover from constant current to constant voltage at predetermined values.

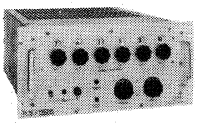
Model No.	Current Range A	Voltage Range V	Regulation %
CVS - 150 (300 - 6)	0 - 6	0 - 300	0.1
CVS - 150 (1000 - 4)	0 - 4	0 - 1000	0.1



DC CONSTANT VOLTAGE SOURCES — For General Calibration.

Constant voltage sources with modulation capability and digital, in-line readout. Used for general calibration purposes, the units are completely solid state, have excellent regulation and reliability. Internal reference and sensitive control circuitry housed in temperature regulated oven.

Model No.	Voltage Range V	Current mA	Regulation %	Accuracy %
VS - 35	0 - 111.1	0 - 100	0.0025	0.01
VS - 36	0 - 21.1	0 - 1000	0.0025	0.01

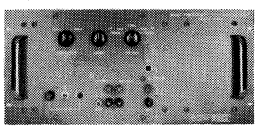


ULTRA STABLE DC CONSTANT CURRENT SOURCES — For Gyro Torquer Supply, IC Testing.

Constant current sources in 5 ppm stability class. Digital readout with 1 ppm resolution. Superior low current operation and line isolation. Modulation above and below zero output or about dc level. Regulation 0.0005%. Accuracy 0.01%.

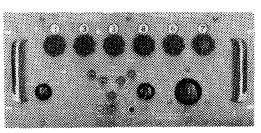
Unique performance made possible by selecting and aging critical components, proportional oven control, elaborate shielding and patented circuitry. Widely used for sophisticated testing of inertial quality gyros, IC's, reference zeners, and other precision current sensitive devices.

Model No.	Current Range mA	Voltage Range V	No. of Decades
CS - 151	0 - 10	0 ± 10	6
CS - 152	0 - 150	0 ± 25	6
CS - 153	0 - 150	0 ± 100	6



PRECISION MICRO-SYN AC SUPPLIES Highly regulated series of single-phase 25 VA sources in 0.1% stability class. Output at either of two preset frequencies in 0.4 to 10 kHz range. Tight phase-lock to external reference frequency signal. Automatic switchover to internal oscillators in the event of reference failure. Four-terminal sensing assures constant voltage at remote load terminals. Short-circuit protection with automatic recovery. Multiple output voltage modes with fixed and variable levels.

Model No.	Frequencies* Hz	Full-scale Levels* V rms
VS - 78	800 & 9600	10 & 50
VS - 93	800 & 3200	10 & 50
VS - 94	800 & 9600	28 & 60
VS - 95	800 & 3200	28 & 60



PRECISION AC POWER SOURCES - CONSTANT VOLTAGE — For Gyro Wheel or Synchro Supply.

Well regulated units supply 2 or 3 phase power of 25 VA per phase. Output at any specified frequency in 0.4 to 10 kHz range. Stability of output from 0.1% to 0.005% depending on unit selected. Four terminal sensing for constant voltage at remote load. Short circuit protection with automatic recovery. Multiple output voltage modes with fixed and variable levels.

Model No.	Frequencies* Hz	Full-scale Levels* V rms
VS - 66	1200	50
VS - 92	800	50
VS - 76	400 & 800	30

AC CONSTANT CURRENT SOURCES — For Fuel Cell Impedance Measurements and Other Current Sensitive Devices.

Supply ac constant current at 60, 400, and 1000 Hz. Regulation and stability 0.1%. Model CS-180 supplies 100 mA at 0 - 5 V rms.

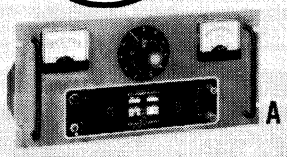
*Other frequencies, voltages, power available on special order.

NORTH HILLS ELECTRONICS, INC.
GLEN COVE, L.I., N.Y. 11542 • PHONE (516) 671-5700

See Page 1046 for Function Modules. See Page 1426 for Voltage/Current Calibrators and Lab Potentiometers. See Page 1046 for Alarm Controls and Measurement Modules.

D. C. POWER SUPPLIES

Opad SINCE 1947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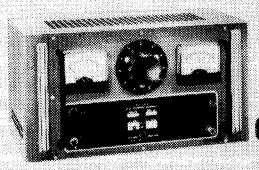
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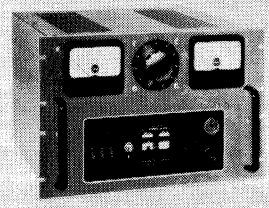
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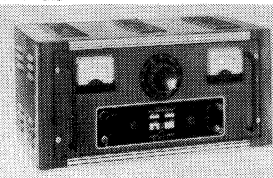
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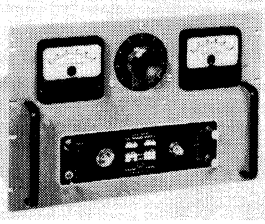
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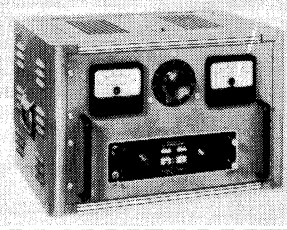
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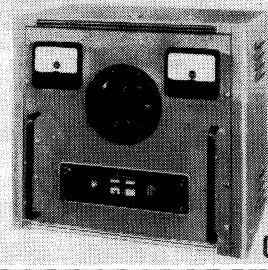
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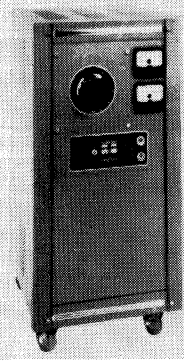

H

D.C. VOLTS	D.C. AMPS	MODEL	STYLE	RIPPLE	DIMENSIONS H X W X D	FIG.	A.C. INPUT	BULLETIN
0-32	5	KM75	RACK	100MV	8¾" X 19" X 9½"	A	115 VOLTS A.C. 60 Hz SINGLE PHASE	102A
	5	KM75B	BENCH	100MV	9" X 17" X 9"	C		
	10	KM81	RACK	100MV	8¾" X 19" X 9½"	A		
	10	KM81B	BENCH	100MV	9" X 17" X 9"	C		
	20	KM87	RACK	100MV	8¾" X 19" X 9½"	A		
	20	KM87B	BENCH	100MV	10½" X 22" X 12"	D		
	40	KM93	RACK	100MV	12¼" X 19" X 13"	B		
	40	KM93B	BENCH	100MV	14" X 22" X 15"	E		
	100	KM100	RACK	160MV	12¼" X 19" X 17¼"	F	208-230 VAC 60 Hz 3 PHASE*	104
	150	KM150	BENCH	160MV	19¼" X 22" X 18"	G		
0-60	10	KN5	RACK	100MV	10½" X 19" X 13½"	B	115 VOLTS A.C. 60 Hz SINGLE PHASE	106
	10	KN5B	BENCH	100MV	12¼" X 22" X 15"	E		
	20	KN10	RACK	100MV	12¼" X 19" X 13½"	B		
	20	KN10B	BENCH	100MV	14" X 22" X 15"	E		
0-125	5	RS20	RACK	1.25V	10½" X 19" X 13"	B	117 VOLTS A.C. 60 Hz SINGLE PHASE	204A
	5	RS20B	BENCH	1.25V	12¼" X 22" X 15"	E		
	10	RS30	RACK	1.25V	12¼" X 19" X 13"	B		
	10	RS30B	BENCH	1.25V	14" X 22" X 15"	E		
	20	RS40	RACK	1.25V	17½" X 19" X 13"	—		
	20	RS40B	BENCH	1.25V	19¼" X 22" X 15"	G		
	24	RS50	RACK	250MV	12¼" X 19" X 17¼"	F	208-230 VAC 60 Hz 3 PHASE*	205
	40	RS60	BENCH	250MV	19¼" X 22" X 18"	G		
	80	RS70	FLOOR	1.25V	48" X 22" X 18"	H		
	120	RS80	FLOOR	1.25V	48" X 22" X 24"	H		
0-250	5	RU60	RACK	2.5V	12¼" X 19" X 13½"	B	117 VOLTS A.C. 60 Hz SINGLE PHASE	206
	5	RU60B	BENCH	2.5V	14" X 22" X 15"	E		
	10	RU70	RACK	2.5V	17½" X 19" X 13½"	—		
	10	RU70B	BENCH	2.5V	19" X 22" X 15"	G		
	12	RU80	RACK	625MV	12¼" X 19" X 17¼"	F	208-230 VAC 60 Hz 3 PHASE*	207
	20	RU90	BENCH	625MV	19¼" X 22" X 18"	G		
	40	RU100	FLOOR	625MV	48" X 22" X 18"	H		
	60	RU150	FLOOR	625MV	48" X 22" X 24"	H		
0-500	5	RW80	RACK	500MV	12¼" X 19" X 17¼"	F	208-230 VAC 60 Hz 3 PHASE*	210
	10	RW90	BENCH	500MV	19¼" X 22" X 18"	G		
	20	RW100	FLOOR	500MV	48" X 22" X 18"	H		
	30	RW150	FLOOR	500MV	48" X 22" X 24"	H		
	40	RW200	FLOOR	500MV	52" X 22" X 24"	H		
0-1000	2.5	SX80	RACK	1V	12¼" X 19" X 17¼"	F	208-230 VAC 60 Hz 3 PHASE*	215
	5	SX90	BENCH	1V	19¼" X 22" X 18"	G		
	10	SX100	FLOOR	1V	48" X 22" X 18"	H		
	15	SX150	FLOOR	1V	48" X 22" X 24"	H		
	20	SX200	FLOOR	1V	52" X 22" X 24"	H		
0-1500	1.5	TY80	RACK	3.75V	12¼" X 19" X 17¼"	F	208-230 VAC 60 Hz 3 PHASE*	217
	3	TY90	BENCH	3.75V	19¼" X 22" X 18"	G		
	7	TY100	FLOOR	3.75V	48" X 22" X 18"	H		
	10	TY150	FLOOR	3.75V	48" X 22" X 24"	H		
	13	TY200	FLOOR	3.75V	52" X 22" X 24"	H		
0-2000	1.25	VZ80	RACK	5V	12¼" X 19" X 17¼"	F	208-230 VAC 60 Hz 3 PHASE*	219
	2.25	VZ90	BENCH	5V	19¼" X 22" X 18"	G		
	5	VZ100	FLOOR	5V	48" X 22" X 18"	H		
	7.5	VZ150	FLOOR	5V	48" X 22" X 24"	H		
	10	VZ200	FLOOR	5V	52" X 22" X 24"	H		

* Three-phase units, incorporating the exclusive FAZEGUARD Sensor (Patented), a solid state phase failure circuit that will turn off the power supply if one or more of the three input phases opens.

Opad
OPAD ELECTRIC COMPANY, INC.
43-12 WALKER STREET • NEW YORK, N. Y. 10013 Telephone: (212) WOrth 6-0380

PEERLESS ELECTRICAL PRODUCTS

CUSTOM POWER SUPPLIES

Designed to Your Requirements

Peerless power supplies are available with DC or AC inputs. AC inputs are normally 60 or 400 cps; DC outputs extend to 10 ma or higher. Regulation values normally range from 5% to 10% from no load to full load; peak-to-peak ripple voltages may be less than 1% of output voltage within this range. When required, closer tolerances can be supplied.

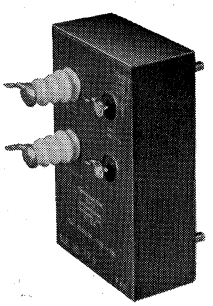
Peerless power supplies can be packaged to meet any operating requirements from commercial to Mil. Spec. And, their dimensions and configurations may also vary to meet specific volume requirements. For complex applications, Peerless has designed and manufactured power supplies that provide two or more outputs, operate in ambients up to 125°C and withstand shocks up to 50 G's. Whether your requirements are conventional or exotic, Peerless can solve the design problems and manufacture in quantity to your exact specifications.

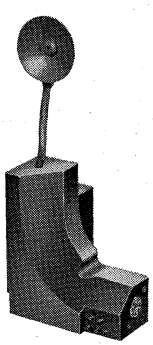
Typical examples of Peerless solutions to unique power supply requirements are shown on this page.

EXAMPLE 14

HIGH VOLTAGE POWER SUPPLY, EPOXY FILLED TO CONFORM TO MIL SPECIFICATIONS

- **Input:** 115 v, 400 cps
- **Output:** 5,000 v DC @ 1 ma
- **Regulation:** 600 v max., 0 load to full load
- **Ripple:** 500 v max., peak-to-peak
- **Packaging:** Conforms to the requirements of MIL-T-27A, Grade 4, Class R, Life X
- **Dimensions (max.):** 3¼" H x 2⅛" W x 4" D
- **Weight:** 1.25 lbs.

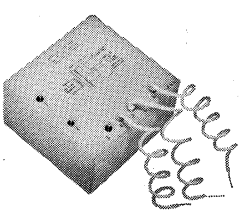




EXAMPLE 15

SPECIAL SHAPED POWER SUPPLY FOR USE WITH CATHODE RAY TUBES

- **Input:** 6 v, unregulated
- **Outup:** 6,500 v DC @ 200 ua
- **Regulation:** 400 v, 0 load to full load
- **Ripple:** 30 v, peak-to-peak
- **Packaging:** Conforms to the requirements of MIL-T-27A, Grade 5, Class R, Life X
- **Dimensions:** 4¼" H x 3⅝" W x 2²⁵⁄₃₂" D
- **Weight:** 1.25 lbs.



EXAMPLE 17

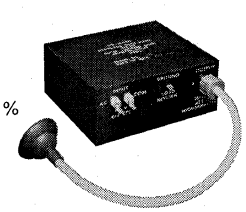
SEALED, REGULATED POWER SUPPLY

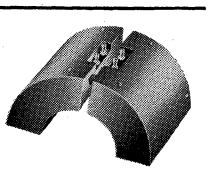
- **Input:** 115 v ± 5%, 380 cps-420 cps
- **Output 1:** 2,600 v DC @ 0.5 ma to 1.5 ma
- **Regulation:** (a) At 109 v input, 1.5 ma output @ 2,600 v min. (with output 2 connected to its load)
  (b) At 121 v input, 0.5 ma output @ 2,680 v max. (with output 2 unloaded)
- **Output 2:** 6.3 v RMS, C.T. @ 600 ma
- **Ambient Temperature:** −55°C to +85°C
- **Dimensions:** 2" H x 4" W x 3¾" D

EXAMPLE 20

SEALED, REGULATED POWER SUPPLY (MIL-E-16, 400, CLASS 3)

- **Input:** 108-132 v, 380-420 cps
- **Output:** 10,000 v ± 5% DC at load current of 100 microamperes
- **Regulation:** Output voltage constant within 2% from no load to full load
  Output voltage constant within ± 1% over range of specified input voltages
- **Ripple:** 0.2% peak-to-peak
- **Dimensions:** 2" H x 4½" W x 5" L excluding terminals and mounting studs





EXAMPLE 21

SEALED, REGULATED POWER SUPPLY

- **Input:** 115 v ± 5%, 380 cps-420 cps
- **Output 1:** 2,600 v DC @ 0.5 ma to 1.5 ma
- **Regulation:** (a) At 109 v input, 1.5 ma output @ 2,600 v min. (with output 2 connected to its load)
  (b) At 121 v input, 0.5 ma output @ 2,680 v max. (with output 2 unloaded)
- **Output 2:** 6.3 v RMS, C.T. @ 600 ma
- **Ambient Temperature:** −55°C to + 85°C
- **Dimensions:** 2½" H, semi-circular (two quarter sections) —inner radius 1⅜"; outer radius 2⅞"

PEERLESS ELECTRICAL PRODUCTS

BASIC GUIDE TO CUSTOM POWER SUPPLY ESTIMATES

This form contains the information required for prompt estimates on design and construction of custom power supplies. We would be pleased to send you these forms for your convenience in establishing your power supply requirements.

1 ( ) If military, show applicable specification_____and for MIL-T-27 Grade_____, Class_____, Life_____, Family_____, and other_____

2 ( ) If commercial, show: fully potted_____, or encased_____.

3 ( ) Ambient temp. _____° C. min, _____° C. max. Temp. rise _____° C. max.

4 ( ) Duty cycle_____If intermittent, indicate time on_____, and time off_____.

5 ( ) Mounting, terminal end ( ), opposite end ( ), inserts ( ), studs ( ), flanges ( ).

6 ( ) Terminals, stand-off ( ), feed-through ( ), lugs ( ), flex leads ( ), other ( ): describe _____

7 ( ) Size limits,_____X_____X_____H
8 ( ) Weight limit_____
9 ( ) Mounting centers_____

To be completed when component will be used in existing equipment, or when space limitations are critical.

10 ( ) Converter (D.C. Source to D.C. Load)

11 ( ) Inverter (D.C. Source to D.C. Load)

12 ( ) Power Supply (A.C. Source to D.C. Load)

A. Input Volts_____Nominal
Volts_____Max.
Volts_____Min.
@_____C.P.S. ± _____C.P.S. or D.C._____, _____ohms source impedance.

B. Additional pertinent supply data_____

OUTPUT

C. Output Data:
Full load volts_____D.C. _____RMS
Nominal Tolerance_____±
Volts or _____±%
Full load current_____u.a.
_____m.a. _____a.
Load current variation:
Max. allowable ripple_____P to P or _____%
Local power factor:
Output frequency c.p.s.
_____square wave
_____size wave
Output frequency tolerance:
±_____c.p.s., or ±_____%

Max. allowable harmonics:
_____%

Permissible output voltage regulation:
a. With input voltage variation ±_____volts
b. With load variation:
±_____%
c. With temperature variation:
_____° C to _____° C

Permissible output frequency tolerance with above variations:
±_____c.p.s.

Output impedance, ohms

D. Other requirements - general:
Efficiency _____% min.
Ambient temperature range _____° C to _____° C
Possible transient voltages in source _____% of nominal voltage. Duration _____u sec.
Flowable "hash" feedback into source ±_____m.v.
Short circuit protection required yes___ no___
Reverse polarity protection required yes___ no___
Cooling:
a. Natural draft_____
b. Forced draft (air blast)_____
c. Heat sink_____
Honning:
Operated at ground potential_____ or floating_____

E. Schematic of applications. Give as much information as possible relating to source of supply, loading, etc.
Separate sheet attached, yes___ no___

TYPICAL SPECIFICATIONS FOR POWER SUPPLIES PEERLESS HAS DESIGNED AND MANUFACTURED IN QUANTITY

Example Number	Input	Output(s)	Regulation	Ripple Volts (Peak to peak)	Size: Height, Depth, Width
33	115 v AC 400 cps	6,000 v DC @ 100 ua and 600 v tap	3%	3%	2 9/16" x 5" x 1 1/4"
34	115 v AC 400 cps	8,500 v DC @ 100 ua	300 v, 0 load to full load	200	2 9/16" x 5" x 1 1/4"
35	105 v AC 400 cps	6,000 v DC @ 200 ua	400 v, 0 load to half load		1 1/2" x 3 5/8" x 3 5/8"
36	115 v AC 400 cps	2,500 v DC @ 1 ma	300 v, 0 load to full load	250	1 1/4" x 3 1/2" x 2 1/2"
37	115 v AC 400 cps	6,000 v DC @ 100 ua	300 v, 0 load to full load	150	2 9/16" x 5" x 1 1/4"
38	115 v AC 400 cps	8,000 v DC @ 60 ua and 1,400 v DC @ 5 ua	400 v, 0 load to full load		1 1/2" x 4 1/8" x 2 15/16"
39	115 v AC 400 cps	8,000 v DC @ 100 ua 2,400 v DC @ 250 ua	550 v, 0 load to full load 25 v, 1/2 load to full load	160 1.0	1 3/4" x 6" x 2 1/16"
40	115 v AC 400 cps	3,000 v DC @ 2 ma	10%	10%	1 1/4" x 4" x 2 1/2"
41	120 v AC 60 cps	8,000 v DC @ 200 ua 750 v DC @ 245 ua	250 v, 0 load to full load	5%	3 1/2" x 6 1/2" x 5"
42	115 v AC 400 cps	2,000 v DC @ 1 ma	10%	10%	1 1/4" x 3 1/4" x 2 1/2"
43	115 v AC 400 cps	1,500 v DC @ 1 ma	10%	10%	1 1/4" x 3 1/4" x 2 1/2"
44	115 v AC 400 cps	8,000 v DC @ 60 ua and 1,500 v DC @ 20 ua	400 v, 0 load to full load	4%	1 1/2" x 4 1/8" x 2 15/16"
45	115 v AC 400 cps	4,000 v DC @ 1 ma	10%	10%	1" x 4" x 3"
46	115 v AC 400 cps	2,500 v DC @ 1 ma	10%	10%	1" x 4" x 3"
47	115 v AC 400 cps	3,000 v DC @ 1 ma	10%	10%	1 1/4" x 3 1/4" x 2 1/2"
48	115 v AC 400 cps	1,200 v DC @ 15 ma	120 v, 0 load to 1/3 full load	50 at 1/3 full load	2 3/8" x 3 1/4" x 2 7/8"
49	115 v AC 400 cps	10,000 v DC @ 1 ma	1000 v, 0 load to full load	1000	1 3/4" x 5 1/4" x 4"
50	11.5 v DC	800 v DC @ 265 ma 350 v DC @ 35 ma 200 v DC @ 120 ma	10%	2% 2% 1%	2 3/8" x 3.56" x 6 5/8"
51	115 v AC 400 cps	700 v DC @ 1 ma	10%	5%	2" x 5 1/4" x 4"
52	115 v AC 400 cps	±1,500 v DC @ 1 ma 6.3 v DC @ .6 amp	10%	5%	1 3/4" x 4 1/2" x 3"

Example Number	Input	Output(s)	Regulation	Ripple Volts (Peak to peak)	Size: Height, Depth, Width
53	117 v AC 60 cps	10,000 v DC @ 100 ua— 250 ma max.	10%	0.1%	3 5/8" x 5" x 6 1/2"
54	115 v AC 400 cps	8,500 v DC @ 1 ma	10%	10%	1 25/32" x 3 1/32" x 4 25/32"
55	115 v AC 400 cps	3,000 v DC @ 225 ma	10%	.5%	1 1/2" x 3" x 4"
56	96 v AC 400 cps	1,650 v DC @ 1.5 ma 525 v DC @ 300 ma	15%	5%	1 3/32" x 3 3/4" x 2 5/16"
57	120 v AC 60 cps	2,000 v DC @ 1 ma —2,000 v DC @ 4 ma	15%	10%	5" x 8" x 4"
58	120 v AC 60 cps	9,000 v DC @ 1 ma tapped at 100 v DC	10%	0.5%	4 5/8" x 5" x 11 1/2"
59	10 v DC	±2,400 v DC @ 500 ua		0.5%	2 11/16" x 2 5/16" x 3 13/16"
60	115 v AC 400 cps	8,000 v DC @ 200 ua 400 v DC @ 2 ma	2%	1%	3 9/16" x 3 1/16" x 4 1/8"
61	21 v DC	350 v DC, 410 v DC 470 v DC @ 7 ma 100 v DC @ 2 ma —21 v DC @ 10 ma 12.5 v (p-p) @ 500 ma	5%	1%	1 7/8" x 2 1/4" x 3 1/2"
62	115 v ± 10% 400 cps	3,500 v DC @ 2 ma	1%	0.1%	4" x 4" x 8 1/2"
63	115 v ± 5% 400 cps	2,600 v DC @ 0.5 to 1.5 ma 6.3 v AC @ 600 ma	2.3%	0.46% (12v)	4" x 3 3/4" x 2"
64	115 v AC 400 cps	7,000 v DC @ .5 ma	10%	7%	2 1/8" x 4" 5 1/4"
65	115 v ± 5% 400 cps	2,600 v DC @ 0.5 to 1.5 ma 6.3 v AC @ 600 ma	2.3%	0.46% (12 v)	4" x 3 3/4" x 2"
66	26 v DC	115 v RMS 400 cps @ 1 amp	±10%		2 27/32 x 3 11/32" x 4"
67	28 v DC ±5 v	115 v RMS 60 cps sine wave 0-120 VA	±5% voltage and frequency	6% max. harmonic content	10" x 14" x 12 1/2"

FOR COMPLETE INFORMATION, PLEASE WRITE:

PEERLESS

ELECTRICAL PRODUCTS

A Division of LTV Ling Altec, Inc.

1515 SOUTH MANCHESTER AVENUE, ANAHEIM, CALIFORNIA

Peschel PP High-Voltage DC Power Packs and Power Supplies

MODELS PP & CPP

Basic DC power packs with or without controls and meters. Available in 1 KV to 500 KV output with current ratings from 1 ma up. Designed for incorporation into other equipment, for lab or industrial use. Applications include: capacitor charging, HV testing, electrostatic processes, including paint spraying, powering tubes and infrared devices. Regulation to ±0.01% available on request.

TWO TYPES OF CONTROLS:

Type A — Line cord, switch, fuse, pilot light, and continuously adjustable output control (0-100 dial on powerstat used for percentage of output indication).

Type C — Line cord, switch, fuse, pilot light, continuously adjustable output by means of powerstat, 2% accuracy voltage and current meters directly at output.

(Additional optional features to fit your requirements available.)

FEATURES

Low Cost — available with or without controls.

Small size, light weight.

Solid state, rugged reliability.

Long life — selenium or silicon rectifiers with high overload characteristics.

Positive polarity — negative on request; reversible polarity on many models.

GENERAL SPECIFICATIONS

Input 117v AC, 60-Hertz, 1-phase below 3KW; all others 208/230 V.

Output Continuously adjustable with powerstat-type control.

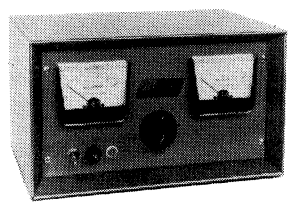
Regulation Approx. 25% N.L. to F.L. Available to 0.01%.

Ripple Approx. 2-3%. Available to 0.01%.

	MODEL	OUTPUT	BASIC POWER PACK	WITH CONTROL STYLE "A"	WITH CONTROL STYLE "C"
AIR INSULATED	PP1-50	1KV - 50 ma.	$100	$150	$200
	PP1-200	1KV - 200 ma.	260	310	405
	PP1-500	1KV - 500 ma.	400	455	550
	PP1-1000	1KV - 1000 ma.	600	670	770
	PP2-5	2KV - 5 ma.	60	110	150
	PP2-50	2KV - 50 ma.	130	175	220
	PP2-100	2KV - 100 ma.	250	300	375
	PP3-80	3KV - 80 ma.	250	300	375
	PP5-5	5KV - 5 ma.	80	120	160
	PP5-50	5KV - 50 ma.	250	300	375
	PP5-200	5KV - 200 ma.	500	575	650
	PP5-500	5KV - 500 ma.	700	825	925
	PP10-5	10KV - 5 ma.	100	160	200
	PP10-25	10KV - 25 ma.	300	370	470
	PP10-100	10KV - 100 ma.	800	900	1000
	PP10-500	10KV - 500 ma.	1700	1900	2000
	PP15-5	15KV - 5 ma.	140	190	260
	PP15-25	15KV - 25 ma.	500	570	670
	PP20-1.5	20KV - 1.5 ma.	110	180	210
	PP20-5	20KV - 5 ma.	190	240	320
	PP20-10	20KV - 10 ma.	230	280	350
	PP20-25	20KV - 25 ma.	500	575	650
	PP20-100	20KV - 100 ma.	1000	1100	1220
	PP30-5	30KV - 5 ma.	250	300	375
OIL INSULATED	PP30-25	30KV - 25 ma.	$775	$875	$975
	PP50-1	50KV - 1 ma.	280	350	390
	PP50-5	50KV - 5 ma.	490	580	680
	PP50-10	50KV - 10 ma.	950	1020	1120
	PP50-50	50KV - 50 ma.	1950	2070	2150
	PP70-5	70KV - 5 ma.	675	780	880
	PP70-10	70KV - 10 ma.	1300	1370	1470
	PP100-2	100KV - 2 ma.	550	620	700
	PP120-5	120KV - 5 ma.	1000	1105	1210
	PP120-10	120KV - 10 ma.	1900	2000	2100
	PP150-5	150KV - 5 ma.	1325	1500	1615
	PP200-2	200KV - 2 ma.	1700	1875	1990

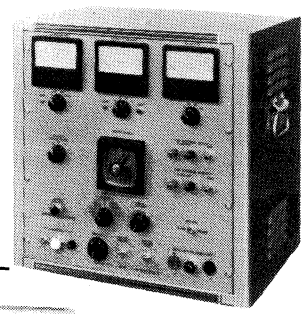
Note: To designate type of control, add letter A or C to basic PP unit. (Example: PP1-50A). To order power pack only, less controls, leave off letters A or C.

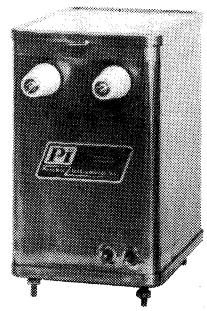
A BROAD RANGE OF MODELS TO CHOOSE FROM



Style "C"

CUSTOM 75 KV TEST SET





HERMETICALLY-SEALED POWER PACKS

CPP10-3

MODEL	OUTPUT	PRICE
CPP3-5	3KV @ 5 ma.	$ 65
CPP5-5	5KV @ 5 ma.	85
CPP10-3	10KV @ 3 ma.	95
CPP20-1.5	20KV @ 1.5 ma.	105

MODEL CCP — GENERAL SPECIFICATIONS

Encapsulant — Semi-rigid solid — Vacuum filled. Cases MIL-T-27A can with 4 mounting studs. Input — 0-115 volts, 50/60-Hertz. Output — Variable with variable input. Output Polarity — Reversible. Circuit — Full wave rectification.

LOW COST • SMALL SIZE
• LIGHTWEIGHT • SOLID STATE
• RUGGED • RELIABLE • LONG LIFE

Peschel Instruments Inc.
Cape Coral Industrial Park — Club Drive, Box 847
Cape Coral, Florida 33904 • (813) LI 2-3164

pioneer magnetics incorporated

1745 BERKELEY STREET, SANTA MONICA, CALIFORNIA 90404 / TEL: 213-393-0136

MIL QUALITY POWER CONVERSION EQUIPMENT

airborne and spaceborne specifications

P.M.I. specializes in the design and production of full military and N.A.S.A. quality Airborne & Spaceborne power conversion systems. P.M.I. builds to the following typical requirements:

MIL-E-4158	Design criteria for ground electronic equipment
MIL-E-5400	Design criteria for airborne electronic equipment
MIL-E-16400	Design criteria for shipborne electronic equipment
ANA Bulletin 400	Selection of parts and processes
MIL-STD-242	Selection of parts and processes
MIL-STD-701	Preferred Semiconductors
MIL-S-19500	Selection of Semiconductors
MIL-STD-461, 462	RFI and EMC requirements
MIL-STD-704	Aircraft Electric Power
MIL-STD-810	Environmental requirements
MIL-E-5272	Environmental requirements

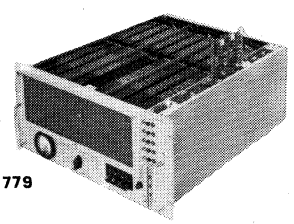
low temperature coefficient converters

STANDARD TEMPERATURE COEFFICIENT: 5PPM/°C

TYPICAL PERFORMANCE:

Output Rating: 20 volts @ 1 Amp DC.
Output Change: Less than 100 millivolts total for ambient change from −50°C to +100°C.

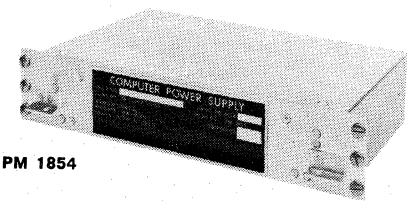
ac to dc power supplies



PM 1779

TYPICAL SPECIFICATIONS:
Input: 1 or 3 phase, 60Hz or 400Hz.
Outputs: From 4V to 1000V, power levels to 5KW. Single or Multiple outputs.
Regulation: Line: To ±.01% for ±10% line.
Load: To ±.01% for NL to FL.
Ripple: To .01% of full voltage.
Temperature Coef.: Standard ±.005/°C (see above).
Response: To 10 μsec.
Ambient Temperature: −55°C to +100°C.
Mechanical: State of the art size and weight.
Safety Features: Overvoltage and overcurrent.

dc to dc converters



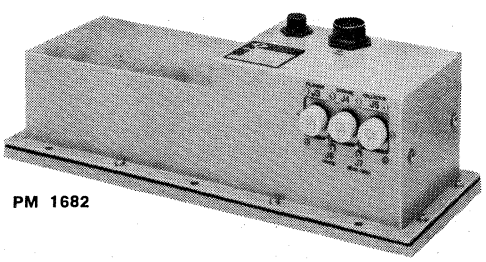
PM 1854

REPRESENTATIVE COMPUTER POWER SUPPLY

Regulated Power: 116 watts.
Size: 64 cubic inches.
Weight: 3 pounds.

TYPICAL SPECIFICATIONS:
Input: 18 VDC to 40 VDC. (Other ranges available). Spikes and ripple per MIL-STD-704.
Outputs: From 4V to 1000V, power levels to 5KW. Single or Multiple outputs.
Regulation: Line: to ±.01%.
Load: to ±.01% for NL to FL.
Ripple: To .05% of full output voltage.
Temperature Coef.: Standard ±.005%/°C (see left).
Response: To 10 μsec.
Ambient Temperature: −55°C to +100°C.
Mechanical: State of the art size and weight.
Safety Features: Overvoltage, overcurrent, and reverse input voltage.

high voltage power supplies



PM 1682

REPRESENTATIVE TWT POWER CONVERTER

Power: 1200 watts.
D.C. Voltages: 4000V Helix, 2700V Collector.

TYPICAL APPLICATIONS:

Traveling-wave tubes, Backward-wave Oscillators, Cathode-ray tubes, and Photo-multiplier devices.

TYPICAL SPECIFICATIONS:
Input: AC or DC ±10%.
Outputs: Multiple, isolated high voltages for helix, collector, dynodes, or aquadag. To 15,000V and 5KW.
Performance: See specs above.
Time Delay: To allow filament warmup previous to high voltage application.
High Voltage Ramp: To allow multiple high voltages to rise and decay together.
Helix Overload: Removes collector and helix potentials to avoid helix intercept damage.

Nickel - Cadmium
R E C H A R G E A B L E

by POWER INCORPORATED

Sealed Cells and Batteries

CAPACITIES UP TO 2000 AMPERE HOURS ON REQUEST

TYPICAL CYLINDRICAL CELLS
(FIG. A) 1.2 VOLTS PER CELL

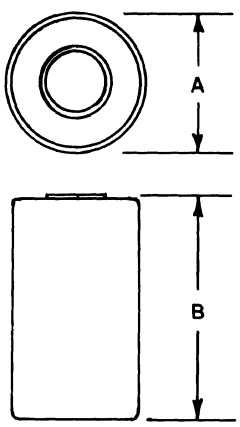


FIG. A

Type	Capacity mAH	Dimensions (in) A	Dimensions (in) B	Wt. oz.
170SC	170	0.625	0.600	0.4
250SC	250	0.542	1.209	0.6
500SC	500	0.554	1.920	1.0
600SC	600	0.625	1.920	1.0
750SC	750	1.020	0.910	1.1
900SC	900	0.562	3.532	1.4
1000SC	1000	1.000	1.280	1.1
1200SC	1200	.875	1.600	1.5
1800SC	1800	1.000	1.840	2.5
2000SC	2000	1.272	1.400	2.8
4000SC	4000	1.289	2.300	4.6
7000SC	7000	1.290	3.490	7.6
8000SC	8000	1.344	4.218	9.8

Oval cell also available (Fig. C) in 4000mAH, W-2.080 T-1.260 and H-1.656 Wt. 0.37 oz.
All battery configurations available with pressure contact buttons or solder lug terminals.

All cylindrical and oval battery types feature a pressure safety device for security and reliability making them especially suited for cordless consumer and electronic products.

CUSTOM BATTERY PACKS

Cylindrical cells are incased in a rigid, high impact case. Case materials are highly dielectric to provide maximum cell insulation at minimum cost. The case is vented to each cell to provide cooling and long life. Packs are available to your specifications in any voltage.

TYPICAL BUTTON CELLS
(FIG. B) 1.2 VOLTS PER CELL

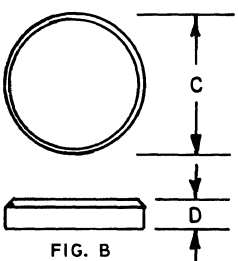


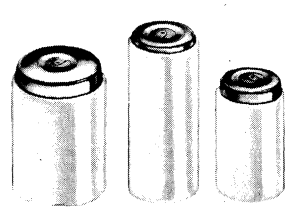
FIG. B

Type	Capacity mAH	Dimensions (in) C	Dimensions (in) D	Wt. oz.
20B	20	0.449	0.201	0.04
50B	50	0.606	0.230	0.09
100B	100	0.984	0.240	0.28
150B	150	0.984	0.260	0.30
180VBH*	180	0.984	0.290	0.39
225B	225	0.984	0.339	0.41
225BH*	225	0.984	0.347	0.44
250VBH*	250	1.340	0.210	0.58
400B	400	0.992	0.571	0.66
450B	450	1.689	0.299	1.10
500BH*	500	1.340	0.374	0.90
1000VBH*	1000	2.000	0.330	2.24
2000VBH*	2000	2.000	0.590	3.50
3000BH	3000	2.000	.976	5.00

*H denotes high rate discharge capability.

Button cell batteries are constructed of sealed nickle cadmium button cells (see fig. B) to meet almost any application requirement. The compact size of button cells permits easy stacking to form multiple cell batteries of optimum power/volume ratio and space utilization. Completely sealed button cells are ideally suited for portable radios, flashlights, photoflash, alarms, and any low-drain, high capacity application.

TYPICAL BUTTON CELL BATTERIES



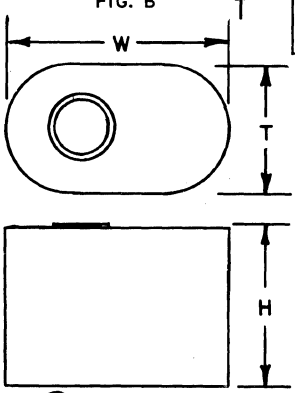
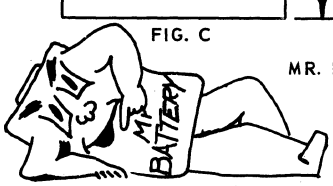


FIG. C

POWER INCORPORATED ALSO MARKETS:

- Emergency lighting units.
- Flashlight and lantern rechargeable batteries.
- Custom and prototype design battery packs built to your specifications.
- Battery chargers for all types of batteries.
- Batteries - **NICKLE CADMIUM - SILVER CADMIUM - SILVER ZINC - MERCURY - SEALED LEAD-ACID.**

INVESTIGATE direct current emergency power sources available in any regulated voltage or current, featuring automatic SCR solid state switchover to a self-contained battery. We have the answer to reliable economical D.C. power with automatic emergency back-up.



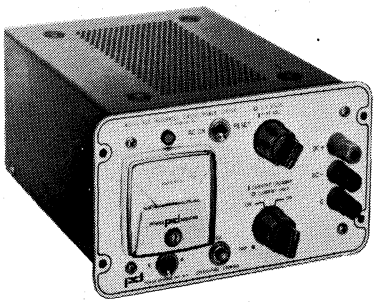
MR. BATTERY SAYS:

"We have over 10,000 cell and battery sizes in stock. If you don't see exactly what you are looking for here, let us know, chances are we'll be able to take care of your application immediately. We'd be happy to answer any questions. If we can't help you, no one can."

POWER INCORPORATED

FOR COMPLETE SPECIFICATIONS, PRICE, AND DELIVERY, WRITE OR PHONE
POWER INC. ● MARKETING DIVISION ● 12809 Eagle Ridge Drive ● Burnsville, Minnesota 55378 ● (612) 890-1360 ●

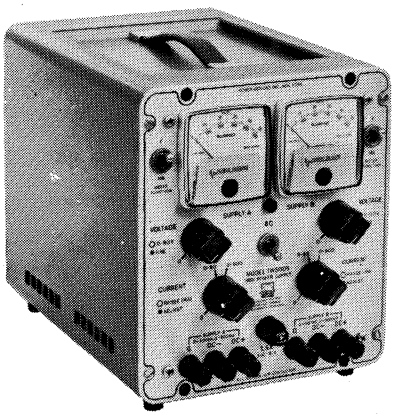
LABORATORY DC POWER SOURCES



Model 630
CASE A
8⅜" w. x 4¾" h. x 11-9/16" d.



Model 5015T
CASE B
5¾" w. x 8⅝" h. x 10⅞" d.



Model TW-5005
CASE C
7¾" w. x 8⅝" h. x 13½" d.

- All units have remote sensing; remote programming.
- Front and rear output terminals.
- Continuously adjustable voltage and current limiting controls.
- Model 5015T, 1010T, 1210S and 3650S feature a current limit indicating monitor.
- Modular package construction suitable for rack mounting. Single or dual mounting in 19" panel.
- Processed under Power Designs' "Predictable-Reliability" program for a 5-year MTBF. The program features: avalanche-controlled silicon rectifiers, stress-tested transistors, pre-aged zener references with extrapolated stability criteria based on 1/f noise changes, computer-grade capacitors, tin-oxide-film resistors, and components operated at 50% of manufacturers' published ratings. Units pre-aged under full-load conditions for a minimum of 50 hours.

PARTIAL LIST OF AVAILABLE UNITS

MODEL	VOLTAGE	CURRENT AMPS	REGULATION LINE/LOAD	RIPPLE Pk to Pk MV	CASE	*PRICE
630	0-6	0-3	0.01% +1mv	1.00	A	$149.50
2015R	0-20	0-1.5	†0.03% or 5mv	0.45	A	175.00
5005S	0-50	0-0.5	0.005% +1mv	1.00	A	149.50
5015T	0-50	0-1.5	†0.01% or 3mv	0.75	B	234.50
1010T	1-100	0-1.0	†0.05% or 15mv	1.50	C	339.50
1210S	0-12	0-10	0.01% +2mv	1.50	C	329.00
TW5005 (Dual)	0-50(2) 0-100 @ 0.5A Series Oper. 0-50 @ 1.0A Parallel Oper.	0-0.5	0.005% +1mv	1.00	C	297.50
3650S	0-36	0-5.0	0.01% +3mv	1.50	C	299.00

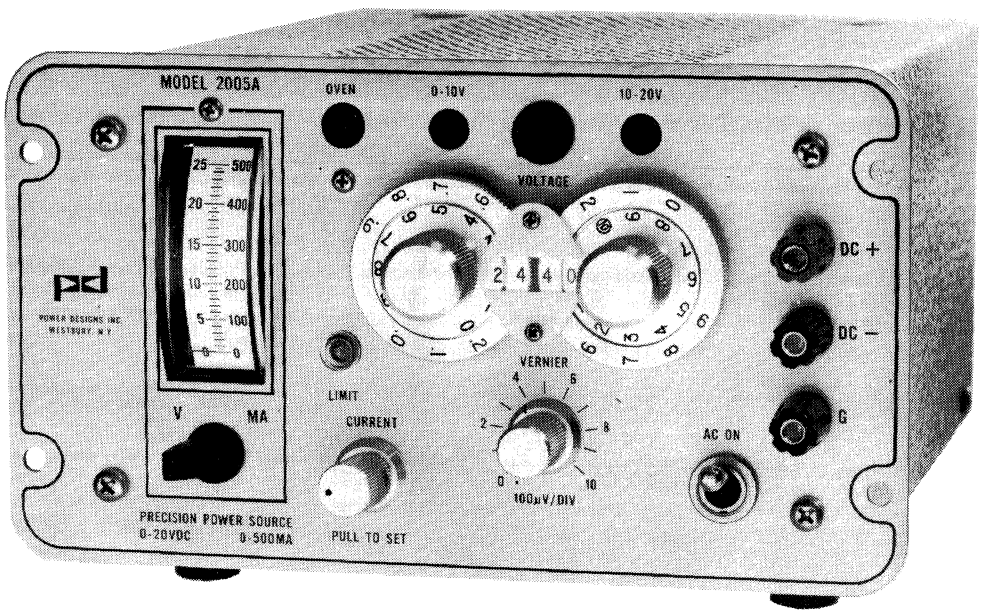
†whichever is greater

*FOB WESTBURY

POWER DESIGNS PACIFIC, INC.
MIRANDA AVENUE • PALO ALTO, CALIFORNIA
415-321-6111 TWX: 910-373-1251

POWER DESIGNS, INC.
1700 SHAMES DRIVE • WESTBURY, N. Y.
516 EDgewood 3-6200 TWX: 510-222-6561

PRECISION POWER SOURCES



- All silicon semiconductor regulator system with new, low noise diff-amp input transistor and specially processed zener voltage reference.
- Advanced solid state circuitry.
- Exceptional stability through design simplicity.
- Critical components maintained at constant ambient in temperature controlled oven.
- Self-restoring electronic overload and short circuit protection with continuously adjustable current limiting control.
- Pull-to-set current limit control with flashing current limit indicator light.
- Performance specifications based on anticipated ratings at end of five years of service.
- Built-in protection agains turn-on or turn-off transients.
- 100 hour minimum pre-aging of power supply prior to test and calibration.
- Individual calibration data furnished with each unit.

PARTIAL LIST OF AVAILABLE UNITS

MODEL	RANGE VOLTS	CURRENT AMPS	REGULATION LINE/LOAD	MAX. RIPPLE PK TO PK	STABILITY	TC PER °C	SIZE	SPECIAL FEATURES	† PRICE
2005A	0-20	0-0.5	.0005%	100μv	<.001% +100μv/8hrs.	.001%	8⅜x4¾ x8 1⅝	4 decade readout with .1% accuracy. Continuous current limiting with panel push button setting. Remote programmable 1000Ω/v.	$325
2020	0-20	0-2.0	100μv	100μv	<.001% +100μv/8hrs.	.001%	5¾ x 8⅝ x10 ⅞	4 decade readout with 0.1% accuracy. Remote programmable 1000Ω/v.	475
1025P	0-100	0-0.250	.0005%	100μv	<.001% +200μv/8hrs.	.001%	8⅜x4¾ x10	Remote programmable only 1000Ω/v. Accurate to .01% of programming resistance. Calibration at front panel. Voltage & current limiting.	295
UPMD-11	+15 −15	0-1.0 0-1.0	100μv/150μv 100μv/150μv	150μv 150μv	.01%/wk .01%/wk	0.001% 0.001%	5⅝x4½ x7½	Modular operational amplifier source. Dual tracking supply–better than 2 mv.	275
X-336	10.0	0-0.250	.0001%	500μv	.005%/mo.	2.5PPM	3x3½ x5¼	Modular secondary standard (adj. ±50mv).	275

WRITE FOR TECHNICAL DATA SHEETS

†FOB Westbury

POWER DESIGNS PACIFIC, INC.
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415-321-6111 TWX: 910-373-1251

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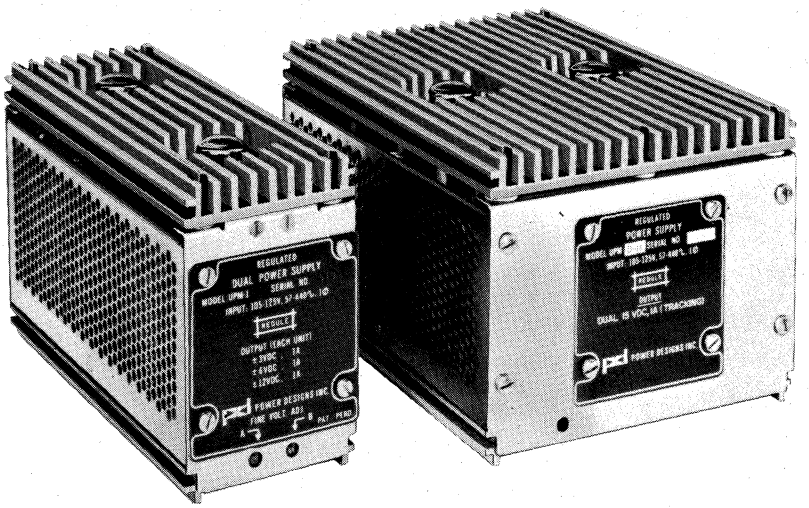
REDULE®
UNIVERSAL POWER SUPPLIES



- Single or dual outputs with choice of several output voltage levels in one package.
- Multi-turn incremental voltage adjustment potentiometer.
- Parallel or series operation with any terminal at ground potential.
- Remote sensing.
- Remote programming.
- Self-restoring fold-back overload and short protection.
- Thermal overload cutout.
- 100% inspected "reliability controlled" silicon semiconductors.
- 50 hour power supply pre-aging prior to test.
- 50 μs recovery time.
- 105-125V, 57-440 Hz input.
- Mounts in any plane, to any surface.
- No external heat sink required.
- Connector keying system prevents mating errors.
- Complete maintainability, reliability and workmanship to most AEC & NASA standards.

PARTIAL LIST OF AVAILABLE UNITS

MODEL	OUTPUT RATING	NUMBER OUTPUTS	REGULATION LINE/LOAD	MAX. RIPPLE PK TO PK	INPUT POWER @ NOM, LINE	†PRICE
UPM-6	24V @ 1½A, 27V @ 1¼A, 30V @ 1A	1	.01% +2mv	1mv	90w	$157.50
UPM-11	0-16V @ 1A	2	.01% +1mv	1mv	80w	199.00
UPM-16*	5, 6V @ 5A	1	.01% +2mv	1mv	85w	169.00
UPM-22	16-30V @ ½A, 30-60V @ ¼A	2	.01% +1mv	1mv	70w	199.00
UPM-33	0-16V @ 2A	1	.01% +1mv	1mv	80w	147.50
UPM-44	16-30V @ 1A, 30-60V @ ½A	1	.01% +1mv	1mv	70w	147.50
UPMD-10	24V @ 3A	1	.04% +2mv	2mv	180w	180.00
UPMD-11	±15V @ 1A (precision tracking)	2	See precision power supply page	105 μv	85w	275.00
UPMD-15	15V DC @ 2A	2	.01% +2mv	1mv	125w	265.00
UPMD-15V	Same as UPMD-15 with overvoltage crowbar protection					290.00
UPMD-X9	100V DC @ ¼A	2	.03% +1mv	1mv	90w	260.00
UPMD-56*	5, 6V @ 10A	1	.01% +2mv	1mv	170w	225.00
UPMD-530N	200-3000V @ 10ma	1	.0025% +5mv	10mv	60w	385.00
UPMD-530P	500-3000V @ 10ma	1	.0025% +5mv	10mv	60w	420.00

* Includes built-in overvoltage crowbar protection.

†FOB Westbury

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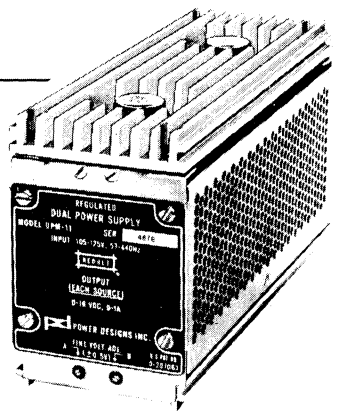
OPERATIONAL AMPLIFIER POWER SOURCES



Model UPM-11: Dual source, each programmable in 1-volt steps from 0 to 16 volts at 1.0 ampere. 25-turn trimmers permit intermediate settings with 10 millivolts resolution.
2¾" x 4½" x 7½" **$199.00**

Model UPM-22: Dual source, each programmable in 1-volt steps from 16-30 volts at ½ ampere and 30-60 volts at ¼ ampere. 25-turn trimmers permit intermediate settings with 25 millivolts resolution.
2¾" x 4½" x 7½" **$199.00**

Model UPMD-15: Dual 15 volt source, at 2 amperes. 25-turn trimmers permit ±0.75V adjustment of each source with a resolution of 10 millivolts.
5½" x 4½" x 7½" **$265.00**

Model UPMD-15V: Same as UPMD-15 with overvoltage crowbar protection.
5½" x 4½" x 7½" **$290.00**

Model UPMD-X9: Dual 100 volt source, at 0.25 amperes. 25-turn trimmers permit ±2V adjustment with a resolution of 50 millivolts.
5½" x 4½" x 7½" **$260.00**

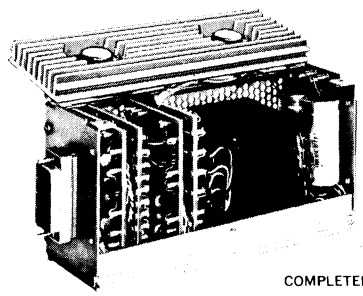
Model UPMD-11: Dual precision tracking source, ±15 volts at 1.0 ampere. 25-turn trimmers permit ±50 millivolts adjustment on master source and 10 millivolts on the tracking source. Regulation is better than 150 microvolts for load or line; ripple less than 150 microvolts peak-to-peak. Stability better than 10 millivolts per week.
5½" x 4½" x 7½" **$275.00**

Model FPM-101: Specifically designed for operation of amplifiers with ±15VDC output at 1A. Tracking accuracy of 0.01%/°C.
2¾" x 4½" x 7½". **$164.00**

ALL PRICES FOB WESTBURY, N.Y.

SEND FOR DETAILS OR CONTACT OUR LOCAL REP

CURRENT CAPACITY UP TO TWO AMPERES



COMPLETELY REPAIRABLE

- Redule® universal modular power supplies mount in any plane to any surface or to standard card bins, without heat sinking.
- Regulation is .01% + 1 millivolt (.01% + 2 MV on Model UPMD-15).
- Ripple less than 1 millivolt peak-to-peak.
- Recovery time less than 50 μs. Units operate from 105-125 V, 57-440 Hz source.

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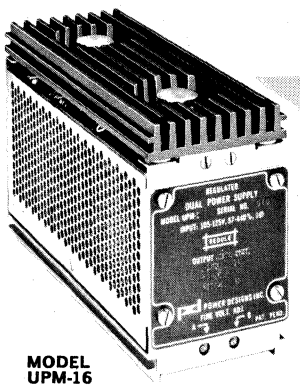
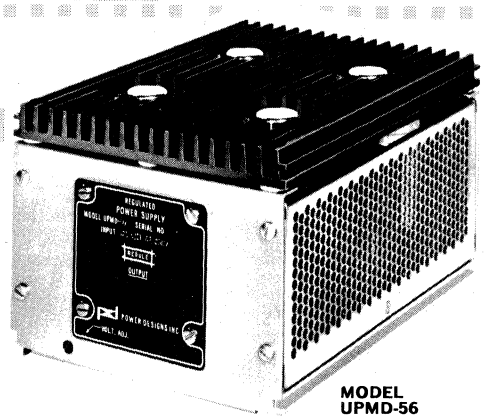
MODULAR INTEGRATED CIRCUIT HIGH STABILITY POWER SOURCES



MODEL UPM-16



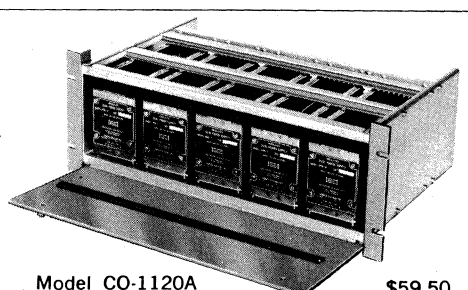
MODEL UPMD-56

WITH BUILT-IN OVERVOLTAGE CROWBAR

	MODEL UPM-16	MODEL UPMD-56
Output:	5 or 6VDC at 5A 0-6V remotely programmable (current derated)	5 or 6VDC at 10A 0-6V remotely programmable (current derated)
Stability:	1MV per 8 hours	1MV per 8 hours
Regulation:	0.01% +2MV	0.01% +2MV
Operating Temp.:	0-50°C	0-50°C (to 80°C derated)
Ripple & Noise:	1MV peak-to-peak	1MV peak-to-peak
†Price:	$169.00	$225.00

Front Loading Power Supply Bin

Accommodates up to 5-UPM modules or 2-UPMD modules plus 1-UPM module or any combination thereof. The bin may be mounted within a standard 19 inch equipment cabinet.



Model CO-1120A
Front View

$59.50

† ALL PRICES FOB WESTBURY

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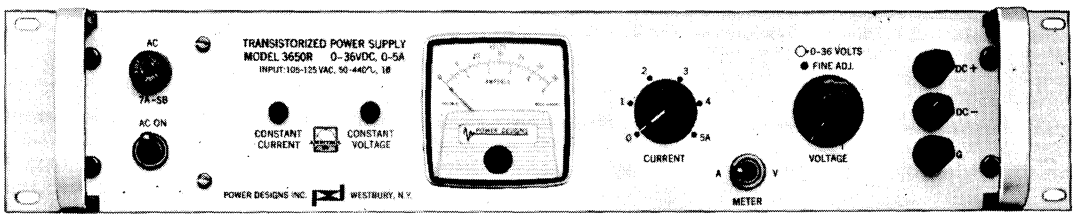
SCR CONTROLLED POWER SOURCES



CONSTANT VOLTAGE/CONSTANT CURRENT

Remote Voltage & Current Programming: Remote Sensing

- All silicon solid state circuitry.
- Constant voltage/current with operating mode indicating lights.
- Compound regulator system with SCR pre-regulator and high speed output regulator.
- Available with line filters to meet MIL-I-26600.
- Provisions for remote indication of operating mode.
- Front and rear access terminals on 3650R and 36100R families.
- High reliability shaped pulse SCR trigger circuitry.
- Fast recovery rectifiers minimize transients at input and output lines.

PARTIAL LIST OF AVAILABLE UNITS

MODEL	RANGE VOLTS	CURRENT AMPS	Mode: Constant Voltage REG.	Constant Voltage RMS RIPPLE	Constant Current REG.	Constant Current RMS RIPPLE	SOURCE IMPEDANCE TO 20KC	SOURCE IMPEDANCE TO 1MC	SIZE	WEIGHT LBS.	FOB WESTBURY PRICE
3650R	0-36	0-5.0	.01% +3mv	500μv	.02% +1ma	3ma	0.025Ω	1.0Ω	19x3½x16	35	$349.50
***3650RF**	0-36	0-5.0	.01% +3mv	500μv	.02% +1ma	3ma	0.025Ω	1.0Ω	19x3½x16	35	375.00
36100R	0-36	0-10.0	.01% +3mv	500μv	.02% +3ma	3ma	0.025Ω	1.0Ω	19x5¼x16	45	463.00
***36100RF**	0-36	0-10.0	.01% +3mv	500μv	.02% +3ma	3ma	0.025Ω	1.0Ω	19x5¼x16	45	483.00

* Meets MIL-I-26600 for RFI

WRITE FOR SPECIFICATION SHEETS

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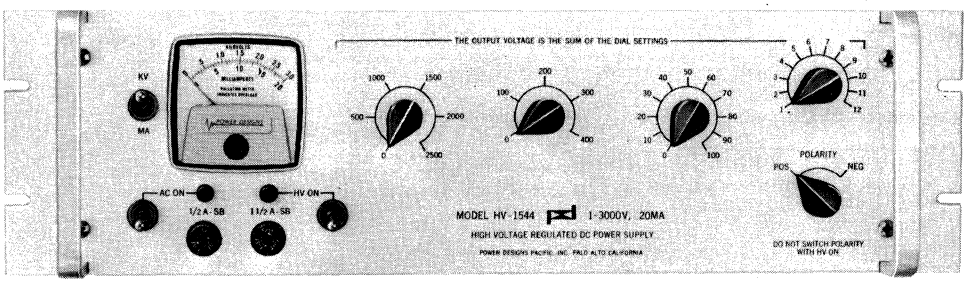
HIGH VOLTAGE PRECISION POWER SOURCES



Model 1544

- High Stability — .005%/hr.; .02%/24 hrs.
- All solid state on Model 3K10.
- Low noise level.
- Superior performance and reliability.
- Self-restoring overload and short circuit protection with fault indicator.
- All silicon semiconductor amplifier with low TC zener reference. Vacuum tube "pass" element.
- Sealed transformers.
- 105-125 V, 50-400 cycles input.
- 0.25% calibration accuracy.
- 10 MV resolution; 25 MV on Model 3K10.
- 50 μS recovery time.
- Voltage and current metering.
- Field proven service.
- TC less than 50 PPM/°C.

PARTIAL LIST OF AVAILABLE UNITS

MODEL	VOLTAGE	CURRENT MA	REGULATION LINE OR LOAD	RIPPLE Pk to Pk MV	SIZE PANEL HT.	† PRICE
2K10	1-2012	0-10	.002% + 2mv	1.0	3½	$ 299
***1565**	1-2012	0-20	.001% + 2mv	1.0	3½	$ 415
1544	1-3012	0-20	.001% + 2mv	1.0	5¼	$ 520
1547	1-3012	0-40	.001% + 2mv	1.0	5¼	$ 575
1545	10-5021	0-20	.001% + 2mv	1.0	8¾	$ 625
1556A	10-6021	0-20	.001% + 2mv	1.0	8¾	$ 625
1543A	10-10021	0-10	.001% + 2mv	5.0	10½	$ 950
3K10	500-3kv	0-10	.001% + 3mv	10	3.0	$ 390

*0.15% Calibration Accuracy

WRITE FOR SPECIFICATION SHEETS

†FOB WESTBURY

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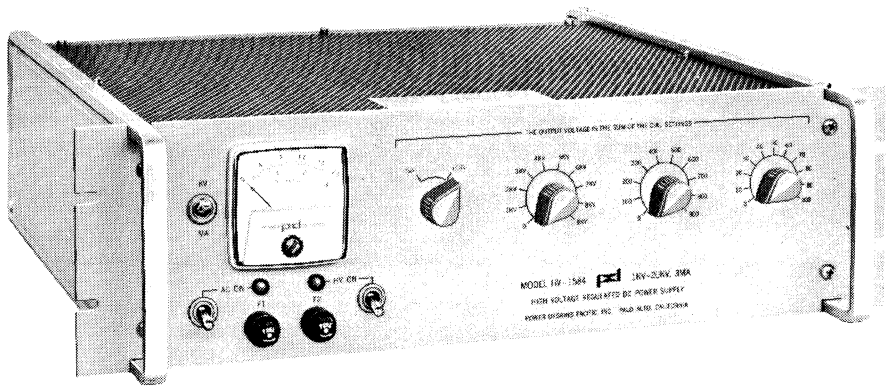
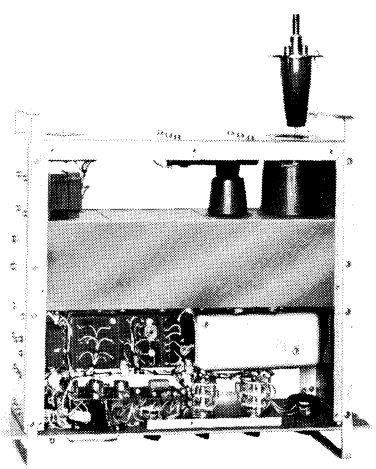
HIGH VOLTAGE
CRT DISPLAY POWER SOURCES





ALL SOLID STATE
CORONA-FREE
HIGH STABILITY
LOW NOISE OUTPUT
ONLY 5¼″ H x 19″ W x 16″ D

Model	Output Voltage	Output Current	Ripple Pk to Pk	Polarity	†Price
1584	1kv to 20kv	0-3ma	250 mv	Positive	$1875.00
1584R	1kv to 20kv	0-1ma	200 mv	Reversible	$2200.00
1579	10kv to 30kv	0-1ma	250 mv	Positive	$2250.00
1579R	10kv to 30kv	0-1ma	250 mv	Reversible	$2575.00

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PMC UNIVERSAL POWER SUPPLIES

precision wide voltage range modules

The UniPower Series of power supplies described on these pages are the result of a unique design concept developed by POWER/MATE CORP. The end result of this design effort is to make available, for the first time, the advantages of a single, all-purpose, wide range supply with the compact size of a narrow range slot supply.

We have provided you with a power supply that can meet the needs of virtually all of your equipment—now, a stock of one or two models takes the place of the dozens previously required. Spare parts inventory is simplified and design time is substantially reduced.

Other outstanding advantages of the UniPower Series are the availability of either internal or external control, internal or external sensing, complete overload and short circuit protection, and the convenience of three mounting surfaces allowing the modules to be fit into virtually any available space.

The high degree of reliability and ruggedness of these all-silicon, solid state circuits has been incorporated into two compact bench supplies and a dual-output op-amp supply that are also described on later pages.

ALL POWER/MATE CORP. UniPower Modules are covered by a full five year warranty. In addition, they have all been tested by an independent laboratory and meet MIL-E-5272C, MIL-E-16400, MIL-E-5422 and MIL-E-4970 environmental requirements. They also meet MIL-I-6181D RFI requirements and the Mean-Time-Between-Failure in excess of 100,000 hours of MIL Handbook 217.

UNI-76
0-34 VOLTS
0.5 AMPS
$76.00

UNI-88
0-34 VOLTS
1.5 AMPS
$99.00

UNI-30C
0-30 VOLTS
TO 5 AMPS
$134.00

UNI-30D
0-30 VOLTS
8 AMPS
$151.00

UNI-30E
0-30 VOLTS
TO 12 AMPS
$174.00

UNI-30F
0-30 VOLTS
TO 18 AMPS
$205.00



UNI-30G
0-30 VOLTS
TO 24 AMPS
$265.00

UNI-30H
0-30 VOLTS
TO 34 AMPS
$315.00

UNI-TWIN-164
DUAL OUTPUT
0-25 VOLTS
0.75 AMPS
$164.00

POWER/MATE CORP. 163 CLAY ST., HACKENSACK, N. J. 07601

UNIVERSAL POWER SUPPLIES PMC

FEATURES

- Integral Heat Sink
- All-Silicon Semiconductors
- 85°C Capacitors
- Rugged Welded Construction
- 3-Way Universal Mounting
- Removable Cover
- Full Component Accessibility
- Voltage Outputs Adjustable
- Currents up to 34 amps
- Regulation Better than ±0.005%
- Short Circuit and Overload Proof

SERIES/PARALLEL OPERATION

These modules may be connected in any series parallel combination of up to four units. Maximum output should not exceed 300 volts.

OUTPUT VOLTAGE vs. OUTPUT CURRENT FOR VARI-RATED UNI-30 ( ) SERIES

CASE SIZE	OUTPUT VOLTAGE													
	0-6V	8	10	12	14	15	16	18	20	22	24	26	28	30
C	5.0	4.6	4.4	4.2	4.1	4.0	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.5
D	8.0	7.6	7.3	6.9	6.6	6.4	6.2	6.0	5.7	5.3	5.0	4.7	4.4	4.0
E	12.0	11.2	10.8	10.3	9.8	9.5	9.2	8.8	8.3	7.9	7.4	6.9	6.4	6.0
F	18.0	16.9	16.2	15.5	14.8	14.4	14.0	13.3	12.6	11.9	11.2	10.5	9.8	9.0
G	24.0	22.5	21.6	20.6	19.6	19.1	18.6	17.7	16.7	15.8	14.8	13.8	12.9	12.0
H	34.0	31.9	30.5	29.2	27.8	27.1	26.4	25.0	23.7	22.4	21.0	19.7	18.3	17.0

SPECIFICATIONS	Uni-76 0.5 Amps	Uni-88 1.5 Amps	Uni-30C To 5 Amps	Uni-30-D To 8 Amps	Uni-30-E To12 Amps	Uni-30-F To 18 Amps	Uni-30-G To 24 Amps	Uni-30-H To 34 Amps
Input Voltage	105-125 Volts, 47-420 CPS for all units							
Output Voltage	0-34	0-34	0-30	0-30	0-30	0-30	0-30	0-30
Regulation	+0.005% or 1 MV for line or load				+0.01% or 1 MV for line or load			
Ripple	Less than 250 microvolts for all units							
Response Time	Less than 20 microseconds for all units							
Temp. Coefficient	Better than 0.01%/°C for all units							
Long Term Stability	Better than 0.025% for 8 hours for all units							
Overload and Short Circuit Protection	Solid state short circuit and overload protected. Instantaneous recovery and automatic reset. Units cannot be damaged by prolonged short circuits or overloads.							
Polarity	May be either positive, negative or floating up to 300 volts for all units							
Operating Ambient	Continuous duty from —20°C to +71°C (See output curve)							

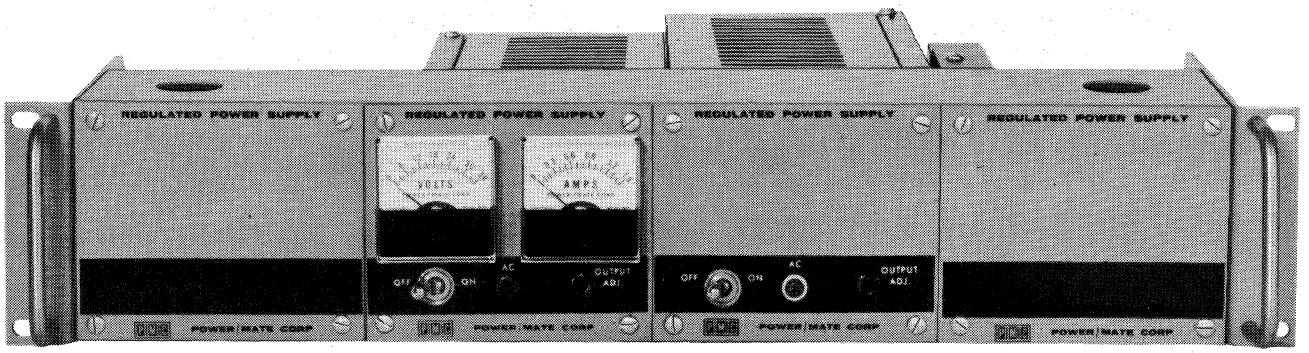
See your local representative or write for complete catalog on these units.

POWER/MATE CORP. 163 CLAY ST., HACKENSACK, N. J. 07601 PMC

PMC BUILDING BLOCK MODULES

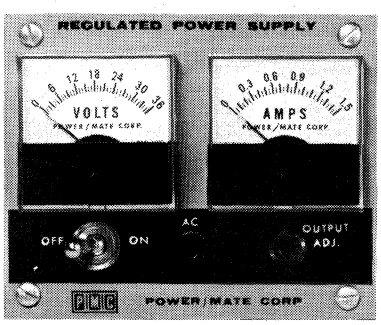
POWER/MATE CORP. has designed the UniPower Series supplies for maximum versatility. Part of this versatility lies in the fact that all of the UniPower units can be used as rack mounted laboratory supplies. By using POWER/MATE CORP.'s economical, in-stock building block components you can incorporate up to four UniPower modules in series, parallel or series/parallel output in a standard 19" rack that is only 3½" high. While these building block units are ideal for use with the UniPower Series, many of the thousands of other POWER/MATE CORP. supplies in single or dual output may be used.

All of the Building Blocks are finished in durable, baked gray enamel, with predrilled and tapped holes, ready for easy assembly. All of the units, like the power supplies used in them, are carried in stock for same day shipment. **How To Order** — Determine the number of the various Building Block units you require and order them by Model number. In ordering metered control panels, be sure to indicate meter ratings by adding first the volt meter rating and then the ammeter rating after the panel Model Number i.e., CPM35-35-1.5 indicates a quarter rack metered panel with a 0-35 voltmeter and a 0-1.5 ammeter.

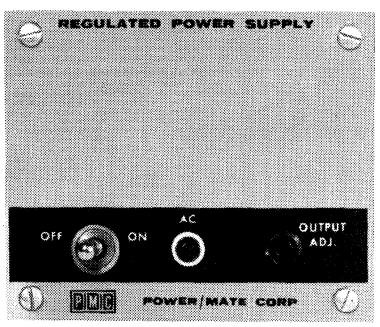


Model AR35 — 19" x 3½" Rack Adapter. All panels screw to pre-punched holes. Mounts up to four Uni-76's, -88's, or Unitwin 164's or 3 Uni-30C's or -30D's or any combination of these supplies. Price **$40.00**

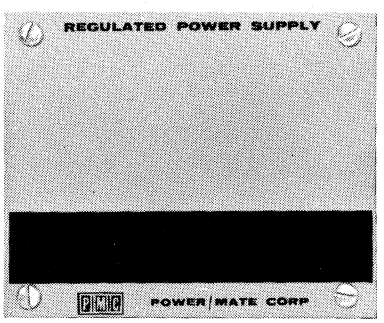
5¼" Rack Accessories for higher current models contact factory for catalog.



Model CPM35 — Quarter Rack Metered Control Panel with ammeter and voltmeter, on-off switch and indicator and screwdriver voltage adjust. On the rear of the panel are input cable, AC fuse and output solder terminals. Meters available are: Voltmeters — 0-10, 0-35, 0-150. Ammeters — 0-0.5, 0-1.5, 0-6. Price **$45.00**

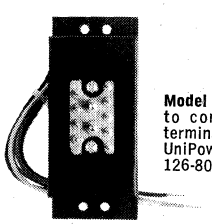


Model CP35 — Control Panel without meters but including the other items listed under CPM35. Price **$20.00**

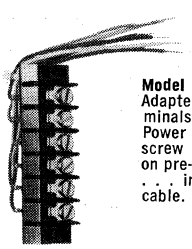


Blank panels for completing rack or mounting special controls are:

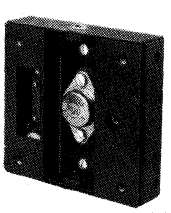
Model P35-4 — ¼ rack size Price **$4.00**
Model P35-2 — ½ rack size Price **$5.00**
Model P35-1 — full panel size Price **$7.50**



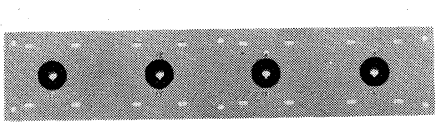
Model PT-1 — Plug Adapter to convert output solder terminals of the UNI 76-88 UniPower units to Amphenol 126-804 plug. Price **$5.50**



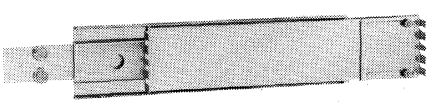
Model BT-1 — Terminal Strip Adapter converts output terminals of UNI-76-88 Uni-Power modules to barrier screw type. Mounts directly on pre-punched holes in case . . . includes hardware and cable. Price **$4.00**



Model OVP-1 — Over-voltage Protection is provided by this self-contained, crowbar-type solid state unit. It is independent of the power supply or the type of failure. It has dual trip voltage ranges (3-24 volts and 24-45 volts) continuously adjustable. Response time is between 3-6 micro-seconds. Dimensions 3⅜" x 2¾₆" x ⅞". Price **$30.**



Model AM35 — Module Adapter permits the use of up to four POWER/MATE style R, RH, or N case supplies on one AR35 Rack Adapter Price **$8.00**



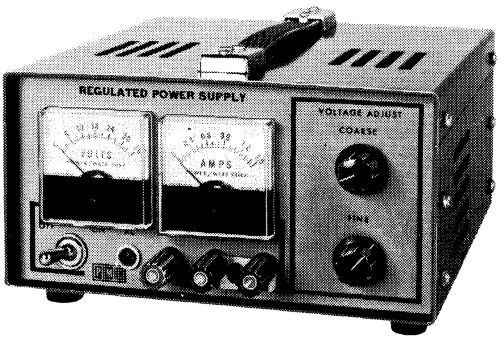
Model CS35 — Rack Slides with quick disconnect feature ball-bearing action. Price **$35.00** per pair

PMC BENCH PACKS



BP-89 $89.00

3⅜"H x 5⅜"W x 7¼"D



BP-118 $118.00

3⅜"H x 6⅞"W x 7¼"D

Here are the PMC Bench Pacs — really versatile, high-performance, low-cost Universal Bench Supplies. Once you read the specs on these economical huskies you agree that they're the perfect variable voltage bench supply for you. They pack all the features of the UniPower modules with the convenience and ease of use of a high priced lab supply. The BP-89 has a large dual range, switched meter for reading voltage and current output. Both Bench Pacs feature front panel coarse and fine controls, five-way binding posts and on-off switch and indicator. Rack mounting kits available. Contact factory for catalog.

ELECTRICAL SPECIFICATIONS

INPUT — 105-125V, 47-420 CPS.

OUTPUT VOLTAGE — 0-34 volts, set by external coarse and fine controls.

OUTPUT CURRENT — BP-89 –0.5 amps — BP-118 –1.5 amps.

REGULATION — Better than ±0.01% or 1 MV for line and load.

RIPPLE — Less than 250 microvolts.

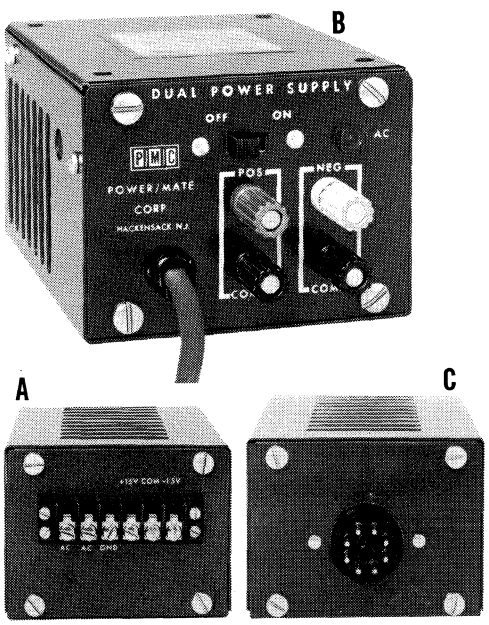
RESPONSE TIME — Less than 20 microseconds.

OVERLOAD & SHORT-CIRCUIT PROTECTION — Solid state short circuit and overload protected. Instantaneous recovery, and automatic reset. Unit cannot be damaged by prolonged short-circuits or overloads.

OUTPUT IMPEDANCE — BP-89 0.0068; **BP-118** 0.0023, ohms or less from DC to 1kc. Above 1kc, the output impedance rises by a factor of ten for each decade increase in frequency.

POLARITY— May be either positive, negative or floating up to 300 volts.

PMC POWERTWIN-99 TRACKING OP-AMP SUPPLY $99.00



The Powertwin-99 is a precisely regulated, dual-output power supply designed specifically for use with Op-Amps and other I.C. devices requiring dual power supplies. Each section of the Powertwin-99 is adjustable from 12 to 18 volts and the compact package has been constructed to meet the environment of MIL-E-5272. Look at the outstanding features of this unit.

ELECTRICAL SPECIFICATIONS

INPUT — 105-125 V AC 50-400 cps single phase.

OUTPUT VOLTAGE — 12.0-18.0 V DC, 0.400 amps (each output).

REGULATION — ±0.05%.

RIPPLE — 1.0 MV rms (max.)

TEMPERATURE COEFFICIENT — Better than 0.01%/°C.

OVERLOAD PROTECTION — Unit will withstand direct short circuit across either output to common or across + to — output terminals for an indefinite period without damage to the supply.

OUTPUT CURRENT vs TEMPERATURE — Each output is rated for 0.400 amperes at 50°C ambient and is derated linearly to 0.300 amps at 71°C.

WEIGHT — Net 3¾ pounds, Shipping 4¾ pounds.

MILITARY SPECIFICATIONS

Designed to meet the environmental requirements of MIL-E-5272 and RFI requirements of MIL-I-6181.

Mean-Time-Between Failures — In excess of 100,000 hours per MIL HDBK 217.

MIL-T-27 TRANSFORMERS

ACCESSORIES

The POWERTWIN-99 may be readily converted to a bench type dual output power supply for lab use simply by removing the front panel barrier strip (a) assembly on the standard model and replacing it with the lab adapter front panel (b). The supply may also be converted back to the standard module type at any time. No soldering is required. The Lab Adapter kit comes complete with panel shown and four rubber mounting feet. Model number LD-1. Price $14.50.

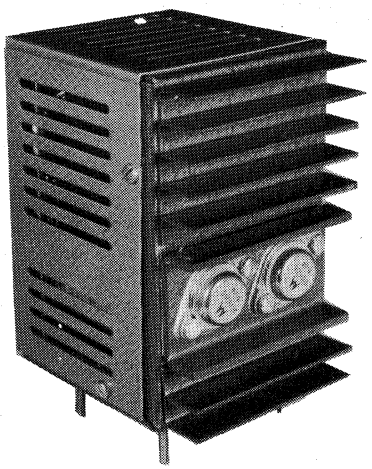
An octal plug (c) output also may be installed in place of the barrier strip. This is easily accomplished without soldering. Model number OP-1. Price $4.00.

POWER/MATE CORP. 163 CLAY ST., HACKENSACK, N. J. 07601

PMC DUAL OUTPUT POWER MODULES

FOR LOGIC CIRCUITS AND EQUIPMENT

DRA SERIES—0.05% REGULATION / DRB SERIES—0.5% REGULATION



The DRA and DRB Series of Dual Output Power Supply Modules provides users of logic circuits and equipment a convenient dual output supply, all in one compact package. This group of supplies provide a choice of thousands of dual voltage and current combinations.

FEATURES

- ✲ **All Silicon Semiconductors throughout**
- ✲ **All components rated for continuous duty at —20 to +71°C**
- ✲ **Short Circuit Proof — may be shorted indefinitely without damage**
- ✲ **Automatic overload & short circuit recovery**

SPECIFICATIONS

INPUT: 105-125V, 47-420 CPS

OUTPUT: See Specific Model

REGULATION: ±0.05% vs line & load for DRA Series; ±0.5% vs line & load for DRB Series

RIPPLE: Less than 0.002%, or 1MV RMS whichever is greater for DRA Series; less than 0.01%, or 5MV RMS whichever is greater, for DRB Series

OPERATING AMBIENT TEMPERATURE: —20 to +71°C

COOLING: None required at specified ambient temp.

POLARITY: May be either positive, negative or floating (up to 300V) each supply independent

OVERLOAD PROTECTION: Solid state short circuit and overload protected. Instantaneous recovery and automatic reset. **Other features same as RA-RB Series.**

HOW TO ORDER

Note the Case Size Factor in the column for each of the two power supplies desired. Add these two numbers together. If the sum is 20 or less, then the supplies selected can be supplied as standard units in the DRA or DRB Series.

The model number for the dual supply consists of the prefix DRA (for 0.05% models) or DRB (for 0.5% models), followed by the voltage and current rating of each supply. Specify the higher voltage unit first. For example, a dual 16V, 0.375A, and a 10V, 0.750A supply in the DRA series is described by the following model number: DRA 16-0.375/10-0.750.

If the sum of the two Case Size Factors exceeds 20, consult the factory or our local representative in your area. We can probably supply it but in a different case size.

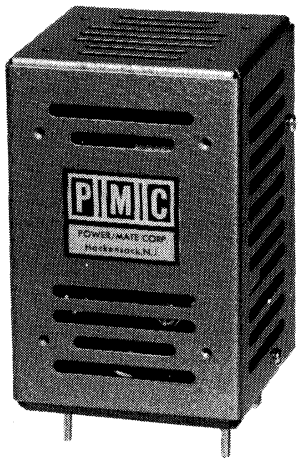
The cost of the dual module is the sum of the costs of the individual supplies selected. For example, the price of a dual module model DRA16-0.375/10-0.750 is the sum of $85 and $95, or $180.

DRA SERIES (0.05% REGULATION) — DRB SERIES (0.5% REGULATION)

OUTPUT VOLTAGE ADJUST RANGE	OUTPUT CURRENT (AMPS)	CASE SIZE	DRA PRICE	DRB PRICE	MODEL NO. (See how to order above)
3-5 see note 1	0.375	4	$ 60	$ 60	4-0.375
	0.750	7	75	75	0-0.750
	1.5	13	95	95	4-1.5
5-7 see note 1	0.200	2	60	60	6-0.200
	0.375	4	60	60	6-0.375
	0.750	7	75	75	6-0.750
	1.5	13	95	95	6-1.5
7-9 see note 1	0.200	2	60	60	8-0.200
	0.375	4	60	60	8-0.375
	0.750	8	75	75	8-0.750
	1.5	15	95	95	8-1.5
9-11	0.200	2	65	60	10-0.200
	0.375	4	80	70	10-0.375
	0.750	8	95	85	10-0.750
	1.5	15	105	95	10-1.5
11-13	0.100	1	60	60	12-0.100
	0.200	2	65	60	12-0.200
	0.375	4	85	75	12-0.375
	0.750	8	95	85	12-0.750
	1.5	16	115	105	12-1.5
13-15	0.100	1	65	60	14-0.100
	0.200	2	75	65	14-0.200
	0.375	4	85	75	14-0.375
	0.750	8	100	90	14-0.750
	1.5	16	125	115	14-1.5
14-16	0.100	1	65	60	15-0.100
	0.200	2	75	65	15-0.200
	0.375	4	85	75	15.0.375
	0.750	8	100	90	15-0.750
	1.5	16	125	115	15-1.5
15-17	0.100	1	65	60	16-0.100
	0.200	2	75	65	16-0.200
	0.375	4	85	75	16-0.375
	0.750	8	105	95	16-0.750
	1.5	16	125	115	16-1.5
17-19	0.100	1	65	60	18-0.100
	0.200	2	75	65	18-0.200
	0.375	4	85	75	18-0.375
	0.750	9	105	95	18-0.750
	1.5	17	125	115	18-1.5
19-22	0.100	1.3	65	60	20-0.100
	0.200	2.6	75	65	20-0.200
	0.375	5	85	75	20-0.375
	0.750	10	105	95	20-0.750
22-25	0.100	1.4	65	60	23-0.100
	0.200	2.8	75	65	23-0.200
	0.375	5.5	85	75	23-0.375
	0.750	10	110	100	23-0.750
25-28	0.100	1.4	65	60	26-0.100
	0.200	2.8	75	65	26-0.200
	0.375	5.5	85	75	26-0.375
	0.750	10.5	110	100	26-0.750
26.5-29.5	0.100	1.5	65	60	28-0.100
	0.200	3	80	70	28-0.200
	0.375	6	90	80	28-0.375
	0.750	12	115	105	28-0.750
28-32	0.050	0.8	60	60	30-0.050
	0.100	1.6	70	60	30-0.100
	0.200	3.2	80	70	30-0.200
	0.375	6	90	80	30-0.375
	0.750	12	115	105	30-0.750
32-36	0.050	0.9	60	60	34-0.050
	0.100	1.7	70	60	34-0.100
	0.200	3.4	85	75	34-0.200
	0.375	6	95	85	34-0.375
	0.750	12.5	115	105	34-0.750
36-40	0.050	0.9	65	60	38-0.050
	0.100	1.7	75	65	38-0.100
	0.200	3.5	85	75	38-0.200
	0.375	6.5	100	90	38-0.375
	0.750	13	115	105	38-0.750
40-45	0.050	1	70	60	42-0.050
	0.100	2	80	70	42-0.100
	0.200	4	90	80	42-0.200
	0.375	7.5	105	95	42-0.375
	0.750	15	120	110	42-0.750
45-50	0.050	1	70	60	47-0.050
	0.100	2	80	70	47-0.100
	0.200	4	90	80	47-0.200
	0.375	7.5	105	95	47-0.375
	0.750	15	125	115	47-0.750
50-56	0.050	1	70	65	53-0.050
	0.100	2	80	70	53-0.100
	0.200	4	90	80	53-0.200
	0.375	7.5	105	95	53-0.375

PMC LOW COST REGULATED SUPPLIES

high performance, solid-state plug-in



FEATURES

Input — 105-125V AC, 47-420 CPS
Output — See specific model listed
Regulation — See chart below
Ripple — Less than 4MV RMS for RC Series; Less than 8MV RMS for RD Series
Operating Ambient Temperature — —20 to +71°C
Output Adjustment — Adjusted by means of internal pot
Cooling — None required within specified ambients
Polarity — May be either positive, negative or floating up to 300 volts
Overload Protection — Short circuit protected, automatic reset

If you're looking for a reliable but low cost power supply that gives good regulation and that can be chassis or rack mounted with an octal plug—you can stop. POWER/MATE CORP. has just what you're looking for. The RC/RD series of power supplies feature all silicon solid state circuitry, a MIL-T-27 Transformer, 88°C Capacitors, overload and short circuit protection and 100,000 hours MTBF. In addition to that, only POWER/MATE CORP. can offer you

All **RC** Series Models only **$65.00** ***SAME DAY SHIPMENT!**** All **RD** Series Models only **$55.00**

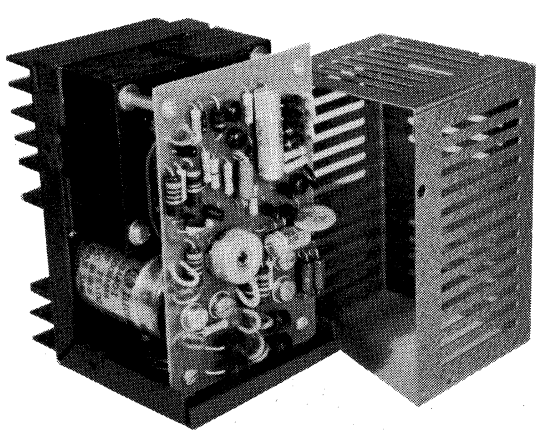
MODEL NO.	OUTPUT VOLTS	OUTPUT AMPS	REGULATION ±%	
			LINE	LOAD
RC-5	3-7	1.0	0.3	0.7
RC-9	7-11	1.0	0.1	0.3
RC-12	11-13	1.0	0.075	0.1
RC-15	13-16	0.5	0.075	0.1
RC-19	16-21	0.5	0.075	0.1
RC-24	21-26	0.5	0.075	0.1
RC-28	26-31	0.5	0.06	0.1
RC-34	31-37	0.5	0.05	0.1
RC-40	37-43	0.5	0.05	0.1
RC-48	43-50	0.5	0.05	0.1

MODEL NO.	OUTPUT VOLTS	OUTPUT AMPS	REGULATION ±%	
			LINE	LOAD
RD-5	3-7	1.0	0.6	1.4
RD-9	7-11	1.0	0.2	0.6
RD-12	11-13	1.0	0.15	0.2
RD-15	13-16	0.5	0.15	0.2
RD-19	16-21	0.5	0.15	0.2
RD-24	21-26	0.5	0.15	0.2
RD-28	26-31	0.5	0.12	0.2
RD-34	31-37	0.5	0.1	0.2
RD-40	37-43	0.5	0.1	0.2
RD-48	43-50	0.5	0.1	0.2

*on RC models

PMC REGULATED POWER MODULES

ALL SILICON—0 TO 400 VOLTS
OUTPUT CURRENTS TO 25 AMPERES
RA SERIES—0.05% REGULATION
RB SERIES—0.5% REGULATION



*on RC Models

FEATURES

- **All Silicon Semiconductors throughout**
- **All components rated for continuous duty at —20 to +71°C**
- **Short Circuit Proof — may be shorted indefinitely without damage**
- **Automatic overload & short circuit recovery**
- **No external heat sink or cooling required up to +71°C**
- **All components accessible and replaceable for maintenance**
- **Top quality components and construction**
- **Competitively priced**
- **Compact mechanical package**
- **Meets MIL-E-5272 specifications**

SPECIFICATIONS

Input — 105-125V AC. 47-420 CPS
Output — See Specific Model Listed
Regulation — ±0.05% or 2 mv (whichever is greater) vs line & load for RA Series; ±0.5% vs line & load for RB Series
Ripple — Less than 0.002%, or 1 mv RMS (whichever is greater) for RA Series; 0.01% or 5 mv RMS for RB Series
Operating Ambient Temperature — —20 to +71°C
Output Adjustment — Either internal or external as desired
Cooling — None required at specified ambients
Polarity — May be either positive, negative, or floating (up to 300 volts)
Overload Protection — Solid state short circuit and overload protected, instantaneous recovery and automatic reset

POWER/MATE CORP. 163 CLAY ST., HACKENSACK, N. J. 07601 PMC

PMC REGULATED POWER MODULES

OUTPUT VOLTAGE ADJUST RANGE	OUTPUT CURRENT (AMPS)	CASE SIZE	0.05% REGULATION PRICE	0.05% REGULATION MODEL NO.	0.5% REGULATION PRICE	0.5% REGULATION MODEL NO.
0-3	0.375	R	$115	RA2 - 0.375	$110	RB2 - 0.375
	0.750	R	120	RA2 - 0.750	110	RB2 - 0.750
	1.5	R	150	RA2 - 1.5	140	RB2 - 1.5
	3.0	RH	190	RA2 - 3.0	180	RB2 - 3.0
	6.0	TH	230	RA2 - 6.0	220	RB2 - 6.0
	12.0	2TH	325	RA2 -12.0	315	RB2 -12.0
	25.0	4TH	425	RA2 -25.0	415	RB2 -25.0
3-5	0.375	R	70	RA4 - 0.375	60	RB4 - 0.375
	0.750	R	85	RA4 - 0.750	75	RB4 - 0.750
	1.5	R	105	RA4 - 1.5	95	RB4 - 1.5
	3.0	RH	135	RA4 - 3.0	125	RB4 - 3.0
	6.0	TH	180	RA4 - 6.0	165	RB4 - 6.0
	12.0	2TH	255	RA4 -12.0	240	RB4 -12.0
	25.0	4TH	360	RA4 -25.0	345	RB4 -25.0
5-7	0.375	R	70	RA6 - 0.375	60	RB6 - 0.375
	0.750	R	85	RA6 - 0.750	75	RB6 - 0.750
	1.5	R	105	RA6 - 1.5	95	RB6 - 1.5
	3.0	RH	135	RA6 - 3.0	125	RB6 - 3.0
	6.0	TH	180	RA6 - 6.0	165	RB6 - 6.0
	12.0	2TH	275	RA6 -12.0	260	RB6 -12.0
	25.0	4TH	405	RA6 -25.0	390	RB6 -25.0
7-9	0.200	R	65	RA8 - 0.200	60	RB8 - 0.200
	0.375	R	80	RA8 - 0.375	70	RB8 - 0.375
	0.750	R	95	RA8 - 0.750	85	RB8 - 0.750
	1.5	R	105	RA8 - 1.5	95	RB8 - 1.5
	3.0	RH	135	RA8 - 3.0	125	RB8 - 3.0
	6.0	TH	190	RA8 - 6.0	175	RB8 - 6.0
	12.0	2TH	280	RA8 -12.0	265	RB8 -12.0
	25.0	4TH	415	RA8 -25.0	400	RB8 -25.0
9-11	0.200	R	65	RA10- 0.200	60	RA10- 0.200
	0.375	R	80	RA10- 0.375	70	RB10- 0.375
	0.750	R	95	RA10- 0.750	85	RB10- 0.750
	1.5	R	105	RA10- 1.5	95	RB10- 1.5
	3.0	RH	135	RA10- 3.0	125	RB10- 3.0
	6.0	TH	195	RA10- 6.0	180	RB10- 6.0
	12.0	2TH	290	RA10-12.0	275	RB10-12.0
	25.0	4TH	425	RA10-25.0	410	RB10-25.0
11-13	0.200	N	65	RA12- 0.200	60	RB12- 0.200
	0.375	N	85	RA12- 0.375	75	RB12- 0.375
	0.750	R	95	RA12- 0.750	85	RB12- 0.750
	1.5	R	115	RA12- 1.5	105	RB12- 1.5
	3.0	RH	135	RA12- 3.0	125	RB12- 3.0
	6.0	TH	200	RA12- 6.0	190	RB12- 6.0
	12.0	2TH	290	RA12-12.0	275	RB12-12.0
	25.0	4TH	440	RA12-25.0	425	RB12-25.0
13-15	0.100	N	65	RA14- 0.100	60	RB14- 0.100
	0.200	N	75	RA14- 0.200	65	RB14- 0.200
	0.375	N	85	RA14- 0.375	75	RB14- 0.375
	0.750	R	100	RA14- 0.750	90	RB14- 0.750
	1.5	R	125	RA14- 1.5	115	RB14- 1.5
	3.0	TH	165	RA14- 3.0	155	RB14- 3.0
	6.0	2TH	210	RA14- 6.0	195	RB14- 6.0
	12.0	3TH	295	RA14-12.0	280	RB14-12.0
	25.0	4TH	455	RA14-25.0	440	RB14-25.0
14-16	0.100	N	65	RA15- 0.100	60	RB15- 0.100
	0.200	N	75	RA15- 0.200	65	RB15- 0.200
	0.375	N	85	RA15- 0.375	75	RB15- 0.375
	0.750	R	100	RA15- 0.750	90	RB15- 0.750
	1.5	R	125	RA15- 1.5	115	RB15- 1.5
	3.0	TH	165	RA15- 3.0	145	RB15- 3.0
	6.0	2TH	210	RA15- 6.0	190	RB15- 6.0
	12.0	3TH	310	RA15-12.0	290	RB15-12.0
	25.0	5TH	455	RA15-25.0	440	RB15-25.0
15-17	0.100	N	65	RA16- 0.100	60	RB16- 0.100
	0.200	N	75	RA16- 0.200	65	RB16- 0.200
	0.375	N	85	RA16- 0.375	75	RB16- 0.375
	0.750	R	105	RA16- 0.750	95	RB16- 0.750
	1.5	R	125	RA16- 1.5	115	RB16- 1.5
	3.0	TH	170	RA16- 3.0	150	RB16- 3.0
	6.0	2TH	215	RA16- 6.0	200	RB16- 6.0
	12.0	3TH	325	RA16-12.0	310	RB16-12.0
	25.0	5TH	460	RA16-25.0	445	RB16-25.0
17-19	0.100	N	65	RA18- 0.100	60	RB18- 0.100
	0.200	N	75	RA18- 0.200	65	RB18- 0.200
	0.375	N	85	RA18- 0.375	75	RB18- 0.375
	0.750	R	105	RA18- 0.750	95	RB18- 0.750
	1.5	R	125	RA18- 1.5	115	RB18- 1.5
	3.0	TH	170	RA18- 3.0	150	RB18- 3.0
	6.0	2TH	230	RA18- 6.0	215	RB18- 6.0
	12.0	3TH	335	RA18-12.0	320	RB18-12.0
	25.0	5TH	460	RA18-25.0	445	RB18-25.0

OUTPUT VOLTAGE ADJUST RANGE	OUTPUT CURRENT (AMPS)	CASE SIZE	0.05% REGULATION PRICE	0.05% REGULATION MODEL NO.	0.5% REGULATION PRICE	0.5% REGULATION MODEL NO.
19-22	0.100	N	$ 65	RA20- 0.100	$ 60	RB20- 0.100
	0.200	N	75	RA20- 0.200	65	RB20- 0.200
	0.375	N	85	RA20- 0.375	75	RB20- 0.375
	0.750	R	105	RA20- 0.750	95	RB20- 0.750
	1.5	R	125	RA20- 1.5	115	RB20- 1.5
	3.0	TH	170	RA20- 3.0	150	RB20- 3.0
	6.0	2TH	235	RA20- 6.0	220	RB20- 6.0
	12.0	3TH	340	RA20-12.0	325	RB20-12.0
	25.0	5TH	465	RA20-25.0	450	RB20-25.0
22-25	0.100	N	65	RA23- 0.100	60	RB23- 0.100
	0.200	N	75	RA23- 0.200	65	RB23- 0.200
	0.375	R	85	RA23- 0.375	75	RB23- 0.375
	0.750	R	110	RA23- 0.750	100	RB23- 0.750
	1.5	RH	130	RA23- 1.5	120	RB23- 1.5
	3.0	TH	175	RA23- 3.0	160	RB23- 3.0
	6.0	2TH	240	RA23- 6.0	225	RB23- 6.0
	12.0	3TH	345	RA23-12.0	330	RB23-12.0
	25.0	5TH	475	RA23-25.0	460	RB23-25.0
25-28	0.100	N	65	RA26- 0.100	60	RB26- 0.100
	0.200	R	75	RA26- 0.200	65	RB26- 0.200
	0.375	R	85	RA26- 0.375	75	RB26- 0.375
	0.750	R	110	RA26- 0.750	100	RB26- 0.750
	1.5	T	140	RA26- 1.5	130	RB26- 1.5
	3.0	TH	180	RA26- 3.0	165	RB26- 3.0
	6.0	2TH	255	RA26- 6.0	240	RB26- 6.0
	12.0	4TH	370	RA26-12.0	355	RB26-12.0
26.5-29.5	0.100	N	65	RA28- 0.100	60	RB28- 0.100
	0.200	R	80	RA28- 0.200	70	RB28- 0.200
	0.375	R	90	RA28- 0.375	80	RB28- 0.375
	0.750	R	115	RA28- 0.750	105	RB28- 0.750
	1.5	T	140	RA28- 1.5	130	RB28- 1.5
	3.0	TH	180	RA28- 3.0	170	RB28- 3.0
	6.0	2TH	255	RA28- 6.0	240	RB28- 6.0
	12.0	4TH	370	RA28-12.0	355	RB28-12.0
28-32	0.050	N	60	RA30- 0.050	60	RB30- 0.050
	0.100	N	70	RA30- 0.100	60	RB30- 0.100
	0.200	R	80	RA30- 0.200	70	RB30- 0.200
	0.375	R	90	RA30- 0.375	80	RB30- 0.375
	0.750	R	115	RA30- 0.750	105	RB30- 0.750
	1.5	T	140	RA30- 1.5	130	RB30- 1.5
	3.0	TH	185	RA30- 3.0	175	RB30- 3.0
	6.0	2TH	265	RA30- 6.0	250	RB30- 6.0
	12.0	4TH	380	RA30-12.0	365	RB30-12.0
32-36	0.050	N	60	RA34- 0.050	60	RB34- 0.050
	0.100	N	70	RA34- 0.100	60	RB34- 0.100
	0.200	R	85	RA34- 0.200	75	RB34- 0.200
	0.375	R	95	RA34- 0.375	85	RB34- 0.375
	0.750	R	115	RA34- 0.750	105	RB34- 0.750
	1.5	T	150	RA34- 1.5	140	RB34- 1.5
	3.0	TH	200	RA34- 3.0	190	RB34- 3.0
	6.0	2TH	285	RA34- 6.0	270	RB34- 6.0
	12.0	4TH	400	RA34-12.0	385	RB34-12.0
36-40	0.050	N	65	RA38- 0.050	60	RB38- 0.050
	0.100	N	75	RA38- 0.100	65	RB38- 0.100
	0.200	R	85	RA38- 0.200	75	RB38- 0.200
	0.375	R	100	RA38- 0.375	90	RB38- 0.375
	0.750	R	115	RA38- 0.750	105	RB38- 0.750
	1.5	T	160	RA38- 1.5	145	RB38- 1.5
	3.0	TH	215	RA38- 3.0	200	RB38- 3.0
	6.0	2TH	310	RA38- 6.0	295	RB38- 6.0
	12.0	4TH	450	RA38-12.0	435	RB38-12.0
40-45	0.050	N	70	RA42- 0.050	60	RB42- 0.050
	0.100	N	80	RA42- 0.100	70	RB42- 0.100
	0.200	R	90	RA42- 0.200	80	RB42- 0.200
	0.375	R	105	RA42- 0.375	95	RB42- 0.375
	0.750	T	120	RA42- 0.750	110	RB42- 0.750
	1.5	T	170	RA42- 1.5	160	RB42- 1.5
	3.0	TH	225	RA42- 3.0	210	RB42- 3.0
	6.0	2TH	315	RA42- 6.0	300	RB42- 6.0
	12.0	4TH	455	RA42-12.0	440	RB42-12.0
45-50	0.050	N	70	RA47- 0.050	60	RB47- 0.050
	0.100	N	80	RA47- 0.100	70	RB47- 0.100
	0.200	R	90	RA47- 0.200	80	RB47- 0.200
	0.375	R	105	RA47- 0.375	95	RB47- 0.375
	0.750	T	125	RA47- 0.750	115	RB47- 0.750
	1.5	T	170	RA47- 1.5	160	RB47- 1.5
	3.0	TH	230	RA47- 3.0	215	RB47- 3.0
	6.0	3TH	320	RA47- 6.0	305	RB47- 6.0
	12.0	5TH	465	RA47-12.0	450	RB47-12.0

REGULATED POWER MODULES PMC

OUTPUT VOLTAGE ADJUST RANGE	OUTPUT CURRENT (AMPS)	CASE SIZE	0.05% REGULATION PRICE	0.05% REGULATION MODEL NO.	0.5% REGULATION PRICE	0.5% REGULATION MODEL NO.
50-56	0.050	N	$ 80	RA53- 0.050	$ 70	RB53- 0.050
	0.100	N	90	RA53- 0.100	80	RB53- 0.100
	0.200	R	105	RA53- 0.200	95	RB53- 0.200
	0.375	R	115	RA53- 0.375	105	RB63- 0.375
	0.750	T	135	RA53- 0.750	125	RB53- 0.750
	1.5	TH	170	RA53- 1.5	155	RB53- 1.5
	3.0	TH	230	RA53- 3.0	215	RB53- 3.0
	6.0	3TH	325	RA53- 6.0	310	RB53- 6.0
56-62	0.050	N	85	RA59- 0.050	75	RB59- 0.050
	0.100	R	95	RA59- 0.100	85	RB59- 0.100
	0.200	R	110	RA59- 0.200	100	RB59- 0.200
	0.375	R	120	RA59- 0.375	110	RB59- 0.375
	0.750	T	140	RA59- 0.750	130	RB59- 0.750
	1.5	TH	210	RA59- 1.5	195	RB59- 1.5
	3.0	2TH	275	RA59- 3.0	255	RB59- 3.0
	6.0	3TH	385	RA59- 6.0	370	RB59- 6.0
62-69	0.050	R	85	RA65- 0.050	75	RB65- 0.050
	0.100	R	95	RA65- 0.100	85	RB65- 0.100
	0.200	R	110	RA65- 0.200	100	RB65- 0.200
	0.375	R	120	RA65- 0.375	110	RB65- 0.375
	0.750	T	140	RA65- 0.750	130	RB65- 0.750
	1.5	TH	215	RA65- 1.5	200	RB65- 1.5
	3.0	2TH	315	RA65- 3.0	300	RB65- 3.0
	6.0	3TH	420	RA65- 6.0	405	RB65- 6.0
69-76	0.050	R	90	RA72- 0.050	80	RB72- 0.050
	0.100	R	100	RA72- 0.100	90	RB72- 0.100
	0.200	R	115	RA72- 0.200	105	RB72- 0.200
	0.375	T	125	RA72- 0.375	115	RB72- 0.375
	0.750	T	150	RA72- 0.750	140	RB72- 0.750
	1.5	TH	250	RA72- 1.5	235	RB72- 1.5
	3.0	2TH	320	RA72- 3.0	305	RB72- 3.0
	6.0	3TH	420	RA72- 6.0	405	RB72- 6.0
76-84	0.050	R	95	RA80- 0.050	85	RB80- 0.050
	0.100	R	105	RA80- 0.100	95	RB80- 0.100
	0.200	R	120	RA80- 0.200	110	RB80- 0.200
	0.375	T	135	RA80- 0.375	125	RB80- 0.375
	0.750	T	165	RA80- 0.750	150	RB80- 0.750
	1.5	TH	255	RA80- 1.5	235	RB80- 1.5
	3.0	2TH	325	RA80- 3.0	310	RB80- 3.0
	6.0	4TH	440	RA80- 6.0	425	RB80- 6.0
84-93	0.050	R	100	RA88- 0.050	90	RB88- 0.050
	0.100	R	110	RA88- 0.100	100	RB88- 0.100
	0.200	R	130	RA88- 0.200	120	RB88- 0.200
	0.375	T	145	RA88- 0.375	135	RB88- 0.375
	0.750	T	175	RA88- 0.750	165	RB88- 0.750
	1.5	TH	275	RA88- 1.5	260	RB88- 1.5
93-103	0.050	R	105	RA98- 0.050	95	RB98- 0.050
	0.100	R	115	RA98- 0.100	105	RB98- 0.100
	0.200	R	130	RA98- 0.200	120	RB98- 0.200
	0.375	T	160	RA98- 0.375	145	RB98- 0.375
	0.750	T	225	RA98- 0.750	210	RB98- 0.750
	1.5	TH	285	RA98- 1.5	270	RB98- 1.5
103-114	0.050	R	115	RA108-0.050	105	RB108-0.050
	0.100	R	125	RA108-0.100	115	RB108-0.100
	0.200	R	135	RA108-0.200	130	RB108-0.200
	0.375	T	185	RA108-0.375	160	RB108-0.375
	0.750	T	260	RA108-0.750	245	RB108-0.750
	1.5	2TH	340	RA108-1.5	325	RB108-1.5

OUTPUT VOLTAGE ADJUST RANGE	OUTPUT CURRENT (AMPS)	CASE SIZE	0.05% REGULATION PRICE	0.05% REGULATION MODEL NO.	0.5% REGULATION PRICE	0.5% REGULATION MODEL NO.
114-126	0.050	R	$115	RA120-0.050	$105	RB120-0.050
	0.100	R	135	RA120-0.100	125	RB120-0.100
	0.200	R	160	RA120-0.200	145	RB120-0.200
	0.375	T	190	RA120-0.375	175	RB120-0.375
	0.750	T	260	RA120-0.750	245	RB120-0.750
	1.5	2TH	340	RA120-1.5	325	RB120-1.5
126-139	0.050	R	125	RA132-0.050	115	RB132-0.050
	0.100	R	145	RA132-0.100	135	RB132-0.100
	0.200	R	160	RA132-0.200	145	RB132-0.200
	0.375	T	200	RA132-0.375	185	RB132-0.375
	0.750	TH	300	RA132-0.750	285	RB132-0.750
139-153	0.050	R	125	RA146-0.050	115	RB146-0.050
	0.100	R	145	RA146-0.100	135	RB146-0.100
	0.200	R	160	RA146-0.200	145	RB146-0.200
	0.375	T	200	RA146-0.375	185	RB146-0.375
	0.750	TH	300	RA146-0.750	285	RB146-0.750
153-168	0.050	R	130	RA160-0.050	120	RB160-0.050
	0.100	R	160	RA160-0.100	145	RB160-0.100
	0.200	R	170	RA160-0.200	160	RB160-0.200
	0.375	T	200	RA160-0.375	185	RB160-0.375
	0.750	TH	300	RA160-0.750	285	RB160-0.750
168-185	0.050	R	135	RA176-0.050	125	RB176-0.050
	0.100	R	165	RA176-0.100	155	RB176-0.100
	0.200	T	205	RA176-0.200	190	RB176-0.200
	0.375	T	250	RA176-0.375	235	RB176-0.375
	0.750	TH	340	RA176-0.750	325	RB176-0.750
185-204	0.050	R	140	RA194-0.050	130	RB194-0.050
	0.100	R	175	RA194-0.100	165	RB194-0.100
	0.200	T	230	RA194-0.200	215	RB194-0.200
	0.375	T	315	RA194-0.375	300	RB194-0.375
	0.750	TH	400	RA194-0.750	385	RB194-0.750
204-225	0.050	R	140	RA214-0.050	130	RB214-0.050
	0.100	R	175	RA214-0.100	165	RB214-0.100
	0.200	T	230	RA214-0.200	215	RB214-0.200
	0.375	T	315	RA214-0.375	300	RB214-0.375
225-250	0.050	R	155	RA236-0.050	145	RB236-0.050
	0.100	R	195	RA236-0.100	185	RB236-0.100
	0.200	T	260	RA236-0.200	245	RB236-0.200
	0.375	TH	350	RA236-0.375	335	RB236-0.375
250-275	0.050	R	160	RA262-0.050	150	RB262-0.050
	0.100	T	210	RA262-0.100	195	RB262-0.100
	0.200	T	280	RA262-0.200	265	RB262-0.200
	0.375	TH	365	RA262-0.375	350	RB262-0.375
275-315	0.050	T	175	RA295-0.050	160	RB295-0.050
	0.100	T	235	RA295-0.100	220	RB295-0.100
	0.200	T	315	RA295-0.200	300	RB295-0.200
	0.375	TH	390	RA295-0.375	375	RB295-0.375
315-340	0.050	T	180	RA327-0.050	170	RB327-0.050
	0.100	T	245	RA327-0.100	230	RB327-0.100
	0.200	T	330	RA327-0.200	315	RB327-0.200
	0.375	TH	415	RA327-0.375	400	RB327-0.375
340-370	0.050	T	190	RA355-0.050	180	RB355-0.050
	0.100	T	255	RA355-0.100	240	RB355-0.100
	0.200	T	340	RA355-0.200	325	RB355-0.200
	0.375	TH	425	RA355-0.375	410	RB355-0.375
370-400	0.050	T	200	RA385-0.050	190	RB385-0.050
	0.100	T	265	RA385-0.100	250	RB385-0.100
	0.200	T	350	RA385-0.200	335	RB385-0.200
	0.375	TH	435	RA385-0.375	420	RB385-0.375

OVERALL CASE SIZES

	L	W	H
N	3	x2½	x4¼
R	3¼	x3¼	x5
RH	3¼	x4⅛	x5
T	4	x5	x6½
TH	4	x5¼	x6½
2TH	5	x10¾	x6½
3TH	6¼	x10¾	x6½
4TH	10	x10¾	x6½
5TH	11¼	x10¾	x6½

Contact Factory or Representative for Catalog giving complete mechanical data.

POWER/MATE CORP. 163 CLAY ST., HACKENSACK, N. J. 07601

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LOW COST MODULAR

POWER SUPPLIES

- **GUARANTEED RELIABILITY**
- **PRICES FROM $29.00**
- **DELIVERY FROM STOCK**



MODEL NUMBER	DC OUTPUT		REGULATION		MAX. RIPPLE RMS	OPTIONS		DIMENSIONS			PRICE 1-25 $ EACH	OVP OPTION C ADDER	ADJ. OPTION D ADDER
	VOLTS	AMPS	LINE	LOAD		OVP (C)	ADJ (D)	H	W	D			
SINGLE OUTPUT UNITS													
3B3.6-.25	3.6	0.25	±0.3%	±0.3%	3mv	5±5%	±3%	1.56	2.50	3.50	$29	$ 7.50	$ 8.50
3C3.6-1.0	3.6	1.0	±0.3%	±0.3%	2mv	5±5%	±3%	1.87	3.25	5.88	$37	10.00	8.50
3D3.6-2.5	3.6	2.5	±0.3%	±0.3%	2mv	5±5%	±3%	2.25	4.00	6.25	$44	10.00	8.50
3B5-.25	5.0	0.25	±0.3%	±0.3%	3mv	6±5%	±3%	1.56	2.50	3.50	$29	7.50	8.50
3C5-1.0	5.0	1.0	±0.3%	±0.3%	2mv	6±5%	±3%	1.87	3.25	5.88	$37	10.00	8.50
3D5-2.5	5.0	2.5	±0.3%	±0.3%	2mv	6±5%	±3%	2.25	4.00	6.25	$44	10.00	8.50
3B6-.25	6.0	0.25	±0.3%	±0.3%	3mv	7.5±5%	±3%	1.56	2.50	3.50	$29	7.50	8.50
3C6-1.0	6.0	1.0	±0.3%	±0.3%	2mv	7.5±5%	±3%	1.87	3.25	5.88	$37	10.00	8.50
3D6-2.5	6.0	2.5	±0.3%	±0.3%	2mv	7.5±5%	±3%	2.25	4.00	6.25	$44	10.00	8.50
3B12-.15	12.0	0.15	±.075%	±.075%	5mv	15±5%	±3%	1.56	2.50	3.50	$29	7.50	8.50
3C12-.5	12.0	0.5	±.075%	±.075%	2mv	15±5%	±3%	1.87	3.25	5.88	$37	10.00	8.50
3D12-1.5	12.0	1.5	±.075%	±.075%	2mv	15±5%	±3%	2.25	4.00	6.25	$44	10.00	8.50
3B15-.15	15.0	0.15	±.075%	±.075%	5mv	18±5%	±3%	1.56	2.50	3.50	$29	7.50	8.50
3C15-.5	15.0	0.5	±.075%	±.075%	2mv	18±5%	±3%	1.87	3.25	5.88	$37	10.00	8.50
3D15-1.2	15.0	1.2	±.075%	±.075%	2mv	18±5%	±3%	2.25	4.00	6.25	$44	10.00	8.50
3B18-0.1	18.0	0.1	±.075%	±.075%	5mv	22±5%	±3%	1.56	2.50	3.50	$29	7.50	8.50
3C18-0.4	18.0	0.4	±.075%	±.075%	2mv	22±5%	±3%	1.87	3.25	5.88	$37	10.00	8.50
3D18-1.0	18.0	1.0	±.075%	±.075%	2mv	22±5%	±3%	2.25	4.00	6.25	$44	10.00	8.50
3B24-.08	24.0	.08	±.075%	±.075%	5mv	30±5%	±3%	1.56	2.50	3.50	$29	7.50	8.50
3C24-.35	24.0	.35	±.075%	±.075%	2mv	30±5%	±3%	1.87	3.25	5.88	$37	10.00	8.50
3D24-.70	24.0	.70	±.075%	±.075%	2mv	30±5%	±3%	2.25	4.00	6.25	$44	10.00	8.50
3C28-.35	28.0	.35	±.075%	±.075%	2mv	36±5%	±3%	1.87	3.25	5.88	$37	10.00	8.50
3D28-.70	28.0	.70	±.075%	±.075%	2mv	36±5%	±3%	2.25	4.00	6.25	$44	10.00	8.50
DUAL OUTPUT UNITS													
3C12D-.25	±12.0	.25	±.02%	±.05%	500μv	15±5%	±3%	1.87	3.25	5.88	$51	$15.00	$15.00
3D12D-.5	±12.0	.50	±.02%	±.05%	500μv	15±5%	±3%	2.25	4.00	6.25	$59	15.00	15.00
3C15D-.25	±15.0	.25	±.02%	±.05%	500μv	18±5%	±3%	1.87	3.25	5.88	$51	15.00	15.00
3D15D-.5	±15.0	.50	±.02%	±.05%	500μv	18±5%	±3%	2.25	4.00	6.25	$59	15.00	15.00
FULLY ADJ. UNITS													
3C18-.25-V	0-18	.25	±.05%+5mv	±.05%+5mv	500μv	N/A	N/A	1.87	3.25	5.88	$47	N/A	N/A
3D18-.5-V	0-18	.5	±.05%+5mv	±.05%+5mv	500μv	N/A	N/A	2.25	4.00	6.25	$57	N/A	N/A
3C36-.13-V	0-36	.13	±.05%+5mv	±.05%+5mv	500μv	N/A	N/A	1.87	3.25	5.88	$47	N/A	N/A
3D36-.25-V	0-36	.25	±.05%+5mv	±.05%+5mv	500μv	N/A	N/A	2.25	4.00	6.25	$57	N/A	N/A

INPUT VOLTAGE: 115 VAC ±10%; 57 to 440 Hz (derate current 10% for operations from 57 to 47 Hz; derate current 20% for operation from 126.5 VAC to 132 VAC; operation at 132 VAC below 57 Hz not advised)

OUTPUT VOLTAGE: preset at factory to ±0.25% ±10mV not adjustable; Option D is ±3% adjustment, single potentiometer (see chart); fully adjustable units (see chart) use two potentiometers; coarse and fine

TRANSIENT RESPONSE: 15 μsec typical for one-half load to full load change

OVERLOAD/SHORT CIRCUIT PROTECTION: units fully protected

STABILITY: typical ±0.025% (for 8 hours after warmup)

OVERVOLTAGE: protection available as Option C (see chart)

TEMPERATURE OPERATING: 0°C to +71°C at full load

STORAGE: −55°C to +85°C

COEFFICIENT: 0.0075%/°C typical

SHIELDING: transformer shield between primary and secondary connected to ground; case is grounded

OUTPUT ISOLATION RESISTANCE: 500 megohm min. at 500 VDC

AIRTRONICS INCORPORATED

POWERTEC DIVISION

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- **COMPLETELY REPAIRABLE**
- **170 MODELS AVAILABLE**

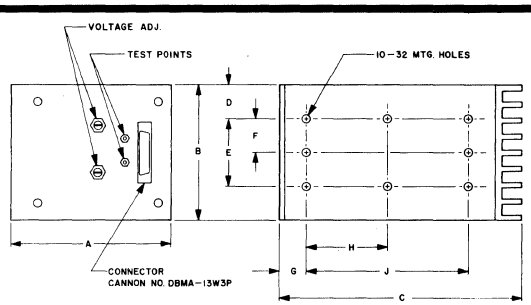
MILITARY SPECIFICATION COMPLIANCE: CIRCUITRY AND CONSTRUCTION MEET **MIL-E-16400, MIL-T-21200, MIL-E-5400, MIL-E-4158** AND **MIL-E-5272.** ALL SEMICONDUCTORS CONFORM TO **MIL-S-19500.** OTHER ELECTRICAL COMPONENTS TO **ANA-400.** HERMETICALLY SEALED TRANSFORMERS MEET **MIL-T-27 GRADE 5.**

ORDERING INFORMATION

ML SERIES NO. 5
CASE SIZE
OUTPUT VOLTAGE
OUTPUT CURRENT
C=OVERVOLTAGE OPTION } ORDER 1
V=VARIABLE OUTPUT } ONLY
HIGH PERFORMANCE UNIT – ADD A

ML SELECTION CHART

VOLTAGE	CURRENT				
	A SIZE	B SIZE	C SIZE	D SIZE	E SIZE
SINGLE OUTPUT					
3.0 VDC	1.2A	2.5A	5.0A	10.0A	20.0A
3.6 VDC	1.2A	2.5A	5.0A	10.0A	20.0A
4.0 VDC	1.2A	2.5A	5.0A	10.0A	20.0A
4.5 VDC	1.2A	2.5A	5.0A	10.0A	20.0A
5.0 VDC	1.2A	2.5A	5.0A	10.0A	20.0A
6.0 VDC	1.1A	2.3A	4.6A	9.2A	18.4A
8.0 VDC	1.0A	2.0A	4.0A	8.0A	16.0A
10 VDC	.85A	1.7A	3.5A	7.0A	14.0A
12 VDC	.80A	1.6A	3.2A	6.4A	12.8A
15 VDC	.70A	1.3A	2.7A	5.4A	10.8A
18 VDC	.60A	1.2A	2.4A	4.8A	9.6A
20 VDC	.55A	1.1A	2.2A	4.4A	8.8A
24 VDC	.47A	.95A	1.9A	3.8A	7.6A
28 VDC	.42A	.85A	1.7A	3.4A	6.8A
36 VDC	.35A	.70A	1.4A	2.8A	5.6A
FULLY ADJUSTABLE UNITS					
0-18 VDC	.30A	.60A	1.20A	2.1A	4.2A
0-36 VDC	.16A	.32A	.64A	1.1A	2.2A



CASE SIZE	DIMENSIONS								
	A	B	C	D	E	F	G	H	J
A	4.94	3.50	6.63	.50	2.500	–	.59	–	5.500
B	4.94	4.00	8.12	.75	2.500	–	.59	–	6.000
C	4.94	5.65	10.00	.64	4.375	–	.59	–	6.750
D	4.94	8.00	10.00	.63	6.750	–	.59	3.688	7.375
E	4.94	13.00	10.75	.63	11.750	5.875	.59	–	7.875

STANDARD AND HIGH PERFORMANCE MODELS

INPUT VOLTAGE: 115 VAC ±10%; 57 to 440 Hz (derate current 10% for operation from 57 to 47 Hz; derate current 20% for operation from 126.5 VAC to 132 VAC; operation at 132 VAC below 57 Hz not advised)

REGULATION: Line is ±.05% for standard and ±.001% for high performance. Load is ±.05% for standard and ±.001% for high performance

RIPPLE/NOISE: .01% +1 Mv P-P standard and .001% +200μv P-P high performance

OVERLOAD/SHORT CIRCUIT PROTECTION: Units fully protected

TRANSIENT RESPONSE: 50 μsec typical for one-half load to full load change

STABILITY: ±.05% standard unit and ±.001% high performance unit after 8 hours warmup

OVERVOLTAGE: set at 10% of nominal

ADJUSTMENT: ±3% for standard model, ±1% for high performance

TEMPERATURE OPERATING: 0°C to 71°C

STORAGE: −55°C to +55°C

COEFFICIENT: ±.01%/°C standard
±.001%/°C high performance

AIRTRONICS INCORPORATED

POWERTEC DIVISION
9168 DESOTO AVE., CHATSWORTH, CALIF. 91311 • Phone (213) 882-0004

POWERTEC
HP
HIGH PERFORMANCE
POWER SUPPLIES

- 400 Hz 3ϕ INPUT
- 2 WATTS / CUBIC INCH
- MEETS MIL-E-5400



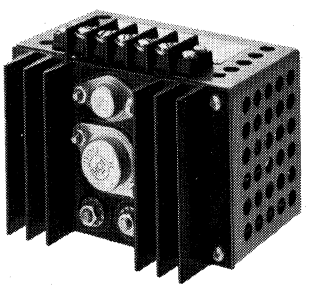
MODEL	VOLTS	AMPS	REGULATION		RIPPLE	ADJ.	DIMENSIONS		
			LINE	LOAD			H	W	D
7C4–15 7D4–30	4.0 4.0	15.0 30.0	±0.25% ±0.25%	±0.25% ±0.25%	3mv RMS 3mv RMS	±5% ±5%	1.50 1.70	8.00 9.00	4.00 6.00
7C5–15 7D5–30	5.0 5.0	15.0 30.0	±0.25% ±0.25%	±0.25% ±0.25%	3mv RMS 3mv RMS	±5% ±5%	1.50 1.70	8.00 9.00	4.00 6.00
7C6–12.5 7D6–25	6.0 6.0	12.5 25.0	±0.25% ±0.25%	±0.25% ±0.25%	3mv RMS 3mv RMS	±5% ±5%	1.50 1.70	8.00 9.00	4.00 6.00
7C12–6.5 7D12–13	12.0 12.0	6.5 13.0	±0.1% ±0.1%	±0.1% ±0.1%	3mv RMS 3mv RMS	±5% ±5%	1.50 1.70	8.00 9.00	4.00 6.00
7C15–5.5 7D15–11	15.0 15.0	5.5 11.0	±0.1% ±0.1%	±0.1% ±0.1%	3mv RMS 3mv RMS	±5% ±5%	1.50 1.70	8.00 9.00	4.00 6.00
7C18–4.5 7D18–9	18.0 18.0	4.5 9.0	±0.1% ±0.1%	±0.1% ±0.1%	3mv RMS 3mv RMS	±5% ±5%	1.50 1.70	8.00 9.00	4.00 6.00
7C24–3.5 7D24–7	24.0 24.0	3.5 7.0	±0.1% ±0.1%	±0.1% ±0.1%	3mv RMS 3mv RMS	±5% ±5%	1.50 1.70	8.00 9.00	4.00 6.00
7C28–3 7C28–6	28.0 28.0	3.0 6.0	±0.1% ±0.1%	±0.1% ±0.1%	3mv RMS 3mv RMS	±5% ±5%	1.50 1.70	8.00 9.00	4.00 6.00

SPECIFICATIONS

INPUT: 115 VAC ±10% line to neutral, 3Ø, 400 Hz ±5%
TEMPERATURE OPERATING: continuous rating at full load −55°C to +80°C base plate temperature
STORAGE: −55°C to +125°C
COEFFICIENT: .01% / °C
MILITARY: MIL-E-5400 requirements met
RFI: MIL-I-6181D requirements met
TRANSIENT RESPONSE: 50 μsec, half load to full load or full load to half load
OVERLOAD/SHORT CIRCUIT PROTECTION: all units are fully protected including overvoltage
PROGRAMMING: ±5% remote voltage margining-standard; remote sensing provided on all units
STABILITY: ±.1% for eight hours after warmup

POWERTEC
FC
ULTRA MINIATURE

- 1 WATT / CUBIC INCH
- QUALITY COMPONENTS
- DELIVERY FROM STOCK



SPECIFICATIONS

INPUT VOLTAGE: 115 VAC ±10%; 57 to 440 Hz
OUTPUT VOLTAGE: ±5% adjustable
TRANSIENT RESPONSE: 25 μsec for one-half to full load change
OVERLOAD / SHORT CIRCUIT PROTECTION: units are fully protected
STABILITY: ±0.075% for 8 hours after warmup
OVERVOLTAGE: Optional for 9D Models
TEMPERATURE OPERATING: continuous rating at full load 0°C to +60°C

SPECIFICATION CHART

MODEL NUMBER	DC OUTPUT		REGULATION		MAX. RIPPLE RMS	ADJ.
	VOLTS	AMPS	LINE	LOAD		
9D3.0-6.0	3.0	6.0	±0.5% +2mv	±.1%	2.5mv	±5%
9D3.5-5.7	3.5	5.7	±0.5% +2mv	±.1%	2.5mv	±5%
9D4.0-5.5	4.0	5.5	±0.5% +2mv	±.1%	2.5mv	±5%
9D4.5-5.2	4.5	5.2	±0.5% +2mv	±.1%	2.5mv	±5%
9D5.0-5.0	5.0	5.0	±0.5% +2mv	±.1%	2.5mv	±5%
9D5.5-4.6	5.5	4.6	±0.5% +2mv	±.1%	2.5mv	±5%
9D6.0-4.3	6.0	4.3	±0.5% +2mv	±.1%	2.5mv	±5%
9D7.5-3.5	7.5	3.5	±0.5% +2mv	±.1%	2.5mv	±5%
9D8.0-3.3	8.0	3.3	±0.5% +2mv	±.1%	5.0mv	±5%
9D9.0-3.0	9.0	3.0	±0.5% +2mv	±.1%	5.0mv	±5%
9D10 -2.8	10	2.8	±0.5% +2mv	±.1%	5mv	±5%
9D12 -2.3	12	2.3	±0.5% +2mv	±.1%	5mv	±5%
9D15 -1.9	15	1.9	±0.5% +2mv	±.1%	5mv	±5%
9D18 -1.6	18	1.6	±0.5% +2mv	±.1%	10mv	±5%
9D20 -1.4	20	1.4	±0.5% +2mv	±.1%	10mv	±5%
9D24 -1.2	24	1.2	±0.5% +2mv	±.1%	10mv	±5%
9D25 -1.1	25	1.1	±0.5% +2mv	±.1%	10mv	±5%
9D26 -1.1	26	1.1	±0.5% +2mv	±.1%	10mv	±5%
9D28 -1.0	28	1.0	±0.5% +2mv	±.1%	10mv	±5%
9D30 -1.0	30	1.0	±0.5% +2mv	±.1%	10mv	±5%

STORAGE: −55°C to +125°C
COEFFICIENT: 0.075% / °C maximum for 9D models
R.F.I.: minimized by use of filters on input and output lines

POWERTEC'S YEARS OF EXPERIENCE IN HIGH FREQUENCY POWER CONVERSION CIRCUITS COUPLED WITH ULTRA DENSE PACKAGING TECHNIQUES SUCH AS THOSE USED IN THE "FC" SERIES ARE APPLICABLE TO YOUR CUSTOM REQUIREMENTS.

AIRTRONICS INCORPORATED

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HC SERIES POWER-MODS

These high current military models were designed to meet power requirements of air transportable huts, vans, ground support equipment, and shipboard operations. They are built to comply fully with **MIL-E-16400, MIL-T-21200,** and **MIL-E-4158.** Semiconductors used meet **MIL-S-19500;** other components meet **ANA-400.** The complete unit meets the environmental requirements of **MIL-E-5272** and **MIL-STD-810.**

POWERTEC
HC
MILITARIZED HIGH CURRENT

SPECIFICATIONS

INPUT VOLTAGE: standard input is 208 VAC ±10%, 3Ø, 47 to 63 Hz. Alternate input is 230 VAC ±10%, 3Ø, 47 to 63 Hz

OUTPUT: 27 VDC to 28 VDC adjustable at 50, 100, or 200 amperes depending on Model

REGULATION: 1% line and 1% load

RIPPLE: 1% RMS

PROTECTION: •) over current protection: 125% (front panel indicator lamp)
•) thermal protection (front panel indicator lamp)

TRANSIENT RESPONSE: less than 75 msec. for recovery to within 2% of output voltage following a load change from full load to half load or half load to full load

METERING: •) voltage: expanded VDC scale ruggedized 24 VDC to 32 VDC
•) current: ruggedized, rates to match output current

RFI FILTERING: to meet MIL-I-6181D

PARALLEL OPERATION: designed for parallel operation without alterations in circuitry.

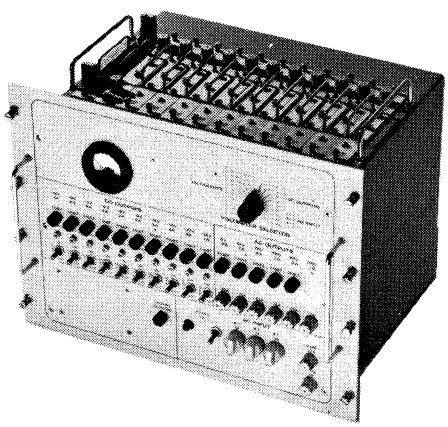
COOLING: internal fan: MIL type with filter

DIMENSIONS: 19″ wide, rack type panel

Output Current	Height	Deep	Weight
200A	14″	22″	275 lbs.
100A	14″	18″	195 lbs.
50A	10½″	18″	125 lbs.

CUSTOM POWER SUPPLIES

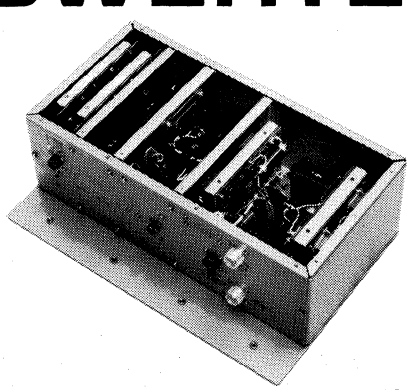
POWERTEC



MODEL 8D164 FULLY MILITARIZED, COMPUTER-CONTROLLED POWER SUPPLY

Model 8D164 is a CUSTOM design used in an air transportable shelter in the Air Force 407L Program. Semiconductors are per **MIL-S-19500,** other components in accordance with **ANA-400.** Full documentation has been produced in compliance with Air Force **375L** series data configuration controls: drawings per **MIL-D-1000, category E, Class 2;** technical manual per **MIL-T-9941;** maintainability analysis per **MIL-HDBK-472;** reliability calculations per **MIL-HDBK-217A.** Features include ten precision regulated DC supplies, 5 AC outputs. Each DC supply is a completely removable and repairable module with adjustable current compensation, and each has a computer programmed high speed output. Complete protection package includes OVP, reverse voltage protection, current limit, overtemperature and fault indicators.

POWERTEC



MODEL 8D212 HIGH RELIABILITY POWER UNIT

Model 8D212 is a CUSTOM power unit for Lawrence Radiation Laboratory used in Project Plowshare. Powertec designed and developed this hi-rel power supply to meet stringent requirements. It is part of an arming circuit and telemetry power source and must operate for indefinite time periods after being buried in an inaccessible underground cannister. A common input conductor supplies a multiplexed power signal to the unit. The unit demodulator separates this signal into DC and AC primary power and converts them to multiple precision outputs. All outputs are regulated and fully protected. Complete documentation including failure mode analysis per **MIL-HDBK-217A** was supplied.

CONTACT POWERTEC WITH YOUR CUSTOM REQUIREMENTS

AIRTRONICS INCORPORATED

POWERTEC DIVISION
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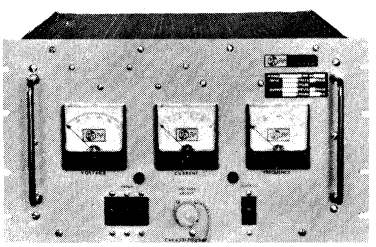
POWER CONVERTERS & SWITCHING REGULATORS

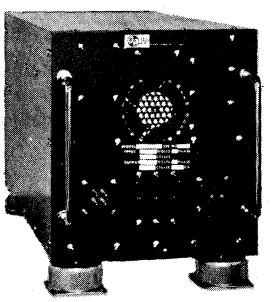
COMPACT — LIGHTWEIGHT — SOLID STATE POWER CONVERTERS FOR AC-AC, AC-DC OR DC-AC AT OUTPUT LEVELS UP TO 20 KVA AND SWITCHING REGULATORS TO 20 AMPS AT 28 VDC



MODEL 125-0400-002

2.5 KVA Power/Converter

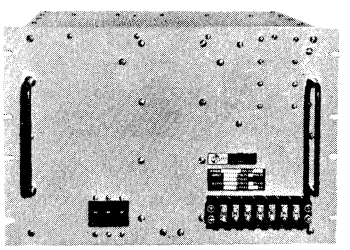
- Input: 120/208 VAC; 60 cps; 3 ϕ; 4 wire wye
- Output: 115 VAC, ± 1%; 400 cps, ± .25%; 1 ϕ; 2.5 KVA
- Short Circuit: Complete protection, manual reset
- Overload: 200% for 4 seconds
- Efficiency: approx. 85%
- Size: 10½" H x 19" W x 17" D
- Weight: 145 lbs.
- Operating Temp: −20°C to +50°C



MODEL 135-0060-001

3.5 KVA Power/Converter

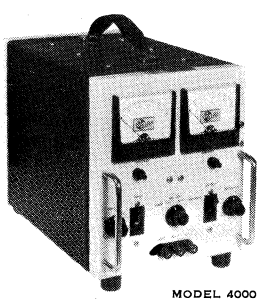
- Input: 120/208 VAC; 360-1000 cps; 3 ϕ; 4 wire wye
- Output: 115 VAC, ± 1%; 60 cps, ± .25%; 1 ϕ; 3.5 KVA
- Short Circuit and Overload: Complete protection, continuous automatic recycling
- Altitude: 15,000 ft. max.
- Efficiency: 88%
- Size: 10"H x 9"W x 21"D
- Weight: 110 lbs. max.
- Operating Temp: −40°C to +75°C



MODEL 145-0060-001

4.5 KVA Power Converter

- Input: 120/208 VAC; 400 cps; 3 ϕ; 4 wire wye
- Output: 115 VAC, ± 1%; 60 cps, ± .25%; 1 ϕ; 4.5 KVA
- Short Circuit and Overload: Complete protection, continuous automatic recycling
- Altitude: 40,000 ft. max., non-pressurized
- Efficiency: approx. 90%
- Size: 12¼"H x 19"W x 18 1/16"D
- Weight: 195 lbs.
- Operating Temp: −50°C to +55°C



MODEL 4000

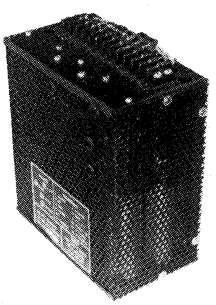
1000 VA Power/Converter

- Input: 120 VAC; 50-450 cps; 1 ϕ
- Output: 100-130 VAC, ± 1%; 360-440 cps, ± .25%; 1 ϕ; 1000 VA
- Short Circuit and Overload: Complete protection, manual reset
- Efficiency: approx. 85%
- Size: 10"H x 8½"W x 13"D
- Weight: 50 lbs.
- Operating Temp: −20°C to +50°C



10-20AMP DC Switching Regulators

- Input: 115 or 230 VAC, 47 to 440 Hz
- Output: 0 to 28 V
- Regulation: 1% combined line, load & temp.
- Load Response: 50 microseconds
- Output Ripple: .1% of output voltage peak
- Operating Temp: −40 to 71°C no derating
- Short Circuit: Complete protection



Custom Units

- Multiple outputs
- Small size/high power ratios
- Lightweight airborne applications
- Efficiencies to 90%
- Solid state reliability
- Meets MIL-1-26600 & MIL-1-6181
- Low cost

POWER SYSTEMS INC. 4023 Del Rey Avenue • Venice, California 90291
Phone: (213) 870-4582 • 391-6817

COMPARE . . .

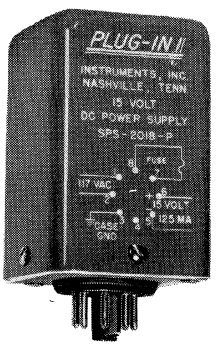
Unequaled for low-cost, accurate, dependable performance under widely varying load and environmental conditions, Plug-In Instruments' power supplies are ideally suited for all commercial, ground support and industrial applications where precise dc power is required for electronic equipment and instrument systems.

DESIGN FEATURES

- Adjustable Voltages: 1 to 28 vdc
- Current Ranges: 0 — 75 to 0 — 800 madc
- Excellent Regulation as Noted
- 0.1 ohm Output Impedance
- 105 to 125 vac 50 to 400 cps Power Required
- Transistorized — Repairable
- Electronic Overload Protection on Series "D" and "E"

REGULATED DC POWER SUPPLIES

GERMANIUM DESIGN

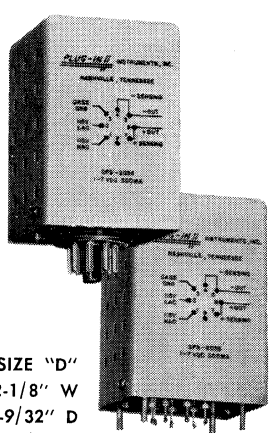


SIZE "B"
3" H x 2" W x 2" D

Model	Volts dc	Current (madc)	Adjust Range	Line Reg. %	Load Reg. %	Ripple mv-rms	Temp Coeff %/°F	Size	Mounting	Price (1-9 Qty.)
PS-2017-P	9	0-175	±5%	±0.05	±0.1	1	0.03	B	Plug-In	$51.00
PS-2010-P	12	0-175	±5%	±0.05	±0.1	1	0.03	B	Plug-In	51.00
PS-2018-P	15	0-125	±5%	±0.04	±0.08	1	0.03	B	Plug-In	51.00
PS-2019-P	18	0-100	±5%	±0.04	±0.08	1	0.025	B	Plug-In	51.00
PS-2047-P	20	0-105	±5%	±0.03	±0.06	1	0.025	B	Plug-In	51.00
PS-2020-P	22.5	0-90	±5%	±0.02	±0.05	1	0.025	B	Plug-In	51.00
PS-2011-P	24	0-90	±5%	±0.02	±0.05	1	0.025	B	Plug-In	51.00
PS-2021-P	28	0-80	±5%	±0.02	±0.05	1	0.025	B	Plug-In	51.00
PS-2048-P	10	0-175	±5%	±0.08	±0.12	1.5	0.03	–	Plug-In	51.00

- AMBIENT TEMPERATURE RATING: 30 TO 120° F

ALL SILCON DESIGN



SIZE "D"
2-1/8" W
2-9/32" D
3-1/8" H

SIZE "E"
2-15/16" W x 3-1/16" D x 4" H

Model	dc Volts Range	Current (madc)	Regulation (mvdc) Line	Regulation (mvdc) Load	Ripple mv-pp	Temp Coeff %/°F	Size	Mounting	Price (1-4 Qty.)
PS-2055-P PS-2055-S	1-6.5	0-300	15	5	4.5	0.03	D	Plug-In Solder-Header	$68.00 70.00
PS-2056-P PS-2056-S	5-9	0-250	15	5	4.5	0.03	D	Plug-In Solder-Header	68.00 70.00
PS-2062-S	1-6.5	0-800	15	10	4.5	0.03	E	Solder-Header	72.00
PS-2063-S	5-9	0-600	15	10	4.5	0.03	E	Solder-Header	72.00
PS-2057-P PS-2057-S	9-13	0-200	2	5	1	0.025	D	Plug-In Solder-Header	61.00 63.00
PS-2058-P PS-2058-S	13-17	0-175	2	5	1	0.02	D	Plug-In Solder-Header	61.00 63.00
PS-2059-P PS-2059-S	17-21	0-150	2	5	1	0.02	D	Plug-In Solder-Header	61.00 63.00
PS-2060-P PS-2060-S	21-25	0-125	2	5	1.5	0.02	D	Plug-In Solder-Header	61.00 63.00
PS-2052-P PS-2052-S	9-13	0-200	2	5	1	0.01	D	Plug-In Solder-Header	73.00 74.00
PS-2053-P PS-2053-S	13-17	0-175	2	5	1	0.01	D	Plug-In Solder-Header	73.00 74.00
PS-2054-P PS-2054-S	17-21	0-150	2	5	1	0.01	D	Plug-In Solder-Header	73.00 74.00

- THESE MODELS INCLUDE ELECTRONIC OVERLOAD AND SHORT-CIRCUIT PROTECTION
- AMBIENT TEMPERATURE RATING: 20 TO 130°F Safe to 140°F

WRITE TODAY FOR DETAILED INFORMATION ON OTHER MODELS OF DC POWER SUPPLIES

ROSEMOUNT
PLUG-IN, INC.

MANUFACTURED BY

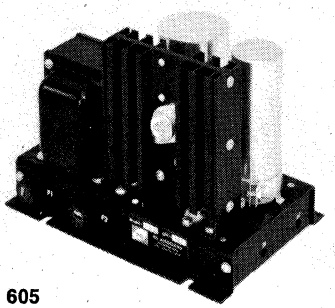
• 1416 LEBANON RD. • NASHVILLE, TENNESSEE 37210

A615/244-1330

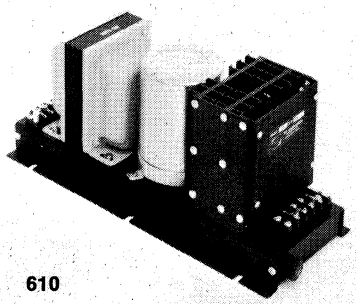
Prices and Specifications Subject to Change Without Notice.
TLX: 55-4349

TWX-810-371-1699

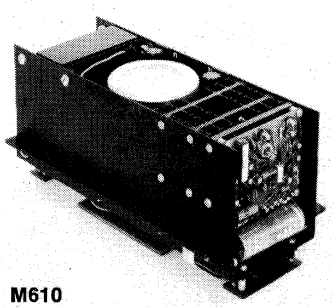
System Power Supplies for Digital I.C. Systems: 600 Series



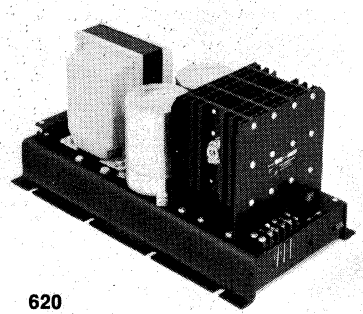
605



610



M610



620

FEATURES

Excellent Transient Response
Low Line and Load Regulation
Adjustable Voltage
Current Limit Short Circuit Protection
High Speed Crow Bar Overvoltage Protection
Convection Cooled
LOW PRICE!! From $125

SPECIFICATIONS

DC output
4.5 to 5.5 volts adj (3.6 volt models available)
5 amps Model 605
10 amps Model 610, 20 amps Model 620

Input
105 to 125 VAC, 45 to 440 Hz

Regulation
±0.1% for ±10% change in input voltage less than 0.25% for zero to full load change

Ripple and Noise
less than 1 mvpp

Transient response
125 mv for 30 μsec for change of half-load to full-load current or vice versa. 250 mv for 30 μsec for change of no-load to full-load current or vice versa

Power supply protection
current limited at 120% of rated load: short circuit proof

Load protection
Optional fast response crow bar, will not exceed adjustable trip point voltage for transients with rise times slower than 0.2 volt/μsec

Will not exceed static trip point volts for more than 200 nanoseconds for step function over-voltage

Cooling
By convection, no forced air required

Operating Temperature
−25 to +55°C, to +70°C at 80% current

Remote Sensing
Sensing terminals provided to enable specific regulation directly at load

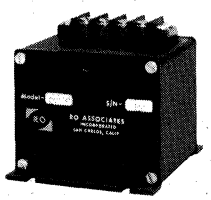
Stability
Output voltage changes less than 0.05% over a 24 hour period after warm up

Temperature coefficient
Output voltage changes less than 0.05%/°C over −25 to +55°C ambient

Output impedance
See regulation and transient response specifications

Controls
Built in potentiometer adjusts output voltage ±10% with resolution of 15 mv

Built in potentiometer adjusts crow bar static trip point with resolution of 15 mv

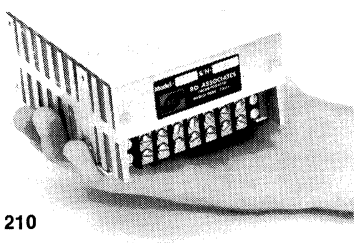


Model OV100
Overvoltage Protector

Self-contained package
Use with all type power supplies
Adjustable trip point . . . 4–10v, 10–25v
Fast response time . . . 200 nsec.
High current capability . . . 10A continuous
Size 2.7″ x 2.8″ x 2.8″
Low Price: $39.50

Model	Voltage	Current	Price	Crowbar Option	Size
605	5 or 3.6V	5A	**$125**	$18	5″ x 7.6″ x 5.8″
M605	5 or 3.6V	5A	**150**	18	4.8″ x 4.9″ x 6.5″
610	5 or 3.6V	10A	**139**	18	13.2″ x 5″ x 5.8″
M610	5 or 3.6V	10A	**175**	18	10.5″ x 4.8″ x 4.9″
620	5 or 3.6V	20A	**189**	18	15″ x 7.5″ x 8″

Miniature Power Converters for Digital I.C. and Analog Circuits: 200 Series



210

Remote Sensing
On model 210 only

MTBF
Over 100,000 hours calculated in accordance with MIL-HDBK-217A

Size
5 1/16" x 4" x 2 1/4", 45 cubic inches

Weight
2 pounds

Mounting
Mounting available on 3 sides by 4, #6–32 tapped inserts

FEATURES

55 watts in 45 cubic inches
5 1/16" x 4" x 2 1/4", weighs 2 lb.
Multiple outputs
70% efficiency
Fully protected
20 KHz operation, no audible noise
RFI filtered

COMMON SPECIFICATIONS

Input
105 to 130 VAC, 50 to 1000 Hz *or* 160 VDC ±10%

Protection
All outputs current limited, continuous overload and short circuit proof. 5 volt outputs have self recovering overvoltage protection set at 6.8 to 7 volts, no overvoltage protection on other outputs.

Temperature Stability
Better than 0.01%/°C

Cooling
Maximum mounting base temperature for full output is 85°C. For no (air or conductive) cooling, max. ambient temperature of 30°C for full output. Derate linearly to 60% power at 60°C ambient and no cooling.

Operating Temperature
−20°C to +85°C

Model	DC Out Volts DC	Amps DC	Regulation		Ripple & Noise	Price 1–49
			Load*	Line ±10%		
210	3.5 to 5.5 adj.	10 A	0.1%	±0.1%	25 mv P-P	**$225.00**
211	(A) 4.5 to 5.5 adj.	5 A	0.1%	±0.1%	20 mv P-P	**$265.00**
	(B) 24	1 A	0.2%	±0.05%	25 mv P-P	
212	(A) 4.5 to 5.5 adj.	5 A	0.1%	±0.1%	20 mv P-P	**$265.00**
	(B) 200 V	25 ma	1%	±0.5%	1% P-P	
213	(A) 4.5 to 5.5 adj.	5 A	0.1%	±0.1%	20 mv P-P	**$325.00**
	(B) ±15 VDC	400 ma each side	0.1%	±0.05%	15 mv P-P	

** LOAD REGULATION is from 0.5 A to F.L. on all 5 volt outputs, 0 to F.L. on all other outputs, from 0 to 0.5 A on 5 volt output regulation is better than 1%.*

ORDER FROM FACTORY OR LOCAL RO REPRESENTATIVE

Boston, Massachusetts
(617) 782-2244

Chicago, Illinois
(312) 774-1500

Dallas, Texas
(214) 363-1526

Houston, Texas
(713) 667-3420

Los Angeles, California
(213) 670-1700

New York, New York
(201) 845-6668

Philadelphia, Pennsylvania
(215) 687-3535

San Francisco, California
(415) 467-1880

Seattle, Washington
(206) 746-6770

St. Louis, Missouri
(314) 423-7200

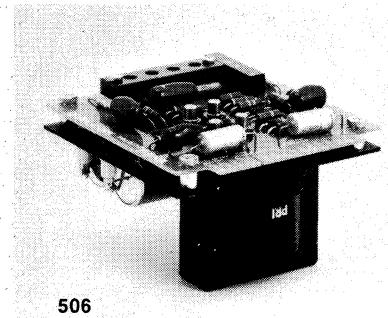
Toronto, Canada
(416) 699-5521

Washington, D.C.
(703) 527-3262

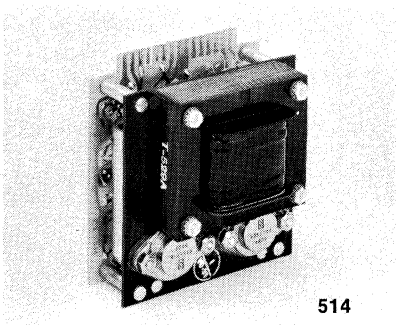
RO

RO Associates, Inc.
3705 Haven Avenue
Menlo Park, California 94025
Phone: (415) 322-5321
TWX: 910-378-5929

Analog Systems Plug-In Power Supplies: 500 Series



506



514

FEATURES
Dual output, 3 wire
Tracking
Current limited
Plug-in flexibility
Adjustable voltage

Model	Voltage	Current Each Channel	Ripple PP	Line ±10%	Regulation Load 0-FL	Price
506	±12 to ±24	150 ma	< 2 mv	0.03%	0.15%	**$95.00**
513	±21 to ±28	300 ma	<10 mv	0.1%	0.3%	**98.00**
514	±12 to ±15	500 ma	< 1 mv	0.02%	0.02%	**99.00**
515	±24	60 ma	<10 mv	0.2%	0.2%	**49.00**
Plug-In Nixie Tube Power Supply						
516*	150–200 V adj.	40 ma	0.2 V	0.5%	1.0%	**$85.00**

** Dimmer circuit available, contact factory.*

ORDER FROM FACTORY OR LOCAL RO REPRESENTATIVE

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Dallas, Texas
(214) 363-1526

Houston, Texas
(713) 667-3420

Los Angeles, California
(213) 670-1700

New York, New York
(201) 845-6668

Philadelphia, Pennsylvania
(215) 687-3535

San Francisco, California
(415) 467-1880

Seattle, Washington
(206) 746-6770

St. Louis, Missouri
(314) 423-7200

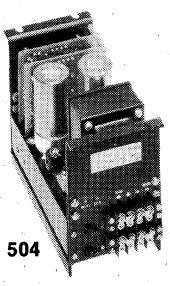
Toronto, Canada
(416) 699-5521

Washington, D.C.
(703) 527-3262

Ultra Stable, 0.02% Regulated System Power Supplies for Digital and Analog Systems

FEATURES

Excellent Regulation
Completely Protected
Low Ripple
Remote Sensing
Programmable
Adjustable Voltage



504

SPECIFICATIONS

Input
105–125 VAC. 45 to 440 Hz

Regulation
±0.01%, for ±10% input change
0.02%, zero to full load

Protection
Current limit, short circuit proof

Temperature
−20 to +70°C operating

Stability
Less than 0.02% per day or per degree C

Ripple
Less than 1 mv P-P

Application	Model	Volts	Amps	Price
dual analog system	504	3 to 32 V	1 A each channel	**$230.00**
Digital IC	505	3 to 6 V	8 A	**199.00**
Digital IC	507	3 to 6 V	5 A	**199.00**
12 volt system	508	11 to 15	4 A	**199.00**
12 volt system	512	11.5 to 12.5	5 A	**199.00**

RO

RO Associates, Inc.
3705 Haven Avenue
Menlo Park, California 94025
Phone: (415) 322-5321
TWX: 910-378-5929

SOLA ELECTRIC SLB

DIVISION OF SOLA BASIC INDUSTRIES

SOLATRON® ±½% LINE VOLTAGE REGULATORS

What It Is

The Solatron® LVR is the first regulator to combine in one unit the qualities of **fast response, "tight" voltage regulation, no moving parts, adjustable output, remote sensing, compactness, and high KVA capacity.**

The Solatron is a solid-state device with no moving parts, requiring no adjustment, maintenance, or attention. It combines the ruggedness typical of transformers with the light weight of electronic control circuitry, resulting in a regulator of remarkable compactness. It has great versatility in mounting, and installation.

Solatron® regulators are available as standard units in KVA ranges from ½ to 500 KVA, and yet they furnish a degree of regulation associated in the past with small VA capacity constant-voltage transformers and power supplies.

Units are available for single or three-phase applications, for either delta or wye connection depending on the service available or the load requirements of your equipment.

And What It Does

Regulation: ±0.5% for line changes. ±1% maximum for any combination of line, load, temperature and frequency changes within limits listed below.

Variation limits: line ±10%, or + 10%/—20%. Frequency 57-63 cycles, 47-53 cycles, or 380-420 cycles depending on model chosen (see catalog listings). Load zero to full load. Temperature 15° to 40°C.

Response: correction begins in first ½ cycle and is typically 100% complete in less than 10 cycles of the AC frequency.

Harmonic content: no harmful wave-form distortion.

Adjustable output: output voltage is adjustable ±10% of nominal output voltage.

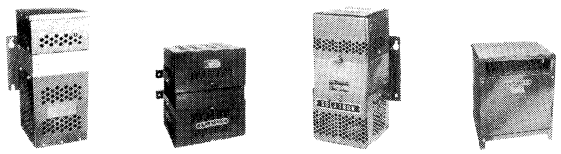
No maintenance: contains no relays, switches, contacts, solenoids, tap, bearings, or other moving parts. No drive motors, servos, or hand cranks. Requires no maintenance: operates completely unattended.

Current capability: withstands high inrush load currents and momentary overloads.

Motor loads: will handle inrush starting current without serious voltage collapse; provides adequate starting torque; no necessity to oversize KVA rating.

Mounting flexibility: may be mounted on wall, floor, or in equipment being regulated. Large terminal compartment, stud or screw-type terminals, knockouts for ease of wiring and installing.

Remote sensing: sensing leads easily connected to load for remote location of Solatron® LVR or for line drop compensation where desired.



SINGLE-PHASE (60 Hz ±3 Hz)

Maximum Output KVA Rating 1	Nominal Output Voltage 2	Output Voltage Adjustability 3	Input Voltage Range 4	Maximum Harmonic Content 5	Catalog Number	Approx. Shipping Weight	Suggested User Price F.O.B. Factory
.5	120	108-132	±10%	3%	31-16-150	30	275.00
.5	120	108-132	+10/—20%	5%	33-16-150	40	300.00
.5	240	216-264	±10%	3%	31-26-150	30	275.00
.5	240	216-264	+10/—20%	5%	33-26-150	40	300.00
1	120	108-132	±10%	3%	31-16-210	40	295.00
1	120	108-132	+10/—20%	5%	33-16-210	58	330.00
1	240	216-264	±10%	3%	31-26-210	40	295.00
1	240	216-264	+10/—20%	5%	33-26-210	58	330.00
2	120	108-132	±10%	3%	31-16-220	55	330.00
2	120	108-132	+10/—20%	5%	33-16-220	100	440.00
2	240	216-264	±10%	3%	31-26-220	55	330.00
2	240	216-264	+10/—20%	5%	33-26-220	100	440.00
3	120	108-132	±10%	7% 6	31-16-230	78	410.00
3	120	108-132	+10/—20%	5%	33-16-230	130	490.00
3	240	216-264	±10%	7% 6	31-26-230	78	410.00
3	240	216-264	+10/—20%	5%	33-26-230	130	490.00
5	120	108-132	±10%	7% 6	31-16-250	100	470.00
5	120	108-132	+10/—20%	5%	33-16-250	185	600.00
5	208	188-228	+10/—20%	5%	33-06-250	185	600.00
5	240	216-264	±10%	7% 6	31-26-250	100	470.00
5	240	216-264	+10/—20%	5%	33-26-250	185	600.00
5	277	250-304	+10/—20%	5%	33-36-250	185	600.00
5	480	432-528	±10%	7% 6	31-46-250	100	470.00
5	480	432-528	+10/—20%	5%	33-46-250	185	600.00
7.5	120	108-132	±10%	7% 6	31-16-275	132	540.00
7.5	120	108-132	+10/—20%	5%	33-16-275	275	730.00
7.5	208	188-228	+10/—20%	5%	33-06-275	275	730.00
7.5	240	216-264	±10%	7% 6	31-26-275	132	540.00
7.5	240	216-264	+10/—20%	5%	33-26-275	275	730.00
7.5	277	250-304	+10/—20%	5%	33-36-275	275	730.00
7.5	480	432-528	±10%	7% 6	31-46-275	132	540.00
7.5	480	432-528	+10/—20%	5%	33-46-275	275	730.00
10	120	108-132	±10%	7% 6	31-16-310	170	600.00
10	120	108-132	+10/—20%	5%	33-16-310	310	810.00
10	208	188-228	+10/—20%	5%	33-06-310	310	810.00
10	240	216-264	±10%	7% 6	31-26-310	170	600.00
10	240	216-264	+10/—20%	5%	33-26-310	310	810.00
10	277	250-304	+10/—20%	5%	33-36-310	310	810.00
10	480	432-528	±10%	7% 6	31-46-310	170	600.00
10	480	432-528	+10/—20%	5%	33-46-310	310	810.00
15	120	108-132	±10%	7% 6	31-16-315	275	750.00
15	120	108-132	+10/—20%	5%	33-16-315	400	960.00
15	208	188-228	+10/—20%	5%	33-06-315	400	960.00
15	240	216-264	±10%	7% 6	31-26-315	275	750.00
15	240	216-264	+10/—20%	5%	33-26-315	400	960.00
15	277	250-304	+10/—20%	5%	33-36-315	400	960.00
15	480	432-528	±10%	7% 6	31-46-315	275	750.00
15	480	432-528	+10/—20%	5%	33-46-315	400	960.00
25	120	108-132	±10%	7% 6	31-16-325	400	900.00
25	120	108-132	+10/—20%	5%	33-16-325	520	1275.00
25	208	188-228	+10/—20%	5%	33-06-325	520	1275.00
25	240	216-264	±10%	7% 6	31-26-325	400	900.00
25	240	216-264	+10/—20%	5%	33-26-325	520	1275.00
25	277	250-304	+10/—20%	5%	33-36-325	520	1275.00
25	480	432-528	±10%	7% 6	31-46-325	400	900.00
25	480	432-528	+10/—20%	5%	33-46-325	520	1275.00
37.5	120	108-132	±10%	8% 6	31-16-337	525	1100.00
37.5	240	216-264	±10%	8% 6	31-26-337	525	1100.00
37.5	480	432-528	±10%	8% 6	31-46-337	525	1100.00
50	120 9	114-126	±10%	9%	31-16-350-5	1050	1840.00 10
50	240 9	228-252	±10%	9%	31-26-350-5	1050	1840.00 10
50	480 9	456-504	±10%	9%	31-46-350-5	1050	1840.00 10
75	120 9	114-126	±10%	9%	31-16-375-5	1625	2305.00 10
75	240 9	228-252	±10%	9%	31-26-375-5	1625	2305.00 10
75	480 9	456-504	±10%	9%	31-46-375-5	1625	2305.00 10
100	120 9	114-126	±10%	9%	31-16-410-5	1900	2760.00 10
100	240 9	228-252	±10%	9%	31-26-410-5	1900	2760.00 10
100	480 9	456-504	±10%	9%	31-46-410-5	1900	2760.00 10
150	120 9	114-126	±10%	9%	31-16-415-5	2200	3305.00 10
150	240 9	228-252	±10%	9%	31-26-415-5	2200	3305.00 10
150	480 9	456-504	±10%	9%	31-46-415-5	2200	3305.00 10

Other Capacities available on order from factory. Contact your nearest Sola Electric distributor or representative. (6 to 8 week delivery).
NOTE: 50Hz units are also available.

THREE-PHASE DELTA (60 Hz ±3 Hz)

Maximum Output KVA Rating 1 11	Nominal Output Voltage 2	Line-to-Line Output Voltage Adjustability	Input Voltage Range	Maximum Harmonic Content	Catalog Number	Approximate Shipping Weight	Suggested User Price F.O.B. Factory
13	208△	188-228	+10/—20%	5%	39-09-313	905	1975.00
17	208△	188-228	+10/—20%	5%	39-09-317	1045	2190.00
26	208△	188-228	+10/—20%	5%	39-09-326	1300	2600.00
43	208△	188-228	+10/—20%	5%	39-09-343	1645	3450.00

Other Capacities available on order from factory. Contact your nearest Sola Electric distributor or representative. (6 to 8 week delivery).
NOTE: 50Hz units are also available.

THREE-PHASE WYE (60 Hz ±3 Hz)

Maximum Output KVA Rating 1	Nominal Output Voltage 2	Line-to-Neutral Output Voltage Adjustability 3	Input Voltage Range 4	Maximum Harmonic Content 5	Catalog Number	Approximate Shipping Weight	Suggested User Price F.O.B. Factory
15	208/120 Y	108-132	+10/—20%	5%	39-06-315	695	1625.00
30	208/120 Y	108-132	+10/—20%	5%	39-06-330	1045	2190.00
45	208/120 Y	108-132	+10/—20%	5%	39-06-345	1300	2600.00

Other Capacities available on order from factory. Contact your nearest Sola Electric distributor or representative. (6 to 8 week delivery).
NOTE: 50 Hz units are also available.

FOOTNOTES

1. At unity power factor and nominal output voltage. Although the KW efficiency is greater than 90%, the VA efficiency under worst-condition operation can be 60% for +10/—20% input voltage range units.
2. The output voltage regulation is ±0.5% for line voltage changes or ±1% for any combination of line voltage, frequency, load or temperature changes within the limits specified.
3. The output voltage adjustability is accomplished by an internal multi-turn potentiometer. Regulation in accordance with note (2) will be maintained at any output voltage setting within the specified adjustable range.
4. The input voltage range (either ±10% or +10/—20%) is based on the output voltage setting. The output voltage is adjustable ±10% of the rated nominal output by means of an internal multi-turn potentiometer. Therefore, the input voltage range shifts lineally with the setting of this control.
5. Maximum additive RMS harmonic content at nominal frequency.
6. 3% maximum additive RMS harmonic content may be obtained by using an auxiliary harmonic filter. See selection chart A.
7. 3% maximum additive RMS harmonic content may be obtained by using three auxiliary harmonic filters (one each line-to-neutral). See selection chart B.
8. 3% maximum additive RMS harmonic content may be obtained by using three auxiliary harmonic filters (one each line-to-line). See selection chart C.
9. Special sensing circuit filters must be ordered when feeding a rectified load. These are furnished at no additional charge.
10. F.O.B. Goldsboro, North Carolina. All other units are F.O.B. Elk Grove Village, Illinois.
11. The lowest line-to-line load should not be less than 70% of the highest line-to-line load, and the highest line-to-line load equal to, or less than, ⅓rd of the three-phase delta nameplate KVA rating. Additionally, the lowest line current should not be less than 90% of the highest line current.

SOLA ELECTRIC SLB

DIVISION OF SOLA BASIC INDUSTRIES

scrdc-III

THE THIRD DIMENSION IN POWER SUPPLIES

Silicon Controlled Rectifier Regulated D.C. Power Supply . . . Sola Electric

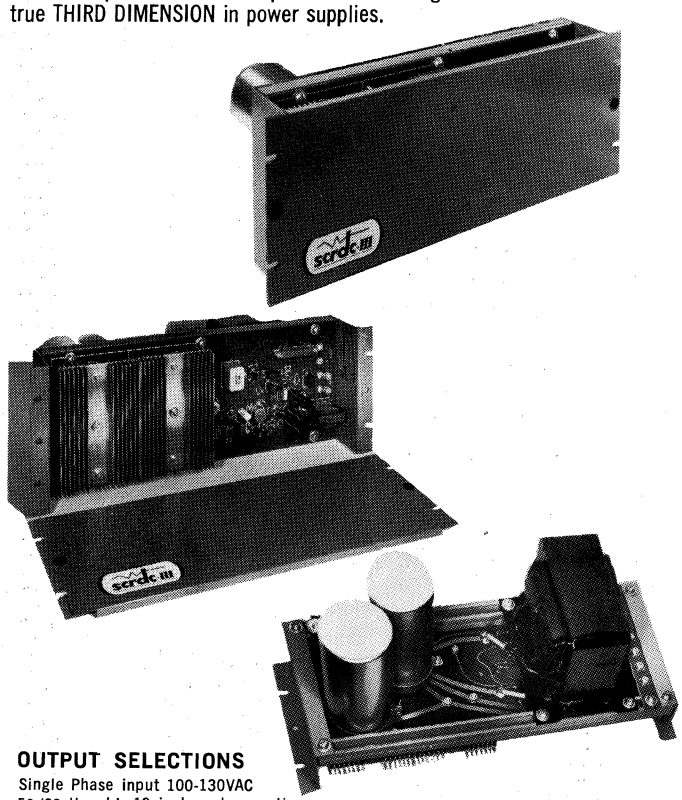
Until now, the user or specifier of regulated power supplies has had two basic choices:

(1) The CVDC or constant Voltage transformer bulk supply — a simple device gaining all of its regulation from the CV transformer. Under a given set of conditions the CVDC provides a total regulation envelope of about ± 10 percent. The CVDC type supply is typically quite economical. (2) A closely regulated transistorized supply . . . usually a series regulated unit providing an overall regulation envelope of ± .1 percent. The cost of this unit is about two to four times the cost of the CVDC.

In between these two cost and regulation extremes, there has always been a need for a supply that performs better than the CVDC but that does not have to be quite as "good" or expensive as the transistorized series regulator.

The SCRDC-III fills this long time void. Now there is a power supply delivering overall regulation of ± 3 percent costing little more than a CVDC type supply. Generally speaking, the SCRDC-III line is priced about 20 percent higher than the cost of a CVDC.

The SCRDC-III is especially designed for use with logic circuitry and as a bulk power source for point-of-use IC regulators. Here is the true THIRD DIMENSION in power supplies.



SCRDC-III FEATURES . .

Long Life . . . SOLA SCRDC-III supplies are conservatively designed with quality controlled components, testing, and inspection to insure no maintenance operation and long life.

Multiple Operation to Increase Current . . . To achieve higher output current ratings than are available as stock designs, paralleling two or three stock units is recommended. Two modes of parallel operation are possible, master/slave or paralleled outputs. Contact your Sola application engineer for details.

Series Connectable . . . To achieve higher output voltage than rated, two or three supplies may be connected in series.

Three-phase Operation . . . Balancing heavy loads on three-phase input lines can be achieved by connecting the inputs of three stock units of the same catalog number to the three-phase line and connecting the outputs in parallel as indicated above in "multiple operation."

SCRDC-III PERFORMANCE CHARACTERISTICS

Static Line Regulation . . . The SOLA SCRDC-III power supplies are designed to hold output voltage variations to within ± 0.1% of nominal or 50 mv., whichever is greater for an input voltage range of 100-130 volts, 50/60 Hz.

Static Load Regulation . . . The SOLA SCRDC-III power supplies are designed to hold output voltage variations to within ± 0.5% of nominal or less for static output load changes within the range of zero to full load.

Ripple/Pard . . . The SOLA SCRDC-III will maintain the output voltage within ±2% of the nominal or less for both periodic and random deviations. The RMS ripple does not exceed 1% of the nominal, or 300 millivolts, whichever is greater.

Dynamic Line Regulation . . . The SOLA SCRDC-III power supplies are designed to hold output voltage variations to within ±1.0% of nominal or less for step line voltage changes of ±10% within the static range given above.

Dynamic Load Regulation . . . The SOLA SCRDC-III power supplies are designed to hold output voltage variations to within ±2.0% of the nominal or less, for step load changes of up to 25% of the full load rating within the load range of 25 to 100% of full load.

Frequency . . . The SOLA SCRDC-III will meet the above regulation criteria over an input frequency range of 47 to 63 Hz without customer tap changing or jumpering.

Response . . . The SOLA SCRDC-III supply will recover from dynamic changes within the specified range given above to levels within the specified static band in less than 250 milliseconds.

Efficiency . . . The efficiencies of the SOLA-SCRDC-III supplies at full load will vary directly as the output voltage and load. Figure I and II below plot efficiencies as a function of load and output voltage level respectively.

Operating Temperature . . . The SOLA SCRDC-III power supply is designed to operate with convection cooling over a range of input ambients to the supply of 0°C to 40°C. The output voltage will vary less than .05%/°C over the operating range. Derate 2.5%/°C up to 50°C.

Isolation . . . Isolation between the primary and secondary of the input transformer provides electrical separation between the AC source and the DC load.

OUTPUT SELECTIONS

Single Phase input 100-130VAC
50/60 Hz std. 19 inch rack mounting

DC OUTPUT Volts	Amps	Watts	Catalog Number	Panel ht. (in.)	Mtg. ctrs. (in.)	Depth Max. (in.)	Ship. Wt. Lbs.	Price
4.5	10	45	39312	7	4	8¼	19	$180.00
4.5	20	90	39322	7	4	8¼	29	210.00
4.5	40	180	39342	8¾	5¾	9½	34	270.00
6	10	60	39313	7	4	8¼	20	185.00
6	20	120	39323	7	4	8¼	30	215.00
6	40	240	39343	8¾	5¾	9½	35	280.00
12	10	120	39314	7	4	8¼	28	190.00
12	20	240	39324	7	4	8¼	32	225.00
12	40	480	39344	8¾	5¾	10¾	48	290.00
24	10	240	39316	7	4	8¼	31	215.00
24	20	480	39326	7	4	9	46	265.00
24	40	960	39346	8¾	5¾	10¾	60	335.00
48	10	480	39319	7	4	9	48	230.00
48	20	960	39329	8¾	5¾	10¾	60	295.00

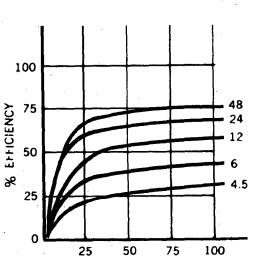


FIGURE 1

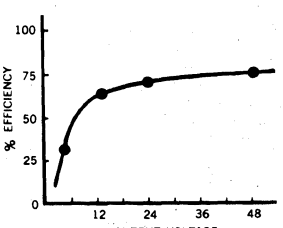


FIGURE 2

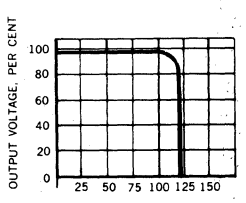


FIGURE 3

Fig. 3 Current-limiting action causes output voltage to collapse on overload.

SOLA® CVDC power supplies, available off-the-shelf.

Sola offers a wide range of CVDC type power supplies which are available from stock of your local electronic parts distributor or the factory. These standard designs are available in any quantity and are the result of Sola custom engineering efforts.

Inherently highly reliable, the CVDC supplies are ruggedly built and use simple circuitry. Fast and dependable regulation, current limiting, and high efficiency are provided by the heart of the supply: the famous Sola Constant Voltage Transformer.

CHARACTERISTICS

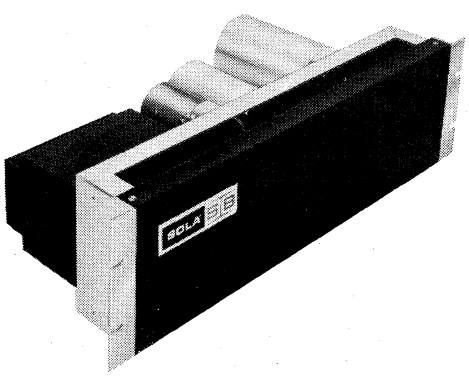
- Fast, dependable line-voltage regulation: within ±1% for fluctuations of ±15%; voltage will return to regulation envelope in approximately 50 milliseconds.
- Load regulation: from 1/2% to 8%, one half to full load.
- Automatic current limiting: short circuit protection; withstands load faults; high overloads cannot damage power supply or equipment components.
- High efficiency: upwards of 75%; low input-power requirements.
- Simplified operation: no adjustments or maintenance; continuous duty.
- Convection cooling.
- Ripple: 1% rms maximum.
- Ambient operating temperature: 50° C maximum.

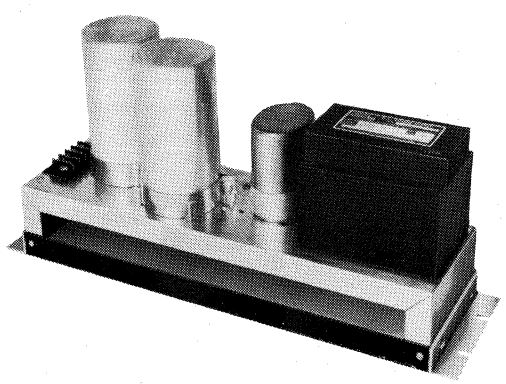
Constant-voltage Sola transformer provides ±1% regulation for line voltage variations as great as ±15%, serves as the heart of CVDC power supplies for voltage-sensitive equipment.

STANDARD CVDC MODELS

(fixed output for pulse, variable, intermittant and fixed loads-Inputs 100-130 volts, 60Hz)

CATALOG NO.	OUTPUT RATINGS VOLTS	AMPS	VA	PANEL HT.	WT. LBS.	PRICE 1-4
281513-2	6	10	60	3½	27	$105.00
282123	6	15	90	5¼	38	115.00
281514-2	12	5	60	3½	18	105.00
282124	12	10	120	5¼	31	120.00
281515-2	18	5	90	3½	20	110.00
282125	18	10	180	5¼	45	145.00
281024-1	24	6	144	5¼	30	105.00
282126	24	10	240	5¼	48	125.00
281203	24	15	360	8¾	64	155.00
282127	24	25	600	7	72	202.00
28626-1	28	8	224	5¼	42	120.00
282128	28	15	420	7	55	195.00
281048	48	4	192	5¼	32	110.00
281561	48	10	480	5½	48	155.00
282129	48	20	960	8¾	95	250.00
281125	125	2	250	5¼	44	125.00
281150	150	2	300	5¼	48	130.00
281200	200	1	200	5¼	39	110.00
281250	250	1	250	5¼	45	115.00





SOLA ELECTRIC STB

DIVISION OF SOLA BASIC INDUSTRIES

Also manufacturers of AC & DC Power Supplies • Sola Constant-Voltage Transformers • Solatron Line-Voltage Regulators • DC-to-AC Inverters • Lighting Ballasts

Sonotone Sintered-Plate



SEALED CELLS Physical and Electrical Characteristics

SONOTONE CELL NUMBER	SIZE	OVER-ALL DIMENSIONS (in inches)						WEIGHT IN OUNCES	CAPACITY IN MAH	CHARGE RATE IN MA
		DIAMETER ±.010		HEIGHT ±.015						
				WITH POSITIVE BUTTON		WITHOUT POSITIVE BUTTON				
		WITH LABEL AND JACKET	WITHOUT LABEL AND JACKET	WITH LABEL AND JACKET	WITHOUT LABEL AND JACKET	WITH LABEL AND JACKET	WITHOUT LABEL AND JACKET			
S-101	AA	.568	.550	1.947	1.947	1.869	1.869	0.80	500	50
S-102	½C	1.018	1.000	1.005	1.000	.950	.945	1.2	710	80
S-103	D	1.286	1.268	2.385	2.385	2.295	2.290	5.5	4000	400
S-104	C	1.018	1.000	1.930	1.930	1.875	1.875	2.6	1800	190
S-106	CD	1.018	1.000	3.055	3.055	3.005	3.000	4.0	2800	300
S-108	F	1.286	1.268	*	*	3.445	3.435	8.3	6500	650
S-113	.875 x 1.625 (Sub-C)	—	.865	*	*	—	1.650	1.6	1200	120
S-126	.625 x .6	—	.625	*	*	—	.610	0.3	170	20
S-131	1 x .35	—	.987	*	*	—	.350	0.50	225	22
S-132	1 x .25	—	.987	*	*	—	.250	0.30	150	15
S-133	1.35 x .36	—	1.35	*	*	—	.360	1.0	500	50
S-140	.593 x 1.92	—	.585	*	*	—	1.905	1.0	570	60
S-142	1 x 1.25	—	1.000	*	*	—	1.250	1.9	1400	145
S-143	1 x 1.14	—	1.000	*	*	—	1.140	1.7	1200	120
S-144	1.27 x 1.42	—	1.268	*	*	—	1.42	3.0	2300	230
†S-213	.875 x 1.625 (Sub-C)	—	.865	*	*	—	1.650	1.6	750	75
‡S-313	.875 x 1.625 (Sub-C)	—	.865	*	*	—	1.650	1.6	800	300
‡S-343	1 x 1.14	—	1.000	*	*	—	1.140	1.5	800	300

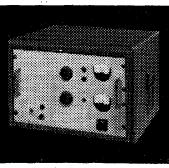
*Not Available in this Configuration
†Low Capacity, Sub-C Cell
‡Fastback Cell—Recharges at 3-hour Rate

For individual cell and battery characteristics for a specific Sonotone sealed cell or battery—such as voltage, capacity, size and other electrical features—write: Battery Division, Sonotone Corporation, Elmsford, New York.



MODULE BATTERIES Physical and Electrical Characteristics

SONOTONE BATTERY NUMBER	BATTERY CELL SIZE	VOLTAGE	NUMBER OF CELLS	CAPACITY (5-hour rate)	DIMENSIONS (in inches)			WEIGHT (in pounds)
					L	W	H	
5-S-113	⅞ x 1⅝	6	5	1.2 A.H.	5	1	1¾	¾
10-S-113	⅞ x 1⅝	12	10	1.2 A.H.	5	2	1¾	1½
20-S-113	⅞ x 1⅝	24	20	1.2 A.H.	10	2	1¾	3
20-S-113	⅞ x 1⅝	24	20	1.2 A.H.	5	4	1¾	3
5-S-104	C	6	5	1.8 A.H.	5 15/16	1 3/16	2	1¼
10-S-104	C	12	10	1.8 A.H.	5 15/16	2⅜	2	2½
20-S-104	C	24	20	1.8 A.H.	11⅞	2⅜	2	5
20-S-104	C	24	20	1.8 A.H.	5 15/16	4¾	2	5
5-S-103	D	6	5	4 A.H.	7½	1½	2½	2¼
10-S-103	D	12	10	4 A.H.	7½	3	2½	4½
20-S-103	D	24	20	4 A.H.	15	3	2½	9
20-S-103	D	24	20	4 A.H.	7½	6	2½	9



PCA-131 CHARGER/ANALYZER

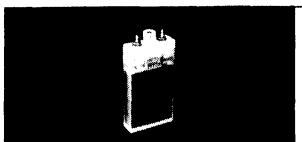
Balances nickel-cadmium battery cells for peak performance, longer life.

Power Requirements	Input Current	Size	Weight
115VAC, 60 cycles	10 amps	21½ x 12¼ x 18"	108 lbs.

For complete individual specifications on Sonotone Batteries write: Battery Div., Dept. B10, Sonotone Corporation, Elmsford, New York 10523.

Find us in SEE OUR SPECIFICATIONS IN VSMF MICROFILM CATALOG FILE **OEM and Military Section**

Nickel-Cadmium Cells and Batteries



VENTED BATTERY CELLS

Physical and Electrical Characteristics

	CELL SERIES	CELL CASE MATERIAL	CAPACITY NOM A.H.	W	T	H	CELL WEIGHT FILLED
HIGH RATE	1H120	N	0.8	1.160	.680	2.258	1.7 oz.
	2H120	N	2.0	1.160	.675	4.000	3.2 oz.
	3H120	N	4.0	2.145	.650	4.016	5.8 oz.
	5H120	N	6.5	2.180	.955	4.060	9.1 oz.
	10H120	N	13	2.740	1.195	4.750	1 lb. 4 oz.
	12H120	N	13	2.419	1.080	6.950	1 lb. 4 oz.
	20H120	N	22	3.110	1.657	5.446	2 lb. 0 oz.
	24H120	N	24	3.180	1.075	8.278	2 lb. 4 oz.
	36H120	N	40	3.135	1.390	9.400	3 lb. 8 oz.
	41H120	N	40	5.110	1.000	8.500	3 lb. 14 oz.
	65H130	N	72	4.980	1.350	11.375	6 lb. 10 oz.
	81H120	N	80	5.120	1.924	8.510	6 lb. 10 oz.
MEDIUM RATE	5BM220	N	5.5	2.110	.850	3.875	9.1 oz.
	12M220	N	13	2.419	1.080	6.950	1 lb. 4 oz.
	24M220	N	25	3.180	1.075	8.278	2 lb. 2 oz.
	36M220	N	40	3.135	1.390	9.400	3 lb. 8 oz.
	65M220	N	72	4.980	1.350	11.375	6 lb. 10 oz.
	100M220	P	111	6.813	2.172	8.730	11 lb. 0 oz.
	280M220	N	260	9.126	3.655	9.925	21 lb. 0 oz.
	24ME220*	N	25	3.180	1.075	11.278	2 lb. 6 oz.
	15M320	N	16	2.317	1.063	5.548	1 lb. 1 oz.
	20M320	N	24	3.110	1.657	5.446	2 lb. 1 oz.
	40M320	P	44	4.050	1.660	7.437	3 lb. 15 oz.
	60M320	P	60	4.718	1.771	8.542	5 lb. 0 oz.
	100M320	P	121	6.813	2.172	8.730	11 lb. 2 oz.
HIGH CAPACITY	3L420	N	4.7	2.145	.650	4.016	6.3 oz.
	5L420	N	7.5	2.185	.955	4.060	9.4 oz.
	5BL420	N	6.0	2.110	.850	3.875	9.3 oz.
	10L420	N	15	2.740	1.195	4.750	1 lb. 3 oz.
	20L420	N	25	3.110	1.657	5.548	2 lb. 1 oz.
	60L420	P	70	4.718	1.771	8.542	5 lb. 3 oz.
	210L420	N	230	8.140	3.170	9.410	20 lb.

N—Nylon P—Polystyrene *Elongated Cell



COMMERCIAL AIRCRAFT BATTERIES

Sonotone FAA-Approved Aircraft Battery Specifications

SONOTONE BATTERY TYPE	CELL TYPE	BATTERY VOLTS	AMP. HOURS AT 5-HR. RATE	CAPACITY 20-MIN. AMP.	5-MIN. AMP.	OVERALL DIMENSIONS IN INCHES (not including mounting brackets) LENGTH	WIDTH	HEIGHT	POUND WEIGHT	CONNECTOR
CA-4	24M220	24	25	65	200	10 1/2	7 13/16	8 3/4	55	Elcon
CA-5	36M220	24	40	100	320	10 1/2	9 15/16	10 1/4	80	Elcon
CA-7	12M220	24	13	30	100	8 3/8	7 3/4	7 3/4	33	Elcon
CA-9	24H120	24	24	75	225	10 1/2	7 13/16	8 3/4	55	Elcon
CA-10	10H120	24	13	35	120	12 3/4	5 11/16	5 3/8	26	Elcon
CA-13	36H120	14	40	100	320	9	3 11/16	4 23/32	45 1/2	Elcon
CA-15A unit	12M220	12	15*	30	100	7 15/16	3 7/8	7 5/8	16	Nut
CA-15B unit**	12M220	12	15*	30	100	7 15/16	3 7/8	7 5/8	16	Nut
CA-20	20M320	24	24	60	180	12	9 13/16	6 5/8	50	Cannon
CA-20H	20H120	24	22	65	200	12	9 13/16	6 5/8	49	Elcon
CA-21H-1	20H120	24	22	65	200	11 3/4	9 5/8	6 1/2	48	Elcon
CA-24A unit	24M220	12	25	65	200	9	4 11/16	8 5/8	26	Wing Nut
CA-24B unit**	24M220	12	25	65	200	9	4 11/16	8 5/8	24	Wing Nut
CA-27†	24ME220	24	25	65	200	10 1/2	7 13/16	11 3/4	68	Elcon
CA-31	3H120	24	4	10	30	14 1/8	2 3/8	4 1/2	10	Spec Cannon
CA-40	40M320	24	44	110	350	15	10 3/8	9 5/8	95	Cannon Spike
CA-44A unit	40M320	12	44	110	350	12 7/8	6 1/8	10 13/16	48	Cannon Spike or Wing Nut
CA-44B unit**	40M320	12	44	110	350	12 7/8	6 1/8	10 13/16	44	Cannon Spike or Wing Nut
CA-51	5H120	24	6.5	15	50	10 1/16	4 3/4	4 5/8	16	Special
CA-52	5H120	24	6.5	15	50	9 15/16	4 13/16	4 5/16	15	Term Stud
CA-54	5H120	24	6.5	15	50	14 3/8	5 1/16	6 1/4	16	Special
CA-54-1	5H120	24	6.5	15	50	14 3/8	5 1/16	6 1/4	16	Special
CA-88A unit	60M320	12	60	150	450	13 15/16	7 1/4	10 13/16	66	Cannon Spike or Wing Nut
CA-88B unit**	60M320	12	60	150	450	13 15/16	7 1/4	10 13/16	60	Cannon Spike or Wing Nut
CA-101	10H120	24	13	35	120	12 7/16	5 5/8	5 9/16	26	Special
CA-103	10H120	24	13	35	120	12 1/8	5 5/8	5 5/8	26 1/2	Nut
CA-105	10H120	24	13	35	120	12 1/8	5 5/8	5 5/8	26 1/2	Nut
CA-121	12M220	26	13	30	100	9 7/16	7 15/16	7 3/4	37	Elcon
CA-125	3H120	24	4	10	30	9	3 3/16	4 23/32	10 1/2	Special
CA-727-3	24M220	24	25	65	200	10 1/2	7 13/16	8 3/4	55	Elcon

*At 8-hour rate. **B unit used with A unit to make 24-volt set. †Elongated Battery

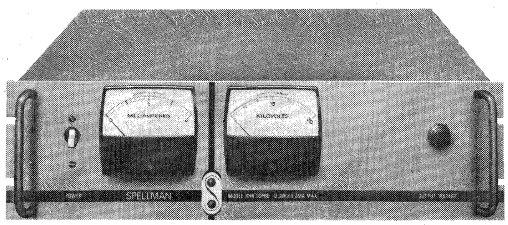
SPELLMAN
HIGH VOLTAGE POWER SUPPLIES

for industry, science instrumentation, education, aerospace, defense, displays

RACK MOUNTED

- All Solid State, Silicon Semiconductors
- Short Circuit and Overload Protected
- High Performance—0.01% Regulation
- Low Price
- Unique Circuitry
- Safety Insured
- Kilovoltmeter and Milliammeter
- Full Range Control With Multiturn Potentiometer

Spellman High Voltage Power Supplies are the result of more than twenty years of development and refinement. Employing unique RF-Oscillator circuitry with an exclusive low stored energy feature, Spellman HV power supplies ensure low corona, low leakage, and long trouble free life.



MAX. RATINGS KV	MA.	WATTS	REGULATED RHR SERIES		UNREGULATED UHR SERIES	
5	2	10	RHR-5P10	$400	UHR-5P10	$325
			RHR-5N10	400	UHR-5N10	325
5	6	30	RHR-5P30	425	UHR-5P30	350
			RHR-5N30	425	UHR-5N30	350
			RHR-5PN30	475	UHR-5PN30	400
5	10	50	RHR-5P50	475	UHR-5P50	400
			RHR-5N50	475	UHR-5N50	400
			RHR-5PN50	525	UHR-5PN50	450
10	1	10	RHR-10P10	470	UHR-10P10	345
			RHR-10N10	470	UHR-10N10	345
10	3	30	RHR-10P30	495	UHR-10P30	370
			RHR-10N30	495	UHR-10N30	370
			RHR-10PN30	575	UHR-10PN30	420
10	6	60	RHR-10P60	535	UHR-10P60	400
			RHR-10N60	535	UHR-10N60	400
			RHR-10PN60	625	UHR-10PN60	450
10	10	100	RHR-10P100	575	UHR-10P100	430
			RHR-10N100	575	UHR-10N100	430
			RHR-10PN100	675	UHR-10PN100	480
15	0.67	10	RHR-15P10	585	UHR-15P10	355
			RHR-15N10	585	UHR-15N10	355
15	2	30	RHR-15P30	620	UHR-15P30	390
			RHR-15N30	620	UHR-15N30	390
			RHR-15PN30	720	UHR-15PN30	440
15	4	60	RHR-15P60	670	UHR-15P60	430
			RHR-15N60	670	UHR-15N60	430
			RHR-15PN60	770	UHR-15PN60	480
15	8	120	RHR-15P120	720	UHR-15P120	470
			RHR-15N120	720	UHR-15N120	470
			RHR-15PN120	820	UHR-15PN120	520
20	0.50	10	RHR-20P10	640	UHR-20P10	380
			RHR-20N10	640	UHR-20N10	380
20	1.5	30	RHR-20P30	685	UHR-20P30	410
			RHR-20N30	685	UHR-20N30	410
			RHR-20PN30	785	UHR-20PN30	460
20	3	60	RHR-20P60	735	UHR-20P60	450
			RHR-20N60	735	UHR-20N60	450
			RHR-20PN60	835	UHR-20PN60	500

MAX. RATINGS KV	MA.	WATTS	REGULATED RHR SERIES		UNREGULATED UHR SERIES	
20	6	120	RHR-20P120	$785	UHR-20P120	490
			RHR-20N120	785	UHR-20N120	490
			RHR-20PN120	885	UHR-20PN120	540
30	0.33	10	RHR-30P10	695	UHR-30P10	380
			RHR-30N10	695	UHR-30N10	380
30	1	30	RHR-30P30	750	UHR-30P30	430
			RHR-30N30	750	UHR-30N30	430
			RHR-30PN30	850	UHR-30PN30	480
			RHR-30PF30	775	—	—
30	2	60	RHR-30P60	800	UHR-30P60	470
			RHR-30N60	800	UHR-30N60	470
			RHR-30PN60	900	UHR-30PN60	520
			RHR-30PF60	825	—	—
30	4	120	RHR-30P120	850	UHR-30P120	510
			RHR-30N120	850	UHR-30N120	510
			RHR-30PN120	950	UHR-30PN120	560
			RHR-30PF120	875	—	—
40	0.75	30	RHR-40P30	800	UHR-40P30	580
			RHR-40N30	800	UHR-40N30	580
			RHR-40PN30	900	UHR-40PN30	630
			RHR-40PF30	825	—	—
40	1.5	60	RHR-40P60	850	UHR-40P60	620
			RHR-40N60	850	UHR-40N60	620
			RHR-40PN60	950	UHR-40PN60	670
			RHR-40PF60	875	—	—
40	3	120	RHR-40P120	925	UHR-40P120	660
			RHR-40N120	925	UHR-40N120	660
			RHR-40PN120	1025	UHR-40PN120	710
			RHR-40PF120	950	—	—
60	0.50	30	RHR-60P30	1150	UHR-60P30	790
			RHR-60N30	1150	UHR-60N30	790
			RHR-60PN30	1300	UHR-60PN30	880
60	1	60	RHR-60P60	1250	UHR-60P60	850
			RHR-60N60	1250	UHR-60N60	850
			RHR-60PN60	1400	UHR-60PN60	940
60	2	120	RHR-60P120	1350	UHR-60P120	910
			RHR-60N120	1350	UHR-60N120	910
			RHR-60PN120	1500	UHR-60PN120	1000
100	1	100	RHR-100P100	1800	UHR-100P100	1200
			RHR-100N100	1800	UHR-100N100	1200

RACK MODELS Size and Weight

19″ relay rack panels with standard notching. Behind-panel depth is 16½″. Any rack model can be furnished installed in a bench-mounting cabinet. Portable units available for most rack mounted ratings.

Output Voltage	Rack Panel Height	Weight	Shipping Weight
5KV thru 30KV	5¼″	28 lbs.	40 lbs.
40KV	8¾″	30 lbs.	42 lbs.
60KV	12¼″	35 lbs.	48 lbs.
100KV	17½″	40 lbs.	55 lbs.

Focus Tap Option on 30KV and 40KV units indicated by PF.

Polarity indicated by P, N, or PN.

SPECIFICATIONS

	RHR SERIES	UHR SERIES
REGULATION		
No load to full load	0.01% or 100mV	±2% of max. rated voltage
Line from Min.-Max.	±0.01% or ±100mV	±2% of max. rated voltage
RIPPLE	0.02% RMS or 200mV	0.1% RMS of max. rated voltage
TEMP. COEFF.	0.01% between 0°C and 60°C	0.2% between 0°C and 60°C
INPUT	105-125V, 50-60Hz, Single phase	

RHR units adjustable from 0 to rated voltage by means of a ten turn precision potentiometer with better than 0.02% resolution.

All rack models have both voltage and current meters.

RF-OSCILLATOR ADVANTAGES

The unique advantages of the RF-OSCILLATOR HIGH-VOLTAGE SUPPLY have been developed and refined by the Spellman Organization for over 20 years.

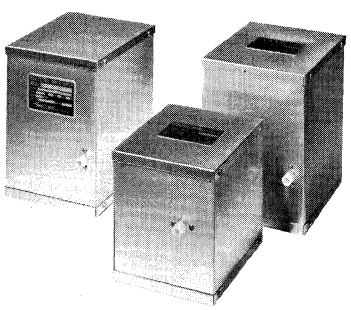
ECONOMY. There is no other way of generating filtered high-voltage DC, unregulated or regulated, that can even begin to compete with the RF oscillator method, between 5 and 100KV, up to 200 Watts.

SAFETY. Since the RF oscillator is operating at a relatively high frequency, very small capacitors are used to achieve low ripple. The RF supply requires only about one-thousandth as much stored energy (CV^2) in its output filter as does any 60 Hertz supply. Consequently, this supply ensures the highest possible degree of personnel protection.

NON-DESTRUCTIVE TESTING. As explained above, the stored energy in the RF filter is so low that these supplies are ideal for cable testing, corona testing, and other processes in which arcs and breakdowns are inevitable, but must not be allowed to damage the components in which they occur.

MODULAR STYLE

HIGH VOLTAGE POWER SUPPLIES



Modules are built into heavy-gage aluminum housings. Seven standard sizes are available.

OPTIONAL ITEMS

Floating outputs, positive/negative dual outputs and special taps available on order. Other modules at higher voltages available on request. Modules with adjustable output available for both DC and AC input.

			FRHM—REGULATED FIXED OUTPUT				UHM—UNREGULATED INPUT—CONTROLLABLE			
			DC—INPUT 24-32V		AC—INPUT 105-125V		DC—INPUT 0-24V		AC-INPUT 0-115V	
REGULATION No load to full load			0.01% or 100mV		0.01% or 100mV		20% of max. voltage		20% of max. voltage	
Line from Min.-Max.			±0.01% or ±100mV		±0.01% or ±100mV		Not applicable		Not applicable	
Ripple			0.02% RMS or 200mV		0.02% RMS or 200mV		0.1% of max. voltage		0.5% of max. voltage	
Temp. Coeff.			0.01%/°C between 0°C and 60°C		0.01%/°C between 0°C and 60°C		0.2%/°C between 0°C and 60°C		0.2%/°C between 0°C and 60°C	
MAX. RATINGS										
KV	MA.	WATTS								
5	2	10	FRHM-5P10D FRHM-5N10D	$235 235	FRHM-5P10A FRHM-5N10A	$285 285	UHM-5P10D UHM-5N10D UHM-5PN10D	$ 75 75 95	UHM-5P10A UHM-5N10A UHM-5PN10A	$110 110 130
5	6	30	FRHM-5P30D FRHM-5N30D	335 335	FRHM-5P30A FRHM-5N30A	385 385	UHM-5P30D UHM-5N30D UHM-5PN30D	200 200 220	UHM-5P30A UHM-5N30A UHM-5PN30A	235 235 255
10	1	10	FRHM-10P10D FRHM-10N10D	260 260	FRHM-10P10A FRHM-10N10A	310 310	UHM-10P10D UHM-10N10D UHM-10PN10D	75 75 95	UHM-10P10A UHM-10N10A UHM-10PN10A	110 110 130
10	3	30	FRHM-10P30D FRHM-10N30D	400 400	FRHM-10P30A FRHM-10N30A	450 450	UHM-10P30D UHM-10N30D UHM-10PN30D	220 220 240	UHM-10P30A UHM-10N30A UHM-10PN30A	255 255 275
15	0.67	10	FRHM-15P10D FRHM-15N10D	435 435	FRHM-15P10A FRHM-15N10A	485 485	UHM-15P10D UHM-15N10D UHM-15PN10D	125 125 145	UHM-15P10A UHM-15N10A UHM-15PN10A	160 160 180
15	2	30	FRHM-15P30D FRHM-15N30D	505 505	FRHM-15P30A FRHM-15N30A	555 555	UHM-15P30D UHM-15N30D UHM-15PN30D	240 240 260	UHM-15P30A UHM-15N30A UHM-15PN30A	275 275 295
20	0.50	10	FRHM-20P10D FRHM-20N10D	435 435	FRHM-20P10A FRHM-20N10A	485 485	UHM-20P10D UHM-20N10D UHM-20PN10D	125 125 145	UHM-20P10A UHM-20N10A UHM-20PN10A	160 160 180
20	1.5	30	FRHM-20P30D FRHM-20N30D	570 570	FRHM-20P30A FRHM-20N30A	620 620	UHM-20P30D UHM-20N30D UHM-20PN30D	260 260 280	UHM-20P30A UHM-20N30A UHM-20PN30A	295 295 315
30	0.33	10	FRHM-30P10D FRHM-30N10D	480 480	FRHM-30P10A FRHM-30N10A	535 535	UHM-30P10D UHM-30N10D	150 150	UHM-30P10A UHM-30N10A	185 185
30	1	30	FRHM-30P30D FRHM-30N30D	635 635	FRHM-30P30A FRHM-30N30A	685 685	UHM-30P30D UHM-30N30D	280 280	UHM-30P30A UHM-30N30A	315 315

SIZE AND WEIGHT

MODEL TYPE	INPUT	RATED KV	OUTPUT WATTS	DIMENSIONS W″	L″	H″	NET WEIGHT	SHIPPING WEIGHT
FRHM	DC	5, 10, 15, & 20	10	5½	7½	7½	4	12
		30		5½	10	9	5	13
FRHM, UHM	DC	all	30	5½	10	9	5	13
FRHM	AC	5, 10, 15 & 20	10	5½	10	8	13	23
		30		5½	12	10	15	25
FRHM, UHM	AC	all	30	5½	12	10	15	25
UHM	DC	5, 10	10	5	6	6	21	10
		15, 20, 30		5¼	6¾	8¼	3	11
UHM	AC	5, 10	10	5	6	9	10	20
		15, 20, 30		5¼	6¾	11¼	11	21

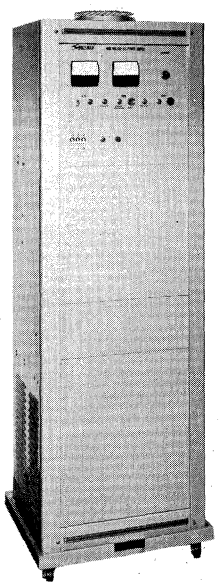
SPELLMAN
HIGH-VOLTAGE ELECTRONICS CORPORATION
Our Third Decade of Leadership in High-Voltage Technology
1930 ADEE AVENUE
BRONX, NEW YORK 10469
(212) 547-0306

SPELLMAN
HIGH VOLTAGE POWER SUPPLIES

for industry, science instrumentation, education, aerospace, defense, displays

SERIES REGULATED POWER SUPPLIES

Table below is an abbreviated listing of standard models. Other units up to 150KVDC and 30KW are also available.



Constant current units available for high power gas lasers with unique start-up features.

REGULATION

Line ±0.01% or ±100 MV over specified range
Load ±0.01% or ±100 MV from no load to full load

RIPPLE

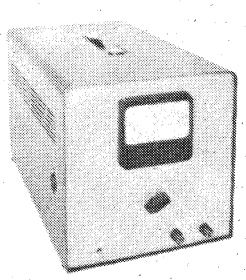
0.02% RMS

CONTROL FEATURES

- Circuit breaker protection
- Overload trip circuit
- Kilivolt meter and milliammeter
- Safety interlock
- Zero start interlock
- Functional indicators and controls

MODEL NO.	VOLTAGE RATING (KV)	CURRENT RATING (MA)	INPUT VOLTAGE
HP5-250SR	0-5 KV	250	105-125V, 60Hz, Single Phase
HP5-500SR	0-5 KV	500	200-240V, 60Hz, Three Phase
HP5-1000SR	0-5 KV	1000	200-240V, 60Hz, Three Phase
HP10-100SR	0-10 KV	100	105-125V, 60Hz, Single Phase
HP10-250SR	0-10 KV	250	200-240V, 60Hz, Three Phase
HP10-500SR	0-10 KV	500	200-240V, 60Hz, Three Phase
HP20-50SR	0-20 KV	50	105-125V, 60Hz, Single Phase
HP20-100SR	0-20 KV	100	200-240V, 60Hz, Three Phase
HP20-200SR	0-20 KV	200	200-240V, 60 Hz, Three Phase

60 Cycle Heavy Duty PORTABLE POWER SUPPLY

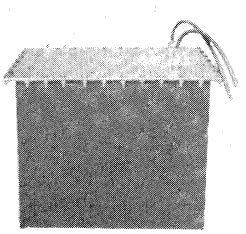


0-60 KV

Low priced stock item for industrial process and test applications.

MODEL NO.	ST-60	PF-60
Input	115V. RMS 60Hz	Single Phase
Output Voltage	Continuously adjustable from 0-60 KV DC	
Output Current	250 microamps at 60 KV 1 milliamp max. below 20 KV	50 microamps at 60 KV 250 microamps max. below 20 KV
Ripple	Less than 2% RMS at rated voltage	
Polarity	Positive with respect to ground	Negative with respect to ground
Size & Weight	11″w x 18″d x 11″h carrying case with handle. Net weight 40 lbs. Shipping weight 55 lbs.	

SOLID STATE
DC POWER SUPPLY for LASERS
15 KV @ 250 ma.



- Input 115 V 50 amp. AC
- Output 15 KV DC @ 250 ma.
- HV floating full wave bridge
- Either negative or positive may be grounded or left floating
- Ideal for gas laser or condenser charging

Model RS-21 .....**$575** Net

MINIATURE ENCAPSULATED MODULES

for CRT and Photomultiplier uses and other applications requiring modular packaging.

MODEL NO.	OUTPUT VOLTAGE RANGE (VOLTS)	OUTPUT CURRENT (MICRO-AMPS)
MRM 1.5P150D	600-1500	100
MRM 1.5N150D	600-1500	100
MRM 1.5P750D	600-1500	500
MRM 1.5N750D	600-1500	500
MRM 1.5P1500D	600-1500	1000
MRM 1.5N1500D	600-1500	1000
MRM 3P300D	1500-3000	100
MRM 3N300D	1500-3000	100
MRM 3P1500D	1500-3000	500
MRM 3N1500D	1500-3000	500
MRM 3P3000D	1500-3000	1000
MRM 3N3000D	1500-3000	1000
MRM 6P600D	3000-6000	100
MRM 6N600D	3000-6000	100
MRM 6P1500D	3000-6000	250
MRM 6N1500D	3000-6000	250
MRM 6P3000D	3000-6000	500
MRM 6N3000D	3000-6000	500
MRM 12P300D	6000-12,000	25
MRM 12N300D	6000-12,000	25
MRM 12P600D	6000-12,000	50
MRM 12N600D	6000-12,000	50
MRM 12P1200D	6000-12,000	100
MRM 12N1200D	6000-12,000	100



Size: 3″ x 4″ x 1″

Input: 28V DC ±10%

Regulation: 0.5% line from variations of ±10%
3% for half to full load
.02%/°C from 0 to 60°C

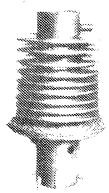
Ripple: .5% or better as required

How to specify Spellman MRM (Miniature Regulated Modules) units.

MRM 1.5 P 150 D

- MRM — Miniature Regulated Module
- 1.5 — Kilovolts
- P — P or N
- 150 — Milliwatts
- D — DC Input

MODEL TRF10
High Voltage
STEP-UP COIL



for transistor drive circuits

OUTPUT TO 10 KV DC @ 1 ma.

Coil driven by single self-oscillating transistor • Input voltage up to 28 V DC approx. 1 amp. • Coil height—4¼″ • Diameter—3″ • Approx. operating frequency 120 KC
Higher voltages available when used with proper rectifier/multiplication circuit.
Complete with technical data and schematic diagram for construction of self-oscillating RF circuit at approximately 120kHz. Other coils available for vacuum-tube circuits.
Model TRF10 . . . $24. Net

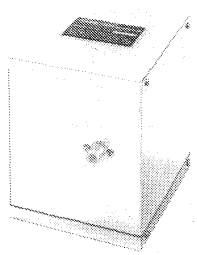
ELECTROSTATIC FLOCKING SYSTEMS

Through our specialized work in high voltage technology we have established a reputation as a leading source for electrostatic flocking systems. We now produce a variety of electrostatic flocking systems for manual and production line use. Spellman Model PB-3 for flat surface flocking and Spellman Model PB-4 for three dimensional flocking are available off the shelf.

CUSTOM AND SPECIAL PURPOSE DESIGNS

Over the years, we have developed and built many thousands of custom power supplies, in hundreds of non-standard mechanical configurations, and hundreds of non-standard ratings. We are prepared to quote promptly and accurately, and deliver on short schedules as well, on most custom requirements.

12 KV
DC-DC MODULES
Model UHM 10PID
for display and CRT applications



4″ x 4″ x 5″

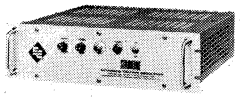
Factory set to desired voltage requirements between 9-12 KV at 100 microamps.

24 V DC Input

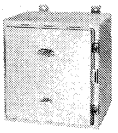
SPELLMAN
HIGH-VOLTAGE ELECTRONICS CORPORATION

Our Third Decade of Leadership in High-Voltage Technology
1930 ADEE AVENUE
BRONX, NEW YORK 10469
(212) 547-0306

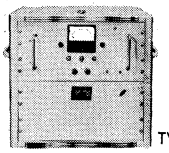
STABILINE® automatic VOLTAGE REGULATORS



TYPE IES9101



TYPE EMT10228



TYPE EMT4115B

Deliver a constant output voltage regardless of variations in input voltage or changes in line current. Types available from 0.25 to 275 kva. Submit specifications for ratings desired but not given in the charts. Input voltage ranges shown are at nominal output voltage; input range shifts with output voltage setting.

EMT SERIES – Electro Mechanical Transistorized types with virtually zero waveform distortion, 47-63 hertz frequency range, very low internal impedance, negligible phase shift and efficiency approximately 99%. Rated accuracy ±.75% for all line voltage or load current variations within unit stated range. Insensitive to load magnitude and power factor; no effect on system power factor.

EMS SERIES – Electro Mechanical Transistorized types for heavier load requirements. Same operating characteristics as EMT Series. Units with letter I before first digit in type number have individual control for each line-to-neutral voltage.

EMK SERIES – Electro Mechanical Transistorized types providing faster correction times than other electromechanical models.

IES SERIES – Instantaneous Electronic Solid-State types having extremely fast correction, no moving parts. Will maintain output voltage within a 100 millivolt rms band for any combination of rated input voltage and/or load from 1.0 to 0 power factor lagging. Efficiency to 95%. All units have provision for remote sensing and have plug-in solid-state circuit boards.

MILITARIZED – Meet requirements of applicable military specifications. Type EMTH41007MH is 3½ x 6 x 4½"; type EM4108MCR fits standard 19" relay rack. Accuracy ±1.0%.



STABILINE®
Full Range REGULATOR CONTROLLERS

TYPE FR500MP

Designed for use with any motor-driven POWERSTAT Variable Transformer. Provide *full range:*

REGULATED AC VOLTAGE – Output voltage will remain within a 2-volt band when used with 120 volt unit and a 4-volt band when used with 240 volt types.

REGULATED AC CURRENT — Current can be regulated accurate within ±1% of maximum current setting with user supplied current transformer and Superior Electric transformer type T6049.

REGULATED DC VOLTAGE – Type FR500DC with a user-supplied d-c power supply will provide regulated d-c voltage.

EMT SERIES

NOMINAL OUTPUT VOLTAGE	OUTPUT VOLTAGE (ADJUSTABLE)	INPUT VOLTAGE RANGE‡‡	MAXIMUM OUTPUT AMPERES	RATED OUTPUT KVA	CORRECTION RATE AT 60 HERTZ (SECONDS/VOLT)	TYPE
50/60 HERTZ, SINGLE PHASE OPERATION						
115	110-120	95-135	20	2.3	0.075	EMT4102B†
			57	6.6	0.075	EMT4106C§
		90-115	52	6.0	0.12	EMT10228
		105-125	114	13.0	0.15	EMT4112B§*
		95-135	144	16.6	0.125	EMT4115B
120◀	110-120	108-137	35	4.2	0.10	EMT4104B††
230‡	220-240	195-255	36	8.3	0.083	EMT4207B
			93	21.4	0.083	EMT4220
		205-250	130	29.9	0.111	EMT4228C
240‡◀	220-240	228-256	35	8.4	0.10	EMT4104B††
460	440-480	400-520	20	9.2	0.041	EMT4407B
			45	20.7	0.041	EMT4418B
50/60 HERTZ, THREE PHASE OPERATION						
230‡	220-240	195-255	33	13.1	0.083	EMT6210YB
			48	19.1	0.083	EMT6215YB
			63	25.1	0.083	EMT6220YB
			145	57.8	0.25	EMT6245YB
			188	74.9	0.25	EMT6270DB
460	440-480	400-520	18	14.3	0.041	EMT6412YB
			24	19.1	0.041	EMT6417YB
			35	27.9	0.041	EMT6425YB
			75	59.8	0.125	EMT6450YB
			100	75.0	0.125	EMT6475YB
		420-500	148	118	0.188	EMT64100YB

EMS SERIES

60 HERTZ, SINGLE PHASE, 2-WIRE						
115	110-120	103.5-126.5	833	100	0.65	EMS41100
230‡	220-240	218.5-241.5	435	100	0.22	EMS42100‡
50/60 HERTZ, SINGLE PHASE, 3-WIRE, INDIVIDUAL LINE CONTROL						
240/120	230-250/115-125	204-276/102-138	104	25.0	.03/.06	EMSI4225
			250	60.0	.03/.06	EMSI4260
	220-240/110-120	228-252/114-126	417	100	.10/.21	EMSI42100††
50/60 HERTZ, THREE PHASE, SINGLE CONTROL						
230‡	220-240	203-257	339	135	0.28	EMS62135Y‡
460	440-480	445-495	230	180	0.30	EMS64180Y
			347	275	0.30	EMS64275Y
50/60 CYCLE, THREE PHASE, INDIVIDUAL LINE CONTROL						
208/120	191-217/115-125	177-239/102-138	250	90.0	.08/.14	EMSI6290Y
		165-233/95-135	525	190	.37/.22	EMSI62190Y††

EMK SERIES

50/60 CYCLE, SINGLE PHASE						
115	110-120	95-135	23	2.6	0.02	EMK4105†
		105-125	46	5.3	0.04	

IES SERIES

50 OR 60 CYCLE ±10%, SINGLE PHASE						
115	110-120	95-135**	4.4	0.5	—	IES91005
			8.7	1.0	—	IES9101
			26.1	3.0	—	IES9103
			52.2	6.0	—	IES9106
			130	15.0	—	IES9115
230	220-240	195-255**	13	3.0	—	IES9203
			26.1	6.0	—	IES9206
			65	15.0	—	IES9215

MILITARIZED TYPES

45-66 HERTZ, SINGLE PHASE						
120	115-125	105-135	66.6	8.0	0.10	EM4108MCR
380-420 HERTZ, SINGLE PHASE						
115	115	103.5-126.5	6	0.69	0.13▲	EMTH41007MH

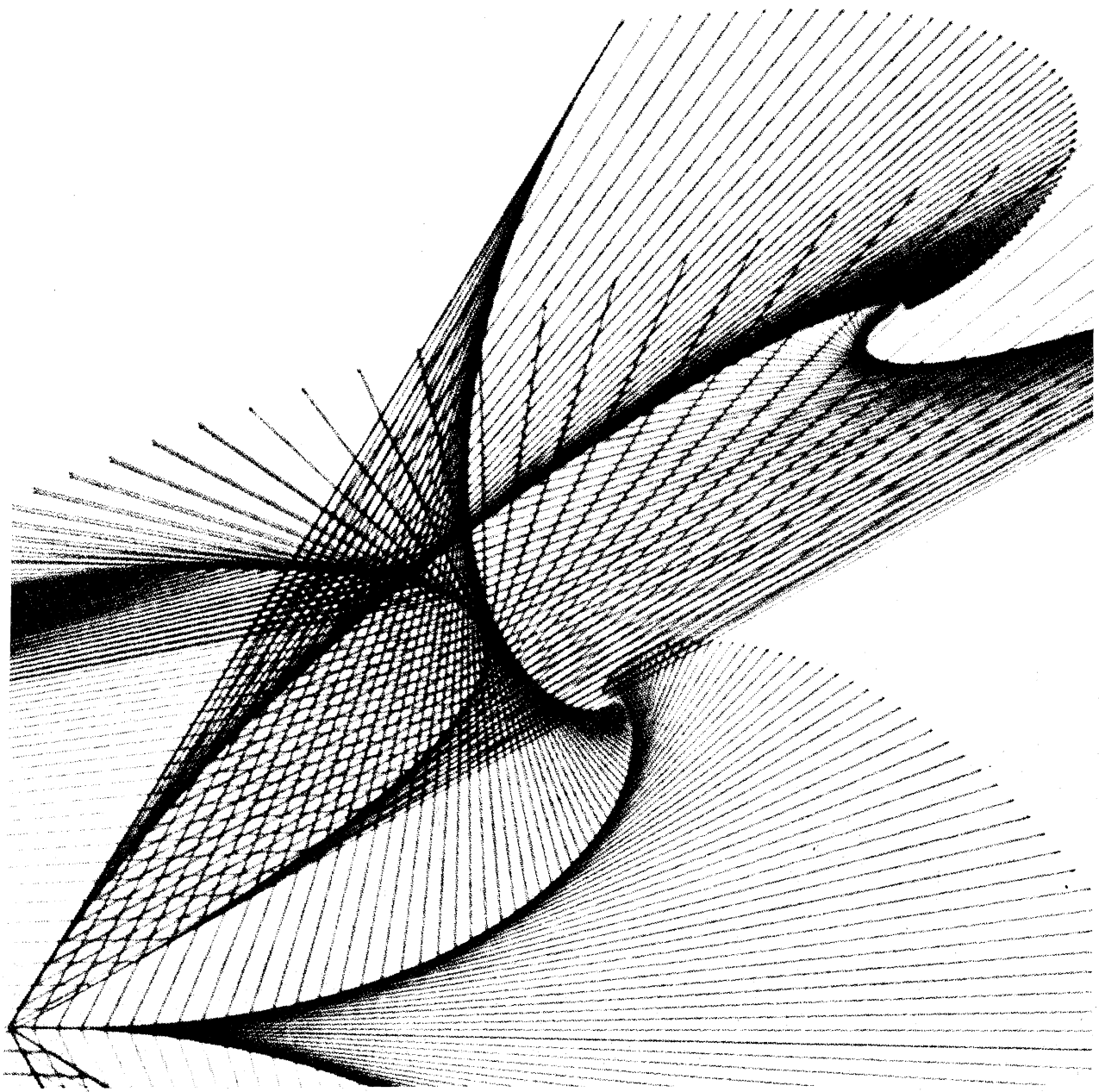
▲At 400 Hertz.
†Also available as rack model (suffix R when ordering).
◀For 60 Hertz operation only.
*Can also be operated on an input range of 95 to 135 volts with a rating of 57 amperes, 6.6 kva and a correction rate of 0.075 seconds per volt.
§Also available as rack (suffix R when ordering) or wall mounted (suffix W when ordering) models.
‡Unit can be converted for 208 volt operation by simple tap changes. Input and output voltage ranges change proportionally.
**At nominal output. Shifts with output voltage setting but not proportionally.
††Also available in open construction (suffix U) and with screened and enclosed (suffix UT) construction.
‡‡At nominal output. Shifts proportionally with output voltage setting.

THE SUPERIOR ELECTRIC COMPANY
1000 MIDDLE STREET, BRISTOL, CONNECTICUT 06010

SEE OTHER SUPERIOR ELECTRIC PRODUCT PAGES IN SECTIONS 2100, 3500 AND 5600

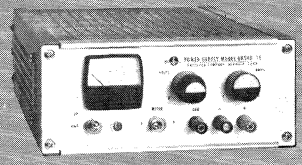
Sorensen Power Supplies

Short Form Catalog



DC power supplies

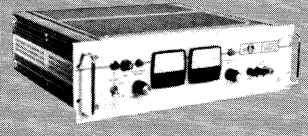
QRS Series
Full Range, Transistorized



QRD Series
With high speed programming[3]



QRC Series
High Efficiency, Transistorized



QHS Series
High Stability[5]
0.1% + 1mV accuracy

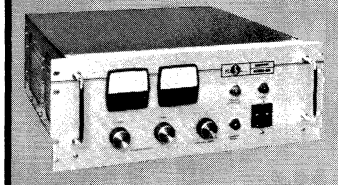


MODEL	Output Voltage (VDC)	Output Current (amps.) max. 40°C	55°C	71°C	Volt. Regulation line & load (comb.)	Voltage Ripple (PARD)*	Curr. Regulation line & load (comb.)	Current Ripple (PARD)* rms	peak to peak	Drift (8 hrs.)	Temperature Coeff.	Transient Response Time	Optional Overvolt. Protect.	% Efficiency (Typ.)	Input Voltage (VAC)	Input Current (amps) @ 115 VAC	Input Freq. (Hz.)	Input Phase	Cabinet[1] Size (in.) Width	Height	Depth	Net Wt. (lbs.) Shpg.	Price
QRS15-2	0-15	2.2	2.0	1.2	±0.01% or ± 1 mV	400μV rms (10 Hz to 7 MHz) 6 mV peak to peak (10 Hz to 25 MHz)	± (.02% + 200 μA)	300μA	3 MA	0.04%	0.015% + 300 μV/°C	50μs	VP1	35	105-125/200-240/210-250	0.95	47 to 440	1φ	8 3/16	31 5/32	12 3/4	12 1/2	27	$145
QRS20-4	0-20	4.4	4.0	2.4			± (.02% + 350 μA)	600μA	3 MA				VP1	42		2.3			8 3/16	5 7/32	13	19 1/2	35	$255
QRS30-1	0-30	1.1	1.0	0.6			± (.02% + 200 μA)	300μA	3 MA				VP1	35		0.95			8 3/16	31 5/32	12 3/4	12 1/2	27	$145
QRS40-.75	0-40	0.825	0.750	0.450			± (.02% + 200 μA)	300μA	3 MA				VP1	35		0.95			8 3/16	31 5/32	12 3/4	12 1/2	27	$145
QRS40-2	0-40	2.2	2.0	1.2			± (.02% + 350 μA)	600μA	3 MA				VP1	42		2.3			8 3/16	5 7/32	13	19 1/2	35	$255
QRS60-.5	0-60	0.55	0.50	0.30			± (.02% + 200 μA)	300μA	3 MA				VP3	35		0.95			8 3/16	31 5/32	12 3/4	12 1/2	27	$155
QRS60-1.5	0-60	1.65	1.50	0.90			± (.02% + 350 μA)	600μA	3 MA				VP3	46		2.3			8 3/16	5 7/32	13	19 1/2	35	$265
QRD15-2	0-15	2.2	2.0	1.2	±0.005% or ± 1 mV	200μV rms (10 Hz to 7 MHz) 3 mV peak to peak (10 Hz to 25 MHz)	± (.01% + 125 μA)	150μA	2 MA	0.025%	0.015% + 200 μV/°C	50μs	VP1	35	105-125/200-240/210-250	0.95	47 to 440	1φ	8 3/16	31 5/32	12 3/4	12 1/2	27	$178
QRD20-4	0-20	4.4	4.0	2.4			± (.01% + 250 μA)	400μA	2 MA				VP1	42		2.3			8 3/16	5 7/32	13	19 1/2	35	$278
QRD30-1	0-30	1.1	1.0	0.6			± (.01% + 125 μA)	150μA	2 MA				VP1	35		0.95			8 3/16	31 5/32	12 3/4	12 1/2	27	$178
QRD40-.75	0-40	0.825	0.750	0.450			± (.01% + 125 μA)	150μA	2 MA				VP1	35		0.95			8 3/16	31 5/32	12 3/4	12 1/2	27	$178
QRD40-2	0-40	2.2	2.0	1.2			± (.01% + 250 μA)	300μA	2 MA				VP1	42		2.3			8 3/16	5 7/32	13	19 1/2	35	$278
QRD60-.5	0-60	0.55	0.50	0.30			± (.01% + 125 μA)	150μA	2 MA				VP3	35		0.95			8 3/16	31 5/32	12 3/4	12 1/2	27	$185
QRD60-1.5	0-60	1.65	1.50	0.90			± (.01% + 250 μA)	300μA	2 MA				VP3	46		2.3			8 3/16	5 7/32	13	19 1/2	35	$285
QRC20-8A	0-20	8.0	6.4	4.0	±0.005% or ± 1 mV	1 mV rms	± 0.05% or ± 4 MA	2MA		0.025% of Eo Max.	0.01% + 500 μV/°C	25μs	VP4	47	105-125/200-240/210-250	4.5	47 to 440		19	3 1/2	17 3/4	36 1/2	60	$425
QRC20-15A	0-20	15.0	12.0	7.5			± 0.05% or ± 8 MA	4MA				25μs	VP4	49		6.8			19	5 1/4	18 1/2	54	75	$525
QRC20-30A	0-20	30.0	24.0	15.0			± 0.05% or ± 16 MA	8MA				50μs	VP6	52		12.6	47-63		19	7	18 1/2	75	95	$695
QRC40-4A	0-40	4.0	3.2	2.0			± 0.075% or ± 3 MA	1MA				25μs	VP4	56		3.5	47 to 440	1φ	8 1/8	5	16 1/8	26	45	$350
QRC40-8A	0-40	8.0	6.4	4.0			± 0.05% or ± 4 MA	2MA				25μs	VP4	58		7.0			19	3 1/2	17 3/4	45	65	$470
QRC40-15A	0-40	15.0	12.0	7.5			± 0.05% or ± 8 MA	4MA				25μs	VP6	61		11.2			19	5 1/4	18 1/2	67	90	$650
QRC40-30A	0-40	30.0	24.0	15.0			± 0.05% or ± 16 MA	8MA				50μs	VP6	64		20.8	47-63		19	7	18 1/2	92	115	$775
QHS20-1.0	0-20	1 Amp (0°C to 50°C)			1ppm + 30μV — line 5ppm + 50μV — load	100μV p-p				See Note 5	(10ppm + 10μV/°C	50μs	VP1	31	105-125/200-240/210-250	.7	47 to 440	1φ	8 3/16	31 5/32	12 3/4	11 1/4	25	$345
QHS40-.5	0-40	.5 Amp (0°C to 50°C)										50μs	VP1	31		.7			8 3/16	31 5/32	12 3/4	11 1/4	25	$345
QHS100-.2	0-100	.2 Amp (0°C to 50°C)										50μs	VP3	31		.7			8 3/16	31 5/32	12 3/4	11 1/4	25	$345

*PARD—"The 'Periodic and Random Deviation' of the output DC voltage, current or power from its average value, with all external operational and environmental parameters maintained constant."

See YELLOW SECTION for Local Offices, Phones

DCR Series
Full Range, Silicon Controlled Rectifiers (meets MIL-I-26600 and MIL-I-6181D)



Notes:

1. Furnished in self-contained cabinet; also fits standard 19″ rack without alterations or additions. Single or dual rack panels for half rack size units are available at $15.00 each panel. Applies to QRC & DCR only. Single and dual 19″ adapters permit rack mounting a single QRD, or two units side by side. $15. (also QRS)
   SINGLE MOUNTING for 3½″ high units RP12
   SINGLE MOUNTING for 5¼″ high units RP13
   DUAL MOUNT FOR 3½″ high units RP14
   DUAL MOUNT for 5¼″ high units RP15
2. Ripple and transient specifications apply at 60Hz and will vary by a factor of $(60/f)^2$ where "f" is the input frequency.
3. QRD Series also operates in High Speed Mode. Programming Time: 25 μs from zero to Emax; 10 μs from Emax to zero (measured at the 10% and 90% points).
4. Optional auxiliary chassis permits operation from 342-418, 390-440 or 414-506 Vac input..
5. Drift — for 8 hours
   QHS 20-1 — 10 ppm + 100μV
   QHS 40-.5 — 10 ppm + 100μV
   QHS 100-.2 — 10 ppm + 100μV
   Drift — for 1 week
   QHS 20-1 — 25 ppm + 200μV
   QHS 40-.5 — 25 ppm + 200μV
   QHS 100-.2 — 25 ppm + 200μV

MODEL	Output Voltage (VDC)	Output Current (amps) max. 30°C	55°C	71°C	Volt. Regulation line & load (comb.)	Voltage Ripple (rms) PARD*	Curr. Regulation line & load (comb.)	Current Ripple (PARD)* rms.	Drift (8 hrs.)	Temp. C °f. (mV/°C)	Transient Response Time	Optional Overvolt. Protect.	% Efficiency (Typ.)	Input Voltage (VAC)	Input Current (amps)	Input Frequency[2] (Hz.)	Input Phase	Cabinet[1] Size (in.) Width	Height	Depth	Weight (lbs.) Net	Shpg.	Price
DCR20-125A	0-20	144	125	82.5	±0.075% or ±8mV	.4%E_o +20mV	±125mA	0.5% Io	.05%	3	30ms	VP 9	62	187-229 207-253	29	47-63	1ϕ	19	10½	20	169	200	$1150
DCR20-250A	0-20	275	250	165	±0.10% or ±8mV	.8%E_o +60mV or 160mV	±500mA	0.8% Io	.10%	8	40ms	VP 18	66	187-229 207-253 [4]	37	47-63	3ϕ	19	17½	22	312	342	$1500
DCR20-1000A	0-20	1100	1000	660	±0.10% or ±8mV	.8% E_o +60mV or 160mV	±2000mA	0.8% Io	.10%	8	40ms	—	74	Note 6	60	Note 6	3ϕ	25	42½	23	805	835	$4200
DCR40-10A	0-40	11.5	10	6.6	±0.075% or ±15mV	.4%E_o +40mV	±20mA	0.5% Io	.05%	6	30ms	VP 10	60	105-125	8	47-63	1ϕ	19	5¼	15	55	65	$360
DCR40-20A	0-40	23	20	13	±0.075% or ±15mV	.4%E_o +40mV	±25mA	0.5% Io	.05%	6	30ms	VP 10	60	105-125	16	47-63	1ϕ	19	5¼	18	77	90	$500
DCR40-35A	0-40	40	35	25	±0.075% or ±15mV	.4%E_o +40mV	±35mA	0.5% Io	.05%	6	30ms	VP 11	67	105-125	27	47-63	1ϕ	19	7	18	102	120	$750
DCR40-60A	0-40	69	60	39.6	±0.075% or ±15mV	.4%E_o +40mV	±60mA	0.5% Io	.05%	6	30ms	VP 11	66	187-229 207-253	25	47-63	1ϕ	19	7	20	131	150	$925
DCR40-125A	0-40	138	125	82.5	±0.10% or ±15mV	.4%E_o +60mV or 160mV	±250mA	0.45% Io	.10%	16	40ms	VP 19	72	187-229 207-253 [4]	35	47-63	3ϕ	19	17½	22	318	348	$1375
DCR40-250A	0-40	275	250	165	±0.10% or ±15mV	.4%E_o +60mV or 160mV	±500mA	0.45% Io	.10%	16	40ms	VP 19	75	Note 6	60 27	Note 6	3ϕ	19	22¾	24	485	515	$2340
DCR40-500A	0-40	550	500	330	±0.10% or ±15mV	.4%E_o +60mV	±1000mA	0.45% Io	.10%	16	40ms	—	79	Note 6	60	Note 6	3ϕ	25	42½	23	805	835	$3850
DCR60-13A	0-60	15	13	8.6	±0.075% or ±15mV	.4%E_o +60mV	±20mA	0.5% Io	.05%	9	30ms	VP 12	64	105-125	16	47-63	1ϕ	19	5¼	18	77	90	$500
DCR60-25A	0-60	28.8	25	16.5	±0.075% or ±15mV	.4%E_o +60mV	±25mA	0.5% Io	.05%	9	30ms	VP 13	69	105-125	30	47-63	1ϕ	19	7	18	100	120	$875
DCR60-40A	0-60	45	40	26.4	±0.075% or ±15mV	.4%E_o +60mV	±40mA	0.5% Io	.05%	9	30ms	VP 13	68	187-229 207-253	23	47-63	1ϕ	19	7	20	130	150	$1090
DCR80-5A	0-80	5.75	5	3.3	±0.075% or ±20mV	.4%E_o +80mV	±15mA	0.5% Io	.05%	12	30ms	VP 12	64	105-125	8	47-63	1ϕ	19	5¼	15	55	65	$380
DCR80-10A	0-80	11.5	10	6.6	±0.075% or ±20mV	.4%E_o +80mV	±20mA	0.5% Io	.05%	12	30ms	VP 12	64	105-125	16	47-63	1ϕ	19	5¼	18	77	90	$600
DCR80-18A	0-80	20.7	18	11.9	±0.075% or ±20mV	.4%E_o +80mV	±25mA	0.5% Io	.05%	12	30ms	VP 13	71	105-125	28	47-63	1ϕ	19	7	18	98	120	$850
DCR80-30A	0-80	34.5	30	19.8	±0.075% or ±20mV	.4%E_o +80mV	±30mA	0.5% Io	.05%	12	30ms	VP 13	69	187-229 207-253	23	47-63	1ϕ	19	7	20	121	140	$900
DCR150-2.5A	0-150	2.88	2.5	1.65	±0.075% or ±30mV	.4%E_o +150mV	±15mA	0.5% Io	.05%	23	30ms	VP 14	68	105-125	8	47-63	1ϕ	19	5¼	15	55	65	$360
DCR150-5A	0-150	5.75	5	3.3	±0.075% or ±30mV	.4%E_o +150mV	±15mA	0.5% Io	.05%	23	30ms	VP 14	66	105-125	16	47-63	1ϕ	19	5¼	18	77	90	$600
DCR150-10A	0-150	11.5	10	6.6	±0.075% or ±30mV	.4%E_o +150mV	±20mA	0.5% Io	.05%	23	30ms	VP 15	72	105-125	28	47-63	1ϕ	19	7	18	95	120	$850
DCR150-15A	0-150	17.3	15	9.9	±0.075% or ±30mV	.4%E_o +150mV	±25mA	0.5% Io	.05%	23	30ms	VP 15	72	187-229 207-253	22	47-63	1ϕ	19	7	18	115	135	$900
DCR150-35A	0-150	38.5	35	23	±0.10% or ±30mV	.4%E_o +200mV or 500mV	±70mA	0.4% Io	.10%	60	40ms	VP 20	77	187-229 207-253 [4]	35	47-63	3ϕ	19	17½	22	312	342	$1500
DCR150-70A	0-150	77	70	47	±0.10% or ±30mV	.4%E_o +200mV or 500mV	±140mA	0.4% Io	.10%	60	40ms	VP 20	81	Note 6	60 27	Note 6	3ϕ	19	22¾	24	480	510	$2495

*PARD—"The 'Periodic and Random Deviation' of the output DC voltage, current or power from its average value, with all external operational and environmental parameters maintained constant."

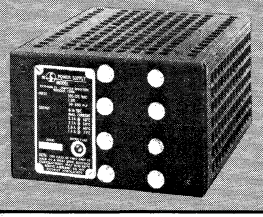
DCR Series (Cont.)
Full Range, Silicon Controlled Rectifiers

Notes:

6. DCR40-250A, DCR150-70A, DCR300-35A and DCR600-18A input voltages: 187-229Vac, 207-253Vac, or 414-506 Vac, at 57-63Hz (0-100% Eo max)
   390-440Vac at 47-63Hz (0-100% Eo max)
   342-418Vac at 47-63Hz (0-90% Eo max)
   DCR20-1000A and DCR40-500A input voltages:
   342-418Vac at 47-63Hz (0-75% Eo max)
   390-440Vac at 47-63Hz (0-92% Eo max)
   414-506Vac at 57-63Hz (0-100% Eo max)

MODEL	Output Voltage (VDC)	Output Current (amps) max. 30°C	55°C	71°C	Volt. Regulation line & load (comb.)	Voltage Ripple (rms) PARD*	Curr. Regulation line & load (comb.)	Current Ripple (PARD)* rms.	Drift (8 hrs.)	Temp. Coeff. (mV/°C)	Transient Response Time	Optional Overvolt. Protect.	% Efficiency (Typ.)	Input Voltage (VAC)	Input Current (amps)	Input Frequency[2] (Hz.)	Input Phase	Cabinet[1] Size (in.) Width	Height	Depth	Weight (lbs.) Net	Shpg.	Price
DCR300-1.25A	0-300	1.44	1.25	.83	±0.075% or ±60mV	.4%E_o +300mV	±15mA	0.5% Io	.05%	45	30ms	VP 16	64	105-125	8	47-63	1φ	19	5¼	15	55	65	$400
DCR300-2.5A	0-300	2.88	2.5	1.65	±0.075% or ±60mV	.4%E_o +300mV	±15mA	0.5% Io	.05%	45	30ms	VP 16	68	105-125	14	47-63	1φ	19	5¼	18	77	90	$600
DCR300-5A	0-300	5.75	5	3.3	±0.075% or ±60mV	.4%E_o +300mV	±15mA	0.5% Io	.05%	45	30ms	VP 17	73	105-125	25	47-63	1φ	19	7	18	95	120	$850
DCR300-8A	0-300	9.2	8	5.3	±0.075% or ±60mV	.4%E_o +300mV	±20mA	0.5% Io	.05%	45	30ms	VP 17	73	187-229 207-253	22	47-63	1φ	19	7	18	115	135	$925
DCR300-18A	0-300	19.8	18	12	±0.10% or ±60mV	.4%E_o +400mV or 1V	±36mA	0.4% Io	.10%	120	40ms	VP 21	78	187-229 207-253 [4]	35	47-63	3φ	19	17¼	22	318	348	$1500
DCR300-35A	0-300	38.5	35	23	±0.10% or ±60mV	.4%E_o +400mV or 1V	±70mA	0.4% Io	.10%	120	40ms	VP 21	82	Note 6	60 27	Note 6	3φ	19	22¾	24	485	515	$2495
DCR600-2.5A	6-600	2.87	2.5	1.65	±0.075% or ±120mV	.4%E_o +600mV	±7mA	0.5% Io	.05%	90	30ms	Std	72	105-125	25	47-63	1φ	19	10½	18	126	150	$875
DCR600-18A	0-600	19.8	18	12	±0.10% or ±120mV	.4%E_o +800mV or 2V	±36mA	0.4% Io	.10%	240	40ms	VP 22	81	Note 6	60 27	Note 6	3φ	19	22¾	24	485	515	$2495
DCR1500-1A	15-1500	1.15	1.0	.66	±0.075% or ±300mV	.4%E_o +1.5V	±4.5mA	0.5% Io	.05%	225	30ms	Std	71	105-125	25	47-63	1φ	19	12¼	18	150	175	$995
DCR3000-.5A	30-3000	.575	.5	.33	±0.075% or ±600mV	.4%E_o +3V	±3.8mA	0.5% Io	.05%	450	30ms	Std	70	105-125	27	47-63	1φ	19	12¼	18	166	190	$1250
DCR6000-.25A	60-6000	.287	.25	.165	±0.075% or ±1.2V	.4%E_o +6V	±3.4mA	0.5% Io	.05%	900	30ms	Std	68	105-125	27	47-63	1φ	19	14	20	170	195	$1495

QSA Series
Modular, Wide Range



MODEL	Output Voltage (VDC)	Output Current (amps) max. 40°	55°	71°	Volt. Regulation line & load (comb.)	Voltage Ripple (PARD)*	RFI Specification	Drift (8 hrs.)	Temperature Coeff.	Transient Response Time	Optional Overvolt. Protect.	% Efficiency (Typ.)	Input Voltage (VAC)	Input Current (amps) @ 115 Vac.	Input Freq. (Hz)	Input Phase	Cabinet Size (in.) Width	Height	Depth	Weight (lbs.) Net	Shpg.	Price
QSA5-6.4	3-7	7.0	5.9	3.1	±.01%	300 microvolts rms (3 millivolts peak to peak)	Meets MIL-I-26600, MIL-I-6181D, MIL-I-16910C	0.025% (after 30 minute warmup)	.015%/°C	20μs	VP4	30	105-125/200-240/210-250	1.6	47 to 440	1φ	5⅛	3 5/16	10	10	13	$149
QSA5-14.6	3-6.5	17.6	14.5	6.0	±.01%				.015%/°C	35μs	VP4	36		3.4			7½	4 15/16	10	22	30	$209
QSA5-18.2	3-6.5	20.5	17.2	12.2	±.01%				.015%/°C	35μs	VP4	36		4.6			7½	4 15/16	12⅝	29	40	$249
QSA10-1.4	0-10	1.5	1.3	0.9	±.005% or ±.2 mV				.01%/°C or .5mV/°C	20μs	VP1	29		.6			3⅜	3 5/16	7	5	8	$89
QSA10-2.2	0-10	2.4	2.15	1.9	±.005% or ±.2 mV				.01%/°C or .5mV/°C	20μs	VP1	35		.8			5⅛	3 5/16	7	8	11	$109
QSA10-3.7	0-10	4.0	3.4	2.5	±.005% or ±.2 mV				.01%/°C or .5mV/°C	20μs	VP1	39		1.4			5⅛	3 5/16	10	10	13	$129

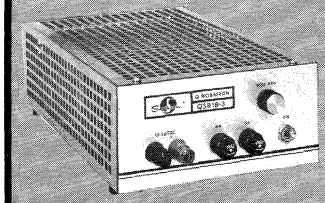
**PARD*—"The 'Periodic and Random Deviation' of the output DC voltage, current or power from its average value, with all external operational and environmental parameters maintained constant."

QSA Series (Cont.)
Modular, Wide Range
(Optional rack mounting adaptors and meters available. Consult factory.)

MODEL	Output Voltage (VDC)	Output Current (amps) max. 40°	55°	71°	Volt. Regulation line & load (comb.)	Voltage Ripple (PARD)*	RFI Specification	Drift (8 hrs.)	Temperature Coeff.	Transient Response Time	Optional Overvolt. Protect.	% Efficiency (Typ.)	Input Voltage (VAC)	Input Current (amps) @ 115 Vac.	Input Freq. (Hz)	Input Phase	Cabinet Size (in.) Width	Height	Depth	Weight (lbs.) Net	Shpg.	Price
QSA12-1.3	8-14	1.4	1.2	0.9	±.005%	300 microvolts rms (3 millivolts peak to peak)	Meets MIL-I-26600, MIL-I-6181D, MIL-I-16910C	0.025% (after 30 minute warmup)	.01%/°C	20μs	VP1	30	105-125/200-240/210-250	.6	47 to 440	1φ	3⅞	3 5/16	7	5	8	$89
QSA12-2.1	8-14	2.3	1.95	1.4	±.005%				.01%/°C	20μs	VP1	32		1.0			5⅛	3 5/16	7	8	11	$109
QSA12-3.8	8-14	4.2	3.5	2.5	±.005%				.01%/°C	20μs	VP1	34		1.6			5⅛	3 5/16	10	10	13	$129
QSA12-9.3	8-14	11.0	9.25	5.3	±.005%				.015%/°C	35μs	VP4	43		3.8			7½	4 15/16	10	22	30	$199
QSA12-13	8-14	15.4	13.0	8.7	±.005%				.015%/°C	35μs	VP4	49		5.2			7½	4 15/16	12⅝	29	40	$249
QSA18-1.1	14-22	1.2	1.0	0.7	±.005%				.01%/°C	20μs	VP1	31		.8			3⅞	3 5/16	7	5	8	$89
QSA18-1.9	14-22	2.1	1.75	1.3	±.005%				.01%/°C	20μs	VP1	33		1.3			5⅛	3 5/16	7	8	11	$109
QSA18-3.0	14-22	3.3	2.75	2.0	±.005%				.01%/°C	20μs	VP1	38		1.8			5⅛	3 5/16	10	10	13	$129
QSA18-6.8	14-22	7.9	6.65	3.3	±.005%				.015%/°C	35μs	VP4	40		4.0			7½	4 15/16	10	22	30	$199
QSA18-10.1	14-22	14.0	10.1	5.8	±.005%				.015%/°C	35μs	VP4	46		5.6			7½	4 15/16	12⅝	29	40	$249
QSA28-.7	22-35	0.77	0.65	0.5	±.005%	300 microvolts rms (3 millivolts peak to peak)	Meets MIL-I-26600, MIL-I-6181D, MIL-I-16910C	0.025% (after 30 minute warmup)	.01%/°C	20μs	VP1	33	105-125/200-240/210-250	.7	47 to 440	1φ	3⅞	3 5/16	7	5	8	$89
QSA28-1.3	22-35	1.4	1.2	0.9	±.005%				.01%/°C	20μs	VP1	34		1.3			5⅛	3 5/16	7	8	11	$109
QSA28-2.0	22-35	2.2	1.85	1.3	±.005%				.01%/°C	20μs	VP1	38		1.8			5⅛	3 5/16	10	10	13	$129
QSA28-6.0	22-30	6.8	5.75	3.4	±.005%				.015%/°C	35μs	VP4	54		4.4			7½	4 15/16	10	22	30	$209
QSA28-8.8	22-30	10.2	8.6	5.0	±.005%				.015%/°C	35μs	VP4	55		6.0			7½	4 15/16	12⅝	29	40	$249
QSA48-.4	35-60	0.44	0.37	0.27	±.005%				.015%/°C	20μs	VP3	38		.7			3⅞	3 5/16	7	5	8	$89
QSA48-.8	35-60	0.88	0.74	0.53	±.005%				.015%/°C	20μs	VP3	44		1.3			5⅛	3 5/16	7	8	11	$119
QSA48-1.2	35-60	1.3	1.1	0.8	±.005%				.015%/°C	20μs	VP3	45		1.8			5⅛	3 5/16	10	10	13	$129
QSA75-.5	60-90	0.55	0.46	0.33	±.005%				.015%/°C	20μs	VP3	51		1.2			5⅛	3 5/16	7	8	11	$119
QSA75-.8	60-90	0.88	0.74	0.53	±.005%				.015%/°C	20μs	VP3	53		1.7			5⅛	3 5/16	10	10	13	$139
QSA120-.5	90-150	0.55	0.46	0.33	±.01%				.015%/°C	20μs	VP8	50		1.8			5⅛	3 5/16	10	10	13	$149
QSA175-.25	150-200	0.28	0.23	0.17	±.01%				.015%/°C	20μs	Consult Factory	54		1.2			5⅛	3 5/16	10	10	13	$160
QSA265-.15	200-330	0.17	0.14	0.1	±.01%				.015%/°C	20μs		48		1.3			5⅛	3 5/16	10	10	13	$175

*PARD—"The 'Periodic and Random Deviation' of the output DC voltage, current or power from its average value, with all external operational and environmental parameters maintained constant."

QSB/QRE Series
Medium Range, Transistorized



MODEL	Output Voltage (VDC)	Output Current (amps) max. 40°	55°	71°	Volt. Regulation line & load (comb.)	Voltage Ripple (PARD)* rms	P-P	Curr. Regulation line & load (comb.)	Current Ripple rms (PARD)*	Drift (8 hrs.)	Temperature Coeff.	Transient Response Time	Optional Overvolt. Protect.	% Efficiency (Typ.)	Meters	Input Voltage (Vac)	Input Current (Aac)	Input Freq. (Hz)	Input Phase	Cabinet[1] Size (in.) Width	Height	Depth	Weight (lbs.) Net	Shpg.	Price
QRE7.5-10	0-7.5	10	9.25	6.6	±.01% or ±.4mV	300μV	2mV	±.2	—		.015%/°C or .5mV/°C	50μs	Std.	37	✓	2.5 1.25	47-440			19	3½	13¼	26	41	**$345**
QRE7.5-20	0-7.5	20	18.5	13	±.01% or ±.4mV	300μV	2mV	±.2	—		.015%/°C or .5mV/°C	50μs	Std.	33	✓	5.0 2.5	47-63			19	5¼	12⅞	37	52	**$495**
QRE7.5-50	0-7.5	50	46.25	33	±.01% or ±.4mV	300μV	2mV	±.2	—		.015%/°C or .5mV/°C	50μs	Std.	40	✓	11.0 5.5	47-63			19	5¼	16⅛	63	78	**$645**
QSB6-4	5-9	4.4	4	3	±.015	250μV	1mV	±.01	100μA		.015%/°C	40μs	VP2	44	—	.75 .38	47-440			7 1/16	3½	8¾	8½	15	**$115**
QSB6-8	5-9	8.8	8	6	±.015	250μV	1mV	±.01	200μA		.015%/°C	40μs	VP2	35	—	1.6 .8	47-440			7 1/16	3½	12 1/16	13	28	**$170**
QSB6-15	5-9	16.5	15	11.2	±.015	250μV	1mV	±.01	370μA		.015%/°C	40μs	VP2	35	✓	3.0 1.5	47-440			19	3½	12½	26	42	**$300**
QSB6-30	5-9	33	30	22.5	±.015	250μV	1mV	±.01	740μA		.015%/°C	40μs	VP7	33	✓	6.0 3.0	47-63			19	5¼	12 1/16	40	55	**$400**
QSB12-2	9-18	2.2	2	1.5	±.005	250μV	1mV	±.01	50μA		.015%/°C	30μs	VP2	44	—	.75 .38	47-440			7 1/16	3½	8¾	8½	15	**$115**
QSB12-4	9-18	4.4	4	3	±.005	250μV	1mV	±.01	100μA		.015%/°C	30μs	VP2	47	—	1.6 .8	47-440			7 1/16	3½	12 1/16	13	28	**$170**
QSB12-8	9-18	8.8	8	6	±.005	250μV	1mV	±.01	200μA		.015%/°C	30μs	VP2	46	✓	3.0 1.5	47-440			19	3½	12½	26	42	**$255**
QSB12-15	9-18	16.5	15	11.2	±.005	250μV	1mV	±.01	370μA		.015%/°C	30μs	VP2	45	✓	6.0 3.0	47-63	1φ		19	5¼	12 1/16	40	55	**$325**
QSB12-30	9-18	33	30	22.4	±.015	500μV	3mV	±.01	740μA		.015%/°C	50μs	Std.	43	✓	9.5 5.0	47-63			19	5¼	15	58	76	**$550**
QSB18-1.5	13-26	1.6	1.5	1.12	±.005	250μV	1mV	±.01	38μA		.015%/°C	25μs	VP2	49	—	.75 .38	47-440			7 1/16	3½	8¾	8½	15	**$115**
QSB18-3	13-26	3.3	3	2.2	±.005	250μV	1mV	±.01	75μA		.015%/°C	25μs	VP2	51	—	1.6 .8	47-440			7 1/16	3½	12 1/16	13	28	**$170**
QSB18-6	13-26	6.6	6	4.5	±.005	250μV	1mV	±.01	150μA		.015%/°C	25μs	VP2	53	✓	3.0 1.5	47-440			19	3½	12½	26	42	**$255**
QSB18-12	13-26	13.2	12	9	±.005	250μV	1mV	±.01	300μA		.015%/°C	25μs	VP2	44	✓	6.0 3.0	47-63			19	6¼	12 1/16	40	55	**$325**
QSB28-1	18-36	1.1	1	.7	±.005	250μV	1mV	±.01	25μA		.015%/°C	25μs	VP2	48	—	.75 .38	47-440			7 1/16	3½	8¾	8½	15	**$115**
QSB28-2	18-36	2.2	2	1.5	±.005	250μV	1mV	±.01	50μA		.015%/°C	25μs	VP2	59	—	1.6 .8	47-440			7 1/16	3½	12 1/16	13	28	**$170**
QSB28-4	18-36	4.4	4	3	±.005	250μV	1mV	±.01	100μA		.015%/°C	25μs	VP2	44	✓	3.0 1.5	47-440			19	3½	12½	26	42	**$255**
QSB28-8	18-36	8.8	8	6	±.005	250μV	1mV	±.01	200μA		.015%/°C	25μs	VP2	56	✓	6.0 3.0	47-63			19	5¼	12 1/16	40	55	**$325**

0.025% (after warmup)

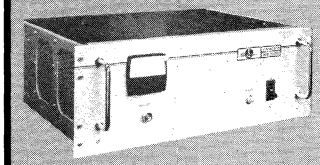
105-125/200-240/210-250

■ Temperature Range: —20°C to +71°C. ■ Series Operation: Up to 200 volts maximum. ■ Parallel Operation: QRE models . . . 4 units maximum; QSB models . . . 20 units maximum. ■ RFI: Meets MIL-1-6181D and MIL-1-16910C. ■ Overload/short circuit protection. ■ Remote sensing. ■ Overvoltage protection: Standard on QRE models and QSB12-30, optional accessory for QSB models (see chart above).

**PARD*—"The 'Periodic and Random Deviation' of the output DC voltage, current or power from its average value, with all external operational and environmental parameters maintained constant."

See YELLOW SECTION for Local Offices, Phones

AC line voltage regulators



	MODEL	Output Voltage (VAC)	Output VA 1φ	Voltage Regulation: Line	Voltage Regulation: Load	Load Power Factor (Typ.)	Distortion (max.) Introduced	Voltmeter		Transient Response Time	Temperature Range	Remote Sensing/Prog.	Overload Protection	Efficiency % (Typ.)	Input Voltage (Vac.)	Input Current (Aac)	Input Freq. (Hz)	Input Phase	Cabinet[8] Size (in.): Width	Height	Depth	Weight (lbs.): Net	Shpg.	Price
ACR Series Silicon Controlled Rectifiers (Meets MIL-I-26600 spec. for Class III equipment)	ACR500	110-120	500	±.1%	±.1%	1.0 to 0 lag.	3%	Standard		30 ms	−20°C to +50°C	✓	✓	88	95 to 130	6	45-55/54-66	1φ	15	5	9	30	40	$332
	ACR1000		1000									✓	✓	90		12			19	5¼	11	45	55	$382
	ACR2000		2000									✓	✓	92		24			19	5¼	15	65	77	$477
	ACR3000		3000									✓	✓	95		36			19	7	15	85	100	$597
	ACR5000		5000	±.15%	±.15%							✓	✓	95		60			19	7	20	145	165	$765
	ACR7500		7500									✓	✓	95		90			19	12¼	20	190	260	$875
	ACR10,000		10,000									✓	✓	95		123			19	12¼	20	190	260	$1270
	ACR15,000		15,000									✓	✓	95		181			19	17½	20	275	350	$1575
FR Series Low Distortion	FR750	110 to 120	750/ 1200	±0.5%		1.0 to .7 lag	.35%[10]	Std.		15 ms	15°C to 35°C	—	✓	85	105 to 125	16	59-61	1φ	19	12¼	15⅞	85	100	$965
"VR" Series (±0.5%) Line Regulators	VR6110	115 Vac nominal (±2% voltage setting tolerance)	15	±0.5%	±5.0% (Typ.)	1.0	20% Typ.	—		25 ms	−20°C to +40°C	—	✓	50	95 to 130	.37	59-61	1φ	2⅝	3	6¼	3	4	$25
	VR6111		30					—				—	✓	70		.41			3⅜	4 3/16	7½	4	5	$30
	VR6112		60					—				—	✓	90		.82			3⅜	4 7/16	7½	5	6½	$36
	VR6113		120					—				—	✓	90		1.65			3⅜	5 1/16	7½	8½	10½	$43
	VR6114		250					—				—	✓	90		3.45			5	5 1/16	12⅜	24	27	$76
	VR6115		500					—				—	✓	90		6.9			5	9⅛	12⅜	40	45	$100

Notes:

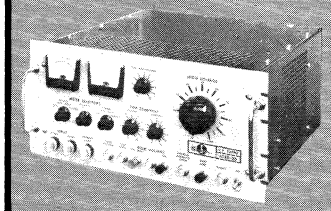
8. ACR models are furnished for standard rack mounting; however, cabinet end bells may be furnished at $40.00 optional. Exception is ACR500 furnished in self-contained cabinet or with optional $15.00 rack panel.

10. With 2% input distortion.

See YELLOW SECTION for Local Offices, Phones

High voltage DC power supplies

	MODEL	Output Voltage, KVdc	Output Current, MAdc	Output Impedance, MΩ	Voltage Regulation	Ripple Voltage, (% rms)	Output Resolution: Voltage	Output Resolution: Current	Meters	Temperature Range	Overload Protection	Indicator Lights	Input Voltage, Vac, 1 ϕ	Input Current, Aac	Input Frequency, Hz	Cabinet[13] Size/Weight (in./lbs.): Width	Cabinet[13] Size/Weight (in./lbs.): Height	Cabinet[13] Size/Weight (in./lbs.): Depth	Cabinet[13] Size/Weight (in./lbs.): Weight	High Voltage Section (if separate) (in/lbs.): Width	High Voltage Section (if separate) (in/lbs.): Height	High Voltage Section (if separate) (in/lbs.): Depth	High Voltage Section (if separate) (in/lbs.): Weight	Price
200 Series 0-30 KV, 3-12 MA	230-6P	0-30	0-6	2.0	✓	6.5	—	—	✓	0°C to 40°C	✓	Five Front Panel Indicator Lights	117 Vac. Nominal	3.5	57 to 63 Hz (For 50 Hz operation ripple may increase 20%)	9	11	15¾	50	—	—	—	—	$685
	230-3/12P	0-30 0-15 0-7.5	0-3 0-6 0-12	1.0 .47 .47	✓	3.5 6.0 18.0	— — —	— — —	✓		✓			1.75		9	11	15¾	55	—	—	—	—	$750
1000 Series 3-150 KV, 5-200 MA	1003-200	0-3	200	.002	✓[11]	2.0[12]	—	—	✓		✓			10.0		19	8¾	15⅝	80	—	—	—	—	$790
	1006-100	0-6	100	.01	✓[11]	2.0[12]	—	—	✓		✓			10.0		19	8¾	15⅝	80	—	—	—	—	$790
	1012-50	0-12	50	.05	✓[11]	2.0[12]	—	—	✓		✓			10.0		19	8¾	15⅝	80	—	—	—	—	$815
	1020-30	0-20	30	.133	✓[11]	2.0[12]	—	—	✓		✓			10.0		19	8¾	15⅝	80	—	—	—	—	$865
	1030-20	0-30	20	.30	✓[11]	2.0[12]	—	—	✓		✓			10.0		19	8¾	15⅝	80	—	—	—	—	$895
	1061	0-60	10	1.2	✓[11]	1.5[12]	—	—	✓		✓			10.0		19	8¾	15⅝	50	14	14¼	14	145	$1195
	1101	0-100	1.5	7.0	✓[11]	4.0[12]	—	—	✓		✓			3.0		19	8¾	15⅝	50	14	14¼	14	145	$1195
	1121	0-120	5	5.0	✓[11]	2.0[12]	—	—	✓		✓			10.0		19	8¾	15⅝	50	18¾	17¼	17¼	275	$1595
	1151	0-150	5	5.0	✓[11]	2.0[12]	—	—	✓		✓			12.0		19	8¾	15⅝	50	22½	27	22½	650	$1795
2000 Series 3-350 KV, 8-1000 MA	2003-1000	0-3	1000	.002	✓[14]	2.0[15]	—	—	✓		✓	Eleven Front Panel Indicator Lights		50 Aac		22	23½	18	175	22	37½	18	350	$1865
	2006-500	0-6	500	.008	✓[14]	1.5[15]	—	—	✓		✓					22	23½	18	175	22	37½	18	350	$1865
	2012-250	0-12	250	.015	✓[14]	2.0[15]	—	—	✓		✓					22	23½	18	175	22	37½	18	350	$1865
	2020-150	0-20	150	.025	✓[14]	2.5[15]	—	—	✓		✓					22	23½	18	175	22	37½	18	350	$2080
	2120-30	0-120	30	2.0	✓[14]	1.0[15]	—	—	✓		✓					22	23½	18	175	30	30	30	1000	$2800
5000 Series 1-30 KV, 0-8 MA	5010-8	1kV to 10kV	8.0	—	Line ±.05 Load ±.05	0.003	1 Vdc	—	✓		✓	"Power ON" "HV Ready"	105 to 125	2.5	60	19	9½	15¾	60	—	—	—	—	$890
	5030-4	5kV to 30kV	4.0	—	Line ±.005 Load ±.025	0.015	20 Vdc	—	✓		✓	"Power ON" "HV ON" "HV Ready"	105 to 125	2.8	60	19	21¾	19¼	105	—	—	—	—	$1085



NOTE: All prices above are U.S.A. list.

Notes:

11. Line regulation available — Option #C1 regulates DC output to ±1.5% — Option #C2 regulates the output to ±0.2% (For ±10% line change).

12. Ripple attenuator available—Option #L2 reduces the output ripple to 0.01% rms.

13. 1000 Series Controller supplied for rack mounting. 2000 Series Controller is supplied in a cabinet (removable for rack mounting). 5000 Series is furnished as standard rack mounted unit with optional $40.00 cabinet side enclosures.

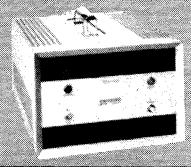
14. Line regulation available (option #C2) regulates output to ±0.2%. (For ±10% line changes).

15. Ripple attenuators available—option #L1 reduces the output ripple to 0.1% rms—option #L2 reduces the output ripple to 0.01% rms.

16. Ripple attenuator available (option #L1) reduces the output ripple to 0.1% rms.

Special purpose power supplies

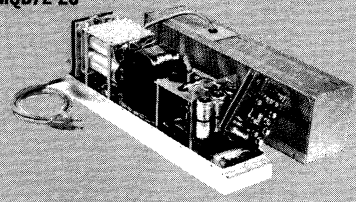
XLS Series Xenon Lamp Supplies



	XLS-150	XLS-35	XLS-450
Starting Voltage	20 kV	20 kV	30 kV
Operating Voltage	20 Vdc ±3V	12 Vdc ±2V	20 Vdc ±3V
Operating Current	7-8 Adc	3.5 Adc	22-28 Adc

Single-shot starting impulse (less than 0.5 joules) assures long lamp life. Current ripple 1.0% rms max.

AEC Nuclear Instrument Module Power Supply MQB72-2C



A precisely regulated, multiple output supply designed in accordance with AEC Specification TID-20893 Rev. 2, Type 1, Class A. This supply is approved for use in standard nuclear instrumentation systems. Features are high reliability, 60°C ambient rating and complete overload protection.

Output	#1	#2	#3	#4
Voltage	+12 Vdc	−12 Vdc	+24 Vdc	−24 Vdc
Current	2.0A*	2.0A*	1.0A*	1.0A*

*72W maximum output capability.

Custom design

Sorensen's standard product technology provides the basis for the company's custom design capability. This diversified product group ranges from component-type constant voltage transformers to large high voltage equipment. Combining engineering capability and production experience with the industry's largest and most complete plant facility enables Sorensen to make custom product recommendations without any of the prejudice often present in negotiating with a narrow-line company with limited custom experience.

To most effectively implement the custom design program, the company has organized a separate applications engineering, design engineering, and manufacturing task force to handle custom work. This group functions almost as a subsidiary of the company, guaranteeing that each custom application will receive the undiluted, uninterrupted attention of a group of specialists concerned only with the optimum solution to each specific problem. The company's engineering staff includes personnel with experience in the design and development of virtually all types of controlled power equipment.

See YELLOW SECTION for Local Offices, Phones

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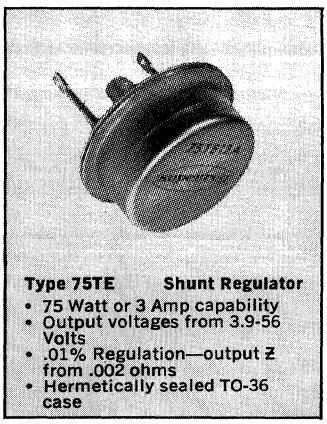
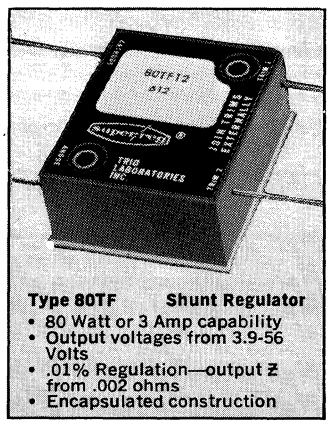
BUILD A POWER SUPPLY IN MINUTES USING ANY DC SOURCE

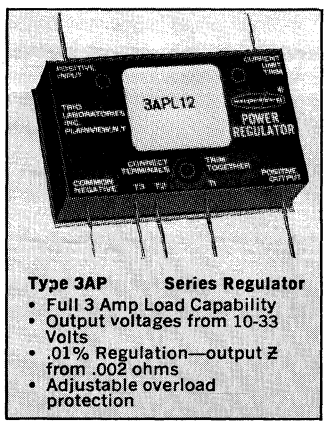
- LOW OUTPUT IMPEDANCE: .01% REGULATION
- 125°C OPERATION
- SHORT CIRCUIT PROTECTION
- TEMPERATURE COMPENSATED: .01%/°C
- ADJUSTABLE OUTPUT: ±10%
- 104 MODELS AVAILABLE



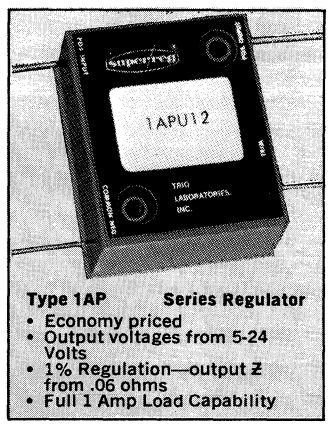
Type 75TE Shunt Regulator
- 75 Watt or 3 Amp capability
- Output voltages from 3.9-56 Volts
- .01% Regulation—output Ƶ from .002 ohms
- Hermetically sealed TO-36 case



Type 80TF Shunt Regulator
- 80 Watt or 3 Amp capability
- Output voltages from 3.9-56 Volts
- .01% Regulation—output Ƶ from .002 ohms
- Encapsulated construction



Type 3AP Series Regulator
- Full 3 Amp Load Capability
- Output voltages from 10-33 Volts
- .01% Regulation—output Ƶ from .002 ohms
- Adjustable overload protection



Type 1AP Series Regulator
- Economy priced
- Output voltages from 5-24 Volts
- 1% Regulation—output Ƶ from .06 ohms
- Full 1 Amp Load Capability

Super/reg miniature regulators, uniquely designed for maximum heat transfer and power handling capability, contain all the electronic circuits necessary for the most sophisticated system needs. Simply connect rough DC from any source – a semi-filtered, half-wave rectified transformer output or even a battery – and you have instant, **precision DC power where you need it:** at the load itself.

Available in shunt and series versions, these ultra-compact configurations provide maximum layout flexibility over a wide range of voltage levels. The point-of-load installation eliminates distribution-line losses and cross-talk. And the off-the-shelf stock levels enable you to build your own custom power supply – literally in minutes!

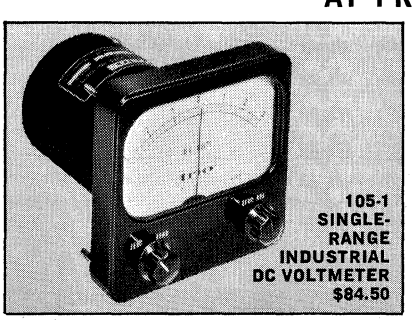
WE'RE ALSO NARROW-MINDED POWER SUPPLY DESIGNERS

We concentrate exclusively on a very narrow yet vital portion of the power supply spectrum – multi-output MIL-design supplies.

We focus on squeezing out those few percentage points more than 75% efficiency, or pushing the power density just a little bit better than 4 delivered watts per cubic inch.

When the supply you need must be smaller, more reliable, more efficient and provide that seemingly impossible combination of parameters, please call on our narrow-minded designers.

STANDARD AND CUSTOM BUILD-IN ELECTRONIC VOLTMETERS AT PRODUCTION PRICE AND DELIVERY!



105-1 SINGLE-RANGE INDUSTRIAL DC VOLTMETER $84.50



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We originated the build-in concept. Today, 17 years later, our 2300 standard variations still represent over 90% of all build-in electronic voltmeters presently in use. No matter how complex **your** needs for AC, DC or phase-sensitive voltage measurements, we'll provide a **custom** build-in voltmeter at **production** price and delivery – from our extensive inventory of solid-state circuit modules.

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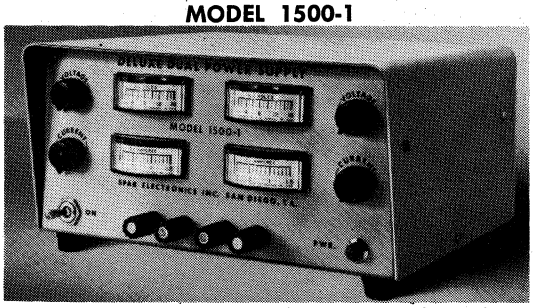
REGULATED D.C. POWER SUPPLIES HIGH PERFORMANCE/LOW COST

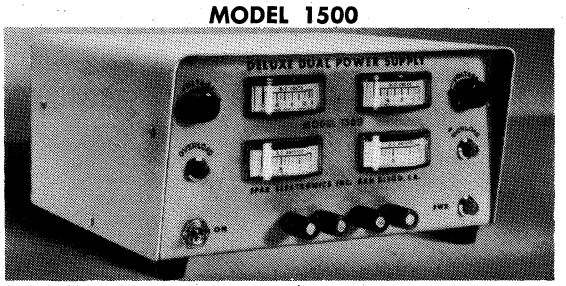
MODEL 1500-1



ADJUSTABLE VOLTAGE — 0 - 16 Volts or 0 - 32 Volts Dual
ADJUSTABLE CURRENT — 0.05 - 1.5 Amps (both sides)

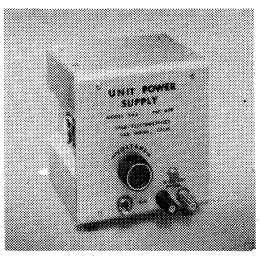
$145.00 F.O.B.

MODEL 1500

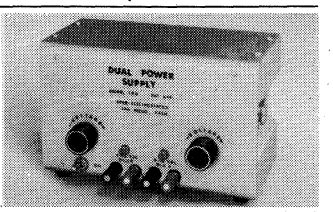


HIGH CURRENT — 1.5 Amps Dual
ADJUSTABLE VOLTAGE — .75 - 16 Volts or 1.5 - 32 Volts Dual
FLASHING OVERLOAD INDICATOR — Both Sides

$115.00 F.O.B.



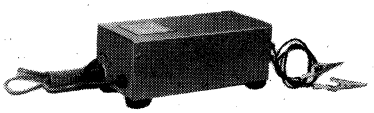
- SOLID STATE DESIGN
- LOW RIPPLE AND NOISE
- LOW WARMUP DRIFT
- LOW OUTPUT IMPEDANCE
- EXCELLENT REGULATION
- SHORT CIRCUIT AND OVERLOAD PROTECTION
- FLASHING OVERLOAD INDICATOR
- WIDE TEMPERATURE OPERATING RANGE
- **ONE YEAR WARRANTY**



MODEL 100 SINGLE

ADJUSTABLE
±16V DC at 1.0 Amp

$45.00 F.O.B.



REGULATED AT LOW COST

MODEL
117C-0-12-1.5R
ADJUSTABLE
0 to 13V DC at 1.5 Amp

$22.00 F.O.B.

MODEL 500 DUAL

ADJUSTABLE — ±16V D.C. at 0.5 Amp
ADJUSTABLE — ±16V D.C. at 0.5 Amp

$69.00 F.O.B.

TYPICAL PERFORMANCE[1] — GENERAL INFORMATION (AC to DC Power Supplies)

MODEL[6]	117C-0-12-1.5R	117C-0-24-.75R	#100	#30	#500	#1500	#1500-1	#1500-B	#1500-C	#1500-1(B)	#1500-A	#1600
PRICE[2]	$22.00	$25.00	$45.00	$55.00	$69.00	$115.00	$145.00	$180.00	$195.00	$220.00	$270.00	$270.00
D.C. OUTPUT	0 to 13V Reg. & 20V Non Reg.	0 to 24V Reg. & 40V Non Reg.	.75 to 16V	0 to 16V	.75 to 32V or .75 to 16V Dual	.75 to 32V or .75 to 16V Dual	0 to 32V or 0 to 16V Dual	.75 to 60V or .75 to 30V Dual	.75 to 32V or .75 to 16V Dual	0 to 60V or 0 to 30V Dual	.75 to 60V or .75 to 30V Dual	0 to 32V or 0 to 16V Dual
CURRENT-OUTPUT	1.5A	0.75A	1.0A	0.3A	0.5A	1.5A	1.5A	1.5A	5.0A	1.5A	5.0A	1.5A
POWER INPUT	105-125VAC 50-400 Hz	105-125VAC 50-400 Hz	105-125VAC 50-400 Hz	105-125VAC 50-400 Hz	105-125VAC 50-400 Hz	105-125VAC 210-250VAC 50-400 Hz	105-125VAC 210-250VAC 50-400 Hz	105-125VAC 210-250VAC 50-60 Hz	105-125VAC 210-250VAC 50-60 Hz	105-125VAC 210-250VAC 50-60 Hz	105-125VAC 210-250VAC 50-60 Hz	105-125VAC 210-250VAC 50-400 Hz
RIPPLE-OUTPUT[3]	30 MV at 1.0A	25MV at .75A	.2MV at .5A	.5MV at .25A	.2MV at .5A	.2MV at .5A	.1MV at 1.5A	.2MV at .5A	1.0MV at 5A	.15MV at 1.5A	.2MV at 5A	.2MV at 1.5A
REGULATION-NL/FL	0.5V at 1.0A	0.7V at .75A	20MV at 1.0A	10MV at .25A	20MV at .5A	25MV at 1.5A	10MV at 1.5A	25MV at 1.5A	35MV at 5A	20MV at 1.5A	35MV at 5A	.001% or 1MV
REGULATION-LINE[4]	±.20V	±.15V	10MV	5MV	10MV	15MV	8MV	10MV	10MV	10MV	10MV	.001% or 1MV
CONSTANT-CURRENT	No	No	No	Yes	No	No	Yes	No	No	Yes	No	.2% or 5MA
CURRENT-ADJUST	No	No	Internal 1.1A	8¾ Turn Pot .05 - .3A	Internal 0.6A	Internal 1.6A	8¾ Turn Pot .05 - 1.5A	Internal 1.5A	Internal 6.0A	8¾ Turn Pot 1.5A	Internal 6.0A	10 Turn Pot 1.5A
IMPEDANCE-OUTPUT	—	—	0.06Ω/100Hz	3Ω/10MHz	0.06Ω/100Hz	0.06Ω/100Hz	0.04Ω/100Hz	0.06Ω/100Hz	0.06Ω/100Hz	0.04Ω/100Hz	0.06Ω/100Hz	0.005Ω/100Hz
RECOVERY TIME	—	—	≦25μSec.	≦25μSec.	≦25μSec.	≦25μSec.	≦25μSec.	≦25μSec.	≦50μSec.	≦25μSec.	≦50μSec.	≦25μSec.
TEMP. OPERATING	0-120°F	0-120°F	0-120°F 2MV/°F	0-120°F .01%/°C	0-120°F 2MV/°F	0-120°F 2MV/°F	0-120°F 0.5MV/°F	0-120°F 2MV/°F	0-120°F 2MV/°F	0-120°F 0.5MV/°F	0-120°F 2MV/°F	0-120°F 0.5MV/°F
THERMAL PROTECTION	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SHORT PROTECTION	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
REMOTE SENSING	No	No	No	No	No	No	Yes	No	No	Yes	No	Yes
VOLTAGE ADJUST	1 Turn	1 Turn	1 Turn	10 Turn	1 Turn	10 Turn	10 Turn	10 Turn	10 Turn	10 Turn	10 Turn	10 Turn
OVERLOAD INDICATOR	No	No	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	No
METERS	No	No	No	VOLT	No	2-Volt 2-Amp	2-Volt 2-Amp	2-Volt 2-Amp	2-Volt 2-Amp	2-Volt 2-Amp	2-Volt 2-Amp	2-Volt 2-Amp
SIZE (WxHxD)	2¾" x 2½" x 6"	2¾" x 2½" x 6"	4¾" x 5½" x 4"	3¾" x 4½" x 5¼"	8½" x 5½" x 4"	8¾" x 4½" x 8½"	8¾" x 4½" x 8½"	8¾" x 4½" x 9½"	8¾" x 4½" x 9½"	8¾" x 4½" x 9½"	8¾" x 4½" x 9½"	8¾" x 4½" x 9½"
WEIGHT	1¾ Lbs.	1¾ Lbs.	2½ Lbs.	2⅛ Lbs.	4 Lbs.	7 Lbs.	7 Lbs.	7¼ Lbs.	12¼ Lbs.	7½ Lbs.	15¼ Lbs.	7 Lbs.
OPTIONS	Fixed or Adjustable	Fixed or Adjustable	Rack Mount	—	Rack Mtg. Fan	Rack Mtg. XXX Shield	Rack Mtg. XXX Shield	Rack Mtg. XXX Shield	Rack Mtg. XXX Shield	Rack Mtg. XXX Shield	Rack Mtg. XXX Shield	Rack Mtg. XXX Shield[5]

NOTES: [1] Typical Performance x 2 = Specification Limit for Regulation, Ripple & Output Impedance. [2] FOB Factory, San Diego, Calif. [3] RMS [4] 105/125VAC [5] Triple Shielded Power Transformer [6] Special Models Available on Request

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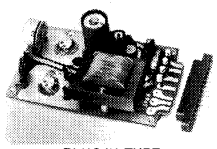
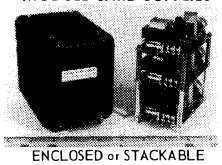
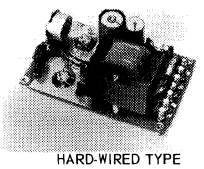
REGULATED D. C. POWER SUPPLIES HIGH PERFORMANCE/LOW COST

MODULE CARD SUPPLIES


PLUG IN TYPE

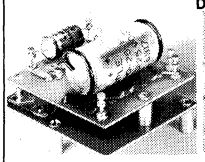
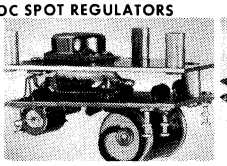
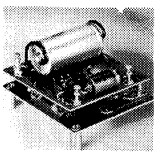

ENCLOSED or STACKABLE


HARD-WIRED TYPE

TYPICAL PERFORMANCE – GENERAL INFORMATION (MODULAR AC TO DC POWER SUPPLIES)

	Mod. #0820	Mod. #1615	Mod. #2512	Mod. #3010	Mod. #0840	Mod. #1630	Mod. #2525	Mod. #3020
Price * (1-9)	$33.00	$33.00	$35.50	$35.00	$38.50	$38.50	$41.00	$41.00
Price * (10-99)	27.50	27.50	30.00	30.00	33.00	33.00	35.50	35.50
Price * (100 Up)	22.00	22.00	25.00	25.00	27.50	27.50	30.00	30.00
D.C. Output	0-8V	7.5-16V	15.5-25V	24-30V	0-8V	7.5-16V	15.5-25V	24-30V
Current Output	200 MA	150 MA	120 MA	100 MA	400 MA	300 MA	250 MA	200 MA
Power Input at 50 to 420 HZ	105-125 VAC	105-125 VAC	105-125 VAC	105-125 VAC	105-125 VAC	105-125 VAC	105-125 VAC	105-125 VAC
Ripple Output	0.2 MV RMS	0.3 MV RMS	0.3 MV RMS	0.3 MV RMS	0.5 MV RMS	0.5 MV RMS	0.4 MV RMS	0.3 MV RMS
Regulation NL/FL	9.0 MV DC	8.0 MV DC	8.0 MV DC	7.0 MV DC	12.0 MV DC	11.0 MV DC	10.0 MV DC	8.0 MV DC
Regulation ± 10V Line Change	4.0 MV DC	5.0 MV DC	6.0 MV DC	6.0 MV DC	4.0 MV DC	5.0 MV DC	6.0 MV DC	6.0 MV DC
Current Adjust	50-200 MA	50-150 MA	50-120 MA	50-100 MA	50-400 MA	50-300 MA	50-250 MA	50-200 MA
Short circuit and Thermally Protected	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant Current Source	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Remote Sensing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Temp. Range	–20 to +70°C	–20 to +70°C	–20 to +70°C	–20 to +70°C	–20 to +70°C	–20 to +70°C	–20 to +70°C	–20 to +70°C
Impedance* Output	3 Ω at 10 MHZ	3 Ω at 10 MHZ	3 Ω at 10 MHZ	3 Ω at 10 MHZ	3 Ω at 10 MHZ	3 Ω at 10 MHZ	3 Ω at 10 MHZ	3 Ω at 10 MHZ
Size (W x H x D)	2.5"x1.8"x4"	2.5"x1.8"x4"	2.5"x1.8"x4"	2.5"x1.8"x4"	2.5"x2"x4"	2.5"x2"x4"	2.5"x2"x4"	2.5"x2"x4"
Weight	0.5 lb.	0.5 lb.	0.5 lb.	0.5 lb.	0.75 lb.	0.75 lb.	0.75 lb.	0.75 lb.
Plug In Type	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hard-wire type	A0820	A1615	A2512	A3010	A0840	A1630	A2525	A3020
Stackable Type	Add -2 & -3	Add -2 & -3	Add -2 & -3	Add -2 & -3	Add -2 & -4	Add -2 & -4	Add -2 & -4	Add -2 & -4

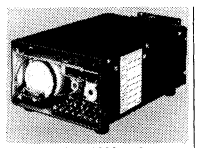
DC SPOT REGULATORS

Model	SR 5-1	SR6-1	SR12-1	SR15-1	SR20-1	SR24-1	SR28-1
Price 1/4	$14.70	$14.70	$14.70	$14.70	$14.70	$14.70	$14.70
Price 100 Up	$ 8.80	$ 8.80	$ 8.80	$ 8.80	$ 8.80	$ 8.80	$ 8.80
DC Output	5V/1.0A	6V/1.0A	12V/1.0A	15V/1.0A	20V/1.0A	24V/1.0A	28V/1.0A
DC Input	9.5/16V	10.5/17V	17/22V	20/25V	25/30V	29/34V	33/39V
AC Input (RMS)	10/17V	11/18V	18/23V	21/26V	26/31V	30/35V	34/40V
Ripple Output	35MV(RMS)	35MV(RMS)	35MV(RMS)	40MV(RMS)	50MV(RMS)	65MV(RMS)	90MV(RMS)
Reg. NL/FL	±.25V	±.25V	±.25V	±.25V	±.25V	±.25V	±.25V
Reg. US Input	±.1V	±.1V	±.1V	±.1V	±.1V	±.1V	±.1V
Z Output (1KHZ)	2Ω	2Ω	2Ω	1Ω	1Ω	1Ω	1Ω
Temp. Operating	-20/+70°C	-20/+70°C	-20/+70°C	-20/+70°C	-20/+70°C	-20/+70°C	-20/+70°C

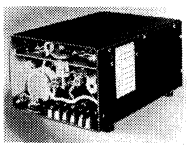
Model	SRA5-1	SRA6-1	SRA12-1	SRA15-1	SRA20-1	SRA24-1	SRA28-1
Price 1/4	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00
Price 100 Up	$18.00	$18.00	$18.00	$18.00	$18.00	$18.00	$18.00
DC Output	5V/1.0A	6V/1.0A	12V/1.0A	15V/1.0A	20V/1.0A	24V/1.0A	28V/1.0A
DC Input	9.5/16V	10.5/17V	17/22V	20/25V	25/30V	29/34V	33/39V
AC Input (RMS)	10/17V	11/18V	18/23V	21/26V	26/31V	30/35V	34/40V
Ripple Output	500μV(RMS)	500μV(RMS)	500μV(RMS)	500μV(RMS)	500μV(RMS)	500μV(RMS)	500μV(RMS)
Reg. NL/FL	.001V	.001V	.01%	.01%	.01%	.01%	.01%
Reg. VS Input	.001V	.001V	.01%	.01%	.01%	.01%	.01%
Z Output	.05Ω	.05Ω	.05Ω	.05Ω	.05Ω	.05Ω	.05Ω
Temp. Stability	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°
Temp. Operating	-20/+70°C	-20/+70°C	-20/+70°C	-20/+70°C	-20/+70°C	-20/+70°C	-20/+70°C

HI-PAK POWER SUPPLIES



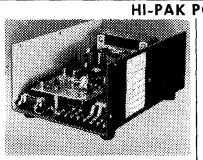
HM-51000-B-C

Price	$163.00 (1/4),$97.80 (100up)
DC Output	3 to 6 Volt at 10 Amp.
Ripple-Out	500μV(RMS)
AC Input	105/125 Vac-50/60 HZ
Reg. NL/FL	.025V
Reg. VS Line	.005V
Size (WXHXL)	5-7/8 x 3-3/4 x 9-3/4
Features	Over Voltage/Fan/71°C



HM-53000-B-C

Price	$212.00 (1/4),$127.20 (100 Up)
DC Output	3 to 6 Volt at 30 Amp.
Ripple-Out	2 MV(RMS)
AC Input	105/125 Vac-50/60 HZ
Reg. NL/FL	.06V
Reg. VS Line	.005V
Size (WXHXL)	6-7/8 x 4-7/8 x 10-3/4
Features	Over Voltage/Fan/71°C



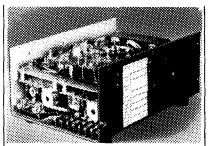
H-12400

Price	$68.00 (1/4),$40.00 (100up)
DC Output	12±1VDC at 4 Amp
Ripple-Out	30 MV(RMS)
AC Input	105/125 or 210/250 VAC-50/1000 HZ
Reg. NL/FL	±2%
Reg. VS Line	±1%
Size (WXHXL)	5-7/8 x 3-3/4 x 8"
Features	Short/Thermal Protection



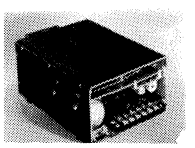
H-12700

Price	$98.00 (1/4), $60.00 (100up)
DC Output	12±1 VDC at 7 Amp
Ripple-Out	5 MV(RMS)
AC Input	105/125 or 210/250 Vac 50/1000 HZ
Reg. NL/FL	±2.5%
Reg. VS Line	±1%
Size (WXHXL)	6-7/8 x 4-7/8 x 9
Features	Short/Thermal Protection



HMD-15150

Price	$127.00(1/4),$76.20(100up)
DC Output	8 to 16 VDC (Dual) at 1.5 Amp
Ripple-Out	500 μV (RMS)
AC Input	105/125 or 210/250 VAC 50/1000 HZ
Reg. NL/FL	±0.05%
Reg. VS Line	±0.05%
Size (WXHXL)	5-7/8 x 3-3/4 x 8
Features	Dual Outputs/Temp. 01%/C°

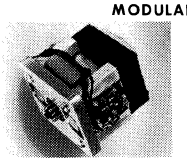


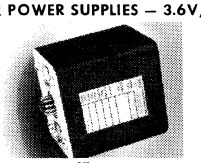
HM-24700-C

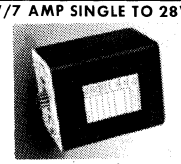
Price	$170.00 (1/4), $102.00 (100up)
DC Output	20 to 25 VDC at 7 Amp
Ripple-Out	500 μV (RMS)
AC Input	105/125 VAC-50/60 HZ
Reg. NL/FL	±0.05%
Reg. VS Line	±0.03%
Size (WXHXL)	6-7/8 x 4-7/8 x 10-3/4
Features	Fan/71°C

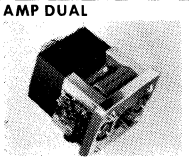
MODULAR POWER SUPPLIES – 3.6V/7 AMP SINGLE TO 28V/1 AMP DUAL

- LOWEST COST
- SMALL SIZE
- HIGH POWER
- .01% REGULATION
- THERMAL STABILITY
- REMOTE SENSING
- UP TO FOUR OUTPUTS


T27D-3.6-2


T27-5-4


T27D-15-2.5


T27-24-4

- SEALED
- RUGGED
- RACK MTG.
- REPAIRABLE
- 11 PIN PLUG
- SHORT PROTECTED
- THERMAL PROTECTION

SINGLE OUTPUT - MEDIUM POWER TYPES - TYPICAL PERFORMANCE

Model (1)	T27-3.6-4	T27-5-4	T27-6-4	T27-10-3	T27-12-3	T27-15-3	T27-20-2.4	T27-24-2.6	T27-28-2
Price 1/4 (2)	$98.50	$98.50	$98.50	$98.50	$98.50	$98.50	$98.50	$98.50	$98.50
Price 100 up	$59.10	$59.10	$59.10	$59.10	$59.10	$59.10	$59.10	$59.10	$59.10
DC Output (V) (3)	3.6±.2V	5±.2V	6±.3V	10±.4V	12±.4V	15±.5V	20±.5V	24±.5V	28±.5V
DC Output (A) (4)	4 Amp	4 Amp	4 Amp	3 Amp	3 Amp	3 Amp	2.4 Amp	2.6 Amp	2 Amp
AC Input at 50/1000 Hz	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac
Ripple Output	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)
Reg. NL/FL	.001V	.001V	.001V	.01%	.01%	.01%	.01%	.01%	.01%
Reg. US Input	.001V	.001V	.001V	.01%	.01%	.01%	.01%	.01%	.01%
Recovery Time	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec
Temp. Coeff.	0.4MV/C°	0.4MV/C°	0.4MC/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°
Temp.Max.Base	71°C	71°C	71°C	71°C	71°C	71°C	71°C	71°C	71°C
Z - Output (5)	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω
Size (WXHXD)	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8
Weight	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.

SINGLE OUTPUT – HIGH POWER TYPES - TYPICAL PERFORMANCE

T27-3.6-7	T27-5-7	T27-6-7	T27-10-5	T27-12-5	T27-15-5	T27-20-4	T27-24-4	T27-28-3
$105.50	$105.50	$105.50	$105.50	$105.50	$105.50	$105.50	$105.50	$105.50
$ 63.30	$ 63.30	$ 63.30	$ 63.30	$ 63.30	$ 63.30	$ 63.30	$ 63.30	$ 63.30
3.6±.2v	5±.2v	6±.3v	10±.4v	12±.4v	15±.5v	20±.5v	24±.5v	28±.5v
7 Amp	7 Amp	7 Amp	5 Amp	5 Amp	5 Amp	4 Amp	4 Amp	3 Amp
105/125 or 210/250 vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac
1.0mv(Rms)	1.0 mv(Rms)	1.0 mv(Rms)	500 μv (Rms)	500 μv (Rms)	500 μv (Rms)	500 μv (Rms)	500 μv (Rms)	500 μv (Rms)
.002V	.002V	.002V	.01%	.01%	.01%	.01%	.01%	.01%
.002V	.002V	.002V	.01%	.01%	.01%	.01%	.01%	.01%
≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec
0.4MV/C°	0.4MV/C°	0.4MV/C°	0.4MV/C°	0.4MV/C°	0.4MV/C°	0.4MV/C°	0.4MV/C°	0.4MV/C°
71°C	71°C	71°C	71°C	71°C	71°C	71°C	71°C	71°C
0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω
4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8
7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.

DUAL OUTPUT - MEDIUM POWER TYPES - TYPICAL PERFORMANCE

Model (1)	T27D-3.6-2	T27D-5-2	T27-6-2	T27D-10-1.5	T27D-12-1.5	T27D-15-1.5	T27D-20-1.2	T27D-24-1.3	T27D-28-1
Price 1/4 (2)	$120.00	$120.00	$120.00	$120.00	$120.00	$120.00	$120.00	$120.00	$120.00
Price 100 up	$ 72.00	$ 72.00	$ 72.00	$ 72.00	$ 72.00	$ 72.00	$ 72.00	$ 72.00	$ 72.00
DC Output (V) (3)	3.6±.2v(x2)	5±.2v(x2)	6±.3v(x2)	10±.4v(x2)	12±.4v(x2)	15±.5(x2)	20±.5v(x2)	24±.5v(x2)	28±.5v(x2)
DC Output (A) (4)	2 Amp. ea.	2 Amp. ea.	2 Amp. ea.	1.5 Amp. ea.	1.5 Amp. ea.	1.5 Amp. ea.	1.2 Amp. ea.	1.3 Amp. ea.	1.0 Amp. ea.
AC Input at 50/1000 Hz	105/125 or 210/250 vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac
Ripple Output	500μv(Rms)	500μv(Rms)	500 μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)	500μv(Rms)
Reg. NL/FL	.001V	.001V	.001V	.01%	.01%	.01%	.01%	.01%	.01%
Reg.: VS Input	.001V	.001V	.001V	.01%	.01%	.01%	.01%	.01%	.01%
Recovery Time	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec
Temp. Coeff.	0.4MV/C°	0.4MV/C°	0.4MV/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°
Temp. Max. Base	71°C	71°C	71°C	71°C	71°C	71°C	71°C	71°C	71°C
Z - Output	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω
Size (WXHXD)	4¼x5½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x4½x3-5/8	4¼x3½x3-5/8	4¼x3½x3-5/8	4¼x3½x3-5/8
Weight	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.	5½ lbs.

DUAL OUTPUT – HIGH POWER TYPES – TYPICAL PERFORMANCE

T27D-3.6-3.5	T27D-5-3.5	T27D-6-3.5	T27D-10-2.5	T27D-12-2.5	T27D-15-2.5	T27D-20-2	T27D-24-2	T27D-28-1.5
$128.00	$128.00	$128.00	$128.00	$128.00	$128.00	$128.00	$128.00	$128.00
$ 76.80	$ 76.80	$ 76.80	$ 76.80	$ 76.80	$ 76.80	$ 76.80	$ 76.80	$ 76.80
3.6±.2v(x2)	5±.2v(x2)	6±.3v(x2)	10±.4v(x2)	12±.4v(x2)	15±.5v(x2)	20±.5v(x2)	24±.5v(x2)	28±.5v(x2)
3.5 Amp. ea.	3.5 Amp. ea.	3.5 Amp.ea.	2.5 Amp.ea.	2.5 Amp.ea.	2.5 Amp.ea.	2 Amp.ea.	2 Amp.ea.	1.5 Amp.ea.
105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac	105/125 or 210/250vac
500 μv(Rms)	500 μv(Rms)	500 μv(Rms)	500 μv(Rms)	500 μv(Rms)	500 μv(Rms)	500 μv(Rms)	500 μv(Rms)	500 μv(Rms)
.001V	.001V	.001V	.01%	.01%	.01%	.01%	.01%	.01%
.001V	.001V	.001V	.01%	.01%	.01%	.01%	.01%	.01%
≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec	≤25μsec
0.4MV/C°	0.4MV/C°	0.4MV/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°	.01%/C°
71°C	71°C	71°C	71°C	71°C	71°C	71°C	71°C	71°C
0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω	0.05Ω
4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8	4¼x5½x3-5/8
7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.	7¾ lbs.

(1) Other models available etc.; 3 or 4 outputs, over-voltage. (2) Discounts at various levels. (3) Other voltages and adjustable models available. (4) Approx. 20% increase–output current–cover off. (5) 100 Hz

Here they are . . . the advanced-design

Power Supply Modules

Technipower is the industry's most nearly *complete* source for the widest range of modular power supplies.

Prove it yourself. (1) Define your specific needs (2) Consult the table to your right. See how many model series in the Technipower line there are which satisfy your needs in general terms. (3) If you have our catalog 691, consult it on the indicated page, and you'll probably find the precise item you want. (If you *don't* have our catalog, call Jack Pumroy, our sales manager, at 203-438-0333, and he'll give you prompt satisfaction.)

If you're not already familiar with Technipower's leading position within the industry, the following description is definitive:

Technipower

Today, the name "Technipower" and "modular power supply" are synonymous. This is no accident. Nearly a decade ago, a group of seasoned power supply people formed Technipower to provide the equipment designer with an economical alternate — the "Power Module" — to the use of costly custom-built or laboratory power supplies. Offering a wide variety of models and packaging, combined with fast delivery, "Power Module" became an industry word.

In this catalog you will find an expression of the Technipower objective: to provide the largest single-source variety of power supplies for OEM use — literally thousands of models to meet just about any application.

Throughout the years, Technipower has stood not only for that objective, but also for the latest in technical advancement. Many advancements in the power supply art have been contributed by Technipower. A few of the more significant are:

First silicon semiconductor catalog product line;

First cataloged power supplies designed to operate above 100°C;

First manufacturer to offer all-silicon semiconductors, exclusively;

First transistorized AC-DC power supply switching regulator;

First commercially offered, AC-DC power supply employing transformation and rectification at high frequency.

Technipower is not resting on its achievements. Backed by the financial and managerial strength of BENRUS, Technipower is moving rapidly and in this catalog presents three important forward steps:

Overvoltage Protection Modules (a technically accurate description) featuring protection not only against transients but also against power supply failure, the major cause of damage to IC's;

DESCRIPTION	TYPE GENERALLY DESCRIBED	MODEL SERIES
OVER 400 MODELS — UNREGULATED.	MODULAR AC-DC SUPPLIES	NP-80
LOWEST COST, SMALLEST SIZE. REPLACES PC-80 SERIES.		NEW PL-80
REPLACES M-65 SERIES. SIZE FOR SIZE, 25% MORE CURRENT.		MC-65
WIDEST VARIETY LINE OF CLOSELY REGULATED MODULES.		P-80
DUAL OUTPUT MODULES.		DP & TDP-80
DESIGNED AND QUALIFIED FOR EXTREME MILITARY APPLICATIONS — GROUND SUPPORT AND AIRBORNE.		PM-95
		F & FD-115
POWER MODULE OF THE FUTURE — LOW COST, SMALLEST SIZE WATT.		NEW HF-80 & HFC-80
50A & 100A "IC" POWER MODULES.		HFT-80
HIGH CURRENT MODULES FOR "BRUTE FORCE" APPLICATIONS.		SCR-80
PROGRAMMABLE POWER MODULES.		RA-80
MINIATURE POINT-OF-LOAD REGULATORS.	MODULAR DC-DC SUPPLIES	CM-95
DC CONVERTER OF THE FUTURE — HIGH EFFICIENCY AT LOW COST.		NEW CD-95 & CDC-95
SINE WAVE, LOW DISTORTION TYPE.	MODULAR INVERTERS	AC & ACD-80
GENERAL PURPOSE SUPPLY FOR TEST APPLICATIONS AND LAB.	LAB AC-DC SUPPLIES	LA-80
ACCESSORY MODULES FOR OVER-VOLTAGE PROTECTION.	OVERVOLTAGE PROTECTORS	NEW OV

The smallest commercially offered Series Regulator power module — the PL-80 Series, featuring new low pricing and offering the latest in silicon transistor power modules;

Major price breakthroughs on the PM-95 military power supplies, the NP-80 unregulated power supplies, etc.

Available from Technipower

And now . . . most popular models available from stock!

TYPE OF REGULATION	ADJUSTMENT RANGE PERCENT RATED OUTPUT	MAXIMUM OUTPUT			BASE TEMP. RATING °C	PAGE IN TECHNIPOWER CATALOG
		VOLTS	AMPS	WATTS		
UNREGULATED	FIXED	1000	25	1000	80	26
CLOSELY REGULATED	20	152	6	75	80	2
		152	30	750	65	6
		325	25	800	80	10
		±150	0.5	10	80	14
		325	25	800	95	18
		325	25	800	115	22
REGULATED	50	1000	50	360	80	34
		10	100	1000	80	32
		160	50	2000	80	30
	100	160	25	1000	80	36
CLOSELY REGULATED	10	24	1.5	35	95	38
REGULATED	50	1000	30	270	95	40
	10	120	4.5	500VA	80	42
	100	160	25	1000	80	54
						44

Additional information contained in our catalog:

Optional Features Pg. 48
Thermal Radiators Pg. 56
Rack Mounts Pg. 52
Mil Qualification Pg. 16
Thermal Data Pg. 58
General Pg. 43

TECHNIPOWER
POWER SUPPLIES

Technipower, Inc. Benrus Center, Ridgefield, Connecticut 06877 A BENRUS SUBSIDIARY

TODD LABORATORY POWER SUPPLIES

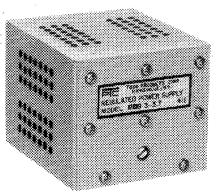
FEATURES

- .01% Regulation
- .5 mV rms ripple
- All silicon—no heat sink required
- 71 degree C operating temperature
- Short circuit and overload protection
- Electronic current foldback with automatic recovery
- Over Voltage protection option
- Designed to meet MIL environmental specifications
- Repairable
- No turn-on or turn-off spikes or overshoot

SINGLE OUTPUT—SLOT RANGE

MMS SERIES

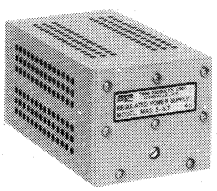
M = Module
M = Miniature 3 7/64 x 3 21/32 x 4 1/2
S = Slot Range
(±10%)



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price
MMS-3-1.1	3	1.1	1.0	0.8	69.
MMS-4-1	4	1.0	0.9	0.7	69.
MMS-5-.88	5	.88	.80	.72	69.
MMS-6-.82	6	.82	.75	.60	69.
MMS-7-.75	7	.75	.68	.54	69.
MMS-8-.69	8	.69	.63	.50	69.
MMS-10-.59	10	.59	.54	.43	69.
MMS-12-.53	12	.53	.48	.38	69.
MMS-14-.46	14	.46	.42	.33	69.
MMS-16-.42	16	.42	.38	.30	69.
MMS-20-.35	20	.35	.32	.25	69.
MMS-24-.32	24	.32	.29	.23	69.
MMS-28-.26	28	.26	.24	.19	69.
MMS-36-.21	36	.21	.19	.15	69.
MMS-48-.16	48	.16	.15	.12	69.
MMS-100-.08	100	.08	.07	.06	89.
MMS-120-.06	120	.06	.06	.05	89.
MMS-150-.05	150	.05	.05	.04	89.

MAS SERIES

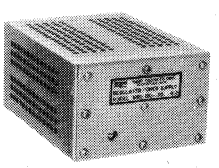
M = Module
A = 3 7/64 x 3 21/32 x 6 1/4
S = Slot Range
(±10%)



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price
MAS-3-3.7	3	3.7	3.4	1.8	99.
MAS-4-3.6	4	3.6	3.3	1.8	99.
MAS-5-3.5	5	3.5	3.2	1.8	99.
MAS-6-3.4	6	3.4	3.1	1.8	99.
MAS-7-3.1	7	3.1	2.8	1.8	99.
MAS-8-2.8	8	2.8	2.6	1.8	99.
MAS-10-2.4	10	2.4	2.2	1.7	99.
MAS-12-2.2	12	2.2	2.0	1.6	99.
MAS-14-2.0	14	2.0	1.8	1.4	99.
MAS-16-1.8	16	1.8	1.7	1.3	99.
MAS-20-1.4	20	1.4	1.3	1.0	99.
MAS-24-1.2	24	1.2	1.1	.88	99.
MAS-28-1.1	28	1.1	1.0	.80	99.
MAS-36-.88	36	.88	.80	.64	99.
MAS-48-.70	48	.70	.63	.50	99.
MAS-100-.34	100	.34	.31	.25	119.
MAS-120-.28	120	.28	.26	.21	119.
MAS-150-.23	150	.23	.21	.17	119.

MBS SERIES

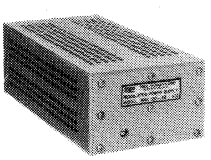
M = Module
B = 3 7/64 x 4 27/32 x 6 1/4
S = Slot Range
(±10%)



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price
MBS-3-5.0	3	5.0	4.5	2.9	115.
MBS-4-5.0	4	5.0	4.5	2.9	115.
MBS-5-5.0	5	5.0	4.5	2.9	115.
MBS-6-5.0	6	5.0	4.5	2.9	115.
MBS-7-4.6	7	4.6	4.2	2.9	115.
MBS-8-4.2	8	4.2	3.8	2.9	115.
MBS-10-3.8	10	3.8	3.5	2.8	115.
MBS-12-3.2	12	3.2	2.9	2.3	115.
MBS-14-2.8	14	2.8	2.6	2.1	115.
MBS-16-2.6	16	2.6	2.4	1.9	115.
MBS-20-2.1	20	2.1	1.9	1.5	115.
MBS-24-1.8	24	1.8	1.6	1.3	115.
MBS-28-1.5	28	1.5	1.4	1.1	115.
MBS-36-1.2	36	1.2	1.1	.88	135.
MBS-48-1.0	48	1.0	.91	.73	135.
MBS-100-.50	100	.50	.46	.37	135.
MBS-120-.42	120	.42	.38	.30	135.
MBS-150-.34	150	.34	.31	.25	135.

MCS SERIES

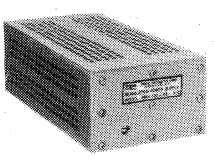
M = Module
C = 3 7/64 x 4 27/32 x 8 3/4
S = Slot Range
(±10%)



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price
MCS-3-7.5	3	7.5	6.5	4.3	135.
MCS-4-7.5	4	7.5	6.5	4.3	135.
MCS-5-7.5	5	7.5	6.5	4.3	135.
MCS-6-7.5	6	7.5	6.5	4.3	135.
MCS-7-7.0	7	7.0	6.4	4.3	135.
MCS-8-6.6	8	6.6	6.0	4.3	135.
MCS-10-5.9	10	5.9	5.4	4.3	135.
MCS-12-5.3	12	5.3	4.8	3.8	135.
MCS-14-4.8	14	4.8	4.4	3.5	135.
MCS-16-4.5	16	4.5	4.1	3.3	135.
MCS-20-3.7	20	3.7	3.4	2.6	135.
MCS-24-3.4	24	3.4	3.1	2.5	135.
MCS-28-3.0	28	3.0	2.7	2.2	135.
MCS-36-2.4	36	2.4	2.2	1.7	155.
MCS-48-2.0	48	2.0	1.8	1.3	155.
MCS-100-1.0	100	1.0	.94	.75	155.
MCS-120-.87	120	.87	.79	.63	155.
MCS-150-.70	150	.70	.64	.51	155.

MDS SERIES

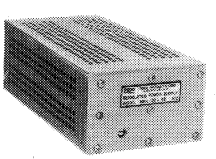
M = Module
D = 4 25/32 x 7 1/2 x 9 3/8
S = Slot Range
(±10%)



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price
MDS-3-13.1	3	13.1	11.8	10.0	205.
MDS-4-13.1	4	13.1	11.8	10.0	205.
MDS-5-12.6	5	12.6	11.3	9.6	205.
MDS-6-12.4	6	12.4	11.1	9.4	205.
MDS-7-12.2	7	12.2	10.9	9.3	205.
MDS-8-12.2	8	12.2	10.9	9.3	205.
MDS-10-10.8	10	10.8	9.7	8.2	205.
MDS-12-10.0	12	10.0	9.0	7.6	205.
MDS-14-9.0	14	9.0	8.1	6.9	215.
MDS-16-8.0	16	8.0	7.2	6.0	215.
MDS-20-7.4	20	7.4	6.6	5.7	215.
MDS-24-6.7	24	6.7	6.0	5.1	215.
MDS-28-6.0	28	6.0	5.4	4.6	215.
MDS-36-5.4	36	5.4	4.8	4.1	235.
MDS-48-4.1	48	4.1	3.7	3.1	235.
MDS-100-1.7	100	1.7	1.5	1.3	235.
MDS-120-1.5	120	1.5	1.3	1.1	235.
MDS-150-1.1	150	1.1	1.0	.85	235.

MES SERIES

M = Module
E = 4 25/32 x 7 1/2 x 11 9/16
S = Slot Range
(±10%)



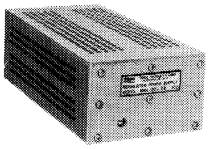
Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price
MES-3-22	3	22.0	19.7	16.8	265.
MES-4-21	4	21.0	18.9	16.1	265.
MES-5-20	5	20.0	18.0	15.3	265.
MES-6-19	6	19.0	17.1	14.5	265.
MES-7-18.5	7	18.5	16.6	14.1	265.
MES-8-18	8	18.0	16.2	13.7	265.
MES-10-16	10	16.0	14.4	12.2	265.
MES-12-15	12	15.0	13.5	11.5	265.
MES-14-14	14	14.0	12.6	10.7	265.
MES-16-13	16	13.0	11.7	9.9	265.
MES-20-12	20	12.0	10.8	9.2	265.
MES-24-11	24	11.0	9.9	8.4	265.
MES-28-10	28	10.0	9.0	7.6	265.
MES-36-8	36	8.0	7.2	6.1	265.
MES-48-6	48	6.0	5.4	4.6	295.
MES-100-2	100	2.0	1.8	1.5	295.
MES-120-1.7	120	1.7	1.5	1.3	295.
MES-150-1.4	150	1.4	1.2	1.0	295.

TODD PRODUCTS CORP.
28 LAUREL ST., HICKSVILLE, N.Y. 11801 — (516) 822-0784

SINGLE OUTPUT—SLOT RANGE

MFS SERIES

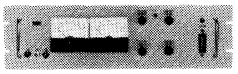
M = Module
F = 4 25/32 x 7 1/2 x 16 1/2
S = Slot Range (±10%)



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price
MFS-3-33	3	33.0	29.0	25.0	315.
MFS-4-32	4	32.0	28.8	24.5	315.
MFS-5-31	5	31.0	27.8	23.6	315.
MFS-6-30	6	30.0	27.0	23.0	315.
MFS-7-29	7	29.0	26.1	22.2	315.
MFS-8-28	8	28.0	25.2	21.4	315.
MFS-10-24	10	24.0	21.6	18.3	315.
MFS-12-21	12	21.0	18.8	16.0	315.
MFS-14-19	14	19.0	17.1	14.5	315.
MFS-16-16.5	16	16.5	14.8	12.5	315.
MFS-20-15.2	20	15.2	13.7	11.6	315.
MFS-24-14	24	14.0	12.6	10.7	315.
MFS-28-13	28	13.0	11.7	9.9	315.
MFS-36-10.4	36	10.4	9.3	7.9	315.
MFS-48-7.7	48	7.7	6.9	5.9	315.
MFS-100-3.3	100	3.3	2.9	2.5	345.
MFS-120-3	120	3.0	2.7	2.3	345.
MFS-150-2.2	150	2.2	1.9	1.6	345.

RAS SERIES

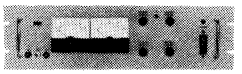
R = Rack
A = 3 1/2" Panel Height
S = Slot Range (±10%)



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price*
RAS-3-45	3	45	40	34	445.
RAS-4-45	4	45	40	34	445.
RAS-5-45	5	45	40	34	445.
RAS-6-45	6	45	40	34	445.
RAS-10-30	10	30	37	22	445.
RAS-12-30	12	30	37	22	445.
RAS-15-25	15	25	22	19	445.
RAS-24-20	24	20	18	15	445.
RAS-28-20	28	20	18	15	445.

RBS SERIES

R = Rack
B = 5 1/4" Panel Height
S = Slot Range (±10%)



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price*
RBS-3-80	3	80	72	61	570.
RBS-4-80	4	80	72	61	570.
RBS-5-80	5	80	72	61	570.
RBS-6-80	6	80	72	61	570.
RBS-10-55	10	55	49	42	570.
RBS-12-55	12	55	49	42	520.
RBS-15-45	15	45	40	34	520.
RBS-24-30	24	30	37	22	520.
RBS-28-30	28	30	37	22	520.

*Meters on front panel—add $30.00.

NOTES: 1. Ratings are for 47 to 65 Hz input. Contact factory for 400 Hz operation.
2. Overvoltage protection available incorporated within the unit—add $90.00.

SPECIFICATIONS—SINGLE OUTPUT

INPUT: 105-132 Volts ac 47-420 Hz.

OUTPUT: Floating, isolated from ground, 300 Vdc max.

REGULATION: LINE: .01% or 1 mV whichever is greater, for rated input line voltage changes.
LOAD: .01% or 1mV whichever is greater, for no-load to full load change at any output within specification.

RIPPLE: Less than .5mV rms, 5 mV Peak to Peak (to 10 MHz) (50-60 Hz).

STABILITY: .02% or 10 mV, whichever is greater, for 8 hrs., after 30 min. warmup. Measured at constant input line, load and amb. temp.

TEMPERATURE COEFFICIENT: (.02% + 100 uV)/Deg. C.

TEMPERATURE RANGE: OPERATING: —20 to +71 Deg. C. (see power rating chart).
NON-OPERATING: —55 to +85 Deg. C.

RECOVERY TIME: 50 microseconds to within 50 mV of regulation spec for no-load to full-load change.

REMOTE PROGRAMMING: RESISTANCE: 1000 ohms/volt.
VOLTAGE: 1 volt/volt.

REMOTE SENSING: The amplifier is capable of compensating for a 1 volt load lead loss and still maintain regulation at the load. An additional 1 volt is available at the output if local sensing is used.

OVERLOAD PROTECTION: Fixed, automatic electronic current foldback limits output current for overload and short circuit conditions. Automatic recovery upon removal of fault condition.

THERMAL PROTECTION: Self-resetting thermostat turns supply off for excessive ambient.

OVERVOLTAGE PROTECTION (OPTIONAL): Adjustable overvoltage protection, mounts externally.

MODE OF OPERATION: Constant voltage with automatic current foldback.

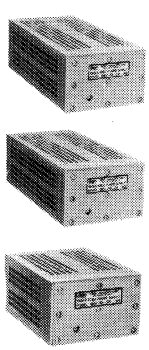
CONTROLS: Recessed screwdriver adjust over output range.

CONNECTIONS: Barrier strip.

MIL SPECS, DESIGNED TO MEET THE FOLLOWING:

RFI	MIL-I-16910
Vibration	MIL-T-4807A
Shock	MIL-E-4970A Proc. 1 & 2
Humidity	MIL-STD-810 Method 507
Temp. Shock	MIL-E-5272C(ASG) Proc. 1
Altitude	MIL-E-4970A Proc 1
Marking	MIL-STD-130 (Component Board)
Quality	MIL-Q-9858
Transformers	MIL-T-27B Grade 6, Class S
Wire	MIL-W-16878
Fungus Nutrients:	None used

DUAL OUTPUT



Model	Nom. Volt.	MAX I AT AMBIENT 50°C	60°C	71°C	Unit Price
MMD-12/12-.13/.13	±12	.13	.12	.095	99.
MMD-15/15-.11/.11	±15	.11	.10	.08	99.
MAD-12/12-.55/.55	±12	.55	.50	.40	140.
MAD-15/15-.47/.47	±15	.47	.44	.34	140.
MBD-12/12-.8/.8	±12	.80	.72	.57	160.
MBD-15/15-.67/.67	±15	.67	.62	.50	160.

SPECIFICATIONS—DUAL OUTPUT-TRACKING SUPPLIES

Negative output tracks positive output to within ±30 mV.

INPUT: 105-132 Vac, 47-420 Hz.

OUTPUT: Common return floating off ground to max of 300 Vdc.

REGULATION: LINE: 0.1% for rated input line voltage changes.
LOAD: 0.1% no load to full load.

RIPPLE: Less than 0.5 mV rms.

STABILITY: 0.2% for 8 hrs. after warm-up measured with all other parameters constant.

TEMPERATURE COEFFICIENT: .02%/°C

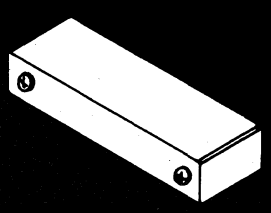
TEMPERATURE: OPERATING: —20° to 71°C
NON-OPERATING: —55° to 85°C

RECOVERY TIME: Less than 50 μsec to 20 mV.

SHORT CIRCUIT PROTECTION: Auto reset current foldback.

REMOTE SENSING: Maintains regulation at load.

OVERVOLTAGE PROTECTION—ADJUSTABLE—CROW BAR



For use with Laboratory or Module Power Supplies. Mounts on rear of unit and is adjusted over ranges listed. Will fire an SCR and present a short circuit across the output, driving the voltage to nominal "0".

Model	Adj. Range	Unit Price	Max I
FOV-A1	3-15 Vdc	30.	10A
FOV-A2	3-50 Vdc	30.	10A
FOV-B1	3-15 Vdc	75.	30A
FOV-B2	3-50 Vdc	75.	30A

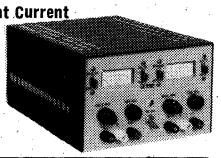
Rack Mount Power Supplies have overvoltage protection circuits incorporated within the unit when this option is specified.

TODD LABORATORY POWER SUPPLIES

Constant Voltage/Constant Current

HAD SERIES

½ Rack
Two Output Dual Range

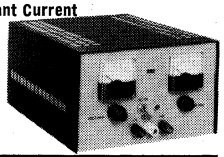


Model		Output Voltage (dc)	Output Current (A)	Unit Price
HAD15/15 2.5/2.5	#1	0-15 or 0-7	at 1.25 at 2.5	189.
	#2	0-15 or 0-7	at 1.25 at 2.5	
HAD50/50-1/1	#1	0-50 or 0-20	at 0.5 at 1.0	189.
	#2	0-50 or 0-20	at 0.5 at 1.0	

Constant Voltage/Constant Current

HBW SERIES

½ Rack
High Power

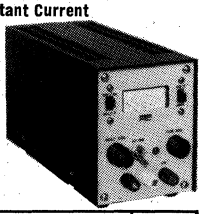


Model	Output Voltage (dc)	Output Current (A)	Unit Price
HBW10-10	0 to 10	0 to 10	349.
HBW10-20	0 to 10	0 to 20	490.
HBW20-6	0 to 20	0 to 6	349.
HBW20-12	0 to 20	0 to 12	399.
HBW40-5	0 to 40	0 to 5	349.
HBW40-8	0 to 40	0 to 8	419.
HBW60-3	0 to 60	0 to 3	319.
HBW60-5	0 to 60	0 to 5	409.
HBW100-1.5	0 to 100	0 to 1.5	479.
HBW100-3	0 to 100	0 to 3	599.
HBW160-1	0 to 160	0 to 1	399.
HBW160-2	0 to 160	0 to 2	499.

Constant Voltage/Constant Current

QAD SERIES

¼ Rack
Dual Range



Model	Output Voltage (dc)	Output Current (A)	Unit Price
QAD15-2.5	0 to 15 or 0 to 7	0 to 1.25 0 to 2.5	99.
QAD50-1	0 to 50 or 0 to 20	0 to 0.5 0 to 1	99.
QAD100-.5	0 to 100 or 0 to 50	0 to .25 0 to .5	129.

SPECIFICATIONS

INPUT: 105-132 Volts ac, 47 to 65 Hz.

OUTPUT: Floating, Isolated from ground up to 300 Vdc max.

CONSTANT VOLTAGE MODE

REGULATION: LINE: 0.01% or 1 mV whichever is greater for rated line voltage changes within specifications.

LOAD: 0.01% or 1 mV no load to full load at any output within specifications.

RIPPLE: Less than 0.5 mV rms, less than 2 mV Peak to Peak (to 10 MHz).

STABILITY: 0.02% or 10 mV for 8 hours after warm up. Measured at constant line, load and ambient temperature.

TEMPERATURE COEFFICIENT: (0.02% + 100 uV)/°C.

OPERATING TEMPERATURE RANGE: 0° to 50°C.

RESPONSE TIME: 50 μsec.

SHORT CIRCUIT & OVERLOAD PROTECTION: Front panel control adjusts current limit from approx. 1% to maximum.

REMOTE PROGRAMMING: Available on all units at approximately 100 ohms/volt, or by voltage ratio of volt/volt. (Open programming leads will cause voltage to rise above rating).

GENERAL SPECIFICATIONS

PROTECTION: AC power line fused for input protection.

CONTROLS: Coarse and fine voltage, and current control located on front panel.

METERS: QAD and HAD Models: A single meter for each output with slide switch to read current, and full range voltage. (2% F.S.) QBW and HBW Models: Voltmeter and ammeter mounted on front panel (2% F.S.).

REMOTE SENSING: The amplifier is capable of compensating for a 1 volt load lead loss and still maintain regulation at the load. An additional 1 volt is available at the output if local sensing is used.

FAST PROGRAMMING: Voltage can be programmed either up or down at rate of 10 mV/microsecond.

CONSTANT CURRENT MODE

CURRENT RANGE: Adjustable by front panel control from 1% to maximum rating.

VOLTAGE COMPLIANCE: 0 to maximum rating.

REGULATION: LINE: 0.4% of I max. for 105 to 132 Vac line change at any output within rating.

LOAD: 0.1% of I max. over rated compliance range.

RIPPLE: .1% rms .2% Peak to Peak to 10 MHz.

STABILITY: .1% of rated current for 8 hours, after warm up, measured with all parameters held constant except time.

TEMPERATURE COEFFICIENT: .1% I max/°C.

REMOTE PROGRAMMING: (Available on QBW and HBW Series) 1000 ohms equal to maximum current.

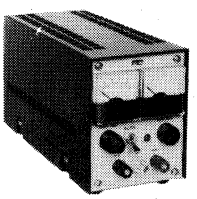
SIZE AND WEIGHTS

Model	H x W x D	Approx. Weight
QAD	4¾" x 4" x 9½"	9 Lbs.
QBW	4¾" x 4" x 16¼"	18 Lbs.
HAD	4¾" x 7 15/16" x 9½"	16 Lbs.
HBW	4¾" x 7 15/16" x 16¼"	33 Lbs.

Constant Voltage/Constant Current

QBW SERIES

¼ Rack
Single Range



Model	Output Voltage (dc)	Output Current (A)	Unit Price
QBW10-5	0 to 10	0 to 5	159.
QBW20-3	0 to 20	0 to 3	159.
QBW40-2	0 to 40	0 to 2	159.

TODD 5-YEAR POWER SUPPLY WARRANTY—PARTS AND LABOR

Todd Products warrants all equipment it manufactures to be free from defects in material and workmanship, and that it will meet its performance specifications for a period of 5 years after original shipment to the purchaser or to the user if originally sold as an OEM item. Our obligation under this warranty is limited to repairing or replacing any instrument which shall be returned to us, or any authorized field service depot, with transportation charges prepaid, prove after our examination to be defective.

We reserve the right to include design changes, and modifications at any time without notice, and without incurring any obligation to make such changes to instruments previously sold, and to discontinue instruments without notice.

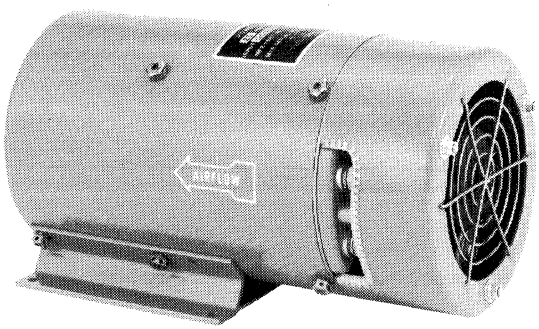
This warranty is in lieu of all other obligations or liabilities expressed or implied, and specifically excludes all liability for consequential damages or costs.

All prices are FOB, Hicksville, N.Y. Prices and specifications are subject to change without prior notice.

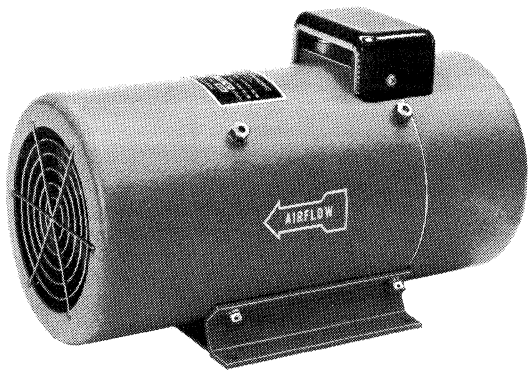
TODD PRODUCTS CORP.
28 LAUREL ST., HICKSVILLE, N.Y. 11801—(516) 822-0784

TUNG-SOL POWER SUPPLIES

Standard units that meet a lot of special requirements



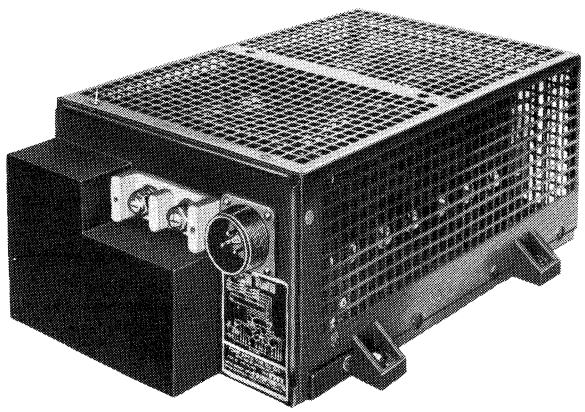
Miniaturized power supply available in four models that provide 28VDC at 25, 50, 100 or 200 amps. All operate from 120/208 v, 47-65 Hz, 3-phase, 4-wire AC inputs.



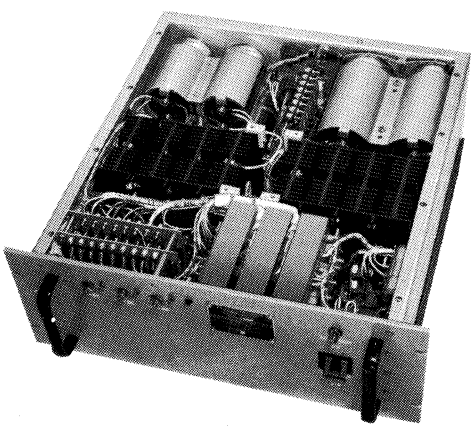
Ground power supply providing 28 VDC at 100, 200, 300, or 400 amps from input power of 400 cps, 200V. RFI per MIL-E-55301 and Environmental per MIL-E-5272.



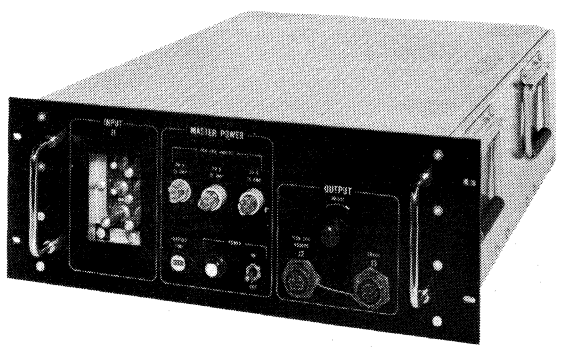
Transmitter-receiver power supply. Eleven different outputs, remotely controllable. Meets MIL-E-16400.



Convection cooled, high voltage regulated airborne power supply. Output: 200A at 28 VDC. Regulation: 8% at 200V.



Highly regulated, multiple output: −24 VDC @ 10 A; −10 VDC @ 10 A and +10 VDC @ 6A. Meets MIL-E-16400.



Three phase line regulator and power supply. Multiple AC-DC regulated outputs at 13.5 and 25A. Meets MIL-T-21200C.

TUNG-SOL®

TUNG-SOL DIVISION

Wagner Electric Corporation

630 W. Mt. Pleasant Avenue, Livingston, N. J. 07039

TWX: 710-994-4865 Phone: (201) 992-1100; (212) 732-5426

®Reg. T.M. Wagner Electric Corporation

Tung-Sol has engineered an extensive line of production power supplies that meet requirements not covered by the usual off-the-shelf types. In-house capability in circuitry, solid state devices, vital components and packaging, is coupled with thorough field experience. As a result, Tung-Sol is producing custom-performance units at prices competitive to less precise types. Why not make your own comparison. Describe your requirements. Our recommendations may result in a better device, a lower price, or both.

TOPAZ INC.

ELECTRONICS MAGNETICS

3802 HOUSTON ST., SAN DIEGO, CALIFORNIA • 92110 (714) 297-4815

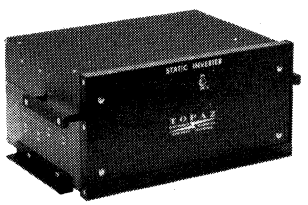
SOLID STATE POWER CONVERSION EQUIPMENT

HIGH-PERFORMANCE INVERTERS, CONVERTERS & FREQUENCY CHANGERS

Available from Stock !!

Topaz static inverters, frequency changers, DC-DC converters and uninterruptible power systems are in use throughout the world. Applications are found wherever quality AC power is needed from DC or "rough" variable sources. Patented designs, which combine in-house transformer and electronic capabilities, contribute to the high quality and reliability of Topaz products. The use of solid-state components, convection cooling, versatile protection circuits, rugged construction and power transistors rather than SCRs (for minimum RFI) in most standard products, assures maximum efficiency and freedom from component failure.

GW SERIES



DC-to-AC INVERTERS SINE WAVE OUTPUT

General Specifications

Regulation — Frequency: ±.05% for all models shown (±1% also available, all models). Output Voltage: ±5% for all sinewave models with any combined change in line and load.
Harmonic Distortion—Less than 3% at full load.
Efficiency—70% nominal
Protection Against—Reversed input polarity; Overloaded or shorted output; Input over-and under-voltage; Automatic current limiting above rated VA.
External Sync—Output frequency can be synchronized with sinewave or pulses—all models.
Construction—All-transistorized for low RFI; Rack or portable (add suffix "D") models available.
Environmental—Temperature-Operating: —20°C to +50°C; Storage: —40°C to 80°C; Shock and Vibration: Suitable for all mobile uses.

60 Hz SINE WAVE OUTPUT

12 or 24 VDC (Dual-Input) MODELS (11-15 or 22-30 VDC inputs)
Also available for 24-32 VDC Input

RACK MODEL NO. (Request GWD for portable version)	SINE WAVE OUTPUT Power Volts AC VA	60 Hz	INPUT Amperage (No load to full load) @12 VDC	@24 VDC	Full Load Eff.	HEIGHT Inches Overall All units 19" wide x13½" deep	Wt. Net (Lbs.)
125 GW-12-24-60	125	115	4 — 18	2 — 9	60%	5¼	30
250 GW-12-24-60	250	115	8 — 32	4 — 16	60%	5¼	39
500 GW-12-24-60	500	115	15 — 60	7.5 — 30	70%	8¾	70
1000 GW-12-24-60	1000	115/230	22 — 120	11 — 60	70%	8¾	95
1500 GW-12-24-60	1500	115	38 — 180	19 — 90	70%	17½	165
2000 GW-12-24-60	2000	115/230	44 — 240	22 — 120	70%	17½	190
2500 GW-12-24-60	2500	115	60 — 300	30 — 150	70%	26¼	260
3000 GW-12-24-60	3000	115/230	70 — 360	35 — 180	70%	26¼	285
4000 GW-12-24-60	4000	115/230	90 — 480	45 — 240	70%	35	380

48 VDC MODELS (42-56 VDC input) — Same outputs and specifications as table above.
Model Designations: 125 GW-48-60, etc.
125 VDC MODELS (105-140 VDC input) — Same outputs and specifications as table above.
Model Designations: 125 GW-125-60, etc.

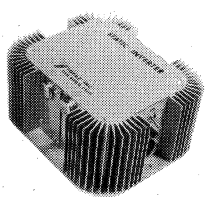
400 Hz SINE WAVE OUTPUT

12 or 24 VDC (Dual-Input) MODELS (11-15 or 22-30 VDC input) — Same outputs and specifications as in 60 Hz table above. Model Designations: 125 GW-12-24-400, etc. Also: 24-32 VDC Input.
48 VDC MODELS (42-56 VDC input) — Same outputs and specifications as table above.
Model Designations: 125 GW-48-400, etc.
125 VDC MODELS (105-140 VDC input) — Same outputs and specifications as table above.
Model Designations: 125 GW-125-400 etc.
(Note: 400 Hz models are approximately ⅓ lighter than 60 Hz models.)

50 Hz SINE WAVE OUTPUT

50 Hz versions available for all ratings and inputs shown in table above, with outputs 80% of listed VA.

G SERIES

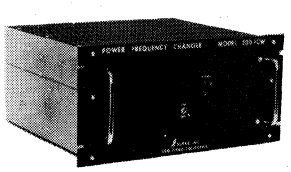


DC-to-AC INVERTERS Square Wave Output

MODEL NUMBER	OUTPUT Power Volts AC VA	60 Hz	INPUT Amperage (No load to full load) @12 VDC	@24 VDC	Full Load Eff.	DIMENSIONS Inches Overall (HxWxD)	Net Wt. (Lbs.)
250 G-12-24-60	250	125	3 — 25	1.5 — 12.5	80%	8¾x19x4½	20
250 GD-12-24-60	250	125	3 — 25	1.5 — 12.5	80%	Mobile Mount 4½x8½x10	20
500 G-12-24-60	500	125	6 — 50	3 — 25	84%	5¼x19x11	40
500-GD-12-24-60	500	125	6 — 50	3 — 25	84%	5¼x19x11	40

50 Hz versions also available, with "—50" Model Number suffix

FW SERIES



General Specifications
Same as "GW" Series above.

NEW!

FREQUENCY CHANGERS

Sine Wave Output

RACK MODEL NO. (Request FWD for portable version)	Power VA	OUTPUT Volts AC	Frequency Hz	RACK HEIGHT Inches Overall	Net Wt. (Lbs.)
125 FW-60	125	115	60	5¼	38
250 FW-60	250	115	60	5¼	47
500 FW-60	500	115	60	8¾	80
1000 FW-60	1000	115/230	60	8¾	110
2000 FW-60	2000	115/230	60	17½	220
3000 FW-60	3000	115/230	60	26¼	330
4000 FW-60	4000	115/230	60	35	440

50 Hz and 400 Hz versions also available in all ratings, with "—400" & "—50" Model No. suffixes.

(Note: 400 Hz models are approximately ¼ lighter than 60 Hz models.)

TOPAZ INC.

ELECTRONICS MAGNETICS

3802 HOUSTON ST., SAN DIEGO, CALIFORNIA • 92110 (714) 297-4815

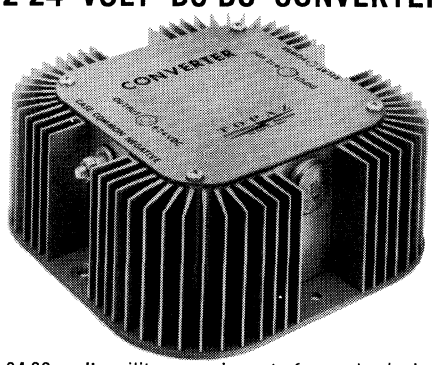
SOLID STATE POWER CONVERSION EQUIPMENT

CUSTOM-DESIGNED INVERTERS, CONVERTERS AND NOISE-SUPPRESSION EQUIPMENT

Topaz maintains an engineering department of power conversion specialists who are eager to design to your special requirements. Shown below are typical examples of products created to solve customers' problems.

NEW! NEW!

12-24 VOLT DC-DC CONVERTERS



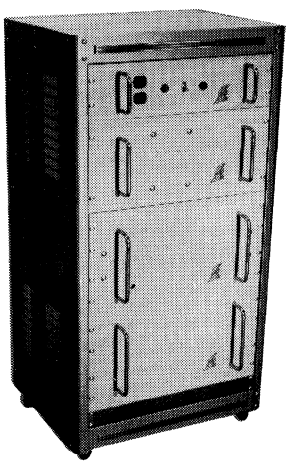
Operates 24-28 volt military equipment from standard commercial vehicles.

Input: 12-15 VDC
Output: 24-28 VDC
Output Power: 360 VA continuous increased starting current for incandescent lamp loads.

Topaz Brochure 69-1 describes standard 250, 500, 1000 and 2000 watt DC-DC converters which provide DC output voltages from 1 volt to 200 KV from 12, 24, 28, 32, 48, 125 or 250 VDC inputs.

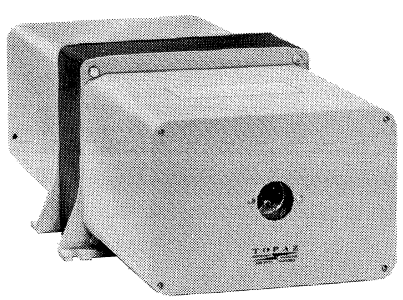
UNINTERRUPTIBLE POWER SYSTEMS

Power systems which do not turn off—even for a fraction of a cycle—when the power line fails are custom-designed by Topaz to specific customer requirements. They consist of an AC-to-DC power supply and battery charger, batteries, and a Topaz DC-to-AC inverter. Batteries in the systems undergo steady trickle charging and periodic equalizing. Topaz will be pleased to custom design your "NO-BREAK" System or provide a minor modification of an existing design to meet your requirements. Request Brochure 69-2.



NEW! NEW!

ULTRA-ISOLATION TRANSFORMERS AND POWER LINE FILTERS



A broad line of noise-suppression equipment—including power filters and line conditioners—is offered by Topaz. Units provide clean, noise-free power for sensitive equipment . . . isolate noisy devices from noise-sensitive equipment . . . and provide effective electrostatic shielding. The equipment incorporates the most advanced techniques of filter design and a unique double-box electrostatic shield. Ratings of 125 VA to 20 KVA are available. Request Brochure 69-3.

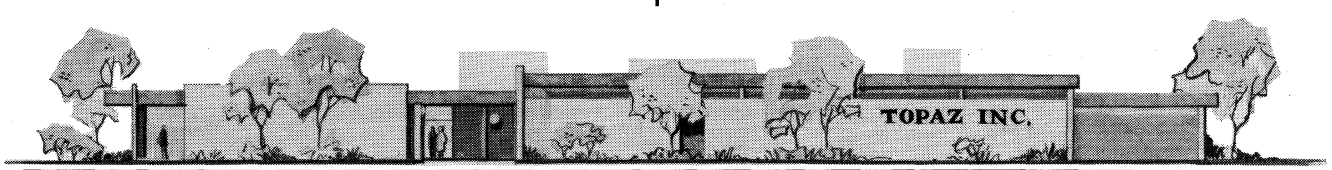
HF SERIES

LIGHTWEIGHT "THIRD GENERATION"

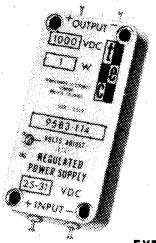
1ϕ and 3ϕ DC-to-AC INVERTERS and FREQUENCY CHANGERS

FROM 2 TO 15 KVA
WITH IMPROVED PERFORMANCE

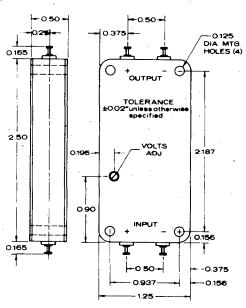
For applications where weight is critical and multiple output frequencies are important, Topaz announces a new series of extremely lightweight inverters. High-frequency carriers are employed to handle the power, thereby drastically reducing the size of the system. For example, a standard 50 Hz 3.2 KVA inverter weighs 380 lbs.; a 3.5 KVA "Third-Generation" inverter with switch-selectable 50, 60 or 400 Hz output weighs only 95 lbs. DETAILS ON REQUEST.



miniature regulated DC-DC power supplies



CASE MATL.-
EXTRUDED ALUMINUM
FINISH-BLACK ANODIZE
(PER MIL-A-8625)



All dimensions in inches

1 watt DC-DC regulated power supplies 9583 series

ELECTRICAL CHARACTERISTICS

TA = +25°C, V_{in} = 28 Vdc, Load = Full (1 Watts), V_{out} = Nominal, (Unless otherwise noted)

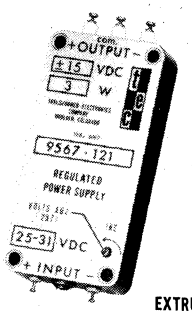
Model	Output			Regulation (Vdc)				
	Voltage (Vdc)	Current (mA)	Ripple (1) (Vp-p)	Line (V_{in}=25 to 31 Vdc)		Load (½ to Full)		Temp. (−55°C to 100°C, Case)
9583	Nom.	Max.	Typ.	Typ.	Max.	Typ.	Max.	Typ.
101	3	330	.020	.025	.035	.098	.110	0.09
102	5	200	.015	.035	.045	.110	.130	0.15
103	7.5	130	.025	.035	.045	.150	.165	0.23
104	10	100	.030	.045	.055	.210	.230	0.30
105	15	67	.050	.075	.085	.250	.275	0.45
106	30	33	.050	.135	.160	.440	.480	0.90
107	50	20	.030	210	.225	.800	.850	1.50
108	75	13	.020	.300	.350	1.20	1.60	2.25
109	100	10	.150	.390	.420	1.30	1.60	3.00
110	150	6.7	.200	.670	.750	2.60	3.10	4.50
111	300	3.3	.225	1.20	1.70	4.00	5.50	9.00
112	500	2.0	.300	2.00	2.60	6.00	8.00	15.0
113	750	1.3	2.4	3.00	3.50	19.0	21.0	22.5
114	1000	1.0	3.0	4.00	5.00	24.0	26.0	30.0
115	1500	0.67	21	6.00	7.50	40.0	50.0	45.0
116	2000	0.50	25	9.50	10.5	68.0	75.0	60.0
117	2500	0.40	20	10.0	13.0	68.0	75.0	75.0
118	3000	0.33	25	12.0	15.0	68.0	75.0	90.0
121	±15	±33	.010	.060	.090	.250	.280	0.30

NOTES:
(1) Filter in Positive Leg, for negative filter prefix part # with "N"
(2) Minimum Load =30 mW
(3) Input terminals shorted to case, output terminals shorted
(4) Reverse polarity protection provided to 50 Vdc.
Contact factory for overload, short circuit, overvoltage, EMI (MIL-I-6181), Surge (MIL-STD-704), Environmental (MIL-E-5400), etc., protection.

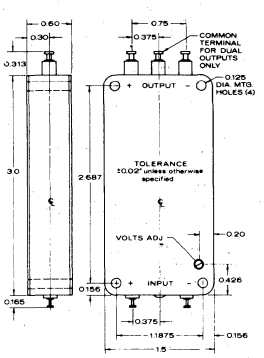
TYPICAL CHARACTERISTICS

Specification	Condition	Typical	Units
Output Volt. Nom.	Model No.	3 to 3000, ±15	Vdc
Output Volt. Adj. Normal Oper. Extended	— Derate to ⅓ Pow.	±10 −40	% %
Ouput Current, Full Load	Model No.	330 to 0.33	mA
Line Regulation	V_{in} = 25-31 Vdc	0.5	%
Load Regulation	½ to Full Load	3	%
Tem. Coefficient	−55 to +100°C, Case	0.02	%/°C
Output Ripple (1)	Model No.	0.6	%p-p
Ripple Frequency	±20% Tol.	10	KHz
Efficiency	Nom. V_{in} & V_{out}, Full Load	41	%
Input Current	Min. Load =30mW	27	mA
Input Current	Full Load	87	mA
Case Temp. Rise	Full Load, Free Air, 25°C	+5	°C
Protection (4)	Reverse Polarity	50	Vdc
Weight	Fully Encap.	2.4	oz.
Volume	—	1.6	IN^3
Derating	To 100°C Case	None Req'd	—

OPERATING RATINGS	Nominal	Absolute Maximum	Units
Input Voltage Range	25-31	—	Vdc
Input Voltage, Continuous (4)	28	31	Vdc
Input Voltage, 1 Sec. Max.	—	50	Vdc
Load (2)	—	1	Watts
Operating Temp. Range, Case (T_c)	—	−55 to +100	°C
Storage Temp. Range	—	−55 to +150	°C
Isolation Voltage (3) Models 101-114, 121 Models 115-118	— —	1000 3000	Vdc Vdc



CASE MATL.-
EXTRUDED ALUMINUM
FINISH-BLACK ANODIZE
(PER MIL-A-8625)



3 watt DC-DC regulated power supplies 9567 series

ELECTRICAL CHARACTERISTICS

TA = +25°C, V_{in} = 28 Vdc, Load = Full (3 Watts), V_{out} = Nominal, (Unless otherwise noted)

Model	Output			Regulation (Vdc)				
	Voltage (Vdc)	Current (mA)	Ripple (1) (Vp-p)	Line (V_{in} = 25 to 31 Vdc)		Load (½ to Full)		Temp. (−55°C to 100°C, Case)
9567	Nom.	Max.	Typ.	Typ.	Max.	Typ.	Max.	Typ.
101	3	1000	0.06	.016	.025	.145	.165	0.45
102	5	600	0.05	.026	.035	.170	.210	0.10
103	7.5	400	0.08	.036	.045	.200	.260	0.15
104	10	300	0.20	.045	.055	.220	.265	0.20
105	15	200	0.06	.060	.080	.360	.410	0.30
106	30	100	0.15	.130	.175	.425	.500	0.60
107	50	60	0.10	.220	.270	.600	.700	1.0
108	75	40	0.38	.300	.350	.900	1.20	1.5
109	100	30	0.20	.450	.550	1.00	1.30	2
110	150	20	0.25	.650	.850	1.50	1.75	3
111	300	10	0.60	1.25	1.75	3.00	3.60	6
112	500	6	0.45	2.20	3.00	4.50	5.20	10
113	750	4	0.50	3.00	4.00	16.0	19.5	15
114	1000	3	0.55	4.00	5.50	16.5	20.0	20
115	1500	2	13.0	6.50	9.00	43.0	55.0	30
116	2000	1.5	16.0	8.00	10.0	39.0	55.0	40
117	2500	1.2	12.0	10.0	13.5	45.0	55.0	50
118	3000	1.0	33.0	12.5	17.0	130	160	60
119	4000	0.75	28.0	17.0	21.0	145	165	80
120	5000	0.60	45.0	20.0	32.0	140	170	100
121	±15	±100	0.09	.060	.090	.350	.410	0.30
122	±25	±60	0.03	.100	.130	.500	.600	0.50
123	±50	±30	0.01	.200	.300	1.00	1.25	1.00
124	±100	±15	0.05	.400	.500	1.50	2.00	2.00

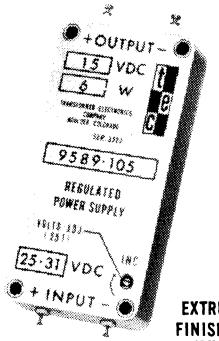
NOTES:
(1) Filter in positive leg, for negative filter prefix part # with "N"
(2) Minimum load = 100 mW
(3) Input terminals shorted to case, output terminals shorted
(4) Reverse polarity protection provided to 50 Vdc
Contact factory for overload, short circuit, overvoltage, EMI (MIL-I-6181), Surge (MIL-STD-704), Environmental (MIL-E-5400), etc., protection.

TYPICAL CHARACTERISTICS

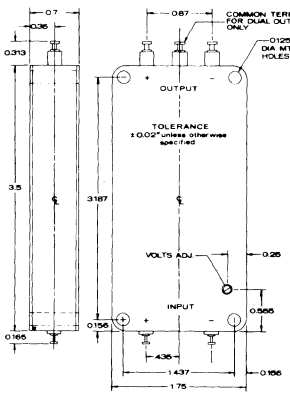
Specification	Condition	Typical	Units
Output Volt. Nom.	Model No.	3 to 5000, ±15 to ±100	Vdc
Output Volt. Adj. Normal Oper. Extended	— Derate to ⅓ Pow.	±10 −40	% %
Output Current, Full Load	Model No.	1000 to 0.60	mA
Line Regulation	V_{in} = 25-31 Vdc	0.5	%
Load Regulation	½ to full load	3	%
Temp. Coefficient	−55°C to +100°C, Case	0.015	%/°C
Output Ripple (1)	Model No.	0.9	%p-p
Ripple Frequency	±20% Tol.	6	KHz
Efficiency	Nom. V_{in} & V_{out}, Full Load	50	%
Input Current	Min. Load = 100 mW	38	mA
Input Current	Full Load	210	mA
Case Temp. Rise	Full Load, Free Air, 25°C	+25	°C
Protection (4)	Reverse Polarity	50	Vdc
Weight	Full Encap.	4.0	oz.
Volume	—	2.7	IN^3
Derating	To +55°C Case	None Req'd.	—

OPERATING RATINGS	Nominal	Absolute Maximum	Units
Input Voltage Range	25-31	—	Vdc
Input Voltage, Continuous (4)	28	31	Vdc
Input Voltage, 1 Sec. Max.	—	50	Vdc
Load (2)	—	3	Watts
Operating Temp. Range Case (T_c)	—	−55 to +100	°C
Storage Temp. Range	—	−55 to +150	°C
Isolation Voltage (3) Models 101-114, 121-124 Models 115-120	— —	1000 5000	Vdc Vdc

miniature regulated DC-DC power supplies



CASE MATL.- EXTRUDED ALUMINUM FINISH-BLACK ANODIZE (PER MIL-A-8625)



All dimensions in inches

6 watt DC-DC regulated power supplies 9589 series

ELECTRICAL CHARACTERISTICS

$T_A = +25°C$, $V_{in} = 28$ Vdc, Load = Full (6 Watts), V_{out} = Nominal, (unless otherwise noted)

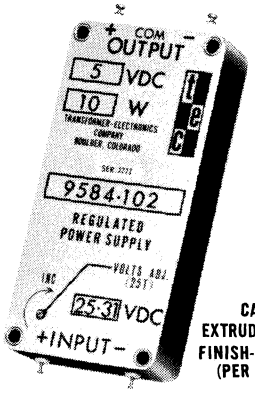
Model	Output			Regulation (Vdc)				
				Line Vin=25 to 31Vdc)		Load (½ to Full)		Temp (-55°C to +100°C) case
9589-	Voltage (Vdc)	Current (mA)	Ripple (Vp-p) (1)					
	Nom.	Max.	Typ.	Typ.	Max.	Typ.	Max.	Typ.
102	5	1200	.050	.003	.005	.150	.230	.075
103	7.5	800	.060	.003	.006	.200	.300	.113
104	10	600	.120	.003	.006	.240	.325	.150
105	15	400	.090	.005	.013	.260	.380	.225
106	30	200	.090	.010	.016	.360	.450	.450
107	50	120	.250	.015	.025	.700	.850	.750
108	75	80	.430	.030	.050	1.00	1.50	1.13
109	100	60	.600	.040	.065	1.10	1.60	1.50
110	150	40	.900	.050	.070	1.50	2.00	2.25
111	300	20	1.80	.100	.125	2.75	4.00	4.50
112	500	12	2.50	.200	.250	5.00	7.00	7.50
113	750	8.0	4.10	.200	.250	7.00	11.0	11.3
114	1000	6.0	6.0	.450	.700	12.5	17.0	15.0
115	1500	4.0	9.0	.500	1.25	35.0	45.0	22.5
116	2000	3.0	12.0	1.25	2.00	35.0	45.0	30.0
117	2500	2.4	15.0	1.40	2.00	50.0	75.0	38.0
118	3000	2.0	18.0	1.50	3.00	85.0	100	45.0
119	4000	1.5	24.0	1.60	2.20	105	125	60.0
120	5000	1.2	30.0	3.00	5.00	125	165	75.0
121	±15	±200	.090	.005	.012	.250	.300	.225
122	±25	±120	.120	.007	.012	.410	.500	.38
123	±50	±60	.300	.025	.050	.800	1.10	.75
124	±100	±30	.500	.025	.060	1.70	2.20	1.50

NOTES:
(1) Filter in positive leg, for negative filter prefix part # with "N"
(2) Minimum Load = 200 mw
(3) Input terminals shorted to case, output terminals shorted
(4) Reverse polarity protection provided to 50 Vdc
Contact factory for Overload, Short Circuit
Over voltage, EMI (MIL-I-6181), Surge (MIL-STD-704), Environmental (MIL-E-5400), etc., protection.

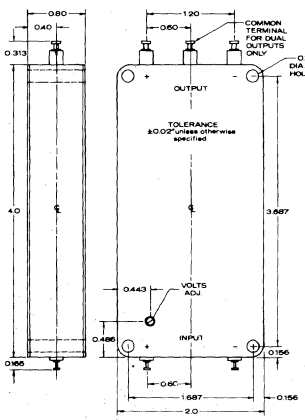
TYPICAL CHARACTERISTICS

Specification	Condition	Typical	Units
Output Voltage, Nominal	Model No.	5 to 5000, ±15 to ±100	Vdc
Output Volt. Adj. Normal Oper. Extended	— Derate to ⅓ Pwr	±10 —40	% %
Output Current, Full Load	Model No.	1200 to 1.2	mA
Line Regulation	V_{in} = 25 to 31 Vdc	0.1	%
Load Regulation	½ to Full Load	3	%
Temp. Coefficient	—55°C to +100°C, Case	0.01	%/°C
Output Ripple (1)	Model No.	0.6	% p-p
Ripple Frequency	±20% Tol.	7	K Hz
Efficiency	Nom V_{in} & V_{out}, Full Load	55	%
Input Current	Min Load = 200 mw	100	mA
Input Current	Full Load	400	mA
Case Temp. Rise	Full Load, Free Air, 25°C	+30	°C
Protection (4)	Reverse Polarity	50	Vdc
Weight	Fully Encap.	7.0	oz.
Volume	—	4.3	IN^3
Derating	To 100°C (Case)	None Req.	—

OPERATING RATINGS	Nominal	Absolute Maximum	Units
Input Voltage Range	25-31	—	Vdc
Input Voltage, Continuous (4)	28	31	Vdc
Input Voltage, 1 Sec. Max.	—	50	Vdc
Load (2)	—	6	Watts
Operating Temp. Range, Case (Tc)	—	—55 to +100	°C
Storage Temp. Range	—	—55 to +150	°C
Isolation Voltage (3) Models 102-114, 121-124 Models 115-120	— —	1000 5000	Vdc Vdc



CASE MATL.- EXTRUDED ALUMINUM FINISH-BLACK ANODIZE (PER MIL-A-8625)



10 watt DC-DC regulated power supplies 9584 series

ELECTRICAL CHARACTERISTICS

$T_A = +25°C$, $V_{in} = 28$Vdc, Load = Full (10 Watts), V_{out} = Nominal, (unless otherwise noted)

Model	Output			Regulation (Vdc)				
				Line (Vin=25 to 31 Vdc)		Load (½ to Full)		Temp (-55°C to +100°C) case
9584-	Voltage (Vdc)	Current (mA)	Ripple (1) (Vp-p)					
	Nom.	Max.	Typ.	Typ.	Max.	Typ.	Max.	Typ.
102	5	2000	.030	.003	.008	.200	.260	.075
103	7.5	1300	.045	.004	.010	.210	.270	.112
104	10	1000	.020	.005	.012	.250	.300	.150
105	15	670	.015	.008	.013	.290	.360	.225
106	30	330	.060	.011	.015	.500	.750	.450
107	50	200	.050	.025	.035	.700	1.10	.750
108	75	130	.075	.030	.045	1.10	1.50	1.13
109	100	100	.100	.037	.065	1.20	2.00	1.5
110	150	67	.150	.055	.080	2.20	3.00	2.25
111	300	33	.30	.100	.220	4.00	6.00	4.50
112	500	20	1.0	.200	.320	7.00	10.0	7.50
113	750	13	1.5	.300	.500	9.00	13.0	11.30
114	1000	10	2.5	.750	1.50	16.0	22.0	15.0
115	1500	6.7	3.0	1.00	1.60	20.0	30.0	22.5
116	2000	5.0	5.5	1.50	2.70	25.0	40.0	30.0
117	2500	4.0	5.0	2.00	3.30	60.0	75.0	38.0
118	3000	3.3	9.0	2.50	4.00	75.0	100	45.0
119	4000	2.5	14.0	2.50	4.50	85.0	125	60.0
120	5000	2.0	17.5	4.00	6.00	120	220	75.0
121	±15	±335	.030	.007	.017	.300	.450	.225
122	±25	±200	.050	.010	.030	.750	.850	.38
123	±50	±100	.100	.016	.030	1.25	1.50	.75
124	±100	±50	.100	.040	.065	1.60	2.75	1.50

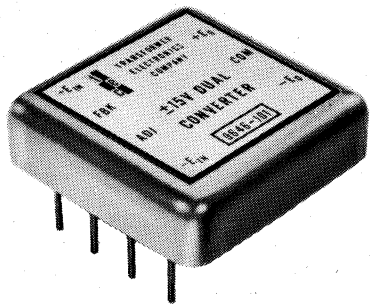
NOTES:
(1) Filter in positive leg, for negative filter prefix part # with "N"
(2) Minimum Load = 300 mw
(3) Input terminals shorted to case, output terminals shorted
(4) Reverse polarity protection provided to 50 Vdc
Contact factory for overload, short circuit, over voltage, EMI (MIL-I-6181), Surge (MIL-STD-704), Environmental (MIL-E-5400), etc., protection.

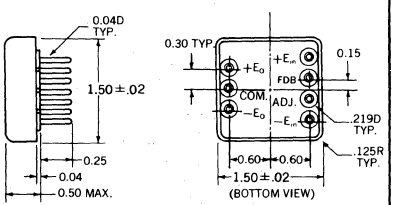
TYPICAL CHARACTERISTICS

Specification	Condition	Typical	Units
Output Voltage, Nominal	Model No.	5 to 5000, ±15 to ±100	Vdc
Output Volt. Adj. Normal Oper. Extended	— Derate to ⅓ Pwr	±10 —40	% %
Output Current, Full Load	Model No.	2000 to 2	mA
Line Regulation	V_{in} = 25 to 31 Vdc	0.15	%
Load Regulation	½ to Full Load	3	%
Temp. Coefficient	—55°C to 100°C, Case	0.01	%/°C
Output Ripple (1)	Model No.	0.3	% p-p
Ripple Frequency	±20% Tol.	6	K Hz
Efficiency	Nom. V_{in} & V_{out}, Full Load	52	%
Input Current	Min. Load = 300MW	120	mA
Input Current	Full Load	690	mA
Case Temp. Rise	Full load, Free air, 25°C	+30	°C
Protection (4)	Reverse Polarity	50	Vdc
Weight	Fully Encap.	9.6	oz.
Volume	—	6.4	IN^3
Derating	To 100°C Case	None Req.	—

OPERATING RATINGS	Nominal	Absolute Maximum	Units
Input Voltage Range	25-31	—	Vdc
Input Voltage, Continuous (4)	28	31	Vdc
Input Voltage, 1 sec. max.	—	50	Vdc
Load (2)	—	10	Watts
Operating Temp. Range, Case (Tc)	—	—55 to +100	°C
Storage Temp. Range	—	—55 to +150	°C
Isolation Voltage (3) Models 102-114, 121-124 Models 115-120	— —	1000 5000	Vdc Vdc

OP-AMP dual converter and regulator





All dimensions in inches; all tolerances ±.005 except as noted.

CASE MATL. — STEEL
FINISH — BRIGHT NICKEL PLATE

dual converter 9646-101

ELECTRICAL CHARACTERISTICS

$T_A = +25°C$, $V_{in} = 28V$, $V_{out}^{\pm} = \pm 19$ Vdc $I_{out}^{\pm} = \pm 120$ mA (unless otherwise noted) Warm-up time, 150 sec.

Parameter	Specification	Symbol	Conditions	Min.	Typ.	Max.	Units
Input	Current	I_{in}	$I_{out}^{\pm} = 0$	—	85	100	mA
	Current	I_{in}	$I_{out}^{\pm} = \pm 120$mA	—	335	360	mA
	Reflected Noise Current	i_r	BW = 1Hz—50MHz, $Z_s \leqq 0.2\Omega$ below 1 KHz(3)	—	930	1350	mAp-p
Output	Positive Voltage Adjust. (2)	V_{out}^{+}	$0 \leqq I_{out} \leqq +120$mA	+14	—	+21	Vdc
	Negative Voltage Adjust. (2)	V_{out}^{-}	$0 \geqq I_{out} \geqq -120$mA	−21	—	−14	Vdc
	Positive Current Available	I_{out}^{+}	$14Vdc \leqq V_{out}^{+} \leqq 21Vdc$	—	—	+120	mA
	Negative Current Available	I_{out}^{-}	$-14Vdc \geqq V_{out}^{-} \geqq -21Vdc$	−120	—	—	mA
	Voltage Differential	$(V_{out}^{+}+V_{out}^{-})$		—	±20	±200	mV
	Voltage Differential with Temperature	$\frac{(V_{out}^{+}+V_{out}^{-})}{\Delta T}$	−25°C≦TA≦85°C	—	±50	±300	mV
	Ripple and Noise Voltage		BW = 1Hz—50 MHz	—	160	480	mVp-p
	Voltage Regulation with Load		$60ma \leqq \lvert I_{out}^{\pm} \rvert \leqq 120$ma	—	275	550	mV
	Voltage Regulation with Temperature		−25°C≦TA≦85°C	—	100	200	mV
	Impedance	Z_{out}	BW = DC to 100 Hz	—	4.6	9	ohms
Transfer	Input/Output Isolation Resistance		Input Terminals shorted and Output Terminals shorted, V = 200 Vdc	500	—	—	M ohms
	Output Voltage Regulation with Input Voltage		$24Vdc \leqq V_{in} \leqq 32Vdc$	—	150	300	mV

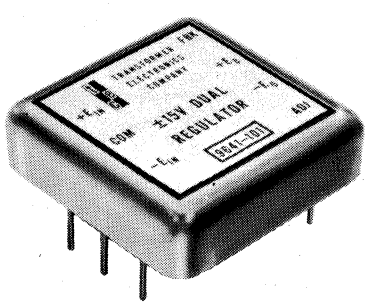
NOTES:
(1) Reverse polarity protection provided to 50 volts
(2) Both outputs adjusted simultaneously by a single external resistor, Typ. 6K for $V_{out}^{\pm} = \pm 19$ Vdc.
(3) Measured differentially using voltage drop method
(4) Compatible with dual regulator for improved performance.

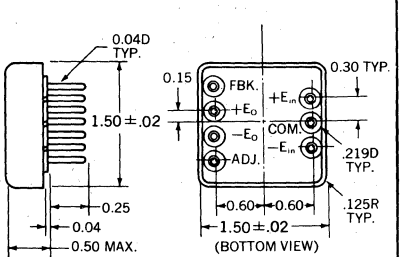
TYPICAL CHARACTERISTICS

Specification	Condition	Typical	Units
Output Voltage	Nominal	±19	Vdc
Output Voltage Adjust	(2)	±14 to ±21	Vdc
Output Current	Full Load	±120	mA
Line Regula.(4)	V_{in} = 24 to 32 Vdc	0.8	%
Load Regula. (4)	½ to Full Load	1.5	%
Temp. Regulation	−25°C to +85°C	0.005	%/°C
Output Ripple	—	0.85	% p-p
Ripple Frequency	±20% Tol.	16	KHz
Efficiency	Nom. V_{in} & V_{out}, Full Load	48	%
Protection	Reverse Polarity	50	Vdc
Weight	Fully Encap.	1.8	oz.
Volume	—	1.125	in³
Derating	To +65°C Ambient	None Req.	—

OPERATING RATINGS	Nominal	Absolute Maximum	Units
Input Voltage Range	24-32	—	Vdc
Input Voltage, Continuous (1)	28	32	Vdc
Input Voltage, 1 Sec. Max.	—	40	Vdc
Load, Each Output	—	120	mA
Operating Temp. Range, Amb. (TA)	—	−25 to +85	°C
Storage Temp. Range	—	−55 to +125	°C
Isolation Voltage, Input/Output	—	200	Vdc

Additional Technical Data Available Upon Request.





All dimensions in inches; all tolerances ±.005 except as noted.

CASE MATL. — STEEL
FINISH — BRIGHT NICKEL PLATE

dual regulator 9641-101

ELECTRICAL CHARACTERISTICS

$T_A = +25°C$, $V_{in}^{+} = 19$ Vdc $V_{in}^{-} = -19$ Vdc (unless otherwise noted)

Parameter	Specification	Symbol	Conditions	Min.	Typ.	Max.	Units
Input	Positive Current	I_{in}^{+}	$V_{out}^{\pm} = 15$ Vdc, $R_L = 150\Omega$	—	105	115	mA
	Negative Current	I_{in}^{-}	$V_{out}^{\pm} = -15$ Vdc, $R_L = 150\Omega$	—	105	115	mA
Output	Positive Voltage (1)	V_{out}^{+}	$150\Omega \leqq R_L < \infty$	14	15	16	Vdc
	Negative Voltage (1)	V_{out}^{-}	$150\Omega \leqq R_L < \infty$	−16	−15	−14	Vdc
	Load Regulation		$150\Omega \leqq R_L \leqq 300\Omega$	—	0.1	0.25	%
	Impedance	Z_{out}	$R_L = 300\Omega$, DC—100Hz	—	0.5	1.0	ohms
	Voltage Change with Temperature	$V_{out}^{\pm}$	−25°C≦TA≦85°C	—	±50	±150	mV
	Voltage Differential	$(V_{out}^{+}+V_{out}^{-})$	$150\Omega \leqq R_L < \infty$	—	±10	±100	mV
	Voltage Differential with Temperature	$\frac{(V_{out}^{+}+V_{out}^{-})}{\Delta T}$	−25°C≦TA≦85°C, $R_L = 300\Omega$	—	±50	±150	mV
	Noise Voltage	e_n	BW = 20Hz—100KHz, ±19 Vdc Input (low noise)	—	10	30	μVRMS
	Load Capacitance	C_L	$150\Omega \leqq R_L < \infty$		NO LIMIT		
	Foldback Cur. Limit	I_{LL}	V_{out} Drops 1% with Increasing Load	110	140	175	mA
	Short Circuit Cur.	$I_{L(s)}$	$R_L < 10\Omega$	—	12	20	mA
Transfer	Line Regula. Factor	(V_{out}/V_{in})	$V_{in}^{\pm} = \pm 18V$ to ±22 Vdc, $V_{out}^{\pm} =$ ±15 Vdc $R_L = 150\Omega$	—	30	150	mV/V
	Ripple Attenuation	$\partial V_{out}/\partial V_{in}$	$e_{in} = 1$ vp-p f = 20Hz—1KHz	—	29	—	db

NOTES:
(1) Both outputs adjusted simultaneously by a single external resistor, typ. 500Ω for $V_{out}^{\pm} = \pm 15$ Vdc.
(2) Short circuit output permissable
(3) Input voltage must be greater than output voltage by 2 volts minimum
(4) Compatible with dual converter for operation from 28 volts DC.

TYPICAL CHARACTERISTICS

Specification	Condition	Typical	Units
Output Voltage	Nominal	±15	Vdc
Output Voltage Adjust	(1)	±14 to ±16	Vdc
Output Current	Full Load	±100	mA
Line Regulation	V_{in} = ±18 to ±22 Vdc	1.0	%
Load Regulation	I_{out} = 0 to 100 mA	0.2	%
Temp. Regulation	−25°C to +85°C	0.006	%/°C
Efficiency	Nom. V_{in} & V_{out} Full Load	75	%
Protection	Continuous short circuit or overload	Yes	—
Weight	Fully Encap.	1.8	oz.
Volume	—	1.125	in³

OPERATING RATINGS	Nominal	Absolute Maximum	Units
Input Voltage Range (3)	±16 — ±28	—	Vdc
Input Voltage, Continuous (4)	±19	±28	Vdc
Load	150 to ∞	Zero (2)	Ohms
Operating Temp. Range, Amb. (TA)	—	−25 to +85	°C
Storage Temp. Range	—	−55 to +125	°C

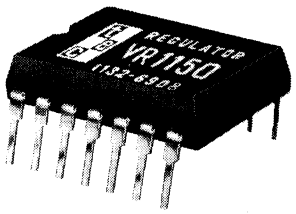
Additional Technical Data Available Upon Request.

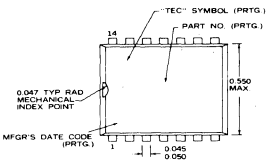
thick film hybrid circuits

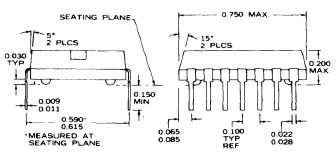
hybrid voltage regulators — VR series

MODEL NO.	OUTPUT
VR1050-1120	+ 5.0 to +12 Volts/250mA
VR1150-1360	+15.0 to +36 Volts/250mA
VR2150-2360	−15.0 to −36 Volts/250mA

The new high performance Hybrid Voltage Regulators in the popular Dual-in-line package feature **minimum external componetry.**







CASE MATL. — EPOXY
LEAD MATL. — GOLD PLATED COPPER

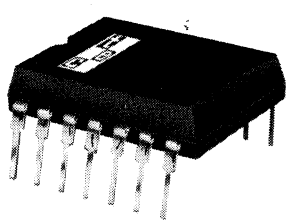
All dimensions in inches

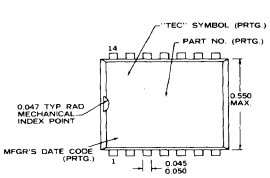
Features:

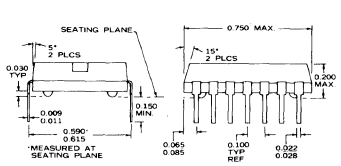
- Input Voltage: (V_{out} +2) to 40 Volts
- .0025% Load Regulation (N.L.-F.L.)
- .001%/volt line regulation
- ±.02%/°C Output Temp. Coefficient
- 75 db ripple attenuation to 10 KHz
- Short circuit proof — Foldback Current Limiting
- External High Current
- Pass Transistor Provisions
- Output Adjustable Externally
- Internally Compensated
- Low Profile 2XDIP Package
- Fixed output voltages

Ideal for "Point of Load" regulators for TTL, DTL, etc. (+5 volts), Opamps (±15 volts) and DC/DC converter preregulators (28 Vdc to +20 Vdc), etc.

See your TEC Field Representative for more information.







CASE MATL. — EPOXY
LEAD MATL. — GOLD PLATED COPPER

custom capability

TEC's capability in Microelectronic circuits is based on the "New Packing Concept" using ceramic as the basic substrate material, onto which a network of conductors, resistors and capacitors are formed. Upon this passive network, silicon active transistor and integrated circuit "chips" are bonded and interconnected to form a high performance functional circuit module. Advantages of this advanced circuit packaging approach are the reduction in size, increased reliability, and decreased cost, for circuit applications where performance and complete "integration" are of prime importance. TEC's facility is complemented with experts in circuit and topology design, tooling, encapsulation, process engineering, assembly, production and quality control.

THICK FILM HYBRID CIRCUITS

- Compatible with monolithic I/C's-DIP package
- High power capability — 30 watts/in²
- Wide range of resistance values — 10 ohms to megohms
- Wide range of capacitance values — to 0.1 mfd
- Wide selection of NPN/PNP and FET devices
- Parasitic capacitance and inductance negligible
- Low "set-up" and unit costs in moderate quantities

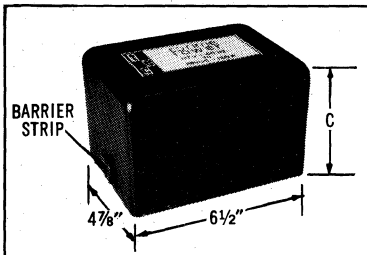
Rapid response is given to your microelectronic circuit requirements within the above definition. Your circuit prototypes are rapidly optimized by our experienced semiconductor and hybrid integrated circuit staff, with quality production units supplied from our modern hybrid circuit production facilty in Boulder, Colorado.

Watch for new **Hybrid Circuit Products** from TEC during 1969 in major electronics publications.



other standard products

30, 60, & 120 watt AC-DC prime power packs PP series



Feature:
- Low Cost
- Ideal for "Point of Load" Regulators
- Convenient Threaded Plate Mounting
- —25 to +70°C Operation
- Attractive Modular Package

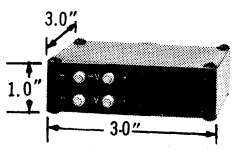
ELECTRICAL SPECIFICATIONS
T_A = 25°C, V_{in} = 117 Vac, Load = Full, V_{out} = Nominal, (unless otherwise noted) Freq. = 60 Hz

MECHANICAL SPECIFICATIONS

MODEL	OUTPUT				REGULATION (Vdc)			DIMENSIONS (inches)		
	Power (W)	Voltage (Vdc) Nom.	Current (A) Max.	Ripple (Vp-p) Typ.	Line (V_{in} = 105 to 135 Vac) Typ.	Load (½ to full) Typ.	Temp. (—25 to +70°C) Typ.	A	B	C
PP1280	30	+28	1.07	1.9	6.5	2.1	0.2	4⅞	6½	3½
PP2200	30	±20	±0.75	1.4	3.9	1.4	0.1			
PP3280	60	+28	2.15	1.9	6.9	2.4	0.1	4⅞	6½	4.0
PP4200	60	±20	±1.5	1.0	5.0	1.1	0.1			
PP5280	120	+28	4.3	2.0	7.5	2.2	0.1	4⅞	6½	4½
PP6200	120	±20	±3.0	1.7	5.0	1.0	0.2			

CASE MATL. — ALUMINUM
FINISH — BLACK ANODIZED (PER MIL-A-8625)

high voltage photomultiplier supplies 9536 series



CASE MATL. — ALUMINUM
FINISH — BLACK ANODIZED (PER MIL-A-8625)

ELECTRICAL CHARACTERISTICS
T_A = 25°C, V_{in} = 28 Vdc,
Load = Full, V_{out} = Nominal (unless otherwise noted)

MODEL 9536	OUTPUT			REGULATION (Vdc)
	VOLTAGE (KVdc) Nom.	CURRENT (μA) Max.	RIPPLE (2) (Vp-p) Typ.	LINE (V_{in} = 25 to 31 Vdc) Typ.
09	.90	150	0.45	0.45
11	1.1	150	0.50	0.55
13	1.3	150	0.55	0.65
16	1.6	150	0.60	0.80
20	2.0	125	0.65	1.00
25	2.5	100	0.70	1.25
30	3.0	80	0.75	1.50
35	3.5	70	0.80	1.75

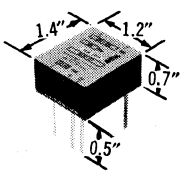
NOTES:
(1) To designate case configuration, prefix model no. with "A" or "B." "A" Case shown, "B" dimensions .875"x1.5"x5.5".
(2) Add suffix "P" for filter in positive leg or "N" for negative.
(3) Temperature coefficient is continuously adjustable from (+) To (—.) It can be adjusted to a specific customer requirement by the customer or by TEC at a nominal charge. Temp. coefficient is factory set at nominal output and full load. Remove top cover to adjust temperature coefficient.

TYPICAL CHARACTERISTICS

Specification	Condition	Typical	Units
Output Voltage, Nominal	Model No.	0.90 to 3.5	KVdc
Output Voltage Adjust	Normal Operating	+5 —20	%
Output Current, Full Load	Model No.	150 to 70	μA
Line Regulation	V_{in} = 25 to 31 Vdc	0.05	%
Temp. Coefficient	—30°C to +70°C	0.002	%/°C
Temp. Coefficient Adjust (3)	—30°C to +70°C	+.05 to —.05	%/°C
Output Ripple	Model No.	0.07	%p-p
Reflected Ripple	Across 1Ω source Z	.005	Vdc
Ripple Frequency	±20% Tol.	5	KHz
Efficiency	Nom. V_{in} & V_{out}, Full Load	50	%
Input Current	No Load	5	mA
Input Current	Full Load	27	mA
Weight	Modules Encap.	8	OZ
Volume	"A" Case (1)	7.8	in^3
Volume	"B" Case (1)	6.5	in^3

OPERATING RATINGS	Nominal	Absolute Maximum	Units
Input Voltage Range	25-31	—	Vdc
Input Voltage, Cont.	28	31	Vdc
Load, Model 09	—	135	mW
Model 11	—	165	mW
Model 13	—	195	mW
Models 16 to 35	—	250	mW
Operating Temp. Range, Case (Tc)	—	—30 to +70	°C
Storage Temp. Range	—	—55 to +125	°C
Isolation Voltage	—	3500	Vdc

miniature DC-DC converters 9570 series



CASE MATL. — MOLDED EPOXY

ELECTRICAL CHARACTERISTICS
T_A = 25°C, V_{in} = 12-24 Vdc,
Load = Full (300 mw), (unless otherwise noted)

MODEL 9570	OUTPUT			REGULATION (Vdc)
	VOLTAGE (Vdc) (1) Nom.	CURRENT (mA) Max.	RIPPLE (vp-p) (V_{in} = 24 Vdc) Typ.	TEMPERATURE (—30°C to +70°C) (V_{in} = 24 Vdc) Typ.
100	1-2	300-150	.20	.05
101	1.5-3	200-100	.15	.06
102	2-4	150-75	.09	.05
103	3-6	100-50	.07	.06
104	5-10	60-30	.06	.08
105	8-16	38-19	.06	.1
106	10-20	30-15	.07	.2
107	15-30	20-10	.05	.3
108	20-40	15-7.5	.08	.4
109	30-60	10-5	.10	.6
110	50-100	6-3	.20	1.0
111	80-160	3.8-1.9	.30	1.6
112	100-200	3-1.5	.40	2.0
113	150-300	2-1	.45	3.0
114	200-400	1.5-0.75	.50	4.0
115	300-600	1-0.5	.60	4.0
116	350-700	0.88-0.44	.65	3.0
117	400-800	0.75-0.38	.70	3.0

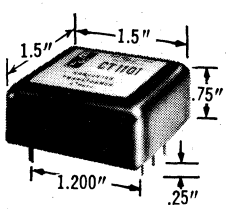
TYPICAL CHARACTERISTICS

Specification	Condition	Typical	Units
Output Voltage Output Voltage Adjust	Model No. (1)	1 to 800 2:1	Vdc —
Output Current, Full Load	Model No.	300 to 0.38	mA
Temp. Regulation	—30°C to +70°C	0.01	%/°C
Output Ripple	Model No.	0.6	%p-p
Ripple Freq. (3)	±20% Tol., V_{in} = 24 Vdc	5	KHz
Efficiency	V_{in} = 12 Vdc, Full Load	70	%
Input Current	No Load, V_{in} = 12 Vdc	2	mA
Input Current	Full Load, V_{in} = 12 Vdc	35	mA
Weight	Fully Encap.	1	OZ
Volume	—	1.2	IN^3

OPERATING RATINGS	Nominal	Absolute Maximum	Units
Input Voltage Range	12-24	—	Vdc
Input Voltage, Cont.	—	28	Vdc
Load	—	300	mW
Operating Temp. Range, Amb. (T_A)	—	—30 to +70	°C
Storage Temp. Range	—	—55 to +125	°C
Isolation Voltage, Input/Output	—	1000	Vdc

NOTES:
(1) Output voltage follows input voltage, tolerance ±20%.
(2) Input terminals shorted, output terminals shorted.
(3) Sync output (square wave) available.

encased DC-DC converter toroidal transformer CT series



CASE MATL. — STEEL
FINISH — BLACK MATTE
TERMINALS — .040" PLATED PINS

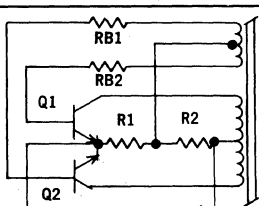
Feature:
- 3 Watts Output
- Shielded Metal Case
- Solder-in Pin Terminations
- —55°C to +100°C Operation

TEC Trans. No.	Fig.	Output Vdc	Output mA	Rectifiers FWD I	Rectifiers PIV	C_1 μfd	C_2 μfd	R_1 ¼W	L_1* mH
CT1030	1	3.0	1000	3A	50V	180/6V	180/6V		0.03
CT1050	1	5.0	600	3A	50V	180/6V	180/6V		0.08
CT1070	1	7.5	400	3A	50V	39/10V	39/10V		0.18
CT1100	1	10	300	3A	50V	68/15V	22/15V		0.12
CT1150	1	15	200	1A	50V	15/20V	15/20V		1.0
CT1300	2	30	100	1A	50V	6.8/35V	6.8/35V		4.0
CT1500	2	50	60	1A	400V	3.9/75V	3.9/75V		7.5
CT1750	2	75	40	1A	400V	2.7/100V	2.7/100V		10.0
CT1101	2	100	30	1A	400V	2.2/125V	2.2/125V		19.0
CT1151	2	150	20	1A	400V	5/200V	5/200V		75.2
CT1301	2	300	10	1A	400V	25/400V	25/400V		75.2
CT1501	2	500	6	1A	800V	.12/600V	.12/600V		
CT1751	3	750	4	1A	1000V	.025/1500V	.025/1500V	4.7K	
CT1102	3	1000	3	250ma	1500V	.025/3000V	.025/3000V	4.7K	

* TEC Available Chokes

NOTES:
(1) Passive voltage multipliers can extend output voltage range to 5000 Vdc
(2) Toroidal chokes are available from TEC
(3) Dual & Multiple outputs available

CIRCUITS:
Inverter Configuration(1)



CT SERIES

Rectifier-Filter Configurations:

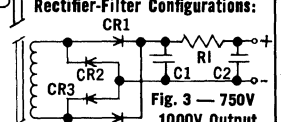


Fig. 3 — 750V 1000V Output

R_1	R_2	R_{B1}	R_{B2}	Q_1	Q_2
390Ω	3.9KΩ	100Ω		2N3019	
⅛W—5% Carbon Comp.				h_{FE}>40	

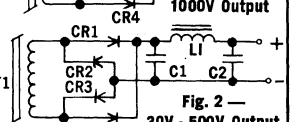


Fig. 2 — 30V - 500V Output

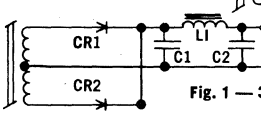


Fig. 1 — 3V - 15V Output

TRANSFORMER-ELECTRONICS COMPANY • P.O. BOX 910 • BOULDER, INDUSTRIAL PARK • BOULDER, COLORADO 80302 • TELEPHONE (303) 442-3837 • TWX 910-940-3246

price list – reliability data

9583 SERIES Part No.	Price 1 ea.	9567 SERIES Part No.	Price 1 ea.	9589 SERIES Part No.	Price 1 ea.	9584 SERIES Part No.	Price 1 ea.	9536 SERIES Part No.	Price 1 ea.	9570 SERIES Part No.	Price 1 ea.
9583101	$196.00	9567101	$178.00	9589102	$177.00	9584102	$192.00	A953609	$650.00	9570100	$ 82.00
9583102	185.00	9567102	168.00	9589103	172.00	9584103	187.00	A953611	650.00	9570101	82.00
9583103	180.00	9567103	164.00	9589104	172.00	9584104	187.00	A953613	650.00	9570102	82.00
9583104	180.00	9567104	164.00	9589105	167.00	9584105	182.00	A953616	650.00	9570103	85.00
9583105	175.00	9567105	159.00	9589106	161.00	9584106	175.00	A953620	650.00	9570104	85.00
9583106	168.00	9567106	153.00	9589107	176.00	9584107	192.00	A953625	650.00	9570105	85.00
9583107	185.00	9567107	168.00	9589108	184.00	9584108	200.00	A953630	650.00	9570106	93.00
9583108	192.00	9567108	175.00	9589109	184.00	9584109	200.00	A953635	650.00	9570107	93.00
9583109	192.00	9567109	175.00	9589110	169.00	9584110	184.00	B953609	650.00	9570108	93.00
9583110	177.00	9567110	161.00	9589111	169.00	9584111	184.00	B953611	650.00	9570109	102.00
9583111	177.00	9567111	161.00	9589112	192.00	9584112	209.00	B953613	650.00	9570110	102.00
9583112	201.00	9567112	183.00	9589113	193.00	9584113	210.00	B953616	650.00	9570111	102.00
9583113	202.00	9567113	184.00	9589114	222.00	9584114	241.00	B953620	650.00	9570112	108.00
9583114	232.00	9567114	211.00	9589115	238.00	9584115	258.00	B953625	650.00	9570113	108.00
9583115	248.00	9567115	226.00	9589116	243.00	9584116	264.00	B953630	650.00	9570114	108.00
9583116	254.00	9567116	231.00	9589117	247.00	9584117	268.00	B953635	650.00	9570115	112.00
9583117	258.00	9567117	235.00	9589118	259.00	9584118	280.00			9570116	112.00
9583118	270.00	9567118	246.00	9589119	269.00	9584119	288.00			9570117	112.00
9583121	209.00	9567119	256.00	9589120	281.00	9584120	299.00				
		9567120	267.00	9589121	198.00	9584121	217.00				
		9567121	190.00	9589122	198.00	9584122	217.00				
		9567122	190.00	9589123	218.00	9584123	238.00				
		9567123	207.00	9589124	227.00	9584124	243.00				
		9567124	216.00								

Dual Converter
9646-101 1 ea. $80.00

Dual Regulator
9641-101 1 ea. $80.00

PP SERIES Part No.	Price 1 ea.
PP1280	$41.20
PP2200	48.60
PP3280	46.40
PP4200	58.20
PP5280	55.80
PP6200	61.00

VR SERIES Part No.	Price 1 ea.
VR1050	$28.00
VR1150	28.00
VR2150	28.00
VR1200	28.00

CT SERIES Part No.	Price 1 ea.
CT1030	$15.50
CT1050	15.90
CT1070	16.40
CT1100	16.80
CT1150	17.30
CT1300	17.70
CT1500	18.20
CT1750	18.60
CT1101	19.10
CT1151	19.50
CT1301	20.00
CT1151	20.40
CT1751	20.90
CT1102	21.30

Prices and specifications in this catalog are effective 1 January 1969, and are subject to change without notice. Discounts up to 35% for 100 pieces. Contact factory for other quantity discounts.

Terms: Net 30 Days **F.O.B. Boulder, Colorado, U.S.A.**

TEC has been manufacturing highly reliable miniature DC to DC converters and associated solid state products since 1959 for industrial, commercial, aerospace and military applications. TEC's standard models utilize high quality components and materials. MTBF data has been calculated per MIL-HDBK-217, (90,000 hours, typical) for the 9583, 9567, 9589, 9584 Series.

These units are designed to meet the environmental requirements of MIL-E-5400 as specified by MIL-T-5422, and as qualified in the following paragraphs:

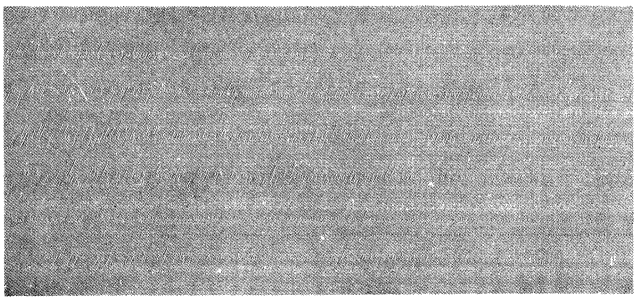
1. Temperature
   Storage (—55° to +150°C), operating case temperature (—55°C to +100°C).
2. Altitude
   Standard catalog models are designed to operate from sea level to 100,000 feet but high voltage units require additional protection for corona.
3. Humidity
   For a nominal charge TEC can encapsulate standard models to meet this requirement.
4. Salt Spray
   Supply cases are anodized aluminum per MIL-A-8625 (anodic film, type II, class II, black), and will allow the units to meet this requirement.
5. Vibration
   Units are manufactured utilizing printed circuitboard construction and vacuum potted with potting compound and have met these requirements.
6. Sand and Dust
   Desert areas — case construction and potting will allow units to meet this requirement.
7. Acceleration and Shock
   Comments in paragraph 5 apply. Units have met these requirements.
8. Explosive Atmosphere
   Cases are designed to prevent flame and explosion propagation.
9. Fungus
   Parts and materials are non-nutrient for fungus.
10. MIL-I-6181D
    For a nominal charge TEC can modify these units to meet this requirement. Additional space may be required on some models.
11. MIL-STD-704A
    Standard catalog models are designed for an input voltage of 25 to 31 VDC. They are reverse polarity protected to 50V and for input transient of 50V for one second. TEC can modify these units with additional protection to meet the total requirements of this specification.

Look in the Yellow Section for Manufacturers' Sales Offices



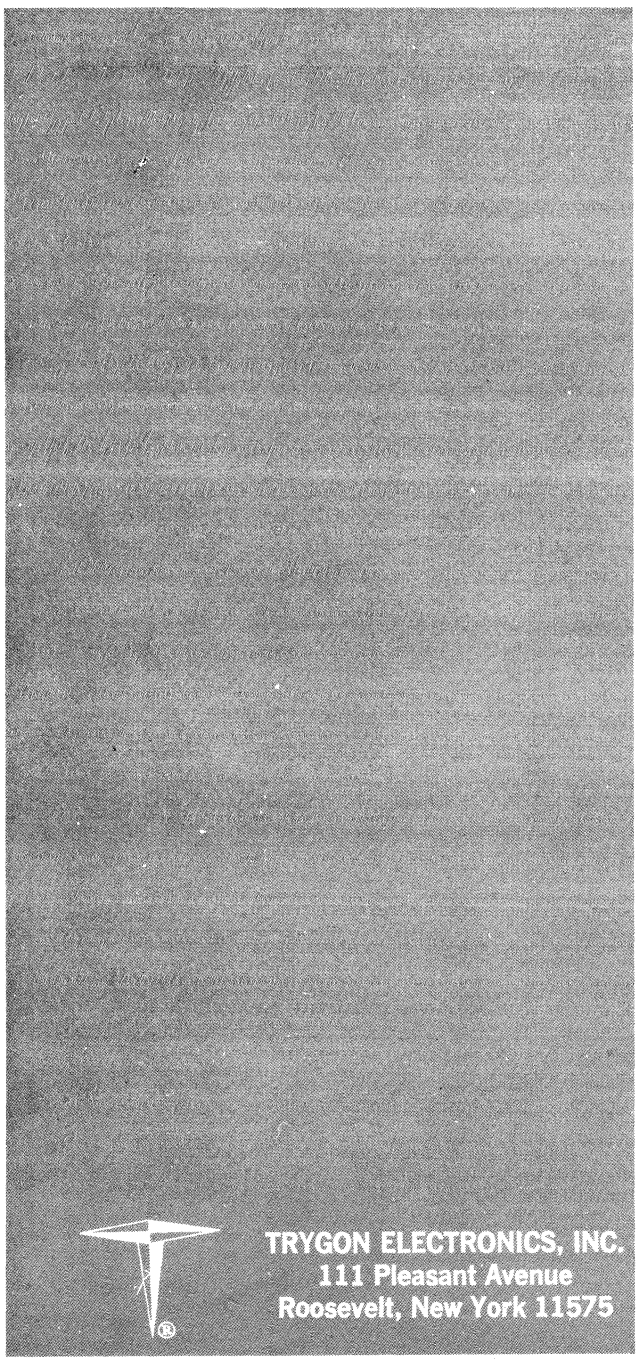
Tell them you found them in **eem**

CONDENSED CATALOG
C69



NEW!

TRYGON POWER SUPPLIES FOR 1969



- FIVE YEAR QUALITY GUARANTEE
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- LOCAL SALES/SERVICE THROUGHOUT U.S.
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- PRECISION POWER AT ECONOMICAL PRICES
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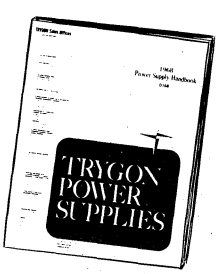
1969 Power Supply Handbook

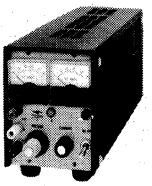


TRYGON ELECTRONICS, INC.
111 Pleasant Avenue
Roosevelt, New York 11575

TEL: (516) 378-2800 TWX: (510) 225-3664

WIDE RANGE POWER SUPPLIES FOR LAB & SYSTEM

SILICON QUARTER RACK SERIES HH



- Constant Voltage/Constant Current
- 0.01% Regulation/0.5 mv RMS Ripple
- 0.05% Stability (0.01% Optional)
- Adjustable Current Limiting

Model	Volts	Amps	Standard Model w/Meters	Overvoltage Protection (OV)	X Stability Qty 1-4
HH7-4	0-7	0-4	$199	$45	$125
HH15-3	0-15	0-3	189	45	125
HH32-1.5	0-32	0-1.5	189	45	125

Other Features: +60°C operation without derating; 5¼" panel height; Ammeter and Voltmeter; Mode Indicator Light; Remote Voltage Programming; Remote Sensing; Coarse and Vernier Voltage Adjust, 47-420 Hz Input Frequency.

HALF RACK SERIES HR



- Constant Voltage/Constant Current
- 0.01% Line Reg./0.05% Load Reg.
- 0.15 mv RMS Ripple
- 0.05% Stability (0.01% Optional)
- Adjustable Current Limiting

Model	Volts	Amps	Standard Model Metered	Overvoltage Protection (OV)	High Stability Option (X)
HR20-1.5	0-20	0-1.5	$169	$65	$125
HR40-750	0-40	0-0.75	169	65	125

Other Features: +50°C operation without derating; 5¼" panel height; Switchable, dual range ammeter/voltmeter; Remote Voltage Programming; Remote Sensing; 48-400 cps input frequency; Coarse and Vernier Voltage and Current Adjust.

SILICON MEDIUM POWER HALF RACK SERIES HR (B), SHR

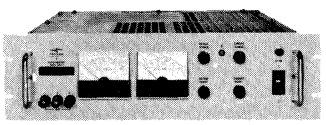


- Constant Voltage/Constant Current
- 0.01% Regulation/0.5 mv RMS Ripple
- 0.05% Stability (0.01% Optional)
- Adjustable Current Limiting
- TRYLINK Precision Current Regulation Mode (HR-B)

Model	Volts	Amps	Standard Model w/Meters	Overvoltage Protection (OV)	X Stability Qty 1-4
SHR20-3A	0-20	0-3	$239	$ 65	$ 125
SHR40-1.5A	0-40	0-1.5	239	65	125
SHR60-1A	0-60	0-1	259	65	125
SHR160-500B	0-160	0-0.5	329	—	125
HR20-5B	0-20	0-5	329	65	125
HR20-10B	0-20	0-10	398	65	125
HR40-3B	0-40	0-3	325	65	125
HR40-5B	0-40	0-5	353	65	125
HR40-7.5B	0-40	0-7.5	429	65	125
HR60-2.5B	0-60	0-2.5	355	65	125
HR60-5B	0-60	0-5	419	90	125
HR160-2B	0-160	0-2	510	90	125

Other Features: +60°C operation without derating; 5¼" panel height; Ammeter and Voltmeter; Mode Indicator Light; Remote Programming; Remote Sensing; Coarse and Vernier Voltage and Current Adjust.

SUPER MERCURY SERIES



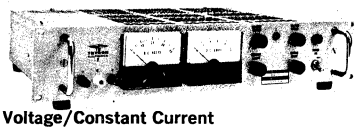
- Constant Voltage/Constant Current
- 0.005% Regulation
- 1mv RMS Ripple
- 25mv P-P Noise
- 0.015% Stability
- Automatic Adjustable Current Limiting
- Ultra High Stability Option
- High Speed Programming Option
- Automatic load share paralleling
- Master slave tracking

Model	Volts	Amps	Panel Hgt. in.	Standard Model w/Meters	OV Option	X Option
M3P8-25 OV	0-8	25	3½	$ 575	Standard	—
M5P8-50 OV	0-8	50	5¼	750	Standard	—
M7C8-100 OV	0-8	100	7	995	Standard	100
M5P15-30	0-15	30	5¼	660	$100	—
M5C15-50	0-15	50	5¼	845	100	100
M7C15-80	0-15	80	7	1250	100	100
M5P36-15	0-36	15	5¼	615	100	—
M5C36-30	0-36	30	5¼	705	100	100
M7C40-50	0-40	50	7	975	100	100
M5P60-10	0-60	10	5¼	660	130	—
M5C60-15	0-60	15	5¼	725	130	100
M7C60-30	0-60	30	7	1070	130	100
M5C160-5	0-160	5	5¼	995	130	100
M7C160-8	0-160	8	7	1250	130	100
M7C160-15	0-160	15	7	1550	150	100

X=Ultra High Stability .005% (C units only)

Other Features: M-C Series, +60°C operation; M-P Series, +50°C operation; Panel heights from 3½" to 10½"; Remote programming and remote sensing; 47-65Hz input frequency.

SILICON RACK SERIES RS



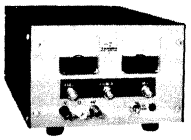
- Constant Voltage/Constant Current
- +71°C Operation Without Derating
- 0.01% Regulation/0.5 mv RMS Ripple
- 0.05% Stability (0.01% Optional)
- Adjustable Current Limiting

Model	Volts	Amps	Panel Hgt. (")	Standard Model w/Meters	Overvoltage Protection (OV)	X Stability Qty 1-4
RS20-7.5A	0-20	0-7.5	3½	$430	$ 95	$125
RS20-15A	0-20	0-15	3½	515	125	125
RS40-5A	0-40	0-5	3½	445	95	125
RS40-10A	0-40	0-10	3½	530	125	125
RS60-7.5A	0-60	0-7.5	3½	625	145	125
RS160-1A	0-160	0-1	3½	550	125	125
RS160-3A	0-160	0-3	3½	685	145	125
RS320-1.5B	0-320	0-1.5	3½	625	N/A	125

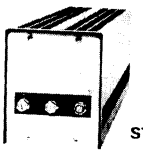
TRYGON ELECTRONICS, INC. 111 PLEASANT AVENUE ROOSEVELT, L. I., N. Y. 11575

SYSTEM SLOT RANGE POWER SUPPLIES

LIBERATOR SUB RACK SERIES LQ/LH



LHS METERED OPTION



LQS STANDARD UNIT



LVS

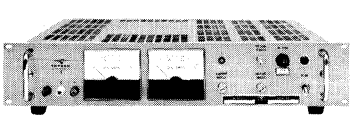
FEATURES

- All silicon design—precision performance
- Low noise for IC and systems applications
- Compact size—Modular and Metered models
- Wide slot voltage range—Adjustable Current Limiting
- Convection cooling—no temperature derating to 60°C
- Remote sensing
- Remote voltage programming
- Extremely low output impedance
- 0.03% Stability (0.01% Optional)
- Overvoltage protection option
- Integral meter and control options
- Quarter Rack and Half Rack Sizes

Model	Volts	Amps 60°C	Amps 71°C	Overvoltage Protection (OV)	Standard Model
LVS4-2.1	2.5-5.5	2.1	1.7	$30*	$105
LQS4-3.8	2.5-5.5	3.8	2.8	35	135
LQS4-8.4	2.5-5.5	8.4	7.7	35	174
LHS4-14	2.5-5.5	14	12.5	75	229
LHS4-25	2.5-5.5	25	23	75	320
LVS6-1.9	4.5-7.8	1.9	1.4	30*	105
LQS6-3.3	4.5-7.8	3.3	2.3	35	135
LQS6-7.7	4.5-7.8	7.7	7.0	35	179
LHS6-13.5	4.5-7.8	13.5	12	75	229
LHS6-24	4.5-7.8	24	22	75	320
LVS8-1.6	6.5-10.5	1.6	1.3	30*	110
LQS8-3.1	6.5-10.5	3.1	2.1	35	139
LQS8-6.5	6.5-10.5	6.5	5.9	35	189
LHS8-11.5	6.5-10.5	11.5	10	75	239
LHS8-21	6.5-10.5	21	19	75	320
LVS10-1.7	8.5-11.5	1.7	1.3	30*	110
LQS10-3	8.5-11.5	3	2.3	35	139
LQS10-6.5	8.5-11.5	6.5	5.9	35	189
LHS10-11.5	8.5-11.5	11.5	10	75	239
LHS10-21	8.5-11.5	21	19	75	320
LVS12-1.4	11-15	1.4	1.1	30*	107
LQS12-2.5	11-15	2.5	1.9	35	135
LQS12-5.7	11-15	5.7	5.2	35	174
LHS12-10	11-15	10	9	75	229
LHS12-18	11-15	18	16	75	320
LVS18-1.1	13.5-20.5	1.1	0.9	30*	107
LQS18-1.9	13.5-20.5	1.9	1.4	35	135
LQS18-4.3	13.5-20.5	4.3	4	35	174
LHS18-7.5	13.5-20.5	7.5	6.5	75	229
LHS18-13	13.5-20.5	13	12.6	75	310
LVS24-.8	18.5-27.5	0.8	0.65	30*	107
LQS24-1.5	18.5-27.5	1.5	1.2	35	135
LQS24-3.3	18.5-27.5	3.3	3	35	174
LHS24-5.7	18.5-27.5	5.7	5	75	219
LHS24-10	18.5-27.5	10	9.7	75	279
LVS28-.75	22-33	0.75	0.6	30*	107
LQS28-1.4	22-33	1.4	1.1	35	135
LQS28-2.9	22-33	2.9	2.7	35	174
LHS28-5.1	22-33	5.1	4.5	75	219
LHS28-9	22-33	9	8.5	75	279
LVS48-.37	32-53	0.37	0.3	30*	110
LQS48-.67	32-53	0.67	0.60	35	139
LQS48-1.9	32-53	1.9	1.7	35	185
LHS48-3.3	32-53	3.3	3	75	229
LHS48-5.8	32-53	5.8	5.2	75	295
LVS65-.23	50-83	0.23	0.2	30*	119
LQS65-1.3	50-83	1.3	1.1	35	199
LHS65-2.8	50-83	2.8	2.5	75	320
LVS100-.18	80-126	0.18	0.15	30*	129
LQS100-.86	80-126	0.86	0.77	35	199
LHS100-2.1	80-126	2.1	1.9	75	320
LVS150-.15	115-161	0.15	0.12	30*	129
LQS150-.67	115-161	0.67	0.62	35	199
LHS150-1.9	115-161	1.9	1.7	75	320

LV = Low Power Module; LQ = Quarter Rack; LH = Half Rack
*OV Modules available, see page 9

LIBERATOR RACK SERIES L3R/L5R



FEATURES

- All silicon design—precision performance
- 0.005% Regulation 1 mv RMS Ripple
- Low noise for IC and systems applications
- 3 mv P-P Noise
- Wide slot voltage ranges—currents to 70A
- 0.01% Stability
- Automatic load share paralleling
- Adjustable Current Foldback Limiting
- Remote sensing and programming
- Low Output Impedance
- +60°C Without Derating

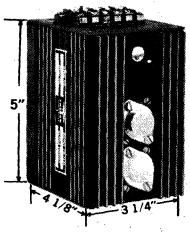
Model	Volts	Amps	Panel Hgt. In.	Overvoltage Protection (OV)	Standard Model w/Meters
L3R4-40	2.5-5.5	40	3½	$90	$470
L5R4-70	2.5-5.5	70	5¼	90	575
L3R6-40	4.5-7.8	40	3½	90	470
L5R6-70	4.5-7.8	70	5¼	90	595
L3R8-25	6.5-10.5	25	3½	90	470
L5R8-50	6.5-10.5	50	5¼	90	595
L3R10-25	8.5-11.5	25	3½	90	505
L5R10-50	8.5-11.5	50	5¼	90	620
L3R12-25	11 -15	25	3½	90	470
L5R12-50	11 -15	50	5¼	90	565
L3R18-20	13.5-20.5	20	3½	90	505
L5R18-40	13.5-20.5	40	5¼	90	620
L3R24-15	18.5-27.5	15	3½	90	470
L5R24-30	18.5-27.5	30	5¼	90	565
L3R28-15	24 -33	15	3½	90	470
L5R28-30	24 -33	30	5¼	90	565
L3R48-8.5	32 -53	8.5	3½	90	520
L5R48-17	32 -53	17	5¼	90	640
L3R65-6	50 -83	6	3½	120	530
L5R65-12	50 -83	12	5¼	120	650
L3R100-4	80 -126	4	3½	120	530
L5R100-8	80 -126	8	5¼	120	680
L3R150-3	115 -161	3	3½	120	530
L5R150-6	115 -161	6	5¼	120	690

Other Features: +60°C operation; 3½" and 5¼" panel heights; 47-65Hz input frequency.

MODULAR POWER SUPPLIES

DUAL OUTPUT SILICON MODULES

- ALL SILICON DESIGN
- +71° C OPERATION WITHOUT DERATING
- 0.1% REGULATION/0.5 MV RIPPLE
- DUAL OUTPUTS (TRACKING)
- INDEPENDENT OF EXTERNAL HEAT SINKS



PSD Series 1

Other Features: Remote Sensing; Recessed Screwdriver Voltage Adjust; 47-420 cps input frequency; Current Limiting short circuit protection.

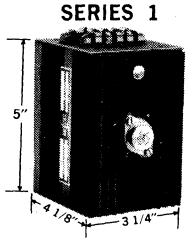
OUTPUTS				PRICE		
Model	*Volts	Amps	Nominal Impedance DC-1KC	1-9	10-49	50-up
PSD12-300	±12	0-0.3	0.05Ω	$127	$119	$115
PSD15-300	±15	0-0.3	0.05Ω	127	119	115

*±0.5 volt adjustment of output #1 from nominal output

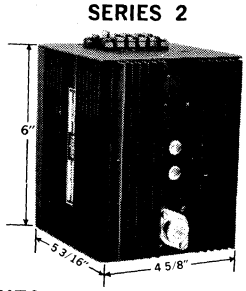
HM — Standard units designed for vertical mounting. For horizontal mounting (HM) add $5.00 for mounting adapters.

- All Silicon Design
- 0.01% Regulation
- +71°C Operation Without Derating
- Independent of External Heat Sinks
- 0.5 mv RMS Ripple (2 mv for units over 100 volts)

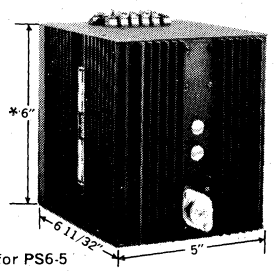
SERIES 1



SERIES 2



SERIES 4



*6½" for PS6-5

Other Features: Remote Programming over output voltage range; Recessed Screwdriver Voltage adjust; Remote Sensing; Series 1 only — 57-400 cps input frequency, Foldback current protection (except D option units which have Automatic Current Limiting); Series 2 and 4 — Automatic current Limiting.

	OUTPUT				PRICE				
Series	Model	Volts	Amps	Nominal Impedance DC-1KC	1-9	10-49	50-up	Overvoltage Protection	High Stability (X) (0.01%)
1	PS3-1.5F	2.5-3.5	0-1.5	0.010	99	95	92	FOV4.7	—
	PS6-1F	4-8	0-1	0.010	97	93	90	FOV9.2	—
	PS12-900F	10-14	0-0.9	0.011	97	93	90	FOV16	—
	PS15-800F	13-17	0-0.8	0.011	99	95	92	FOV19	—
	PS18-800F	16-20	0-0.8	0.013	99	95	92	FOV23	—
	PS20-400	0-20	0-0.4	0.025	99	95	92	OV	X
	PS24-700F	22-26	0-0.7	0.015	99	95	92	FOV28	—
	PS28-600F	26-30	0-0.6	0.017	99	97	94	FOV34	—
	PS32-250	0-32	0-0.25	0.040	99	97	94	OV	X
	PS48-400F	46-50	0-0.4	0.025	114	111	107	FOV52	—
	PS50-150	0-50	0-0.15	0.065	103	98	95	OV	X
	PS60-200F	50-70	0-0.2	0.03	114	111	107	FOV82	—
	PS100-200F	90-110	0-0.2	0.065	124	114	112	—	—
	PS150-120F	140-160	0-0.12	0.067	139	131	127	—	—
	PS200-100F	190-210	0-0.1	0.1	139	131	127	—	—
2	PS12-2	0-12.5	0-2	0.005	167	154	147	OV	X
	PS20-1.5	0-20	0-1.5	0.006	167	154	147	OV	X
	PS32-1.25	0-32	0-1.25	0.008	172	165	153	OV	X
	PS50-750	0-50	0-0.75	0.015	182	165	154	OV	X
	PS100-400	0-100	0-0.4	0.065	193	177	171	—	X
	PS160-250(1)	0-160	0-0.25	0.067	198	182	176	—	X
4	PS6-5	0-6	0-5	0.0010	182	166	159	OV	X
	PS12-4	0-12.5	0-4	0.0025	182	166	159	OV	X
	PS20-3	0-20	0-3	0.0030	182	166	159	OV	X
	PS32-2.5	0-32	0-2.5	0.0040	187	174	163	OV	X
	PS50-1.5	0-50	0-1.5	0.0075	193	174	163	OV	X
	PS100-750	0-100	0-0.75	0.0070	199	186	179	—	X
	PS160-500(1)	0-160	0-0.5	0.0070	208	191	184	—	X

(1) Recessed screwdriver voltage adjustment range 80v to 160v, remote programming over full range 0 to 160v.

Option Prices — PS Series 1, 2, and 4	1-4	5-9	10-49	50-up
Horizontal Mounting (HM)	$ 5	$ 5	$ 5	$ 5
Series 1 Overvoltage Protection (FOV & OV)	60	50	45	45
Series 2 & 4 Overvoltage Protection (OV)	95	75	70	70
High Stability (X)	75	45	35	25
(1) Special Voltage	75	40	22	8
(2) Series Start (D)	35	18	10	5
Solder Lugs (SL) — Special orders only	75	25	15	5
Octal Sockets (OS) — Special orders only	75	25	15	5

OPTIONS AVAILABLE

Overvoltage Protection — OV
Provides a maximum output voltage clamp for internal and external OV protection.

High Stability — X
0.01% stability with a T.C. of (0.01% + 200 μv)/°C.

Special Voltages — F
Special voltage available for suffix F units. The available current output will be that of the next high voltage standard unit.

Series Start Option — D
Available for Series 1 Modules only. Not required for PS3, PS6, Series 2,4, and wide range units.

Solder Lug Terminals — SL (Special factory order only)

Octal Socket (plug-in) — OS (Special factory order only)

Horizontal Mounting — HM

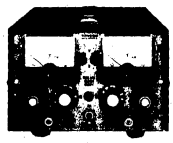
For Higher Power Modular Ratings—See Liberator Sub Rack Series

TRYGON ELECTRONICS, INC. 111 PLEASANT AVENUE ROOSEVELT, L. I., N. Y. 11575

LABORATORY POWER SUPPLIES

SILICON DUAL LAB SERIES DL

Model	Volts	Amps	Price w/Meters
DL40-1	Dual 0-20	0-1	$249
These outputs available from standard unit.	0-20	0-2	
	Dual 0-40	0-0.5	
	0-40	0-1	
	0-80	0-0.5	



- Dual Outputs, Independently Adjustable
- Dual Ranges on Each Output
- 0.01% Regulation/250 μv RMS Ripple
- 0.05% Stability
- Calibrated Current Limiting

Other Features: +50°C operation without derating; 5¼" panel height; Switchable, dual range, ammeter/voltmeter for each supply; Selectable current limit ranges; Remote Voltage Programming; Remote Sensing; 100-125/200-250 VAC input; 47-420 Hz input frequency; Automatic Adjustable Current Limiting; Coarse and Vernier Voltage Adjust.

ECONOMY LAB SERIES EAL

- True Economy Lab Supply
- 0.01% Regulation
- 0.5 MV Ripple

Model	Volts	Amps	Price Metered
EAL10-1	0-10	0-1.0	$99
EAL20-500	0-20	0-0.5	99
EAL32-300	0-32	0-0.3	99
EAL50-250	0-50	0-0.25	99



Other Features: Small size, 3½" x 4⅛" x 6½"; Switchable front panel volt/ammeter; Concentric voltage adjust; AC power switch and pilot light; Three-wire line cord and fuse on rear panel; 57-65 Hz input.

TRYLAB® SERIES T



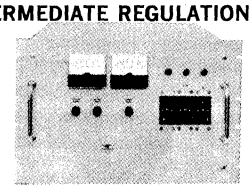
- 0.05% Regulation
- 0.5 mv RMS Ripple
- 0.05% Stability

Model	Volts	Amps	Price Metered
T50-2	0-50	0-2	$249

Other Features: +50°C operation without derating; Switchable ammeter voltmeter; Remote Sensing; 50-400 cps input frequency; Automatic Electronic Switching, Model T50-2; Constant Voltage; Constant Current, Vernier Voltage Adjust.

INTERMEDIATE REGULATION POWER SUPPLIES

INTERMEDIATE REGULATION SERIES CR

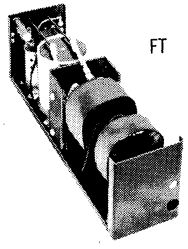


- Constant Voltage/ Constant Current
- 0.2% Regulation 150 mv RMS Ripple
- 0.25% Stability
- Adjustable Current Limiting

Model	Volts	Amps	Panel Hgt. (")	Overvoltage Protection (OV)	Standard Model w/Meters
CR20-150	0-20	0-150	12¼	$325	$1450
CR36-100	0-36	0-100	12¼	300	1350
CR65-55	0-65	0-55	12¼	300	1350
CR110-30	0-110	0-30	12¼	—	1450

FERRORESONANT SERIES FT

- Modular Construction
- Fixed DC Output Voltages
- 1% Line Regulation
- 1% Stability
- Current Limiting

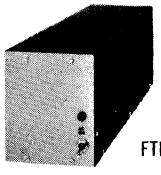


Model	Volts	Amps	Load Regulation ½ Load to Full Load (Volts)	Ripple (mv) RMS	Prices 25-49
FT6-25	6.3	0-25	0.6	500	$125
FT12-15	12	0-15	1	400	125
FT15-10	15	0-10	0.9	400	125
FT18-10	18	0-10	0.9	400	125
FT24-8	24	0-8	1	400	125
FT28-7	28	0-7	0.9	400	125
FT48-4	48	0-4	1.4	400	125
FT150-1	150	0-1	5	500	125
FT300-500	300	0-0.5	10	700	125

Not available in small quantities. Price for 50 and up $119 each.

FERRORESONANT SERIES FTR

- Modular (FT) or ¼ Rack Mount (FTR)
- Fixed DC Output Voltages
- 1% Line Regulation
- 1% Stability
- Current Limiting



Model	Volts	Amps	Load Regulation ½ Load to Full Load (Volts)	Ripple (mv) RMS	Prices 1-8
FTR6-25	6.3	0-25	0-6	500	$152
FTR12-15	12	0-15	1	400	179
FTR15-10	15	0-10	0.9	400	179
FTR18-10	18	0-10	0.9	400	179
FTR24-8	24	0-8	1	400	152
FTR28-7	28	0-7	0.9	400	152
FTR48-4	48	0-4	1.4	400	179
FTR150-1	150	0-1	5	500	179
FTR300-500	300	0-0.5	10	700	179

Other Features: +55°C Operation without derating; 5¼" panel height.

TRYGON ELECTRONICS, INC. 111 PLEASANT AVENUE ROOSEVELT, L. I., N. Y. 11575

STATIC POWER

From

UNITRON

DIVISION OF ELECTRIC MACHINERY MFG. COMPANY

SPECIALISTS IN SOLID STATE POWER CONVERSION

UNINTERRUPTABLE POWER SYSTEMS

FREQUENCY CONVERTERS AND STATIC INVERTERS FOR MILITARY AND INDUSTRIAL SYSTEMS APPLICATIONS

VARIABLE SPEED DRIVES FOR CONTROL OF AC MOTORS

SPECIAL PURPOSE STATIC POWER EQUIPMENT

Since its establishment in 1960, Unitron has specialized in the design and development of solid-state static power conversion equipment. Pioneering in power applications, Unitron has continued to help define the state of the art and now supplies power conversion equipment for military, commercial and industrial users. Unitron's leadership has been accomplished by a philosophy which stresses the use of the best in design and manufacturing techniques and quality components to produce equipment of high reliability and superior performance within practical economic limits.

Many units developed by Unitron to meet specific requirements have a wide range of practical applications and have become a part of Unitron's standard line. In addition, Unitron designs, develops and manufactures specialized custom power equipment. Unitron engineers will be glad to discuss your specific static power conversion problem with you, and show you how Unitron can help you achieve the best solution.

UNINTERRUPTABLE POWER SYSTEMS
Static Inverter / Battery / Battery Charger

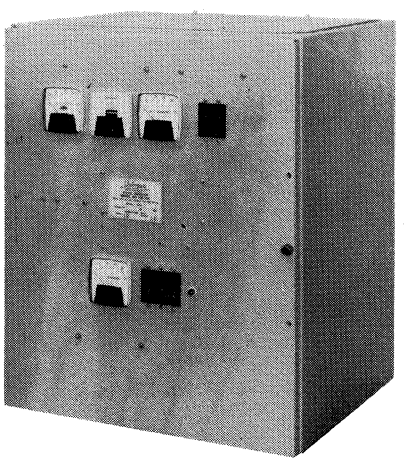
1, 3, and 5 KVA single phase units ▪ Versatile, low-cost standby power system ▪ For continuous line supply or continuous inverter supply operation ▪ Manual, relay or static switching ▪ Optional line synchronization ▪ Fully metered ▪ Overload protected ▪ Excellent voltage and frequency regulation ▪ Low maintenance

APPLICATIONS: To provide continuous power for data processing and critical process controls, or to allow the orderly shutdown of a process, in the event of line power failure.

Static Inverter	USI-100	USI-101	USI-102
Input	105-140 VDC	105-140 VDC	105-140 VDC
Output	1 KVA	3 KVA	5 KVA
Voltage Regulation*	118 RMS ± 4%	118 RMS ± 4%	118 RMS ± 4%
Frequency Regulation*	60 Hz ±1%	60 Hz ±1%	60 Hz ±1%
Harmonic Distortion*	5% max.	5% max.	6% max.
Power Factor	0.80 lagging to 1.0		
Operating Temperature	–20°C to +40°C (–4°F to +104°F)		

***Under all conditions of line, load and temperature**

Please consult factory for higher power ratings.



MODEL USI-102
5KVA

Battery Chargers: Model UBC-100, 18 amp; UBC-101, 50 amp, and UBC-102, 90 amp.

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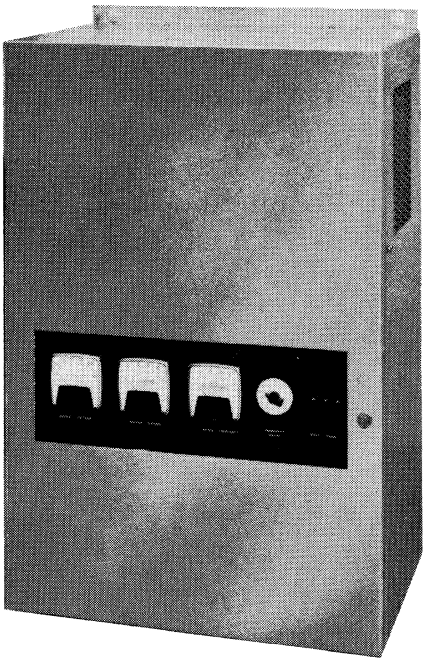
SPECIALISTS IN SOLID STATE POWER CONVERSION

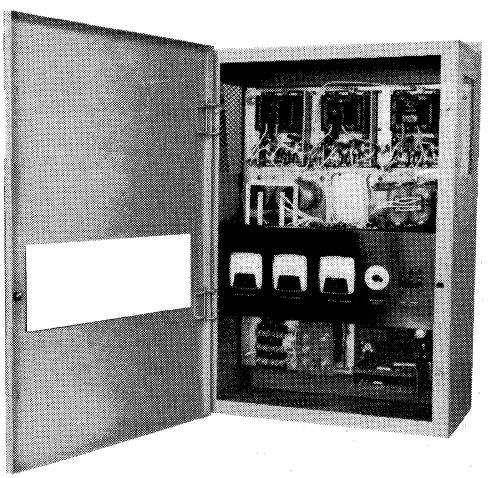
VARIABLE SPEED DRIVES FOR CONTROL OF AC MOTORS

■ Soft start capability ■ Full range speed control ■ Self compensating for load variations ■ Maintains full torque into load ■ Open- or closed-loop operation ■ Easily installed on existing motors ■ No structural modifications required ■ Metered for simple check-out



APPLICATIONS: Rotary, reciprocating and centrifugal pumps and compressors; large circular saws and fans; cranes and hoists; winding, polishing, grinding, milling and textile machinery; motor generator sets; and all applications where speed control, torque control, or soft starts are required.

Simple, low-cost controller provides variable frequency supply with constant volt-seconds to AC motors; maintains full torque into load. Precision control makes AC motors practical for changing or high inertial loads. Soft start and overload limiting capabilities reduce inrush current to 1.5 full load motor current, eliminate need for external starters. May be located in any convenient location; no structural modifications required. Modular construction facilitates ease of check-out and low mean time to repair. Available in special housings for hazardous, corrosive, and other hostile environments. ***Standard units 10-100 HP; consult factory for higher HP ratings.***



GENERAL SPECIFICATIONS

HORSEPOWER: 10 through 100 HP with full range of intermediate values.

INPUT VOLTAGE: 3 ϕ, 220 or 440 VAC, $\pm$15%.

INPUT FREQUENCY: 50 or 60 Hz, $\pm$1.5%

OUTPUT VOLTAGE (AT FULL SPEED): 3 ϕ, 220 or 440 VAC (nominal)

OUTPUT FREQUENCY: 2 to 60 Hz (higher maximum frequencies available on special order).

OUTPUT FREQUENCY STABILITY: $\pm$1%

CONVERSION EFFICIENCY (AT FULL LOAD): 95%

OPERATING TEMPERATURE RANGE: –30°C to +55°C

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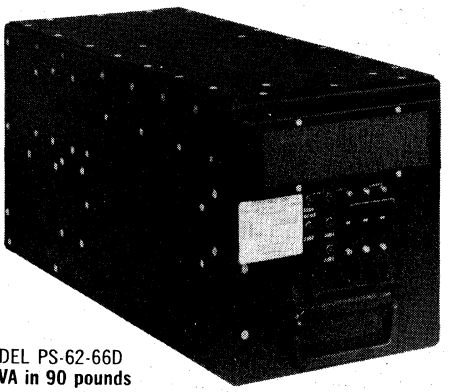
SPECIALISTS IN SOLID STATE POWER CONVERSION

1624 NORTH FIRST STREET • P.O. BOX 1331 • GARLAND, TEXAS 75040 • (AC 214) 276-8591 • TWX 910-860-5195

FREQUENCY CONVERTERS

400 Hz to 60 Hz SINE WAVE OUTPUT

Meets Applicable MIL Specifications for Airborne and Ground Support Equipment



MODEL PS-62-66D
3.5KVA in 90 pounds

FEATURES

■ High efficiency ■ RFI protection ■ Short circuit and overload protection ■ Long, maintenance-free operation ■ Self-contained cooling ■ Light weight ■ Low distortion

APPLICATIONS

These converters provide a dependable source of 60 Hz sine wave power for airborne and air-transportable test equipment. They are also used with 60 Hz ground equipment wherever primary power available is 400 Hz. Applications include use with oscilloscopes, metering equipment, recorders, cryptographic machines, and teletypes.

MODEL	POWER	INPUT		OUTPUT		SIZE (Dim. in Inches)
PS-65-225-7	400 VA	115/200 VAC	400 Hz	115 VAC ± 5 %	60 Hz ± 1.0%	7.8 x 5.2 x 21.3
PS-64-162	750 VA	115/200 VAC	400 Hz	115 VAC ± 5 %	60 Hz ± 1.0%	7.5 x 12 x 20.5
PS-61-41B	1500 VA	115/200 VAC	400 Hz	115 VAC ± 10 %	60 Hz ± 1.0%	19 x 10.5 x 14.25
PS-62-66D	3500 VA	115/200 VAC	400 Hz	115 VAC ± 2.5%	60 Hz ± 1.0%	10 x 9 x 21.6
PS-61-33D	8000 VA	115/200 VAC	400 Hz	115 VAC ± 2.5%	60 Hz ± 1.0%	12.2 x 20 x 23.5

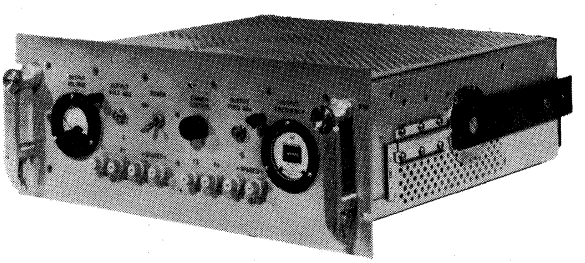
All units available with other input voltages, and frequencies of 360-1000 Hz.

All units available with output frequency to 0.01%.

FREQUENCY CONVERTERS

60 Hz to 400 Hz SINE WAVE OUTPUT

Meets Applicable MIL Specifications for Shipboard and Ground Support Equipment



MODEL PS-65-243-1

FEATURES

■ High efficiency ■ Small size ■ Light weight ■ Low distortion ■ Virtually no audible noise ■ Long, maintenance-free operation ■ Short circuit and overload protection ■ RFI protection

APPLICATIONS

Extremely stable and quiet-operating, these converters are excellent for flight simulators, and wherever 400 Hz power is required to operate airborne-type equipment. Other applications include ground support systems, design and test labs, and shipboard installations.

MODEL	POWER	INPUT		OUTPUT		SIZE (Dim. in Inches)
PS-65-243-1	1000 VA	115 VAC	60 Hz 1ϕ	*115 VAC ± 2%	§400 Hz ± 1.0%	19 x 7 x 20.5
PS-67-325-1	2000 VA	115/200 VAC	60 Hz 3ϕ	115 VAC ± 2%	400 Hz ± 1.0%	11.75 x 18 x 22.75
PS-67-326-1	2500 VA	115/200 VAC	60 Hz 3ϕ	115/200 VAC ± 2%	400 Hz ± 1.0%	14 x 18 x 25.25
PS-68-346R	3500 VA	115/200 VAC	60 Hz 3ϕ	115 VAC ± 2%	400 Hz ± 1.0%	19 x 17.5 x 21.5
PS-65-216-2	8000 VA	115/200 VAC	60 Hz 3ϕ	115/200 VAC ± 2%	400 Hz ± 0.5%	19 x 19 x 21.75
PS-67-337	15000 VA	120/208 VAC	60 Hz 3ϕ	120/208 VAC ± 2%	400 Hz ± 1.0%	19 x 42 x 21.75

*Adjustable, 105 to 125 VAC §Adjustable, 380 to 420 Hz

Model PS-67-325-R available in rack-mount, fully-metered configuration.

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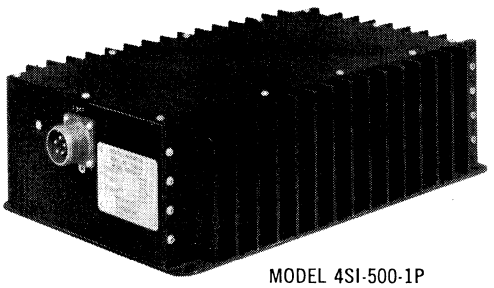
SPECIALISTS IN SOLID STATE POWER CONVERSION

STATIC INVERTERS

28 VDC to 400 Hz SINE WAVE OUTPUT

Meets Applicable MIL Specifications for Airborne and Ground Support Equipment



MODEL 4SI-500-1P

FEATURES

■ Overload and short-circuit protected ■ High efficiency ■ Light weight ■ Voltage-regulated ■ Low distortion ■ Stable output frequency ■ Long, maintenance-free operation ■ Virtually no audible noise ■ RFI protection

APPLICATIONS

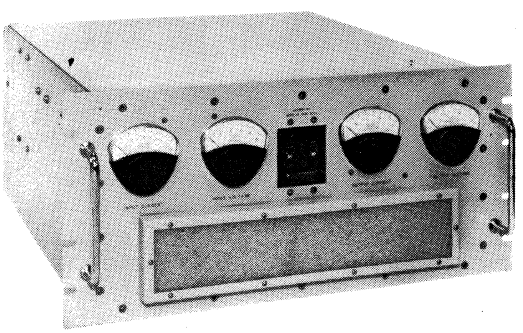
These inverters are ideal for providing AC power from DC sources to one or more items of airborne equipment, and also are excellent sources of power for 400 Hz ground support equipment. Typical applications include use with weather radar, Doppler navigation systems, artificial horizons, omni's, autopilots, ADF, DME, transceivers, transponders, and engine analyzers.

MODEL	POWER	INPUT	OUTPUT		SIZE (Dim. in Inches)
PS-67-321	75 VA	24 to 32 VDC	26 VAC ± 5%	400 Hz ± 5%	11.5 x 7 x 5
4SI-125-1P	125 VA	24 to 32 VDC	115 VAC ± 2%	400 Hz ± 1%	9.7 x 6 x 3.4
4SI-250-1P	250 VA	24 to 32 VDC	115 VAC ± 2%	400 Hz ± 1%	11.2 x 6.5 x 4.2
4SI-500-1P	500 VA	24 to 32 VDC	115 VAC ± 2%	400 Hz ± 1%	14.2 x 8.7 x 4.2
4SI-750-3P	750 VA	24 to 32 VDC	115/200 VAC ± 2%	400 Hz 3ϕ ± 1%	17.4 x 10.2 x 7.7
4SI-3000-3P	3000 VA	22.5 to 30 VDC	115/200 VAC ± 3%	400 Hz 3ϕ ± 5%	21.5 x 20 x 26

STATIC INVERTERS

28 VDC to 60 Hz SINE WAVE OUTPUT

Meets Applicable MIL Specifications for Airborne and Ground Support



MODEL PS-67-324-1

FEATURES

■ High efficiency ■ Light weight ■ Small size ■ Low distortion ■ Virtually no audible noise ■ Long, maintenance-free operation ■ Short circuit and overload protection ■ RFI protection

APPLICATIONS

For aircraft instrumentation systems with 28 VDC electrical systems, and for flying laboratories, these instruments provide an excellent source of 60 Hz power. Applications for these inverters include power for oscilloscopes, meters, cryptographic machines, teletypes, and recorders.

MODEL	POWER	INPUT	OUTPUT		SIZE (Dim. in Inches)
PS-65-178-B	250 VA	24 to 32 VDC	115 VAC ± 2%	60 Hz ± 1.0%	7.9 x 10.4 x 14
PS-65-236	500 VA	24 to 32 VDC	115 VAC ± 2%	60 Hz ± 1.0%	7.9 x 10.4 x 17.3
PS-63-81A	1000 VA	24 to 32 VDC	115 VAC ± 2%	60 Hz ± 0.1%	19 x 8.75 x 20.2
PS-67-324-1	2000 VA	24 to 32 VDC	115 VAC ± 5%	60 Hz ± 1.0%	19 x 8.75 x 20
PS-64-154	3600 VA	24 to 32 VDC	115 VAC ± 5%	60 Hz ± 1.0%	13 x 22.8 x 24.4

All units available with output frequency of 0.01%.

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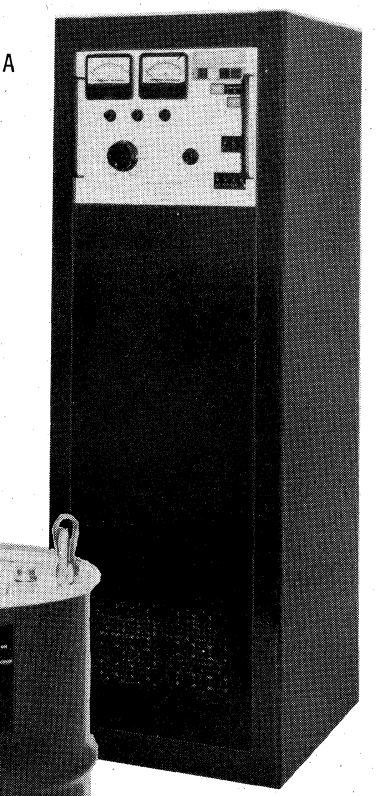
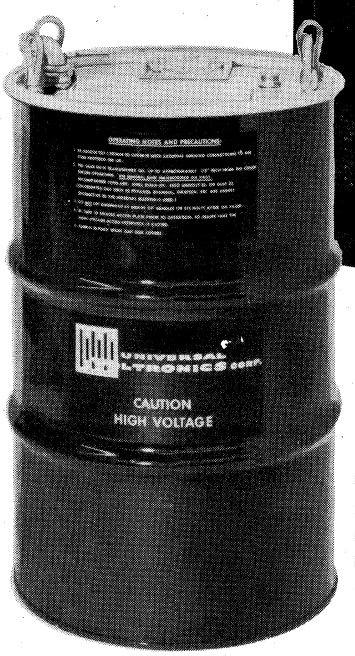
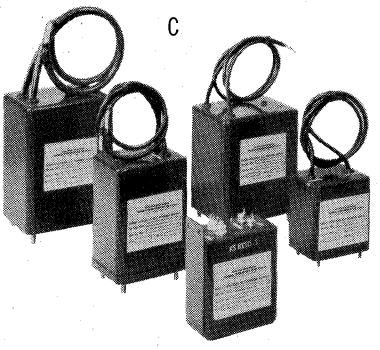
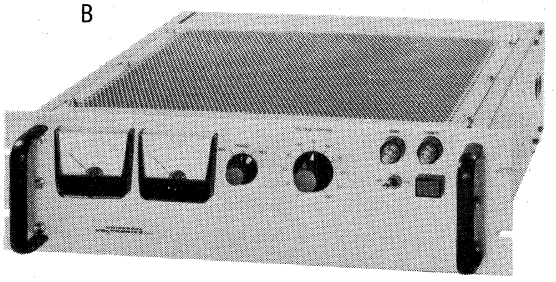
high VOLTAGE DC POWER SUPPLIES









ADJUSTABLE OUTPUT POWER SUPPLIES

Series "BA" adjustable power supplies and series "BP" power packs are available at voltage ratings from 1 KVDC through 2000 KVDC at output power ratings from 1 watt to 250 kilowatts continuous. The adjustable series includes applications oriented control features and package design as shown in photos A and B. The power pack series (photos C and D) has many applications in OEM systems and for general laboratory use.

Every UVC power supply includes conservatively rated high voltage components designed and manufactured under the strict control of the specialized UVC technical staff to insure continuous duty, long term, trouble free operation. A one year factory backed and field supported warranty policy accompanies each shipment.

LOOK AT THESE FEATURES

1. **Ripple** Each power supply offers a standard ripple specification of 5% maximum or better. Optional filters and attenuators are available for every UVC supply to reduce ripple to as low as .01% rms.
2. **Polarity** Each power supply offers the flexibility of reversible output polarity performance.
3. **Protection** Overvoltage and overcurrent protection features are available as both adjustable range and fixed value circuits. All access areas and doors are interlocked for personnel protection and all energy storage components and circuits are discharge protected for personnel protection.
4. **Package** Rack mounted, floor and bench operable as well as portable design are among the packages available for UVC standard high voltage power supplies.

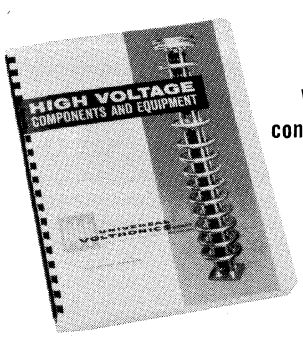


PRECISELY REGULATED EQUIPMENT

Precisely regulated performance over wide adjustment range, low ripple, fast response and high stability enable the series "BRE" power supplies to be used in exacting work for x-ray spectroscopy, electron microscopes, TWTs, ion bombardment experiments, particle separators.

These precisely regulated power supplies are available in voltage ratings from 1 KV through 500 KVDC at continuous duty output power up to 40 KW. Our regulation circuitry techniques realize performance specifications which are virtually independent of input line variations or no load-full load changes. Ripple in most cases is 0.01% rms and the output polarity is available as both fixed and reversible. Two voltage adjustment schemes are offered, namely digital dialable control for the most exacting applications and continuous coarse and vernier controls. In the digital dialable scheme, we allow for adjustment in increments of 10 KV, 1 KV, 100 volts, 10 volts, 1 volt and 0-1 volt vernier. This system provides the assurance that the actual output is always within 1% of the dial readings. As indicated, you may select a coarse and vernier voltage adjustment scheme and realize economic savings without sacrificing basic regulated performance. Regulation accuracy of $\pm 0.25\%$; $\pm 0.1\%$; $\pm 0.05\%$ and $\pm 0.01\%$ for line or load changes are available on most series "BRE" power supplies.

A new line of solid state, precisely regulated power packs for photo multiplier and CRT applications have also been recently introduced. These supplies are available at voltage ratings up to 20 KVDC.



Write or phone for Catalog UVC-669 containing complete specifications for the extensive line of UVC high voltage power supplies.

UNIVERSAL VOLTRONICS

27 Radio Circle Drive,
Mt. Kisco, N.Y. 10549
914-241-1300

If you think Varo Static Power just makes custom-designed industrial power supplies, you're wrong.

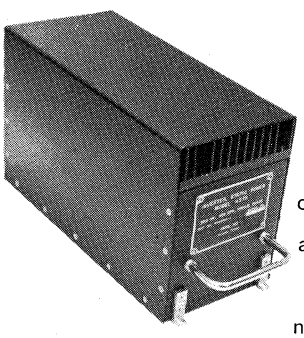
We also make custom-designed power supplies and inverter/converters for military applications.

In fact, that's how Varo got its start. With some pretty unorthodox ideas about military airborne static inverters.

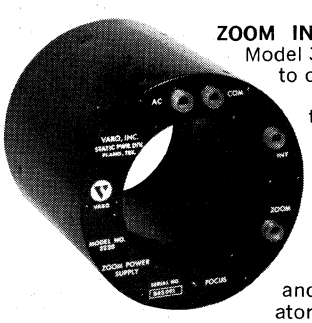
We developed the very first one, and we've been at it ever since. Our production facility includes things like a tape-controlled mill, automatic insertion machines for PCB loading, and environmental test lab for altitude, temperature, and vibration.

MIL-SPECS with which we're accustomed to working include: MIL-STD-704, MIL-I-6181, MIL-STD-810, MIL-E-5400, MIL-T-5422, MIL-STD-100, MIL-D-1000, MIL-STD-826, MIL-STD-756, MIL-HDBK-217, MIL-D-70327, MIL-I-26600, MIL-STD-454, MIL-Q-9858A, and MIL-I-45208A.

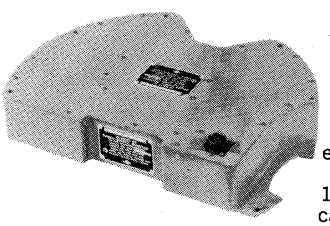
Here are the kinds of custom-designed military power supplies we make.



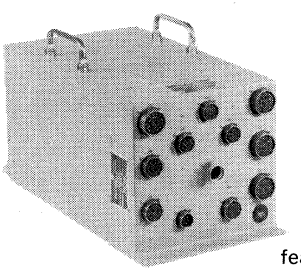
AIRBORNE INVERTER, SINGLE PHASE. Model 4375 is ideal for airborne applications because of light weight, high performance, and compactness. Through the use of silicon components, improved efficiency and reliability are achieved throughout the circuit. Output voltage regulation is achieved through the use of closed loop feedback techniques. The unit has short-circuit protection as well as input voltage reversal protection. It is a 250VA, 400 cycle, single phase, fully qualified inverter.



ZOOM INTENSIFIER POWER SUPPLY. Model 3220 power supply is designed to operate a 40/80 mm grounded cathode zoom intensifier system. Modularized construction inherently provides an MTTR of less than 15 minutes. Five basic modules consisting of: (1) a power conditioner and input regulator, (2) a focus generator, (3) a zoom generator, (4) an anode generator, and (5) an anode 2-3 drive generator, are the principle elements of the system. Specifications of this power supply include: Input, 18-31VDC, 15 watts max; Transients, 80V, 100 Msec. max. or 200V, 10msec. max; Stability, ±1% drift max/month; Operating Temperature, −55°C to +52°C; Dimensions, O.D. 5.97", I.D. 3.75", Length 6.0".



MISSILE SYSTEM CONVERTER/INVERTER. Model 4380 Converter/Inverter is designed to supply power for missile system electronics under extreme environmental conditions. Its MTBF exceeds 1500 hours under the worse case operating conditions. A demonstrated MTTR of less than 0.8 hours has been attained through the use of modularized construction. The units operates from a MIL-STD-704 DC source. Specifications of the unit are as follows: Input, 24-32VDC; DC Output, 150VDC; Current, 1.33 Amps max; Regulation, ±10%; Ripple, 1.5V P-P max; AC Output, 115 VAC RMS (325VAC P-P), single phase, 400 cycle; Efficiency, 70% minimum; Protection, Short Circuit, input under over voltage and reverse polarity; Operating Temperature, −54°C to +90°C; Operating Altitude 60,000 feet.



AIRBORNE COMPUTER POWER SUPPLY. Model 3209 solid-state multi-output Airborne Converter is designed to provide power for a fire-control computer and associated equipment. It features on and off sequencing to protect the computer memory. Inputs and outputs are isolated from each other. Outputs feature individual overvoltage and overcurrent short-circuit protection. Specifications of the unit include: Input, 115VAC, 3 phase, 400 cycle; Efficiency greater than 65%; Operating Temperature, −54°C + 71°C; MTBF in excess of 2000 hours; Size, 15.62" x 9.12" x 8.62".

For more information contact: Military Sales Manager.

VARO

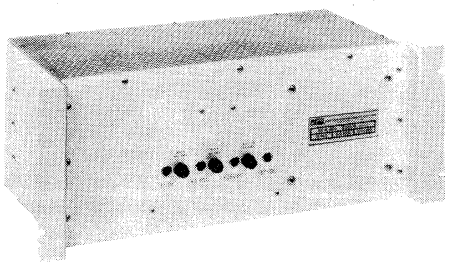
STATIC POWER DIVISION 1600 DALLAS NORTH PARKWAY. PLANO, TEXAS 75074 (214) AD 1-5111 TWX 910-860-5640

If you think Varo static power just makes custom-designed power supplies and inverter/converters for military purposes, you're wrong.

We also make custom-designed industrial power supplies.

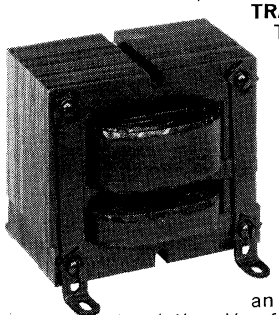
Because we make custom-designed industrial power supplies, a lot of people think we probably have an extensive line of off-the-shelf equipment. But we don't. We don't have off-the-shelf anything. Everything is custom-designed or adapted to meet exact specs. Does this kind of professionalism pay off? It must. We've had to double our facilities about every eighteen months since we started.

Here are the kinds of custom-designed industrial power supplies we make.



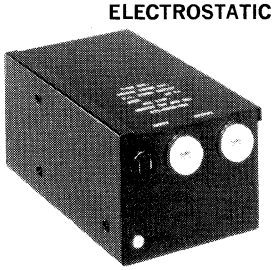
MODEL 3202 COMPUTER PRINTER POWER SUPPLY
We custom design regulated computer power supplies. They're available with multiple output, on-off sequencing, remote sensing, and they can meet UL requirements.

VAROFORMER,™ A 1969 MODEL FERRORESONANT TRANSFORMER FOR COMPUTERS.



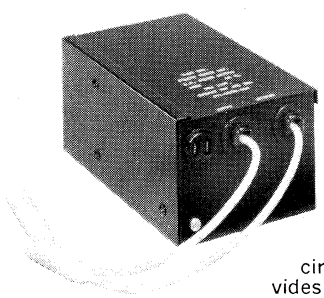
The Varoformer is a computer-designed ferroresonant transformer. It requires less core material, less copper, and less resonant capacitance, and yet maintains the same regulator performance of conventional units. We are able to build the Varoformer to specs by abandoning the equal core area hypothesis. The Varoformer makes operation in the right half plane possible. As an example, we have built a 4% regulating Varoformer with the following characteristics: Line Variation, ±15%; Frequency Variation, ±1%; Load Range, 25% to 100%; Regulation, ±4% which is maintained with combined line load and frequency variation; Temperature Rise, 30°C to 65°C depending on power rating. All this with a typical 30% size reduction over the conventional design.

ELECTROSTATIC AIR CLEANER POWER SUPPLY.



These units employ a ferroresonant transformer to provide the required regulation. Reliable High Voltage Silicon Diodes provide full-wave rectification with capacitance filtering for a low ripple output. Maximum short-circuit current is limited to 5ma to meet UL requirements. This power supply was designed with the following characteristics: Input Variation, ±15%; Outputs, 15KV Max; Secondary Load Current, 2.8 ma Max; Ripple, 5%; Regulation ±5%.

ELECTROSTATIC COPIER-POWER SUPPLY.



Available in three versions, these power supplies all incorporate a ferroresonant transformer for regulation and short-circuit protection, as well as reliable High Voltage Silicon Diodes. The least expensive unit utilizes half-wave rectification to produce pulsating DC. Next, there is the version utilizing a unique circuit configuration which provides pulsating DC with a high DC average. Finally, the more expensive version utilizes full-wave rectification and produces filtered DC with low ripple content. Characteristics of these power supplies are: Input Variation, ±15%; Output 15KV Max; Secondary Voltage Range, Up to 15KV Peak; Secondary Load Current, Up to 2.8 Mils; Regulation, 8%; Ripple, 10%.

For more information contact: Industrial Sales Manager.

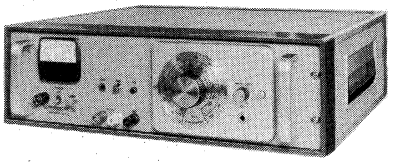
VARO

STATIC POWER DIVISION 1600 DALLAS NORTH PARKWAY, PLANO, TEXAS 75074 (214) AD 1-5111 TWX 910-860-5640

REGULATED, WIDE BAND AC to AC POWER SUPPLIES

"S" SERIES POWER SUPPLIES THE STANDARD "S" SERIES FEATURES:

- All silicon solid state components
- Single phase and multi-phase outputs
- Advanced, state-of-the-art designs
- Accepts over 50 different plug-in oscillators
- Rack mounted units and bench models
- 18 Models from 130 VA to 6000 VA.



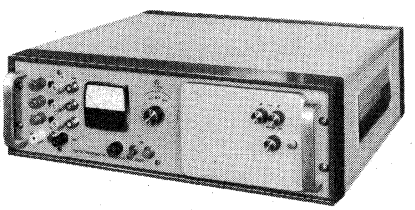
All aluminum parts are finished in gold iridite or black anodize. Steel parts are cadmium plated and finished with gold iridite. Front panels are standard Vector light blue gray semi-gloss enamel. Other paint available on special order. Furnish color chip and federal specification number.

SINGLE PHASE OUTPUT

MODEL	POWER OUTPUT VA	DIMENSIONS (Inches) H	W	D	MODEL	POWER OUTPUT VA	DIMENSIONS (Inches) H	W	D
130-S	130	5¼	19	14	750-S	750	12¼	19	20
200-S	200	5¼	19	14	1000-S	1000	12¼	19	20
300-S	300	7	19	20	1500-S	1500	14	19	20
500-S	500	7	19	20	2000-S	2000	14	19	20

3 PHASE OUTPUT

MODEL	POWER OUTPUT VA	DIMENSIONS (IN.) H	W	D	MODEL	POWER OUTPUT VA	DIMENSIONS (IN.) H	W	D
Y-150-S	150	5¼	19	17	Y-1500-S	1500	12¼	19	20
Y-390-S	390	5¼	19	17	Y-1800-S	1800	14	19	20
Y-500-S	500	7	19	20	Y-2500-S	2500	14	19	20
Y-600-S	600	7	19	20	Y-4500-S	4500	24½	19	20
Y-900-S	900	12¼	19	20	Y-6000-S	6000	24½	19	20



ELECTRICAL SPECIFICATIONS (APPLY TO SINGLE & 3 PHASE MODELS)

INPUT DATA

VOLTAGE: 105 to 125 V AC, single phase for all units 600 VA and below (nominal 115 volts). If 210 to 250 V input voltage desired, add suffix "2" to model number. All models from 750 VA to 6000 VA are normally supplied with 208/230 V AC 3 phase input. 440/460 AC 3 phase input also available, add suffix "3" to model number.

FREQUENCY: 47 to 65 Hz. 47 to 480 Hz available on special order.

INPUT CONNECTION: All units have barrier strips at the rear.

OUTPUT DATA

BASIC FREQUENCY RANGE: All single phase output models 45 Hz to 10 KHz.

DISTORTION: 2% or less including plug-in oscillator.

VOLTAGE: Variable from 0 to 130 volts.

POWER OUTPUT: Full rated VA from 110 to 130 volts.

POWER FACTOR: Full rated VA from unity to 0.7 lead or lag. Greater power factor with some derating.

LINE REGULATION: ±0.25% over input voltage range, at full rated VA.

LOAD REGULATION: ±0.25% from no load to full load.

RECOVERY: 100 microseconds.

OVERLOAD: Automatic overload protection with manual reset and overload indicator.

HUM AND NOISE: —60 DB below full output.

OUTPUT CONNECTIONS: Five way binding posts on front panel and barrier strips at rear.

OUTPUT CONFIGURATION: Single phase models have two wire floating output (one side may be grounded) insulated for 500 volts RMS.

ADDITIONAL SPECIFICATIONS FOR 3 PHASE UNITS

All electrical specifications shown above apply to 3 phase units plus the following:

PHASE UNBALANCE: 100% phase unbalance will not affect any electrical specification.

OUTPUT CONFIGURATION: Four wire, neutral floating. Units will accept △ or Y loads. The neutral, or any one leg may be grounded.

OUTPUT VOLTAGE: 0-130 volts, line to neutral.
0-225 volts, line to line Y.
0-130 volts, line to line △.

METERING: Units of 900 VA and over are supplied with 3 output volt meters. Units below 900 VA are supplied with one meter and a switch to read line to neutral, line to Y, and line to △.

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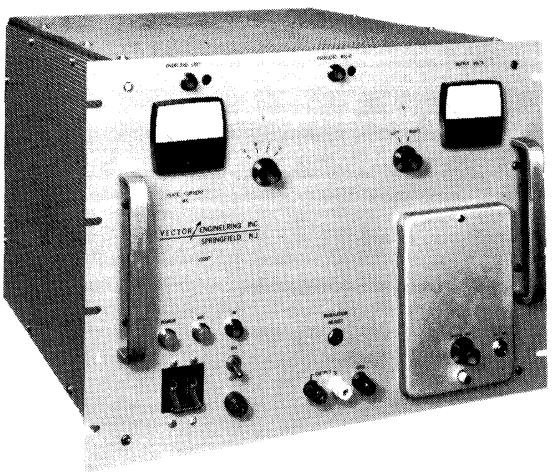
"T" SERIES AMPLIFIERS



The "T" series of regulated A.C. power sources is an extension of the "S" series in the higher power range with outputs up to 20,000 VA. The standard "T" series feature all silicon solid state components except for the output stage where rugged, forced air vacuum tubes are used. These units can also be used as high power audio amplifiers. The supplies are compact, ruggedly constructed, and contain all of the electrical and mechanical features of the "S" series except as follows: Distortion: 2% max., Line regulation: ±0.5%, Load regulation: ±0.5%.

SINGLE PHASE OUTPUT

MODEL	POWER OUTPUT VA	DIMENSIONS (Inches) H	W	D
2000-T	2000	14	19	20
3000-T	3000	45	25	25
5000-T	5000	45	25	25
7500-T	7500	45	36	26
10000-T	10,000	56	42	34
15000-T	15,000	56	42	34
20000-T	20,000	56	42	34

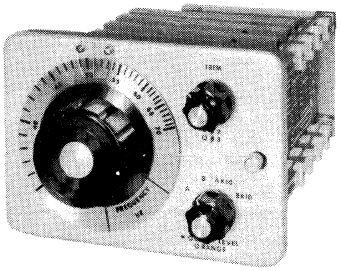
THREE PHASE OUTPUT

MODEL	POWER OUTPUT VA	DIMENSIONS (Inches) H	W	D
Y-5000-T	5000	45	25	25
Y-7500-T	7,500	58	30	30
Y-10000-T	10,000	58	30	30
Y-15000-T	15,000	78	34	34
Y-20000-T	20,000	78	34	34

NOTE:

Two phase and four phase units are available on short delivery. All "T" units are in semi-military angle and skin enclosures. The bottom is fitted with skids for fork lift truck. Casters and/or removable lifting eyes are available on request.

PLUG-IN OSCILLATORS FOR "S" AND "T" SERIES



These oscillators feature all silicon solid state components and precision variable frequency determining elements and are available in **single phase, two phase,** and **three phase.** All single phase oscillators are provided with an external signal input.

Frequency stability: Oscillators may be ordered with frequency stability ranges from ±0.5% thru ±0.001% as shown in the table below.

FREQUENCY RANGE	FREQUENCY STABILITY ±0.5%	±0.25%	±0.1%	±0.01%	±0.001%
ANY FIXED FREQUENCY BETWEEN 45 and 10 KHz	X	X	X	X	X
VARIABLE					
45 to 75 Hz	X	X	X		
320 to 480 Hz	X	X	X		
320 to 2000 Hz	X	X	X		
45 to 6000 Hz	X	X			
45 to 10000 Hz	X	X			

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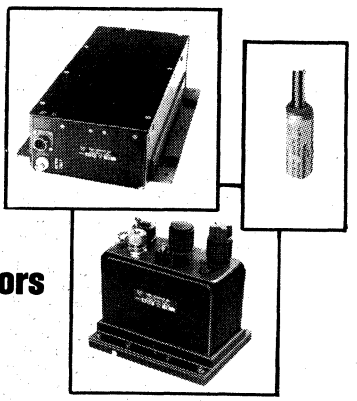
TWX: 710-983-4448

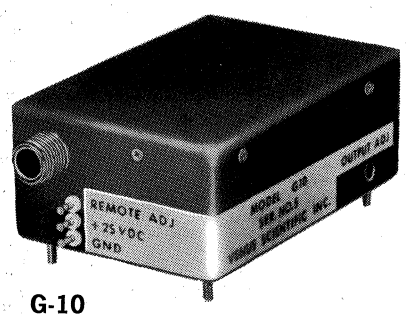
VENUS SCIENTIFIC INC.

MINIATURE HIGH VOLTAGE CAPABILITIES



- variable DC to DC converters
- photomultiplier power supplies
- precision cathode ray tube power supplies
- multiple-output high voltage power supplies
- image intensifier tube gated power supplies
- nanosecond-switching kilovolt pulse generators
- high voltage multipliers
- high voltage oscillators
- remote controlled intensifier tube "zoom" power supplies
- kilovolt test sets for gated image intensifier tubes
- fast switching power supplies for two-color cathode ray tubes

CATHODE RAY TUBE POWER SUPPLIES



G-10
PRICE $490

- output adjustable from 1000 to 10,500 VDC @ 500 μa
- ripple 0.15% peak-to-peak at full load
- line/load regulation ±0.1%
- efficiency >50% at full load
- MTBF 42,100 hours at 71°C
- weighs only 1¼ lb.
- volume 15 cu. in.
- operates from —55 to +71°C without derating
- 50,000 ft. altitude
- MIL-E-5400
- input voltage 24 to 32 VDC
- short circuit and reverse-polarity protected
- temperature coefficient 0.025%/°C from —55°C to +71°C



H-20
PRICE $680

- output adjustable from 10 KV to 20 KV
- ripple 0.05% P/P at full load
- line/load regulation ±0.05%
- efficiency >50% at full load
- volume 30 cu. in.
- operates from —55 to +71°C without derating
- shielded, encapsulated
- short circuit and reverse-polarity protected
- temperature coefficient 0.005%/°C from —55°C to +71°C
- input 28 VDC ±10%
- available with negative output at same price—Model H20N

Send for Catalog

(All prices and specifications subject to change without notice)

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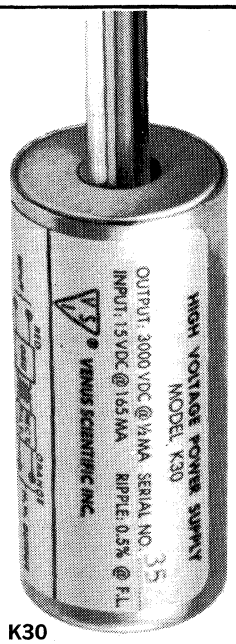
VENUS SCIENTIFIC INC.



K30
ACTUAL SIZE

PHOTOMULTIPLIER POWER SUPPLIES

- small — 1" dia. x 2¼" long
- shielded, encapsulated
- operates from −55 to +71°C
- qualified per MIL-STD-810
- MTBF >100,000 hr at 71°C
- output proportional to input
- fast response
- output floating; input floating
- short circuit protected
- reverse-polarity protected

photomultipliers — flying spot scanners — image dissectors — ionization chambers
scan converters — CRT bias circuits — scintillation tubes — geiger tubes

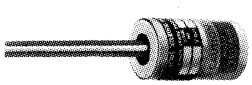
Model	Input	Output Range	Ripple (p-p)	Efficiency at Full Load	Price (1-9)
K15	3V to 15V	300V to 1500V @ 1.0 ma	0.1%	>50%	$149
K30	3V to 15V	600V to 3000V @ 0.5 ma	0.5%	>50%	$158
Q30*	2V to 12V	600V to 3000V @ 0.2 ma	0.25%	>60%	$168

**Designed for battery applications—Idling current only 8 ma.*

For operation in vacuum environments, these units will be supplied in a 3" long can having a high vacuum seal. In specifying a vacuum unit, add the suffix "Z" to the model number (i.e. K30Z) and an additional $30 to the unit price.



32R4



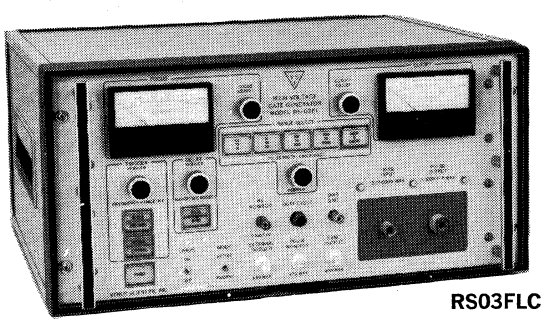
0-6.75

HIGH VOLTAGE OSCILLATORS

- fixed or proportional output
- short circuit protected
- reverse-polarity protected
- miniature packages
- flat packs for insert mounting
- designed for image intensifier applications

Model	Input	Output (p-p)	Nominal Frequency	Type	Price
32R4	18 to 32 Vdc	1200 Vac to 3500 Vac	10 KHz	Adjustable, line regulated	$265
0-6.75	6.75 Vdc	2800 Vac	3 KHz	Output proportional to input	$98

32R4 Dimensions: 3" x 1¾" x ⅞"



RS03FLC

HIGH VOLTAGE GATE GENERATOR IMAGE INTENSIFIER TEST SET

- PRF to 10 KHz
- Output gate can be floated to ±25 KV
- Completely solid state
- 55 ns rise and fall times
- Max. Pulse Amplitude . . . 3000 v P/P
- Pulse Width Adj. from 0.5 μsec. to 100 msec.
- Pulse Delay Adj. from 0.3 μsec. to 50 μsec.

APPLICATIONS:
■ QC inspection/test ■ laboratory simulation ■ high speed shutter for image intensifier tube ■ automatic exposure control for intensifier tube or photomultiplier ■ LIDAR range gate ■ direct viewing image intensifiers ■ vidicon coupled image intensifiers

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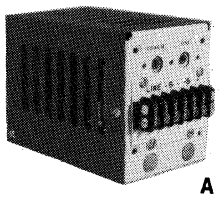
VMI

VIKING MODULES, INC.
WALTHAM, MASSACHUSETTS 02154

223 CRESCENT STREET
WALTHAM, MASS. 02154
PHONE: 617-891-7898

MODULAR POWER SUPPLIES

CASES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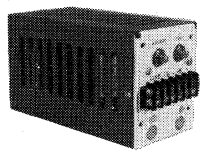
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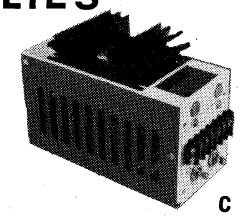

C

100 SERIES

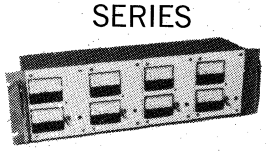
MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	CASE SIZE	RIPPLE	REG.	PRICE
101	0-40	.5A	A	250uV	±.005%	79.00
102	0-40	1.0A	B	250uV	±.005%	89.00
103	0-40	2.0A	C	250uV	±.005%	99.00
104	0-20V	4.0A	C	500uV	±.005% + 1mv	139.00
108	0-40V	3.0A	C	500uV	±.005% + 1mv	129.00
109	0-110	1.0A	B	500uV	±.005% + 1mv	149.00
111	0-10V	6.0A	C	1mv	±.05% + 1mv	169.00

300 SERIES

MICROLOGIC & IC POWER SUPPLIES

MODEL	CASE SIZE	VOLTAGE RANGE	CURRENT	ADJUSTABLE OVERVOLTAGE	RIPPLE	REG-ULATION	PRICE
301	A	3-7	1A	Yes	1mv	.05%	89.00
302	B	3-7	3A	Yes	1mv	.05%	139.00
303	C	3-7	6A	Yes	1mv	.05%	179.00
*305	A	9.5-26	1.5A	No	1mv	.05%	89.00
*306	B	9.5-26	3A	No	1mv	.05%	99.00
*±10% Voltage Range Adjustment. Specify Voltage.							

500 SERIES



MODEL	DESCRIPTION	PRICE
RP500	Rack Panel Adaptor	35.00
P540	¼ Rack Panel Blank	3.50
P541	¼ Rack Panel w/Switch, Pilot lite, fuse, Adjustment	17.00
P542	¼ Rack Panel w/Voltmeter, Ammeter, Pilot lite, fuse	35.00
P543	½ Rack Panel Blank	5.00
P544	Full Rack Panel Blank	7.50

200 SERIES

DUAL SUPPLIES

MODEL	OUTPUT VOLTAGE	OUTUPT CURRENT	RIPPLE	CASE SIZE	REG.	PRICE
203	12-21/12-21	0.5A	500uV	A	±.025%	99.00
204	12-21/12-21	1.5A	500uV	C	±.05%	169.00

VMI

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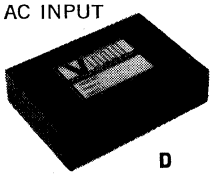
PHONE: 617-891-7898

DUAL ENCAPSULATED SUPPLIES

115V AC INPUT

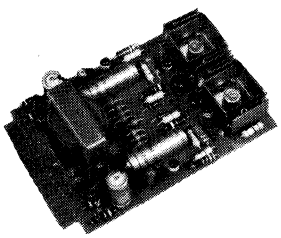


D

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	REG.	RIPPLE	SIZE	PRICE
201	15/15	50ma	.08%	1mv	D	49.00

DUAL CARD SUPPLIES

115V AC INPUT



MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	REG.	RIPPLE	PRICE
206	15/15	25ma	.05%	1mv	29.00
206-1	12-21/12-21	25ma	.05%	1mv	29.00
207	15/15	50ma	.05%	1mv	39.00
207-1	12-21/12-21	50ma	.05%	1mv	39.00
208	15/15	100ma	.05%	1mv	59.00
208-1	12-21/12-21	100ma	.05%	1mv	59.00

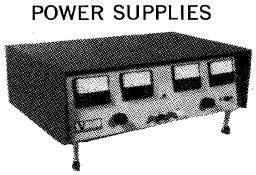
400 SERIES

LABORATORY POWER SUPPLIES

MODEL	VOLTAGE RANGE	CURRENT	REGULATION	PRICE
LS-401	0-110V	.5A	.01%	169.00
LS-402	0-40V	.5A	.01%	98.00
LS-403	0-40V	1.5A	.01%	118.00

700 SERIES

DUAL LABORATORY POWER SUPPLIES

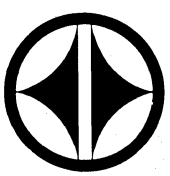


MODEL	VOLTAGE RANGE	CURRENT EACH SIDE	REGULATION	PRICE
DLS-701	0-40/0-40	.5A	.05%	179.00
DLS-702	0-40/0-40	1.5A	.05%	219.00

ACCESSORIES

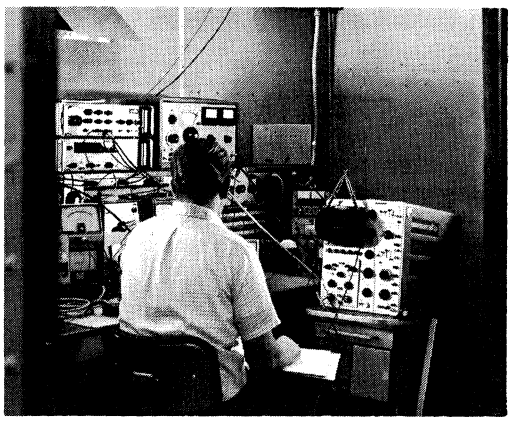
MODEL	DESCRIPTION	PRICE
APC-15	Printed Circuit Card Plug in Connector	2.00

Look in the Green Section for Products and their Manufacturers

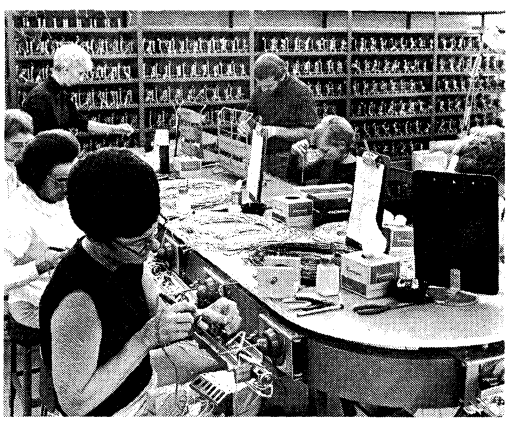


Tell them you found them in **eem**

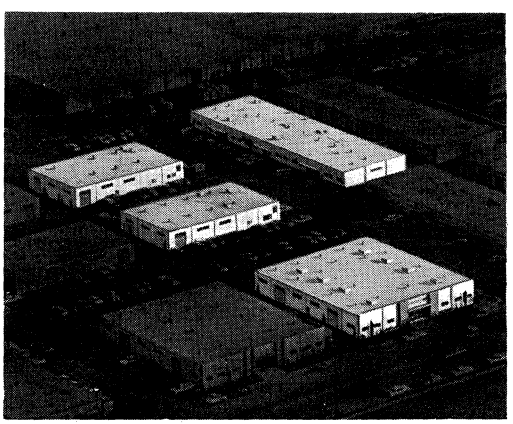
WANLASS Custom Power Supplies



Custom Engineering and Development.



Mechanical Assembly.



Wanlass plant facilities in Santa Ana, California.

Wanlass can achieve design economy while improving the performance of your electrical equipment. To find out how, write for a free copy of our brochure "The Capacity For Achievement".



Custom OEM power conditioning assemblies in ratings from microwatts to megawatts with the revolutionary advantages of

Wanlass Transient Free Parametric Power!

Wanlass manufactures power supplies, voltage regulators, inverters, converters, frequency converters and filters in custom and standard configurations to meet any power conditioning need. Cost and performance advantages to OEM's are substantial due to state-of-the-art design and construction capabilities combined with proprietary technologies recently developed at Wanlass. Foremost among these developments is PARAFORMER™, the most significant invention in power magnetics in the 20th century.

WANLASS PARAX™ TECHNOLOGY — By rhythmically varying the inductance of a magnetic circuit, the Wanlass PARAFORMER™ achieves transient free energy transfer without relying on mutual inductance. It also regulates voltage, exhibits minimum waveform distortion, provides electrical isolation, transforms voltage and prevents line voltage irregularities from being transmitted to the load and load voltage irregularities from being reflected back to the line. Successfully applied with custom specifications to voltage regulators, line filters, AC and DC power supplies, inverters, DC converters and frequency converters, the PARAFORMER™ principle also functions in off-the-shelf products under the trade name PARAX™.

WANLASS CLIP-AC™ TECHNOLOGY — This proprietary technology utilizes circuitry that symmetrically clips unregulated input-voltage peaks to produce a constant output waveform, which can then be transformed into a variety of regulated output voltages through the use of an appropriate transformer. Any desired AC voltage regulation precision can be achieved with true RMS, average or peak voltage held to a constant, in ratings up to 1KVA. Due to generally superior performance, CLIP-AC™ is the logical successor to the ferroresonant transformer for most AC regulation requirements. It is also smaller, lighter, less expensive.

WANLASS VARAX™ TECHNOLOGY — VARAX™ utilizes another all-new magnetic voltage regulating concept discovered by Wanlass. It is an electrically variable inductor which can be controlled over a wide inductance range by the application of small DC control currents. When compared with conventional saturable reactors, VARAX™ devices offer smaller size, lighter weight, greater reliability, less waveform distortion, lower cost, inherent decoupling of AC power from entering the DC control circuitry. Spike-free regulation to ±0.5% and efficiency to 95% are typical for units with ratings from 500VA output from 100-130 VAC single-phase, 47-63 Hz input.

SOLID STATE POWER SUPPLIES
A capacity to produce 100,000. power supplies per year

MULTI-OUTPUT VOLTAGE REGULATORS
0.1% line regulation at unit costs as low as $12.00!

HEAVY POWER SUPPLIES
AC voltage regulators or power supplies rated to 10KVA.

PARAMETRIC SWITCHING SUPPLIES
40KC high frequency switching with no load transients.

CIRCUIT ASSEMBLIES
Assembly costs as low as 3¢ per component.

COMPLETE SYSTEMS
A single source of integrated power conditioning and control.

Custom Products Division

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WANLASS

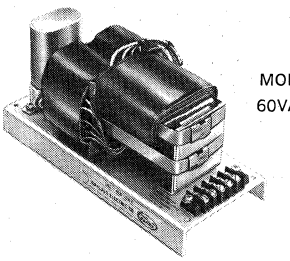
DC Power Supplies and AC Line Conditioners

Economy models available off the shelf

Wanlass Industrial Products Division applies the exclusive PARAX™, VARAX™ and CLIP-AC™ technologies to a broad line of OEM economy-type AC and DC power conditioners in standard configurations for off-the-shelf distribution by more than 50 key distributors throughout the nation.

Eliminate line transients, noise and even arrest lightning with the Wanlass Paraformer™! (And get 0.25% AC line regulation as part of the deal!)

THE WANLASS PARAFORMER is the revolutionary power transfer component that effects parametric transfer of power without solid-state or mechanical elements. Standard units rated from 60 to 5000 VA in stock.



MODEL PEC-60
60VA @ $95.00

In Stock at these Distributors

ALABAMA
Cramer/Huntsville, Inc. Huntsville: (205) 536-4493
ARIZONA
Liberty Electronics Phoenix: (602) 264-4438
CALIFORNIA
Newark Electronics Inglewood: (213) 678-0441
Radio Products, Inc. Los Angeles: (213) 748-1271
Zack Electronics Palo Alto: (415) 326-5432
COLORADO
Newark-Denver Denver: (303) 757-3351
CONNECTICUT
Cramer/Connecticut Hamden: (203) 288-7771
FLORIDA
Cramer/Florida, Inc. Ft. Lauderdale: ENTER. 1776
GEORGIA
Cramer/Atlanta Atlanta: (404) 541-5421
ILLINOIS
Newark Electronics Chicago: (312) 638-4411
LOUISIANA
Newark-New Orleans New Orleans: (504) 834-9470
MARYLAND
Cramer-Baltimore Baltimore: (301) 354-0100
Cramer-Washington Rockville: (301) 424-2700
Philadelphia Electronics Baltimore: ENTER. 9-7444
MASSACHUSETTS
Cramer Electronics Newton: (617) 969-7700
MICHIGAN
Newark-Detroit Oak Park: (313) 548-0250
Newark-Industrial Grand Rapids: (616) 452-1411
MINNESOTA
Newark-Minneapolis Minneapolis: (612) 331-6350
Stark Electronics Minneapolis: (612) 332-1325
MISSOURI
Olive Ind. Electronics St. Louis: (314) 863-7800
NEW JERSEY
Philadelphia Electronics Princeton: ENTER. WX 8825
NEW YORK
Cramer Electronics Elmhurst: (212) 478-4000
Cramer-Eastern Syracuse: (315) 455-6641
Cramer-Rochester Rochester: (716) 482-7080
Newark-Electronics Center New York: (212) 255-4600
Summit Distributors Buffalo: (716) 884-3450
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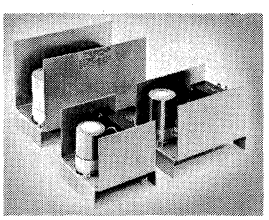
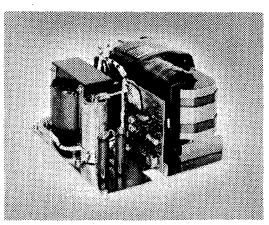
Electronic Sales Seattle: (206) 932-0330



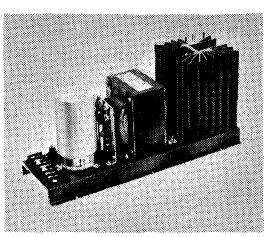
ECONOMY OEM DC POWER SUPPLIES. Series regulated units currently in large volume production and available in 30-60-120 watt models with output voltages ranging from 3.6 to 60 volts. Economy is the keynote with unit prices beginning at $46-$58-$86 and decreasing to as low as $27 each in large quantities. Features include ±1% regulation, 0.1% ripple, 47-63 Hz operation, automatic short circuit protection, and wide range adjustability of output voltage.

← 30-60-120 Watt OEM DC Power Supplies



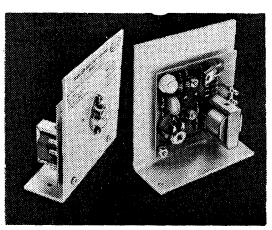
VARIABLE INDUCTOR AC POWER REGULATORS. A highly reliable, frequency insensitive series identified as the VARAX™. Ideal for remote or unattended sites, high starting loads, all lagging power-factor loads, it features 47-63 Hz operation at 105-130V, ±1% line and load regulation and over 90% efficiency with full load. Price for 1.5 KVA unit is only $127.50 in 50-99 quantities.

← TYPICAL 1500 VA VARAX™
Model No. VVR-1501



INTEGRATED CIRCUIT DC POWER SUPPLIES. A specially designed series for OEM and systems application to IC and MOS circuits. Standard IC 60-120-200 watt models available with output voltages from 3.6 to 60 volts and priced at $125, $170 and $225 respectively. High performance HPIC series also available with ±0.05% regulation (standard ±0.25%), 2 millivolt ripple (standard, 5 millivolts) and complete isolation. HPIC prices are $150, $195 and $250. Also request data on the Wanlass new "PIC" parametrically preregulated DC power supply line with positive protection from line transients and switching spikes!

← TYPICAL 5V @ 25A IC-MOS Power Supply
Model 200-25IC-5



CLIP-AC™ AC POWER REGULATORS. CVR, CVRS and C-3000 Models using the Wanlass CLIP-AC™ principle to decrease audible noise, size, weight and cost while improving performance. Feature ±1% line and load regulation, 47-420Hz operation and high surge-power capability. 120 watt units are priced as low as $14. C-3000 line is a true RMS clipping regulator with auto-transformer output priced at $39 for a 60 VA unit. New CVRS line provides 110V regulated true RMS AC output with no power transformer. Request bulletin CVRS-369!

← TYPICAL 120 VA CLIP-AC™ Voltage Regulator
Model CVR-120

For complete information on our low-cost power supplies and line conditioners, contact Wanlass or the distributor nearest you.

Or ask for bulletin WDP-1168



Industrial Products Division

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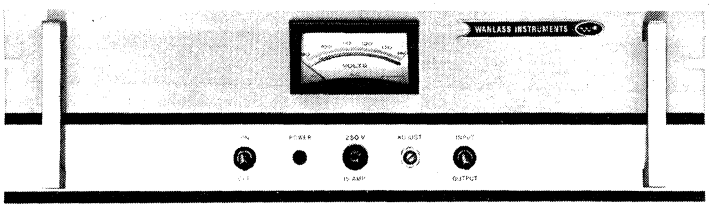
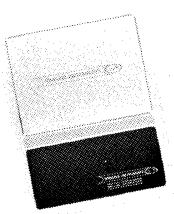
WANLASS Precision Instruments

Wanlass Instruments manufactures a complete line of instruments in rack-panel or bench configurations for multi-purpose power supply requirements and for AC power conditioning, dynamic line filtering, and voltage regulation. These instruments utilize the proprietary technologies of PARAX™ and VARAX™ power conditioning (regulation and filtering) to provide laboratories and test facilities with transient-free AC line conditioning.



DESCRIPTION	MODEL NO.	AC INPUT (VOLTS)	AC OUTPUT (VOLTS)	LINE (±) REG. (± 10V)	LOAD (±) REG. (10 or 25 to FL)	RESPONSE TIME	DISTORTION (%)	FREQ. (HZ)	VA	FILTERING TO 1 MHZ	PHASE	APPLICATIONS	SIZE H" x W" x D"	WT. (LBS.)	PRICE
PARAX POWER CONDITIONER	P-1405	105-125	117	0.25	1.5	0	~5	60	500	50 db	1	filter and regulate lab or production instruments	5-3/4 x 9-3/4 x 16-1/2	50	275.00
PARAX POWER CONDITIONER	PD-1410	105-125	117	0.25	1.5	0	~5	60	1000	50 db	1	test stand, 100 db between loads	7 x 19 x 17-1/4	97	550.00
PARAX POWER CONDITIONER	P-1425	105-125	117	+5	1.5	0	~5	60	2500	50 db	1	computer or system	10-1/2 x 19 x 18-1/2	155	750.00
PARAX POWER CONDITIONER	P-1450	105-125	117	.5	1.5	0	~5	60	5000	50 db	1	industrial, production or entire lab	21 x 19 x 20	325	1500.00
PARAX POWER CONDITIONER	P4-1405	105-125	117	1.0	2.5	0	~5	400	500	50 db	1	400 Hz test evaluation	5-3/4 x 8-1/2 x 10-1/2	18.5	395.00
PARAX POWER CONDITIONER	P4-1410	105-125	117	1.0	2.5	0	~5	400	1000	50 db	1	400 Hz test evaluation	5-3/4 x 8-1/2 x 10-1/2	24	625.00
REGULATED POWER CONDITIONER	P4-1605	105-125	110-120	0.1	0.5	0 for 1% 10-20 ms for .1%	3	400	500	50 db	1	testing precision 400 Hz gyros, components and instruments	5-3/4 x 8-1/2 x 10-1/2	22	925.00
REGULATED POWER CONDITIONER	P4-1605-3	105-125	110-120	0.1	0.5	0 for 1% 10-20 ms for .1%	3	400	500	50 db	3	testing precision 400 Hz gyros, components and instruments	8-3/4 x 19 x 20	150	2875.00
REGULATED POWER CONDITIONER	P-1605	105-125	110-120	0.1	0.5	0 for 1% 10-20 ms for .1%	3	60	500	50 db	1	60 Hz for controlled critical measurements	7 x 19 x 16	80	775.00
SOLID STATE POWER CONDITIONER	RF-1310	95-130	110-120	0.1	0.1	Reg 30ms filter 1 μs	3	60	1000	No SCR or O.V. Spikes	1	critical measurements	5-1/4 x 19 x 12	40	575.00
SOLID STATE POWER CONDITIONER	RF-1330	95-130	110-120	0.1	0.1	Reg 30ms filter 1 μs	3	60	3000	No SCR or O.V. Spikes	1	critical measurements	5-1/4 x 19 x 12	75	975.00
SOLID STATE POWER CONDITIONER	RF-1350	95-130	110-120	0.1	0.1	Reg 30ms filter 1 μs	3	60	5000	No SCR or O.V. Spikes	1	critical measurements	5-1/4 x 19 x 12	100	1275.00
VARAX POWER CONDITIONER	V-2005	100-130	110-120	0.5	0.5	50 ms	~5	47-63	500	20 db	1	multi Hz input for motor generator	5-1/4 x 19 x 12	40	300.00
VARAX POWER CONDITIONER	V-2010	100-130	110-120	0.5	0.5	50 ms	~5	47-63	1000	20 db	1	multi Hz input for motor generator	7 x 19 x 9	75	350.00
VARAX POWER CONDITIONER	V-2030	100-130	110-120	0.5	0.5	50 ms	~5	47-63	3000	20 db	1	multi Hz input for motor generator	8-3/4 x 19 x 16	105	525.00
DYNAMIC LINE FILTER	F-3010	115-Nom	115 Nom	—	—	—	1	60	10A RMS 25A Peak	40 db Decade	1	filter SCR spikes, any low level noise for lab, test	4-7/8 x 8-3/8 x 10-5/8	6	225.00
DC POWER SUPPLY	MP-16	105-132 210-264	0-16	0.01	0.01	5 μs	—	47-63	1.6A	—	1	multi-purpose lab, test	4-7/8 x 8-3/8 x 10-5/8	12	195.00
DC POWER SUPPLY	MP-40	105-132 210-264	0-40DC	0.01	0.01	5 μs	—	47-63	1.6A	—	1	multi-purpose lab, test	4-7/8 x 8-3/8 x 10-5/8	12	195.00
AC/DC PARAX	P-5505	105-125	0-140 0-8	0.25 5 MV	1.5 5 MV	0 10 μs	~5	60 60	500 15A	50 db	1	Q.C. test, and development labs	5-1/4 x 19 x 17	70	875.00
1 TO 3 CONVERTER	P-2410	115-Nom	208-240	5%	—	—	—	60	1000 333/ϕ	—	1 to 3	1 to 3 conversion at a fraction of the cost - portable	5-3/4 x 8-1/2 x 16	60	475.00
1 TO 3 CONVERTER	P4-2410	115-Nom	208-240	5%	—	—	—	400	1000 333/ϕ	—	1 to 3	1 to 3 conversion at a fraction of the cost - portable	5-3/4 x 8-1/2 x 16	22	675.00

Instruments sold throughout the United States by specially trained electronic instrument representatives. For a complete catalog or additional technical information contact Wanlass Instruments or your local representative.



Instruments Division

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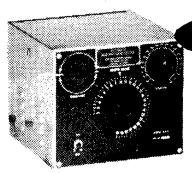
RUSH

PRODUCTION PROVED

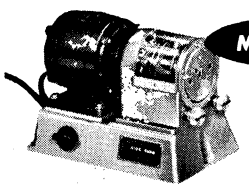
WIRE STRIPPERS, TWISTERS & CUTTERS

And FREE Engineering, Design and Testing Laboratory Services



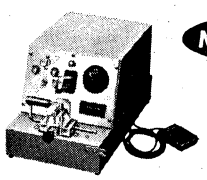
Model AB-4 — AND RUSH MODEL AB4-SC WIRE AND TUBING CUTTER

Automatically measures, cuts and counts while in operation. Designed primarily for manufacturer who cuts and strips wire and tubing by hand. Delivers constant supply of length controlled pieces ready for stripping. Spool fed, it is ideal for short run production. Perfect companion to RUSH's Model K-15.



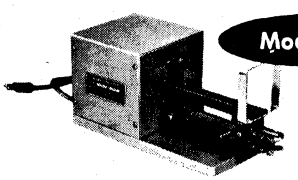
Model C-100 — RUSH CENTRIFUGAL BLADE WIRE STRIPPER

Tames the "Toughies" of modern insulations. Adjusts easily to length and depth of cut while running! Designed primarily for removal of Teflon. It is equally effective for Nylon, P.V.C., Neoprene, rubber, braided cotton and other modern insulations. Week after week of running without slightest adjustments—and with no rejects.



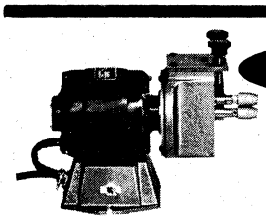
Model MSS-105 — RUSH BLUE ARC STRIPPER

Designed specially for coaxial and shielded cable. It severs shielding at predetermined point and fuses strands together to prevent fraying. Ground-wire can be fused to shielding in same operation. It can be equipped to handle a range of types and sizes of shielded cable.



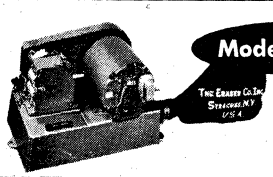
Model A5C — RUSH THERMAL WIRE STRIPPER

Designed primarily for bench-type uniform stripping of most types of Thermo-plastic insulations. Has multi-level temperatures control; finger lever controls stripping element contact pressure. Positive mechanical stop gives adjustable control of uniform stripping length. Strips from AWG 1 to AWG 43 without adjustment.



Model R-1 — RUSH CLOSE-UP WIRE STRIPPER

Designed specially for accurate close-up work on wires AWG #36 or finer. Built-in precision minimizes damage to wires. Has RUSH's Easy-Entrance Wheels. For close tolerance stripping of fine wire at assembly operation, inquire about portable Model "HR-1" with three-foot flexible shaft.



Model DV-1A — RUSH WIRE STRIPPER

Fast, neat, compact, accurate and highly efficient. Strips most types of film-insulated wires. Collects dangerous dust and keeps work areas neat and clean. Protects workers' health. For stripping at work area (large transformer coils, etc.) ask for the hand held, heavy duty, Portable Stripper PD-1.

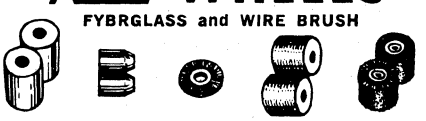
RUSH CUSTOM DESIGNED INDUSTRIAL EQUIPMENT

Designed and Built Specially for Your Particular Operation

The RUSH Engineering and Testing Laboratories of the Eraser Company are at your disposal entirely free of cost or obligation to you. RUSH will test your particular samples of wires or tubing and recommend a RUSH stripper for you. If the situation warrants, we will design and build a machine entirely suited to your particular needs at a price that will please and satisfy you. Avail yourself of this service as many other manufacturers have done and you will be pleased and pleasantly surprised with our policy of full cooperation with you in solving any problem you now have. Send for free catalog of complete line of products and services.

RUSH WHEELS

FYBRGLASS and WIRE BRUSH



Standard and Custom Made Stripping Wheels

Whatever the specification and stripping job—RUSH makes the WHEEL—from soft self-flaring FybRglass Wheel for delicate wire work to extra firm Wire-Brush Wheel for tough jobs. The wire wheel sections are also available in nylon, brass and horsehair. The variety of Stripping Wheels include the famous Wobble Wheels with their oscillating motion for longer work-life . . . and the Easy-Entrance Wheels for quick and simple engaging of wire for stripping. Both of these popular RUSH Wheels are available in the specific hardness and durable quality required for your particular job.

INQUIRE ABOUT OUR WIRE TWISTING EQUIPMENT

OUR GUARANTEES

WE GUARANTEE that every service rendered and every product we make will be honestly described.
WE GUARANTEE that any product made by us will give you the service you have the right to expect.

THE ERASER COMPANY, Inc.

Note: This is only a partial listing of our complete line.

RUSH WIRE STRIPPER DIVISION

THE ERASER COMPANY, INC.
P.O. Box 1342
Syracuse, N. Y. 13201

GTI CORPORATION
Dix Engineering Division

SEALING EQUIPMENT
IC and INFRARED SEALERS



LABORATORY AND PILOT FLAT PACK SEALER

FP-VP-1M

A perimeter type, hermetic sealer for IC, Thick and Thin Film Packages. Sophisticated solid state circuitry permits complete control over the sealing atmosphere, location of heat, time at temperature and rate of heat-up and anneal rates. All the sealing stages are adjustable, flexible as to sequence and preprogrammed when desired; though any stage can be suspended or by-passed for experimental purposes.

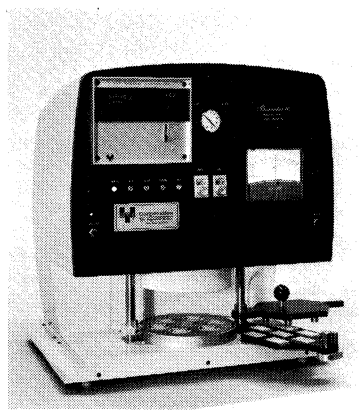
Packages can range from ¼" x ⅛" to 1¾" x 1¾" and may be of glass, "Kovar"* or ceramic.

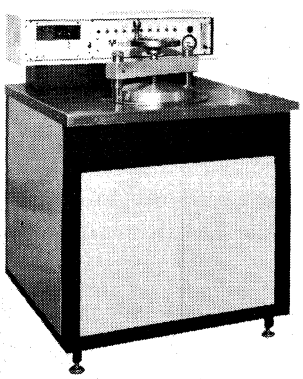
PRODUCTION FLAT PACK SEALER

FP-VP-17 (seven head model illustrated)

Laboratory precision at production rates is main advantage of this perimeter type, multi-head hermetic sealer for IC, Thick and Thin Film Packages. Similar to the FP-VP-1M described above, this sealer can be provided with one to ten independently monitored sealing heads.

Preprogrammed to the proper sealing profile for the particular package, the sealer automatically purges, evacuates, backfills with inert gas, perimeter heats (heatsinks protect the device) anneals the package automatically and recycles precisely. Depending on the number of sealing heads, packages up to 1¾" x 1¾" can be sealed.





GLASS-TO-METAL PROGRAMMABLE, SEALER

DAP-700

For glass-to-metal, soldering and brazing operations at precisely controlled temperatures up to 1,000°C with complete control over the sealing atmosphere for vacuum, positive pressure and inert gas, this solid state controlled sealer can be completely preprogrammed for all parameters of the sealing cycle. Custom tooled for semi-automatic loading, the sealer can seal most standard types of semiconductor packages and component parts.

PACKAGE SEALING APPLICATION CENTERS

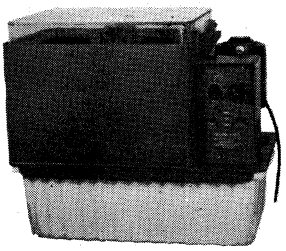
As a major supplier of glass and metal parts, "Flat Paks" and many other "Hi Integrity" packages as well as sealing equipment, GTI is uniquely equipped to help the engineer develop reliable sealing procedures and maximum production yields. Application centers are located in Costa Mesa, Calif., Providence, R. I., and Miesbach, West Germany. Any GTI Sales Engineer can arrange for analysis and recommendations on your package situation.

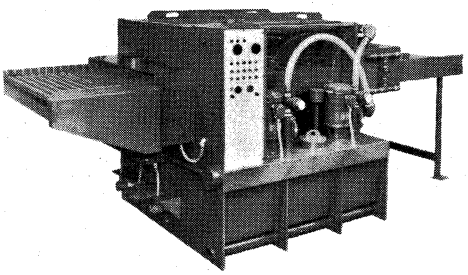
*"Kovar" is a registered trademark of Westinghouse Electric Corporation.

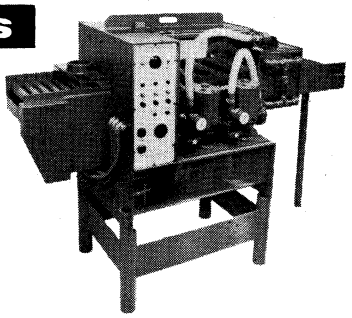
KRESSILK PRODUCTS

THE QUALITY LINE OF PRINTED CIRCUIT MANUFACTURING EQUIPMENT

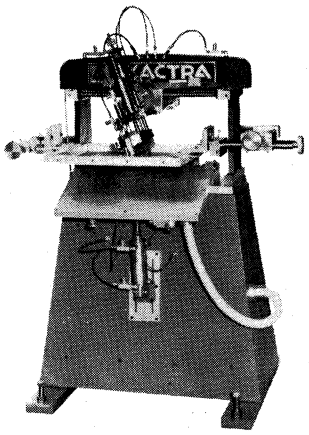
DEA "JET-SPRAY" ETCHERS

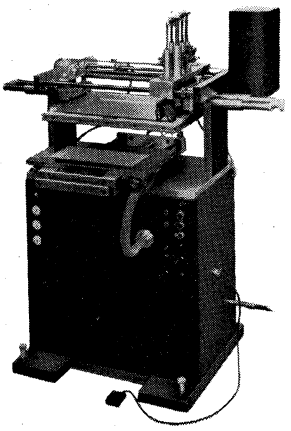


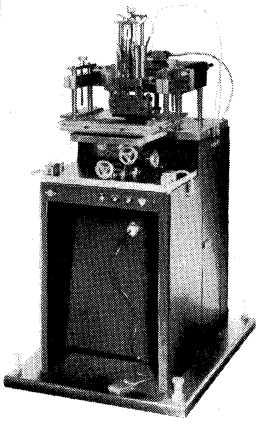




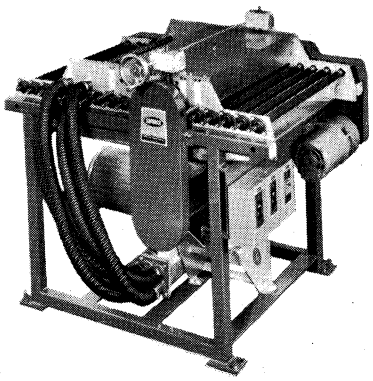
KP SCREEN PRINTERS







SOMACA



A COMPLETE LINE OF AUXILIARY EQUIPMENT AND SUPPLIES

ROLTINNER



KRESSILK is the top name for circuit board manufacturing and chemical milling equipment. Light printers, screen printers. Etchers, cleaning machines, dryers, soldering equipment, films, resists . . . all of the very highest quality manufacture and performance, backed by the KRESSILK warranty.

Write for technical bulletin eem and specifications

KRESSILK PRODUCTS, INC.

Xylem Company
322 So. Fourth St.
Minneapolis, Minn.

420 Saw Mill River Road. Elmsford N. Y. 10523
AREA CODE 914 592-5010 TELEX 01-25572
2434 Dempster St., Des Plaines, Ill.

Leonard W. Smith
P.O. Box 267
434 Pond Street
Westwood, Mass.

KRESSILK PRODUCTS

AT ALL EASTMAN KODAK STORES, INC.

SODECO Impulse Counters for

TOTALIZING

In modern instrumentation, production controls, and data handling systems, a rapid, accurate means of totalizing is often required. Low cost, easily read totalizing impulse counters are preferred as the means of recording this information. Sodeco totalizers, due to their reliability and small size are widely specified for counting instruments, control systems and centralized control stations.

PREDETERMINING

These small 4 or 5 digit counters provide for visual in-line count and control function in a single compact unit. It is readily preset to any number from 1 to 9999 (9) and after the preselected number of counts have been registerd a SPDT contact reverses permitting a control function. Applications calling for automatic recycling or batch counting prefer Sodeco predetermining counters.

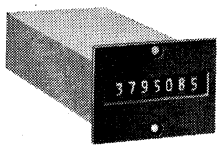
PRINTING

Whenever a permanent record of units or events is desired, the Sodeco printing counter for serial and parallel entry counting, will serve to maintain this record, with a minimum space requirement. As count is by electromagnetic action, the counter may be remotely located from the point of count generation.

TRANSMITTING

Reliable operation of any electromagnetic counter requires that the counter coil be energized by a pulse within specifications. Sodeco transmitters provide a controlled pulse, and protect against false count, or coil burnout.

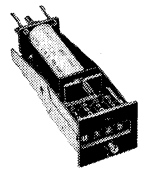
TOTALIZING



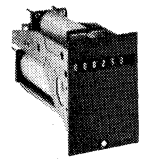
No reset 3 to 8 digits, manual toggle reset 3-6; counting speed — 10, 25 or 50 impulses/second. (8 digit non-reset 10 ips only) DC operation. Model illustrated TCe7e. **Send for Bulletin 201.**



Electric reset by single impulse; 4, 5 or 6 digits; 10, 25 or 50 impulses second; DC operation. Model illustrated TCeF6E. **Send for Bulletin 201.**

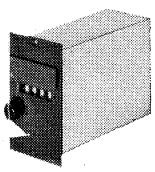


Pushbutton resets figures to zero; 4, 5 or 6 digits; AC (10 i/sec max) or DC (10 or 25 i/sec). Model illustrated TCeBZ5E — 1.654″ x 2.047″ x 1.811.″ **Send for Bulletin 212.**

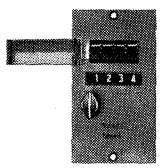


NON-RESET ECONOMY COUNTER—4 digit; DC 12, 24, 48, 110; 10 i/sec; life expectation minimum 50 million impulses. Model illustrated TCe5. 1.10″ x .81″ x 4.49″. **Send for Bulletin 223.**

PREDETERMINING



This series of 4 and 5 digit DC operated counters count from a preset number toward zero. They are preset to any number from 1 to 9999 (9) and after the preselected number of counts have been registered a SPDT contact reverses permitting a control function. Model illustrated TCeF4PE. 1.722″ x 3.228″ x 4.016″. **Send for Bulletin 402.**

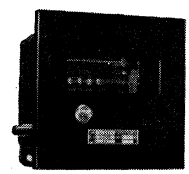


This predetermining counter is basically equivalent to the TCeF4PE type, however the supply is taken directly from 110 or 220 V AC. The count and reset coils are provided with a spark suppressor. Model illustrated 2TCeF4PE — 2.01″ x 4.02″ x 4.42″. **Send for Bulletin 402.**



Actuates switch at preset counts; 5 digits; manual or electric reset; panel or surface mount; 10 i/sec; AC or DC. Model illustrated TiZ5P1E — 5.669″ x 5.669″ x 2.795″. **Send for Bulletin 501.**

ADD-SUBTRACT



A rugged differential counter with 2 drive systems and a control contact. Indication is on one register with 1 system adding and 1 system subtracting. A SPDT contact is actuated when the register is in the zero position. AC or DC operation. Model illustrated TiZ4RcEh. **Send for Bulletin 501.**

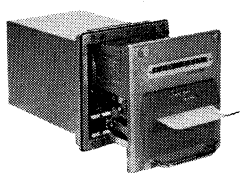
PRINTING COUNTERS



2 Models

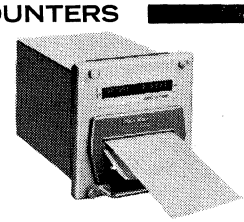
Visual readout and print; 6 digit serial entry totalizer; 10 impulses per second; AC or DC operation. Model illustrated PL103 — 2.84″ x 5.67″ x 7.72″. **Send for Bulletin 371 and Technical Manual 1112.**

Visual readout and print; 5 decades for serial and/or parallel entry counting; 10 or 20 impulses per second; DC operation. Not illustrated model PN107 — 2.84″ x 5.76″ x 7.16″. **Send for Bulletin 371 and Technical Manual 1112.**

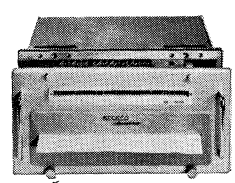


This printing counter provides not only a 6 digit serial entry totalizer but also a synchronous motor (110 V AC) driven time and date register of month, day, hour and minute. 10 impulses per second for serial entry totalizer. If parallel entry 20 impulses per second — 5.67″ x 5.67″ x 7.72″. DC or AC operation. **Send for Bulletin 371 and Technical Manual 1113.**

Also available for printing on card or tape and card.



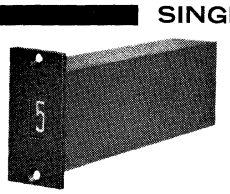
This unit consists of 10 decades for parallel entry counting. Any combination of decades may be wired for serial entry and in order to cover a wide range of applications alpha drums for code identification and special ratio drums for time and date registration have been made available. 10 or 20 impulses per second. DC operation. Model illustrated PN207 — 5.67″ x 5.67″ x 7.16.″ **Send for Bulletin 371 and Technical Manual 1113.**



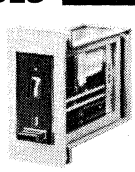
A multi-element unit providing a maximum 20 decade capacity, printing on tape or card. Any 5 decade element can be removed and in its place a 6 digit serial entry totalizer or a synchronous motor driven time and date register. This high capacity printer can be equipped with any combination of elements suitable for definite applications. DC operation. Model illustrated PL4005. 11.34″ x 5.67″ x 7.16″. **Bulletin 371 and Technical Manual 1111.1.**

Also available for printing on card.

SINGLE DECADES



This series of easy to read Sodeco impulse counters is fitted with a single numbered drum. Supplied with or without auxiliary contacts. Multi-digit counting chains can be accomplished as well as being used as predetermining registers, programmers or a single digit register. DC operation. Model illustrated ES2153 — 0.87″ x 1.73″ x 4.43″. **Send for Bulletin 101.**

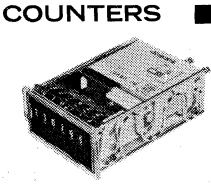


This new Sodeco ES4 Electric readout counter makes available in one compact unit a single digit, high speed impulse counter equipped with a 10 position readout switch, a transfer contact, a zero reset contact and a predetermining switch. Less than 2″ high, 1″ wide, & 3″ deep. Counting speed 25 ips. Standard voltage 24 V DC with 12 and 48 V DC on special order. **Send for Bulletin 1249.**

NEW TOTALIZING COUNTERS



COMPACT TOTALIZER — New, compact, low wattage, long life counter, 6 digit (8 without reset); counting speeds 25 or 60 c/sec; non-reset, manual or electric reset; 24 V DC standard. 1.89″ x 0.94″ x 2.83″. Surface or flush mounting. **Send for Bulletin 1248.**



The new Sodeco Model RG..E impulse counter with front-plate and spring loaded mounting is a compact, low wattage, long life counter that is ideal for multiple counter installations. Available with manual, electric, or no reset. Available in 5, 6 or 8 digits and counting speeds of 10, 25 or 60 ips. 24 V DC is standard, 12, 36, 48, 60, 110 and 220 V DC also available. **Send for Bulletin 1252.**

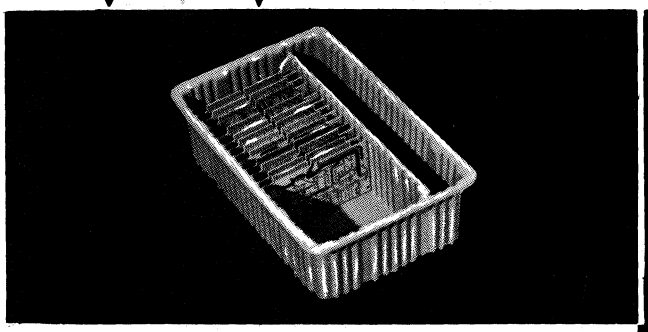
Write for detailed specifications and application information.

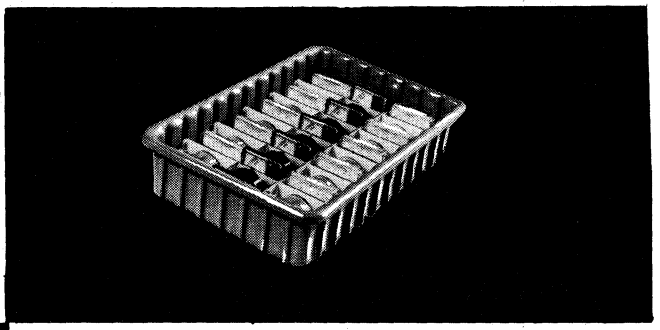
NOTE: Part numbers are for illustrated types. Also available in variations indicated.

Broad variety of types and wide range of operating voltages permits selection of the precise counter for the application.

LANDIS & GYR, INC.
45 W. 45th STREET, NEW YORK, N. Y. 10036
Tel: (212) 586-4644 • TWX: (710) 581-5888

P C C TOTE BOXES

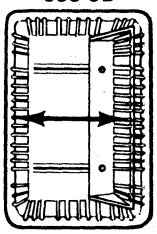




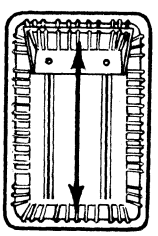
CIRCUIT BOARD BOXES
with adjustable "retainer wall"* *patent pending

300 SERIES

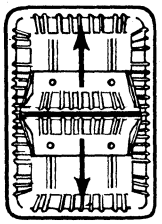
300 CB



300 CBX

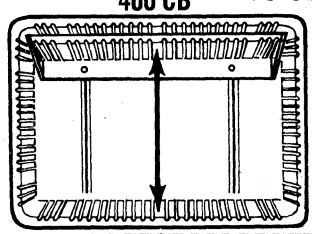


Install extra "Retainer Wall"* in any model and double circuit board capacity.

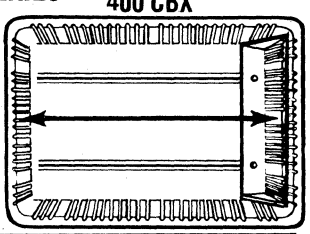


400 SERIES

400 CB



400 CBX



MODEL NUMBER	BOARD CAPACITY	MAXIMUM BOARD SIZE	PRICE
300-5CB	19	9¼" x 5"	$3.50
300-6CB	19	9¼" x 6"	3.70
300-7CB	19	9¼" x 7"	4.00
300-5CBX	11	14" x 5"	3.40
300-6CBX	11	14" x 6"	3.60
300-7CBX	11	14" x 7"	3.90
400-5CB	26	14½" x 5"	5.80
400-6CB	26	14½" x 6"	6.00
400-7CB	26	14½" x 7"	6.90
400-8CB	26	14½" x 8"	8.00
400-9CB	26	14½" x 9"	8.40
400-5CBX	19	20" x 5"	5.50
400-6CBX	19	20" x 6"	5.70
400-7CBX	19	20" x 7"	6.60
400-8CBX	19	20" x 8"	7.70
400-9CBX	19	20" x 9"	8.10

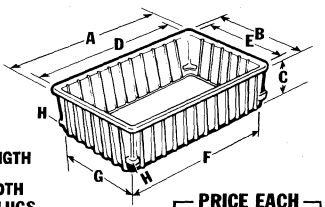
SECOND RETAINER WALLS*

MODEL NUMBER	EXTRA BOARD CAPACITY	PRICE
300 CBW	19	1.20
300 CBXW	11	1.00
400 CBW	26	1.50
400 CBXW	19	1.20
	*Patents Pending	

TRANSPARENT SNAP-ON DUST COVERS

300 S.O.	Clear Snap-On Covers for 300 Series	1.50
300 R.	Clear Regular Covers for 300 Series	1.45
400 S.O.	Clear Snap-On Covers for 400 Series	3.00
400 R.	Clear Regular Covers for 400 Series	2.80

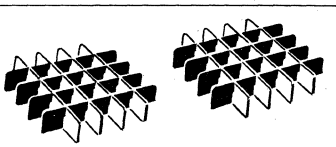
TOTE BOXES



A—OVERALL LENGTH
B—OVERALL WIDTH
C—OVERALL HEIGHT
D—TOP INSIDE LENGTH
E—TOP INSIDE WIDTH
F—BOTTOM INSIDE LENGTH
G—BOTTOM INSIDE WIDTH
H—STACKING LUGS (OPTIONAL)

DIMENSIONS IN COLUMNS "A" THROUGH "G" ARE IN INCHES								WT. (ABS)	PRICE EACH		
BOX NO.	A	B	C	D	E	F	G		ABS WITH STACKING LUGS	GREY LINEAR POLYETHYLENE	GREY OR WHITE ABS
100	10½	3⅞	2½	9¾	3	9¼	2⅜	3½ oz.	N.A.	N.A.	$ .82
200-2	10¾	8⅛	2¼	9⅜	6¾	9⅛	6½	5 oz.	$1.09	$1.20	1.01
200-3	10¾	8¼	3¼	9⅜	6¾	9⅛	6½	6 oz.	1.28	1.40	1.18
200-5	10¾	8¼	5	9⅜	6¾	9⅛	6½	8 oz.	1.50	1.78	1.37
300-1	10¾	8¼	1⅝	9⅜	6¾	9⅛	6½	11 oz.	N.A.	1.80	1.80
300-2	16⅜	10⅞	2¼	14⅞	9¼	14¾	9⅛	11½ oz.	1.95	1.85	1.85
300-3	16⅜	10⅞	3¼	14⅞	9¼	14¾	9⅛	12 oz.	2.00	1.90	1.90
300-4	16⅜	10⅞	4	14⅞	9¼	14¾	9⅛	14 oz.	2.35	2.20	2.20
300-5	16⅜	10⅞	5	15	9⅜	14¾	9⅛	15 oz.	2.50	2.29	2.29
300-6	16⅜	10⅞	6	15	9⅜	14¾	9⅛	1#	2.55	2.40	2.40
300-7	16⅜	10⅞	7	15	9⅜	14¾	9⅛	1# 3½ oz.	2.90	2.80	2.70
300-8	16⅜	10⅞	8	15	9⅜	14¾	9⅛	1# 6 oz.	3.20	3.10	3.00
400-3	22⅜	17½	3	20⅛	15⅛	20	15	1# 13 oz.	4.00	2.90	3.80
400-4	22⅜	17½	4	20⅛	15⅛	20	15	1# 14 oz.	4.10	3.10	3.90
400-5	22⅜	17½	5	20⅛	15⅛	20	15	1# 15 oz.	4.20	3.30	3.98
400-6	22⅜	17½	6	20⅛	15⅛	20	15	2#	4.40	3.60	4.15
400-7	22⅜	17½	7	20⅛	15⅛	20	15	2# 9 oz.	5.25	4.10	4.95
400-8	22⅜	17½	8	20¼	15¼	20	15	3#	6.55	4.85	6.19
400-9	22⅜	17½	9	20¼	15¼	20	15	3# 4 oz.	6.85	5.60	6.47

NOTE: Grey ABS boxes will be supplied unless otherwise specified. Please allow extra week for delivery of white ABS boxes. Grey ABS boxes only, have grained exterior. Boxes with stacking lugs available from stock in ABS, or in polyethylene by quotation. When ordering specify polyethylene boxes by suffix "P.E." to Box No. (e.g., "300-5 P.E."). To specify boxes with stacking lugs use suffix S.L. (e.g., "300-5 S.L.").

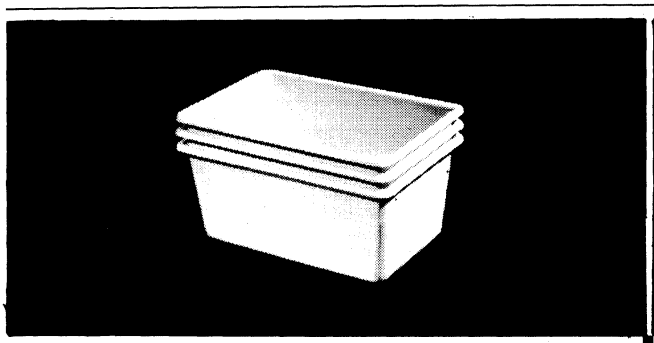


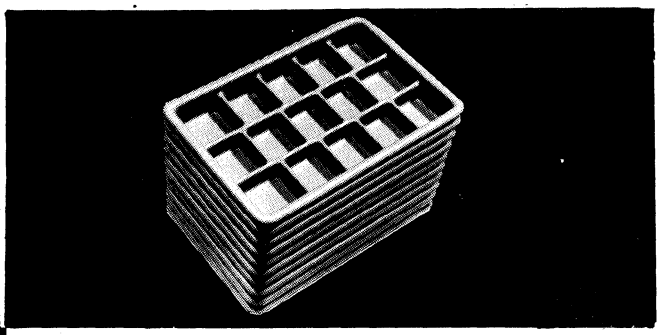
DIVIDERS

	HEIGHT	LATERAL 1/16" Thick		LATERAL 1/8" Thick		LONGITUDINAL 1/16" Thick		LONGITUDINAL 1/8" Thick	
200 SERIES BOXES SLOTTED FOR: 5 LONGITUDINAL 7 LATERAL DIVIDERS	1"	211	$.04	211	$.06	212	$.05	212	$.08
	2"	221	.06	221	.09	222	.07	222	.11
	2¼"	221A	.07	221A	.11	222A	.08	222A	.12
	4"	241	.11	241	.18	242	.12	242	.18
	4½"	241A	.12	241A	.20	242A	.13	242A	.20
300 SERIES BOXES SLOTTED FOR: 7 LONGITUDINAL 11 LATERAL DIVIDERS	1"	311	.05	311	.08	312	.07	312	.11
	2"	321	.07	321	.11	322	.11	322	.11
	2¼"	321A	.08	321A	.12	322A	.12	322A	.20
	4"	341	.12	341	.18	342	.18	342	.28
	4½"	341A	.13	341A	.20	342A	.20	342A	.33
400 SERIES BOXES SLOTTED FOR: 11 LONGITUDINAL 15 LATERAL DIVIDERS	1"	411	.07	411	.11	412	.08	412	.12
	2"	421	.11	421	.18	422	.14	422	.22
	2¼"	421A	.12	421A	.20	422A	.15	422A	.25
	4"	441	.18	441	.28	442	.23	442	.37
	4½"	441A	.20	441A	.33	442A	.25	442A	.40

NOTE: 1/16" Dividers Will Be Supplied Unless Otherwise Specified. Standard Dividers Slotted on 1¼" Centers.

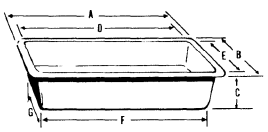
PROTECT-ORGANIZE - STORE ALL SMALL PARTS





SMOOTH WHITE ABS RIBLESS NESTERS

A O.D. Top Lid Length
B O.D. Top Lid Width
C O.D. Depth
D I.D. Top Lid Length
E I.D. Top Lid Width
F I.D. Bottom Length
G I.D. Bottom Width



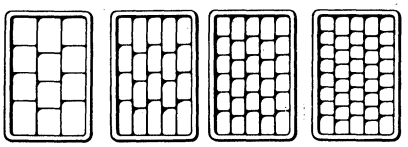
Dimensions in columns "A" through "G" are in inches.

Box No.	A	B	C	D	E	F	G	Weight	Starting Gauge	Grey-White ABS Price
100-N	10½	3⅞	2½	9¾	3	9¼	2⅜	3½ oz.	.125	$ .90
200-2N	11¾	8¼	2	9⅜	6¾	9⅛	6½	5¾ oz.	.100	1.20
200-3N	11¾	8¼	3	9⅜	6¾	9	6¼	6 oz.	.100	1.25
200-5N	11¾	10⅞	5	9⅜	6¾	8½	6	7¼ oz.	.125	1.40
300-2N	16⅜	10⅞	2	15⅛	9⅜	14¾	9⅛	12 oz.	.100	1.95
300-3N	16⅜	10⅞	3	15⅛	9⅜	14⅝	9	12½ oz.	.100	2.00
300-5N	16⅜	10⅞	5	15⅛	9⅜	14⅜	8½	15 oz.	.125	2.40
300-6N	16⅜	10⅞	6	15⅛	9⅜	14⅛	8⅜	1 lb. 3 oz.	.156	2.80
300-7N	16⅜	10⅞	7	15⅛	9⅜	14	8¼	1 lb. 4 oz.	.156	2.90
400-3N	22⅜	17½	3	20¼	15¼	20	14⅞	2 lb.	.125	4.00
400-5N	22⅜	17½	5	20¼	15¼	19½	14⅝	2 lb. 4 oz.	.156	5.00
400-6N	22⅜	17½	6	20¼	15¼	19⅜	14⅜	2 lb. 8 oz.	.156	5.20
400-7N	22⅜	17½	7	20¼	15¼	19¼	14¼	3 lb.	.187	6.60
400-8N	22⅜	17½	8	20¼	15¼	19⅛	14⅛	3 lb. 8 oz.	.219	6.90
400-9N	22⅜	17½	9	20¼	15¼	19	14	3 lb. 12 oz.	.219	7.20

NOTE: White ABS Boxes Will Be Supplied Unless Otherwise Specified. Please Allow Extra Week For Delivery of Grey ABS Boxes. Grey ABS Boxes Only Have Grained Exterior.

STACKABLE COMPARTMENTED ASSEMBLY TRAYS

$2.50 each

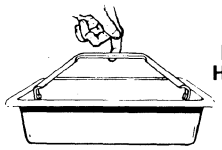


Model 3012 **Model 3020** **Model 3030** **Model 3040**

MODEL:	COMPARTMENTS:	DIMENSIONS:
3012	12 in 3 rows	2¾" x 3⅛"
3015	15 in 3 rows	2¾" x 2½"
3020	20 in 5 rows	1½" x 3¼"
3030	30 in 5 rows	1½" x 1⅞"
3040	40 in 5 rows	1½" x 1⅜"

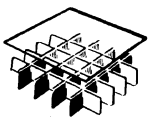
NOTE: Be certain when ordering covers to include proper suffix — 300-R (Regular) or 300-SO (Snap-on). Butyrate cover will be supplied unless white or grey ABS is specified.

ACCESSORIES

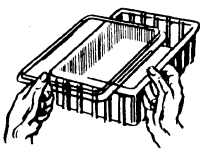


BASKET HANDLES

SEPARATORS



COVERS



LABEL PADS AND HOLDERS



BASKET HANDLES	
For 200 Series	$ .80
For 300 Series	1.00
For 400 Series	1.25
HANDLES OF DURABLE ALUMINUM	

SEPARATORS	
For 200 Series	$.20
For 300 Series	.40
For 400 Series	.80

STACKING STRIPS	
For 200 Series	$ .55
For 300 Series	.80
For 400 Series	1.00

STACKING STRIPS PERMIT POSITIVE STACKING WHEN DIVIDERS OR COVERS ARE NOT USED.

COVERS

SERIES	REGULAR GREY ABS	REGULAR CLEAR BUTYRATE	SNAP-ON GREY ABS	SNAP-ON CLEAR BUTYRATE
For 100 Series	$ .50	$ .60	$ .52	$ .65
For 200 Series	.60	.75	.64	.80
For 300 Series	1.10	1.45	1.15	1.50
For 400 Series	2.00	2.80	2.20	3.00

NOTE: Order By Series Number With Suffix Letter R (Regular), S-O (Snap-On); Example: 300 S-O When Ordering 300 Series Snap-On Cover. Butyrate Cover Will Be Supplied Unless ABS Is Specified.

LABEL PADS AND HOLDERS

SIZE—INCHES	PAD-LOOSE	PAD-APPLIED	PAD AND HOLDER-LOOSE	PAD AND HOLDER-APPLIED
2¼ x 3	$.06	$.16	$.14	$.24
2¼ x 5	.08	.18	.20	.30
3 x 5	.10	.20	.26	.36
3½ x 7¼ (PUNCH CARD)	.12	.22	.32	.42

A 5% discount shall apply to orders of $500 or over; 10% to orders of $1000 or over; 15% to apply to orders of $2500 or over. Terms: Net 10th, F.O.B. Detroit, Michigan • Prices subject to change without notice.

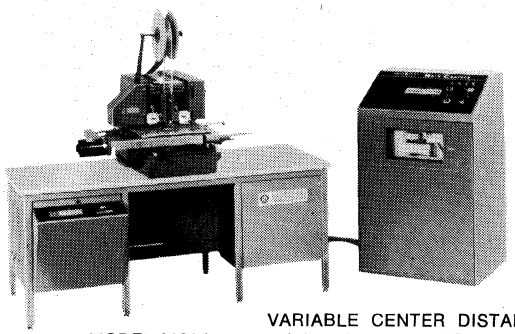
PANEL CONTROLS CORP. 1000 MT. ELLIOTT AVENUE, DETROIT, MICHIGAN 48207 • TEL. (313) 568-2400

Universal ENGINEERED ELECTRONIC

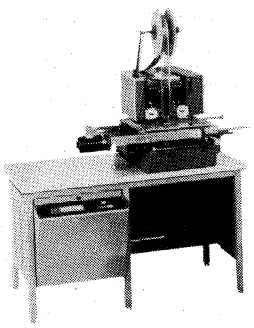
PRINTED CIRCUIT BOARD INSERTION MACHINES

PANTOGRAPH OPERATED . . . NUMERICALLY CONTROLLED . . . COMPUTERIZED TOTAL SYSTEMS

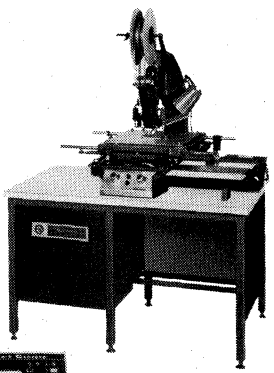
AXIAL LEAD COMPONENTS



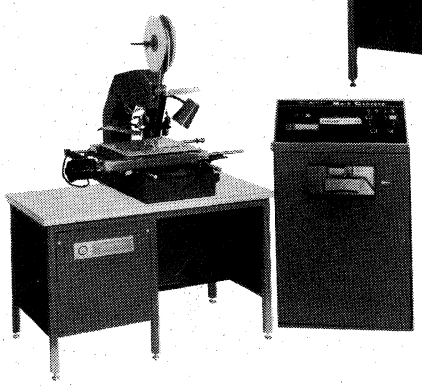
VARIABLE CENTER DISTANCE MODEL 6262 inserts axial lead parts into PC boards on as many as 999 different center distances between pads from 0.300″ to 1.260″ with a single board handling. Programmable for wire diameters from 0.015″ to 0.32″ and 0.020″ to 0.037″.



DUAL CENTER DISTANCE MODEL 6271 N/C (also available with pantograph) for insertion at two adjustable center distances. Programmable 8-position depth stop. More economical to purchase than a fixed head machine plus second head for alternate center distance — with all downtime for changeover eliminated.



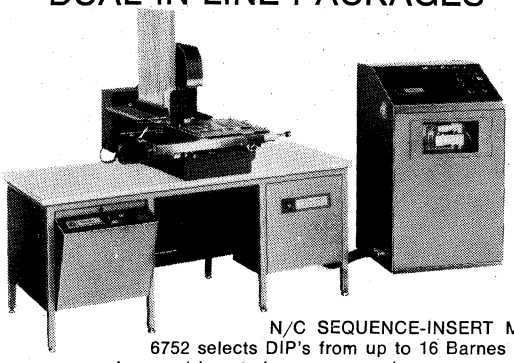
PANTOGRAPH — FIXED CENTER DISTANCE inserts reel packaged axial lead components at rates in excess of 2,000 an hour; rates as high as 5,600 have been attained.



N/C FIXED CENTER DISTANCE MODEL 6253 (also available with dual heads) inserts sequenced axial lead components at rates in excess of 4,500 an hour.

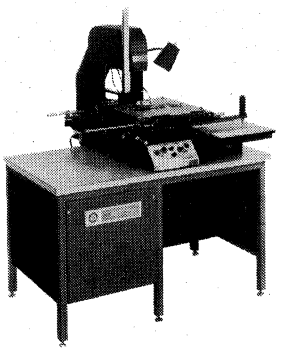
OTHER INSERTION MACHINES include jumper wire . . . square "wire wrap pin" . . . wire "stitcher" . . . PC board terminals . . . drill press. Additional adaptations of Universal's basic pantograph and N/C positioning systems can be produced to meet special requirements where close tolerance parts location is needed.

DUAL IN-LINE PACKAGES

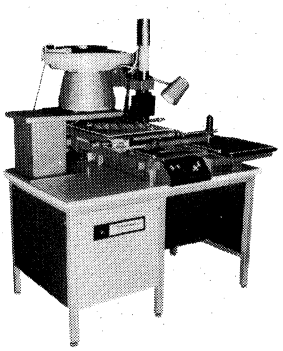


N/C SEQUENCE-INSERT MODEL 6752 selects DIP's from up to 16 Barnes carrier magazines and inserts in programmed sequences at rates as high as 2,500 an hour.

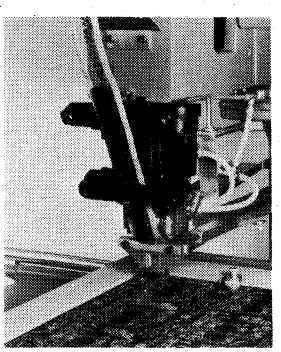
PANTOGRAPH — INSERT MODEL 6413 inserts DIP's from Barnes carrier magazines at rates up to 1,800 an hour. Models also available to sequence and insert 4, 8, or 16 different DIP's from Barnes magazines or stick input.



TRANSISTORS



LEAD TAPED transistors can be inserted as "axial lead" components at rates of approx. 4,000 an hr. from this N/C Model 6352. Also available with pantograph operation.



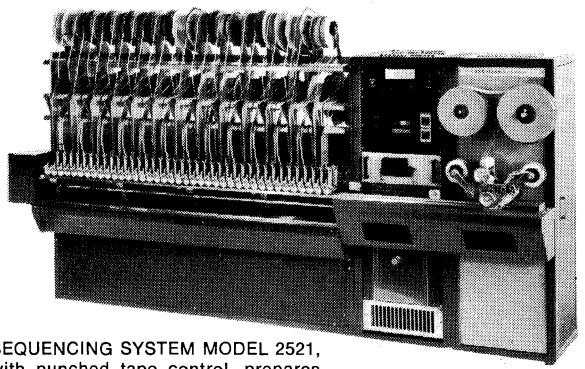
BOWL FED transistors are inserted as "axial lead" components at rates as high as 3600 from this Model 6351. Other models available to insert transistors "conventional" position.

CONTRACT MANUFACTURING . . . SHORT RUN STAMPING. Universal also offers extensive modern facilities for contract manufacturing, ranging from prototypes to production scale runs, using latest facilities for electronic assembling and short run stamping.

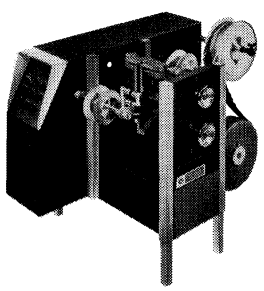
ELECTRO-MECHANICAL PRODUCTION EQUIPMENT

COMPONENT PACKAGING MACHINES

AXIAL LEAD COMPONENTS

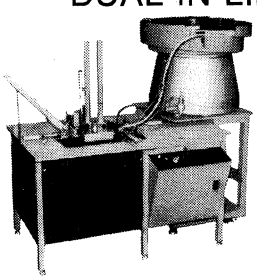


SEQUENCING SYSTEM MODEL 2521, with punched tape control, prepares reels of axial lead components in sequence for automatic PC board insertion. Up to 39 dispensing stations can be fed from lead taped units, magazines or cardboard packages.



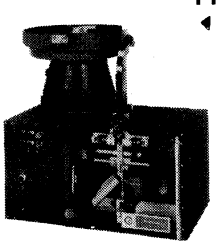
AXIAL LEAD TAPING MACHINE MODEL 2315 lead tapes and reel packages components. Available with bowl feed, lead straightening & trimming, testing and orienting accessories. Operates at rates as high as 15,000 an hour.

DUAL IN-LINE MODULES

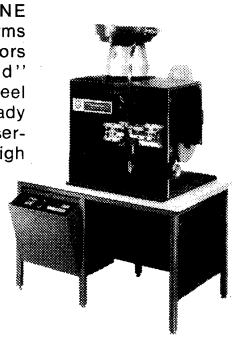


BARNES CARRIER LOADER MODEL 4411 inserts bowl fed DIP's into carriers at rates up to 4,000 an hour.

TRANSISTORS

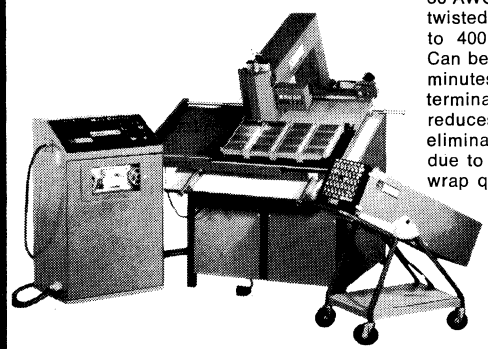


◀ "PREPPER" – LEAD TAPING MACHINE MODEL 3315 forms bowl fed transistors into "axial lead" components and reel packages them ready for PC board insertion at rates as high as 7,000 an hour.

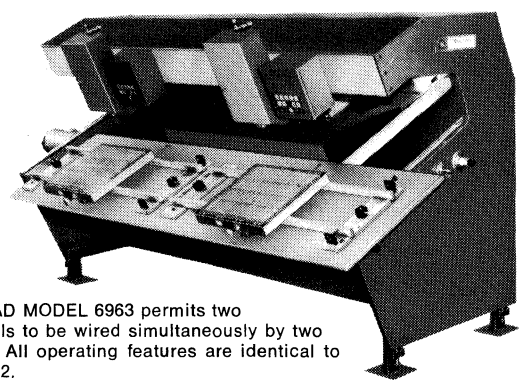


PREPPER MODEL 3421 prepares TO-18 and other transistors for mechanical insertion into PC boards at rates up to 5,000 an hour. ▶

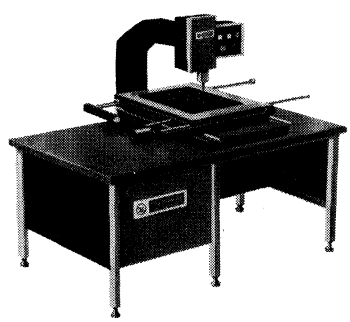
SEMI-AUTOMATIC WIRE TERMINATION SYSTEMS



SINGLE HEAD MODEL 6952 terminates 24 and 30 AWG wires, including twisted pairs, at rates up to 400 wires an hour. Can be changed over in minutes for clip on wire termination. Drastically reduces rework time by eliminating wiring errors due to misplacement or wrap quality.



DUAL HEAD MODEL 6963 permits two back panels to be wired simultaneously by two operators. All operating features are identical to Model 6952.



SINGLE HEAD MODEL 6951 is designed for smaller back panels with a wiring area not larger than 16″ by 18″. Operating features are similar to Model 6952.

COMPONENT PROCESS SYSTEMS & CUSTOM PRODUCTION EQUIPMENT

Process line sub-assemblies and complete systems can be supplied for automated operations including diode, capacitor and resistor assembly, testing, orienting, sorting, body coating, marking, curing, and reel packaging. For full information send for Bulletin 2000.

UNIVERSAL INSTRUMENTS CORPORATION • East Frederick St. / Binghamton, New York 13902 / 607-772-1710

Low frequency, long term, real time magnetic tape recorders, systems



- ONE-INCH: Model 19429
- ONE-HALF INCH: Model 17373

APPLICATIONS

oceanography
off-shore platform monitoring
submerged buoy monitoring
medical
seismology
geomagnetic
meteorological
process monitoring
maintenance recording

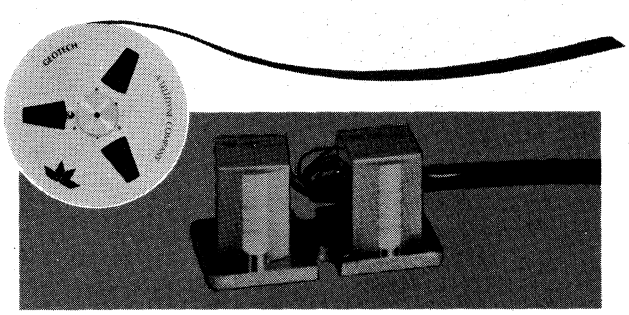
photo: model 19429

SPECIFICATIONS FOR FM RECORDING

TAPE SPEED IPS	NO. OF CHANNELS ½"	NO. OF CHANNELS 1"	DATA FREQUENCY RANGE ± 3 db [1]	FM CENTER FREQUENCY	RECORDING TIME (7200 FT TAPE)	SIGNAL TO NOISE RATIO (RMS TO RMS)	POWER (WATTS) [2] ½" DC	½" AC	1" DC	1" AC
0.03	7	14	dc to 5 Hz	27 Hz	33.3 days	40 db	19	21	25	27
0.06	7	14	dc to 10 Hz	54 Hz	16.6 days	40 db	19	21	25	27
15/160	7	14	dc to 17 Hz	84.4 Hz	10.6 days	40 db	19	21	25	27
15/16	7	14	dc to 170 Hz	844 Hz	25.5 hours	40 db	28	30	34	36

[1] Direct-recording mode available

[2] One-half inch also available: low-power, dc



TAPE & REPRODUCE HEADS

Geotech supplies tape, and builds flux-responsive reproduce heads with associated electronics for specific applications/requirements. Geotech's unique flux-responsive real-time playback heads reproduce analog signals with a dynamic range equal to that obtained in higher-speed instrumentation recorders.

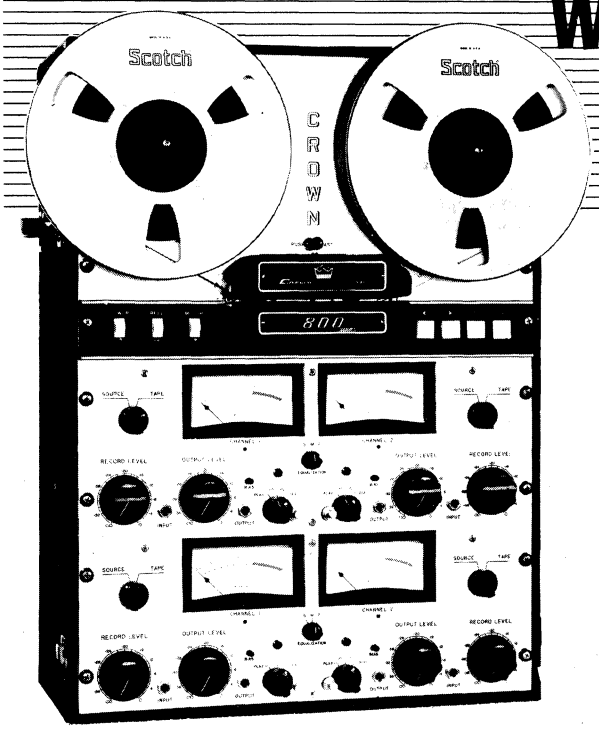
Recorders are instrumentation-grade units suitable for field or laboratory use. Reproduce channel may be used to read out data from magnetic tape as it is being recorded without interrupting recording process, which allows continuous monitoring of entire data system. Reproduce channel is switchable to any record channel. Recorders are IRIG compatible. Recording speeds and center frequencies allow analysis on any IRIG standard unit.

For additional information, write c/o Dept. 14; GEOTECH — A Teledyne Company; 3401 Shiloh Road; Garland, Texas 75040

GEOTECH
A TELEDYNE COMPANY

Crown

WIDEBAND POWER AMPS
PRECISION TAPE DECKS



All models handle ¼-inch tape and reels 5"-10½", all 19" rack mount

Standard speeds 15-15/16 ips with 1 to 4 channels

Patented electro-magnetic brakes never need adjustment

Lifetime lubrication of all bearing surfaces

True straight-line threading with easy-edit design

Individual erase, record and play heads for 1, 2, or 4 tracks

Five years proven solid state circuitry — etched circuit modules

Extremely low noise electronics; modular transport construction

Strict quality control with individual proof-of-performance records—entirely American made

Over 40 standard models $545-$3700; custom modifications for OEM use

Also available: slow speed data loggers (down to 0.33 ips), duplicator systems, and complete series of players

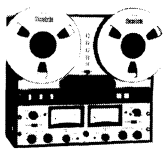
TWO BASIC TRANSPORT STYLES:

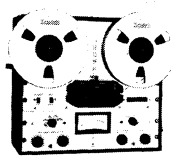
700 Rugged, high-quality simple unit with only 9 moving parts; automatic stop in "play" mode

800 700 construction plus computer logic control—never breaks tape; IC logic levels for remote control and function readout; ideal for systems integration; 10 moving parts; photocell tape sensor, edit switch, cue lever; automatic replay accessory.

FOUR STYLES OF ELECTRONICS:

Varying features and degrees of flexibility to match user requirements.

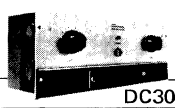
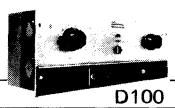




TYPICAL PERFORMANCE CHARACTERISTICS

(varies with model & options selected)

speed-ips	response-Hz	S/N-db	W&F-%
15	+2db 50-30K	60	0.06
7 1/2	+2db 30-25K	55	0.09
3 3/4	+2db 50-15K	50	0.18
1 7/8	+3db 50-10db	45	0.35
15/16	+3db 50-5K	45	0.50


	DC300	D100	D40
Output—4Ω load	330 w/channel	100 w/channel	40 w/channel
Response (1w)	±0.1db 0Hz-20KHz	±0.1db 20 Hz-20KHz	±0.1db 20 Hz-20KHz
S/N	100db below 150w	90db below 100w	90db below 30w
IM dist—8Ω load	under 0.1% 0.01w-150w	under 0.3% 0.01w-100w	under 0.3% 0.01w-30w
Dimensions	7"x19"x9¾"	7"x19"x9"	1¾"x19"x7½"
Weight	40 lbs	30 lbs	7½ lbs
Price*	$685	$475	$199

*subject to change without notice

DC300 — Lab Standard DC Amplifier
Outstanding for exceptional signal purity and stability coupled with unusually high power capabilities; output ± 50 volts DC, 35 volts RMS AC; DC drift under 3 mv up to 55° C.

D100 — High Power Audio Amplifier
Excellent general-purpose power amp with outstanding response, distortion and stability.

D40 — Ultra-Compact Audio Amplifier
Small, high-quality amplifier with unusually wide power band-width.

All Crown power amplifiers are completely stable two-channel units with internal protection for all loads. Rugged instrument-grade construction guaranteed three years for parts and labor. Custom modifications available for quantity OEM purchases.

CROWN International
Box 1000, Dept. EEM
Elkhart, Ind., 46514

Phone 219+523-4919
EXTENSION 21M CLYDE W. MOORE

Kinelogic

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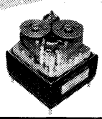
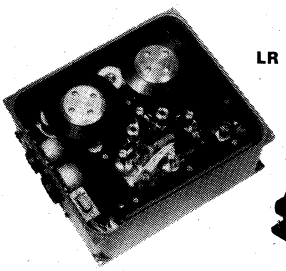
YE



SC

special purpose magnetic tape recorders

Leading manufacturer of instrumentation type recorders for field and space environments. Widest line of standard recorders — optimized to your application • Proprietary drive system reduces operating parts 30%; withstands severe environments, gives bidirectional operation, constant tape tensioning and very low flutter.



LR



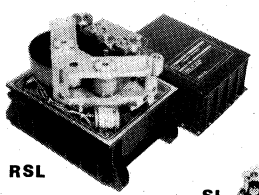
HM

RECORDERS FOR AIR/SEA/GROUND APPLICATIONS

CHARACTERISTICS		MODEL SC	MODEL LR	MODEL L	MODEL HM	MODEL YE	MODEL DP	TYPE F
TAPE CAPACITY	*WIDTH (INCHES)*	1.0	0.5 or 1.0	0.5 or 1.0	0.5 or 1.0	1.0	0.25	0.5 or 1.0
	LENGTH (FEET)	60	650	1000	2250	4600	615	220
TAPE SPEEDS	*SPEEDS (ips) IN STD. RECORDER*	15	3.75/1.875, 15/7.5, 60/30	3.75/1.875, 15/7.5, 60/30	3.75/1.875, 15/7.5, 60/30	3.75/1.875, 15/7.5, 60/30	1.875	45/22.5
	ELEC. SEL. RATIOS	—	2:1	2:1	2:1	2:1	—	2:1
SIZE IN INCHES	*WIDTH*	4	7.6	9.5	10.75	15	5	6.12
	LENGTH	4	6.6	7.5	15.375	21	8	6.12
	HEIGHT	4	3.87	4.25	4.905	5	3	3.25
WEIGHT IN POUNDS		4	7	11	30	45 (incl. elec.)	6.1	10
POWER REQUIRED	*VOLTAGE*	28 Vdc	28 Vdc	28 Vdc	28 Vdc or 115 Vac	28 Vdc	28 Vdc Control 115Vac, 400 Hz ± 1 Hz	28 Vdc
	WATTS	15	15 (at 30 ips)	22	45	30 (w/o elec.)	3 (DC) <15 VA	22
DATA RECORDING SUITABILITY		Digital	Analog & Digital	Analog & Digital	Analog or Digital	Analog or Digital	VOICE	Digital

SPACE RECORDERS (SATELLITE, DEEP PROBES)

CHARACTERISTICS		MODEL SL	MODEL CJ	MODEL LS-1	MODEL LS-2	MODEL RSL	MODEL LL
TAPE CAPACITY	*WIDTH (INCHES)*	1.0	0.25	1.0	1.0	1.0	0.25
	LENGTH (FEET)	125	480	1090	1090	400	625 (cartridge)
TAPE SPEED (ips) in Std. Recorder		30	single speed 1 to 30 ips	2.4 & 4.8 Record 19.2 Playback	4.5 Record 24 Playback	4	two speed 0.468, 15
SIZE IN INCHES	*WIDTH*	4.2 Dia.	6.0	10.5	10.5	6.0	6.9
	LENGTH	4.2 Dia.	7.75	9.0	9.0	5.0	11.0
	HEIGHT	4.125	4.0	6.0	6.0	5.0	3.5
WEIGHT IN LBS*		3.8	5.9	12	12	5.5	8
REQUIRED POWER	*VOLTAGE*	28 Vdc	2ϕ, 21 Vac	28 Vdc	28 Vdc	28 Vdc	28 Vdc
	WATTS	25	2.5 at 4 ips	16 in Record 22 in Playback	16 in Record 22 in Playback	6	10
DATA RECORDING SUITABILITY		Analog or Digital	Digital	Digital	Digital	Digital	Analog, Digital and FM

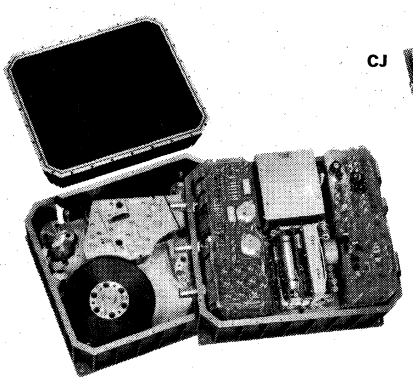


RSL

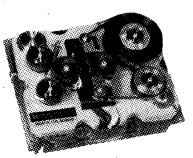


SL

*All specifications nominal. Size and weight include control electronics but exclude data electronics, except for RSL, which includes two Rec. & P/B channels. Write or phone Kinelogic for additional information on these or other Kinelogic recorders.



LS-1/LS-2



CJ

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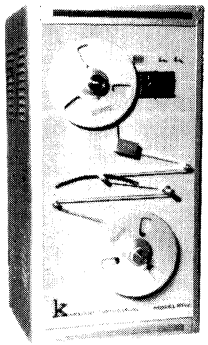
electronics and accessories



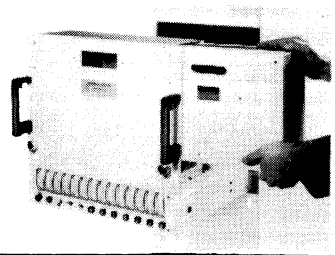
TAPE WINDER *MODEL KTW*

Transfers 0.25", 0.5" or 1.0" tape at constant tension from a standard 10.5" or 14" reel to a customer's special-purpose hub. Constant and high tension is particularly important for tape packs used in a vibration or shock environment where layer-to-layer tape slippage can cause a recorder malfunction. Tape packs also have less than 0.5 mils layer-to-layer edge variation. This assures optimum tape guidance, minimum flutter and dynamic skew.

Winder is designed to accommodate almost any take-up hub or reel. Constant tension wind is provided by a tension arm and servo system — 16 oz. for 1.0" tape, 8 oz. for 0.5" tape and 4 oz. for 0.25" tape. Winding speed is ≈50 ips. Winder incorporates tape footage counter and automatic control for stopping when pre-set length has been wound. Guides for all tape widths (0.25", 0.5" & 1.0") are supplied as standard. Cabinet dimensions: 33.5" H x 22" W x 17" D. Power: 115V ±10%, 60 Hz, 1 Ph at 1.5A. Weight ≈145 lbs.

GROUND PLAYBACK STATION *MODEL GSH*

In some applications it is desirable to use a Kinelogic recorder in the same manner as a tape magazine or cartridge (i.e., the recorder is removed from test vehicle and without removing cover or tape, is inserted in a Playback Station to reproduce recorded data. This technique is particularly appropriate where untrained personnel must be employed to handle the equipment. It is also advantageous in dusty or humid environments since the equipment does not have to be opened for playback.



ELECTRONICS FOR AIR/SEA/GROUND APPLICATIONS

Power requirement: 28 ±4 Vdc. Will withstand transients up to 45V for 250 ms. Packaging: Full encapsulation. Test points: Provided on the front panel. Connector: Cannon DA 15P. Environmental capability (limits on specified performance) — Temperature: −20°C to +85°C. Humidity: Designed to meet MIL-E-5272. Linear accelerations: 100g. Vibration: 25g to 2000 Hz. Shock: 150g, 5 ms, R/11 ms D.

Amplifier Type	Size in inches H	W	D	Weight in Oz.
Record	2.00	0.75	2.187	3
Playback	2.00	0.75	4.25	6

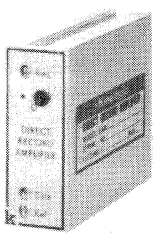
RECORD

BIAS OSCILLATOR *MODEL EAB*

Output: 750 KHz ± 3% — Amplitude: 2 volt rms sinewave — Amplitude Stability: ±0.5 db for specified environment — Even Order Harmonic Distortion: Less than 0.5% rms — Load Capability: adequate to drive 1 to 14 Kinelogic Direct Record Amplifiers Model EAR — Power Consumption ≈ 1.2 watts

PRECISION REFERENCE OSCILLATOR *MODEL EAF*

Output Freq: 200, 100, 50, 25, 17, 12.5, 6.25, 3.125 KHz and 60 Hz are available. Two outputs are provided — one for supplying a reference multiplex type signal to Direct Record Amplifiers — the second for driving a record head and providing saturation recording on a separate tape track. Freq. Accuracy: ±0.01% Multiplex Output — Harmonic Distortion: Less than 0.3% total rms, Ampl. Stability: ±0.5 db for specified environment, Output Amplitude: 2 volts rms, Load Capability: 14 Direct Record Amplifiers — Power Consumption ≈ 1.5 watts



DIGITAL RECORD AMPLIFIER *MODEL EDR*

NRZ (mark) or NRZ (level) type inputs selectable by switch provide full tape saturation. Standard input logic level: Logical "0" is 0 volts, Logical "1" is +6 volts — Input Clock Mark: change in voltage level (+6 to 0 or 0 to +6 volts) — Other logic levels available. Input Z (data or clock): "1" input — Input signal must supply max. 10 ma. "0" input — Input signal must sink min. of 1.27 ma. Max. data rate: 30 Kbps. Power consumption ≈2.25 watts.

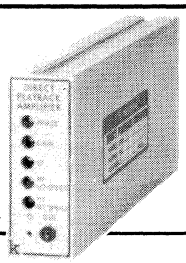
FM RECORD AMPLIFIER *MODEL EFR*

Input sensitivity: 0.5 to 4 Volts peak for ±40% dev. — Input Z: 100K ohms, unbalanced. Center freq: Most IRIG Freq. available — DC linearity: ±0.25% from best straight line — Worst case combination of Temperature Power Input Variation, and 8 Hour Drift results in a freq. dev. less than 3% of the full bandwidth — Power Consumption: ≈2W

DIRECT RECORD AMPLIFIER *MODEL EAR*

Data Input Sensitivity: 0.1 to 1.5 volts rms — Input Z: 100 k ohms, unbalanced — Freq. Response ±1 db (constant current): 100 Hz to 128 KHz — Total Harmonic Distortion: Less than 0.3% — Output Amplitude Stability: ±0.5 db — Precision Reference Signal and Bias Inputs are also provided. Amplifier designed to use 750 KHz bias. Power Consumption: ≈ 1.2 watts

PLAYBACK



DIGITAL PLAYBACK AMPLIFIER *MODEL EDP*

Amplifier employs peak detection which reduces pulse jitter during play to a minimum. Triggering in the reconstruct amplifier section is essentially independent of input signal amplitude. Output is NRZ (mark). Logical "0" is no change in voltage level: or vice versa. Max. bit rate: 30 Kbps. Output Z < 100 ohms. Amplifiers will handle 6 tape speeds with front panel switch (manual). Power consumption ≈1 watt.

FM PLAYBACK AMPLIFIER *MODEL EFP*

Available for any std. IRIG Center Frequency — Amplifiers having a Frequency Response which complies with either Low Band or Intermediate Band IRIG Specifications are available — Linearity: ±0.25 of best straight line for full bandwidth output — Total rms Harmonic Distortion: Less than 0.5% — Output Z < 100 ohms — Output Level: 0 to ±1.4 volts peak. Power Consumption ≈ 1 watt

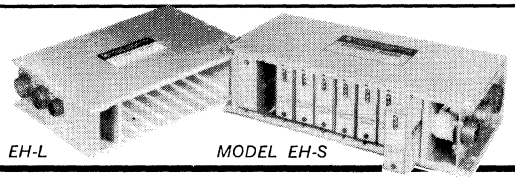
DIRECT PLAYBACK AMPLIFIER *MODEL EAP*

Amplifiers having Output Characteristics complying with either the Low Band or Intermediate Band IRIG Specification are available. Normal Output Level: 1 volt rms — Output Z: less than 100 ohms — Total RMS Harmonic Distortion: less than 0.5% — Both Amplitude and Phase Equalization for 1 or 2 tape speeds are available. Power Consumption ≈ 1 watt

ELECTRONICS HOUSINGS

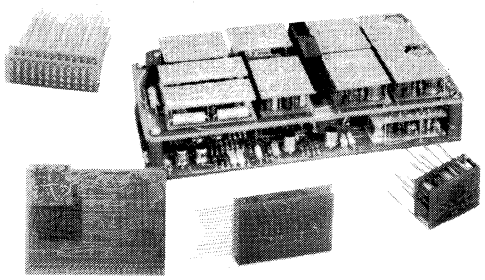
EH-S 9.312" x 2.437" x 4.125"

EH-L 9.312" x 2.437" x 6.125"



MODEL EH-L *MODEL EH-S*

Housing wired to accept any combination of 9 Kinelogic Amplifiers — Model EH-S for record modules, Model EH-L for playback amplifiers. Available with thermostatically controlled heaters to extend operation of Kinelogic Electronics from −20°C to −54°C.



SPACE ELECTRONICS

Kinelogic data and control electronics for space use are tailored for each individual application. The electronics are adaptions of a special group of circuits, designed and developed by Kinelogic to minimize size, weight, and power consumption, and also to meet the highest reliability standards. Cordwood and other condensed packaging techniques are employed for fabrication of hybrid modules (combination of IC and discrete components) which in turn are mounted on multi-layer "mother" boards. This approach minimizes interconnecting wiring. Fabrication is to NASA standards with assembly and soldering accomplished by NASA certified personnel in a "clean" environment.

Available circuits include digital, (NRZ and Biphase) direct, and FM record and playback amplifiers plus head track switching logic, inverters, control logic, power supplies, etc. Typical characteristics of a single channel of data electronics are shown in the Table.

	Digital		Direct		FM	
Characteristics	Rec.	P/B	Rec.	P/B	Rec.	P/B
Size (cubic inches)*	0.7	1.5	1.3	1.3	1.0	2.0
Weight (oz)*	0.3	0.8	0.8	1.3	0.5	2.0
Power Consumption (Milliwatts)	100	180	100	50	100	160

*The size and weight of the interconnecting "mother" board must be added to the above numbers in order to estimate system values.

Kinelogic

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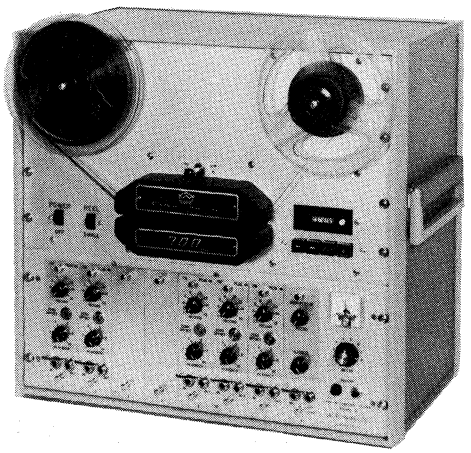
Low Cost Tape Recording Systems

MODEL A
8 CHANNEL ANALOG RECORDER



This instrument meets the long standing need for a versatile, low-cost, multi channel tape recorder. We have integrated a high-quality Crown tape deck with our FM and direct electronics to produce a machine of remarkable performance and value. The plug-in electronics allows up to eight channels in any combination. Eight tracks are recorded across standard ¼ inch tape.

FM plug-ins are available for all 4 tape speeds. The bandwidth at 7½ in/sec is DC-1000 c/s. All FM plug-ins have wide ±72% deviation for low noise. Data input required is 1.5V p-p. Linearity is within ±1%. All four plug-ins are compatible to allow time base compression/expansion.

The audio plug-in operates at all four speeds with equalization by an internal switch.The input for a ceramic microphone output is one watt. A meter monitors recording level and FM carrier setting.

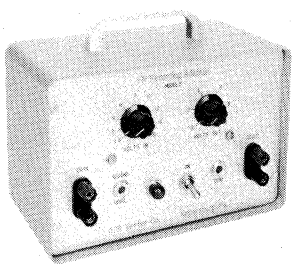
The Crown transport used in the Model A operates at 15/16, 1⅞, 3¾ and 7½ ips. It accepts 5, 7, and 10½ inch reels. It is an exceptional three meter design featuring fully electro-magnetic operation (PATENTED). There are no clutches, brakes, or similar friction elements with their inherent complexities.

MODEL A RECORDING SYSTEM, complete, less plug-ins **$1725.00**

AUDIO PLUG-IN, per channel **85.00**

FM-715 PLUG-IN (7½ in/sec), per channel **160.00**

ALL OTHER FM PLUG-INS, per channel **120.00**



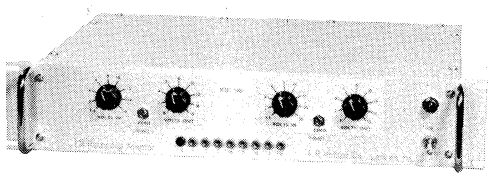
MODEL 2
$165.00

Record and Playback DC Signals on any Tape Recorder with one of our FM Recording Adaptors.

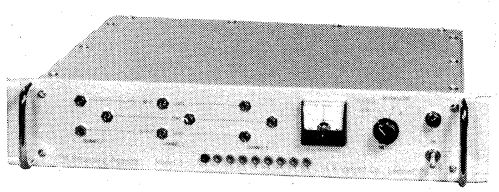
Essentially a VCO, Discriminator, and Power Supply, the Model 2 allows recording and playback of signals in the DC-100 c/s band. 1.5 V p-p is required to fully modulate the VCO over its 400 to 4000 c/s range. The unusually wide deviation minimizes flutter effects; only 0.6% p-p (mid-band) noise is observed with a typical $100.00 recorder. Nonlinearity is less than ±1%. The VCO and Discriminator operate concurrently, thus allowing monitoring during the recording process. Data output corresponding to full modulation is 10 V p-p behind 4000 ohms. This instrument is also useful for telemetering data over telephone, radio, or other audio links.

The Model 2D is a dual version of the Model 2 for use with stereo recorders. All specifications are identical to the Model 2 above. The unit mounts in 3½" of rack space and has all connectors on the back. Test points on the panel allow convenient monitoring of system performance. Both Models 2 and 2D are available in DC-300 and DC-1000 c/s bandwidth versions at the same price. Units are also available for time-base expansion and compression. Write or call for details.

MODEL 2D **$300.00**



MODEL 3 **$650.00**



This is a Multiplexed FM Recording Adaptor. It records three channels of data on a single tape track; six channels of data can be recorded using two Model 3's and a stereo recorder. The Model 3 records with three VCO's which operate in three separate audio bands. On playback, these three carriers are separated by bandpass filters which are followed by precision limiters and three discriminators for recovering the original data. The deviation in each channel is ±40%; information bandwidths are DC-30 c/s, DC-100 c/s and DC-300 c/s for the three channels. The recorder must reproduce frequencies from 300-7500 c/s. Other specifications are: input for full deviation, 1.5 V p-p; Data output, 10 V p-p behind 4000 ohms; Noise and crosstalk, less than 1% p-p; Linearity, within ±1%; carrier frequencies, 540, 1700, and 5400 c/s.

Write or Call for Complete Specifications

Data subject to change without notice.

Prices fob Rebersburg, Pennsylvania

EST. 1962

A. R. VETTER CO.

P. O. Box 143, Rebersburg, Pa.

Telephone (814) 349-5461

GENERAL INFORMATION

ADLAKE Mercury Displacement Relays are all designed and built to meet the most exacting demands of industry. They have won their high place in the electrical field by doing the tough and tricky jobs that ordinary equipment could at best do in an uncertain manner. They have proved their ability to stand up under the most adverse conditions of temperature, dust and moisture, in all types of applications. All the care required for the manufacture of high-grade instruments is used in the manufacture of the switches. All switch parts are specially cleaned, and contamination is avoided by use of tweezers, gloves, etc., when making assemblies.

Adlake SINCE 1857

MERCURY DISPLACEMENT RELAYS

LABORATORY APPROVALS

Many Adams & Westlake relays carry the Underwriters' Laboratories label. All do not carry this label, mainly because the line is so broad and varied in content. However, our policy is to obtain the Laboratories' recognition of the more popular items of time delay and quick acting load relays.

A form of approval of extreme importance to various companies in the control industry is that of Factory Mutual Laboratories acceptance. The Laboratories approve the use of Adams & Westlake time delay relays in combustion control circuits. Their approval covers our entire line of standard A.C. operated timing relays regardless of contact arrangement or length of time delay. This information is contained in their detailed report No. 12130 of September 9, 1952.

The Canadian Standards Association has listed under SWITCHES — Automatic — Magnetic Type, Adams & Westlake mercury displacement relays, 1, 2 or 3 pole; contacts normally open or normally closed, quick make-and-break only. This information is listed in their file No. 18583 of April 14, 1961.

ADVANTAGES • FEATURES

CONSTRUCTION



The hermetically sealed contact envelope is constructed of non-magnetic stainless steel.

SEALS



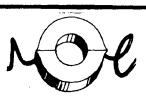
Positive leakproof sealing of electrodes is assured by the use of properly selected metals and glass components having properly matched thermal expansion characteristics.

CERAMICS



At points of electrical contact where arcing may occur, ceramics with great temperature-resistance are used to reduce any destructive effect caused by the arc. Other ceramics of constant and controlled density are used to insure dependable time delay characteristics. The exclusive ADLAKE fusing method secures ceramics in place, insuring high dielectric properties and reliable, trouble-free performance.

COILS



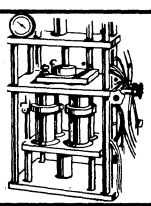
Standard commercial ADLAKE Relays are now made with molded coils in epoxy resin. These coils, which give better heat radiation and absolute moisture proofing, are another ADLAKE first. They have been tested by millions of operations at maximum capacity, making it possible to guarantee ADLAKE Relays against coil failure.

CONTACTS



ADLAKE Relays use mercury-to-mercury contacts. This liquid contact completely eliminates failures caused by low contact pressure, contact burning, pitting and sticking — and the inherent high surface tension of mercury imparts an ideal snap action to the contacts. The mercury-to-mercury contact provides a new and clean contacting surface for each operation.

EVACUATING, PRESSURE FILLING AND GAS FILL



Research has definitely established that even infinitely small traces of impurities and occluded gases, or organic materials, reduce the life period and the reliability of any mercury switch. Therefore, ADLAKE engineers have established control methods of evacuating and pressure filling which completely eliminate any possibility of such contamination. ADLAKE Mercury Relays are filled with a purified dry gas which performs many functions: It provides a stable, non-oxidizing atmosphere, quenches the arc, dissipates the heat generated at contact points, and retards mercury vaporization and ionization.

SELECTION FACTORS

In order to get the right relay for your job — the relay that will give you the best performance — it is essential that certain information, concerning the conditions under which the relay must perform, be carefully considered. We therefore recommend that answers to the following questions be forwarded to us with your inquiry or order.

1. APPLICATION
- a. What kind of job is relay to do?
- b. Is application special in any way?
- c. Will mounting be stationary, on shipboard, or on railroads? On Diesel locomotives or passenger cars?

2. TYPE OF LOAD
- a. What is the voltage in the load circuit?
- b. What is the amperage in the load circuit?
- c. Is it A.C. or D.C.? If A.C., what is the frequency?
- d. What is the nature of the load?
  - Heater load?
  - Lamp load?
  - Motor load?
  - Current inrush and running current?
  - Other types of inductive load?

3. CONTACT ARRANGEMENT
- a. Do you require a relay which has a normally open or normally closed contact?

4. DUTY
- a. How often is relay to be operated?
- b. How long is relay to be energized in each operation?

5. TIME DELAY CHARACTERISTICS
- a. What operating time do you want to achieve, maximum and minimum seconds?
- b. Is timing to be on closing or opening of the contacts?

6. COIL RATING
- a. What is your maximum and minimum coil operating voltage or current?
- b. Is coil to be operated from an A.C. or a D.C. circuit? If A.C., what frequency?

7. MOUNTING SPACE
- a. Are there any limitations on space for applying relay?

WARRANTY POLICY

ADLAKE Relays are warranted against defective workmanship and materials for one year. Replacement will be made at any time within that year, providing the relay has not been subject to improper use.

THE ADAMS & WESTLAKE COMPANY A SUBSIDIARY OF ALLIED PRODUCTS CORPORATION

1025 North Michigan Street, Elkhart, Indiana 46514 (219) 264-1141 • TWX 219-522-3102 • TELEX 25-8458 • CABLE ADLAKE

MERCURY DISPLACEMENT RELAYS

GENERAL INFORMATION

Underwriters' Laboratories Listed Relays

TIME DELAY RELAYS

U.L. File #E23321

Industrial Control Equipment — Auxiliary Devices.

Adlake #1040 and #1101 Type Time Delay Relays, with Pigtail Leads.

Normally Open Contacts — Single Pole Single Throw.

Slow Operate (Make) From 0.5 Seconds To and Including 10 Seconds, By One (1) Second Increments, i.e., 0.5 Sec., 1 Sec., 2 Sec., etc. These Relays All With Quick Release (Break) Feature.

Slow Release (Break) From 0.5 Seconds To and Including 10 Seconds, By One (1) Second Increments, As Above, These Relays All With Quick Operate (Make) Feature.

COIL VOLTAGES:
115, 230 or 440 Volts, 50/60 Cycles

U.L. RATING:
3 Amps. Normal — 30 Amps. Inrush
115 Volts, 50/60 Cycles Standard Pilot Duty
230 Volts, 50/60 Cycles Heavy Pilot Duty
10 Amps. — 115 Volts AC
5 Amps. — 230 Volts AC

U.L. File #E27809

Switches, Magnetically Operated.

Adlake #1040 and #1101 Type Time Delay Relays, with Pigtail Leads.

Normally Open Contacts — Single Pole Single Throw.

Slow Operate (Make) From 15 Seconds To and Including 60 Seconds By Five (5) Second Increments, i.e., 15 Sec., 20 Sec., 25 Sec., etc.

These Relays All With Quick Release (Break) Feature.

COIL VOLTAGES:
115, 230 or 440 Volts, 50/60 Cycles

U.L. RATING:
7.5 Amps. — 115 Volts AC
2.5 Amps. — 230 Volts AC

LOAD RELAYS

U.L. File #27809

Switches, Magnetically Operated.

Adlake #1140 Type Load Relay, with Pigtail Leads.

Normally Open or Closed contacts — Single Pole, Single Throw — Quick Acting.

COIL VOLTAGES:
24 or 48 Volts DC
18-24, 115 or 230 Volts, 50/60 Hz.

U.L. RATING:
30 Amps. — 115 Volts AC
20 Amps. — 230 Volts AC

U.L. File #E27809

Switches, Magnetically Operated.

Adlake #1140-45-TL Type Relay, with Pigtail Leads.

Normally Open Contact — Single Pole, Single Throw — Quick Acting.

COIL VOLTAGES:
18-24, 115 or 230 Volts, 50/60 Hz.

U.L. RATING:
30 Amps. — Tungsten Only — 115 Volts AC

U.L. File #E25303

Sign Flashers

Adlake #1140-55 Type Load Relays, with Pigtail Leads.

Normally Open Contact — Single Pole, Single Throw — Quick Acting.

COIL VOLTAGES:
115 or 230 Volts, 50/60 Hz.

U.L. RATING:
25 Amps., Inductive, 115 Volts AC
30 Amps., Tungsten Only, 115 Volts AC

Duty cycle 25 operations per minute maximum

U.L. File #E27809

Switches, Magnetically Operated.

Adlake #1155, #1155-A & #1155-T Type Relays, Molded Head with Compression Terminals.

Normally Open or Closed Contacts — Single Pole, Single Throw — Quick Acting.

COIL VOLTAGES:
12, 24, 48, 115 or 230 Volts DC
12, 24, 48, 115 or 230 Volts, 50/60 Hz.

U.L. RATING:
1155 Type — 35 Amps. — 115 Volts AC
20 Amps. — 230 Volts AC
1155-A Type — 16 Amps. — 277 Volts AC
1155-T Type — 35 Amps. — Tungsten Only — 115 Volts AC

U.L. File #27927

Industrial Control Equipment — Magnetic Motor Controllers.

Adlake #1123-100 & #1133-100 Type Relays, with Pigtail Leads.

Normally Open Contacts — Double Pole, Single Throw — Quick Acting — Triple Pole, Single Throw — Quick Acting.

COIL VOLTAGES:

1123 Type Double Pole	1133 Type Triple Pole
6 V.D.C.	24 V.D.C.
24 V.D.C.	115 Volts, 50/60 Hz.
48 V.D.C.	
115 Volts, 50/60 Hz.	

U.L. RATING: (Per Pole)
1.5 H.P. — 35 Amps. — 120 V.A.C.
1.5 H.P. — 20 Amps. — 240 V.A.C.

U.L. File #E27927

Motor Controllers, Magnetic.

Adlake #1040 and #1101 Type Load Relays, with Pigtail Leads.

Normally Open or Closed Contacts — Single Pole, Single Throw — Quick Acting.

COIL VOLTAGES:
115 or 230 Volts, 50/60 Cycles

U.L. RATING:
2 H.P. — 30 Amps. — 115 V.A.C. (Medium Duty)
2 H.P. — 20 Amps. — 230 V.A.C. (Medium Duty)
3 H.P. — 50 Amps. — 115 V.A.C. (Heavy Duty)
3 H.P. — 30 Amps. — 230 V.A.C. (Heavy Duty)

U.L. File #E27809

Switches, Magnetically Operated.

Adlake #1101-87 Type Relay, with Pigtail Leads.

Normally Open Contact — Single Pole, Single Throw — Quick Acting.

COIL VOLTAGES:
115 or 230 Volts, 50/60 Hz.

U.L. RATING:
75 Amps. — 115 V.A.C.
69.5 Amps. — (8000 Watts) Tungsten Only — 115 V.A.C.

U.L. File #E25303

Sign Flashers.

Adlake #1101-75 Type Load Relays, with Pigtail Leads.

Normally Open Contact — Single Pole, Single Throw — Quick Acting.

COIL VOLTAGES:
115 or 230 Volts, 50/60 Hz.

U.L. RATING:
50 Amps., Inductive, 115 Volts AC
50 Amps., Tungsten, 115 Volts AC Only

Duty Cycle 25 Operations Per Minute Maximum

U.L. File #27809

Switches, Magnetically Operated.

Adlake #2101 and #2101-T Type Relays, Molded Head with Compression Terminals.

Normally Open Contact — Single Pole, Single Throw — Quick Acting.

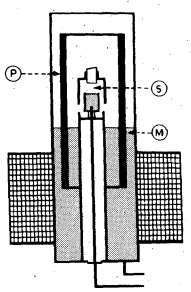
COIL VOLTAGES:
24, 115, 230, or 440 Volts DC
24, 115, 230, or 440 Volts, 50/60 Hz.

U.L. RATING:
2101 Type 100 Amps. — 115 Volts AC
2101-T Type 100 Amps. (12,000 Watts) Tungsten Only — 120 Volts AC

TIME DELAY OPERATION

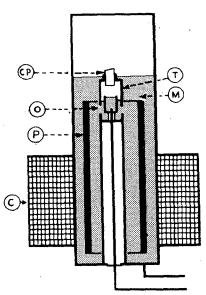
NORMALLY OPEN SLOW MAKE

The accompanying sketches are not mechanical drawings. They show how ADLAKE Relays work, not construction detail.



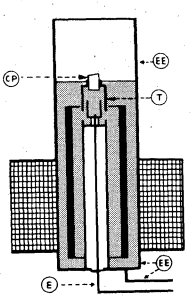
De-energized

Plunger P is floating in mercury M. Space indicated by S is filled with inert gas.



Energized

Coil C pulls plunger P down into mercury M. Mercury thus displaced enters thimble T through orifice O. Inert gas in thimble gradually escapes through ceramic plug CP, thus effecting time delay.



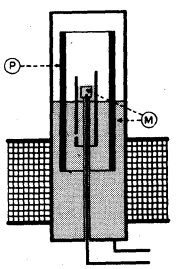
Energized

Mercury now fills thimble T, is completely leveled off and mercury-to-mercury contact established between electrodes E and EE. Degree of porosity of plug CP determines length of time delay.

TIME DELAY OPERATION

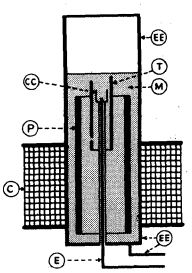
NORMALLY OPEN SLOW BREAK

The accompanying sketches are not mechanical drawings. They show how ADLAKE Relays work, not construction detail.



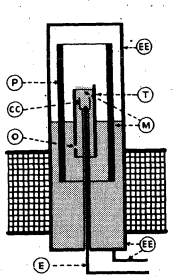
De-energized

Plunger P is floating in mercury M.



Energized

Coil C pulls plunger P down into mercury M. Mercury thus displaced completely fills thimble T and overflows lip of ceramic cup CC. This establishes mercury-to-mercury contact between electrodes E and EE.



De-energized

Plunger P returns to its floating position. Mercury inside thimble T flows through orifice O seeking its level with mercury outside thimble. When the mercury level inside thimble T falls below lip of ceramic cup CC, mercury-to-mercury contact between electrodes E and EE is broken. Diameter of orifice O determines length of opening time delay.

MERCURY DISPLACEMENT RELAYS

TIME DELAY RELAYS

The time delay characteristics of the ADLAKE Relay are fixed and non-adjustable. Normal line voltage fluctuations or ambient temperatures from —37.8° to 200°F. have no material effect on these characteristics.

The mercury-to-mercury contact which takes place within the hermetically sealed envelope assures positive action and freedom from failure.

ADLAKE Relays are available with fixed time delay in either make or break. Also available with time delays on both make and break. Time Delay Relays are available to meet your minimum operating time requirements in seconds up to a maximum delay of 20 minutes.

COILS:

A.C. Operated Relays

Available up to 440 Volts A.C. (25-50 & 60 Hz.)
Epoxy Molded (All Standard Voltages)
Leads — #18 ga. flexible — 1/32" wall p.v.c. insulation — 90°C rating — up to 10" long (10" and 12" std.)
Current coils available up to 50 Amps.

COIL DATA — TYPICAL

Timing Function	Resistance (ohms D.C. ± 10% @ 20°C)	Current (Amps.)	Watts	Coil Volts A.C. (50/60 Hz.)
Slow Make Quick Break	375	0.076	4.5	115
	1120	0.045	5.5	230
	5400	0.020	6.7	440
Quick Make Slow Break (20 Sec. Max.)	375	0.080	4.7	115
	1120	0.048	5.8	230
	5400	0.021	7.0	440
Quick Make Slow Break (Over 20 Sec.)	250	0.114	6.4	115
	1120	0.049	5.8	230
	5400	0.032	9.7	440
Slow Make Slow Break	375	0.078	4.4	115
	1120	0.049	5.5	230
	5400	0.020	6.7	440

COILS:

D.C. Operated Relays

Available up to 230 Volts D.C.
Epoxy Molded (All Standard Voltages).
Leads — #18 ga. flexible — 1/32" wall p.v.c. insulation — 90°C minimum rating — up to 10" long (10" Std.).
Current coils available up to 50 Amps.

COIL DATA — TYPICAL

Timing Function	Resistance (ohms D.C. ± 10% @ 20°C)	Current (Amps.)	Watts	Coil Volts D.C.
Slow Make Quick Break	250	0.096	2.4	24
	1500	0.032	1.6	48
	6000	0.028	2.6	125
Quick Make Slow Break (20 Sec. Max.)	370	0.065	1.6	24
	1500	0.032	1.6	48
	6000	0.028	2.6	125
Quick Make Slow Break (Over 20 Sec.)	250	0.098	2.4	24
	1500	0.032	1.6	48
	6000	0.028	2.6	125
Slow Make Slow Break	370	0.065	1.6	24
	1500	0.032	1.6	48
	3700	0.034	4.3	125

CONTACTS:

Single Pole, Single Throw.
Normally Open or Normally Closed.

Mercury-to-Mercury, hermetically sealed, all metal enclosed, welded construction.
Leads — #16 ga. flexible — 1/32" wall p.v.c. insulation — 90°C rating — 8" long.

CONTACT RESISTANCE — 0.028 ohms maximum.

CONTACT RATING

Timing Function	115 VOLTS				230 VOLTS				440 VOLTS			
	A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)	
	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.
Slow Make-Quick Break	15	10	1.5	1.0	5	3	0.5	0.3	None	None	None	None
Quick Make-Slow Break	5	2.5	0.5	0.15	1.5	0.8	0.15	0.1	None	None	None	None
Slow Make-Slow Break	5	2.5	0.5	0.15	1.5	0.8	0.15	0.1	None	None	None	None

When Time Delay is:	Contact Rating is:
0.5 to 10 seconds	Loads as shown
11 to 60 seconds	50% of loads as shown
61 to 120 seconds	25% of loads as shown
over 120 seconds	10% of loads as shown

RELAY TYPES — A.C. OPERATED

Type No. When Supplied With:			And:
Pig Tail Leads	Back Molded Panel	Molded Head w/Compression Terms.	Contact Arrangement
1040-8	1040-44	1040-8M	Normally Open
1101-8	1101-44	—	Normally Open
1040-34	1040-45	1040-34M	Normally Closed
1101-34	1101-45	—	Normally Closed

FINISH: Types 1040 & 1200 — Cadmium Plate & Lacquer
Type 1101 — Black Enamel (Wrinkle)

RELAY TYPES — D.C. OPERATED

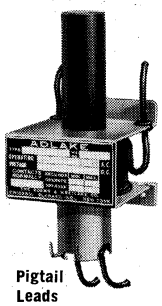
Type No. When Supplied With:		And:
Pig Tail Leads	Front Panel w/Stud Terminals	Contact Arrangement
1200-12	1200-36F	Normally Open
1200-54	1200-60F	Normally Closed

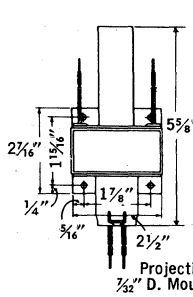
Adlake SINCE 1857

MERCURY DISPLACEMENT RELAYS

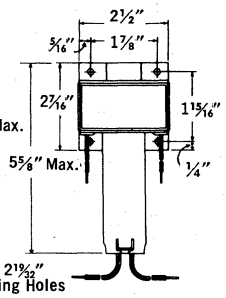
TIME DELAY RELAYS

TYPES 1040 & 1101



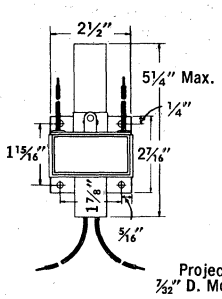


Normally Open
Series 1040-8

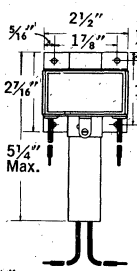


Normally Closed
Series 1040-34

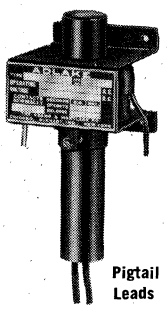
TYPE 1040



Normally Open
Series 1101-8



Normally Closed
Series 1101-34



TYPE 1101

Normally Open — Slow Operate (Make) — Quick Release (Break)

Coil Volts A.C. (50/60 Hz.)	Catalog Number		Time Delay — Seconds	
	Series 1040-8 w/Pigtail Leads	Series 1101-8 w/Pigtail Leads	Operate (Make)	Release (Break)
115	1040-8-65	1101-8-65	0.5	Quick
230	1040-8-298	1101-8-298	0.5	Quick
440	1040-8-133	1101-8-133	0.5	Quick
115	1040-8-84	1101-8-84	1	Quick
230	1040-8-101	1101-8-101	1	Quick
440	1040-8-134	1101-8-134	1	Quick
115	1040-8-307	1101-8-307	2	Quick
230	1040-8-88	1101-8-88	2	Quick
440	1040-8-142	1101-8-413	2	Quick
115	1040-8-102	1101-8-102	3	Quick
230	1040-8-85	1101-8-85	3	Quick
440	1040-8-325	1101-8-325	3	Quick
115	1040-8-58	1101-8-58	4	Quick
230	1040-8-319	1101-8-319	4	Quick
440	1040-8-311	1101-8-311	4	Quick
115	1040-8-70	1101-8-70	5	Quick
230	1040-8-60	1101-8-60	5	Quick
440	1040-8-115	1101-8-115	5	Quick
115	1040-8-59	1101-8-59	6	Quick
230	1040-8-72	1101-8-72	6	Quick
440	1040-8-56	1101-8-56	6	Quick
115	1040-8-67	1101-8-67	7	Quick
230	1040-8-327	1101-8-327	7	Quick
440	1040-8-328	1101-8-328	7	Quick
115	1040-8-329	1101-8-329	8	Quick
230	1040-8-330	1101-8-330	8	Quick
440	1040-8-331	1101-8-331	8	Quick
115	1040-8-260	1101-8-260	9	Quick
230	1040-8-250	1101-8-250	9	Quick
440	1040-8-326	1101-8-326	9	Quick
115	1040-8-37	1101-8-37	10	Quick
230	1040-8-39	1101-8-39	10	Quick
440	1040-8-332	1101-8-332	10	Quick
115	1040-8-95	1101-8-644	15	Quick
230	1040-8-148	1101-8-148	15	Quick
440	1040-8-333	1101-8-333	15	Quick
115	1040-8-78	1101-8-78	20	Quick
230	1040-8-42	1101-8-42	20	Quick
440	1040-8-334	1101-8-334	20	Quick
115	1040-8-62	1101-8-62	25	Quick
230	1040-8-244	1101-8-244	25	Quick
440	1040-8-335	1101-8-335	25	Quick
115	1040-65-5	1101-65-5	30	Quick
230	1040-8-38	1101-8-38	30	Quick
440	1040-8-146	1101-8-146	30	Quick
115	1040-8-639	1101-8-639	35	Quick
230	1040-8-640	1101-8-640	35	Quick
440	1040-8-641	1101-8-641	35	Quick
115	1040-8-180	1101-8-180	40	Quick
230	1040-8-168	1101-8-168	40	Quick
440	1040-8-336	1101-8-336	40	Quick
115	1040-8-105	1101-8-317	45	Quick
230	1040-8-254	1101-8-254	45	Quick
440	1040-8-339	1101-8-339	45	Quick
115	1040-8-98	1101-8-98	50	Quick
230	1040-8-124	1101-8-124	50	Quick
440	1040-8-337	1101-8-337	50	Quick
115	1040-8-495	1101-8-495	55	Quick
230	1040-8-642	1101-8-642	55	Quick
440	1040-8-643	1101-8-643	55	Quick
115	1040-8-57	1101-8-57	60	Quick
230	1040-8-164	1101-8-164	60	Quick
440	1040-8-338	1101-8-468	60	Quick

Normally Open — Quick Operate (Make) — Slow Release (Break)

Coil Volts A.C. (50/60 Hz.)	Catalog Number		Time Delay — Seconds	
	Series 1040-8 w/Pigtail Leads	Series 1101-8 w/Pigtail Leads	Operate (Make)	Release (Break)
115	1040-8-30	1101-8-30	Quick	0.5
230	1040-8-234	1101-8-234	Quick	0.5
440	1040-8-341	1101-8-341	Quick	0.5
115	1040-8-111	1101-8-111	Quick	1
230	1040-8-342	1101-8-342	Quick	1
440	1040-8-163	1101-8-163	Quick	1
115	1040-8-43	1101-8-43	Quick	2
230	1040-8-47	1101-8-47	Quick	2
440	1040-8-48	1101-8-142	Quick	2
115	1040-8-90	1101-8-90	Quick	3
230	1040-8-55	1101-8-55	Quick	3
440	1040-8-80	1101-8-80	Quick	3
115	1040-8-77	1101-8-77	Quick	4
230	1040-8-343	1101-8-343	Quick	4
440	1040-8-344	1101-8-344	Quick	4
115	1040-8-44	1101-8-44	Quick	5
230	1040-8-150	1101-8-224	Quick	5
440	1040-8-345	1101-8-345	Quick	5
115	1040-8-346	1101-8-346	Quick	6
230	1040-8-100	1101-8-100	Quick	6
440	1040-8-347	1101-8-347	Quick	6
115	1040-8-206	1101-8-206	Quick	7
230	1040-8-159	1101-8-159	Quick	7
440	1040-8-348	1101-8-348	Quick	7
115	1040-8-45	1101-8-45	Quick	8
230	1040-8-320	1101-8-320	Quick	8
440	1040-8-349	1101-8-349	Quick	8
115	1040-8-350	1101-8-350	Quick	9
230	1040-8-351	1101-8-351	Quick	9
440	1040-8-352	1101-8-352	Quick	9
115	1040-8-278	1101-8-278	Quick	10
230	1040-8-353	1101-8-353	Quick	10
440	1040-8-287	1101-8-287	Quick	10
115	1040-8-359	1101-8-400	Quick	15
230	1040-8-297	1101-8-297	Quick	15
440	1040-8-692	1101-8-692	Quick	15
115	1040-8-176	1101-8-176	Quick	20
230	1040-8-781	1101-8-781	Quick	20
440	1040-8-647	1101-8-647	Quick	20
115	1040-8-637	1101-8-637	Quick	25
230	1040-8-786	1101-8-26	Quick	25
440	1040-8-787	1101-8-787	Quick	25
115	1040-8-302	1101-8-302	Quick	30
230	1040-8-455	1101-8-455	Quick	30
440	1040-8-549	1101-8-549	Quick	30
115	1040-8-788	1101-8-788	Quick	35
230	1040-8-789	1101-8-789	Quick	35
440	1040-8-790	1101-8-790	Quick	35
115	1040-8-236	1101-8-236	Quick	40
230	1040-8-791	1101-8-791	Quick	40
440	1040-8-792	1101-8-792	Quick	40
115	1040-8-493	1101-8-493	Quick	45
230	1040-8-464	1101-8-464	Quick	45
440	1040-8-793	1101-8-793	Quick	45
115	1040-8-616	1101-8-616	Quick	50
230	1040-8-794	1101-8-794	Quick	50
440	1040-8-795	1101-8-795	Quick	50
115	1040-8-796	1101-8-796	Quick	55
230	1040-8-797	1101-8-797	Quick	55
440	1040-8-798	1101-8-798	Quick	55
115	1040-8-73	1101-8-73	Quick	60
230	1040-8-417	1101-8-417	Quick	60
440	1040-8-482	1101-8-496	Quick	60

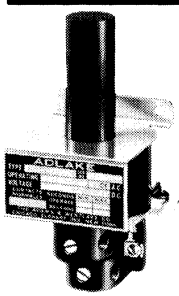
Allake SINCE 1857

MERCURY DISPLACEMENT RELAYS

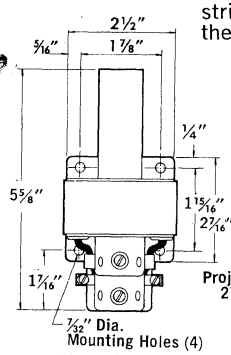
TIME DELAY RELAYS

TYPES 1040 & 1101 (continued) — Molded Head & Panel Mounted

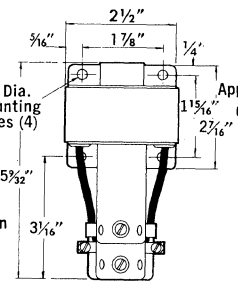
Besides being easier to install, Type 1040-M Molded Head Relays offer higher component density than panel-mounted types. Compression terminals are molded in place with self-extinguishing epoxy resin. Dummy screw terminals for coil connection are provided on the sides of the contact casting. To install: place the relay in your equipment; strip the wire and apply the leads to the proper terminals; and secure the compression terminals.



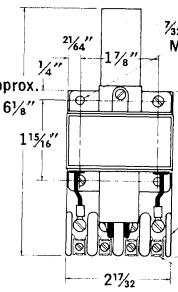
Molded Head Normally Open Type 1040-8M



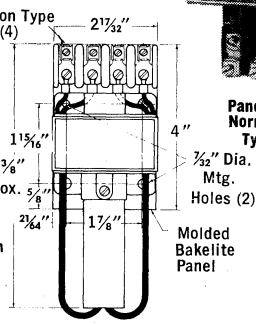
Normally Open Series 1040-8M



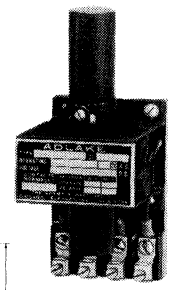
Normally Closed Series 1040-34M



Normally Open Series 1101-44

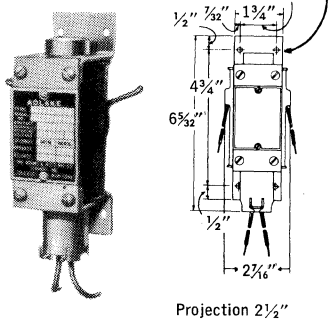


Normally Closed Series 1101-45

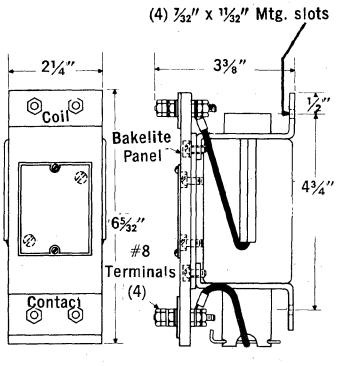


Panel Mounted Normally Open Type 1101-44

TYPE 1200



Series 1200-12 — Normally Open or Series 1200-54 — Normally Closed With Pigtail Leads



Series 1200-36F — Normally Open or Series 1200-60F-Normally Closed With Front Panel & Stud Terminals

Normally Open — Slow Operate (Make) — Quick Release (Break)

Coil Volts D.C.	Catalog Number 1200-12 Series w/ Pigtail Leads	Time Delay — Seconds Operate (Make)	Release (Break)
24	1200-12-452	0.5	Quick
48	1200-12-323	0.5	Quick
125	1200-12-137	0.5	Quick
24	1200-12-140	1	Quick
48	1200-12-266	1	Quick
125	1200-12-80	1	Quick
24	1200-12-277	2	Quick
48	1200-12-220	2	Quick
125	1200-12-50	2	Quick
24	1200-12-177	3	Quick
48	1200-12-302	3	Quick
125	1200-12-63	3	Quick
24	1200-12-418	4	Quick
48	1200-12-453	4	Quick
125	1200-12-81	4	Quick
24	1200-12-251	5	Quick
48	1200-12-85	5	Quick
125	1200-12-43	5	Quick
24	1200-12-187	6	Quick
48	1200-12-399	6	Quick
125	1200-12-170	6	Quick
24	1200-12-186	7	Quick
48	1200-12-430	7	Quick
125	1200-12-150	7	Quick
24	1200-12-454	8	Quick
48	1200-12-135	8	Quick
125	1200-12-120	8	Quick
24	1200-12-455	9	Quick
48	1200-12-456	9	Quick
125	1200-12-420	9	Quick
24	1200-12-172	10	Quick
48	1200-12-154	10	Quick
125	1200-12-95	10	Quick
24	1200-12-104	15	Quick
48	1200-12-228	15	Quick
125	1200-12-82	15	Quick
24	1200-12-199	20	Quick
48	1200-12-222	20	Quick
125	1200-12-212	20	Quick
24	1200-12-457	25	Quick
48	1200-12-458	25	Quick
125	1200-12-115	25	Quick
24	1200-12-149	30	Quick
48	1200-12-188	30	Quick
125	1200-12-47	30	Quick
24	1200-12-374	35	Quick
48	1200-12-459	35	Quick
125	1200-12-460	35	Quick
24	1200-12-461	40	Quick
48	1200-12-404	40	Quick
125	1200-12-235	40	Quick
24	1200-12-261	45	Quick
48	1200-12-276	45	Quick
125	1200-12-263	45	Quick
24	1200-12-248	50	Quick
48	1200-12-462	50	Quick
125	1200-12-424	50	Quick
24	1200-12-463	55	Quick
48	1200-12-464	55	Quick
125	1200-12-465	55	Quick
24	1200-12-449	60	Quick
48	1200-12-197	60	Quick
125	1200-12-106	60	Quick

Normally Open — Quick Operate (Make) — Slow Release (Break)

Coil Volts D.C.	Catalog Number 1200-12 Series w/ Pigtail Leads	Time Delay — Seconds Operate (Make)	Release (Break)
24	1200-12-284	Quick	0.5
48	1200-12-466	Quick	0.5
125	1200-12-60	Quick	0.5
24	1200-12-467	Quick	1
48	1200-12-468	Quick	1
125	1200-12-469	Quick	1
24	1200-12-470	Quick	2
48	1200-12-118	Quick	2
125	1200-12-41	Quick	2
24	1200-12-471	Quick	3
48	1200-12-167	Quick	3
125	1200-12-62	Quick	3
24	1200-12-472	Quick	4
48	1200-12-473	Quick	4
125	1200-12-382	Quick	4
24	1200-12-264	Quick	5
48	1200-12-136	Quick	5
125	1200-12-78	Quick	5
24	1200-12-474	Quick	6
48	1200-12-475	Quick	6
125	1200-12-46	Quick	6
24	1200-12-476	Quick	7
48	1200-12-477	Quick	7
125	1200-12-38	Quick	7
24	1200-12-478	Quick	8
48	1200-12-119	Quick	8
125	1200-12-318	Quick	8
24	1200-12-479	Quick	9
48	1200-12-480	Quick	9
125	1200-12-481	Quick	9
24	1200-12-411	Quick	10
48	1200-12-237	Quick	10
125	1200-12-75	Quick	10
24	1200-12-482	Quick	15
48	1200-12-185	Quick	15
125	1200-12-193	Quick	15
24	1200-12-171	Quick	20
48	1200-12-84	Quick	20
125	1200-12-179	Quick	20
24	1200-12-483	Quick	25
48	1200-12-484	Quick	25
125	1200-12-485	Quick	25
24	1200-12-169	Quick	30
48	1200-12-486	Quick	30
125	1200-12-39	Quick	30
24	1200-12-487	Quick	35
48	1200-12-488	Quick	35
125	1200-12-489	Quick	35
24	1200-12-490	Quick	40
48	1200-12-325	Quick	40
125	1200-12-491	Quick	40
24	1200-12-492	Quick	45
48	1200-12-493	Quick	45
125	1200-12-494	Quick	45
24	1200-12-495	Quick	50
48	1200-12-496	Quick	50
125	1200-12-497	Quick	50
24	1200-12-498	Quick	55
48	1200-12-499	Quick	55
125	1200-12-500	Quick	55
24	1200-12-198	Quick	60
48	1200-12-196	Quick	60
125	1200-12-54	Quick	60

Adlake SINCE 1857

MERCURY DISPLACEMENT RELAYS

LOAD RELAYS-LIGHT DUTY(30-35 AMPS)

TYPES 1140, 1155, 1200, 1123 & 1133

COILS

Available up to 440 Volts A.C. (25-50 & 60 Hz.) and 230 Volts D.C.

Epoxy molded (All Standard Voltages).

Leads — #18 ga. flexible — 1/32" wall p.v.c. insulation — 90°C Rating — up to 10" long (10" and 12" standard).

Current coils available up to 50 Amps.

CONTACTS

Single Pole, Single Throw
Double Pole, Single Throw (Independent Circuits).
Triple Pole, Single Throw (Independent Circuits).
Normally Open or Normally Closed.
Mercury-to-Mercury, hermetically sealed, all metal enclosed, welded construction.
Leads — #12 ga. flexible — 1/32" wall p.v.c. insulation — 90°C Rating — (Normally Open 9" long and Normally Closed 8" long standard).

CONTACT RESISTANCE: 0.005 ohms maximum.

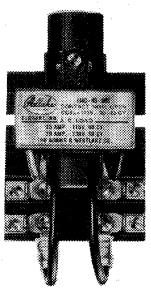
CONTACT RATINGS: Factory Recommended — Duty Cycle 44 Operations Per Minute Maximum

Load Type	115 VOLTS				230 VOLTS				440 VOLTS			
	A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)	
	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.
Ampere Rated	35*	20	5	2.5	20	10	2.5	1.0	None	None	None	None
Tungsten Rated	35	25	None	None	None	None	None	None	None	None	None	None

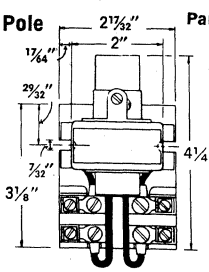
* Note: Underwriters' Laboratories Listed 1140 Type Relays carry 30 Ampere. Non-Inductive Rating at 115 V.A.C.

FINISH: Types 1140, 1123 & 1133 — Black Enamel (Wrinkle)
Types 1155 & 1200 — Cadmium Plate & Lacquer

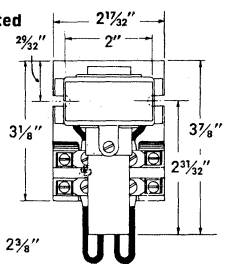
TYPE 1140 — Single Pole



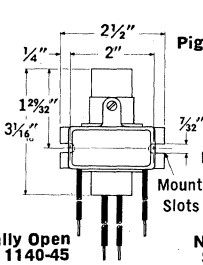
Panel Mounted Type 1140 — "Mighty Midget"



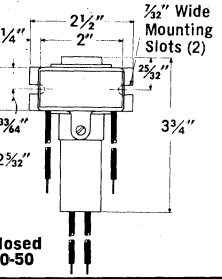
Normally Open Series 1140-45-MM



Normally Closed Series 1140-50-MM



Normally Open Series 1140-45



Normally Closed Series 1140-50

TYPE 1140 Normally Open

COIL DATA — TYPICAL				CATALOG NUMBER	
Volts A.C. (50/60 Hz.)	Resistance ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1140-45 Series w/Pigtail Leads	1140-45-MM Series w/Back Molded Panel & Compression Terminals
18-24	28	0.360	5.7	*1140-45-106	1140-45-MM-1
115	575	0.083	5.9	*1140-45-7	1140-45-MM
230	2500	0.041	5.7	*1140-45-41	1140-45-MM-2
440	13,000	0.017	7.8	1140-45-16	1140-45-MM-16

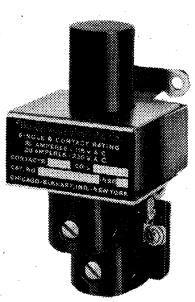
* Indicates Underwriters' Laboratories Listed Relays (See Page2164)

TYPE 1140 Normally Closed

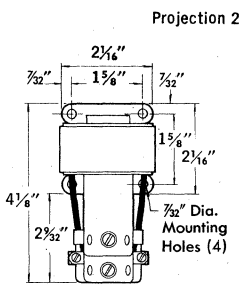
COIL DATA — TYPICAL				CATALOG NUMBER	
Volts A.C. (50/60 Hz.)	Resistance ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1140-50 Series w/Pigtail Leads	1140-50-MM Series w/Back Molded Panel & Compression Terminals
24	28	0.400	6.3	*1140-50-15	1140-50-MM-10
115	1000	0.047	3.1	*1140-50	1140-50-MM
230	2500	0.037	4.9	*1140-50-22	1140-50-MM-9
440	13,000	0.016	6.3	1140-50-4	1140-50-MM-16

* Indicates Underwriters' Laboratories Listed Relays (See Page2164).
DC Coils Also Available

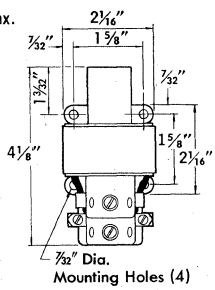
TYPE 1155 Single Pole (Molded Head with Compression Terminals)



Molded Head Type 1155



Normally Open Series 1155-O



Normally Closed Series 1155-C

TYPE 1155 Normally Open

COIL DATA — TYPICAL				CATALOG NUMBER
(50/60 Hz.) Volts A.C.	Resistance ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1155-O Series Molded Head w/Compression Terminals
24	28	0.360	5.7	*1155-O6-24
115	575	0.083	5.9	*1155-O6-115
230	2500	0.041	5.7	*1155-O6-230
440	13,000	0.017	7.8	1155-O6-440

*Indicates Underwriters' Laboratories Listed Relays (See Page2164).

TYPE 1155 Normally Closed

COIL DATA — TYPICAL				CATALOG NUMBER
Volts A.C. (50/60 Hz.)	Resistance ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1155-C Series Molded Head w/Compression Terminals
24	28	0.400	6.3	*1155-C6-24
115	1000	0.047	3.1	*1155-C6-115
230	2500	0.037	4.9	*1155-C6-230
440	13,000	0.016	6.3	1155-C6-440

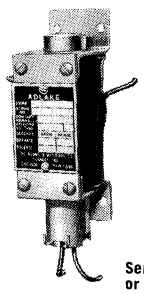
*Indicates Underwriters' Laboratories Listed Relays (See Page 2164).
DC Coils Also Available

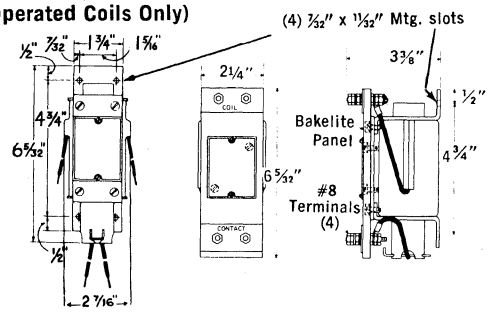
Allake SINCE 1857

MERCURY DISPLACEMENT RELAYS

LOAD RELAYS-LIGHT DUTY(30-35 AMPS)

TYPE 1200 (DC Operated Coils Only)
Single Pole





Series 1200-100 Normally Open or Series 1200-105 Normally Closed with Pigtail Leads

Series 1200-100F Normally Open or Series 1200-105F Normally Closed with Front Panel and Stud Terminals

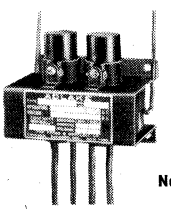
TYPE 1200 Normally Open

COIL DATA — TYPICAL				CATALOG NUMBER	
Volts D.C.	Resistance ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1200-100 Series w/Pigtail Leads	1200-100F Series w/Front Panel & Stud Terminals
24	370	0.065	1.6	1200-100-9	1200-100F-9
48	1500	0.033	1.6	1200-100-7	1200-100F-7
125	6000	0.021	2.6	1200-100-6	1200-100F-6
230	12,870	0.017	4.0	1200-100-1	1200-100F-1

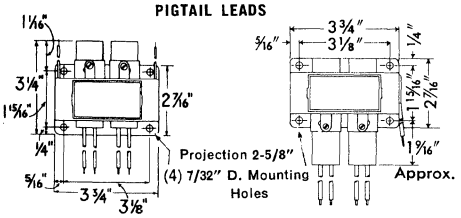
TYPE 1200 Normally Closed

COIL DATA — TYPICAL				CATALOG NUMBER	
Volts D.C.	Resistance ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1200-105 Series w/Pigtail Leads	1200-105F Series w/Front Panel & Stud Terminals
24	370	0.065	1.6	1200-105-11	1200-105F-11
48	1500	0.033	1.6	1200-105-7	1200-105F-7
125	6000	0.021	2.6	1200-105-3	1200-105F-3
230	12,870	0.017	4.0	1200-105-2	1200-105F-2

TYPE 1123
Double Pole



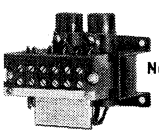
PIGTAIL LEADS

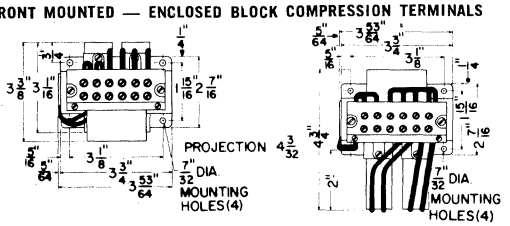


Normally Open Series 1123-100 Normally Closed Series 1123-105

FRONT MOUNTED — ENCLOSED BLOCK COMPRESSION TERMINALS

Pigtail Leads Type 1123

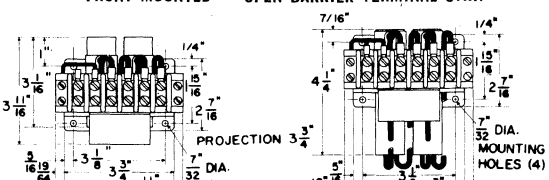




Normally Open Series 1123-100 FT Normally Closed Series 1123-105 FT

FRONT MOUNTED — OPEN BARRIER TERMINAL STRIP

Front Mounted Enclosed Block (Ft.) Type 1123 (Typical)



Normally Open Series 1123-100-FB Normally Closed Series 1123-105-FB

*Indicates Underwriters Laboratories Listed Relays (see Page 2164)

TYPE 1123 Normally Open

COIL DATA - TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1123-100 Series w/Pigtail Leads	1123-100-FB Series w/Open Barrier Terminal Strip	1123-100-FT Series w/Enclosed Terminal Block
24	4	1.22	12.9	1123-100-25	1123-100-25FB	1123-100FT-25
115	190-220	0.152	8.5	*1123-100-1	1123-100-1FB	1123-100FT-1
230	835	0.084	9.5	1123-100-3	1123-100-3FB	1123-100FT-3
440	4400	0.038	10.8	1123-100-4	1123-100-4FB	1123-100FT-4

TYPE 1123 Normally Closed

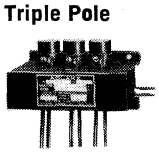
COIL DATA - TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1123-105 Series w/Pigtail Leads	1123-105-FB Series w/Open Barrier Terminal Strip	1123-105-FT Series w/Enclosed Terminal Block
24	4	1.41	15.7	1123-105-25	1123-105-25FB	1123-105FT-25
115	380	0.088	4.7	1123-105	1123-105-FB	1123-105FT
230	835	0.062	6.0	1123-105-7	1123-105-7FB	1123-105FT-7
440	4400	0.029	8.6	1123-105-5	1123-105-5FB	1123-105FT-5

TYPE 1133 Normally Open

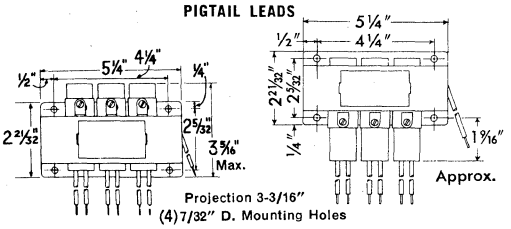
COIL DATA - TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1133-100 Series w/Pigtail Leads	1133-100-FB Series w/Open Barrier Terminal Strip	1133-100-FT Series w/Enclosed Terminal Block
24	4	1.77	18.0	1133-100-7	1133-100-7FB	1133-100FT-7
115	107	0.448	20.0	1133-100	1133-100-FB	1133-100FT
230	300	0.165	14.5	1133-100-2	1133-100-2FB	1133-100FT-2
440	1530	0.085	19.5	1133-100-1	1133-100-1FB	1133-100FT-1

*Indicates Underwriters' Laboratories Listed Relays (see Page 2164)

TYPE 1133
Triple Pole



PIGTAIL LEADS



Pigtail Leads Type 1133 Front Mounted

Normally Open Series 1133-100 Normally Closed Series 1113-105

TYPE 1133 Normally Closed

COIL DATA - TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1133-105 Series w/Pigtail Leads	1133-105-FB Series w/Open Barrier Terminal Strip	1133-105-FT Series w/Enclosed Terminal Block
24	4	1.100	11.2	1133-105-12	1133-105-12FB	1133-105FT-12
115	40	0.154	6.4	1133-105	1133-105-FB	1133-105FT
230	300	0.120	10.5	1133-105-2	1133-105-2FB	1133-105FT-2
440	1530	0.058	13.6	1133-105-5	1133-105-5FB	1133-105FT-5

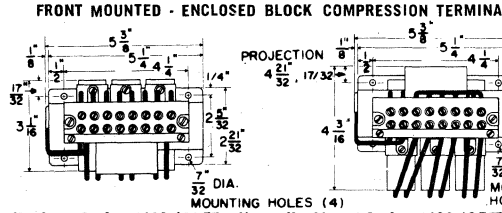
D.C. coils also available.

FRONT MOUNTED - ENCLOSED BLOCK COMPRESSION TERMINALS

FRONT MOUNTED - OPEN BARRIER TERMINAL STRIP

Front Mounted Open Barrier Terminal Strip (FB) Type 1133 (Typical)





Normally Open Series 1133-100 FT Normally Closed Series 1133-105 FT Normally Open Series 1133-100-FB Normally Closed Series 1133-105-FB

Adlake SINCE 1857

MERCURY DISPLACEMENT RELAYS

LOAD RELAYS — MEDIUM DUTY (30 AMPS)

TYPES 1040, 1101, 1141, 1200, 1123 & 1133

COILS

Available up to 440 Volts A.C. (25-50 & 60 Hz.) and 230 Volts D.C.

Epoxy Molded (All Standard Voltages).

Leads — #18 ga. flexible — 1/32" wall p.v.c. insulation — 90°C.
Rating — up to 10" long (10" and 12" standard).

Current coils available up to 50 Amps.

CONTACTS

Single Pole, Single Throw.
Double Pole, Single Throw (Independent Circuits).
Triple Pole, Single Throw (Independent Circuits).
Normally Open or Normally Closed.
Mercury-to-Mercury, hermetically sealed, all metal enclosed, welded construction.
Leads — #12 ga. flexible — 1/32" wall p.v.c. insulation — 90°C
Rating — 6" long (1141 Type - Standard). — 12" long (other Types-Standard).

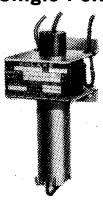
CONTACT RESISTANCE: 0.003 ohms Maximum

CONTACT RATINGS: Factory Recommended — Duty Cycle 44 Operations Per Minute Maximum

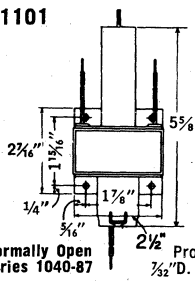
	115 VOLTS				230 VOLTS				440 VOLTS			
	A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)	
LOAD TYPE	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.
Ampere Rated	30	30 (2 H.P.)	10	5	30	20 (2 H.P.)	5	2.5	15	7.5	2	1

FINISH: Types 1101, 1141, 1123 & 1133 — Black enamel (wrinkle)
Types 1040 & 1200 — Cadmium plate & lacquer

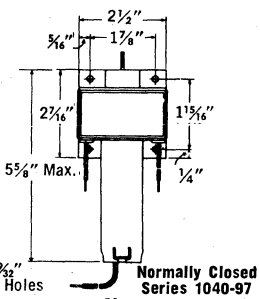
TYPES 1040 & 1101 Single Pole



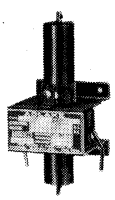
Pigtail Leads Type 1040



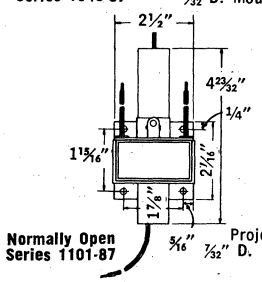
Normally Open Series 1040-87



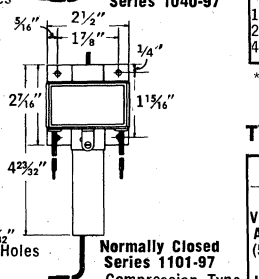
Normally Closed Series 1040-97



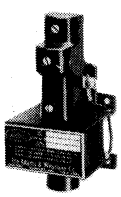
Pigtail Leads Type 1101



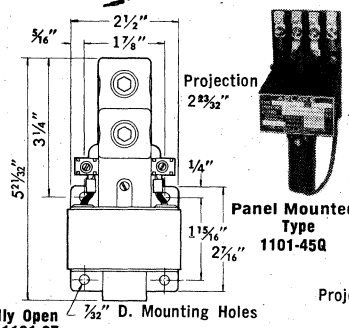
Normally Open Series 1101-87



Normally Closed Series 1101-97

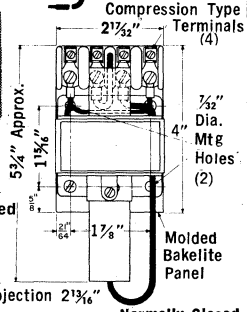


Molded Head Type 1101-87M



Normally Open Series 1101-87

Panel Mounted Type 1101-45Q

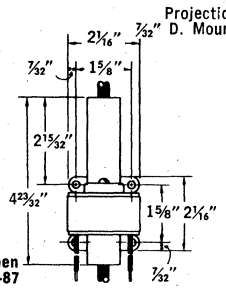


Normally Closed Series 1101-45Q

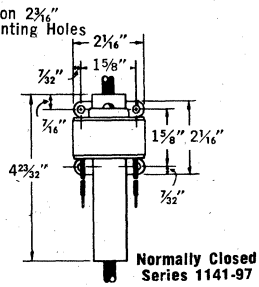
TYPE 1141 Single Pole



Pigtail Leads Type 1141



Normally Open Series 1141-87



Normally Closed Series 1141-97

TYPES 1040 & 1101 Normally Open

COIL DATA — TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @20°C	Current (Amps.)	Watts	1040-87 Series w/Pigtail Leads	1101-87 Series w/Pigtail Leads	1101-87M Series Molded Head w/Compression Terminals
24	12	0.500	4.8	1040-87-7	1101-87-7	1101-87M-7
115	250	0.108	5.6	*1040-87	*1101-87	1101-87M
230	1120	0.067	7.5	*1040-87-1	*1101-87-1	1101-87M-1
440	5400	0.025	5.6	1040-87-12	1101-87-12	1101-87M-12

*Indicates Underwriters' Laboratories Listed Relays (see Page 2164)

TYPES 1040 & 1101 Normally Closed

COIL DATA — TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @20°C	Current (Amps.)	Watts	1040-97 Series w/Pigtail Leads	1101-97 Series w/Pigtail Leads	1101-45Q Series w/Back Molded Panel & Compression Terminals
24	26	0.230	2.8	1040-97-8	1101-97-8	1101-45Q-314
115	800	0.037	2.3	*1040-97	*1101-97-2	1101-45Q-313
230	2960	0.020	2.3	*1040-97-1	*1101-97-1	1101-45Q-312
440	5400	0.018	4.4	1040-97-12	1101-97-12	1101-45Q-317

*Indicates Underwriters' Laboratories Listed Relays (see Page 2164)
DC Coils Also Available

TYPE 1141 Normally Open

COIL DATA — TYPICAL			CATALOG NUMBER	
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1141-87 Series w/Pigtail Leads
24	20	0.520	7.5	1141-87-60
115	380	0.112	7.3	1141-87
230	1,500	0.056	7.2	1141-87-1
440	8,800	0.024	8.9	1141-87-12

TYPE 1141 Normally Closed

COIL DATA — TYPICAL			CATALOG NUMBER	
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1141-97 Series w/Pigtail Leads
24	36	0.255	3.6	1141-97-60
115	1,000	0.052	2.7	1141-97-2
230	3,000	0.029	3.9	1141-97-1
440	13,000	0.014	6.0	1141-97-12

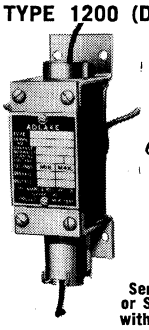
DC Coils Also Available

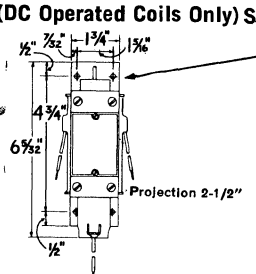
Adlake SINCE 1857

MERCURY DISPLACEMENT RELAYS

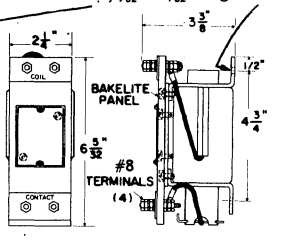
LOAD RELAYS — MEDIUM DUTY (30 AMPS)

TYPE 1200 (DC Operated Coils Only) Single Pole





Series 1200-87 Normally Open or Series 1200-97 Normally Closed with Pigtail Leads



Series 1200-87F Normally Open or Series 1200-97F Normally Closed with Front Panel & Stud Terminals

TYPE 1200 Normally Open

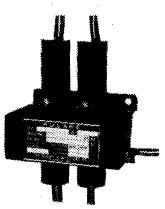
COIL DATA — TYPICAL				CATALOG NUMBER	
Volts D.C.	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1200-87 Series w/Pigtail Leads	1200-87F Series w/Front Panel & Stud Terminals
24	250	0.092	2.2	1200-87-22	1200-87F-22
48	1,500	0.032	1.6	1200-87-32	1200-87F-32
125	6,000	0.021	2.6	1200-87	1200-87F
230	12,870	0.017	4.0	1200-87-21	1200-87F-21

TYPE 1200 Normally Closed

COIL DATA — TYPICAL				CATALOG NUMBER	
Volts D.C.	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1200-97 Series w/Pigtail Leads	1200-97F Series w/Front Panel & Stud Terminals
24	370	0.062	1.5	1200-97-18	1200-97F-18
48	3,700	0.013	0.6	1200-97-19	1200-97F-19
125	12,870	0.010	1.2	1200-97-1	1200-97F-1
230	12,870*	0.010	2.3	1200-97R-16	1200-97R-16F

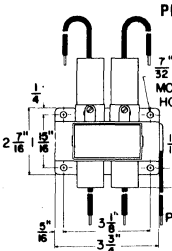
*Note: Coil requires 12,000 ohms, 10 watts, series resistor — supplied mounted on relay.

TYPE 1123 Double Pole

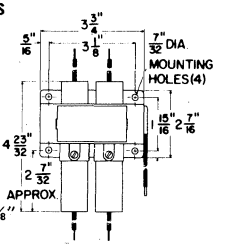


Pigtail Leads Type 1123

PIGTAIL LEADS

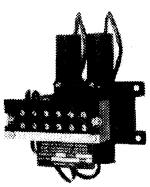


Normally Open Series 1123-87

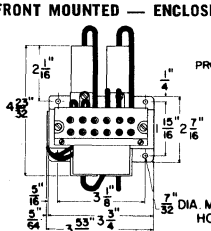


Normally Closed Series 1123-97

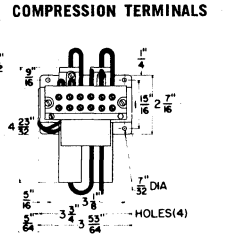
FRONT MOUNTED — ENCLOSED BLOCK COMPRESSION TERMINALS



Front Mounted Enclosed Block (FT) Type 1123 (Typical)

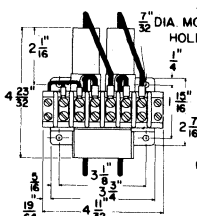


Normally Open Series 1123-87FT

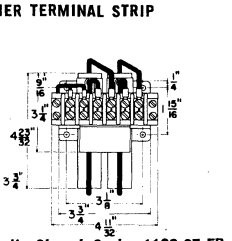


Normally Closed Series 1123-97FT

FRONT MOUNTED — OPEN BARRIER TERMINAL STRIP



Normally Open Series 1123-87-FB



Normally Closed Series 1123-97-FB

TYPE 1123 Normally Open

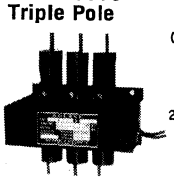
COIL DATA — TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1123-87 Series w/Pigtail Leads	1123-87-FB Series w/Open Barrier Terminal Strip	1123-87FT Series w/Enclosed Terminal Block
24	4	1.100	10.8	1123-87-43	1123-87-43FB	1123-87FT-43
115	98	0.268	13.7	1123-87	1123-87-FB	1123-87FT
230	435	0.120	14.5	1123-87-1	1123-87-1FB	1123-87FT-1
440	1600	0.062	14.7	1123-87-6	1123-87-6FB	1123-87FT-6

Type 1123 Normally Closed

COIL DATA — TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1123-97 Series w/Pigtail Leads	1123-97-FB Series w/Open Barrier Terminal Strip	1123-97FT Series w/Enclosed Terminal Block
24	4	0.960	10.9	1123-97-43	1123-97-43FB	1123-97FT-43
115	190-220	0.105	5.7	1123-97	1123-97-FB	1123-97FT
230	1350	0.048	4.8	1123-97-1	1123-97-1FB	1123-97FT-1
440	6800	0.019	4.2	1123-97-6	1123-97-6FB	1123-97FT-6

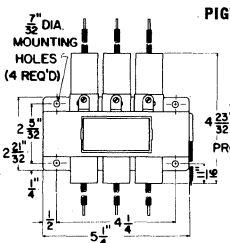
D.C. coils also available.

TYPE 1133 Triple Pole

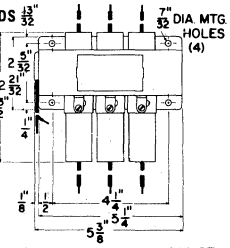


Pigtail Leads Type 1133

PIGTAIL LEADS

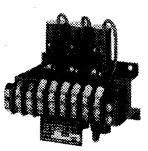


Normally Open Series 1133-87

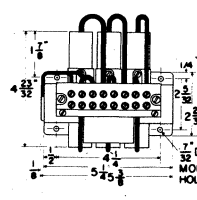


Normally Closed Series 1133-97

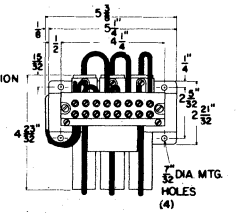
FRONT MOUNTED — ENCLOSED BLOCK COMPRESSION TERMINALS



Front Mounted Open Barrier Strip (FB) Type 1133 (Typical)



Normally Open Series 1133-87FT



Normally Closed Series 1133-97FT

TYPE 1133 Normally Open

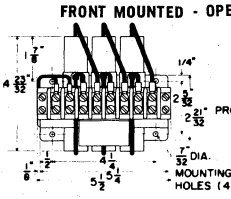
COIL DATA — TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20° C	Current (Amps.)	Watts	1133-87 Series w/Pigtail Leads	1133-87-FB Series w/Open Barrier Terminal Strip	1133-87FT Series w/Enclosed Terminal Block
24	2.76	1.72	19.4	1133-87-8	1133-87-8FB	1133-87FT-8
115	40	0.464	23	1133-87	1133-87-FB	1133-87FT
230	107	0.268	23	1133-87-1	1133-87-1FB	1133-87FT-1
440	568	0.117	21	1133-87-6	1133-87-6FB	1133-87FT-6

TYPE 1133 Normally Closed

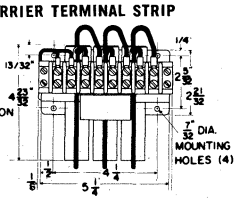
COIL DATA — TYPICAL				CATALOG NUMBER		
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20° C	Current (Amps.)	Watts	1133-97 Series w/Pigtail Leads	1133-97-FB Series w/Open Barrier Terminal Strip	1133-97FT Series w/Enclosed Terminal Block
24	4	0.990	10.8	1133-97-8	1133-97-8FB	1133-97FT-8
115	69	0.250	12.5	1133-97	1133-97-FB	1133-97FT
230	568	0.062	6	1133-97-1	1133-97-1FB	1133-97FT-1
440	1530	0.051	12.7	1133-97-6	1133-97-6FB	1133-97FT-6

D.C. coils also available.

FRONT MOUNTED - OPEN BARRIER TERMINAL STRIP



Normally Open Series 1133-87-FB



Normally Closed Series 1133-97-FB

Adlake SINCE 1857

MERCURY DISPLACEMENT RELAYS

LOAD RELAYS-HEAVY DUTY(50 AMPS)

TYPES 1040, 1101, 1141, 1200, 1123 & 1133

COILS

Available up to 440 Volts A.C. (25-50 & 60 Hz.) and 230 Volts D.C.

Epoxy Molded (All Standard Voltages).

Leads — #18 ga. flexible — 1/32" Wall p.v.c. insulation — 90°C. Rating — up to 10" long (10" and 12" standard). Current coils available up to 50 Amps.

CONTACTS

Single Pole, Single Throw.
Double Pole, Single Throw (Independent Circuits).
Triple Pole, Single Throw (Independent Circuits).
Normally Open or Normally Closed.
Mercury-to-Mercury, hermetically sealed, all metal enclosed, welded, construction.
Leads — #6 ga. flexible — 1/32" wall, Temflex #105. Thermoplastic — 105°C. Rating — 6" long (1141 Type — Standard). 12" long (other types — standard). Leads terminated with lug for 1/4" dia. stud.

CONTACT RESISTANCE: 0.003 ohms maximum.

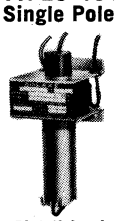
CONTACT RATINGS: Factory Recommended—Duty Cycle 44 Operations per Minute Maximum.

LOAD TYPE	115 VOLTS				230 VOLTS				440 VOLTS			
	A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)	
	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.
Ampere Rated	50	30 (3 H.P.)	10	5	35	20 (3 H.P.)	5	2.5	15	7.5	2	1

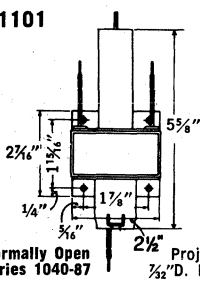
Tungsten Rating:
75 Amps. — Resistive — 115 V.A.C.
69.5 Amps., (8000 watts) Tungsten — 115 Volts A.C.

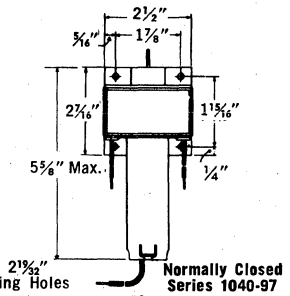
FINISH: Types 1101, 1141, 1123 & 1133—Black enamel (wrinkle)
Types 1040 & 1200 — Cadmium plate and lacquer

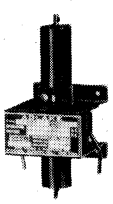
TYPES 1040 & 1101 Single Pole



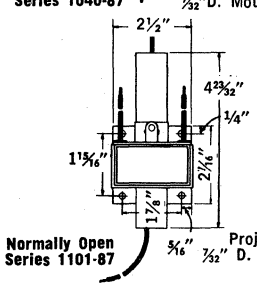
Pigtail Leads Type 1040

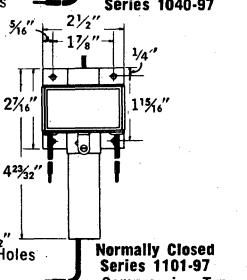






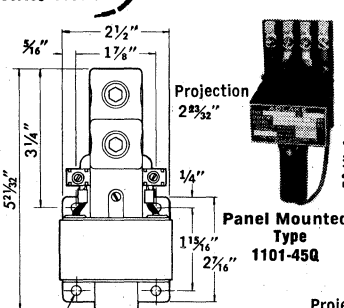
Pigtail Leads Type 1101



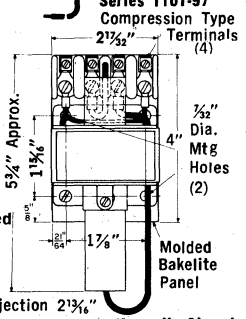




Molded Head Type 1101-87M



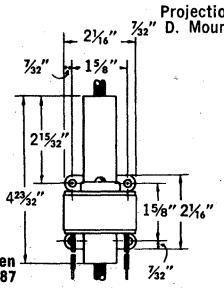
Panel Mounted Type 1101-45Q

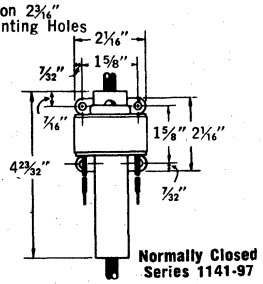


TYPE 1141 Single Pole



Pigtail Leads Type 1141





TYPES 1040 & 1101 Normally Open

COIL DATA - TYPICAL				CATALOG NUMBER		
Volts A.C. 50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1040-87 Series w/Pigtail Leads	1101-87 Series w/Pigtail Leads	1101-87M Series Molded Head w/ Compression Terminals
24	12	0.500	4.8	1040-87-13	1101-87-13	1101-87M-13
115	250	0.108	5.6	*1040-87-4	*1101-87-4	1101-87M-4
230	1120	0.067	7.5	*1040-87-5	*1101-87-5	1101-87M-5
440	5400	0.025	5.6	1040-87-9	1101-87-11	1101-87M-11

* Indicates Underwriters' Laboratories Listed Relays (see Page 2164)

TYPES 1040 & 1101 Normally Closed

COIL DATA - TYPICAL				CATALOG NUMBER		
Volts A.C. 50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1040-97 Series w/Pigtail Leads	1101-97 Series w/Pigtail Leads	1101-45Q Series w/Back Molded Panel & Compression Terminals
24	26	0.230	2.8	1040-97-13	1101-97-13	1101-45Q-514
115	800	0.037	2.3	*1040-97-4	*1101-97-4	1101-45Q-513
230	2960	0.020	2.3	*1040-97-7	*1101-97-7	1101-45Q-512
440	5400	0.018	4.4	1040-97-11	1101-97-11	1101-45Q-517

* Indicates Underwriters' Laboratories Listed Relays (see Page 2164)
DC Coils Also Available

TYPE 1141 Normally Open

COIL DATA — TYPICAL				CATALOG NUMBER
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1141-87 Series w/Pigtail Leads
24	20	0.520	7.5	1141-87-13
115	380	0.112	7.3	1141-87-4
230	1500	0.056	7.2	1141-87-5
440	8800	0.024	8.9	1141-87-11

TYPE 1141 Normally Closed

COIL DATA — TYPICAL				CATALOG NUMBER
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1141-97 Series w/Pigtail Leads
24	36	0.255	3.6	1141-97-13
115	1000	0.052	2.7	1141-97-4
230	3000	0.029	3.9	1141-97-7
440	13,000	0.014	6.0	1141-97-11

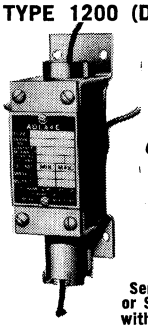
DC Coils Also Available

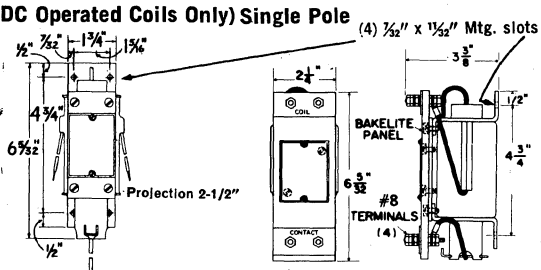
Allake SINCE 1885

MERCURY DISPLACEMENT RELAYS

LOAD RELAYS-HEAVY DUTY(50 AMPS)

TYPE 1200 (DC Operated Coils Only) Single Pole





Series 1200-87 Normally Open or Series 1200-97 Normally Closed with Pigtail Leads

Series 1200-87F Normally Open or Series 1200-97F Normally Closed with Front Panel & Stud Terminals

TYPE 1200 Normally Open

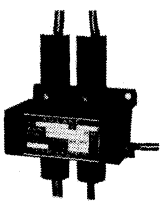
COIL DATA — TYPICAL				Catalog Number	
Volts D.C.	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1200-87 Series w/Pigtail Leads	1200-87F Series w/Front Panel & Stud Terminals
24	250	0.092	2.2	1200-87-7	1200-87F-7
48	1500	0.032	1.6	1200-87-31	1200-87F-31
125	6000	0.021	2.6	1200-87-4	1200-87F-4
230	12,870	0.017	4.0	1200-87-9	1200-87F-9

TYPE 1200 Normally Closed

COIL DATA — TYPICAL				Catalog Number	
Volts D.C.	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1200-97 Series w/Pigtail Leads	1200-97F Series w/Front Panel & Stud Terminals
24	370	0.062	1.5	1200-97-3	1200-97F-3
48	3700	0.013	0.6	1200-97-15	1200-97F-15
125	12,870	0.010	1.2	1200-97-4	1200-97F-4
230	12,870*	0.010	2.3	1200-97R-17	1200-97R-17F

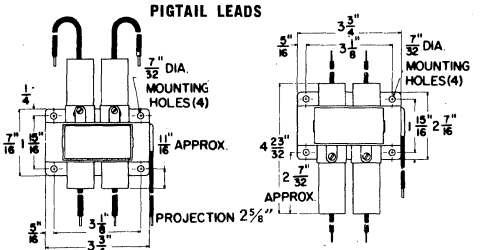
* Note: Coil requires 12,000 ohms, 10 watts, series resistor — supplied with relay.

TYPE 1123 Double Pole



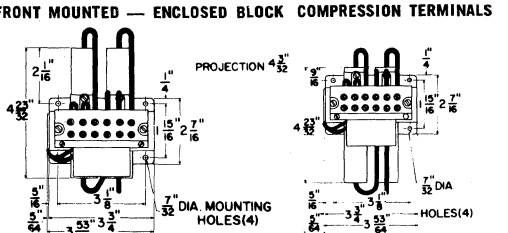
Pigtail Leads Type 1123

PIGTAIL LEADS

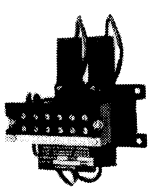


Normally Open Series 1123-87 Normally Closed Series 1123-97

FRONT MOUNTED — ENCLOSED BLOCK COMPRESSION TERMINALS

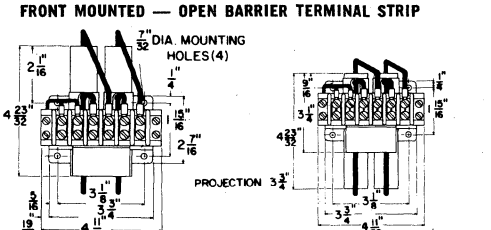


Normally Open Series 1123-87FT Normally Closed Series 1123-97FT



Front Mounted Enclosed Block (FT) Type 1123 (Typical)

FRONT MOUNTED — OPEN BARRIER TERMINAL STRIP



Normally Open Series 1123-87-FB Normally Closed Series 1123-97-FB

TYPE 1123 Normally Open

COIL DATA — TYPICAL				Catalog Number	
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1123-87 Series w/Pigtail Leads	1123-87FT Series w/Enclosed Terminal Block
24	4	1.100	10.8	1123-87-37	1123-87FT-37
115	98	0.268	13.7	1123-87-4	1123-87FT-4
230	435	0.120	14.5	1123-87-5	1123-87FT-5
440	1600	0.062	14.7	1123-87-56	1123-87FT-56

TYPE 1123 Normally Closed

COIL DATA — TYPICAL				Catalog Number	
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1123-97 Series w/Pigtail Leads	1123-97FT Series w/Enclosed Terminal Block
24	4	0.960	10.9	1123-97-37	1123-97FT-37
115	190-220	0.105	5.7	1123-97-4	1123-97FT-4
230	1350	0.048	4.8	1123-97-5	1123-97FT-5
440	6800	0.019	4.2	1123-97-26	1123-97FT-26

D.C. coils also available.

TYPE 1133 Normally Open

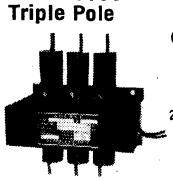
COIL DATA — TYPICAL				Catalog Number	
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1133-87 Series w/Pigtail Leads	1133-87FT Series w/Enclosed Terminal Block
24	2.76	1.72	19.4	1133-87-37	1133-87FT-37
115	40	0.464	23	1133-87-4	1133-87FT-4
230	107	0.268	23	1133-87-5	1133-87FT-5
440	568	0.117	21	1133-87-10	1133-87FT-10

TYPE 1133 Normally Closed

COIL DATA — TYPICAL				Catalog Number	
Volts A.C. (50/60 Hz.)	Resistance Ohms D.C. ±10% @ 20°C	Current (Amps.)	Watts	1133-97 Series w/Pigtail Leads	1133-97FT Series w/Enclosed Terminal Block
24	4	0.990	10.8	1133-97-37	1133-97FT-37
115	69	0.250	12.5	1133-97-4	1133-97FT-4
230	568	0.062	6	1133-97-5	1133-97FT-5
440	1530	0.051	12.7	1133-97-10	1133-97FT-10

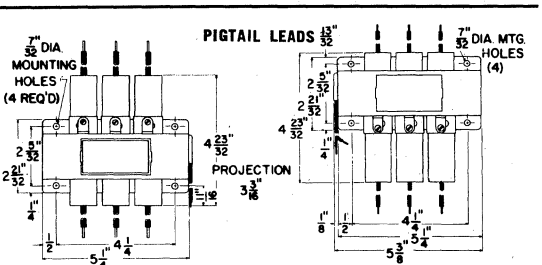
D.C. coils also available.

TYPE 1133 Triple Pole



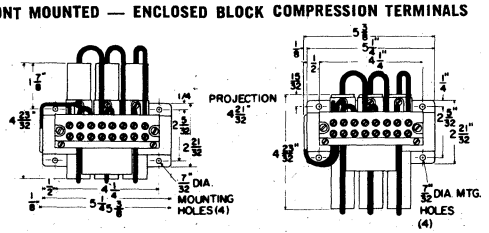
Pigtail Leads Type 1133

PIGTAIL LEADS 13/32"

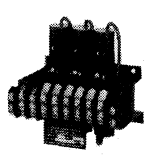


Normally Open Series 1133-87 Normally Closed Series 1133-97

FRONT MOUNTED — ENCLOSED BLOCK COMPRESSION TERMINALS

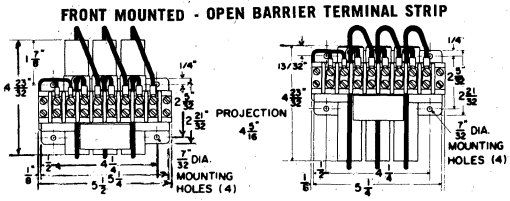


Normally Open Series 1133-87FT Normally Closed Series 1133-97FT



Front Mounted Open Barrier Strip (FB) Type 1133 (Typical)

FRONT MOUNTED - OPEN BARRIER TERMINAL STRIP



Normally Open Series 1133-87-FB Normally Closed Series 1133-97-FB

MERCURY DISPLACEMENT RELAYS

LOAD RELAYS-(100 AMPS)

TYPE 2101 SINGLE POLE, NORMALLY OPEN

Remember when a 100 ampere load relay looked its size? Most still do.

This is the exception — Adlake's Type 2101 mercury displacement relay. This new molded head, screw terminal unit — rated 100 amperes at 115 volts—occupies less than 57 cubic inches. Yet all the reliability built into every Adlake relay is there.

The Type 2101 is now demonstrating its dependability in high current (15,000 amperes) applications of short duration, in capacitor-discharge and arc welding installations plus heating and lighting applications.

Adlake design and quality manufacture insure 2101's low contact resistance and its ability to withstand 100% overloads for periods up to 60 seconds. Added reliability through the use of epoxy molded coil is backed by Adlake's guarantee of freedom from coil failure.

COILS

Available up to 440 Volts A.C. (25-50 & 60 Hz.) and 230 Volts D.C.

Epoxy Molded — Random Wound (All Standard Voltages)

Leads — #18 ga. flexible — 1/32" wall p.v.c. insulation — 90°C. Minimum Rating. Terminated to screw terminals on sides of Molded Head Contact.

CONTACTS

Normally Open — Single Pole, Single Throw — Molded Head.

Mercury-to-Mercury, hermetically sealed, all metal enclosed welded construction.

Compression terminals molded in place with flame-proof epoxy resin.

Terminal Capacity — wire size 1/0 Stranded to 2/0 solid.

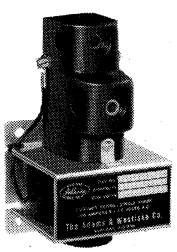
CONTACT RESISTANCE: 0.0005 ohms maximum.

CONTACT RATINGS:

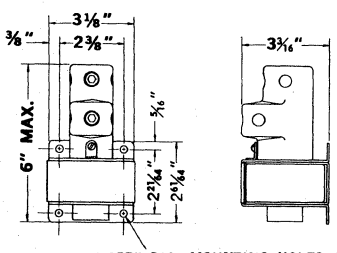
115 VOLTS				230 VOLTS				440 VOLTS			
A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)		A.C. (Amps.)		D.C. (Amps.)	
Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.	Non-Ind.	Ind.
100	60	20	10	70	40	10	5	30	15	4	2

Tungsten Rating: 100 Amps. (12,000 watts) Tungsten Only — 120 V.A.C.
Duty Cycle: 6 operations per minute maximum.
See Page 2164 for Underwriters' Laboratories Listing.

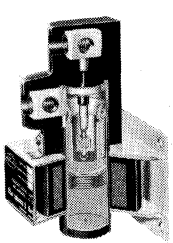
FINISH: Cadmium Plate and Lacquer



TYPE 2101



.257" DIA. MOUNTING HOLES (4)
NOTE: COIL TERMINALS & LEADS OMITTED



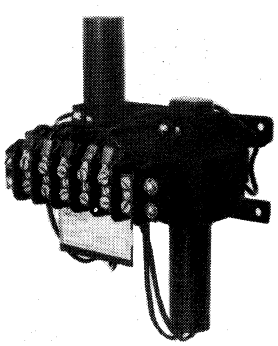
Normally Open

COIL DATA — TYPICAL				CATALOG NUMBER	
Volts	Resistance (Ohms)	Current (Amps.)	Watts	Ampere Rated	Tungsten Rated
24 (50/60 A.C.)	2.1	1.54	14	2101-06-24	2101-06T-24
115 (50/60 A.C.)	64	0.31	14.3	2101-06-115	2101-06T-115
230 (50/60 A.C.)	209	0.16	14.5	2101-06-230	2101-06T-230
440 (50/60 A.C.)	1100	0.07	15.4	2101-06-440	2101-06T-440
24 D.C.	63	0.38	9.0	2101-0D-24	2101-0DT-24
115 D.C.	1100	0.11	12.1	2101-0D-115	2101-0DT-115

OTHER REPRESENTATIVE TYPES

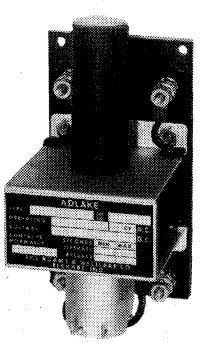
Various Configurations and Mounting Arrangements are available for Adlake Mercury Displacement Relays. Shown are but a few of the many possibilities.

Our engineering department is ready to assist in developing ideas to fit your needs.



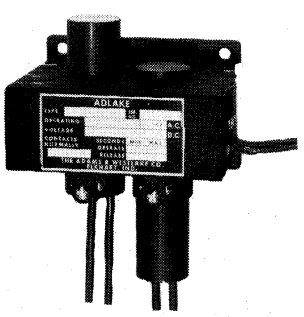
1101-51-FB

2-Separate relays with iron circuits welded. Combinations of load and timer contacts available.



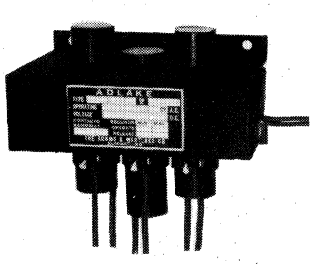
1040-85

Panel with stud terminations.



1123-150

(2-Pole Combination)
1-normally open light duty contact.
1-normally closed light duty contact.



1133-150

(3-Pole Combination)
2-normally open light duty contacts.
1-normally closed light duty contact.

GENERAL INFORMATION

Mercury-Wetted Relays — manufactured under Western Electric Co. license agreement

It is well known that the mercury contact does not become dirty or pitted — always provides positive closure — has low contact resistance throughout its life. The resistance of single contacts including that of the internal wiring between base terminals is less than **50 milliohms** for normal new switch contacts. Repetitive measurements on individual relays are constant to a **few milliohms.**

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS

MOUNTING POSITION

For best performance, these relays are designed to be operated in a vertical position. Permormance is reduced when relays are operated at small angles off the vertical position. Where necessary to mount at an angle other than vertical, it is recommended that the departure not exceed 30 degrees from vertical.

ENCLOSURES AND TERMINATIONS

While 8-Pin and 11-Pin Bakelite Tube Bases and 14-Pin Glass-to-Metal Headers have been specified, other bases and terminals may be obtained. The standard housing is steel, cadmium plated with a golden chromate conversion coating. The MWB and MWC Relays differ from the standard in that they are supplied in a cast epoxy package and the MWSA Relay is provided with a tin plate cover. While ADLAKE MW & MWS Relays do not require hermetic sealing of the enclosure, certain applications may require this feature. Hermetic sealing can be furnished under certain conditions when specified.

MOUNTING ACCESSORIES

BAKELITE SOCKETS — 8-Pin Amphenol 77-MIP-8 or equal
11-Pin Octal Style Amphenol 77-MIP-11 or equal
14-Pin Mica-filled Bakelite socket Munston #198-201
AN/MS Socket size 20 Code 27S (14 contacts)
7-Pin Miniature Amphenol 147-505

VIBRATION AND SHOCK

While ADLAKE MW and MWS Relays have a glass-sealed switch, they are not fragile and neither are they dangerous to handle. They will withstand handling and normal transportation shocks.

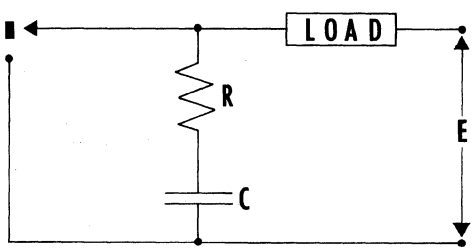
SELECTION FACTORS

In order to get the right relay for your application — the relay that will give you the best performance — it is essential that certain information concerning the conditions under which the relay must perform be carefully considered. We, therefore, recommend that answers to the following questions be forwarded to us with your inquiry or order:

1. **APPLICATION**
   a. What is relay required to do?
   b. Is application special in any way?
2. **CONTACT ARRANGEMENT**
   a. How many switches are needed in each relay?
   b. Do contacts or switches require shielding?
3. **COIL ARRANGEMENT**
   a. Is a single winding required, or should coil have more than one independent winding?
   b. What are operating currents?
   c. Any other coil requirements?
4. **TERMINATION**
   a. What base is required?
   b. What base wiring diagram will be needed?
5. **ENCLOSURE**
   a. Will hermetic sealing of can be required?
6. **MISCELLANEOUS**
   a. Are there any other features required?

CONTACT PROTECTION

Except for specific instances of light loads, the relay contacts must be protected by a network composed of a resistor and a capacitor in series as shown in the following diagram. This protection should be physically located as close as possible to the relay terminals.



Contact Protection Network to be used with ADLAKE Neutral Type MW and Sensitive Type MWS Relays

The preferred values of R and C, except for the conditions stated subsequently, can be evaluated from the following equations:

$$C = \frac{I^2}{10} \text{ microfarads}$$

$$R = \frac{E}{10I^{\left(1+\frac{50}{E}\right)}}$$

where I = load current in amperes immediately prior to opening of contacts.
E = source voltage immediately prior to closing of contacts.

The "break" action of mercury relays is extremely rapid, with the result that very large peak voltages can be developed across the load at that time. To reduce these peak voltages to safe levels, the value of C in the protective network can be increased above the minimum value of equation (1) required for contact protection. The appropriate value can be determined by measurement of peak values within the first few milliseconds after break of the contacts. Consideration must also be given to protection of the load and circuit wiring.

Where circuit applications of these relays involve the condition of a source of power across the front and back contacts, it is particularly important to fulfill the contact protection requirements and insure that the current ratings are not exceeded. In some applications, this may require the incorporation of a current limiting impedance in the power circuit.

To assure long service life and to provide adequate contact protection, the values derived from the equation must be applied as follows:

E	I	C	R
Less than 50	Less than 2.5 amperes	Use calculated value	May be omitted
Up to 70	All other conditions	Use calculated value	3 X calculated value permissible
@ 100 v.	All other conditions	Use calculated value	Within 50% of calculated value
@ 150 v.	All other conditions	Use calculated value	Within 10% of calculated value
Above 150 v.	All other conditions	Use calculated value	Follow calculated value closely

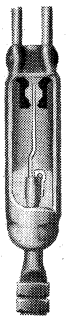
Note: For any voltages more than 50, the value of R must not be less than 0.5 ohm.

WARRANTY POLICY ADLAKE Mercury Wetted Contact Relays are warranted against defective workmanship and materials for one year. Replacement will be made at any time within that year, providing the relay has not been subject to improper use.

THE ADAMS & WESTLAKE COMPANY A SUBSIDIARY OF ALLIED PRODUCTS CORPORATION
1025 North Michigan Street, Elkhart, Indiana 46514 (219) 264-1141 • TWX 219-522-3102 • TELEX 25-8458 • CABLE ADLAKE

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS
SENSITIVE FORM C & D



The ADLAKE Sensitive Relay represents a technical breakthrough in the mercury-wetted contact relay field.

Described in various terminology, i.e., High Speed, Sensitive, Bridging or Non-Bridging, the sensitive type switch capsule also makes use of the capillary action of mercury to provide a film of the metal on the contact surfaces. In general, the switch is similar to the MW (neutral) type. Two fixed contacts — one normally open, one normally closed — instead of four, as in the MW (neutral) type contacts, are sealed in the glass envelope. Operation of the switch is achieved through the use of a single operating coil, single or multiple-wound. Operating characteristics, however, are determined by permanent magnet biasing, in a manner similar to ADLAKE MWP-16000 (neutral type) relays. As the switch unit of these relays is filled with hydrogen at high pressure, the relays are factory-sealed and under no circumstances should be disassembled without taking necessary safety precautions in the event of breakage of the switch.

SPECIFICATIONS

CONTACT ARRANGEMENT SPDT, Form C, non-bridging, break before make (single-side-stable, bi-stable or chopper). SPDT, Form D, bridging, make before break (single-side-stable, bi-stable or chopper).

CONTACT RESISTANCE 50 Milliohms max.

CONTACT RATING 2 amperes max., 500 volts max., 100 volt-amperes peak with contact protection consisting of a series resistor — capacitor network in parallel with the relay contacts. The values of resistance and capacitance may be calculated from the formulas as shown on Page

BOUNCE None.

CONTACT RISE TIME (less contact protection) 10 nano-seconds or less.

LIFE One billion operations may be expected if contact ratings with recommended contact protection are observed.

STAND OFF VOLTAGE 1000 VAC 60 cps. between mutually insulated terminals, except between windings of bifilar construction dual wound coils.

INSULATION RESISTANCE 1000 megohms min. @ 500 VDC, 25°C, 45% RH between all mutually insulated terminals except between windings of bifilar construction dual wound coils.

BRIDGING TIME, FORM D 50 to 500 microseconds.

TRANSFER (null) TIME, FORM C 50 to 600 microseconds.
(Typical bridge and transfer times are measured on a time interval meter with switch operating at 60 times per second).

DEFINITIONS

Sensitivity Terminology

MUST OPERATE — Current required to operate the least sensitive relay of a given specification.

NON-OPERATE — Current at which the most sensitive relay will not operate.

HOLD — Current above which all relays will remain operated, once they have been operated.

MUST RELEASE — Current at which all relays will have released.

The MUST OPERATE and the NON-OPERATE values are the limits within which a specified relay will operate. The HOLD and MUST RELEASE values are the limits within which a specified relay will release. It should be noted that the four terms specified above are maximum values and that the average relays will operate and release at approximately average values.

Adjustment Terminology —

(All polarized & sensitive relays)

SINGLE SIDE STABLE — Adjustment of the permanent magnets for armature return to the normally closed contacts when coil current has been lowered to "must release" value.

BI-STABLE (MAGNETIC LATCHING) — Adjustment of the permanent magnets so armature will remain in the position last operated until sufficient current of opposite polarity is applied to the coil.

CHOPPER — Adjustment of the permanent magnets to provide equal dwell ±5% on the fixed contacts when coil is driven by the specified 60 cps. voltage.

Timing Terminology

OPERATE MAKE TIME, TYPICAL

Interval from coil energization until the armature reaches the normally open contact at given drive level.

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED

Interval from coil de-energized until the armature makes the normally closed contacts.

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS
SENSITIVE FORM C & D — PRINTED CIRCUIT TYPES

AWCM/AWDM

SENSITIVITY, TYPICAL

SINGLE SIDE STABLE
Must Operate: 30 Ampere Turns
Must Release: 6 Ampere Turns

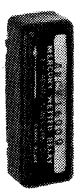
BI-STABLE
Must Operate: ±15 Ampere Turns
Non-Operate: ± 4 Ampere Turns

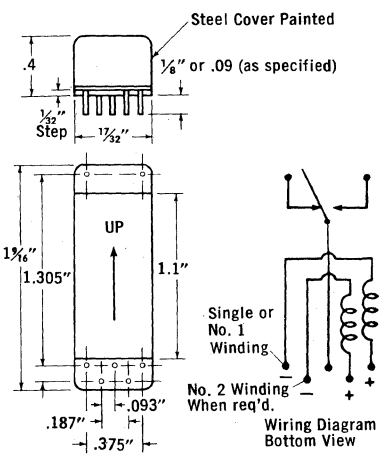
OPERATE MAKE TIME, TYPICAL

Single-Side-Stable		Bi-Stable	
Ampere Turns Total	Milli-seconds	Ampere Turns Total	Milli-seconds
30	2.8	15	3.5
55	1.2	40	1.2
80	1.0	65	.95

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE

1.1 Milliseconds.
1.1 Milliseconds.





AWCM/AWDM — Single Side Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS			
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)		FORM C CONTACTS		FORM D CONTACTS	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	.09" Pin Lg. AWCM-	.125" Pin Lg. AWCM-	.09" Pin Lg. AWDM-	.125" Pin Lg. AWDM-
2.2	260	0.27	113	.05	20.7	1.0	2.0	16011	16011-1	15011	15011-1
3.1	320	0.32	94	.07	18.7	1.2	2.3	16021	16021-1	15021	15021-1
4.4	370	0.40	81	.08	16.2	1.4	2.8	16031	16031-1	15031	15031-1
5.9	430	0.45	70	.10	14.0	1.6	3.2	16041	16041-1	15041	15041-1
13.0	600	0.71	49	.14	10.0	2.4	4.8	16051	16051-1	15051	15051-1
18.7	760	0.81	40	.18	7.9	2.8	5.7	16061	16061-1	15061	15061-1
27.7	950	1.0	32	.22	6.3	3.5	7.0	16071	16071-1	15071	15071-1
50	1250	1.3	24	.28	4.8	4.7	9.4	16081	16081-1	15081	15081-1
70	1550	1.6	20	.35	3.9	5.5	11	16091	16091-1	15091	15091-1
125	2000	2.1	15	.46	3.0	7.5	15	16101	16101-1	15101	15101-1
185	2400	2.6	13	.60	2.5	9.0	18	16111	16111-1	15111	15111-1
325	3300	3.3	9.1	.77	1.8	12	24	16121	16121-1	15121	15121-1
435	3900	3.7	7.7	.94	1.6	14	28	16131	16131-1	15131	15131-1
680	4900	4.6	6.1	1.1	1.3	18	35	16141	16141-1	15141	15141-1
1120	6350	5.9	4.8	1.4	1.0	22	44	16151	16151-1	15151	15151-1
1750	7900	7.4	3.8	1.7	.8	28	55	16161	16161-1	15161	15161-1
2650	9000	9.9	3.4	2.2	.7	34	68	16171	16171-1	15171	15171-1
3900	10,600	12.5	2.9	2.7	.6	42	83	16181	16181-1	15181	15181-1
6100	13,250	15.5	2.3	3.5	.5	52	103	16191	16191-1	15191	15191-1
9000	15,500	20	2.0	4.2	.4	63	125	16201	16201-1	15201	15201-1

AWCM/AWDM — Single Side Stable, Dual Wound Coils

COIL DATA								STANDOFF VOLTAGE BETWEEN WINDINGS (vdc)	CATALOG NUMBERS			
		MUST OPERATE (Either Winding)		MUST RELEASE (Either Winding)		VOLTAGE (One Winding Only) (vdc)			Form C Contacts		Form D Contacts	
RESISTANCE Ohms ±10%	TURNS	(vdc)	(madc)	(vdc)	(madc)	Nom.	Max.		.09" Pin Lg. AWCM-	.125" Pin Lg. AWCM-	.09" Pin Lg. AWDM-	.125" Pin Lg. AWDM-
60/60	1000/1000	2.0	30	.44	7.8	5	10	500	16501	16501-1	15501	15501-1
90/90	1200/1200	2.5	25	.58	7.2	6	13	400	16511	16511-1	15511	15511-1
155/155	1650/1650	3.1	18	.74	5.3	8	16	400	16521	16521-1	15521	15521-1
205/205	1950/1950	3.5	15.5	.92	5.0	9	19	400	16531	16531-1	15531	15531-1
340/340	2450/2450	4.6	12.3	1.1	3.6	12	24	400	16541	16541-1	15541	15541-1
560/560	3175/3175	5.8	9.5	1.4	2.8	15	31	400	16551	16551-1	15551	15551-1
870/870	3950/3950	7.3	7.6	1.8	2.3	19	39	200	16561	16561-1	15561	15561-1
1320/1320	4500/4500	9.7	6.7	2.2	1.8	24	48	200	16571	16571-1	15571	15571-1
1980/1980	5300/5300	12.3	5.7	2.8	1.5	29	59	200	16581	16581-1	15581	15581-1
3000/3000	6625/6625	15.0	4.5	3.5	1.3	36	73	200	16591	16591-1	15591	15591-1
4500/4500	7750/7750	19.0	3.9	4.2	1.0	44	89	200	16601	16601-1	15601	15601-1

AWCM/AWDM — Bi-Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS			
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)		Form C Contacts		Form D Contacts	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	.09" Pin Lg. AWCM-	.125" Pin Lg. AWCM-	.09" Pin Lg. AWDM-	.125" Pin Lg. AWDM-
2.2	260	±0.14	±58	± .030	±15.0	1.0	2.0	16012	16012-1	15012	15012-1
3.1	320	±0.16	±47	± .035	±12.5	1.2	2.3	16022	16022-1	15022	15022-1
4.4	370	±0.21	±45	± .043	±10.8	1.4	2.8	16032	16032-1	15032	15032-1
5.9	430	±0.26	±40	± .050	± 9.3	1.6	3.2	16042	16042-1	15042	15042-1
13.0	600	±0.36	±25	± .078	± 6.7	2.4	4.8	16052	16052-1	15052	15052-1
18.7	760	±0.41	±20	± .089	± 5.3	2.8	5.7	16062	16062-1	15062	15062-1
27.7	950	±0.48	±16	± .10	± 4.2	3.5	7.0	16072	16072-1	15072	15072-1
50	1250	±0.66	±12	± .14	± 3.2	4.7	9.4	16082	16082-1	15082	15082-1
70	1550	±0.75	± 9.7	± .16	± 2.6	5.5	11	16092	16092-1	15092	15092-1
125	2000	±1.0	± 7.5	± .22	± 2.0	7.5	15	16102	16102-1	15102	15102-1
185	2400	±1.3	± 6.2	± .28	± 1.7	9.0	18	16112	16112-1	15112	15112-1
325	3300	±1.6	± 4.5	± .35	± 1.2	12	24	16122	16122-1	15122	15122-1
435	3900	±1.8	± 3.9	± .40	± 1.0	14	28	16132	16132-1	15132	15132-1
680	4900	±2.3	± 3.1	± .50	± .82	18	35	16142	16142-1	15142	15142-1
1120	6350	±2.9	± 2.4	± .63	± .63	22	44	16152	16152-1	15152	15152-1
1750	7900	±3.7	± 1.9	± .80	± .51	28	55	16162	16162-1	15162	15162-1
2650	9000	±4.9	± 1.7	±1.0	± .44	34	68	16172	16172-1	15172	15172-1
3900	10,600	±6.1	± 1.4	±1.3	± .38	42	83	16182	16182-1	15182	15182-1
6100	13,250	±7.6	± 1.1	±1.6	± .30	52	103	16192	16192-1	15192	15192-1
9000	15,500	±9.6	± 1.0	±2.1	± .26	63	125	16202	16202-1	15202	15202-1

AWCM/AWDM — Bi-Stable, Dual Wound Coils

COIL DATA								STANDOFF VOLTAGE BETWEEN WINDINGS (vdc)	CATALOG NUMBERS			
		MUST OPERATE (Either Winding)		NON-OPERATE (Either Winding)		VOLTAGE (One Winding Only) (vdc)			Form C Contacts		Form D Contacts	
RESISTANCE Ohms ±10%	TURNS	(vdc)	(madc)	(vdc)	(madc)	Nom.	Max.		.09" Pin Lg. AWCM-	.125" Pin Lg. AWCM-	.09" Pin Lg. AWDM-	.125" Pin Lg. AWDM-
60/60	1000/1000	±1.0	±15	± .29	±5.4	5	10	500	16502	16502-1	15502	15502-1
90/90	1200/1200	±1.3	±12.5	± .38	±4.2	6	13	400	16512	16512-1	15512	15512-1
155/155	1650/1650	±1.6	± 9.1	± .49	±3.5	8	16	400	16522	16522-1	15522	15522-1
205/205	1950/1950	±1.7	± 7.7	± .61	±3.3	9	19	400	16532	16532-1	15532	15532-1
340/340	2450/2450	±2.3	± 6.1	± .73	±2.4	12	24	400	16542	16542-1	15542	15542-1
560/560	3175/3175	±2.9	± 4.7	± .98	±1.9	15	31	400	16552	16552-1	15552	15552-1
870/870	3950/3950	±3.7	± 3.8	±1.2	±1.5	19	39	200	16562	16562-1	15562	15562-1
1320/1320	4500/4500	±4.8	± 3.3	±1.4	±1.2	24	48	200	16572	16572-1	15572	15572-1
1980 1980	5300/5300	±6.1	± 2.8	±1.8	±1.0	29	59	200	16582	16582-1	15582	15582-1
3000/3000	6625/6625	±7.6	± 2.3	±2.3	± .85	36	73	200	16592	16592-1	15592	15592-1
4500/4500	7750/7750	±9.4	± 1.9	±2.8	± .69	44	89	200	16602	16602-1	15602	15602-1

NOTE:
Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS
SENSITIVE FORM C & D—PRINTED CIRCUIT TYPES

AWCX/AWDX

SENSITIVITY, TYPICAL

SINGLE SIDE STABLE
Must Operate: 45 Ampere Turns
Must Release: 7.5 Ampere Turns

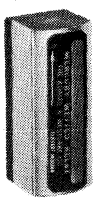
BI-STABLE
Must Operate: ±21 Ampere Turns
Non-Operate: ± 6 Ampere Turns

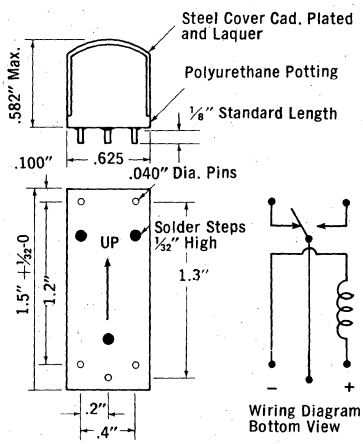
OPERATE MAKE TIME, TYPICAL

Single-Side-Stable		Bi-Stable	
Ampere Turns Total	Milli-seconds	Ampere Turns Total	Milli-seconds
45	1.7	21	1.9
70	1.1	46	1.0
95	1.0	71	.9

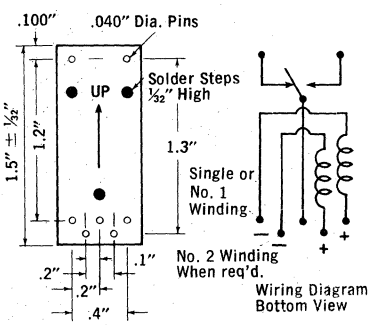
RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE

1.1 Milliseconds.





SINGLE WOUND COIL



DUAL WOUND COIL

NOTE:
Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

AWCX/AWDX — Single Side Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS	
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)			
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Form C Contacts AWCX-	Form D Contacts AWDX-
2	200	.5	222	.05	27.7	1.0	2.0	16051-S	15051-S
18	675	1.3	66.8	.18	11.0	3.0	6.0	16491-S	15491-S
56	1125	1.5	24.0	.30	6.0	5.5	11.0	16301-S	15301-S
85	1350	3.1	33.3	.42	5.5	6.5	13.0	16331-S	15331-S
115	1500	3.8	30.0	.52	5.0	7.6	15.1	16121-S	15121-S
275	2750	5.2	17.0	.69	2.8	11.7	23.4	16421-S	15421-S
450	3490	6.4	12.9	.85	2.1	15	30.0	16261-S	15261-S
675	3900	8.6	11.6	1.1	1.9	18.4	36.7	16041-S	15041-S
940	4350	10.5	10.1	1.4	1.7	21.7	43.3	16351-S	15351-S
1250	4730	12.9	9.4	1.8	1.6	25.0	50.0	16541-S	15541-S
1425	5340	13.0	8.4	1.8	1.4	26.7	53.4	16581-S	15581-S
1800	4800	18.6	9.4	2.6	1.6	30.0	60.0	16161-S	15161-S
1950	5530	17.6	8.2	2.3	1.3	31.2	62.4	16571-S	15571-S
2400	5780	20.6	7.8	2.8	1.3	34.6	69.2	16011-S	15011-S
4000	11,250	17.6	4.0	2.4	0.67	45	90	16021-S	15021-S
9200	15,800	14.2	1.4	1.6	0.2	74	148	16791-S	15791-S
15,000	19,500	21.5	1.3	2.7	0.2	86.5	173	16671-S	15671-S

AWCX/AWDX — Single Side Stable, Dual Wound Coils

COIL DATA								CATALOG NUMBERS	
		MUST OPERATE (Either Winding)		MUST RELEASE (Either Winding)		VOLTAGE (vdc) (Either Winding)			
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Form C Contacts AWCX-	Form D Contacts AWDX-
30/30	615/615	2.4	73	.33	12.2	3.6	7.8	16661-S	15661-S
70/70	900/900	2.3	30	.47	7.5	6	12	16681-S	15681-S
135/135	1310/1310	5.0	34	.69	5.7	8.2	16.4	16911-S	15911-S
250/250	1690/1690	7.3	26.7	1.0	4.4	11	22	16871-S	15871-S
460/460	2700/2700	8.4	16.6	1.1	2.8	15	30	16631-S	15631-S
675/675	3150/3150	10.6	14.3	1.4	2.4	18.5	37	16771-S	15771-S
1100/1100	3750/3750	14.5	12.0	2.0	2.0	23.5	47	16641-S	15641-S
2000/2000	5620/5620	17.6	8.0	2.3	1.3	31.5	63	16081-S	15081-S
4275/4275	6900/6900	18	3.9	3.8	0.99	46	92	16241-S	15241-S

AWCX/AWDX — Bi-Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS	
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)			
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Form C Contacts AWCX-	Form D Contacts AWDX-
2	200	± 0.22	±100	±0.05	±29.6	1.0	2.0	16052-S	15052-S
18	675	± 0.62	± 31.1	±0.14	± 8.9	3.0	6.0	16492-S	15492-S
56	1125	± 1.15	± 18.7	±0.27	± 5.3	5.5	11.0	16302-S	15302-S
85	1350	± 1.5	± 15.6	±0.34	± 4.4	6.5	13.0	16332-S	15332-S
115	1500	± 1.8	± 14.0	±0.41	± 4.0	7.6	15.1	16122-S	15122-S
275	2750	± 2.5	± 8.0	±0.56	± 2.3	11.7	23.4	16422-S	15422-S
450	3490	± 3.0	± 6.0	±0.69	± 1.7	15.0	30.0	16262-S	15262-S
675	3900	± 4.0	± 5.4	±0.84	± 1.5	18.4	36.7	16042-S	15042-S
940	4350	± 5.1	± 4.9	±1.2	± 1.4	21.7	43.3	16352-S	15352-S
1250	4730	± 6.1	± 4.4	±1.5	± 1.3	25.0	50.0	16542-S	15542-S
1425	5340	± 6.3	± 4.0	±1.4	± 1.1	26.7	53.4	16582-S	15582-S
1800	4800	± 8.8	± 4.4	±1.9	± 1.2	30.0	60.0	16162-S	15162-S
1950	5530	± 8.1	± 3.8	±1.9	± 1.1	31.2	62.4	16572-S	15572-S
2400	5780	± 9.8	± 3.7	±2.2	± 1.0	34.6	69.2	16012-S	15012-S
4000	11,250	± 8.4	± 1.9	±1.8	± 0.5	45	90	16022-S	15022-S
9200	15,800	±13.2	± 1.3	±3.3	± 0.4	74	148	16792-S	15792-S
15,000	19,500	±16.5	± 1.0	±4.1	± 0.3	86.5	173	16672-S	15672-S

AWCX/AWDX — Bi-Stable, Dual Wound Coils

COIL DATA								STANDOFF VOLTAGE BETWEEN WINDINGS	CATALOG NUMBERS	
		MUST OPERATE (Either Winding)		NON-OPERATE (Either Winding)		VOLTAGE (vdc) (Either Winding)				
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.		Form C Contacts AWCX-	Form D Contacts AWDX-
30/30	615/615	±1.13	±34.2	± .26	±9.7	3.6	7.8	500	16662-S	15662-S
70/70	900/900	±1.20	±15.0	± .41	±6.6	6.0	12	500	16682-S	15682-S
135/135	1310/1310	±2.38	±16.0	± .54	±4.5	8.0	16	500	16912-S	15912-S
325/325	2570/2570	±2.50	± 7.0	± .91	±3.1	13	26	400	16532-S	15532-S
460/460	2700/2700	±3.95	± 7.8	± .91	±2.2	15	30	400	16632-S	15632-S
675/675	3150/3150	±4.8	± 6.5	±1.1	±1.9	18.5	37	400	16772-S	15772-S
1100/1100	3750/3750	±6.8	± 5.6	±1.6	±1.6	23.5	47	400	16642-S	15642-S
2000/2000	5620/5620	±8.4	± 3.8	±2.0	±1.1	31.5	63	200	16082-S	15082-S
4275/4275	6900/6900	±9.2	± 2.0	±4.6	±0.9	46	92	200	16242-S	15242-S

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS

SENSITIVE FORM C & D — PRINTED CIRCUIT TYPES

AWCA/AWDA/MWSA

SENSITIVITY, TYPICAL

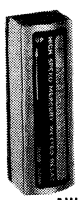
SINGLE SIDE STABLE
Must Operate: 60 Ampere Turns
Must Release: 10 Ampere Turns

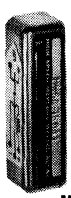
BI-STABLE
Must Operate: ±28 Ampere Turns
Non-Operate: ± 8 Ampere Turns

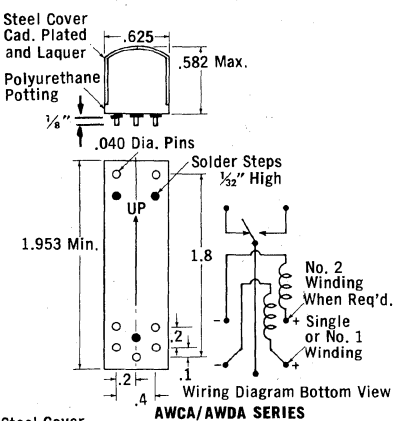
OPERATE MAKE TIME, TYPICAL

Single-Side-Stable		Bi-Stable	
Ampere Turns Total	Milli-seconds	Ampere Turns Total	Milli-seconds
90	1.8	58	1.4
160	1.3	128	1.1
260	1.1	228	1.0

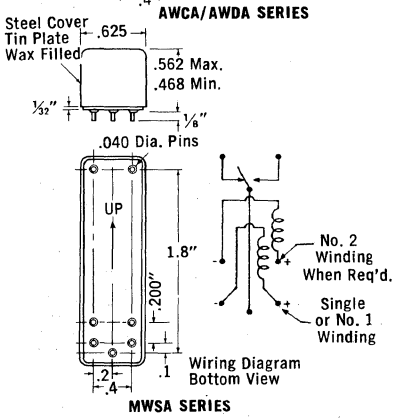
RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE
1.3 Milliseconds.


AWCA/AWDA


MWSA



AWCA/AWDA SERIES



MWSA SERIES

NOTE:
Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.
All Resistance and Voltage values shown are based on a temperature value of 25°C.
* Indicates limited stock item.

AWCA/AWDA/MWSA — Single Side Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS			
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)		Form C Contacts		Form D Contacts	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWCA-	MWSA-	AWDA-	MWSA-
2	270	.5	222	.05	27.7	1.0	2.0	16051-S	16051	15051-S	15051
18	900	1.3	66.8	.18	11.0	3.0	6.0	16491-S	16491	15491-S	15491
34	1150	1.2	32	.24	7.8	4.1	8.2	16561-S	16561	15561-S	15561
56	1500	1.5	24	.30	6.0	5.5	11	16301-S	16301	15301-S	15301
65	1575	2.7	37.4	.36	6.2	5.7	11.4	16511-S	16511	15511-S	15511
85	1800	3.1	33.3	.42	5.5	6.5	13.0	16331-S	16331	15331-S	15331
90	1590	3.8	37.7	.51	6.3	6.7	13.4	16321-S	16321	15321-S	15321
115	2000	3.8	30.0	.52	5.0	7.6	15.1	16121-S	16121	15121-S	15121
275	3525	5.2	17.0	.69	2.8	11.7	23.4	16421-S	16421*	15421-S	15421
385	4000	3.8	9.0	.73	2.1	14	28	16251-S	16251	15251-S	15251
450	4650	6.4	12.9	.85	2.1	15	30	16261-S	16261*	15261-S	15261
500	4020	8.2	14.9	1.1	2.4	16	32	16271-S	16271	15271-S	15271
620	5500	7.4	10.9	1.0	1.8	17.5	35	16141-S	16141	15141-S	15141
675	5200	8.6	11.6	1.1	1.9	18.4	36.7	16041-S	16041*	15041-S	15041
940	5800	10.5	10.1	1.4	1.7	21.7	43.3	16351-S	16351*	15351-S	15351
950	4950	12.7	12.1	1.7	2.0	21.8	43.6	16431-S	16431	15431-S	15431
1250	6400	12.9	9.4	1.8	1.6	25.0	50.0	16541-S	16541	15541-S	15541
1425	7125	13	8.4	1.8	1.4	26.7	53.4	16581-S	16581*	15581-S	15581
1450	7500	7.7	4.8	1.6	1.2	27.0	54.0	16231-S	16231	15231-S	15231
1800	6400	18.6	9.4	2.6	1.6	30.0	60.0	16161-S	16161*	15161-S	15161
1950	7375	17.6	8.2	2.3	1.3	31.2	62.4	16571-S	16571*	15571-S	15571
2400	7700	20.6	7.8	2.8	1.3	34.6	69.2	16011-S	16011*	15011-S	15011
2430	10,000	9.7	3.6	2.0	0.91	35	70	16391-S	16391	15391-S	15391
3620	12,400	12.0	2.9	2.4	0.74	42.5	85	16311-S	16311	15311-S	15311
3800	12,000	21.0	5.0	2.8	0.83	43.5	87	16131-S	16131	15131-S	15131
4000	15,000	17.6	4.0	2.4	0.67	45	90	16021-S	16021*	15021-S	15021
5000	14,000	23.2	4.3	3.2	0.71	50	100	16841-S	16841	15841-S	15841
5500	14,400	15.0	2.5	3.0	0.61	52.5	105	16371-S	16371	15371-S	15371
8600	18,000	19.0	2.0	3.8	0.49	65	130	16781-S	16781	15781-S	15781
9200	21,000	14.2	1.4	1.6	0.2	74	148	16793-S	16793	15793-S	15793
15,000	26,000	21.5	1.3	2.7	0.2	86.5	173	16671-S	16671	15671-S	15671

AWCA/AWDA/MWSA — Single Side Stable, Dual Wound Coils

COIL DATA									CATALOG NUMBERS			
		MUST OPERATE (Either Winding)		MUST RELEASE (Either Winding)		VOLTAGE (vdc) (Either Winding)		STANDOFF VOLTAGE BETWEEN WINDINGS	Form C Contacts		Form D Contacts	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.		AWCA-	MWSA-	AWDA-	MWSA-
30/30	820/820	2.4	73	.33	12.2	3.9	7.8	500	16661-S	16661	15661-S	15661
70/70	1200/1200	2.3	30	.47	7.5	6	12	500	16681-S	16681	15681-S	15681
115/115	1560/1560	3.0	23	.60	5.8	7.5	15	500	16291-S	16291	15291-S	15291
135/135	1750/1750	5.0	34	.69	5.7	8.2	16.4	500	16911-S	16911	15911-S	15911
190/190	2000/2000	3.8	18	.79	4.6	9.5	19	400	16691-S	16691	15691-S	15691
250/250	2250/2250	7.3	26.7	1.0	4.4	11	22	400	16871-S	16871	15871-S	15871
325/325	2570/2570	5.0	14	1.0	3.4	13	26	400	16531-S	16531	15531-S	15531
460/460	3600/3600	8.4	16.6	1.1	2.8	15	30	400	16631-S	16631	15631-S	15631
490/490	3000/3000	6.2	12	1.3	2.9	15.5	31	400	16711-S	16711	15711-S	15711
675/675	4200/4200	10.6	14.3	1.4	2.4	18.5	37	400	16771-S	16771	15771-S	15771
730/730	3750/3750	7.7	9.6	1.6	2.4	19	38	400	16741-S	16741	15741-S	15741
810/810	4090/4090	13.0	14.6	1.7	2.4	20	40	400	16751-S	16751	15751-S	15751
975/975	3680/3680	8.8	8.2	1.1	1.3	22	44	400	16861-S	16861	15861-S	15861
1100/1100	5000/5000	14.5	12	2.0	2.0	23.5	47	400	16641-S	16641	15641-S	15641
1250/1250	5000/5000	10	7.2	2.0	1.8	25	50	400	16471-S	16471	15471-S	15471
1860/1860	6200/6200	12	5.8	2.5	1.5	30.5	61	200	16401-S	16401	15401-S	15401
2000/2000	7500/7500	17.6	8.0	2.3	1.3	31.5	63	200	16081-S	16081	15081-S	15081
2300/2300	7200/7200	21.0	8.3	2.7	1.3	34	68	200	16061-S	16061	15061-S	15061
2760/2760	7200/7200	15	5.0	3.0	1.2	37	74	200	16761-S	16761	15761-S	15761
4275/4275	9200/9200	18	3.9	3.8	0.99	46	92	200	16241-S	16241	15241-S	15241

AWCA/AWDA/MWSA — Bi-Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS			
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)		Form C Contacts		Form D Contacts	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWCA-	MWSA-	AWDA-	MWSA-
2	270	± 0.22	±100.0	±0.05	±29.6	1.0	2.0	16052-S	16052	15052-S	15052
18	900	± 0.62	± 31.1	±0.14	± 8.9	3.0	6.0	16492-S	16492	15492-S	15492
34	1150	± 0.91	± 24.4	±0.21	± 7.0	4.1	8.2	16562-S	16562	15562-S	15562
56	1500	± 1.15	± 18.7	±0.27	± 5.3	5.5	11.0	16302-S	16302	15302-S	15302
65	1575	± 1.3	± 17.8	±0.30	± 5.1	5.7	11.4	16512-S	16512	15512-S	15512
85	1800	± 1.5	± 15.6	±0.34	± 4.4	6.5	13.0	16332-S	16332	15332-S	15332
90	1590	± 1.8	± 17.6	±0.41	± 5.0	6.7	13.4	16322-S	16322	15322-S	15322
115	2000	± 1.8	± 14.0	±0.41	± 4.0	7.6	15.1	16122-S	16122	15122-S	15122
275	3525	± 2.5	± 8.0	±0.56	± 2.3	11.7	23.4	16422-S	16422	15422-S	15422
385	4000	± 3.0	± 7.0	±0.69	± 2.0	14.0	28.0	16252-S	16252	15252-S	15252
450	4650	± 3.0	± 6.0	±0.69	± 1.7	15.0	30.0	16262-S	16262	15262-S	15262
500	4020	± 3.9	± 7.0	±0.90	± 2.0	16.0	32.0	16272-S	16272	15272-S	15272
620	5500	± 3.5	± 5.1	±0.84	± 1.5	17.5	35.0	16142-S	16142	15142-S	15142
675	5200	± 4.0	± 5.4	±0.84	± 1.5	18.4	36.7	16042-S	16042	15042-S	15042
940	5800	± 5.1	± 4.9	±1.2	± 1.4	21.7	43.3	16352-S	16352	15352-S	15352

Bi-Stable, Single Wound Coils continued next page

Adlake SINCE 1857

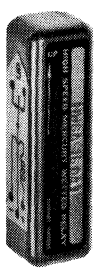
MERCURY WETTED CONTACT RELAYS

SENSITIVE FORM C & D — PRINTED CIRCUIT TYPES

AWCA/AWDA/MWSA (continued)



AWCA/AWDA



MWSA

See Page 2181 for Sensitivity, Timing, Dimensions and Wiring Diagrams

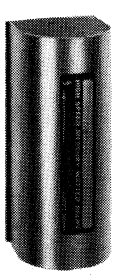
AWCA/AWDA/MWSA — Bi-Stable, Single Wound Coils (continued)

COIL DATA								CATALOG NUMBERS			
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)		Form C Contacts		Form D Contacts	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWCA-	MWSA-	AWDA-	MWSA-
950	4950	± 6.0	± 5.7	±1.4	± 1.6	21.8	43.6	16432-S	16432	15432-S	15432
1250	6300	± 6.1	± 4.4	±1.5	± 1.3	25.0	50.0	16542-S	16542	15542-S	15542
1425	7125	± 6.3	± 4.0	±1.4	± 1.1	26.7	53.4	16582-S	16582	15582-S	15582
1450	7500	± 5.4	± 3.7	±1.4	± 1.1	27.0	54.0	16232-S	16232	15232-S	15232
1800	6400	± 8.8	± 4.4	±1.9	± 1.2	30.0	60.0	16162-S	16162	15162-S	15162
1950	7375	± 8.1	± 3.8	±1.9	± 1.1	31.2	62.4	16572-S	16572	15572-S	15572
2400	7700	± 9.8	± 3.7	±2.2	± 1.0	34.6	69.2	16012-S	16012	15012-S	15012
2430	10,000	± 7.5	± 2.8	±1.7	± 0.8	35.0	70	16392-S	16392	15392-S	15392
3620	12,400	± 9.0	± 2.3	±2.0	± 0.6	42.5	85	16312-S	16312	15312-S	15312
3800	12,000	± 9.7	± 2.4	±2.4	± 0.7	43.5	87	16132-S	16132	15132-S	15132
4000	15,000	± 8.4	± 1.9	±1.8	± 0.5	45	90	16022-S	16022	15022-S	15022
5000	14,000	±11.0	± 2.0	±2.7	± 0.6	50	100	16842-S	16842	15842-S	15842
5500	14,400	±11.5	± 1.9	±3.0	± 0.6	52.5	105	16372-S	16372	15372-S	15372
8600	18,000	±14.2	± 1.5	±3.1	± 0.4	65.0	130	16782-S	16782	15782-S	15782
9200	21,000	±13.2	± 1.3	±3.3	± 0.4	74.0	148	16792-S	16792	15792-S	15792
15,000	26,000	±16.5	± 1.0	±4.1	± 0.3	86.5	173	16672-S	16672	15672-S	15672

AWCA/AWDA/MWSA — Bi-Stable, Dual Wound Coils

COIL DATA									CATALOG NUMBERS			
		MUST OPERATE (Either Winding)		NON-OPERATE (Either Winding)		VOLTAGE (vdc) (Either Winding)		STANDOFF VOLTAGE BETWEEN WINDINGS	Form C Contacts		Form D Contacts	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.		AWCA-	MWSA-	AWDA-	MWSA-
30/30	820/820	±1.13	±34.2	± .26	±9.7	3.9	7.8	500	16662-S	16662	15662-S	15662
70/70	1200/1200	±1.20	±15.0	± .41	±6.6	6.0	12	500	16682-S	16682	15682-S	15682
115/115	1560/1560	±1.50	±12.0	± .53	±5.1	7.5	15	500	16292-S	16292	15292-S	15292
135/135	1750/1750	±2.38	±16.0	± .54	±4.5	8.0	16	500	16912-S	16912	15912-S	15912
190/190	2000/2000	±1.90	± 9.0	± .68	±4.0	9.5	19	400	16692-S	16692	15692-S	15692
250/250	2250/2250	±3.4	±12.4	± .78	±3.5	11.0	22	400	16872-S	16872	15872-S	15872
325/325	2570/2570	±2.50	± 7.0	± .91	±3.1	13.0	26	400	16532-S	16532	15532-S	15532
460/460	3600/3600	±3.95	± 7.8	± .91	±2.2	15	30	400	16632-S	16632	15632-S	15632
490/490	3000/3000	±3.10	± 5.8	±1.2	±2.7	15.5	31	400	16712-S	16712	15712-S	15712
675/675	4200/4200	±4.8	± 6.5	±1.1	±1.9	18.5	37	400	16772-S	16772	15772-S	15772
730/730	3750/3750	±3.9	± 4.8	±1.4	±2.1	19	38	400	16742-S	16742	15742-S	15742
810/810	4090/4090	±6.10	± 6.85	±1.4	±1.9	20	40	400	16752-S	16752	15752-S	15752
975/975	3680/3680	±8.25	± 7.6	±1.9	±2.2	22	44	400	16862-S	16862	15862-S	15862
1100/1100	5000/5000	±6.8	± 5.6	±1.6	±1.6	23.5	47	400	16642-S*	16642*	15642-S	15642
1250/1250	5000/5000	±5.0	± 3.6	±1.8	±1.6	25	50	400	16472-S	16472	15472-S	15472
1860/1860	6200/6200	±6.0	± 3.0	±2.2	±1.3	30.5	61	200	16402-S	16402	15402-S	15402
2000/2000	7500/7500	±8.4	± 3.8	±2.0	±1.1	31.5	63	200	16082-S	16082	15082-S	15082
2300/2300	7200/7200	±9.6	± 3.8	±2.3	±1.1	34	68	200	16062-S	16062	15062-S	15062
2760/2760	7200/7200	±7.5	± 2.5	±2.7	±1.1	37	74	200	16762-S	16762	15762-S	15762
4275/4275	9200/9200	±9.2	± 2.0	±4.6	±0.9	46	92	200	16242-S	16242	15242-S	15242

AWCL/AWDL



AWCL/AWDL

See Page 2181 for Sensitivity, Timing, Dimensions and Wiring Diagrams

AWCL/AWDL — Single Side Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS	
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)		Form C Contacts	Form D Contacts
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWCL-	AWDL-
2	600	0.10	45.5	.014	7.8	0.33	2	16051-S	15051-S
12	1400	0.26	19.5	.035	3.3	0.86	4.9	16481-S	15481-S
22	2040	0.35	14.6	.067	3.4	1.1	6.6	16491-S	15491-S
40	2800	0.54	12.2	.14	3.8	1.4	8.9	16191-S	15191-S
90	4325	0.62	6.3	.09	1.1	2.1	13	16321-S	15321-S
130	4900	0.8	5.6	.12	1.0	2.7	16	16121-S	15121-S
200	6000	1.0	4.6	.14	0.8	3.3	20	16131-S	15131-S
350	7660	1.4	3.6	.19	0.6	4.6	26	16421-S	15421-S
500	9450	1.6	2.9	.22	0.5	5.3	31	16261-S	15261-S
600	10,450	1.9	2.9	.38	0.7	5.7	34	16401-S	15401-S
800	11,500	3.8	4.4	1.6	2.3	7.0	37	16351-S	15351-S
1000	12,350	2.4	2.2	.36	0.4	8.1	44	16431-S	15431-S
1900	17,800	3.3	1.6	.68	0.4	10.7	61	16161-S	15161-S
2500	18,800	3.9	1.4	.45	0.2	13.3	70	16011-S	15011-S
4000	23,400	8.8	2.0	3.8	1.0	17.1	90	16021-S	15021-S
4000	23,400	5.3	1.2	.72	0.2	17.1	90	16022-S	15022-S
7000	31,675	6.9	0.9	.88	0.14	22.1	118	16091-S	15091-S
11,000	38,050	8.5	0.7	1.2	0.12	28.9	148	16721-S	15721-S
17,000	44,250	11.2	0.6	1.5	0.10	38.4	184	16411-S	15411-S
25,000	53,000	13.8	0.5	2.0	0.09	47.2	224	16241-S	15241-S
70,000	90,000	22.6	0.3	3.1	0.05	77.7	374	16501-S	15501-S
100,000	100,000	30.0	0.3	5.0	0.05	100	448	16531-S	15531-S

NOTE:

Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

MERCURY WETTED CONTACT RELAYS
SENSITIVE FORM C & D — PRINTED CIRCUIT TYPES

AWCL/AWDL
(continued)

SENSITIVITY, TYPICAL

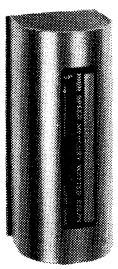
SINGLE SIDE STABLE
Must Operate: 27 Ampere Turns
Must Release: 5 Ampere Turns

BI-STABLE
Must Operate: ±15 Ampere Turns
Non-Operate: ± 4 Ampere Turns

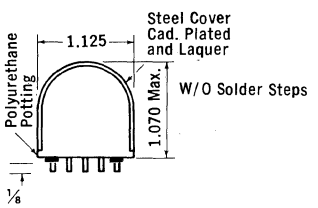
OPERATE MAKE TIME, TYPICAL

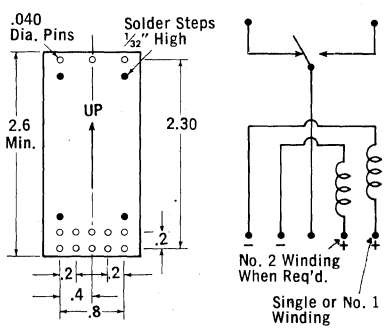
Single-Side-Stable		Bi-Stable	
Ampere Turns Total	Milli-seconds	Ampere Turns Total	Milli-seconds
80	2.5	65	2.2
130	1.8	115	1.7
230	1.5	215	1.4
330	1.3	315	1.2
430	1.2	415	1.1

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE
1.4 Milliseconds



AWCL/AWDL





Wiring Diagram
Bottom View

NOTE:
Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

AWCL/AWDL — Single Side Stable, Dual Wound Coils

COIL DATA								CATALOG NUMBERS	
		MUST OPERATE (Either Winding)		MUST RELEASE (Either Winding)		VOLTAGE (vdc) (Either Winding			
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Form C Contacts AWCL-	Form D Contacts AWDL-
25/25	1400/1400	.37	13.6	0.05	2.3	1.8	7.0	16661-S	15661-S
135/135	3250/3250	1.2	8.3	.18	1.5	4.2	16.5	16151-S	15151-S
180/180	4100/4100	1.3	6.6	.19	1.2	4.4	19.0	16931-S	15931-S
250/250	4725/4725	1.6	5.8	.22	1.0	5.3	22.4	16231-S	15231-S
500/500	6200/6200	2.4	4.3	.36	0.8	8.0	31.6	16271-S	15271-S
700/700	7100/7100	2.9	3.8	.44	0.7	9.8	37.4	16461-S	15461-S
1100/1100	8700/8700	3.8	3.1	.49	0.5	12.6	47.0	16591-S	15591-S
2000/2000	11,700/11,700	5.1	2.3	.72	0.4	17.1	63.2	16841-S	15841-S
12,000/12,000	30,000/30,000	11.9	0.9	2.16	0.2	40.0	155.0	16181-S	15181-S

AWCL/AWDL — Bi-Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS	
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)			
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Form C Contacts AWCL-	Form D Contacts AWDL-
2	600	± .056	±25.5	± .012	±6.7	0.33	2	16052-S	15052-S
12	1400	± .14	±10.6	± .031	±2.9	0.86	4.9	16482-S	15482-S
22	2040	± .18	± 7.5	± .040	±2.0	1.1	6.6	16492-S	15492-S
40	2800	± .24	± 5.5	± .050	±1.4	1.4	8.9	16192-S	15192-S
90	4325	± .34	± 3.5	± .074	±0.92	2.1	13	16322-S	15322-S
130	4900	± .43	± 3.0	± .096	±0.82	2.7	16	16122-S	15122-S
200	6000	± .55	± 2.5	± .12	±0.67	3.3	20	16132-S	15132-S
350	7660	± .77	± 2.0	± .16	±0.52	4.6	26	16422-S	15422-S
500	9450	± .88	± 1.6	± .19	±0.42	5.3	31	16262-S	15262-S
600	10,450	± .99	± 1.5	± .20	±0.38	5.7	34	16402-S	15402-S
800	11,500	± 1.1	± 1.3	± .25	±0.35	7.0	37	16352-S	15352-S
1000	12,350	± 1.3	± 1.2	± .28	±0.32	8.1	44	16434-S	15434-S
1900	17,800	± 1.8	± 0.86	± .37	±0.22	10.7	61	16162-S	15162-S
2500	18,800	± 2.3	± 0.82	± .47	±0.21	13.3	70	16014-S	15014-S
4000	23,400	± 2.9	± 0.65	± .61	±0.17	17.1	90	16023-S	15023-S
7000	31,675	± 3.7	± 0.48	± .82	±0.13	22.1	118	16092-S	15092-S
11,000	38,050	± 4.8	± 0.40	±1.1	±0.11	28.9	148	16722-S	15722-S
17,000	44,250	± 6.5	± 0.35	±1.4	±0.09	38.4	184	16412-S	15412-S
25,000	53,000	± 8.0	± 0.29	±1.8	±0.08	47.2	224	16244-S	15244-S
70,000	90,000	±12.8	± 0.17	±2.5	±0.04	77.7	374	16502-S	15502-S
100,000	100,000	±16.5	± 0.15	±4.0	±0.04	100	448	16532-S	15532-S

AWCL/AWDL — Bi-Stable, Dual Wound Coils

COIL DATA								CATALOG NUMBERS	
		MUST OPERATE (Either Winding)		NON-OPERATE (Either Winding)		VOLTAGE (vdc) (Either Winding)			
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Form C Contacts AWCL-	Form D Contacts AWDL-
25/25	1400/1400	±0.29	±10.7	± .067	±2.8	1.8	7.0	16662-S	15662-S
135/135	3250/3250	±0.68	± 4.6	± .14	±1.2	4.2	16.5	16152-S	15152-S
180/180	4100/4100	±0.73	± 3.7	± .16	±1.0	4.4	19.0	16932-S	15932-S
250/250	4725/4725	±0.88	± 3.2	± .19	±0.85	5.3	22.4	16232-S	15232-S
500/500	6200/6200	±1.3	± 2.4	± .29	±0.65	8.0	31.6	16272-S	15272-S
700/700	7100/7100	±1.8	± 2.3	± .35	±0.56	9.8	37.4	16462-S	15462-S
1100/1100	8700/8700	±2.2	± 1.8	± .45	±0.46	12.6	47.0	16592-S	15592-S
2000/2000	11,700/11,700	±2.9	± 1.3	± .61	±0.34	17.1	63.2	16842-S	15842-S
12,000/12,000	30,000/30,000	±6.6	± 0.5	±1.4	±0.13	40.0	155.0	16182-S	15182-S

Addlake SINCE 1857

MERCURY WETTED CONTACT RELAYS

SENSITIVE FORM C & D — PRINTED CIRCUIT TYPES

AWCA/AWDA (2 SWITCH)

SENSITIVITY, TYPICAL

SINGLE SIDE STABLE
Must Operate: 50 Ampere Turns
Must Release: 10 Ampere Turns

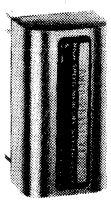
BI-STABLE
Must Operate: ±25 Ampere Turns
Non-Operate: ± 4 Ampere Turns

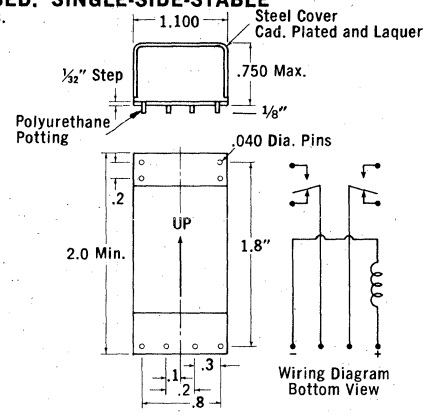
OPERATE MAKE TIME, TYPICAL

Single-Side-Stable		Bi-Stable	
Ampere Turns Total	Milli-seconds	Ampere Turns Total	Milli-seconds
75	2.6	50	3.0
100	2.0	75	2.3
150	1.5	125	1.6
250	1.4	175	1.4
350	1.3	225	1.3

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE

1.8 Milliseconds.





AWCA/AWDA (2 SWITCH)
Single Side Stable, Single Wound Coils

COIL								CATALOG NUMBERS	
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)		Form C Contacts	Form D Contacts
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWCA-	AWDA-
18	1000	1.1	54.7	.18	11	3.3	7.3	26491	25491
70	1800	2.1	27.8	.34	5.5	6.3	14.5	26111	25111
270	3500	4.2	14.3	.68	2.8	12.6	28.5	26231	25231
510	4600	6.2	11.0	1.0	2.2	18.6	39.0	26171	25171
900	7500	7.4	7.5	1.0	1.3	22.2	42.5	26151	25151
1950	8900	12	5.62	1.9	1.1	36	76.5	26201	25201
4700	14,000	18	3.57	3.0	.71	54	120	26011	25011
11,400	21,600	29	2.30	4.7	.46	87	185	26191	25191
28,000	33,500	46	1.50	7.5	.30	138	290	26101	25101
43,500	42,000	58	1.20	9.4	.24	174	360	26161	25161

AWCA/AWDA (2 SWITCH)
Bi-Stable, Single Wound Coils

COIL								CATALOG NUMBERS	
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)		Form C Contacts	Form D Contacts
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWCA-	AWDA-
18	1000	± .50	±25.0	± .06	±4.0	3.3	7.3	26492	25492
70	1800	± 1.1	±13.9	± .14	±2.2	6.3	14.5	26112	25112
270	3500	± 2.1	± 7.1	± .27	±1.1	12.6	28.5	26232	25232
510	4600	± 3.0	± 5.4	± .40	± .87	18.6	39.0	26172	25172
900	7500	± 3.3	± 3.3	± .43	± .53	22.2	42.5	26152	25152
1950	8900	± 6.0	± 2.8	± .79	± .45	36	76.5	26202	25202
4700	14,000	± 9.3	± 1.8	±1.2	± .29	54	120	26012	25012
11,400	21,600	±15.0	± 1.2	±1.9	± .19	87	185	26192	25192
28,000	33,500	±23.1	± .75	±3.0	± .12	138	290	26102	25102
43,500	42,000	±28.7	± .60	±3.9	± .10	174	360	26162	25162

AWCS/AWDS (2 SWITCH)

SENSITIVITY, TYPICAL

SINGLE SIDE STABLE
Must Operate: 90 Ampere Turns
Must Release: 10 Ampere Turns

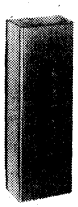
BI-STABLE
Must Operate: ±45 Ampere Turns
Non-Operate: ± 8 Ampere Turns

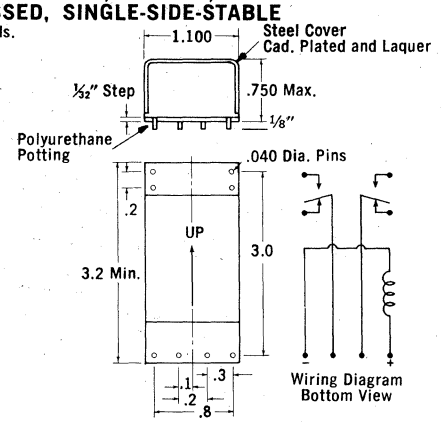
OPERATE MAKE TIME, TYPICAL

Single-Side-Stable		Bi-Stable	
Ampere Turns Total	Milli-seconds	Ampere Turns Total	Milli-seconds
115	2.6	70	3.0
140	2.0	95	2.3
190	1.5	145	1.6
290	1.4	195	1.4
390	1.3	245	1.3

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE

1.8 Milliseconds.





AWCS/AWDS (2 SWITCH)
Single Side Stable, Single Wound Coils

COIL								CATALOG NUMBERS	
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)		Form C Contacts	Form D Contacts
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWCS-	AWDS-
40	2000	2.0	45.0	.18	5.0	4.5	11.0	26451	25451
90	2800	3.2	32.1	.29	3.6	6.7	16.5	26111	25111
140	3500	4.0	25.7	.35	2.8	8.4	20.5	26121	25121
400	6500	6.1	13.8	.54	1.5	14.2	34.7	26211	25211
540	7900	6.8	11.5	.63	1.3	16.5	40.3	26021	25021
700	8500	8.2	10.6	1.1	1.8	18.7	46.0	26221	25221
900	9500	9.4	9.5	.89	1.1	21.2	52.0	26151	25151
1250	10,000	12.4	9.0	1.1	1.0	25.0	61.2	26541	25541
2350	14,000	16.5	6.4	1.5	0.7	34.3	84.0	26071	25071
6000	20,200	29.7	4.5	2.7	0.5	55.0	134.0	26091	25091

AWCS/AWDS (2 SWITCH)
Bi-Stable, Single Wound Coils

COIL								CATALOG NUMBERS	
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)		Form C Contacts	Form D Contacts
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWCS-	AWDS-
40	2000	± 1.0	±22.5	± .14	±4.0	4.5	11.0	26452	25452
90	2800	± 1.6	±16.1	± .23	±2.9	6.7	16.5	26112	25112
140	3500	± 1.3	±12.9	± .29	±2.3	8.4	20.5	26122	25122
400	6500	± 3.0	± 6.9	± .43	±1.2	14.2	34.7	26212	25212
540	7900	± 3.4	± 5.7	± .48	±1.0	16.5	40.3	26022	25022
700	8500	± 4.1	± 5.3	± .59	± .94	18.7	46.0	26222	25222
900	9500	± 4.7	± 4.7	± .68	± .84	21.2	52.0	26152	25152
1250	10,000	± 6.2	± 4.5	± .90	± .80	25.0	61.2	26542	25542
2350	14,000	± 8.3	± 3.2	±1.2	± .57	34.3	84.0	26072	25072
6000	20,200	±14.5	± 2.2	±2.1	± .40	55.0	134.0	26092	25092

NOTE:

Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS
SENSITIVE FORM C & D-PLUG-IN TYPES

MWCX/MWDX

SENSITIVITY, TYPICAL

SINGLE SIDE STABLE

Must Operate: 45 Ampere Turns
Must Release: 7.5 Ampere Turns

BI-STABLE

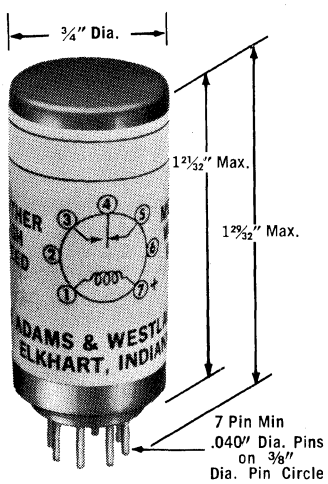
Must Operate: ±21 Ampere Turns
Non-Operate: ± 6 Ampere Turns

OPERATE MAKE TIME, TYPICAL

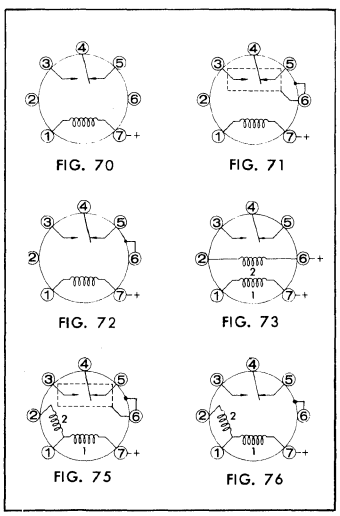
Single-Side-Stable		Bi-Stable	
Ampere Turns Total	Milli-seconds	Ampere Turns Total	Milli-seconds
45	1.7	21	1.9
70	1.1	46	1.0
95	1.0	71	.9

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE

1.1 Milliseconds



BASE FIGURES



NOTE:

Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

MWCX/MWDX — Single Side Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	MUST RELEASE Voltage (vdc)	MUST RELEASE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	Fig. 70 MWCX-	Fig. 71 MWCX-	Fig. 72 MWCX-	Fig. 70 MWDX-	Fig. 71 MWDX-	Fig. 72 MWDX-
2	200	0.5	222	.05	27.7	1.0	2.0	16051-0	16051-1	16051-2	15051-0	15051-1	15051-2
18	675	1.3	66.8	.18	11.0	3.0	6.0	16491-0	16491-1	16491-2	15491-0	15491-1	15491-2
56	1125	1.5	24.0	.30	6.0	5.5	11.0	16301-0	16301-1	16301-2	15301-0	15301-1	15301-2
85	1350	3.1	33.3	.42	5.5	6.5	13.0	16331-0	16331-1	16331-2	15331-0	15331-1	15331-2
115	1500	3.8	30.0	.52	5.0	7.6	15.1	16121-0	16121-1	16121-2	15121-0	15121-1	15121-2
275	2750	5.2	17.0	.69	2.8	11.7	23.4	16421-0	16421-1	16421-2	15421-0	15421-1	15421-2
450	3490	6.4	12.9	.85	2.1	15.0	30.0	16261-0	16261-1	16261-2	15261-0	15261-1	15261-2
675	3900	8.6	11.6	1.1	1.9	18.4	36.7	16041-0*	16041-1	16041-2	15041-0	15041-1	15041-2
940	4350	10.5	10.1	1.4	1.7	21.7	43.3	16351-0	16351-1	16351-2	15351-0	15351-1	15351-2
1250	4730	12.9	9.4	1.8	1.6	25.0	50.0	16541-0	16541-1	16541-2	15541-0	15541-1	15541-2
1425	5340	13.0	8.4	1.8	1.4	26.7	53.4	16581-0	16581-1	16581-2	15581-0	15581-1	15581-2
1800	4800	18.6	9.4	2.6	1.6	30.0	60.0	16161-0	16161-1	16161-2	15161-0	15161-1	15161-2
1950	5530	17.6	8.2	2.3	1.3	31.2	62.4	16571-0	16571-1	16571-2	15571-0	15571-1	15571-2
2400	5780	20.6	7.8	2.8	1.3	34.6	69.2	16011-0	16011-1	16011-2	15011-0	15011-1	15011-2
4000	11,250	17.6	4.0	2.4	0.67	45	90	16021-0	16021-1	16021-2	15021-0	15021-1	15021-2
9200	15,800	14.2	1.4	1.6	0.2	74	148	16791-0	16791-1	16791-2	15791-0	15791-1	15791-2
15,000	19,500	21.5	1.3	2.7	0.2	86.5	173	16671-0	16671-1	16671-2	15671-0	15671-1	15671-2

MWCX/MWDX — Single Side Stable, Dual Wound Coils

COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE (Either Winding) Voltage (vdc)	MUST OPERATE (Either Winding) Current (madc)	MUST RELEASE (Either Winding) Voltage (vdc)	MUST RELEASE (Either Winding) Current (madc)	VOLTAGE (vdc) (Either Winding) Nom.	VOLTAGE (vdc) (Either Winding) Max.	Fig. 73 MWCX-	Fig. 75 MWCX-	Fig. 76 MWCX-	Fig. 73 MWDX-	Fig. 75 MWDX-	Fig. 76 MWDX-
30/30	615/615	2.4	73	.33	12.2	3.6	7.8	16661-3	16661-5	16661-6	15661-3	15661-5	15661-6
70/70	900/900	2.3	30	.47	7.5	6	12	16681-3	16681-5	16681-6	15681-3	15681-5	15681-6
135/135	1310/1310	5.0	34	.69	5.7	8.2	16.4	16911-3	16911-5	16911-6	15911-3	15911-5	15911-6
250/250	1690/1690	7.3	26.7	1.0	4.4	11	22	16871-3	16871-5	16871-6	15871-3	15871-5	15871-6
460/460	2700/2700	8.4	16.6	1.1	2.8	15	30	16631-3	16631-5	16631-6	15631-3	15631-5	15631-6
675/675	3150/3150	10.6	14.3	1.4	2.4	18.5	37	16731-3	16731-5	16731-6	15731-3	15731-5	15731-6
1100/1100	3750/3750	14.5	12.0	2.0	2.0	23.5	47	16641-3	16641-5	16641-6	15641-3	15641-5	15641-6
2000/2000	5620/5620	17.6	8.0	2.3	1.3	31.5	63	16081-3	16081-5	16081-6	15081-3	15081-5	15081-6
4275/4275	6900/6900	18	3.9	3.8	0.99	46	92	16241-3	16241-5	16241-6	15241-3	15241-5	15241-6

MWCX/MWDX — Bi-Stable, Dual Wound Coils

COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	NON-OPERATE Voltage (vdc)	NON-OPERATE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	Fig. 70 MWCX-	Fig. 71 MWCX-	Fig. 72 MWCX-	Fig. 70 MWDX-	Fig. 71 MWDX-	Fig. 72 MWDX-
2	200	± 0.22	±100	±0.05	±29.6	1.0	2.0	16052-0	16052-1	16052-2	15052-0	15052-1	15052-2
18	675	± 0.62	± 31.1	±0.14	± 8.9	3.0	6.0	16492-0	16492-1	16492-2	15492-0	15492-1	15492-2
56	1125	± 1.15	± 18.7	±0.27	± 5.3	5.5	11.0	16302-0	16302-1	16302-2	15302-0	15302-1	15302-2
85	1350	± 1.5	± 15.6	±0.34	± 4.4	6.5	13.0	16332-0	16332-1	16332-2	15332-0	15332-1	15332-2
115	1500	± 1.8	± 14.0	±0.41	± 4.0	7.6	15.1	16122-0	16122-1	16122-2	15122-0	15122-1	15122-2
275	2750	± 2.5	± 8.0	±0.56	± 2.3	11.7	23.4	16422-0	16422-1	16422-2	15422-0	15422-1	15422-2
450	3490	± 3.0	± 6.0	±0.69	± 1.7	15.0	30.0	16262-0	16262-1	16262-2	15262-0	15262-1	15262-2
675	3900	± 4.0	± 5.4	±0.84	± 1.5	18.4	36.7	16042-0	16042-1	16042-2	15042-0	15042-1	15042-2
940	4350	± 5.1	± 4.9	±1.2	± 1.4	21.7	43.3	16352-0	16352-1	16352-2	15352-0	15352-1	15352-2
1250	4730	± 6.1	± 4.4	±1.5	± 1.3	25.0	50.0	16542-0	16542-1	16542-2	15542-0	15542-1	15542-2
1425	5340	± 6.3	± 4.0	±1.4	± 1.1	26.7	53.4	16582-0	16582-1	16582-2	15582-0	15582-1	15582-2
1800	4800	± 8.8	± 4.4	±1.9	± 1.2	30.0	60.0	16162-0	16162-1	16162-2	15162-0	15162-1	15162-2
1950	5530	± 8.1	± 3.8	±1.9	± 1.1	31.2	62.4	16572-0	16572-1	16572-2	15572-0	15572-1	15572-2
2400	5780	± 9.8	± 3.7	±2.2	± 1.0	34.6	69.2	16012-0	16012-1	16012-2	15012-0	15012-1	15012-2
4000	11,250	± 8.4	± 1.9	±1.8	± 0.5	45	90	16022-0	16022-1	16022-2	15022-0	15022-1	15022-2
9200	15,800	±13.2	± 1.3	±3.3	± 0.4	74	148	16792-0	16792-1	16792-2	15792-0	15792-1	15792-2
15,000	19,500	±16.5	± 1.0	±4.1	± 0.3	86.5	173	16672-0	16672-1	16672-2	15672-0	15672-1	15672-2

MWCX/MWDX — Bi-Stable, Dual Wound Coils

COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE (Either Winding) Voltage (vdc)	MUST OPERATE (Either Winding) Current (madc)	NON-OPERATE (Either Winding) Voltage (vdc)	NON-OPERATE (Either Winding) Current (madc)	VOLTAGE (vdc) (Either Winding) Nom.	VOLTAGE (vdc) (Either Winding) Max.	Fig. 73 MWCX-	Fig. 75 MWCX-	Fig. 76 MWCX-	Fig. 73 MWDX-	Fig. 75 MWDX-	Fig. 76 MWDX-
30/30	615/615	±1.13	±34.2	± .26	±9.7	3.6	7.8	16662-3	16662-5	16662-6	15662-3	15662-5	15662-6
70/70	900/900	±1.20	±15.0	± .41	±6.6	6	12	16682-3	16682-5	16682-6	15682-3	15682-5	15682-6
135/135	1310/1310	±2.38	±16.0	± .54	±4.5	8.2	16.4	16912-3	16912-5	16912-6	15912-3	15912-5	15912-6
250/250	1690/1690	±2.50	± 7.0	± .91	±3.1	11	22	16872-3	16872-5	16872-6	15872-3	15872-5	15872-6
460/460	2700/2700	±3.95	± 7.8	± .91	±2.2	15	30	16632-3	16632-5	16632-6	15632-3	15632-5	15632-6
675/675	3150/3150	±4.8	± 6.5	±1.1	±1.9	18.5	37	16732-3	16732-5	16732-6	15732-3	15732-5	15732-6
1100/1100	3750/3750	±6.8	± 5.6	±1.6	±1.6	23.5	47	16642-3	16642-5	16642-6	15642-3	15642-5	15642-6
2000/2000	5620/5620	±8.4	± 3.8	±2.0	±1.1	31.5	63	16082-3	16082-5	16082-6	15082-3	15082-5	15082-6
4275/4275	6900/6900	±9.2	± 2.0	±4.6	±0.9	46	92	16242-3	16242-5	16242-6	15242-3	15242-5	15242-6

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS

SENSITIVE FORM C & D - PLUG-IN TYPES

MWS

SENSITIVITY, TYPICAL

SINGLE SIDE STABLE
Must Operate: 27 Ampere Turns
Must Release: 5 Ampere Turns

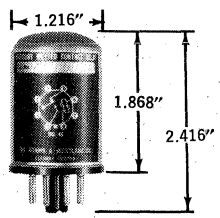
BI-STABLE
Must Operate: ±15 Ampere Turns
Non-Operate: ± 4 Ampere Turns

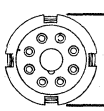
OPERATE MAKE TIME, TYPICAL

Single-Side Stable		Bi-Stable	
Ampere Turns Total	Milli-seconds	Ampere Turns Total	Milli-seconds
80	2.0	65	1.8
130	1.6	115	1.5
230	1.3	215	1.3
330	1.2	315	1.1
430	1.1	415	1.0

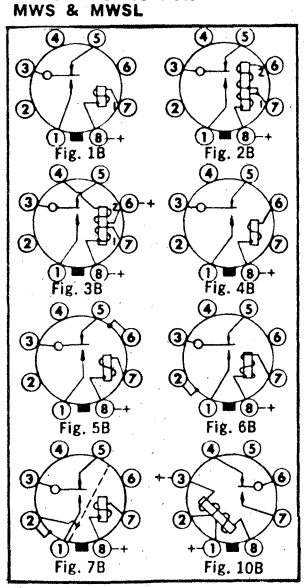
RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE

1.4 Milliseconds.





BASE FIGURES FOR MWS & MWSL



NOTE:
Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures. All Resistance and Voltage values shown are based on a temperature value of 25°C.
* Indicates limited stock item.

MWS — Single Side Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	MUST RELEASE Voltage (vdc)	MUST RELEASE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	Fig. 1B MWS-	Fig. 5B MWS-	Fig. 7B MWS-	Fig. 1B MWS-	Fig. 5B MWS-	Fig. 7B MWS-
2.8	550	.15	49.7	.021	8.55	.5	2.3	16051-1B	16051-5B	16051-7B	15051-1B	15051-5B	15051-7B
6.6	770	.26	35.5	.036	6.10	.7	3.6	16861-1B	16861-5B	16861-7B	15861-1B	15861-5B	15861-7B
12	1130	.32	24.2	.045	4.16	1.1	4.9	16481-1B	16481-5B	16481-7B	15481-1B	15481-5B	15481-7B
22	1540	.43	17.7	.060	3.05	1.4	6.6	16491-1B	16491-5B	16491-7B	15491-1B	15491-5B	15491-7B
33	1850	.54	14.8	.075	2.54	1.7	8.1	16171-1B	16171-5B	16171-7B	15171-1B	15171-5B	15171-7B
50	2380	.63	11.5	.088	1.97	2.1	10.0	16191-1B*	16191-5B	16191-7B	15191-1B	15191-5B	15191-7B
70	2690	.78	10.2	.11	1.75	2.6	11.8	16321-1B	16321-5B	16321-7B	15321-1B	15321-5B	15321-7B
110	3300	1.0	8.28	.14	1.42	3.3	14.8	16121-1B	16121-5B	16121-7B	15121-1B	15121-5B	15121-7B
195	4200	1.4	6.50	.20	1.12	4.6	19.8	16131-1B	16131-5B	16131-7B	15131-1B	15131-5B	15131-7B
330	5750	1.7	4.75	.24	0.82	5.7	25.7	16421-1B	16421-5B	16421-7B	15421-1B	15421-5B	15421-7B
440	6350	2.1	4.30	.29	0.74	6.9	29.7	16261-1B	16261-5B	16261-7B	15261-1B	15261-5B	15261-7B
550	6800	2.4	4.02	.34	0.69	8.1	33.2	16401-1B*	16401-5B	16401-7B	15401-1B	15401-5B	15401-7B
1050	9740	3.2	2.80	.45	0.48	10.8	46	16431-1B	16431-5B	16431-7B	15431-1B	15431-5B	15431-7B
2200	12,900	5.1	2.11	.71	0.36	17.1	66	16011-1B	16011-5B	16011-7B	15011-1B	15011-5B	15011-7B
3850	17,400	6.6	1.57	.93	0.27	22.1	88	16021-1B*	16021-5B	16021-7B	15021-1B	15021-5B	15021-7B
4000	23,400	8.8	2.00	3.6	1.00	17.1	90	16081-1B	16081-5B	16081-7B	15081-1B	15081-5B	15081-7B
4000	23,400	5.5	1.25	.90	0.25	17.1	90	16082-1B	16082-5B	16082-7B	15082-1B	15082-5B	15082-7B
6000	20,500	8.8	1.33	1.2	0.23	29.3	110	16091-1B	16091-5B	16091-7B	15091-1B	15091-5B	15091-7B
10,000	33,500	9.0	0.82	1.3	0.14	29.8	142	16111-1B	16111-5B	16111-7B	15111-1B	15111-5B	15111-7B
11,000	38,050	8.7	0.72	1.2	0.12	29.5	148	16721-1B*	16721-5B	16721-7B	15721-1B	15721-5B	15721-7B
14,000	29,200	14.5	0.94	2.0	0.16	48.0	167	16711-1B	16711-5B	16711-7B	15711-1B	15711-5B	15711-7B
17,000	44,250	11.6	0.62	1.5	0.10	38.4	184	16411-1B	16411-5B	16411-7B	15411-1B	15411-5B	15411-7B
25,000	53,000	14.3	0.52	2.0	0.09	47.2	224	16241-1B	16241-5B	16241-7B	15241-1B	15241-5B	15241-7B
25,000	53,000	23.4	0.85	9.4	0.42	47.2	224	16242-1B	16242-5B	16242-7B	15242-1B	15242-5B	15242-7B
25,000	53,000	25.9	0.94	11.7	0.52	47.2	224	16243-1B	16243-5B	16243-7B	15243-1B	15243-5B	15243-7B

MWS — Single Side Stable, Dual Wound Coils

COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE (Either Winding) Voltage (vdc)	MUST OPERATE (Either Winding) Current (madc)	MUST RELEASE (Either Winding) Voltage (vdc)	MUST RELEASE (Either Winding) Current (madc)	VOLTAGE (vdc) (Either Winding) Nom.	VOLTAGE (vdc) (Either Winding) Max.	Fig. 2B MWS-	Fig. 3B MWS-	Fig. 10B MWS-	Fig. 2B MWS-	Fig. 3B MWS-	Fig. 10B MWS-
100/100	2350/2350	1.3	11.5	.18	2.1	4.3	14.2	16521-2B	16521-3B	16521-10B	15521-2B	15521-3B	15521-10B
150/150	3000/3000	1.4	9.0	.23	1.7	5.0	17.3	16771-2B	16771-3B	16771-10B	15771-2B	15771-3B	15771-10B
250/250	3140/3140	2.4	8.6	.36	1.6	8.0	22.4	16211-2B	16211-3B	16211-10B	15211-2B	15211-3B	15211-10B
575/575	6000/6000	2.8	4.5	.43	0.83	9.6	34	16781-2B	16781-3B	16781-10B	15781-2B	15781-3B	15781-10B
1100/1100	8000/8000	4.1	3.4	.59	0.60	13.8	47	16591-2B	16591-3B	16591-10B	15591-2B	15591-3B	15591-10B
2300/2300	12,000/12,000	5.6	2.2	.87	0.42	19.2	68	16791-2B	16791-3B	16791-10B	15791-2B	15791-3B	15791-10B
4000/4000	16,000/16,000	7.5	1.7	1.1	0.31	25	89	16921-2B	16921-3B	16921-10B	15921-2B	15921-3B	15921-10B
7500/7500	20,400/22,250	10.7	1.3	1.6	0.24	36	122	16201-2B	16201-3B	16201-10B	15201-2B	15201-3B	15201-10B

MWS — Bi-Stable, Single Wound Coils

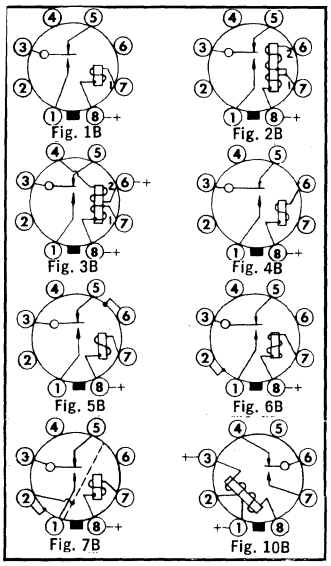
COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	NON-OPERATE Voltage (vdc)	NON-OPERATE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	Fig. 1B MWS-	Fig. 5B MWS-	Fig. 7B MWS-	Fig. 1B MWS-	Fig. 5B MWS-	Fig. 7B MWS-
2.8	550	± .09	±27.8	± .02	± 7.3	.5	2.3	16052-1B	16052-5B	16052-7B	15052-1B	15052-5B	15052-7B
6.6	770	± .14	±19.9	± .03	± 5.2	.7	3.6	16862-1B	16862-5B	16862-7B	15862-1B	15862-5B	15862-7B
12	1130	± .18	±13.5	± .04	± 3.5	1.1	4.9	16482-1B	16482-5B	16482-7B	15482-1B	15482-5B	15482-7B
22	1540	± .23	± 9.7	± .05	± 2.6	1.4	6.6	16492-1B	16492-5B	16492-7B	15492-1B	15492-5B	15492-7B
33	1850	± .30	± 8.27	± .06	± 2.2	1.7	8.1	16172-1B	16172-5B	16172-7B	15172-1B	15172-5B	15172-7B
50	2380	± .35	± 6.43	± .08	± 1.7	2.1	10.0	16192-1B	16192-5B	16192-7B	15192-1B	15192-5B	15192-7B
70	2690	± .44	± 5.68	± .09	± 1.5	2.6	11.8	16322-1B	16322-5B	16322-7B	15322-1B	15322-5B	15322-7B
110	3300	± .56	± 4.64	± .12	± 1.2	3.3	14.8	16122-1B	16122-5B	16122-7B	15122-1B	15122-5B	15122-7B
195	4200	± .78	± 3.64	± .16	± .95	4.6	19.8	16132-1B	16132-5B	16132-7B	15132-1B	15132-5B	15132-7B
330	5750	± .97	± 2.66	± .21	± .70	5.7	25.7	16422-1B	16422-5B	16422-7B	15422-1B	15422-5B	15422-7B
440	6350	±1.2	± 2.41	± .25	± .63	6.9	29.7	16262-1B	16262-5B	16262-7B	15262-1B	15262-5B	15262-7B
550	6800	±1.4	± 2.25	± .29	± .59	8.1	33.2	16402-1B	16402-5B	16402-7B	15402-1B	15402-5B	15402-7B
1050	9740	±1.8	± 1.57	± .39	± .41	10.8	46	16432-1B	16432-5B	16432-7B	15432-1B	15432-5B	15432-7B
2200	12,900	±2.9	± 1.18	± .61	± .31	17.1	66	16012-1B	16012-5B	16012-7B	15012-1B	15012-5B	15012-7B
3850	17,400	±3.7	± 0.88	± .79	± .23	22.1	88	16022-1B	16022-5B	16022-7B	15022-1B	15022-5B	15022-7B
4000	23,400	±2.9	± 0.65	± .61	± .17	17.1	90	16083-1B	16083-5B	16083-7B	15083-1B	15083-5B	15083-7B
6000	20,500	±5.0	± 0.75	±1.0	± .19	29.3	110	16092-1B	16092-5B	16092-7B	15092-1B	15092-5B	15092-7B
10,000	33,500	±5.1	± 0.46	±1.1	± .12	29.8	142	16122-1B	16112-5B	16112-7B	15112-1B	15112-5B	15112-7B
11,000	38,050	±4.8	± 0.40	±1.1	± .11	29.5	148	16722-1B	16722-5B	16722-7B	15722-1B	15722-5B	15722-7B
14,000	29,200	±8.0	± 0.52	±1.8	± .14	48.0	167	16712-1B	16712-5B	16712-7B	15712-1B	15712-5B	15712-7B
17,000	44,250	±6.5	± 0.35	±1.4	± .09	38.4	184	16412-1B	16412-5B	16412-7B	15412-1B	15412-5B	15412-7B
25,000	53,000	±8.0	± 0.29	±1.8	± .08	47.2	224	16244-1B	16244-5B	16244-7B	15244-1B	15244-5B	15244-7B

Allake SINCE 1857

MERCURY WETTED CONTACT RELAYS

SENSITIVE FORM C & D—PLUG-IN TYPES

BASE FIGURES FOR MWS & MWSL



MWS — Bi-Stable, Dual Wound Coils

COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE (Either Winding) Voltage (vdc)	MUST OPERATE (Either Winding) Current (madc)	NON-OPERATE (Either Winding) Voltage (vdc)	NON-OPERATE (Either Winding) Current (madc)	VOLTAGE (vdc) (Either Winding) Nom.	VOLTAGE (vdc) (Either Winding) Max.	Fig. 2B MWS-	Fig. 3B MWS-	Fig. 10B MWS-	Fig. 2B MWS-	Fig. 3B MWS-	Fig. 10B MWS-
100/100	2350/2350	± .72	±6.5	± .15	±1.7	4.3	14.2	16522-2B	16522-3B	16522-10B	15522-2B	15522-3B	15522-10B
150/150	3000/3000	± .84	±5.1	± .17	±1.3	5.0	17.3	16772-2B	16772-3B	16772-10B	15772-2B	15772-3B	15772-10B
250/250	3140/3140	±1.3	±4.8	± .29	±1.3	8.0	22.4	16212-2B	16212-3B	16212-10B	15212-2B	15212-3B	15212-10B
575/575	6000/6000	±1.4	±2.2	± .34	± .67	9.6	34	16782-2B	16782-3B	16782-10B	15782-2B	15782-3B	15782-10B
1100/1100	8000/8000	±2.3	±1.9	± .49	± .50	13.8	47	16592-2B	16592-3B	16592-10B	15592-2B	15592-3B	15592-10B
2300/2300	12,000/12,000	±3.3	±1.3	± .68	± .33	19.2	68	16792-2B	16792-3B	16792-10B	15792-2B	15792-3B	15792-10B
4000/4000	16,000/16,000	±4.1	± .94	± .90	± .25	25	89	16922-2B	16922-3B	16922-10B	15922-2B	15922-3B	15922-10B
7500/7500	20,400/22,250	±6.0	± .73	±1.3	± .19	36	122	16202-2B	16202-3B	16202-10B	15202-2B	15202-3B	15202-10B

CHOPPERS

RESISTANCE Ohms ±10%	TURNS	AC — VOLTAGE (rms)	CATALOG NUMBERS Form C Contacts Fig. 1B MWS-	Form C Contacts Fig. 5B MWS-	Form C Contacts Fig. 7B MWS-	Form D Contacts Fig. 1B MWS-	Form D Contacts Fig. 5B MWS-	Form D Contacts Fig. 7B MWS-
550	6800	6.3	16403-1B	16403-5B	16403-7B	15403-1B	15403-5B	15403-7B
4000	23,400	18.5	16084-1B*	16084-5B*	16084-7B	15084-1B	15084-5B	15084-7B

MWSL

SENSITIVITY, TYPICAL

SINGLE SIDE STABLE
Must Operate: 27 Ampere Turns
Must Release: 5 Ampere Turns

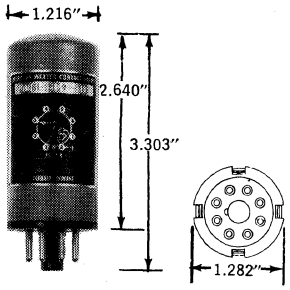
BI-STABLE
Must Operate: ±15 Ampere Turns
Non-Operate: ± 4 Ampere Turns

OPERATE MAKE TIME, TYPICAL

Single-Side-Stable		Bi-Stable	
Ampere Turns Total	Milliseconds	Ampere Turns Total	Milliseconds
80	2.5	65	2.2
130	1.8	115	1.7
230	1.5	215	1.4
330	1.3	315	1.2
430	1.2	415	1.1

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE

1.4 Milliseconds.



NOTE:

Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

MWSL — Single Side Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	MUST RELEASE Voltage (vdc)	MUST RELEASE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	Fig. 1B MWSL-	Fig. 5B MWSL-	Fig. 7B MWSL-	Fig. 1B MWSL-	Fig. 5B MWSL-	Fig. 7B MWSL-
2	600	0.10	45.5	.014	7.8	0.33	2	16051-1B	16051-5B	16051-7B	15051-1B	15051-5B	15051-7B
12	1400	0.26	19.5	.035	3.3	0.86	4.9	16481-1B	16481-5B	16481-7B	15481-1B	15481-5B	15481-7B
22	2040	0.35	14.6	.067	3.4	1.1	6.6	16491-1B	16491-5B	16491-7B	15491-1B	15491-5B	15491-7B
40	2800	0.54	12.2	.14	3.8	1.4	8.9	16191-1B	16191-5B	16191-7B	15191-1B	15191-5B	15191-7B
90	4325	0.62	6.3	.09	1.1	2.1	13	16321-1B	16321-5B	16321-7B	15321-1B	15321-5B	15321-7B
130	4900	0.8	5.6	.12	1.0	2.7	16	16121-1B*	16121-5B	16121-7B	15121-1B	15121-5B	15121-7B
200	6000	1.0	4.6	.14	0.8	3.3	20	16131-1B*	16131-5B	16131-7B	15131-1B	15131-5B	15131-7B
350	7660	1.4	3.6	.19	0.6	4.6	26	16421-1B	16421-5B	16421-7B	15421-1B	15421-5B	15421-7B
500	9450	1.6	2.9	.22	0.5	5.3	31	16261-1B	16261-5B	16261-7B	15261-1B	15261-5B	15261-7B
600	10,450	1.9	2.9	.38	0.7	5.7	34	16401-1B	16401-5B	16401-7B	15401-1B	15401-5B	15401-7B
800	11,500	3.8	4.4	1.6	2.3	7.0	37	16351-1B	16351-5B	16351-7B	15351-1B	15351-5B	15351-7B
1000	12,350	2.4	2.2	.36	0.4	8.1	44	16431-1B*	16431-5B	16431-7B	15431-1B	15431-5B	15431-7B
1900	17,800	3.3	1.6	.68	0.4	10.7	61	16161-1B	16161-5B	16161-7B	15161-1B	15161-5B	15161-7B
2500	18,800	3.9	1.4	.45	0.2	13.3	70	16011-1B	16011-5B	16011-7B	15011-1B	15011-5B	15011-7B
4000	23,400	8.8	2.0	3.8	1.0	17.1	90	16021-1B	16021-5B	16021-7B	15021-1B	15021-5B	15021-7B
4000	23,400	5.3	1.2	.72	0.2	17.1	90	16022-1B	16022-5B	16022-7B	15022-1B	15022-5B	15022-7B
7000	31,675	6.9	0.9	.88	0.14	22.1	118	16091-1B*	16091-5B	16091-7B	15091-1B	15091-5B	15091-7B
11,000	38,050	8.5	0.7	1.2	0.12	28.9	148	16721-1B	16721-5B	16721-7B	15721-1B	15721-5B	15721-7B
17,000	44,250	11.2	0.6	1.5	0.10	38.4	184	16411-1B	16411-5B	16411-7B	15411-1B	15411-5B	15411-7B
25,000	53,000	13.8	0.5	2.0	0.09	47.2	224	16241-1B	16241-5B	16241-7B	15241-1B	15241-5B	15241-7B
70,000	90,000	22.6	0.3	3.1	0.05	77.7	374	16501-1B	16501-5B	16501-7B	15501-1B	15501-5B	15501-7B
100,000	100,000	30.0	0.3	5.0	0.05	100	448	16531-1B	16531-5B	16531-7B	15531-1B	15531-5B	15531-7B

MWSL — Bi-Stable, Single Wound Coils

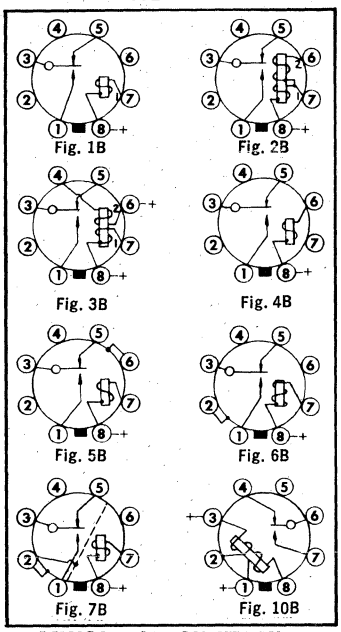
COIL DATA								CATALOG NUMBERS					
								Form C Contacts			Form D Contacts		
RESISTANCE Ohms ±10%	TURNS	MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	NON-OPERATE Voltage (vdc)	NON-OPERATE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	Fig. 1B MWSL-	Fig. 5B MWSL-	Fig. 7B MWSL-	Fig. 1B MWSL-	Fig. 5B MWSL-	Fig. 7B MWSL-
2	600	±.056	±25.5	± .012	±6.7	0.33	2	16052-1B	16052-5B	16052-7B	15052-1B	15052-5B	15052-7B
12	1400	± .14	±10.6	± .031	±2.9	0.86	4.9	16482-1B	16482-5B	16482-7B	15482-1B	15482-5B	15482-7B
22	2040	± .18	± 7.5	± .040	±2.0	1.1	6.6	16492-1B	16492-5B	16492-7B	15492-1B	15492-5B	15492-7B
40	2800	± .24	± 5.5	± .050	±1.4	1.4	8.9	16192-1B	16192-5B	16192-7B	15192-1B	15192-5B	15192-7B
90	4325	± .34	± 3.5	± .074	±0.92	2.1	13	16322-1B	16322-5B	16322-7B	15322-1B	15322-5B	15322-7B
130	4900	± .43	± 3.0	± .096	±0.82	2.7	16	16122-1B	16122-5B	16122-7B	15122-1B	15122-5B	15122-7B
200	6000	± .55	± 2.5	± .12	±0.67	3.3	20	16132-1B	16132-5B	16132-7B	15132-1B	15132-5B	15132-7B
350	7660	± .77	± 2.0	± .16	±0.52	4.6	26	16422-1B	16422-5B	16422-7B	15422-1B	15422-5B	15422-7B
500	9450	± .88	± 1.6	± .19	±0.42	5.3	31	16262-1B*	16262-5B	16262-7B	15262-1B	15262-5B	15262-7B
600	10,450	± .99	± 1.5	± .20	±0.38	5.7	34	16402-1B	16402-5B	16402-7B	15402-1B	15402-5B	15402-7B
800	11,500	± 1.1	± 1.3	± .25	±0.35	7.0	37	16352-1B	16352-5B	16352-7B	15352-1B	15352-5B	15352-7B
1000	12,350	± 1.3	± 1.2	± .28	±0.32	8.1	44	16434-1B	16434-5B	16434-7B	15434-1B	15434-5B	15434-7B
1900	17,800	± 1.8	± 0.86	± .37	±0.22	10.7	61	16162-1B	16162-5B	16162-7B	15162-1B	15162-5B	15162-7B
2500	18,800	± 2.3	± 0.82	± .47	±0.21	13.3	70	16014-1B	16014-5B	16014-7B	15014-1B	15014-5B	15014-7B
4000	23,400	± 2.9	± 0.65	± .61	±0.17	17.1	90	16023-1B	16023-5B	16023-7B	15023-1B	15023-5B	15023-7B
7000	31,675	± 3.7	± 0.48	± .82	±0.13	22.1	118	16092-1B*	16092-5B	16092-7B	15092-1B	15092-5B	15092-7B
11,000	38,050	± 4.8	± 0.40	±1.1	±0.11	28.9	148	16722-1B	16722-5B	16722-7B	15722-1B	15722-5B	15722-7B
17,000	44,250	± 6.5	± 0.35	±1.4	±0.09	38.4	184	16412-1B	16412-5B	16412-7B	15412-1B	15412-5B	15412-7B
25,000	53,000	± 8.0	± 0.29	±1.8	±0.08	47.2	224	16244-1B	16244-5B	16244-7B	15244-1B	15244-5B	15244-7B
70,000	90,000	±12.8	± 0.17	±2.5	±0.04	77.7	374	16502-1B	16502-5B	16502-7B	15502-1B	15502-5B	15502-7B
100,000	100,000	±16.5	± 0.15	±4.0	±0.04	100	448	16532-1B	16532-5B	16532-7B	15532-1B	15532-5B	15532-7B

MERCURY WETTED CONTACT RELAYS

SENSITIVE FORM C & D - PLUG-IN TYPES

MWSL
(continued)

BASE FIGURES FOR MWS & MWSL



MWSL — Single Side Stable, Dual Wound Coils

RESISTANCE Ohms ±10%	TURNS	COIL DATA: MUST OPERATE (Either Winding) Voltage (vdc)	MUST OPERATE (Either Winding) Current (madc)	MUST RELEASE (Either Winding) Voltage (vdc)	MUST RELEASE (Either Winding) Current (madc)	VOLTAGE (vdc) (Either Winding) Nom.	VOLTAGE (vdc) (Either Winding) Max.	CATALOG NUMBERS: Form C Contacts Fig. 2B MWSL-	Form C Contacts Fig. 3B MWSL-	Form C Contacts Fig. 10B MWSL-	Form D Contacts Fig. 2B MWSL-	Form D Contacts Fig. 3B MWSL-	Form D Contacts Fig. MW
25/25	1400/1400	.37	13.6	.05	2.3	1.8	7.0	16661-2B	16661-3B	16661-10B	15661-2B	15661-3B	15661
135/135	3250/3250	1.2	8.3	.18	1.5	4.2	16.5	16151-2B	16151-3B	16151-10B	15151-2B	15151-3B	15151
180/180	4100/4100	1.3	6.6	.19	1.2	4.4	19.0	16931-2B	16931-3B	16931-10B	15931-2B	15931-3B	15931
250/250	4725/4725	1.6	5.8	.22	1.0	5.3	22.4	16231-2B	16231-3B	16231-10B	15231-2B	15231-3B	15231
500/500	6200/6200	2.4	4.3	.36	0.8	8.0	31.6	16271-2B	16271-3B	16271-10B	15271-2B	15271-3B	15271
700/700	7100/7100	2.9	3.8	.44	0.7	9.8	37.4	16461-2B	16461-3B	16461-10B	15461-2B	15461-3B	15461
1100/1100	8700/8700	3.8	3.1	.49	0.5	12.6	47.0	16591-2B	16591-3B	16591-10B	15591-2B	15591-3B	15591
2000/2000	11,700/11,700	5.1	2.3	.72	0.4	17.1	63.2	16841-2B	16841-3B	16841-10B	15841-2B	15841-3B	15841
12,000/12,000	30,000/30,000	11.9	0.9	2.16	0.2	40.0	155.0	16181-2B	16181-3B	16181-10B	15181-2B	15181-3B	15181

MWSL — Bi-Stable, Dual Wound Coils

RESISTANCE Ohms ±10%	TURNS	COIL DATA: MUST OPERATE (Either Winding) Voltage (vdc)	MUST OPERATE (Either Winding) Current (madc)	NON-OPERATE (Either Winding) Voltage (vdc)	NON-OPERATE (Either Winding) Current (madc)	VOLTAGE (vdc) (Either Winding) Nom.	VOLTAGE (vdc) (Either Winding) Max.	CATALOG NUMBERS: Form C Contacts Fig. 2B MWSL-	Form C Contacts Fig. 3B MWSL-	Form C Contacts Fig. 10B MWSL-	Form D Contacts Fig. 2B MWSL-	Form D Contacts Fig. 3B MWSL-	Form D Contacts Fig. MWS
25/25	1400/1400	±0.29	±10.7	± .067	±2.8	1.8	7.0	16662-2B	16662-3B	16662-10B	15662-2B	15662-3B	15662
135/135	3250/3250	±0.68	± 4.6	± .14	±1.2	4.2	16.5	16152-2B	16152-3B	16152-10B	15152-2B	15152-3B	15152
180/180	4100/4100	±0.73	± 3.7	± .16	±1.0	4.4	19.0	16932-2B	16932-3B	16932-10B	15932-2B	15932-3B	15932
250/250	4725/4725	±0.88	± 3.2	± .19	±0.85	5.3	22.4	16232-2B	16232-3B	16232-10B	15232-2B	15232-3B	15232
500/500	6200/6200	±1.3	± 2.4	± .29	±0.65	8.0	31.6	16272-2B	16272-3B	16272-10B	15272-2B	15272-3B	15272
700/700	7100/7100	±1.8	± 2.3	± .35	±0.56	9.8	37.4	16462-2B	16462-3B	16462-10B	15462-2B	15462-3B	15462
1100/1100	8700/8700	±2.2	± 1.8	± .45	±0.46	12.6	47.0	16592-2B	16592-3B*	16592-10B	15592-2B	15592-3B	15592
2000/2000	11,700/11,700	±2.9	± 1.3	± .61	±0.34	17.1	63.2	16842-2B	16842-3B	16842-10B	15842-2B	15842-3B	15842
12,000/12,000	30,000/30,000	±6.6	± 0.5	±1.4	±0.13	40.0	155.0	16182-2B	16182-3B	16182-10B	15182-2B	15182-3B	15182

CHOPPERS

RESISTANCE Ohms ±10%	TURNS	AC — VOLTAGE (rms)	CATALOG NUMBERS: Form C Contacts Fig. 1B MWSL-	Form C Contacts Fig. 5B MWSL-	Form C Contacts Fig. 7B MWSL-	Form D Contacts Fig. 1B MWSL-	Form D Contacts Fig. 5B MWSL-	Form D Contacts Fig. MWS
600	10,450	6.3	16403-1B	16403-5B	16403-7B	15403-1B	15403-5B	15403
7000	31,675	18.5	16093-1B	16093-5B	16093-7B	15093-1B	15093-5B	15093

MWSL- (2 SWITCH)

SENSITIVITY, TYPICAL

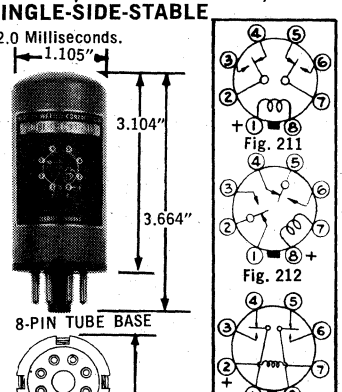
SINGLE SIDE STABLE
Must Operate: 90 Ampere Turns
Must Release: 10 Ampere Turns

BI-STABLE
Must Operate: ±45 Ampere Turns
Non-Operate: ± 8 Ampere Turns

OPERATE MAKE TIME, TYPICAL

Single-Side-Stable Ampere Turns Total	Single-Side-Stable Milli-seconds	Bi-Stable Ampere Turns Total	Bi-Stable Milli-seconds
115	2.6	70	3.0
140	2.0	95	2.3
190	1.5	145	1.6
290	1.4	195	1.4
390	1.3	245	1.3

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED, SINGLE-SIDE-STABLE



NOTE:
Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

MWSL (2 SWITCH) — Single Side Stable, Single Wound Coil

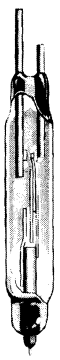
±10% RESISTANCE Ohms	TURNS	COIL DATA: MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	MUST RELEASE Voltage (vdc)	MUST RELEASE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	CATALOG NUMBERS: Form C Contacts Fig. 211 MWSL-	Form C Contacts Fig. 212 MWSL-	Form C Contacts Fig. 213 MWSL-	Form D Contacts Fig. 211 MWSL-	Form D Contacts Fig. 212 MWSL-	Form D Contacts Fig. MWS
40	2000	2.0	45.0	.18	5.0	4.5	11.0	26451-11	26451-12	26451-13	25451-11	25451-12	25451
90	2800	3.2	32.1	.29	3.6	6.7	16.5	26111-11	26111-12	26111-13	25111-11	25111-12	25111
140	3500	4.0	25.7	.35	2.8	8.4	20.5	26121-11	26121-12	26121-13	25121-11	25121-12	25121
400	6500	6.1	13.8	.54	1.5	14.2	34.7	26211-11	26211-12	26211-13	25211-11	25211-12	25211
540	7900	6.8	11.5	.63	1.3	16.5	40.3	26021-11	26021-12	26021-13	25021-11	25021-12	25021
700	8500	8.2	10.6	1.1	1.8	18.7	46.0	26221-11	26221-12	26221-13	25221-11	25221-12	25221
900	9500	9.4	9.5	.89	1.1	21.2	52.0	26151-11	26151-12	26151-13	25151-11	25151-12	25151
1250	10,000	12.4	9.0	1.1	1.0	25.0	61.2	26541-11	26541-12	26541-13	25541-11	25541-12	25541
2350	14,000	16.5	6.4	1.5	0.7	34.3	84.0	26071-11	26071-12	26071-13	25071-11	25071-12	25071
6000	20,200	29.7	4.5	2.7	0.5	55.0	134.0	26091-11	26091-12	26091-13	25091-11	25091-12	25091

MWSL (2 SWITCH) — Bi-Stable, Single Wound Coils

RESISTANCE Ohms ±10%	TURNS	COIL DATA: MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	NON-OPERATE Voltage (vdc)	NON-OPERATE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	CATALOG NUMBERS: Form C Contacts Fig. 211 MWSL-	Form C Contacts Fig. 212 MWSL-	Form C Contacts Fig. 213 MWSL-	Form D Contacts Fig. 211 MWSL-	Form D Contacts Fig. 212 MWSL-	Form D Contacts Fig. MWS
40	2000	± 1.0	±22.5	± .14	±4.0	4.5	11.0	26452-11	26452-12	26452-13	25452-11	25452-12	25452
90	2800	± 1.6	±16.1	± .23	±2.9	6.7	16.5	26112-11	26112-12	26112-13	25112-11	25112-12	25112
140	3500	± 1.3	±12.9	± .29	±2.3	8.4	20.5	26122-11	26122-12	26122-13	25122-11	25122-12	25122
400	6500	± 3.0	± 6.9	± .43	±1.2	14.2	34.7	26212-11	26212-12	26212-13	25212-11	25212-12	25212
540	7900	± 3.4	± 5.7	± .48	±1.0	16.5	40.3	26022-11	26022-12	26022-13	25022-11	25022-12	25022
700	8500	± 4.1	± 5.3	± .59	± .94	18.7	46.0	26222-11	26222-12	26222-13	25222-11	25222-12	25222
900	9500	± 4.7	± 4.7	± .68	± .84	21.2	52.0	26152-11	26152-12	26152-13	25152-11	25152-12	25152
1250	10,000	± 6.2	± 4.5	± .90	± .80	25.0	61.2	26542-11	26542-12	26542-13	25542-11	25542-12	25542
2350	14,000	± 8.3	± 3.2	±1.2	± .57	34.3	84.0	26072-11	26072-12	26072-13	25072-11	25072-12	25072
6000	20,200	±14.5	± 2.2	±2.1	± .40	55.0	134.0	26092-11	26092-12	26092-13	25092-11	25092-12	25092

MERCURY WETTED CONTACT RELAYS

NEUTRAL FORM D



The ADLAKE MW Mercury-Wetted Contact Relay is sometimes referred to as the neutral type and often described as Bridging — Contact Form D (Make-Before-Break). The MW relay is comprised of one or more (a maximum of four) switch elements and a single operating coil — single or multiple wound. Each switch or contact assembly consists of two normally open contacts, two normally closed contacts, and a single swinger or armature. The normally closed contact condition is achieved by spring tension of the armature which holds the swinger or armature contact against the normally closed contacts. The swinger of the switch consists of a cantilever reed structure projecting from the bottom end of the glass envelope and interposing the two sets of fixed contacts supported from the top end. Mercury-wetting on the fixed and moving contacting surfaces is maintained by a capillary wick-feed system, associated with the cantilever reed, and connected to a small reservoir filled with mercury at the bottom of the switch. As the switch unit of these relays is filled with hydrogen at high pressure, the relays are factory-sealed and under no circumstances should be disassembled without taking necessary safety precautions in the event of breakage of the switch.

SPECIFICATIONS

CONTACT ARRANGEMENT SPDT, Form D, bridging, make before break.

CONTACT RESISTANCE 50 Milliohms max.

CONTACT RATING 5 amperes max., 500 volts max., 250 volt-amperes peak with contact protection consisting of a series resistor —capacitor network in parallel with the relay contacts. The values of resistance and capacitance may be calculated from the formulas as shown on Page

BOUNCE None.

CONTACT RISE TIME (less contact protection) 10 nano-seconds or less.

LIFE One billion operations may be expected if contact ratings with recommended contact protection are observed.

STAND OFF VOLTAGE 1000 VAC 60 cps. between mutually insulated terminals, except between windings of bifilar construction dual wound coils.

INSULATION RESISTANCE 1000 megohms min. @ 500 VDC. 25°C, 45% HR between all mutually insulated terminals except between windings of bifilar construction dual wound coils.

BRIDGING TIME 1 Millisecond max.

DEFINITIONS

Sensitivity Terminology

MUST OPERATE — Current required to operate the least sensitive relay of a given specification.

NON-OPERATE — Current at which the most sensitive relay will not operate.

HOLD — Current above which all relays will remain operated, once they have been operated.

MUST RELEASE — Current at which all relays will have released.

The MUST OPERATE and the NON-OPERATE values are the limits within which a specified relay will operate. The HOLD and MUST RELEASE values are the limits within which a specified relay will release. It should be noted that the four terms specified above are maximum values and that the average relays will operate and release at approximately average values.

Adjustment Terminology —

(All polarized & sensitive relays)

SINGLE SIDE STABLE — Adjustment of the permanent magnets for armature return to the normally closed contacts when coil current has been lowered to "must release" value.

BI-STABLE (MAGNETIC LATCHING) — Adjusmtent of the permanent magnets so armature will remain in the position last operated until sufficient current of opposite polarity is applied to the coil.

CHOPPER — Adjustment of the permanent magnets to provide equal dwell ±5% on the fixed contacts when coil is driven by the specified 60 cps. voltage.

Timing Terminology

OPERATE MAKE TIME, TYPICAL
Interval from coil energization until the armature reaches the normally open contact at given drive level.

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED

Interval from coil de-energized until the armature makes the normally closed contacts.

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS
NEUTRAL FORM D – PRINTED CIRCUIT TYPES

AWNA

SENSITIVITY

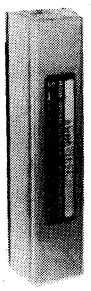
Must Operate: 190 Ampere Turns
Non Operate: 124 Ampere Turns
Hold: 147 Ampere Turns
Must Release: 84 Ampere Turns

OPERATE MAKE TIME, TYPICAL

Ampere Turns Total	Milliseconds
240	4.2
290	3.3
390	2.5
490	2.4
590	2.3

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED

3.2 Milliseconds.



SERIES AWNA/AWPB

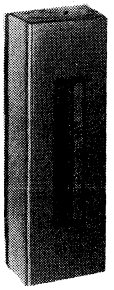
AWPA/AWPB

SENSITIVITY, TYPICAL

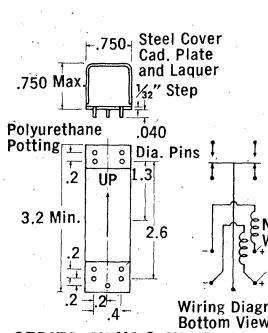
SINGLE SIDE STABLE
Must Operate: 70 Ampere Turns
Must Release: 5.5 Ampere Turns

BI-STABLE
Must Operate: ± 35 Ampere Turns
Non-Operate: ±5.5 Ampere Turns

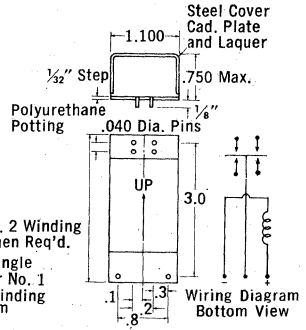
Relay types AWNA and AWPB are identical in size and configuration. Each is a single switch-Form D-neutral (bridging) type relay, and is available with either single or dual wound coil. Relay type AWPB is polarized by means of permanent magnets and is available in Single-Side-Stable, Bi-Stable or Chopper form.



SERIES AWPA
(Single Switch)
AWNA (2 Switch)



SERIES AWNA & AWPB



SERIES AWPA

AWNA (2 SWITCH)

SENSITIVITY

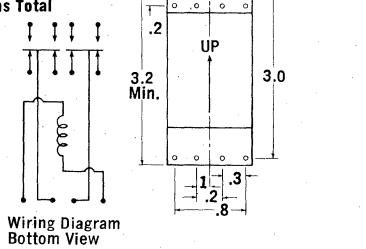
Must Operate: 220 Ampere Turns
Must Release: 97 Ampere Turns

OPERATE MAKE TIME, TYPICAL

Milliseconds	Ampere Turns Total
8	250
5.2	320
3.6	420
3.0	520

RELEASE MAKE TIME, TYPICAL UNSUPPRESSED

3.6 Milliseconds.



NOTE:

Positive potential applied to the start of windings indicated by symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

AWNA — Single Wound Coils

COIL DATA								
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)		CATALOG NUMBERS
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWNA-
20	1225	3.4	155	1.2	68.5	4.8	8.9	1648
26	1375	3.85	138	1.4	61.1	5.4	10.2	1649
40	1600	5.24	119	1.9	52.5	7.3	12.6	1619
50	2000	5.22	95	1.9	42.0	7.3	14.1	1605
70	2250	6.5	84.5	2.3	37.3	9.1	16.7	1651
150	3450	9.1	55.0	3.3	24.3	12.7	24	1612
200	3800	11.0	50.0	4.0	22.1	15.4	28	1613
265	4320	11.7	44.0	4.6	19.4	16.4	32	1642
450	5675	16.6	33.5	6.0	14.8	23.2	42	1626
750	7825	20.0	24.3	7.2	10.7	28.0	55	1604
960	7500	26.8	25.4	9.7	11.2	37.5	62	1643
1100	8350	27.6	22.8	9.9	10.0	38.6	66	1654
1500	9580	32.9	19.9	11.9	8.8	46.1	77	1615
2000	10,550	39.6	18.0	14.4	8.0	55.4	89	1601
3500	13,100	55.9	14.5	20.1	6.4	78.3	118	1602
4300	14,200	63.3	13.4	22.8	5.9	88.6	131	1653

AWPA/AWPB — Single Side Stable, Single Wound Coils

COIL DATA									
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)		CATALOG NUMBERS	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWPA-	AWPB-
20	1225	1.3	57.2	.08	4.5	2.6	8.9	16481	16481
26	1375	1.5	50.9	.09	4.0	3.0	10.2	16491	16491
40	1600	1.9	43.8	.12	3.4	3.8	12.6	16191	16191
50	2000	1.9	35.0	.13	2.9	3.8	14.1	16051	16051
70	2250	2.4	31.0	.15	2.4	4.8	16.7	16511	16511
150	3450	3.3	20.3	.21	1.6	6.6	24	16121	16121
200	3800	4.0	18.4	.25	1.4	8.0	28	16131	16131
265	4320	4.7	16.2	.31	1.3	9.4	32	16421	16421
450	5675	6.1	12.3	.28	0.7	12.2	42	16261	16261
750	7825	7.3	8.9	.47	0.7	14.6	55	16041	16041
960	7500	9.8	9.3	.60	0.7	19.6	62	16431	16431
1100	8350	10.2	8.4	.59	0.6	20.4	66	16541	16541
1500	9580	12.0	7.3	.81	0.6	24.0	77	16151	16151
2000	10,550	14.7	6.7	.90	0.5	29.4	89	16011	16011
3500	13,100	20.4	5.3	1.3	0.4	40.8	118	16021	16021
4300	14,200	22.7	4.8	1.5	0.4	45.4	131	16531	16531

AWPA/AWPB — Bi-Stable, Single Wound Coils

COIL DATA									
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)		CATALOG NUMBERS	
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWPA-	AWPB-
20	1225	± .63	±28.6	± .08	±4.5	2.6	8.9	16482	16482
26	1375	± .72	±25.4	± .09	±4.0	3.0	10.2	16492	16492
40	1600	± .96	±21.9	± .12	±3.4	3.8	12.6	16192	16192
50	2000	± .96	±17.5	± .13	±2.9	3.8	14.1	16052	16052
70	2250	± 1.2	±15.5	± .15	±2.4	4.8	16.7	16512	16512
150	3450	± 1.7	±10.1	± .21	±1.6	6.6	24	16122	16122
200	3800	± 2.0	± 9.2	± .25	±1.4	8.0	28	16132	16132
265	4320	± 2.4	± 8.1	± .31	±1.3	9.4	32	16422	16422
450	5675	± 3.0	± 6.1	± .28	±0.7	12.2	42	16262	16262
750	7825	± 3.6	± 4.4	± .47	±0.7	14.6	55	16042	16042
960	7500	± 4.9	± 4.6	± .60	±0.7	19.6	62	16432	16432
1100	8350	± 5.1	± 4.2	± .59	±0.6	20.4	66	16542	16542
1500	9580	± 5.9	± 3.6	± .81	±0.6	24.0	77	16152	16152
2000	10,550	± 7.3	± 3.3	± .90	±0.5	29.4	89	16012	16012
3500	13,100	±10.0	± 2.6	±1.3	±0.4	40.8	118	16022	16022
4300	14,200	±11.4	± 2.4	±1.5	±0.4	45.4	131	16532	16532

CHOPPERS

RESISTANCE Ohms ±10%	TURNS	AC — VOLTAGE (rms)	CATALOG NUMBERS AWPA-	AWPB-
450	5675	6.3	16264	16264
2000	10,550	18.5	16014	16014
4300	14,200	28.0	16534	16534

AWNA (2 SWITCH) — Single Wound Coils

COIL DATA								
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)		CATALOG NUMBERS
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	AWNA-
40	2000	4.8	110.0	1.7	48.5	7.2	12.7	2645
90	2800	7.8	78.6	2.8	34.6	11.7	19.0	2611
140	3500	9.7	62.8	3.5	27.7	14.6	23.7	2612
400	6500	14.9	33.8	5.3	14.9	22.4	40.0	2621
540	7900	16.3	27.5	5.8	12.0	24.5	46.5	2602
700	8500	19.9	25.9	7.2	11.4	29.9	53.0	2622
900	9500	23.0	23.2	8.3	10.2	34.5	60.0	2615
1250	10,000	30.3	22.0	10.9	9.7	45.5	71.0	2654
2350	14,000	40.6	15.7	14.6	6.9	60.9	97.0	2607
6000	20,200	72.0	10.9	25.9	4.8	108	143.0	2609

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS

NEUTRAL FORM D - PLUG-IN TYPES

MW (SINGLE SWITCH)

SENSITIVITY

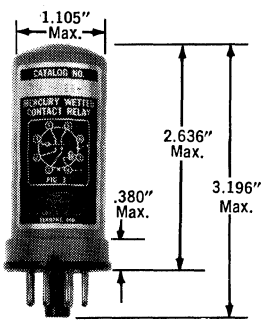
Must Operate: 190 Ampere Turns
Non-Operate: 124 Ampere Turns
Hold: 147 Ampere Turns
Must Release: 84 Ampere Turns

OPERATE MAKE TIME, TYPICAL

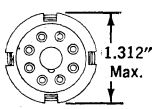
Ampere Turns Total	Milliseconds
290	4.5
390	3.6
490	3.0

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED

3.4 Milliseconds.



8-PIN TUBE BASE



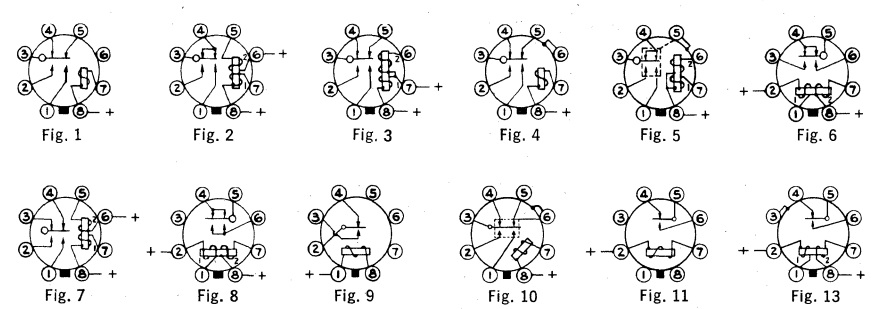
MW (SINGLE SWITCH) — Single Wound Coils

COIL DATA								CATALOG NUMBERS				
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)						
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Fig. 1 MW-	Fig. 4 MW-	Fig. 9 MW-	Fig. 10 MW-	Fig. 11 MW-
2	600	0.7	315	.25	140	1	2.5	1605-1*	1605-4	1605-9	1605-10	1605-11
5	1000	1.05	190	.38	84	1.5	3.9	1686-1	1686-4	1686-9	1686-10	1686-11
12	1400	1.8	136	.65	60	2.4	6	1648-1	1648-4	1648-9	1648-10	1648-11
22	2040	2.25	93.1	.82	41.2	3.1	8.1	1649-1	1649-4	1649-9	1649-10	1649-11
34	2630	2.7	72.3	.98	32	3.7	10	1617-1*	1617-4	1617-9	1617-10	1617-11
40	2800	2.98	67.7	1.1	30	4	11	1619-1	1619-4*	1619-9	1619-10	1619-11
60	3380	3.71	56.2	1.3	24.8	5	13	1651-1	1651-4	1651-9	1651-10	1651-11
90	4325	4.35	44	1.6	19.4	6	16	1632-1	1632-4	1632-9	1632-10	1632-11
130	4900	5.55	38.8	2.0	17.1	7.5	20	1612-1*	1612-4*	1612-9	1612-10	1612-11
200	6000	6.97	31.7	2.5	14	9.5	25	1613-1	1613-4	1613-9	1613-10	1613-11
350	7660	9.55	24.8	3.4	11	13	32	1642-1	1642-4	1642-9	1642-10	1642-11
500	9450	11.1	20.1	4.0	8.9	15	39	1626-1*	1626-4	1626-9	1626-10	1626-11
600	10,450	12	18.2	4.3	8	16	42	1640-1	1640-4	1640-9	1640-10*	1640-11
700	9500	15.4	20	5.6	8.9	21	45	1604-1*	1604-4*	1604-9	1604-10	1604-11
800	11,500	14.5	16.5	5.2	7.3	20	48	1635-1	1635-4	1635-9	1635-10	1635-11
1000	12,350	16.9	15.4	6.1	6.8	24	55	1643-1*	1643-4	1643-9	1643-10	1643-11
1900	17,800	22.4	10.7	8.0	4.7	30	75	1616-1*	1616-4	1616-9	1616-10	1616-11
2500	18,800	27.8	10.1	10.1	4.5	38	87	1601-1*	1601-4*	1601-9	1601-10	1601-11
4000	23,400	35.6	8.1	12.9	3.6	48	110	1602-1*	1602-4*	1602-9	1602-10	1602-11
7000	31,675	46.2	6	16.4	2.6	64	145	1609-1*	1609-4	1609-9	1609-10	1609-11
11,000	38,000	60.5	5	22	2.2	82	180	1611-1*	1611-4	1611-9	1611-10	1611-11
17,000	44,250	80.5	4.3	29	1.9	110	225	1641-1*	1641-4	1641-9	1641-10	1641-11
25,000	53,000	99	3.6	36	1.6	135	275	1624-1*	1624-4	1624-9	1624-10*	1624-11

MW (SINGLE SWITCH) — Dual Wound Coils

COIL DATA									CATALOG NUMBERS					
			MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)							
WINDING No.	RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Fig. 2 MW-	Fig. 3 MW-	Fig. 5 MW-	Fig. 6 MW-	Fig. 7 MW-	Fig. 8 MW-
1	100	3015	6.9	63	2.5	27.9	10	17	1652-2	1652-3	1652-5	1652-6	1652-7	1652-8
2	100	3050	7.5	68.3	2.7	30.2	10	17						
1	120	3450	7.3	55	2.6	24.5	10	19	1606-2	1606-3	1606-5	1606-6*	1606-7	1606-8
2	125	2850	10	73	3.9	34.7	13	19						
1	250	4100	12.8	46.4	4.6	20.5	17	27	1621-2	1621-3*	1621-5	1621-6	1621-7	1621-8
2	250	5000	11.4	41.6	4.4	19.8	17	27						
1	650	6330	21.5	30	7.8	13.3	30	44	1639-2	1639-3	1639-5	1639-6	1639-7	1639-8
2	2000	12,670	36.1	16.4	14	7.8	48	78						
1	700	7100	24.6	32	8.9	14.2	35	46	1646-2	1646-3	1646-5	1646-6	1646-7	1646-8
2	700	7100	24.6	32	8.9	14.2	35	46						
1	700	5925	24.6	32	8.9	14.2	34	46	1603-2*	1603-3	1603-5	1603-6	1603-7	1603-8
2	3300	16,950	44.7	12.3	17.2	5.8	60	99						
1	1020	7950	26.8	23.9	9.6	10.5	45	55	1610-2	1610-3	1610-5	1610-6	1610-7	1610-8
2	970	8200	27.1	25.4	9.8	11.2	45	54						
1	2000	11,700	35.9	16.3	13.3	7.4	48	78	1622-2	1622-3	1622-5	1622-6	1622-7	1622-8
2	2000	11,700	35.9	16.3	13.3	7.4	48	78						
1	7500	20,400	76.7	9.3	27.7	4.1	105	150	1620-2	1620-3	1620-5	1620-6	1620-7	1620-8
2	7500	22,250	76.7	9.3	27.7	4.1	105	150						
1	11,500	29,800	81	6.4	29	2.8	110	186	1645-2	1645-3	1645-5	1645-6	1645-7	1645-8
2	11,500	19,430	135	10.7	49.7	4.8	170	186						

BASE FIGURES



NOTE:
Positive potential applied to the start of windings indicated by the symbol + will windings indicated by the symbol + will close the contacts shown open on the base connection figures.
All Resistance and Voltage values shown are based on a temperature value of 25°C.
* Indicates limited stock item.

Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS

NEUTRAL FORM D - PLUG-IN TYPES

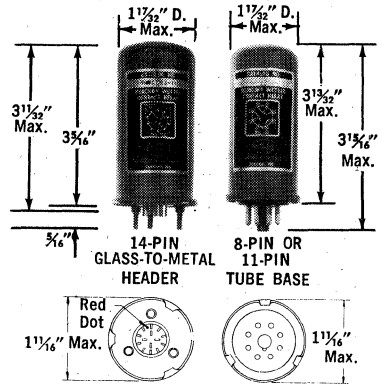
MW (2 SWITCH) & MW (3 SWITCH)

SENSITIVITY,
Must Operate: 250 Ampere Turns
Non-Operate: 145 Ampere Turns
Hold: 190 Ampere Turns
Must Release: 105 Ampere Turns

OPERATE MAKE TIME, TYPICAL

MW (2 SWITCH) Ampere Turns Total	MW (2 SWITCH) Milli-seconds	MW (3 SWITCH) Ampere Turns Total	MW (3 SWITCH) Milli-seconds
350	4.1	350	5.5
400	4.2	400	4.8
450	3.7	450	4.3
500	3.5	500	4.0
550	3.3	550	3.7
600	3.1	600	3.5
650	2.9	650	3.2

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED
MW (2 SWITCH) 3.8 Milliseconds.
MW (3 SWITCH) 4.0 Milliseconds.



MW (4 SWITCH)

SENSITIVITY
Must Operate: 265 Ampere Turns
Non-Operate: 145 Ampere Turns
Hold: 190 Ampere Turns
Must Release: 115 Ampere Turns

OPERATE MAKE TIME, TYPICAL

Ampere Turns Total	Milliseconds
365	6.6
415	5.8
465	5.1
515	4.6
565	4.4
615	4.2
665	3.8

RELEASE MAKE TIME, TYPICAL, UNSUPPRESSED
4.5 Milliseconds.



NOTE:
Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

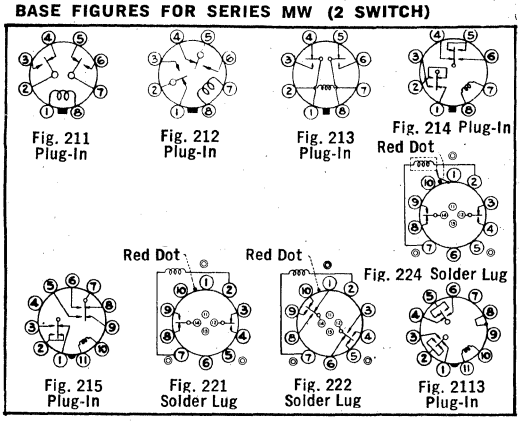
All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

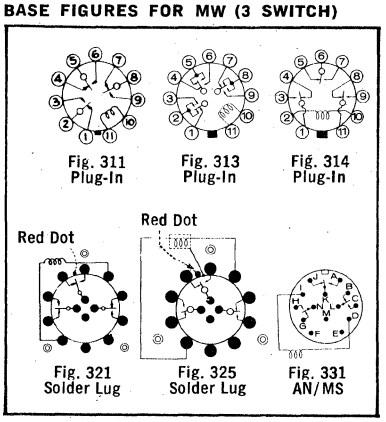
MW (2 SWITCH) & MW (3 SWITCH) — Single Wound Coils

COIL DATA: RESISTANCE ohms ±10%	TURNS	MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	MUST RELEASE Voltage (vdc)	MUST RELEASE Current (madc)	VOLTAGE (vdc) Nom.	VOLTAGE (vdc) Max.	CATALOG NUMBERS 2 Switch Fig. 211 MW-	2 Switch Fig. 212 MW-	2 Switch Fig. 221 MW-	3 Switch Fig. 311 MW-	3 Switch Fig. 314 MW-	3 Switch Fig. 321 MW-
3	550	1.5	455	.51	191	2.5	3.5	2604-11	2604-12	2604-21	3613-11	3613-14	3613-21
8.5	950	2.47	264	.84	110	3.6	5.8	2606-11	2606-12	2606-21	3614-11	3614-14	3614-21
14	1270	3.04	197	1.0	82	4.5	7.5	2614-11	2614-12	2614-21	3615-11	3615-14	3615-21
22	1575	3.85	159	1.3	66.5	5.6	9.4	2609-11	2609-12	2609-21	3616-11	3616-14	3616-21
35	2000	4.8	125	1.6	52.5	7	12	2649-11	2649-12	2649-21	3611-11	3611-14	3611-21
50	2270	6.04	110	2.0	46	9	14	2608-11	2608-12	2608-21	3601-11*	3601-14	3601-21
85	3025	7.71	82.7	2.6	34.7	11.5	18	2611-11*	2611-12	2611-21	3617-11	3617-14	3617-21
140	3760	10.3	66.5	3.5	28	15	24	2630-11	2630-12*	2630-21	3612-11*	3612-14	3612-21
215	4600	12.9	54.4	4.4	22.8	19	29	2613-11	2613-12	2613-21	3618-11*	3618-14	3618-21
250	4700	14.6	53.2	5.0	22.4	21.5	32	2623-11	2623-12	2623-21	3619-11	3619-14	3619-21
315	5715	15.3	44	5.2	18.5	22.5	36	2603-11	2603-12*	2603-21	3604-11*	3604-14	3604-21
500	7190	19.2	34.8	6.5	14.6	28	45	2617-11	2617-12*	2617-21	3606-11*	3606-14	3606-21
700	8200	23.5	30.5	8.0	12.8	35	53	2602-11	2602-12*	2602-21	3602-11	3602-14	3602-21
800	9100	24.2	27.5	8.3	11.5	36	57	2618-11	2618-12	2618-21	3624-11	3624-14	3624-21
1230	11,380	30.4	22.1	10.3	9.3	45	71	2615-11	2615-12	2615-21	3608-11*	3608-14	3608-21
2000	13,800	39.8	18.1	13.7	7.6	60	90	2620-11	2620-12	2620-21	3620-11	3620-14	3620-21
2500	15,000	45.9	16.7	15.7	7	68	100	2607-11*	2607-12	2607-21	3607-11	3607-14	3607-21
5000	21,870	62.1	11.3	21.1	4.7	90	142	2601-11*	2601-12*	2601-21	3603-11*	3603-14	3603-21
7100	25,000	77.5	9.9	26.2	4.1	115	169	2605-11	2605-12*	2605-21	3605-11	3605-14	3605-21
10,000	29,200	94.2	8.6	32.4	3.6	140	200	2619-11	2619-12	2619-21	3610-11*	3610-14	3610-21
12,500	35,100	98	7.1	33.7	3	145	224	2612-11	2612-12	2612-21	3609-11	3609-14	3609-21
20,000	45,800	120	5.5	41.4	2.3	170	283	2626-11	2626-12	2626-21	3621-11*	3621-14	3621-21
32,000	56,250	157	4.5	51.8	1.8	230	357	2610-11	2610-12	2610-21	3622-11	3622-14	3622-21
45,000	63,600	195	3.9	64.8	1.6	285	425	2616-11	2616-12	2616-21	3623-11	3623-14	3623-21

BASE FIGURES FOR SERIES MW (2 SWITCH)



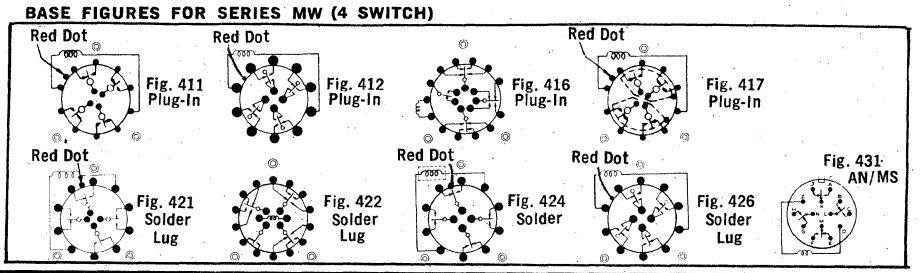
BASE FIGURES FOR MW (3 SWITCH)



MW (4 SWITCH) — Single Wound Coils

COIL DATA: RESISTANCE Ohms ±10%	TURNS	MUST OPERATE Voltage (vdc)	MUST OPERATE Current (madc)	MUST RELEASE Voltage (vdc)	MUST RELEASE Current (madc)	Voltage (vdc) Nom.	Voltage (vdc) Max.	CATALOG NUMBERS Fig. 411 MW-	Fig. 421 MW-	Fig. 422 MW-	Fig. 431 MW-
8	870	2.68	305	.95	132	4.3	5.7	4602-11	4602-21	4602-22	4602-31
10	1025	2.84	259	1.0	112	4.6	6.3	4601-11	4601-21	4601-22	4601-31
15	1200	3.65	221	1.3	96	6.0	7.7	4605-11	4605-21	4605-22	4605-31
25	1580	4.61	168	1.6	72.5	7.5	10	4608-11	4608-21	4608-22	4608-31
40	2050	5.69	130	2.0	56.1	10	13	4604-11	4604-21	4604-22	4604-31
65	2650	7.15	100	2.5	43.5	12	16	4624-11*	4624-21	4624-22	4624-31
100	3220	9.05	82.3	3.3	36.9	15	20	4618-11	4618-21	4618-22	4618-31
150	3600	12.2	73.6	4.3	32	20	24	4610-11	4610-21	4610-22	4610-31
230	4760	14.1	55.7	5.0	24.2	24	30	4630-11*	4630-21*	4630-22	4630-31
390	6310	18	42	6.6	19	30	40	4620-11*	4620-21	4620-22	4620-31
645	8110	23.2	32.7	8.2	14.2	38	51	4623-11*	4623-21*	4623-22	4623-31
700	7500	27.2	35.4	9.6	15.3	45	53	4609-11*	4609-21	4609-22	4609-31
900	7860	33.4	33.7	11.8	14.6	60	60	4616-11	4616-21	4616-22	4616-31
1400	11,550	35.4	23	12.4	9.9	58	75	4607-11*	4607-21*	4607-22	4607-31
2400	15,100	46.4	17.6	16.4	7.6	75	98	4637-11	4637-21	4637-22	4637-31
3500	18,200	56	14.6	19.8	6.3	92	118	4619-11	4619-21	4619-22	4619-31
4000	17,000	68.5	15.6	24.1	6.7	112	126	4603-11	4603-21	4603-22	4603-31
6500	25,300	75	10.5	26.3	4.5	125	161	4615-11*	4615-21	4615-22	4615-31
10,000	30,900	94.3	8.6	33.3	3.7	155	200	4606-11	4606-21*	4606-22	4606-31
14,000	38,000	107	7.0	37.8	3	175	237	4622-11	4622-21	4622-22	4622-31
23,000	45,000	149	5.9	51.7	2.5	240	303	4625-11	4625-21	4625-22	4625-31
34,000	52,000	191	5.1	67.3	2.2	310	370	4627-11	4627-21	4627-22	4627-31
58,000	72,400	234	3.66	83	1.59	380	480	4637-11	4637-21	4637-22	4637-31

BASE FIGURES FOR SERIES MW (4 SWITCH)



Adlake SINCE 1857

MERCURY WETTED CONTACT RELAYS

NEUTRAL FORM D - PLUG-IN TYPES

MWP (SINGLE SWITCH)

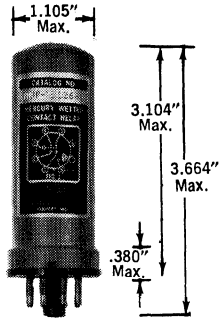
SENSITIVITY, TYPICAL

SINGLE SIDE STABLE

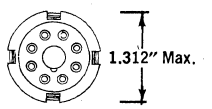
Must Operate: 70 Ampere Turns
Must Release: 5.5 Ampere Turns

BI-STABLE

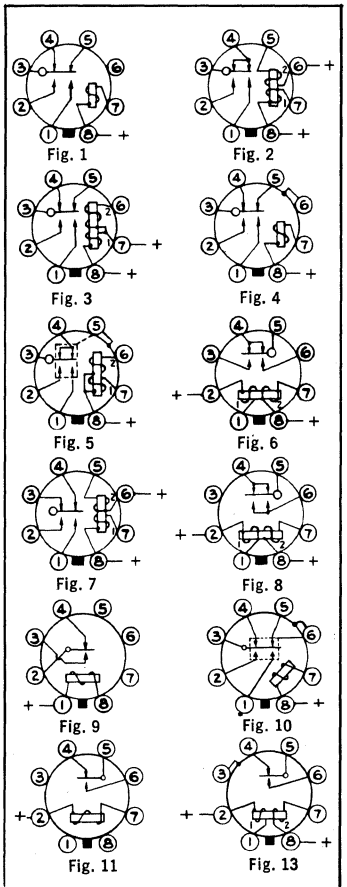
Must Operate: ± 35 Ampere Turns
Non-Operate: ±5.5 Ampere Turns



8-PIN TUBE BASE



BASE FIGURES



NOTE:

Positive potential applied to the start of windings indicated by the symbol + will close the contacts shown open on the base connection figures.

All Resistance and Voltage values shown are based on a temperature value of 25°C.

* Indicates limited stock item.

MWP — Single Side Stable, Single Wound Coil

COIL DATA								CATALOG NUMBERS				
		MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)						
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Fig. 1 MWP-	Fig. 4 MWP-	Fig. 9 MWP-	Fig. 10 MWP-	Fig. 11 MWP-
2	600	0.28	125	.027	15	0.7	2.5	16051-1	16051-4	16051-9	16051-10	16051-11
5	1000	0.48	88	.067	15	1	3.9	16861-1	16861-4	16861-9	16861-10	16861-11
34	2630	1.6	41.5	0.47	15.5	3	10	16171-1	16171-4	16171-9	16171-10	16171-11
40	2800	1.1	25	.072	2	3	11	16191-1	16191-4	16191-9	16191-10	16191-11
90	4325	1.6	16	0.1	1.3	5	16	16321-1*	16321-4	16321-9	16321-10	16321-11
90	3230	3.2	32	1.2	15	6	16	16331-1*	16331-4	16331-9	16331-10	16331-11
130	4900	2.2	15.1	.094	0.81	6	20	16121-1	16121-4	16121-9	16121-10	16121-11
200	6000	2.6	11.7	0.11	0.6	7	25	16131-1	16131-4	16131-9	16131-10	16131-11
350	7660	3.7	9.65	0.16	0.5	10	32	16421-1	16421-4	16421-9	16421-10	16421-11
350	7660	4.9	12.8	1.26	4	10	32	16422-1	16422-4	16422-9	16422-10	16422-11
500	9450	4.3	7.83	0.19	0.42	11	39	16261-1	16261-4	16261-9	16261-10	16261-11
700	9500	5.7	7.4	0.53	0.84	15	45	16041-1	16041-4	16041-9	16041-10	16041-11
700	9500	9.2	12	2.5	4	15	45	16042-1	16042-4	16042-9	16042-10	16042-11
800	11,500	5.4	6.09	0.37	0.52	14	48	16351-1	16351-4	16351-9	16351-10	16351-11
800	11,500	7	7.9	0.72	1	14	48	16354-1	16354-4	16354-9	16354-10	16354-11
1000	12,350	6.2	5.6	0.36	0.4	18	55	16431-1	16431-4	16431-9	16431-10	16431-11
1000	12,350	6.6	6	0.54	0.6	18	55	16432-1*	16432-4	16432-9	16432-10	16432-11
1000	12,350	9.6	8.7	2.7	3	18	55	16433-1	16433-4	16433-9	16433-10	16433-11
1000	12,350	6.6	6	0.54	0.6	18	55	16434-1	16434-4	16434-9	16434-10	16434-11
1000	12.350	6.2	5.6	0.18	0.2	18	55	16435-1	16435-4	16435-9	16435-10	16435-11
1900	17,800	8.8	4.2	0.68	0.4	24	75	16161-1	16161-4	16161-9	16161-10	16161-11
2500	18,800	10.8	3.94	0.47	0.21	27	87	16011-1	16011-4	16011-9	16011-10	16011-11
4000	23,400	13	2.96	0.86	0.24	35	110	16021-1*	16021-4	16021-9	16021-10	16021-11
4000	23,400	17.6	4	3.9	1.1	35	110	16022-1*	16022-4	16022-9	16022-10	16022-11
4000	23,400	20.7	4.7	6.1	1.7	35	110	16023-1	16023-4	16023-9	16023-10	16023-11
4000	23,400	26	5.9	10.1	2.8	35	110	16024-1	16024-4	16024-9	16024-10	16024-11
4000	23,400	14.3	3.24	0.86	0.24	35	110	16027-1	16027-4	16027-9	16027-10	16027-11
4000	23,400	13.2	3	1.2	0.35	35	110	16028-1	16028-4	16028-9	16028-10	16028-11
7000	31,675	17	2.21	1.2	0.19	45	145	16091-1	16091-4	16091-9	16091-10	16091-11
7000	31,675	27.5	3.57	8.9	1.42	45	145	16092-1	16092-4	16092-9	16092-10	16092-11
7000	31,675	24.6	3.2	7	1.12	45	145	16093-1	16093-4	16093-9	16093-10	16093-11
11,000	38,000	22.9	1.89	2.1	0.21	60	180	16111-1*	16111-4	16111-9	16111-10	16111-11
11,000	38,000	24.9	2.06	1.7	0.17	60	180	16114-1	16114-4	16114-9	16114-10	16114-11
25,000	53,000	36.3	1.32	3.7	0.15	95	275	16241-1*	16241-4	16241-9	16241-10	16241-11
25,000	53.000	54.5	1.98	14.6	0.65	95	275	16242-1	16242-4	16242-9	16242-10	16242-11

MWP — Bi-Stable, Single Wound Coils

COIL DATA								CATALOG NUMBERS				
		MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)						
RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Fig. 1 MWP-	Fig. 4 MWP-	Fig. 9 MWP-	Fig. 10 MWP-	Fig. 11 MWP-
34	2630	± 0.5	±13.3	±0.07	±2.3	3	10	16172-1	16172-4	16172-9	16172-10	16172-11
200	6000	± 1.3	± 5.85	±0.16	±0.92	7	25	16132-1	16132-4	16132-9	16132-10	16132-11
600	10,450	± 2.2	± 3.36	±0.28	±0.52	12	43	16402-1	16402-4	16402-9	16402-10	16402-11
4000	23,400	± 6.6	± 1.50	±0.83	±0.23	35	110	16025-1*	16025-4	16025-9	16025-10	16025-11
11,000	38,000	±11.1	± 0.92	±1.4	±0.14	60	180	16112-1	16112-4	16112-9	16112-10	16112-11

MWP — Single Side Stable, Dual Wound Coils

COIL DATA									CATALOG NUMBERS					
			MUST OPERATE		MUST RELEASE		VOLTAGE (vdc)							
WINDING No.	RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Fig. 2 MWP-	Fig. 3 MWP-	Fig. 5 MWP-	Fig. 6 MWP-	Fig. 7 MWP-	Fig. 8 MWP-
1	250	4100	5.0	18	0.36	1.6	12	27	16211-2	16211-3	16211-5	16211-6	16211-7	16211-8
2	250	5000	5.0	18	0.36	1.6	10	27						
1	700	5925	10.9	14.2	1.7	2.8	24	46	16031-2	16031-3*	16031-5	16031-6	16031-7	16031-8
2	3300	16,950	20.7	5.7	2.9	0.98	39	99						
1	1020	7950	15.7	14	5.5	6	26	55	16101-2	16101-3	16101-5*	16101-6	16101-7	16101-8
2	970	8200	17.1	16	5.0	5.8	24	54						
1	1800	10,540	13.2	6.65	1.8	1.14	35	73	16251-2	16251-3	16251-5	16251-6	16251-7	16251-8
2	1775	10,980	13.2	6.76	1.7	1.09	33	73						
1	7500	20,400	30	3.63	1.3	0.2	75	150	16202-2	16202-3	16202-5	16202-6	16202-7	16202-8
2	7500	22,250	30	3.63	1.2	0.18	68	150						

MWP — Bi-Stable, Dual Wound Coils

COIL DATA									CATALOG NUMBERS					
			MUST OPERATE		NON-OPERATE		VOLTAGE (vdc)							
WINDING No.	RESISTANCE Ohms ±10%	TURNS	Voltage (vdc)	Current (madc)	Voltage (vdc)	Current (madc)	Nom.	Max.	Fig. 2 MWP-	Fig. 3 MWP-	Fig. 5 MWP-	Fig. 6 MWP-	Fig. 7 MWP-	Fig. 8 MWP-
1	100	3015	± 1.2	±11.7	±0.16	±1.8	7	17	16522-2	16522-3	16522-5	16522-6	16522-7	16522-8
2	100	3050	± 1.5	±13.4	±0.16	±1.8	7	17						
1	100	2700	± 1.4	±13	±0.18	±2.0	8	17	16072-2	16072-3	16072-5	16072-6	16072-7	16072-8
2	1100	9000	± 5.5	± 4.5	±0.60	±0.61	25	57						
1	250	4100	± 2.4	± 8.6	±0.29	±1.3	12	27	16212-2	16212-3	16212-5	16212-6	12612-7	16212-8
2	250	5000	± 2.3	± 8.2	±0.25	±1.1	10	27						
1	700	5925	± 4.6	± 6.0	±0.58	±0.93	24	46	16032-2	16032-3*	16032-5	16032-6	16032-7	16032-8
2	3300	16,950	± 8.7	± 2.4	±0.95	±0.32	39	99						
1	1020	7950	± 4.9	± 4.41	±0.63	±0.69	26	55	16102-2	16102-3	16102-5	16102-6	16102-7	16102-8
2	970	8200	± 5.3	± 4.96	±0.58	±0.67	24	54						
1	1800	10,540	± 6.6	± 3.34	±0.84	±0.52	35	73	16252-2	16252-3	16252-5	16252-6	16252-7	16252-8
2	1775	10,980	± 7.4	± 3.76	±0.80	±0.50	33	73						
1	7500	20,400	±14.2	± 1.72	±1.8	±0.27	75	150	16201-2	16201-3	16201-5	16201-6	16201-7	16201-8*
2	7500	22,250	±15.1	± 1.83	±1.7	±0.25	68	150						
1	11,500	29,800	±14.9	± 1.18	±1.8	±0.18	77	185	16452-2	16452-3	16452-5	16452-6	16452-7	16452-8
2	11,500	19,430	±22.8	± 1.80	±2.9	±0.28	120	185						

CHOPPERS

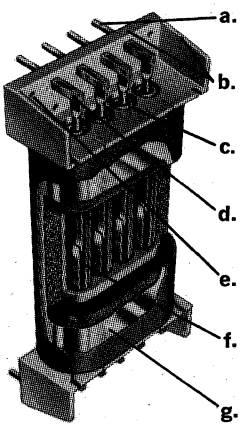
RESISTANCE ohms ±10%	TURNS	AC — VOLTAGE (rms)	CATALOG NUMBERS				
			Fig. 1 MWP-	Fig. 4 MWP-	Fig. 9 MWP-	Fig. 10 MWP-	Fig. 11 MWP-
500	9450	6.3	16263-1*	16263-4	16263-9	16263-10	16263-11
600	10,450	6.3	16403-1	16403-4	16403-9	16403-10	16403-11
4000	23,400	18.5	16026-1*	16026-4*	16026-9	16026-10	16026-11

GENERAL INFORMATION

For over forty years the name "ADLAKE" has been recognized as the utmost in quality and reliability in the Mercury Displacement and Mercury Wetted Contact Relay Fields. Now all this experience is being put to use in offering a line of dry reed relays to meet the most exacting demands of industry.

The Adlake Dry Reed Relays presented in this catalog have been selected as the most used contact configurations, keeping in mind the short delivery requirements normally required. These relays uphold the Adlake tradition of high quality and reliability.

All Adlake Reed Relays are supplied with contaminate-free contacts to assure long and dependable life. The coils used are accurately wound, as well as soundly insulated, and rigid controls are maintained on the critical parts of all relays from raw material through completed assembly to provide additional reliability.



ADVANTAGES OF ADLAKE DRY REED RELAYS

a. Non-magnetic inter-connecting pins for printed circuit board insertion can be bent, cut, etc. They also relieve stresses and prevent breakage of glass-metal seal if board is flexed. This assures maintenance of operating characteristics.

b. Molded ledge is extra thick with two sides giving additional rigidity for further structural protection of switch seals.

c. Each switch is housed in its own cradle.

d. Standard connection of switch lead to pin is soldered.

e. Bobbin ledge has additional pin holes available for various grid spacings.

f. Contacts are rhodium plated for higher load and longer life characteristics.

g. Magnetic shielding layer prevents interaction from other flux-generating, electrical apparatus.

APPLICATION NOTES—DATA

1. The relays shown in this catalog as medium sensitivity have been selected as the best choice to provide nominal requirements of both time and power consumption. If higher switching speed, at greater coil power; or power conservation, at slower speeds, is most important, lower or higher sensitivity relays can be supplied appropriately rated as to contact life.
2. Generally speaking, the power consumption at the level of sensitivity will grow as the number of poles of a relay is increased.
3. Likewise, as the number of poles increases, the speed of closure and release will become greater.
4. Unless the relay loads are purely resistive, arc suppression to protect the relay contacts is highly recommended. In all cases, the contacts in Adlake Dry Reed Relays are suitable for any relay coil winding in the same series, if proper arc suppression is used.

SELECTION FACTORS—DESIGN OPTIONS

In order to get the correct relay for your application — the relay that will give you the best performance—it is essential that certain information concerning the conditions under which the relay must perform be carefully considered. We, therefore, recommend that answers to the following questions be determined, and forwarded to us, with your inquiry or order for standard and/or special Adlake Dry Reed Relays.

1. Application
   - **a.** What is relay required to do?
   - **b.** Is application special in any way?
2. Contacts
   - **a.** How many contacts are needed in each relay?
   - **b.** What amount and type of load will contacts be required to switch or carry?
3. Coil
   - **a.** What is the nominal operating coil voltage?
   - **b.** What are the minimum and maximum voltages available?
   - **c.** Is sensitivity a problem? If so, what is the main consideration? Switching speed or power consumption?
4. General
   - **a.** What pin spacing is required?
   - **b.** Are there any other features needed?

Adlake engineers will be pleased to assist you in the proper application of reed devices to your requirements any time during the design phase. Your inquiry is invited.

THE ADAMS & WESTLAKE COMPANY A SUBSIDIARY OF ALLIED PRODUCTS CORPORATION

1025 North Michigan Street, Elkhart, Indiana 46514 (219) 264-1141 • TWX 219-522-3102 • TELEX 25-8458 • CABLE ADLAKE

Adlake SINCE 1857

DRY REED RELAYS

MINIATURE SIZE
Series ARAM (Form A)
ARBM (Form B)
Max. Power Rating—
15 Watts — 25 VA

INTERMEDIATE SIZE
Series ARAI (Form A)
ARBI (Form B)
Max. Power Rating—
15 Watts — 25 VA

STANDARD SIZE
Series ARAS (Form A)
ARBS (Form B)
Max. Power Rating—
25 Watts — 40 VA

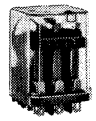
All series available with coils rated 6, 12, 24 or 48 Volts D.C. Form A relays available in 1, 2, 3 or 4 Pole configurations as standard items. Larger Number of Poles available upon request. Form B relays available in 1 or 2-pole configurations.
Request complete catalog for detail information.

COMPETITIVE!



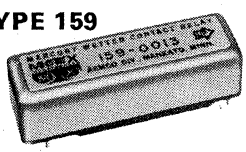
Competitive is the word! Midtex/AEMCO is competitive in range of products . . . competitive in price . . . competitive in delivery dates . . . and competitive in design know-how. Get the sort of broad range support you need from a single source. We welcome the opportunity to compete "glove-to-nose" with any of the giants in the relay and timer business!

INDUSTRIAL

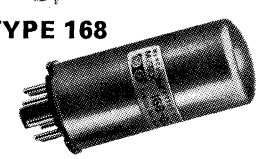
	TYPE 155	TYPE 156	TYPE 157	TYPE 48 *Single Coil Latching Action*
				
CONTACTS	U/L Recognized 1, 2, & 3 PDT 5 & 10 amp	U/L Recognized 1, 2, 3 & 4 PDT Low Level to 3 amp	1, 2 & 3 PDT 5 & 10 amp	1 & 2 PDT 10 amp
COILS	6 to 240 VAC 6 to 110 VDC	6 to 240 VAC 6 to 110 VDC	6 to 240 VAC 6 to 110 VDC	6 to 240 VAC 6 to 110 VDC
ENCLOSURES	Open and Dust Cover	Dust Cover and Hermetically Sealed	Open and Dust Cover	Open
TERMINALS	Solder, Plug-in, Wire-wrap, 3/16" Quick Disconnect	Solder/Plug-in, Printed Circuit, #78 Taper Tab	Solder/Plug-in/ 3/16" Quick Disconnect	Solder, 3/16" Quick Disconnect

MERCURY WETTED

TYPE 159



TYPE 168



CONTACTS
1 Form C or 1 Form D, Mercury Wetted, Bi-stable or Mono-stable, 2 amp max., 500 V max., 100 VA max.

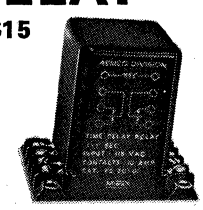
COILS
Single Wound 0.28 to 120 VDC
0.10 to 220 VDC
Double Wound 1.2 to 86 VDC
0.20 to 150 VDC

TERMINALS
Printed Circuit Octal Plug

ELECTRONIC TIME DELAY

TYPE 615





ADJUSTABLE DELAY FIXED DELAY

IN-PUT VOLTAGES
12, 24, 48 VDC
120 VAC

CONTACTS
1 to 3 PDT, 10 amp, 120/240 VAC

TERMINALS
Plug-in, Solder, Printed Circuit or Screw

DELAY TYPES
Delay on Operate
Delay on Release
Repeat Cycle Timing

DELAY RANGE

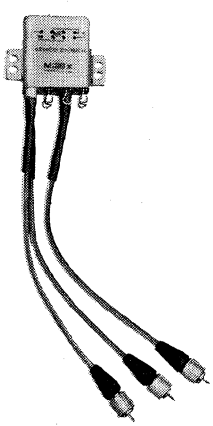
0.1 to 1 sec.	1 to 100 sec.
1 to 10 sec.	1 to 300 sec.

REPEAT ACCURACY
2% at nominal voltage and 25°C ambient.
10% over/voltage and temperature range.

TEMPERATURE RANGE
−40°F. to +150°F.

COAXIAL CRYSTAL CAN

TYPE 153



RF CHARACTERISTICS

Frequency	VSWR	Crosstalk
50 MHz	1.05/1	−62 DB
200 MHz	1.06/1	−50 DB
1000 MHz	1.15/1	−35 DB

Characteristic Impedance 50 ohms

CONTACTS
2C Coaxial or 1C Coaxial 1C Aux.
100 Watts RF, 2 amp 28 VDC

COILS
6 to 48 VDC

ENCLOSURE
Hermetically Sealed

TERMINALS
RG188/AU Cable or ultra-miniature connectors, Solder hook for auxiliary

ENVIRONMENTAL
Mil-R-5757

PROGRAMMERS AND ASSEMBLIES

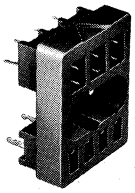
Midtex/AEMCO manufactures a wide variety of circuit board and wired assemblies incorporating either solid state or synchronous motor time references and relay or micro switch output which are available to Midtex /AEMCO or customer design.

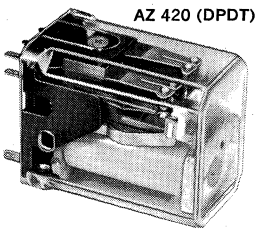
MIDTEX INCORPORATED
AEMCO DIVISION
10 STATE STREET, MANKATO, MINNESOTA 56001
PHONE 507-388-6286
TWX 507-890-8129

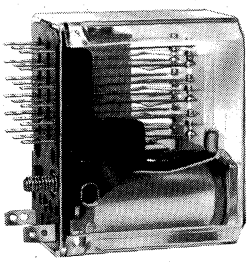
American Zettler, inc.

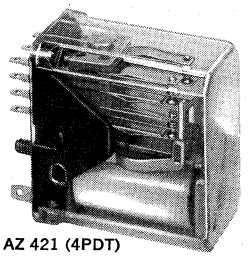
RELAYS AND SOLENOIDS

SERIES AZ 420* – MINIATURE GENERAL PURPOSE RELAYS – UP TO 6 FORM C


ST 140-A1


AZ 420 (DPDT)

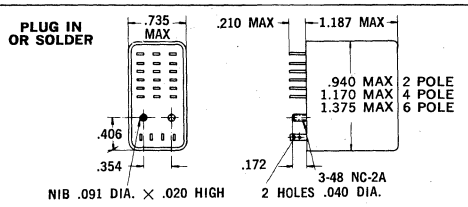

AZ 431 (6PDT)

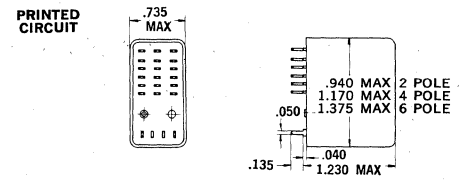

AZ 421 (4PDT)

■ International Standard type ■ Combination plug in/wire or PC terminals ■ Low level bifurcated, 2 amp or 5 amp contacts ■ Life expectancy more than 100 million operations ■ Form A, B, C and D contacts are available ■ Molded cradle eliminates phenolic dust inside the relay ■ Balanced, spring-held armature allows dependable operation in any position ■ Round core and larger coil volume provides more pull force, eliminating expensive, sensitive version ■ Slim profile mounting with right-angle socket ■ Sockets are of unbreakable fiberglass-filled base and have unique knife-type connectors for dependable contact ■ Prices from $1.70 each in production quantity ■ Available from stock.

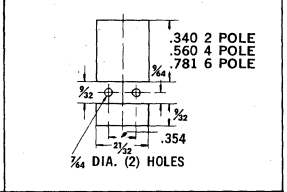
MECHANICAL SPECIFICATIONS

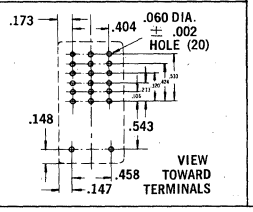
DIMENSIONS (inches)



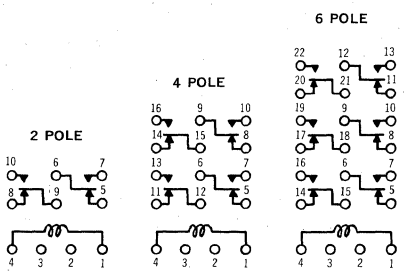


SUGG. PANEL LAYOUT OR P/C BOARD





WIRING DIAGRAM



Tolerances ± .010 • Standard relays have gold plated terminals.

ELECTRICAL SPECIFICATIONS

CONTACT RATING — noninductive load
Light Duty (Code L): Fine silver goldplated — low level to 2 amps @ 26 VDC or 1 amp @ 115 VAC
Heavy Duty (Code H): Silver cadmium oxide — 5 amp @ 26 VDC or 3 amp @ 115 VAC (other contact material available)

LIFE EXPECTANCY
Mechanical Operations: 10^8 — Operation at Rated Load: 10^6

CONTACT RESISTANCE
50 milliohms max. initially — 200 milliohms at end of life

OPERATE TIME
at two times "must operate" voltage or current: ≤ 8ms

RELEASE TIME
at two times "must operate" voltage or current: ≤ 3ms

CONTACT BOUNCE
at 10 ma contact current:
2 ms max. at operate, N.O. contacts
3 ms max. at release, N.C. contacts

DIELECTRIC STRENGTH
1000 V rms; 500 V rms across contact gap

INSULATION RESISTANCE
1000 megohms minimum @ 25°C, 100 VDC, 50% RH

COIL TEMPERATURE
Max. 105°C (220°F)

AMBIENT TEMPERATURE
Operating: —55°C (—72°F) to 80°C (175°F) @ nominal operating voltage
Storage: —55°C (—72°F) to 105°C (220°F)

VIBRATION
Operating: .062 DA @ 5-55 Hz; 10g @ 55-110 Hz
Non Operating: 10g @ 5-500 Hz

SHOCK
Operating: 20g @ 11 ms
Non Operating: 30g @ 11 ms

WEIGHT
23 to 35 grams (approx. 1 oz.)

Ordering information and operating data on next page.

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RELAYS AND SOLENOIDS

SERIES AZ 420* – MINIATURE GENERAL PURPOSE RELAYS

2- AND 4-POLE TYPE

TABLE I – BASIC TYPES

Mounting	2 or 5 amp 2C Contacts	2 or 5 amp 4C, 6A, 6B Contacts	High Voltage Contacts	High Frequency Contacts
Plug-in or Solder Stud Mounting	AZ 420	AZ 421	AZ 421/8	AZ 426 (not plug-in)
PC-terminals No Mounting Stud	AZ 428	AZ 429	AZ 429/8	—

TABLE III – CONTACT CODE

	Light Duty 2 amps @ 26 vdc 1 amp @ 115 vac Single Button	Light Duty 2 amps @ 26 vdc 1 amp @ 115 vac Bifurcated Button	Heavy Duty 5 amps @ 26 vdc 3 amps @ 115 vac Single Button	High Voltage 2 amps @ 115 vdc 1 amp @ 250 vac Single Button	High Frequency 250 milli amps @ 125 vac 0.6 pf capacity Single Wire
4 FORM C	1L	10L	1H	—	—
6 FORM A	2L	20L	2H	—	—
6 FORM B	3L	30L	3H	—	—
2 FORM C	4L	40L	4H	8L	9L

TABLE II – COIL CODE – STANDARD COILS

Coil Code	COIL DATA Nom. Oper. vdc	Max. Cont. vdc	Resistance ohms ±10%	MUST OPERATE (2) 2C Contacts mA	2C Contacts VDC	4C, 6A, 6B Contacts mA	4C, 6A, 6B Contacts VDC
2	3	5	14	75	1.2	112	1.8
15	6	10	52	37	2.2	57	3.3
1011	12	19	185	20	4.1	30	6.1
80	18	30	430	14	6.6	22	10.4
08	20	35	600	12	8	18	11.9
70	24	38	700	12	9.1	18	13.8
07	26	45	1 K	9	10	13.5	14.9
56	48	72	2.5 K	5.4	14.8	8.3	22.8
40	72	110	5.8 K	4.2	27	6.3	40
408	90	142	10 K	3.1	34	4.5	50
035	115	175	15 K	2.4	40	3.5	58

For bifurcated and heavy duty contacts add ⅓ of the listed "Must Operate" value.

6-POLE TYPE

TABLE I

Basic Type	DESCRIPTION
AZ 431	Polycarbonate dustcover, combined solder/plug-in terminals
AZ 439	Polycarbonate dustcover, printed circuit terminals

TABLE III – STANDARD CONTACTS

Cont. Code	Contact Rating @ 26VDC
1L	2 Amp Single Fine Silver Goldplated
10L	2 Amp Bifurcated Fine Silver Goldplated
1H	5 Amp Single Silver Cadmium Oxide

TABLE II – STANDARD COILS

Coil Code	COIL DATA Nom. Oper. VDC	Max. Cont. VDC	Resist. Ohms ±10%	Induct. Henrys (1)	MUST OPERATE (2) .2 Amp. Cont. Single mA	.2 Amp. Cont. Single VDC	5 Amp. Cont. Single 2 Amp. Cont. Bifur mA	5 Amp. Cont. Single 2 Amp. Cont. Bifur VDC
18	6	7	25	0.4	106	3.2	140	4
13	12	14	90	1.3	59	5.5	78	8
80	24	30	430	5.5	29	14	38	18
07	36	45	1000	15	17	20	24	26
06	48	61	1800	26	13.5	27	18	35
56	60	72	2500	38	11	31	15	41
04	115	138	9000	120	6.5	62	8.5	85

All values at 20°C (1) Inductance for closed armature. For open armature, divide by two. (2) Relay will pull in with less than "must operate" value.

HOW TO ORDER

1. select basic relay type from Table I
2. add coil code from Table II
3. add contact code from Table III

For Example: AZ 431 – 07 – 1L
Plug-in type
1000 ohm coil resistance
6 PDT contacts single, light duty

Ordering information for sockets and hardware—see next page. For free samples or assistance in specifying your relay, contact our office or your nearest engineering representative listed in the yellow section.

SERIES AZ 480 – GENERAL PURPOSE RELAYS – 10 AMP CONTACTS



- 10 Amp @ 115 VAC silver cadmium oxide contacts
- Up to 3 form C contacts
- DC or AC coils, also sensitive version
- 8 or 11 pin octal socket or PC terminals
- Dimensions over all: 2.65 x 1.45 x 1.38 (octal) 1.78 x 1.35 x 1.26 (PC term)
- Weight: 3 oz.



- 10 Amp @ 115 VAC silver cadmium oxide contacts
- Up to 4 form C contacts
- DC or AC coils
- Mounting with base plate, 6-32 stud or one 6-32 screw
- Solder or PC terminals
- Dimensions over all: 1.65 x 1.26 x .95 (up to 3 pole) 1.65 x 1.26 x 1.24 (4 pole)
- Weight: 2.3 oz.

STANDARD RELAYS: (Closed, Octal Socket)

COIL VOLTAGE	SPDT AZ 480 ▼		DPDT AZ 480 ▼		3 PDT AZ 480 ▼	
6 VDC 12 VDC 24 VDC	$5.48	-2-1 -3-1 -4-1	$5.95	-2-2 -3-2 -4-2	$7.45	-2-3 -3-3 -4-3
110 VDC	$5.95	-9-1	$6.45	-9-2	$7.95	-9-3
	AZ 481 ▼		AZ 481 ▼		AZ 481 ▼	
6 VAC 12 VAC 24 VAC	$5.48	-2-1 -3-1 -4-1	$5.95	-2-2 -3-2 -4-2	$7.45	-2-3 -3-3 -4-3
120 VAC	$5.65	-7-1	$6.00	-7-2	$7.60	-7-3

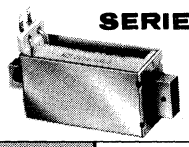
8 pin socket PN 920733; 11 pin socket PN 920734
Retainer PN 920735

STANDARD RELAYS: (Open, Solder Lugs)

COIL VOLTAGE	SPDT AZ 482 ▼		DPDT AZ 482 ▼		3PDT AZ 482 ▼		4 PDT AZ 482 ▼	
6 VDC 12 VDC 24 VDC	$3.20	-2-1 -3-1 -4-1	$3.55	-2-2 -3-2 -4-2	$4.10	-2-3 -3-3 -4-3	$4.80	-2-8 -3-8 -4-8
110 VDC	$3.78	-9-1	$4.12	-9-2	$4.40	-9-3	$5.40	-9-8
	AZ 483 ▼		AZ 483 ▼		AZ 483 ▼		AZ 483 ▼	
6 VAC 12 VAC 24 VAC	$3.21	-2-1 -3-1 -4-1	$3.80	-2-2 -3-2 -4-2	$4.25	-2-3 -3-3 -4-3	$5.35	-2-8 -3-8 -4-8
120 VAC	$3.30	-7-1	$3.90	-7-2	$4.30	-7-3	$5.40	-7-8

Add letter A to Part No. for stud mounting and B for tapped core
Prices for 1-24 pcs.

SERIES AZM 260 – MINIATURE PULL SOLENOIDS FOR DC OPERATION



- Compact design ■ Rectangular shape for highest space-power efficiency ■ One hole mounting
- Maximum stroke, 5/16" ■ Molded bobbin ■ Brass sleeving ■ Prices from $1.20 ea. in production quantities
- Available from stock

STANDARD SOLENOIDS

TYPE	DIMENSIONS (Inches)	CONTINUOUS DUTY Pull Force at 1/16" stroke	Coil Resistance for 6 vdc	12 vdc	24 vdc	115 vdc	10% Duty (½ sec. max. on / 4½ sec. min. off) Pull Force at 1/16" stroke	Coil Resistance for 6 vdc	12 vdc	24 vdc	115 vdc
AZM 260	13/32 x 5/16 x 1 1/16	2¼	10	32	150	3700	10	1.4	4	16	415
AZM 261	17/32 x 13/32 x 1 1/16	3¼	8.6	30	130	2500	14	—	3.3	13	280
AZM 262	5/8 x ½ x 1 29/32	6¼	5.7	21	80	2300	20	—	—	10	220
AZM 263	7/8 x 1 1/16 x 2 1/8	12½	4.2	16	73	1450	72	—	—	8	115

All data at 20°C – Other coils for different duty cycles or voltages available – to order add coil resistance to type

*Pat. Pend.

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American Zettler, inc.

SOCKETS AND HARDWARE

SOCKETS FOR MINIATURE GENERAL PURPOSE RELAYS—AZ 420, 421, 431

PART NO.	NO. OF POLES	DIMENSIONS (inches)	SUGGESTED PANEL LAYOUT OR P/C BOARD	
ST-140-A1 FOR AZ 420 ST-141-A1 FOR AZ 421 ST-345-A1 FOR AZ 431	2 4 6	SOCKET FOR WIRING OR PC	2 POLE 11/32 4 POLE 5/16 6 POLE 25/32 2 POLE 4 POLE 6 POLE	ACTUAL SIZE 4 POLE
ST-342-A1 FOR AZ 420 ST-350-A1 FOR AZ 421 N.A.	2 4 6	RIGHT-ANGLE SOCKET FOR PC	2 POLE 4 POLE 6 POLE	ACTUAL SIZE 4 POLE
ST-349-A1 FOR AZ 420 ST-343-A1 FOR AZ 421 ST-354-A1 FOR AZ 431	2 4 6	RIGHT-ANGLE SOCKET FOR PC	2 POLE 4 POLE 6 POLE	ACTUAL SIZE 4 POLE

TOLERANCES: ±.010 Standard sockets have silver-plated terminals and are dipped in flux for easy machine soldering.

HARDWARE

ST-140-1 ST-141-1 ST-345-1	2 4 6	Retainer (for all socket versions)
ST-140-2	ALL	Grounding Clip

ORDER INFORMATION

Order socket, retainer and grounding clip (if desired) by separate part numbers. To specify sockets with gold plated terminals, substitute —A2 for —A1.

ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

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AGASTAT® timing instruments

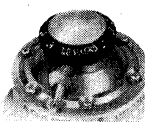
NEW 2400 SERIES electropneumatic timing/relays

AGASTAT timing relays are electrically actuated, but pneumatically timed... they recirculate their own filtered air supply for long timing ranges, easy adjustment, instant recycling... no need for stable voltage supply for accurate timing... less temperature sensitivity.



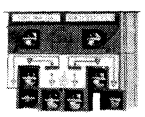
- Timing on Pull-in or Drop-out, or **both** in one unit.
- No power required during timing in Delay-on-Drop-Out models.
- All popular AC and DC operating voltages.
- DPDT switches, capacities to 20 amps.
- Field-replaceable coils and switchblocks.

Request Bulletin SR-2



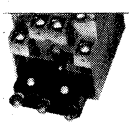
time-calibrated adjustment dials

eleven linear adjustment ranges provide delays from milliseconds to 60 minutes with direct-reading dial adjustment



front terminals

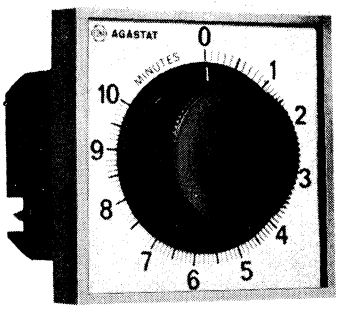
out-front accessibility with permanent identification, for easy wiring



auxiliary switch options

easily-added auxiliary switches handle extra circuits or provide two-step timing

new panelmount style



Including all features of upright model plus a modern dial plate and knob, with mechanism protected behind the panel; available in all twelve direct-reading dial ranges.

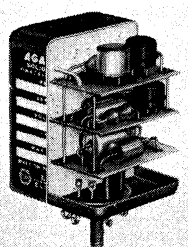
Request Bulletin SR-24

ELECTRONIC MODELS

R-C models: Full line of AC and DC units in a wide range of delay-on-energizing or de-energizing types. Static or relay outputs with adjustable or fixed timing and broad adjustment ranges.

- 18-32 vdc or 115 vac models.
- —55°C to 100°C ambients.
- timing from .01 to 300 sec. standard; higher ranges available.
- repeat accuracy to ±0.5%.

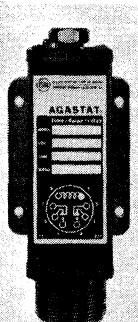
Bulletin SS-3



New Magnetic models: The inherent high accuracy of the magnetic core counter principle is applied for the first time to a new line of AGASTAT electronic timers featuring fewer components, lower power consumption and increased flexibility.

- timing period extended to hours, days, or years.
- repeat accuracy as high as ±0.25%.
- static or relay outputs, to 10 amps.
- —55°C to 85°C ambients.
- non-destruct memory feature available.
- easily adapted to multi-function capabilities.

Bulletin SS-4



MINIATURE PNEUMATIC t/d/r

Hermetically sealed or unsealed units for MIL-spec or other demanding applications where space is limited. Features operating principles of 2400 series; AC or DC operation, timing on pull-in or drop-out or both, DPDT switches.

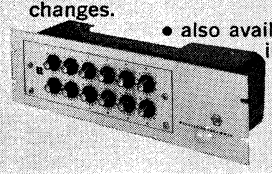
- inherent transient protection, excellent recycling characteristics.
- adjustable timing to 3 minutes, capacities to 10 amps.
- timing-without-power capability.

Bulletin SM-2

PROGRAMMER AND STEPPING SWITCHES

Individual process steps controlled by high-accuracy time-calibrated dials. New design permits external control override at each step for greater flexibility and safety.

- adjustable during operation.
- exceptional accuracy—single solid state timer.
- unmatched flexibility—fast setup and program changes.
- also available without time control in advanced design stepping switch models.



Bulletin SP-3

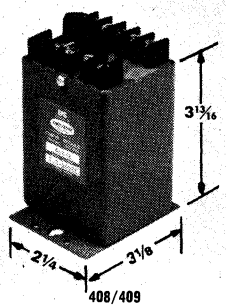
AMERACE·ESNA CORPORATION

AGASTAT DIVISION
ELIZABETH, NEW JERSEY

ELECTRONIC TIMING DEVICES

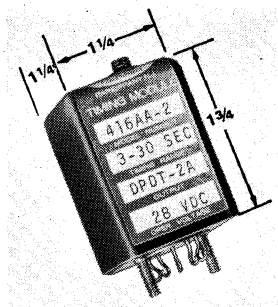
Artisan Electronics

5 EASTMANS ROAD, PARSIPPANY, NEW JERSEY 07054



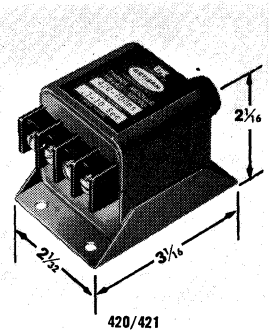
408/409

Industrial Time Delay Relays — adjustable, rugged and highly accurate — operating from 115 VAC as a delay on pull in (408) or a delay on drop out (409). Adjustable ranges of .025 to 2.5 seconds, 2.5 to 25 seconds, 10 to 100 and 20 to 300 seconds. Timing repeatability is ±1%. **Bulletin T 208.**



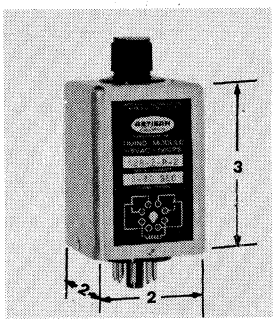
416/476

Universal military timing unit with an internal relay output (416) or solid state output (476). Both have various mounting configurations, adjustment capabilities (delay range of 30 milliseconds to 300 seconds) and are supported by an independent testing laboratory's detailed reliability report. **Bulletin T 206.**



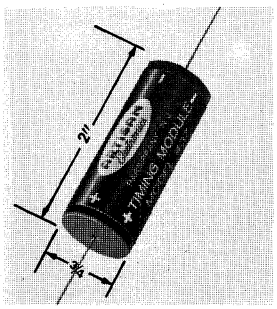
420/421

All solid state flasher/delay module. Adjustable unit capable of switching the full AC supply to the load as a 50% duty cycle flasher (420), or at the end of an adjusted delay period (421). **Bulletin T 205.**



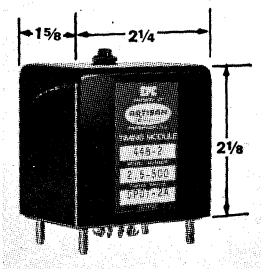
428

Industrial TDR, featuring the optimum in economy and flexibility. Various fixed or adjustable timing ranges and 2% repeat accuracy. **Bulletin T 204.**



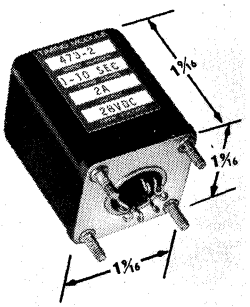
437

Miniature, fixed time delay (.025 to 300 sec.) with a full 2 amp solid state output, 3% repeatability, broad operating voltage in same unit and priced under $5.00 in quantity. **Bulletin T 211.**



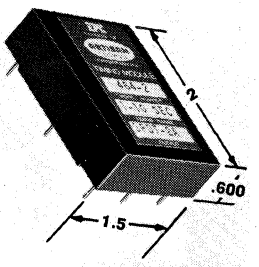
448

Adjustable time delays to 500 seconds, operating from 18 to 32 VDC, and capable of either a delay on pull in or a delay on drop out in the same application. **Bulletin T 209.**



473

Solid state flasher, 24 to 32 VDC, with capability of externally controlling both "ON" and "OFF" periods, and flashing under a no load condition. **Bulletin T 207.**



484

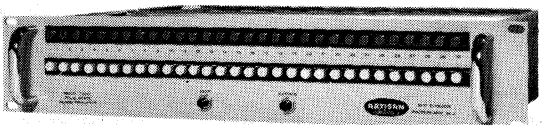
Summation timing module, which accumulates time until the input time is equal to a pre-set delay when its relay contacts transfer. **Bulletin T 203.**

CONTROL AND TERMINAL EQUIPMENT



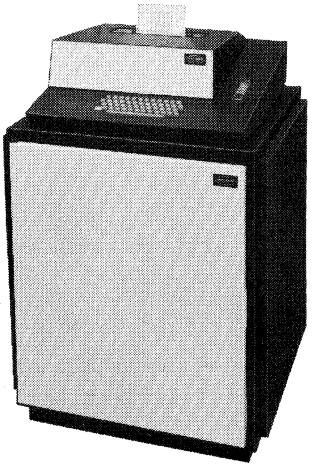
492 — Repeat and Predetermine Cycle Timer

Combines a repeat cycle timer (with adjustable "ON" and "OFF" time) and a predetermine counter for total cycles. Adjustable in 3 ranges from 0.1 sec. to 300 sec. through panel controls. Relay output, DPDT rated 10 amps; timing repeatability, ±1%; operating voltage, 105-130 VAC, 60 Hz, at 20 V.A. **Bulletin C 606.**



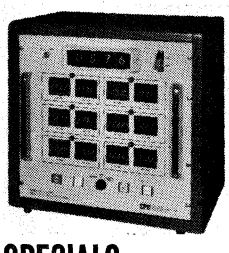
7007C — Annunciator

This 30-channel all solid state alarm indicator/annunciator is designed especially for detecting and isolating failures, abnormal conditions or malfunctions in a wide range of electronic and similar equipments. Features a completely wired chassis and a partial number of interchangeable modules for initial economy and future expansion. 40 watts maximum power required; operates from 115 VAC, with other voltages available. **Bulletin CC 603.**



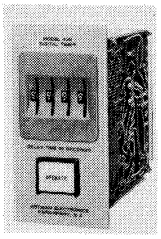
1270 — Event Recorder

A 250 channel event recorder, 29 column capacity, alpha numeric automatic print out plus date and time recording with each event. Application example in conjunction with supervisory control systems and single replacement of groups of pen recorders. Price $60 to $80 per channel. **Bulletin CC 609.**



10397 — Programmer

Used for the complete automatic control of processes, simulation, laboratory experiments or any equipment requiring flexibility in program changes. This unit independently or sequentially controls 6 different events from the start of a program to a maximum of 999.9 seconds. Each event may be preset by a 4-digit thumb wheel switch on the front panel for automatic turn-on and turn-off operation. Timing resolution, 0.1 second; operating voltage 105-130 VAC (60 cycles). Other available. **Bulletin CC 601.**



490 — Digital Timing Control

An advanced digital timing control permitting easy selection of any required time delay range from 0.1 sec. increments with extreme accuracies and at an economical price. This device is a completely solid state digital timing control capable of delay on pull in or delay on drop out through a SPDT relay with a 5 amp output, resistive at 115 VAC. Power required, 1 watt max; operating voltages 115 VAC. Many options available. **Bulletin CC 605.**

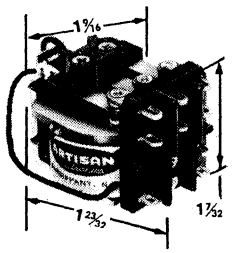
SPECIALS

The production of special devices to customer specifications is "state of the art" at Artisan and, in most cases, prices of custom models are no greater than those for stock items. **Bulletin T 210.**

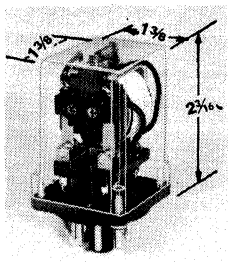
ELECTROMECHANICAL RELAYS

Artisan Electronics

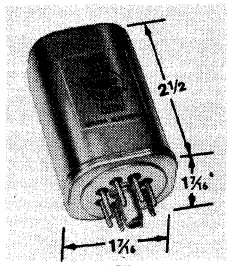
5 EASTMANS ROAD, PARSIPPANY, NEW JERSEY 07054



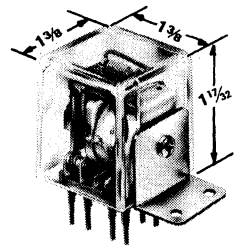
RE



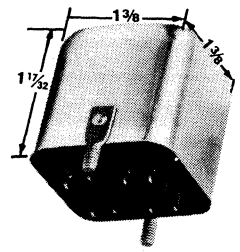
REP



REH

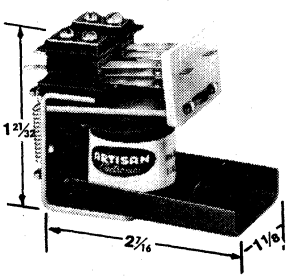


REKT

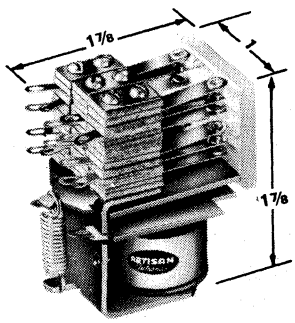


RED

General purpose relays designed for low cost, dependable switching of control circuits. Small, rugged, highly efficient with switching capacity to 10 amps and 3 PDT contact configuration. Available with hermetically sealed, plastic or metal plug enclosures; metal dust covers for chassis mounting; solder lug, quick disconnect and printed circuits board terminals and any coil voltage. **Bulletin R 301.**

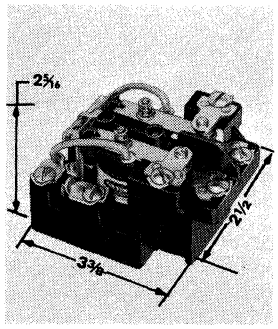


RH,



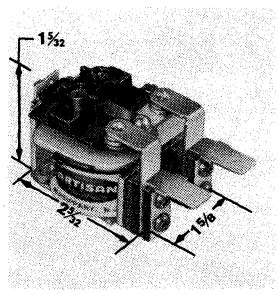
RHR

Specifically designed for maximum economy, these units are slightly larger and less sensitive than the RE Series, but feature 10 amp standard contacts (15 amperes available) and any combination of contact configurations through 9 PDT. This all-purpose component employs a nylon blade lifter that assures dependable operation. Also, metal and hermetically sealed enclosures and other quick disconnect (.110, .187 & .250) terminations are available. **Bulletin R 302.**



PJ

A power relay engineered for extra long life at loads of 25 amperes with DPST or DPDT contact configuration. Operates from any voltage to 240 volts AC or DC. 110 volts AC in Stock. **Bulletin R 304.**



RB

This single pole, single throw, normally closed double break (Form Y) is a compact, economical unit rated at 30 amperes at 30 VDC or 115 VAC and is specifically designed for emergency lighting use. Available with dust-proof enclosure. Coil voltages to 110 VDC or 240 VAC. **Bulletin R 306.**

LATCHING (REL, RHL, RELM)

Mechanical latching relays mounted on a common plate. Either relay when momentarily energized is mechanically held by the other. Used for ON-OFF switching, power reversal and similar applications with either identical or different voltages for each coil. Model REL (open) and Model RELM (enclosed plug in) are capable of up to 3PDT contacts on each relay. Model RHL is capable of up to 6PDT on one relay associated with a plain latching coil. **Bulletin R 303.**

SENSITIVE (RS, PE)

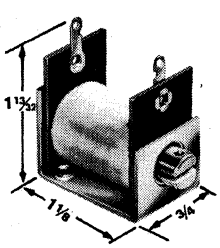
Model RS, a sensitive, economical relay, offers 60 milliwatts per pole (1, 2 or 3 Form "C" available) as standard and to 25 mw/pole special. Model PE (plate circuit unit similar to RE at top) offers 125 mw/pole standard and to 90 special. **Bulletin R 305.**

ACTUATORS (RC, RM)

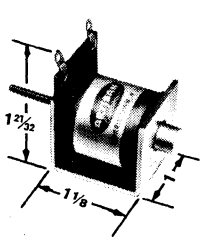
Actuators, coil and armature assembly of RE and RH respectively, offering life of 5 million operations at forces of 2 to 5 ounces on RC and 4 to 20 ounces on RM at a stroke of .080" depending on duty cycle and AC or DC operation. Coil voltages to 110 VDC or 240 VAC. Higher forces at shorter strokes; solder lugs or quick disconnect termina!s available. **Bulletin A 501.**

SOLENOIDS

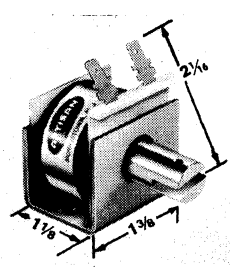
Light weight, compact solenoids utilize the economical U frame design for both continuous and intermittent duty. They are ideal for AC (to 220V) and DC (to 110V) applications in automatic equipment requiring up to twenty pounds force, such as vending machines, recording equipment and business machines. Can be furnished for high temperature ambients and in a wide range of plunger styles. Suffix A denotes pull type, G, push type. **Bulletin S 401.**



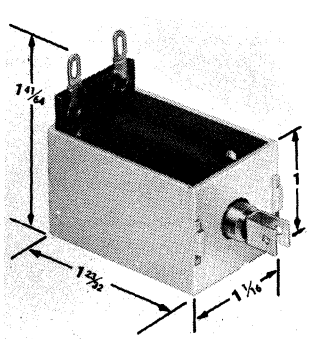
DSA, DSG



BRA, BRG



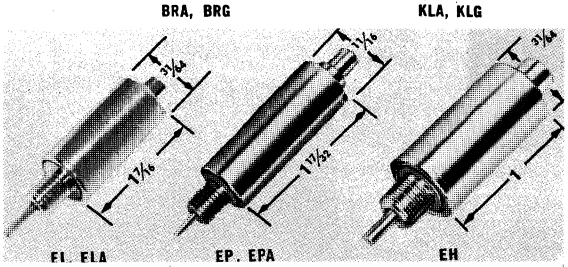
KLA, KLG



FA

Box frame solenoid specifically designed for efficient DC operation up to 110 volts. Actuator forces from 7 ounces at 3/4" stroke to 125 ounces seated. Intermittent and continuous duty forces proportionally less. **Bulletin S 403.**

Cylindrical solenoids offering close spacing and extra long life for both continuous and intermittent duty, these miniature solenoids are used where size and forces required are less than 50 ounces. Their applications include data processing equipment, such as tape-fed automatic operation of business machines, pen-lifting duties on chart recorders and flag-raising on instrument panels for warning purposes. Operation to 125 VDC. Available with threaded bushing or "C" ring mounting. **Bulletin S 402.**



EL, ELA **EP, EPA** **EH**

BABCOCK RELAYS

Unequalled for accurate, dependable performance under widely varying load and environmental conditions, Babcock hermetically sealed relays are ideally suited for continuous-duty airborne and ground system applications.

All relays in the Babcock line meet or exceed MIL-R-5757D and applicable sections of related military specifications. For complete assurance of reliable performance in critical applications, each relay series undergoes extensive life testing under a separate reliability program. First of its type in the relay industry, the Babcock program furnishes failure rate data guaranteeing miss-free operation within the critical parameters of missile usage.

DESIGN FEATURES

High-Flux Magnetic Design: High sensitivity with minimum coil power • Constant force across gap • High contact pressure.

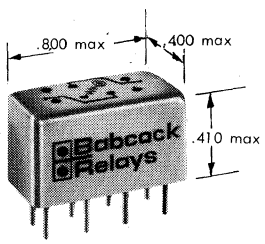
Contaminant-Free Operation: High-reliability series available with all-welded construction and activated porous glass getters.

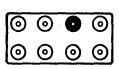
Hermetically Sealed Construction: Dry filled with 90% nitrogen, 10% helium, and leak tested to 10^{-8}cc /sec.

Universal Contacts: Exclusive Babcock "universal contacts" permit relay operation from dry circuit to rated load with the same contact set.

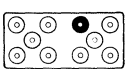
Vibration and Shock Immunity: Balanced armature and low-inertia components.

BR16, BR17 RELAYS





BR16



BR17

HALF-SIZE CRYSTAL CAN RELAYS — Dry Circuit to 2 Amp. Series

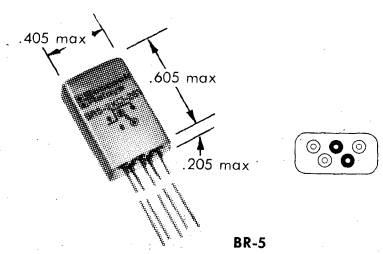
BR17 Latching

Contacts: 2 amp., DPDT • **Dry Circuit:** 1 μa @ 1 mv • **Contact Bounce:** 2 ms max. @ Max. rated load • **Mil Spec:** MIL-R-5757 • **Vibration:** 30g, 38-2000 Hz • **Shock:** 50g, 11 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations, min. @ rated load, 125°C; 1,000,000 operations, min. @ low level, 125°C • **Drop Out:** 10% min. of max. pull-in • **Mounting Types:** flange • **Terminal Styles:** plug-in, solder hook, gold-plated plug-in.

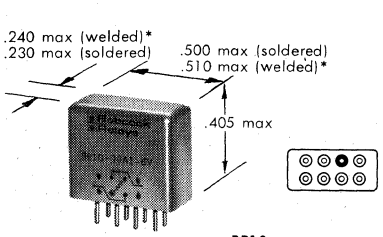
Nominal Coil Voltage		6 VDC	12 VDC	26 VDC	48 VDC
Pull-in Voltage (max.) @ 25°C		3.0 VDC	6 VDC	13 VDC	24 VDC
Pull-in Voltage (max.) @ 125°C		4.4 VDC	8.4 VDC	18.0 VDC	33 VDC
Type	Oper. & Rel. Time (max)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)
BR16	4 ms	50	190	900	2.8K
BR17A, C, D, E	3 ms	50	190	900	2.8K
BR17B	3 ms	90	340	1500	5.0K

NOTE: All data for BR17 (except Type B) are for each coil separately.

BR5, BR10 RELAYS



BR-5



BR10

MICRO/MICROMINIATURE RELAYS — Dry Circuit to 1 Amp. Series

Contacts: 1 amp.; BR5, SPDT; BR10 DPDT • **Mil Spec:** MIL-R-5757 • **Vibration:** 30g, 38-3000 Hz • **Shock:** BR5 — 125g, 11 ms; BR10 — 150g, 11 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations, min. @ 1 amp., 125°C; 150,000 operations, min. @ 0.5 amp., 125°C (BR10 only) • **Drop Out:** 10% min. of max. pull-in • **Mounting:** BR5 — slip-on tab, flange; BR10 — flange • **Terminal Styles:** plug-in, solder hook, gold-plated plug-in (BR10 only), 1.5" printed circuit leads.

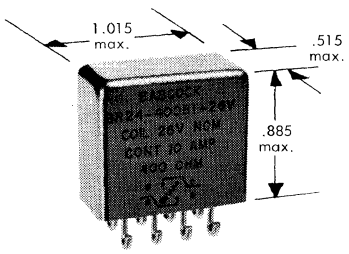
Nominal Coil Voltage		12 VDC	18 VDC	26 VDC
Pull-in Voltage (max.) @ 25°C		6.7 VDC	9.5 VDC	13 VDC
Pull-in Voltage (max.) @ 125°C		9.5 VDC	13.5 VDC	18 DC
Type	Oper. & Rel. Time (max)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)
BR-5	4 ms	500	1K	2K

Nominal Coil Voltage		6 VDC	12 VDC	18 VDC	26 VDC
Pull-in Voltage (max.) @ 25°C		3.0 VDC	6.0 VDC	9.0 VDC	13.0 VDC
Pull-in Voltage (max.) @ 125°C		4.4 VDC	8.4 VDC	12.5 VDC	18 VDC
Relay Type	Oper. & Rel. Time (max)	Coil Res. ±10% @ 25°C	Coil Res. ±10% @ 25°C	Coil Res. ±10% @ 25°C	Coil Res. ±10% @ 25°C
BR10T, 10W	3.5 ms	90 Ω	330Ω	750Ω	1500Ω

NOTE: BR10T Soldered, BR10W Welded

BABCOCK PRECISION RELAYS

NEW BR24 RELAY

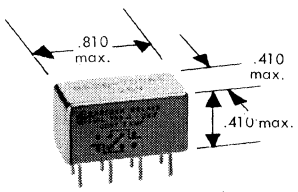


MINIATURE RELAYS — Dry Circuit to 10 Amp. Series
All-Welded Construction

Contacts: 10 amp., DPDT • **Mil Spec:** MIL-R-5757 • **Bounce Time:** 2 ms max. @ rated load • **Vibration:** 20g, 38-2000 Hz • **Shock:** 50g, 11 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations min. @ rated load, 125°C • **Drop Out:** 10% min. of max. pull-in • **Mounting Types:** flange, bracket • **Terminal Styles:** plug-in, solder hook, 3" printed circuit leads.

Nominal Coil Voltage		6 VDC	12 VDC	26 VDC
Pull-in Voltage (max.) @ 25°C		3.0 VDC	6.0 VDC	13.0 VDC
Pull-in Voltage (max.) @ 125°C		4.6 VDC	8.3 VDC	18.0 VDC
Type	Oper. & Rel. Time (max.)	Coil Res. ± 10% @ 25° (ohms)	Coil Res. ± 10% @ 25° (ohms)	Coil Res. ± 10% @ 25° (ohms)
BR24	7 ms	21	85	400

NEW BR26 RELAY

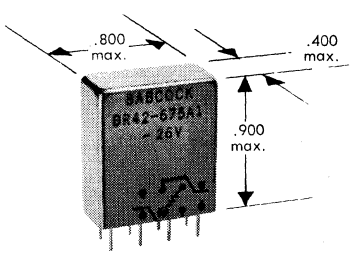


HALF-SIZE CRYSTAL CAN RELAYS — Dry Circuit to 2 Amp. Series
All-Welded Construction

Contacts: 2 amp., DPDT • **Mil Spec:** MIL-R-5757 • **Bounce Time:** 2 ms max. @ rated load • **Vibration:** 30g, 38-2000 Hz • **Shock:** 50g, 11 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations min. @ rated load, 125°C • **Drop Out:** 10% min. of max. pull-in • **Mounting Types:** flange • **Terminal Styles:** plug-in, solder hook, gold-plated plug-in.

Nominal Coil Voltage		6 VDC	12 VDC	26 VDC
Pull-in Voltage (max.) @ 25°C		3.0 VDC	6.0 VDC	13.0 VDC
Pull-in Voltage (max.) @ 125°C		4.4 VDC	8.4 VDC	18.0 VDC
Type	Oper. & Rel. Time (max.)	Coil Res. ± 10% @ 25°C (ohms)	Coil Res. ± 10% @ 25°C (ohms)	Coil Res. ± 10% @ 25°C (ohms)
BR26	4 ms	37	150	700

NEW BR42 RELAY

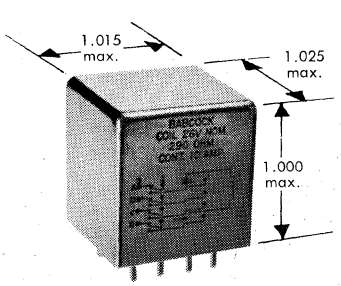


MINIATURE RELAYS — Dry Circuit to 2 Amp. Series
All-Welded Construction

Contacts: 2 amp., DPDT • **Mil Spec:** MIL-R-5757 • **Bounce Time:** 2 ms max. @ 2 amps. • **Vibration:** 20g, 38-2000 Hz • **Shock:** 50g, 11 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations min. @ rated load, 125°C • **Drop Out:** 10% min. of max. pull-in • **Mounting Types:** flange • **Terminal Styles:** plug-in, solder hook, 3" printed circuit leads.

Nominal Coil Voltage		6 VDC	12 VDC	26 VDC	115 VDC
Pull-in Voltage (max.) @ 25°C		3.0 VDC	6.0 VDC	13.0 VDC	57.5 VDC
Pull-in Voltage (max.) @ 125°C		4.4 VDC	8.4 VDC	18.0 VDC	79.0 VDC
Type	Oper. & Rel. Time (max.)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)
BR42	5 ms	36	140	675	13.2K

NEW BR30 RELAY



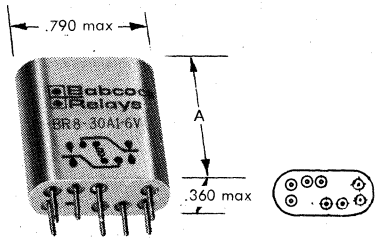
MINIATURE AIRCRAFT RELAYS — 4PDT • MIL-R-6106
All-Welded Construction

Contacts: 10 amp., 4PDT • **Mil Spec:** MIL-R-6106 • **Bounce Time:** 2 ms max. @ not more than 100 ma. • **Vibration:** 30g, 70-3000 Hz • **Shock:** 100g, 10 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations min. • **Mounting Types:** flange • **Terminal Styles:** gold-plated plug-in, solder hook.

Nominal Coil Voltage		6 VDC	12 VDC	28 VDC
Maximum Coil Voltage		8 VDC	15 VDC	29 VDC
Pull-in Voltage (max.) @ 125°C		4.5 VDC	9.0 VDC	18.0 VDC
Type	Oper. & Rel. Time (max.)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)
BR30	10 ms	18	72	290

BABCOCK PRECISION RELAYS

BR8 RELAYS



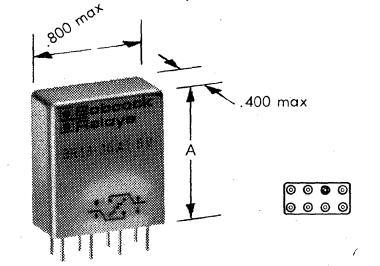
BR8, 8Z: A = .870 max
BR8H: A = 1.190 max

CRYSTAL CAN RELAYS — Dry Circuit to 2 Amp. Series

Contacts: 2 amp., DPDT • **Life:** 100,000 operations min. @ rated load, 125°C • **Bounce Time:** 2 ms max. @ rated load • **Mil Spec:** MIL-R-5757 • **Vibration:** 30g, 38-2000 Hz • **Shock:** 50g, 11 ms. • **Temp. Range:** —65°C to +125°C • **Drop Out:** 10% min. of max. pull-in • **Mounting Types:** flange, bracket • **Terminal Styles:** plug-in, solder hook, 3″ printed circuit leads.

Nominal Coil Voltage		6 VDC	12 VDC	26.5 VDC	115 V DC
Pull-in Voltage (max.) @ 25°C		3.0 VDC	6 VDC	13 VDC	57.5 VDC
Pull-in Voltage (max.) @ 125°C		4.4 VDC	8.4 VDC	18.0 VDC	79 VDC
Type	Oper. & Rel. Time (max)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)
BR8	5ms	30	120	600	10K
BR8HZ	7ms	60	240	1K	

BR12, BR13 RELAYS



BR13 A = .900 max
BR12, A = .890 max
BR12H, 12K A = 1.270 max
BR13H, 13K A = 1.290 max

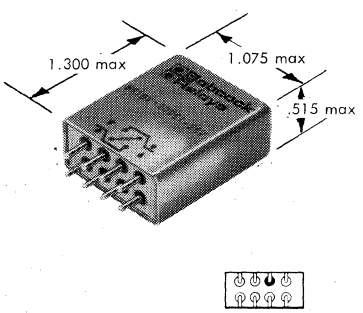
MICROMINIATURE RELAYS — Dry Circuit to 3 Amp. Series
Non-Welded BR12 — Welded BR13

Contacts: 2 and 3 amp., DPDT • **Mil Spec:** MIL-R-5757 • **Bounce Time:** 2 ms max. @ rated load • **Vibration:** 30g, 38-2000 Hz • **Shock:** 50g, 11 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations min. @ rated load, 125°C • **Drop Out:** 10% min. of Max. pull-in • **Mounting Types:** flange • **Terminal Styles:** plug-in, solder hook, 3″ printed circuit leads.

Nominal Coil Voltage		6 VDC	12 VDC	26.5 V DC	115 VDC
Pull-in Voltage (max) @ 25°C		3.0 VDC	6 VDC	13 VDC	57.5 VDC
Pull-in Voltage (max) @ 125°C		4.4 VDC	8.4 VDC	18.0 VDC	79 VDC
Type	Oper. & Rel. Time (max)	Coil Res. ± 10% @ 25°C	Coil Res. ± 10% @ 25°C	Coil Res. ± 10% @ 25°C	Coil Res. ± 10% @ 25°C
BR12, 12P/BR13,	5 ms	36	140	675	12K
BR12H/BR13H	6 ms	85	350	1600	28K
BR12K/BR13K	15 ms	220	850	4000	40K max.

Ultra-Sensitive "Tall Can" Models: BR12H, BR13H, (3 amps), BR12K, BR13K (2 amps)

BR7, BR19 RELAYS

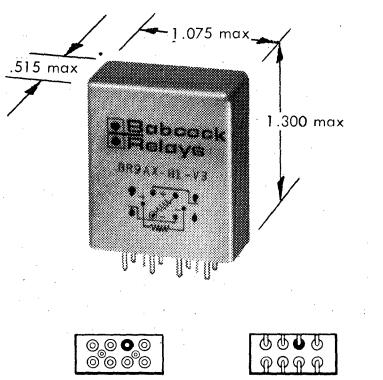


SUBMINIATURE RELAYS — Dry Circuit to 10 Amp. Series
High Reliability — Non-Welded BR7 — Welded BR19

Contacts: 10 amp., BR7X/BR19X; 5 amp., BR7Y/BR19Y; DPDT • **Mil Spec:** MIL-R-5757 • **Vibration:** 30g, 38-2000 Hz • **Shock:** 50g, 11 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations min. @ rated load, 125°C • **Bounce Time:** 2 ms max. @ rated load • **Drop Out:** 10% min. of max. pull-in • **Mounting Types:** flange, bracket • **Terminal Styles:** plug-in, solder hook, 3″ printed circuit leads.

Nominal Coil Voltage		6 V DC	12 V DC	26.5 V DC	115 V AC, AF
Pull-in Voltage (max.) @ 25°C		3.0 VDC	6 VDC	13 VDC	57.5 VAC
Pull-in Voltage (max.) @ 125°C		4.4 VDC	8.4 VDC	18.0 VDC	79 VDC
Type	Oper. & Rel. Time (max)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C (ohms)	Coil Res. ±10% @ 25°C AF (ohms)
BR7X/BR19X	7 ms	16	65	300	1.4K AC
BR7Y/BR19Y	8.5 ms	50	190	900	3.8K AC

BR9, BR20 RELAYS



(BR9 & BR20B only)

MAGNETIC LATCHING RELAYS — Dry Circuit to 10 Amp. Series
Non-Welded BR9 — Welded BR20

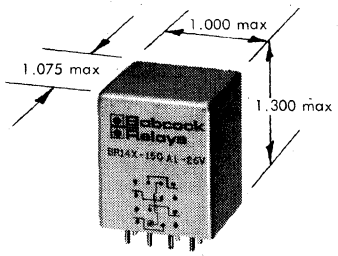
Contacts: 10 amp., DPDT • **Mil Spec:** MIL-R-5757 • **Vibration:** 30g, 38-2000 Hz • **Shock:** 50g, 11 ms • **Temp. Range:** —65°C to +125°C • **Bounce Time:** 2 ms max. @ rated load • **Life:** 100,000 operations min. @ rated load, 125°C • **Mounting Types:** bracket, flange • **Terminal Styles:** plug-in, solder hook, 3″ printed circuit leads.

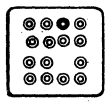
Nominal Coil Voltage		6 V DC	12 V DC	26.5 V DC	115 V DC
Latch/Reset Volt.(max.) @ 25°C		3.0 VDC	6 VDC	13 VDC	57.5 VDC
Latch/Reset Volt.(max.) @ 125°C		4.4 VDC	8.4 VDC	18.0 VDC	79 VDC
Type	Oper. Time (max)	Coil Res. ±10% Ω @ 25°C	Coil Res. ±10% Ω @ 25°C	Coil Res. ±10% Ω @ 25°C	Coil Res. ±10% Ω @ 25°C
BR9AX BR20AX	10ms *	30	120	600	10,000
BR9BX, BR20BX	10ms	65	250	1200	20,000

Note: All data for BR9 & BR20 (except Type B) are for each coil separately.

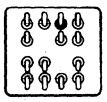
BABCOCK PRECISION RELAYS

BR14, BR18 RELAYS





(BR18 only)



(BR14 & BR18B only)

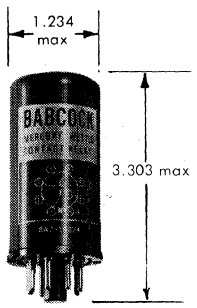
4PDT RELAYS — Dry Circuit to 10 Amp. Series
Non-Latching BR14 — Latching BR18

Contacts: 10 amp., 4PDT • **Coil Operations:** DC-60 and 400 Hz; AC—available • **Mil Spec:** MIL-R-5757 • **Vibration:** 30g, 38-2000 Hz • **Shock:** 50g, 11 ms • **Temp. Range:** —65°C to +125°C • **Life:** 100,000 operations min. @ rated load, 125°C • **Bounce Time:** 2 ms max. @ rated load • **Drop Out:** 10% min. of max. pull-in (BR14 only) • **Mounting Types:** 4-hole bracket • **Terminal Styles:** plug-in, solder hook.

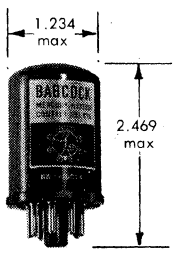
Nominal Coil Voltage		6 VDC	12 VDC	26 VDC	115 VDC	115 VAC, AF
Pull-in Voltage (max.) @ 25°C		3.0 VDC	6 VDC	13 VDC	57.5 VDC	57.5 VAC
Pull-in Voltage (max.) @ 125°C		4.4 VDC	8.4 VDC	18.0 VDC	79 VDC	79 VAC
Type	Oper. & Rel. Time (max).	Coil Res. ±10% @ 25°C	Coil Res. ±10% @ 25°C	Coil Res. ±10% @ 25°C	Coil Res. ±10% @ 25°C	Coil Res. ±10% @ 25°C
BR14Y	8.5 ms	22	85	400	7000	1500 AC
BR14W	8.5 ms	16	65	300	5500	1300 AC
BR14X	7.5 ms	8	32	150	2750	650 AC
BR18AX,	10ms	15	60	300	5K	—
BR18BX	10ms	37	125	600	10K	—

NOTE: All data for BR18 (except Type A) are for each coil separately.

BW SERIES



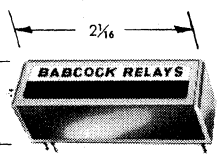
BW-2



BW-3



BW-4



BW-5

MERCURY-WETTED CONTACT RELAYS
Form "C" Non-Bridging

	BW-2	BW-3	BW-4	BW-5
Coil Resistance (ohms)	2 thru 25K	275 thru 14K	65 thru 24K	115 thru 1950
Maximum power dissipation @ 35°C (watts)	2.0	1.5	1.0	1.7
Contacts	1 form C; SPDT (break-before-make)	1 form C; SPDT (break-before-make)	1 form C; SPDT (break-before-make)	1 form C; SPDT (break-before-make)
Contact rating				
Amperes (max)	2.0	2.0	2.0	2.0
Volts (max)	500	500	500	500
Va (max) with contact protection	100.0	100.0	100.0	100.0
Adjustment				
Single side stable*				
Must operate power (Max. Sensitivity)	3.7 mW	6.3 mW	20 mW	20 mW
Must release power Bi-stable**	.1 mW	.2 mW	.8 mW	.8 mW
Must release power	±1.2 mW	±2.0 mW	±6 mW	±6 mW
Chopper adjustment	Relays are adjusted to follow 60 Hz sinusoidal AC current with approximately equal dwell on the fixed contacts. Available on models BW-2 and BW-3 only.			
Contact resistance				
Typical (milliohms)	25	25	25	25
Maximum (milliohms)	40	40	40	40
Dielectric strength	1000 volts RMS	1000 volts RMS	1000 volts RMS	1000 volts RMS
Insulation Resistance***	10,000 MΩ min.	10,000 MΩ min.	10,000 MΩ min.	10,000 MΩ min.
Coil temperature rise per watt of power dissipation	15°C	20°C	40°C	40°C

*The permanent magnets are adjusted so that the relay will release (open its front contact) when the current through its coil is reduced to less than the 'must release' value.

**The permanent magnets are adjusted to hold the armature in the position to which it was last operated until sufficient current of opposite polarity is applied.

***Special Order

Write today for detailed information describing Babcock precision relays.

BABCOCK RELAYS • A DIVISION OF BABCOCK ELECTRONICS CORPORATION

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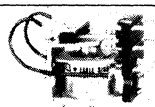
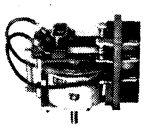
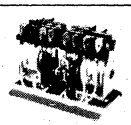
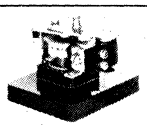
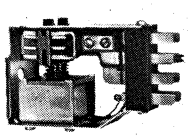
General Purpose And Medium Power Relays

The quality control and value engineering behind Eagle relays are your assurance of reliability and maximum life expectancy. Their operating characteristics exceed those of other relays in their class. Many options are available in contact materials, ratings, coils, and electrical characteristics within the economical area of standard, catalog items. In addition, Eagle can fulfill special requirements. Besides standard slotted solder lug terminals, printed circuit and 3/16" disconnect terminals are available. Contacts on the general purpose and medium power relays are silver cadmium oxide; all 5 Amp and 10 Amp contacts are gold flashed. Dust covers and hermetic sealing are available for all units. Write for your copy of complete, new 16-page, color relay catalog.

	Type and Description	Contact Arrangement	Contact Rating	Size and Weight	Pull-In Speed	Drop-Out Speed
	**20AA Economy Open Type** for AC, DC, and Plate Circuit	SPDT DPDT 3PDT	5A and 10A @ 115 Vac	1⅞" x 1 7/32" x 1½" 2 ounces	22 ms avr.	12 ms avr.
	**20BA Economy Open Type** Sensitive Plate Circuit	SPDT	5A @ 115 Vac	1⅞" x 1 5/16" x 1½" 2 ounces		
	**22AP Enclosed Plug-In** with 8 and 11 pins for AC, DC, and Plate Circuit	SPDT DPDT (8 pin) 3PDT (11 pin)	5A and 10A @ 115 Vac	1⅜" x 2⅛" x 1⅜" 3 ounces	22 ms avr.	12 ms avr.
	**25AA Open Type** for AC, DC, and Plate Circuit	SPDT DPDT 3PDT	5A and 10A @ 115 Vac 5A-1/10 HP @ 115 VAC 10A-⅛ HP @ 115 Vac ¼ HP @ 230 Vac ½ HP @ 230 Vac	1 7/8" x 1 9/32" x 1½" 2 ounces	22 ms avr.	12 ms avr.
	**25AB Open Type** Printed Circuit for AC, DC, and Plate Circuit	SPDT DPDT 3PDT	5A and 10A @ 115 Vac 5A-1/10 HP @ 115 Vac 10A-⅛ HP @ 115 Vac ¼ HP @ 230 Vac ½ HP @ 230 Vac	2 7/32" x 1 9/32" x 1½" 2 ounces	22 ms avr.	12 ms avr.
	**25BL Dual Latcher** for AC, DC	2PDT 4PDT 6PDT	5A and 10A @ 115 Vac	2⅞" x 2¼" x 1½" 4.5 ounces	22 ms avr.	12 ms avr.
	**25PD Medium Power** 25 Amp Double Break for AC, DC	SPST-NO-DB	15A @ 115/230 Vac 25A @ 115/230 Vac 1½ HP @ 115/230 Vac	2 3/32" x 1 9/32" x 1 27/32" 2¾ ounces	50 ms max.	30 ms max.
	**25PS Medium Power** 20 Amp for AC, DC	SPDT	20A @ 115/230 Vac 1 HP @ 115/230 Vac	2¼" x 1 9/32" x 1 13/16" 3 ounces	50 ms max.	30 ms max.
	**LA57 Power Relay.** Ideal for Tungsten Lamploads.	DPDT Double Break	15A Tungsten Lampload @ 120 VAC 240 A inrush 50 A Res @ 120 VAC 30 A Res @ 240 VAC	3¼" x 1⅝" x 2¼" 12 ounces	14 ms	16 ms

NOTE: Over 3,000 types of General Purpose and Medium Relays are available from basic components. For complete description and specifications, write to Eagle Signal Division, E. W. Bliss Company, Federal Street, Davenport, Iowa.

GW Eagle Signal Division
E.W. Bliss Company
A GULF + WESTERN COMPANY

Automatic Controls

MINIATURE REED RELAYS

CONTACT RATINGS

	FORM A & B	FORM C
Contact Material	Rhodium	Rhodium
Maximum Voltage (Volts)	50 VDC, 150 VAC	30 VDC
Maximum Current	Switch, .375 amp Carry, 2.5 amps	.100 amp
Maximum Power (Watts, DC)	6 watts	3 watts
Resistive or properly suppressed (VA, AC)	10 VA	
Maximum Resistance		
Initial	100 milliohms	150 milliohms
End-of-life	2 ohms	2 ohms
Peak Breakdown Voltage	300 volts	250 volts
Life & Reliability		
At Rated Load	20 x 10^6 operations	20 x 10^6 operations
Dry Circuit	500 x 10^6 operations	500 x 10^6 operations

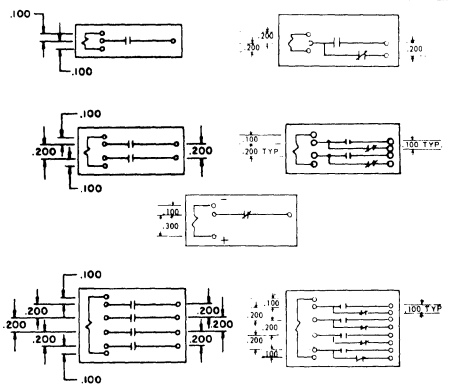
More sensitive coils are available — 3v and 48v coils are also available.

OPERATING PARAMETERS

Speed	Depending upon sensitivity selected and number of poles, the speed of miniature size relays is from 1 msec to 2½ msec, including contact bounce and coil time.
Insulation Resistance	
Coil to ground	50 megohms (min)
Coil to contact	500 megohms (min)
Temperature Range	−50°C to +105°C
Vibration	10G @ 2000 cycles/sec (open or closed)
Shock	15G (min)

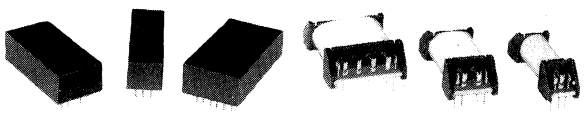
COIL DATA — 941-947

WIRING DIAGRAMS



Other coils available for reduced costs:

	1 Pole	2 Pole	3 Pole
6V	225 Ohms 350	210 Ohms 425	90 Ohms 140
12V	900 1400	850 1300	350 550
24V	3600 5600	3400 5200	1400 2200



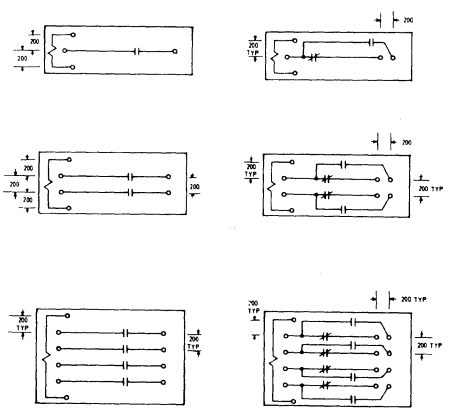
Part Numbers Open Form A	Open Form C	Encapsulated Form A	Encapsulated Form C	Rated VDC	Must Operate VDC†	Max. VDC	Must Release VDC†	Nom. MA	Resistance Ohms†
1 POLE									
941-0101	941-3101	947-0101	947-3101	6	4.8	12	0.5	11	550
941-0102	941-3101	947-0101	947-3102	12	9.6	24	1.0	5.5	2200
941-0103	941-3103	947-0103	947-3103	24	19.2	48	2.0	2.7	8800
2 POLES									
941-0201	941-3201	947-0201	947-3101	6	4.8	12	0.5	11	550
941-0202	941-3202	947-0202	947-3102	12	9.6	24	1.0	5.5	2200
941-0203	941-3203	947-0203	947-3103	24	19.2	48	2.0	2.7	8800
4 POLES									
941-0401	941-3401	947-0401	947-3101	6	4.8	12	0.5	27	225
941-0402	941-3402	947-0402	947-3102	12	9.6	24	1.0	13	900
941-0403	941-3403	947-0403	947-3103	24	19.2	48	2.0	6.5	3600
1 FORM B **									
941-2201		947-2201		6	4.8	10.5	0.5	18	325
941-2202		947-2202		12	9.6	21.0	1.0	9	1300
941-2203		947-2203		24	19.2	42.0	2.0	4.5	5200

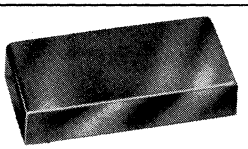
**Caution: Coil voltages in excess of the specified maximum voltages may cause reclosure of contacts.

Many contact combinations are possible combining form A, B, and C, contacts in one relay. While no such combinations are shown in this bulletin, they are readily available. Your inquiry is welcomed.

COIL DATA — 942-948

WIRING DIAGRAMS





Part Numbers Open	Encapsulated	Rated VDC	Must Operate VDC†	Max. VDC	Must Release VDC†	Nom. MA	Resistance Ohms†
1 POLE — FORM A							
942-0101	948-0101	6	4.8	12	0.5	8	750
942-0102	948-0102	12	9.6	24	1.0	4	3000
942-0103	948-0103	24	19.2	48	2.0	3	7500
2 POLES — FORM A							
942-0201	948-0201	6	4.8	12	0.5	15	400
942-0202	948-0202	12	9.6	24	1.0	7.5	1600
942-0203	948-0203	24	19.2	48	2.0	3.7	6400
4 POLES — FORM A							
942-0401	948-0401	6	4.8	12	0.5	24	250
942-0402	948-0402	12	9.6	24	1.0	12	1000
942-0403	948-0403	24	19.2	48	2.0	6	4000

† Values shown measure at 25°C.

CONTACT RATINGS	FORM A & B	FORM C
Contact Material	Rhodium	Rhodium
Maximum Voltage (Volts)	150 VDC, 250 VAC	250 VDC
Maximum Current	Switch, 1.0 amps Carry, 6 amps	.250 amps 2.5 amps
Maximum Power (Watts, DC)	25 watts	10.0 watts
Resistive or properly suppressed (VA, AC)	40 VA	5.0 VA
Maximum Resistance		
Initial	50 milliohms	200 milliohms
End-of-life	2 ohms	2 ohms
Peak Breakdown Voltage	500 volts	500 ohms
Life & Reliability		
Aat Rated Load	20 x 10^6 operations	5 x 10^6 operations
Dry Circuit	500 x 10^6 operations	500 x 10^6 operations

OPERATING PARAMETERS

Speed	Depending upon sensitivity selected and number of poles, the speed for standard size relays is from 2½ msec to 6 msec, including contact bounce and coil time.
Insulation Resistance	
Coil to ground	100 megohms (min)
Coil to contact	1000 megohms (min)
Temperature Range	−50°C to +105°C
Vibration	10G @ 10-55 cycles/sec (open or closed)
Shock	15G (min)

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COOK ELECTRIC
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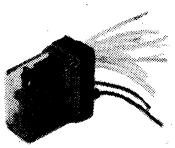
Automatic Controls INDUSTRIAL RELAYS

ADVANCED DESIGN, FOUR POLE DOUBLE THROW CONTACT WITH FULL 10 AMP CAPACITY . . . REQUIRES ⅓ LESS VOLUME, 20% LESS MOUNTING SPACE



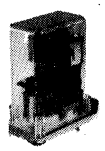
TYPE 811
GENERAL PURPOSE

This precisely engineered relay offers you the advantage of a four pole, double throw contact arrangement with full 10 ampere capacity in a dust type enclosure,

Quick disconnect terminals, .110 inches, are standard and a mating socket is also available for plug-in applications.

A manual operator mounted in the cover is an optional feature for those interested in trouble shooting circuits by means of contact closure. A pilot light can be supplied to indicate power to the relay coil.

Adequate spacing: ⅛ inch through air and ¼ inch over the surface is provided to meet all UL and CSA requirements for 150 volt applications. (UL listed. File No. E 43328).



TYPE 815
MECHANICAL LATCH RELAY

Another unique relay development from Cook Electric, combining maximum efficiency with new economy PLUS . . . the new mechanical latch system which provides a continual locked-in power source without constant control power.

No overlap of contacts . . . all contacts actuated by single armature; Lexan latch pawl gives 20 million operations minimum; Both operate and reset coils have separate termination for ease of circuit design; Mounting through chassis cut out, brackets or socket; Quick connect terminals are standard; Four pole, double throw contact with full 10 ampere capacity.

The most practical applications for the mechanical latch relay are as a memory device to monitor circuit functions, and as a process control device applied to a sequence of events.



TYPE 818
ADJUSTABLE TIME DELAY

The addition of a solid state timing module into the widely acclaimed Cook Electric 811 relay package yields an outstanding time delay relay—Type 818—to round out a distinguished family of industrial, dust-cover, plug-in relays.

Cook Electric's new adjustable time delay relay comes in three timing ranges, to meet your specific applications.

Timing Range	Adjustment (Part Nos.) Knob	Scw'driver
0.2 — 2.2 seconds	818-0001	818-0006
2.0 — 22.0 seconds	818-0002	818-0007
20.0 — 200.0 seconds	818-0003	818-0008

These units have built-in transient protection which are good for 1000 volt AC peak for a duration of ½ cycle (60 CPS), and a mechanical life of 20 million operations at no load.

COIL DATA Coil Current — 10MA during timing
45MA after timing

Repeat Accuracy ±3%

SPECIFICATIONS

CONTACT ARRANGEMENT
4 Pole double throw
CONTACT RATING
10 Amp @ 120 VAC Resistive
CONTACT MATERIAL
Silver cadmium oxide
COILS
Available for 6, 12, 24, 48 and 120V 60 Hz or DC (240 VAC - 811 only)
Type 818 - 115 VAC only
Epoxy encapsulated

COIL POWER
811
3.3 VA AC - 1.5 watts D.C.
815
3 VA AC - 1.5 watts D.C.-Operate
5 VA AC - 2.3 watts D.C.-Release
OPERATING VOLTAGE
Both AC and DC coils will withstand 110% rated voltage continuously. AC picks up 85% of nominal or less. DC picks up 80% of nominal or less
OPERATE & RELEASE TIME
15 milli-seconds nominal

LIFE
Mechanical—20,000,000 operations
Electrical —500,000 at 10 amps, 120V AC resistive
ENCLOSURE
Clear polycarbonate dust cover
AMBIENT
—20°C to 60°C
DIELECTRIC
1500V RMS
SIZE
Overall—Approximately 1⅜"x2⅞"x 2⅛" (Depending on model)

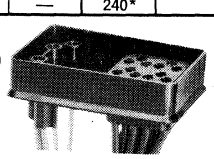
WEIGHT
811 5 oz. **815** 6.5 oz. **818** 7.5 oz.
MOUNTING
Plug-in or panel
RECEPTACLES
Contacts—AMP P/N 61078-1
Coils—AMP P/N 60527-1
SOCKETS
P/N 960-0500
P/N 960-0700

COIL AND OPERATING CHARACTERISTICS — TYPE 811 AND 815.

Part Numbers DC Operation 811	815	Nominal Coil Voltage	DC Operation — Continuous Duty: 811 Coil Resistance (Ohms) ±10% @ 20°C	811 Coil Nominal Coil Current (MA)	815 Oper. & Reset Coil Coil Resistance (Ohms) ±10% @ 20°C	815 Oper. & Reset Coil Nominal Coil Current (MA)	AC (60 Hz) — Continuous Duty: 811-815 Operate Coil Nominal Coil Current (MA)	811-815 Operate Coil Coil Resistance (Ohms) ±10% @ 20°C	811-815 Operate Coil Nominal Impedance @ 60Hz (Ohms)	815 Reset Coil Coil Resistance (Ohms) ±10% @ 20°C	815 Reset Coil Nominal Impedance @ 60Hz (Ohms)	815 Reset Coil Nominal Coil Current (MA)	Part Numbers AC Operation 811	815
811-0001	815-0001	6	24	250	16	375	560	2.5	10.7	2.5	7.2	840	811-0011	815-0011
811-0003	815-0003	12	96	125	64	187	280	10	43	10	28.6	420	811-0013	815-0013
811-0005	815-0005	24	385	62.5	256	93	140	40	172	40	114	210	811-0015	815-0015
811-0007	815-0007	48	1550	31	1000	48	70	160	688	160	456	105	811-0017	815-0017
811-0009	815-0009	120	9600	12.5	6400	18.7	28	1000	4300	1000	2855	42	811-0019	815-0019
—	—	240*			—	—	14	4000	17200	4000	11400	21	811-0021	815-0021

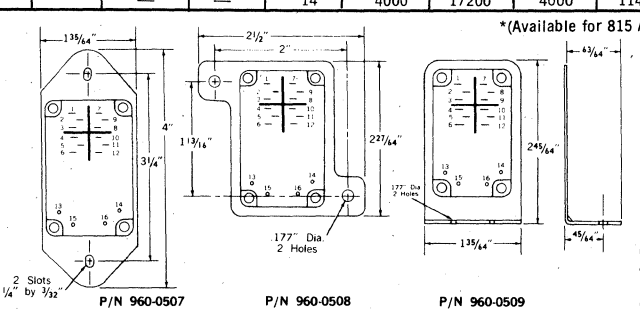
*(Available for 815 AC only).

960-0500



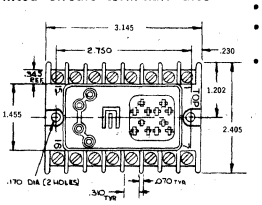
SOCKET
The molded self-extinguishing nylon socket is easily attached to a mounting bar or a panel cut-out. Two #8 screws are used for mounting in either case. Pre-terminated wires are brought to the socket and easily inserted into the housing. These may be easily removed with a simple tool if a wiring change is required, either during assembly or in the field. The relay is inserted or removed without disturbing the wiring.

The relay is engaged by the walls of the housing, making the relay secure—no chance for it to "wobble" out due to normal vibration. No extra clamping devices are required.



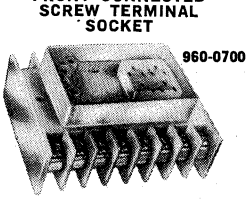
P/N 960-0507 P/N 960-0508 P/N 960-0509

MOUNTING
The 811 relay may be mounted directly to the panel by either a mounting bracket or socket. Wire wrap, termi point and printed circuit terminals also available.

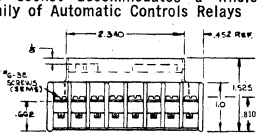


FRONT CONNECTED SCREW TERMINAL SOCKET

960-0700



FEATURES
- Nylon Construction (prevents breakage)
- Captive Pressure Plates
- Wiring without removal of Relay
- All wiring remains on one plane
- Continuous end-to-end mounting
- Accommodates up to two #14 wires per terminal
- One socket accommodates a whole family of Automatic Controls Relays



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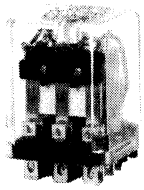
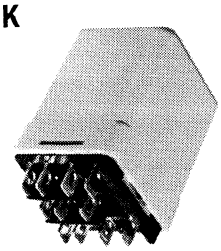
Automatic Controls INDUSTRIAL RELAYS

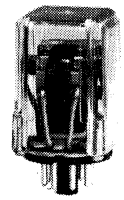
NEW INDUSTRIAL RELAYS from COOK



TYPE 880
General Purpose Relay
3PDT, 10 Amp Contacts

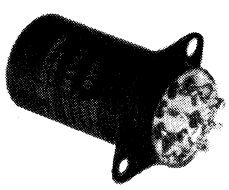


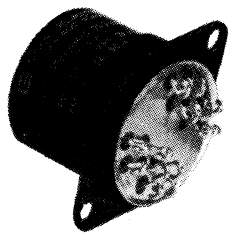
TYPE 886
Time Delay Relay
Fixed or Adjustable

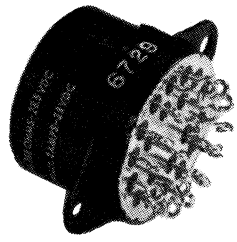


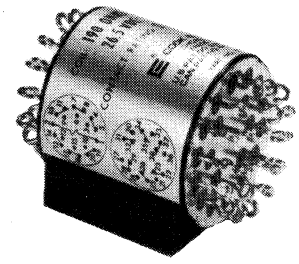
TYPE 821-822
Series Sensitive Relay
20 MW-SPDT, DPDT
AC and DC Coils

MICROPOISE INDUSTRIAL RELAYS — TELEPHONE & MILITARY TYPE RELAYS









The Micropoise line of relays brings you the ultimate in packaging density, contact reliability and minimum coil power requirements. Available in two, four, six and twelve pole double throw configurations, the Micropoise line offers the design engineer the right relay for any application demanding adherence to MIL-R-5757.

A simple efficient solenoid motion actuates the armature without rotating parts, fragile glass bead insulators or overstressed spring members. Direct linear contact motion makes wider contact gaps and more wipe possible.

Coils are hermetically sealed from all other parts of the relay where intermediate current and low level current requirements exist.

Standard contact material is palladium for general purpose 2 ampere switching circuit applications. For intermediate current through full load (2 ampere @ 28VDC) a contact material of palladium with a gold alloy overlay is standard. Gold alloy (68% Au/26% Ag/6% Pt) contacts are used for dry circuit conditions.

For nominal coil voltage of 26.5VDC all relays are adjusted to pick-up at 14VDC maximum at 20°C, assuring operation within specifications at —65°C and 125°C. By standardizing on these five basic types, all with three distinct contact ratings, it is possible to offer shorter lead times and lower costs. All relays are available with other coil ratings, mounting methods and plug-in configurations.

MOUNTINGS

Various types of mounting arrangements can be adapted to any of the Micropoise relays. Send us your requirements and a prompt quotation will be forwarded to you.

Mating Socket		
Mfg.	**P/N**	**Micropoise Type**
Amphenol	77-854	LC
Armel	HR Series	LB
Armel	HRW Series	LA

HEADERS

Headers, potted with epoxy resin, can be supplied with leads number coded and cut to length.

STANDARD COIL DATA

Micropoise Type	Cook P/N	Contact Arrangement	Contact[1] Rating Resistive	Nominal Coil Voltage DC	Coil[2] Resistance	Diam. Max.	Height Max.
LA-2	721-0101	2PDT	H	26.5	400	.635	1.260
	721-0102	2PDT	M	26.5	400	.635	1.260
	721-0103	2PDT	L	26.5	400	.635	1.260
LB-4	722-0001	4PDT	H	26.5	300	1.015	1.010
	722-0002	4PDT	M	26.5	300	1.015	1.010
	722-0003	4PDT	L	26.5	300	1.015	1.010
LC-4	723-0101	4PDT	3	26.5	260	1.200	.950
	723-0102	4PDT	M	26.5	260	1.200	.950
	723-0103	4PDT	L	26.5	260	1.200	.950
LC-6	725-0101	6PDT	H	26.5	260	1.200	.950
	725-0102	6PDT	M	26.5	260	1.200	.950
	725-0103	6PDT	L	26.5	260	1.200	.950
LC-12	726-0001	12PDT	H	26.5	190	1.200	1.165
	726-0002	12PDT	M	26.5	190	1.200	1.165
	726-0003	12PDT	L	26.5	190	1.200	1.165

1. H—2A (α), 28VDC
M—10^{-3} to 0.3A (α), 28VDC—Hermetically sealed coils
L—10^{-5} to 10^{-3}A (α), < 0.050VDC—Hermetically sealed coils
2. Coil resistance ±10% at 20°C
3. 3A (α), 28VDC

SPECIAL COILS

Various coils have been designed to meet circuit requirements. Some of these are listed below. If you have other specifications, a design can be generated to satisfy your needs.

Volts DC	Resistance	Micropoise Type	Height Max.
12	75	LC-6	.950
110	7000	LC-6	1.200
26.5	400	LC-6	1.200
26.5	280	LA-2	1.045

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C. P. CLARE & CO.

3101 PRATT BOULEVARD, CHICAGO, ILLINOIS 60645 ■ PHONE: (312) 262-7700

MERCURY-WETTED CONTACT RELAYS

Input analog switching, output power conversion switching, solid state input and output buffering.

- Life: 22 x 10^9 operations.
- Low, constant contact resistance.
- No contact bounce.
- Switching speeds as fast as 1 millisecond.
- Versatile contact load capabilities . . . low level to 250 va.
- High power gain . . . up to 5,000 with no noise sensitivity.
- Wide range of sensitivities: 2.0 mw to 550 mw.

TYPE HG 1-FORM D CONTACT (SPDT BRIDGING) 5A, 500 V. MAX.*

Clare Part Number	Nominal Resistance (Ohms)	Base Figure (Next Page)	Must Opreate Current (ma-dc)	Must Release Current (ma-dc)	Must Operate Voltage (vdc)	Maximum Voltage (vdc)
HG-1001	2500	1	10	4.4	28	87
HG-1002	4000	1	7.5	3.3	33	110
HG-1003 Wdg.1	700	2	32	14	25	46
HG-1003 Wdg.2	3300	2	13	4.9	47	99
HG-1004	700	1	19	8.3	15	45
HG-1011	11000	1	5.0	2.2	61	180
HG-1012	130	4	37	16	5.4	20
HG-1017	4000	4	7.5	3.3	33	110
HG-1019	40	4	67	30	2.9	11
HG-1026	500	1	20	8.7	11	39
HG-1043	1000	1	15	6.6	17	55

TYPE HG 2A 2-FORM D CONTACTS (DPDT BRIDGING) 5A., 500 V. MAX.*

HG2A-1001	5000	2A1	11	4.7	62	142
HG2A-1002	700	2A2	31	13	24	53
HGSA-1003	315	2A2	44	19	15	36
HG2A-1004	5000	2A2	11	4.7	62	142
HG2A-1013	10000	2A2	8.6	3.6	94	200
HG2A-1015	1250	2A2	22	9.3	30	71

TYPE HG 3A 3-FORM D CONTACTS (3PDT BRIDGING) 5A., 500 V. MAX.*

HG3A-1003	5000	3A1	11	4.7	62	142
HG3A-1004	315	3A1	44	19	15	36
HG3A-1006	500	3A1	35	15	19	45
HG3A-1008	1250	3A1	22	9.3	30	71

TYPE HG4A 4-FORM D CONTACTS (4PDT BRIDGING) 5A., 500 V. MAX.*

HG4A-1006	10000	4A1	8.6	3.7	94	200
HG4A-1007	1400	4A1	23	9.9	35	75
HG4A-1011	390	4A1	42	18	18	40

* 250 VA max. with required contact protection All values at 25°C. Resistance values ±10%.

TYPE HGS 1-FORM D CONTACT (SPDT BRIDGING) 2A., 500 V. MAX.**
(Higher Speed, Greater Sensitivity than Type HG)

SINGLE SIDE STABLE

HGS-1005	4000	S1	1.25	0.25	5.5	90
HGS-1006	2500	S1	1.4	0.17	3.9	70
HGS-1009	600	S1	2.9	0.69	1.9	34
HGS-1014	1000	S1	2.2	0.38	2.4	44
HGS-1016	7000	S1	0.87	0.14	6.7	118
HGS-1017	11000	S1	0.72	0.12	8.7	148
HGS-1018	500	S1	2.9	0.50	1.6	31
HGS-1048	4000	S4	2.0	1.0	8.8	90
HGS-5015***	1000	S1	2.2	0.38	2.4	44
HGS-5016***	25000	S1	0.52	0.09	14.3	224

BI-STABLE DOUBLE WOUND COIL

HGS-1019	1100/1100	S3	±1.8 - 1.8	—	±2.2 - 2.2	47 - 47
HGS-5002	135/135	S3	±4.5 - 4.5	—	±.67 - .67	47 - 47
HGS-5013	1100/1100	S3	±1.8 - 1.8	—	±2.2 - 2.2	47 - 47

CHOPPER

HGS-1004	600	S1	—	—	6.3 vac-rms	—

** 100 VA with required contact protect. All values at +25°C. Resistances ±10%.
*** Form C contact action.

FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

TYPE HG



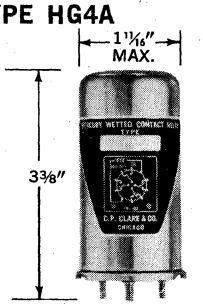
TYPE HG
Octal Plug

TYPE HG2A & HG3A



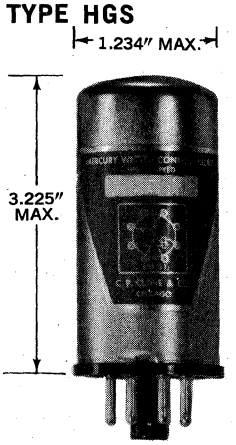
TYPE HG2A & HG3A
HG2A Octal Plug
HG3A 11-Pin Octal style plug.

TYPE HG4A



TYPE HG4A
14 or 20 Pin glass-to-metal plug.

TYPE HGS



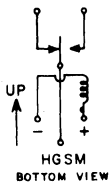
TYPE HGS
Octal Plug.

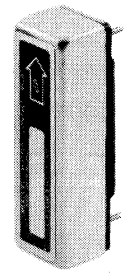
CLARE

Clare Mercury-Wetted Contact Relays for PC Board

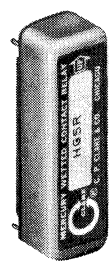
Clare Part Number	Nominal Resistance (ohms)	Schematic	Must Operate Current (ma-dc)	Must Release Current (ma-dc)	Must Operate Voltage (vdc)	Max. Voltage (vdc)
TYPE HGSM: 1-FORM D CONTACT (SPDT BRIDGING) 2A., 500 V. MAX.** IN 1000 SERIES OR 1-FORM C CONTACT (SPDT NON-BRIDGING) 2A., 500 V. MAX.** IN 5000 SERIES.						
SINGLE SIDE STABLE						
HGSM-1001	1425	Single Wound	8.3	1.4	13	53.4
HGSM-1002	940	Single Wound	10.1	1.7	10.5	43.3
HGSM-1003	2400	Single Wound	7.35	1.2	20.6	69.2
HGSM-1005	65	Single Wound	37.4	6.2	2.7	11.4
HGSM-1009	275	Single Wound	17.0	2.8	5.2	23.4
HGSM-1010	450	Single Wound	12.9	2.1	6.4	30.0
HGSM-1011	675	Single Wound	11.6	1.9	8.6	36.7
HGSM-5001	1425	Single Wound	8.3	1.4	13	53.4
HGSM-5002	1950	Single Wound	7.5	1.2	17.6	62.4
HGSM-5010	675	Single Wound	11.6	1.9	8.6	36.7
HGSM-5011	940	Single Wound	10.1	1.7	10.5	43.3
BI-STABLE						
HGSM-1016	#1 1100 #2 1100	Double Wound	±7.25 ±5.7	—	±8.77 ±6.9	46.9 46.9
HGSM-5003	#1 1100 #2 1100	Double Wound	±7.25 ±5.7	—	±8.77 ±6.9	46.9 46.9
HGSM-5020	#1 460 #2 460	Double Wound	±7.8 ±7.8	—	±3.95 ±3.95	30.3 30.3
TWO CAPSULE SINGLE SIDE STABLE						
HGS2M-5006	500	Single Wound	18.3	1.8	10	38.7
TYPE HGSR: 1-FORM D CONTACT (SPDT BRIDGING) 2A., 500 V. MAX. IN 10,000** SERIES OR 1-FORM C CONTACT (SPDT NON-BRIDGING) 2A., 500 V. MAX.** IN 50,000 SERIES.						
SINGLE SIDE STABLE						
HGSR-11111L00	185	Single Wound	14	3.24	2.90	18
HGSR-11111P00	680	Single Wound	7.5	1.5	5.7	35
HGSR-11111T00	2650	Single Wound	3.8	.83	11	68
HGSR-11111W00	9850	Single Wound	2.1	.43	21	125
HGSR-51111L00	185	Single Wound	14	3.24	2.90	18
HGSR-51111P00	680	Single Wound	7.5	1.6	5.7	35
HGSR-51111T00	2650	Single Wound	3.8	.83	11	68
HGSR-51111W00	9850	Single Wound	2.1	.43	21	125
BI-STABLE DOUBLE WOUND COIL						
HGSR-12112P00	340/340	Double Wound	±7.5	—	2.8	24
HGSR-12112W00	4500/4500	Double Wound	±2.1	—	11.0	89
HGSR-52112P00	340/340	Double Wound	±7.5	—	2.8	24
HGSR-52112W00	4500/4500	Double Wound	±2.1	—	11.0	89

** 100 VA max. with required circuit protection. Note: All values at 25°C. Resistances specified are ±10%.

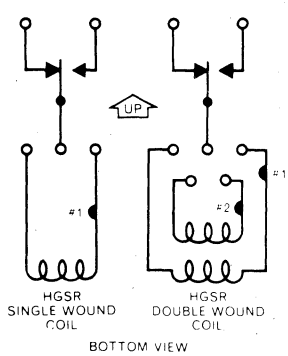




TYPE HGSM
.040" Dia. Pins on
.10" Grid Spacing



TYPE HGSR
.025 D/A. Pins on
.093" Grid Spacing



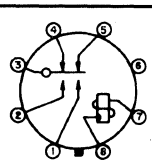


FIG. 1

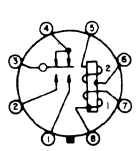


FIG. 2

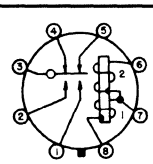


FIG. 3

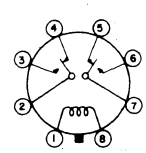


FIG. 2A1

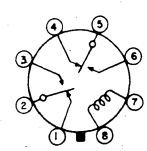


FIG. 2A2

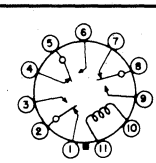


FIG. 3A1

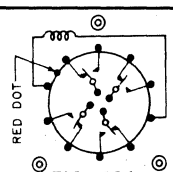


FIG. 4A1

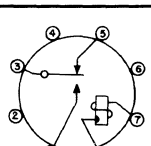


FIG. S1

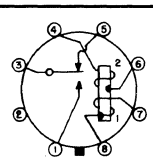


FIG. S3

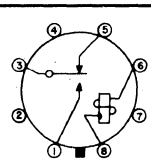


FIG. S4

Positive potential applied to the start of the winding indicated by the symbol ● will close the contacts shown open on the electrical schematics.

FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

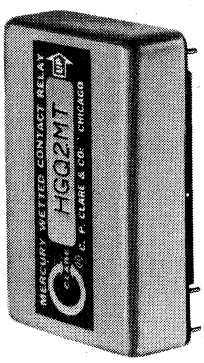
C. P. CLARE & CO.

3101 PRATT BOULEVARD, CHICAGO, ILLINOIS 60645 ■ PHONE: (312) 262-7700

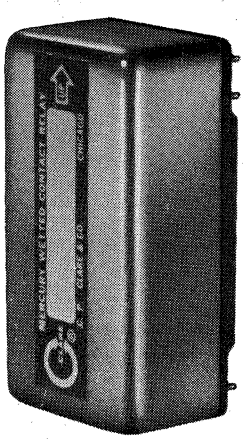
MERCURY-WETTED CONTACT RELAYS
ULTRA HIGH SPEED AND LOW LEVEL



HGQM
.025" Dia. Pins
on .1" Centers.



HGQ2MT
.025" Dia. Pins
on .1" Centers.



HGS2MT
.040" Dia. Pins

	HGQM / HGQ2MT	HGS2MT
• ULTRA HIGH SPEED	750 μs response time at nom. coil power.	2.1 ms response time at nom. coil power.
• MINIATURE FOR PCB MOUNTING	.4 in. high profile.	.75 in. high profile.
• LOW CONTACT RESISTANCE	10-20 milliohms, ±2 over life.	10-50 milliohms, ±2 over life.
• BILLION OPERATION RELIABILITY	1 x 10^9 operations.	20 x 10^9 operations.
• SWITCHES MICROVOLTS OR AMPERES	0 to 1A., 0 to 500V. 100 VA max. w/contact protection.	0 to 2A., 0 to 500V. 100 VA max. w/contact protection.
• HIGH SENSITIVITY	Bi-stable: 175 mw. Single-side stable: 325 mw or 85 mw at reduced dynamic performance.	325 mw.
• LOW NOISE & THERMAL EMF	Less than 5 μv contact noise (minimum equipment resolution), dc to 100K Hz, 3 ms after coil energization. Thermal EMF 15 μv less.	Less than 10 μv contact noise, .06 Hz to 100 KHz, 10 ms after coil energization. Thermal EMF 15 μv or less at 25°C.

TYPE HGQM SINGLE-SIDE STABLE: 1-FORM C CONTACT*

CLARE PART NUMBER	RECOMMENDED NOMINAL VOLTAGE (vdc)	COIL RESISTANCE ±10% (ohms)	MUST OPERATE VOLTAGE (vdc)	MUST RELEASE VOLTAGE (vdc)	MAXIMUM VOLTAGE (vdc)
HGQM5001	6	125	3	0.6	14
HGQM5002	12	435	6	1.25	30
HGQM5003	24	1750	12	2.5	56
HGQM5004	48	6100	24	5.0	110

TYPE HGQM BI-STABLE: 1-FORM C CONTACT*

CLARE PART NUMBER	RECOMMENDED NOMINAL VOLTAGE (vdc)	COIL RESISTANCE ±10% (ohms)	MUST OPERATE VOLTAGE (EITHER WINDING) (vdc)	MUST NOT OPERATE VOLTAGE (EITHER WINDING) (vdc)	MAXIMUM VOLTAGE (ONE WINDING ONLY) (vdc
HGQM5021	6	205/205	3	1.25	19
HGQM5022	12	875/875	6	2.5	39
HGQM5023	24	3000/3000	12	5.0	73

TYPE HGQ2MT: 2-FORM C CONTACTS*

CLARE PART NUMBER	RECOMMENDED NOMINAL VOLTAGE (vdc)	COIL RESISTANCE ±10% (ohms)	MUST OPERATE VOLTAGE (vdc)	MUST RELEASE VOLTAGE (vdc)	MAXIMUM VOLTAGE (vdc)
HGQ2MT5001	6	55.5	3.5	0.6	14
HGQ2MT5002	12	250	7	1.25	30
HGQ2MT5003	24	870	14	2.5	56
HGG2MT5004	48	3500	28	5.0	110

TYPE HGS2MT UNSHIELDED

CLARE PART NUMBER 2 FORM C	2 FORM D	NOMINAL VOLTAGE (dc)	COIL RESISTANCE (ohms ±10%)	MUST OPERATE VOLTAGE (dc)	MUST RELEASE VOLTAGE (dc)
HGS2MT5001	HGS2MT1001	6	130	3.0	0.5
HGS2MT5002	HGS2MT1002	12	520	6.0	1.0
HGS2MT5003	HGS2MT1006	24	2200	12.0	2.0
HGS2MT5004	HGS2MT1009	48	8000	24.0	4.0

TYPE HGS2MT ELECTROSTATICALLY SHIELDED

CLARE PART NUMBER 2 FORM C	2 FORM D	NOMINAL VOLTAGE (dc)	COIL RESISTANCE (ohms ±10%)	MUST OPERATE VOLTAGE (dc)	MUST RELEASE VOLTAGE (dc)
HGS2MT5044	HGS2MT1010	6	130	3.0	0.5
HGS2MT5005	HGS2MT1011	12	520	6.0	1.0
HGS2MT5006	HGS2MT1012	24	2200	12.0	2.0
HGS2MT5010	HGS2MT1013	48	8000	24.0	4.0

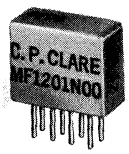
* FORM C AFTER INITIAL BRIDGING AFTER PHYSICAL INVERSION.

FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

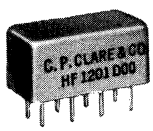
CLARE MILITARY-TYPE (CRYSTAL CAN) RELAYS

Aerospace and ground support equipment, communications, instrumentation, data processing, industrial process control

- Long electrical and mechanical life, under extreme conditions of temperature, shock, vibration, linear acceleration.
- Sensitivities from 40 mw.
- Wide variety of mounting styles.
- Wide range of relay types in addition to those listed.
- Versatile contact capabilities — low level to 10 amp. Gold-plated contact areas, high contact pressures, positive wiping action.



Type MF
L — .500″
W — .230″
H — .400″
Data Sheet 756



Type HF
L — .810″
W — .410″
H — .410″
Manual 701



Type F
L — .800″
W — .400″
H — .900″
(Standard crystal can size)
Manual 701



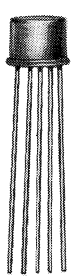
Type PF
L — 1.075″
W — .515″
H — 1.300″
Data Sheet 757

TYPICAL STOCK RELAYS

Relay Type	Part Number	Enclosure	Vibration Resistance
MF	MF1201N00	Plain Case	20g
	MF1202N00	Ear Brackets	20g
	MF1105N00	Side Brackets	20g
HF	HF1201D00	Plain Case	30g
F	RP7630G2	Plain Case	30g
	RP7631G12	Side Plate	20g
	RP7632G1	Ear Brackets	20g
	RP7633G4	Stud — top	15g
	RP7640G1	Stud — side	20g
F	RP7641G2	Plain Case	30g
	RP7641G8	Plain Case	30g
	RP9809G1	Ear Brackets	20g
	RP9817G1	Ear Brackets	20g
	RP9895G3	Side Plate	20g
	RP9896G9	Side Plate	20g
PF	PF1101L00	Plain Case	20g
	PF1102L00	Ear Brackets	20g
	PF1203L00	Ear Brackets	20g

Electrical Characteristics	MF	HF	F	PF
Contact Arrangement	2 Form C (dpdt)			
Contact Rating — High Level	0.5 amp. res. @ 30 vdc, +125°C 150,000 miss-free operations.	2.0 amp. res. @ 28 vdc 1.0 amp. res. @ 115 vdc 100,000 miss-free operations, monitored at every operation for a maximum drop of 1.0% of source voltage.		10.0 amp. res. @ 28 vdc — 100,000 miss-free operations.
Contact Rating — Low Level	Note 1	Note 2	Note 2	
Contact Resistance Before Life	50 milliohms max. @ 6v, 100 ma			10 milliohms max. (measured per MIL-R-5757)
Contact Resistance After Life	100 milliohms max @ 6v, 100 ma			20 milliohms max.
Coil Resistance (ohms) Relays Shown	1500	1250	675	300
Available	30-5500	40-3500	35-10,000	16-4800
Must Operate Sensitivity, Nominal (mw) Relays Shown	125	160	250	550
Available	125	160	40	550
Must operate Voltage dc at 25°C Relays Shown	13.0	14.0	13.5	12.5
Available	5.25-45	5.0-48	3.2-51	3.0-54

Note 1: 10 μa @ 10mv; 150,000 miss-free operations monitored at every operation for a maximum drop of 0.5mv.
Note 2: 10 μa @ 10mv; 100,000 miss-free operations monitored at every operation for a maximum drop of 0.5mv.



TYPE TF TRANSISTOR CASE RELAY — MILITARY OR INDUSTRIAL

- Low level to 1 amp. contact rating.
- 2.0 ms max. operate time.
- 80 g ½ sinewave shock, 11 ±1 ms.
- 30 g to 3000 cps vibration.
- Hermetically sealed welded enclosure.
- 100,000 min. operations at 28 vdc lamp. resistive load.
- Temperature ranges:
  Military: −65°C to +125°C
  Industrial: −55°C to +75°C

Type TF Relays combine the advantages of electromechanical performance (immunity to transients, input-output isolation, positive on-off switching, etc.) with assembly and handling techniques for pcb mounting with transistors and other solid state devices. For complete information, call your Clare sales engineer.

	COIL RESISTANCE OHMS	MUST OPERATE SENSITIVITY (NOMINAL)	MUST OPERATE VOLTAGE AT 25°C
1-FORM C CONTACT	98-2000	100 mw	4.5-18 vdc
2-FORM C CONTACTS	98-2000	130 mw	4.5-18 vdc

FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

C. P. CLARE & CO.
3101 PRATT BOULEVARD, CHICAGO, ILLINOIS 60645 ■ PHONE: (312) 262-7700

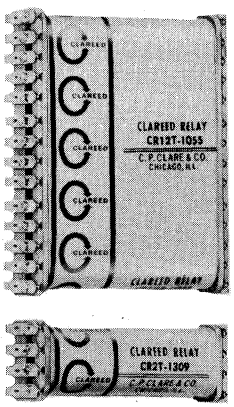
CLAREED® SEALED-CONTACT REED RELAYS

Industrial control, data logging and instrumentation, communication switching, ground control and check-out systems.

- Inherent reliability with no maintenance (contacts sealed in glass).
- Switching speeds in low millisecond range.
- Immunity to transient electrical noise.
- Contact load versatility... low level to 50 va.
- Life: 20 x 10^6 or 100 x 10^6 at full rated load depending on choice of switches.
- One to twelve contacts.
- Packaging for pcb or wired chassis... or as functional pcb assemblies.

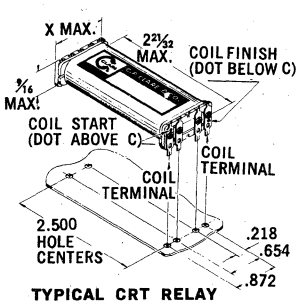
CLARE TYPE CRT

Clare Part No.	Nominal Operating Voltage dc	Must Operate Voltage dc at +25°C	Coil Resistance	Contact Action	Maximum Voltage at +25°	Must Release Voltage at +25°	X Dimension (inches)
CRT-1007	6	4.4	160	1 Form A	20	0.60	5/8
CR2T-1004	6	4.5	88	2 Form A	18	0.54	27/32
CR3T-1005	6	4.6	70	3 Form A	17	0.54	1 1/16
CR5T-1004	6	4.4	40	5 Form A	16	0.48	1 1/2
CR6T-1003	6	4.3	31	6 Form A	15	0.47	1 49/64
CR8T-1002	6	4.2	25	8 Form A	15	0.46	2 13/64
CR12T-1001	6	3.8	14	12 Form A	13	0.40	3 7/64
CRT-1010	12	8.7	600	1 Form A	38	1.20	5/8
CR2T-1006	12	7.3	235	2 Form A	28	0.88	27/32
CR3T-1007	12	7.4	180	3 Form A	28	0.86	1 1/16
CR5T-1007	12	8.7	155	5 Form A	32	0.95	1 1/2
CR6T-1006	12	8.4	120	6 Form A	29	0.92	1 49/64
CR8T-1005	12	8.4	96	8 Form A	29	0.91	2 13/64
CR12T-1004	12	7.5	53	12 Form A	25	0.79	3 7/64
CRT-1013	24	18.0	2500	1 Form A	78	2.5	5/8
CR2T-1010	24	18.0	1400	2 Form A	68	2.2	27/32
CR3T-1011	24	18.0	1070	3 Form A	67	2.1	1 1/16
CR5T-1010	24	19.0	650	5 Form A	63	2.0	1 1/2
CR6T-1009	24	18.0	510	6 Form A	60	1.9	1 49/64
CR8T-1008	24	17.0	380	8 Form A	58	1.8	2 13/64
CR12T-1007	24	16.0	210	12 Form A	50	1.6	3 7/64
CRT-1016	48	35.0	9450	1 Form A	150	4.8	5/8
CR2T-1013	48	36.0	5400	2 Form A	133	4.4	27/64
CR3T-1014	48	38.0	4450	3 Form A	137	4.4	1 1/16
CR5T-1013	48	37.0	2550	5 Form A	124	3.9	1 1/2
CR6T-1012	48	34.0	1900	6 Form A	117	3.8	1 49/64
CR8T-1011	48	32.0	1450	8 Form A	114	3.5	2 13/64
CR12T-1010	48	32.0	900	12 Form A	107	3.3	3 7/64
CRT-1026	24	18.0	1400	1 Form B	55	2.2	27/32
CR2T-1025	24	17.0	690	2 Form B	37	1.2	1 1/16
CR2T-1041	24	17.0	455	1 Form C	33	1.8	1 1/16
CR4T-1009	24	20.0	410	2 Form C	34	1.0	1 1/2
CR6T-1025	24	17.0	235	3 Form C	32	1.1	2 13/64
CR8T-1025	24	19.0	210	4 Form C	31	0.97	3 7/64
CR2T-1058	24	17.0	455	1A and 1B	33	1.8	1 1/16
CR4T-1027	24	20.0	410	2A and 2B	34	1.0	1 1/2
CR6T-1056	24	17.0	235	3A and 3B	32	1.1	2 13/64
CR8T-1040	24	19.0	210	4A and 4B	31	0.97	3 7/64



CONTACT RATING:
1 amp. max., 250 volts max., 15 va max.

PACKAGING:
Coils and contacts have fixed terminals for printed circuit board mounting.



TYPICAL CRT RELAY

BI-STABLE (LATCHING)

CRT-1065	24	17.0/17.0	6400/6400	1 Form A	58	—	27/32
CR2T-1079	24	16.7/16.7	3200/3200	2 Form A	52	—	1 1/16

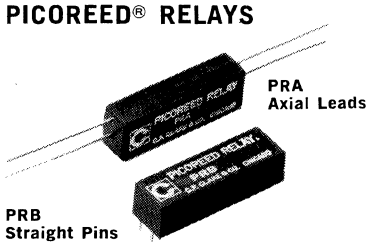
For detail characteristics see Data Sheet 951. * Max. voltage based on 2.4 watt.

FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

CLARE MINIATURE SEALED-CONTACT REED RELAYS

Applications, General Characteristics, Life: See Facing Page

PICOREED® RELAYS

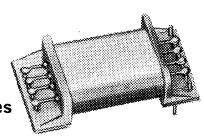


PRA
Axial Leads

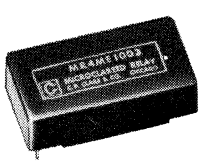
PRB
Straight Pins

High-speed subminiature glass-encapsulated reed relays in molded epoxy modules. Response time, size sensitivity and reliability characteristics provide complete electrical and packaging compatibility with IC solid-state devices. Economical reliable solid-state input-output isolation buffering. Load capability: low level to 10 va. Module sizes:
L — .781"; W — .250"; H — .187"

MICROCLAREED® RELAYS



MRMC
Open-type modules



MRME
Molded Epoxy

(Similar metal-covered relays also available with and without polyurethane fill)

All the advantages of Clareed Relays in one-fifth the size. Switching speeds as low as 500 microseconds — fully compatible with other process-control equipment. Immune to false operation by transients — insensitive to overload transients which would damage solid-state devices. Load capability: low level to 10 va. Sizes:

	MRMC Relays	MRME Relays	MRMD, MRMF
L	1 15/64"	1 19/64"	1.266"
H	11/32"	.385"	.316"
W	See W in Table at Right		

PICOREED® RELAYS

Clare Part Number	Nominal Operating Voltage DC	Must Operate Voltage DC at +25°C	Coil Resistance Ohms ±10% at +25°C	Contact Action	Maximum Voltage at +25°C	Must Release Voltage DC at +25°C
PRA 3010	5*	3.75	387	1 Form A	19	.62
PRB 3010	5*	3.75	387	1 Form A	19	.62
PRA 2010	6	4.3	387	1 Form A	19	.62
PRB 2010	6	4.3	387	1 Form A	19	.62
PRA 2013	12	7.8	1200	1 Form A	34	1.1
PRB 2013	12	7.8	1200	1 Form A	34	1.1
PRA 2016	24	15.7	5380	1 Form A	73	2.2
PRB 2016	24	15.7	5380	1 Form A	73	2.2

*Sensitive relay (available at slight price increase for other voltages).

MICROCLAREED® RELAYS

Clare Part Number	Nominal Operating Voltage DC	Must Operate Voltage DC at +25°C	Coil Resistance Ohms ±10% at +25°C	Contact Action	Max. Voltage at +25°C	Must Release Voltage DC at +25°C	"W"
MRMC-1041	6	4.0	218	1 Form A	14	.29	11/32"
MR2MC-1041	6	4.0	168	2 Form A	14	.36	29/64"
MR3MC-1041	6	4.0	125	3 Form A	14	.37	35/64"
MR4MC-1041	6	4.0	95	4 Form A	13	.35	21/32"
MR5MC-1041	6	4.0	70	5 Form A	12	.49	3/4"
MRMC-1042	12	8.0	790	1 Form A	28	.57	11/32"
MR2MC-1042	12	8.0	635	2 Form A	28	.57	29/64"
MR3MC-1042	12	8.0	510	3 Form A	28	.92	35/64"
MR4MC-1042	12	8.0	410	4 Form A	28	.78	21/32"
MR5MC-1042	12	8.0	285	5 Form A	25	1.0	3/4"
MRMC-1043	24	16.0	3060	1 Form A	55	1.1	11/32"
MR2MC-1043	24	16.0	2580	2 Form A	56	1.4	29/64"
MR3MC-1043	24	16.0	1950	3 Form A	55	1.6	35/64"
MR4MC-1043	24	16.0	1500	4 Form A	54	1.9	21/32"
MR5MC-1043	24	16.0	1070	5 Form A	49	2.0	3/4"
MRMC-1044	48	32.0	12,200	1 Form A	110	2.2	11/32"
MR2MC-1044	48	32.0	9450	2 Form A	106	3.4	29/64"
MR3MC-1044	48	32.0	7450	3 Form A	102	3.3	35/64"
MR4MC-1044	48	32.0	5750	4 Form A	104	3.1	21/32"
MR5MC-1044	48	32.0	4350	5 Form A	98	4.0	3/4"
MRMC-1045	6	4.0	280	1 Form B	8.7	.38	29/64"
MR2MC-1045	6	4.0	125	2 Form B	9.4	.40	35/64"
MR3MC-1045	6	4.0	46	3 Form B	8.8	.36	3/4"
MR4MC-1045	6	4.0	46	2A2B	8.8	.36	3/4"
MRMC-1046	12	8.0	1030	1 Form B	18	.92	29/64"
MR2MC-1046	12	8.0	510	2 Form B	18	1.5	35/64"
MR3MC-1046	12	8.0	170	3 Form B	17	.76	3/4"
MR4MC-1046	12	8.0	170	2A2B	17	.77	3/4"
MRMC-1047	24	16.0	3930	1 Form B	35	1.7	29/64"
MR2MC-1047	24	16.0	1950	2 Form B	38	2.3	35/64"
MR3MC-1047	24	16.0	700	3 Form B	34	1.5	3/4"
MR4MC-1047	24	16.0	700	2A2B	35	1.5	3/4"
MRMC-1048	48	32.0	15,800	1 Form B	67	2.9	29/64"
MR2MC-1048	48	32.0	7450	2 Form B	70	4.5	35/64"
MR3MC-1048	48	32.0	2670	3 Form B	68	3.1	3/4"
MR4MC-1048	48	32.0	2670	2A2B	70	2.9	3/4"
MR2MC-1049	6	4.0	51	1A1B	9.0	.45	35/64"
MR3MC-1049	6	4.0	40	2A1B	9.5	.39	21/32"
MR2MC-1050	12	8.0	210	1A1B	18	.76	35/64"
MR3MC-1050	12	8.0	148	2A1B	17	.66	21/32"
MR2MC-1051	24	16.0	780	1A1B	35	1.4	35/64"
MR3MC-1051	24	16.0	600	2A1B	35	1.3	21/32"
MR2MC-1052	48	32.0	3170	1A1B	70	2.8	35/64"
MR3MC-1052	48	32.0	2310	2A1B	69	2.7	21/32"

* Open-type modules listed. For enclosed type, prefix alters thus: Epoxy molded, MRME: Metal covered, MRMD; metal covered, polyurethane filled, MRMF. "W" dimension of MRME are 1/16" greater than listed. For MRMD and MRMF, comparable dimensions are: 11/32", .372"; 29/64", .472"; 35/64", .572"; 21/32", .672"; 3/4", .772".

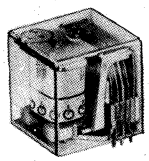
FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

C. P. CLARE & CO.

3101 PRATT BOULEVARD, CHICAGO, ILLINOIS 60645 ■ PHONE: (312) 262-7700

TELEPHONE-TYPE RELAYS

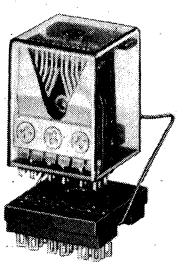
TYPE LB



Direct PCB Mounting, 6 Form C, with Clear Plastic Cover.
For detail characteristics see Data Sheet 552B.

Clare Part No.	Nominal Operating Voltage	Must Operate Voltage	Max. Coil Voltage
LB-0060B00	12	6.9	17.7
LB-0060D00	24	14.4	37.7
LB-0060H00	14	8.4	21.9
LB-0060J00	34	19.0	52.9
LB-0060K00	30	17.6	46.9

TYPE LBP



Plug-in for use with sockets.

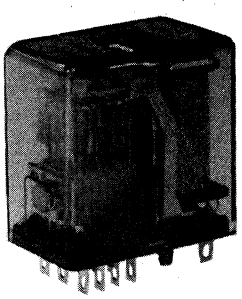
Clare Part No.	Nominal Operating Voltage	Must Operate Voltage	Max. Coil Voltage
LBP-0060D00	24	14.4	37.7
LBP-0060K00	30	17.6	46.9

For detail characteristics see Data Sheet 522B.

ACCESSORIES

Clare Part No.	Description
RP-15450-G5	Socket for Wired Assemblies
RP-15450-G6	Socket for PCB Mounting
RP-15423	14 Relay Mounting Strip—19"
RP-15613	13 Relay Mounting Strip—19"

VARLEY



Direct Plug-in Relay with Clear Plastic Dust Cover.

Clare Part No.	Nominal Operating Voltage dc	Coil Resistance in Ohms ±10%	Contact Action	Contact Rating
VP2CAB12	12	185	2C	Note 1
VP2CAB26	26	700	2C	Note 1
VP2CAB47	47	2500	2C	Note 1
VP2CAB120	120	15000	2C	Note 1
VP2CBB12	12	185	2C	Note 1
VP2CBB26	26	700	2C	Note 1
VP2CBB47	47	2500	2C	Note 1
VP2/HDCAB12	12	185	2C	Note 2
VP2/HDCAB26	26	700	2C	Note 2
VP2/HDCAB120	120	15000	2C	Note 2
VP4CAB12	12	185	4C	Note 1
VP4CAB26	26	700	4C	Note 1
VP4CAB47	47	2500	4C	Note 1
VP4CAB120	120	15000	4C	Note 1
VP4CBB26	26	700	4C	Note 1
VP4CBB47	47	2500	4C	Note 1
VP4CBB120	120	15000	4C	Note 1
VP6MAB12	12	185	6A	Note 1
VP6MAB26	26	700	6A	Note 1
VP6MAB120	120	15000	6A	Note 1
VP6MBB26	26	700	6A	Note 1

Note 1: 1 amp max., 100 volts max., 30 watts.
Note 2: 5 amps max., 220 volts max., 100 watts.

MISCELLANEOUS ITEMS

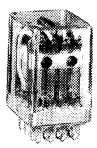
Clare Part No.	Description
RP-15223-5	SOCKET—Printed Circuit TERMINALS—for VP2C Relay
RP-15223	SOCKET—Printed Circuit TERMINALS—for VP4C, VP6M, VP2/HD Relays
RP-15223-1	SOCKET—Solder tab TERMINALS—for VP2C Relay
RP-15223-2	SOCKET—Solder tab TERMINALS—for VP4C, VP6M, VP2/HD Relays

FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

CLARE GENERAL PURPOSE RELAYS

Series GP1 - 4PDT, 3 AMP, AC or DC

- 1/10 hp, 250 VAC contact rating.
- Opposite polarity design.
- Choice of six contact types: Gold flashed silver button, silver cadmium oxide button, palladium button, gold alloy button, palladium crossbar, gold alloy crossbar.
- Designed for U/L recognition.
- Interchangeable with existing relays.
- Competitively priced.
- Delivery off-the-shelf in 132 models listed — fast delivery on customized variations.



CLARE GP1 GENERAL PURPOSE RELAY

The new general purpose relay from Clare, 30-year-leader in relays and related control components.

Typical applications: Appliances, vending machines, business machines, industrial control systems, communications, instrumentation, peripheral EDP equipment.

Height: 1.281″
Width: 1.109″
Depth: .859″

Voltage (vdc)	PART NUMBERS		Coil Resistance (ohms)	Average Current (ma)
	Gold Flashed Silver Button Contacts	Silver Cadmium Oxide Button Contacts		
6	GP1R11D0000	GP1R21D0000	40*	150
12	GP1R11D1000	GP1R21D1000	160*	75
24	GP1R11D2000	GP1R21D2000	650*	37
48	GP1R11D3000	GP1R21D3000	2,600*	18
90	GP1R11D4000	GP1R21D4000	9,000*	10
110	GP1R11D5000	GP1R21D5000	11,000*	10

Voltage (vac)	PART NUMBERS		Coil Resistance (ohms)	Average Current (ma)
	Gold Flashed Silver Button Contacts	Silver Cadmium Oxide Button Contacts		
6	GP1R11A0000	GP1R21A0000	11**	200
12	GP1R11A1000	GP1R21A1000	43**	100
24	GP1R11A2000	GP1R11A2000	160**	52
48	GP1R11A3000	GP1R21A3000	668**	25
120	GP1R11A6000	GP1R21A6000	3,900**	11

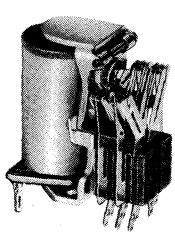
Relays listed above are stock items with same polarity rating and solder lug/plug in terminals. Stock relays with opposite polarity rating may be ordered by changing "R" to "Q". 3/16″ pcb terminals may be ordered by changing the second digit after the letter "R" from "1" to "2". For taper tabs, change this digit to "3".

TELEPHONE-TYPE RELAYS

Industrial, commercial and military ground systems where cost and life are important considerations.

- Long Life: up to 50 x 10^6 operations.
- Variety of enclosures and contact materials.
- Variety of terminals... pcb, direct plug-in, solder, taper tab.
- Highly reliable contacts, with independent twin contact surfaces.
- Stable, adjustment-free operation.
- Consistently reliable performance at low cost.

TYPE J



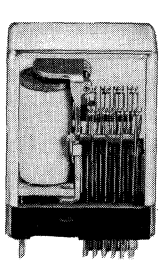
TERMINALS: Solder tabs — slotted.

MOUNTING: Two #6-32 NC tapped holes in relay heelpiece; mounting hardware included in relay price.

For detail characteristics see Manual 501.

Clare Part No.	Nominal Operating Voltage dc	Coil Resistance in Ohms ±10%	Contact Action	Contact and Rating
J242C24	24	500	2C	Note 1
J244C24	24	500	4C	Note 1
J246C24	24	300	6C	Note 1
J482C24	48	1300	2C	Note 1
J486C24	48	1000	6C	Note 1
J1102C24	110	6500	2C	Note 1
J1104C24	110	6500	4C	Note 1
J1106C24	110	5000	6C	Note 1

TYPE JDP



Direct Plug-in Relay Clear Plastic Dust Cover, Socket and Mounting Screws included in Relay Price.

For detail characteristics see Data Sheet 551.

Clare Part No.	Nominal Operating Voltage dc	Coil Resistance in Ohms ±10%	Contact Action	Contact and Rating
JDP242C24	24	500	2C	Note 1
JDP244C24	24	500	4C	Note 1
JDP246C24	24	300	6C	Note 1
JDP484C24	48	1300	4C	Note 1
JDP486C24	48	1000	6C	Note 1
JDP1104C24	110	6500	4C	Note 1
JDP1106C24	110	5000	6C	Note 1

Note 1 — Twin Palladium. 4 Amps, 150 Watts, A.C., N.I.

FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

C. P. CLARE & CO.

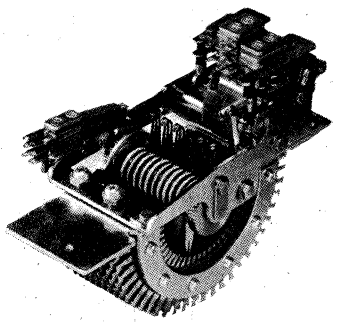
3101 PRATT BOULEVARD, CHICAGO, ILLINOIS 60645 ■ PHONE: (312) 262-7700

STEPPING SWITCHES

Mass sequential switching — counting, totalizing, scanning, sequence control, circuit monitoring.

- Low cost scanning and counting.
- Maximum switching density.
- Special purpose shorting switches . . . "All But One," "Progressive," "Alternate" operations.
- Long service life and low maintenance.
- Special high voltages are availale.
- Special modifications and functional assemblies for handling complex sequential switching operations.

For detail characteristics see Manual 601.



CONTACT RATINGS:

Bank and Wiper — Switch 100 ma, 30 vdc resistive . . . Carry 3 amps . . . Interrupter and Off-Normal — 2 amps, 150 watts.



QUICK-MOUNT MODELS AVAILABLE

Fast unit-for-unit replacement — no resoldering — minimum downtime. See Data Sheet 651-3A

	Clare Part No.	Nominal Operating Voltage dc	Coil Resistance	No. of Levels	Interrupter Contacts	Off-Normal Contacts
TYPE 20	20-2404	24	35	4 of 20 pt.	1C	1C
	20-2408	24	35	8 of 20 pt.	1C	1C
	20-2412	24	20	12 of 20 pt.	1C	1C
	20-2416	24	20	16 of 20 pt.	1C	1C
	20-2428	24	35	8 of 40 pt.	1C	1C
	20-4808	48	100	8 of 20 pt.	1C	1C
TYPE 26	26-2404	24	35	4 of 26 pt.	1C	1C
	26-2408	24	35	8 of 26 pt.	1C	1C
	26-2416	24	20	16 of 26 pt.	1C	1C
	26-2428	24	35	8 of 52 pt.	1C	1C
	26-4812	48	70	12 of 26 pt.	1C	1C
	26-11004	110	600	4 of 26 pt.	1C	1C
	26-11008	110	600	8 of 26 pt.	1C	1C
	26-11012	110	400	12 of 26 pt.	1C	1C
	26-11024	110	600	4 of 52 pt.	1C	1C
TYPE 210	210-2403	24	24	3 of 10 pt.	1C	1C
	210-2406	24	24	6 of 10 pt.	1C	1C
	210-2409	24	20	9 of 10 pt.	1C	1C
	210-2412	24	20	12 of 10 pt.	1C	1C
	210-11003	110	600	3 of 10 pt.	1C	1C
	210-11006	110	600	6 of 10 pt.	1C	1C
	210-11012	110	400	12 of 10 pt.	1C	1C
TYPE 211	211-2403	24	24	3 of 11 pt.	1C	1C
	211-2406	24	24	6 of 11 pt.	1C	1C
	211-2412	24	20	12 of 11 pt.	1C	1C
	211-11003	110	600	3 of 11 pt.	1C	1C
	211-11006	24	24	6 of 11 pt.	1C	1C
	211-11009	110	400	9 of 11 pt.	1C	1C

ACCESSORIES

Clare Part No.	Description
RP-2702	Short Bracket (used with Rubber Mounts
RP-2703	Long Bracket (Type 20 and 26)
RP-2902	Long Bracket for Type 20 and 26
RP-2903	Short Bracket for Type 20 and 26
RP-3335	Switch Rubber Mounts, Type 26
RP-3336	Switch Rubber Mounts, Type 20
RP-9565	Mounting Stud for Type 11 Switch
RP-11049	Switch Rubber Mounts, Type 210 & 211
RP-11062	Shelf Mtg. Bracket, Type 200

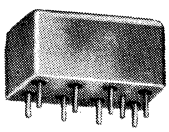
Clare Part No.	Description
RP-11068	Base Mounting Bracket, Type 200
RP-11723-G6	24 VDC Varistors
RP-11723-G14	110 VDC Varistors
RP-8047	Stepping Switch Rectifier Unit for 115 VDC
RP-9466	Lubrication Kit — Standard
RP-9467	Lubrication Kit — Low Temperature
RP-11375	Switch Tool Kits

FOR MORE DETAILED INFORMATION CONSULT YOUR CLARE SALES OFFICE OR NEAREST DISTRIBUTOR.

COMPUTER COMPONENTS INC.

REEDLAYS

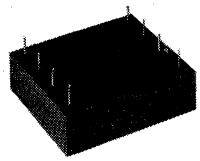
88-06 Van Wyck Expressway Jamaica 18, New York Tel: AXtel 1-3500



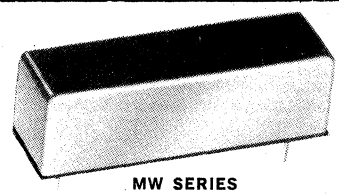
MG SERIES



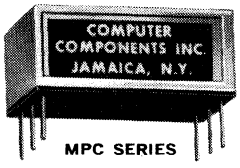
CCR SERIES



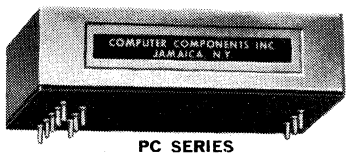
HVPC SERIES



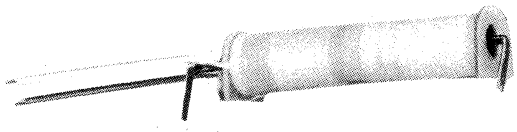
MW SERIES



MPC SERIES



PC SERIES



LO SERIES

SERIES	NUMBER OF POLES AVAILABLE	CONTACT RATING RESISTIVE			MAXIMUM INITIAL CONTACT RES. OHMS	MINIMUN BREAK-DOWN VOLTAGE D. C.	OPERATE TIME NOMINAL MILLISECS	MINIMUM I. R. AT +25°C	LIFE AT RATED LOAD OPER'S
		MAX AMPS D. C.	MAX. VOLTS D. C.	MAX WATTS D. C.					
MPC-A	1 TO 6 POLES FORM A	.003 TO .500	28 TO 1000	10	.150 TO .200	400 TO 1200	1.0 TO 1.5	10^9	10^7
MPC-C	1 TO 6 POLES FORM C	.250 TO .500	28 TO 150	3 TO 6	.150 TO .200	200 TO 250	1.5 TO 2.0	10^9	10^7
MG-A	1 OR 2 POLES FORM A	.250	150	7	.200	250	1.0	10^9	10^7
MG-C	1 OR 2 POLES FORM C	.250	150	4	.200	200	1.0	10^9	10^7
PC-A	1 TO 6 POLES FORM A	1.0 TO 3.0	250 TO 1000	15 TO 100	.150 TO .500	400 TO 1500	1.0 TO 1.5	10^9	10^7
PC-C	1 TO 6 POLES FORM C	.5 TO 1.5	100 TO 500	3 TO 20	.150 TO .500	350 TO 1000	1.5 TO 2.0	10^9	10^7
CCR-A	1 TO 4 POLES FORM A	.003 TO .500	28 TO 1000	10	.150 TO .200	400 TO 1200	1.0 TO 1.5	10^9	10^7
CCR-C	1 OR 2 POLES FORM C	.250 TO .500	28 TO 150	3 TO 6	.150 TO .200	200 TO 250	1.5 TO 2.0	10^9	10^7
MOPC-A	1 TO 6 POLES FORM A	.003 TO .500	28 TO 1000	10	.150 TO .200	400 TO 1200	1.0 TO 1.5	10^9	10^7
OPC-A	1 POLE ONLY FORM A	1.0 TO 3.0	250 TO 1000	15 TO 50	.150	500 TO 1500	1.0	10^9	10^7
OPC-C	1 POLE ONLY FORM C	.5 TO 1.5	100 TO 500	3 TO 20	.150 TO .500	350 TO 1000	2.5	10^9	10^7
MWMPC-A	1 TO 4 POLES FORM A	1.0	100	28 OR 50	.100	1000	1.0	10^9	20×10^6 50×10^6
MWPC-A	1 TO 4 POLES FORM A	3.0	400	50	.075	1000	1.0	10^9	20×10^6
XL-A	1 TO 4 POLES FORM A	.5	28	10	.200	250	1.0	10^{10}	10^6 AT 12 V $.5\times10^6$ AT 28 V
XL-C	1 TO 4 POLES FORM C	.5	28	6	.200	250	1.0	10^{10}	

- ALL RELAYS ABOVE ARE AVAILABLE WITH THE FOLLOWING FEATURES:
  - 6, 12, 24 AND 48 V.D.C. COILS.
  - MAGNETIC AND/OR ELECTROSTATIC SHIELDING.
  - HIGHER INSULATION RESISTANCE.
  - AVAILABLE FOR +125°C OPERATION (STANDARD TEMPERATURE -55°C TO +85°C.)
- FOR DETAILED INFORMATION WRITE OR PHONE FOR OUR LATEST CATALOG.

BASIC REED RELAYS

REED COILS

SIZE (End drawings actual size)	CAT. NO. TYPE	VOLTS	TURNS	WIRE SIZE	RESISTANCE OHMS (Nominal)	AMP./TURNS (Nominal)	MILLIWATTS (Nominal)
2" lg x .562" OD	S	6	4000	34	105	250	400
		12	7700	37	360		
		24	13500	40	1400		
		32	15000	41	1930		
		48	24000	43	5150		
SR 2" lg x .500" OD .500 SF	SR SF	6	4200	34	113	200	330
		12	7400	38	450		
		24	15000	40	1650		
		32	18000	42	2840		
		48	24000	44	5890		
1.450" lg x .470" OD	SP	6	3800	36	150	150	250
		12	7300	39	600		
		24	15000	42	2400		
		32	18750	43	4000		
		48	30000	45	9200		
1.187" lg x .700" OD	SA	6	2300	33	65	200	575
		12	4500	36	255		
		24	8500	39	965		
		32	12000	40	1810		
		48	17000	42	3660		
2" lg x .500" x .720" OS	SD	6	3000	33	90	200	430
		12	5700	36	335		
		24	11000	39	1290		
		32	14000	40	2165		
		48	24000	42	5700		
2" lg x .843" OD	M	6	2100	31	50	250	700
		12	4000	34	175		
		24	9000	37	820		
		32	12400	38	1400		
		48	17000	40	3120		
U .800" lg x .375" OD .437 UF	U UF	6	3200	38	150	125	240
		12	5700	42	625		
		24	12600	44	2500		
		32	17000	45	4000		
		48	25000	47	8600		
.800" lg x .500" x .375" OS	UD	6	2100	36	86	125	400
		12	4250	39	350		
		24	8100	42	1320		
		32	10500	43	2250		
		48	17500	45	5500		
.772" lg x .710" x .340" OS	UT	6	1500	36	85	105	420
		12	3000	39	340		
		24	6000	42	1300		
		32	8500	43	2550		
		48	12000	45	5300		
.690" lg x .875" x .500" OS	T	6	2200	35	100	125	350
		12	4200	38	400		
		24	8000	41	1600		
		32	11000	42	2800		
		48	14800	44	5800		

★ Bias Magnet Required

REEDS (See Chart At Right)

NUMBER REEDS	REED FIG.	CONTACT FORMS
1	3 or 4	1 A
1	5	1 C
1	6	1 C or 1 D
1	3 or 4	1 A
1	5	1 C
1	6	1 C or 1 D
1	3 or 7	1 A
1	5 or 6	1 C
1	8	1 C
1	9	1 C or 1 D
2	3 or 4	2 A
2	3 & 5	1 A & 1 C
2	6	2 C or 2 D
3	3 or 4	3 A
3	5	3 C
3	6	3 C or 3 D
3	3 & 5	2 A & 1 C
3	3 & 5	1 A & 2 C
3	7	3 A
1	1 or 2	1 A
1	2	1 C
2	2	2 A
3	1	3 A
2	1	2 B ★
2	1	1 A & 1 B ★
2	1	1 C ★
2	2	2 C
5	1	5 A
5	1	4 A & 1 B ★
5	1	3 A & 2 B ★
4	1	4 B ★
4	1	2 C ★
4	2	4 A
3	2	1 A & 2 B ★
3	2	1 B & 1 C ★
3	2	2 A & 1 B ★
3	2	1 A & 1 C ★
6	1	6 A
5	1	5 A
4	1	3 A & 1 B ★
4	1	2 A & 1 C ★
4	1	2 A & 2 B or 2 C ★
3	1	3 B ★
5	1	4 A & 1 B ★
5	1	1 A & 2 C ★
4	2	4 C

PRICES

COILS ONLY

1-9	10-24	25-99	100-249
$1.50	$1.27	$1.12	$ .97
1.65	1.40	1.27	1.07
1.80	1.53	1.35	1.17
2.40	2.04	1.80	1.56
3.00	2.55	2.25	1.95
1.50	1.27	1.12	.97
1.65	1.40	1.27	1.07
1.80	1.53	1.35	1.17
2.40	2.04	1.80	1.56
3.00	2.55	2.25	1.95
1.30	1.20	1.05	.95
1.50	1.35	1.20	1.10
1.75	1.60	1.45	1.25
2.00	1.80	1.65	1.45
2.65	2.40	2.20	1.95
1.50	1.27	1.12	.97
1.65	1.40	1.27	1.07
1.80	1.53	1.35	1.17
2.40	2.04	1.80	1.56
3.00	2.55	2.25	1.95
1.70	1.45	1.28	1.10
1.90	1.60	1.45	1.25
2.10	1.80	1.60	1.40
2.55	2.20	1.95	1.70
3.20	2.75	2.40	2.10
1.60	1.36	1.20	1.04
1.70	1.45	1.27	1.10
2.00	1.70	1.50	1.30
2.65	2.25	2.00	1.70
3.00	2.55	2.25	1.95
1.20	1.02	.90	.78
1.30	1.10	.97	.85
1.70	1.45	1.27	1.10
2.10	1.78	1.57	1.36
4.00	3.40	3.00	2.60
1.35	1.15	1.05	.90
1.45	1.25	1.10	.95
1.80	1.60	1.35	1.20
2.05	1.75	1.52	1.30
2.85	2.40	2.15	1.85
1.28	1.10	.97	.83
1.30	1.12	1.00	.86
1.70	1.45	1.28	1.12
2.00	1.60	1.42	1.22
2.80	2.38	2.10	1.82
1.05	.89	.79	.68
1.15	.98	.86	.75
1.30	1.10	.97	.85
1.45	1.23	1.09	.94
1.85	1.57	1.39	1.20

REED COILS

SIZE (End drawings actual size)	CAT. NO. TYPE	VOLTS	TURNS	WIRE SIZE	RES. OHMS Nominal	AMP TURNS Nominal	mW Nominal
Similar to "SD" for 2 short reeds Fig. 3 .625" .655 LEADS 3" flexible standard. P C pins optional. SE .812" SEF LENGTH 1.450"	SE SEF	6	3200	34	117	160	350
		12	6000	37	433		
		24	11000	40	1610		
		32	14500	41	2740		
		48	23500	43	7200		
Takes miniature reeds 12 Fig 2 up to 23 Fig 1 .875" LEADS 3/4" #20 T C 1.375" LENGTH .718"	UH	12	3300	34	180	200	800
		24	6000	37	720		
		32	8300	38	1400		
		48	10600	40	2640		
3/4" 1 1/8" COIL CONNECTIONS BOTH ENDS LEADS #20 T C All dimensions are nominal.	SG 3	12	4000	34	205	240	700
		24	9000	37	850		
		32	11290	38	1430		
		48	18000	40	3800		
		110	32000	43	13000		
3/4" 1 3/8"	SH 4	12	3600	33	160	260	900
		24	7300	36	650		
		32	9190	37	1090		
		48	14000	39	2500		
		110	30675	42	12300		
3/4" 1 1/2" 3/4" 2" (Drawing reduced)	SJ 5	12	3100	32	130	280	1150
		24	6000	35	520		
		32	7500	36	830		
		48	10950	38	1950		
		110	25176	41	8900		
3/4" 1 3/4"	SK 6	12	2600	31	100	310	1450
		24	5000	34	400		
		32	6890	35	680		
		48	10185	37	1575		
		110	21000	40	7150		

REEDS

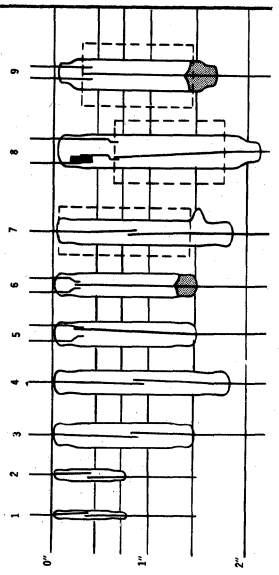
NO. REEDS	REED FIG.	CONTACT FORMS
2	3 5 6 7	A or C
12	2	A or C*
or combinations to 23	1	A
*Form C is new. Size same as Fig. 2		
3	3 4 5 6	A or C
4	3 4 5 6	A or C
5	3 4 5 6	A or C
6	3 4 5 6	A or C

PRICES

COILS ONLY

1 - 9	10 - 24	25 - 99	100 - 249
1.70	1.45	1.28	1.10
1.90	1.60	1.45	1.25
2.10	1.8	1.60	1.40
2.55	2.20	1.95	1.70
3.20	2.75	2.40	2.10
1.70	1.45	1.27	1.10
2.00	1.70	1.50	1.30
2.65	2.25	2.00	1.70
3.00	2.55	2.25	1.95
2.60	2.10	1.80	1.60
3.00	2.40	2.10	1.80
3.40	2.70	2.40	2.10
3.50	2.80	2.50	2.20
6.10	5.00	4.30	3.70
2.70	2.20	1.90	1.70
3.00	2.40	2.10	1.80
3.20	2.60	2.30	1.95
3.70	3.00	2.60	2.20
6.50	5.20	4.60	3.90
2.80	2.30	2.00	1.80
3.10	2.50	2.20	1.95
3.20	2.60	2.30	2.00
3.60	2.90	2.50	2.15
5.20	4.20	3.70	3.20
2.90	2.40	2.10	1.90
3.20	2.70	2.30	2.00
3.50	2.90	2.50	2.10
3.90	3.20	2.80	2.30
5.50	4.40	3.90	3.30

REED SWITCHES



STANDARD	MINIATURE	2	.125"	A or C	B	Any (Dry)					
		1	.095"	A	B	Any (Dry)					
		3	.220"	A	B	Any (Dry)					
		4		A	B	Any (Dry)					
		5		C	—	Any (Dry)					
		6		C, D	Bistable	Vert. to 30° (Hg Wet)					
		7		A	B	Any (Dry)					
	JUMBO	8	.320"	C	—	Any (Dry)					
		9		C, D	—	Vert. to 30° (Hg Wet)					
	REED FIG.		DIAMETER	CONTACT FORM	CONTACT FORM with Bias Magnet	MOUNTING POSIT.					

PRICES COILS ONLY

Prices for larger quantities upon request

PRICES are for coils with 3" lead. Add $3.00/C for P/C Pin Termination.

TO ORDER: Specify coil type by LETTER plus VOLTAGE desired for flexible leads (example SF-12, UV-32). For printed circuit pins add suffix P (example: SD-12-P, T-6-P).

NOTE: We do not catalog complete relays, due to the extensive variety of switches and coils available. Write for relay prices.

COTO-COIL CO., INC. Coto SINCE 1917

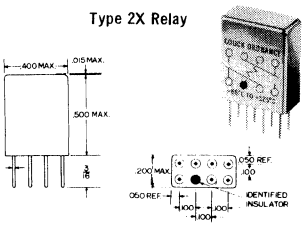
57 PAVILION AVE., PROVIDENCE, R. I. 02905
Telephone (401) 941-3355

Export Dept.: 13 E. 40th St., N. Y., N. Y. 10016

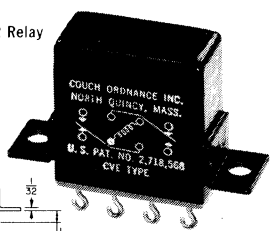
RUGGED ROTARY RELAYS

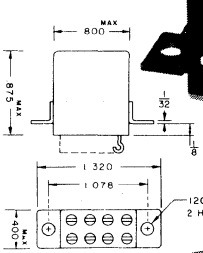
EXCEPTIONAL RELIABILITY WHERE THE ENVIRONMENT IS EXTREME

Type 2X Relay



Type 2R Relay



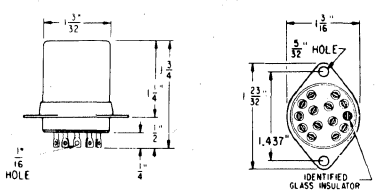


One of five standard mounting styles

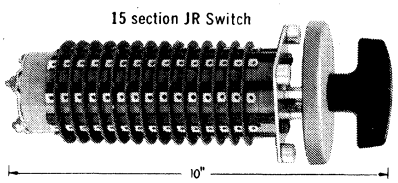
Type 4C36B Relay



One of six standard mounting styles



15 section JR Switch



MICRO MICRO-MINIATURE ROTARY RELAY

Catalog Number	Coil Resistance ±10% @ 25°C	Maximum Pull-In Current	Minimum Drop-Out Current	Nominal Operating Value	Coil Sensitivity	DATA SHEET NO.
	Ohms	MA.		Volts	Milliwatts	
2X15B480-A	1000	12	1.0	26.5	150	9
2X10B490-A	1500	8.0	0.67	26.5	100	9A
1X07B495-A	2000	6.0	0.50	26.5	70	10
1X10B490-A	1500	8.0	0.67	26.5	100	10A

Weight: 0.1 oz. Maximum
Ambient Temperature: −65°C to +125°C
Contacts: 2 Form C (DPDT)
Vibration: 20 G to 2,000 CPS
Shock: 75 G
Dielectric Strength: 500 VAC

MICRO-MINIATURE ROTARY RELAYS

ONE SIZE — 4 DIFFERENT SENSITIVITIES

Catalog Number	Coil Resistance ±10% @ 25°C	Maximum Pull-In Current	Minimum Drop-Out Current	Nominal Operating Value	Coil Sensitivity	DATA SHEET NO.
	Ohms	MA.	MA.	Volts	Milliwatts	
2R25A420-B	625	19	1.9	26.5	250	6
2R10A440-B	1500	8.2	.82	26.5	100	6
2RO4A460-B	4000	3.2	.32	26.5	40	6
2RO2A470-B	6250	2.0	.2	26.5	25	8

Weight: 18 ± 1 Gram
Ambient Temperature: −65°C to +125°C
Contacts: 2PDT (2 Form C) 2A @ 30 VDC
Vibration: 30 G to 2,000 CPS
Shock: 100 G

SUB-MINIATURE ROTARY RELAYS

STANDARD 26.5 VDC RELAYS

Catalog Number	Number Form C Contacts	Contact Rating 100,000 Operations	Coil Resistance ±10% @ 25°C	Maximum Pull-In Current	Nominal Operating Value	Notes	DATA SHEET NO.
			Ohms	MA.	Volts		
2A37-B	2	3 AMPS 30VDC	475	27	26.5	Dry Ckt. Capability	3
4A36-B	4	3 AMPS 30VDC	300	41	26.5	Dry Ckt. Capability	2
4C36-B	4	5 AMPS 30VDC	300	41	26.5	Heavy Duty	1
2B36-B	2	10 AMPS 30VDC	300	41	26.5	Heavy Duty	4
4AP36-AF	4	3 AMPS 30VDC	300	41	26.5	Dry Ckt. Plug-In	5
4D36-L	4	5 AMPS 30VDC	300	41	26.5	50G Vibration	7

Weight: 3.2 oz. Max.
Ambient Temperature: −65° to +125°C
Vibration: 20 G to 2000 CPS
Insulation Resistance: 1000 Megohms Min.
Shock: 75 G Min.

THE JR MULTIPOLE ROTARY SWITCH

The JR Switch is manufactured in accordance with MIL-S-21604 (Ships). It features contact ratings of 10A at 125VAC and 5A at 125VDC. Switches can be assembled with any number of sections up to 25 and can contain any combination of rotor types.

DATA SHEET NO.
S-1
S-2

S. H. COUCH DIVISION

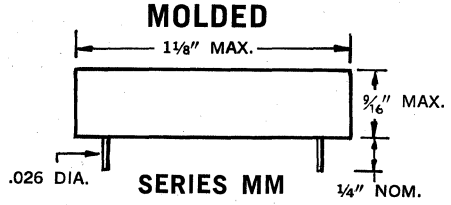
ESB INCORPORATED

3 Arlington Street, North Quincy, Massachusetts 02171 · Tel. (617) 298-4147

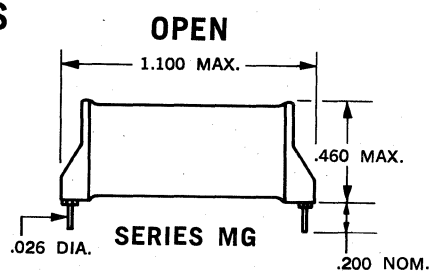
Douglas
RANDALL inc.
6 PAWCATUCK AVENUE WESTERLY, RHODE ISLAND 02891
Phone: 203-599-1750
A SUBSIDIARY OF WALTER KIDDE & CO., INC.
Kidde

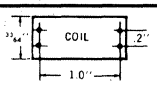
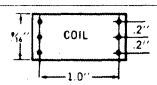
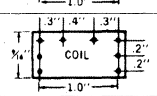
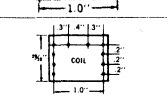
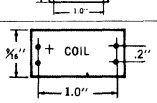
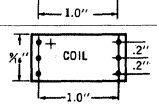
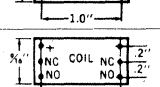
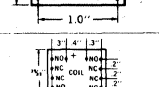
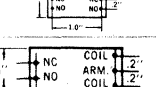
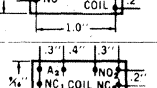
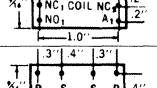
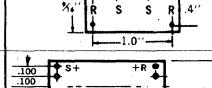
MINIATURE REED RELAYS

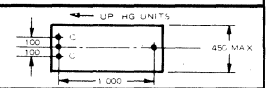
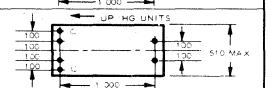
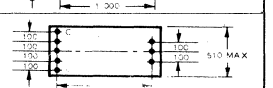
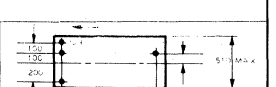
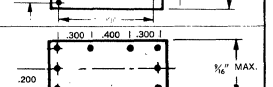
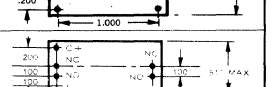
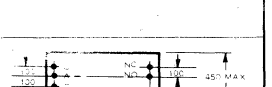
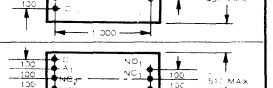
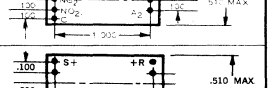
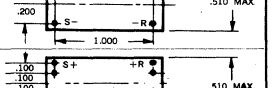
MOLDED



OPEN

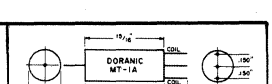
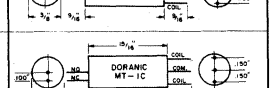


Contact Form	Nominal VDC	Part Number	D.C.R. Ω ±10% @25°C	Terminal Layout (Bottom View)
1A*	6 12 24	6MM1A 12MM1A 24MM1A	250 1000 4000	
2A*	6 12 24	6MM2A 12MM2A 24MM2A	170 675 2700	
3A	6 12 24	6MM3A 12MM3A 24MM3A	110 450 1800	
4A*	6 12 24	6MM4A 12MM4A 24MM4A	95 375 1500	
1B*	6 12 24	6MM1B 12MM1B 24MM1B	170 675 2700	
2B	6 12 24	6MM2B 12MM2B 24MM2B	110 450 1800	
1A1B*	6 12 24	6MM1A1B 12MM1A1B 24MM1A1B	110 450 1800	
2A2B	6 12 24	6MM2A2B 12MM2A2B 24MM2A2B	50 200 800	
1C	6 12 24	6MM1C 12MM1C 24MM1C	250 1000 4000	
2C	6 12 24	6MM2C 12MM2C 24MM2C	170 675 2700	
1A (Latching)	6 12 24	6MML1A 12MML1A 24MML1A	85/85 340/340 1350/1350	
2A (Latching)	6 12 24	6MML2A 12MML2A 24MML2A	55/55 225/225 900/900	

Part Number	D.C.R. Ω ±10% @ 25°C	Terminal Layout (Bottom View)
6MG1A 12MG1A 24MG1A	250 1000 4000	
6MG2A 12MG2A 24MG2A	170 675 2700	
6MG3A 12MG3A 24MG3A	110 450 1800	
6MG1B 12MG1B 24MG1B	170 675 2700	
6MG2B 12MG2B 24MG2B	110 450 1800	
6MG1A1B 12MG1A1B 24MG1A1B	110 450 1800	
6MG1C 12MG1C 24MG1C	250 1000 4000	
6MG2C 12MG2C 24MG2C	170 675 2700	
6MGL1A 12MGL1A 24MGL1A	85/85 340/340 1350/1350	
6MGL2A 12MGL2A 24MGL2A	55/55 225/225 900/900	

SERIES MT

MINIATURE TUBULAR

1A	6 12 24	6MT1A 12MT1A 24MT1A	187 750 3000	
1C	6 12 24	6MT1C 12MT1C 24MT1C	187 750 3000	

CONTACT RATING:
FORM A & B UNITS: 10W or 12VA (500ma or 250V max.).
FORM C UNITS: 3W (250ma or 28V max.).

CONTACT RESISTANCE: .150 ohms max. initial.

* Mercury Wetted Contacts are available in these forms.

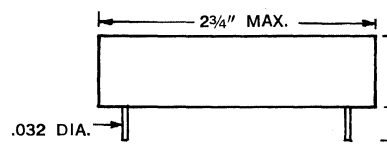
CONTACT RATING: 1A or 28VDC max.

CONTACT RESISTANCE: 50 milliohms max.

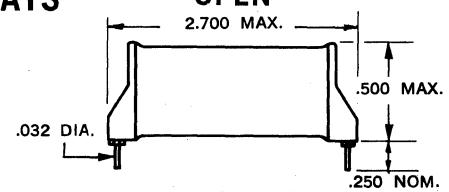
Douglas RANDALL inc.
6 PAWCATUCK AVENUE WESTERLY, RHODE ISLAND 02891
Phone: 203-599-1750
A SUBSIDIARY OF WALTER KIDDE & CO., INC.
Kidde

STANDARD SIZE REED RELAYS

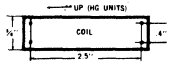
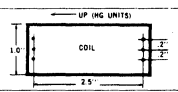
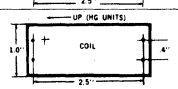
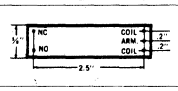
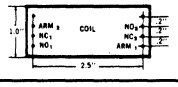
MOLDED



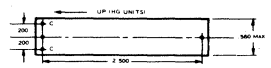
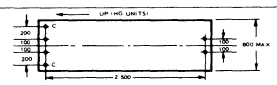
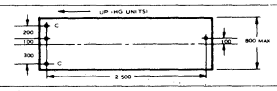
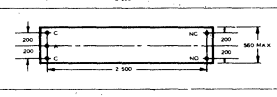
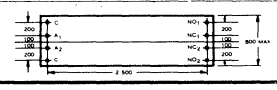
OPEN



SERIES SM, HP and Hg

Contact Form	Nominal VDC	Part Number	D.C.R.Ω ±10% @ 25°C	Terminal Layout (Bottom View)
1A*	6	6SM1A	180	
	12	12SM1A	725	
	24	24SM1A	2900	
2A*	6	6SM2A	175	
	12	12SM2A	700	
	24	24SM2A	2750	
1B*	6	6SM1B	175	
	12	12SM1B	700	
	24	24SM1B	2750	
1C	6	6SM1C	180	
	12	12SM1C	725	
	24	24SM1C	2900	
2C	6	6SM2C	175	
	12	12SM2C	700	
	24	24SM2C	2750	

SERIES SG, HPG and HgG

Part Number	D.C.R.Ω ±10% @ 25°C	Terminal Layout (Bottom View)
6SG1A	180	
12SG1A	720	
24SG1A	2880	
6SG2A	110	
12SG2A	440	
24SG2A	1760	
6SG1B	110	
12SG1B	440	
24SG1B	1760	
6SG1C	180	
12SG1C	720	
24SG1C	2880	
6SG2C	110	
12SG2C	440	
24SG2C	1760	

SERIES SM AND SG

CONTACT RATING:
FORM A & B UNITS: 15W or 15VA (1 amp. or 250V max.)
FORM C UNITS: 3W (500 ma or 250V max.)

CONTACT RESISTANCE:
FORM A & B UNITS: .075 ohms max. initial.
FORM C UNITS: .100 ohms max. initial.

SERIES HP (MOLDED) AND HPG (OPEN)

Available in the above arrangements:

CONTACT RATING:
FORM A & B UNITS: 50W or 50VA (3 amp. or 1000V max.).
FORM C UNITS: 20W (1 amp. or 300V max.).

CONTACT RESISTANCE:
FORM A & B UNITS: .200 ohms max. initial.
FORM C UNITS: .250 ohms max. initial.

***SERIES Hg AND SERIES HgG**

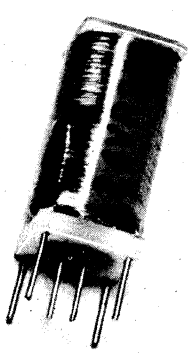
Standard size mercury wetted contact relay available with following rating:

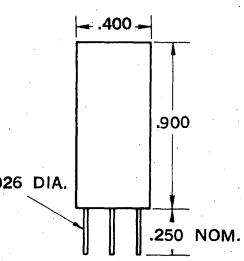
CONTACT RATING: 3 amp. or 250VDC max.
CONTACT RESISTANCE: 35 milliohms max.

VertiReed RELAYS

SERIES VR

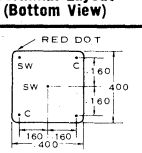
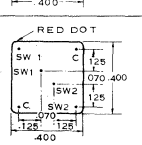
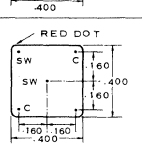
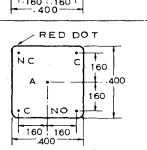
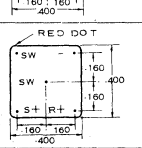
Series VR Reed Relays are designed for applications where printed circuit board area is severely limited. The use of open bobbins provides protection for the reed switches and a rugged mounting support for the printed circuit terminals as well as low cost construction. For additional protection the coil leads and top switch leads are enclosed by the coil wrapper. The relays listed on the reverse side are standard. Other coil voltages, resistances and power requirements are produced on a special basis. Adaptations using small mercury wetted reed relays may also be obtained with a slight increase in height. As is the case with all DORANIC Relays, latching versions are also produced to operate on momentary pulses, and both electromagnetic and electrostatic shielding may be included on request.





CONTACT RATING:
FORM A & B UNITS: 10W or 120VA (.500A or 250V max.).
FORM C UNIT: 3W or V3A (.250A or 28VDC max.).

CONTACT RESISTANCE:
FORM A & B UNITS: .150 ohms max. initial.
FORM C UNIT: .200 ohms max. initial.

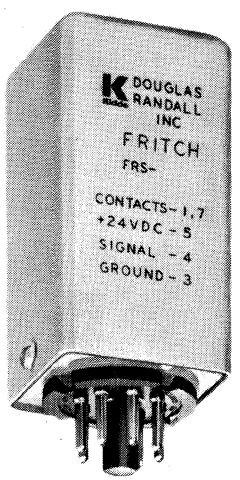
Contact Form	Nominal VDC	Part Number	DCR ±10% @ 25°C	Terminal Layout (Bottom View)
1A	6	6VR1A	225	
	12	12VR1A	900	
	24	24VR1A	3600	
2A	6	6VR2A	145	
	12	12VR2A	575	
	24	24VR2A	2300	
1B	6	6VR1B	225	
	12	12VR1B	900	
	24	24VR1B	3600	
1C	6	6VR1C	225	
	12	12VR1C	900	
	24	24VR1C	3600	
1AL (Latching)	6	6VR1AL	105/105	
	12	12VR1AL	425/425	
	24	24VR1AL	1700/1700	

Douglas RANDALL inc.
6 PAWCATUCK AVENUE WESTERLY, RHODE ISLAND 02891
Phone: 203-599-1750
A SUBSIDIARY OF WALTER KIDDE & CO., INC.
Kidde

FRITCH: Frequency Responsive Switch Offers these Features

Douglas Randall, Inc., *FRITCH* combines solid state circuitry with reliable reed relay outputs into a component capable of responding to any selected frequency from 25Hz to 100KHz at speeds as fast as 75 operations per second. Bandwidth is ± 2% to ± 5% depending on signal voltage and temperature control. Typical operation is from a 5VRMS ± 10% signal, over a temperature range of −40°C to +65°C using a power supply of 24VDC with only 2MA standby and 25ma operating current.

The ability of the FRITCH to function accurately with a relatively uncontrolled signal level and to provide complete isolation of output signal from input signal in addition to the features listed above, make it excellent for telemetry, touch tone decoding, remote selection of several command functions over one pair of lines, central station signaling and many other applications.

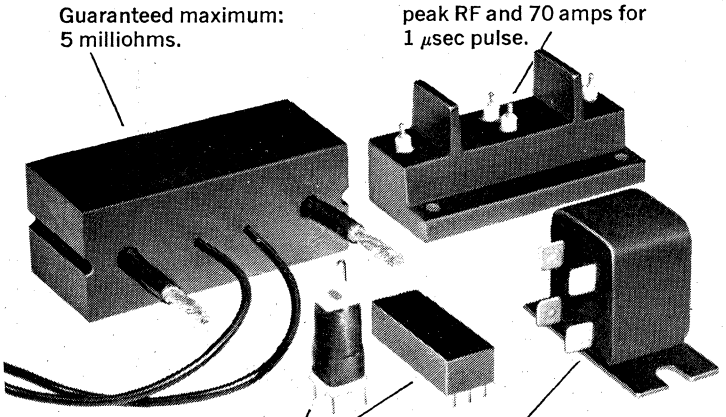


- **Broad Frequency Range—25Hz to 100KHz**
- **Low Signal Power—Only Imw**
- **Fast Response—As low as 5ms**
- **Shock & Vibration Resistant**
- **Plug-in or P. C. Mounting—in any position**

Assemblies are available to decode all touch tone frequency signals or any combination of frequencies between 25Hz and 100KHz. Units can be provided to fit existing hardware. Sensitive versions can be supplied which will respond to signals as low as 0.020 volts.

ULTRA-LOW CONTACT RESISTANCE
Guaranteed maximum: 5 milliohms.

HIGH VOLTAGE
Will break 15,000 volts peak RF and 70 amps for 1 μsec pulse.



VERTICAL MOUNT AND LOW PROFILE
For use where available space is limited. Low profile relay shown is .315" high. Vertical mount relay fits into .4" square.

SPECIAL MOUNTING
An example of one configuration designed to meet special mounting and terminal requirements.

SPECIAL REED RELAYS

In addition to standard relays Douglas-Randall, Inc. has developed many special versions to meet unusual size, terminal layout and electrical requirements. Special molding techniques make this possible without expensive tooling. Douglas Randall also makes special assemblies of reed switches, either molded or mounted on P.C. boards.

DELTROL CONTROLS

Manufacturers of: RELAYS, SOLENOIDS and TIMERS

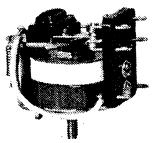
RELAYS





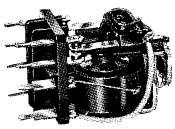
25 Series

Miniature cradle-type relay. Contacts; gold bonded fine silver, standard; other material available on request. Terminals: gold plated, pierced solder type. Mounting: four No. 3-48 holes on .375" x .375" centers. Includes snap-on dust cover.



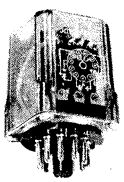
100 Series

Low cost, general purpose relay, designed for long, trouble-free life. Armature stop. 1/8" dia., silver cadmium oxide, gold flashed contacts, 5 amp. 3/16" dia., silver cadmium oxide, gold flashed contacts, 10 amp. Mounting: 6-32 mounting stud and self-locking locator tab.



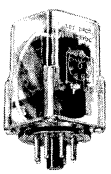
100UP/101UP Series

Printed circuit, mounted relay with phenolic insulating barriers. Contact Ratings: 5 amp. 1/8" dia. Silver Cadmium Oxide contacts, gold-flashed. 10 amp. 3/16" dia. Silver Cadmium Oxide contact, gold-flashed. Relay provided with armature stop to maintain adjusted characteristics through life of relay. Conforms to UL requirements.



105 Series

General purpose plug-in relay. Clear butyrate dust cover. With built-in bulb indicator. Bulb is in parallel with the relay coil and indicates voltage or current available in power circuit. 3/16" dia., silver cadmium oxide contacts, gold-flashed, 10 amp. Mountings: Standard 8 and 11 pin plugs.



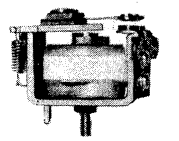
106/107 Series

Series 100U/101U not in plug-in series. Greater spacings provide the optimum in plug-in relays. 106 – 5 amp contacts; 107 – 10 amp contacts.



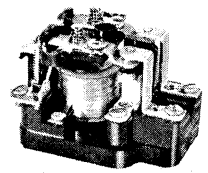
105ML Series

General purpose magnetic latching plug-in relay with positive snap-action magnetic latch. Up to 5PDT with 5 or 10 amp rating. Height of relay up to three poles: 3-3/16"; four and five poles: 3-19/32". Dust-tight clear cover is standard.



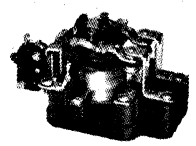
120 Series

Rugged, small size, medium duty power relay. Available as SPDT or SPST-NO-DM contact configuration. 1/4" dia., silver cadmium, gold-flashed contacts, rated 15 amp SPDT, 10 amp DM configuration. Terminals: combination .250 quick connect and solder hold.



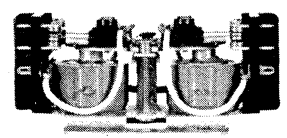
900 Series

Power relay. Long life, rugged construction. UL File No. 37066 CSA File No. 20690. Dust cover.



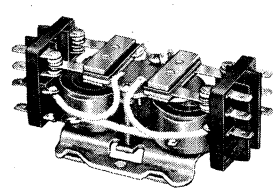
900-1C Series

Power relay with snap-action 10 amp, 1/3 H.P., SPDT auxilliary switch. Screw terminals are standard.



100ML/101ML

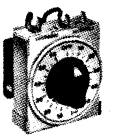
General purpose magnetic latching relay. Positive magnetic latch. UL approved. Up to 6PDT, 5 or 10 amp, contact rating. Standard solder or 3/16" quick-connect terminals.



140ML Series

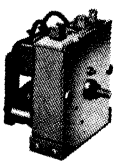
General purpose magnetic latching relay with 15 amp rating. Relay has Deltrol positive snap-action magnetic latch. Terminals accept 3/16" quick-connect terminals or soldered connections.

TIMERS



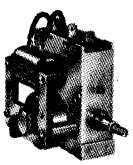
Model 116-D1

This interval timer switches contacts 1-4 OFF and contacts 1-3 ON at the beginning of each preset timed interval. At the end of the preset timed interval, contacts 1-4 switch to ON and contacts 1-3 switch to OFF.



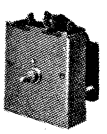
Model 159-D

This interval timer switches contacts 1-4 to OFF and contacts 1-3 to ON at the beginning of each preset timed interval. At the end of each preset timed interval, contacts 1-3 switch to OFF and contacts 1-4 switch to ON. Near end of each preset timed interval, buzzer will sound for a short period, then shut off.



Model 110

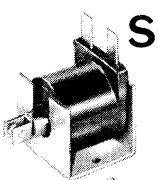
This pushbutton timer starts by manually depressing push button. Pushing button closes timer switch contacts 1-3, energizing timer load and timer motor. Upon completion of fixed time interval, contacts 1-3 open, shutting off timer load and timer motor.



Model 135-D1

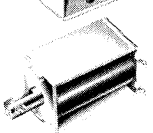
This repeat cycle timer switches contacts 1-4 OFF and 1-3 ON for a fixed time duration during each timing cycle. Timer will continue to repeat the preselected time cycle as long as power is applied.

SOLENOIDS



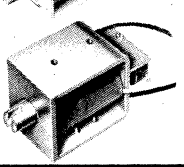
Type C-8

Low cost, low and medium power solenoids designed especially for volume applications where low cost is essential.



Type D-17

Designed for low and medium power applications. Constructed to provide maximum useful life and efficiency.



Type PS-65

Designed for high power applications. This high power is derived by incorporating coils having two windings: a high-surge current pull-in winding that starts the solenoid plunger in motion, and a low-drain winding for holding the plunger in a seated position. The windings are switched automatically by the motion of the plunger. Rated for continuous duty.

SALES REPRESENTATIVES

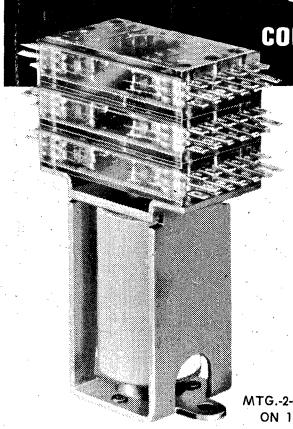
Relays, Solenoids, Timers - RST; Relays, Solenoids - RS; Solenoids, Timers - ST; Relays, Timers - RT; Relays - R

R	**Arlington, Mass.,**	Nelson & Schoonmaker, Ed Skilton, 617-643-5454
RST	**Atlanta, Georgia,**	Winfield/Southeast, Jack Kessler, 404-636-3023
RST	**Baltimore, Md.,**	Shiplett-Warrington, Scott Warrington, 301-821-6274
RST	**Chicago, Ill.,**	Lincoln Hodges & Assoc., Chuck Hodges, 312-561-8440
RST	**Cleveland, Ohio,**	Del Steffen & Assoc., Del Steffen, 216-261-5055
RST	**College Pk., Md.,**	Shiplett-Warrington Assoc., L. Shiplett, 301-864-5757
RST	**Council Bluffs, Ia.,**	William Pfeiffer & Co., W. Pfeiffer, 712-322-8280
RST	**Dallas, Texas,**	Carey & Associates, Inc., Deane Miars, 214-361-6234
RST	**Dayton, Ohio,**	Del Steffen & Associates, Alfred Steffen, 513-293-3145
RST	**Denver, Colorado,**	Ruby Sales Co., No. 6, C.H. Mulder, 303-755-1714
ST	**Fairfield, Connecticut,**	Charles H. Weber, Jr., Phone-203-259-5386
RST	**Flint, Michigan,**	C & R Associates, Bernhard Stroh, 313-233-0580
RST	**Fort Wayne, Indiana,**	W. Bieberich Co., Paul Schlaudroff, 219-432-2537
RST	**Houston, Texas,**	Carey and Associates, Inc. Bill Carey, 713-869-3623
RT	**Kansas City, Missouri,**	M-C Sales, Eugene J. McCaffrey, 816-842-4640
RT	**Minneapolis, Minnesota,**	Clark R. Gibb Co., Clark Gibb, 612-377-1200
S	**Minneapolis, Minn.,**	R.J. Sales & Engineering, D. Olson, 612-922-1425
RST	**N. Miami, Fla.,**	Winfield Electronic Sales Co., W. Kessler, 305-751-5566
RST	**Portland, Oregon,**	Almac/Stroum Elec., John Wandell, 503-292-3534
RST	**Plainview, L.I., N. York,**	Deltrol Controls, David Yonis, 516-931-3815
RST	**Rochester, Michigan,**	C & R Assoc., G. Kent Rosenquist, 313-651-1890
RST	**Rochester, New York,**	Deltrol Controls, Robert Tesch, 716-473-3340
S	**St. Louis, Missouri,**	Gordon Fixman Co., G. Fixman, 314-725-5219
RST	**Seattle, Wash.,**	Almac Stroum Electronics, Sam Stroum, 206-763-2300
RST	**Stratford, New Jersey,**	A.E. Luba & Assoc., A.E. Luba, 609-784-5000
RST	**Sunnyvale, Calif.,**	M & M Electronics, Inc., W. Mackin, 408-252-8514
R	**Thomaston, Conn.,**	Nelson & Schoonmaker, Len Nelson, 203-283-5959
RST	**Toronto, Ont., Can.,**	Power Service Products, J. O'Brien, 416-239-2977
S	**Tulsa, Oklahoma,**	T.J. Ray Company, T.J. Ray, 918-627-1515
RST	**Wauwatosa, Wisc.,**	F.C. DuBois & Assoc., F.C. DuBois, 414-774-3100
RST	**Woodland Hills, Cal.,**	Cummings & Assoc., C. Cummings, 213-340-6035

DELTROL CONTROLS *A Division of Deltrol Corp.*
2745 S. 19th St., Milwaukee, Wis. 53215, Phone 414-671-6800, Telex 2-6871

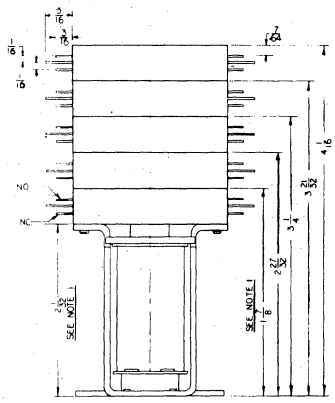
electronic controls, inc.

T-BAR® Switch/Relays



T-BARS are for switching more circuits in less space ...up to 60 circuits simultaneously!

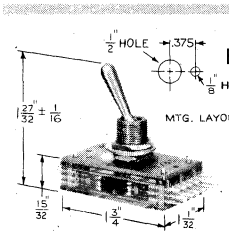
MTG.-2-#6-32 NF HOLES ON 1.375 CENTERS



SERIES 801 T-BAR RELAY COIL CHARACTERISTICS*

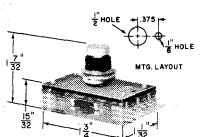
	12 POLES 1 WAFER RELAY Wt: 4.5 oz.			24 POLES 2 WAFER RELAYS Wt: 6.75 oz.			36 POLES 3 WAFER RELAYS Wt: 7.25 oz.			48 POLES*** 4 WAFER RELAYS Wt: 8.5 oz.			60 POLES 5 WAFER RELAYS Wt: 9 oz.		
Voltage	Resistance Ohms	Current Amps	Power Watts	Resistance Ohms	Current Amps	Power Watts	Resistance Ohms	Current Amps	Power Watts	Resistance Ohms	Current Amps	Power Watts	Resistance Ohms	Current Amps	Power Watts
6 VDC	11.9	0.504	3.01	11.09	0.541	3.24	7	0.857	5.06	5.5	1.09	6.54	5.5	1.09	6.54
12 VDC	49.1	0.244	2.96	45	0.267	3.19	28	0.429	5.16	22	.545	6.54	22	.545	6.54
24 VDC	193	0.124	2.98	174	0.138	3.32	111	0.216	5.15	94	.255	6.12	94	.255	6.12
28 VDC	258	0.109	3.03	227	0.123	3.44	150	0.187	5.23	120	.233	6.52	120	.233	6.52
48 VDC	778	0.062	2.98	674	0.071	3.41	438	0.110	5.26	350	.137	6.58	350	.137	6.58
110 VDC	3963	0.028	3.05	3450	0.032	3.54	2355	0.047	5.18	1930	.057	6.27	1930	.057	6.27
115 VAC**	3963	0.024	2.80	3450	0.027	3.10	2355	0.041	4.72	1930	.049	5.62	1930	.049	6.54

*All characteristics are nominal and subject to normal manufacturing tolerances, other voltages available on special order.
**115 VAC units are made with a full wave bridge rectifier and use the same coils as listed under 110 VDC units.
***Four-wafer relays with all "A" form contacts use three-wafer relay coils.
NOTE 1: ONE WAFER RELAYS USE A SHORTER ACTUATOR ASS'Y. — INSTEAD OF 2-1/32 AS SHOWN. THE ACTUATOR IS 1-15/32 HIGH.



SERIES 802 Bat Handle T-Bar Switches

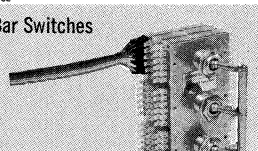
SERIES 803 Push Button Switch



Series 802 & 803

No. of Poles	Weights Oz. Approx.
12	2.0
24	2.5
36	3.0

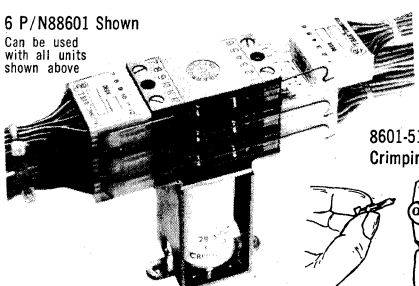
Ganged T-Bar Switches



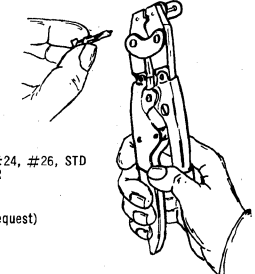
Toggles may be ganged for controlling additional circuits . . . 48, 72, 108, etc. Shown here, 108 poles.

T-BAR Connectors save time and reduce installation costs using individual snap-in crimp terminals crimped to pre-stripped wire and then snapped into a contact block, which forms the connector. The connector is pushed onto the wafer terminals, eliminating soldering. Because we offer a connector, rather than a receptacle, harness work can be completed outside the chassis and therefore no fancy chassis work is required to accept a receptacle. It not only makes the metal work simpler, but it also saves layout engineering and drafting time. Since T-Bar Switch/Relays are so easily mounted, they are often found on the back of meter panels or on their own brackets.

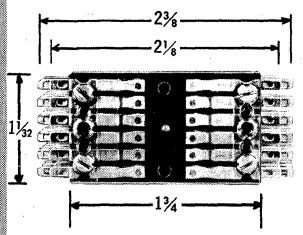
6 P/N88601 Shown
Can be used with all units shown above



8601-51 Crimping Tool



PHYSICAL PROPERTIES:
Wire Accommodated: (1) #18, #20, #22, #24, #26, STD (2) #22, #24, #26 STR
Connector Material: Nylon Zytel or Lexan®
Snap-in Contact Material: Phosphor Bronze
Snap-in Contact Finish: Tin Plated (other on request)
Retaining Clip Material: Stainless Steel
Connector Weight: Approximately 0.3 oz.



GENERAL FEATURES:

The series 801 T-Bar Relays are solenoid actuated multi-pole relays with a unique design permitting stack-up of enclosed contact "wafers." Each wafer has a maximum of 12 pole double throw contacts thereby allowing ECI to supply the 801 relay with any combination from 4 to 60 poles.

CONTACT RATING:
3 amp, resistive load 150 watt maximum make or break;
5 amp, 500 watt maximum carry.

CONTACT MATERIAL:
Gold bonded, fine silver. standard. Others available on special order.

CONTACT FORMS:
"A" single throw N.O.
"B" single throw N.C.
"C" double throw, break before make
"D" double throw, make before break

NUMBER OF POLES (RELAYS):
One Wafer — 12 poles
Two Wafers — 24 poles
Three Wafers — 36 poles
Four Wafers — 48 poles
Five Wafers — 60 poles ("A" form only)

OPERATE VOLTAGE:
Min. voltage: 80% of nominal at 25°C

RELEASE VOLTAGE:
Max. voltage: 20% of nominal at 25°C

OPERATE TIME:
One Wafer Relay — 15 ms. max.
Two Wafer Relay — 25 ms. max.
Three Wafer Relay — 30 ms. max.
Four Wafer Relay — 35 ms. max.
Five Wafer Relay — 40 ms. max.

RELEASE TIME:
5 ms. max. (36 pole) — 10 ms. max. (12 pole)

TERMINALS:
Solder tab that also mates with T-Bar connector P/N 88601 (two required per wafer)

ENCLOSURE:
Contacts enclosed in dust tight plastic enclosure that is separated from the actuator assembly. Withstands Mil. Std. — 202 method 106B moisture resistance test.

LIFE:
Mechanical — 20,000,000 operations minimum for relay
Electrical — 20,000,000 operations minimum at 100 milliamps to 100,000 minimum at 5 amps, 150 watts resistive load.

DIELECTRIC:
1000 vrms terminals to case at sea level and 25°C
1000 vrms terminal to terminal at sea level and 25°C
1000 vrms coil to case at sea level and 25°C

TEMPERATURE RANGE:
—55°C to +85°C

INSULATION RESISTANCE:
5,000 megohms @ 25°C minimum

ORDERING INFORMATION:
Specify Series No. — number of poles plus contact form letter-coil voltage. For example a 36 pole double throw relay with a 24 VDC coil is: 801-36C-24

MANUFACTURED BY:

electronic controls, inc.

T-Bar Switch/Relay Div. •
Danbury Road, Wilton, Conn. • (203) 762-8351

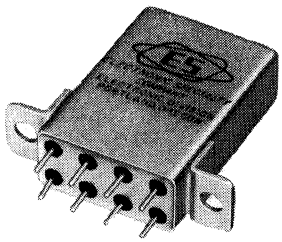
Manufactured under 1 or more of the following patents: 3,206,990, 3,226,508

® "T-Bar" — Reg. T.M.

ES ELECTRONIC SPECIALTY RELAYS

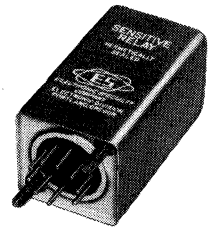
71R

2PDT Micro Miniature Sensitive
40 MW Pull-In
Dry-Circuit to 2 Amp Loads
Pin, Hook and 3″ Wire Terminals
Welded Sealing Available



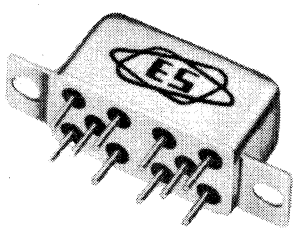
R400

2PDT Miniature Sensitive
40 MW Pull-In (20M-1PDT)
Dry-Circuit to 2 Amp Loads
(5 Amp Version: 41 Series)



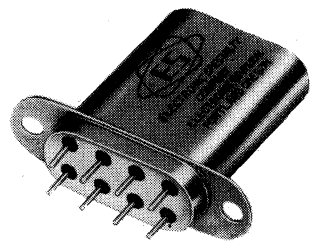
55N

2PDT Half Size Crystal Can Sensitive Latching
Bifurcated Contacts
90 MW Transfer
Dry-Circuit to 2 Amp Load
Pin, Hook and 3″ Wire Terminals
Welded Sealing



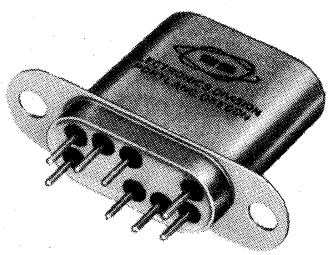
80N

2PDT Micro Miniature Sensitive
Sealed Coils
Bifurcated Contacts
40 MW Pull-In
Dry Circuit to 3 Amp Load
Pin, Hook and 3″ Wire Terminals



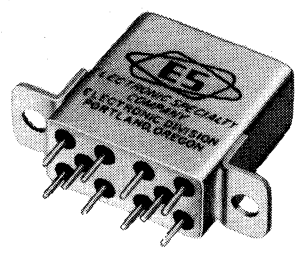
68N

2PDT Crystal Can
Bifurcated Contacts
300 MW Pull-In
2 Amp Loads
Pin, Hook and 3″ Wire Terminals



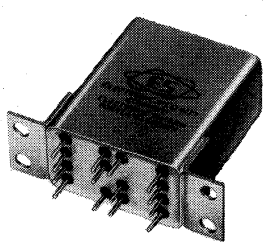
77R 79N

2PDT Crystal Can
Sensitive Latching 90 MW Transfer
Non-Latching 250 MW Pull-In, Bifurcated Contacts
Dry Circuit to 2 Amp Loads (79N-3 Amp)
Pin, Hook and 3″ Wire Terminals
Welded Sealing



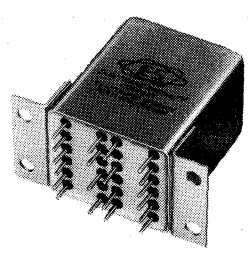
90N 92N

4PDT Micro Miniature
Sensitive Non-Latching and Latching
80 MW Pull-In
Dry Circuit to 3 Amp
Pin, Hook and 3″ Wire Terminals



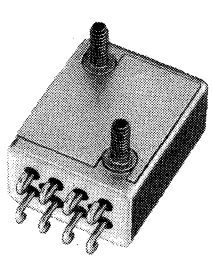
100N 102N

6PDT Micro Miniature
Sensitive Non-Latching and Latching
150 MW Pull-In
Dry Circuit to 3 Amp Load
Pin, Hook and 3″ Wire Terminals



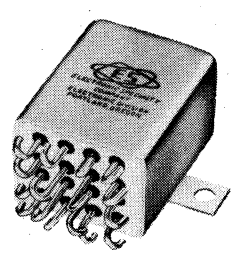
93 94

2PDT 10 Amp Loads
Micro Miniature
Non-Latching 500 MW Pull-In
Latching 150 MW Transfer
Pin and Hook Terminals



103 104

4PDT 10 Amp Loads
Micro Miniature
Non-Latching 1000 MW Pull-In
Latching 300 MW Transfer
Pin and Hook Terminals



Mounting Arrangements — All Relays come with plain, side bracket, side studs and flanges. All relays meet or exceed the requirements of MIL-R-5757D. **Vibration** — up to 30 G's and 3000 CPS. **Life** — 100,000 minimum up to 5,000,000 on some series at dry circuit. **Coil Resistance** — 10 to 12,000 DC OHMS at +25°C. Additional information is available in ES switching components catalog.

ES ELECTRONIC SPECIALTY CO. / ELECTRONICS DIVISION — PORTLAND
18900 N.E. Sandy Blvd., Portland, Oregon 97220 • Phone (503) 665-0121 • TWX 910-469-8782

ESSEX
RBM controls

RBM CONTROLS

ESSEX INTERNATIONAL, INC. CONTROLS DIVISION: 131 GODFREY STREET • LOGANSPORT, INDIANA 46947 • PHONE 219-753-7521

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

A.C. ENGINEERING DESIGN DATA

Type	Magnet Coil Rating (Volt Amperes)			Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals - 60 cy. RMS			Contact Material		Electrical Life		**Mechanical Life		Maximum Operating Ambient Degrees Fahrenheit
	Inrush	Sealed Nom.	Sealed Max.	Pick-up	*Max. Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power Rating	Pilot Rating	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
59	No Magnet Coil			85%	110%	1500	1000	1500	—	Fine Silver	100,000	1	1,000,000	1	140
75	16	10	12	85%	110%	1500	1000	1500	Silver Alloy	—	†100,000	6	1,000,000	60	140
80	27	15.6	17	85%	110%	1500	1500	1500	Silver Alloy	—	†100,000	3	1,000,000	60	130
84	4	2.8	3	85%	110%	1500	1000	1500	Silver Alloy	Fine Silver	100,000	6	1,000,000	60	140
84T	9	2.8	3	85%	110%	1500	1000	1500	—	Gold Alloy	100,000	6	1,000,000	60	140
85	90	19	23	85%	110%	2200	2200	2200	Silver Alloy	—	†100,000	6	500,000	10	130
91	22	8	10	85%	110%	1500	1000	1500	Fine Silver	•Gold Alloy	†100,000	6	750,000	60	130
92	24	8.9	12	85%	110%	1500	1000	1500	Fine Silver	•Gold Alloy	†100,000	6	750,000	60	130
93	4.5	3.0	4	85%	110%	1500	1000	1500	Fine Silver	•Gold Alloy	100,000	6	10,000,000	60	160
129	10	4.5	5	85%	110%	1500	1000	1500	Silver Alloy	—	†100,000	3	500,000	60	130
129AR	10	4.5	5	85%	110%	1500	1000	1500	Silver Alloy	—	†100,000	3	500,000	60	130
143	24	8.9	12	85%	110%	1500	1000	1500	Silver Alloy	—	†100,000	6	500,000	30	130
187	1.3	1.3	1.5	85%	110%	1000	1000	1000	—	Silver Alloy	†100,000	6	10,000,000	60	150
189	No Magnet Coil			85%	110%	1500	1000	1500	Silver Alloy	Silver Alloy	100,000	1	200,000	1	140
987	9	5.5	6.5	85%	110%	1500	1000	1500	Fine Silver	•Gold Alloy	100,000	6	1,000,000	60	140
C	90	18	21	85%	110%	2200	2200	2200	Silver Alloy	—	†100,000	6	1,000,000	10	130
CR	90	18	21	85%	110%	2200	2200	2200	Silver Alloy	—	†100,000	6	1,000,000	10	130
S	50	14.5	17	85%	110%	2200	2200	2200	Silver Alloy	—	†100,000	6	500,000	10	130

D.C. ENGINEERING DESIGN DATA

Type	Nominal Magnetic Coil Rating (Watts)	Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals - 60 cy. RMS			Contact Material		Electrical Life		**Mechanical Life		Maximum Operating Ambient Degrees Fahrenheit
		Pick-up	*Max. Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power Rating	Pilot Rating	Oper. At Rated Load	Oper. Per Min.	Oper. At No. Load	Oper. Per Min.	
60	2	75%	110%	1000	1000	1000	Fine Silver	—	100,000	4	250,000	4	122
70	9	75%	110%	500	500	500	Copper or Silver	—	100,000	4	250,000	4	122
84D	3	75%	110%	1500	1000	1500	—	Silver Alloy	100,000	6	1,000,000	60	140
91D	6.5	75%	110%	1500	1000	1500	Fine Silver	—	100,000	6	750,000	60	140
92D	7	75%	110%	1500	1000	1500	Fine Silver	—	100,000	6	750,000	60	140
93	1.5	75%	110%	1500	1000	1500	Fine Silver	•Gold Alloy	100,000	6	10,000,000	60	160
150	2	75%	110%	500	500	500	Silver Alloy	—	500,000	12	1,000,000	12	122
BRM	Switch Only—No Magnet Coil			500	250	250	—	Special Alloy	5,000,000	60	2,000,000,000	7200	185
BRMR1	0.100	60%	110%	500	250	250	—	Special Alloy	2,000,000	60	2,000,000,000	7200	185
BRMR2	0.150	60%	110%	500	250	250	—	Special Alloy	2,000,000	60	2,000,000,000	7200	185
BRS	Switch Only—No Magnet Coil			500	500	250	—	Special Alloy	20,000,000	60	2,000,000,000	7200	185
BRSR1	0.125	75%	110%	500	500	250	—	Special Alloy	20,000,000	60	2,000,000,000	7200	185
BRSR2	0.250	75%	110%	500	500	250	—	Special Alloy	20,000,000	60	2,000,000,000	7200	185
All Type MS	Current Sensitive			1000	1000	1000	—	•Gold Alloy	100,000	60	10,000,000	180	185
TRM	Switch Only—No Magnet Coil			250	250	250	—	Special Alloy	2,000,000	60	2,000,000,000	7200	185
TRMR1	0.150	70%	110%	250	250	250	—	Special Alloy	2,000,000	60	2,000,000,000	7200	185
TRMR2	0.250	70%	110%	250	250	250	—	Special Alloy	2,000,000	60	2,000,000,000	7200	185

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

** Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions. Electric life substantially greater when operated below rated load.

† Load tests — making inrush ratings (0.4 to 0.5 P.F.) — breaking 125% continuous rating (0.65 to 0.8 P.F.).

• Cross-bar contacts.

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

PART NUMBERS AND PRICES

Catalog #	Net Price
70-901	$4.00
70-902	4.00
70-903	4.00
70-904	4.00
70-905	6.90
70-906	6.90
70-907	6.90
70-908	6.90
70-909	10.50
70-910	10.50
70-911	10.50
70-912	10.50
70-913	4.00
70-914	4.00
70-915	4.00
70-916	4.00
70-917	4.00
70-918	4.00
70-919	4.00
70-920	4.00
70-921	9.40
70-922	9.40
70-923	9.40
70-924	9.40
75-901	4.59
75-902	4.59
75-903	4.59
75-904	4.59
75-905	4.59
75-906	4.59
80-901	7.27
80-902	7.27
80-904	7.27
81-201045-11000	3.05
81-214026-29000	3.30
81-202045-55000	8.90
81-301045-39000	4.52
84-901	3.06
84-902	3.06
84-903	3.37
84-904	3.67
84-905	3.32
84-906	3.37
84-907	3.65
84-908	4.00
84-912	3.03
84-913	3.29
84-914	3.65
84-916	3.29
84-917	3.60
84-918	3.90
84-922	2.98
84-923	2.96
84-924	3.70
84-926	3.36
84-927	3.60
84-928	3.98
84D-902	3.37
84D-903	3.37
84TD-902	7.57
84TD-903	7.57
84TE-902	7.57
84TE-903	7.57
85-901	10.80
85-902	10.80
85-903	10.80
91-180-1	.60
91-901	5.87
91-902	6.47
91-903	6.33
91-904	5.79
91-905	5.99
91-906	6.27
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91-909	5.99
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91D-912	5.78
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92-902	7.22
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92-904	6.96
92-905	6.78
92-906	7.59
92-907	7.14
92-908	7.37
92-909	7.80
92-910	7.14
92-911	7.28
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92D-911	7.13
92D-912	7.13
92D-913	7.22
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93-902	4.15
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93-904	3.42
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93-906	4.62
93-907	3.42
93-908	$4.15
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93-910	3.84
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93-913	3.26
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93-915	4.20
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93-950	4.02
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93-993	4.47
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93P-902	6.46
93P-903	8.04
93P-904	5.78
93P-905	6.46
93P-906	8.04
93P-907	5.78
93P-908	6.46
93P-909	8.04
93P-910	6.20
93P-911	6.88
93P-912	8.46
93P-913	5.73
93P-914	6.41
93P-915	7.98
93P-916	5.73
93P-917	6.41
93P-918	7.98
93P-919	5.73
93P-920	6.41
93P-921	7.98
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93P-923	7.04
93P-924	8.61
93P-931	5.73
93P-932	6.36
93P-933	7.88
93P-934	5.73
93P-935	6.37
93P-936	7.88
93P-937	5.73
93P-938	6.36
93P-939	7.88
93P-940	5.67
93P-941	6.78
93P-942	8.30
93P-943	5.67
93P-944	6.30
93P-945	7.83
93P-946	5.67
93P-947	6.30
93P-948	7.83
93P-949	5.67
93P-950	6.30
93P-951	7.98
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93P-954	$8.46
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93P-957	6.35
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93P-959	5.84
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93Q-902	4.73
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93Q-904	3.94
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93Q-913	3.73
93Q-914	4.73
93Q-915	4.83
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129AR-902	6.40
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129AR-905	7.46
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187-901	14.06
187-902	15.00
189-901	9.24
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189-903	10.93
987-902	4.10
987-903	4.20
987-904	4.44
987-906	4.22
987-907	4.35
987-908	4.55
987-910	4.66
987-911	4.79
987-912	4.99
BRM-902	$1.25
BRMR1-901	5.11
BRMR1-902	5.16
BRMR1-903	5.26
BRMR2-901	7.15
BRMR2-902	7.18
BRMR2-903	7.24
BRS-901	1.25
BRSR1-901	4.77
BRSR1-902	4.83
BRSR1-903	4.87
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BRSR2-903	6.33
C10-901	12.60
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C10-903	12.60
C15-901	18.72
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C30-901	19.95
C30-902	19.95
C30-903	19.95
C50R-901	27.90
C50R-902	27.90
C50R-903	27.90
MS25-901	2.29
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MS25-903	2.60
MS25-904	2.43
MS25-905	2.86
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MS25P-901	5.10
MS25P-902	5.14
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MS25P-904	5.24
MS25P-905	5.67
MS25P-906	6.20
MS40-901	2.11
MS40-902	2.18
MS40-903	2.18
MS40-904	2.26
MS40-905	2.26
MS40-906	2.35
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MS50-902	4.36
MS50-903	4.63
MS50-904	4.86
MS50-905	5.13
MS50-906	5.66
MS50-921	5.53
MS50-922	5.53
MS50-923	5.60
MS50-924	6.03
MS50-925	6.31
MS50-926	6.83
MS50P-901	8.05
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MS50P-906	9.35
MS50P-921	9.88
MS50P-922	9.88
MS50P-923	9.96
MS50P-924	10.44
MS50P-925	10.88
MS50P-926	11.75
MS64-901	2.21
MS64-902	2.27
MS64-903	2.50
MS64-904	2.69
MS64-911	2.27
MS64-912	2.34
MS64-913	2.31
MS64-914	2.76
99-801170-187	3.58
99-801170-186	3.61
99-801170-185	3.87
99-804170-197	5.15
99-804170-196	5.22
99-804170-195	5.29
S30-901	11.55
S30-902	11.55
S30-903	11.55
S40-901	13.10
S40-902	13.10
S40-903	13.10
TRM-901	5.00
TRMR1-901	10.07
TRMR1-902	10.12
TRMR1-903	10.12
TRMR2-901	14.59
TRMR2-902	14.62
TRMR2-903	14.68

Listed here are standard controls only — for variations or special designs consult the factory



RBM CONTROLS

STANDARD CATALOG CONTROLS

available immediately at factory prices from . . .

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ARKANSAS
Bluff City Jonesboro 501-932-7811

CALIFORNIA
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Kierulff Electronics L. A. 213-685-5511
Fisher Switches Palo Alto 415-321-4080
Kierulff Electronics San Diego 714-278-2112

COLORADO
Kierulff Electronics Denver 303-825-7033
Newark-Denver Elec. Denver 303-757-3351

CONNECTICUT
Cramer Electronics Hamden 203-288-7771

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Hammond Electronics Daytona Beach 904-253-0531
Hammond Electronics Ft. Myers 813-334-2277
Hammond Electronics Jacksonville 904-356-4851
Hammond Electronics Lakeland 813-686-4145
Electronic Equip. Miami 305-635-0421
Hammond Electronics Orlando 305-241-6601
Hammond Electronics Tampa 813-253-0104

GEORGIA
Specialty Distributing Atlanta 404-873-2521

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Newark Electronics Chicago 312-638-4411

INDIANA
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MARYLAND
Powell Electronics Beltsville 301-474-1030

MASSACHUSETTS
Cramer Electronics Newton 617-969-7700

MICHIGAN
Raido Electronics Grand Rapids 616-459-4611
Rissi Electronics Detroit 313-834-8420

MINNESOTA
Lew Bonn Minneapolis 612-339-9461

MISSISSIPPI
Bluff City Columbus 601-328-6212
Bluff City Greenville 601-334-4412
Bluff City Tapelo 601-842-6832

MISSOURI
Burstein-Applebee Kansas City 816-221-4266
Interstate Industrial St. Louis 314-353-8313

NEW MEXICO
Kierulff Electronics Albuquerque 505-268-3901

NEW YORK
E-T Instruments New York 212-675-2400
Arrow Electronics Farmingdale 516-694-6800
Stack Electronics Binghamton 607-723-6326
Summit Distributors Buffalo 716-884-3450
Roburn Agencies (Export) New York 212-966-2130

NORTH CAROLINA
Dixie Radio Charlotte 704-334-6480

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Pioneer-Standard Cleveland 216-432-0010
Srepeo Pioneer Dayton 513-224-0871

OKLAHOMA
Oil Capital Electronics Tulsa 918-836-2541
Texas Instr. Tulsa 918-583-8121

OREGON
Lou Johnston Portland 503-222-9551

PENNSYLVANIA
Powell Electronics Philadelphia 215-724- 1900
R.P.C. Electronics Pittsburgh 412-782-3844

SOUTH CAROLINA
Dixie Radio Columbia 803-253-5333

TENNESSEE
Bluff City Memphis 901-276-4501
Bluff City Union City 901-885-1861
Electra Distributing Nashville 615-255-8444

TEXAS
Texas Instr. Dallas 214-357-6121
Texas Instr. Houston 713-666-2175

WASHINGTON
Washington Electronics Seattle 206-682-4380

WISCONSIN
Raido Parts Co. Milwaukee 414-276-4160

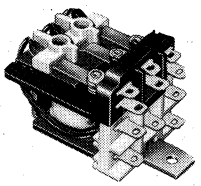
WRITE FOR STANDARD CONTROLS CATALOG

ESSEX INTERNATIONAL, INC.
CONTROLS DIVISION

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

A.C.-D.C. GENERAL PURPOSE RELAYS

TYPE 93

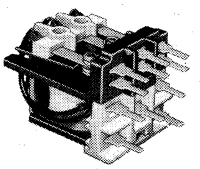


Solder Terminals
(Fig. 1a)

Solder terminal type has combined front, single hole screw and stud mounting, screw and stud included. All terminals out front. One piece molded bobbin and terminal board construction. Highly resistant to arc tracking. Printed circuit type may be controlled by SCR if firing angle, is no more than 10 degrees.*

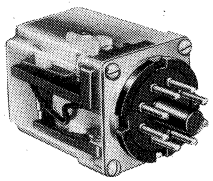
Size: 1 15/16" x 1 5/16" x 1 5/16" U.L. and C.S.A.

TYPE 93



Printed Circuit
(Fig. 1b)

TYPE 93P

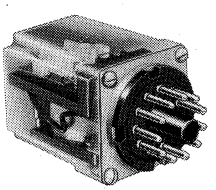


8 Pin Plug-In
(Fig. 2)

8 pin octal base for single and two pole. 11 pin base for three pole. High impact case. Standard pin connections.

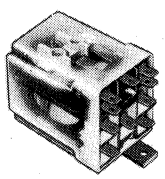
Size: 2 1/8" x 1 7/16" x 1 9/16". U.L. and C.S.A.

TYPE 93P



11 Pin Plug-In
(Fig. 2)

TYPE 93Q

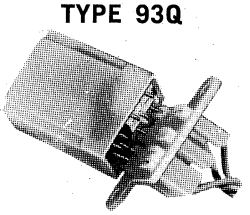


Quick Connect
(Fig. 3)

Enclosed quick connect type designed for front mounting or polarized socket mounting. For socket mounting use 93-153-1 socket kit. Front mounting relay has .20 x .187 terminals. High impact case.

Size: 2 1/8" x 1 7/16" x 1 9/16". U.L. and C.S.A.

TYPE 93Q



Relay Receptacle
93-153-1

A.C. CONTACT RATINGS

A.C. Voltage	Fine Silver Button		Gold-Alloy Cross Bar	
	Inductive	Resistive	Inductive	Resistive
120	1/6 H.P.	10 Amp.	1/10 H.P.	5 Amp.
240	1/3 H.P.	5 Amp.	1/6 H.P.	3 Amp.

D.C. CONTACT RATINGS

Button	Cross Bar
@ 28 V.D.C.	@ 28 V.D.C.
5 Amp. Resistive	5 Amp. Resistive
Consult Factory on U.L. and C.S.A.	

Coil Voltage	D.C. Resistance in Ohms @ 25°C	Contact Form	Open Type: Solder Terminals (Fig. 1a) 10 Amp. Button Contacts Catalog Number	Open Type: Solder Terminals (Fig. 1a) 5 Amp. Cross-Bar Contacts Catalog Number	Open Type: Printed Circuit (Fig. 1b) 5 Amp. Cross-Bar Contacts Catalog Number	Enclosed Type: Plug-In (Fig. 2) 10 Amp. Button Contacts Catalog Number	Enclosed Type: Plug-In (Fig. 2) 5 Amp. Cross-Bar Contacts Catalog Number	Enclosed Type: Quick Connect Terminals (Fig. 3) 10 Amp. Button Contacts Catalog Number	Enclosed Type: Quick Connect Terminals (Fig. 3) 5 Amp. Cross-Bar Contacts Catalog Number
6 (50/60 CY.)	3.5	1PDT	93-901	93-931	—	93P-901	93P-931	93Q-901	93Q-931
		2PDT	93-902	93-932	—	93P-902	93P-932	93Q-902	93Q-932
		3PDT	93-903	93-933	—	93P-903	93P-933	93Q-903	93Q-933
12 (50/60 CY.)	14	1PDT	93-985	93-988	*93-991	93P-955	93P-958	93Q-955	93Q-958
		2PDT	93-986	93-989	*93-992	93P-956	93P-959	93Q-956	93Q-959
		3PDT	93-987	93-990	*93-993	93P-957	93P-960	93Q-957	93Q-960
24 (50/60 CY.)	55	1PDT	93-904	93-934	*93-964	93P-904	93P-934	93Q-904	93Q-934
		2PDT	93-905	93-935	*93-965	93P-905	93P-935	93Q-905	93Q-935
		3PDT	93-906	93-936	*93-966	93P-906	93P-936	93Q-906	93Q-936
120 (50/60 CY.)	1400	1PDT	93-907	93-937	*93-967	93P-907	93P-937	93Q-907	93Q-937
		2PDT	93-908	93-938	*93-968	93P-908	93P-938	93Q-908	93Q-938
		3PDT	93-909	93-939	*93-969	93P-909	93P-939	93Q-909	93Q-939
208/240 (50/60 CY.)	4850	1PDT	93-910	93-940	—	93P-910	93P-940	93Q-910	93Q-940
		2PDT	93-911	93-941	—	93P-911	93P-941	93Q-911	93Q-941
		3PDT	93-912	93-942	—	93P-912	93P-942	93Q-912	93Q-942
6 D.C.	24	1PDT	93-913	93-943	—	93P-913	93P-943	93Q-913	93Q-943
		2PDT	93-914	93-944	—	93P-914	93P-944	93Q-914	93Q-944
		3PDT	93-915	93-945	—	93P-915	93P-945	93Q-915	93Q-945
12 D.C.	96	1PDT	93-916	93-946	*93-976	93P-916	93P-946	93Q-916	93Q-946
		2PDT	93-917	93-947	*93-977	93P-917	93P-947	93Q-917	93Q-947
		3PDT	93-918	93-948	*93-978	93P-918	93P-948	93Q-918	93Q-948
24 D.C.	384	1PDT	93-919	93-949	*93-979	93P-919	93P-949	93Q-919	93Q-949
		2PDT	93-920	93-950	*93-980	93P-920	93P-950	93Q-920	93Q-950
		3PDT	93-921	93-951	*93-981	93P-921	93P-951	93Q-921	93Q-951
110 D.C.	8000	1PDT	93-922	93-952	—	93P-922	93P-952	93Q-922	93Q-952
		2PDT	93-923	93-953	—	93P-923	93P-953	93Q-923	93Q-953
		3PDT	93-924	93-954	—	93P-924	93P-954	93Q-924	93Q-954

Listed here are standard controls only — for variations or special designs consult the factory

DESIGN DATA ON PAGE 2226

PRICES ON PAGE 2227

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

A.C.-D.C. GENERAL PURPOSE RELAYS

TYPE 84

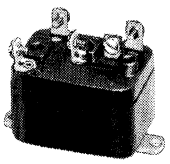


FIGURE 1



FIGURE 2

SIZE 2⅜" x 1⅝" x 1½"

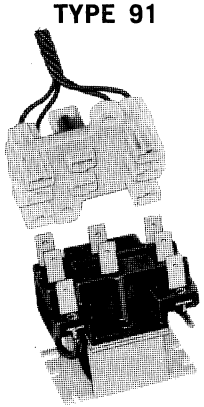
- Totally Enclosed
- Low Cost
- Screw or ¼" Quick Connect Termination
- Hardware Included
- Operates Any Position
- Isolated Coil
- I or T Mounting Brackets
- A.C. Coils Rated 50/60 cy
- U.L. and C.S.A.

SINGLE POLE NORMALLY OPEN and SINGLE POLE DOUBLE THROW

Coil Voltage A.C.	Catalog Number Figure 1		Contact Rating 125/250 V.A.C.	
	1PNO	1PDT	Inductive	Resistive
6	84-901	84-905	N.O. 8 Amps. Continuous 25 Amps. Inrush D.T. 8 Amps. Continuous 18 Amps. Inrush	N.O. 16 Amps. Continuous D.T. 8 Amps. Continuous
24	84-902	84-906		
120	84-903	84-907		
230/240	84-904	84-908		
Coil Voltage A.C.	**Catalog Number Figure 2**			
	1PNO	**1PDT**		
24	84-912	84-916		
120	84-913	84-917		
230/240	84-914	84-918		
24	84-922	84-926	3 Amps. @ 125 V.A.C. or 1.5 Amps. @ 250 V.A.C. Pilot Duty	
120	84-923	84-927		
230/240	84-924	84-928		

Coil Voltage D.C.	Resistance in Ohms @ 25°C	Catalog Number Figure 1	D.C. Contact Rating Inductive	
			Voltage	Current
12	90	84D-902	12	3 Amp.
24	280	84D-903	24	1.5 Amp.

TYPE 91



SEPARATE 91-180-1 SOCKET AND TERMINAL KIT
SIZE 2⅛" x 1⅞" x 2⅜"

- ¼" Quick Connect Termination
- U.L. and C.S.A.
- Enclosed Contacts
- Operates Any Position
- Solenoid Action
- Wiring Terminals Included
- A.C. Coils Rated 50/60 cy.
- Can Be Panel Mounted

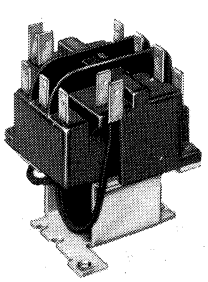
TWO POLE DOUBLE THROW

Coil Voltage A.C.	Catalog Number	Circuit Rating Terminals		Power Rating (A)	
		1-2-3	4-5-6	Inductive	Resistive
24	91-901	(A)	(A)	12 Amp. Cont. 60 Amp. Inrush 125 V.A.C. 6 Amp. Cont. 35 Amp. Inrush 250 V.A.C.	15 Amp. 277 V.A.C. Max.
120	91-902				
230/240	91-903				
24	91-904	(A)	(B)		
120	91-905				
230/240	91-906				
24	91-907	(B)	(B)		
120	91-908				
230/240	91-909				

			Pilot Rating (B)	
			Inductive	Resistive
			125 V.A. 1/10 H.P. 125/250 V.A.C.	3 Amp. 277 V.A.C. Max.

Coil Voltage D.C.	Catalog Number	Resistance in Ohms @ 25°C	D.C. Contact Rating - Resistive
6	91D-911	7	10 Amps. @ 32 V. Max.
12	91D-912	29	
24	91D-913	115	

TYPE 92



SIZE 2⅜" x 2⅜" x 2¾"

- ¼" Quick Connect Termination
- U.L. and C.S.A.
- Enclosed Contacts Operates Any Position
- Solenoid Action
- Wiring Terminals Included
- Manual Operating Button
- A.C. Coils Rated 50/60 cy

THREE POLE DOUBLE THROW

Coil Voltage A.C.	Catalog Number	Circuit Rating			Power Rating (A)	
		X	Y	Z	Inductive	Resistive
24	92-901	(A)	(A)	(A)	12 Amp. Cont. 60 Amp. Inrush 125 V.A.C. 6 Amp. Cont. 35 Amp. Inrush 250 V.A.C.	15 Amp. 277 V.A.C. Max.
120	92-902					
230/240	92-903					
24	92-904	(A)	(B)	(A)		
120	92-905					
230/240	92-906					
24	92-907	(B)	(A)	(B)		
120	92-908					
230/240	92-909					
24	92-910	(B)	(B)	(B)		
120	92-911					
230/240	92-912					

			Pilot Rating (B)	
			Inductive	Resistive
			120 V.A. 1/10 H.P. 125/250 V.A.C.	3 Amp. 277 V.A.C. Max.

Coil Voltage D.C.	Catalog Number	Resistance in Ohms @ 25°C	D.C. Contact Rating - Resistive
6	92D-911	6.5	10 Amps. @ 32 V. Max.
12	92D-912	26	
24	92D-913	104	

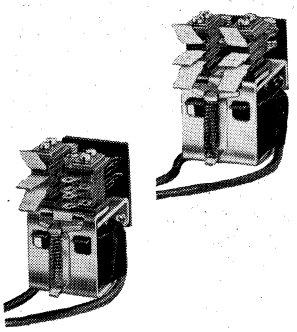
Listed here are standard controls only — for variations or special designs consult the factory

DESIGN DATA ON PAGE 2226 PRICES ON PAGE 2227

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

A.C. GENERAL PURPOSE RELAYS

TYPE 987



SIZE 2⅛" x 1" x 2"

- 9" Lead Wire Coil
- Front or Rear Mounting
- Hardware Included
- Quick Connect Terminals on 15 Amp Poles
- Solder Terminals on 3 Amp Poles

TWO POLE and THREE POLE DOUBLE THROW

Coil Voltage 60 cy.	Contact Form	Catalog Number	Contact Rating — Non-Inductive 125/250 V.A.C.	
			Left Stack	Right Stack
24	2PDT	987-902	SPDT - 15 AMP.	SPDT - 3 AMP.
120	2PDT	987-903		
240	2PDT	987-904		
24	2PDT	987-906	SPDT - 15 AMP.	SPDT - 15 AMP.
120	2PDT	987-907		
240	2PDT	987-908		
24	3PDT	987-910	SPDT - 15 AMP.	2PDT - 3 AMP.
120	3PDT	987-911		
240	3PDT	987-912		

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

A.C. POWER RELAYS

TYPE 129

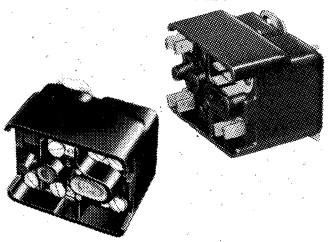


FIGURE 1 FIGURE 2

SIZE 2⅜" x 1⅞" x 1⅞"

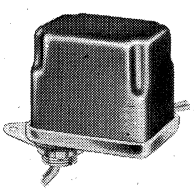
- Double-Break Contacts
- Totally Enclosed
- Hi-Impact Case
- Screw or ¼" Quick Connect Termination
- Hardware Included
- U.L. and C.S.A.
- Non-Positional

SINGLE POLE NORMALLY OPEN and SINGLE POLE DOUBLE THROW

Coil Voltage (50/60 cy.)	Catalog Number				Contact Rating 250 V.A.C. Max.	
	Figure 1		Figure 2			
	1PNO	†1PDT	1PNO	†1PDT	Inductive	Resistive
6	129-901	129-905	—	—	18 Amp. Continuous 1 H.P.-125 V. 2 H.P.-250 V.	18 Amp. Continuous
24	129-902	129-906	129-911	129-914		
120	129-903	129-907	129-912	129-915		
208/230	129-904	129-908	129-913	129-916		

† All contact terminals must be wired same polarity.

TYPE 129AR



SIZE 2¾" x 2⅜" x 3⅛"

- Totally Enclosed
- Hi-Impact Case
- Double-Break Contacts
- Easy to Mount
- U.L. and C.S.A.
- Pre-Wired
- No Enclosure Required
- Low Cost

SINGLE POLE NORMALLY OPEN and SINGLE POLE DOUBLE THROW

Coil Voltage (50/60 cy.)	Catalog Number		Contact Rating — 250 V.A.C. Max.	
	1PNO	†1PDT	Inductive	Resistive
— 24	129AR-901	129AR-904	18 Amp. Continuous 1 H.P.-120 V. 2 H.P.-250 V.	18 Amp. Continuous
120	129AR-902	129AR-905		
208/230	129AR-903	129AR-906		

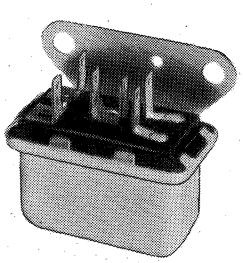
FITS ANY ½" KNOCK-OUT. MEETS STANDARD CODE REQUIREMENTS.
Underwriters Lab. white card listed. File E12139D 184N13.13 7/17/63.
Aluminum die-cast base and bushing. High impact phenolic enclosure.
Locknuts and position locking washer included. Color coded 8" lead wires.

† All contact terminals must be wired same polarity.

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

TYPE 150 D.C. POWER RELAYS

TYPE 150



SIZE 2¼" x 1½" x 2"

- Metal Case
- Totally Enclosed
- Isolated Coil
- Side Bracket
- ¼" Quick-Connect Termination
- Hardware Included
- Low Cost

SINGLE POLE NORMALLY OPEN

D.C. Coil Voltage	Resistance in Ohms	Catalog Number	Contact Rating	
			Voltage	Current
6	11	150-901	6	25 Amp.
12	44	150-902	12	25 Amp.
24	176	150-903	24	12 Amp.

SINGLE POLE DOUBLE THROW

D.C. Coil Voltage	Resistance in Ohms	Catalog Number	Contact Rating	
			Voltage	Current
6	11	150-904	6	15 Amp.
12	44	150-905	12	15 Amp.
24	176	150-906	24	7.5 Amp.

Listed here are standard controls only — for variations or special designs consult the factory

DESIGN DATA ON PAGE 2226 PRICES ON PAGE 2227

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

A.C. POWER CONTACTORS

TYPE 75

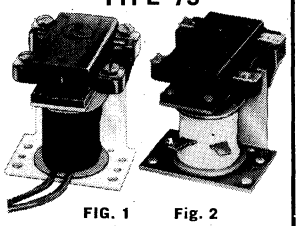


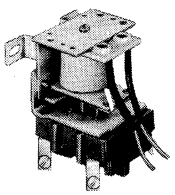
FIG. 1 Fig. 2
SIZE 2½" x 2⅛" x 2¼"

Screw Power Termination #8 Solid Wire Max.
•
13" Lead Wire or Quick Connect Coil Terminals
•
Hardware Included

TWO POLE NORMALLY OPEN

Coil Voltage (60 cy.)	Catalog Number Fig. 1	Catalog Number Fig. 2	Contact Rating (A.C.) Inductive	Contact Rating (A.C.) Resistive
24	75-901	75-904	1 H.P. Per Pole 115/230 V. 2 Pole Rating 2 H.P. — 230 V. or 18 Amp. Cont. 90 Amp. Inrush	25 Amp. 240 V. Per Pole
115/120	75-902	75-905		
230/240	75-903	75-906		

TYPE 80



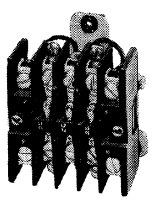
SIZE 3⅛" x 2⅝" x 2⅞"

Screw Power Termination #8 Solid Wire Max.
•
Double-Break Contacts
•
Hi-Dielectric
•
9" Coil Leads
•
Mount as Shown
•
Low Cost

TWO POLE NORMALLY OPEN

Coil Voltage (60 cy.)	Catalog Number	Contact Rating (A.C.) Inductive
24	80-901	25 Amp. Continuous 150 Amp. Inrush 250 V. Max.
120	80-902	
240	80-904	

TYPE 85



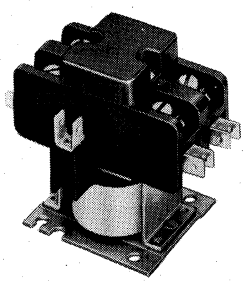
SIZE 3½" x 3⅛" x 2⅝"

Screw Terminals
•
#8 Solid Wire Max.
•
Double Break Contacts
•
¼" Auxiliary Wiring Terminals
•
Straight-Thru Wiring
•
Hi-Dielectric Materials

THREE POLE NORMALLY OPEN

Coil Voltage (50/60 cy.)	Catalog Number	Contact Rating (A.C.) — Inductive 250 V.	Contact Rating (A.C.) — Inductive 600 V.
24	85-901	25 Amp. Cont. 150 Amp. Inrush	12.5 Amp. Cont. 75 Amp. Inrush
120	85-902		
208/240	85-903		

TYPE 143



SIZE 3¼" x 2⅜" x 2½"

Straight-Through Wiring
•
Low Cost
•
Auxiliary Quick-Connect Terminals
•
U.L. and C.S.A.
•
Hardware Included
•
Screw Power Terminals For #10 Solid Wire Max.
•
25 Amp Unit Has Cover
•
Double-Break Contacts

TWO POLE NORMALLY OPEN

Coil Voltage (50/60 cy.)	Catalog Number	Contact Rating Inductive	Contact Rating Resistive
24	143-901	18 Amp. Cont. 90 Amp. Inrush @ 277 V.A.C. Per Pole	25 Amp. @ 277 V.A.C. Per Pole
120	143-902		
208/240	143-903		
24	143-911	25 Amp. Cont. 150 Amp. Inrush @ 277 V.A.C. Per Pole	35 Amp. @ 277 V.A.C. Per Pole
120	143-912		
208/240	143-913		

TYPE S30 TYPE S40



FIG. 1

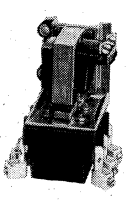


FIG. 2

SIZE 3⅞"x2⅜"x2½" SIZE 3⅞"x2¾"x2½"

Solenoid Action
•
Enclosed Contacts
•
Resilient Mounting
•
Screw Power Termination For #8 Solid Wire Max.
•
Epoxy Coil
•
Hi-Dielectric
•
Double Break Contacts

THREE POLE NORMALLY OPEN — 30 AMP. — Figure 1

Coil Voltage (50/60 cy.)	Catalog Number	Contact Rating (A.C.) — Inductive Voltage	Continuous	Inrush
24	S30-901	250 600	30 Amp. 15 Amp.	180 Amp. 90 Amp.
115	S30-902			
230	S30-903			

THREE POLE NORMALLY OPEN — 40 AMP. — Figure 2

Coil Voltage (50/60 cy.)	Catalog Number	Contact Rating (A.C.) Inductive
24	S40-901	40 Amp. Continuous 200 Amp. Inrush 250 V. Max.
115	S40-902	
230	S40-903	

Listed here are standard controls only — for variations or special designs consult the factory

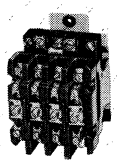
ENGINEERING DESIGN DATA ON PAGE 2226 • NET PRICES ON PAGE 2227

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

A.C. INDUSTRIAL CONTACTORS

UNIQUE DESIGN PERMITS COMMON BASE, COIL & MAGNET FOR CONTACTOR RATINGS FROM 10 TO 50 AMPERES • DOUBLE BREAK "NO-KISS" CONTACT ACTION • REPLACEABLE CONTACTS & COIL • EPOXY SEALED MOLDED MAGNET COIL HOUSING • LAMINATED CORROSION RESISTANT E-TYPE MAGNET & SELF-ALIGNING ARMATURE • HI-DIELECTRIC ARC RESISTANT MOLDED CONTACT BLOCK & CARRIER • 50/60 CYCLE MAGNET COIL • RESILIENT MOUNTING

TYPE C10
10 AMP. — 600 VOLTS



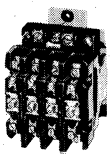
SIZE 3⅝" x 2¾" x 3⅜"

Pressure Type Power Terminals #10 Solid Wire Max.
•
All Contacts Convert to N.C.
•
Double Break Contacts

FOUR POLE NORMALLY OPEN

Coil Voltage (50/60 cy.)	Catalog Number	Contact Rating (A.C.)		
			Horsepower	
		Voltage	Single Phase	Three Phase
24	C10-901	110	½	¾
		220	¾	1
110	C10-902	600	1	1
			Resistive	
220	C10-903	10 Amp. 600 V. Max. (Per Pole)		

TYPE C15
15 AMP. — 600 VOLTS



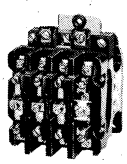
SIZE 3⅝" x 2¾" x 3⅜"

Pressure Type Power Terminals #10 Solid Wire Max.
•
All Contacts Convert to N.C.
•
Double Break Contacts

FOUR POLE NORMALLY OPEN

Coil Voltage (50/60 cy.)	Catalog Number	Contact Rating (A.C.)		
			Horsepower	
		Voltage	Single Phase	Three Phase
24	C15-901	110	1	1½
		220	1½	2
110	C15-902	600	1½	2
			Resistive	
220	C15-903	15 Amp. 600 V. Max. (Per Pole)		

TYPE C30



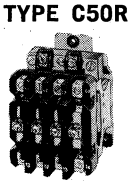
SIZE 3⅝" x 2¾" x 3⅜"

30 Amp. 600 Volts
•
Pressure Type Power Terminals #6 Solid Wire Max.
•
SPNO Auxiliary Converts to N.C.
•
Double Break Contacts

THREE POLE NORMALLY OPEN PLUS 15 AMP. AUX.

Coil Voltage (50/60 cy.)	Catalog Number	Contact Rating (A.C.)		
			Horsepower	
		Voltage	Single Phase	Three Phase
24	C30-901	110	2	3
		220	3	7½
110	C30-902	600	5	10
			Resistive	
220	C30-903	30 Amp. — 600 V. (Per Pole)		

TYPE C50R



SIZE 3⅝" x 2¾" x 3⅜"

50 Amp. 480 Volts
•
Pressure Type Power Terminals #6 Stranded Wire Max.
•
Double Break Contacts

FOUR POLE NORMALLY OPEN

Coil Voltage (50/60 cy.)	Catalog Number	Contact Rating (A.C.)
24	C50R-901	Resistive Only For Electric Heating 50 Amp. — 480 Volt Max.
110	C50R-902	
220	C50R-903	

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

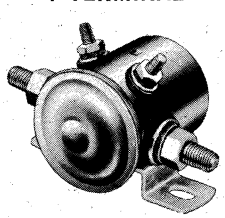
TYPE 70 D.C. POWER CONTACTORS

NON-TURNING STUDS • DRAWN STEEL DUST PROOF ENCLOSURE • COPPER STUD POWER & COIL TERMINALS • DOUBLE BREAK ROTATING DISC MOVABLE CONTACT • SOLENOID ACTUATED • SUGGESTED MOUNTING — CAP DOWN

CONTACT RATING D.C. INDUCTIVE LOAD — 36 V. MAX.

Voltage (D.C.)	Normally Open		Normally Closed	
	Continuous	Inrush	Continuous	Inrush
6	80 Amp.	300 Amp.	60 Amp.	100 Amp.
12	80 Amp.	150 Amp.	60 Amp.	60 Amp.
24-36	50 Amp.	50 Amp.	30 Amp.	30 Amp.

4 TERMINAL



SIZE 2½" x 3½" x 2½"

Four Terminal
•
Isolated Coil
•
Silver or Copper Contacts
•
Hardware Included
•
Continuous Duty Coil
•
Ease In Wiring

SINGLE POLE NORMALLY OPEN

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-901	Copper
12	19	70-902	
24	60	70-903	
36	114	70-904	
6	4	70-905	Silver
12	19	70-906	
24	60	70-907	
36	114	70-908	

Continued next page

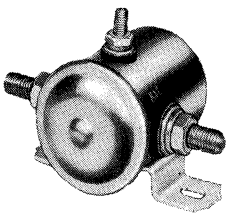
Listed here are standard controls only — for variations or special designs consult the factory

ENGINEERING DESIGN DATA ON PAGE 2226 • NET PRICES ON PAGE 2227

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

TYPE 70 D.C. POWER CONTACTORS
Continued

3 TERMINAL



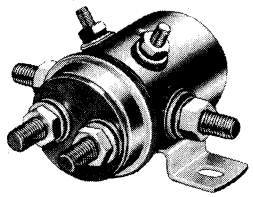
SIZE 2½" x 3½" x 2½"

Three Terminal
•
Continuous Duty Coil
•
Copper Contacts
•
Hardware Included
•
Coil Common to Case or Coil Common to Battery
•
Rugged Construction

SINGLE POLE NORMALLY OPEN

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-913	Copper — Coil Grounded to Case
12	19	70-914	
24	60	70-915	
36	114	70-916	
6	4	70-917	Copper — Coil Common to Load
12	19	70-918	
24	60	70-919	
36	114	70-920	

6 TERMINAL



SIZE 3⅜" x 3⁹⁄₁₆" x 2½"

Six Terminal
•
Continuous Duty Coil
•
Isolated Coil
•
Hardware Included
•
Choice of 2 Types Contacts

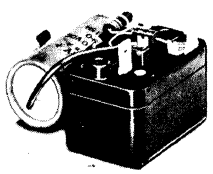
SINGLE POLE DOUBLE THROW

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-909	N.O. and N.C. Silver
12	19	70-910	
24	60	70-911	
36	114	70-912	
6	4	70-921	N.O. Copper and N.C. Silver
12	19	70-922	
24	60	70-923	
36	114	70-924	

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

A.C. & D.C. TIME DELAY RELAYS

TYPE 84T



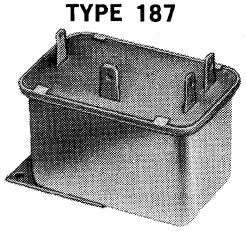
SIZE 2⅝" x 2¼" x 1½"

Rectifier/Capacitor Type
•
Fixed Timing
•
¼" Quick-Connect Termination
•
Wiring Terminals Included
•
Approx. Reset Time 4 Seconds
•
Rectifier/Capacitor Type Delay Available on Other Types

RECTIFIER/CAPACITOR TYPE SINGLE POLE DOUBLE THROW

Coil (50/60 cy.)	Contact Action: Delay After Coil Energized	Contact Action: Delay After Coil De-Energized	Catalog Number	Time Delay in Seconds ±25%	Contact Rating (A.C.) Inductive
115/120	X	—	84TE-902	2	3 Amp. 125 V. 1.5 Amp. 250 V. Continuous
230/240	X	—	84TE-903	2	
115/120	—	X	84TD-902	2	
230/240	—	X	84TD-903	2	

TYPE 187



SIZE 3" x 1¾" x 2¼"

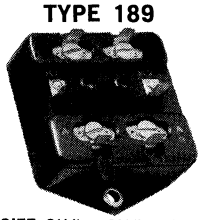
Metal Case
•
Totally Enclosed
•
Flat Bracket
•
¼" Quick-Connect Termination
•
Repeat ±2% @ 25°C and Nom. Voltage

SOLID STATE — FIELD ADJUSTABLE TYPE SINGLE POLE NORMALLY OPEN

Coil Voltage (50/60 cy.)	Time Delay on Pick-up	Catalog Number	Contact Rating Inductive
24 V.	.5 - 90 seconds	187-901	1 Amp. @ 120 V.A.C.
120 V.	.5 - 90 seconds	187-902	

Hidden trimming resistor for tamper-proof field timing adjustment. Reset time 100 M.S. Can use Types 93, 84, 91, 92, 129, 143 or 75 as slave relay.

TYPE 189



SIZE 3½" x 2¾" x 1½"

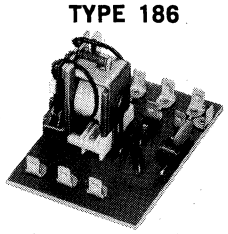
¼" Quick-Connect Coil Terminals
•
Screw and Quick-Connect Power Termination
•
Hi-Impact Case
•
Non Positional
•
Ambient Compensated

THERMAL TYPE TWO POLE NORMALLY OPEN

Operating: A.C. Voltage	Operating: Watts	Catalog Number	Contact Rating: Inductive	Contact Rating: Resistive
24 V	6	189-901	12 Amp. Cont. 72 Amp. Inrush @ 250 V.A.C.	25 Amp. @ 277 V.A.C.
120 V	6	189-902		
240 V	12	189-903		

Fixed time to close — after energization 20-40 seconds. Reset time — approx. 60 seconds.

TYPE 186



SIZE 3½" x 3½" x 2½"

Solid State Circuit Combined with RBM Type 93 Relay
•
Control Liquid Level Sense Temperature Variation or Light Intensity
•
PC Board Construction
•
Operates on 24VAC to 220 VAC
•
¼" Quick Connect Terminals

SEMI SOLID STATE TYPE THRU 3PDT

SEE RBM TYPE 93 FOR RELAY SPECIFICATIONS Page 2228

CONSULT FACTORY FOR SPECIAL DESIGN OR APPLICATION
CONSULT FACTORY FOR PRICING

Listed here are standard controls only — for variations or special designs consult the factory

ENGINEERING DESIGN DATA ON PAGE 2226 • NET PRICES ON PAGE 2227

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

COMPUTER RELAYS

TYPE 81

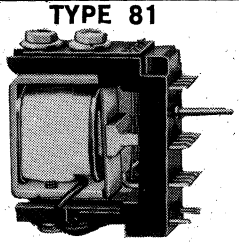


FIG. 1 2" x 5/8" x 2"

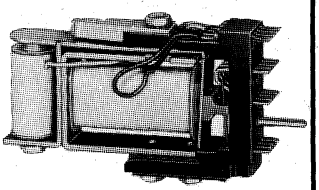


FIG. 2 2" x 5/8" x 2 3/4"

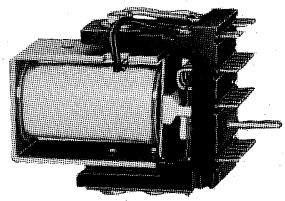


FIG. 3 2" x 15/16" x 2 3/4"

- Wire Contacts
- Plug-in Design
- Hardware Available
- 4 PDT Standard (Fig. 1)
  4PDT Latch (Fig. 2)
  6PDT (Fig. 3)
- High Speed
- Long Life
- Single or Double Coil Windings
- Standard or Long Yoke Available
- All Coil Voltages Thru 115 VDC Max.

Part Number	Fig.	Pole Form	D.C. Res.	Rated Voltage ±10%	Operate Time (M.S.)
81-201045-11000	1	4 PDT	720	45	5.5
81-214026-29000	3	4 PDT	500	26	10.0
81-202045-55000	2	4 PDT	395 332	45	6.6
81-301045-39000	3	6 PDT	216	45	4.5

CONTACT PERFORMANCE GUIDE*

RESISTIVE LOAD — NO ARC SUPPRESSION — 48 V.D.C.

	Electrical Life				
Contact Load Amperes	0.025	0.100	0.500	1.0	3.0
Number of Operations (Million)	200	100	20	5	Carry Only. No Make or Break.

*Based on tests with relay operating rate 30 per second. Consult factory for life expectancy for inductive loads — with or without arc suppression, giving contact loads, frequency of operation and "on time" ratio.

Consult factory on all prices. Final price depends on type of hardware required. Competitive pricing.

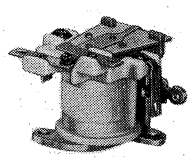
RBM CONTROLS
ESSEX INTERNATIONAL, INC.

MINIATURE D.C. SENSITIVE RELAYS

SINGLE POLE DOUBLE THROW — TWO POLE DOUBLE THROW — THREE POLE NORMALLY OPEN

Electrical Life				Mechanical Life	Operate Time (Incl. Bounce)	Vibration	Shock	Operating Ambient
NON-INDUCTIVE LOAD	0.5 Amp.	1.0 Amp.	2.0 Amp.	100,000,000 At 180 Operations Per Minute (No Load)	20 Milliseconds	2G 10-55 Cycles	2G Operate 10G Non-Operate	−55°C to +85°C
NUMBER OPERATIONS	1,000,000	300,000	100,000					

TYPE MS40



SIZE 1 1/8" x 1 1/8" x 15/16"

- Solder Terminals
- 4-40 Mounting
- Armature Common to Frame
- Long Life
- Low Cost

SINGLE POLE DOUBLE THROW — OPEN TYPE

Contact Rating	Coil Power	
2 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.050 Watts
	Maximum Capacity	1.0 Watts

D.C. Magnet Coil At 25°C			
Nominal Voltage or Current	*Max. Pick-up Voltage or Current	†Resistance in Ohms	Catalog Number
18.7 MA.	14 MA.	250	MS40-901
13.5 MA.	10 MA.	500	MS40-902
11.0 MA.	8.2 MA.	750	MS40-903
9.3 MA.	7 MA.	1000	MS40-904
7.7 MA.	5.8 MA.	1500	MS40-905
6.0 MA.	4.5 MA.	2500	MS40-906
4.3 MA.	3.2 MA.	5000	MS40-907
3.5 MA.	2.6 MA.	7500	MS40-908
2.9 MA.	2.2 MA.	10000	MS40-909

*D.O. Approx. 35% of PU. †Nominal ±10%.

TYPE MS64

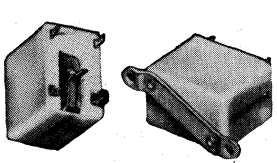


FIG. 1 FIG. 2

SIZE 1 3/16" x 3/4" x 1 1/8"

- Printed Circuit Terminals or Bracket Mounting
- Isolated Contacts
- Snap-on Cover
- Molded Construction

SINGLE POLE DOUBLE THROW — ENCLOSED TYPE

Contact Rating	Coil Power	
2 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.050 Watts
	Maximum Capacity	1.0 Watts

D.C. Magnet At 25°C				
Nominal Voltage or Current	*Max. Pick-up Voltage or Current	†Resistance in Ohms	Catalog Number Fig. 1	Catalog Number Fig. 2
6 V.	4.5 V.	400	MS64-901	MS64-911
12 V.	9.0 V.	1600	MS64-902	MS64-912
24 V.	18.0 V.	6500	MS64-903	MS64-913
3. MA.	2.3 MA.	10000	MS64-904	MS64-914

*D.O. Approx. 35% of PU. †Nominal ±10%.

Listed here are standard controls only — for variations or special designs consult the factory

ENGINEERING DESIGN DATA ON PAGE 2226 • NET PRICES ON PAGE 2227

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

MINIATURE D.C. SENSITIVE RELAYS

TYPE MS25P

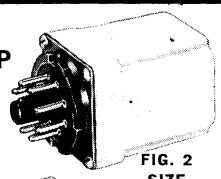
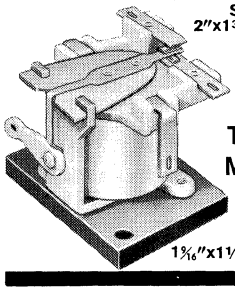


FIG. 2 SIZE 2"x1 3/8"x1 3/8"



TYPE MS25

FIG. 1 SIZE 1 5/16"x1 1/2"x1 7/16"

OPEN TYPE
Solder Terminals
•
Isolated Contacts
•
Protective Contact Cover
•
Insulating Fiber Base

ENCLOSED TYPE
8 Pin Plug-In
•
Isolated Contacts
•
High Impact Case

SINGLE POLE DOUBLE THROW

Contact Rating	Coil Power	
2 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.040 Watts
	Maximum Capacity	1.5 Watts

D.C. Magnet Coil At 25°C				
Nominal Voltage or Current	*Max. Pick-up Voltage or Current	†Resistance in Ohms	Fig. 1 Catalog Number	Fig. 2 Catalog Number
6 V.	4.5 V.	510	MS25-901	MS25P-901
12 V.	9.0 V.	2025	MS25-902	MS25P-902
24 V.	18.0 V.	8100	MS25-903	MS25P-903
3.7 MA.	2.8 MA.	5000	MS25-904	MS25P-904
2.7 MA.	2.0 MA.	10000	MS25-905	MS25P-905
2.1 MA.	1.6 MA.	15000	MS25-906	MS25P-906

*D.O. Approx. 35% of PU. †Nominal ±10%.

TYPE MS50P

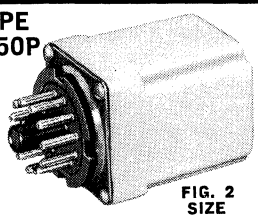
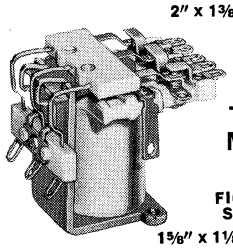


FIG. 2 SIZE 2" x 1 3/8" x 1 3/8"



TYPE MS50

FIG. 1 SIZE 1 5/8" x 1 1/8" x 1 3/8"

OPEN TYPE
Solder Terminals
•
Isolated Contacts
•
Protective Contact Cover

ENCLOSED TYPE
8 or 11 Pin Plug-In
•
Isolated Contacts
•
High Impact Case

TWO POLE DOUBLE THROW

Contact Rating	Coil Power	
2 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.125 Watts
	Maximum Capacity	1.5 Watts

D.C. Magnet Coil At 25°C				
Nominal Voltage or Current	*Max. Pick-up Voltage or Current	†Resistance in Ohms	Fig. 1 Catalog Number	Fig. 2 Catalog Number
6 V.	4.5 V.	160	MS50-901	MS50P-901
12 V.	9.0 V.	650	MS50-902	MS50P-902
24 V.	18.0 V.	2600	MS50-903	MS50P-903
6.7 MA.	5.0 MA.	5000	MS50-904	MS50P-904
4.7 MA.	3.5 MA.	10000	MS50-905	MS50P-905
3.9 MA.	2.9 MA.	15000	MS50-906	MS50P-906

*D.O. Approx. 35% of PU. †Nominal ±10%.
Also available in three pole double throw configuration.

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

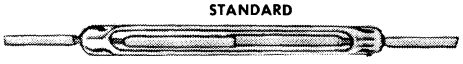
D.C. ENGINEERING DESIGN DATA

BRM-902
MINIATURE



BI-REED ®

BRS-901
STANDARD



BI-REED ®

TRM-901
MINIATURE



TRI-REED ®

Contact Form		Single Pole Normally Open						Single Pole Double Throw		
Miniature or Standard		Miniature			Standard			Miniature		
Catalog Number		BRM-902			BRS-901			TRM-901		
Non-Inductive Contact Rating	Make and Break	15 VA. A.C. — 5 Watts D.C. ¼ Amp. Maximum up to 250 Volts			15 VA. A.C. — 15 Watts D.C. 1.0 Amp. Maximum up to 250 Volts			15 VA. A.C. — 5 Watts D.C. ¼ Amp. Maximum up to 125 V. A.C. or 32 V. D.C.		
	No Make or Break	1.0 Amp. 250 V.			5 Amp. 250 V.			1 Amp. 125 V. A.C. or 32 V. D.C.		
Contact Life Based on 10 Ohm Miss Test	Resistive Load (D.C.)	10 Micro-Amp. @ 10 Milli-Volts	⅛ Amp. @ 32 Volts		10 Micro-Amp. @ 10 Milli-Volts	⅛ Amp. @ 32 Volts		10 Micro-Amp. @ 10 Milli-Volts	⅛ Amp. @ 32 Volts	
	Number Operations	100,000,000	10,000,000		200,000,000	125,000,000		100,000,000	10,000,000	
Approximate Overall Dimensions		Over Leads	Glass Length	Glass Diameter	Over Leads	Glass Length	Glass Diameter	Over Leads	Glass Length	Glass Diameter
		1.5"	0.75"	0.100"	3.35"	2.1"	0.200"	1.5"	0.60"	0.125"
Weight		0.315 Grams			2.5 Grams			0.295 Grams		
Minimum Breakdown Voltage (60 cy. R.M.S.)		250 V.			500 V.			250 V.		
Minimum Insulation Resistance (Megohms)		500 K.			500 K.			100 K.		
Initial Contact Resistance (Milliohms Max.)		150			50			150		
Maximum Operate Time (Milliseconds)		Pull-In (Including Bounce)		Release	Pull-In (Including Bounce)		Release	Pull-In (Including Bounce)		Release
		1.0		0.5	2.0		0.5	1.0		0.5
Ampere-Turns To Operate		Pull-In			Pull-In			Pull-In		
		Nominal	Minimum	Drop Out	Nominal	Minimum	Drop Out	Nominal	Minimum	Drop Out
		50 ±15	20	50% of P.U.	100 ±15	60	30% of P.U.	50 ±15	35	70% of P.U.
Nominal Coil Power		0.335 Watts			0.360 Watts			0.335 Watts		
Vibration		15G — 2000 C.P.S.			20G — 750 C.P.S.			15G — 2000 C.P.S.		
Shock (JAN S-44)		50G (Min.)			40G (Min.)			50G (Min.)		
Ambient Temperature Range		−55° to +85°C			−55° to +85°C			−55° to +85°C		
Standard Test Coil Specifications Available	Wire Size	#44			#36			#44		
	Number Turns	10,000			10,000			10,000		
	Tube I.D.	0.150"			0.210"			0.150"		
	Tube O.D.	0.200"			0.375"			0.200"		
	Tube Length	0.75"			1.75"			0.75"		

Listed here are standard controls only — for variations or special designs consult the factory

ENGINEERING DESIGN DATA ON PAGE 2226 • NET PRICES ON PAGE 2227

RBM CONTROLS
ESSEX INTERNATIONAL, INC.

MINIATURE D.C. GLASS REED RELAYS

TYPE BRMR
MINIATURE

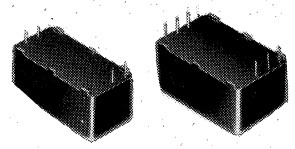


FIGURE 1 FIGURE 2

SIZE Fig. 1 - 1 9/64" x 5/16" x 35/64"
SIZE Fig. 2 - 1 9/16" x 47/64" x 35/64"
PLUS LEADS

See BRM-902 For Contact Rating

•

Operate Time 1 M.S. Including Bounce

•

Release Time 0.5 M.S. Max.

•

Magnetically Shielded

Coil Power	Nominal Voltage	Max. Pick-up Voltage	Minimum Drop-out Voltage	Max. Pick-up Current	Resistance in Ohms ±10%	Catalog Number
SINGLE POLE NORMALLY OPEN — Figure 1						
1.0 Watts Max. @ 25°C	6 V.	3.25 V.	0.8 V.	27.0 MA.	105	BRMR1-901
	12 V.	6.5 V.	1.0 V.	15.5 MA.	420	BRMR1-902
	28 V.	15.2 V.	2.5 V.	6.5 MA.	2350	BRMR1-903
TWO POLE NORMALLY OPEN — Figure 2						
1.5 Watts Max. @ 25°C	6 V.	3.25 V.	0.8 V.	46.5 MA.	70	BRMR2-901
	12 V.	6.5 V.	1.0 V.	25.2 MA.	280	BRMR2-902
	28 V.	15.2 V.	2.5 V.	9.8 MA.	1540	BRMR2-903

TYPE TRMR
MINIATURE

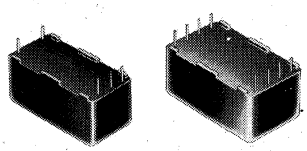


FIGURE 1 FIGURE 2

SIZE Fig. 1 - 1 9/64" x 5/16" x 35/64"
SIZE Fig. 2 - 1 9/16" x 47/64" x 35/64"
PLUS LEADS

See TRM-901 For Contact Rating

•

Operate Time 1 M.S. Including Bounce

•

Release Time 0.5 M.S. Max.

•

Shielded

Coil Power	Nominal Voltage	Max. Pick-up Voltage	Minimum Drop-out Voltage	Max. Pick-up Current	Resistance in Ohms ±10%	Catalog Number
TRUE FORM — SINGLE POLE DOUBLE THROW — Figure 1						
1.0 Watts Max. @ 25°C	6 V.	4 V.	1.5 V.	42 MA.	105	TRMR1-901
	12 V.	8 V.	3 V.	21 MA.	420	TRMR1-902
	28 V.	19 V.	6 V.	8 MA.	2350	TRMR1-903
TRUE FORM — TWO POLE DOUBLE THROW — Figure 2						
1.5 Watts Max. @ 25°C	6 V.	4 V.	1.5 V.	64 MA.	70	TRMR2-901
	12 V.	8 V.	3 V.	32 MA.	280	TRMR2-902
	28 V.	19 V.	6 V.	12 MA.	1540	TRMR2-903

TYPE BRSR
STANDARD

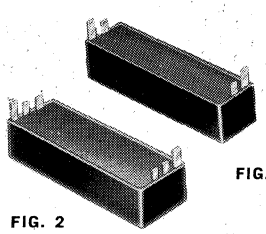


FIG. 1

FIG. 2

SIZE Fig. 1 - 2.55" x .675" x .625"
SIZE Fig. 2 - 2.55" x .925" x .625"

See BRS-901 For Contact Rating

•

Operate Time 2 M.S. Including Bounce

•

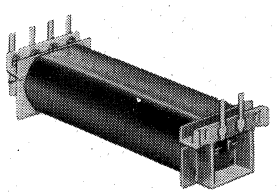
Release Time 0.5 M.S. Max.

•

Shielded

Coil Power	Nominal Voltage	Max. Pick-up Voltage	Minimum Drop-out Voltage	Max. Pick-up Current	Resistance in Ohms ±10%	Catalog Number
SINGLE POLE NORMALLY OPEN						
3.0 Watts Max. @ 25°C	6 V.	4.5 V.	0.55 V.	43.0 MA.	115	BRSR1-901
	12 V.	9.0 V.	1.10 V.	22.5 MA.	445	BRSR1-902
	28 V.	18.0 V.	2.50 V.	7.8 MA.	2550	BRSR1-903
TWO POLE NORMALLY OPEN						
3.2 Watts Max. @ 25°C	6 V.	4.5 V.	0.51 V.	86.5 MA.	58	BRSR2-901
	12 V.	9.0 V.	1.00 V.	45.0 MA.	220	BRSR2-902
	28 V.	18.0 V.	2.10 V.	13.3 MA.	1500	BRSR2-903

TYPE OBRSR



SIZE 2 35/64" x 55/64" x 5/16"

See BRS-901 For Contact Rating

•

Shielded

•

Operate Time 2 M.S. Including Bounce

•

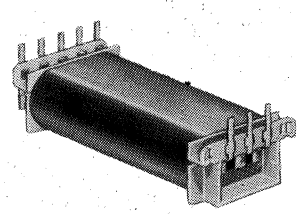
Release Time 0.5 M.S. Max.

•

Open Type

Coil Power	Nominal Voltage	Max. Pick-up Voltage	Minimum Drop-out Voltage	Max. Pick-up Current	Resistance in Ohms ±10%	Catalog Number
TWO POLE NORMALLY OPEN						
3.0 Watts Max. @ 25°C	6 V.	4.5 V.	0.55 V.	55.5 MA.	88	OBRSR2-901
	12 V.	9.0 V.	1.10 V.	28.0 MA.	350	OBRSR2-902
	28 V.	18.0 V.	2.50 V.	14.5 MA.	1400	OBRSR2-903

TYPE OBRSR



SIZE 2 35/64" x 1 3/64" x 5/16"

See BRS-901 For Contact Rating

•

Shielded

•

Operate Time 2 M.S. Including Bounce

•

Release Time 0.5 M.S. Max.

•

Open Type

Coil Power	Nominal Voltage	Max. Pick-up Voltage	Minimum Drop-out Voltage	Max. Pick-up Current	Resistance in Ohms ±10%	Catalog Number
THREE POLE NORMALLY OPEN						
3.4 Watts Max. @ 25°C	6 V.	4.5 V.	0.55 V.	112.5 MA.	45	OBRSR3-901
	12 V.	9.0 V.	1.10 V.	55.0 MA.	180	OBRSR3-902
	28 V.	18.0 V.	2.50 V.	18.5 MA.	1070	OBRSR3-903

Listed here are standard controls only — for variations or special designs consult the factory

ENGINEERING DESIGN DATA ON PAGE 2226 • NET PRICES ON PAGE 2227

Until now, designing with mercury relays meant taking the good with the bad. The trade-off for long life, high-speed closure and no contact bounce has been a bulky package (about ¾ cu. in.) that must be babied in a vertical position.

But not any more! Now Logcell® Mercury Film Relays offer all the advantages of mercury-wetted relays . . . plus miniature size (0.06 cu. in.), operation in **any** mounting position, and shock and vibration resistance suitable for many airborne, marine and other mobile applications.

Whether you require the specific advantages of mercury relays for computer logic circuits, advanced instrumentation or high-speed control systems . . . or just need a tiny rugged relay that will last and last and last, consider Logcells:

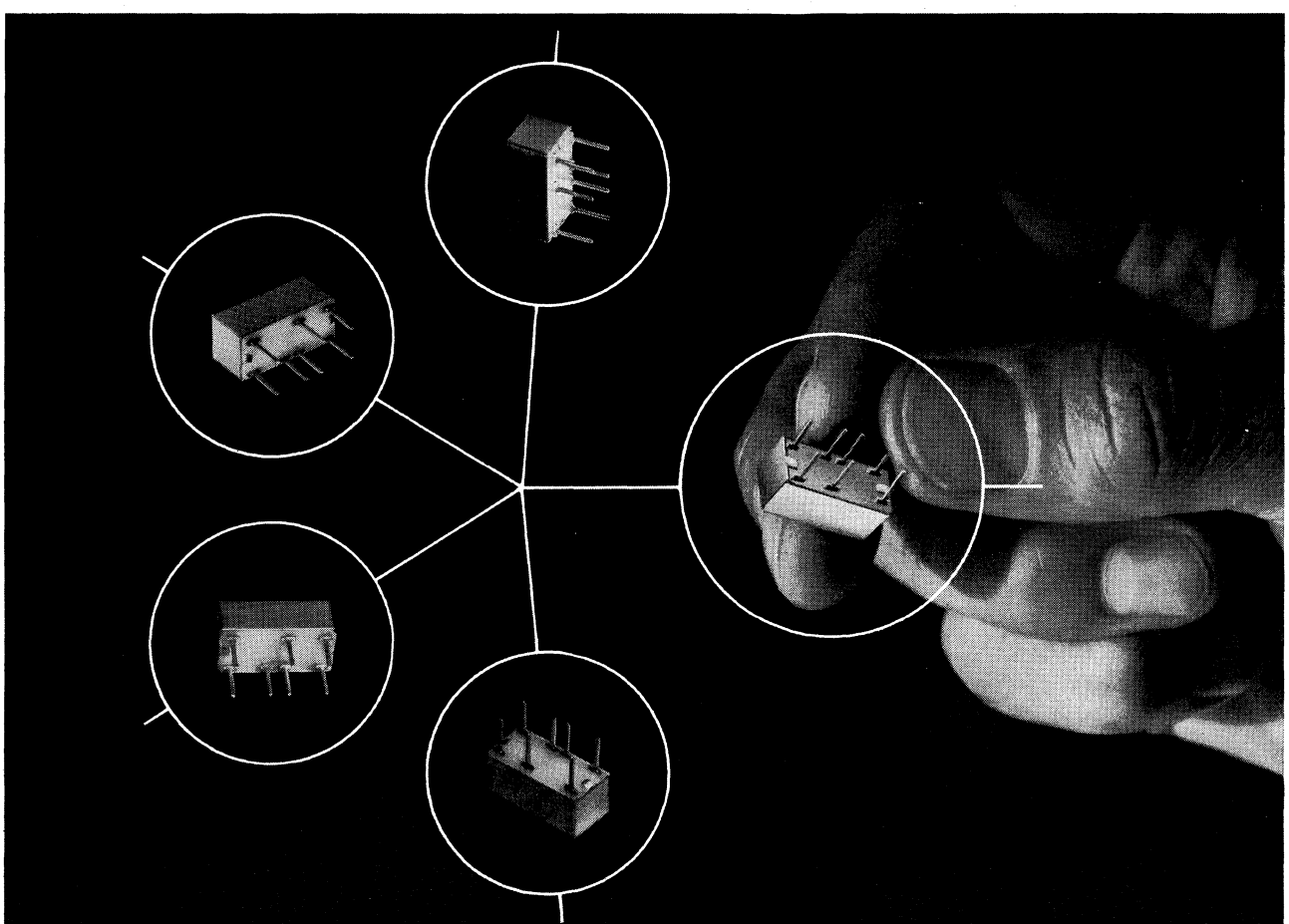
- Long life — units tested to billions of cycles
- No contact bounce
- Operation in any mounting plane
- Form "C" SPDT contacts
- Fast operating time — 2 ms
- No measurable AC contact noise
- Thermal noise less than 0.2 microvolt
- Switches dry circuits to 2 amps at 0-6 volts
- Inherent contact memory — requires no holding current (mono-stable models also available)

For complete information about revolutionary new Logcell Mercury Film Relays — and Logcell Mercury Film Switches — write Fifth Dimension Inc., Box 483, Princeton, New Jersey 08540 or call (609) 924-5990.

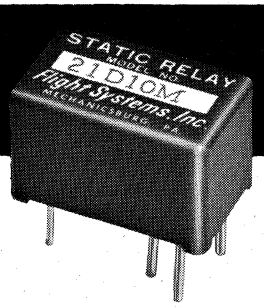
5-D FIFTH DIMENSION INC.

here at last . . .

a miniature mercury relay that operates IN ANY POSITION



The STATIC RELAY



- **FAST—50 Microseconds Actuating & Release Time**
- **VERSATILE—Over 50 Megohm Load-to-Control Isolation**
- **DEPENDABLE—No Moving Parts—Unlimited Life—No Contacts to Wear Out**
- **QUIET—No Bounce, No Arc, No Noise**
- **STRONG—Will Withstand The Most Severe Shock and Vibration**
- **SAFE—Will Operate in Explosive and Corrosive Atmospheres**
- **FLEXIBLE—Can Be Factory Modified to Most Any Switching Application**

CONTACT ARRANGEMENT	MAX LOAD CURRENT	AC MODEL NUMBER	CONTROL I @ 5 VDC	DC MODEL NUMBER	CONTROL I @ 5 VDC	PRICE—EITHER AC or DC 1-10	11-25	26-50	SIZE OD LXWXH
SPST	300 ma 1 AMP 2.5 AMPS	11A10X 11A25X	12 ma 20 ma	11D3X 11D10X 11D25X	12 ma 30 ma 50 ma	$27.50 27.85 28.75	$25.20 25.45 26.10	$23.75 23.90 24.35	.688" X 1.125" X .750"
	6 AMPS	11A60X	25 ma	11D60X	100 ma	29.75	27.50	25.05	1.00" X 1.50" X .687"
	10 AMPS	11A100X	35 ma	11D100X	150 ma	34.80	33.15	29.90	1.50" X 1.50" X 1.00"
DPST	300 ma 1 AMP 2.5 AMPS	21A10X 21A25X	24 ma 40 ma	21D3X 21D10X 21D25X	24 ma 60 ma 100 ma	39.80 41.75 42.00	36.50 38.50 38.75	32.00 34.05 34.30	.688" X 1.125" X .750"
	6 AMPS	21A60X	50 ma	21D60X	200 ma	42.30	39.00	34.50	1.00" X 1.50" X .687"
	10 AMPS	21A100X	70 ma	21D100X	300 ma	47.25	44.10	39.60	1.25" X 2.50" X 1.00"
			CONTROL AND BIAS I @ 5 VDC		CONTROL AND BIAS I @ 5 VDC				
SPDT	300 ma 1 AMP 2.5 AMPS	12A10X 12A25X	14 ma 22 ma	12D3X 12D10X 12D25X	14 ma 32 ma 50 ma	39.80 40.30 41.40	36.50 37.00 38.60	32.75 33.20 34.75	1.00" X 1.50" X .687"
	6 AMPS	12A60X	27 ma	12D60X	100 ma	42.25	39.10	35.45	1.50" X 1.50" X 1.00"
	10 AMPS	12A100X	37 ma	12D100X	150 ma	47.15	44.25	41.50	1.25" X 2.50" X 1.00"
DPDT	300 ma 1 AMP 2.5 AMPS	22A10X 22A25X	28 ma 44 ma	22D3X 22D10X 22D25X	28 ma 64 ma 100 ma	49.75 50.55 52.15	44.00 48.10 50.50	39.25 45.25 47.15	1.50" X 1.50" X 1.00"
	6 AMPS	22A60X	54 ma	22D60X	200 ma	54.50	52.05	49.75	1.25" X 1.50" X 1.00"
	10 AMPS	22A100X	74 ma	22D100X	300 ma	59.50	56.85	53.20	1.75" X 1.75" X 2.00"

NOTE: In Order to Perform THE NORMALLY CLOSED "CONTACT" FUNCTION ON DOUBLE THROW RELAYS, A BIAS VOLTAGE IS REQUIRED.

THESE CONTROL AND BIAS CURRENT REQUIREMENTS MAY BE SUBSTANTIALLY REDUCED ON RELAYS DESIGNED FOR HIGHER CONTROL AND BIAS VOLTAGES.

COMPARE THESE PERFORMANCE FEATURES

DC STATIC RELAY

DC LOAD VOLTAGE
DC CONTROL VOLTAGE
Load Voltage (min-max): 0 to 60 VDC
Load Types: resistive, inductive or capacitive (max. in-rush, 3.5 times max. load current rating for one second.)
Actuating Time: 50 microseconds
Release Time: 50 microseconds
Maximum Repetition Rate: 2000 operations per second
Closed Contact Resistance: 0.20 ohms max.
Open Contact Resistance: 10 megohms min.
Operating Temperature Range: —20°C to +75°C
Storage (non-operating) Temperature Range: —55°C to +100°C
NOTE: The DC STATIC RELAY is available in a full Mil-Spec Version in all models. The Mil-Spec version meets MIL-E-5400 Class IV. Contact the factory for price & delivery.

AC STATIC RELAY

AC LOAD VOLTAGE
DC CONTROL VOLTAGE
Load Voltage (min-max): 20-200 V PEAK, 1 Hz to 1 KHz
Load Types: resistive, reactive (p.f 0.5 leading or lagging)
Actuating Time: 100 microseconds
Release Time: less than ½ cycle at load frequency
Closed Contact Resistance: 0.20 ohms max.
Open Contact Resistance: 10 megohms min.
Operating Temperature Range: —20°C to +75°C
Storage (non-operating) Temperature Range: —55°C to +100°C

DRY CIRCUIT STATIC RELAY

For Instrumentation and Computation
- CLOSED "CONTACT DROP": 10 MV max @ 10 ma
- ACTUATING & RELEASE TIME: 50 microseconds
- REPETITION RATE: 3000 operations per second

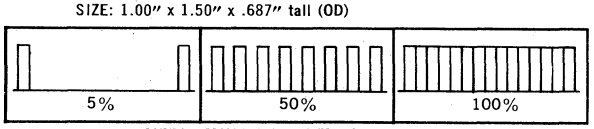
PERFORMANCE SPECIFICATIONS

LOAD:	0 to 60 VDC Resistive 0-10 ma
CONTROL:	5 VDC @ 25 ma
OPEN CONTACT RESISTANCE:	500 Megohms
TEMPERATURE RANGE:	—20°C to +75°C
SIZE:	.688" x 1.125" x .750" Tall (OD)
LOAD-TO-CONTROL ISOLATION:	50 Megohms min.

CONTACT CONFIGURATION	MODEL NUMBER	PRICE 1-10	11-25	26-50	51-100
SPST	11Q01	29.75	26.10	21.90	18.95
DPST	21Q01	33.00	29.50	25.75	23.00

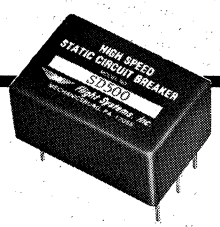
PROPORTIONAL STATIC RELAY

Voltage Programmable
PROVIDES OUTPUT PULSES IN PROPORTION TO CONTROL SIGNAL LEVEL
LOAD RANGE: 22-32 VDC. RESISTIVE or INDUCTIVE (other ranges available)
PROPORTIONAL RANGE: 5% to 100% OF LOAD POWER
CONTROL SIGNAL: 1 to 20 VDC @ 20 ma (ALSO AVAILABLE WITH 1 to 20 MILLIVOLTS CONTROL SIGNAL)
LOAD-TO-CONTROL ISOLATION: 50 Megohms
RESPONSE TIME: 1 MILLISECOND
LINEARITY: ±3%
SIZE: 1.00" x 1.50" x .687" tall (OD)



OUTPUT MAY BE FILTERED TO SUPPLY DC

LOAD CURRENT	MODEL NUMBER	PRICE 1-10	11-25	26-50	51-100
0 to 1 AMP	11R10	39.70	34.95	31.00	27.50
0 to 2.5 AMPS	11R25	41.00	36.80	33.60	28.25
0 to 5 AMPS	11R50	48.50	43.15	37.20	32.75



COMPLETELY PROGRAMMABLE
NO MOVING PARTS

PROTECT YOUR SOLID-STATE CIRCUITRY WITH THE FASTEST CIRCUIT BREAKERS MADE

FLIGHT SYSTEMS, INC. Announces the High Speed D. C. Static Circuit Breaker. The ultimate in circuit protection, the Static Circuit Breaker gives a clean, arc-free, bounceless break at 50 microseconds after current overload. The Static Circuit Breaker is insensitive to heat, shock, vibrations and will operate in any explosive or corrosive atmosphere. With its logic control of all functions and wide range of available modifications, the Static Circuit Breaker will adapt to most existing systems at very low cost. Since the current sensor is completely isolated from the switch portion of the Static Circuit Breaker, it is possible to monitor the current in a circuit different from the one being protected. The current sensor responds to D.C. or peak A.C. currents, regardless of polarity. Remote sensing is also possible. CONTACT YOUR LOCAL FLIGHT SYSTEMS, INC. REPRESENTATIVE OR THE FACTORY FOR COMPLETE SPECIFICATIONS AND PRICES.

NEED A SPECIAL VERSION OF THE STATIC RELAY? WE SPECIALIZE IN SERVICE! 2 to 3 WEEKS DELIVERY ON CUSTOM-BUILT RELAYS. WANT MORE INFORMATION? CALL (717) 697-0333 FOR DETAILS.

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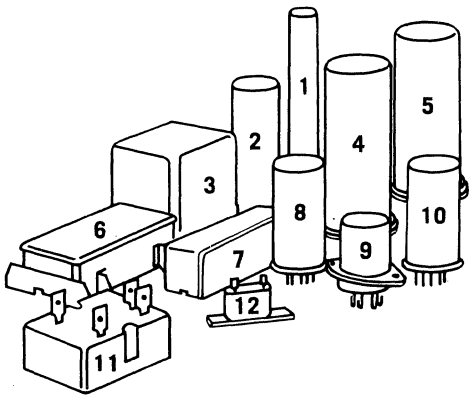
G-V

your complete source for timing and temperature control devices





ITEM NO.	PART	DESCRIPTION
1	C8 Series Electrical Thermostat	Hermetically sealed, adjustable, immersion type. Temp. range: −65° to +300°F. Rated 1000 W. Differential ±1°F. Vibration, 2000 Hz; Shock, 50g.
2	Series R, T&H Miniature Hermetically Sealed Thermal Time Delay Relay	Sealed, adjustable. Delays: 0.1-240 secs. Operating voltages: 6.3-230V, AC/DC. Meets MIL-R-19648. 7 Pin plug-in or flange mountings.
3	900064 Series General Purpose Solid State Time Delay	Solid state timing circuit. Delays: 0.1-30 secs. Operating temp.: −55°C to +85°C. Operating voltage: 18-32 V DC. Vibration: 2000 Hz; Shock, 50g.
4	Red Line (DT) Series. Industrial Timing Relay	Octal size. Steel sheathed heater. Dust-proof, tamper-proof. Delays: 0.5-180 secs. Operating voltages: 6.3-230 V, AC/DC.
5	Red Line (DM) Series. Instant Reset Thermal Timing Element	Provides instant reset during and after time delay when used with magnetic relay. Delays: 0.75-360 secs. Operating voltage: 6.3-230 V, AC/DC.
6	PT Series High Precision Thermal Timing Relay	±5% over −55°C to +125°C. Vibration, 20g, 2000 Hz; Shock, 50g, 11 ms. Delays: 3-180 secs. Heater Voltages: 6.3-115 V AC/DC.
7	JT Series Thermal Time Delay	Designed for printed circuit board mounting. Stainless internal construction. Dust-proof. Tamper-proof. Delays: 2-180 secs. Operating voltages: 6.3-230 V, AC/DC. Also available in Instant Reset version, Series JM.
8	Thermette Series. Commercial Thermal Timer	9 Pin miniature thermal time delay. Metal enclosed. Dust-proof. Delays: 5-180 secs. Operating voltage: 6.3-26V, and 115 V, AC/DC.
9	LT Series. Sub-miniature Thermal Time Delay	Flange mounting, hermetically sealed with seated height only 40% of standard miniature timers. Delays: 2-75 secs. Operating voltages: 6.3-115 V AC/DC. Vibration: 1000 Hz.
10	Air Flow Sensing Switch	Positive protection when air flow stops — operates alarm or automatic shut-off. Operates in any position. Heater voltages: 6.3, 26 and 115 V AC/DC.
11	Quick Connect Type Industrial Thermal Relay	Surface mounting, dust-proof. Time delays: 5 to 180 seconds. Temperature compensated. Heater voltages: 6.3, 26 and 115 AC/DC. Contacts SPST, NO or NC.
12	VE-2 Series Electrical Thermostat	Surface sensing thermostat. Preset or adjustable. Low differential. High degree contact force/motion. Vibration: 2000 Hz; Shock, 50g.

G-V

G-V CONTROLS INC.

LIVINGSTON, NEW JERSEY 07039

(201) 992-6200

604

HERMETICALLY SEALED RELAYS

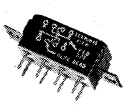
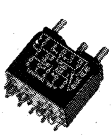
Unmatched for reliability, the light weight, thermal capabilities, and high resistance to shock of these hermetically sealed relays make them ideally suited for military and industrial electronic applications.

The reliability factor stems from exacting assembly (in a "White Room" where necessary), rigid quality control, well-equipped lab facilities and precise testing procedures. These manufacturing techniques, combined with GE's advanced engineering design, produce top-quality relays with dependable characteristics exceeding those of static switching devices.

Contact resistance is held to a minimum by silver contacts (with gold flash) combined with high contact forces.

All high-temperature components allow the operation of these relays in ambient temperatures between −65°C to +125°C.

Units are available with studs or brackets for mounting. The micro line has tab brackets for printed-circuit board application. Headers can be furnished with solder hooks, three-inch leads, plug-in (with socket availability information) and many special terminals. *Write for Bulletin GEA-6628*

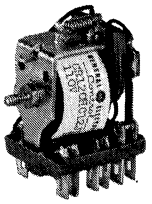
	Contact Form	Contact Rating	Sensitivity	Size & Weight	Vibration Capabilities	Shock	Operate Time	Release Time
 **TRANSISTOR SIZE TO-5[2] (3SBS)** All-welded including coils High contact forces, overtravel Low contact resistance High thermal margin	2PDT	1A at 28 Vd-c 0.2A at 28 Vd-c Ind.	120 mw	0.37″x0.37″x0.275″ 0.09 oz.	30 G's to 3000 cps	100 G's for 11 ms	2 ms max	1 ms max
 **150 GRID-SPACE (3SBC, 3SBH)** New small size Low profile — only 0.32″ high Terminals on 0.150″ centers All-welded construction	2PDT 4PDT	1A at 28Vd-c ½ at 115Va-c	135 mw 250 mw	0.32″x0.61″x0.31″ 0.13 oz. 0.32″x0.61″x0.61″ 0.24 oz.	30 G's to 3000 cps	50 G's for 11 ms	4 ms max	4 ms max
 **150 GRID MAGNETIC LATCH (3SBM)** New small size Low profile All-welded construction Snap action — no hang-up	4PDT	2A at 28 Vd-c 0.5A 115 Va-c	Single coil 100 mw Dual coil 200 mw	0.61″x0.61″x0.32″ 0.28 oz.	30 G's to 3000 cps	100 G's for 11 ms	4 ms max	4 ms max
 **HALF-SIZE MICRO (3SAV)** Terminals on 0.2″ centers All-welded construction Bifurcated contacts Power or low-level switching	2PDT	2A at 28 Vd-c 1A at 115Va-c	260 mw	0.4″x0.8″x0.4″ 0.35 oz.	30 G's to 3000 cps	50 G's for 11 ms	4 ms max	4 ms max
 **HALF-SIZE PLASTIC CASE (3SBV)** Low profile +85°C operation Bifurcated contacts Rugged construction	2PDT	2A at 30 Vd-c 0.5A 115Va-c	285 mw	0.48″x0.88″x0.49″ 0.3 oz.	——	——	5 ms max	5 ms max
 **LATCHING MICRO (3SAM)** All-welded construction Snap action — no hang-up 50 milliwatt sensitivity Power or low-level switching Grid spaced	2PDT	2A at 28Vd-c 1A at 115Va-c	50 mw 75 mw	0.9″x0.8″x0.4″ 0.75 oz.	30 G's to 3000 cps	100 G's for 11 ms	5 ms max	5 ms max
 **4-POLE MICRO (3SAH)** All-welded construction No solder, solder flux Power or low-level switching Terminals on 0.2″ centers	4PDT	2A at 26.5 Vd-c 1A at 115 Va-c	400 mw	0.81″x1.01″x0.61″ 1.0 oz.	30 G's to 3000 cps	50 G's for 11 ms	6 ms max	5 ms max
 **DOUBLE HERMETIC SEAL REED (3SBN)** Sealed coils Low profile Low sensitivity Rugged construction	1PNO through 6PNO 1PDT through 5PDT	10W to 100V 3W to 100V	40 mw per pole 50 mw per pole	From 0.3″x1.45″x0.35″ to 0.89″x1.45″x0.35″ 0.23 oz. to 0.62 oz.	30 G's to 2000 cps	50 G's for 11 ms	1 ms max 2 ms max	0.2 ms max 0.2 ms max

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

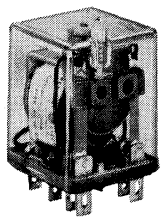
GENERAL ELECTRIC

RELAYS

CR120 TYPE H GENERAL-PURPOSE RELAYS



Open, stud-mounting relay



General purpose control socket plug-in form with manual operator

These compact, economical relays are ideal for the highly repetitive operations required in the output of electronic equipment and in small, built-in chassis-type control panels where space is at a premium.

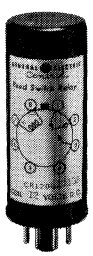
FEATURES

- **Variety of Forms** — 5-amp, 10-amp relays and latch forms and current sensitive relays are available.
- **Mounting Flexibility** — forms available for front- or back-connection, plug-in or channel-mounting. Open relays either stud- or screw-mounted.
- **Small Size** — occupies only 3 to 5 cubic inches.
- **Not Position Sensitive** — relays will operate in any position.
- **Easy Connection** — combination push-on, solder-type terminals (.110 and .205 inch) available for front, back or plug-in connection.
- **Manual Operator, Indicating Light 110-250 V** — available on dust-covered, back-connected and plug-in forms permits check of relay operation.

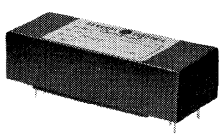
Write for Bulletin GEA-7882

REED SWITCH RELAYS

CR120 TYPE G



Tube-type plug-in



Enclosed printed-circuit

CR120 Type G relays provide extremely long electrical and mechanical life.

They are available in a wide variety of mounting and connection arrangements including plug-in; printed-circuit; bracket-mount or stud-mount with solder-tab, wire-wrap or quick-connect terminals.

You can select relays which perform latching, timing, or current-sensing functions as well an ON-OFF switching.

Relays are magnetically shielded. High-fidelity contacts are hermetically sealed in an inert gas to prevent contamination.

Many standard factory modifications are available to meet wide application requirements.

Contact Characteristics

Maximum rating (a-c or d-c):
15 watts, resistive
1.0 ampere maximum
250 volts maximum (60 cycles rms)

Contact resistance (initial): 30-60 milliohms

Life expectancy (electrical):
20 million operations at maximum rating
100 million operations at ½ max rating
200 million operations at low load

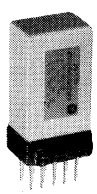
Resonant frequency (reed): 1080 cps

Operation

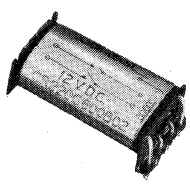
Nominal coil power:

SPDT 450 mw	SPDT latch 270 mw
DPDT 680 mw	DPDT latch 580 mw
3PDT 1000 mw	

CR220 TYPE G



Plug-in with socket attached



Open printed-circuit

CR220 Type G relays are small, compact units that are ideal for applications where fast operating time and low power are required such as for scanning, instrumentation, counting and data processing.

These small relays are available in a variety of compact housings suitable for multi-relay applications. You can choose forms for timing functions as well as ON-OFF switching. Mounting arrangements include printed-circuit, plug-in, bracket or channel-mounting. Bracket or channel-mounted forms are available with one- or two-level solder/push-on (0.110 x 0.032 in.) or wire-wrap terminals.

Relays are magnetically shielded, contacts are hermetically sealed. A wide variety of factory modifications are offered.

Contact Characteristics

Maximum rating (a-c or d-c):
15 watts, resistive
1.0 ampere maximum
250 volts maximum (60 cycles rms)

Contact resistance (initial): 30-60 milliohms

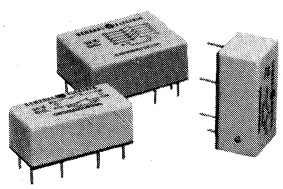
Life expectancy (electrical):
20 million operations at maximum rating
100 million operations at ½ max rating
200 million operations at low load

Resonant frequency (reed): 1100 cps

Operation

Nominal coil power:
Printed circuit: 1P 350 mw, 2P 600 mw, 3P 700 mw, 4P 900 mw, 5P 1200 mw, 6P 1600 mw
Plug-in & bracket: 1P 350 mw, 2P 600 mw, 3P 770 mw, 4P 1000 mw, 5P 1400 mw, 6P 2300 mw, 8P 2300 mw, 12P 4000 mw

CR120 TYPE M



CR120 Type M relays are miniature units that provide fast operating time, long life, and reliability in a minimum amount of space. You can get as many as five circuits in a relay only 0.88 x 1.12 inches. They are available as enclosed printed-circuit forms.

The relays perform ON-OFF switching, and are ideal for scanning, instrumentation, counting and data processing applications.

Enclosed forms assure mechanical protection and may be ordered with or without potting compound. They are not affected by magnetic fields created by adjacent relays. All contacts are hermetically sealed to give the highest possible fidelity. The miniature reed switches are manufactured and tested under clean-room conditions.

Forms with dual winding coils, special coil voltages, alternate pin length, and electrostatic shielding are also offered.

Contact Characteristics

Maximum rating (a-c or d-c):
4 watts, resistive
0.125 ampere maximum
120 volts maximum (60 cycles rms)

Contact resistance (initial): 200 milliohms

Life expectancy (electrical):
5 million operations at maximum rating
15 million operations at ½ max rating

Resonant frequency (reed): 2000 cps

Operation

Nominal coil Power:

1P 150 mw	4P & 5P 800 mw
2P & 3P 500 mw	

Write for Bulletin GEA-7396

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

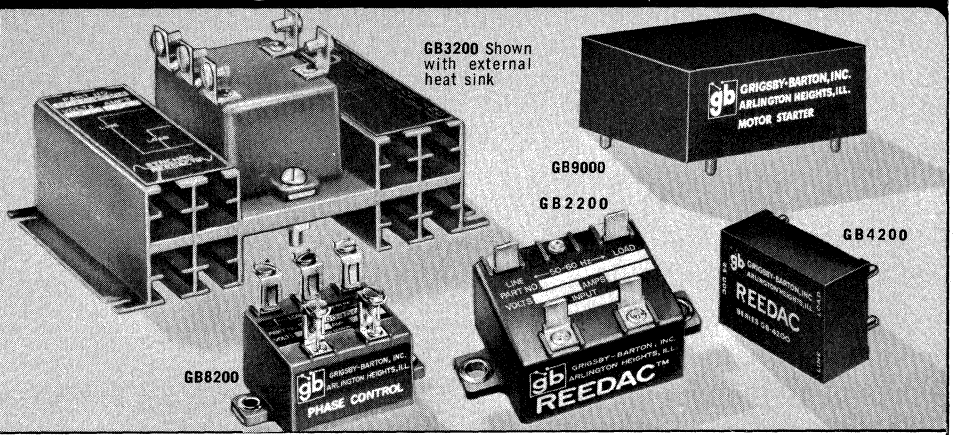
GENERAL ELECTRIC

REEDACS*/REED RELAYS/SYSTEMS/LOGIC CARDS
"Excellence through innovation!"

REEDACS

When you think TRIACS, *think* REEDACS*

Reedacs* incorporates solid state switching components based on Triac capabilities, and are specifically designed for inductive, tungsten or resistive loads rated up to 30 AMPS and to 220 VRMS. Inputs are switch closure, AC or DC pulse, DC or transistor logic. Inrush load is 10 times rating.



GB2200 STANDARD REEDAC — Designed for general heavy duty applications, it has random bounceless turn on and zero crossing turn off. Rated to 30 AMPS at 220 VRMS.

GB3200 SYNCHRONOUS REEDAC — Solid state device permits switching heavy inductive loads with no minimum load current meeting MIL-STD-826A. Rated to 30 AMPS at 220 VRMS.

GB4200 MINIATURE REEDAC — Rated at 2 AMPS, it is designed for PC board assembly. Compatible for logic card use.

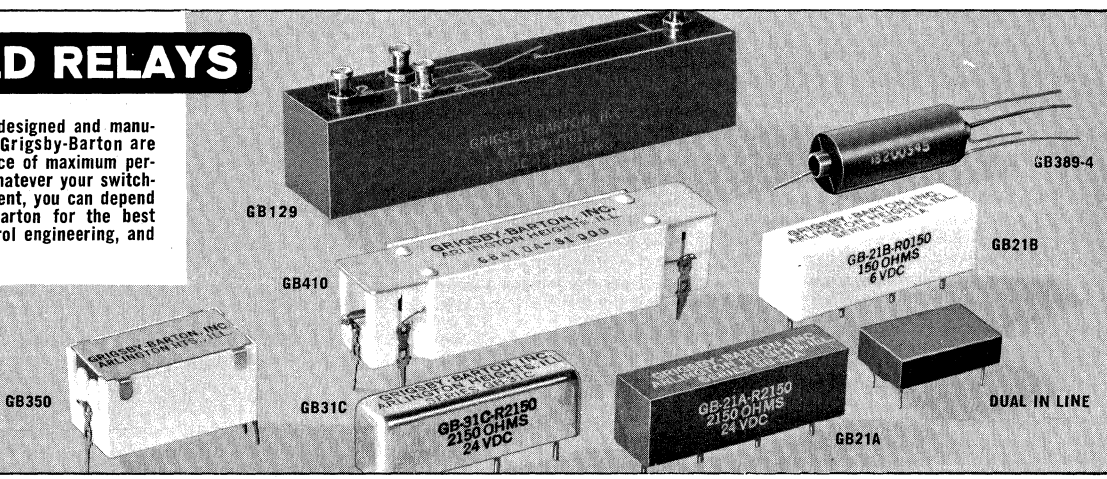
GB8200 PHASE CONTROL — Rated to 30 AMPS at 220 VRMS, the 8200 series is designed for high power factor inductive loads providing 1.5° symmetry.

GB9000 MOTOR STARTER — Solid state device is used as an off, forward-reverse motor switch. Rated up to 30 AMPS at 220 VRMS, it is designed for such applications as strip chart recorders, and machine and process motor controls.

*Patent Pending

REED RELAYS

Reed relays designed and manufactured by Grigsby-Barton are your assurance of maximum performance. Whatever your switching requirement, you can depend on Grigsby-Barton for the best quality, control engineering, and reliability.



DUAL IN LINE — Compatible with IC packages that have integrated circuits. Used as a logic interface in the computer field.

GB21A GB21B GB31C— Versatile single pole reed relays used widely in the communications industry. Available in forms A, B, C. Rated to 1KC switching.

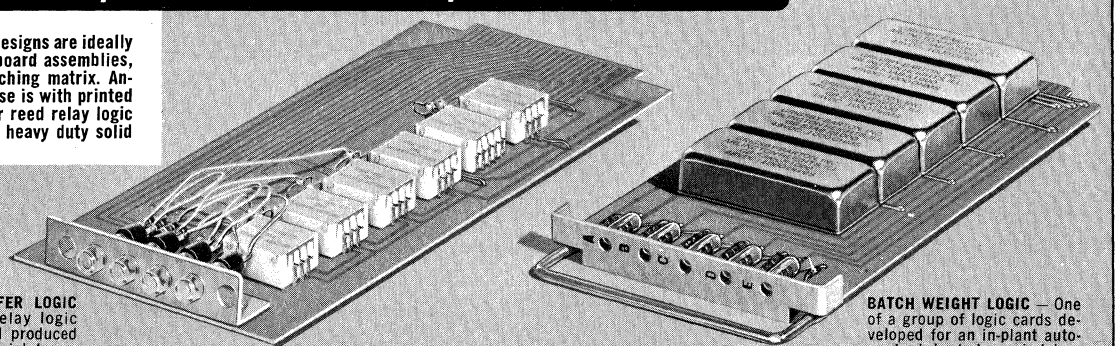
GB350 GB410—Low cost commercial reed relays are adaptable for standard PC board assembly.

GB129 — High voltage relay available in Forms A or B, and rated up to 25KV. Applications: Biomedical, power supplies, and test equipment.

GB389-4 — Newly designed low noise, ultra-high open circuit installation for use in analog computers. Employs both electrostatic and magnetic shielding in epoxy molded construction.

SYSTEMS / SUB SYSTEMS / LOGIC CARDS

Grigsby-Barton designs are ideally suited to logic board assemblies, such as in switching matrix. Another multiple use is with printed circuit cards for reed relay logic interfacing with heavy duty solid state controls.



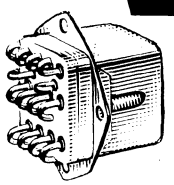
MATERIAL TRANSFER LOGIC — Typical reed relay logic card designed and produced to control a material transfer system.

BATCH WEIGHT LOGIC — One of a group of logic cards developed for an in-plant automated batch weighing system.

GRIGSBY-BARTON, INC.

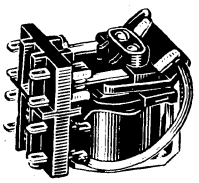
ENGINEERS AND MANUFACTURERS OF REEDACS*/REED RELAYS/LOGIC CARDS/SYSTEMS
107 NORTH HICKORY STREET. ARLINGTON HEIGHTS, ILLINOIS 60006 • TELEPHONE: AREA CODE 312/392-5900

RELAYS AC DC



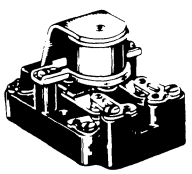
SERIES 4005 RELAY

The smallest, lightest commercially available 4 PDT relay that will switch a three-phase 10 amp. inductive or resistive load. Weighs only 2½ oz.; measures just 1.14" x 1.125" x 1.03". Rated 28 VDC or 115 or 115/200 V 400 cycles AC. Meets or exceeds MIL-R-6106-D with no restrictions on overload or rupture tests.



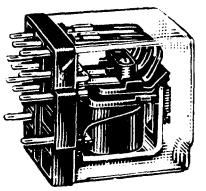
SERIES 1200 RELAY

Small, efficient relay rated at 10 amperes, 115 volts, non-inductive A.C. Heavy solder lug terminals molded in phenolic block, with barriers for over-surface insulation. Up to three pole, double throw contacts. Size: $1\frac{11}{16}$" x 1¼" x $1\frac{3}{8}$". Approx. wt. 1.9 oz.



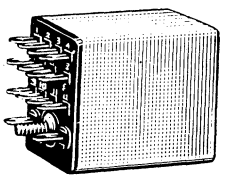
SERIES 2300 POWER RELAY

Has 15 amp. contacts. Inverted coil construction protects armature and contacts. Contacts D.P.D.T. U/L rated for 15 amps at 115 VAC non-inductive, or 1 H.P. at 115/230 v., 60 c. Screw type terminals easily accessible. Size: $3\frac{5}{16}$" x 2½" x $2\frac{1}{16}$". Shipping wt. 8 oz.



SERIES 1220 RELAY

10 ampere DPDT or 3PDT relay is designed to reduce both cost and height by eliminating radio-type plug, extra wiring and sub-assembly between relay and plug. Complete with dust cover and mounting bracket. Plug-in, solder or quick-connect terminals. U/L listed. Size: $1\frac{5}{32}$" x $1\frac{11}{16}$" x $1\frac{9}{16}$". Coils available for 6-240 VAC, 6-110 VDC.



SERIES 1310 RELAY

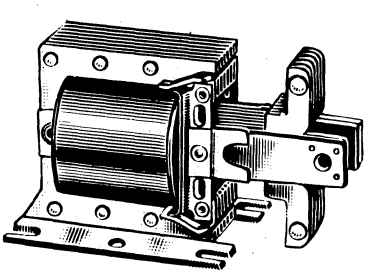
This is Guardian's 4PDT 3 amp plug-in relay. Designed and built for maximum endurance and reliability, it is especially suitable for computers, data processing, logic systems, business machines, or any other application that requires uncompromising quality. The new 1300 Series is available AC or DC, plug-in or quick-disconnect, 6 to 115 VAC and 6 to 110 VDC. Contact rating 3 amps at 30 VDC or 115 VAC resistive.

Get your entire Control Assembly from Guardian, Complete and Ready to Plug in... Anything from a Single Switch to a complete Machine Control. • Write today.

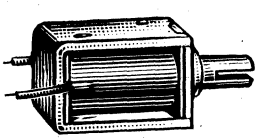
SOLENOIDS

The Guardian solenoid line is the most complete in the industry. It includes intermittent or continuous duty types up to 230V, A.C. or up to 230V, D.C. A new line of tubular solenoids now provides a range from a pull of 50 pounds to a fraction of an ounce.

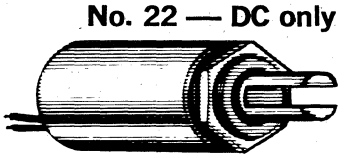
Guardian's engineering department is ready at all times to assist in modifying standard solenoids or developing custom engineered units to fit your specialized applications.



No. 18 — AC only



No. 22 — DC only



NEW No. T6 — DC Solenoid

Write for free Solenoid Bulletins No. TS and G

GUARDIAN® ELECTRIC

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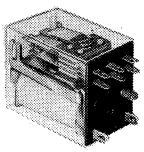
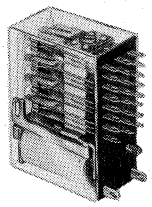
HART/ADVANCE RELAY DIVISION
OAK ELECTRO/NETICS CORP.
CRYSTAL LAKE, ILLINOIS 60014 • TELEPHONE: 815 - 459-5000 • TWX: 910-634-3353 • CABLE ADDRESS: OAKMANCO

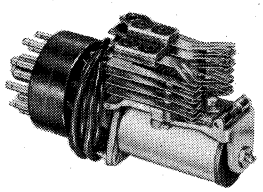
TELEPHONE RELAYS

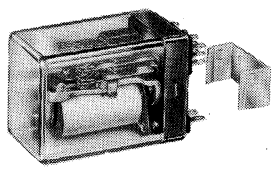
VERSAPAC TYPE 67

The Hart-Advance "VersaPac" 67 miniature industrial relay is especially designed for industrial applications requiring 2 to 8 form C's where space, weight and cost are important. Single and bifurcated contacts rated at 3 and 5 amps are available. The use of Armco magnetic ingot iron and a one-piece frame and core provide for unusually precise adjustments. Mechanical life expectancy is in excess of 100 million operations. Contact resistance is: .050 ohms max. before life; .100 ohms max. after life. A plastic cover protects the relay, and sockets are available.


2 FORM C


8 FORM C


PLUG-IN


TYPE 8 PI

TYPE 8

The Hart-Advance type 8 is an extremely versatile multi-contact telephone type relay. It is available with many variations of coils, contact arrangements and ratings, adjustments, terminals and mountings. Armco magnetic ingot iron is used in all parts of the magnetic circuit. Contact blades are made of spring temper nickel-silver. Standard contacts are twin palladium alloy, gold flashed. Standard terminals are solder type, but printed circuit and taper tab terminals may also be supplied.

The Series 8PI is a Type 8 relay with specific spring forms and a mating flush mounted socket and clear plastic cover which snaps over the socket. Outstanding benefits include pre-wiring socket possibilities, quick installation and removal of relay, environmental protection, and cost savings. Relay is supplied less socket and cover unless specified.

See page 3, "Type 8 Magnetic Latching" relay.

SPECIFICATIONS	TYPE 67 VERSA PAC	TYPE 8
weight	2 Pole, 1.0 oz. 4 Pole, 1.2 oz. 6 Pole, 1.3 oz. 8 Pole, 1.4 oz. max.	open approx. 3 oz., enclosed approx. 8 oz.
size	2 form C L = 1 3/16" W = 3/4" H = 15/16" 8 form C L = 1 3/16" W = 3/4" H = 1 5/8"	1C or 2C — 1 3/32" H x 2 5/32" L x 1 3/32" W
enclosure	acrylontrile styrene cover	open, dustite, or hermetically sealed
contact forms	C	A, B, C, D, E
contact arrangement	standard 2C, 4C, 6C, 8C	1 form C through 8 form C max
standard contact material & rating	silver composite, 3 amp resistive rating silver composite, 5 amp resistive rating (power adjust.)	contacts available to meet special applications different contacts may be mixed on the same relay
contact codes	special to 7 amps (without cover)	1, 2, 3, 4, 4G, 5, 6, 8, 10, 11, 12, 16, 18, 20, 21, 24G, 216, MS
ambient temperature	−55°C to +71°C	−55°C to +85°C
terminals	plug-in or solder (solder lug or printed circuit sockets available)	solder, plug-in, taper tab, and printed circuit
mounting	plug-in or one #3-48 NC-2A stud	two #6-32 tapped holes on 3/4" centers
dielectric strength	1000 volts RMS, contacts to ground 500 volts RMS between open contacts	1000 volts RMS
insulation resistance	1000 megohms minimum at 25°C	100 megohms min.
sensitivity	2C & 4C, 575 MW 6C, 1 W 8C, 1.2 W	160 MW per form C
coil dissipation	1.8 watts max	4.3 watts max.

POWER ADJUSTMENT TYPE 67

contacts	coil letter	nominal voltage	resistance ohms (25°C)	must operate volts (25°C)
2C, 4C	A	6	52	4.8
	D	12	185	9.6
	G	24	700	18.0
	K	48	2500	38.4
	N	115	15,000	92.0
6C	B	6	25	4.8
	E	12	90	9.6
	H	24	430	18.0
	L	48	1550	38.4
	P	115	9000	92.0
8C	C	6	20	4.8
	F	12	72	9.6
	J	24	350	19.2
	M	48	1250	38.4
	R	115	8000	92.0

SENSITIVE ADJUSTMENT TYPE 67

resistance ohms (25°C)	coil letter	maximum operate current (milliamperes) 2C 85 MW	4C 175 MW	6C 275 MW	8C 375 MW
1000	S	8.5	13.0	16.6	19.4
2500	K	5.8	8.4	10.5	12.3
5000	T	4.1	6.2	7.5	8.7
10,000	V	3.1	4.5	5.3	6.2
15,000	N	2.6	3.5	4.3	5.0

STANDARD COILS AND OPERATING VALUES* — TYPE 8

		DC			AC (60 cycle)	
contacts	nominal Voltage	resistance ohms (25°C)	must operate volts (25°C)	operate time	resistance ohms (25°C)	must operate volts (25°C)
2C	6	20	2.5	.017	1.6	4.0
	12	100	5.0	.017	5.0	7.0
	24	300	9.0	.017	23.0	18.0
	48	1300	21.0	.017	—	—
	110-115	8000	56.0	.017	400	75.0
	220-230	16000	80.0	.017	2400	180.0
3C	6	20	3.0	.021	1.6	4.5
	12	100	6.5	.021	5.0	7.5
	24	300	11.0	.021	23.0	18.5
	48	1300	26.0	.021	—	—
	110-115	8000	64.0	.021	400	80.0
	220-230	16000	110.0	.021	2400	185.0
4C	6	20	3.5	.024	1.6	5.0
	12	100	7.0	.024	5.0	8.0
	24	300	14.0	.024	23.0	19.0
	48	1300	30.0	.024	—	—
	110-115	8000	80.0	.024	400	85.0
	220-230	16000	125.0	.024	2400	190.0
6C	6	20	5.0	.034	1.6	5.5
	12	100	10.0	.034	5.0	9.5
	24	300	19.0	.034	23.0	21.0
	48	1300	40.0	.034	—	—
	110-115	8000	95.0	.034	400	95.0
	220-230	16000	160.0	.034	2400	200.0

* The operating specifications shown are typical and many variations from these values may be obtained by the proper selection of the coil, contacts, and adjustment.

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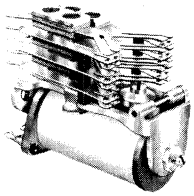
TELEPHONE RELAYS

TYPE 8 MAGNETIC LATCHING



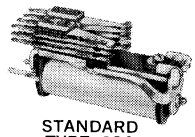
The Type 8ML remains magnetically latched from remnant magnetism until demagnetized by reverse polarity pulse.

The Type 8LA is a mechanical latch using two Type 8 relays. Pile-ups of up to twelve Form C can be supplied (six on each unit).

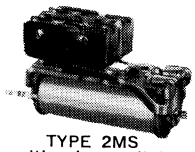
contact arrangement	COILS operate voltage	operate resist. ohms	release voltage	release resist. ohms
4 form C	24VDC	150	110VAC	11,000
4 form C	24VDC	150	24VDC	2,000
4 form C	110VAC	1000	24VDC	12,500

other spring and coil combinations available upon request

TYPE 2

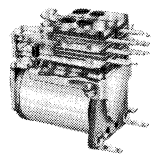


STANDARD TYPE 2QA (Quick Acting)

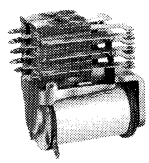


TYPE 2MS with micro switch

The Hart-Advance type 2 relay is a long frame telephone type designed especially for long life and application versatility. All parts of the magnetic circuit are of magnetic ingot iron for DC operation and silicon steel for AC. Contacts are available to meet applications from dry circuit to 10 amps. Varnish Impregnated coils and pile-up can be supplied to meet extreme humidity conditions. The type 2 is available with special coils and adjustments to provide for slow operate or slow release timing while snap switch contacts and micrometer adjustments are also available. A wide variety of enclosures adds versatility to the type 2 relay.



TYPE 4B with taper tab terminals



TYPE 4C

TYPE 4

The Hart-Advance type 4 is a compact, high reliability telephone type relay. Magnetic ingot iron is used for all parts of the magnetic circuit. The type 4 is the smallest in overall size while the 4A is the same overall size yet provides for greater coil winding space. The 4B has the same general construction but is slightly larger to provide for still greater coil winding space. The type 4C is the same size as the 4B but utilizes an armature bearing pin in lieu of bearing screws to increase sensitivity and provide for faster operating speed. All standard type 4's are supplied with solder terminals while taper tab, printed circuit, and plug-in features are also available. Through the use of ¼" dia. silver contacts, the type 4C can be supplied with double make contacts with a rating of 35 amps.

SPECIFICATIONS	TYPE 2	TYPE 4, 4A, 4B, & 4C
weight	open approx. 10 oz., enclosed approx. 19 oz.	open approx. 3 oz., enclosed approx. 5 oz.
size	1C or 2C: 1 9/16 H x 4 1/16 L x 1 1/2 W	1C or 2C: 1 11/64 H x 1 11/16 L x 1 1/32 W
enclosure	open, dustite, or hermetically sealed	open, dustite, or hermetically sealed
contact forms	A, B, C, D, E	A, B, C, D, E (1 form X on 4C power relay)
contact arrangement	10 form C maximum	4, 4A, 4BAC — 4 form C max. 4B & 4C — 6 form C max.
contact codes	1, 2, 3, 4, 4G, 5, 6, 8, 10, 11, 12, 16, 18, 20, MS	Same as Type 2 (except code 20 n/a)
ambient temperature	−55°C to +85°C	−55°C to +85°C
terminals	solder or taper tab	solder, taper tab, and printed circuit
mounting	two #8-32 tapped holes on ¾" centers	4 and 4A — four #4-40 tapped holes 4B and 4C — two #4-40 tapped holes (variations available)
dielectric strength	1000 volts RMS standard	1000 volts RMS
insulation resistance	100 megohms min.	100 megohms min.
sensitivity	90 MW max. per form C	per form C: 4—200 MW; 4A—200 MW; 4B—160 MW; 4C—140 MW
coil dissipation	DC relay — 10 watts	3 watts max.

STANDARD COILS AND OPERATING VALUES

		TYPE 2					TYPE 4										
		DC			AC		TYPE 4†		TYPE 4A†		TYPE 4B†		TYPE 4BAC‡		TYPE 4C†		
contacts	nominal voltage	resistance ohms (25°C)	must op. volts (25°C)	operate time seconds*	resist. ohms (25°C)	must op. volts (25°C)	resistance ohms (25°C)	must op. volts (25°C)	resistance ohms (25°C)	must op. volts (25°C)	resistance ohms (25°C)	must op. volts (25°C)	resistance ohms (25°C)	must op. volts (25°C)	resistance ohms (25°C)	must op. volts (25°C)	operate time seconds*
1C	6	50	2.0	.022	0.2	3	30	4.0	30	4.0	30	1.9	1.6	5.5	30	2.0	.010
	12	250	4.5	.022	0.7	9	120	8.0	125	8.0	120	5.0	12	9.5	75	4.0	.010
	24	600	7.0	.022	4	14	300	14.0	300	14.0	425	6.5	55	20	425	7.0	.010
	48	2000	14.0	.022	13	36	1000	25.0	1000	25.0	1300	15.0	103	42	1300	13.0	.010
	110-115	3600	16.0	.022	100	90	6000	65.0	6500	65.0	6500	39.0	950	95	6500	30.0	.010
	220-230	10,000	30.0	.022	360	150	—	—	—	—	16000	62.0	2900	190	16000	56.0	.010
2C	6	50	3.0	.032	0.2	4	30	4.0	30	4.0	30	3.0	1.6	5.5	30	2.5	.014
	12	250	6.0	.032	0.7	9	120	9.0	125	9.0	120	7.0	12	9.5	75	4.5	.014
	24	600	9.0	.032	4	15	300	16.0	300	16.0	425	9.0	55	20	425	10.0	.014
	48	2000	18.0	.032	13	38	1000	30.0	1000	30.0	1300	22.0	103	42	1300	17.0	.014
	110-115	3600	23.0	.032	100	95	6000	75.0	6500	75.0	6500	52.0	950	95	6500	42.0	.014
	220-230	10,000	40.0	.032	360	160	—	—	—	—	16000	96.0	2900	190	16000	64.0	.014
3C	6	50	3.0	.035	0.2	4	30	4.5	30	4.5	30	3.6	1.6	5.5	30	3.0	.018
	12	250	6.5	.035	0.7	9	120	10.0	125	10.0	120	8.0	12	9.5	75	6.5	.018
	24	600	11.0	.035	4	16	300	20.0	300	20.0	425	14.5	55	20	425	13.0	.018
	48	2000	20.0	.035	13	40	1000	38.0	1000	38.0	1300	29.0	103	42	1300	21.0	.018
	110-115	3600	29.0	.035	100	95	6000	85.0	6500	85.0	6500	65.0	950	95	6500	46.0	.018
	220-230	10,000	45.0	.035	360	165	—	—	—	—	16000	112.0	2900	190	16000	80.0	.018
4C	6	50	3.5	.040	0.2	4	30	5.0	30	5.0	30	4.0	1.6	5.5	30	3.5	.022
	12	250	7.5	.040	0.7	9	120	11.0	125	11.0	120	8.5	12	9.5	75	7.5	.022
	24	600	12.0	.040	4	18	300	21.0	300	21.0	425	18.0	55	20	425	15.0	.022
	48	2000	22.0	.040	13	40	1000	40.0	1000	40.0	1300	32.5	103	42	1300	27.0	.022
	110-115	3600	32.0	.040	100	95	6000	95.0	6500	95.0	6500	72.0	950	95	6500	62.0	.022
	220-230	10,000	60.0	.040	360	165	—	—	—	—	16000	128.0	2900	190	16000	112.0	.022

* approximate operate time at nominal voltage † DC only ‡ 60 cycle AC

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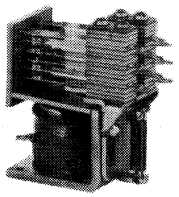
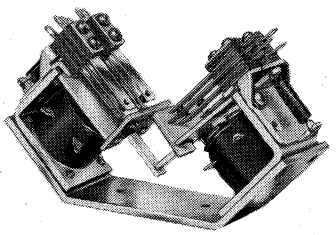
GENERAL PURPOSE RELAYS

TYPE 12



TYPE 12



TYPE 12 LA
(Latching)

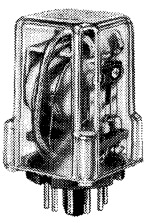
The Hart-Advance Type 12 is a general purpose relay that combines low cost and contact versatility to make it ideal for many applications. It is available with contact ratings of 5 or 10 amps and configurations of 1 thru 6 form C; and is suitable for AC or DC operation. Its versatility is further enhanced through the use of one of the standard enclosures.



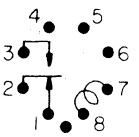
GHA—5 AMP CONTACTS
GHB—10 AMP CONTACTS
GHS—5 AMP CONTACTS
PLATE CIRCUIT RELAY

TYPE GH

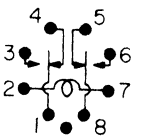
The Hart-Advance GH relay is especially engineered for maximum efficiency at lowest cost. The small size of this relay allows for installation in equipment where space is a problem. GH relays are available in 3 open series — GHA (5 ampere rating), GHB (10 ampere rating), GHS (5 ampere plate circuit type). These relays are also available in plastic dustite enclosures with 8 pin plug for 1C and 2C, and 11 pin for 3C. UL approved versions available.



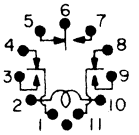
GHP—ENCLOSED GHA
GHH—ENCLOSED GHB
GHE—ENCLOSED GHS



8-pin SPDT(1C)



8-pin DPDT(2C)



11-pin 3PDT(3C)

STANDARD WIRING

SPECIFICATIONS	TYPE 12	TYPE GH
weight	Type 12 — 7 oz. max.; Type 12LA — 15 oz. max.	open — 2 ounces max.; enclosed — 3 ounces max.
enclosure	open or dustite (Type 12 only)	open, dustile or hermetically sealed
contact arrangement	Type 12 — 1 thru 6 form A, B, or C or combinations thereof. Type 12LA — latch, 6 form C max.; unlatch 2 form C max.	1, 2, or 3 form C
contact material	⅛″ silver and/or 3/16″ silver	5 amp — silver, gold flashed 10 amp — silver cadmium oxide, gold flashed
contact resistance	.100 ohms max. before life	.100 ohms max.
contact rating	⅛″ silver — 5 amps resistive at 115 VAC or 26.5VDC 3/16″ silver — 10 amps resistive at 115VAC or 26.5VDC	GHA, GHP, GHS, GHE 5 amps resistive at 115VAC or 26.4 VDC 2 amps inductive at 115VAC or 26.5VDC GHB, GHH 10 amps resistive at 115VAC or 26.5VDC 5 amps inductive at 115VAC or 26.5VDC
ambient temperature	−55°C to +85°C	open −55°C to +85°C enclosed −55°C to +50°C (special −55°C to +85C°)
terminals	solder lug	solder lug
mounting	four 6 — 32 tapped holes	#6-32 tapped hole
dielectric strength	500 volts RMS	500 volts RMS
insulation resistance	100 megohms minimum	100 megohms min.
operate time	.025 sec. max. — (6 form C at nominal voltage)	.015 seconds max. at nominal voltage
release time	.010 sec. max. at nominal voltage	.010 seconds max. at nominal voltage
sensitivity	DC relay — 300 milliwatts per form C; AC relay — 6 volt amps	GHA, GHB DC delay 1.0 watts; AC relay 3 volt-amperes GHS, GHE 1C — 130MW 2C — 260MW 3C — 350MW
coil dissipation	4 watts maximum at 25°C	DC relay — 3 watts max. at 25°C; AC relay — 6 volt-amperes

TYPE 12 & 12LA

contacts	nominal voltage	DC resistance ohms (25°C)	DC must operate volts	AC resistance ohms (25°C)	AC must operate volts
2C	6	17	5	1.2	4
	12	64	8	9	8
	24	215	17	19	18
	48	800	38	—	—
	110-115	5000	70	645	85
	220	9300	165	2500	175
3C	6	17	5	1.2	5
	12	64	9	9	8.5
	24	215	18	19	19
	48	800	40	—	—
	110-115	5000	80	645	90
	220	9300	175	2500	180
6C	6	17	5	1.2	5
	12	64	10	9	10
	24	215	20	19	20
	48	800	43	—	—
	110-115	5000	95	645	95
	220	9300	185	2500	185

TYPE GH

General Purpose Types GHA — GHP — GHB — GHH

nominal voltage	DC resistance ohms (25°C)	DC must operate volts (25°C)	DC must release volts (25°C)	AC resistance ohms (25°C)	AC must operate volts (25°C)
6	25	5	1	4	5
12	100	10	2	16	10
24	400	20	4	63	20
48	1600	40	8	250	40
110-115	8000	95	20	1600	95
220	32,000	185	60	5000	185

Plate Circuit Types GHS — GHE

resistance ohms (25°C)	must operate current (amps) 1C	2C	3C
2500	.0072	.010	.012
5000	.005	.0072	.0083
10,000	.0036	.005	.0058

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GENERAL PURPOSE RELAYS

SERIES W, WU

GENERAL DESCRIPTION — The Series W is a double-pole, double-throw relay, available with socket for plug-in application or for use without socket with standard quick-connect terminals for simplicity and ease in wiring. Rated for 1 and 2 HP motor loads, it offers high quality, dependable performance and long life.

These relays are ideal for use in appliances, automation equipment, motor starting, heater circuits, clock controlled systems, laundry equipment, vending machines, machine tools, furnace controls, panel boards and air conditioners.



SERIES W

Series WU — UL approved to UL508. Provided with Class A insulation.

The Series W plug-in design allows rapid removal and replacement of relays for preventive maintenance. Servicemen can replace relays without wiring and soldering problems.

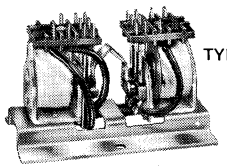
THREE BASIC MOUNTING ARRANGEMENTS — Type 1—Panel Mountings. Type 2—Side Mountings. Type 3—Socket (Includes retaining clip.)

W-RELAY HOLDING CIRCUIT — Available as an optional extra is a normally open holding contact for the coil circuit. This permits sustaining operation of the relay from momentary switches, as found in customary Start-Stop push-button stations, without sacrificing one of the heavy-duty load contacts where the coil voltage may be different from the load circuit voltage.

FUNCTIONAL SWITCH ASSEMBLY DESIGN — Evenly spaced contact return springs give almost simultaneous contact transfer on both sets of contacts. Simple one-piece construction of the contact fingers together with oversized contacts and the solid silver contact bar give long, trouble-free life.

TYPE LG

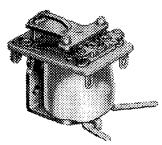
The Hart-Advance LG Relay combines two of the popular GH series into a latching assembly ideally suited for applications where it is desirable to use only a momentary signal to produce a continuous indication, and to reset electrically. This unit is available with 5 or 10 amp contacts and contact arrangements of 1 through 6 form C.



TYPE LG

TYPE MK

The Hart-Advance MK relay requires less than ½ cubic inch mounting space. All parts are cadmium cronak plated to prevent corrosion. Insulation material of silicone glass and hinges or beryllium copper assure stable performance under shock, vibration, and temperature extremes. The MK is available with palladium contacts and contact arrangements of 1 and 2 form C. Mounting of the open relay is accomplished by means of a single 2-56 screw. Also available are a choice of 3 standard hermetically sealed enclosures.



TYPE MK

STANDARD CATALOG LISTINGS — SERIES W RELAYS

	nominal voltage	pull-in voltage (max. @ 25°C)	coil resistance (ohms)	Part Number (prefix WU denotes UL approved model)
DC	6VDC	4VDC	14	WU006D1-278 WU006D2-252 WU006D3-171
	12VDC	8VDC	50	WU012D1-279 WU012D2-253 WU012D3-159
	24VDC	16VDC	250	WU024D1-280 WU024D2-281 WU024D3-129
	48VDC	32VDC	1,000	WU048D1-282 WU048D2-283 WU048D3-181
	100VDC	75VDC	5,000	WU100D1-284 WU100D2-285 WU100D3-286
	150VDC	140VDC	30,000	WU150D1-287 WU150D2-288 WU150D3-289
AC	6VAC	5VAC	.83	WU006A1-290 WU006A2-291 WU006A3-197
	12VAC	10VAC	4	WU012A1-292 WU012A2-246 WU012A3-293
	24VAC	20VAC	14	WU024A1-294 WU024A2-161 WU024A3-295
	115VAC	95VAC	250	WU115A1-166 WU115A2-141 WU115A3-099
	208VAC	175VAC	1,000	WU208A1-296 WU208A2-227 WU208A3-218
	220VAC	185VAC	1,000	WU220A1-297 WU220A2-140 WU220A3-108
	240VDC	200VAC	1,200	WU240A1-298 WU240A2-220 WU240A3-130

NOMINAL COIL DATA — COIL WATTAGE - A.C. Coils—7½ Volt Amperes (in-rush 15 V.A.) D.C. Coils—2.5 Watts. Operating Time—20 ms max. A.C., 30 ms max. D.C. Dropout Time—15 ms max. A.C. 15 ms max. D.C. Coil Voltage—4 V. to 240 V. (50-60 Cycles) A.C. 4 V. to 240 V. D.C.

SPECIFICATIONS	SERIES W, WU	TYPE LGA & LGB	TYPE MK
size	height 1.875; width 1.50; depth 1.50	1.88 H x 3.03 L x 1.70 W	.796 H x .968 L x .625 W
weight	10 ounces max.	5 ounces max.	0.5 ounces max.
enclosure	cover assembly	not available	open, dustite or hermetically sealed
contact arrangement	DPDT 2Z	1 thru 6 form C (3 max. per coil)	1 or 2 form C
contact material	solid silver or silver cadmium oxide available gold flashed	5 amp — silver, gold flashed 10 amp — silver cadmium oxide, gold flashed	palladium
contact resistance		.100 ohms maximum	.050 ohms max.
contact rating	25 amps resistive at 120VAC or 240VAC 25 amps inductive 120VAC 1 h.p. 120VAC — 2 h.p. 240VAC 25 amps resistive 24VDC	LGA—5 amps resistive at 115VAC or 26.5VDC 2 amps inductive at 115VAC or 26.5VDC LGB—10 amps resistive at 115VAC or 26.5VDC 5 amps inductive at 115VAC or 26.5VDC	1 amp resistive at 115VAC or 26.5VDC 0.6 amps inductive at 115VAC or 26.5VDC
ambient temperature	−55°C to +85°C	−55°C to +85°C	−55°C to +85°C
terminals	spade type — ¼" x .032 standard	solder lug	solder lug
mounting	8-32 tapped hole	two .156" dia. holes on 1⅜" centers	2-56 UNC-3B tapped hole
dielectric strength	500 volts RMS	500 volts RMS	500 volts RMS
insulation resistance	100 megohms per min.	100 meg ohms minimum	100 megohms min.
operate time	30ms max. AC — 40ms max. DC	.015 sec. max. at nominal voltage	.006 sec. max. at nominal voltage
release time	15ms max. AC — 15ms max. DC	.010 sec. max. at nominal voltage	.005 sec. max. at nominal voltage
sensitivity	DC relay — 1 watt AC relay — 6.5 volt amps	DC relay — 2 watts nominal; AC relay — 3 volt amperes nominal	1 form C, .50 watts; 2 form C, .80 watts
coil dissipation	DC relay — 2.5 watts AC relay — 7.5 volt amps	3 watts maximum at 25°C	1.5 watts max. at 25°C

STANDARD COILS AND OPERATING VALUES

TYPE LGA & LGB

	DC		AC	
nominal voltage	resistance ohms (25°C)	must operate volts (25°C)	resistance ohms (25°C)	must operate volts (25°C)
6	16	5	2.5	5
12	63	10	10	10
24	250	20	40	20
110-115	5000	90	1000	95
220	—	—	3700	195

TYPE MK

	1 FORM C			2 FORM C		
nominal voltage	resistance ohms (25°C)	must operate volts	must release	resistance ohms (25°C)	must operate volts	must release
6	50	5	1.0	30	5	1.0
12	200	10	2.0	120	10	2.0
24	800	20	4.0	500	20	4.0
32	1200	28	5.0	800	28	5.0
48	3000	40	8.0	2000	38	8.0
60	5000	50	10.0	3000	50	10.0
110	10,000	95	20.0	10,000	95	20.0

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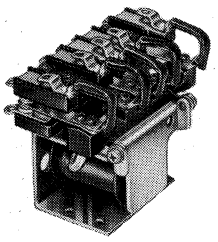
POWER RELAYS

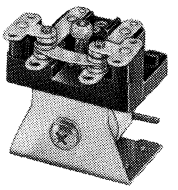
TYPE 33B & 33BLA



TYPE 33B — 5 POLE

The Hart-Advance type 33B relay is a compact power relay designed for versatility and long life. It is available as a latching or non-latching unit of 1 through 5 poles with contact ratings of up to 25 amps. Quick disconnect terminals and a wide variety of enclosures add to its versatility. Contacts and terminals are mounted on molded phenolic blocks, and adjusting screws on each blade permit close adjustment of contact gap, overtravel and contact pressure. The armature pivots on machined phosphor bronze bearing pins, while adjustment of the armature and yoke assembly allows precise alignment between armature and pole face.

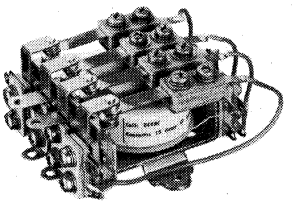
TYPE PG



TYPE PG1Z

The Hart-Advance type PG is a general purpose power relay available in AC or DC with DPDT(2C) or SPDT-DB(1Z) contact arrangements. This relay is excellent for general industrial power control circuits. The standard relay has a contact rating of 15 amps but the 1Z arrangement offers a 30 amp rating. The additional rating is achieved by including a jumper between the blades, thus providing heavy duty contacts without affecting the physical size, vibration, or shock characteristics. A wide variety of enclosures are also available.

TYPE PC



TYPE PC4C

The Hart-Advance PC relay is a compact positive-acting unit available with either AC or DC coil. This relay is used in air conditioning and lighting systems, small motor starting, garage door openers —wherever dependable circuit switching is necessary. The 1/4" dia. contacts are rated at 15 amps resistive at 115VAC or 26.5VDC. Contact arrangements from 1 through 4 poles are available. The large contact surfaces are kept clean by good wiping action.

SPECIFICATIONS	TYPE 33B & 33BLA	TYPE PG	TYPE PC
weight	8 ounces max.	4.5 ounces	8 ounces max.
enclosure	open, dustite or hermetically sealed	open, dustite or hermetically sealed	not available
contact arrangement	1 thru 5 form A, B or C, or combinations thereof	2 form A, B, or C, max; or 1 X, Y, or Z max.	up to 4 form A, B, or C; or combinations thereof
contact material	code 13—3/16" dia. silver; code 14—1/4" dia. silver; code 15—1/4" dia.silver-cadmium; code 31—1/4" dia. Tungsten (form A or B only)	1/4" dia., silver cadmium oxide	1/4" dia. fine silver
contact resistance	.100 ohms maximum	.100 ohms max.	.100 ohms max.
contact rating	code 13—10 amps., 125 volts AC resist. code 14—20 amps., 125 volts AC resist. code 15—25 amps., 125 volts AC resist. code 31—25 amps., 250 volts AC resist.	15 amps resistive at 115VAC or 26.5VDC 5 amps inductive at 115VAC or 26.5VDC 30 amps for form X, Y, or Z	15 amps resistive at 115VAC or 26.5VDC 5 amps inductive at 115 VAC or 26.5 VDC
ambient temperature	−55°C to +85°C	−55°C to +85°C	−55°C to +85°C
terminals	solder lug	solder lugs	solder lugs
mounting	four 6-32 tapped holes	four 6-32 tapped holes	two 6-32 tapped holes on 2" centers
dielectric strength	1000 volts RMS	500 volts RMS	500 volts RMS standard; 1000 volts special
insulation resistance	100 megohms min.	100 megohms min.	100 megohms
operate time	.030 sec. max. at nominal voltage (5 form C)	.020 sec. max. at nominal voltage	.025 sec. max. at nominal voltage
release time	.010 sec. max. at nominal voltage	.010 sec. max. at nominal voltage	.010 sec. max. at nominal voltage
sensitivity	1C—650 mw; 2C—800 mw; 3C—900 mw; 4C—1 watt; 5C—1.3 watts	DC relay — 2 watts; AC relay — 12 volt-amperes	1 watt
coil dissipation	6 watts max. at 25°C	5 watts maximum at 25°C	DC relay—3 watts; AC relay—12 volt-amps

STANDARD COILS AND OPERATING VALUES

TYPE 33B & 33BLA

contacts	nominal voltage	DC resistance ohms (25°C)	DC must operate volts	DC operate time seconds	AC resistance ohms (25°C)	AC must operate volts
1C	6	18	3.5	.016	1	5.0
	12	35	6.5	.016	3.2	10.0
	24	250	16.0	.017	9	22.0
	48	800	27.0	.016	46	46.0
	115	5000	65.0	.020	215	100
	230	10,000	110	.016	1100	185
3C	6	18	4.5	.019	1	5.0
	12	35	7.5	.019	3.2	10.0
	24	250	20.0	.020	9	22.0
	48	800	32.0	.020	46	46.0
	115	5000	77.0	.020	215	100
	230	10,000	130	.016	1100	200
5C	6	18	5.0	.025	1	5.0
	12	35	8.5	.025	3.2	10.5
	24	250	22.0	.027	9	22.5
	48	800	42.0	.025	46	46.5
	115	5000	85.0	.028	215	105
	230	10,000	150	.025	1100	205

TYPE PG

voltage nominal	DC ohms (25°C) resistance	DC volts (25°C) must operate	AC ohms (25°C) resistance	AC volts (25°C) must operate
6	16	4.5	1.6	5
12	63	9	4	10
24	250	20	—	18
48	1000	40	63	40
110-115	6300	95	400	95
220	25,000	185	1600	185
440	—	—	6300	375

TYPE PC

6	16	4.5	1.6	5
12	63	10	4	10
24	250	20	16	20
48	1000	40	100	40
110-115	4000	95	450	95
220	16,000	170	1600	185
440	—	—	6300	375

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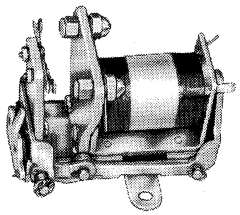
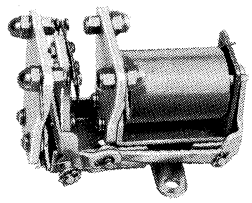
TELEPHONE & POWER RELAYS



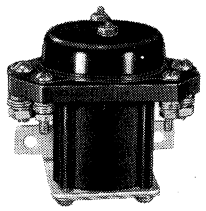
TYPE HV/1X



TYPE HV/1Z

TYPE HV HIGH VOLTAGE SWITCHING RELAY

The Hart-Advance HV relay is a small unit developed especially for making and breaking high voltage circuits of low current capacities. Its excellent insulation characteristics will permit the relay to handle higher voltages than relays of comparable size. A system of levers operating the armature provides the necessary wide gap for high voltage switching, but keeps the size of the relay to a minimum. The contact assembly is mounted on ceramic to insure high insulation plus strength and low energy loss. The specially designed contact assembly provides for minimum bounce. The ¼" diameter silver cadmium oxide contacts will break up to 5000V RMS at 200 milliamps current. Special forms available in oil-filter enclosure for switching up to 12,000 volts.



TYPE ES

TYPE ES

The Hart-Advance type ES contactor is a compact, ruggedly built, enclosed, solenoid-type relay designed for heavy duty DC applications. Originally designed and built for military applications. the ES is now widely used in both military and industrial applications. This unit is ideal for use in transferring high current loads. The dust-tite enclosure assures trouble free operation while the ⅜" double-make contacts provide dependable load control. The unit employs an unusually powerful solenoid with spring loading to ensure positive operate and release.

SPECIFICATIONS	TYPE HV	TYPE ES
weight	7.5 ounces maximum	11 ounces max.
enclosure	not available	dust-tite — gasket sealed
contact arrangement	1 form X, Y, or Z	1 form X (double make) only
contact material	¼" dia. silver cadmium oxide	⅜" dia. silver-cadmium oxide
contact resistance	.100 ohms nominal	.100 ohms max.
contact rating	will break up to 5000 volts RMS at 200 MA current, 8000 volts on special order	50 amps resistive, 30 amps inductive at 26.5 VDC
ambient temperature	−55°C to +85°C	−55°C to +85°C
terminals	solder lug	stud and nut
mounting	two 3/16" dia. holes on 1¾" centers	two 7/32" dia. holes on 1⅞" centers
dielectric strength	6000 volts RMS terminals to ground 500 volts RMS coil to ground	500 volts RMS standard; 1000 volts special
insulation resistance	100,000 megohms min.	100 megohms min.
operate time	.015 sec. max. at nominal voltage	.030 sec. max. at nominal voltage
release time	.010 sec. max. at nominal voltage	.015 sec. max. at nominal voltage
sensitivity	350 milliwatts	5 watts max.
coil dissipation	6 watts max. at 250°C	10 watts at 25°C

STANDARD COILS AND OPERATING VALUES

TYPE HV

(Available for DC operation only)

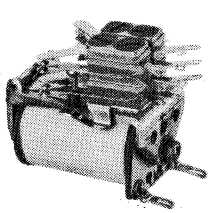
nominal voltage	resistance ohms (25°C)	must operate volts (25°C)
6	7.5	5
12	30	10
24	120	20
48	475	45
110	3000	95
220	12,000	185

TYPE ES

(Available for DC operation only)

resistance ohms (25°C)	must operate volts (25°C)	must release volts (25°C)
6	5	1.0
25	11	2.0
100	20.1	4.0
440	35	7.0
2800	93.5	19.0
11250	195	39.0

TYPE 9



The Hart-Advance Type 9 is a miniature telephone type designed to provide reliability normally found only in larger relays. The magnetic parts are magnetic ingot iron, while the contact springs are spring temper nickel silver. The armature pivots on a precision ground bearing pin of stainless steel. Many standard enclosures are available.

SPECIFICATIONS	TYPE 9
weight	open approx. 1.2 oz., enclosed approx. 3 oz.
size	1C or 2C: 1 1/32 H x 1¼ L x 2 3/32 W
enclosure	open, dustite, or hermetically sealed
contact forms	A, B, C
contact arrangement	6 form C max.
contact codes	1, 2, 3, 4, 4G, 5, 6, 10, 11, 16
ambient temperature	−55°C to +85°C
terminals	solder
mounting	two #4-40 tapped holes on ⅜" centers
dielectric strength	1000 volts RMS
insulation resistance	100 megohms min.
sensitivity	200 MW per form C
coil dissipation	3 watts max.

STANDARD COILS AND OPERATING VALUES

TYPE 9

(Available For DC Only)

contacts	nominal voltage	resistance ohms (25°C)	must operate volts (25°C)	operate time*
2C	6	30	4.5	.008
	12	80	6.0	.008
	24	300	11.0	.008
	48	1200	22.0	.008
	110-115	6500	55.0	.008
4C	6	30	5.0	.012
	12	80	9.0	.012
	24	300	18.0	.012
	48	1200	33.0	.012
	110-115	6500	80.0	.012
6C	6	20	5.0	.020
	12	70	10.0	.020
	24	270	20.0	.020
	48	1200	44.0	.020
	110-115	6500	100.0	.020

*Approximate operate time at nominal voltage — all types.

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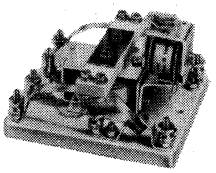
COAXIAL ANTENNA RELAYS

TYPE AT

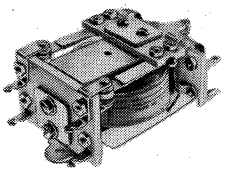
The Hart-Advance AT relay is designed especially for heavy duty Radio Frequency transmitter antenna changeover, and high voltage switching applications. This relay is for fixed-station usage with a conservative rating of 1 KW. It is also ideal for switching industrial loads because of its ¼" diameter silver contacts and wide contact gap. The AT relay is built for easy connection to antenna lines and is available with auxiliary single pole single throw normally open contacts. The AL latching relay is an adaptation of the AT to be used when it is desirable to use only momentary current for relay switching.



TYPE AT2C

TYPE AH

The Hart-Advance AH relay is designed specifically for Radio Frequency operation. The small size of this unit makes it ideal for use in compact sets where the load does not exceed ½ KW. High contact pressure is obtained through the use of long phosphor bronze springs. Low-loss handling of radio frequency energy is assured by the steatite insulation, and adequate spacing between contacts. This relay is fast and positive in action and will operate in any position. Standard contact rating is 10 amps resistive. The AH is available for either AC or DC operation.



TYPE 2C

STANDARD COILS AND OPERATING VALUES

	TYPE AT					RESET COIL RESISTANCE TYPE AL ONLY		TYPE AH			
	DC		AC					DC		AC	
nominal voltage	resistance ohms (25°C)	must operate volts (25°C)	resistance ohms (25°C) AL	AT	must operate volts (25°C)	resistance ohms (25°C) DC	AC	resistance ohms (25°C)	must operate volts (25°C)	resistance ohms (25°C)	must operate volts (25°C)
6	10	5	1	1	5	16	4	16	5	1.6	5
12	40	10	4	4	10	63	6.3	63	10	4	10
24	160	20	16	16	20	250	40	250	20	16	20
48	630	40	63	63	40	1000	—	1000	40	—	—
110-115	4000	95	250	400	95	4000	630	4000	95	450	95
220	16,000	185	1000	1600	185	16000	2500	25,000	185	1600	185

SPECIFICATIONS	TYPE AT & AL	TYPE AH
weight	type AT — 12.6 ounces max.; type AL — 14 ounces max.	5.5 ounces maximum
contact arrangement	2 form C max. (1A aux. contact available; AT only)	2 form C max. (1C aux. contact available)
contact material	¼" dia. fine silver	¼" dia. fine silver
contact resistance	.100 ohms nominal	.100 ohms nominal
contact rating	15 amps resistive at 115VAC or 26.5VDC 5 amps inductive at 115VAC or 26.5 VDC	10 amps resistive at 115VAC or 26.5 VDC 5 amps inductive at 115VAC or 26.5 VDC
ambient temperature	−55°C to +85°C	−55° to +85°C
terminals	stud and nut	solder lug
mounting	four .156 dia. clearance holes for 6-32 screws	two 6-32 tapped holes on 2" centers
dielectric strength	standard: 500 volts RMS special: 1000 volts RMS between non-connected terminals, between terminals and ground, and between coil and ground can be met on 2C contacts only. 1A auxiliary contacts are at ground (frame) potential.	standard: 500 volts RMS special: 3000 volts RMS between non-connected terminals and ground; 1000 volts RMS between coil and ground
insulation resistance	100,000 megohms min.	100,000 megohms min.
operate time	.015 sec. max. at nominal voltage	.015 sec. max. at nominal voltage
release time	.010 sc. max. at nominal voltage	.010 sec. max. at nominal voltage
sensitivity	DC relay — 2 watts max.; AC relay — 9 volt amperes	DC relay 1 watt max.; AC relay 8 volt amps max.
coil dissipation	DC relay — 3 watts; AC relay — 12 volt amperes	DC relay — 3 watts; AC relay — 12 volt amps

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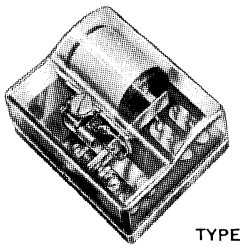
SENSITIVE D.C. RELAYS
TIME AND THERMAL TIME DELAY RELAYS


TYPE SV

TYPE SV

The Hart-Advance SV is an ultra-sensitive durable, dustite and fully adjustable relay incomparable for use in any DC circuit restricted to a few thousandsths of a watt power consumption. The counter-balanced armature design permits excellent operation in any position. The transparent, molded plastic cover guards against dust or dirt reaching the contacts or other working parts — yet allows immediate visual inspection. The sturdy molded bakelite base has both screw and solder terminal connectors, and a convenient means of mounting is provided.

Standard factory adjustment is 5 milliwatt sensitivity and field adjustments are easily made by using the vernier screws. The silver contacts and spring tension can be accurately and permanently set—yet easily changed.

SPECIFICATIONS	TYPE SV
weight	6.5 ounces max.
enclosure	clear plastic dustite cover
contact arrangement	1 form C (SPDT)
contact material	⅛″ dia. silver
contact resistance	.050 ohms max.
contact rating	1 amp resistive at 115VAC or 26.5VDC 0.5 amp inductive at 115VAC or 26.5VDC
ambient temperature	−55°C to +85°C
terminals	solder lug
mounting	two 9/64″ dia. holes
dielectric strength	500 volts RMS
insulation resistance	100 megohms min.
operate time	.020 sec. max. at 3 times operate voltage
release time	.020 sec. max. at 3 times operate voltage
sensitivity	.005 watts (factory adjustment)
coil dissipation	4 watts maximum at 25°C

STANDARD COILS AND OPERATING VALUES
TYPE SV

resistance ohms (25°C)	must operate volts (25°C)	must operate current (MA)
.005	.005	1000
1000	2.20	2.20
1600	2.82	1.80
2200	3.30	1.50
3500	4.20	1.20
4000	4.50	1.10
5500	5.25	0.95
8700	6.60	0.75
10,000	7.10	0.70
14,000	8.40	0.60
20,000	10.00	0.50
30,000	11.40	0.38
40,000	14.00	0.35

other coil resistances available upon request.

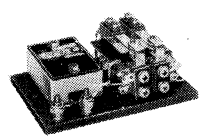
SERIES DT

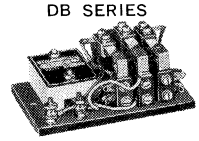

SERIES DT

The Hart-Advance DT relay is an efficient, dependable, low cost thermal delay relay. It may be used in conjunction with various relays for delayed making or breaking of controlled circuits. The DT has an adjustable time delay of 5 to 60 seconds and is supplied with an isolated heater with 4 terminal connections. Simply constructed, this unit is housed in unglazed porcelain and operates on the bi-metal-thermal principle. The heat rise is negligible because of the porcelain housing. This assures uniform operation, subject only to ambient temperature changes and line voltage fluctuation.

TYPE DB & DM

The Hart-Advance DB-DM adjustable time delay relay is excellent for use in pre-heating tube filaments, specialized lighting circuits, photographic controls, and protection applications. The DB provides a time delay before break. When energized, it immediately closes the controlled circuit — remaining closed only for the preset period, or until the initial circuit is broken. The DM provides a delay before make. Once energized, it furnishes an adjustable delayed make for the controlled circuit. When the controlled circuit is completed, it remains closed until the initial circuit is broken. Completion of the controlled circuits starts the cooling of the time delay device. Both series utilize a bi-metallic thermal unit which can be adjusted for delays of 5 to 60 seconds. Cooling of the thermal units for proper re-cycling requires 8 to 10 times the delay period.


DB SERIES


DM SERIES

SPECIFICATIONS	TYPE DT
weight	1.4 ounces max.
contact arrangement	1 form A or B only
contact material	⅛″ dia. silver
contact rating	2 amps resistive at 115VAC or 26.5VDC 0.8 amps inductive at 115VAC or 26.5 VDC
ambient temperature	−55°C to +85°C
terminals	solder lug. Supplied with an isolated heater with four connections.
mounting	two 5/32″ dia. clearance holes for 6-32 screws
coil voltage	standard 6, 12, 24, 115 or 220 volts AC or DC. Upon request, any DC or AC voltage up to 220 volts can be supplied.
coil	2 watts nominal required to operate
timing	adjustable delay of 5 to 60 seconds
timing tolerance	±10% at 25°C; ±25% over ambient temp. range
cooling period	8 to 10 times the preset delay period

SPECIFICATIONS	TYPE DB & DM
weight	8 ounces max.
enclosure	not available
contact arrangement	2 form C max. (DPDT)
contact material	¼″ dia. fine silver
contact resistance	.100 ohms max.
contact rating	10 amps resistive at 115 VAC or 26.5 VDC 5 amps inductive at 115VAC or 26.5 VDC
ambient temperature	−55°C to +85°C
terminals	stud and nut
mounting	two .152 dia. holes on 3 5/16″ centers
dielectric strength	500 volts RMS
insulation resistance	100 megohms min.
delay time & tolerance	5 to 60 seconds ±10% at 26°C; ±25% over amb. temp.
recycling time	8 to 10 times the delay period
sensitivity	DC relay 1.5 watts; AC relay 10 volt-amps
coil dissipation	DC relay — 3 watts max.; AC relay — 14 V/A

STANDARD COILS AND OPERATING VALUES — TYPE DB & DM

nominal voltage	DC		AC	
	resistance ohms (25°C)	must operate volts (25°C)	resistance ohms (25°C)	must operate volts (25°C)
6	16	5	1.6	5
12	63	10	4	10
24	250	20	16	20
48	1000	40	—	—
110-115	4000	95	450	95
220	—	—	1600	195

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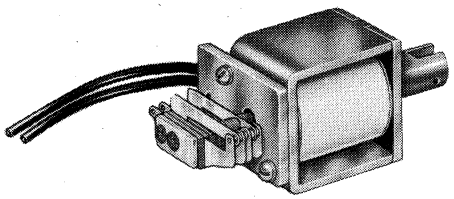
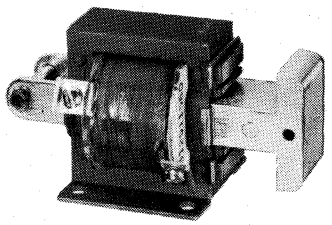
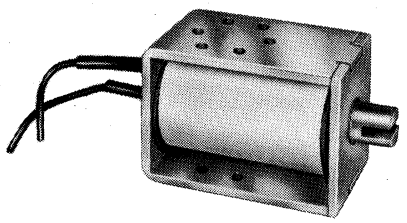
SOLENOIDS



SOLID FRAME SOLENOID
with Auxiliary Contacts



LAMINATED FRAME SOLENOID



SOLID FRAME SOLENOID

Hart-Advance solid frame solenoids are manufactured using high grade steel in all parts of the magnetic circuit. Carefully controlled annealing after all machining operations are completed, assures maximum efficiency. The frame is dove-tailed and staked to the end plate to add mechanical strength and to increase performance. The solid frame solenoids are supplemented by the type 51 laminated frame unit which has been designed and engineered to meet the most stringent AC requirements. A wide selection of special features is available to fit each solenoid to a specific application.

TYPE	41		42		38		39		40		51
size	1 x 1 7/32 x 1 1/4		1 x 1 7/32 x 2		1 9/16 x 1 27/32 x 1 5/8		1 9/16 x 1 27/32 x 2 1/8		1 9/16 x 1 27/32 x 2 5/8		2 1/16 x 1 15/16 x 3 1/2
weight (oz.)	6		8		12		16		20		16
coil watts max. at 25°C	3		6		10		12		15		60 VA
voltage	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC	
std. plunger	AX	AU	AX	AU	AX	AY	AX	AY	AX	AU	
max. stroke inches	3/8"		1/2"		1/2"		5/8"		7/8"		1"
plunger dia.	7/16"		7/16"		1/2"		1/2"		1/2"		

COIL RESISTANCE FOR STANDARD VOLTAGES

DC voltage	41 cont	41 25% duty	42 cont	42 25% duty	38 cont	38 25% duty	39 cont	39 25% duty	40 cont	40 25% duty	51
6	12	2.8	8	1.6	4.6	1	4.2	.8	3.6	.8	NOT AVAILABLE
12	59	12	30	8	15	6	11	4.2	12	3.6	
24	198	59	117	30	60	15	59	16	47.5	21	
48	775	198	420	117	300	60	250	59	225	47.5	
115	4500	1400	2300	675	1513	400	1584	310	1570	417	

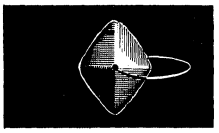
AC voltage	41 cont	41 25% duty	42 cont	42 25% duty	38 cont	38 25% duty	39 cont	39 25% duty	40 cont	40 25% duty	51 cont	51 25% duty
6	1.0	.33	.8	.5	.75	.13	.45	.10	.8	.5	.25	.11
12	11	2.74	3.3	.8	2.50	.75	1.40	.45	1.5	.8	.70	.25
24	44	11	30	3.3	10	2.50	7	1.40	3.6	1.5	1.1	.70
115	744	229	368	223	137	50	142	29.5	84	25	30	15
230	3400	830	1100	494	473	187	410	142	417	84	150	65
460	—	—	—	—	—	—	—	—	—	—	650	285

PULL IN OUNCES AT 25°C

LBS. PULL

duty	41 cont		41 25%		42 cont		42 25%		38 cont		38 25%		39 cont		39 25%		40 cont		40 25%		51 cont	51 25%
stroke	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC		
sealed	11	60	30	130	16	128	42	130	30	150	58	280	22	160	64	260	20	160	56	300	17	20
1/8"	4	3	16	18	8	16	21	48	14	40	40	128	8	40	40	140	7	64	40	140	6	8
1/4"	1.5	1.5	8	10	3	8	12	32	9	14	22	70	6	12	28	100	4	27	24	96	4.5	6.5
3/8"	1	1	4	4	2	4	9	18	5	7	15	40	5	4	24	60	3	12	18	80	4	6
1/2"					1	2	7	11	3	3	12	20	5	2	20	40	3	6	17	60	3.5	5
5/8"													5	1	20	26	2	3	17	30	3	4.5
3/4"																	2	2	17	20	2.5	3.0
7/8"																	2	1	17	12	1.5	2.0
1"																					.8	1.0

duty based on 4 min. cycle — Tolerance on pull ±20% — specials available



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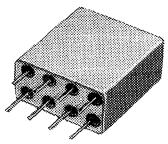
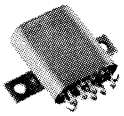
MILITARY TYPE CRYSTAL CAN RELAYS



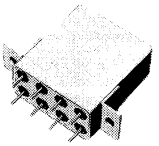
TYPE 30

The Hart-Advance TYPE 30 microminiature relay combines compactness with rugged dependability. The superior performance designed and built into this double-pole/double throw relay makes it the ideal component for the most demanding military and commercial applications — aircraft and missile controls, computers, communication systems, and other hi-grade electronic circuitry. Outstanding features include rotary armature, bifurcated gold-flashed contacts rated at Low Level to 2 Amps and 250 MW maximum sensitivity. Another Hart-Advance exclusive is "Thermo-Dri" nitrogen back-filling of the hermetically sealed unit for contamination-free operation under the most adverse environmental conditions. The TYPE 30 is available in a wide range of header and mounting configurations. Meets MIL R5757/10 and NASA specifications.



TYPE MV

The Hart-Advance MV combines proven design with modern production methods to provide a reliable DPDT micro-miniature relay for the most demanding applications. The use of gold plated silver-magnesium-nickel contacts allows for reliable switching from dry circuit to 2 amps. The simple, efficient magnetic circuit combined with dual coil construction provide for maximum sensitivity. This relay is available from stock in all popular header and enclosure styles with custom enclosures manufactured on special order. Meets MIL R5757/10.



TYPE VR

The Hart-Advance TYPE VR is a .2" grid-spaced, hermetically sealed relay developed to exceed the requirements of MIL R5757/D. This unit will withstand 100 G shock and 35 G vibration through 3,000 CPS. Having a nominal operating power of 250 MW, the VR can also be supplied as a 100 MW relay. The DPDT contacts are gold plated silver-magnesium-nickel alloy with a rating of 3 Amps resistive at 28 VDC. Meets and exceeds MIL R5757/10.

SPECIFICATIONS	TYPE 30	TYPE MV	TYPE VR
size	height, .875; width, .800 max.; thickness, .400 max.	height, .875"; width, .797" max.; thickness, .359" max.	height, .875" max.; width, .800" max.; thickness, .400" max.
weight	.6 ounces max.	0.6 ounce max.	.65 ounces max.
enclosure	hermetically sealed; back filled with thermo dry nitrogen, with helium tracer	hermetically sealed, back filled with dry nitrogen; with helium tracer	hermetically sealed, back filled with dry nitrogen; with helium tracer
contact arrangement	DPDT (2 form C)	DPDT (2 form C)	DPDT (2 form C)
contact resistance	0.050 ohm max. per contact	per contact 0.050 ohms max.	per contact 0.050 ohm max.
contact rating*	2 amps resistive 26.5 volts DC 1 amp inductive 26.5 volts DC	2 amp 26.5 VDC or 115 VAC and low level	low level to 3 amps, 28 volts DC or 115 VAC resistive
life expectancy	100,000 operations at 2 amps	100,000 operations at 2 amps at 125°C	100,000 operations at rated current at 125°C
capacitance	close contacts to case — 2.0 MMFD open contacts to case — 1.1 MMFD between pairs of contacts — 1.0 MMFD between adjacent contact pairs — 1.0 MMFD	closed contacts to case 2.0 MMFD max. open contacts to case 1.0 MMFD max. between pairs of contacts 1.0 MMFD max. between adjacent contact pairs 1.5 MMFD max.	closed contacts to case 2.0 MMFD max. open contacts to case 1.0 MMFD max. between pairs of contacts 1.0 MMFD max. between adjacent pairs of contacts 1.5 MMFD max.
ambient temperature	−65°C to +125°C	−65°C to +125°C	−65°C to +125°C
shock	65 G's for 11 MS	50 G's for 11 MS	100 G's for 11 MS
vibration	.062 excursion, 5-75 CPS; 20 G's 75-2000 CPS on mountings 01, 07, 08, others are 15 G's	10-34 CPS 0.4 inches DA; 20 G's to 2000 CPS	10-34 CPS .4 DA, 35 G to 3000 CPS
linear acceleration	100 G's	100 G's	100 G's
salt spray	50 hours minimum	50 hours minimum	50 hours min.
standard finish	enamel finish, fungus resistance, over unfused electro-tin	enamel finish, fungus resistant, over unfused electro-tin	enamel finish, fungus-resistant over unfused electro-tin
terminals	solder hook, 3" leads, plug-in (matching socket available)	solder hook, 3" leads, plug in (matching socket available)	solder hook, 3" leads, plug in (matching socket available)
mounting	all popular styles available	all popular styles available	all popular styles available
dielectric strength	1000 volts RMS between terminals and case at sea level — 500 to 750 volts RMS between open contacts at sea level — 500 volts RMS between coil and ground	1000 volts RMS between terminals and case at sea level — 500 volts RMS between open contacts, 350 volts at 70,000 ft.	1000 volts RMS between terminals and case at sea level — 500 volts RMS between open contacts, 350 volts at 70,000 ft.
insulation resistance	1000 megohms at 125°C	100 megohms at 125°C	1000 megohms at 125°C
operate time	5 milliseconds max.	5 milliseconds max.	5 milliseconds max.
release time	5 milliseconds max.	5 milliseconds max.	5 milliseconds max.
contact bounce	1 milliseconds max.	1 milliseconds max.	1 milliseconds max.
sensitivity	250 milliwatts max.	250 milliwatts max.	250 milliwatts max.; 100 MW at reduced vibration & shock
MIL-Spec	MIL-R-5757/10	MIL-R-5757/10	MIL-R-5757/10

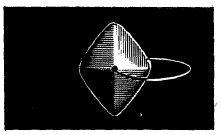
* low level requirement must be specified to assure maximum reliability

STANDARD COILS AND OPERATING VALUES

TYPE 30				
coil letter	resistance ohms (25°C)	nominal voltage	must operate volts (25°C)	must release volts (25°C)
A	35	6.3	3.5	.7
B	60	7.6	4.1	.8
C	110	11.0	5.5	1.1
D	200	12.6	7.2	1.4
E	340	20.4	10.2	2.0
F	425	20.8	11.3	2.2
G	675	26.5	13.5	2.6
H	1825	45.6	24.0	4.8
J	2450	48.0	26.5	5.3
K	3150	55.0	32.0	6.4
L	5675	73.8	42.0	8.0
M	9100	110	54.0	11.0

TYPE MV			
resistance ohms (25°C)	nominal voltage	must operate volts (25°C)	must release volts (25°C)
30	6.0	2.7	0.25
60	8.0	3.8	0.30
100	11.0	5.0	0.40
120	12.0	5.5	0.50
200	15.5	7.0	0.60
400	22.0	10.0	0.80
500	24.0	11.0	0.96
550	25.0	11.8	1.10
600	26.0	12.3	1.00
850	32.0	14.5	1.20
1000	35.0	16.0	1.30
2000	50.0	23.0	1.90
2500	55.0	25.0	2.00
4000	70.0	32.0	2.60
5000	78.0	35.0	2.80

TYPE VR			
resistance ohms (25°C)	nominal voltage	must operate volts (25°C)	must release volts (25°C)
35	6.3	3.0	.3
50	8.0	3.5	.3
80	10.0	4.5	.4
125	12.5	5.6	.5
218	16.5	7.5	.8
348	20.8	9.3	.9
500	25.0	11.2	1.1
675	26.5	13.0	1.3
1250	39.5	17.7	1.8
1374	41.7	18.7	1.9
1500	43.0	19.4	1.9
2000	50.0	22.4	2.2
2450	55.2	25.0	2.5
3530	66.4	29.7	2.9
5000	79.2	35.4	3.5
9100	110	48.0	4.8



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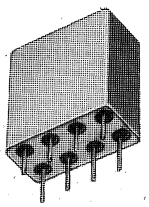
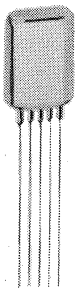
MILITARY TYPE CRYSTAL CAN RELAYS



TYPE TKS

The Model TKS Relay is designed specifically for long life dry circuit reliability and low operating power requirements, Hart-Advance Series T relays incorporate these design features. The coil and switch sections are completely isolated, eliminating contact contamination from organic coil materials. Unique hinged armature design eliminates bearings and pins, prevents contact contamination from bearing particles. Birfurcated contacts; parallel switching improves dry circuit reliability. Welded construction prevents contact contamination from solder fluxes or migrating flux particles. Improved sensitivity, designed for operation at 100 milliwatts or less at pull-in.



TYPE NM

The Hart-Advance TYPE NM relay is the ideal component for aircraft, missile, control equipment, and other applications where extended life is essential and where space limitations are critical — occupies less than .04 cubic-inch. Contact resistance is extraordinarily low, making it invaluable for dry circuit applications. The simplified design of the TYPE NM achieves high shock and vibration resistance and affords an operating sensitivity of 100 MW. Available from stock with either screw-down mounting bracket or mounting bracket for printed circuit use.

SPECIFICATIONS	TYPE TKS	TYPE NM
size	height, 1⅛″ max.; width 13/16″ max.; thickness, 13/32″	height, .531″; width, .392″; thickness, .196″
weight		.09 ounce max.
enclosure	hermetically sealed, coil & switch sections completely isolated	hermetically sealed, back filled with dry nitrogen; also can be supplied with helium tracer
contact arrangement	DPDT	SPDT (1 form C)
contact resistance	less than .050 ohms	per contact 0.050 ohm max.
contact rating*	dry circuit to 2 amps @ 30VDC	.25 amp, 26.5 volts DC
life expectancy	100,000 operations @ 2 amps	100,000 operations at .25 amps at 85°C
ambient temperature	−65°C to +125°C	−55°C to +85°C
shock	50 G's	50 G's for 11 MS
vibration	2000 cps @ 20 G's	15 G's — 10 to 2000 cycles (with 6B346000 MTG Bkt)
salt spray	48 hours min.	50 hours min.
standard finish	enamel finish, fungus-resistant over unfused electro-tin	fused electro tin
terminals	solder hook, 3″ leads, plug-in (matching socket available)	.016″ diameter by 1.5″ long
mounting	all popular styles available	all popular styles available
dielectric strength	1000 volts RMS between terminals & case at sea level — 500 volts RMS between open contacts, 350 volts at 70,000 ft.	500 volts RMS at sea level 350 volts at 70,000 ft
insulation resistance	1000 megohms	100 megohms at 500VDC
operate time	10 milliseconds max.	4 milliseconds max.
release time	5 milliseconds max.	8 milliseconds max.
contact bounce	1 millisecond max.	1 millisecond max.
sensitivity	100 milliwatts	100 MW max.
MIL-Spec	MIL-R-5757D	

* low level requirement must be specified to assure maximum reliability

STANDARD COILS AND OPERATING VALUES

TYPE TKS

DC VOLTAGE	6 to 50 VDC
OPERATED POWER @ 25°C	100 MW of Pull-In
RESISTANCE	To 7500 Ohms Standard

TYPE NM

ohms (25°C) resistance	voltage DC nominal	current (MA) (25°C) must operate	current (MA) (25°C) must release
50	4	44	1.32
200	8	22	.66
500	12	14	.42
1000	16	10	.30
2000	24	7	.21

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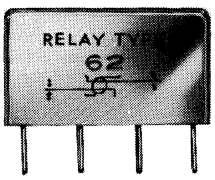
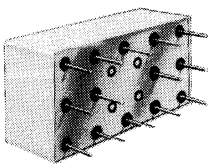
MICRO-MINIATURE MILITARY TYPE RELAYS



TYPE 62

TYPE 62

A highly versatile half-size microminiature relay, the Hart-Advance TYPE 62 is ideally suited to all of today's modern circuitry as well as tomorrow's advanced military systems. Superior dependability, uniformity, and sensitivity are assured through the uniquely simplified design of the TYPE 62. Greater resistance to vibration and shock is achieved through unitized welded construction and balanced armature with integral return spring and back stop. Increased reliability and sensitivity are accomplished by use of a single coil having optimum magnetic characteristics. Greater heat dissipation is afforded by the massive pole pieces. The use of gold-flashed, silver-magnesium-nickel alloy contacts provides exceptional stability in high temperature environments. For contamination-free operation, the TYPE 62 is hermetically sealed and back-filled with "Thermo-Dri" nitrogen. Meets MIL R5757/9 and NASA specifications.


TYPE 64

TYPE 64

The TYPE 64 embodies engineering advances truly unique among today's four-pole, double-throw relays — twice the versatility of conventional 2 PDT's, half the size of conventional 4 PDT's . . . with no sacrifice in performance! Designed specifically to meet aero-space needs, the TYPE 64 features All-Welded Construction and "Thermo-Dri" nitrogen backfilling to assure contamination-free operation. Symmetrical circuitry simplifies wiring. Available in various coil resistances and all popular header stlyes. The TYPE 64 sets a new standard of relay reliability . . . Meets MIL-R-5757/12.

SPECIFICATIONS	TYPE 62	TYPE 64
size	height, .410″ max; width, .810″ max.; thickness, .410″ max.	height, .440 max.; width, .610 max.; length, 1.010 max.
weight	.25 ounces	1.0 ounce max.
enclosure	hermetically sealed; back filled with thermo dry nitrogen, with helium tracer	hermetically welded; back filled with thermo-dri nitrogen, with helium tracer
contact arrangement	DPDT (2 form C)	4PDT (4 form C)
contact resistance	per contact .050 ohms max.	0.050 ohm max. per contact
contact rating*	2 amps at 26.5 volts DC resistive, also low level circuit applications: 50 millivolt, 30 micro amps, 500 ohm trigger	2 amps resistive at 28VDC; 1 amp inductive at 28VDC
life expectancy	100,000 operations or more at 2 amps 1,000,000 operations or more at low level	1000 operations at rated load; 1,000,000 at low level
capacitance	closed contacts to case — 2.0 MMFD max. open contacts to case — 1.1 MMFD max. between pairs of contacts — 1.0 MMFD max. between adjacent contact pairs — 1.0 MMFD max.	closed contacts to case — 3 MMFD max. open contacts to case — 1.5 MMFD max. between pairs of contacts — 1.5 MMFD max. between adjacent contact pairs — 3.0 MMFD max.
ambient temperature	−65°C to +125°C	−65°C to +125°C
shock	65 G's for 11 MS	65 G's for 11 MS
vibration	5 - 55 CPS at .125″ excursion, 55 - 2000 CPS at 20 G's	.125 excursion, 10 - 55 CPS; 30G, 55 - 2000 CPS
linear acceleration	100 G's	100 G's
salt spray	50 hours minimnum	50 hours min.
standard finish	enamel finish, fungus resistant, over unfused electro-tin	fungus resistant enamel over unfused electro-tin
terminals	solder hook, 3″ leads, plug-in (matching socket available)	solder hook, 3″ leads, plug-in (matching socket available)
mounting	all popular styles available	all popular styles available
dielectric strength	1000 RMS between terminals and case at sea level 500 volts RMS between open contacts at sea level 500 volts RMS between coil and ground	1000 volts RMS between terminals and case at sea level 500 volts RMS between open contacts at sea level 500 volts RMS between coil and ground
insulation resistance	1000 megohms at 125°C	1000 megohms at 125°C
operate time	4 milliseconds max.	10 MS max. including bounce
release time	4 milliseconds max.	5 MS max. including bounce
contact bounce	1 millisecond max.	1 MS max.
sensitivity	less than 250 milliwatts	less than 400 milliwatts
MIL-Spec	MIL-R-5757/9	MIL-R-5757/12

* low level requirement must be specified to assure amiximum reliability

STANDARD COILS AND OPERATING VALUES

	TYPE 62				TYPE 64			
coil letter	resistance ohms (25°C)	nominal voltage DC	must operate volts (25°C)	must release volts (25°C)	resistance ohms (25°C)	nominal voltage DC	must operate volts (25°C)	must release volts (25°C)
A	38	6.0	3.7	.8	20	5.2	2.7	0.4
B	60	7.5	4.5	1.0	35	6.3	3.7	0.5
C	100	10.0	5.9	1.3	50	8.5	4.5	0.6
D	145	12.0	6.9	1.5	75	10.0	5.2	0.8
E	260	16.0	9.6	2.0	120	12.6	6.6	1.0
F	425	20.5	11.6	2.3	210	17.0	9.0	1.3
G	700	26.5	13.8	2.5	325	22.0	11.5	1.7
H	1090	33.0	17.4	3.8	500	26.5	13.5	2.0
J	1650	40.5	22.8	5.0	775	32.0	16.9	2.5
K	2385	48.5	27.8	6.0	1230	42.0	21.8	3.2
L	3550	59.5	32.9	7.0	1750	48.0	26.4	3.9
M	4830	69.5	41.7	9.0	2600	60.0	32.6	4.8
N	—	—	—	—	4000	75.0	41.4	6.1
P	—	—	—	—	6500	90.0	54.0	8.0
Q	—	—	—	—	11,300	110	68.0	11.0

HART/ADVANCE RELAY DIVISION
OAK ELECTRO/NETICS CORP.
CRYSTAL LAKE, ILLINOIS 60014 • TELEPHONE: 815 - 459-5000 • TWX: 910-634-3353 • CABLE ADDRESS: OAKMANCO

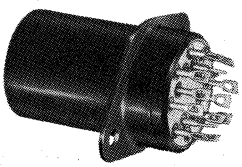
MILITARY RELAYS

TYPE R

Size for size, ounce for ounce, and at any standard shock and vibration resistance, Hart-Advance Series R relays can be built to carry a broader range of voltages and amperages than any other relay of its type commercially available today.

In both laboratory tests and actual service, they excell in reliability. Standard as single coil units, they are also available with two coils (either or both of which will operate the unit) in 2-pole or 4-pole, double-throw models.

TYPES RA & SA



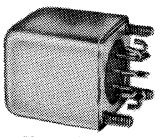
SERIES RA & SA

Hart-Advance Series RA and SA miniature relays incorporate rectified circuits using the highest grade miniature silicon diode rectifiers in a very unique potted construction within the coil case of the relay. This construction permits the RA and SA relays to be operated from an external AC power source and continue to provide the same reliable performance found in the Hart-Advance Series R and S relays. (See Bulletins R-12-15 and S-13-18 respectively.)

Several types of rectifier circuits are available including: half wave (back to back); full wave bridge and special circuits.

Series SA relays differ from RA relays in that they have completely inorganic switches. These SA relays should be used where you require long shelf life, long periods between operations, dry circuit switching and utmost reliability. In actual service under many adverse environmental conditions, the Series RA and SA — like the Series R and S relays — have excellent reliability. Physically and electrically, Series RA and SA are interchangeable.

TYPE VGS



TYPE VGS

The Hart-Advance TYPE VGS, an ultrasensitive version of the former VG Series, is a hermetically-sealed, rotary action, DPDT, miniature relay ideally suited for aircraft and missile use. Engineered for sensitivity, this rugged compact relay occupies less than one cubic-inch of space and withstands 15 G's to 2,000 CPS vibration while utilizing only 125 MW of power.

The gold plated silver-magnesium-nickel alloy contacts are rated at 5 Amps resistive. Reliable operation at temperatures from −55°C to +125°C is attained by using the latest in magnetic and insulation materials and by manufacturing under ideal conditions of temperature, humidity, and dust control.

TYPE S

Combining the broad range of performance characteristics pioneered by Hart-Advance Series R Relays, with new design features for even greater reliability in dry circuits, Series S Relays will permit intermixing of dry and wet circuits safely in such applications as guided missiles, computers, jet engine controls, automation control systems and similar critical devices.

Coils are separately sealed within the outer hermetically sealed cases to isolate the switch mechanism from possible contamination by gases from the coil insulation. Contacts are specially processed and cleaned before assembly; the switch mechanism has been simplified and insulators are entirely inorganic to eliminate other possible causes of malfunction.

SPECIFICATIONS	TYPE VGS	SERIES R & S	SERIES RA & SA
size	height, 1.140″ max.; width, .890″ max.; length, .890″ max.	height 1 13/16″; diameter 1 1/16″	height 1 13/16″; diameter 1 1/16″
weight	1.5 ounces max.	4.0 ounces max.	3.75 to 4.0 ounces
enclosure	hermetically sealed; back filled with thermo-dri nitrogen, also available with helium tracer	hermetically sealed per MIL Spec	hermetically sealed per MIL Spec
contact arrangement	2 PDT (2 form C)	4 PDT, 2PDT	4 PDT
contact resistance	0.050 ohm max per contact		
contact rating	5 amps resistive at 26.5VDC or 115VAC	2, 5, 7½, 10 amps resistive @ 26.5VDC; or 115VAC	2, 5, 7½, 10 amps resistive @ 26.5VDC; or 115VAC
life expectancy	100,000 operations at rated load	100,000 cycles minimum	100,000 cycles minimum
capacitance	closed contacts to case 3.0 MMFD max. open contacts to case 2.0 MMFD max. between pairs of contacts 2.0 MMFD max. between adjacent contact pairs 0.5 MMFD max.	less than 5 picofarads contacts to case less than 2½ picofarads between contacts	less than 5 picofarads contacts to case less than 2½ picofarads between contacts
ambient temperature	−55°C to +125°C	−65°C to +125°C	−65°C to +125°C
shock	50 G's for 11 MS	operation: 30, 40, 50 G's plus	operation: 30, 40, 50 G's plus
vibration	.062 excursion, 10 - 55 cps; 15G, 55 - 2000 cps	15G, 55 - 5000 cps; 20G's, 55 - 2000cps	15G, 55 - 5000 cps; 20G's, 55 - 2000cps
salt spray	50 hours min.	50 hours min.	50 hours min.
terminals	solder hook, or 9 pin plug	plug-in or solder	plug-in or solder
mounting	studs	10 standard arrangements	10 standard arrangements
dielectric strength	1000 volts RMS between terminals and case at sea level — 500 volts RMS between open contacts at sea level 500 volts RMS between coil and ground	1000 volts RMS between terminals and case at sea level — 500 volts RMS between open contacts at sea level 500 volts RMS between coil and ground	1000 volts RMS between terminals and case at sea level — 500 volts RMS between open contacts at sea level 500 volts RMS between coil and ground
insulation resistance	100 megohms min. at 500VDC	100 megohms @ 200°C 1000 megohms @ room temperature	1000 megohms @ room temperature 100 megohms @ 200°C
operate time	20 MS max. including bounce	per requirement	per requirement
release time	10 MS max. including bounce	per requirement	per requirement
sensitivity	125 milliwatts max.	per requirement	per requirement

STANDARD COILS AND OPERATING VALUES — TYPE VGS

resistance ohms (25°C)	nominal voltage DC	must operate current (MA) (25°C)	must release current (MA) (25°C)	resistance ohms (25°C)	nominal voltage DC	must operate current (MA) (25°C)	must release current (MA) (25°C)
12	4.2	93.0	14.5	2000	55.0	7.2	1.1
30	6.5	58.0	9.1	3100	68.0	5.7	.9
50	8.5	45.0	7.1	5000	85.0	4.5	.7
80	11.0	36.0	5.6	8000	110.0	3.6	.5
120	13.2	29.0	4.6	10,000	125.0	3.2	.5
300	21.0	18.0	2.9	12,500	138.0	2.8	.4
500	27.0	14.2	2.2	20,000	170.0	2.2	.3
800	34.0	11.2	1.8				

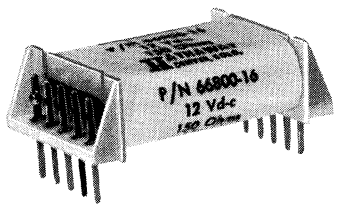
Coil Data, Models R & S — Resistances: 1 ohm to 50,000 ohms; Arrangements: single coil, two independent coils, either or both of which will operate unit. Continuous duty.

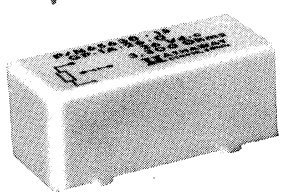
Coil Data, Models RA & SA — 28 - 220 V, 60 - 400 cycles A.C. Various rectifier circuits are available, i.e., half wave, full wave and special circuits. Continuous duty.

HATHAWAY COMPONENTS

MINIATURE

DRIREED SWITCHES, RELAYS







NEW 2 AMP—25 WATT SWITCHING
1.6" x .5" x .5"

OPEN FRAME
Intermediate Reed Relay.
Also available with snap-on magnetic shielding case.

"GP" GENERAL PURPOSE:
1A Size: .5" x .5" x 1.15"

HERMETIC SEALED CONTACTS

EPOXY SEALED CASE
Nylon Case and Bobbin, Epoxy filled.

INSTRUMENTATION RELAY
Printed Circuit mounting.
Less than 1 ms switch time, 5 x 10^8 Ohms minimum isolation resistance.

LOW SILHOUETTE
.350" x .350" x 1.2"

NEW 1 AMP OR MICROAMP

OPEN FRAME
Low Silhouette at .350" high .150" plug-in pin spacing. Low-loss, spot welded reed to pin connection. Also available with snap-on magnetic shielding case.

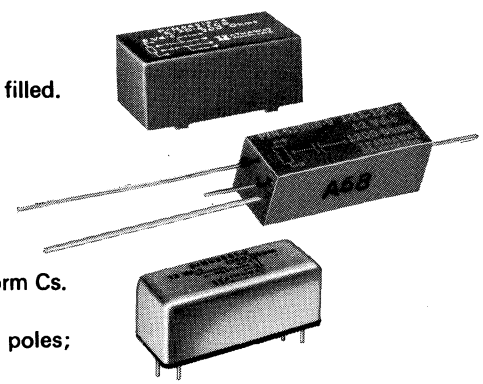
HIGH EFFICIENCY, 1 FORM A 120 MW STD. TO 50 MW SPECIAL

"K" SERIES
1A Size: .5" x .5" x 1.5"
PC mounting, Nylon case and bobbin, Epoxy filled.
Efficient coil with low power consumption.

"J" SERIES
1A Size: .4" x .4" x 1.10"
Axial lead version of the K Series.

"R" SERIES
Versatile, ruggedized. Up to 12 Form 'A's — 4 Form Cs. Many special configurations.

Electrostatic shield. Magnetic latch up to 2 poles; pick and hold up to 11 poles.



MINIATURE DRIREED SWITCHES

	MODEL	DESCRIPTION	MAX. VOLTS RMS 60Hz	MAX. CURRENT	MAX. WATTS
	DCS	Micro-miniature Switch .5" L x .088" Dia.	100	.125 AMP	2
	DCD	Dry Circuit Switch .8" L x .106" Dia., .088" Dia. or .135" Dia.	250	.125 AMP	4
	FAR	Miniature Power Switch .8" L x .135" Dia., 106" Dia. or .088" Dia.	250	1 AMP	10
	IAD	Intermediate Power Switch 1.15" L x .165" Dia.	350	2 AMP	25
	FCD	True Form "C" Switch .8" L x .135" Dia.	200	.125 AMP	2

HATHAWAY COMPONENTS
A Division of Hathaway Instruments, Inc.
Established 1938

5250 East Evans Avenue
Denver, Colorado 80222
(303) 756-8301 • TWX 910-931-0569

RELAYS WITH EXTRA DIMENSION

TO-5 MICROMINIATURE RELAYS — SERIES MA AND MS

NEW

Product Bulletin 90

All welded, DPDT relays manufactured in accordance with MIL-R-5757.

CONTACT RATING

1 ampere at 32 volts DC max, low level 0 to 0.1 ampere at 50 mV DC or AC, minimum current per MIL-R-5757/40 and /70.

UNIQUE PROCESSING TECHNIQUES ENSURE LONG LIFE

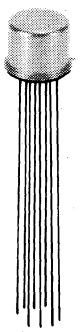
All handling and processing techniques are fully controlled and documented. Complete identification and traceability records are maintained. All parts are 100 percent inspected and cleaned prior to assembly. Critical assembly and inspection stations are housed within laminar flow work stations.

HI-G'S CLEANING PROCESS REMOVES ALL TYPES OF CONTAMINATES

A unique cleaning system entirely housed in a laminar flow bench utilizing vapor degreasing, ultrasonic agitation, spray cleaning, and use of solvents with an organic base, water and detergent is capable of removing organic as well as inorganic soils. A special spray cleaning process using a highly volatile solvent is used as a final cleanup of the completed assembly.

VACUUM DEGASSING

After final cleaning, the relays are immediately placed into a vacuum outgassing station. The vacuum system is fully protected against contamination with molecular sieve traps, liquid nitrogen, and water cooled optical baffles. A high temperature vacuum oven with controls capable of maintaining temperature limits and gradients within ±1°C is connected to the pumping station. Relays are outgassed above 200°C at vacuum levels of 10^{-6} torr (0.001 micron) for 16 hours.



FULL SIZE

FINAL SEAL OPERATION

At the conclusion of the outgassing cycle, the open relays are passed from the vacuum oven through an interlock into an atmospheric controlled dry box. The back filling gas is continuously recirculated through an inert gas purification system, capable of changing the entire volume of gas within the dry box every 5 minutes. Within the dry box is a projection seal welder, which hermetically seals the housing to the relay assembly.

FINAL TEST

All relays are checked for contact resistance, pull in and drop out, dielectric strength, insulation resistance, contact bounce, operate and release time, and coil resistance. Additionally, each relay is submitted to a 5000 cycle low level miss test.

ELECTRICAL CHARACTERISTICS

Sensitivity at 25°C: MA Series — 125 mW.
MS Series — 65 mW.

Life: 50,000 operations at min current loads.
100,000 operations min at max rated load.
1,000,000 operations min at low level.

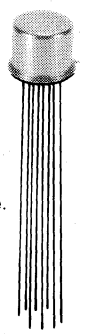
Overload: 2 amps at 32 VDC for 100 operations min.

Contact Resistance: (a) 100 milliohms initial at rated load.
(b) 200 milliohms after rated life.
(c) 3Ω max during min current life. 0.5Ω after life.
(d) 50Ω max at 15 μA and 15 mV rms.

Contact Bounce: 1.5 ms max.

Operate Time: 2.0 ms max at nom coil voltage at 25°C (MA Series).
4.0 ms max at nom coil voltage at 25°C (MS Series).

Release Time: 1.5 ms at 25°C (MA Series).
2.0 ms max at 25°C (MS Series).



Dielectric Strength: 500 V rms between all mutually insulated points at sea level.

Insulation Resistance: 5000 MΩ min between mutually insulated terminals.

ENVIRONMENTAL CHARACTERISTICS

Temperature Range: −65°C to +125°C.

Vibration: 0.5" DA from 5-34 Hz, 30 G from 34-3000 Hz, 10 μs max contact opening.

Shock: 75 G (11 ms duration), saw tooth, 10 μs max contact opening.

Acceleration: 100 G.

Leakage Rate: 1×10^{-8} cc/s max.

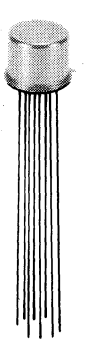
WEIGHT

Series MA: 2.9 grams max.

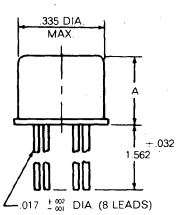
Series MS: 4.5 grams max.

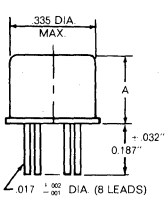
SERIES MA Long Lead Part No.	Plug In Part No.	DC Coil Voltage Max	DC Coil Voltage Nom	DC Coil Resistance Ohms ±10% at 25°C	Max DC Pull-In Voltage at 125°C	Max DC Drop-Out Voltage
MAW-6	MAP-6	8	6	98	4.5	3.2
MAW-9	MAP-9	12	9	220	6.8	4.9
MAW-12	MAP-12	16	12	390	9.0	6.5
MAW-18	MAP-18	24	18	880	13.5	10.0
MAW-26	MAP-26	32	26.5	1560	18.0	13.0

SERIES MS Long Lead Part No.	Plug In Part No.	DC Coil Resistance Ohms ±10% at 25°C	Min DC Pull-In Current mA	Min DC Drop-Out Current mA	Max Continuous Voltage at 125°C
MSW-200	MSP-200	200	17.3	1.7	10
MSW-850	MSP-850	850	8.4	0.8	21
MSW-3.3K	MSP-3.3K	3300	4.3	0.4	41
MSW-6.5K	MSP-6.5K	6500	3.0	0.3	57
MSW-11K	MSP-11K	11000	2.4	0.2	75



ENCLOSURE AND HEADER STYLES:

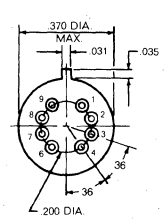




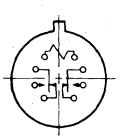
DIMENSION A

Series MA = 0.275 max
Series MS = 0.375 max

NOTE: Terminal numbers are for reference only and do not appear on part.



BOTTOM VIEW



ELECTRICAL DIAGRAM

Spring St. & Rt. 75, Windsor Locks, Conn. 06096, 203-623-2481

Authorized Hi-G Relay Distributors are located throughout the U.S. and Canada.

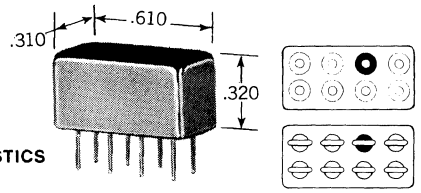
RELAYS WITH EXTRA DIMENSION

.150 GRID RELAY — SERIES G Product Bulletin 95

All welded, DPDT relay manufactured in accordance with MIL-R-5757.

NEW

the MINI- G™



ELECTRICAL CHARACTERISTICS

Sensitivity at 25°C: 135 mW.

Life: 100,000 operations min at rated load and 125°C.

Overload: 2 amps at 30 VDC for 100 operations min.

Contact Resistance: (a) 50 milliohms initial at rated load.
(b) 150 milliohms after rated life.
(c) 3Ω max during min current life.
(d) 50Ω max at 10 mA and 30 mV rms.

Contact Bounce: 1.2 ms max measured at 100 mA at 6 VDC.

Operate Time: 4.0 ms max at nom coil voltage at 25°C (including bounce)

Release Time: 4.0 ms max at 25°C (including bounce)

Dielectric Strength: 500 V rms between all mutually insulated points at sea level; 750 V rms between contacts and case.

Insulation Resistance: 1000 MΩ min between mutually insulated terminals.

CONTACT RATING

1 ampere resistive at 30 volts DC max, 0.125 ampere resistive at 115 volts rms, 400 Hz, case grounded, low level 0 to 0.1 ampere at 50 mV DC or AC, minimum current per MIL-R-5757/37.
2 ampere resistive at 30 volts DC max (50,000 operations min)

ENVIRONMENTAL CHARACTERISTICS

Temperaure Range: −65°C to +125°C.

Vibration: 0.5″ DA from 5-34 Hz, 30 G from 34-3000 Hz, 10 μs max contact opening.

Shock: 100 G (11 ms duration), saw tooth, 10 μs max contact opening.

Acceleration: 100 G.

Leakage Rate: 1 x 10^{-8} cc/s max.

WEIGHT

0.13 oz.

Voltage Code	DC Coil Voltage max	DC Coil Voltage nom	DC Coil Resistance Ohms ±10% at 25°C	Max DC Pull-In Voltage at 125°C	Max DC Drop-Out Voltage at 25°C
106	8	6	56	3.6	1.6
112	16	12	210	7.2	3.2
126	32	26.5	1350	18.0	8.1

™ *Trademark pending registration*

QPL PRODUCTS

The following relays are manufactured to meet the requirements of MIL-R-5757.

HALF SIZE CRYSTAL CAN RELAY — SERIES 2K-2299

Hi-G Part Number	MIL Part Number	MIL Type Designation
2K-2299-1	M5757/9-001	RY4XX4B3L11
2K-2299-2	M5757/9-002	RY4XX4B3L12
2K-2299-3	M5757/9-003	RY4YY4B3P11
2K-2299-4	M5757/9-004	RY4YY4B3P12

Coil resistance 700 ohms ±15% @ 25°C
Pull-in 18 Vdc max. } over temperature range
Drop-out 1.5 Vdc min. }
Temperature range −65°C to +125°C
Contact bounce 1 ms max.
Operate and release time 4 ms max.
Vibration 20G @ 10-2000 Hz
Shock 100 G

CRYSTAL CAN RELAY SERIES 2B-1506

Coil resistance 675 ohms ±10% @ 25°C
Pull-in 18 Vdc max. } over temperature range
Drop-out 1.5 Vdc min. }
Temperature range −65°C to +125°C
Operate and release time 6 ms max
Vibration 20 G @ 10-2000 Hz
Shock 100 G

Hi-G Part Number	MIL Part Number	Hi-G Part Number	MIL Part Number	Hi-G Part Number	MIL Part Number	Hi-G Part Number	MIL Part Number
2B-1506-1	M5757/10-001	2B-1506-12	M5757/10-012	2B-1506-23	M5757/10-023	2B-1506-35	M5757/10-035
2B-1506-2	M5757/10-002	2B-1506-13	M5757/10-013	2B-1506-24	M5757/10-024	2B-1506-36	M5757/10-036
2B-1506-3	M5757/10-003	2B-1506-14	M5757/10-014	2B-1506-25	M5757/10-025	2B-1506-37	M5757/10-037
2B-1506-4	M5757/10-004	2B-1506-15	M5757/10-015	2B-1506-26	M5757/10-026	2B-1506-38	M5757/10-038
2B-1506-5	M5757/10-005	2B-1506-16	M5757/10-016	2B-1506-27	M5757/10-027	2B-1506-39	M5757/10-039
2B-1506-6	M5757/10-006	2B-1506-17	M5757/10-017	2B-1506-28	M5757/10-028	2B-1506-40	M5757/10-040
2B-1506-7	M5757/10-007	2B-1506-18	M5757/10-018	2B-1506-29	M5757/10-029	2B-1506-41	M5757/10-041
2B-1506-8	M5757/10-008	2B-1506-19	M5757/10-019	2B-1506-30	M5757/10-030	2B-1506-42	M5757/10-042
2B-1506-9	M5757/10-009	2B-1506-20	M5757/10-020	2B-1506-31	M5757/10-031	2B-1506-43	M5757/10-043
2B-1506-10	M5757/10-010	2B-1506-21	M5757/10-021	2B-1506-32	M5757/10-032	2B-1506-44	M5757/10-044
2B-1506-11	M5757/10-011	2B-1506-22	M5757/10-022	2B-1506-33	M5757/10-033	2B-1506-141	M5757/10-141
				2B-1506-34	M5757/10-034		

Authorized Hi-G Relay Distributors are located throughout the U.S. and Canada.

Spring St. & Rt. 75, Windsor Locks, Conn. 06096, 203-623-2481

QPL PRODUCTS

CURRENT SENSITIVE CRYSTAL CAN RELAY — 40 mW — DPDT SERIES 2BC-1510

Hi-G Part No.	MIL Part No.	DC Coil Resistance Ohms ±10% @ 25°C	Nominal Coil Current mA	Max Pickup Current mA	Dropout Current mA Max	Dropout Current mA Min
2BC-1510-11	M5757/13-011	20	90	45.0	22.5	4.5
2BC-1510-12	M5757/13-012	100	40	20.0	10.0	2.0
2BC-1510-13	M5757/13-013	500	18	9.0	4.5	0.9
2BC-1510-14	M5757/13-014	1,000	13	6.5	3.1	0.65
2BC-1510-15	M5757/13-015	1,500	11	5.2	2.6	0.52
2BC-1510-16	M5757/13-016	2,000	9	4.5	2.2	0.50
2BC-1510-17	M5757/13-017	2,500	8	4.0	2.0	0.40
2BC-1510-18	M5757/13-018	5,000	6	2.8	1.4	0.30
2BC-1510-19	M5757/13-019	8,000	5	2.3	1.1	0.23
2BC-1510-20	M5757/13-020	10,000	4	2.0	1.0	0.20
2BC-1510-31	M5757/13-031	20	90	45.0	22.5	4.5
2BC-1510-32	M5757/13-032	100	40	20.0	10.0	2.0
2BC-1510-33	M5757/13-033	500	18	9.0	4.5	0.9
2BC-1510-34	M5757/13-034	1,000	13	6.5	3.1	0.65
2BC-1510-35	M5757/13-035	1,500	11	5.2	2.6	0.52
2BC-1510-36	M5757/13-036	2,000	9	4.5	2.2	0.50
2BC-1510-37	M5757/13-037	2,500	8	4.0	2.0	0.40
2BC-1510-38	M5757/13-038	5,000	6	2.8	1.4	0.30
2BC-1510-39	M5757/13-039	8,000	5	2.3	1.1	0.23
2BC-1510-40	M5757/13-040	10,000	4	2.0	1.0	0.20
2BC-1510-41	M5757/13-041	20	90	45.0	22.5	4.5
2BC-1510-42	M5757/13-042	100	40	20.0	10.0	2.0
2BC-1510-43	M5757/13-043	500	18	9.0	4.5	0.9
2BC-1510-44	M5757/13-044	1,000	13	6.5	3.1	0.65
2BC-1510-45	M5757/13-045	1,500	11	5.2	2.6	0.52
2BC-1510-46	M5757/13-046	2,000	9	4.5	2.2	0.50
2BC-1510-47	M5757/13-047	2,500	8	4.0	2.0	0.40
2BC-1510-48	M5757/13-048	5,000	6	2.8	1.4	0.30
2BC-1510-49	M5757/13-049	8,000	5	2.3	1.1	0.23
2BC-1510-50	M5757/13-050	10,000	4	2.0	1.0	0.20
2BC-1510-51	M5757/13-051	20	90	45.0	22.5	4.5
2BC-1510-52	M5757/13-052	100	40	20.0	10.0	2.0
2BC-1510-53	M5757/13-053	500	18	9.0	4.5	0.9
2BC-1510-54	M5757/13-054	1,000	13	6.5	3.1	0.65
2BC-1510-55	M5757/13-055	1,500	11	5.2	2.6	0.52
2BC-1510-56	M5757/13-056	2,000	9	4.5	2.2	0.50
2BC-1510-57	M5757/13-057	2,500	8	4.0	2.0	0.40
2BC-1510-58	M5757/13-058	5,000	6	2.8	1.4	0.30
2BC-1510-59	M5757/13-059	8,000	5	2.3	1.1	0.23
2BC-1510-60	M5757/13-060	10,000	4	2.0	1.0	0.20
2BC-1510-61	M5757/13-061	20	90	45.0	22.5	4.5
2BC-1510-62	M5757/13-062	100	40	20.0	10.0	2.0
2BC-1510-63	M5757/13-063	500	18	9.0	4.5	0.9
2BC-1510-64	M5757/13-064	1,000	13	6.5	3.1	0.65
2BC-1510-65	M5757/13-065	1,500	11	5.2	2.6	0.52
2BC-1510-66	M5757/13-066	2,000	9	4.5	2.2	0.50
2BC-1510-67	M5757/13-067	2,500	8	4.0	2.0	0.40
2BC-1510-68	M5757/13-068	5,000	6	2.8	1.4	0.30
2BC-1510-69	M5757/13-069	8,000	5	2.3	1.1	0.23
2BC-1510-70	M5757/13-070	10,000	4	2.0	1.0	0.20

10 AMP CRYSTAL CAN RELAY — SERIES 2T-2911/2T-2994

Hi-G Part No.	MIL Part No.
2T-2911-1	M5757/23-001
2T-2911-2	M5757/23-002
2T-2911-3	M5757/23-003
2T-2911-4	M5757/23-004
2T-2911-5	M5757/23-005

Hi-G Part No.	MIL Part No.
2T-2994	M5757/28

CRYSTAL CAN RELAYS

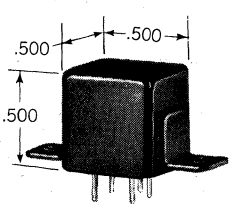
ENVIRONMENTAL CHARACTERISTICS FOR STANDARD CRYSTAL CAN SERIES

Life: 100,000 operations at 125°C and rated load.
Temperature: −65°C to +125°C, operating.
Vibration: 10 to 2000 Hz, 20G min.
Shock: 100 G, 11 milliseconds.
Sealing: Hermetic, to 80,000′

Insulation Resistance: 1000 megohms min., except coil-to-case at high temperature 500 megohms min.

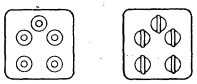
Dielectric Strength: Contacts-to-case: 1000 volts rms, 60 Hz, mutually insulated terminals: 500 volts rms standard.

DICE CUBE® — MINIATURE RELAY — SERIES C Product Bulletin 101



CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere 400 Hz, case grounded and dry circuit.



Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Max Pull-in Voltage @ 25°C	Min Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3.5	.5	80
112	12	14.4	7	1.0	325
126	26.5	32	15	2	1500

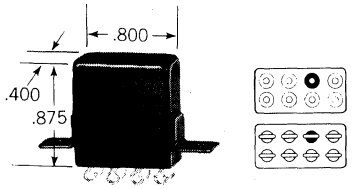
Spring St. & Rt. 75, Windsor Locks, Conn. 06096, 203-623-2481

Authorized Hi-G Relay Distributors are located throughout the U.S. and Canada.

CRYSTAL CAN RELAYS

2 AMP CRYSTAL CAN RELAY —SERIES 2B

Product Bulletin 120



CONTACT RATING

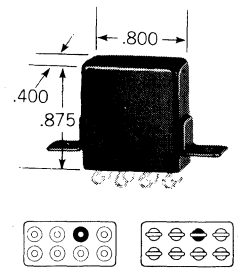
2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts rms, 400 Hz, case grounded and dry circuit.

NOTE: BR types for operation at 60 to 400 Hz with specifications shown. Units may be used at higher frequencies, but individual values of voltage may change.
2-pole units only available as standard catalog item.

Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Max Pull-in Voltage @ 25°C	Min Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
2B (DC only, 2-Pole Only)					
106	6	7.2	3.1	.5	40
112	12	14.4	6.3	.75	160
126	26.5	32	13.0	1.5	675
148	48	58	25.0	2.5	2500
176	76	90	35.0	3.0	5000
2BR (AC Only, 2-Pole Only)					
126	26.5	32	15	2	575
148	48	58	28	3	2000
176	76	90	44	4	3500
215	115	125	66	5	5000

5 AMP CRYSTAL CAN RELAY — SERIES 2BN

Product Bulletin 120A



CONTACT RATING

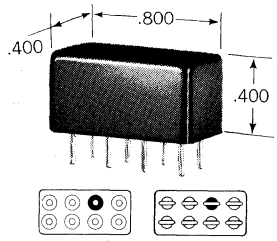
5 amperes resistive at 30 volts DC; 3 ampere resistive at 115 volts rms, 400 Hz, case grounded; 2 ampere resistive at 115 volts rms, 60 Hz, case grounded.

NOTE: For AC operation BNR types are available on request.

Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Max Pull-in Voltage @ 25°C	Min Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3.1	.5	35
112	12	14.4	6.3	.75	140
126	26.5	32	13.0	1.5	600
148	48	58	25.0	2.5	2200
176	76	90	35.0	3.0	4400

HALF-SIZE CRYSTAL CAN RELAY — SERIES 2K

Product Bulletin 102



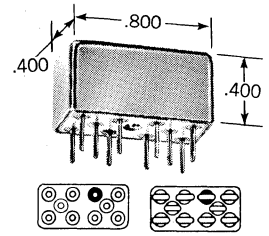
CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts rms, 400 Hz, case grounded and dry circuit.

Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Max Pull-in Voltage @ 25°C	Min Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3	.35	40
112	12	14.4	6	.75	150
126	26.5	32	13	1.5	675

HALF-SIZE LATCHING RELAY — DUAL COIL — DPDT — SERIES KL

Product Bulletin 103



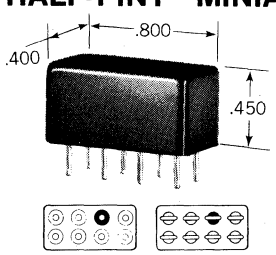
CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts rms, 400 Hz case grounded and dry circuit.

Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Set/Reset Voltage @ + 25°C	DC Coil Resistance Ohms ±10% @ 25°C
112	12	14.4	6	250
126	26.5	32	13	1000

HALF-PINT® MINIATURE 4 AMP RELAY — SERIES 2HA

Product Bulletin 100



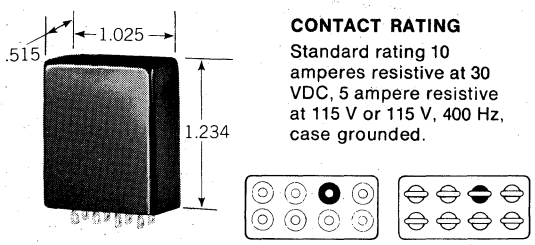
CONTACT RATING

4 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts rms, 400 Hz, case grounded

Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Max Pull-in Voltage @ 25°C	Min Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3.4	.35	40
112	12	14.4	6.5	.75	150
126	26.5	32	13.0	1.5	600

CRYSTAL CAN RELAYS

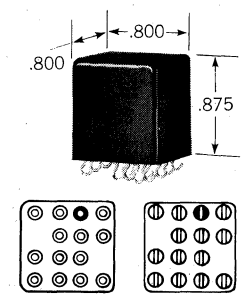
10 AMP CRYSTAL CAN RELAY — SERIES T Product Bulletin 150



CONTACT RATING
Standard rating 10 amperes resistive at 30 VDC, 5 ampere resistive at 115 V or 115 V, 400 Hz, case grounded.

Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Max Pull-in Voltage @ 25°C	Min Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3.3	.5	22
112	12	14.4	6.7	1.0	90
126	26.5	32	13.0	2.0	330
215	115	125	52.0	5	5500

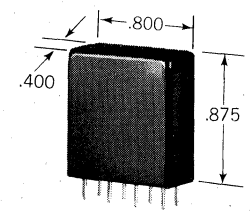
4PDT CRYSTAL CAN RELAY — SERIES 4B Product Bulletin 122



CONTACT RATING
2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts rms, 400 Hz, case grounded.

Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Max Pull-in Voltage @ 25°C	Min Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3.5	.5	30
112	12	14.4	7	1.0	125
126	26.5	32	15	2	570
148	48	58	28	3	2000
176	76	90	44	4	4500
215	115	125	66	5	9500

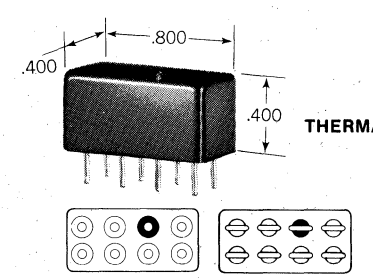
THERMAL EMF RELAYS — SERIES EK-EB Product Bulletin 156



CONTACT RATING
The series EK & EB have been specifically designed to minimize the thermal EMF generation of the relay contacts during low level switching. Although the design is centered around this low level application, the relay is capable of switching signals up to and including 2 amperes at 30 VDC.

Relay Type	Series 2EK	Series 2EB
Rated Contact Current	2 Amperes	2 Amperes
Maximum Weight	0.37 Ounce	0.95 Ounce
Construction	All Welded	All Welded
Notes	Available in 2-pole units	Available in 2-pole units

Type	Voltage Code	Nominal DC Coil Voltage	Max Continuous Coil Voltage	Max Pull-in Voltage @ 25°C	Min Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
2EK	**106**	6	7.2	3.1	.35	40
or	**112**	12	14.4	6.3	.75	160
2EB	**126**	26.5	32	13.0	1.5	675



THERMAL EMF: 10 microvolts max. between closed contacts with relay at room ambient and coil energized and stabilized with nominal rated voltage.

The thermal EMF generation is measured on EK and EB relays while enclosed in a chamber that provides a shielded test condition and a still air environment.

All inter-connections are symmetrical to minimize function variations. Measurements are made using a high impedance micro voltmeter.

ENVIRONMENTAL CHARACTERISTICS FOR STANDARD CRYSTAL CAN SERIES

Life: 100,000 operations at 125°C and rated load.
Temperature: −65°C to +125°C, operating.
Vibration: 10 to 2000 Hz, 20G min.
Shock: 100 G, 11 milliseconds.
Sealing: Hermetic, to 80,000′

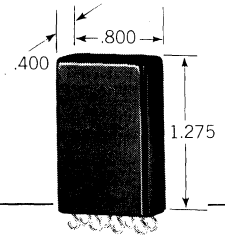
Insulation Resistance: 1000 megohms min., except coil-to-case at high temperature 500 megohms min.

Dielectric Strength: Contacts-to-case: 1000 volts rms, 60 Hz, mutually insulated terminals: 500 volts rms standard.

Spring St. & Rt. 75, Windsor Locks, Conn. 06096, 203-623-2481

Authorized Hi-G Relay Distributors are located throughout the U.S. and Canada.

CRYSTAL CAN RELAYS



CURRENT SENSITIVE CRYSTAL CAN RELAY — 40 mW — SERIES BC

Product Bulletin 135

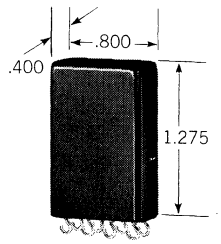
CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts rms, 400 Hz, case grounded.

2 BC RELAY — DPDT — 40 mW						1 BC RELAY —SPDT—25 mW			
Voltage Code	Coil Res. at 25°C	Nominal Coil Voltage (VDC)	Nominal Coil Current (mA)	Max P.I. Current (mA)	Min D.O. Current (mA)	Nominal Coil Voltage (VDC)	Nominal Coil Current (mA)	Max P.I. Current (mA)	Min D.O. Current (mA)
101	20	1.8	89.2	44.6	4.5	1.4	70.6	35.3	3.5
102	30	2.2	73.0	36.5	3.7	1.8	57.6	28.8	2.9
103	50	2.8	56.6	28.3	2.8	2.2	44.6	22.3	2.3
104	75	3.5	46.2	23.1	2.3	2.8	36.6	18.3	1.8
105	100	4.0	40.0	20.0	2.0	3.2	31.6	15.8	1.6
106	200	5.7	28.4	14.2	1.4	4.5	22.4	11.2	1.2
107	300	7.0	23.0	11.5	1.2	5.5	18.2	9.1	.90
109	500	9.0	17.8	8.9	.90	7.1	14.2	7.1	.70
112	875	12.0	13.5	6.75	.70	9.4	10.7	5.34	.54
113	1000	12.6	12.6	6.32	.64	10.0	10.0	5.0	.50
118	2000	18.0	8.9	4.45	.50	14.2	7.1	3.53	.36
120	2500	20.0	8.0	4.0	.40	15.8	6.3	3.2	.32
128	5000	28.0	5.6	2.8	.30	22.5	4.5	2.23	.23
135	8000	36.0	4.5	2.23	.23	29.0	3.6	1.77	.18
140	10000	40.0	4.0	2.0	.20	32.0	3.2	1.58	.16

CURRENT SENSITIVE CRYSTAL CAN RELAY — 5 AMP — SERIES 2BCN

Product Bulletin 135A



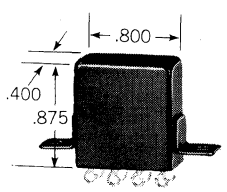
CONTACT RATING

5 amperes resistive at 30 volts DC, 3 ampere resistive at 115 volts rms, 400 Hz, case grounded, 2 amperes resistive at 115 volts rms, 60 Hz, case grounded.

2BCN (DC only, 2 pole only)					
Voltage Code	Nominal DC Coil Voltage	Nominal Coil Current (mA)	Max Pull-in Current (mA)	Min Drop-out Voltage (mA)	DC Coil Resistance Ohms ±10% @ 25°C
106	6	54.5	27.3	3.0	110
112	12	26.7	13.4	1.4	450
128	28	11.2	5.6	.6	2500
140	40	8.0	4.0	.4	5000

CURRENT SENSITIVE CRYSTAL CAN RELAY — 40 mW — SERIES BK

Product Bulletin 136



CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts rms, 400 Hz, case grounded.

2 BK RELAY — DPDT — 40 mW						1 BK RELAY —SPDT—25 mW			
Voltage Code	Coil Res. at 25°C	Nominal Coil Voltage (VDC)	Nominal Coil Current (mA)	Max P.I. Current (mA)	Min D.O. Current (mA)	Nominal Coil Voltage (VDC)	Nominal Coil Current (mA)	Max P.I. Current (mA)	Min D.O. Current (mA)
101	20	1.8	89.2	44.6	4.5	1.4	70.6	35.3	3.5
102	30	2.2	73.0	36.5	3.7	1.8	57.6	28.8	2.9
103	50	2.8	56.6	28.3	2.8	2.2	44.6	22.3	2.3
104	75	3.5	46.2	23.1	2.3	2.8	36.6	18.3	1.8
105	100	4.0	40.0	20.0	2.0	3.2	31.6	15.8	1.6
106	200	5.7	28.4	14.2	1.4	4.5	22.4	11.2	1.2
107	300	7.0	23.0	11.5	1.2	5.5	18.2	9.1	.90
109	500	9.0	17.8	8.9	.90	7.1	14.2	7.1	.70
112	875	12.0	13.5	6.75	.70	9.4	10.7	5.34	.54
113	1000	12.6	12.6	6.32	.64	10.0	10.0	5.0	.50
118	2000	18.0	8.9	4.45	.50	14.2	7.1	3.53	.36
120	2500	30.0	8.0	4.0	.40	15.8	6.3	3.2	.32
128	5000	28.0	5.6	2.8	.30	22.5	4.5	2.23	.23
135	7000	32.0	4.8	2.4	.24	28.0	3.8	1.88	.18

Authorized Hi-G Relay Distributors are located throughout the U.S. and Canada.

Spring St. & Rt. 75, Windsor Locks, Conn. 06096, 203-623-2481

CRYSTAL CAN RELAYS

RADIO FREQUENCY RELAYS

Product Bulletin 155

Standard input and output connections from RF contacts are RG-196/U Teflon insulated coaxial cable, 6″ in length, unterminated. Other lengths, types of cable, or coaxial connector terminations available on special order. These relays meet or exceed the applicable portions of MIL-R-5757/D and MIL-R-3928.

RADIO FREQUENCY CHARACTERISTICS	
Frequency Range	0 - 500 MHz*
Voltage Standing Wave Ratio (VSWR)	<1.1:1 typical
Insertion Loss	0.16db typical
Characteristic Impedance	50 ohms†
Crosstalk	−50db typical

** Usable to 1000 MHz with reduced RF characteristics*
† Other impedances available on special order

DICE CUBE RADIO FREQUENCY RELAY — SERIES RFC

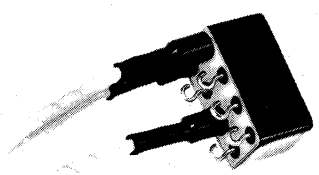


Operate Power 150 mW

Relay Type	RFC
Size	0.5-inch cube
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	0.3 ounce (without terminations)

NOTE: Electrical characteristics same as series C

HALF SIZE CRYSTAL-CAN RADIO FREQUENCY RELAY — SERIES RFK

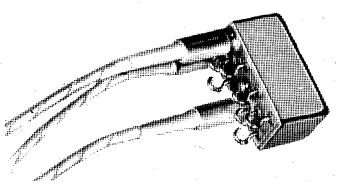


Operate Power 250 mW

Relay Type	RFK
Size	.4 x .8 x .4 inch
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	0.37 ounce (without terminations)

NOTE: Electrical characteristics same as series K

LATCHING HALF SIZE CRYSTAL-CAN RADIO FREQUENCY RELAY — SERIES RFKL

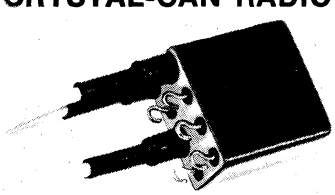


Operate Power 150 mW

Relay Type	RFKL
Size	.4 x .8 x .4 inch
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	0.37 ounce (without terminations)

NOTE: Electrical characteristics same as series KL

CRYSTAL-CAN RADIO FREQUENCY RELAY — SERIES RFB

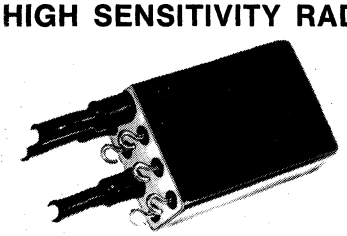


Operate Power 250 mW

Relay Type	RFB
Size	.875 x .800 x .400 inch
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	0.95 ounce (without terminations)

NOTE: Electrical characteristics same as series B

HIGH SENSITIVITY RADIO FREQUENCY RELAY — SERIES RFBC



Operate Power 40 mW

Relay Type	RFBC
Size	1.275 x .800 x .400 inch
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	1.0 ounce (without terminations)

NOTE: Electrical characteristics same as series BC

ENVIRONMENTAL CHARACTERISTICS FOR STANDARD CRYSTAL CAN SERIES

Life: 100,000 operations at 125°C and rated load.
Temperature: −65°C to +125°C, operating.
Vibration: 10 to 2000 Hz, 20G min.
Shock: 100 G, 11 milliseconds.
Sealing: Hermetic, to 80,000′

Insulation Resistance: 1000 megohms min., except coil-to-case at high temperature 500 megohms min.

Dielectric Strength: Contacts-to-case: 1000 volts rms, 60 Hz, mutually insulated terminals: 500 volts rms standard.

Spring St. & Rt. 75, Windsor Locks, Conn. 06096, 203-623-2481

Authorized Hi-G Relay Distributors are located throughout the U.S. and Canada.

CRYSTAL CAN RELAYS

ASSURED RELIABILITY RELAYS — SERIES AR Product Bulletin 154

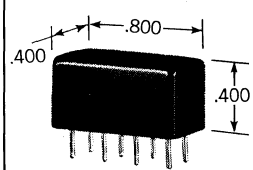
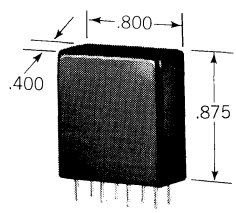
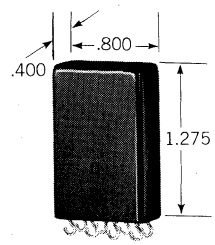
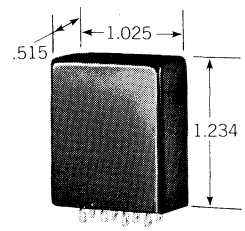
AR SERIES FEATURES

- All welded construction
- State of the art materials
- Intermediate current switching capability
- Vibration immunity to 30 G's, 3000 Hz
- Shock immunity to 150 G's
- Available with bifilar wound coils (For coil transient suppression)
- Available with ceramic terminal seals
- Meets requirements of MIL-R-39016
- 100% environmental testing





Hi-G's AR Series production facilities are completely atmosphere controlled and meet the requirements of a class 100 clean room per MIL-STD-209. Contamination is virtually eliminated.

	Half Size Crystal Can TYPE ARK	Full Size Crystal Can TYPE ARB	Sensitive Crystal Can TYPE ARBC	10 Amp Crystal Can TYPE ART
				
Weight	.35 oz Max.	.9 oz Max.	1.0 oz Max.	2.0 oz Max.
Shock	100 G, 11 ms, ½ sine	150 G, 11 ms, ½ sine	75 G, 11 ms, ½ sine	75 G, 11 ms, ½ sine
Vibration	30 G, 3000 Hz	30 G, 3000 Hz	25 G, 3000 Hz	25 G, 3000 Hz
Contacts	DPDT, 2 A at 28 Vdc	DPDT, 2 A at 28 Vdc	DPDT, 2 A at 28 Vdc	DPDT, 10 A at 28 Vdc
Sensitivity	250 mW at pick-up	280 mW at pick-up	40 mW at pick-up	575 mW at pick-up
Rated Life (Operations)				
High & intermediate level	100,000	100,000	100,000	100,000
Low level	500,000	500,000	500,000	500,000
Maximum Rated Load at Maximum Ambient Temperature (Case Grounded)				
dc resistive	2.0 A at 28.0 Vdc	2 A at 28.0 Vdc	2.0 A at 28.0 Vdc	10.0 A at 28.0 Vdc
ac resistive (60-400 Hz)	0.5 A at 115 Vrms	0.5 A at 115 Vrms	0.3 A at 115 Vrms	5.0 A at 115 Vrms
dc inductive	1.0 A at 28.0 Vdc (200 mH)	1.0 A at 28.0 Vdc (200 mH)	0.8 A at 28.0 Vdc (200 mH)	5.0 A at 28.0 Vdc (50 mH)
ac inductive (50% PF) (60-400Hz)	0.3 A at 115 Vrms	0.3 A at 115 Vrms	0.3 A at 115 Vrms	3.0 A at 115 Vrms
Ambient temperature range (operating)	−65°C to +125°C	−65°C to +125°C	−65°C to +125°C	−65°C to +125°C
Dielectric strength (volts rms 60 Hz)	500 V coil to frame 750 V between open cont. 1000 V all other points	500 V coil to frame 1000 V all other points	500 V coil to frame 1000 V all other points	500 V coil to frame 1000 V all other points
Insulation resistance (at 500 Vdc test potential)	10,000 MΩ minimum	10,000 MΩ minimum	10,000 MΩ minimum	10,000 MΩ minimum

Authorized Hi-G Relay Distributors are located throughout the U.S. and Canada.

Spring St. & Rt. 75, Windsor Locks, Conn. 06096, 203-623-2481

STATE OF THE ART MINIATURE GLASS REED RELAYS

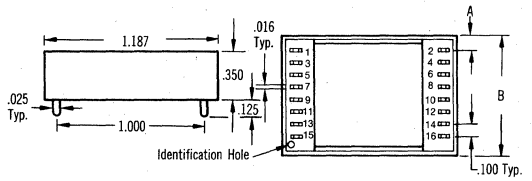
Product Bulletin 160

PHYSICAL DIMENSIONS

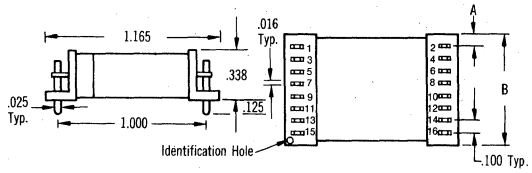
PC MOUNTING TYPES, .100 GRID

SERIES 3500 — Inline Pins

Box Shield

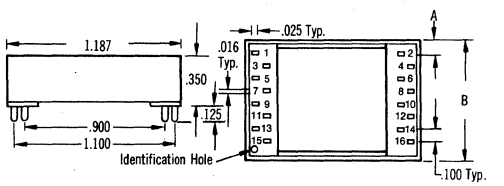


Foil Shield

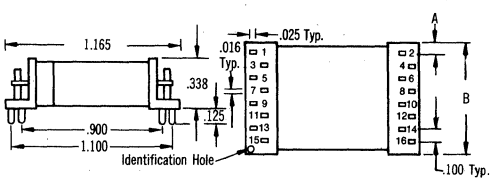


SERIES 3700 — Staggered Pins

Box Shield



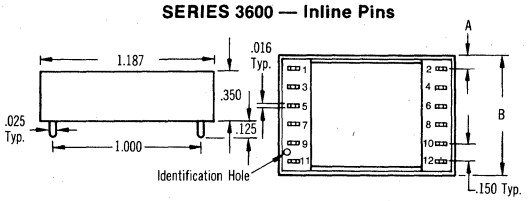
Foil Shield



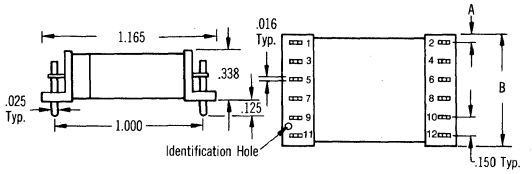
PC MOUNTING TYPES, .150 GRID

SERIES 3600 — Inline Pins

Box Shield

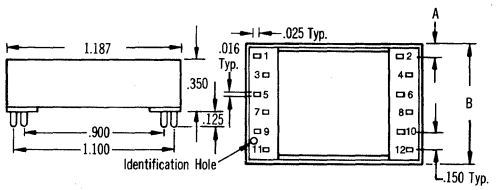


Foil Shield

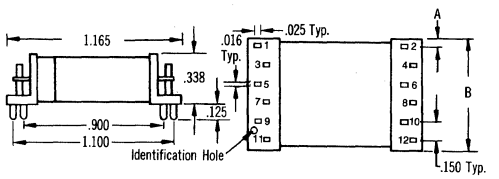


SERIES 3800 — Staggered Pins

Box Shield



Foil Shield

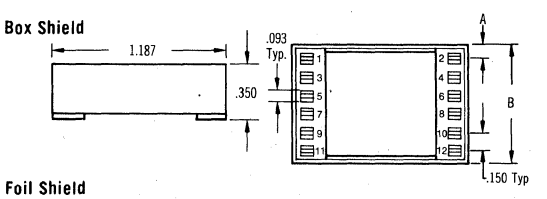


RELAY DIMENSIONS

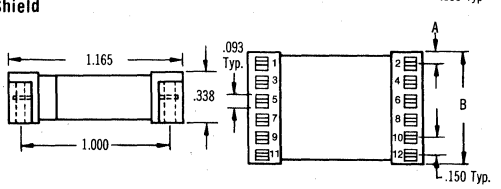
	.100 Grid Models			.150 Grid Models		
	Poles	Dim. "A"	Dim. "B"	Poles	Dim. "A"	Dim. "B"
Box Shield Models	1	.130	.464	1	.080	.464
	2	.155	.614	2	.080	.614
	3	.080	.764	3	.080	.764
	4	.106	.914	4	.080	.914
	Poles	Dim. "A"	Dim. "B"	Poles	Dim. "A"	Dim. "B"
Foil Shield Models	1	.120	.440	1	.070	.440
	2	.145	.590	2	.070	.590
	3	.070	.740	3	.070	.740
	4	.096	.890	4	.070	.890

SERIES 3600 — Plug-in (Berg Pins)

Box Shield



Foil Shield



SUGGESTED INQUIRY DATA:

1) Definition of Life
2) Contact Resistance at end of Life
3) Contact Loading(s)
4) Speed and Bounce Requirement(s)
5) Shielding, Electrostatic and/or Magnetic
6) Environmental Conditions
7) Potting

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STATE OF THE ART MINIATURE GLASS REED RELAYS

Product Bulletin 160

TYPICAL COIL DATA @ 25°C

Rated Coil Voltage		5VDC	6VDC	12VDC	24VDC	48VDC
1 Pole	Resistance	245Ω	245Ω	965Ω	4,200Ω	7,385Ω
	Coil Power @ PI	.066W	.100W	.100W	.100W	.200W
2 Pole	Resistance	180Ω	180Ω	377Ω	1,520Ω	5,730Ω
	Coil Power @ PI	.086W	.140W	.260W	.260W	.260W
3 Pole	Resistance	125Ω	125Ω	500Ω	1,330Ω	4,300Ω
	Coil Power @ PI	.130W	.185W	.185W	.280W	.340W
4 Pole	Resistance	107Ω	107Ω	195Ω	794Ω	3,460Ω
	Coil Power @ PI	.160W	.230W	.500W	.500W	.500W
Pull-In Voltage, Max.		4.0	4.8	9.6	19.2	38.2
Drop-Out Voltage, Min.		1.0	.5	1.0	2.0	4.0

TYPICAL RELAY DATA

Operate Time	1 Millisecond Max.
Release Time	.1 Millisecond Max.
Insulation Resistance	$1 \times 10^{11}\Omega$ Min. at 50 % RH
Coil to Contact Capacitance	2 Picofarads Max.
Operating Temp. Range	−65°C to +85°C
Shock	50G
Vibration	(500-2000 Hz) at 30G
Breakdown Voltage (coil to contact)	500 VRMS

TYPICAL CAPACITANCE VALUES

Electrostatic Shielding	Across Open Contacts	Coil to Contact
None	0.2 pf	2.0 pf
Partial	0.2 pf	0.2 pf
Full	0.2 pf	0.002 pf

TYPICAL CONTACT DATA

Contact Configuration	FORM A				FORM B				TRUE FORM C	
Contact Code	A O	A V	A M	A Q	B O	B V	B M	B Q	C O	C C
Features	General Purpose	High Voltage	Mercury Wetted	High Speed	General Purpose	High Voltage	Mercury Wetted	High Speed	General Purpose	Heavy Duty
Rating, DC Watts	10	10	25	3	10	10	25	3	3	10
Max. Voltage, DC	250	1500	100	28	250	1500	100	28	28	100
Max. Current, Amps	.500	.003	1.0	.100	.500	.003	1.0	.100	.100	.500
Operate Time, ms	.700	.700	2.0	.200	.700	.700	2.0	.200	2.0	.800
Bounce Time, ms	.200	.200	none	.150	.200	.200	none	.150	.500	.200
Life @ Rated Loads	20×10^6	10×10^6	50×10^6	10×10^6	20×10^6	10×10^6	50×10^6	10×10^6	5×10^6	5×10^6
Life @ Signal Loads	100×10^6	100×10^6	200×10^6	100×10^6	100×10^6	100×10^6	200×10^6	100×10^6	100×10^6	100×10^6
Initial Contact Resistance	.200Ω	.200Ω	.050Ω	.200Ω	.200Ω	.200Ω	.050Ω	.200Ω	.200Ω	.200Ω
Breakdown Voltage	300	1500	1000	250	300	1500	1000	250	250	250

ORDERING INFORMATION

Series Number — determines terminal Grid:

3500 = Inline Pins, 3700 = Stagger Pins } .100 Grid

3600 = Inline & Plug-in, 3800 = Stagger Pins } .150 Grid

Variation Code — **00** through **99** determines shielding and special features.

Number of Poles — **1** through **4.**

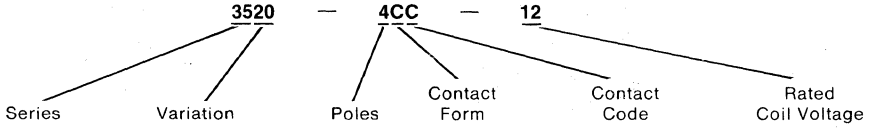
Contact "form" or configuration — **A, B,** or **C.**

A = Normally open contacts
B = Normally closed contacts
C = one normally open and one normally closed contact

Contact code — **A** through **Z** describes specific plating and blade designs.

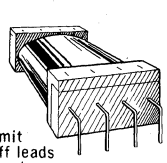
Coil Voltage (rated) — **5, 6 ,12, 24** or **48** dc.

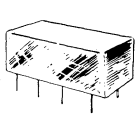
EXAMPLE:

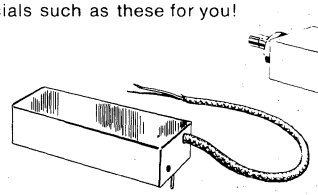


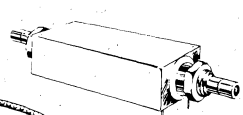
describes a .100 grid PC mounted relay with external magnetic shielding. It has 4 form C contacts designed for the heavy duty switching of 10 watts and a coil rated at 12 volts dc.

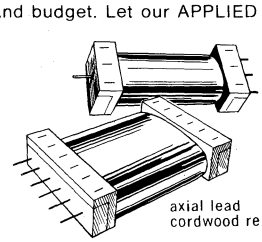
SPECIALS: Special versions of Series 3500/3600 relays are limited only by the bounds of imagination and budget. Let our APPLIED IMAGINATION work to produce specials such as these for you!


outboard bends permit clipping off leads to replace relay without special desoldering tools


½ size crystal can glass reed relay


low capacitance specials


RF reed relay


axial lead cordwood relays

Authorized Hi-G Relay Distributors are located throughout the U.S. and Canada.

Spring St. & Rt. 75, Windsor Locks, Conn. 06096, 203-623-2481

ELECTRONIC TIME DELAY RELAYS, VOLTAGE & PHASE SENSORS

ELECTRICAL CHARACTERISTICS

Input Voltage: 18 to 31 volts DC. Reverse polarity protection provided on all standard units.

Delay Time Tolerance: ±10%. Tolerances to ±5% are available on special order.

Recycle Time: 0.5% (nominal delay time) — recycle time maximum @ 25°C.

Recovery Time: 0.1 second maximum up to 20 seconds delay. 0.5 second maximum up to 100 seconds.

Reset Time: 10 milliseconds maximum.

ENVIRONMENTAL CHARACTERISTICS

Temperature Range: −55°C to +85°C, or −55°C to +125°C.

Vibration: 20G, 10 to 2000 Hz.

Shock: 50G, 11 ±1 milliseconds duration.

Insulation Resistance: 1000 megohms at 500 volts DC.

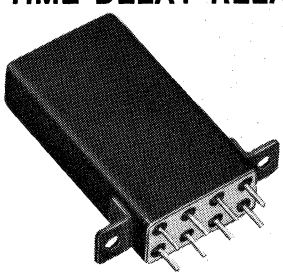
Dielectric Strength: Contacts to case: 1000 volts rms, 60 Hz; mutually insulated terminals: 500 V rms.

Sealing: Hermetic to 72,000′.

Life: 100,000 operations minimum.

UNLESS OTHERWISE SPECIFIED

TIME DELAY RELAYS — SERIES 2400 Product Bulletin 167B



FEATURES

The Series 2400 Time Delay Relay combines a solid-state timing circuit and a half-size Hi-G relay in a package only slightly longer than a standard crystal-case housing. This combination provides the current-carrying capacity and the environmental immunity of Hi-G's electro-mechanical relays with the long life and quick response of hybrid circuits.

Delay Times: 50 milliseconds to 100 seconds Delay-on-make.

Contact Rating: 2 amperes resistive at 30 volts DC. 1 ampere at 115V, 400 Hz.

Contact Arrangement: DPDT.

Weight: 1.2 oz. maximum.

Dimensions: Base .4 x .8 inches max. Height 1.5 inch max.

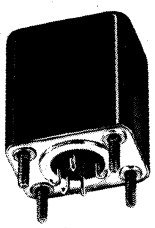
SPECIFY:

Series 2401: for operation in the −55°C to +85°C temperature range.

Series 2402: for operation in the −55°C to +125°C temperature range.

DELAY-ON-MAKE TIMERS, AC or DC TYPES, 1 to 4 POLES — SERIES 1600/1700

Product Bulletin 164



FEATURES: Hi-G Delay-on-Make Timers are available with either fixed or adjustable delays. Each adjustable relay covers one decade, e.g., 62 ms to 620 ms. You may select the decade that best suits your application within the range from 50 milliseconds to 180 seconds.

Delay Times: Fixed: 50 ms to 180 sec Adjustable: See tables below.

10 Amp Types: Standard contact rating 10 amperes resistive at 30 volts DC or 115 volts, 400 Hz; 5 amperes inductive at 28 volts DC.

Dimensions: Base: 1.25 x 1.75 inches. Height: 2.3 inches.

4 Amp Types: Standard contact rating 4 amperes resistive at 30 volts DC.

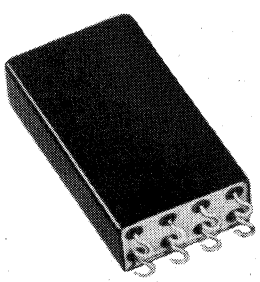
Input Voltages: DC units: 18 to 31 volts. AC units: 105 to 125 volts, 400 Hz.

Dimensions: Base: 1.0 x 1.25 inches max. Height: See Tabulation.

Type	Function	Contact Arrangement	Range (seconds)	Timing Code
1610	Fixed	SPDT	optional	XXXX
1611	Fixed	DPDT	optional	XXXX
1710	Adjustable	SPDT	0.1 to 1.0	1001
1711	Adjustable	SPDT	0.5 to 5	5001
1712	Adjustable	SPDT	1.0 to 10	1002
1713	Adjustable	SPDT	5 to 50	5002
1714	Adjustable	SPDT	18 to 180	1803
1715	Adjustable	DPDT	0.1 to 1.0	1001
1716	Adjustable	DPDT	0.5 to 5	5001
1717	Adjustable	DPDT	1.0 to 10	1002
1718	Adjustable	DPDT	5 to 50	5002
1719	Adjustable	DPDT	18 to 180	1803

Type	Input	Temperature Range (°C)	Housing Height (inches)	Contact Arrangement
1601/1701	DC	−55 to +85	1.6	SPDT
1602/1702	DC	−55 to +85	1.7	DPDT
1603/1703	DC	−55 to +85	2.0	3PDT
1604/1704	DC	−55 to +85	2.0	4PDT
1621/1721	DC	−65 to +125	1.6	SPDT
1622/1722	DC	−65 to +125	1.7	DPDT
1623/1723	DC	−65 to +125	2.0	3PDT
1624/1724	DC	−65 to +125	2.0	4PDT
1651/1751	AC	−55 to +85	2.0	SPDT
1652/1752	AC	−55 to +85	2.0	DPDT
1653/1753	AC	−55 to +85	2.4	3PDT
1654/1754	AC	−55 to +85	2.4	4PDT
1671/1771	AC	−65 to +125	2.0	SPDT
1672/1772	AC	−65 to +125	2.0	DPDT
1673/1773	AC	−65 to +125	2.4	3PDT
1674/1774	AC	−65 to +125	2.4	4PDT

SOLID STATE TIMING MODULE — SERIES 1800/1900 Product Bulletin 168



FEATURES: The Hi-G Timing Module is an all solid-state timer that offers excellent reliability over a useful life well in excess of one million operations. It has a fast reset time, is remarkably stable over a wide temperature range, and can provide delays as short as 10 milliseconds.

Delay Times: Refer to Timing Module Types Table.

Reset Time: 100 microseconds.

Output: Single pole, normally open. Rated at 1 ampere at 25°C derating to 250 ma at 125°C; inductive loads require an external diode. Maximum forward leakage 2 ma at 31 volts DC.

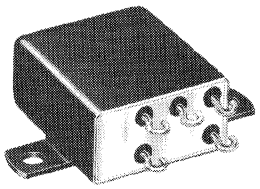
Dimensions: Base: .4 x .8 inch max. Height: See Tabulation.

TIMING MODULE TYPES

Series	Type	Timing Range	Temperature Range	Housing Height
1801	fixed	1 ms to 60 sec	−55° to +85°C	1.275 inches
1802	fixed	60 to 120 sec	−55° to +85°C	1.45 inches
1851	fixed	1 ms to 40 sec	−65° to +125°C	1.275 inches
1852	fixed	40 to 80 sec	−65° to +125°C	1.45 inches
1901	adjustable	1 ms to 45 sec	−55° to +85°C	1.275 inches
1902	adjustable	45 to 90 sec	−55° to +85°C	1.45 inches
1951	adjustable	1 ms to 30 sec	−65° to +125°C	1.275 inches
1952	adjustable	30 to 60 sec	−65° to +125°C	1.45 inches

ELECTRONIC TIME DELAY RELAYS, VOLTAGE & PHASE SENSORS

SOLID STATE TIMING MODULE — SERIES 1860 Product Bulletin 169



This Hi-G Timing Module is a solid-state timer hermetically sealed and encapsulated in a standard crystal-case housing which results in an extremely rugged, high performance assembly. All the standard relay headers are available for the timing module, making it directly interchangeable with most relay mounting hardware. (See 2B Relay.)

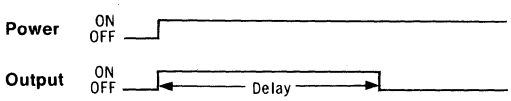
Delay Times: 10 milliseconds to 20 seconds.

Output: Single pole, normally open. Rated at 250 ma at 25°C. Derating linearly to 75 ma at 125°C. Inductive loads require an external diode. Typical leakage current 15 μa (in non-conducting state) at 85°C.

INTERVAL TIMERS — SERIES 4600/4700/4800 Product Bulletin 161

FUNCTION

Apply power and the output will energize immediately. After timeout, the output will revert to deenergized state. Remove and reapply power to recycle.



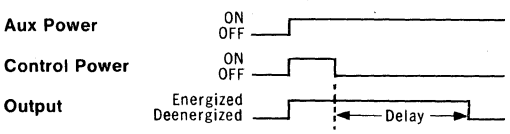
The function of an interval timer is to provide a defined time period. This time period or pulse is considered to be the conducting state of a solid state timing module, or the energized state when utilizing an electromechanical relay for output.

The Hi-G approach uses precise circuit designs in compact simplicity to meet the need for a sound balance between reliability and economy. Standard devices include both solid state and electromechanical output configurations. The Series 4800 represents the solid state timing module. For electromechanical relay output the 4600 Series offers fixed delay times, while the 4700 is an adjustable version.

DELAY-ON-RELEASE TIMERS — SERIES 5600/5700/5800 Product Bulletin 162

FUNCTION

Apply auxiliary power. Upon application of control power, the output will energize immediately. When control power is removed the delay begins. At the end of the delay period, the timer will deenergize.

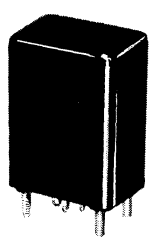


The time period of a delay-on-release timer begins with removal of control power. Prior to this the unit is energized and remains so until control power is removed and the delay period completed. In some cases, this logic is referred to as delay-on-release, dropout, or deenergization. There are many variations. However, Hi-G takes the most common approach as defined by the timing diagram.

Hi-G offers the Series 5600 in fixed delay times and the Series 5700 as adjustable with external resistor, both with electromechanical relay output. The series 5800 is all solid state and capable of driving most crystal can relays.

VOLTAGE SENSING RELAY / DC VOLTAGE LEVEL MONITOR — SERIES 1310

Product Bulletin 181



FEATURES

The Hi-G 1310 Series Voltage Sensor is essentially a voltage monitoring circuit operating on a snap-action transistor circuit with low drift and inherent temperature compensation. This device will either open or close a circuit when a predetermined voltage is present at its input.

Pull-in Voltage: 17 to 33 volts DC. Other voltage levels available on special order. Please specify voltage level to the nearest tenth of a volt when ordering.

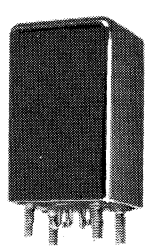
Accuracy: $\pm 2^1/_2$ percent of specified value over the temperature range. -65°C to $+125$°C.

Drop-Out Voltage: 0.5 volt maximum under actual pull-in voltage at any given point throughout the temperature range.

Maximum Allowable Applied Voltage: 150 percent of specified pull-in voltage.

AC Sensors: Single and 3 phase AC voltage detectors are available on special order. The 3 phase sensors can be provided in combination with Series 1400 phase sequence detectors.

PHASE SENSING RELAY 3ø POWER SYSTEM MONITOR — SERIES 1400 Product Bulletin 180



FEATURES

Hi-G Phase Sensors monitor three-phase power systems.

Two types of Phase Sensors are available as standard items, the P-type and the Q-type. P-type units will energize only when all three phases are in the proper sequence. They will deenergize only when power is removed. The P-type unit is best suited to applications where static loads are used and where regenerated voltage will not be present if a phase opens.

Q-type units perform the same functions as the P-type and, in addition, they will also deenergize if any phase is disconnected or grounded. The voltage of the faulted phase or the regenerated voltage must be below 70 percent of the nominal phase-to-phase voltage. Q-type units are suitable for motor loads where a regenerated voltage is produced.

Neither P nor Q-type units require connection to a neutral leg.

For heavy-current applications Phase Sensing Relays are used with slave relays having heavy-duty contact ratings.

Standard Phase Sensor Types

Type	Voltage ±10%	Frequency ±10%	Max Power Required	Mountings	Operating Characteristics
1407	115 V	60 Hz	4 Watts	A, B, C	P
1408	115 V	400 Hz	4 Watts	A, B, C	P
1409	208 V	60 Hz	6 Watts	A, B, C	P
1410	208 V	400 Hz	6 Watts	A, B, C	P
1437	115 V	60 Hz	6 Watts	A, B	Q
1438	115 V	400 Hz	6 Watts	A, B	Q
1439	208 V	60 Hz	9 Watts	B	Q
1440	208 V	400 Hz	9 Watts	B	Q

CONTACTS: SPDT.

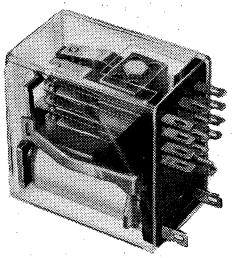
CONTACT RATING:

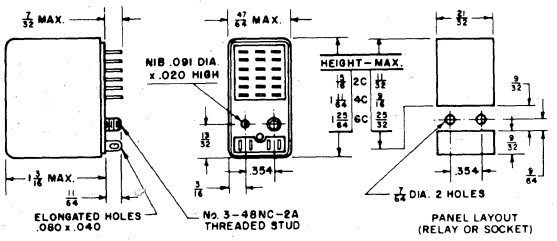
2 amperes resistive at 30 volts DC.
0.5 ampere inductive at 30 volts DC.
1 ampere inductive at 115 volts, 60 or 400 Hz.
0.25 ampere inductive at 115 volts, 60 or 400 Hz.
0.25 ampere resistive at 208 volts, 60 or 400 Hz.
0.1 ampere inductive at 28 volts, 60 or 400 Hz.

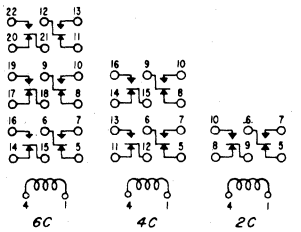
INDUSTRIAL PRODUCTS

112 PARKWAY DRIVE SOUTH • HAUPPAUGE, NEW YORK 11787 • 516-543-6700

SERIES CR . . . MINIATURE INDUSTRIAL RELAYS . . . DUST PROTECTED







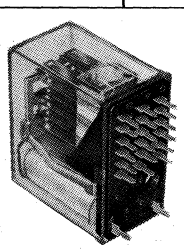
Solder/Plug-in Terminals

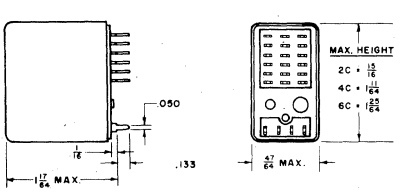
Part Number	Contact Form	Rating Amps	Nominal Volts DC	Resistance (ohms ± 10%)	List Price
2 Amp.					
CR2DDSA- 6VDN	DPDT	2	6	52	$3.20
CR2DDSA- 12VDN	DPDT	2	12	185	3.20
CR2DDSA- 24VDN	DPDT	2	24	700	3.20
CR2DDSA- 48VDN	DPDT	2	48	2500	3.20
CR2DDSA-115VDN	DPDT	2	115	15000	4.90
CR4DDSA- 6VDN	4PDT	2	6	52	3.60
CR4DDSA- 12VDN	4PDT	2	12	185	3.60
CR4DDSA- 24VDN	4PDT	2	24	700	3.60
CR4DDSA- 48VDN	4PDT	2	48	2500	3.60
CR4DDSA-115VDN	4PDT	2	115	15000	5.30
CR6DDSA- 6VDN	6PDT	2	6	25	4.60
CR6DDSA- 12VDN	6PDT	2	12	90	4.60
CR6DDSA- 24VDN	6PDT	2	24	430	4.60
CR6DDSA- 48VDN	6PDT	2	48	1550	4.60
CR6DDSA-115VDN	6PDT	2	115	9000	5.50
5 Amp.					
CR2DDSF- 6VDN	DPDT	5	6	52	3.30
CR2DDSF- 12VDN	DPDT	5	12	185	3.30
CR2DDSF- 24VDN	DPDT	5	24	700	3.30
CR2DDSF- 48VDN	DPDT	5	48	2500	3.30
CR2DDSF-115VDN	DPDT	5	115	15000	5.00
CR4DDSF- 6VDN	4PDT	5	6	52	3.80
CR4DDSF- 12VDN	4PDT	5	12	185	3.80
CR4DDSF- 24VDN	4PDT	5	24	700	3.80
CR4DDSF- 48VDN	4PDT	5	48	2500	3.80
CR4DDSF-115VDN	4PDT	5	115	15000	5.50
CR6DDSF- 6VDN	6PDT	5	6	25	4.90
CR6DDSF- 12VDN	6PDT	5	12	90	4.90
CR6DDSF- 24VDN	6PDT	5	24	430	4.90
CR6DDSF- 48VDN	6PDT	5	48	1550	4.90
CR6DDSF-115VDN	6PDT	5	115	9000	5.80

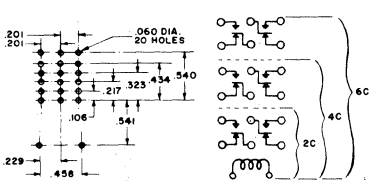
Part Number	Contact Form	Rating Amps	Nominal Volts DC	Resistance (ohms ± 10%)	List Price
Bifurcated Contacts					
CR2DDSB- 6VDN	DPDT	2	6	52	3.60
CR2DDSB- 12VDN	DPDT	2	12	185	3.60
CR2DDSB- 24VDN	DPDT	2	24	700	3.60
CR2DDSB- 48VDN	DPDT	2	48	2500	3.60
CR2DDSB-115VDN	DPDT	2	115	15000	5.30
CR4DDSB- 6VDN	4PDT	2	6	52	4.00
CR4DDSB- 12VDN	4PDT	2	12	185	4.00
CR4DDSB- 24VDN	4PDT	2	24	700	4.00
CR4DDSB- 48VDN	4PDT	2	48	2500	4.00
CR4DDSB-115VDN	4PDT	2	115	15000	5.70

Sensitive

Part Number	Contact Form	Rating Amps	Resistance (ohms ± 10%)	Pickup I (maDC)	List Price
CR2DDSS- 1000RDS	DPDT	1	1000	8.5	$3.50
CR2DDSS- 2500RDS	DPDT	1	2500	5.8	3.50
CR2DDSS- 5000RDS	DPDT	1	5000	4.1	4.00
CR2DDSS-10000RDS	DPDT	1	10000	3.1	4.40
CR4DDSS- 1000RDS	4DPT	1	1000	13.0	3.95
CR4DDSS- 2500RDS	4PDT	1	2500	8.4	3.95
CR4DDSS- 5000RDS	4PDT	1	5000	6.2	4.45
CR4DDSS-10000RDS	4PDT	1	10000	4.5	4.85
CR6DDSS- 1000RDS	6PDT	1	1000	16.0	5.50
CR6DDSS- 2500RDS	6PDT	1	2500	10.0	5.50
CR6DDSS- 5000RDS	6PDT	1	5000	7.2	6.00
CR6DDSS-10000RDS	6PDT	1	10000	5.0	6.40







Printed Circuit Terminals

Part Number	Contact Form	Rating Amps	Nominal Volts DC	Resistance (ohms ± 10%)	List Price
CR2DDCA- 6VDN	DPDT	2	6	52	$3.20
CR2DDCA- 12VDN	DPDT	2	12	185	3.20
CR2DDCA- 24VDN	DPDT	2	24	700	3.20
CR2DDCA- 48VDN	DPDT	2	48	2500	3.20
CR2DDCA-115VDN	DPDT	2	115	15000	4.90
CR4DDCA- 6VDN	4PDT	2	6	52	3.60
CR4DDCA- 12VDN	4PDT	2	12	185	3.60
CR4DDCA- 24VDN	4PDT	2	24	700	3.60

Part Number	Contact Form	Rating Amps	Nominal Volts DC	Resistance (ohms ± 10%)	List Price
CR4DDCA- 48VDN	4PDT	2	48	2500	3.60
CR4DDCA-115VDN	4PDT	2	115	15000	5.30
CR6DDCA- 6VDN	6PDT	2	6	25	4.60
CR6DDCA- 12VDN	6PDT	2	12	90	4.60
CR6DDCA- 24VDN	6PDT	2	24	430	4.60
CR6DDCA- 48VDN	6PDT	2	48	1550	4.60
CR6DDCA-115VDN	6PDT	2	115	9000	5.50

INDUSTRIAL PRODUCTS

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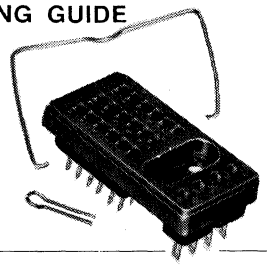
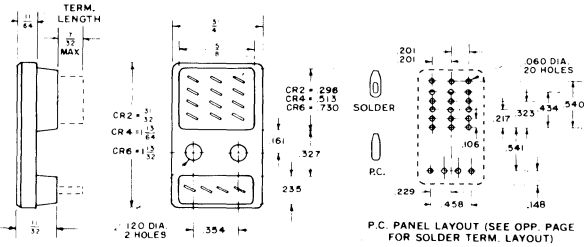
SERIES CR . . . SOCKET ORDERING GUIDE

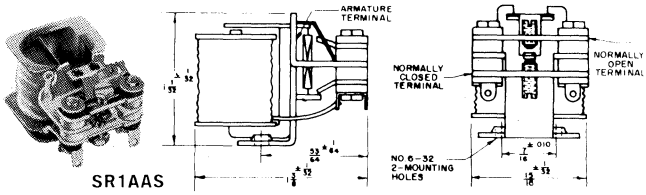
Relay Series	Socket No. (Inc. grnd clip & retainer) Solder Term	P.C. Term	List Price
CR2 CR4 CR6	CR2 SO1 CR4 SO1 CR6 SO1	CR2 SO2 CR4 SO2 CR6 SO2	$.55 .60 .95

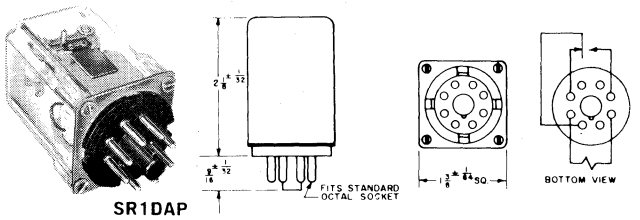


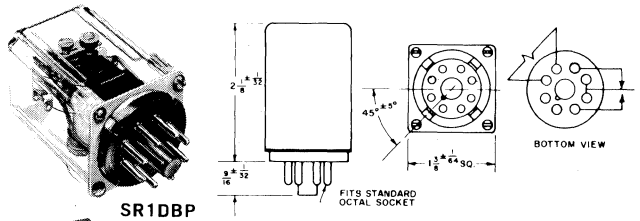


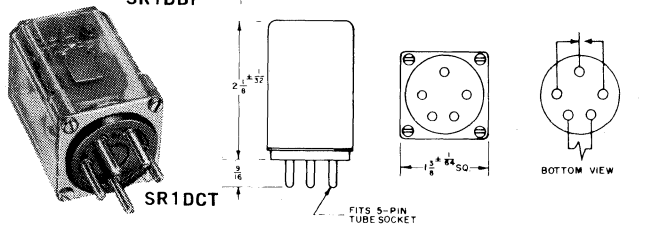
SERIES SR1 . . . MINIATURE SENSITIVE RELAY

Part Number	Contact Form	Rating Amps	Resistance (ohms ± 10%)	Pickup I (maDC)	List Price
Open					
SR1AAS- 500RDN	SPDT	2	500	4.5	$4.20
SR1AAS- 1000RDN	SPDT	2	1000	3.2	4.20
SR1AAS- 2000RDN	SPDT	2	2000	2.2	4.20
SR1AAS- 2500RDN	SPDT	2	2500	2.0	4.40
SR1AAS- 5000RDN	SPDT	2	5000	1.4	4.70
SR1AAS- 8000RDN	SPDT	2	8000	1.1	4.90
SR1AAS- 10000RDN	SPDT	2	10000	1.0	5.20
SR1AAS- 1000RDS	SPDT	1	1000	2.3	4.55
SR1AAS- 5000RDS	SPDT	1	5000	1.0	5.05
SR1AAS- 10000RDS	SPDT	1	10000	0.7	5.55
SR1AAS- 13000RDS	SPDT	1	13000	0.6	5.55
Dust Protected...Octal Plug...90° Rotation					
SR1DAP- 500RDN	SPDT	2	500	4.5	5.90
SR1DAP- 1000RDN	SPDT	2	1000	3.2	5.90
SR1DAP- 2000RDN	SPDT	2	2000	2.2	5.90
SR1DAP- 2500RDN	SPDT	2	2500	2.0	6.10
SR1DAP- 5000RDN	SPDT	2	5000	1.4	6.40
SR1DAP- 8000RDN	SPDT	2	8000	1.1	6.60
SR1DAP- 10000RDN	SPDT	2	10000	1.0	6.90
SR1DAP- 1000RDS	SPDT	1	1000	2.3	6.25
SR1DAP- 5000RDS	SPDT	1	5000	1.0	6.75
SR1DAP- 10000RDS	SPDT	1	10000	0.7	7.25
SR1DAP- 13000RDS	SPDT	1	13000	0.6	7.25
Dust Protected...Octal Plug...45° Rotation					
SR1DBP- 500RDN	SPDT	2	500	4.5	5.90
SR1DBP- 1000RDN	SPDT	2	1000	3.2	5.90
SR1DBP- 2000RDN	SPDT	2	2000	2.2	5.90
SR1DBP- 2500RDN	SPDT	2	2500	2.0	6.10
SR1DBP- 5000RDN	SPDT	2	5000	1.4	6.40
SR1DBP- 8000RDN	SPDT	2	8000	1.1	6.60
SR1DBP- 10000RDN	SPDT	2	10000	1.0	6.90
Dust Protected...5 Pin Plug					
SR1DCT- 1000RDN	SPDT	2	1000	3.2	6.20
SR1DCT- 2500RDN	SPDT	2	2500	2.0	6.40
SR1DCT- 5000RDN	SPDT	2	5000	1.4	6.70
SR1DCT- 10000RDN	SPDT	2	10000	1.0	7.20



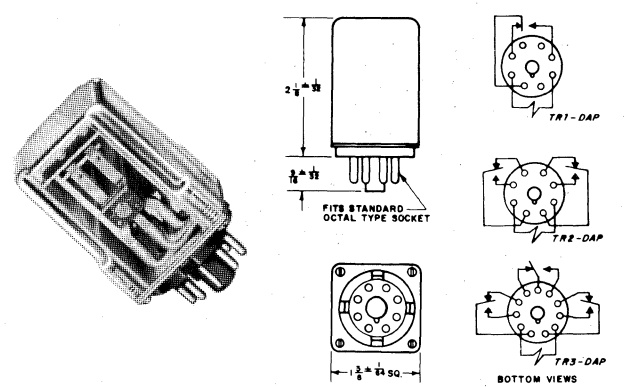






SERIES TR . . . MINIATURE GENERAL PURPOSE RELAY. . . 5 Amp . . . Dust Protected . . . Octal Plug

Part Number	Contact Form	Rating Amps	Nominal Volts	Resistance (ohms ± 10%)	List Price
TR1DAPF- 6VDN	SPDT	5	6DC	52	$5.50
TR1DAPF- 12VDN	SPDT	5	12DC	185	5.50
TR1DAPF- 24VDN	SPDT	5	24DC	700	5.50
TR1DAPF- 48VDN	SPDT	5	48DC	2500	5.50
TR1DAPF- 110VDN	SPDT	5	110DC	10000	6.20
TR1DAPF- 115VAN	SPDT	5	115AC	——	5.60
TR2DAPF- 6VDN	2PDT	5	6DC	52	6.10
TR2DAPF- 12VDN	2PDT	5	12DC	185	6.10
TR2DAPF- 24VDN	2PDT	5	24DC	700	6.10
TR2DAPF- 48VDN	2PDT	5	48DC	2500	6.10
TR2DAPF- 110VDN	2PDT	5	110DC	10000	6.80
TR2DAPF- 115VAN	2PDT	5	115AC	——	6.20
TR3DAPF- 6VDN	3PDT	5	6DC	52	7.60
TR3DAPF- 12VDN	3PDT	5	12DC	185	7.60
TR3DAPF- 24VDN	3PDT	5	24DC	700	7.60
TR3DAPF- 48VDN	3PDT	5	48DC	2500	7.60
TR3DAPF- 110VDN	3PDT	5	110DC	10000	8.30
TR3DAPF- 115VAN	3PDT	5	115AC	——	7.70



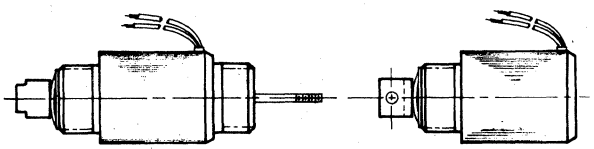
TEC • MAGNETICS

A Subsidiary of HI G

TEC-SOL STANDARD LINE

TEC • MAGNETICS "Tec-Sol" Solenoids offer the widest, most complete line of solenoids ever produced for industrial, and military applications, and are available in push or pull type, pressurized & non-pressurized, five different duty cycles, attachable mounting brackets, adjustable stroke, and captivated plunger.

STANDARD NON-PRESSURIZED

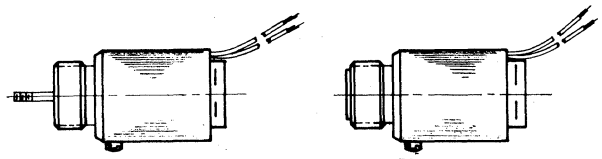


PUSH TYPE PULL TYPE

Available in two lengths:

Sizes	O.D.		Short Length	Long Length
8	½	X	⅝	1.00
10	⅝	X	¾	1¾
12	¾	X	15/16	1½
14	⅞	X	1⅛	1¾
16	1.00	X	1¼	2.00
18	1⅛	X	1⅜	2¼
20	1¼	X	1½	2½
22	1⅜	X	1⅝	2¾
24	1½	X	1¾	3.00
26	1⅝	X	1 15/16	3¼

STANDARD PRESSURIZED



PUSH TYPE PULL TYPE

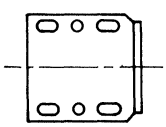
Available in following lengths:

Sizes	O.D.		Length
12	¾	X	1 3/16
14	⅞	X	1⅜
16	1.00	X	1 9/16
18	1⅛	X	1¾
20	1⅛	X	1 15/16
22	1⅜	X	2⅛
24	1½	X	2 5/16

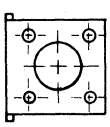
Internal springs available on all standards

Send now for your free Tec-Sol solenoid calculator to quickly and accurately select the right solenoid for your application

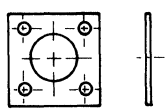
STANDARD MOUNTING BRACKETS



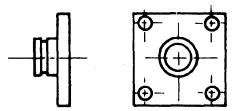
Bottom View



Front and Side

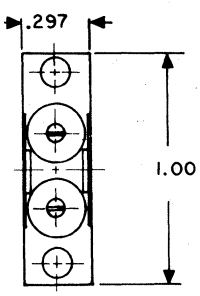


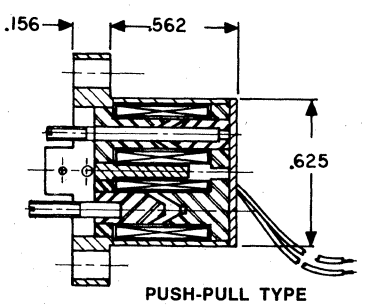
Front



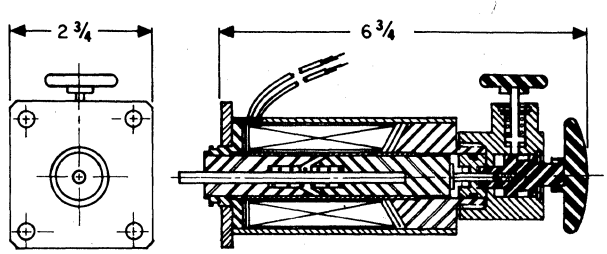
Front Flange Adapter Kit Pressurized

CUSTOM DESIGNED SOLENOIDS





PUSH-PULL TYPE



PRESSURIZED PUSH TYPE MANUAL OVERRIDE

TEC • MAGNETICS is an acknowledged leader in the design and manufacture of solenoids and electro-magnetic devices for all types of applications. If you have a special requirement, Tec • Magnetics welcomes the opportunity to serve you.

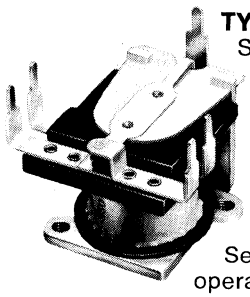
TEC • MAGNETICS

A Subsidiary of HI G INCORPORATED

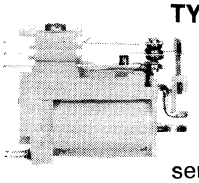
12117 Slauson Ave. • Santa Fe Springs, Cal. 90670 • Tel: (213) 698-0565

Quality Performers from ITT Jennings.

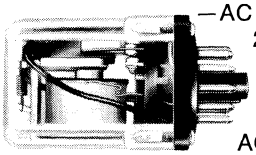
Here are some proven performers from one of the broadest lines of electro-mechanical relays ever offered. All quality-tested and available now with off-the-shelf delivery.



TYPE JAA
Small general purpose ac or dc relays. 1 or 2 Form C contacts.
Contact ratings:
Silver or palladium 0.3A
100 VDC or 115 VAC 30 W
silver cadmium oxide.
1 amp 28 VDC or 115 VAC 50 W
Available in following versions:
Sensitive, power, latching, slow operate and precision adjust.



TYPE JBJA
2 or 4 Form C
Contact rating:
10 amp 380 VAC or 200 VDC
Coil power nominal 1.6W
spade type terminals chassis mount
sensitive, low cost, high current relay.

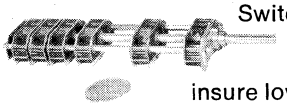


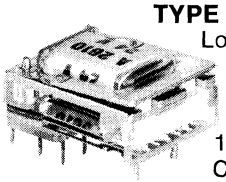
TYPE JBGA
—AC OR DC operated
2 or 3 Form C
Contact Rating:
Silver: 5 amp 250 VAC or
250 VDC 1000 VA or 250 watts
AG/CDo: 10 amp 120 VAC or 26 VDC
Coil power nominal 1.5 or 1.8 VA Plug-in type with dust cover. Also available in open types.



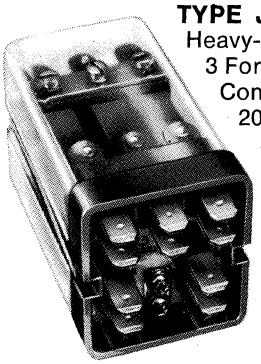
TYPE JWFA
One Form D contact arrangement.
(5A rating). Mercury wetted.
Operates on approx. 800 mW.
Plugs in to standard octal socket.
Encapsulated inside metal can.
Switched power 250 VA
Switched voltage 500 V a.c. or d.c.

TYPE JSR-325
Miniature low profile rotary switch
Up to 5 switching sections available.
Low .44 in height, detent angle 30° 1 to 6 poles.
1 - 12 positions. Solder directly to PC board
Switched current: 50 ma
Switched power: 3 W
Enclosed sections insure low contact resistance.

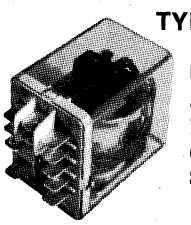




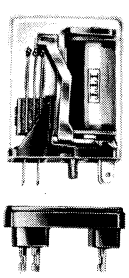
TYPE JAEA/B/C
Low profile printed circuit board relay
2, 4 or 6 Form C bifurcated contacts only. Contact ratings: .4 @ 30 VDC
Max. voltage 100 VDC or VAC
12 W or 12 VA
Coils 6 to 48 VDC, 0.68 W @ 24 V
printed circuit board mounting
plastic protective cage.



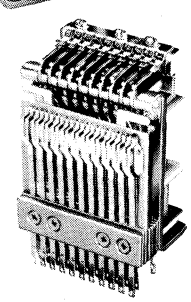
TYPE JCTA
Heavy-duty industrial relay
3 Form C heavy-duty contacts
Contact ratings:
20A, 440 V ac or 250 V dc
3600 VA or 360 W dc
Operates on approx. 5.8 VA ac or 2.3 dc. Single-stud or four-hole chassis mounting.
AMP Faston connections.
Fitted with plastic dust cover.
.157 in. electrical clearances throughout. Exceptionally long life.



TYPE JBNC
Medium duty appliance relay
Up to 3 Form C Contacts
ac or dc coils
Max. switched power: 2200 VA or 500 W per contact.
Switched current (max): 15A



TYPE JAKB/C/D/F/G/H/J/4M
Small plug-in dc relay up to 6 Form C contacts, silver or gold.
Contact ratings (max):
To 3 amp 100 VDC 56W
operates on approx. 125 mW dc
Chassis or plug-in mounting
Fitted with plastic dust cover.



TYPE JKAA
Counting relay. 10 Form A twin precious metal, light duty contacts.
Contact ratings:
0.3A 30 VDC 10W plug-in or chassis mounting. Dust cover on contacts.
Exceptionally long life.
Solder or wire wrap connections.
Extreme reliability.

There are many more relay types in production at ITT... some newly developed and others matching industry standard types. Vacuum relays, contactors and telephone specialties such as stepping switches and cross bar switches are among the proven performers. Contact us for any of your relay needs, including the services of a highly qualified engineering group to solve specific problems. ITT Jennings, a division of International Telephone and Telegraph Corporation, 970 McLaughlin Ave., San Jose, California 95108. Telephone: (408) 292-4025

JENNINGS ITT

Vacuum Relays mean Reliability

ki'lo·vac *n.* (F. *kilo*, thousand. L. *vacuus*)
1. That technology which offers reliable performance in high voltage relays resulting from operation at kilovolt levels in a vacuum dielectric.
2. *adj.*, pertaining to short contact travel, low contact mass, contacts free of oxides/pitting, and minimum contact bounce.

KILOVAC vacuum relays (ceramic or glass) are specified by design engineers for performance and reliability not available in conventional relays:

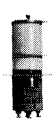
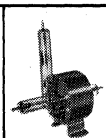
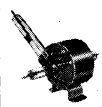
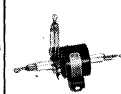
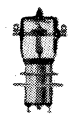
HIGH VOLTAGE ISOLATION: 2000 volts per mil of contact gap with predictable, repeatable isolation well in excess of rated values.

LOW AND STABLE CONTACT RESISTANCE: 0.015 ohms typical, with no contact oxidation or maintenance.

FAST SWITCHING TIME: 10 ms typical, due to small contact gap and short armature travel.

LONG LIFE: Millions of cycles with minimum degradation in electrical performance.

Any one of these standard features will justify your selection of KILOVAC vacuum relays. KILOVAC design and years of production experience permits immediate off-the-shelf delivery from a broad product line with voltages up to 50 KV. Special modifications provided in extremely short order.

									
KILOVAC TYPE	**HC-1†**	**KC-4†**	**HVS-1**	**HVS-10**	**H-5**	**H-6**	**H-7**	**H-8**	**H-9**
Contact arrangement	SPDT	SPST-Latching	SPDT	SPDT	SPST N.O.	SPST N.C.	SPDT	SPDT	SPST N.C.
Rated operating voltage (KVDC)	2.5	10	17	17	5	5	5	15	15
Test voltage (KVDC)	5	12	22	25	7.5	7.5	7.5	20	20
Continuous current, max. (amps DC)	18	28	7	8	4	4	4	15	15
*Max. current at rated voltage switching under load (amps DC)	0.5	0.5	0.5	1.0	0.25	0.25	0.1	0.5	0.5
Contact resistance, max. (ohms)	0.010	0.015	0.015	0.015	0.020	0.020	0.020	0.015	0.015
Operating time, max. (ms)	6	5	20	20	10	10	10	15	15
Coil resistance (ohms ± 10% @ 25°C)	335	12	128	65	250	250	200	265	265
Coil voltage (VDC, nominal)	26.5	26.5	26.5	40	26.5	26.5	26.5	26.5	26.5
Nominal dimensions (inches)	¾D x 1½H	¾D x 2¾H	4¾L x 5H	5L x 3¼H	2L x ¾H	2L x ¾H	2⅞L x 2H	1D x 3H	1¼D x 2¾H
Nominal weight (oz)	1	2	15	14	1	1	1	3	3
Mounting style**	threaded base	flange base	foot bracket	foot bracket	foot bracket	foot bracket	foot bracket	threaded base	solder flange
Approximate unit price (1-9 pcs)	$54	factory quote	$55	$55	$62	$62	$62	$98	$98

*All ratings are for pure resistive circuits. Contact factory for other circuits vs. ratings. **Other styles available †Ceramic envelope

...Reliability means KILOVAC

High vacuum technology has made high voltage switching practical with considerable savings in space and weight. KILOVAC uses the latest in vacuum pumping techniques, utilizing the "ion" type pump and achieving, in production, hard vacuums to 10^{-8} mm of mercury or better. Special manufacturing techniques include kovar-to-glass seals, final assembly in a dust and contaminant free area, specially selected glass and specially developed KILOVAC high voltage aging techniques.

KILOVAC relays are widely used in ECM, communications, sonar, radar, pulse-forming networks, medical electronics, and other high voltage equipment, or low voltage equipment where extreme reliability is a must. Many KILOVAC models are interchangeable with other manufacturers' types.

KILOVAC's broad line and "Quick Reaction Time" is geared to your most critical delivery schedule.

For complete technical information call your nearest KILOVAC sales-engineering representative or write directly to us.

KILOVAC, a company small enough to be responsive, large enough to be responsible.

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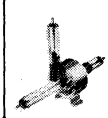
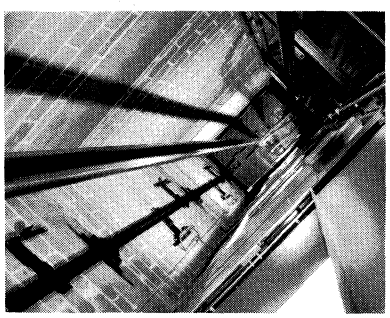
									
KILOVAC TYPE	**H-11/S2**	**H-12**	**H-16**	**H-17**	**H-18**	**H-19**	**H-23 #**	**H-25**	**H-35**
Contact arrangement	SPST N.O.	SPDT	DPDT	SPDT	DPDT	DPDT	SPST-N.C.	SPDT	SPDT
Rated operating voltage (KVDC)	12	8	12	25	10	20	30	50	35
Test voltage (KVDC)	15	12	15	30	12	30	35	60	40
Continuous current, max. (amps DC)	15	15	15	25	10	20	15	15	10
*Max. current at rated voltage switching under load (amps DC)	0.1	0.1	0.5	0.1	0.1	0.1	0.1	—	0.1
Contact resistance, max. (ohms)	0.015	0.015	0.030	0.015	0.020	0.010	0.015	0.015	0.015
Operating time, max. (ms)	18	18	20	25	15	40	30	60	30
Coil resistance (ohms ± 10% @ 25°C)	250	250	120	120	265	225	120	120	50
Coil voltage (VDC, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal dimensions (inches)	1D x 1⅝H	1D x 1¾H	1D x 3¼H	2D x 3½H	1D x 2H	2D x 3¼H	2D x 3¾H	3D x 7½H	8¼L x 5¼H
Nominal weight (oz)	2	2	5	5	4	7	7	30	15
Mounting style**	threaded base	threaded Base	threaded base	flange base	threaded base	threaded base	threaded base	threaded base	mounting bracket
Approximate unit price (1-9 pcs)	$110	$110	$128	$128	$135	$135	$135	factory quote	$110

*All ratings are for pure resistive circuits. Contact factory for other circuits vs. ratings.
**Other styles available

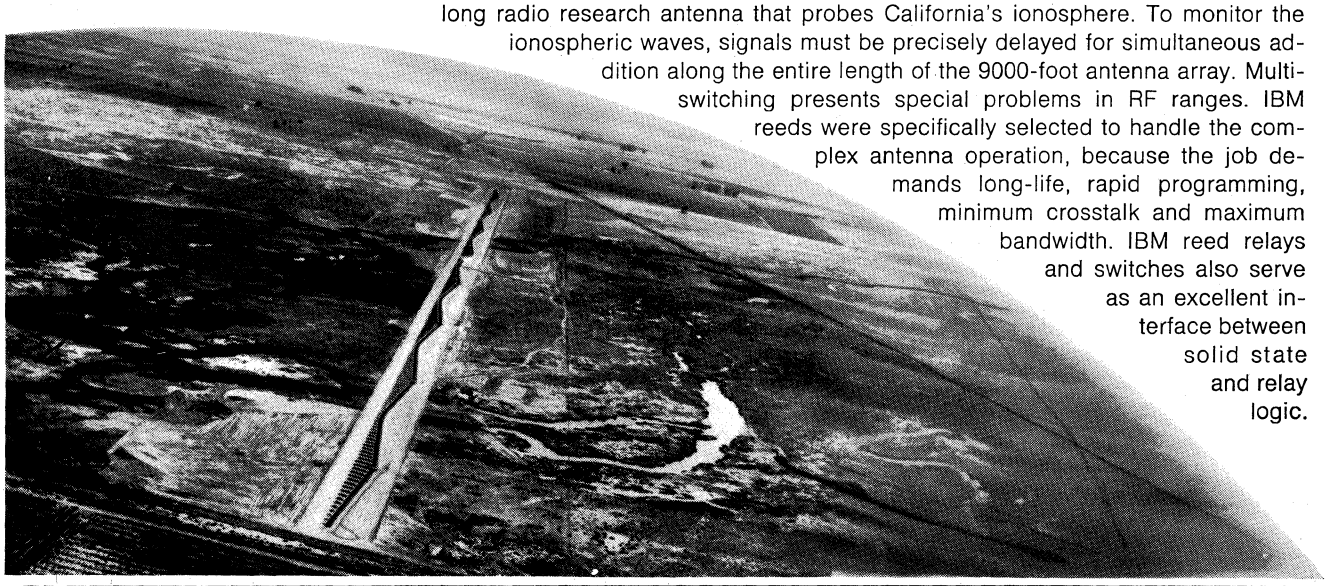
#H-24, same spec as H-23, except H-24 is SPST, N.O.

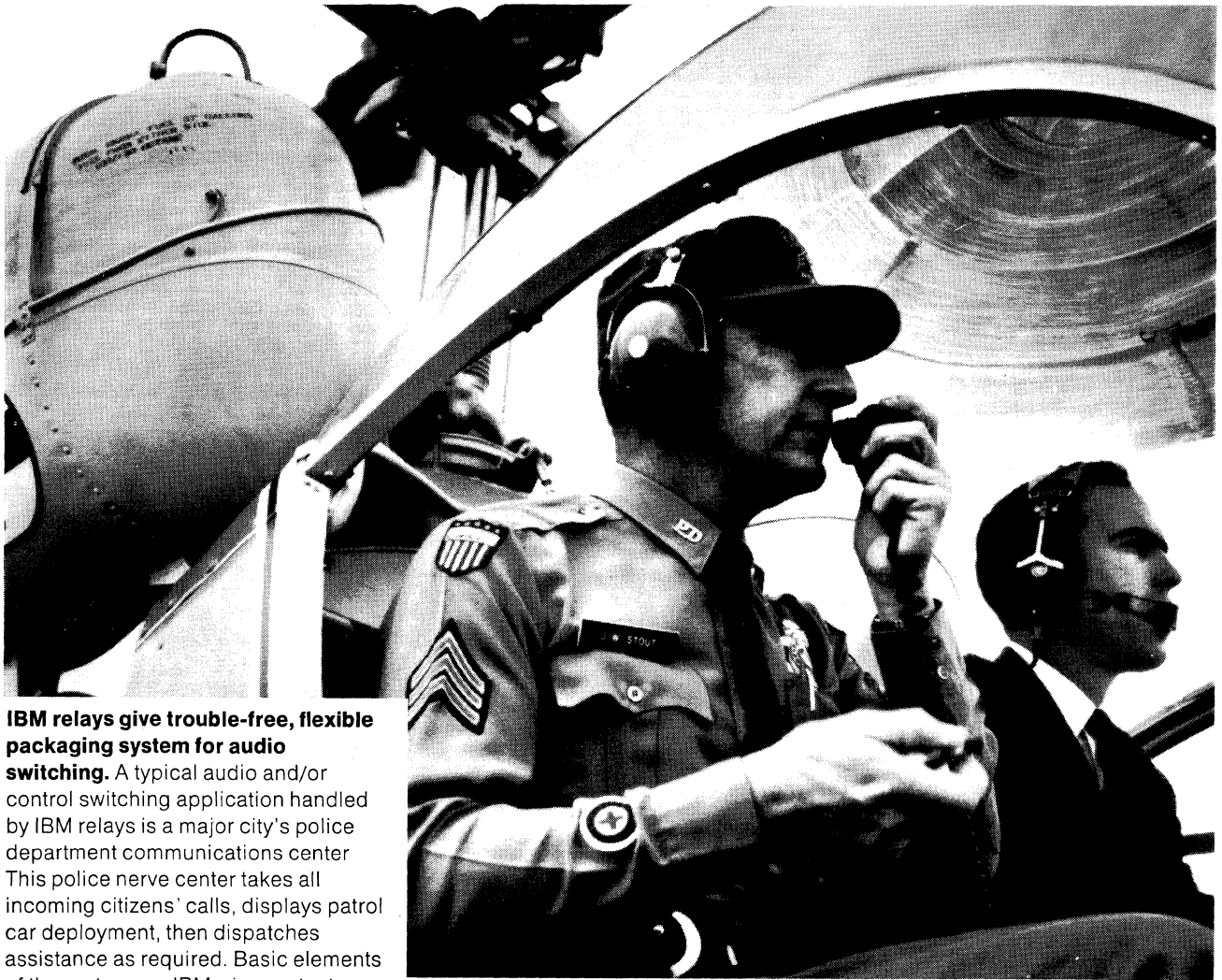
Some new switching applications for IBM relays you may want to think about.

IBM relays reduce size and cost of elevator control switching. IBM relays now help elevator manufacturers reduce the size of increasingly complex control systems without sacrificing reliability. Because IBM's long-life wire contact relays allow very dense packaging, manufacturers can cut elevator control unit size by over 75%. This also means substantial production savings plus economies in shipping and installation. IBM relays cost less per contact and their multi-pole design reduces the number of relays needed. Further flexibility is provided by the relay's plug-in insertion and taper-pin wiring of receptacles which allow for expansion. Long life, ease of maintenance as well as compact pluggability make IBM relays an ideal solution to new elevator control system design.



IBM reeds deliver high reliability in switching low-level RF signals. For applications requiring fast, ultra-reliable, low-level switching IBM offers a line of reed relays and switches. These reeds are particularly suited for complex products where trouble-free, remote control dependability is critical. Take, for example, the huge 1.6-mile-long radio research antenna that probes California's ionosphere. To monitor the ionospheric waves, signals must be precisely delayed for simultaneous addition along the entire length of the 9000-foot antenna array. Multi-switching presents special problems in RF ranges. IBM reeds were specifically selected to handle the complex antenna operation, because the job demands long-life, rapid programming, minimum crosstalk and maximum bandwidth. IBM reed relays and switches also serve as an excellent interface between solid state and relay logic.





IBM relays give trouble-free, flexible packaging system for audio switching. A typical audio and/or control switching application handled by IBM relays is a major city's police department communications center This police nerve center takes all incoming citizens' calls, displays patrol car deployment, then dispatches assistance as required. Basic elements of the system are IBM wire contact relays, which after more than 10,000 hours of continuous duty have proven 100% reliable. This is expected, however, since IBM relays offer normal life of 200-million-plus operations. The relays are in critical circuits where overall operation of the system is affected. Since the same IBM relay handles both an audio function and a control (DC) mode circuit, design and service are also greatly simplified. The dual-purpose single component also speeds access for any diagnostic analysis of the switching modules.

IBM components help solve control switching problems. IBM offers a wide range of switching componentry and associated packaging hardware for a variety of design problems. These products cover all sorts of unexpected design applications from communications centers to automatic elevators, baggage information displays to gigantic electric signs. Time-tested and field-proven, IBM components deliver ultra-long-life, compact packaging and significant cost savings.

Send for full information on: ☐ Wire contact relays; ☐ Reed relays and switches; ☐ Circuit packaging systems. Write: IBM Industrial Products Dept. EEM, 1271 Avenue of the Americas, New York, N. Y. 10020.

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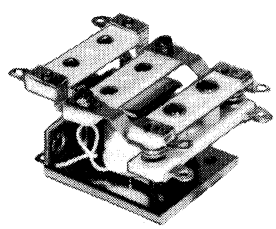
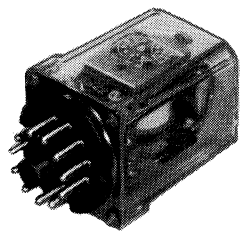
GENERAL PURPOSE RELAYS from KURMAN STOCK

SERIES 26

Series 26 Relays are stocked in dc and ac coil voltages with contacts to 4pdt in the open type and to 3pdt in the dust covered type. Standard contact rating at 28 vdc or 115 vac for open type is 20 amps to 3pdt, 10 amps for 4pdt; 10 amps for all dust covered plug in relays. Series 26 relays are rated for 15 g's shock, 10 g's vibration from 10 to 500 Hz. Series 26D relays (dust covered plug in) are available with indicator lights across the coil.



OPEN TYPE
Series 26



DUST COVERED
Series 26D

DC

	Part Number	Coil Resistance	Operating Specifications: Approx. Pull-In Current In MA	Pull-In Voltage In Volts	Maximum Coil Voltage	Coil Power	Contact Rating at 28VDC or 115VAC (Amps)	List Price
OPEN	**SPDT**							
	261C-6VDC	43	108	4.6	13	½ Watt	20	**$6.10**
	261C-12VDC	170	54	9.2	26	½ Watt	20	**6.10**
	261C-24VDC	680	27	18.4	52	½ Watt	20	**6.10**
	261C-48VDC	2700	14	36.7	108	½ Watt	20	**6.10**
	261C-110VDC	6800	8.6	58.4	165	½ Watt	20	**7.35**
	DPDT							
	262C-6VDC	27	193	5.0	10	1 Watt	20	**6.60**
	262C-12VDC	108	96	9.5	21	1 Watt	20	**6.60**
	262C-24VDC	428	48	18	41	1 Watt	20	**6.60**
	262C-48VDC	1700	24	41	82	1 Watt	20	**6.60**
	262C-110VDC	6800	12	80	165	1 Watt	20	**7.35**
	DPDT							
	26L2C-6VDC	27	185	5.0	10	1 Watt	30	**8.70**
	26L2C-12VDC	108	88	9.5	21	1 Watt	30	**8.70**
	26L2C-24VDC	428	48	20	41	1 Watt	30	**8.70**
	26L2C-110VDC	6800	12	80	165	1 Watt	30	**9.35**
	3PDT							
	263C-6VDC	17	300	5.05	8.2	1.5 Watts	20	**8.15**
	263C-12VDC	68	148	10	16.5	1.5 Watts	20	**8.15**
	263C-24VDC	270	75	20	33	1.5 Watts	20	**8.15**
	263C-48VDC	1080	37	40	66	1.5 Watts	20	**8.15**
	263C-110VDC	6800	15	100	165	1.5 Watts	20	**8.90**
	4PDT							
	264C-6VDC	11	430	4.7	6.6	2.0 Watts	10	**8.95**
	264C-12VDC	43	220	9.3	13	2.0 Watts	10	**8.95**
	264C-24VDC	170	108	19	26	2.0 Watts	10	**8.95**
	264C-48VDC	680	54	37	52	2.0 Watts	10	**8.95**
	264C-110VDC	4280	22	93	130	2.0 Watts	10	**9.60**
DUST COVERED	**SPDT**							
	26D1C-6VDC	27	136	3.7	10	1 Watt	10	**5.85**
	26D1C-12VDC	108	68	7.3	21	1 Watt	10	**5.85**
	26D1C-24VDC	428	34	14.7	41	1 Watt	10	**5.85**
	26D1C-48VDC	2700	14	36.7	108	1 Watt	10	**5.85**
	26D1C-110VDC	6800	8.6	58.4	165	1 Watt	10	**6.45**
	DPDT							
	26D2C-6VDC	27	193	5.0	10	1 Watt	10	**6.60**
	26D2C-12VDC	108	96	9.5	21	1 Watt	10	**6.60**
	26D2C-24VDC	428	48	20	41	1 Watt	10	**6.60**
	26D2C-48VDC	1700	24	41	82	1 Watt	10	**6.60**
	26D2C-110VDC	6800	12	80	165	1 Watt	10	**7.25**
	3PDT							
	26D3C-6VDC	17	300	5.05	8.2	1.5 Watts	10	**8.25**
	26D3C-12VDC	68	148	10	16.5	1.5 Watts	10	**8.25**
	26D3C-24VDC	270	75	20	33	1.5 Watts	10	**8.25**
	26D3C-48VDC	1080	37	40	66	1.5 Watts	10	**8.25**
	26D3C-110VDC	6800	15	100	165	1.5 Watts	10	**8.95**

AC

	Part Number	Coil Resistance	Approx. AC Current In MA at Pull-In Voltage	AC Voltage in Volts at 60 Hz: Pull-In Voltage	Nom. Coil Voltage	Max. Coil Voltage	Coil Power	Contact Rating at 28VDC or 115VAC (Amps)	List Price
OPEN	**SPDT**								
	261C-6VAC	2.7	736	5.5	6	7.0	4 VA	20	**$6.10**
	261C-12VAC	11	368	9.5	12	14	4 VA	20	**6.10**
	261C-24VAC	43	184	20	24	28	4 VA	20	**6.10**
	261C-115VAC	1080	36	95	115	140	4 VA	20	**6.10**
	261C-230VAC	4280	18	190	230	280	4 VA	20	**6.95**
	DPDT								
	26L2C-6VAC	2.5	675	5.5	6	6.9	4 VA	30	**8.70**
	26L2C-12VAC	10	335	10	12	14	4 VA	30	**8.70**
	26L2C-24VAC	39	170	21	24	27	4 VA	30	**8.70**
	26L2C-115VAC	480	35	95	115	130	4 VA	30	**8.70**
	26L2C-230VAC	3900	17	190	230	270	4 VA	30	**9.35**
	DPDT								
	262C-6VAC	2.5	675	5.5	6	6.9	4 VA	20	**6.60**
	262C-12VAC	10	337	10	12	14.1	4 VA	20	**6.60**
	262C-24VAC	39	170	21	24	27	4 VA	20	**6.60**
	262C-115VAC	980	33.7	95	115	140	4 VA	20	**6.60**
	262C-230VAC	3900	17.0	195	230	270	4 VA	20	**7.10**
	3PDT								
	263C-6VAC	2.5	675	5.5	6	6.9	4 VA	20	**8.35**
	263C-12VAC	10	337	10.5	12	14.1	4 VA	20	**8.35**
	263C-24VAC	39	170	21	24	27	4 VA	20	**8.35**
	263C-115VAC	980	33.7	95	115	140	4 VA	20	**8.35**
	263C-230VAC	3900	17.0	190	230	270	4 VA	20	**8.75**
DUST COVERED	**SPDT**								
	26D1C-6VAC	3.0	675	6	6	6.8	4 VA	10	**5.90**
	26D1C-12VAC	12	337	12	12	13.5	4 VA	10	**5.90**
	26D1C-24VAC	49	170	24	24	27	4 VA	10	**5.90**
	26D1C-115VAC	1200	33.7	115	115	130	4 VA	10	**5.90**
	26D1C-230VAC	4900	17.0	230	230	260	4 VA	10	**6.75**
	DPDT								
	26D2C-6VAC	3.0	675	5.5	6	6.8	4 VA	10	**6.65**
	26D2C-12VAC	12	337	9.5	12	13.5	4 VA	10	**6.65**
	26D2C-24VAC	49	170	20	24	27	4 VA	10	**6.65**
	26D2C-115VAC	1200	33.7	95	115	130	4 VA	10	**6.65**
	26D2C-230VAC	4900	17.0	195	230	260	4 VA	10	**7.10**
	3PDT								
	26D3C-6VAC	3.0	675	6	6	6.8	4 VA	10	**8.35**
	26D3C-12VAC	12	337	12	12	13.5	4 VA	10	**8.35**
	26D3C-24VAC	49	170	24	24	27	4 VA	10	**8.35**
	26D3C-115VAC	1200	33.7	115	115	130	4 VA	10	**8.35**
	26D3C-230VAC	4900	17.0	230	230	260	4 VA	10	**8.75**
HERMETICALLY SEALED	**DPDT**								
	26S01	980	35	95	115	130	4 VA	10	**15.50**
	DPDT								
	26S20	980	35	95	115	130	4 VA	10	**16.90**

	Part Number	Coil Resistance	Nominal Voltage	Contact Arrangement	List Price
NEON INDICATOR	**DPDT**				
	26D2CN-6VDC	27	6VDC	DPDT	**$7.55**
	26D2CN-12VDC	108	12VDC	DPDT	**7.55**
	26D2CN-24VDC	428	24VDC	DPDT	**7.55**
	26D2CN-110VDC	6800	110VDC	DPDT	**8.25**
	3PDT				
	26D3CN-6VDC	17	6VDC	3PDT	**9.35**
	26D3CN-12VDC	68	12VDC	3PDT	**9.35**
	26D3CN-24VDC	270	24VDC	3PDT	**9.35**
	26D3CN-110VDC	6800	110VDC	3PDT	**9.80**

	Part Number	Coil Resistance	Nominal Voltage	Contact Arrangement	List Price
NEON INDICATOR	**DPDT**				
	26D2CN-6VAC	3	6VAC	DPDT	**$7.65**
	26D2CN-12VAC	12	12VAC	DPDT	**7.65**
	26D2CN-24VAC	49	24VAC	DPDT	**7.65**
	26D2CN-115VAC	1200	115VAC	DPDT	**7.65**
	26D2CN-230VAC	4900	230VAC	DPDT	**8.05**
	3PDT				
	26D3CN-6VAC	3	6VAC	3PDT	**9.35**
	26D3CN-12VAC	12	12VAC	3PDT	**9.35**
	26D3CN-24VAC	49	24VAC	3PDT	**9.35**
	26D3CN-115VAC	1200	115VAC	3PDT	**9.35**
	26D3CN-230VAC	4900	230VAC	3PDT	**9.80**

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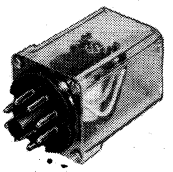
SENSITIVE RELAYS from KURMAN STOCK

SERIES 5

Series 5 Relays are current sensitive with 10 milliwatts sensitivity for the spdt and 100 mw per pole sensitivity for multipole types. Standard contact ratings at 28 vdc or 115 vac are 2 amps for spdt, 5 amps for multipole relays. Series 5 relays are available from stock in open and dust covered plug-in versions.



DUST COVERED
Series 5D



OPEN TYPE
Series 5

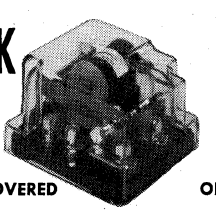
DC	Part Number	Coil Resistance In Ohms ±10%	Pull In	Currents in MA		Approx. Voltage in Volts		Sensitivity In Milliwatts Per Pole	List Price
				Max.	Drop Out	At Pull In I	At Max. I		
OPEN	**SPDT**								
	51C-A37D	500.	4.5	63	0.45	2.2	31.5	10	**$5.70**
	51C-A40D	2000.	2.3	32	0.22	4.5	64.0	10	**5.70**
	51C-A42D	5000.	1.4	20	0.14	7.0	100	10	**5.80**
	51C-A43D	8000.	1.2	16	0.11	9.6	128	10	**6.20**
	51C-B44D	13000.	0.6	12	0.06	8.2	156	5	**6.20**
	DPDT								
	52C-500D	500.	20	63	2	10.0	31	100	**6.20**
	52C-2500D	2500.	8.8	28	.8	22.0	70	100	**6.20**
	52C-5000D	5000.	6.3	20	.6	32.0	100	100	**6.40**
	52C-8000D	8000.	5.0	16	.5	40.0	128	100	**6.80**
	52C-10000D	10000.	4.4	14	.4	44.0	140	100	**6.80**
	3PDT								
	53C-500D	500.	24	63	2	12.2	31	100	**7.80**
	53C-2500D	2500.	11	29	1	27.5	72	100	**7.80**
	53C-5000D	5000.	7.7	20	.7	38.6	100	100	**7.90**
	53C-8000D	8000.	6.0	16	.6	49.0	128	100	**8.15**
	53C-10000D	10000.	5.4	14	.5	54.0	140	100	**8.35**
	4PDT								
	54C-500D	500.	28.2	63	2	14.2	31	100	**8.20**
	54C-2500D	2500.	12.7	29	1	31.8	72	100	**8.20**
	54C-5000D	5000.	8.9	20	.8	44.4	100	100	**8.30**
	54C-8000D	8000.	7.0	16	.7	57.2	128	100	**8.55**
	54C-10000D	10000.	6.4	14	.6	64.0	140	100	**8.75**
DUST COVERED	**SPDT**								
	5D1C-A37D	500.	4.5	63	0.45	2.2	31.5	10	**6.80**
	5D1C-A40D	2000.	2.3	32	0.22	4.5	64.0	10	**6.80**
	5D1C-A42D	5000.	1.4	20	0.14	7.0	100	10	**6.90**
	5D1C-A43D	8000.	1.2	16	0.11	9.6	128	10	**7.30**
	5D1C-B44D	13000.	0.6	12	0.06	8.2	156	5	**7.30**
	DPDT								
	5D2C-500D	500.	20	63	2	10.0	31	100	**7.30**
	5D2C-2500D	2500.	8.8	28	.8	22.0	70	100	**7.30**
	5D2C-5000D	5000.	6.3	20	.6	32.0	100	100	**7.50**
	5D2C-8000D	8000.	5.0	16	.5	40.0	128	100	**7.90**
	5D2C-10000D	10000.	4.4	14	.4	44.0	140	100	**7.90**
	3PDT								
	5D3C-500D	500.	24	63	2	12.2	31	100	**8.90**
	5D3C-2500D	2500.	11	29	1	27.5	72	100	**8.90**
	5D3C-5000D	5000.	7.7	20	.7	38.6	100	100	**9.00**
	5D3C-8000D	8000.	6.0	16	.6	49.0	128	100	**9.25**
	5D3C-10000D	10000.	5.4	14	.5	54.0	140	100	**9.45**
	4PDT								
	5D4C-500D	500.	28.2	63	2	14.2	31	100	**9.30**
	5D4C-2500D	2500.	12.7	29	1	31.8	72	100	**9.30**
	5D4C-5000D	5000.	8.9	20	.8	44.4	100	100	**9.40**
	5D4C-8000D	8000.	7.0	16	.7	57.2	128	100	**9.65**
	5D4C-10000D	10000.	6.4	14	.6	64.0	140	100	**9.85**

AC	Part Number	Coil Resistance	Approx. AC Current in MA at Nom. Voltage	AC Voltage in Volts at 60 Hz			List Price
				Pull in	Nominal	Maximum	
OPEN	**SPDT**						
	51C-83A	32.	64	4.7	6	9.1	**$6.75**
	51C-86A	125.	32	9.3	12	18	**6.75**
	51C-89A	500.	16	18.5	24	36	**6.75**
DUST COVERED	**SPDT**						
	5D1C-83A	32.	64	4.7	6	9.1	**7.85**
	5D1C-86A	125.	32	9.3	12	18	**7.85**
	5D1C-89A	500.	16	18.5	24	36	**7.85**

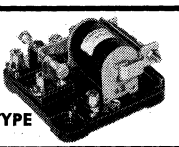
ULTRA SENSITIVE RELAYS from KURMAN STOCK

SERIES 300

Series 300 Ultra-Sensitive relays operate on only 2 milliwatts of power and yet can switch ½ amp at 28 vdc or 1 amp at 115 vac. They are ideal in low power input circuits where available power is at a minimum. They provide extremely low drain in battery operated equipment.



DUST COVERED



OPEN TYPE

DC	Part Number	Coil Resistance In Ohms ±10%	Operating Characteristics						Sensitivity In Milliwatts	List Price
			Currents In MA			Approx. Voltage in Volts				
			Pull In	Maximum	Drop Out	At Pull In	At Maximum	At Drop Out		
SERIES 300	310DC35	470	2.1	65	0.2	1.0	31	0.09	2	**$10.70**
	310DC37	1200	1.3	41	0.13	1.56	49	0.15	2	**10.70**
	310DC40	4680	0.65	20	0.06	3.0	98	0.3	2	**10.70**
	310DC42	11700	0.41	13	0.04	4.8	152	0.48	2	**12.95**
	310DC44	29250	0.26	8	0.02	7.6	243	0.7	2	**14.95**

AC	Part Number	Coil Resistance In Ohms ±10%	Operating Characteristics				List Price
			Approx. AC Current in MA at Nom. Voltage	AC Voltage in Volts at 60 Hz			
				Minimum	Nominal	Maximum	
SERIES 300	321DC78	19	59	5.2	6	17	**$11.30**
	321DC81	73	29	10	12	33	**11.30**
	321DC84	292	15	20	24	66	**11.30**
	321DC91	7300	3.2	95	115	300	**11.30**

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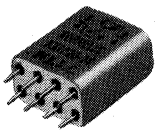
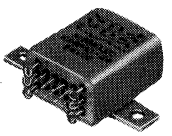
GENERAL PURPOSE CRYSTAL CAN RELAYS from KURMAN STOCK

SERIES KX

Series KX1 (2pdt) and KX4 (4pdt) Relays feature 2 amp contacts, 50 g's shock, and 20 g's vibration from 10 to 2000 Hz. KX1 relays have pins on 0.2" grid, KX4 on 0.1" grid. Both types available from stock with hook, or pin style headers.

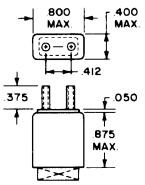


Dpdt General Purpose
150 Milliwatts/pole

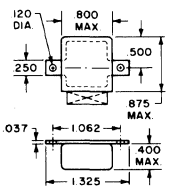


4pdt General Purpose
75 Milliwatts/Pole

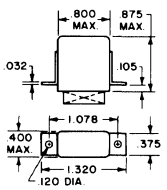
STYLE C



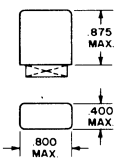
STYLE D



STYLE E



STYLE O

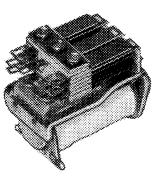


	Relay Number KX1 Series (DPDT)		Case Style	Terminal	DC Resistance (Ohms)	Nominal Voltage (VDC)	(25°C) (VDC) Pull-In Max.	(VDC) Min Drop-Out	List Price
DPDT	KX1P20	-6	O	Pin	35	6	3.5	0.3	$11.00
	KX1H2C		C	Hook					11.00
	KX1H2D		D	Hook					11.00
	KX1H2E		E	Hook					11.00
	KX1P20	-12	O	Pin	150	12	7	0.7	11.00
	KX1H2C		C	Hook					11.00
	KX1H2D		D	Hook					11.00
	KX1H2E		E	Hook					11.00
	KX1P20	-24	O	Pin	600	24	13.5	1.3	11.00
	KX1H2C		C	Hook					11.00
	KX1H2D		D	Hook					11.00
	KX1H2E		E	Hook					11.00
	Relay Number KX4 Series (4PDT)								
4DPT	KX4H4D	-6	D	Hook	35	6	3.5	0.3	26.00
	KX4H4E		E	Hook					26.00
	KX4H4D	-12	D	Hook	150	12	7	0.7	26.00
	KX4H4E		E	Hook					26.00
	KX4H4D	-24	D	Hook	600	24	13.5	1.3	26.00
	KX4H4E		E	Hook					26.00

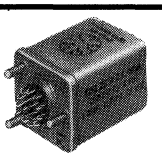
MINIATURE TELEPHONE RELAYS from KURMAN STOCK

SERIES M

Stocked only in 4pdt contacts, Kurman Miniature Telephone Relays, Series M, have 3 amp contacts, withstand 15 g's shock and 10 g's vibration from 10 to 500 Hz. Two specific ac models (hermetically-sealed only) and four open dc types, are stocked.



OPEN TYPE



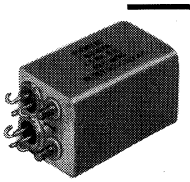
HERMETICALLY SEALED TYPE

Part Number	Coil Resistance In Ohms	Approx. Current in MA at Nom. Voltage	Voltage in Volts			List Price
			Pull-In	Nominal	Maximum	
M004-6D	30	200	5	6	11	$6.95
M004-12D	120	100	9.5	12	22	6.95
M004-24D	480	50	20	24	44	6.95
M004-110D	12000	9.2	95	110	220	7.95
Also STOCKED are the following Hermetically Sealed Relays:						
SM004-26D	300	89	18VDC	26VDC	35VDC	14.60
SM004-115A	3000	20	100VAC	115VAC	130VAC	16.75

SENSITIVE MILITARY-TYPE RELAYS from KURMAN STOCK

SERIES T

Series T Military-Type Relays are stocked in dpdt with contacts rated at 2 amps resistive at 28 vdc or 115 vac. Type T Relays are rated for 10 g's vibration from 10 to 55 Hz; 15 g's shock.



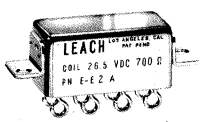
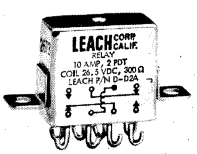
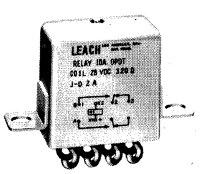
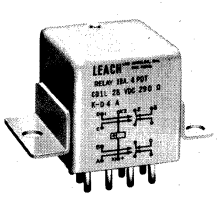
TWIN HEADER
Series T

Part Number	Coil Resistance in Ohms	Currents in MA		Approximate Voltage		List Price
		Pull-In	Maximum	Drop-out	At Pull-In	
T002-2000	2000	4.5	35	1.5	9	$16.00
T002-5000	5000	2.8	22	1.0	14	17.00
T002-8000	8000	2.3	18	.8	18	18.00

KURMAN INSTRUMENT CORP. • 15 BURKE LANE / SYOSSET, NEW YORK 11791 • (516) 921-7550

Leach Subminiature Relays Dry Circuit to 10 Amps

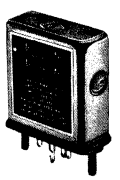
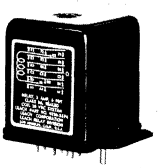
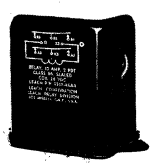
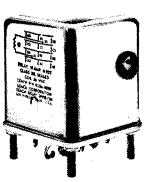
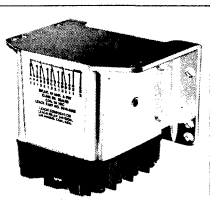
LEACH
CORPORATION
RELAY DIVISION
5915 Avalon Boulevard
Los Angeles, California
Tel: (213) 232-8221

		Contact Rating, Amps – Resistive	Contact Configuration	Nominal Operating Voltages	Resistance, Ohms ±10% @ 25°C	Bounce Time, Sec. Max. @ 26.5 VDC	Release Time, Sec. Max. Incl. Bounce @ 26.5 VDC	Operate Time Sec. Max. Incl. Bounce @ 26.5 VDC	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, Oz.
2 Amp, 2PDT Series G Microminiature Only 0.32 inch high, these low level to 2 amp relays save space where it's most needed in electronic circuit packaging. All welded construction assures reliable performance. 150 mil terminal spacing provides ample space for terminal connections, assures good dielectric capability. MIL-R-5757. 0.32"x0.310"x0.610".		Dry Circuit to 2	2 PDT	6 12 26.5 VDC	56 210 1350	.001	.004	.004	30	100	0.13
2 Amp, 2PDT Series E All welded half size relay for dry circuit/low level to 2 amp switching. Bifilar coil winding available. 6 mounting and 3 terminal types. MIL-R-5757. .800"x.410"x.400".		Dry Circuit to 2	2PDT	6 12 26.5 VDC	38 150 700	.002	.004	.004	30	100	.30
10 Amp, 2PDT Series D Most compact, welded relay for use where size and performance are critical. 6 mounting styles and 3 terminal types. MIL-R-5757. 1.015"x.885"x.515".		10	2PDT	6 12 26.5 VDC	18 70 300	.002	.010	.010	20	50	1.2
10 Amp, 2PDT Magnetic Latching Series CL Magnetic latch, all welded relay. Resistive contact rating: 10 amps. 5 mounting and 3 terminal types. MIL-R-5757. 1.015"x1.100"x.515".		10	2PDT Magnetic Latch	6 12 26.5 48 VDC	Each Coil 38 150 600 2350	.002	NA	.015	30	50	1.6
10 Amp, 2PDT Series J Balanced-Force* Relay. All welded, hermetically sealed. Special features insure meeting rupture and overload requirements. 3 mounting and 3 terminal types. MIL-R-6106. 1.015"x1.000"x.515". AC coil model available. 1.015"x1.125"x.515".		10	2PDT	6 12 28 VDC	20 80 320	.001	DC Coils .010	DC Coils .010	30	100	DC Coils 1.4
				28 115 VAC, 400 Hz	I_{coil} Max. .200 .040		AC Coils .050	AC Coils .015			AC Coils 1.4
10 Amp, 4PDT Series K Balanced-Force* Relay. All welded, polarized. Special features insure meeting rupture and overload requirements. 3 mounting and 3 terminal types. MIL-R-6106. AC coil model available. 1.015"x1.000"x1.015".		10	4PDT	6 12 28 VDC	18 70 290	.001	DC Coils .015	DC Coils .015	30	100	DC Coils 2.5
				28 115 VAC, 400 Hz	I_{coil} Max. .225 .040		AC Coils .050	AC Coils .020			AC Coils 2.7

*Patented and T.M. Leach Corp.

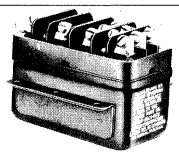
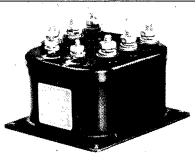
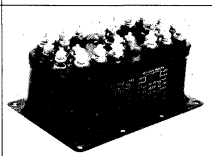
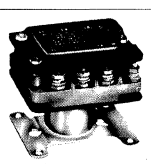
Leach Power and Control Relays 5 to 15 Amps

LEACH
CORPORATION
RELAY DIVISION
5915 Avalon Boulevard
Los Angeles, California
Tel: (213) 232-8221

		Contact Rating, Amps–Resistive	Contact Configuration	Nominal Operating Voltages	Resistance, Ohms ± 10% @ 25°C for 28 VDC	Maximum Release Time, Seconds	Maximum Operate Time, Seconds	Bounce Time, Seconds, Maximum	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, Lbs.
5 Amp, 2PDT **Series 9229** **Series 9235; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC, 400 Hz. Resistive: 5 amps; Inductive: 3 amps. 1.750″ x 1.531″ x .687″. MIL-R-6106, MIL-R-5757.		5	2PDT	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	9229 248Ω	AC Coils .050 DC Coils .020	AC Coils .020	.002	10	25	.18
					9235 310Ω	N.A.	DC Coils .020				.20
5 Amp, 4PDT **Series 9220** **Series 9228; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC, 400 Hz. Resistive: 5 amps; Inductive: 3 amps. 1.750″ x 1.531″ x 1.032″. MIL-R-6106, MIL-R-5757.		5	4PDT	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	9220 248Ω	AC Coils .050 DC Coils .020	AC Coils .020	.002	10	25	.30
					9228 200Ω	N.A.	DC Coils .020				.30
5 Amp, 6PDT **Series 9226** **Series 9223; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC, 400 Hz. Resistive: 5 amps; Inductive: 3 amps. 1.812″ x 1.531″ x 1.531″. MIL-R-6106, MIL-R-5757.		5	6PDT	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	9226 180Ω	AC Coils .050 DC Coils .020	AC Coils .020	.002	10	25	.40
					9223 200Ω	N.A.	DC Coils .020				.67
10 Amp, 2PDT **Series 9227** **Series 9237; Magnetic Latch** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. Resistive: 10 amps; Inductive: 6 amps DC and 10 amps AC. 1.781″ x 1.531″ x 1.032″. MIL-R-6106, MIL-R-5757.		10	2PDT	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	9227 175Ω	AC Coils .050 DC Coils .020	AC Coils .020	.002	10	25	.30
					9237 200Ω	N.A.	DC Coils .020				.30
10 Amp, 4PDT **Series 9224** **Series 9225; Magnetic Latch** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. Resistive: 10 amps; Inductive: 6 amps DC and 10 amps AC. 1.812″ x 1.531″ x 1.531″. MIL-R-6106, MIL-R-5757.		10	4PDT	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	9224 110Ω	AC Coils .050 DC Coils .020	AC Coils .020	.002	10	25	.43
					9225 200Ω	N.A.	DC Coils .020				.40
15 Amp, 4PDT **Series 9274** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. Resistive: 10 amps DC and 15 amps AC; Inductive: 10 DC and AC. 1.80″ x 2.06″ x 2.06″. MIL-R-6106.		15	4PDT	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	92Ω	AC Coils .050 DC Coils .020	AC Coils .025 DC Coils .025	N.O. .003 N.C. .005	10	25	.80

Leach Power Contactors 20 to 400 Amps

LEACH
CORPORATION
RELAY DIVISION
5915 Avalon Boulevard
Los Angeles, California
Tel: (213) 232-8221

		Contact Ratings, Amps – Resistive	Contact Configuration	Nominal Operating Voltages	Resistance – Ohms ± 10% @ 25°C – 26.5 VDC	Bounce Time, Seconds, Maximum	Release Time, Seconds, Maximum	Operate Time, Seconds, Maximum	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, Lbs.		Latch Model Available
20 Amp Series 9324 3PST/NO 25g shock, 10g vibration Bifilar coil winding available. MIL-R-6106.		20	3PST/NO	28 VDC; 115 VAC, 400 Hz; 115 VAC, 60 Hz	160	.002	AC Coils .050 DC Coils .010	AC Coils .025 DC Coils .020	10	25	.60	No
20 Amp Series 9325 3PDT/NO Mechanical interlock version of 9324. MIL-R-6106.		20	3PDT/NO	28 VDC; 115 VAC, 400 Hz; 115 VAC, 60 Hz	160	.005	AC Coils .050 DC Coils .010	AC Coils .025 DC Coils .020	10	25	1.4	Mech. Interlock
25 Amp Series 9123—3PST/NO 50g shock, 15g vibration. Auxiliary 5 amp contacts available. MIL-R-6106. Repairable models available.		25	3PST/NO	28 VDC; 115 VAC, 400/60 Hz	50	.002	AC Coils .050 DC Coils .010	.025	15	50	1.25	No
50 Amp Series 9124—3PST/NO 50g shock, 15g vibration. Auxiliary 5 amp contacts available. MIL-R-6106. Repairable models available.		50	3PST/NO	28 VDC; 115 VAC, 400/60 Hz	50	.002	AC Coils .050 DC Coils .010	.025	15	50	1.25	No
50 Amp Series 9125—6PST/NO Mechanical interlock version of 9124. MIL-R-6106. Aux. 5 amp contacts available.		50	6PST/NO	28 VDC; 115 VAC, 400/60 Hz	50	.002	AC Coils .050 DC Coils .010	.030	10	50	2.90	Mech. Interlock
100 Amp Series 9213 Sealed rotary, 1, 2, 3 and 4 pole. Auxiliary contacts from 5 amps. MIL-R-6106.		100	3PST/NO 4PST/NO	28 VDC; 115 VAC, 400 Hz; 115 VAC, 60 Hz	44.5	.010	AC Coils .060 DC Coils .020	AC Coils .040 DC Coils .030	10	25	2.7	No
25 to 100 Amp Series 9207 Unsealed rotary, 1, 2, 3 and 4 pole. Auxiliary contacts from 5 amps. MIL-R-6106.		25-100	3PST/NO 4PST/NO	28 VDC; 115 VAC, 400 Hz; 115 VAC, 60 Hz	44.5	.010	AC Coils .050 DC Coils .020	.030	10	50	1.6	No
25 to 400 Amp Solenoid Type Power Contactors MIL-R-6106.		25-400	1PST/NO 3PST/NO	28 VDC	Varying	N/A	.015	.040	2	25	2.6	No

Leach Electronic Time Delays

LEACH
CORPORATION
RELAY DIVISION
5915 Avalon Boulevard
Los Angeles, California
Tel: (213) 232-8221

	Enclosures	Enclosure Types Available	Timing Range (1)	Contact Rating–Resistive	Contact Configuration	Temperature Range	Accuracy (1)	Input Voltage	Maximum Operating Current @ 25°C	Transient Protection	Weight, Maximum	Dimensions, Maximum by Enclosure Type
Time Delay on Operate, Relay Output Series R300 Available in enclosure types 10, 20, 30	 Type 10	10	100 ms to 300 sec.	2 and 10 amp	2 PDT and 4 PDT	−55° to +125°C	±10%	18 to 32VDC	150 ma	pos. and neg.	8 oz.	1.5″ x 1.5″ x 1.8″
		20	100 ms to 300 sec.	2 and 10 amp	2 PDT				150 ma	pos. and neg.	5 oz.	1.2″ x 1.0″ x 1.8″
		30	100 ms to 180 sec.	2 amp	2 PDT				60 ma	pos.	3 oz.	1.0″ x 1.0″ x 1.3″
Time Delay on Operate, Solid State Output Series S300 Available in enclosure types 20, 30, 40	 Type 20	20	10 ms to 300 sec.	500 ma max.	1 PNO	−55° to +125°C	±10%	18 to 32VDC	60 ma	pos. and neg.	5 oz.	1.2″ x 1.0″ x 1.8″
		30	10 ms to 180 sec.	500 ma max.	1 PNO				30 ma	pos.	3 oz.	1.0″ x 1.0″ x 1.3″
		40	10 ms to 20 sec.	250 ma max.	1 PNO				30 ma	pos.	1 oz.	1.0″ x 0.5″ x 1.1″
Time Delay on Release, Relay Output, Positive or Negative Control Series R400 Available in enclosure types 10, 20, 30	 Type 30	10	100 ms to 300 sec.	2 and 10 amp	1 PDT and 3 PDT	−55° to +125°C	±10%	18 to 32VDC	150 ma	pos. and neg.	8 oz.	1.5″ x 1.5″ x 1.8″
		20	100 ms to 300 sec.	2 and 10 amp	1 PDT				150 ma	pos. and neg.	5 oz.	1.2″ x 1.0″ x 1.8″
		30	100 ms to 180 sec.	2 amp	1 PDT				60 ma	pos.	3 oz.	1.0″ x 1.0″ x 1.3″
Time Delay on Release, Solid State Output, Positive or Negative Control Series S400 Available in enclosure types 20, 30	 Type 40	20	10 ms to 300 sec.	500 ma max.	1 PNO	−55° to +125°C	±10%	18 to 32VDC	60 ma	pos. and neg.	5 oz.	1.2″ x 1.0″ x 1.8″
		30	10 ms to 180 sec.	500 ma max.	1 PNO				60 ma	pos.	3 oz.	1.0″ x 1.0″ x 1.3″
Time Delay on Operate, Solid State Output, Epoxy Case Series S350 Available in epoxy enclosure type 50	 Type 50	Epoxy 50	50 ms to 20 sec.	250 ma max.	1 PNO	−55° to +125°C	±10%	18 to 32VDC	15 ma	pos.	1 oz.	0.9″ x 0.9″ x 0.4″

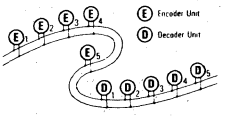
(1) Units with extended timing ranges and greater accuracy are available on special order.

RESONANT REED RELAYS REMOTE CONTROL SWITCHING WITH AUDIO SIGNALS

An audio tone can be generated by an electronic oscillator or resonant reed encoder circuit, then transmitted by wire or radio. The tone activates a resonant reed relay to perform a control function.

Bramco reeds permit over 60 selective control frequencies within the 67 to 3000 Hz spectrum. This is assured by: (1) the narrow response bandwidth of about 1% for decoders and (2) the high accuracy of Bramco reed encoders (1/10 of 1% of design frequency).

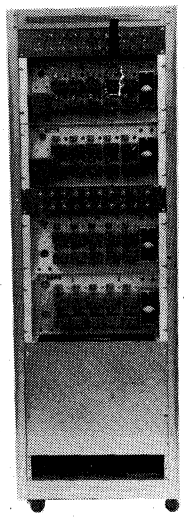
Shown here is a partial list of Bramco components and modules stocked for immediate shipment. Temperature stability of most Bramco reed products is .002% per °C.



A single pair of wires, or a leased telephone line, can carry the audio signals for a complete control system.



For inaccessible areas or mobile installations, a radio transmitter and receiver system can carry the signals.



BRAMCO 20/20 AM TONE TELEMETRY SYSTEM—

Just one of several readily available standard packages.

The Bramco tone transmitters and receivers are mounted onto standard 19″ chassis. All components, including the tone transmitters, tone receivers, amplifiers, power supplies, and relays, plug into the factory-wired chassis. This building block concept permits the user to begin with a partial complement of tone channels, then add modules as the system expands.

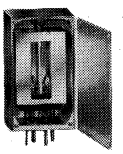
Price is approximately $150 per channel, compared to $250 per channel for the most popular LC type AM tone channels.

ALSO IN STOCK:

MA25C Solid State Linear Amplifier, 600 ohm input, adjustable gain 0 to 47 db. For up to 20 simultaneous tones. 1-9 qty., $69.

MPS1C Power Supply, 24 VDC at 800 ma, regulated and filtered, 1-9 qty., $59.

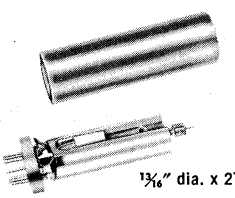
If the product you need isn't shown please contact factory or local representative for details on other stock models. We also custom design components, modules and systems to solve specific control problems. For Bramco LC Filters see sec. 2700.



.395″ x .620″ x 1.10″

RF20 CONTACTLESS RESONANT REED FILTER

Works as audio tone filter with sharp selectivity or as frequency source for stable audio tone generator. ***Frequency range:** 80 to 3000 Hz. **Frequency tolerance:** ±0.15%. **Impedance:** approx. 1000 ohms at resonance (input and output). **Input signal:** 0.1 VRMS. **Transfer ratio:** 30 to 60% at resonance (varies inversely to frequency). **Bandpass (typical):** ±0.35% at −12 db. ±2.5% at −18 db. **Price:** 1-9 qty., $20. A major state-of-the-art advance. Contactless concept makes it ideal for continuous tone fail-safe applications. Twin coil design with isolated input and output. Ideal for use as either encoder or decoder. Internally shock mounted, plug-in design.



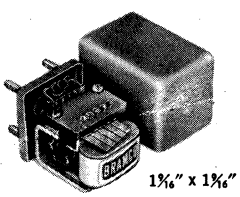
$1\frac{3}{16}$″ dia. x $2\frac{19}{32}$″

RE1 SINGLE CHANNEL RESONANT REED OSCILLATOR STABILIZER

***Frequency range:** 300 to 1600 Hz. **Frequency tolerance:** ±.1%. **Coil resistance:** 600 ohms. **Output:** Sine wave 2 VRMS in Bramco circuit. **Price:** 1-9 qty., $15. Hermetically sealed, internally shock mounted, 7 pin miniature tube base.

RD1 SINGLE CHANNEL FREQUENCY SENSING RESONANT REED RELAY

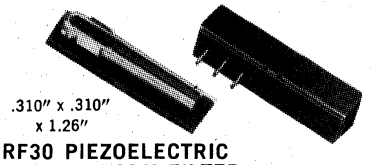
***Frequency range:** 300 to 1600 Hz. **Nominal bandwidth:** ±0.75% at 5 VRMS. **Coil resistance:** 600 ohms. **Contact rating:** 100 ma peak at 12 VDC. **Price:** 1-9 qty., $15. Hermetically sealed, internally shock mounted, 7 pin miniature tube base.



$1\frac{9}{16}$″ x $1\frac{9}{16}$″ x $2\frac{1}{4}$″

RD5S MULTI-CHANNEL FREQUENCY SENSING RESONANT REED RELAY

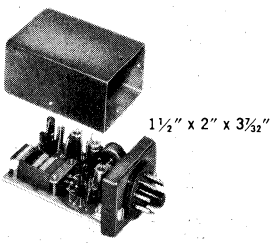
***Frequency range:** 200 to 600 Hz. **Nominal bandwidth:** ±1% at 6 VRMS. **Coil resistance:** 530 ohms. **Contact rating:** 100 ma peak at 50 VDC. **Price:** RD5S (housed) 1-9 qty., $21. RD5 (open) 1-9 qty., $12.50. Compact low cost, multi-frequency relay. It controls five switching circuits, individually or simultaneously.



.310″ x .310″ x 1.26″

RF30 PIEZOELECTRIC TUNING FORK FILTER

Smallest, most economical of Bramco audio tone family. **Frequency Range:** 300 to 3000 Hz. **Impedance:** approx. 300K (input and output). **Drive Level:** 2 VRMS. **Temperature Stability:** approx. 0.0035% per °C. Ideal when shock and mounting characteristics of RF20 are not required.



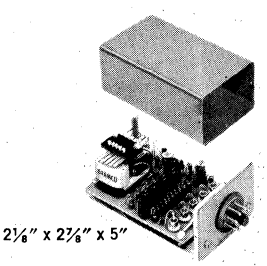
$1\frac{1}{2}$″ x 2″ x $3\frac{3}{32}$″

ME201C SINGLE CHANNEL RESONANT REED ENCODER MODULE

***Frequency range:** 80 to 3000 Hz. **Frequency tolerance:** ±0.15%. **Output:** Sine wave, adjustable to 2 VRMS into 600 ohms. **Power required:** 15 ma at 12 or 24 VDC. **Price:** 1-9 qty., $59. A complete transistorized fixed frequency oscillator circuit with plug-in, dual coil, RF20 resonant reed. Features independent feedback and output level adjustments. Standard octal tube base.

MD201C SINGLE CHANNEL RESONANT REED DECODER MODULE

***Frequency range:** 80 to 3000 Hz. **Nominal bandwidth:** ±0.75%. **Input signal:** 0.1 to 2.0 VRMS. **Output function:** 50 ma maximum. **Power required:** 15 ma at 12 VDC or 24 VDC plus external load. **Price:** 1-9 qty., $59. A complete transistorized high gain amplifier, contactless RF20 reed filter and secondary switching circuit. Standard octal tube base. Designed for continuous tone fail-safe applications. Ideal for systems with up to 10 simultaneous tones over phone lines.



$2\frac{1}{8}$″ x $2\frac{7}{8}$″ x 5″

MD5C FIVE CHANNEL RESONANT REED DECODER MODULE

***Frequency range:** 200 to 600 Hz. **Nominal bandwidth:** ±1% (constant above 2.0 VRMS input). **Input signal:** 1.5 to 5.0 VRMS (into 0.2 megohms). **Output functions:** 5 with 50 ma at 24 VDC. **Power required:** 30 ma at 24 VDC plus external loads. **Price:** 1-9 qty., $79. A complete transistorized high gain, constant output amplifier, multi-channel decoder with 5 secondary transistor switching circuits. Standard octal tube base. Designed for non-simultaneous tone systems.

LEDEX

BRAMCO CONTROLS DIVISION, LEDEX INC.
College and South Streets, Piqua, Ohio 45356 • Phone 513-773-8271

LOGITEK ELECTRONIC SENSORS & CONTROLS

DIVISION. GENERAL DEVICES. INC.

Logitek's comprehensive line of time-delay and voltage-, frequency- and phase-sensitive relays utilize the most advanced design and manufacturing techniques for long-term reliability—provide uncompromising performance in rigorous military, aerospace and industrial systems. All units are hermetically sealed, meet applicable requirements of MIL-I-6181D, MIL-R-5757D, MIL-R-6106C, and MIL-Std-704A. Contact ratings 2A and 10A resistive, 1A and 5A inductive, operating life 100,000 cycles minimum.

PHASE ROTATION SENSORS

Protect rotating components and other three-phase loads from damage that could occur from phase reversals or absence of any phase. Contacts may be used to disconnect load or operate alarms.

Operating Voltage	120/208 vac, 400 Hz, 3 Ø, wye
Phase Displacement	120 ±5 degrees max.
Permissible Distortion	total 8%, any harmonic 5%
Response Time	20 msec max.
Case Style	A, B, C, D

For data, request Bulletin 201

SOLID STATE FLASHERS

Up to 10 channels; conform to MIL specs for airborne applications. Cordwood packaging for maximum density, hard mounted and encapsulated.

Input	18-31 vdc
Load Current	up to 2.5 A
Flash Rate	up to 120 per min
Flash/Off Ratio	up to 2.4:1
Case Style	A, B, C, D

For data, request Bulletins 701 thru 704

DC VOLTAGE SENSING RELAYS

Provide alarm or disconnect signals when DC line voltage departs from normal. Insensitive to normal transients. Available with factory-set or adjustable bandwidth and time delays to pickup and drop-out.

Sense Band	18-32 vdc
Accuracy	±0.6 vdc
Hysteresis	0.5 ±0.2 vdc max.
Case Styles	A, B, C, D

For data, request Bulletin 401

AC VOLTAGE SENSING RELAYS

Provide alarm, indication or disconnect signals for single—or 3—phase lines when voltage exceeds high or low limits. Available with time delays to prevent dropout due to transients.

Input Power	115 vac, 400 Hz nominal
Sense Bands	96 to 140 vac
Time Delays	10 ms to 10 sec.
Case Style	A, B, C, D

For data, request Bulletins 801, 802, 803 and 804

FREQUENCY SENSING RELAYS

Time-delayed, band frequency sensing relays, for applications where systems must be de-energized or alarms actuated when line frequency departs from normal. For single-phase or wye-wired systems.

Line Voltage	100-130 vrms
Nominal Line Frequency	60 or 400 Hz
Accuracy	up to ±3% of nominal
Delay	20 ms to 10 sec
Case Style	A, B, C, D

For data, request Bulletin 501

AC SOLID STATE RELAYS

Contactless relays for long life and high reliability. Normally-open and normally-closed configurations with complete isolation between switching and coil terminals.

Operating Voltage	12-32 vdc
Control Signal	Ground
Switched Signal	2-150 vac, 40-400 Hz
Pull-In Time	100 usec max
Drop-Out Time	½ cycle max
Case Style	E, F, G, H

For data, request Bulletin 901

TIME DELAY RELAYS

Delay on drop-out, pull-in, true delay on drop-out and controlled-delay on drop-out. Timing ranges from 50 msec to 300 sec, factory-set or externally adjustable. Standard and crystal can sizes.

Operating Voltage	18-31 vdc
Accuracy	10%, 5%, 2%
Repeatability	±1%, any voltage and temperature
Reset Time	5 msec max.
Case Style	A, B, C, D

For data, request Bulletins 601, 602, 603, 604, 605, 606

POWER MONITORS

Provide time-delayed alarm or shutdown signals when voltage, frequency or phase rotation characteristics of power line depart from specified limits.

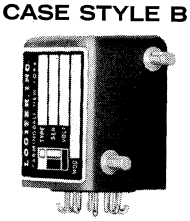
Voltage	120/280 vac, 3 Ø, 4-wire, wye
Voltage Sense Band	100-150 vrms
Frequency Sense Band	300-500 Hz
Pickup and Dropout Delay	50 ms to 10 sec.
Case Styles	A, D

For data, request Bulletin 1001

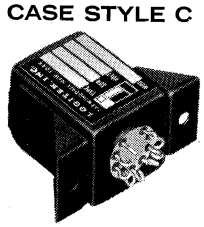
CASE STYLE A



CASE STYLE B



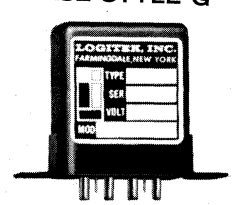
CASE STYLE C



CASE STYLE D



CASE STYLE G



LOGITEK 42 CENTRAL AVENUE, FARMINGDALE, NEW YORK 11738 • (516) 694-3080
DIVISION. GENERAL DEVICES. INC.



LIBERTY CONTROLS

DIV. OF LIBERTY LEASING CO., INC.

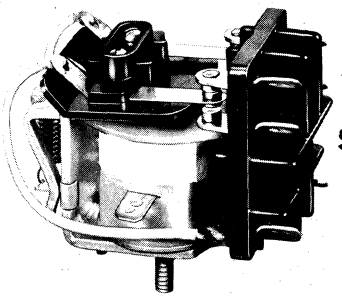
(FORMERLY MOSSMAN-ELLIOTT CORP.)

RELAYS, TELEPHONE TYPE • POWER RELAYS • SOLENOIDS • TIMERS • ELECTRO-MECHANICAL DEVICES

SPECIAL CONTACT MATERIAL AVAILABLE

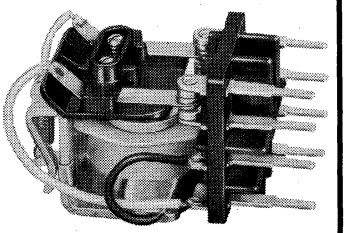
CONSULT US

Standard - Silver Cad - Oxide - Gold Flashed



210 215 SERIES

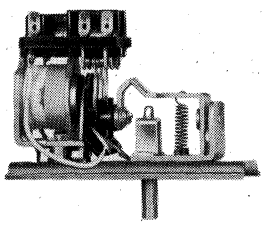
GENERAL PURPOSE RELAY



LISTED BY UNDERWRITERS LABORATORIES FILE #35253

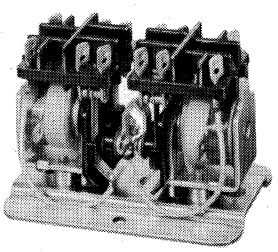
For use where acceptibility of the combination is determined by U/L

LATCHING TYPES MANUAL RESET 218 SERIES



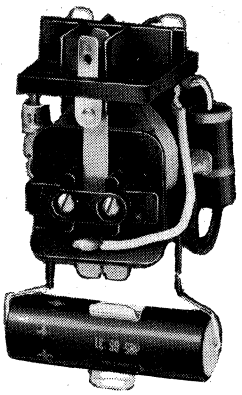
Any Relay up to 3PDT may be used on this unit.

ELECTRICAL SWITCHING OR RESET 214 SERIES



Any combination of Relays up to 6PDT may be used, including 2 different coil voltages or resistances.

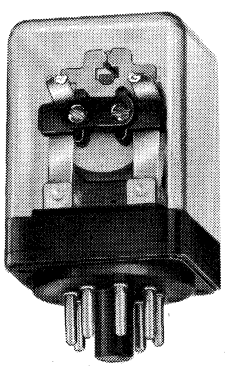
TIME DELAY RELAY



Delays of .01 to 180 seconds Available. Contacts to 3PDT.

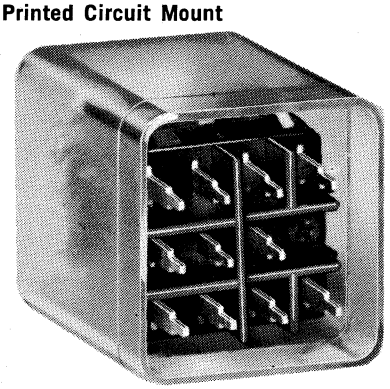
220 & 225 SERIES

GENERAL PURPOSE PLUG-IN



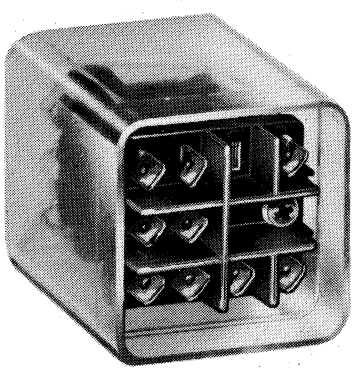
223 & 228 SERIES

Printed Circuit Mount



224 & 229 SERIES

Combination .187" or Solder Lug



HERMETIC SEALING AVAILABLE — CONSULT US

NOTICE: Special Wiring Circuits Contact Arrangements and Coil Voltages are Available.

Consult The Factory

LIBERTY CONTROLS

DIV. OF LIBERTY LEASING CO., INC.

Shorewood, Illinois • RFD 5 Joliet, Illinois 60431

Phone (815) 725 - 2241

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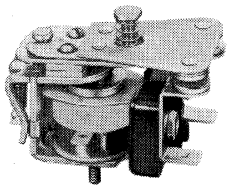
RELAYS, TELEPHONE TYPE • POWER RELAYS • SOLENOIDS • TIMERS • ELECTRO-MECHANICAL DEVICES

CONTACT RATING
25 AMPS @ 120 - 240 V.A.C. RESISTIVE
1 HP 120 - 240 V.A.C.



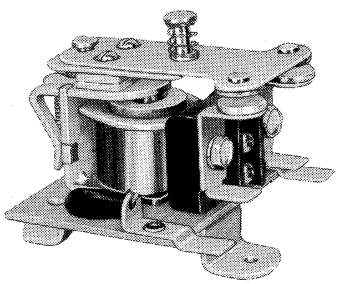
240 250 SERIES

LISTED BY UNDERWRITERS LABORATORIES FILE #35253

For use where acceptability of the combination is determined by U/L

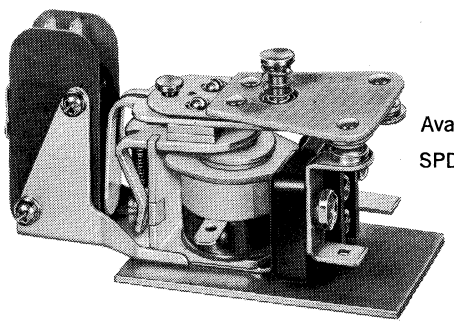
STANDARD CONTACT MATERIAL
SILVER - CAD - OXIDE

240 SERIES



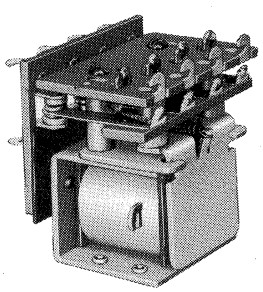
Available with 5 Amp SPDT Auxiliary Switch — 241 Series

251 SERIES



Available with 5 Amp SPDT Auxiliary Switch — 251 Series

630 SERIES POWER RELAY



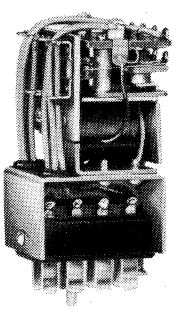
2 - 3 - 4 POLE HEAVY DUTY RELAY

15-AMP CONTACTS

Rated at 15 Amps
120V 60HZ Resistive Gold Plated Silver Contacts

The 630 relay is a heavy duty multi-purpose, multi-contact relay. Varied contact combinations and high dielectric phenolic insulation afford great versatility and utility. The 630 relay is widely used in such applications as industrial controls, elevator controls, communications equipment and electronic measuring devices. Rugged, heavy duty construction and large gold plated silver contacts make this a relay to provide long trouble free life. Available for AC or DC operation.

PLUG-INS



633 SERIES

633 Series available with 8 Pin, 12 Pin, and 18 Pin Jones Plugs

634 Series available with 8 Pin, 12 Pin, and 20 Pin Octal Type Plugs

NOTICE: Special Contact Materials Available. Special Coil Voltages Available.

Consult The Factory

LIBERTY CONTROLS
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Shorewood, Illinois • RFD 5 Joliet, Illinois 60431
Phone (815) 725 - 2241



LIBERTY CONTROLS

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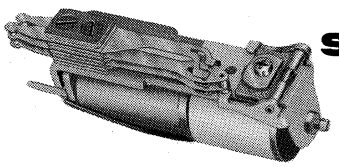
(FORMERLY MOSSMAN-ELLIOTT CORP.)

RELAYS, TELEPHONE TYPE • POWER RELAYS • SOLENOIDS • TIMERS • ELECTRO-MECHANICAL DEVICES

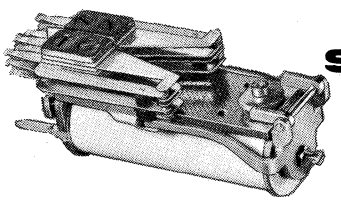
Many Contact Materials Available
Single or Twin Contacts
Contact Forms A to E
24 Springs Max. Per Pile-up



B SERIES
Telephone Type Relay

Types
DC
BQA — (Quick Acting)
BSO — (Slow Operating)
BSR — (Slow Releasing)
AC
BAC — (Quick Acting)

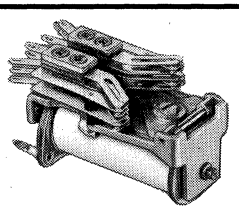
General Purpose Telephone Type Relay
Single or Twin Contacts
Contact Forms A to E
26 Springs Max. Per Pile-up



C SERIES
Telephone Type Relay

Types
DC
CQA — (Quick Acting)
CSO — (Slow Operate)
CSA — (Slow Rlease)
AC
CAC — (Quick Acting)

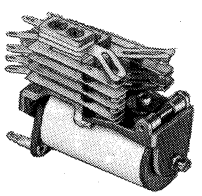
High Sensitivity in Minimum Space
Single or Twin Contacts
Contact Forms A to E
24 Springs Max. Per Pile-up



F SERIES
Telephone Type Relay

Types
FQA — (Quick Acting)
FSO — (Slow Operate)
FSR — (Slow Release)

Many Contact Materials Available
Single or Twin Contacts
Available in Open Types, Lexan Cover, Metal Cover & Hermetically Sealed



G SERIES
Telephone Type Relay

Types
DC
GQA — (Quick Acting)
GSO — (Slow Operate)
GSR — (Slow Release)
AC
GAC — (Quick Acting)

SERIES G LATCH RELAY



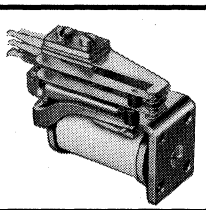
The Series G Latch Relay is made up of two Series G relays with provisions for mechanical interlock.

GQIN PLUG-IN



The GQIN in a Series G relay with a mating flush mounted socket and clear plastic cover which snaps over the socket. The Series GQIN features no internal wiring to improve reliability.

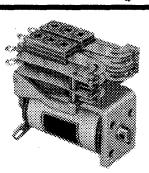
Single Contacts — Single Pile-up
Contact Forms A to E
12 Springs Maximum



M SERIES
Telephone Type Relay

Types
DC
MQA — (Quick Acting)
MSO — (Slow Operate)
MSR — (Slow Release)
AC
MAC — (Quick Acting)

Small — Lightweight
Small or Twin Contacts
Contact Forms A, B, C or D
7 Springs Max. Per Pile-up



S SERIES
Telephone Type Relay

Types
SQA — (Quick Acting)
SKO — (Quick Acting) Oversize Coil

NOTICE: Special Wiring Circuits Contact Arrangements and Coil Voltages are Available.

Consult The Factory

LIBERTY CONTROLS
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LIBERTY CONTROLS

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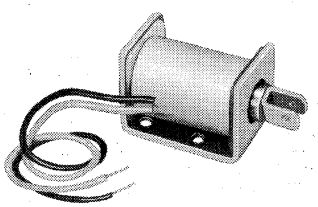
RELAYS, TELEPHONE TYPE • POWER RELAYS • SOLENOIDS • TIMERS • ELECTRO-MECHANICAL DEVICES

SOLENOIDS

Efficient, useful and simple, Liberty Controls solenoids are designed with the same thoroughness and manufactured with the same integrity that characterizes all Liberty Controls products.

The heavy one piece U-shaped frame and the end plate are made of pure magnetic ingot iron — properly annealed to obtain maximum magnetic efficiency. The dove-tailed frame and end plate are securely staked together, forming an assembly that is permanently tight and inherently efficient. Coils of top-grade magnet wire are precision wound on specially treated bobbins. For high temperature applications, special magnetic wire is used and coils are impregnated with a tough, inorganic electrical varnish. Available for either AC or DC

TYPE 61

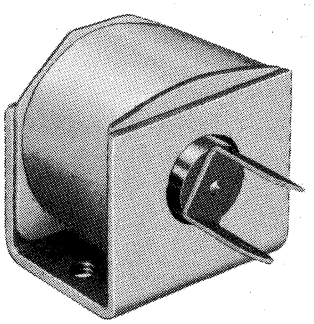


Size: .750″ x .813″ x 1 3/16″ Long

Mounting: 3 — #6-32 Holes

Termination: Wire Leads, Solder Terminals, .187 & .250 Quick Disconnects

TYPE 62

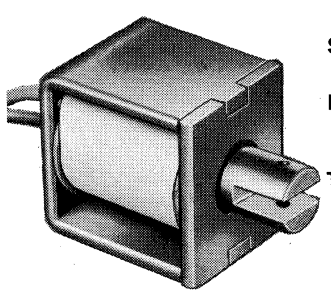


Size: 1.076″ x 1.375″ x 1.156″ Long

Mounting: 2 — #10-32 Holes on 1″ Centers

Termination: Wire Leads, Solder Terminals, .187 & .250 Quick Disconnects

TYPE 81

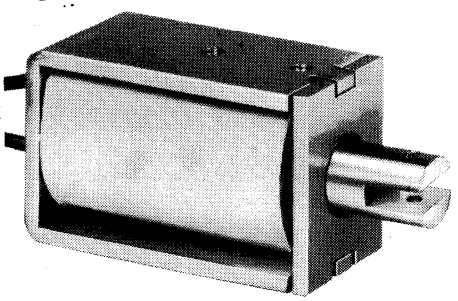


Size: 1″ x 1 1/4″ x 1 3/32″ Long

Mounting: 4 — #8-32 Holes on 5/8″ Centers

Termination: Wire Leads, Solder Terminals, .187 & .250 Quick Disconnects

TYPE 82

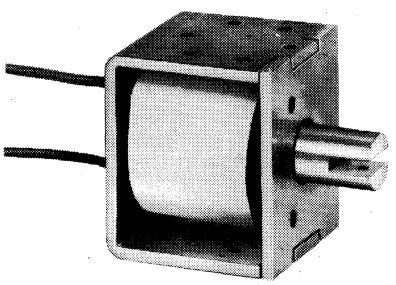


Size: 1″ x 1 1/4″ x 2″ Long

Mounting: 4 — #8-32 Holes on 5/8″ Centers

Termination: Wire Leads, Solder Terminals, .187 & .250 Quick Disconnects

TYPE 88

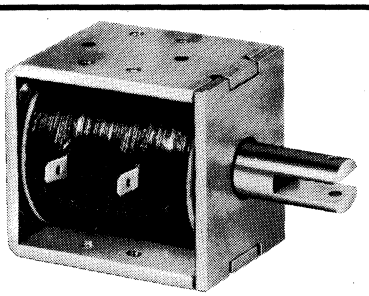


Size: 1.562″ x 1.882″ x 1 5/8″ Long

Mounting: 4 — #8-32 Holes on 1/2″ x 15/16″ Centers

Termination: Wire Leads, Solder Terminals, .187 & .250 Quick Disconnects

TYPE 89

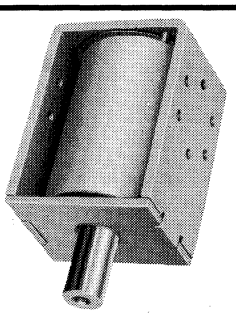


Size: 1 9/16″ x 1 3/4″ x 2 1/8″ Long

Mounting: 4 — #8-32 Holes on 1/2″ x 15/16″ Centers

Termination: Wire Leads, Solder Terminals, .187 & .250 Quick Disconnects

TYPE 90



Size: 1.562″ x 1.818″ x x 2 5/8″ Long

Mounting: 4 — #8-32 Holes on 1/2″ x 15/16″ Centers

Termination: Wire Leads, Solder Terminals, .187 & .250 Quick Disconnects

NOTICE: Special Arrangements of Frame, Mounting & Plunger Styles are Available.

Consult The Factory

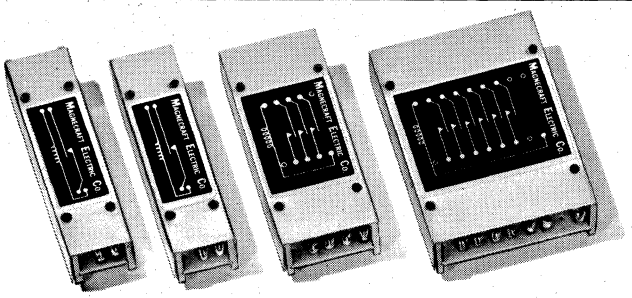
LIBERTY CONTROLS

DIV. OF LIBERTY LEASING CO., INC.

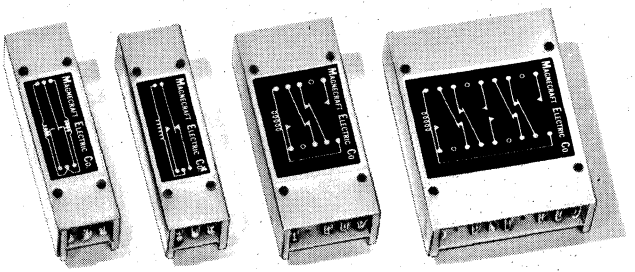
Shorewood, Illinois • RFD 5 Joliet, Illinois 60431

Phone (815) 725 - 2241

Low Profile, MPC Package, Standard Size, Printed Circuit Reed Relays

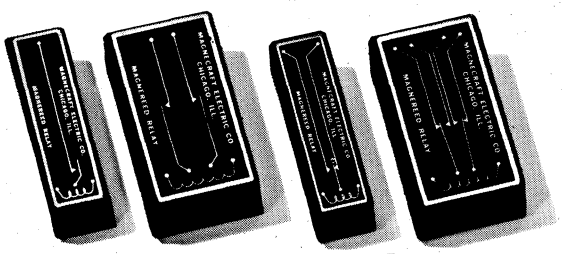


102RMPC SPST-NO 3 ampere POWER | 102MPC SPST-NO | 102MPC 3PST-NO | 102MPC 6PST-NO



103LMPC SPDT Magnetic Latching | 103MPC SPDT | 103MPC DPDT | 103MPC 4PDT

Encapsulated, Standard Size, Printed Circuit

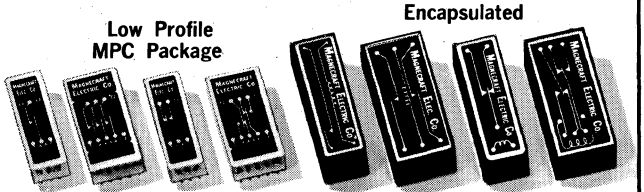


102PC SPST-NO | 102PC DPST-NO | 103PC SPDT | 103PC DPDT

Miniature Printed Circuit Reed Relays

Low Profile MPC Package

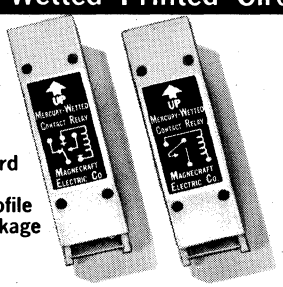
Encapsulated



101MPC SPST-NO | 101MPC 3PST-NO | 104MPC SPDT | 104MPC DPDT | 101PC SPST-NO | 101PC DPST-NO | 104PC SPDT | 104PC DPDT

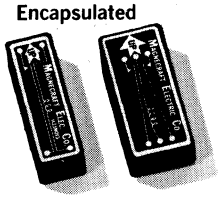
Mercury-Wetted Printed Circuit Reed Relays

Standard Size Low Profile MPC package



133MPC SPDT | 132MPC SPST-NO

Miniature Encapsulated



131PC SPST-NO | 131PC DPST-NO

Magnecraft® Relays

for all applications!

You'll find on these pages just a few of the many types and sizes of relays we make. In our extensive stock relay line are:

General Purpose	Time Delay
Telephone Type	Industrial Power
Coaxial	Hermetically Sealed

Reed and Mercury Wetted Relays

In addition, we can furnish specially designed relays to fit any specific design or unusual application you require.

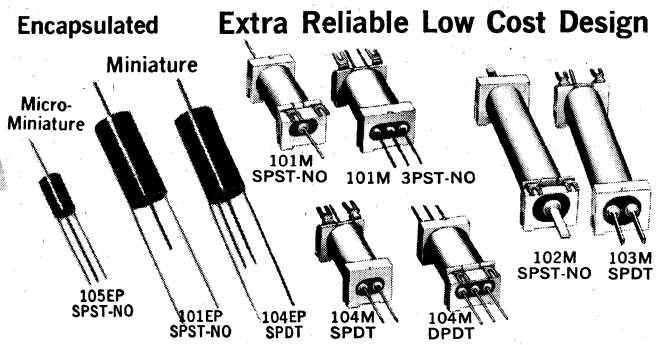
Since relays are our only business, we have an extensive knowledge and experience in this field, which we wish to share with you. That's why we prepared an informative "Designer's Handbook on Reed and Mercury Wetted Relays." It's yours for the asking as well as a copy of our latest stock catalog.

Magnecraft Relays available in many countries

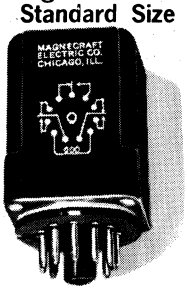
Magnecraft Relays are available from sales representatives at low factory prices throughout the United States, Canada and Western Europe. Whatever the relay application, your local Magnecraft sales representative is the man to see. His phone number is shown at right.

Dry Reed Relays with Axial Leads

Encapsulated — Extra Reliable Low Cost Design

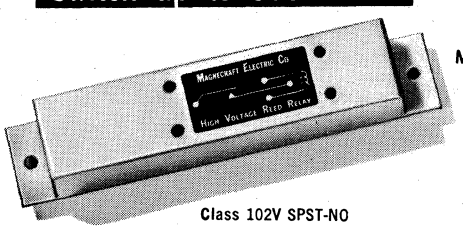


Plug-in Mounted Standard Size



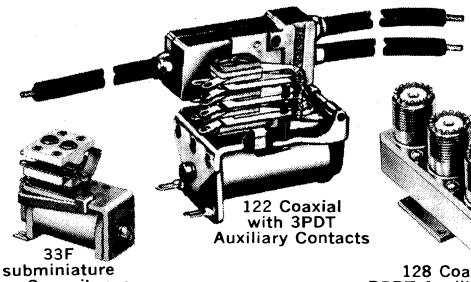
103CP DPDT, 3PDT

High Voltage Reed Relays Switch up to 5000 Volts



Class 102V SPST-NO

Coaxial and other RF Switching Relays

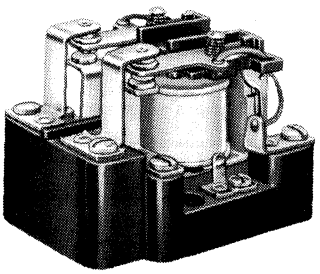


33F subminiature Low Capacitance

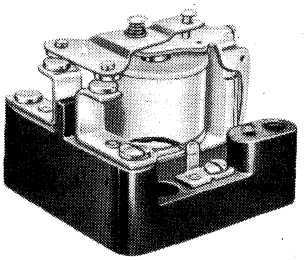
122 Coaxial with 3PDT Auxiliary Contacts

128 Coaxial with DPDT Auxiliary Contacts

Heavy Duty Power Relays



99 Heavy Duty Power 25 amps to DPDT UL Listing



99D Heavy Duty Power 50 amps SPST-NO-DB

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RELAYS YOU CAN RELY ON!

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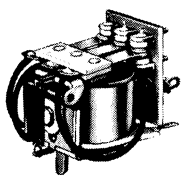
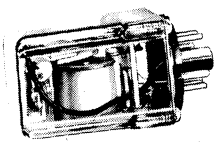
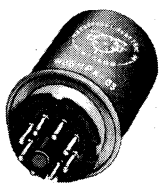
General Purpose Relays



88 open type 10 amps to 3PDT

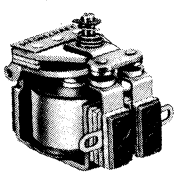


88CP enclosed plug-in mounted 10 amps to 3PDT

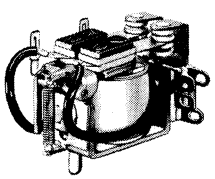


88HP hermetically sealed

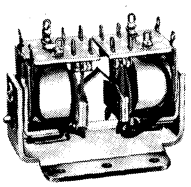
Power and Latching Relays



88D Power 50 amps SPST-NO-DB

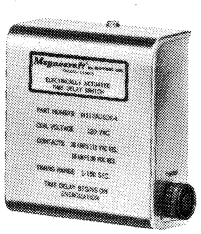


88R Power 15 amps to DPDT

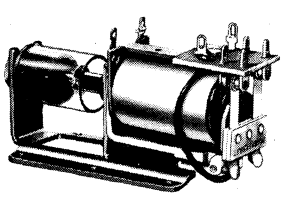


88L Latching 10 amps to 6PDT

Time Delay Relays

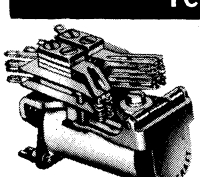


112 Electrically Actuated Time Delay 10 amps to DPDT with metal enclosure



110 Air Dashpot Time Delay 10 amps to 3PDT

Telephone Type Relays



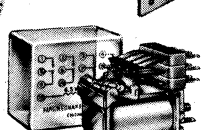
22T small size bifurcated contacts 4 amps to 6PDT



11 miniature 5 amps to 6PDT



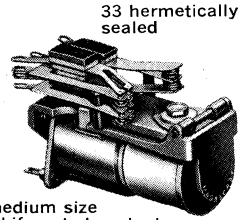
33 hermetically sealed



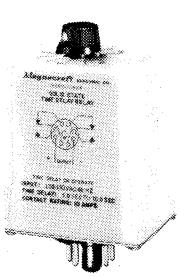
77 subminiature 5 amps, 4PDT snap-on cover



33 subminiature 3 amps to 4PDT



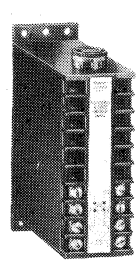
66 medium size with bifurcated contacts



211CP Solid State Time Delay 10 amps to DPDT

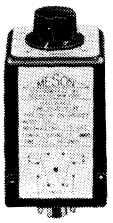
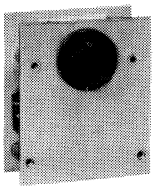
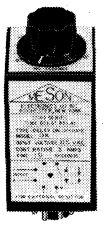


113C Manually Activated Time Delay 10 amps to SPDT



112M Electrically Actuated Time Delay 10 amps to DPDT with molded plastic enclosure

GUARANTEED MESON TIME DELAY RELAYS AT SPECIAL LOW PRICES

		1500 Series	1600 Series	1700 Series
				
Type		Delay on energizing	Delay on energizing	Delay on energizing
Models*		OF, OK, OE	OF, OK	OF, OK, OE
Enclosure		Black Polystyrene	Open—Should be mounted in moisture-free environment	Black High Impact Styrene
Mounting		Plug-in Octal for OF and OK 11 pin for OE	Panel Mounting (4 6-32 screws) 250 FASTON Terminals	Plug-in Octal
Output		DPDT 10 amp/115V AC resistive	SPDT 3A/115V AC resistive	SPDT 3A/115V AC resistive
Accuracy		±5% of full scale OK model	±10% of full scale OK model	±10% of full scale OK model
Repeatability		±1% after 2nd operation	±4%	±2% after 2nd operation
Reset Time		60 ms. max.	100 ms. max.	60 ms. max.
Recycle Time		60 ms. max.	2 sec. for 4% repeatability	2 sec. for 10% accuracy
Temperature	**Operate:**	—40° to +55°C	—10° to +55°C	—10° to +55°C
	Storage:	—55° to +85°C	—55° to +85°C	—55° to +85°C
Life		10,000,000 mechanical operations, minimum		
Power	**AC models**	10 ma deenergized, 10VA energized	10 ma, typically at any voltage AC or DC	10 ma deenergized, 25 ma max. energized
	DC models	10 ma deenergized, 3 watts max. energized		10 ma deenergized, 25 ma max. energized
Transient Protection		1000 V for 1 ma provided by thyrector diode	Protected against component damage and false triggering by capacitor across input.	Protected against component damage and false triggering by capacitor across input.
Other protection		DC models will not be damaged by application of reversed polarity input voltage		
Standard Input Voltages**		A2, A4 D2, D4, D5	A1, A2, A4 D2, D4	A2, A4 D2, D4, D5
Control Rate OE Model		10K ohms/sec.	N/A	10K ohms/sec.
Standard Knob Adjustable Times		10, 60, 180, 300 sec.	10, 30, 60, 180 sec.	10, 60, 180 sec.
Standard Fixed Times		1, 5, 10, 30, 60, 120, 180, 240, 300 sec.	1, 5, 10, 30, 60, 120, 180 sec.	1, 5, 10, 30, 60, 120, 180 sec.
Price—100 lot qty. range—depending on model		**$14.82 to 17.75**	**$11.73 to 12.50**	**$9.15 to 11.30**

* Models OF — Fixed
OK — Knob Adjustable
OE — Externally Adjustable

** A1 — 210-250 VAC
A2 — 105-125 VAC
A4 — 20-30 VAC

D2 — 95-125 VDC
D4 — 20-32 VDC
D5 — 10-14 VDC

WRITE OR CALL FOR COMPLETE DATA SHEETS

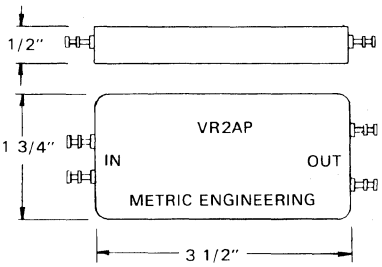
MESON ELECTRONICS, INC.
380 COTTAGE STREET • ROCHESTER, N.Y. 14611
Phone (716) 235-7070 A publicly owned company

DC VOLTAGE REGULATORS

• Completely Encapsulated • Withstand High Shock & Vibration • Efficient Series Circuit

4.0 AMP OUTPUT CURRENT
OUTPUT REGULATION:
Line: ±.02% for ±10% input voltage change.
±.05% for ±20% input voltage change.
Load: ±.1% with a 40% load change.
Maximum allowable dissipation: 80 watts @ +50°C Base.
Internal Potentiometer for ±10% voltage adjustment.
Input range from + or − 3 volts to + or − 40 volts maximum.
Protected against short circuits.





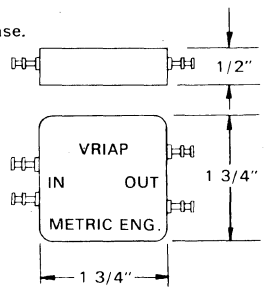
VR-2 Output setting range +3.2V to +12.0V
VR-7 Output Setting range −3.2V to −12.0V
Price: 1-9 units $79.50 ea.

VR-2 Output setting range +12.01V to +37V
VR-7 Output setting range −12.01V to −37V
Price: 1-9 units $74.50 ea.

PLEASE SPECIFY EXACT OUTPUT VOLTAGE AND INPUT VOLTAGE RANGE (IF AVAILABLE)

2.0 AMP OUTPUT CURRENT
OUTPUT REGULATION:
Line: ±.02% for ±10% input voltage change.
±.05% for ±20% input voltage change.
Load: ±.1% with a 40% load change.
Maximum allowable dissipation: 40 watts @ +50°C Base.
Internal Potentiometer for ±10% voltage adjustment.
Input range from + or − 3 volts to + or − 40 volts maximum.
Protected against short circuits.



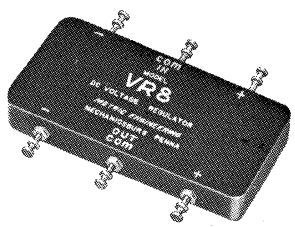


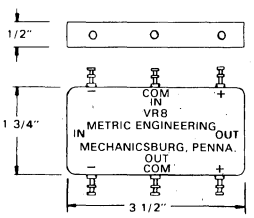
VR-1 Output setting range +3.2V to +12.0V
VR-6 Output setting range −3.2V to −12.0V
Price: 1-9 units $68.50 ea.

VR-1 Output setting range +12.01V to +37V
VR-6 Output setting range −12.01V to −37V
Price: 1-9 units $63.50 ea.

PLEASE SPECIFY EXACT OUTPUT VOLTAGE AND INPUT VOLTAGE RANGE (IF AVAILABLE)

POSITIVE AND NEGATIVE
DC VOLTAGE REGULATOR PACKAGE
2 or 4 amperes on each output
Independently Adjustable outputs by internal pot
Independent protection against short circuits
REGULATION:
±.02% for ±10% input voltage change
±.05% for ±20% input voltage change
±.1% with a 40% load change
Input Range from 3 volts differential to ±40 volts maximum

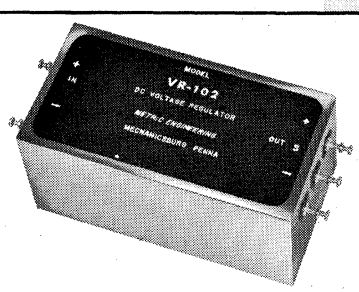




2 AMP MODEL NOS.	OUTPUT VOLTAGES	PRICE 1-9 UNITS
VR8AP	+3.6 to +12V & −3.6 to −12V	132.00 ea.
VR8BP	+3.6 to +12V & −12.01 to −37V	127.00 ea.
VR8CP	+12.01V to 37V & −3.6 to −12V	127.00 ea.
VR8DP	+12.01 to 37V & −12.01 to −37V	122.00 ea.

4 AMP MODEL NOS.	OUTPUT VOLTAGES	PRICE 1-9 UNITS
VR9AP	+3.6 to +12V & −3.6 to −12V	149.00 ea.
VR9BP	+3.6 to +12V & −12.01 to −37V	144.00 ea.
VR9CP	+12.01V to 37V & −3.6 to −12V	144.00 ea.
VR9DP	+12.01 to 37V & −12.01 to −37V	139.00 ea.

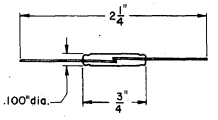
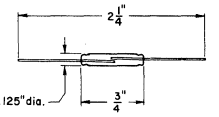
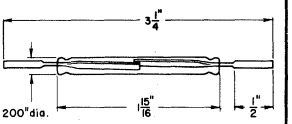
HI-POWER REGULATOR
15 AMPS—100 WATTS
Input: 15 to 50 VDC
Output: 10 to 45 VDC
Current: 15 amp maximum
Regulation: ±1% or better
Power Dissipation: 100 Watts at +50°C. base
Package Size: 2" x 2" x 4"
Model VR102 Price: 1-9 units 225.00 ea.



Order by Model No. from this page. Special Models Available to drive external transistors for high-power applications. Call or write for more information.

ME METRIC ENGINEERING
A Division of Greenray Industries, Inc.
P.O. Box 324
E. Simpson Road
Mechanicsburg, Pa. 17055
(717) 766-0741
SEND TODAY FOR COMPLETE CATALOG.

NPE's quality reed switches and reed relays meet industry's most demanding requirements

REED SWITCHES	SUBMINIATURE DRY REED SWITCH 692-121	MINIATURE DRY REED SWITCH 692-221	STANDARD DRY REED SWITCH 694-321
			
PHYSICAL CHARACTERISTICS			
Contact arrangement	Form A (SPSTNO)	Form A (SPSTNO)	Form A (SPSTNO)
Contact material*	Rhodium*	Rhodium*	Rhodium*
Atmosphere	Dry inert gas	Dry inert gas	Dry inert gas
Termination	Solderable or weldable	Solderable or weldable	Solderable or weldable
CONTACT RATINGS (maximum)			
Voltage	100 volts D.C., 150 volts A.C.	100 volts D.C., 150 volts A.C.	150 volts D.C., 250 volts A.C.
Current (switch)	.5 amp	.5 amp	1.5 amps
Current (carry)	3 amps	3 amps	6 amps
Power (D.C.)	15 watts	15 watts	25 watts
Power (A.C. suppressed)	25 volt-amperes	25 volt-amperes	40 volt-amperes
Resistance (initial)	100 milliohms	100 milliohms	50 milliohms
Peak breakdown voltage	300 volts	300 volts	500 volts
OPERATING PARAMETERS			
Pull-in (specify range)	25 to 80 ampere turns	25 to 80 ampere turns	40 to 100 ampere turns
Drop-out (specify range)	approx. ½ of pull-in	approx. ½ of pull-in	approx. ½ of pull-in
Operate speed	1 msec (incl. bounce)	1 msec (incl. bounce)	2.5 msec (incl. bounce)
Release speed	.1 msec	.1 msec	1.0 msec
Closure rate (maximum)	2000 hertz	2000 hertz	400 hertz
Temperature range	−55°C to +150°C	−55°C to +150°C	−55°C to +155°C
Insulation resistance	10^{12} ohms max.	10^{12} ohms max.	10^{12} ohms max.
Capacitance	.5 picofarad	.5 picofarad	1.5 picofarads
Shock	200G max., 11 ±1 msec	200G max., 11 ±1 msec	100G max., 11 ±1 msec
Vibration	30G max. @ 0 to 1700 hertz	30G max. @ 0 to 1700 hertz	30G max. @ 0 to 600 hertz
LIFE AND RELIABILITY (End-of-Life criteria: contact resistance of 1 ohm max. for Rated and Intermediate Loads, 2 ohms max. for Low Level and Dry Circuit Loads)			
Rated Power Load — Life	20×10^6	20×10^6	20×10^6
Intermediate Load — Life	100×10^6	100×10^6	100×10^6
Low Level Load — Life	100×10^6	100×10^6	100×10^6
Dry Circuit Load — Life	500×10^6	500×10^6	500×10^6

*NPE Dry Reed Switches are also available with diffused gold contacts. Physical Characteristics, Contact Ratings and Operating Parameters for gold contact switches available on request.

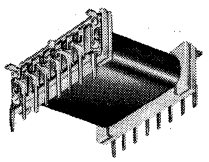
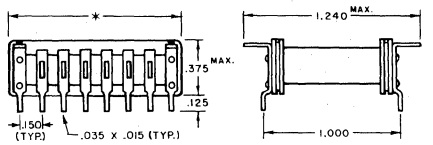
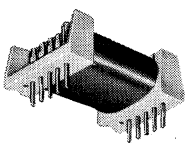
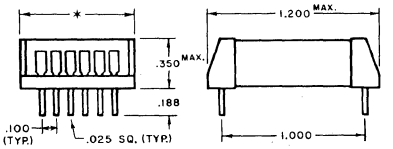
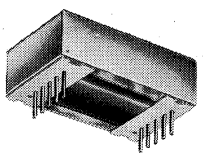
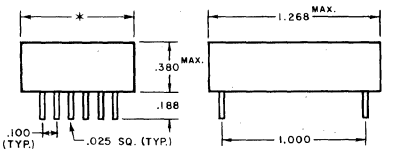
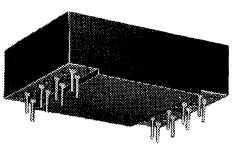
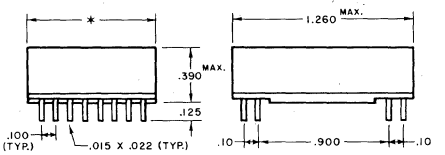
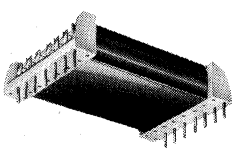
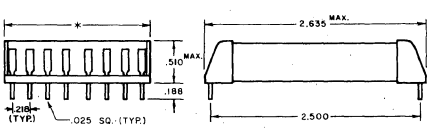
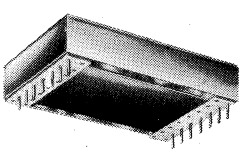
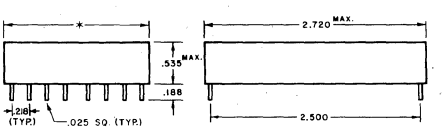
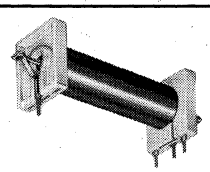
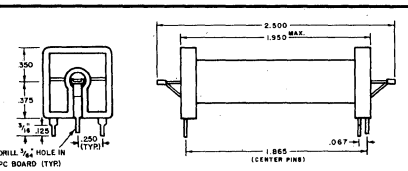
NPE REED SWITCHES are manufactured from basic quality components on automatic equipment in white-room facilities, free from dust and moisture to guarantee flawless contacts and reliable operation. Standard precision wound coils are available for testing all NPE reed switches.

NPE REED RELAYS contain certain inherent advantages, because we manufacture all of the components used in these products, including reed switches and coils. Furthermore, NPE also fabricates other more sophisticated electronic equipment, such as logic cards, matrices, and control systems, which incorporate NPE reed relays. Thus we maintain complete control of the entire process of our reed relays, in addition to having a working knowledge of their end use.

NPE

WRITE FOR DETAILS AND DESIGN ASSISTANCE

REED RELAYS

SERIES		END (TYP.) AND SIDE VIEWS	AVAILABLE CONTACT FORMS
812 MINIATURE			1A 1A1B 4A2B 2A 1A2B 1B1C(1A2B) 3A 1A1C(2A1B) 1C 4A 2A1B 2C 5A 2A2B 3C 6A 3A1B 4C 1B 3A2B 1A(mag.latch) 2B 4A1B 2A(mag.latch)
822 MINIATURE			1A 1A1C(2A1B) 1A(mag.latch) 2A 2A1B 2A(mag.latch) 3A 1B1C(1A2B) 4A 1C 1B 2C 2B 3C 1A1B 1A2B
823 MINIATURE			1A 1A1C(2A1B) 1A(mag.latch) 2A 2A1B 2A(mag.latch) 3A 1B1C(1A2B) 4A 1C 1B 2C 2B 3C 1A1B 1A2B
824 MINIATURE			1A 1A1B 1C 2A 1A2B 2C 3A 1A1C(2A1B) 3C 4A 2A1B 4C 5A 3A1B 1A(mag.latch) 6A 3A2B 2A(mag.latch) 1B 4A1B 2B 1B1C(1A2B)
842 STANDARD			1A 2B 4A1B 2A 1A1B 5A2B 3A 1A2B 1B1C(1A2B) 4A 1A1C(2A1B) 1C 5A 2A1B 2C 6A 2A2B 1A(mag.latch) 8A 3A1B 2A(mag.latch) 1B 3A2B
843 STANDARD			1A 2B 4A1B 2A 1A1B 5A2B 3A 1A2B 1B1C(1A2B) 4A 1A1C(2A1B) 1C 5A 2A1B 2C 6A 2A2B 1A(mag.latch) 8A 3A1B 2A(mag.latch) 1B 3A2B
852 STANDARD			1A

* Variable dimension depending on series and contact configuration. (Range: 812 Series: .445 to 1.20; 822 Series: .405 to .780; 823 Series: .465 to .855; 824 Series: .382 to .882; 842 Series: .645 to 2.170; 843 Series: .700 to 2.216 inches.)

CONTACT RATINGS For miniatures, see preceding page reed switch part number 692-121; for standards see reed switch part number 694-321.

LIFE AND RELIABILITY For miniatures see preceding page reed switch part number 692-121; for standards see reed switch part number 694-321.

OPERATING PARAMETERS	MINIATURE	STANDARD
Temperature:	−55°C to +105°C	−55°C to +105°C
Shock:	100G max., 11± 1 msec	100G max., 11± 1 msec
Vibration:	30G max. @ 0 to 1700 hertz	30G max. @ 0 to 600 hertz
Insulation resistance:	10^{12} ohms max.	10^{12} ohms max.
Capacitance:	.5 picofarad	1.5 picofarads

NEW PRODUCT ENGINEERING, INC. *A Subsidiary of Wabash Magnetics, Inc.*
812 Manchester Avenue, Wabash, Indiana 46992 Telephone (219) 563-2191 TWX 810-290-2722

TIME DELAY RELAYS

Time delay relays produced by E. V. NAYBOR LABORATORIES are available for both delay on operate and delay on release of coil power.

The TO and TQ Series are OPERATE DELAY relays using solid state circuitry integral with an electromagnetic relay.

The TD, TDS and TLC Series are RELEASE DELAY relays and provide delay with a power-off condition. The TD uses an air dashpot to provide delay, the TDS makes use of a copper slug in the magnetic circuit for delay of flux and the TLC provides delay period by use of a solid state electronic-magnetic circuit.

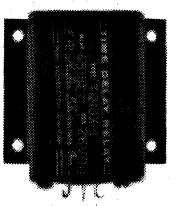
All time delay relays manufactured by E. V. NAYBOR LABORATORIES are available as both open and hermetically sealed (suffix H) units and can meet the most severe environmental conditions. Recycle time (except TDS) is less than .025 seconds on all units.

TO, TQ SERIES



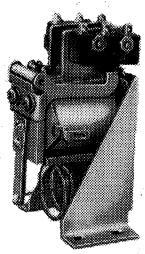
TO - 1 Dia. x 2½ Max.

SPECIFICATIONS:
CONTACT ARRANGEMENT — Type TO 1, 2, 3 & 4 pole, double-throw. Type TQ 1 and 2 pole, double-throw.
DELAY AVAILABLE — To 500 seconds. External adjustment and longer delays available.
CONTACTS — Rated at 2 amps. resistive load for TO and 5 amps resistive load for TQ at 26.5 VDC or 115 VAC.
COIL — Standard for 26.5 VDC. Other voltages available.
TEMPERATURE RANGE — Standard at −55 degrees C. to +85 degrees C.
VIBRATION — 15 G. to 2,000 cycles for TO, 10 G., 10 to 55 cycles for TQ.
SHOCK — 50 G. for 11 milliseconds for TO. Mechanical resistance for TO and TQ, 100 G.
DIELECTRIC — Test at 1,000 volts RMS.
ACCURACY — ±4% for TO, ±10% for TQ.
REPEATABILITY — ±1% for TO, ±2% for TQ.



TQ - 2⅝ x 1⅝ x 1

TD SERIES



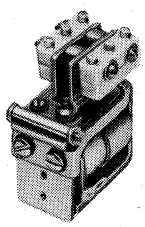
· 2⅝H x 1⅝ x 1⅝

SPECIFICATIONS:
CONTACT ARRANGEMENT — 1, 2 and 3 pole double throw.
DELAY AVAILABLE — Standard range — to 4 seconds for 3 pole — to 6 seconds for 2 pole and to 8 seconds for single pole units. Recycle time less than .025 seconds.
CONTACTS — Rated at 5 amperes resistive load at 125 or 250 VAC for 100,000 operations.
COIL — Standard coil resistance for 26.5 VDC operation, 425 ±10% ohms. Other values available to 12,000 ohms. Coil operation from .5 watt to 3 watts depending upon operating conditions. Also available for AC.
TEMPERATURE RANGE — Standard at −55 degrees C. to +85 degrees C.
VIBRATION — Ten G. from 10 to 500 cycles.
SHOCK — Operating to 50 G. — mechanical resistance to 100 G.
DIELECTRIC — Test 1,000 volts RMS.
WEIGHT — 4.5 ounces.
ACCURACY — Above 1.0 second ±20%. Below 1.0 second ±40%.



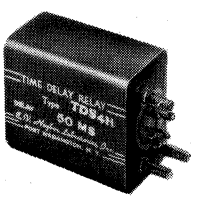
2⅝H x 1⅝ x 1 1/16

TDS SERIES



1¾H x 1⅜ x 1⅛

SPECIFICATIONS:
CONTACT ARRANGEMENT — Single pole — double throw (TDS3H), and double pole — double throw (TDS6H).
DELAY AVAILABLE — Standard range to 200 milliseconds. Under certain conditions to 300 milliseconds.
CONTACTS — Rated at 5 amperes resistive load at 125 or 250 VAC to 100,000 operations. Rated at 4 amperes resistive load at 30 VDC for 50,000 operations.
COIL — Standard coil resistance for 26.5 VDC operation, 425 ±10% ohms. Other values available to 10,000 ohms.
TEMPERATURE RANGE — Standard at −55 degrees C. to +85 degrees C.
ALTITUDE — To 70,000 feet. **WEIGHT** — 5 ounces.
DIELECTRIC — Test at 1,000 volt RMS.
ACCURACY — ±10% at rated voltage and 25 degrees C.



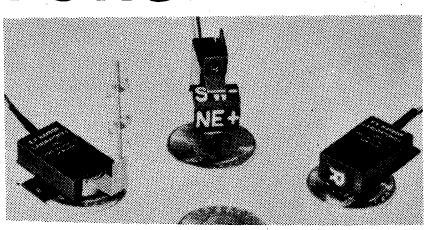
2⅛H x 1⅝ x 1

SYMBOL INDICATORS

The F Series indicators are subminiature electromagnetic devices which provide highly dependable display under all environmental conditions.

Operation is accomplished in a new magnetic circuit which surrounds a permanent magnet rotor. Energization of a dual coil D.C. electromagnet, causes rotation of the permanent magnet rotor. Magnetic latching is also available, with reversal of polarity to return to reset position. Basic case size of this unit is 1 x 5/16 x .270. Mounting and indicating configuration is to customer requirements.

A fault indicator is also available in a basic case size .700 x .400 x .200. This unit is magnetically latched on fault signal. Resetting is accomplished by polarity reversal, or pulse fault or reset.

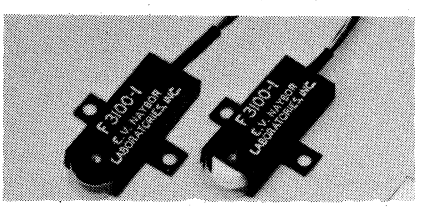


THE E. V. NAYBOR LABORATORIES, INC., "High Reliability" Electro-magnetic Fault Indicator involves an astute and new design which provides exceptional sensitivity without the use of "solid state" amplification.

A two-coil unit, this device is basically intended to provide pulse fault and pulse reset indication.

Life expectancy is high and should be considered exceeding 100 million operations and continuous duty in excess of 100,000 hours. Shelf life can be conservatively rated at a minimum of five years.

This small-sized unit (1.000 x .375 x .200) has basic application for use in "BITE" Systems. Such units have the inherent ability to sense and indicate faults visually and hold this indication in a magnetically latched condition. Reset is accomplished by application of an equivalent pulse on the reset terminals of this device. **Solid state high sensitivity model also available.**



ALL UNITS BUILT IN ACCORDANCE WITH MILITARY SPECIFICATIONS

E. V. NAYBOR LABORATORIES, INC.
PORT WASHINGTON, NEW YORK 11050 **POrt Washington 7-4300**

RELAYS . . . TELEPHONE QUALITY


RAF TYPE

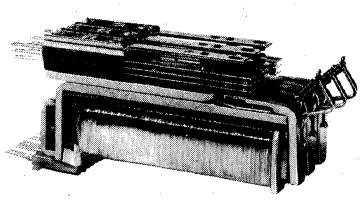
SPECIFICATIONS

Ambient Temperature Range
0°C to + 85°C.
Insulation Resistance
1000 megohms minimum.
Dielectric Strength
500 VAC or 750 VDC.

Contact Resistance
50 milliohms maximum at a closed circuit current of 2 amps and an open circuit voltage of 6 VDC (Norloy Silver).
Contact Rating
.4 amp resistive at 50 VDC (Bifurcated Norloy Silver).
Mechanical Life
100 million operations under normal conditions.
Finish
Zinc plate, chromate treated to MIL-F-14072, is used to ensure maximum resistance to corrosion.
Operating Speed
Fast operate 12 to 18 MS Slow operate 30 to 40 MS
Fast release 10 to 15 MS Slow release 100 to 150 MS
Military Specifications
Military type versions designed to meet MIL-R-5757D.

Pile-Up Form	D.C. Maximum	Min. Oper. MA	Coil Res. Ohms	Stock Number	Price
1A	70	5.3	1000	300467	$3.53
1A	110	3.5	3500	300073	4.64
1B	70	6.2	1000	301333	3.31
1B	110	3.5	3500	300285	4.64
1C	50	11.0	500	300375	4.36
1C	70	7.5	1000	300274	3.61
1C	120	4.0	4000	300982	4.32
2A	70	8.5	1000	300616	3.47
2B	70	6.3	1000	302444	3.84
2C	50	13.5	500	301373	4.64
2C	50	17.0	1000	300621	3.95
2C	120	4.5	4000	300726	4.82
3A	70	9.5	1000	301498	3.90
3B	50	16.0	1000	301566	3.90
3C	40	24.0	600	300661	4.83
3C	50	19.0	1000	301572	4.89
3C	70	12.0	2000	300242	4.82
3C	120	6.0	3500	301627	6.59
4A	50	14.5	500	300705	8.49
4A	70	11.5	2000	301915	8.63
4C	70	13.0	1000	300786	5.11
4C	70	9.5	2000	300361	5.67
4C	120	8.0	3000	300845	6.04
6A	48	19.0	600	300524	5.58
6A	50	19.0	1000	300034	5.18
6B	48	28.0	800	301418	5.18
6C	70	15.0	1000	300275	6.39
6C	85	11.5	2000	300360	6.93
6C	120	9.0	3000	300993	7.31
7A	50	19.0	500	301569	6.12
8A	50	23.0	1000	301723	6.17
8A	80	11.5	2000	301535	5.88
9A	48	20.0	600	300525	6.86
10A	75	11.5	1250	301312	6.79
12A	50	25.0	500	302208	8.57
12A	70	16.0	1000	300277	7.00
12A	80	13.0	2000	301048	7.53
1A2B	70	10.5	2000	300327	4.07
1A2C	70	11.0	2000	301041	4.92
1A4C	90	9.7	2000	301613	5.86
1A6C	55	20.0	1000	300858	6.72
1A6C	90	12.0	2000	300516	6.29
1C1D	60	10.5	1000	300657	4.38
2A1C	48	13.5	600	301484	4.37
2A1C	50	14.0	1000	301146	5.48
2A2C	50	19.0	1000	300777	5.01
2A2C	85	8.0	2000	301253	5.46
3A1C	80	10.0	1250	300383	5.42
3A1C	70	12.0	2000	301037	4.97
3A3C	50	23.0	1000	300552	5.50
3A3C	80	11.0	2000	300257	6.62
4A1C	48	21.0	1000	302264	5.23
5A2C	85	10.5	1000	301709	6.73
6A1C	50	16.0	500	301986	7.10
6A4C	50	26.0	1000	300767	7.04
7A1C	70	14.0	1000	300276	5.84
7A2C	50	30.0	800	300089	6.60
7A3C	80	13.0	2000	302244	7.15
1A1B1C	65	11.5	1000	301568	5.09
1A1B3C	65	14.0	1000	302122	6.37
1A2B6C	50	22.0	1000	301893	6.86
2A1B2C	65	12.5	1000	300752	5.60
2A1B6C	50	23.0	1000	302141	7.82
3A2B3C	75	13.0	1250	301407	8.10
3A3B1C	70	13.5	1000	302452	5.69
3A3B2C	50	22.0	1000	300520	6.43

3X TYPE



3X TYPE

Pile-Up Form A	B	C	Operate Max. A	B	C	DC Max. A	B	C	Coil Resistance A	B	C	Part No.	List Price
1A	2C	2C	10.5	14	14	48	60	60	1300	2100	2100	302912	15.30
1A	1B1C1D	1B1C1D	7.8	16	16	60	60	60	2100	2100	2100	302955	14.80
1C	1A1C	1A1C	44	20	20	13	38	38	100	800	800	302884	15.50
1C	1B2C	2C	17	30	24	38	38	38	800	800	800	302966	13.70
1C	1B2C	1A2C	17	30	30	38	38	38	800	800	800	302919	12.60
1C	1C	1C	26	26	26	26	26	26	400	400	400	302939	12.80
1C	1A1A1B	1A1B	16	30	17	38	38	38	800	800	800	302915	13.50
1D	3A	3A	14	18	18	38	48	48	800	1300	1300	302910	13.80
2A	2A	2A	18	18	18	38	38	38	800	800	800	302950	13.00
2A	2A	2A	13	13	13	60	60	60	2100	2100	2100	302927	13.80
2A	2A	3A	18	18	22	38	38	38	800	800	800	302984	13.30
2A	1A2D	2C	11.5	18	15	60	60	60	2100	2100	2100	302894	14.70
2A	3A1B	2A	18	31	18	38	38	38	800	800	800	302986	13.50
2C	2C	2C	20	20	20	48	48	48	1300	1300	1300	302993	16.20
2C	2C	1A1C1D	20	20	28	48	48	38	1300	1300	800	302928	14.50
2C	3A	1B1C1D	21	21	22	48	48	48	1300	1300	1300	302905	14.60
2C	1B2C	1C1D	21	24	14	48	48	60	1300	1300	2100	302902	15.50
3A	4A	4A	13.5	31	31	60	38	38	2100	800	800	302947	14.50
3B	3B	3B	8.5	8.5	8.5	90	90	90	4500	4500	4500	302909	14.00
4A	4A	4A	31	31	31	38	38	38	800	800	800	302969	14.50
4A	1A2D	2A1C	30	23	23	38	48	48	800	1300	1300	302889	15.20
4A	1A1C	1A2D	15.1	13.5	18	60	60	60	2100	2100	2100	302901	15.10
4A	1A3B	1B2C	20	26	19	60	48	60	2100	1300	2100	302908	16.90
4A	1B1C	1A1C	35	16	16	31	48	48	600	1300	1300	302936	17.30
4A	3A1B	2A2B	31	31	31	38	38	38	800	800	800	302995	14.50
1A1B	2A1C	2D	18	22	16	38	48	48	800	1300	1300	302933	14.20
1A1B	2A1C	2A1C	18	28	28	38	38	38	800	800	800	302959	13.90
1A1C	4A	4A	26	24	24	41	48	48	1000	1300	1300	302971	14.30
1A1C	3A1B	1A1C1D	12.5	24	22	60	48	48	2100	1300	1300	302924	14.80
1A1D	1A1D	1A1D	11.5	11.5	11.5	60	60	60	2100	2100	2100	302960	14.40
1A2B	1A	1A2C	13.5	7.7	23	60	60	48	2100	2100	1300	302914	14.20
1A3B	1A3B	1A3B	26	26	26	48	48	48	1300	1300	1300	302888	15.30
1A2C	1A2C	1A2C	23	23	23	48	48	48	1300	1300	1300	302998	15.00
1A2C	1A2C	1A2C	23	18	23	48	60	48	1300	2100	1300	302913	15.10
1A2C	3A1B	1A1C	23	24	12.5	48	48	60	1300	1300	2100	302938	14.70
1A2C	1A2C	1A1C1D	22	22	22	48	48	48	1300	1300	1300	302962	15.10
1A2D	1A1B1C	2A2B	22	20	24	48	48	48	1300	1300	1300	302947	14.50
1B2C	2C	1C	23	20	11	48	48	60	1300	1300	2100	302970	15.20
1B2C	1B2C	1B2C	18	18	18	60	60	60	2100	2100	2100	302976	15.30
2A1B	2A1C	1A1C	14	28	12.5	60	38	60	2100	800	2100	302990	14.60
2A1C	2A1C	2A1C	28	28	28	38	38	38	800	800	800	302958	14.30
2A1C	2A1C	2A1C	18	18	18	60	60	60	2100	2100	2100	302903	17.10
2A1C	1A1B1C	2A1C	17	16	17	60	60	60	2100	2100	2100	302965	15.10
2A1D	1C	1A	30	24	14.5	31	26	31	600	400	600	302934	13.40
2A2B	2C	2C	41	21	21	31	48	48	600	1300	1300	302896	14.10
2A2B	2C	2C	24	18	18	48	48	48	1300	1300	1300	302968	14.50
2A2B	2C	4A	24	18	24	48	48	48	1300	1300	1300	302949	14.80
2A2B	4A	4A	20	20	20	60	60	60	2100	2100	2100	302892	15.20
2A2B	2C	1A1B1C	25	19	17	48	48	60	1300	1300	2100	302899	15.60
2B1C	1A1C1D	2C	32	22	20	38	48	48	800	1300	1300	302973	14.60
3A1B	4A	2C	25	25	15.5	48	48	60	1300	1300	2100	302890	14.80
3A1B	1A2C	1A2C	24	22	22	48	48	48	1300	1300	1300	302961	15.00
3A1B	1B2C	1B2C	31	18	18	38	60	60	800	2100	2100	302994	15.00
3A1B	3A1B	3A1B	31	31	31	38	38	38	800	800	800	302954	14.50
3A1B	2A2B	1A1B1C	30	30	21	38	38	48	800	800	1300	302897	14.60
1A1B1C	1A2B	2A	17	18	19	60	48	40	2100	1300	950	302886	14.10
1A1B1C	1A2C	2A2B	35	40	41	31	31	26	600	600	400	302895	13.90
1A1B1C	1A3B	1B2C	20	32	18	48	38	60	1300	800	2100	302996	14.90
1A1C1D	1A1C1D	3A1B	22	22	24	48	48	48	1300	1300	1300	302920	15.20
1A1C1D	1A1C1D	1A1C1D	22	22	22	48	48	48	1300	1300	1300	302978	15.20

TYPE 10,000 part number — 308004 relay. . . list price $4.28



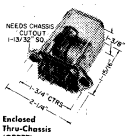
The 10,000 series relay is completely dependable for critical switching and control circuit applications where maximum reliability, long life and high efficiency are prime factors. Occupying only one cubic inch of volume, the 10,000 type relay also offers the optimum utilization of space coupled with ease of mounting. This relay is used in all relay telephone switching systems manufactured by North with minimum maintenance. Unvarying long life fit this relay for intricate counting, memorizing, sequencing, switching, controlling and many other various applications in industry where fail and safe performance is essential.

NORTH ELECTRIC Electronetics Division/Galion, Ohio 44833/419-468-8100
A subsidiary of United Utilities, Incorporated

OHMITE has the answer in general purpose, latching and solid state relays

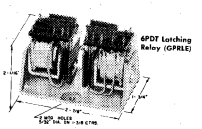
GPR GENERAL PURPOSE RELAYS — Includes Indicator, Plate, Thyratron & Latching Versions in Unenclosed & Enclosed Types











Simple, rugged, low cost relays handling substantial power for small size. Uncomplicated design provides unusual flexibility for making and changing connections and mounting. Stock includes relays in versatile enclosures, some with indicator light, also plate, thyratron and latching versions. Wide commercial and industrial use where economy and versatility are important. **BASIC (Unenclosed) RELAY:** All connections terminate on barrier-type terminal panel on combination solder—quick-connect (push-on) lugs which accept AMP 110 female connectors.

ENCLOSED RELAYS (GPRTA-, GPRTT-, GPRTS-, GPRTP-). Four types of clear plastic enclosures as follows:

"GPRTA" — ("Terminals-Above-Chassis" type).
"GPRTT" — ("Terminals-Through-Chassis"type).
"GPRTS" — type ("Terminals for Socket Use") for plug-in mounting in Ohmite socket "SOGPR".
"GPRTP" — ("Plug Base" type).

Contact Ratings: Two ratings — fine silver contacts, 5 amps at 115 VAC or 32 VDC; silver-cadmium contacts, 10 amps.

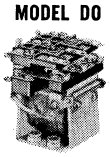
Insulation: Tested at 1500 VAC.

Coil Wattage: 1.4 watts DC operation;; 1.6 watts (2.0 volt-amps) AC except 2.4 watts (3.70 volt-amps) for 4-pole AC and AC latching relays.

Latching Relay: Consists of two GPR relays with armatures linked so that the n.o. contacts of one are mechanically latched in closed position when, and after, this relay is energized. When 2nd relay is energized, first relay restores and latches 2nd. Permits switching of twice the number of circuits and holding without coil current. Unenclosed type "GPRLE". Enclosed type "GPRLETP" in clear plastic case with Jones plug P-324-SB fitting S-324-AB socket.

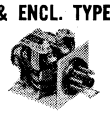
DO SERIES ALL PURPOSE RELAYS

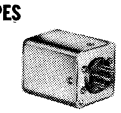
MODEL DO RELAY AC or DC OPERATION



Ideal for mobile equipment applications where severe shock and vibration are encountered. Coil drain: 3-watts DC, 6 watts 60 cycle AC. Contact ratings: 10 amps. at 115 v. AC; 32 volt DC resistive load. Insulation tested at 1500 v. AC. Size, (4 pole) 2¼ x 2¹⁄₁₆ x 1¹³⁄₁₆"; (3 pole) 2¼ x 1⅝ x 1¹³⁄₁₆".

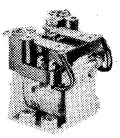
MODEL DOS PLUG-IN & ENCL. TYPES





Model DOS, DPDT relay with standard octal plug base, unenclosed or enclosed types. Enclosed dust-proof type has drawn aluminum cover. Overall dimensions, exclusive of plug: DOSPX-1T — 1⅝ x 2 x 1¹⁵⁄₁₆"; DOSEPX-5T — 2⅛ x 2½ x 2⅛". Contacts — 15 amps.

MODEL DOS RELAY AC or DC OPERATION



Quality, general-purpose relays originally designed to meet rigorous aircraft specs. Extremely compact yet rugged. Coil drain: 2.5 watts DC, 3 watts at 60 cycles AC. ontact ratings: DP, 15 amps. at 115 v. AC or 32 v. DC resistive load; SP, 25 amps. Molded phenolic insulation; tested at 1500 v. AC. 1⅞ x 1⅝ x 1³³⁄₃₂".

DOS RELAYS IN HERMETIC ENCLOSURES



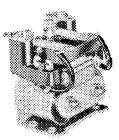
Hermetic Enclosures with 8 Terminaals
DOSHX-39T, 115VDC
DOSHX-40T, 115VAC



Hermetic Enclosures with Octal Plugs
DOSHPX-46T, 115VDC
DOSHPX-47T, 115VAC

Hermetically Sealed non-removable enclosures, filled with dry nitrogen, are also available to provide protection under adverse ambient conditions. DOS relays with 115 volt AC or DC coils are provided in these enclosures with either octal plug (DOSHPX-) or solder-terminal (DOSHX-) connectors as illustarted. **Weights:** 8 oz. each approx.

MODEL DOSY RELAY FOR PLATE CIRCUIT OPERATION



The high operating sensitivity makes the DOSY relay adaptable to a wide range of electronic control circuits, such as plate circuit controls, etc.

The insulation is of high grade, molded phenolic material. At 115 v. AC or 32 v. DC, resistive load. Model DOSY relay has a contact rating of 15 amperes.

There are two DPDT types, one having 10,000 ohms coil resistance (maximum pull-in current of 8 ma. DC); the other having 5,000 ohms coil resistance. Dimensions are same as for Model DOS next column.

DO RELAYS IN HERMETIC ENCLOSURES



DOHPX-16T, 3PDT, 11 Prongs
DOHPX-15T, 4PDT, 20 Prongs



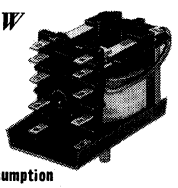
DOHX-22T, 3PDT 14 Terminals
DOHX-23T, 4PDT 14 Terminals

Stock DO relays with 115 volt coil in hermetically sealed metal enclosures, filled with dry nitrogen. Both 3 and 4-pole DO relays are supplied in these enclosures with plug (DOHPX-) or solder terminal (DOHX-) connectors as illustrated. **Weights:** 3-pole hermetic relay approx. 14 oz.; 4-pole approx. 15 oz.

LATCHING RELAYS

NEW

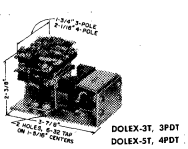
GPRM Magnetic Latching Relay



The new Series GPRM magnetic latching relays have no mechanical latching levers. Unlike conventional latching arrangements, magnetic latching relays do not have critical lever adjustments which limit mechanical life and are less susceptible to shock and vibration.

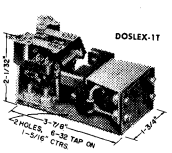
Small Size
Long Life
Reliability
Positive Action
Low Power Consumption
Economical Price

MODEL DO LATCHING RELAY (DOLEX)



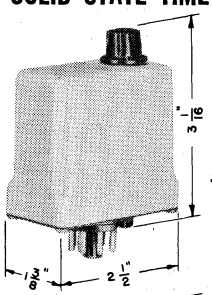
Consists of Model DO relay and a "reset magnet" with both armatures mechanically latched so that the normally open contacts of the relay remain closed when the relay energizing voltage is removed. The relay releases to normal position when the reset coil is pulsed. Permits "holding" of circuits without continuous coil current. Coils of stock units (both relays and reset coils) are 115VAC. Available with 3 or 4-pole relays. **Weights:** 3-pole — 16.5 oz.; 4-pole — 17 oz.

MODEL DOS LATCHING RELAY (DOSLEX-1T)



Consists of Model DOS relay and a "reset magnet" with both armatures mechanically latched so that the normally open contacts of the relay remain closed when the relay energizing voltage is removed. The relay releases to normal position when the reset coil is pulsed. Permits "holding" of circuits without continuous coil current. Coils of stock units (both relay and reset magnet) are 115VAC. **Weight:** 14.2 oz.

SOLID STATE TIME DELAY RELAYS



INTERNAL OR EXTERNAL RELAY

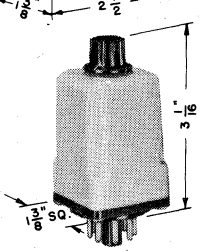
Ohmite Time Delay Relays consist of a solid state timing network and an electromechanical relay which is energized by the timing network. For the "Delay on Operate" type of relay, the electro-mechanical relay can be supplied in the same enclosure as the timing network or can be external to it. The internal electromechanical relay has DPDT contacts rated at 10 amperes. Where an external relay is required, Ohmite GPR, DOS or DO relays can be used.

DELAY AND DELAY ADJUSTMENTS

Variable — The Variable Ohmite Time Delay Relay offers three variable ranges:

0.1 to 10 seconds
0.6 to 60 seconds
1.8 to 180 seconds

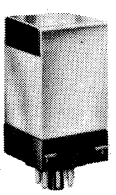
Fixed Maximum and Remote — Is supplied with a factory set time delay. However, incorporates provisions for connecting an external resistor to reduce time delay from the max. A variable resistance may be used to adjust the delay from nearly the max. to the min.

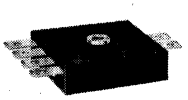


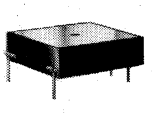
Operating Voltage Ratings:
AC: 24, 115 **DC: 24, 48, 110**

Contacts and Rating of Internal Relay: DPDT, 10 amperes at 115 VA, 32VDC resistive.

MODEL SSA SOLID STATE RELAYS *NEW*







- **No Moving Parts — No Contact Bounce or Wear**
- **Extraordinary Life, Reliability, Sensitivity, Speed**
- **Universal "Coil"**
- **Switches up to 10 amps at 40°C (on metal panel)**
- **Transient Protected — No False Actuation**

Model SSA relays are completely solid state. No moving parts and are not subject to the difficulties as with electromechanical relays. Excellent performance under severe shock and vibration.

Provide the ultimate in reliability, long life and trouble free service. They can replace electromechanical relays in critical applications where exceptional life and reliability are paramount or where reduction of maintenance is desired.

The Model SSA relay, a completely solid state device, is a true relay in the functional sense since its input ("coil") is completely isolated from its switching ("contact") elements. In the case of two-pole relays, one pole is isolated from the other.

WIDE RANGE CAPABILITY
Universal "Coil" Input, High Sensitivity

Universal "Coil" Input: Broad capability due to the universal input. Accepts a wide range of both AC and DC voltages to high frequencies:

AC — 3 to 140 volts, (to 25,000 cps) and
DC — 3 to 200 volts

High Sensitivity: Model SSA relays will operate on as little as 6 milliwatts. Capable of operating directly from integrated circuits (IC's) and serve as ideal interface between linear or digital systems and power circuits.

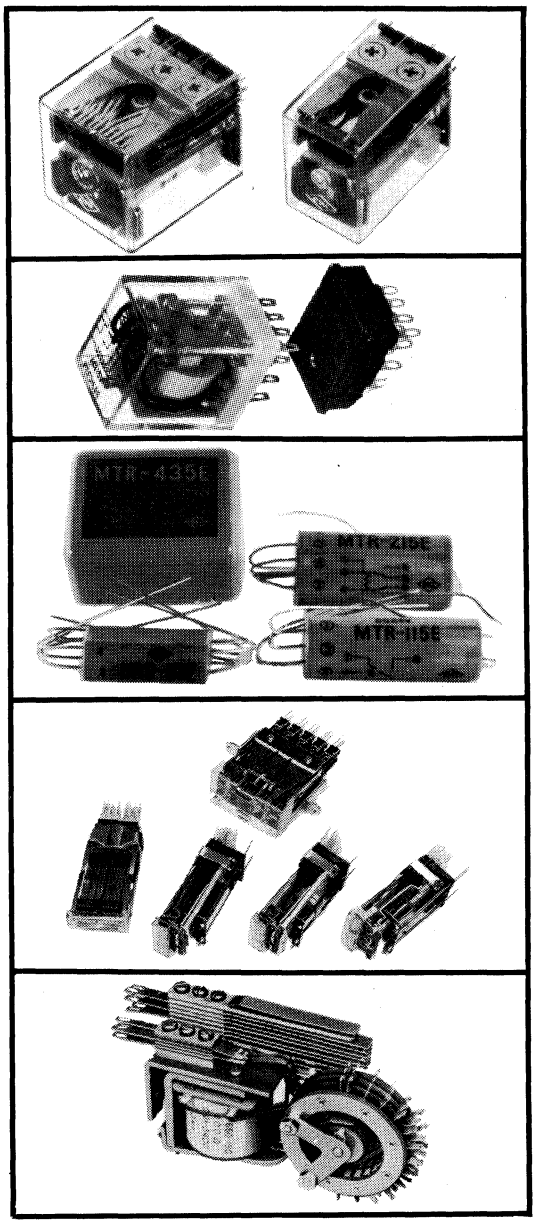
WRITE FOR COMPLETE INFORMATION ON ALL OHMITE RELAYS.

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company • 3635 HOWARD STREET, SKOKIE, ILLINOIS 60076 • PHONE (312) 675-2600 • TWX 910-223-0805

Relay Products

Since 1881
PROVEN QUALITY

TELEPHONE TYPE and GENERAL PURPOSE RELAYS



REC/RED SERIES (Equivalent to WECO MA/MB Types) Multi-contact — Small DC Relays — 4 or 6 Form C Twin Silver Palladium alloy with gold overlay contacts. Printed Circuit Board or Plug-in Mounting — Clear plastic dust cover. Life 100 million operations.

REE SERIES (4 PDT AC or DC General Purpose Plug-in Type) Gold-flashed silver contacts. Rated: 3 AMPS. @ 30V DC or 120V AC resistive. Solder terminals — W/mating socket available with PC or solder terminals. Life 50 million operations.

MRD/MTR/URD SERIES (Reed Contact Types) No adjustment or maintenance problem, high efficiency, extremely long life, and high speed switching operation.

WA, WG, WJ, WK, WM SERIES (High Reliability Wire Spring Types) up to 30 Form C Twin Palladium Alloy Light Duty Contact Springs, very efficient reliable operation. Life up to one billion operations.

OD SERIES (Rotary Type Stepping Switches) Compact — Lightweight — Low Power Consumption — Varied Applications. Equipped with multi-level contacts and wipers for automatic selection and counting mechanisms. Life up to 2 million or more operations.

ALSO AVAILABLE — Power, Latching, Frequency, Coaxial, Flat Type, Mercury Relays and Cross-Bar Switches, plus many other telephone components.

WRITE FOR DETAILED INFORMATION AND PRICES:

ATTENTION: TELEPHONE COMPONENTS SALES DIVISION

OKI ELECTRONICS OF AMERICA INC.

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FORT LAUDERDALE, FLORIDA 33316

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TEL. 523-7202
523-6571

TWX: 510-955-9837

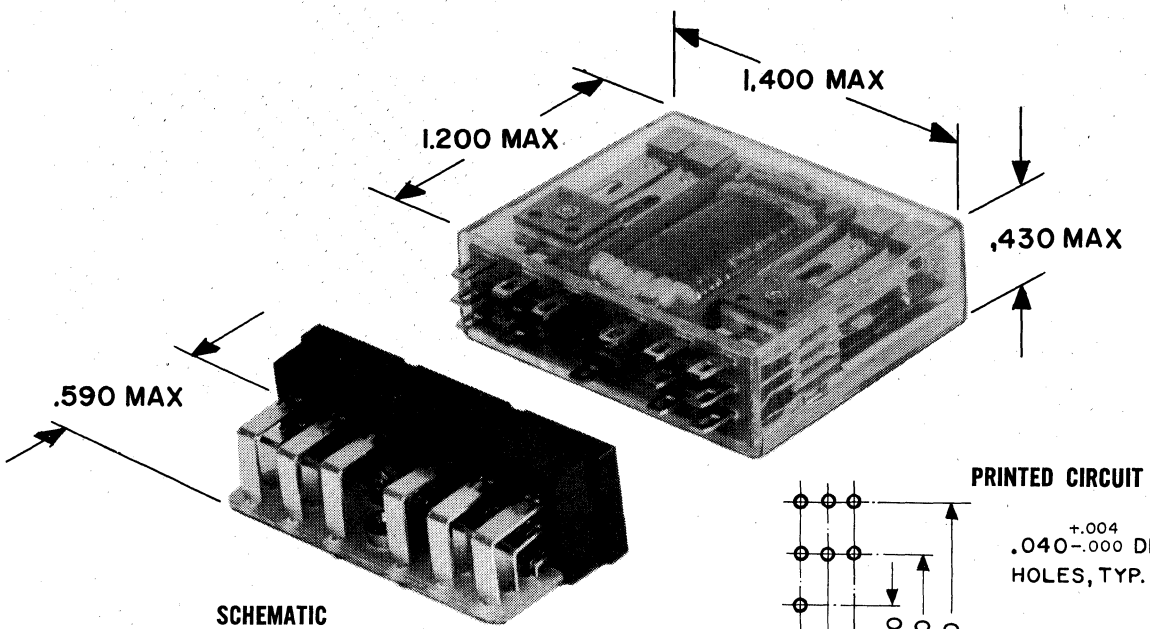
PARELCO, INC.

26181 AVENIDA AEROPUORTO, SAN JUAN CAPISTRANO, CALIFORNIA 92675
PHONE: 714 - 493-4507 • TWX: 910-596-1412

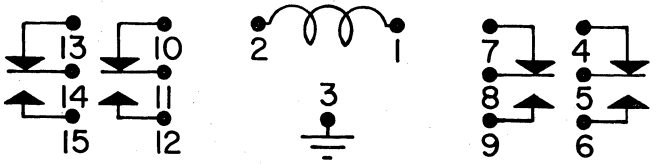
MODEL R40 SLIMLINE® DC OPERATED RELAY

THE PARELCO SLIMLINE FOUR POLE RELAY OFFERS YOU THE BENEFITS OF:

- Flat Slimline package for printed circuit board use. Allows .6" board mounting centers.
- A variety of contacts for loads from true dry circuit to 10 amps.
- Wide range of coil voltages — 3.0 VDC for IC applications to 115.0 VDC.

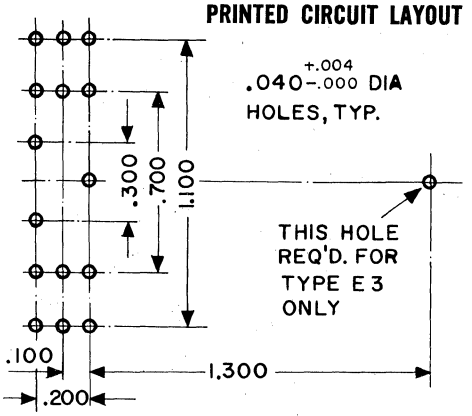


SCHEMATIC

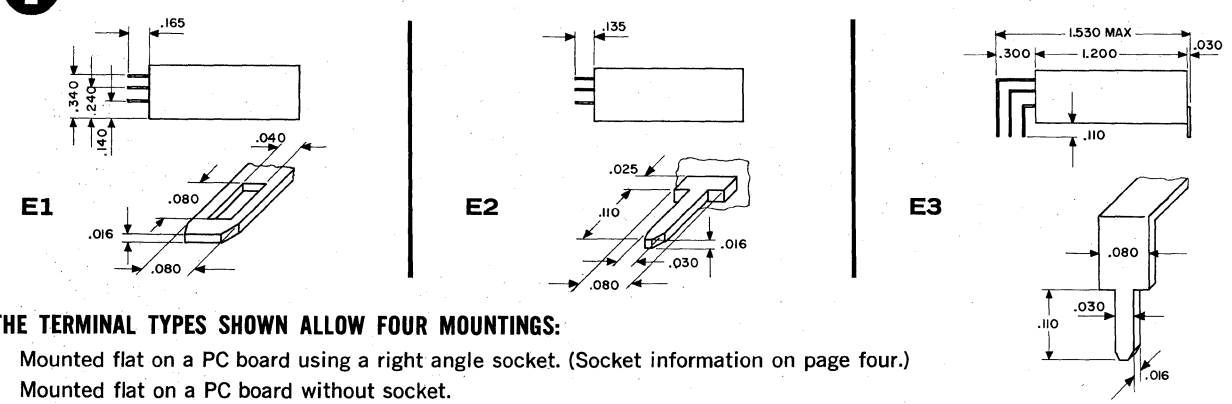


NOTE: POSITIONS 4, 5, 6, 13, 14, 15 ARE VACANT FOR 2 POLE UNITS

PRINTED CIRCUIT LAYOUT



1 RELAY TERMINAL CONFIGURATIONS

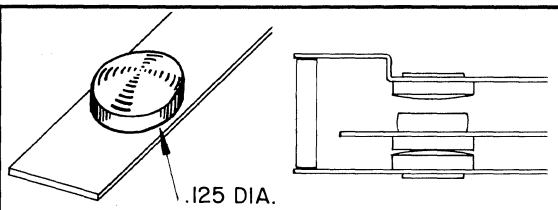
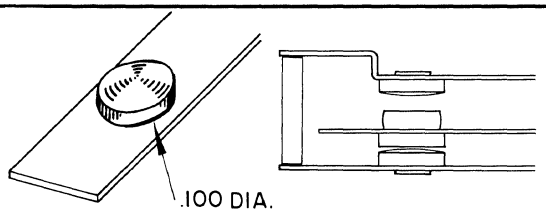
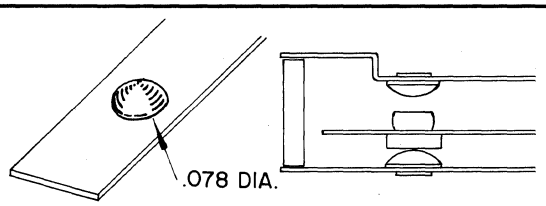
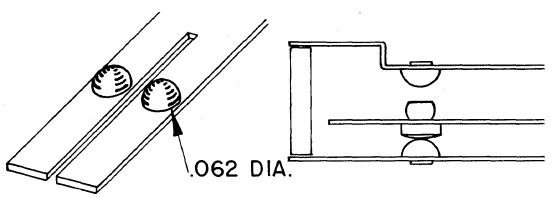
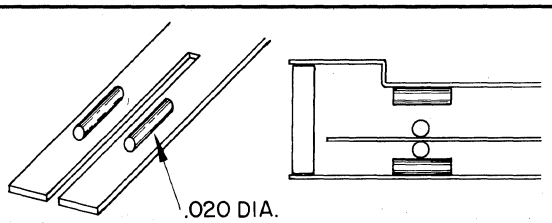


THE TERMINAL TYPES SHOWN ALLOW FOUR MOUNTINGS:

Mounted flat on a PC board using a right angle socket. (Socket information on page four.)
Mounted flat on a PC board without socket.
Vertically mounted on a PC board using a socket.
Vertically mounted on a PC board without socket.
Chassis mounted with direct solder connections or socket optional.

② CONTACT DATA

RESISTIVE LOAD RATING @ 28.0 VDC OR 115.0 VAC

W 10 Amp	2	2 Form C		Typical 10 Amps Maximum 15 Amps Minimum .200 Amps
X 5 Amp	2	2 Form C		Typical 5 Amps Maximum 7.5 Amps Minimum .200 Amps
	4	4 Form C		
Y 2 Amp	2	2 Form C		Typical 2.0 Amps Maximum 3.0 Amps Minimum 0.01 Amps
	4	4 Form C		
Z .100 Amp	2	2 Form C		Typical 100 Milliamps Maximum 2.0 Amps Minimum 1.0 Milliamps
	4	4 Form C		
L 500 Microamps	2	2 Form C		Typical 500 Microamps Maximum 250 Milliamps Minimum Dry Circuit
	4	4 Form C		

③ OPERATING CHARACTERISTICS

V — STANDARD VOLTAGE ADJUSTMENT

Coil Resistance at 25°C ±10%		VDC at 25° C		
2 Form C (Except W2) Pull in Power 250 mw	4 Form C (And W2) Pull in Power 400 mw	Nominal Coil Voltage	Pull in Voltage (Maximum)	Maximum Continuous
20	12	3.0	2.25	4.5
80	50	6.0	4.5	9.0
320	200	12.0	9.0	18.0
1.2 K	800	24.0	18.0	36.0
5.0 K	3.2 K	48.0	36.0	72.0
11.0 K	7.5 K	72.0	54.0	108.0
25.0 K	18.0 K	115.0	86.0	172.0

TO SELECT YOUR SLIMLINE:

1. Choose your required terminals.
2. Select the correct contacts.
3. Specify the proper coil value.

PART NUMBER EXAMPLE:

Slimline Model **R40 — E1 — L4 — V800**

1. Plug-in Terminals
2. Dry Circuit Crossbar Type Contact 4 Form C
3. Coil Value — 700 for 24 VDC Nominal

Special coil values and contact arrangements are available. Call PARELCO application engineering.

GENERAL SPECIFICATIONS

CONTACT AND LIFE DATA:

Actuator Displacement (V. Adj.) ..... .040 min.
Overtravel (V. Adj.) ..... .010 min.
Contact Material .....Codes W, X — Silver cadmium oxide, gold bonded
Codes Y, Z — Fine silver, gold bonded
Code L — Gold-platinum-silver alloy
Life, Mechanical .....100,000,000 operations
Life, Electrical .....See table
Contact Resistance .....50 milliohms maximum initially
200 milliohms maximum after life

COIL DATA

Max. coil dissipation at 25° C .....1.6 watts
Coil temperature rise .....28° C per watt
Maximum coil temperature .....105° C (221° F)

OPERATING AND ELECTRICAL DATA

Drop out .....10% minimum of pull-in voltage or current
Dielectric strength ....1000 vrms; 500 vrms across Z & L code contact gaps
Insulation Resistance .....10,000 megohms at 25° C and 50% R.H.
Typical capacitance .....Contact-contact ..... 3 picofarads
Coil-frame .....30 picofarads
Coil-contacts ..... 5 picofarads

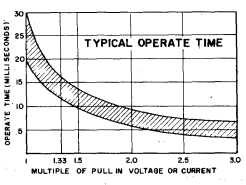
ENVIRONMENTAL CHARACTERISTICS

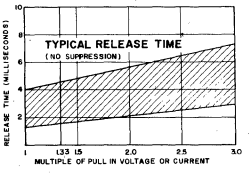
Operating Temperature Range ....−55 to +72 degree C (−67 to+162°F)
Vibration .....0.06" DA, 5-55 Hz Operating with no contact chatter
Shock .....15 g operating, 30 g mechanical

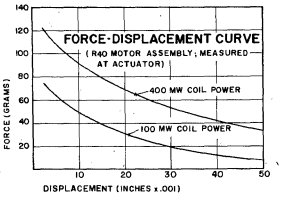
WEIGHT .....25 to 30 grams, depending on configuration

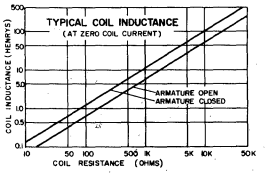
TYPICAL LIFE EXPECTANCY FOR SWITCHING RESISTICE LOADS AT 25° C

Current	Voltage	Contacts	Life (Operations)
10.0 Amp	115 vac, 60 Hz	W	2×10^5
10.0 Amp	28 vdc	W	4×10^5
5.0 Amp	115 vac, 60 Hz	X	2×10^5
5.0 Amp	28 vdc	X	6×10^5
2.0 Amp	28 vdc	Y, Z	1.5×10^6
2.0 Amp	28 vdc	Y, Z	6×10^5
1.0 Amp	28 vdc	Y, Z	12×10^6
100 ma	28 vdc	Y, Z	12×10^6
50 ma	6 vdc	Z	5×10^7
10 ua	10 mv	L	5×10^7





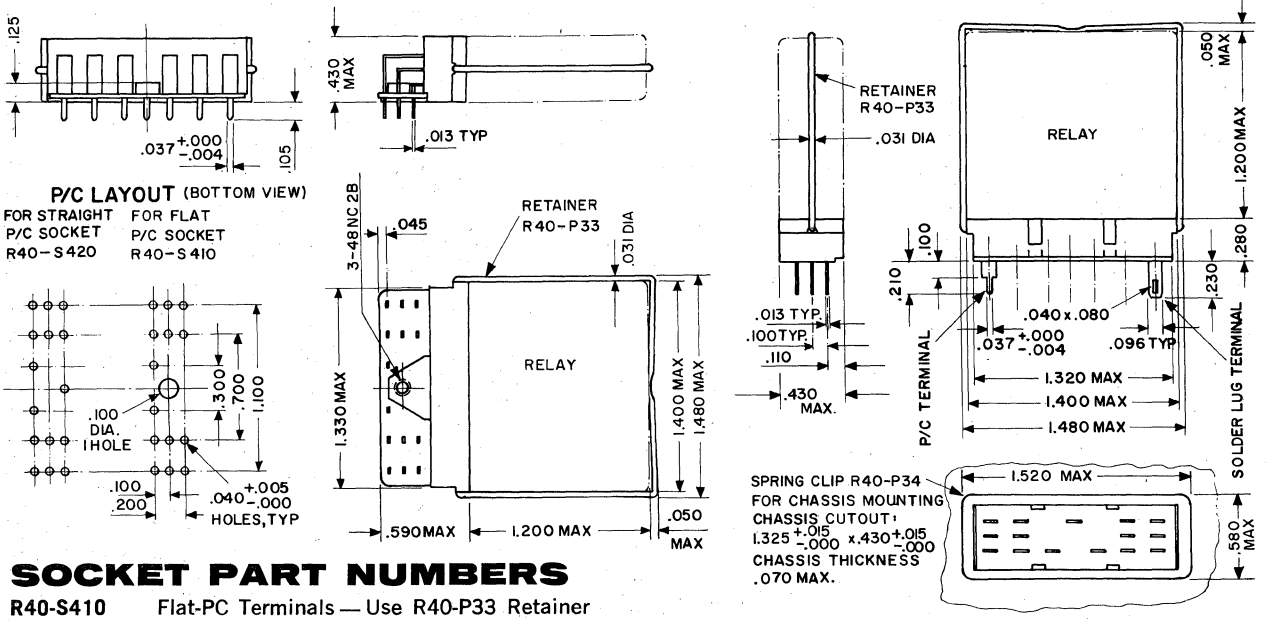




MODEL R40 SOCKET DETAILS

R40-S410 FLAT P/C TERMINAL SOCKET

R40-S420 P/C TERMINAL SOCKET
R40-S430 SOLDER LUG TERMINAL SOCKET



SOCKET PART NUMBERS

R40-S410 Flat-PC Terminals — Use R40-P33 Retainer
R40-S420 Vertical-PC Terminals — Use R40-P33 Retainer
R40-S430 Solder Lug Terminals — Use R40-P33 Retainer and R40-P34 Mounting Clip.

PARELCO, INC.
26181 Avenida Aeropuerto, San Juan Capistrano, California 92675
Phone: (714) 493-4507 TWX: 910-596-1412
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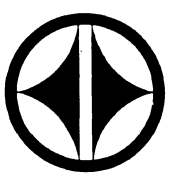
Look in the Green Section for Products and their Manufacturers



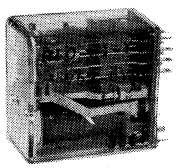
Tell them you found them in eem

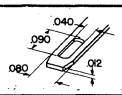
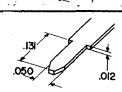
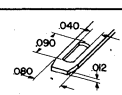
PARELCO, INC.

SERIES R10 DC-OPERATED RELAYS
A CUSTOM TAILORED MODEL FOR EVERY APPLICATION

1 SELECT TYPE OF RELAY TERMINALS AND MOUNTING

R10-E — with Transparent Enclosure

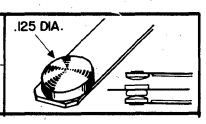


1	Solder terminals, stud or plug-in mounting	
2	Printed circuit terminals, no stud mounting	
3	Solder terminals, 2 top mounting holes	

2 DESIGNATE RATINGS AND NUMBER OF CONTACTS

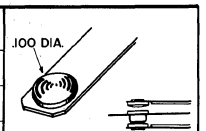
W — 10 amp.

2	2 Form C
4	4 Form C



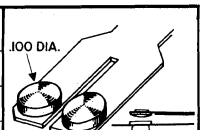
X — 5 amp.

2	2 Form C
4	4 Form C
6	6 Form C
8	8 Form C



M — *

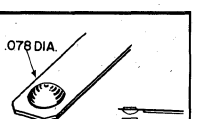
2	2 Form C
4	4 Form C
6	6 Form C
8	8 Form C



* 5 Amp (Bifurcated)

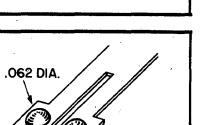
Y — 2 amp.

2	2 Form C
4	4 Form C
6	6 Form C
8	8 Form C



Z •

2	2 Form C
4	4 Form C
6	6 Form C
8	8 Form C



• Low Level (Bifurcated)

L †

2	2 Form C
4	4 Form C
6	6 Form C
8	8 Form C



† Dry Circuit (Cross Bar)

3 SPECIFY ADJUSTMENT AND COIL RESISTANCE

V — STANDARD VOLTAGE ADJUSTMENT

Coil Resistance at 25° C ±10% (ohms) 2 & 4 Form C Pull in Power 500 mw	6 Form C Pull in Power 850 mw	8 Form C Pull in Power 1000 mw	VDC at 25° C Pull in (max.)	VDC at 25° C Nominal	Max. Continuous
10	6.0	5.0	2.25	3.0	2.2 w Coil Disp.
52	25	20	4.5	6.0	
185	90	72	9.0	12.0	
700	430	350	18.0	24.0	
2.5K	1.5K	1.25K	36.0	48.0	
5.8K	3.5K	2.8K	54.0	72.0	
15.0K	9.0K	8.0K	86.0	115.0	

S — SENSITIVE VOLTAGE ADJUSTMENT

Coil Resistance at 25° C ±10% (ohms) 2 Form C Pull in Power 100 mw	4 Form C Pull in Power 175 mw	6 Form C Pull in Power 250 mw	8 Form C Pull in Power 400 mw	VDC at 25° C (Pull in (max.)	VDC at 25° C Nominal	Max. Continuous
50	30	20	12	2.25	3.0	2.2 w Coil Disp.
200	110	80	52	4.5	6.0	
800	450	320	200	9.0	12.0	
3.2K	1.8K	1.2K	800	18.0	24.0	
13.0K	7.5K	5.2K	3.2K	36.0	48.0	
28.0K	16.0K	13.0K	7.5K	54.0	72.0	
50.0K	40.0K	30.0K	16.0K	86.0	115.0	

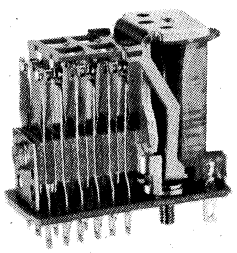
J — SENSITIVE CURRENT ADJUSTMENT

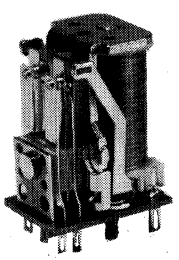
Coil Resistance at 25° C ±10%	Maximum Pull in Current (ma) 2 Form C Pull in Power 85 mw	4 Form C Pull in Power 175 mw	6 Form C Pull in Power 250 mw	8 Form C Pull in Power 400 mw	Maximum Coil Current (ma)
1.0K	8.5	13.0	16.0	20.0	45.0
2.5K	5.8	8.4	10.0	13.0	28.0
5.0K	4.1	6.2	7.2	9.0	20.0
10.0K	3.1	4.5	5.0	6.4	14.0
15.0K	2.6	3.5	4.2	5.3	11.5
30.0K	1.7	2.5	2.9	3.7	8.3

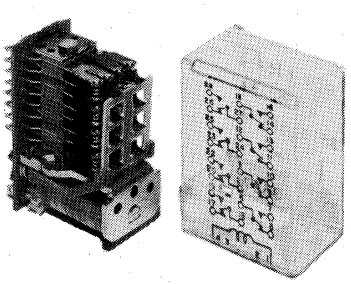
VB — BIFILAR WINDING

Bifilar coils protect relay drive transistors. The transient voltage spike is limited to 150% of the normal coil voltage. To specify simply change "V" to "VB". Available in "V" adjustment only. (To 48 V. nom.)

4 ADD MATCHING SOCKET







Special Relays

PARELCO regularly manufactures a wide variety of special relays, custom designed to meet individual circuit requirements. Our Engineering department, experienced in circuit analysis, will gladly assist you in specifying your relay. Coil impedance and relay sensitivity can be varied over wide limits. Unusual contact configurations, such as Form B, D, etc., are available. Relays with mixed contact current ratings are easily made. There is no charge for the required engineering or for a sample relay meeting your specifications. Just let us know your requirements.

PARELCO, INC.

26181 AVENIDA AEROPUORTO, SAN JUAN CAPISTRANO, CALIFORNIA 92675
PHONE: 714 - 493-4507 • TWX: 910-596-1412

TO SELECT YOUR PARELCO R10 RELAY

1. Decide on type of terminal and mounting.
2. Select rating and number of contacts.
3. Choose the proper coil resistance.
4. Pick the mating socket (from back of this page).
5. Order from Parelco representative (see back cover for name and location).

EXAMPLE:

R10-E1	Y-4	V-700	A10-2 SOCKET
R10 Type Relay with Transparent Enclosure, Solder Terminals and Mounting Stud	4 Form C Contacts Rated at 2 amps	700 ohm Coil for 24v Operation	Chassis Mount Socket For A Four Form C Relay

GENERAL SPECIFICATIONS

CONTACT AND LIFE DATA:

Actuator Displacement (V. Adj.) ..... .045 min.
Overtravel (V. Adj.) ..... .012 min.
Contact Material .....Codes W, M, X — Silver cadmium oxide, gold bonded
Codes Y, Z — Fine silver, gold bonded
Code L — Gold-platinum-silver alloy
Life, Mechanical .....100,000,000 operations
Life, Electrical .....See table below

TYPICAL LIFE EXPECTANCY FOR SWITCHING RESISTIVE LOADS AT 25° C

Current	Voltage	Contacts	Adjustment	Life (Operations)
10.0 Amp	115 vac, 60 Hz	W	V	2×10^5
10.0 Amp	28 vdc	W	V	4×10^5
5.0 Amp	115 vac, 60 Hz	X, M	V	2×10^5
5.0 Amp	28 vdc	X, M	V	6×10^5
2.0 Amp	28 vdc	Y, Z	V	1.5×10^6
2.0 Amp	28 vdc	Y, Z	S, J	6×10^5
1.0 Amp	28 vdc	Y, Z	V, S, J	12×10^6
100 ma	28 vdc, 115 vac	Y, Z	V, S, J	1×10^8
50 ma	6 vdc	Z	V, S, J	5×10^7
10 ua	10 mv	L	V, S, J	5×10^7

Contact Resistance .....50 milliohms maximum initially
200 milliohms maximum after life
Contact Bounce .....2.0 milliseconds maximum, N.O. contacts at operate
3.5 milliseconds maximum, N.C. contacts at release

COIL DATA

Max. coil dissipation at 25° C .....2.2 watts
Coil temperature rise .....26° C per watt
Maximum coil temperature .....105° C (221° F)

OPERATING AND ELECTRICAL DATA

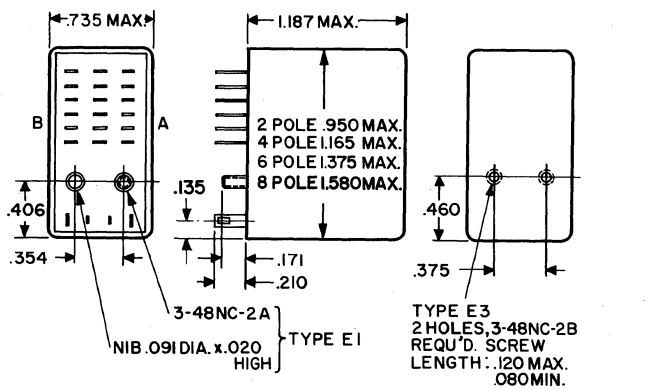
Drop out .....10% minimum of pull-in voltage or current for standard adjustments
Dielectric strength ....1000 vrms; 500 vrms across Z & L code contact gaps
Insulation Resistance .....10,000megohms at 25° C and 50% R.H.
Typical capacitance .....Contact-contact ..... 2 picofarads
Coil-frame .....30 picofarads
Coil-contacts ..... 2 picofarads

ENVIRONMENTAL CHARACTERISTICS

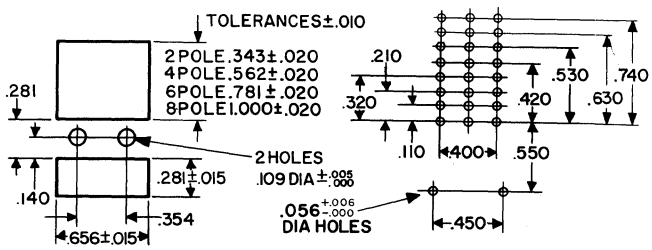
Operating Temperature Range ....−55 to +72 degree C (−67 to+162°F)
Vibration .....0.06" DA, 5-55 Hz 8 g, 55-110 Hz
Operating with no contact chatter
Shock .....15 g operating, 30 g mechanical

WEIGHT .....22 to 40 grams, depending on configuration

SERIES R10 RELAY DIMENSIONS



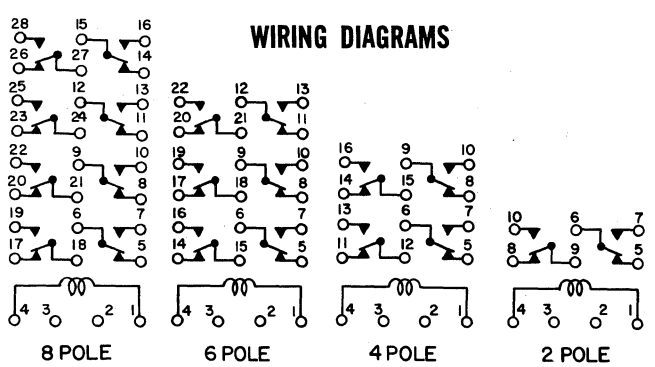
A: SCHEMATIC STAMPED ON THIS SIDE
B: PART NO. STAMPED ON THIS SIDE

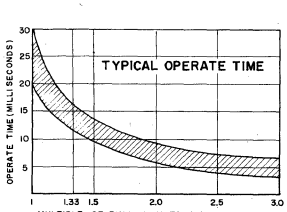


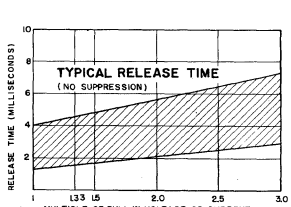
SUGGESTED PANEL LAYOUT FOR RELAY AND SOCKET

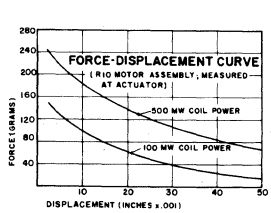
P/C BOARD PATTERN TYPE E2

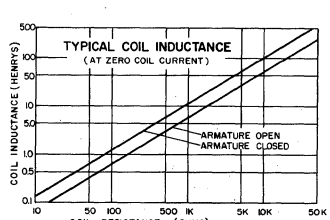
WIRING DIAGRAMS







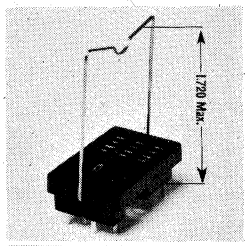




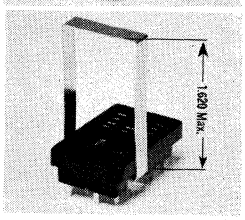
PARELCO SOCKET DETAILS

RETAINING METHODS

WIRE RETAINER

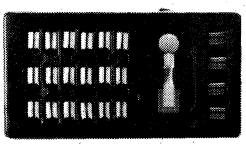


STRAP RETAINER
(for P/C Sockets Only)

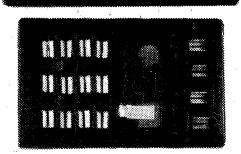


GROUNDING METHODS

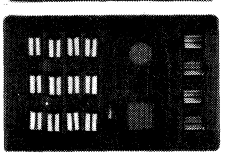
GROUNDING STRIP (Pre-Installed) Mounting Stud of Relay Contacts Grounding Strip — Grounding Strip Grounded with Screw or Rivet Through Hole.



GROUNDING TERMINAL (Pre-Installed — P/C Sockets Only) Mounting Stud of Relay Contacts Ground Terminal.



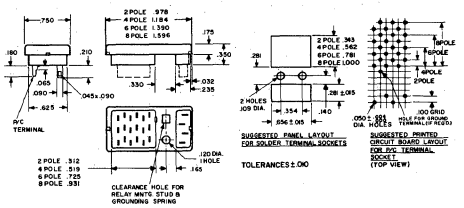
NO GROUNDING PROVISION



RETAINER PART NUMBERS

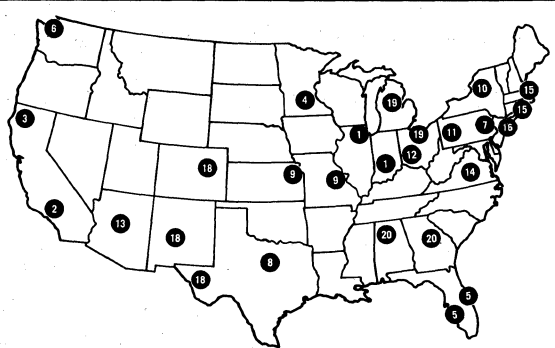
P28-1	Wire Retainer, 2 Pole
P28-2	Wire Retainer, 4 Pole
P28-3	Wire Retainer, 6 Pole
P28-4	Wire Retainer, 8 Pole
P49	Strap Retainer (2, 4, 6 & 8 Poles)

SOCKET MECHANICAL DATA



SOCKET PART NUMBERS

Socket P/N	No. of Poles	Terminal	Grounding Prov.	Retainer
A10-1	2	Solder	Strip	Wire
-2	4	Solder	Strip	Wire
-3	6	Solder	Strip	Wire
-11	8	Solder	Strip	Wire
-10	2	Solder	Strip	None
-20	4	Solder	Strip	None
-30	6	Solder	Strip	None
-110	8	Solder	Strip	None
A11-1	2	P/C	Strip	Wire
-2	4	P/C	Strip	Wire
-3	6	P/C	Strip	Wire
-11	8	P/C	Strip	Wire
-4	2	P/C	None	Wire
-5	4	P/C	None	Wire
-6	6	P/C	None	Wire
-12	8	P/C	None	Wire
-7	2	P/C	Terminal	Wire
-8	4	P/C	Terminal	Wire
-9	6	P/C	Terminal	Wire
-13	8	P/C	Terminal	Wire
-10	2	P/C	Strip	None
-20	4	P/C	Strip	None
-30	6	P/C	Strip	None
-110	8	P/C	Strip	None
-40	2	P/C	None	None
-50	4	P/C	None	None
-60	6	P/C	None	None
-120	8	P/C	None	None
-70	2	P/C	Terminal	None
-80	4	P/C	Terminal	None
-90	6	P/C	Terminal	None
-130	8	P/C	Terminal	None



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Chicago, Ill. 60646
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(213) 295-7781

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P.O. Box 2087)
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4 ROBERT W. MARSHALL CO.
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Minneapolis, Minn. 55416
(612) 929-0457

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Dravo Building
Bellevue, Wash. 98004
(206) 454-0667

7 DANCO CORPORATION
Germantown & Quarry Hall Rds. (P.O. Box 245)
Fairview Village, Penn. 19409
(215) 275-2600
(215) 248-1619

8 LEE SALES COMPANY
2838 Posey Drive
Irving, Texas 75060
(214) 363-3831

9 PENZER ASSOCIATES, INC.
5600 West 95th St.
P.O. Box 6264
Overland Park, Kans. 66207
(913) 381-0004

PENZER ASSOCIATES, INC.
400 Brooks Lane
Hazelwood, Mo. 63042
(314) 731-4334

10 ADVANCED COMPONENTS CORP., INC.
119 Luther Ave.
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(315) 472-7886

ADVANCED COMPONENTS CORP., INC.
5 Sanhurst Dr.
Scottsville, New York 14546
(716) 889-1429

ADVANCED COMPONENTS CORP., INC.
P.O. Box 3514
Rochester, New York 14609
(716) 482-2153

ADVANCED COMPONENTS CORP., INC.
P.O. Box B
Whitesboro, New York 13492
(315) 736-9195

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(914) 471-1623

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Dayton, Ohio 45419
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22 A. D. ELECTRONICS CO.
7969 Engineer Rd.
Suite 106
San Diego, Calif. 92111
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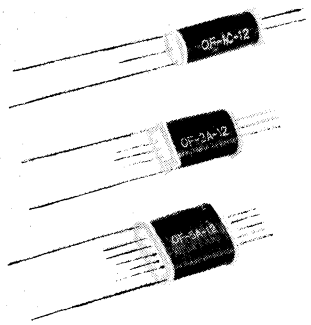
26181 Avenida Aeropuerto, San Juan Capistrano, California 92675
Phone: (714) 493-4507 TWX: 910-596-1412
ENGINEERING REPRESENTATIVES AND STOCKING POINTS IN MAJOR INDUSTRIAL CENTERS

PHIPPS PRECISION PRODUCTS

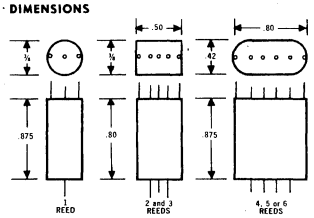
7641 DENSMORE AVENUE
VAN NUYS, CALIFORNIA 91406
TELEPHONE: (213) 785-3109

MINIATURE REED RELAY AND RELAY ASSEMBLIES

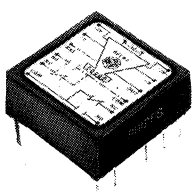


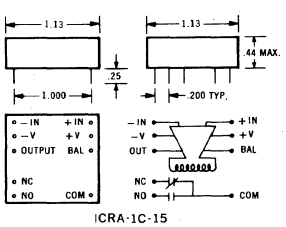
PHIPPS PRECISION PRODUCTS manufactures all types of reed relay assemblies. The most popular is the open frame (OF) series; however, other popular series include printed circuit board (PC) series and relay assemblies packaged in vector cans (VC series) for plug-in socket mounting. In addition to these standard types, PHIPPS designs and manufactures special purpose reed relay assemblies to meet any specific customer application. These include latching relays in single or multiple contact configurations; multiple contact reed relays up to 100 contacts per relay; special mounting, coil resistance, pull-in and drop-out characteristics per customer specifications; mercury wetted relays in any configuration; and time delay relays using reeds. PHIPPS PRECISION PRODUCTS engineers will give your specialized requirements in reed relay and reed matrix applications immediate attention.

DIMENSIONS



"ICR" SERIES COMPARATOR RELAYS AND WINDOW COMPARATORS





ICRA-1C-15

COMPARATOR RELAYS

The "ICR" series is a completely new family of differential comparator relays that combine the most advanced integrated circuit technology with reed relay life, speed, and reliability. Sizes of these units are less than half that of existing operational amplifier/relay assemblies. Self-contained in one integral package, "ICR" units consist of an integrated circuit operational amplifier precisely matched to a reed relay. Applications include: temperature controllers, precision analog gates, sample and hold circuits, overvoltage protection circuits, sorter/classifiers, alarm devices, differential threshold comparators, process controls, go/no-go controls and limit controls.

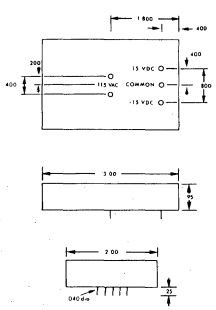
PROGRAMMABLE HYSTERESIS

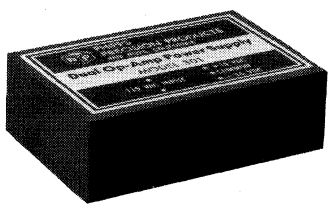
In applications where the input signal varies gradually through the comparator trip level or where noise is present on the input signal, it is desirable to introduce hysteresis in a comparator circuit. The programmable hysteresis option to the "ICR" comparator relay permits the desired hysteresis (voltage difference between relay pull-in and drop-out) to be programmed by connecting the appropriate resistance between the hysteresis terminals on the "ICR" module. Trip level and input impedance are unaffected, and design of sophisticated positive-feedback networks is eliminated.

WINDOW COMPARATOR

The window comparator consists of two ICR type relays packaged together driving either a common relay, SPDT, DPDT, or two separate relays with SPST, DPST, SPDT or DPDT contacts. SPST contacts can be either normally open (A FORM) or normally closed (B FORM) reeds. Single pole contacts are available with either dry or mercury wetted reed contacts. The window comparator can sense the input signal to a high reference level and a low reference level. This level range is limited by the differential input signal capability of the integrated circuit. Programmable hysteresis is an added feature which allows the designer to eliminate chatter caused by noise on the input signal voltage.

DUAL OP-AMP POWER SUPPLY





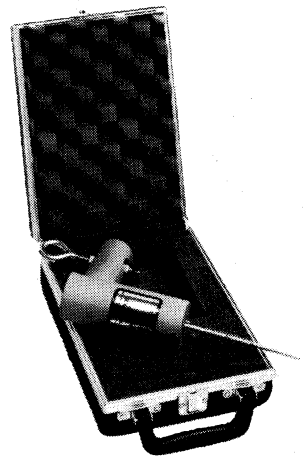
50MA and 100MA OUTPUTS

Phipps Models 301 and 301A are completely self-contained dual output power supplies designed to power circuit modules such as operational amplifiers, comparators, etc., requiring dual +15VDC and −15VDC inputs or single 30VDC input. Designed to operate directly off a 115VAC input, Models 301 and 301A are epoxy cast into modules designed to be soldered directly onto printed circuit boards or plugged into special sockets.

Other outstanding features include small size (only 0.95 x 2 x 3 inches for Model 301), lightweight (only 8 ounces for Model 301), ±0.1VDC output accuracy, less than 1 millivolt RMS ripple, and complete short circuit protection.

Other power supplies including dual voltages are also available.

PI (SAFETY) METER



This new series of PI-Meters incorporate a complete re-design which increases sensitivity and reliability. Capable of detecting voltages from 100 VRMS to an infinite AC voltage, the meter incorporates a self test feature which verifys unit operation prior to each use. The rugged case incorporates an eye bolt to connect to a hot stick for checking for high voltages in dangerous and in-accessible areas. A single 9 VDC battery provides approximately 4000 hours of intermittent operation.

The meter was originally designed as a safety tool to determine whether or not an underground transformer was turned off prior to a lineman entering the transformer area. However, unit features make it ideally suited for any application involving high voltage.

ultDELAY® TIME DELAY RELAYS

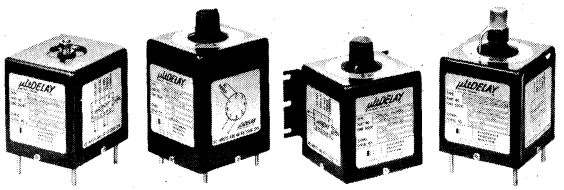
Three lines offering combinations of accuracy, features, size, and cost to meet all requirements. All models are solid-state and have been "value-engineered" to deliver ultra-reliable performance.

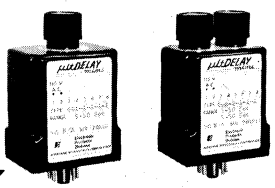
REPRESENTATIVE APPLICATIONS:

SEQUENCE TIMER
BATCH PROGRAMMER
COMPUTER INTERFACING
CONVEYOR SEQUENCING
INJECTION MOLDING

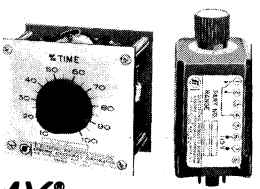
ultDELAY®

—the ultimate in accuracy and adaptability





ultDELAY® mini —budget-priced companion to ultDELAY



ultDELAY®-ECONOmini —switch mode 1 or 2 in an economical design

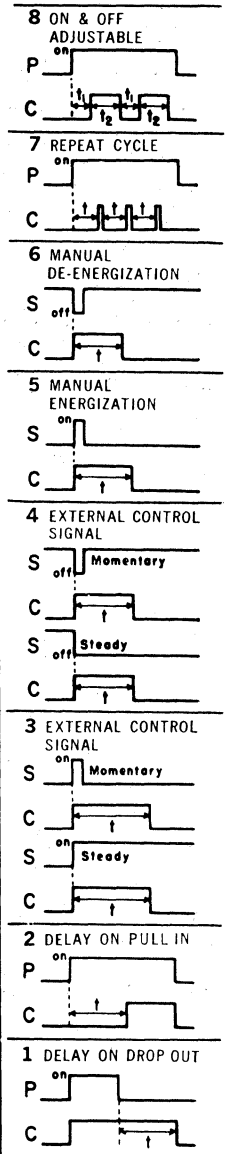
SPECIFICATIONS

	ultDELAY	ultDELAY—mini	ultDELAY-ECONOmini
TIMING RANGES, ADJ.	Ten standard ranges from .05 seconds minimum to 60 minutes maximum. Other ranges or pre-set times are available as options.		
REPEATABILITY (OF SET-POINT VALUE, AT CONSTANT VOLT. AND TEMP.)	±1% of Set Point	±2% of Set Point	±4% of Set Point
RESET TIME, MAX	30 ms	30 ms	50 ms
SWITCH CONTACTS*	SPDT, DPDT, 3PDT, 10A, 120 VAC or 28 VDC	SPDT, 10A, 120 VAC or 28 VDC	SPDT, or DPDT 10A, 120 VAC
AMBIENT LIMITS: COMPENSATED OPERATIONAL OR STORAGE	—5° to 150°F —67° to 257°F	32° to 125°F —67° to 257°F	—5° to 150°F —5° to 150°F
OPERATING VOLTAGES	90-140 or 200-240 VAC, 40-5,000 Hz; or 21-36 VDC	100-130 or 220 VAC, 50/60 Hz; or 23-33 VDC	100-130 VAC, 50-60 Hz or 24-32 VDC
MOUNTING	Stud, flange, or panel	Plug-in or panel adapter	Plug-in or panel
TERMINALS	Octal plug or two 8-screw terminal strips	Octal plug or terminal adapter	Octal plug or terminal board
SWITCH MODES	1 through 8	1-3 and 5-8	1 (with standby power) or 2
OPTION	Remote set point adjustment		

*Solid State output switching available.

ORDERING: *State model no., voltage, range, and options. Descriptive literature on request.*

SWITCH MODES



P—Operate Power
C—Contact Position
S—Control Signal

PLESSEY AIRBORNE CORPORATION

1414 Chestnut Ave., Hillside, N.J. 07205 Tel. (201) 688-0250 TWX 710-985-4667

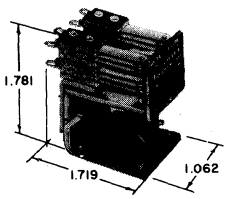
AVAILABLE IN CANADA

See Plessey Airborne ads in Section 2200, pages 1048 & 1049

POTTER & BRUMFIELD
Division of American Machine & Foundry Company, Princeton, Indiana 47570

GENERAL PURPOSE RELAYS

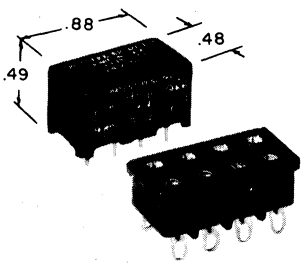
GA SERIES Low cost, all purpose, multiple contact, voltage switching relay. Used for many industrial control applications. Tinned, pierced solder type terminals. Contacts: 3/16" dia. silver, designed for maximum self-cleaning action. Mounting: No. 8-32 tapped core with locating boss. Weight: 3½ ozs. See GF series for similar relays having 10 amp ratings.



HP SERIES This commercial microminiature relay is recommended for applications requiring high performance in minimum space, such as TV cameras, dictating machines, desk top computers, copying machines and others. For circuit board or socket mounting and encased in a high impact dust cover, the HP is a half crystal case size relay with terminals on a .200" grid.

9HP1 solder terminal socket and retainer for HP relay. Box of 10 **NET $4.75**

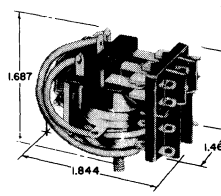
Additional specifications of HP series.



KA AND KAP SERIES Small, low cost, highly efficient general purpose relays for handling light power loads such as small motors, solenoids and other relays, and general automation work. All KA and KAP relays with "Y" suffix bear CSA* listing and carry U/L component recognition (File No. E22575). Mechanical life expectancy: 10 million operations. Duty: Continuous. Contacts: Movable, 1/8" dia. gold-flashed silver; stationary, 5/32" dia. wide silver overlay.

The KA is the open version of this series. Mounting: One No. 6-32 threaded stud and locating tab on 7/16" centers. Weight: 2 ozs. The KAP is the enclosed model and is protected by a clear, high impact plastic dust cover. Terminals: 8 or 11-pin plug. Weight: 3 ozs.

"G" suffix indicates silver-cadmium-oxide contacts on movables rated 10 amps.

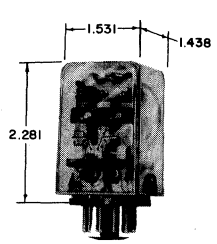


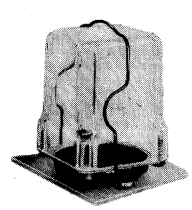
HOLD DOWN SPRINGS Designed to insure secure mounting of relays in any position. Will accommodate machine screws or rivets.

For KAP relays: (shown above)
9KA1 50 per box **NET $5.80**

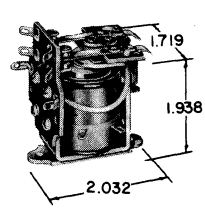
For KCP and KRP relays (pages 6 and 3)
9KR15 50 per box **NET $5.80**

For KUP plain case relays (page 3)
9KU3 50 per box **NET $5.25**





KL SERIES Multiple contact relay. Varied contact combinations and high dielectric phenolic insulation affords extreme versatility and utility. Widely used in such applications as industrial controls, elevator controls, communications equipment and electronic measuring devices. Mounting: All models — Two No. 6-32 tapped holes on 1 7/16" centers. Contacts: 1/8" dia. gold-flashed silver. Weight: 5 ozs.



* Canadian Standards Assoc. File No. LR-15734

† Sealed Relay
§ Enclosed Relay

GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RESALE PRICE
	Voltage or Current	Resistance in Ohms	Nominal Power	Arrangement	Rate in Amps	
GA11A	6V	1.7	6VA	DPDT	5	$3.70
GA11A	12V	6.8	6VA	DPDT	5	3.70
GA11A	24V	24	6VA	DPDT	5	3.70
GA11A	120V	690	6VA	DPDT	5	3.70
GA11D	6V	18	2.0W	DPDT	5	3.70
GA11D	12V	72	2.0W	DPDT	5	3.70
GA11D	24V	288	2.0W	DPDT	5	3.70
GA11D	110V	6,050	2.0W	DPDT	5	4.20
GA14A	24V	24	6VA	3PDT	5	4.45
GA14A	120V	690	6VA	3PDT	5	4.45
GA14D	24V	288	2.0W	3PDT	5	4.45
GA17A	6V	1.7	6VA	4PDT	5	5.35
GA17A	12V	6.8	6VA	4PDT	5	5.35
GA17A	24V	24	6VA	4PDT	5	5.35
GA17A	120V	690	6VA	4PDT	5	5.35
GA17A	240V	2,950	6VA	4PDT	5	5.80
GA17D	6V	18	2.0W	4PDT	5	5.35
GA17D	12V	72	2.0W	4PDT	5	5.35
GA17D	24V	288	2.0W	4PDT	5	5.35
GA17D	110V	6,050	2.0W	4PDT	5	5.90
HP11D§	12V	218	.662W	DPDT	2	7.95
HP11D§	24V	870	.662W	DPDT	2	7.95
KA5AY	6V	6	2VA	SPDT	5	$3.50
KA5AY	12V	21	2VA	SPDT	5	3.50
KA5AY	24V	75	2VA	SPDT	5	3.50
KA5AY	120V	2,250	2VA	SPDT	5	3.50
KA5AY	240V	9,110	2VA	SPDT	5	4.00
KA5AG	6V	6	2VA	SPDT	10	3.55
KA5AG	12V	21	2VA	SPDT	10	3.55
KA5AG	24V	75	2VA	SPDT	10	3.55
KA5AG	120V	2,250	2VA	SPDT	10	3.55
KA5AG	240V	9,110	2VA	SPDT	10	4.05
KA5DY	6V	32.1	1.2W	SPDT	5	3.35
KA5DY	12V	120	1.2W	SPDT	5	3.35
KA5DY	24V	472	1.2W	SPDT	5	3.35
KA5DY	110V	10,000	1.2W	SPDT	5	4.05
KA5DG	6V	32.1	1.2W	SPDT	10	3.40
KA5DG	12V	120	1.2W	SPDT	10	3.40
KA5DG	24V	472	1.2W	SPDT	10	3.40
KA5DG	110V	10,000	1.2W	SPDT	10	4.10
KA11AY	6V	6	2VA	DPDT	5	4.25
KA11AY	12V	21	2VA	DPDT	5	4.25
KA11AY	24V	75	2VA	DPDT	5	4.25
KA11AY	120V	2,250	2VA	DPDT	5	4.25
KA11AY	240V	9,110	2VA	DPDT	5	4.65
KA11AG	6V	6	2VA	DPDT	10	4.35
KA11AG	12V	21	2VA	DPDT	10	4.35
KA11AG	24V	75	2VA	DPDT	10	4.35
KA11AG	120V	2,250	2VA	DPDT	10	4.35
KA11AG	240V	9,110	2VA	DPDT	10	4.75
KA11DY	6V	32.1	1.2W	DPDT	5	3.75
KA11DY	12V	120	1.2W	DPDT	5	3.75
KA11DY	24V	472	1.2W	DPDT	5	3.75
KA11DY	110V	10,000	1.2W	DPDT	5	4.40
KA11DG	6V	32.1	1.2W	DPDT	10	3.90
KA11DG	12V	120	1.2W	DPDT	10	3.90
KA11DG	24V	472	1.2W	DPDT	10	3.90
KA11DG	110V	10,000	1.2W	DPDT	10	4.50
KA14AY	6V	6	2VA	3PDT	5	4.65
KA14AY	12V	21	2VA	3PDT	5	4.65
KA14AY	24V	75	2VA	3PDT	5	4.65
KA14AY	120V	2,250	2VA	3PDT	5	4.65
KA14AY	240V	9,110	2VA	3PDT	5	5.15
KA14AG	6V	6	2VA	3PDT	10	4.85
KA14AG	12V	21	2VA	3PDT	10	4.85
KA14AG	24V	75	2VA	3PDT	10	4.85
KA14AG	120V	2,250	2VA	3PDT	10	4.85
KA14AG	240V	9,110	2VA	3PDT	10	5.30
KA14DY	6V	32.1	1.2W	3PDT	5	4.25
KA14DY	12V	120	1.2W	3PDT	5	4.25
KA14DY	24V	472	1.2W	3PDT	5	4.25
KA14DY	110V	10,000	1.2W	3PDT	5	4.90
KA14DG	6V	32.1	1.2W	3PDT	10	4.40
KA14DG	12V	120	1.2W	3PDT	10	4.40
KA14DG	24V	472	1.2W	3PDT	10	4.40
KA14DG	110V	10,000	1.2W	3PDT	10	5.10
KAP5AG§	24V	75	2VA	SPDT	10	6.10
KAP5AG§	120V	2,250	2VA	SPDT	10	6.10
KAP5DG§	24V	472	1.2W	SPDT	10	6.00
KAP5DG§	110V	10,000	1.2W	SPDT	10	6.65
KAP11AY§	24V	75	2VA	DPDT	5	6.65
KAP11AY§	120V	2,250	2VA	DPDT	5	6.65
KAP11AY§	240V	9,110	2VA	DPDT	5	7.10
KAP11AG§	6V	.6	2VA	DPDT	10	6.75
KAP11AG§	24V	75	2VA	DPDT	10	6.75
KAP11AG§	120V	2,250	2VA	DPDT	10	6.75
KAP11DG§	24V	472	1.2W	DPDT	10	6.70
KAP11DG§	110V	10,000	1.2W	DPDT	10	7.40
KAP11DY§	12V	120	1.2W	DPDT	5	6.60
KAP11DY§	24V	472	1.2W	DPDT	5	6.60
KAP11DY§	110V	10,000	1.2W	DPDT	5	7.30
KAP14AY§	24V	75	2VA	3PDT	5	8.30
KAP14AY§	120V	2,250	2VA	3PDT	5	8.30
KAP14AY§	240V	9,110	2VA	3PDT	5	8.70
KAP14AG§	24V	75	2VA	3PDT	10	8.45
KAP14AG§	120V	2,250	2VA	3PDT	10	8.45
KAP14DG§	24V	472	1.2W	3PDT	10	8.40
KAP14DG§	110V	10,000	1.2W	3PDT	10	9.05
KAP14DY§	12V	120	1.2W	3PDT	5	8.20
KAP14DY§	24V	472	1.2W	3PDT	5	8.20
KAP14DY§	110V	10,000	1.2W	3PDT	5	8.85
KL5A	120V	760	2.9VA	SPDT	5	4.25
KL5D	24V	600	1.1W	SPDT	5	4.00
KL11A	12V	7.8	2.9VA	DPDT	5	5.30
KL11A	24V	33	2.9VA	DPDT	5	5.30
KL11A	120V	760	2.9VA	DPDT	5	5.30
KL14A	24V	33	2.9VA	3PDT	5	5.90
KL14A	120V	760	2.9VA	3PDT	5	5.90
KL14D	24V	600	1.1W	3PDT	5	5.65
KL14D	110V	10,000	1.1W	3PDT	5	6.35
KL17A	6V	2.25	2.9VA	4PDT	5	7.00
KL17A	24V	33	2.9VA	4PDT	5	7.00
KL17A	120V	760	2.9VA	4PDT	5	7.00
KL17D	12V	140	1.1W	4PDT	5	6.60
KL17D	24V	600	1.1W	4PDT	5	6.60
KL17D	110V	10,000	1.1W	4PDT	5	7.30

POTTER & BRUMFIELD

Division of American Machine & Foundry Company, Princeton, Indiana 47570

GENERAL PURPOSE RELAYS (CONTINUED)

KHU/KHP/KHS SERIES Small, rugged, 4PDT, available for AC or DC operation. Only KHU relays carry Underwriters' Laboratories component recognition. KHU and KHP have nylon dust covers; KHS is hermetically sealed in metal enclosure. These relays are designed to meet the exacting requirements of data processing, computer and process control applications. Contacts are 3/32" gold-flashed silver and are rated 3 amps @ 30V DC or 120V AC resistive for 100,000 operations. "12" suffix indicates silver-cadmium-oxide contacts. Mounting: Solder terminals with a No. 3-48 5/16" long. Adaptable to sockets (below) with printed circuit or solder lug terminals. Weights without sockets; KHU or KHP 1⅛ ozs.; KHS 1⅝ ozs.

KHU/KHP hold down spring (similar to KCP-KRP, above.)

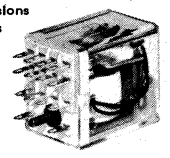
9KH3 50 per box, weight 3 ozs. Net $5.50

9KH1 Solder terminal sockets and retainers. Box of 10 Net $6.60

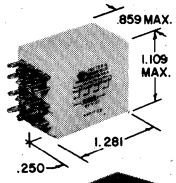
9KH2 Printed circuit terminal sockets. Box of 10 Net $6.60

Weight per box: 4 ozs.

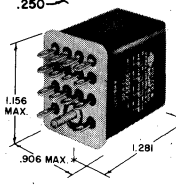
Dimensions same as KHP



KHU

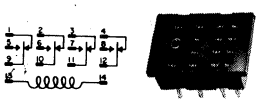


KHP



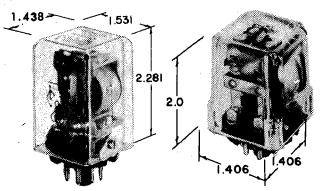
KHS

KRP SERIES Versatile, multi-contact arrangement. Enclosed in a clear high impact plastic dust cover. Standard 8-pin octal-type plug for KRP5 and KRP11, 11-pin for KRP-14. Weight: Approx. 3 ozs. Contacts: 5 amp, 3/16" dia. gold-flashed silver, 10 amp 3/16" dia. silver cadmium-oxide. See KCP-KRP hold down spring for special mounting applications. See KRP-N indicator lamp relay for current monitoring applications.

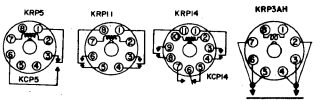


KRP-N INDICATOR LAMP RELAY A general purpose relay incorporating a lamp to indicate current or voltage availability in power circuit. Contacts: 3/16" dia. silver cadmium-oxide. Enclosure: Clear, high impact plastic dust cover. Mounting: Standard octal plug. Weight: Approx. 3 ozs.

Hold down spring (Please see page 2).



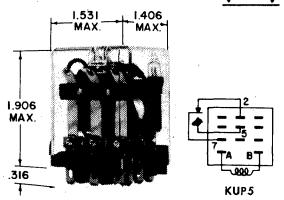
"P" — CASE A clear high impact plastic case for mounting rectifiers, capacitors, resistors or a combination of these. Available with octal-type plug with 8 or 11-pins. Comes complete with four screws. Weight: .5 ozs. each. See KCP-KRP Hold Down Spring for special mounting applications.



35D070 Case (8-pin plug) NET $ .65

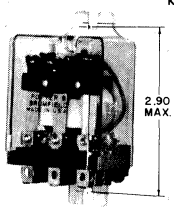
35D072 Case (11-pin plug) NET $ .80

KUP SERIES This reliable 10-ampere relay for industrial control is available with a socket that is also rated 10 amperes. The .187" terminals of the relay are of the quick-connect/solder type. Sockets are priced separately and their terminals are of the pierced solder type. The KUP is enclosed in a clear, high impact plastic dust cover. Silver-cadmium-oxide contacts assure long contact life. Operation: Continuous.



KUP5

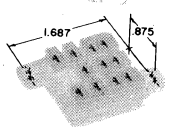
KUP SERIES with slotted flange for direct-to-chassis mounting. Identical in both electrical and mechanical specifications as the KUP described above, except that they are not suitable for socket mounting. The .187" terminals are of the quick-connect/solder type. Slot width: .156". Weight: 3 ozs.



All models carry U/L Component Recognition.

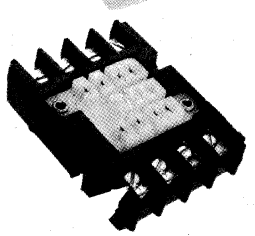
9KU1 pierced solder terminals sockets and retainers for KUP plain case relays. Rated 10 amperes; molded nylon. Mounting hole .165" dia.
Box of 5 NET $3.95

9KU5 sockets with .187" quick-connect terminals. Mounting hole .165" dia.
Box of 5 NET $6.30



9KU2 printed circuit pin terminal sockets for KUP relays. Will accept .187" terminals of KUP in plain case. Molded nylon. Mounting hole .165" dia.
Box of 5 NET $4.75

9KU4 screw terminal socket for KUP plain case relays to 2 Form C. The nylon socket (accepts .187" terminals) is riveted to the bakelite frame that provides screw terminals.
Box of 5 NET $13.15



* Canadian Standards Assoc. File No. LR-15734

† Sealed Relay
§ Enclosed Relay

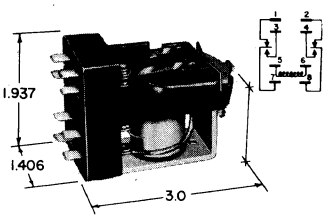
GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RESALE PRICE
	Voltage or Current	Resistance in Ohms	Nominal Power	Arrangement	Rate in Amps	
KHU17A11§	6V	10.5	1.2VA	4PDT	3	5.55
KHU17A11§	12V	43	1.2VA	4PDT	3	5.55
KHU17A11§	24V	160	1.2VA	4PDT	3	5.55
KHU17A11§	120V	3,900	1.2VA	4PDT	3	6.05
KHU17D11§	6V	40	900MW	4PDT	3	5.05
KHU17D11§	12V	160	900MW	4PDT	3	5.05
KHU17D11§	24V	650	900MW	4PDT	3	5.05
KHU17D12§	24V	650	900MW	4PDT	3	5.20
KHU17D11§	48V	2,600	900MW	4PDT	3	5.25
KHU17D11§	90V	9,000	900MW	4PDT	3	5.90
KHU17D11§	110V	11,000	900MW	4PDT	3	5.90
KHU17D12§	110V	11,000	900MW	4PDT	3	5.05
KHP17A11§	6V	10.5	1.2VA	4PDT	3	5.55
KHP17A11§	12V	43	1.2VA	4PDT	3	5.55
KHP17A11§	24V	160	1.2VA	4PDT	3	5.55
KHP17A11§	120V	3,900	1.2VA	4PDT	3	6.05
KHP17D11§	6V	40	900MW	4PDT	3	5.05
KHP17D11§	12V	160	900MW	4PDT	3	5.05
KHP17D11§	24V	650	900MW	4PDT	3	5.05
KHP17D12§	24V	650	900MW	4PDT	3	5.20
KHP17D11§	48V	2,600	900MW	4PDT	3	5.25
KHP17D11§	90V	9,000	900MW	4PDT	3	5.90
KHP17D11§	110V	11,000	900MW	4PDT	3	5.90
KHP17D12§	110V	11,000	900MW	4PDT	3	6.05
KHS17A11†	6V	10.5	1.2VA	4PDT	3	9.55
KHS17A11†	12V	43	1.2VA	4PDT	3	9.55
KHS17A11†	24V	160	1.2VA	4PDT	3	9.55
KHS17A11†	120V	3,900	1.2VA	4PDT	3	9.90
KHS17D11†	6V	40	900MW	4PDT	3	8.55
KHS17D11†	12V	160	900MW	4PDT	3	8.55
KHS17D11†	24V	650	900MW	4PDT	3	8.55
KHS17D11†	110V	11,000	900MW	4PDT	3	9.40
KRP5A§	6V	6	2VA	SPDT	5	6.00
KRP5A§	24V	75	2VA	SPDT	5	6.00
KRP5A§	120V	2,250	2VA	SPDT	5	6.00
KRP5AG§	6V	6	2VA	SPDT	10	6.15
KRP5AG§	24V	75	2VA	SPDT	10	6.15
KRP5AG§	120V	2,250	2VA	SPDT	10	6.15
KRP5D§	6V	32.1	1.2W	SPDT	5	5.95
KRP5D§	12V	120	1.2W	SPDT	5	5.95
KRP5D§	24V	472	1.2W	SPDT	5	5.95
KRP5D§	110V	10,000	1.2W	SPDT	5	6.60
KRP5DG§	6V	32.1	1.2W	SPDT	10	6.10
KRP5DG§	12V	120	1.2W	SPDT	10	6.10
KRP5DG§	24V	472	1.2W	SPDT	10	6.10
KRP5DG§	110V	10,000	1.2W	SPDT	10	6.70
KRP11A§	6V	6	2VA	DPDT	5	6.65
KRP11A§	12V	21	2VA	DPDT	5	6.65
KRP11A§	24V	75	2VA	DPDT	5	6.65
KRP11A§	120V	2,250	2VA	DPDT	5	6.65
KRP11A§	240V	9,110	2VA	DPDT	5	7.10
KRP11AG§	6V	6	2VA	DPDT	10	6.90
KRP11AG§	12V	21	2VA	DPDT	10	6.90
KRP11AG§	24V	75	2VA	DPDT	10	6.90
KRP11AG§	120V	2,250	2VA	DPDT	10	6.90
KRP11AG§	240V	9,100	2VA	DPDT	10	7.35
KRP11D§	6V	32.1	1.2W	DPDT	5	6.60
KRP11D§	12V	120	1.2W	DPDT	5	6.60
KRP11D§	24V	472	1.2W	DPDT	5	6.60
KRP11D§	110V	10,000	1.2W	DPDT	5	7.30
KRP11DG§	6V	32.1	1.2W	DPDT	10	6.85
KRP11DG§	12V	120	1.2W	DPDT	10	6.85
KRP11DG§	24V	472	1.2W	DPDT	10	6.85
KRP11DG§	110V	10,000	1.2W	DPDT	10	7.50
KRP14A§	6V	6	2VA	3PDT	5	8.30
KRP14A§	12V	21	2VA	3PDT	5	8.30
KRP14A§	24V	75	2VA	3PDT	5	8.30
KRP14A§	120V	2,250	2VA	3PDT	5	8.30
KRP14A§	240V	9,110	2VA	3PDT	5	8.70
KRP14AG§	6V	6	2VA	3PDT	10	8.60
KRP14AG§	12V	21	2VA	3PDT	10	8.60
KRP14AG§	24V	75	2VA	3PDT	10	8.60
KRP14AG§	120V	2,250	2VA	3PDT	10	8.60
KRP14AG§	240V	9,100	2VA	3PDT	10	9.00
KRP14D§	6V	32.1	1.2W	3PDT	5	8.20
KRP14D§	12V	120	1.2W	3PDT	5	8.20
KRP14D§	24V	472	1.2W	3PDT	5	8.20
KRP14D§	110V	10,000	1.2W	3PDT	5	8.85
KRP14DG§	6V	32.1	1.2W	3PDT	10	8.50
KRP14DG§	12V	120	1.2W	3PDT	10	8.50
KRP14DG§	24V	472	1.2W	3PDT	10	8.50
KRP14DG§	110V	10,000	1.2W	3PDT	10	9.20
KRP11AN§	6V	6	2VA	DPDT	10	7.90
KRP11AN§	12V	21	2VA	DPDT	10	7.90
KRP11AN§	24V	75	2VA	DPDT	10	7.90
KRP11AN§	120V	2,250	2VA	DPDT	10	7.90
KRP11AN§	240V	9,110	2VA	DPDT	10	8.30
KRP11DN§	6V	32.1	1.2W	DPDT	10	7.80
KRP11DN§	12V	120	1.2W	DPDT	10	7.80
KRP11DN§	24V	420	1.2W	DPDT	10	7.80
KRP11DN§	110V	10,000	1.2W	DPDT	10	8.50
KRP14AN§	6V	6	2VA	3PDT	10	9.60
KRP14AN§	12V	21	2VA	3PDT	10	9.60
KRP14AN§	24V	75	2VA	3PDT	10	9.60
KRP14AN§	120V	2,250	2VA	3PDT	10	9.60
KRP14AN§	240V	9,110	2VA	3PDT	10	10.05
KUP5A15§	6V	5.1	2VA	SPDT	10	3.90
KUP5A15§	12V	21	2VA	SPDT	10	3.90
KUP5A15§	24V	75	2VA	SPDT	10	3.90
KUP5A15§	120V	2,250	2VA	SPDT	10	3.90
KUP5A15§	240V	9,110	2VA	SPDT	10	4.30
KUP5D15§	6V	32.1	1.2W	SPDT	10	3.75
KUP5D15§	12V	120	1.2W	SPDT	10	3.75
KUP5D15§	24V	472	1.2W	SPDT	10	3.75
KUP5D15§	110V	10,000	1.2W	SPDT	10	4.35
KUP11A15§	6V	5.1	2VA	DPDT	10	4.75
KUP11A15§	12V	21	2VA	DPDT	10	4.75
KUP11A15§	24V	75	2VA	DPDT	10	4.75
KUP11A15§	120V	2,250	2VA	DPDT	10	4.75
KUP11A15§	240V	9,110	2VA	DPDT	10	5.15
KUP11D15§	6V	32.1	1.2W	DPDT	10	4.25
KUP11D15§	12V	120	1.2W	DPDT	10	4.25
KUP11D15§	24V	472	1.2W	DPDT	10	4.25
KUP11D15§	110V	10,000	1.2W	DPDT	10	4.90
KUP14A15§	6V	4.2	2.75VA	3PDT	10	5.30
KUP14A15§	12V	18	2.75VA	3PDT	10	5.30
KUP14A15§	24V	72	2.75VA	3PDT	10	5.30
KUP14A15§	120V	1,700	2.75VA	3PDT	10	5.30
KUP14A15§	240V	7,200	2.75VA	3PDT	10	5.70
KUP14D15§	6V	32.1	1.2W	3PDT	10	4.90
KUP14D15§	12V	120	1.2W	3PDT	10	4.90
KUP14D15§	24V	472	1.2W	3PDT	10	4.90
KUP14D15§	110V	10,000	1.2W	3PDT	10	5.30
KUP14A55§*	6V	4.2	2.75VA	3PDT	10	5.30
KUP14A55§*	12V	18	2.75VA	3PDT	10	5.30
KUP14A55§*	24V	72	2.75VA	3PDT	10	5.30
KUP14A55§*	120V	1,700	2.75VA	3PDT	10	5.30
KUP14A55§*	240V	7,200	2.75VA	3PDT	10	5.70
KUP14D55§*	6V	32.1	1.2W	3PDT	10	4.90
KUP14D55§*	12V	120	1.2W	3PDT	10	4.90
KUP14D55§*	24V	472	1.2W	3PDT	10	4.90
KUP14D55§*	110V	10,000	1.2W	3PDT	10	5.30

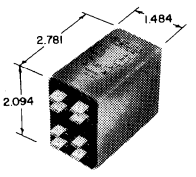
POTTER & BRUMFIELD
Division of American Machine & Foundry Company, Princeton, Indiana 47570

POWER RELAYS

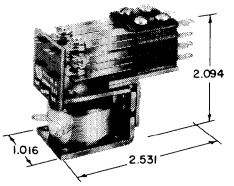
AB SERIES For appliance and general purpose applications where rugged construction, long life and quiet operation are required. All equipped with terminals to fit snap-on connectors and may also be applied to printed circuits using dip soldering. Snap-on screw adaptors packed with each relay. All AC models carry U/L component recognition (File No. E29244) and CSA* listing. Mounting: Two No. 8-32 tapped holes, on 1¼" centers. Silver contacts. Weight: Approx. 5 ozs.



ABC SERIES Medium duty power relay with dust cover. For small motors, industrial control and similar applications. All equipped with terminals to fit snap-on connectors and may also be applied to printed circuits using dip soldering. Snap-on screw adaptors packed with each relay. All AC models carry U/L component recognition (File No. E292-44) and CSA* listing. Mounting: One No. 8-32 threaded stud ⅜" long and locating tab on 5/16" centers. Contacts: ¼" dia. silver. Weight: Approx. 7 ozs.



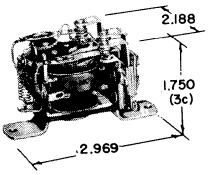
GF SERIES Medium duty power relay for industrial control applications. Long contact arms have ¼" dia. silver contacts rated at 10 amps at 120V AC or 28V DC resistive. Contacts have excellent wipe or self-cleaning action. Tinned, pierced solder terminals. Mounting: 8-32 tapped core with locating boss. Weight: 4.75 ozs. (See GA series, page 1, for similar voltage actuated relays.)



MR SERIES A medium duty power relay that can handle small motors, transmitters, and general purpose applications. Mounting: Two 5/32" dia. holes on 2¼" centers for MR3 and 11, 2⅝" centers for MR2, 5 and 14. Contacts: 7/32" dia. silver. Weight: 4 ozs.

MS/MR Metal dust cover similar to PM/PR shown below. 3⅝" x 2⅜" x 2 21/32". Weight: 7.5 ozs.

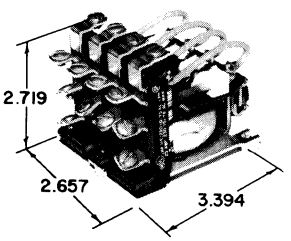
35D130 fits MS/MR **NET $2.20**



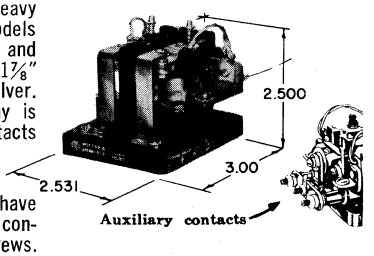
PM SERIES A compact heavy duty 4PDT power relay for polyphase and heavy duty switching applications. Screw terminals. Has ¼" silver-cadmium-oxide contacts rated at 25 amps at 120V., 25 amps at 240V. 50/60 Hz resistive AC, 1HP per movable arm at 120V. or 240V. AC single phase, U/L (File No. E22575) and CSA* listed, except 480V. Mounts by one front keyhole and two rear channel slots for 8-32 screws on 2" x 2½" triangular centers. Weight: 14 ozs.

9PM1 Adaptor plates for mounting PM on PR mounting holes. Box of 10 **NET $1.75**

Enclosures for PM relay — see below.



PR SERIES Heavy duty relay for industrial control applications requiring long life and fast action. Heavy duty screw type terminals. All AC and DC models except PR-11AL5 carry U/L (File No. E22575) and CSA* listing. Mounting: Two 3/16" dia. holes on 1⅞" centers. Weight: 11 ozs. max. Contacts: 5/16" dia. silver. Enclosure: See "PR" cover. The PR11AL5 relay is equipped with 3/16" dia. silver SPDT auxiliary contacts rated at 5 amps.



PM and PR DUST COVERS These dust covers have a sheet metal base with knockouts for ½" dia. conduit and an aluminum cover fitted with two screws. Finished in gray hammertone. Mounting: Three No. 10 holes on 1⅞" x 4⅛" centers. Approx. weight: 1 lb.

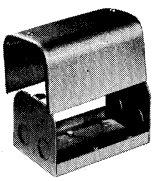
35D227 Metal cover for PM only **NET $3.45**

9PM2 Plastic dust cover for PM only. Box of 4 **NET $1.90**

35D013 Metal cover for PR only **NET $3.45**

PM:
L 5.313
W 3.812
H 3.812

PR:
L 5.312
W 3.375
H 3.125



*Canadian Standards Assoc. File No. LR-15734

§ Enclosed Relay

POWER RELAYS

TYPE	COILS			CONTACTS		SUGG. RESALE PRICE
	Voltage or Current	Resistance in Ohms	Nominal Power	Arrangement	Rate in Amps	
AB11AY	6V	1.3	6.4VA	DPDT	10	$ 5.85
AB11AY	24V	23	6.4VA	DPDT	10	5.85
AB11AY	120V	510	6.4VA	DPDT	10	5.85
AB11AY	240V	2,050	6.4VA	DPDT	10	6.30
AB11D	12V	72	2.0W	DPDT	10	5.70
AB11D	24V	288	2.0W	DPDT	10	5.70
AB11D	110V	6,050	2.0W	DPDT	10	6.30
ABC11AY§	6V	1.3	6.4VA	DPDT	10	7.05
ABC11AY§	24V	23	6.4VA	DPDT	10	7.05
ABC11AY§	120V	510	6.4VA	DPDT	10	7.05
ABC11AY§	240V	2,050	6.4VA	DPDT	10	7.50
ABC11D§	6V	18	2.0W	DPDT	10	6.95
ABC11D§	12V	72	2.0W	DPDT	10	6.95
ABC11D§	24V	288	2.0W	DPDT	10	6.95
ABC11D§	110V	6,050	2.0W	DPDT	10	7.50
GF17A	12V	6.8	6VA	4PDT	10	7.35
GF17A	24V	24	6VA	4PDT	10	7.35
GF17A	120V	690	6VA	4PDT	10	7.35
GF17A	240V	2,950	6VA	4PDT	10	7.75
GF17D	6V	18	2.0W	4PDT	10	7.35
GF17D	12V	72	2.0W	4PDT	10	7.35
GF17D	24V	288	2.0W	4PDT	10	7.35
GF17D	110V	6,050	2.0W	4PDT	10	7.75
MR3A	6V	2.75	3.25VA	SPST-NO-DB	10	4.30
MR3A	24V	50	3.25VA	SPST-NO-DB	10	4.30
MR3A	120V	1,250	3.25VA	SPST-NO-DB	10	4.30
MR3D	6V	24	1.6W	SPST-NO-DB	10	3.90
MR3D	12V	96	1.6W	SPST-NO-DB	10	3.90
MR3D	24V	360	1.6W	SPST-NO-DB	10	3.90
MR5A	6V	2.75	3.25VA	SPDT	8	3.85
MR5A	12V	13.25	3.25VA	SPDT	8	3.85
MR5A	24V	50	3.25VA	SPDT	8	3.85
MR5A	120V	1,250	3.25VA	SPDT	8	3.85
MR5A	240V	4,600	3.25VA	SPDT	8	4.30
MR5D	6V	24	1.6W	SPDT	8	3.55
MR5D	12V	96	1.6W	SPDT	8	3.55
MR5D	24V	360	1.6W	SPDT	8	3.55
MR5D	110V	8,000	1.6W	SPDT	8	4.10
MR11A	6V	2.75	3.25VA	DPDT	8	5.40
MR11A	12V	13.25	3.25VA	DPDT	8	5.40
MR11A	24V	50	3.25VA	DPDT	8	5.40
MR11A	120V	1,250	3.25VA	DPDT	8	5.40
MR11A	240V	4,600	3.25VA	DPDT	8	5.85
MR11D	6V	24	1.6W	DPDT	8	5.15
MR11D	12V	96	1.6W	DPDT	8	5.15
MR11D	24V	360	1.6W	DPDT	8	5.15
MR11D	110V	8,000	1.6W	DPDT	8	5.65
MR14A	6V	2.75	3.25VA	3PDT	8	6.45
MR14A	12V	13.25	3.25VA	3PDT	8	6.45
MR14A	24V	50	3.25VA	3PDT	8	6.45
MR14A	120V	1,250	3.25VA	3PDT	8	6.45
MR14A	240V	4,600	3.25VA	3PDT	8	6.85
MR14D	6V	24	1.6W	3PDT	8	6.10
MR14D	12V	96	1.6W	3PDT	8	6.10
MR14D	24V	360	1.6W	3PDT	8	6.10
MR14D	110V	8,000	1.6W	3PDT	8	6.60
PM17AY	6V	.37	14VA	4PDT	25	13.60
PM17AY	12V	1.4	14VA	4PDT	25	13.60
PM17AY	24V	5.0	14VA	4PDT	25	13.60
PM17AY	120V	120	14VA	4PDT	25	13.60
PM17AY	240V	587	14VA	4PDT	25	14.10
PM17A	480V	1,790	14VA	4PDT	25	15.00
PM17DY	6V	8.2	4.4W	4PDT	25	13.00
PM17DY	12V	33	4.4W	4PDT	25	13.00
PM17DY	24V	132	4.4W	4PDT	25	13.00
PM17DY	110V	2,760	4.4W	4PDT	25	13.65
PR1AY	24V	12	9.8VA	SPST-NO	25	4.45
PR3AY	6V	.86	9.8VA	SPST-NO-DB	25	4.55
PR3AY	12V	3.2	9.8VA	SPST-NO-DB	25	4.55
PR3AY	24V	12	9.8VA	SPST-NO-DB	25	4.55
PR3AY	120V	290	9.8VA	SPST-NO-DB	25	4.55
PR3AY	240V	1,200	9.8VA	SPST-NO-DB	25	5.00
PR3DY	6V	18	2.0W	SPST-NO-DB	25	4.55
PR3DY	12V	71	2.0W	SPST-NO-DB	25	4.55
PR3DY	24V	288	2.0W	SPST-NO-DB	25	4.55
PR3DY	110V	6,050	2.0W	SPST-NO-DB	25	5.25
PR5AY	6V	.86	9.8VA	SPDT	25	4.80
PR5AY	12V	3.2	9.8VA	SPDT	25	4.80
PR5AY	24V	12	9.8VA	SPDT	25	4.80
PR5AY	120V	290	9.8VA	SPDT	25	4.80
PR5AY	240V	1,200	9.8VA	SPDT	25	5.25
PR5DY	6V	18	2.0W	SPDT	25	4.80
PR5DY	12V	71	2.0W	SPDT	25	4.80
PR5DY	24V	288	2.0W	SPDT	25	4.80
PR5DY	110V	6,050	2.0W	SPDT	25	5.45
PR7AY	6V	.86	9.8VA	DPST	25	5.40
PR7AY	12V	3.2	9.8VA	DPST	25	5.40
PR7AY	24V	12	9.8VA	DPST	25	5.40
PR7AY	120V	290	9.8VA	DPST	25	5.40
PR7AY	240V	1,200	9.8VA	DPST	25	5.90
PR7DY	6V	18	2.0W	DPST	25	5.40
PR7DY	12V	71	2.0W	DPST	25	5.40
PR7DY	24V	288	2.0W	DPST	25	5.40
PR7DY	110V	6,050	2.0W	DPST	25	6.10
PR11AY	6V	.86	9.8VA	DPDT	25	7.10
PR11AY	12V	3.2	9.8VA	DPDT	25	7.10
PR11AY	24V	12	9.8VA	DPDT	25	7.10
PR11AY	120V	290	9.8VA	DPDT	25	7.10
PR11AY	240V	1,200	9.8VA	DPDT	25	7.65
PR11AY	480V	4,500	9.8VA	DPDT	25	8.60
PR11AL5	6V	.86	9.8VA	DPDT	20	9.00
PR11AL5	12V	3.2	9.8VA	DPDT	20	9.00
PR11AL5	24V	12	9.8VA	DPDT	20	9.00
PR11AL5	120V	290	9.8VA	DPDT	20	9.00
PR11AL5	240V	1,200	9.8VA	DPDT	20	9.45
PR11DY	6V	18	2.0W	DPDT	25	7.10
PR11DY	12V	71	2.0W	DPDT	25	7.10
PR11DY	24V	288	2.0W	DPDT	25	7.10
PR11DY	110V	6,050	2.0W	DPDT	25	7.75

POTTER & BRUMFIELD
Division of American Machine & Foundry Company, Princeton, Indiana 47570

SPECIAL PURPOSE RELAYS

AP SERIES RATCHET, IMPULSE A reliable compact unit for applications requiring on-off or reversing action on alternate operations. Positive ratchet operation at all speeds on impulses as short as 60 ms. Intermittent operation only. Mounting: Three 5/32" dia. holes on 3 3/8" x 7/8" triangular centers. Contacts: 3/16" dia. silver. Weight: 7 ozs. Coils for intermittent duty only.

BU BUZZER AC operated coil with a spring steel armature which buzzes when coil is energized. Used extensively in test equipment, laboratories and a host of other applications where a small light weight, dependable buzzer is required. Weight: 1 5/8 ozs. Mounting: No. 6-32 tapped core.

GM SERIES Unusually versatile switching makes this impulse/sequencing relay especially suitable for single coil latching. The 2 Form C contact arrangement is switched alternately by cam action during drop-out of the armature. It can also be furnished with additional 2 Form C auxiliary contacts (designated by "L"). AC version operates on a 50% coil duty cycle (5 Min. max.). Mounting: 8-32 tapped core with locating boss. Weights: With aux. contacts 4 3/4 ozs. Without aux. contacts 4 ozs.

The GM1N10 and GM1N12 AC or DC use the basic GM structure with uni-directional printed circuit boards with 10 or 12-steps, respectively. The board is attached to an extension of the ratchet shaft. The movable contact arm advances one position each time the armature **drops out.** Contact rating: .25 amps. Contact arrangement: SP-10 pos. and SP-12 pos. Size: 2.312" x 1.875" x 2".

KB SERIES LATCHING RELAY Both release and trip coils must be for the same voltage. One coil operates relay to set latch and other coil releases it. Ideal for memory work and overload applications. Operates on momentary impulse to either coil. Mounting: Two 5/32" dia. holes on 1 3/8" centers. Weight: 6 ozs. Contacts: 1/8" dia. silver rated 5 amps; "G" suffix indicates silver-cadmium-oxide contacts on movables rated 10 amps. AC relays with 5 amp. Contacts carry U/L component recognition (File No. 29244) and are CSA* listed. AC coil for intermittent duty only.

KBP SERIES LATCHING RELAY Enclosed in a translucent polypropylene dust cover, the KBP is furnished with 20-pin octal type plugs for socket mounting. Contact arrangements of 4PDT and 5PDT are available. Otherwise all specifications are identical to the KB series described above. U/L component recognition does not apply to the KBP series. Weight: 8 ozs.

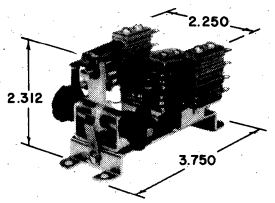
KM SERIES Subminiature relay for applications requiring unusually small relays with up to 3-poles 3/32" dia. silver contacts. Withstands 30g mechanical shock and .06" excursion 10 to 55 Hz mechanical vibration. Used extensively in small business machines, alarm systems, automatic toys and communications systems. Mounting: One 2-56 tapped core and locating .062" dia. half-punch on .187" centers. Solder terminals. Weight: .58 ozs.

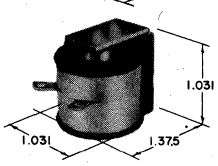
PLATE CIRCUIT AND SENSITIVE RELAYS

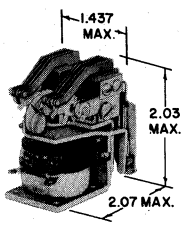
KCP SERIES Low cost plate circuit relay enclosed in clear high impact plastic cover. Sensitivity 125 mw single pole; 250 mw double pole; 375 mw three pole. Mounting: Standard octal plug-in type. Eight pin for KCP5 and KCP11. Eleven pin for KCP14. Contacts: 1/8" dia. gold-flashed silver. Weight: Approximately 3 ozs. Use KCP-KRP hold down spring when vibration is a factor or when using inverted or horizontal mounting.

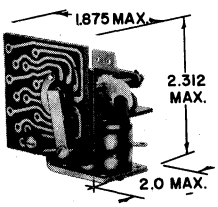
LB SERIES Designed for top performance, long life at an unusually low cost. Each coil is wound with a given coil resistance and factory adjusted to operate on minimum current requirements. Mounting: Two 3/16" dia. holes on 2 7/32" centers. Contacts: 1/8" dia. silver. Weight: Approximately 2 ozs.

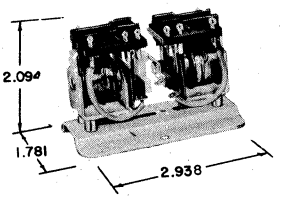
* Canadian Standards Assoc. File No. LR-15734

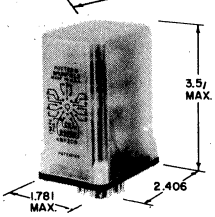


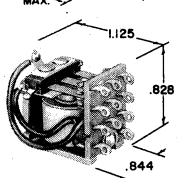








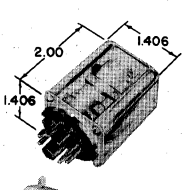


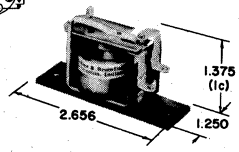












SPECIAL PURPOSE RELAYS

TYPE	COILS: Voltage or Current	COILS: Resistance in Ohms	COILS: Nominal Power	CONTACTS: Arrangement	CONTACTS: Rate in Amps	SUGG. RESALE PRICE
AP11A	6V	.6	18.5VA	DPDT	5	$ 9.65
AP11A	12V	2.28	18.5VA	DPDT	5	9.65
AP11A	24V	8.8	18.5VA	DPDT	5	9.65
AP11A	120V	240	18.5VA	DPDT	5	9.65
AP11A	240V	900	18.5VA	DPDT	5	10.20
AP11D	6V	4.0	9.0W	DPDT	5	9.65
AP11D	24V	65	9.0W	DPDT	5	9.65
AP11D	110V	1,350	9.0W	DPDT	5	10.40
AP17A	24V	8.8	18.5VA	4PDT	5	11.70
AP17A	120V	240	18.5VA	4PDT	5	11.70
AP17D	12V	15.5	9.0W	4PDT	5	11.70
AP17D	24V	65	9.0W	4PDT	5	11.70
AP17D	110V	1,350	9.0W	4PDT	5	12.45
BU	6V	2.75	4.6VA	—	—	1.95
BU	12V	13.25	4.6VA	—	—	1.95
BU	24V	50	4.6VA	—	—	1.95
BU	120V	1,250	4.6VA	—	—	1.95
GM11A	24V	16	9.4VA	DPDT	3	8.00
GM11A	120V	420	9.4VA	DPDT	3	8.00
GM11AL11	120V	420	9.4VA	DPDT/DPDT	3	11.35
GM11D	12V	36	4W	DPDT	3	7.65
GM11D	24V	144	4W	DPDT	3	7.65
GM11D	110V	3,025	4W	DPDT	3	8.20
GM11DL11	12V	36	4W	DPDT/DPDT	3	11.15
GM11DL11	24V	144	4W	DPDT/DPDT	3	11.15
GM1N10A	120V	510	9.4VA	SP-10 pos.	.25	9.85
GM1N12A	120V	510	9.4VA	SP-12 pos.	.25	10.00
GM1N10D	24V	144	4W	SP-10 pos.	.25	9.60
GM1N12D	24V	144	4W	SP-12 pos.	.25	9.75
KB17AY	6V	2.3	5VA	4PDT	5	11.60
KB17AY	12V	10	5VA	4PDT	5	11.60
KB17AY	24V	42	5VA	4PDT	5	11.60
KB17AY	120V	1,030	5VA	4PDT	5	11.60
KB17AY	240V	4,100	5VA	4PDT	5	12.45
KB17AG	6V	2.3	5VA	4PDT	10	11.70
KB17AG	12V	10	5VA	4PDT	10	11.70
KB17AG	24V	42	5VA	4PDT	10	11.70
KB17AG	120V	1,030	5VA	4PDT	10	11.70
KB17AG	240V	4,100	5VA	4PDT	10	12.55
KB17D	6V	13.1	2.7W	4PDT	5	10.40
KB17D	12V	52	2.7W	4PDT	5	10.40
KB17D	24V	230	2.7W	4PDT	5	10.40
KB17D	110V	4,560	2.7W	4PDT	5	11.75
KB17DG	6V	13.1	2.7W	4PDT	10	10.65
KB17DG	12V	52	2.7W	4PDT	10	10.65
KB17DG	24V	230	2.7W	4PDT	10	10.65
KB17DG	110V	4,560	2.7W	4PDT	10	11.95
KB23AY	24V	27	7.8VA	6PDT	5	13.90
KB23AY	120V	700	7.8VA	6PDT	5	13.90
KB23AG	24V	27	7.8VA	6PDT	10	14.10
KB23AG	120V	700	7.8VA	6PDT	10	14.10
KB23D	24V	230	2.7W	6PDT	5	12.60
KB23DG	24V	230	2.7W	6PDT	10	12.95
KB23DG	110V	4,560	2.7W	6PDT	10	14.30
KBP17A§	120V	1,030	5VA	4PDT	5	16.30
KBP17AG§	120V	1,030	5VA	4PDT	10	16.50
KBP17D§	24V	230	2.7W	4PDT	5	15.15
KBP17DG§	12V	52	2.7W	4PDT	10	15.40
KBP17DG§	24V	230	2.7W	4PDT	10	15.40
KBP20A§	120V	700	7.8VA	5PDT	5	16.80
KBP20AG§	120V	700	7.8VA	5PDT	10	17.05
KBP20DG§	12V	52	2.7W	5PDT	10	16.20
KBP20DG§	24V	230	2.7W	5PDT	10	16.20
KM5D	6V	36	1.1W	SPDT	2	$3.80
KM5D	12V	144	1.1W	SPDT	2	3.80
KM5D	24V	500	1.1W	SPDT	2	3.80
KM11D	6V	36	1.1W	DPDT	2	4.15
KM11D	12V	144	1.1W	DPDT	2	4.15
KM11D	24V	500	1.1W	DPDT	2	4.15
KM14D	6V	36	1.1W	3PDT	2	4.80
KM14D	12V	144	1.1W	3PDT	2	4.80
KM14D	24V	500	1.1W	3PDT	2	4.80
KCP5§	7.2MA	2,500	125MW	SPDT	2	6.50
KCP5§	5MA	5,000	125MW	SPDT	2	6.60
KCP5§	3.6MA	10,000	125MW	SPDT	2	7.05
KCP11§	10MA	2,500	250MW	DPDT	2	6.95
KCP11§	7.2MA	5,000	250MW	DPDT	2	7.05
KCP11§	5MA	10,000	250MW	DPDT	2	7.50
KCP14§	12.3MA	2,500	375MW	3PDT	2	8.55
KCP14§	8.7MA	5,000	375MW	3PDT	2	8.65
KCP14§	6.1MA	10,000	375MW	3PDT	2	9.10
LB5	9MA	2,500	200MW	SPDT	5	2.85
LB5	6.3MA	5,000	200MW	SPDT	5	3.05
LB5	4.5MA	10,000	200MW	SPDT	5	3.30

§ Enclosed Relay

POTTER & BRUMFIELD
Division of American Machine & Foundry Company, Princeton, Indiana 47570

PLATE CIRCUIT RELAYS (CONTINUED)

LM SERIES (See KL page 2 for similar voltage actuated relays.) Sensitivity: 100 milliwatts for single pole and 200 milliwatts for double pole. Medium cost, high quality relay with 7/32" dia. gold-flashed silver contacts. Pick-up adjustable by tail spring adjusting screw. Mounting: Two No. 6-32 tapped holes on 1 13/16" centers. Weight: Approximately 5 ozs. DC Coils only.

PW SERIES (In both voltage and current actuated models.) Sensitivity: 40 mw for current actuated models, 180 mw for voltage actuated models. Precision, light weight, hermetically sealed relay for aircraft and missile applications. Will withstand 10g vibration to 500 Hz. Mounting: Standard 7-pin miniature tube base. Weight: Approx. 1 oz.

RS SERIES (In both voltage and current actuated models.) 60 mw. sensitivity. Low-cost, small, light weight, sensitive relay for radio-sonde, light dimmer and model applications. Mounting: Two No. 4-40 tapped holes on diagonal 3/4" x 3/8" centers. Contacts: Bar palladium. Weight: 1½ ozs.

SM SERIES (In both voltage and current actuated models.) Sensitivity 75 mw for current actuated models. Medium cost, light weight, dust covered (right) or hermetically sealed (left) relay for light contact loads found in computers, model airplanes and similar applications. Extremely long mechanical life because of reed armature. Mounting: Sealed, standard 7-pin miniature tube socket; dust cover, two 3/32" dia. holes on 17/32" centers. Contacts: Stationary silver; movable rhodium. Weight: 1 oz. max.

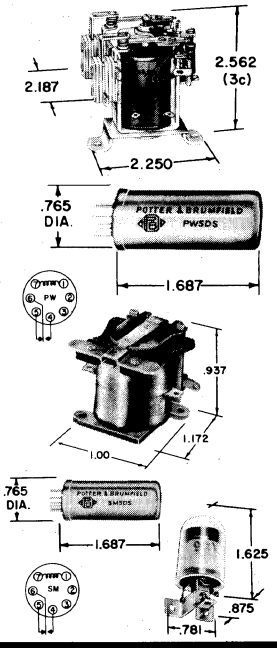


PLATE CIRCUIT AND SENSITIVE RELAYS

TYPE	COILS			CONTACTS		SUGG. RESALE PRICE
	Voltage or Current	Resistance in Ohms	Nominal Power	Arrangement	Rate in Amps	
LM5	6.3MA	2,500	100MW	SPDT	5	4.35
LM5	4.5MA	5,000	100MW	SPDT	5	4.55
LM5	3.2MA	10,000	100MW	SPDT	5	4.90
LM11	9MA	2,500	200MW	DPDT	5	6.20
LM11	6.3MA	5,000	200MW	DPDT	5	6.40
LM11	4.5MA	10,000	200MW	DPDT	5	7.05
PW5DS†	6V	202	180MW	SPDT	1	11.85
PW5DS†	12V	810	180MW	SPDT	1	11.85
PW5DS†	24V	3,240	180MW	SPDT	1	11.85
PW5LS†	2.8MA	5,000	40MW	SPDT	1	12.25
PW5LS†	2.0MA	10,000	40MW	SPDT	1	12.70
RS5D	6V	335	110MW	SPDT	2	2.90
RS5D	12V	1,350	110MW	SPDT	2	3.05
RS5D	5MA	2,500	60MW	SPDT	2	3.15
RS5D	3.5MA	5,000	60MW	SPDT	2	3.45
RS5D	2.5MA	10,000	60MW	SPDT	2	4.00
SM5DS†	6V	80	500MW	SPDT	.25	7.25
SM5DS†	12V	360	500MW	SPDT	.25	7.25
SM5DS†	24V	900	500MW	SPDT	.25	7.25
SM5LS§	2.7MA	10,000	75MW	SPDT	.25	6.90
SM5LS†	3.9MA	5,000	75MW	SPDT	.25	7.55
SM5LS†	2.7MA	10,000	75MW	SPDT	.25	8.10

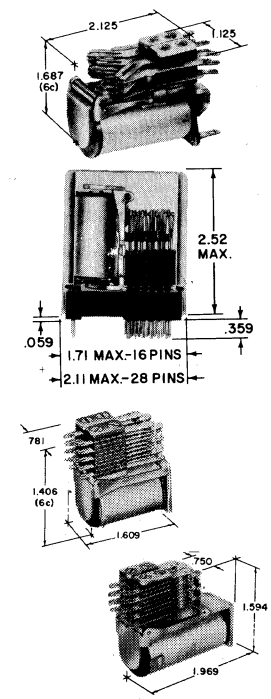
TELEPHONE TYPE RELAYS

LS SERIES Short springs and light weight armature provide fast action without sacrificing reliability and long life. Stainless steel hinge bearing designed to give 100 million operations. Tinned, pierced solder terminals. Mounting: Two No. 6-32 tapped holes on ¾" centers. Bifurcated contact arms with 1/16" dia. twin palladium contacts. Weight: Approximately 4 ozs.

The LSP version has identical specifications as the LS, except that it is enclosed in a high impact, clear plastic cover and is provided with a rectangular socket with combination taper tab or solder terminations. Enables plug-in like any other plug-in component. Two sizes of sockets and covers are available: 16-pin for 4 Form C (4PDT) or 28-pin for 6 Form C (6PDT). Dimensions: LSP17D: 1.71" x 1.39" x 2.52" seated; weight: 4 ozs. LSP23D: 2.11"x1.39"x2.52" seated; weight: 4½ ozs.

MH SERIES MINIATURE TYPE Ideal for applications where space and weight are factors. Mounting: Open model, MH11L, one No. 6-32 threaded stud 17/32" long plus locating boss. All other open models have four No. 3-48 holes on 3/8" x 3/8" centers. Sealed models, M enclosures, three 6-32 NC 2 threaded studs on 1¼" x ½" centers. D enclosures, three 6-32 threaded studs on 1 3/16" x 1 3/16" centers. All sealed models have hook end solder terminals. All models have 1/8" dia. gold-flashed silver contacts. Weight: Open models 2½ oz. max. Sealed models 5 ozs. max.

ML SERIES A small telephone type relay having excellent sensitivity and outstanding switching capabilities. Ideal for transistorized computer networks, telephone systems and battery powered communications equipment. Single contact arms have 1/8" dia. gold-flashed silver contacts rated at 3 amps for 100,000 operations. Pierced solder terminals. Mounting: Four 3-48 holes on 3/8" centers. Weight: 2.5 ozs.

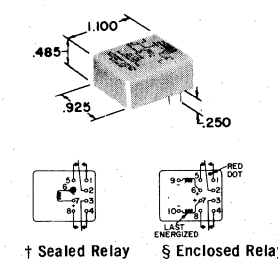


LS17D	24V	300	1.9W	4PDT	4	$ 6.25
LS17D	48V	1,300	1.8W	4PDT	4	6.40
LS17D	110V	8,000	1.5W	4PDT	4	6.65
LS23D	24V	300	1.9W	6PDT	4	7.55
LS23D	48V	1,300	1.8W	6PDT	4	7.70
LS23D	110V	8,000	1.5W	6PDT	4	8.05
LSP17D§	24V	300	1.9W	4PDT	4	8.20
LSP17D§	48V	1,300	1.8W	4PDT	4	8.30
LSP17D§	110V	8,000	1.5W	4PDT	4	8.60
LSP23D§	24V	300	1.9W	6PDT	4	10.15
LSP23D§	48V	1,300	1.8W	6PDT	4	10.25
LSP23D§	110V	8,000	1.5W	6PDT	4	10.55
MH11L	4.5MA	10,000	200MW	DPDT	3	6.55
MH11LM†	4.5MA	10,000	200MW	DPDT	3	11.15
MH17D	6V	23	1.6W	4PDT	5	6.55
MH17D	12V	96	1.6W	4PDT	5	6.55
MH17D	24V	365	1.6W	4PDT	5	6.55
MH17DM†	12V	96	1.6W	4PDT	5	13.30
MH17DM†	24V	365	1.6W	4PDT	5	13.30
MH17AMR†	120V	6,200	2VA	4PDT	5	21.70
MH23D	6V	13.3	2.5W	6PDT	5	8.30
MH23D	12V	62.3	2.5W	6PDT	5	8.30
MH23D	24V	245	2.5W	6PDT	5	8.30
MH23D	110V	5,000	2.5W	6PDT	5	8.80
MH23DD†	12V	62.3	2.5W	6PDT	5	17.65
MH23DD†	24V	245	2.5W	6PDT	5	17.65
ML11D	4.0MA	2,500	40MW	DPDT	3	$ 7.00
ML11D	2.83MA	5,000	40MW	DPDT	3	7.15
ML11D	2.0MA	10,000	40MW	DPDT	3	7.50
ML17D	5.65MA	2,500	80MW	4PDT	3	8.30
ML17D	4.0MA	5,000	80MW	4PDT	3	8.50
ML17D	2.83MA	10,000	80MW	4PDT	3	8.80
ML23D	6.93MA	2,500	120MW	6PDT	3	9.40
ML23D	4.9MA	5,000	120MW	6PDT	3	9.60
ML23D	3.4MA	10,000	120MW	6PDT	3	9.90

HIGH PERFORMANCE RELAYS

FC SERIES Conventional micro-miniature relay lies flat on printed circuit board. Withstands 150g shock, 400g linear acceleration, 30g vibration to 2000 Hz. Ambient temperature range: —65° to +125°C. Hermetically welded. Bifurcated contacts. Plugs in on .2" grid. Meets applicable sections of MIL-R-5757D, and MSFC-SPEC-339. Weight: .75 oz.

FL SERIES Dual-coil latching relay has same specs as above, except operates by pulsing each coil alternately (observing coil polarity); or connecting the coils in series from a reversing (polarized) source. Remains latched without coil power.



† Sealed Relay § Enclosed Relay

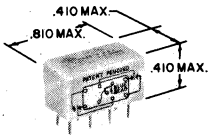
FC11D	6V	60	.65W	DPDT	3	$18.80
FC11D	12V	210	.65W	DPDT	3	18.80
FC11D	24V	900	.65W	DPDT	3	18.80
FC4037	26.5V		MIL-R-5757D or RY4YY4B3			18.80
FL11D	6V	67.5	.65W	DPDT	3	21.15
FL11D	12V	230	.65W	DPDT	3	21.15
FL11D	24V	1,000	.65W	DPDT	3	21.15

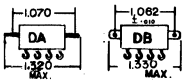
POTTER & BRUMFIELD

Division of American Machine & Foundry Company, Princeton, Indiana 47570

HIGH PERFORMANCE RELAYS (CONTINUED)

HC SERIES A micro-miniature, non-polarized, non-latching half-size crystal case relay for high reliability performance. Its high-torque motor structure and bifurcated, gold-plated silver DPDT contacts, rated dry circuit to 2 amps @ 28V DC resistive, provide positive performance in low level applications. Temperature range: —65°C to +125°C. Hermetically welded. HC11D has plug-in, plain case; HC11DA has hook-end solder terminals and shoulder brackets; HC11DB has hook-end solder terminals and flat mounting plate with 2 holes. The HC series meets or exceeds all applicable sections of MIL-R-5757D/9, and complies with MSFC-SPEC-339. Size: Plain case .8" x .4" x .4" (seated). Weight: ¼ oz.





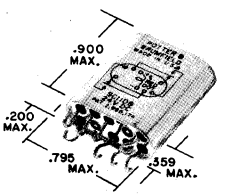
HL SERIES A companion micro-miniature relay with identical specifications as the HC described above, except that it is a dual-coil latching relay. The HL can be operated: by (1) pulsing each coil alternately, observing coil polarity; or (2) from a reversing (polarized) power source by connecting like polarities. Approximately 150 milliwatts @ 25°C coil temperature are required for each coil. Coils will operate in less than 3 milliseconds at nominal voltage @ 25°C.

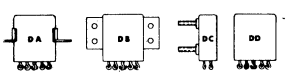


Dimensions same as HC

SC SERIES Micro-miniature permanent magnet relay for low power, high shock/vibration applications. 200g shock, 30g vibration to 2000 Hz with no contact openings. Ambient temperature range: —65°C to +125°C. Features single coil action and conforms to standard micro-miniature coil operation except polarized connections because of magnetic circuit. Positive terminal marked with red dot. Mounting: SC11D**, —DA, —DB, DC and DD correspond to similarly designed SL mountings. SCG11D has rectangular header with terminals on .2" grid. Weight: ¾ oz.

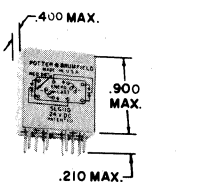
**Armel No. HRK-1, 8-pin receptacles available from distributors for plug-in applications.





SL SERIES Dual coil micro-miniature magnetic latching relay with same shock/vibration, resistance and ambient temperature range as SC. Coils may be connected in series for polar operation. Mounting: SL11D* for plug-in applications: —DA has shoulder flanges with two .104" x .136" holes on a 1.062" center; —DB has a welded bracket with four .125" dia. holes on 1.062" x .281" centers; —DC has two No. 4-40 NC 2A threaded studs on .488" x .220" diagonal centers; —DD has plain case with hook end solder terminals. SLG11D has plug-in terminals on .2" grid.

*Viking No. P/N VBO/3DV 1 10-pin receptacles available from distributor for plug-in applications.



TELEPHONE TYPE RELAYS

TYPE	COILS			CONTACTS		SUGG. RESALE PRICE
	Voltage or Current	Resistance in Ohms	Nominal Power	Arrangement	Rate in Amps	
HC11D	24V	814	.72W	DPDT	.2	18.40
HC11DA	24V	814	.72W	DPDT	2	18.40
HC11DB	24V	814	.72W	DPDT	2	18.40
HL11D	24V	1,000	.65W	DPDT	2	$36.75
SC11D	6V	35	1W	DPDT	2	19.00
SC11D	12V	135	1W	DPDT	2	19.00
SC11D	24V	550	1W	DPDT	2	19.00
SC11DA	6V	35	1W	DPDT	2	19.00
SC11DA	12V	135	1W	DPDT	2	19.00
SC11DA	24V	550	1W	DPDT	2	19.00
SC11DB	6V	35	1W	DPDT	2	19.00
SC11DB	12V	135	1W	DPDT	2	19.00
SC11DB	24V	550	1W	DPDT	2	19.00
SC11DC	24V	550	1W	DPDT	2	19.00
SC11DD	24V	550	1W	DPDT	2	19.00
SCG11D	24V	550	1W	DPDT	2	19.00
SC7141	26.5V	MIL-R-5757D/10C-141 or RY4NA3B3L01				19.15
SL11D	6V	40	1W	DPDT	2	20.85
SL11D	12V	160	1W	DPDT	2	20.85
SL11D	24V	630	1W	DPDT	2	20.85
SL11DA	6V	40	1W	DPDT	2	20.85
SL11DA	12V	160	1W	DPDT	2	20.85
SL11DA	24V	630	1W	DPDT	2	20.85
SL11DB	6V	40	1W	DPDT	2	20.85
SL11DB	12V	160	1W	DPDT	2	20.85
SL11DB	24V	630	1W	DPDT	2	20.85
SL11DC	24V	630	1W	DPDT	2	20.85
SL11DD	24V	630	1W	DPDT	2	20.85
SLG11D	24V	630	1W	DPDT	2	20.85

SPECIFY COIL VOLTAGE OR RESISTANCE WHEN ORDERING

VOLTAGE SENSORS

CS SERIES Two types of accurate, low cost solid state voltage sensors are available. First, an adjustable pick-up and drop-out series for 24V DC and 120V AC voltage sources. Second, a series with factory-fixed pick-up and adjustable drop-out, also for 24V DC and 120V AC voltage sources. All are provided with standard octal plugs for socket mounting and are enclosed in a nylon dust cover. Please see the tables for ranges of voltage adjustments.

SPECIFICATIONS

Sensing Current Drain: Maximum of 3 ma.

Maximum Current Drain: After sensing: 30 ma.

Accuracy of Set Point: 1% after initial setting.

Reverse Polarity Protection: Yes, on DC types.

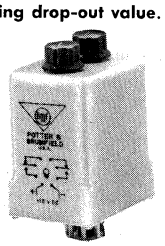
Operating Temperature: —40°C to +55°C.

Load Switching Relay Contacts:
2 Form C (DPDT). Rating: 3 amps 28V DC resistive; 120V AC resistive.

Expected Life:
Mechanical: 10 million operations.
Electrical: 100,000 operations minimum @ rated load.



Fixed pick-up and adjustable drop-out. One knob for setting drop-out value.



Adjustable pick-up and drop-out. Two knobs for setting desired values.

ADJUSTABLE PICK-UP AND DROP-OUT

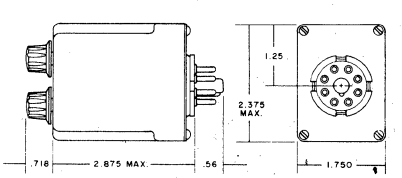
Type	Pick-up Range (Volts)	Drop-out Range (Volts)	Type of Voltage	Sugg. Resale Price
CSJ38-30010	20-30	18-28	AC(50/60Hz)	$29.75
CSJ38-70010	92-140	90-138	AC(50/60Hz)	32.50
CSL38-30010	20-30	18-28	DC	25.75

FIXED PICK-UP AND ADJUSTABLE DROP-OUT

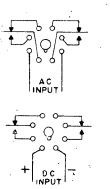
CSJ38-71010	105	90-103	AC(50/60Hz)	$28.75
CSL38-31010	22	16-20	DC	22.70

Tolerances: All limits indicated above are ± 5% on high and low ranges.

OUTLINE DIMENSIONS



SCHEMATICS



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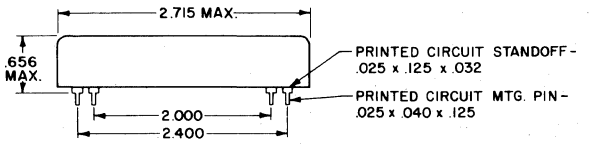
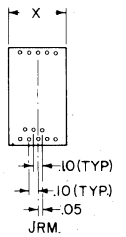
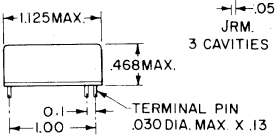
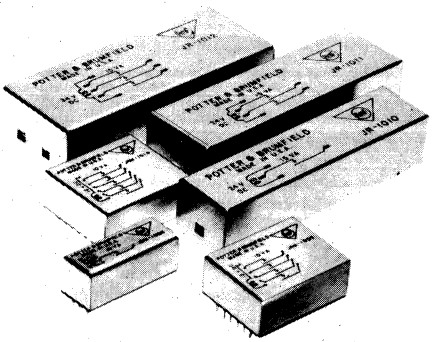
DRY REED RELAYS

OUTLINE DIMENSIONS









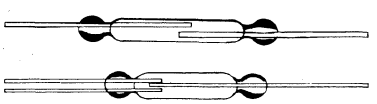
JR (STANDARD) SERIES

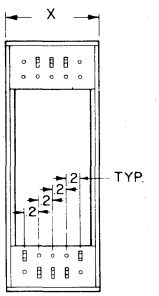
JRM (MINIATURE) SERIES

Fast response, reliable performance, high sensitivity, and long life make JR standard and JRM miniature series relays especially suited for data processing applications, computer equipment, logic circuitry and various other sophisticated control circuits.

TWO TYPES OF BASIC CAPSULES

Both JR and JRM relays employ dry reed glass capsules with two basic types of contact arrangements, Form A (SPST-NO) or Form C (SPDT). Biasing with a permanent magnet changes Form A to a Form B (SPST-NC). This arrangement requires that coil polarity be observed. It uses a two-cavity bobbin. Combining one Form A with one Form B results in a single Form C (SPDT) break-before-make; this uses a three-cavity bobbin. A "true" Form C (SPDT) uses a reed switch with two stationary and one movable contact. The movable contact is normally closed until the coil is energized, causing a "true" Form C (SPDT) break-before-make; it uses a single-cavity bobbin.





SPECIFICATIONS

Pick-up: 75% of nominal @ 25°C.

Operate Time: At nom. voltage @ 25°C.: JR: 3ms. JRM: 1ms.

Release Time: At 25°C.: JR: .5ms. JRM: .05ms.

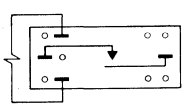
Coil Power: Based upon nom. voltage and resistance.

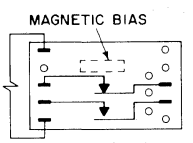
JR: 1 capsule — 240 mw; 2 capsules — 360 mw; 3 capsules — 720 mw; 4 capsules — 960 mw; 5 capsules 1.5 w.

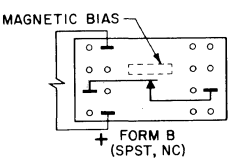
JRM: 1 capsule — 180 mw; 2 capsules — 275 mw; 3 capsules — 420 mw; 4 capsules — 540 mw; 5 capsules — 720 mw.

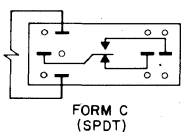
For additional specifications see columnar listings and drawings.

TYPICAL WIRING DIAGRAMS









OUTLINE DIMENSIONS

JR Standard Relays — **Weights**

X = 1 Cavity = .687" max. — 1.50 ozs.
X = 2 Cavities = .890" max. — 2.00 ozs.
X = 3 Cavities = 1.094" max. — 2.50 ozs.
X = 4 Cavities = 1.297" max. — 3.00 ozs.
X = 5 Cavities = 1.516" max. — 3.50 ozs.

JRM Miniature Relays

X = 1 Cavity = .437" max. — .366 oz.
X = 2 Cavities = .562" max. — .395 oz.
X = 3 Cavities = .703" max. — .530 oz.
X = 4 Cavities = .813" max. — .620 oz.
X = 5 Cavities = .968" max. — .781 oz.

JR STANDARD SERIES

TYPE	COILS: Sugg. Nominal Voltage	COILS: Resistance in Ohms	CONTACTS: Arrangement	CONTACTS: Reed Rating Watts	Number of Cavities	SUGG. RESALE PRICE
JR1000	6	150	1A	15	1	$ 3.05
JR1001	6	100	2A	15	2	4.10
JR1020	6	150	1A	50	1	4.30
JR1040	6	150	1C*	10	1	7.65
JR1041	6	100	2C*	10	2	8.40
JR1060	6	100	1B	15	2	4.10
JR1005	12	600	1A	15	1	3.05
JR1006	12	400	2A	15	2	4.10
JR1008	12	150	4A	15	4	5.70
JR1025	12	600	1A	50	1	4.30
JR1045	12	600	1C*	10	1	7.65
JR1046	12	400	2C*	10	2	8.40
JR1063	12	400	1B	15	2	4.10
JR1086	12	200	1A+1B	15	3	5.05
JR1010	24	2,400	1A	15	1	3.55
JR1011	24	1,600	2A	15	2	4.35
JR1013	24	600	4A	15	4	6.00
JR1030	24	2,400	1A	50	1	4.60
JR1031	24	1,600	2A	50	2	6.90
JR1050	24	2,400	1C*	10	1	8.00
JR1051	24	1,600	2C*	10	2	8.50
JR1066	24	1,600	1B	15	2	4.15
JR1088	24	800	1A+1B	15	3	5.35
JR1089	24	384	2A+2B	15	5	8.35

*True Form C

JRM MINIATURE SERIES

JRM1000	6	200	1A	10	1	3.30
JRM1001	6	130	2A	10	2	4.80
JRM1003	6	67	4A	10	4	7.65
JRM1036	6	130	1B	10	2	4.20
JRM1037	6	86	2B	10	3	5.60
JRM1048	6	86	1A+1B	10	3	5.60
JRM1049	6	50	2A+2B	10	5	8.60
JRM1006	12	800	1A	10	1	3.30
JRM1007	12	520	2A	10	2	4.80
JRM1009	12	268	4A	10	4	7.65
JRM1040	12	520	1B	10	2	4.20
JRM1041	12	344	2B	10	3	5.60
JRM1050	12	344	1A+1B	10	3	5.60
JRM1051	12	200	2A+2B	10	5	8.60
JRM1012	24	3,200	1A	10	1	3.60
JRM1013	24	2,080	2A	10	2	4.95
JRM1015	24	1,072	4A	10	4	7.75
JRM1044	24	2,080	1B	10	2	4.30
JRM1045	24	1,376	2B	10	3	5.75
JRM1052	24	1,376	1A+1B	10	3	5.75
JRM1053	24	800	2A+2B	10	5	8.75

*True Form C

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Division of American Machine & Foundry Company, Princeton, Indiana 47570

MERCURY-WETTED CONTACT RELAYS

JM SERIES Rare long life, high speed, and unvarying dependability — all are the result of the basic component of these relays: a hermetically sealed glass capsule. It contains the contact arrangement and a small reservoir of mercury sealed in a high pressure hydrogen atmosphere. A film of mercury is renewed for every operation — that's why you can think in terms of billions of operations without contact bounce, pits or welds.

TWO TYPES OF CAPSULES The capsules used in JMF and JMF2 (with 2 capsules) modules and JML relays has a SPDT, break-before-make (Form C), non-bridging contact arrangement. Each capsule used in JMP, and JM1 to JM4 relays has a SPDT, make-before-break (Form D), bridging contact arrangement. JMF, JMF2, JML and JMP series achieve a high rate of sensitivity by factory-adjusted magnet biasing.

MOUNTING POSITION: Upright mounting required, but deviation from upright up to 30° causes only minor deviation in operating characteristics.

CONTACT RATINGS

JMF, JMF2 and JML: 500V max., and 2 amps max., 100 VA max.*

JMP and JM1 to JM4: 500V max., and 5 amps max., 250 VA max.

*With contact protection unless in a low level circuit. Details of a simple protection circuit consisting of resistor and capacitor in series are packed with each relay.

TERMINATIONS


Figure 11


Figure 12


Figure 21


Figure 22


Figure 23
Hook Solder


Figure 31

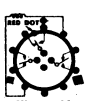


Figure 32
Hook Solder

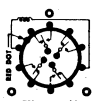


Figure 41
14 Pin Miniature Plug

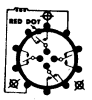


Figure 42
Hook Solder


Figure 51


Figure 52


Figure 53


Figure 82


Figure 81

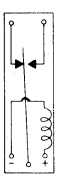
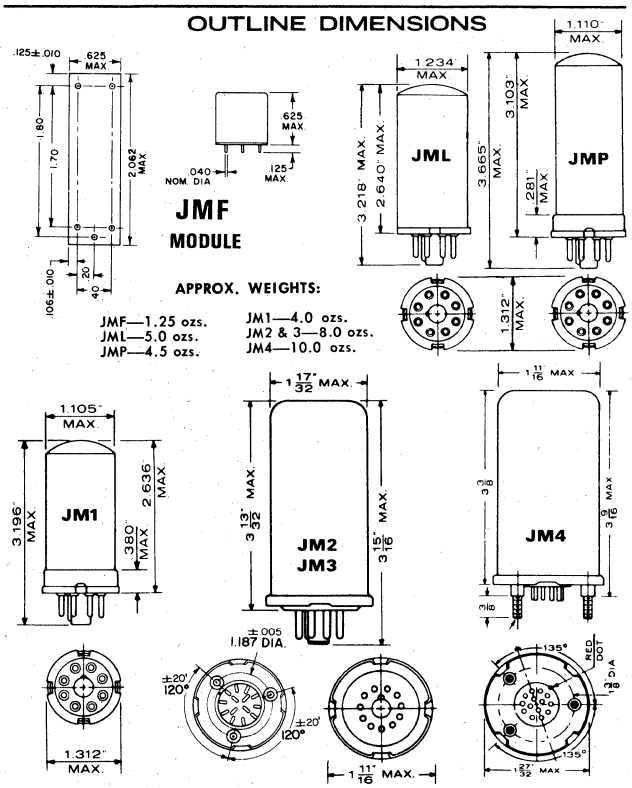


Fig. 61
FOR JMF MODULE

OUTLINE DIMENSIONS



TYPE	SERIES: Capsule	SERIES: Coil	SERIES: Terminal Figure No.	COIL CHARACTERISTICS: Resistance in Ohms ±10%	Sugg. Nominal Operate DC	Soak* ma. DC	Must Operate DC	Must Release DC	SUGG. RESALE PRICE
JMF PRINTED CIRCUIT MODULE. SENSITIVE FORM C NON-BRIDG.									
	SINGLE-SIDE-STABLE								
	JMF 1070		—61	450	16.13 ma.	—	12.9 ma.	2.1 ma.	$10.80
	JMF 1080		—61	675	14.50 ma.	—	11.6 ma.	1.9 ma.	10.80
	JMF 1120		—61	1425	10.50 ma.	—	8.4 ma.	1.4 ma.	10.80
	JMF 1150		—61	2400	9.75 ma.	—	7.8 ma.	1.3 ma.	
	JMF 1160		—61	4000	5.00 ma.	—	4.0 ma.	0.67 ma.	11.35
	BI-STABLE								
	JMF 5080		—61	675	+6.75 ma.	—	+5.4 ma.	—5.4 ma.	10.80
JMF2 DUAL-CAPSULE FORM C NON-BRIDG.									
	SINGLE-SIDE-STABLE								
	JMF2 1000		—71	130	6.0V DC	—	3.0V DC	0.5V DC	20.70
	JMF2 1001		—71	520	12.0V DC	—	6.0V DC	1.0V DC	20.70
	JMF2 1002		—71	2200	24.0V DC	—	12.0V DC	2.0V DC	21.25
JML SENSITIVE FORM C NON-BRIDG.									
	SINGLE-SIDE-STABLE								
	JML 1061		—81	40	12.19 ma.	36.0	9.75 ma.	1.68 ma.	13.35
	JML 1110		—81	350	4.45 ma.	13.1	3.56 ma.	0.61 ma.	13.35
	JML 1160		—81	1000	2.76 ma.	8.1	2.21 ma.	0.38 ma.	13.35
	JML 1190		—81	2500	1.79 ma.	4.0	1.43 ma.	0.17 ma.	14.25
	JML 1200		—81	4000	1.56 ma.	3.4	1.25 ma.	0.25 ma.	14.25
	JML 1240		—81	11000	.90 ma.	2.6	0.72 ma.	0.12 ma.	14.25
	JML 1260		—81	25000	.65 ma.	1.9	0.52 ma.	0.09 ma.	14.25
	BI-STABLE								
	JML 5160		—81	1000	+1.55 ma.		+1.24 ma.	—1.24 ma.	13.90
	JML 5200		—81	4000	+ .66 ma.		0.53 ma.	—0.53 ma.	14.25
	JML 5430		—82	(1) 1100 (2) 1100	+2.20 ma.		1.76 ma.	—1.76 ma.	15.60
	CHOPPER						Voltage RMS 60 Hz		
	JML 8130		—81	600	9.0V		6.3V		13.90
JMP POLARIZED FORM D BRIDGING	SINGLE-SIDE-STABLE								
	JMP 1160		—11	1000	7.00 ma.	16.2	5.60 ma.	0.40 ma.	17.50
	JMP 1200		—11	4000	3.70 ma.	8.55	2.96 ma.	0.24 ma.	18.75
	BI-STABLE								
	JMP 5200		—11	4000	+1.88		+1.5 ma.	—1.5 ma.	18.75
	CHOPPER						Voltage RMS 60 Hz		
	JMP 8120		—12	500	9.00V		6.3V		18.05
	JMP 8240		—11	11000	165.50V		117.0V with 1200 ohm (±5%) ½ watt resistor in series with coil		19.30

*Current to be applied to the coil winding for at least 2 seconds just prior to current flow tests.

TYPE	SERIES: Capsule	SERIES: Coil	SERIES: Terminal Figure No.	COIL CHARACTERISTICS: Resistance in Ohms ±10%	Sugg. Nominal Operate DC	MUST OPERATE Current DC	MUST OPERATE Voltage DC @ 25°C	MAX. VOLTAGE (at 35°C)	SUGG. RESALE PRICE
JM1 FORM D BRIDGING 1 CAPSULE SPDT	SPDT Single Coil								
	JM1 106		—12	40	83.70 ma.	67.7 ma.	2.98	9.0	16.15
	JM1 109		—12	130	47.50 ma.	38.8 ma.	5.55	16.1	16.15
	JM1 112		—11	500	25.00 ma.	20.1 ma.	11.10	31.6	16.15
	JM1 114		—11	700	25.00 ma.	20.0 ma.	15.40	37.4	16.15
	JM1 114		—12	700	12.50 ma.	20.0 ma.	15.40	37.4	16.15
	JM1 118		—11	2500	10.00 ma.	10.1 ma.	27.80	70.7	16.40
	JM1 119		—11	4000	10.00 ma.	8.1 ma.	35.60	89.5	8.15
	JM1 120		—11	7000	6.25 ma.	6.0 ma.	46.20	117.0	17.00
	JM1 121		—11	11000	4.50 ma.	5.0 ma.	60.50	148.0	17.00
	JM1 123		—11	25000		3.6 ma.	99.00	224.0	17.00
JM2 FORM D BRIDGING 2 CAPSULES DPDT	DPDT Single Coil								
	JM2 104		—22	50	137.50 ma.	110.0 ma.	6.04	12.25	26.20
	JM2 106		—21	140	81.25 ma.	65.5 ma.	10.00	20.5	26.20
	JM2 109		—22	315	55.00 ma.	44.0 ma.	15.30	30.7	26.20
	JM2 110		—22	500	42.25 ma.	34.8 ma.	19.20	38.7	26.20
	JM2 111		—22	700	37.30 ma.	30.5 ma.	23.50	45.8	26.20
	JM2 112		—22	1250	27.50 ma.	22.1 ma.	30.40	61.2	26.20
	JM2 115		—21	5000	13.75 ma.	11.3 ma.	62.10	122.0	26.20
	JM2 115		—22	5000	13.75 ma.	11.3 ma.	62.10	122.0	26.20
JM3 FORM D BRIDGING 3 CAPSULES 3PDT	3PDT Single Coil								
	JM3 109		—31	315	55.00 ma.	44.0 ma.	15.30	30.7	33.90
	JM3 110		—31	500	42.25 ma.	34.8 ma.	19.20	38.7	33.90
	JM3 111		—31	700	37.30 ma.	30.5 ma.	23.50	45.8	33.90
	JM3 115		—31	5000	13.75 ma.	11.3 ma.	62.10	122.0	33.90
JM4 FORM D BRIDGING 4 CAPSULES 4PDT	4PDT Single Coil								
	JM4 106		—41	65	125.00 ma.	42.0 ma.	7.15	15.1	43.70
	JM4 110		—41	390	52.50 ma.	35.4 ma.	18.00	37.0	43.70

Octal style plugs, except Fig. 23, 32, 42 (Hook Solder), Fig. 41 (14-Pin miniature plug).

POTTER & BRUMFIELD
Division of American Machine & Foundry Company, Princeton, Indiana 47570

SOLID STATE TIME DELAY RELAYS

A wide selection of three separate series of solid state time delay controls are represented by Potter & Brumfield time delay relays, the CD series, the CH series, and the CU series. The differences between the three types consist in their degree of accuracy, the variety available in each series, and their cost.

BASIC TIMING CIRCUIT The basic timing circuit of all three series consists of a resistor in series with a capacitor. When the input voltage is applied to the resistor-capacitor circuit, the voltage across the capacitor slowly increases. When the firing level is reached a solid state trigger circuit acts to turn on a solid state output switch that energizes a switching relay or external electrical load. The solid state design eliminates cams, clutches and motors. Using no moving parts, the timing circuit can have no mechanical wear, an advantage that is especially desirable when accurate recycling is required.

CU SERIES An outstanding value in a solid state time delay relay at low cost, the CU series is designed for delay on operate applications in machine tool controls, copiers, office equipment, coin-operated machines, process controls and many others. It is available in two types: Fixed time delay that is set at the factory and cannot be modified. Second, adjustable with an external resistor. For minimum time two terminals, 2 and 5, must be shorted; for maximum time the listed external resistor between terminals 2 and 5 must be added. For intermediate times select a lesser value resistor, or a potentiometer. Either model can be furnished in two types of enclosures with the relay in the same enclosure as the solid state unit. The CU series is offered with delay on operate only.

CUA and CUC are fixed time delays. **CUF and CUH** are resistor adjustable delays. All with internal DPDT 10 amp contact relay.

CUA 41-70010	**CUF 41-70010**
CUA 41-70120	**CUF 41-70120**
CUC 41-30010	**CUH 41-30010**
CUC 41-30120	**CUH 41-30120**
CUA 41-30010	**CUF 41-30010**
CUA 42-70010	**CUF 42-70010**
CUA 42-70120	**CUF 42-70120**
CUC 42-30010	**CUH 42-30010**
CUC 42-30120	**CUH 42-30120**
CUA 42-30010	**CUF 42-30010**

CU-41 is a plain case relay, **CU-42** has a slotted flange case. Diagram A is for fixed delays, diagram B for resistor adjustable delays.

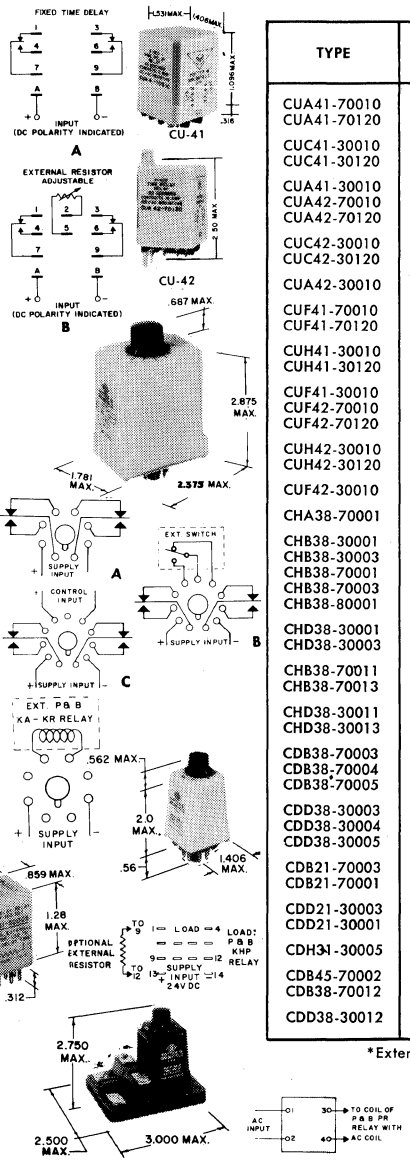
CH SERIES The CH series is intended for a wide range of industrial applications where economy is of greater interest than highly critical performance. It is available in two types: Knob-adjustable with the relay in the same enclosure as the solid state unit. The second type has a fixed time delay period that is set at the factory and cannot be modified; its case has no knob. The CH series is available for time delay on operate and on release.

CH-38 and CD-38. Knob-adjustable delay "on operate" wtih internally mounted DP-DT relay. Contacts rated to 10 amps. Diagram A.

CHA-38-70001	**CHD-38-30003**
CHB-38-30001	**CDB-38-70003**
CHB-38-30003	**CDB-38-70004**
CHB-38-70001	**CDB-38-70005**
CHB-38-70003	**CDD-38-30003**
CHB-38-80001	**CDD-38-30004**
CHD-38-30001	**CDD-38-30005**

Delay "on release" CH requires auxiliary SPDT switch or relay contacts: CBH-38-70011, CHB-38-70013, CHD-38-30011, CHD-38-30013: Diagram B. CD "release" occurs when "Control" circuit is de-energized; supply circuit must be on continuously:

CDB-38-70012, CDD-38-30012: Diagram C.



TYPE	TIME DELAY IN SECONDS	INPUT VOLTAGE	NOTES	SUGG. RESALE PRICE
CUA41-70010	10	120V AC	1	$12.50
CUA41-70120	120	120V AC	1	14.00
CUC41-30010	10	24V DC	1	12.50
CUC41-30120	120	24V DC	1	14.00
CUA41-30010	10	24V AC	1	12.50
CUA42-70010	10	120V AC	1	12.50
CUA42-70120	120	120V AC	1	14.00
CUC42-30010	10	24V DC	1	12.50
CUC42-30120	120	24V DC	1	14.00
CUA42-30010	10	24V AC	1	12.50
CUF41-70010	1.0—10	120V AC	200 K.*	13.25
CUF41-70120	1.0—120	120V AC	2.4 Meg.*	14.50
CUH41-30010	1.0—10	24V DC	160 K.*	13.25
CUH41-30120	1.0—120	24V DC	2 Meg.*	14.50
CUF41-30010	1.0—10	24V AC	200 K.*	13.25
CUF42-70010	1.0—10	120V AC	200 K.*	13.25
CUF42-70120	1.0—120	120V AC	2.4 Meg.*	14.50
CUH42-30010	1.0—10	24V DC	160 K.*	13.25
CUH42-30120	1.0—120	24V DC	2 Meg.*	14.50
CUF42-30010	1.0—10	24V AC	200 K.*	13.25
CHA38-70001	10	120V AC	1	17.45
CHB38-30001	1.0—10	24V AC	1	18.50
CHB38-30003	1.0—180	24V AC	1	18.50
CHB38-70001	1.0—10	120V AC	1	18.50
CHB38-70003	1.0—180	120V AC	1	18.50
CHB38-80001	1.0—10	240V AC	1	19.50
CHD38-30001	1.0—10	24V DC	1	17.50
CHD38-30003	1.0—180	24V DC	1	17.50
CHB38-70011	1.0—10	120V AC	1 & 7	22.50
CHB38-70013	1.0—180	120V AC	1 & 7	22.50
CHD38-30011	1.0—10	24V DC	1 & 7	20.50
CHD38-30013	1.0—180	24V DC	1 & 7	20.50
CDB38-70003	0.1—10	120V AC	1	43.80
CDB38-70004	0.6—60	120V AC	1	43.80
CDB38-70005	1.8—180	120V AC	1	43.80
CDD38-30003	0.1—10	24V DC	1	41.55
CDD38-30004	0.6—60	24V DC	1	41.55
CDD38-30005	1.8—180	24V DC	1	41.55
CDB21-70003	0.1—10	120V AC	2	38.70
CDB21-70001	1.8—180	120V AC	2	38.70
CDD21-30003	0.1—10	24V DC	3	38.35
CDD21-30001	1.8—180	24V DC	3	38.35
CDH31-30005	180 Max.	24V DC	4 & 5	38.90
CDB45-70002	0.6—60	120V AC	6	37.05
CDB38-70012	0.6—60	120V AC	1 & 7	52.45
CDD38-30012	0.6—60	24V DC	1 & 7	49.50

*External resistor (not furnished) for maximum time.

CD SERIES Remarkably dependable, accurate and flexible, the CD series offers an unusually wide selection of operational configurations, all with accurate time delay values, fast reset time and excellent repeatability. It is available in two types: Knob-adjustable in two versions, one with the relay in the same enclosure as the solid state unit, the other with an auxiliary relay. A second type is adjustable with an external resistor. The CD series is available for time delay on operate or on release.

CD-21. Knob-adjustable. Use with P&B KRP relays (see page 3) as listed under Note 2.

CDB-21-70003	**CDD-21-30003**
CDB-21-70001	**CDD-21-30001**

CD-31. Adjustable with external resistor (not furnished). Use with KHP relay (see page 2), Note 4.

CDH-31-30005

CD-45. Knob-adjustable. For heavy duty when used with PR power relay (see page 4) as listed under Note 6.

CDB-45-70002

NOTES

1. Has internal relay with DPDT contacts rated at 10 amperes, 120V AC.
2. Use with Potter & Brumfield relay KRP5AG-120V AC, KRP11AG— 120V or KRP14AG— 120V AC or KRP14AG— 120V AC.
3. Use with Potter & Brumfield KRP5DG— 24V DC, KRP11DG— 24V DC or KRP-14DG— 24V DC relay.
4. Use with Potter & Brumfield KHP-17D11— 24V DC relay.
5. Supplied with 180 seconds delay; adjustable to 1.8 seconds with external resistor (not furnished).
6. Use with Potter & Brumfield PR11AY— 120V AC relay.
7. Provides delay on release; all others have delay on operate.

APPROX. WEIGHTS:

SERIES CD-31 2.00 ozs.	SERIES CD-45 6.00 ozs.
SERIES CD-21 4.25 ozs.	SERIES CD-38 8.25 ozs.
SERIES CH-38 4.00 ozs.	ALL SERIES CU 3.25 ozs.

Relays? Go no further.

Here, considerably abbreviated, are the Price Electric relays — the most complete line of industrial and military relays available from a single source. Naturally, we show only the most popular types and sizes. You'll find the rest, and all the information you need to select the right relay, in our catalog. Write for your copy.

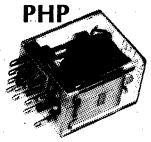
PRICE ELECTRIC CORPORATION

Hi-Spec Electronics Corporation

A North American Phillips Corporation

Industrial Relays

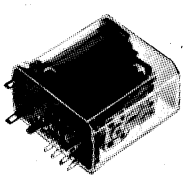
PHP



4PDT—3 amp, 28 VDC/115 VAC res. Coil —up to 115 VAC and DC. Dust cover with plug-in and socket available.

Coil VDC	Part No.	Coil VAC	Part No.
6	PHP-17D- 6	6	PHP-17A- 6
12	PHP-17D-12	24	PHP-17A- 24
24	PHP-17D-24	115	PHP-17A-115

GP



2, 4, and 6 pole, 2 amp, 28 VDC/115 VAC res. Coil—up to 115 VDC, sensitivity as low as 50 mw for DPDT. Dust cover with plug-in and socket available. Also relays with twin contacts.

Some standard relays:

Coil VDC	Part No. DPDT	Part No. 4DPT	Part No. 6PDT
6	GP-2C- 6	GP-4C- 6	GP-6C- 6
12	GP-2C-12	GP-4C-12	GP-6C-12
24	GP-2C-24	GP-4C-24	GP-6C-24
48	GP-2C-48	GP-4C-48	GP-6C-48

VK

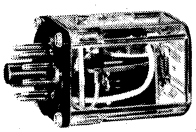


3 pole, 10 amp, 28 VDC/115 VAC res. Coil —up to 115 VAC and DC. Dust cover with plug-in and sockets available.

Some standard relays:

Coil VDC	Part No.	Coil VAC	Part No.
12	VK-14D-12	24	VK-14A- 24
24	VK-14D-24	115	VK-14A-115

L



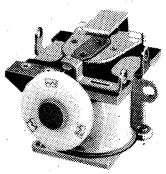
Up to 4PDT 5 or 10 amp, 28 VDC/115 VAC res.

Coil: Typical: 12 VDC 120 ohms
115 VAC 2250 ohms

Open or completely dust covered with 8/11 pin octal plug.

Contact	Coil Volts	Part No. Open Style	Part No. Dust Covered
3 PDT 5 Amp	12 DC	LK-14D- 12	LKP-14D- 12
3 PDT 5 Amp	115 AC	LK-14A-115	LKP-14A-115
3 PDT 10 Amp	12 DC	LH-14D- 12	LKP-14D- 12
3 PDT 10 Amp	115 AC	LH-14A-115	LKP-14A-115

31



SP—3 amp, 28 VDC/115 VAC res. Coil—176 MW. Typical—12 VDC 440 ohms. Stabilized Memory Relay—every other pulse to relay coil closes the contact. Open or completely dust covered with 8 pin octal plug.

Coil VDC	Part No. Solder Terminals	Part No. Printed Circuit Terminals
6	31A112AC	31A111AC
12	31A112AE	31A111AE
24	31A112AG	31A111AG

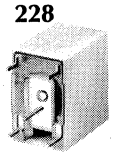
220



DPDT—2 amp, 28 VDC/115 VAC res. Coil—572 MW. Typical—12 VDC 110 ohms. Completely dust covered, for direct PC mount.

Coil VDC	Part No.
6	22E121DA
12	22E121DD
24	22E121DG

228



SPDT—2 amp, 28 VDC/115 VAC res. Coil —50 MW. Typical—12 VDC 1760 ohms. Completely dust covered, for direct PC mount.

Coil VDC	Part No.
6	28A111CE
12	28A111CG
24	28A111CI

1000

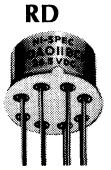


SPDT—3 amp, 28 VDC/115 VAC res. Coil —44 MW. Typical—12 VDC 1760 ohms. Dust covers for contact area, solder or PC terminals.

Coil VDC	Solder Terminals	Part No.
6	10F211CE	10F211CE
12	10F212CG	10F211CG
24	10F212CI	10F211CI

Military Relays

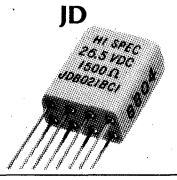
RD



DPDT—1 amp, 28 VDC res. Coil—130 MW. Typical—26.5 VDC 1500 ohms. Ambient Temp.— −65 to +125°C. Vibr.—30 G up to 3000 H_z. Shock—80 G, 11 msec. Mil-Spec.—MIL-R-5757.

Coil VDC	Part No. Wire Lead Terminals
26.5	RDA011BC1

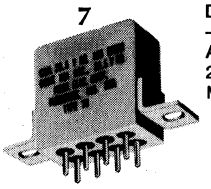
JD



DPDT—1 amp, 28 VDC res. Coil—150 MW. Typical—26.5 VDC 1500 ohms. Ambient Temp.— −65 to +125°C. Vibr.—20 G up to 2000 H_z. Shock: 50 G, 11 msec. Mil-Spec.—MIL-R-5757.

Coil VDC	Part No. Wire Lead Terminals
26.5	JDBO23DF1

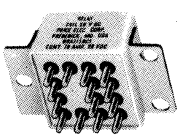
7



DPDT—10 amp, 28 VDC/115 VAC res. Coil —565 MW. Typical—26.5 VDC 300 ohms. Ambient Temp.— −65 to +125°C. Vibr.—20 G up to 2000 H_z. Shock—50 G, 11 msec. Mil-Spec.—MIL-R-5757 & MIL-R-6106.

Coil VDC	Part No. Plug-In Terminals	Part No. Solder Hook Terminals
26.5	BO7D111BC3	BO7D112BC3

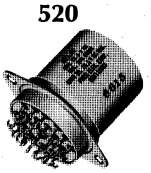
8



4PDT—10 amp, 28 VDC/115 VAC res. Coil —565 MW. Typical—26.5 VDC 300 ohms. Ambient Temp.— −65 to +125°C. Vibr.—30 G up to 3000 H_z. Shock—100 G, 10 msec. Mil-Spec.—MIL-R-5757 & MIL-R-6106.

Coil VDC	Part No. Plug-In Terminals	Part No. Solder Hook Terminals
26.5	AO8B111CC3	AO8B112CC3

520



6PDT—2 amp, 28 VDC/115 VAC res. Coil —700 MW. Typical—26.5 VDC 240 ohms. Ambient Temp.— −65 to +125°C. Vibr.—15 G up to 2000 H_z. Shock—50 G, 11 msec. Mil-Spec.—MIL-R-5757.

Coil VDC	Part No. Plug-In Terminals	Part No. Solder Hook Terminals
26.5	03C111DC1	03C112DC1

8200



DPNO—100 amp, 28 VDC/115 VAC res. DPNO—25 amp, 28 VDC/115 VAC res. Coil —3 W. Typical—24 VDC 50 ohms. Ambient Temp.— −70 to +125°C. Vibr.—15 G up to 500 H_z. Shock—70 G. Mil-Spec.—MIL-R-6106.

Coil VDC	Part No. Dust Covered	Part No. Hermetically Sealed
28 VDC	82CO11BD3	82C342DD3

All relays shown here, and more, are available from our local distributor. Ask him for a Price Electric Relay Catalog, or write us: Price Electric Corporation, Frederick, Maryland 21701

REMVAC COMPONENTS, INC.

37-55 61st Street Woodside, New York 11377 (212) TW 9-6100

HP-RELAYS

- UL Approval
- Two types: solder type (S-terminal) and plug-in (R-terminal).
- Both types available for 6V, 12V, 24V, 48V, and 110V DC applications, and 6V, 12V, 24V, 48V, 115V, 220V, and 240V AC applications.
- Both AC & DC high power applications at all voltage levels.
- Contact arrangements: DPDT, 3PDT, and 4PDT available in all types at all voltages.
- Mech. life: over 10,000,000
- Long life, excellent reliability, and superior contact performance up to 10A 250V AC
- Complete standardization and simplification allows minimized sizes and lowest prices.
- Totally interchangeable with U.S. components, including pin configurations.

Max. switch-off current	10A AC
Max. switch-on current	20A AC
Max. contact current	10A
Max. contact voltage	250V AC
Max. contact power	120W
Shock resistance	10G



R-SERIES
Can only be used for plug-in into standard sockets. Panel & surface mounting sockets are available for HP relays.

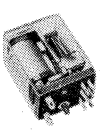


S-SERIES
Can be used without alteration with direct solder tab connection or with AMP-connectors, type Faston 205. For plug-in or printed circuit applications.

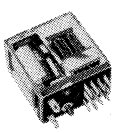
K-RELAYS

- UL Approval
- 10P twin contact force
- Mech life: 10^8
- Low operating force
- Negligible contact bounce
- Interchangeable
- 20 μ gold-plated mercury contacts
- Long life expectancy
- Low price

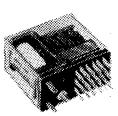
Max. switching capacity	2A; for type K2F—5A
Max. switching voltage	220V
Max. switching power	50W (120VA); for type K2F—100W (500VA)
Max. contact current	4A; for K2F—6A
Vibration resistance	10G to 55Hz



Type K2 DPDT



Type K4 4PDT



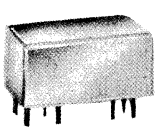
Type K6 6PDT

Type	Current	Contacts	Voltages 3	6	12	24	28	42	48	60	110	220
K2	DC	DPDT	x	x	x	x		x	x	x	x	
K2A	50Hz	DPDT		x	x	x			x		x	x
K2A	60Hz	DPDT		x	x	x			x		x	x
K2F	DC with 5A contact	DPDT		x	x	x	x	x		x	x	
K4	DC	4PDT	x	x	x	x			x	x	x	
K6	DC	6PDT		x	x	x			x	x	x	

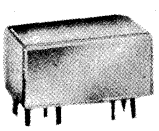
R-RELAYS

New type of high speed, SPDT, reed contact relay

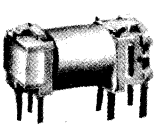
- 5P rhodium twin contacts
- 60 megohm contact resistance
- High reliability
- Low operating power
- Up to 500Hz operating frequency
- Temperature compensation
- Mechanical life: 10^9
- Low price



Type RS Shielded Hermetically sealed



Type RH Hermetically sealed



Type RO Unsealed

Max. switching load	1A
Max. switching voltage	110V
Max. switching power	20W
Switch-on/contact current	1.5/1
Shock resistance	30G

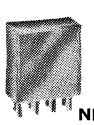
TWO BASIC TYPES:

Single side stable SPDT contacts—to be used as a neutral nonpolarized relay.

Bistable (latching) SPDT contacts—to be operated by either single wound coil (chopper) or double wound coil.

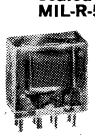
N-RELAYS

- For RF and dry circuit applications
- Suitable for DC operation
- SPDT and DPDT
- High reliability
- Long life expectancy
- Low contact resistance
- NH, NDH, N, and ND types available at following voltages: 3V, 6V, 12V, 24V, 28V, 42V, 60V, 100V



NH and NDH

Hermetically sealed MIL-R-5757D



N and ND

Plastic cover

HM-RELAYS

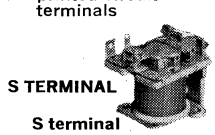
- SPDT
- Both P and S types available at following voltages: 3V, 6V, 9V, 12V, 18V, 24V, 35V, 42V, and 60V.
- Minimum 15P contact pressure
- High life
- Low price
- Mechanical life: 20,000,000

Max. switch off current	3A
Max. switch on current	10A
Max. contact current	6A
Max. contact voltage	250V
Max. contact power	90W/1 KVA



P TERMINAL

P terminal
Mounting by printed circuit terminals



S TERMINAL

S terminal
Mounting by two mounting screws to an insulating plate.

REMVAC COMPONENTS, INC.

37-55 61st Street Woodside, New York 11377 (212) TW 9-6100

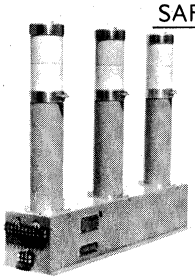
Sole agents for components manufactured by Matsushita Electric Works, Ltd.

ROSS ENGINEERING CORPORATION

HIGH VOLTAGE DEVICES

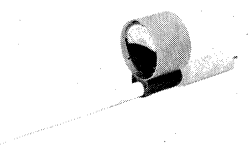
SWITCHES, RELAYS, MEASUREMENT, CONTROL, ENERGY STORAGE SYSTEMS, SAFETY, AND ACCESSORIES.

DC, 60 CYCLES, RF, PULSE, FOR ELECTRONIC AND POWER. 1,000 VOLTS TO 600,000 VOLTS.



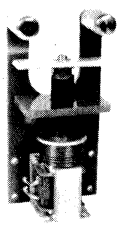
VACUUM POWER INTERRUPTING CONTACTORS AND CIRCUIT BREAKERS

5 to 38 KV RMS operate
50 to 600 amps continuous
2,000 to 12,000 amps interrupt



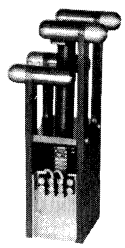
HI-Z™ HIGH VOLTAGE VOLTMETER

High Impedance
Portable
Instrumentation
.001V to 120KV



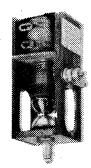
HV RELAYS
MODEL E

Open style
50 to 100 amps
12 to 120 KV PK
12 KV $54.00
40 KV $79.00
150 KV $480.00



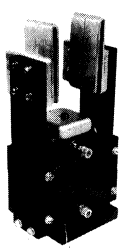
SPDT RELAYS
MODEL E-DT

Economical
Open Style
12 to 70 KV
50 to 100 amps
12 KV $71.00
25 KV $94.00



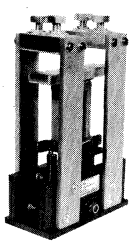
SPHERE GAP RELAYS
MODEL EE

Small Size
Gravity operated
12 to 100 KV
15 to 50 amps
Adjustable
Sphere Gap contacts
0-15 KV to 20-120 KV PK
25 KV $82.00



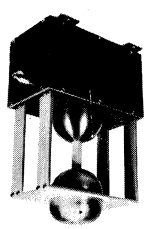
HIGH CURRENT SWITCH
MODEL GB

100 to 4,000 amps
Continuous
Small size
to 100 KV, PK test
Air solenoid operated
27 KV 600 A $190.00



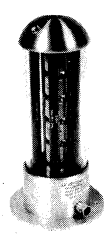
RF RELAYS
MODEL GA

High Current
Air operated to 100 KV PK
10 to 600 amps



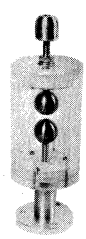
GROUNDING RELAYS
MODEL D

Gravity operated
to 600 KV, 100 amps
Low corona
50 KV $180.00
120 KV $390.00



VOLTAGE DIVIDERS
MODEL VD

Compensated
DC to RF
to 450 KV, PK
30 KV $180.00
120 KV $425.00



SPHERE GAPS
MODEL SG

Enclosed
Adjustable
to 600 KV, PK
2 to 40 KV $49.00
6 to 88 KV $98.00

HV SAFETY GROUNDING INTERLOCKS, SAFETY DEVICES, SPECIALTIES. Models pictured are examples of a related series. Currents are RMS continuous ratings. Voltages listed are Peak 60 Cycle Test values. Operating values are generally 1/3 to 2/3 that of peak test values. Spark-over is generally 10% to 30% higher than peak test listed. Let us quote on specific items since most models are available NO, NC, SPDT, and latching, with 115 AC actuators. Many items are not listed and prices and models can change without notice.

WRITE FOR CATALOG EM 68-A

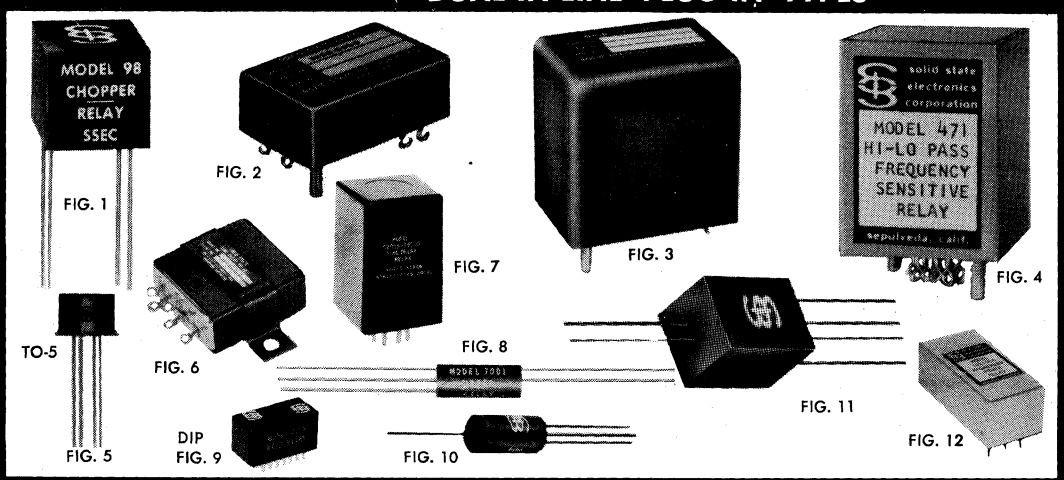
ROSS ENGINEERING CORPORATION: 11915 Shadybrook, Saratoga, California 95070
Phone (408) 253-1572 or 253-1573

2 69

SOLID STATE RELAYS AND REED RELAYS

AC, DC, HI, LO POWER TYPES
MICROSECOND SWITCHING
TIME DELAY, FREQUENCY SENSITIVE
LATCHING, LIGHT-CONTROLLED TYPES

SMALLEST, MOST SENSITIVE
HI, LO POWER, BINARY, LO VOLTAGE
TRANSISTOR & INTEGRATED CIRCUIT
DUAL-IN-LINE PLUG-IN TYPES



microminiature | lightweight | low power | high speed | indefinitely long life
rugged | inertialess | low level | high efficiency | temperature stable

SOLID STATE & REED RELAYS

DESCRIPTION

Solid state and reed relays provide the most reliable types of isolated switching presently available. Solid state relays are the most rugged and fastest (2 microsecond switching through 2000 G's). The Models 98 and 1285-5050 are DC contact types (to 50 ma) whereas the 2828-3504 (4 amps) and 2850-40020 (20 amps) are AC types. Reed relays are the fastest, most rugged and reliable of the electromechanical types (3 amps within 1 millisecond through 50 G's). They have very high isolation between drive and glass enclosed contacts. The 7001, 8001, 8021 Microreed Relays are the smallest, lowest drive power units made. The 7031 and 8031 are dual-in-line plug-in units designed for transistors and integrated circuits (3 volts, 25 ma drive). The 7051 and 8051 latching reed relays are logical binary types with non-volatile memory (each contact remembers the last command). Series 10 are power type reed relays. The 651 and 671 types are light actuated relays (high isolation and solid state contacts). The Models 471 and 476 are under/over and bandpass frequency detectors for remote monitoring, control and decoding. The 2825-50200 and the C2835-28500 are time-delay relays having solid state and reed output contacts respectively. These units are now being used for many applications. They are virtually immune to shock and vibration making them ideally suited for aerospace, military, industrial, R & D usage where miniaturization, power conservation and elimination of maintenance are prime requisites. Microfilm data sheets and application notes will be found in VSMF or the Thomas Supplementary File.

Phone, wire or write our engineering department for an immediate reply, recommendation or catalog. Many shipments are same day, if you call early.

COMPARATIVE TABLE OF SPECIFICATIONS FOR SOLID STATE & REED RELAYS

				CONTACTS						ENVIRONMENTAL				MECHANICAL		
Model	Type	Volts DC	Z kΩ	Volts	Current amps	Power watts	Form	On msec	Off msec	Temp. °C	Shock G	Vib. G	Acc. G	Size inches	Wt. grams	Fig.
98	Solid State Chopper-Relay	6-12	0.6	±20	0.02	0.4	SPST	.002	.01	−55 to +100	500	50	800	0.84x0.84x0.75	17	1
1285-5050	Solid State Relay	22-32	5	±50	0.05	1	SPST	.002	.005	−55 to +125	1000	300	2000	1.00x1.59x0.56	25	2
2828-3504	Solid State AC Relay	26-32	1	150rms	4rms	600	SPST	.002	.01	−55 to +125	500	100	1000	1.25x1.25x1.75	84	3
2850-40020	Solid State AC Relay	26-30	0.5	140rms	20rms	2800	SPST	.01	.025	−55 to +75	500	75	500	1.63x1.63x2.38	400	4
471	Hi-Lo Pass Freq Sens Relay	15-30pk	2	28	0.25	3	SPDT	1	1	−30 to +80	50	50	400	1.31x1.31x1.75	115	4
476	Bandpass Freq Sens Relay	15-30pk	2	28	0.25	3	SPDT	1	1	−30 to +80	50	50	400	1.31x1.31x1.75	115	4
651	Raylay (Light Sens)	2-3	0.08	125	0.02	0.25	SPST	20	30	−25 to +75	1000	100	800	0.26x0.36 Dia.	1	5
671-15	Latching Raylay	1-3	0.06	15	0.35	0.25	SPST	10	30	−65 to +125	1000	100	800	0.26x0.36 Dia.	1	5
671-30	Latching Raylay	1-3	0.06	30	0.35	0.25	SPST	10	30	−55 to +100	1000	100	800	0.26x0.36 Dia.	1	5
671-60	Latching Raylay	1-3	0.06	60	0.35	0.25	SPST	10	30	0 to +75	1000	100	800	0.26x0.36 Dia.	1	5
671-100	Latching Raylay	1-3	0.06	100	0.35	0.25	SPST	10	30	−55 to +125	1000	100	800	0.26x0.36 Dia.	1	5
2825-50200	Time Delay Relay	28	0.6	50	0.2	2	SPST	.002	.004	−55 to +100	700	50	800	1.06x1.06x0.50	28	6
C2835-28500	Time Delay Relay	28	0.8	28	0.5	10	SPST	1	1	−55 to +100	100	20	100	0.90x0.90x1.25	28	7
7001	Microreed Relay	3	0.15	28	0.25	3	SPDT	1	0.2	−55 to +125	50	50	400	0.75x0.30 Dia.	2	8
8001	Microreed Relay	3	0.2	250	0.5	10	SPST	0.6	0.1	−55 to +125	50	50	400	0.90x0.25 Dia.	2	8
8021	Microreed Relay	9-12	0.15	28	0.25	3	SPST	0.6	0.1	−55 to +125	50	50	400	0.60x0.20 Dia.	2	8
7031	Dipreed Relay	3	0.15	28	0.25	3	SPDT	1	0.2	−55 to +125	50	50	400	0.50x0.95x0.46	8	9
8031	Dipreed Relay	3	0.2	250	0.5	10	SPST	0.6	0.1	−55 to +125	50	50	400	0.50x0.95x0.46	8	9
7032	Dipreed Relay	3	0.08	28	0.25	3	DPDT	1	0.2	−55 to +125	50	50	400	0.50x0.95x0.46	8	9
8032	Dipreed Relay	3	0.1	250	0. 5	10	DPST	0.6	0.1	−55 to +125	50	50	400	0.50x0.95x0.46	8	9
7051	Binary Latching Reed Relay	±6	1	28	0.25	3	SPDT	1.2	1.2	−55 to +100	50	50	400	0.63x0.63x0.86	13	11
8051	Binary Latching Reed Relay	±6	1	250	0.5	10	SPST	1.2	1.2	−55 to +100	50	50	400	0.63x0.63x0.86	13	11
Series 9000	Minireed Relays	6-48	—	250	0.5	10	Multi	0.6	0.1	−55 to +125	50	50	400	1.00x0.50 Dia.	10	10
Series 10	Magnereed Power Relays	6-48	—	500	1.5-3	50	Multi	2	2	−55 to +100	25	25	200	1.41x2.89x1.06	125	12

Phone, wire or write for specifications and application literature describing above units or consult your microfilm files (VSMF or Thomas Supplementary)

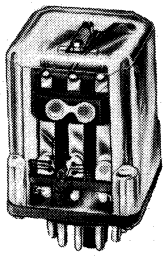
SOLID STATE ELECTRONICS CORP.
15321 RAYEN STREET
SEPULVEDA, CALIFORNIA 91343
Area Code 213 — 894-2271 • 785-4473

OTHER PRODUCTS — SEE EEM SECTIONS 5200 & 5900

FREQMETERS (MODULAR & VISUAL)
DC DIFFERENTIAL OPERATIONAL AMPLIFIERS
XTAL PULSE GENERATORS
VOLTAGE CONTROLLED OSCILLATORS
TONE OSCILLATORS - TRANSFORMERS
RELAYS (SOLID STATE, TIME DELAY, REED, LIGHT)
MINIATURE TELEMETER SYSTEMS
PRESSURE TRANSDUCERS
DIGITAL LOGIC MODULES
SOLID STATE CHOPPERS

SCHRACK RELAYS

CAD SERIES

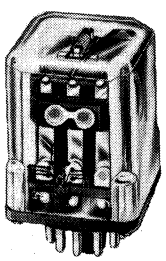


Contacts	10 Amp. Rating SPDT	DPDT	3PDT
Relay Type	CAD5A10	CAD11A10	CAD14A10
6 volts a.c. 12 volts a.c. 24 volts a.c. 115 volts a.c.	$4.95	$5.55	$6.75
230 volts a.c.	$5.50	$5.95	$7.15
Relay Type	CAD5D10	CAD11D10	CAD14D10
6 volts d.c. 12 volts d.c. 24 volts d.c.	$4.95	$5.55	$6.75
110 volts d.c.	$5.50	$5.95	$7.15

5 AMP ALSO AVAILABLE

Same basic design as CA series; however, with clear plastic dust cover and octal-type plug-in base. Case is secured firmly to base by 4 "upset" plastic studs. Contact carrier plate is self-centering. Contact carrier is made of "KERIPOLE," a polyester material with glass fibre filling.

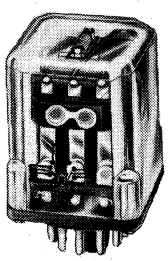
CSD SERIES



A plate circuit relay, similar to the CAD Type; however with increased sensitivity (125 MW per movable arm).

Contacts	2 Amp. Rating SPDT	DPDT	3PDT
Relay Type	CSD5	CSD11	CSD14
2500 ohms	$5.20	$5.60	$6.80
5000 ohms	$5.30	$5.70	$6.90
10,000 ohms	$5.70	$6.10	$7.30

SENSITIVE RELAY — CMD SERIES



In this series there are eleven types in three classifications.

No.	Coil	List Price
CMD-5D	600Ω	$4.95
CMD-5D	2400Ω	4.95
CMD-5D	9600Ω	5.20
CMD-11D	450Ω	6.10
CMD-11D	1890Ω	6.10
CMD-11D	7300Ω	6.10
CMD-5A	540Ω	5.00
CMD-5A	234Ω	4.75
CMD-5A	1000Ω	4.75
CMD-5A	3850Ω	4.75
CMD-5A	6900Ω	5.30

1. D.C. Relays with one form C contact Type CMD 5D—Pull-in sensitivity 40 mw; Coil Windings — 600 ohm, 2400 ohm, 9600 ohm

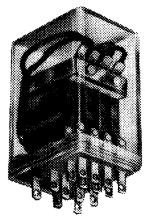
2. D.C. Relays with two form C contacts Type CMD 11D — Pull-in sensitivity 60 mw; Coil Windings — 450 ohm, 1890 ohm, 7300 ohm

3. A.C. Relays with one form C contact Type CMD 5A — Pull-In sensitivity 80 MVA; Coil Windings — 540 ohm, 234 ohm, 1000 ohm, 3850 ohm, and 6900 ohm

Contact ratings are 2 amps at 115 VAC.
Contact points are gold-flashed silver.

NEW MINIATURE UNIVERSAL TYPE RA

A precision piece of equipment at a commercial price —



1.515" high, 0.847" wide with dust cover

designed for use in computers, data processing equipment, communications equipment, process control applications, and other equally important systems.

Type RA is a four pole universal type relay for 4 PDT or double-make, double-break (DPDT-DB) action. 3/32" contacts rated at 3A — normally supplied in gold-flashed silver. Also available in silver cadmium oxide, gold nickel, silver palladium, etc.

STANDARD COIL DATA — **Sockets Available**

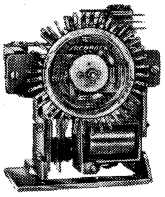
DC Voltage	Resistance in Ohms ± 10% at 25° C	List Prices	AC Voltage	Average AC current in MA (relay closed)	List Prices
6	40	$3.50	6	200	$4.10
12	160	3.50	12	100	4.10
24	650	3.50	24	52	4.10
48	2,600	4.20	48	25	4.80
90	9,000	4.20	115	10.5	4.80
110	11,000	4.20			

Printed Circuit Terminals at Same Prices

TYPE RR REMANENCE RELAYS

Magnetic Latching for miniaturized circuitry. Same physical characteristics as RA. Voltages from 24-220 AC and 12-110 DC. Same electrical characteristics as CRD and CRF on opposite page. Prices range from $4.50-$5.30 list.

ROTARY STEPPING SWITCH TYPE RT



The SCHRACK Rotary Stepping Switch is a combination of three reliable components:

1. Standard Relay with 1 Form C heavy-duty contact.
2. Ratchet driven Rotary Switch consisting of four banks of twelve or ten points each with sliding bifurcated wipers.
3. Ratchet driven Stepping Relay with two cams which actuate one Form C contact each.

Schrack Rotary Stepping Switches have a highly efficient magnetic circuit and a driving mechanism designed for maximum operating safety. All components are mounted on a rigid die-cast light metal frame and contacts are permanently molded in a sturdy melamine plastic.

ROTARY SWITCH terminals are arranged in a circular pattern with four groups of twelve points each. A conversion can make it operate with 3 groups of 16 each. An alternate version with 4 x 10 points is available for applications requiring decimal counting. Each group occupies a quadrant of the circle and contains a common bus which is connected to the twelve or ten insulated points in sequence by means of a sliding wiper as the switch is operated.

TYPE RT 304 — 4 x 12 Contact Points $19.00 ea.
TYPE RT 404 — 4 x 10 Contact Points $19.00 ea.

SEND FOR DISCOUNT SCHEDULES

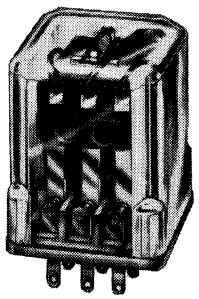
FOR FURTHER INFORMATION ASK FOR CATALOG

SCHRACK ELECTRICAL SALES CORPORATION

1140 BROADWAY NEW YORK, N. Y. 10001

SCHRACK RELAYS

SINGLE COIL MAGNETIC LATCHING RELAYS — TYPES CRD & CRF



This is a bi-stable power relay held in operated position by a strong residual magnetism of the coil core after the coil is de-energized. The coil core is of a special alloy having sufficient remnant magnetic force to hold the armature locked-in for an indefinite period of time after being energized momentarily.

In design, these magnetic latching relays are identical, except for the base, with the Schrack Type CAD plug-in relay. Contacts are rated at 5 or 10 amps depending on materials used. DPDT (2 form C) or 3 DPDT (3 form C) versions are available.

LATCHING RELAY — TYPE CBT



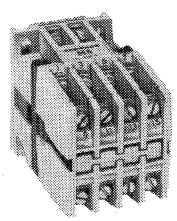
A dual coil mechanical latching relay. Each relay operates on a momentary impulse on either coil and is held in the set position until released by an impulse on the other coil. Both coils must be for the same voltage and are continuously rated.

Contact rating: 10 amps. (Based on 600 operations per hour at 115 volts AC 60 cy. resistive load).

May be operated continuously at 1000 cycles per hour.

The CBT relays have a transparent dust cover and a sturdy base plate of insulating material. Screw-type terminals are provided for all contact and coil connections. Available in voltages from 6-230 AC and 6-110 DC.

MULTI-POLE CONTACTORS TYPES M4, M6, M8, M10



Small, low-cost units

Versatile — with auxiliary contacts.

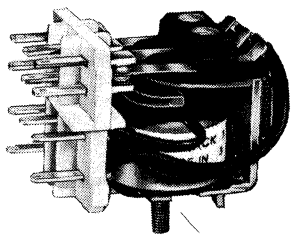
These are compact 8-pole air-break contactors. Principal applications for the M4 type are control circuits (pilot duty), but also may be used for switching of small single-phase or threephase motors. Type M8 has 4 contacts with increased rating and 4 contacts identical with M4. Types M6 and M10 have same features as M4 and M8, but have 3 main contacts and 1 auxiliary contact — intended for industrial applications.

NEW **LIST PRICES:**

M4 — $12.00
M6 — 15.00
M8 — 12.00
M10 — 15.00

STOCKED IN OUR N. Y. WAREHOUSE

OPEN RELAY TYPE CA



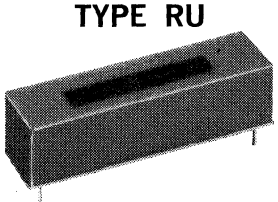
Recognized under the components program of Underwriters Laboratories, Inc.

5 AMP RATING	CA5A5	CA11A5	CA14A5
6 volts a.c.			
12 volts a.c.			
24 volts a.c.	$2.60	$3.00	$3.85
115 volts a.c.			
230 volts a.c.	2.95	3.40	4.20
	CA5D5	**CA11D5**	**CA14D5**
6 volts d.c.			
12 volts d.c.			
24 volts d.c.	$2.60	$3.00	$3.80
60 volts d.c.			
110 volts d.c.	2.95	3.40	4.15

10 AMP RATING	CA5A10	CA11A10	CA14A10
6 volts a.c.			
12 volts a.c.			
24 volts a.c.	$2.65	$3.05	$3.90
115 volts a.c.			
230 volts a.c.	3.00	3.45	4.30
	CA5D10	**CA11D10**	**CA14D10**
6 volts d.c.			
12 volts d.c.			
24 volts d.c.	$2.65	$3.05	$3.85
60 volts d.c.			
110 volts d.c.	3.00	3.45	4.25

A robust and dependable open-type relay, equipped with lugs suitable for soldering and for mounting of AMP-FASTON Connectors, Series 110. Contact rating: 5 amps or 10 amps; according to contact material. Standard coils available: 6, 12, 24, 115, 230 volts a.c.; 6, 12, 24, 110 volts d.c. **Standard versions include 1, 2, or 3 Form C contacts. Optional: solder lugs for printed circuit boards, and .187 Faston Connectors.**

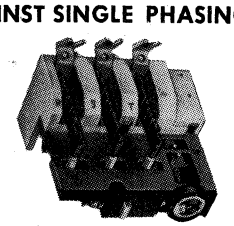
DRY REED RELAYS TYPE RU



May be incorporated into printed circuits as easily as other components. These are rugged, compact, high-power units available in a wide range of voltages and contact arrangements featuring long mechanical life (100 mill. operations). They are not influenced by mounting position and are fully protected against corrosive atmospheres.

	TYPE	PILE-UP	LIST PRICE
½ AMP. 3 WATTS	RU510 103	1A	$ 4.05
	106		4.15
	112		4.30
	124		4.80
	RU520 103	2A	6.85
	106		6.95
	112		6.95
	124		7.25
	RU530 103	3A	9.65
	106		9.80
	112		9.85
	124		10.35
.1 AMP 4 WATTS	RU511 103	1C	12.70
	106		12.80
	112		12.90
	124		13.45
	RU521 103	2C	24.10
	106		24.20
	112		24.20
	124		24.40
	RU531 103	3C	35.50
	106		35.60
	112		35.80
	124		35.95
1 AMP 15 WATT	RU512 103	1A	4.20
	106		4.25
	112		4.35
	124		4.75
	148		5.60
3 AMP 50 WATT	RU513 103	1A	8.20
	106		8.25
	112		8.35
	124		8.75
	148		9.55

LOW COST PROTECTION AGAINST SINGLE PHASING IN A THREE WAY SYSTEM



Operates by the use of bi-metallic strips and dissimilar coefficients of expansion under temperature changes.
When temperature increases due to overload, a microswitch is activated in any leg of a three phase circuit.
Microswitch is normally placed in series with the solenoid of any switching device in the 3 phase line. Reset button may be manually or automatically operated.

WRITE FOR COMPLETE SPECIFICATIONS & APPLICATIONS.

SEND FOR DISCOUNT SCHEDULES

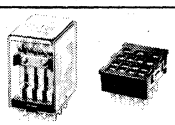
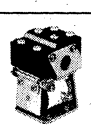
FOR FURTHER INFORMATION ASK FOR CATALOG

SCHRACK ELECTRICAL SALES CORPORATION

1140 BROADWAY NEW YORK, N. Y. 10001

SIGMA RELAYS

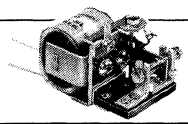
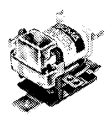
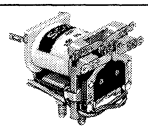
Shown below are selected Sigma relays, with a capsule listing of general characteristics. For a complete product listing, send for Sigma's new catalog of preferred standard and stock relays. Individual data sheets on specific relay types are also available.

GENERAL PURPOSE					
SERIES	COIL		CONTACTS		
	VAC Max.	VDC Max.	POLES (up to)	RATING (amperes)	
 11 (UL)	115	48	SPDT	0.5 to 5	
 50 (UL)	230	110	3PDT	5 to 10	
 59 (UL)		24	SPDT	2	
 62		110	6PDT	5	
 65 (UL)		24	SPDT	1	
 67 (UL)	115	110	4PDT	3	
 68 (UL)	230	110	3PDT	5 to 10	
POWER					
 55	230	110	4PDT	230 VAC: 15	28 VDC: 10
 57	230	110	3PDT	15	6

Sigma also markets a wide range of precision snap switches (see section 5100) and a complete line of instruments and controls (see section 2900).

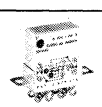
SIGMA

SENSITIVE

SERIES	COIL			CONTACTS	
	PICKUP POWER, MIN.	Resistance		POLES (up to)	RATING (amperes)
		MIN. (milliohms)	MAX. (ohms)		
 4 (UL)	20 spmw	12	12,000	SPDT	0.1 to 2.5
 5 (UL)	1 spmw	100	26,000	SPDT	.25 to 1.5
 41 (UL)	32 mw or 0.06 va	12	12,000	SPDT	1 to 10
 42 (UL)	0.30 va or 100 spmw	8 ohms	14,000	DPDT	1 to 5
 48 (UL)	10mw	3,500 ohms	5,000	SPDT	2

HIGH PERFORMANCE

These relays all suitable for dry-circuit switching.

SERIES	COIL		CONTACTS	
	PICKUP POWER, MIN.	VDC	POLES (up to)	RATING (amperes, max.)
 22	12.5 mw	6 to 48	DPDT	2
 32	50 spmw	1.5 to 26.5	DPDT	2
 33*	100 mw	3 to 110	DPDT	2
 34	20 spmw	1.5 to 26.5	DPDT	2
 35	40 spmw	1.5 to 26.5	DPDT	2
 36*	260 spmw	6 to 48	DPDT	2

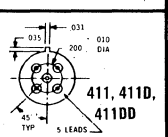
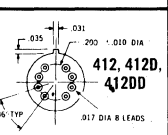
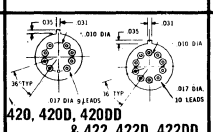
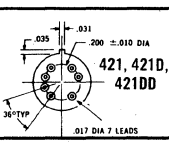
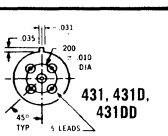
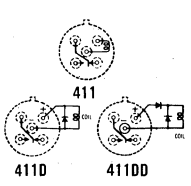
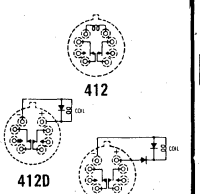
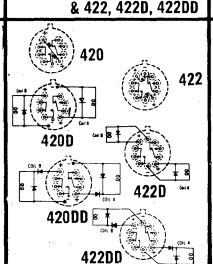
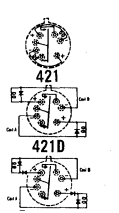
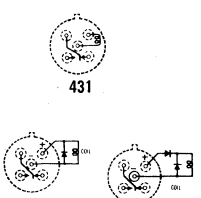
*Denotes Qualified Product Listing to Mil-R-5757E

SIGMA INSTRUMENTS INC
Braintree, Massachusetts 02185

TELEDYNE TRANSISTOR CASE RELAYS

All welded construction
TO-5 transistor type enclosure
Contacts — gold plated for dry circuit requirements.
Hermetically sealed
Excellent for high isolation switching
Capable of withstanding high shock and vibration

Insulation Resistance — 10,000 megohms min between mutually insulated terminals
Terminal Strength — Each terminal will withstand a 1 lb. pull in any direction
Temperature Range — —65°C to +125°C (for 415 series —55°C to +125°C)
Enclosure — All welded. Hermetically sealed.
Weight — 0.08 ounce to 0.15 ounce
Applicable Specification — Meets or exceeds MIL-R-5757D
Rated Duty — Continuous
Contact Resistance — 0.1 ohm max before life 0.2 ohm max after life at max rated current
Most configurations available from local distributors Other characteristics available

	 411 411D 411DD SPDT	 412 412D 412DD DPDT	 420/422 420D/422D 420DD/422DD MAG-LATCH DPDT	 421 421D 421DD MAG-LATCH SPDT	 431 431D 431DD SENSITIVE SPDT
CONTACT RATING (OPERATIONS)	10^7 @ low level 10^6 @ 0.5 amps 10^5 @ 1.0 amps	10^7 @ low level 10^6 @ 0.5 amps 10^5 @ 1.0 amps	10^7 @ low level 10^5 @ 0.5 amps	10^7 @ low level 10^5 @ 0.5 amps	10^7 @ low level 10^6 @ 0.5 amps 10^5 @ 1.0 amps
CONTACT BOUNCE	1.5 MS Max.	1.5 MS Max.	2.0 MS Max.	0.5 MS Max.	1.5 MS Max.
OPERATE POWER (PULL-IN)	100 MW @ 25°C	130 MW @ 25°C	100 MW @ 25°C	100 MW @ 25°C	40 MW @ 25°C
OPERATE TIME	2.0 MS Max. @ 25°C	2.0 MS Max. @ 25°C	1.5 MS Max. @ 25°C	1.5 MS Max. @ 25°C	3.5 MS Max. @ 25°C
RELEASE TIME	411 1.5 MS 411D 4 MS 411DD 4 MS Max. @ 25°C	412 1.5 MS 412D 4 MS 412DD 4 MS Max. @ 25°C	—	—	431 3.5 MS 431D 4 MS 431DD 4 MS Max. @ 25°C
OVERLOAD	2 amps @ 28V DC	2 amp @ 28V DC	1 amp @ 28V DC	1 amp @ 28V DC	2 amp @ 28V DC
VIBRATION	30G's to 3000 cps	30G's to 3000 cps	30G's to 3000 cps	50G's to 3000 cps	30G's to 3000 cps
SHOCK	80G's, 11 MS	80G's, 11 MS	80G's,11MS	150G's, 6 MS	80G's, 11 MS
DIELECTRIC STRENGTH	500 VRMS 300 VRMS @ 1.3" Hg	500 VRMS 125 VRMS @ 1.3" Hg	500 VRMS 125 VRMS @ 1.3" Hg	500 VRMS 125 VRMS @ 1.3" Hg	500 VRMS 350 VRMS NC-NO 300 VRMS @ 1.3" Hg
NOMINAL COIL DATA VOLTAGE DC	5, 6,9,12,18,26.5	5, 6,9,12,18,26.5	5, 6,9,12,18,26.5	5, 6,9,12,18,26.5	5, 6,12,26,32,40
RESISTANCE (Ω ±10% @ 25°C)	411 & 411D—63, 125, 280, 500, 1130, 2000 411DD — 50, 98, 280, 500, 1130, 2000	412 & 412D — 50, 98, 220, 390, 800, 1560 412DD — 39, 78, 220, 390, 800, 1560	420/422 & 420D/422D 61, 120, 280, 500, 1130, 2000 420DD/422DD—48,97, 280, 500, 1130, 2000	421 & 421D—61, 120, 280, 500, 1130, 2000 421DD — 48, 97, 280, 500, 1130, 2000	16Ω to 11KΩ
H (HEIGHT OF CAN)	.265 Max.	.265 Max.	.275 Max.	.275 Max.	.375 Max.
X (NUMBER OF LEADS)	5 leads	8 leads	420 — 9 leads 422 — 10 leads	7 leads	5 leads
LEAD LOCATION	 411, 411D, 411DD	 412, 412D, 412DD	 420, 420D, 420DD & 422, 422D, 422DD	 421, 421D, 421DD	 431, 431D, 431DD
SCHEMATIC (viewed from header)	 411 411D 411DD	 412 412D 412DD	 420 422 420D 422D 420DD 422DD	 421 421D 421DD	 431 431D 431DD

TELEDYNE RELAYS
A TELEDYNE COMPANY
3155 W. El Segundo Boulevard
Hawthorne, California 90250
(213) 679-2205 • 772-4357

All Relays shown are available with built-in arc suppression diodes.

TELEDYNE TRANSISTOR CASE RELAYS

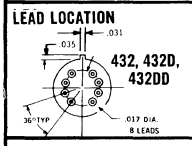
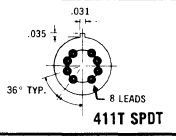
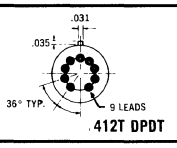
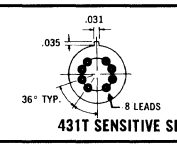
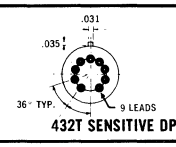
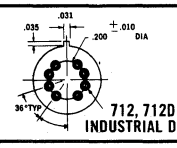
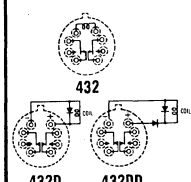
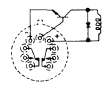
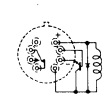
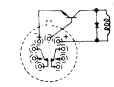
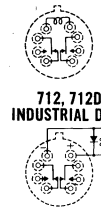
All welded construction
TO-5 transistor type enclosure
Contracts – gold plated
for dry circuit requirements
Hermetically sealed
Excellent for high isolation switching
Capable of withstanding high shock and vibration

Teledyne is currently providing for space flight applications Screened Relays which meet or exceed the following NASA Screening Specifications:

Marshall Space Flight Center—SPEC.
MSFC—SPEC—339
MSFC—SPEC—339A
MSFC—SPEC—40M37496

Goddard Space Flight Center—SPEC.
GSFC—SPEC—601.100,
change 2 Paragraph 3.8

Jet Propulsion Laboratory—SPEC.
JPL—SPEC—ZZP—2073

 432 432D 432DD SENSITIVE DPDT	 411T SPDT	 412T DPDT	 431T SENSITIVE SPDT	 432T SENSITIVE DPDT	 712 712D INDUSTRIAL DPDT
10^7 @ low level 10^6 @ 0.5 amps 10^5 @ 1.0 amps	10^7 @ low level 10^6 @ 0.5 amps 10^5 @ 1.0 amps	10^7 @ low level 10^6 @ 0.5 amps 10^5 @ 1.0 amps	10^7 @ low level 10^6 @ 0.5 amps 10^5 @ 1.0 amps	10^7 @ low level 10^6 @ 0.5 amps 10^5 @ 1.0 amps	10^7 Min. Mechanical 10^6 @ 0.5 amps 10^5 @ 1.0 amps
1.5 MS Max.	1.5 MS Max.	1.5 MS Max.	1.5 MS Max.	1.5 MS Max.	———
60 MW @ 25°C	.12 to .71 MW @ 25°C	.15 to .90 MW @ 25°C	.06 to .36 MW @ 25°C	.07 to .45 MW @ 25°C	185 MW @ 25°C
4.0 MS Max. @ 25°C	2.0 MS Max. @ 25°C	2.0 MS Max. @ 25°C	4.0 MS Max. @ 25°C	4.0 MS Max. @ 25°C	4.0 MS Max. @ 25°C
432 2 MS 432D 7.5 MS 432DD 7.5 MS } Max. @ 25°C	7.5 MS Max. @ 25°C	7.5 MS Max. @ 25°C	7.5 MS Max. @ 25°C	7.5 MS Max. @ 25°C	712 — 3 MS Max. 712D — 6 MS Max.
2 amp @ 28V DC	2 amp @ 28V DC	2 amp @ 28V DC	2 amp @ 28V DC	2 amp @ 28V DC	2 amp @ 28V DC
30G's to 3000 cps	30G's to 3000 cps	30 G's to 3000 cps	30G's to 3000 cps	30G's to 3000 cps	.06 Double ampl. from 10 to 50 cps, 10G's to 500 cps
80G's, 11 MS	80G's, 11MS	80G's, 11 MS	80G's, 11 MS	80G's, 11MS	30G's, 11 MS
500 VRMS 350 VRMS NC-NO 125 VRMS @ 1.3" Hg	500 VRMS 125 VRMS @ 1.3" Hg	500 VRMS 125 VRMS @ 1.3" Hg	500 VRMS 350 VRMS NC-NO 125 VRMS @ 1.3" Hg	500 VRMS 350 VRMS NC-NO 125 VRMS @ 1.3" Hg	350 VRMS
5, 6, 12, 26, 36, 48	5, 6, 9, 12, 18, 26.5	5, 6, 9, 12, 18, 26.5	5, 6, 9, 12, 18, 26.5	5, 6, 9, 12, 18, 26.5	5, 6, 9, 12, 18, 26.5
16Ω to 11KΩ	63, 125, 280, 500, 1130, 2000	50, 98, 220, 390, 880, 1560	125, 255, 630, 1025, 2300, 4000	100, 200, 400, 850, 1600, 3300	50, 100, 220, 399, 880, 1560
.375 Max.	.265 Max.	.265 Max.	.375 Max.	.375 Max.	.275 Max.
8 leads	8 leads	9 leads	8 leads	9 leads	8 leads
LEAD LOCATION  432, 432D, 432DD	 411T SPDT	 412T DPDT	 431T SENSITIVE SPDT	 432T SENSITIVE DPDT	 712, 712D INDUSTRIAL DPDT
SCHEMATICS (viewed from header)  432 432D 432DD	 411T SPDT	 412T DPDT	 431T SENSITIVE SPDT	 432T SENSITIVE DPDT	 712, 712D INDUSTRIAL DPDT

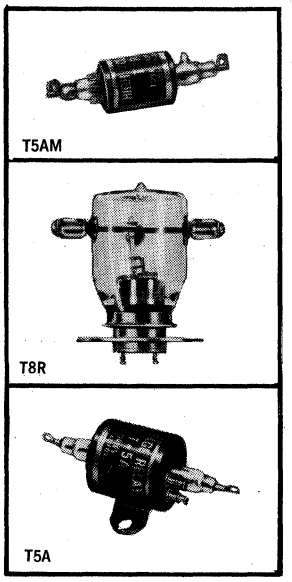
TELEDYNE RELAYS
A TELEDYNE COMPANY
3155 W. El Segundo Boulevard
Hawthorne, California 90250
(213) 679-2205 • 772-4357

All Relays shown are available with built-in arc suppression diodes.

TORR LABORATORIES, INC.

high reliability

VACUUM RELAYS



Torr Laboratories is a leading producer of high voltage relays, vacuum capacitors and associated devices in the high voltage, high vacuum electronics field.

By means of very high vacuum it is possible to miniaturize high voltage components to a degree not possible by conventional methods. The near absence of air and gasses means high standoff voltages, freedom from electrode contamination, minimum arcing and rapid recovery in case of overloads. Vacuum components are also independent of temperature and atmospheric conditions and are ideally suited for applications where long life and reliability are essential.

Send for our complete catalogue.

TORR . . . the famous name in vacuum

TORR TYPE	TVS-1[2]	TMR-9[2,5]	TB2A	T8T	T8S	T8R
Contact Arrangement	SPDT, Form C	SPDT, Form C	DPDT, Form 2C	SPDT, Form C	SPDT, Form C	SPDT, Form C
Operating Voltage (peak)	17.5 KV	17.5 KV	20 KV	18 KV, air 26 KV, oil	18 KV, air 26 KV, oil	30 KV, air 35 KV, oil
Test Voltage (peak)	22.5 KV	27.0 KV	25 KV	18KV	18 KV	25 KV
Max. Contact Resistance (ohms)	.012	.012	.010	.010	.010	.012
Total Operate Time (milliseconds)	15	15	15	12	12	12
Total Release Time (milliseconds)	15	15	10	10	10	10
Coil Voltages Available	26.5 VDC 117.0 VAC	40.0 VDC	26.5 VDC	26.5 VDC	26.5 VDC	26.5 VDC
Coil Resistance (ohms) ± 10% @ 25°C	128.0 (DC) 2000 (AC)	65	225	265	265	120
Continuous Current (amps) RMS —60 cps	9.0	10.0	20[1]	15[1]	15[1]	25[1]
Nominal Weight (oz.)	7.0	7.0	5.0	4.0	4.0	4.0
Nominal Size (inches)	4¾ x 3¾	4½ x 3¼	1¼ x 3	1⅛ x 2¾	1⅛ x 2¾	2 x 3½
Body Style	T-shape	T-shape	cylindrical	cylindrical	cylindrical	cylindrical
Mounting Style[3]	with or without foot bracket	foot bracket	threaded style	threaded style	flange style with or without mounting holes[6]	flange style[6]
Typical Application	AC, DC, Pulse	Medical-Defibrillator, AC, DC, Pulse	RF, AC, DC, Pulse	RF, AC, DC, Pulse	RF, AC, DC Pulse	RF, AC, DC Pulse
Shock	30G — 11 ms	30G — 11 ms	30G — 11 ms	30G — 11 ms	30G — 11 ms	30G — 11 ms
Vibration	10G —55 cps	15G —55 cps	5G, 55—2000 cps 10G, 55—500 cps	10G—500 cps 5G—2000 cps	10G—500 cps 5G—2000 cps	10G—400 cps
General Construction	glass-metal	glass-metal	glass-metal	glass-metal	glass-metal	glass-metal
Federal Stock Number	5945-803-6104	—	5945-776-5948	594-755-4247 (E323)	—	

[1] Consult Torr data sheet for higher frequency values
[2] Patent pending
[3] Other mounting styles available
[4] Torr patented design
[5] Model available in smaller size for portable defibrilator use, Specify Model TMR-9A
[6] The style without mounting holes is desirable when the relay is soldered directly into a transformer of a pulse forming network which is oil filled.

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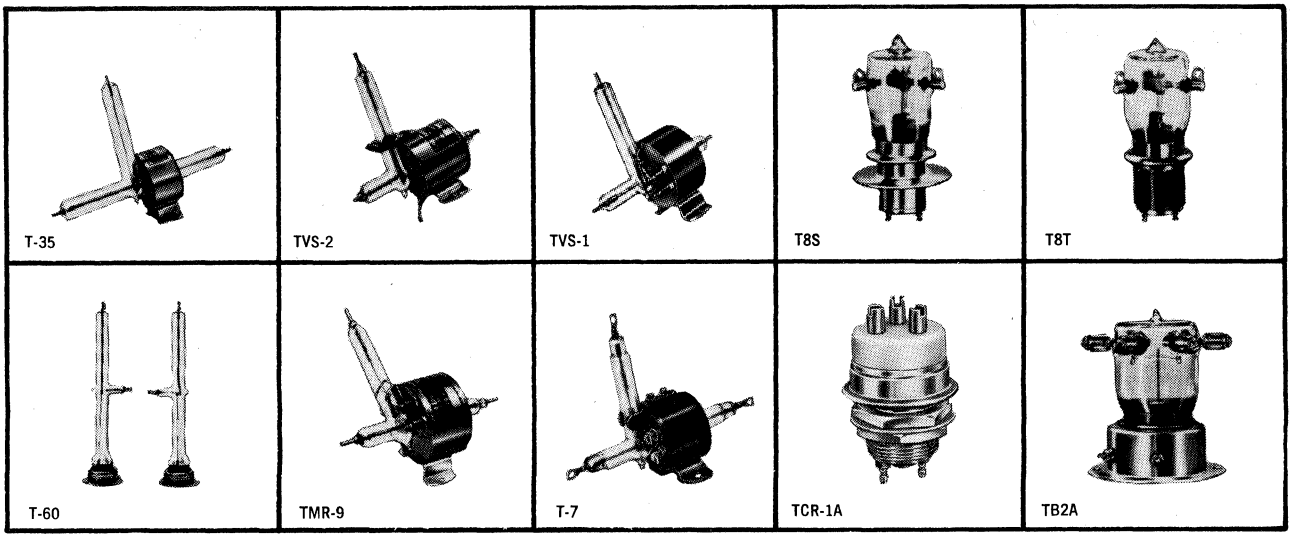


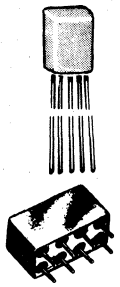
TCR-1A[2]	T5A	T5AM[2]	TVS-2	T-7	T-35	T-60[4]
SPDT, Form C	SPST, Form A or B	SPST, Form A	SPDT, Form C	SPDT, Form C	SPDT, Form C	SPST, Form A or B
3.0 KV, air 20 KV, oil	5.5 KV	4.0 KV	17.5 KV	7.5 KV	35 KV	60 KV
3.0 KV	10 KV	3.0 KV	22.0 KV	12.0 KV	45 KV	70 KV
.010	.015	.020	.015	.015	.015	.015
4	10	500 micro-seconds	13	10	15	15
4	10	500 micro-seconds	13	10	15	15
26.5 VDC	26.5 VDC	26.5 VDC	26.5 VDC	26.5 VDC	26.5 VDC 117.0 VAC	26.5 VDC
330	250	170	40	200	50 (DC) 2000 (AC)	120-220
15[1]	4.5	4.0	7.0[1]	4.0	10.0	20
1.0	1.0	1.0	7.0	1.0	10	12
1 x 1¼	¾ x 2	½ x 2	4¾ x 3¾	2¾ x 2½	7½ x 5½	3 x 13
cylindrical	cylindrical	cylindrical	T-shape	T-shape	T-shape	cylindrical
threaded style	foot bracket	with or without foot bracket	foot bracket	foot bracket	foot bracket	flange base
RF, AC, DC Pulse	AC, DC, Pulse	Very high speed operation—AC, DC Pulse	RF, DC, Pulse	AC, DC, Pulse	AC, DC, Pulse	AC, DC, Pulse
55G — 11 ms	50G — 11 ms	100G — 11 ms	10G — 11 ms	10G — 11 ms	10G — 11 ms	10G — 11 ms
10G—2000 cps	10G—55 cps 5G—1500 cps	30G—500 cps 20G—2000 cps	10G—55 cps	20G—500 cps	10G—55 cps	10G—55 cps
miniature ceramic-metal	miniature glass-metal	miniature glass-metal	glass-metal copper-clad electrodes	miniature glass-metal	glass-metal	glass-metal
—	5945-919-3221	—	5945-259-5877	—	—	—

TORR LABORATORIES, INC.

2228 Cotner Avenue • Los Angeles, California 90064 • (213) 477-1224 • TWX: 213-490-3972

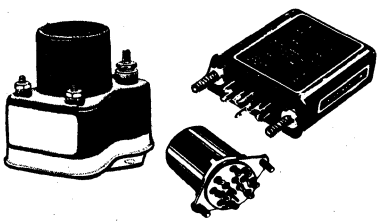
CRYSTAL CAN MICROMINIATURE

Extremely small, lightweight sealed units. Meet requirements of MIL-R-6106 and 5757. Single, double and 4 pole; half size; transistor size and standard; all sensitivities and mounting types up to 10 amp. contact ratings.



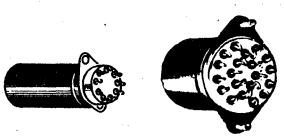
AN, MS, RY and AIRCRAFT

One of the largest stocks in the world.



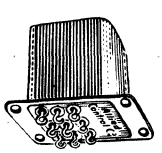
SUBMINIATURE – MINIATURE

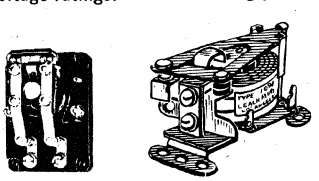
Compact, highly efficient relays, particularly for dry circuitry. Developed to meet Spec. MIL-R-5757. Up to 6 PDT. Hermetically sealed. Up to 10 amp contacts; all voltage ratings. Open frame miniature types in wide variety of units in SPDT and DPDT.



POWER

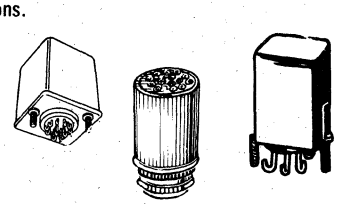
Open frame and sealed types up to 30 amps in all voltage ratings.





HERMETICALLY SEALED

Standard and special types with solder lug or plug-in headers in almost all configurations.



Universal RELAYS

MOST MAKES

•

ALL TYPES

•

PRODUCTION QUANTITIES IN STOCK

Faster Delivery at Lower Prices

SEND FOR CATALOG E

Universal RELAY CORP.

42 White Street, New York, N.Y. 10013

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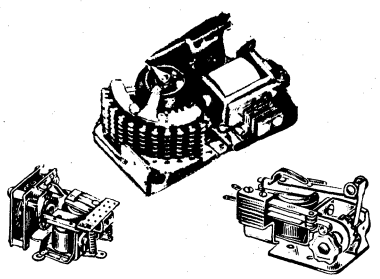
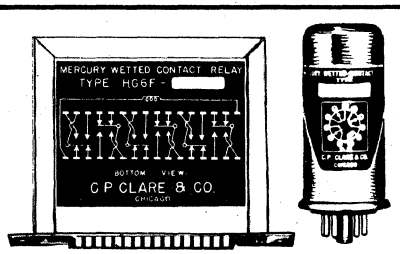
TWX No. 710-581-4461



STEPPING and IMPULSE

An almost unlimited variety of standard and special types in all rated voltages up to 22 levels—up to 50 positions.

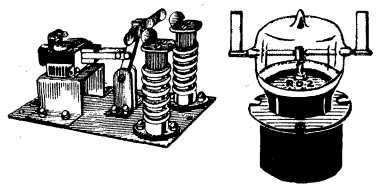


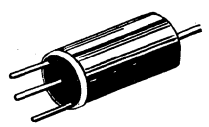
MERCURY WETTED

High speed, hermetically sealed relays, capable of a billion operations without failure. Up to 6 PDT in plug-in, solder lug and printed circuit types both polarized and non-polarized in all voltage ratings.

HIGH VOLTAGE and VACUUM

A wide variety of both vacuum and open frame types up to 60 KV in single and multiple pole types.



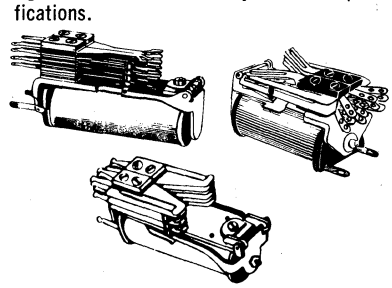


REED

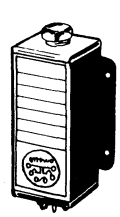
An almost unlimited variety of standard and special types in single and multiple arrangements at all rated voltages.

TELEPHONE

Versatile, multi-pole relays in all popular styles and every voltage and contact configuration. Made to industry standard specifications.



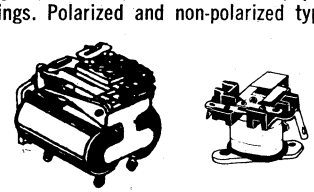
SOLID STATE and OTHER TIMING DEVICES



Timers with accurate repeat cycle mechanism. Available in single and multiple contact configurations with ranges from milliseconds to 15 minutes and more.

SENSITIVE TYPES

Single and multipole units in all popular ratings. Polarized and non-polarized types.



MANY OTHER TYPES IN STOCK

Latching • Thermal • Choppers • Snap-Action Switches

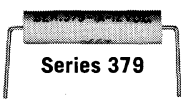


THE Wheelock FAMILY OF REED RELAYS

ULTRA-MINIATURE REED RELAYS

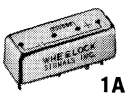


Series 372



Series 379

- Occupies only 0.02 cu. in.
- Operates on only 50 mw of power
- Operate time 300 microseconds (typical)
- Insulation resistance as high as 1 x $10^{14}\Omega$
- Contacts rated at a full 7 watts



1A

Series 442

- Smallest Multi-Pole Relays in Industry
- Occupies 0.055 cu. in. per pole
- Operates on 90 mw
- P.C. board mount
- Contacts rated at full 7 watts

MICRO-MINIATURE REED RELAYS

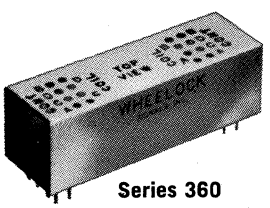
- Contact rating: 10W, 500 ma
- Coil voltages: 6, 12 or 24 VDC
- Insulation resistance: 5 x $10^{10}\Omega$

PRINTED CIRCUIT BOARD MODEL



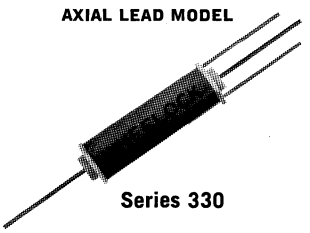
Series 3421

HIGH DENSITY MODEL



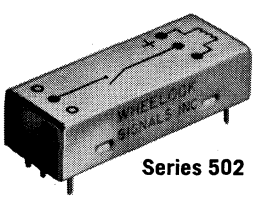
Series 360

AXIAL LEAD MODEL



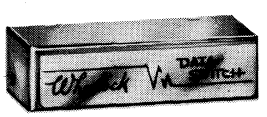
Series 330

MINIATURE REED RELAYS



Series 502

- All contact configurations available
- Coil voltages: 6-48 VDC
- Contact rating: 10 watts
- Standard 1″ grid spacing



Series 262

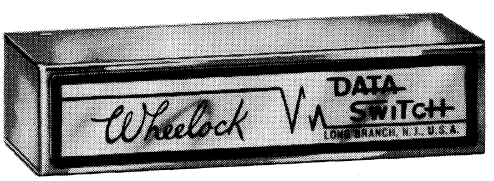
- Contact arrangements, single pole to 6 pole models
- Coil voltages: 6 to 48 VDC
- Coil ratings: 125 to 600 mw
- Contact rating: 10W

STANDARD REED RELAYS

- Coil ratings: 200 to 1500 mw
- Contact ratings to 50W
- Operating time: 2.5 ms (typical)
- Coil voltages: 6 to 120 VDC

MERCURY WETTED REED RELAYS

- Contacts: 1 to 5 pole
- Coil ratings: 200 mw for 1 pole, to 1500 mw for 5 poles
- Coil voltages: 6 to 120 VDC
- Contact rating: 3 amp up to 50W



Series 3002 & Series 3002 Hg

Wheelock

For complete details on how Wheelock can help solve problems involving space, weight and environmental limitations, write for the NEW Wheelock Reed Relay Catalog. It features the latest test data on reed relay life and reliability, dynamic characteristics and static characteristics.

SIGNALS INC. • 273 BRANCHPORT AVENUE • LONG BRANCH, NEW JERSEY 07740 • (201) 222-6880

WABCO
WESTINGHOUSE AIR BRAKE COMPANY
AEROSPACE DEPARTMENT
Swissvale Post Office, Pittsburgh, Pa. 15218

RELAYS FOR AEROSPACE & INDUSTRIAL APPLICATION

This series of crystal case relays is produced with meticulous care under controlled conditions. The relays are designed to meet advanced circuit requirements of high-density packaging and printed circuit boards, and feature a balanced, rotary type armature to provide maximum immunity to severe shock, vibration and acceleration forces.

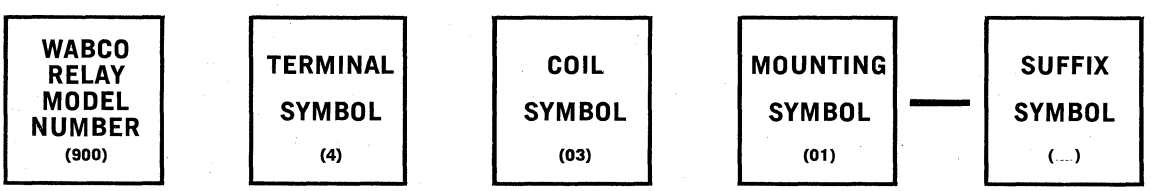
All relays meet or exceed the rigorous requirements of MIL-R-5757. Temperature ratings — from −65 degrees C to +125 degrees C. Vibration — 20 G from 10 to 2000 cps. Shock — 50 G for 11 milliseconds. Life expectancy — 100,000 operations at maximum rated loads. Special dry circuit misstest available for all relays upon request.

The following tables list only a few of the most popular combinations of relays, mountings, header terminals, coils and contact ratings that are available. Inquiries concerning specific applications and special requirements are welcomed. See the Representative listing in this catalog or write our Pittsburgh office directly.

HOW TO ORDER

CRYSTAL CASE RELAYS

As a convenience to our customers, a catalog numbering system has been incorporated in this brochure to permit the selection of the proper relay for a specific application. The Catalog Number consists of five parts as referenced in the diagram below. The first three-digit Symbol always is used initially in the Catalog Number to identify WABCO Model Number. Explanation of the remaining parts is contained as follows:



Citing Catalog Number 90040301 as an example, it can be determined that the ordering number is constructed in the following manner:

Symbol 900 indicates the Model 900 One-Sixth Size Crystal Case SPDT Relay.

The Terminal Symbol 4 refers to the type of terminals used in this specific relay. As described on Model 900 Relay Section, under header terminals, Symbol 4 denotes a terminal header with half-inch leads.

Coil Symbol 03 denotes a 2000-ohm coil for 20 to 30 volts D.C. operation. Information pertaining to this reference is found within the Coil Performance Table.

Symbol 01 refers to the mounting arrangement for this particular relay, and this information is found in Model 900 Relay Section, under mounting styles. The Symbol 01 mounting style features a relay without mounting brackets for direct application to printed circuit boards.

Space is reserved at the end of the Catalog Number for a two-digit Suffix Symbol. If the standard dry circuit miss-test is required, Symbol 01 should be added as a suffix. Catalog Number 90040301-01 is the relay described above with a dry circuit miss-test applied.

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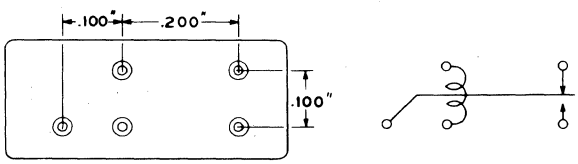
MODEL 900—ONE SIXTH SIZE CRYSTAL CASE RELAY SPDT

- Meets or exceeds MIL-R-5757D.
- Ideally suited for high density packaging.
- Volume is less than 0.050 cubic inch.
- The 0.1 inch grid-spaced terminals make it ideal fo use in standard P.C. boads.
- Low power requirement.
- Heavy magnetic structure.
- Rugged reliability and operating characteristics.
- Designed for application in aircraft, missiles, spacecaft or ship-board or ground-support equipment.



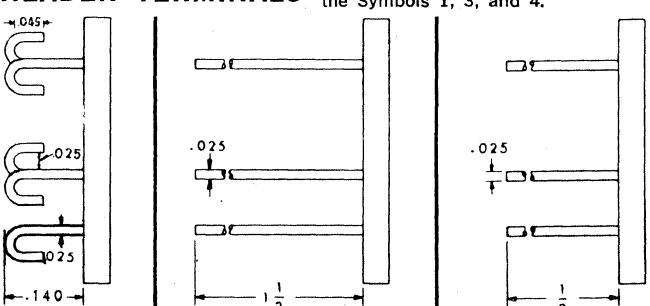
CIRCUIT DIAGRAM

The Model 900 One-Sixth Size Crystal Case SPDT Relay features a 0.1-inch grid-spaced terminal configuration which ideally permits its use in standard printed circuit boards utilized by the aerospace and electronics industries.



HEADER TERMINALS

Terminal types are identified by the Symbols 1, 3, and 4.



Symbol 1
Hook-type solder terminals

Symbol 3
1½-inch leads

Symbol 4
Half-inch leads

SPECIFICATIONS

GENERAL DATA

Description — A hermetically sealed rotary type microminiature general purpose relay which meets the requirements of MIL-R-5757D
Weight — 0.15 ounce maximum
Terminals — Solder-hook, half-inch leads, and 1½-inch leads
Mountings — A variety of standard mountings is available. See Section C
Contacts — SPDT-Form C (break before make)

ELECTRICAL DATA

Coil voltage — 26.5 volts D.C. nominal with 2000-ohm coil. See Coil Performance Table for additional coil voltages
Contact resistance — 0.05 ohm maximum at rated current, 0.1 ohm after life tests at rated current
Contact ratings — Low level dry circuit loads up to a maximum of 1.0 ampere, 26.5 volts D.C. resistive load
Dielectric strength — 500 volts RMS at 60 Hz (sea level), and 300 volts RMS at 70,000 feet
Operate time — 4 milliseconds maximum including bounce at rated coil voltage and 25°C
Release time — 4 milliseconds maximum including bounce at rated coil voltage and 25°C
Insulation resistance — Coil to case 500 megohms minimum. All other points 1000 megohms minimum

ENVIRONMENTAL DATA

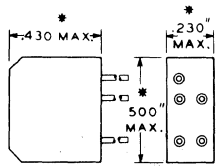
Temperature rating — 65°C to +125°C
Vibration — 0.1" D.A. or 20G peak from 10 to 2000 Hz
Shock — 50G for 11 milliseconds
Life — 100,000 operations at maximum rated load

COIL PERFORMANCE TABLE

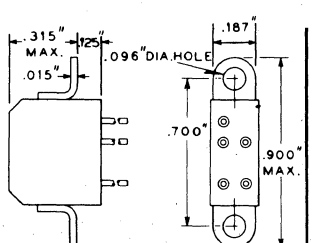
Coil Symbol	01	02	03	04	05
Rated Voltage	6	12	26.5	48	76
Operating Volts D.C.: min.	5	10	20	36	64
max.	7.5	15	30	54	96
Coil Resistance in Ohms ±10%	90	310	2000	5700	16,000
Max. Pick-up Milliamps	30	16.9	6.5	3.9	2.3
Max. Drop-out Milliamps	16.2	9.1	3.5	2.1	1.2
Min. Drop-out Milliamps	3.7	2.1	0.80	0.48	0.28

Coil Symbols for other operating voltages will be furnished upon request.

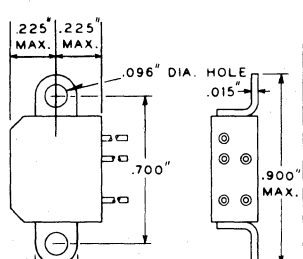
MOUNTING STYLES



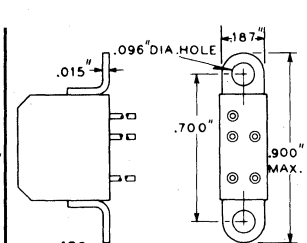
Symbol 01
Without mounting brackets or studs



Symbol 10
With brackets for mounting relay with header projecting through the mounting surface



Symbol 11
With brackets for mounting relay on its side



Symbol 12
With brackets for mounting relay flush with the header surface

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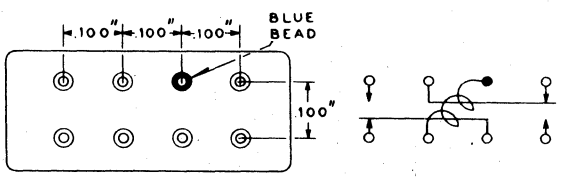
MODEL 901—ONE SIXTH SIZE CRYSTAL CASE RELAY 2PDT

- Meets or exceeds MIL-R-5757D and MIL-R-5757/19 and MIL-5757/30. Refer to latest issue of QPL5757.



CIRCUIT DIAGRAM

The Model 901 One-Sixth Size Crystal Case 2PDT Relay features a 0.1-inch grid-spaced terminal configuration which ideally permits its use in standard printed circuit boards utilized by the aerospace and electronics industries.



SPECIFICATIONS

GENERAL DATA

Description — A hermetically sealed rotary type microminiature general purpose relay which meets the requirements of MIL-R-5757D, and MIL-R-5757/19
Weight — 0.15 ounce maximum
Terminals — Solder-hook, half-inch leads, and 1½-inch leads
Mountings — A variety of standard mountings is available. See Section C
Contacts — 2PDT — Form C (break before make)

ELECTRICAL DATA

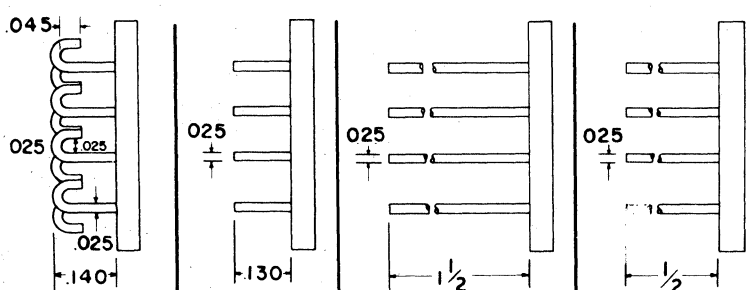
Coil voltage — 26.5 volts D.C. nominal with 1500-ohm coil (See Coil Performance Table for additional coil voltages)
Contact resistance — 0.05 ohm maximum at rated current, 0.1 ohm after life test at rated current
Contact ratings — Low level dry circuit loads up to a maximum of 1.0 ampere, 26.5 volts D.C. resistive load
Dielectric strength — 350 volts RMS at 60 Hz across open contacts, 500 volts RMS all other points at sea level; 300 volts RMS all points at 70,000 feet
Operate time — 4 milliseconds maximum including bounce at rated coil voltage and 25°C
Release time — 4 milliseconds maximum including bounce at rated coil voltage and 25°C
Insulation resistance — Coil to case 500 megohms minimum. All other points 1000 megohms minimum

ENVIRONMENTAL DATA

Temperature rating — —65°C to +125°C
Vibration — 0.1" D.A. or 20G peak from 10 to 2000 Hz
Shock — 50G for 11 milliseconds
Life — 150,000 operations at maximum rated load

HEADER TERMINALS

Terminal types are indicated by the Symbols 1, 2, 3, and 4.



Symbol 1 Hook-type solder terminals

Symbol 2 Plug-in terminals (Gold Plated)

Symbol 6 (Tin-Plate)

Symbol 3 1½-inch leads

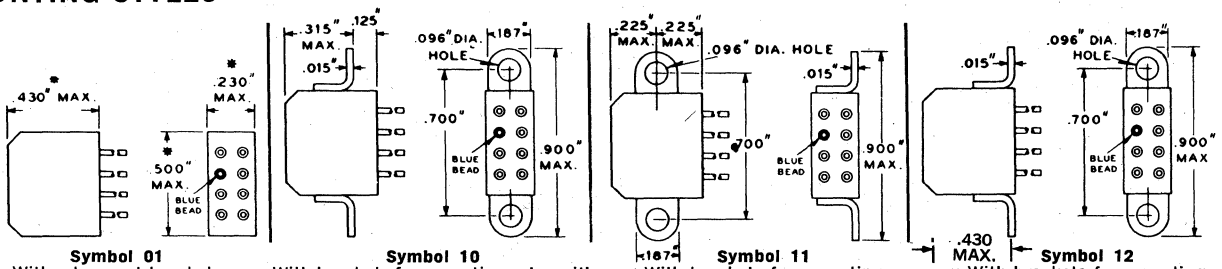
Symbol 4 Half-inch leads

COIL PERFORMANCE TABLE

Coil Symbol	01	02	03	04	05
Rated Voltage	6	12	26.5	48	76
Operating Volts D.C.: min.	5	10	20	36	64
max.	7.5	15	30	54	96
Coil Resistance in ohms ±10%	90	310	1500	5700	16,000
Max. Pickup Milliamps	33.3	19.3	8.6	4.4	2.5
Max. Drop-out Milliamps	25.2	14.6	6.5	3.3	1.9
Min. Drop-out Milliamps	3.8	2.2	1.0	0.5	0.29

Coil symbols for other operating voltages will be furnished upon request.

MOUNTING STYLES



Symbol 01 Without mount brackets or studs

Symbol 10 With brackets for mounting relay with header projecting through the mounting surface or for plug in relay

Symbol 11 With brackets for mounting relay on its side

Symbol 12 With brackets for mounting relay flush with the header surface

* Body dimensions apply to all mountings

(Flange mountings are designed to use a #2 Fillister head screw)

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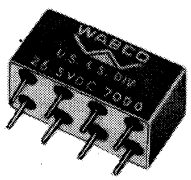
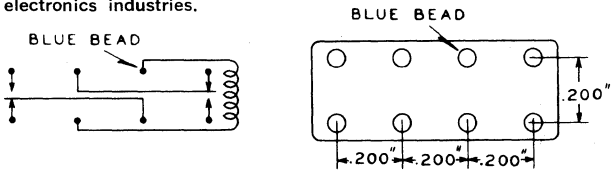
MODEL 902—HALF SIZE CRYSTAL CASE RELAY 2PDT



- Small size, fast response, reliable and efficient operation.
- For use in aircraft, guided missiles, spacecraft, shipboard and ground support equipment.
- One-half height and weight of standard crystal case relay.
- Ideally suited for P.C. board application.
- The 0.2 inch grid-paced header permits interchangeability with standard crystal case.
- Can be mounted in a variety of positions without affecting operational performance.
- Designed to MIL-R-5757.

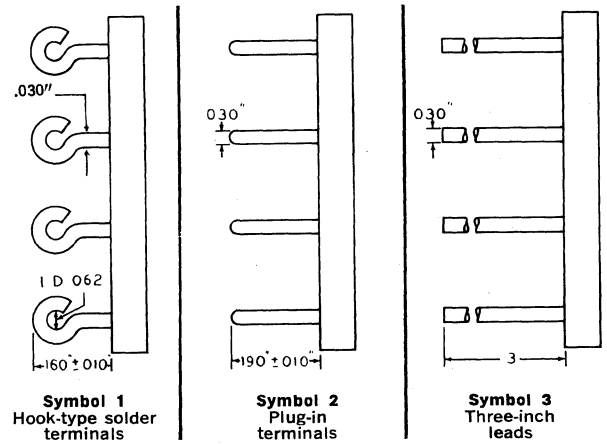
CIRCUIT DIAGRAM

The Model 902 General Purpose Half-Size Crystal Case Relay features a 0.2-inch grid-spaced terminal configuration which ideally permits its use in standard printed circuit boards utilized by the aerospace and electronics industries.



HEADER TERMINALS

Terminal Types are identified by the Symbols 1, 2, and 3.



Symbol 1
Hook-type solder terminals

Symbol 2
Plug-in terminals

Symbol 3
Three-inch leads

SPECIFICATIONS

GENERAL DATA

Description — A hermetically sealed General Purpose Half-Size rotary type Crystal Case relay which meets the requirements of MIL-R-5757D
Weight — 0.3 ounce maximum
Terminals — Solder-hook, plug-in, and three-inch leads
Mountings — A variety of standard mountings is available
Contacts — 2PDT, Form C (break before make)

ELECTRICAL DATA

Coil voltage — 26.5 volts D.C. nominal with 700-ohm coil (other operating voltages listed in Coil Performance Table)
Contact ratings — From low level, dry circuit loads to 2 amperes, 26.5 volts D.C. resistive load
Dielectric strength — 1000 volts RMS except 500 volts RMS from coil to case and across open contacts
Operate time — 5 milliseconds maximum including bounce at rated voltage and 25°C
Release time — 5 milliseconds maximum including bounce at rated voltage and 25°C
Insulation resistance — 1000 megohms minimum

ENVIRONMENTAL DATA

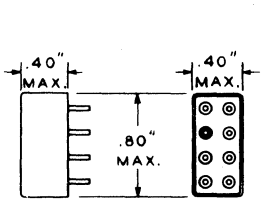
Temperature rating — —65°C to +125°C
Vibration — .1" D.A. or 20G from 10 to 2000 Hz
Shock — 50G for 11 milliseconds
Life — 100,000 operations at maximum rated load

COIL PERFORMANCE TABLE

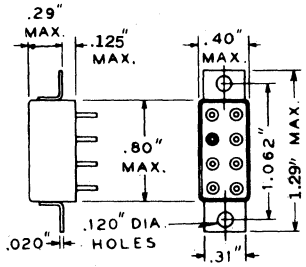
Coil Symbol	01	02	03	04
Rated Voltage	6	12	26.5	48
Operating Volts D.C.: min.	5	10	20	36
max.	7.5	15	30	54
Coil Resistance in Ohms ±10%	37	160	700	2400
Max. Pick-up Volts at 25°C	3.1	6.4	13	24.0
125°C	4.3	8.9	18	33.3
Max. Pick-up MA	93	45	21	11
Max. Drop-out Volts at 25°C	2.4	4.9	10	18.5
125°C	3.3	6.8	14	25.6
Max. Drop-out MA	72	34	16	8
Min. Drop-out Volts at 25°C	0.2	0.5	1.0	1.8
Min. Drop-out MA	4.9	2.8	1.3	0.7

Coil symbols for other operating voltages will be furnished upon request.

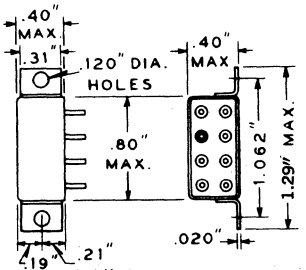
STANDARD MOUNTING STYLES



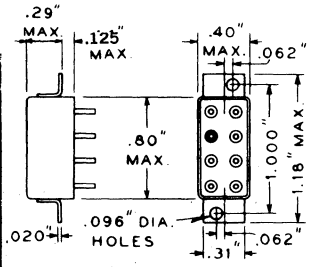
Symbol 01
Without mounting brackets or studs



Symbol 10
Upright bracket mounting, 2 holes centered



Symbol 11
Side bracket mounting



Symbol 20
Upright bracket mounting 2 holes off-center, (for plug-in relays)

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MODEL 903—CRYSTAL CASE RELAY 2PDT

- Meets or exceeds MIL-R-5757D and MIL-R-5757/10. Refer to latest issue of QPL-5757.
- Designed to meet advanced circuitry requirements.
- Features the "S" type header.
- Ideally suited for use in control and data handling systems, missiles, aircraft, space vehicles, and shipboard and ground support equipment.
- Many combinations of mountings, header terminals, coils for use with low and high level switching.

GENERAL DATA

Description — Hermetically sealed General Purpose Crystal Case rotary-type relay with "S" type header designed to meet the requirements of MIL-5757D and MIL-R-5757/10

Weight — 0.6 ounce maximum
Terminals — Solder-hook, plug-in, and three-inch leads
Mountings — Various for "S" type
Contacts — 2PDT Form C (break before make)

ELECTRICAL DATA

Coil voltage — Standard operating voltages and coil resistances listed in Coil Performance Table

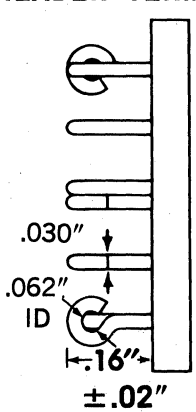
Contact resistance — 0.05 ohm maximum at rated load, 0.1 ohm maximum after life
Contact ratings — Low level dry circuit loads up to a maximum of 2 amperes, 28 volts D.C. resistive load
Dielectric strength — (At sea level) 1000 volts RMS except 500 volts RMS from coil to case and across open contacts
Operate time — 6 milliseconds maximum, including bounce, at rated coil voltage and 25°C (increases slightly for high resistance coils)
Release time — 6 milliseconds maximum, including bounce, at rated coil voltage and 25°C
Insulation resistance — Coil to case 500 megohms minimum. All other points 1000 megohms minimum

ENVIRONMENTAL DATA

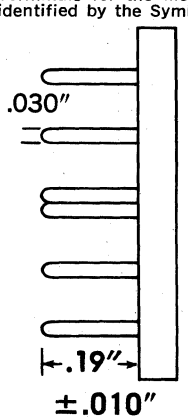
Temperature rating — —65°C to +125°C
Vibration — 0.1" D.A. or 20G peak from 10 to 2000 Hz
Shock — 50G for 11 milliseconds
Life — 100,000 operations at maximum rated loads

HEADER TERMINALS

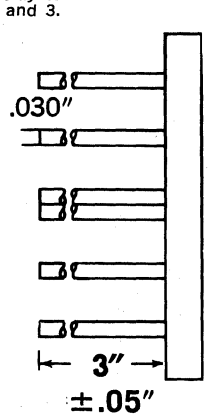
Terminals for the Model 903 relay is identified by the Symbols 1, 2, and 3.



Symbol 1
Hook-type solder terminals



Symbol 2
Plug-in terminals



Symbol 3
Three-inch leads

MODEL 903

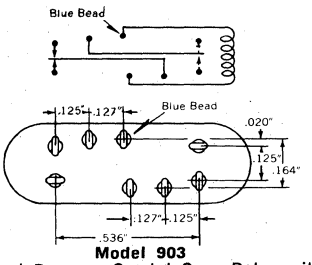
COIL PERFORMANCE TABLE

Coil Symbol	01	02	03	04	05	06	07
Rated Voltage	6	12	26.5	48	76	98	120
Operating Volts D.C.: min.	4.5	9.1	20	35	57	74	92
max.	6.7	13.5	30	52	85	110	135
Coil Resistance in Ohms ±10%	29	116	550	1770	4500	7700	11,700
Max. Pick-up Volts at 25°C	3.0	6.0	13.0	23.0	37.0	48.0	60.0
125°C	4.1	8.3	18.0	32.0	51.5	66.5	83.0
Max. Pick-up Milliamps	115	57	26	14	9.1	7.0	5.7
Max. Drop-out Volts at 25°C	2.3	4.6	10.0	17.0	27.5	36.5	45.5
125°C	3.2	6.4	14.0	23.5	38.0	50.5	63.0
Max. Drop-out Milliamps	88	44	20	10	6.8	5.3	4.3
Min. Drop-out Volts at 25°C	0.3	0.6	1.5	2.4	4.1	5.3	6.7
Min. Drop-out Milliamps	9.0	4.6	2.4	1.2	0.8	0.6	0.5

Coil Symbols for other operating voltages will be furnished upon request.

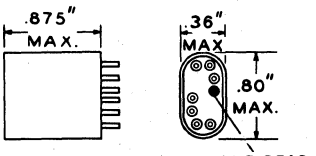
HEADER STYLE

The Header Style of the General Purpose Crystal Case Relay is referenced by the Symbol 903. A reference to this Symbol indicates the following.

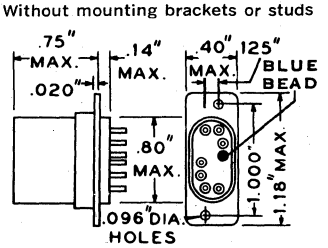


Model 903
General Purpose Crystal Case Relay with an "S" type header and oval case

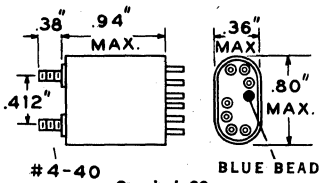
STANDARD MOUNTING STYLES



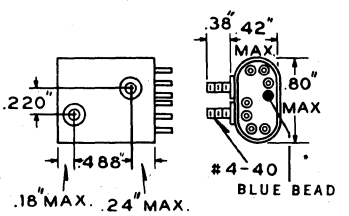
Symbol 01
Without mounting brackets or studs



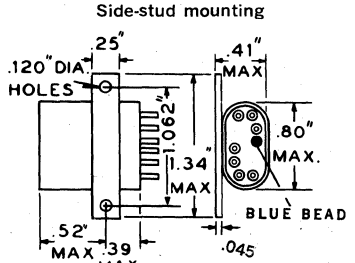
Symbol 20
Bottom 2-hole off-center flange mounting (For plug-in relays)



Symbol 30
Top stud mounting



Symbol 31
Side-stud mounting



Symbol 40
Side bracket-mounting

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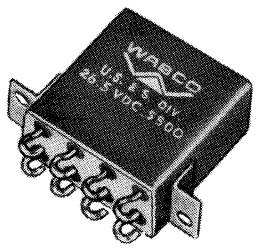
WABCO

MODEL 904—CRYSTAL CASE RELAY 2PDT

(Same as Model 903, except 0.2-inch grid space header)



GENERAL DATA

Description — Hermetically sealed General Purpose Crystal Case rotary-type relay with 0.2-inch grid-spaced header designed to meet the requirements of MIL-R-5757D and MIL-R-5757/10
MIL-R-5757D and MIL-R-5757/10
Weight — 0.6 ounce maximum
Terminals — Solder-hook, plug-in, and three-inch leads
Mountings — Various for 0.2-inch grid-spaced header
Contacts — 2PDT Form C (break before make)

ELECTRICAL DATA

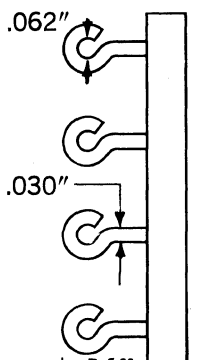
Coil voltage — Standard operating voltages and coil resistances listed in Coil Performance Table
Contact resistance — 0.05 ohm maximum at rated load, 0.1 ohm maximum after life
Contact ratings — Low level dry circuit loads up to a maximum of 2 amperes, 28 volts D.C. resistive load
Dielectric strength — (At sea level) 1000 volts RMS except 500 volts RMS from coil to case and across open contacts
Operate time — 6 milliseconds maximum, including bounce, at rated coil voltage and 25°C (increases slightly for high resistance coils)
Release time — 6 milliseconds maximum, including bounce, at rated coil voltage and 25°C
Insulation resistance — Coil to case 500 megohms minimum. All other points 1000 megohms minimum

ENVIRONMENTAL DATA

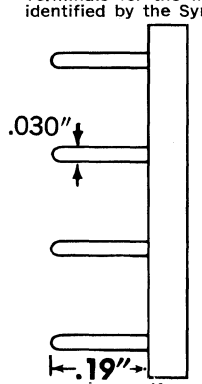
Temperature rating — —65°C to +125°C
Vibration — 0.1" D.A. or 20G peak from 10 to 2000 Hz
Shock — 50G for 11 milliseconds
Life — 100,000 operations at maximum rated loads

HEADER TERMINALS

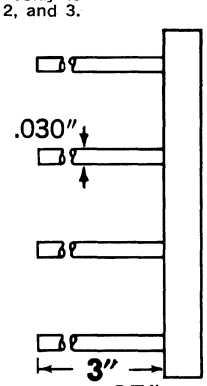
Terminals for the Model 904 relay is identified by the Symbols 1, 2, and 3.



Symbol 1
Hook-type solder terminals



Symbol 2
Plug-in terminals



Symbol 3
Three-inch leads

MODEL 904

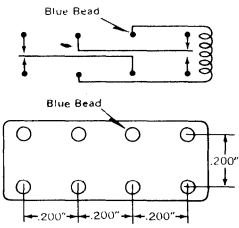
COIL PERFORMANCE TABLE

Coil Symbol	01	02	03	04	05	06	07
Rated Voltage	6	12	26.5	48	76	98	120
Operating Volts D.C.: min.	4.5	9.1	20	35	57	74	92
max.	6.7	13.5	30	52	85	110	135
Coil Resistance in Ohms ±10%	29	116	550	1770	4500	7700	11,700
Max. Pick-up Volts at 25°C	3.0	6.0	13.0	23.0	37.0	48.0	60.0
125°C	4.1	8.3	18.0	32.0	51.5	66.5	83.0
Max. Pick-up Milliamps	115	57	26	14	9.1	7.0	5.7
Max. Drop-out Volts at 25°C	2.3	4.6	10.0	17.0	27.5	36.5	45.5
125°C	3.2	6.4	14.0	23.5	38.0	50.5	63.0
Max. Drop-out Milliamps	88	44	20	10	6.8	5.3	4.3
Min. Drop-out Volts at 25°C	0.3	0.6	1.5	2.4	4.1	5.3	6.7
Min. Drop-out Milliamps	9.0	4.6	2.4	1.2	0.8	0.6	0.5

Coil Symbols for other operating voltages will be furnished upon request.

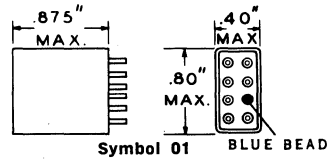
HEADER STYLE

The Header Style of the General Purpose Crystal Case Relay is referenced by the Symbol 904. A reference to one of these Symbols indicates the following:

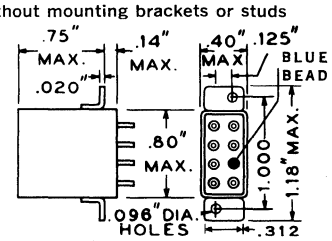


Model 904
General Purpose Crystal Case Relay with a 0.2-inch grid-spaced header and rectangular case

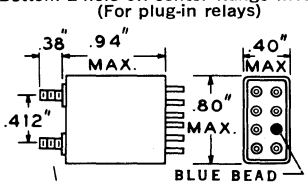
STANDARD MOUNTING STYLES



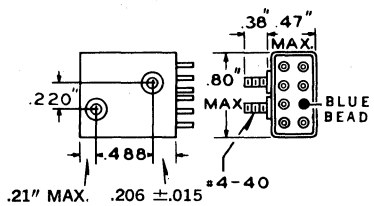
Symbol 01
Without mounting brackets or studs



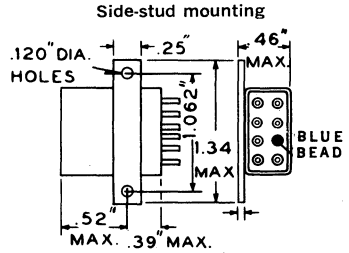
Symbol 20
Bottom 2-hole off-center flange mounting (For plug-in relays)



Symbol 30
Top stud mounting



Side-stud mounting



Symbol 40
Side-bracket mounting

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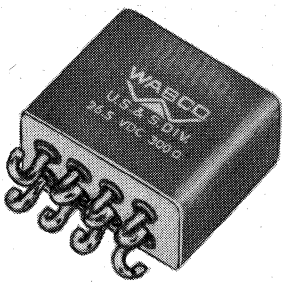
MODEL 925 2PDT-10 AMPERE CRYSTAL CASE RELAYS



- Small size and light weight
- For Aircraft, Missiles, Space Vehicles, Shipboard and Ground Support Equipment
- Ideally suited for Aircraft and Missile Power Control Systems
- Many mountings, operating voltages and terminals available

GENERAL DATA

Description — A 2PDT, 10 Ampere, hermetically sealed general purpose rotary crystal case relay
Weight — 1.28 ounces, maximum
Terminals — Solder-lug and plug-in types
Mountings — A variety of standard mountings available
Contacts — 2PDT, Form C (break before make)

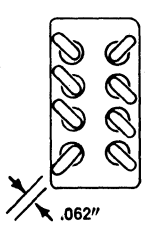
ELECTRICAL DATA

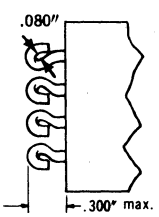
Coil Voltage — See Coil Performance Table for standard operating voltages and coil resistances
Contact Rating — 10 amperes resistive, 6 amperes inductive, 3 amperes motor, or 2 amperes lamp load at 28 vdc or 115 vac/400 Hz, single phase
Dielectric Strength — 1250 v RMS at sea level, 350 v RMS at 80,000 feet
Operate Time — 0.010 seconds maximum
Release Time — 0.010 seconds maximum
Contact Bounce Time — 0.005 seconds maximum (normally closed contacts)
0.002 seconds maximum (normally open contacts)
Insulation Resistance — 1000 megohms minimum; coil-to-case, 500 megohms minimum

ENVIRONMENTAL DATA

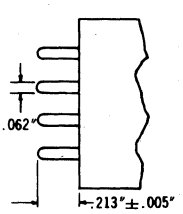
Temperature Rating — —70°C to +125°C
Vibration — 0.1" D.A. or 20G from 10 to 2000 Hz
Shock — 50G
Life — 100,000 operations minimum at rated loads except 20,000 operations minimum at rated inductive load

HEADER TERMINALS

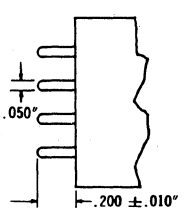




Symbol 1
Solder-lug terminals



Symbol 2—tin coated
Symbol 5—gold plated
Plug-in terminals



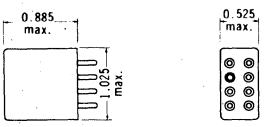
Symbol 4—tin coated
Symbol 6—gold plated
Plug-in terminals

COIL PERFORMANCE TABLE

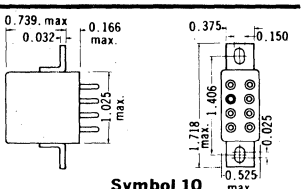
Coil Symbol	01	02	03	04
Rated Voltage	6	12	26.5	48
Operating Volts D.C.: min.	4.5	9.1	20	35
max.	6.7	13.5	30	52
Coil Resistance in Ohms ±10%	16	65	300	950
Max. Pick-up Volts at 25°C	3.3	6.6	14.0	26.5
125°C	4.2	8.4	18.0	33.6
Max. Pick-up Milliamps	229	113	52	31
Max. Drop-out Volts at 25°C	2.3	4.6	10.0	18.5
125°C	3.2	6.5	14.0	25.8
Max. Drop-out Milliamps	160	79	37	22
Min. Drop-out Volts at 25°C	0.4	0.8	1.6	3.0
Min. Drop-out Milliamps	22	11.2	4.8	2.9

Coil Symbols for other operating voltages will be furnished upon request.

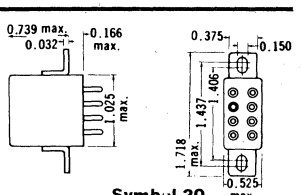
STANDARD MOUNTING STYLES



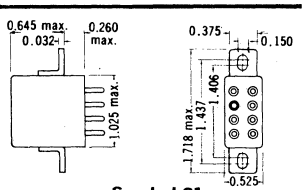
Symbol 01
No mounting provisions



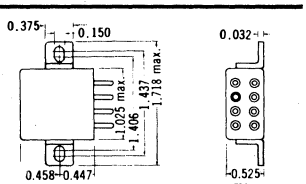
Symbol 10
Bracket mounting



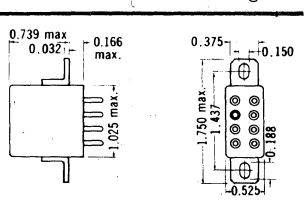
Symbol 20
Bracket mounting



Symbol 21
Bracket mounting

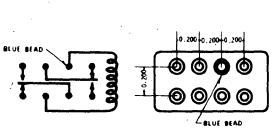


Symbol 22
Side bracket mounting



Symbol 30
Bracket mounting

CIRCUIT DIAGRAM AND TERMINAL SPACING



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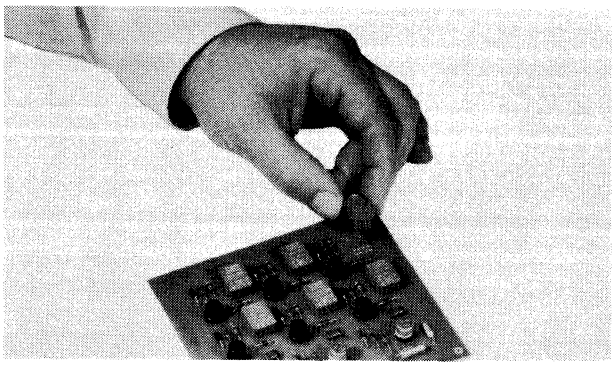
MODEL 910 SPDT — MODEL 911 DPDT FLAT-PACK RELAY



LOW PROFILE SPDT AND DPDT HERMETICALLY SEALED

ROTARY ARMATURE TYPE RELAYS FOR DIRECT PC BOARD MOUNTING

ALLOW PC BOARDS TO BE SPACED CLOSER TOGETHER
¼" maximum relay height

REDUCES COST OF RELAY ASSEMBLY TO PC BOARD
Self-mounted when plugged directly into PC Board holes and solder dipped
No free leads to fish through PC Board holes
No additional mounting bracket screws or rivets required

IMPROVED RELIABILITY
No exposed flexible leads extending from Relay to PC Board
Rigid ¼" length x .025 dia. terminals

TRIED AND PROVEN RELAYS WHICH MEET MIL-R-5757D
Utilizes the Proven WABCO ⅛ size Crystal Case Relays which meet MIL-R-5757/19

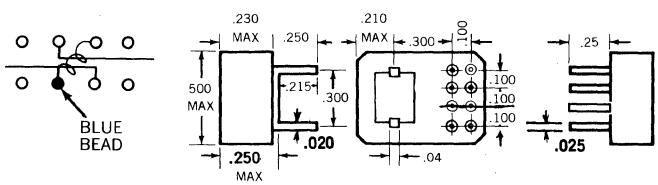
AVAILABLE IN SPDT MODEL 910 RELAY OR DPDT MODEL 911 RELAY

WABCO FLAT-PACK RELAY ORDERING REFERENCE

DC COIL VOLTAGE	SPDT	WABCO CATALOG NO. DPDT	
6	91020110	91120110	Add -01 suffix to Catalog No. if dry circuit Miss-Test is required
12	91020210	91120210	
26.5	91020310	91120310	
48	91020410	91120410	
76	91020510	91120510	

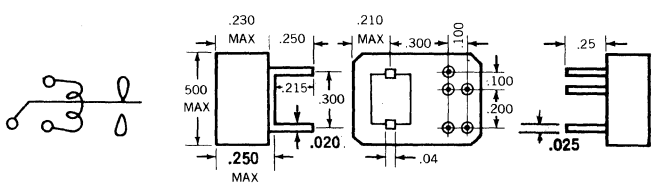
CIRCUIT DIAGRAM

MODEL 911



CIRCUIT DIAGRAM

MODEL 910



SPECIFICATIONS

GENERAL

Size — .687" max. length x .500 max. width x .250" max. height
Weight — .18 ounce maximum
Contacts — 2PDT — Form C (Break before make)

ELECTRICAL RATINGS

Coil voltage — Coils available for 6, 12, 26.5, 48 and 76 V.D.C. Others available upon request. (See Coil Performance Table below).
Contact rating — Low level dry circuit loads up to a maximum of 1.0 ampere, 26.5 V.D.C. resistive load
Life — 100,000 operations at maximum rated load
Contact resistance — 0.05 ohm maximum at rated current, 0.1 ohm after life test at rated current
Dielectric strength — 350 volts RMS at 60 Hz across open contacts, 500 volts RMS all other points at sea level; 300 volts RMS all points at 70,000 feet
Operate time — 4 milliseconds maximum including bounce at rated coil voltage and 25°C
Release time — 4 milliseconds maximum including bounce at rated coil voltage and 25°C
Insulation resistance — Coil to case 500 megohms minimum. All other points 1000 megohms minimum

ENVIRONMENTAL RATINGS

Temperature rating — —65°C to 125°C
Vibration — 0.1" D.A. or 20G peak from 10 to 2000 Hz
Shock — 50G for 11 milliseconds

COIL PERFORMANCE TABLE

	SPDT MODEL 910 RELAY					DPDT MODEL 911 RELAY				
Rated Voltage	6	12	26.5	48	76	6	12	26.5	48	76
Operating Volts D.C.: min.	5	10	20	36	64	5	10	20	36	64
max.	7.5	15	30	54	96	7.5	15	30	54	96
Coil Resistance in Ohms ±10%	90	310	2000	5700	16,000	90	310	1500	5700	16,000
Max. Pick-up Milliamps	30	16.9	6.5	3.9	2.3	33.3	19.3	8.6	4.4	2.5
Max. Drop-out Milliamps	18.8	9.1	3.5	2.1	1.2	25.2	14.6	6.5	3.3	1.9
Min. Drop-out Milliamps	3.7	2.1	0.80	0.48	0.28	3.8	2.2	1.0	0.5	0.29

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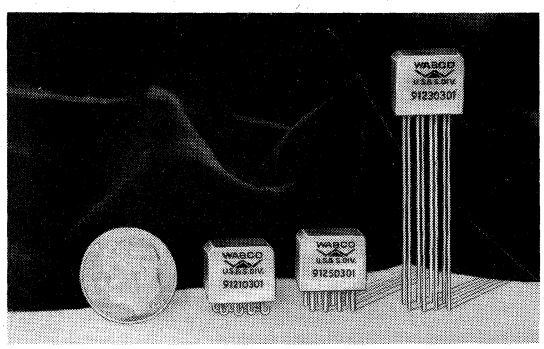
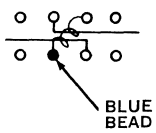
MODEL 912 DPDT 1 AMP. TINY INDUSTRIAL RELAYS



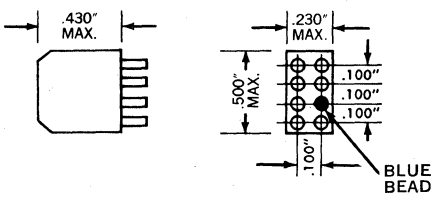
ROTARY ARMATURE TYPE FOR INDUSTRIAL APPLICATIONS WHERE MINIMUM SIZE AND WEIGHT ARE REQUIRED

- LOW COST
- 1/6 CRYSTAL CAN SIZE (.50"L x .23"W x .43"H)
- PULL-IN SENSITIVITY — 170MW MAXIMUM
- 50G SHOCK — 10G VIBRATION
- TEMPERATURE RANGE — 25°C TO 85°C
- MOUNTS DIRECTLY ON PC BOARD (.1" TERMINAL SPACING)

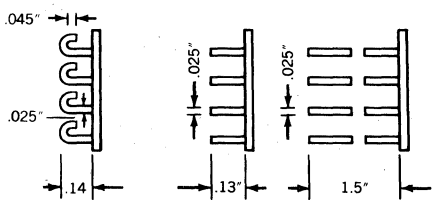
CIRCUIT DIAGRAM



CASE



TERMINALS



SPECIFICATIONS

PHYSICAL

Weight — .1 ounce
Enclosure — unsealed
Case material — nickel silver
Mounting styles — various flange mountings available
Terminals — hook, plug-in 1½" leads. Others available
Contact arrangement — DPDT (2 Form C)

ENVIRONMENTAL

Temperature range — —25°C to 85°C
Vibration — 10G, 10-2000 Hz
Shock — 50G, 11MS — With Relay Cemented in Position

ELECTRICAL

Operating voltages — 6, 12, 26.5 (See Coil Operating Characteristics)
Pull-in sensitivity at 25°C — 170MW Max.
Contact rating — 1.0 Amp. at 28 V.D.C. Resistance Load
2.0 Amp. at 28 V.D.C. Overload
.25 Amp. at 115 VRMS Resistive Load
(With Case Grounded)
Contact life — Rated Load 100,000 OPR
Overload 100 OPR
Contact resistance — 20 ohms Max.
.50 ohms Max. After Life
Operate time incl. bounce — 10MS Max.
Release time incl. bounce — 10MS Max.
Insulation resistance — 100 Megohms — Min. at 100 V.D.C.
Dielectric strength — 350 VRMS at Sea Level between all Insulated Points

ORDERING REFERENCE

	Rated Voltage	6 V.D.C.	12 V.D.C.	26.5 V.D.C.
Coil Operating Characteristics	Coil Res. ±10% (ohms)	90	310	1500
	Max. Pull-in V.D.C. at 25°C	3.4	6.9	15.2
	Max. Pull-in V.D.C. at 85°C	4.3	8.5	18.8
	Max. Drop-out V.D.C. at 25°C	2.3	4.5	10.0
	Max. Drop-out V.D.C. at 85°C	2.9	5.6	12.4
	Min. Drop-out V.D.C. at 25°C	0.25	0.50	1.0
	Min. Drop-out V.D.C. at —25°C	0.20	0.40	0.80
Catalog Number Ordering Reference	With Hook Terminals	91210101	91210201	91210301
	With 1.5" Leads	91230101	91230201	91230301
	With .13" Plug-in Pins	91260101•	91260201	91260301

• Also available as SPDT AS MODEL..913

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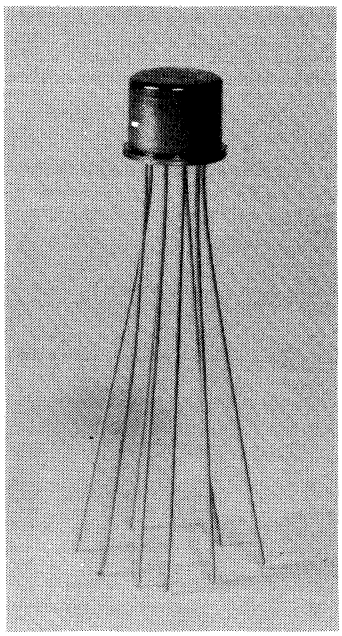
MODEL 914 TRANSISTOR TO-5 RELAYS DPDT



- Transistor TO-5 type enclosure
- All welded construction
- Hermetically sealed
- Contacts — gold plated for dry circuit requirements.
- Capable of withstanding high shock and vibration.

SPECIFICATIONS

PHYSICAL

Weight — 0.1 ounce
Enclosure — Hermetically sealed. All welded.
Case Material — Nickel Silver
Mounting Style — No mount — for printed circuit boards.
Terminals — 1.5 inch leads.
Contact Arrangement — DPDT-(2 Form C).

ENVIRONMENTAL

Temperature Range — 65°C to +125°C.
Vibration — 30G to 3,000 Hz.
Shock — 80Gs for 11 milliseconds.
Terminal Strength — 1 lb pull in any direction.

ELECTRICAL

Operating Voltages — 6, 9, 12, 18, 26.5 (See coil operating characteristics.)
Pull-in Sensitivity — 130 MW max.
Contact Rating — 1.0 Amp. at 28V DC Resistive Load.
Contact Life — 1,000,000 operations at low level.
100,000 operations at rated load.
100 operations at 2.0 amp.

CONTACT RESISTANCE

0.1 ohm max before life.
0.2 ohm max after life at max rated current (measured 1/8" from header).
Operate Time — 2.0 Milliseconds max. at rated coil voltage.
Release Time — 1.5 Milliseconds max.
Contact Bounce — 1.5 Milliseconds max.

INSULATION RESISTANCE

5,000 megohms min. between mutually insulated terminals.

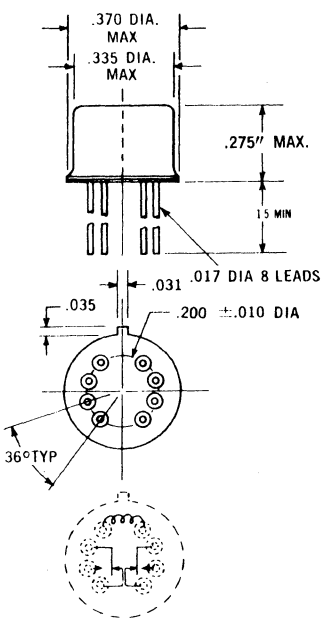
DIELECTRIC STRENGTH

500 V RMS 60Hz at sea level; 125 V RMS 60Hz at 70,000 feet.

ORDERING INFORMATION

For a 26.5 V relay with 1.5 inch leads for printed circuit board use order 91430301. For other coil voltages see Coil Operating Characteristics Table.

MECHANICAL SPECIFICATIONS



Schematic
Viewed from header

COIL OPERATING CHARACTERISTICS

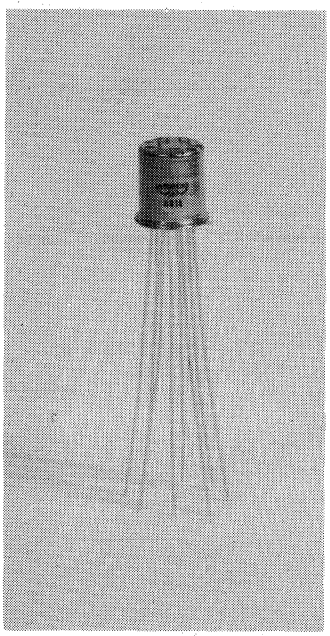
COIL SYMBOL		01	10	02	11	03
Coil Voltage (Volts DC)	NOM.	6	9	12	18	26.5
	MAX.	8	12	16	24	32
	MIN.	4.5	6.8	9	13.5	18
DC Coil Resistance (Ohms ±10% at 25°C)		98	220	390	880	1560
Pull-In Current (MA Max.)		36.5	24.5	18.3	12.2	9.1
Drop-Out Voltage (Volts DC Max.)		3.2	4.9	6.5	10	13

Rated Duty: Continuous

NOTE: Also available in a commercial version as Model 934. Contact factory for details.

WABCO
WESTINGHOUSE AIR BRAKE COMPANY
AEROSPACE DEPARTMENT
Swissvale Post Office, Pittsburgh, Pa. 15218

MODEL 916 TRANSISTOR TO-5 RELAYS SENSITIVE DPDT



- TO-5 transistor type enclosure
- All welded construction
- Hermetically sealed
- Contacts — gold plated for dry circuit requirements.
- Capable of withstanding high shock and vibration.

SPECIFICATIONS

PHYSICAL

Weight — 0.15 ounce
Enclosure — Hermetically sealed. All welded.
Case Material — Nickel Silver
Mounting Style — No mount — for printed circuit boards.
Terminals — 1.5 inch leads.
Contact Arrangement — DPDT-(2 Form C).

ENVIRONMENTAL

Temperature Range — 65°C to +125°C.
Vibration — 30G to 3,000 Hz.
Shock — 80Gs for 11 milliseconds.
Terminal Strength — 1 lb pull in any direction.

ELECTRICAL

Operating Voltages — 6, 12, 26.5, 36, 48. (See coil operating characteristics.)
Pull-in Sensitivity — 60 MW max.
Contact Rating — 1.0 Amp. at 28V DC Resistive Load.
Contact Life — 1,000,000 operations at low level.
100,000 operations at rated load.
100 operations at 2.0 amp.

CONTACT RESISTANCE

0.1 ohm max before life.
0.2 ohm max after life at max rated current (measured 1/8" from header).
Operate Time — 4.0 Milliseconds max. at rated coil voltage.
Release Time — 2.0 Milliseconds max.
Contact Bounce — 1.5 Milliseconds max.

INSULATION RESISTANCE

5,000 megohms min. between mutually insulated terminals.

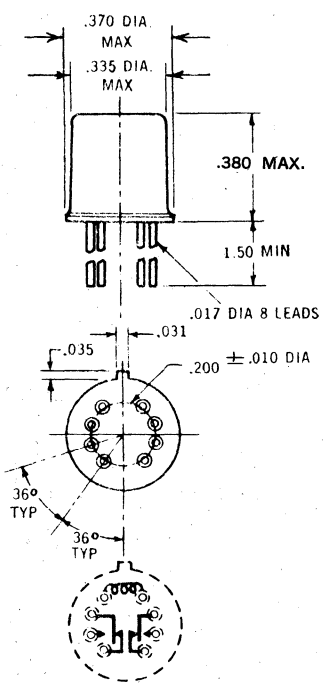
DIELECTRIC STRENGTH

5,000V RMS, 60Hz at sea level.
350V RMS, 60Hz between contacts.
125V RMS, 60Hz at 70,000 feet.

ORDERING INFORMATION

For a 26.5 V relay with 1.5 inch leads for printed circuit board use order 91430301. For other coil voltages see Coil Operating Characteristics Table.

MECHANICAL SPECIFICATIONS



COIL OPERATING CHARACTERISTICS

COIL SYMBOL		01	02	03	10	04
Suggested Coil Source Voltage (Volts DC)	NOM.	6	12	26.5	36	48
	MAX.	10	20	40	57	75
DC Coil Resistance (OHMS ±10% at 25°C)		200	850	3300	6500	11,000
Pull-In Current (MA Max.)		17.5	8.4	4.2	3.0	2.4

Rated Duty: Continuous

NOTE: Also available in a commercial version as Model 935. Contact factory for details.

WESTINGHOUSE AIR BRAKE COMPANY
AEROSPACE DEPARTMENT
Swissvale Post Office, Pittsburgh, Pa. 15218

WABCO

MINIATURE RELAYS

WABCO miniature relays, as manufactured by Aerospace Department of Westinghouse Air Brake Company, are rugged, hermetically sealed rotary type balanced armature relays designed to meet or exceed the requirements of MIL-R-5757 and MSFC-SPEC-333. Temperature rating — from −65°C to +125°C for both a-c and d-c relays. Vibration — 20G from 10 to 2000 Hz. Shock — 50G for 11 milliseconds. Life — 100,000 operations at rated loads. Sockets for plug-in relays are available on request. Special dry circuit miss-test available for all relays on request.

TWO TYPES OF RELAYS H, J

GENERAL DESCRIPTION

(General purpose & Sensitive in ½" Longer Case)

The WABCO Miniature Relay is a rugged relay featuring exceptionally sturdy terminals and husky contacts for high current applications. It is designed to meet the rigid requirements of MIL-R-5757D. The rugged qualities of this relay permit its use in airborne and guided missile electronic equipment and similar vital applications where efficient and reliable operation under extreme environmental conditions is mandatory. Although the Type H Relay operates basically on D.C., operation on A.C., when required, is provided by the incorporation of rectifiers within the relay.

A balanced, rotary-type armature is used to provide maximum immunity to severe shock, vibration and acceleration forces. Glass-coated cylindrical contact actuators attached to the rotary armature assure square mating of the contact surfaces. The WABCO Type H Relay is the smallest 4PDT, 10-Ampere rotary-type relay currently available. It occupies no more space than the popular WABCO 6PDT, 2-Ampere miniature relays.

The special techniques employed in manufacturing the complete line of reliable WABCO A.C. and D.C. miniature relays are utilized to produce the new Type H Relay in large quantities.

This precision relay is designed to meet or exceed the requirements of MIL-R-5757D and MSFC-339.

Prominent among the design features in the Type J Relay is the use of inorganic materials in the contact chamber, a new mechanical damping mechanism to maintain a minimum of contact bounce, and a new contact structure to insure miss-free operation at low level or high level contact loads. This relay is physically interchangeable with the well-known WABCO Type M 6PDT Relay which has been used extensively by the aerospace and electronics industries for many years.

The Aerospace Department of Westinghouse Air Brake Company welcomes customer inquiries concerning specific applications and special requirements.

ORDERING INFORMATION

The catalog numbering system incorporated in this brochure will enable our customers to select the proper WABCO Type H Relay for their particular application with relative ease. A sample catalog number is referenced in the diagram below to illustrate the method of building such numbers. Symbol "H" is always used as the first character in the catalog number to identify the WABCO Type H 4PDT, 10-Ampere Miniature Relay. Explanation of the remaining parts is contained as follows:

WABCO RELAY SYMBOL	COIL INDICATOR	MOUNTING STYLE	CONTACT IDENTIFICATION	FORM "C" CONTACTS	HEADER TERMINAL
H	35	H	K	4	H

Citing Catalog Number H35HK4H as an example, it can be determined that the catalog number is constructed in the following manner:

Letter "H," as stated above, immediately identifies the WABCO Type H Relay.

The number "35" is a Coil Indicator and information pertaining to this reference will be found in the Coil Resistance Table I. Within Coil Resistance Table I, it is stated that this relay will operate over a range of 20 to 30 volts with a nominal coil resistance of 200 ohms. Other pertinent performance data are also found in Table I.

The second letter "H" refers to the Mounting Style for this particular relay. The H-type mounting features a 2-hole mounting flange at the terminal end of the relay.

The letter "K" refers to the Contact Type. It denotes contacts for resistive loads up to ten amperes to 26.5 volts D.C.

The number "4" indicates the number of Form C (break-before-make) contacts.

The final letter "H" indicates the terminal type as described by item, header terminal. The "H" denotes a hook-type terminal for solder connections.

WABCO
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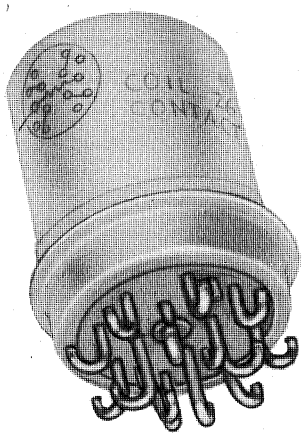
AEROSPACE DEPARTMENT
Swissvale Post Office, Pittsburgh, Pa. 15218

TYPE H 4PDT MINIATURE RELAY 4 POLE 10 AMP

The new WABCO Type 4PDT, 10-Ampere Miniature Relay is a rugged relay featuring exceptionally sturdy terminals and husky contacts for high current applications. It is designed to meet the rigid requirements of MIL-R-5757D and MSFC 339. The rugged qualities of this relay permit its use in airborne and guided missile electronic equipment and similar vital applications where efficient and reliable operation under extreme environmental conditions is mandatory. Although the Type H Relay operates basically on D.C., operation on A.C., when required, is provided by the incorporation of rectifiers within the relay.

A balanced, rotary-type armature is used to provide maximum immunity to severe shock, vibration and acceleration forces. Glass-coated cylindrical contact actuators attached to the rotary armature assure square mating of the contact surfaces. The WABCO Type H relay is the smallest 4PDT, 10-Ampere rotary-type relay currently available. It occupies no more space than the popular WABCO 6PDT, 2-Ampere miniature relays.

The special techniques employed in manufacturing the complete line of reliable Aerospace Department A.C. and D.C. miniature relays are utilized to produce the new Type H relay in large quantities. Aerospace Department of Westinghouse Air Brake Company welcomes customer inquiries concerning applications and special requirements.



COIL PERFORMANCE TABLE

The A.C. operated Type H relay is made in the long case only and is identified by the Coil Indicator "A.C." It incorporates a full-wave silicon rectifier circuit for the —65°C to +125°C temperature range.

Operating Voltage	115 volts A.C., 60 to 400 Hz	
Operating Current	.025	
Maximum Pick-up Volts	at 25°C	75 volts
	at 85°C	93 volts
	at 125°C	104 volts
Maximum Drop-out Volts	at 25°C	54 volts
	at 85°C	67 volts
	at 125°C	75 volts
Minimum Drop-out Volts	at 25°C	9 volts
	at 85°C	11 volts
	at 125°C	12 volts
Operating Time	25 milliseconds nominal pick-up and 50 milliseconds nominal drop-out	

SPECIFICATIONS

GENERAL DATA

Description — A hermetically sealed miniature rotary-type relay designed to meet the requirements of MIL-R-5757D and MSFC 339.

Weight — 3.75 ozs. in the standard case; 5.0 ozs in the long case

Terminals — Solder lug

Mountings — Various flange mountings available

ELECTRICAL DATA

Coil voltage — Voltage range, coil resistance, pick-up voltage, drop-out voltage and other data shown in Coil Performance Table I for standard case D.C. relays' Table II for long case D.C. relays, and Table III for A.C. relays. **Maximum contact voltage drop** — 175 millivolts

Contact ratings — 10 amperes, 26.5 volts, D.C. resistive load

Contact bounce — 2.0 milliseconds maximum

Dielectric strength — 1000 volts rms at all points

Operate time — 17 milliseconds maximum pick-up time and 7 milliseconds maximum drop-out time at 26.5 volts and 25°C for 26.5 volt, 200-ohm coil D.C. relays. Operating time increases for higher coil resistances

Insulation resistance — 1000 megohms minimum at 500 volts D.C.

ENVIRONMENTAL DATA

Temperature rating — —65°C to +125°C

Vibration — 20G to 2000 Hz

Shock — 50G

Life — 100,000 operations at rated load

COIL PERFORMANCE TABLE — STANDARD CASE SIZE — TABLE I

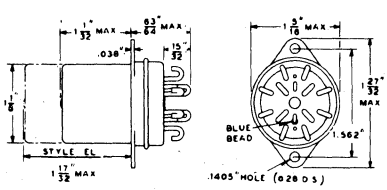
Catalog Indicator	29	32	35	38	42
Rated Voltage	6	12	26.5	48	115
Operating Minimum	5.0	10	20	40	100
Volts D.C. Maximum	7.5	15	30	60	150
Nominal Coil Resistance (Ohms)	14	60	200	900	5500
Maximum Pick-up Volts at 25°C	3.7	6.4	13.5	25.9	70.0
85°C	4.5	7.9	16.7	32.0	86.9
125°C	5.1	8.8	18.8	36.0	97.4
Maximum Pick-up Amps	.236	.122	.067	.032	.014
Maximum Drop-out Volts at 25°C	2.6	4.8	10.0	18.5	50.0
125°C	3.6	6.7	14.0	25.6	70.0
Maximum Drop-out Amps	.167	.089	.048	.023	.010
Minimum Drop-out Volts at 25°C	.33	.74	1.5	2.9	7.9
Minimum Drop-out Amps	.026	.011	.006	.003	.0013

COIL PERFORMANCE TABLE — LONG CASE SIZE — TABLE II

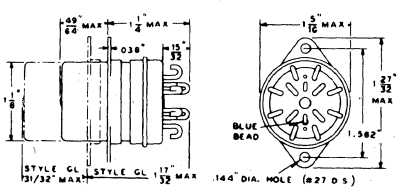
Catalog Indicator	29	32	35	38	42	A.C.
Rated Voltage	6	12	26.5	48	115	115 VRMS
Operating Minimum	5.0	10	20	40	100	107 VRMS
Volts D.C. Maximum	10	20	40	80	200	135
Nominal Coil Resistance (Ohms)	25	96	400	1600	9500	*See Below
Maximum Pick-up Volts at 25°C	3.7	6.5	13.5	25.9	70.5	80
85°C	4.6	8.1	16.7	32	87.5	99
125°C	5.2	9.0	18.8	36	98	104
Maximum Pick-up Amps	.131	.077	.038	.018	.008	—
Maximum Drop-out Volts at 25°C	2.6	6.1	9.6	18.5	50	54
125°C	3.6	8.5	13.3	25.6	69.5	75
Maximum Drop-out Amps	.090	.043	.027	.013	.006	—
Minimum Drop-out Volts at 25°C	.33	.96	1.5	2.9	7.9	9.0
Minimum Drop-out Amps	.015	.005	.0034	.0016	.0007	—

MOUNTING STYLES

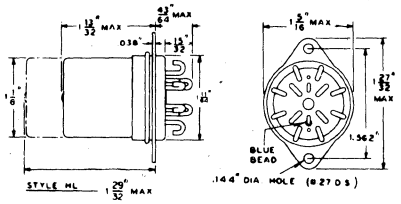
The Mounting Style references are identified by the letters E, G, H, T, and P. To indicate long case mounting styles, the letter 'L' is added to each of the listed letters.



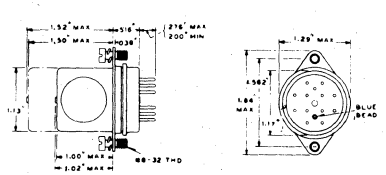
E — Body flange mount



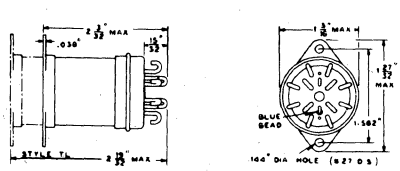
G — Center-of-gravity flange mount



H — Header flange mount



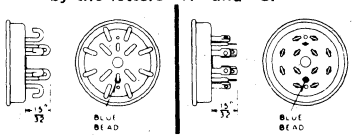
P — Plug-in



T — Top flange mount

HEADER TERMINALS

Terminal types are identified by the letters "H" and "S."



CONTACT IDENTIFICATION

The contact identification for the 10-ampere, 26.5 volts D.C. resistive load contacts is designated by the letter "K."

NUMBER OF FORM C CONTACTS

This relay has a 4-pole, double-throw contact arrangement which is identified by the number "4" in the catalog number.

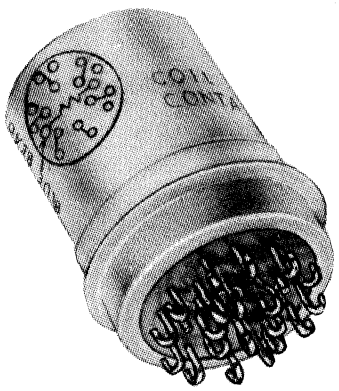
WESTINGHOUSE AIR BRAKE COMPANY
AEROSPACE DEPARTMENT
Swissvale Post Office, Pittsburgh, Pa. 15218

WABCO

TYPE J 6PDT MINIATURE RELAY 6 POLE AC & DC

The Aerospace Department of Westinghouse Air Brake Company announces the Type J 6PDT Miniature Relay, a highly reliable miniature relay. This precision relay is designed to meet or exceed the requirements of MIL-R-5757D and MSFC-339.

Prominent among the design features in the Type J Relay is the use of inorganic materials in the contact chamber, a mechanical damping mechanism to maintain a minimum of contact bounce, and a contact structure to insure miss-free operation at low level or high level contact loads. This relay is physically interchangeable with the well-known WABCO Type M 6PDT Relay which is in use extensively by the aerospace and electronics industries.



COIL PERFORMANCE TABLE — STANDARD CASE SIZE — TABLE I

Catalog Indicator	29	32	35	38	42
Rated Voltage	6	12	26.5	48	115
Operating Minimum	5.0	10	20	40	100
Volts D.C. Maximum	7.5	15	30	60	150
Nominal Coil Resistance (Ohms)	14	60	200	900	5500
Maximum Pick-up Volts at 25°C 85°C 125°C	3.7 4.5 5.1	6.4 7.9 8.8	13.5 16.7 18.8	25.9 32.0 36.0	70.0 86.9 97.4
Maximum Pick-up Amps	.236	.122	.067	.032	.014
Maximum Drop-out Volts at 25°C 125°C	2.6 3.6	4.8 6.7	10.0 14.0	18.5 25.6	50.0 70.0
Maximum Drop-out Amps	.167	.089	.048	.023	.010
Minimum Drop-out Volts at 25°C	.33	.74	1.5	2.9	7.9
Minimum Drop-out Amps	.026	.011	.006	.003	.0013

COIL PERFORMANCE TABLE — LONG CASE SIZE — TABLE II

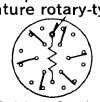
Catalog Indicator	29	32	35	38	42	A.C.
Rated Voltage	6	12	26.5	48	115	115 VRMS
Operating Minimum	5.0	10	20	40	100	107 VRMS
Volts D.C. Maximum	10	20	40	80	200	135
Nominal Coil Resistance (Ohms)	25	96	400	1600	9500	*See Below
Maximum Pick-up Volts at 25°C 85°C 125°C	3.7 4.6 5.2	6.5 8.1 9.0	13.5 16.7 18.8	25.9 32 36	70.5 87.5 98	80 99 104
Maximum Pick-up Amps	.131	.077	.038	.018	.008	—
Maximum Drop-out Volts at 25°C 125°C	2.6 3.6	6.1 8.5	9.6 13.3	18.5 25.6	50 69.5	54 75
Maximum Drop-out Amps	.090	.043	.027	.013	.006	—
Minimum Drop-out Volts at 25°C	.33	.96	1.5	2.9	7.9	9.0
Minimum Drop-out Amps	.015	.005	.0034	.0016	.0007	—

SPECIFICATIONS

A.C. AND D.C. TYPE J MINIATURE RELAYS

GENERAL DATA

Description — A hermetically sealed, miniature rotary-type relay, designed to meet the requirements of MIL-R-5757D and MSFC-339.



Contact arrangement —

Weight — 3.75 ounces — standard case
5.00 ounces — long case

Terminals — Solder-hook or plug-in

Finish — Tin Plate over Cadmium Plate

Sockets — Information on sockets for the plug-in mounting can be found on the next page

ELECTRICAL DATA

Voltage range, coil resistance, pick-up voltage, drop-out voltage, and other data are shown in Tables I or II.

Contact ratings — See Contact Identification

Contact bounce — 2.0 milliseconds standard, consult factory for other available limits

Dielectric strength — 1000 volts RMS except across open contacts
750 volts RMS across open contacts

Insulation resistance — 1000 megohms minimum, all points

Operate and release time — D.C. Relays — 17 milliseconds maximum operate time and 7 milliseconds maximum release time at rated voltage and 25°C for 26.5-volt and 200-ohm relay. Operate and release times increase for higher coil resistances.
A.C. Relays — 115 volts A.C. relays, operate time 25 milliseconds maximum, release time 50 milliseconds maximum at 115 volts A.C. and 25°C

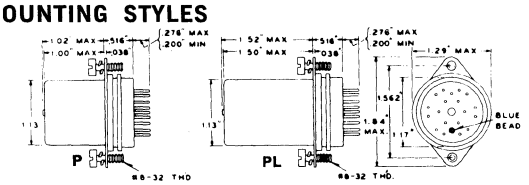
Temperature rating — All Type J Relays are rated at —65°C to 125°C (MIL-R-5757D — Class B)

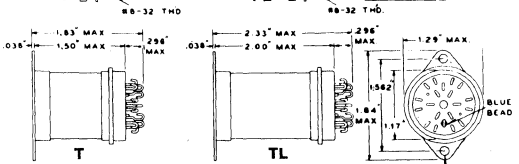
Vibration — Mounting Styles E, H, and G recommended for 10 to 2000 Hz at .06" D.A. or 20G (MIL-R-5757D — Symbol 4). All other mountings rated at 10 to 2000 Hz at .06" D.A. or 15G (MIL-R-5757D — Symbol 3)

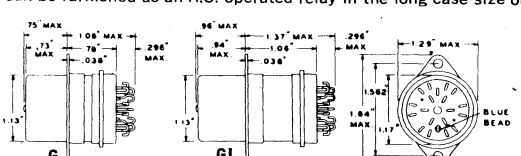
Shock — 50G — 11 milliseconds (MIL-R-5757D — Symbol 3)

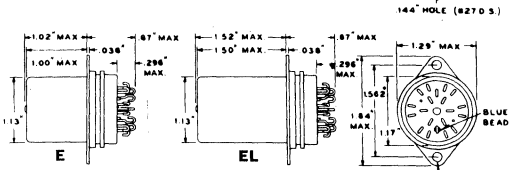
A.C. Relays — The Type J Relay can be furnished as an A.C. operated relay in the long case size only

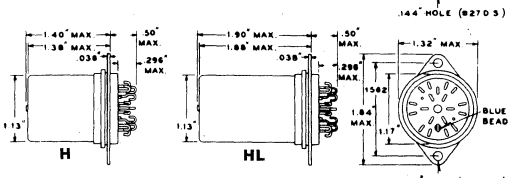
MOUNTING STYLES





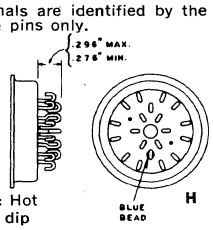




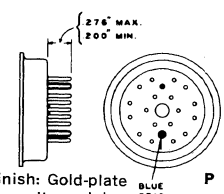


HEADER TERMINALS

Terminals are identified by the letters H or P. The finish shown is on the pins only.



Finish: Hot solder dip



Finish: Gold-plate over silver plate

NUMBER OF FORM C CONTACTS

The number 6 shown in this location indicates the number of form C contacts in the standard Type J relay.

CONTACT IDENTIFICATION

P — 100,000 operations — low level to 5.0 amperes, 26.5 volts D.C. resistive load. 2.5 ampere maximum 26.5 volts D.C. inductive load.

D — "P" contacts with a 5000 operation miss-test performed at a low level load. Standard level is 16 millivolts open-circuit voltage with 8 microamperes short-circuit current. Reject point 750 ohms per contact.

H — "P" contacts with a 5000 operation miss-test performed at a high-level load. Standard load is 0.5 ampere at 28 volts with reject point at 2 ohms plus 0.03 ohm per contact.

NOTE: The mountings shown are for standard relays. Other mounting styles and variations to these standards are available. Consult factory for additional information.

WABCO
WESTINGHOUSE AIR BRAKE COMPANY
AEROSPACE DEPARTMENT
Swissvale Post Office, Pittsburgh, Pa. 15218

WABCO RELAY SOCKETS

SOCKETS FOR J PLUG-IN RELAYS

WABCO miniature relays can be supplied as plug-in units with mating sockets. All general specification information referenced previously and coil resistance variations can be incorporated in the plug-in relay.

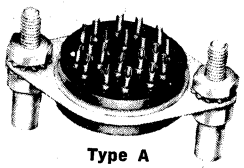
The insertion of the letter "P" or "PL" as the mounting catalog indicator in the catalog number designates a plug-in relay.

The mating sockets are available in two types of insulation material and terminals for top or bottom chassis mounting.

SOCKET TYPE A

Specification

Molded asbestos filled melamine insulation material, gold plated contacts and solder pot terminals as shown.

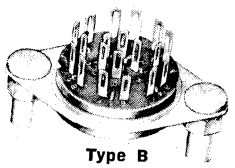


Type A

SOCKET TYPE B

Specification

Mica filled phenol formaldehyde insulation material, gold plated contacts and pierced terminals as shown.

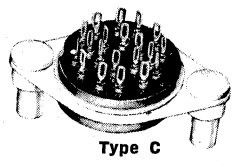


Type B

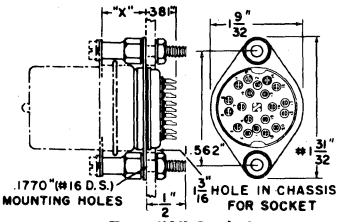
SOCKET TYPE C

Specification

Molded asbestos filled melamine insulation material, gold plated contacts and eyelet terminals as shown.

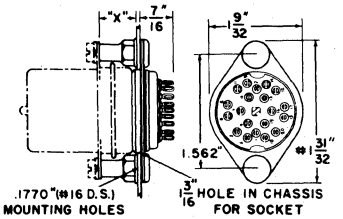


Type C



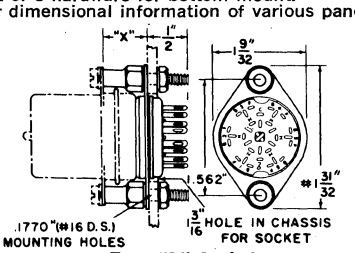
Type "A" Socket

with class 1 hardware for top mount on any size panel.



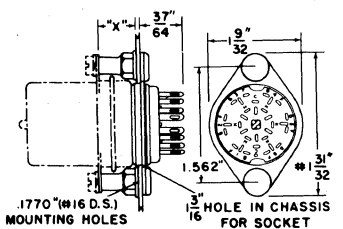
Type "C" Socket

with class 2 or 3 hardware for bottom mount.
See table for dimensional information of various panel thicknesses.



Type "B" Socket

with class 1 hardware for top mount on any size panel.



Type "B" Socket

with class 2 or 3 hardware for bottom mount.
See table for dimensional information of various panel thicknesses.

* Denotes maximum dimension.

DIMENSIONAL TABLE

Hardware Class	X dimension	Panel Thickness
1	1 1/16"	1/16" to 1/4"
2	9/16"	1/16" to 7/64"
3	1/2"	1/8" to 5/32"

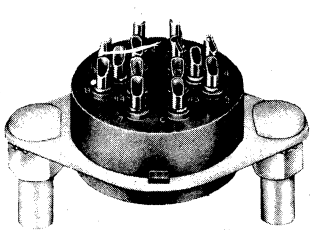
Socket catalog ordering information is as follows:

WABCO Socket Symbol	Contact Form	Socket Type	Hardware Class
S	6-6PDT	Type A, B or C	1, 2 or 3 as shown above

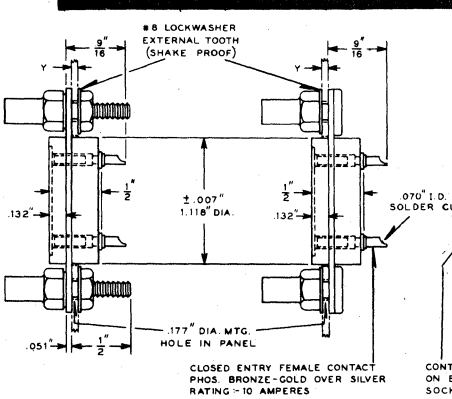
Example: S6A2 — WABCO socket 6PDT Melamine insulation material, solder pot terminals, bottom mount on 1/16" to 7/64" chassis.

SOCKETS FOR H PLUG-IN RELAYS

A socket for use with the Plug-in relay is available from AirBorn Connectors Division, 2618 Manana Drive, Dallas, Texas 75220. These sockets are available with the mounting hardware classes shown below.



Ordering Reference From AirBorn Connectors Div.	Panel Mounting Location	Panel Thickness Dim. Y
CRB12-2SA1	Top	1/64 to 1/4
CRB12-2SA2	Bottom	1/16 to 7/64
CRB12-2SA3	Bottom	1/8 to 5/32



Type A Socket
Top mount

Type A Socket
Bottom mount

Amperex Resistors LINEAR NON-LINEAR

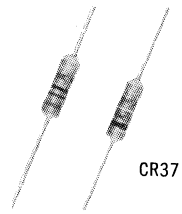
CARBON FILM

These resistors offer high stability, low noise and long life. For applications requiring steady low power drop. Accuracy and consistency are relatively unaffected by adverse climatic conditions. Range from 1Ω to 10M. Pure carbon or nickel film deposited on a high grade ceramic body.

	1/10W	1/4W	1/2W
P_{nom} $T_A \leq 70°C$	0.1W	0.25W	0.5W
Max. voltage AC or DC	150V	250V	350V
Permissible RMS applied for 1 sec. across insulation	300V	500V	700V
Insulation resistance	10^4MΩ	10^4MΩ	10^6MΩ

Amb. temp. (all types) **−55 to + 155°C**

Style	Range	Tolerance (±)
CR16 (1/10W)	10Ω to 220k	5%
	270k to 1M	10%
CR25 (1/4W)	1Ω to 3.9Ω	10%
	4.3Ω to 1M	5%
	10Ω to 1M	2%
	1.2M to 10M	10%
CR37 (1/2W)	1Ω to 10M	10%
	4.3Ω to 1M	5%
	10Ω to 1M	2%



CARBON POTENTIOMETER

Reliable trimmers, despite small size and low cost, for tube or transistorized PCs. Consist of annular carbon track riveted to base plate of resin bonded paper. Screw driver slot or plastic knob for readjustment. Available in seven mechanical types.

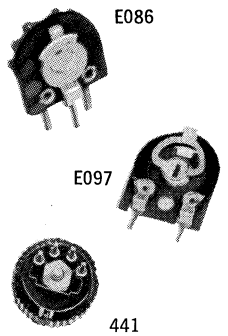
Dimensions

Type	Length	Width	Depth
E097	0.787	0.709	0.177
E086	0.394	0.394	0.150
	Diameter		**Depth**
440	.488 ± .002		.205 ± .008

Type E086: Linear Resistance Range: 100Ω to 1M ±20%: 13 ranges
Effective angle of rotation ..... 240 ±5°
Maximum permissible power dissipation (of total resistance) at an ambient temperature of 40°C 0.1W
Permissible ambient temperature range ..... −30° to +70°C

Type E097: Linear Resistance Range: 100Ω to 4.7M ±20%: 15 ranges
Effective angle of rotation ..... 220 ±5°
Maximum permissible power dissipation (of total resistance) at ambient temperature of 40°C 0.25W
Permissible ambient temperature range ..... −30° to +70°C

Type 440: Linear Resistance Range: 4700Ω, 10KΩ, 22KΩ, ±20%
Nominal resistance values 4.7K, 10K, 22K
Resistance law ..... linear and logarithmic
Working temperature range ..... −10° to +70°C
Life expectancy ..... in excess of 15,000 cycles
(Available with ON-OFF switch as Type 441)

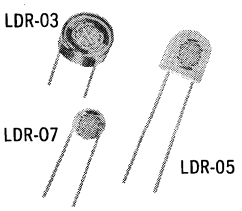


LIGHT DEPENDENT

LDRs, made from cadmium sulfide, are semiconductors whose conductivity increases when irradiated by wave lengths within a certain range of the spectrum. Made in specific versions with relevant electrical characteristics for control, counting, measuring, alarm and switching applications.

Type	Description	Diameter (")	Thickness (")
LDR-03	Makrolon case and epoxy resin	0.55 ± 0.196	0.35 ± 0.06
LDR-05	Plastic case and epoxy resin	0.43 ± 0.006	0.14 ± 0.004
LDR-07	Lacquered protective coating	0.34 ± 0.16	0.071 ± 0.002

Applications: Auto Parking & Headlight Dimmers, TV Brightness Control, Exposure Meters, Flame Control in Oil Burners, Magnetic Tape Controls, etc.

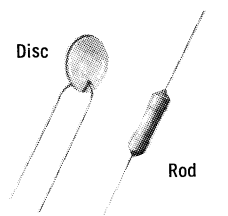


VOLTAGE DEPENDENT

Most important property is the non-linearity between their resistance and the applied voltage. Voltage dependency is due to contact resistance between the silicon carbide crystals. Crystal contacts form a network of series and parallel resistors which determine the electrical characteristics.

Available Types
Disc types available: 0.8W to 3W
Rod types available: 0.7W

Applications
VDRs can be used in spark suppression and contact-protection applications, as well as in series with a resistor for voltage stabilization. Although the stabilizing circuit with a VDR cannot compete with more elaborate circuits, it has vital advantages of simplicity and small space adaptability.

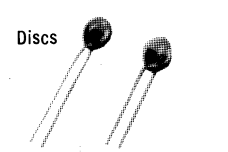


POSITIVE TEMPERATURE COEFFICIENT THERMISTORS

PTC Thermistors increase in resistance as the temperature increases. PTCs are disc shaped with connecting leads and are lacquer coated for protection against atmospheric influences.

Available Types
Standard Discs 1W 40 to 50V series
Standard Discs 0.5W 25V series

Applications
Resistance changes of 10%/°C or better permit the use of PTCs wherever any of the following factors are decisive: ambient temperature; dissipated power; inertia of PTC and positive temperature coefficient.

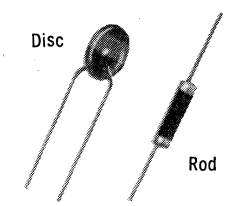


NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

NTC thermistors are resistors which exhibit a high negative temperature coefficient of resistivity. They are made of semiconducting oxidic materials. The resistance of the oxides decreases rapidly when the temperature rises.

Available Types
Rod Type
Disc Type
Miniature Bead Type
Special Types for Automobiles
Special Types for Radio and TV

Applications
Resistance changes of 3% to 6% per °C permit the use of NTCs in applications such as: ambient temperature measurement and control; resistance determined by dissipation and time delays.



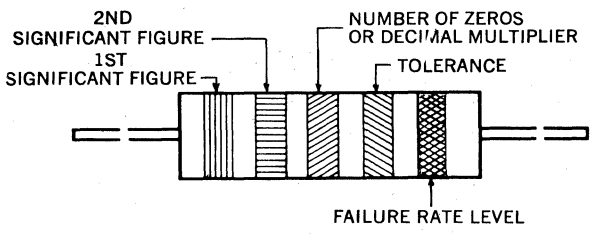
AMPEREX ELECTRONIC CORPORATION
Component Division: 35 Hoffman Ave., Hauppauge, N.Y.
Telephone: 516-234-7000 TWX 510-227-8552

Amperex®
TOMORROW'S THINKING IN TODAY'S PRODUCTS

SPEER RELIABLE FIXED COMPOSITION RESISTORS

- Complete line of ¼, ½, 1 and 2 watt composition resistors that meet or exceed all of the requirements specified by MIL-R-11 and RS 172.
- Established Reliability style RCR 07 and RCR 20 and RCR 32 resistors per MIL-R-39008.
- Integration of core and insulating shell into a uniform solid structure.
- Lead wire design that provides tight anchorage within the resistor core.
- Heavy coating of 100% pure tin on lead wires for superior soldering characteristics even after extended storage.
- Weldable ETP copper leads.
- Operation at full wattage rating at 70°C without derating.
- Prompt delivery—usually from stock.

Established Reliability Color Code
Per MIL-R-39008 Speer SRR Resistors



Color	Significant Figure	Multiplier	5th Band Color
BLACK	0	1	1.0
BROWN	1	10	.1
RED	2	100	.01
ORANGE	3	1,000	.001
YELLOW	4	10,000	FAILURE
GREEN	5	100,000	RATE
BLUE	6	1,000,000	LEVEL
VIOLET	7		%/
GRAY	8		THOUSAND
WHITE	9		HOURS
GOLD	5% TOLERANCE	0.1	
SILVER	10% TOLERANCE	0.01	
NO COLOR	20% TOLERANCE		

DIMENSIONS

			BODY			LEAD	
Speer Type	Mil Type	Rating In Watts	Diameter D	Length L	Wire Size A.W.G.	Nom. Dia. LD	Length LL
SR 1/4	RC 07	¼	.090±.008	.250±.031	#22	.025	1½±1/8
SRR 1/4	RCR 07	¼	.090±.008	.250±.031	#22	.025	1½±1/8
SR 1/2	RC 20	½	.138±.007	.390±.025	#20	.032	1½±1/8
SRR 1/2	RCR 20	½	.138±.007	.390±.025	#20	.032	1½±1/8
SR 1	RC 32	1	.225±.010	.562±.030	#18	.040	1½±1/8
SRR 1	RCR 32	1	.225±.010	.562±.030	#18	.040	1½±1/8
SR 2	RC 42	2	.312±.010	.688±.030	#17	.045	1½±1/8

MAXIMUM CONTINUOUS WORKING VOLTAGE

(per MIL-R-11, RS-172 and MIL-R-39008)

Power Rating (Watt)	Max. Cont. W.V. (D.C. or R.M.S.)
¼	250
½	350
1	500
2	500

D. C. RESISTANCE TEST VOLTAGES

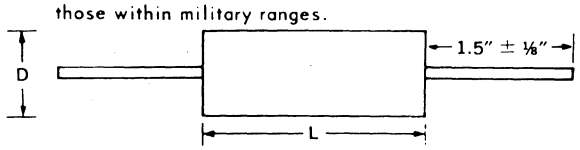
(per MIL-R-11, RS-172 and MIL-R-39008)

Resistance, Nominal Ohms	Test Potential Volts
2.7 to 91 Incl.	0.5 to 1
100 to 910 Incl.	2.5 to 3
1,000 to 9,100 Incl.	8 to 10
10,000 to 91,000 Incl.	24 to 30
0.1 Megohm & Higher	80 to 100

AIRCO Speer Electronic Components
BRADFORD, PENNSYLVANIA TEL 814-362-5536 TWX 510-695-5921
Formerly Speer Resistor Division Speer Carbon Co.

JEFFERS JXP PRECISION METAL FILM RESISTORS

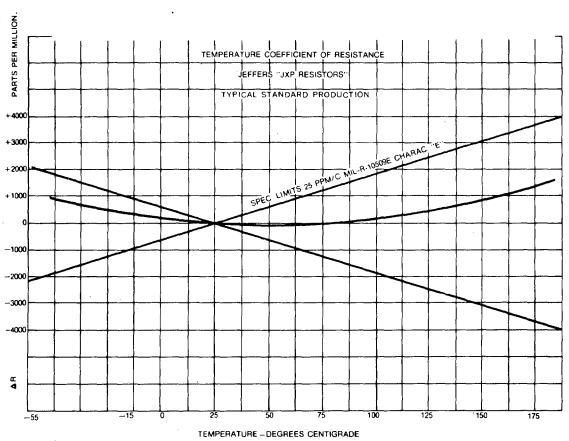
All JXP resistors meet or exceed the requirements for Characteristic E (± 25 ppm/°C) metal film resistors as set forth in MIL-R-10509.
Resistors of any resistance value within the ranges specified in the accompanying table are available for short time delivery. The resistance ranges specified for the commercial listings below are extended beyond standard military ranges. Performance within these ranges, however, is considered to be equivalent to those within military ranges.



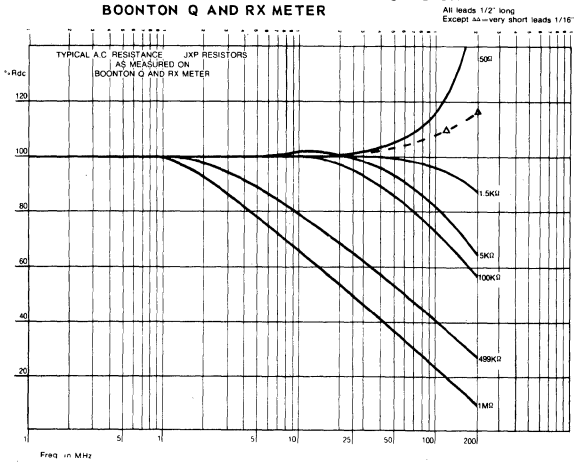
Wattage at 125°C	Military		Commercial		Length A Max.	Diameter B Max.	Axial Lead # Size
	Style	Range	Style	Range			
1/10	RN55E	49.9Ω - 100K	JXP55	25Ω - 150K*	0.260	0.115	#22 AWG
1/8	RN60E	49.9Ω - 499K	JXP60	35Ω - 500K*	0.400	0.136	#22 AWG
1/4	RN65E	49.9Ω - 1M	JXP65	30Ω - 1.5M*	0.590	0.210	#22 AWG
1/2	RN70E	49.9Ω - 1M	JXP70	35Ω - 2.0M*	0.730	0.250	#20 AWG

Special tolerances to ±0.02%. Standard TC: 0 ± 25 ppm/°C (−55°C + 175C). Special TC's to ±5 ppm°C over limited temperature spans.
*Extended ranges may be supplied on special order.
Standard lead material is 100% tin coated low oxygen content copper with a non-borated gold interface.
Other lead materials can be supplied as special order items.

TEMPERATURE COEFFICIENT OF RESISTANCE FOR TYPICAL STANDARD PRODUCTION JXP RESISTORS



TYPICAL A.C. RESISTANCE AS MEASURED ON BOONTON Q AND RX METER



Airco Speer capability as a leading producer of low temperature coefficient, precision resistors is derived from significant proprietary advances in metal film technology and the establishment of a manufacturing facility and product philosophy that is devoted exclusively to production of only the highest grade of precision resistors. This concentration of effort has eliminated the necessary compromises in equipment and processes and reduced the diversion of skills which would otherwise be necessary for the accommodation of a multi-grade product line.

In other words, Airco Speer makes all its parts to a T C of 25 **ppm** or less. It does not "sort" to find production lots which will hopefully contain a large percentage of 25 **ppm** units.

This product plan has resulted in some important contributions to quality and economical precision resistor manufacture. For example:

All operations in the manufacture of JXP precision resistors are carried out under qualified white room conditions, an important factor in statistical reliability.

Shortest delivery available for precision resistors is a natural result of the efficiencies of a manufacturing operation that deals with only one grade of product.

In addition to manufacturing facilities, Airco Speer has complete environmental test facilities, instrument calibration and certified measurement ability for precision resistor evaluation.

You can order standard or custom-tailored JXPs, matched sets —even networks and packaged assemblies. Write:

AIRCO Speer Electronic Components
DUBOIS, PENNSYLVANIA TEL 814-371-2100 TWX 510-693-3096
Formerly Jeffers Electronics Division Speer Carbon Co.

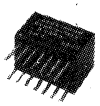
ANGSTROHM PRECISION LADDER NETWORKS

Angstrohm offers a complete product line of standard Ladder Network circuits and encasements designed to accommodate a broad field of applications.

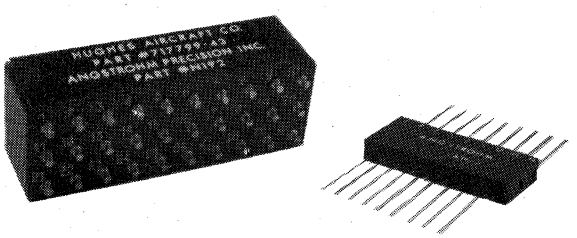
Circuits: R-2R type binary voltage ladders
R-2R type binary current ladders
Current summing networks
4-2-2-1 and 8-4-2-1 type BCD ladders
Related dividers within the same case

Encasements: LB series, molded flatpacks 1/10" thick
LN series, molded flatpacks 3/16" thick
QV series, encapsulated modules—for minimal circuit board space consumption
QH series, low profile encapsulated modules

• Discrete, Monolithic, and Hybrid construction • Standard and interchangeable techniques • Optimized designs for requirements of precision, stability, reliability, cost, and quantity.



Accuracy to ±.005% and ±1 ppm/°C tracking Manned Space, Mil, Industrial applications.



ANGSTROHM PRECISION METAL FILM RESISTORS

C series

Conformally coated epoxy insulated.

Manufactured to exceed the requirements of MIL-R-10509 and MIL-R-55182.



Style	MIL-R-10509	MIL-R-55182	Power 75°C	Rating 125°C	Resistance Range		Max. Dia.	Max. Length
					Standard	Extended		
C50	RN50	RNR50	1/8 w	1/20 w	49.9Ω-100K	10Ω-200K	.078	.170
C55	RN55	RNR55	1/4 w	1/10 w	49.9Ω-100K	10Ω-500K	.098	.260
C60	RN60	RNR60	5/16 w	1/8 w	49.9Ω-499K	10Ω-1.0 meg	.145	.430
C65	RN65	RNR65	1/2 w	1/4 w	49.9Ω-1.0 meg	1.0Ω-3.0 meg	.190	.605

FEATURES:

- Power ratings 1/20 watt to 1/2 watt at 125°C
- Resistance ranges 1.0Ω to 2 megohms
- Resistance tolerances ±1% to ±.05%
- Temp. coeff. from ±10 ppm/°C to ±100 ppm/°C
- Stability levels of ±.5% max. change at 2,000 hrs. load life. Available to ±.25%/yr. load life stability spec.
- Military grade moisture protection
- Leads: tinned copper, gold dumet, nickel, others as specified. All leads per Mil Std. 1276.
- Full conformance to NASA traceability specification NPC 200-3

SPECIAL FEATURES: Specific 100% acceptance testing and lot sampling tests are often applied to C series resistors to verify conformance to customer specifications and/or military specifications.

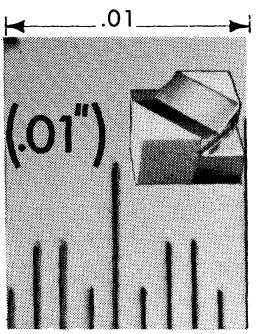
RC Networks

STATE OF THE ART RESISTANCE-CAPACITANCE (RC) NETWORKS

- Conventional size and micro-miniature networks for aerospace, military and computer applications.
- Precision matched for: Filters, Twin T Filter Networks, Loss pass RF Filters, Time Constant Charging Circuits, etc.
- Special form factor resistors to track and match capacitors within ±10 ppm/°C over the temperature range of −55°C to ±125°C.

V series

TYPE V2 — FLIP-TRIM FIXED OR ADJUSTABLE METAL FILM CHIP RESISTOR.



Available either as a fixed or adjustable resistor without moving parts. Flip-Trim (Pat. Pend.) may be supplied factory adjusted or user adjusted before or after installation to up to five times its base value.

CHARACTERISTICS:

- Size: .040" x .040" x .020"
- Ranges available from 10Ω to 4600Ω
- Factory or user adjusted to .02%
- Temperature coefficients to 25 ppm/°C
- Temperature range from −55°C to +175°C
- Power rating is 25 milliwatts at 125°C
- Mounting and electrical connection by means of solder pads on bottom surface.

APPLICATIONS INCLUDE:

- Miniature discrete trimmer chip resistor
- Integrated circuits
- Precision hybrid chip

Phone: (213) 989-3061
TWX 910-495-1795
Telex 65-1410
ANGSTROHM PRECISION INC.
7811 LEMONA AVE., VAN NUYS, CAL. 91405

ANGSTROHM PRECISION MOLDED METAL FILM RESISTORS

S series:

Manufactured to exceed the requirements of MIL-R-55182, specification for established reliability fixed film precision resistors. Their most usual applications are in space equipments and high-reliability weapons, navigational and data systems.



Capabilities and Features:

- 100% acceptance tested (minimum standard process)
  - Short time overload at 6¼ times the 125°C rated power for 5 seconds at 25°C. Maximum ΔR allowed is ±.1% (MIL-R-10509 allows ±.25%).
  - Burn-in 3 hours at 4 times the 125°C rated power at 25°C. Maximum ΔR allowed is ±.1%.
- Vacuum transfer molded epoxy cases
- Operating stabilities to 100 ppm/yr
- Resistance tolerances down to ±.02%
- Resistance values from 1.0Ω to 5.0 megohms
- Temperature coefficient tolerances to ±5 ppm/°C
- Specific nominal temperature coefficients other than zero may be specified
- Matched sets to ±.01% and ±1 ppm/°C tracking
- Traceable factory serialization and data documentation
- 100% acceptance testing for load life, temperature cycling, thermal shock, X-ray, microscopic visual inspection, etc.
- Minimum standard Lot Quality Assurance in accordance with MIL-R-55182 monthly, quarterly and semi-annual requirements for level R (.01%) failure rate; (proved better than .002%)
- Full conformance to NASA specification NPC 200-3
- Choice of weldable and/or solderable leads

Style	MIL-R 55182	Power Rating 75°C	Power Rating 125°C	Resistance Range Standard	Resistance Range Extended	Max. Diameter	Max. Body Length
S25	RNR50	1/10 w	1/20 w	49.9Ω - 100K	10Ω - 200K	.067	.165
S50	RNR50	1/10 w	1/20 w	49.9Ω - 100K	10Ω - 200K	.076	.175
S51	RNR54	1/5 w	1/10 w	49.9Ω - 200K	10Ω - 500K	.098	.275
S51	RNR55	1/5 w	1/10 w	49.9Ω - 100K	10Ω - 500K	.098	.275
S57	RNR57	1/4 w	1/8 w	49.9Ω - 500K	10Ω - 1.5 meg	.165	.296
S60	RNR60	1/4 w	1/8 w	49.9Ω - 500K	10Ω - 2.0 meg	.165	.390
S62	—	1/4 w	1/8 w	49.9Ω - 400K	10Ω - 1.5 meg	.098	.385
S63	RNR63	1/2 w	1/4 w	49.9Ω - 1.0 meg	20Ω - 3.0 meg	.240	.575
S65	RNR65	1/2 w	1/4 w	49.9Ω - 1.0 meg	10Ω - 3.0 meg	.225	.675
S70	RNR70	1 w	1/2 w	24.9Ω - 1.0 meg	20Ω - 5.0 meg	.327	.765
S75	—	2 w	1 w	30Ω - 2.0 meg	20Ω - 10 meg	.430	1.095

J series:

- Qualified for manned space flight applications. Qualification and 10,000 hrs life tested by NASA Contractor's Laboratories.
- Provides 100% Contractor's yield to Reliability Screening tests
- Individually traceable Serial Numbered parts and test data; data shipped with parts.

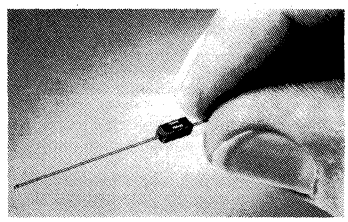
J SERIES resistors are basically the S series product with the concept of 100% reliability screening extended to include several and combined full rated and overstress tests, and unit traceable documentation. Tests include Short Time Overload, Six hours Burn-in, Temperature Cycling, 168 hours Load Life, Temperature Coefficient, and Microscopic Visual Inspection. Refer to J series detail bulletin.

- Sizes and Power Ratings: same as available in S series
- Resistance Values: 5.0Ω to 5.0 megohms, refer to detail catalog
- Resistance Tolerances (after testing): ±1%, ±.5%, ±.25%, and ±.1%
- Temperature Coefficients: from ±100 ppm/°C to ±5 ppm/°C.

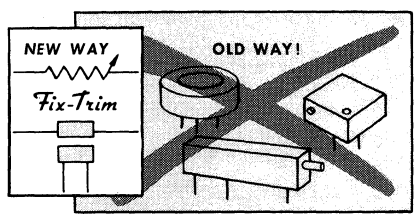
Fix-Trim™... the ONE-for-MANY RESISTOR

for Development or Production

• Adjustable • Subminiature • Molded

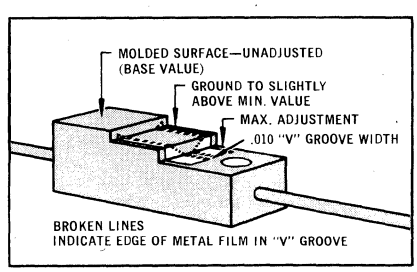


Unequalled flexibility. Metal Film stability. Unique internal construction.



Fix-Trims can replace trimming pots, and are ideal for *precision* hybrid circuits. Each Fix-Trim provides wide range adjustability. Only 3 base ranges are needed to replace 96 fixed resistor 1% values or 192 .25% standard values per decade.

Simple, easy adjustment even in active circuits—with infinite resolution, and accuracies to ±0.02%.



Above: Grinding removes molded top surface first; then portions of "V" groove resistance element from high alumina substrate, increasing length: width ratio —and resistance value proportionately. Epoxy mold material covering remainder of metal film element provides mechanical and environmental protection, which may be improved by overcoating or potting.

Meet MIL-R-55182 & 10509 performance requirements. Base ranges cover 10Ω to 50,000Ω. .05 Watt at 125°C. Size .090" x .085" x .200" with 1" leads. Temp. coefficient 100, 50 and 25 ppm/°C. Weight .25 grams. Un-molded, leadless, solderable Fix-Trim "chip" elements and molded radial lead Fix-Trims are also available.

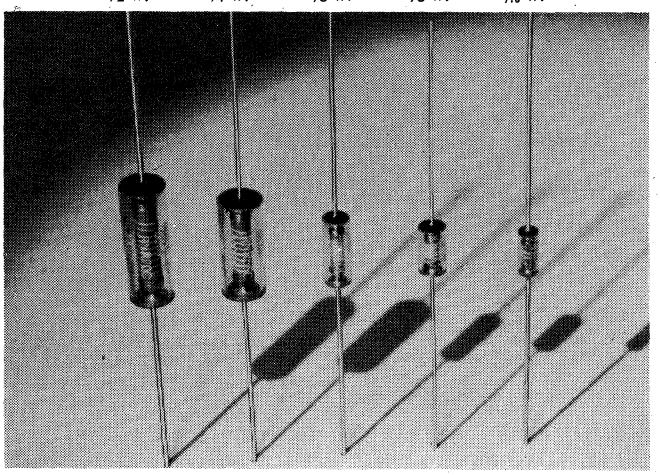
Fix-Trim "Starter Kits," laboratory and production adjusting systems now available.

Phone: (213) 989-3061
TWX 910-495-1795
Telex 65-1410
ANGSTROHM PRECISION INC.
7811 LEMONA AVE., VAN NUYS, CAL. 91405

WARD LEONARD ELECTRONIC COMPONENTS

HERMETIC SEAL METAL FILM RESISTORS per MIL-R-55182

WLH70 RNR70 ½ w. | WLH65 RNR65 ¼ w. | WLH60 RNR60 ⅛ w. | WLH57 RNR57 ⅛ w. | WLH55 RNR55 1/10 w.



Features

- Hermetic enclosure
- Inert gas environment
- To MIL-R-55182 specs, styles RNR and RNN
- Ultimate in extended life and reliability
- 1/10, ⅛, ¼, ½ watt sizes (5 case sizes)

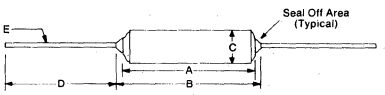
For today's sophisticated aerospace, military and oceanography programs ... wherever the application or environment demands the ultimate in resistor reliability, Ward Leonard's hermetically sealed metal film resistors are unquestionably first-choice. The WLH glass-to-metal hermetic seal protects the resistance element from virtually any adverse environmental influence.

Designations		Watt Rating @ 125°C	Volts Max.	Resistance Range in Ohms		Approx. Dimensions (in inches)					Weight GMS (approx.)
MIL-55182 Style	W.L. Style			Min.	Max.	A max.	B max.	C-dia. max.	D nom.	E AWG	
RNR55	WLH55	1/10	200	49.9	100K	.281	.311	.120	1.50	#22	.314
RNR57	WLH57	⅛	200	10.0	200K	.311	.362	.160	1.25	#24	.317
RNR60	WLH60	⅛	250	49.9	499K	.437	.500	.165	1.50	#22	.485
RNR65	WLH65	¼	300	49.9	1.0 Meg.	.655	.740	.250	1.50	#22	.950
RNR70	WLH70	½	350	24.9	1.0 Meg.	.796	.880	.260	1.50	#20	1.300

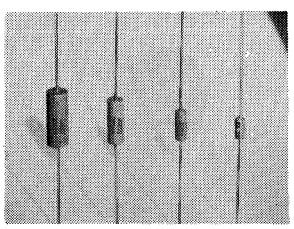
TEMPERATURE COEFFICIENT CODE

MIL-R-55182 Characteristic	Resist. Temp. Coef. from −55°C to +175°C
C	±50PPM/°C
E	±25PPM/°C

RESISTANCE TOLERANCE: ±1%
Mil Part #RNR—C—FP



RESISTORS per MIL-R-10509 Char. C, D & E



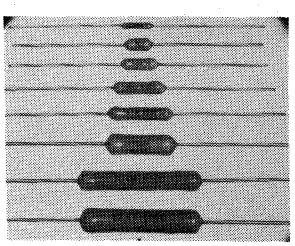
- Precision metal film
- Molded and conformal
- Full ohmic range
- Close TC's and tolerances
- Stock, made-to-order and custom designed

Designations			Watt Ratings @ 125°C	MIL Range Ohms	
MIL	Molded W.L.	Conformal W.L.		Min.	Max.
RN50	—	WLC50	1/20	10.0	100K
RN55	WL55	WLC55	1/10	49.9	100K
RN60	WL60	WLC60	⅛	49.9	499K
RN65	WL65	WLC65	¼	49.9	1 Meg.
RN70	WL70	WLC70	½	49.9	1.5 Meg.

Note: Tolerances ±1 to ±.05%. Matched sets to order.

POWER RESISTORS

Wire-Wound Enamel and Silicone Coated

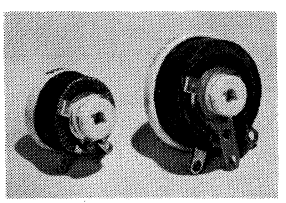


- Fixed, adjustable and non-inductive styles
- Axial lead 1 to 12.5 w.
- Tab Type 5 to 550 w.
- Wide ohmic range
- Broad selection of terminals, mountings and enclosures

Ward Leonard offers an extensive line of power resistors for MIL and industrial use both stock and made-to-order. High quality ceramic cores, vitreous enamel or silicone protective coatings and low TC resistance wire afford high stability and overload capacity. Axial lead MIL-R-26 resistors to 14 w.; tab terminal to 210 w. Send for RESISTOR catalog.

POWER RHEOSTATS

Features



- **Vitreous enamel bonded**
- **Molded high density ceramic base and ring**
- **Uniform resistance winding**
- **12.5 to 300 w. in six sizes**
- **Designed to MIL-R-22 specs**

Ward Leonard's top quality vitreous enamel wire-wound power rheostats belong in your specs for ground support and test equipment, process controls and a broad variety of electronic and industrial uses ... when performance must be reliable. Stocked in over 39 popular resistance values, they are available with a broad selection of accessories and special features. Short delivery cycle on manufactured items. Write for catalog.

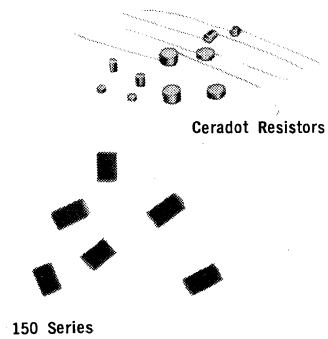
Designations		Watts 300°C rise 40° amb.	Ohms Range		Ring Diameter
WL	MIL		Min.	Max.	
MP06	RP06	12.5	1	5K	7/8"
MP10	RP10	25	1	5K	1 15/16"
MP15	RP15	50	0.5	10K	2 3/32"
100R	—	100	1	10K	3 5/32"
150R	—	150	1	10K	4"
300R	—	300	1	2.5K	6"

WARD LEONARD
SUBSIDIARY OF RIKER CORPORATION
Main Plant: 75 South St., Mt. Vernon, N. Y. 10550
Tel.: 914-664-1000 TWX 914-699-4997
Metal Film Div.: Box 1827, Hagerstown, Md. 21740
Tel.: 301-739-8722 TWX 710-853-6834
Affiliated with Angstrohm Precision, Inc.

CTS CORPORATION ELKHART, INDIANA

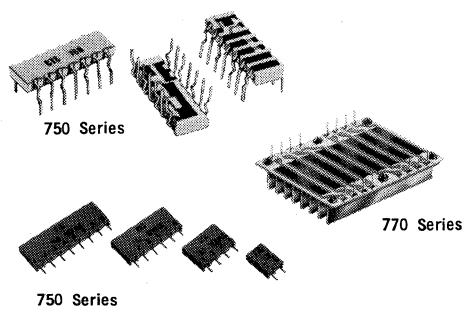
RESISTORS & RESISTOR MODULES

SOLID CERMET PELLET AND CHIP RESISTORS



	Series					
	A	B	C	E	150	151
Size, Dia. x Length	.050" x .030"	.100" x .062"	.050" x .062"	.100" x .030"	.075" x .050" x .030"	.090" x .050" x .030"
Minimum Resistance	50Ω	25Ω	100Ω	15Ω	200Ω	200Ω
Maximum Resistance	100KΩ	50KΩ	200KΩ	25KΩ	350KΩ	350KΩ
Wattage Rating at 125°C	1/10	1/8	1/10	1/10	1/8	1/8
Temp. Coefficient, ppm/°C	±300	±300	±300	±300	±300	±300
Voltage Rating	50V	50V	50V	50V	50V	50V
Standard Res. Tolerance	±10%	±10%	±10%	±10%	±10%	±10%
Spec. Res. Tol. Avail.	5%, 2%, 1%	5%, 2%, 1%	5%, 2%, 1%	5%, 2%, 1%	5%, 2%, 1%	5%, 2%, 1%
Termination—Gold	Yes	Yes	Yes	Yes	Yes	Yes
Termination—Plat. Gold	Yes	Yes	Yes	Yes	Yes	Yes
Termination—Tinned	Yes	Yes	Yes	Yes	Yes	Yes
Termination—Silver	No	No	No	No	Yes	Yes
Termination—Leaded	Yes	Yes	Yes	Yes	No	No
Order From	Lafayette	Lafayette	Lafayette	Lafayette	Lafayette	Lafayette

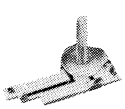
RESISTOR MODULES



	Series		
	750	760	770
Description	2, 4, 6 and 8 pin in-line modules on .125" lead centers	14 and 16 pin dual in-line modules on .100" lead centers	1.5" x 1.225" high, power terminating module on .125" lead centers. Supplied with and without heat sink.
Minimum Resistance			
Maximum Resistance	10Ω	10Ω	10Ω
Wattage Rating	1 MegΩ	1 MegΩ	1 MegΩ
Std. Temp. Coefficient in ppm/°C	8 pin—2.0 watts 4 pin—1.0 watts	1.0 Watt	8 to 20 Watts
Spl. Temp. Coefficient in ppm/°C	±300 ±150	±300 ±150	Contact Factory Contact Factory
Std. Resistance Tol.	±5%	±5%	±1%
Spl. Resistance Tol.	±0.5%	±1%	±0.5%
Order From	Berne	Berne	Lafayette

POTENTIOMETER-RESISTOR NETWORK

670 SERIES



A potentiometer-resistor network for high voltage circuits where an adjustable pick-off is desired.

Resistance Range:
R1—1-50 Megohms
R2—1-30 Megohms
R3—1-25 Megohms
R4—1-10 Megohms

Standard Resistance Tolerance: ±30%

Minimum Resistance Tolerance:
R1, R3 & R4—±10%
R2 —±25%

Max. Voltage Rating—8000 V

Power Rating—3 watts @ 55°C

Mfg. at Elkhart

HIGH VOLTAGE RESISTOR

680 SERIES



High resistance, high voltage Cermide resistor available with and without taps. It is designed for bleeder resistor, voltage divider networks and other high voltage applications.

Resistance Range:
20K Ohms to 1,000 Megohms

Standard Resistance Tolerance—±30%

Minimum Resistance Tolerance—±10%

Max. Voltage Rating—30,000 V

Power Rating—3.5 watts @ 55°C

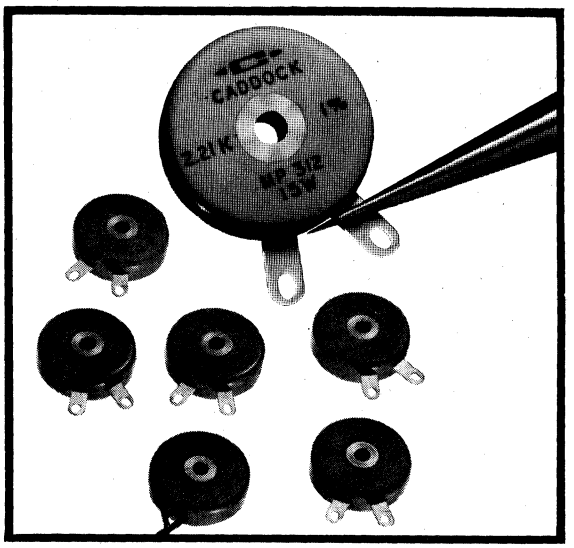
Mfg. at Elkhart

ORDERING INFORMATION:

Place orders at locations shown above, using the following addresses:

CTS of Berne, Inc., 406 Parr Road, Berne, Indiana 46711 • Telephone 219-589-3111 • TWX 810-323-1580
CTS Microelectronics, Inc., P.O. Box 1278, Lafayette, Indiana 47902 • Telephone 317-463-2565 • TWX 810-342-1882
CTS of Elkhart, Div., 1142 W. Beardsley Ave., Elkhardt, Indiana 46514 • Telephone 219-JA3-0210 • TWX 810-294-2256

NEW TYPE MP POWER FILM RESISTORS*
CHASSIS MOUNTED

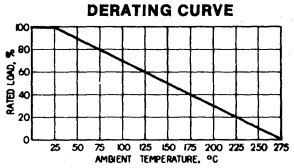


Features: High Stability Micronox Film Element ■ Non-Inductive ■ Higher Resistance Range ■ Lower Cost ■ Low Profile—Smaller Size—Lighter Weight

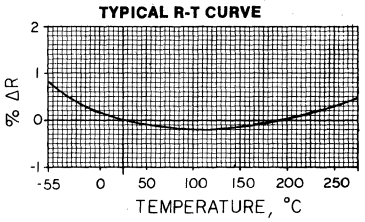
Micronox film is fired on high strength ceramic substrate; then mounted on anodized aluminum base. This construction gives vastly improved efficiency in heat transfer from resistor element to chassis. Molded silicone encases the electrical elements for high environmental performance.

*PATENTS PENDING

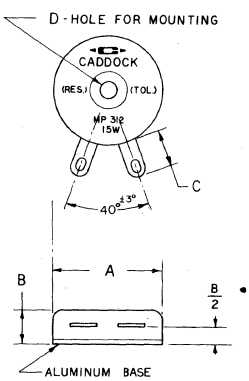
DERATING CURVE



TYPICAL R-T CURVE



Model No.	Power Rating† (watts)	Max. Voltage	Diele. Str.	High Temp. TC ppm/°C‡	Resistance Range Min.	Resistance Range Max.	Dimensions A	Dimensions B	Dimensions C	Dimensions D	Terminals
MP311	15	300	600	50	50Ω	200K	.600 ±.015	.188 ±.010	—	.092 ±.002	12" Teflon Leads 26 AWG 7x34
MP312	15	300	600	50	10Ω	200K	.600 ±.015	.188 ±.010	.185 ±.015	.092 ±.002	Gold Plated Solder Lugs
MP329	30	450	1000	50	50Ω	200K	.850 ±.015	.250 ±.015	—	.142 ±.002	12" Teflon Leads 22 AWG 7x30
MP330	30	450	1000	50	10Ω	200K	.850 ±.015	.250 ±.015	.250 ±.015	.142 ±.002	Gold Plated Solder Lugs



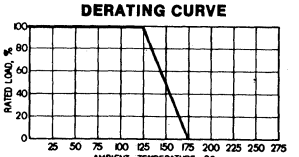
†Rating based on chassis mounting—MP311 and MP312 on 4x6x2x.040 aluminum chassis
MP329 and MP330 on 5x7x2x.040 aluminum chassis

‡Temperature Coefficient: Referenced to 25°C, ΔR taken at +150°C and +275°C. (Low temp. TC will be nominally —85ppm/°C at —55°C. See typical Temperature-Resistance curve.)

Resistance Tolerance: ±1% Standard. (Other tolerances available on special order). **Insulation Resistance:** 5000Meg dry. **Thermal Shock:** Per Mil R 18546-D, max. R shift .5% or .5Ω, whichever is greater. **Overload:** 5 times rated power for 5 seconds per Mil R 18546-D, max. R shift .5% or .5Ω, whichever is greater. **Moisture Resistance:** Per Mil Std 202, Method 106, as modified by Mil R 18546, max. R shift .5% or .5Ω, whichever is greater. **Shock:** 50G, per Mil Std 202, Method 205, test condition C, max. R shift .2%, or .5Ω, whichever is greater. **Vibration:** Per Mil Std 202, Method 204, test condition B, max. R shift .2% or .5Ω, whichever is greater. **Loadlife:** 1000 hrs., per Mil R 18546-D, chassis mounted, max. R shift 1% or .5Ω, whichever is greater.

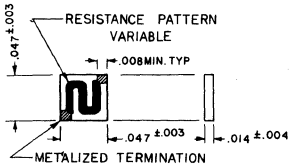
NEW TYPE MC PRECISION CHIP RESISTORS
(10Ω to 7.5 Megohm) for Hybrid Circuit Application

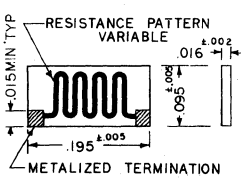
DERATING CURVE



Now the precision and stability of discrete Micronox film components is available for hybrid circuit application. Film is fired on alumina substrate. Terminations are gold alloy, suitable for gold ball bonding (thermo-compression or ultrasonic) and for aluminum wire bonding (ultrasonic). MC625 can be tinned for solder reflow connections. Back side of chip is metalized with gold alloy for ultrasonic bonding or soldering to header or substrate.

Model No.	Power Rating†	Max. Voltage	Max. Oper. Temp.	Dielect. Str.	TC ‡ ppm/°C	Resistance Range Min.	Resistance Range Max.
MC115	.15	100	175°C	300	80	10Ω	400K
MC625	.25	300	175°C	300	80	.4Meg	7.5Meg

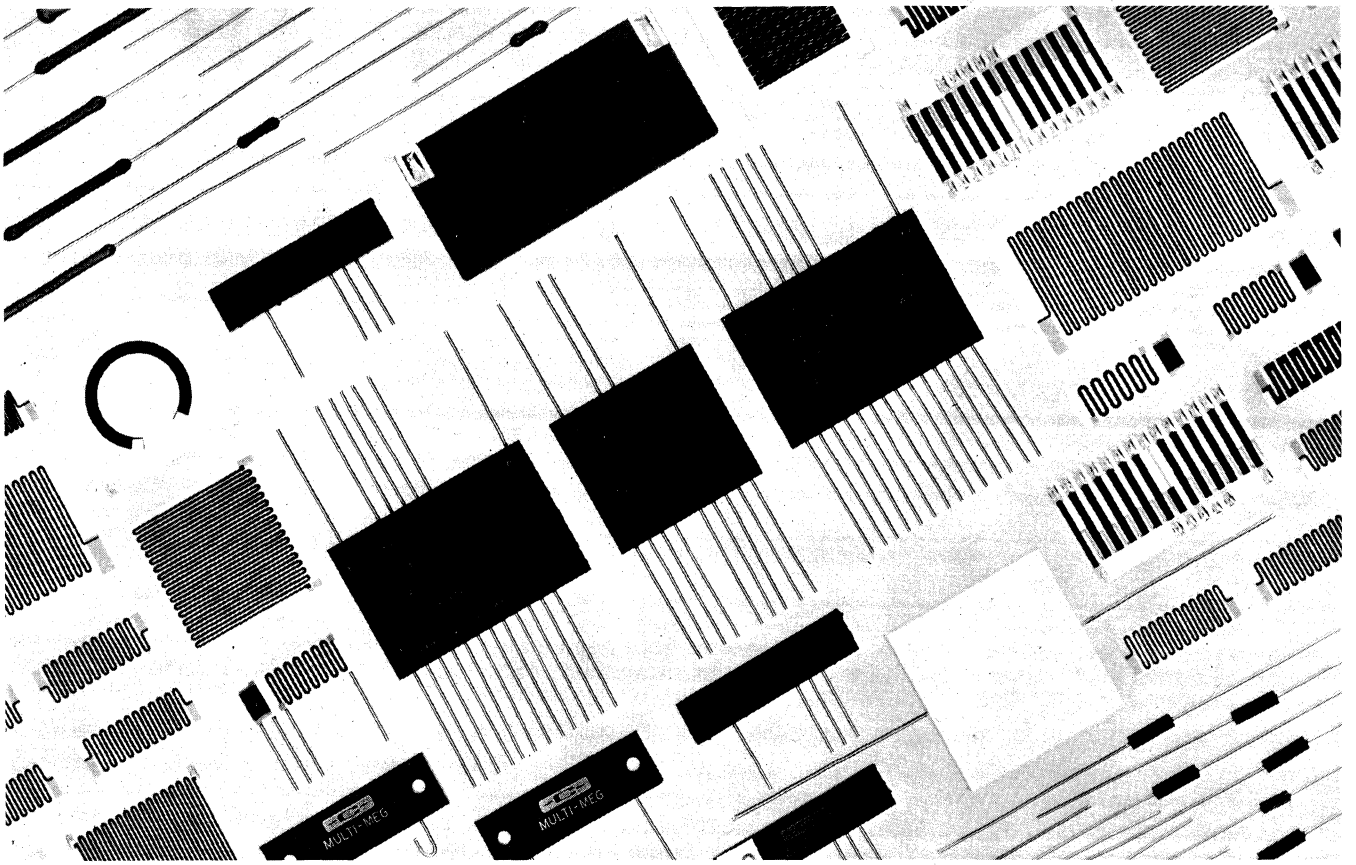




†When mounted on metal or ceramic base with 10x chip area min.
‡Temp. Coefficient Referenced to 25°C, ΔR at —15°C and +105°C. **Resistance Tolerance:** ±1% standard (other tolerances available on special order). **Insulation Resistance:** 10,000Meg (dry, 100V) **Temperature Cycling:** Mil Std 202, Method 102, Test Condition C, max. R shift .5%, or .5Ω whichever is greater. **Overload:** 5x rated power for 5 seconds, max. R shift .5%, or .5Ω, whichever is greater. **Over Voltage:** 1.5x max. voltage for 5 seconds, max. R shift .5% or .5Ω whichever is greater. **Loadlife:** 1000 hrs. at rated power, max. R shift .5%, or.5Ω, whichever is greater.

CADDOCK ELECTRONICS

3127 Chicago Avenue, Riverside, California 92507 • Telephone: (714) 683-5361

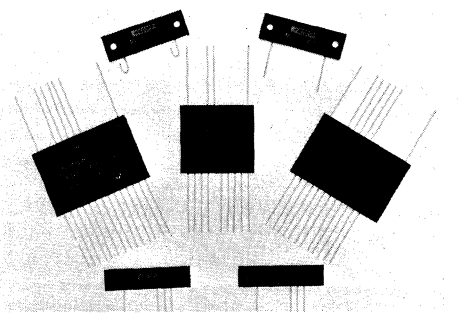


SPECIAL RESISTIVE DEVICES

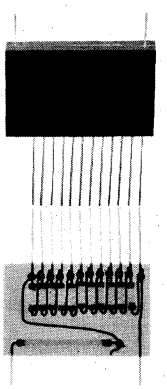
Caddock produces miniature wirewound and film resistors, as well as networks on ceramic substrate. We can combine the best of these techniques in producing your special resistor or network requirement.

- **HIGH RESISTANCE RESISTORS to 5000 megs, 1%, 80 PPM/°C**
- **PRECISION VOLTAGE DIVIDERS with tracking as close as 2 PPM/°C**
- **DAC LADDER NETWORKS to 12 bits, and DECADE NETWORKS to your specs**

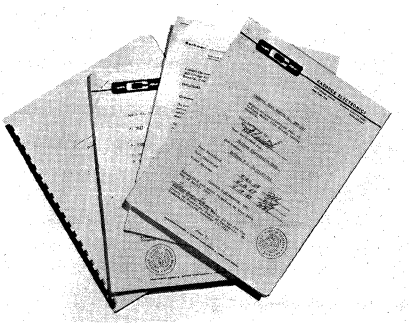
Send us prints or sketches on your specific requirement for a prompt design and cost proposal.



MOLDING FACILITIES equipped to produce your package design, or mold your networks in available package configurations.



X-RAY FACILITIES available to verify and assure integrity and soundness of package—up to 100% inspection.



TESTING FACILITIES to supply output and performance data under actual operating temperature extremes. Qualifying test data available to satisfy qualification requirement on similar devices.

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CADDOCK ELECTRONICS 3127 Chicago Avenue, Riverside, California 92507 • Phone (714) 683-5361

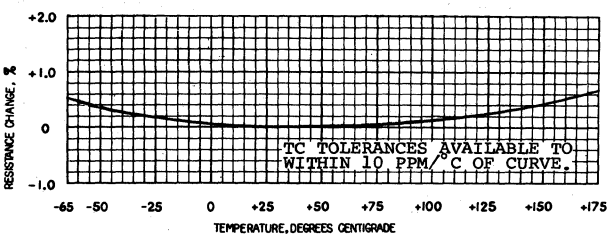
CADDOCK ADVANCED STATE OF THE ART

MICRONOX* Resistance Films

Micronox resistance films are produced exclusively by Caddock Electronics. They are composed of complex oxides fired in air at temperatures above 1400°F. The resulting films are relatively insensitive to high ambient temperatures and thermal shock. Precision resistors, useable to 1000°F. can be made with these films. The films show negligible effect from moisture.

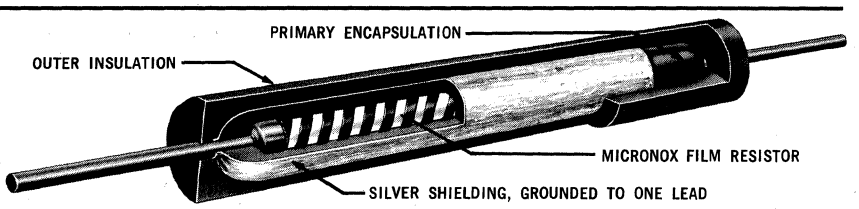
This totally new approach to precision resistors and networks opens new design possibilities because of the wide resistance range, precise temperature characteristics, and high temperature and power capability. Temperature coefficient can be accurately reproduced (±10ppm/°C. if required). The typical curve shown will vary slightly with resistivity of the film and configuration of the substrate.

Micronox oxide systems provide an almost continuous range of resistivity from 5 ohms per square to 25,000 ohms per square, without degradation of electrical characteristics throughout this range.

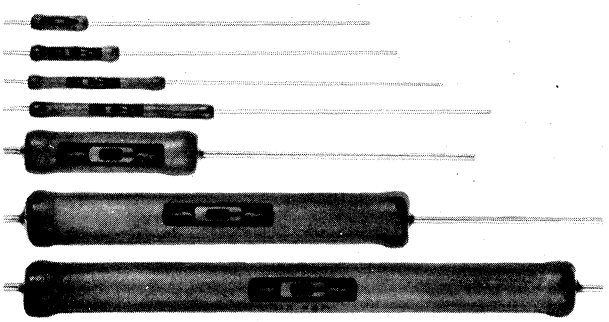


TYPE MG & MH Miniature Megohm Resistors

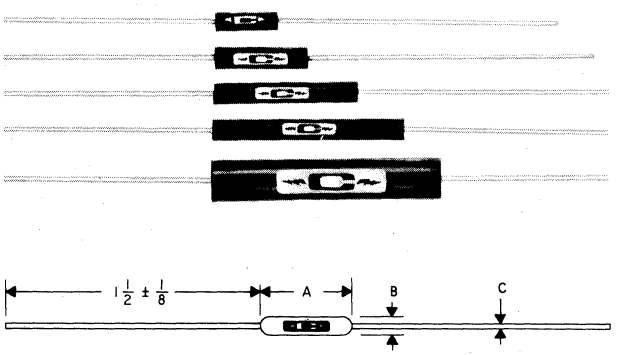
EXCLUSIVE SHIELDED RESISTOR MODEL MH711, designed for extremely high voltage applications, in very high resistance strings. Unit remains exceptionally stable since shielding prevents film degradation from corona developed in high voltage fields.



TYPE MG



TYPE MH

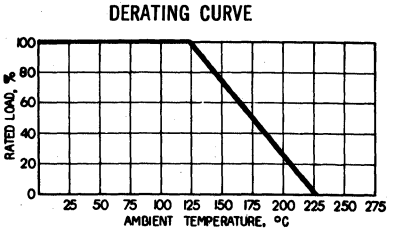


Miniaturized to one-fifth the size of conventional types, covering the 1 to 220 megohm range. Micronox film sintered on high strength core. End cap construction.

Resistance Tolerance: ±1% (tolerances to .2% on special order). **Insulation Resistance:** 100 megohms, minimum. **Overvoltage:** 1.5 times working voltage for 5 seconds, R shift .8% max. **Thermal Shock:** MIL-STD-202, method 107, cond. C, R shift .5% max. **Moisture Resistance:** MIL-STD-202, method 106, R shift .8% max. **Loadlife:** 1000 hours at rated power, R shift .8% max.

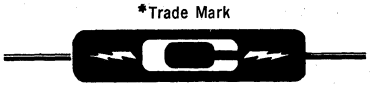
Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encapsulation	Leadwire
						Min.	Max.	A	B	C		
MG 650	.5	600	225°C	750	80	500 K	5 meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MG 660	.6	1000	225°C	750	80	1 meg	10 meg	.500 ±.030	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MG 680	.8	1500	225°C	750	80	1 meg	15 meg	.750 ±.030	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MG 710	1.0	2000	225°C	750	80	1 meg	20 meg	1.000 ±.040	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MG 721	2.0	2500	225°C	1000	80	1 meg	30 meg	1.000 ±.050	.240 ±.030	.040 ±.002	Silicone Conformal	Tinned Copperweld
MG 750	3.0	3000	225°C	1000	80	3 meg	150 meg	2.125 ±.060	.315 ±.030	.040 ±.002	Silicone Conformal	Tinned Copperweld
MG 780	5.0	4000	225°C	1000	80	4 meg	220 meg	3.125 ±.060	.315 ±.030	.040 ±.002	Silicone Conformal	Tinned Copperweld
MH 651	.5	600	175°C	750	80	500 K	5 meg	.313 ±.020	.094 ±.006	.025 ±.002	Black Molded Type	Gold Plated Dumet
MH 661	.6	1000	175°C	2000	80	1 meg	10 meg	.500 ±.030	.114 ±.010	.025 ±.002	Black Molded Type	Gold Plated Dumet
MH 681	.8	1500	175°C	2000	80	1 meg	15 meg	.750 ±.030	.114 ±.010	.025 ±.002	Black Molded Type	Gold Plated Dumet
MH 713	1.0	2000	175°C	2000	80	1 meg	20 meg	1.000 ±.030	.114 ±.010	.025 ±.002	Black Molded Type	Gold Plated Dumet
	Type MH with special internal shielding, designed to eliminate degradation due to corona											
MH 711	1.0	2000	175°C	2000	80	1 meg	20 meg	1.200 ±.040	.220 ±.015	.025 ±.002	Black Molded Type	Gold Plated Dumet

DERATING CURVE



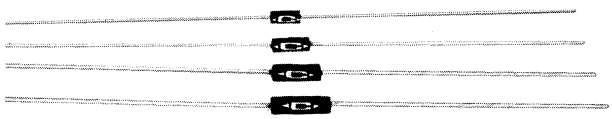
†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

*Trade Mark

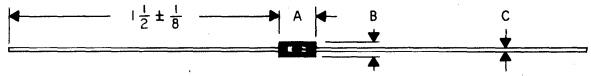


MICROMINIATURE FILM RESISTORS

TYPE ML & MM Precision Film Resistors



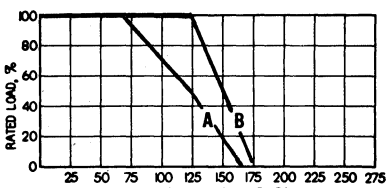
Micronox film on high strength core for greater resistance range. End cap construction. Molded type case for increased resistance to abrasion and solvents. Twice the power rating of metal film resistors of a given size.



Resistance Tolerance: ±1% (tolerances to .1% on special order). **Insulation Resistance:** 100 megohms, minimum. **Overload:** 5 times rated power for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater. **Overvoltage:** 1.5 times max. voltage for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater. **Thermal Shock:** MIL-STD-202, method 107, cond. B, R shift .2% max., or .5 ohms max., whichever is greater. **Moisture Resistance:** MIL-STD-202, method 106, R shift .5% max., or .5 ohms max., whichever is greater. **Loadlife:** 1000 hours at rated power, R shift .5% max., or .5 ohms, whichever is greater.

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encapsulation	Leadwire
						Min.	Max.	A	B	C		
ML 104	.08	200	175°C	400	50	50Ω	300 K	.160 ±.010	.065 ±.010	.016 ±.002	Green Molded Type	Gold Plated Dumet
ML 114	.15	200	175°C	500	50	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Green Molded Type	Gold Plated Dumet
ML 123	.10	200	165°C	450	100	50Ω	600 K	.250 ±.020	.094 ±.006	.025 ±.002	Green Molded Type	Tinned Copperweld
ML 124	.25	300	175°C	750	50	50Ω	600 K	.250 ±.020	.094 ±.006	.025 ±.002	Green Molded Type	Gold Plated Dumet
ML 131	.4	500	175°C	750	50	50Ω	1 meg	.313 ±.020	.094 ±.006	.025 ±.002	Green Molded Type	Gold Plated Dumet
MM 112	.12	200	175°C	400	50	10Ω	500 K	.160 ±.010	.065 ±.010	.016 ±.002	Black Molded Type	Gold Plated Dumet
MM 125	.25	200	175°C	500	50	10Ω	1 meg	.188 ±.020	.070 ±.015	.020 ±.002	Black Molded Type	Gold Plated Dumet
MM 152	.4	300	175°C	750	50	10Ω	2 meg	.250 ±.020	.094 ±.006	.025 ±.002	Black Molded Type	Gold Plated Dumet
MM 177	.6	500	175°C	750	50	20Ω	5 meg	.313 ±.020	.094 ±.006	.025 ±.002	Black Molded Type	Gold Plated Dumet

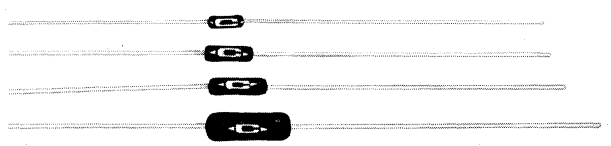
DERATING CURVE



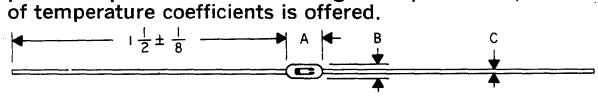
A—ML 123 B—MM & ML

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

TYPE MR & MS Power Film Resistors



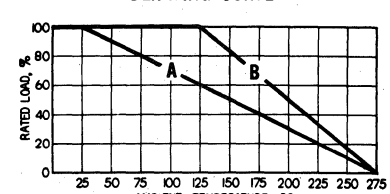
Micronox film on high strength core. End cap construction. Featuring smallest size for given power ratings. Specially designed with a wide range of resistance values for high temperature operation. For less stringent requirements, a choice of temperature coefficients is offered.



Resistance Tolerance: ±1% (tolerances to .1% on special order). **Insulation Resistance:** 100 megohms, minimum. **Overload:** 5 times rated power for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater. **Overvoltage:** 1.5 times max. voltage for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater. **Thermal Shock:** MIL-STD-202, method 107, cond. C, R shift .5% max., or .5 ohms max., whichever is greater. **Moisture Resistance:** MIL-STD-202, method 106, R shift .5% max., or .5 ohms max., whichever is greater. **Loadlife:** 1000 hours at rated power, R shift .5% max., or .5 ohms max., whichever is greater.

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encapsulation	Leadwire
						Min.	Max.	A	B	C		
MR 129	.25	200	275°C	500	150	10Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Nickel
MR 154	.40	300	275°C	750	150	10Ω	1 meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MR 178	.60	500	275°C	750	150	20Ω	3 meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MS 126	.25	200	275°C	500	50	10Ω	1 meg	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated Dumet
MS 150	.5	—	275°C	500	50	10Ω	2 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated Dumet
MS 151	.5	300	275°C	750	50	10Ω	2 meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 175	.75	—	275°C	750	50	10Ω	2 K	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 176	.75	500	275°C	750	50	20Ω	5 meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 210	1.0	—	275°C	750	50	20Ω	3 K	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 220	2.0	—	275°C	750	50	50Ω	4 K	.400 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal	Tinned Copperweld

DERATING CURVE



A—Models MS150, MS175, MS210, MS220
B—all MR models, and MS126, MS151, MS176

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

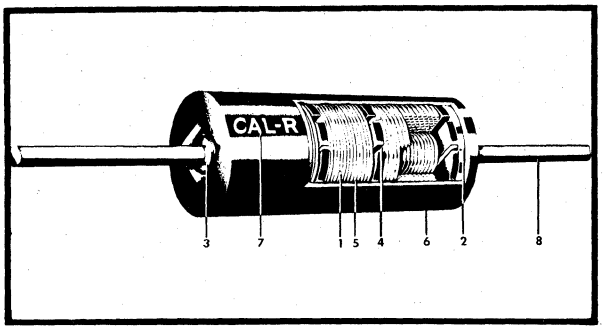
CADDOCK ELECTRONICS
3127 Chicago Avenue, Riverside, California 92507 • Telephone: (714) 683-5361

CAL-R, INC.

CALIFORNIA RESISTOR DIVISION

CAL–R Precision Wire Wound Resistors are manufactured to the most exacting specifications insuring compliance with the stringent requirements of both military and commercial applications. All **CAL–R** resistor products are produced using unique proprietary methods of construction resulting in highly reliable performance characteristics. Selections can be made from standard and customized miniature wire wound bobbin styles, silicone coated axial lead power and deep finned metal clad chassis mount power resistors as well as precision resistor networks.

wire wound bobbin resistors – miniature



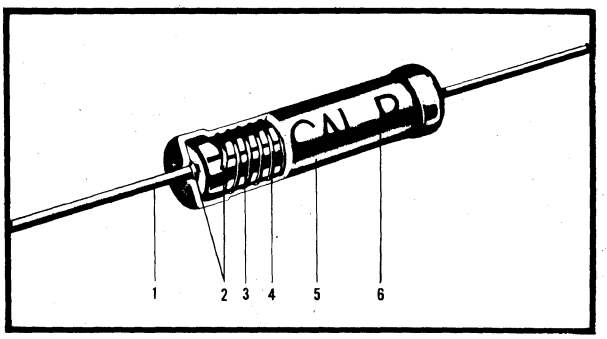
OUTSTANDING FEATURES

1. All pies filled for maximum heat dissipation.
2. Unique recessed end cap designed to isolate winding termination from all lead stress.
3. Terminals welded to end cap for maximum strength.
4. Double slots tangent to mandrel to prevent shorting between pie windings.
5. Protective overcoating covering entire resistor before molding.
6. Resistor element encased in non-burning epoxy by transfer molding techniques.
7. Marking ink of catalyzed epoxy will withstand all standard printed circuit board solvents.
8. Standard lead . . . 50 micro inch gold plate over annealed Dumet.

ELECTRICAL CHARACTERISTICS

- **Tolerance:** 1 to 0.005% absolute. To 0.002% matching tolerance for matched sets.
- **Temperature Coefficient:** 10 ppm/°C is standard. Special TC's in ranges from +6000ppm to 2ppm/°C available.
- **Windings:** Multiple pie reversed type to minimized inductance.
- **Resistance:** Ranges .1 ohm to 10 megohms.
- **Environmental:** Meets or exceeds all requirements of MIL-R-93D.

precision power resistors



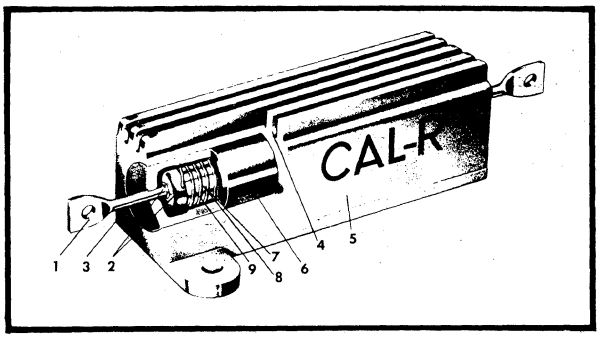
OUTSTANDING FEATURES

1. Tinned copperweld leads are standard. Nickel A or Alloy 180 available.
2. Completely welded construction . . . terminal to terminal.
3. Core alumina and steatite ceramics, centerless ground for uniformity, chemically treated for utmost purity of winding surface.
4. Resistance wire . . . procured to exacting specifications.
5. Tough silicone coating to give maximum wire protection and extra high resistance to moisture.
6. Marking ink of catalyzed epoxy will withstand most printed circuit solvents.

ELECTRICAL CHARACTERISTICS

- **Tolerances:** 5.0% to .01% . . . 1% standard for off-shelf delivery.
- **Temperature Coefficient:** 20 ppm/°C standard. Special TC's to 5 ppm/°C available.
- **Dielectric strength:** Greater than 1000 V.A.C.
- **Thermal Shock:** SA & SAX Types from 275°C to −55°C. SAV & SAVX Types from 350°C to −55°C.
- **Resistance Range:** From 0.05 ohms to 250K ohms.
- **Inductive Types (SA & SAV):** Single layer space wound with largest wire permissible.
- **Non-Inductive Types (SAX & SAVX):** Dual balanced windings for minimum inductance.
- **Environmental:** Meets or exceeds requirements of MIL-R-26E.

power resistors – metal clad chassis mount

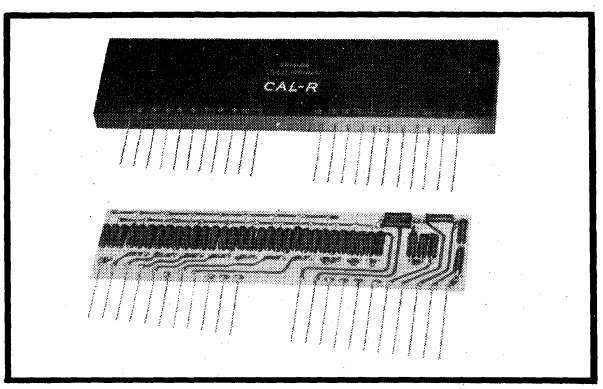


OUTSTANDING FEATURES

1. Tinned copperweld leads standard.
2. Completely welded construction . . . terminal to terminal.
3. High density extruded aluminum housing provides superior heat conduction.
4. Housing deep finned for maximum heat dissipation.
5. Distinctive gold anodized finish for maximum resistance to extreme environmental conditions.
6. Special molding compound with high thermal conductivity of $25/cal/sec/cm^2/degree\ C/cm \times 10^{-4}$.
7. Windings . . . High uniformity single layer space wound, designed to give maximum core coverage for even heat dissipation.
8. Resistance wire . . . Procured to exacting specifications.
9. Core . . . Steatite ceramic, centerless ground for uniformity, chemically treated for utmost purity of winding surface.

ELECTRICAL CHARACTERISTICS

- **Tolerances:** 5.0% to .05% . . . 1% standard for off-shelf delivery.
- **Temperature Coefficient:** 30 ppm/°C standard. Special TC's to 5 ppm/°C available.
- **Dielectric Strength:** Greater than 500 V.A.C. on MC–80. 1000 V.A.C. on MC–100 and MC–250, and greater than 2000 V.A.C. on MC–500.
- **Environmental:** Meets or exceeds all requirements of MIL-R-18546D including "N" characteristic.



precision resistor networks

Cal-R engineers, specialists in advanced network design, offer precision assemblies, packaged to meet the most exacting specifications.

OUTSTANDING FEATURES: ■ Precision resistors used exclusively ■ All circuits assembled on printed circuit boards ■ Pins cut on an angle for easy P.C. board insertion ■ Epoxy encapsulated ■ Meets or exceeds all requirements of MIL-R-93 & MIL-R-26

GENERAL SPECIFICATIONS:

Resistor values: From 1 ohm thru 5 megohms
Full scale accuracy: to .005%
Temp. coefficient tracking: to 1 PPM/°C
Temp. coefficient absolute: to 2 PPM/°C
Ambient temp. range: −55°C to +125°C
Standard temp. coefficient: 0 to ±10 PPM
Stability: to 10 PPM per year
Fast Recovery time: to within .02% of final value within 100ns.

Call CAL-R on your next network application . . . our application engineering department is at your service.

For additional information please contact factory . . .

CAL-R, INC.
a subsidiary of **CapTech Inc.**
CALIFORNIA RESISTOR DIVISION

1601 Olympic Boulevard
Santa Monica, California 90404
(213) 451-9761
TWX 910-343-6966

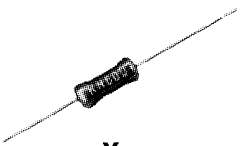
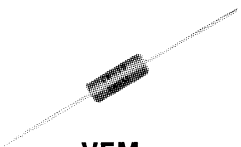
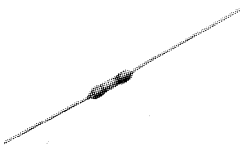
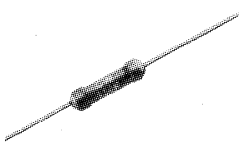
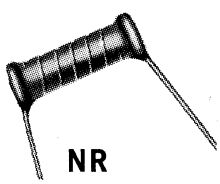
CAL–R California Resistor delivers special resistors to solve unique packaging problems. For more information about special resistor designs contact your local representative or **CAL–R** California Resistor directly.

PRECISION FILM RESISTORS, WIRE-WOUND POTENTIOMETERS AND AUTOMOTIVE SPARK SUPPRESSORS

Precision Metal Film Resistors

PRODUCT REFERENCE CHART — MIL R 10509

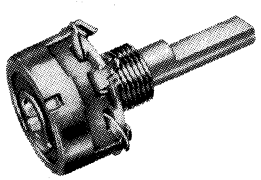
GENERAL SPECIFICATIONS

SERIES	DESCRIPTION	CW Type	MIL Style	MIL Char.	Wattage Rating 70°C	Wattage Rating 125°C	Resistance Min. - Max.
 X	Vacuumette type "X" series are conformal coated, evaporated metal film resistors designed for higher performance and stability, identified by a reddish-brown color of E-coating. In addition to standard temperature coefficients per MIL characteristics, they are available with T.C. of ±100 PPM (EIA Code T1).	X54/X55	RN55	D, C, E	⅛	1/10	10Ω - 301K
		X60	RN60	D, C, E	¼	⅛	10Ω - 1 Meg.
		X65	RN65	D, C, E	½	¼	10Ω - 2 Meg.
 VFM	VFM series are molded resistors, with more types in the higher wattages than Series "X," and made by the same rigid manufacturing methods. They are identified by a tan color molded jacket providing greater mechanical protection and will sustain rough handling.	VFM05	RN60	D, C, E	¼	⅛	10Ω - 1 Meg.
		VFM10	RN65	D, C, E	½	¼	10Ω - 2 Meg.
		VFM15	RN70	D, C, E	¾	½	10Ω - 2.49 Meg.
		VFM25	RN75	B, C, E	1	1	10Ω - 5.11 Meg.
 VF*	VF series trim line resistors are offered as a multi-rated, multi-purpose conformally coated metal film. Smaller than MIL type, they provide the same maximum performance capabilities at a lower cost. Units are coded similar to "X" series, but are identified by standard commercial marking.	VF05	—	—	⅛	⅛	10Ω - 1 Meg.
		VF11	—	—	¼	¼	10Ω - 2 Meg.
		VF15	RN20	X	½	½	10Ω - 2.5 Meg.
		VF25	RN25	X	1	1	10Ω - 5 Meg.
 NA	Noblette type NA series are metal film resistors with the advantage of extreme high and low resistance values in varying wattages. Values are obtained by application of "noble" metals through a C-W developed pyro-chemic process. Film is protected by a layer of vitreous enamel and a rubberized, charcoal gray enamel paint. Axial lead construction.	NA15	—	—	½w @ 40°C		0.5Ω - 3 Meg.
		NA20	—	—	½w @ 40°C		0.5Ω - 3 Meg.
		NA25	—	—	1w @ 40°C		0.5Ω - 5 Meg.
		NA30	—	—	2w @ 40°C		1.0Ω - 10 Meg.
 NR	Nobeloy type NR resistors are similar in composition and appearance to NA series, except that they have radial lead construction. Resistor body is in tube form, permitting additional mounting by means of a thru-bolt. They also offer higher and lower resistance value in varying wattages from ½W to 5W.	NR20	—	—	½w @ 40°C		0.5Ω - 3 Meg.
		NR25	—	—	1w @ 40°C		0.5Ω - 5 Meg.
		NR30	—	—	2w @ 40°C		1.0Ω - 10 Meg.
		NR50	—	—	5w @ 40°C		2.0Ω - 10 Meg.

NOTE: *Available 1N, T.C., T1, T2, T9.

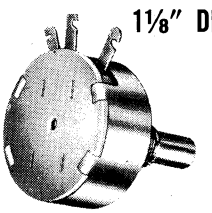
MIL CHAR. **D** = T.C. ±100 PPM (T1) **E** = T.C. ± 25 PPM (T9)
C = T.C. ± 50 PPM (T2) **B** = T.C. ±150 PPM

1½" DIAMETER WIRE-WOUND CONTROLS



Electrical circuit choice of potentiometer, rheostat, or fader up to 10,000 ohms resistance. Power dissipation to 3.0 watts with anticipated life of 10,000 cycles. Available with grounded or insulated rotor and plastic or metal shafts. Choice of mounting style: bushing (illustrated), eyelet-to-chassis, twist tab, or snap-in ears to printed circuit board. Request Bulletin No. 2080-67.

1⅛" DIAMETER WIRE-WOUND CONTROLS



Resistance range to 25,000 ohms. Available as potentiometer, rheostat, or "L" pad. Up to 5.0 watts power dissipation with anticipated life to 25,000 cycles. Available with insulated rotor and choice of bushing or twist-tab mount. Bushing and shaft dimensions available to meet your specific requirements. Request Bulletin No. 2060.

AUTOMOTIVE and OIL BURNER SPARK SUPPRESSORS

For suppression of radio and television noise interference due to ignition spark discharge at plugs and high tension distributor; and due to ignition discharge action of oil burner igniting coil. Complete line of resistive type suppressors. Request Bulletin 125.

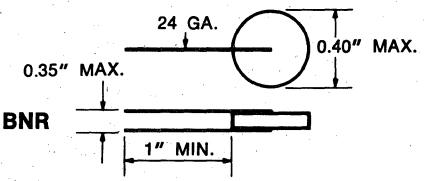
C-W products assure high reliability at reasonable prices. Full cooperation on custom engineering, field service, emergency stocking and special models.

See Sec. 5100 for complete line of C-W Slide-Switches.

CONTINENTAL-WIRT ELECTRONICS CORP.
26 W. QUEEN LANE, PHILADELPHIA, PA. 19144
(AREA CODE 215) VI 8-7700
TWX 710-670-1230

Carborundum Varistors

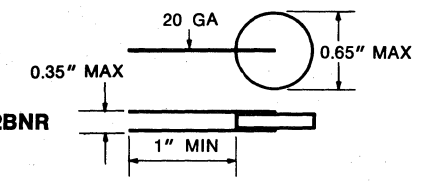
551BNR



Current Milliamps	Voltage DC±10%	Max. Ratio E @ 1.0 ma / E @ 0.1 ma	Nominal "N"	Carborundum Part Number
1.0	9.0	2.4	3.1	551BNR-26
1.0	11.0	2.3	3.7	551BNR-27
1.0	14.0	2.2	3.7	551BNR-28
1.0	18.0	2.1	3.9	551BNR-29
1.0	24.0	2.0	4.2	551BNR-30
1.0	29.0	1.9	4.5	551BNR-31
1.0	40.0	1.8	4.8	551BNR-32
1.0	54.0	1.8	4.9	551BNR-33
1.0	68.0	1.8	5.0	551BNR-34
1.0	88.0	1.8	5.1	551BNR-35

Specifications—1. Continuous power rating @ 40°C—0.30 watt. 2. Maximum voltage—100 volts. 3. Moisture-proof PVC coating.

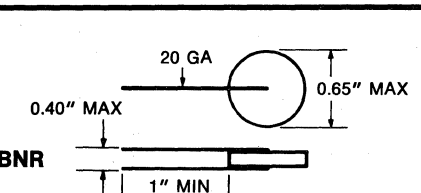
432BNR



Current Milliamps	Voltage DC±10%	Max. Ratio E @ 1.0 ma / E @ 0.1 ma	Nominal "N"	Carborundum Part Number
1.0	6.0	2.9	2.5	432BNR-101
1.0	7.5	2.5	3.0	432BNR-102
1.0	10.0	2.3	3.2	432BNR-103
1.0	12.0	2.2	3.3	432BNR-104
1.0	17.0	2.0	3.7	432BNR-105
1.0	24.0	1.8	4.2	432BNR-106
1.0	30.0	1.8	4.2	432BNR-107
1.0	40.0	1.8	4.2	432BNR-108
1.0	48.0	1.8	4.6	432BNR-109
1.0	70.0	1.8	4.6	432BNR-110
1.0	90.0	1.7	4.8	432BNR-111

Specifications—1. Continuous power rating @ 40°C—0.5 watt. 2. Maximum voltage—100 volts. 3. Moisture-proof PVC coating.

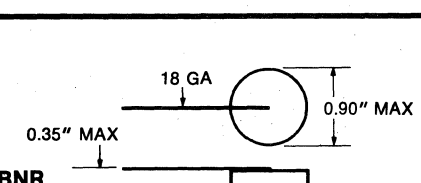
379BNR



Current Milliamps	Voltage DC±10%	Max. Ratio E @ 1.0 ma / E @ 0.1 ma	Nominal "N"	Carborundum Part Number
1.0	12.0	2.9	2.5	379BNR-10
1.0	15.0	2.5	3.0	379BNR-11
1.0	20.0	2.3	3.2	379BNR-12
1.0	24.0	2.2	3.3	379BNR-13
1.0	34.0	2.0	3.7	379BNR-14
1.0	48.0	1.9	4.2	379BNR-15
1.0	60.0	1.8	4.2	379BNR-16
1.0	80.0	1.8	4.2	379BNR-17
1.0	100.0	1.8	4.6	379BNR-18
1.0	135.0	1.8	4.6	379BNR-19
1.0	180.0	1.7	4.8	379BNR-20

Specifications—1. Continuous power ratlng @ 40°C—0.50 watt. 2. Maximum voltage—200 volts. 3. Moisture-proof PVC coating.

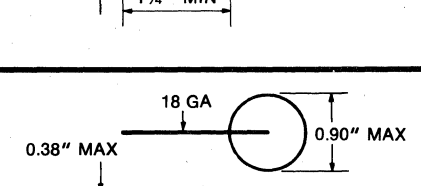
328BNR



Current Milliamps	Voltage DC±10%	Max. Ratio E @ 1.0 ma / E @ 0.1 ma	Nominal "N"	Carborundum Part Number
1.0	2.0	3.0	2.2	328BNR-40
1.0	3.0	2.7	2.5	328BNR-41
1.0	4.5	2.6	2.6	328BNR-42
1.0	6.0	2.4	3.0	328BNR-43
1.0	8.0	2.4	3.0	328BNR-44
1.0	12.0	2.2	3.7	328BNR-45
1.0	14.0	2.0	3.7	328BNR-46
1.0	18.0	1.9	4.2	328BNR-47
1.0	24.0	1.8	4.2	328BNR-48
1.0	33.0	1.8	4.2	328BNR-49
1.0	48.0	1.8	4.6	328BNR-50
1.0	60.0	1.8	4.6	328BNR-51
1.0	80.0	1.7	4.8	328BNR-52

Specifications—1. Continuous power rating @ 40°C—0.75 watt. 2. Maximum voltage—100 volts. 3. Moisture-proof PVC coating.

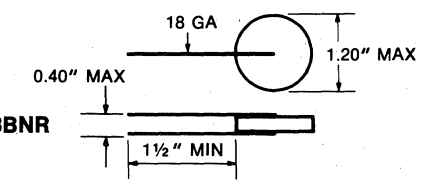
925BNR



Current Milliamps	Voltage DC±10%	Max. Ratio E @ 1.0 ma / E @ 0.1 ma	Nominal "N"	Carborundum Part Number
1.0	12.0	2.4	3.0	925BNR-10
1.0	16.0	2.4	3.0	925BNR-11
1.0	24.0	2.0	3.7	925BNR-12
1.0	28.0	2.0	3.7	925BNR-13
1.0	36.0	1.9	4.0	925BNR-14
1.0	48.0	1.9	4.2	925BNR-15
1.0	68.0	1.8	4.2	925BNR-16
1.0	90.0	1.8	4.6	925BNR-17
1.0	120.0	1.8	4.6	925BNR-18
1.0	160.0	1.7	4.8	925BNR-19

Specifications—1. Continuous power rating @ 40°C—0.75 watt. 2. Maximum voltage—200 volts. 3. Moisture-proof PVC coating.

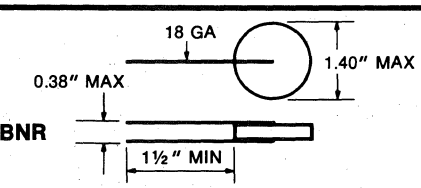
463BNR



Current Milliamps	Voltage DC±10%	Max. Ratio E @ 5.0 ma / E @ 0.5 ma	Nominal "N"	Carborundum Part Number
5	16	2.2	3.3	463BNR-30
5	24	2.2	3.3	463BNR-31
5	28	2.0	3.7	463BNR-32
5	36	2.0	3.7	463BNR-33
5	48	1.9	4.2	463BNR-34
5	62	1.8	4.2	463BNR-35
5	85	1.8	4.2	463BNR-36
5	110	1.7	4.8	463BNR-37
5	140	1.7	4.8	463BNR-38
5	190	1.7	5.0	463BNR-39

Specifications—1. Continuous power rating @ 40°C—1.5 watts. 2. Maximum voltage—200 volts. 3. Moisture-proof PVC coating.

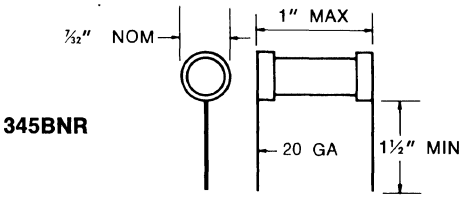
927BNR



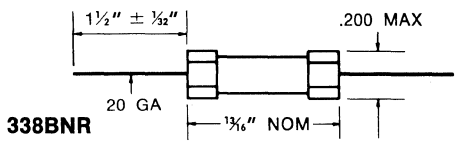
Current Milliamps	Voltage DC±10%	Max. Ratio E @ 5.0 ma / E @ 0.5 ma	Nominal "N"	Carborundum Part Number
5	9	2.7	2.6	927BNR-19
5	15	2.4	3.0	927BNR-20
5	25	2.3	3.1	927BNR-21
5	40	2.3	3.2	927BNR-22
5	70	2.2	3.5	927BNR-23
5	100	2.1	3.7	927BNR-24
5	140	1.9	4.8	927BNR-25

Specifications—1. Continuous power rating @ 40°C—2.25 watts. 2. Maximum voltage—150 volts. 3. Moisture-proof PVC coating.

Carborundum Varistors



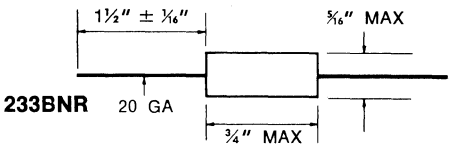
345BNR



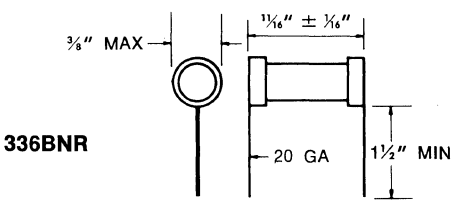
338BNR

Current Milliamps	Voltage DC ±10%	Max. Ratio E @ 1.0 ma / E @ 0.1 ma	Nominal "N"	Carborundum Part Number
1.0	100	2.1	3.1	345 or 338BNR-18
1.0	135	2.0	3.4	" " 338BNR-19
1.0	180	1.9	3.6	" " 338BNR-20
1.0	240	1.8	4.1	" " 338BNR-21
1.0	320	1.8	4.1	" " 338BNR-22
1.0	430	1.7	4.7	" " 338BNR-23
1.0	575	1.7	4.8	" " 338BNR-24
1.0	750	1.7	4.8	" " 338BNR-25

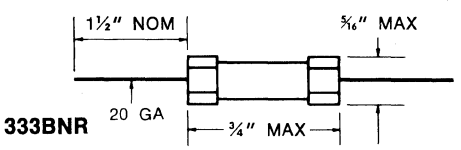
Specifications—1. Continuous power rating @ 40°C—0.75 watt. 2. Maximum voltage—1000 volts. 3. No. 338 coating—none; No. 343 coating—GLY.



233BNR



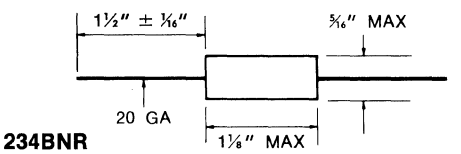
336BNR



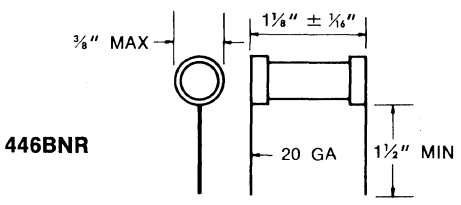
333BNR

1	68	2.2	3.3	233, 336 or 333BNR-30
1	88	2.2	3.3	" " " 333BNR-31
1	110	2.0	3.7	" " " 333BNR-32
1	140	2.0	3.7	" " " 333BNR-33
1	175	1.8	4.2	" " " 333BNR-34
1	250	1.8	4.2	" " " 333BNR-35
1	320	1.8	4.2	" " " 333BNR-36
1	410	1.7	4.8	" " " 333BNR-37
1	520	1.7	4.8	" " " 333BNR-38
1	710	1.7	5.0	" " " 333BNR-39

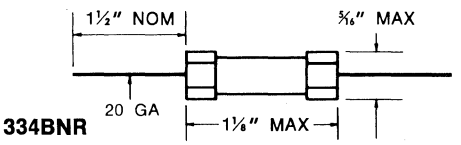
Specifications—1. Continuous power rating @ 40°C—1.00 watt. 2. Maximum voltage—800 volts. 3. No. 233 coating—epoxy; No. 333 coating—none; No. 336 coating—GLY.



234BNR



446BNR



334BNR

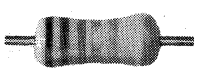
1	135	2.2	3.3	234, 446 or 334BNR-42
1	175	2.2	3.3	" " " 334BNR-43
1	220	2.0	3.7	" " " 334BNR-44
1	290	2.0	3.7	" " " 334BNR-45
1	350	1.9	4.2	" " " 334BNR-46
1	500	1.8	4.2	" " " 334BNR-47
1	680	1.8	4.2	" " " 334BNR-48
1	825	1.7	4.8	" " " 334BNR-49
1	1050	1.7	4.8	" " " 334BNR-50

Specifications—1. Continuous power rating @ 40°C—1.50 watts. 2. Maximum voltage—1500 volts. 3. No. 234 coating—epoxy; No. 334 coating—none; No. 446 coating—GLY.

CORNING
ELECTRONICS
Houghton Park, Corning, New York 14830 / Phone 607, 962-4444

We make resistors for guys who can't stand failures

LOW POWER RESISTORS

APPLICATIONS	Corning Style	MIL Type	MIL Spec. (MIL-R-)	MIL Char.	Wattage Rating	Rated Temp. °C	Derated Temp. °C	Hot Spot	Volt. Rating	Resistance Range	Stand. Tol.	Body Dia. Max.
LOW POWER INSULATED FLAME PROOF	*FP½				½	70°	150°		350	10Ω-470K	2.5%	.150″
	FP 2		·		3, 2	40°, 70°	250°	222°, 190°	500	9Ω-90K	5, 10%	.325″
	FP 3				4, 3	40°, 70°	250°	277°, 253°	500	9Ω-40K	5, 10%	.325″
	FP 4				5, 4	40°, 70°	250°	258°, 245°	500	16Ω-90K	5, 10%	.325″
	FP 5				7, 5	40°, 70°	250°	288°, 254°	600	19Ω-90K	5, 10%	.325″
	FP 7				—7	— 70°	250°	— 290°	700	24Ω-90K	5, 10%	.325″
	FY 10				10, —	40°, —	250°	333° —	700	24Ω-90K	5, 10%	.325″

HIGH RELIABILITY RESISTORS

APPLICATIONS	Type	MIL. Type	MIL. Spec. (MIL-R-)	MIL. Char.	Wattage Rating	Rated Temp. °C	Stand. Tol.	Temp. Co-eff.	Resistance Range	Lead Dia.	Dia. Max.	Body Length Max.	Clean Lead, Max. Length
HRN	HRN 4	RNR 55		H	1/10	125	½-1%	50PPM	49.9Ω-150K	.025	.098	.250″	.281″
	HRN 5	RNR 60		H	⅛	125	½-1%	50PPM	49.9Ω-499K	.025	.148	.416″	.450″
	HRN 6	RNR 65		H	¼	125	½-1%	50PPM	49.9Ω-1MEG	.025	.200	.593″	.633″
HRL	HRL 4	RLR 07	39017		¼	70	2-5%	100PPM	51Ω-150K	.025	.098	.250″	.281″
	HRL 5	RLR 20	39017		½	70	2-5%	100PPM	10Ω-499K	.032	.148	.416″	.450″
	HRL 32				1	70	2-5%	200PPM	10Ω-1MEG	.040	.200	.593″	.813″
	HRL 42				1.5	70	2-5%	200PPM	10Ω-1.5MEG	.045	.325	.718″	.718″
"A"	A 51	21 ER	38101		⅛	70	1-2%	200PPM	51Ω-150K	.020	.098	.235″ ±.015″	.281″
	A 52	22 ER	38101		⅓	70	1-2%	200PPM	51Ω-300K	.025	.158	.390″ ±.020″	.075″
	A 53	23 ER	38101		1	70	1-2%	200PPM	51Ω-620K	.033	.260	.570″ ±.025″	.650″

PRECISION, SEMI-PRECISION AND GENERAL PURPOSE RESISTORS

Application	Corning Style	MIL. Type	MIL. Spec. (MIL-R-)	MIL. Char.	Wattage Rating	Rated Temp., °C	Derated Temp., °C	Volt Rating	Resistance Range	Stand. Tol.	Body Dia. Max.	Body Length Max.	Clean Wire to Wire Max.
PRECISION	NC 4	RN 55		C	⅛, 1/10	70°, 125°	165°, 175°	200	49.9Ω-150K 49.9Ω-301K	½% 1%	.098″	.250″	.281″
	NC 5	RN 60	10509 F	C	¼, ⅛	70°, 125°	165°, 175°	250	49.9Ω-499K 49.9Ω-1MEG	½% 1%	.148″	.416″	.450″
	NC 6	RN 65		C	½, ¼	70°, 125°	165°, 175°	300	49.9Ω-1MEG 49.9Ω-2MEG	½% 1%	.200″	.593″	.633″
PRECISION	NA 55	RN 55		D	⅛, 1/10	70°, 125°	165°, 175°	200	49.9Ω-150K 10Ω-301K	½% 1%	.098″	.250″	.281″
	NA 60	RN 60	10509 F	D	¼, ⅛	70°, 125°	165°, 175°	300	49.9Ω-499K 10Ω-1MEG	½% 1%	.148″	.416″	.450″
	NA 65	RN 65		D	½, ¼	70°, 125°	165°, 175°	350	49.9Ω-1MEG 10Ω-2MEG	½% 1%	.200″	.593″	.633″
	NA 70	RN 70		D	¾, ½	70°, 125°	165°, 175°	500	51Ω-1MEG	½,1%	.263″	.790″	.875″
SEMI-PRECISION	C 3	—	—	—	⅛	70°	150°	200	10Ω-150K	1,2,5,10%	.066″	.160″	.160″
	C 4	RL 07	22684 B	S	¼	70°	150°	250	10Ω-301K	1,2,5%	.098″	.250″	.281″
			(10509)		⅛	70°	165°						
			(10509)		1/10	125°	175°						
					⅛	125°	175°						
	C 5	RL 20	22684 B	S	½	70°	150°	350	10Ω-1MEG	1,2,5%	.148″	.416″	.450″
			(10509)		¼	70°	165°						
					⅛	125°	175°						
					¼	125°	175°						

GLASS AND METAL OXIDE FILM RESISTORS

Perfect combination to handle resistor jobs

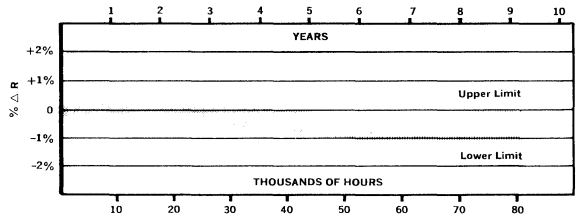
Dependable resistor performance, tailored to specific circuit requirements results from CORNING® Materials and process skills.

High resistivity tin oxide film is combined with optical quality glass substrate yielding exceptionally strong, uniform resistance components.

This construction is the basic reason for the proven stability and reliability demonstrated in the 80,000 hour test data summarized at right.

80,610 TOTAL TEST HOUR DATA DEMONSTRATES LONG TERM STABILITY RESULTING FROM THIS UNIQUE CONSTRUCTION.

Extended load life performance, 150 CORNING N-20 Style Resistors, 10K, 0.3 watts



Corning Style	Clean Wire to Wire Max.	Lead Dia. (±.002)	Temp. Coeff.	Load Life △R	Moist. Resist. △R	Temp. Cycle △R	Short Time Overload △R	Low Temp. Oper. △R	Dielectric Withstand △R	Effect Solder Heat △R	Term. Strength △R	Shock △R	Vibration △R	Shelf Life △R	Volt. Coeff. (Typical)
*FP½	0.380″	.032″	±150 ppm/°C	±1.5%	±1.5%	±1%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.2%	.001%/V
FP 2	0.718″	.045″		±5%	±2%	±1%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.2%	.001%/V
FP 3	0.955″	.032″		±5%	±2%	±1%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.2%	.001%/V
FP 4	1.565″	.032″	±200 ppm/°C from −55° to +150°C	±5%	±2%	±1%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.2%	.001%/V
FP 5	1.745″	.032″		±5%	±2%	±1%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.2%	.001%/V
FP 7	2.075″	.032″		±5%	±2%	±1%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.2%	.001%/V
FP 10	2.075″	.032″		±5%	±2%	±1%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.5%	±.2%	.001%/V

* FP½ (FP-20) is qualified to MIL-R-22684

Type	Volt. Rating	Temp. Cycle △R	Low Temp. Oper. △R	Term. Strength △R	Dielectric Withstand. Voltage △R	Effect Solder Heat △R	Moist. Resist. △R	Shock △R	Vibration △R	Short Time Overload △R	Load Life 250HR	Load Life 2000HR	Failure Rate, % Per 1000 Hours, 60% Confidence Level
HRN 4	200	.25%	.25%	.20%	.25%	.10%	.4%	.25%	.25%	NA	.25%	.5%	0.00093 where failure is defined
HRN 5	250	.25%	.25%	.20%	.25%	.10%	.4%	.25%	.25%	NA	.25%	.5%	as > ±2% △R after 2000 hours
HRN 6	300	.25%	.25%	.20%	.25%	.10%	.4%	.25%	.25%	NA	.25%	.5%	load life test.
HRL 4	250	.25%	.25%	.25%	.25%	.20%	1%	.5%	.5%	.5%	.5%	2%	0.004 where failure is defined
HRL 5	350	.25%	.25%	.25%	.25%	.20%	1%	.5%	.5%	.5%	.5%	2%	as > ±2% △R after 2000 hours
HRL 32	500	.5%	.5%	.25%	.5%	.25%	1%	.5%	.5%	.5%	1%	4%	load life test, for HRL 4 and
HRL 42	500	.5%	.5%	.25%	.5%	.25%	1%	.5%	.5%	.5%	1%	4%	5. ±4% for HRL 32 and 42.
A 51	150	.5%	.5%	.25%	.25%	.25%	1%	.5%	.5%	.5%	±2%	(1000HR)	0.002 where failure is defined
A 52	250	.5%	.5%	.25%	.25%	.25%	1%	.5%	.5%	.5%	±2%	(1000HR)	as > ±2% △R after
A 53	350	.5%	.5%	.25%	.25%	.25%	1%	.5%	.5%	.5%	±2%	(1000HR)	1000 hours load life test.

Data based on guaranteed Corning specifications. Actual performance typically better.
R, H and HL Styles not recommended for use above 200°C

Corning Style	Stand. Lead Dia.	Temp. Coeff.	Load Life △R	Moist. Resist. △R	Temp. Cycle △R	Short Time Overload △R	Low Temp. Oper. △R	Dielectric Withstanding △R	Effect Solder Heat △R	Term. Strength △R	Shock △R	Vibration △R	Shelf Life △R	Volt Co-Eff. (Typical)
NC 4	.025″		±.5%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.10%	±.10%	±.10%	±.10%	.001%/V
NC 5	.025″	±50 ppm from −55°C to +175°C	±.5%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.10%	±.10%	±.10%	±.10%	.001%/V
NC 6	.025″		±.5%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.10%	±.10%	±.10%	±.10%	.001%/V
NA 55	.025″	±100 ppm/°C from −55°C to +175°C	±.5%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.10%	±.10%	±.10%	±.10%	.001%/V
NA 60	.025″	for NA 55, 60 and 65. ±150 ppm/°C	±.5%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.10%	±.10%	±.10%	±.10%	.001%/V
NA 65	.025″	from −55°C to +165°C for NA 70.	±.5%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.10%	±.10%	±.10%	±.10%	.001%/V
NA 70	.032″		±.5%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.20%	±.10%	±.10%	±.10%	.001%/V
C 3	.020″	±100, 200 ppm	±1.0%	±.5%	±0.25%	±0.5%	±0.25%	±0.25%	±0.1%	±0.20%	±0.25%	±0.25%	±.10%	.001%/V
C 4	.025″		1%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.10%	±.10%	±.10%	±.10%	.001%/V
			0.5%											
			0.5%											
			1%											
C 5	.032″	±100 ppm from −55°C to +175°C	1%	±.5%	±.25%	±.25%	±.25%	±.10%	±.10%	±.10%	±.10%	±.10%	±.10%	.001%/V
			0.5%											
			0.5%											
			1%											

Data based on guaranteed Corning specifications. Actual performance typically better.

For Optimum Value in Resistors and Potentiometers... DALE®

WIREWOUND PRECISION RESISTORS, ESTABLISHED RELIABILITY

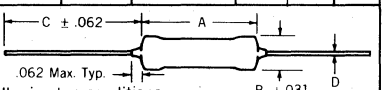
■ TYPE ARS*



Failure rate .00015% per 1000 hours at 50% rated power, 25°C ambient (60% confidence level). Failure defined as ΔR > 0.5%.

DALE TYPE	MIL-R-39007 TYPE	MIL-R-39007B TYPE	POWER RATING (watts)	MIN. RES. (ohms)	MAX. RES. (ohms)	MAX. WORKING VOLTAGE	MAX. WEIGHT (GRAMS)	DIM. A	DIM. B	DIM. C	DIM. D
ARS-2	RWR-71	RWR-71	2	0.1	16.2K	180	1.6	.812±.062	.187	1.5	.032
ARS-5	RWR-67	RWR-74	5	0.1	12K	250	4.75	.875±.062	.312	2.0	.040
ARS-10	RWR-68	RWR-78	10	0.1	40K	650	12.00	1.780±.062	.375	2.0	.040
AGS-1		RWR-81	1	0.5	1.0K	25	.35	.250±.031	.085	1.5	.020
AGS-3	RWR-70	RWR-80	2.25	0.1	2.67K	52	.375	.406±.031	.094	1.5	.020
AGS-5		RWR-89	4	0.1	4.12K	112	1.25	.560±.062	.187	1.5	.032
AGS-10		RWR-84	7	0.1	12.4K	275	4.25	.875±.062	.312	2.0	.040

Tolerance: All established reliability resistors have a standard resistance tolerance of 1%.



POWER RATING

Dale ARS and AGS power ratings are based on the following two conditions:

1. 1% maximum ΔR in 1000 hours load life.
2. 275°C maximum operating temperature.

■ TYPE AGS*

Miniature version of ARS Series with BeO core for optimum thermal conductivity, operational stability and increased reliability. Significantly smaller size. Failure rate .000054% per 1000 hours at 50% rated power, 25°C ambient (60% confidence level). Failure defined as ΔR > 0.5%.

*Available with solderable and weldable leads.

■ TYPE ARH

Advanced design housed power wirewounds made on the same line and under the same high reliability standards as the ARS and AGS. Failure rate of .1% at 100% rated power.



DALE TYPE	MIL-R-39009A TYPE	POWER RATING (watts) MTD.	POWER RATING (watts) FREE AIR	RESISTANCE RANGES (ohms) MIN.	RESISTANCE RANGES (ohms) MAX.	MAX. WORKING VOLTAGE	MAX. WT. GRAMS
ARH-5	RER-60	5	3	.1	4.12K	220	3
ARH-10	RER-65	10	6	.1	5.62K	340	8
ARH-25	RER-70	15	8	.1	12.1K	650	15
ARH-50	RER-75	30	10	1.0	39.2K	1400	32

Tolerance: All established reliability resistors have a standard resistance tolerance of 1%. Non-inductive versions also available.

DIMENSIONS: See section on RH resistors. Types ARH-5 thru 50 will correspond with RH-5 thru 50.

POWER RATING

Dale ARH resistor ratings are based on the following requirements:

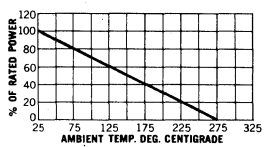
1. 275° maximum internal hotspot temperature
2. 1% maximum ΔR in 2000 hour load life
3. Proper heat sink

   4x6x2x.040 aluminum chassis = ARH-5 and ARH-10

   5x7x2x.040 aluminum chassis = ARH-25 and ARH-50

DERATING
ARS, AGS, ARH

Established reliability data is based on operation at 50% rated power at 25°C. At high ambient temperatures, the derating curve at right applies:



■ TYPE AWA



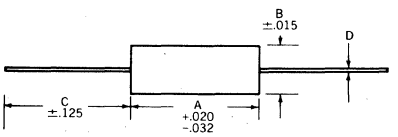
Established reliability epoxy-molded precision bobbin wirewound resistor with high stability and low T.C.; offers excellent moisture protection and low noise. Quality verified by acceptance testing.

DALE TYPE	MIL-R-39005A TYPE	POWER RATING (Watts)	MINIMUM RESISTANCE RANGE (Ohms) .01%	.02%	.05%	.1%	1%	MAX. RES. (Ohms) ALL TOL.	MAX. WORKING VOLTAGE	MAX. WT. (Grams)	DIM. A	DIM. B	DIM. C	DIM. D
AWA-55	RBR-55	.15	10	10	10	10	.1	250K	200	1.2	.500	.250	2.000	.032
AWA-54	RBR-54	.25	10	10	10	10	.1	450K	300	1.5	.750	.250	2.000	.032
AWA-53	RBR-53	.33	10	10	10	10	.1	1.1 Meg.	300	3.1	.750	.375	2.000	.032
AWA-52	RBR-52	.50	10	10	10	10	.1	1.21 Meg.	600	3.8	1.000	.375	2.000	.032

POWER RATING

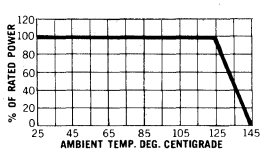
Dale AWA power ratings are based on the following two conditions:

1. 1% maximum ΔR in 2000 hours load life.
2. 125°C maximum operating temperature.



DERATING

Dale AWA resistors have an operating temperature range of −55°C to +145°C. Derating is required for temperatures above 125°C. The curve at right applies.



METAL FILM PRECISION RESISTORS, ESTABLISHED RELIABILITY

■ TYPE EMF



Established reliability epoxy-molded metal film resistor. Failure rate estimated at .1%. Goal is .001% to conditions of MIL-R-55182.

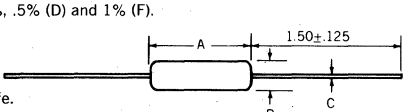
DALE TYPE	MIL. TYPE	125°C RATING	MAX. WT. (Grams)	MAX. WORKING VOLTAGE	RESISTANCE RANGE (Ohms) T-1 (K)	T-2 (H)	T-9 (J)	DIM. A	DIM. B	DIM. C
EMF 55	RNR 55	1/10 w	.35	200	49.9 to 301K	49.9 to 100K	49.9 to 100K	.260 ±.010	.094 ±.006	.025 Dia.
EMF 60	RNR 60	1/8 w	.45	250	30.1 to 499K	49.9 to 499K	49.9 to 499K	.406 ±.015	.135 ±.010	.025 Dia.
EMF 65	RNR 65	1/4 w	.84	300	24.9 to 1 Meg.	49.9 to 1 Meg.	49.9 to 1 Meg.	.593 ±.015	.203 ±.015	.025 Dia.

Standard Resistance Tolerances: .1% (B), .25%, .5% (D) and 1% (F).

POWER RATING

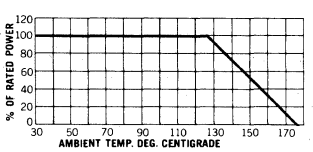
Dale EMF power ratings are based on the following two conditions:

1. 0.5% maximum ΔR in 2000 hours load life.
2. 175°C maximum operating temperature.



DERATING

Dale EMF resistors have an operating temperature range of −65°C to +175°C. They must be derated according to the curve at right.



DALE® for Optimum Value in Wirewound Resistors

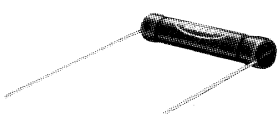
WIREWOUND PRECISION RESISTORS, SILICONE COATED *(Available with Weldable Leads)*

■ TYPE RS



Meets applicable requirements of MIL-R-39007, MIL-R-26E, MIL-R-26C and MIL-R-23379. Non-inductive styles available.

■ TYPE RLS



Radial leads for printed circuit board mounting. Meets applicable requirements of MIL-R-26E. Non-inductive styles available.

DALE TYPE	MIL-R-26E TYPE*	DALE RATING U .05% thru 5%	DALE RATING V 3% & 5%	RESISTANCE RANGES (OHMS) .05% .1%, .25%	RESISTANCE RANGES (OHMS) .5%, 1% 3%, 5%	MAX.** WORKING VOLTAGE U	MAX.** WORKING VOLTAGE V	MAX. WT. GRAMS	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)† ± 90 PPM	± 50 PPM	± 30 PPM	± 20 PPM
RS-¼	—	.4 W	—	10 to 950	1 to 3.4K	20	—	.21	Below 1 Ω	1 to 6.9	—	7 to 3.4K
RS-½	—	.75 W	—	10 to 1.3K	1 to 4.9K	29	—	.23	Below 1 Ω	1 to 9.9	—	10 to 4.9K
RS-1A	RW-70	1.0 W	—	1 to 2.7K	.1 to 10.4K	52	—	.34	Below 1 Ω	1 to 9.9	10 to 19	20 to 10.4K
RS-1B	—	1.1 W	—	1 to 4.0K	.1 to 15K	62	—	.40	Below 1 Ω	1 to 9.9	10 to 29	30 to 15K
RS-2	—	4.0 W	5.5 W	1 to 12.7K	.1 to 47.1K	210	250	2.1	Below 1 Ω	1 to 9.9	10 to 79	80 to 47.1K
RS-2A	—	3.25 W	4.75 W	1 to 11.4K	.1 to 42.1K	185	220	.90	Below 1 Ω	1 to 9.9	10 to 79	80 to 42.1K
RS-2B	RW-79	3.0 W	3.75 W	1 to 6.5K	.1 to 24.5K	135	148	.70	Below 1 Ω	1 to 9.9	10 to 49	50 to 24.5K
RS-2C	—	2.5 W	3.25 W	1 to 8.6K	.1 to 32.3K	138	157	1.6	Below 1 Ω	1 to 9.9	10 to 59	60 to 32.3K
RS-2C-23	RW-69	2.5 W	3.25 W	1 to 8.6K	.1 to 32.3K	138	157	1.6	Below 1 Ω	1 to 9.9	10 to 59	60 to 32.3K
RS-5	—	5.0 W	6.5 W	.5 to 25.7K	.1 to 95.2K	330	376	4.2	Below 1 Ω	1 to 9.9	10 to 169	170 to 95.2K
RS-5-69	RW-74	5.0 W	6.5 W	.5 to 24.5K	.1 to 91.0K	323	368	4.2	Below 1 Ω	1 to 9.9	10 to 169	170 to 91.0K
RS-5-70	RW-67	5.0 W	6.5 W	.5 to 25.7K	.1 to 95.2K	330	376	4.2	Below 1 Ω	1 to 9.9	10 to 169	170 to 95.2K
RS-7	—	7.0 W	9.0 W	.5 to 41.4K	.1 to 154K	504	576	4.7	Below 1 Ω	1 to 9.9	10 to 269	270 to 154K
RS-10	—	10 W	13 W	.5 to 73.4K	.1 to 273K	799	911	9.0	Below 1 Ω	1 to 9.9	10 to 469	470 to 273K
RS-10-38	RW-78	10 W	13 W	.5 to 71.3K	.1 to 265K	788	898	9.0	Below 1 Ω	1 to 9.9	10 to 469	470 to 265K
RS-10-39	RW-68	10 W	13 W	.5 to 73.4K	.1 to 273K	799	911	9.0	Below 1 Ω	1 to 9.9	10 to 469	470 to 273K

**Max. working voltage determined at .0008 dia. wire resistance values.

†Consult factory for special T.C. requirements.

*MIL-R-39007, MIL-R-26C, MIL-R-23379 TYPES

	MIL-R-39007	MIL-R-26C (G & V)	MIL-R-23379
RS-1A	—	—	RWP-18
RS-2B	RWR-89	—	—
RS-2C	—	RW-69	—
RS-2C-23	—	—	RWP-20
RS-5	RWR-74	RW-67	RWP-21
RS-10	RWR-78	RW-68	RWP-23

POWER RATINGS RS, RLS, G SERIES

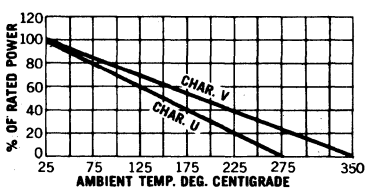
These Series have two power ratings, depending on operating temperature and stability requirements.

CHARACTERISTIC U: 1. 275°C maximum hotspot temperature
2. .5% maximum ΔR in 2000 hour load life

CHARACTERISTIC V: 1. 350°C maximum hotspot temperature
2. 3% maximum ΔR in 2000 hour load life

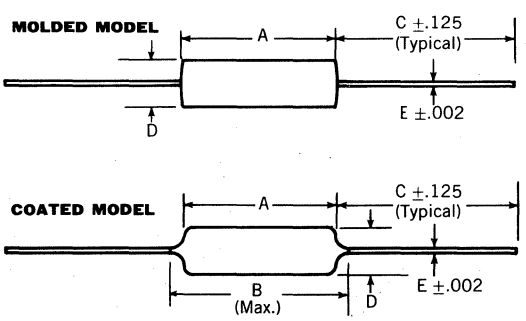
DERATING RS, RLS, G

RS, RLS and G coated resistors have an operating temperature range of −55°C to +350°C. Dale RS molded resistors have an operating temperature range of −55°C to +275°C. They must be derated at high ambient temperatures according to the curves below.



DIMENSIONS (Consult factory for RLS Types)

	TYPE	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E
MOLDED MODELS	RS-¼	.250±.015	—	1.500	.078±.015	.020
	RS-½	.312±.015	—	1.500	.078±.015	.020
	RS-1A	.422±.015	—	1.500	.093±.032	.020
	RS-1B	.575±.015	—	1.500	.093±.032	.020
COATED MODELS	RS-2	.625±.062	.765	2.000	.250±.032	.040
	RS-2A	.812±.062	.890	1.500	.188±.032	.032
	RS-2B	.560±.062	.622	1.500	.187±.031	.032
	RS-2C	.500±.062	.593	1.500	.218±.032	.040
	RS-2C-23	.500±.062	.593	1.500	.218±.032	.032
	RS-5	.875±.062	1.000	2.000	.312±.032	.040
	RS-5-69	.875±.062	.937	2.000	.312±.031	.040
	RS-5-70	.875±.062	1.000	1.500	.312±.031	.032
	RS-7	1.218±.062	1.281	2.000	.312±.032	.040
	RS-10	1.780±.062	1.875	2.000	.375±.032	.040
	RS-10-38	1.780±.062	1.842	2.000	.375±.031	.040
	RS-10-39	1.780±.062	1.875	1.500	.375±.031	.032



DALE® for Optimum Value in Wirewound Resistors

WIREWOUND PRECISION RESISTORS, SILICONE COATED *(Available with Weldable Leads)*

■ TYPE G



Beryllium oxide core for decreased size, increased stability. Meets applicable specifications of MIL-R-39007, MIL-R-26 and MIL-R-23379. Non-inductive styles available.

■ TYPE GL



Radial leads for printed circuit board mounting. Meets applicable requirements of MIL-R-26E.

DALE TYPE	MIL-R-26E TYPE*	DALE RATING U .05% thru 5%	DALE RATING V 3% & 5%	RESISTANCE RANGES (OHMS) .05% .1%, .25%	RESISTANCE RANGES (OHMS) .5%, 1%, 3%, 5%	MAX.** WORKING VOLTAGE U	MAX.** WORKING VOLTAGE V	MAX. WT. GRAMS	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)† ± 90 PPM	± 50 PPM	± 30 PPM	± 20 PPM
G-1	RW-81	1.0 W	—	10 to 950	1 to 3.4K	33	—	.20	Below 1 Ω	1 to 6.9	—	7 to 3.4K
G-2	—	1.5 W	—	10 to 1.3K	1 to 4.9K	42	—	.21	Below 1 Ω	1 to 9.9	—	10 to 4.9K
G-3	RW-80	2.25 W	—	1 to 2.7K	.1 to 10.4K	80	—	.34	Below 1 Ω	1 to 9.9	10 to 19	20 to 10.4K
G-5	—	4.0 W	5 W	1 to 6.5K	.1 to 24.5K	153	170	.80	Below 1 Ω	1 to 9.9	10 to 49	50 to 24.5K
G-5A	—	4.5 W	6.5 W	1 to 11.4K	.1 to 42.1K	214	257	.95	Below 1 Ω	1 to 9.9	10 to 79	80 to 42.1K
G-5C	—	5 W	7 W	1 to 8.6K	.1 to 32.3K	194	230	1.2	Below 1 Ω	1 to 9.9	10 to 59	60 to 32.3K
G-6	—	6 W	8 W	1 to 12.7K	.1 to 47.1K	258	298	2.0	Below 1 Ω	1 to 9.9	10 to 79	80 to 47.1K
G-10	—	7 W	10 W	.5 to 25.7K	.1 to 95.2K	390	467	3.6	Below 1 Ω	1 to 9.9	10 to 169	170 to 95.2K
G-12	—	10 W	12 W	.5 to 41.4K	.1 to 154K	607	665	4.2	Below 1 Ω	1 to 9.9	10 to 269	270 to 154K
G-15	—	15 W	18 W	.5 to 73.4K	.1 to 273K	979	1072	7.6	Below 1 Ω	1 to 9.9	10 to 469	470 to 273K

**Maximum Working Voltage determined at .0008 dia. wire resistance values. †Consult factory for special T.C. requirements.

*MIL-R-39007, MIL-R-26C, MIL-R-23379 TYPES

	MIL-R-39007	MIL-R-26C	MIL-R-23379
G-1	RWR-81	—	RWP-17
G-2	RWR-82	—	—
G-3	RWR-80	—	RWP-19
G-5C	—	RW-69	—
G-5C-2	—	—	RWP-20
G-10	RWR-84	RW-67	RWP-21
G-15	—	RW-68	RWP-23

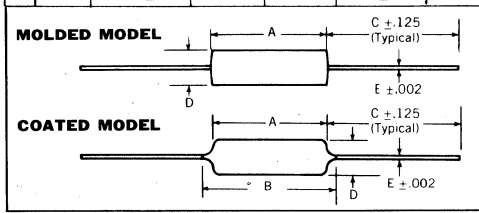
POWER RATING
Power ratings of Dale G resistors are 1.4 to 4 times higher than those of conventional wirewound resistors of equivalent size.

Stability When Dale G resistors are operated at the same ratings (Char. U) as conventional Dale RS resistors of equivalent size, the shift in resistance is 50% or less than that of the RS.

For additional power and derating information, see section on RS resistors.

DIMENSIONS

	TYPE	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E
MOLDED MODELS	G-1	.250±.015	—	1.500	.078±.015	.020
	G-2	.312±.015	—	1.500	.078±.015	.020
	G-3	.422±.015	—	1.500	.093±.032	.020
COATED MODELS	G-5	.562±.062	.640	1.500	.188±.032	.032
	G-5A	.812±.062	.890	1.500	.188±.032	.032
	G-5C	.500±.062	.593	1.500	.218±.032	.040
	G-6	.625±.062	.765	2.000	.250±.032	.040
	G-10	.875±.062	1.000	2.000	.312±.032	.040
	G-12	1.218±.062	1.281	2.000	.312±.032	.040
	G-15	1.780±.062	1.875	2.000	.375±.032	.040

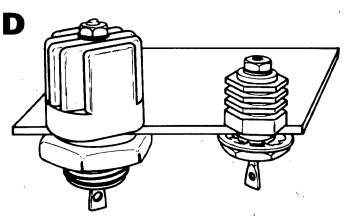


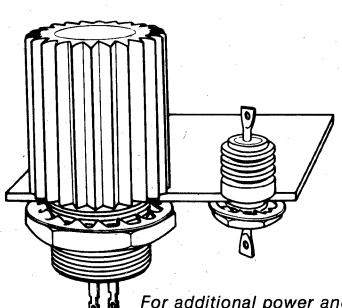
WIREWOUND POWER RESISTORS, HEAT SINK ENCASED

■ TYPE PH

TWO TERMINAL CONFIGURATIONS (PH-10-1, PH-25, PH-50 and PH-100). Thru chassis mounting—two connections required on one or both sides of panel. Meet electrical and environmental requirements of MIL-R-18546.

SINGLE TERMINATION, CHASSIS GROUND (PH-10-5 and PH-25-8). Speeds assembly time as only one connection is required. Often utilized as a drive line resistor in a high speed core memory system using a series termination technique. Non-inductive windings have low reactance properties giving exceptionally fast cycle time.





For additional power and derating information, see section on RH resistors

DALE TYPE	DALE RATING (WATTS)	RESISTANCE RANGES (OHMS) .05%, .1%, .25%	RESISTANCE RANGES (OHMS) .5%, 1%, 3%	MAX. WORKING VOLTAGE	MAX.* WT. (GRAMS)	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)† ±50 PPM	±30 PPM	±20 PPM
PH-10A	10	1 to 12.7K	.1 to 47.1K	240	6	1 to 9.9	10 to 79	80 to 47.1K
PH-10-1	10	1 to 12.7K	.1 to 47.1K	240	6	1 to 9.9	10 to 79	80 to 47.1K
PH-10-5	10	.5 to 6.3K	.1 to 23.5K	170	6	1 to 9.9	10 to 79	80 to 23.5K
PH-25	25	.5 to 25.7K	.1 to 95.2K	425	22	1 to 9.9	10 to 169	170 to 95.2K
PH-25-8	25	.25 to 12.8K	.1 to 47.7K	300	22	1 to 9.9	10 to 169	170 to 47.7K
PH-50	50	3 to 52K	.1 to 75K	1500	80	1 to 99	100 to 999	1K to 75K
PH-100	100	5 to 35K	.1 to 50K	1700	186	1 to 99	100 to 999	1K to 50K

*A weight increase of 10% should be allowed for non-inductive types. †Consult factory for values below 1Ω and for special T.C. requirements.

DALE® for Optimum Value in Housed Wirewound Resistors

WIREWOUND POWER RESISTORS, HEAT SINK ENCASED



Patented design. Mount to the chassis. Provide high power and precision tolerance in a variety of sizes, mounting and terminal configurations. RH and HG types exceed MIL-R-18546. Non-inductive styles available.

■ TYPE RH

5 through 250 watts. Bonus power dissipation ability within MIL-R-18546 size.

■ TYPE HG

Beryllium oxide core for optimum heat dissipation. Doubles Mil. Spec. power at no increase in size. Exceptional stability at mil. levels.

DALE TYPE	MIL-R-18546 TYPE	MIL-R-39009 TYPE	POWER RATING* (WATTS)		RESISTANCE RANGES (OHMS)		MAX. WORKING VOLTAGE	MAX.† WT. GRAMS	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)††		
			DALE**	MIL	.05%, .1%, .25%	.5%, 1%, 3%			±50 PPM	±30 PPM	±20 PPM
RH-5	RE-60	RER-60	7.5 (5)	5	1 to 6.5K	.1 to 24.5K	160	3	1 to 9.9	10 to 49	50 to 24.5K
RH-10	RE-65	RER-65	12.5 (10)	10	1 to 12.7K	.008 to 47.1K	265	6	1 to 9.9	10 to 79	80 to 47.1K
RH-25	RE-70	RER-70	25	20	.5 to 25.7K	.008 to 95.2K	550	13	1 to 9.9	10 to 169	170 to 95.2K
RH-50	RE-75	RER-75	50	30	.5 to 73.4K	.01 to 273K	1250	28	1 to 9.9	10 to 469	470 to 273K
RH-100	RE-77	–	100	75	.3 to 50K	.1 to 50K	1900	400	1 to 99	100 to 949	950 to 50K
RH-250	RE-80	–	250	120	.3 to 75K	.1 to 75K	2300	800	1 to 99	100 to 999	1K to 75K
HG-5	RE-60	–	15	5	1 to 6.5K	.1 to 24.5K	220	3	1 to 9.9	10 to 49	50 to 24.5K
HG-10	RE-65	–	20	10	1 to 12.7K	.1 to 47.1K	340	6	1 to 9.9	10 to 79	80 to 47.1K
HG-25	RE-70	–	35	20	.5 to 25.7K	.1 to 95.2K	650	13	1 to 9.9	10 to 169	170 to 95.2K
HG-50	RE-75	–	50	30	.5 to 73.4K	.1 to 273K	1400	28	1 to 9.9	10 to 469	470 to 273K

*Rating is based on chassis mounting area and stability. For MIL-R-39009 ratings, see section on ARH resistors.

**NOTE: Figures in parentheses on RH-5 and RH-10 indicate wattage printed on these resistors. New construction allows them to be rated at 7.5 and 12.5 watts – but they will be printed with these higher ratings only upon customer request.

†A weight increase of 10% should be allowed for non-inductive styles.

††Consult factory for values below 1 ohm and for special T.C. requirements.

POWER RATING RH, HG, PH TYPES

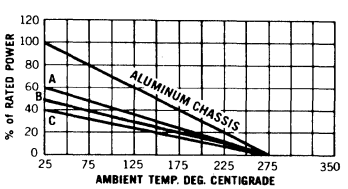
Dale housed resistor ratings are based on the following requirements:

1. 275°C maximum internal hotspot temperature
2. 1% maximum ΔR in 1000 hour load life for RH-5, 10, 25, 50; PH-10, 25, 50. 3% maximum ΔR in 1000 hour load life for RH-100, 250; PH-100.
3. Proper heat sink.
   4x6x2x.040 aluminum chassis = RH-5, 10; HG-5, 10; PH-10
   5x7x2x.040 aluminum chassis = RH-25; HG-25, 50; PH-25
   12x12x.059 aluminum panel = RH-50
   12x12x.125 aluminum panel = RH-100, 250; PH-50, 100

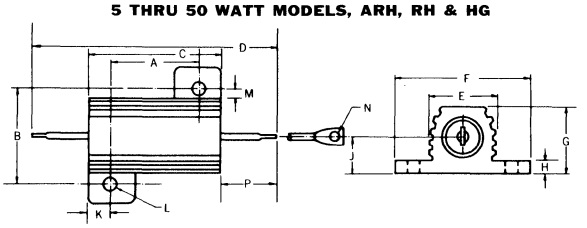
DERATING

Dale housed resistors have an operating temperature range of –55°C to +275°C. Derating is required for reduced chassis mounting area and for high ambient temperatures. The following curves apply to operation of unmounted resistors:

A = RH-5, 10
B = RH-25; PH-10, 25
C = RH-50, 100, 250; PH-50, 100; HG-5, 10, 25, 50



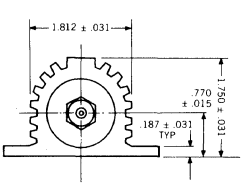
5 THRU 50 WATT MODELS, ARH, RH & HG

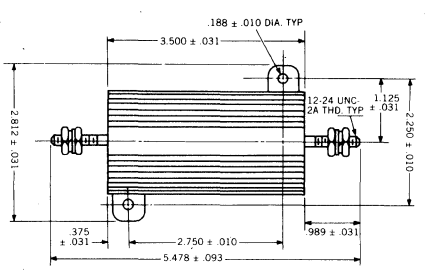


DIMENSIONS – 5 thru 50 WATT MODELS – ARH, RH & HG

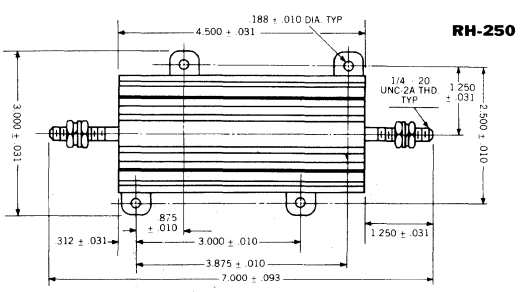
TYPE	A	B	C	D	E	F	G	H	J	K	L	M	N	P
ARH-5 RH-5, HG-5	±.444 .005	±.490 .005	±.600 .031	±1.125 .062	±.334 .015	±.646 .015	±.320 .015	±.065 .010	±.133 .010	±.078 .010	±.093 .005	±.078 .015	±.050 .005	±.262 .062
ARH-10 RH-10, HG-10	±.562 .005	±.625 .005	±.750 .031	±1.375 .062	±.420 .015	±.800 .015	±.390 .015	±.075 .010	±.165 .010	±.093 .010	±.093 .005	±.102 .015	±.086 .005	±.312 .062
ARH-25 RH-25, HG-25	±.719 .005	±.781 .005	±1.062 .031	±1.938 .062	±.550 .015	±1.080 .015	±.546 .015	±.088 .010	±.231 .010	±.172 .010	±.125 .005	±.115 .015	±.086 .005	±.438 .062
ARH-50 RH-50, HG-50	±1.563 .005	±.844 .005	±1.968 .031	±2.781 .062	±.630 .015	±1.140 .015	±.610 .015	±.088 .010	±.260 .010	±.196 .010	±.125 .005	±.107 .015	±.086 .005	±.406 .062

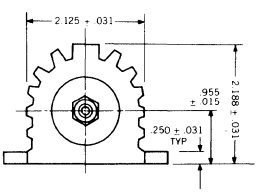
RH-100





RH-250



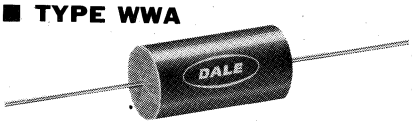


DALE® for Optimum Value in Bobbin Wirewound Resistors

WIREWOUND PRECISION RESISTORS, BOBBIN TYPE *(Available with Weldable Leads)*

Non-inductive precision resistors. Epoxy molded for high dielectric strength and complete environmental protection. Meet applicable requirements of MIL-R-39005 and MIL-R-93D.

■ TYPE WWA



Patented design insures high stability. Special tolerances and matching available.

■ TYPE MWA



Subminiature size retains Dale's unique bobbin-type design and high protection molding coating.

DALE TYPE	MIL-R-93 TYPE	POWER RATING (WATTS)	MINIMUM RESISTANCE RANGE (OHMS)* .05%	.1%	.25%	.5%	1%	MAXIMUM RESISTANCE (OHMS) ALL TOLERANCES	MAXIMUM WORKING VOLTAGE	MAXIMUM WEIGHT (GRAMS)
MWA-8	–	.1	50	10	5	2	1	100K	27	.21
MWA-10	–	.125	50	10	5	2	1	160K	37	.23
WWA-13	–	.125	50	10	5	2	1	311K	50	.35
WWA-22	–	.15	130	20	5	.2	.1	600K	100	.9
WWA-23	RB-56	.15	105	12	5	.2	.1	650K	150	1.0
WWA-24	RB-55	.20	40	12	6	.2	.1	900K	200	1.2
WWA-26	RB-54	.25	20	10	5	.2	.1	1.72 Meg.	300	1.5
WWA-36	RB-53	.33	15	4	1	.2	.1	4 Meg.	300	3.1
WWA-38	RB-52	.50	10	3	1	.2	.1	5.4 Meg	600	3.8
WWA-44	†	.5	15	4	1	.2	.1	5.75 Meg.	500	3.4
WWA-45	†	.5	10	3	1	.2	.1	7.5 Meg.	550	5.4
WWA-48	RB-57	.75	10	3	1	.2	.1	11.5 Meg.	850	6.5
WWA-412	RB-58	.875	10	3	1	.2	.1	17.5 Meg.	1050	8.4
WWA-416	RB-59	1	10	3	1	.2	.1	23 Meg.	1400	15.5

*Consult factory for tolerances below .05%.

†Although there is no direct mil. model of the same physical size, the Dale type will meet the electrical and environmental requirements of MIL-R-93.

SPECIAL MODIFICATIONS

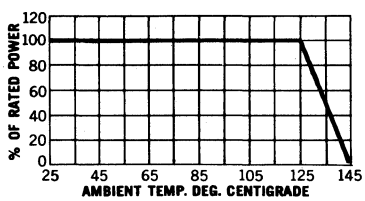
- Special tolerances are available to as low as .005%.
- Resistors can be matched to a tolerance of .001%.
- Special T.C.'s are available to ±2 ppm/° C over a limited temperature range.
- T.C.'s can be matched to an accuracy of 1 ppm/° C.

POWER RATING

MWA, WWA and WWP power ratings correspond to MIL-R-93 ratings and are based on .5% maximum ΔR in 1500 hours load life. For commercial applications, power ratings may be doubled.

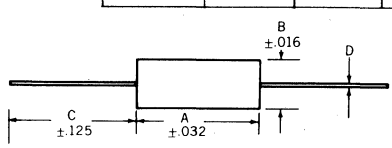
DERATING

Dale MWA, WWA and WWP resistors have an operating temperature range of −55° C to +145° C. Derating is required for temperatures above 125° C. The curve at right applies.



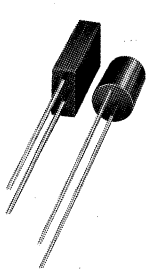
DIMENSIONS

TYPE	DIM. A	DIM. B	DIM. C	DIM. D
MWA-8	.250	.078	1.500	.020
MWA-10	.312	.078	1.500	.020
WWA-13	.375	.125	2.000	.020
WWA-22	.250	.250	2.000	.032
WWA-23	.375	.250	2.000	.032
WWA-24	.500	.250	2.000	.032
WWA-26	.750	.250	2.000	.032
WWA-36	.750	.375	2.000	.032
WWA-38	1.000	.375	2.000	.032
WWA-44	.500	.500	2.00	.040
WWA-45	.625	.500	2.00	.040
WWA-48	1.00	.500	2.00	.040
WWA-412	1.500	.500	2.00	.040
WWA-416	2.00	.500	2.00	.040



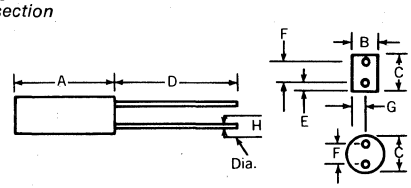
■ TYPE WWP

Rectangular or round printed circuit construction. High resistance per unit volume. Meets applicable requirements of MIL-R-93.



DALE TYPE	MIL-R-93D TYPE	POWER RATING (WATTS)	MINIMUM RESISTANCE RANGE (OHMS) .02%	.05%	.1%	.25%	.5%	1%	MAXIMUM RESISTANCE (OHMS) ALL TOLERANCES	MAXIMUM WORKING VOLTAGE	MAXIMUM WEIGHT (GRAMS)
WWP-18	–	⅛ W	1.5K	600	150	50	25	10	1 Megohm	150 V	1.0
WWP-14	–	¼ W	1K	400	150	50	25	10	1.5 Megohms	300 V	1.5
WWP-225	RB-71	⅛ W	–	105	12	5	.2	.1	515K	150 V	1.0

For additional Power Rating and Derating Information, see section on MWA and WWA styles.



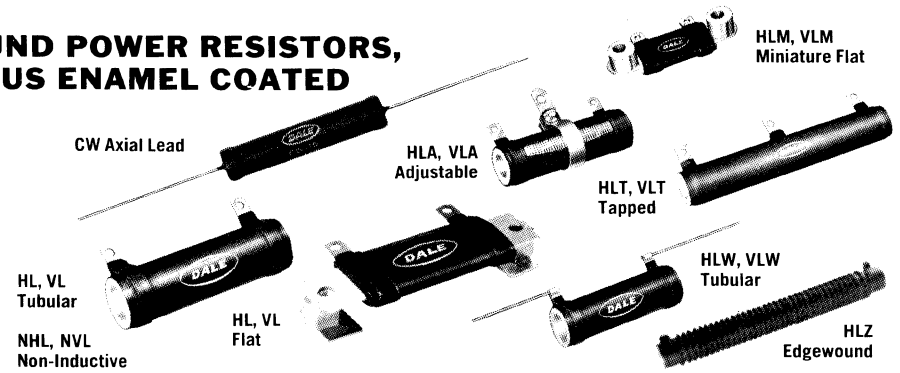
DIMENSIONS

TYPE	A (±.020)	B (±.020)	C (±.020)	D (Min.)	E (±.010)	F (±.010)	G (±.010)	H
WWP-18	.300	.125	.250	1	.062	.125	.062	.032
WWP-14	.600	.125	.250	1	.062	.125	.062	.032
WWP-225	.312	–	.250	1	.025	.200	–	.025

DALE® for Optimum Value in Wirewound Resistors

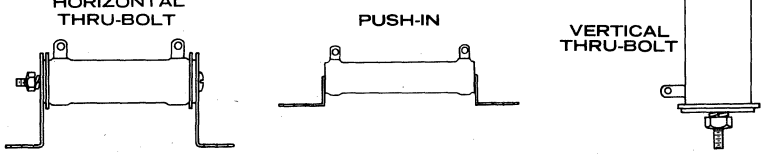
INDUSTRIAL WIREWOUND POWER RESISTORS, SILICONE AND VITREOUS ENAMEL COATED

Dale's expanded industrial wirewound line provides both silicone and vitreous coated models. Silicone models are recommended where maintenance of tolerance and T.C. is of primary concern. Vitreous models are recommended where maximum resistance to chemical action is required.

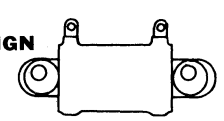


TYPE	APPLICATION	APPLICABLE MIL SPEC AND TYPES	WATTAGE RATING	RESISTANCE RANGE	CORE SIZES	TERMINALS	MOUNTINGS	TOLERANCE
CW Axial Lead	Axial leads. For applications requiring high performance at low cost	MIL-R-26 RW-67, 68, 69	2.5-13 watts	.1 ohm to 100K ohms	Body Dia. .188 to .375" Body Length .500 to 1.781" Leads 1.5 to 2"	Leads	Terminals	±5% (10% below 1 ohm)
HL, VL Tubular	General purpose wirewound resistors with a broad power range.	MIL-R-26 RW-29, 30, 31, 32, 33, 35, 36, 37, 38, 47	5-225 watts	.1 ohm to 1.3 Megohms	O.D. 1/4 to 1-1/8" Length 1-10½"	Lugs	Push-in bracket or thru-bolt	±5% (10% below 1 ohm)
NHL, NVL Non-Inductive	High frequency circuits and applications requiring low inductive effect and minimum distributed capacity	None	5-225 watts	1 ohm to 90K ohms	O.D. 1/4 to 1-1/8" Length 1-10½"	Lugs or Leads	Push-in bracket or thru bolt	±5%
HL, VL Flat	For limited space requiring high power-to-size ratio. Vertical or horizontal stacking.	MIL-R-26 RW-20 thru RW-24	24-95 watts	.1 ohm to 150K ohms	Length 1¼ to 6"	Lugs	Spring push-in	±5% (10% below 1 ohm)
HLM, VLM Miniature Flat	For limited space, high power-to-size requirements particularly in high vibration areas.	None	10-20 watts	.1 ohm to 51K ohms	Length 3/4 to 2-1/16"	Lugs	Thru mount with spacers	±5% (10% below 1 ohm)
HLA, VLA Adjustable	For resistance or voltage adjustment	MIL-R-19365C RX-29, 32, 33, 35, 36 37, 38, 47	12-225 watts	1 ohm to 100K ohms	O.D. 5/16 to 1-1/8" Length 1½ to 10½"	Lugs	Push-in bracket or thru bolt	±5%
HLT, VLT Tapped	For voltage divider networks	MIL-R-26 RW-22, 23, 24, 33, 35, 36, 37, 38, 47	11-225 watts	.1 ohm to 1.1 Megohms	O.D. 5/16 to 1-1/8" Length 1½ to 10½"	Lugs	Push-in bracket or thru bolt	±10% each section (±10% total)
HLW, VLW Tubular	General application where terminal wires are required for direct electrical connection	None	3-20 watts	.1 ohm to 80K ohms	O.D. 13/64 to 7/16" Length 1" to 2"	Lugs with terminal wires	Terminals, thru bolt or push-in bracket	±5% (10% below 1ohm)
HLZ Edge-wound	For heavy duty requirements where space is at a premium. High thermal capacity.	None	35-375 watts	.05 ohm to 32 ohms	O.D. 1/4 to 1-1/8" Length 1 to 10-1/2"	Lugs	Push-in bracket or thru bolt	±10%

MOUNTING BRACKETS for TUBULAR STYLES



EXCLUSIVE BRACKET DESIGN FOR MINIATURE FLAT STYLE



Mounting strap fits snugly through core and is bound tightly against unit by two eccentric spacers. Eliminates expensive cements and improves heat transfer and power handling capabilities.

DALE® for Optimum Value in Metal Film Resistors

PRECISION METAL FILM RESISTORS *(Available with Weldable Leads)*

Vacuum-deposited metal film resistors. Meet both MIL-R-10509 and MIL-R-22684.
Good R.F. characteristics. Low noise level. Wide choice of tolerances and T.C.'s.

■ TYPE MF



Epoxy molded. Meets MIL-R-10509 and MIL-R-22684.

■ TYPE MFF



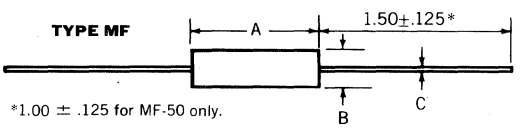
Epoxy conformal coated. Meets electrical and environmental characteristics of MIL-R-10509F, but is dimensionally smaller.

DALE TYPE	MIL-R-10509 TYPE	125° C RATING (Char. C & E)	70° C RATING (Char. D)	MIL-R-22684		MAX. WT. (Grams)	MAX. WORKING VOLTAGE	DIMENSIONS			
				TYPE	RATING			A	B	C	D
MF50	RN-50	1/20 w	1/10 w	–	–	.11	200	.150±.020	.065±.015	.016 Dia.	–
MF-1/10	RN-55	1/10 w	1/8 w	RL-07	1/4 w	.35	200	.260±.010	.095±.005	.025 Dia.	–
MF-1/8	RN-60	1/8 w	1/4 w	RL-20	1/2 w	.45	300	.406±.015	.135±.010	.025 Dia.†	–
MF-1/4	RN-65	1/4 w	1/2 w	–	–	.84	350	.593±.015	.203±.015	.025 Dia.	–
MFS-1/2	RN-70	1/2 w	3/4 w	–	–	1.6	500	.730±.020	.250±.015	.032 Dia.	–
MF-3/4	RN-70F	3/4 w*	–	–	–	1.9	500	.790±.020	.260±.015	.032 Dia.	–
MF-1	RN-75	–	1 w**	–	–	4.4	500	1.093±.020	.375±.015	.032 Dia.	–
MF-2	RN-80	–	2 w**	–	–	7.9	750	2.188±.020	.375±.015	.032 Dia.	–
CMF-1/10	–	1/10 w	1/8 w	–	–	.25	200	.264±.031	.089±.008	.025 Dia.	.328
MFF-1/8	–	1/8 w	–	–	–	.40	300	.343±.031	.109±.015	.025 Dia.	.453
MFF-1/4	–	1/4 w	–	–	–	.65	350	.468±.031	.125±.015	.025 Dia.	.578
MFF-1/2	–	1/2 w	–	–	–	.95	500	.562±.031	.187±.031	.032 Dia.	.734
MFF-1	–	–	1 w	–	–	2.7	500	.937±.062	.296±.031	.032 Dia.	1.187
MFF-2	–	–	2 w	–	–	4.7	750	2.062±.062	.296±.031	.032 Dia.	2.312

*Characteristic F **Characteristic B †.032" MIL-R-22684

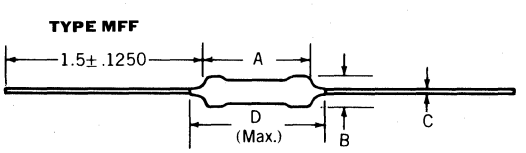
Tolerance MIL-R-10509 ±1%, ±.5%, ±0.25%, ±0.10% standard,
MIL-R-22684 ±2%, ±5%. Special tolerances and matching on request.

TYPE MF



*1.00 ± .125 for MF-50 only.

TYPE MFF

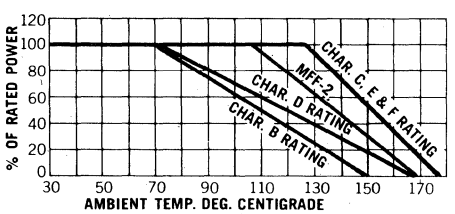


POWER RATING

Dale MF resistors have two power ratings, depending on operating temperatures of 70° C and 125° C. MFF resistor power ratings are based on full power at 125° C. All are based on a maximum ΔR of .5% in 1000 hour load life.

DERATING

Dale MF resistors have an operating temperature range of −65° C to +175° C. They must be derated according to the curves at right.



RESISTANCE RANGE (OHMS)

1%, .5%, .25%, .1%

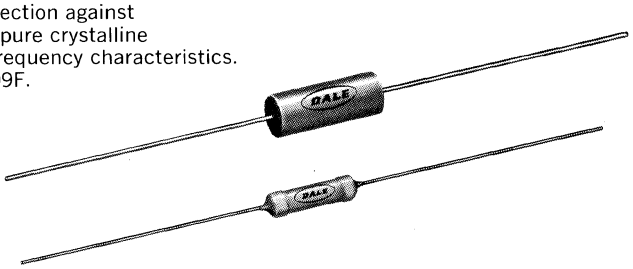
	T-0* (Char. D)	T-1* (Char. D)	T-2 (Char. C)	T-9 (Char. E)
MF50	24.9Ω-100KΩ	49.9Ω-100KΩ	100Ω-100KΩ	100Ω-100KΩ
MF-1/10, CMF-1/10	10Ω-301KΩ	30.1Ω-301KΩ	30.1Ω-301KΩ	30.1Ω-301KΩ
MF-1/8, MFF-1/8	10Ω-1 Meg.	24.9Ω-1 Meg.	30.1Ω-499KΩ	30.1Ω-499KΩ
MF-1/4, MFF-1/4	10Ω-2 Meg.	24.9Ω-2 Meg.	30.1Ω-1 Meg.	30.1Ω-1 Meg.
MFS-1/2, MFF-1/2	10Ω-2.49 Meg.	24.9Ω-2.49 Meg.	24.9Ω-1 Meg.	24.9Ω-1 Meg.
MF-3/4	10Ω-2.49 Meg.	24.9Ω-2.49 Meg.	100Ω-1 Meg.	100Ω-1 Meg.
MF-1, MFF-1	10Ω-5.11 Meg.	24.9Ω-4.02 Meg.	49.9Ω-2.61 Meg.	49.9Ω-2.61 Meg.
MF-2, MFF-2	30.1Ω-10 Meg.	100Ω-8 Meg.	100Ω-6 Meg.	200Ω-5.11 Meg.

*T-0 and T-1 are available in tolerance of ±.25% and greater only.
11 standard T.C.'s available in −55° C to +175° C range.

DALE® for Optimum Value in Carbon Film Resistors

DEPOSITED CARBON RESISTORS *(Available with Weldable Leads)*

Designed for inherent stability, long load life and excellent protection against environmental factors in a wide range of applications. Made of pure crystalline carbon film bonded to selected ceramic cores. Excellent high frequency characteristics. Types DC and MC meet functional requirements of MIL-R-10509F.



■ TYPE MC

Molded housing. Completely insulated and protected against environmental or mechanical damage. Specially formulated molding compound gives best humidity protection available.

■ TYPE DC

Specially coated for complete insulation against moisture, salt spray and other severe environmental factors. Miniature size.

DALE TYPE	MIL. TYPE		POWER RATING (WATTS)		MINIMUM RESISTANCE (OHMS)	MAXIMUM 1% RESISTANCE (OHMS)	MAXIMUM 2% RESISTANCE (OHMS)	MAX. WT. (GRAMS)		MAXIMUM WORKING VOLTAGE
	MC	DC	B	D*				MC	DC	
MC-1/10, DC-1/10	RN-55	—	1/10	1/8	2	400K	400K	.35	.20	200
MC-1/8, DC-1/8	RN-60	—	1/8	1/4	1	3 Megohms	5 Megohms	.45	.30	300
MC-1/4, DC-1/4	RN-65	RN-10	1/4	1/2	2	5 Megohms	6 Megohms	.85	.35	350
MCS-1/2, DCS-1/2	RN-70	RN-20	1/2	3/4	1	10 Megohms	15 Megohms	1.50	.80	500
MC-1, DC-1	RN-75	RN-25	1	—	1	15 Megohms	30 Megohms	4.50	2.8	500
MC-2, DC-2	RN-80	RN-30	2	—	2	100 Megohms	125 Megohms	8.25	5.5	750
— DC-5	—	—	—	5	5	150 Megohms	300 Megohms	—	21.9	14,000

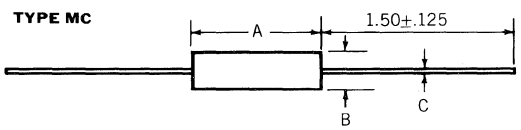
*Applies to MC only.

Tolerance: .5%, 1%, 2%

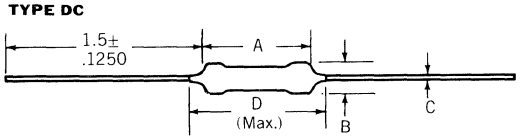
Operating Temp. Range: −55° C to +165° C

Temperature Coefficient: −200 PPM to −500 PPM, depending on value within normal resistance range.

TYPE MC



TYPE DC



DIMENSIONS

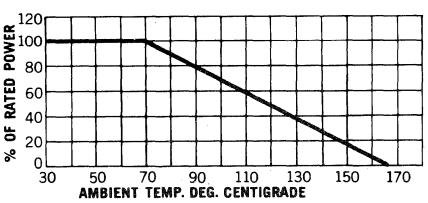
DALE TYPE	A	B	C	D
MC-1/10	.260±.010	.095±.005	.025 Dia.	—
MC-1/8	.406±.015	.135±.010	.025 Dia.	—
MC-1/4	.593±.015	.203±.015	.025 Dia.	—
MCS-1/2	.730±.020	.250±.015	.032 Dia.	—
MC-1	1.093±.020	.375±.015	.032 Dia.	—
MC-2	2.188±.020	.375±.015	.032 Dia.	—
DC-1/10	.281±.031	.094±.015	.025 Dia.	.375
DC-1/8	.343±.031	.109±.031	.025 Dia.	.453
DC-1/4	.468±.031	.109±.031	.025 Dia.	.578
DCS-1/2	.562±.062	.187±.031	.032 Dia.	.734
DC-1	.937±.062	.296±.031	.032 Dia.	1.187
DC-2	2.062±.062	.296±.031	.032 Dia.	2.312
DC-5	4.000±.125	.438±.031	.040 Dia.	4.300

POWER RATING

Dale MC and DC power ratings are based on 1% maximum ΔR in 1000 hours load life at 70° C.

DERATING

Dale MC and DC resistors have an operating temperature range of −55° C to +165° C. They must be derated at high ambient temperatures according to the curve.



For complete information write or phone-

DALE ELECTRONICS, INC.

P.O. Box 609 • COLUMBUS, NEBRASKA 68601

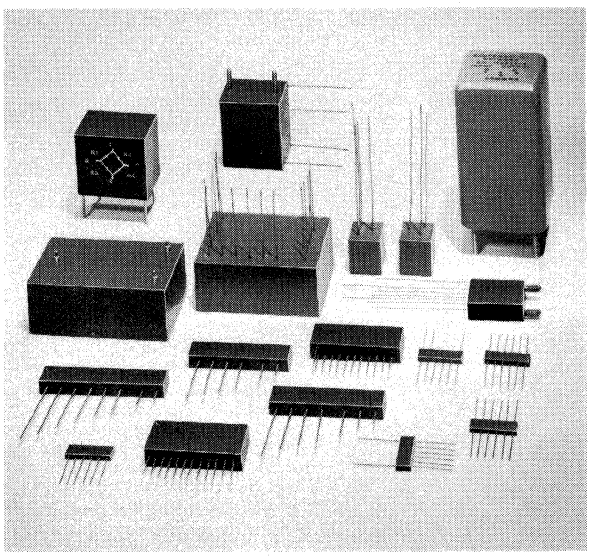
PHONE: 402-564-3131 • TWX: 402-564-2807 • TELEX: 048-6434

DALE® for Optimum Value in Packaged Networks

WIREWOUND FILM and CERMET PACKAGED NETWORKS

FEATURES

- Choice of linear wirewound, bobbin wirewound, metal film, carbon film or cermet elements
- Less components to stock or handle
- Reduced inspection time
- Ease of assembly
- Matched resistors cannot be mixed or lost
- Complete environmental protection
- Dale networks meet or exceed requirements of MIL-R-26, MIL-R-93 or MIL-R-10509, depending on type of element used.
- Packaged to meet your requirements



GENERAL RESISTOR ELECTRICAL CAPABILITIES WIREWOUND AND FILM NETWORKS

	WIREWOUND	FILM (Carbon & Metal)
POWER RATING:	.1 to 10 W	.02 to .5 W
RESISTANCE RANGE:	1 ohm to 1.5 Meg.	5 ohms to 5 Meg.
TOLERANCE:	.02% to 1%	.1% to 1%
TOLERANCE MATCH:	.005%	.05%
TEMPERATURE COEFFICIENT:	5 PPM/°C from 0°C to +75°C	25 PPM/° C
TEMPERATURE COEFFICIENT MATCH:	2 PPM/°C from 0°C to +75°C	7 PPM/° C
RESISTANCE STABILITY:	.005%/yr.	.03%/yr.
OPERATING TEMPERATURE:	−65°C to +145°C	−55° C to +175° C

LADDER NETWORKS

- **OUTPUT ACCURACY:** ±.05% full scale accuracy or ± 1/2 least significant bit, whichever is less.
- **OUTPUT VARIATION WITH TEMP.:** ±.1% full scale accuracy or ±1 least significant bit, whichever is less.
- **OPERATING TEMP. RANGE** (For Accuracies Specified Above): −55°C to +70°C (Film Type) −55°C to +125°C (Wirewound Type)
- **INPUT RESISTANCE** (All inputs connected): 1KΩ to 500KΩ
- **OUTPUT RESISTANCE** (All inputs grounded): 250Ω to 125KΩ
- **INSULATION RESISTANCE:** 100 Megohms Minimum
- **TERMINALS:** Solderable or weldable wire leads
- **PACKAGING:** Epoxy or Silicone resin potting, Transfer molded, Can encapsulated. Other types of special packaging available to meet your requirements.

BINARY DIGITAL-TO-ANALOG LADDER NETWORKS:

Resistor Parameters for meeting 4 and 8 bit dimensional requirements

	WIREWOUND	FILM
POWER RATING:	⅛ watt from −55° C to +125° C, derated linearly to 0 at +145° C	½ watt from −55° C to +70° C, derated linearly to 0 at +145° C
TEMPERATURE COEFFICIENT:	0 ± 20 PPM/° C, from −55° C to +125° C. Lower TC's available upon request.	400 PPM/° C max. TC's available down to 25 PPM/° C
HEAT RISE:	20° C max. at rated power	60° C max. at rated power

GENERAL RESISTOR ELECTRICAL CAPABILITIES CERMET NETWORKS

Resistor Tolerance: 1%-10% depending on design requirements

Temperature Coefficient: ± 300 PPM/° C from −55° C to +150° C. Special T.C.'s as low as ±50 PPM/° C can be provided over limited temperature ranges. T.C. tracking within ±30 PPM is possible.

Power Loading: Up to 100 watts/square inch (with suitable heat sink).

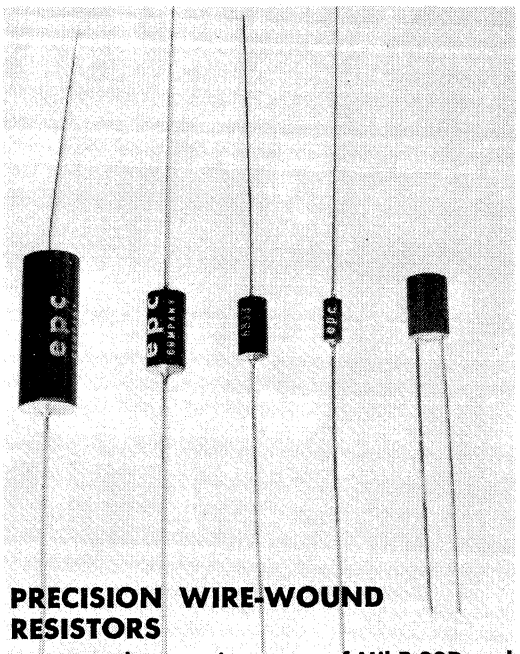
Load Life: Δ R < 0.5% per 1,000 hours (room temperature) at 16 watts/square inch loading.

Moisture Changes: per MIL-STD-202, Method 103.

In addition to the networks described, Dale can design and produce special units to your specifications for circuit designs that do not fall into standard sizes or configurations. If your circuit design requires a network which does not fall into the standard sizes and configurations shown here, contact the Sales Department of Dale Electronics, Inc., Box 609, Columbus, Nebr. Phone: 402-564-3131.

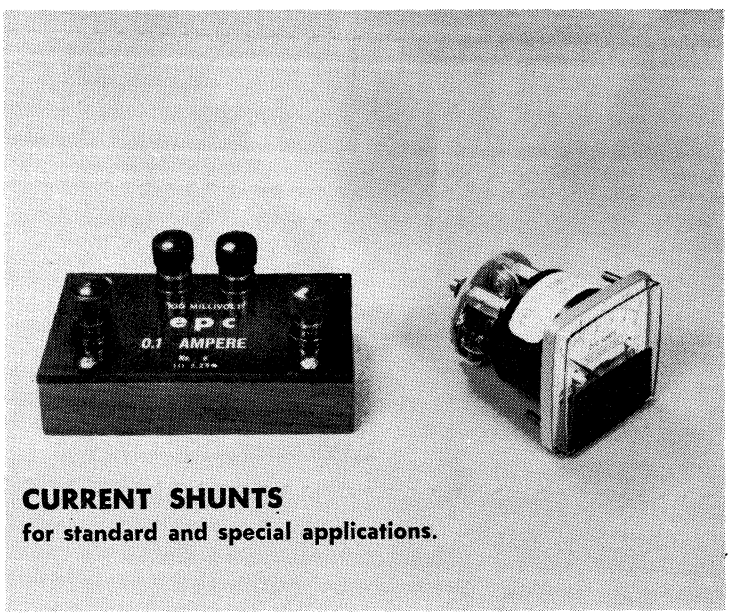
epc CORPORATION

MANUFACTURERS OF PRECISION WIRE-WOUND RESISTORS • RESISTOR NETWORKS CURRENT SHUNTS AND HIGH VOLTAGE DIVIDERS • NO ORDER TOO SMALL OR LARGE



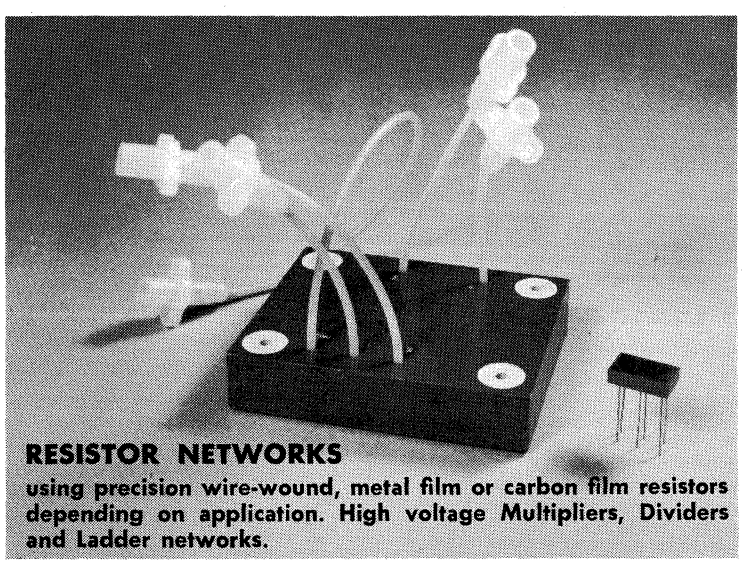
PRECISION WIRE-WOUND RESISTORS

to meet the requirements of Mil-R-93D and special applications. Standard T.C. ±10 ppm/°C. Tolerances to.005% on most types.



CURRENT SHUNTS

for standard and special applications.

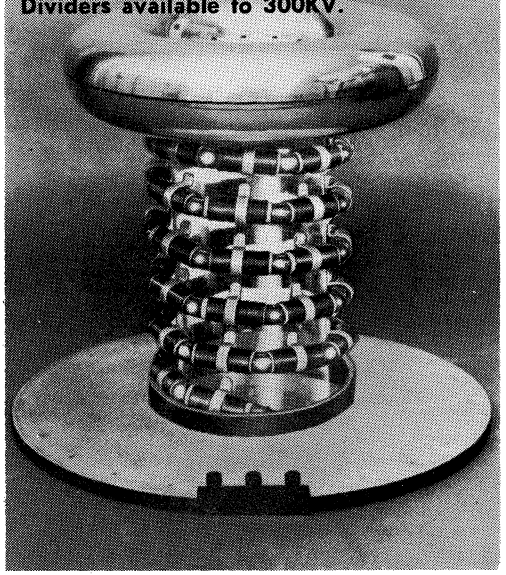


RESISTOR NETWORKS

using precision wire-wound, metal film or carbon film resistors depending on application. High voltage Multipliers, Dividers and Ladder networks.

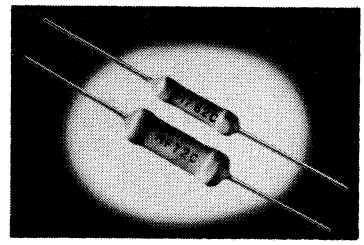
HIGH VOLTAGE DIVIDERS

shielded 100 KV high voltage standards with ratio accuracy of .05%. Other Dividers available to 300KV.



ELECTRONIC PRECISION COMPONENTS CORPORATION

2 BROOKDALE PLACE • MOUNT VERNON, N. Y. 10550 • TELEPHONE: (914) 664-2333



METAL FILM PRECISION RESISTORS

CHARACTERISTIC CODE: Characteristic D (0 ±100 PPM/°C)
Characteristic C & F (0 ±50 PPM/°C)
Characteristic E (0 ±25 PPM/°C)
MIL-R-22684 (0 ±150 PPM/°C)

ELECTRA/MIDLAND TYPES & DIMENSIONS			POWER RATING (WATTS) @		CHARACTERISTIC & T.C. of R (PPM/°C)	RESISTANCE RANGE (See Notes)	TOLERANCE(5)	MIL EQUIV.
MOLDED	CONFORMALLY COATED							
MIL LINE		TRIM LINE	125°C	70°C				
	MF3C A = .130/.170 B = .050/.080 AWG = #26		1/20		D = ±100 C = ±50 E = ±25	10 ohm-100K 30.1 ohm-100K 30.1 ohm-100K	F F F	RN50
MF4 A = .250/.270 B = .115/.135 AWG = #22	MF4C A = .219/.281 B = .083/.103 AWG = #22		1/10	1/8	D = ±100 C = ±50 E = ±25	10 ohm-301K 30.1 ohm-301K 30.1 ohm-200K	F,D B,C,D,F B,C,D,F	RN55
MF5 A = .385/.415 B = .125/.145 AWG = #22	MF52C A = .375/.430 B = .130/.160 AWG = #22	MF5C A = .281/.343 B = .083/.103 AWG = #22	1/8	1/4	D = ±100 C = ±50 E = ±25	10 ohm-1 Meg.(1) 30.1 ohm-499K 30.1 ohm-499K	F,D B,C,D,F B,C,D,F	RN60
MF6 A = .580/.610 B = .205/.225 AWG = #22	MF62C A = .600/.656 B = .157/.177 AWG = #22	MF6C A = .375/.560 B = .130/.160 AWG = #22	1/4 1/2	1/2	D = ±100 C = ±50 E = ±25 F = ±50	10 ohm-2 Meg.(2) 49.9 ohm-1 Meg. 49.9 ohm-1 Meg. 49.9 ohm-1 Meg.	F,D B,C,D,F B,C,D,F B,C,D,F	RN65
MF7 A = .745/.765 B = .245/.275 AWG = #20	MF72C A = .688/.765 B = .220/.320 AWG = #20	MF7C A = .600/.656 B = .150/.180 AWG = #20	1/2 3/4	3/4	D = ±100 C = ±50 E = ±25 F = ±50	10 ohm-2.49 Meg.(3) 49.9 ohm-1 Meg. 49.9 ohm-1 Meg. 49.9 ohm-1 Meg.	F,D B,C,D,F B,C,D,F B,C,D,F	RN70
MF8 A = 1.100/1.120 B = .390/.410 AWG = #20		MF8C A = .960/1.020 B = .280/.320 AWG = #20	1		B = ±100 C = ±50 E = ±25	10 ohm-5.11 Meg.(4) 49.9 ohm-2 Meg. 49.9 ohm-2 Meg.	F,D B,C,D,F B,C,D,F	RN75
MF9 A = 2.215/2.265 B = .375/.415 AWG = #20		MF9C A = 2.025/2.165 B = .280/.320 AWG = #20	2		B = ±100 C = ±50 E = ±25	100 ohm-10 Meg. 100 ohm-10 Meg. 249 ohm-5.11 Meg.	F,D B,C,D,F B,C,D,F	RN80
	MFO7C A = .219/.281 B = .082/.098 AWG = #22		1/8	1/4	±150	51 ohm-150K 10 ohm-301K (extended range-commercial only)	G,J	RL07
	MF20C A = .384/.416 B = .130/.160 AWG = #20		1/4	1/2	±150	51 ohm-470K 15 ohm-499K (extended range-commercial only)	G,J	RL20

TO ORDER, SPECIFY (TYP.): MF52C – E – 1001 – F
(Add lead options, packing data if needed.)

NOTES: Carbon Film will be supplied in the following values with T.C. of R. = −200 to −500 PPM/°C:
(1) 10 Ω to 14.9 Ω and 500K to 1 Meg.
(2) 10 Ω to 14.9 Ω and 1.02 Meg. to 2.0 Meg.
(3) 10 Ω to 14.9 Ω and 1.51 Meg. to 2.49 Meg.
(4) 10 Ω to 48.7 Ω and 2.01 Meg. to 5.11 Meg.
(5) Tolerance Code: B = 0.10%, C = 0.25%, D = 0.50%, F = 1.0%, G = 2.0%, J = 5.0%
(6) MF35 Maximum Value 100K

CURRENT LIMITING FUSE

The Current Limiting Fuse provides unexcelled performance for critical circuit protection by opening at extremely fast, predictable current-time overloads. It offers timed protection required in circuits with predictable starting and load surge currents yet require fast protection against damaging spikes or overloads.

This is a one-shot device employing a low resistance Electra cermet fired junction onto a non-conducting glass subtrate. No arc, plasma, or vapor may escape the package.

TYPES	S100-32 S125-32 P200L-32	P800L-32	P500L-32 P500L-75	P600L-32 P600L-75	S100-115 S125-115
1. "Opening" time (Seconds) @% rated load @25°C.	Min. Max. – .004 @ 316%	Min. Max. .010 2.000 @ 200% .00025 .010 @ 400% .00012 .004 @ 500%	Min. Max. – .1 @ 316%	Min. Max. .4 10.000 @ 200% .0015 .018 @ 400% .00025 .003 @ 600%	Min. Max. – .075 @ 316%
2. Max. operating voltage	32 Vrms 45 Vpeak		32 Vrms 45 Vpeak 75 Vrms 105 Vpeak	32 Vrms 45 Vpeak 75 Vrms 105 Vpeak	115 Vrms 160 Vpeak

3. Current Ratings
All Types
Amps

1/16	13.500	25.000 40.00	25.000 40.00	77.00
1/8	4.200	7.500 13.00	7.500 13.00	25.00
1/4	1.400	2.500 3.50	2.500 3.50	8.00
3/8	0.600	1.000 1.50	1.000 1.50	4.00
1/2	0.450	0.650 0.90	0.650 0.90	2.80
3/4	0.300	0.300 0.43	0.300 0.43	1.30
1	0.160	0.200 0.28	0.200 0.28	0.77
1.5	0.110	0.100 0.14	0.100 0.14	not available
2	0.075	0.070 0.087	0.070 0.087	not available
3	0.050	0.046 0.046	0.046 0.046	not available
5	0.022	0.022 0.022	0.022 0.022	not available

PACKAGE: Type P200L-32, P500L-32, P600L-32, P800L-32
S125-32, S125-115
S100-32, S100-115
P500L-75, P600L-75

To order specify Type Number followed by current rating. Example: Type P200L-32 1/8 amp Would be ordered as P200L-32-1/8

DISCRETE MICRO RESISTOR CHIP TF50P

This discrete micro resistor chip, 50 mils by 50 mils, offers versatility for micro circuit designers. Electra cermet is used with glass as a passivation material. It has gold terminations for mounting. The back of the chip is gold screened to provide substrate mounting (heat sink).

Resistance Range 10 ohms to 100k ohms (standard decade values)	TC of R ±100 PPM/°C MAX.	Matching	to ±0.25% available
Tolerance	±5% standard (J) ±1% available (F)	Power Rating	.01 watt @ 125°C ambient, chip mounted in free air. Gold backing is provided for heat sinking.

ELECTRA/MIDLAND CORPORATION
CERMETRIK DIV.
3347 Industrial Court San Diego, Calif. 92121

Charles T. Gamble Industries

PRECISION WIRE WOUND RESISTORS & NETWORKS

Charles T. Gamble Industries has engineered and designed non-inductive precision wire wound resistors to meet the requirements of Mil-R-93D. These resistors are completely sealed against the effects of high humidity and salt water immersion cycling. The material used in the manufacture of our resistors has a very high dielectric strength. The bobbin material used in winding the resistors is one and the same as the encapsulating material. All resistors use resistance wire with very low thermal E.M.F. to the copper leads. Where thermal effects can be disregarded, welded construction with nickel alloy leads may be specified.

Standard temperature coeficient is ±10 PPM/°C. Lower T.C.'s, and T.C.'s as high as 6000 PPM/°C can be supplied.

Tolerance available (non power styles): 1%, 0.5%, 0.1%, 0.05%, 0.025%, 0.02% and 0.01%. Resistors with tolerances of 0.1% and below are stabilized by artificial aging and temperature cycling.

NETWORKS: RC NETWORKS, LADDER NETWORKS, VOLTAGE DIVIDERS, BINARY NETWORKS

Sub-miniature Axial lead Precision resistors have been designed for applications where space is a prime factor.

Encapsulated printed circuit resistors are designed for printed circuit board application, where space is a factor.

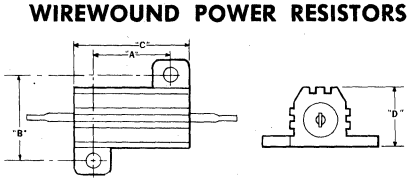
Radial lug type resistors have been designed to meet the requirements of Mil-R-93D.

All resistors are hermetically sealed with epoxy resin to protect the windings against the effects of high humidity and salt water immersion cycling. Resistors can either be inductive or non-inductive wound.

The materials used in the construction of radial lug type resistors are identical to those used in the construction of axial lead types.

These resistors are supplied with a thru hole for mounting to the chassis by means of a #6 thru bolt.

HEAT SINK MOUNTED PRECISION WIREWOUND POWER RESISTORS



POWER RATING	DIMENSIONS A	B	C	D	MAXIMUM OHMS
10 WATT	.562	.625	.750	.390	20,000
25 WATT	.718	.781	1.062	.542	60,000
50 WATT	1.563	.844	1.968	.610	70,000

Ratings shown are based upon use of appropriate chassis mounting.

STANDARD AXIAL LEAD PRECISION RESISTORS

Type	Military Specs. New	Old	Commercial Wattage Rating	Max. Resist. Based on .0007 E Alloy	Military Wattage Rating	Max. Volts	Size Length	Dia.
0808AL			.125W	300K		200V	¼″	¼″
1108AL	RB56		.125W	350K	.125W	250V	1 1/32″	¼″
1608AL	RB55	AFRT 10	.250W	400K	.15 W	184V	½″	¼″
1208AL			.200W	350K	.250W	225V	⅜″	¼″
2408AL	RB54	AFRT 11	.333W	1 meg.	.250W	300V	¾″	¼″
2412AL	RB53	AFRT 12	.500W	1.2 meg.	.333W	300V	¾″	⅜″
3212AL	RB52	AFRT 13	1.000W	2 meg.	.400W	600V	1″	⅜″
1616AL			.500W	1.3 meg.		300V	½″	½″
3216AL	RF57	AFRT 14	1.000W	3 meg.	.750W	600W	1″	½″
4816AL	RB58	AFRT 15	2.000W	6 meg.	1.000W	900V	1½″	½″
6416AL	RB59	AFRT 16	2.500W	10 meg.	1.250W	1200V	2″	½″
2008AL			.500W	.425 meg.		300V	⅝″	¼″
1612AL			.400W	.500 meg.		300V	½″	⅜″
2012AL			.750W	.600 meg.		600V	⅝″	⅜″
3208AL			.500W	1.1 meg.		300V	1″	¼″
2016AL			.750W	2 meg.		600V	⅝″	½″
1212AL			.250W	1 meg.		225V	⅜″	⅜″

SUB-MINIATURE AXIAL LEAD PRECISION RESISTORS

Type	Commercial Wattage Rating	Maximum Resistance based on .0007 E Alloy	Maximum Voltage	Size Length	Dia.
500156AL	.1W	70K	85 Volts	½″	5/32″
625156AL	.15W	100K	125 Volts	⅝″	5/32″
375125AL	.125	50K	72 Volts	⅜″	⅛″
109250AL	.120	25K	50 Volts	¼″	7/64″
375187AL	.1W	40K	65 Volts	⅜″	3/16″
375109AL	.120	30K	55 Volts	⅜″	7/64″
375093AL	.1	20K	55 Volts	⅜″	3/32″

ENCAPSULATED PRINTED CIRCUIT RESISTORS

Type	Military Specs.	Commercial Wattage	Military Wattage	Max. Volts	Max. Resist. Based on .0007	Sizes Length	Dia.	Lead Spacing	Lead Length
0808PC		.125W		90V	70K	¼″	¼″	.100	1″
1208PC		.200W		200V	200K	⅜″	¼″	.100	1″
1608PC		.250W		184V	400K	½″	¼″	.100	1″
2408PC		.333W		300V	1 meg.	¾″	¼″	.100	1″
3208PC		.500W		750V	1.1 meg.	1″	¼″	.100	1″
1008PC	RB71	.250W	.125W	240V	250K	5/16″	¼″	.200	1″
1612PC	RB70	.500W	.250W	150V	.301 meg.	½″	⅜″	.200	1″
3212PC		1.000W		1350V	1.75 meg.	1″	⅜″	.250	1″
3232PC		1.250W		1700V	2.50 meg.	1″	½″	.250	1″

STANDARD RADIAL LUG PRECISION RESISTORS

Type	Military Specs. New	Old	Commercial Wattage	Military Wattage Rating	Maximum Voltage	Max. Resist. Based on .0007	Size Length	Dia.
1616RLU	RB08	AFRT 17	.500	¼W	300V	885K	½″	½″
2020RLU	RB16	AFRT 18	.666	⅓W	300V	1 meg.	⅝″	⅝″
3220RLU	RB17	AFRT 19	1.000	½W	600V	2.5 meg.	1″	⅝″
4024RLU	RB18		1.500	¾W	600V	6.5 meg.	1¼″	¾″
6828RLU	RB19		2.000	1W	900V	12 meg.	2⅛″	⅞″

CHARLES T. GAMBLE INDUSTRIES
Precision Wire Wound Resistors
New Jersey Avenue & Fairview Street
Riverside, New Jersey 08075 Tel: (609) 461-1900

PRECISION METAL FILM RESISTORS

IRC®

TRW INC.

MIL-R-55182C QUICK REFERENCE CHART

MIL Specified Characteristic	C (Hermetically sealed)	H (Non-hermetically sealed)	E (Hermetically sealed)	J (Non-hermetically sealed)	K (Non-hermetically sealed)
Maximum resistance-temperature characteristic Temperature Coefficient or T.C.	±0.005% or ±50 PPM/°C	±0.005% or ±50 PPM/°C	±0.0025% or ±25 PPM/°C	±0.0025% or ±25 PPM/°C	±.010% or ±100 PPM/°C
Maximum ambient temperature at rated wattage	125°C	125°C	125°C	125°C	125°C
Maximum ambient temperature at zero wattage derating	175°C	175°C	175°C	175°C	175°C
MIL (IRC) specified sizes—					
RNC50, RNR50 (MMC)	—	1/20 W, 200 V (T2)	—	1/20 W, 200 V (T9)	1/20 W, 200 V (T0)
RNC54, RNR54 (CCM)	—	1/10 W, 200 V (T2)	—	1/10 W, 200 V (T9)	—
RNC55, RNR55 (CCM)	1/10 W, 200 V	1/10 W, 200 V (T2)	1/10 W, 200 V	1/10 W, 200 V (T9)	1/10 W, 200 V (T0)
RNC60, RNR60 (CCA)	1/8 W, 250 V	1/8 W, 250 V (T2)	1/8 W, 250 V	1/8 W, 250 V (T9)	1/8 W, 250 V (T0)
RNC63, RNR63	1/4 W, 300 V	—	1/4 W, 300 V	—	—
RNC65, RNR65 (CCB)	1/4 W, 300 V	1/4 W, 300 V (T2)	1/4 W, 300 V	1/4 W, 300 V (T9)	1/4 W, 300 V (T0)
RNC70, RNR70	1/2 W, 350 V	—	1/2 W, 350 V	—	1/2 W, 350 V (T0)
Resistance tolerances ± percent	1.0%, 0.5%	1.0%, 0.5%	1.0%, 0.5%, 0.1%	1.0%, 0.5%, 0.1%	1.0%, 0.5%

MIL-R-10509 QUICK REFERENCE CHART

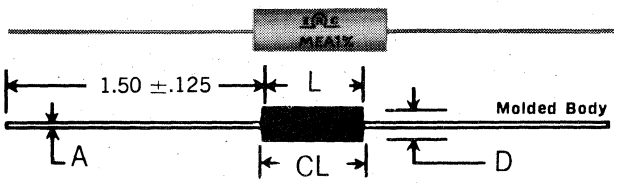
MIL Specified Characteristic	B	C	D	E
Maximum resistance-temperature characteristic. (Temperature Coefficient or T.C.)	±0.05% or ±500 PPM/°C	±0.005% or ±50 PPM/°C	+0.02% −0.05% or +200 PPM/°C −500 PPM/°C	±0.0025% or ±25 PPM/°C
Maximum ambient temperature for full rated wattage	70°C	125°C	70°C	125°C
Temperature limits for linear wattage derating from 100% loading	150°C	175°C	165°C	175°C
MIL (IRC) Specified Sizes—				
RN50 (MMC)	—	1/20 W, 200 V (T2)	—	1/20 W, 200 V (T9)
RN55 (CCM, CEA)	—	1/10 W, 200 V (T2)	1/8 W, 200 V (T0)	1/10 W, 200 V (T9)
RN60 (MEA, CCA)	—	1/8 W, 250 V (T2)	1/4 W, 300 V (T0)	1/8 W, 250 V (T9)
RN65 (MEB, CCB, MDB)	—	1/4 W, 300 V (T2)	1/2 W, 350 V (T0)	1/4 W, 300 V (T9)
RN70 (MEC, MDC)	—	1/2 W, 350 V (T2)	3/4 W, 500 V (T0)	1/2 W, 350 V (T9)
RN75 (MDF, MEF)	1 W, 500 V*	1 W, 500 V (T2)	—	1 W, 500 V (T9)
RN80 (MDH)	2 W, 750 V*	—	—	—
MIL specified resistance tolerances (others available for commercial units)	1.0%	1.0%, 0.5%, 0.25%, 0.1%	1.0%	1.0%, 0.5%, 0.25%, 0.1%

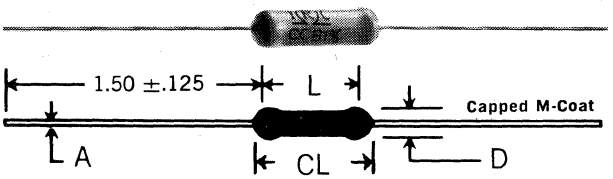
*Available in this characteristic only.

HIGH STABILITY PRECISION METAL FILM RESISTORS

TRW INC.

MOLDED AND M-COAT TYPES





IRC Type	Standard Resistance Range (Ohms)	Maximum Extended Range (Ohms)	Wattage (W) 70°C	Wattage (W) 125°C	Maximum Continuous Voltage (V)	MIL-R-10509 Char.	MIL-R-10509 Resistance Range (Ohms)	Dimensions in Inches: Body Length (L)	Body Dia. (D)	Clean Lead Length (CL)	Lead Gage (A)	
MOLDED TYPES												
MEA T-0	10 to 499K	1.5 Meg	1/4	1/8	250V	D	10 to 1 Meg	.406 ±.015	.130 ±.010	.545	#22	.0253
T-2 T-9	30.1 to 499K	—				C-E	49.9 to 499K					
MEB T-0	10 to 1 Meg	2.0 Meg	1/2	1/4	300V	D	10 to 2 Meg	.594 ±.015	.203 ±.015	.733	#22	.0253
T-2 T-9	49.9 to 1 Meg	—				C-E	49.9 to 1 Meg					
MEC T-0	10 to 1.5 Meg	3.0 Meg	3/4	1/2	350V	D	10 to 2.49 Meg	.719 ±.020	.261 ±.020	.863	#20	.032
T-2 T-9	24.9 to 1.5 Meg	—				C-E	24.9 to 1 Meg					
MEF T-0	49.9 to 4 Meg	10.0 Meg		1	500V	B	10 to 5.1 Meg	1.105 ±.020	.395 ±.020	1.253	#20	.032
T-2 T-9	49.9 to 4 Meg	—				C-E	49.9 to 2 Meg					
MEH T-0	100 to 10 Meg	30.0 Meg		2	750V	B	30.1 to 10 Meg	2.234 ±.020	.395 ±.020	2.378	#20	.032
T-2 T-9	100 to 10 Meg	—				—						
CAPPED M-COAT TYPES (CONFORMALLY COATED)												
UC† T-0	50 to 10K	—	1/20 W at 100°C		200V			.125 ±.020	.047 ±.010	.160	#30	.010*
T-2	50 to 10K	—										
MMC T-0	10 to 100K	200K	1/8	1/20	200V	—	—	.152 ±.020	.065 ±.010	.200	#26	.016**
T-2 T-9	49.9 to 100K	—				C-E	10 to 100K					
CCM T-0	20 to 301K	1.5 Meg	1/8	1/10	200V	D	10 to 301K	.250 ±.031	.088 ±.010	.325	#22	.0253
T-2 T-9	30.1 to 301K	—				C-E	49.9 to 100K					
CEA T-0	10 to 499K	1.5 Meg	1/4	1/8	250V	D	10 to 301K	.250 ±.031	.090 ±.010	.325	#22	.0253
T-2 T-9	30.1 to 499K	—				C-E	49.9 to 100K					
CCA T-0	10 to 1 Meg	2.0 Meg	1/2	1/4	300V	D	10 to 1 Meg	.400 ±.031	.140 ±.020	.540	#22	.0253
T-2 T-9	49.9 to 1 Meg	—				C-E	49.9 to 499K					
CCB T-0	10 to 1.5 Meg	3.0 Meg	3/4	1/2	350V	D	10 to 2 Meg	.594 ±.031	.180 ±.020	.734	#22	.0253
T-2 T-9	49.9 to 1.5 Meg	—				C-E	49.9 to 1 Meg					
CEC T-0	10 to 1.5 Meg	3.0 Meg	1	1/2	350V	—	—	.594 ±.031	.180 ±.020	.734	#20	.032
T-2 T-9	49.9 to 1.5 Meg	—				C-E	—					

*Gold Plated Dumet Leads 1.00 ±.062 †Trademark of TRW Inc. **Lead Length 1.00 ±.062

TEMPERATURE COEFFICIENTS

These high stability evaporated metal film resistors are available in nine temperature coefficient tolerances.

MIL-R-10509 Char.	Code	Temperature** Coefficient	Temperature Span
*D	T-0	0 ±100PPM/°C	−55°C to +165°C
*C	T-2	0 ±50PPM/°C	−55°C to +175°C
*E	T-9	0 ±25PPM/°C	−55°C to +175°C
	T-3	0 to +100PPM/°C	−55°C to +165°C
	T-4	0 to −100PPM/°C	−55°C to +165°C
	T-5	0 ±25PPM/°C	+25°C to +145°C
	T-6	0 to +50PPM/°C	−55°C to +165°C
	T-7	0 to −50PPM/°C	−55°C to +165°C
	T-8	0 ±25PPM/°C	+25°C to +165°C
		0 ±35PPM/°C	−55°C to +25°C

*Standard types. All others are special.
**Parts Per Million per degree centigrade (100PPM equals 0.01%).
T.C. code marking is combined with the code for the date of manufacture.

RESISTANCE RANGE

The maximum extended ranges shown above are also available with a TC of +100PPM/°C, −250PPM/°C—Code TR or +100PPM/°C, −500PPM/°C—Code TE ±1.0% tol. only.

TOLERANCES

Metal film resistors are supplied in standard tolerances of ±1.0%, ±0.5%, and ±0.25%. In addition, tolerances of ±0.1% and ±0.05% are available on special order.

VOLTAGE COEFFICIENT

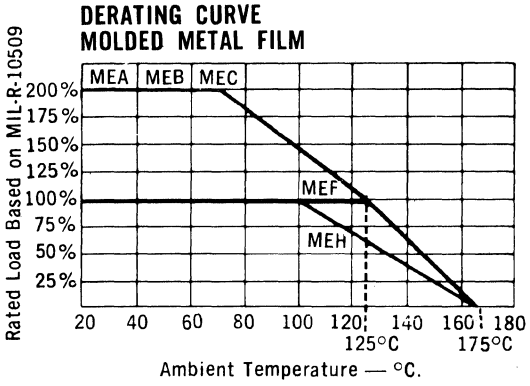
Voltage coefficient when measured between 1/10 and full rated voltage is less than 5PPM/Volt, for all values. On low and medium value resistors, the voltage coefficient is essentially zero.

HIGH STABILITY PRECISION METAL FILM RESISTORS

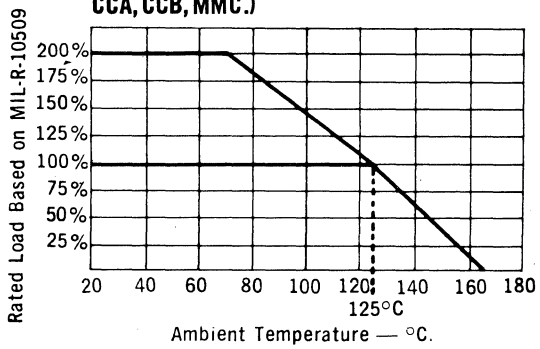
IRC®

TRW INC.

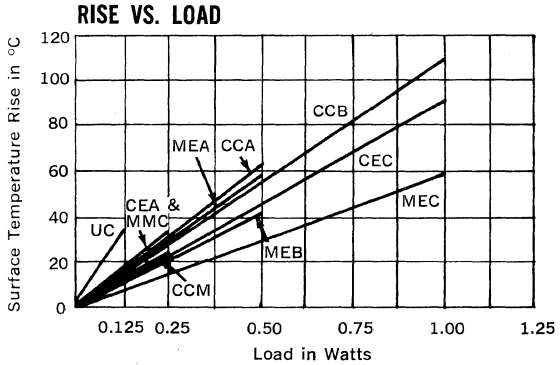
DERATING CURVE
MOLDED METAL FILM



DERATING CURVE
M-COAT METAL FILM (UC,CCM,CEA, CCA,CCB,MMC.)



SURFACE TEMPERATURE RISE VS. LOAD



METAL FILM MATCHING

Metal Films can be matched to within the maximum deviations outlined

TYPE OF MATCH	MINIMUM TOLERANCE MATCH	MINIMUM TC MATCH	MAXIMUM DEVIATION BETWEEN ANY TWO UNITS IN SET	TEMPERATURE
Tolerance (All Units Same Value)	0.02%	NA	0.02%	25°C Only
Tolerance — Ratio	0.05%	NA	0.05%	25°C Only
TC Only (T5, T8 or T9)	NA	3 PPM/°C	initial tolerance +0.024%	25°C to 105°C
TC Only (T9 Only)*	NA	8 PPM/°C	initial tolerance +0.11%	−55°C to +165°C
TC and Tolerance All Units Same Value (T5, T8 or T9)	0.02%	3 PPM/°C	0.044%	25°C to 105°C
TC and Tolerance All Units Same Value (T9 Only)*	0.02%	8 PPM/°C	0.13%	−55°C to +165°C
TC and Tolerance Ratio (T5, T8 or T9)	0.05%	3 PPM/°C	0.074%	25°C to 105°C
TC and Tolerance Ratio (T9 Only)*	0.05%	8 PPM/°C	0.16%	−55°C to +165°C

Resistors may not be returned after 90 days. Resistors must be outside specification by more than 0.02% to be returnable for deviation.

* Units matched for an operating temperature span exceeding +25°C to +105°C (−55°C to +165°C maximum), all units in the set must be of same style. When units are ratio matched for this excessive operating temperature span all units must also fall within a single range of resistance values as indicated.

MEA . . . 100 ohms — 25K
1K — 500K

MEF . . . 150 ohms — 120K
1K — 1 meg
2K — 2.5 meg
4K — 4 meg

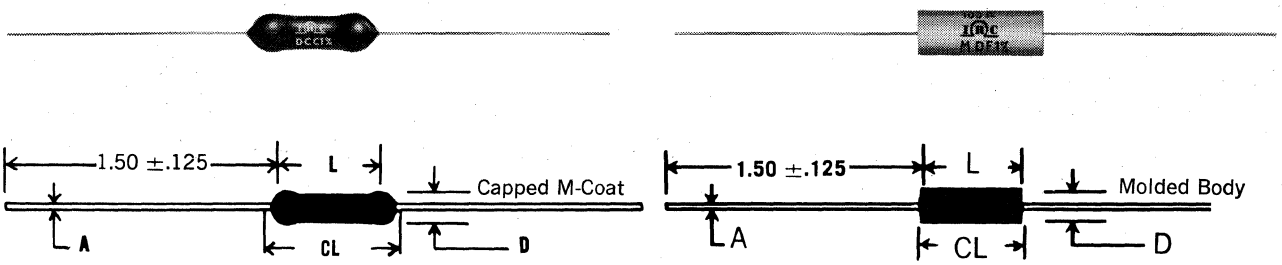
MEB . . . 100 ohms — 40K
2K — 700K
3K — 1 meg

MEH . . . 300 ohms — 300K
3K — 5 meg
7K — 10 meg

MEC . . . 150 ohms — 55K
2K — 500K
3K — 1.5 meg

MOLDED & COATED DEPOSITED CARBON FILM RESISTORS

TRW INC.



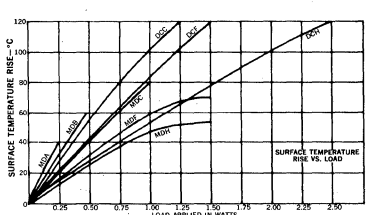
IRC Type	Wattage "X" Char. 40°C	Wattage "B" Char. 70°C	Wattage "D" Char. 70°C	IRC 125°C	Maximum Voltage	Standard Resistance Range (Ohms)	MIL-R-10509 Resistance Range (Ohms)	MIL Type		Ranges Available at ±0.5% Tolerance Min.	Ranges Available at ±0.5% Tolerance Max.
MOLDED TYPE											
MDA	—	1/8	1/4	1/8	300V	10 to 5 Meg*	10 to 1.0 Meg	RN60B	RN60D	50	500K
MDB	—	1/4	1/2	1/4	350V	10 to 5 Meg*	10 to 2.0 Meg	RN65B	RN65D	50	500K
MDC	—	1/2	3/4	1/2	500V	10 to 25 Meg*	10 to 2.49 Meg	RN70B	RN70D	50	1 Meg
MDF	—	1	—	—	500V	10 to 50 Meg*	10 to 5.11 Meg	RN75B	—	100	2 Meg
MDH	—	2	—	—	750V	15 to 100 Meg*	30.1 to 10 Meg	RN80B	—	200	2.5 Meg
CAPPED M-COAT TYPE (CONFORMALLY COATED)											
DCC	1/2	1/2	—	—	350VDC	10 to 25 Meg*	10 to 2.0 Meg	RN20X	—	50	1 Meg
CAPPED TYPE											
DCF	1	—	—	—	500VDC	10 to 50 Meg*	10 to 4.99 Meg	RN25X	—	100	2 Meg
DCH	2	—	—	—	750VDC	15 to 100 Meg*	30.1 to 10 Meg	RN30X	—	200	2.5 Meg

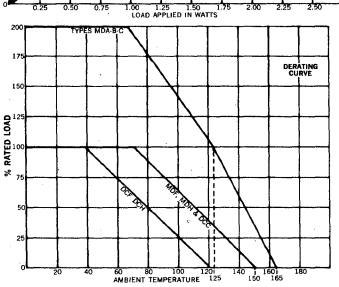
*These high resistance values, being above the highest MIL-R-10509 top values, have higher temperature coefficients, but otherwise are designed to meet the requirements of the specification (see Temperature Coefficient Curves). These high resistance values must be measured carefully under controlled conditions of humidity and temperature, to reduce possible variations due to test conditions and temperature coefficients. Due to higher temperature coefficient, value above approximately two times MIL maximum will be supplied with a standard tolerance of ±2.0%.

TOLERANCE. Standard tolerance is ±1%. ±0.5% tolerance is available at a slight additional cost.

VOLTAGE COEFFICIENT. This factor is negligible. Statistically, the voltage coefficient is less than 20 ppm/v.

SHELF LIFE. Shelf life tests show average resistance change of less than 0.25%.





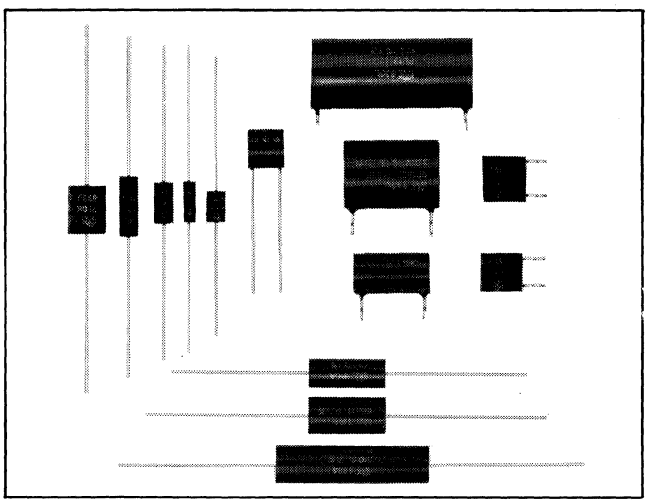
DIMENSIONS

IRC TYPE	BODY LENGTH (L)	BODY DIAMETER (D)	CLEAN LEAD LENGTH (CL)	LEAD GAUGE (A)
DCC	.594 ±.031	.180 ±.020	.750	#20 .032
DCF	.938 ±.062	.297 ±.031	1.250	#20 .032
DCH	2.062 ±.062	.297 ±.031	2.375	#20 .032
MDA	.406 ±.015	.130 ±.010	.545	#22 .0253
MDB	.594 ±.015	.203 ±.015	.733	#22 .0253
MDC	.719 ±.020	.261 ±.020	.863	#20 .032
MDF	1.105 ±.020	.395 ±.020	1.253	#20 .032
MDH	2.234 ±.020	.395 ±.020	2.378	#20 .032

ENCAPSULATED PRECISION WIREWOUND RESISTORS

TRW INC.

FOR RELIABLE PERFORMANCE IN DEMANDING APPLICATIONS



- ACCURACY TO ±.005%
- LONG-TERM STABILITY TO 10 PPM/YR
- TEMPERATURE COEFFICIENTS TO ±1 PPM/°C
- VOLTAGE COEFFICIENT, .01 PPM/Volt
- NOISE FREE PER MIL-STD-202 TESTS
- MIL-R-39005 PERFORMANCE

ACCURACY—Standard IRC resistors are manufactured to tolerances as close as ±.01% in values of 100 ohms or more. Special resistors can be made to ±.005%. Resistors can be supplied in sets matched in value or ratio to ±.001%.

OPERATING TEMPERATURE/POWER RATING—Normal operating temperature range is −55°C to +145°C. The wattages shown in the resistor tables are rated at 125°C.

LEAD MATERIAL — Unless otherwise specified, PH resistors are supplied with tin-coated copper leads. Gold plated nickel, plain nickel, and 180 alloy leads are stocked and can be supplied when specified at small additional cost.

TEMPERATURE COEFFICIENT — Precision wirewound resistors provide the closest temperature coefficients of any resistor type available. Unless otherwise specified, the standard IRC temperature coefficient will be supplied over the temperature range of −55°C to +145°C. All temperature coefficients are referenced to 25°C.

STANDARD

0 ±10 PPM/°C 100 ohm and greater
0 ±15 PPM/°C 10 ohm to 100 ohm
0 ±30 PPM/°C 1.0 ohm to 10 ohm
0 ±90 PPM/°C Less than 1.0 ohm

Closer and special temperature coefficients are available on request.

HN & PH SERIES
AXIAL LEAD TYPES

IRC TYPE	MIL STYLE		MAX. VALUE .0005 WIRE	COMMERCIAL WATTAGE	MAXIMUM VOLTS	LENGTH†	DIAMETER‡	LEAD GAUGE
	MIL-R -39005	MIL-R -93						
HN090A			66 K	.03	100	.200	.085	24
HN103A			86 K	.05	100	.187	.100	24
HN104A			164 K	.06	100	.250	.100	24
HN105A			210 K	.06	100	.300	.100	24
HN114A			200 K	.06	100	.250	.125	24
HN116A			310 K	.07	200	.375	.125	22
HN118A			475 K	.08	200	.500	.125	22
HN128A			950 K	.10	400	.500	.160	22
HN136A			940 K	.25	300	.375	.187	22
HN138A	RBR74		1.4 Meg.	.25	300	.500	.187	22
HN206A	RBR75		1.2 Meg.	.20	150	.295	.250	22
HN207A	RBR56	RB56	1.5 Meg.	.20	200	.344	.250	20
HN208A	RBR55	RB55	2.5 Meg.	.33	400	.500	.250	20
HN212A	RBR54	RB54	*2.2 Meg.	.50	600	.750	.250	20
HN308A			2.3 Meg.	.50	400	.500	.375	20
HN312A	RBR53	RB53	*4.9 Meg.	.60	600	.750	.375	20
HN316A	RBR52	RB52	*2.2 Meg.	1.00	900	1.00	.375	20
HN516A	RBR57	RB57	*4.0 Meg.	1.25	900	1.00	.500	20
PH148A		RB56	1.0 Meg.	.125	300	.375	.250	20
PH216A			3.2 Meg.	.75	600	1.00	.250	20
PH308A			2.3 Meg.	.50	400	.500	.375	20
PH310A			3.6 Meg.	.50	500	.625	.375	20
PH507A			3.9 Meg.	.60	400	.500	.500	20
PH509A			*2.1 Meg.	.60	500	.625	.500	20
PH524A		RB58	*6.6 Meg.	1.50	1000	1.500	.500	20
PH532A		RB59	*9.4 Meg.	2.00	1200	2.00	.500	20
PH628A			*10.0 Meg.	2.00	1000	1.75	.625	20

*Higher ohmic value available in these resistors on special order. †HN Series, ±.020; PH Series, +.062, —.031. ‡HN Series, ±.010; PH Series, ±.031.

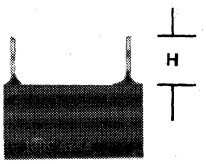
Radial lead and printed circuit resistors are also available. For complete data, contact your nearest IRC Sales Office.

ENCAPSULATED / UNENCAPSULATED PRECISION WIREWOUND RESISTORS

TRW INC.

PH SERIES
SOLDER LUG TYPES

IRC TYPE	MIL-R-93D STYLE	MAX. VALUE .0005 WIRE	COMMERCIAL WATTAGE	MAXIMUM VOLTS	LENGTH +0.062 —0.031	DIAMETER ±0.031	DIM. "H"
PH307L		2.1 Meg.	.50	300	0.438	0.375	0.312
PH507L	RB08	3.9 Meg.	.60	300	0.500	0.500	0.375
PH509L	RB16	* 2.1 Meg.	.60	300	0.625	0.500	0.375
PH516L	RB17	* 4.0 Meg.	1.25	600	1.00	0.500	0.375
PH524L	RB72	* 6.6 Meg.	1.50	900	1.50	0.500	0.375
PH532L	RB73	* 9.4 Meg.	2.00	1200	2.00	0.500	0.375
PH583L		* 1.2 Meg.	.50	300	0.438	0.625	0.406
PH628L		*10.0 Meg.	2.00	900	1.75	0.625	0.344
PH740L	RB18	*19.0 Meg.	2.00	900	1.25	0.875	0.375
PH836L	RB19	*25.0 Meg.	2.50	1200	2.125	0.906	0.344



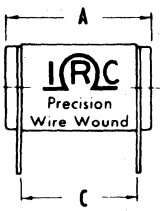
*Higher ohmic value available in these resistors on special order.

UNENCAPSULATED PRECISION WIREWOUND RESISTORS (TYPE WWJ)
RADIAL LUG TYPE CLOSE TOLERANCE DEVICES FOR LESS SEVERE ENVIRONMENTS

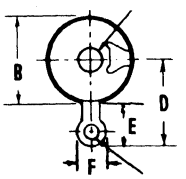
RADIAL LUG TYPE

IRC TYPE NUMBER	WW2J	WW3J	WW4J	WW5J	WW8J	WW11J
Rating in watts - 65°C (see page 2241 for derating)	2	.50	1	1	.50	.50
Maximum Volts	2000	400	700	1000	250	500
Number of sections	8	2	4	4	1	2
Minimum Resistance (ohms) ±1% tol.	0.01	0.01	0.01	0.01	0.05	0.01
Maximum Resistance (.0009 dia. wire)	20 meg.	1.6 meg.	4 meg.	7.5 meg.	1.5 meg.	2 meg.
Dimensions (inches)						
A Dimension	2.12	.56	1.00	1.25	.47	.66
B Dimension	.91	.59	.59	.78	.59	.59
C Dimension	1.78	.38	.78	.97	.31	.44
D Dimension	.78	.63	.63	.72	.63	.63
E Dimension	.31	.31	.31	.31	.31	.31
F Dimension	.19	.19	.19	.19	.19	.19

Close tolerance for less severe environments



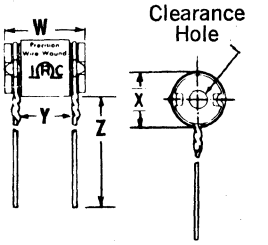
Clearance Hole for #6 Screw



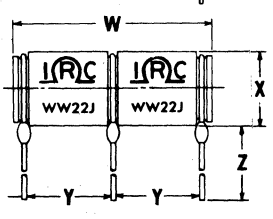
.09" Dia Hole

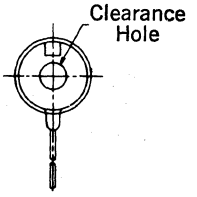
RADIAL LEAD TYPE

IRC TYPE NUMBER	WW3J	WW4J	WW8J	WW10J	WW11J	WW20J
Rating in watts - 65°C (see page 2241 for derating)	.50	1	.50	.25	.50	.25
Maximum Volts	400	700	250	150	500	150
Number of sections	2	4	1	1	2	1
Minimum Resistance (ohms) ±1% tol.	0.01	0.01	0.05	0.1	0.01	1.0
Maximum Resistance (.0009 dia. wire)	1.6 meg.	4 meg.	1.5 meg.	215K	2 meg.	150K
Dimensions (inches)						
Lead Diameter (AWG)	#20	#20	#20	#22	#20	#22
W Dimension	.56	1.00	.47	.41	.66	.31
X Dimension	.59	.59	.59	.28	.59	.25
Y Dimension	.38	.78	.31	.28	.44	.22
Z Dimension	2.50*	2.50*	2.50*	2.00*	2.50*	2.00*
Clearance hole to fit	#6 SCREW	#6 SCREW	#6 SCREW	#2 SCREW	#6 SCREW	#2 SCREW



IRC TYPE NUMBER	WW21J	WW22J (Center Tapped)	WW23J	WW24J (Center Tapped)
Rating in watts - 65°C (see page 2241 for derating)	.25	.25†	.50	.50†
Maximum Volts	300	150†	300	400†
Number of sections	2	2	2	4
Minimum Resistance (ohms) ±1% tol.	1.0	1.0†	0.05	0.1†
Maximum Resistance (.0009 dia. wire)	500K	250K†	1.5 meg.	1.5 meg.†
Dimensions (inches)				
Lead Diameter (AWG	#22	#22	#20	#20
W Dimension	.75	.75	.75	1.00
X Dimension	.25	.25	.38	.50
Y Dimension	.66	.31†	.59	.41†
Z Dimension	2.00*	2.00*	2.50*	2.50*
Clearance hole to fit	#2 SCREW	#2 SCREW	#6 SCREW	#6 SCREW





*Lengths are standard. 2", 3" and 4" also available on request.
†Per tapped section.

MANY WWJ TYPES IMMEDIATELY AVAILABLE FROM YOUR LOCAL IRC DISTRIBUTOR WITH BACK-UP STOCKS IN PHILADELPHIA, PENNA.

MINIATURE PRECISION POWER WIREWOUND RESISTORS

TRW INC.

IRC Type	MIL-R-26E Equiv. & Rating (Watts) at 25°C	IRC Rating 350°C Max. Hot Spot (Watts) at Ambient 125°C	25°C	Commercial Range (Ohms) Min.	Max.	Max. Cont. Working Volt.	Non-Inductive Ranges (Ohms) Min.	Max.
AS-1/2		0.5	1	0.5	6K	100	*	*
AS-1	RW70U (1)	1	2	0.1	7.5K	130	0.1	3.8K
AS-2	RW69V (3)	2	3	0.1	20K	140	0.5	10K
AS-2A		2.5	4	0.1	42.1K	300	0.5	21K
AS-2B	RW79U (3)	3	4	0.1	24K	185	0.5	12K
AS-3		3	5	0.1	30K	200	0.5	15K
AS-5	RW74U (5) RW67V (6.5)	5	7	0.1	60K	400	0.8	30K
AS-7		7	9	0.1	90K	600	1.0	45K
AS-10	RW68V (11) RW78U (10)	10	14	0.1	175K	1000	3.0	50K
ASC-10	RW55V (7)	7	10	0.1	90K	600	1.0	45K
ASC-15	RW56V (14)	10	15	0.1	175K	1000	3.0	50K

*Inductance on AS-½ is less than 1 μh at 1 MC.

MIL-R-26C IRC Type	MIL Type	Rating (Watts) G	V	Range (Ohms) Min.	Max.
AS-2	RW59, 69	2.5	3	0.1	2K
AS-5	RW57, 67	5	6.5	0.1	8.2K
AS-10	RW58, 68	8	11	0.1	20K
ASC-10	RW55	5	7	0.1	5.1K
ASC-15	RW56	10	14	0.1	8.2K

MIL-R-23379A IRC Type	MIL Type	Rating (Watts)	Range (Ohms) Min.	Max.
AS-1	RWP-18	1	1	1.21K
AS-2	RWP-20	3	0.1	3.57K
AS-5	RWP-21	5	0.1	12.1K
AS-10	RWP-23	10	0.499	40.2K

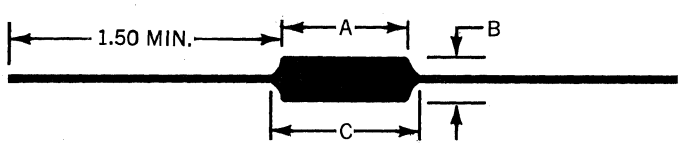
AVAILABLE RESISTANCE/TOLERANCE OHMS

IRC Type	0.1%	0.25%	.5%, 1%	3%, 5%
AS-1/2	5-2K	2.5-2K	1-6K	0.5-6K
AS-1	5-3K	2.5-3K	1-7.5K	0.1-7.5K
AS-2	5-4.2K	2.5-4.2K	1-20K	0.1-20K
AS-2A	5-8K	2.5-8K	1-42.1K	0.1-42.1K
AS-2B	5-4.5K	2.5-4.5K	1-24K	0.1-24K
AS-3	5-6.5K	2.5-6.5K	1-30K	0.1-30K
AS-5	5-15.5K	2.5-15.5K	1-60K	0.1-60K
AS-7	5-22K	2.5-22K	1-90K	0.1-90K
AS-10	5-55K	2.5-55K	1-175K	0.1-175K
ASC-10	5-22K	2.5-22K	1-90K	0.1-90K
ASC-15	5-55K	2.5-55K	1-175K	0.1-175K

PHYSICAL DIMENSIONS INCHES

IRC Type	Dim. A ±.032	Dim. B ±.032	Dim. C Max.	Lead Dia.	Weight Grams
AS-1/2	.312	.062	.375	.020	.185
AS-1	.406	.093	.500	.020	.235
AS-2	.500	.218	.625	.032	.960
AS-2A	.812	.187	.937	.032	1.10
AS-2B	.562	.187	.687	.032	.900
AS-3	.687	.250	.812	.040	1.60
AS-5	.875	.312	1.000	.040	2.57
AS-7	1.250	.312	1.375	.040	3.32
AS-10	1.812	.375	1.937	.040	5.46
ASC-10	1.375	.468	1.468	.040	10.3
ASC-15	2.000	.468	2.093	.040	14.0

PACKAGING—Ladder Pack (standard) and Lead Tape (optional at additional cost).
CUT & FORMED LEADS—Contact TRW with your requirements.
POSITIVE TEMPERATURE COEFFICIENT—Available to +5500 PPM/°C, contact TRW.
FUSIBLE TYPES—Available for missile, computer and other critical applications, contact TRW.
CONTROLLED RISE TIME—devices available, contact TRW.



IRC BOONE DIVISION OF TRW INC. • P.O. BOX 393 • BOONE, N.C. 28607 • (704) 264-8861 • TWX 510-936-3241

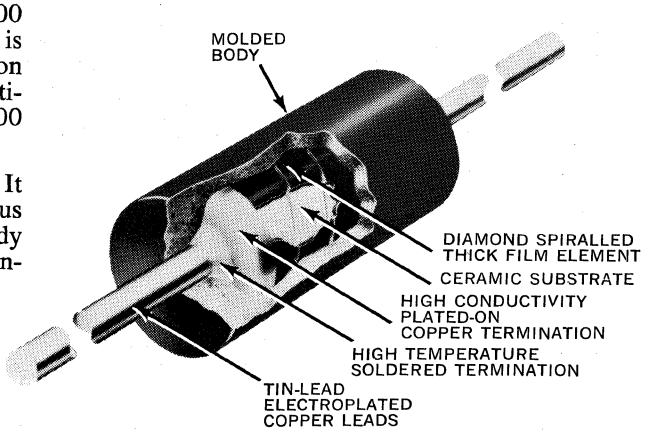
PRECISION & SEMI-PRECISION METAL GLAZE RESISTORS

TRW INC.

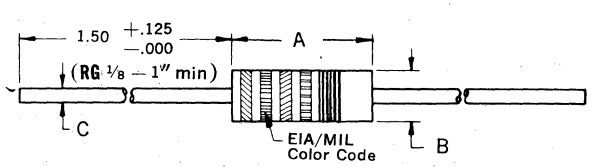
IRC's new molded Metal Glaze resistors provide stability, reliability and precision unmatched anywhere for the price.

They meet or exceed all MIL-R-22684 and MIL-R-39017 requirements. Load life stability, for instance is four times better than MIL allowance. Typical △R is 0.5% after 1000 hours, full load at 70°C. Even at higher temperatures, △R is still typically under MIL limits. Tested for over 16.2 million hours under MIL-R-39017 conditions. The maximum estimated failure rate at 60% confidence is .0058% per 1000 hours.

The Metal Glaze resistance element is extremely rugged. It is 100 times thicker than conventional films and is impervious to environmental extremes. The tough, uniform molded body resists solvents and the mechanical abuse of automatic handling equipment.



IRC Type	Resistance (Ohms) Min.	Max.	Tolerance (±%)	Power Rating (W @ °C)		Temperature Coefficient (Max. ±PPM/°C)	MIL-R-	Style	Nominal Dimensions A	B	C	Identification (color bands)	Max. Cont. Working Voltage (Volts)
RG1/8	10	30K	5	1/8	70	500	11	RC05	.150	.063	.016	4	200
RG1/4	6.2	680K	5	1/2 or 1/4	70 125	400	11	RC07	.250	.090	.025	4	250
RG07	51	150K	2, 5	1/4	70	200	22684	RL07	.250	.090	.025	5	250
RGR07	10	150K	2, 5	1/4	70	200	39017	RLR07	.250	.090	.025	Marked only	250
TF07	1	10	1, 2, 5	1/4	70	100	—	—	.250	.090	.025	5	250
TO55	10	301K	1	1/4 or 1/8	70 125	100	—	—	.250	.090	.025	5 or Marked	250
T55	10	301K	1	1/8	70	+200, −500	10509	RN55D	.250	.090	.025	Marked only	200
RG20	4.3	470K	2, 5	1/2	70	200	22684	RL20	.390	.140	.032	5	350
RGR20	4.3	1 Meg.	2, 5	1/2	70	200	39017	RLR20	.390	.140	.032	Marked only	350
TF20	1	10	1, 2, 5	1/2	70	100	—	—	.390	.140	.032	5	350
TO60	10	499K	1	1/2	70	100	—	—	.390	.140	.025	5 or Marked	350
T60	24.9	499K	1	1/4	70	+200, −500	10509	RN60D	.390	.140	.025	Marked only	300
RG32	10	1 Meg.	2, 5	1	70	200	22684	RL32	.562	.190	.040	5	500
RGR32	10	1 Meg.	2, 5	1	70	200	39017	RLR32	.562	.190	.040	Marked only	500
RG42	10	1.5 Meg.	2, 5	2	70	200	22684	RL42	.688	.318	.045	5	500



Reliability screening is available to all military specifications and to virtually any specification required by the user. Where test specifications have not been established, TRW can provide unbiased assistance in determining the most meaningful screening tests for specific application needs.

¼ TO 2 WATTS CARBON COMPOSITION AND WIREWOUND RESISTORS

IRC®

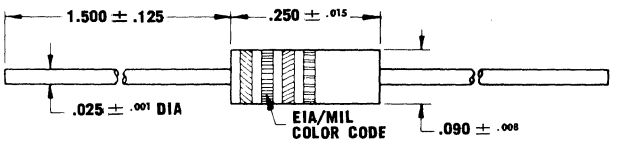
TRW INC.

TYPE GBT®-¼

¼ Watt Carbon Composition

SPECIFICATIONS

MIL-R-11 Style	RC07
MIL-R-39008 Style	RCR07
Resistance, Standard	RC07-2.7 Ohms thru 22 Megohms RCR07-2.7 Ohms thru 22 Megohms (EIA/MIL Standard Values)
Tolerances, Standard	±5%, 10%, 20%
Power Rating	¼ Watt @ 70°C derating to 0 @ 150°C



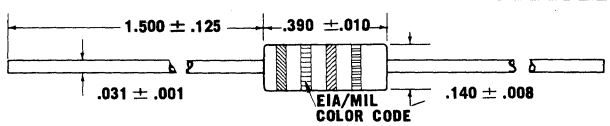
Maximum Continuous Working Voltage	250 Volts
Minimum Insulation Resistance — Dry	10,000 Megohms
Minimum Insulation Resistance — Wet	100 Megohms
Minimum Dielectric Withstanding Voltage:	
Atmospheric Pressure	500 Volts, R.M.S.
Reduced Pressure	325 Volts, R.M.S.
Hot Spot Temperature Rise at ¼ Watt	32°C, Average
Shunt Capacitance	0.15 pf, Average

TYPE GBT®-½

½ Watt Carbon Composition

SPECIFICATIONS

MIL-R-11 Style	RC20
MIL-R-39008 Style	RCR20
Resistance, Standard	RC20-2.7 Ohms thru 22 Megohms RCR20-2.7 Ohms thru 22 Megohms
Special	24 Megohms thru 100,000 Megohms (EIA/MIL Standard Values)
Tolerances, Standard	±5%, 10%, 20%
Special	±5%, 10%, 20%, 30% (depending on resistance value)
Power Rating	½ Watt @ 70°C derating to 0 @ 150°C



Maximum Continuous Working Voltage	350 Volts
Minimum Insulation Resistance — Dry	10,000 Megohms
Minimum Insulation Resistance — Wet	100 Megohms
Minimum Dielectric Withstanding Voltage:	
Atmospheric Pressure	700 Volts, R.M.S.
Reduced Pressure	450 Volts, R.M.S.
Hot Spot Temperature Rise at ½ Watt	50°C, Average
Shunt Capacitance	0.175 pf, Average

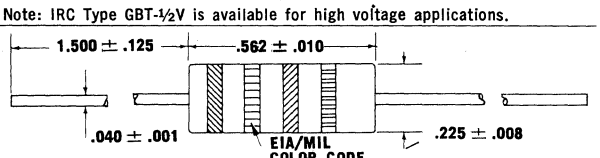
Note: IRC Type GBT-½V is available for high voltage applications.

TYPE GBT®-1

1 Watt Carbon Composition

SPECIFICATIONS

MIL-R-11 Style	RC32
Resistance, Standard	RC32-2.7 Ohms thru 22 Megohms
Special	24 Megohms thru 270 Megohms (EIA/MIL Standard Values)
Tolerances, Standard	±5%, 10%, 20%
Special	±5%, 10%, 20%, 30% (depending on resistance value)
Power Rating	1 Watt @ 70°C derating to 0 @ 150°C



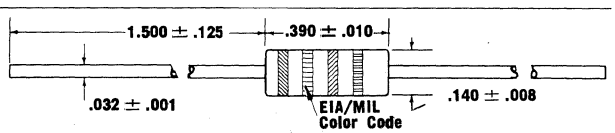
Maximum Continuous Working Voltage	500 Volts
Minimum Insulation Resistance — Dry	10,000 Megohms
Minimum Insulation Resistance — Wet	100 Megohms
Minimum Dielectric Withstanding Voltage:	
Atmospheric Pressure	1000 Volts, R.M.S.
Reduced Pressure	625 Volts, R.M.S.
Hot Spot Temperature Rise at 1 Watt	70°C, Average
Shunt Capacitance	0.25 pf, Average

TYPE BW-20

1 Watt Wirewound

SPECIFICATIONS

MIL-R-11 Style Size Equivalent	RC20
Resistance, Standard	0.24 Ohms thru 750 Ohms (EIA/MIL Standard Values)
Tolerances, Standard	±5%, 10%
Special	±2%
Power Rating	1 Watt 50°C ½ Watt 100°C ¼ Watt 125°C; derating to 0 @ 160°C



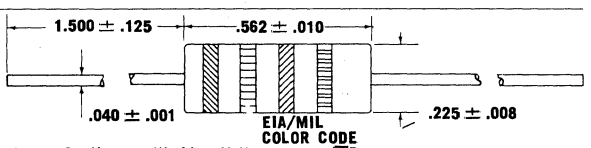
Maximum Continuous Working Voltage	$\sqrt{PR}$
Minimum Insulation Resistance — Dry	10,000 Megohms
Minimum Insulation Resistance — Wet	100 Megohms
Minimum Dielectric Withstanding Voltage:	
Atmospheric Pressure	700 Volts, R.M.S.
Reduced Pressure	450 Volts, R.M.S.
Hot Spot Temperature Rise at 1 Watt	100°C
Marking	Standard EIA/MIL Color Code (double width first band)

TYPE BWH

2 Watts Wirewound

SPECIFICATIONS

MIL-R-11 Style Size Equivalent	RC32
Resistance, Standard	0.10 Ohms thru 2400 Ohms (EIA/MIL Standard Values)
Tolerances, Standard	±5%, 10%
Power Rating	2 Watts @ 70°C 1 Watt @ 115° C ½ Watt @ 137°C; derating to 0 @ 160°C



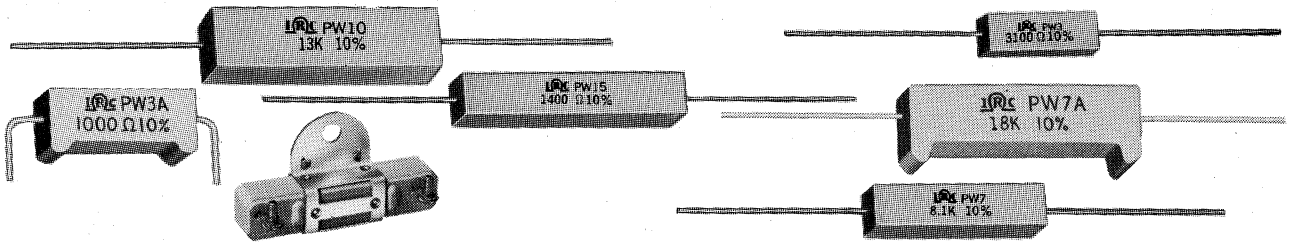
Maximum Continuous Working Voltage	$\sqrt{PR}$
Minimum Insulation Resistance — Dry	10,000 Megohms
Minimum Insulation Resistance — Wet	100 Megohms
Minimum Dielectric Withstanding Voltage:	
Atmospheric Pressure	1,000 Volts, R.M.S.
Reduced Pressure	625 Volts, R.M.S.
Hot Spot Temperature Rise at 2 Watts	115°C
Current Noise	Negligible
Marking	Standard EIA/MIL Color Code (double width first band)

PACKAGING AND CUT & FORMED LEADS

IRC general purpose resistors are packaged in a variety of styles. Cut and formed leads are also available. Consult TRW with your specific requirements.

HIGH TEMPERATURE POWER RESISTORS

TRW INC.



FEATURING FIREPROOF INORGANIC CONSTRUCTION
for temperature compensation • circuit protection

IRC Type PW Wirewound Resistors are available in nine ratings: 2, 3, 5, 7, 10, 15, 20, 22 and 50 watts.

DESIGN AND CONSTRUCTION: The resistance elements of PW resistors are rigorously quality controlled for resistance, temperature coefficient, diameter and elongation. The wire is wound on a fiberglass core, which forms a smooth, uniform surface. The fill is the same inorganic fireproof material used in premium IRC resistors. The husky, oxygen-free copper lead wires are held by 1/4 hard brass terminals. The whole assembly is then sealed in a crackfree steatite ceramic case. Special PW resistors are also available for circuit protection and temperature compensation. Optional construction is available for printed circuit board applications.

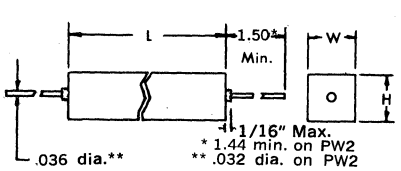
TOLERANCE: ±5% and ±10% (standard) tolerances on Standard Temperature Coefficient Resistors.

SPECIFICATIONS

IRC Type	Power Rating† W @ °C	Resistance Min.* (ohms)	Resistance Max. (ohms)	Standard Temperature Coefficient (−55°C to +275°C) 0.06%/°C (ohms)	Standard Temperature Coefficient (−55°C to +275°C) 0.03%/°C (ohms)	Special Temperature Coefficients +0.55%/°C (ohms)	+0.45%/°C (ohms)	+0.26%/°C (ohms)	+0.13%/°C (ohms)
PW2	2 85	0.18	2.4K	0.18 to 0.62	0.68 to 2.4K	0.1 to 30	0.24 to 130	0.82 to 120	1.0 to 10
PW3	3 40	0.1	7.5K	0.1 to 0.27	0.3 to 7.5K	0.1 to 56	0.1 to 270	0.20 to 270	0.24 to 20
PW5	5 40	0.1	8.5K	0.1 to 0.36	0.39 to 8.5K	0.1 to 68	0.1 to 300	0.24 to 300	0.27 to 22
PW7	7 40	0.1	18K	0.1 to 0.56	0.62 to 18K	0.1 to 150	0.15 to 680	0.51 to 670	0.62 to 51
PW10	10 40	0.18	30K	0.18 to 0.91	1.0 to 30K	0.1 to 240	0.24 to 1100	0.82 to 1100	1.0 to 82
PW15	15 25	0.18	30K	0.18 to 0.91	1.0 to 30K	0.1 to 240	0.24 to 1100	0.82 to 1100	1.0 to 82
PW20	20 25	0.24	2K	0.24 to 0.39	0.43 to 560	0.1 to 3	0.1 to 16	0.14 to 36	0.14 to 39
PW22	22 25	.27	12K	0.27 to 1.3	1.3 to 12K	0.15 to 360	0.36 to 1800	1.25 to 1800	1.5 to 120
PW50	50 25	0.43	560	—	0.43 to 560	0.1 to 5	0.1 to 27	0.24 to 60	0.24 to 65

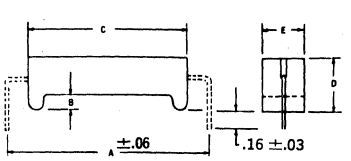
*CONSULT TRW FOR LOWER RANGES. †Derated to 0 @ 250°C.

DIMENSIONS
2, 3, 5, 7, 10, 15 and 22-WATT STYLES



DIMENSIONS ±.03

TYPE	L	W	H
PW2	.69	.25	.25
PW3	.88	.31	.31
PW5	.88	.38	.35
PW7	1.39	.38	.35
PW10	1.88	.38	.35
PW15	1.88	.50	.50
PW22	2.50	.50	.50

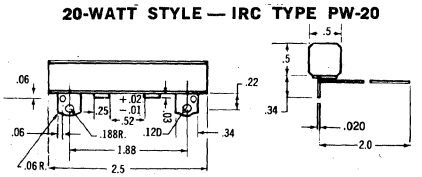


RECOMMENDED MTG. DIM.

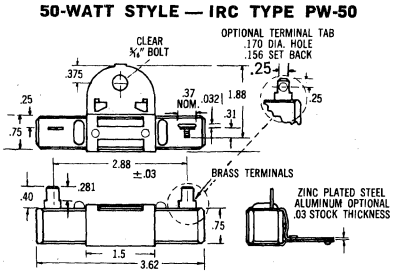
TYPE	A	B	C	D	E
PW-2A	1.06	.06	.69	.31	.25
PW-3A	1.25	.06	.88	.38	.31
PW-5A	1.25	.06	.88	.41	.38
PW-7A	1.75	.12	1.39	.47	.38
PW-10A	2.25	.12	1.88	.47	.38
PW-15A	2.25	.12	1.88	.50	.50

Standard parts are supplied with straight axial leads. Consult factory for available configurations for printed circuit mounting.

20-WATT STYLE — IRC TYPE PW-20



50-WATT STYLE — IRC TYPE PW-50



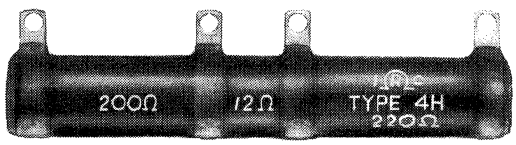
TUBULAR POWER WIREWOUND RESISTORS

IRC®

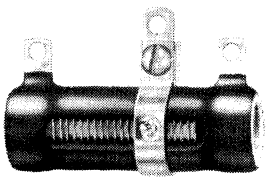
TRW INC.



FIXED



TAPPED



ADJUSTABLE

TOLERANCE, Standard tolerance for tubular resistors is ±5% above 1 ohm and ±10% below 1 ohm. Tolerance on adjustable, tapped, and non-inductive resistors is ±10%.

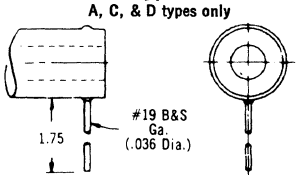
(Wattage ratings are based on 350°C hot spot at 40°C ambient with resistor suspended in free air without mounting hardware.)

IRC Wattage	IRC Type	(Fixed only) Ratings MIL Equiv.	(Fixed only) Ratings V	Core Dimension Length in inches	Core Dimension O.D. in inches	Core Dimension I.D. in inches	Terminals Std.	Terminals Special	Minimum Ohms‡	Max. Ohms .0025 wire	Max. Ohms .00175 wire	(A) Max. Ohms .0014 wire	(Fixed only) Max. Ohms .0008 wire
4	⅞A			.88	.31	.19	12A	1*, 13A	0.10	200	775	—	10K
5	1A			1.00	.31	.19	13A	1**, 12A	0.10	530	1,550	—	15K
12	1¾A(A)	RW29	11	1.75	.31	.19	13A†	1, 12A	0.10	2,500	5,600	10K	50K
12	1C	RW30	11	1.00	.44	.27	12A	1, 13A	0.10	900	2,500	—	20K
15	1½C	RW31	14	1.50	.44	.27	12A	1, 13A	0.10	2,000	6,300	—	50K
20	2C(A)	RW32	17	2.00	.44	.27	13A†	1, 12A	0.10	4,000	10K	16K	80K
25	2D(A)			2.00	.56	.38	12A	1,4A, 13A	0.10	4,500	12K	20K	100K
26	3C(A)	RW33	26	3.00	.44	.27	12A	1,13A	0.10	8,000	18K	31K	150K
30	2½D(A)			2.50	.56	.38	12A	1,4A, 13A	0.10	6,500	18K	30K	150K
35	3D(A)			3.00	.56	.38	12A	1,4A, 13A	0.10	8,250	23.8K	40K	200K
45	3E(A)			3.00	.75	.50	12A	4A, 13A	0.15	11K	31K	50K	250K
50	3½E(A)			3.50	.75	.50	12A	4A, 13A	0.20	13.5K	40K	65K	300K
50	4D(A)			4.00	.56	.38	12A	1,4A, 13A	0.20	12K	35K	60K	300K
60	4E(A)	RW35	55	4.00	.75	.50	12A	4A, 13A	0.20	16K	45K	75K	350K
60	5D(A)			5.00	.56	.38	12A	1,4A, 13A	0.25	15.5K	45K	80K	400K
65	4½E(A)			4.50	.75	.50	12A	4A, 13A	0.25	18.5K	53.5K	88K	400K
75	5E(A)			5.00	.75	.50	12A	4A, 13A	0.27	21K	61K	100K	450K
80	4H(A)	RW36	78	4.00	1.12	.75	4A	—	0.30	23K	68.5K	110K	525K
100	6½E(A)			6.50	.75	.50	12A	4A, 13A	0.36	28.5K	82.5K	140K	600K
120	6H(A)	RW37	113	6.00	1.12	.75	4A	—	0.47	38K	112.5K	180K	850K
130	6½H(A)			6.50	1.12	.75	4A	—	0.56	41.5K	120K	220K	900K
160	8H(A)	RW38	159	8.00	1.12	.75	4A	—	0.68	54K	156K	280K	1.15 meg.
175	8½H(A)			8.50	1.12	.75	4A	—	0.75	57K	167K	300K	1.25 meg.
225	10½H(A)	RW47	210	10.50	1.12	.75	4A	—	0.91	72K	210K	350K	1.5 meg.
250	12H(A)			12.00	1.12	.75	4A	—	1.00	82K	244K	400K	1.75 meg.

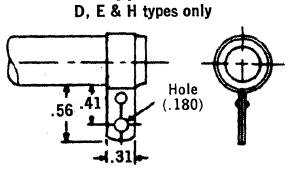
* 6 Watts ** 8 Watts † 12A std. on adjustable type ‡ Except #1 terminal

(A) Adjustable resistors are shown by adding the letter "A" to the designation of standard resistors.

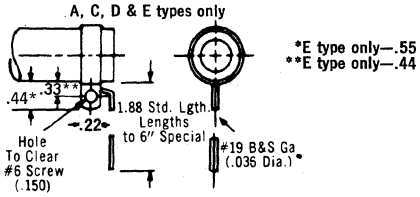
Type 1
A, C, & D types only



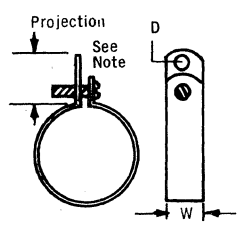
Type 4A
D, E & H types only



Type 12A (no Lead)
Type 13A (with Lead)
A, C, D & E types only



Tapper, ferrule and non-inductive types available, consult TRW.



Dimensions

IRC Type	W	Proj.	D
A	.19	.54	.120
C	.25	.59	.156
D	.25	.78	.15
E	.31	.75	.18
H	.31	.75	.18

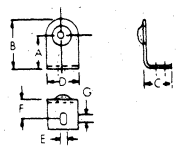
NOTE: D, E & H types are threaded. Type A & C are furnished with screw and nut.

TUBULAR & FLAT POWER WIREWOUND RESISTORS

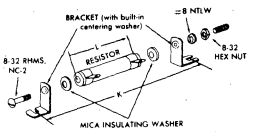
TRW INC.

BRACKET TYPES

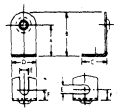
D and DD BRACKETS



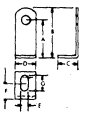
D, DD, E, or H BRACKET MOUNTING (Thru-Bolt)



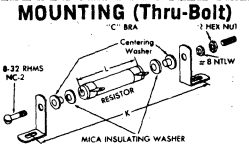
E and H BRACKETS



C BRACKET

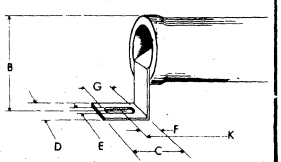


MOUNTING (Thru-Bolt)

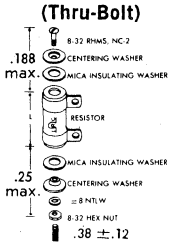


MATERIALS: Standard is steel with cadmium or zinc plate. Thru-bolt mounting hardware in brass with nickel plate is available at additional cost.

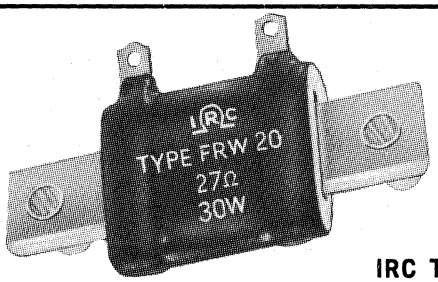
Z BRACKET STANDARD



VERTICAL MOUNTING (Thru-Bolt)



Bracket Type	Use With Resistor O.D.	Use With Resistor Type	DIMENSIONS A	B	C	D	E	F	G	K = L +
C	.44	C	1.00	1.38	.75	.50	.22	.44	.44	1.00
D	.56	D	.44	.75	.87	.62	.14	.62	.22	1.31
DD	.56	D	.69	1.00	.62	.62	.14	.37	.22	.81
E	.75	E	1.13	1.56	.87	.87	.28	.37		.81
H	1.13	H	1.50	2.06	1.00	1.13	.37	.50		1.06
Z-0	.31	A		.59	.50	.31	.17	.23	.27	.47
Z-1	.56	D		1.25	.56	.31	.17	.31	.30	.62
Z-2	.75	E		1.44	.62	.37	.17	.34	.36	.68
Z-3	1.13	H		2.06	.69	.50	.19	.40	.25	.81
Z-4	.44	C		.63	.45	.22	.14	.25	.14	.50



IRC TYPE FRW

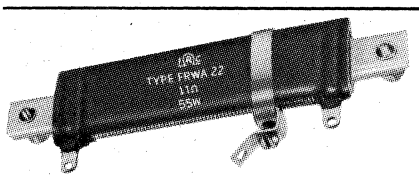
TOLERANCES

Standard tolerance for single section, flat power wirewound resistors is ±5% above 1 ohm, and ±10% between 1 ohm.

Standard tolerance on tapped and adjustable FRW resistors is ±10%.

Wattage rating based on 350°C hot spot at 40°C ambient with resistor mounted horizontally on a 10" x 10" x .040" steel plate in free air using standard mounting brackets.

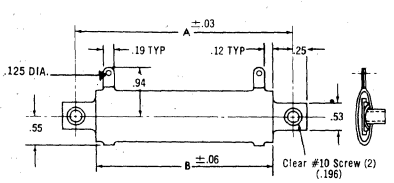
IRC Wattage	IRC Type	MIL Type and Rating	V Watts	DIMENSIONS Mounting Centers	Core Length	Minimum Ohms	Max. Ohms .0025 Wire	Max. Ohms .00175 Wire	Max. Ohms .0014 Wire
30	FRW-20	RW20	21	2.00	1.25	0.1	2.75K	8K	15K
40	FRW-21	RW21	31	2.75	2.00	0.1	6K	18K	35K
55	FRW-22	RW22	53	4.25	3.50	0.20	13K	38K	75K
70	FRW-23	RW23	68	5.50	4.75	0.25	19K	56K	110K
95	FRW-24	RW24	91	6.75	6.00	0.35	25K	75K	140K



ADJUSTABLE FLAT TYPE FRWA

The adjustable feature of Tubular Type Resistors is also available on Flat Type FRWA Resistors. Adjustable FRWA's come in four sizes.

The general characteristics of Tubular Type Resistors also pertain to FRWA units. However, the compact design of these resistors provides a much higher power-space ratio than that of standard tubular resistors. Non-magnetic mounting brackets extend into the resistor. These aid in heat distribution along the entire length of the unit and serve as conductors to transfer internal heat to the chassis. Mounting bracket design prevents the resistor from rotating and loosening.

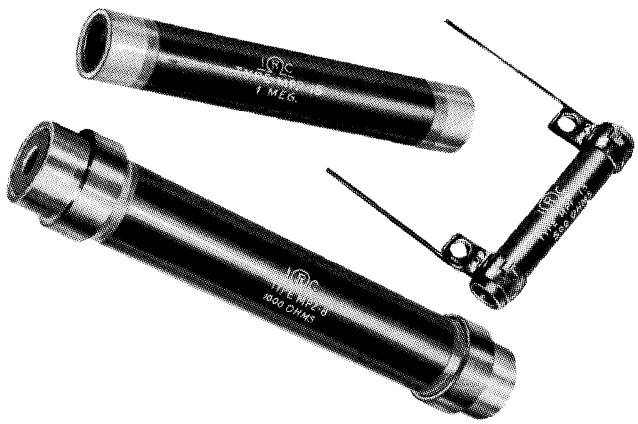


IRC Wattage	IRC Type	DIMENSIONS A Mounting Centers	B Core Length	Minimum Ohms	Max. Ohms .0025 Wire	Max. Ohms .00175 Wire	Max. Ohms .0014 Wire
40	FRWA-21	2.75	2.00	0.1	6K	18K	35K
55	FRWA-22	4.25	3.50	0.2	13K	38K	75K
70	FRWA-23	5.50	4.75	0.25	19K	56K	110K
95	FRWA-24	6.75	6.00	0.35	25K	75K	140K

*Adjustable resistors are shown by adding the letter "A" to the designation of standard resistors.

HIGH FREQUENCY, HIGH VOLTAGE RESISTORS

TRW INC.



TYPE MP

IRC type MP resistors have a specially designed resistance film which provides optimum performance in all characteristics while operating at high frequencies. The cross-sectional area of this exclusive film is held to less than 0.001" thickness to assure low inherent capacity and freedom from skin-effect.

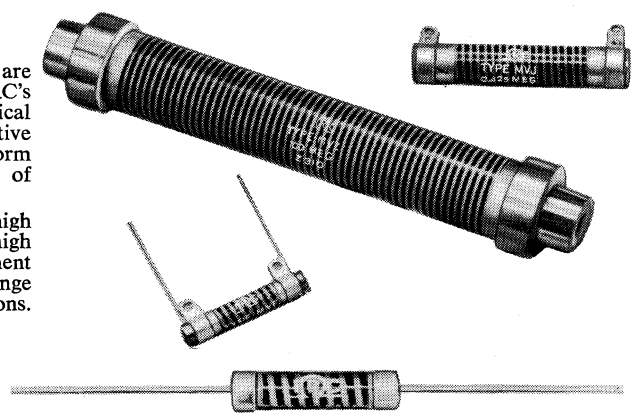
Terminal bands of colloidal silver are applied to each end of the resistor to form a permanent low resistance contact to the resistance film. Lug, axial lead or ferrule terminals, when required, are secured to the silver end-bands. A protective coating is baked on the entire resistor film.

Type MP Resistors are used extensively for applications such as broad band RF amplifiers, RF probes, rhombic antenna terminating resistors, dummy loads for transmitters and dielectric heating equipment, television side-band filters, surge generator and other circuits involving high frequency measuring circuits and radar pulse equipment.

TYPE MV

For high voltage requirements where high resistance and power are needed, IRC Type MV Resistors offer exceptional stability. IRC's exclusive composition film type resistance coating is applied in helical form on a ceramic tube to provide a conducting path of long, effective length. The mechanical spacing of the helical turns gives a uniform pitch, and allows uniform voltage gradient throughout the length of the resistor.

MV Resistors are particularly suited for voltmeter multipliers, high resistance standards, bleeders, grid leaks, voltage dividers, TV high voltage circuits, cathode ray tube circuits. Also, protective equipment for high voltage circuits, photoelectric cell applications, high range bridge circuits, ionization chambers and similar electronic applications.

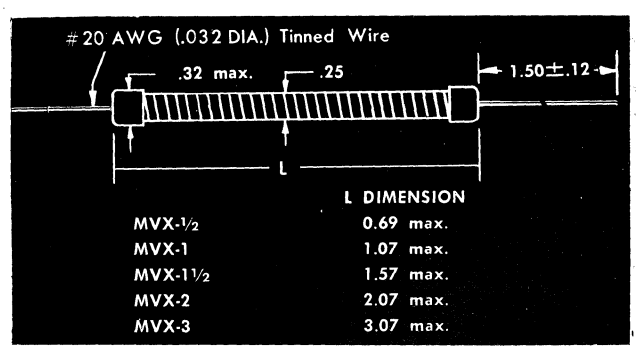


HIGH OHMIC—TYPE MVX

Type MVX meets the requirements for a small, high-range resistor with axial leads. It can be mounted through a hole in a panel or terminal board of insulating material without terminal interference. Construction corresponds to that of other MV types except for the terminal and method of terminal attachment.

TERMINALS. MVX Resistors can be furnished with or without end caps and axial leads. When furnished without leads, contact must be made to .25-inch silvered ends by pressure clips, since they cannot be soldered.

TOLERANCE. Standard tolerance for MVX Resistors is ±20%. ±5% and ±10% are available as shown in the table at right, at extra cost.



Type	Power Rating In Watts	Peak Voltage Rating	MINIMUM AVAILABLE RESISTANCE ±5%, 10%, 20% Tolerance	MAXIMUM AVAILABLE RESISTANCE ±5% Tol. In Megs	±10% Tol. In Megs	±20% Tol. In Megs
MVX-½	.5	1,000	1K	200	1,000	4,000
MVX-1	1	3,500	2.5K	350	2,500	8,000
MVX-1½	1.5	7,500	5K	700	5,000	16,000
MVX-2	2	10,000	10K	1,000	10,000	20,000
MVX-3	3	15,000	10K	1,000	12,500	30,000

HIGH FREQUENCY, HIGH VOLTAGE RESISTORS

TRW INC.

SPECIFICATIONS

WITH LUG TERMINALS OR COLLOIDAL SILVER TERMINALS

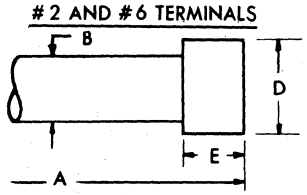
Type	Terminal Type	Power Rating† (W @ 25°C)	MP Peak Voltage Rating* (Volts)	MV Peak Voltage Rating* (KV)	MV Minimum Available Resistance ±10% or ±20% Tolerance	MV Minimum Available Resistance ±5% Tolerance	MV Maximum Available Resistance (Megs)	MP Resistance Min. in Ohms	MP Resistance Max. in Megs	Body Length	Dimensions in Inches: Resistor Body Diameter	Dimensions in Inches: Ceramic Inside Diameter	Dimensions in Inches: Width of Silver Bands #15 Term.
MPC/MVC-1	‡**	1	500	3.5	2.5K	10K	10,000	20	30	1.00±.03	.31±.03	Thd. #6-32	—
MPC/MVC-2	‡**	2	750	7.5	5K	25K	20,000	35	70	1.75±.03	.31±.03	Thd. #6-32	—
MPC/MVC-3	‡**	3	1,400	15.0	10K	100K	40,000	50	130	3.00±.03	.31±.03	Thd. #6-32	—
MPC/MVC-5	‡**	5	2,600	30.0	20K	200K	75,000	100	250	5.5 ±.06	.31±.03	Thd. #6-32	—
MPX/MVX-1	Axial Leads	1	500	3.5	See page 2391 For Ranges			20	25	1.00±.03	.25±.03	—	—
MPX/MVX-2	Axial Leads	2	750	10.0				30	100	2.00±.03	.25±.03	—	—
MPX/MVX-3	Axial Leads	3	1,250	15.0				50	150	3.00±.06	.25±.03	—	—
MPH/MVH-2	‡	4	1,000	15.0	20K	150K	60,000	30	50	2.5 ±.06	.56±.03	Thd. #6-32	—
MPH/MVH-4	‡	6	1,750	25.0	50K	400K	100,000	50	100	4.00±.06	.56±.03	Thd. #6-32	—
MPF/MVF	12, 13	2	500	5.0	2.5K	25K	15,000	20	50	1.75±.03	.31±.03	.19±.03	.38±.03
MPG/MVG	12, 13, 15, 16, 17	4	500	5.0	10K	100K	25,000	20	20	2.00±.03	.56±.03	.38±.03	.56±.06
MPJ/MVJ	12, 13, 15, 16, 17	5	1,000	10.0	20K	200K	50,000	35	50	3.00±.03	.56±.03	.38±.03	.56±.06
MPB/MVB	15	7.5	1,200	12.0	50K	400K	100,000	20	30	3.11±.03	1.00±.03	.75±.03	.56±.06
MPD/MVD	15	10	1,500	15.0	100K	700K	100,000	25	40	3.80±.03	1.00±.03	.75±.03	.56±.06
MPK/MVK	15, 16, 17	10	2,000	20.0	40K	300K	100,000	70	100	5.00±.03	.56±.03	.38±.03	.56±.06
MPP/MVP	12, 13, 15, 16, 17	10	1,750	15.0	50K	400K	100,000	35	70	4.5 ±.06	.75±.03	.50±.03	.56±.06
MPA/MVA	15, 16, 17	20	2,750	25.0	200K	1.0meg	100,000	35	75	6.5 ±.06	1.12±.03	.75±.03	.56±.06
MPZ/MVZ	15, 16, 17	20	2,750	25.0	200K	1.0meg	100,000	35	70	6.12±.06	1.12±.03	.75±.03	.56±.06
MPE/MVE	15, 16, 17	25	3,800	40.0	300K	1.5meg	100,000	40	100	8.31±.06	1.12±.03	.75±.03	.56±.06
MPO/MVO	15, 16, 17	30	4,750	50.0	400K	2.0meg	100,000	50	125	10.5±.06	1.12±.03	.75±.03	.56±.06
MPQ/MVQ	15, 17	50	4,750	50.0	500K	3.5meg	100,000	30	65	10.5±.12	2.00±.05	1.56±.03	.88±.06
MPR/MVR	15, 17	90	8,500	100.0	1meg	7.0meg	100,000	60	130	18.5±.12	2.00±.05	1.56±.03	.88±.06
MVM-5	‡	5	—	30.0	Std. Tol. ±2% 100 Meg. to 1500 Meg.			—	—	5.5 ±.06	.31±.03	Thd. #6-32	—
MVM-6	‡	6	—	30.0	Std. Tol. ±2% 100 Meg. to 1500 Meg.			—	—	6.0 ±.06	.31±.03	Thd. #6-32	—

‡ Solder lug or screw mounted.
* Rated continuous working voltage determined by $E = \sqrt{PR}$
E should not exceed value listed in column above
** Also available with axial leads.
†Derated to 0 at 105°C

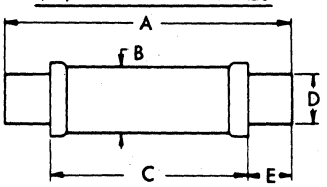
E = Max. continuous voltage
P = Power in watts
R = Resistance in ohms

These resistors are also available as ferrules in some sizes. Consult TRW.

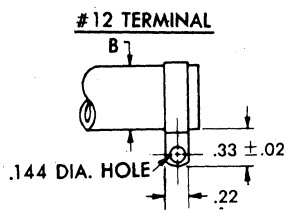
#2 AND #6 TERMINALS



#5, 7 AND 8 TERMINALS



#12 TERMINAL



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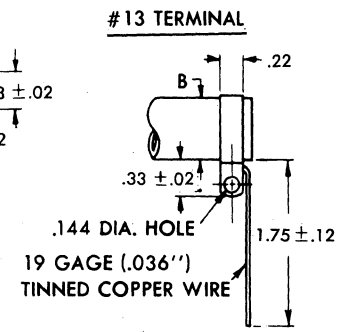
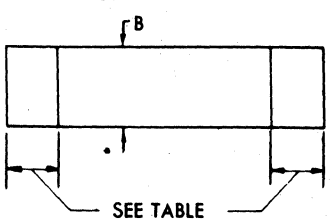


#15 TERMINAL



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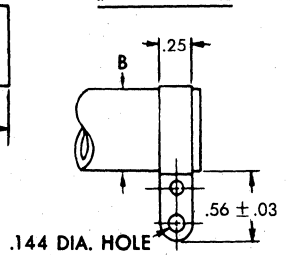
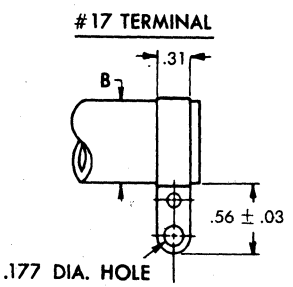
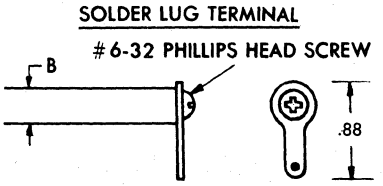


#17 TERMINAL

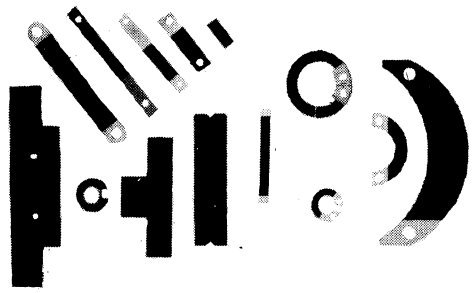


SOLDER LUG TERMINAL



RESISTANCE STRIPS & CONCENTRIC DISC RESISTORS

TRW INC.



CONCENTRIC DISC RESISTORS

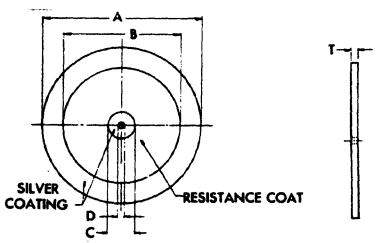
RESISTANCE ELEMENTS

Concentric Disc Resistors are die stamped from resistance strip. Inner and outer rings of colloidal silver are applied to provide contact with coaxial line fixtures. *Mechanical pressure type contacts must be used rather than soldered connections.*

RESISTANCE VALUES AND TOLERANCES

Standard resistance values available are 5 ohms to 100,000 ohms. Standard tolerance is ±20% with ±10% available on special order. For other resistance values or tolerances contact TRW, Boone, N.C.

DIMENSIONS



STANDARD DISCS*

Disc Types	Dimensions in Inches				
	A	B	C	D	T**(±.005)
DRT	.25	.22	.12	.076	.027
DRU	.28	.22	.12	.076	.027
DRX	.38	.28	.12	.076	.027
DRB	.50	.38	.12	.076	.027
DRD	.63	.44	.19	.076	.027
DRF	.75	.50	.25	.076	.027
DRJ	1.00	.75	.25	.076	.027
DRN	1.50	1.25	.25	.076	.027

* Special sizes available upon request.
Sizes include standard dimensions for colloidal silver contact rings.
** Other thicknesses available on special order.

CHARACTERISTICS

Power Rating

Type	Power Rating in Watts at 25°C ambient	Power Rating in Watts at 40°C ambient
DRT	0.06	0.03
DRU	0.07	0.03
DRX	0.10	0.05
DRB	0.12	0.06
DRD	0.14	0.08
DRF	0.16	0.09
DRJ	0.45	0.25
DRN	1.30	0.70

Discs should not be operated at a maximum surface temperature exceeding 80°C.

VOLTAGE RATING

. Maximum rated voltage is 500 volts per inch of current path, but not to exceed power ratings shown above.

RESISTANCE PER SQUARE

While Concentric Disc Resistors should not be ordered in terms of ohms/square it may be desirable for other purposes to determine this value. Following is the formula:

$$\text{resistance/square} = \left[\frac{2.73}{\log_{10}\frac{B}{C}}\right]\left[\text{total resistance}\right]$$

Where B and C are as shown in the figure under DIMENSIONS above.

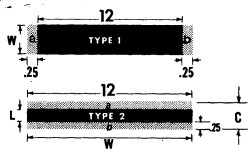
HOW TO ORDER

Standard Concentric Disc Resistors should be ordered by the disc type, total resistance between silver terminals and resistance tolerance. Special concentric discs should give all dimensions indicated above, total resistance between silver terminals and resistance tolerance.

RESISTANCE STRIPS

DIMENSIONS AND TYPES

IRC Standard Resistance Strips are available in two types as shown in the figure and table below.



DIMENSIONS IN INCHES
Note: a and b areas are silver terminations

TYPE 1

Length Between Terminals ±.06	Total Strip Width (W) ±.03	Thickness (±.005)
12	0.88	.027
12	1.19	.027
12	1.38	.027
12	1.50	.027
12	1.75	.027
12	2.75	.027

TYPE 2

Width W ±.06	L ±.03	C ±.03	Thickness (±.005)
12	.38	0.88	.027
12	.69	1.19	.027
12	.88	1.38	.027
12	1.00	1.50	.027
12	1.25	1.75	.027
12	2.25	2.75	.027

Special lengths, widths, and thicknesses are available. Consult TRW, P.O. Box 393, Boone, N.C. 28607.

TOLERANCE

Standard tolerance is ±20%. Special Tolerances of ±15% and ±10% are available on special order.

RESISTANCE VALUES

19 ohms/square to 1.0 megohm/square.

COATING

IRC resistance strips consist of a high grade paper base phenolic laminate with IRC resistance material permanently bonded. They can be supplied with a low resistance colloidal silver contact coating over any portion of the surface where a low resistance positive contact is desired. Mechanical pressure type contacts must be used rather than soldered connections.

JULIE RESISTORS — PRIMARY STANDARD RESISTORS AND RESISTOR SETS

RESISTORS • RATIO SETS • DECADES • NETWORKS

PRIMARY STANDARD RESISTANCE OVENS PRO-106

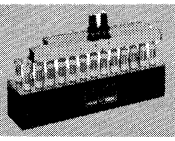


- From .001 ohms to 1 megohm
- to .0008% absolute (depending on value)
- Temperature coefficient less than .05 PPM/°C to 28°C
- NBS traceability

The Model PRO-106 is a Primary Standard Resistance Oven comprising a multivalued, temperature regulated set of extremely precise and stable resistance standards. The model is suitable for use as a central primary standard resistance facility for the test and calibration of all secondary standards and for the calibration of non-temperature-regulated primary standards.

Model PRO-106 contains resistors in decade steps from 10 ohms to 1 megohm.
Model PRO-106L contains resistors in decade steps from .001 ohms to 10 ohms.

DECADE TRANSFER RESISTANCE SERIES, DTR SERIES



- Stability .0001%/year depending on value
- Ratios of 1:1, 1:9 and 1:10 easily and quickly obtained through use of plug-in bars
- Bootstrap standards from 1 ohm to 10 megohms

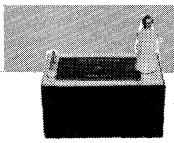
The Decade Transfer Resistance Series is the newest addition to the Julie line of high accuracy, high stability resistor networks. It consists of eleven resistors connected in such a way that absolute ratios of 1:1, 1:9 and 1:10 can be obtained by merely plugging in a set of connecting bars. Its use extends from checking resistance standards by a bootstrapping technique, to volt-box and sensing resistors.

Accessories

TS-10 bars to place ten resistors in parallel
TS-10/9 bars to place nine resistors in parallel
TS-1 bars to place nine resistors in three sets of three parallel resistors

The DTR series is also available for rack mounting.

KV VOLTAGE DIVIDER KV SERIES



- Minimal Leakage
- No Corona
- From 10,000 Volts to 100,000 Volts

The Model KV Voltage Divider Series is a compact, accurate and highly stable, high voltage resistance set hermetically sealed in an oil reservoir to provide reduction in transient current-temperature effects. Its carefully engineered internal construction and its high voltage terminal mounted on a specially designed ceramic standoff insulator minimizes leakage and corona.

Ranges available:

KV-10	10,000V : 10V : 1V	
KV-25	25,000V : 10V : 1V	
KV-50	50,000V : 10V : 1V	
HV-85	85,000V : 10V : 1V	
HV-100	100,000V : 10V : 1V	

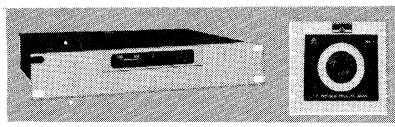
(Other ranges and taps available on special request)

Stability: .0015%/year
Power Coefficient: .0001% per watt
Temperature Coefficient: .00005%/°C
Resistance: 1000 ohms/volt
Accuracy: .01%; ±.05% above 50KV

SYNCHRO/RESOLVER BRIDGES 0.002%

These instruments permit checking synchro transmitters, receivers, differential transformers or 4-wire induction resolvers for electrical error every 5° or every 10° of angular rotation to very high accuracy.

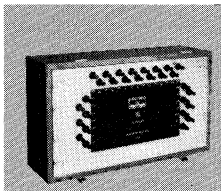
Accuracy: ± 0.002% (4 seconds of arc)
Frequency: 800 cps standard
2 KHz and 10 KHz on request
Harmonic distortion: zero



5° Steps	10° Steps
PSB-5	PSB-10
PRB-4	PRB-10
MSB-5	MSB-10
MRB-5	MRB-10

RATIO AND VOLT BOX SETS 0.001%

Precision DV-series volt-box sets permit the extension of potentiometer ranges without compromise of accuracy. Use uniquely stable Julie primary standard resistors in a compact configuration. NBS-Certifiable.



DV-1500/25

Model	Max input	Output	Max ranges
DV-1500	1500 v	1/1.5 v	11
DV-1500/25	1500 v	1.5/0.75 v	25
DV-1000	1000 v	1/1.5 v	7
DV-750	750 v	1.5 v	10
DV-500	500 v	1.5 v	6
DV-300	300 v	1.5 v	9

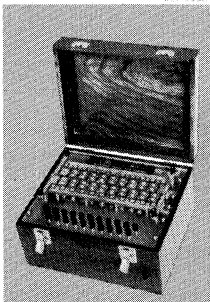
Other ranges available on request. See also Julie resistor networks page in this catalog — Type BMR, BDR, DMR.

Accuracy: 0.001%
Source loading: 1000 ohms/volt
Temp coeff: less than 1.5 ppm/°C

RESISTANCE, CONDUCTANCE AND RATIO STANDARDS

The RCS-105/7 is a primary standard for resistance, conductance and ratio. It is made up of 10 Type NB-1 standard resistors which may be connected in series, parallel, and series-parallel for complete flexibility of resistance and conductance synthesis. The elimination of leakage and interconnection uncertainties makes the RCS-105/7 a virtually error-free transfer standard. NBS-Certifiable.

RCS-105/7
0.00001% (Ratio) 0.0015% (Res/cond)



RCS-105/7	Resistor Val. (ohms)	RANGE Resistance (ohms)	RANGE Conductance (mhos)
A	1	.1 to 10	10^{-1} to 10
B	10	1 to 10^2	10^{-2} to 1
C	10^2	10 to 10^3	10^{-3} to 10^{-1}
D	10^3	10^2 to 10^4	10^{-4} to 10^{-2}
E	10^4	10^3 to 10^5	10^{-5} to 10^{-3}
F	10^5	10^4 to 10^6	10^{-6} to 10^{-4}
G	10^6	10^5 to 10^7	10^{-7} to 10^{-5}
H	10^7	10^6 to 10^8	10^{-8} to 10^{-6}

ALL MODELS: **Accuracy:** ratio 0.00001%, transfer 0.2 ppm per decade, resistance or conductance 0.0015%; **Stability:** 0.0005% absolute per year; **Temp coeff:** 5.0 ppm/°C abs, 1.5 ppm/°C rel.

Other resistance and conductance standards include the MRS-106 which is a plug-in multiple resistance standard containing 5 NB-1 resistors in oil-filled, hermetically-sealed enclosure.

See also types DMR, BMR, BDR

OVENIZED RESISTANCE, CONDUCTANCE AND RATIO STANDARDS

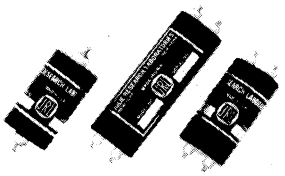
Temperature coefficient .05 PPM/°C. Model RCO-105/7 differs from the RCS-105/7 in that a temperature controlled environment encloses the various resistors so that resistance changes due to temperature variation are kept to .05 PPM/°C from 15°C to 25°C.

JULIE RESISTORS — PRIMARY STANDARD RESISTORS AND RESISTOR SETS

RESISTORS • RATIO SETS • DECADES • NETWORKS

NB-1 RESISTORS AND RESISTANCE RATIOS —

Absolute Accuracy: 0.0015%;
Ratio Accuracy: 0.0005%
NBS Certifiable



These ultra-stable, oil-immersed, primary standard resistors and ratio sets provide unequalled absolute accuracy and stability. This exceptional performance is attained through the application of special manufacturing techniques to a unique design* that makes possible efficient large-scale production of resistors to primary-standard accuracy and stability.

Individual resistors are made with accuracies up to 0.0015%, while ratio accuracy is as high as 0.0005%. Special design techniques minimize temperature coefficients, and the effects of power dissipation as well as electrically and thermally induced transients. Differential expansion and winding strains are compensated.

Up to 3 resistors may be provided in a single can. Low ohmic values are available as 4-terminal resistors.

* Covered by U.S. and Canadian patents.

SPECIFICATIONS

	Resistors	Ratios
Range:	0.1 ohm-10 megohms	up to 10^6:1
Accuracy:	0.0015% 1K-1 Meg	0.0005% (near 1:1)
Stability:	0.0015%/year	0.0005%/year
Temp. Coeff.:	5 ppm/°C (2.5 ppm/°C available)	2 ppm/°C (0.5 ppm/°C available)
Self-heating:	10 ppm/watt	Depends on individual coeff.
Voltage:	200V between term.	200V across set
Thermal Transients:	Less than 0.0005% at rated current	
Power:	Allow for temp. rise of 10°C/watt	
Construction:	Hermetically sealed in oil in metal case	

RESISTANCE — STANDARD SETS

DECADE — BINARY — BINARY-DECIMAL — 0.0015% Accuracy

These exceptionally-economical, compact and accurate resistance sets consist of appropriately proportioned groups of NB-1 Primary Standard Resistors, oil-immersed in hermetically-sealed steel cases for maximum shielding and minimum thermal effects. Very wide ranges of resistance and ratio values may be synthesized by appropriate interconnection of terminals on the top of the case.

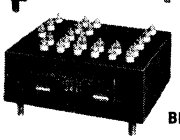
DMR models contain 12 identical resistors; BDR models contain 21 resistors with values proportioned 1, 2, 2, 4 by decades; BMR models contain 17 resistors in a binary-coded sequence for digital-analog conversion (BMR-104S contains two identical sets of 13). In most cases, absolute accuracy of 0.0015%, **ratio accuracy of five parts per million,** are standard.



DMR-104/5/6



BMR-104S



BMR-105/BDR-105

	BDR BINARY-DECIMAL SETS		BMR BINARY SETS			DMR DECADE SETS					
Model	BDR-105	BDR-105A	BMR-104S	BMR-105	BMR-105A	DMR-103	DMR-104	DMR-105	DMR-105A	DMR-106	DMR-107
No. Resistors/Set	21		26 (2x13)	17		12					
Each Resistor	——			——		100Ω	1KΩ	10KΩ	10KΩ	100KΩ	1 Meg Ω
Proportional Resistance Relationship or Coded Sequence	1, 2, 2, 4 Code by Decades (1-Ohm steps)		Binary (Two Identical Sets	Binary 1-65, 536 ohms (1-ohm steps)		12 identical values (11th and 12th permit Kelvin-Varley use, and self-checking by the Wenner Method)					
Total Resistance	100K		29996.337	131,071		1200Ω	12KΩ	120KΩ	120KΩ	1.2 Meg Ω	12 Meg Ω
Accuracy	0.0015%	0.001%	0.005%	0.0015%	0.001%	0.003%	0.0015%	0.0015%	0.001%	0.0015%	0.003%
Absolute Stability/year	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%
Temperature Coefficient	5 ppm/°C			5 ppm/°C		5 ppm/°C					
Self-Heating Coefficient	0.0003%/Watt		0.0003%/Watt			0.0003%/Watt					
Thermal transients (max, at 2 ma)	0.0005% fs		0.0005% fs			0.0005%					

OPERATIONAL AMPLIFIER SUMMING NETWORKS



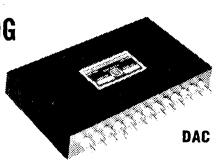
SUM

0.005% Accuracy from —55°C to +85°C

Precision high-stability input and/or feedback networks, whose components share a common design-fabrication-stabilization-test sequence, as well as a common housing medium, offering maximum practical uniformity of characteristics under wide ambient temperature swings.

Accuracy: To 0.0015% over limited temp. range
Tracking: To 0.005%, —55° to +85°C Low and/or matched phase shift—to 1/20 milliradian at 1 megohm impedance level

DIGITAL/ANALOG CONVERTER NETWORKS



DAC

0.0015% Accuracy

For high-speed, high accuracy conversion under stringent environmental conditions. Two to 36 resistors per network, hermetically sealed in metal case for full performance in military environments. Variations for specific networks, any desired code, readily available.

Accuracy: 0.0015% (isothermal); 0.005% —55° to +85°C
Range: 0 to 10 megohms
Temp. Coeff.: as low as 2.5 ppm/°C relative
Self-Heating: to 10 ppm/Watt
Speed: 0.02μsec

MIL-ENVIRONMENT RESISTOR NETWORKS



MTR

0.0015% Accuracy

High precision, maintained over the entire Military temperature range by matching coefficients. Special trimming to non-standard temperature and/or power levels, and extremely low and/or matched phase shift, readily provided.

Accuracy: to 0.0015% isothermal.
Tracking: 0.005% over MIL temperature range.
Temp. Coeff.: 2.5 ppm/°C relative.

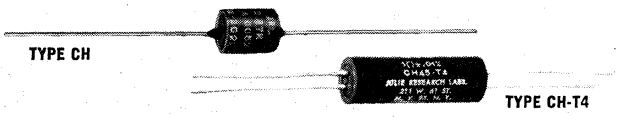
CONTACT HOME OFFICE FOR SPECIAL DESIGNS OR OTHER REQUIREMENTS

JULIE RESEARCH LABORATORIES, INC.

211 WEST 61st STREET, NEW YORK, NEW YORK 10023 • (212) 245-2727

JULIE RESISTORS — PRODUCTION STYLE RESISTORS

COMPACT OIL-FILLED PRECISION RESISTORS



TYPE CH

TYPE CH-T4

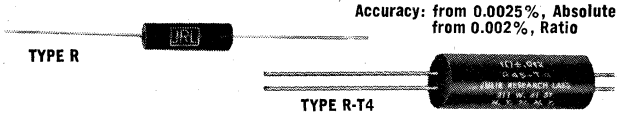
Absolute Accuracy from 0.002% • **Ratio Accuracy from 0.0015%**

An outgrowth of the proprietary techniques established by JRL in developing the now-widely-known NB-1 Primary Standard Resistor, these economical, compact, oil-filled, hermetically-sealed units make it possible for the first time to incorporate standards-laboratory accuracy and stability into commercial and militarized equipment intended for operation over extremes of environmental stress. Operating reliably over the ambient temperature range from —45°C to +85°C, essentially immune to aging, drift, or deterioration from influences such as humidity, salt spray, fungus, or dust, CH resistors bring a new degree of freedom, with economy, to today's critical equipment designs. The CH-T4 further incorporates four-terminal construction, permitting use of extremely low resistance values with complete elimination of lead resistance uncertainties. Low-reactance type HCH also available, for carrier-frequency or high-speed pulse applications.

Range: 0.1 ohm - 5 megohms. (Ratio sets, 1:1 to 10^6:1). 4- terminal construction recommended whenever R x % tolerance is 1 milliohm or less.
Standard Accuracy: 0.005%. Ratio sets, 0.0025% for ratios near 1:1 Accuracies from 0.002% to 0.1% also available, at corresponding prices.
Stability: 0.002% (2-terminal), 0.003% (4-terminal) per year.
MIL Conditions: —45°C to +85°C: ±0.02% Accuracy, ±0.005% Matching, ±0.002% Retrace.
Temp. Coeff.: Resistors, 5 ppm/°C (1.0 ppm/°C available)
Ratios 2.5 ppm/°C (0.7 ppm/°C available)
Current: Up to 2 amperes
Voltage: 300V across terminals, 500V to case
Reactance: Style HCH offers minimum and/or matched-phase shift.
Sizes: ⅜" or ½" diam., ½ to 2" long.

AXIAL-LEAD, COMPACT ENCAPSULATED PRECISION RESISTORS

Accuracy: from 0.0025%, Absolute from 0.002%, Ratio



TYPE R

TYPE R-T4

Unique basic design, special manufacturing techniques, make possible the efficient, large-scale production of these encapsulated resistors with reliabilty and uniformity previously attained only by individual selection and calibration. Their high accuracy and stability, wide range, low cost, enable significant improvement in equipment reliability and performance, plus savings in size, weight, complexity, man-hours, and material. Special characteristics are readily provided —low or matched reactance, arbitrary or matched coefficients, intermediate accuracies of 0.05% and better. Four terminal Type R-T4 provides extremely low resistance values, eliminates lead resistance uncertainties.

Range: 0.1 ohm - 10 megohms (Ratios, 1:1 to 10^6:1)
Standard Accuracy: 0.01%, 1 ohm to 5 megohms (Ratios, 0.005% for ratios near 1:1) Accuracies from 0.0025% to 0.05% also available, at corresponding prices.
Stability: 0.003% per year for standard ranges.
MIL Conditions: —45°C to +85°C: 0.02% Accuracy, 0.005% matching, 0.003% Retrace.
Temp. Coeff.: Resistors, 5 ppm/°C (1.0 ppm/°C available)
Ratios, 2.5 ppm/°C (0.7 ppm/°C available)
Power Ratings: To 250 volts (1000V on special order), to 2 amperes, to 2 watts.
Sizes: ¼" to ½" diam., 5/16" to 2" long.

TOP-HAT ENCAPSULATED PRECISIOIN RESISTORS, FOR PRINTED CIRCUIT BOARDS

Absolute Accuracies from 0.0025%

Ratio Accuracies from 0.002%

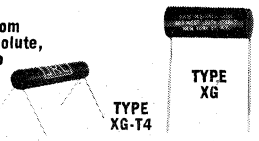


TYPE RS

Julie Type RS resistors offer still another configuration in which the high accuracy, high stability, and broad range of values of JRL encapsulated premium resistors are made available for efficient economical incorporation into your equipment designs. Ratings are the same as listed for Type XG above, with a range from 1 ohm to 750K ohms, and a ¼ watt power rating, packaged in the familiar top hat form shown above. With a diameter of 13/32" and a ½" length.

RADIAL-LEAD, ENCAPSULATED PRECISION RESISTORS

Accuracies from 0.0025% Absolute, 0.002% Ratio



TYPE XG

TYPE XG-T4

Mass-produced radial-lead encapsulated resistors, offering a reliability and uniformity heretofore available only in individually selected and calibrated units. Material control and processing methods minimize aging, drift, and environmental influences such as humidity, salt spray, shock, and vibration. Their unusual reliability in MIL environments particularly recommends these resistors for use in critical military equipment. High accuracy and stability, wide range, and low cost, are standard; special characteristics — low or matched reactance, arbitrary or matched coefficients, intermediate accuracies, are readily provided. 4-terminal (XG-T4) units offer very low resistances, without lead resistance uncertainties.

Range: 0.1 ohm to 10 megohms (Ratios, 1:1 to 10^6:1)
Standard Accuracy: 0.01% (1 ohm to 5 megohms). Ratios, 0.005% for ratios near 1:1. Accuracies from 0.05% up available at correspondingly lower costs.
Stability: 0.003% per year for standard ranges.
MIL Conditions: —45°C to +85°C: 0.02% accuracy, 0.005% matching, 0.003% Retrace.
Temp. Coeff.: 5 ppm/°C (1.0 ppm/°C available)
Ratios, 2.5 ppm/°C (0.7 ppm/°C available)
Power Ratings: To 250V (1000V on special order), to 2 amperes, to 2 watts.
Sizes: ⅜" to 5/8" diameter, 5/16" to 2 1/16" long.

LOW REACTANCE ENCAPSULATED PRECISION RESISTORS

Accuracies: from 0.0025%, Absolute from 0.002%, Ratio



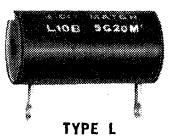
TYPE H

Type H resistors feature a unique low-reactance construction, markedly superior to conventional "Ayrton-Perry" designs. It facilitates extremely tight control of both the inherent inductance and shunt capacitance, as well as the internal geometry of the resistor, so that quadrature-error specifications of ±0.01% can easily be met without resorting to trimming adjustments. Minimum phase shift, or matched phase shift, applications at carrier frequencies, and high-speed pulse applications, are particular provinces of the Type H.

Range: 1 ohm - 5 megohms. Ratios, 1:1 to 10^6:1.
Standard Accuracy: 0.01%, 100 ohms - 5 megohms. Ratios, 0.005% for ratios near 1:1. Intermediate accuracies of 0.05% available, at correspondingly lower costs.
Stability: 0.003% per year, for standard ranges.
MIL Conditions: —45°C to +85°C: 0.02% accuracy, 0.005% matching, 0.003% Retrace.
Temp. Coeff.: 5 ppm/°C (1.0 ppm/°C available)
Ratios, 2.5 ppm/°C (0.7 ppm/°C available)
Power Ratings: to 1000 volts, to 2 amperes, to 2 watts.
Sizes: ⅜" to ½" diameter, ½" to 2" long. Axial wire leads.

RADIAL LUG ENCAPSULATED PRECISION RESISTORS

Absolute Accuracy from 0.0025%
Ratio Accuracy from 0.002%



TYPE L

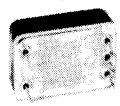
Equivalent to MIL resistor sizes RB 16, 17, 18 and 19 (per MIL-R-93). Julie Type L encapsulated resistors feature radial lug construction, and uniquely-high performance standards under military environmental conditions. Humidity, salt spray, shock, vibration, aging, drift, and other influences are drastically minimized by JRL processing and manufacturing techniques. The unusual reliability exhibited by Type L resistors over the ambient temperature range from —45°C to +85°C makes them particularly well-suited for use in military equipment, and their low cost makes it practical to undertake new orders of precision in quantity-production of instrumentation and equipment for rigorous field use.

Range: 1 ohm to 10 megohms (See Julie Type GL for ratios).
Standard Accuracy: 0.01%, 100 ohms to 5 megohms. Intermediate accuracies, 0.05% and up, and higher accuracies available at corresponding prices.
Stability: 0.003% per year, for standard range.
MIL Conditions: —45°C to +85°C: 0.02% Accuracy, 0.005% Matching, 0.003% Retrace.
Temp. Coeff.: 5 ppm/°C (1.0 ppm/°C available)
Power Ratings: To 300V, to 2 amperes, to 2 watts
Sizes: 5/8" to 1" diameter, 5/16" to 2 1/32" long

JULIE RESISTORS — SPECIAL PURPOSE RESISTORS AND CURRENT SHUNTS

PREMIUM RESISTORS • RESISTOR NETWORKS

MINIATURE (LOW-PROFILE) OIL FILLED PRECISION RESISTORS FOR PRINTED CIRCUITS





TYPE PC

Absolute Accuracy from 0.002%
Stability per Year from 0.0015%

Developed specifically for printed circuit applications, the Type PC network represents another advancement in the state-of-the-art of precision resistance manufacture. These economical, miniature oil-filled, hermetically-sealed units, intended for direct manual or automatic insertion into standard-grid terminal arrangements on printed-circuit boards, are an ideal means of incorporating standards-laboratory accuracy into commercial and militarized equipment using plug-in, modular construction, and intended for operation over extremes of environmental stress.

The materials and manufacturing processes used ensure a unit essentially immune to aging, drift, and environmental deterioration. The metal shell of the PC permits mounting on an appropriate heat sink, thus increasing its power-dissipating ability, decreasing its thermal time constant, and yielding a self-heating coefficient as low as 0.0025% per watt. Its performance over the Military temperature range, and its freedom from the effects of humidity, altitude, salt-spray, fungus, dust, as well as its resistance to shock and vibration, recommend it for the toughest military assignments. Sealed-in-glass terminals provide connection to 4-terminal or two 2-terminal resistors, and to the case (which may thus be grounded, guarded or floated). Low reactance type HPC also available, for low and/or matched phase shift applications, and high-speed pulse use.

Range: 0.1 to 2 megohms. Ratio sets 1:1 to 10^6 to 1.
Standard Accuracy: 0.005%, 1000 ohms to 1 megohm. Ratios, 0.0025% for ratios near 1:1. Accuracies from 0.002% to 0.01% also available, at corresponding prices.
Stability: 0.002% per year.
MIL Conditions: —45°C to +85°C: 0.02% Accuracy, 0.005% Matching, 0.002% Retrace.
Temp. Coeff.: 5 ppm/°C (1.0 ppm/°C available)
Ratios, 2.5 ppm/°C (0.5 ppm/°C available)
Power Ratings: To 300 volts, to 2 amperes, to 1 watt
Size: 1¾₄" long, 5⁷⁄₆₄" wide. Seated height, ½".

RC INTEGRATING NETWORKS

0.01% Accuracy



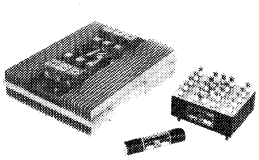
RC NETWORK

JRL fabrication processes, in effect, permit utilizing all of the stability and accuracy performance advantages of Julie resistors so as to produce RC products having higher inherent precision and reliability than can be obtained with the finest capacitors.

A selected, aged, trimmed capacitor is measured for acceptably-low temperature retrace, voltage retrace, leakage and dielectric absorption; appropriate resistors are then wound, trimmed, and stabilized so as to produce an essentially equal and opposite temperature coefficient, and the exact RC product required. No trimming adjustments whatsoever are required in use, to achieve specified performance. (If the customer wishes to specify a trimming rheostat, for setting the RC product after assembly, allowance can be made in the network resistance, to accommodate that facility.)

Absolute Time Constant Accuracy, 25°C: ±0.01%
Max. Temp. Coeff. of RC Product: ±15 PPM/°C
Max. Voltage Retrace: (5 cycles of 150 volts for 30 minutes): ±0.0005%
Max. Temp. Retrace: (Five 4-hr. cycles, —10°C to +71°C): ±0.01%
Max. 1-yr. drift in RC product: ±0.01%

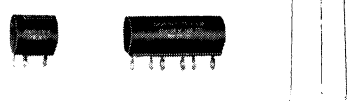
PRECISION HIGH CURRENT SHUNTS MODEL CS-106



Three configurations of precision compact high current shunts are offered in values of .001 to 1.0 ohms and cover a range from 0 to 50 amps. When used in conjunction with nanovolt potentiometer PVP-1001J and Direct Reading ratio set DRRS-108, these shunts permit up to .0025% DC measurements at 10 amps. The temperature coefficient is 5ppm and power coefficients are in the range of .05 ppm to 5 ppm/watt.

GROUP-ENCAPSULATED PRECISION RESISTORS RADIAL-LEAD OR RADIAL-LUG TERMINALS

Absolute Accuracy from 0.002%

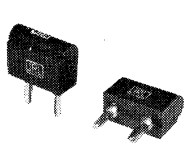


TYPE GL

The proprietary construction techniques responsible for the uniquely-accurate JRL wire-wound resistor lend themselves equally well to the production of group-encapsulated units. The Type GL offers distinct advantages in applications that demand not only a high absolute accuracy in resistance or resistance-ratio values, but also a high degree of uniformity in long-term performance under varying environmental conditions. Simultaneously manufactured and processed, the individual resistors exhibit a high degree of intrinsic uniformity; simultaneously encapsulated in a common medium, their uniformity is perpetuated throughout the encapsulation curing, and conditioning processes, and persists during installation and extended operation in the end equipment, since all environmental influences are experienced to the same degrees, under identical conditions. In most instances, the accuracy and stability of these combinations eliminate the need for "trimming" potentiometers, with appreciable savings in total material cost, labor cost, size, and complexity, besides a significant improvement in reliability and equipment performance. The Type GL is available in radial-lug and radial-wire-lead configurations, as well as in low-reactance (Type HGL) form for carrier-frequency or high-speed-pulse applications.

Range: 1 ohm to 5 megohms. Ratios, 1:1 to 10^6:1
Standard Accuracy: 0.01%, 100 ohms to 5 megohms (available to 0.0025%) Ratios, 0.005% for ratios near 1:1 (available to 0.002%)
Stability: 0.003% per year. Ratios, 0.002% for ratios near 1:1 (Higher stabilities available on order)
MIL Conditions: —45°C to +85°C: 0.02% Accuracy, 0.002% Retrace. Ratios, 0.01% Accuracy, 0.001% Retrace.
Temp. Coeff: 5 ppm/°C (1 ppm/°C available)
Ratios, 2.5 ppm/°C (0.7 ppm/°C available)
No. Resistors Per String: 2 to 10, depending on resistances required.
Power Ratings: (per Section): to 300 Volts, to 2 amperes, to 1 watt
Sizes: 5⁄₁₆" to 5⁄₈" diameter, length according to resistance required.

PLUG-IN STANDARD RESISTORS



A complete line of precision encapsulated standard resistors with banana plug termination on ¾" centers is available at values from one ohm to 2 megohms.

Encapsulated in high temperature epoxy. Designed for use as standards, bridge resistors and as very accurate and very stable components for high precision test and measurement instruments and production equipment.

The units are designed to fit any standard insulated double connector having binding posts at ¾" spacing between center lines. Overall dimensions are 1¹¹⁄₁₆"h x 1⁵⁄₁₆"w x 2¹⁄₃₂"d. The resistor housing measures ³¹⁄₃₂"h x 1⁵⁄₁₆"w x 2¹⁄₃₂"d.

See Type L for performance specifications.

*** SEE ALSO 2900 SECTION FOR JULIE INSTRUMENTS, VOLTBOXES, RATIO SETS.**

CONTACT HOME OFFICE FOR SPECIAL DESIGNS OR OTHER REQUIREMENTS

JULIE RESEARCH LABORATORIES, INC.
211 WEST 61st STREET, NEW YORK, NEW YORK 10023 • (212) 24[illegible]-2727

PRECISION WIREWOUND **RESISTORS** TO 0.001%

ECONISTORS — Low Cost, Immediate Shipment From Stock

NOW: Econistors—standard values, IN STOCK on both coasts! Econistors are very low cost epoxy encapsulated precision wirewounds. In-stock tolerances of ±.1%, .025%, .01% and .005% at all standard values, ±3 PPM T.C. Qualified to MIL-R-93D (RB55). Low Reactance.

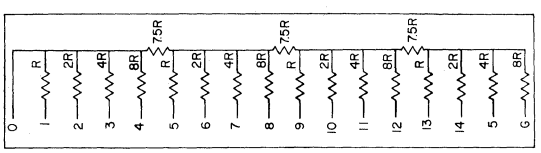
8E16 ECONISTORS — PRICES* — STANDARD VALUES

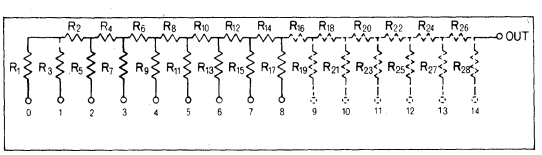
Exact Resistance Value In Ohms	±1% Tolerance			±025% Tolerance			±01% Tolerance			±005% Tolerance		
	1-9 pcs	10-49 pcs	50-99 pcs	1-9 pcs	10-49 pcs	50-99 pcs	1-9 pcs	10-49 pcs	50-99 pcs	1-9 pcs	10-49 pcs	50-99 pcs
10												
20	$1.10	$1.00	$ .90	$1.25	$1.15	$1.05	$1.70	$1.60	$1.50	$4.40	$3.50	$2.60
50												
100												
250												
500												
1 K												
1.5 K	.95	.85	.70	1.10	1.05	.95	1.45	1.35	1.25	3.95	2.99	2.05
2 K												
2.5 K												
5 K												
10 K												
20 K												
25 K	1.00	.90	.75	1.15	1.10	1.00	1.50	1.40	1.30	3.95	2.99	2.05
40 K												
50 K	1.00	.90	.80	1.15	1.10	1.00	1.55	1.45	1.35	3.95	2.99	2.05
100 K	1.10	1.00	.90	1.25	1.20	1.15	1.70	1.60	1.45	4.15	3.25	2.35
180 K	1.25	1.20	1.10	1.60	1.55	1.45	1.95	1.85	1.69	4.40	3.50	2.65
200 K												
250 K	1.40	1.35	1.25	1.75	1.70	1.60	2.10	2.00	1.84	4.55	3.65	2.80
500 K	1.90	1.80	1.70	2.30	2.20	2.05	2.70	2.60	2.40	5.15	4.25	3.35
1 Meg.	3.40	3.05	2.75	3.60	3.25	3.00	3.80	3.65	3.20	5.95	5.05	4.15

*PER RESISTOR; EXACT VALUE; F.O.B. MT. VERNON, N. Y., DOMESTIC NON-STANDARD VALUES: Available in all tolerances from 1 ohm to 1.1 Megohm, two week delivery. Write for Bulletin 811.

AND check GR for "HI-REL", Hermetic-sealed axial or radial leads and printed circuit types. "NANISTORS", Ultra High-Speed resistors. "CURRISTORS", Precision Current Sensing resistors. GR resistors are used on Apollo, F-111, Subroc, Lunar Orbiter, LEM, Titan, Poseidon, Polaris, etc.

FOR ANY WW RESISTOR NEED — CHECK GR FIRST!





NETWORKS — NETWORKS — NETWORKS — NETWORKS!

GR manufactures virtually every kind of resistive network you are likely to need: Ladders, Voltage Reference, R/C, D/A, Summing, A/D, Power Supply Reference, Twin-T Filters, Cold Junction Compensation, Phase Shift, etc., etc. The best performance, the best delivery result from our "state of the art" measurement capability. Thinking networks? Think GR.

OMNILADDER I Universal Miniature Ladder Networks — FROM STOCK!

GR breaks through with the only universal 8 to 16 bit ladder network with external switch compensation available from stock. Here's Omniladder I. Type: Miniature encapsulated, plug-in. Accuracy: 1/2 Least Significant Bit. R Values: 5K or 25K ohms. Input: to 30 volts. Response Time: 100 ns. Op. Temp. Range: −55°C +125°C (Mil. version). Dimensions: 1" x 1.40" x 0.2". Price: $15 to $110 depending upon no. bits, quantity, etc.

GR NETWORKS!

U.S.A.: 500 NUBER AVENUE, MT. VERNON, NEW YORK (212) 292-1500 TWX 710 560 0014
EUROPE: 39 RUE ROTHSCHILD, GENEVA, SWITZERLAND (022) 31 81 80 TELEX 22266

GENERAL RESISTANCE DIVISION OF CHRONETICS

KELVIN PRECISION WIRE-WOUND RESISTORS POWER RESISTORS & REED RELAYS

Kelvin is a pioneer in the field of very high stability, close tolerance, precision wire-wound resistors. Resistors shown represent only part of the broad Kelvin line. Complete catalog data is available on request.

Typical "HRL" Resistor Test Results

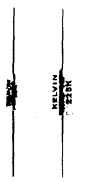
TEST	MIL-R-39005 MAXIMUM	"HRL" SERIES AVERAGE	"HRL" SERIES MAXIMUM
Short Time Overload	±.01%	.0012%	.0080%
Temperature Cycling	±.05	.0014	.0100
Moisture Resistance	±.1	.0072	.0192
Dielectric Strength	±.01	.0010	.0013
Terminal Strength	±.05	.0001	.0004
Shock	±.01	.0008	.0010
Vibration	±.01	.0007	.0020

HIGH RELIABILITY "HRL" SERIES

Kelvin's "HRL" Series Resistors were designed to achieve a failure rate of .005%/1000 hours at a 90% confidence level. All data is based on life tests conducted at full rated power at 125°C for a minimum of 1500 hours. No "acceleration factors" are used. Present failure rates are .006%/1000 hours at a 60% confidence level.

KELVIN TYPE	WATTAGE	RESISTANCE MAXIMUM	DIA. ±.015	LENGTH ±.015	MAXIMUM VOLTS	LEAD DIA.	MIL-R-38101	MIL-R-39005
HRL-20	.08	25K	.187	.375	150 V	#22		
HRL-1009	.125	50K	.250	.295	150 V	#22	38101 12	
HRL-1097	.125	90K	.193†	.500	150 V	#22	38101 7	
HRL-417	.125	125K	.250	.343	150 V	#20		RBR-56
HRL-467	.150	225K	.250	.500	150 V	#20		RBR-55
HRL-334	.200	350K	.375	.500	300 V	#20		
HRL-812	.250	500K	.250	.750	300 V	#20	38101-4-8-11	RBR-54
HRL-815	.333	750K	.375	.750	300 V	#20		RBR-53
HRL-1100	.500	600K	.312	.812	300 V	#20	38101-5-9	
HRL-254	.500	1.5 meg	.375	1.000	600 V	#20		RBR-52
HRL-27	.750	2.0 meg	.500	1.000	600 V	#20	38101-3-6-10	

† ±.010 Tolerance



SUB-MINIATURE TYPES

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±.1/64	LENGTH ±.1/32	MAX. VOLTS	LEAD DIA.
273-P	.04	50K	.080	.250	75	#24
EP-00	.05	100K	.080	.375	100	#24
460-P	.06	125K	.100	.281	100	#24
375-P	.05	100K	.125	.125	75	#24
301-P	.05	175K	.125	.250	100	#24
EP-01	.10	200K	.125	.375	100	#22
470-P	.10	500K	.160	.500	100	#24
EP-20	.15	700K	.187	.375	100	#22
304-P	.15	500K	.250	.250	100	#22
430-P	.15	600K	.250	.312	100	#20
417-P	.20	700K	.250	.343	100	#20

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximums shown; TOLERANCES: 1% through .005% available on most types and resistance values; TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

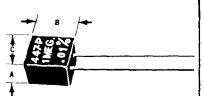
COMBINATION AXIAL-RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±.1/64	LENGTH ±.1/32	MAX. VOLTS	LEAD DIA.
315-P	.05	100K	.080	.375	100	#24
303-P	.05	100K	.125	.250	100	#24
162-P	.10	200K	.125	.375	100	#22
158-P	.15	700K	.187	.375	100	#22

PRINTED CIRCUIT TYPES

High Density Packaging

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	SIZE ±.020 A	B	C	MAX. VOLTS	LEAD DIA.	LEAD SPACING
446-P	.250	2 Meg	.140"	.270"	.500"	100	#20	.250
447-P	.125	1 Meg	.140"	.270"	.250"	100	#20	.125



*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximums shown; TOLERANCES: 1% through .005% available on most types and resistance values.

Standard Printed Circuit

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±.1/64	LENGTH ±.1/32	MAX. VOLTS	LEAD DIA.	LEAD SPACING
252-P	.15	375K	.250	.250	100	#22	.150
176-P	.15	450K	.250	.312	100	#22	.150
178-P	.20	650K	.250	.400	200	#22	.150
277-P	.20	700K	.250	.437	200	#22	.150
471-P	.25	750K	.250	.500	300	#22	.150
177-P	.30	850K	.312	.500	400	#22	.200
179-P	.30	1.1M	.375	.500	400	#22	.200
155-P	.50	3.0M	.500	.625	400	#22	.250

HIGH STABILITY SERIES

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE	RESISTANCE MAX	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
OA	.15	560K	.187	.375	300	#22
OB	.75	1.2 Meg	.250	.500	300	#22
OC	.33	2.2 Meg	.250	.750	400	#22
OD	.33	2.4 Meg	.375	.500	300	#20
OI	.50	3.6 Meg	.375	.828	400	#20
OF	.60	5.2 Meg	.375	1.000	400	#20
OG	.50	4.0 Meg	.500	.500	400	#20
OH	.60	6.4 Meg	.500	.625	400	#20
OI	1.00	8.0 Meg	.500	1.000	800	#20
OK	1.50	10.0 Meg	.500	1.500	900	#20
OL	1.75	10.5 Meg	.500	1.750	900	#20
OM	2.00	13.0 Meg	.500	2.000	1000	#20



LONG TERM STABILITY: .003% resistance change per year maximum under conditions involving normal equipment and room temperature variations. Engineering report E-001 available on request.

STANDARD TYPES

AXIAL-WIRE LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
EP-21	.25	1.5 Meg	.250	.500	400	#22
467-P	.25	1.5 Meg	.250	.500	400	#20
EP-23	.33	2.75 Meg	.250	.750	400	#22
812-P	.33	2.75 Meg	.250	.750	400	#20
363-P	.40	3.0 Meg	.250	1.000	400	#22
334-P	.33	3.0 Meg	.375	.500	300	#20
815-P	.50	4.5 Meg	.375	.750	600	#20
EP-24	.50	4.5 Meg	.375	.828	600	#20
EP-25	.50	5.0 Meg	.500	.500	400	#20
254-P	.60	6.5 Meg	.375	1.000	800	#20
EP-26	.60	8.0 Meg	.500	.625	400	#20
EP-27	1.00	10.0 Meg	.500	1.000	800	#20
EP-28	1.50	12.0 Meg	.500	1.500	800	#20
366-P	1.75	13.0 Meg	.500	1.750	900	#20
EP-29	2.00	15.0 Meg	.500	2.000	1000	#20

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximums shown; TOLERANCES: 1% through .005% available on most types and resistance values; TEMPERATURE COEFFICIENT: ±20 ppm/°C standard; WINDINGS: Non-inductive.



LUG and RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/32	LENGTH ±1/32	MAX. VOLTS	TERMINAL TYPE*	MOUNTING HOLE
EP-22	.10	350K	.312	.250	100	#24 x 2" (Wire Lead)	#2
346-P	.25	1.0M	.375	.440	150	Lug	#4
264-P	.33	1.5M	.375	.500	300	Lug	#4
EP-09	.50	4.0M	.500	.500	400	Lug	#6
263-P	.50	4.0M	.625	.500	400	Lug	#6
EP-15	.60	5.0M	.500	.625	400	Lug	#6
EP-16	1.00	6.5M	.500	1.000	800	Lug	#6
EP-30	1.50	10.0M	.500	1.500	900	Lug	#6

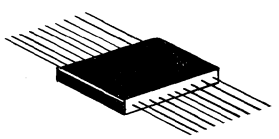
*All Lug Types available with #20 gage radial leads (except EP-22) by specifying letter "R" after type number.

FOR FAST RISE TIME APPLICATIONS

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE	RESISTANCE MAX.	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
RTA	.15	560 K	.187	.375	300	#22
RTB	.25	1.2 Meg	.250	.500	400	#22
RTC	.33	2.2 Meg	.250	.750	400	#22
RTD	.33	2.4 Meg	.375	.500	300	#20
RTE	.50	3.6 Meg	.375	.828	400	#20
RTF	.60	5.2 Meg	.375	1.000	400	#20
RTG	.50	4.0 Meg	.500	.500	400	#20
RTH	.60	6.4 Meg	.500	.625	400	#20
RTJ	1.00	8.0 Meg	.500	1.000	800	#20
RTK	1.50	10.0 Meg	.500	1.500	900	#20
RTL	1.75	10.5 Meg	.500	1.750	900	#20
RTM	2.00	13.0 Meg	.500	2.000	1000	#20

"RT" style resistors provide exceptionally high frequency performance, in addition to the other recognized advantages of wire-wound resistors. □ "RT" resistors can be supplied with rise times as low as 25 nanoseconds (from 10% to 90% of peak pulse amplitude with a 100 KC pulse input), depending on resistance values and physical configurations.



RESISTOR NETWORKS

Kelvin develops and produces, to customer requirements, packaged resistor networks for use as voltage dividers, analog to digital converters, summing and integrator networks, binary resistive networks and special configurations.

Electrical Characteristics Available:

- Nominal resistance tolerances to ±.002% (DC)
- Resistance ratio tolerances as close as .0005% (DC)
- Long term resistance stability of ±.001% per year.
- Low reactances to provide rise times as low as 25 nanoseconds.
- Temperature coefficients of resistors track as close as 0.5 ppm/°C. from —55° to +125°C.

Standard resistor networks in two series (R-2R and BCD) are available from catalog specifications. The potting, encapsulation and physical size flexibility of Kelvin resistors and case production techniques makes it possible to offer custom built units to exact customer requirements at reasonable prices. Our engineering department will review your requirements and submit price quotation and technical notes. 12-page Bulletin LN-37 available on request.

REED RELAYS

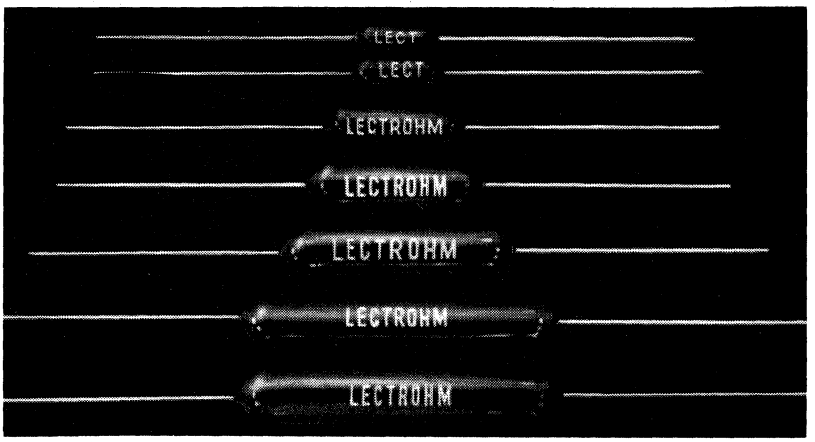
Kelvin offers a broad line of reed relays for reliable, fast switching applications. These feature 1 AMP contacts (10 watts), switching speeds to .5 MS, coil voltages to 48 VDC, and completely encapsulated printed circuit board packages.

POWER RESISTORS

Kelvin manufactures a complete line of precision power resistors in wattages from .25 to 15 watts with a "V" characteristic rating at 350° C. We also offer beryllium core subminiature power resistors and chassis mount resistors from 5 watts to 50 watts. An ultra high wattage series, to 5000 watts, is available in round or corrugated wire configurations. Ask for Catalog PR-711.

KELVIN 5919 Noble Ave. • Van Nuys, California 91401 • Phone: (213) 782-6662

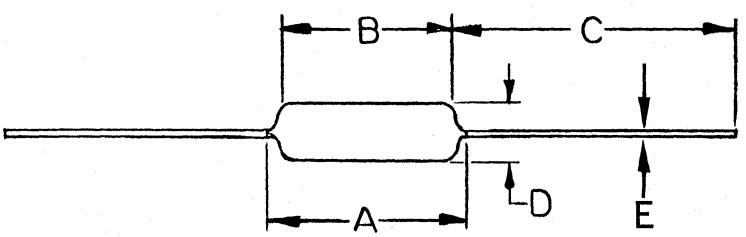
Lectrohm AXIAL LEAD RESISTORS



LECTROHM'S complete line of welded axial lead wire-wound resistors are coated with ceramic silicone or vitreous enamel.

Silicone Coating	Vitreous Coating	Mil R 26	Wattage for 275°C Hot Spot	Wattage for 350°C Hot Spot	LENGTH A Max.	LENGTH B Max.	LENGTH C ±1/8	D* ±1/32	E Diam.	Min. Res.	Max. Res.
XTA1			.8	1	.660	.500	1½	.093	.020	1.0	6K
XTA2	VTA2		1.5	2	.630	.468	1½	.170	.025	0.1	6K
XTA3	VTA3	RW69	3	3.6	.670	.515	1½	.200	.032	0.1	10K
XTA5A	VTA5A		4	5	.950	.781	1½	.240	.032	0.1	15K
XTA5	VTA5	RW67	5	6.5	1.170	.968	1½	.300	.032	0.1	25K
XTA8	VTA8		6.5	8	1.437	1.23	1½	.300	.032	0.1	35K
XTA10A	VTA10A		8	10	2.063	1.843	1½	.300	.032	0.1	50K
XTA10	VTA10	RW68	10	12.5	2.125	1.875	1½	.375	.040	0.1	60K
XTA14	—	RW55	11	14	1.562	1.375	1½	.480	.040	0.5	40K
XTA20	—	RW56	16	20	2.312	2.125	1½	.480	.040	0.5	80K

* Diameter may be exceeded on very low value resistors.



COATINGS: Lectrohm's coatings, whether vitreous or ceramic silicone have a uniformity which is required for automatic insertion.

WATTAGE: Watt ratings have been established for hot spot temperatures of 275°C and 350°C for use in an ambient temperature of 40°C. (See table.)

Table of Standard Resistance Values (OHMS)

AXIAL LEAD TYPE				
1.0	50	390	1200	9000
1.5	56	400	1500	10000
2.0	68	430	1800	15000
2.4	75	450	2000	20000
3.0	82	470	2500	22000
4.0	100	500	3000	25000
5.0	120	560	3300	27000
7.5	150	600	4000	30000
10	200	620	4700	40000
15	220	680	5000	47000
20	250	750	5600	50000
22	270	800	6200	
30	300	900	7000	
33	330	1000	7500	

HOW TO ORDER

Order Resistors by Series Number Followed by Resistance and Tolerance
Example: **XTA 3 - 150 T3**

XTA	3	150	T3
TYPE AXIAL CERAMIC-SILICONE COATING	WATTAGE RATING	RESISTANCE OHMS	TOLERANCE %

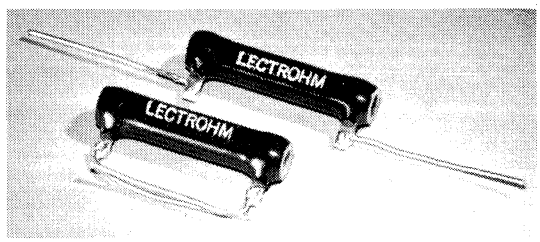
Lectrohm, Inc.
A subsidiary of
COOK ELECTRIC
5562 Northwest Highway • Chicago, Ill. 60630 • 312/763-1700

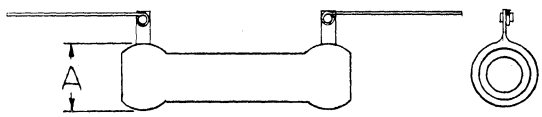
Lectrohm VITREOUS ENAMELED RESISTORS

Selection Guide-Standard Types

FIXED (Pig Tail Lead)

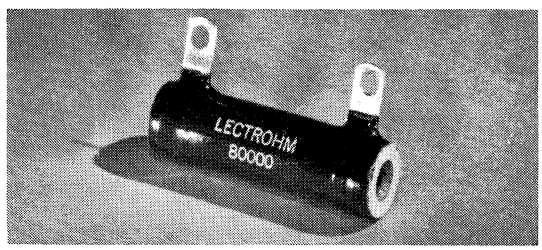
Series No.	Wattage Rating	RESISTANCE (ohms) Max.	RESISTANCE (ohms) Min.	CORE DIMENSIONS Length (±1/16)	CORE DIMENSIONS O.D. (±1/32)	CORE DIMENSIONS I.D. (±1/32)	A Max.
CA5	5	10000	0.1	1	5/16	3/16	11/32
CA10	10	50000	0.1	1 3/4	5/16	3/16	11/32
CA20	20	100000	0.1	2	7/16	5/16	17/32

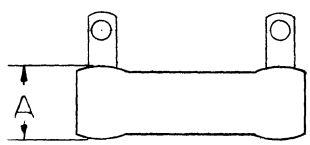




FIXED (Tab Terminal)

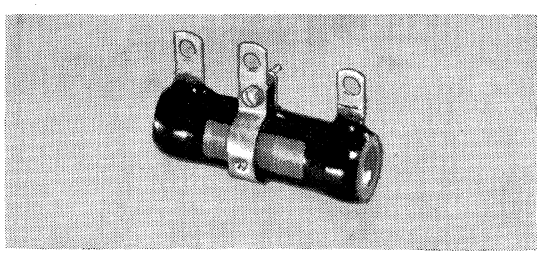
E25	25	100000	0.1	2	9/16	5/16	11/16
E50	50	250000	0.2	4	9/16	5/16	11/16
E75	75	390000	0.5	6	9/16	5/16	11/16
E100	100	600000	0.5	6 1/2	3/4	1/2	27/32
E160	160	1200000	0.8	8 1/2	1 1/8	3/4	1 1/4
E200	200	1500000	1.0	10 1/2	1 1/8	3/4	1 1/4





ADJUSTABLE

D10	10	10000	1.0	1 3/4	5/16	3/16	11/32
D25	25	25000	1.0	2	9/16	5/16	11/16
D50	50	100000	1.0	4	9/16	5/16	11/16
D75	75	100000	1.0	6	9/16	5/16	11/16
D100	100	100000	1.0	6 1/2	3/4	1/2	27/32
D160	160	100000	1.0	8 1/2	1 1/8	3/4	1 1/4
D200	200	100000	1.0	10 1/2	1 1/8	3/4	1 1/4



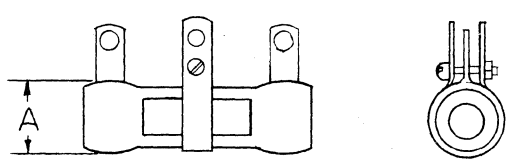


Table of Standard Resistance Values (OHMS)

1.0	25	200	2000	10000
2.0	50	250	2500	15000
3.0	75	500	3000	25000
4.0	100	750	3500	50000
5.0	125	1000	5000	100000
10.0	150	1500	7500	

HOW TO ORDER

Order Resistors by Series Number Followed by Resistance and Tolerance. Example: **E 50 - 100 T5**

E	50	100	T5
TYPE FIXED LUG	WATTAGE RATING	RESISTANCE OHMS	TOLERANCE %

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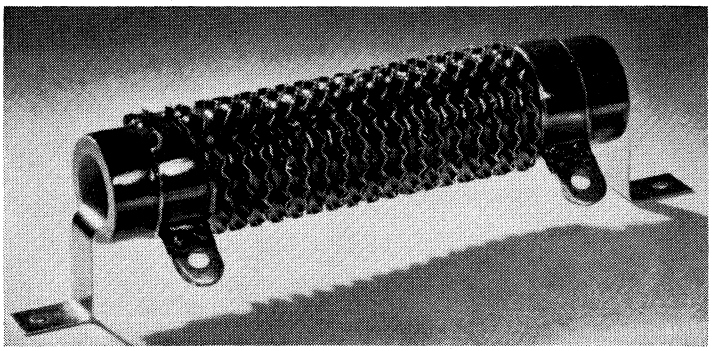
ROE SERIES

Watts	CORE SIZE O.D.	I.D.	Length	RESISTANCE Min. Ohms	Max.* Ohms
36	9/16	5/16	2	0.02	1.8
45	9/16	5/16	3	0.03	3.0
90	9/16	5/16	4	0.04	3.8
105	9/16	5/16	5	0.05	5.2
135	9/16	5/16	6	0.06	6.5
100	3/4	1/2	3 1/2	0.03	3.7
105	3/4	1/2	4	0.04	4.6
135	3/4	1/2	5	0.06	6.5
160	3/4	1/2	6	0.07	8.3
180	3/4	1/2	6 1/2	0.08	9.0
125	1	5/8	4	0.06	6
150	1	5/8	5	0.08	8.5
190	1	5/8	6	0.10	11.5
215	1	5/8	7	0.12	13.5
315	1	5/8	10	0.20	21
155	1 1/8	3/4	4 1/4	0.06	5.5
185	1 1/8	3/4	5	0.09	10.5
220	1 1/8	3/4	6	0.11	12.5
240	1 1/8	3/4	6 1/2	0.12	13
300	1 1/8	3/4	8 1/2	0.17	20
375	1 1/8	3/4	10 1/2	0.22	25
400	1 1/8	3/4	11 1/4	0.24	26
420	1 1/8	3/4	11 3/4	0.30	28



"RIB-ON-EDGE" RESISTORS

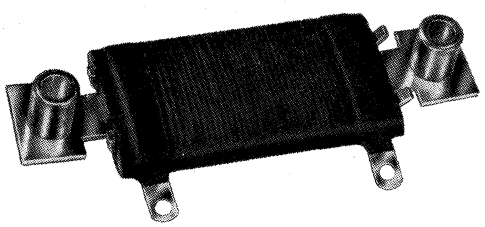
Rib-on-edge resistors are made to order for high wattage service where low resistances are required. They are also used for intermittent duty where relatively small size resistors must dissipate high wattages.

Rib-on-edge resistors are constructed of special alloy ribbon resistance wire crinkled and wound on edge around a tubular ceramic core. The resistance element is welded to a heavy terminal. The entire assembly is then secured to the ceramic tube by a special high temperature vitreous enamel. This type of resistor is classed as a "bare" resistor by NEMA and Underwriters' Standards and has a 375°C maximum operating temperature. The higher temperature rise permits the higher rating.

Rib-on-edge resistors can be made in fixed, adjustable, or tapped styles.

* Maximum resistances can be increased 25% with Lectrohm's unique full-crinkle winding.

Order by series number and resistance required.
(ROE followed by watts and ohms.)
OTHER SIZES CAN BE MADE TO FIT YOUR REQUIREMENTS.



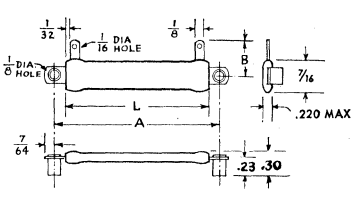
LECTROHM OVALS

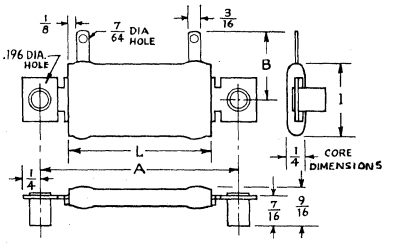
Flat- or oval-core type units have an oval cross section and are mounted by flat brackets of "stud type" for stacking, or "step brackets" for normal mounting. The mounting bracket is constructed of aluminum which acts as a heat sink and makes the higher wattage rating for the size core. They are available with ceramic silicone coating.

Miniature Oval	XOVMS Series				Core Size 3/8 x 1/8
Free Air Watts	Resistance Min.	Max.	L	A	B
10	1	15K	3/4"	1"	7/16"
15	1	25K	1"	1 1/4"	7/16"
20	1	40K	1 1/2"	1 3/4"	7/16"
25	1	50K	2"	2 5/16"	7/16"

Step bracket (push-on) is not applicable.

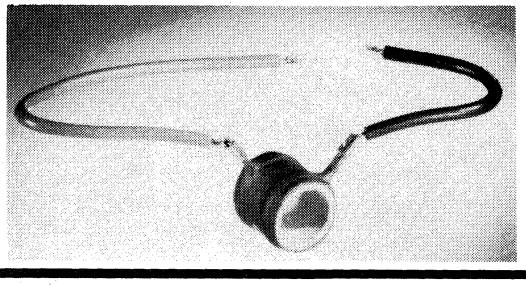
Standard Oval Stacking Bracket	XOVS Series				Core Size 1 x 1/4
Free Air Watts	Resistance Min.	Max.	L	A	B
30	0.1	10K	1 1/4"	2"	15/16"
40	0.2	25K	2"	2 3/4"	15/16"
55	0.3	50K	3 1/2"	4 1/4"	15/16"
65	0.4	80K	4 3/4"	5 1/2"	15/16"
75	0.5	100K	6"	6 3/4"	15/16"

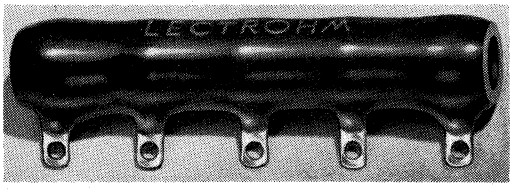




SPECIAL RESISTORS

Resistors having special lug configurations, tapped sections, special blank spaces, insulated flexible leads and many other special custom features, are available.





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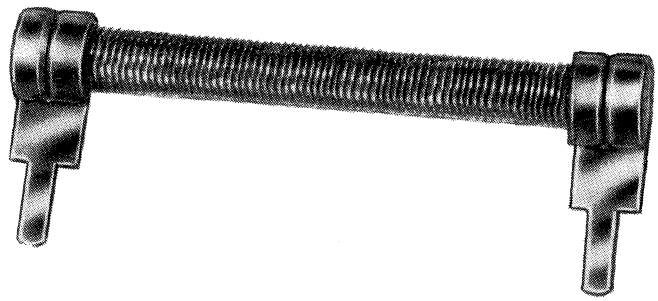
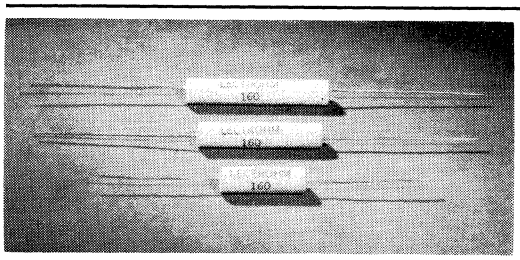
TYPE FP RESISTORS

Lectrohm type FP power resistor is one of the lowest cost power resistors available for printed circuit board applications.

The resistance element is tightly wound with premium quality resistance wire on fiberglas cores. Tinned steel terminals are clinched to the resistance element by automatic machines.

Terminals are designed to be inserted in 0.050″ or 0.070″ diameter holes. Center-to-center distance of prongs on terminals are variable from 0.5″ to 2.5″. Power rating is 4 watts per inch and resistance range is from 0.2 ohms per inch to 1,000 ohms per inch.



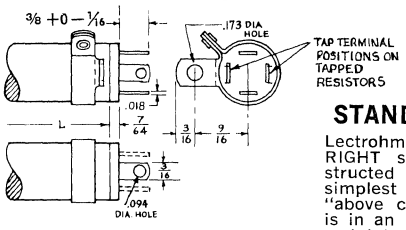


Lectrohm's SAC Series contains the patented fiberglas element from the FLU Series inclosed in a ceramic tube. The tube is then filled with quartz and the ends are sealed with humidity resistant silicone. SAC's are also available with "fuse weld" construction upon request.

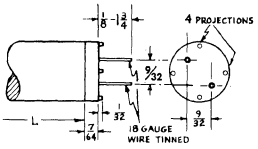
SAC SERIES

Series	Dim.	Watts	Max. Res.
SAC5	5/16 x 1	5	2,000 ohms
SAC7	5/16 x 1½	7	3,000 ohms
SAC10	5/16 x 1¾	10	4,000 ohms

SOLDER LUG TYPE

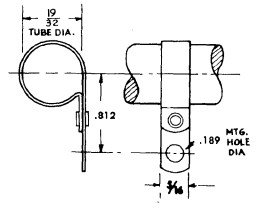


PRINTED CIRCUIT



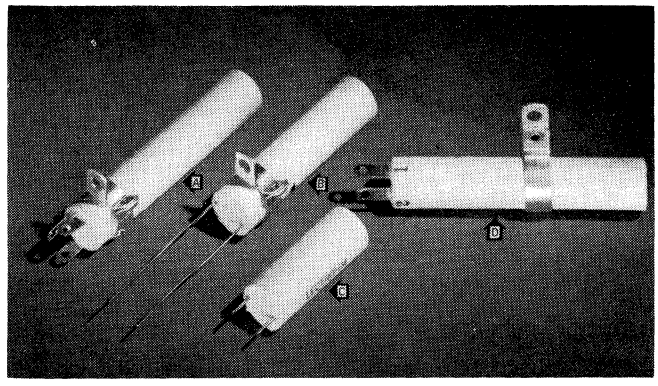
HORIZONTAL MOUNTING BRACKET

Catalog No. 53163



STANDARD UPRIGHT

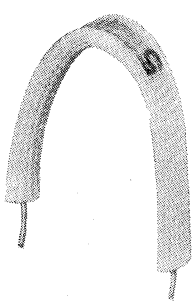
Lectrohm's STANDARD UPRIGHT style resistor is constructed so as to present the simplest form of mounting for "above chassis." The element is in an insulated shell with a metal bracket having a single mounting hole. The terminals can be wire leads, solder lugs, or spaced wire leads for printed board use. Intermediate taps on the windings are available.



RESISTOR SPECIFICATIONS

Pigtail Type Series	Lug Type Series	Printed Circuit Series	Horizontal Mounting Series	Length L	Watts	Max. Res.
UC10	UE10	UP10	UM10	1½″	10	5,000 ohms
UC15	UE15	UP15	UM15	2″	15	7,500 ohms
UC20	UE20	UP20	UM20	2½″	20	10,000 ohms
UC25	UE25	UP25	UM25	3″	25	12,500 ohms
UC30	UE30	UP30	UM30	3½″	30	15,000 ohms

Order by series number and resistance required.



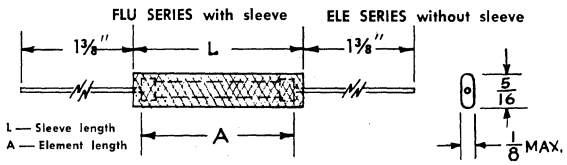
LECTROHM FLEXIBLES

LECTROHM STANDARD FLEXIBLES (FLU Series) are fixed wirewound resistors that can be used in small, confined spaces, and, being flexible, can be bent to conform to the available space. The are wound on a specially treated flat fiberglas core and insulated by a fiberglas sleeve. Free air rating is 2 watts per inch with the surface temperature at the hottest spot not exceeding 340°F. The terminals are hot tinned brass clamped to the resistance element so securely that they will stand a 10 pound pull applied axially. Lead wires are hot tinned 18, 20 and 22 gauge, 1⅜ inches. long.

The sleeved or insulated type is the FLU Series. It is also available without sleeving (bare element) in our ELE Series.

Maximum resistance is 2000 ohms per inch of winding and minimum resistance is 0.2 ohms per inch. Fuse-weld construction is limited to 750 ohms per inch.

STANDARD FLEXIBLE



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SPECIALISTS IN PRECISION WIRE WOUND RESISTORS AND NETWORKS

PRECISION RESISTOR HIGH DENSITY NETWORKS. Summing Networks, Voltage Dividers, RC Networks, Ladder Networks, Voltage Reference, Binary Coded Networks, Temperature compensated networks—all form factors, Hermetic seal oil filled networks, encapsulated networks.

SUBMINIATURE PRECISION WIRE WOUND RESISTORS. Axial lead resistors .093 x .188. Printed circuit resistors—down to .188 x .312.

HIGH SPEED PRECISION RESISTORS. Fast rise times in the area of 50 nanoseconds depending on size and value. Ideal for switching or pulse circuits.

MATCHED TEMPERATURE COEFFICIENTS. Similar or dissimilar values can be tracked to within 1 ppm/°C over expanded temp range.

AC MATCHING. Precision resistors networks suitable for operation at a specific frequency or frequency ranges.

LOW TEMPERATURE COEFFICIENTS. As low as 1 ppm/°C from −55°C to +125°C.

TEMPERATURE COMPENSATING RESISTORS. Resistors can be supplied with any T.C. from −45ppm to +6000ppm. Excellent for cross compensation with R.C. combinations.

HIGH STABILITY PRECISION WIRE WOUND RESISTORS. Documented stability of better than .003% per year. Specially developed loose winding techniques and cycling procedures provide a stress-free completely stable winding.

HIGH ACCURACY. .0025% available on most sizes on a production basis.

PROVEN RELIABILITY. Continuous program covering several years with accumulated life test and environmental test data.

OIL-FILLED RESISTORS. For the ultimate in stability with time and temperature. Oil-filled resistors and resistor networks are completely cushion wound and stress relieved.

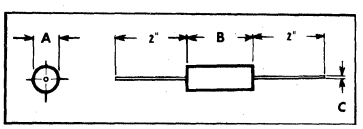
- MIL-R-93D TYPES
- POPULAR MARSTAN STYLES

The full line of Marstan Precision Wire-Wound Resistors includes MIL-R-93D Military types and a wide variety having different form factors, sizes and lead types, only a few of which are shown. At no increase in cost, we will custom design a Resistor to suit your specific application. Voltage ratings can vary even within a given size. All parts are cushion wound and encapsulated to meet or exceed the most stringent environments.

All Resistor Types and Series available in tolerances of 1%, .5%, .25%, .1%, .05%, .01%, .005% and .0025%.

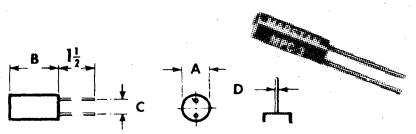
"MAW" SERIES ENCAPSULATED AXIAL LEAD STYLE





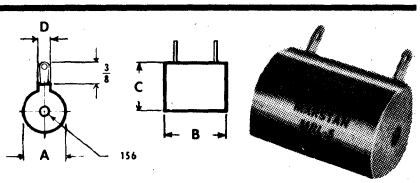
MARSTAN STYLE	MIL STYLE	A DIAMETER (Inches)	B LENGTH (Inches)	C (AWG)	COMMERCIAL WATTAGE (Watts)	COMMERCIAL RESISTANCE (Max. Ohms)
MAW-01		.093	.188	#26	.1	75K
MAW-1		.125	1/4	#24	.1	150K
MAW-1A		.156	5/16	#24	.125	175K
MAW-2		.150	3/8	#24	.2	200K
MAW-2F		.187	.375	#24	.2	200K
MAW-3		3/16	1/2	#24	.25	400K
MAW-4	RB 56	1/4	5/16	#20	.25	400K
MAW-5	RB 55 AFRT 10	1/4	1/2	#20	.33	500K
MAW-5A		1/2	1/2	#20	.5	1 Meg.
MAW-6		1/4	5/8	#22	.33	650K
MAW-7	RB 54 AFRT 11	1/4	3/4	#20	.5	1 Meg.
MAW-8	RB 53 AFRT 12	3/8	3/4	#20	.75	2 Meg.
MAW-9	RB 52 AFRT 13	3/8	1	#20	1	3 Meg.
MAW-10	RB 57 AFRT 14	1/2	1	#20	1.25	5 Meg.
MAW-11	RB 58 AFRT 15	1/2	1-1/2	#20	1.5	7.5 Meg.
MAW-12	RB 59 AFRT 16	1/2	2	#20	2	10 Meg.

"MPC" SERIES ENCAPSULATED PRINTED CIRCUIT STYLE



MARSTAN STYLE	A DIAMETER (Inches)	B LENGTH (Inches)	C SPACING (Inches)	D (AWG)	COMMERCIAL WATTAGE (Watts)	COMMERCIAL RESISTANCE (Max. Ohms)
MPC-1	1/4	3/8	.125	#22	.25	350 K
MPC-1A RB-70	3/8	1/2	.200	#20	.25	800 K
MPC-1B RB-71	1/4	11/32	.200	#22	.125	350 K
MPC-2	1/4	1/2	.125	#22	.33	700 K
MPC-3	1/4	3/4	.125	#22	.5	1.1 Meg.
MPC-4	3/8	3/8	.187	#20	.33	650 K
MPC-5	3/8	5/8	.187	#20	.5	1.5 Meg.
MPC-6	3/8	1	.187	#20	1	3 Meg.
MPC-7	1/2	5/8	.250	#20	.75	2.75 Meg.
MPC-8	1/2	1	.250	#20	1	6 Meg.
MPC-9	1/2	1-1/2	.250	#20	1.5	10 Meg.

"MRL" SERIES ENCAPSULATED RADIAL LUG STYLE



MARSTAN STYLE	*MIL STYLE	A DIAMETER (Inches)	B LENGTH (Inches)	MINISCUS C (Inches)	MINISCUS D (Inches)	COMMERCIAL WATTAGE (Watts)	COMMERCIAL RESISTANCE (Max. Ohms)
MRL-1	RB 08 RB 09 AFRT 17	1/2	1/2	5/8	3/16	.5	1.5 Meg.
MRL-2	RB 15	5/8	1/2	3/4	3/16	.5	2.5 Meg.
MRL-3	RB 16 AFRT 18	9/16	19/32	11/16	3/16	.75	3.5 Meg.
MRL-4	RB 17 AFRT 19	9/16	1	11/16	3/16	1	5 Meg.
MRL-5	RB 18	11/16	1-1/4	13/16	3/16	1.5	10 Meg.
MRL-6	AFRT 20	1/2	1-1/2	5/8	3/16	1.5	7.5 Meg.
MRL-7	AFRT 21	1/2	2	5/8	1/4	2	10 Meg.
MRL-8	RB 19	7/8	2-1/8	1	1/4	2.5	15 Meg.

*MIL Styles conform to MIL Specifications and are not provided with Commercial Styles Miniscus (Dimensions C & D).

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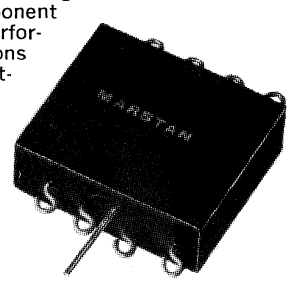
RC NETWORKS
NOW FOR THE FIRST TIME

in one facility, Balco-Marstan combines manufacturing capabilities in Precision Film Capacitors and Precision Wire-Wound Resistors.

TEMP. RANGE	NOMINAL TIME CONSTANT	CLOSEST INITIAL TOLERANCE	RC PRODUCT STABILITY AFTER TEMP. CYCLING	RC PRODUCT VARIATION WITH TEMP.
—55°c To +85°c	1.0 μ sec. to 100 sec.	±0.03%	±0.03%	0±25ppm/°c
	101 μ sec. to 1m sec.	±0.03%	±0.03%	0±15ppm/°c
	1.1 m sec. to 5 sec.	±0.02%	±0.02%	0±10ppm/°c
—55°c To +125°c	5.1 sec. to 20 sec.	±0.03%	±0.03%	0±15ppm/°c
	100 μ sec. to 1 ms	±0.04%	±0.04%	0±20ppm/°c
	1.1 m sec. to 5 sec.	±0.03%	±0.03%	0±15ppm/°c
	5.1 sec. to 20 sec.	±0.05%	±0.05%	0±30ppm/°c
	21 sec. to 200 sec.	±0.15%	±0.15%	0±50ppm/°c

It is no longer necessary to purchase separate components whose compatibility is a matter of chance. Attempting to closely match dissimilar parts is expensive and risky. AT BALCO-MARSTAN WE ARE SPECIALISTS. Your RC application will be reviewed by a staff experienced in the pitfalls of network design.

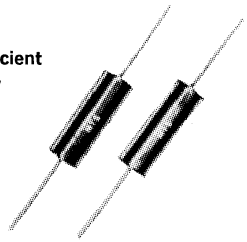
Our unique side by side processing insures the ultimate in component compatibility and over-all performance. Our files of applications include Integrators, Phase Shifters, Oscillators, Twin-T Filters, etc.

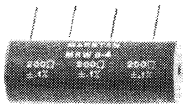


RC product accuracy and stability is dependent on practical restraints on the individual components and, to aid the circuit designer in realistically computing system accuracy, the table (at left) has been developed.

SPECIAL RESISTOR STYLES

"MTS" Series are temperature-sensitive resistors with **matched temperature coefficient characteristics** for temperature indicators, cold junction compensators for thermocouples, diode ballasts and other current limiting devices. Special linear and non-linear temperature-resistance characteristics available with Marstan techniques. Resistance temperature coefficient matches are possible within 1 ppm/°C over the temperature range.





Special Multi Tap Precision Resistors, which serve where space requirements are critical, may be ordered. Ease of installation can greatly reduce manufacturing costs.

THESE ARE TWO OF THE MANY CONFIGURATIONS AND SPECIAL STYLES AVAILABLE. WE ALSO MANUFACTURE A WIDE RANGE OF HIGH SPEED AND TEMPERATURE SENSITIVE RESISTORS.

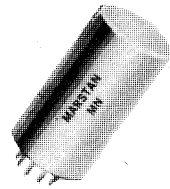
MARSTAN OIL-FILLED RESISTORS—"MOA" SERIES

Through the selection of materials and unique manufacturing techniques, Marstan Oil-Filled Resistors ("MOA" Series) are available in stabilities of .0025%, absolute accuracies of .0025% and matched tolerances of .001% are available.



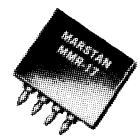
Data supplied upon request.

PRECISION NETWORK ASSEMBLIES

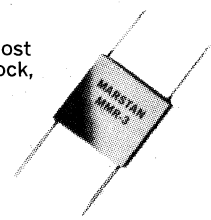


Marstan networks are manufactured in a multitude of shapes, sizes and terminal configurations.

Utilizing the most sophisticated methods of packaging and circuit design, it is possible to provide matched resistors with nominal tolerances of .0025% **matched to each other** to .001%. In addition, special techniques allow for exact tracking over wide temperature ranges.

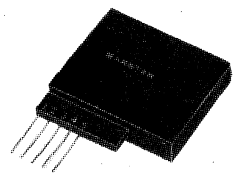


Marstan is a specialist in the use of foams, epoxy, polyester, polyurethane or various controlled inert atmospheres. Special formulations are available to meet the most severe environmental specifications of shock, vibration, humidity, salt water immersion as well as ambient temperatures from —75°C to 250°C.



TYPICAL APPLICATION AREAS ARE —RC NETWORKS, R2R BINARY LADDERS, SUMMARY NETWORKS, VOLTAGE DIVIDERS, INTEGRATORS, BRIDGES, CONVERTERS, TIMING NETWORKS, ZENER COMPENSATION NETWORKS, ETC.

For more complete data on precision network assemblies, ask for Marstan Catalog P-7.

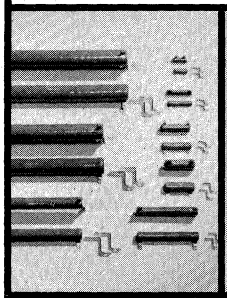


MAIN PLANT: 307 WASHINGTON STREET, ORANGE, NEW JERSEY 07050, TEL. (201) 677-1200

MEMCOR COMPONENTS

A PRODUCT OF
LTV ELECTROSYSTEMS, INC.
MEMCOR DIVISION
HUNTINGTON, INDIANA 46750

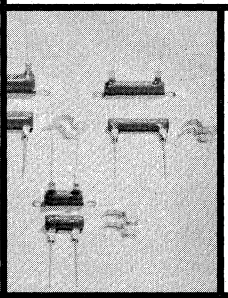
WIREWOUND RESISTORS



TYPE FR
TAB TERMINAL

POWER RATING
5-200 WATTS
STD. RES. RANGE
1-100,000 OHMS
CORE SIZE
1" x 15/16" TO
10 1/2" x 1 1/8"

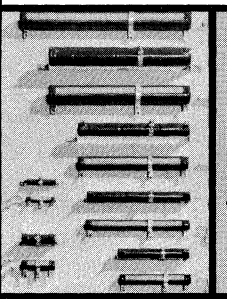
VITREOUS ENAMEL WIREWOUND
FIXED TUBULAR
WITH TABS
(MILITARY EQUIVALENT AVAILABLE)



TYPE FRL
RADIAL LEAD TERMINAL

POWER RATING
5-20 WATTS
STD. RES. RANGE
1-100,000 OHMS
CORE SIZE
1" x 15/16" TO
2" x 7/16"

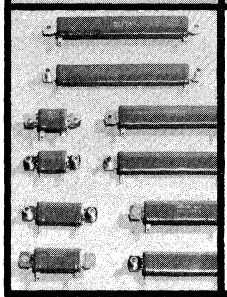
VITREOUS ENAMEL WIREWOUND
FIXED TUBULAR
WITH LEADS



TYPE AR
TAB TERMINAL

POWER RATING
10-200 WATTS
STD. RES. RANGE
1-100,000 OHMS
CORE SIZE
1 3/4" x 15/16" TO
10 1/2" x 1 1/8"

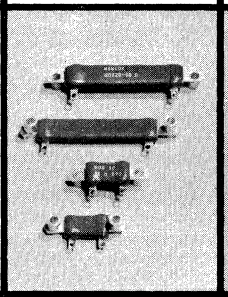
VITREOUS ENAMEL WIREWOUND
ADJUSTABLE TUBULAR
WITH TABS



TYPE OR
TAB TERMINAL

POWER RATING
30-55 WATTS
STD. RES. RANGE
1-20,000 OHMS
CORE SIZE
1 1/4" x 1" x 5/16"
TO 3 1/2" x 1" x
5/16"

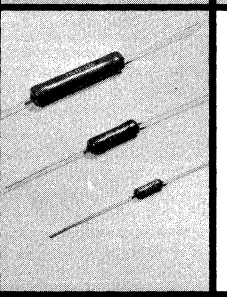
VITREOUS ENAMEL WIREWOUND
OVALS
WITH TABS
(MILITARY EQUIVALENT AVAILABLE)



TYPE MOR
TAB TERMINAL

POWER RATING
10-20 WATTS
STD. RES. RANGE
1-50,000 OHMS
CORE SIZE
3/4" x 3/8" x
1 15/16" TO
2" x 3/8" x
2 5/8"

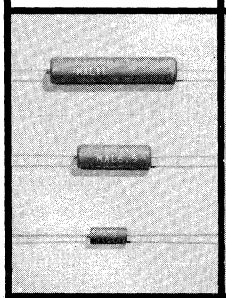
VITREOUS ENAMEL WIREWOUND
MIDGET OVALS
WITH TABS



TYPE VAL
AXIAL LEAD

POWER RATING
3-10 WATTS
STD. RES. RANGE
1-51,000 OHMS
CORE SIZE
3/16" x 5/32" TO
1 11/32" x 5/16"

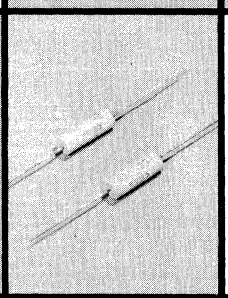
VITREOUS ENAMEL WIREWOUND
AXIAL LEADS
(MILITARY EQUIVALENT AVAILABLE)



TYPE MAL
AXIAL LEAD

POWER RATING
1-11 WATTS
STD. RES. RANGE
1-200,000 OHMS
UNIFORM DIMENSIONS
CLOSE TOLERANCES

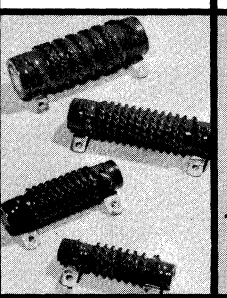
MOLDED SILICONE
AXIAL LEADS
(MILITARY EQUIVALENT AVAILABLE)



TYPE MVR
AXIAL LEAD

POWER RATING
3.25-11 WATTS
STD. RES. RANGE
1-25,000 OHMS
CORE SIZE
.547" x .203" TO
1.781" x .313"

MOLDED VITREOUS
AXIAL LEADS
ROUND



TYPE RR
TAB TERMINAL

POWER RATING
40-1500 WATTS
STD. RES. RANGE
0.02-100 OHMS
CORE SIZE
2" x 9/16" TO
20" x 2 1/2"

VITREOUS ENAMEL WIREWOUND
EDGEWOUND
WITH TABS

MEMCOR COMPONENTS

A PRODUCT OF
LTV ELECTROSYSTEMS, INC.
MEMCOR DIVISION
HUNTINGTON, INDIANA 46750

POWER RHEOSTATS

TYPE 12 1/2
12½ WATT
1-5000 OHMS
7/8" DIAM.-.035 LBS.

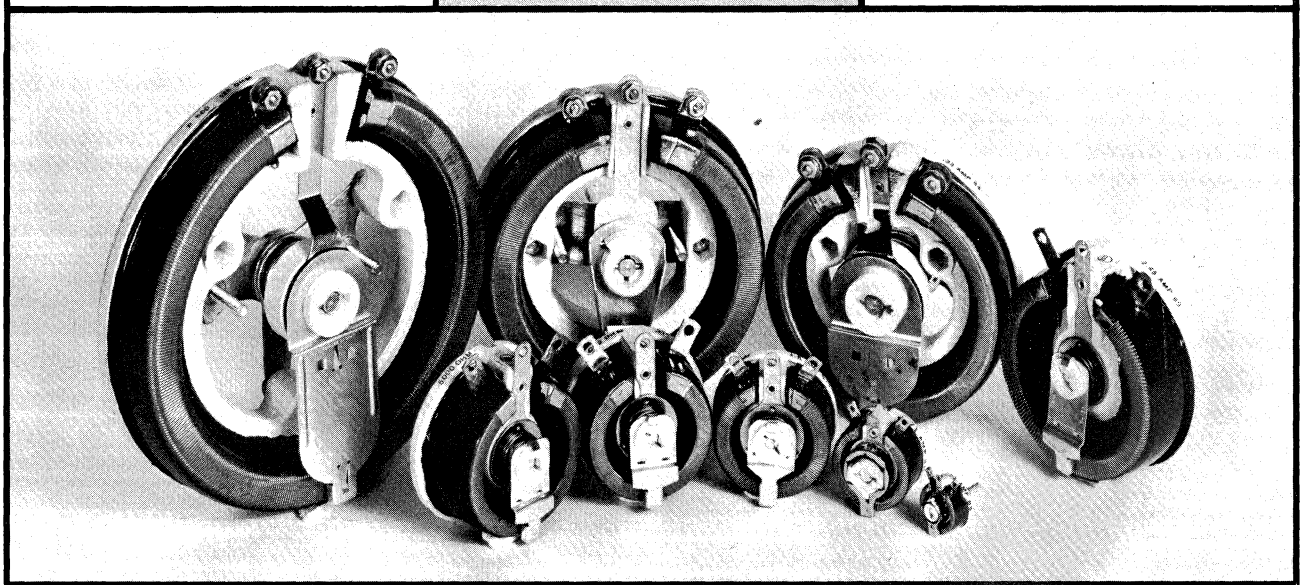
TYPE 25
25 WATT
1-5000 OHMS
1 9/16" DIAM.-0.23 LBS.

TYPE 50
50 WATT
0.5-10,000 OHMS
2 15/16" DIAM.-0.45 LBS.

TYPE 75
75 WATT
0.5-10,000 OHMS
2 3/4" DIAM.-0.60 LBS.

TYPE 100
100 WATT
0.5-10,000 OHMS
3 1/8" SIAM.-0.72 LBS.

TYPE 150
150 WATT
0.5-10,000 OHMS
4" DIAM.-1.50 LBS.



TYPE 225
225 WATT
1-2500 OHMS
5" DIAM.-2.18 LBS.

TYPE 300
300 WATT
1-2500 OHMS
6" DIAM.-3.0 LBS.

TYPE 500
500 WATT
1-2500 OHMS
8" DIAM.-3.75 LBS.

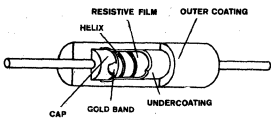
TYPE 750
750 WATT
1-2500 OHMS
10" DIAM.-7.31 LBS.

TYPE 1000
1000 WATT
1-2000 OHMS
12" DIAM.-10.0 LBS.

SPECIAL RHEOSTATS WITH TAPERED SECTIONS, LOCKING DEVICES, OFF POSITIONS, TANDEM MOUNTINGS, SPECIAL SHAFTS ON BUSHINGS, AND MANY OTHER VARIATIONS CAN BE SUPPLIED

MALLORY RESISTORS

PRECISION METAL ALLOY FILM RESISTORS



	MAF 60		MAF 65		MAC 60		MAC 65	
	@ 70°C	@ 125°C	@ 70°C	@ 125°C	@ 70°C	@ 125°C	@ 70°C	@ 125°C
Power rating	¼w	⅛w	½w	¼w	¼w	⅛w	½w	¼w
Voltage rating	300v	250v	350v	300v	300v	250v	350v	300v
Life: △R max. @ 1000 hrs.	±0.5%	±0.5%	±0.5%	±0.5%	±1.0%	±1.0%	±1.0%	±1.0%
Moisture res. △R max.	±0.5%	±0.5%	±0.5%	±0.5%	±1.5%	±1.5%	±1.5%	±1.5%
Short time overload, △R max.	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%
Temp. cycling △R max.	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%
Low temp. operation △R max.	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%
Resistance to solder heat △R max.	±0.1%	±0.1%	±0.1%	±0.1%	±0.10%	±0.10%	±0.10%	±0.10%
Insulation res. megohm min.	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Dielectric withstanding voltage △R	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%
Voltage coefficient typical %/volt	.001	.001	.001	.001	.001	.001	.001	.001

RESISTANCE RANGE

MAF-65 & MAC-65

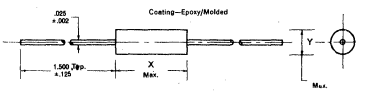
Minimum 30.1 ohms, maximum 1 megohms. Standard decade values available. For non-standard values, contact factory.

MAF-60 & MAC-60

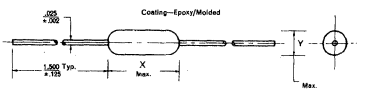
Minimum 30.1 ohms, maximum 499K ohms. Standard decade values available. For non-standard values, contact factory.

RESISTANCE TOLERANCE

±1.0%, ±0.5% standard for all values, for ±0.25% and ±0.10% contact factory.



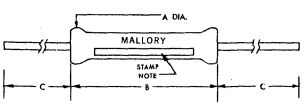
	MAF-60	MAF-65
X	.377	.627
Y	.127	.189



	MAC-60	MAC-65
X	.320	.500
Y	.125	.165

METAL OXIDE FILM RESISTORS — MOL

The MOL axial lead type resistor consists of an oxide film bonded to a ceramic base at a high temperature. Resistance spiralling of the oxide film is controlled electronically. End caps, equipped with welded axial leads, are fitted under pressure to the ceramic base.



Type	Resistance Min.	Resistance Max.	Std. Tol.	Diameter A	Length B	Length of Leads C	Power Rating Watts	Power Rating Ambient
2MOL	30	500K	10%	5/16" ±1/32"	11/16" ±.040	1½" ±⅛"	2	70°C
3MOL	40	620K	10%	5/16" ±1/32"	15/16" ±1/16"	1½" ±⅛"	3	70°C
4MOL	85	125K	10%	5/16" ±1/32"	1 9/16" ±1/16"	1½" ±⅛"	4	70°C
5MOL	95	125K	10%	5/16" ±1/32"	1¾" ±1/16"	1½" ±⅛"	5	70°C
7MOL	125	125K	10%	5/16" ±1/32"	2 1/16" ±1/16"	1½" ±⅛"	7	70°C



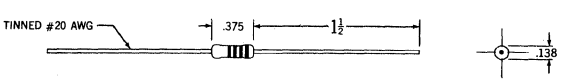
Leads Available in 17 or 20 AWG

SEMI-PRECISION METAL ALLOY RESISTORS

The Mallory MAL-20 ½ watt (70°C) is an axial lead semi-precision metal alloy film resistor designed for use in computers, industrial instrumentation, color television and other entertainment products.

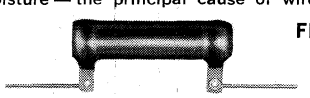
Resistance range of the MAL-20 is 47 ohms to 470 K ohms. Standard tolerance is ±2% and ±5%. The ½ watt power rating of the MAL-20 is derated linearly to 150°C. Maximum rated voltage is 350 VDC. Temperature coefficient of ±100 PPM/°C and ±150 PPM/°C. Dielectric withstanding voltage 750 volts RMS.

The MAL-20 meets or exceeds the requirements of MIL-R-22684. The unit is moisture resistant epoxy coated and color coded to industry standards. It is available in bulk packaging or with reel lead taping.



VITREOUS ENAMEL RESISTORS

The coating on Mallory wire-wound resistors is a special vitreous, non-alkaline, non-hygroscopic enamel prepared under controlled conditions, applied in uniform thickness and vitrified at carefully regulated temperatures. The core is completely sealed by a durable, glass-like coating that is impervious to moisture — the principal cause of wire corrosion.



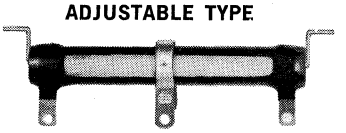
Wattage	Style	Resistance Range (Ohms)	Dim. A
5	HHJ	1 to 5,000	1"
10	1HJ	1 to 50,000	1¾"
20	2HJ	5 to 100,000	2"

FIXED TYPES



Wattage	Style	Resistance Range (Ohms)	Dim. B	Dim. C
25	2.5HJ	1 to 100,000	2"	¾"
50	5HJ	10 to 100,000	4"	¾"
100	10HJ	25 to 100,000	6½"	¾"
200	20HJ	25 to 100,000	10½"	1¼"

ADJUSTABLE TYPE



Wattage	Style	Resistance Range (Ohms)	Dim. D	Dim. E
10	1AV	1 to 10,000	2⅝"	⅝"
25	2AV	1 to 25,000	3"	¾"
50	5AV	5 to 50,000	3"	¾"
100	10AV	50 to 75,000	7½"	¾"
200	20AV	50 to 75,000	11⅞"	1¼"

AXIAL LEAD FIXED STYLE AE



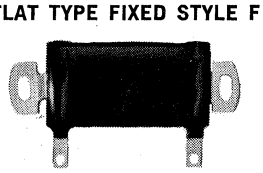
Style "AE" axial lead resistors are for application in industrial and electronic devices, including military and other special electronic equipment.

These resistors are made of the highest quality ceramic core, resistance wire and vitreous enamel coatings available.

TABLE OF MADE TO ORDER RESISTORS — AXIAL LEAD FIXED — VITREOUS ENAMELED

Free Air Watt Rating	Overall Length	Overall O.D.	Minimum Resistance	Maximum Resistance	Equivalent MIL-R-26 Style
3	9/16	¼	0.1	10,000	RW59
5	1	11/32	0.1	25,000	RW57
10	1¾	13/32	0.1	50,000	RW58

FLAT TYPE FIXED STYLE F



The flat design of the Mallory flat style vitreous enamel wire-wound resistors makes these resistors especially adaptable to design requirements where space is at a premium, for they fit well into stack-mounting requirements. A strong ceramic core is used, uniformly wound to prevent "hot-spots," and coated with a moisture resistant vitreous enamel for a dependable, longer operating unit.

There are five conservatively rated wattages available. The resistance ranges from 1 to 100K ohms.

TABLE OF MADE TO ORDER RESISTORS —FLAT FIXED TYPE

Free Air Watt Rating	Core Length	Core Width	Core Thickness	Minimum Resistance	Maximum Resistance	Equivalent MIL-R-26 Style
30	1¼	1	1/64	0.1	10,000	RW20
40	2	1	1/64	0.2	25,000	RW21
55	3½	1	1/64	0.3	50,000	RW22
65	4¾	1	1/64	0.4	80,000	RW23
75	6	1	1/64	0.5	100,000	RW24

Standard Mallory components are available from authorized Mallory distributors throughout the United States.

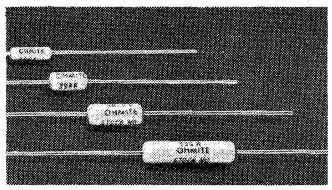
MALLORY CONTROLS COMPANY
a division of P. R. MALLORY & CO. INC.
Box 327, Frankfort, Indiana 46041; Telephone: 317-654-5501

SERIES 99 MOLDED AXIAL LEAD VITREOUS ENAMELED RESISTORS

- **FIRST MOLDED, WIREWOUND, VITREOUS ENAMEL RESISTOR**
- **INSULATED! Meets 1000 VAC Test**
- **WITHSTANDS 1500°F Temperature without Distortion**
- **RESISTS Chipping, Breaking**
- **VITRIFIED MARKINGS, Resist Abrasion and Active Solvents**
- **UNIFORM SIZE Permits Clip-Mounting with Significant Heat Sink Benefits**
- **HIGH OVERLOAD CAPABILITY**

An exclusive technique (U.S. Patent No. 3,229,237) permits application of the vitreous enamel coating by **molding** instead of the conventional "dip" process. The dimensionally consistent and thicker coating that results, guarantees a 1000 VAC insulation rating plus unparalleled capability for withstanding very high temperatures, high humidity and immersion in salt solution.

These resistors are normally mounted by their axial leads. However, their consistent form also permits mounting in clips with heat sink benefits up to 100%. Resistor markings are also vitreous and will not burn off even under extreme overloads. Resistance tolerance is ±5%. Series 99 resistors meet the requirements of MIL-R-26 for "insulated" resistors. See Bulletin 103 or Catalog 50 for specific MIL types.



TYPE 994, COMMERCIAL, HIGH STABILITY

Standard Tolerance 3% • Tolerances to 0.25% Available

Type 994 units feature long term stability and the Series 99 low temperature coefficient of resistance (T.C.).

Stability: Type 994 resistors, on a 2000 hour, cyclic, load-life test (1½ hour on, ½ hour off) have less than ±2% △R.

Standard Tolerance for Type 994 resistors is ±3%. Tolerances to ±0.25% are available.

Ohmite Style	Rated Watts @ 25°C	Dimensions (inches) Lgth. ±.015	Dia. +.031 −.000	Leads 1½" AWG	Typ. Wt. (g's)	Resistance Range (Ohms)	Max. Wkg. Volts RMS
994-1A	1.5	.422*	.125*	24	0.4	0.1-6650	
994-2A	2.25	.375	.188	20	0.8	0.1-6490	85
994-3A	3.25	.547	.203	20	1.3	0.1-22,100	190
994-5A	6.5	.922	.312	20	3.6	0.1-80,600	460
994-5B	5	.938	.203	20	2.0	0.1-53,600	500
994-7A	9	1.218	.312	20	4.5	0.1-118,000	670
994-10A	11	1.781	.312	20	6.9	0.1-187,000	1100
994-15A	14	2.00	.394	20	13.0	0.1-243K	1100

TYPE 995, COMMERCIAL POWER APPLICATIONS

Standard tolerance for Type 995 units is ±5% for values 1 ohm and above; ±10% for values below 1 ohm. For tolerances to ±0.25%, consult factory.
Low temperature coefficient.

5% TOLERANCE; CLOSER TOLERANCES AVAILABLE

Ohmite Style	Rated Watts @ 25°C	Dimensions (inches) Lgth. ±.015	Dia. +.031 −.000	Leads 1½" AWG‡	Typ. Wt. (g's)	Resistance Range† (Ohms)	Max. Wkg. Volts RMS
995-1A	1.5	.422*	.125*	24	0.4	0.1-6650	
995-2A	2.25	.375	.188	20	0.8	0.1-6490	85
995-3A	3.25	.547	.203	20	1.3	0.1-22,100	190
995-5A	6.5	.922	.312	20	3.6	0.1-80,600	460
995-5B	5	.938	.203	20	2.0	0.1-53,600	500
995-7A	9	1.218	.312	20	4.5	0.1-118,000	670
995-10A	11	1.781	.312	20	6.9	0.1-187,000	1100
995-15A	15	2.00	.394	20	13	0.1-243,000	1100

* Tolerance ±.015, −.005. † For closer tolerances than 1%, minimum value is 1 ohm. ‡ AWG 20 = .032″; AWG 24 = .020″.

TYPE 991 FOR MILITARY APPLICATIONS

Meets the requirements of MIL-R-26E, Styles RW67V, RW68V and RW69V (350°C max. hot spot). Surpass the stability requirements of ±3% ΔR on the 2000 hour cyclic load-life test. The low TC of Series 99 units far surpasses the requirements of MIL-R-26E. Standard resistance tolerance is ±5% for values 1 ohm and above; below 1 ohm, ±10%; other tolerances can be supplied.

RESISTORS FOR MIL-R-26E

Ohmite Style	"V" Char. MIL Style	"V" Char. Rated Watts @25°C	Ohms Range	Dimensions Lgth. ±.015	Dia. +.001 −.000	Leads 1½ AWG	Typ. Wt. (g's)
991- 3A	RW69V	3	0.1-2K	.547	.203	20	1.3
991- 5A	RW67V	6.5	0.1-8.2K	.922	.312	20	3.6
991-10A	RW68V	11	0.1-20K	1.781	.312	20	6.9
991-15A	RW56V	14	0.1-9.1K	2.00	.394	20	13.0

SERIES 88 MOLDED PRECISION POWER RESISTORS

FOR T.C. LESS THAN 0 ±10PPM/°C AND NONINDUCTIVE VERSIONS, CONSULT FACTORY.

TYPE 882 FOR COMMERCIAL POWER APPLICATIONS

This type intended for commercial power applications. These units derate to zero watts at 350°C ambient; T.C. = 0 ±10ppm/°C ; insulation tested at 1000 VAC except 500 volts for 1 watt size.

STANDARD TOLERANCE ±3%, CLOSER AVAILABLE

Ohmite Style	Nom. Watts 25°C	Dimensions Lgth. +.020 −.010	Dia. ±.020	Leads 1½" AWG	Typ. Wt. Grams	Ohms Range Std. 3% Tol.	Max. Wkg. Volts RMS
882-1A	1.5	0.417	0.105	24	0.3	0.10-10,700	—
882-1B	1.5	0.542	0.105	24	0.3	0.10-17,400	—
882-2	2.25	0.375	0.188	20	0.6	0.10-10,500	85
882-3	3.25	0.542	0.230	20	1.3	0.10-34,800	200
882-5	6.5	0.917	0.323	18	3.3	0.10-127,000	460
882-7	9	1.218	0.323	18	4.3	0.10-187,000	670
882-10	11	1.822	0.343	18	6.3	0.10-316,000	1100

* Ohmite's standard power tolerance is 3% supplied at no extra charge over 5% for values 1 ohm and higher; 10% for values below 1 ohm. Closer tolerances are available.

TYPE 884 HIGH STABILITY, PRECISION-POWER TYPE

Type 884 resistors (Riteohm 88) are classified as high stability, precision-power types. They are aged and conservatively rated for maximum long term stability and exhibit superior characteristics despite relatively high operating temperature at rated wattage.

Type 884 units are available in tolerances of 0.05% and derate † to zero watts at 275°C ambient; T.C. = 0 ±ppm/°C; insulation tested at 1000 VAC except 500 volts for 1 watt size.
† For applications where maximum stability is of primary importance as may be the case with close tolerance resistors, a derating of 50% is recommended.



STANDARD TOLERANCES TO .05% AVAILABLE FOR VALUES 1 OHM AND ABOVE

Ohmite Style	Nom. Rated Watts 25°C	Dimensions Lgth. +.020 −.100	Dia. ±.020	Leads 1½" Long AWG	Typ. Wt. (g's)	Resistance Ranges² Closer Than 0.5% Tol. (Min. Ohms)	0.5% Tol. & Greater (Min. Ohms)	Max. Ohms All Tols.	Max. Wkg. Volts RMS
884-1A[1]	1	0.417	0.105	24	0.3	0.499	0.10	10,700	
884-1B	1	0.542	0.105	24	0.3	0.499	0.10	17,400	
884-2	2	0.375	0.188	20	0.6	0.499	0.10	10,500	85
884-3[2]	3	0.542	0.230	20	1.3	0.499	0.10	34,800	200
884-5[3]	5	0.917	0.323	18	3.3	0.499	0.10	127,000	460
884-7	7	1.218	0.323	18	4.3	0.499	0.10	187,000	670
884-10[4]	10	1.822	0.343	18	6.3	0.499	0.10	316,000	1100

[1] Commercial equivalent of RW70.
[2] Commercial equivalent of RW79 except for size.
[3] Commercial equivalent of RW74
[4] Commercial equivalent of RW78 except for size.

TUBULAR VITREOUS ENAMELED RESISTORS

TYPE 200, BROWN DEVILS

"BROWN DEVIL" (Type 200) vitreous enameled, wirewound resistors, have been an industry byword for small rugged power resistors. Compact, with surprising overload capability. Five sizes are stocked in a broad selection of values.



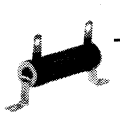
Ohmite Style	Rated Watts	Dimensions Lgth.	Dia.	Leads 1½" AWG	Resistance Range (Ohms)
200-3	3	7/16	.200	20	1.0 to 10K
200-5¼	5¼	5/8	¼	20	1.0 to 20K
200-8	8	1	5/16	18	1.0 to 25K
200-12	12	1¾	5/16	18	0.5 to 50K
200-20	20	2	7/16	18	0.5 to 100K

TYPE 270, FIXED, RADIAL LUG

Lug type resistors are wire-wound on high quality ceramic cores, protected and insulated by Ohmite vitreous enamel.

Wire of finest alloy and largest possible size is used for each resistance. Original uniform close spacing of the turns maintained by anchoring effect of the vitreous enamel. Wire securely welded to the terminal lugs. Resistance tolerance: ±5% for values 1 ohm or higher; ±10% below 1 ohm.

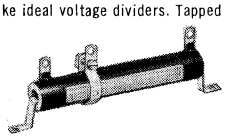
Wattage ratings are for use in free air. When mounted in closed spaces or where circulation of air is restricted, they should not be used at more than one-half rating.



Ohmite Style	Rated Watts	Core Dimensions Lgth	Dia.	Resistance Range (Ohms)
270-12	12	1¾	5/16	.51 to 51K
270-25	25	2	5/16	1 to 100K
270-50	50	4	5/16	1 to 250K
270-100	100	6½	¾	1 to 100K
270-175	175	8½	1⅛	1 to 100K
270-225	225	10½	1⅛	1 to 100K

TYPE 210, "DIVIDOHM®" ADJUSTABLE

"Dividohm" resistors make ideal voltage dividers. Tapped "bleeders" are made by using one or more adjustable lugs, as required. Also useful for obtaining odd resistance values.



"Dividohm" resistors are vitreous enameled resistors on which a narrow strip has been left uncovered to expose a portion of each turn. Contact is made by an embossed contact on the adjustable lug.

Ohmite Style	Rated Watts	Core Dimensions Lgth.	Dia.	Resistance Range (Ohms)
210-12	12	1¾	5/16	1 to 10K
210-25	25	2	5/16	1 to 25K
210-50	50	4	5/16	1 to 100K
210-75	75	6	5/16	1 to 100K
210-100	100	6½	¾	1 to 100K
210-175	175	8½	1⅛	1 to 100K
210-225	225	10½	1⅛	1 to 100K

TYPE 250, THIN RESISTORS

Ohmite Code	Rated Watts	Core Dimensions Lgth.	W.	Thk.	Range (Ohms)
250-10TA-51	10	¾	⅜	⅛	1 to 15K
250-15TA-51	15	1	⅜	⅛	1 to 25K
250-20TA-51	20	2	⅜	⅛	1 to 50K
250-25TD-51	25	1½	13/16	¼	1 to 15K
250-30TE-57	30	1¼	1	¼	1 to 10K
250-40TE-57	40	2	1	¼	1 to 25K
250-55TE-57	55	3½	1	¼	1 to 30K

Ohmite "Thin Resistors" are intended for use in equipment where space is at a premium. They are wound on flat, oval shaped ceramic cores, and covered with Ohmite's exclusive, vitreous enamel protective coating. Cores for "Standard" Thin Resistors are ¼" thick at the thickest part; for the "Miniature" group, ⅛" thick. Equipped with lug terminals. Aesistance tolerance, ±5%.



Stack-mounted "Thin" resistors

Mounting brackets, an integral part of these units, extend through the resistor core to equalize heat distribution and to conduct heat directly to the mounting surface — one reason why these units provide equivalent wattage with less bulk and in less space. Wattage ratings assume the use of a metal mounting surface. Reduce ratings 15% for non-metallic surfaces.

Can be mounted or compactly and conveniently stacked by means of bracket studs, hollow to receive assembly bolts. Total height of these resistors from bottom of mounting stud to top of resistor: 5/16" for Standard units and 1/32" for the Miniature units.

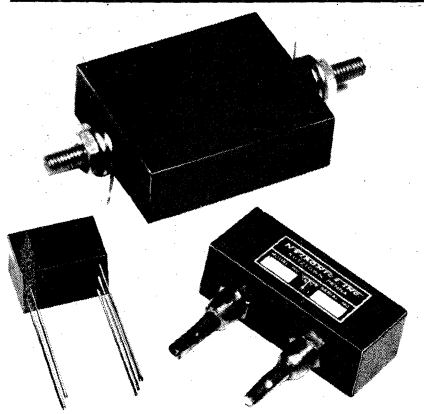
For other sizes, closer tolerances, non-stacking brackets, Dividohm adjustable or other features, consult factory.

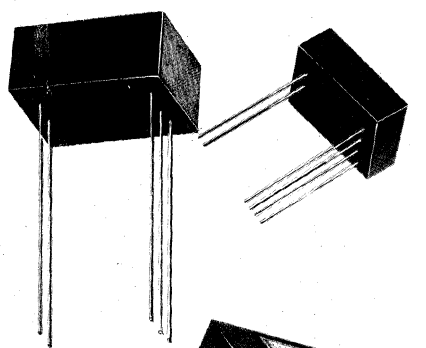
WRITE FOR COMPLETE INFORMATION AND SPECIFICATIONS ON OHMITE RESISTORS

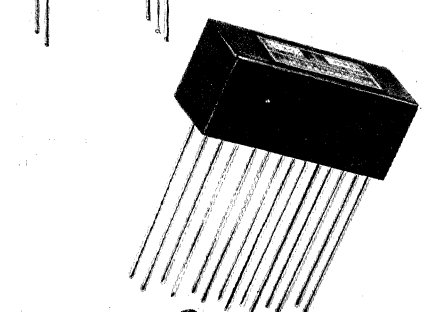
OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company • 3635 HOWARD STREET, SKOKIE, ILLINOIS 60076 • PHONE (312) 675-2600 • TWX 910-223-0805

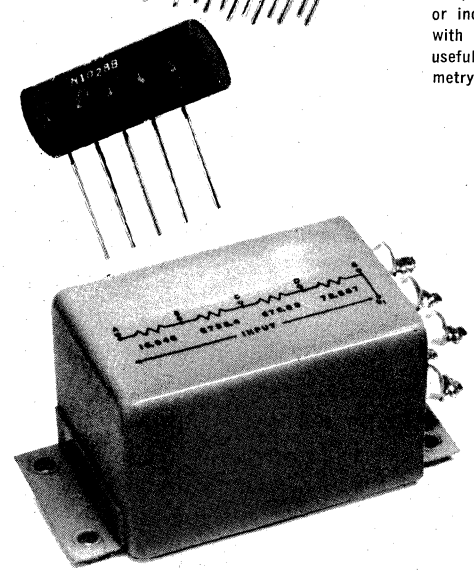
NYTRONICS, INC.
STANDARD COMPONENTS GROUP

RESISTOR NETWORKS







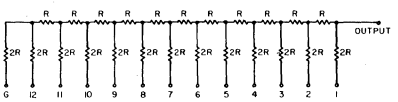


BINARY LADDER NETWORKS

The standard R-2R ladder network for A/D and D/A conversion is available practically off the shelf from Nytronics, Inc. Any desired impedance level is supplied as well as source impedance compensation if required. As in the summing networks, maximum error is less than ½ LSB under the worst case environmental conditions.

A standard 12 bit network in printed circuit configuration is 1⅝"x⅝"x⅝" high. Virtually any special considerations can be incorporated into the design of these networks, such as feedback resistors, attenuating resistors, etc.

All standard units are epoxy encapsulated and will meet the applicable requirements of MIL-R-93, MIL-E-5400, MIL-Q-9858, et al.



Typical ladder network, 12-bit input

Model Number

Basic Number: RN 10____-____-____. Describe unit as follows:

RN 10(A)-(B)-(C), where

A is the number of bits

B is the basic resistance

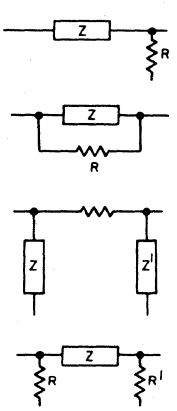
C is the code for Relay (R) or Semiconductor (S) input switching.

Therefore: An 8-bit network, 25K ohms impedance, fed through relays would have the model number: RN-1008-25K-R

PHASE SHIFT AND TIMING NETWORKS

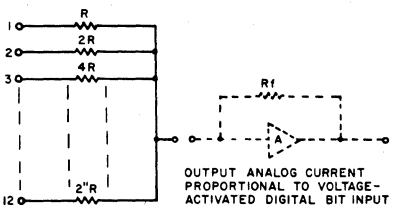
Because of the versatility of the wirewound resistor over all other types of resistors, phase shift or timing networks of great accuracy can be provided. Typically, the resistors are manufactured to compensate for the characteristics of the capacitor or inductor so as to nullify the C or L variation with environment. These networks are especially useful for phase correction in servo systems, telemetry, computors, etc.

TYPICAL NETWORKS



BINARY SUMMING NETWORKS

Input voltages, representing binary-coded numbers are automatically added to give accurate analog currents as the output of these Summing Networks. 4 bit through 12 bit modules are available in standard packages. Summation error of any module is less than ½ the least significant bit (LSB), for any conditions of environments. Standard units are epoxy encapsulated and designed for printed circuit mounting. The 12 bit package size is 2"x1"x1⅛" high. Special requirements such as feedback resistors, source compensation, shielding, form factors, etc. are available.



Binary Summing Module, Schematic, 12-bit input

Model Number

Basic Number: BN 10____-____-____. Describe the unit as follows:

BN 10(A)-(B)-(C), where

A is the number of bits

B is the basic resistance

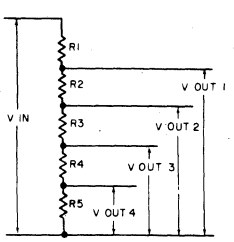
C is the code for Relay (R) or Semiconductor (S) input switching.

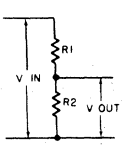
Therefore: An 8-bit network, 5 Kilohms impedance, fed through relays would have the model number: BN-1008-5-R

VOLTAGE DIVIDER NETWORKS

Networks with errors of less than 1 ppm are available in many package configurations from Nytronics, Inc. Ratios from 1:1 to 100:1 and greater are supplied to your exacting specifications. All the resistors used are manufactured specifically for the particular application intended thereby assuring the proper ratios and matches for the specific environments.

Typical Voltage Divider Networks





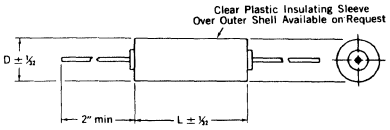
Precision Resistor Division
NYTRONICS, INC.

Industrial Avenue, Kutztown, Penna. 19530
Tel: 215-683-7307

NYTRONICS, INC.
STANDARD COMPONENTS GROUP

PRECISION RESISTORS

HERMETICALLY-SEALED wire-wound RESISTORS



Nytronics, Inc. Type S precision wire-wound resistors are oil-filled and hermetically sealed to reduce thermal effects and eliminate humidity and atmospheric effects (as occur in epoxy-potted or ceramic-sealed resistors). The outer shell of Type S resistors is made of hot tinned extruded brass; end seals are hermetic-sealing glass bonded to metal. End seals are soldered to the outer shell. Resistance wire is carefully unreeled and terminated to assure an unstressed wire condition prior to hermetic sealing. Specially-prepared resistance wire is employed. Maximum resistance values listed in the table are for .00065" minimum wire diameter.

Typical applications:

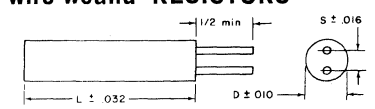
- Resistor Standards
- Bridge Ratio Arms
- Precision Meter Multipliers
- Feedback Resistors for Operational Amplifiers
- Divider & Ladder Networks

SPECIFICATIONS

Accuracy:	To better than	±0.001%
Matching:	To better than	±0.0001%
Temperature Coefficient:	To better than	1 ppm/°C
TC Match:	To better than	0.25 ppm/°C
Long Term Stability:	To better than	±0.0005%

NEW TYPE #	D In.	L In.	Leads (AWG)	Max R (ohms)	Max P (W)	Max V (V)
S 2512	1/4	3/4	20	800 K	1/2	300
S 2516	1/4	1	20	1 Meg	1/2	600
S 3112	5/16	3/4	20	1 Meg	1/2	300
S 3116	5/16	1	20	1.2 Meg	1/2	600
S 3716	3/8	1	20	2 Meg	5/8	600
S 3719	3/8	1 3/16	20	2.5 Meg	3/4	600
S 5016	1/2	1	20	5 Meg	3/4	600
S 5028	1/2	1 3/4	20	6 Meg	1 1/2	900
S 5032	1/2	2	20	7 Meg	2	1200
S 7516	3/4	1	20	6 Meg	1 3/4	600
S 7532	3/4	2	20	10 Meg	2 1/4	1200
S 9924	1	1 1/2	20	10 Meg	2 1/4	900
S 9928	1	1 3/4	20	10 Meg	2 1/2	1200

PRINTED CIRCUIT wire-wound RESISTORS

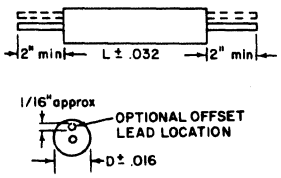


SPECIFICATIONS

Accuracy:	To ±0.001%
Matching:	To ±0.0001%
Temperature Coefficient:	To 1 ppm/°C
TC Match:	To 0.25 ppm/°C
Long Term Stability:	To ±0.005%
Rise Times:	To 10 nano seconds

NEW TYPE #	D	L	S	Leads (AWG)	Max R (ohms)	Max P (Watts)	Max V (Volts)	MIL Type #
P 2504	1/4	1/4	.150	22	350K	.100	150	
P 2505	1/4	5/16	.150	22	450K	.125	300	
P 2506	1/4	3/8	.150	22	550K	.188	150	
P 2508	1/4	1/2	.150	22	700K	.250	300	
P 2510	1/4	5/8	.150	22	900K	.333	300	
P 2805	.280	5/16	.200	22	450K	.125	300	RB 71
P 3108	5/16	1/2	.200	22	1.25M	.375	300	
P 3706	3/8	3/8	.200	22	1.00M	.250	300	
P 3708	3/8	1/2	.200	22	1.50M	.375	300	RB70
P 3712	3/8	3/4	.200	22	2.00M	.625	600	
P 5008	1/2	1/2	.300	22	1.75M	.500	300	
P 5016	1/2	1	.300	22	3.50M	1.000	600	

AXIAL LEAD wire-wound RESISTORS



Either Centerline or Offset Lead Available Location Optional Unless Specified

SPECIFICATIONS

Accuracy:	To ±0.005%
Matching:	To ±0.001%
Temperature Coefficient:	To 1 ppm/°C
TC Match:	To 0.25 ppm/°C
Long Term Stability:	To ±0.005%
Rise Times:	To 10 nano seconds

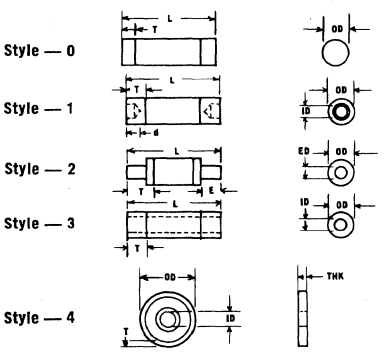
NEW TYPE #	D In.	L In.	Leads (AWG)	Max R (ohms)	Max P (watts)	Max V (volts)	MIL Type #
A 1003	.100	3/16	24	50K	.050	50	
A 1206	1/8	3/8	22 or 24	130K	.063	150	
A 1208	1/8	1/2	22 or 24	170K	.100	150	
A 1506	.150	3/8	22 or 24	130K	.100	150	
A 1508	.150	1/2	22 or 24	170K	.125	150	
A 1806	3/16	3/8	22 or 24	200K	.125	150	
A 1808	3/16	1/2	22 or 24	260K	.188	150	
A 2504	1/4	1/4	24	250K	.125	150	
A 2505	1/4	5/16	22 or 24	300K	.125	150	
A 2506	1/4	3/8	22 or 24	350G	.188	150	RB 56
A 2508	1/4	1/2	22 or 24	500K	.250	300	RB 55
A 2510	1/4	5/8	22 or 24	800K	.333	300	
A 2512	1/4	3/4	20 or 22	1.00M	.500	600	RB 54
A 2516	1/4	1	20 or 22	1.25M	.500	600	
A 3106	5/16	3/8	22 or 24	1.00M	.250	300	
A 3112	5/16	3/4	20 or 22	1.20M	.500	300	
A 3114	5/16	7/8	20	2.50M	.500	600	
A 3116	5/16	1	20	2.50M	.625	600	
A 3708	3/8	1/2	20	1.75M	.375	300	
A 3709	3/8	9/16	20	2.50M	.438	300	
A 3710	3/8	5/8	20	3.00M	.500	300	
A 3712	3/8	3/4	20	4.00M	.625	600	RB 53
A 3716	3/8	1	20	5.00M	.750	600	RB 52
A 3720	3/8	1 3/16	20	5.00M	1.000	600	
A 5008	1/2	1/2	20	3.50M	.500	300	
A 5010	1/2	5/8	20	4.50M	.625	300	
A 5014	1/2	7/8	20	8.00M	.875	600	
A 5016	1/2	1	20	10.00M	1.000	600	RB 57
A 5020	1/2	1 1/4	20	12.00M	1.250	600	
A 5024	1/2	1 1/2	20	15.00M	1.500	900	RB 58
A 5028	1/2	1 3/4	20	18.00M	1.750	900	
A 5032	1/2	2	20	20.00M	2.000	1200	RB 59
A 6209	5/8	9/16	20	4.50M	.750	300	
A 6220	5/8	1 1/4	20	15.00M	1.500	600	
A 7520	3/4	1 1/4	20	20.00M	2.000	600	

THIN FILM MICROWAVE RESISTORS

Minimum inductance, no spiralling
D.C. to 10,000 MC
1 to 400 ohms on Discs
10 to 1500 ohms on Rods & Tubes

—55°C to 150°C Carbon
—55°C to 200°C Metal
Temperature Coefficient:
Metal Film ±75 PPM
Carbon Film —200 PPM

Notes: 1. Substrate: Ceramic (standard). 2. Standard Resistance Tolerance: Carbon ±1%; Metal ±3%. 3. The nominal power rating is for units suspended in free air. 4. The resistance film on Discs is normally supplied on both sides of carbon film and one side of metal film resistors. 5. Terminals: Normally supplied plated; pretinned on special order. 6. Other sizes, Substrates, Resistances and Tolerances available to meet customer requirements.



STYLE — 4

Catalog No.	OD	ID	THK	T	Nom. Power Watts Metal & Carbon
DC-250-068-4	.250	.068	.040	.020	.050
DC-280-093-4	.280	.093	.040	.020	0.50
DC-343-076-4	.343	.076	.045	.031	1.00
DC-368-062-4	.368	.062	.040	.031	1.00
DC-375-076-4	.375	.076	.032	.031	1.00
DC-503-075-4	.503	.075	.064	.047	2.00
DC-503-172-4	.503	.172	.064	.047	2.00
DC-560-137-4	.560	.137	.064	.047	3.00
DC-831-125-4	.831	.125	.094	.062	4.00

Carbon & Metal Rods, Tubes & Discs

STYLE — 0

Catalog No.	OD	L	T	Nom. Power Watts Metal	Carbon
RC-020-120-0	.020	.120	.031	0.10	*
RC-020-160-0	.020	.160	.031	0.12	*
RC-020-200-0	.020	.200	.047	0.14	*
RC-040-120-0	.040	.120	.031	0.20	*
RC-040-160-0	.040	.160	.031	0.25	*
RC-040-200-0	.040	.200	.047	0.30	*
RC-060-120-0	.060	.120	.031	0.40	*
RC-060-160-0	.060	.160	.031	0.50	*
RC-060-200-0	.060	.200	.047	0.60	*
RC-125-531-0	.125	.531	.094	1.00	0.50
RC-125-625-0	.125	.625	.094	1.50	0.75
RC-125-1000-0	.125	1.000	.094	2.00	1.00
RC-162-750-0	.162	.750	.094	2.00	1.00
RC-250-875-0	.250	.875	.094	5.00	2.50

STYLE — 1

Catalog No.	OD	ID	L	d	T	Nom. Power Watts Metal	Carb.
RC-125-375-1	.125	.062	.375	.093	.062	1.00	0.50
RC-191-500-1	.191	.136	.500	.109	.094	1.50	0.75

STYLE — 2

Catalog No.	OD	ED	L	E	T	Nom. Power Watts Metal	Carb.
RC-073-342-2	.073	.050	.342	.046	.056	0.50	0.25
RC-125-500-2	.125	.093	.500	.062	.094	1.00	0.50

STYLE — 3

Catalog No.	OD	ID	L	T	Nom. Power Watts Metal	Carb.
TC-125-250-3	.125	.070	.250	.047	0.50	0.25
TC-125-500-3	.125	.070	.500	.094	1.00	0.50

INFORMATION FOR ORDERING

Specify:

1. Resistive Film { Metal - M / Carbon - C
2. Catalog No.
3. Resistance Desired
4. Resistance Tolerance

Example:

M	RC-125-531-0	50 Ω	1%
↓	↓	↓	↓
Metal Film	Catalog No.	Resistance	Tolerance

Precision Resistor Division
NYTRONICS, INC.
Industrial Avenue, Kutztown, Penna. 19530
Tel: 215-683-7307

Pyrofilm Resistor Company, Inc.

SETTING NEW STANDARDS IN RELIABILITY

METAL FILM

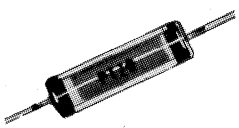


Conformal coated high precision metal film resistors offer superior stability and reliability at a reasonable cost. Features include: small size, impervious to moisture, low noise, low T.C. and resistance range of 10 ohms to 100 Megohms. Surpasses MIL-R-10509 and MIL-R-55182. In-plant testing facilities are available. Standard T.C.: ±10, ±25, ±50 and ±100 ppm/°C.

WRITE FOR BULLETIN #PM-725

Pyrofilm	Mil-R-10509	Rating, Watts		Resistance Range-Ohms	
		Mil.	Comm.	Min.	Max.
PME50	RN50	1/20	1/8	10	1M
PME55	RN55	1/10	1/8	10	3M
PME60	RN60	1/8	1/4	49	7.5M
PME65	RN65	1/4	1/2	49	15M
PME70	RN70	1/2	1	24	30M
PME75	RN75	1	2	49	50M
PME754	None	None	5	1M	100M

CARBON FILM Char-G

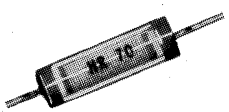


PyroSeal hermetically glass-sealed deposited carbon film resistors approved on most missile programs. Unmatched in performance with proven load-life stability for continuous 50,000 hours. Surpasses MIL-R-10509 and MIL-R-55182.

WRITE FOR BULLETIN #PC-925

Pyrofilm	Mil-R-10509 Char-G	Rating, Watts		Resistance Range-Ohms	
		Mil.	Comm.	Min.	Max.
PT60	RN60	1/8	1/4	10	4.9M
PT65	RN65	1/4	1/2	10	9M
PT70	RN70	1/2	1	10	9M
PT500	None	None	1/2	10	5M
PT1000	None	None	1	10	100M
PT2000	None	None	2	30	200M

HIGH MEGOHM

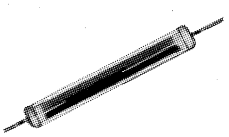


PyroSeal miniature high resistance series offers long-term stability at higher than MIL resistance ranges. Uneffected by environmental conditions. Surpasses MIL-R-10509 and MIL-R-55182.

WRITE FOR BULLETIN #PC-925

Pyrofilm	Resistance Ohms	Max. DC-W.V.	Body Dimensions	
			Dia.	Length
HR60	5 M to 35M	300	.125	.406
HR70	1 M to 100M	500	.250	.780
HR1000	1 M to 500M	750	.280	1.031
HR2000	1 M to 1000M	1000	.280	2.031

HIGH VOLTAGE



You can assure maximum stability with minimum size, low temperature coefficient, and voltage coefficient, for applications requiring high voltages. Processed and stabilized at high temperatures, these resistors have exceptional shelf stability and are virtually immune to other environmental conditions.

WRITE FOR BULLETIN #HV-5MA

Pyrofilm	Resistance	D.C.		Body Dimen.	
		Cont. Max. Voltage	Max. Power	Dia.	Length
HV 1000 N10	1M to 500M	1000	.5W	.280	1.031
HV 1000 N5	1M to 500M	2000	.5W	.280	1.031
HV 2000 N10	1M to 1000M	2500	1W	.280	2.031
HV 2000 N5	1M to 1000M	5000	1W	.280	2.031
HV 3000 N10	1M to 1000M	5000	1W	.280	3.031
HV 3000 N5	1M to 1000M	10,000	1W	.280	3.031

NETWORKS



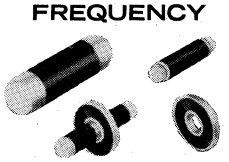
A small, lower cost, compact package of resistors for use in high precision networks such as: voltage dividers, feed-back networks, summing networks, etc. Original ratio values are maintained over wide temperature ranges for extended periods of time. Up to 9 half-watt resistors of values up to 10 megohms can be packaged in 0.6 cu. in.

WRITE FOR BULLETIN #N-20

• Metal Film •Carbon Film

Manufactured to customer specifications. Matched carbon or metal film precision resistors as unmounted sets, sealed in metal cans, epoxy encapsulated or ceramic protected. Matching capabilities. ±0.1% in resistance, ±1 ppm/°C in temperature coefficient for carbon film. Ratio matched within ±.05%. Temperature coefficient matched within ±5 ppm/°C for metal film.

MICRO-WAVE HIGH FREQUENCY



Pyrofilm micro-thin deposited carbon film microwave resistors are extremely stable, precision components specifically designed for microwave applications such as: coax. waveguide & high frequency attenuators, terminations, probes, dummy loads, coupling loops, and high power components. Available in rods, discs, tee pads and custom configurations.

WRITE FOR BULLETIN #RD25-5

Power Rating: to 25 watts
Tolerance: ±1.0% at 25°C
Resistance Range: 1 ohm to 4K
Temperature Coefficients: —200 to —300ppm/°C
Frequency Range: DC to 10,000 MHz
VSWR: 1.05 at 4000MHz
Temp. Range: —55°C to +160°C

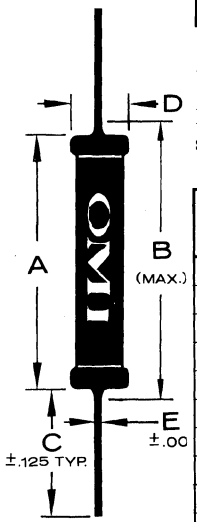
Pyrofilm Resistor Company, Inc.

60 SOUTH JEFFERSON ROAD
WHIPPANY, N. J. 07981
TEL. 201-887-8100

OMI RESISTORS T SERIES

OMTRONICS MANUFACTURING, INC. • 2406 LEAVENWORTH STREET, OMAHA, NEBRASKA 68105 • (402) 348-9500

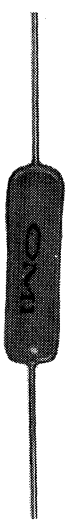
PRECISION POWER RESISTORS, AXIAL LEADS



Highly reliable, silicone coated, precision resistors manufactured to meet MIL-R-26 specifications. There are 17 basic sizes with power ratings from ½ to 10 watts and resistance ranges from .05 ohms to 275K ohms. Resistance tolerances from .05% to 5% (1%, standard). Temperature coefficient of resistance 2PPM up (20PPM, standard).

OMI TYPE	MIL TYPE	OMI WATTAGE RATING		RESISTANCE RANGE		MAX. WORKING VOLTAGE*		Max. Weight Grams	PHYSICAL DIMENSIONS				
		U	V	Min.	Max.	U	V		A	B	C	D	E
T-½A	—	.4	—	.5	3.4K	18	—	.21	.210 ±.015	.265	1.500	.078 ±.015	.020
T-½	—	.75	—	.5	7.5K	31	—	.30	.330 ±.015	.390	1.500	.078 ±.015	.020
T-1A-20	RW-70 U	1.0	1.25	.1	10K	50	55	.36	.406 ±.031	.437	1.500	.093 ±.031	.020
T-1A	—	1.0	1.25	.1	10K	50	55	.36	.406 ±.031	.437	1.500	.093 ±.031	.020
T-1B	—	1.1	1.30	.1	12K	62	67	.40	.530 ±.015	.590	1.500	.093 ±.031	.020
T-1C	—	1.0	—	.1	5K	28	33	.33	.265 ±.015	.335	1.500	.093 ±.031	.020
T-2	—	1.5	—	.1	10K	72	79	.95	.343 ±.015	.410	1.500	.187 ±.031	.032
T-2A	—	3.0	3.75	.1	22K	135	148	.70	.560 ±.062	.622	1.500	.187 ±.031	.032
T-2A-20	RW-79 U	3.0	3.75	.1	22K	135	148	.70	.560 ±.062	.622	1.500	.187 ±.031	.032
T-2B	—	3.0	—	.1	40K	170	200	.92	.812 ±.062	.890	1.500	.188 ±.031	.032
T-2C	—	2.5	3.00	.05	32K	138	157	1.5	.500 ±.062	.593	2.000	.218 ±.032	.040
T-2C-20	RW-69 V	2.5	3.00	.05	32K	138	157	1.5	.500 ±.062	.593	2.000	.218 ±.032	.040
T-3	—	4.0	5.50	.05	40K	210	250	2.3	625 ±.062	.765	2.000	.250 ±.032	.040
T-5	—	5.0	6.00	.05	90K	300	365	4.3	.875 ±.062	.937	2.000	.312 ±.031	.040
T-5-20	RW-74 U	5.0	6.00	.05	90K	300	365	4.3	.875 ±.062	.937	2.000	.312 ±.031	.040
T-6	—	6.0	6.50	.05	95K	330	376	4.8	1.000 ±.094	1.094	2.000	.312 ±.031	.040
T-6-20	RW-67 V	6.0	6.5	.05	95K	330	376	4.8	1.000 ±.094	1.094	2.000	.312 ±.031	.040
T-7	—	7.0	8.00	.05	100K	350	390	5.2	1.185 ±.062	1.247	2.000	.312 ±.031	.040
T-7A	—	7.0	9.00	.05	150K	504	576	7.0	1.375 ±.094	1.469	2.000	.469 ±.094	.040
T-7A-20	RW-55 V	7.0	9.00	.05	150K	504	576	7.0	1.375 ±.094	1.469	2.000	.469 ±.094	.040
T-10	—	10.0	11.00	.05	250K	788	898	9.0	1.780 ±.062	1.842	2.000	.375 ±.031	.040
T-10-20	RW-78 U	10.0	11.00	.05	250K	788	898	9.0	1.780 ±.062	1.842	2.000	.375 ±.031	.040
T-10B-20	RW-68 V	10.0	11.00	.05	250K	788	898	9.0	1.875 $^{+.063}_{-.125}$	1.875	2.000	.344 ±.094	.040
T-10A	—	10.5	14.00	.05	275K	799	911	10.0	1.925 ±.062	2.094	2.000	.375 ±.062	.040
T-10A-20	RW-56 V	10.5	14.00	.05	275K	799	911	10.0	2.000 ±.094	2.094	2.000	.469 ±.094	.040

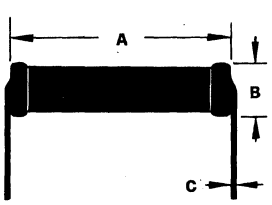
* Max. working voltage determined at .0008 wire.



SPECIAL FEATURES • Close tolerances (to .01% available). • Extremely high stability. • Low TC of resistance (to 2PPM). • Welded construction terminal to terminal. • Wide temperature range; from —65° to 275°C. • A specially formulated silicone coating makes OMI T-series resistors impervious to moisture, salt spray, abrasion and expanded temperatures.

PRECISION POWER RESISTORS, RADIAL LEADS

TR SERIES



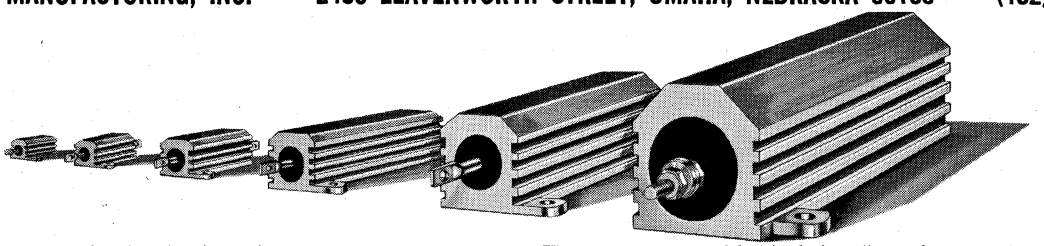
SPECIFICATIONS

TR electrical, mechanical, material, power rating and derating specifications are identical to models of equivalent wattage and size in the OMI T Series. Also available, non-inductively wound, and identified as the "NR" Series.

Type	Dim. A	Dim. B	Dim. C
TR-1A	.406 ±.031	.093 ±.031	.020
TR-1B	.531 ±.031	.093 ±.031	.020
TR-2A	.562 ±.062	.187 ±.031	.020
TR-2C	.500 ±.062	.218 ±.031	.032
TR-2B	.812 ±.062	.187 ±.031	.020
TR-3	.625 ±.062	.250 ±.031	.032
TR-5	.875 ±.062	.312 ±.031	.032
TR-7	1.218 ±.062	.312 ±.031	.032
TR-10	1.780 ±.062	.375 ±.031	.032

OMI RESISTORS HT HF

OMTRONICS MANUFACTURING, INC. • 2406 LEAVENWORTH STREET, OMAHA, NEBRASKA 68105 • (402) 348-9500



HT Models are anodized, aluminum-housed, precision wire-wound resistors, designed to chassis mount for maximum heat dissipation. They are manufactured to meet or exceed MIL-R-18546 specifications. Four sizes: 5 to 50 watts (mounted), resistance ranges from .1 ohm to 250K, depending on size. Tolerances —1% standard — .05% to 5% available. Temperature coefficient from 2PPM up. (20PPM, standard.)

HF Models are identical in dimensions, resistance ranges, tolerance and temperature coefficients with those of the HT Series, but offer a great increase in their power ratings as similar size through the use of beryllium oxide cores for increased heat dissipation. These are manufactured to exceed MIL-R-18546 power ratings.

STANDARD ELECTRICAL SPECIFICATIONS

OMI Type		MIL Type	Power Rating (Watts)*			Resistance Range		Max. Working Voltage		Max. Weight Grams
			HF (OMI)	HT	MIL	MIN.	MAX.	HF	HT	
HF-5	HT-5	RE-60	15	5	5	.1	22K	220	160	3
HF-10	HT-10	RE-65	20	10	10	.1	47K	340	265	7
HF-25	HT-25	RE-70	35	25	20	.1	90K	650	550	14
HF-50	HT-50	RE-75	50	50	30	.1	250K	1400	1250	29
	HT-75			75		.1	75K		1500	120

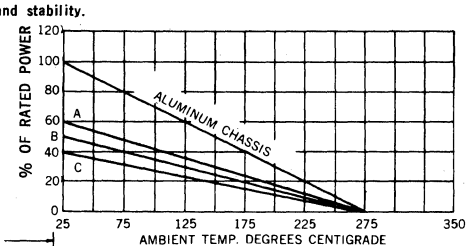
*Rating is based on chassis mounting area and stability.

Chassis Dimensions:

HT-5, HF-5, HT-10 and HF-10 — 6x4x2x .04", Aluminum Chassis.

HT-25, HF-25, HT-50 and HF-50 — 7x5x 2x.04". Aluminum Chassis.

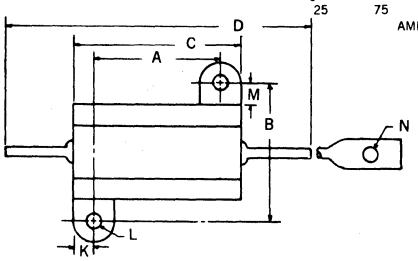
HT-75 — 12"x12"x.062, Aluminum Panel.

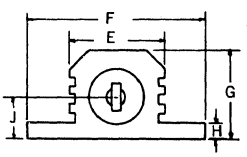


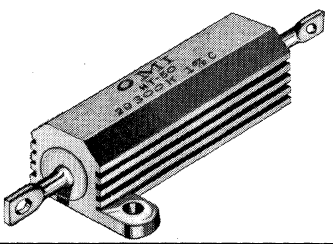
DERATING

OMI, HT and HF resistors have an operating temperature range of —55°C to +275°C. Derating is required for reduced chassis mounting area and for high ambient temperatures. The graph curves shown apply to operation of unmounted resistors. Free air rating.

A = HT5, HT-10
B = HT-25
C = HT-50, all HF Series and HT-75







DIMENSIONAL SPECIFICATIONS — HOUSED TYPE

TYPE		A	B	C	D	E	F	G	H	J	K	L	M	N
HF-5	HT-5	.444 ±.005	.490 ±.005	.600 ±.031	1.125 ±.062	.334 ±.015	.646 ±.015	.320 ±.015	.065 ±.010	.140 ±.010	.078 ±.010	.093 ±.005	.078 ±.015	.050 ±.005
HF-10	HT-10	.562 ±.005	.625 ±.005	.750 ±.031	1.375 ±.062	.430 ±.015	.800 ±.015	.400 ±.015	.075 ±.010	.190 ±.010	.093 ±.010	.093 ±.005	.102 ±.015	.086 ±.005
HF-25	HT-25	.719 ±.005	.781 ±.005	1.062 ±.031	1.938 ±.062	.530 ±.015	1.080 ±.015	.560 ±.015	.085 ±.010	.260 ±.010	.172 ±.010	.125 ±.005	.115 ±.015	.086 ±.005
HF-50	HT-50	1.563 ±.005	.844 ±.005	1.968 ±.031	2.781 ±.062	.615 ±.015	1.140 ±.015	.615 ±.015	.085 ±.010	.300 ±.010	.196 ±.010	.125 ±.005	.107 ±.015	.086 ±.005
	HT-75	2.125 ±.005	1.500 ±.005	2.500 ±.031	3.375 ±.093	1.125 ±.031	1.875 ±.031	1.125 ±.031	.125 ±.015	.625 ±.015	.187 ±.015	.172 ±.005	.187 ±.015	.095 ±.005

HN HFN

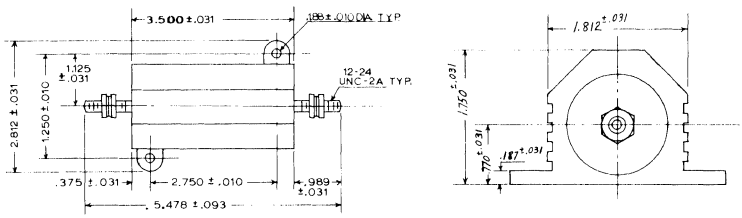
ALUMINUM HOUSED, NON-INDUCTIVE

HN and HFN Models with equivalent electrical and physical specifications to the HT and HF Series are also available with non-inductive windings. To order HT, non-inductively wound, specify "HN". To order HF, non-inductively wound, specify "HFN" instead of the basic HT and HF models. **NOTE:** The following conditions apply to non-inductive types as compared to HT or HF:

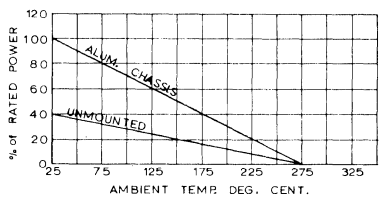
1. Maximum resistance values must be divided by 2.
2. Maximum working voltage must be multiplied by .707.
3. Maximum weights may slightly exceed those shown above.

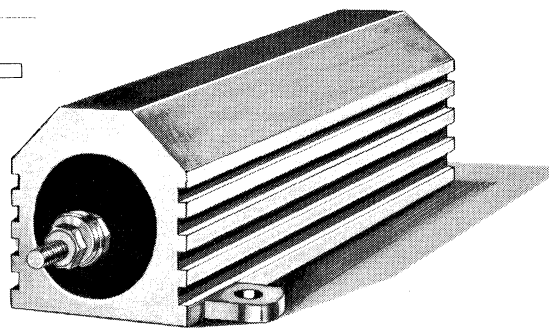
OMI RESISTORS HT

OMTRONICS MANUFACTURING, INC. • 2406 LEAVENWORTH STREET, OMAHA, NEBRASKA 68105 • (402) 348-9500



HT-100

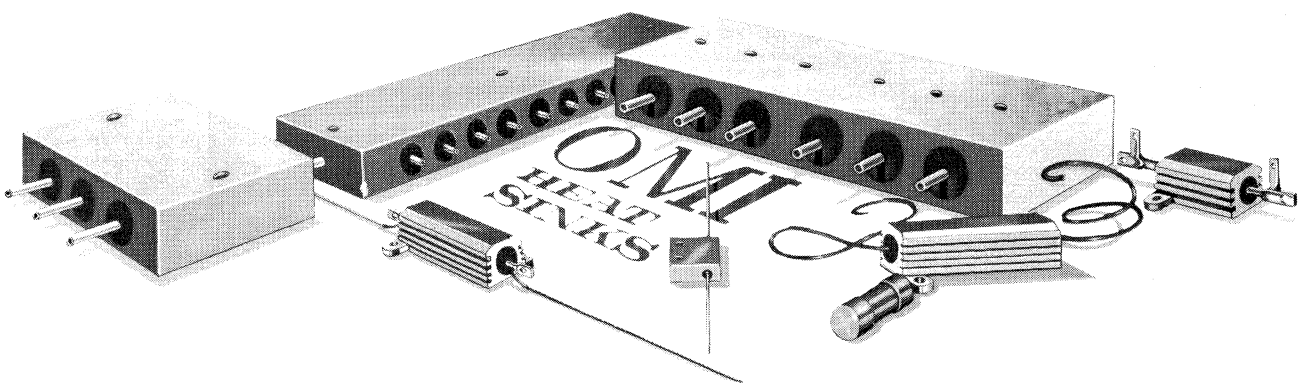




STANDARD ELECTRICAL SPECIFICATIONS

OMI Type	MIL Type	Power Rating (Watts)*		Resistance Range		Max. Working Voltage	Max. Weight Grams
		(OMI) HT	MIL	MIN.	MAX.	HT	
HT-100	RE-77	100	75	.1	50K	1900	400

Chassis Dimensions: 12" X 12" X .125 Aluminum Panel.



OMI

HEAT SINK CAPABILITIES

OMI's factory tooling and engineering experience put at your disposal facilities of design and production to manufacture a resistor to your specific requirements. Unique . . . maximum quantity . . . or specially, exacting quality . . . call on OMI.

These special resistors are manufactured to customer specifications for exact applications and show an indication of OMI's versatility in the field of Heat Sink Resistors.

Outstanding characteristics include:

A. High power capabilities.

B. 4-Wire low value resistors as well as the standard 2-wire units.

C. Combined characteristics such as .05 ohms ±5 PPM and 4-wire termination.

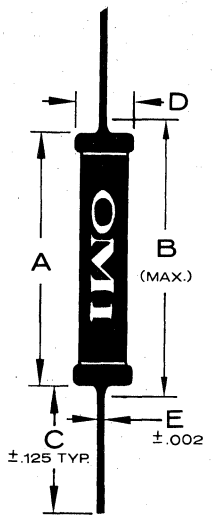
D. All resistors are high-temperature, high-pressure, integrally molded into their housing construction.

This advanced state of the art allows us to confidently solicit your inquiries on special resistor requirements.

OMI RESISTORS F SERIES

OMTRONICS MANUFACTURING, INC. • 2406 LEAVENWORTH STREET, OMAHA, NEBRASKA 68105 • (402) 348-9500

SILICONE COATED RESISTORS, AXIAL LEADS BERYLLIUM OXIDE CORE

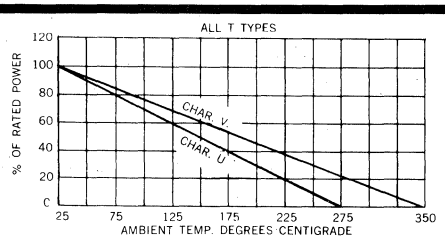


The OMI F Series resistors — at ratings from 1 to 15 watts—offer greatly increased power ratings over conventional resistors of equivalent size. All resistors in the F Series are manufactured in accordance with MIL. Specs. and are available in ten basic physical sizes with resistance ranges from 0.1 ohm to 250K ohms. Resistance tolerances from 0.05% to 5% (1%, standard) and temperature coefficient of resistance from 2PPM up (20PPM, standard).

OMI TYPE	MIL TYPE	OMI WATTAGE RATING		RESISTANCE RANGE		MAX. WORKING VOLTAGE*		Max. Weight Grams	PHYSICAL DIMENSIONS				
		U	V	Min.	Max.	Min.	Max.		A	B	C	D	E
F-1	RW-81U	1.0 W	1.5 W	1	3.4K	29	35	.21	.250 ±.031	.265	1.500	.078 ±.015	.020
F-2	—	1.5 W	2.0 W	1	7.5K	42	48	.21	.312 ±.015	.327	1.500	.078 ±.015	.020
F-3	RW-80U	2.25W	2.75W	.1	10K	74	81	.36	.406 ±.031	.437	1.500	.093 ±.032	.020
F-5	—	4.0 W	5 W	.1	22K	153	170	.80	.562 ±.062	.640	1.500	.188 ±.032	.032
F-5A	—	4.5 W	6.5 W	.1	40K	214	257	.96	.812 ±.062	.890	1.500	.188 ±.032	.032
F-5C	—	5 W	7 W	.1	32K	194	230	1.5	.500 ±.062	.593	2.000	.218 ±.032	.040
F-6	—	6 W	8 W	.1	40K	258	298	2.3	.625 ±.062	.765	2.000	.250 ±.032	.040
F-10	—	7 W	10 W	.1	90K	390	467	4.3	.875 ±.062	1.000	2.000	.312 ±.032	.040
F-12	—	10 W	12 W	.1	100K	607	665	5.2	1.218 ±.062	1.281	2.000	.312 ±.032	.040
F-15	—	15 W	18 W	.1	250K	979	1072	9.0	1.780 ±.062	1.875	2.000	.375 ±.032	.040

* Maximum working voltage determined at .0008 dia. wire.

SPECIAL FEATURES All features of the conventional precision power resistors, plus the beryllium oxide core for optimum heat dissipation, allow reduction of physical size of resistor while maintaining equivalent power ratings of conventional types.



DERATING

Applicable to both F and T Series

Both OMI, T and F Series resistors have an operating temperature range of −55°C to 275°C (characteristic U) or to 350°C (characteristic V). Derating is required for high ambient temperatures in accordance with the curve shown at left.

N FN

NON-INDUCTIVE TYPES

Available with both Axial and Radial Leads

OMI Models of equivalent physical and electrical specifications are available with non-inductive windings. They are identified by the letter "N"; to order non-inductively wound T Series, specify "N"; to order non-inductively wound F Series, specify "FN".

NOTE: The following conditions apply to specifications applicable to the non-inductively wound types, as compared to the basic T or F types.

1. Maximum resistance must be diveded by 2.
2. Maximum working voltage must be multiplied by .707.
3. Maximum weights may slightly exceed those shown for the basic T or F types.

MINIATURE POWER RESISTORS

FR SERIES

Radial Leads

As in the OMI, TR Series, models of equivalent electrical, mechanical, power rating and derating specifications are available in FR3, FR5, FR5A, FR5C, FR6, FR10, FR12, and FR15 dimensions. These models are also available non-inductively wound and identified as the FNR Series.

TEMPERATURE COEFFICIENT

Although all OMI, T, F, HT and HF resistors are manufactured with a temperature coefficient of ±20PPM/°C over the full temperature range and resistance range as standard production, closer temperature coefficients are available.

Special Close T.C. Availability: All styles can be supplied with temperature coefficients of ±10PPM, ±5PPM, and ±2PPM. Non-inductively wound styles can be supplied with ±10PPM.

Temperature Range: −65°C to +275°C.

Tolerance Range: 0.05% to 5%.

Resistance Range: 0 to 2 watts, 25 ohms to maximum for each size.
Over 2 watts, 50 ohms to maximum for each size.

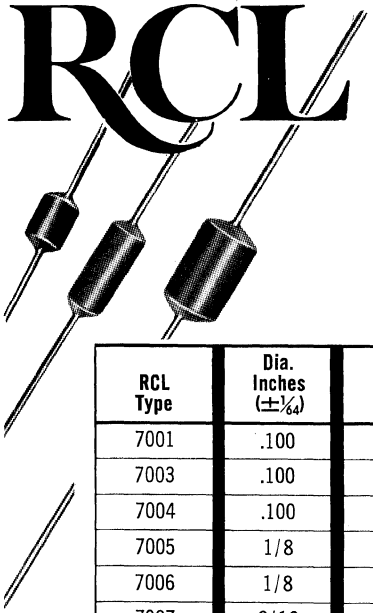
Code to Designate Special T.C: 10PPM C-10
5PPM C-5
2PPM C-2

To Order Resistors with Special T.C., Specify:
(example)

Resistor Type	Resistance Value	Tolerance	T.C. Code
T-5	4700 ohms	0.5%	C-5

RCL

subminiature axial lead resistors



These extremely small, encapsulated resistors meet and exceed the specifications of MIL-R-93D. Special RCL techniques also allow the production of custom sizes at minimal cost to the customer.

Tolerances available: from ±1.0% to ±0.001%

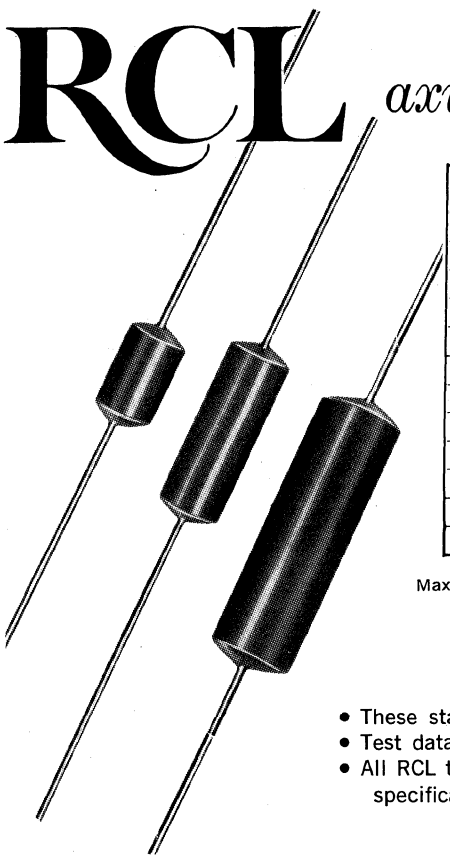
Temperature coefficient: Standard is ±10 PPM/°C.
Temperature coefficients available as low as ±1 PPM/°C.

RCL Type	Dia. Inches (±1/64)	Length Inches (±1/32)	Max. Watts	Max. Volts	Max. Res. .001 Wire	Max. Res. .0005 Wire	Non-inductive	Lead Diam. (Length 2" ±1/8")
7001	.100	.200	0.05	75	10K	100K	No	#26AWG
7003	.100	.260	0.05	100	10K	150K	No	#24AWG
7004	.100	.300	0.05	100	10K	250K	Yes	#24AWG
7005	1/8	1/4	0.1	100	10K	300K	Yes	#22AWG
7006	1/8	5/16	0.1	100	16K	350K	Yes	#22AWG
7007	3/16	3/8	0.125	200	60K	700K	Yes	#22AWG
7008	1/4	1/4	0.150	100	100K	1 Meg.	Yes	#20AWG
7009	1/4	11/32	0.25	200	127K	1.4 Meg.	Yes	#22AWG
7010	1/4	1/2	0.33	400	226K	3 Meg.	Yes	#20AWG

Maximum wattage rating is at 25° C through 125° C

RCL

axial lead encapsulated resistors



lead length: 2" ±1/8" #20 AWG, **non-inductive winding**

Type	MIL-R-93D Type	Dia. In. (±1/64)	Lgth In. (±1/32)	Maximum Watts	MIL Wattage	Maximum Volts	Max. Res. .001 Wire
7009	RB-56	1/4	11/32	0.25	0.125	200	127K
7010	RB-55	1/4	1/2	0.33	0.15	400	226K
7020	RB-54	1/4	3/4	0.50	0.25	400	511K
7030	RB-53	3/8	3/4	0.60	0.33	400	750K
7040	RB-52	3/8	1	1.00	0.50	800	1.5 Meg.
7044	—	1/2	1/2	0.50	—	400	1 Meg.
7045	—	1/2	5/8	0.60	—	400	1 Meg.
7045A	—	7/16	5/8	0.60	—	400	650K
7050	RB-57	1/2	1	1.25	0.75	800	2 Meg.
7050A	—	7/16	1	1.25	—	800	1.5 Meg.
7060	RB-58	1/2	1-1/2	1.50	1.0	900	3 Meg.
7070	RB-59	1/2	2	2.00	1.25	1,200	5 Meg.

Maximum wattage rating is from −55° C to +125° C.

MILITARY SPECIFICATIONS

- These standard sizes meet the physical dimensions of MIL-R-93D.
- Test data and approval information available.
- All RCL types meet and exceed the electrical and environmental characteristics of this specification.

INDUSTRY'S BEST DELIVERY

RCL

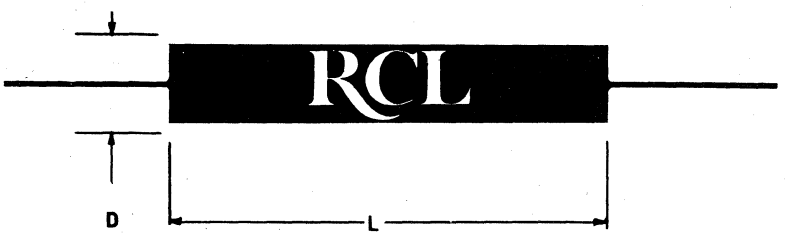
ELECTRONICS, INC.

General Sales Office:
700 South 21st Street, Irvington, N. J. (Area Code 201) 374-3311 • TWX 710-999-5511

RCL *high positive special temperature coefficient wire wound resistors*

RCL TYPE #	COMPETITIVE "SENSISTOR" TYPE #	DIA. ±.015	LENGTH ±1/32	RCL RESISTANCE RANGE	THERMAL TIME CONSTANT	LEAD DIAM. AWG
8000	TM 1/8	.140	.406	1 Ohm to 10K	30 Sec. Max.	#22
8001	TM 1/4	.200	.585	1 Ohm to 20K	54 Sec. Max.	#22

High positive TC of +0.7%/°C (Approx.)



RCL has developed its own proprietary special alloy resistance wire which gives the unusually high positive TC of silicon, together with the basic advantages of resistance wire which are:

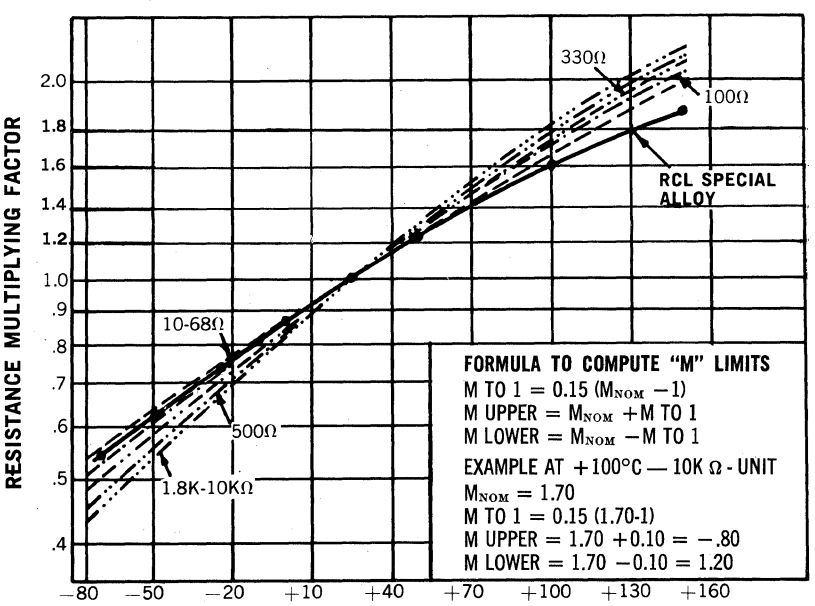
- Provides temperature compensation.
- Much greater stability for digital and linear integrated circuits.
- Closer resistance tolerances.
- Broader range of resistance values.
- Operating temperature range from −55°C to +125°C.
- Derated to zero watts at 150°C.
- Lead length 1½" (±⅛")

	STANDARD TOLERANCES AVAILABLE AT 25°C	TOLERANCES AVAILABLE ON SPECIAL ORDER AT 25°C
RCL	±10%	±5%, ±3%
"SENSISTOR"	±10%	±5%

—— **RCL SPECIAL ALLOY WIRE-WOUND RESISTOR CURVE**

----- **SILICON CURVE**

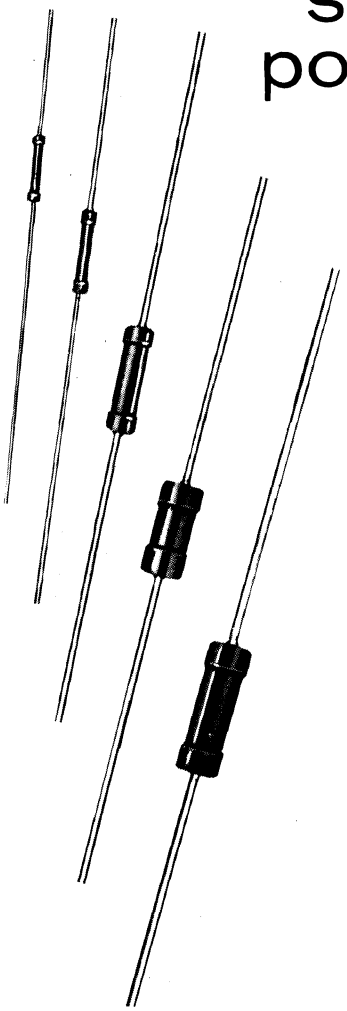
High positive TC of +0.7%/°C (Approx.)



COMPARISON OF RCL SPECIAL ALLOY RESISTORS TO POSITIVE TEMPERATURE COEFFICIENT SILICON RESISTORS

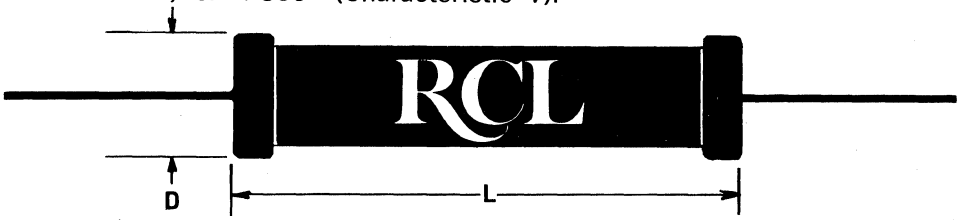
RCL **ELECTRONICS, INC.**
General Sales Office:
700 South 21st Street, Irvington, N. J. (Area Code 201) 374-3311 • TWX 710-999-5511

RCL SERIES T
silicone coated precision power wire-wound resistors



General Specifications Available:

- ☐ **Standard temperature coefficient:** ±10 PPM/°C. Additional TC's available from −50 PPM/°C to +6000 PPM/°C.
- ☐ **Tolerance:** ±1.0% is standard. Available to ±.01%.
- ☐ **Wattage Range:** ½ watts to 14 watts.
- ☐ **Resistance Values:** from .01 ohms to 275K. Higher values available.
- ☐ **Coating:** Silicone coating withstands moisture, salt, water immersion, and cleansing solutions.
- ☐ **Leads:** Tinned copperweld is standard. Leads are weldable and solderable.
- ☐ **Dielectric Strength:** 1000 VAC "V" block test.
- ☐ **Insulation Resistance:** 5000 Megohms minimum at 100 volts D.C.
- ☐ **Wide Temperature Range:** From −65°C to +275°C (Characteristic U) or +350° (Characteristic V).



RCL TYPE	MIL-R 26 E TYPE	WATTAGE RATING U	WATTAGE RATING V	DIMENSIONS DIA. ±.031*	DIMENSIONS LEN. ±.062*	MAX. RESISTANCE RCL MAX.	MAX. RESISTANCE MIL-R 26 E MAX.	LEAD DIAM.
T-½A		.4		.078	.220	2.5K		#24
T-½		.75		.078	.330	7.5K		#24
T-1A		1.0	1.25	.093	.406	10K		#24
T-1A-70	RW-70	1.0		.094	.406 ±.031	10K	3.16K	#24
T-1B		1.1	1.30	.093	.530	12K		#24
T-1C		1.0		.093	.280	5K		#24
T-2		1.5		.156	.343	10K		#20
T-2A		3.0	3.75	.187	.500	22K		#20
T-2A-69	RW-69		3.00	.188 ±.063	.500 ±.063	22K	.91K	#20
T-2B		3.0	3.75	.188	.812	40K		#20
T-2B-79	RW-79	3.0		.187	.560	22K	10.5K	#20
T-2C		3.0	3.25	.250	.500	40K		#18
T-3		4.0	5.5	.250	.625	45K		#18
T-5		5.0	6.5	.312	.875	91K		#18
T-5-74	RW-74	5.0		.312	.875	95K	38.3K	#18
T-6		6.0	7.5	.312	1.000	95K		#18
T-6-67	RW-67		6.5	.313 ±.063	1.000 ±.094	95K	3.6K	#20
T-7		7.0	9.00	.312	1.185	100K		#18
T-7A		7.0	9.00	.375	1.375	150K		#18
T-7A-55	RW-55		7.00	.469 ±.094	1.375 ±.094	150K	9.1K	#20
T-10		10.0	13.00	.375	1.812	250K		#18
T-10-78	RW-78	10.0		.375	1.780	260K	90.9K	#18
T-10-68	RW-68		11.00	.344 ±.094	1.875 $^{+.063}_{-.125}$	265K	8.2K	#20
T-10A		10.5	14.00	.375	1.925	275K		#18
T-10-A-56	RW-56		14.00	.469 ±.094	2.000 ±.094	275K	16K	#20

Lead Length: 1¼" minimum. * Tolerance applies to all types unless otherwise indicated.

POWER RATINGS:

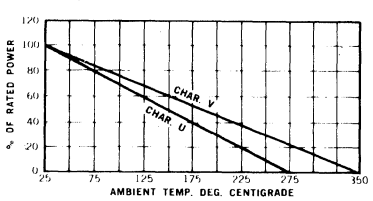
The RCL "T" Series has two power ratings, depending on operating temperature and stability requirements:

CHARACTERISTIC U: 275°C maximum hot-spot temperature.

CHARACTERISTIC V: 350°C maximum hot-spot temperature.

DERATING:

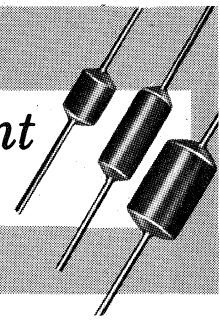
RCL Series "T" resistors have an operating temperature range of −65°C to +275°C (Characteristic U), or to +350°C (Characteristic V).



Ultra-fast delivery for prototpyes and initial production needs.

RCL ELECTRONICS, INC.
General Sales Office:
700 South 21st Street, Irvington, N. J. (Area Code 201) 374-3311 • TWX 710-999-5511

RCL special temperature coefficient wire wound resistors



- Applications include transistor circuits, zener diode temperature compensation, temperature measuring devices.
- Available in a range of temperature coefficients from −50 ppm/°C. to +6,000 ppm/°C.
- Values range from 10 ohms to 5 megohms.
- All available with axial or printed circuit leads.
- All meet applicable paragraphs of Mil-R-93D

These special T.C.'s are arrived at by the blending of special metals and alloys, and therefore the T.C. characteristics may vary over extremes of temperature. Each of these alloys has a special temperature characteristic. If your specific application necessitates coverage over a wide temperature range, please contact the factory for special details.

These T.C.s may be applied to almost all of the RCL precision and power resistors. Write for catalog for complete details.

Considerable attention should be paid to the column headed "R FACTOR". This factor should be applied to the "MAX RESISTANCE" values found for the style chosen in the normal catalog listing, and the resulting figure becomes the true maximum resistance for this high T.C. unit. This is caused by the varying resistivities of the metals used to obtain the listed T.C.'s.

Special Temperature Coefficients available (see table below)

COLD RANGE −55°C to +25°C	HEAT RANGE +25°C to +105°C	R FACTOR Multiply Max. R by
−50 ±20	**−50 ±20**	1.00
−30 ±10	**−30 ±10**	1.00
±3	**±3**	1.00
±5	**±5**	1.00
±10	**±10**	1.00
±20	**±20**	1.00
+95 ±20	**+85 ±20**	.80
+110 ±10	**+100 ±10**	.80
+120 ±10	**+110 ±10**	.75
+150 ±30	**+150 ±30**	.85
+180 ±20	**+180 ±20**	.80
+280 ±30	**+280 ±30**	.25
+380 ±40	**+400 ±40**	.70
+700 ±200	**+650 ±200**	.60
+850 ±80	**+850 ±80**	.60
+1100 ±100	**+1050 ±100**	.50
+1250 ±100	**+1150 ±100**	.50
+1500 ±200	**+1450 ±200**	.55
+2600 ±200	**+2550 ±200**	.50
+3400 ±300	**+3600 ±300**	.36
+4000 ±400	**+4500 ±400**	.10
+5000 ±300	**+6000 ±300**	.05

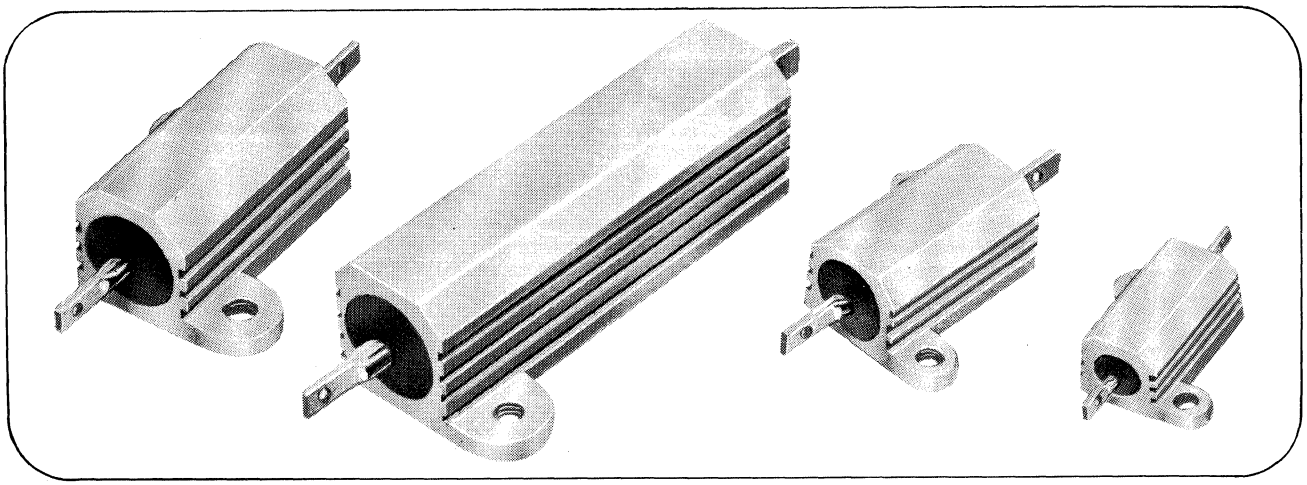
Above T.C.'s refer to .001 minimum wire diameter. Some alloys available in sizes as low as .0007.

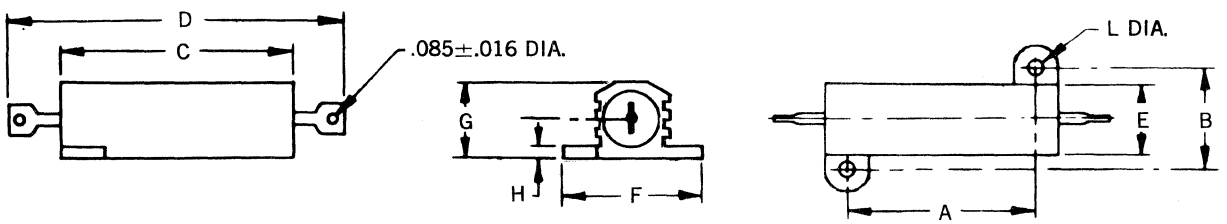
INDUSTRY'S BEST DELIVERY

RCL **ELECTRONICS, INC.**

General Sales Office
700 South 21st Street,
Irvington, N. J. 07111
(Area Code 201) 374-3311
TWX 710-999-5511

RCL aluminum housed precision power resistors





TYPE	A	B	C	D	E	F	G	H	L	MIL-Type
Tol.	±.005	±.005	±.032	±.062	±.015	±.015	±.015	±.010	±.005	—
AL-5	.445	.490	.600	1.125	.335	.645	.321	.065	.094	RE-60
AL-10	.562	.625	.750	1.375	.420	.795	.400	.074	.094	RE-65
AL-25	.750	.780	1.060	1.940	.530	1.075	.560	.087	.125	RE-70
AL-50	1.562	.845	1.970	2.780	.615	1.135	.615	.087	.125	RE-75

FEATURES

- Tolerance: Available from ±3% to ±.01%.
- Standard T.C.: ±10 PPM/°C. Lower T.C.'s are available.
- All popular types, 5 watts through 50 watts
- Molded and welded construction
- Screw mounts on chassis
- Exceptionally high stability at all conventional power ratings
- Utilizes heat-sink effect of chassis
- Clearly marked on top surface of housing for ease of identification after mounting
- Exceeds MIL-R-18546D
- Complete protection against environment

RCL TYPE	MIL-R-18546D TYPE	POWER RATING* (WATTS) RCL	MIL	RESISTANCE RANGES (OHMS)	MAX. WORKING VOLTAGE	MAX. WT. GRAMS
AL-5	RE-60G	7.5	5	.05 to 24.5K	160	3
AL-10	RE-65G	12.5	10	.05 to 47.1K	265	6
AL-25	RE-70G	25	20	.05 to 95.2K	550	14
AL-50	RE-75G	50	30	.05 to 273K	1250	29

Rating based on chassis mounting.

NON INDUCTIVE STYLES:
The same physical and electrical specifications are available with non-inductive winding. They are identified by adding the letter N after the AL identification.

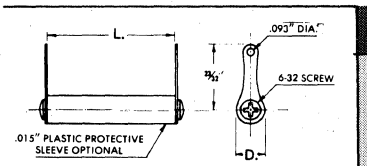
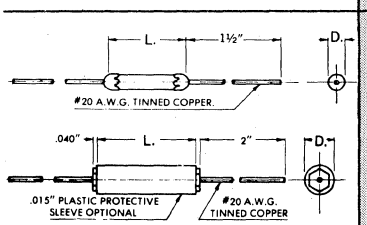
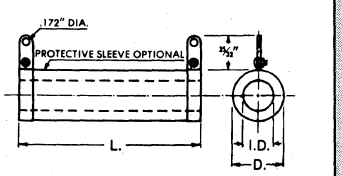
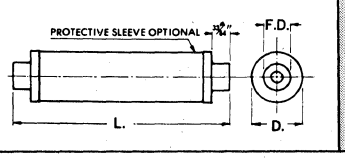
RCL ELECTRONICS, INC.
General Sales Office:
700 South 21st Street, Irvington, N. J. (Area Code 201) 374-3311 • TWX 710-999-5511

RPC

proven quality resistors ...because we care first*

PRECISION CARBON FILM RESISTORS

HIGH VOLTAGE **HIGH FREQUENCY** **HIGH MEGOHM**

	Terminal	Watts	Volts	Ohms	Res. Tol.*	Dimensions
	Radial Lugs	1 to 10	500 to 40 KV	20 Ohms to 25 G	±3%, ±5% ±10%, ±15%	5/16"D x 1" L to 9/16"D x 6½"L
	Axial Wire Leads	¼ to 3	250 to 15 KV	20 Ohms to 25 G		0.10"D x 9/16"L to 5/16"D x 3"L
	Radial Bands	10 to 100	3 KV to 125 KV	20 Ohms to 100 G		¾"D x 4½"L to 2"D x 18½"L
	Ferrule Ends	20 to 100	4 KV to 125 KV	20 Ohms to 100 G		1⅛"D x 7-11/16"L to 2"D x 19-11/16"L

*Available in ±1% and ±2% in most resistance ranges.

Types illustrated are protected by a high temperature electrical varnish coating. All types available encapsulated in filled epoxy resin.

Consult RPC for custom designs to meet your specific specifications.

PRECISION WIRE WOUND RESISTORS

Complete line of radial, axial and lug types in miniature and standard sizes that exceed the requirements of MIL-R-29, MIL-R-93 and MIL-R-39005.

Power wire wound resistors in miniature and standard types, silicone coated for operation to 350°C. Non-inductive winding available for high frequency operation.

PRECISION RESISTOR NETWORKS

Complete capability for the design, fabrication and testing of resistor networks to your exacting requirements.

Resistance Products Co.

914 South 13th Street Harrisburg, Penna. 17104
Phone (717) 236-5081 TWX 510 650-4920

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FLEXIBLE FACILITIES
. . . INFLEXIBLE STANDARDS

TM* TRADEMARK USED PURSUANT TO LICENSE

Over 25 Years' *Versatile* OHMIC CAPABILITY Meet Your Wirewound Resistor Requirements

AXIAL LEAD

No.	Watts	Resistance Min. Max.	Dimensions O.D. x Lgth.
3 AX	3	0.1- 10,000	¼ max. x 9/16
5 AX	5	0.1- 30,000	11/32 max. x 1 1/16
10 AX	10	0.1- 50,000	13/32 max. x 1 5/16

MIL-R-26 AXIAL LEAD

RW67V	6.5	0.10- 3,600	11/32 x 1 1/16
RW68V	11	0.10- 8,200	13/32 x 1 5/16
RW69V	3	0.10- 910	¼ x 9/16

Silicone-base coated, moisture-resistant.
TC = 0 ± 20 ppm/°C, 10 ohms and above.
Commercial equivalents available.

FIXED LUG

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1 M	5	0.1- 11,000	5/16 x 1
1¾ M	10	0.1- 50,000	5/16 x 1¾
2 E	20	0.25-100,000	7/16 x 2
2 B	25	0.25-100,000	9/16 x 2
4 B	50	0.5-175,000	9/16 x 4
6½ C	100	1.0-300,000	¾ x 6½
8½ R	160	1.0-300,000	1⅛ x 8½
10½ R	200	1.0-400,000	1⅛ x 10½

MIL-R-26 FIXED LUG

RW29V	11	0.10- 5,600	7/16 x 1¾
RW30V	11	0.10- 2,700	9/16 x 1
RW31V	14	0.10- 6,800	9/16 x 1½
RW32V	17	0.10-10,000	9/16 x 2
RW33V	26	0.10-18,000	9/16 x 3
RW35V	55	0.10-43,000	29/32 x 4

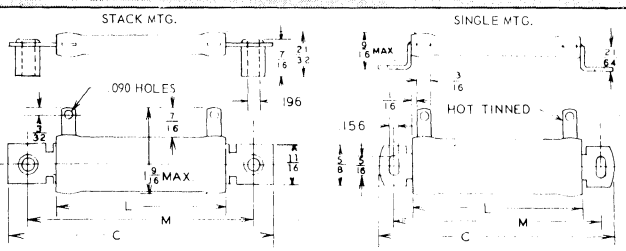
ADJUSTABLE

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1¾ MA	10	1.0- 10,000	5/16 x 1¾
2 BA	25	1.0- 25,000	9/16 x 2
4 BA	50	1.0-100,000	9/16 x 4
6 BA	75	1.0-100,000	9/16 x 6
6½ CA	100	1.0-100,000	¾ x 6½
8½ RA	160	1.0-100,000	1⅛ x 8½
10½ RA	200	1.0-100,000	1⅛ x 10½

MIL-R-19365 ADJUSTABLE

RX29V	11	1- 470	7/16 x 1¾
RX32V	17	1- 910	9/16 x 2
RX33V	26	1-1,500	9/16 x 3
RX35V	55	1-3,600	29/32 x 4

FLAT OVAL



Watts* Free Air	Core—L	Min. Ohms	Max. Ohms	Mounting	C	M
30	1¼	0.1	10K	Single Stack	2⅛ 2½	1¾ 2
40	2	0.2	30K	Single Stack	2⅞ 3¼	2½ 2¾
55	3½	0.3	60K	Single Stack	4⅜ 4¾	4 4¼
65	4¾	0.4	85K	Single Stack	5⅝ 6	5¼ 5½
75	6	0.5	100K	Single Stack	6⅞ 7¼	6½ 6¾

MINIATURE, FLAT OVAL

Construction similar to above large size resistors.

WATTS* Free Air	Min. Ohms	Max. Ohms
10	1.0	15 K
15	1.0	25 K
20	1.0	50 K

Write for Bulletin RMF 5.0/1068

*Ratings of large and miniature, flat oval resistors based on mounting on steel panel 10" x 10" x .040". When mounted on non-metallic surface, reduce wattage approximately 15%.

RIBBON-WOUND RESISTORS

Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.	Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.
400	1⅛	11¼	0.24	18.00	135	¾	5	0.06	4.25
375	1⅛	10½	0.22	16.50	105	¾	4	0.04	3.00
300	1⅛	8½	0.17	13.00	100	¾	3½	0.03	2.40
240	1⅛	6½	0.11	8.20	135	9/16	6	0.06	5.50
185	1⅛	5	0.09	6.40	105	9/16	5	0.05	3.65
180	¾	6½	0.08	6.00	90	9/16	4	0.04	2.75

Available with adjustable tap bands or with tapped windings.

NON-INDUCTIVE RESISTORS: for high frequency power circuits. Available in all fixed-lug types, 10 watts and larger. Standard tolerances: ±10%.

RESISTANCE TOLERANCES: Standard: ±5%, 1.0 ohm and over. Special: down to ±1%.

Write For Complete Catalog

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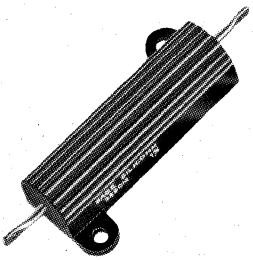
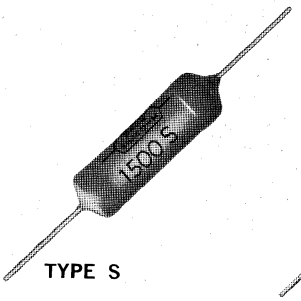
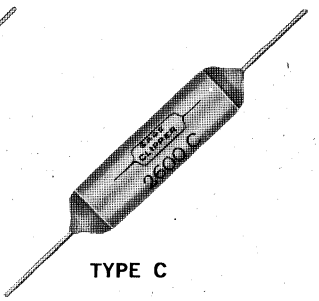
SAGE ELECTRONICS CORPORATION



TYPE M



TYPE S



TYPE C

TYPE C CLIPPER METAL SHEATHED RESISTORS

Similar in all respects to Type S, fully insulated plus addition of metal sleeve for heat sink mounting in spring clip holders.

STYLE	Rating Watts
	Full heat sink rating
2200C	6
2250C	6
2400C	7
2550C	11
2600C	14
2650C	16
2750C	20

TYPE S, NS SILICONE COATED POWER RESISTORS

Meet or exceed MIL-R-26D requirements. N designates non-inductive.

STYLE	Rating Watts	Nominal Size		Lead Dia.	Standard Range, Ω	
		Length	Dia.		Regular Winding	Non-Inductive*
100S	1	.400	.094	.020	8400	3000
200S	2	.400	.125	.020	11000	3900
300S	3	.400	.187	.020	15000	5300
250S	.5	.250	.078	.020	3800	1350
500S	.8	.312	.078	.020	5000	1750
750S	1	.531	.094	.020	12000	4200
1000S	1	.406	.094	.020	8400	3000
1100S	2	.500	.125	.032	15000	5500
1150S	2	.687	.125	.032	25500	9000
1200S	3	.500	.187	.032	20000	7000
1230S	3	.500	.219	.040	20000	7000
1240S	3	.562	.187	.032	24000	8400
1250S	3	.812	.187	.032	40000	14000
1300S	3	.625	.250	.040	30000	10500
1400S	4	.750	.250	.040	42000	15000
1500S	5	.875	.312	.040	71000	25000
1550S	5	1.000	.312	.040	88000	31000
1600S	7	1.219	.312	.040	114000	40000
1650S	8	1.375	.375	.040	170000	60000
1700S	10	1.781	.375	.040	230000	80000
1750S	10	1.937	.375	.040	257000	90000
1900S	10	1.375	.431	.040	210000	73000
1950S	11	1.937	.431	.040	314000	110000

*S styles only

SAGE SILICOHM® fixed wirewound units are not ordinary power resistors. They provide remarkable miniaturization vs required wattage performance. Sage has pioneered the area of power handling capacity combined with precision and stability features ordinarily associated with MIL-R-93 and like resistors.

TYPE SB & NSB HIGH WATTAGE COMMERCIAL BERYLLIA CORE RESISTORS

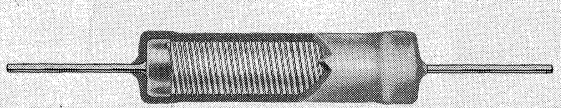
STANDARD SOLDERABLE LEADS	STANDARD WELDABLE LEADS	RATED WATTS		Approx. Grams WEIGHT
		G	V	
250SB	257SB	1	1.5	.18
500SB	507SB	1.5	2	.28
1000SB	1007SB	2.25	2.75	.32
1200SB	1207SB	3.5	4.5	1.0
1230SB		5	6.5	1.1
1240SB	1247SB	4	5	1.1
1250SB	1257SB	4.5	6	1.2
1300SB	1307SB	6	8	1.8
1500SB	1507SB	7	9	3.6
1600SB	1607SB	9	12	4.2
1700SB	1707SB	14	18	7.3



One watt 250SB actual size.

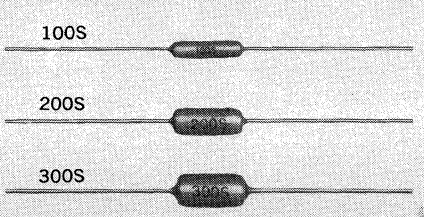
TYPE S CONSTRUCTION

Showing ceramic core, spaced single layer winding welded to monel cap, and multiple layer Impervohm® coating.



MINIATURE TYPE S "CORDWOOD" SERIES

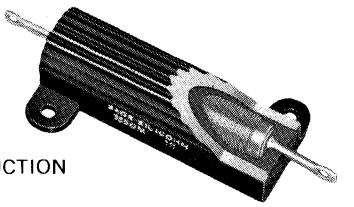
1, 2, 3 watt .4 inch body length



SAGE *For complete specifications request Catalog R-66*

INDUSTRY'S FINEST RESISTORS...Commercial, Military, High Reliability

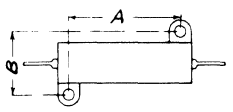
TYPE M METAL CLAD CHASSIS MOUNT RESISTORS



TYPE M CONSTRUCTION

Aluminum housed resistors for heat sink mounting. Meet or exceed requirements of MIL-R-18546D. Dielectric strength to 2500 volts rms.

All dimensions are inches nominal. Complete specifications available on request.



STYLE	Rating Watts	A	B	Max. Resistance Ω	
				Regular Winding	Non-Induct.
3105M	8	.444	.490	24,000	8,400
3010M	14	.562	.625	30,000	10,500
3225M	25	.719	.781	71,000	25,000
3550M	50	1.562	.844	230,000	80,000

TYPE MB HIGH WATTAGE
BERYLLIUM OXIDE CORES

STYLE	RATED WATTS 25°C ambient	
	chassis mounted	free air
3105 MB/NMB	15	6
3010 MB/NMB	20	8
3225 MB/NMB	35	14
3550 MB/NMB	50	20

MB suffix designates regular single layer wind, NMB non-inductive wind.

MIL-R-26D TYPE DESIGNATIONS

EXAMPLE: RW69 V 471

- RW69 — Body Style
- V — Characteristic, V only (350°C max.)
- 471 — Nominal resistance, Ω. Two significant digits plus third indicating number of zeros. Below 10ΩR = decimal and last digit is significant.

TOLERANCE: ±5% for values 1Ω and up; ±10% below 1Ω.
TC: ±260 ppm/°C 20Ω and up; 400 ppm/°C below 20Ω.

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE (Single layer wound .00175 min. wire dia.)
RW55V	1900S	7	.1—5100
RW56V	1950S	14	.1—9100
RW67V	1550S	6.5	.1—3600
RW68V	1700S	11	.1—8200
RW69V	1200S	3	.1—910

EXAMPLE: RW70 U 49R9 F

- RW70 — Body Style
- U — Characteristic, U only (275°C max.)
- 49R9 — Nominal resistance, Ω. Three significant digits plus fourth indicating number of zeros. Below 10ΩR decimal and following digits are significant.
- F — Tolerance ± % B = .1% D = .5% F = 1.0%

TC: ±30 ppm/°C 10Ω and above
±50 ppm/°C 1Ω to 10Ω
±90 ppm/°C below 1Ω

MIL STYLE	SAGE STYLE	MIL WATTS	VOLTAGE Max.	DEFINED OHMIC RANGE		
				Min.	Max. for .001" wire (Navy)	Max. for .0008" wire (all other)
RW70U	1000S	1	—	.1	1210	3160
RW74U	1500S	5	300	.1	12100	38300
RW78U	1700S	10	720	.1	40200	90900
RW79U	1240S	3	135	.1	3570	10500
RW80U	1000SB	2	—	.1	1240	3160
RW81U	250SB	1	25	.1	649	—

MIL-R-18546D TYPE DESIGNATIONS

Example: RE65 G 1001

- RE65 — Style
- G — Characteristic, 275°C Max. G for regular inductive winding N for non-inductive winding
- 1001 — Nominal resistance, Ω. ±1% only. Three significant digits plus fourth indicating number of zeros. Below 100Ω R = decimal and following digits are significant.

T.C. ±30 ppm/°C 2000Ω and above
±50 ppm/°C under 2000Ω

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE	
			Min.	Max. (.001 wire)
RE60G	3105M	5	.1	3320
RE60N	3105NM	5	1.0	1650
RE65G	3010M	10	.1	5620
RE65N	3010NM	10	1.0	2800
RE70G	3225M	20	.1	12100
RE70N	3225NM	20	1.0	6040
RE75G	3550M	30	.1	39200
RE75N	3550NM	30	1.0	19600

CONSIDER THESE DETAILS:

- Wattage Rating, ½ to 50 watts
- Tolerance and stability as close as .05%
- T.C. 20 ppm/°C or 10 ppm/°C
- 1000 volt rms body insulation
- Low values not available in other resistors (specials to .01Ω)
- Characteristic U or V wattage rating: to 275°C or 350°C
- Power load life stability <.5%/1000 hours
- Weldable leads when specified
- Non-inductive winding when specified

SAGE ELECTRONICS CORPORATION
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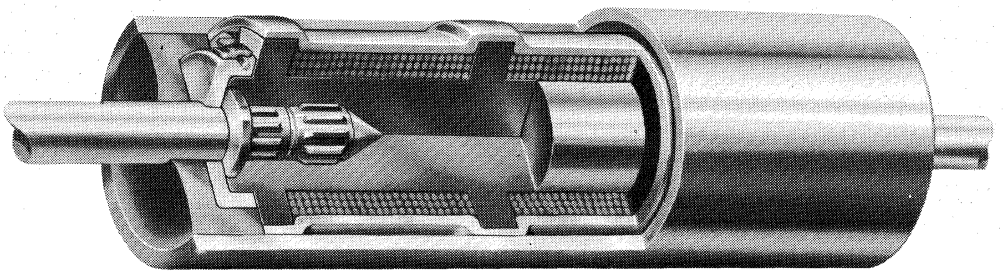
CONTROL *shallcross*

PRECISION WIREWOUND RESISTORS TO

Precision bobbin-type resistors



- Shallcross Precision Bobbin-Type Resistors meet the requirements for failure rate R (0.01% per 1000 hours) of Established Reliability specification MIL-R-39005.
- Competitively priced commercial versions for use where complete documentation is not required.
- Temperature coefficients of resistance to ±1ppm/°C.
- Resistance tolerances to ±0.0025%.
- 34 standard axial lead sizes — as small as 0.085 diameter by 0.200 long.
- 8 standard printed circuit sizes — with 0.200 inch standard-grid lead spacing.



Shallcross series HR resistors are supplied to the most stringent reliability standards established by the military, missile, and aerospace industries. Separate production facilities with specialized procedures and unusually strict quality control have been developed and are maintained to produce resistors with superior documented reliability.

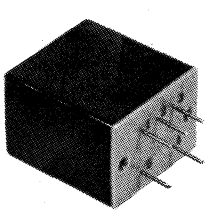


Actual size types SP10 and HR10
MIL-R-39005 type RBR56

Shallcross series VA, SP, and PC resistors are designed to meet military specification MIL-R-93 and a wide range of commercial specifications for critical parameter applications. Forty years of experience in the manufacture of precision wirewound resistors allow Shallcross to produce these quality resistors at competitive prices for commercial users.

A host of options are available on bobbin type resistors so that your needs may be met exactly. In addition to the wide range of sizes, resistances, and resistance tolerances, temperature coefficients from —30ppm/°C. to +5800-ppm/°C. are available. Special winding techniques are avaliable to minimize reactance. Other options are listed in Shallcross catalog LA194, available on request to your local representative or Shallcross.

Precision wirewound

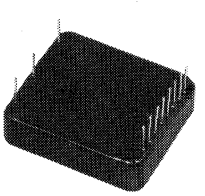


Shallcross Precision Networks represent an economical means of specifying inter-related resistors. The most frequent uses involve analog-digital and digital-analog converters, precision voltage dividers, operational amplifier summing networks, etc. With high accuracy of matching (to 0.005%) over a wide temperature range, the potential uses are numerous.

The stability of wirewound resistors yields matching accuracies that are state-of-the-art, both as shipped and after many years of operation.

The networks are available in package configurations to your specifications. Only a few popular packages are pictured here.

Shallcross networks are temperature

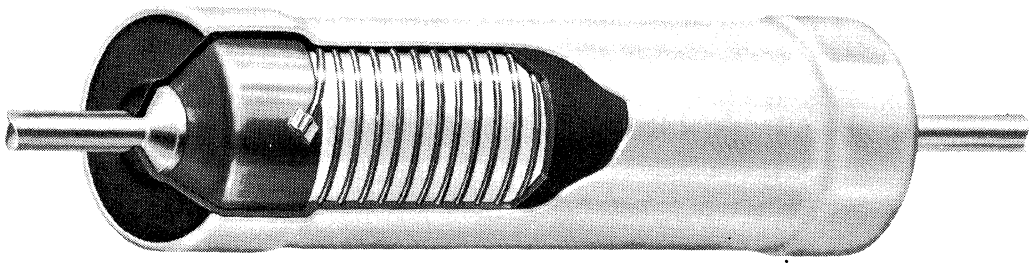


SHALLCROSS RESISTORS AND NETWORKS SPECIFIED ON APOLLO, LEM, MINUTEMAN,

For complete catalogs and engineering assistance call Shallcross. Phone 919-965-2341

COMMERCIAL AND ESTABLISHED RELIABILITY SPECIFICATIONS

Precision power resistors





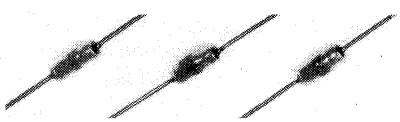
- Shallcross Precision Power Resistors are designed to meet the requirements for failure rate R (0.01% per 1000 hours) of Established Reliability specification MIL-R-39007.
- Competitively priced commercial version for use where complete documentation is not required.
- 11 standard sizes available to cover power ratings up to 15 watts at 275°C. hotspot.
- High thermal conductivity beryllia cores achieve minimum size for given power dissipation.
- Steatite and alumina cores for use where space is available and cost important.
- Resistance tolerances to ±0.1%.

Shallcross Precision Power Resistors combine excellent precision and stability with high operating temperature to achieve miniaturization in power dissipation.

Established Reliability resistor series PR is manufactured with exceptional process control and is fully documented. A silicone resin coating and a clear teflon sleeve provide excellent continuous protection of the resistor element through 275°C.

Resistance wire ends are sandwich-welded to the end caps as shown for maximum reliability. The cap and lead design isolates the terminations from external stresses. Premium grade wires are wound under precise stress control on centerless ground cores.

Commercial resistor series LA is designed to meet military specification MIL-R-26, characteristics U (275°C.), and V (350°C.). Application data and further detail on each resistor style are given in Shallcross catalog LA194, available upon request. Ask your local representative (listed in the yellow pages of EEM) or write Shallcross.



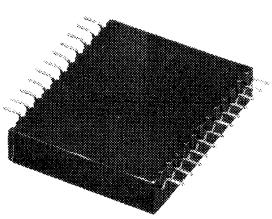
Actual size type LA68 and PR68
MIL-R-39007 type RWR81 — 1 watt

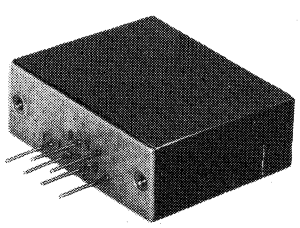
resistor networks

matched at three temperatures — high-limit, low-limit, and mid-range, so that they will track to **your** specifications over the temperature range that you require. Typical temperature ranges that Shallcross meets:

10°C. to + 50°C. for industrial work
—20°C. to + 85°C. for commercial avionics
—65°C. to +125°C. for military systems

Take advantage of Shallcross experience early in your project. Shallcross will help you specify your networks to achieve the accuracies you desire in a manner that best simplifies manufacturing and test procedures—and thereby minimizes the costs to you.





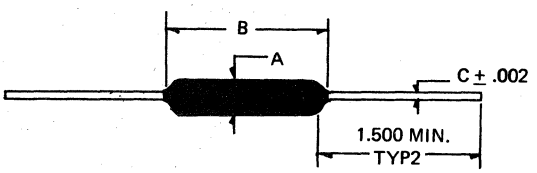
F-111, MOHAWK, SENTINEL, AND MANY OTHER RELIABILITY-CONSCIOUS PROGRAMS

TWX: 510-920-0740, E. Preston Street, Selma, N.C. 27576 *shallcross*
A SUBSIDIARY OF CUTLER-HAMMER CONTROL

POWER RESISTORS

TYPE EL SILICONE POWER

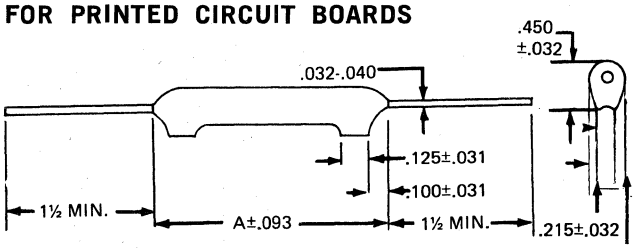
MEETS OR EXCEEDS MIL-R-26



Tel Labs Style	Mil Desig. (RW)	Diameter (A)	Length (B)	Lead Size (C)	Wattage 275°C	Wattage 350°C	Radial Leads (special)	Radial Leads Size
EL¼		.090±.031	.215±.031	.020	0.5W	1.0W	Yes	—
EL½		.090±.031	.280±.031	.020	0.5W	1.0W	Yes	.020
EL1A	RW70	.090±.031	.395±.031	.020	1.0W	1.25W	Yes	.020
EL1B		.090±.031	.530±.031	.020	1.0W	1.25W	Yes	.020
EL1C		.135±.031	.335±.031	.025	1.0W	2.0W	No	—
EL2		.250±.031	.625±.062	.032-.040	3.0W	4.0W	Yes	.032
EL2A		.187±.031	.825±.062	.032	3.25W	4.5W	Yes	.032
EL2B		.187±.031	.625±.062	.032	3.0W	3.5W	Yes	.032
EL2C	RW59, 69	.250±.031	.562±.062	.032-.040	3.0W	4.0W	Yes	.032
EL2D		.250±.031	.500±.062	.032-.040	3.0W	4.0W	Yes	.032
EL2E		.195±.031	.500±.062	.025	2.5W	3.5W	No	—
EL2F		.187±.031	.500±.062	.032	2.5W	3.0W	Yes	.032
EL2G		.187±.031	.430±.062	.032	2.5W	3.0W	Yes	.032
EL2H		.187±.031	.385±.062	.032	2.5W	3.0W	Yes	.032
EL21	RW79	.195±.031	.560±.062	.032	3.0W	3.5W	Yes	.032
EL3		.295±.031	.500±.062	.032-.040	3.0W	4.0W	Yes	.032
EL5	RW74	.290±.062	.925±.093	.032-.040	5.0W	6.0W	Yes	.032
EL5A	RW57, 67	.350±.062	1.000±.093	.032-.040	5.0W	6.5W	Yes	.032
EL7		.290±.062	1.200±.093	.032-.040	5.0W	6.5W	Yes	.032
EL7A		.350±.062	1.360±.093	.032-.040	5.0W	7.0W	Yes	.032
EL10A	RW58, 68	.350±.062	1.815±.093	.040	10.0W	12.0W	Yes	.032

TYPE ELM POWER RESISTORS

FOR PRINTED CIRCUIT BOARDS



DATA CHART 1

TEL LABS STYLE	LENGTH "A"	WATTAGE "U"	WATTAGE "V"	RESISTANCE .05%—0.5%	1%—5%	RADIAL LEADS
ELM5A	1.000	5W	6W	.5Ω-35k	.1Ω- 90k	YES
ELM7A	1.360	6W	7W	.5Ω-45k	.1Ω-100k	YES
ELM10A	1.815	10W	12W	.5Ω-75k	.1Ω-275k	YES

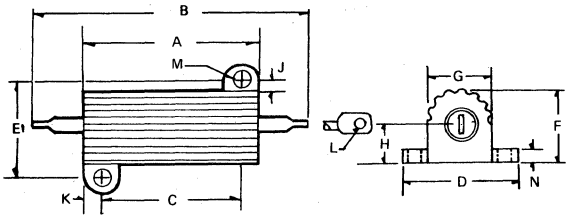
DATA CHART 2

TEL LABS STYLE	TEMPERATURE COEFFICIENT ±50 PPM	±30 PPM	±20 PPM
ELM5A	BELOW 1Ω	1Ω to 9.9Ω	10Ω to 90k
ELM7A	BELOW 1Ω	1Ω to 9.9Ω	10Ω to 100k
ELM10A	BELOW 1Ω	1Ω to 9.9Ω	10Ω to 275k

1. Less than 100°C temp., rise when derated to 30% of wattage under characteristic "V."
2. Silicone Coated
3. Non-Inductively wound version available. One-half the resistance value shown in data chart 1.
4. Reduces the possibility of burned printed circuit boards.
5. Insures resistor identification.
6. Shock and vibration problems reduced when properly installed.

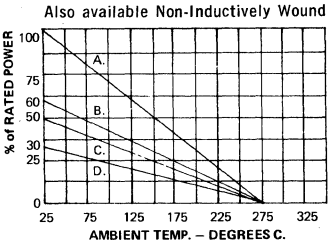
TYPE EH CHASSIS MOUNT

ALUMINUM HOUSED



TEL LABS STYLE	A ±.031	C ±.005	E ±.005
EH5	.600	.444	.490
EH10	.750	.562	.625
EH25	1.062	.718	.781
EH50	1.937	1.562	.843

Also available Non-Inductively Wound



MOUNTING

EH25, 50 5x7x2 Aluminum Chassis
EH5, 10 4x6x2 Aluminum Chassis

WEIGHT (AVG.)

EH5 3.0 GRAMS
EH10 5.6 GRAMS
EH25 11.7 GRAMS
EH50 25.0 GRAMS

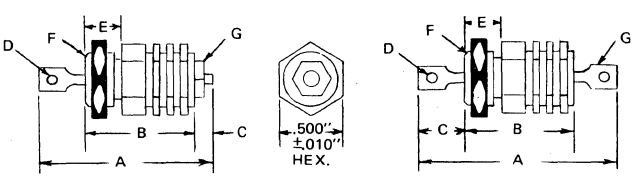
A. EH5, 10, 25, 50 Mounted
B. EH10 Unmounted
C. EH5, 25 Unmounted
D. EH50 Unmounted

TEL LABS STYLE (Anodyzed)	WATTAGE Mounted	WATTAGE Unmounted	RESISTANCE RANGE 1% - 5%	TEMP. COEFFICIENT ±50 PPM	TEMP. COEFFICIENT ±20 PPM
EH5	8W	4W	0.1Ω to 22K	0.1Ω to 30Ω	OVER 30Ω
EH10	10W	6W	0.1Ω to 40K	0.1Ω to 50Ω	OVER 50Ω
EH25	25W	10W	0.1Ω to 70K	0.1Ω to 100Ω	OVER 100Ω
EH50	50W	12W	0.1Ω to 250K	0.1Ω to 300Ω	OVER 300Ω

Meets or exceeds MIL R-18546D.

TYPE FP ALUMINUM HOUSED

FEED THROUGH



POWER RATING

275° C maximum hotspot Temperature
Heat Sink 4"x6"x2"x.040" Aluminum Chassis
FP10 one end grounded
FP10-1 Feed through terminals — one each side chassis

WEIGHT 6 GRAMS

Available Noninductively Wound (FP10N). One-Half Maximum Resistance of Table 2.

TEL LABS STYLE	WATTAGE MOUNTED ON SPECIFIED HEAT SINK	RESISTANCE RANGE 1% - 5%	TEMP. COEFFICIENT ±50 PPM	TEMP. COEFFICIENT ±20 PPM
FP10	10W	.1Ω to 35K	0.1Ω to 30Ω	OVER 30Ω
FP10-1	10W	.1Ω to 35K	0.1Ω to 50Ω	OVER 50Ω

TEL LABS STYLE	A ±.031"	B ±.010"	C ±.031"	D ±.005"	E ±.010"	F	G
FP10	1.265"	.750"	.180"	.086"	.250"	3/8-24 UNF-2A	4/40 UNC
FP10-1	1.400"	.750"	.325"	.086"	.250"	3/8-24 UNF-2A	SAME AS D

TEL LABS, INC. 1050 – 1060 SECOND STREET
MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: 603-625-8994 TWX 710-220-1844

PRECISION RESISTORS

TYPE SA EPOXY

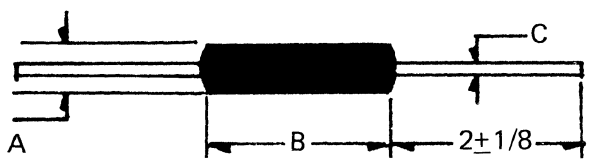
ENCAPSULATED AXIAL

DESIGNED TO MEET OR EXCEED MILR93D.

All units represented may be modified for minimum inductance and capacitive effects at frequencies above the audio range. Rise and decay time characteristics are measured from 10% to 90% of peak pulse amplitude with a 100 kilocycle pulse input.

Temperature coefficients are available to 0 ± 4PPM/°C and T.C. matches are available to 2PPM/°C.

Stabilities of 0.005% per year are available on a production basis.



Tel Labs Style	Mil R93D Desig.	Diam. A ± .015	Length B ± .031	Lead Diam. C.	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. VOLTAGE Mil.	MAX. VOLTAGE Comm.
SA1	RB55	.250	.500	.032	226 K	1.1 Meg	.15W	.3W	400	400
SA2	RB54	.250	.750	.032	448 K	2 Meg	.25W	.4W	300	400
SA3	RB53	.375	.875	.032	750 K	8 Meg	.333W	.5W	300	400
SA4	RB52	.375	1.000	.032	1.5 Meg	10 Meg	.5W	.75W	600	800
SA5	RB57	.500	1.062	.032	2 Meg	16 Meg	.75W	1.0W	800	1000
SA6	RB58	.500	1.531	.032	3 Meg	24 Meg	1.0W	1.5W	900	1200
SA7	RB59	.500	2.031	.032	5.11 Meg	24 Meg	1.25W	2.0W	1200	1800
SA11		.250	.625	.032		400 K		.33W		800
SA13		.312	.937	.032		1.2 Meg		.5W		800
SA16	RB56	.250	.375	.032	127 K	205 K	.125W	.25W	200	200
SA19		.250	.250	.032		500 K		.2W		200

NOTE: In no case should maximum voltage exceed wattage rating.

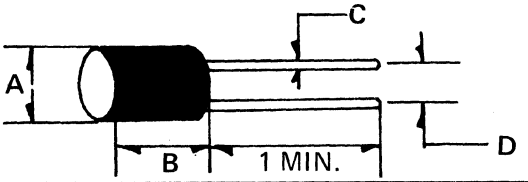
SUBMINIATURES

Tel Labs Style	Diameter A ±.015	Length B ±.031	Lead Diam. C.	Maximum Value	Maximum Wattage	Maximum Voltage
SA9	.135	.312	.025	400 K	.08W	100
SA10	.185	.560	.025	500 K	.2W	100
SA17	.109	.270	.020	200 K	.05W	100
SA20	.165	.500	.025	400 K	.150W	100, 200
SA21	.187	.375	.025	500 K	.125W	100, 200
SA22	.150	.437	.025	375 K	.07W	100
SA24	.125	.250	.020	75 K	.05W	100
SA25	.110	.300	.020	85 K	.05W	100
SA26	.125	.375	.025	140 K	.05W	100
SA29	.100	.300	.025	80 K	.05W	100
SA30	.200	.405	.025	175 K	.05W	100
SA31	.100	.220	.020	70 K	.04W	100

In no case should maximum voltage exceed wattage rating.

TYPE PW SERIES

Conformal and Shell Encapsulated. Designed Specifically for Printed Circuit Applications. Temperature coefficients from 0±20 PPM to 0±5 PPM Matching to 2 PPM. Inductive or Noninductive Winding. Stabilities available on a production basis to 0.0005%/year.



Mil R 93D Desig.	Tel Labs Style	A ± .015	B ± .032	C	D ± .015	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. V. Mil.	MAX. V. Comm.
RB71	PW1	.250	.312	.025	.200	100K	125K	.125W	.15W		300
	PW2	.250	.406	.025	.200		175K		.2W		600
RB70	PW20	.375	.500	.032	.200, .250	301K	375K	.250W	.33W	150	600
	PW40	.468	.625	.032	.250, .300		500K		.3W		600
	PW31	.500	.625	.032	.250, .300		1.75 Meg		.6W		600
	PW10	.406	1.250	.032	.250, .300		1.0 Meg		1.0W		1200
	PW50	.531	1.000	.032	.250, .300		3.0 Meg		1.0W		1200

TYPE CR/CA/CL SERIES

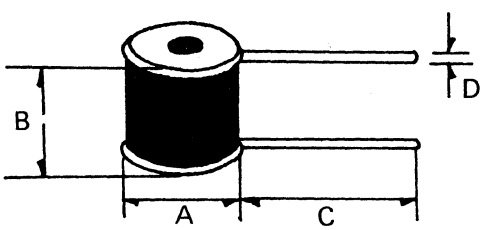
CERAMIC CORE RESISTORS

"CR" Ceramic Radial Leads

"CA" Ceramic Axial Leads

"CL" Ceramic Lugs

Ceramic spool type unit. Windings sealed in varnish. Hole provided for screw mounting. Operate from -65°C to 105°C. Inherently good stability.
Excellent for use under laboratory conditions and most commercial applications.

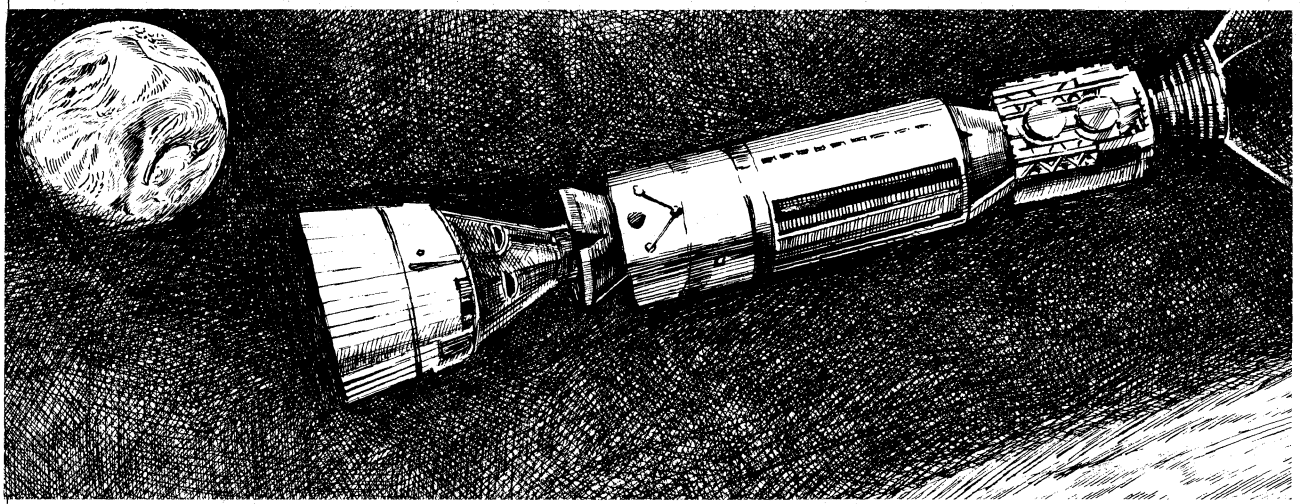


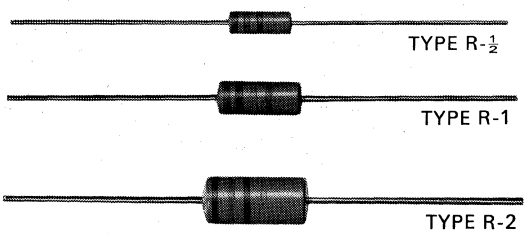
Style	Diameter A ±.015	Length B ±.031	Lead Diam. D	Max Value (.0005 Wire)	Wattage	Max. V	Hole (clearance) Screw #
CR16	.250	.250	0.20	100K	0.1W	200	0
CR1	.250	.406	.020-0.25	400K	0.15W	400	2
CR23	.281	.343	.020-.025	250K	0.15W	200	2
CR18	.343	.312	.020-.025	400K	0.2W	200	6
CR2	.250	.687	.020-.025	1.25 Meg.	0.25W	400	0
CR20	.375	.437	.020-.032	1.0 Meg.	0.25W	200	4
CR25	.500	.437	.025-.032	1.5 Meg.	0.33W	400	6
CR27	.375	.656	.025-.032	1.5 Meg.	0.5W	400	4
CR31	.500	.625	.025-.032	3.0 Meg.	0.5W	400	6
CR35	.500	.562	.025-.032	3.25 Meg.	0.5W	400	6
CR53	.500	1.000	.025-.032	6.0 Meg.	1.0W	800	6
CR60	.750	1.250	.025-.032	6.0 Meg.	1.5W	800	6
CR71	.812	2.093	.025-.032	20.0 Meg.	2.5W	1600	6

1. All units above may be supplied with Axial Leads, specify "CA".
2. Lugs may be supplied on the following; CL25, CL31, CL35, CL53, CL60, CL71

TEL LABS, INC. 1050 – 1060 SECOND STREET
MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: 603-625-8994 TWX 710-220-1844

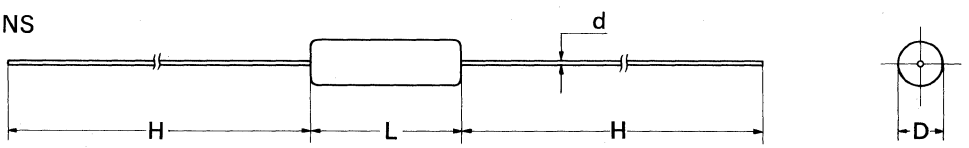
DEPOSITED CARBON FILM RESISTORS
HIGH STABILITY. HOT MOLDED





These MIL style hot molded carbon film fixed resistors possess highly reliable characteristics. R-½ reliability exceeds all requirements of MIL-R-11E, and also meets MILR-22684. BUT at composition prices!

DIMENSIONS



TYPE	BODY DIMENSIONS				WIRE TERMINATIONS			
	DIAMETER (D)		LENGTH (L)		DIAMETER (d)		LENGTH (H)	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)
R-1/2	0.142±0.02	3.6±0.5	$0.394^{+0.03}_{-0.02}$	$10.0^{+0.8}_{-0.5}$	0.0315±0.004	0.8±0.1	1.5±0.12	38.0±3.0
R-1	0.224±0.02	5.7±0.5	0.563±0.02	14.3±0.5	0.0393±0.004	1.0±0.1	1.5±0.12	38.0±3.0
R-2	0.319±0.02	8.1±0.5	0.689±0.02	17.5±0.5	0.0472±0.004	1.2±0.1	1.5±0.12	38.0±3.0

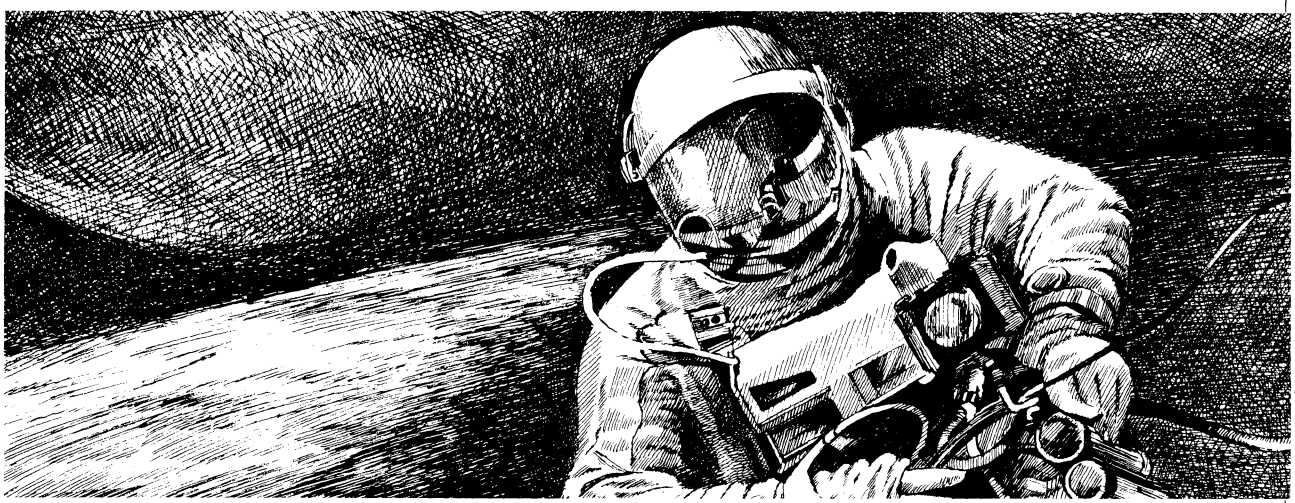
TYPICAL PERFORMANCE CHARACTERISTICS

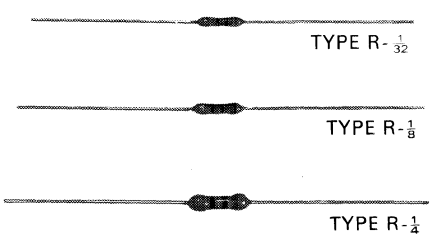
Type R-½ R-1, R-2 (molded) carbon film resistors have a very high frequency characteristic with low temperature coefficient, close tolerance and excellent low noise, as compared with composition types or similar products on the market.

TYPE	MIL STYLE	RATING WATTS AT 70°C	MAXIMUM WORKING VOLTAGE	RESISTANCE TOLERANCES	RESISTANCE RANGE	TEMPERATURE COEFFICIENT (Average)	INSULATION RESISTANCE
R-1/2	RL20	0.5W	350V d.c or a.c RMS	±2% ±5%	10Ω to 750K 5.1Ω to 1MΩ	—350ppm/°C	10^4 megohms minimum @500V d.c
R-1	RL32	1.0W	500V d.c or a.c RMS	±2% ±5%	5.1Ω to 3MΩ	—300ppm/°C	10^4 megohms minimum @500V d.c
R-2	RL40	2.0W	500V d.c or a.c RMS	±2% ±5%	5.1Ω to 5MΩ	—300ppm/°C	10^4 megohms minimum @500V d.c

TOYO ELECTRONICS INDUSTRY CORPORATION

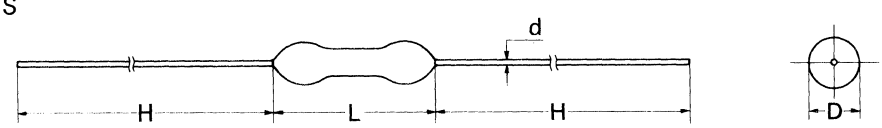
DEPOSITED CARBON FILM RESISTORS
MINIATURE. COATED





Our automated and accurate processing systems turn out nearly 7 million R (coated) type per day.....
Originally designed by Toyo Electronics Industry Corp. for general purpose applications in low power equipment and miniature printed-circuits. This R (coated) type is conformally coated with an inner coat of epoxy resin and an outer sheath of melamine resin. Performance characteristics meet all requirement of JIS-C-6402, and greatly exceed those of any composition types.

DIMENSIONS



TYPE	BODY DIMENSIONS				WIBE TERMINATIONS			
	DIAMETER (D)		LENGTH (L)		DIAMETER (d)		LENGTH (H)	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)
R-1/32	0.065	1.65±0.15	0.272	6.9±0.7	0.018	0.45±0.02	1.181	30.0±3.0
R-1/8	0.087	2.2 ±0.2	0.295	7.5±1.0	0.021	0.55±0.02	1.181	30.0±3.0
R-1/4	0.110	2.8 ±0.2	0.355	9.0±1.0	0.021	0.55±0.02	1.181	30.0±3.0

TYPICAL PERFORMANCE CHARACTERISTICS

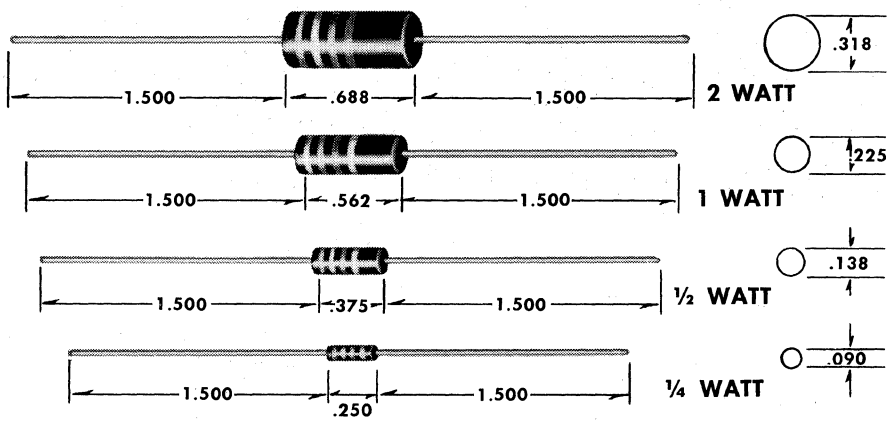
TYPE	RATING		RESISTANCE TOLERANCES	RESISTANCE RANGE	AVERAGE TEMPERATURE COEFFICIENT	
	WATTS AT 40°C	VOLTS d.c or a.c RMS			BELOW 100KΩ	ABOVE 100KΩ
R-1/32	0.031W	50V	± 5% (J) ±10% (K)	0.5Ω to 250KΩ	−300ppm/°C	−400ppm/°C
R-1/8	0.125W	200V		0.5Ω to 820KΩ	−300ppm/°C	−400ppm/°C
R-1/4	0.25 W	250V		0.5Ω to 1.5MΩ	−250ppm/°C	−400ppm/°C

HEAD OFFICE: 21, Sain Misosaki-cho, Ukyo-ku, Kyoto 615. (JAPAN)
TELEPHONE: (075) 311-2121 (10 Lines).
EXPORT DEPT.: P.O. BOX 103 CENTRAL, Kyoto.

Rohm QUALITY · RELIABILITY

STACKPOLE

FIXED COMPOSITION RESISTORS



Stackpole Resistors offer superior performance in terms of load life, moisture resistance, shelf life, and other important characteristics. Available in ¼, ½, 1, and 2 watt insulated types in resistance values with 5%, 10% and 20% tolerances as shown below.

EASIEST SOLDERING

is asured thanks to an exclusive extra solder coating applied after the usual tin dipping. Leads of Stackpole Resistors solder readily by any method—dip or iron—stay tarnish free even after months in storage. And, their baked-on color codes resist solvent scrubbing operations . . . maintain uniform, attractive appearance.

269 STANDARD VALUES FOR MODERN CIRCUITRY

±20%	±10%	±5%	±20%	±10%	±5%	±20%	±10%	±5%	±20%	±10%	±5%
10	10	10		390	390	15000	15000	15000		560000	560000
		11			430			16000			620000
	12	12	470	470	470		18000	18000	680000	680000	680000
		13			510			20000			750000
15	15	15		560	560	22000	22000	22000		820000	820000
		16			620			24000			910000
	18	18	680	680	680		27000	27000	1.0 Meg	1.0 Meg	1.0 Meg
		20			750			30000			1.1 Meg
22	22	22		820	820	33000	33000	33000		1.2 Meg	1.2 Meg
		24			910			36000			1.3 Meg
	27	27	1000	1000	1000		39000	39000	1.5 Meg	1.5 Meg	1.5 Meg
		30			1100			43000			1.6 Meg
33	33	33		1200	1200	47000	47000	47000		1.8 Meg	1.8 Meg
		36			1300			51000			2.0 Meg
	39	39	1500	1500	1500		56000	56000	2.2 Meg	2.2 Meg	2.2 Meg
		43			1600			62000			2.4 Meg
47	47	47		1800	1800	68000	68000	68000		2.7 Meg	2.7 Meg
		51			2000			75000			3.0 Meg
	56	56	2200	2200	2200		82000	82000	3.3 Meg	3.3 Meg	3.3 Meg
		62			2400			91000			3.6 Meg
68	68	68		2700	2700	100000	100000	100000		3.9 Meg	3.9 Meg
		75			3000			110000			4.3 Meg
	82	82	3300	3300	3300		120000	120000	4.7 Meg	4.7 Meg	4.7 Meg
		91			3600			130000			5.1 Meg
100	100	100		3900	3900	150000	150000	150000		5.6 Meg	5.6 Meg
		110			4300			160000			6.2 Meg
	120	120	4700	4700	4700		180000	180000	6.8 Meg	6.8 Meg	6.8 Meg
		130			5100			200000			7.5 Meg
150	150	150		5600	5600	220000	220000	220000		8.2 Meg	8.2 Meg
		160			6200			240000			9.1 Meg
	180	180	6800	6800	6800		270000	270000	10.0 Meg	10.0 Meg	10.0 Meg
		200			7500			300000			11.0 Meg
220	220	220		8200	8200	330000	330000	330000		12.0 Meg	12.0 Meg
		240			9100			360000			13.0 Meg
	270	270	10000	10000	10000		390000	390000	15.0 Meg	15.0 Meg	15.0 Meg
		300			11000			430000			16.0 Meg
330	330	330		12000	12000	470000	470000	470000		18.0 Meg	18.0 Meg
		360			13000			510000			20.0 Meg
									22.0 Meg	22.0 Meg	22.0 Meg

AVAILABLE THROUGH LEADING INDUSTRIAL ELECTRONIC PARTS DISTRIBUTORS

Electronic Components Div., **STACKPOLE CARBON COMPANY**

VISHAY STANDARD PRECISION RESISTORS



Now, you get precision, speed and uniform TC for all R values . . . reliable, total performance no other resistor can possibly offer — in small size, competitively-priced resistors — available in any quantity — with fast delivery.

Every Vishay Precision Resistor offers this total-spec-package . . . *as standard:*

- Absolute Tolerance: to 0.005%
- TC (all R values): 0±1ppm/°C. (0° to 60°C.)
- Shelf Stability: 25ppm/yr. (50/3 yrs.) (also see "H" Series)
- Load Stability: 0.015% (60°C., 2000 hrs.)
- Response Time (to 100 MHz.): 1 ns. (no ringing)
- Non-inductive . . . Non-measurable Noise

STANDARD VISHAY STYLES (are available in tolerances of 0.01%, 0.02%, 0.05%, 0.10%, 0.25%, 0.50% and 1.0% . . . . to 0.005% in S102 style)

Style	Std. Ranges (ohms)	Power (Watts)	Dimensions	Lead Spacing
S102	30 to 50K*	0.30	H — .320±.020 L — .295±.010 W— .100±.010	.150 ±.010
S104	60 to 100K	0.50	H — .520±.020 L — .565±.020 W— .150±.010	.400 ±.020
S105	90 to 150K	0.75	H — .520±.020 L — .810±.020 W— .150±.010	.650 ±.020
S106	5K to 200K	1.00	H — .520±.020 L —1.190±.020 W— .245±.020	.650 ±.020
S302	30 to 50K*	0.30	H — .200±.020 L — .375±.020 W— .375±.020	AXIAL LEADS
C302	30 to 50K*	0.30	D — .275±.010 L — .510±.020	

*Also available in 10Ω to 30Ω range to tolerance of 0.1%

VISHAY "H" SERIES (Hermetically Sealed) PRECISION RESISTORS



Ultimate STABILITY, PRECISION, SPEED (5ppm/yr. stability . . . tolerance to 0.001%).

Now, you can have bedrock shelf stability (5ppm/yr.), higher precision, (0.001%), and unequalled TC (Absolute—0±1ppm/°C., Tracking — 0.5ppm/°C., and Matching — 0.25ppm/°C.) . . . plus all the other unique Vishay Resistor specs . . . in Vishay's new "H" Series Precision Resistors.

VISHAY "H" SERIES SPECIFICATIONS

Vishay Type No.	DIMENSIONS		Min. Res. (ohms)	Max. Res. (ohms)	Max. Power* (watts)	Max. Working Voltage (DC or RMS)	Standard Tolerances Available
HP202	0.400x0.425x0.177		30	50K	0.30	250	See below
	Diameter	Length					
HA412	⅜	⅝	30	50K	0.30	250	0.0010%† 0.0025%‡
HA512	½	⅝	30	150K	0.50	350	0.0050%
HA414	⅜	1	30	100K	0.50	350	0.01%
HA516	½	1	120	300K	1.00	500	0.02% 0.05%
HA518	½	1½	180	500K	1.25	600	0.10% 1.0%

*Maximum power listed at ambient temperature of 25°C. without heat sink. For high accuracy and stability, derating is recommended. †1K min. ‡500 ohms min.

VISHAY RESISTOR NETWORKS

. . . fastest, most accurate, most stable networks you can buy. No trade-offs, outstanding total performance . . . as these standard specs show:

FULL SCALE ACCURACY: to ±0.001% (0° to 60°C.)

SHELF STABILITY: 25ppm (3 yrs.) guaranteed

SPEED: Rise time — 2 ns.
Settling time: <50ns. to 0.01% nominal

NON-MEASURABLE NOISE

VISHAY CUSTOM NETWORKS — Vishay network experience can help you solve your toughest problems. Send specs for a prompt quotation.

SERIES 500 H—0.500 in. W—0.750 in. L—See Chart ("A" dim.)

Number of Bits	"A" Dim. (nom.)	Vol. (cu. in.)
4 or 5	0.700	0.263
6, 7 or 8	1.080	0.405
9 or 10	1.300	0.488
11	1.500	0.563
12 or 13	1.660	0.623
14 or 15	1.900	0.713

SERIES 375 H—0.365 in. W—1.230 in. L—See Chart ("A" dim.)

Number of Bits	"A" Dim. (nom.)	Vol. (cu. in.)
4	0.730	0.328
5 or 6	1.080	0.485
7 or 8	1.380	0.620
9 or 10	1.680	0.754
11 or 12	1.980	0.889
13 or 14	2.280	1.024
15	2.590	1.158

HIGH ACCURACY, VERSATILE VISHAY DECADE BOXES feature ±0.005% accuracy, 5ppm/yr. or 20ppm/yr. stability, usable from DC to 100 MHz. Ranges: 1 to 99,999 ohms in 1 ohm steps (5-digit model); 0.05 to 100,000 ohms in 0.01 increments (7-digit model).

U.S. Patent No. 3,405,381

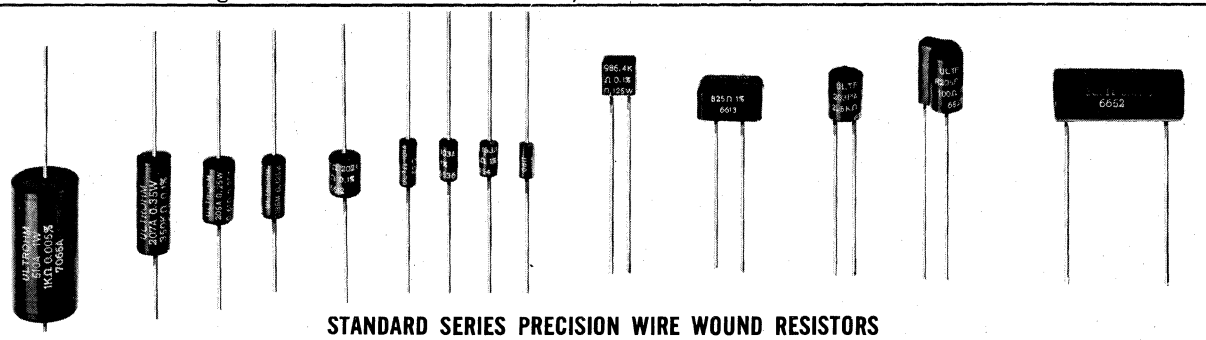
VISHAY RESISTOR PRODUCTS a division of Vishay Intertechnology, Inc.
63 Lincoln Highway ■ Malvern, Pa, 19355

ULTRONIX INC.

PRECISION RESISTORS

TECHNOLOGICAL LEADERSHIP IN PASSIVE COMPONENTS

P.O. BOX 1090 ■ 461 NORTH 22ND ST., GRAND JUNCTION, COLO. 81501 ■ PH. (303) 242-0810 ■ TWX (910) 929-6965
West Coast Marketing Office: 1723 CLOVERFIELD BLVD., SANTA MONICA, CAL. 90404 ■ PH. (213) 870-9346 or 393-9611



STANDARD SERIES PRECISION WIRE WOUND RESISTORS

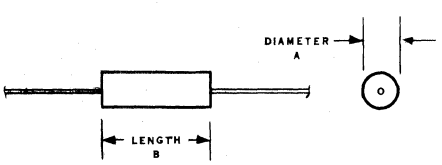
- ☐ ACCURACY to .005%
- ☐ OPERATIONAL STABILITY; 30 PPM YEAR
- ☐ TEMPERATURE COEFFICIENT TO ±5 PPM/°C
- ☐ RELIABILITY TO .001%/1000 HR.
- ☐ OVER FORTY SIZES AND STYLES
- ☐ NOISE FREE
- ☐ LOW THERMAL EMF
- ☐ ENVIRONMENTALLY STABLE
- ☐ ZERO VOLTAGE COEFFICIENT
- ☐ SURPASSES MIL-R-39005A & MIL-R-93D

DESCRIPTION — Highly accurate, reliable Ultronix resistors are available in over forty styles and sizes with power ratings from .1 to 2 watts at 125°C. Standard accuracies are 1%, .1% .05%, .02% and .01% with guaranteed resistance shift within 30 ppm (one year at full power). First year drift is less than 10 ppm with S Series. On the Minute Man I Program Ultronix resistors operated more than 450,000,000 part hours with no field failures for a field failure rate of .00022% per 1,000 hours at 60% confidence. Standard resistor types meet or exceed MIL-R-39005A and MIL-R-93D.

APPLICATION — All major U.S. aerospace programs use Ultronix standard resistors in addition to discriminating commercial users. All resistor applications requiring accuracies better than .05%, stabilities of 10 ppm, or temperature coefficients less than 25 ppm/°C are applications for Ultronix resistors. Many applications requiring accuracies as loose as .1% under stringent environmental conditions demand the use of wire wound resistors due to the instabilities of other resistor types under moisture, shock, vibration, and other conditions. Typical circuit functions such as D to A conversion, ladder dividers, and zener compensation are performed by Ultronix resistors. Also, resistors for special applications can be custom designed to your specific needs.

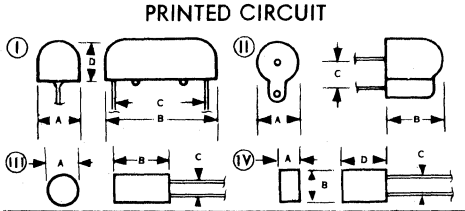
DESIGN AND OPERATIONAL FEATURES — Ultronix molds bobbins and resistors of **STAKYD,** a specially compounded polyester having triple the time-temperature stability of epoxy. All welded construction is used throughout, lead to tab welds are made by automatic equipment, and are protected by encapsulation within the bobbin. Dual pi wall construction is used in all multiple pi Ultronix resistors. This feature eliminates the shorting failure mode of single pi wall resistors when reverse winding from one pi section to the next. All Ultronix resistors are stabilized by a unique time/temperature cycle to remove winding stresses before trimming to exact value. Resistors are 100% inspected per mechanical and electrical specifications. Sample lots from each day's production are accumulated and tested to the requirements of MIL-R-39005A, MIL-R-93D, and **ULTRA,** Ultronix own high reliability specification. Samples are taken from **all** production, not only military orders. When you specify Ultronix components, you get the benefit of Quality Assurance which has been approved by every major aerospace company and government agency.

AXIAL



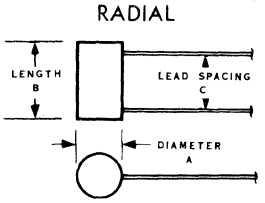
STYLE	DIMENSION A Dia.	DIMENSION B Length	WATTS @ 125°C	STYLE	DIMENSION A Dia.	DIMENSION B Length	WATTS @ 125°C
101A	.130	.375	.1	210A	.250	1.00	.5
102A	.110	.250	.1	305A	.375	.500	.35
103A	.150	.300	.1	307A	.375	.750	.5
105A	.160	.500	.1	308A	.312	.815	.5
153A	.150	.245	.1	310A	.375	1.00	.7
184A	.187	.375	.1	505A	.500	.500	.5
185A	.188	.500	.12	510A	.500	1.00	1.0
202A	.250	.310	.15	515A	.500	1.50	1.5
203A	.250	.343	.25	517A	.500	1.75	2.0
204A	.250	.375	.25	520A	.500	2.00	2.0
205A	.250	.50	.25				
207A	.250	.750	.35				

PRINTED CIRCUIT



STYLE	FIG	DIMENSION A	DIMENSION B	DIMENSION C	DIMENSION D	WATTS @ 125°C
102P	IV	.125	.250	.125	.250	.125
103RP	I	.160	.300	.200	.150	.1
104P	IV	.125	.500	.250	.280	.25
134P	IV	.125	.500	.250	.320	.25
202P	II	.250	.305	.175	.125	.15
202RP	I	.250	.300	.200	.270	.15
203PA	III	.270	.320	.200		.25
204PA	III	.260	.447	.15		.25
205P	II	.250	.500	.175	.125	.25
205RP	I	.250	.500	.400	.250	.25
207RP	I	.250	.750	.656	.250	.35
505P	II	.500	.625	.325	.235	.5
505PA	III	.495	.490	.300		.5
510P	II	.500	1.125	.325	.235	1.0

RADIAL



STYLE	DIMENSION A Dia.	DIMENSION B Length	DIMENSION C	WATTS @ 125°C
103R	.150	.350	.250	.1
105R	.160	.500	.406	.1
205R	.250	.500	.406	.25
207R	.250	.750	.656	.35
210R	.250	1.00	.906	.5
305R	.375	.500	.406	.5
307R	.375	.750	.656	.5
310R	.375	1.00	.906	.7
505R	.500	.500	.406	.5
510R	.500	1.00	.906	1.0

LEADS: Tin-plated copper standard, gold-plated nickel available

PRECISION RESISTORS

ULTRONIX INC. TECHNOLOGICAL LEADERSHIP IN PASSIVE COMPONENTS

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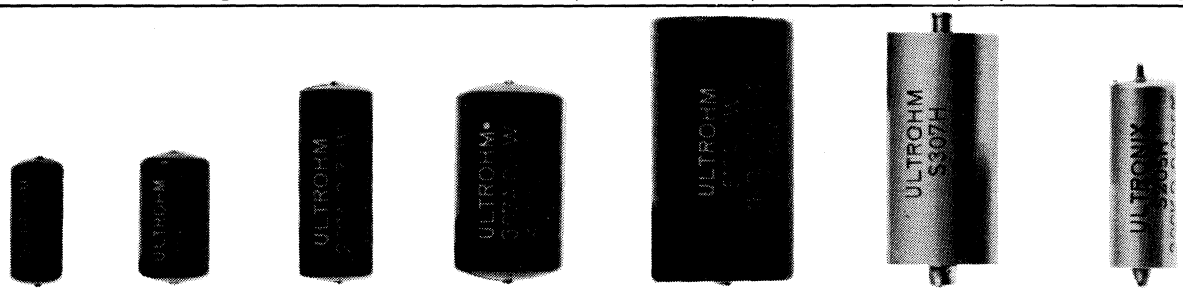
West Coast Marketing Office: 1723 CLOVERFIELD BLVD., SANTA MONICA, CAL. 90404 ■ PH. (213) 870-9346 or 393-9611



S SERIES HIGH STABILITY PRECISION WIRE WOUND RESISTORS

- ☐ ACCURACY TO .0025%
- ☐ OPERATIONAL STABILITY 10 PPM/YEAR
- ☐ ENVIRONMENTALLY STABLE
- ☐ TEMPERATURE COEFFICIENT TO 1 PPM/°C
- ☐ RELIABILITY TO .001%/1000 HR.
- ☐ ZERO VOLTAGE COEFFICIENT
- ☐ NOISE FREE
- ☐ LOW THERMAL EMF
- ☐ SURPASSES MIL-R-39005A REQUIREMENTS

DESCRIPTION — Ultronix High Stability S Series wire wound resistors are designed for applications requiring maximum accuracy and stability in stringent environments. Ultronix resistors far exceed the requirements of existing military specifications. Resistance shift due to full power operation for one year is GUARANTEED to be less than 10 ppm. Ultronix resistors have more than 45,000,000 part hours of failure rate verification testing. Documented failure rates are better than .0010% per 1000 hours at 60% confidence and 100% stress. High stability series resistors exceed the requirements of both MIL-R-39005A and MIL-R-39D.

APPLICATION — Resistor applications requiring accuracies better than .05%, stabilities of 100 ppm, or temperature coefficients less than ±25 ppm are applications for wire wound resistors. As environmental demands increase, resistor selection is dictated more by environmental stability than by initial accuracy. If resistor accuracy of 0.1% or better must be maintained under vibration, shock, or other typical military environments, the proper resistor selection is Ultronix wire wound due to environmental instabilities of other resistors. To determine if you should be using Ultronix resistors, compare your circuit needs under your environmental requirements with the stabilities per Table 1.

DESIGN AND OPERATIONAL FEATURES — Ultronix molds bobbins and resistors of STAKYD, a specially compounded polyester having triple the time-temperature stability of epoxy. All welded construction is used throughout. Lead to tab welds are made by automatic equipment and are protected by encapsulation within the bobbin. Dual pi wall construction is used in **all** multiple pi Ultronix resistors. This feature eliminates the shorting failure mode from one pi section to the next.

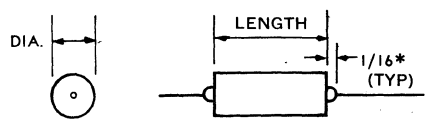
Environmental protection is provided by molded STAKYD, or glass to metal sealed tubes, if complete hermetic seal is required. All Ultronix resistors are stabilized by a time/temperature cycle to remove winding stress before trimming to the exact value. Resistors are 100% inspected per electrical and mechanical specifications. Sample lots from each day's production are accumulated and tested to the requirements of MIL-R-39005A, MIL-R-93D, and ULTRA, Ultronix own high reliability specification.

TABLE I

RESISTOR ENVIRONMENTAL STABILITY COMPARISON

Table I compares the resistance stabilities required by the various military specifications and the stabilities of ULTRONIX S Series resistors under the same test conditions.

TEST	ULTRONIX WIRE WOUND "S" SERIES	METAL FILM MIL-R 10509E	ESTAB. RELI-ABILITY WIRE WOUND MIL-R-39005A	GENERAL PURPOSE WIRE WOUND MIL-R-93D
TEMPERATURE CYCLE	.001%	.25%	.05%	.20%
LOW TEMP OP	.002%	.25%	.01%	.25%
STOL	.001%	.25%	.01%	0.1%
DIELECTRIC STRENGTH AT SEA LEVEL	.001%	.25%	.01%	.25%
MOISTURE RESISTANCE	.005%	.50%	.10%	.25%
TEMPERATURE COEFFICIENT -55°C TO +125°C	0 ± 5 ppm	0 ± 25 ppm	0 ± 10 ppm	0 ± 20 ppm
SHOCK	.001%	.25%	.01%	0.10%
VIBRATION	.001%	.25%	.01%	0.10%
TERMINAL STRENGTH	.002%			
LIFE	.001% @125°C	0.5% @125°C	0.2% @125°C	0.5 @125°C



* Hermetically Sealed Parts Only

TABLE II

STYLE NO.	DIMENSION, ± .010 DIA.	LENGTH	WATTS AT 125°C	MAX. VOLTS	MIN. VALUE	MAX. VALUE VS. WIRE DIA. .001	.0009	.0007	.00045
S185	.188	.500	.12	300	.1 ohms	45.0K	65.0K	120K	600K
S205	.250	.500	.25	300	.1 ohms	80.0K	110K	220K	1.2M
S207	.250	.750	.35	600	.1 ohms	150K	200K	390K	2.0M
S307	.375	.750	.50	300	.1 ohms	250K	340K	650K	3.4M
S308	.312	.815	.50	300	.1 ohms	150K	200K	390K	2.0M
S510	.500	1.000	1.00	600	.1 ohms	1.0M	1.4M	2.7M	10M
*S205H	.233	.687	.25	300	.1 ohms	80.0K	110K	220K	1.2M
*S307H	.312	.875	.50	300	.1 ohms	250K	340K	650K	3.4M

ULTRONIX INC.

PRECISION RESISTORS

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SPECIFICATIONS

STANDARD SERIES

☐ ACCURACY—Standard accuracies are 1%, .1%, .05%, .02% and .01%. Special resistors can be made to .005% accuracy with values and ratios matched to .001%. For more accurate resistors order Ultronix S series which can be supplied to .0025%.

☐ TEMPERATURE COEFFICIENT — Standard T.C.: From −55°C to +125°C is:

0 ±10 ppm, 50 Ω and over	0 ±30 ppm, 1 Ω to 10 Ω
0 ±15 ppm, 10 Ω to 50 Ω	0 ±90 ppm, less than 1 Ω

Special T.C.'s can be supplied in all standard wire alloys from 1 ppm to +5500 ppm/°C over limited temperature ranges.

☐ STABILITY — Long term stability of standard Ultronix resistors under typical operating conditions is better than 30 ppm for the first year, and less than 10 ppm per year in succeeding years. Typical shifts in resistance due to tests run per MIL-R-39005A are per Table I. If greater stabilities are required specify Ultronix S Series resistors.

☐ NOISE — Per MIL-STD-202 tests, noise is not present. Thermal EMF is less than 4 micro volts.

☐ VOLTAGE COEFFICIENT — Less than .01 ppm/volt.

☐ OPERATING TEMPERATURE — Wattages are rated at 125°C. Resistors used at higher ambient temperature, must be derated by a factor of 5% for each degree over 125°C. Normal operating range is −55°C to +145°C. −55°C to +145°C.

☐ MILITARY SPECIFICATION — Standard resistors meet or exceed the requirements of MIL-93D and MIL-R-39005A. Military specification size conversion to Ultronix size is per Table II.

MILITARY SPECIFICATIONS

STYLE NUMBER		ULTRONIX STYLE
MIL-R-93D	MIL-R-39005A	
RB52	RBR52	310A
RB53	RBR53	307A
RB54	RBR54	207A
RB55	RBR55	205A
RB56	RBR56	202A
RB57	RBR57	510A
RB58		515A
RB59		520A
RB71	RBR71	203PA
	RBR74	185A
	RBR75	202A
	RBR76	308A

☐ FREQUENCY CHARACTERISTICS — Ultronix resistors are non-inductive wound. A detail specification of the frequency characteristics of wire wound resistors, in limited space, is difficult. Frequency response is dependent upon the physical dimensions of the resistor, number of pi, distance between the pi, length of wire, or ohmic value, the ratio of wire insulation thickness to wire diameter and winding geometry. All of these items are controllable and may be varied to obtain reactive parameters to match your specified needs. For the large majority of applications however, the small reactance encountered in our resistors is negligible. In general, resistor values above about 10 K will be capacitive, and will not exceed 1 to 3 pfd depending on value. Resistors below 10 K will be inductive and less than 20 microhenries.

If you have specific speed requirements our applications group will be pleased to review them and recommend the resistor type best suited to your needs.

STABILITY	
TEST	ΔR
Load life @125°C	.003%
STOL	.005%
Moisture resistance	.015%
High temp exposure	.005%
Dielectric strength,	.002%
Acceleration,	.002%
Ultrasonic cleaning,	.002%
Shock & Vibration	.002%

☐ LEADS — Standard material is tin coated copper, 2.0 ±.25 inches long. 100 series resistors are supplied with 22 GA, all others, 20 GA. Gold plated nickel and "A" nickel leads are available on request.

S SERIES

☐ ACCURACY — .05%, .02%, .01% & .005% are standard S Series accuracies. Special resistors are supplied to .0025%. Values and ratios can be matched to .001%.

☐ TEMPERATURE COEFFICIENT — Standard T.C. is as follows over the range −55°C to +125°C.

0 ± 7 ppm, 50 Ω and over	0 ±30 ppm, 1 Ω to 10 Ω
0 ±15 ppm, 10 Ω to 50 Ω	0 ±90 ppm, less than 1 Ω

Special T.C.'s are supplied to 0 ±1 ppm over limited temperature ranges. If high T.C. parts are required order Ultronix Standard Series resistors in which T.C.'s are supplied in all available wire alloys to +5500 ppm/°C.

☐ STABILITY — Long term resistance stability of S Series resistors under full power is guaranteed to be within 10 ppm for the first year and 5 ppm per year in succeeding years.

☐ NOISE — is not present per MIL-STD-202 tests. Thermal EMF is less than 4 micro volts.

☐ VOLTAGE COEFFICIENT — Less than .01 ppm/volt.

☐ OPERATING TEMPERATURE — −55°C to +145°C, Wattages are rated at 125°C. Resistors used at higher ambient temperatures must be derated by a factor of 5% for each degree over 125°C.

☐ FREQUENCY CHARACTERISTICS — Ultronix resistors are non-inductively wound. A detail specification of the frequency characteristics of wire wound resistors, in limited space, is difficult. Frequency response is dependent upon the physical dimensions of the resistor, number of pi, distance between the pi, length of wire, or ohmic value, the ratio of wire insulation thickness to wire diameter, and winding geometry. All of these items are controllable and may be varied to obtain reactive parameters to match your specified needs. For the large majority of applications, however, the small reactance encountered in our resistors is negligible. In general, resistor values above about 10 K will be capacitive, and will not exceed 1 to 3 pfd depending on value. Resistors below 10 K will be inductive and less than 20 microhenries.

If you have specific speed requirements our applications group will be pleased to review them and recommend the resistor type best suited to your needs.

☐ LEADS — Standard material is tin coated copper, 2.0 ±.25 inches long. 100 series resistors are supplied with 22 GA, all others, 20 GA. Gold plated nickel and "A" nickel leads are available on request.

ULTRONIX INC. POWER RESISTORS

TECHNOLOGICAL LEADERSHIP IN PASSIVE COMPONENTS

P.O. BOX 1090 ■ 461 NORTH 22ND ST., GRAND JUNCTION, COLO. 81501 ■ PH. (303) 242-0810 ■ TWX (910) 929-6965
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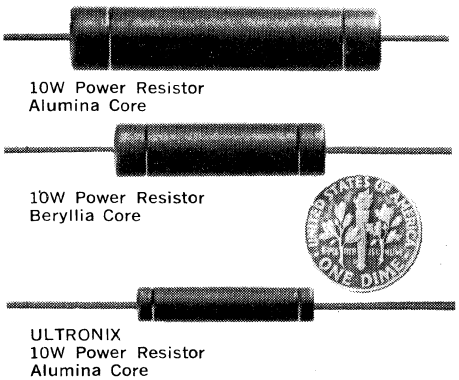
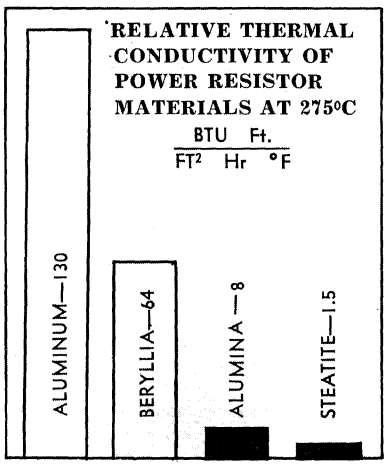
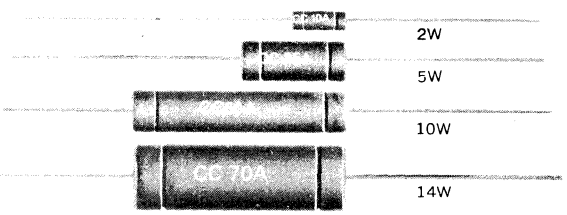
HIGHER POWER OR SMALLER SIZE



The size differential between 10 watt power resistors with alumina cores, beryllia cores and the ULTRONIX aluminum cores is graphically shown at left. An ULTRONIX power resistor with solid aluminum core requires ⅓ the volume of a beryllia core resistor, and 1/14 the volume of an alumina core resistor—at the same power ratings. These power/size advantages mean you can double the power and operate at the same temperature of an equal size beryllia core resistor—or you can operate at the same power levels and temperatures with a resistor size ⅓ the volume of a beryllia core resistor.



FOUR STANDARD POWER RATINGS



ULTRONIX, DIKRAN vs. CONFORMAL SILICON

Coating Material Comparison

	Silicon Coatings	Ultronix
DIALECTRIC STRENGTH	800 Volts/MIL	3400 Volts/MIL
WATER ABSORPTION (%/24 hr)	0.15	0.05
THERMAL CONDUCTIVITY (CAL-CM)/(Sec-CM²-°C)	35 x 10⁻⁵	80 x 10⁻⁵
MAX OPER TEMPERATURE	500°F	700°F
CHEMICAL RESISTANCE	Poor	Excellent

ULTRONIX PART NO.	MIL-R-26D	MIL-R-39007 A	POWER @25°C: MIL SPEC RATING FOR APPLICABLE SIZE	POWER @25°C: ULTRONIX RATING	MIN. RESIS.	MAX.* RESIS. (.0007 Wire)	MAX. WORKING VOLTAGE	LENGTH	DIA.	LEAD SIZE	LEAD LENGTH
CC10A	RW81	RWR 81	1 W	2 W	1.0 Ω	4K Ω	34 VDC	.250 ±.031	.085 ±.031	22 AWG	2.00 ±.125
CC25A	RW79	RWR 89	3 W	5 W	0.1 Ω	15K Ω	135 VDC	.530 ±.031	.187 ±.031	20 AWG	2.00 ±.125
CC50A				10 W	0.1 Ω	40K Ω	280 VDC	1.00 ±.062	.187 ±.031	20 AWG	2.00 ±.125
CC70A				14 W	0.1 Ω	65K Ω	450 VDC	1.000 ±.062	.312 ±.031	20 AWG	2.00 ±.125

* Higher ohmic values available with finer wire.

Ultronix Power Resistors are manufactured in two series; the CC Series and the MS Series. These resistors are in conformance with the Ultronix basic philosophy of providing superior components through technological advancements. Both series boast the proven benefits of the new dielectrically coated solid aluminum core. This feature alone gives Ultronix power resistors cooler operation and greater stability than competitive units. By combining the aluminum core with Ultronix high emmisitivity DIKRAN conformal encapsulant, we have made the CC Series which is fully qualified to the High Reliability Resistor Specification MIL-R-39007 and in addition gives complete solvent and moisture resistance, smallest size, and eliminates harmful outgassing. The MS Series Resistor encapsulates the aluminum core in molded silicone. The molded encapsulation eliminates body to lead meniscus and gives highly repeatable physical dimensions. These features make the MS Series ideally adaptable to automatic insertions and still retain the aluminum core's inherent superior stability as well as Military Specification moisture and solvent resistance.

ULTRONIX INC.

POWER RESISTORS

TECHNOLOGICAL LEADERSHIP IN PASSIVE COMPONENTS

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WIRE WOUND POWER RESISTORS MOLDED SILICONE SERIES

- ☐ MOLDED SILICONE ENCAPSULANT
- ☐ HIGH STABILITY
- ☐ SMALL SIZE
- ☐ SOLVENT RESISTANT
- ☐ MOISTURE RESISTANT
- ☐ ALL WELDED CONSTRUCTION
- ☐ MEETS OR EXCEEDS MIL-R-39007A & MIL-R-26D

DESCRIPTION — Supplied in many miniaturized sizes from 1 to 7 watts, Ultronix resistors feature durable, die molded silicone bodies and aluminum cores and fill the needs of the most demanding military and commercial applications. MS resistors offer improved stability, clip mounting capabilities, and are ideally suited to automated circuit assembly techniques.

APPLICATION — Size and shape repeatability of ±.005", within each production lot, makes these components ideal for high speed automated circuit assembly. Consistent clean lead to clean lead dimensions with complete lack of meniscus eliminates cracks during automated lead bending. The high density of SILCAP coating combined with uniform body size and shape allow these resistors to be clip mounted for heat sink purposes with no insulation breakdown. Resistor power rating can be doubled by heat sinking to a metal surface equivalent to .040" thick aluminum with an area of 1.5 square inches per watt.

DESIGN AND OPERATIONAL FEATURES — Ultronix pioneered the use of dielectrically coated aluminum as power resistor core material. Aluminum's higher thermal conductivity assures optimum heat dissipation, and minimizes "hot spot", one of the major causes of resistor instability. MS series resistors demonstrate stabilities typically twice as good as required by MIL-39007A (see figure 1). End caps are of stainless steel selected for its compatibility with the resistance wire, to minimize thermal EMF. SILCAP, the Ultronix molded encapsulant, is a dense, uniformly thick protective coating of pure silicone polymer which gives vastly superior solvent and moisture resistance over the commonly used co-polymer silicone conformal coatings. Complete lot traceability is maintained throughout all operations, another Quality Assurance benefit from Ultronix.

SPECIFICATIONS

ACCURACY: Standard tolerances are 5%, 3%, and 1%, closer tolerance is available on request.

TERMINALS: Tinned, copperweld leads are standard, Grade "A" nickel, untinned, available on request.

CORE: Aluminum core for high heat dissipation.

ELEMENT: Low temperature coefficient, High resistivity, nickel chrome alloys.

DIELECTRIC: 500VAC for MS-1 & MS-2, 1000VAC for others.

INSULATION RESISTANCE: Measured terminal to core equals 10^5 meg ohms minimum at 25°C, and 10^4 meg ohms minimum at 300°C.

END CAPS: Stainless steel end caps to minimize thermal EMF.

SHORT TIME OVERLOAD: Three seconds at 5 times rated power for MS-1 & MS-2. Others, 3 seconds at 10 times rated power.

INDUCTANCE: Less than 5μh.

ENCAPSULATION: Ultronix SILCAP, pure silicone polymer molding material.

STABILITY: MS Series stabilities are typically twice that required per MIL-R-39007A and are shown in Fig. 1.

TEMPERATURE COEFFICIENT:
Less Than 1 Ohm .....±90 ppm
1 Ohm to Below 10 Ohms .....±50 ppm
10 Ohms and Above .....±20 ppm

TEST	MIL-R-39007A REQUIRED Δ R	MS SERIES MAXIMUM Δ R
Life 1000 Hour	± .5% + .05 Ohm	± .3% + .05 Ohm
Temperature Cycle	± .2% + .05 Ohm	± .1% + .05 Ohm
Moisture Resistance	± .2% + .05 Ohm	± .1% + .05 Ohm
Short Time Overload	± .2% + .05 Ohm	± .1% + .05 Ohm
Dielectric	± .1% + .05 Ohm	± .05% + .05 Ohm
Shock	± .1% + .05 Ohm	± .05% + .05 Ohm
Vibration	± .1% + .05 Ohm	± .05% + .05 Ohm
Terminal Strength	± .1% + .05 Ohm	± .05% + .05 Ohm

RESISTOR SIZES

Ultronix Style	MIL-R-39007A	MIL-R-26D	Power Rating @ 25°C	Min. Resis. Value	Max.* Resis. Value (.001 wire)	Max. Working Voltage	Length	Dia.	Lead Size	Lead Length
MS-1	RWR 81	RW 81	1 Watt	0.1 Ω	464 Ω	25 VDC	.250 ±.031	.085 ±.020	24 AWG	1.5 Min.
MS-2	RWR 80	RW 70	2 Watts	0.1 Ω	1,210 Ω	50 VDC	.406 ±.031	.094 ±.031	24 AWG	1.5 Min.
MS-3	RWR 89	RW 79	3 Watts	0.1 Ω	3,570 Ω	110 VDC	.560 ±.062	.187 ±.031	20 AWG	1.5 Min.
MS-7	RWR 84	RW 74	7 Watts	0.1 Ω	12,400 Ω	300 VDC	.875 ±.062	.312 ±.031	18 AWG	1.5 Min.

* Higher ohmic value available with finer wire.

ULTRONIX INC.

POWER RESISTORS

TECHNOLOGICAL LEADERSHIP IN PASSIVE COMPONENTS

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CC SERIES, WIRE WOUND POWER RESISTORS

- ☐ SMALLEST SIZE
- ☐ SOLVENT RESISTANT
- ☐ NO OUTGASSING
- ☐ IMPERVIOUS TO MOISTURE
- ☐ HIGH STABILITY
- ☐ MEETS OR EXCEEDS MIL-R-39007A
- ☐ LOWER OPERATING TEMPERATURES

DESCRIPTION — Ultronix CC Series Power Resistors offer the smallest package size available in the industry for a given power rating due to the greater thermal conductivity of the solid aluminum core and the high emissivity of the Ultronix encapsulating material, DIKRAN. Ultronix aluminum cores have twice the heat conductivity of beryllia and 16 times that of common alumina core.

Ultronix encapsulation material DIKRAN, unlike common silicone conformal coatings, is completely impervious to all solvents encountered in cleaning operations. The resilience and excellent adhesion factor of DIKRAN gives superior moisture resistance, and eliminates the shelf life and low power moisture problems of competitive power resistors. DIKRAN's extreme stability does away with outgassing and the associated open contact contamination caused by silicone coated resistors. These features of higher thermal conductivity, elevated temperature capabilities, and superior environmental resistance, make CC Series Power Resistors the most reliable units available in the industry today.

APPLICATION — Ultronix CC Series Power Resistors are specifically designed for applications which can not be satisfied by standard power resistors, and for those critical applications requiring the utmost in reliability. Review the following comparison, under Design and Operational Features to determine if your application could be better satisfied by Ultronix CC Series Power Resistors.

DESIGN AND OPERATIONAL FEATURES

CC SERIES DIKRAN COATED ALUMINUM CORE POWER RESISTORS	SILICONE COATED CERAMIC CORE POWER RESISTORS
Are truly moisture resistant	Absorb moisture, have shelf life and low power corrosion problems under moisture conditions.
Have minimal outgassing of non-contaminating material.	Outgas silicone which contaminates open contacts.
Are solvent resistant	Dissolve in chlorinated solvents used in circuit board cleaning.
Operate at lower, more even temperatures, improving stability 2 to 1	Develop "hot spots" and associated instabilities.
Are 1/3 to 1/10 the volume of equally rated resistors	Waste space
Are clip mountable under all conditions with up to 200 VDC differential, restistor to chassis.	Develop insulation breakdown if clip mounted, particularly under moisture conditions.
Are capable of operating at higher temperatures (maximum 700°F)	Maximum 500°F

SPECIFICATIONS

ACCURACY: Standard tolerances are 5%, 3%, and 1%, closer tolerance is available on request.

TERMINALS: Tinned, copperweld leads are standard, Grade "A" nickel, untinned, available on request. For nickel leads derate power rating 30%.

CORE: Aluminum core for high heat dissipation.

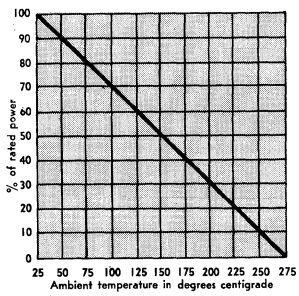
ELEMENT: Low temperature coefficient, high resistivity, nickel chrome alloys.

DIELECTRIC: 500VAC for CC10A (2 watt), 1000 VAC for all others.

INSULATION RESISTANCE: Measured terminal to core equals 10^5 meg ohms minimum at 25°C, and 10^4 meg ohms minimum at 300°C.

END CAPS: Stainless steel end caps to minimize thermal EMF.

STABILITY: Due to the unique construction and the efficient heat dissipation of the aluminum core, stability is inherently greater.



POWER DERATING CURVE FOR HIGH AMBIENT TEMPERATURES — ULTRONIX Type CC aluminum core resistors operate in a normal temperature range of −55°C to +275°C. At higher temperatures in this range, they must be derated. The power derating curve shows the percent of rated power at varying ambient temperatures.

SHORT TIME OVERLOAD:

CC10A 5x Ultronix rated power for 3 seconds
CC25A 5x Ultronix rated power for 5 seconds
CC50A 10x Ultronix rated power for 5 seconds
CC70A 10x Ultronix rated power for 5 seconds

INDUCTANCE: Less than 5μ h.

TEMPERATURE COEFFICIENT: Over the temp. range of −55°C to +275°C

Less Than 1 Ohm — ±90 ppm
1 Ohm to Below 10 Ohms — ±50 ppm
10 Ohms and Above — ±20 ppm

Special TC is available upon request.

ULTRONIX INC.

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RESISTIVE NETWORKS R-2R

TECHNOLOGICAL LEADERSHIP IN PASSIVE COMPONENTS

DIGITAL ⇔ ANALOG CONVERTER NETWORKS, R-2R SERIES

DESCRIPTION — Ultronix R-2R resistive networks are high reliability ladder adder circuits. By addition of a comparator and associated clock and gate logic to the network output, R-2R networks may also be used for analog digital conversion.

Techniques used in producing these highly stable ladder networks make possible straight binary conversion to 14 bits with ±½ least significant bit accuracy giving a capacity of recognition of 1 part in more than 30,000. Networks are designed to stay within ±½ LSB accuracy over their rated temperature range for the life of the unit.

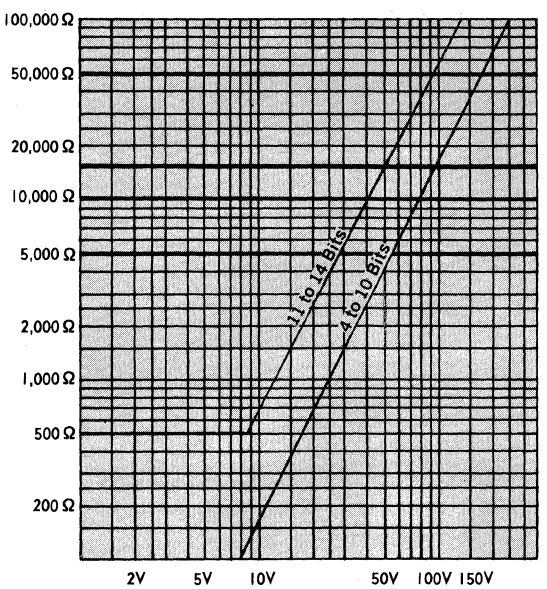
APPLICATION — Ultronix converter networks have been selected for demanding applications in many United States aerospace programs. They have performed on the moon in Surveyor I and III as well as in F-4 and F-111 Aircraft. Any application which requires the accurate conversion of binary coded signals to analogs, or analog signals to binary is a possible application for ULN series converter networks.

The accuracies shown in Table 1 take into consideration resistance variations due to temperature change over the networks rated temperature range. Table II is provided to allow determination of the minimum value of "R" to be used with a given binary input voltage to maintain the accuracies and stabilities specified. The value of "2R" may be compensated to take into consideration the internal resistance of the related switching device if necessary.

Long term stability is specified in Table 1 in parts per million variation of output voltage with respect to input voltage, or variation of binary weighting, under constant operating temperature for one year.

DESIGN AND OPERATIONAL FEATURES — ULN 100 and ULN 150 networks are packaged in Diallyl Phthalate boxes and utilize all welded construction. The ladder circuits are made of Ultronix ultrastable, high reliability wire wound resistors that meet or exceed the requirements of MIL-R-93D and MIL-R-39005A. Special configurations can be supplied to meet your specific requirements.

SERIES	NO. OF BITS	2^n WHERE n=NO. OF BITS	OPERATING TEMPERATURE RANGE	ACCURACY TO FULL SCALE	STABILITY (Long Term)	SPEED TO SETTLE TO ½ LSB*
100/150	4	16	-55 to + 125°C	±.05%	±20 ppm/yr	0.1 μ sec
100/150	5	32	-55 to + 125°C	±.05%	±20 ppm/yr	0.1 μ sec
100/150	6	64	-55 to + 125°C	±.05%	±20 ppm/yr	0.1 μ sec
100/150	7	128	-55 to + 125°C	±.05%	±20 ppm/yr	0.1 μ sec
100/150	8	256	-55 to + 125°C	±.05%	±20 ppm/yr	0.2 μ sec
100/150	9	512	-55 to + 125°C	±.05%	±20 ppm/yr	0.2 μ sec
100/150	10	1,024	-55 to + 125°C	±.05%	±20 ppm/yr	0.5 μ sec
100/150	11	2,048	-55 to + 125°C	±½ LSB* (±.025%)	±20 ppm/yr	0.5 μ sec
100/150	12	4,096	-55 to + 125°C	±½ LSB (±.012%)	±20 ppm/yr	1.0 μ sec
100/150	13	8,192	-25 to + 75°C	±½ LSB (±.006%)	±10 ppm/yr	1.0 μ sec
100/150	14	16,384	0° to + 50°C	±½ LSB (±.003%)	±10 ppm/yr	2.0 μ sec
200	4	16	0° to + 50°C	±½ LSB (±6.25%)	±50 ppm/yr	0.1 μ sec
200	5	32	0° to + 50°C	±½ LSB (±3.12%)	±50 ppm/yr	0.1 μ sec
200	6	64	0° to + 50°C	±½ LSB (±1.56%)	±50 ppm/yr	0.1 μ sec
200	7	128	0° to + 50°C	±½ LSB (± .78%)	±50 ppm/yr	0.1 μ sec
200	8	256	0° to + 50°C	±½ LSB (± .39%)	±50 ppm/yr	0.2 μ sec



1. Part number. Show as:

ULN 100 12 10K / 20K

Type
Number of bits
R (ohms)
2R (ohms)

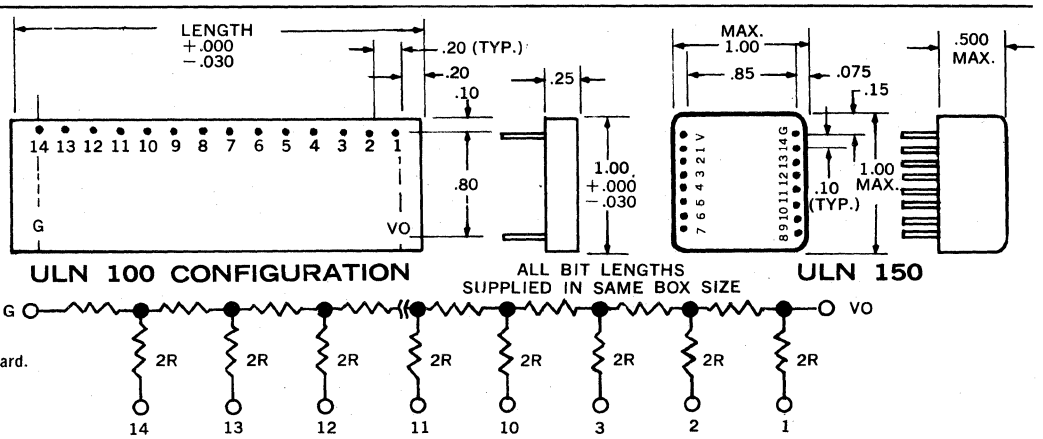
Special Features, if Required

Speed requirements.
Feed-back or attenuating resistor.
Compensation for transistor switch resistance.
Show your circuit modifications.

NO. BITS	LENGTH
3	0.80
4	1.00
5	1.20
6	1.40
7	1.60
8	1.80
9	2.00
10	2.20
11	2.40
12	2.60
13	2.80
14	3.00

22 AWG gold plated nickel leads, 1" min. length standard.

All Tolerances ±.010 unless otherwise specified

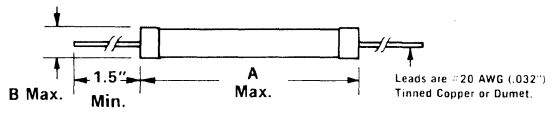


VICTOREEN RESISTORS

When You Require Precision Resistors for Ultracritical Applications Involving

HIGH VOLTAGE · HIGH IMPEDANCE · HIGH STABILITY · HIGH WATTAGE

TYPE MOX (Metal Oxide Glaze) RESISTORS



Type Number	Resistance Range	Wattage Rating @ 70°C	Max* Oper Voltage	Max. Oper Temp	Dimensions, inches A	Dimensions, inches B	Encapsulation
MOX-400	2500 megohms	.25	1000 V	220°C	.420±.050	.130±.010	Si Conformal
MOX-750	5000 megohms	.50	2000 V	220°C	.790±.050	.130±.010	Si Conformal
MOX-1125	10,000 megohms	1.00	5000 V	220°C	1.175±.060	.130±.010	Si Conformal
MOX-1	500 megohms	2.5	7500 V	220°C	1.062±.060	.284±.010	Si Conformal
MOX-2	1000 megohms	5	15,000 V	220°C	2.062±.060	.284±.010	Si Conformal
MOX-3	1500 megohms	7.5	22,500 V	220°C	3.062±.060	.284±.010	Si Conformal
MOX-4	2000 megohms	10	30,000 V	220°C	4.000±.060	.284±.010	Si Conformal
MOX-5	2500 megohms	12.5	37,500 V	220°C	5.062±.060	.284±.010	Si Conformal

*Applicable above critical resistance

MOX-1E — MOX-5E in same values with diameter (**B**) $.315^{+.030}_{-.020}$

2 and 5% available in all values. 1% to 1000 megohms.

Temp Coefficient: This parameter varies with resistance value. Coefficients of 150 ppm in the low resistance values can be maintained, increasing to 2000 ppm in the higher values.

Voltage Coefficient: This parameter also depends on resistance value. Where a low voltage coefficient is required, it is possible to obtain values of 5 ppm or less.

Stability: Better than ±2% for 2000 hours at full load for MOX-400, -750, -1125; better than ±1% for 2000 hours for MOX-1 through -5.

Insulation Resistance: Adequate to 750 volts; with our special epoxy versions MOX-1E — MOX-5E available. This increases to 6000 volts with an attendant loss of power handling capabilities.

Standard Tolerances: For MOX-1 through -5, 1%, 2% and 5% available in all types and values. 2 and 5% available in all values. 1% to 1000 megohms. For MOX-400, -750, and -1125, 1% to 2000 megohms, 2% to 5000 megohms, 5% to 10,000 megohms. ½% in limited values on request.

For Less Critical Applications Involving HIGH VOLTAGE · HIGH IMPEDANCE HIGH WATTAGE

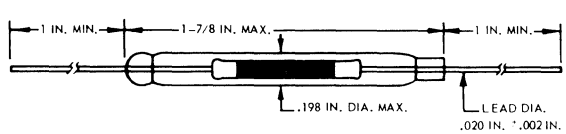
VARNISHED CARBON RESISTORS

HV Series High Voltage Resistors Features—Resistances from .01—25,000 megohms. Power ratings: Radial lug 1—10W; axial lead 1—5W. Max working voltages: Radial lug 3500—40,000 volts; axial lead 3500—30,000 volts.

HP Series High Power Resistors Features — Radial band type. Resistances 0.5—100,000 megohms. Power ratings 12—100W. Max working voltages 15—125 KV.

HF Series High Frequency Resistors — Elements are applied as a solid coating resulting in low inductance. Features: Resistances 20 ohms—100 megohms. Power ratings: Radial lug 1—10W; radial band 12—90W; axial lead 1—5W. Max working voltages: Radial lug 375—3100; radial band 1250—8500; axial lead 375—1500 volts.

TYPE RX-1 HI-MEGOHM RESISTORS



Features — Hi-Megohm resistors continue to be Victoreen's forte and the Type RX-1 series is pre-eminent as the most reliable of its type. Manufactured in accordance with MIL-R-14293A, characteristic T. Carbon coated glass rod resistor element banded with silver for electrical contact. Special silicone varnish coating. Noise level negligible. Available in resistances from 10^7—10^{14} ohms. Power rating is 1 divided by resistance in megohms. Tolerance 1% below 10^{12}, 2% and 5% below 10^{13} ohms, 10% over entire range. Max working voltage 1000V. Max ambient temperature 100°C.

VICTOREEN INSTRUMENT DIVISION
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VICTOREEN

A-3505

WELWYN RESISTORS

RELIABILITY IN RESISTORS — FROM 0.1 Ω TO 1,000,000 Meg.

MINIATURE OXIDES to MIL-R-22684B

Type	Rating Watts	MIL Type	Dielectric Strength	Rated Voltage	Resistance Range Min.	Max.
F07	1/4	RL-07	1000V	250 Volts	47 Ω	150K
F20	1/2	RL-20	1000V	350 Volts	10 Ω	470K

TYPE	LGTH.		DIA.		LEADS	
F07	.250″	±.031″	.090″	±.008″	.025″	±.002″
F20	.375″	±.025″	.145″	±.005″	.032″	±.002″

TOLERANCE: STD. AT ±1%, ±2% AND ±5%

IDENTIFICATION: STD. COLOR BANDING

PRICES: .033 - .30 (Bulletin M3B)

PLUS A COMPLETE LINE OF FLAMEPROOF POWER OXIDES, 2 - 10 WATT (BULLETIN M5).

PRECISION METAL FILM to 150 MEG.

Type No.	Resistance Range	T.C. in PPM	Wattage Rating @ 70°C	125°C	Dimensions L	D
M11E	50Ω — 250K	25	½	¼	.470″	.145″
M11C	10Ω — 1 Meg.	50				
M11D	10Ω — 1 Meg.	100				
M11	High Value 1.1 Meg. to 10 Meg.	150				
M12E	50Ω — 500K	25	1	½	.625″	.205″
M12C	10Ω — 2 Meg.	50				
M12D	10Ω — 2 Meg.	100				
M12	High Value 2.1 Meg. to 25 Meg.	150				
M13E	50Ω — 1 Meg.	25		1	.840″	.285″
M13C	10Ω — 3 Meg.	50				
M13D	10Ω — 3 Meg.	100				
M13	High Value 3.1 Meg. to 50 Meg.	150				
M14E	120Ω — 2 Meg.	25	2W @ 100°C		2.000″	.285″
M14C	40Ω — 5 Meg.	50				
M14D	10Ω — 10 Meg.	100				
M14	High Value 10.1 Meg. to 150 Meg.	150				

TOLERANCE: 1% STD. ALSO .05% AND 0.25% (Bulletin M14C)

PRICE: .10 - 4.50

HIGH VOLTAGE OXIDES

Welwyn Type	Watts @ 40°C	Termination	Dimensions L	D	**Working Voltage	Pulse Voltage	Temp. Rise	Tolerance	Resistance Range Min.	Max.
F43D	½	Standard Wire Leads	1.094″	0.312″	4KV	15KV	26°C	± 2%	2M	3,000M
F43KU	½	Comb. Lead/Threaded Cap	1.188″	0.312″	4KV	15KV	26°C	± 5%	2M	100,000M
*F43TU	½	Threaded Caps, Both Ends	1.280″	0.312″	4KV	15KV	26°C	±10%		
F44D	1	Standard Wire Leads	2.000″	0.312″	14KV	50KV	36°C	± 2%	2M	10,000M
F44KU	1	Comb. Lead/Threaded Cap	2.094″	0.312″	14KV	50KV	36°C	± 5%	2M	150,000M
*F44TU	1	Threaded Cap, Both Ends	2.187″	0.312″	14KV	50KV	36°C	±10%		

* 10-32 x 5/16″ Coupling Stud Supplied with Each Unit. TOLERANCE STD. AT ±2% AND ±5% PRICES: 1.10 to 3.50 (Bulletin M7C)

ULTRA LOW VALUES

TYPE	WATTS	% TOL.	LGTH.	DIA.	RESISTANCE RANGE MIN.	MAX.
A20	1/2	1, 2, 5	.375″	.145″	0.1 Ω	9.9 Ω
A31	1-1/2	2, 5, 10	.6875″	.203″	0.27 Ω	27 Ω
A32	3	2, 5, 10	.8906″	.328″	0.27 Ω	27 Ω

PRICES: .075 - .95 (BULLETINS LV10A)

ULTRA HIGH VALUES (GLASS ENCLOSED)

TYPE	LGTH.	DIA.	STD. TOL.	RESISTANCE RANGE MIN.	MAX.
M51	1-5/8″	1/4″	±1%, ±2%, ±5%	10 Meg.	1,000,000 Meg.

Manufactured by an entirely new process utilizing Welwyn-developed CEROX. The performance of this component is significantly superior to any other similar item now available.

PRICES: 2.20 - 21.00 (BULLETIN HV8B)

ATTENUATOR PADS

WRITE FOR BULLETIN AP13 COVERING OUR EXTENSIVE LINE OF PADS.

NEW MINIATURE HIGH VALUE

MH51 ½″ x 9/64″ ±10, 20%, 30 Meg. to 5,000 Meg. VC — 1 PPM/Volt, 5 KV Pulse (BULLETIN HV9)

WELWYN NOW MARKETING & WAREHOUSING BEYSCHLAG OF WEST GERMANY

SUPERIOR QUALITY 5% DEPOSITED CARBONS PRICED COMPETITIVELY WITH COMPS

Europe's leading supplier of deposited carbon resistors Beyschlag products are now being stocked in depth both in the U.S.A. and Canada. Quality control at every step in the production process, coupled with highly automated manufacturing technique, guarantees the enviable reputation for quality and reliability that Beyschlag have earned throughout the world for over 20 years.

Type	Wattage @ 40°C	70°C	L	D	Wkg. Volt	Tol.	Range
BB	3/8	1/4	.250″	.098″	150	5%	10 Ω - 1 M
						2%	10 Ω - 1 M
B1/8	1/2	1/3	.325″	.114″	250	5%	1 Ω - 1 M
						2%	4.7 Ω - 1 M
B1/3	3/4	1/2	.475″	.166″	500	5%	1 Ω - 10 M
						2%	1 Ω -5.1 M
B1/2	1	2/3	.550″	.236″	630	5%	4.7 Ω - 22 M
						2%	4.7 Ω -5.1 M
B1	2	1 1/3	.740″	.355″	750	5%	10 Ω - 22 M
						2%	10 Ω -5.1 Ω

(BULLETIN WB-1)

ALL PRICES SHOWN FOR GUIDANCE ONLY. SPECIFIC PRICES SUBJECT TO VALUE, TOLERANCE, QUANTITY AND SPECIFICATION.

USA: WELWYN INTERNATIONAL, INC. • 811 SHARON DR. • WESTLAKE, OHIO • (216) 871-8900 • TWX 810-427-9125 • CABLE WELINT • TELEX 00985276

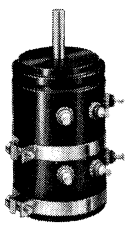
CANADA: WELWYN CANADA LTD. • P.O. BOX 2484 • 1255 BRYDGES ST. • LONDON, ONT. • CAN. • (519) 451-9490 • CABLE WELCAN • TELEX 024-843

GAMEWELL® precision potentiometers

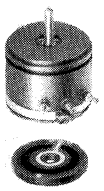
CUSTOM-ENGINEERED WIRE WOUND AND CONDUCTIVE PLASTIC TYPES

...FOR YOUR MOST DEMANDING APPLICATIONS—Higher standards of performance at competitive prices are being demanded of today's electronic equipment. How does the precision pot stack up in this situation? It almost becomes a necessity. With Gamewell you specify exactly what you want — *no* more and *no* less! Gamewell precision pots pay off in the long run. They're tough. They're dependable. And they're remarkably precise. In most cases they actually cost less, when all is considered, than so called "economy" pots. Choice? You tell us. We can do — note the broad line of types shown below. These types represent but a small segment of the scope of Gamewell's *craftsmanship*. Let your pot requirements take a turn for the better; call in your local Gamewell representative today or write for a copy of our new detailed pot catalog.

WIRE WOUND OR CONDUCTIVE PLASTIC ELEMENT, SINGLE-TURN METAL-CASED MODELS LINEAR—NON-LINEAR



MODEL (WW)		8WB	8W	10WB	12W	14WB	14W	17W	17SC*	17SC-2BR*	18W	18SC*
MODEL (CP)		—	8C	—	—	—	14C	17C	—	—	18C	18C—
Size		½	½	⅝	¾	⅞	⅞	1 1/16	1 1/16	1 1/16	1⅛	1⅛
Resistance Range	WW	50-55K	50-55K	50-40K	100-50K	100-100K	100-100K	125-120K	1K-35K	1K-35K	140-140K	300-20K Per Quad
Ohms (Std.)	CP	—	500-20K	—	—	—	500-20K	1K-20K	—	—	1K-20K	
LINEARITY (Std.) ±%	WW	3.0	1.0	0.5	0.5	1.0	0.5	0.5	1% Conf.	1.5% Conf.	0.5	1% Conf.
	CP	—	1.0	—	—	—	0.5	0.5	—	—	0.5	Spec.

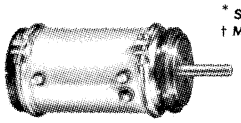


MODEL (WW)		21W	23W	26W	28W	30XS*	30XS ¼*	32W	32SC*	32MP†	48W	48SC*
MODEL (CP)		21C	23C	26C	28C	—	—	32C	32C—	32C—	48C	48C—
Size		1 5/16	1 7/16	1⅝	1¾	1⅞	1⅞	2	2	2	3	3
Resistance Range	WW	160-145K	200-155K	200-175K	250-200K	2K-80K	2K-80K	300-225K	500-60K Per Quad	100-475K	500-260K	1K-80K Per Quad
Ohms (Std.)	CP	1K-20K	1K-25K	1K-30K	1K-40K	—	—	1K-50K		1K-50K	5K-100K	
Linearity (Std.) ±%	WW	0.3	0.25	0.25	0.25	0.7% Conf.	0.7% Conf.	0.15	0.6% Conf.	0.3	0.1	0.5% Conf.
	CP	0.5	0.4	0.35	0.35	—	—	0.3	Spec.	0.3	0.25	Spec.

Note: Precision units are usually supplied with servo mounting flanges — bushing or 3-hole mountings are available when specified.

* *SINE COSINE MODELS*
† *MODULAR TYPE*

WIRE WOUND MULTITURN MODELS — 10 TURN 3 AND 5 TURNS AVAILABLE



MODELS	140	230	290
Size (OD-Inches)	⅞	1 7/16	1 13/16
Resistance Range (Ohms)	125-300K	250-400K	400-600K
Linearity (Std.) ±	±0.25%	±0.2%	±0.15%

WIRE WOUND SINGLE TURN PLASTIC-CASED MODELS



MODELS	A or B	A or B	A or B	A or B	A or B
Size (OD-Inches)	1¼	1⅝	2	3	5
Resistance Range (Ohms)	100-75K	150-110K	175-150K	300-260K	500-600K
Linearity (Std.) % ±	±0.25	±0.2	±0.15	±0.1	±0.07

"A" means non-phaseable "B" means phaseable (clamp rings)

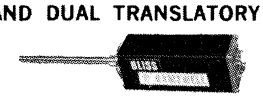
SINE COSINE MODELS

MODEL	RL11*	RL14*
Size	2 5/16	4⅜
Resistance	16K (Std.	34.4K (Std.)
Conf. (P to N)	±0.8%	±0.6%

° Sine cosine types (Not illustrated)

All above models may be ganged when specified except for RL models

SINGLE AND DUAL TRANSLATORY MODELS

LINEAR  NON-LINEAR

Model 20T square case 1¼" — advise stroke length needed.

Stroke (Inch)	1.25	2.50	5.00	8.00	12.00	14.00	16.00
OA Length (Inch)	2.5	3.75	6.25	9.25	13.158	16.50	17.338
Resistance Range	100 Ohms to 40K Ohms/Inch for All Strokes ±5% Std.						
Linearity-Conf.	Independent Lin. ±1% Std. — Non-Linear Conf. ±0.5% Std.						

Conductive plastic and wire wound elements available in translatory models. ***"Elements Only" to Your Specification. Send for Details.***

FIRST...WHEN PRECISION COUNTS!

Member of VRCI

Now available from:

Eagle Signal Division
E.W. Bliss Company
A GULF + WESTERN COMPANY

736 Federal Street
Davenport, Iowa 52803

AMPHENOL POTENTIOMETERS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MICROPOT® PRECISION POTENTIOMETERS

	Size in Inches				Amphenol Model No.	Standard Resistance Range in Ohms	Standard Resistance Tolerance	Linearity Tolerance		Temperature Range
	Diameter	Length	Shaft Dia.					Standard	Minimum Practical	
SINGLE TURN	7/8	.797	1/8		2540	10 to 100K Range A	≤10K ±5% >10K ±3%	≤50Ω ±1.0% 100-250Ω ±0.75% >500Ω ±0.5%	±0.25%	—55°C to +150°C
	1 1/8	.593	1/8		2550	10 to 100K Range A	≤10K ±5% >10K ±3%	≤50Ω ±1.0% 100-500Ω ±0.75% >500Ω ±0.5%	±0.25%	—55°C to +150°C
	1 5/8	.818	1/4		2560	10 to 100K Range A	≤5K ±5% >5K ±3%	≤800Ω ±1% >800Ω ±0.5%	±0.15%	—55°C to +150°C
	2	1.018	1/4		2580	20 to 125K Range B	≤5K ±5% >5K ±3%	≤50Ω ±1% >50Ω ±0.5%	±0.15%	—55°C to +150°C
	3	1.018	1/4		2590	20 to 200K Range C	≤5K ±5% >5K ±3%	±0.5%	±0.1%	—55°C to +150°C
	1 7/16	.656	1/4		3460	100 to 50K Range D	±5%	±0.5%		—55°C to +125°C
3-TURN	7/8	1.055 Serv. .930 Bush.	1/8		2130	10 to 50K Range J	10-30Ω ±5% 100-50K ±3%	±0.5%	±0.1%	—55°C to +125°C
	1 3/4	1 31/64	1/4		205-3T[1]	10 to 50K Range F	10Ω ±10% 50-50K ±3%	±0.5%	±0.1%	—55°C to +105°C
	2	1 3/8 Serv. 1 7/16 Bush.	1/4		930[2]	20 to 50K Range H	≤100Ω ±10% >100Ω ±3%	±0.25%	±0.05%	—55°C to +125°C
10-TURN	7/8	1.182	1/4		4100	100 to 100K Range M	100-100K ±5%	±0.25%	±0.05%	−55°C to +125°C
	7/8	1.455	1/4		2150	25 to 100K Range K	25-50Ω ±5% 100-100K ±3%	±0.25%	±0.05%	—55°C to +105°C
	7/8	1.455	1/8		2160	25 to 100K Range K	25-25Ω ±5% 100-100K ±3%	±0.25%	±0.05%	—55°C to +105°C
	7/8	1.455	1/4		2170[1]	25 to 100K Range K	25-50Ω ±5% 100-100K ±3%	±0.15%	±0.05%	—55°C to +105°C
	7/8	1.573 Serv. 1.448 Bush.	1/8		2100	25 to 120K Range I	25-25Ω ±5% 100-100K ±3% 120K ±5%	±0.25%	±0.05%	—55°C to +125°C
	1 13/16	2 1/8	1/4		2200	25 to 300K Range L	25-50Ω ±5% 100-100K ±3% 200K ±5%	≤100Ω ±0.5% 100Ω-200K ±0.25% ≥200K ±0.5%	±0.05%	—55°C to +105°C
	1 13/16	2 1/8	1/4		2220	25 to 300K Range L	25-50Ω ±5% 100-100K ±3% 200K ±5%	±0.25% ±0.15% ±0.25%	±0.05%	—55°C to +105°C
	1 13/16	2 1/8	1/4		2250[3]	25 to 300K Range L	25-50Ω ±5% 100-100K ±3% 200K ±5%	≤100Ω ±0.5% 100Ω-200K ±0.25% ≥200K ±0.5%	±0.05%	—55°C to +105°C
	1 13/16	2 1/8	1/4		2270[4]	25 to 300K Range L	25-50Ω ±5% 100-100K ±3% 200K ±5%	±0.25% ±0.15% ±0.25%	±0.05%	—55°C to +105°C
	1 3/4	2 1/8	1/4		205[1]	1.15 to 300K Range E	≤25Ω ±10% >25Ω ±3%	±0.1%	±0.05%	—55°C to +105°C
	2	2 1/16 Serv. 2 1/4 Bush.	1/4		900[2]	1 to 100K Range G	≤25Ω ±10% >25Ω ±3%	±0.1%	±0.015%	—55°C to +125°C

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Amphenol Controls Division
Amphenol Corporation, Janesville, Wisconsin

[1] Zero base linearity standard
[2] Absolute linearity standard
[3] Different mounting configuration than Model 2200
[4] Different mounting configuration than Model 2220

AMPHENOL POTENTIOMETERS

AMPHENOL
THE BUNKER RAMO CORPORATION

NEW SINGLE-TURN POTENTIOMETERS EXCEED MIL-R-12934D

Amphenol now offers five single turn potentiometers that meet MIL-R-12934D in all requirements. The 2500 series potentiometers feature rugged welded terminations; a dual contact wiper that withstands up to 50 g's shock or acceleration; diallyl phthalate construction of rotor, insulator ring and element mount for high stability under varying humidity and temperature environments; and a movable clamp band that allows all phasing and zero settings to be accomplished in the field.

Maximum Power Rating, Watts	Type of Mounting	Maximum No. of Sections	Application	Resistance Range
1.25 At 85°C	Servo[5]	6	MIL-R-12934D RR0900	A
1.5 At 85°C	Servo[5]	6	MIL-R-12934D RR1100	B
2 At 85°C	Servo[5]	8	MIL-R-12934D RR1500	C
4 At 85°C	Servo[5]	8	MIL-R-12934D RR2000	D
6 At 85°C	Servo[5]	8	MIL-R-12934D RR3000	E
4 At 40°C	Bushing	3	Commercial	F
4 At 40°C	Bushing Servo	3	Military Industrial	G
3 At 40°C	Bushing	1	Military Industrial	H
3 At 40°C	Bushing Servo	3	Military Industrial	I
2 At 40°C	Bushing	2	Industrial Commercial	J
3 At 40°C	Bushing	2	Industrial Commercial	K
3 At 40°C	Bushing Servo	2	Industrial Commercial	L
3 At 40°C	Bushing Servo	2	Industrial Commercial	
5 At 40°C	Bushing Servo	3	MIL-R-12934D RR1000	
5 At 40°C	Bushing	3	Industrial Commercial	
5 At 40°C	Bushing	3	Industrial Commercial	
5 At 40°C	Bushing	3	Industrial Commercial	
5 At 40°C	Bushing	3	Industrial Commercial	
5 At 40°C	Bushing	1	Military Industrial	
5 At 40°C	Bushing Servo	3	Military Industrial	

RESISTANCE RANGE A

10	200	5K	50K
20	500	10K	100K
50	1K	20K	
100	2K	30K	

RESISTANCE RANGE B

20	500	10K	100K
50	1K	20K	125K
100	2K	30K	
200	5K	50K	

RESISTANCE RANGE C

20	500	10K	100K
50	1K	20K	200K
100	2K	30K	
200	5K	50K	

RESISTANCE RANGE D

100	1K	10K	50K
500	5K		

RESISTANCE RANGE E

1.15	200	10K	200K
2.9	500	20K	300K
25	1K	30K	
50	2K	50K	
100	5K	100K	

RESISTANCE RANGE F

10	200	2K	20K
50	500	5K	30K
100	1K	10K	50K

RESISTANCE RANGE G

1	100	2K	30K
3	200	5K	50K
25	500	10K	100K
50	1K	20K	

RESISTANCE RANGE H

20	200	2K	20K
50	500	5K	30K
100	1K	10K	50K

RESISTANCE RANGE I

25	500	10K	100K
50	1K	20K	120K
100	2K	30K	
200	5K	50K	

RESISTANCE RANGE J

10	300	3K	30K
30	500	5K	50K
100	1K	10K	
200	2K	20K	

RESISTANCE RANGE K

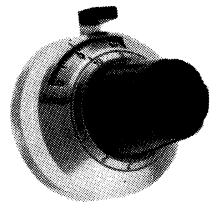
25	500	10K	100K
50	1K	20K	
100	2K	30K	
200	5K	50K	

RESISTANCE RANGE L

25	500	10K	100K
50	1K	20K	200K
100	2K	30K	300K
200	5K	50K	

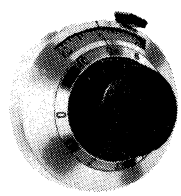
[5] Available in Servo or Bushing Mount for Military-Industrial 2400 Series.

Specify these concentric scale Microdials for precise potentiometer control



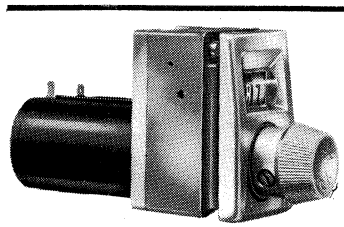
1370 Dial

Only ⅞" diameter (1" with finger brake), this 10-turn Microdial® projects 1 3/16" from panel. Don't let the small size of this dial fool you. It has the same silent gear action of the conventional size Amphenol dials. It indicates angular position of potentiometers and multiturn devices of 10 turns and less with 1000:1 indexing accuracy. Inner dial counts turns, outer dial ticks off hundredths. Locks rigidly on to shaft to eliminate backlash. Epicyclical internal gearing assures read-out accuracy. Finger-tip disc offers positive brake action without disturbing critical settings.



1350 Series, concentric

Indicates angular position of potentiometers and multiturn devices of ten turns and less with 1000:1 indexing accuracy. Inner dial counts turns, outer dial ticks off hundredths. Locks rigidly onto shaft to prevent backlash. Internal gearing is epicyclical type so you always know exact reading. Fingertip brake holds shaft position until reset.



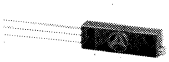
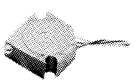
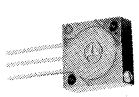
3100 Dial-Pot Assembly

Amphenol's Dial-Pot assembly saves you time and money . . . eliminates costly mounting and phasing. If you now buy pots and dials separately, but for the same application, your production people must (1) mount the pot from back of panel, (2) mount the dial from front of panel, and (3) phase the dial to the pot so the dial reads zero at electrical output. Amphenol prephases and preassembles the 3100 dial to any potentiometer at no extra cost. You simply mount the assembly from rear of panel and wire into your circuit.

AMPHENOL POTENTIOMETERS

AMPHENOL
THE BUNKER-RAMO CORPORATION

MICROPOT® TRIMMING POTENTIOMETERS

	Description	All Units Shown ½ Size	Amphenol Model No.	Adjustment Turns	Terminals [2]	Resistance Range in Ohms	Resistance Tolerance	Temperature Range
WIREWOUND	Wirewound		992[1] 994[1]*	22	L, SL, P	10 to 50K Range A	10 to 75 ±10% 100 ohms to 100K ±5%	−65°C to +105°C
	Microminiature Wirewound		2600 2610*	22	P	10 to 20K Range C	±10%	−65°C to +125°C
	Miniature High Temperature Wirewound		2700[4]*	15	L, W	10 to 50K Range G	±5%	−65°C to +175°C
	High Temperature Wirewound		2750[3]*	22	L, SL, P	10 to 50K Range B	±5%	−65°C to +175°C
	High Temperature Wirewound		2860[1] 2850[1]*	22	L, SL, P	10 to 50K Range B	±5%	−65°C to +175°C
	Subminiature ½" Square Wirewound		2900[5]*	25	L, P, W, X	10 to 50K Range G	±5%	−65°C to +175°C
	Microminiature ⅜" Square Wirewound Solvent-Resistant		3600 3610*	23	P, WR	100 to 20K Range H	±10%	−65°C to +125°C
	Microminiature Wirewound Solvent-Resistant		3800 3810*	22	P	10 to 20K Range C	±10%	−65°C to +125°C
FILM-MET™‡	High Temperature Film-Met™ Infinite Resolution		2851[1]*	22	L, SL, P	20 to 10K Range I	±10%	−55°C to +150°C
	Subminiature ½" Square Film-Met™ Infinite Resolution		2901[5]*	25	L, P, W, X	10 to 20K Range C	±10%	−55°C to +150°C
	Microminiature Film-Met™ Infinite Resolution Solvent-Resistant		3811*	15	P	10 to 20K Range C	±10%	−55°C to +125°C
CERMET	High Temperature Cermet Infinite Resolution		2855[1]*	22	P	100 to 1 Meg. Range F	±10%	−55°C to +150°C
	Subminiature ½" Square Cermet Infinite Resolution		2905[5]*	25	P, L, W	10 to 5 Meg. Range E	±10%	−55°C to +150°C
	Microminiature Cermet Infinite Resolution Solvent-Resistant		3805 3815*	22	P	50 to 500K Range D	±10%	−55°C to +125°C

[1] Panel mounting bracket available, order part no. 999
[2] Terminations: L—Color coded wire lugs
SL—Gold plated solder lugs
P—Cold plated printed circuit pins
W—Uninsulated gold-plated leads
[3] Panel mounting bracket available, order part no. 2799
[4] Panel mounting bracket available, order part no. 2749
[5] Panel mounting bracket available, order part no. 2949
* Humidity Proof
‡ U. S. Patent No. 3,353,134; also foreign patents

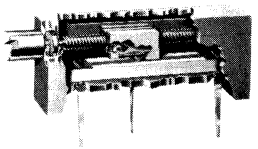
AMPHENOL POTENTIOMETERS

AMPHENOL
THE BUNKER-RAMO CORPORATION

Temperature Coefficient, Potentiometer (PPM/°C)	Maximum Power Rating in Watts	Size in Inches H	W	L	Application
30 nom. 70 max.	1 @ 40°C	0.32	0.28	1.25	Industrial Commercial
50 nom. 100 max.	1 @ 40°C	0.31	0.16	0.75	Commercial
30 nom. 70 max.	1 @ 70°C	0.32	0.18	1.0	MIL-R-27208A RT10
30 nom. 70 max.	1 @ 70°C	0.32	0.19	1.25	MIL-R-27208A RT12
30 nom. 70 max.	1 @ 70°C	0.32	0.28	1.25	Military Industrial MIL-R-27208A RT11
30 nom. 70 max.	1 @ 70°C	0.5 0.5 0.5	0.220 0.187 0.195	0.5P 0.5L 0.5W	MIL-R-27208A RT22
50 nom. 100 max.	½ @ 40°C	0.20	0.375	0.375	Commercial
50 nom. 100 max.	1 @ 40°C	0.31	0.16	0.75	Commercial
100	¾ @ 85°C	0.32	0.28	1.25	Military Industrial
100	¾ @ 85°C	0.5 0.5 0.5	0.220 0.187 0.195	0.5P 0.5L 0.5W	Miliary Industrial
10 ohm to 5K - 100 10K to 20K - 70	¾ @ 40°C	0.31	0.16	0.75	Commercial
250	¾ @ 85°C	0.32	0.28	1.25	MIL-R-22097 RJ11
10 ohm - 350 20 ohm to 5 meg. - 250	½ @ 85°C	0.5 0.5 0.5	0.220 0.187 0.195	0.5P 0.5L 0.5W	MIL-R-22097 RJ22
250	¾ @ 40°C	0.31	0.16	0.75	Commercial

®MICROPOT — Trademark registered U.S. Patent Office
Humidity-proof trimmers pass MIL-R-27208A moisture resistance test.

Film-Met™ by Amphenol



It's an exclusive Amphenol resistance element* completely different from wirewounds and cermets.

Film-Met™ is a 100% metal element, not a cermet material. The process is different, too. We use a vacuum deposition chamber and our patented process to evaporate metal alloys onto an insulating substrate. The resistive track is then protected by a noble metal overlay.

But the big Film-Met difference is performance.

Film-Met offers both infinite resolution and a low temperature coefficient of 100 ppm/°C maximum. 50 ppm/°C is available on request. It also provides excellent high frequency and pulse characteristics along with low current and low thermal noise.

* U.S. Patent No. 3,353,134; also foreign patents.

RESISTANCE RANGE A

10	100	700	12K
15	150	750	15K
20	200	1K	20K
25	250	2K	25K
30	300	3K	30K
40	350	4K	50K
50	400	5K	
60	500	7K	
75	600	10K	

RESISTANCE RANGE B

10	200	5K	30K
20	500	10K	50K
50	1K	20K	
100	2K	25K	

RESISTANCE RANGE C

10	100	1K	10K
20	200	2K	20K
50	500	5K	

RESISTANCE RANGE D

50	1K	10K	100K
100	5K	50K	500K
500			

RESISTANCE RANGE E

10	200	5K	50K	1 Meg.
20	500	10K	100K	2 Meg.
50	1K	20K	250K	2.5 Meg.
100	2K	25K	500K	5 Meg.

RESISTANCE RANGE F

100	1K	20K	250K
200	2K	25K	500K
500	5K	50K	1 Meg.
	10K	100K	

RESISTANCE RANGE G

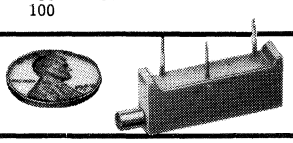
10	100	5K	25K
20	500	10K	50K
50	1K	15K	
100	2K	20K	

RESISTANCE RANGE H

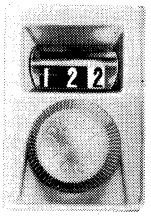
100	500	2K	10K
200	1K	5K	20K

RESISTANCE RANGE I

20	200	1K	5K
50	500	2K	10K
100			



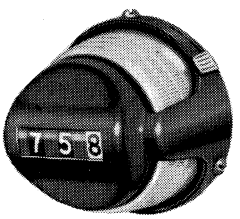
Get fast digital readout from this new miniature Microdial®



Remarkably accurate (1000:1 indexing accuracy) miniature 3100 Series dial almost makes a standard circular dial look gigantic by comparison. This new Microdial measures only 1-1/8 x 1-21/32 inches and protrudes only 25/32" from a panel.

Digits (with illumination optional) are magnified by convex lens in recessed window. Three-digit, ten-turn dial rotates continuously forward or backward with push-pull fingertip brake to lock settings. This 3100 miniature Microdial will mount on panels from 1/16" through 3/16" thick. Special readouts also available.

Standard color: natural brushed aluminum finish.



1300 Series, digital

Gives you fast, accurate indication of shaft position up to 1,000 turns. All models (3-digit 10-turn, 4-digit 100-turn, and 5-digit 1,000 turn) mount directly on shaft to be controlled, eliminating backlash. Speed: up to 6,000 counts per minute.

Large, contrasting numerals readable even from angular view because convex windows reduce glare, reflections. Rugged, dust-sealed construction includes nylon counter wheels, brass gear assemblies, knurled aluminum control knobs. Brake optional. Special readouts are also optional. This dial is also supplied in militarized models.



1330 Series, digital

You get straight-on or angular readout, even in the dark, with this illuminated turns-counting Microdial. One-piece 1.5x lens/window magnifies numerals. In exactly ten turns, unit counts from 000 through 999. Fingertip brake locks settings in place.

This Microdial is sealed against dust and moisture, yet its snap-on cap makes lamp replacement easy. Standard finishes for color coding: dark or light gray, red, white, and black; other colors available on request.

Microdial—
Trademark Registered U.S. Patent Office

Helipot® PRECISION POTENTIOMETERS

SINGLE-TURN (WIREWOUND, CERMET & CONDUCTIVE PLASTIC)

Housing Diameter (inches)	Resistance Element	Helipot Model Number	Mounting Type	Bearing Type	Range of Resistance Values (ohms)	Min. Practical Independent Linearity* (±%)	Power Rating (Watts at °C)	Starting Torque (max.,02-in.)	Number of cups (max.,02-in.)	Ambient Temperature Range (°C)
	Wire	TP	Bushing	Ball	186-15K	0.2	1.25-70	0.1	5	—65t o 125
	Wire	TSP	Servo	Ball	186-15K	0.2	1.25-70	0.1	5	—65 to 125
	Wire	5101	Bushing	Sleeve	186-116K	0.25	0.75-40	0.2	5	—25 to 85
⅞	Wire	5103	Servo	Ball	186-116K	0.25	0.75-40	0.2	5	—25 to 85
	Cermet	3103	Servo	Ball	70-1 meg	0.3	1.25-50	0.5	6	—25 to 105
	Cermet	6103	Servo	Ball	70-1 meg	0.3	3.0-85	0.5	6	—65 to 150
	C.P.	3153	Servo	Ball	1K-50K	0.2	1.0-50	0.5	6	—25 to 105
	C.P.	6153	Servo	Ball	1K-50K	0.1	1.5-70	0.5	6	—65 to 125
	Wire	5203	Servo	Ball	50-100K	0.15	4.0-85	0.15	5	—65 to 150
	Wire	5211	Bushing	Sleeve	50-25K	0.15	1.0-40	0.4	5	—25 to 85
	Wire	5212	Servo	Sleeve	50-25K	0.15	1.0-40	0.4	5	—25 to 85
1 1/16	Wire	5213	Servo	Ball	50-25K	0.15	1.0-40	0.3	5	—25 to 85
	Cermet	3203	Servo	Ball	50-1 meg	0.25	1.5-50	0.5	5	—25 to 105
	Cermet	6213	Servo	Ball	50-1 meg	0.25	5.0-85	0.5	6	—65 to 150
	C.P.	3253	Servo	Ball	1K-50K	0.15	1.25-50	0.5	6	—25 to 105
	C.P.	6263	Servo	Ball	1K-50K	0.10	1.5-70	0.5	6	—65 to 125
	Wire	5311	Bushing	Sleeve	10-44.6K	0.25	2.0-40	1.0	1	—25 to 85
	Cermet	3301	Bushing	Sleeve	1K-1 meg	0.3	0.75-65	10.	1	—25 to 105
	Cermet	6301	Bushing	Ball	150-1 meg	0.25	6.0-85	0.7	1	—65 to 150
1 5/16	Cermet	6303	Servo	Ball	150-1 meg	0.25	6.0-85	0.7	1	—65 to 150
	C.P.	3351	Bushing	Sleeve	1K-75K	0.3	0.75-65	1.0	1	—25 to 105
	C.P.	6351	Bushing	Ball	1K-75K	0.05	2.5-70	1.5	8	—65 to 125
	C.P.	6353	Servo	Ball	1K-75K	0.05	2.5-70	1.5	8	—65 to 125
	Wire	5401	Bushing	Sleeve	25-50K	0.15	2.0-40	1.6	8	—65 to 85
	Wire	5402	Servo	Sleeve	25-50K	0.15	2.0-40	1.6	8	—65 to 85
1 7/16	Wire	5403	Servo	Ball	25-50K	0.15	2.0-40	0.6	8	—65 to 85
	Wire	5404	Pilot	Sleeve	25-50K	0.15	2.0-40	1.6	8	—65 to 85
	Wire	5405	Pilot	Ball	25-50K	0.15	2.0-40	0.6	8	—65 to 85
	Wire	5611	Bushing	Sleeve	15-80K	0.10	3.5-40	1.5	8	—65 to 85
	Wire	5612	Servo	Sleeve	15-80K	0.10	3.5-40	1.5	8	—65 to 85
	Wire	5613	Servo	Ball	15-80K	0.10	3.5-40	0.8	8	—65 to 85
	Wire	5614	Pilot	Sleeve	15-80K	0.10	3.5-40	1.5	8	—65 to 85
	Wire	5615	Pilot	Ball	15-80K	0.10	3.5-40	0.8	8	—65 to 85
2	Wire	5616	Pilot/Servo	Sleeve	15-80K	0.10	3.5-40	1.5	8	—65 to 85
	Wire	5617	Pilot/Servo	Ball	15-80K	0.10	3.5-40	0.8	8	—65 to 85
	Cermet	6601	Bushing	Ball	100-1 meg	0.15	10.0-85	1.5	8	—65 to 150
	Cermet	6603	Servo	Ball	100-1 meg	0.15	10.0-85	1.5	8	—65 to 150
	C.P.	6651	Bushing	Ball	1K-75K	0.05	2.5-70	1.5	8	—65 to 125
	C.P.	6653	Servo	Ball	1K-75K	0.05	2.5-70	1.5	8	—65 to 125
	Wire	5711	Bushing	Sleeve	25-145K	0.075	5.0-40	1.5	8	—65 to 85
	Wire	5712	Servo	Sleeve	25-145K	0.075	5.0-40	1.5	8	—65 to 85
3	Wire	5713	Servo	Ball	25-145K	0.075	5.0-40	1.3	8	—65 to 85
	Wire	5714	Pilot	Sleeve	25-145K	0.075	5.0-40	1.5	8	—65 to 85
	Wire	5715	Pilot	Ball	25-145K	0.075	5.0-40	1.3	8	—65 to 85

*Values listed are available on special order. Standard Independent Linearity for all Helipot single-turn precision potentiometers is ±0.5%.

LEGEND TO ABBREVIATIONS: **C.P.**—Conductive Plastic. **Pilot**—3 hole/pilot mount. **Pilot/Servo**—Servo/3 hole pilot mount. **FQ**—Factory quote.

MULTI-TURNS (WIREWOUND)

Housing Diameter (inches)	Number of Turns	Helipot Model Number	Mounting Type	Bearing Type	Range of Resistance Values (ohms)	Standard Independent Linearity (± %)	Min. Practical Independent Linearity (± %)	Power Rating (watts at °C)	Starting Torque (max., 02-in.)	Ambient Temperature Range (°C)
	3	7363	Servo	Ball	3-32.3K	0.25	0.15	1.5 at 40	0.6	—65 to 85
		7366	Bushing	Ball	3-32.3K	0.25	0.15	1.5 at 40	0.8	—65 to 85
	5	7463	Servo	Ball	5-53.8K	0.25	0.15	1.5 at 40	0.6	—65 to 85
		7466	Bushing	Ball	5-53.8K	0.25	0.15	1.5 at 40	0.8	—65 to 85
		7216	Bushing	Sleeve	10-125K	0.25	0.05	1.5 at 40	0.6	—65 to 85
⅞		7221	Bushing	Sleeve	10-125K	0.25	0.05	1.5 at 40	0.6	—65 to 85
		7223	Servo	Ball	10-125K	0.25	0.05	1.5 at 40	0.6	—65 to 85
	10	7233	Servo	Ball	250-125K	0.25	0.05	2.0 at 70	0.6	—65 to 125
		7246	Bushing	Sleeve	10-125K	0.25		2.0 at 25	2.0	—65 to 85
		7263	Servo	Ball	10-107.8K	0.20	0.05	2.0 at 40	0.6	—65 to 125
		7266	Bushing	Sleeve	10-107.8K	0.20	0.05	2.0 at 40	0.8	—65 to 125
		C	Bushing	Sleeve	5-194.7K	0.50	0.10	3.0 at 40	3.0	—65 to 85
	3	9301	Bushing	Sleeve	30-192.6K	0.25	0.04	3.0 at 40	1.3	—65 to 85
1 13/16		9303	Servo	Ball	30-192.6K	0.25	0.04	3.0 at 40	1.3	—65 to 85
		A	Bushing	Sleeve	10-648K	0.25	0.05	5.0 at 40	3.0	—65 to 85
	10	7601	Bushing	Sleeve	100-650K	0.15	0.015	5.0 at 40	1.3	—65 to 85
		7603	Servo	Ball	100-650K	0.15	0.015	5.0 at 40	1.3	—65 to 85
		B	Bushing	Sleeve	40-1.987 meg	0.5	0.025	10.0 at 40	2.7	—65 to 85
	15	BS	Servo	Sleeve	40-1.987 meg	0.5	0.025	10.0 at 40	2.7	—65 to 85
		BSP	Servo	Ball	40-1.987 meg	0.5	0.025	10.0 at 40	2.7	—65 to 85
3 5/16	25	D	Bushing	Sleeve	60-3.312 meg	0.5	0.025	15.0 at 40	3.5	—65 to 85
		DSP	Servo	Ball	60-3.312 meg	0.5	0.025	15.0 at 40	3.5	—65 to 85
	40	E	Bushing	Sleeve	125-5.298 meg	0.5	0.025	20.0 at 40	3.5	—65 to 85
		ESP	Servo	Ball	125-5.298 meg	0.5	0.025	20.0 at 40	3.5	—65 to 85

Helipot® NON-LINEAR PRECISION POTENTIOMETERS

Helipot manufactures non-linear precision potentiometers, identical to linear models in every way except for the resistance element. Non-linear models, with outputs ranging from the simplest monotonic function to the most complex non-monotonic function, can be supplied with either wirewound, cermet or conductive plastic resistance elements. The approximate conformity, total resistance and power rating of a Helipot non-linear potentiometer can be determined by using the following formulas and the constants listed in the table below.

$$\text{Conformity} = (\text{max. slope}) \times (\text{min. practical linearity})$$

$$\text{Total Resistance} = \frac{\text{max. total resistance}}{\text{max. slope}}$$

$$\text{Power Dissipation} = \frac{\text{max. slope}}{\text{power rating}}$$

SINGLE-TURN WIREWOUNDS

	Nominal Diameter					
	⅞"	1 1/16"	1 5/16"	1 7/16"	2"	3"
Min. Practical Linearity (± %)	0.15	0.12	0.10	0.08	0.07	0.05
Max. Total Resistance (ohms)	60K	100K	45K	50K	215K	145K
Power Rating (watts at 40°C)	1.25	1.50	1.50	3.5	3.5	5.0

MULTI-TURN WIREWOUNDS

	Nominal Diameter and Rotation					
	⅞" 1,800°	⅞" 3,600°	1 13/16" 1,080°	1 13/16" 3,600°	3 5/16" 5,400°	3 5/16" 9,000°
Min. Practical Linearity (± %)	0.075	0.05	0.04	0.025	0.025	0.025
Max. Total Resistance (ohms)	63K	125K	190K	650K	2 meg	3.3 meg
Power Rating (watts at 40°C)	1.4	2.0	3.0	5.0	10.0	15.0

SINGLE-TURN CERMETS

	Nominal Diameter			
	⅞"	1 1/16"	1 5/16"	2"
Min. Practical Linearity (± %)	0.25	0.20	0.20	0.15
Max. Total Resistance (ohms)	1 meg	1 meg	1 meg	1 meg
Power Rating (watts at 85°C)	3.0	5.0	6.0	10.0

SINGLE-TURN CONDUCTIVE PLASTICS

	Nominal Diameter			
	⅞"	1 1/16"	1 5/16"	2"
Min. Practical Linearity (± %)	1.00	1.00	0.075	0.05
Max. Total Resistance (ohms)	50K	50K	100K	150K
Power Rating (watts at 25°C)	1.25	1.75	2.0	3.0

Helipot DUODIAL® & DIGIDIAL® TURNS-COUNTING DIALS

	DUODIAL MODEL								
	RBB	RB RBC RBD	RBJ	2601	2606 2607	901	902	903	904
Counting capacity, max., turns	15					10	15	25	40
Diameter, nominal	1 13/16"			⅞"		4¾"			
Depth, from face of panel	19/64"	1"		51/64"		1 1/32"			
For shaft diameter	¼"		⅛"	⅛"	¼"	¼"			
Max. shaft extension, face of panel	15/16"	13/16"		43/64"	25/32"	23/32"			
Min. shaft extension, face of panel	45/64"	9/16"		15/32"	7/64"	15/32"			
For bushing thread	½-32-NS	⅜-32-NEF	¼-32-NEF			⅜-32-NEF			
Max. bushing extension, face of panel	17/32"	13/32"	19/64"	17/64"	19/64"	¼"			
Locking mechanism	Positive Action					Not Available			

For use with Helipot® precision potentiometer models:

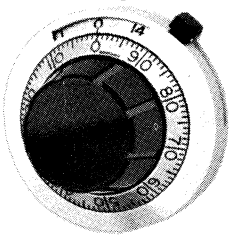
RBB, 902	2601	RB, RBC, RBD, 2606, 2607	901	903	904
B	7221	7216, 7246, 7266, 7366 7466, 7601, 9301, A, C	A	D	E

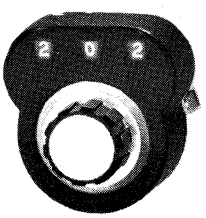
	DIGIDIAL MODEL					
	201	202	203	205	210	211
Counting capacity, max., turns	10					
Height	2 1/16"			2 3/32"	1 21/32"	
Width	1 15/16"			1 61/64"	1 7/32"	
Depth, from face of panel	1⅛"			1½"	1 9/32"	
For shaft diameter	¼"					⅛"
Max. shaft extension, face of panel	⅜					
Min. shaft extension, face of panel	17/32"					
For bushing thread	⅜-32-NEF					¼-32-NEF
Max. bushing extension, face of panel	¼"					
Color	Blue	Black	Gray	Black with satin trim		
Locking mechanism	Positive action, friction type					

For use with Helipot® precision potentiometer models:

201, 202, 203, 205, 210	211
7216, 7246, 7266, 7366, 7466, 7601, 9301, A, C	7221


Series 2600


Series RB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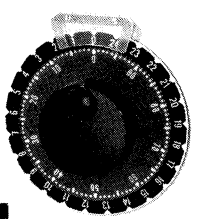
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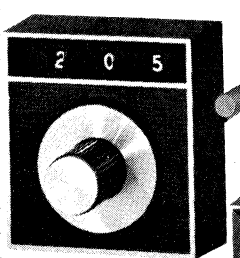
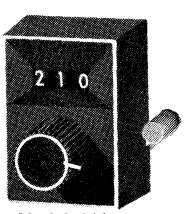
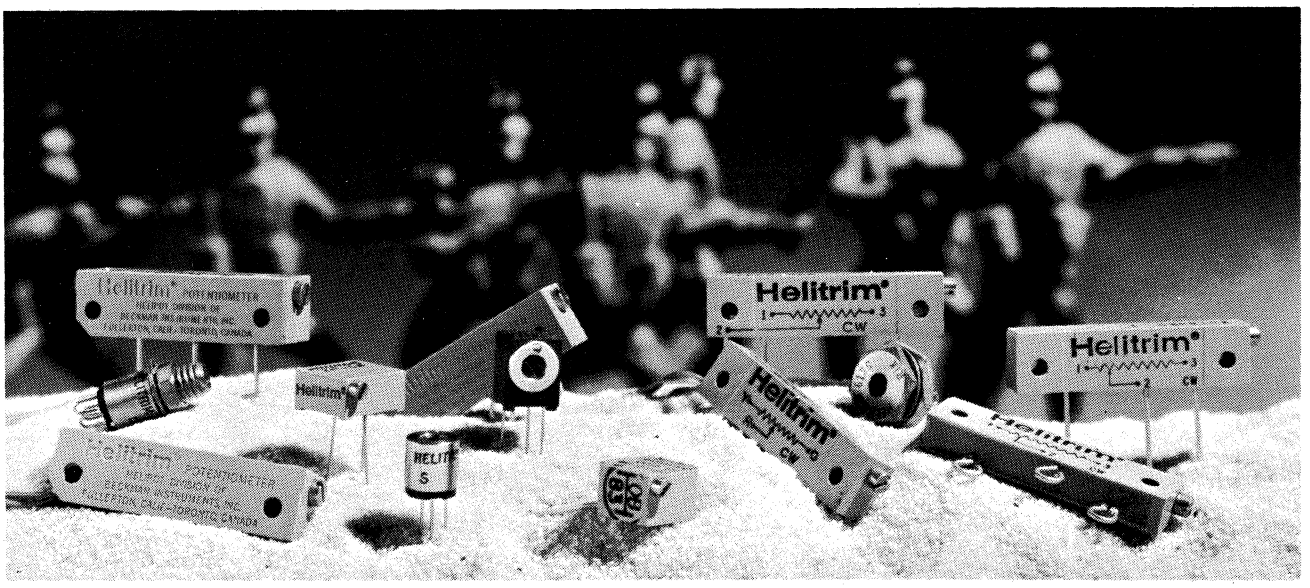

Model 205


Model 210

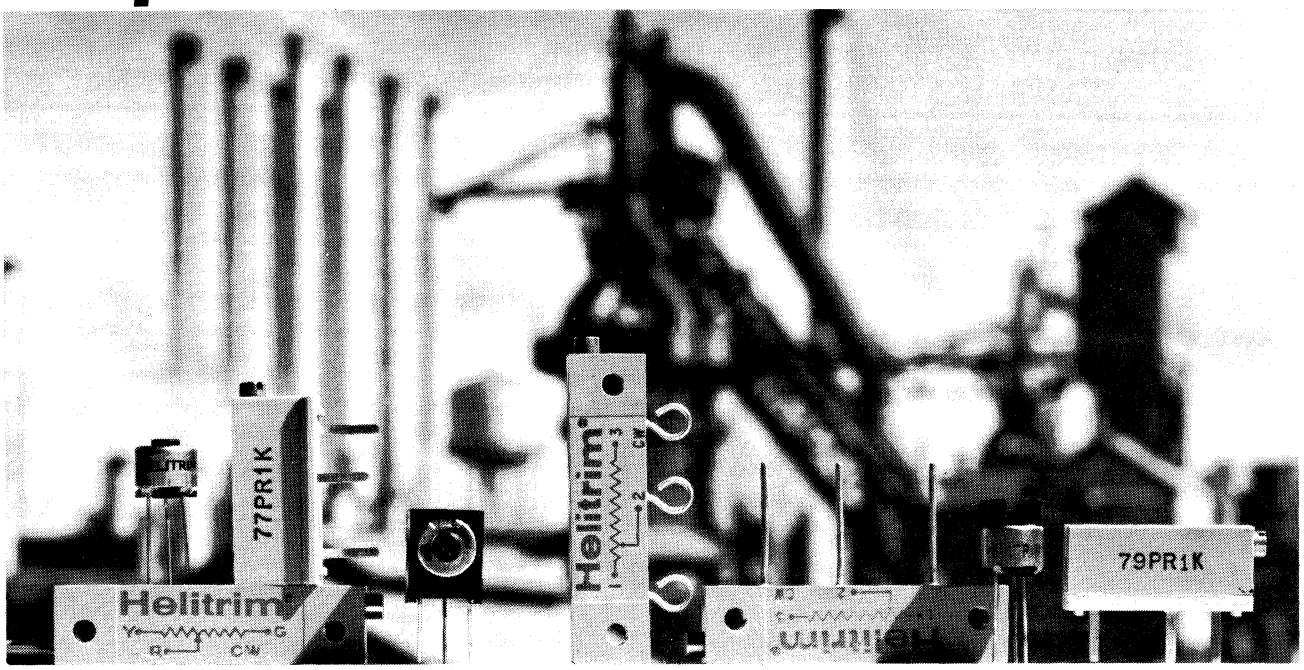
Helipot® TRIMMING POTENTIOMETERS



MILITARY—CERMET

	Series 55	Series 56	Series 58	Series 61	Series 63
MIL-SPEC style	RJ11	RJ12	THIN RJ11	RJ50	RJ24
Range of standard resistance values	10Ω thru 2megΩ	10Ω thru 2megΩ	10Ω thru 2megΩ	10Ω thru 1megΩ	10Ω thru 2megΩ
Standard resistance tolerance (closer tolerances available)	50Ω thru 2megΩ; ±10% other values; ±20%	50Ω thru 2megΩ; ±10% other values; ±20%	50Ω thru 2megΩ; ±10% other values; ±20%	100Ω thru 500KΩ; ±10% other values; ±20%	100Ω thru 500KΩ; ±10% other values; ±20%
Resolution	Essentially infinite	Essentially infinite	Essentially infinite	Essentially infinite	Essentially infinite
Voltage setting ability (% of full scale)	±0.01	±0.01	±0.01	±0.05%	±0.01%
Power rating, watts	1.0 at 85°C	1.0 at 85°C	1.0 at 85°C	0.5 at 85°C	0.5 at 85°C
Adjustment turns, nominal	22	22	22	1	20
Operating temperature range	−65°C to 175°C	−65°C to 175°C	−65°C to 175°C	−65°C to 150°C	−65°C to 150°C
Standard resistance values & tempcos	ohms ppm/°C 10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg, 2 meg — 0 to −250	ohms ppm/°C 10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg, 2 meg — 0 to −250	ohms ppm/°C 10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg, 2 meg — 0 to −250	ohms ppm/°C 10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg — 0 to −250	ohms ppm/°C 10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg, 2 meg — 0 to −250
Dimensions, L x H x W, inches	1¼ x .290 x 11/32	1¼ x .320 x .195	1¼ x .320 x .195	¼ Dia. x ¼ high	⅜ x ⅜ x 3/16
Mounting configurations	Lead, Pin, Lug	Lead, Pin	Pin, Lug	Pin top adjust, Pin side adjust, Panel mount	Lead, Bottom pins, Edge pin stop adjust, Edge pins side adjust
Price, list	$5.50	$5.50	$5.50	$5.50 (61P)	$6.50
	High quality, RJ11 style trimmer meets or exceeds Characteristic C and exceeds Characteristics A and B of MIL-R-22097.	RJ12 style trimmer meets or exceeds Characteristic C and exceeds Characteristics A and B or MIL-R-22097.	Thin trimmer with RJ11 style pin spacing meets or exceeds Characteristic C and exceeds Characteristics A and B of MIL-R-22097.	¼" diameter single-turn RJ50 style trimmer meets or exceeds Characteristic C and exceeds Characteristics A and B of MIL-R-22097.	⅜" square military RJ24 style trimmer meets or exceeds Characteristics A, B and C of MIL-R-22097.

Helipot® TRIMMING POTENTIOMETERS



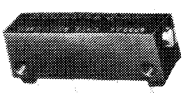
GENERAL PURPOSE—CERMET

	Series 50	Series 62	Series 66	Series 76-77-79	Series 78
Range of standard resistance values	10Ω thru 2megΩ	10Ω thru 1megΩ	10Ω thru 2megΩ	10Ω thru 2megΩ	10Ω thru 2megΩ
Standard resistance tolerance (closer tolerances available)	50Ω thru 2meg; ±10% other values; ±20%	100Ω thru 500KΩ; 15% other values; ±20%	100Ω thru 500KΩ; ±10% other values; ±20%	100Ω thru 500KΩ; ±10% other values; ±20%	100Ω thru 500KΩ; ±10% other values; ±20%
Resolution	Essentially infinite	Essentially infinite	Essentially infinite	Essentially infinite	Essentially infinite
Voltage setting ability (% of full scale)	±0.01%	±0.05%	±0.05%	±0.05%	±0.05%
Power rating, watts	1.5 at 125°C	0.5 at 70°C	0.5 at 25°C	0.75 at 25°C	0.75 at 70°C
Adjustment turns, nominal	32	1	20	15	22
Operating temperature range	−65°C to 200°C	−25°C to 125°C	−25°C to 105°C	−55°C to 105°C	−25°C to 125°C
Standard resistance values & tempcos (ohms — ppm/°C)	10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg, 2 meg — 0 to −250	10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg — 0 to −250	10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg, 2 meg — 0 to −250	10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg, 2 meg — 0 to −250	10, 20, 50 — 0 to +500 100, 200, 500 — 0 to +250 1K, 2K, 5K, 10K, 20K, 25K, 50K — ±100 100K, 200K, 250K, 500K, 1 meg, 2 meg — 0 to −250
Dimensions, L x H x W, inches	1¼ x 5/16 x .297	¼ Dia. x ¼ high	⅜ x ⅜ x .200	¾ x .340 x .190	1¼ x .320 x .195
Mounting configurations	Pin, Lead, Lug	Pin top adjust, Pin top thumbwheel adjust, Pin side adjust	Bottom pin, Edge pin top adjust, Edge pin side adjust	Pin	Lead, Pin, Lug
Price, list	$8.00 (Lead) $7.50 (Pin, Lug)	$1.75 (Pin top adjust) $2.50 (other styles)	$3.50	$1.95	$3.00
	High temperature trimmer with metal housing meets most requirements of MIL-R-22097.	Commercially-priced miniature trimmer available with stops and longer pins.	Low-cost ⅜" square trimmer sealed for PC board washing and potting with low viscosity materials.	Economical ¾" trimmer sealed for solvent cleaning and low viscosity potting.	This adjustment trimmer with sealed plastic housing and RJ11 style pin spacing.

BOURNS ADJUSTMENT POTENTIOMETERS

CARBON ELEMENT GENERAL PURPOSE






		Dimensions H W L	Termi-nals [1]	Res. Tol. (%)	Power (Watt) at 70°C	Max. Temp. °C	Adj. Turns	Humid-ity [5] Mil Spec	Standard Resis-tances Ω [3]	1-9	Prices 10-24	25-49
215	RESISTON[7] ELEMENT	.31x.25x1.25	L,S,P	±20	0.25 at 50°C	135	22	Steady State	5K-5 Meg	4.86	4.50	4.05
235	RESISTON[7] ELEMENT	.36x.30x1.34	L,S,P	±20	0.25 at 50°C	135	22	Yes	5K-5 Meg	7.02	6.50	5.85
272 274 276	COMMERCIAL TRIMIT RESISTALOY[7] ELEMENT POTENTIOMETER	.31x.25x1.25	L,S,P	±20	0.20 at 25°C	105	25	No	5K-5 Meg	3.78	3.50	3.15
3066	HUMIDITY PROOF COMMERCIAL E-Z-TRIM[7] POTENTIOMETER	.36x.28x1.0	S,P	±20	0.20 at 25°C	85	15	No	20K-1 Meg	1.95	1.85	1.75
3068	COMMERCIAL E-Z-TRIM[7] POTENTIOMETER	.36x.28x1.0	S,P	±20	0.20 at 25°C	85	15	No	20K-1 Meg	1.85	1.71	1.54
3368	SINGLE-TURN RESISTON[7] ELEMENT	.50 dia. x.24	P	±20	0.25 at 50°C	105	285°	Steady State	20K-1 Meg	5.94	5.50	4.95
		.50 dia. x.55	S						20K-1 Meg	6.75	6.25	5.63

CARBON ELEMENT HIGH-PERFORMANCE

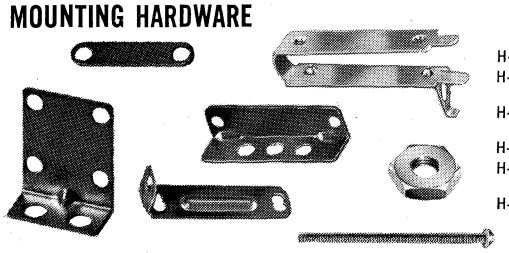







3001	MICRO-MINIATURE HIGH TEMPERATURE RESISTON[7] ELEMENT	.31x.16x.75	P	±20	0.20	150	15	Yes	20K-1 Meg	9.18	8.50	7.65
3011	HIGH TEMPERATURE RESISTON[7] ELEMENT (RJ 11)	.31x.28x1.25	L,P	±20	0.25 at 50°C	150	22	Yes	5K-5 Meg	7.02	6.50	5.85
3051	HIGH TEMPERATURE RESISTON[7] ELEMENT (RJ 12)	.31x.19x1.25	L,S,P	±20	0.25 at 50°C	150	22	Yes	5K-5 Meg	7.02	6.50	5.85
3251	HIGH TEMPERATURE RESISTON[7] ELEMENT (RJ 22)	.19x.50x.50	L	±20	0.5 at 50°C	150	25	Yes	20K-1 Meg	7.83	7.25	6.53
		.22x.50x.50	P,W									
3281	MICRO-MINIATURE RESISTON[7] ELEMENT	.20x.375x.375	L,P,W	±20	0.5 at 50°C	150	25	Yes	20K-1 Meg	7.56	7.00	6.30
3301	MICRO-MINIATURE RESISTON[7] ELEMENT	.375x.25x.31	W	±20	0.25	150	300°	Yes	10K-1 Meg	5.94	5.50	4.95
		.31 dia. x.19	P						10K-1 Meg	8.91	8.25	7.43
		.31 dia. x.47	S									

MOUNTING HARDWARE



H-01 —1½", 2-56 machine screw
H-02 —2-56 Stainless steel rod stock (12" length only)
H-03 —2.56 Hex nut, stainless steel for use on H-01 and H-02
H-04 —1-72 machine screw, 1" long
H-05 —1-72 hex nut, stainless steel (for use on H-04)
H-12S—Stainless steel side bracket for models with 1" mounting centers
H-22S—Stainless steel side bracket for models with ¾" mounting centers
H-25 —Stainless steel stacking straps for models with 0.520" mounting centers
H-11E—Stainless steel end bracket for models with 1" mounting centers
H-21E—Stainless steel end bracket for models with ¾" mounting centers
H-26S—Stainless steel side bracket for models with 0.520" mounting centers

NOTES

[1] Key to terminal types: L=Insulated stranded leads. S=Solder Lugs (includes panel mount bushings on models 3300S, 3301S, 3367S, 3368S only). P=Printed circuit pins (flat mounting). W=Printed circuit pins (edge mounting). Additional worm gear terminal classification: W=Printed circuit pins (edge mounting—top adjustment). H=Printed Circuit pins (edge mounting—side adjustment).

[2] Franchised local distributors quote factory prices to 500 pieces. Contact factory for prices in high quantities.

[3] The following resistances are standard if they fall within the limits listed: Wirewound—10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 25K, 50K, 100K. RESISTON, RESISTALOY—5K, 10K, 20K, 50K, 100K, 200K, 500K, 750K, 1 Meg., 2 Meg., 5 Meg. PALIRIUM—2, 5, 10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K, 750K, 1 Meg. Other resistances available on special order.

[4] Closer tolerances available on request except commercial models.

[5] All models are sealed against sand and dust.

[6] Humidity-proof versions available on special order. Contact factory for part number, price and delivery.

[7] BOURNS, TRIMPOT, TWINPOT, TRIMIT, E-Z-TRIM, RESISTALOY, RESISTON, PALIRIUM, SILVERWELD, KNOBPOT and QUADRATRON are registered trademarks of Bourns, Inc. Other products made by Bourns, Inc., are identified by trademarks which include: TRIMISTOR, TRIMM, MIL-F-TRIM, CARBOLON, PANLTRIM, MILISEAL, CLOCKPOT, TRIMR, MICROTRIM, RESISTRIM, TRIMPOT JR., B, LABPOT, INFINITRON, DIALPOT, and TRIMPONENT. Bourns, Inc. is the owner of rights under the following listed United States Letters Patents relating to certain of its adjustment potentiometers: 2,706,230/2,777,926/2,805,-307/2,831,949/2,873,337/2,882,375/2,922,976/2,935,716/2,945,198/2,946,-975/3,010,092/3,018,459/2,898,569/3,089,110/RE 25,412/RE 25,725/3,107,-336/RE 25,510/3,124,779/3,124,955/3,139,601. Other patents pending. Certain Bourns products are under issued and pending foreign patents.

BOURNS INC ADJUSTMENT POTENTIOMETERS

CERMET ELEMENT TRIMPOT POTENTIOMETER

NEW PRODUCT DEVELOPMENT

The vast improvements following the original design and prototype of the first adjustment potentiometer has now, as in the past, meant that Bourns sets the standard for the industry. The new products and processes constantly being developed – RESISTON® carbon and PALIRIUM® cermet elements, and the virtually indestructible SILVERWELD® termination, to name a few–serve to show that Bourns produces today what others predict for tomorrow.

Bourns potentiometers – not merely first, but the largest producer in the industry.

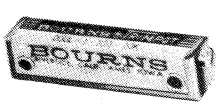
PRODUCT ENGINEERING

This group of highly trained, professional personnel utilize their specialized training to provide rapid, accurate technical assistance. Their individual experience and technical knowledge about adjustment potentiometers enables them to provide this service in a concise manner which saves you time and cuts costs. Such vital and time-saving assistance–available, incidentally, only from Bourns–is another part of the Bourns Total Value picture.



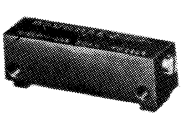
		Dimensions H W L	Terminals [1]	Res. Tol. (%)	Power (Watt) at 70°C	Max. Temp. °C	Adj. Turns	Humidity [5] Mil Spec	Standard Resistances Ω [3]	Prices 1-9	Prices 10-24	Prices 25-49
3012	HIGH TEMPERATURE PALIRIUM[7] CERMET ELEMENT (RJ 11)[2]	.31x.28x1.25	L,P	±10	1.0	175	22	Yes	10-1 Meg	5.94	5.50	4.95
3052	HIGH TEMPERATURE PALIRIUM[7] CERMET ELEMENT (RJ 12)[2]	.31x.19x1.25	L,S,P	±10	1.0	175	22	Yes	10-1 Meg	5.94	5.50	4.95
3009	COMMERCIAL E-Z-TRIM[7] POTENTIOMETER	.35x.19x.75	P,Y	±10	0.75 at 25°C	125	20	Yes	10-1 Meg	1.94	1.84	1.75
3059	HIGH TEMPERATURE HUMIDITY PROOF	.32x.19x1.25	L,P,Y,J	±10	1.0	150	22	Yes	10-1 Meg	3.00	2.85	2.70
3069	COMMERCIAL E-Z-TRIM[7] POTENTIOMETER	.35x.25x.75	P	±10	0.75 at 25°C	125	20	Yes	10-1 Meg	1.94	1.84	1.75
3082	MICRO-MINIATURE PALIRIUM[7] CERMET ELEMENT	.10x.15x.50	P	±10	0.3 at 85°C	150	10	Yes	10-1 Meg	7.70	7.13	6.42
3099	DUAL IN-LINE CERMET ELEMENT CERMET ELEMENT	.30x.19x.75	P	±10	0.75 at 25°C	125	20	Yes	10-1 Meg	3.75	3.35	3.00
3252	HIGH PERFORMANCE HUMIDITY PROOF	.50x.50x.22	L,P,W,X	±10	1.0	150	23	Yes	10-2 Meg	5.62	5.35	5.06
3262	MICRO-MINIATURE HIGH TEMPERATURE	.25x.17x.25	W,X,P	±10	0.25 at 85°C	175	12	Yes	10-1 Meg	7.70	7.40	7.10
3282	MICRO-MINIATURE PALIRIUM[7] CERMET ELEMENT	.20x.375x.375	L,P,W,H	±10	.5 at 85°C	175	25	Yes	10-1 Meg	6.50	6.18	5.85
3292	THIN LINE PALIRIUM[7] CERMET ELEMENT (RT 24)[2]	.15x.375x.375	L,P,W,X	±10	.5 at 85°C	175	22	Yes	10-1 Meg	6.50	6.18	5.85
3329	HIGH PERFORMANCE PALIRIUM[7] CERMET ELEMENT	.250 Dia. x .180	H,W,P	±20	0.50	150	240°	Yes	10-1 Meg	1.75	1.66	1.57

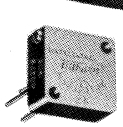
WIREWOUND ELEMENT GENERAL PURPOSE











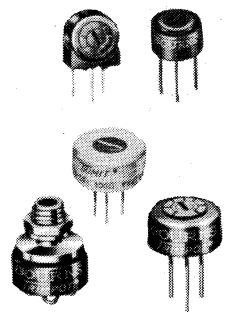
200		.31x.25x.1.25	L,S,P / L	±10	0.5	125	25	Steady State	10-10K 20K & 25K 50K 100K	4.86 6.48 7.56 9.18	4.50 6.00 7.00 8.50	4.05 5.40 6.30 7.65
236	HUMIDITY PROOF	.36x.30x1.34	L,S,P / L	±10	0.8	135	25	Yes	10-10K 20K & 25K 50K 100K	7.02 8.64 9.18 11.34	6.50 8.00 8.50 10.50	5.85 7.20 7.65 9.45
260	HIGH TEMPERATURE	.28x.25x1.25	L,S,P / L	±10	1.0	175	25	Steady State	10-10K 20K & 25K 50K 100K	5.94 7.56 8.10 9.72	5.50 7.00 7.50 9.00	4.95 6.30 6.75 8.10
271 273 275	COMMERCIAL TRIMIT[7] POTENTIOMETER	.28x.25x1.25	L,S,P	±10	0.50 at 25°C	105	25	Steady State	10-10K 20K 50K	3.19 4.32 5.40	2.95 4.00 5.00	2.66 3.60 4.50
3005	SEALED COMMERCIAL E-Z-TRIM[7] POTENTIOMETER	.31x.17x.75	P	±10	1.0 at 40°C	125	20	Steady State	10-20K	2.00	1.85	1.75
3007	COMMERCIAL E-Z-TRIM[7] POTENTIOMETER	.31x.16x.75	P	±10	1.0 at 40°C	125	20	Steady State	10-25K	1.75	1.62	1.46
3065	HUMIDITY PROOF COMMERCIAL E-Z-TRIM[7] POTENTIOMETER	.36x.29x1.0	P	±10	0.5 at 25°C	85	15	Steady State	50-20K	1.95	1.85	1.75
3067	COMMERCIAL E-Z-TRIM[7] POTENTIOMETER	.36x.28x1.0	S,P	±10	0.5 at 25°C	85	15	Steady State	50-20K	1.85	1.71	1.54
3255	COMMERCIAL TRIMIT[7] POTENTIOMETER	.19x.50x.50 .22x.50x.50	L P,W,X	±5	1.0 at 50°C	150	25	No	10-10K 20K-25K 50K	4.76 5.25 5.71	4.52 4.99 5.42	4.28 4.73 5.14

REFER TO NOTES—PAGE 4

CONTINUED

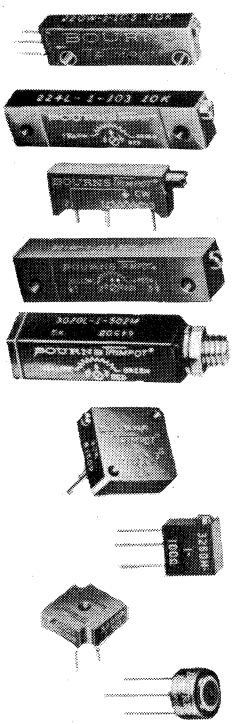
BOURNS ADJUSTMENT POTENTIOMETERS

WIREWOUND ELEMENT GENERAL PURPOSE
CONTINUED



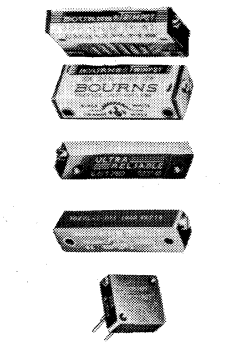
		Dimensions H W L	Termi-nals [1]	Res. Tol. (%)	Power (Watt) at 70°C	Max. Temp. °C	Adj. Turns	Humid-ity [5] Mil Spec	Standard Resis-tances Ω [3]	1-9	Prices 10-24	25-49
3305	COMMERCIAL TRIMIT[7] POTENTIOMETER	.31x.25x.375	W	±5	1.5 at 70°C	125	280°	Steady State	10-5K	2.25	2.16	2.07
		.31 dia. x.19	P						10K	2.50	2.40	2.30
									20K	3.00	2.88	2.76
									10-5K	1.75	1.68	1.61
									10K	2.00	1.92	1.84
									20K	2.50	2.40	2.30
3365	INDUSTRIAL TRIMIT[7] POTENTIOMETER	.59x.315x.50	W	±5	1.0 at 25°C	125	280°	Yes	10-10K	3.55	3.23	2.90
		.50 dia. x.23	P						20K & 25K	4.38	3.98	3.58
									50K	4.71	4.28	3.85
									10-10K	3.30	3.00	2.70
									20K & 25K	4.13	3.75	3.38
									50K	4.46	4.05	3.65
3367	SUB-MINIATURE SINGLE-TURN	.50 dia. x.24	P	±5	0.5	105	285°	Steady State	10-20K	4.86	4.50	4.05
		.50 dia. x.54	S						50K	6.84	6.33	5.70
									10-20K	5.67	5.25	4.73
									50K	7.65	7.08	6.38

WIREWOUND ELEMENT HIGH-PERFORMANCE



220	SUB-MINIATURE HIGH TEMPERATURE (RT 10)	.31x.18x1.0	L,W	±5	1.0	175	15	Yes	10-10K	8.64	8.00	7.20
									20K & 30K	10.26	9.50	8.55
224	HIGH TEMPERATURE (RT 12)	.32x.19x1.25	L,S,P	±5	1.0	175	22	Yes	10-10K	7.02	6.50	5.85
									20K & 25K	8.64	8.00	7.20
									50K	9.18	8.50	7.65
									100K	11.34	10.50	9.45
3000	MICRO-MINIATURE HIGH TEMPERATURE	.31x.16x.75	P	±10	0.5	175	15	Yes	50-10K	9.72	9.00	8.10
									20K	10.80	10.00	9.00
3010	HIGH TEMPERATURE (RT 11)	.31x.28x1.25	L,P	±5	1.0	175	25	Yes	10-10K	7.02	6.50	5.85
									20K & 25K	8.64	8.00	7.20
									50K	9.18	8.50	7.65
									100K	11.34	10.50	9.45
3070	FINE RESOLUTION	.31 x.31x1.06	H	±5	1.5	175	10	Yes	100-20K	10.50	10.25	10.00
		.375x.31x1.06	P						50K	12.50	12.25	12.00
		.31 x.31x1.06	S,L						100-20K	11.50	11.20	10.90
									50K	13.50	13.20	12.90
3250	SUB-MINIATURE HIGH TEMPERATURE (RT 22)	.19x.50x.50	L	±5	1.0	175	25	Yes	10-10K	6.71	6.22	5.59
									20K & 25K	7.56	7.00	6.30
									50K	10.00	9.27	8.34
		.22x.50x.50	P,W,X						10-10K	7.23	6.69	6.02
									20K & 25K	7.97	7.38	6.64
									50K	10.53	9.75	8.78
3260	MICRO-MINIATURE HIGH TEMPERATURE	.25x.25x.17	H,W	±5	0.2	175	11	Yes	10-1K	7.50	6.95	6.25
									2K & 5K	8.25	7.64	6.88
									10K & 20K	10.50	9.72	8.75
									25K	11.00	10.19	9.17
3290	MICRO-MINIATURE HIGH TEMPERATURE	.150x.375x.375	P	±5	1.0	175	25	Yes	10-10K	7.33	6.79	6.11
		.145x.375x.375	L						20K & 25K	8.75	8.10	7.30
		.145x.375x.390	W,H						50K	10.10	9.35	8.42
3300	MICRO-MINIATURE SINGLE-TURN HIGH TEMPERATURE	.37x.25x.31	W	±5	0.5	175	300°	Yes	10-10K	5.94	5.50	4.95
		.31 dia. x.18	P						25K	7.56	7.00	6.30
		.31 dia. x.46	S						10-10K	8.91	8.25	7.43
									25K	10.53	9.75	8.78

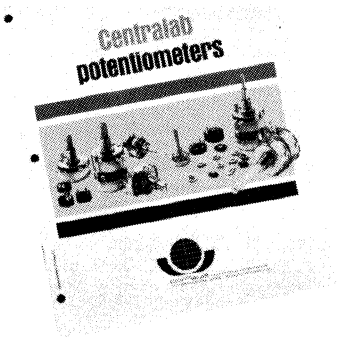
WIREWOUND ELEMENT SPECIAL PURPOSE



207	HIGH POWER (2-WATT)	.81x.28x1.25	L	±10	2.0 at 50°C	175	25	No[6]	100-50K	10.26	9.50	8.55
									100K	11.88	11.00	9.90
209	DUAL ELEMENT TWINPOT[7] POTENTIOMETER	.31x.50x1.25	L	±10	0.5 (each element)	135	25	No[6]	10-10K	12.96	12.00	10.80
									20K & 25K	14.58	13.50	12.15
									50K	16.20	15.00	13.50
224-500	ULTRA-RELIABLE	.32x.19x1.25	L,P	±5	0.5	150	22	Yes	100-10K	14.58	13.50	12.15
									20K	16.20	15.00	13.50
3020	HIGH POWER HUMIDITY PROOF	.33x.25x1.25	L	±5	3.75	200	25	Yes	100-10K	14.04	13.00	11.70
									20K & 25K	15.66	14.50	13.05
									50K	16.20	15.00	13.50
3250-501	HIGH RELIABILITY	.19x.50x.50	L	±5	0.5	150	25	Yes	100-10K	13.50	12.50	11.25
		.22x.50x.50	P,W,X						20K	14.58	13.50	12.15

REFER TO NOTES—PAGE 4

Centralab potentiometers and trimmers are available in the size, resistance wattage and styles you need!



Request your copy of this potentiometer catalog through Centralab's advertising department.

Below is a brief summary of the types listed in our sixty page potentiometer catalog. These potentiometers are in many cases available ganged and with either front or rear mounted wafer switches as well as rear mounted line switches. Special tapers for almost every application are already available.

Most of these potentiometers have dustproof construction. Equivalent noise resistance of as low as ½% of nominal maximum resistance is available.

Many models are available with numerous mountings and terminal configurations, enabling easy fitting into printed circuit boards or wired construction.

Diameter Inches	Rotation Mechanical	Resistance Range, Ohms	Tapers	Terminals	Power Rating	Application Mil.	Com'l.	Ind.
MODEL 1 MINIATURE COMPOSITION—SPST Switch Available								
5/8 without knob 45/64 with knob	260°	200—10 meg	variety	solder lug or P.C.	.2W @ 40°C		X	X
MODEL 2 COMPOSITION—Available in an almost unlimited range of mountings, terminals, shafts & line switches								
15/16	300°	200—10 meg	variety	variety of solder lugs & P.C.	.5W @ 40°C		X	X
MODEL 3 COMPOSITION								
43/64	260°	100—10 meg	variety	solder lug	.25W @ 40°C	X	X	X
43/64	260°	100—10 meg	variety	solder lug	.5W @ 70°C	X	X	X
MODEL 3W WIRE WOUND								
43/64	250°	30K—10 meg	variety	solder lug	1.5W @ 40°C		X	X
43/64	250°	30K—10 meg	variety	solder lug	2.W @ 70°C	X		X
MODEL 4 WIRE WOUND								
1-5/32	295°	1—100K	variety	solder lug	.5W @ 40°C	X	X	X
MODEL 5 COMPOSITION SINGLE OR MULTIPLE MINIATURE TRIMMERS (with integral fixed PEC® resistors & capacitors on ceramic plate optional)								
approx. 3/4" square (single unit)	290°	200—10 meg	linear	solder lug or P.C.	.25W @ 70°C	X	X	X
MODEL 6 MINIATURE COMPOSITION—SPST Switch Available								
1/2	250°	200—10 meg	variety	solder lug	.1W @ 40°C		X	X
MODEL 8 MICRO-MINIATURE COMPOSITION—SPST Switch Available								
9/32	250°	200—10 meg	variety	P.C.	.1W @ 40°C		X	
MODEL 9 MINIATURE COMPOSITION								
45/64	260°	100—10 meg	variety	solder lug or P.C.	.2W @ 40°C	X	X	X
MODEL 12 HOT MOLDED								
1-7/64	312°	10-5 meg	variety	solder lug	2.25 @ 70°C	X	X	X

FOR IMMEDIATE DELIVERY

Many types, in most popular resistance ranges, are stocked by Centralab Industrial Distributors.

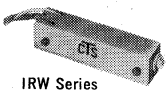
CENTRALAB
Electronics Division
GLOBE-UNION INC.
5757 NORTH GREEN BAY AVENUE
MILWAUKEE, WISCONSIN 53201

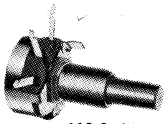
CTS CORPORATION ELKHART, INDIANA TRIMMERS

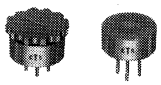
WIREWOUND


112 Series


111 Series


IRW Series


118 Series

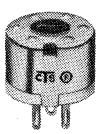

350 Series

Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
110-112	1700	3/4" Dia.	1.5-3	1/2Ω-10KΩ	105°C	Berne
115-118	1750	3/4" Dia.	2-3	1/2Ω-20KΩ	105°C	Berne
350	5500	1/2" Dia.	1	50Ω-20KΩ	125°C	Asheville
IRW*	5625	1¼" Recti-linear	1/2	400Ω-2KΩ	150°C	Canada

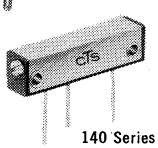
*Infinite resolution wire wound

COMPOSITION


220 Series


330 Series

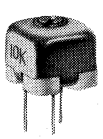

201 Series

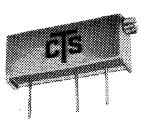

140 Series

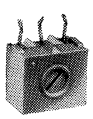
Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
140*	2600	1¼" Recti-linear	1/4	100Ω-1 Meg	125°C	California
201	1201	19/32" Dia.	1/8	100Ω-5 Meg	85°C	Elkhart
203	1203	Side-by-Side	1/8	100Ω-5 Meg	85°C	Asheville
220	2500	7/16" x 1/2"	1/8	100Ω-2.5 Meg	85°C	California
330 (Carbon Ceramic)	2330B	1/2" Dia.	3/8	100Ω-2.5 Meg	150°C	California

*MIL Style RJ-11—MIL-R-22097C

CERMET

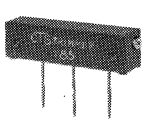

340 Series


190 Series


360 Series


175 Series


165 Series


185 Series

Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
165	3165B	3/8" Square	1/2	20Ω-2.5 Meg	150°C	Berne
170	3170	1/2" Square	3/4	20Ω-2 Meg	150°C	Berne
175*	3175	1/2" Square	1/2	50Ω-1 Meg	150°C	Berne
185	3185	1¼" Recti-linear	1	25Ω-1 Meg	175°C	Micro
B185	B3185	Bushing Mount	—	—	—	Micro
190	3190	3/4" Recti-linear	1/2	20Ω-1 Meg	125°C	Berne
340	3340	1/4" Square	1/2	10Ω-500K	150°C	Berne
360	3360	7/16" x 25/64"	1/2	20Ω-2.5 Meg	125°C	Berne
385	3385	.345" Dia.	1/8	20Ω-500K	175°C	Berne
630	3630B	1/2" Dia.	1/2	20Ω-2.5 Meg	150°C	Berne
660	3660	3/8" Dia.	1/4	100Ω-500K	175°C	Berne

*Approved to MIL-R-22097 style RJ22

ORDERING INFORMATION: Place orders at locations shown above, using the following addresses:

CTS of Elkhart, Div., 1142 W. Beardsley Ave., Elkhart, Indiana 46514 • Telephone 219-JA 3-0210 • TWX 810-294-2256
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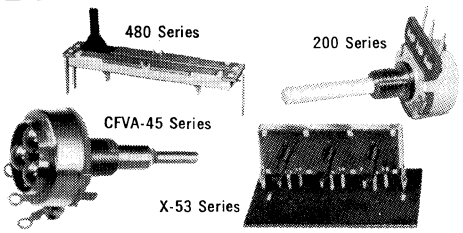
CTS CORPORATION ELKHART, INDIANA POTENTIOMETERS

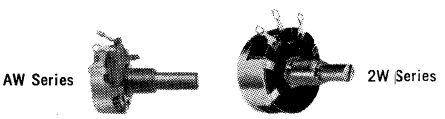
COMMERCIAL COMPOSITION



Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
45	Cat. 1000	15/16" Dia.	1/4 to 3/4	100Ω-10 Meg	85°C	Elkhart*
VA45	1150	15/16" Dia.	1/4 to 3/4	100Ω-10 Meg	85°C	California
70	1100	3/4" Dia.	.2 to .3	200Ω-7.5 Meg	85°C	California
200	1200	5/8" Dia.	.2 to 1/4	100Ω-5 Meg	85°C	Elkhart
2-200 & C2-200	1200A	5/8" Dia.	.2 to 1/4	100Ω-5 Meg	85°C	Elkhart
M-250	1300	9/32" Dia.	1/10	500Ω-10 Meg	85°C	Asheville
480	1480	2" Slide con.	1/4-1/2	100Ω-10 Meg	55°C	Elkhart
HVC	1600	2" Dia.	2	5KΩ-50 Meg	100°C	Asheville
X52-53	2700	Side-by-side	1/4-1/3	250Ω-10 Meg	85°C	Asheville

*West of Mississippi River order from California.

COMMERCIAL WIREWOUND



Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
25	2001	1 17/32" Dia.	4	3Ω-25K	85°C	California
252	1901	1 17/64" Dia.	2	3Ω-15K	85°C	California
2W	1800	1 1/4" Dia.	2	1Ω-50K	100°C	Asheville
AW	2100	15/16" Dia.	5	1Ω-25K	105°C	Asheville
VA-AW	1150	15/16" Dia.	5	1Ω-25K	105°C	Asheville

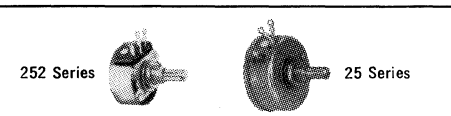
MILITARY COMPOSITION



Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
65 (RV5)*	2400	3/4" Dia.	1/2	100Ω-2.5 Meg	150°C	California
90 (RV2)*	2300A	15/16" Dia.	1	100Ω-2.5 Meg	150°C	California

*Approved to MIL-R-94B

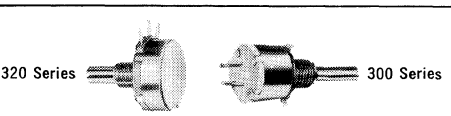
MILITARY WIREWOUND



Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
25 (RA30)*	2000	1 17/32" Dia.	4	3Ω-25K	105°C	California
252 (RA20)*	1900	1 17/64" Dia.	2	3Ω-15K	105°C	California
WP (RA20)*	2200	1 1/4" Dia.	2	3Ω-15K	105°C	Asheville

*Approved to MIL-R-19

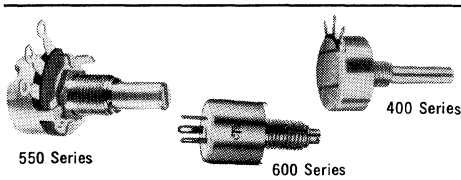
MILITARY AND INDUSTRIAL CARBON CERAMIC



Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
300 (RV6)*	2450	1/2" Dia.	3/4	100Ω-2.5 Meg	150°C	California
320 (RV4)*	1400	1 1/16" Dia.	3	250Ω-2.5 Meg	150°C	California
321	1401	1 1/16" Dia.	3	250Ω-2.5 Meg	150°C	California

*Approved to MIL-R-94B

MILITARY AND INDUSTRIAL CERMET



Series	Data Sheet	Description	Wattage	Resistance Range	Max. Op. Temp.	Order From
400	3400	1 3/4" Dia.	3	20Ω-5 Meg	175°C	Berne
500	3500	3/4" Dia.	1 1/2	20Ω-5 Meg	175°C	Berne
550 (RVC5)*	3550A	3/4" Dia.	2	50Ω-5 Meg	150°C	Berne
2-550 & C2-550	3550B	3/4" Dia.	2	50Ω-5 Meg	150°C	Berne
600 (RVC6)*	3600	1/2" Dia.	1/2	20Ω-2.5 Meg	175°C	Berne
660	3660	3/8" Dia.	1/4	100Ω-500K	175°C	Berne

*Approved to MIL-R-23285B

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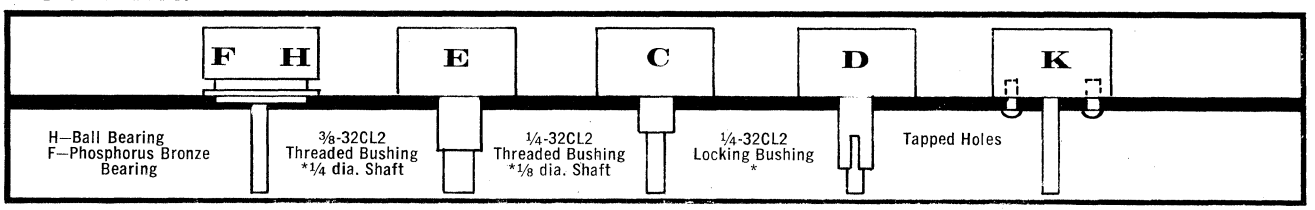
WIRE WOUND SINGLE TURN — MIL STD.									PLASTIC HOUSING—COM.		
SIZE	½″	⅞″	1 1/16″	1 7/16″	1⅝″	1¾″	2″	3″	2″	3″	
TYPE	120	118	223	157	136	160	119	236	508	511	
MIL. SIZE	05	09	11	15	17	18	20	30	—	—	
FUNCTION ANGLE	320°	320°	320°	320°	320°	320°	350°	350°	320°	320°	
STD. LIN.	±.5%	±.4%	±.3%	±.25%	±.2 %	±.18%	±.15%	±.1%	±.25%	±.25%	
SPL. LIN.	±.3%	±.25%	±.2%	±.1%	±.1%	±.09%	±.09%	±.07%	±.2%	±.2%	
MAX. RES.	75KΩ	100KΩ	100KΩ	150KΩ	150KΩ	175KΩ	200KΩ	500KΩ	250KΩ	500KΩ	
WATTS	2	3	3.5	4	4	4	4.5	5	3	5	

MOUNTING



CONDUCTIVE PLASTIC SINGLE TURN — MIL STD.									PLASTIC HOUSING—COM.		
SIZE	½″	⅞″	1 1/16″	1 7/16″	1⅝″	1¾″	2″	3″	2″	3″	
TYPE	CP120	CP118	CP223	CP157	CP136	CP160	CP119	CP236	CP508	CP511	
MIL. SIZE	05	09	11	15	17	18	20	30	—	—	
FUNCTION ANGLE	320°	340°	340°	345°	345°	345°	345°	345°	345°	345°	
STD. LIN.	±.7%	±.5%	±.5%	±.4%	±.4%	±.35%	±.3%	±.25%	±1%	±.7%	
SPL. LIN.	±.2%	±.1%	±.05%	±.04%	±.04%	±.03%	±.03%	±.01%	±.5%	±.25%	
MAX. RES.	60KΩ	100KΩ	150KΩ	150KΩ	175KΩ	200KΩ	250KΩ	400KΩ	250KΩ	400KΩ	
WATTS	1	1.4	1.6	2	2.2	2.6	3	5	3	5	

GENERAL SPECIFICATIONS

WIRE WOUND POTENTIOMETERS	CONDUCTIVE PLASTIC POTENTIOMETERS
Resistance Tolerance ±5% Std. Spl. Avail.	Resistance Tolerance ±5% Std. Spl. Avail.
Function Angles Spl. Available.	Function Angles Spl. Available.
Rotation Continuous, Stops Available.	Rotation Continuous, Stops Available.
Taps to Single Turn of Wire With Positive Elimination of Failure.	Taps of Low Resistance or Zero Width Available.
Power Rating to Zero Watts at 150°C.	Power Rating to Zero Watts at 150°C.
Ambient Temp. −65°C to +125°C Std. to 150°C Available.	Ambient Temp. −65°C to +125°C Std. to 150°C Available.

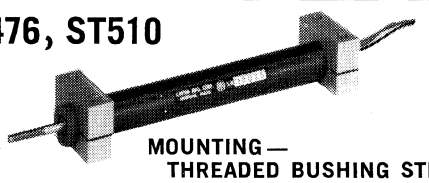
CARTER MANUFACTURING CORPORATION

WIRE WOUND MULTI-TURN POTENTIOMETERS

SIZE	½″	½″	½″		SIZE	⅞″	⅞″	⅞″	
TYPE	120-3	120-5	120-10		TYPE	118-3	118-5	118-10	
MIL SIZE	05	05	05		MIL SIZE	09	09	09	
FUNCTION ANGLE	1080°	1800°	3600°		FUNCTION ANGLE	1080°	1800°	3600°	
STD. LIN.	±.75%	±.5%	±.2%		STD. LIN.	±.15%	±.08%	±.04%	
SPL. LIN.	±.2%	±.1%	±.05%		SPL. LIN.	±.07%	±.04%	±.02%	
MAX. RES.	30KΩ	50KΩ	100KΩ		MAX. RES.	30KΩ	50KΩ	100KΩ	
WATTS	2	2	2		WATTS	3	3	3	
TAPS	AS SPEC.	AS SPEC.	AS SPEC.		TAPS	AS SPEC.	AS SPEC.	AS SPEC.	

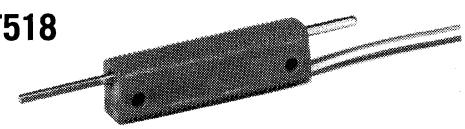
RECTILINEAR POTENTIOMETERS — WIRE OR CONDUCTIVE PLASTIC

ST476, ST510



MOUNTING — THREADED BUSHING STD.
CLAMPS - SPECIAL

ST518

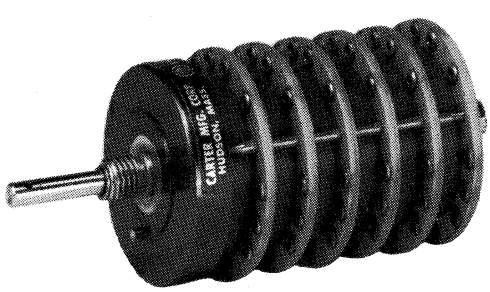


ST403



TYPE	SIZE	STROKE	RES. Ω	STD. LIN.	SPL. LIN.	ELEMENTS	WATTS 125°
ST476	½″ Dia.	To 8″	100K/″ Max.	2% Stroke	1% Stroke	1 or 2	1
ST510	¾″ Dia.	To 12″	150K/″ Max.	2% Stroke	1% Stroke	1 or 2	1.5
ST518	5/16″ x ¼″ x 1¼″	To ½″	75K/″ Max.	2% Stroke	1% Stroke	1	.25
ST403	1¼″ x 1¼″	To 36″	100K/″ Max.	2% Stroke	1% Stroke	1 or 2	1

SWITCHES



CARTER MANUFACTURES CUSTOM MADE SWITCHES IN CONJUNCTION WITH POTENTIOMETERS OR AS ENCLOSED WAFER TYPES. THEY MAY BE SIMPLE ANGLE INDICATORS OR PRECISION COMMUTATORS. SUCH APPLICATIONS REQUIRING HIGH PRECISION, MINIATURIZATION & SOPHISTICATED SWITCHING FUNCTIONS HAVE BEEN SOLVED, MANY WITHIN THE PARAMETERS OF COMMON SWITCH APPROACHES. CARTER'S UNIQUE SWITCH ENGINEERING HAS SUPPLIED THE ANSWER WHEN THE NUMBER OF POLES OR CONTACTS ARE IN CONTRADICTION WITH THE AVAILABLE SPACE. WHEN INTERCONNECTIONS BECOME A PROBLEM THEY CAN BE GREATLY REDUCED BY CUSTOM DESIGNED INTERNAL INTERCONNECTIONS INCREASING RELIABILITY & IMPROVED APPEARANCE.

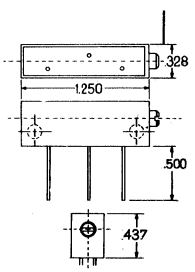
DESIGN & SELECTION CRITERIA of

MINIATURE TRIMMERS

MULTI-TURN
Series 76



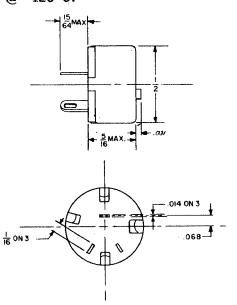
Resistance Range: To 20K ohms • **Tolerance:** ±5% • **Power Rating:** .75W @ 85°C, Derated to zero @ 150°C.



SINGLE-TURN
Series 371



Resistance Range: 100 ohms to 1 megohm • **Tolerance:** ±20% standard, ±10% also available • **Working Voltage:** 350 volts R.M.S. max • **Power Rating:** ¼ watt @ 70°C derated linearly to zero watts @ 120°C.

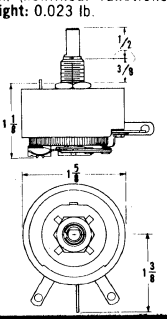


RHEOSTAT

POWER RHEOSTAT
Series 25

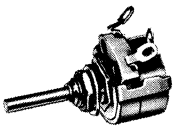


Resistance Range: 0.5 to 5K ohms • **Tolerance:** ±10% or closer • **Power Rating:** 25W @ 25°C. • **Working Voltage:** 350V max. • **Effective Rotation:** 280°±5° (250°±5° with off switch) • **Tapers:** 18 ohms per° max. (nonlinear functions) • **Weight:** 0.023 lb.

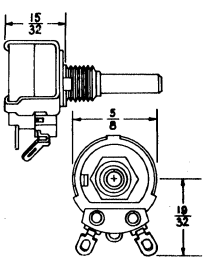


COMPOSITION-ELEMENT POTENTIOMETERS

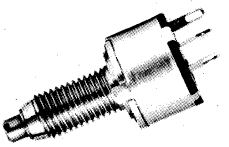
0.3 WATT
Series 48



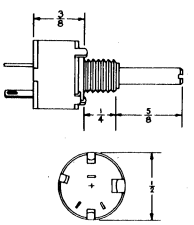
Resistance Range: Linear 100 ohm to 5 megohms, **Tapered** 500 to 2.5 megohms • **Tolerance: Linear** To 100K ohms ±10%, over 100K ohms: ±20%, **Tapered** 20% of all values • **Power Rating: Linear** 0.3W to 10K ohms; 0.2W over 10K ohms @ 40°C, Derated to zero power @ 85°C • **Weight:** 0.14 oz.



0.5 WATT
Series 63

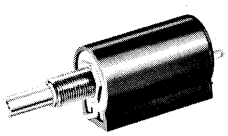


Resistance Range: 100 ohms to 5 megohms • **Tolerance:** To 1 megohm ±10%, over 1 megohm ±20% • **Power Rating:** 0.5W @ 70°C, Derated to zero power at 120°C.

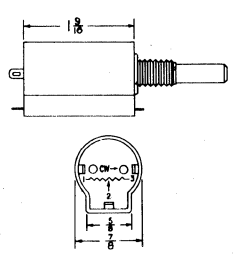


PRECISION POTENTIOMETERS

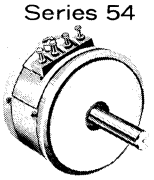
MULTI-TURN
Series 62



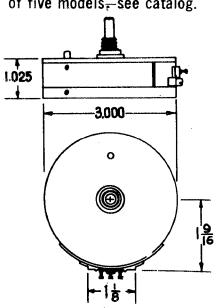
Resistance Range: To 100K ohms • **Tolerance:** ±5% • **Linearity:** 0.25% Absolute • **Power Rating:** 2W @ 25°C, Derated to zero @ 85°C • **Maximum Number of Turns:** 10 • **Weight:** 1.34 oz.



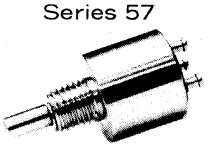
VARI-PHASE
Series 54



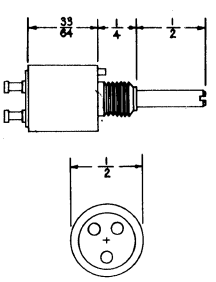
Resistance Range: To 300K ohms • **Tolerance: Standard** ±5%, **Special** ±1% • **Linearity: Standard** ±0.5% Absolute, **Special** ±0.15% Indep. • **Power Rating:** 6.1W @ 40°C, Derated to zero @ 125°C • **Maximum Number of Gangs:** 12 • **Weight:** 4.5 oz. • **Note:** One of five models—see catalog.



MINIATURE
Series 57



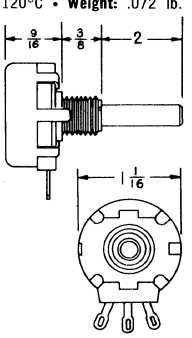
Resistance Range: Standard To 25K ohms, **Special** To 100K ohms • **Tolerance:** Standard ±10%, **Special** To ±3% • **Linearity:** Standard ±2.0%, **Special** Specify • **Power Rating: Standard** 2W @ 70°C, **Special** Specify • **Weight:** .25 oz.



2 WATTS MOLDED
Series 53



Resistance Range: Linear 50 ohms to 10 megohms • **Tapered** 250 ohms to 5 megohms • **Tolerance:** To 1 megohm 10%, over 1 megohm ±20% • **Power Rating:** 2W @ 70°C, Derated to zero power @ 120°C • **Weight:** .072 lb.



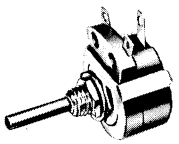
CLAROSTAT

CLAROSTAT MFG. CO., INC. DOVER, NEW HAMPSHIRE

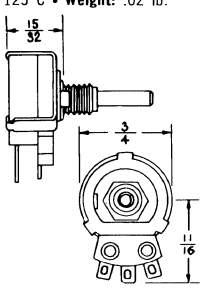
RESISTANCE & SWITCHING DEVICES

WIRE-WOUND POTENTIOMETERS

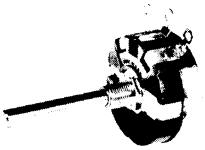
1.5 WATTS
Series 49



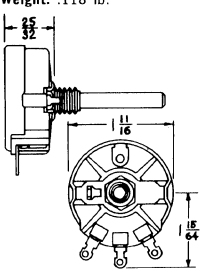
Resistance Range: 1 to 20K ohms • **Tolerance:** ±10% or closer, specify • **Linearity:** ±5% or closer, specify • **Power Rating:** 1.5W @ 40°C, Derated to zero power @ 125°C • **Weight:** .02 lb.



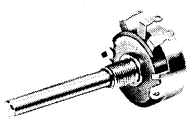
3 WATTS
Series 58



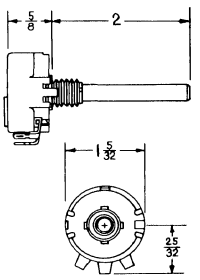
Resistance Range: 1 ohm to 75K ohms • **Tolerance:** ±10% or closer, specify • **Linearity:** ±5% or closer, specify • **Power Rating:** 3 or 4W (specify) @ 40°C, Derated to zero power @ 105°C • **Typical Weight:** .118 lb.



2 WATTS
Series 43



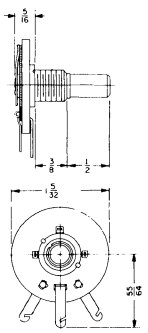
Resistance Range: 1 ohm to 50K ohms • **Tolerance:** 10% or closer, specify • **Linearity:** 5% or closer, specify • **Power Rating:** 2W @ 40°C, Derated to zero power @ 105°C • **Weight:** .077 lb.



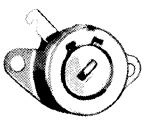
1 WATT HUMDINGER
Series MH



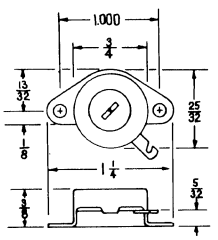
Resistance Range: 2 to 15K ohms • **Tolerance:** ±10% • **Power Rating:** 1 W @ 40° C. • **Taps:** Available in any position • **Effective Rotation** 280° • **Weight:** 0.024 lb.



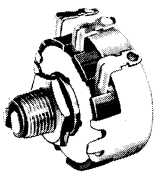
2 WATTS HUMDINGER
Series 39



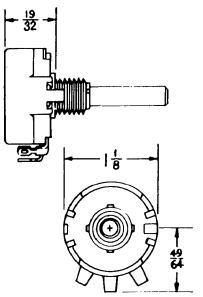
Resistance Range: 4 ohms to 5K ohms • **Tolerance:** ±20% • **Power Rating:** 2 Watts @ 40°C • **Weight:** 0.008 lb.



4 WATTS
Series 45



Resistance Range: 1 ohm to 10,000 ohms • **Tolerance:** ±10% or closer, specify • **Linearity:** ±5% or closer, specify • **Power Rating:** 4W @ 40°C, Derated to zero power @ 135°C • **Weight:** .077 lb.



FIXED WIRE-WOUND POWER RESISTORS

GREENOHM — Cement-Coated type, extra rugged, 5 to 200 watts.

GREENOHM, Jr — Ceramic-cased axial lead, 5 to 20 watts.

STANDEES — Ceramic-cased for upright chassis mounting, 10-20 watts.

SERIES ZT — Stack-mounting, cement coating, 30-75 watts.

FLEXOHMS & GLASOHMS — Flexible resistors for point-to-point circuitry.

GREENOHM "V" — Vitreous enameled power resistors 5-200 watts.

SERIES VZT — Vitreous enameled, stack-mounting, 30-75 watts.

SERIES SC — Precision molded power resistors, 1 to 10 watts.

SERIES VC — Vitreous enameled, axial lead 3, 6.5, 11 watts.

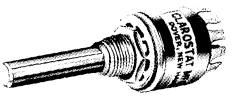
GREENOHM EDGE-WOUND — Vitreous enameled power resistors, 90-375 watts.

SERIES 25 & 25G — Power-type variable resistors, 25 watts — 0.5 ohm to 5000 ohms.

SERIES 50 & 50G — Power-type variable resistors, 50 watts — 0.5 ohm to 10K ohms.

SWITCHES

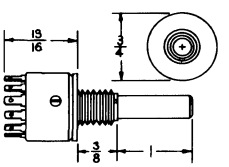
MINIATURIZED ROTARY SELECTOR SWITCHES
Series BHM



Current Rating: 50 ma @ 300 V.A.C. or d.c.; 500 ma @ 30 V.A.C. or d.c.

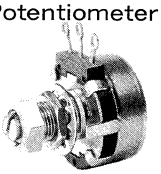
Switch Variations:
Shorting: Single pole, 12 positions; 2 pole, 6 positions; 3 pole, 4 positions; 4 pole, 3 positions.
Non-Shorting: Single pole, 12 positions, 2 pole, 6 positions; 3 pole, 4 positions; 4 pole, 3 positions.

Contact Resistance: 0.005 ohms.

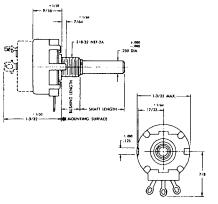


THE QUIET ONES

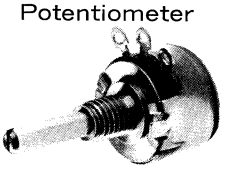
2 WATTS
Series 380
Potentiometer



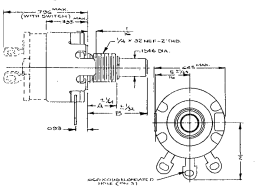
Resistance Range: 100 ohms to 5 megohms. **Tolerance:** ±10% thru 0.5 megohms. **Linearity:** ±5%. **Power Rating:** 2W (single control). **Noise:** linear single controls max. initial noise level of 1% RT. **Weight:** 0.072 lbs.



1 WATT
Series 381
Potentiometer



Resistance Range: 100 ohms to 5 megohms linear; 500 ohms to 2 megohms tapered. **Tolerance:** ±10% thru 0.5 megohms; ±20% over 0.5 megohms. **Linearity:** ±5% (graph) **Power Rating:** 1 watt (single control). **Noise:** linear single controls max. initial noise level of 1% RT. **Weight:** 0.017 lbs.



Write to:

Clarostat Mfg. Co., Inc. Dover, New Hampshire

CLAROSTAT

CLAROSTAT MFG. CO., INC. DOVER, NEW HAMPSHIRE

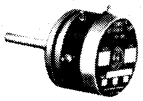
Infinite Resolution PRECISION COMPONENTS

ROTARY Single-Turn POTENTIOMETERS

LINEAR-FUNCTIONAL/SINE-COSINE



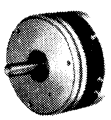
#50



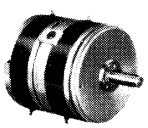
#78



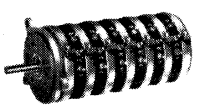
#105 (Ganged)



#205



#206 (Ganged)



#175 (Ganged Special)

SPECIFICATIONS

	LINEAR	SINE-COSINE
Mechanical Rotation	360° Continuous	
Electrical Function Angle	350° Nominal	360°
Resistance Range	0.5KΩ-2 MegΩ	500Ω 50KΩ/Quad.
Best Linearity or Conformity	.1% ÷ Inch of Dia.	.3% P-P ÷ Inch of Dia.
Virtual Resolution	1/250,000	
Wattage	Diameter x 2 Watt(s)	
Temperature Range	—55°C to 150°C	
Taps, Maximum No.	Diameter x 6	
Starting Torque (In.—Oz.)	Diameter x .15	Diameter x .3
Guaranteed Life (at 100 R.P.M.)	To 30 Million Cycles Depending on Circuitry	

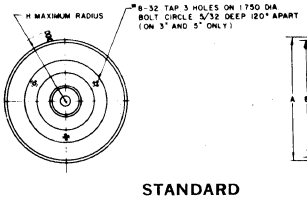
DIMENSIONS

MODEL	50 Linear	78 Linear	105 Linear 106 Sin-Cos	155 Linear 156 Sin-Cos	175 Linear 176 Sin-Cos	175S / 205S / 305S Linear	205 Linear 206 Sin-Cos	305 Linear 306 Sin-Cos	505 Linear 506 Sin-Cos
A	1/2	7/8	1 3/32	1 7/16	1 3/4	—	2	3	5
B*	.4375	7500	1.0300	1.3125	1.5620	—	1.8750	2.8750	4.8750
C*	—	—	—	—	—	—	—	.7500	.7500
D*	.1250	.1250	.1250	.1250	.2500	—	.2500	.2500	.2500
E	.060	.040	.040	.062	.060	—	.060	.047	.047
F	47/64	.635	.635	.725	.985	.725 Each add'l cup adds only .200" Length	.985	1.350	1.870
H	**	19/32	11/16	29/32	1 1/32		1 1/32	1 13/16	2 13/16
K	3/8	3/8	3/8	3/8	3/8		3/8	3/8	3/8
L	5/8	3/4	3/4	3/4	3/4		3/4	3/4	3/4

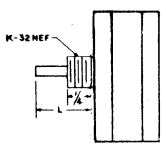
*+.0000 —.0005
**Axial Rear Terminations

Low Torque-Low Inertia Pots are Available in 1¼" O.D.

	177 Linear	178 Sin-Cos
Torque, In.-Oz.	1	2
Inertia, Oz.-In.²	.025	.065



STANDARD



BUSHING MOUNT

ROTARY Multi-Turn POTENTIOMETERS

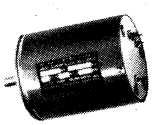
LINEAR-FUNCTIONAL



#5010



#7814



#20010

SPECIFICATIONS

MODEL	5010	7810**	7820**	7813/7814***	20010
Mechanical Rotation	3600° +20° —0°	3700° MIN.	7200° +100° —0°	3600° +100° —0°	3600° +110° —0°
Electrical Function Angle	3600° ±10°	3600° ±10°	7200° ±10°	3600° ±5°	3600° ±5°
Resistance Range	5KΩ—500KΩ	250Ω—125KΩ		5KΩ—1.5 MegΩ	5KΩ—3 MegΩ
Best Linearity or Conformity	0.1%	.075%	.05%	0.05%	0.01%
Virtual Resolution (Typical)	1/150,000	1/200,000		1/400,000	
Wattage at 25°C	2	1		2	4
Temperature Range	—55°C to +150°C				
Taps Maximum No.*	1	2		1	
StartingTorque(In Oz)at25°C	0.2	1.5		0.5	1.0
Guaranteed Life (at 100 R.P.M.)	To 100 x 10⁶ Revolutions Depending on Circuitry				
Stop Strength	10 IN.-OZ. MAX.			75 IN.-OZ.	160 IN.-OZ.

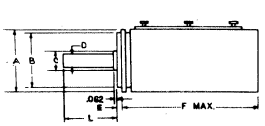
*For voltage reference, specify 0° width taps. For current carrying, specify zero resistance taps.
**Available in Dual Units, same case dimensions.
***Model 7813 same as 7814 except for axial rear terminations

DIMENSIONS

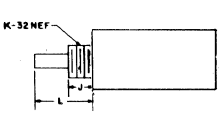
MODEL	5010	7810	7820	7814	20010
A	.500	.875			2.000
B*	.4735	.750		.750	1.875
C	.188	.273		—	
D*	0.937	.1875		.1250	.250
E	.062				.035
F	1.531	1.953		1.875	2.625
H	.400	.600		.562	**
J	.250				.312
K	.250	.375			
L	.625	.750		.500	.750

*+.0000 —.0005
**Axial Rear Terminations





STANDARD

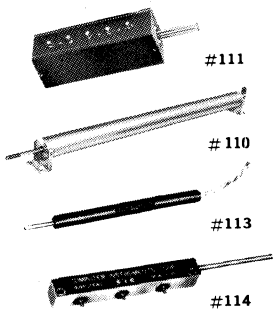


BUSHING MOUNT

Infinite Resolution PRECISION COMPONENTS

LINEAR MOTION POTENTIOMETERS

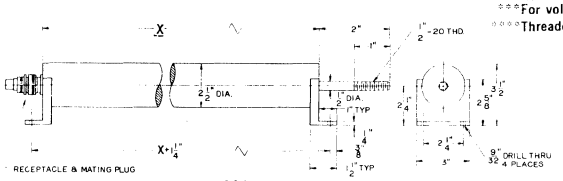
LINEAR-FUNCTIONAL



SPECIFICATIONS

MODEL	110*	111*	112	113*	114	116**	117	118**	119*
Electrical Stroke	To 60"	To 28"	To 12"	To 4"	To 1"	To 12"	To 1.5"	To 1.25"	To 10"
Cross Section Configuration	○	□	□	○	□	□	▭	▭	○
Resistance Range	250Ω/in. to 200KΩ/in.	150Ω/in. to 200KΩ/in.		500Ω/in. to 250KΩ/in.		150Ω/in. to 125KΩ/in.	250Ω/in. to 125KΩ/in.	500Ω/in. to 250KΩ/in.	350Ω/in. to 250KΩ/in.
Best Linearity	0.2% of Length of Electrical Stroke								
Virtual Resolution	1/400,000								
Wattage	1 Watt per Inch of Stroke								
Temperature Range	55° to +150°C								
Taps Maximum No. ***	4	To Suit		1		To Suit	1		
Starting Force Oz. at 25°C	16	8	4	8	4		8		
Life	30 Million Strokes, Depending on Circuitry								
Shaft Misalignment Feature	Available			Not Available		Available	Not Available	Available	

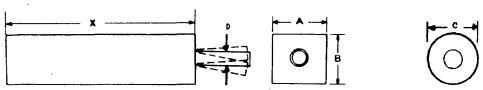
*Available in Dual Units, same case dimensions.
**Available in Dual Unit providing the resistance and function of both elements is the same.
***For voltage reference, specify zero width taps. For current carrying, specify zero resistance taps.
****Threaded, ball, spring-return and other shaft endings available.



MODEL 110

DIMENSIONS

MODEL	110*	111*	112	113*	114	116**	117	118**	119*
A	—	1.00	.500	—	.250	.500	.967	.875	—
B	—	1.00	1.10	—	.312	1.100	.635	.500	—
C	2.50	—	—	.500	—	—	—	—	.750
D	.50	.250	.187	.125	.0625	.1875	.1565	.1875	
X	Length of Mech. Travel +6"	Length of Mech. Travel +1.125"	Length of Mech. Travel +1.210"	Length of Mech. Tfavel +1.375"	1.75"	Length of Mech. Travel +1.210"	3.01"	2.50"	Length of Mech. Travel +2.00"



COMMUTATORS—PRECISION SWITCHES

SPECIFICATIONS

MODEL	5015	715	115	1715	215	315	515
Mechanical Rotation	360° Continuous						
Max. Number of Isolated Conductive Segments	6	8	8	20		38	62
Tolerance on Contact Spacing	2°		1½°	1°		1/2°	
Max. Number of Wipers Per Cup*	1		2		4		
Tolerance on Wiper Spacing	2°	1½°	1°		1/2°	1/4°	
Typ. Wiper Current	100 MA	250 MA					
Starting Torque (Max. In.—Oz.)**	.05	.2		3		.5	.8
Temperature Range	−55° to +150°C						
Max. Operating Speed (R.P.M.)	1000	1000		900			500
Guaranteed Life†	To 90 x 10⁶ at 1000 R.P.M.	To 30 x 10⁶ Cycles at 100 R.P.M.					

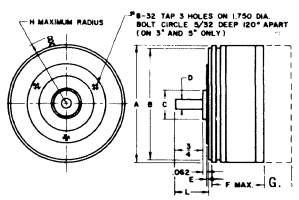
*If Wire Terminations are used, Maximum No. of Poles can be Increased by a Factor of 3.
**Less if Required. Specify.
†Depending on Circuitry

DIMENSIONS

MODEL	5015	715	115	1715	215	315	515
A	1/2	7/8	1 3/32	1 3/4	2	3	5
B*	.437	.7500	1.0300	1.5620	1.8750	2.8750	4.8750
C*	—	—	—	—	—	.7500	.7500
D*	.125	.1250	.1250	.2500	.2500	.2500	.2500
E	.060	.040	.040	.060	.060	.060	.060
F	.640	.635	.655	.985	.985	1.050	1.050
G	—	.250	.250	.465	.465	.500	.500
H	**	19/32	11/16	1 1/32	1 5/32	1 13/16	2 13/16
J	—	1/4	1/4	1/4	1/4	1/4	1/4
K	—	3/8	3/8	3/8	3/8	3/8	3/8

*Tolerance +.0000 −.0005 **Axial Rear Wire Terminations

Commutators can be supplied in ganged assemblies with potentiometers.



STANDARD BUSHING MOUNT

COMPUTER INSTRUMENTS CORPORATION/92 MADISON AVE., HEMPSTEAD, N.Y. 11550/516-483-8200

Infinite Resolution PRECISION COMPONENTS

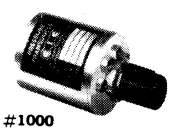
PRESSURE TRANSDUCERS & SWITCHES

LINEAR/AIR SPEED/ALTITUDE/SQUARE ROOT/FLOW

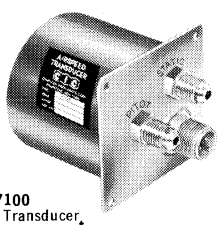
SPECIFICATIONS

MODEL	1000 Miniature	3000 Commercial	4000 Commercial	4500 Oil Filled	4500F Delta P Flow	6000 Low Pressure	6100 Mil Standard	6200 Hi Pressure	7000 Altitude	7100 Air Speed
Pressure Range, PSI.	0-15 to 0-350 Gage, Diff., Absolute	0-200 to 0-5000 Gage	0-2 to 0-200 Gage, Diff., Absolute	0-2 to 0-200 Differential		0-.01 to 0-2 Gage, Differential	0-2 to 0-200 Gage, Diff., Absolute	0-100 to 0-5000 Gage, Diff., Absolute	0-100,000 ft.	0-1000 Knots
Linearity	To 0.5%		To 0.3%		–	0.3%			0.4%	±1 Knot
Repeatability	±0.1%		±.05%	±0.1%		.05%			15'	±0.4 Knot
Temp. Sensitivity	.02% per °C			.01% per °C					.01% per °C	±01% per °C
Input: Wattage	0.2		0.25	0.4	0.25	.20	.25		.25	
Standard Case Pressure	200 PSIA	–	200 PSIA	1000 PSIA		100 PSIA	150 PSIA	500 PSIA	–	
Diameter A	1.156	1.62	2.00			3.20	2.44		2.44	
Length B	1.39	0.90	2.16	3.20		2.84		1.09	2.84	
Switch Differential	1%	.8%	.6%	1%		2%	.8%	.6%	–	
Switch Current	2 Amperes, Max., Resistive, All Models									
Switch Life	10 Million Cycles, Depending on Circuitry									

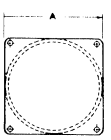
Note: Also available in current type pressure transmitters: ranges 0-2 to 0-5000 PSIA and current output of 1-5 ma, 4-20 ma. in EXPLOSION-PROOF housing.

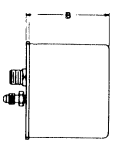


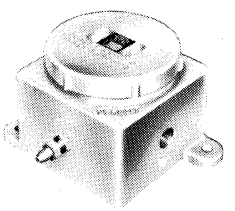
#1000



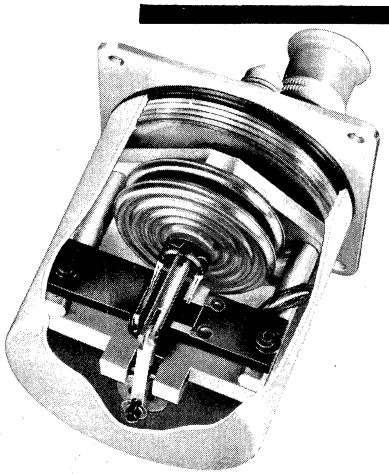
#7100
Air Speed Transducer

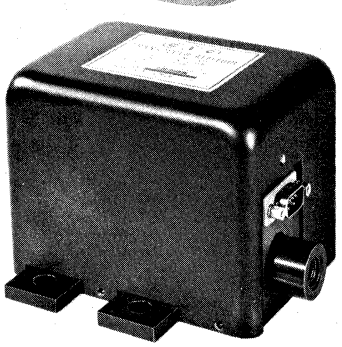






EXPLOSION-PROOF
(Available in All Models)





AIR DATA TRANSDUCERS

CIC's Model 7000 and 7100 Altitude and Airspeed Transducers provide high AC or DC outputs, virtually infinite resolution, and extremely long life through the use of a unique CIC conductive film potentiometer element. Precise shaping of the film element to compensate for the non-linear pressure vs altitude or airspeed relationship affords a highly accurate output directly proportional to altitude or airspeed.

Used in many military and commercial aircraft, these transducers provide a firm building block for many of CIC's Air Data Systems.

CIC's series 8000 "NULL BALANCE" Transducers utilize an inductive type pressure sensor and servo follow-up system for the utmost in pressure sensitivity and accuracy. For altitude or airspeed outputs, a shaped CIC conductive film potentiometer provides correction for the non-linear pressure relationships.

Units available to cover Altitude ranges from –1K' to 2K' Full Scale up to –1K' to 100K' Full Scale, and Airspeed ranges from 0-100KTS Full Scale up to 0-1000KTS Full Scale.

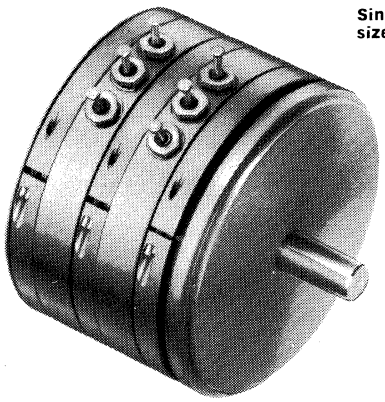
Special versions include circuitry which converts the transducer into a low cost Altitude Controller.

Digilog
PRECISION POTENTIOMETERS

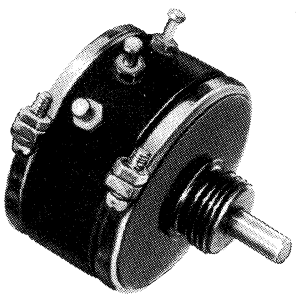
A product family in which Digilog can quickly meet your needs for

- **NON-LINEAR FUNCTIONS**
- **SPECIAL CONFIGURATIONS**
- **APPLICATION ENGINEERING KNOW-HOW**

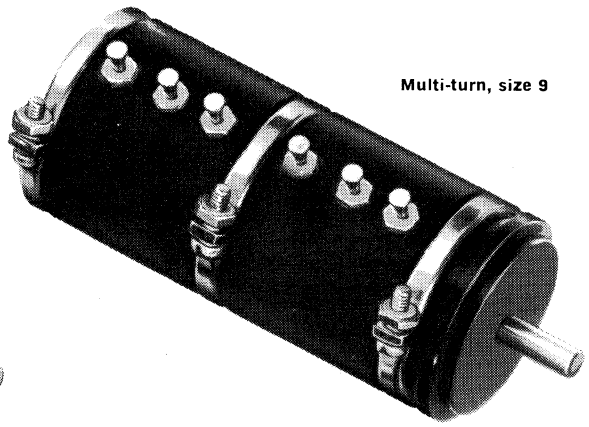
Need custom winding or non-standard configurations? Do you have problems with "dry circuit" noise, high wiper currents, special temperature or radiation environments? Digilog has both know-how and facilities to come up with the solutions — fast.



Single turn sizes 14-30



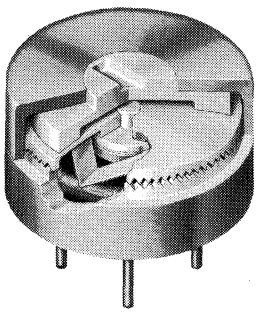
Single turn, sizes 8-11



Multi-turn, size 9

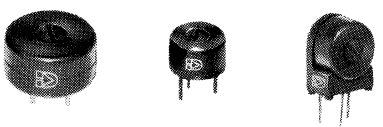
Shaft diameters, ⅛" and ¼"
Servo, bushing and screw mounting types
Power ratings, 1.5 to 7.5 watts
Temp. range, −55°C to +125°C

Temp. coefficient of resistance, +50 PPM/°C nominal
Stnd. resistance tolerance, ± 3%
All models comply with applicable paragraphs of MIL-R-12934
For special requirements, submit drawings and specs or request application data sheet



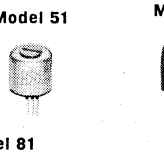
"DIFFERATIO" MODELS
Wirewound and metal film

Models 20 & 21 — ½"
Models 30 & 31 — ⅓"
Models 40 & 41 — ⅓"

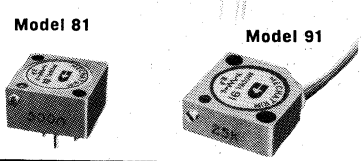


"MECHATRIM" MODELS
Metal Film

Model 51
Model 61



Model 81
Model 91



DIGILOG TRIMMING POTENTIOMETERS

• Single and multiple turn • Wirewound and metal film • Exclusive "differatio" models with 20-turn electrical and mechanical travel

TRIMMING POTENTIOMETERS

MODEL	STYLE	Element Type	Resistance Range (ohms)	Dimensions (Inches) W L H	Electrical & Mechanical Travel	Power Rating (Watts)
20	Round, Top Adj. P.C. Pins	Wirewound	100-20,000	0.500 dia.x0.250	20 Turns Stops & Clutch	1.0
21	Round, Top Adj. P.C. Pins	Metal Film	500-25,000	0.500 dia. x0.250	20 Turns Stops & Clutch	1.0
30	Round, Top Adj. P.C. Pins	Wirewound	50-20,000	0.312 dia.x0.180	20 Turns Stops & Clutch	0.5
31	Round, Top Adj. P.C. Pins	Metal Film	100-10,000	0.312 dia.x0.180	20 Turns Stops & Clutch	0.5
40	Side Adjust P.C. Pins	Wirewound	50-20,000	0.250x0.312x0.375	20 Turns Stops & Clutch	0.5
41	Side Adjust P.C. Pins	Metal Film	100-10,000	0.250x0.312x0.375	20 Turns Stops & Clutch	0.5
*51	Round, Top Adj. P.C. Pins	Metal Film	100-10,000	0.280 dia.x0.250	300° Stops	0.5
*61	Side Adjust P.C. Pins	Metal Film	100-10,000	0.312x0.312x0.360	300° Stops	0.5
*81	Square P.C. Pins	Metal Film	200-25,000	0.500x0.500x0.235	40 Turns Continuous	1.0
*91	Square Flex. Leads	Metal Film	200-25,000	0.500x0.500x0.190	40 Turns Continuous	1.0

Temperature Range: —55° C to +175° C; **Standard Resistance Tolerance:** Wirewound elements ·5%; Metal-film elements ·20%; **Temperature Coefficient of Resistance:** ±30 PPM/°C Nominal.

Digi'og Electronics Corporation Trimming Potentiometers comply with the applicable paragraphs of MIL-R-22097 and MIL-R-27208.

* Models 51 and 61 are the MECHATRIM® HT-250-2 and HT-250-4 and Models 81 and 91 are the MECHATRIM® HT-500-2 and HT-500-1 formerly manufactured by the Mechatrol Division of Servomechanisms, Inc., and by Teledyne Precision, Inc.

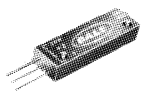
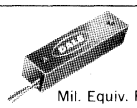
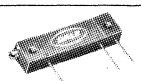
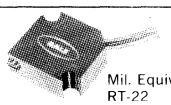
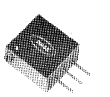
digilog electronics corp.
P.O. Box 9368 (701F Third Avenue North), Seattle, Wash. 98109
Phone (206) 284-6811 TWX 910-444-1665

DALE® for Optimum Value in Potentiometers

TRIMMER QUICK REFERENCE GUIDE

- New rectilinear wirewound and film models
- New square wirewound models
- Expanded low-priced Econo-Trim series with sealability for pennies more
- Mil-style construction methods used throughout
- Panel mount models available in most series

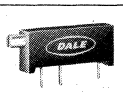
MILITARY GRADE TRIMMER POTENTIOMETERS (High Temperature, Precision)

SERIES	ILLUSTRATION	MODEL	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	HUMIDITY PROOF (Mil. Spec.)	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
600	 Mil. Equiv. RT-10	691 680 690* 697* 692*	• Alternate position Printed Circuit Pins 22 AWG • Printed Circuit Pins 22 AWG • Hook Type Wire Solder Terminal • 28 AWG Stranded Teflon Leads • 26 AWG Solid Leads	10 ohms to 100K ohms ±5%	Yes	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	15 ± 2	.18	.32	1.00
1200	 Mil. Equiv. RT-11	1287 1288* 1299*	• Printed Circuit Pins 21 AWG • Stranded Teflon Leads 28 AWG • Spade Type Solder Lug	10 ohms to 100K ohms ±5%	Yes	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	25 ± 2	.28	.31	1.25
1600	 Mil. Equiv. RT-12	1680 1697* 1692* 1690*	• Printed Circuit Pins 21 AWG • Stranded Teflon Leads 28 AWG • 22 AWG Solid Wire • Solder Lug	10 ohms to 100K ohms ±5%	Yes	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	22 ± 3	.19	.32	1.25
5000	 Mil. Equiv. RT-22	5050 5080 5091	• Stranded Teflon Leads 30 AWG • Printed Circuit Pins 21 AWG, Edge Mount • Printed Circuit Pins 21 AWG	10 ohms to 50K ohms ±5%	Yes	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	25 ± 2	.19 .22 .22	.50 .50 .50	.50 .50 .50
5800	 Mil. Equiv. RT-24	5850 5891 5880 5887	• Stranded Teflon Leads 30 AWG • Printed Circuit Pins 22 AWG, Base Mount • Printed Circuit Pins 22 AWG, Edge Mount • Printed Circuit Pins 22 AWG Side Adjust	10 ohms to 50K ohms ±5%	Yes	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	25 ± 3	.145 .150 .145 .150	.375 .375 .375 .375	.375 .375 .375 .375

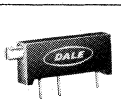
*Indicates model is also available in Panel Mount version.

COMMERCIAL GRADE ECONO-TRIM POTENTIOMETERS

WIREWOUND ELEMENT

SERIES	ILLUSTRATION	MODEL	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	HUMIDITY PROOF (Mil. Spec.)	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
2300		2387 2317 2389 2319	• Unsealed } Printed Circuit Terminals, Gold Plated • Sealed } • Unsealed } Hook-type Solder Lugs, Gold Plated • Sealed }	10 ohms to 50K ohms ±10%	Optional	0.5 watt at 25° C, derated to 0 at 105° C	−55° C to 105° C	15 turns nominal	.36	.28	1.00
2400		2487 2417	• Unsealed } Printed Circuit Terminals, Gold Plated • Sealed }	10 ohms to 50K ohms ±10%	Optional	1 watt at 40° C, derated to 0 at 125° C	−55° C to 125° C	20 turns nominal	.31	.16	.75

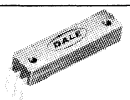
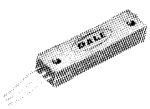
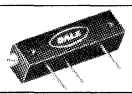
FILM ELEMENT

8300		8387 8317 8389 8319	• Unsealed } Printed Circuit Terminals Gold Plated • Sealed } • Unsealed } Hook-type Solder Lugs, Gold Plated • Sealed }	10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values	Optional	.75 watt at 25° C, derated to 0 at 105° C	−55° C to 105° C	15 turns nominal	.36	.28	1.00
8400		8487 8417	• Unsealed } Printed Circuit Terminals Gold Plated • Sealed }	10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values	Optional	.75 watt at 25° C, derated to 0 at 125° C	−55° C to 125° C	20 turns nominal	.31	.16	.75

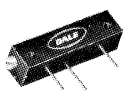
DALE® for Optimum Value in Potentiometers

INDUSTRIAL GRADE TRIMMER POTENTIOMETERS

WIREWOUND ELEMENT

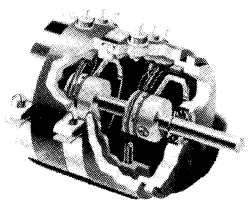
SERIES	ILLUSTRATION	MODEL	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	HUMIDITY PROOF (Mil. Spec.)	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
100		195	• 28 AWG Stranded Vinyl Leads emerging separately	10 ohms to 100K ohms ±5%	No	0.8 watt at 70° C, derated to 0 at 135° C	−65° C to 135° C	25 ± 2	.22	.31	1.32
		193	• 28 AWG Stranded Vinyl Leads attached to Lugs						.22	.31	1.25
		198	• Gold-plated Printed Circuit Solder Lug						.22	.31	1.25
		199	• Gold-plated Solder Lug						.22	.31	1.25
200		295	• 28 AWG Stranded Vinyl Leads emerging separately	10 ohms to 100K ohms ±10%	No	0.5 watt at 70° C, derated to 0 at 105° C	−65° C to 105° C	25 ± 2	.22	.31	1.32
		293	• 28 AWG Stranded Vinyl Leads attached to Lugs						.22	.31	1.25
		298	• Gold-plated Printed Circuit Solder Lug						.22	.31	1.25
		299	• Gold-plated Solder Lug						.22	.31	1.25
300		398	• Gold-plated Printed Circuit Solder Lug	10 ohms to 100K ohms ±15%	No	.25 watt at 70° C, derated to 0 at 85° C	−65° C to 85° C	25 ± 2	.22	.31	1.25
		399	• Gold-plated Solder Lug								
1100		1187	• Printed Circuit Pins 21 AWG	10 ohms to 100K ohms ±10%	No	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	25 ± 2	.28	.31	1.25
		1188*	• 28 AWG Stranded Teflon Leads								
		1199*	• Spade-type Solder Lug								
2100		2187	• Printed Circuit Pins 21 AWG	10 ohms to 100K ohms ±10%	Optional	1 watt at 70° C, derated to 0 at 125° C	−65° C to 125° C	25 ± 2	.28	.31	1.25
		2188*	• Stranded Vinyl Leads 28 AWG								
		2199*	• Spade Type Solder Lug								
2200		2280	• Printed Circuit Pins 22 AWG	10 ohms to 100K ohms ±10%	Optional	1 watt at 70° C, derated to 0 at 125° C	−65° C to 125° C	15 ± 2	.18	.32	1.00
		2292	• 26 AWG Solid Leads								
		2297	• 28 AWG Stranded Vinyl Leads								

FILM ELEMENT

SERIES	ILLUSTRATION	MODEL	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	HUMIDITY PROOF (Mil. Spec.)	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
8100		8187	• Printed Circuit Pins 21 AWG	10 ohms to 2 Megohms ±10% 100Ω to 500K ±20% other values	Optional	.75 watt at 70° C, derated to 0 at 125° C	−65° C to 125° C	25 ± 2	.28	.31	1.25
		8188*	• Stranded Vinyl Leads 28 AWG								
		8189*	• Gold-plated Solder Lug								

*Indicates model is also available in Panel Mount version.

PRECISION POTENTIOMETERS—SINGLE TURN *(Write for Catalog B)*



• Precision machined anodized aluminum cups • Molded Diallyl Phthalate liners • Welded tap and terminal construction • Precious metal wipers and slip rings • Flush clamp bands • Gold-plated terminals • Precision sleeve or ball bearings • Centerless ground stainless steel shafts • Single or ganged units.

SPECIFICATIONS:

- Meet requirements of MIL-R-12934 and NAS-710
- Eight physical sizes, 3/4" to 3" diameter
- Electrical angles and functions to specification
- Special mechanical configurations available

ORDERING INFORMATION

WHERE TO ORDER:

From your Authorized Dale Distributor, your Dale Representative, or Dale Electronics, Inc., Box 609, Columbus, Nebraska 68601 — PHONE 564-3131 AREA CODE 402 TWX 402-564-2807

TERMS: 1% 10—Net 30 **F.O.B. POINT:** Columbus, Nebraska

SPECIAL CHARGES:

Minimum Order Charge..... $10.00
Minimum Item Charge..... $ 7.50

DALE ELECTRONICS, INC.

1342 28th Ave., Columbus, Nebraska 68601

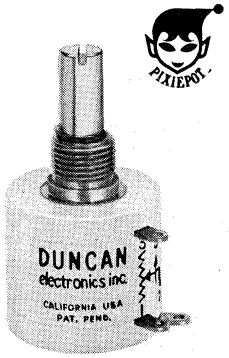
"From Duncan With Love"

PRECISION LINEAR AND NON-LINEAR POTENTIOMETERS AND MINIATURE TURNS-COUNTING DIALS

SUPER-ECONOMY PIXIEPOTS

The only thing smaller than Duncan Electronics' PIXIEPOT® is the price — under $3.50 in production quantities! It's the one and only precision 10-turn miniature pot at this price with all these features:

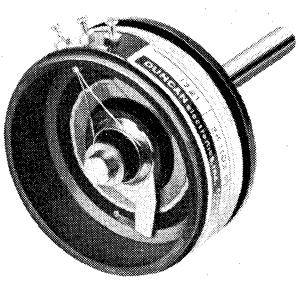
- Length: only ¾"
- Diameter: only ⅞"
- Linearity: ±0.25%
- Resistance Range: 100 ohms to 100K ohms
- Power Rating: 2 watts @ +20°C
- Temperature Range: —25°C to +85°C
- Resolution: Better than ANY wirewound pot TWICE its size
- Slotted Stainless Steel Shaft/C ring
- Now you can save big dollars on your instrument and system requirements. Specify Model 3253 PIXIEPOT potentiometers in a combination package with Model 61 miniature turns-counting dials at one super-budget price . . . under $7.00 in production quantities. In-stock delivery, of course.



RESOLON CONDUCTIVE PLASTIC

Duncan Electronics' RESOLON® single-turn, non-wirewound potentiometers are the perfect result of years of development. The RESOLON potentiometer's conductive plastic element provides a wide, flat surface that permits the use of multiple-finger wiper contacts. Either linear or non-linear functions may be provided by these potentiometers. State-of-the-art design and strict quality control add up to these outstanding features:

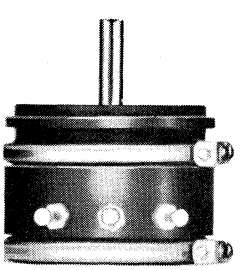
- Long Life: 20 million shaft revolutions without significant change in characteristics
- Low Temperature Coefficient: —300ppm/°C max.
- Wide Temperature Range: —65°C to +125°C
- Conformance to all applicable MIL specs, including MIL-R-39023
- Low Output Smoothness: maximum of 0.1% of total applied voltage
- Linearity and conformity tolerance to ±.05%
- Single-turn/servo-mounted; available in ⅞" to 3" diameters



PRECISION WIREWOUND POTS

Duncan Electronics' precision wirewound single-turn and multi-turn potentiometers offer such outstanding features as rugged diallyl phthalate housings; stainless steel shafts and clamp bands; gold-plated, turret-type terminals; welded terminations, and life expectancy to two million shaft revolutions. Military versions meet all applicable portions of MIL-R-12934. Design features include:

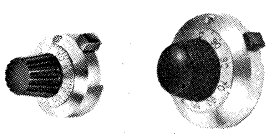
- Resistance Element: use of long-life, low-tempco resistance wire.
- Wiper Design: precious metal contact provides "leaf-spring" wiping action for positive contact at severe vibration and shock levels
- Slip-Ring Design: novel seating action of dual "whisker" in V-groove slip-ring virtually eliminates possibility of contact discontinuity from shock or vibration.
- Rotor Design: special low-inertia rotor allows quick response in stringent servo applications
- Housing: use of glass-filled diallyl phthalate (for military models) and special high-impact plastic (for commercial versions) assures high strength, excellent environmental resistance & dielectric properties.



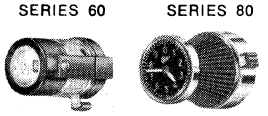
TURNS-COUNTING DIALS!

Duncan Electronics has three big series of miniature turns-counting dials to enable the accurate positioning of multi-turn potentiometers. Yet despite their compactness, each dial provides for optimum readability — you can take precise readings at a glance from any angle. Duncan miniature turns-counting dials all feature positive-action locks, and require minimum panel drilling and mounting hardware. You can count on Duncan for fast in-stock delivery at the right low prices too.

- **SERIES 60:** inner scale graduated in fiftieths of a turn; outer scale in full turns from 0 to 9.
- **SERIES 80:** a 10-turn counter indicates full turns completed; the 100-division scale indicates hundredths of a turn.
- **SERIES 70**
- **Digital Model 71:** magnifying face lens projects 3-digit readout to a hundredth of a turn
- **Clockface Model 76:** only ⅞" diameter is ideal for minimum space applications. Excellent readability to 50ths of a turn.



SERIES 60 SERIES 80



SERIES 70
Model 71 Model 76

de

DUNCAN electronics, inc.

a division of Systron-Donner Corp.

2865 FAIRVIEW ROAD, COSTA MESA, CALIFORNIA 92626
TEL: (714) 545-8261 • TWX (910) 595-1128

Call, write or wire Duncan Electronics for complete details

THICK FILM RESISTOR NETWORKS (DUAL-IN-LINE PACKAGE)

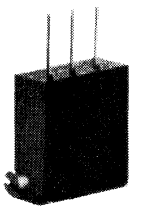
Electra cermet is used in making thick film networks. Passivation is accomplished by screening with a glass material. Electra technology offers the advantage that substrate, cermet, and passivation materials have nearly the same expansion coefficient hence networks can be provided with superior TC of R characteristics.

1. **Resistance Range:** 10 ohms to 1.5 megohm
2. **Resistance Tolerance:** ±1% to ±10%
3. **Number per Network:** Up to 13 depending upon circuit.
4. **Absolute TC of R:** ±100 PPM/°C., −55°C to 125°C
5. **Tracking TC of R:** ±5 PPM/°C., resistors with 20:1 R ratio within a package.
6. **Matching of Resistance:** To ±.1%
7. **Package:** 14 Pin DIP Ceramic, Epoxy Sealed, 1 watt @ 70°C.
   14 Pin DIP Plastic, ½ watt @ 70°C.

CERMET TRIMMING POTENTIOMETERS

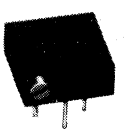
ELECTRIM™ ¼" SQUARE CERMET TRIMMERS

Type Number	Resistance Range	Terminal Types Available	T R Tolerance	Operating Temp Range	T. C. PPM/°C	Power Rating	Seal
Hi-Performance RJ26	**10 Ohms to 2 Megohms**	**P,W,X**	**±10%**	**−65 to +150°C**	**±100 100 Ohms-500K Ohms**	**.25 Watt at 85°C**	**Immersion in 85°C water**
Mil-R-22097D Char. "C" RJ26	**100 Ohms to 1 Megohm**	**P,W,X**	**±10%**	**−55 to +150°C**	**±250**	**.25 Watt at 85°C**	**Immersion in 85°C water**



ELECTRIM™ ⅜" SQUARE CERMET TRIMMERS

Type Number	Resistance Range	Terminal Types Available	T R Tolerance	Operating Temp Range	T. C. PPM/°C	Power Rating	Seal
Hi-Performance RJ24	**10 Ohms to 2 Megohms**	**L,P,W,X**	**±10%**	**−65 to +150°C**	**±100 200 Ohms to 1 Meg**	**.5 Watt at 85°**	**Immersion in 85°C water**
Mil-R-22097D char. "C" RJ24	**100 Ohms to 1 Megohm**	**P,W,X**	**±10%**	**−55 to +150°C**	**±250**	**.5 Watt at 85°C**	**Immersion in 85°C water**
Industrial ET 24	**10 Ohms to 2 Megohms**	**L,P,W,X**	**±20%**	**−55 to +150°C**	**±250**	**.5 Watt at 85°C**	**Immersion in 85°C water**



ELECTRIM™ ¾" RECTANGULAR CERMET TRIMMERS

Type Number	Resistance Range	Terminal Types Available	T R Tolerance	Operating Temp Range	T. C. PPM/°C	Power Rating	Seal
Industrial ET34P	**10 Ohms to 2 Megohms**	**PC Pins**	**±20%**	**−55 to +150°C**	**±250**	**.5 Watt at 85°C**	**Immersion in 85°C water**
RJ11 Pin-spaced ET34X	**10 Ohms to 2 Megohms**	**RJ11 spaced PC Pins**	**±20%**	**−55 to +150°C**	**±250**	**.5 Watt at 85°C**	**Immersion in 85°C water**



TR—total resistance
PC—printed circuit
MIL-R-22097D—non wirewound trimmer mil spec.
TC—temperature coefficient
PPM/°C—parts per million per degrees centigrade

ELECTRA/MIDLAND CORPORATION
CERMETRIK DIV.
3347 Industrial Court San Diego, Calif. 92121

SUPERPOT PRECISION CONDUCTIVE PLASTIC POTENTIOMETERS

INFINITE RESOLUTION—LOW NOISE—CO-MOLDED ELEMENTS—LONG LIFE—CONFORMS TO MIL-R-39023

Electrical		751P	752P	749P	757P	754P	743P
Body Diameter		.875	1.062	1.438	1.750	2.000	3.000
Resistance Range (Ohms)		250 - 100K	250 - 150K	250 - 150K	500 - 200K	500 - 200K	500 - 300K
Resistance Tolerance	Standard	±10%	±10%	±10%	±10%	±10%	±10%
	Special	±5%	±5%	±5%	±5%	±5%	±5%
Power Dissipation for Standard Resistance Values @ 85°C		1.3 Watts Derated to 0 at 150°C	1.5 Watts Derated to 0 at 150°C	1.8 Watts Derated to 0 at 150°C	2 Watts Derated to 0 at 150°C	2.2 Watts Derated to 0 at 150°C	2.5 Watts Derated to 0 at 150°C
Independent Linearity	Standard	±0.5%	±0.5%	±0.40%	±0.35%	±0.3%	±0.25%
	Special	±0.20%	±0.15%	±0.10%	±0.10%	±0.1%	±0.05%
Electrical Angle—Nom.		342°	350°	351°	352°	353°	355°

PRECISION WIREWOUND POTENTIOMETERS

HIGH RESOLUTION—LOW NOISE—HIGH FUNCTIONAL ACCURACY
CUSTOM ENGINEERED—CONFORMS TO MIL-R-12934F

Electrical		977	751	752	741	749	757	754	743
Diameter		.750	.875	1.062	1.125	1.438	1.750	2.000	3.000
Resistance Range (Ohms) ±5%		1K to 50K	200 to 100K	300 to 150K	300 to 150K	600 to 250K	1 to 300K	800 to 350K	1K to 340K
Resolution (Applies to Maximum Electrical Angle Only)	Up to 1K	0.36 to 0.14%	0.3 to 0.19%	0.3 to 0.2%	0.2 to 0.17%	0.28 to 0.17%		0.28 to 0.12%	0.15 to 0.09%
	1K to 25K	0.14 to 0.073%	0.19 to 0.092%	0.2 to 0.09%	0.17 to 0.075%	0.17 to 0.05%	0.15 to 0.054%	0.12 to 0.061%	0.09 to 0.048%
	25K to 100K		0.092 to 0.06%	0.09 to 0.06%	0.075 to 0.045%	0.05 to 0.04%	0.054 to 0.035%	0.061 to 0.035%	0.048 to 0.03%
	Over 100K			0.06 to 0.05%	0.045 to 0.033%	0.04 to 0.035%	0.035 to 0.028%	0.035 to 0.027%	0.03 to 0.02%
Linearity Tolerance Independent	Standard	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.25%	±0.25%	±0.25%
	Special	±0.15%	±0.15%	±0.15%	±0.15%	±0.15%	±0.15%	±0.10%	±0.075%
Effective Electrical Angle		350° NOM	350° NOM	350° NOM	350° NOM	350° NOM	350° NOM	350° NOM	350° NOM
Power Rating Watts/CUP	Single—CUP STD @ 40°C/H. Temp. @ 85°C	1.5/1.5	2/2	2/2	2/2	4/4	6/6	8/8	6
	Multi—CUP STD @ 40°C/H. Temp. @ 85°C	1/1	1/1	1/1	1/1	2/2	3/3	4/4	5
Number of Additional Taps Available		Up to 8	Up to 10	Up to 13	Up to 13	Up to 16	Up to 24	Up to 23	Up to 27

Sine Cosine, Log and Empirical Functions in Both Conductive Plastic and Wirewound Precision Potentiometers Available.

PRECISION WIREWOUND MULTI-TURNS

	Resistance Range	Independent Linearity	Resolution	Electrical Angle
TYPE 990 7/8"	100 to 200K ±2%	Standard 0.1% Special 0.05%	0.05% to 0.01%	Standard 3600 $^{+\ 4\%}_{-\ 0^\circ}$

Available in Loaded Linear and Non-Linear Functions.

Note: Greater angles, resistance ranges and tighter tolerances in both Wirewound and Conductive Plastic potentiometers available on special order. Complete specifications available, write or call for information.

FAIRCHILD CONTROLS ALSO MANUFACTURES PRESSURE TRANSDUCERS, PRESSURE SWITCHES, LEVEL CONTROLS, OPERATIONAL AMPLIFIERS, SIGNAL CONDITIONING EQUIPMENT.

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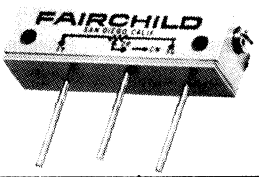
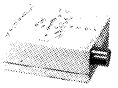
CABLE: FAIRCON-HICKSVILLE, NEW YORK, U.S.A.

FAIRCHILD TRIMMERS: WIREWOUND, FILMPOT® METAL FILM, CERMET







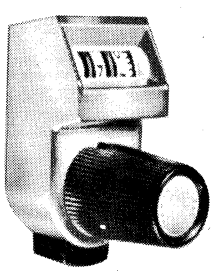
STANDARD TYPES		STANDARD RECTANGULAR	NARROW RECTANGULAR			3/8" Square End-mounted Adj. Screw	3/8" Square Side-mounted Adj. Screw (Note 2)	1/2" Square End-mounted Adj. Screw	1/2" Square Side-mounted Adj. Screw (Note 2)
WIREWOUND	COM'L	6010	6020			TF38	TF38W (S)	TF12	TF12W (S)
	MIL	RT11C2	RT12C2			To be determined	To be determined	RF22	To be determined
FILM (10-10KΩ) OR CERMET (20K-1MΩ)	COM'L	6011	6021	6022	6023 6030 6031	6120	6120X	On special order (Note 3)	On special order (Note 3)
	MIL	RJ11C	RJ12	(See Note 1)	(See Note 4)	RJ24CX	RJ24CX	—	—

(1) Equivalent to RJ12 case with RJ11 pin arrangement.
(2) Flexible lead connectors not available in this type. Part number shown is complete, except for resistance designation.
(3) 3/8"-square film-type trimmers (6120PW and X) are functionally and physically suitable for substitution in 1/2"-square requirements. 1/2"-square film-type trimmers can be supplied on special order, if mandatory.
(4) No MIL equivalents. 6023 has restricted temp. range. −25° to +25°C. 6030, 6031 are.165"wide x .750" long (see drawings, page 5).

STANDARD RESISTANCE VALUES	RECTANGULAR	3/8" SQUARE	1/2" SQUARE
WIREWOUND	Standard for 6010, 6020: 10 100 1K 10K 50K 20 200 2K 20K 50 500 5K 25K Semi-Standard for 6010, 6020: 75K, 100K, 125K, 150K, 175K	Standard for TF38: 10 100 1K 10K 25K 30 200 2K 14K 500 500 5K 20K	Standard for TF12: 10 200 2K 20K 50 500 5K 25K 100 1K 10K 50K
FILM	Standard for 6011, 6021, 6022, 6023, 6030, 6031: 10 100 1K 10K 20 200 2K 50 500 5K	Standard for 6120: 10 100 1K 10K 20 200 2K 50 500 5K	Available on special order (6120 is normallly acceptable substitute)
CERMET	Standard for 6011, 6021, 6022, 6023, 6030, 6031: 20K 100K 1M. 25K 200K 50K 500K	Standard for 6120: 20K 100K 1M. 25K 200K 50K 500K	Available on special order (6120 is normally acceptable substitute)

Note: Faircon Series 7000 Panel-Mount Brackets for Faircon Rectangular Trimmers are also available.

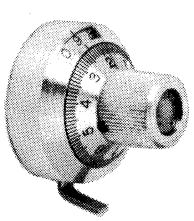
FAIRDIAL TURNS-COUNTING DIALS



DIGITAL TYPE DFD

- **250 Parts Per Million Reading Accuracy**
- **High-Density Packaging— Up To 72 Per Square Foot!**

INDICATION: Digital, three digit counting wheels registering from 000 to 999. Four intermediate graduations between adjacent numerals on right hand counter wheel.

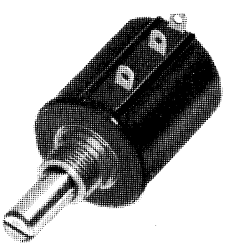


ANALOG TYPE DFA

- **1 Part in 1000 Reading Accuracy**
- **Up to 99 Dials Per Square Foot of Panel Space!**

INDICATION: Single counter type wheel and a graduated circular dial registering a total count of 999.

FAIRCON TYPE MF-78 WIREWOUND 10-TURN PRECISION POTENTIOMETERS



- **.007% to .033% Resolution**
- **±0.2% Linearity**
- **2 Watts Rated Dissipation**
- **In Less Than 1 Cubic Inch!**

The MF-78 is available in 9 standard resistance values: 500, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 125K ohms—other values can be furnished on special order. Standard tolerance in Total Resistance value is ±3%.

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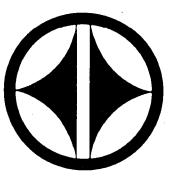
Look in the Yellow Section for Manufacturers' Sales Offices

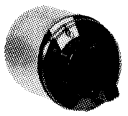


Tell them you found them in **eem**

esi Precision Decades and Components

Electro Scientific Industries available panel mount decades, dividers and individual resistors that provide the nucleus components for all our precision measurement and calibration equipment (see Section 2900). The patented Dekadial® stacked decades save panel space at 0.02% accuracy in the decades, 20 ppm for the dividers. The miniature Dekadials are now 2.2 inches width, 4 inches in depth. Solid silver-alloy switches are used throughout, plus silicone-treated ceramic switch wafers. The wire-wound resistors are produced by a proprietary aging process for highest precision and stability.

RESISTIVE DECADES

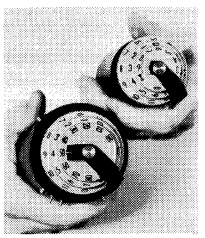


DS 12 Individual Decade Resistor. Nine different total resistances available for DC and audio frequency applications. Can be used as a divider by cutting jumper.



DS 625A Dual Dekastat. Six miniature resistor decades dual mounted for easy in-line reading.

DEKASTATS



DS 325A Miniature Dekastat. 3 decade coaxial available in three different total resistances.

DS 1365 Precision Dekastat. Three coaxial decades available in four different total resistances.

MODEL	DESCRIPTION	PER STEP	TOTAL RESISTANCE	NOMINAL ACCURACY	PRICE
DS 12	Single 10-step resistance decades	0.01 Ω—1 MΩ	0.1 Ω—10 MΩ	0.02%	$ 25.—$100.
DS 325A	3-Decade coaxial miniature	1, 10, 100 Ω	1.2, 12, 120 kΩ	0.02%	75.
DS 326	Miniature coaxial; 2 decades plus rheostat	0.1, 1, 10 Ω/dial div.	1.2, 12, 120 kΩ	0.02%	80.
DS 625A	Miniature 6-dial, dual coaxial	0.1 Ω	120 kΩ	0.02%	155.
		0.01 Ω, 1 Ω	12 kΩ, 1.2 MΩ	0.02%	160.
DS 1265	Decade resistor, coaxial 2 decades plus rheostat	0.1, 1, 10 Ω/dial div.	1.2, 12 kΩ	0.02%	95.
			120 kΩ*	0.02%	115.
DS 1365	Decade resistor, coaxial, 3 decades	1, 10, 100 Ω	1.2, 12, 120 kΩ	0.02%	95.
		0.01 Ω	120 Ω*	0.02%	120.
DS 1463	4 dial coaxial, 3 decades plus rheostat	0.1, 1 Ω/dial div.	12, 120 kΩ	0.02%	110.
DS 1464	Decade resistor—4 decade coaxial	0.1, 1 Ω	1.2, 12 kΩ	0.02%	110.
		10 Ω	120 kΩ	0.02%	120.
		0.01 Ω, 100 Ω	120 Ω, 1.2 MΩ*	0.02%	140.

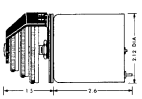
*Special order

DEKAPOT® DIVIDERS

DP 1311 Decade Potentiometer. Kelvin-Varley linearity is guaranteed 20 ppm stable/yr. Three decades plus 100-division potentiometer gives resolution of 0.0003%. Three different values available.



DP 310 Miniature Decade Potentiometer. Just 2.2 inches of panel, but 2 decades and 100-division potentiometer with same basic operation performance of larger decades.



DEKATRANS®

DT 1145 Miniature Decade Ratio Transformer. Dekatrans are inductive voltage dividers for use at audio frequencies. High input impedance, low output, and low phase shift make it ideal for testing voltage and current division, turns-ratio measurement, divider calibration and impedance comparison.

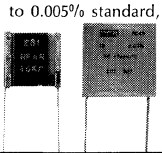


MODEL	DESCRIPTION	VALUE OR RATIO	LINEARITY	PRICE
*DV 411	Resistive Divider, adjustable base, 3 decades plus pot	1 kΩ	20 ppm	$ 235.
		10, 100 kΩ	20 ppm	190.
DP 1211	Panel-mounting—coaxial dial decade potentiometer (Kelvin-Varley); 2 decades plus pot	1, 10 kΩ	20 ppm	95.
		100 kΩ*	20 ppm	110.
		1 k to 100 kΩ*	20 ppm	140.
DP 1311	Decade potentiometer—3 decades plus pot	1, 10, 100 kΩ	20 ppm	145.
		1 kΩ to 100 kΩ	20 ppm	180.
DP 310	Miniature potentiometer, 2 decades plus pot	1, 10, 100 kΩ	50 ppm	100.
DT 1135	Panel mounting ratio transformer—2 decades plus pot	1.1105	100 ppm	185.
DT 1145	Panel mounting ratio transformer—3 decades plus pot	1.11100	10 ppm	260.

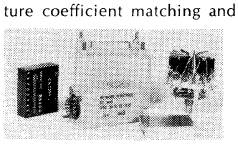
*Special order

PRECISION WIREWOUND RESISTORS AND RESISTOR NETWORKS

Wirewound Resistors. A special ageing process ensures stability to 0.005% standard, or 0.001% on the best available. Standard accuracy is 0.01%, but 0.0015% is available. Changes in environment have little affect and ac residuals are low. Come in open frames (RF), encased in diallyl phthalate (RC) or hermetically-sealed cases (RH).



Custom Resistor Networks. Ideal for solving problems in ratio, temperature coefficient matching and special packaging. Economical and backed by 2-year warranty. Packaging available in variety of configurations, from low cost terminal boards to MIL-approved, hermetically sealed units. Ratios of 1:1 matched to 0.0002%; temperature coefficients matched to 1 ppm/°.



SEE ESI'S TEST INSTRUMENTS AND STANDARDS IN SECTION #2900

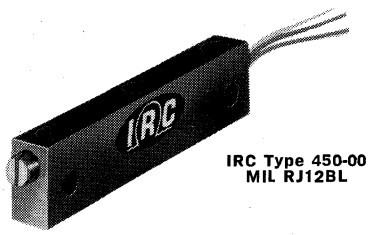
Electro Scientific Industries, 13900 N.W. Science Park Dr., Portland, Oregon 97229

PRECISION RECTANGULAR METAL GLAZE TRIMMERS

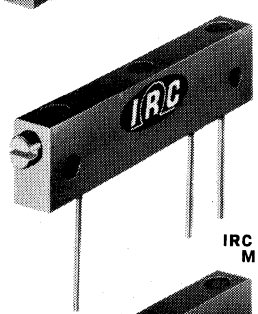
TRW INC.

IRC has a Circuitrim potentiometer for every application. IRC offers all 4 popular styles: rectangular, square, round and cube in both MIL and economy packages. Circuitrim potentiometers are also available in a large assortment of mounting styles. The following pages graphically portrays IRC's complete line.

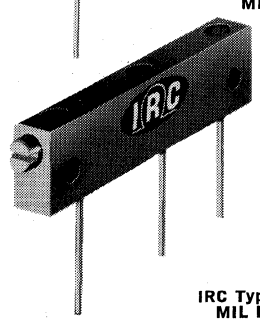
1¼" RECTANGULAR



IRC Type 450-00
MIL RJ12BL

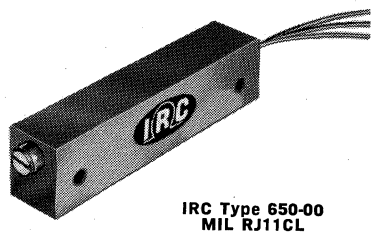


IRC Type 450-10
MIL RJ12BP

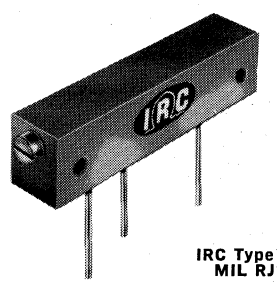


IRC Type 450-20
MIL RJ12BY

1¼" RECTANGULAR



IRC Type 650-00
MIL RJ11CL



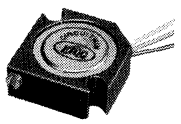
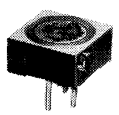
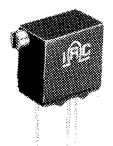
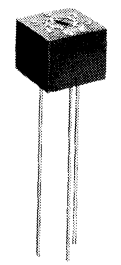
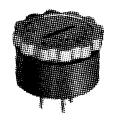
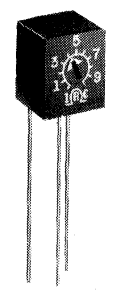
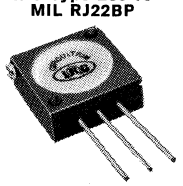
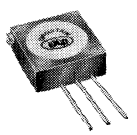
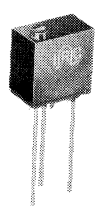
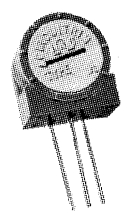
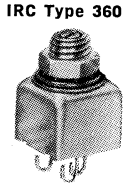
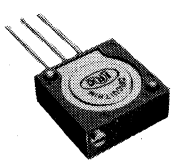
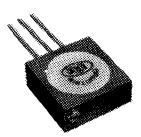
IRC Type 650-20
MIL RJ11CP

SPECIFICATIONS

ELECTRICAL			
Resistance Range	100Ω to 20K	25K to 1 Meg.	100Ω to 20K
Resistance Tolerance	±5%	±10% (Std.)	±5%
Power Rating	¾W @ 85°C	½W @ 70°C	¾W @ 85°C
Operating Temperature Range	—55°C to +150°C	—55°C to +125°C	—65°C to +150°C
Temperature Coefficient (Max.)	±250PPM/°C	(25K to 500K) ±250PPM/°C	±250PPM/°C
MECHANICAL			
Dimensions (L x W x H)	1.25 x .190 x .315	1.25 x .190 x .315	1.25 x .275 x .315
Total Adjustment Turns	22 ±5	22 ±5	22 ±5
	Meets the difficult Char. C performance of MIL-R-22097. Bushing mount version available.	Thin line MIL-R-22097, Char. B trimmer. Available in 20% tolerance at reduced cost.	The most stable Infinite Resolution trimmer available. Typical △R after Load Life test is 0.8%, far surpassing Char. C performance

PRECISION SQUARE, ROUND & CUBE METAL GLAZE TRIMMERS

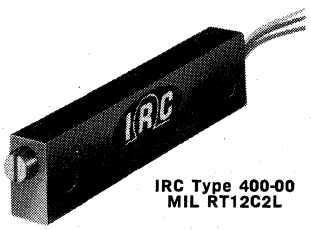
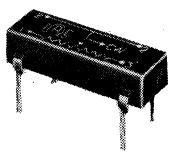
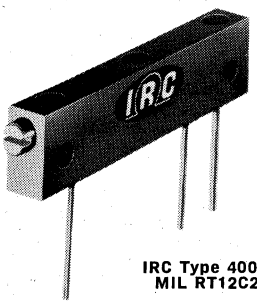
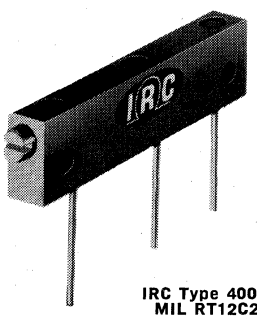
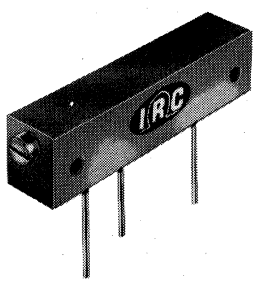
TRW INC.

	½" SQUARE	⅜" SQUARE	5/16" SQUARE	½" ROUND	5/16" CUBE
	 IRC Type 255-00 MIL RJ22BL	 IRC Type 750-10 MIL RJ24BP	 IRC Type 850-20	 IRC Type 150	 IRC Type 350
	 IRC Type 255-10 MIL RJ22BP			 IRC Type 160	 IRC Type 360
	 IRC Type 255-207 MIL RJ22BX	 IRC Type 750-307	 IRC Type 850-208	 IRC Type 156-4	 IRC Type 370
	 IRC Type 255-208 MIL RJ22BW	 IRC Type 750-308			

SPECIFICATIONS					
ELECTRICAL					
Resistance Range	100Ω to 2 Meg.	100Ω to 1 Meg.	100Ω to 1 Meg.	100Ω to 2 Meg.	50Ω to 1 Meg.
Resistance Tolerance	±10% (Std.)	±10% (Std.)	±10% (Std.)	±10% (Std.)	±10% (Std.)
Power Rating	¾W @ 70°C	½W @ 70°C	0.3W @ 70°C	¾W @ 70°C	0.3W @ 70°C
Operating Temperature Range	—55°C to +150°C	—65°C to +125°C	—65°C to +150°C	—55°C to +150°C	—55°C to +125°C
Temperature Coefficient (Max.)	(1K to 2 Meg.) ±250PPM/°C	(1K to 1 Meg.) ±250PPM/°C	(1K to 500K) ±250PPM/°C	(1K to 1 Meg.) ±250PPM/°C	(500Ω to 500K) ±250PPM/°C
MECHANICAL Dimensions (L x W x H)	(255-00, -207, -208) .50 x .50 x .192	(Type 750-10) .375 x .375 x .195	.312 x .312 x .190	(Type 150) .50 Dia. x .235	(Type 350) 5/16" x 5/16" x 15/64"
Total Adjustment Turns	24 ±2	19 ±2	13 ±2	1	1
	Meets MIL-R-22097, Char. B requirements. Bushing mount also available.	MIL style performance in choice of 3 pin arrangements.	Smallest Infinite Resolution trimmer available with multiple mechanical turns.	Commercial pricing with speedy single-turn adjustment. Further savings available in 20% tolerance version.	MIL performance in micro-miniature package.

PRECISION RECTANGULAR WIREWOUND TRIMMERS

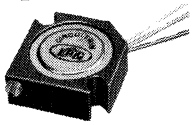
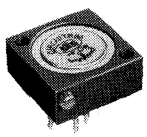
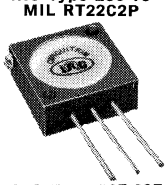
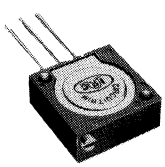
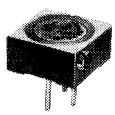
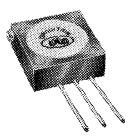
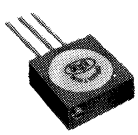
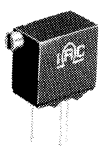
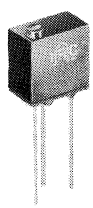
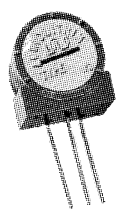
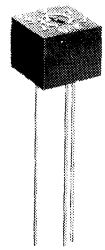
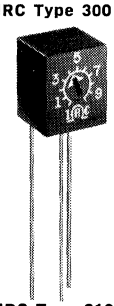
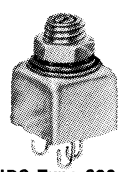
TRW INC.

	1¼" RECTANGULAR	1¼" RECTANGULAR	DUAL IN-LINE "IC" PACKAGE
	 IRC Type 400-00 MIL RT12C2L	 IRC Type 600-00 MIL RT11C2L	 IRC Type 940
	 IRC Type 400-10 MIL RT12C2P		
	 IRC Type 400-20 MIL RT12C2Y	 IRC Type 600-20 MIL RT11C2P	
SPECIFICATIONS			
ELECTRICAL			
Resistance Range	10Ω to 100K	10Ω to 100K	10Ω to 20K
Resistance Tolerance	±5%	±5%	±10%
Power Rating	1W @ 70°C	1W @ 70°C	1W @ 40°C
Operating Temperature Range	—65°C to +150°C	—65°C to +150°C	—65°C to +125°C
Temperature Coefficient (Max.)	±50PPM/°C	±50PPM/°C	±50PPM/°C
MECHANICAL			
Dimensions (L x W x H)	1.25 x .190 x .315	1.25 x .275 x .315	(TO-116 Size) .76 x .25 x .20
Total Adjustment Turns	22 ±5	22 ±5	18 Nom.
	Thinnest MIL style trimmer meeting MIL-R-27208. Also available with bushing mount.	Popular MIL-R-27208 trimmer for toughest service. #12-28 bushing mount available.	Unique design Dual in-Line "IC" package for convenience in P.C. board layout and manufacturing ease.

PRECISION SQUARE, ROUND & CUBE WIREWOUND TRIMMERS

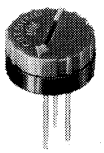
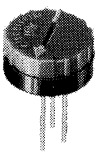
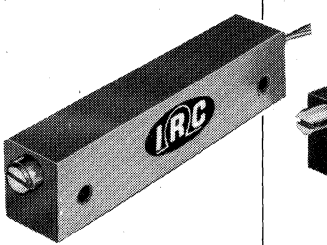
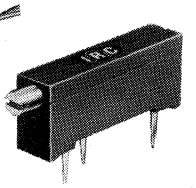
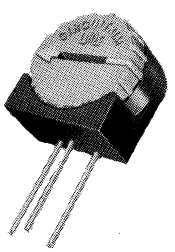
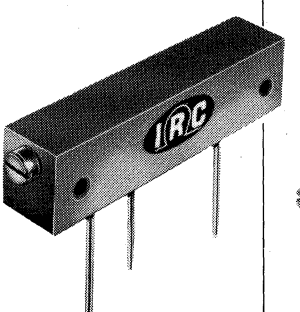
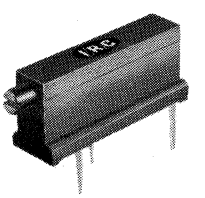
IRC®

TRW INC.

	½" SQUARE	⅜" SQUARE	5/16" SQUARE	½" ROUND	5/16" CUBE
	 IRC Type 205-00 MIL RT22C2L  IRC Type 205-10 MIL RT22C2P  IRC Type 205-207 MIL RT22C2X  IRC Type 205-208 MIL RT22C2W	 IRC Type 700-10 MIL RT24C2P  IRC Type 700-307  IRC Type 700-308	 IRC Type 800-20  IRC Type 800-208	 IRC Type 100  IRC Type 110  IRC Type 106-2	 IRC Type 300  IRC Type 310  IRC Type 320
SPECIFICATIONS					
ELECTRICAL					
Resistance Range	10Ω to 50K	10Ω to 50K	10Ω to 20K	50Ω to 50K	50Ω to 20K
Resistance Tolerance	±5%	±5%	±5%	±5%	±5%
Power Rating	1W @ 70°C	¾W @ 85°C	0.6W @ 70°C	1W @ 70°C	Types 300 & 310-0.6W, Type 320 1W @ 60°C
Operating Temperature Range	—65°C to +175°C	—65°C to +175°C	—65°C to +150°C	—55°C to +150°C	—55°C to +150°C
Temperature Coefficient	±50PPM/°C Max.	±50PPM/°C Max.	±50PPM/°C Max.	±70PPM/°C Max.	±70PPM/°C Max.
MECHANICAL Dimensions (L x W x H)	(205-00, -207, -208) .50 x .50 x .192	(Type 700-10) .375 x .375 x .195	.312 x .312 x .190	(Type 100) .50 Dia. x .235	(Type 300) 5/16" x 5/16" x 15/64"
Total Adjustment Turns	25 ±2	21 ±2	15 ±2	1	1
	Meets all MIL-R-27208 requirements. Bushing mount also available.	Meets all MIL-R-27208 requirements. Ideal for tight space needs.	Smallest worm and gear actuated trimmer meeting MIL performance while economically priced.	MIL performance at commercial prices. Features speedy single-turn adjustment. Also available in a variety of mounting styles.	Humidity proof performance in a micro-miniature package.

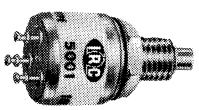
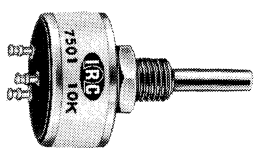
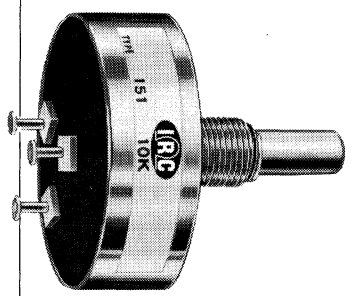
RECTANGULAR & ROUND COMMERCIAL/INDUSTRIAL TRIMMERS

TRW INC.

	½" ROUND WIREWOUND	½" ROUND METAL GLAZE	1¼" RECTANGULAR WIREWOUND	¾" RECTANGULAR WIREWOUND
	 IRC Type 500	 IRC Type 550	 IRC Type 60-00	 IRC Types 900-20 & 910-20
	 IRC Type 506	 IRC Type 556	 IRC Type 60-20	 IRC Types 920-20 & 930-20
SPECIFICATIONS				
ELECTRICAL				
Resistance Range	10Ω to 50K	100Ω to 2 Meg.	10Ω to 50K	10Ω to 20K
Resistance Tolerance	±10%	±30%	±10%	±10%
Power Rating	½W @ 70°C	½W @ 70°C	1W @ 70°C	1W @ 40°C
Operating Temperature Range	—55°C to +105°C	—25°C to +105°C	—55°C to +125°C	—65°C to +125°C
Temperature Coefficient (Max.)	±100PPM/°C	(1K to 1 Meg.) ±250PPM/°C	±70PPM/°C	±100PPM/°C
MECHANICAL **Dimensions (L x W x H)**	(Type 500) ½" Dia. x 15/64"	(Type 550) ½" Dia. x 15/64"	1.25 x .275 x .315	.75 x .16 x .31
Total Adjustment Turns	1	1	22 ±5	20 Nom.
	For applications requiring low initial cost with excellent wirewound stability.	Infinite Resolution, low cost and mechanically rugged design trimmers in the popular ½" dia. size.	Truly a sturdy trimmer that you can "set and forget." Bushing mount also available.	Smallest rectangular trimmer for low cost commercial and industrial needs.

PRECISION ROTARY SINGLE-TURN WIREWOUND TRIMMERS

TRW INC.

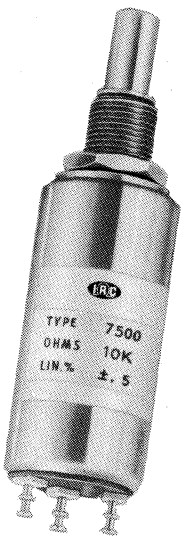
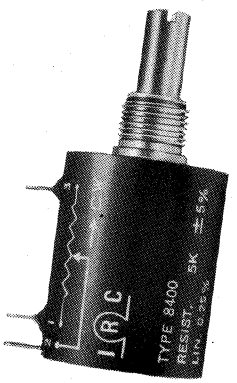
	½" ROUND	¾" ROUND	1½" ROUND
	 IRC Type 5001	 IRC Type 7501	 IRC Type 151
SPECIFICATIONS			
ELECTRICAL			
Resistance Range	10Ω to 50K	50Ω to 75K	100Ω to 100K
Resistance Tolerance	±5%	±5%	±5%
Power Rating	2W @ 40°C	2¼W @ 40°C	3½W @ 40°C
Operating Temperature Range	—55°C to +150°C	—55°C to +150°C	—55°C to +125°C
Linearity	±5%	±1%	±0.5%
MECHANICAL **Dimensions (Dia. x L)**	½" x 63/64"	¾" x 1¼"	1½" x 1½"
Mechanical Rotation	320° ±5° (Stops Std.)	Continuous (Stops available)	Continuous (Stops available)
Electrical Rotation	320° ±5°	345° ±5°	350° ±5°

For panel-mounted applications involving severe environmental or high temperature conditions, these IRC single-turn, metal cased trimming potentiometers handle power requirements to 3½ watts. Moisture sealed construction is available for all types.

See page 1172 for Revodex® Counting Dials.

PRECISION MULTI-TURN WIREWOUND POTENTIOMETERS

TRW INC.

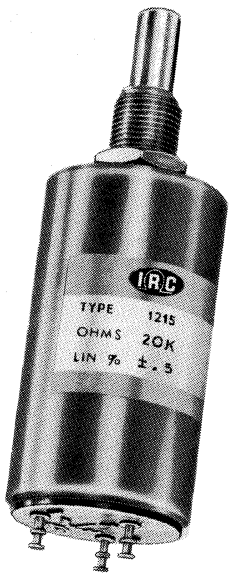
	½" DIAMETER, 10 TURNS	¾" DIAMETER, 10 TURNS	¾" DIAMETER, 10 TURNS	⅞" DIAMETER, 10 TURNS
	 IRC Type 5000	 IRC Type 7300	 IRC Type 7500	 IRC Type 8400
SPECIFICATIONS				
ELECTRICAL				
Resistance Range	25Ω to 100K	100Ω to 100K	50Ω to 250K	100Ω to 100K
Resistance Tolerance	±5% (Std.)	±5%	±5% (Std.)	±5%
Power Rating	1½W @ 40°C	3W @ 40°C	3W @ 40°C	3W @ 40°C
Operating Temperature Range	—55°C to +125°C	—55°C to +105°C	—55°C to +125°C	—55°C to +105°C
Linearity	±.5% (Std.)	100Ω to 2K ±.5% 5K and up ±.25%	±.25% (Std.)	±.25%
MECHANICAL **Dimensions (Dia. x LBP)**	½" x 1 39/64"	¾" x 1 47/64"	¾" x 1 55/64"	⅞" x 1⅛"
Rotation	3600° +4° —0°	3600° +15° —0°	3600° +4° —0°	3600° +15° —0°
	A sturdy, yet compact multi-turn that can take rough handling with its 100 oz. in. Stop Strength.	Compact, plastic case design with readily accessible end terminals.	Unique metal case construction for excellent moisture protection.	Most popular size multi-turns. Also available in 3 turns or with ⅛" dia. shaft and ¼" dia. bushing.

See page 1172 for Revodex® Counting Dials.

PRECISION MULTI-TURN WIREWOUND POTENTIOMETERS

IRC®

TRW INC.

	1″ DIAMETER, 10 TURNS	1″ DIAMETER, 15 TURNS	1½″ DIAMETER, 10 TURNS
	 IRC Type 1000	 IRC Type 1215	 IRC Type HD-150
SPECIFICATIONS			
ELECTRICAL			
Resistance Range	500Ω to 250K	500Ω to 450K	500Ω to 600K
Resistance Tolerance	±5% (Std.)	±5% (Std.)	±3% (Std.)
Power Rating	3W @ 40°C	4W @ 40°C	5W @ 40°C
Operating Temperature Range	—55°C to +125°C	—55°C to +125°C	—55°C to +100°C
Linearity	±.25% (Std.)	±.1% (Std.)	±.25% (Std.)
MECHANICAL **Dimensions (Dia. x LBP)**	1″ x 1 35/64″	1″ x 2 5/32″	1½″ x 2″
Rotation	3600° +4° —0°	5400° +4° —0°	3600° +4° —0°
	IRC patented stop system gives 100 oz. in. Stop Strength plus availability in 2 to 10 turns.	Metal case construction. Also available in 20 turn version.	For industrial requirements demanding the best resolution and linearity.

See page 1172 for Revodex® Counting Dials.

MALLORY CONTROLS

CARBON CONTROLS

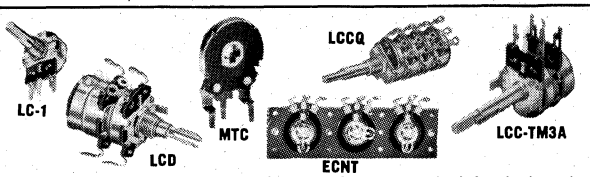
LC-1 — Mallory single bushing mount printed circuit type No. 1.

LCD — Mallory tandem dual bushing mount and twist ear mount. Any style mounting available. Any length metal shaft available. Also available with nylon shaft.

LCC-TM3A — Mallory concentric shaft dual printed circuit type number 3A twist ear mount. Any type mounting available. Any length metal shaft.

LCCQ — Mallory section concentric shaft control. Various combinations are available.

ECNT — Triple twist ear mounting nylon shaft. Standard FMS 3/8", 1/2", 3/4" and flush. Taps are not available in this design.

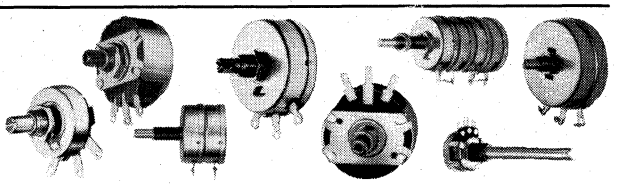


MTC — This Mallory type miniature trimmer control is designed for printed circuitry. It can be used in transistorized or tube circuits and wherever an occasionally adjusted, low wattage, carbon type variable resistance source is needed.

WIREWOUND CONTROLS

With a range of 2 to 12½ watts, Mallory offers the widest range of commercial wire-wound controls available. Within this wattage range, there are 19 different styles of wire-wound controls and 14 different styles of wire-wound attenuators that will meet nearly all applications where a variable wire-wound control or attenuator is specified.

When to Specify Variable Wire-Wound Controls: Mallory wire-wound controls and attenuators are ideal in all electrical and electronic circuits requiring a power dissipation of 2 - 12½ watts. They effectively bridge the gap between the services performed by carbon potentiometers and those performed by the larger vitreous enameled power rheostats.



Wire-wound potentiometers offer a much higher degreee of precision in overall tolerance, linearity and special curves than is obtainable from carbon units.

MASTER SPECIFICATION TABLE — WIREWOUND CONTROLS

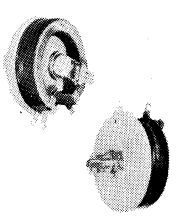
Watts	Style	Dia.	Depth	Std. Bushing	Std. Shaft Dia.	Degrees of Rotation: Mechanical	Degrees of Rotation: Electrical†	Degrees of Rotation: Electrical‡	Resistance: Min. Ohms	Resistance: Max. Ohms	Operating Torque*	Contact Arm	Available Taps	Locating Lug: Radius	Locating Lug: Location	Voltage Breakdown	Equivalent MIL-R-19 Style	Remarks
2	C	1 3/64	7/16	3/8-32	1/4	280	—	255	1	25K	1 1/4-6 in.oz.	Grounded	None	—	None Available	—		Open Housing.
2	QC	1 3/64	7/16	3/8-32	1/4	280	—	255	1	25K	1 1/4-6 in.oz.	Grounded	None	—	None Available	—		Same as Style C except Military Construction.
2	CV	1 5/64	1 5/32	3/8-32	1/4	280	—	255	1	25K	1 1/4-6 in.oz.	Grounded	None	—	None Available	—		Same as Style C except enclosed housing.
2	QCV	1 5/64	1 5/32	3/8-32	1/4	280	—	255	1	25K	1 1/4-6 in.oz.	Grounded	None	—	None Available	—		Same as Style CV except Military Construction.
3	R	1 3/32	5/8	3/8-32	1/4	297	260	290	1	50K	1 1/4-6 in.oz.	Insulated	50%	17/32	3:00 and/or 9:00	900 V RMS		
3	QR	1 3/32	5/8	3/8-32	1/4	297	260	290	1	50K	1 1/4-6 in.oz.	Insulated	50%	17/32	3:00 and/or 9:00	900 V RMS	RA20	Same as Style R except Military Construction.
4	M	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	1/2-3 in.oz.	Insulated	Any Location	17/32	3:00 and/or 9:00	900 V RMS		
4	QM	1 5/8	9/16	3/8-32	1/4	300	245	275	1/2	100K	1 1/4-6 in.oz.	Insulated	Any Location	17/32	3:00 and/or 9:00	900 V RMS	RA30	Same as Style M except Military Construction.
5	SC	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	1/2-3 in.oz.	Insulated	None	15/64	3:00 and/or 9:00	900 V RMS		
5	QSC	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	1/2-3 in.oz.	Insulated	None	15/64	3:00 and/or 9:00	900 V RMS	RA10	Same as Style SC except Military Construction.
5	VW	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	1 -6 in.oz.	Insulated	None	17/32	3:00 and/or 9:00	900 V RMS		
5	QVW	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	1 -6 in.oz.	Insulated	None	17/32	3:00 and/or 9:00	900 V RMS		Same as Style VW except Military Construction.
7	E	2 5/16	53/64	3/8-32	1/4	307	—	295	3	150K	1 1/2-6 in.oz.	Insulated or Grounded	None	17/32	3:00 and/or 9:00	900 V RMS		
10	SCG	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	1/2-3 in.oz.	Insulated	None	15/64	3:00 and/or 9:00	900 V RMS		
10	QSCG	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	1/2-3 in.oz.	Insulated	None	15/64	3:00 and/or 9:00	900 V RMS		Same as Style SCV except Military Construction.
10	VWG	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	1 -6 in.oz.	Insulated	None	17/32	3:00 and/or 9:00	900 V RMS		Same as Style VWG except Military Construction.
10	QVWG	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	1 -6 in.oz.	Insulated	None	17/32	3:00 and/or 9:00	900 V RMS		
12½	MG	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	1 1/4-6 in.oz.	Insulated	Any Location	17/32	3:00 and/or 9:00	900 V RMS		
12½	QMG	1 5/8	9/16	3/8-32	1/4	300	245	275	1/2	100K	1 1/4-6 in.oz.	Insulated	Any Location	17/32	3:00 and/or 9:00	900 V RMS		Same as Style MG except Military Construction.

† Electrical with switch ‡ Electrical without switch * A higher torque 6-20 in. oz. is available upon request for styles C, QC, CV, QCV, R, QR, M, QM, E, MG, and QMG

POWER WIREWOUND RHEOSTATS

STYLE "K" RHEOSTATS — Mallory offers a broad range of power rheostats in eight different wattage sizes with resistance values ranging from 0.5 to 10,000 ohms.

Style "K" rheostats are precision-constructed to provide long life and exact performance in hundreds of different electrical and electronic applications. All current-carrying parts are electrically insulated by dimensionally stable ceramic parts. All styles have been tested up to 5000V without breakdown between live parts and shaft or bushing.



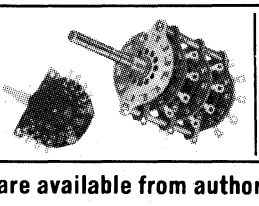
Watts	Style	Dia. (in.)	Depth (ins.)	Locating Lug	Rotation (Deg.)	Min. Ohms	Max. Ohms	*U.L. Volt. Rating	Std. Shaft Dia.	Rotational Torque
25	25K	1 1/16	1 3/8	1/2" radius	295	0.5	5,000	300	1/4	
50	50K	2 13/32	1 17/32	1/2" radius	300	0.5	10,000	300	1/4	4 oz./in.
75	75K	2 25/32	1 5/8	1/2" radius	300	0.5	10,000	300	1/4	to
100	100K	3 1/8	1 11/16	1/2" radius	300	0.5	10,000	300	1/4	3 lb./in.
150	150K	4 1/32	1 3/4	1/2" radius	305	0.5	10,000	300	1/4	
225	225K	5	2 3/8	None	310	0.5	5,000	600	3/8	4 oz./in.
300	300K	6 1/16	2 25/32	None	315	0.5	5,000	600	3/8	to
500	500K	8	2 27/32	None	325	0.5	5,000	600	3/8	7 oz./in.

* This rating does not apply to tapered windings or special cores or bases.

SWITCHES

Mallory's broad line of rotary, lever and push button switches are known throughout the world for reliability.

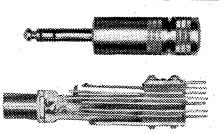
Whether your requirements are for prototype or production use, Mallory can readily supply a standard switch from stock or custom-made-unit tailored to your specifications.



JACKS AND PLUGS

Mallory offers a wide variety of jacks and phone plugs capable of meeting the designer's most exacting needs. An infinite number of circuit combinations is standard for various jack frame styles.

Each plug provides a conventional receptacle capable of mating with various plugs.



Standard Mallory components are available from authorized Mallory distributors throughout the United States.

MALLORY

MALLORY CONTROLS COMPANY

a division of P. R. MALLORY & CO. INC.

Box 327, Frankfort, Indiana 46041; Telephone: 317-654-5501

MARKITE®

CONDUCTIVE PLASTIC PRECISION POTENTIOMETERS

The Industry's Most Comprehensive Line

STANDARD SINGLE-TURN ROTARY POTENTIOMETERS

with NAS710 Servo, Panel or Custom Mounts

	Size (Nom. body dia.)	Std. Resistance Range	Linearity* Standard	Linearity* Special Accuracy (Single)	Electrical Travel (Nominal)	Ambient Temperature Range
SINGLE GANG OR MULTI-GANG (to 8 cups and more) (Terminals on the side)						
SPACE-SAVING SLIMLINE Only 0.2" length for each additional cup. Diameters available: 1¼", 1½", 1¾", 1¾", 2" and 3".	1¼"	500Ω to 25KΩ	±0.5%	±0.08%	344°	—65°C. to +125°C. standard; to +270°C. special, for limited periods.
	2"	1KΩ to 50KΩ	±0.5%	±0.03%	352°	
STANDARD SERIES Diameters available: ½" (with wire leads), ¾", 1¼", 1¾", 1¾", 2", 3" and 5".	1¼"	250Ω to 120KΩ	±0.5%	±0.13%	345°	
	2"	500Ω to 250KΩ	±0.5%	±0.06%	353°	
SINGLE GANG ONLY (Terminals at the rear) Diameters available: ½", ¾", 1¼", 1¾", 1¾", 2" & 3"	1¼"	250Ω to 120KΩ	±0.5%	±0.08%	345°	
	2"	500Ω to 250KΩ	±0.5%	±0.03%	353°	

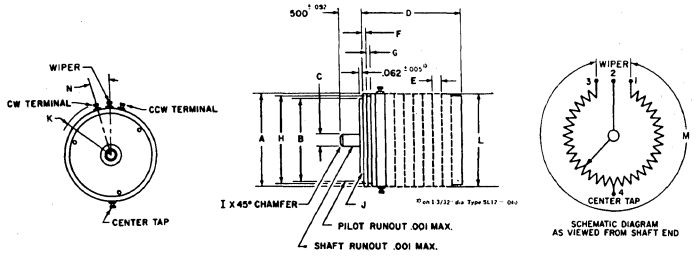
STANDARD RECTILINEAR (Translatory) POTENTIOMETERS

Stroke ranges shown are standard; from 0.2" to multi-foot strokes can be furnished.

	Std. Resistance Range	Linearity Standard	Linearity Special Accuracy
END ACTUATED—CYLINDRICAL CASE ½" diameter, stroke lengths 1" to 3", with single resistance element.	250Ω/in. to 15KΩ/in.	±0.5%	±0.05%
¾" diameter, stroke lengths 1" to 10" with single or dual resistance elements.		±0.5%	±0.05%
END ACTUATED—RECTANGULAR CASE 1.075" x 0.500" cross-section, stroke length 1.290"—with single or dual elements.	130Ω to 65KΩ	±1.0%	±0.5%
SIDE ACTUATED—RECTANGULAR CASE 1.750" x 0.875" cross section, stroke lengths 1.890" or 2.850"—with single resistance element.	200Ω to 100KΩ (1.890" stroke) 300Ω to 150KΩ (2.850" stroke)	±1.0%	±0.5%

*Unless otherwise specified, these are Independent Linearity values. In most cases, Terminal, Zero-based or Absolute Linearities can be supplied to these values.

STANDARD SLIMLINE SERIES . . . 3-WEEK DELIVERY



MECHANICAL SPECIFICATIONS

		Size (Nom. body dia.)	1-1/16"	1-3/32"	1-7/16"	1-3/4"	2"	3"
		Markite Type Number	SL11	SL12	SL15	SL18	SL20	SL30
DIMENSIONS (IN INCHES)	A	±.005	1.062	1.093	1.437	1.750	2.000	3.000
	B	(+.0000)(−.0005)	.9688	1.0300	1.3125	—	—	—
		(+.0000)(−.0010)	—	—	—	1.562	1.875	2.875
	C	(+.0000)(−.0003)	.1247	.1247	.2497	.2497	.2497	.2497
	D	Max. (Length of single cup unit)	.630	.630	725	725	.725	725
	E	(Length of each additional cup)	.200	.200	.200	.200	.200	.200
	F	±.005	.062	.060	.093	.093	.093	.093
	G	Min.	.057	.055	.073	.073	.073	.073
	H	Max.	.975	1.030	1.312	1.625	1.875	2.875
	I	± 010	1/64	1/64	1/32	1/32	1/32	1/32
	J	Lateral runout	.0015	.0015	.0015	.002	.002	.003
	K	(Max. radius to top of terminal)	43/64	43/64	27/32	1-1/32	1-9/64	1-41/64
	L	O.D. of cup (Max.)	1.073	1.073	1.449	1.761	2.011	3.011
	M	(Nom. Electrical Travel)	344°	344°	348°	351°	352°	355°
	N	(Typical)	25°	25°	20°	20°	15°	15°
	Mechanical Travel		360° Standard, Continuous					
	Torque — standard, oz.-in. —	Single Cup Unit	0.35	0.35	0.50	0.60	0.70	0.80
		Each Additional Cup	0.31	0.31	0.40	0.50	0.50	0.60
	Moment of Inertia — gm-cm² —	Single Cup Unit	1.9	1.9	3.5	3.7	4.0	6.3
		Each Additional Cup	1.8	1.8	3.3	3.5	3.8	6.1
	Weight — oz. —	Single Cup Unit	0.96	0.96	1.79	2.21	2.70	5.82
		Each Additional Cup	0.21	0.21	0.32	0.38	0.39	0.57
	Mounting — Servo, per NAS710 standard		RR-11	—	RR-15	RR-18	RR-20	RR-30

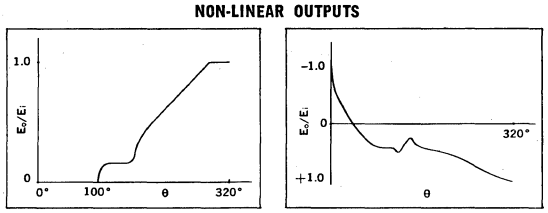
ELECTRICAL SPECIFICATIONS

Size (Nom. Body Dia.)	1-1/16"	1-3/32"	1-7/16"	1-3/4"	2"	3"
Standard Resistances	1K, 5K, 10K, 20K		1K, 5K, 10K, 20K, 50K		2K, 5K, 10K, 20K, 50K	2K, 10K, 20K, 50K, 100K
Resistance Tolerance	±10%					
Standard Linearity	±0.5% or ±0.2% (Please specify)					
Resolution	SUBSTANTIALLY INFINITE					
Ambient Temperature Range	−65°C. to +125°C., standard, continuous					
Continuous Power Dissipation (at 20°C., in air) *	1.5w	1.5w	2.0w	3.0w	3.2w	5.0w
Insulation Resistance	Greater than 20 megohms @ 500 VDC					
Dielectric Strength	1000 VRMS @ standard atmospheric conditions					

* Single Cup

- INFINITE RESOLUTION (no servo hunting)
- LONG USEFUL LIFE (many milions of cycles in system use)
- INCREASED RELIABILITY (rugged 1-piece molded element)
- NO CATASTROPHIC FAILURE (no sudden opens or shorts)
- HIGH ACCURACY: ±0.5% standard linearity; special accuracy to ±0.01% on 5" dia. units
- STABLE OUTPUT AND CONTINUOUS OPERATION IN EXTREME ENVIRONMENTS (no wiper bounce)
- CONSISTENTLY LOW NOISE IN SYSTEM USE (uniform and predictable throughout long life)
- INSIGNIFICANT QUADRATURE EFFECTS (to at least 100 Kc)
- UNIFORM PERFORMANCE OF PROTOTYPES AND QUALITY PRODUCTION (Close duplication assured through molding with precision steel dies)

NON-LINEAR OUTPUTS



The high accuracy functions above typify Markite's virtually unlimited capability in meeting the most demanding output requirements. These range from the simplest to the most complex functions, whether monotonic or reversing, with or without multiple inflections.

These units provide the same operational advantages furnished by Markite linear output potentiometers, including infinite resolution, exceptionally long useful life, consistently low noise in system use and stable, continuous operation even under extreme environments. Integral molding of any required series and/or parallel pads into the rugged one-piece molded element eliminates external components and wiring, improves reliability as well as temperature and humidity stability.

For more complete specification data on Markite standard and custom precision potentiometers, write today for Markite Condensed Catalog S-65. For assistance with your applications problems, write to Markite, or contact the Markite Representative in your area.

MARKITE CORPORATION
155 Waverly Place, New York, N.Y. 10014
Phone: (212) ORegon 5-1384
TWX: 710-581-3673

NYTRONICS, INC.
STANDARD COMPONENTS GROUP

CONDUCTIVE PLASTIC POTENTIOMETERS

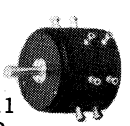
conductive plastic • single turn • servo mount

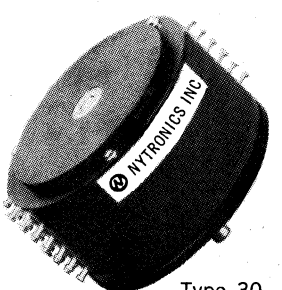
Type	Single Cup Standard Size		Resistance Range R ±10% Std.	Resistance Range R ±10% Spl.	Independent Linearity or Conformity Std.	Independent Linearity or Conformity Spl.	Watts @ 25°C	Electr. Angle (nom.)	Torque 1 Cup Std.	Torque 1 Cup Spl.	Max. Gang	Weight Ounces	See DWG Below A	See DWG Below B	See DWG Below C Min.
11	dia. length shaft dia. shaft length.	1.062 .630 .1247 .50	500 to 25K	200 to 100K	±.5%	±.07%	1.5	344° ±1°	.35	.10	8 Cups	1st cup 0.93 Add'l cups 0.20 ea.	.062	.062	.057
15	dia. length shaft dia. shaft length.	1.437 .725 .2497 .50	500 to 50K	250 to 200K	±.4%	±.05%	2.1	348° ±1°	.50	.20	8 Cups	1st cup 1.65 Add'l cups 0.30 ea.	.062	.093	.073
18	dia. length shaft dia. shaft length	1.750 .725 .2497 .50	500 to 50K	250 to 200K	±.4%	±.04%	3.0	351° ±1°	.60	.30	8 Cups	1st cup 2.15 Add'l cups 0.35 ea.	.062	.093	.073
20	dia. length shaft dia. shaft length	2.000 .725 .2497 .50	750 to 75K	350 to 300K	±.4%	±.035%	3.2	352° ±1°	.70	.35	8 Cups	1st cup 2.60 Add'l cups 0.35 ea.	.062	.093	.073
30	dia. length shaft dia. shaft length	3.000 .725 .2497 .50	1K to 100K	500 to 400K	±.4%	±.025%	5.0	355° ±1°	.90	.45	8 Cups	1st cup 5.60 Add'l cups 0.50 ea.	.062	.093	.073

*Additional length per additional cups = .200

Mechanical Rotation — 360° (Stops available)
Ball Bearings — Precision type bearings
Servo Mounting End — Anodized Aluminum
Insulation Resistance — 20 megohms at 1500 VDC
Dielectric Strength — 1000 VRMS at 60 CPS, sea level
Linearity Strip Chart — Furnished upon request
Total Resistance Tolerance — to 5% special
Temperature Range — (—55°C to 125°C)
Service Life (Cycles) — to 50,000,000
Vibration — 5 to 3000 CPS
Shock — 100G
Temperature Coefficient — 400 ppm/°C
• **SPECIAL RESISTOR ELEMENTS** •
LINEAR & NON LINEAR
FUNCTIONS AVAILABLE

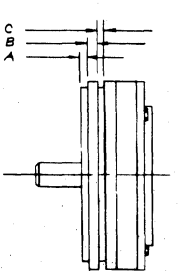

Type 11
1 Cup


Type 11
2 Cup



Type 30
6 Cup

Tol .XXX = ±.005
Rear Shaft
Extension Available



ALSO CONTACT US FOR COMMUTATOR-TYPE ROTARY SWITCHES; ANALOG-TO-DIGITAL SHAFT POSITION BRUSH ENCODERS; AND PRECISION CALIBRATING GONIOMETERS . . .

ELECTRO-MEC
INSTRUMENT CORPORATION
A SUBSIDIARY OF NYTRONICS, INC.

183 Commercial Street, Watertown, Connecticut 06795
203-274-5431

NYTRONICS, INC.
STANDARD COMPONENTS GROUP

PRECISION POTENTIOMETERS

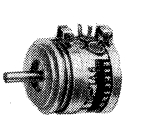
wire-wound • single turn • servo mount • linear and non-linear

Type	Single Cup Standard Size	Resistance Range OHMS ±5% Std.	Linearity (Ind)/360° Standard	Linearity (Ind)/360° Special	Resolution/360° Standard	Resolution/360° Special	Electrical Angle (Non-Shorting Gap)
9	dia. 0.878 length 0.812 shaft dia. 0.1248 shaft length 0.47	100Ω to 1KΩ 1 KΩ to 3KΩ 3KΩ to 100KΩ	±0.80% ±0.50% ±0.50%	±0.50% ±0.40% ±0.20%	0.23 0.14 0.08	0.08 0.07 0.06	342°±3° 354°±2°SPL
11	dia. 1.062 length 0.899 shaft dia. 0.1248 shaft length 0.47	102Ω to 600Ω 600Ω to 2400Ω 2400Ω to 102KΩ	±0.70% ±0.60% ±0.50%	±0.45% ±0.30% ±0.15%	0.18 0.13 0.08	0.08 0.065 0.054	350°±2° 354°±1.5°SPL
15	dia. 1.437 length 0.93 shaft dia. 0.1248 shaft length 0.47	170Ω to 1KΩ 1 KΩ to 5KΩ 5KΩ to 170KΩ	±0.60% ±0.50% ±0.40%	±0.30% ±0.25% ±0.12%	0.13 0.08 0.06	0.06 0.04 0.035	351°±2° 354°±1.5°SPL
18	dia. 1.75 length 0.977 shaft dia. 0.2498 shaft length 0.62	200Ω to 1KΩ 1 KΩ to 4KΩ 4KΩ to 200KΩ	±0.50% ±0.40% ±0.30%	±0.30% ±0.20% ±0.10%	0.10 0.08 0.06	0.06 0.035 0.03	353°±1° 354°±1°SPL
20	dia. 2.00 length 1.00 shaft dia. 0.2498 shaft length 0.62	230Ω to 2KΩ 2KΩ to 5KΩ 5KΩ to 230KΩ	±0.50% ±0.40% ±0.30%	±0.22% ±0.18% ±0.10%	0.09 0.07 0.05	0.05 0.03 0.025	355°±1° 357°±1°SPL
30	dia. 3.00 length 1.00 shaft dia. 0.2498 shaft length 0.62	370Ω to 2KΩ 2KΩ to 10KΩ 10KΩ to 370KΩ	±0.40% ±0.30% ±0.20%	±0.15% ±0.10% ±0.06%	0.06 0.05 0.03	0.04 0.025 0.015	356°±1° 358°±0.5°SPL
1395	**Ultra Low Torque** dia. 1.245 length, incl. bushing mount* 1.44 shaft dia. 0.0780 shaft length 0.42	150Ω to 600Ω 600Ω to 2.4KΩ 2.4KΩ to 150KΩ	±0.70% ±0.60% ±0.50%	±0.45% ±0.30% ±0.15%	0.18 0.13 0.08	0.08 0.06 0.054	351°±2° 354°±1.5°SPL

*Bushing: ⅜-32 thread x 0.410

Mechanical Rotation – 360° (Stops available)
Ball Bearings – Precision type bearings
Connections – All are welded with ribbon leads
Internal Clamps – Optional
Noise – 100 ohms ENR (NAS 710 Section 3.1.1)**
Insulation Resistance – 1000 megohms at 50 VDC (MIL STD 202C Method 301)
Quadrature Voltage – 2 Millivolts/volt at 400 CPS Max
Dielectric Strength – 1000 VRMS at 60 CPS, sea level (MIL STD 202C Method 301)
Linearity Strip Chart – Furnished upon request
Total Resistance Tolerance – to 1% special**
Temperature Range – −55°C to 105°C (to +150°C special)
Service Life (Cycles) – 500,000 to 1,000,000**
Vibration – 15G – 50 to 3000 CPS (MIL STD 202C Method 204 Condition D)
Shock – 50G – 11 milliseconds per MIL STD 202C Method 205C
***These values vary as they are interrelated with other performance characteristics. Exact limits upon request.*

Shown ½ actual size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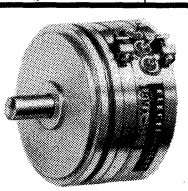
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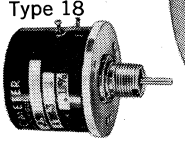
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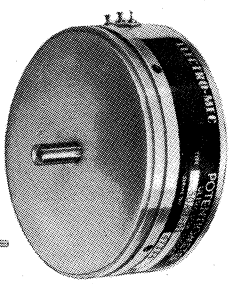
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ALSO CONTACT US FOR COMMUTATOR-TYPE ROTARY SWITCHES; ANALOG-TO-DIGITAL SHAFT POSITION BRUSH ENCODERS; AND PRECISION CALIBRATING GONIOMETERS . . .

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INSTRUMENT CORPORATION
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OHMITE has the answer in wirewound rheostats

Twelve sizes in wirewound, vitreous enameled rheostats are stocked by Ohmite distributors all over the country and at the Ohmite factory. This selection, the most extensive available to industry, covers ratings that meet the major portion of design, production and emergency needs. Ratings of 7½, 12½, 25, 50, 75, 100, 150, 225, 300, 500, 750 and 1000 watts are standard.

FEATURES OF CONSTRUCTION: Ohmite rheostats are designed to produce permanently smooth, close control. The construction is all ceramic and metal; there is nothing to smoke, char, shrink, or shift. All models have insulated shafts with provision to keep the rheostat from turning on the panel. The resistance wire is wound over a solid ceramic core. Each turn is a separate resistance step and is locked against shifting by vitreous enamel (except Model C). The core and base are also bonded by vitreous enamel. The pivoted universal-action-mounted contact brush is of metal-graphite and varies to fit current and resistance. It rides upon a large flat surface and assures perfect contact without wear on the wire. Pressure at the contact and at the center lead are independent. Ohmite Rheostat Models H, J, G, K, L, P, and N, all marked Series A, are listed under the Underwriters' Laboratories Reexamination Service.

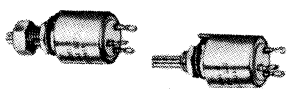
RATING: The current carrying capacities shown in the tables are for use in **free air;** when units are enclosed, these currents should be reduced possibly as much as 30% to 50%, depending upon the degree of ventilation. The rated current will cause the rheostat to dissipate its rated wattage when the full resistance is in the circuit.

MODEL C, MINIATURE — 7.5 Watts* (See Bul. 203)

The Model C provides greater design flexibility. In addition to its small size, its versatile solder terminals will also plug into common transistor sockets or circuit boards. It is stocked with both standard and locking type bushings.

Ohms	Amps.	Std. Shaft Stock No.	Std. Shaft Net 1-4	Locking Shaft Stock No.	Locking Shaft Net 1-4
10	.86	4908	$8.59	4948	$10.48
15	.71	4909	8.59	4949	10.48
25	.55	4910	8.59	4950	10.48
35	.46	4911	8.59	4951	10.48
50	.39	4912	8.59	4852	10.48
75	.32	4913	8.59	4953	10.48
100	.27	4914	8.59	4954	10.48
150	.22	4915	8.59	4955	10.48
200	.19	4916	8.59	4956	10.48
250	.17	4917	8.59	4957	10.48
350	.15	4918	8.59	4958	10.48
500	.12	4919	8.59	4959	10.48
750	.10	4920	8.59	4960	10.48
1000	.086	4921	9.72	4961	11.61
1500	.071	4922	9.72	4962	11.61
2500	.055	4923	9.72	4963	11.61
3500	.046	4924	10.15	4964	12.04
5000	.039	4925	10.15	4965	12.04

* Rating on Metal Panel.



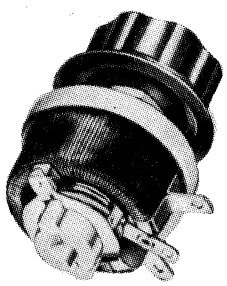
Diameter: .515″ max.
Shaft: ⅛″ Diameter.
Standard—**Code:** C—_____—S-1 (Ohms)
Locking—**Code:** C—_____—LO-1 (Ohms)
Resistace Tolerance: ±10%
Torque: 0.25 to 3 oz.-inch
Weight: 0.27 oz.
Standard Mounting: For panels up to ⅛″ by ¼-32 bushing with non-turn projection. Solder terminals also fit EIA type TSE-3R100 transistor socket.
Rotation: 300° ±5°
Standard Knob: No. 5151. Specify separately on order when desired.

MODEL H — 25 Watts

Diameter: 1 5/16″. **Code:** H—_____—F-2. (Ohms) **Shaft:** ¼″ diameter.
Resistance Tolerance: ±10%. **Torque:** 0.25 to 0.5 pound-inch. **Weight:** 0.19 lb. **Standard Mounting:** For panels up to ¼″ by ⅜″-32 bushing with No. 5050 non-turn washer. **Rotation:** 300° ±5°. **Standard Knob:** No. 5150. Specify separately on order when desired.

Stock No.	Total Ohms	Max. Amps.	Net 1-4	Stock No.	Total Ohms	Max. Amps.	Net 1-4
0140	1	5.000	$5.05	0154	250	.316	$4.55
0141	2	3.540	5.05	0155	350	.267	4.55
0142	3	2.880	5.05	0156	500	.222	4.55
0143	6	2.040	5.05	0157	750	.182	4.55
0144	8	1.770	5.05	0158	1,000	.155	5.05
0145	10	1.580	5.05	0159	1,500	.129	5.05
0146	15	1.290	4.55	0160	2,500	.100	5.05
0147	25	1.000	4.55	0161	3,500	.084	5.35
0148	35	.845	4.55	0162	5,000	.070	5.35
0149	50	.707	4.55	4200†	7,500	.058	5.55
0150	75	.575	4.55	4201†	10,000	.050	5.55
0151	100	.500	4.55	4202†	15,000	.040	6.05
0152	125	.445	4.55	4203†	20,000	.035	6.80
0153	175	.375	4.55	4204†	25,000	.032	7.50

†Silicone-ceramic coating, 500 V. max. Not listed UL Series A.

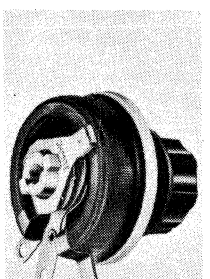


MODEL J — 50 Watts

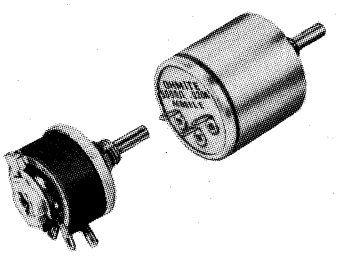
Diameter: 2 5/16″. **Code:** J—_____—F-2. (Ohms) **Shaft:** ¼″ diameter.
Shaft: ¼″ diameter. **Resistance Tolerance:** ±10%. **Torque:** 0.25 to 2.0 pound-inches. **Weight:** 0.32 lb. **Standard Mounting:** For panels up to ¼″ by ⅜″-32 bushing with No. 5050 non-turn washer. **Rotation:** 300° ±5°. **Standard Knob:** No. 5150. Specify separately on order when desired.

Stock No.	Total Ohms	Max. Amps.	Net 1-4	Stock No.	Total Ohms	Max. Amps.	Net 1-4
0308	0.5	10.000	$5.65	0324	500	.316	$5.05
0309	1	7.070	5.65	0325	800	.250	5.35
0310	2	5.000	5.65	0326	1,000	.224	5.35
0311	4	3.530	5.65	0327	1,600	.176	5.35
0312	6	2.880	5.65	0328	2,500	.141	5.35
0313	8	2.500	5.05	0329	3,500	.119	5.65
0314	12	2.040	5.05	0330	5,000	.100	5.65
0315	16	1.760	5.05	0331	8,000	.079	5.65
0316	22	1.500	5.05	0332	10,000	.070	5.65
0317	35	1.190	5.05	4210†	15,000	.058	6.40
0318	50	1.000	5.05	4211†	20,000	.050	7.25
0319	80	.790	5.05	4212†	25,000	.045	8.00
0320	125	.630	5.05	4213†	30,000	.041	8.85
0321	150	.575	5.05	4214†	40,000	.035	10.30
0322	225	.470	5.05	4215†	50,000	.032	11.25
0323	300	.408	5.05				

†Silicone-ceramic coating, 750 V. max. Not listed UL Serial A.



MODEL E — 12.5 Watts*



Diameter: ⅞″ Unenclosed.
Code: E—_____—R-1 (Ohms) Dia: 1 3/64″ in aluminum enclosure
Code: EW—_____—R-1 (Ohms)
Shaft: ⅛″ Diameter.
Resistance Tolerance: ±10%.
Torque: 1 to 6 oz.-inch
Weight: 0.6 oz.; enclosed 0.85 oz.
Standard Mounting: For panels up to ⅛″ by ¼″-32 bushing, with non-turn projection.
Rotation: 300° ±5°.
Standard Knob: No. 5151. Specify separately on order when desired.

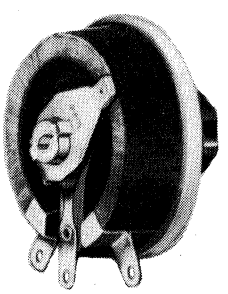
Total Ohms	Max. Amps.	Stock No.	Net 1-4	Stock No.	Net 1-4
1	3.53	0101	$5.05	W0101	$6.95
2	2.50	0102	5.05	W0102	6.95
2.5	2.24	0102A	5.05	W0102A	6.95
3	2.04	0103	5.05	W0103A	6.95
5	1.58	0103A	5.05	W0103A	6.95
6	1.44	0104	5.05	W0104	6.95
8	1.25	0105	5.05	W0105	6.95
10	1.12	0106	5.05	W0106	6.95
15	.91	0107	4.55	W0107	6.35
25	.71	0108	4.55	W0108	6.35
35	.60	0109	4.55	W0109	6.35
50	.50	0110	4.55	W0110	6.35
75	.41	0111	4.55	W0111	6.35
100	.35	0112	4.55	W0112	6.35
125	.32	0113	4.55	W0113	6.35
150	.29	0113A	4.55	W0113A	6.35
175	.27	0114	4.55	W0114	6.35
200	.25	0114A	4.55	W0114A	6.35
250	.22	0115	4.55	W0115	6.35
350	.19	0116	4.55	W0116	6.35
500	.16	0117	4.55	W0117	6.35
750	.13	0118	4.55	W0118	6.35
1,000	.11	0119	5.05	W0119	6.95
1,500	.091	0120	5.05	W0120	6.95
2,500	.071	0121	5.05	W0121	6.95
3,500	.060	0122	5.35	W0122	7.25
5,000	.050	0123	5.35	W0123	7.25
7,500	.041	4190†	5.55	W4190†	7.45
10,000	.035	4191†	5.55	W4191†	7.45
12,500	.031	4192†	6.05	W4192†	7.95
15,000	.029	4193†	6.05	W4193†	7.95

†Silicone-ceramic coating, 350 V. max.
*Rating on metal panel.

MODEL G — 75 Watts

Diameter: 2¾″. **Code:** G—_____—F-2. (Ohms) **Shaft:** ¼″ diameter.
Resistance Tolerance: ±10%. **Torque:** 0.5 to 2.0 pound-inches. **Weight:** 0.52 lb. **Standard Mounting:** For panels up to ¼″ by ⅜″-32 bushing with No. 5050 non-turn washer. **Rotation:** 300° ±5°. **Standard Knob:** No. 5150. Specify separately on order when desired.

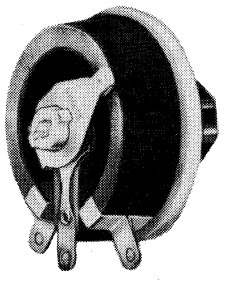
Stock No.	Total Ohms	Max. Amps.	Net 1-4	No. Stock	Ohms Total	Amps. Max.	1-4 Net
1100	0.5	12.300	$7.65	1112	200	.612	$7.05
1101	1	8.660	7.65	1113	300	.500	7.05
1102	2	6.120	7.65	1114	400	.433	7.05
1103	3	5.000	7.65	1115	500	.388	7.05
1104	5	3.880	7.65	1116	750	.316	7.65
1105	7.5	3.160	7.65	1117	1,000	.274	7.65
1106	10	2.740	7.65	1118	1,500	.224	7.65
1107	16	2.170	7.05	1119	2,000	.194	7.65
1108	25	1.730	7.05	1120	2,500	.173	7.65
1109	50	1.230	7.05	1121	5,000	.123	8.20
1110	75	1.000	7.05	1122	7,500	.100	8.85
1111	100	.866	7.05	1123	10,000	.087	8.85



MODEL K — 100 Watts

Diameter: 3⅛″. **Code:** K—_____—F-2. (Ohms) **Shaft:** ¼″ diameter.
Resistance Tolerance: ±10%. **Torque:** 0.5 to 2.0 pound-inches. **Weight:** 0.64 lb. **Standard Mounting:** For panels up to ¼″ by ⅜″-32 bushing with No. 5050 non-turn washer. **Rotation:** 300° ±5°. **Standard Knob:** No. 5150. Specify separately on order when desired.

Stock No.	Total Ohms	Max. Amps.	Net 1-4	Stock No.	Total Ohms	Max. Amps.	Net 1-4
0440	0.5	14.100	$8.45	0452	200	.707	$7.95
0441	1	10.000	8.45	0453	300	.575	7.95
0442	2	7.070	8.45	0454	400	.500	7.95
0443	3	5.750	8.45	0455	500	.447	7.95
0444	5	4.470	8.45	0456	750	.365	7.95
0445	7.5	3.650	8.45	0457	1,000	.316	8.45
0446	10	3.160	8.45	0458	1,500	.258	8.45
0447	16	2.500	7.95	0459	2,000	.224	8.45
0448	25	2.000	7.95	0460	2,500	.200	8.45
0449	50	1.410	7.95	0461	5,000	.141	9.05
0450	75	1.150	7.95	0462	7,500	.115	9.65
0451	100	1.000	7.95	0463	10,000	.100	10.20



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SINGLE-TURN CONDUCTIVE PLASTIC AND WIREWOUND PRECISION POTENTIOMETERS

- AVAILABLE WITH LINEAR OR NONLINEAR FUNCTIONS
- AVAILABLE WITH MULTIPLE TAPS
- AVAILABLE IN SINGLE OR MULTI-CUP CONFIGURATIONS
- AVAILABLE IN SERVO OR BUSHING MOUNTS
- AVAILABLE WITH OTHER COMPONENTS DESIGNED-IN (SPRING-RETURNS, STOPS, SWITCHES, MOTORS, ETC.

RELATIVE MERITS OF CONDUCTIVE PLASTIC VS. WIREWOUND

The major advantages of conductive plastic potentiometers over wirewounds are infinite resolution and longer life. In most other respects, the two types are comparable. NEI has made it a strong point over the years to maintain **balanced** capability in conductive plastic and wirewound potentiometers. Each has its advantages in given applications, and NEI is the **only** company that can objectively recommend and supply **either** type.

GENERAL SPECIFICATIONS — CONDUCTIVE PLASTIC

Resistance Tolerance
Standard: ±10%

Ambient Temperature Range
Standard: −55°C to +150°C

Bearings
Stainless steel ball bearings are standard.

Mechanical Rotation
Normally continuous; however, stops are available.

Electrical Function Angle
Standard: 340° ±5°

Travel Resolution
Essentially infinite

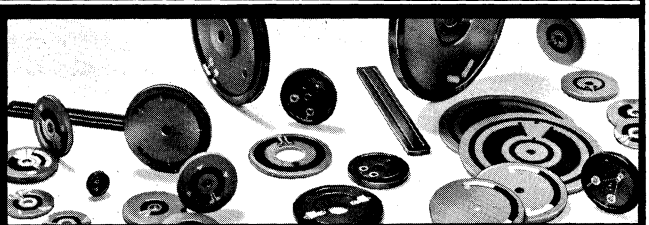
Life
50 million revolutions

SERIES	DIAMETER	NOMINAL RESISTANCE RANGE	NOMINAL POWER RATING	MAXIMUM STARTING TORQUE	NOMINAL ACCURACY
55 FT	½″	1K to 10K	0.5 W @ 25°C	0.35 oz-in	±1.0%
34 FT	¾″	1K to 20K	1.0 W @ 25°C	0.35 oz-in	±0.75%
78 FT	⅞″	1K to 25K	1.0 W @ 25°C	0.35 oz-in	±0.75%
116 FT	1 1/16″	1K to 50K	1.0 W @ 25°C	0.35 oz-in	±0.5%
176 FT	1 7/16″	1K to 75K	1.5 W @ 25°C	0.50 oz-in	±0.5%
158 FT	1⅝″	1K to 75K	2.0 W @ 25°C	0.50 oz-in	±0.5%
200 FT	2″	1K to 100K	3.0 W @ 25°C	0.75 oz-in	±0.3%
300 FT	3″	1K to 100K	5.0 W @ 25°C	1.0 oz-in	±0.25%

VALUES SHOWN ABOVE ARE NOMINAL. FOR SPECIFIC REQUIREMENTS, REFER TO NEI'S COMPLETE CATALOG OR CONTACT OUR APPLICATIONS ENGINEERING DEPARTMENT.

PRECISION CONDUCTIVE PLASTIC ELEMENTS

NEI can supply elements for any customer requirement; including linear and rotary motion, linear or nonlinear functions, and radial sector or full rotary elements. Elements can be molded to meet virtually any packaging requirement, and can be supplied with matching wiper arm assemblies.



GENERAL SPECIFICATIONS — WIREWOUND

Resistance Tolerance
Standard: ±5%

Ambient Temperature Range
Standard: −55°C to +125°C
Special: −55°C to +150°C

Bearings
Stainless steel ball-bearings are standard.

Mechanical Rotation
Normally continuous; however, stops are available.

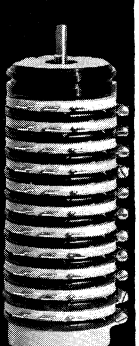
SERIES	DIAMETER	NOMINAL RESISTANCE RANGE	NOMINAL POWER RATING	MAXIMUM STARTING TORQUE	NOMINAL ACCURACY
55W	½″	100 ohms to 50K	2W @ 25°C	0.5 oz-in	±3.0%
34W	¾″	100 ohms to 100K	2W @ 25°C	0.45 oz-in	±2.0%
78W	⅞″	100 ohms to 150K	2.5W @ 25°C	0.4 oz-in	±1.0%
116W	1 1/16″	100 ohms to 150K	3W @ 25°C	0.4 oz-in	±0.75%
176W	1 7/16″	100 ohms to 250K	3W @ 25°C	0.5 oz-in	±0.5%
158W	1⅝″	500 ohms to 350K	3.5W @ 25°C	0.65 oz-in	±0.5%
200W	2″	500 ohms to 500K	4W @ 25°C	0.80 oz-in	±0.40%
300W	3″	500 ohms to 750K	6W @ 25°C	1.0 oz-in	±0.25%

VALUES SHOWN ABOVE ARE NOMINAL. FOR SPECIFIC REQUIREMENTS, REFER TO NEI'S COMPLETE CATALOG OR CONTACT OUR APPLICATIONS ENGINEERING DEPARTMENT.

WAFERPOT™ SINGLE-TURN PRECISION CONDUCTIVE PLASTIC POTENTIOMETERS

(LINEAR & NONLINEAR FUNCTION POTENTIOMETERS SPECIFICALLY DESIGNED FOR HIGH-DENSITY PACKAGING)

		MODEL 78FT	MODEL 116FT	MODEL 176FT	MODEL 200FT
SPECIFICATIONS — MECHANICAL	Body Diameter	⅞″	1 1/16″	1 7/16″	2″
	Length (single cup only)	.680	.680	.680	.680
	Length each additional cup	.200	.200	.200	.200
	Starting Torque (per cup, additional)	.35 oz-in MAX. .25 oz-in MAX.	.35 oz-in MAX. .25 oz-in MAX.	.50 oz-in MAX. .35 oz-in MAX.	.75 oz-in MAX. .50 oz-in MAX.
ELECTRICAL	Standard Resistance Values	1K to 50K	1K to 50K	1K to 75K	1K to 100K
	Standard Resistance Tolerance	±10%	±10%	±10%	±10%
	Standard Accuracy	±0.5%	±0.5%	±0.5%	±0.3%
	Travel Resolution (essentially infinite for all models)				
	Electrical Function Angle	340° ±5°	340° ±5°	340° ±5°	340° ±5°
	Power Rating @ 25°C (derates linearly to 0 watts @ 125°C)	1.0 watt	1.0 watt	1.5 watts	3.0 watts



THE SPECIFICATIONS SHOWN ABOVE ARE TYPICAL. SPECIAL ELECTRICAL REQUIREMENTS AND MECHANICAL REQUIREMENTS CAN BE MET FOR VIRTUALLY ALL PARAMETERS.

STANDARDS DIVISION

new england instrument company

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SPECIFICATIONS

ECONOPOT® MKI

MODEL NUMBER	MOUNTING	INDEPENDENT LINEARITY (STANDARD)	TOTAL RESISTANCE	(100 PCS. OR MORE)
78ESA102	Servo	1%	1K	$13.60
78ESA502	Servo	1%	5K	13.60
78ESA103	Servo	1%	10K	13.60
78ESB102	Servo	0.5%	1K	16.45
78ESB502	Servo	0.5%	5K	16.45
78ESB103	Servo	0.5%	10K	16.45
78ESC102	Servo	0.25%	1K	19.55
78ESC502	Servo	0.25%	5K	19.55
78ESC103	Servo	0.25%	10K	19.55
78EBA102	Bushing	1%	1K	11.55
78EBA502	Bushing	1%	5K	11.55
78EBA103	Bushing	1%	10K	11.55
78EBB102	Bushing	0.5%	1K	14.40
78EBB502	Bushing	0.5%	5K	14.40
78EBB103	Bushing	0.5%	10K	14.40
78EBC102	Bushing	0.25%	1K	17.50
78EBC502	Bushing	0.25%	5K	17.50
78EBC103	Bushing	0.25%	10K	17.50

All data subject to change without notice

ELECTRICAL CHARACTERISTICS — ALL MODELS

PARAMETER	VALUE	REMARKS
Resistance	1K, 5K, 10K	See table
Linearity	1%, 0.5%, 0.25%	See table
Electrical Angle	340° ±5°	
Output smoothness		As per MIL-R-39023
Rotational Life (Servo)	10,000,000 revolutions	without catastrophic failure
Resolution		Essentially infinite
Minimum Voltage		As specified in MIL-R-39023
End Voltage	0.5% of total applied voltage, maximum	As specified in MIL-R-39023
Power Rating	1 watt at 70°C derated to 0 at 125°C	As per Class 5 of MIL-R-39023
Insulation Resistance	1000 megohms minimum	As specified in MIL-R-39023
Dielectric Withstanding Voltage	750 volts rms	As specified in MIL-R-39023 for units less than 1¼" diameter
Resistance Tolerance	±10%	

ENVIRONMENTAL CHARACTERISTICS — ALL MODELS

PARAMETER	VALUE
Temperature Cycling	Test condition C, Method 102 of MIL-STD-202C
Operating Temperature	−65°C to +125°C
Humidity Cycling	Will meet MIL-R-12934 for Class 5 units
Salt Spray	Will meet test as specified in MIL-R-12934
Shock	50G. 11 milliseconds as per MIL-R-12934 Test Condition C
Vibration	0.06 inches double amplitude or 15G, whichever is less, from 10-2000 cps, as specified in MIL-R-12934, Test Condition B

DESIGN OPTIONS

1. Center Tap: (Voltage tap located at 50% plus or minus the linearity tolerance)
   ADD the following prices:
   Linearity:
   (a) ± 5% ..... $ 2.00
   (b) ± 1% 5.00
   (c) ± .5% 5.00
   (d) ± .25% 7.50

2. Shaft Variations: Standard is ⅛" Diameter:
   (a) Shaft Diameter ¼" (servo only) requires 1/16" longer shaft than standard ..... ADD $3.00
   (b) Shaft length up to 2" (standard ⅛" diameter) ..... ADD $2.00
   (c) Screw driver slot shaft end: ADD $1.00
   (d) Shaft ground flat on one side: ADD $2.00

3. Electrical angle other than standard:
   (Standard 340° ± 5°)
   Engineering charge per order $70.00
   ADD per unit 5.00

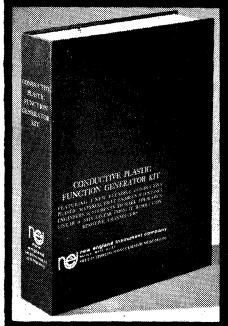
4. Torque Requirements (standard 0.5 oz.-in.):
   (a) Low torque (servo mounted units only) down to 0.2 in.-oz. minimum ..... ADD $5.00
   (b) High torque (bushing mounted units only) up to 6 in.-oz. ADD $5.00

5. Linearity (Standard .25%, .5%, 1%,) 5.0% linearity or greater with resistance tolerance ± 20%
   Deduct $2.00

6. Linearity accuracies greater than 0.25% with standard resistance tolerance ..... prices on request.
   Resistance tolerances better than 10% ..... prices on request.

CONDUCTIVE PLASTIC FUNCTION GENERATOR KIT

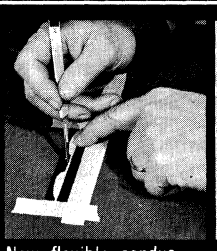
FEATURING A NEW FLEXIBLE CONDUCTIVE PLASTIC MATERIAL THAT ENABLES SCIENTISTS, ENGINEERS, & STUDENTS TO MAKE THEIR OWN LINEAR & NON-LINEAR INFINITE RESOLUTION RESISTIVE TRANSDUCERS



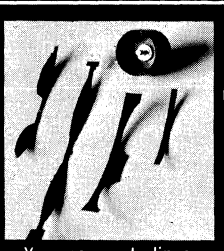
Conveniently packaged for book-case storage



Contains everything needed to make your own potentiometers



New flexible conductive plastic material (PATENT PENDING) enables you to cut complex element shapes for virtually any required electrical function in a 1K to 40 K resistance range.



You can cut linear or nonlinear elements for rotary pots up to 2" diameter or for linear motion applications up to 5" stroke.



Develop your own working prototype potentiometers. Save time and cost, and prove out your requirements in advance.

new england instrument company nei

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STANDARDS DIVISION

ECONOPOT® MKII

MECHANICAL SPECIFICATIONS — SERVO MODELS

TYPE	A ±.005	B +.0000 −.0005	C +.0000 −.0003	D ±.030	E MAX.	F MAX.	*G MAX.	H ±.005	J ±.005	K MIN.	L ±.015	M ±2°	N MAX.	P MAX.	R MAX.	S ±.010 ±5°	**T MAX.
78	.875	.750 .749	.1248	.625	.790	.505	.145	.062	.062	.057	.355	30°	.605	.605	.781	.015x45°	.900
116	1.062	.9688	.1248	.625	.790	.505	.145	.062	.062	.057	.355	25°	.680	.680	.975	.015x45°	1.090
176	1.437	1.3125	.2498	.625	.910	.505	.201	.062	.062	.088	.355	20°	.910	.910	1.312	.030x45°	1.472
200	2.000	1.8750	.2498	.625	.910	.505	.201	.062	.093	.088	.335	15°	1.170	1.152	1.875	.030x45°	2.000

For Single Gang Depth Dimension — "E" is the Total Depth
For Multi Gang Depth Dimension —"E" for First Cup "F" for each Additional Cup "G" for Cover

*Not used on one gang.
**Diameter over clamp ring (optional)

Note: Clamp rings are optional. Mounting hardware supplied.

MECHANICAL SPECIFICATIONS — BUSHING MODELS

TYPE	A ±.005	B +.0000 −.0003	C CL2 THD.	D ±.030	E ±.015	F MAX.	G MAX.	H ±.005	J MAX.	K ±2°	L MAX.	M MAX.	N ±.005	P ±.003	**R MAX.	S CHAMFER +.010 ±5°
78	.875	.1248	¼x32	⅜	⅜	.727	.510	.355	.062	30°	.605	.605	.312	.062	.900	¼x45°
114	1.250	.2498	⅜x32	⅜	⅜	.855	.800	.500	.062	30°	.818	.850	.531	.093	1.320	½x45°
158	1.625	.2498	⅜x32	⅜	⅜	.855	.800	.500	.062	30°	1.011	1.080	.531	.093	1.703	½x45°
200	2.000	.2498	⅜x32	⅜	⅜	1.000	.960	.685	.067	25°	1.165	1.152	.531	.125	2.000	½x45°

For Single Gang Depth Dimension—"F" is Total Depth
For Multi Gang Depth Dimension —"F" for First Cup "G" for each Additional Cup

**Diameter over clamp ring (optional)

ELECTRICAL SPECS-SERVO MODELS

POT DIA.	TYPE NO.	RESISTANCE AVAILABLE STD. (OHMS)	LINEARITY AVAILABLE STD.	POWER RATING
.875	78	1,000 5,000 10,000 25,000 50,000	±.25% ± .5% ± 1%	1 Watt
1.062	116	1,000 10,000 25,000 50,000	± .25% ± .5% ± 1%	1 Watt
1.437	176	1,000 10,000 25,000 50,000 100,000	± .25% ± .5% ± 1%	2 Watt
2.000	200	1,000 10,000 25,000 50,000 100,000	±.25% ± .5% ± 1%	2 Watt

80 STOCK MODELS

ELECTRICAL SPECS-BUSHING MODELS

POT DIA.	TYPE NO.	RESISTANCE AVAILABLE STD. (OHMS)	LINEARITY AVAILABLE STD.	POWER RATING
.875	78	1,000 5,000 10,000 25,000 50,000	±.25% ± .5% ± 1%	1 Watt
1.250	114	1,000 10,000 25,000 50,000	±.25% ± .5% ± 1%	1 Watt
1.625	158	1,000 10,000 25,000 50,000 100,000	±.25% ± .5% ± 1%	2 Watt
2.000	200	1,000 10,000 25,000 50,000 100,000	±.25% ± .5% ± 1%	2 Watt

All Data Subject to Change Without Notice.

GENERAL SPECIFICATIONS

MECHANICAL

Precision Machined Aluminum Parts are Anodized for Corrosion Resistance

Bearings
Stainless Steel Ball Bearings are Standard on Servo Models

Housings (All Models)
Precision Fabricated from Diallyl Phthalate

Shaft
Centerless Ground Stainless Steel

Mechanical Rotation
Continuous 360° (Stops Available on Bushing Models)

Maximum Starting Torque (Servo Models):
0.5 in-oz. for first cup/0.3 in-oz. for each additional cup

ELECTRICAL

Total Resistance Tolerance
Standard ±10%

Function Angle
Standard 340° ±5°

Resistance tolerances better than 10% . . . prices on request.

Output smoothness per MIL-R-39023

Electrical Overtravel
Supplied Both Ends of Electrical Function

Dielectric Strength
1000 VRMS under Standard Atmospheric Conditions

Travel Resolution
Less than 0.0050° (Essentially Infinite)

PRECISION ELECTRONIC COMPONENTS LTD.

variable resistors and trimmer potentiometers

An affiliate of Airco Speer Electronic Components

Manufactured with precision craftsmanship for the INDUSTRIAL-MILITARY MARKET

PEC offers industrial and military electronic equipment manufacturers the most reliable variable resistors available today at **very competitive prices.**

Because of PEC's unique flexibility special items, as well as standards, can be produced with shorter delivery times and more attractive prices, than any other manufacturer can provide.

New hot molding manufacturing processes are applied to all PEC variable resistors. In a single production operation the resistance element is integrated with a low resistance collector, heavy plated terminals and an insulating base to form a sturdy, reliable one-piece subassembly, insensitive to thermal shock and vibration. The bridging contact brush is a single block of corrosion free carbon.

The resistance element of PEC trimmer pots is a specially developed metal glaze with **low temperature coefficient** and **low contact noise.**

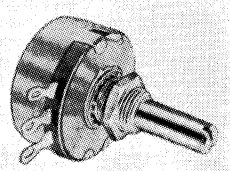
PEC variable composition resistors and metal ceramic trimmer potentiometers meet or exceed the requirements of Mil-R-94 and Mil-R-22097.

All PEC variable resistors are designed for **broad spectrum reliability,** which means that combinations of actual physical and electrical stresses are applied during quality assurance testing in addition to the standard rotational and load life tests.

Recently completed rotational life tests document average resistance change of 3% after two million cycles under full load. (PEC type M, Style RV4)

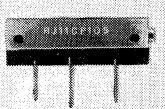
A whole range of **"beyond-mil-specified"** tests are performed on a daily basis; these include; immersion in hot water, fixed current noise, rotational "audio" noise, output smoothness. and contact resistance variation tests.

Send for our multi-page catalog which provides complete specifications on PEC components.



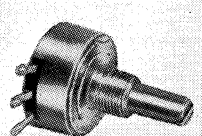
TYPE "K"
Style RV 4
2 Watt
1-3/32" Dia.

Available in all shaft and bushing types. Meets or exceeds requirements of MIL-R-94C. Also available in ganged units, concentric shafts, etc.



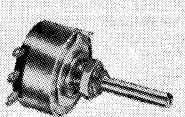
TYPE "A"
Style "RJ-11"
22 Turn Trimmer

Rectangular 1¼" x 1¾" x ⅜" metal ceramic resistor element.



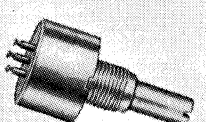
TYPE "N"
Style RV 2
1 Watt
29/32" Dia.

Also available in multi-section units. Meets or exceeds requirements of MIL-R-94C.



TYPE "T"
Style RV 5
1/2 Watt
3/4" Dia.

Available in all shaft and bushing types. Half as deep as Type "S". Meets or exceeds requirements of MIL-R-94C.



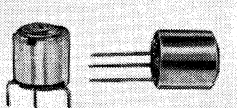
TYPE "R"
1 Watt
3/4" Dia.

The smallest unit available with ⅜" Dia. bushing and ¼" Dia. shaft.



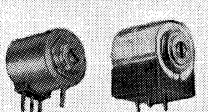
TYPE "S"
Style RV 6
1/2 Watt
1/2" Dia.

Available in all shaft and bushing types. Meets or exceeds requirements of MIL-R-94C.



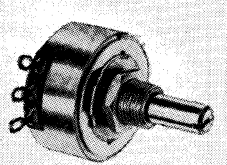
TYPE "P"
1/3 Watt
1/2" Dia.

Adapted from our Type "S" for printed circuit board mounting.



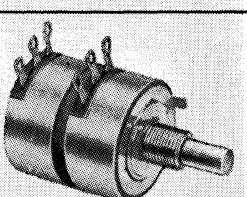
TYPE "L"
1/3 Watt
1/2" Dia.

Similar to our Type "P", except with right angle termination.



TYPE "M"
Style RV 4
2 Watt
1-3/32" Dia.

Available in all shaft and bushing types. Meets or exceeds requirements of MIL-R-94C.



TYPE "MM"
Style RV 4
Dual

Also available with concentric shaft or in triple or quad units. Meets or exceeds requirements of MIL-R-94C.

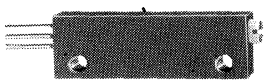
PRECISION ELECTRONIC COMPONENTS LTD. 19 Hafis Road, Toronto 15, Ontario, Canada | Phone: 416-249-7103 TWX: 610-492-1341

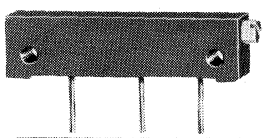
REON RESISTORS/POTENTIOMETERS

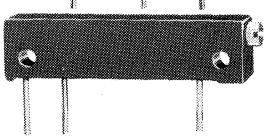
Reon manufactures a complete line of wirewound resistors to Mil-R-93C

MULTI-TURN TRIMMING POTENTIOMETERS WIREWOUND

High Temperature—175°C
Humidity Proof—Mil
Wirewound—5% Tol.
Meets Mil-R-27208B


Model 101/ Style RT10


Model 201/ Style RT11

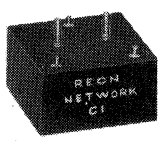

Model 301/ Style RT12

FEATURES

- ★ High power dissipation: 1 watt at 70°C
- ★ Operating temperature range: −65°C to +175°C
- ★ Moisture proof per MIL-STD—202C Method 106
- ★ GROUP Weld technique joins terminals directly to several turns of the resistance coil for High reliable terminations.
- ★ One piece molded housing:
  - ★ Provides a direct contact heat sink for the resistance coil, eliminating hot spots.
  - ★ Bonds each coil of the resistance element in place.
  - ★ Seals out moisture, eliminating external sealing problems.
- ★ Matched materials assure minimum stress on resistance wire and minimum temperature coefficient.
- ★ One piece self-locking contact wiper assures maximum reliability and setting stability when exposed to vibration, shock and acceleration.
- ★ Unique length and diameter of the resistance element permits the use of more turns of larger diameter resistance wire resulting in a more rugged assembly, and exceptional resolution.

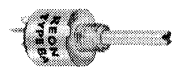
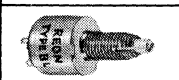
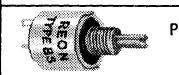
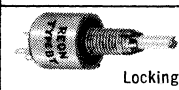
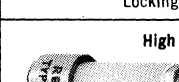
RESISTANCE NETWORKS

- ★ Ladder
- ★ Fast rise time
- ★ Close temperature coefficient match (1 PPM)
- ★ Custom made to your specifications





VARIABLE RESISTORS ½" Diameter: Conductive Plastic Element

Reon Type	DESCRIPTION	Mil-R-94 Type
BA	 Standard Bushing	RV6N
BL	 Locking Bushing	RV6L
BS	 Panel Seal Standard Bushing	RV6S
BT	 Panel Seal Locking Bushing	RV6T
BH	High Voltage Bushing (3,500 V) 	

SPECIFICATIONS:
Power Rating—½w @ 70°, 0 w @ 120°C
Resistance Range—50 ohms* to 5 megohms

STANDARD VALUES:

100 Ohms*	5,000 Omhs	.25 Meg*
250 Ohms	10,000 Ohms	.5 Meg
500 Ohms	25,000 Ohms	1 Meg
1000 Ohms	50,000 Ohms	2.5 Meg*
2500 Ohms	.1 Meg	5 Meg*

*available linear only

Tolerance—10% (5% & 20% also available)
Rotation—295° (360° also available)
Tapers—(A) Linear (C) Clockwise Semilog (F) ccw semilog
Terminal Types—Lug or pin lead
Mounting Data—Bushing: ¼" Diameter ¼", ⅜", ½" lengths
Shaft: ⅛" Diameter 3/16" thru 3" lengths

SINGLE TURN TRIMMING POTENTIOMETERS Conductive Plastic Element—½" Diameter

Reon Type	DESCRIPTION	Height
H	 Printed Circuit Mount	.532
CK	 Knob Adjust	.350
CL	 Screw Adjust	.350
CN	 Right Angle Mount *	.625

*** Also available for Models B & H.**

SPECIFICATIONS:
Power Rating—¼ w @ 70°C, 0 w @ 120°C
Resistance Range—50 ohms to 5 Megohms

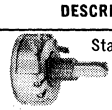
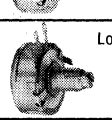
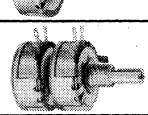
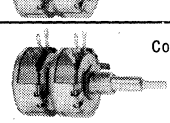
STANDARD VALUES:

50 Ohms*	5,000 Ohms	.25 Meg
100 Ohms*	10,000 Ohms	.5 Meg
250 Ohms*	25,000 Ohms	1 Meg
500 Ohms	50,000 Ohms	2.5 Meg*
1000 Ohms	100,000 Ohms	5.0 Meg*
2500 Ohms		

*Linear Taper Only
Tolerance—10% (5% & 20% also available)
Rotation—295° (360° also available)
Tapers—(A) Linear, (C) Clockwise Semilog, (F) ccw semilog
Terminal Types—Lead or Lug (with or without Ground Lug)
Shaft—Stainless Steel or Plastic

NOTE: All types meet environmental conditions of MIL-R-94D

VARIABLE RESISTORS 1⅛" Diameter: Carbon Element

Reon Type	DESCRIPTION	Mil-R-94 Type
RA	 Standard Bushing	RV4N
RL	 Locking Bushing	RV4L
RD	 2 Section (also available in 3 & 4 section)	
RC	 Concentric Shaft	

SPECIFICATIONS:
Power Rating—2 w @ 70°C, 0 w @ 120°C
Resistance Range—50 ohms to 5 megohms

STANDARD VALUES:

100 Ohms	5,000 Ohms	.25 Meg
250 Ohms	10,000 Ohms	.5 Meg
500 Ohms	25,000 Ohms	1 Meg
1000 Ohms	50,000 Ohms	2.5 Meg
2500 Ohms	.1 Meg	5 Meg

Tolerance—10% (20% also available)
Rotation—312°
Tapers—(A) Linear, (C) Clockwise Semilog (F) ccw semilog . . . under 100 ohms available linear only
Terminal Types—Lug
Mounting Data—Bushing: ⅜" Diameter ¼", ⅜", ½" lengths High Voltage available
Shaft: ¼" Diameter ⅜" thru 3" lengths Switch also available

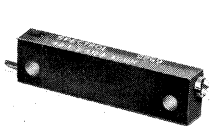
REON reon resistor corporation
155 saw mill river road, yonkers, n. y. 10701, (914) 965-9850

Spectrol

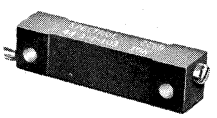
TRIMMING POTENTIOMETERS

If your electronic equipment design calls for precise trimming with high reliability at realistic cost per unit, you should know—(1) Spectrol designs virtually eliminate noise, hot spots, burnouts, and wiper shifting; (2) Spectrol's selection of terminal configurations is the broadest in the industry; (3) Spectrol trimmers are available in all major configurations, sizes and performance types including ultraminiatures and models that meet severest environmental MIL-SPECS; (4) All models are 100% electrically inspected; and (5) Prices on these military-quality industrial trimmers (many less than $2. each in quantity) are keyed to a competitive market.

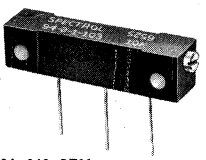
All units shown ¾ actual size



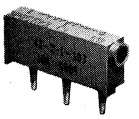
Models 42, 78, RT12



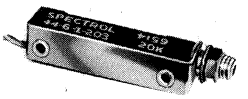
Models 44, 74, 94, 949, RT11



Models 44, 74, 949



Model 41



Panel Mount*

	DESCRIPTION[2]	MODEL NO.*	ADJUSTMENT RATIO	TEMPERATURE COEFFICIENT OF RESISTIVITY (PPM/°C)	RESISTANCE TOLERANCE	MAXIMUM POWER RATING (WATTS)	SIZE (INCHES)[1]	STANDARD RESISTANCE RANGE (OHMS)	PRICE 1-9
RECTANGULAR MILITARY TYPE MEETS MIL-R-27208	WIREWOUND L, PC	RT11C2P and L†	22 to 1	50	±5%	1 @ 70°C	H .315 W .280 L 1.250	10 to 10K 20K	5.38 5.93
	WIREWOUND L, PC	RT12C2P and L†	22 to 1	50	±5%	1 @ 70°C	H .315 W .190 L 1.250	10 to 10K 20K	5.38 5.93
RECTANGULAR HUMIDITY-PROOF	WIREWOUND L, PC	42†	22 to 1	50	±5%	1 @ 70°C	H .315 W .190 L 1.250	10 to 10K 20K 50K 100K	5.75 6.44 6.95 8.62
	WIREWOUND L, PC, SH	44†	22 to 1	50	±5%	1 @ 70°C	H .315 W .280 L 1.250	10 to 10K 20K 50K 100K	5.56 6.22 6.73 8.35
RECTANGULAR INDUSTRIAL TYPE	WIREWOUND L, PC, SH	74†	22 to 1	50	±10%	1 @ 70°C	H .315 W .280 L 1.250	10 to 10K 20K 50K	4.93 5.53 5.97
	WIREWOUND L, PC, SH	94†	22 to 1	100	±10%	½ @ 70°C	H .313 W .281 L 1.250	50 to 10K 20K	3.15 3.52
	NON-WIREWOUND PC (CERMET)	41†	15 to 1	±250	±20%	½ @ 70°C	H .312 W .160 L .750	10 to 1 Meg	1.85
	NON-WIREWOUND L, PC, SH (CERMET)	78†	22 to 1	±250	±20%	¾ @ 70°C	H .320 W .195 L 1.250	10 to 1 Meg	3.00
	NON-WIREWOUND L, PC, SH (CERMET)	949†	22 to 1	±250	±20%	¾ @ 70°C	H .313 W .281 L 1.250	100 to 1 Meg	3.03

[1] DIMENSIONS FOR SQUARE TYPES ARE GIVEN FOR BASIC LEAD WIRE VERSIONS ONLY, EXCEPT RT24 IS BASE PIN AND MODEL 51 EDGE PINS
[2] TERMINATIONS: L — COLOR CODED LEAD WIRES, SH — SOLDER HOOKS, PC — PRINTED CIRCUIT PINS.
[3] TEMPERATURE COEFFICIENT OF NON-WIREHOUNDS (CERMET) RATED AT NOMINAL RESISTANCE RANGES 1000 to 250 KΩ
* PANEL MOUNT ADAPTER KITS AVAILABLE FOR $.87 IN 1-9 PIECES QUANTITY.
† DISTRIBUTOR ITEMS.

Spectrol

TRIMMING POTENTIOMETERS

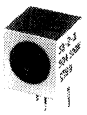
Rectangulars—Large diameter mandrels dissipate heat efficiently to eliminate burnouts and open circuit failures. Dual wipers maintain positive contact under shock. Military and industrial models. **Squares and Rounds**—Mandrel and case configurations contribute to high power dissipation. All models meet or exceed applicable environmental military specifications, and are humidity-proof at no extra cost. **The Model 53**—Offers a unique, molded, seamless housing which provides a leak-proof trimmer with outstanding reliability and uniform construction characteristics.

All units shown actual size

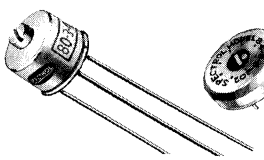

Model 50, RT24


Model 51


Model 53


Model 53


Model 55, RT22


Model 80

Model 84


Model 84

	DESCRIPTION[2]	MODEL NO.*	ADJUSTMENT RATIO	TEMPERATURE COEFFICIENT OF RESISTIVITY (PPM/°C)[3]	RESISTANCE TOLERANCE	MAXIMUM POWER RATING (WATTS)	SIZE (INCHES)[1]	STANDARD RESISTANCE RANGE (OHMS)	PRICE 1-9
SQUARE HUMIDITY-PROOF	WIREWOUND L, PC	50†*	23 to 1 Continuous or Stops and Clutch	50	±5%	3/4 @ 85°C	H .375 W .190 L .375	10 to 10K 20K 50K	6.80 7.62 8.23
	WIREWOUND L, PC	RT24C2P	23 to 1 Stops & Clutch	50	±5%	3/4 @ 85°C	H .435 W .375 L .375	10 to 10K	4.81
	WIREWOUND PC	51	23 to 1	50	±5%	3/4 @ 85°C	H .375 W .190 L .375	10 to 10K 20K 50K	6.80 7.62 8.23
	WIREWOUND L, PC	55†*	23 to 1 or 42 to 1	50	±5%	1.5 @ 70°C	H .500 W .190 L .500	10 to 10K 20K 50K	5.78 6.48 6.99
	WIREWOUND L, PC	RT22C2 P&L †	23 to 1 or 37 to 1	50	±5%	1.5 @ 70°C	H .500 W .190 L .500	50 to 10K 20K	5.35 L 5.84 L 4.81 PC 5.28 PC
ROUND HUMIDITY-PROOF	SIDE OR TOP ADJUST NON-WIREWOUND PC	53†	1 to 1	±250	±20%	0.5 @ 85°C	(Top Adjust) H .343 Dia. .343 (Side Adjust) H .355 W .313	10 to 1 Meg 10 to 1 Meg	2.13 2.55
	WIREWOUND W	80†	1 to 1	50	±5%	1 @ 50°C	H .241 Dia. .345	10 to 10K 20K 50K	3.74 4.18 4.52
	SCREWDRIVER ADJUST WIREWOUND PC	84-3-8†	1 to 1	50	±4%	1.5 @ 70°C	H .180 Dia. .500	10 to 10K 20K 50K 100K	3.32 3.71 4.01 4.98
	KNOB ADJUST WIREWOUND PC	84-3-10†	1 to 1	50	±4%	1.5 @ 70°C	H .270 Dia. .550	10 to 10K 20K 50K 100K	4.00 4.47 4.83 6.00
	BUSHING PANEL MOUNT WIREWOUND SH	84-5-6†	1 to 1	50	±4%	1.5 @ 70°C	H .470 Dia. .500	10 to 10K 20K 50K 100K	5.10 5.71 6.17 7.65

Spectrol

SPECTROL ELECTRONICS CORPORATION
17070 E. Gale Ave., City of Industry, Calif. 91745

Spectrol

TRIMMING POTENTIOMETERS

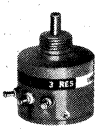
For most applications, choose from the complete Spectrol series of single-turn, three-turn, five-turn, ten-turn, precision wirewound potentiometers listed on these two pages. Many models can be ganged and easily phased in the field.

Close linearities are assured by winding equipment designed and built in-house by Spectrol. Other quality features include: fine resolution from extra-long resistance elements; high reliability through a unique "whisker" slip ring brush that assures positive contact under severe shock and vibration, yet exhibits low torque and long rotational life; and mounting flexibility with optional servo bushing and screw mountings. All models meet or exceed applicable military and commercial specifications for rotational load life, temperature range, shock, vibration, humidity and salt spray.▲

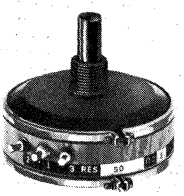
All units shown ½ size



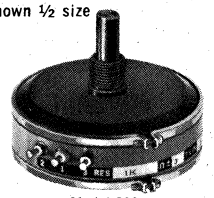
Model 140



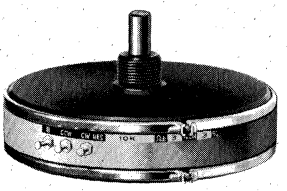
Model 702



Model 202



Model 302



Model 402

	MODEL NO.	RESISTANCE RANGE (OHMS)	RESISTANCE TOLERANCE	LINEARITY TOLERANCE STANDARD	LINEARITY TOLERANCE BEST PRACTICAL[1]	MAXIMUM POWER RATING (WATTS)	OPERATING TEMPERATURE RANGE	SIZE (INCHES)[2]	MOUNTING AVAILABLE	PRICE 1-9[3]
SINGLE-TURN WIREWOUND MILITARY	*100	5 to 39K	±3% (±5% below 50Ω)	100Ω to 39K ±0.5% 5Ω to 100Ω ±1.0%	±.15%	2.75 @ 40°C	—55°C to +105°C	Dia. 1.312 Length .705 Shaft Dia. .250	Bushing Servo	12.00 17.00
	*110	5 to 30K	±3% (±5% below 20Ω)	300Ω to 30K ±0.5% 5Ω to 300Ω ±1.0%	±.20%	2 @ 40°C	—55°C to +105°C	Dia. 1.125 Length .470 Shaft. Dia. .125	Bushing Servo	18.00 23.00
	*122	5 to 142K	±3% (±5% below 20Ω)	200Ω to 142K ±0.5% 5Ω to 200Ω ±1.0%	±.20%	1.5 @ 70°C	—65°C to +125°C	Dia. 1.062 Length .687 Shaft Dia. .125	Bushing Servo	23.00 28.00
	142	50 to 70K	±5%	±1.0%	±.50%	2 @ 40°C	—55°C to +125°C	Dia. .500 Length .625 Shaft Dia. .125	Servo	17.50
	*170	5 to 49K	±3% (±5% below 50Ω)	100Ω to 49K ±.50% 5Ω to 100Ω ±.75%	±.15%	2.75 @ 40°C	—55°C to +105°C	Dia. 1.438 Length .705 Shaft Dia. .250	Bushing Servo	18.00 23.00
	*190	5 to 65K	±3% (±5% below 50Ω)	500Ω to 65K ±.30% 50Ω to 500Ω ±.50% 5Ω to 50Ω ±.75%	±.15%	3.5 @ 40°C	—55°C to +105°C	Dia. 1.625 Length .800 Shaft Dia. .250	Bushing Servo Screw	18.00 23.00 23.00
	*202	5 to 65K	±3% (±5% below 50Ω)	500Ω to 65K ±.25% 50Ω to 500Ω ±.50% 5Ω to 50Ω ±1.0%	±.15%	3.5 @ 70°C	—65°C to +125°C	Dia. 1.750 Length .705 Shaft Dia. .250	Bushing Servo Screw	18.00 20.00 21.00
	*302	5 to 85K	±3% (±5% below 50Ω)	200Ω to 85K ±.25% 50Ω to 200Ω ±.50% 5Ω to 50Ω ±1.0%	±.10%	4.0 @ 70°C	—65°C to +125°C	Dia. 2.000 Length .705 Shaft Dia. .250	Bushing Servo Screw	19.00 21.00 21.00
	*402	10 to 155K	±3% (±5% below 100Ω)	200Ω to 158K ±.25% 10Ω to 200Ω ±.50%	±.075%	6.0 @ 70°C	—65°C to +125°C	Dia. 3.000 Length .705 Shaft Dia. .250	Bushing Servo Screw	21.00 23.00 23.00
	*702	5 to 109K	±3% (±5% below 20Ω)	500Ω to 109K ±0.5% 5Ω to 500Ω ±1.0%	±.25%	1.25 @ 70°C	—65°C to +125°C	Dia. .875 Length .687 Shaft Dia. .125	Bushing Servo	20.00 25.00
SINGLE-TURN WIREWOUND INDUSTRIAL	132†	5 to 39K	±3% (±5% below 50Ω)	200Ω to 39K ±0.5% 5Ω to 200Ω ±1.0%	±.20%	2.75 @ 40°C	—55°C to +105°C	Dia. 1.312 Length .625 Shaft Dia. .250	Bushing	7.00
	140†	50 to 70K	±5%	±1.0%	±.50%	2 @ 40°C	—55°C to +125°C	Dia. .500 Length .305 Shaft Dia. .125	Bushing	8.65

[1] BEST PRACTICAL LINEARITY FIGURES SHOWN FOR THE VARIOUS MODELS APPLY TO HIGHER RESISTANCE UNITS. CONSULT MANUFACTURER WITH SPECIFIC REQUIREMENTS.

[2] DIMENSIONS LISTED ARE FOR THE BUSHING MOUNT VERSIONS.

[3] THE PRICES SHOWN ARE FOR STANDARD LINEARITY.

[4] 163 HAS .250 INCH SHAFT DIA.

* UNITS ARE GANGABLE.

† DISTRIBUTOR ITEMS.

▲ MANY SINGLE-TURN AND MULTI-TURN POTENTIOMETERS MEET OR EXCEED MIL-R-12934 REQUIREMENTS.

Spectrol

PRECISION POTENTIOMETERS

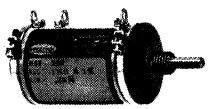
For special applications, remember Spectrol's well-earned reputation for unusual service in providing special precision potentiometers to help equipment designers solve unique problems.

In addition to offering a full line of off-the-shelf models, Spectrol is a custom house whose success is founded on exceptional responsiveness to its customers' needs and requirements. You can confidently turn to Spectrol for highly competent support in your most challenging design assignments for which no standard potentiometer is available.

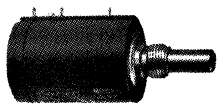
All units shown ½ size



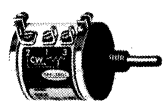
Model 162



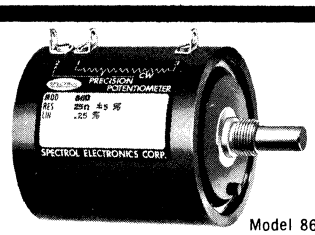
Model 502



Model 532



Model 552



Model 860

	MODEL NO.	RESISTANCE RANGE (OHMS)	RESISTANCE TOLERANCE	LINEARITY TOLERANCE STANDARD	LINEARITY TOLERANCE BEST PRACTICAL[1]	MAXIMUM POWER RATING (WATTS)	OPERATING TEMPERATURE RANGE	SIZE (INCHES)[2]	MOUNTING AVAILABLE	PRICE 1-9[3]
THREE-TURN WIREWOUND MILITARY	*552	5 to 45K	±3% (±5% below 50Ω)	±.25%	±.125%	1.0 @ 70°C	−65°C to +125°C	Dia. .875 Length .948 Shaft Dia. .125	Bushing Servo	15.00 20.00
	*820	15 to 119K	±3% (±5% below 50Ω)	±.25%	±.075%	3.75 @ 40°C	−55°C to +105°C	Dia. 1.438 Length 1.240 Shaft Dia. .250	Bushing Servo	25.00 30.00
	*852	15 to 155K	±3% (±5% below 100Ω)	±.25%	±.05%	2.0 @ 70°C	−65°C to +125°C	Dia. 1.812 Length 1.284 Shaft Dia. .250	Bushing Servo Screw	14.00 20.00 20.00
THREE-TURN WIRE-WOUND INDUSTRIAL	830†	15 to 155K	±3% (±5% below 100Ω)	±.25%	±.05%	3 @ 40°C	−55°C to +105°C	Dia. 1.812 Length 1.220 Shaft Dia. .250	Bushing	10.00
FIVE-TURN WIRE-WOUND INDUSTRIAL	520	10 to 76K	±3% (±5% below 50Ω)	±.25%	±.15%	2 @ 40°C	−55°C to +105°C	Dia. .875 Length 1.094 Shaft Dia. .250	Bushing	12.00
TEN-TURN WIREWOUND MILITARY	*502	15 to 152K	±3% (±5% below 100Ω)	±.25%	±.05%	2.0 @ 70°C	−65°C to +125°C	Dia. .875 Length 1.448 Shaft Dia. .125	Bushing Servo	15.00 20.00
	*570	20 to 185K	±3% (±5% below 150Ω)	±.25%	±.05%	3 @ 40°C	−55°C to +105°C	Dia. 1.000 Length 1.448 Shaft Dia. .250	Bushing Servo Screw	15.00 20.00 20.00
	*802	20 to 519K	±3% (±5% below 200Ω)	±.25%	±.025%	5.0 @ 70°C	−65°C to +125°C	Dia. 1.812 Length 2.062 Shaft Dia. .250	Bushing Servo Screw	15.00 20.00 20.00
	*870	40 to 398K	±3% (±5% below 150Ω)	±.25%	±.03%	6.5 @ 40°C	−55°C to +105°C	Dia. 1.438 Length 2.015 Shaft Dia. .250	Bushing Servo	25.00 30.00
TEN-TURN WIREWOUND INDUSTRIAL	162† 163 164	100 to 100K	±5%	±.30%	±.15%	2 @ 40°C	−55°C to +125°C	Dia. .500 Length 1.000 Shaft Dia. .094[4]	162 (Bush) 163 (Bush) 164 (Servo)	10.00 11.50 18.50
	500†	15 to 152K	±3% (±5% below 100Ω)	±.25%	±.05%	3 @ 40°C	−55°C to +125°C	Dia. .875 Length 1.448 Shaft Dia. .125	Bushing Servo	15.00 20.00
	510†	15 to 152K	±3% (±5% below 100Ω)	±.25%	±.10%	3 @ 40°C	−55°C to +105°C	Dia. .875 Length 1.448 Shaft Dia. .250	Bushing	10.00
	530†	100 to 150K	±5%	±.25%	±.10%	3 @ 40°C	−55°C to +105°C	Dia. .875 Length 1.400 Shaft Dia. .250	Bushing	7.00
	532†	15 to 150K	(±5%	±.25%	±.10%	3 @ 40°C	−55°C to +105°C	Dia. .875 Length 1.330 Shaft Dia. .250	Bushing	6.65
	860†	20 to 519K	±3% (±5% below 200Ω)	±.25%	±.10%	8 @ 40°C	−55°C to +105°C	Dia. 1.812 Length 2.000 Shaft Dia. .250	Bushing	10.00

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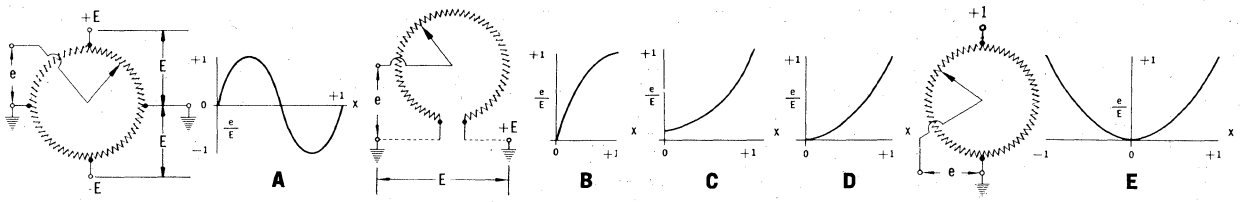
NON-LINEAR POTENTIOMETERS

On the tables below, high and low values of resistance, with corresponding "best practical" peak-to-peak conformity obtainable, are given for the functions in each model size under the conditions of full electrical rotation and unloaded slider. For function angles less than full rotation, resistance and conformity values can be calculated based on resistance being directly proportional to the function angle, and conformity being inversely proportional to the function angle.

Empirical (Data Points)

Resistance and conformity is given in the table below in terms of S (maximum $\frac{\Delta\left(\frac{e}{E}\right)}{\Delta X}$), provided the following conditions are met. $0 \leq \frac{e}{E} \leq 1, 0 \leq X \leq 1$ and $\frac{\Delta\left(\frac{e}{E}\right)}{\Delta X}$ does not change sign (i.e., no slope reversal).



	MODEL NO.	DIA. (INCHES)	360° SIN	A	90° SIN	B	SINGLE SIDED SQUARE	D	DOUBLE SIDED SQUARE	E	SINGLE CYCLE EXP.	C	TWO CYCLE EXP.	C	EMPIRICAL	
SINGLE-TURN	702	7/8	3.5K	.9%	13K	.5	10K	.6	2.8K	1.2	10K	.7	5K	1.4	27K / S	S(0.32)
			250Ω	1.1	1K	.6	1K	.7	250Ω	1.4	1K	.8	500Ω	1.6	1K / S	S(0.41)
	100	1 5/16	6K	.6%	22K	.35	18K	.4	5K	.8	17K	.45	8.5K	.9	53K / S	S(0.22)
			500Ω	.8	1K	.5	1K	.55	250Ω	1.1	1K	.6	500Ω	1.2	1K / S	S(0.33)
	110	1 1/8	5K	.85%	18K	.45	14K	.55	4K	1.1	14K	.60	7K	1.2	35K / S	S(0.29)
			250Ω	1.1	1K	.55	1K	.70	250Ω	1.3	1K	.80	500Ω	1.6	1K / S	S(0.41)
	122	1 1/16	5K	.75%	18K	.4	14K	.5	4K	1.0	14K	.55	7K	1.1	39K / S	S(0.26)
			250Ω	1.0	1K	.5	1K	.65	250Ω	1.2	1K	.7	500Ω	1.4	1K / S	S(0.37)
	170	1 7/16	7.5K	.55%	28K	.3	22K	.35	6K	.7	20K	.4	10K	.8	59K / S	S(0.19)
			500Ω	.7	1K	.4	1K	.5	500Ω	.9	1K	.55	1K	1.0	2K / S	S(0.26)
	190	1 5/8	10K	.5%	35K	.25	30K	.3	8K	.6	28K	.35	14K	.7	77K / S	S(0.16)
			1K	.6	2K	.35	1K	.45	500Ω	.8	1K	.5	1K	.9	2K / S	S(0.24)
	202	1 3/4	12K	.45%	45K	.25	35K	.3	10K	.55	34K	.35	17K	.65	77K / S	S(0.15)
			1K	.55	2K	.35	1K	.45	1K	.7	1K	.45	1K	.85	2K / S	S(0.22)
	302	2	15K	.4%	60K	.2	45K	.25	13K	.45	45K	.3	22K	.55	103K / S	S(0.13)
			1K	.5	2K	.3	2K	.35	1K	.55	2K	.4	1K	.75	2K / S	S(0.19)
	402	3	25K	.25%	95K	.15	75K	.15	20K	.3	70K	.2	35K	.35	213K / S	S(0.08)
			1K	.35	2K	.2	2K	.25	1K	.4	2K	.25	1K	.5	4K / S	S(0.12)
THREE-TURN	552	7/8	7K	.5%	25K	.3	20K	.35	5K	.65	20K	.4	10K	.75	61K / S	S(0.18)
			500Ω	.6	1K	.35	1K	.40	250Ω	.75	1K	.45	1K	.85	1K / S	S(0.22)
	820	1 7/16	20K	.3%	75K	.15	60K	.2	15K	.4	55K	.25	28K	.45	175K / S	S(0.10)
			1K	.35	2K	.2	1K	.3	1K	.45	1K	.3	1K	.55	2K / S	S(0.13)
	852	1 13/16	25K	.25%	95K	.15	75K	.15	20K	.3	75K	.2	35K	.35	228K / S	S(0.08)
			1K	.3	2K	.2	2K	.2	1K	.35	1K	.25	1K	.45	2K / S	S(0.11)
TEN-TURN	502	7/8	24K	.2%	85K	.1	70K	.15	19K	.25	65K	.15	33K	.3	205K / S	S(0.065)
			1K	.25	2K	.15	1K	.2	1K	.3	1K	.2	1K	.35	2K / S	S(0.085)
	570	1	30K	.15%	100K	.1	80K	.1	23K	.2	80K	.15	40K	.25	249K / S	S(0.055)
			1K	.2	2K	.15	1K	.15	1K	.25	1K	.2	1K	.3	2K / S	S(0.075)
	870	1 7/16	70K	.15%	250K	.075	200K	.075	50K	.15	190K	.1	85K	.2	582K / S	S(0.04)
			1K	.2	4K	.1	4K	.1	1K	.2	2K	.15	1K	.25	4K / S	S(0.055)
	802	1 13/16	90K	.1%	320K	.05	250K	.075	70K	.15	250K	.075	125K	.15	760K / S	S(0.03)
			1K	.15	4K	.075	2K	.1	1K	.2	2K	.1	1K	.2	5K / S	S(0.04)

SWITCHES AND MULTIDIALS

Spectrol Model 87 Rotary Selector Switch introduces a new dimension of flexibility to discrete component circuitry. Now, for the first time, miniature switches are available in volume quantities at production-line prices for mounting directly on printed circuit boards, or for panel mounting. Designed with only two moving parts, this unique ½-inch switch has application wherever printed circuit boards are used . . . can be used to make other components do multiple duty. Spectrol offers this switch in either continuous or stop models, with up to ten positions for single-pole, up to five positions for double-pole, and up to three positions for three-pole units.

Multidials: Spectrol also offers a complete line of precision turns-counting dials for use on multi-turn potentiometers and other rotating devices.

All units shown ½ size



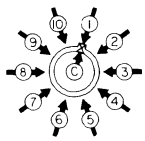
Model 87



Model 87



Model 87



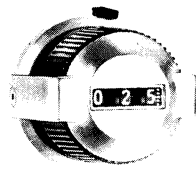
Switch Circuit Diagram (10-Position Shown)



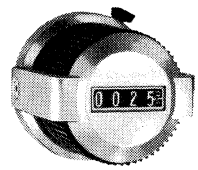
Model 11



Model 21



Model 25-1-13



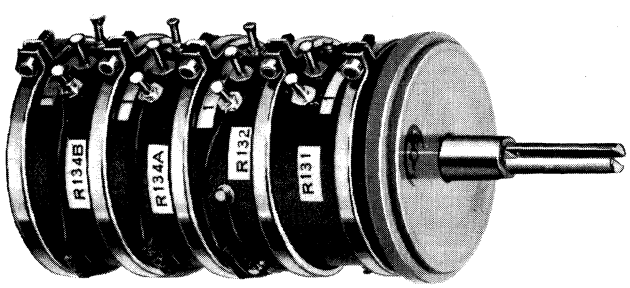
Model 25-4-13

ROTARY SELECTOR SWITCHES

DESCRIPTION	MODEL NO.*	SWITCH ACTION	CONTACT CURRENT RATING	LIFE AT RATED CURRENT	CONTACT RESISTANCE	OPERATING TEMPERATURE RANGE	SIZE (INCHES)	PRICE 1-9
SCREWDRIVER ADJUST	87-11-10[2]	POSITIVE DETENT, 36° INDEXING, STOPS	250MA @ 28VDC	4,000 SWITCHING OPERATIONS, PER POSITION	.05Ω MAX.	—65° to +150°C	H .190 Dia. .500	4.13
KNOB ADJUST	87-21-10[2]	POSITIVE DETENT, 36° INDEXING, STOPS	250MA @ 28VDC	4,000 SWITCHING OPERATIONS, PER POSITION	.05Ω MAX.	—65° to +150°C	H .280 Dia. .550	4.79
BUSHING PANEL MOUNTING	87-31-10[2]	POSITIVE DETENT, 36° INDEXING, STOPS	250MA @ 28VDC	4,000 SWITCHING OPERATIONS, PER POSITION	.05Ω MAX.	—65° to +150°C	H .480 Dia. .500	5.29

MULTI-TURN TURNS COUNTING DIALS

MODEL NO.	NUMBER OF TURNS	MINOR SCALE DIVISION	SHAFT BORE (INCHES)	FINISH	SIZE (INCHES)	PRICE 1-9
11-1-11†	11	1/50 TURN	.250	SATIN CHROME ⊙	Dia. 1.000 Depth .812	7.75
21-1-11†	15	1/100 TURN	.250	SATIN CHROME ⊙	Dia. 1.812 Depth 1.000	5.75
25-1-13†	11 (3 Digit)	1/500 TURN	.250	SATIN CHROME	Dia. 1.812 Depth 1.625	14.25
25-4-13†	100 (4 Digit)	1/500 TURN	.250	SATIN CHROME	Dia. 1.812 Depth 1.625	19.75



Spectrol

OFFERS SPECIAL CAPABILITIES

PRECISION POTENTIOMETERS • TRIMMING POTENTIOMETERS • SWITCHES • DIALS

'SPEC' POTENTIOMETERS can be provided to meet your design requirements. Pots with clutches, brakes, switches, or other special mechanical or electrical features, can be designed and packaged the way you need them.

APPROVED MIL-SPEC POTS—Spectrol also offers a full line of approved Mil-Spec potentiometers (RR series) to MIL-R-12934.

⊙ MODELS 11 AND 21 AVAILABLE WITH BLACK CHROME (11-1-21/21-1-21) OR BRUSHED CHROME (11-1-31/21-1-31)

1 POLE/POSITION OPTIONS AVAILABLE THROUGH DISTRIBUTORS OR FACTORY

2 SINGLE POLE, TEN ACTIVE POSITIONS, STOPS

* INSULATION RESISTANCE AND DIELECTRIC WITHSTANDING VOLTAGE: NOT LESS THAN 1,000 MEGOHMS AND 1,000 VOLTS AC AT SEA LEVEL, RESPECTIVELY. SHOCK: 50 G'S FOR 11 MILLISECONDS. (METHOD 205B OF MIL-STD-202B). NON-SHORTING

VIBRATION: 20 G'S AT 20-2,000 CPS. (METHOD 204, TEST CONDITION D OF MIL-STD-202B).

† DISTRIBUTOR ITEMS.

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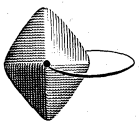
17070 E. Gale Ave., City of Industry, Calif. 91745

TECHNO MINIATURE WIREWOUND



Backed by a vigorous and extensive program of reliability testing, Techno wirewound trimming potentiometers have earned a reputation for quality and performance unmatched in the industry. Complete Quality Assurance facilities, including a fully equipped and MIL-approved test and environmental laboratory, guarantee the consistently superior performance of every Techno trimmer.

Techno's unique design incorporates a limited number of internal parts into a two-half plastic case that permits 100% final inspection prior to sealing. The design provides maximum flexibility and a uniform standard of excellence for a wide variety of military and industrial applications.

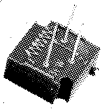
Throughout the electronics industry, designers and engineers have learned to trust Techno when precision trimming potentiometers are needed.

⅜" SQUARE WIREWOUND TRIMMING POTENTIOMETERS

HUMIDITY PROOF

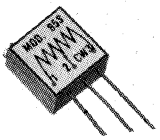

MODEL 117S

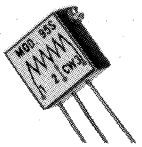

MODEL 126S


MODEL 133S

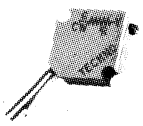

MODEL 151S

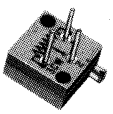

MODEL 176S

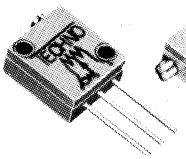

MODEL 85S

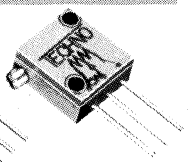

MODEL 95S

MILITARY — MIL-R-27208









MODEL RT24C2L MODEL RT24C2P MODEL RT24C2W MODEL RT24C2X

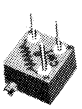
MODEL NO.	RESISTANCE RANGE (ohms)[1]	TERMINALS[2]	ADJUSTMENT TURNS[3]
	Chart A		
117S	10 – 50k	L	25
126S	10 – 50k	P	25
133S	10 – 50k	P[4]	25
151S	10 – 50k	W	25
176S	10 – 50k	X	25
85S	10 – 50k	W offset	25
95S	10 – 50k	X offset	25
RT24C2L	10 – 10k	L	25
RT24C2P	10 – 10k	P	25
RT24C2W	10 – 10k	W	25
RT24C2X	10 – 10k	X	25

¼" SQUARE WIREWOUND TRIMMING POTENTIOMETERS

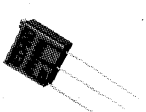
HUMIDITY PROOF

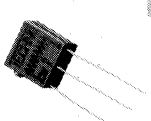

MODEL 12S

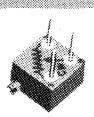

MODEL 14S


MODEL 15S

MILITARY — MIL-R-27208





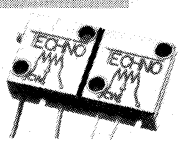


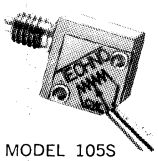
MODEL RT27C2W MODEL RT27C2X MODEL RT27C2P

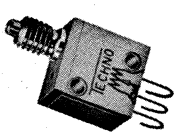
	Chart B		
12S	10 – 25k	W[5]	25
14S	10 – 25k	X[6]	25
15S	10 – 25k	P[7]	25
RT27C2W	10 – 5k	W[5]	25
RT27C2X	10 – 5k	X[6]	25
RT27C2P	10 – 5k	P[7]	25

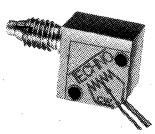
SPECIAL WIREWOUND TRIMMING POTENTIOMETERS


MODEL 191S


MODEL 193S


MODEL 105S


MODEL 160S


MODEL 108S

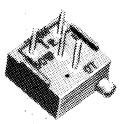
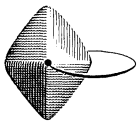

MODEL 75SCT

	Chart C		
191S Dual Trimmer	10 – 50k[8]	X	25
193S Dual Trimmer	10 – 50k[9]	L	25
105S Panel Mount	10 – 50k	L	25
160S Panel Mount	10 – 50k	SH	25
108S Shaft Lock	10 – 50k	L	25
75SCT Center Tap	100 – 20k	P	25

TECHNO-COMPONENTS CORP. A SUBSIDIARY OF OAK ELECTRO/NETICS CORP
7803 LEMONA AVENUE ▪ VAN NUYS, CALIFORNIA 91405 ▪ (213) 781-1642 ▪ TWX: 910-495-2015

TRIMMING POTENTIOMETERS



Established Reliability — Style RTR24

Techno provides 100% screening in accordance with MIL-R-39015 for 3/8" square trimming potentiometers in P, W and X styles. Consult factory for details.

SIZE (Inches)	POWER RATING (watts)	TEMPERATURE RANGE (°C)
.375 x .375 x .150	1 @ 50°C	−65 to 175
.375 x .375 x .218	1 @ 50°C	−65 to 175
.375 x .375 x .190	1 @ 50°C	−65 to 175
.405 x .375 x .185	1 @ 50°C	−65 to 175
.405 x .375 x .185	1 @ 50°C	−65 to 175
.375 x .375 x .203	1 @ 50°C	−65 to 175
.375 x .375 x .203	1 @ 50°C	−65 to 175
.375 x .375 x .150	¾ @ 85°C	−65 to 175
.375 x .375 x .218	¾ @ 85°C	−65 to 175
.405 x .375 x .185	¾ @ 85°C	−65 to 175
.405 x .375 x .185	¾ @ 85°C	−65 to 175
.250 x .250 x .156	½ @ 50°C	−65 to 175
.250 x .250 x .156	½ @ 50°C	−65 to 175
.250 x .250 x .185	½ @ 50°C	−65 to 175
.250 x .250 x .156	⅜ @ 85°C	−65 to 175
.250 x .250 x .156	⅜ @ 85°C	−65 to 175
.250 x .250 x .185	⅜ @ 85°C	−65 to 175
.405 x .775 x .185	1 @ 50°C	−65 to 175
.405 x .775 x .185	1 @ 50°C	−65 to 175
.453 x .437 x .282	1 @ 50°C	−65 to 175
.453 x .468 x .282	1 @ 50°C	−65 to 175
.453 x .437 x .282	1 @ 50°C	−65 to 175
.375 x .375 x .250	1 @ 50°C	−65 to 175

CHART A

STANDARD RESISTANCES

RESISTANCE (ohms)	MILITARY RT24	HUMIDITY PROOF	NOMINAL RESOLUTION (%)
10	X	X	1.1
20	X	X	.85
50	X	X	.65
100	X	X	.51
200	X	X	.40
500	X	X	.45
1K	X	X	.34
2K	X	X	.27
5K	X	X	.20
10K	X	X	.16
20K		X	.13
50K		X	.10

CHART B

RESISTANCE (ohms)	MILITARY RT27	HUMIDITY PROOF	NOMINAL RESOLUTION (%)
10	X	X	1.65
20	X	X	1.35
50	X	X	1.13
100	X	X	.82
200	X	X	.62
500	X	X	.62
1K	X	X	.49
2K	X	X	.34
5K	X	X	.27
10K		X	.21
20K		X	.17
25K		X	.16

CHART C

RESISTANCE (ohms)	NOMINAL RESOLUTION (%)	RESISTANCE (ohms)	NOMINAL RESOLUTION (%)
10	1.1	2K	.27
20	.85	5K	.20
50	.65	10K	.16
100	.51	20K	.13
200	.40	25K	.12
500	.45	35K	.11
1K	.34	50K	.10

NOTES:

1. Tolerance: ±5%. Closer tolerances available.
2. Terminal legend: L = stranded insulated leads. P = printed wiring pins, base mounted. W = printed wiring pins, edge mounted 180° from adjustment shaft. X = printed wiring pins edge mounted 90° from adjustment shaft. SH = solder hooks.
3. All models with clutch stop rotation.
4. Standoffs to facilitate printed wiring board washing.
5. Available with Teflon insulated 5-inch leads as Model 11S.
6. Available with Teflon insulated 5-inch leads as Model 13S.
7. Available with .030" printed wiring board standoffs as Model 16S.
8. Resistance value per section.

U.S. Patent Numbers 3,096,498 and 3,195,092.

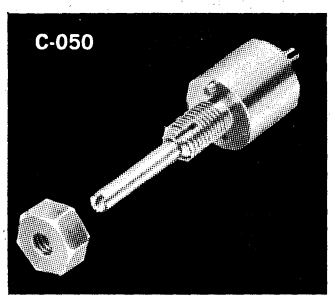
TECHNO-COMPONENTS CORP. A SUBSIDIARY OF OAK ELECTRO/NETICS CORP

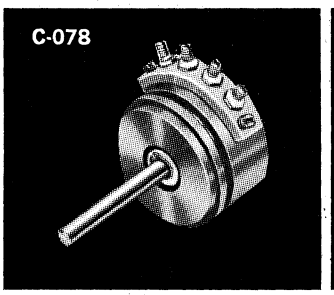
7803 LEMONA AVENUE ▪ VAN NUYS, CALIFORNIA 91405 ▪ (213) 781-1642 ▪ TWX: 910-495-2015

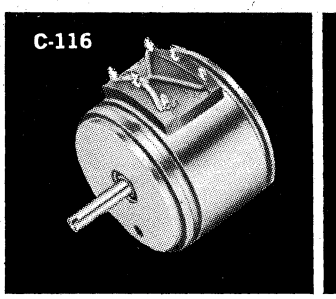
SAMARIUS HAS THE ANSWER

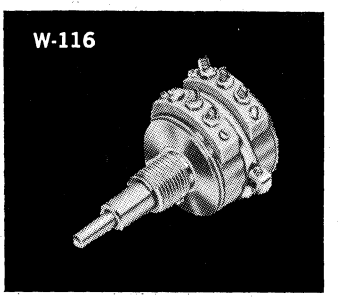
IF YOUR PROBLEM IN POTENTIOMETERS IS LITTLE OR BIG—DELICATE OR RUGGED—ACCURATE OR PRECISE—SINGLE OR MULTIPLE—THIN OR THICK—MINIATURE OR MONSTER—LIGHT OR HEAVY—SAMARIUS HAS THE ANSWER FOR YOU.

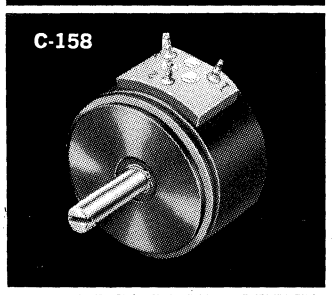
Our complete line of precision potentiometers start from Series C-050—½" micro miniature to Series HP-500—5" high resolution and linearity accurate potentiometers.

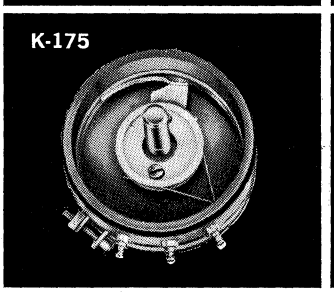


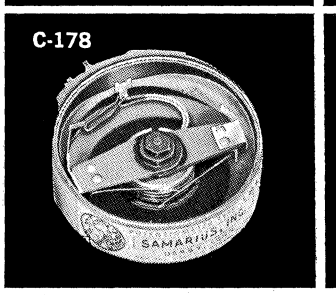


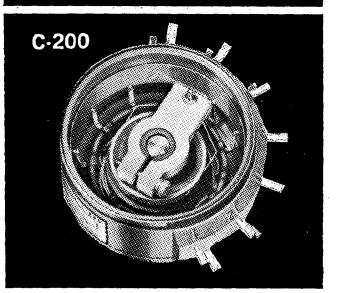


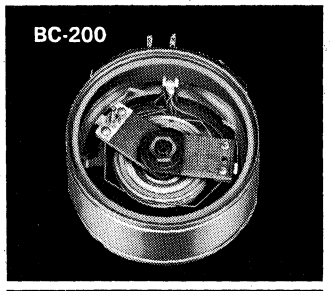


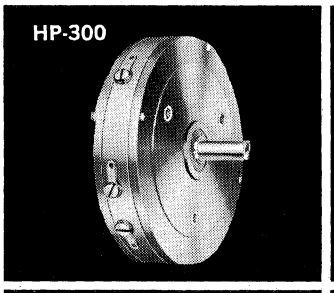


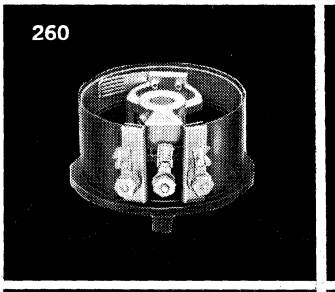


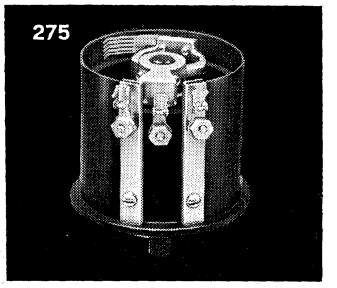


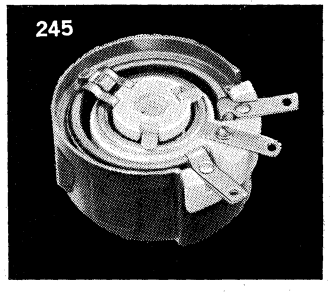


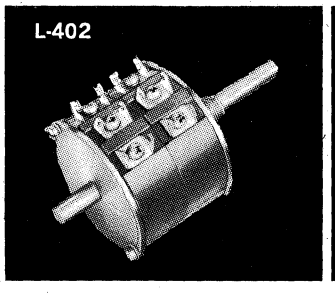


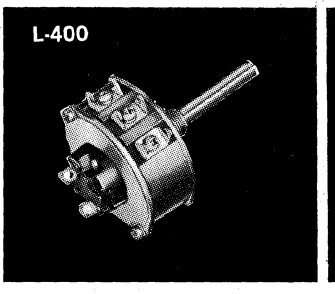


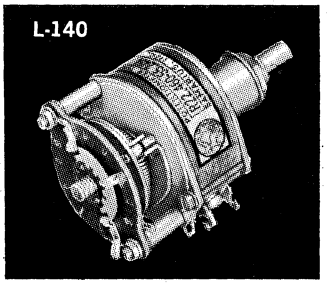




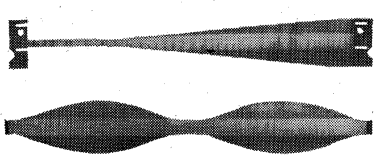








HIGH PRECISION POTENTIOMETER WINDINGS



Samarius, Inc. furnish their clients with a custom winding service for wire wound potentiometer elements in card and mandrel types. Linear or functional requirements are acheived through cooperative R & D with customers. Card profiles are ground with exact duplication from master templates on our own engineered and built machines to tolerances to meet all specifications. We can supply card windings for ¼" miniature potentiometers to cards 12 feet long and 4 inches wide. Mandrel windings are available up to 16 feet long in any type of wire needed. Over 30 years' experience in supplying high precision potentiometer windings to the field. Call on our engineering staff for their help in solving your winding or potentiometer problems.

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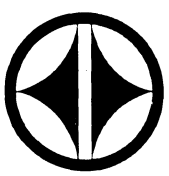
Look in the Green Section for Products and their Manufacturers



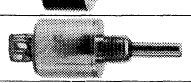
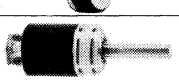
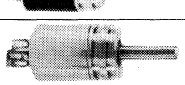
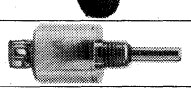
Tell them you found them in **eem**

WATERS POTENTIOMETERS

WATERS MANUFACTURING INC. • WAYLAND, MASSACHUSETTS 01778

WATERS' SINGLE TURN POTENTIOMETERS

WATERS single turn potentiometers are designed to meet exact military and industrial requirements, to provide the assured service demanded by any given application. Military standards and specifications including MIL-R-39002, MIL-R-12934, MIL-R-19, MIL-R-39023 are used as guides and/or determining factors. Reliability, accuracy, setability and stability — all important characteristics when an important function is to be performed.

	Waters Type	SIZE IN INCHES Dia.	Length	Shaft Dia.		Standard Resistance Range	Standard Resistance Tolerance	LINEARITY TOLERANCE Standard	Minimum
WIREWOUND	JP/2▲	1/2	1/2	1/8		100 to 10K	±5%	±3%	±1%
	JP/2C▲	1/2	1/2	1/8		50 to 10K	±10%	±5%	±1%
	JPD2▲	1/2	11/32	Dial Pot		10 to 20K	±5%	±5%	±5%
	APD1/2▲	1/2	1/2	Dial Pot		10 to 20K	±5%	±3%	±3%
	AP1/2; APR1/2; APS1/2*▲	1/2	1/2-45/64	1/8		10 to 100K	±5%	±3%	±1%
	APW1/2▲ APH1/2▲	1/2	37/64-Case 31/64-Case**	1/8		10 to 100K	±5%	±3%	±1%
	PT3/4C▲	25/32	13/16	1/8		50 to 10K	±10%	±5%	±3%
	RT7/8***▲	7/8	57/64	1/8		10 to 250K	±5%	±3%	±0.5%
	API1/16▲ API1/8▲	1/16 1/8	1 9/64 1 1/64	1/8 1/4		25 to 300K	±5%	±2%	±0.25%
	PT112W▲	1 1/8	1 1/2	1/4		50 to 250K	±10%	±10%	±1%
	WP1/2; WPS1/2*; WPR1/2▲	1/2	Variable	1/8		10 to 100K	±5%	±3%	±1%
	WPW1/2▲*****	1/2	1 23/64	1/8		50 to 100K	±5%	±1%	±1%
	WP7/8▲	7/8	1 5/16	1/8		10 to 250K	±5%	±1%	±0.5%
	WPI1/16▲ WPI1/8▲	1/16 1/8	1 5/16 1 37/64	1/8 1/4		25 to 300K	±5%	±1%	±0.25%
	WPSC1 1/8▲*****	1 1/8	1 37/64	1/4		20K	±5%	Terminal Conformity ±1%	
MystR®	PT112M†	1 1/8	1 1/2	1/4		10 to 1 Meg.	<250K ±10% >251K ±20%	±10%	±0.5%
	RT7/8-M***	7/8	57/64	1/8		500Ω to 250K 251K to 1 Meg.	±10% ±20%	±10%	±0.25%
	AP1 1/16-M† AP1 1/8-M†	1 1/16 1 1/8	1 3/16 1 25/64	1/8 and 1/4		1K to 1 Meg.	±10%	±10%	±0.25%
	MAP1/2; MAPS1/2; MAPW1/2****	1/2	1/2-45/64	1/8		500Ω to 250K 251K to 1 Meg.	±10% ±20%	±10%	±0.5%
	RM11†	Rectilinear 1.260 x .340 x .266				500 to 1 Meg.	<50K ±10% >51K ±20%	Independent	Independent

* Resistance Range: 10-20K
** Hermetically Sealed
*** Type RST7/8: Available 1/4" Dia. Shaft, 3/8 Threaded Bushing
**** Sine-Cosine Function
***** Water and Humidity Proof

▲ Wirewound
† MYSTR® (MystR is Waters conductive plastic resistance film element and is a registered trademark).

WATERS POTENTIOMETERS

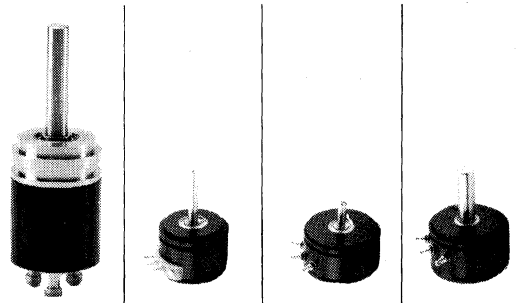
WATERS MANUFACTURING INC. • WAYLAND, MASSACHUSETTS 01778

Among recent important developments in Waters' research and development program is the achievement of a LOW NOISE characteristic on Types JP/2, PT 3/4C, APR 1/2 and APD 1/2. These potentiometers are now available with an EQUIVALENT NOISE RESISTANCE of 5Ω as a **standard** specification. MystR Servo Series have performed well over 400,000,000 dither cycles with end-of-test results of Output Smoothness 0.1% and less than 0.5% change in Total Resistance. This series is now available to MIL-R-39023.

Temperature Range	Max. Power Rating/Watts	Ganging	Application
−65° to +135°C	1.5 At 85°C	1	RK-09 MIL-R-39002
−55° to +105°C	2 At 40°C	1	Industrial Trimmer
−55° to +150°C	1 At 85°C	1	MIL-R-19A
−55° to +105°C	1 At 40°C	1	MIL-R-19A
−65° to +125°C	2 At 60°C	3 (Radial Terminal)	Military Industrial
−65° to +125°C	2 At 60°C	1	MIL-E-5272
−55° to +105°C	1.5 At 40°C	2	MIL-R-19A RA10
−65° to +125°C	3 At 60°C	3	Military Industrial
−65° to +125°C	4 At 60°C	3	Military Industrial
−55° to +125°C	2 At 40°C	3	Industrial
−65° to +125°C	2 At 60°C	2	Military Industrial
−65° to +125°C	2 At 60°C	—	Military Industrial
−65° to +125°C	3 At 60°C	4	Military Industrial
−65° to +125°C	4 At 60°C	4	Military Industrial
−65° to +125°C	4 At 60°C	4	Military Industrial
−55° to +125°C	2 At 40°C	3	Industrial
−65° to +125°C	1 At 60°C	3	Military Industrial
−65° to +150°C	2 At 60°C	3	Military Industrial
−65° to +125°C	1 At 65°C	—	Military Industrial
−65° to +125°C	0.25 At 40°C	—	Military Industrial

Send for Catalog Showing Complete Specifications and Product Line Including Multi-Turn Dials, Shaft Locking Devices and Pot Hook® Mounting Devices.

MystR® Servo Series



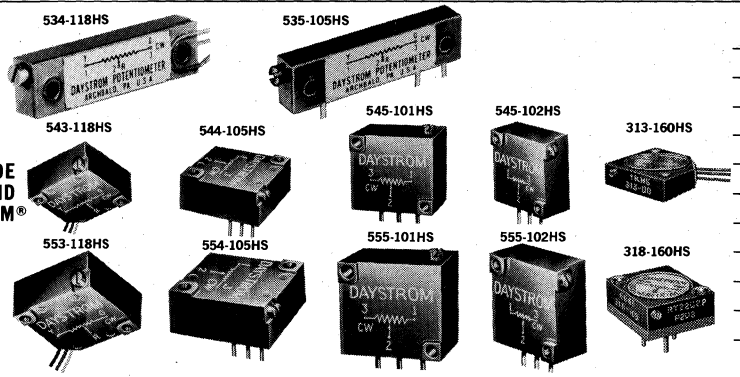
STANDARD SPECIFICATIONS	WP½-M	WP⅞-M	WP-1 1/16-M	WP1⅛-M
Resistance Range and Tolerance	10Ω-250K ±10% 251K-1Meg ±20%	500Ω-250K ±10%	1K to 1Meg ±10%	1K to 1Meg ±10%
Independent Linearity	±2%	±2%	±3%	±3%
Electrical Continuity Travel	340° Nom.	340° ±5°	350° ±5%	350° ±5%
Output Smoothness	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Temperature Range	−65° to +125°C	−65° to +125°C	−65° to +150°C	−65° to +150°C
Power Dissipation Rating	1 @ 60°C	1 @ 60°C	2 @ 60°C	2 @ 60°C
Mechanical Rotation	Continuous	Continuous	Continuous	Continuous

PROVEN CHARACTERISTICS OF MystR®
(Available in Most Types)

- Infinite Resolution
- Stability: < 1% ΔR
- Long Shelf Life
- Resistance Temperature: From −65°C to 150°C, < 5% ΔR
- Output Smoothness: < 0.1%
- Rotational Life: 100,000,000 cycles
- Moisture Resistance: < 5% ΔR
- Low Degradation
- Dither-life: in excess of 400×10^6

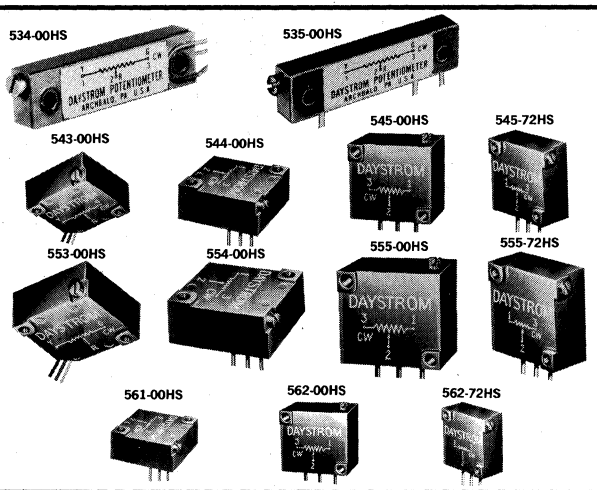
WESTON®-DAYSTROM POTENTIOMETERS

MILITARY GRADE WIREWOUND SQUARETRIM®



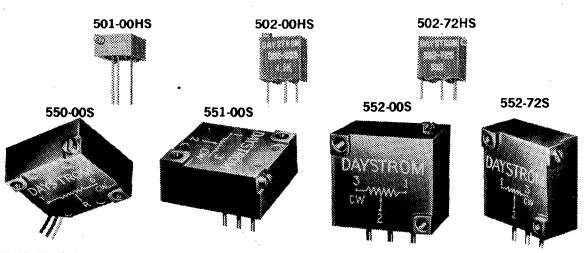
MODEL No.	TERMINALS
534-118HS	L
535-105HS	P
543-118HS	L
544-105HS	P
545-101HS	W
545-102HS	X
553-118HS	L
554-105HS	P
555-101HS	W
555-102HS	X
313-160HS	L
318-160HS	P

GENERAL PURPOSE WIREWOUND SQUARETRIM®



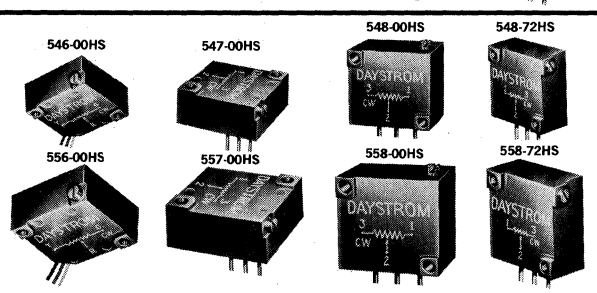
534-00HS	L
535-00HS	P
543-00HS	L
544-00HS	P
545-00HS	W
545-72HS	X
553-00HS	L
554-00HS	P
555-00HS	W
555-72HS	X
561-00HS	P
562-00HS	W
562-72HS	X

INDUSTRIAL COMMERCIAL MULTI-TURN WIREWOUND-TRIMMING



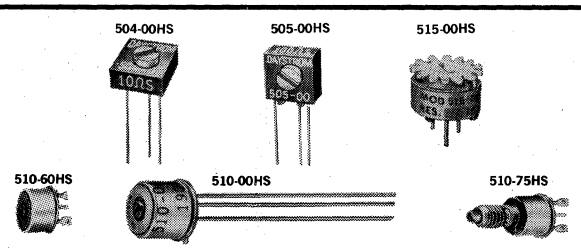
501-00HS	P
502-00HS	W
502-72HS	X
550-00S	L
551-00S	P
552-00S	W
552-72S	X

HI-STABILITY CERMET ELEMENT



546-00HS	L
547-00HS	P
548-00HS	W
548-72HS	X
556-00HS	L
557-00HS	P
558-00HS	W
558-72HS	X

WIREWOUND SINGLE TURN



504-00HS	P
505-00HS	X
510-60HS	S
510-00HS	P
510-75HS	S
515-00HS	P

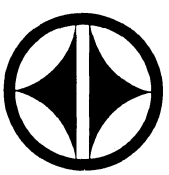
a Schlumberger company

WESTON® WESTON COMPONENTS DIVISION

Archbald, Pa. 18403

MILITARY DESIGNATION	SIZE INCHES	THICK INCHES	STAND. RES. RANGE (OHMS)	RES. TOL.	PWR. RATING (WATTS)	MAX. OPER. TEMP. FROM −55 DEG. C.	HUMIDITY	STOPS	MECH. ADJUST. (TURNS)
RT12C2L	.315 x 1.25	.190	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	24
RT12C2P	.315 x 1.25	.190	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	24
RT24C2L	.375 x .375	.150	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	25
RT24C2P	.375 x .375	.160	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	25
RT24C2W	.375 x .375	.160	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	25
RT24C2X	.375 x .375	.160	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	25
RT22C2L	.500 x .500	.187	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	35
RT22C2P	.500 x .500	.220	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	35
RT22C2W	.500 x .500	.220	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	35
RT22C2X	.500 x .500	.220	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	35
RTR22DL	.500 x .500	.187	200—50K	5%	.75 @ 85°C	150	MIL-R-39015	Standard	45
RTR22DP	.500 x .500	.255	200—50K	5%	.75 @ 85°C	150	MIL-R-39015	Standard	45
N.A.	.315 x 1.25	.190	10—50K	5%	1 @ 70°C	150	MIL-R-27208	Standard	24
N.A.	.315 x 1.25	.190	10—50K	5%	1 @ 70°C	150	MIL-R-27208	Standard	24
N.A.	.375 x .375	.150	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	25
N.A.	.375 x .375	.160	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	25
N.A.	.375 x .375	.160	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	25
N.A.	.375 x .375	.160	10—50K	5%	.75 @ 85°C	150	MIL-R-27208	Standard	25
N.A.	.500 x .500	.187	10—50K	5%	1 @ 70°C	150	MIL-R-27208	Standard	35
N.A.	.500 x .500	.220	10—50K	5%	1 @ 70°C	150	MIL-R-27208	Standard	35
N.A.	.500 x .500	.220	10—50K	5%	1 @ 70°C	150	MIL-R-27208	Standard	35
N.A.	.500 x .500	.220	10—50K	5%	1 @ 70°C	150	MIL-R-27208	Standard	35
N.A.	.250 x .250	.170	10—20K	5%	.2 @ 70°C	150	MIL-R-27208	Standard	13
N.A.	.250 x .250	.170	10—20K	5%	.2 @ 70°C	150	MIL-R-27208	Standard	13
N.A.	.250 x .250	.170	10—20K	5%	.2 @ 70°C	150	MIL-R-27208	Standard	13
N.A.	.312 x .312	.175	10—20K	5%	.6 @ 70°C	150	MIL-R-27208	Standard	15
N.A.	.312 x .312	.200	10—20K	5%	.6 @ 70°C	150	MIL-R-27208	Standard	15
N.A.	.312 x .312	.190	10—20K	5%	.6 @ 70°C	150	MIL-R-27208	Standard	15
N.A.	.500 x .500	.187	10—50K	5%	1 @ 70°C	150	A-Steady	Standard	35
N.A.	.500 x .500	.220	10—50K	5%	1 @ 70°C	150	A-Steady	Standard	35
N.A.	.500 x .500	.220	10—50K	5%	1 @ 70°C	150	A-Steady	Standard	35
N.A.	.500 x .500	.220	10—50K	5%	1 @ 70°C	150	A-Steady	Standard	35
N.A.	.375 x .375	.150	200—1 Meg	10%	.5 @ 85°C	150	MIL-R-22097	Standard	25
N.A.	.375 x .375	.160	200—1 Meg	10%	.5 @ 85°C	150	MIL-R-22097	Standard	25
N.A.	.375 x .375	.160	200—1 Meg	10%	.5 @ 85°C	150	MIL-R-22097	Standard	25
N.A.	.375 x .375	.160	200—1 Meg	10%	.5 @ 85°C	150	MIL-R-22097	Standard	25
N.A.	.500 x .500	.187	200—1 Meg	10%	.5 @ 85°C	150	MIL-R-22097	Standard	35
N.A.	.500 x .500	.220	200—1 Meg	10%	.5 @ 85°C	150	MIL-R-22097	Standard	35
N.A.	.500 x .500	.220	200—1 Meg	10%	.5 @ 85°C	150	MIL-R-22097	Standard	35
N.A.	.500 x .500	.220	200—1 Meg	10%	.5 @ 85°C	150	MIL-R-22097	Standard	35
N.A.	.312 x .312	.175	10—20K	5%	.6 @ 70°C	150	MIL-R-27208	Standard	1
N.A.	.312 x .312	.190	10—20K	5%	.6 @ 70°C	150	MIL-R-27208	Standard	1
N.A.	.360 Dia.	.250	10—30K	5%	1 @ 50°C	175	H-Cyclic	Standard	1
N.A.	.360 Dia.	.250	10—30K	5%	1 @ 50°C	175	H-Cyclic	Standard	1
N.A.	.360 Dia.	.250	10—30K	5%	1 @ 50°C	175	H-Cyclic	Standard	1
N.A.	.500 Dia.	.317	10—50K	5%	1 @ 55°C	150	MIL-R-27208	Positive	1

Look in the Yellow Section for Manufacturers' Sales Offices



Tell them you found them in **eem**

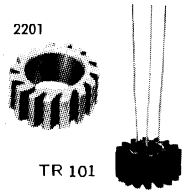
astrodyne, inc.

electrical/electronic

HEAT TRANSFER AND DISSIPATION DEVICES

From TO-18 sizes to high power heat sinks designed for use with high heat generating "pressure pack" rectifiers, there are standard Astrodyne heat dissipating devices and extrusions available from stock. In addition to natural convection and forced air units, Astrodyne stocks a complete line of compact heat exchangers. Catalogs and technical literature available on request for all items.

PRESS-FIT/CIRCUIT BOARD TYPES



2201/TR-101 Series—for optimum natural convection cooling of all standard TO-size transistors used in printed circuit boards, computer cards, etc. Four sizes in TR series provide from 1 to 4 square inches surface area.

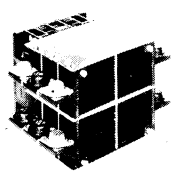
2700 (Convection)/2800 Conduction Series —provide greater surface contact plus secure mounting. Eight units provide thermal resistance ranging from 2°C/watt (2801) to 28°C/watt (2701).


2703

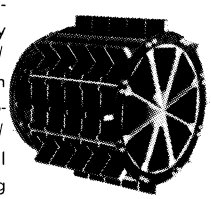

2300

2300 Series — free circulation, low-profile units for circuit-board use. Four heat sinks (½", ¾", 1", 1¼" x 1.81"² base) of high conductivity aluminum alloy, supplied with black anodize or gold iridite.

FORCED CONVECTION


2401-12B

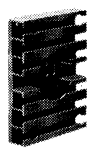
Modular Design permits custom assembly of compact electronic/heat sink units which may incorporate associated electronics and/or terminals. Model 2601 permits mounting more than 40 units to single fan.

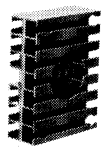

2601-40B

NATURAL CONVECTION UNITS

with 20% Greater Cooling Surface*

Catalog NC-2500 plus actual size outline drawing chart on request.


2501


2502

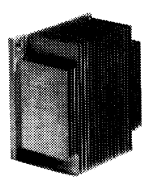

2513


2517

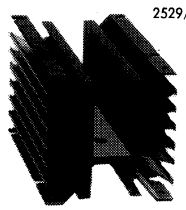
*Provided by Astrodyne patented T-FIN Construction.

HIGH POWER — CRITICAL COOLING

Model 2450 in four standard sizes (2 x 2", 3 x 3", 4 x 4" and 4 x 6") provides exceptionally low thermal resistance for effective use with "pressure-pack" rectifiers. 4 x 4" unit dissipating 650 watts with 1500 LFM forced air has thermal resistance of 0.105°C/watt with 23 fins and 0.089°C/watt with 33 fins.


2450

2529/2530



Model 2507 handles heavy duty SCR devices on easily accessible, wide shelf.

Models 2529/2530 "Little Giant" heat sinks (5 and 6" lengths) provide .35°C/watt thermal resistance at 100 watts with natural convection for high power rectifier assemblies.

THERMAL/CONDUCTIVE/BONDING COMPOUNDS



THERMAL BOND 312 — general purpose conductive adhesive available in 5 oz. kits (12/carton — $46.60, individual boxes — $4.65 each), 2 qt. cans, 2 gal. cans.

CONDUCTIVE COMPOUND 829 — supplied in ready-to-use 1, 2, 4 and 8 ounce jars ($1.25, $2.00, $3.25 and $5.75 each — 12 jars/carton). Providing optimum, long-term thermal/electrical contact plus protection against oxidation.



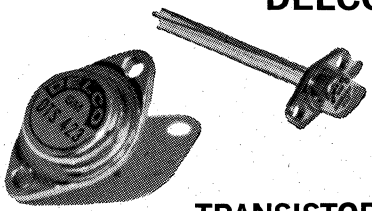
POTTING COMPOUND 166 — for potting heat generating devices such as transformers, resistors, etc. Available in mix-and-use packages (jar of compound, vial of hardener). 12 boxes to case $42.00. Individual boxes $4.25 each.

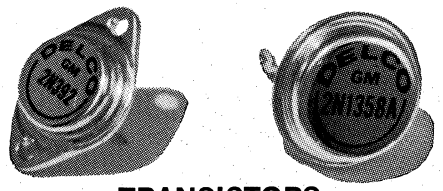


CALL COLLECT FOR COMPLETE INFORMATION AND QUOTATIONS ON ANY ASTRODYNE HEAT SINKS

astrodyne, inc.
SUBSIDIARY OF ROANWELL CORP.
207 CAMBRIDGE ST., BURLINGTON, MASS. (617) 272-3850

DELCO RADIO POWER SEMICONDUCTORS





TRANSISTORS

NPN SILICON TO-36, HIGH VOLTAGE

Type	Ic	VCBO	VCEO	hFE @ Ic Amps		VCE(sat) @ Ic Volts @ Amps	
2N2580	5	400	400	10/40 4 min	5 10	0.7	5.0
2N2580M†	5	400	400	10/40	5	0.7	5.0
2N2581	10	400	400	25/65 10 min	5 10	1.0	10.0
2N2582	5	500	500	10/40 4 min	5 10	0.7	5.0
2N2583	10	500	500	25/65 10 min	5 10	1.0	10.0
2N3079	10	200	200	10/50	5	.14Ω*	5.0
2N3080	10	300	300	10/50	5	.14Ω*	5.0

NPN SILICON TO-3, HIGH VOLTAGE

DTS-103	15	80	60	20/55	5	1.8	10
DTS-104	15	80	60	50/120	5	1.5	10
DTS-105	15	100	80	20/55	5	1.8	10
DTS-106	15	110	90	20/55	5	1.8	10
DTS-107	15	120	100	20/55	5	1.8	10
DTS-401	3.5	400	400	30/90	1.0	.8	1.0
DTS-402	3.5	400	400	30/90	1.0	.8	1.0
DTS-410	3.5	200	200	30/90	1.0	0.8	1.0
DTS-411	3.5	300	300	30/90	1.0	0.8	1.0
DTS-413	2.0	400	400	20/80	0.5	0.8	0.5
DTS-423	3.5	400	400	30/90	1.0	0.8	1.0
DTS-423M†	3.5	400	400	30/90	1.0	0.8	1.0
DTS-424	3.5	500	500	30/90	1.0	.8	1.0
DTS-425	3.5	500	500	30/90	1.0	.8	1.0
DTS-430	5	400	400	15/45	2.5	0.9	2.5
DTS-431	5	400	400	15/35	2.5	0.7	2.5
DTS-431M†	5	400	400	15/35	2.5	0.7	2.5
DTS-701	.5		800	20 min.	.12		
DTS-702	3.0	1200	1000	2.5 min.	2.0		
2N3902	3.5	400	400	20/100	1.0	.8	1.0
JAN 2N3902	3.5	700⑧	400	30/90	1.0	.8	1.0
2N5157	3.5	700⑧	500	30/90	1.0	.8	1.0
2N5241	5	400	400	15/35	2.5	0.7	2.5

PNP GERMANIUM TO-36 ALLOY BASE

2N173	15	60	45	35/70	5.0	1.0	12.0
2N174	15	80	55	25/50	5.0	0.9	12.0
JAN 2N174A	15	80	40	40/80	1.2	0.7	12.0
2N277	15	40	25	35/70	5.0	0.3②	12.0
2N278	15	50	30	35/70	5.0	1.0	12.0
2N441	15	40	25	20/40	5.0	0.3②	12.0
2N442	15	50	30	20/40	5.0	0.3②	12.0
2N443	15	60	45	20/40	5.0	1.0	12.0
2N1099	15	80	55	35/70	5.0	0.7	12.0
2N1100	15	100	65	25/50	5.0	0.7	12.0
2N1358	15	80	40	40/80	1.2	0.7	12.0
2N1358A	15	100	60	25/50	5.0	0.7	12.0
JAN 2N1358	15	80	40	25/50	5.0	0.7	12.0
2N1412	15	100	65	25/50	5.0	0.7	12.0
JAN 2N1412A	15	100	70	25/50	5.0	0.6	12.0
2N1518	25	50	40	15/60	15	0.7	25
2N1519	25	80	60	15/60	15	0.7	25
2N1520	35	50	40	17/68	15	0.6	35
2N1521	35	80	60	17/68	15	0.6	35
2N1522	50	50	40	25/100	15	0.5	50
2N1523	50	80	60	25/100	15	0.5	50
2N1970	15	100	50	17/40	5.0	1.0	12.0
2N2075	15	80	65	20/40	5.0	0.7	12.0
2N2076	15	70	55	20/40	5.0	0.7	12.0
2N2077	15	50	45	20/40	5.0	0.9	12.0
2N2078	15	40	25	20/40	5.0	0.9	12.0
2N2079	15	80	65	35/70	5.0	0.7	12.0
2N2080	15	70	55	35/70	5.0	0.7	12.0
2N2081	15	50	45	35/70	5.0	0.9	12.0
2N2082	15	40	25	35/70	5.0	0.9	12.0
JAN 2N2210				use JAN 2N1412A			
2N2490	15	70	50	20/40	5.0	0.7	12.0
2N2491	15	60	40	35/70	5.0	0.7	12.0
2N2492	15	80	65	25/50	5.0	0.5	12.0
2N2493	15	100	75	25/50	5.0	0.5	12.0

① VCES ② VCER ③ Power gain db ④ Max. ⑤ Typical
⑥ VCEX ⑦ VCE Sus ⑧ @ 90° C-REB = 100 ohm
⑨ VCBX *RSAT † Military Type Spec.

TRANSISTORS

PNP GERMANIUM TO-3 ALLOY BASE

Type	Ic	VCBO	VCEO	hFE @ Ic Amps		VCE(sat) @ Ic Volts @ Amps	
2N176	7	30	30①	25/90	.500	1.0	3.0
2N255A	5	15	15③	25③	.450		
2N297A	4	60	40	40/100	.500	1.0	2.0
2N301	3	40	32	62.5	.700		
2N301A	3	60	32	62.5	.700		
2N379	7	80⑨	40	20/90	2.0	1.0	2.0
2N380	7	60⑨	30	20/90	2.0	1.0	2.0
2N392	5	60	45	60/150	3.0	0.5	3.0
2N456A	7	40	20	30/90	5.0	0.5	5.0
2N456B	7	40	30	30/90	5.0	0.5	5.0
2N457A	7	60	30	30/90	5.0	0.5	5.0
2N457B	7	60	40	30/90	5.0	0.5	5.0
2N458A	7	80	40	30/90	5.0	0.5	5.0
2N458B	7	80	45	30/90	5.0	0.5	5.0
2N554	5	15	30	30	1.0		
2N669	3	30⑤	30①	250④	.500	0.4⑤	3.0
2N1011	5	80	40	30/75	3.0	1.5	3.0
2N1021	7	100	50	30/90	5.0	0.5	5.0
2N1021A	7	100	50	30/90	5.0	0.5	5.0
2N1022	7	120	50	30/90	5.0	0.5	5.0
2N1022A	7	120	55	30/90	5.0	0.5	5.0
2N1159	5	80	60	30/75	3.0	1.0	3.0
2N1160	7	80	60	20/50	5.0	1.0	5.0
2N1168	5	50	30	60⑤	3.0	.25⑤	3.0
2N1534	5	40	20	35/70	3.0	1.2	3.0
2N1535	5	60	30	35/70	3.0	1.2	3.0
2N1536	5	80	40	35/75	3.0	1.2	3.0
2N1539	5	25	20	50/100	3.0	0.3	.300
2N1540	5	40	30	50/100	3.0	0.3	.300
2N1541	5	55	40	50/100	3.0	0.3	.300
2N1542	5	65	50	50/100	3.0	0.3	.300
2N1543	5	80	60	50/100	3.0	0.3	.300
2N1544	5	25	20	75/150	3.0	0.2	.300
2N1545	5	40	30	75/150	3.0	0.2	.300
2N1546	5	55	40	72/150	3.0	0.2	.300
2N1547	5	65	50	75/150	3.0	0.2	.300
2N1553	15	40	20	30/60	10	0.5	10
2N1554	15	60	30	30/60	10	0.5	10
2N1555	15	80	40	30/60	10	0.5	10
2N1556	15	100	50	30/60	10	0.5	10
2N1557	15	40	20	50/100	10	0.4	10
2N1558	15	60	30	50/100	10	0.4	10
2N1559	15	80	40	50/100	10	0.4	10
2N1560	15	100	50	50/100	10	0.4	10
2N5156	10	100	60⑦	25/60	5.0	1.0	10
DTG-110	7	40	40②	74/250	1.0	0.5	2.0

PNP GERMANIUM TO-3 NU-BASE

DTG-110A	25	110④	70	50/300	1.0		
DTG-110B	25	90④	40⑦	65/300	1.0	0.5	5.0
DTG-600	25	90⑥	50⑦	50/115⑤	5.0	0.75	25
DTG-601	25	90⑥	60⑦	50/115⑤	5.0	0.75	25
DTG-602	25	100⑥	70⑦	50/115⑤	5.0	0.75	25
DTG-603	25	90⑥	80⑦	50/	5.0	0.75	25.0
DTG-603M†	25	90⑥	80⑦	50/	5.0	0.75	25.0
DTG-1200	15	120②	120⑦	20	8.0	0.5	12
DTG-1010	15	325⑧	110⑦	100⑤	8.0	0.5	12
DTG-1110	15	200⑥	80⑦			0.5	10
DTG-2000	25	60⑥	30⑦	25	8.0	0.9	25
DTG-2100	25	80⑥	60⑦	25	8.0	0.9	25
DTG-2200	25	100⑥	80⑦	25	8.0	0.9	25
DTG-2300	25	120⑥	100⑦	25	8.0	0.9	25
DTG-2400	25	140⑥	120⑦	25	8.0	0.9	25
DTG-2400M†	25	140⑥	120	25/125	10.0	0.9	25
2N5155	25	140⑥	120⑦	25/100	8.0	0.9	25

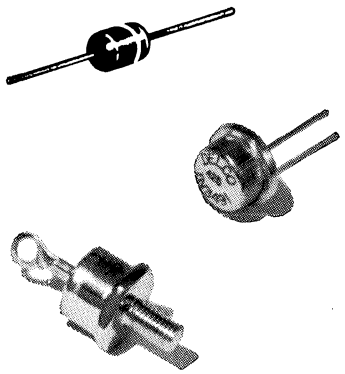
PNP GERMANIUM TO-41 NU-BASE

2N1073	10	40②	40②	20/60	5.0	0.6	5.0
2N1073A	10	80②	80②	20/60	5.0	0.6	5.0
2N1073B	10	120②	120②	20/60	5.0	0.6	5.0

PNP GERMANIUM TO-37 NU-BASE

2N3212	5	100⑥	80	30/90	3.0	0.5	5.0
2N3213	5	80⑨	60	30/90	3.0	0.5	5.0
2N3214	5	60⑥	40	30/90	3.0	0.5	5.0
2N3215	5	40⑥	30	25/100	3.0	0.5	5.0

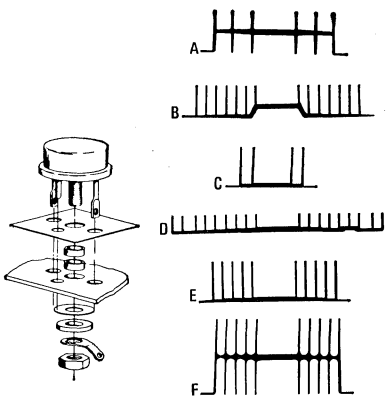
SILICON POWER RECTIFIERS



TYPE	MAXIMUM AVERAGE CURRENT	P.R.V. AND MAXIMUM CONTINUOUS DC BLOCKING VOLTAGE	REVERSE CURRENT	FORWARD VOLTAGE DROP	REPETITIVE PEAK FORWARD CURRENT
AXIAL LEAD					
DRS-102	1.5A	200V	10 μA	0.9V	10A
DRS-104	1.5A	400V	10 μA	0.9V	10A
DRS-106	1.5A	600V	10 μA	0.9V	10A
DRS-108	1.5A	800	10 μ	.9V	10A
DRS-110	1.5A	1000	10 μ	.9V	10A
DRS-112	1.5A	1200	10 μ	.9V	10A
PRESS FIT					
IN3491	25A	50V	10 mA	0.7V	110A
IN3492	25A	100V	10 mA	0.7V	110A
IN3493	25A	200V	8 mA	0.7V	110A
STUD BASE					
IN3208	15A	50V	10 mA	1.5V	70A
IN3209	15A	100V	10 mA	1.5V	70A
IN3210	15A	200V	10 mA	1.5V	70A
DRS250	250A	800V	10 mA	.55V	4500A
DRS251	250A	1000V	10 mA	.55V	4500A
DRS252	250A	1200V	10 mA	.55V	4500A
DRS253	250A	1400V	10 mA	.55V	4500A
DRS254	250A	1600V	10 mA	.55V	4500A

All rectifiers available with reverse polarity (Anode connected to base). To order, add "R" to type number.

HEAT SINKS AND ACCESSORIES



PART NUMBER	OUT-LINE	DESCRIPTION	†THERMAL RESIS.	MAX. WIDTH	MAX. DEPTH	MAX. LENGTH
7270725	A	Single Punch, Universal Mount	2.3° C/watt	3.125″	1.370″	4.690″
7281352	A	Double Punched, Universal Mount	2.3° C/watt	3.125″	1.370″	4.690″
7270606	A	Unpunched, Unpainted	2.3° C/watt	3.125″	1.370″	4.690″
7300811	A	Double punched for 2 Press Fit Rectifiers	2.3° C/Watt	3.125″	1.370″	4.690″
7281361	B	Double Punched, Universal Mount	1.6° C/watt	3.125″	1.080″	6.135″
7281364	B	Unpunched, Unpainted	1.6° C/watt	3.125″	1.080″	6.135″
7281357	C	Punched for Diamond Base Only	5.0° C/watt	1.625″	1.330″	2.930″
7281360	C	Unpunched, Unpainted	5.0° C/watt	1.625″	1.330″	2.930″
7281351	D	Double Punched, Universal Mount	2.2° C/watt	3.125″	.750″	.750″
7281354	D	Unpunched, Unpainted	2.2° C/watt	3.125″	.750″	.750″
7281355	E	Double Punched, Universal Mount	2.2° C/watt	3.125″	1.330″	4.850″
7281353	E	Unpunched, Unpainted	2.2° C/watt	3.125″	1.330″	4.850″
7276040	E	Punched for Round Base Only	3.5° C/watt	1.531″	1.330″	4.850″
7277151	E	Punched for Diamond Base Only	3.5° C/watt	1.531″	1.330″	4.850″
7278482	E	Unpunched, Unpainted	3.5° C/watt	1.531″	1.330″	4.850″
7281366	F	Double Punched, Universal Mount	1.3° C/watt	3.125″	2.475″	4.850″
7281369	F	Unpunched, Unpainted	1.3° C/watt	3.125″	2.475″	4.850″
7269634	F	Insulating Spacer				
7274633	F	TO 36 (Round Base) Mtg. Kit	Furnished with All Transistors and Rectifiers Purchased in Sample Quantities			
7274775	F	TO 3 (Diamond Base) Mtg. Kit				
7276383	F	TO 4 (Min. Dia. Base) Mtg. Kit				
7276396	F	DO 5 (6 Rectifier) Mtg. Kit				
7305209		TO-41 (Diamond base) Mtg. Kit.				
7305210		TO-3 (Silicon) Mtg. Kit.				

†Typical value with length of fin positioned vertically.

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A Directory outlining, by device and type number, the broad range of semiconductor products available from General Electric for both signal and power applications is presented on this and the following three pages. Included among others are audio amplifier IC's, economy transistors and triggers, and SCR's for power control.

General Electric provides technical back-up service to you through your GE Electronic Components Sales Operation (see inside front cover for nearby Office). Your GE representative will be glad to help you find the best circuit solution to your design problems. Call him at any time for product information or application assistance. In addition, your General Electric Distributor can provide you with personal service, factory prices, and fast delivery from inventory.

PRODUCT CHARACTERISTICS

Individual specification sheets may be ordered by JEDEC type or GE house number. Or Line Folders may be ordered by Line Folder numbers as identified below:

Number	Subject	Number	Subject
1	Tunnel Diodes	7	Rectifier Diode and SCR Stacks
2	Epoxy Transistors	8	Military Types and High Reliability Devices
3	Triode Thyristors	9	Signal Diodes
4	Switch and Trigger Devices	10	Germanium Diodes
5	Integrated Circuits	11	Solid-state Subassemblies
6	Rectifier Diodes	12	Selenium Components

Also available is a listing of all published specifications on GE semiconductors. Order Publication 450.52.

Order any of the above from General Electric Company, Distribution services — Building 6, Schenectady, N. Y. 12305.

SIGNAL SEMICONDUCTORS

SILICON TRANSISTORS

SIGNAL — NPN PLANAR

Small Signal Amplifiers — Audio to 30MHz

2N2711	2N2926	2N3394	2N3721
2N2712	2N3391	2N3395	2N3900
2N2923	2N3391A	2N3396	2N3900A
2N2924	2N3392	2N3397	2N5172
2N2925	2N3393	2N3398	

High-frequency Amplifiers and Oscillators — 262.5 kHz to 100 MHz Epitaxial

2N3843	2N3845A	2N3856	2N5232
2N3843A	2N3854	2N3856A	2N5232A
2N3844	2N3854A	2N3858	2N5249
2N3844A	2N3855	2N3859	2N5249A
2N3845	2N3855A	2N3860	

High-frequency Amplifiers and Oscillators — 100 mHz to 950 MHz Epitaxial

2N3662	2N3663	D16G6

Large Signal Amplifiers and Medium-speed Switches — Epitaxial

2N2713	2N3414	2N3975	2N4951
2N2714	2N3415	2N3976	2N4952
2N3402	2N3416	2N4256	2N4953
2N3403	2N3417	2N4424	2N4954
2N3404	2N3973	2N4425	
2N3405	2N3974	2N4426	

High-voltage Applications — to 100 MHz

2N3858A	2N3877	2N5174	2N5176
2N3859A	2N3877A	2N5175	

High-speed Switches — Low Storage Times — Epitaxial, Gold Doped

2N3605	2N3607	2N5028	2N5030
2N3606	2N5027	2N5029	

Monolithic Darlington Amplifiers

D16P1	2N5305	2N5307	2N5308
D16P2	2N5306		

General-Purpose PNP Amplifiers

2N5354	D29A7	D29A9	D29A11
2N5355	D29A8	D29A10	D29A12
2N5356			

Dual Diodes

1N4951	16H1	16U3	16U4
1N4952			

Power Transistors

D27C1	D28A5	D28C3	D28D
D27C2	D28A6	D28C4	D28D10
D27C3	D28A9	D28C5	2N4054
D27C4	D28A10	D28D1	2N4055
D27D1	D28A12	D28D2	2N4056
D27D2	D28A13	D28D3	2N4057
D27D3	D28C1	D28D4	
D27D4	D28C2	D28D5	

GROWN DIFFUSED — NPN PASSIVATED

2N332	2N337	2N542A	D4C28
2N332A	2N337A	2N543	D4C29
2N333	2N338	2N543A	D4C30
2N333A	2N338A	2N1248	D4C31
2N334	2N478	2N1276	D4D20
2N334A	2N479	2N1277	D4D21
2N335	2N479A	2N1278	D4D22
2N335A	2N480	2N1279	D4D24
2N335B	2N480A	2N1417	D4D25
2N336	2N541	2N1418	D4D26
2N336A	2N542	2N2349	

POWER — NPN PASSIVATED MESA

2N497	2N657A	2N2201	2N2727
2N497A	2N2017	2N2202	2N2995
2N498	2N2106	2N2203	D7A30
2N498A	2N2107	2N2204	D7A31
2N656	2N2108	2N2239	D7A32
2N656A	2N2196	2N2611	
2N657	2N2197	2N2726	

Triple-diffused NPN Passivated

2N1616	2N1618	2N1724A	D6C
2N1617	2N1724	2N1725	

MICROTAB — 0.105" Max. Body Height

D26B1	D26C3	D26E4	D26G1
D26B2	D26E1	D26E5	D30A1
D26C1	D26E2	D26E6	D30A2
D26C2	D26E3	D26E7	D30A3

GERMANIUM TRANSISTORS

NPN RATE GROWN

2N78	2N169	2N293	2N1087
2N78A	2N169A	2N1086	2N1694
2N167A	2N292	2N1086A	

PNP ALLOY

2N43A	2N321	2N461	2N1175A
2N44A	2N322	2N508	2N1303
2N123	2N323	2N508A	2N1305
2N186A	2N324	2N524	2N1307
2N187A	2N394	2N525	2N1413
2N188A	2N395	2N526	2N1414
2N189	2N396	2N527	2N1415
2N190	2N396A	2N1057	2N1614
2N191	2N397	2N1097	2N1924
2N192	2N404	2N1098	2N1925
2N241A	2N404A	2N1144	2N1926
2N319	2N413	2N1145	
2N320	2N414	2N1175	

SPECIAL SILICON PRODUCTS

REFERENCE AMPLIFIERS

RA1	RA1C	RA2B	RA3B
RA1A	RA2	RA3	
RA1B	RA2A	RA3A	

PLANAR SILICON CONTROLLED SWITCHES (SCS)

3N81	3N83	3N85
3N82	3N84	3N86

SILICON UNILATERAL SWITCH (SUS)

2N4983	2N4985	2N4987	2N4989
2N4984	2N4986	2N4988	2N4990

SILICON BILATERAL SWITCH (SBS)

2N4991	2N4992	2N4993	D13Q500

UNIJUNCTION TRANSISTORS

2N489	2N493A	2N2418A	2N2647
2N489A	2N493B	2N2418B	2N2840
2N489B	2N494	2N2419	5G514
2N490	2N494A	2N2419A	5G515
2N490A	2N494B	2N2419B	5G516
2N490B	2N494C	2N2420	D5E37
2N490C	2N1671	2N2420A	D5E43
2N491	2N1671A	2N2420B	D5E44
2N491A	2N1671B	2N2421	D5E45
2N491B	261671C	2N2421A	D5K1
2N492	2N2160	2N2421B	D5K2
2N492A	2N2417	2N2422	D13T1
2N492B	2N2417A	2N2422A	D13T2
2N492C	2N2417B	2N2422B	
2N493	2N2418	2N2646	

DIAC — BI-DIRECTIONAL TRIGGER DIODE

ST2

DUAL (AND MULTICHIP) DEVICES

DIFFERENTIAL AMPLIFIERS

NPN 6-terminal Pkgs. with 2 Isolated Pellets

2N2060	2N2643	2N2919	2N3522
2N2223	2N2644	2N2920	2N3523
2N2223A	2N2652	2N3513	2N3524
2N2453	2N2652A	2N3514	D12A8
2N2453A	2N2910	2N3515	D12A104
2N2480	2N2913	2N3516	D12A108
2N2480A	2N2914	2N3517	D12E026
2N2639	2N2915	2N3518	D12E109
2N2640	2N2916	2N3519	D12E126
2N2641	2N2917	2N3520	
2N2642	2N2918	2N3521	

CHOPPERS

NPN 5-terminal Pkgs. with 2 Matched Pellets

2N2356	2N2356A	2N3082	2N3083

DARLINGTONS

NPN 4-terminal Pkgs. with 2 Pellets Connected in Darlington Configuration

2N997	2N998	2N999	2N2785

SEMICONDUCTOR PRODUCTS

SIGNAL SEMICONDUCTORS

MICROELECTRONICS

HYBRID CIRCUITS

D12X009	D12X018	D12X120	D12X248
D12X010	D12X020	D12X205	D12X255
D12X011	D12X030	D12X207	D12X257
D12X012	D12X037	D12X218	D12X258
D12X014	D12X101	D12X235	D12X264
D12X015	D12X119	D12X239	D12X292

INTEGRATED CIRCUITS

PA108	PA223	PA335	PD455
PA113	PA230	PA350	PD460
PA116	PA234	PA351	PD474
PA126	PA237	PA424	
PA189	PA238	PA908	
PA222	PA246	PD436	

SILICON DIODES

SIGNAL DIODES
Planar Expitaxial

1N914	1N4150	1N4447	1N4607
1N914A	1N4151	1N4448	1N4608
1N914B	1N4152	1N4449	1N4727
1N916	1N4153	1N4450	1N4828
1N916A	1N4154	1N4451	1N4863
1N916B	1N4305	1N4453	1N4864
1N4148	1N4444	1N4454	
1N4149	1N4446	1N4606	

Multipellet Diodes and Stabistors

1N4156	1N4829	1N5179	MDP300
1N4157	1N4830	MDP200	MDP400

Matched Pairs and Quads

1N4306 (MP-1) 1N4307 (MQ-1) MP-2 MQ-2

GERMANIUM DIODES

GOLD-BONDED AND POINT-CONTACT TYPES

1N34	1N38B	1N54	1N60
1N34A	1N48	1N54A	1N60A
1N34AS	1N50	1N56	1N60C
1N35	1N51	1N56A	1N60D
1N38	1N52	1N58	1N61
1N38A	1N52A	1N58A	1N62
1N63	1N114	1N287	1N542
1N64	1N115	1N288	1N616
1N65	1N116	1N289	1N617
1N66	1N117	1N290	1N618
1N66A	1N117A	1N291	1N631
1N67	1N118	1N292	1N632
1N67A	1N118A	1N294	1N633
1N68	1N119	1N294A	1N634
1N68A	1N120	1N295	1N636
1N69	1N126	1N295A	1N700
1N69A	1N126A	1N297	1N771
1N70	1N127	1N297A	1N771A
1N70A	1N127A	1N298	1N771B
1N75	1N128	1N298A	1N772
1N81	1N128A	1N308	1N772A
1N81A	1N139	1N309	1N773
1N82A	1N140	1N310	1N773A
1N86	1N141	1N312	1N774
1N87A	1N142	1N313	1N774A
1N88	1N143	1N355	1N775
1N89	1N144	1N447	1N776
1N90	1N145	1N448	1N777
1N95	1N191	1N449	1N781
1N96	1N192	1N450	1N781A
1N96A	1N198	1N452	1N805
1N97	1N198A	1N453	1N909
1N97A	1N198B	1N454	1N910
1N98	1N265	1N455	1N911
1N98A	1N266	1N476	1N949
1N99	1N267	1N478	1N996
1N99A	1N268	1N480	1N3121
1N100	1N270	1N490	1N3125
1N100A	1N273	1N497	1N3225
1N102	1N276	1N498	1N3465
1N107	1N277	1N499	1N3466
1N108	1N278	1N500	1N3573
1N111	1N279	1N501	1N3769
1N112	1N281	1N502	
1N113	1N283	1N541	

TUNNEL DIODES

GENERAL PURPOSE

1N3712	1N3715	1N3718	1N3721
1N3713	1N3716	1N3719	TD-9
1N3714	1N3717	1N3720	

LOW-COST

TD-710	TD-714	TD-717	
TD-712	TD-715	TD-718	
TD-713	TD-716	TD-719	

ULTRA-HIGH-SPEED SWITCHING

TD-251	TD-253	TD-254A	TD-256A
TD-251A	TD-253A	TD-255	
TD-252	TD-253B	TD-255A	
TD-252A	TD-254	TD-256	

MICROWAVE

TD-401	TD-411	TD-421	TD-431
TD-402	TD-412	TD-422	TD-432
TD-403	TD-413	TD-423	TD-433
TD-404	TD-414	TD-424	TD-434
TD-405	TD-415	TD-425	TD-435
TD-406	TD-416	TD-426	TD-436
TD-407	TD-417	TD-427	TD-437
TD-408	TD-418	TD-428	TD-438
TD-409	TD-419	TD-429	TD-439

BACK DIODES

1N4090	BD-4	BD-402	BD-406
BD-1	BD-5	BD-403	BD-407
BD-2	BD-6	BD-404	
BD-3	BD-7	BD-405	

OPTO-ELECTRONIC DEVICES

LIGHT DETECTORS
Light-Activated SCS
L1V

Photo Transistor
L14A502

Photo Darlington Amplifier
L14B

Microphoto Diodes — NPN

31F2	32F2	33F2	34F2
30F2			

Light-Activated SCR's

L8A	L9A	L811A	L911A
L8F	L9F	L811F	L911F
L8U	L9U	L811U	L911U

POWER SEMICONDUCTORS

SILICON POWER TRANSISTORS

NPN PASSIVATED MESA

2N497	2N657A	2N2201	2N2727
2N497A	2N2017	2N2202	2N2995
2N498	2N2106	2N2203	D7A30
2N498A	2N2107	2N2204	D7A31
2N656	2N2108	2N2239	D7A32
2N656A	2N2196	2N2611	
2N657	2N2197	2N2726	

RECTIFIER DIODES

GERMANIUM LOW-CURRENT
Up to 1200 mA, Up to 400 PRV

1N91	1N151	1N158	JAN 1N93A
1N92	1N152	1N315	
1N93	1N153	1N368	

SILICON SUBMINIATURE GLASS
Lead-mounted — Up to 600 mA, Up to 600 PRV

1N645	1N676	1N683	1N3544
1N645A	1N677	1N684	1N3545
1N646	1N678	1N685	1N3546
1N647	1N679	1N686	1N3547
1N648	1N681	1N687	1N3548
1N649	1N682	1N689	1N3549

SILICON LOW-CURRENT
Flangeless — Up to 1.0 A, Up to 800 PRV

1N2610	1N2614	1N3191	1N3642
1N2611	1N2615	1N3639	
1N2612	1N3189	1N3640	
1N2613	1N3190	1N3641	

Lead-mounted — Up to 1.5A, Up to 1000 PRV

1N440	1N442B	1N445	1N539
1N440B	1N443	1N445B	1N540
1N441	1N443B	1N536	1N547
1N441B	1N444	1N537	1N560
1N442	1N444B	1N538	1N599
1N599A	1N604	1N1101	1N1692
1N600	1N604A	1N1102	1N1693
1N600A	1N605	1N1103	1N1694
1N601	1N605A	1N1487	1N1695
1N601A	1N606	1N1488	1N1696
1N602	1N606A	1N1489	1N1697
1N602A	1N1095	1N1490	
1N603	1N1096	1N1491	
1N603A	1N1100	1N1492	

Glass-encapsulated, Passivated — Up to 1.0 A, Up to 800 PRV, Transient-protected

1N5059	1N5061	A14A	A14P
1N5060	1N5062	A14F	

Stud-mounted — Up to 3.3A, Up to 1000 PRV

1N253	1N1116	1N1124	1N1127
1N254	1N1117	1N1124A	1N1128
1N255	1N1118	1N1125	1N1128A
1N256	1N1119	1N1126	
1N1115	1N1120	1N1126A	

Rectifier Diodes continued on next page.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

SEMICONDUCTOR PRODUCTS DEPT.
GENERAL ELECTRIC

SEMICONDUCTOR PRODUCTS

POWER SEMICONDUCTORS

RECTIFIER DIODES (Cont'd)

SILICON MEDIUM-CURRENT
Up to 20A, Up to 1000 PRV

1N1199A	1N1346A	1N3213	A40B
1N1200A	1N1347A	1N3214	A40C
1N1201A	1N1348A	1N3569	A40D
1N1202A	1N1612	1N3570	A40E
1N1203A	1N1613	1N3571	A40F
1N1204A	1N1614	1N3572	A40M
1N1205A	1N1615	1N3573	A44A
1N1206A	1N1616	1N3574	A44B
1N1341A	1N3208	1N3670A	A44C
1N1342A	1N3209	1N3671A	A44D
1N1343A	1N3210	1N3672A	A44E
1N1344A	1N3211	1N3673A	A44F
1N1345A	1N3212	A40A	A44M

Fast Recovery, Stud-mounted — Up to 30A, Up to 400 PRV, 100 Nanoseconds

1N3879	1N3892	1N3910	A28F
1N3880	1N3893	1N3911	A129M
1N3881	1N3899	1N3912	A129N
1N3882	1N3900	1N3913	A129P
1N3883	1N3901	A28A	A129PB
1N3889	1N3902	A28B	A139M
1N3890	1N3903	A28C	A139N
1N3891	1N3909	A28D	A139P

Up to 35A, Up to 1000 PRV

1N248C	1N1187	1N1198A	1N2160
1N249C	1N1188	1N2154	1N3765
1N250C	1N1189	1N2155	1N3766
1N1183	1N1190	1N2156	1N3767
1N1184	1N1195A	1N2157	1N3768
1N1185	1N1196A	1N2158	
1N1186	1N1197A	1N2159	

SILICON HIGH-CURRENT
Up to 160A, Up to 1200 PRV (1500 Trans. PRV)

1N3260	1N3269	1N3293 (A70M)
1N3261	1N3270	1N3294 (A70N)
1N3262	1N3271	1N3295 (A70P)
1N3263	1N3272	1N3296 (A70PB)
1N3264	1N3273	A70S
1N3265	1N3289 A70B)	A70T
1N3266	1N3290 (A70C)	A70PA
1N3267	1N3291 (A70D)	
1N3268	1N3292 (A70E)	

Up to 500A, Up to 1800 PRV (2000 Trans. PRV)

1N3735 (A90A)	A291PN	A296M	A540D
1N3736 (A90B)	A291PS	A296N	A540E
1N3737 (A90C)	A292PC	A296P	A540L
1N3738 (A90D)	A292PD	A296S	A540M
1N3739 (A90E)	A292PE	A296T	A540N
1N3740 (A90M)	A292PM	A296PA	A540P
1N3741 (A90N)	A292PN	A296PB	A540S
1N3742 (A90P)	A292PS	A296PC	A540T
1N4044	A295B	A296PD	A540PA
1N4045	A295C	A296PE	A540PB
1N4046	A295D	A296PM	A540PC
1N4047	A295E	A296PN	A540PD
1N4048	A295M	A296PS	A540PE
1N4049	A295N	A29620	A540PM
1N4050	A295P	A390A	A540PN
1N4051	A295S	A390B	A540PS
1N4052	A295T	A390C	A540PT
1N4053	A295PA	A390D	A570A
1N4054	A295PB	A390E	A570C
1N4055	A295PC	A390M	A570D
1N4056	A295PD	A390N	A570E
A90S	A295PE	A390P	A570M
A90T	A295PM	A390S	A570N
A90PA	A295PN	A390T	A570P
A90PB	A295PS	A390PA	A570S
A291PC	A296B	A390PB	A570T
A291PD	A296C	A540A	
A291PE	A296D	A540B	
A291PM	A296E	A540C	

TRIODE THYRISTERS (SCR's)

SILICON LOW-CURRENT
0.5 to 4.0A (RMS), Up to 400 PRV

2N877	2N1597	2N2323A	2N2344
2N878	2N1598	2N2324	2N2345
2N879	2N1599	2N2324A	2N2346
2N880	2N1929	2N2325	2N2347
2N881	2N1930	2N2325A	2N2348
2N884	2N1931	2N2326	C6A
2N885	2N1932	2N2326A	C6B
2N886	2N1933	2N2327	C6F
2N887	2N1934	2N2327A	C6G
2N888	2N1935	2N2328	C6U
2N889	2N2322	2N2328A	
2N1595	2N2322A	2N2329	
2N1596	2N2323	2N2329A	

Flat Pack — 4.2A (RMS), Up to 300 PRV

C106A1 thru C106A41	C106F1 thru C106F41
C106B1 thru C106B41	C106Q1 thru C106Q41
C106C1 thru C106C41	C106Y1 thru C106Y41

SILICON MEDIUM-CURRENT
7.4 thru 35A (RMS), Up to 1200 PRV

2N681	2N3650	C20C	C35G
2N682	2N3651	C20D	C35H
2N683	2N3652	C20F	C35M
2N684	2N3653	C20U	C35N
2N685	2N3654	C22A	C35S
2N686	2N3655	C22B	C35U
2N687	2N3656	C22C	C37A
2N688	2N3657	C22D	C37B
2N689	2N3658	C22F	C37C
2N690	2N3753	C22U	C37D
2N691	2N3754	S30A	C37E
2N692	2N3755	C30B	C37F
2N1770	2N3756	C30C	C37M
2N1770A	2N3757	C30D	C37N
2N1771	2N3758	C30F	C37S
2N1771A	2N3759	C30U	C37U
2N1772	2N3760	C31A	C38A
2N1772A	2N3761	C31B	C38B
2N1773	2N5204	C31C	C38C
2N1773A	2N5205	C31D	C38D
2N1774	2N5206	C31F	C38E
2N1774A	2N5207	C31U	C38F
2N1775	C12A	C32A	C38G
2N1775A	C12B	C32B	C38H
2N1776	C12C	C32C	C38U
2N1776A	C12F	C32D	C40A
2N1777	C12G	C32F	C40B
2N1777A	C12H	C32U	C40C
2N1778	C12U	C33A	C40D
2N1842	C15A	C33B	C40F
2N1843	C15B	C33C	C40G
2N1844	C15C	C33D	C40N
2N1845	C15D	C33F	C40U
2N1846	C15E	C33U	C122B
2N1847	C15F	C35A	C122D
2N1848	C15G	C35B	C122F
2N1849	C15H	C35C	C137E
2N1850	C15M	C35D	C137M
2N2619	C20A	C35E	C137N
2N3649	C20B	C35F	C137PB

SILICON HIGH-CURRENT
55 thru 1100A (RMS), Up to 1800 PRV

2N1792	2N1913	2N2030	C45S
2N1793	2N1914	C45A	C45T
2N1794	2N1915	C45B	C45U
2N1795	2N1916	C45C	C46A
2N1796	2N2023	C45D	C46B
2N1797	2N2024	C45E	C46C
2N1798	2N2025	C45F	C46D
2N1909	2N2026	C45G	C46E
2N1910	2N2027	C45H	C46F
2N1911	2N2028	C45M	C46G
2N1912	2N2029	C45N	C46H
C46M	C145P	C182D	C380N
C46N	C145PA	C180E	C380P
C46S	C145PB	C180M	C380S
C46T	C150E	C180N	C380T
C46U	C150M	C180P	C380PA
C50A	C150N	C180S	C380PB
C50B	C150P	C180T	C380PC
C50C	C150S	C180PA	C385A
C50D	C150T	C180PB	C385B
C50E	C150PA	C180PC	C385C
C50F	C150PB	C185A	C385D
C50G	C150PC	C185B	C385E
C50H	C151E	C185C	C385M
C50M	C151M	C185D	C501N
C50N	C151N	C185E	C501P
C50S	C151P	C185M	C501S
C50T	C151S	C280N	C501T
C50U	C151T	C280P	C501PA
C52A	C151PA	C280S	C501PB
C52B	C152E	C280T	C501PC
C52C	C152M	C280PA	C501PD
C52D	C152N	C280PB	C501PE
C52E	C152P	C280PC	C501PM
C52F	C152S	C280PE	C501PS
C52G	C152T	C280PM	C506A
C52H	C152PA	C280PS	C506B
C52M	C152PB	C290A	C506C
C52N	C152PC	C290B	C506D
C52S	C153E	C290C	C506E
C52T	C153M	C290D	C506M
C52U	C153N	C290E	C507A
C55A	C153P	C290F	C507B
C55B	C153S	C290M	C507C
C55C	C153T	C290N	C507D
C55D	C153PA	C290P	C507E
C55E	C154A	C290S	C507M
C55F	C154B	C290T	C507N
C55G	C154C	C290PA	C507P
C55H	C154D	C290PB	C507S
C55M	C154E	C291E	C507T
C55U	C155A	C291M	C507PA
C56A	C155B	C291N	C507PB
C56B	C155C	C291P	C507PC
C56C	C155D	C291S	C507PD
C56D	C155E	C291T	C508A
C56E	C156A	C291PA	C508B
C56F	C156B	C291PB	C508C
C56G	C156C	C350E	C508D
C56H	C156D	C350M	C508E
C56M	C156E	C350N	C508M
C56U	C157A	C350P	C508N
C60A	C157B	C350S	C508P
C60B	C157C	C350T	C508S
C60C	C157D	C350PA	C508T
C60D	C157E	C350PB	C508PA
C60E	C158E	C350PC	C508PB
C60F	C158M	C354A	C510A
C60G	C158N	C354B	C510B
C60H	C158P	C354C	C510C
C60U	C158S	C354D	C510D
C62A	C158T	C354E	C510E
C62B	C158PA	C354M	C510M
C62C	C158PB	C355A	C510S
C62D	C159E	C355B	C520A
C62E	C159M	C355C	C520B
C62F	C159N	C355D	C520C
C62G	C159P	C355E	C520D
C62H	C159S	C355M	C530A
C62U	C159T	C380A	C530B
C145E	C159PA	C380B	C530C
C145M	C159PB	C380C	C530D
C145N	C180A	C380D	C530E
C145S	C180B	C380E	C530M
C145T	C180C	C380M	

Water- and Air-Cooled SCR's
Up to 1200A (RMS), Up to 1800 V Blocking

C28120	C29120	C500	C501

SEMICONDUCTOR PRODUCTS

POWER SEMICONDUCTORS

RECTIFIER DIODE STACKS

GERMANIUM LOW-CURRENT
A211 — up to 6A at 55 C amb or 630 PRV

SILICON LOW-CURRENT
A411, A1011—up to 18A at 25 C amb or 3360 PRV

SILICON MEDIUM-CURRENT
A2011, A2511, A3511 — up to 65A at 55 C amb or 1800 PRV
A3512 (5″ fin) — up to 108A at 55 C amb or 1800 PRV

POTTED RECTIFIER DIODE CIRCUITS
A220 — up to 0.4A at 55 C amb or 1800 PRV
A420 — up to 2.0A at 50 C amb or 3000 PRV
A421 — up to 0.65A at 25 C amb or 10,000 PRV
A422 — up to 1.5A at 25 C amb or 2000 PRV

CONTROLLED AVALANCHE RECTIFIER DIODE IN POTTED ASSEMBLY
1N1730 — up to 0.1 A at 100 C amb or 5000 PRV
1N2382 — up to 0.075 A at 100 C amb or 10,000 PRV
A723 — up to 0.82 A at 50 C amb or 6000 PRV
A725 — up to 0.15 A at 100 C amb or 10,000 PRV

SILICON HIGH-CURRENT
A7011-7014, A9013, A9015-9016 — up to 690A at 40 C amb or 1000 PRV

SELENIUM RECTIFIER DIODES AND STACKS

Available in a variety of voltages and cell sizes, finishes and mountings that include low-cost epoxy encapsulated types, dual diode types, miniature tubular-catridge type, standard stud intermediate type, thyrector diodes, selenium arc suppressions, large plate stacks, copper oxide types, selenium computer diodes, and special miniature epoxy encapsulated thyrector diodes. Many others to suit individual needs.

CONTROLLED A-C SWITCHES

TRIAC — BI-DIRECTIONAL TRIODES FOR GATE-CONTROL OF A-C POWER

SC35A	SC40E	SC46B	SC51F
SC35B	SC40F	SC46D	3C60B
SC35D	SC41A	SC46E	SC60D
SC35E	SC41B	SC46F	SC60E
SC35F	SC41D	SC50A	SC61B
SC36A	SC41E	SC50B	SC61D
SC36B	SC41F	SC50D	SC61E
SC36D	SC45A	SC50E	SC141B
SC36E	SC45B	SC50F	SC141D
SC36F	SC45D	SC51A	SC146B
SC40A	SC45E	SC51B	SC146D
SC40B	SC45F	SC51D	
SC40D	SC46A	SC51E	

DIAC — BI-DIRECTIONAL TRIGGER DIODE FOR GATE TRIGGER OF TRIACs OR SCRs
ST2

TRIAC AND SCR ASSEMBLIES

S100 LINE
Seven circuit configurations with 6, 10, or 15 A TRIACS for 120 or 240 V (RMS) power lines.

S200 LINE
Zero-voltage switching AC power controllers for 10 and 15A; 120, 240, and 270 V service.

S300 LINE
With PA436 phase control IC for automatic control of AC motors and lamps.

SILICON CONTROLLED AVALANCHE RECTIFIER DIODES

HIGH-VOLTAGE UNITS WITH BUILT-IN VOLTAGE REGULATOR (ZENER) DIODE PROTECTION

IN4506	IN4509	IN4525	IN4528
IN4507	IN4510	IN4526	IN4529
IN4508	IN4511	IN4527	IN4530

1-WATT SILICON VOLTAGE REGULATOR (ZENER) DIODES

IN1765, A	IN1769, A	IN1773, A	Z4X5.1A
IN1766, A	IN1770, A	IN1774, A	Z4X5.1B
IN1767, A	IN1771, A	IN1775, A	Z4X14A
IN1768, A	IN1772, A	IN1776, A	Z4X14B

CUSTOMIZED ASSEMBLIES

Using discrete components, they are available in a variety of mechanical configurations, including printed circuit boards, potted modules, standard tube shells, and many special packages to meet individual needs.

SCR COMBINATION STACKS

A new concept in stack design that includes SCR's, compatible rectifiers, heatsinks, interconnections, and all hardware in one package. Installation requires only mounting bolts and electrical connections for power and triggering signal.

HIGH RELIABILITY TYPES

Type	Nearest Com'l Type	Type	Nearest Com'l Type
A4DR1200	1N540	A38BR1200	1N2156
A6MR1200	1N649	A38BR1201	1N4525
A16MR1200	1N3191	A38BR1202	1N3911
A27BR1200	1N1202	A38DR1200	1N2158
A27BR1201	1N4506	A38DR1201	1N4526
A27DR1200	1N1204	A38DR1202	1N3913
A27DR1201	1N4507	A38MR1200	1N2160
A27MR1200	1N1206	A38MR1201	1N4527
A27MR1201	1N4508	C5AR1200	2N2324
A28BR1200	A28B	C5BR1200	2N2326
A28BR1201	1N3891	C5DR1200	2N2329
A28DR1200	A28D	C11DR1200	2N1777
A28DR1201	1N3893	C35DR1200	2N688

MILITARY TYPES

SILICON CONTROLLED RECTIFIERS

Military Spec MIL-S-19500	Type
/108B (Amd 1)	JAN 2N682, 3, 5-9
/168B	JAN 2N1771A, 2A, 4A, 6A, 7A
/204A (Amd 1)	JAN 2N1910W, 11W, 13W, 15W, 16W, JAN 2N2031W
/276 (Amd 1)	JAN 2N2323, 4, 6; 2N2323A, 4A, 6A

TRANSISTORS AND DIODES

Military Spec MIL-S-19500	Type	Military Spec MIL-S-19500	Type
/6A	JAN 2N43A, 44A	/90 (Amd 1)	JAN 2N78A
/11B	JAN 2N167A	/116D	JAN 1N4148 JAN TX1N4148
/30 (Amd 2)	JAN 2N123		
/37	JAN 26333, 35, 36	/126B	JAN 2N1303, JAN 1305, 07
/45 (Amd 2)	JAN 2N461		
/60D	JAN 2N526	/144D	JAN 1N4454, JAN TX1N4454
/64C	JAN 2N396A		
/69D (Amd 1)	JAN 2N337, 38	/269	JAN 1N3713, 15, JAN 2N3717, 19, 21
/74D (Amd 1)	JAN 2N497, 98 JAN 2N656,57		
/75B	JAN 2N489A thru 94A	/207B (Amd 1)	JAN 2N2060, JAN TX2N2060

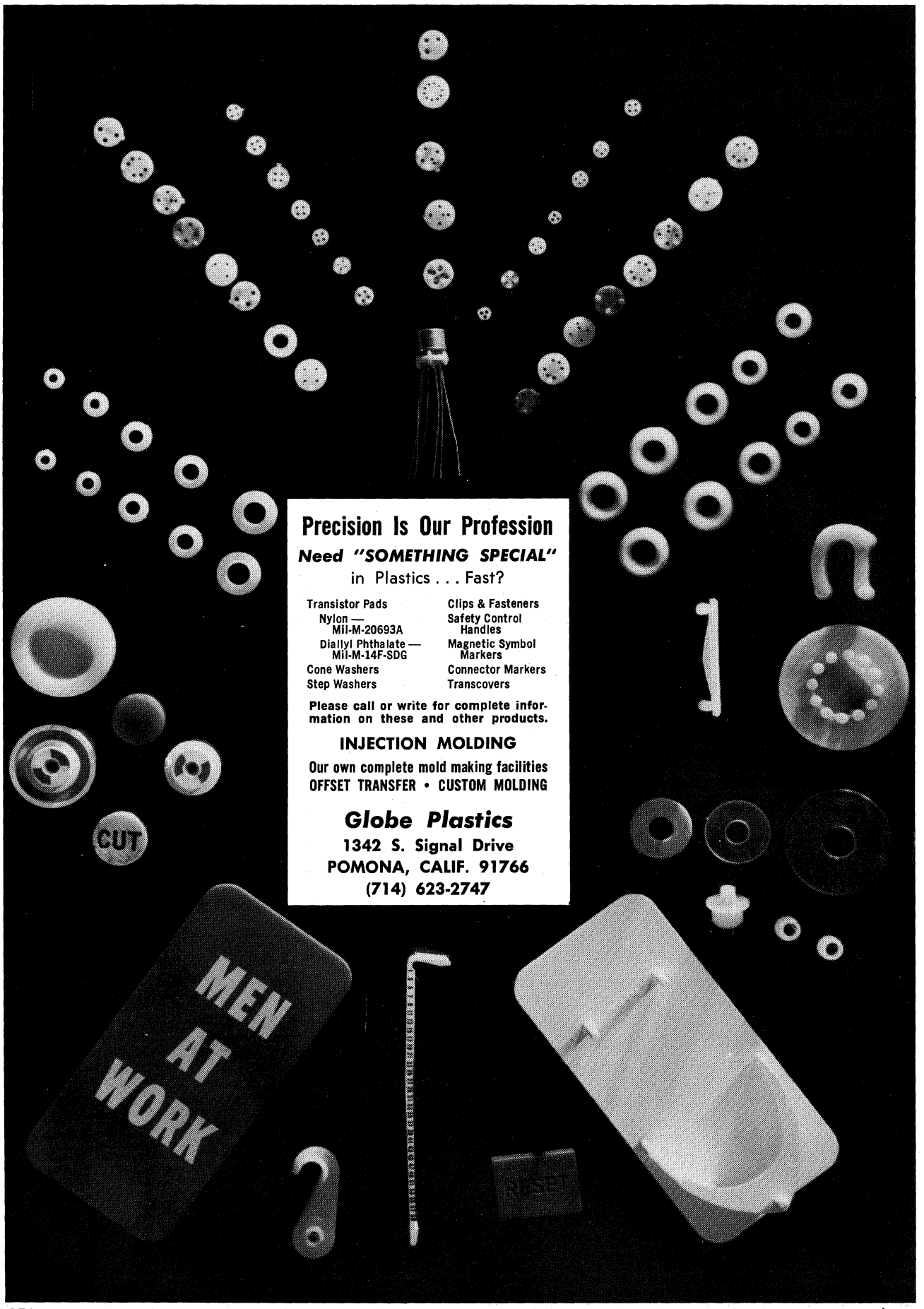
SILICON AND GERMANIUM RECTIFIER DIODES‡

Military Spec MIL-S-19500	Type
/134A	JAN 1N249B, JAN 1N250B, JAN 1N2135A
/155C	JAN 3189, 90, 91; JAN TX1N3189, 90, 91
/162B (Amd 3)	JAN 1N614,R; 15,R; 16,R
/202A (Amd 2)	JAN 1N538, 40, 47
/240B (Amd 1)	JAN 1N645, 47, 49; JAN TX1N645, 47, 49
/246C (Amd 1)	JAN 1N3289,R; 91,R; 93,R; 94,R; 95,R
/260A	JAN 1N1202, 04, 06
/266B	JAN 1N3879, 80, 81, 82, 83
/293A	JAN 1N93A
/297 (Amd 2)	JAN 1N1184, 86, 88
/304A	JAN 1N3889, 90, 91, 92, 93
/308 (Amd 3)	JAN 1N3909, 10, 11, 12, 13

‡ JAN 1N93A is germanium, all others are silicon.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

SEMICONDUCTOR PRODUCTS DEPT.
GENERAL ELECTRIC



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TR SERIES TRANSISTOR RADIATORS

SELF-ADJUSTING TO THE FOLLOWING OUTLINES:

TO-5	TO-12	TO-33	TO-43
TO-9	TO-16	TO-39	
TO-11	TO-29	TO-42	

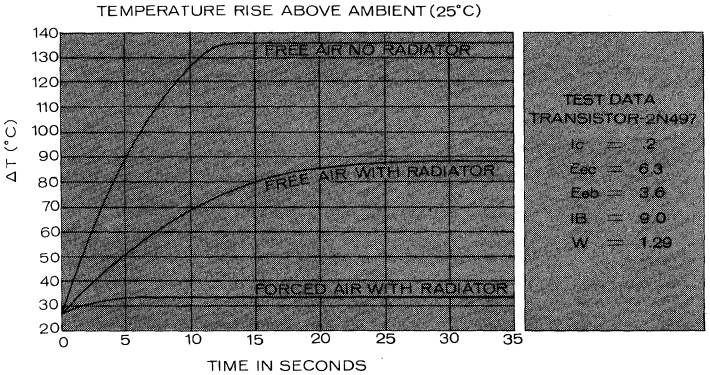
SPECIFICATIONS:

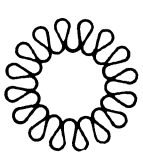
MATERIAL . . . . . BERYLLIUM COPPER #25
FINISH . . . ALL STANDARD FINISHES AVAILABLE

FEATURES:

• PROTECTS SOLID STATE DEVICES AGAINST DESTRUCTIVE HEAT RISE • REDUCES STOCK INVENTORY • OTHER SIZES AND MOUNTING ACCESSORIES AVAILABLE.

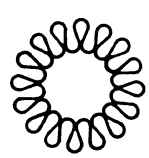
TEMPERATURE RISE ABOVE AMBIENT (25°C)



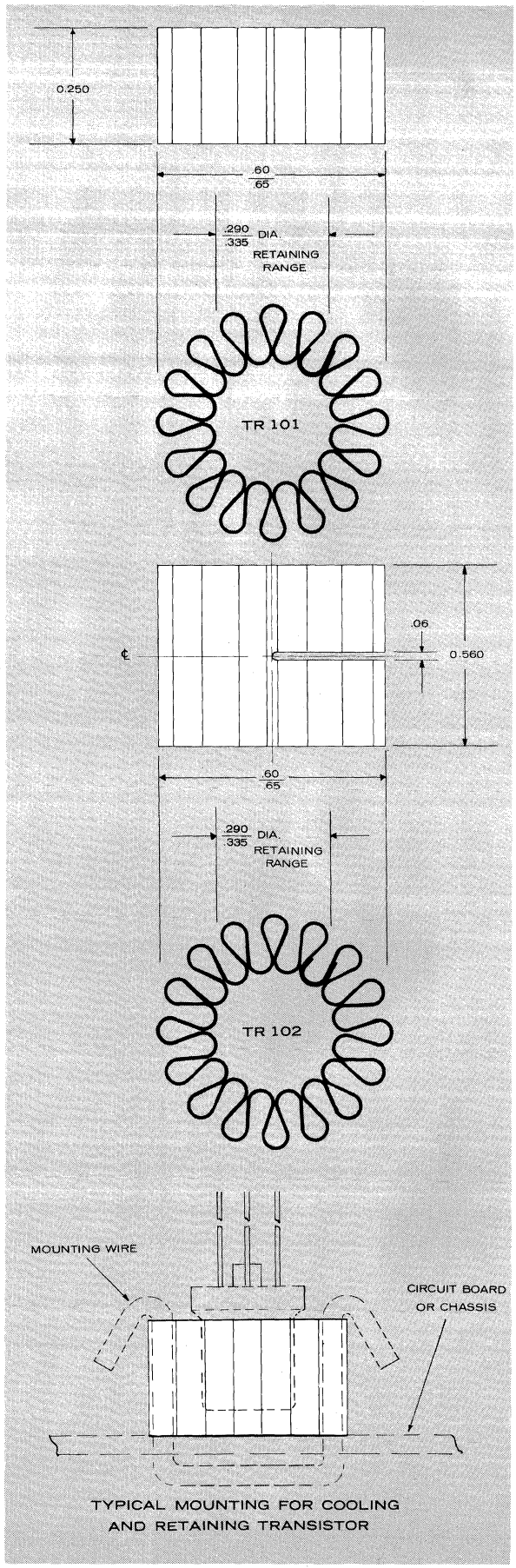


TR 101 AND TR 102 ORDERING INFORMATION

SPECIFY MODEL NO.
EXAMPLE: TR 101
STD. FINISH BLACK EBANOL
OTHERS AVAILABLE TO ORDER



INLAND ELECTRONIC PRODUCTS CORPORATION
403 SO. RAYMOND ST. • PASADENA, CALIF. 91101 • 213-681-9579



TYPICAL MOUNTING FOR COOLING AND RETAINING TRANSISTOR

THE ADVANCED LINE OF HALL EFFECT DEVICES AND MAGNETORESISTORS FOR

DETECTION
MEASUREMENT
COMPUTATION
CONTROL
PROBES
MULTIPLIERS
MODULATORS
TAPE HEADS
CURRENT MEASURING RINGS
PICK-UPS
WATTMETERS
TRANSDUCERS

ISC MAGNETICS DIVISION products are the result of over fifteen years research, development and application engineering on Hall Effect components and magneto-resistors for a broad range of detection, measurement, computation and control applications.

More than 30 different Hall generators and 15 different magnetoresistors, all in stock for immediate delivery, are available as standard catalog items.

Our applications engineering staff is at your disposal to discuss requirements for "black boxes" and complete systems involving processing, material handling, current regulation, and other automatic controls for military, space, and industrial applications.

COMPLETE GALVANOMAGNETIC DEVICE CATALOG AVAILABLE.



ISC

PARTIAL LIST OF HALL GENERATORS

Nomenclature		Type	Sens. V/AKG	Control Current (MA)	Input/Ouput Resistance	Size L/W/T (D)	Price
Transverse Field Probes	Flexible	FA-22e	0.063	150	2	4.00/.120/.032	$ 33.00
	General	EA-218	0.085	100	3	.280/.128/.020	19.00
	Precision	FC-33	0.145	100	5	.600/.320/0.060	91.44
	Thin	SBV-525	0.097	100	2.5	.800/.080/.012	79.00
	Ultrathin	RHY-19	0.150	100	3.5	.880/.088/.006	198.00
Axial Field Probes	General	RHY-11	0.07	150	3	0.180	28.34
	Small	SBV-552	0.04	100	1.5	0.148	71.46
	Ultra small	RHY-10	0.07	100	2	0.150	66.50

Nomenclature		Type	Sens. V/AKG	Control Current (MA)	Input/Output Resistance	Size L/W/T (D)	Price
Special Environment Field Probes	−269 to +80°C Axial	RHY-18	0.6	35	30	0.160	$33.25
	−269 to +80°C Transverse	RHY-17	0.6	60	30	0.360 x 0.172 x 0.020	30.25
	−70 to +230°C Transverse	SV-210X	0.6	60	30	0.320 x 0.140 x 0.020	47.25

Numerous other probes, including thin film and ferrite embedded types are described in our catalog and all are stocked for immediate delivery.

Multiplers and current sensing yoke assemblies using Hall Generators or Magnetoresistors can be designed to OEM requirements.

MAGNETORESISTORS

More than 15 different magnetoresistors are stocked covering a wide range of zero field resistances (47 to 5,000 ohms), units with resistance changes of from 1.5 to 3.2 and temperature coefficients of from −0.05 to −0.40%/°C.

MAGNETICS ISC DIVISION

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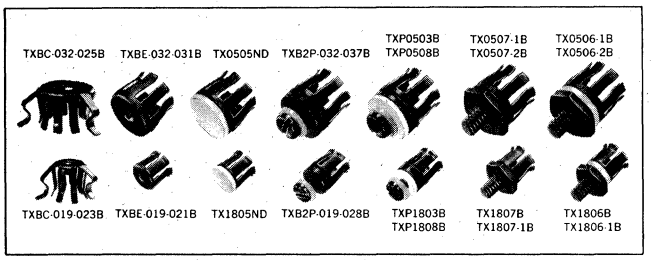
IERC

Semiconductor Heat Sinks/Dissipators

THERMAL-LINK RETAINERS — FOR TO-5, TO-18 TYPE TRANSISTORS



Efficient retainers and heat sinks when mounted to P-C boards due to their excellent conductivity and extra mass. Also efficient thermal links between transistor and chassis or heat sink. Beryllium copper spring fingers firmly retain transistors, fit wide case diameter variations; make transistor insertion and removal easy. Available with BeO washer for high frequency applications. Send for Bulletins 141 and 144.

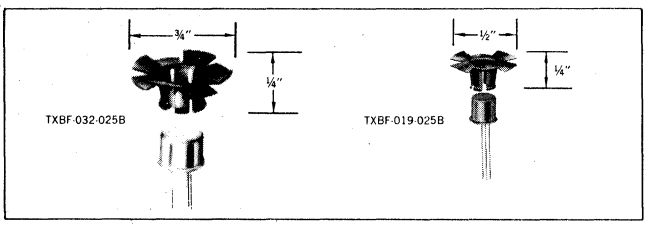
IERC PART NO. THERMAL-LINK WITH BeO	TRANSISTOR CASE SIZE	MOUNTING METHOD	QUANTITY PRICES 1-9	10-24	25-49	50-99	100-499
TXP1803B *	ALL TO-18	2-56 SCREW†	1.67	1.53	1.39	1.25	1.12
TXP1808B **	ALL TO-18	2-56 SCREW†	2.70	2.48	2.25	2.03	1.80
TXP0503B *	ALL TO-5	4-40 SCREW†	1.67	1.53	1.39	1.25	1.12
TXP0508B **	ALL TO-5	4-40 SCREW†	2.70	2.48	2.25	2.03	1.80
TX1805ND **	ALL TO-18	SOLDER	2.70	2.48	2.25	2.03	1.80
TX0505ND **	ALL TO-5	SOLDER	2.70	2.48	2.25	2.03	1.80
TX1806B ***	ALL TO-18	4-40 STUD	3.00	2.75	2.50	2.25	2.00
TX1806-1B ***	ALL TO-18	6-32 STUD	3.00	2.75	2.50	2.25	2.00
TX0506-1B ***	ALL TO-5	6-32 STUD	3.00	2.75	2.50	2.25	2.00
TX0506-2B ***	ALL TO-5	10-32 STUD	3.00	2.75	2.50	2.25	2.00

For dimensions of Thermal-Link retainers with BeO add .06" to height dimension of standard Thermal-Link retainers.

IERC PART NO. STANDARD THERMAL-LINK	DIMENSIONS DIA.	HEIGHT	TRANSISTOR CASE SIZE	MOUNTING METHOD	QUANTITY PRICES 1-24	25-99	100-499	500-999
TXBC-019-023B	.43"	.23"	ALL TO-18	SPRING CLIP	.35	.305	.27	.24
TXBC-032-025B	.56"	.25"	ALL TO-5	SPRING CLIP	.35	.305	.27	.24
TXBE-019-021B	.22"	.21"	ALL TO-18	RIVET OR SOLDER	.275	.245	.22	.195
TXBE-032-031B	.37"	.31"	ALL TO-5	RIVET OR SOLDER	.275	.245	.22	.195
TXB2P-019-028B	.22"	.28"	ALL TO-18	2-56 SCREW†	.61	.54	.49	.44
TXB2P-032-037B	.37"	.37"	ALL TO-5	4-40 SCREW†	.61	.54	.49	.44
TX1807B	.25"	.50"	ALL TO-18	4-40 STUD	.99	.88	.79	.70
TX1807-1B	.25"	.50"	ALL TO-18	6-32 STUD	.99	.88	.79	.70
TX0507-1B	.37"	.59"	ALL TO-5	6-32 STUD	.99	.88	.79	.70
TX0507-2B	.37"	.59"	ALL TO-5	10-32 STUD	.99	.88	.79	.70
TXBP-050-037B	.54"	.37"	ALL TO-8	4-40 SCREW†	1.70	1.53	1.36	1.19

*Separate BeO washer. **BeO washer brazed to dissipator. ***BeO washer brazed between stud and dissipator. †Screw and shouldered nylon washer included. Letter "B" at end of part number denotes black cadmium finish; delete letter "B" for Insulube 448 finish; for dull nickel, substitute letters "ND". Contact your IERC representative or the factory regarding other transistor case sizes or finishes. Insulube 448 finish is a 500 volt dielectric coating.

"FAN TOP" SERIES — FOR TO-5, TO-18 TYPE TRANSISTORS

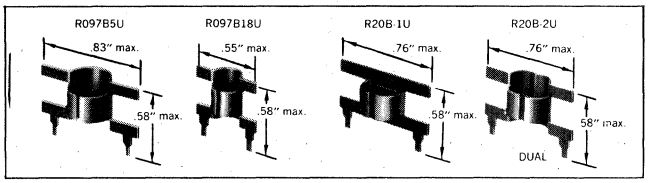


Low cost units give excellent case temperature reductions in natural or forced convection. Design allows location of other components close to transistors; adds virtually nothing to board height. Beryllium copper spring fingers firmly retain transistors, fit wide range of case diameters. Fast, press-fit installation without tools. Send for Bulletin 131.

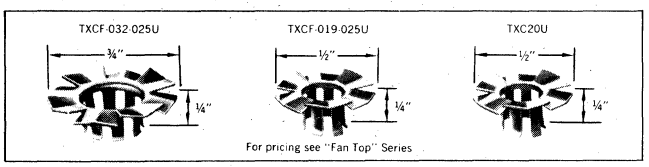
IERC PART NO.	TRANSISTOR CASE SIZE	QUANTITY PRICES 1-24	25-99	100-499	500-999	1000-2499
TXBF-032-025B	All .305" to .335" cases (TO-5, TO-9, etc.)	.21	.185	.165	.145	.125
TXBF-019-025B	All .178" to .196" cases (TO-18, etc.)	.21	.185	.165	.145	.125
TXCF-032-025U	All .305" to .335" cases (TO-5, TO-9, etc.)	.113	.092	.076	.069	.062
TXCF-019-025U	All .178" to .196" cases (TO-18, etc.)	.10	.082	.068	.061	.055
TXC20U	X-20, "D" Style	25-49 .085	50-99 .076	100-249 .068	250-499 .061	500-999 .055

DISSIPATORS/RETAINERS FOR PLASTIC/CERAMIC TRANSISTORS

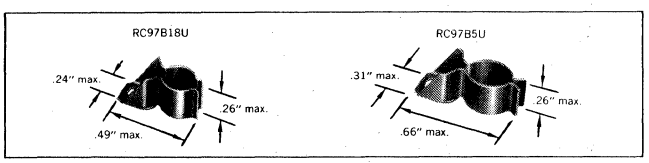
New IERC designs help you get maximum efficiency from epoxy semiconductors. Power ratings can be increased from 10% to 33% or additional operating safety margins provided. Send for Bulletin 148.



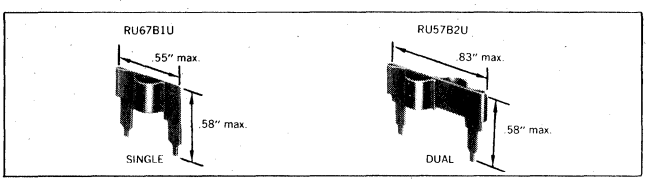
Spade-Type — Excellent dissipator and retainers. "Stand-off" legs provide positive 0.1" grid location for automatic insertion in P-C board; hold transistor above solder, eliminating possible thermal damage.



Fan-Top — Provides excellent dissipation with no loss in board area of vertical clearance space.



Clip-Type — Highly efficient dissipator retainer; also used as thermal-link or radiating device. Space and clip types excellent for RF shielding also.

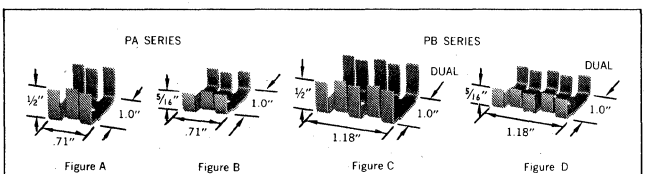


Universal-Type — Unique spring clip retainer accommodates variations in case diameters. Both single and dual models accept all popular D-case transistors. Exceptionally efficient. Permits increased power capabilities, higher operational safety margins, and provides good stability in adverse environments. Legs hold transistor away from solder heat. Dual model ideal for matched-pair applications. Send for Bulletin 150.

SPADE SERIES	QUANTITY PRICES 1-24	25-49	50-99	100-249	250-499	500-999
R097B5U	.072	.061	.054	.047	.040	.036
R097B18U	.066	.056	.049	.043	.036	.033
R20B-1U	.066	.056	.049	.043	.036	.033
R20B-2U	.069	.058	.051	.044	.037	.033
R20DB-1U	.066	.056	.049	.043	.036	.033
R20DB-2U	.069	.058	.051	.044	.037	.033
CLIP SERIES						
RC97B5U	.069	.058	.051	.044	.037	.033
RC97B18U	.066	.056	.049	.043	.036	.032
UNIVERSAL "D" SERIES						
RU67B1U	.072	.061	.054	.047	.040	.036
RU67B2U	.087	.074	.066	.058	.050	.042

*Above items are manufactured from commercial brass, no finish. Parts are also available made from beryllium copper. Available finishes are black oxide and black cadmium. Contact your IERC representative or the factory for information on alternate finishes.

PA AND PB SERIES — FOR FLAT RECTANGULAR PLASTIC CASES



Accommodates flat, rectangular, medium power thyristors, transistors and SCR's. Staggered fingered design and aluminum construction maximize dissipation. In natural convection a PA will allow a single X-58 or case 90 device to be operated with 80% more power. See Bulletin 149.

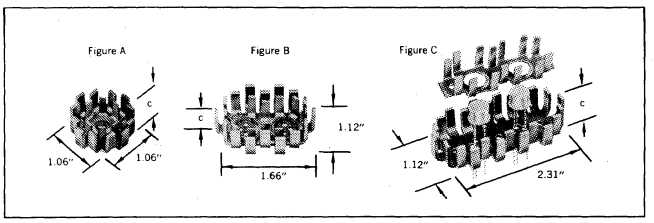
PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

IERC
INTERNATIONAL ELECTRONIC RESEARCH CORPORATION
a corporate division of DYNAMICS CORPORATION OF AMERICA
135 West Magnolia Blvd. Burbank, California 91508 213/849-2481

PA & PB SERIES	FIGURE NO.	QUANTITY PRICES					
		1-24	25-49	50-99	100-249	250-499	500-999
PA1U	A	.150	.128	.113	.098	.083	.072
PA1-1U	A	.150	.128	.113	.098	.083	.072
PA2U	B	.145	.123	.108	.093	.078	.069
PA2-1U	B	.145	.123	.108	.093	.078	.069
PB1U	C	.189	.160	.142	.124	.106	.090
PB1-2U	C	.189	.160	.142	.124	.106	.090
PB1-3U	C	.189	.160	.142	.124	.106	.090
PB2U	D	.180	.153	.135	.117	.099	.087
PB2-2U	D	.180	.153	.135	.117	.099	.087
PB2-3U	D	.180	.153	.135	.117	.099	.087

Commercial or Military black anodize available on request.

LP SERIES — FOR TO-5, TO-18 TYPE TRANSISTORS



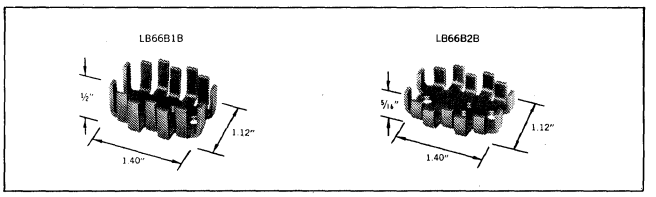
Versatile transistor cooling devices provide excellent heat dissipation in applications of low to high power transistors of TO-5 and TO-18 configurations. IERC's efficient staggered-finger configuration optimizes convection currents and radiating surface area. Available for single and multiple transistor mounting. Send for Bulletin 135.

IERC PART NO.	DIMENSION "C"	NUMBER OF TRANSISTORS	JEDEC OUTLINE NO.	FIGURE NO.	QUANTITY PRICES			
					1-24	25-99	100-249	250-499
LP5A1B	1/2"	1	TO-5, TO-9	A	.82	.73	.65	.60
LP5A2B	5/16"	1	TO-5, TO-9	A	.80	.71	.63	.58
LP18A1B	1/2"	1	TO-18	A	.82	.73	.65	.60
LP18A2B	5/16"	1	TO-18	A	.80	.71	.63	.58
LP18A3B	1/2"	2	TO-18	A	.98	.87	.78	.72
LP18A4B	5/16"	2	TO-18	A	.96	.85	.76	.70
LP5B1B	1/2"	1	TO-5, TO-9	B	.85	.76	.68	.62
LP5B2B	5/16"	1	TO-5, TO-9	B	.84	.75	.67	.61
LP5B3B	1/2"	2	TO-5, TO-9	B	1.02	.91	.82	.75
LP5B4B	5/16"	2	TO-5, TO-9	B	1.00	.89	.80	.73
LP5C1B	1/2"	1	TO-5, TO-9	C	.92	.82	.74	.67
LP5C2B	5/16"	1	TO-5, TO-9	C	.87	.78	.70	.64
LP5C3B	1/2"	2	TO-5, TO-9	C	1.08	.96	.87	.80
LP5C4B	5/16"	2	TO-5, TO-9	C	1.04	.93	.84	.77

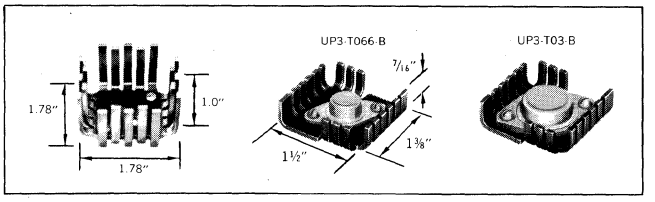
Note: Clamp sections may be used separately as retaining devices; change first two letters of the part number to "LC". Base section LB5A1B or LB5A2B may be used separately for TO-37 transistors such as 2N1172 and 2N1609. Delete letter "B" from part number for Insulube 448 finish. Consult your IERC representative or factory for special orders.

DISSIPATORS FOR CASE MOUNTED SEMICONDUCTORS

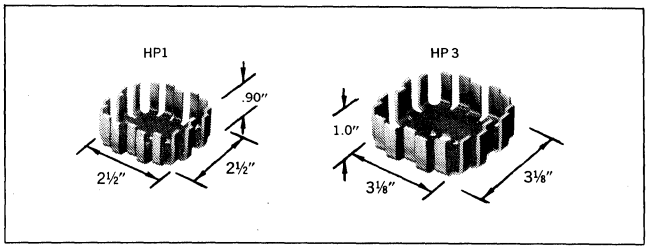
Standard LB, UP, HP, E1, E2 and E3 Series parts are aluminum with black anodize finish. However, all parts are available unplated, or with Insulube® 448 which provides positive insulation up to 500 volts. For Insulube® 448 finish delete letter "B" at end of part number. For unplated parts delete "B" and add "U".



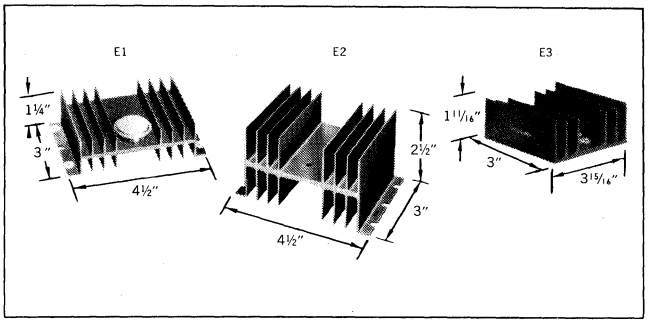
LB Series — For TO-66 Type Transistor Only — In natural convection the LB's efficient staggered-finger design dissipates 9 watts with case temperature held to less than 150°C. In forced air (1,000 FPM) the LB dissipates 15 watts with case temperature maintained at 90°C. Requires only 1.7 sq. in. of mounting area. Send for Bulletin 146.



UP Series — For Power Type Transistors and Diodes — Design gives maximum dissipation in medium power applications at lower cost than comparable finned extrusions. Staggered finger configuration allows maximum efficiency in both natural convection and forced air at less weight and volume. Increased dissipation achieved by mounting dissipators back-to-back on a bracket. Send for Bulletin 134.



HP Series — For Power Type Transistors and Diodes — Heat dissipating performance of IERC's staggered-finger design is comparable to conventional extrusions up to 3 times as heavy and 30% larger. Two sizes: may be used separately or with the smaller unit nested in the larger unit. Send for Bulletin 139.



Extrusions — E1, E2 and E3 Series — Optimized fin design gives the most power dissipation for volume and weight. Standard finish black anodize. Standard units supplied with mounting notches and choice of six popular semiconductor mounting hole patterns. Send for Bulletins 142 (E1 and E2) and 145 (E3).

IERC PART NO.	JEDEC OUTLINE NO.	QUANTITY PRICES			
		1-24	25-49	50-99	100-499
LB66B1B	TO-66	.31	.27	.24	.22
LB66B2B	TO-66	.27	.24	.22	.20
UP-000B *	BLANK	.78	.68	.62	.55
UP-TO3B *	TO-3	.78	.68	.62	.55
UP-TO6B *	TO-6	.78	.68	.62	.55
UP-TO15B *	TO-15	.78	.68	.62	.55
UP-TO66B *	TO-66	.78	.68	.62	.55
UP-TOV-7B *	UNIVERSAL **	.78	.68	.62	.55
UP3-000B	BLANK	.38	.34	.31	.28
UP3-TO3B	TO-3	.38	.34	.31	.28
UP3-TO66B	TO-66	.38	.34	.31	.28
HP1-000B	BLANK	.97	.86	.78	.71
HP1-TO3B	TO-3	.97	.86	.78	.71
HP1-TO6B	TO-6	.97	.86	.78	.71
HP1-TO15B	TO-15	.97	.86	.78	.71
HP1-TO66B	TO-66	.97	.86	.78	.71
HP1-TOV-2B	UNIVERSAL **	.97	.86	.78	.71
HP3-000B	BLANK	1.11	.99	.89	.79
HP3-TO3B	TO-3	1.11	.99	.89	.79
HP3-TO6B	TO-6	1.11	.99	.89	.79
HP3-TO15B	TO-15	1.11	.99	.89	.79
HP3-TO66B	TO-66	1.11	.99	.89	.79
HP3-TOV-2B	UNIVERSAL **	1.11	.99	.89	.79

*Above parts are 1" high; for ¾", add numeral "2" after first two letters of part number; for ½", add numeral "1" after first two letters; example: UP2-TO3-B describes a dissipator ¾" high, with TO-3 hole pattern and black anodize finish. For other hole patterns, see your IERC representative or consult the factory.

EXTRUSION TYPE	IERC PART NO.	TRANSISTOR MOUNTING HOLE PATTERN	QUANTITY PRICES				
			1-24	25-49	50-99	100-249	250-499
E1 and E3 ***	E1003-0600B	TO-3	1.62	1.38	1.30	1.12	.97
	E1006-0600B	TO-6	1.62	1.38	1.30	1.12	.97
	E1015-0600B	TO-15	1.62	1.38	1.30	1.12	.97
	E100V-0600B	UNIVERSAL **	1.62	1.38	1.30	1.12	.97
	E1066-0600B	TO-66	1.62	1.38	1.30	1.12	.97
	E1000-0600B	BLANK	1.38	1.18	1.11	.95	.82
E2	E2003-0600B	TO-3	2.28	1.94	1.86	1.57	1.35
	E2006-0600B	TO-6	2.28	1.94	1.86	1.57	1.35
	E2015-0600B	TO-15	2.28	1.94	1.86	1.57	1.35
	E2066-0600B	TO-66	2.28	1.94	1.86	1.57	1.35
	E200V-0600B	UNIVERSAL **	2.28	1.94	1.86	1.57	1.35
	E2000-0600B	BLANK	2.04	1.74	1.67	1.40	1.20

Note: Other lengths, in ½" increments are available. Specify non-standard hole patterns by JEDEC Outline Number, or by transistor type.

**Combination hole pattern for TO-3, TO-6, TO-36 or studs up to ¼" dia.

***For E3 configuration change first numeral of part no. to 3. For example E3000-0600B.

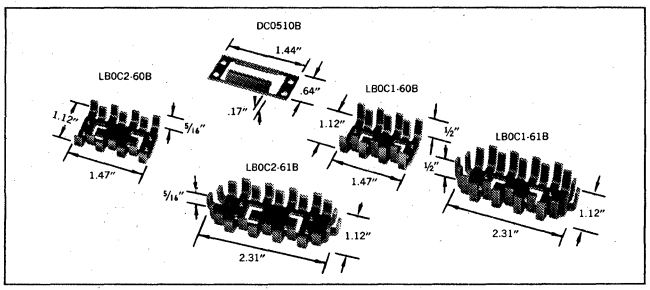
PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

IERC
INTERNATIONAL ELECTRONIC RESEARCH CORPORATION
a corporate division of DYNAMICS CORPORATION OF AMERICA
135 West Magnolia Blvd. Burbank, California 91508 213/849-2481

IERC — Semiconductor Heat Sinks/Dissipators and Tube Shields

PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

MICROCIRCUIT PACKAGE DISSIPATORS



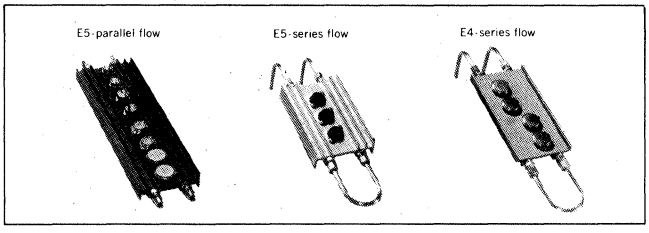
Models in this series consist of a retainer and dissipator. Retainer may be used alone to mount the package to a conduction plane, or used with the dissipator in radiation/convection modes. In natural convection, the LBOC2-60B with clamp dissipates 3.6 watts with a case temperature rise of 103°C. The slightly larger LBOC2-61B with clamp dissipates 5 watts with the same case temperature rise. All models incorporate IERC's efficient, patented staggered-finger design. Send for Bulletin 151.

IERC PART NO.	QUANTITY PRICES				
	1-24	25-49	50-99	100-499	500-999
Dissipator Base Component					
LBOC1-60B	.51	.47	.44	.41	.38
LBOC2-60B	.51	.47	.44	.41	.38
LBOC1-61B	.51	.47	.44	.41	.38
LBOC2-61B	.51	.47	.44	.41	.38
Retainer					
DC0510B	.51	.47	.44	.41	.38
Hardware for above Dissipator/Retainer Components					
Group A4*	.20	.18	.16	.14	.12

Retainer is made of beryllium copper and finished with black cadmium. Dissipator is fabricated of aluminum and finished with black anodize.

*Hardware sets consist of 4 screws, 4 nuts and washers. When ordering, specify quantity of sets required. (Example: 100 sets, Group A4 Hardware)

FLUID COOLED HEAT SINKS

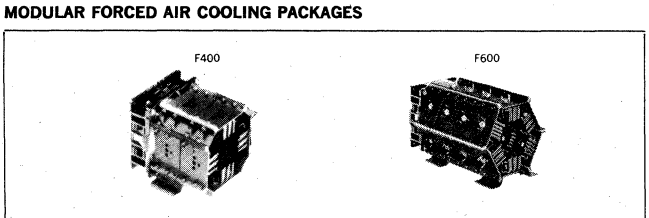


Compact, highly efficient aluminum heat sinks for power transistors and diodes. 1000 watts dissipation in less than 45 cu. in. Parallel or series flow; open or closed loop systems. Standard lengths from 6" to 4' in 1½" increments. All standard transistor hole patterns available. Standard ¼" tube fittings. Various finishes. Send for Bulletin 147.

IERC PART NO.	QUANTITY PRICES—PER FOOT			
	1-9	10-49	50-99	100-Over
E4 Series (one foot section) See Note*	14.00	11.60	9.25	8.25
E5 Series (one foot section) See Note*	14.50	12.10	10.25	8.75
Mounting Hole Pattern Per Pattern	.25	.20	.15	.15

*The above series of heat sinks are manufactured to specific customer requirements. Prices listed include material, saw cutoff, deburring, fluid passage holes tapped and clear anodize finish.

MODULAR FORCED AIR COOLING PACKAGES



IERC's design provides the best use of the output of most available fan types for economical thermal control in multiple semiconductor installations. Two types, each as much as 50% lighter in weight than other assemblies with comparable power dissipation. **F-600 Series** units are available with one to four hexagonal banks with six modules each. Cools up to 24 semiconductors with one muffin fan. Available assembled or in kit form. **F-400 Series** units have one to four banks of four modules each to cool up to 16 semiconductors with one fan. Available assembled or in kit form. Bulletins 136, 137.

DELIVERED	CAPACITY				QUANTITY PRICES				
	F-400		F-600						
	BANKS	MODULES	BANKS	MODULES	1-9	10-49	50-99	100-249	250-499
KIT FORM	1	4	1	6	20.40	17.30	15.25	13.20	12.20
	2	8	2	12	38.40	32.70	28.80	24.90	23.00
	3	12	3	18	57.60	49.00	43.25	37.50	34.60
	4	16	4	24	76.80	65.20	57.50	49.80	46.00
ASSEMBLED	1	4	1	6	24.00	21.60	19.25	17.80	16.35
	2	8	2	12	43.20	38.80	34.40	31.80	29.20
	3	12	3	18	64.80	58.30	51.80	47.85	43.90
	4	16	4	24	86.40	77.80	69.20	63.90	58.60

Note: Order through IERC representatives or direct from factory.

INSULUBE® 448 FINISH FOR HEAT DISSIPATORS

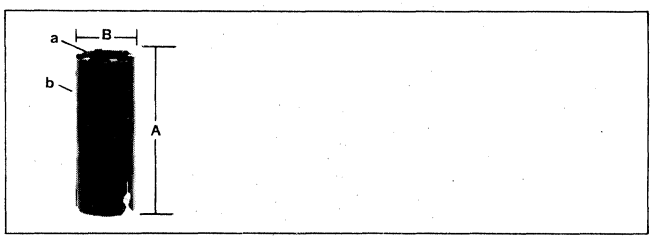
Insulube 448 is the only proven finish for positive electrical insulation in electronic equipment that meets the most stringent environmental requirements. Non-hygroscopic. High emissivity surface. Salt Spray resistant. Low thermal resistance. Unaffected by elevated temperature. High dielectric strength. High insulation resistance. Send for Bulletin 123.

Heat dissipating electron tube shields

Tubes fail primarily because of the heat they generate and the environment in which they operate. If tubes are operated at a lower bulb temperature, their life can be greatly extended.

The simple solution to high tube temperature is IERC's heat dissipating tube shields shown below.

TRN THERMA-REL SERIES HEAT DISSIPATING SHIELDS



Gives you six times longer use of electronic equipment before failure; costs only a fraction of that of a replacement tube. Directly replaces the obsolete JAN shields. Flexible, black cadmium plated beryllium copper liner adapts to variations in bulb contour and diameter. Positive base attachment gives superior retention in shock and vibration environment. Meets or exceeds all military requirements for heat dissipating tube shields and is qualified to applicable military specifications.

IERC PART NO.	MIL. SPEC. PART NO.	DIMENSIONS		TUBE SIZE	QUANTITY PRICES			
		A MAX.	B DIA.		1-24	25-99	100-499	500-999
TRN5-5015B	M24251/6-1	1-1/2"	7/8"	SHORT 7 PIN	.56	.51	.45	.39
TRN5-5020B	M24251/6-2	2"	7/8"	MED. 7 PIN	.58	.53	.47	.41
TRN5-5025B	M24251/6-3	2-1/2"	7/8"	LONG 7 PIN	.66	.60	.53	.46
TRN6-6015B	M24251/6-4	1-1/2"	1"	SHORT 9 PIN	.64	.58	.51	.44
TRN6-6020B	M24251/6-5	2"	1"	MED. 9 PIN	.66	.60	.53	.46
TRN6-6025B	M24251/6-6	2-1/2"	1"	LONG 9 PIN	.72	.65	.58	.50
TRN6-6027B	M24251/6-7	2-3/4"	1"	EX. LONG 9 PIN	.78	.71	.63	.54

Note: TRN6-6027B is designed for use with 6094 and similar size tubes.

DRAWING CODE	Component Part	Material	Finish
a	Liner	Beryllium Copper QQ-C-533	Black Cadmium QQ-P-416
b	Shell	Aluminum QQ-A-318	Black Anodize MIL-A-8625

IERC

INTERNATIONAL ELECTRONIC RESEARCH CORPORATION
a corporate division of DYNAMICS CORPORATION OF AMERICA
135 West Magnolia Blvd. Burbank, California 91502 213/849-2481

INTERNATIONAL RECTIFIER
SEMICONDUCTOR DIVISION / 233 KANSAS STREET / EL SEGUNDO / CALIFORNIA 90245 / CABLE RECTUSA / TELEPHONE AREA CODE 213 / 678-6281

SILICON CONTROLLED RECTIFIERS, POWER LOGIC-TRIACS, AND FIRING CIRCUITS

IR leads all others in the applications of SCR's and of their related Firing Circuits. With three types of SCR's (the exclusive Epitaxial SCR, the super-speed Inverter-Type SCR, and the Standard-of-the-industry Alloyed-Diffused SCR), IR can satisfy any requirement from its broad listing of standard devices, or, if necessary, can select special devices, or develop a new series, to meet your needs.

POWER LOGIC TRIACS

IR also offers the highest rated, most powerful triacs in the industry, the 2N5257 series of 200 Ampere Logic-Triacs. 60 and 100 Ampere Logic-Triacs offer completely different packaging and junctions to extend the range of power triac applications.

SCR FIRING CIRCUITS

To complete the application of SCR's and Triacs, IR lists a complete line of SCR Firing Circuits.

Look to IR for single source semiconductor shopping.

HOW TO USE THIS SECTION

SILICON CONTROLLED RECTIFIERS

Data is listed by current rating on pages 1 and 2.

Look for these specifications opposite the "PARAMETER" heading.

PARAMETERS		RATING	
Symbol	Definition	Symbol	Definition
$I_{T(RMS)}$	Max. RMS on-state current	—	Amperes
$I_{T(AV)}$	Max. average forward current @ 180° conduction	—	Amperes
T_J	Operating temperature range	(°C)	Degrees Celsius
I_{GT}	Typical gate current to trigger @ 25°C	(mA)	Milliamperes
V_{GT}	Typical gate voltage to trigger @ 25°C	(V)	Voltage
Case	Case outline (see pp. 13-15)		

Then check opposite the "VOLTAGE" heading for the part number of the voltage required. FOR EXAMPLE:

For an SCR with an RMS current of 6 Amperes, you can choose any of the three series listed below under the 7.4A current rating beginning with "5RC10A." IR's popular 5RC series would offer you:

- RMS current rating of 7.4 Amperes
- Average current rating of 4.7 Amperes
- Junction operating temperature of -65° to 125°C
- Typical gate characteristics of 10mA and 1.2 V
- It is available in the TO-64 case outline and with IR's alloyed-diffused construction.

For a 250 Volt unit, you should select IR's 5RC30A, 300 Volt, 7.4 Ampere SCR.

POWER LOGIC-TRIACS

Data is listed on page 2.

Specifications are detailed the same as for SCR's.

FIRING CIRCUITS

Data is listed on page 2.

Specifications are detailed in an easily understood form.

SILICON CONTROLLED RECTIFIERS

PARAMETERS / VOLTAGES													
I_T (RMS) (AMPS)		4.0	4.7		7.4		7.4	25	16	16	25	25
I_T (AV) (AMPS)		2.55	3		4.7		4.7	16	10	10	16	16
T_J (°C)		−40° to 110°	−65° to 125°		−65° to 125°		−65° to 150°	−65° to 125°	−40° to 100°	−65° to 125°	−65° to 125°	−65° to 125°
I_{GT} @ 25°C (mA)		.2 mA	8		10		10	30	30	30	30	30
V_{GT} @ 25°C (V)		1	1		1.2		1.2	1.7	1.7	1.7	1.7	1.5
Case (pp. 13-15)		A-2	TO-64		TO-64		TO-64	TO-48	TO-48	TO-48	TO-48	TO-48
Type		Al. Diff.	Al. Diff.		Al. Diff.		Al. Diff.	Al. Diff.	Al. Diff.	Al. Diff.	Al. Diff.	Al. Diff.
					(1)	(1)	(1)				(2)	
25 Volts	PART NUMBERS	—	—	—	—	2N1770	2N1770A	—	2N1842	2N1842A	—	2N681
30 Volts		IR106Y1	—	—	—	—	—	—	—	—	—	—
50 Volts		IR106F1	—	2N1600	—	2N1771	2N1771A	—	2N1843	2N1843A	—	2N682
100 Volts		IR106A1	3RC10A	2N1601	5RC10A	2N1772	2N1772A	10RC10A	2N1844	2N1844A	10RCF10A	2N683
150 Volts		—	—	—	—	2N1773	2N1773A	—	2N1845	2N1845A	—	2N684
200 Volts		IR106B1	3RC20A	2N1602	5RC20A	2N1774	2N1774A	10RC20A	2N1846	2N1846A	10RCF20A	2N685
250 Volts		—	—	—	—	2N1775	2N1775A	—	2N1847	2N1847A	—	2N686
300 Volts		IR106C1	3RC30A	2N1603	5RC30A	2N1776	2N1776A	10RC30A	2N1848	2N1848A	10RCF30A	2N687
400 Volts		—	3RC40A	2N1604	5RC40A	2N1777	2N1777A	10RC40A	2N1849	2N1849A	10RCF40A	2N688
500 Volts		—	3RC50A	—	5RC50A	2N1778	—	10RC50A	2N1850	2N1850A	10RCF50A	2N689
600 Volts		—	3RC60A	—	5RC60A	2N2619	—	10RC60A	—	—	10RCF60A	2N690
700 Volts		—	—	—	—	—	—	—	—	—	—	2N691
800 Volts		—	—	—	—	—	—	10RC80A	—	—	10RCF80A	2N692
1000 Volts		—	—	—	—	—	—	10RC100A	—	—	—	—
1200 Volts		—	—	—	—	—	—	10RC120A	—	—	—	—

PARAMETERS / VOLTAGES													
I_T (RMS) (AMPS)		35	35	35		63	80	80	80	110		110	110
I_T (AV) (AMPS)		22.3	22.3	22.3		40	50	50	50	70		70	70
T_J (°C)		−65° to 125°	−65° to 125°	−65° to 125°	−25° to 150°	−40° to 105°	−40° to 125°	−40° to 125°	−40° to 150°	−40° to 125°		−65° to 150°	−40° to 125°
I_{GT} @ 25°C (mA)		30	30	30		110 Max.	35	35	35	35		35	35
V_{GT} @ 25°C (V)		1.5	1.5	1.5		3.0 Max.	2.0	1.0	1.0	1.2		1.2	1.0
Case (pp.13-15)		TO-48	TO-48	TO-48		A-1	TO-94	TO-94	TO-94	TO-48	TO-94	TO-49	TO-94
Type		Al. Diff.	Al. Diff.	Al. Diff.		Al. Diff.	Al. Diff.	Epitaxial	Epitaxial	Al. Diff.		Al. Diff.	Epitaxial
			(2)	(3)			(4)	(4)	(4) (5)			(6)	
25 Volts	PART NUMBERS	—	—	—	—	—	—	—	—	2N1909	—	2N2023	—
50 Volts		—	—	—	—	40RCS5	—	—	—	2N1910	—	2N2024	—
100 Volts		16RC10A	16RCF10A	18RC10	22RC10	40RCS10	36RC10A	—	—	2N1911	71RC10A	2N2025	—
150 Volts		—	—	—	—	—	—	—	—	2N1912	—	2N2026	—
200 Volts		16RC20A	16RCF20A	18RC20	22RC20	40RCS20	36RC20A	—	—	2N1913	71RC20A	2N2027	—
250 Volts		—	—	—	—	—	—	—	—	2N1914	—	2N2028	—
300 Volts		16RC30A	16RCF30A	18RC30	22RC30	40RCS30	36RC30A	—	—	2N1915	71RC30A	2N2029	—
400 Volts		16RC40A	16RCF40A	18RC40	22RC40	40RCS40	36RC40A	—	—	2N1916	71RC40A	2N2030	—
500 Volts		16RC50A	16RCF50A	18RC50	22RC50	40RCS50	36RC50A	36RA50	—	2N1805	71RC50A	—	71RA50
600 Volts		16RC60A	16RCF60A	18RC60	22RC60	40RCS60	36RC60A	36RA60	36REH60	2N1806	71RC60A	—	71RA60
700 Volts		—	—	—	—	—	—	—	—	2N1807	—	—	—
800 Volts		16RC80A	—	18RC80	—	—	36RC80A	36RA80	36REH80	—	71RC80A	—	71RA80
1000 Volts		16RC100A	—	18RC100	—	—	—	36RA100	36REH100	—	—	—	71RA100
1100 Volts		—	—	—	—	—	—	36RA110	36REH110	—	—	—	71RA110
1200 Volts		—	—	—	—	—	—	36RA120	36REH120	—	—	—	71RA120
1300 Volts		—	—	—	—	—	—	36RA130	36REH130	—	—	—	71RA130

(1) V_{gt}—Min. gate Voltage: 5RC-A series = 0.1 @ 125°C
2N1770 series = 0.3 @ 125°C
2N1770A series = 0.2 @ 150°C
t_q—Typical Turn-off time: 5RC-A & 2N1770 series = 30 μsec
2N1770A series = 50 μsec

(2) t_q—Max. turn-off time = 12 μsec
(3) I_{TSM}—Max. Peak surge current = 350A
(4) 36 are flexible lead devices (TO-94) Replace with 37 for flag terminal devices (TO-83).

(5) I_{RM} & I_{DM} = 100 μA
(6) 71 types are flexible lead (TO-94), replace with 72 for flag terminal TO-83.

INTERNATIONAL RECTIFIER
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SILICON CONTROLLED RECTIFIERS

PARAMETERS														
I_T (RMS) (AMPS)	110	110	110	110	125		160	160	180	235		235
I_T (AV) (AMPS)	70	70	70	70	80		100	100	115	150		150
T_J (°C)	−40° to 125°	−40° to 125°	−40° to 150°	−65° to 125°	−40° to 125°		−40° to 125°	−40° to 125°	−40° to 125°	−40° to 125°		−40° to 125°
I_{GT} @ 25°C (mA)	35	25	35	100	100		50	35	35	50		35
V_{GT} @ 25°C (V)	1.0	1.0	1.0	2.0	2.5		1.3	1.2	1.2	1.3		1.3
Case	TO-94	TO-94	TO-94	TO-83	TO-94		TO-93	TO-93	A-3	TO-93		TO-93
Type	Epitaxial	Epitaxial	Epitaxial	Al. Diff.	ACE		Al. Diff.	Epitaxial	Hockey-Puk	Al. Diff.		Al. Diff.
VOLTAGES / PART NUMBERS	(1) (2)		(1)		(3)	(3) (4)					(5)	
50 Volts	—	—	—	2N1792	—	—	—	—	—	—	—	2N2503
100 Volts	—	—	—	2N1793	—	—	101RC10	—	—	151RC10	151RC10A	2N2504
150 Volts	—	—	—	2N1794	—	—	—	—	—	—	—	—
200 Volts	—	—	—	2N1795	—	—	101RC20	—	—	151RC20	151RC20A	2N2505
250 Volts	—	—	—	2N1796	—	—	—	—	—	—	—	—
300 Volts	—	—	—	2N1797	—	—	101RC30	—	—	151RC30	151RC30A	2N2506
400 Volts	—	—	—	2N1798	—	—	101RC40	—	—	151RC40	151RC40A	2N2507
500 Volts	71RB50	—	—	2N1799	81RLA50	81RLB50	101RC50	101RA50	115PA50	151RC50	151RC50A	2N2508
600 Volts	71RB60	2N3091	71REH60	2N1800	81RLA60	81RLB60	101RC60	101RA60	115PA60	151RC60	151RC60A	—
700 Volts	—	2N3092	—	2N1801	—	—	—	—	—	—	—	—
800 Volts	71RB80	2N3093	71REH80	2N1802	81RLA80	81RLB80	101RC80	101RA80	115PA80	151RC80	151RC80A	—
900 Volts	—	2N3094	—	2N1803	—	—	—	—	—	—	—	—
1000 Volts	71RB100	2N3095	71REH100	2N1804	81RLA100	81RLB100	—	101RA100	115PA100	—	—	—
1100 Volts	71RB110	2N3096	71REH110	—	81RLA110	81RLB110	—	101RA110	—	—	—	—
1200 Volts	71RB120	2N3097	71REH120	—	81RLA120	81RLB120	—	101RA120	115PA120	—	—	—
1300 Volts	71RB130	2N3098	71REH130	—	—	—	—	101RA130	115PA130	—	—	—

PARAMETERS											
I_T (RMS) (AMPS)	235		275	400	400	470		550	740	60	100	200
I_T (AV) (AMPS)	150		175	250	250	300		350	470	—	—	—
T_J (°C)	−40° to 125°		−40° to 125°	−40° to 125°	−40° to 125°	−40° to 125°		−40° to 125°	−40° to 125°	−40° to 125°	−40° to 125°	−40° to 125°
I_{GT} @ 25°C (mA)	35		35	35	40	40		40	40	200	200	200
V_{GT} @ 25°C (V)	1.2		1.2	1.2	1.2	1.2		1.2	1.2	1.5	1.5	1.5
Case	TO-93		A-3	A-3	TO-118	TO-118		TO-118	A-4	TO-94	TO-94	TO-93
Type	Epitaxial		Hockey-Puk	Hockey-Puk	Epitaxial	Epitaxial		Epitaxial	Hockey-Puk			
VOLTAGES / PART NUMBERS		(6)					(6)			POWER LOGIC-TRIACS		
400 Volts	—	—	—	—	—	—	—	—	—	60AL40	100AC40	2N5257
500 Volts	151RA50	151RB50	175PA50	250PA50	250RA50	300RA50	300RB50	350RA50	470PA50	—	—	—
600 Volts	151RA60	151RB60	175PA60	250PA60	250RA60	300RA60	300RB60	350RA60	470PA60	60AC60	100AC60	2N5258
800 Volts	151RA80	151RB80	175PA80	250PA80	250RA80	300RA80	300RB80	350RA80	470PA80	60AC80	100AC80	2N5259
1000 Volts	151RA100	151RB100	175PA100	250PA100	250RA100	300RA100	300RB100	350RA100	470PA100	60AC100	100AC100	2N5260
1100 Volts	151RA110	151RB110	175PA110	250PA110	250RA110	300RA110	300RB110	350RA110	470PA110	—	—	—
1200 Volts	151RA120	151RB120	175PA120	250PA120	250RA120	300RA120	300RB120	350RA120	470PA120	—	—	—
1300 Volts	151RA130	151RB130	175PA130	250PA130	—	—	—	—	—	—	—	—

(1) 71 types are flexible lead (TO-94) replace with 72 for flag terminal TO-83
(2) Similar to 71RA series but with faster turn-off capability
(3) Accelerated Cathode Excitation type for fast turn-on, di/dt = 800 A/μsec
(4) Inverter type
(5) I_{TSM} = 3,500 A
(6) Fast turn-off capability

IR FIRING CIRCUITS

IR's series of Firing Circuits offers the advantages of "Hard Firing" gate signals, a good "back porch" to eliminate "starved gate" conditions, signal isolation, and negative biasing.

Standard units are available off the shelf, special order devices will be quoted in quantity shipments.

Firing Circuits for IR's Logic-Triacs are available on special order.

STANDARD FIRING CIRCUITS

Part Number	Connection	Voltage	No. of SCR's
CL-1050	Single phase	120/240V	1 or 2
CL-1066	Three phase, three wire	240/480V	3
CL-788	Three phase, four wire	240V	3
CL-789	Three phase, four wire	480V	3
CL-1076	Three phase, three wire	240/480V	6

SPECIAL UNITS

Part Number	Similar to	Except	No. of SCR's
CL-781	CL-1050	120V input only	1 or 2
CL-782	CL-1050	240V input only	1 or 2
CL-783	CL-1066	240V input only	3
CL-784	CL-1066	480V input only	3

POWER LOGIC-TRIACS

IR's three LOGIC-TRIAC series offer circuit designers a wide array of specification advantages in high current and voltage ratings. The "logic" capability allows the selection of the conduction direction as a function of the gate signal.

With the gate biased positive with respect to Main Terminal 1, the device will turn on only if Main Terminal 2 is positive with respect to Main Terminal 1.

With the gate biased negative with respect to Main Terminal 1, the device will conduct with Main Terminal 2 either positive or negative with respect to Main Terminal 1.

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SELENIUM AND SILICON HIGH POWER RECTIFIERS

Listed on these pages are the basic specifications for the complete series of IR's silicon power rectifiers.

Also listed are limited references to IR's selenium rectifiers. IR offers an extensive selection of standard and special order selenium devices including: power stacks, multi-circuit stacks, cartridges, miniature stacks, diodes, loose cell kits, voltage suppressors (Klip-Sels), and contact protectors.

Your local IR Industrial Distributor or IR Field Office will gladly supply you with complete specifications, ordering assistance, and price and delivery quotations.

HOW TO USE THIS SECTION

SELENIUM RECTIFIERS—See listings below.

SILICON POWER RECTIFIERS—Devices are listed by current rating on page 4.

Look for these specifications opposite the "PARAMETER" heading.

PARAMETER		RATINGS	
Symbol	Definition	Symbol	Definition
I_F (AV)	Max. average forward current	—	Amperes
I_{FM} (surge)	Max. peak one cycle, non-repetitive surge current	—	Amperes
I^2t	Max. I^2t rating (non-repetitive, for 5 to 8.3 milliseconds)	(A^2sec)	Amperes squared seconds
T_J	Max. operating junction temperature range	(°C)	Degrees Celsius
Case	Case outline (See pp. 13–15)	—	—

Then check opposite the "VOLTAGE" heading for the part number of the voltage required.

FOR EXAMPLE: (Refer to page 4)

For a rectifier with a current rating of 65 Amperes and a surge rating of 1,000 Amperes, you would locate these parameters under the 70 Ampere current rating on page 4.

This series offers you:

70 Ampere current rating
1,200 Ampere surge current rating
6,000 I^2t rating
—40° to 200°C junction temperature operating range
Available in IR's B-4 case.

For a rectifier with a 500 Volt rating, you would order IR's part number "70H50A".

SELENIUM RECTIFIER POWER STACKS

H 2 B 2 S D B G X TYPICAL STACK CODE

H — **2** — **B** — **2**

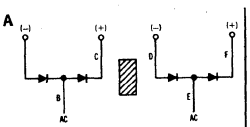
Cell Type	Number of Cells in Series per Arm	Type of Circuit				Number of Cells in Parallel per Arm
		Type	Arms	Type	Arms	
		Single Phase		Three Phase		
A	Determined by RMS Voltage applied and RMS Reverse Voltage Rating of Cells	H—Half Wave	1	S—Half Wave +	3	Determined by DC Current required and Cell Current Capacity
B		B—Bridge	4	L—Half Wave —	3	
C		C—Center Tap +	2	T—Bridge	6	
L		J—Center Tap —	2	U—Center Tap	6	
D		D—Doubler	2	Z—MAG Amp. Bridge	6	
P		M—MAG Amp. Bridge	4	Y—MAG Amp. Bridge	6	
J						
F						
H						

S — **D** — **B** — **G** — **X**

Type of Spacing	Type of Finish	Type of Mounting	Reverse Voltage Rating	Type of Cell
N—Narrow	D—Commercial Finish Standard Coating	A—Bolt, no Mtg. Bracket	G—26 Volt	X—Standard and High Voltage.
S—Standard	T—Military Finish Multiple Casting with Fungicide	B—Stud, no Mtg. Bracket	H—30 Volt	D—Double Density
W—Wide	T2 } Special	C—Bolt with One Mtg. Bracket	K—33 Volt	T—Triple Density
	T3 } Military	D—Stud, Two Mtg. Brackets	L—36 Volt	Q—Quadruple Density
	T4 } Finishes	E—Eyelet	M—40 Volt	
			P—45 Volt	

MULTI-CIRCUIT SELENIUM RECTIFIER POWER STACKS

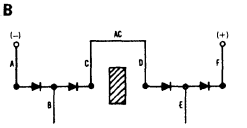
A



2 Doubler Stacks

NOTE: Supplied configuration—for indicated circuits, add connections.

B



Half Wave or Doubler Type With Center Link

IR Number	Output ⓞ D.C. Volt	Output ⓞ D.C. Amp	Input A.C. V RMS	IR Number	Output ⓞ D.C. Volt	Output ⓞ D.C. Amp	Input A.C. V RMS
J29D2(1)	29	1.9	36	J29D13(2)	29	13.0	36
J58D2	58	1.9	72	J58D13	58	13.0	72
J135D2	135	1.9	180	J135D13	135	13.0	180
J29D7(2)	29	7.0	36	J29D25(2)	29	25.0	36
J58D7	58	7.0	72	J58D25	58	25.0	72
J135D7	135	7.0	180	J135D25(3)	135	25.0	180

(1) Supplied with No. 20 copper wire for bussing.
(2) Supplied with hardware as needed for bussing.
(3) Replaces J280D25. May be marked with both numbers.
(4) Connected as 1φ bridge. Circuit detail E.

For forced cooling @ 800 LFM, multiply rating by 3.

CONTACT PROTECTORS

AC TYPES IR No.	Max. Working Volts ac	Max. Coil Current (Amp)
S1V1P	26	.20
S2V2P	52	.20
S3V3P	78	.20
S4V4P	104	.20
S5V5P	130	.20
S6V6P	156	.20
S1Z1P	26	.60
S2Z2P	52	.60
S3Z3P	78	.60
S4Z4P	104	.60
S5Z5P	130	.60
S6Z6P	156	.60
S1W1P	26	1.2
S2W2P	52	1.2
S3W3P	78	1.2
S4W4P	104	1.2
S5W5P	130	1.2
S6W6P	156	1.2

DC TYPES IR No.	Max. Working Volts dc	Max. Coil Current (Amp)
S1V1P	22	.25
S2V1P	44	.25
S3V2P	66	.25
S4V2P	88	.25
S5V2P	110	.25
S6V2P	132	.25
S7V2P	154	.25
S1Z1P	22	.90
S2Z1P	44	.90
S3Z2P	66	.90
S4Z2P	88	.90
S5Z2P	110	.90
S6Z2P	132	.90
S7Z2P	154	.90
S1W1P	22	2.0
S2W1P	44	2.0
S3W2P	66	2.0
S4W2P	88	2.0
S5W2P	110	2.0
S6W2P	132	2.0
S7W2P	154	2.0

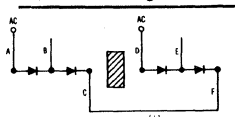
KLIP-SELS TRANSIENT VOLTAGE SUPPRESSORS

Peak Reverse Voltage	Max. RMS (not to be Exceeded)	Individual Rectifier Rated through 3 Amp* (Top Hat) through (3F)	Individual Rectifier Rated through 16 Amp* (6F) through (16F)
50	26	KY1DPF	KZ1DPF
100	52	KY2DPF	KZ2DPF
150	78	KY3DPF	KZ3DPF
200	104	KY4DPF	KZ4DPF
300	130	KY5DPF	KZ5DPF
300	156	KY6DPF	KZ6DPF
400	182	KY7DPF	KZ7DPF
400	208	KY8DPF	KZ8DPF
500	234	KY9DPF	KZ9DPF
600	260	KY10DPF	KZ10DPF
600	286	KY11DPF	KZ11DPF
700	312	KY12DPF	KZ12DPF
800	338	KY13DPF	KZ13DPF
800	364	KY14DPF	KZ14DPF
900	390	KY15DPF	KZ15DPF
900	416	KY16DPF	KZ16DPF
1000	442	KY17DPF	KZ17DPF
1100	468	KY18DPF	KZ18DPF
1200	494	KY19DPF	KZ19DPF
1200	520	KY20DPF	KZ20DPF

Peak Reverse Voltage	Max. RMS (not to be Exceeded)	Individual Rectifier Rated through 60 Amp*	Individual Rectifier Rated through 250 Amp*
50	26	KSA1DAF	KSL1DAF
100	52	KSA2DAF	KSL2DAF
150	78	KSA3DAF	KSL3DAF
200	104	KSA4DAF	KSL4DAF
300	130	KSA5DAF	KSL5DAF
300	156	KSA6DBF	KSL6DBF
400	182	KSA7DBF	KSL7DBF
400	208	KSA8DBF	KSL8DBF
500	234	KSA9DBF	KSL9DBF
600	260	KSA10DBF	KSL10DBF
600	286	KSA11DBF	KSL11DBF
700	312	KSA12DBF	KSL12DBF
800	338	KSA13DBF	KSL13DBF
800	364	KSA14DBF	KSL14DBF
900	390	KSA15DBF	KSL15DBF
900	416	KSA16DBF	KSL16DBF
1000	442	KSA17DBF	KSL17DBF
1100	468	KSA18DBF	KSL18DBF
1200	494	KSA19DBF	KSL19DBF
1200	520	KSA20DBF	KSL20DBF
600	286	KSP11DBF	For rectifiers 250 Amps & above

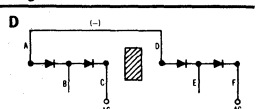
* Based on average industrial loading.

C



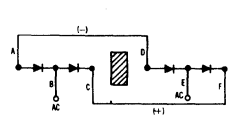
Center Tap, Common Positive

D



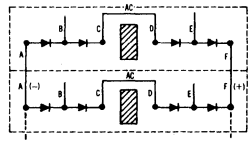
Center Tap, Common Negative

E



Single Phase Bridge

F



Multiple Stack—Single Phase Bridge
Use additional units as required

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HIGH POWER SILICON RECTIFIERS

PARAMETERS												
I_F (AV) (AMPS)		15	20	35	40	60	70	100	100	150	150	150
I_{FSM} (surge) (AMPS)		250	300	500	500	700	1,200	1,600	3,000	3,000	3,000	3,000
I^2t (A^2sec)		260	500	510	510	2,000	6,000	10,500	36,000	36,000	36,000	36,000
T_J (°C)		−65° to 175°	170° Max.	−65° to 180°	−65° to 175°	−65° to 175°	−40° to 200°	−40° to 200°	−40° to 200°	−65° to 200°	−65° to 200°	−65° to 200°
Case (pp. 13-15)		B-1	B-10	B-1	B-1	B-1	B-4	DO-5	DO-5	DO-30	DO-5	DO-30
VOLTAGE	PART NUMBERS											
50 Volts		—	21PT5	1N1183	40HF5	1N2128	—	—	—	1N3111	—	—
100 Volts		1N3209	21PT10	1N1184	40HF10	1N2129	70H10A	1N3288	1N3288A	1N3085	150K10A	150L10A
150 Volts		—	—	1N1185	40HF15	1N2130	70H15A	—	—	—	150K15A	150L15A
200 Volts		1N3210	21PT20	1N1186	40HF20	1N2131	70H20A	1N3289	1N3289A	1N3086	150K20A	150L20A
250 Volts		—	—	—	—	1N2132	70H25A	—	—	—	150K25A	150L25A
300 Volts		1N3211	—	1N1187	40HF30	1N2133	70H30A	1N3290	1N3290A	1N3087	150K30A	150L30A
350 Volts		—	—	—	—	—	—	—	—	—	—	—
400 Volts		1N3212	21PT40	1N1188	40HF40	1N2135	70H40A	1N3291	1N3291A	1N3088	150K40A	150L40A
500 Volts		1N3213	—	1N1189	40HF50	1N2137	70H50A	1N3292	1N3292B	1N3089	150K50A	150L50A
600 Volts		1N3214	21PT60	1N1190	40HF60	1N2138	70H60A	1N3293	1N3293A	1N3090	150K60A	150L60A
700 Volts		—	—	—	40HF70	—	70H70A	—	—	—	150K70A	150L70A
800 Volts		—	—	—	40HF80	—	70H80A	1N3294	1N3294A	1N3091	150K80A	150L80A
900 Volts		—	—	—	40HF90	—	70H90A	—	—	—	150K90A	150L90A
1000 Volts		—	—	—	40HF100	—	70H100A	1N3295	1N3295A	1N3092	150K100A	150L100A
1200 Volts		—	—	—	—	—	—	1N3296	1N3296A	1N5162	150K120A	150L120A

PARAMETERS											
I_F (AV) (AMPS)		200	250	250	250	275	300	300	330	800	800
I_{FSM} (surge) (AMPS)		3,500	4,500	4,500	3,500	5,000	5,000	6,250	6,500	7,500	9,000
I^2t (A^2sec)		50,000	80,000	80,000	50,000	100,000	100,000	150,000	175,000	225,000	350,000
T_J (°C)		−40° to 169°	−65° to 200°	−40° to 200°	−40° to 175°	−65° to 190°	−40° to 200°	−40° to 200°	−40° to 200°	−40° to 200°	−65° to 200°
Case (pg. 13-15)		B-3	DO-9	DO-9	B-5	DO-9	DO-9	B-8	B-7	B-8	B-9
VOLTAGES	PART NUMBERS										
50 Volts		200UB5	1N2054	—	—	1N4044	300U5A	—	—	—	500UDF5A
100 Volts		200UB10	1N2055	1N3735	—	1N4045	300U10A	—	—	—	500UDF10A
150 Volts		—	1N2056	—	—	1N4046	300U15A	—	—	—	—
200 Volts		200UB20	1N2057	1N3736	—	1N4047	300U20A	—	—	—	500UDF20A
250 Volts		—	1N2058	—	—	1N4048	300U25A	—	—	—	—
300 Volts		200UB30	1N2059	1N3737	—	1N4049	300U30A	—	—	—	500UDF30A
350 Volts		—	1N2060	—	—	—	—	—	—	—	—
400 Volts		200UB40	1N2061	1N3738	—	1N4050	300U40A	—	—	—	500UDF40A
450 Volts		—	1N2062	—	—	—	—	—	—	—	—
500 Volts		200UB50	1N2063	1N3739	—	1N4051	300U50A	—	—	—	500UDF50A
600 Volts		—	1N2064	1N3740	251UL60S (1)	1N4052	300U60A	—	—	501V60	500UDF60A
700 Volts		—	1N2065	—	—	1N4053	300U70A	—	—	—	500UDF70A
800 Volts		—	1N2066	1N3741	251UL80S	1N4054	300U80A	—	—	501V80	500UDF80A
900 Volts		—	1N2067	—	—	1N4055	300U90A	—	—	—	500UDF90A
1000 Volts		—	1N2068	1N3742	251UL100S	1N4056	300U100A	—	—	501V100	500UDF100A
1200 Volts		—	—	1N3743	251UL120S	—	—	301U120 (2)	331VF120 (2)	501V120	500UDF120A
1300 Volts		—	—	—	251UL130S	—	—	—	—	—	—
1400 Volts		—	—	1N3744	—	—	—	301U140	331VF140	501V140	—
1600 Volts		—	—	—	—	—	—	301U160	331VF160	501V160	—
1800 Volts		—	—	—	—	—	—	301U180	331VF180	501V180	—
2000 Volts		—	—	—	—	—	—	301U200	331VF200	501V200	—

(1) Fast Recovery Rectifier—add suffix to part number for Max. reverse recovery time:
S20 = 2.0 μsec.
S15 = 1.5 μsec.
Refer to Engineering Catalog.

(2) Ratings for reverse polarity units differ from basic units.
Refer to Engineering Catalog.

ZENER REGULATORS, VOLTAGE REFERENCES & LOW POWER SILICON RECTIFIERS

This section lists basic parameters to give you quick, easy reference to International Rectifier's Zener Regulators, Voltage Reference Diodes, and Low Power Silicon Rectifiers.

HOW TO USE THIS SECTION

Zener Regulators

Devices are listed by power rating on pages 4 through 6.
Look for specifications opposite the "PARAMETER" heading.
- Power rating
- Maximum operating temperature
- Standard tolerance range. (Other tolerances are specified in the Notes section.)
- Notes (Which are defined on page 5.)
- Case style (See pp. 13-15.)

Then check opposite the "VOLTAGE" heading for the part number of the voltage required.

Voltage Reference Diodes

Devices are separated into standard and time-stable types on page 6. They are listed by nominal zener voltage (V_Z) and by part number.

Each device is identified by:
- Part number
- Nominal zener voltage (V_Z)
- Nominal temperature coefficient

Each series is identified in the Comments column by:
- Power rating
- Case style and the differences of the "A" and "B" versions where applicable

Low Power Rectifiers

Devices are listed by current ratings on page 7.
Look for these specifications opposite the "PARAMETER" heading.
- Current rating.
- Maximum Peak One Cycle Surge Current (I_{FM}[surge]).
- Case connection to the stud or case.
- Case style.

Then check opposite the "VOLTAGE" heading for the part number of the voltage required.

Your local IR Industrial Distributor or IR Field Office will gladly supply you with complete specifications, ordering assistance, and price and delivery quotations.

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ZENERS REGULATORS

PARAMETERS	150mW	250mW	200mW
Power Rat.			
Max. Temp (°C)	200°	200°	150°
Tolerance	—	—	10%
Notes (pg. 5)	—	1	3
Case (pp. 13-15)	C-1	DO-7	DO-7

VOLTAGES	PART NUMBERS							
Vz	PN	Izt (mA)	PN	Izt	Vz	PN	Izt (mA)
2.0-3.2	1N465	5	1N702	5	4.8	1N761	10
3.0-3.9	1N466	5	1N703	5	5.8	1N762	10
3.7-4.5	1N467	5	1N704	5	7.1	1N763	10
4.3-5.4	1N468	5	1N705	5	8.7	1N764	10
5.2-6.4	1N469	5	1N706	5	10.5	1N765	5
6.2-8.0	1N470	5	1N707	5	12.7	1N766	5
7.5-10	1N1313	0.20	—	—	15.7	1N767	5
9.0-12	1N1314	0.20	—	—	19.0	1N768	5
11-14.5	1N1315	0.20	—	—	23.5	1N769	5
13.5-18	1N1316	0.20	—	—	—	—	—
17-21	1N1317	0.20	—	—	—	—	—
20-27	1N1318	0.20	—	—	—	—	—
25-32	1N1319	0.20	—	—	—	—	—
30-39	1N1320	0.20	—	—	—	—	—

NOTES:
1.

PN	Vz
1N702A	2.3-2.9
1N703A	3.23-3.67
1N704A	3.9-4.3
1N705A	4.58-5.12
1N706A	5.5-6.1
1N707A	6.65-7.55

2. 1N708 thru 1N725 10%. A = 5%
3. Add 'A' for 5% tolerance
4. Add 'A' for 10% tolerance
5. 1N1961: Vz = 14.5
6. Add 'T5' for 5% tolerance;
   'T10' for 10%
   'T20' for 20%
7. Add 'A' for 10% tolerance;
   'B' for 5%
8. Polarity—Cathode to Stud only.
9. Polarity—Anode to Stud; add 'R' for Cathode to Stud.

PARAMETERS	250mW	400mW	400mW	400mW	400mW
Power Rating					
Max. Temp (°C)	200°	175°	175°	150°	200°
Tolerance (%)	—	10%	20%	10%	5%
Notes	2	3	4	3	—
Case (pp. 13-15)	DO-7	DO-7	DO-7	DO-7	DO-7

VOLTAGES	PART NUMBERS								
Vz	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)
2.4	—	—	1N4370	20	—	—	—	—	—	—
2.7	—	—	1N4371	20	—	—	—	—	—	—
3.0	—	—	1N4372	20	—	—	—	—	—	—
3.3	—	—	1N746	20	—	—	—	—	—	—
3.6	—	—	1N747	20	—	—	—	—	—	—
3.9	—	—	1N748	20	—	—	—	—	—	—
4.3	—	—	1N749	20	—	—	—	—	—	—
4.7	—	—	—	—	—	—	—	—	1N3510	20
9.7	—	—	1N750	20	—	—	—	—	—	—
5.1	—	—	1N751	20	—	—	—	—	1N3611	20
5.6	1N708	25	1N752	20	—	—	1N1956	5	1N3512	20
6.2	1N709	25	1N753	20	—	—	—	—	1N3513	20
6.8	1N710	25	1N754	20	1N957	18.5	1N1957	5	1N3514	20
7.5	1N711	25	1N755	20	1N958	16.5	—	—	1N3515	10
8.2	1N712	25	1N756	20	1N959	15.0	1N1958	5	1N3516	10
9.1	1N713	12	1N757	20	1N960	14.0	—	—	1N1517	10
10	1N714	12	1N758	20	1N961	12.5	1N1959	5	1N3518	10
11	1N715	12	—	20	1N962	11.5	—	—	1N3519	10
12	1N716	12	1N759	20	1N963	10.5	1N1960	1	1N3520	10
13	1N717	12	—	—	1N964	9.5	—	—	1N3521	5
14	—	—	—	—	—	—	1N1961	1	—	—
15	1N718	12	—	—	1N965	8.5	—	—	1N3522	5
16	1N719	12	—	—	1N966	7.8	—	—	1N3523	5
18	1N720	12	—	—	1N967	7.0	1N1962	1	1N3524	5
20	1N721	4	—	—	1N968	6.2	—	—	1N3625	5
22	1N722	4	—	—	1N969	5.6	1N1963	1	1N3526	5
24	1N723	4	—	—	1N970	5.2	—	—	1N3527	5
27	1N724	4	—	—	1N971	4.6	1N1964	1	1N3528	4
30	1N725	4	—	—	1N972	4.2	—	—	1N3529	4
33	—	—	—	—	1N973	3.8	1N1965	0.2	1N3530	3

PARAMETERS	1W	1W	1W	1W	1W	1W
Power Rating						
Max. Temp.	165°	165°	175°	175°	175°	175°
Standard Tolerance	10%	20%	10%	10%	20%	20%
Notes	3	6	3	3	7	6
Case (P. 13)	C-3	C-3	DO-13	DO-13	DO-13	DO-27

VOLTAGES	PART NUMBERS											
Vz	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)
3.0	—	—	—	—	—	—	—	—	—	—	—	—
3.3	—	—	—	—	1N3821	76	—	—	—	—	1ZS3.3	76
3.6	—	—	—	—	1N3822	69	—	—	—	—	1ZS3.6	69
3.9	1N1518	50	1Z3.9	50	1N3823	64	—	—	—	—	1ZS3.9	64
4.3	—	—	1Z4.3	50	1N3824	58	—	—	—	—	1ZS4.3	58
4.7	1N1519	40	1Z4.7	40	1N3825	53	—	—	—	—	1ZS4.7	53
5.1	—	—	1Z5.1	40	1N3826	49	—	—	—	—	1ZS5.1	49
5.6	1N1520	35	1Z5.6	35	1N3827	45	1N1765	100	—	—	1ZS5.6	45
6.2	—	—	1Z6.2	35	1N3828	41	1N1766	100	—	—	1ZS6.2	41
6.8	1N1521	30	1Z6.8	30	1N3829	37	1N1767	100	1N3016	37	1ZS6.8	37
7.5	—	—	1Z7.5	30	—	—	1N1768	100	1N3017	34	1ZS7.5	34
8.2	1N1522	25	1Z8.2	25	—	—	1N1769	100	1N3018	31	1ZS8.2	31
9.1	—	—	1Z9.1	25	—	—	1N1770	50	1N3019	28	1ZS9.1	28
10	1N1523	20	1Z10	20	—	—	1N1771	50	1N3020	25	1ZS10	25
11	—	—	1Z11	20	—	—	1N1772	50	1N3021	23	1ZS11	23
12	1N1524	15	1Z12	15	—	—	1N1773	50	1N3022	21	1ZS12	21
13	—	—	1Z13	15	—	—	1N1774	50	1N3023	19	1ZS13	19
15	1N1525	13	1Z15	13	—	—	1N1775	50	1N3024	17	1ZS15	17
16	—	—	1Z16	13	—	—	1N1776	50	1N3025	15.5	1ZS16	15.5
18	1N1526	10	1Z18	10	—	—	1N1777	50	1N3026	14.0	1ZS18	14.0
20	—	—	1Z20	10	—	—	1N1778	15	1N9027	12.5	1ZS20	12.5
22	1N1527	9	1Z22	9	—	—	1N1779	15	1N3028	11.5	—	—
24	—	—	1Z24	9	—	—	1N1780	15	1N3029	10.5	—	—
27	1N1528	7	1Z27	7	—	—	1N1781	15	1N3030	9.5	—	—
30	—	—	1Z30	7	—	—	1N1782	15	1N3031	8.5	—	—
33	—	—	—	—	—	—	1N1783	15	1N3032	7.5	—	—
36	—	—	—	—	—	—	1N1784	15	1N3033	7.0	—	—
39	—	—	—	—	—	—	1N1785	15	1N3034	6.5	—	—
43	—	—	—	—	—	—	1N1786	15	1N3035	6.0	—	—
47	—	—	—	—	—	—	1N1787	15	1N3036	5.5	—	—
51	—	—	—	—	—	—	1N1788	15	1N3037	5.0	—	—
56	—	—	—	—	—	—	1N1789	15	1N3038	4.5	—	—
62	—	—	—	—	—	—	1N1790	5	1N3039	4.0	—	—
68	—	—	—	—	—	—	1N1791	5	1N3040	3.7	—	—
75	—	—	—	—	—	—	1N1792	5	1N3041	3.3	—	—
82	—	—	—	—	—	—	1N1793	5	1N3042	3.0	—	—
91	—	—	—	—	—	—	1N1794	5	1N3043	2.8	—	—
100	—	—	—	—	—	—	1N1795	5	1N3044	2.5	—	—
110	—	—	—	—	—	—	1N1796	5	1N3045	2.3	—	—
120	—	—	—	—	—	—	1N1797	5	1N3046	2.0	—	—
130	—	—	—	—	—	—	1N1798	5	1N3047	1.9	—	—
150	—	—	—	—	—	—	1N1799	5	1N3048	1.7	—	—
160	—	—	—	—	—	—	1N1800	5	1N3049	1.6	—	—
180	—	—	—	—	—	—	1N1801	5	1N3050	1.4	—	—
200	—	—	—	—	—	—	1N1802	5	1N3051	1.2	—	—

INTERNATIONAL RECTIFIER
SEMICONDUCTOR DIVISION / 233 KANSAS STREET / EL SEGUNDO / CALIFORNIA 90245 / CABLE RECTUSA / TELEPHONE AREA CODE 213 / 678-6281

ZENERS REGULATORS

PARAMETERS																		
Power Rating	1W		3.5W		3.5W		10W		10W		10W		10W		10W		50W	
Max. Temp.	200°		165°		165°		165°		165°		175°		175°		175°		175°	
Standard Tolerance	10%		10%		20%		10%		20%		10%		10%		20%		20%	
Notes	3		3, 8		6, 8		3, 8		6		3, 8		3, 9		7, 9		7, 9	
Case (P. 13)	C-9		DO-4		DO-4		DO-4		DO-4		DO-4		DO-4		DO-4		C-8	

VOLTAGES	PART NUMBERS																	
Vz (V)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)	PN	Izt (mA)
3.3	1N4728	76	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3.6	1N4729	69	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3.9	1N4730	64	1N1588	150	3Z3.9	150	1N1599	500	10Z3.9	500	1N3993	640	—	—	—	—	—	—
4.3	1N4731	58	—	—	3Z4.3	150	—	—	10Z4.3	500	1N3994	580	—	—	—	—	—	—
4.7	1N4732	53	1N1589	125	3Z4.7	125	1N1600	400	10Z4.7	400	1N3995	530	—	—	—	—	—	—
5.1	1N4733	49	—	—	3Z5.1	125	—	—	10Z5.1	400	1N3996	490	—	—	—	—	—	—
5.6	1N4734	45	1N1590	110	3Z5.6	110	1N1601	350	10Z5.6	350	1N3997	445	—	—	—	—	—	—
6.2	1N4735	41	—	—	3Z6.2	110	—	—	10Z6.2	350	1N3998	405	—	—	—	—	—	—
6.8	1N4736	37	1N1591	100	3Z6.8	100	1N1602	300	10Z6.8	300	1N3999	370	1N1805	1000	1N2970	370	1N3305	1850
7.5	1N4737	34	—	—	3Z7.5	100	—	—	10Z7.5	300	1N4000	335	1N1806	1000	1N2971	335	1N3306	1700
8.2	1N4738	31	1N1592	80	3Z8.2	80	1N1603	250	10Z8.2	250	—	—	1N1807	1000	1N2972	305	1N3307	1500
9.1	1N4739	28	—	—	3Z9.1	80	—	—	10Z9.1	250	(3)	(9)	1N1808	500	1N2973	275	1N3308	1370
10	1N4740	25	1N1593	70	3Z10	70	1N1604	200	10Z10	200	1N2498	500	1N1351	500	1N2974	250	1N3309	1200
11	1N4741	23	—	—	3Z11	70	—	—	10Z11	200	1N2499	500	1N1352	500	1N2975	230	1N3310	1100
12	1N4742	21	1N1594	50	3Z12	50	1N1605	170	10Z12	170	1N2500	500	1N1353	500	1N2976	210	1N3311	1000
13	1N4743	19	—	—	3Z13	50	—	—	10Z13	170	1N1816(3)	500(9)	1N1354	500	1N2977	190	1N3312	960
14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N2978	180	1N3313	890
15	1N4744	17	1N1595	40	3Z15	40	1N1606	140	10Z15	140	1N1817	500	1N1355	500	1N2979	170	1N3314	830
16	1N4745	15.5	—	—	3Z16	40	—	—	10Z16	140	1N1818	500	1N1356	500	1N2980	155	1N3315	870
17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N2981	145	1N3316	740
18	1N4746	14.0	1N1596	35	3Z18	35	1N1607	110	10Z18	110	1N1819	500	1N1357	150	1N2982	140	1N3317	700
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N2983	130	1N3318	660
20	1N4747	12.5	—	—	3Z20	35	—	—	10Z20	110	1N1820	250	1N1358	150	1N2984	125	1N3319	630
22	1N4748	11.5	1N1597	30	3Z22	30	1N1608	90	10Z22	90	1N1821	250	1N1359	150	1N2985	115	1N3320	570
24	1N4749	10.5	—	—	3Z24	30	—	—	10Z24	90	1N1822	250	1N1360	150	1N2986	105	1N3321	520
25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N2987	100	1N3322	500
27	1N4750	9.5	1N1598	25	3Z27	25	1N1609	70	10Z27	70	1N1823	250	1N1361	150	1N2988	95	1N3323	460
30	1N4751	8.5	—	—	3Z30	25	—	—	10Z30	70	1N1824	250	1N1362	150	1N2989	85	1N3324	420
33	1N4752	7.5	—	—	—	—	—	—	—	—	1N1825	150	1N1363	150	1N2990	75	1N3325	380
36	1N4753	7.0	—	—	—	—	—	—	—	—	1N1826	150	1N1364	150	1N2991	70	1N3326	350
39	1N4754	6.5	—	—	—	—	—	—	—	—	1N1827	150	1N1365	150	1N2992	65	1N3327	320
43	1N4755	6.0	—	—	—	—	—	—	—	—	1N1828	150	1N1366	150	1N2993	60	1N3328	290
45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N2994	55	1N3329	280
47	1N4756	5.5	—	—	—	—	—	—	—	—	1N1829	150	1N1367	150	1N2995	55	1N3330	270
50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N2996	50	1N3331	250
51	1N4757	5.0	—	—	—	—	—	—	—	—	1N1830	150	1N1368	150	1N2997	50	1N3332	245
52	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N2998	50	1N3333	240
56	1N4758	4.5	—	—	—	—	—	—	—	—	1N1831	150	1N1369	150	1N2999	45	1N3334	220
62	1N4759	4.0	—	—	—	—	—	—	—	—	1N1832	50	1N1370	50	1N3000	40	1N3335	200
68	1N4760	3.7	—	—	—	—	—	—	—	—	1N1833	50	1N1371	50	1N3001	37	1N3336	180
75	1N4761	3.3	—	—	—	—	—	—	—	—	1N1834	50	1N1372	50	1N3002	33	1N3337	170
82	1N4762	3.0	—	—	—	—	—	—	—	—	1N1835	50	1N1373	50	1N3003	30	1N3338	150
91	1N4763	2.8	—	—	—	—	—	—	—	—	1N1836	50	1N1374	50	1N3004	28	1N3339	140
100	1N4764	2.5	—	—	—	—	—	—	—	—	1N2008(3)	50(9)	1N1375	50	1N3005	25	1N3340	120
105	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N3006	25	—	—
110	—	—	—	—	—	—	—	—	—	—	1N2009	50	1N1809	50	1N3007	23	—	—
120	—	—	—	—	—	—	—	—	—	—	1N2010	50	1N1810	50	1N3008	20	—	—
130	—	—	—	—	—	—	—	—	—	—	1N2011	50	1N1811	50	1N3009	19	—	—
140	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N3010	18	—	—
150	—	—	—	—	—	—	—	—	—	—	1N2012	50	1N1812	50	1N3011	17	—	—
160	—	—	—	—	—	—	—	—	—	—	—	—	1N1813	50	1N3012	16	—	—
175	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1N3013	14	—	—
180	—	—	—	—	—	—	—	—	—	—	—	—	1N1814	50	1N3014	14	—	—
200	—	—	—	—	—	—	—	—	—	—	—	—	1N1815	50	1N3015	12	—	—

VOLTAGE REFERENCE DIODES

Part No.	Vz	Nom. Temp. Coeff.	Comments
STANDARD VOLTAGE REFERENCES			
1N3496	5.9-6.5	0.005	250 mW, DO-7 Case
1N3497	5.9-6.5	0.002	
1N3498	5.9-6.5	0.001	
1N3499	5.9-6.5	0.0005	
1N821	5.9-6.5	0.01	400 mW, DO-7 Case
1N823	5.9-6.5	0.005	Z_Z = 15 Ohms
1N825	5.9-6.5	0.002	"A"; Z_Z = 10 Ohms
1N827	5.9-6.5	0.001	
1N829	5.9-6.5	0.0005	
1N826	6.2-6.9	0.002	400 mW, DO-7 Case
1N828	6.2-6.9	0.001	
1N3779	6.3-6.7	0.015	400 mW, DO-7 Case
1N3780	6.3-6.7	0.01	
1N3781	6.3-6.7	0.005	
1N3782	6.3-6.7	0.002	
1N3783	6.3-6.7	0.001	
1N3784	6.3-6.7	0.0005	
1N4565	6.4, ±5%	0.01	400 mW, DO-7 Case
1N4566	6.4, ±5%	0.005	Z_Z = 200 Ohms
1N4567	6.4, ±5%	0.002	Δ BV @ 0° to 75°
1N4568	6.4, ±5%	0.001	"A" = Δ BV @ −55°
1N4569	6.4, ±5%	0.0005	to 25°, 25° to 100°

Part No.	Vz	Nom. Temp. Coeff.	Comments
STANDARD VOLTAGE REFERENCES			
1N4570	6.4, ±5%	0.01	400 mW, DO-7 Case,
1N4571	6.4, ±5%	0.005	Z_Z = 100 Ohms
1N4572	6.4, ±5%	0.002	Δ BV @ 0° to 75°
1N4573	6.4, ±5%	0.001	"A" = Δ BV @ −55°
1N4574	6.4, ±5%	0.005	to 25°, 25° to 100°
1N4575	6.4, ±5%	0.01	400 mW, DO-7 Case,
1N4576	6.4, ±5%	0.005	Z_Z = 50 Ohms
1N4577	6.4, ±5%	0.002	Δ BV @ 0° to 75°
1N4578	6.4, ±5%	0.001	"A" = Δ BV @ −55°
1N4579	6.5, ±5%	0.0005	to 25°, 25° to 100°
1N4580	6.4, ±5%	0.01	400 mW, DO-7 Case,
1N4581	6.4, ±5%	0.005	Z_Z = 25 Ohms
1N4582	6.4, ±5%	0.002	Δ BV @ 0° to 75°
1N4583	6.4, ±5%	0.001	"A" = Δ BV @ −55°
1N4584	6.4, ±5%	0.0005	to 25°, 25° to 100°
1N3154	8.0-8.8	0.01	400 mW, DO-7 Case,
1N3155	8.0-8.8	0.005	Δ BV @ −55° to
1N3156	8.0-8.8	0.002	25°, 25° to 100°
1N3157[1]	8.0-8.8	0.001	"A" = Δ BV @ −55° to 25°, 25° to 150°
1N935	8.55-9.45	0.01	500 mW, DO-7 Case,
1N936	8.55-9.45	0.005	Δ BV @ 0° to 75°
1N937	8.55-8.45	0.002	"A" = Δ BV @ −55°
1N938	8.55-9.45	0.001	to 25°, 25° to 100°
1N939	8.55-9.45	0.0005	"B" = Δ BV @ −55° to 25°, 25° to 150°

Part No.	Vz	Nom. Temp. Coeff.	Comments
TIME STABLE REFERENCES			
1N3501	6.2-6.5	0.0013	400 mW, DO-7 Case
1N3502	6.2-6.5	0.00065	
1N3503	6.2-6.5	0.0013	
1N3504	6.2-6.5	0.0013	
6.2SR1	5.9-6.5	0.01	400 mW, DO-7 Case,
6.2SR2	5.9-6.5	0.005	Δ BV 0.155 mV/
6.2SR3	5.9-6.5	0.002	1000 Hr.
6.2SR4	5.9-6.5	0.001	Z_Z = 15 Ohms "A" = Z_Z = 10 Ohms
1N429	5.9-6.5	0.01	400 mW, C-1 Case
1N430	8.0-8.8	0.001	
1N430A	8.0-8.8	0.001	
1N1530	8.0-8-8	0.002	250 mW, C-4 Case
1N1530A	8.0-8.8	0.001	
1N1735	6.2, ±5%	0.01	C-6 Case,
1N1736	12.4, ±5%	0.01	"A" = Nom. Temp
1N1737	18.6, ±5%	0.01	Coeff. = 0.005
1N1738	24.8, ±5%	0.01	
1N1739	31.0, ±5%	0.01	
1N1740	37.2, ±5%	0.01	
1N1741	43.4, ±5%	0.01	
1N1742	49.6, ±5%	0.01	

[1] Available only in basic version.

INTERNATIONAL RECTIFIER
SEMICONDUCTOR DIVISION / 233 KANSAS STREET / EL SEGUNDO / CALIFORNIA 90245 / CABLE RECTUSA / TELEPHONE AREA CODE 213 / 678-6281

LOW POWER SILICON RECTIFIERS

PARAMETERS / VOLTAGES	PART NUMBERS													
Current Rating		400mA	750mA	750mA	750mA	750mA	750mA	800mA	1.0A	1.0A	1.0A	1.0A	1.3A	1.3A	1.5A
I_{FM} (surge) (AMPS)		20	25	10	30	40	35	40	40	50	50	50	40	40	50
Case Connection (Stud)		—	—	Cathode	Cathode	Anode	Cathode	—	Cathode	—	—	Cathode	—	Cathode	—
Case (pp. 13-15)		C-7	DO-27	DO-13	DO-13	DO-13	C-10	DO-39	DO-1	DO-27	DO-39	C-10	C-3	DO-13	DO-27
50 Volts		—	(1) —	1N2103	—	—	—	—	1N2858A	—	—	—	—	—	1N4816
100 Volts		—	—	1N2104	1N2610	—	—	—	1N2859A	5A1	10D1	—	10B1	10C1	1N4817
150 Volts		—	—	—	—	—	—	—	—	—	—	—	—	—	—
200 Volts		—	1N2069	1N2105	1N2611	1N3639	1N3193	—	1N2860A	5A2	10D2	1N5211	10B2	10C2	1N4818
300 Volts		—	—	1N2106	1N2612	—	—	—	1N2861A	5A3	10D3	—	10B3	10C3	1N4819
400 Volts		4D4	1N2070	1N2107	1N2613	1N3640	1N3194	8D4	1N2862A	5A4	10D4	1N5212	10B4	10C4	1N4820
500 Volts		—	—	1N2108	1N2614	—	—	—	1N2863A	5A5	10D5	—	10B5	10C5	1N4821
600 Volts		4D6	1N2071	—	1N2615	1N3641	1N3195	8D6	1N2864A	5A6	10D6	1N5213	10B6	10C6	1N4822
700 Volts		—	—	—	—	—	—	—	—	—	—	—	—	—	1N5052
800 Volts		—	—	—	1N2616	1N3642	1N3196	—	—	5A8	10D8	1N5214	10B8	10C8	1N5053
900 Volts		—	—	—	—	—	—	—	—	—	—	—	—	—	—
1000 Volts		—	—	—	1N2617	—	1N3563	—	—	5A10	10D10	—	10B10	10C10	1N5054

(1) 1N2069A series: I_{RM} = 5mA

PARAMETERS / VOLTAGES	PART NUMBERS													
Current Rating		2.0A	3.0A	3.0A	3.0A	3.3A	3.5A	6.0A	6.0A	6.0A	12.0A	12.0A	12.0A
I_{FM} (surge) (AMPS)		50	25	15	40	25	35	150	150	150	200	240	250
Case Connection (Stud)		—	Cathode	Cathode	Cathode	Cathode	Cathode	Cathode	Cathode	Cathode	Cathode	Cathode	Cathode
Case (pp. 13-15)		DO-27	DO-4	DO-4	DO-4	DO-4	DO-4	DO-4	DO-4	DO-4	DO-4	DO-4	DO-4
50 Volts		20A05	—	1N2348	—	—	—	1N1341	1N1341A	1N1341B	1N1199	1N1199A	1N1199B
100 Volts		20A1	—	1N2349	3F10	—	1N3569	1N1342	1N1342A	1N1342B	1N1200	1N1200A	1N1200B
150 Volts		—	—	1N2350	—	—	—	1N1343	1N1343A	1N1343B	1N1201	1N1201A	1N1201B
200 Volts		20A2	1N1124	—	3F20	1N1124A	1N3570	1N1344	1N1344A	1N1344B	1N1202	1N1202A	1N1202B
300 Volts		20A3	1N1125	—	3F30	1N1125A	1N3571	1N1345	1N1345A	1N1345B	1N1203	1N1203A	1N1203B
400 Volts		20A4	1N1126	—	3F40	1N1126A	1N3572	1N1346	1N1346A	1N1346B	1N1204	1N1204A	1N1204B
500 Volts		20A5	1N1127	—	3F50	1N1127A	1N3573	1N1347	1N1347A	1N1347B	1N1205	1N1205A	1N1205B
600 Volts		20A6	1N1128	—	3F60	1N1128A	1N3574	1N1348	1N1348A	1N1348B	1N1206	1N1206A	1N1206B
700 Volts		—	—	—	—	1N3649	—	6F70A	1N3987	6F70B	1N3670	1N3670A	—
800 Volts		20A8	—	—	3F80	1N3650	—	6F80A	1N3988	6F80B	1N3671	1N3617A	12F80B
900 Volts		—	—	—	—	—	—	6F90A	1N3989	6F90B	1N3672	1N3672A	—
1000 Volts		20A10	—	—	3F100	—	—	6F100A	1N3990	6F100B	1N3673	1N3673A	12F100B

SILICON ASSEMBLIES

Listing includes selected pre-engineered molded and open stack assemblies.
IR has a proven record of supplying new and unusual designs to meet stringent or unorthodox parameters.
For further assistance in ordering, or detailed information for designing, call your local IR Distributor, or your local IR Field Office, or IR's El Segundo offices.

GENERAL PURPOSE MOLDED CIRCUITS

Basic series of full wave bridges are specified. Other circuits shown are available.

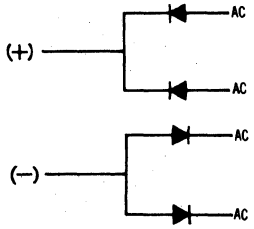
RATINGS AND CHARACTERISTICS

Part Number	10DB	18DB	50FB	60FB
I_{FM} (surge)—Max. peak one cycle surge current	40	40	200	150
I_{FM}—Max. repetitive peak current	4	5	20	—
T_A—Operating temp (°C)	−40° to 140°	−40° to 140°	−20° to 140°	—
T_J—Operating temp (°C)	—	—	—	−65° to 150°

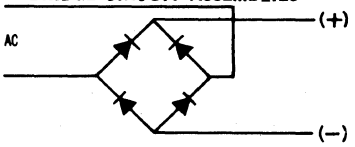
NOTE

Suitable safety factors—both voltage and current—commensurate with individual application conditions must be applied to the absolute maximum ratings to safeguard against voltage transients and current surges.

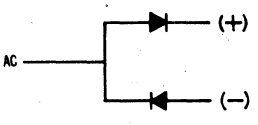
CENTER TAP CIRCUIT ASSEMBLIES



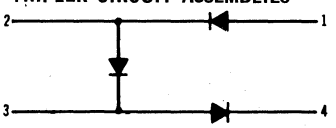
BRIDGE CIRCUIT ASSEMBLIES



DOUBLER CIRCUIT ASSEMBLIES



TRIPLER CIRCUIT ASSEMBLIES



RATINGS—ABSOLUTE MAXIMUMS

I_F (AV)—Max. avge output current @ 50°C Amb. (AMPS)		Part Number	V_{RM} (non-rep)—Max. non-repetitive peak reverse	V_{RM} (rep)—Max. repetitive peak reverse voltage (V)
Resistive load	Capacitive load (1)			

BRIDGE CIRCUIT ASSEMBLIES

1 Amp Bridge				
1.0	0.7	10DB1P	250	100
1.0	0.7	10DB2P	350	200
1.0	0.7	10DB4P	600	400
1.0	0.7	10DB6P	800	600
1.8 Amp Bridge				
1.8	1.3	18DB2A	350	200
1.8	1.3	18DB3A	450	300
1.8	1.3	18DB4A	600	400
1.8	1.3	18DB5A	700	500
1.8	1.3	18DB6A	800	600
1.8	1.3	18DB7A	900	700
1.8	1.3	18DB8A	1000	800
1.8	1.3	18DB10A	1250	1000
5 Amp Bridge				
3.75	3.0	50FB1L	125	100
3.75	3.0	50FB2L	250	200
3.75	3.0	50FB3L	375	300
3.75	3.0	50DB4L	500	400
3.75	3.0	50FB5L	625	500
3.75	3.0	50FB6L	750	600
6 Amp Bridge				
6.0	—	60FB05L	50	35
6.0	—	60FB1L	100	70
6.0	—	60FB2L	200	140
6.0	—	60FB3L	300	210
6.0	—	60FB4L	400	280
6.0	—	60FB6L	600	420

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PLUG-IN RECTIFIERS

MAXIMUM CONDITIONS:

T_J—Operating Temperature (°C): −60° to 170°

T_{stg}—Storage Temperature (°C): −60° to 170°

Weight: 1/3 oz.

Case: D-3 (Page 13)

MAXIMUM RATINGS

Part Number	1N1081	1N1082	1N1083	1N1084	5MA1	5MA2	5MA3	5MA4	5MA5	5MA6	5MA8	5MA10
V_{RM}—Max. Peak Reverse Voltage V_R—Max. Continuous Reverse d.c. Voltage (Volts)	100*	200*	300*	400*	100	200	300	400	500	600	800	1000
I_F (AV)—Max. Avge Rect'd Output Current @ 75°C (A)	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

*JEDEC Registered Values

SOLID-STATE TUBE REPLACEMENTS

Silicon rectifiers molded on tube-type bases to replace vacuum tube and mercury vapor tube rectifiers. Cross Reference data is available. Dimensions are the same as the tube the device replaces.

Part Number	V_{FM}—Working Peak Reverse Voltage per Leg (Volts)	I_{FM} (AV)—Max. dc Output Current @ 70°C (mA)
1N570 (ST-1A)	1,500	75
1N1150A	1,600	750*
1N1237	1,600	750*
1N1238	1,600	750*
1N1239	2,800	500*
1N1262 (ST-7)	4,500	250*
1N2389 (ST-14)	1,600	600
1N2490	1,600	500*
1N2630 (ST-1)	1,500	85
1N2631 (ST-2)	1,600	600
1N2632 (ST-2A)	2,800	200
1N2633 (ST-3)	1,600	600

Part Number	V_{FM}—Working Peak Reverse Voltage per Leg (Volts)	I_{FM} (AV)—Max. dc Output Current @ 70°C (mA)
1N2634 (ST-4)	1,600	600
1N2635 (ST-5)	1,500	85
1N2636 (ST-6)	1,500	85
1N2637 (ST-7A)	10,400	250
ST-8	1,250	80
ST-9	10,000	1,250
ST-10	10,000	1,250
ST-11	7,500	125
ST-12	40,000	100
ST-13	1,275	130
ST-15	15,000	1,750

* @ 100°C

MEDIUM CURRENT MOLDED CIRCUITS

Medium current full wave, single-phase, bridge circuits.

Lead colors: Yellow = AC Red = + Black = −
Max. dc Output Current @ 55°C and Resistive Load: 10 Amperes.
I_{FM} (surge)—Max. Peak One-cycle Non-recurrent Surge Current: 300 Amperes.
I_{FM}—Max. Recurrent Peak Forward Current: 60 Amperes.
Operating Temperature Range: −65° to +150°C.
Case; Pigtail Leads: D-4 Page 13
Lug Terminals: D-5 Page 14

MAXIMUM RATINGS

IR Part Number		100PB05P	100PB1P	100PB2P	100PB3P	100PB4P	100PB6P
V_{RM}—Maximum Peak Reverse Voltage V_R—Maximum Continuous Reverse dc Voltage (Volts)		50	100	200	300	400	600
V_{RMS}—Maximum RMS Input (Volts) @ 55°C		35	70	140	210	280	420
DC Output Voltage (Volts)	Res. Load	30	60	120	180	240	360
	Cap. Load	35	70	140	210	280	420

HIGH VOLTAGE MOLDED CIRCUITS

Listed below are 3 series of half-wave assemblies. Doubler assemblies are also available from International Rectifier.

RATINGS—ABSOLUTE MAXIMUM OPERATING RANGE

IR Number	JEDEC No.	V_{RM} (rep)—Max. rep. peak reverse volt. per leg (KV) (1)	I_F (AV)* @ 50°C	I_{FM} (surge)—Max. peak one-cycle, non-repetitive surge current (Amps)	I_R (AV)—Max. average reverse current (μA)	Operating Temperature (°C)	Storage Temperature (°C)	Case (Page 14)
HALF-WAVE ASSEMBLY								
Avalanche Type 67D—N Series								
67D050H04TNN	—	5.0	0.25					
67D075H04TNN	—	7.5	0.25					
67D100H04TNN	—	10.0	0.25					
67D120H04TNN	—	12.0	0.25	35	1	−65° to 140°	−65° to 150°	D-7
67D150H04TNN	—	15.0	0.25					
67D200H04TNN	—	20.0	0.25					
67D300H04TNN	—	30.0	0.25					
67D400H04TNN	—	40.0	0.25					
RC Compensated Type 67D—S Series (2)								
67D050H20TTS	—	5.0	0.35					
67D075H20TTS	—	7.5	0.35					
67D100H20TTS	—	10.0	0.35					
67D120H20TTS	—	12.0	0.35					
67D150H20TTS	—	15.0	0.35					
67D200H20TTS	—	20.0	0.35	35	270	−65° to 140°	−65° to 150°	D-8
67D250H20TTS	—	25.0	0.35					
67D300H20TTS	—	30.0	0.35					
67D400H20TTS	—	40.0	0.35					
67D500H20TTS	—	50.0	0.35					
67D600H20TTS	—	60.0	0.35					
67D750H20TTS	—	75.0	0.35					

RATINGS—ABSOLUTE MAXIMUM OPERATING RANGE

IR Number	JEDEC No.	V_{RM} (rep)—Max. rep. peak reverse volt. per leg (KV) (1)	I_F (AV)* @ 50°C	I_{FM} (surge)—Max. peak one-cycle, non-repetitive surge current (Amps)	I_R (AV)—Max. average reverse current (μA)	Operating Temperature (°C)	Storage Temperature (°C)	Case (Page 14)
HALF-WAVE ASSEMBLY								
RC Compensated Type 67C—S Series (2)								
67C015H20LSS	1N4865	1.5	1.25					
67C024H20LSS	1N4866	2.4	1.25					
67C030H20LSS	1N4867	3.0	1.25					
67C050H20LSS	1N4868	5.0	1.25					
67C075H20LSS	1N4869	7.5	1.25					
67C100H20LSS	1N4870	10.0	1.25					
67C120H20LSS	1N4871	12.0	1.25	50	270	−65° to 175°	−65° to 175°	D-8
67C150H20LSS	1N4872	15.0	1.25					
67C200H20LSS	1N4873	20.0	1.25					
67C250H20LSS	1N4874	25.0	1.25					
67C300H20LSS	1N4875	30.0	1.25					
67C400H20LSS	1N4876	40.0	1.25					
67C500H20LSS	1N4877	50.0	1.25					
67C750H20LSS	1N4878	75.0	1.25					

* I_F (AV)—Max. average forward current (A) with resistive load @ 180° conduction.
(1) This value is absolute maximum value. Derate by 50% for a standard safety factor.
(2) Also available with turret lugs, or pigtail leads, and threaded studs.
For 67C-S and 67D-S series, optional electrical connections and mounting facilities are available.

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HIGH POWER CARTRIDGE RECTIFIERS

A practical series of rectifiers, molded to minimize flash-over and corona at high altitudes. Special ratings are listed for forced air cooling. Case Outline: D-9 Page 14.

	MINIATURE AXIAL LEAD CARTRIDGES				STANDARD SERIES, FERRULE MOUNTED CARTRIDGES					HIGH CURRENT SERIES, FERRULE MOUNTED CARTRIDGES					
V_{RM} (rep)—Max. repetitive peak reverse voltage (V)	JEDEC Number	(I_F (AV)—Max. average forward current (mA)) @ 25°C	@ 100°C	IR Number (1)	(I_F (AV)—Max. average forward current (mA)) @ 50°C	@ 100°C	JEDEC Number	(JEDEC) I_F (AV)—Max. average forward current @ 75°C (mA)	IR Number (1)	(IR) I_F (AV)—Max. average forward current @ 50°C (mA)	JEDEC Number	(I_F (AV)—Max. average forward current (mA)) Oil Immersed temp. @ 25°C	Forced convection—Air Temp. @ 75°C (1)	IR Number (1)	I_F (AV)—Max. avge forward current @ 50°C (mA) Forced air & oil Immersed (1)
0.6	1N2373	250	100	67D006H53PNN	250	100	—	—	—	—	—	—	—	—	—
1.0	1N2374	250	100	67D010H53PNN	250	100	—	—	—	—	—	—	—	—	—
1.5	1N2375	200	100	67D015H53PNN	250	100	1N1133	75	67D015H55FNN	250	1N1745	380	300	67D015H55FNN	500
1.5	—	—	—	—	—	—	1N1134	100	—	—	1N1746	440	360	—	—
1.8	—	—	—	—	—	—	1N1135	65	67D018H55FNN	250	1N1747	360	270	67D018H55FNN	500
1.8	—	—	—	—	—	—	1N1136	85	—	—	1N1748	420	330	—	—
2.0	1N2376	200	100	—	—	—	—	—	—	—	—	—	—	—	—
2.0	—	—	—	67D020H53PNN	250	100	—	—	—	—	—	—	—	—	—
2.4	1N2377	150	75	—	—	—	1N1137	50	67D024H55FNN	250	1N1749	320	220	67D024H55FNN	500
2.4	—	—	—	—	—	—	1N1138	60	—	—	1N1750	380	270	—	—
3.0	1N2378	150	75	—	—	—	—	—	—	—	—	—	—	—	—
3.0	—	—	—	67D030H53PNN	250	100	—	—	—	—	—	—	—	—	—
3.6	—	—	—	—	—	—	1N1139	65	—	—	1N1751	370	290	—	—
3.6	—	—	—	—	—	—	1N1140	65	67D036H55FNN	250	1N1752	360	280	67D036H55FNN	500
4.0	1N2379	100	50	—	—	—	—	—	—	—	—	—	—	—	—
4.8	—	—	—	—	—	—	1N1141	60	—	—	1N1753	330	230	—	—
4.8	—	—	—	—	—	—	1N1142	50	67D048H55FNN	250	1N1754	320	220	67D048H55FNN	430
5.0	—	—	—	67D050H53PNN	250	100	—	—	67D050H55FNN	250	—	—	—	67D050H55FNN	430
6.0	1N2380	100	50	—	—	—	1N1143	50	—	—	1N1755	290	210	—	—
6.0	—	—	—	—	—	—	1N1143A	65	—	—	1N1756	360	280	—	—
7.2	—	—	—	—	—	—	1N1144	50	—	—	1N1757	290	240	—	—
7.2	—	—	—	—	—	—	1N1145	60	—	—	1N1758	330	230	—	—
7.5	—	—	—	—	—	—	—	—	67D075H55FNN	250	—	—	—	67D075H55FNN	375
8.0	—	—	—	67D080H53PNN	250	100	1N1146	45	—	—	1N1759	250	220	—	—
10.0	1N2381	75	25	—	—	—	—	—	67D100H55FNN	250	—	—	—	67D100H55FNN	375
10.0	—	—	—	67D100H53PNN	250	100	—	—	—	—	—	—	—	—	—
12.0	—	—	—	67D120H53PNN	250	100	1N1147	45	—	—	1N1760	250	220	—	—
12.0	—	—	—	—	—	—	—	—	67D120H55FNN	250	—	—	—	67D120H55FNN	375
14.0	—	—	—	—	—	—	1N1148	50	—	—	1N1761	300	240	—	—
15.0	—	—	—	67D150H53PNN	250	100	—	—	67D150H55FNN	250	—	—	—	67D150H55FNN	375
16.0	—	—	—	—	—	—	1N1149	45	—	—	1N1762	250	220	—	—
20.0	—	—	—	67D200H53PNN	250	100	—	—	67D200H55FNN	250	—	—	—	67D200H55FNN	375
25.0	—	—	—	67D250H53PNN	250	100	—	—	67D250H55FNN	250	—	—	—	67D250H55FNN	375
30.0	—	—	—	67D300H53PNN	250	100	—	—	67D300H55FNN	250	—	—	—	67D300H55FNN	375
40.0	—	—	—	—	—	—	—	—	67D400H55FNN	250	—	—	—	67D400H55FNN	375
50.0	—	—	—	—	—	—	—	—	67D500H55FNN	250	—	—	—	67D500H55FNN	375

(1) At 2000 LFM Air Velocity

SILICON STACK ASSEMBLIES

International Rectifier offers the widest selection of standard stack assemblies and the largest potential for special order devices.

RECTIFIER CIRCUITS

As listed, rectifier circuits incorporate only standard rectifier devices. IR offers standard stacks in 6 circuit configurations with ratings of 12 to 1820 Amperes and 100 to 2000 Volts.

HYBRID CIRCUITS

Incorporating both silicon controlled rectifiers and standard rectifiers, these stacks provide controlled power for many applications. Four standard series are listed, with ratings of 8 to 720 Amperes and 100 to 1300 Volts.

SILICON CONTROLLED RECTIFIER CIRCUITS

All SCR circuits provide greater power control range for many applications. IR offers 17 standard circuits with ratings of 11 to 1300 Amperes and 100 to 1300 Volts.

SINGLE PHASE BRIDGE Case D-10 Page 14

I_d (Absolute max.) dc output current @ 40°C amb. (Adc) Natural conv.	12	24	35	
V_{RM} (rep) Max. repetitive peak reverse voltage (Volts)	IR Part Number	IR Part Number	V_{RM} (non-rep) Max. non-rep. peak reverse voltage (Volts)	IR Part Number
50	B6F5	B12F5	70	B70H5
100	B6F10	B12F10	200	B70H10
200	B6F20	B12F20	300	B70H20
300	B6F30	B12F30	400	B70H30
400	B6F40	B12F40	525	B70H40
500	B6F50	B12F50	650	B70H50
600	B6F60	B12F60	800	B70H60
700	B6F70	B12F70	925	B70H70
800	B6F80	B12F80	1050	B70H80
900	B6F90	B12F90	1175	B70H90
1000	B6F100	B12F100	1300	B70H100

IGNITRON REPLACEMENT

IR's 200IR70 REPLACES THESE IGNITRONS:

FG238B	AY555/653B
WL653B	WL555/653B
5555	GL555/FG238B
	GL5555

CHARACTERISTICS:

THERMAL-MECHANICAL		IR No. 200IR70
	Temperature Storage	−40° to +120C°
	Temperature Operating	−40° to +65°C
	Operating Frequency	50 to 400 H_z
ELECTRICAL RATINGS		
V_{RM} (non-rep)	Maximum Transient Peak Reverse Voltage Non-Repetitive .005 sec. max.	1600V
V_{RM} (rep)	Maximum Repetitive Peak Reverse Voltage	
	Transient Suppression Module Limits	1200V
	Repetitive Peak Reverse Voltage to	735V
I_F (AV)	Forward Current (180° Cond. Period) @ 50°C Max. Amb. Temp.	
	Natural Convection Cooled	225A
	Forced Air Cooled @ 1000 L FM	475A

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LIGHT SENSITIVE DEVICES

IR offers both Silicon and Selenium photovoltaic cells for convenient design and product selection.

Complete specifications and detailed application data are available. For ordering and pricing information, contact your local IR Industrial Distributor, or your local IR Field Office, or IR's El Segundo Offices.

SILICON PHOTOVOLTAIC CELLS

Silicon Cells are commonly used for light sensing and power generation because of their high efficiency.

A normal response time for Silicon Cells is 2 microseconds. The cells respond well to the longer wavelength (red) light and poorly to the shorter wavelength (blue) light.

SELENIUM PHOTOVOLTAIC CELLS

Selenium Cells offer color response similar to human vision and are especially useful in ultraviolet range applications. Due to a slightly higher internal impedance, selenium has a slower frequency response than silicon.

SILICON READOUT ARRAYS

Designed for perforated tape and punched card data reading systems, analog-to-digital encoders, and shaft positioning systems, these readout photocells provide high speed response to light passing through punched cards or tape.

Typical current generated is 175 μA for 0.01 square inch of active area with load impedance of 1,000Ω and 500 FC illumination.

ELECTRICAL CHARACTERISTICS @ 500 FC, Color Temp. 2800°K Tungsten, 26°C Ambient

Parameter	—08 Series		—10 Series	
	Typical	Minimum	Typical	Minimum
Short Circuit Current (μA) (1)	250	225	315	250
Load Current (μA) (1)	180	145	270	200
Load Voltage (mV) (1)	180	145	270	200
Open Circuit Voltage (mV) (1)	325	—	325	—
Response Time (μsec) (2)	2.0		2.0	

MECHANICAL CHARACTERISTICS

Center to Center Spacing (inch)	0.087	0.100
Active Area (inch)		
width	0.077	0.90
length	0.160	0.160

Cell listed is P-on-N. For N-on-P, use "A" in place of "P" (SAR-2-08 for N-on-P). For leads, add "PL" to code (SPR-2-08PL for leads). For baseplate, add "B" to code (SPR-2-08B, SAR-2-08BPL).

Part Number	Number of Segments	Overall Length (inches)	Part Number	Number of Segments	Overall Length (inches)
SPR-2-08	2	0.174	SPR-2-10	2	0.200
SPR-3-08	3	0.261	SPR-3-10	3	0.300
SPR-4-08	4	0.348	SPR-4-10	4	0.400
SPR-5-08	5	0.435	SPR-5-10	5	0.500
SPR-6-08	6	0.522	SPR-6-10	6	0.600
SPR-7-08	7	0.609	SPR-7-10	7	0.700
SPR-8-08	8	0.696	SPR-8-10	8	0.800
SPR-9-08	9	0.783	SPR-9-10	9	0.900
SPR-10-08	10	0.870	SPR-10-10	10	1.000

SOLAR CELL STANDARD

Precisely calibrated to provide accurate radiation measurement. This standard is the solid-state analog to the pyroheliometer standard. Each cell is calibrated against primary standard cells which were calibrated at Table Mountain, California.

This cell is used to check the efficiencies of production silicon solar cells and to calibrate artificial light sources in terms of solar energy radiation.

Each cell is supplied with an 8½" X 11" curve of the cell output characteristics. Each cell comes in a special carrying case, and the device incorporates thermocouple lead and plug-in output terminals.

IR Solar Cell Standard....Part Number SC-9

STANDARD INDIVIDUAL SILICON CELLS

This is a listing of popular silicon cells offered by IR. These cells offer excellent characteristics and high reliability in an inexpensive form.

Electrical Characteristics @ 100 mW/cm², M = 1

Part Number	Minimum Conversion Efficiency	Minimum Power Output (mW)	Minimum Output Current (mA)
(1)			
SPR-1-08E7	7%	0.55	1.25
SPR-1-08E10	10%	0.78	1.95
SPR-1-10E7	7%	0.64	1.60
SPR-1-10E10	10%	0.92	2.30
(2)			
S0505E6	6%	1.2	3.0
S0505E7	7%	1.4	3.5
S0505E8	8%	1.6	4.0
S0505E9	9%	1.8	4.5
S0505E10	10%	2.0	5.0
S0505E11	11%	2.2	5.5
S0505E12	12%	2.4	6.0
S0510E6	6%	2.4	6.0
S0510E7	7%	2.8	7.0
S0510E8	8%	3.2	8.0
S0510E9	9%	3.6	9.0
S0510E10	10%	4.0	10.0
S0510E11	11%	4.4	11.0
S0510E12	12%	4.8	12.0
S0520E6	6%	4.8	12.0
S0520E7	7%	5.6	14.0
S0520E8	8%	6.4	16.0
S0520E9	9%	7.2	18.0
S0520E10	10%	8.0	20.0
S0520E11	11%	8.8	22.0
S0520E12	12%	9.6	24.0
S1010E4	4%	3.6	9.0
S1010E5	5%	4.5	11.3
S1010E6	6%	5.4	13.5
S1010E7	7%	6.3	15.8
S1010E8	8%	7.2	18.0
S1020E4	4%	7.2	18.0
S1020E5	5%	9.0	22.5
S1020E6	6%	10.8	28.0
S1020E7	7%	12.6	31.5
S1020E8	8%	14.4	36.0
S1010GE6	6%	5.4	11.8
S1010GE7	7%	6.3	13.7
S1010GE8	8%	7.2	15.7
S1010GE9	9%	8.1	17.7
S1010GE10	10%	9.0	19.6
S1010GE11	11%	9.9	21.5
S1010GE12	12%	10.8	23.5

(1) Cells listed are P-on-N. For N-on-P, use "A" in place of "P" (SAR-1-08E7 for N-on-P).
(2) All cells listed are P-on-N. For N-on-P, use "A" in place of "E" (S0505A6 for N-on-P).

Listing Continues.

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STANDARD INDIVIDUAL SILICON CELLS—Continued

Part Number	Minimum Conversion Efficiency	Minimum Power Output (mW)	Minimum Output Current (mA)
(2) S1020GE6	6%	10.8	23.5
S1020GE7	7%	12.6	27.2
S1020GE8	8%	14.4	31.3
S1020GE9	9%	16.2	35.3
S1020GE10	10%	18.0	39.2
S1020GE11	11%	19.8	43.0
S1020GE12	12%	21.6	47.0
S2020GE6	6%	22.8	49.5
S2020GE7	7%	26.6	57.8
S2020GE8	8%	30.4	66.0
S2020GE9	9%	34.2	74.5
S2020GE10	10%	38.0	82.6
S2020GE11	11%	41.8	91.0
S2020GE12	12%	45.6	99.3
S2900E5	5%	28.5	68.0
S2900E6	6%	34.2	82.0
S2900E7	7%	39.9	95.0
S2900E8	8%	46.3	109.0
S2900E9	9%	51.3	120.0
S2900E10	10%	57.0	136.0

(1) Cells listed are P-on-N. For N-on-P, use "A" in place of "P" (SAR-1-08E7 for N-on-P).
(2) All cells listed are P-on-N. For N-on-P, use "A" in place of "E" (S0505A6 for N-on-P).

SOLAR POWER MODULES

Assemblies listed are designed for solar power conversion. They are suited for remote locations. Three types are listed below.

Unmounted Power Modules: Individual modules of single cells connected in series.

Weatherproof Modules: Individual cells imbedded in an epoxy resin providing a rugged, shockproof, weatherproof housing.

Hermetically Sealed Solar Power Converters: Cells mounted on hard anodized aluminum base with an O-ring seal and replaceable plexiglass cover.

UNMOUNTED POWER MODULES

The first number in the part number code indicates the number of cells in series. The last number indicates the conversion efficiency rating. That is, 2SM1020E4 has 2 cells in series and a conversion efficiency rating of 4%.

Electrical Characteristics @ 100 mW/cm², M = 1

Part Number (1)	Minimum Output Power (mW)	Minimum Output Voltage (Volts)	Minimum Output Current (mA)
2SM1020E4	14.4	0.8	18.0
2SM1020E5	18.0	0.8	21.5
2SM1020E6	21.6	0.8	27.0
2SM1020E7	25.2	0.8	31.6
2SM1020GE8	28.8	0.8	36.0
2SM1020GE9	32.4	0.8	40.5
2SM1020GE10	36.0	0.8	45.0
3SM1020E4	21.6	1.2	18.0
3SM1020E5	27.0	1.2	21.5
3SM1020E6	32.4	1.2	27.0
3SM1020E7	37.8	1.2	31.6
3SM1020GE8	43.2	1.2	36.0
3SM1020GE9	48.6	1.2	40.5
3SM1020GE10	54.0	1.2	45.0
5SM1020E4	36.0	2.0	18.0
5SM1020E5	45.0	2.0	21.5
5SM1020E6	54.0	2.0	27.0
5SM1020E7	63.0	2.0	31.6
5SM1020GE8	72.0	2.0	36.0
5SM1020GE9	81.0	2.0	40.5
5SM1020GE10	90.0	2.0	45.0

(1) All cells listed are P-on-N. For N-on-P use "A" in place of "E".
For pigtail leads add "PL" at end of code.
For ribbon leads add "T" at end of code.

WEATHERPROOF MODULES
ELECTRICAL CHARACTERISTICS @ 100 mW/cm², M = 1

Part Number	Minimum Output Voltage (Volts)	Minimum Load Current (mA)	Minimum Power (mW)
SP2A40B	1.6	36	58
SP2B48B	1.6	40	64
SP4C40B	3.2	36	115
SP2C80B	1.6	72	115
SP4D48B	3.2	40	128
SP2D96B	1.6	80	128

SOLAR POWER CONVERTERS

Electrical Characteristics @ 100 mW/cm², M = 1

Each unit has an overall diameter of 12 inches and a bolt circle of 11.25 inches.

Part Number	Minimum Load Voltage (Volts)	Minimum Load Current (mA)	Power Output (W)
SP14H52D	14.4	52	0.75
SP14J69E	14.4	69	1.0
SP14K104F	14.4	104	1.5

SELENIUM PHOTOCELLS

Selenium photocells are popular for light meters, as well as many other light-sensing applications. Many special parameters may be selected to meet specific requirements. Complete specifications for these standard series devices are included in IR's Engineering Catalog.

RECTANGULAR TYPES			ROUND TYPES		
Cell Type	Output Current 100fc 100 Ohms (Microamperes)	Size (in.) L x W	Cell Type	Output Current 100fc 100 Ohms (Microamperes)	Diameter (in.)
B1	32	0.59 x 0.24	A2	12	0.25
B2	77	0.72 x 0.44	A3	20	0.38
B4	120	0.88 x 0.54	A5	250	1.13
B5	250	1.44 x 0.64	A7	440	1.50
B10	380	1.69 x 0.88	A10	600	1.75
B15	640	1.69 x 1.69	A15	770	2.0
B17	710	6.0 x 0.50	A30	1400	2.75
B20	900	2.0 x 2.0	PC103	600	OD-2.0
B30	2200	3.25 x 3.25			ID-0.69

MOUNTED CELLS

Mounted Cell Type	Typical Output Current 100 fc 100 Ohms (Microamps)	Size (in.)
B10-M	320	1.1 x 0.3
A5-M	220	1.2 Diameter
A7-M	350	1.7 Diameter
A10-M	550	1.9 Diameter
A15-M	700	2.1 Diameter

MOISTURE RESISTANT CELLS

Hermetic Sealed Cell Type	Typical Output Current 100fc 100 Ohms (Microamps)	Size (in.)
DP-5	600	2.0 square
DP-3	66	.925 x .750 (1)
DP-2	24	.360 x .750 (2)

(1) Crystal case; window in side
(2) Crystal case; window in top

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HEAT EXCHANGERS

You look to IR for quality devices. Now you can look to IR for total system design, development, and components

For further data, call your local IR Industrial Distributor, or local IR field office, or IR's El Segundo Offices.

IR Part No.	Types of Devices	Dimensions (Pgs. 14 & 15)	Dimension L	Dimension A	Dimension B
HE-030	3' Undrilled	F-1	3'	—	—
HE-032	"	F-2	3'	—	—
HE-034	"	F-3	3'	—	—
HE-040	"	F-4	3'	—	—
HE-050	"	F-5	3'	—	—
HE-052	"	F-6	3'	—	—
HE-053	"	F-6	3'	—	—
HE-061	"	F-8	3'	—	—
HE-080	'H', up to 120 in.	F-9	Up to 120"	—	—
HE-085	'I', up to 120 in.	F-10	Up to 120"	—	—
HE-101	TO-18, 24, 28, 40, 44	F-11	—	.150	.640
HE-102	TO-5, 9, 11, 12, 16, 26, 29, 33, 39, 42, 43, 45	F-11	—	.255	.720
HE-103	TO-8, 38, 48	F-12	—	—	—
HE-200	Undrilled	F-13	.50	—	—
HE-201	TO-3	F-13	.50	—	—
HE-202	TO-36	F-13	.50	—	—
HE-210	Undrilled	F-13	.75	—	—
HE-211	TO-3	F-13	.75	—	—
HE-212	TO-36	F-13	.75	—	—
HE-220	Undrilled	F-13	1.00	—	—
HE-221	TO-3	F-13	1.00	—	—
HE-222	TO-36	F-13	1.00	—	—
HE-230	Undrilled	F-13	1.25	—	—
HE-231	TO-3	F-13	1.25	—	—
HE-232	TO-36	F-13	1.25	—	—
HE-300	Undrilled	F-1	1.25	—	—
HE-310	Undrilled	F-1	2.00	—	—
HE-320	Undrilled	F-2	1.50	—	—
HE-321	TO-3	F-2	1.50	—	—
HE-322	TO-36	F-2	1.50	—	—
HE-330	Undrilled	F-2	3.00	—	—
HE-331	TO-3	F-2	3.00	—	—
HE-340	Undrilled	F-3	3.00	—	—
HE-341	TO-3	F-3	3.00	—	—
HE-400	Undrilled	F-4	.75	—	—
HE-403	TO-64, DO-4, 10-32 Stud	F-4	.75	—	—
HE-410	Undrilled	F-4	1.50	—	—
HE-414	TO-48, TO-65, DO-5, 1/4-28 Stud	F-4	1.50	—	—
HE-415	For 2 TO-48, TO-65, DO-5, 1/4-28 Studs	F-4	1.50	—	—
HE-416	For 2 TO-64, DO-4, 10-32 Studs	F-4	1.50	—	—
HE-417	DO-21, 24, Press Fit	F-4	1.50	—	—
HE-420	Undrilled	F-4	3.00	—	—
HE-424	TO-48, TO-65, DO-5, 1/4-28 Stud	F-4	3.00	—	—
HE-425	For 2 TO-48, TO-65, DO-5, 1/4-28 Studs	F-4	3.00	—	—
HE-500	Undrilled	F-5	1.50	—	—
HE-501	TO-3	F-5	1.50	—	—
HE-502	TO-36	F-5	1.50	—	—
HE-503	TO-64, DO-4, 10-32 Stud	F-5	1.50	—	—
HE-504	TO-48, TO-65, DO-5, 1/4-28 Stud	F-5	1.50	—	—
HE-510	Undrilled	F-5	3.00	—	—
HE-511	TO-3	F-5	3.00	—	—
HE-512	TO-36	F-5	3.00	—	—
HE-520	Undrilled	F-6	3.00	1.88	.200
HE-530	Undrilled	F-6	3.00	2.63	.190
HE-531	TO-3	F-6	3.00	2.63	.190
HE-532	TO-36	F-6	3.00	2.63	.190
HE-540	Undrilled	F-7	5.50	—	—
HE-600	Undrilled	F-14	5.00	—	—
HE-610	Undrilled	F-8	5.50	—	—
HE-620	Undrilled	F-15	6.00	—	—
HE-630	Undrilled	F-16	6.00	—	—
HE-638	DO-9, TO-93, 3/4-16 Stud	F-16	6.00	—	—
HE-640	Undrilled	F-16	9.00	—	—
HE-650	Undrilled	F-17	3.50	—	—
HE-660	Undrilled	F-17	6.00	—	—
HE-670	Undrilled	F-17	12.00	—	—
HE-800	'H', 4" Long	F-9	4.00	—	—
HE-810	'H', 5" Long	F-9	5.00	—	—
HE-820	'H', 6" Long	F-9	6.00	—	—
HE-850	'I', 3" Long	F-10	3.00	—	—
HE-860	'I', 4" Long	F-10	4.00	—	—
HE-870	'I', 5" Long	F-10	5.00	—	—
HE-900	Epoxy	200 gm resin, 14 gms catalyst		—	—
HE-910	Thermal Joint Compound	2 oz.		—	—
HE-911	Thermal Joint Compound	8 oz.		—	—
HE-920	Mounting Bracket	For HE-500 & HE-510		—	—
HE-921	Mounting Bracket	For HE-530 & HE-540		—	—
HE-930	Insulating Washer	For HE-300, 400, & 500 Series		—	—
HE-931	Insulating Washer	For HE-600 Series		—	—

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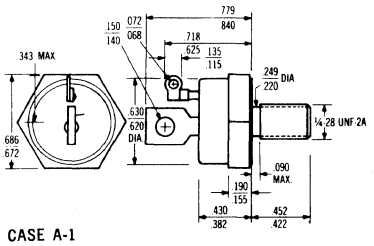
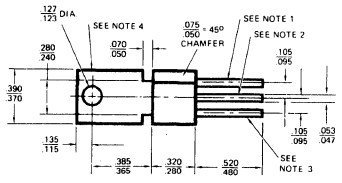
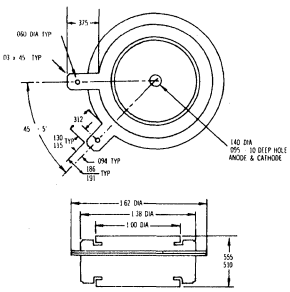


CASE A-1



DIMENSION NOTES:
1. Gate lead adjacent to chamfer.
2. Anode
3. Cathode
4. Internally connected to anode.

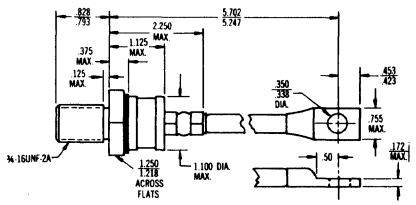
CASE A-2



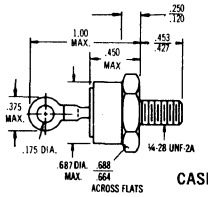
CASE A-3

SYMBOL	INCHES MIN.	INCHES MAX.
A①		.424
ØB②④	.047	.053
ØD	.610	.640
$ØD_1$	.501	.505
$ØD_2$①		.140
F	.080	.190
J④	.500	
N	.200	.250
N_1	.180	.250

① Applies to 25P Series, Lead Flattened
② Applies to 1N3491 & 25PW Series.

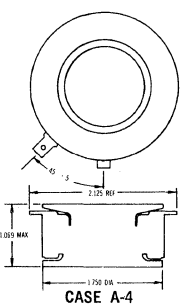


CASE B-6 CONFORMS TO JEDEC OUTLINE DO-9

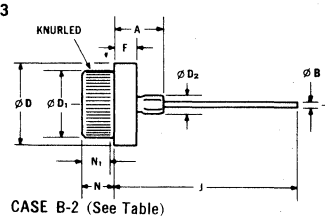


CASE B-1

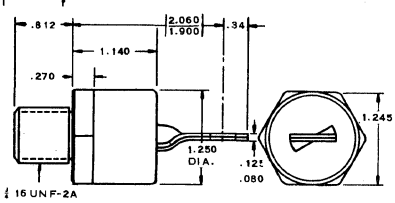
CONFORMS TO JEDEC OUTLINE DO-5

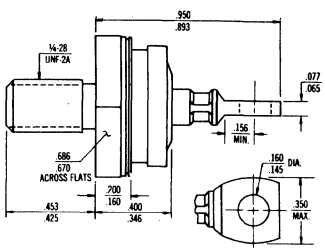


CASE A-4



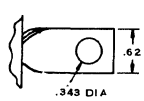
CASE B-2 (See Table)



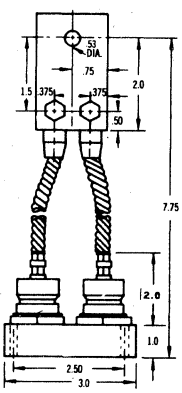


CONFORMS TO JEDEC OUTLINE DO-5

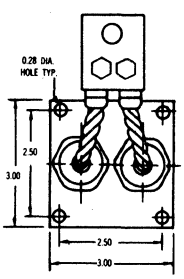
CASE B-4

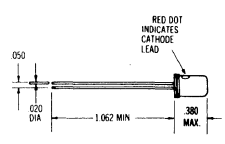


CASE B-5

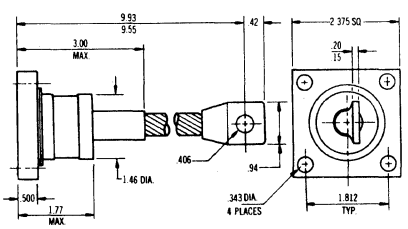


CASE B-9

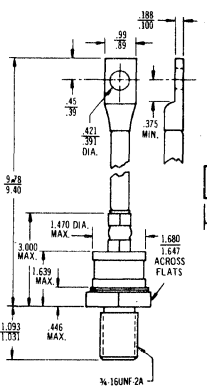




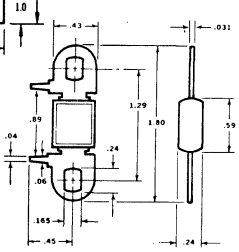
CASE C-1



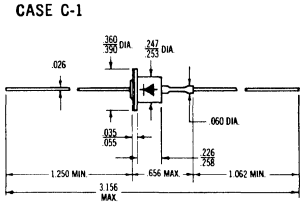
CASE B-7



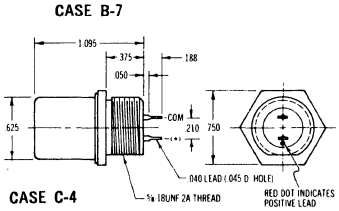
CASE B-8



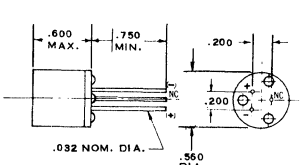
CASE B-10



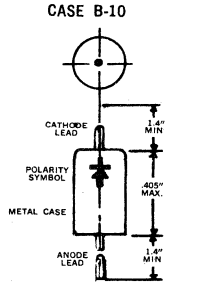
CASE C-3



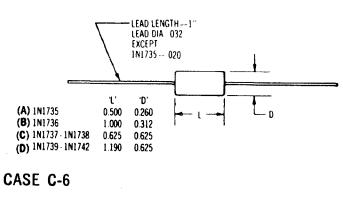
CASE C-4



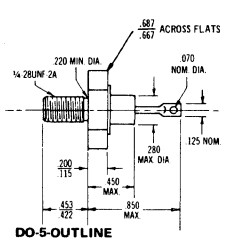
CASE C-5



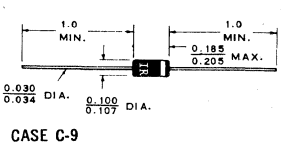
CASE C-10



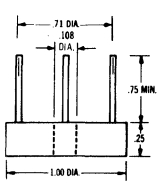
CASE C-6



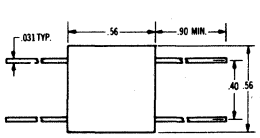
DO-5-OUTLINE
CASE C-8



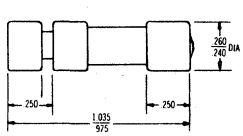
CASE C-9



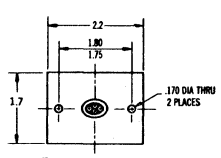
CASE D-1



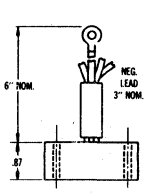
CASE D-2



CASE D-3



CASE D-4



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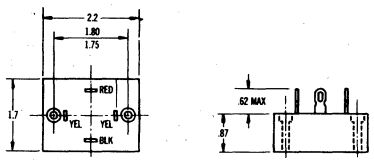
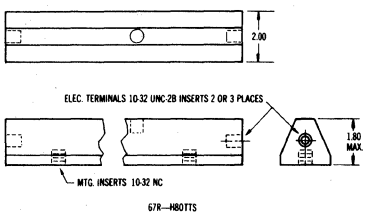
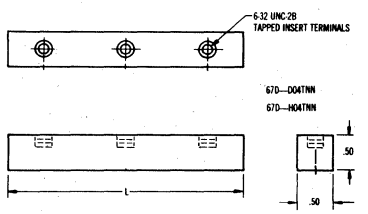


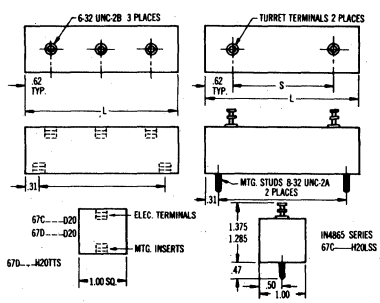
CASE D-5



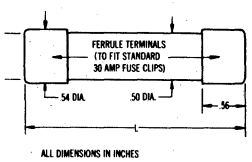
CASE D-6

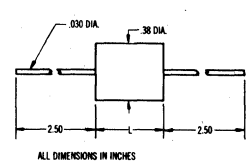


CASE D-7



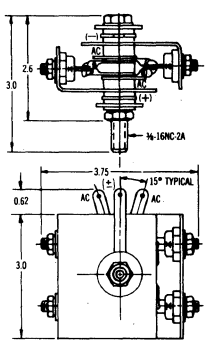
CASE D-8



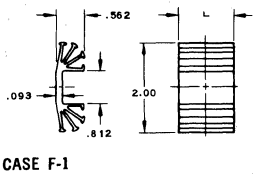


L VARIES WITH
RATING AND SERIES
SEE CATALOG D FOR DETAILS

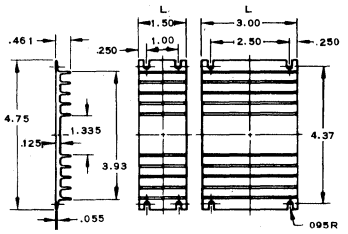
CASE D-9



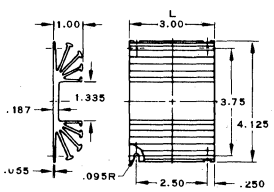
CASE D-10



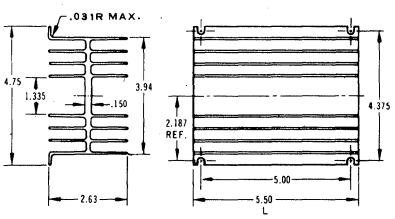
CASE F-1



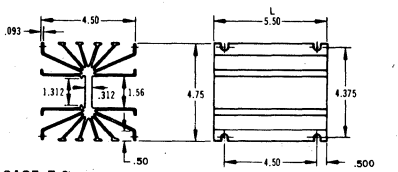
CASE F-2



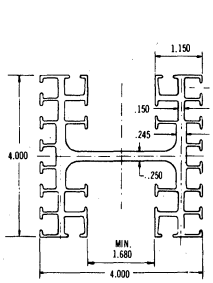
CASE F-3



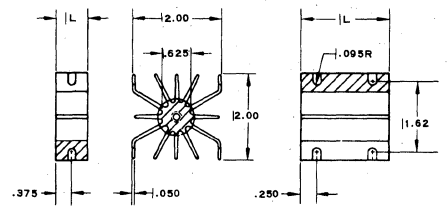
CASE F-7



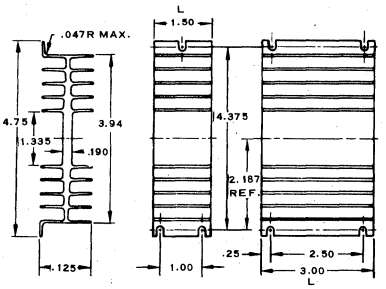
CASE F-8



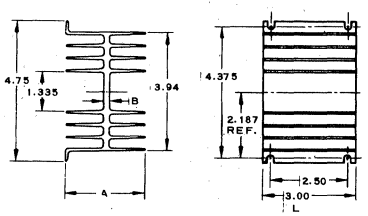
CASE F-9



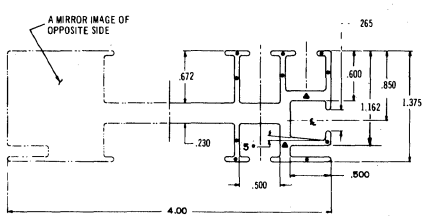
CASE F-4



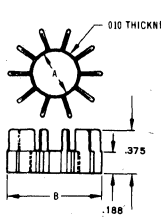
CASE F-5



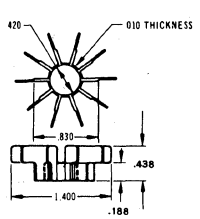
CASE F-6



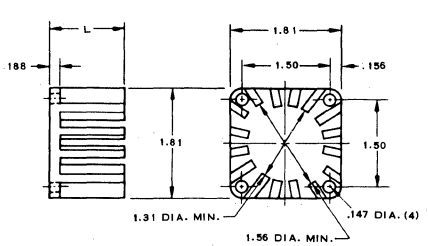
CASE F-10



CASE F-11



CASE F-12



CASE F-13

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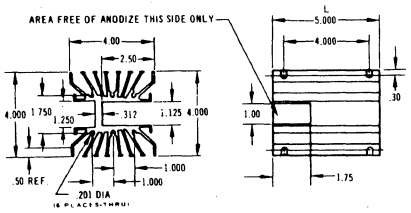
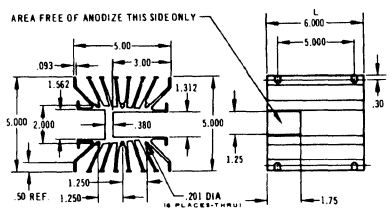
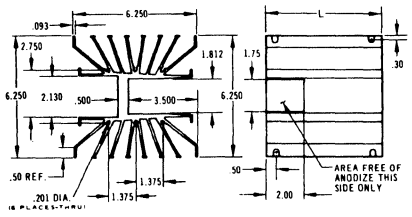


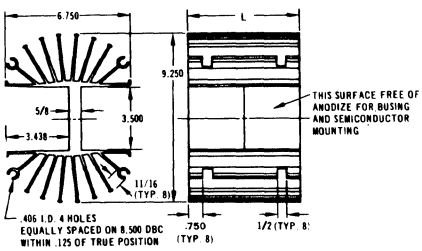
CASE F-14



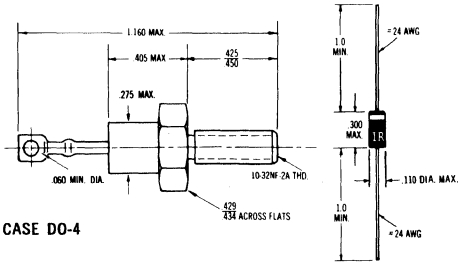
CASE F-15



CASE F-16

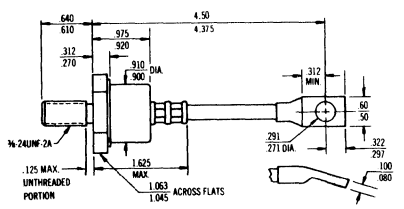


CASE F-17

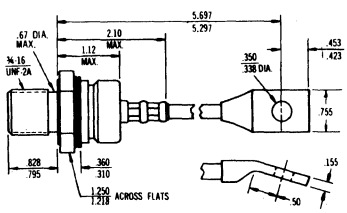


CASE DO-4

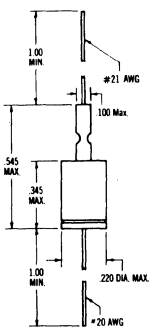
CASE DO-7



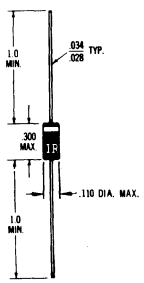
CASE DO-8



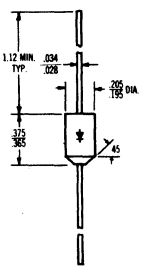
CASE DO-9



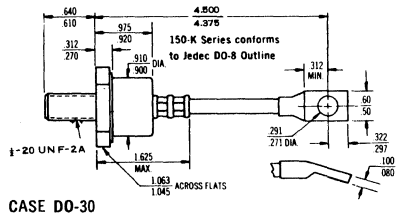
CASE DO-13



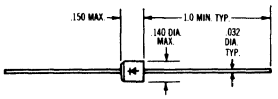
CASE DO-15



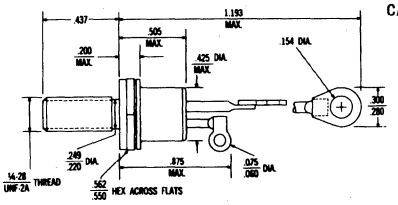
CASE DO-27



CASE DO-30



CASE DO-39



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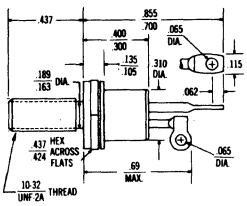

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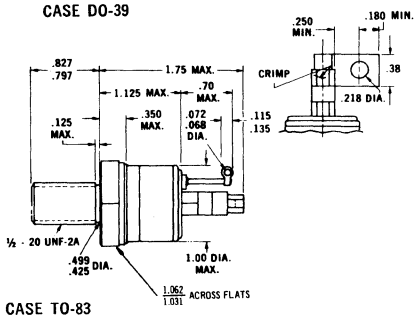

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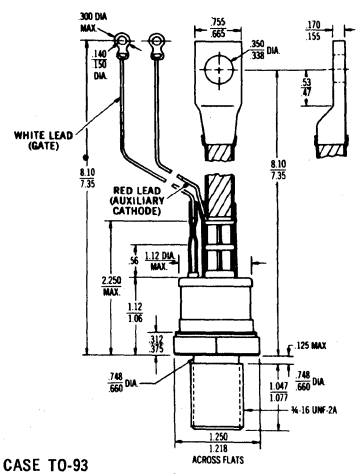

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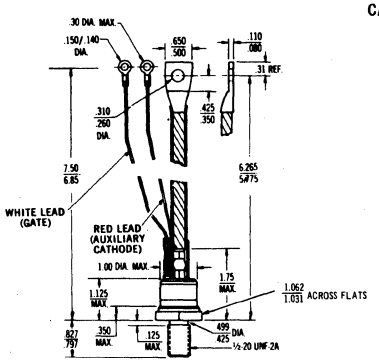

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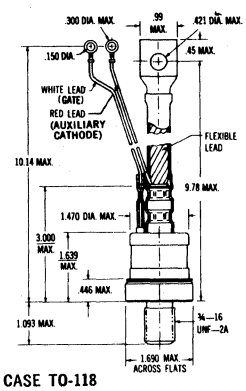
CONFORMS TO TO-49 WHEN AUXILLIARY CATHODE LEAD IS REMOVED



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HUGHES SEMICONDUCTORS
500 Superior Avenue • Newport Beach, Calif. 92663
HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION

contents

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Monolithic Circuits (See EEM Section 3130)....**1621 - 1629**
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Silicon Transistors
Small Signal Transistors **2559**
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some notes about our hughes catalog in **eem**...

These 50 catalog pages represent a broad variety of popular and readily available semiconductor products. Our complete semiconductor line also includes the following families which do not appear in this edition of EEM:

Silicon Voltage References
Germanium Transistors
Field-Effect and UHF/VHF Transistors
Dual and Darlington Transistors
Thyristors and Triggers
Silicon Capacitor Diodes
Special Package Silicon Rectifiers
Special Assemblies

In some cases the specific type you require may not be listed in our EEM pages. Because Hughes can supply virtually any semiconductor type you need, we encourage you to check directly with the factory over our toll-free "Hot Line". Or, call the Hughes sales office in your area.

our special device capabilities...

You'll find that Hughes can answer most any requirement you have for monolithic and discrete component **dice.** For special package or hybrid applications, contact us by "Hot Line" at the factory, or call your local Hughes sales office.

Additionally, Hughes can supply devices in the "LID" (Leadless Inverted Device) or "Hermet" microtransistor configurations. Hughes regional sales offices and our factory sales personnel are ready to handle your inquiry. Call us.

discrete devices



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germanium diodes

Type	Max. Peak Reverse Voltage (volts)	Max. Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA)	Reverse Voltage (volts)	Power Dissipation (mW)	Case Style
1N34	75	1.0	5	50	10	130	DO-7
1N34A	75	1.0	5	30	10	130	DO-7
1N35*	50	1.0	7.5	10	10	—	DO-7
1N36	36	1.0	4	100	25	130	DO-7
1N38	125	1.0	3	6	3	130	DO-7
1N38A	125	1.0	5	5	3	130	DO-7
1N38B	125	1.0	25	6	3	130	DO-7
1N40	25	1.5	12.7	35	10	—	DO-7
1N42	115	1.5	12.8	—	—	—	DO-7
1N44	115	1.0	3	1000	50	130	DO-7
1N45	110	1.0	3	410	50	130	DO-7
1N46	80	1.0	3	1500	50	130	DO-7
1N47	150	1.0	4	500	100	—	A-23a
1N48	85	1.0	5	800	50	130	DO-7
1N49	75	1.0	5	200	20	130	DO-7
1N50	75	1.0	5	80	20	130	DO-7
1N51	50	1.0	2.5	1500	50	130	DO-7
1N52	85	1.0	5	150	50	130	DO-7
1N52A	85	1.0	25	100	50	130	DO-7
1N54	75	1.0	5	10	10	130	DO-7
1N54A	75	1.0	5	7	10	130	DO-7
1N55	150	1.0	5	800	150	—	DO-7
1N55A	170	1.0	4	500	150	—	A-90
1N55B	180	1.0	5	500	150	—	DO-7
1N56	45	1.0	15	300	30	130	DO-7
1N56A	50	1.0	15	300	30	130	DO-7
1N57	100	1.0	3.6	300	75	130	DO-7
1N57A	80	1.0	4	500	75	130	DO-7
1N58	125	1.0	5	800	100	130	DO-7
1N58A	125	1.0	5	600	100	130	DO-7
1N60	40	1.0	5	200	10	80	DO-7
1N60A	40	1.0	5	60	10	80	DO-7
1N61	140	1.0	5	300	100	80	DO-7
1N62	140	1.0	5	700	100	80	DO-7
1N63	125	1.0	5	50	50	130	DO-7
1N63A	100	1.0	4	50	50	80	DO-7
1N65	80	1.0	2.5	200	50	80	DO-7
1N66	60	1.0	5	50	10	80	DO-7
1N66A	60	1.0	5	50	10	80	DO-7
1N67	90	1.0	4	5	5	80	DO-7
1N67A	100	1.0	5	5	5	80	DO-7
1N68	100	1.0	3	625	100	80	DO-7
1N68A	130	1.0	5	625	100	80	DO-7
1N69	85	1.0	5	50	10	130	DO-7
1N69A	75	1.0	5	30	10	80	DO-7
1N70	125	1.0	5	25	10	130	DO-7
1N70A	125	1.0	3	25	10	130	DO-7
1N71	40	1.0	15	300	30	—	M-46
1N73	70	1.5	15	—	—	—	DO-7
1N74	75	1.5	15	—	—	—	M-4
1N75	125	1.0	5	50	50	130	DO-7
1N81	50	1.0	5	10	10	130	DO-7
1N81A	55	1.0	3	10	10	130	DO-7
1N84	25	1	60	750	15	80	DO-7
1N86	70	1	4	50	10	80	DO-7
1N87	23	.25	.1	30	1.5	80	DO-7
1N87A	23	.25	.1	10	1.5	80	DO-7
1N88	90	1	5	75	100	80	DO-7
1N89	100	1	5	8	5	80	DO-7
1N90	75	1	5	500	50	80	DO-7
1N90MP	60	1	5	500	50	80	DO-7
1N95	75	1	10	500	50	80	DO-7
1N96	75	1	20	500	50	80	DO-7
1N96A	75	1	40	500	50	80	DO-7
1N97	100	1	10	8	5	80	DO-7
1N97A	90	1	20	8	5	80	DO-7
1N98	100	1	20	8	5	80	DO-7
1N98A	100	1	40	8	5	80	DO-7
1N99	100	1	10	5	5	80	DO-7
1N100	100	1	20	5	5	80	DO-7
1N100A	100	1	40	50	50	80	DO-7
1N102	125	1	15	3	25	—	DO-7
1N103	20	1	30	750	15	80	DO-7
1N104	25	1	30	750	15	80	DO-7
1N107	10	1	150	200	10	80	DO-7

Type	Max. Peak Reverse Voltage (volts)	Max. Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA)	Reverse Voltage (volts)	Power Dissipation (mW)	Case Style
1N108	50	1	50	200	50	80	DO-7
1N111	75	1	5	25(1)	10	80	DO-7
1N112	75	1	5	50(1)	10	80	DO-7
1N113	75	1	5	25(1)	10	80	DO-7
1N114	75	1	5	50(1)	10	80	DO-7
1N115	75	1	5	100(1)	10	80	DO-7
1N116	75	1	5	100	50	80	DO-7
1N117	75	1	10	100	50	80	DO-7
1N117A	70	1	20	100	50	—	A-23a
1N118	75	1	20	100	50	80	DO-7
1N118A	75	1	40	100	50	80	DO-7
1N120	60	1	5	250(1)	10	80	DO-7
1N126	75	1.0	5	50	10	80	DO-7
1N127	125	1.0	3	25	10	80	DO-7
1N127A	125	1.0	3	25	10	80	DO-7
1N128	40	1.0	3	10	10	30	A-21
1N128A	40	1.0	3	10	10	30	A-21
1N133	5	0.5	3	300	5	—	DO-7
1N135	75	1.0	5	850	50	80	DO-7
1N139	50	1.0	20	1500	50	130	DO-7
1N140	85	1.0	40	300	50	130	DO-7
1N141	80	1.0	20	50	50	80	A-23a
1N142	115	1.0	5	100	100	130	A-23a
1N143	70	1.0	5	0.02	5	—	A-23a
1N144	40	1.0	100	200	20	130	DO-7
1N145	40	1.0	40	100	10	130	DO-7
1N175	125	1.0	5	50	50	80	DO-7
1N191	75	1.0	5	125(1)	50	80	DO-7
1N192	75	1.0	5	250(1)	50	80	DO-7
1N198	80	1.0	4	10	10	80	DO-7
1N198A	80	1.0	4	50	50	80	DO-7
1N198B	100	1.0	4	50	50	80	DO-7
1N265	80	1.0	4	100	60	50	DO-7
1N266	30	1.0	4	75	30	50	DO-7
1N267	25	1.0	4	12	10	—	DO-7
1N268	40	1.0	6	25	10	—	A-23a
1N270	100	1.0	200	100	50	80	DO-7
1N273	35	1.0	100	20	20	80	DO-7
1N276	75	1.0	40	100	50	80	DO-7
1N277	125	1.0	200	250	50	80	DO-7
1N277M	100	1.0	100	—	—	—	DO-7
1N278	60	1.0	20	125(2)	50	80	DO-7
1N279	35	1.0	100	200	20	80	DO-7
1N281	75	1.0	100	30	10	80	DO-7
1N282	15	1.0	40	—	—	80	DO-7
1N283	25	1.0	200	20	10	80	DO-7
1N287	40	1.0	20	1500	50	80	DO-7
1N288	70	1.0	40	350	50	80	DO-7
1N289	80	1.0	20	50	50	80	DO-7
1N290	100	1.0	5	100	100	80	DO-7
1N291	100	1.0	40	100	100	80	DO-7
1N292	70	1.0	100	200	50	80	DO-7
1N294	60	1.0	5	10	10	80	DO-7
1N295	40	—	—	200	10	80	DO-7
1N295A	40	—	—	200	10	80	DO-7
1N297	80	1.0	3.5	10	5	80	DO-7
1N297A	80	1.0	3.5	10	5	80	DO-7
1N298	70	2.0	30	250	40	80	DO-7
1N298A	70	2.0	30	10	5	80	DO-7
1N304	55	1.5	2	2	10	80	DO-7
1N305	60	0.8	100	2	10	150	DO-7
1N306	15	0.8	100	2	10	150	DO-7
1N307	125	1.0	100	5	10	150	DO-7
1N308	8	1.0	300	500	8	80	DO-7
1N309	30	1.0	100	100	20	80	DO-7
1N310	100	1.0	15	20	20	80	DO-7
1N312	50	1.0	30	50	50	80	DO-7
1N313	100	1.0	20	10	20	80	DO-7
1N314	75	1.0	15	50(3)	10	80	DO-7
1N355	80	1.0	4	5	5	80	DO-7
1N367	15	—	20	—	—	—	M-85
1N417	60	1.0	50	120	60	80	DO-7
1N418	60	1.0	7	120	60	80	DO-7
1N419	80	1.0	125	180	90	80	DO-7
1N447	40	1.0	25	60	30	80	DO-7

Notes: (1) $T_A = +55°C$ (2) $T_A = +75°C$ (3) $T_A = +85°C$ (4) $T_A = +70°C$

* Matched pairs of 1N34's

HUGHES SEMICONDUCTORS
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HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION

germanium diodes cont'd

Type	Max. Peak Reverse Voltage (volts)	Max. Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA)	Reverse Voltage (volts)	Power Dissipation (mW)	Case Style
1N448	100	1.0	25	30	30	80	DO-7
1N449	40	1.0	50	30	30	80	DO-7
1N450	100	1.0	50	50	50	80	DO-7
1N451	175	1.0	50	150	150	80	DO-7
1N452	35	1.0	100	30	30	130	DO-7
1N453	115	1.0	100	30	30	130	DO-7
1N454	60	1.0	200	50	50	130	DO-7
1N455	35	1.0	300	30	30	130	DO-7
1N476	90	1.0	3	180	75	80	DO-7
1N477	90	1.0	3	180	75	80	DO-7
1N478	90	1.0	5	155	75	80	DO-7
1N479	90	1.0	5	155	75	80	DO-7
1N480	60	1.0	5	—	—	—	DO-7
1N490	60	1.0	5	—	—	—	A-96
1N497	25	1.0	100	20	20	75	DO-7
1N498	45	1.0	100	25	40	75	DO-7
1N499	60	1.0	100	30	50	75	DO-7
1N500	70	1.0	100	40	60	75	DO-7
1N501	90	.8	100	20	80	75	DO-7
1N502	115	.8	100	20	100	75	DO-7
1N527	20	.3	1	50	10	80	DO-7
1N571	15	1.0	200	100(1)	10	80	DO-7
1N616	30	1.0	8	18	1.5	80	DO-7
1N617	90	1.0	3	11	10	80	DO-7
1N618	90	1.0	5	7	10	80	DO-7
1N631	60	3.5	50	—	—	80	DO-7
1N632	60	1.0	7	120	60	80	DO-7
1N633	90	—	—	—	—	80	DO-7
1N634	125	1.0	50	35	30	80	DO-7
1N635	175	1.0	50	175	150	—	DO-7
1N695	25	1.0	100	2	10	80	DO-7
1N695A	25	0.5	10	2	10	80	DO-7
1N699	105	1.0	100	250(4)	75	80	DO-7
1N770	20	0.5	15	15	10	80	DO-7
1N771	90	1.0	100	25	50	80	DO-7
1N771A	90	1.0	200	25	50	80	DO-7
1N771B	90	1.0	400	25	50	80	DO-7
1N772	80	1.0	100	50	50	80	DO-7

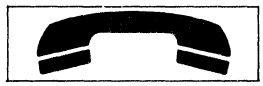
Type	Max. Peak Reverse Voltage (volts)	Max. Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA)	Reverse Voltage (volts)	Power Dissipation (mW)	Case Style
1N772A	80	1.0	200	50	50	80	DO-7
1N773	75	1.0	100	10	10	80	DO-7
1N773A	75	1.0	200	10	10	80	DO-7
1N774	70	1.0	100	15	10	80	DO-7
1N774A	60	1.0	200	15	10	80	DO-7
1N775	70	1.0	100	20	10	80	DO-7
1N776	20	1.0	50	200	10	80	DO-7
1N777	75	1.0	100	125(1)	50	80	DO-7
1N781	40	.45	10	5	10	80	DO-7
1N781A	40	.45	10	5	—	—	DO-7
1N788	60	1.0	100	200(2)	—	—	DO-7
1N805	40	1.0	3	100	10	80	A-23a
1N835	30	1.0	100	200(2)	—	—	DO-7
1N909	60	1.0	100	10	—	—	DO-7
1N910	40	1.0	100	10	—	—	DO-7
1N911	30	1.0	100	10	10	80	DO-7
1N933	100	1.0	4	10	—	—	DO-7
1N949	50	.39	10	10	10	80	DO-7
1N994	6.5	1.0	10	30	6	80	DO-7
1N995	15	1.0	10	10	6	80	DO-7
1N996	20	0.8	40	15	15	80	DO-7
1N1093	15	0.4	5	75(1)	15	—	DO-7
1N3125	55	0.4	5	12(2)	20	—	DO-7
1N3287	15	.26±20%	1	15	2	80	DO-7
1N3287W	6	1.0	100	15	2	—	DO-7
1N3465	60	1.0	200	20	45	—	DO-7
1N3466	40	1.0	200	15	30	80	DO-7
1N3467	18	0.5	20	15	15	80	DO-7
1N3468	18	0.5	20	60	15	80	DO-7
1N3469	35	1.0	600	15	20	80	DO-7
1N3470	35	1.0	600	30	20	80	DO-7
1N3483	8	1.1	250	4	10	100	DO-7
1N3592	25	0.5	10	20	20	80	DO-7
1N3666	80	.5-1	200	10	20	75	DO-7
1N3769	90	0.5	25	5	5	80	DO-7
1N4523	15	.35	1.0	30	10	—	DO-7
1N4524	10	.35	1.0	12	6	—	DO-7
1N4827	30	1.0	40	15	10	—	DO-7

250 milliwatt — Hughes house types DO-7 case style

Hughes Type No.	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA)	Reverse Voltage (volts)
HD1026	50	1.0	25	850	50
HD1038	15	1.0	3	10	5
HD1403	90	1.0	30	5	5
HD1404	30	0.5	10	4	3
HD1405	30	0.3	1	4	3
HD1409	30	1.0	50	100	30
HD1412	40	1.0	100	100	30
HD1416	100	1.0	100	250	50
HD1422	20	>.3<.7	2	35	15
HD1426	70	1.0	200	15	15
HD1436	25	1.0	100	4	10
HD1437	50	1.0	40	6	35
HD1441	10	0.3	0.5	10	5
HD1442	30	0.3	0.5	10	5
HD1445	75	0.85	100	100	50
HD1468	50	1.0	20	500	50
HD1472	20	1.0	40	50	40
HD1473	30	0.32	1.6	50	30
HD1478	75	0.8	120	10	60
HD1492	35	0.75	100	6	4
HD1531A	80	1.0	200	25	50
HD1531B	80	1.0	200	25	50
HD1531C	80	1.0	200	25	50
HD1532	75	1.0	20	50	50
HD1532A	75	1.0	20	50	50

Hughes Type No.	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA)	Reverse Voltage (volts)
HD1532H	75	1.0	20	5	5
HD1704	75	1.0	200	220	40
HD1705	100	0.7	100	25	50
HD1705A	120	0.5	10	25	100
HD1706	80	0.5	10	25	50
HD1707	50	0.5	10	25	30
HD1810	50	0.75	100	5	10
HD1811	30	0.75	100	10	10
HD1811AQ	25	0.85	100	30	20
HD1811B	25	1.0	40	50	22
HD1811BK	30	0.3	1	10	5
HD1811D	20	1.0	100	10	5
HD1811G	30	0.75	100	10	10
HD1812	10	1.0	100	20	5
HD1812D	10	0.4	2	5	6
HD1840	30	0.7	100	10	10
HD1841	20	0.7	100	20	10
HD1841B	15	0.5	10	10	6
HD1842	6	1.0	100	30	3
HD1842A	6	0.45	10	4	2.6
HD1870	15	0.7	100	100	15
HD1870G	30	1.0	80	8	12
HD1871	10	0.7	100	20	5
HD1871A	10	0.8	100	10	5
HD1871C	6	>0.35<0.435	15	10	2

Notes: (1) $T_A = +55°C$ (2) $T_A = +75°C$ (3) $T_A = +85°C$ (4) $T_A = +70°C$



hughes hot line

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germanium diodes cont'd

250 milliwatt — Hughes house types

DO-7 case style — (cont'd)

Hughes Type No.	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA)	Reverse Voltage (volts)
HD1871E	7	0.65	100	10	5
HD1871G	14	0.7	100	20	5
HD1871M	15	0.5	10	10	6
HD1872	6	1.0	100	30	3
HD1872G	6	1.0	100	30	5
HD1954	60	1.0	100	2	10
HD1961	80	1.0	30	6	12
HD1964	—	1.0	70	12	30
HD1965	25	1.0	100	100	20
HD1966	80	1.0	400	10	10
HD2038	—	1.0	3	5	15
HD2046	70	1.0	1.1	50	50
HD2047	70	1.0	1.1	100	50
HD2048	75	1.0	5	1000	50
HD2051	125	1.0	4	50	50
HD2085	100	1.0	7.5	20	10
HD2120	75	1.0	5	30	10
HD2130	30	0.75	100	10	10
HD2135	60	1.0	5	100	50
HD2135A	75	1.0	5	100	50
HD2145	10	1.0	100	50	5
HD2149	70	1.0	3	10	10
HD2150	100	1.0	100	50	50
HD2151	100	1.0	50	50	50
HD2152	40	1.0	100	200	20
HD2154	100	1.0	150	40	20
HD2155	75	1.0	50	500	50
HD2158	100	1.0	200	50	50
HD2160	75	1.0	200	50	50
HD2165	130	1.0	100	—	—
HD2166	80	1.0	50	100	50
HD2167	75	1.0	50	50	50
HD2170	130	1.0	50	500	100
HD2172	70	1.0	200	—	—
HD2174	75	1.0	100	100	50
HD2179	100	1.0	100	20	50
HD2182	35	1.0	100	200	20
HD2183	25	1.0	50	—	—
HD2184	40	1.0	20	25	10
HD2187	75	4.0	4.5	—	—
HD2191	25	0.4	5	—	—
HD2205	30	1.0	20	10	5
HD2219	75	1.0	50	50	50
HD2220	75	1.0	5	15	10
HD2231	75	1.0	5	15	10
HD2236	30	—	—	150	10
HD2248	40	1.0	100	50	20
HD2254	40	1.0	150	—	—
HD2257	60	1.0	>4.0<7.0	500	50
HD2258	60	1.0	5	7	10

Hughes Type No.	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA)	Reverse Voltage (volts)
HD2264	70	1.0	3	5	15
HD2265	70	1.0	5	25	15
HD2266	100	1.0	4	5	5
HD2274	70	1.0	5	500	50
HD2284	75	2.0	25	500	40
HD2289	75	1.0	10	50	50
HD2302	30	1.0	10	15	6
HD2364	60	1.0	2.5	10	10
HD2372	100	1.0	3	50	50
HD2378	50	1.0	5	10	10
HD2552	30	0.5	5	50	20
HD2563	70	1.0	20	10	10
HD2569	75	1.0	100	10	10
HD2581	35	1.0	220	25	15
HD2584	75	0.5	6	25	10
HD2586	35	1.0	100	200	30
HD2595	40	0.45	10	5	10
HD2602	60	0.35	1	50	50
HD2604	45	1.0	200	50	25
HD2605	20	0.5	2	10	10
HD2607	60	1.0	20	30	10
HD2608	60	1.0	300	50	50
HD2609	50	0.5	10	40	40
HD2613	40	1.3	45	10	10
HD2658	75	1.0	20	30	10
HD2659	80	1.0	50	100	60
HD2762	80	1.0	20	50	50
HD2764	80	1.0	50	50	50
HD2766	80	1.25	25	10	10
HD2767	40	1.0	20	25	10
HD2768	50	0.4	10	100	10
HD2924	25	0.5	5	250	25
HD2926	40	1.0	50	500	5
HD2934	20	1.0	100	5	20
HD2936	30	1.0	20	15	10
HD2940	50	1.0	100	30	10
HD2943	110	1.0	100	25	50
HD2944	100	0.6	50	5	10
HD2948	40	0.3	1	10	6
HD2960	50	—	—	50	25
HD2969	40	1.0	100	100	30
HD2970	15	1.0	100	50	10
HD2972	70	0.35	3	25	50
HD2974	60	0.65	75	50	40
HD2975	75	1.8	10	5	5
HD2976	60	>0.35<0.45	10	50	40
HD2978	60	1.0	100	250	50
HD2982	20	1.0	300	20	6
HD2983	30	1.0	15	10	5
HD2984	110	1.3	2.5	30	50

HUGHES SEMICONDUCTORS
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silicon diodes

Type	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA) 25°C	Reverse Current (μA) 150°C (See Notes)	Reverse Voltage (volts)	Capacitance (pf)	Recovery Time (μ sec)	Power Dissipation (mW)	Case Style
1N82A	5.0	0.5	15	15	—	0.5	—	—	250	DO-7
1N194	50	2.0	1.5	60	600	40	—	0.1	250	DO-7
1N194A	56	1.0	40	—	—	—	—	0.1	250	DO-7
1N195	50	2.0	2.0	80	700	40	—	0.1	250	DO-7
1N196	50	2.0	1.5	40	500	50	—	0.1	250	DO-7
1N200	6.8	1.0	50	0.5	5 (2)	6.8	50*	—	150	C-1
1N201	8.2	1.0	35	0.5	5 (2)	8.2	35*	—	150	C-1
1N202	10	1.0	30	0.5	5 (2)	10	30*	—	150	C-1
1N203	12	1.0	23	0.5	5 (2)	12	28*	—	150	C-1
1N204	15	1.0	17	0.5	5 (2)	15	25*	—	150	C-1
1N205	18	1.0	12	0.1	10 (2)	18	20*	—	150	C-1
1N206	22	1.0	9	0.1	10 (2)	22	15*	—	150	C-1
1N207	27	1.0	7	0.1	10 (2)	27	12*	—	150	C-1
1N208	33	1.0	5.5	0.1	10 (2)	33	10*	—	150	C-1
1N209	39	1.0	4.5	0.1	10 (2)	39	8*	—	150	C-1
1N210	47	1.0	3.5	0.1	10 (2)	47	6*	—	150	C-1
1N211	56	1.0	2.7	1.0	50 (2)	56	5.6*	—	150	C-1
1N212	68	1.0	2.0	1.0	50 (2)	68	5.2*	—	150	C-1
1N213	82	1.0	1.5	1.0	50 (2)	82	4.8*	—	150	C-1
1N214	100	1.0	1.2	1.0	50 (2)	100	4.5*	—	150	C-1
1N215	120	1.0	0.9	1.0	50 (2)	120	4.2*	—	150	C-1
1N216	150	1.0	0.7	5	100 (2)	150	3.8*	—	150	C-1
1N217	180	4.0	6.5	5	100 (2)	180	3.5*	—	150	C-1
1N218	220	4.0	6.0	5	100 (2)	220	3.2*	—	150	C-1
1N219	270	4.0	3.0	5	100 (2)	270	3.0*	—	150	C-1
1N220	330	4.0	2.2	5	100 (2)	330	2.8*	—	150	C-1
1N221	390	4.0	2.0	5	100 (2)	390	2.6*	—	150	C-1
1N222	470	4.0	1.5	5	100 (2)	470	2.4*	—	150	C-1
1N251	30	1.0	5	0.1	10 (1)	10	—	0.15	150	A-1
1N251A	125	1.0	10	10	—	10	—	—	250	DO-7
1N252	20	1.0	10	0.1	10 (1)	5	—	0.15	150	DO-7
1N252A	125	1.0	10	10	50 (1)	10	—	0.15	250	DO-7
1N300	15	1.0	15	.001	0.1 (2)	10	5.0**	—	150	DO-7
1N301	70	1.0	5	.01	0.2 (2)	10	4.0**	—	150	C-47
1N301A	70	1.0	18	.01	0.2 (2)	10	5.0**	—	150	C-47
1N302	225	1.0	1	.01	0.5 (2)	10	2.0**	—	150	C-47
1N302A	225	1.0	5	.01	0.5 (2)	10	2.0**	—	150	C-47
1N303	125	1.0	3	.01	0.3 (2)	10	3.0**	—	150	DO-7
1N303A	125	1.0	12	.01	0.3 (2)	10	3.0**	—	150	DO-7
1N303B	125	1.0	50	.01	0.3 (2)	10	3.3**	—	150	DO-7
1N330	32	1.0	3	.03	—	20	—	—	150	DO-7
1N331	16	1.0	5	.01	—	10	—	—	150	DO-7
1N350	70	1.0	20	.03	5 (1)	60	—	—	150	C-1b
1N351	120	1.0	20	.03	5 (1)	100	—	—	150	C-1b
1N352	170	1.0	20	.05	10 (1)	150	—	—	150	C-1b
1N353	225	1.0	20	0.1	20 (1)	200	—	—	150	C-1b
1N354	325	1.0	20	0.1	20 (1)	300	—	—	150	C-1b
1N379	8.2	1.0	35	0.5	5.0 (2)	8.2	—	—	150	DO-7
1N380	10	1.0	30	0.5	5.0 (2)	10	—	—	150	DO-7
1N381	12	1.0	23	0.5	5.0 (2)	12	—	—	150	DO-7
1N382	15	1.0	17	0.5	5.0 (2)	15	—	—	150	DO-7
1N383	18	1.0	12	0.1	10 (2)	18	—	—	150	DO-7
1N384	22	1.0	9.0	0.1	10 (2)	22	—	—	150	DO-7
1N385	27	1.0	7.0	0.1	10 (2)	27	—	—	150	DO-7
1N386	33	1.0	5.5	0.1	10 (2)	33	—	—	150	DO-7
1N387	39	1.0	4.5	0.1	10 (2)	39	—	—	150	DO-7
1N388	47	1.0	3.5	0.1	10 (2)	47	—	—	150	DO-7
1N389	56	1.0	2.7	1.0	50 (2)	56	—	—	150	DO-7
1N390	68	1.0	2.0	1.0	50 (2)	68	—	—	150	DO-7
1N391	82	1.0	1.5	1.0	50 (2)	82	—	—	150	DO-7
1N392	100	1.0	1.2	1.0	50 (2)	100	—	—	150	DO-7
1N393	120	1.0	0.9	1.0	50 (2)	120	—	—	150	DO-7
1N394	150	1.0	0.7	5.0	100 (2)	150	—	—	150	DO-7
1N431	68	—	10	—	1.0 (3)	68	—	—	150	C-1
1N432	40	1.0	10	.005	3	10	4	.003	250	C-47
1N432A	40	1.0	20	—	3	10	4	.003	—	C-47
1N432B	40	1.0	50	—	7	10	5.5	.003	—	C-47
1N433	145	1.0	3.0	—	7	10	1.3	.003	—	C-47
1N433A	145	1.0	10	—	7	10	1.5	.003	—	C-47
1N433B	145	1.0	50	—	7	10	1.5	.003	—	C-47
1N434	180	1.0	2	.01	0.4 (2)	10	1.0	—	250	C-47
1N434A	180	1.0	7	—	0.4 (2)	10	1.3	.003	—	C-47
1N456	30	1.0	40	.025	5	25	—	—	250	A-21
1N456A	30	1.0	100	.025	5	25	—	—	250	A-46
1N456AM	30	1.0	100	.025	5	25	—	—	—	A-2a

Notes: (1) +125°C (2) +100°C (3) +80°C * @ 6V test voltage ** @ 10V test voltage † mA

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silicon diodes cont'd

Type	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA) 25°C	Reverse Current (μA) 150°C (See Notes)	Reverse Voltage (volts)	Capacitance (pf)	Recovery Time (μ sec)	Power Dissipation (mW)	Case Style
1N457	70	1.0	20	.025	5	60	—	—	250	A-21
1N457A	70	1.0	100	.025	5	60	—	—	250	A-46
1N457AM	70	1.0	100	.025	5	60	—	—	300	A-2a
1N457M	80	1.0	20	.025	5	60	—	—	200	A-2
1N458	150	1.0	7	.025	5	125	—	—	250	A-21
1N458A	150	1.0	100	.025	5	125	—	—	250	A-46
1N458AM	150	1.0	100	.025	5	125	—	—	300	A-2a
1N458M	175	1.0	7	.025	5	125	—	—	200	A-2
1N459	200	1.0	3	.025	5	175	—	—	250	A-21
1N459A	200	1.0	100	.025	5	175	—	—	250	A-46
1N460A	90	1.0	1.5	—	10	75	4.5	2.0	—	C-47
1N460B	90	1.0	50	—	10	75	5.0	2.0	—	C-47
1N461	30	1.0	15	0.5	30	25	—	—	250	A-21
1N461A	30	1.0	100	0.5	30	25	—	—	250	A-46
1N461AM	30	1.0	100	0.5	30	25	—	—	300	A-2a
1N461M	30	1.0	15	0.5	30	25	—	—	300	A-2a
1N462	70	1.0	5	0.5	30	60	—	—	250	A-21
1N462A	70	1.0	100	0.5	30	60	—	—	250	A-46
1N462AM	70	1.0	100	0.5	30	60	—	—	300	A-2a
1N462M	70	1.0	5	0.5	30	60	—	—	300	A-2a
1N463	200	1.0	1	.5	30	175	—	—	250	DO-7
1N463A	200	1.0	100	.5	30	175	—	—	250	DO-7
1N464	150	1.0	3	.5	30	125	—	—	250	DO-7
1N464A	150	1.0	100	.5	30	125	—	—	250	DO-7
1N482	40	1.1	100	.25	30	30	—	—	250	DO-7
1N482A	40	1.0	100	.025	15	30	—	—	250	DO-7
1N482B	40	1.0	100	.025	5	30	—	—	250	DO-7
1N482BM	40	1.0	100	.025	5	30	—	—	300	A-2a
1N482C	36	1.0	100	.025	—	30	—	—	300	A-21
1N482M	40	1.1	100	.25	30	30	—	—	300	A-2a
1N483	80	1.1	100	.25	30	60	—	—	250	DO-7
1N483A	80	1.0	100	.025	15	60	—	—	250	DO-7
1N483AM	80	1.0	100	.025	15	60	—	—	300	A-2a
1N483B	80	1.0	100	.025	5	60	—	—	250	DO-7
1N483BM	80	1.0	100	.025	5	60	—	—	300	A-2a
1N483C	70	1.0	100	.005	—	60	—	—	300	A-21
1N483M	80	1.0	100	.25	30	60	—	—	300	A-2a
1N484	150	1.1	100	.25	30	125	—	—	250	DO-7
1N484A	150	1.0	100	.025	15	125	—	—	250	DO-7
1N484B	150	1.0	100	.025	5	125	—	—	250	DO-7
1N484C	130	1.0	100	.005	—	125	—	—	—	A-21
1N485	200	1.1	100	.25	30	175	—	—	250	DO-7
1N485A	200	1.0	100	.025	15	175	—	—	250	DO-7
1N485B	200	1.0	100	.025	5	175	—	—	250	DO-7
1N485C	180	1.0	100	.005	—	175	—	—	250	A-21
1N486	250	1.1	100	.25	50	225	—	—	250	DO-7
1N486A	250	1.0	100	.05	25	225	—	—	250	DO-7
1N486B	250	1.0	100	.05	10	225	—	—	250	DO-7
1N487	330	1.1	100	.25	50	300	—	—	250	DO-7
1N487A	330	1.0	100	0.1	25	300	—	—	250	DO-7
1N487B	300	1.0	100	.025	10	300	—	—	—	A-21
1N488	420	1.1	100	.25	50	380	—	—	250	DO-7
1N488A	420	1.0	100	0.1	25	380	—	—	250	DO-7
1N488B	380	1.0	100	0.1	10	380	—	—	250	DO-7
1N619	30	1.0	3	.08	16 (2)	10	—	—	—	A-1
1N625	35	1.5	4	1.0	30	20	—	1.0	200	DO-7
1N625A	20	1.5	10	0.1	30	20	—	0.5	200	DO-7
1N626	50	1.5	4	1.0	30	35	—	1.0	200	DO-7
1N626A	35	1.5	10	0.1	30	35	—	0.5	200	DO-7
1N627	100	1.5	4	1.0	30	75	—	1.0	200	DO-7
1N627A	75	1.5	10	0.1	30	75	—	0.5	200	DO-7
1N628	150	1.5	4	1.0	30	125	—	1.0	200	DO-7
1N629	200	1.5	4	1.0	30	175	—	1.0	200	DO-7
1H643	200	1.0	10	.025	5 (1)	10	—	0.3	200	DO-7
1N643A	200	1.0	100	.025	5 (2)	10	—	—	200	DO-7
1N645	275 (2)	1.0	400	0.2	15 (2)	275	—	—	400	DO-7
1N645A	225	1.0	400	0.2	—	225	—	—	600	A-1
1N646	360 (2)	1.0	400	0.2	15 (2)	360	—	—	400	DO-7
1N647	480 (2)	1.0	400	0.2	20 (2)	480	—	—	400	DO-7
1N648	600 (2)	1.0	400	0.2	20 (2)	600	—	—	400	DO-7
1N649	720 (2)	1.0	400	0.2	25 (2)	720	—	—	400	DO-7
1N658	120	1.0	100	.05	25	50	—	0.3	200	DO-7
1N658A	120	1.0	100	.025	10	50	—	0.3	200	DO-7
1N659	55	1.0	6	5	25 (2)	50	—	0.3	200	A-1
1N659A	50	1.0	10	.05	50	50	—	0.3	200	DO-7

Notes: (1) +125°C (2) +100°C

HUGHES SEMICONDUCTORS
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silicon diodes cont'd

Type	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA) 25°C	Reverse Current (μA) 150°C (See Notes)	Reverse Voltage (volts)	Capacitance (pf)	Recovery Time (μ sec)	Power Dissipation (mW)	Case Style
1N660	110	1.0	6	5	50 (1)	100	—	0.3	200	DO-7
1N661	220	1.0	6	10	100 (1)	200	—	0.3	200	DO-7
1N661A	200	1.0	10	.03	50	200	—	0.3	200	DO-7
1N662*	100	1.0	10	1	20 (1)	10	—	0.5	200	A-1
1N662A	100	1.0	100	—	—	—	—	0.5	—	A-1
1N663	100	1.0	100	5	50 (1)	75	—	0.5	200	DO-7
1N663A	100	—	100	—	20 (2)	75	8.0	0.1	—	A-46
1N676	115	1.0	200	1.0	—	115	—	—	400	DO-7
1N677	115	1.0	400	1.0	—	115	—	—	400	DO-7
1N678	230	1.0	200	1.0	—	230	—	—	400	DO-7
1N679	230	1.0	400	1.0	—	230	—	—	400	DO-7
1N681	340	1.0	200	1.0	—	340	—	—	400	DO-7
1N682	340	1.0	400	1.0	—	340	—	—	400	DO-7
1N683	455	1.0	200	1.0	—	455	—	—	400	DO-7
1N684	455	1.0	400	1.0	—	455	—	—	400	DO-7
1N686	565	1.0	400	1.0	—	565	—	—	400	DO-7
1N687	680	1.0	200	1.0	—	680	—	—	400	DO-7
1N689	680	1.0	400	1.0	—	680	—	—	400	DO-7
1N690	40	1.0	400	.25	50	30	—	0.8	250	DO-7
1N691	80	1.0	400	.25	50	60	—	0.8	250	DO-7
1N692	150	1.0	400	.25	50	120	—	0.8	250	DO-7
1N693	200	1.0	400	.25	50	160	—	0.8	250	DO-7
1N696	40	1.0	10	.015	20	20	—	.005	250	DO-7
1N697	120	1.0	250	1.0	800	50	25	0.1	250	DO-7
1N789	30	1.0	10	1.0	30 (2)	20	—	0.5	200	A-46
1N790	30	1.0	10	5.0	30 (2)	20	—	0.5	200	A-46
1N791	30	1.0	50	5.0	30 (2)	20	—	0.5	200	A-46
1N792	30	1.0	100	5.0	30 (2)	20	—	0.5	200	A-46
1N793	60	1.0	10	1.0	30 (2)	50	—	0.5	200	A-46
1N794	60	1.0	10	5.0	30 (2)	50	—	0.25	200	A-46
1N795	60	1.0	50	5.0	30 (2)	50	—	0.5	200	A-46
1N796	60	1.0	100	5.0	30 (2)	50	—	0.5	200	A-46
1N797	120	1.0	10	1.0	30 (2)	100	—	0.5	200	A-46
1N798	120	1.0	10	5.0	30 (2)	100	—	0.25	200	A-46
1N799	120	1.0	50	5.0	30 (2)	100	—	0.5	200	A-46
1N800	120	1.0	100	5.0	30 (2)	100	—	0.5	200	A-46
1N801	150	1.0	10	1.0	30 (2)	125	—	0.5	200	A-46
1N802	150	1.0	50	5.0	50 (2)	125	—	0.5	200	A-46
1N803	200	1.0	10	5.0	50 (2)	175	—	0.5	200	A-46
1N804	200	1.0	50	10	50 (2)	175	—	0.5	200	A-46
1N806	110	1.0	4	0.5	50 (1)	100	—	0.3	200	DO-7
1N807	200	1.0	4	0.5	50 (1)	175	—	0.3	200	DO-7
1N808	110	1.0	100	1.0	50 (2)	100	—	0.3	200	DO-7
1N809	220	1.0	100	1.0	50 (2)	20	—	0.3	200	DO-7
1N810	50	1.0	10	1.0	—	40	7.0	.05	200	A-182
1N811	20	1.0	1	1.0	10 (1)	10	—	.25	150	DO-7
1N812	30	1.0	2	0.1	10 (1)	10	—	.25	150	DO-7
1N813	15	1.0	5	0.5	10 (1)	5	—	.25	150	DO-7
1N814	40	1.0	2	0.1	10 (1)	20	—	.25	150	DO-7
1N815	15	1.5	100	0.5	10 (1)	5	—	.25	150	DO-7
1N816	—	0.64 ±10%	1	0.1	—	4	—	—	250	DO-7
1N818	80	1.5	30	0.25	20 (2)	60	—	0.5	—	A-21
1N837	100	1.0	150	0.1	—	—	—	0.5	—	A-21
1N837A	100	1.0	150	0.1	20 (2)	80	3.5	0.3	—	A-21
1N838	150	1.0	150	0.1	—	—	—	0.5	—	A-21
1N840	40	1.0	150	0.1	20 (2)	40	3.5	0.3	—	A-21
1N841	120	1.0	150	0.1	20 (2)	120	3.5	0.3	—	A-21
1N844	100	1.0	200	0.1	15 (2)	80	—	0.5	—	A-21
1N845	200	1.0	200	0.1	15 (2)	160	—	0.5	—	A-21
1N846	50	1.0	200	20	—	35	—	—	400	DO-7
1N848	200	1.0	200	20	—	140	—	—	400	DO-7
1N849	300	1.0	200	20	—	210	—	—	400	DO-7
1N850	400	1.0	200	20	—	280	—	—	400	DO-7
1N851	500	1.0	200	20	—	350	—	—	400	DO-7
1N852	600	1.0	200	20	—	420	—	—	400	DO-7
1N853	700	1.0	200	20	—	490	—	—	400	DO-7
1N854	800	1.0	200	20	—	560	—	—	400	DO-7
1N855	900	1.0	200	20	—	630	—	—	400	DO-7
1N856	1000	1.0	200	20	—	700	—	—	400	DO-7
1N857	50	1.0	150	20	—	35	—	—	400	DO-7
1N879	—	1.0	200	20	—	50	—	—	400	DO-7
1N891	60	1.0	50	0.1	25 (5)	50	10	0.3	250	DO-7
1N892	120	1.0	50	0.1	25	100	—	0.3	250	DO-7
1N893	240	1.0	50	0.1	25	200	—	0.3	250	DO-7
1N903	—	1.0	10	0.1	10 (2)	40	—	4	250	DO-7

Notes: (1) +125°C (2) +100°C

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silicon diodes cont'd

Type	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA) 25°C	Reverse Current (μA) 150°C (See Notes)	Reverse Voltage (volts)	Capacitance (pf)	Recovery Time (μ sec)	Power Dissipation (mW)	Case Style
1N903A	—	1.0	20	0.1	10 (2)	40	—	4	250	DO-7
1N904	—	1.0	10	0.1	10 (2)	30	1.0	.004	250	DO-7
1N904A	40	1.0	20	0.1	10 (2)	30	1.0	.004	250	DO-7
1N905	—	1.0	10	0.1	10 (2)	20	1.0	.004	250	DO-7
1N905A	30	1.0	20	0.1	10 (2)	20	1.0	.004	250	DO-7
1N906	—	1.0	10	0.1	10 (2)	20	2.5	.004	250	DO-7
1N906A	—	1.0	20	0.1	10 (2)	20	2.5	.004	250	DO-7
1N907	—	1.0	10	0.1	10 (2)	30	2.5	.004	250	DO-7
1N907A	—	1.0	20	0.1	10 (2)	30	2.5	.004	250	DO-7
1N908	—	1.0	10	0.1	10 (2)	40	2.5	.004	250	DO-7
1N908A	—	1.0	20	0.1	10 (2)	40	2.5	.004	250	DO-7
1N914	100	1.0	10	.025	50	20	4.0	.004	250	DO-7
1N914A	100	1.0	20	.025	50	20	4.0	.004	250	DO-7
1N914B	100	1.0	100	.025	50	20	4.0	.004	250	DO-7
1N915	50	1.0	50	.025	5 (2)	10	4.0	.01	—	A-21d
1N916	100	1.0	10	.025	50	20	2.0	.004	250	DO-7
1N916A	100	1.0	20	.025	50	20	2.0	.004	250	DO-7
1N916B	75	1.0	20	.025	50	20	2.0	.004	250	DO-7
1N917	30	1.0	10	.05	—	10	—	0.3	250	A-21d
1N920	36	1.0	500	0.25	—	30	—	0.3	250	DO-7
1N921	70	1.0	500	0.25	—	60	—	0.3	250	DO-7
1N922	100	1.0	500	0.25	—	90	—	0.3	250	DO-7
1N923	130	1.0	500	0.25	—	120	—	0.3	250	DO-7
1N925	40	1.0	5	1.0	20 (2)	10	4.0	.15	250	DO-7
1N926	40	1.0	5	0.1	10 (2)	10	4.0	.15	250	DO-7
1N927	65	1.0	10	0.1	10 (2)	10	4.0	.15	250	DO-7
1N928	—	1.0	10	0.1	10 (2)	10/100	—	.15	250	DO-7
1N929	20	1.0	20	100	—	25	—	—	80	DO-7
1N930	50	1.0	20	100	—	75	—	—	80	DO-7
1N931	100	1.0	20	100	—	125	—	—	—	DO-7
1N932	200	1.0	20	100	—	250	—	—	—	DO-7
1N934	70	1.0	30	.025	—	60	—	—	—	DO-7
1N948	40	1.5	100	0.25	20	30	—	1.0	250	DO-7
1N993	8	1.5	10	1.0	—	6	—	.004	50	DO-7
1N997	35	1.0	10	.03	5	12	—	0.15	—	A-21b
1N3062	75 @ 5μA	1.0	20	0.1	100	50	1	.002	250	DO-7
1N3063	75	0.85	10	0.1	100	50	2	.004	250	DO-7
1N3064	75	1.0	10	0.1	100	50	2	.004	250	DO-7
1N3065	75	1.0	20	0.1	100	50	1.5	.004	250	DO-7
1N3066	75	1.0	10	0.1	100	50	1	.002	250	DO-7
1N3067	30	1.0	5	0.1	100	20	4	.004	250	DO-7
1N3068	30	1.0	5	0.1	100	20	6	.050	250	DO-7
1N3069	65	1.0	50	0.1	100	50	6	.050	250	DO-7
1N3070	200	1.0	100	0.1	100	175	5	.050	250	DO-7
1N3071	200	1.0	100	0.1	100	150	5	.050	—	DO-7
1N3123	40	1.5	10	0.1	10† (2)	40	0.8	.004	—	DO-7
1N3124	40	1.0	20	0.1	—	40	2.0	.004	—	DO-7
1N3257	100	1.0	30	.025	25	20/50	2	.003	250	DO-7
1N3258	100	1.0	100	.025	25	20/50	4	.004	250	DO-7
1N3550	180	1.0	500	—	200 (2)	180	—	1.5	—	DO-7
1N3596	20	1.0	30	0.1	100	20	1.0	.004	—	DO-7
1N3597	150	1.2	400	0.1	100	150	5.0	0.3	—	DO-7
1N3598	50	0.85	10	0.1	100	50	2.0	.04	—	DO-7
1N3599	150	1.0	100	0.1	100	150	5.0	.05	—	A-93
1N3600	50	1.0	200	0.1	100	50	2.5	.004	250	DO-7
1N3601	75	1.0	10	10	100	75	3.0	.005	—	DO-7
1N3602	75	1.0	20	0.1	—	50	3.0	.005	—	DO-7
1N3604	75	1.0	50	.05	50	50	2	.004	250	DO-7
1N3605	30	0.55	0.1	.05	50	30	2	.002	—	DO-7
1N3606	50	0.55	0.1	.05	50	50	2	.002	—	DO-7
1N3643	1000	5.0	250	5.0	—	1000	—	—	1000	A-83a
1N3644	1500	5.0	250	5.0	—	1500	—	—	1000	A-83a
1N3645	2000	5.0	250	5.0	—	2000	—	—	1000	A-83a
1N3646	2500	5.0	250	5.0	—	2500	—	—	1000	A-83a
1N3647	3000	5.0	250	5.0	—	3000	—	—	1000	A-83a
1N3668	30	1.0	5	—	10 (1)	15	1.0	0.15	—	DO-7
1N3731	100	1.0	100	.05	50	50	2	.003	250	DO-7
1N3872	90	1.0	150	0.1	—	75	5.0	.015	—	DO-7
1N3958	100	0.5	1.25	—	400	100	—	3.0	—	DO-4
1N3959	200	0.5	1.25	—	400	200	—	3.0	—	DO-4
1N3960	300	0.5	1.25	—	400	300	—	3.0	—	DO-4
1N3961	400	0.5	1.25	—	400	400	—	3.0	—	DO-4
1N3962	500	0.5	1.25	—	400	500	—	3.0	—	DO-4
1N3963	600	0.5	1.25	—	400	600	—	3.0	—	DO-4
1N3992	4000	5.0	250	—	—	—	—	—	1000	A-83a

Notes: (2) +100°C (5) +50°C Am †

HUGHES SEMICONDUCTORS
HUGHES AIRCRAFT COMPANY
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silicon diodes cont'd

Type	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA) 25°C	Reverse Current (μA) 150°C (See Notes)	Reverse Voltage (volts)	Capacitance (pf)	Recovery Time (μ sec)	Power Dissipation (mW)	Case Style
1N4009	35	1.0	30	0.1	100	25	4	.004	250	DO-7
1N4087	—	.700 min./.750 max.	5	.09	100	50	1.8	.030	250	DO-7
	—	.975 max.	30	—	—	—	—	—	—	DO-7
1N4092	50	1.0	5	1.0	—	10	10	—	250	DO-7
	—	—	—	—	5 (4)	20	—	—	—	DO-7
1N4147	30	1.0	30	5	—	30	6.0	.01	—	DO-7
1N4148	100	1.0	10	.025	50	20	4	—	400	DO-35
1N4149	100	1.0	10	.025	50	20	2	—	400	DO-35
1N4150	50	.54 min./.62 max.	1.0	0.1	100	50	2.5	—	400	DO-35
1N4151	75	1.0	50	.05	50	50	2	—	400	DO-35
1N4152	40	.490 min./.550 max.	0.1	.05	50	30	2	—	400	DO-35
1N4153	75	.490 min./.550 max.	0.1	.05	50	50	2	—	400	DO-35
1N4154	35	1.0	30	0.1	100	25	4	—	400	DO-35
1N4157	30	2.7	100	.05	50	20	20	—	400	A-159a
1N4242	40	1.0	10	0.1	100 (2)	20	2.0	.002	—	M-117a
1N4243	40	1.0	10	0.1	100 (2)	20	2.0	.002	—	M-117a
1N4305	50	0.85	10	0.1	100	50	2.0	.004	400	DO-35
1N4306††	50	0.55	0.1	.05	.05	50	1.0	.002	—	M-117
1N4307††	50	0.55	0.1	.05	.05	50	1.0	.002	—	M-118
1N4308	100	0.53	0.25	0.1	0.1	75	2.0	.002	—	DO-7
1N4376	20	1.1	50	0.1	0.1	10	1.0	.00075	—	DO-7
1N4389	5.0	1.0	2.0	100	—	5.0	—	—	—	DO-7
1N4390	20	1.0	5.0	0.2	2 (2)	5.0	1.0	.0005	—	DO-7
1N4391	20	1.0	2.0	0.2	2 (2)	5.0	1.0	.0005	—	DO-7
1N4392	15	1.0	2.0	1.0	20 (2)	5.0	1.0	.0005	—	DO-7
1N4446	100	1.0	20	.025	.05	20	4.0	.004	250	DO-7
1N4447	100	1.0	20	.025	50	20	2.0	.004	250	DO-7
1N4448	100	1.0	100	.025	50	20	4.0	.004	250	DO-7
1N4449	100	1.0	30	.025	50	20	2.0	.004	250	DO-7
1N4450	40	1.0	200	.05	50	30	4.0	.004	—	A-48bt
1N4451	40	1.0	300	.05	50	20	6.0	.01	—	A-48bt
1N4454	75	1.0	10	0.1	100	50	2.0	4.0	500	DO-35
1N4606	85	1.1	250	0.1	25 @ 100°C	50	2.5	4.0	500	DO-35

Hughes house types

Hughes Type No.	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA) @ 25°C	Reverse Current (μA) @ Test Temp.	Reverse Voltage (volts)	Capacitance (pf)	Recovery Time (μ sec)	Power Dissipation (mW)	Case Style
HD4416	25	>.62<.72	2	25	—	25	—	—	250	DO-7
HD4416A	25	>.62<.72	2	25	—	25	—	—	250	DO-7
HD4418	30	1.0	10	—	50 @ 100°C	25	—	—	250	DO-7
HD4419	70	1.0	10	—	50 @ 100°C	60	—	—	250	DO-7
HD4444	50	1.0	1	2	—	50	—	—	250	DO-7
HD4537	—	0.6	5	10	—	2	—	—	250	DO-7
HD4607	30	1.0	10	1	—	10	4	0.1	250	DO-7
HD4636	50	>.63<.67	1	1	30 @ 100°C	35	4	1.0	250	DO-7
HD4698	60	1.0	25	0.5	10 @ 75°C	40	6	.02	250	DO-7
HD4756	40	1.0	20	0.1	10 @ 100°C	30	3	.004	250	DO-7
HD4904A	50	>.58<.63	1	0.1	2 @ 75°C	20	—	—	250	DO-7
HD5000	20	1.0	5	0.2	2 @ 100°C	5	—	—	125	DO-35
HD5000E	20	1.0	5	0.5	5 @ 100°C	5	—	—	125	DO-35
HD5001	20	1.0	5	1	10 @ 100°C	5	—	—	125	DO-35
HD5002	20	1.0	2	0.2	2 @ 100°C	5	—	—	125	DO-35
HD5003	20	1.0	2	1	10 @ 100°C	5	—	—	125	DO-35
HD5004	15	1.0	2	1	20 @ 100°C	5	—	—	125	DO-35
HD6001	30	1.0	15	0.5	30 @ 150°C	25	—	—	250	DO-7
HD6002	70	1.0	5	0.5	30 @ 150°C	60	—	—	250	DO-7
HD6179	30	1.0	15	1	—	25	—	—	250	DO-7
HD6224	30	1.0	10	2	60 @ 150°C	25	—	—	250	DO-7
HD6225	70	1.0	10	2	60 @ 150°C	60	—	—	250	DO-7
HD6259	30	1.0	40	—	5 @ 100°C	25	—	3.5	250	DO-7
HD6556	80	1.5	4	20	—	50	—	1.0	250	DO-7
HD6677	20	1.0	6	0.5	—	10	15	0.3	250	DO-7

Notes: (1) +125°C (2) +100°C (4) +70°C †† Matched pairs

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silicon diodes cont'd

Hughes house types — (cont'd)

Hughes Type No.	Maximum Peak Reverse Voltage (volts)	Maximum Forward Voltage (volts)	Forward Current (mA)	Reverse Current (μA) @ 25°C	Reverse Current (μA) @ Test Temp.	Reverse Voltage (volts)	Capacitance (pf)	Recovery Time (μ sec)	Power Dissipation (mW)	Case Style
HD6874	6	1.0	100	0.1	50 @ 150°C	50	2	—	250	DO-7
HDS10	100	1.0	250	.05	50 @ 150°C	50	2	.004	500	DO-35
HDS11	100	1.0	150	.05	50 @ 150°C	50	2	.004	500	DO-35
HDS12	100	1.0	75	.05	100 @ 150°C	50	3	.004	500	DO-35
HDS50	75	1.0	250	0.1	100 @ 150°C	50	3	.004	500	DO-35
HDS51	75	1.0	150	0.1	100 @ 150°C	50	3	.004	500	DO-35
HDS52	75	1.0	75	0.1	100 @ 150°C	50	3	.004	500	DO-35
HDS100	100	1.0	250	0.1	100 @ 150°C	50	3	.004	500	DO-35
HDS110	100	1.0	150	0.1	100 @ 150°C	50	3	.004	500	DO-35
HDS120	100	1.0	75	0.1	100 @ 150°C	50	3	.004	500	DO-35

silicon zener diodes

NOTES: The following notes explain variations in the standard type numbers listed for Silicon Zener Diodes. "Note" numbers are inserted above type numbers in the "Type" column. A note number then pertains to all types which follow it, up to that point where another note number is inserted and takes effect for subsequent types.

1. Standard tolerances of 5.0% and 10% are available — no suffix is ±10% tolerance; suffix "A" denotes ±5% tolerance.
2. Standard tolerance of ±5%.
3. Standard tolerance of ±20%.
4. Standard tolerances of 5.0%, 10%, and 20% are available — no suffix is 20% tolerance; suffix "A" denotes ±10% tolerance; suffix "B" is ±5% tolerance.
5. Reverse polarity types available; add suffix "R."
6. Standard tolerances of 1.0%, 5.0% and 10% are available — no suffix is ±10%; suffix "A" denotes ±5% tolerance; suffix "B" is ±1%.
7. Standard tolerance of ±15%.
8. Impedance is derived from the 60 cycle AC voltage which results when an AC current having an RMS value equal to 10% of the DC Zener current is superimposed upon the DC current.
9. Standard tolerance of ±10%.
10. Standard types are ±10% tolerance; suffix "A" denotes ±5% tolerance; suffix "C" denotes ±10% clipper; suffix "CA" denotes ±5% clipper.

150 milliwatt

Type	Zener Voltage V_Z (volts)	Dynamic Impedance Z_Z (ohms) (Note 8)	Zener Current I_Z (mA)	Case Style
(Note 1)				
1N225, A	8.75	—	0.2	C-1
1N226, A	10.5	—	0.2	C-1
1N227, A	12.8	—	0.2	C-1
1N228, A	15.7	—	0.2	C-1
1N229, A	19.0	—	0.2	C-1
1N230, A	23.5	—	0.2	C-1
1N231, A	28.5	—	0.2	C-1
1N232, A	34.5	—	0.2	C-1
1N233, A	41.0	—	0.2	C-1
1N234, A	48.0	—	0.2	C-1b
1N235, A	58.0	—	0.2	C-1b
1N236	71.0	—	0.2	C-1b
1N237	88.0	—	0.2	C-1b
1N238	105.0	—	0.2	C-1b
1N239	128.0	—	0.2	C-1b
(Note 1)				
1N1313, A	8.75	—	0.2	C-1
1N1314, A	10.50	—	0.2	C-1
1N1315, A	12.75	—	0.2	C-1
1N1316, A	15.75	—	0.2	C-1
1N1317, A	19.00	—	0.2	C-1
1N1318, A	23.50	—	0.2	C-1
1N1319, A	28.50	—	0.2	C-1
1N1320, A	34.50	—	0.2	C-1
1N1321, A	41.00	—	0.2	C-1
1N1322, A	48.50	—	0.2	C-1
1N1323, A	58.00	—	0.2	C-1
1N1324, A	71.00	—	0.2	C-1
1N1325, A	87.50	—	0.2	C-1
1N1326, A	105.00	—	0.2	C-1
1N1327, A	127.50	—	0.2	C-1

200 milliwatt

Type	Zener Voltage V_Z (volts)	Dynamic Impedance Z_Z (ohms) (Note 8)	Zener Current I_Z (mA)	Case Style
(Note 3)				
1N370	1.85	—	20	A-193a
(Note 7)				
1N371	2.35	—	20	A-193a
1N372	2.9	—	15	A-193a
(Note 9)				
1N373	3.5	—	10	A-193a
1N374	4.1	20	5.0	A-193a
(Note 2)				
1N375	4.1	17.5	5.0	A-193a
1N376	4.95	15	5.0	A-193a
1N377	5.9	10	5.0	A-193a
(Note 6)				
1N465	2.6	60	5.0	C-1
1N466	3.5	55	5.0	C-1
1N467	4.1	45	5.0	C-1
1N468	4.9	35	5.0	C-1
1N469	5.8	20	5.0	C-1
1N470	7.1	10	5.0	C-1
1N471	3.5	65	5.0	C-1
1N472	4.1	60	5.0	C-1
1N473	4.9	50	5.0	C-1
1N474	5.8	40	5.0	C-1
1N475	7.1	25	5.0	C-1
(Note 1)				
1N1929	5.6	8.0	5.0	A-127
1N1930	6.8	7.0	5.0	A-127
1N1931	8.2	15	5.0	A-127
1N1932	10	22	5.0	A-127
1N1933	12	30	1.0	A-127
1N1934	15	50	1.0	A-127
1N1935	18	70	1.0	A-127
1N1936	22	100	1.0	A-127
1N1937	27	200	1.0	A-127
1N1938	33	300	0.2	A-127
1N1939	39	400	0.2	A-127
1N1940	47	500	0.2	A-127

HUGHES SEMICONDUCTORS
HUGHES AIRCRAFT COMPANY
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silicon zener diodes cont'd

250 milliwatt

low noise types (maximum noise density $N_D = 40\mu V$ per square root cycle)

Type	Zener Vz (volts)	Dynamic Impedance Zz (ohms) (Note 8)	Zener Current Iz (mA)	Reverse Current (μA)	Reverse Voltage (volts)	Max. Forward Voltage (volts)	Forward Current (mA)	Case Style
(Note 2)								
1N4099	6.8	200	0.250	10.0	5.17	1.0	200	DO-7
1N4100	7.5	200	0.250	10.0	5.70	1.0	200	DO-7
1N4101	8.2	200	0.250	1.0	6.24	1.0	200	DO-7
1N4102	8.7	200	0.250	1.0	6.61	1.0	200	DO-7
1N4103	9.1	200	0.250	1.0	6.92	1.0	200	DO-7
1N4104	10	200	0.250	1.0	7.60	1.0	200	DO-7
1N4105	11	200	0.250	0.05	8.44	1.0	200	DO-7
1N4106	12	200	0.250	0.05	9.12	1.0	200	DO-7
1N4107	13	200	0.250	0.05	9.87	1.0	200	DO-7
1N4108	14	200	0.250	0.05	10.65	1.0	200	DO-7
1N4109	15	100	0.250	0.05	11.40	1.0	200	DO-7
1N4110	16	100	0.250	0.05	12.15	1.0	200	DO-7
1N4111	17	100	0.250	0.05	12.92	1.0	200	DO-7
1N4112	18	100	0.250	0.05	13.67	1.0	200	DO-7
1N4113	19	150	0.250	0.05	14.44	1.0	200	DO-7
1N4114	20	150	0.250	0.01	15.20	1.0	200	DO-7
1N4115	22	150	0.250	0.01	16.72	1.0	200	DO-7
1N4116	24	150	0.250	0.01	18.25	1.0	200	DO-7

Type	Zener Vz (volts)	Dynamic Impedance Zz (ohms) (Note 8)	Zener Current Iz (mA)	Reverse Current (μA)	Reverse Voltage (volts)	Max. Forward Voltage (volts)	Forward Current (mA)	Case Style
(Note 2)								
1N4117	25	150	0.250	0.01	19.00	1.0	200	DO-7
1N4118	27	150	0.250	0.01	20.46	1.0	200	DO-7
1N4119	28	200	0.250	0.01	21.28	1.0	200	DO-7
1N4120	30	200	0.250	0.01	22.80	1.0	200	DO-7
1N4121	33	200	0.250	0.01	25.08	1.0	200	DO-7
1N4122	36	200	0.250	0.01	27.38	1.0	200	DO-7
1N4123	39	200	0.250	0.01	29.65	1.0	200	DO-7
1N4124	43	250	0.250	0.01	32.65	1.0	200	DO-7
1N4125	47	250	0.250	0.01	35.75	1.0	200	DO-7
1N4126	51	300	0.250	0.01	38.76	1.0	200	DO-7
1N4127	56	300	0.250	0.01	42.60	1.0	200	DO-7
1N4128	60	400	0.250	0.01	45.60	1.0	200	DO-7
1N4129	62	500	0.250	0.01	47.10	1.0	200	DO-7
1N4130	68	700	0.250	0.01	51.68	1.0	200	DO-7
1N4131	75	700	0.250	0.01	57.00	1.0	200	DO-7
1N4132	82	800	0.250	0.01	62.32	1.0	200	DO-7
1N4133	87	1000	0.250	0.01	66.12	1.0	200	DO-7
1N4134	91	1200	0.250	0.01	69.16	1.0	200	DO-7
1N4135	100	1500	0.250	0.01	76.00	1.0	200	DO-7

400 milliwatt

(Note 1)								
1N702	2.0/3.2	60	10	75	1.0	—	—	DO-7
1N703	3.0/3.9	55	10	50	1.0	—	—	DO-7
1N704	3.7/4.5	45	10	5	1.0	—	—	DO-7
1N705	4.3/5.4	35	10	5	1.5	—	—	DO-7
1N706	5.2/6.4	20	10	5	1.5	—	—	DO-7
1N707	6.2/8.0	10	10	5	3.5	—	—	DO-7
1N708	5.6	2.6	25	5	3.5	—	—	DO-7
1N709	6.2	4.1	25	5	3.5	—	—	DO-7
1N710	6.8	4.7	25	5	3.5	—	—	DO-7
1N711	7.5	5.3	25	5	3.5	—	—	DO-7
1N712	8.2	6.0	25	5	3.5	—	—	DO-7
1N713	9.1	7.0	12	5	3.5	—	—	DO-7
1N714	10.0	8.0	12	5	8.0	—	—	DO-7
1N715	11.0	9.0	12	5	8.0	—	—	DO-7
1N716	12.0	10.0	12	5	9.0	—	—	DO-7
1N717	13.0	11.0	12	—	—	—	—	DO-7
1N718	15.0	13.0	12	—	—	—	—	DO-7
1N719	16.0	15.0	12	—	—	—	—	DO-7
1N720	18.0	17.0	12	—	—	—	—	DO-7
1N721	20.0	20.0	4	—	—	—	—	DO-7
1N722	22.0	24.0	4	—	—	—	—	DO-7
1N723	24.0	28.0	4	—	—	—	—	DO-7
1N724	27.0	35.0	4	—	—	—	—	DO-7
1N725	30.0	42.0	4	—	—	—	—	DO-7
1N726	33.0	50.0	4	—	—	—	—	DO-7
1N727	36.0	60.0	4	—	—	—	—	DO-7
1N728	39.0	70.0	4	—	—	—	—	DO-7
1N729	43.0	84.0	4	—	—	—	—	DO-7
1N730	47.0	98.0	4	—	—	—	—	DO-7
1N731	51.0	115	4	—	—	—	—	DO-7
1N732	56.0	140	4	—	—	—	—	DO-7
1N733	62.0	170	2	—	—	—	—	DO-7
1N734	68.0	200	2	—	—	—	—	DO-7
1N735	75.0	240	2	—	—	—	—	DO-7
1N736	82.0	280	2	—	—	—	—	DO-7
1N737	91.0	340	1	—	—	—	—	DO-7
1N738	100	400	1	—	—	—	—	DO-7
1N739	110	490	1	—	—	—	—	DO-7
1N740	120	570	1	—	—	—	—	DO-7
1N741	130	650	1	—	—	—	—	DO-7
1N742	150	860	1	—	—	—	—	DO-7
1N743	160	970	1	—	—	—	—	DO-7
1N744	180	1200	1	—	—	—	—	DO-7
1N745	200	1400	1	—	—	—	—	DO-7
1N746	3.3	28	20	10	1.0	1.0	100	DO-7

(Note 1)								
1N747	3.6	24	20	10	1.0	1.0	100	DO-7
1N748	3.9	23	20	10	1.0	1.0	100	DO-7
1N749	4.3	22	20	2	1.0	1.0	100	DO-7
1N750	4.7	19	20	2	1.0	1.0	100	DO-7
1N751	5.1	17	20	1	1.0	1.0	100	DO-7
1N752	5.6	11	20	1	1.0	1.0	100	DO-7
1N753	6.2	7	20	0.1	1.0	1.0	100	DO-7
1N754	6.8	5	20	0.1	1.0	1.0	100	DO-7
1N755	7.5	6	20	0.1	1.0	1.0	100	DO-7
1N756	8.2	8	20	0.1	1.0	1.0	100	DO-7
1N757	9.1	10	20	0.1	1.0	1.0	100	DO-7
1N758	10.0	17	20	0.1	1.0	1.0	100	DO-7
1N759	12.0	30	20	0.1	1.0	1.0	100	DO-7
1N761, A	4.3/5.4	40	10	—	—	—	—	DO-7
1N762, A	5.2/6.4	18	10	—	—	—	—	DO-7
1N763, A	6.2/8.0	7	10	—	—	—	—	DO-7
1N763-3	7.5	7	10	—	—	—	—	DO-7
1N764, A	7.5/10.0	12	10	—	—	—	—	DO-7
1N765, A	9.0/12.0	45	5	—	—	—	—	DO-7
1N766, A	11.0/14.5	55	5	—	—	—	—	DO-7
1N767, A	13.5/18.0	70	5	—	—	—	—	DO-7
1N768, A	17/21	100	5	—	—	—	—	DO-7
1N769, A	20/27	150	5	—	—	—	—	DO-7
(Note 4)								
1N957	6.8	4.5	18.5	150	4.9	1.5	200	DO-7
1N958	7.5	5.5	16.5	75	5.4	1.5	200	DO-7
1N959	8.2	6.5	15.0	50	5.9	1.5	200	DO-7
1N960	9.1	7.5	14.0	25	6.6	1.5	200	DO-7
1N961	10.0	8.5	12.5	10	7.2	1.5	200	DO-7
1N962	11.0	9.5	11.5	5	8.0	1.5	200	DO-7
1N963	12.0	11.5	10.5	5	8.6	1.5	200	DO-7
1N964	13.0	13.0	9.5	5	9.4	1.5	200	DO-7
1N965	15.0	16.0	8.5	5	10.8	1.5	200	DO-7
1N966	16.0	17.0	7.8	5	11.5	1.5	200	DO-7
1N967	18.0	21.0	7.0	5	13.0	1.5	200	DO-7
1N968	20.0	25.0	6.2	5	14.4	1.5	200	DO-7
1N969	22.0	29.0	5.6	5	15.8	1.5	200	DO-7
1N970	24.0	33.0	5.2	5	17.3	1.5	200	DO-7
1N971	27.0	41.0	4.6	5	19.4	1.5	200	DO-7
1N972	30.0	49.0	4.2	5	21.6	1.5	200	DO-7
1N973	33.0	58.0	3.8	5	23.8	1.5	200	DO-7
1N974	36.0	70.0	3.4	5	25.9	1.5	200	DO-7
1N975	39.0	80.0	3.2	5	28.1	1.5	200	DO-7
1N976	43.0	93.0	3.0	5	31.0	1.5	200	DO-7
1N977	47.0	105.0	2.7	5	33.8	1.5	200	DO-7



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silicon zener diodes cont'd

400 milliwatt — (cont'd)

Type	Zener Vz (volts)	Dynamic Impedance Zz (ohms) (Note 8)	Zener Current Iz (mA)	Reverse Current (μA)	Reverse Voltage (volts)	Max. Forward Voltage (volts)	Forward Current (mA)	Case Style
(Note 4)								
1N978	51.0	125	2.5	5	36.7	1.5	200	DO-7
1N979	56.0	150	2.2	5	40.3	1.5	200	DO-7
1N980	62.0	185	2.0	5	44.6	1.5	200	DO-7
1N981	68.0	230	1.8	5	49.0	1.5	200	DO-7
1N982	75.0	270	1.7	5	54.0	1.5	200	DO-7
1N983	82.0	330	1.5	5	59.0	1.5	200	DO-7
1N984	91.0	400	1.4	5	65.5	1.5	200	DO-7
1N985	100	500	1.3	—	—	—	—	DO-7
1N986	110	750	1.1	—	—	—	—	DO-7
1N987	120	900	1.0	—	—	—	—	DO-7
1N988	130	1100	0.95	—	—	—	—	DO-7
1N989	150	1500	0.85	—	—	—	—	DO-7
1N990	160	1700	0.80	—	—	—	—	DO-7
1N991	180	2200	0.68	—	—	—	—	DO-7
1N992	200	2500	0.65	—	—	—	—	DO-7
(Note 2)								
1N3506	3.3	24	20	4	1	—	—	DO-7
1N3507	3.6	22	20	2	1	—	—	DO-7
1N3508	3.9	20	20	0.4	1	—	—	DO-7
1N3509	4.3	18	20	0.1	1	—	—	DO-7
1N3510	4.7	16	20	5.0	2	—	—	DO-7
1N3511	5.1	14	20	2.0	2	—	—	DO-7
1N3512	5.6	8	20	5.0	3	—	—	DO-7
1N3513	6.2	3	20	5.0	4	—	—	DO-7

Type	Zener Vz (volts)	Dynamic Impedance Zz (ohms) (Note 8)	Zener Current Iz (mA)	Reverse Current (μA)	Reverse Voltage (volts)	Max. Forward Voltage (volts)	Forward Current (mA)	Case Style
(Note 2)								
1N3514	6.8	3	20	1.0	5	—	—	DO-7
1N3515	7.5	4	10	0.5	6	—	—	DO-7
1N3516	8.2	5	10	0.25	7	—	—	DO-7
1N3517	9.1	6	10	0.025	7	—	—	DO-7
1N3518	10	7	10	0.010	8	—	—	DO-7
1N3519	11	8	10	0.010	9	—	—	DO-7
1N3520	12	10	10	0.010	10	—	—	DO-7
1N3521	13	12	5	0.010	11	—	—	DO-7
1N3522	15	14	5	0.010	13	—	—	DO-7
1N3523	16	16	5	0.010	14	—	—	DO-7
1N3524	18	18	5	0.010	16	—	—	DO-7
1N3525	20	20	5	0.010	18	—	—	DO-7
1N3526	22	35	5	0.010	19	—	—	DO-7
1N3527	24	38	5	0.010	20	—	—	DO-7
1N3528	27	40	4	0.010	22	—	—	DO-7
1N3529	30	48	4	0.010	24	—	—	DO-7
1N3530	33	50	3	0.010	26	—	—	DO-7
1N3531	36	75	3	0.010	28	—	—	DO-7
1N3532	39	100	3	0.010	30	—	—	DO-7
1N3533	43	130	2	0.010	35	—	—	DO-7
1N3534	47	150	2	0.010	38	—	—	DO-7
(Note 1)								
1N4370	2.4	30	20	100	1.0	1.5	200	DO-7
1N4371	2.7	30	20	75	1.0	1.5	200	DO-7
1N4372	3.0	29	20	50	1.0	1.5	200	DO-7

600 milliwatt

Type	Zener Voltage Vz (volts)	Dynamic Impedance Zz (ohms) (Note 8)	Zener Current Iz (mA)	Case Style
(Note 2)				
1N4628	6.8	700	19.0	DO-14
1N4629	7.5	700	17.0	DO 14
1N4630	8.2	700	15.0	DO-14
1N4631	9.1	700	14.0	DO-14
1N4632	10.0	700	13.0	DO-14
1N4633	11.0	700	12.0	DO-14
1N4634	12.0	700	11.0	DO-14
1N4635	13.0	700	9.5	DO-14
1N4636	15.0	700	8.5	DO-14
1N4637	16.0	700	7.8	DO-14

Type	Zener Voltage Vz (volts)	Dynamic Resistance Zz (ohms) (Note 8)	Zener Current Iz (mA)	Case Style
(Note 2)				
1N4638	18.0	750	7.0	DO-14
1N4640	22.0	750	5.6	DO-14
1N4641	24.0	750	5.2	DO-14
1N4642	27.0	750	4.6	DO-14
1N4643	30.0	1000	4.2	DO-14
1N4644	33.0	1000	3.8	DO-14
1N4645	36.0	1000	3.4	DO-14
1N4646	39.0	1000	3.2	DO-14
1N4647	43.0	1500	3.0	DO-14
1N4648	47.0	1500	2.7	DO-14

1 watt

Type	Zener Voltage Vz (volts)	Dynamic Resistance RD (ohms) (Note 8)	Zener Current Iz (mA)	Case Style
(Note 1)				
1N1765	5.6	1.2	100	DO-13
1N1766	6.2	1.5	100	DO-13
1N1767	6.8	1.7	100	DO-13
1N1768	7.5	2.1	100	DO-13
1N1769	8.2	2.4	100	DO-13
1N1770	9.1	3.0	50	DO-13
1N1771	10.0	3.5	50	DO-13
1N1772	11.0	4.2	50	DO-13
1N1773	12.0	5.0	50	DO-13
1N1774	13.0	5.8	50	DO-13
1N1775	15.0	7.6	50	DO-13
1N1776	16.0	8.6	50	DO-13
1N1777	18.0	11	50	DO-13
1N1778	20.0	13	15	DO-13
1N1779	22.0	16	15	DO-13
1N1780	24.0	18	15	DO-13
1N1781	27.0	23	15	DO-13
1N1782	30.0	28	15	DO-13
1N1783	33.0	33	15	DO-13
1N1784	36.0	39	15	DO-13

Type	Zener Voltage Vz (volts)	Dynamic Resistance RD (ohms) (Note 8)	Zener Current Iz (mA)	Case Style
(Note 1)				
1N1785	39.0	45	15	DO-13
1N1786	43.0	54	15	DO-13
1N1787	48	64	15	DO-13
1N1788	51	74	15	DO-13
1N1789	56	88	15	DO-13
1N1790	62	105	5	DO-13
1N1791	68	125	5	DO-13
1N1792	75	150	5	DO-13
1N1793	82	175	5	DO-13
1N1794	91	220	5	DO-13
1N1795	100	260	5	DO-13
1N1796	110	320	5.0	DO-13
1N1797	120	390	5.0	DO-13
1N1798	130	450	5.0	DO-13
1N1799	150	600	5.0	DO-13
1N1800	160	700	5.0	DO-13
1N1801	180	900	5.0	DO-13
1N1802	200	1100	5.0	DO-13
1N1875	8.2	5.0	25.0	A-126
1N1876	10.0	6.0	25.0	A-126

Type	Zener Voltage Vz (volts)	Dynamic Resistance RD (ohms) (Note 8)	Zener Current Iz (mA)	Case Style
(Note 1)				
1N1877	12.0	7.0	25.0	A-126
1N1878	15.0	8.0	25.0	A-126
1N1879	18.0	9.0	25.0	A-126
1N1880	22.0	24.0	8.0	A-126
1N1881	27.0	27.0	8.0	A-126
1N1882	33.0	30.0	8.0	A-126
1N1883	39.0	35.0	8.0	A-126
1N1884	47.0	50.0	8.0	A-126
1N1885	56.0	75.0	8.0	A-126
1N1888	100	400	3.0	A-126
(Note 7)				
1N2032	4.8	55	10	DO-12
1N2033	5.8	20	10	DO-12
1N2034	7.1	8.0	10	DO-12
1N2035	8.75	15.0	10	DO-12
1N2036	10.5	50.0	5	DO-12
1N2037	12.75	70.0	5	DO-12
1N2038	15.75	120.0	5	DO-12
1N2039	19.0	200.0	5	DO-12
1N2040	23.5	300.0	5	DO-12

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silicon zener diodes cont'd

1 watt—Hughes house types

HUGHES Type No.* (Note 4)	Nominal Zener Voltage Vz (volts)	Zener Test Current Izt (mA)	Maximum Zener Impedance Zzt @ Izt (ohms)	Zzk @ Izk (ohms)	Izk (mA)	Maximum DC Zener Current (mA)	Nominal Temperature Coefficient (%/°C)	Case Style
HZ1608	6.8	37	3.5	700	1.0	145	.040	DO-27
HZ1705	7.5	34	4.0	700	0.5	130	.045	DO-27
HZ1802	8.2	31	4.5	700	0.5	120	.048	DO-27
HZ1901	9.1	28	5.0	700	0.5	110	.051	DO-27
HZ110	10	25	7	700	0.25	100	.055	DO-27
HZ111	11	23	8	700	0.25	90	.060	DO-27
HZ112	12	21	9	700	0.25	80	.065	DO-27
HZ113	13	19	10	700	0.25	75	.065	DO-27
HZ115	15	17	14	700	0.25	65	.070	DO-27
HZ116	16	15.5	16	700	0.25	60	.070	DO-27
HZ118	18	14	20	750	0.25	55	.075	DO-27
HZ120	20	12.5	22	750	0.25	50	.075	DO-27
HZ122	22	11.5	23	750	0.25	45	.080	DO-27
HZ124	24	10.5	25	750	0.25	40	.080	DO-27
HZ127	27	9.5	35	750	0.25	35	.085	DO-27
HZ130	30	8.5	40	1000	0.25	33	.085	DO-27
HZ133	33	7.5	45	1000	0.25	30	.085	DO-27
HZ136	36	7.0	50	1000	0.25	27	.085	DO-27
HZ139	39	6.5	60	1000	0.25	25	.090	DO-27
HZ143	43	6.0	70	1500	0.25	23	.090	DO-27
HZ147	47	5.5	80	1500	0.25	21	.090	DO-27
HZ151	51	5.0	95	1500	0.25	20	.090	DO-27
HZ156	56	4.5	110	2000	0.25	18	.090	DO-27
HZ162	62	4.0	125	2000	0.25	16	.090	DO-27
HZ168	68	3.7	150	2000	0.25	14	.090	DO-27
HZ175	75	3.3	175	2000	0.25	13	.090	DO-27
HZ182	82	3.0	200	3000	0.25	12	.090	DO-27
HZ191	91	2.8	250	3000	0.25	11	.090	DO-27
HZ1100	100	2.5	350	3000	0.25	10	.090	DO-27
HZ1110	110	2.3	450	4000	0.25	9	.095	DO-27
HZ1120	120	2.0	550	4500	0.25	8.3	.095	DO-27
HZ1130	130	1.9	700	5000	0.25	7.6	.095	DO-27
HZ1140	140	1.8	900	5500	0.25	7.0	.095	DO-27
HZ1150	150	1.7	1000	6000	0.25	6.6	.095	DO-27
HZ1160	160	1.6	1100	6500	0.25	6.2	.095	DO-27
HZ1175	175	1.4	1200	7000	0.25	5.7	.095	DO-27
HZ1180	180	1.4	1200	7000	0.25	5.5	.095	DO-27
HZ1200	200	1.2	1500	8000	0.25	5.0	.100	DO-27

* Maximum Forward Voltage Drop for all units — 1.5V @ 200mA.

1.5 watt—Hughes house types

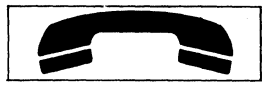
HUGHES Type No.* (Note 4)	Nominal Zener Voltage Vz (volts)	Zener Test Current Izt (mA)	Maximum Zener Impedance Zzt @ Izt (ohms)	Zzk @ Izk (ohms)	Izk (mA)	Maximum DC Zener Current (mA)	Nominal Temperature Coefficient (%/°C)	Case Style
HZ15705	7.5	51	3.0	500	0.5	195	.045	DO-27
HZ15802	8.2	46	3.0	500	0.5	180	.048	DO-27
HZ15901	9.1	42	4.0	500	0.5	165	.051	DO-27
HZ1510	10	37	5.0	500	0.25	150	.055	DO-27
HZ1511	11	35	6.0	500	0.25	135	.060	DO-27
HZ1512	12	32	7.5	500	0.25	120	.065	DO-27
HZ1513	13	29	8	500	0.25	112	.065	DO-27
HZ1515	15	26	10	500	0.25	97	.070	DO-27
HZ1516	16	23	12	500	0.25	90	.070	DO-27
HZ1518	18	21	18	550	0.25	82	.075	DO 27
HZ1520	20	19	20	550	0.25	75	.075	DO-27
HZ1522	22	17	20	550	0.25	67	.080	DO-27
HZ1524	24	16	20	550	0.25	60	.080	DO-27
HZ1527	27	15	25	550	0.25	52	.085	DO-27
HZ1530	30	13	30	700	0.25	49	.085	DO-27
HZ1533	33	11	40	700	0.25	45	.085	DO-27
HZ1536	36	10	45	700	0.25	40	.085	DO-27
HZ1539	39	9.5	50	700	0.25	39	.090	DO-27
HZ1543	43	9	60	1200	0.25	34	.090	DO-27
HZ1547	47	8.5	70	1200	0.25	31	.090	DO-27
HZ1551	51	7.5	80	1200	0.25	30	.090	DO-27
HZ1556	56	6.5	90	1200	0.25	27	.090	DO-27
HZ1562	62	6.0	110	1700	0.25	24	.090	DO-27
HZ1568	68	5.5	125	1700	0.25	21	.090	DO-27
HZ1575	75	5.0	150	1700	0.25	20	.090	DO-27
HZ1582	82	4.5	175	2500	0.25	18	.090	DO-27
HZ1591	91	3.8	200	2500	0.25	17	.090	DO-27
HZ15100	100	3.7	300	2500	0.25	15	.090	DO-27
HZ15110	110	3.5	400	3500	0.25	14	.095	DO-27
HZ15120	120	3.0	500	4000	0.25	12	.095	DO-27
HZ15130	130	2.8	600	4500	0.25	11.5	.095	DO-27
HZ15140	140	2.5	700	5000	0.25	11.2	.095	DO-27
HZ15150	150	2.4	900	5500	0.25	10.6	.095	DO-27
HZ15160	160	2.3	1000	6000	0.25	9.2	.095	DO-27
HZ15175	175	2.1	1100	6500	0.25	7.8	.095	DO-27
HZ15180	180	2.0	1100	6500	0.25	7.6	.095	DO-27
HZ15200	200	1.8	1200	7000	0.25	7.5	.100	DO-27

* Maximum Forward Voltage Drop for all units — 1.5V @ 200mA.

1.5 watt temperature compensated Hughes house types— (and JEDEC equivalents, also available)

JEDEC No.	HUGHES Type No.	Nominal Zener Voltage Vz@Izt (volts)	Zener Test Current Izt (mA)	Maximum Dynamic Impedance @ Izt (ohms)	Maximum Temperature Coefficient ±%/°C	Maximum Temperature Coefficient ±mV/°C	Maximum Power Rating (watts)	Case Style
	HTC8A50A	8.0	10.0	20	.005	.40		HL-1A
	HTC8A5A	8.0	10.0	20	.0005	.04	1.5	HL-1A
	HTC10A50A	10.0	10.0	20	.005	.50		HL-1A
	HTC10A5A	10.0	10.0	20	.0005	.05	1.5	HL-1A
	HTC1204A50A	12.4	10.0	25	.005	.60		HL-1A
	HTC1204A5A	12.4	10.0	25	.0005	.06	1.5	HL-1A
	HTC1406A50A	14.6	10.0	30	.005	.73		HL-1A
	HTC1406A5A	14.6	10.0	30	.0005	.073	1.5	HL-1A
	HTC1608A50A	16.8	10.0	30	.005	.84		HL-1A
	HTC1608A5A	16.8	10.0	30	.0005	.084	1.5	HL-1A
	HTC1805A50A	18.5	10.0	30	.005	.925		HL-1A
	HTC1805A5A	18.5	10.0	30	.0005	.092	1.5	HL-1A
	HTC21A50A	21.0	10.0	35	.005	1.05		HL-1A
	HTC21A5A	21.0	10.0	35	.0005	.105	1.5	HL-1A
	HTC23A50A	23.0	10.0	40	.005	1.15		HL-1A
	HTC23A5A	23.0	10.0	40	.0005	.115	1.5	HL-1A

JEDEC No.	HUGHES Type No.	Nominal Zener Voltage Vz @ Izt (volts)	Zener Test Current Izt (mA)	Maximum Dynamic Impedance @ Izt (ohms)	Maximum Temperature Coefficient ±%/°C	Maximum Temperature Coefficient ±mV/°C	Maximum Power Rating (watts)	Case Style
	HTC27A50A	27.0	10.0	45	.005	1.35		HL-1A
	HTC27A5A	27.0	10.0	45	.0005	.135	1.5	HL-1A
	HTC30A50A	30.0	10.0	50	.005	1.50		HL-1A
	HTC30A5A	30.0	10.0	50	.0005	.150	1.5	HL-1A
	HTC33A50A	33.0	10.0	55	.005	1.65		HL-1A
	HTC33A5A	33.0	10.0	55	.0005	.165	1.5	HL-1A
	HTC37A50A	37.0	7.5	80	.005	1.85		HL-1A
	HTC37A5A	37.0	7.5	80	.0005	.185	1.5	HL-1A
	HTC43A50A	43.0	7.5	90	.005	2.15		HL-1A
	HTC43A5A	43.0	7.5	90	.0005	.215	1.5	HL-1A
	HTC47A50A	47.0	7.5	100	.005	2.35		HL-1A
	HTC47A5A	47.0	7.5	100	.0005	.235	1.5	HL-1A
1N4057	HTC1204A50A	12.4	10.0	25	.005	.60		HL-1A
1N4057A	HTC1204A20A	12.4	10.0	25	.002	.24	1.5	HL-1A
1N4058	HTC1406A50A	14.6	10.0	30	.005	.73		HL-1A
1N4058A	HTC1406A20A	14.6	10.0	30	.002	.29	1.5	HL-1A



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silicon zener diodes cont'd

1.5 watt temperature compensated — (cont'd)

Hughes house types — (including JEDEC types available)

JEDEC No.	HUGHES Type No.	Nominal Zener Voltage V_Z @ I_{ZT} (volts)	Zener Test Current I_{ZT} (mA)	Maximum Dynamic Impedance @ I_{ZT} (ohms)	Maximum Temperature Coefficient ±%/°C	Maximum Temperature Coefficient ±mV/°C	Maximum Power Rating (watts)	Case Style
1N4059	HTC1608A50A	16.8	10.0	30	.005	.84		HL-1A
1N4059A	HTC1608A20A	16.8	10.0	30	.002	.33	1.5	HL-1A
1N4060	HTC1805A50A	18.5	10.0	30	.005	.925		HL-1A
1N4060A	HTC1805A20A	18.5	10.0	30	.002	.37	1.5	HL-1A
1N4061	HTC21A50A	21.0	10.0	35	.005	1.05		HL-1A
1N4061A	HTC21A20A	21.0	10.0	35	.002	.42	1.5	HL-1A
1N4062	HTC23A50A	23.0	10.0	40	.005	1.15		HL-1A
1N4062A	HTC23A20A	23.0	10.0	40	.002	.46	1.5	HL-1A
1N4063	HTC27A50A	27.0	10.0	45	.005	1.35		HL-1A
1N4063A	HTC27A20A	27.0	10.0	45	.002	.54	1.5	HL-1A
1N4064	HTC30A50A	30.0	10.0	50	.005	1.50		HL-1A
1N4064A	HTC30A20A	30.0	10.0	50	.002	.60	1.5	HL-1A
1N4065	HTC33A50A	33.0	10.0	55	.005	1.65		HL-1A
1N4065A	HTC33A20A	33.0	10.0	55	.002	.66	1.5	HL-1A
1N4066	HTC37A50A	37.0	7.5	80	.005	1.85		HL-1A
1N4066A	HTC37A20A	37.0	7.5	80	.002	.74	1.5	HL-1A
1N4067	HTC43A50A	43.0	7.5	90	.005	2.15		HL-1A
1N4067A	HTC43A20A	43.0	7.5	90	.002	.86	1.5	HL-1A
1N4068	HTC47A50A	47.0	7.5	100	.005	2.35		HL-1A
1N4068A	HTC47A20A	47.0	7.5	100	.002	.94	1.5	HL-1A

2 watt

HUGHES Type No.* (Note 4)	Nominal Zener Voltage V_Z (volts)	Zener Test Current I_{ZT} (mA)	Maximum Zener Impedance Z_{ZT} @ I_{ZT} (ohms)	Maximum Zener Impedance Z_{ZK} @ I_{ZK} (ohms)	Maximum Zener Impedance I_{ZK} (mA)	Maximum DC Zener Current (mA)	Nominal Temperature Coefficient (±%/°C)	Case Style
HZ2901	9.1	55	4.0	500	0.5	165	.051	DO-27
HZ210	10	50	5.0	500	0.25	150	.055	DO-27
HZ211	11	45	6.0	500	0.25	135	.060	DO-27
HZ212	12	42	7.5	500	0.25	120	.065	DO-27
HZ213	13	38	8	500	0.25	112	.065	DO-27
HZ215	15	33	10	500	0.25	97	.070	DO-27
HZ216	16	31	12	500	0.25	90	.070	DO-27
HZ218	18	28	18	550	0.25	82	.075	DO-27
HZ220	20	25	20	550	0.25	75	.075	DO-27
HZ222	22	23	20	550	0.25	67	.080	DO-27
HZ224	24	21	20	550	0.25	60	.080	DO-27
HZ227	27	18	25	550	0.25	52	.085	DO-27
HZ230	30	17	30	700	0.25	49	.085	DO-27
HZ233	33	15	40	700	0.25	45	.085	DO-27
HZ236	36	14	45	700	0.25	40	.085	DO-27
HZ239	39	13	50	700	0.25	39	.090	DO-27
HZ243	43	12	60	1200	0.25	34	.090	DO-27
HZ247	47	11	70	1200	0.25	31	.090	DO-27
HZ251	51	9.8	80	1200	0.25	30	.090	DO-27
HZ256	56	8.8	90	1200	0.25	27	.090	DO-27
HZ262	62	8.1	110	1700	0.25	24	.090	DO 27
HZ268	68	7.4	125	1700	0.25	21	.090	DO-27
HZ275	75	6.7	150	1700	0.25	20	.090	DO-27
HZ282	82	6.1	175	2500	0.25	20	.090	DO-27
HZ291	91	5.5	200	2500	0.25	18	.090	DO-27
HZ2100	100	5.0	300	2500	0.25	17	.090	DO-27
HZ2110	110	4.5	400	3500	0.25	14	.095	DO-27
HZ2120	120	4.2	500	4000	0.25	12	.095	DO-27
HZ2130	130	3.8	600	4500	0.25	11.5	.095	DO-27
HZ2140	140	3.6	700	5000	0.25	11.2	.095	DO-27
HZ2150	150	3.3	900	5500	0.25	10.6	.095	DO-27
HZ2160	160	3.1	1000	6000	0.25	9.2	.095	DO-27
HZ2175	175	2.9	1100	6500	0.25	7.8	.095	DO-27
HZ2180	180	2.8	1100	6500	0.25	7.6	.095	DO-27
HZ2200	200	2.5	1200	7000	0.25	7.5	.100	DO-27

* Maximum Forward Voltage Drop for all units — 1.5V @ 200mA.

2 watt temperature compensated

JEDEC No.	HUGHES Type No.	Nominal Zener Voltage V_Z @ I_{ZT} (volts)	Zener Test Current I_{ZT} (mA)	Maximum Dynamic Impedance @ I_{ZT} (ohms)	Maximum Temperature Coefficient ±%/°C	Maximum Temperature Coefficient ±mV/°C	Maximum Power Rating (watts)	Case Style
1N4069	HTC51A50B	51.0	7.5	110	.005	2.55		HL-1B
1N4069A	HTC51A20B	51.0	7.5	110	.002	1.02	2.0	HL-1B
	HTC51A5B	51.0	7.5	110	.0005	.255	2.0	HL-1B
1N4070	HTC56A50B	56.0	7.5	120	.005	2.80		HL-1B
1N4070A	HTC56A20B	56.0	7.5	120	.002	1.12	2.0	HL-1B
	HTC56A5B	56.0	7.5	120	.0005	.280	2.0	HL-1B
1N4071	HTC62A50B	62.0	7.5	135	.005	3.10		HL-1B
1N4071A	HTC62A20B	62.0	7.5	135	.002	1.24	2.0	HL-1B
	HTC62A5B	62.0	7.5	135	.0005	.310	2.0	HL-1B
1N4072	HTC68A50B	68.0	5.0	230	.005	3.40		HL-1B
1N4072A	HTC68A20B	68.0	5.0	230	.002	1.36	2.0	HL-1B
	HTC68A5B	68.0	5.0	230	.0005	.340	2.0	HL-1B
1N4073	HTC75A50B	75.0	5.0	250	.005	3.75		HL-1B
1N4073A	HTC75A20B	75.0	5.0	250	.002	1.50	2.0	HL-1B
	HTC75A5B	75.0	5.0	250	.0005	.375	2.0	HL-1B
1N4074	HTC82A50B	82.0	5.0	270	.005	4.10		HL-1B
1N4074A	HTC82A20B	82.0	5.0	270	.002	1.64	2.0	HL-1B
	HTC82A5B	82.0	5.0	270	.0005	.410	2.0	HL-1B
1N4075	HTC87A50B	87.0	5.0	290	.005	4.35		HL-1B
1N4075A	HTC87A20B	8.70	5.0	290	.002	1.74		HL-1B
	HTC87A5B	87.0	5.0	290	.0005	.435	2.0	HL-1B
1N4076	HTC91A50B	91.0	5.0	310	.005	4.55		HL-1B
1N4076A	HTC91A20B	91.0	5.0	310	.002	1.82	2.0	HL-1B
	HTC91A5B	91.0	5.0	310	.0005	.455	2.0	HL-1B
1N4077	HTC100A50B	100.0	5.0	340	.005	5.00		HL-1B
1N4077A	HTC100A20B	100.0	5.0	340	.002	2.00	2.0	HL-1B
	HTC100A5B	100.0	5.0	340	.0005	.500	2.0	HL-1B
1N4078	HTC105A50B	105.0	2.5	700	.005	5.25		HL-1B
1N4078A	HTC105A20B	105.0	2.5	700	.002	2.10	2.0	HL-1B
	HTC105A5B	105.0	2.5	700	.0005	.525	2.0	HL-1B
1N4079	HTC110A50B	110.0	2.5	740	.005	5.50		HL-1B
1N4079A	HTC110A20B	110.0	2.5	740	.002	2.20	2.0	HL-1B
	HTC110A5B	110.0	2.5	740	.0005	.550	2.0	HL-1B
1N4080	HTC120A50B	120.0	2.5	800	.005	6.00		HL-1B
1N4080A	HTC120A20B	120.0	2.5	800	.002	2.40	2.0	HL-1B
	HTC120A5B	120.0	2.5	800	.0005	.600	2.0	HL-1B

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silicon zener diodes cont'd

2.5 watt temperature compensated

JEDEC No.	HUGHES Type No.	Nominal Zener Voltage V_Z@I_{ZT} (volts)	Zener Test Current I_{ZT} (mA)	Maximum Dynamic Impedance @ I_{ZT} (ohms)	Maximum Temperature Coefficient ±%/°C	Maximum Temperature Coefficient ±mV/°C	Maximum Power Rating (watts)	Case Style
1N4081	HTC130R50C	130.0	2.5	840	.005	6.50		HL-1C
1N4081A	HTC130A20C	130.0	2.5	840	.002	2.60	2.5	HL-1C
	HTC130A5C	130.0	2.5	840	.0005	.650	2.5	HL-1C
1N4082	HTC140A50C	140.0	2.5	960	.005	7.00		HL-1C
1N4082A	HTC140A20C	140.0	2.5	960	.002	2.80	2.5	HL-1C
	HTC140A5C	140.0	2.5	960	.0005	.700	2.5	HL-1C
1N4083	HTC150A50C	150.0	2.5	1020	.005	7.50		HL-1C
1N4083A	HTC150A20C	150.0	2.5	1020	.002	3.00	2.5	HL-1C
	HTC150A5C	150.0	2.5	1020	.0005	.750	2.5	HL-1C

JEDEC No.	HUGHES Type No.	Nominal Zener Voltage V_Z@I_{ZT} (volts)	Zener Test Current I_{ZT} (mA)	Maximum Dynamic Impedance @ I_{ZT} (ohms)	Maximum Temperature Coefficient ±%/°C	Maximum Temperature Coefficient ±mV/°C	Maximum Power Rating (watts)	Case Style
1N4084	HTC175A50C	175.0	2.5	1150	.005	8.75		HL-1C
1N4084A	HTC175A20C	175.0	2.5	1150	.002	3.50	2.5	HL-1C
	HTC175A5C	175.0	2.5	1150	.0005	.875	2.5	HL-1C
1N4085	HTC200A50C	200.0	2.5	1350	.005	10.00		HL-1C
1N4085A	HTC200A20C	200.0	2.5	1350	.002	4.00	2.5	HL-1C
	HTC200A5C	200.0	2.5	1350	.0005	1.00	2.5	HL-1C

3 watt

HUGHES Type No.* (Note 4)	Nominal Zener Voltage V_Z (volts)	Zener Test Current I_{ZT} (mA)	Maximum Zener Impedance Z_{ZT} @ I_{ZT} (ohms)	Maximum Zener Impedance Z_{ZK} @ I_{ZK} (ohms)	Maximum Zener Impedance I_{ZK} (mA)	Maximum DC Zener Current (mA)	Nominal Temperature Coefficient (%/°C)	Case Style
HZ3705	7.5	100	2	500	0.5	390	.045	HL-2
HZ3802	8.2	93	3	500	0.5	360	.048	HL-2
HZ3901	9.1	84	3	500	0.5	330	.051	HL-2
HZ310	10	75	4	500	0.25	300	.055	HL-2
HZ311	11	69	5	500	0.25	270	.060	HL-2
HZ312	12	63	5	500	0.25	240	.065	HL-2
HZ313	13	57	5	500	0.25	225	.065	HL-2
HZ315	15	50	6	500	0.25	195	.070	HL-2
HZ316	16	46.5	8	500	0.25	180	.070	HL-2
HZ318	18	42	10	550	0.25	165	.075	HL-2
HZ320	20	37.5	11	550	0.25	150	.075	HL-2
HZ322	22	34.5	12	550	0.25	135	.080	HL-2
HZ324	24	30.5	12	550	02.5	120	.080	HL-2
HZ327	27	28.5	18	550	0.25	105	.085	HL-2
HZ330	30	26.5	20	700	0.25	99	.085	HL-2
HZ333	33	22.5	22	700	0.25	90	.085	HL-2
HZ336	36	21.0	25	700	0.25	81	.085	HL-2
HZ339	39	19.5	30	700	0.25	75	.090	HL-2
HZ343	43	18.0	35	1200	0.25	69	.090	HL-2
HZ347	47	16.5	40	1200	0.25	63	.090	HL-2

HUGHES Type No.* (Note 4)	Nominal Zener Voltage V_Z (volts)	Zener Test Current I_{ZT} (mA)	Maximum Zener Impedance Z_{ZT} @ I_{ZT} (ohms)	Maximum Zener Impedance Z_{ZK}@ I_{ZK} (ohms)	Maximum Zener Impedance I_{ZK} (mA)	Maximum DC Zener Current (mA)	Nominal Temperature Coefficient (%/°C)	Case Style
HZ351	51	15.0	45	1200	0.25	60	.090	HL-2
HZ356	56	13.5	55	1700	0.25	54	.090	HL-2
HZ362	62	12.0	65	1700	0.25	48	.090	HL-2
HZ368	68	11.1	75	1700	0.25	42	.090	HL-2
HZ375	75	10.0	90	1700	0.25	39	.090	HL-2
HZ382	82	9.0	100	2500	0.25	36	.090	HL-2
HZ391	91	8.4	125	2500	0.25	33	.090	HL-2
HZ3100	100	7.5	200	2500	0.25	30	.090	HL-2
HZ3110	110	6.9	225	3000	0.25	27	.095	HL-2
HZ3120	120	6.0	275	3500	0.25	25	.095	HL-2
HZ3130	130	5.7	350	4000	0.25	22.8	.095	HL-2
HZ3140	140	5.4	450	4000	0.25	21	.095	HL-2
HZ3150	150	5.0	500	4500	0.25	19.8	.095	HL-2
HZ3160	160	4.8	550	5000	0.25	18.6	.095	HL-2
HZ3175	175	4.3	600	5500	0.25	17	.095	HL-2
HZ3180	180	4.1	600	5500	0.25	16.5	.095	HL-2
HZ3200	200	3.7	750	6500	0.25	15	.100	HL-2

* Maximum Forward Voltage Drop for all units — 1.5V @ 200mA.

10 watt

Type	Zener Voltage V_Z (volts)	Dynamic Resistance R_D (ohms) (Note 8)	Zener Current I_Z (mA)	Case Style
(Notes 5, 9)				
1N1351	10	2	500	DO-4
1N1352	11	2	500	DO-4
1N1353	12	2	500	DO-4
1N1354	13	2	500	DO-4
1N1355	15	2	500	DO-4
1N1356	16	3	500	DO-4
1N1357	18	3	150	DO-4
1N1358	20	3	150	DO-4
1N1359	22	3	150	DO-4
1N1360	24	3	150	DO-4
1N1361	27	3	150	DO-4
1N1362	30	4	150	DO-4
1N1363	33	4	150	DO-4
1N1364	36	5	150	DO-4
1N1365	39	5	150	DO-4
1N1366	43	6	150	DO-4
1N1367	47	7	150	DO-4
1N1368	51	8	150	DO-4
1N1379	56	9	150	DO-4
1N1370	62	12	50	DO-4

Type	Zener Voltage V_Z (volts)	Dynamic Resistance R_D (ohms) (Note 8)	Zener Current I_Z (mA)	Case Style
(Notes 5, 9)				
1N1371	68	14	50	DO-4
1N1372	75	20	50	DO-4
1N1373	82	22	50	DO-4
1N1374	91	35	50	DO-4
1N1375	100	40	50	DO-4
(Notes 1, 5)				
1N1588	3.9	2.9	150	DO-4
1N1588A	3.9	2.9	150	DO-4
1N1589	4.7	2.5	125	DO-4
1N1589A	4.7	2.5	125	DO-4
1N1590	5.6	1.9	110	DO-4
1N1590A	5.6	1.5	110	DO-4
1N1591	6.8	0.87	100	DO-4
1N1591A	6.8	0.73	100	DO-4
1N1592	8.2	0.60	80	DO-4
1N1592A	8.2	0.55	80	DO-4
1N1593	10.0	1.05	70	DO-4
1N1593A	10.0	0.88	70	DO-4
1N1594	12.0	2.2	50	DO-4
1N1594A	12.0	1.9	50	DO-4

Type	Zener Voltage Vz (volts)	Dynamic Resistance R_D (ohms) (Note)	Zener Current Iz (mA)	Case Style
(Notes 1, 5)				
1N1595	15.0	5.1	40	DO-4
1N1595A	15.0	4.9	40	DO-4
1N1596	18.0	8.0	35	DO-4
1N1596A	18.0	7.1	35	DO-4
1N1597	22.0	12.0	30	DO-4
1N1597A	22.0	10.5	30	DO-4
1N1598	27.0	18.0	25	DO-4
1N1598A	27.0	17.0	25	DO-4
1N1599	3.9	0.96	500	DO-4
1N1599A	3.9	0.92	500	DO-4
1N1600	4.7	0.85	400	DO-4
1N1600A	4.7	0.77	400	DO-4
1N1601	5.6	0.55	350	DO-4
1N1601A	5.6	0.41	350	DO-4
1N1602	6.8	0.28	300	DO-4
1N1602A	6.8	0.22	300	DO-4
1N1603	8.2	0.36	250	DO-4
1N1603A	8.2	0.29	250	DO-4
1N1604	10.0	0.78	200	DO-4
1N1604A	10.0	0.71	200	DO-4



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silicon zener diodes cont'd

10 watt — cont'd.

Type	Zener Voltage V_Z (volts)	Dynamic Resistance R_D (ohms) (Note 8)	Zener Current I_Z (mA)	Case Style
(Notes 1, 5)				
1N1605	12.0	1.12	170	DO-4
1N1605A	12.0	1.10	170	DO-4
1N1606	15.0	1.90	140	DO-4
1N1606A	15.0	1.90	140	DO-4
1N1607	18.0	2.60	110	DO-4
1N1607A	18.0	2.45	110	DO-4
1N1608	22.0	3.9	90	DO-4
1N1608A	22.0	3.6	90	DO-4
1N1609	27.0	6.6	70	DO-4
1N1609A	27.0	5.5	70	DO-4
1N1803	5.6	1.0	1000	DO-4
1N1804	6.2	1.0	1000	DO-4
1N1805	6.8	1.0	1000	DO-4
1N1806	7.5	1.0	1000	DO-4
1N1807	8.2	1.0	1000	DO-4
1N1808	9.1	1.0	500	DO-4
1N1809	110.0	47.0	50	DO-4
1N1810	120.0	56.0	50	DO-4
1N1811	130.0	65.0	50	DO-4
1N1812	150.0	82.0	50	DO-4
1N1813	160.0	93.0	50	DO-4
1N1814	180.0	115.0	50	DO-4
1N1815	200.0	140.0	50	DO-4
1N1816	13.0	2.0	500	DO-4
1N1817	15.0	2.0	500	DO-4
1N1818	16.0	3.0	500	DO-4
1N1819	18.0	3.0	500	DO-4
1N1820	20.0	3.0	250	DO-4
1N1821	22.0	3.0	250	DO-4
1N1822	24.0	3.0	250	DO-4
1N1823	27.0	3.0	250	DO-4
1N1824	30.0	4.0	250	DO-4
1N1825	33.0	4.0	150	DO-4
1N1826	36.0	5.0	150	DO-4
1N1827	39.0	5.0	150	DO-4
(Notes 1, 5)				
1N1828	43.0	6.0	150	DO-4
1N1829	47.0	7.0	150	DO-4
1N1830	51.0	8.0	150	DO-4
1N1831	56.0	9.0	150	DO-4
1N1832	62.0	12.0	50	DO-4
1N1833	68.0	14.0	50	DO-4
1N1834	75.0	20.0	50	DO-4
1N1835	82.0	22.0	50	DO-4
1N1836	91.0	35.0	50	DO-4
1N2008	100	40	50	DO-4
1N2009	110	47	50	DO-4
1N2010	120	56	50	DO-4
1N2011	130	65	50	DO-4
1N2012	150	82	50	DO-4
(Notes 7, 5)				
1N2041	4.8	1.0	1000	DO-4
1N2042	5.8	0.7	1000	DO-4
1N2043	7.1	0.8	1000	DO-4
1N2044	8.75	0.8	1000	DO-4
1N2045	10.5	1.5	500	DO-4
1N2046	12.75	2.0	500	DO-4
1N2047	15.75	3.0	500	DO-4
1N2048	19.0	3.0	500	DO-4
1N2049	23.5	8.0	150	DO-4
(Notes 2, 5)				
1N2041-1	4.5	1.0	1000	DO-4
1N2041-2	5.0	1.0	1000	DO-4
1N2042-1	5.5	0.7	1000	DO-4
1N2042-2	6.0	0.7	1000	DO-4
1N2043-1	6.5	0.8	1000	DO-4
1N2043-2	7.0	0.8	1000	DO-4
1N2043-3	7.5	0.8	1000	DO-4
1N2044-1	8.0	0.8	1000	DO-4
1N2044-2	8.5	0.8	1000	DO-4
1N2044-3	9.0	0.8	1000	DO-4
1N2044-4	9.5	0.8	1000	DO-4
1N2045-1	10.0	1.5	500	DO-4
1N2045-2	11.0	1.5	500	DO-4
1N2046-1	12.0	2.0	500	DO-4
1N2046-2	13.0	2.0	500	DO-4
1N2046-3	14.0	2.0	500	DO-4
1N2047-1	15.0	3.0	500	DO-4
1N2047-2	16.0	3.0	500	DO-4
1N2047-3	17.0	3.0	500	DO-4
1N2048-1	18.0	3.0	500	DO-4
1N2048-2	19.0	3.0	500	DO-4
1N2048-3	20.0	3.0	500	DO-4
1N2049-1	22.0	8.0	150	DO-4
1N2049-2	24.0	8.0	150	DO-4
1N2049-3	26.0	8.0	150	DO-4
(Note 10)				
1N2498	10	2.0	500	DO-4
1N2499	11	2.0	500	DO-4
1N2500	12	2.0	500	DO-4
(Notes 4, 5)				
1N2970	6.8	1.2	370	DO-4
1N2971	7.5	1.3	335	DO-4
1N2972	8.2	1.5	305	DO-4
1N2973	9.1	2.0	275	DO-4
1N2974	10.0	3.0	250	DO-4
1N2975	11.0	3.0	230	DO-4
1N2976	12.0	3.0	210	DO-4
1N2977	13.0	3.0	190	DO-4
1N2978	14.0	3.0	180	DO-4
1N2979	15.0	3.0	170	DO-4
1N2980	16.0	4.0	155	DO-4
1N2981	17.0	4.0	145	DO-4
1N2982	18.0	4.0	140	DO-4
1N2983	19.0	4.0	130	DO-4
1N2984	20.0	4.0	125	DO-4
1N2985	22.0	5.0	115	DO-4
1N2986	24.0	5.0	105	DO-4
1N2987	25.0	6.0	100	DO-4
1N2988	27.0	7.0	95	DO-4
1N2989	30.0	8.0	85	DO-4
1N2990	33.0	9.0	75	DO-4
1N2991	36.0	10.0	70	DO-4
1N2992	39.0	11.0	65	DO-4
1N2993	43.0	12.0	60	DO-4
1N2994	45.0	13.0	55	DO-4
1N2995	47.0	14.0	55	DO-4
1N2996	50.0	15.0	50	DO-4
1N2997	51.0	15.0	50	DO-4
1N2998	52.0	15.0	50	DO-4
1N2999	56.0	16.0	45	DO-4
1N3000	62.0	17.0	40	DO-4
1N3001	68.0	18.0	37	DO-4
1N3002	75.0	22.0	33	DO-4
(Notes 4, 5)				
1N3003	82.0	25.0	30	DO-4
1N3004	91.0	35.0	28	DO-4
1N3005	100	40.0	25	DO-4
1N3006	105	45.0	25	DO-4
1N3007	110	55.0	23	DO-4
1N3008	120	75.0	20	DO-4
1N3009	130	100	19	DO-4
1N3010	140	125	18	DO-4
1N3011	150	175	17	DO-4
1N3012	160	200	16	DO-4
1N3013	175	250	14	DO-4
1N3014	180	260	14	DO-4
1N3015	200	300	12	DO-4
(Notes 1, 5)				
1N3993	3.9	2.0	640	DO-4
1N3994	4.3	1.5	580	DO-4
1N3995	4.7	1.2	530	DO-4
1N3996	5.1	1.1	490	DO-4
1N3997	5.6	1.0	445	DO-4
1N3998	6.2	1.1	405	DO-4
1N3999	6.8	1.2	370	DO-4
1N4000	7.5	1.3	335	DO-4
(Note 4)				
1N4258	6.8	1.2	370	S-134
1N4259	7.5	1.3	335	S-134
1N4260	8.2	1.5	305	S-134
1N4261	9.1	2.0	275	S-134
1N4262	10.0	3.0	250	S-134
1N4263	11.0	3.0	230	S-134
1N4264	12.0	3.0	210	S-134
1N4265	13.0	3.0	190	S-134
1N4266	15.0	3.0	170	S-134
1N4267	16.0	4.0	155	S-134
1N4268	18.0	4.0	140	S-134
1N4269	20.0	4.0	125	S-134
1N4270	22.0	5.0	115	S-134
1N4271	24.0	5.0	105	S-134
1N4272	27.0	7.0	95	S-134
1N4273	30.0	8.0	85	S-134
1N4274	33.0	9.0	75	S-134
1N4275	36.0	10.0	70	S-134
1N4276	39.0	11.0	65	S-134
1N4277	43.0	12.0	60	S-134
1N4278	47.0	14.0	55	S-134
1N4279	51.0	15.0	50	S-134
1N4280	56.0	16.0	45	S-134
1N4281	62.0	17.0	40	S-134
1N4282	68.0	18.0	37	S-134
1N4283	75.0	22.0	33	S-134
1N4284	82.0	25.0	30	S-134
1N4285	91.0	35.0	28	S-134
1N4286	100	40.0	25	S-134
1N4287	110	55.0	23	S-134
1N4288	120	75.0	20	S-134
1N4289	130	100	19	S-134
1N4290	150	175	17	S-134
1N4291	160	200	16	S-134
1N4292	180	260	14	S-134
1N4293	200	300	12	S-134

Flange Mounted (Case Style TO-3) Type	Stud Mounted (Case Style DO-5) Type	Nominal Zener Voltage, V_Z (volts)	Zener Current I_Z (mA)	Dynamic Resistance (R_D) (ohms((Note 8)
(Notes 4, 5)				
1N2804	1N3305	6.8	1850	0.2
1N2805	1N3306	7.5	1700	0.3
1N2806	1N3307	8.2	1500	0.4
1N2807	1N3308	9.1	1370	0.5
1N2808	1N3309	10	1200	0.6
1N2809	1N3310	11	1100	0.8
1N2810	1N3311	12	1000	1.0
1N2811	1N3312	13	960	1.1
1N2812	1N3313	14	890	1.2
1N2813	1N3314	15	830	1.4
1N2814	1N3315	16	780	1.6
1N2815	1N3316	17	740	1.8
1N2816	1N3317	18	700	2.0
1N2817	1N3318	19	660	2.2
1N2818	1N3319	20	630	2.4
(Notes 4, 5)				
1N2819	1N3320	22	570	2.5
1N2820	1N3321	24	520	2.6
1N2821	1N3322	25	500	2.7
1N2822	1N3323	27	460	2.8
1N2823	1N3324	30	420	3.0
1N2824	1N3325	33	380	3.2
1N2825	1N3326	36	350	3.5
1N2826	1N3327	39	320	4.0
1N2827	1N3328	43	290	4.5
1N2828	1N3329	45	280	4.5
—	1N3330	47	270	5.0
—	1N3331	50	245	5.2
—	1N3332	51	245	5.2
—	1N3333	52	240	5.5
—	1N3334	56	220	6.0
(Notes 4, 5)				
—	1N3335	62	200	7.0
—	1N3336	68	180	8.0
—	1N3337	75	170	9.0
—	1N3338	82	150	11
—	1N3339	91	140	15
	1N3340	100	120	20
1N2839	1N3341	105	120	25
1N2840	1N3342	110	110	30
1N2841	1N3343	120	100	40
1N2842	1N3344	130	95	50
—	1N3345	140	90	60
—	1N3346	150	85	75
1N2844	1N3347	160	80	80
—	1N3348	175	70	85
1N2845	1N3349	180	68	90
1N2846	1N3350	200	65	100

HUGHES SEMICONDUCTORS
HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION
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silicon rectifiers

lead mounted silicon rectifiers DO-1 case style — (cont'd)

The following condition applies, except where otherwise noted, for all silicon rectifier types in ths catalog:

Test Voltage = Peak Inverse Voltage

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Ambient Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Reverse Current (μA) @ Ambient Temp. (°C)	Notes
1N441	200	0.3 @ 25	1.5 @ 0.3	0.75 @ 25	—
1N441B	200	0.5 @ 100	1.5 @ 0.75	0.75 @ 25	—
1N442	300	0.3 @ 25	1.5 @ 0.3	1 @ 25	—
1N442B	300	0.5 @ 100	1.5 @ 0.75	1 @ 25	—
1N443	400	0.3 @ 25	1.5 @ 0.3	1.5 @ 25	—
1N443B	400	0.5 @ 100	1.5 @ 0.75	1.5 @ 25	—
1N444	500	0.3 @ 25	1.5 @ 0.3	1.75 @ 25	—
1N444B	500	0.4 @ 100	1.5 @ 0.75	1.75 @ 25	—
1N445	600	0.3 @ 25	1.5 @ 0.3	2 @ 25	—
1N445B	600	0.4 @ 100	1.5 @ 0.75	2 @ 25	—
1N530	100	0.3 @ 100	1.5 @ 0.3	300 @ 25	—
1N531	200	0.3 @ 100	1.5 @ 0.3	300 @ 25	—
1N532	300	0.3 @ 100	1.5 @ 0.3	300 @ 25	—
1N533	400	0.3 @ 100	1.5 @ 0.3	300 @ 25	—
1N534	500	0.3 @ 100	1.5 @ 0.3	300 @ 25	—
1N535	600	0.3 @ 100	1.5 @ 0.3	300 @ 25	—
1N536	50	0.25 @ 150	1.1 @ 0.5	300 @ 150	2
1N537	100	0.25 @ 150	1.1 @ 0.5	300 @ 150	2
1N538	200	0.25 @ 150	1.1 @ 0.5	300 @ 150	2
1N539	300	0.25 @ 150	1.1 @ 0.5	300 @ 150	2
1N540	400	0.25 @ 150	1.1 @ 0.5	300 @ 150	2
1N547	600	0.25 @ 150	1.2 @ 0.5	300 @ 150	2
1N560	800	0.25 @ 100	1.3 @ 0.25	300 @ 100	2
1N561	1000	0.25 @ 100	1.3 @ 0.25	300 @ 100	2
1N588	1500	0.1 @ 50	1.5 @ 0.1	300 @ 150	2
1N589	1500	0.25 @ 50	1.5 @ 0.25	300 @ 150	2
1N599	50	0.3 @ 100	1.5 @ 0.2	25 @ 25	—
1N599A	50	0.3 @ 100	1.5 @ 0.4	1 @ 25	—
1N600	100	0.3 @ 100	1.5 @ 0.2	25 @ 25	—
1N600A	100	0.3 @ 100	1.5 @ 0.4	1 @ 25	—
1N601	150	0.3 @ 100	1.5 @ 0.2	25 @ 25	—
1N601A	150	0.3 @ 100	1.5 @ 0.4	1 @ 25	—
1N602	200	0.3 @ 100	1.5 @ 0.2	25 @ 25	—
1N602A	200	0.3 @ 100	1.5 @ 0.4	1 @ 25	—
1N603	300	0.3 @ 100	1.5 @ 0.2	25 @ 25	—
1N603A	300	0.3 @ 100	1.5 @ 0.4	1 @ 25	—
1N604	400	0.3 @ 100	1.5 @ 0.2	25 @ 25	—
1N604A	400	0.3 @ 100	1.5 @ 0.4	1 @ 25	—
1N605	500	0.3 @ 100	1.5 @ 0.2	25 @ 25	—
1N605A	500	0.3 @ 100	1.5 @ 0.4	1 @ 25	—
1N606	600	0.3 @ 100	1.5 @ 0.2	25 @ 25	—
1N606A	600	0.3 @ 100	1.5 @ 0.4	1 @ 25	—
1N1095	500	0.25 @ 150	1.1 @ 500	300 @ 150	2
1N1096	600	0.25 @ 150	1.1 @ 500	300 @ 150	2
1N1100	100	0.25 @ 150	1.5 @ 0.75	300 @ 150	2
1N1101	200	0.25 @ 150	1.5 @ 0.75	300 @ 150	2
1N1102	300	0.25 @ 150	1.5 @ 0.75	300 @ 150	2
1N1103	400	0.25 @ 150	1.5 @ 0.75	300 @ 150	2
1N1104	500	0.25 @ 150	1.5 @ 0.75	300 @ 150	2
1N1105	600	0.25 @ 150	1.5 @ 0.75	300 @ 150	2
1N1108	800	0.25 @ 150	1.5 @ 0.75	300 @ 150	2
1N1169	400	0.79 @ 80	0.9 @ 0.5 (7)	3500 @ 100	—
1N1169A	400	0.5 @ 100	1.1 @ 1	100 @ 25	—
1N1217	50	0.6 @ 100	1.15 @ 1	500 @ 25	—
1N1217A	150	0.6 @ 100	1.15 @ 1	50 @ 25	—
1N1218	100	0.6 @ 100	1.15 @ 1	500 @ 25	—
1N1218A	100	0.6 @ 100	1.15 @ 1	50 @ 25	—
1N1219	150	0.6 @ 100	1.15 @ 1	500 @ 25	—
1N1219A	150	0.6 @ 100	1.15 @ 1	50 @ 25	—
1N1220	200	0.6 @ 100	1.15 @ 1	500 @ 25	—
1N1220A	200	0.6 @ 100	1.15 @ 1	50 @ 25	—
1N1221	300	0.5 @ 100	1.15 @ 1	500 @ 25	—
1N1221A	300	0.5 @ 100	1.15 @ 1	50 @ 25	—
1N1222	400	0.5 @ 100	1.15 @ 1	500 @ 25	—
1N1222A	400	0.5 @ 100	1.15 @ 1	50 @ 25	—
1N1223	500	0.5 @ 100	1.15 @ 1	500 @ 25	—
1N1223A	500	0.5 @ 100	1.15 @ 1	50 @ 25	—
1N1224	600	0.45 @ 100	1.15 @ 1	500 @ 25	—
1N1224A	600	0.45 @ 100	1.15 @ 1	50 @ 25	—
1N1225	700	0.45 @ 100	1.15 @ 1	500 @ 25	—
1N1225A	700	0.45 @ 100	1.15 @ 1	50 @ 25	—
1N1226	800	0.4 @ 100	1.15 @ 1	500 @ 25	—
1N1226A	800	0.4 @ 100	1.15 @ 1	50 @ 25	—
1N1251	50	0.5 @ 25	1 @ 0.5	500 @ 125	2
1N1252	100	0.5 @ 25	1 @ 0.5	500 @ 125	2
1N1253	200	0.5 @ 25	1 @ 0.5	500 @ 125	2
1N1254	300	0.5 @ 25	1 @ 0.5	500 @ 125	2
1N1255	400	0.5 @ 25	1 @ 0.5	500 @ 125	2
1N1256	500	0.32 @ 25	1 @ 0.32	500 @ 125	2
1N1257	600	0.3 @ 25	1 @ 0.3	500 @ 125	2
1N1258	700	0.28 @ 25	1 @ 0.28	500 @ 125	2
1N1259	800	0.27 @ 25	1 @ 0.27	500 @ 125	2, 3
1N1260	900	0.25 @ 25	1 @ 0.25	500 @ 125	2, 3
1N1261	1000	0.24 @ 25	1 @ 0.24	500 @ 125	2, 3
1N1406	600	0.125 @ 75	5 @ 1.2	10 @ 25	—
1N1407	800	0.125 @ 75	5 @ 1.2	10 @ 25	—
1N1408	1000	0.125 @ 75	5 @ 1.2	10 @ 25	—
1N1409	1200	0.125 @ 75	5 @ 1.2	10 @ 25	—
1N1410	1500	0.125 @ 75	6.25 @ 1.2	10 @ 25	—
1N1443	1000	0.6 @ 100	1.15 @ 1	500 @ 25	—
1N1486	500	0.78 @ 50	1.1 @ 0.5	20 @ 25	—
1N1487	100	0.75 @ 25	0.55 @ 0.25	400 @ 125	2, 4
1N1488	200	0.75 @ 25	0.55 @ 0.25	300 @ 125	2, 4
1N1489	300	0.75 @ 25	0.55 @ 0.25	300 @ 25	2, 4
1N1490	400	0.75 @ 25	0.55 @ 0.25	300 @ 25	2, 4
1N1491	500	0.75 @ 25	0.55 @ 0.25	300 @ 25	2, 4
1N1492	600	0.75 @ 25	0.55 @ 0.25	300 @ 25	2, 4
1N1556	100	0.75 @ 100	1.4 @ 0.6	1000 @ 100	—
1N1557	200	0.75 @ 100	1.4 @ 0.6	1000 @ 100	—
1N1558	300	0.75 @ 100	1.4 @ 0.6	1000 @ 100	—
1N1559	400	0.75 @ 100	1.4 @ 0.6	1000 @ 100	—
1N1560	500	0.75 @ 100	1.4 @ 0.6	1000 @ 100	—
1N1644	50	0.75 @ 50	0.5 @ 0.25	400 @ 150	2, 4
1N1645	100	0.75 @ 50	0.5 @ 0.25	400 @ 150	2, 4
1N1646	150	0.75 @ 50	0.5 @ 0.25	400 @ 150	2, 4
1N1647	200	0.75 @ 50	0.5 @ 0.25	300 @ 150	2, 4
1N1648	250	0.75 @ 50	0.5 @ 0.25	300 @ 150	2, 4
1N1649	300	0.75 @ 50	0.5 @ 0.25	300 @ 150	2, 4
1N1650	350	0.75 @ 50	0.5 @ 0.25	300 @ 150	2, 4
1N1651	400	0.75 @ 50	0.5 @ 0.25	300 @ 150	2, 4
1N1652	500	0.75 @ 50	0.5 @ 0.25	300 @ 150	2, 4
1N1653	600	0.75 @ 50	0.5 @ 0.25	300 @ 150	2, 4
1N1692	100	0.6 @ 50	0.6 @ 0.25	500 @ 100	2, 4
1N1693	200	0.6 @ 50	0.6 @ 0.25	500 @ 100	2, 4
1N1694	300	0.6 @ 50	0.6 @ 0.25	500 @ 100	2, 4
1N1695	400	0.6 @ 50	0.6 @ 0.25	500 @ 100	2, 4
1N1696	500	0.6 @ 50	0.6 @ 0.25	0.5 @ 100	2, 4
1N1697	600	0.6 @ 50	0.6 @ 0.25	0.5 @ 100	2, 4
1N2072	50	0.75 @ 25	1.2 @ 0.5	250 @ 100	—
1N2073	100	0.75 @ 25	1.2 @ 0.5	250 @ 100	—
1N2074	150	0.75 @ 25	1.2 @ 0.5	250 @ 100	—
1N2075	200	0.75 @ 25	1.2 @ 0.5	250 @ 100	—
1N2076	250	0.75 @ 25	1.2 @ 0.5	250 @ 100	—
1N2077	300	0.75 @ 25	1.2 @ 0.5	250 @ 100	—
1N2078	400	0.75 @ 25	1.2 @ 0.5	250 @ 100	—
1N2079	500	0.75 @ 25	1.2 @ 0.5	250 @ 100	—
1N2080	50	0.5 @ 25	1.5 @ 0.5	350 @ 100	—
1N2081	100	0.5 @ 25	1.5 @ 0.5	350 @ 100	—
1N2082	200	0.5 @ 25	1.5 @ 0.5	350 @ 100	—
1N2083	300	0.5 @ 25	1.5 @ 0.5	350 @ 100	—
1N2084	400	0.5 @ 25	1.5 @ 0.5	350 @ 100	—
1N2085	500	0.5 @ 25	1.5 @ 0.5	350 @ 100	—
1N2086	600	0.5 @ 25	1.5 @ 0.5	350 @ 100	—
1N2103	50	0.75 @ 25	1.2 @ 0.75	300 @ 25	—
1N2104	100	0.75 @ 25	1.2 @ 0.75	300 @ 25	—
1N2105	200	0.75 @ 25	1.2 @ 0.75	300 @ 25	—
1N2106	300	0.75 @ 25	1.2 @ 0.75	300 @ 25	—
1N2107	400	0.75 @ 25	1.2 @ 0.75	300 @ 25	—
1N2108	500	0.75 @ 25	1.2 @ 0.75	300 @ 25	—
1N2117	720	0.75 @ 50	1.3 @ 0.75	10 @ 25	—

Notes:
(2) I_R averaged over one cycle.
(3) Reverse polarity available; add suffix R.
(4) V_F average volts at average current
(7) At 25°C Ambient.



hughes hot line
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silicon rectifiers cont'd

lead mounted silicon rectifiers

DO-1 case style — (cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Ambient Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Reverse Current (μA) @ Ambient Temp. (°C)	Notes
1N2357	1400	0.4 @ 25	2.0 @ 0.65	1.0 @ 25	—
1N2358	1500	0.4 @ 25	2.0 @ 0.65	1.0 @ 25	—
1N2359	1600	0.4 @ 25	2.0 @ 0.65	1.0 @ 25	—
1N2360	1800	0.4 @ 25	2.0 @ 0.65	1.0 @ 25	—
1N2361	2000	0.4 @ 25	2.0 @ 0.65	1.0 @ 25	—
1N2373	600	0.25 @ 25	3.0 @ 0.4	10 @ 25	—
1N2374	1000	0.25 @ 25	3.0 @ 0.4	10 @ 25	—
1N2485	200	0.75 @ 55	1 @ 0.75	1 @ 55	—
1N2486	300	0.75 @ 55	1 @ 0.75	1 @ 55	—
1N2487	400	0.75 @ 55	1 @ 0.75	1 @ 55	—
1N2488	500	0.75 @ 55	1 @ 0.75	1 @ 55	—
1N2489	600	0.75 @ 55	1 @ 0.75	1 @ 55	—
1N2501	800	0.15 @ 25	1.5 @ 0.1	20 @ 25	—
1N2502	1000	0.15 @ 25	1.5 @ 0.1	20 @ 25	—
1N2503	1200	0.15 @ 25	1.5 @ 0.1	20 @ 25	—
1N2504	1500	0.15 @ 25	1.5 @ 0.1	20 @ 25	—
1N2505	800	0.3 @ 25	1.5 @ 0.2	20 @ 25	—
1N2506	1000	0.3 @ 25	1.5 @ 0.2	20 @ 25	—
1N2507	1200	0.3 @ 25	1.5 @ 0.2	20 @ 25	—
1N2508	1500	0.3 @ 25	1.5 @ 0.2	20 @ 25	—
1N2858	50	0.75 @ 75	1.2 @ 0.75	400 @ 100	2
1N2859	100	0.75 @ 75	1.2 @ 0.75	400 @ 100	2
1N2860	200	0.75 @ 75	1.2 @ 0.75	400 @ 100	2
1N2861	300	0.75 @ 75	1.2 @ 0.75	300 @ 100	2
1N2862	400	0.75 @ 75	1.2 @ 0.75	300 @ 100	2
1N2863	500	0.75 @ 75	1.2 @ 0.75	300 @ 100	2
1N2864	600	0.75 @ 75	1.2 @ 0.75	300 @ 100	2

DO-12 case style

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) Ambient Temp. (°C)	Maximum Forward Voltage (volts) Forward Current (Amps)	Reverse Current (μA) Ambient Temp. (°C)	Notes
1N1701	50	0.15 @ 150	1.3 @ 0.6	10 @ 25	—
1N1702	100	0.15 @ 150	1.3 @ 0.6	10 @ 25	—
1N1703	200	0.15 @ 150	1.3 @ 0.6	10 @ 25	—
1N1704	300	0.15 @ 150	1.3 @ 0.6	10 @ 25	—
1N1705	400	0.15 @ 150	1.3 @ 0.6	10 @ 25	—
1N1706	500	0.15 @ 150	1.3 @ 0.6	10 @ 25	—
1N1707	50	0.5 @ 55	1.2 @ 0.5	10 @ 25	—
1N1708	100	0.5 @ 55	1.2 @ 0.5	10 @ 25	—
1N1709	200	0.5 @ 55	1.2 @ 0.5	10 @ 25	—
1N1710	300	0.5 @ 55	1.2 @ 0.5	10 @ 25	—
1N1711	400	0.5 @ 55	1.2 @ 0.5	10 @ 25	—
1N1712	500	0.5 @ 55	1.2 @ 0.5	10 @ 25	—
1N1763	400	0.5 @ 75	3 @ 0.5 (7)	100 @ 25	11
1N1764	500	0.5 @ 75	3 @ 0.5 (7)	100 @ 25	11
1N2013	50	0.2 @ 150	1.5 @ 0.5 (7)	500 @ 150	—
1N2014	100	0.2 @ 150	1.5 @ 0.5 (7)	500 @ 150	—
1N2015	150	0.2 @ 150	1.5 @ 0.5 (7)	500 @ 150	—
1N2016	200	0.2 @ 150	1.5 @ 0.5 (7)	500 @ 150	—
1N2017	250	0.2 @ 150	1.5 @ 0.5 (7)	500 @ 150	—
1N2018	300	0.2 @ 150	1.5 @ 0.5 (7)	500 @ 150	—
1N2019	350	0.2 @ 150	1.5 @ 0.5 (7)	500 @ 150	—
1N2020	400	0.2 @ 150	1.5 @ 0.5 (7)	500 @ 150	—
1N2609	50	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N2610	100	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N2611	200	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N2612	300	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N2613	400	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N2614	500	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N2615	600	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N2616	800	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N2617	1000	0.75 @ 50	1 @ 0.75	1 @ 25	—
1N3072	50	0.2 @ 150	1.5 @ 0.5	1 @ 25	2
1N3073	100	0.2 @ 150	1.5 @ 0.5	1 @ 25	2
1N3074	150	0.2 @ 150	1.5 @ 0.5	1 @ 25	2
1N3075	200	0.2 @ 150	1.5 @ 0.5	1 @ 25	2
1N3076	250	0.2 @ 150	1.5 @ 0.5	1 @ 25	2
1N3077	300	0.2 @ 150	1.5 @ 0.5	1 @ 25	2
1N3078	350	0.2 @ 150	1.5 @ 0.5	1 @ 25	2
1N3079	400	0.2 @ 150	1.5 @ 0.5	1 @ 25	2
1N3080	500	0.2 @ 150	1.5 @ 0.5	1 @ 25	—

DO-12 case style — (cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) Ambient Temp. (°C)	Maximum Forward Voltage (volts) Forward Current (Amps)	Reverse Current (μA) Ambient Temp. (°C)	Notes
1N3081	600	0.2 @ 150	1.5 @ 0.5	1 @ 25	—
1N3082	200	0.5 @ 150	1 @ 0.75	5 @ 25	—
1N3083	400	0.5 @ 150	1 @ 0.75	5 @ 25	—
1N3084	600	0.5 @ 150	1 @ 0.75	5 @ 25	—
1N3189	200	1 @ 100	1 @ 0.75	5 @ 25	—
1N3190	400	1 @ 100	1 @ 0.75	5 @ 25	—
1N3191	600	1 @ 100	1 @ 0.75	5 @ 25	—
1N3193	200	0.75 @ 75	1.2 @ 1	5 @ 25	—
1N3194	400	0.75 @ 75	1.2 @ 1	5 @ 25	—
1N3195	600	0.75 @ 75	1.2 @ 1	5 @ 25	—
1N3196	800	0.75 @ 75	1.2 @ 1	5 @ 25	—
1N3253	200	0.75 @ 75	1.2 @ 1	5 @ 25	29
1N3254	400	0.75 @ 75	1.2 @ 1	5 @ 25	29
1N3255	600	0.75 @ 75	1.2 @ 1	5 @ 25	29
1N3256	800	0.75 @ 75	1.2 @ 1	5 @ 25	29
1N3639	200	0.75 @ 75	1.1 @ 1	200 @ 75	2, 29
1N3640	400	0.75 @ 75	1 @ 1	200 @ 75	2, 29
1N3641	600	0.75 @ 75	1 @ 1	200 @ 75	2, 29
1N3642	800	0.5 @ 75	1 @ 1	200 @ 75	2, 29

DO-13 case style

1N1915	800	1.5 @ 25	—	10 @ 25	—
1N1916	900	1.5 @ 25	—	10 @ 25	—

HL-1 case style

1N3563	1000	0.4 @ 75	1.2 @ 0.5 (7)	0.2 @ 75	11
1N4139	50	3 @ 75	1.2 @ 3	.025 @ 25	3, 11
1N4140	100	3 @ 75	1.2 @ 3	.025 @ 25	3, 11
1N4141	200	3 @ 75	1.2 @ 3	.025 @ 25	3, 11
1N4142	400	3 @ 75	1.2 @ 3	.025 @ 25	3, 11
1N4143	600	3 @ 75	1.2 @ 3	.025 @ 25	3, 11
1N4144	800	3 @ 75	1.2 @ 3	.025 @ 25	3, 11
1N4145	1000	3 @ 75	1.2 @ 3	.025 @ 25	3, 11
1N4146	1200	3 @ 75	1.2 @ 3	.025 @ 25	3, 11
1N4597	5000	.025 @ 40	5 @ .025(15)	0.16 @ 130	11

HL-1 case style — Hughes house types

Hughes Type No.	Peak Inverse Voltage (volts)	Forward Current (volts)	Maximum Forward Voltage Drop @ Rated Forward Current (Amps)	Maximum Reverse Current @ Rated PIV @ 25°C (μA)	Peak Repetitive Current (60 cycle) (Amps)	Maximum ½ Cycle Surge Rating (60 cycle) (Amps)
HF13A	50	3	1.2	25	50	300
HF13B	100	3	1.2	25	50	300
HF13C	200	3	1.2	25	50	300
HF13D	300	3	1.2	25	50	300
HF13E	400	3	1.2	25	50	300
HF13F	500	3	1.2	25	50	300
HF13G	600	3	1.2	25	50	300
HF13H	700	3	1.2	25	50	300
HF13I	800	3	1.2	25	50	300

Notes:

(2) I_R averaged over one cycle.

(3) Reverse polarity available; add suffix R.

(7) At 25°C Ambient.

(11) For applications with critical case dimension considerations, we recommend you contact factory to confirm these types will suit your exact requirements.

(15) At 40°C Ambient

(29) Plastic insulating sleeve over body.

HUGHES SEMICONDUCTORS
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HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION

silicon rectifiers cont'd

miniature axial lead silicon rectifiers
DO-27 case style—Hughes house types

Hughes Type No.*	Peak Inverse Voltage (volts)	Forward Current (Amps)	Maximum Forward Voltage Drop @ Rated Forward Current (volts)	Maximum Reverse Current @ Rated PIV @ 25°C (μA)	Peak Repetitive Current (60 Cycle) (Amps)	Maximum ½ Cycle Surge Rating (60 Cycle) (Amps)
HF11A	50	1	1.2	10	10	60
HF11B	100	1	1.2	10	10	60
HF11C	200	1	1.2	10	10	60
HF11D	300	1	1.2	10	10	60
HF11E	400	1	1.2	10	10	60
HF12A	50	2	1.2	25	20	200
HF12B	100	2	1.2	25	20	200
HF12C	200	2	1.2	25	20	200
HF12D	300	2	1.2	25	20	200
HF12E	400	2	1.2	25	20	200

DO-27 case style—Hughes house types

Hughes Type No.*	Peak Inverse Voltage (volts) (Note 7)	RMS Voltage (volts) (Note 7)	Average DC Rectified Forward Current (mA) (Note 7)	Recurrent Peak Current (Amps) (Note 7)	Maximum Reverse Leakage DC Test Current @ 25°C (μA)	Maximum Dynamic Reverse Current (mA) (Note 13)	Maximum Forward Voltage Drop @ Rated Current (Vdc) (Note 13)
HR11A1	50	35	150	10	10	0.2	1.2
HR11A2	50	35	250	10	10	0.2	1.2
HR11A3	50	35	500	10	10	0.2	1.2
HR11A4	50	35	750	10	10	0.2	1.2
HR11A	50	50	1100	12	10	0.2	1.2
HR11B1	100	70	150	10	10	0.2	1.2
HR11B2	100	70	250	10	10	0.2	1.2
HR11B3	100	70	500	10	10	0.2	1.2
HR11B4	100	70	750	10	10	0.2	1.2
HR11B	100	70	1100	12	10	0.2	1.2
HR11C1	200	140	150	10	10	0.2	1.2
HR11C2	200	140	250	10	10	0.2	1.2
HR11C3	200	140	500	10	10	0.2	1.2
HR11C4	200	140	750	10	10	0.2	1.2
HR11C	200	140	1100	12	10	0.2	1.2
HR11E1	400	280	150	10	10	0.2	1.2
HR11E2	400	280	250	10	10	0.2	1.2
HR11E3	400	280	500	10	10	0.2	1.2
HR11E4	400	280	750	10	10	0.2	1.2
HR11E	400	280	1100	12	10	0.2	1.2
HR11F1	500	360	150	10	10	0.2	1.2
HR11F2	500	360	250	10	10	0.2	1.2
HR11F3	500	360	500	10	10	0.2	1.2
HR11F4	500	360	750	10	10	0.2	1.2
HR11F	500	360	1100	12	10	0.2	1.2
HR11G1	600	420	150	10	10	0.2	1.2
HR11G2	600	420	250	10	10	0.2	1.2
HR11G3	600	420	500	10	10	0.2	1.2
HR11G4	600	420	750	10	10	0.2	1.2
HR11G	600	420	1100	12	10	0.2	1.2
HR11J1	800	560	75	10	10	0.2	1.2
HR11J2	800	560	150	10	10	0.2	1.2
HR11J3	800	560	250	10	10	0.2	1.2
HR11J4	800	560	500	10	10	0.2	1.2
HR11J5	800	560	750	10	10	0.2	1.2
HR11J	800	560	1100	12	10	0.2	1.2
HR11M1	1000	700	75	10	10	0.2	1.2
HR11M2	1000	700	150	10	10	0.2	1.2
HR11M3	1000	700	250	10	10	0.2	1.2
HR11M4	1000	700	500	10	10	0.2	1.2
HR11M5	1000	700	750	10	10	0.2	1.2
HR11M	1000	700	1100	12	10	0.2	1.2
HR11N	1200	840	1100	12	10	0.2	1.2

*All units meet environmental requirements of MIL-S-19500. Operating temperature: —65°C to +150°C. Thermal resistance: 70° C/W. Insulated body. Altitude: 80,000. Solid silver leads. 10 lb. 10 lb. pull test.

Notes: (7) At 25°C Ambient. (13) At 100°C Ambient.

DO-27 case style—Hughes house types
(and JEDEC equivalents, also available)

Hughes Type No.*	JEDEC Type No.*	Peak Inverse Voltage (volts)	DC Output Current (Amps)	8 Millisecond Non-Recurrent Surge Current (Amps)	Maximum Reverse Current (μA)	Maximum DC Forward Voltage Drop (volts)
—	1N5170	15	2	200	25	1.2
HR12A	1N5171	50	2	200	25	1.2
HR12B	1N5172	100	2	200	25	1.2
HR12C	1N4517	200	2	200	25	1.2
HR12D	1N5173	300	2	200	25	1.2
HR12E	1N5174	400	2	200	25	1.2
HR12F	1N5175	500	2	200	25	1.2
HR12G	1N5176	600	2	200	25	1.2
HR12J	1N5177	800	2	200	25	1.2
HR12M	1N5178	1000	2	200	25	1.2
HR12N	—	1200	2	200	25	1.2

*All units meet environmental requirements of MIL-S-19500C.

miniature silicon glass rectifiers — DO-29 case style

Type	Maximum Peak Reverse Voltage (volts)	Ambient Temp. (°C) Maximum Average Forward Current (Amps)	Forward Current (Amps) Maximum Forward Voltage (volts)	Ambient Temp. (°C) Reverse Current (mA)	Notes
1N4383	200	1 @ 100	1 @ 1	.010 @ 25	—
1N4384	400	1 @ 100	1 @ 1	.010 @ 25	—
1N4385	600	1 @ 100	1 @ 1	.010 @ 25	—
1N4585	800	.6 @ 100	1 @ 1	.010 @ 25	—
1N4586	1000	.6 @ 100	1 @ 1	.010 @ 25	—

stud mounted silicon power rectifiers DO-4 case style

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Case Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Reverse Current (mA) @ Case Temp. (°C)	Notes
1N253	95	1 @ 150	2 @ 2	.1 @ 150	—
1N254	190	0.4 @ 150	2 @ 0.8	.1 @ 150	—
1N255	380	0.4 @ 150	2 @ 0.8	.15 @ 150	—
1N256	570	0.2 @ 150	2 @ 0.4	.25 @ 150	—
1N332	400	0.4 @ 150	2 @ 0.8	.2 @ 150	—
1N333	400	0.2 @ 150	2 @ 0.4	.2 @ 150	—
1N334	300	0.4 @ 150	2 @ 0.8	.2 @ 150	—
1N335	300	0.2 @ 150	2 @ 0.4	.2 @ 150	—
1N336	200	0.4 @ 150	2 @ 0.8	.1 @ 150	—
1N337	200	0.2 @ 150	2 @ 0.4	.2 @ 150	—
1N338	100	1 @ 150	2 @ 2	.2 @ 150	—
1N339	100	0.4 @ 150	2 @ 0.8	.1 @ 150	—
1N340	100	0.2 @ 150	2 @ 0.4	.5 @ 150	—
1N341	400	0.4 @ 150	2 @ 0.8	.1 @ 150	—
1N342	400	0.2 @ 150	2 @ 0.4	.5 @ 150	—
1N343	300	0.4 @ 150	2 @ 0.8	.5 @ 150	—
1N344	300	0.2 @ 150	2 @ 0.4	0.5 @ 150	—
1N345	200	0.4 @ 150	2 @ 0.8	0.5 @ 150	—
1N346	200	0.2 @ 150	2 @ 0.4	0.5 @ 150	—
1N347	100	1 @ 150	2 @ 2	0.5 @ 150	—
1N348	100	0.4 @ 150	2 @ 0.8	0.5 @ 150	—
1N349	100	0.2 @ 150	2 @ 0.4	0.5 @ 150	—
1N550	100	0.5 @ 125	1.5 @ 0.5	0.5 @ 25	6
1N551	200	0.5 @ 125	1.5 @ 0.5	1 @ 25	6
1N552	300	0.5 @ 125	1.5 @ 0.5	1.5 @ 25	6
1N553	400	0.5 @ 125	1.5 @ .05	2.5 @ 25	6
1N554	500	0.5 @ 125	1.5 @ 0.5	3.5 @ 25	6
1N555	600	0.5 @ 125	1.5 @ 0.5	.5 @ 25	6
1N562	800	0.4 @ 125	1.75 @ 0.4	15 @ 25	6
1N563	1000	0.4 @ 125	1.75 @ 0.4	20 @ 25	6

(6) I_R in μADC



hughes hot line

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silicon rectifiers cont'd

stud mounted silicon power rectifiers

DO-4 case style — (cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Case Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Reverse Current (mA) @ Case Temp. (°C)	Notes
1N607	50	0.8 @ 100	1.5 @ 0.2	25 @ 25	6, 3
1N607A	50	0.8 @ 100	1.5 @ 0.4	1 @ 25	6, 3
1N608	100	0.8 @ 100	1.5 @ 0.2	25 @ 25	6, 3
1N608A	100	0.8 @ 100	1.5 @ 0.4	1 @ 25	6, 3
1N609	150	0.8 @ 100	1.5 @ 0.2	25 @ 25	6, 3
1N609A	150	0.8 @ 100	1.5 @ 0.4	1 @ 25	6, 3
1N610	200	0.8 @ 100	1.5 @ 0.2	25 @ 25	6, 3
1N610A	200	0.8 @ 100	1.5 @ 0.4	1 @ 25	6, 3
1N611	300	0.8 @ 100	1.5 @ 0.4	25 @ 25	6, 3
1N611A	300	0.8 @ 100	1.5 @ 0.2	1 @ 25	6, 3
1N612	400	0.8 @ 100	1.5 @ 0.4	25 @ 25	6, 3
1N612A	400	0.8 @ 100	1.5 @ 0.2	1 @ 25	6, 3
1N613	500	0.8 @ 100	1.5 @ 0.4	25 @ 25	6, 3
1N613A	500	0.8 @ 100	1.5 @ 0.2	1 @ 25	6, 3
1N614	600	0.8 @ 100	1.5 @ 0.4	25 @ 25	6, 3
1N614A	600	0.8 @ 100	1.5 @ 0.2	1 @ 25	6, 3
1N1115	100	0.6 @ 150	0.65 @ 0.6	0.4 @ 150	4
1N1116	200	0.6 @ 150	0.65 @ 0.6	0.3 @ 150	4
1N1117	300	0.6 @ 150	0.65 @ 0.6	0.3 @ 150	4
1N1118	400	0.6 @ 150	0.65 @ 0.6	0.3 @ 150	4
1N1119	500	0.6 @ 150	0.65 @ 0.6	0.3 @ 150	4
1N1120	600	0.6 @ 150	0.65 @ 0.6	0.3 @ 150	4
1N1124	200	1 @ 150	1.1 @ 1	0.3 @ 150	3
1N1124A	200	1 @ 150	1.1 @ 1	0.3 @ 150	—
1N1125	300	1 @ 150	1.1 @ 1	0.3 @ 150	3
1N1125A	300	1 @ 150	1.1 @ 1	0.3 @ 150	—
1N1126	400	1 @ 150	1.1 @ 1	0.3 @ 150	3
1N1126A	400	1 @ 150	1.1 @ 1	0.3 @ 150	—
1N1127	500	1 @ 150	1.1 @ 1	0.3 @ 150	3
1N1127A	500	1 @ 150	1.1 @ 1	0.3 @ 150	—
1N1128	600	1 @ 150	1.1 @ 1	0.3 @ 150	3
1N1128A	600	1 @ 150	1.1 @ 1	0.3 @ 150	—
1N1130	1500	0.3 @ 25	15 @ 0.3	0.05 @ 25	5
1N1199	50	12 @ 150	1.3 @ 12	10 @ 150	5, 3
1N1199A	50	12 @ 150	1.3 @ 12	3 @ 150	—
1N1199B	50	12 @ 150	1.1 @ 12	0.9 @ 150	—
1N1200	100	12 @ 150	1.3 @ 12	10 @ 150	5, 3
1N1200A	100	12 @ 150	1.3 @ 12	2.5 @ 150	—
1N1200B	100	12 @ 150	1.1 @ 12	0.9 @ 150	—
1N1201	150	12 @ 150	1.3 @ 12	10 @ 150	5, 3
1N1201A	150	12 @ 150	1.3 @ 12	2.25 @ 150	—
1N1201B	150	12 @ 150	1.1 @ 12	0.9 @ 150	—
1N1202	200	12 @ 150	1.3 @ 12	10 @ 150	3, 5
1N1202A	200	12 @ 150	1.3 @ 12	2 @ 150	—
1N1202B	200	12 @ 150	1.1 @ 12	0.9 @ 150	—
1N1203	300	12 @ 150	1.3 @ 12	10 @ 150	3, 5
1N1203A	300	12 @ 150	1.3 @ 12	1.75 @ 150	—
1N1203B	300	12 @ 150	1.1 @ 12	0.9 @ 150	—
1N1204	400	12 @ 150	1.3 @ 12	10 @ 150	3, 5
1N1204A	400	12 @ 150	1.3 @ 12	1.5 @ 150	—
1N1204B	400	12 @ 150	1.1 @ 12	0.9 @ 150	—
1N1205	500	12 @ 150	1.3 @ 12	10 @ 150	3, 5
1N1205A	500	12 @ 150	1.3 @ 12	1.25 @ 150	—
1N1205B	500	12 @ 150	1.1 @ 12	0.9 @ 150	—
1N1206	600	12 @ 150	1.3 @ 12	10 @ 150	3, 5
1N1206A	600	12 @ 150	1.3 @ 12	1 @ 150	—
1N1206B	600	12 @ 150	1.1 @ 12	0.9 @ 150	—
1N1227 (1)	50	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1227A(1)	50	1.6 @ 140	1.15 @ 1	0.5 @ 150	5
1N1228 (1)	100	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1228A(1)	100	1.6 @ 140	1.15 @ 1	0.5 @ 150	5
1N1229 (1)	150	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1229A(1)	150	1.6 @ 140	1.15 @ 1	0.5 @ 150	5
1N1230 (1)	200	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1230A(1)	200	1.6 @ 140	1.15 @ 1	0.5 @ 150	5
1N1231 (1)	300	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1231A(1)	300	1.6 @ 140	1.15 @ 1	0.5 @ 150	5
1N1232 (1)	400	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1232A(1)	400	1.6 @ 140	1.15 @ 1	0.5 @ 150	5
1N1233 (1)	500	1.6 @ 140	1.15 @ 1	0.5 @ 125	5

DO-4 case style — (cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Case Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Reverse Current (mA) @ Case Temp. (°C)	Notes
1N1233A(1)	500	1.6 @ 140	1.15 @ 1	0.5 @ 150	5
1N1234 (1)	600	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1234A(1)	600	1.6 @ 140	1.15 @ 1	0.5 @ 150	5
1N1235 (1)	700	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1236 (1)	800	1.6 @ 140	1.15 @ 1	0.5 @ 125	5
1N1341	50	6 @ 150	1.2 @ 10	10 @ 150	3, 5
1N1341A	50	6 @ 150	1.2 @ 10	3 @ 150	3
1N1341B	50	6 @ 150	1.1 @ 6	.45 @ 150	3
1N1342	100	6 @ 150	1.2 @ 10	10 @ 150	3, 5
1N1342A	100	6 @ 150	1.2 @ 10	2.5 @ 150	3
1N1342B	100	6 @ 150	1.1 @ 6	.45 @ 150	3
1N1343	150	6 @ 150	1.2 @ 10	10 @ 150	3, 5
1N1343A	150	6 @ 150	1.2 @ 10	2.25 @ 150	3
1N1343B	150	6 @ 150	1.1 @ 6	.45 @ 150	3
1N1344	200	6 @ 150	1.2 @ 10	10 @ 150	3, 5
1N1344A	200	6 @ 150	1.2 @ 10	2 @ 150	3
1N1344B	200	6 @ 150	1.1 @ 6	.45 @ 150	3
1N1345	300	6 @ 150	1.2 @ 10	10 @ 150	3, 5
1N1345A	300	6 @ 150	1.2 @ 10	1.75 @ 150	3
1N1345B	300	6 @ 150	1.1 @ 6	.45 @ 150	3
1N1346	400	6 @ 150	1.2 @ 10	10 @ 150	3, 5
1N1346A	400	6 @ 150	1.2 @ 10	1.5 @ 150	3
1N1346B	400	6 @ 150	1.1 @ 6	.45 @ 150	3
1N1347	500	6 @ 150	1.2 @ 10	10 @ 150	3, 5
1N1347A	500	6 @ 150	1.2 @ 10	1.25 @ 150	3
1N1347B	500	6 @ 150	1.1 @ 6	.45 @ 150	3
1N1348	600	6 @ 150	1.2 @ 10	10 @ 150	3, 5
1N1348A	600	6 @ 150	1.2 @ 10	1 @ 150	3
1N1348B	600	6 @ 150	1.1 @ 6	.45 @ 150	3
1N1537	50	1.6 @ 140	1.5 @ 2.5	0.5 @ 150	3
1N1538	100	1.6 @ 140	1.5 @ 2.5	0.5 @ 150	3
1N1539	150	1.6 @ 140	1.5 @ 2.5	0.5 @ 150	3
1N1540	200	1.6 @ 140	1.5 @ 2.5	0.5 @ 150	3
1N1541	300	1.6 @ 140	1.5 @ 2.5	0.5 @ 150	3
1N1542	400	1.6 @ 140	1.5 @ 2.5	0.5 @ 150	3
1N1543	500	1.6 @ 140	1.5 @ 2.5	0.5 @ 150	3
1N1544	600	1.6 @ 140	1.5 @ 2.5	0.5 @ 150	3
1N1551	100	0.75 @ 100	1.4 @ 0.75	1 @ 100	—
1N1552	200	0.75 @ 100	1.4 @ 0.75	1 @ 100	—
1N1553	300	0.75 @ 100	1.4 @ 0.75	1 @ 100	—
1N1554	400	0.75 @ 100	1.4 @ 0.75	1 @ 100	—
1N1555	500	0.75 @ 100	1.4 @ 0.75	1 @ 100	—
1N1581	50	3 @ 150	1.5 @ 6	0.5 @ 150	3
1N1582	100	3 @ 150	1.5 @ 6	0.5 @ 150	3
1N1583	200	3 @ 150	1.5 @ 6	0.5 @ 150	3
1N1584	300	3 @ 150	1.5 @ 6	0.5 @ 150	3
1N1585	400	3 @ 150	1.5 @ 6	0.5 @ 150	3
1N1586	500	3 @ 150	1.5 @ 6	0.5 @ 150	3
1N1587	600	3 @ 150	1.5 @ 6	0.5 @ 150	3
1N1612	50	5 @ 150	1.5 @ 10	1 @ 150	3
1N1612A	50	5 @ 150	1.1 @ 6(7)	0.5 @ 150(8)	—
1N1613	100	5 @ 150	1.5 @ 10	1 @ 150	3
1N1613A	100	5 @ 150	1.1 @ 6(7)	0.5 @ 150(8)	—
1N1614	200	5 @ 150	1.5 @ 10	1 @ 150	3
1N1614A	200	5 @ 150	1.1 @ 6(7)	0.5 @ 150(8)	—
1N1615	400	5 @ 150	1.5 @ 10	1 @ 150	3
1N1615A	400	5 @ 150	1.1 @ 6(7)	0.5 @ 150(8)	—
1N1616	600	5 @ 150	1.5 @ 10	1 @ 150	3
1N1616A	600	5 @ 150	1.1 @ 6(7)	0.5 @ 150(8)	—
1N2026	50	1 @ 150	2 @ 2	0.5 @ 150	3
1N2027	200	1 @ 150	2 @ 2	0.5 @ 150	3
1N2028	300	1 @ 150	2 @ 2	0.5 @ 150	3
1N2029	400	1 @ 150	2 @ 2	0.5 @ 150	3
1N2030	500	1 @ 150	2 @ 2	0.5 @ 150	3
1N2031	600	1 @ 150	2 @ 2	0.5 @ 150	3
1N2216	50	0.4 @ 150	1.2 @ 1.5	0.5 @ 150	—
1N2218	500	0.4 @ 150	1.2 @ 1.5	0.5 @ 150	3
1N2220	600	0.4 @ 150	1.2 @ 1.5	0.5 @ 150	3
1N2222	800	0.3 @ 150	1.2 @ 2	.75 @ 150	—
1N2222A	800	0.3 @ 150	1.2 @ 2	.35 @ 150	—

Notes: (1) DO-4 package with modified anode lug
(3) Reverse polarity (anode to stud) available; add suffix R
(4) V_F full cycle average (5) I_R — DC or peak value (6) I_R in μADC
(7) At 25°C Ambient (8) Ambient temperature

HUGHES SEMICONDUCTORS
HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION
500 Superior Avenue • Newport Beach, Calif. 92663

silicon rectifiers cont'd

stud mounted silicon power rectifiers

DO-4 case style — (cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Case Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Reverse Current (mA) @ Case Temp. (°C)	Notes
1N2224	1000	0.3 @ 150	1.2 @ 2	.75 @ 150	—
1N2224A	1000	0.3 @ 150	1.2 @ 2	.35 @ 150	—
1N2226	1200	0.3 @ 150	1.2 @ 2	.75 @ 150	—
1N2226A	1200	0.3 @ 150	1.2 @ 2	.35 @ 150	—
1N2228	50	1 @ 150	0.6 @ 1.5	0.5 @ 150	3, 4
1N2230	200	1 @ 150	0.6 @ 1.5	0.5 @ 150	3, 4
1N2232	300	1 @ 150	0.6 @ 1.5	0.5 @ 150	3, 4
1N2234	400	1 @ 150	0.6 @ 1.5	0.5 @ 150	3, 4
1N2238	600	1 @ 150	0.6 @ 1.5	0.5 @ 150	3, 4
1N2240	800	5 @ 25(7)	0.6 @ 1.5(7)	0.75 @ 150(8)	3
1N2240A	800	5 @ 25(7)	0.6 @ 5 (7)	0.35 @ 150(8)	3
1N2246	50	10 @ 25	0.6 @ 10 (7)	1 @ 150(8)	3
1N2246A	50	10 @ 25	0.6 @ 10 (7)	0.5 @ 150(8)	3
1N2248	100	10 @ 25	0.6 @ 10 (7)	1 @ 150(8)	3
1N2248A	100	10 @ 25	0.6 @ 10 (7)	0.5 @ 150(8)	3
1N2250	200	10 @ 25	0.6 @ 10 (7)	1 @ 150(8)	3
1N2250A	200	10 @ 25	0.6 @ 10 (7)	0.5 @ 150(8)	3
1N2252	300	10 @ 25	0.6 @ 10 (7)	1 @ 150(8)	3
1N2252A	300	10 @ 25	0.6 @ 10 (7)	0.5 @ 150(8)	3
1N2254	400	10 @ 25	0.6 @ 10 (7)	1 @ 150(8)	3
1N2254A	400	10 @ 25	0.6 @ 10 (7)	0.5 @ 150(8)	3
1N2256	500	10 @ 25	0.6 @ 10 (7)	1 @ 150(8)	3
1N2256A	500	10 @ 25	0.6 @ 10 (7)	0.5 @ 150(8)	3
1N2258	600	10 @ 25	0.6 @ 10 (7)	1 @ 150(8)	3
1N2258A	600	10 @ 25	0.6 @ 10 (7)	0.5 @ 150(8)	3
1N2266	50	0.3 @ 150	0.6 @ 1	.35 @ 150	4
1N2268	500	0.3 @ 150	0.6 @ 1	.35 @ 150	4
1N2270	600	0.3 @ 150	0.6 @ 1	.35 @ 150	4
1N2272	50	6 @ 150	1.2 @ 20	1 @ 150	3
1N2273	100	6 @ 150	1.2 @ 20	1 @ 150	3
1N2274	200	6 @ 150	1.2 @ 20	1 @ 150	3
1N2275	300	6 @ 150	1.2 @ 20	1 @ 150	—
1N2276	400	6 @ 150	1.2 @ 20	1 @ 150	3
1N2277	500	6 @ 150	1.2 @ 20	1 @ 150	—
1N2278	600	6 @ 150	1.2 @ 20	1 @ 150	3
1N2279	800	6 @ 150	1.2 @ 20	1 @ 150	—
1N2280	1000	20 @ 25(8)	0.6 @ 20 (7)	1 @ 150(8)	—
1N2281	1200	20 @ 25(8)	0.6 @ 20 (7)	1 @ 150(8)	—
1N2362	1400	1 @ 25	2 @ 1.5(7)	.001 @ 25 (8)	—
1N2362A	1400	5 @ 25(8)	2 @ 8 (7)	.001 @ 25 (8)	—
1N2362B	1400	10 @ 25(10)	2 @ 15 (7)	.001 @ 25 (8)	—
1N2364	1500	1 @ 25(8)	2 @ 1.5(7)	.001 @ 25 (8)	—
1N2364A	1500	5 @ 25(8)	2 @ 8 (7)	.001 @ 25 (8)	—
1N2364B	1500	10 @ 25	2 @ 15 (7)	.001 @ 25 (8)	—
1N2366	1600	1 @ 25(8)	2 @ 1.5(7)	.001 @ 25 (8)	—
1N2366A	1600	5 @ 25(8)	2 @ 8 (7)	.001 @ 25 (8)	—
1N2366B	1600	10 @ 25	2 @ 15 (7)	.001 @ 25 (8)	—
1N2367	1600	1 @ 25(8)	2 @ 1.5(7)	.001 @ 25 (8)	—
1N2368	1800	1 @ 25(8)	2 @ 1.5(7)	.001 @ 25 (8)	—
1N2368A	1800	5 @ 25(8)	2 @ 8 (7)	.001 @ 25 (8)	—
1N2368B	1800	10 @ 25(10)	2 @ 15 (7)	.001 @ 25 (8)	—
1N2491	50	6 @ 150	1.2 @ 12	2 @ 150	3
1N2492	100	6 @ 150	1.2 @ 12	2 @ 150	3
1N2493	200	6 @ 150	1.2 @ 12	2 @ 150	3
1N2494	300	6 @ 150	1.2 @ 12	2 @ 150	3
1N2495	400	6 @ 150	1.2 @ 12	2 @ 150	3
1N2496	500	6 @ 150	1.2 @ 12	2 @ 150	3
1N2497	600	6 @ 150	1.2 @ 12	2 @ 150	3
1N2512	100	4 @ 30	1.1 @ 1.5(7)	.002 @ 25 (8)	3
1N2513 *	200	4 @ 30	1.1 @ 1.5(7)	1 @ 150(8)	3
1N2514	300	4 @ 30	1.1 @ 1.5(7)	1 @ 150(8)	3
1N2515	400	4 @ 30(8)	1.1 @ 1.5(7)	.002 @ 25 (8)	3
1N2516	500	4 @ 30	1.1 @ 1.5(7)	.002 @ 25 (8)	3
1N2517	600	4 @ 30(16)	1.1 @ 1.5(7)	.002 @ 25 (8)	3
1N2784	200	22 @ 40(8)	1.5 @ 25 (9)	.002 @ 25 (8)	3
1N2785	400	22 @ 40(8)	1.5 @ 25 (9)	.002 @ 25 (8)	3
1N3569	100	3.5 @ 85(10)	0.5 @ 2.5(24)	0.4 @ 150(8)	3
1N3570	200	3.5 @ 85(10)	0.5 @ 2.5(24)	0.4 @ 150(8)	3
1N3571	300	3.5 @ 85(10)	0.5 @ 2.5(24)	0.4 @ 150(8)	3
1N3572	400	3.5 @ 85(10)	0.5 @ 2.5(24)	0.4 @ 150(8)	3

DO-4 case style — (cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Case Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Reverse Current (mA) @ Case Temp. (°C)	Notes
1N3573	500	3.5 @ 85(10)	0.5 @ 2.5(24)	0.4 @ 150(8)	3
1N3574	600	3.5 @ 85(10)	0.5 @ 2.5(24)	0.4 @ 150(8)	3
1N3615	50	16 @ 155(10)	—	3 @ 175(10)	3
1N3616	100	16 @ 155(10)	—	2.5 @ 175(10)	3
1N3617	150	16 @ 155(10)	—	2.3 @ 175(10)	3
1N3618	200	16 @ 155(10)	—	2 @ 175(10)	3
1N3619	300	16 @ 155(10)	—	1.8 @ 175(10)	3
1N3620	400	16 @ 155(10)	—	1.5 @ 175(10)	3
1N3621	500	16 @ 155(10)	—	1.3 @ 175(10)	3
1N3622	600	16 @ 155(10)	—	1 @ 175(10)	3
1N3623	800	16 @ 155(10)	—	0.75 @ 175(10)	3
1N3624	1000	16 @ 155(10)	—	0.6 @ 175(10)	3
1N3649	800	3 @ 25 (8)	1.1 @ 3 (7)	0.2 @ 150(8)	—
1N3650	1000	3 @ 25 (8)	1.1 @ 3 (7)	0.2 @ 150(8)	3
1N3919	1000	5 @ 100(8)	2 @ 5 (13)	0.5 @ 100	—
1N3934	1200	10 @ 25 (8)	2 @ 10(7)	.001 @ 25 (8)	—
1N3987	700	6 @ 150	1.5	1 @ 150(8)	3
1N3988	800	6 @ 150	1.5	0.8 @ 150(8)	3
1N3989	900	6 @ 150	1.5	0.7 @ 150(8)	3
1N3990	1000	6 @ 150	1.5	0.6 @ 150(8)	3
1N4012	700	12 @ 150	1.3 @ 12(24)	0.5 @ 150(8)	—
1N4013	800	12 @ 150	1.3 @ 12(24)	0.5 @ 150(8)	—
1N4458	800	5 @ 150(10)	1.5 @ 5 (25)	0.5 @ 150(10)	3
1N4459	1000	5 @ 150(10)	1.5 @ 5 (25)	0.5 @ 150(10)	3
1N4506	200	12 @ 135	1.4 @ 12	2.5 @ 135	—
1N4507	400	12 @ 135	1.4 @ 12	2.5 @ 135	—
1N4508	600	12 @ 135	1.4 @ 12	2.5 @ 135	—
1N4509	800	12 @ 135	1.4 @ 12	2.5 @ 135	—
1N4510	1000	12 @ 135	1.4 @ 12	2.5 @ 135	—
1N4511	1200	12 @ 135	1.4 @ 12	2.5 @ 135	—

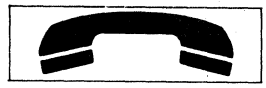
DO-4 case style — Hughes house types

Hughes Type No.	Peak Inverse Voltage (volts)	Forward Current (Amps)	Maximum Forward Voltage Drop @ Rated Forward Current (volts)	Maximum Reverse Current @ Rated PIV @ 25°C (μA)	Peak Repetitive Current (60 cycle) (Amps)	Maximum ½ Cycle Surge Rating (60 cycle) (Amps)
HF16A	50	6	1.2	25	50	300
HF16B	100	6	1.2	25	50	300
HF16C	200	6	1.2	25	50	300
HF16D	300	6	1.2	25	50	300
HF16E	400	6	1.2	25	50	300

DO-5 case style

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) Case Temp. (°C)	Maximum Forward Voltage (volts) Forward Current (Amps)	Reverse Current (mA) Case Temp. (°C)	Notes
1N248	50	10 @ 150	1.5 @ 25	5 @ 150	3
1N248A, B	50	20 @ 150	1.5 @ 50	5 @ 150	3
1N249	100	10 @ 150	1.5 @ 25	5 @ 150	3
1N249A, B	100	20 @ 150	1.5 @ 50	5 @ 150	3
1N250	200	10 @ 150	1.5 @ 25	5 @ 150	3
1N250A, B	200	20 @ 150	1.5 @ 50	5 @ 150	3
7N1183	50	35 @ 140	1.4 @ 100	10 @ 140	3
1N1184	100	35 @ 140	1.4 @ 100	10 @ 140	3
1N1184A	100	40 @ 150	1.1 @ 100	2.5 @ 150	—
1N1185	150	35 @ 140	1.4 @ 100	10 @ 140	3
1N1185A	150	40 @ 150	1.1 @ 100	2.5 @ 150	—
1N1186	200	35 @ 140	1.4 @ 100	10 @ 140	3
1N1187	300	35 @ 140	1.4 @ 100	10 @ 140	3
1N1187A	300	40 @ 150	1.1 @ 100	2.5 @ 150	—
1N1188	400	35 @ 140	1.4 @ 100	10 @ 140	3

Notes: (3) Reverse polarity (anode to stud) available; add suffix R
(4) V_F full cycle average (7) At 25°C Ambient (8) Ambient temperature
(9) At 25°C case (10) Base temperature (13) At 100°C Ambient (16) Case temperature
(24) At 150°C Ambient (25) At 150°C Base



hughes hot line
(800)854-3280 / in California (714)548-0671

silicon rectifiers cont'd

stud mounted silicon power rectifiers

DO-5 case style — (cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) Case Temp. (°C)	Maximum Forward Voltage (volts) Forward Current (Amps)	Reverse Current (mA) Case Temp. (°C)	Notes
1N1188A	400	40 @ 150	1.1 @ 100	2.5 @ 150	—
1N1189	500	35 @ 140	1.4 @ 100	10 @ 140	3
1N1189A	500	40 @ 150	1.1 @ 100	2.5 @ 150	—
1N1190	600	35 @ 140	1.4 @ 100	10 @ 140	—
1N1190A	600	40 @ 150	1.1 @ 100	2.5 @ 150	—
1N1191	50	18 @ 140	1.3 @ 50	10 @ 140	3, 5
1N1192	100	18 @ 140	1.3 @ 50	10 @ 140	3, 5
1N1192A	100	22 @ 150	1.2 @ 60	2.5 @ 150	3
1N1193	150	18 @ 140	1.3 @ 50	10 @ 140	3, 5
1N1193A	150	22 @ 150	1.2 @ 60	2.5 @ 150	3
1N1194	200	18 @ 140	1.3 @ 50	10 @ 140	3, 5
1N1194A	200	22 @ 150	1.2 @ 60	2.5 @ 150	3
1N1195	300	18 @ 140	1.3 @ 50	10 @ 140	3, 5
1N1196	400	18 @ 140	1.3 @ 50	10 @ 140	3, 5
1N1196A	400	22 @ 150	1.2 @ 60	2.5 @ 150	3
1N1197	500	18 @ 140	1.3 @ 50	10 @ 140	3, 5
1N1197A	500	22 @ 150	1.2 @ 60	2.5 @ 150	3
1N1198	600	18 @ 140	1.3 @ 50	10 @ 140	3, 5
1N1301	50	37 @ 120	1.5 @ 50(7)	2.0 @ 150	—
1N1302	100	37 @ 120	1.5 @ 50(7)	2.0 @ 150	—
1N1304	200	37 @ 120	1.5 @ 50(7)	2.0 @ 150	—
1N1306	300	37 @ 120	1.5 @ 50(7)	2.0 @ 150	—
1N1434	50	30 @ 25	1.2 @ 60	5 @ 150	3
1N1435	100	30 @ 25	1.2 @ 60	5 @ 150	3
1N1436	200	30 @ 25	1.2 @ 60	5 @ 150	3
1N1437	400	30 @ 25	1.2 @ 60	5 @ 150	3
1N1444	1000	1.6 @ 145	1.15 @ 1	0.5 @ 125	—
1N2021	150	10 @ 150	1.5 @ 25	5 @ 150	3
1N2022	250	10 @ 150	1.5 @ 25	5 @ 150	3
1N2023	300	10 @ 150	1.5 @ 25	5 @ 150	3
1N2024	350	10 @ 150	1.5 @ 25	5 @ 150	3
1N2025	400	10 @ 150	1.5 @ 25	5 @ 150	3
1N2154	50	25 @ 145	0.6 @ 25	5 @ 145	3, 4
1N2155	100	25 @ 145	0.6 @ 25	4.5 @ 145	3, 4
1N2156	200	25 @ 145	0.6 @ 25	4.0 @ 145	3, 4
1N2157	300	25 @ 145	0.6 @ 25	3.5 @ 145	4
1N2158	400	25 @ 145	0.6 @ 25	3.0 @ 145	3, 4
1N2159	600	25 @ 145	0.6 @ 25	2.5 @ 145	3, 4
1N2160	600	25 @ 145	0.6 @ 25	2.0 @ 145	3, 4
1N2282	300	35 @ 25(8)	0.6 @ 35(7)	5 @ 150(8)	—
1N2283	400	35 @ 25(8)	0.6 @ 35(7)	5 @ 150(8)	—
1N2284	500	35 @ 25(8)	0.6 @ 35(7)	5 @ 150(8)	—
1N2285	600	35 @ 25(8)	0.6 @ 35(7)	5 @ 150(8)	—
1N2446	50	20 @ 150	1.1 @ 20	5 @ 150	3
1N2447	100	20 @ 150	1.1 @ 20	5 @ 150	3
1N2448	150	20 @ 150	1.1 @ 20	5 @ 150	3
1N2449	200	20 @ 150	1.1 @ 20	5 @ 150	3
1N2450	250	20 @ 150	1.1 @ 20	5 @ 150	3
1N2451	300	20 @ 150	1.1 @ 20	5 @ 150	3
1N2452	350	20 @ 150	1.1 @ 20	5 @ 150	3
1N2453	400	20 @ 150	1.1 @ 20	5 @ 150	3
1N2454	500	20 @ 150	1.1 @ 20	5 @ 150	3
1N2455	600	20 @ 150	1.1 @ 20	5 @ 150	3
1N2456	700	20 @ 150	1.1 @ 20	5 @ 150	3
1N2457	800	20 @ 150	1.1 @ 20	5 @ 150	3
1N2786	200	10 @	1.2 @ 10	10 @ 150(8)	—
1N2787	400	10 @	1.2 @ 10	10 @ 150(8)	—
1N2788	200	50 @ 40(8)	1.5 @ 100(9)	2.0 @ 150	—
1N2789	400	50 @ 40(8)	1.5 @ 100(9)	2.0 @ 150	—
1N2793	50	5 @ 150	1.25 @ 15	5 @ 150	3
1N2794	100	5 @ 150	1.25 @ 15	5 @ 150	3
1N2795	150	5 @ 150	1.25 @ 15	5 @ 150	3
1N2796	200	5 @ 150	1.25 @ 15	5 @ 150	3
1N2797	250	5 @ 150	1.25 @ 15	5 @ 150	3
1N2798	300	5 @ 150	1.25 @ 15	5 @ 150	3
1N2799	350	5 @ 150	1.25 @ 15	5 @ 150	3
1N2800	400	5 @ 150	1.25 @ 15	5 @ 150	3
1N3208	50	15 @ 150	1.5 @ 40	10 @ 150	3
1N3209	100	15 @ 150	1.5 @ 40	10 @ 150	3

Notes: (3) Reverse polarity (anode to stud) available; add suffix R
(4) V_F full cycle average (5) I_R—DC or peak value (7) At 25°C Ambient
(8) Ambient temperature (9) At 25°C case (10) Base temperature

DO-5 case style — (cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) Case Temp. (°C)	Maximum Forward Voltage (volts) Forward Current (Amps)	Reverse Current (mA) Case Temp. (°C)	Notes
1N3210	200	15 @ 150	1.5 @ 40	10 @ 150	3
1N3211	300	15 @ 150	1.5 @ 40	10 @ 150	3
1N3212	400	15 @ 150	1.5 @ 40	10 @ 150	3
1N3213	500	15 @ 150	1.5 @ 40	10 @ 150	3
1N3214	600	15 @ 150	1.5 @ 40	10 @ 150	3
1N3765	700	35 @ 140	1.8 @	5 @ 140(10)	3
1N3766	800	35 @ 140	1.8 @	5 @ 140(10)	3
1N3767	900	35 @ 140	1.8 @	5 @ 140(10)	3
1N3768	1000	35 @ 130	1.8 @	5 @ 140(10)	3
1N4525	200	35 @ 115	1.4 @ 35	3.5 @ 115	—
1N4526	400	35 @ 115	1.4 @ 35	3.5 @ 115	—
1N4527	600	35 @ 115	1.4 @ 35	3.5 @ 115	—
1N4528	800	35 @ 115	1.4 @ 35	3.0 @ 115	—
1N4529	1000	35 @ 115	1.4 @ 35	2.5 @ 115	—
1N4530	1200	35 @ 115	1.4 @ 35	2.0 @ 115	—

DO-7 case style

1N3282	1000	0.1 @ 25(8)	2.5 @ 0.1(7)	0.1 @ 100(8)	—
1N3283	1500	0.1 @ 25(8)	2.5 @ 0.1(7)	0.1 @ 100(8)	—
1N3284	2000	0.1 @ 25(8)	2.5 @ 0.1(7)	0.1 @ 100(8)	—
1N3285	2500	0.1 @ 25(8)	2.5 @ 0.1(7)	0.1 @ 100(8)	—
1N3286	3000	0.1 @ 25(8)	2.5 @ 0.1(7)	0.1 @ 100(8)	—

DO-8 case style

1N4587	100	150 @ 110(8)	1.4 @ 150(18)	30 @ 200(8)	—
1N4588	200	150 @ 110(8)	1.4 @ 150(18)	30 @ 200(8)	—
1N4589	300	150 @ 110(8)	1.4 @ 150(18)	28 @ 200(8)	—
1N4590	400	150 @ 110(8)	1.4 @ 150(18)	28 @ 200(8) @ 100V	—
1N4591	500	150 @ 110(8)	1.4 @ 150(18)	25 @ 200(8) @ 100V	—
1N4592	600	150 @ 110(8)	1.4 @ 150(18)	20 @ 200(8)	—
1N4593	800	150 @ 110(8)	1.4 @ 150(18)	17 @ 200(8)	—
1N4594	1000	150 @ 110(8)	1.4 @ 150(18)	14 @ 200(8)	—
1N4595	1200	150 @ 110(8)	1.4 @ 150(18)	12 @ 200(8)	—
1N4596	1400	150 @ 110(8)	1.4 @ 150(18)	11 @ 200(8)	—
1N4878	100	100 @ 120	1.3 @ 100(19)	5.0 @ 120	—

DO-9 case style

1N2054	50	250 @ 100	1.3 @ 250(20)	25 @ 135(8) @ 40V	3
1N2055	100	250 @ 100	1.3 @ 250(20)	25 @ 135(8) @ 80V	3
1N2056	150	250 @ 100	1.3 @ 250(20)	25 @ 135(8) @ 120V	3
1N2057	200	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 160V	3
1N2058	250	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 200V	3
1N2059	300	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 240V	3
1N2060	350	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 280V	3
1N2061	400	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 320V	3
1N2062	450	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 360V	3
1N2063	500	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 400V	3
1N2064	600	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 480V	3
1N2065	700	250 @ 100	1.3 @ 250(20)	17 @ 135(8) @ 560V	3

(18) At 110°C Ambient (19) At 120°C case (21) Junction temperature
(22) At 125°C Case (23) At 130°C Case

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NEWPORT BEACH DIVISION

silicon rectifiers cont'd

stud mounted silicon power rectifiers DO-9 case style—(cont'd)

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) Case Temp. (°C)	Maximum Forward Voltage (volts) Forward Current (Amps)	Reverse Current (mA) Case Temp. (°C)	Notes
1N2066	800	250 @ 100	1.3 @ 250(20)	16 @ 135(8) @ 650V	3
1N2067	900	250 @ 100(8)	1.3 @ 250(20)	14 @ 135(8) @ 720V	3
1N2068	1000	250 @ 100(8)	1.3 @ 250(20)	12 @ 135(8) @ 800V	3
1N3175	1200	240 @ 100	1.4 @	15 @ 100(21)	—
1N3176	1400	240 @ 100	1.4 @	15 @ 100(21)	—
1N3260	50	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3261	100	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3262	150	160 @ 125	1.25 @ 160(22)	12 @ 125 @ 100V	3
1N3263	200	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3264	250	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3265	300	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3266	350	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3267	400	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3268	500	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3269	600	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3270	700	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3271	800	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3272	900	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3273	1000	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3274	1200	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3275	1400	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3276	1600	160 @ 125	1.25 @ 160(22)	12 @ 125	3
1N3735	100	250 @ 130	1.1 @ 250(23)	16 @ 130(10)	3
1N3736	200	250 @ 130	1.1 @ 250(23)	16 @ 130(10)	3
1N3737	300	250 @ 130	1.1 @ 250(23)	16 @ 130(10)	3
1N3738	400	250 @ 130	1.1 @ 250(23)	16 @ 130(10)	3
1N3739	500	250 @ 130	1.1 @ 250(23)	13 @ 130(10)	3
1N3740	600	250 @ 130	1.1 @ 250(23)	12 @ 130(10)	3
1N3741	800	250 @ 130	1.1 @ 250(23)	9.0 @ 130(10)	3
1N3742	1000	250 @ 130	1.1 @ 250(23)	7.0 @ 130(10)	3
1N3743	1200	250 @ 130	1.1 @ 250(23)	7.0 @ 130(10)	3
1N3744	1400	250 @ 130	1.1 @ 250(23)	7.0 @ 130(10)	3
1N4044	50	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4045	100	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4046	150	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4047	200	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4048	250	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4049	300	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4050	400	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4051	500	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4052	600	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4053	700	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4054	800	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4055	900	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4056	1000	275 @ 120	1.35 @ 275(19)	15 @ 120	3
1N4879	100	160 @ 120	1.3 @ 160(19)	10 @ 120	—
1N4880	100	250 @ 120	1.2 @ 250(19)	10 @ 120	—

DO-30 case style

1N3085	100	150 @ 100	1.2 @ 150(17)	25 @ 150	3
1N3086	200	150 @ 100	1.2 @ 150(17)	17 @ 150	3
1N3087	300	150 @ 100	1.2 @ 150(17)	17 @ 150	3
1N3088	400	150 @ 100	1.2 @ 150(17)	17 @ 150	3
1N3089	500	150 @ 100	1.2 @ 150(17)	17 @ 150	3
1N3090	600	150 @ 100	1.2 @ 150(17)	17 @ 150	3
1N3091	800	150 @ 100	1.2 @ 150(17)	16 @ 150	3
1N3092	1000	150 @ 100	1.2 @ 150(17)	12 @ 150	3

Note: (3) Reverse polarity (anode to stud) available; add suffix R
(7) At 25°C Ambient (8) Ambient temperature (10) Base temperature
(17) At 150°C Case (19) At 120°C Case (21) Junction temperature
(22) At 125°C Case (23) At 130°C Case

stud mounted fast recovery silicon rectifiers

Type	Case Style	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Case Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Average Reverse Current (mA) @ Case Temp. (°C)	Recovery Time (nsec)	Peak Reverse Recovery Current (Amps)	Notes
1N3874	DO-10	50	6@100	1.4@6	3@100	200	2	—
1N3875	DO-10	100	6@100	1.4@6	3@100	200	2	—
1N3876	DO-10	200	6@100	1.4@6	3@100	200	2	—
1N3877	DO-10	300	6@100	1.4@6	3@100	200	2	—
1N3879	DO-4	50	6@100	1.4@6	3@100	200	2	3
1N3880	DO-4	100	6@100	1.4@6	3@100	200	2	3
1N3881	DO-4	200	6@100	1.4@6	3@100	200	2	3
1N3882	DO-4	300	6@100	1.4@6	3@100	200	2	3
1N3883	DO-4	400	6@100	1.4@6	3@100	200	2	3
1N3884	DO-10	50	12@100	1.4@12	5@100	200	2	3
1N3885	DO-10	100	12@100	1.4@12	5@100	200	2	3
1N3886	DO-10	200	12@100	1.4@12	5@100	200	2	3
1N3887	DO-10	300	12@100	1.4@12	5@100	200	2	3
1N3888	DO-10	400	12@100	1.4@12	5@100	200	2	3
1N3889	DO-4	50	12@100	1.4@12	5@100	200	2	3
1N3890	DO-4	100	12@100	1.4@12	5@100	200	2	3
1N3891	DO-4	200	12@100	1.4@12	5@100	200	2	3
1N3892	DO-4	300	12@100	1.4@12	5@100	200	2	3
1N3893	DO-4	400	12@100	1.4@12	5@100	200	2	3
1N3899	DO-5	50	20@100	1.4@20	10@100	200	3	3
1N3900	DO-5	100	20@100	1.4@20	10@100	200	3	3
1N3901	DO-5	200	20@100	1.4@20	10@100	200	3	3
1N3902	DO-5	300	20@100	1.4@20	10@100	200	3	3
1N3903	DO-5	400	20@100	1.4@20	10@100	200	3	3
1N3909	DO-5	50	30@100	1.4@30	15@100	200	3	3
1N3910	DO-5	100	30@100	1.4@30	15@100	200	3	3
1N3911	DO-5	200	30@100	1.4@30	15@100	200	3	3
1N3912	DO-5	300	30@100	1.4@30	15@100	200	3	3
1N3913	DO-5	400	30@100	1.4@30	15@100	200	3	3

stud mounted silicon power rectifiers HL-4 case style—Hughes house types

Hughes Type No.*	Peak Inverse Voltage (volts)	DC Output Current (Amps)	8 Millisecond Non-Recurrent Surge Current (Amps)	Maximum Reverse Current (μA)	Maximum DC Forward Voltage Drop @ 6 Amps (volts)	Notes
HR16A	50	6	300	25 (7)	1.2 (7)	3
HR16B	100	6	300	25 (7)	1.2 (7)	3
HR16C	200	6	300	25 (7)	1.2 (7)	3
HR16D	300	6	300	25 (7)	1.2 (7)	3
HR16E	400	6	300	25 (7)	1.2 (7)	3
HR16F	500	6	300	25 (7)	1.2 (7)	3
HR16G	600	6	300	25 (7)	1.2 (7)	3
HR16J	800	6	300	25 (7)	1.2 (7)	3
HR16M	1000	6	300	25 (7)	1.2 (7)	3
HR16N	1200	6	300	25 (7)	1.2 (7)	3

* 6 Ampere types, when mounted to 3"x 3"x 1/16" aluminum heat sink or equivalent

stud mounted silicon power rectifiers with insulated base DO-10 case style

Type	Maximum Peak Reverse Voltage (volts)	Maximum Average Forward Current (Amps) @ Case Temp. (°C)	Maximum Forward Voltage (volts) @ Forward Current (Amps)	Reverse Current (mA) @ Case Temp. (°C)	Notes
1N2152	500	6 @ 150	1.2 @ 10(7)	0.5 @ 150(8)	—
1N2152A	500	6 @ 150	1.0 @ 10(7)	0.1 @ 150(8)	—
1N2153	600	6 @ 150	1.2 @ 10(7)	0.5 @ 150(8)	—
1N2217	50	0.5 @ 150	1.2 @ 1.5	0.5 @ 150	—
1N2219	500	0.4 @ 150	1.2 @ 1.5	0.5 @ 150	3



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silicon transistors

NOTES:

The following notes define test conditions or parameters. They are inserted directly below their appropriate column headings throughout the transistor section.

NOTE 1 — (for Power Dissipation @ 25°C)

A = Ambient Temperature
C = Case Temperature
J = Junction Temperature

NOTE 2 — (for BV_{CE-})

O = Base Open
R = Specified Resistance
S = Base Shorted
V = Used only when Voltage Bias is applied
X = Base-Emitter Back Biased

NOTE 3 — (for hf—)

E = Common Emitter
B = Common Base
C = Common Collector

NOTE 4 — (for f—)

B = Common Base Cutoff
E = Common Emitter Cutoff
M = Minimum Frequency of Oscillations
T = Current Gain-Bandwidth Product

silicon small signal transistors
medium speed switches

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N337	NPN	125 (C)	150	45	—	20	55	10	—	—	—	10 (B)	TO-5
2N338	NPN	125 (C)	150	45	—	45	150	10	—	—	—	20 (B)	TO-5
2N496	PNP	150 (A)	140	10	10 (V)	15	—	15	0.15	5.0	9.0 (E)	7.2 (T)	TO-1
2N696	NPN	600 (A)	175	60	40 (R)	20	60	150	1.5	150	—	40 (T)	TO-5
2N696A	NPN	800 (A)	300	60	35 (O)	20	60	150	1.5	150	15 (E)	40 (T)	TO-5
2N697	NPN	600 (A)	175	60	40 (R)	40	120	150	1.5	150	—	40 (T)	TO-5
2N697A	NPN	800 (A)	300	60	35 (O)	40	120	150	1.5	150	25 (E)	50 (T)	TO-5
2N698	NPN	800 (A)	200	120	80 (R)	20	60	150	1.2	50	15 (E)	40 (T)	TO-5
2N699	NPN	600 (A)	175	120	80 (R)	40	120	150	5.0	150	15 (E)	50 (T)	TO-5
2N699A	NPN	800 (A)	300	120	80 (R)	40	120	150	5.0	150	15 (E)	50 (T)	TO-5
2N858	PNP	150 (A)	140	40	40 (O)	10	60	5.0	0.15	5.0	15 (E)	5.0 (T)	TO-18
2N859	PNP	150 (A)	140	40	40 (O)	25	100	5.0	0.15	5.0	30 (E)	6.0 (T)	TO-18
2N860	PNP	150 (A)	140	25	25 (O)	10	40	5.0	0.15	5.0	15 (E)	6.5 (T)	TO-18
2N861	PNP	150 (A)	140	25	25 (O)	25	75	5.0	0.15	5.0	30 (E)	7.5 (T)	TO-18
2N862	PNP	150 (A)	140	15	15 (O)	12	48	5.0	0.15	5.0	20 (E)	8.0 (T)	TO-18
2N863	PNP	150 (A)	140	15	15 (O)	25	100	5.0	0.15	5.0	40 (E)	10 (T)	TO-18
2N864	PNP	150 (A)	140	6	6 (O)	20	100	5.0	0.1	5.0	25 (E)	16 (T)	TO-18
2N865	PNP	150 (A)	140	10	6 (O)	45	125	5.0	0.1	5.0	100 (E)	24 (T)	TO-18
2N869A	PNP	360 (A)	200	25	18 (O)	40	120	30	0.15	10	—	400 (T)	TO-18
2N947	NPN	360 (A)	150	20	15 (R)	20	—	10	0.4	5.0	—	200 (T)	TO-18
2N1131	PNP	600 (A)	175	50	35 (O)	20	45	150	1.5	150	15 (E)	50 (T)	TO-5
2N1131A	PNP	600 (A)	175	60	40 (O)	20	45	150	1.5	150	15 (E)	50 (T)	TO-5
2N1132	PNP	600 (A)	175	60	40 (O)	30	90	150	1.5	150	25 (E)	60 (T)	TO-5
2N1132A	PNP	600 (A)	175	60	40 (O)	30	90	150	1.5	150	25 (E)	60 (T)	TO-5
2N1132B	PNP	600 (A)	175	70	45 (O)	30	90	150	1.5	150	25 (E)	60 (T)	TO-5
2N1252	NPN	600 (A)	175	30	20 (R)	15	45	150	1.5	150	—	40 (T)	TO-5
2N1253	NPN	600 (A)	175	30	20 (R)	30	90	150	1.5	150	—	50 (T)	TO-5
2N1507	NPN	600 (A)	175	60	30 (R)	100	300	150	1.5	150	—	50 (T)	TO-5
2N1613	NPN	800 (A)	200	75	50 (R)	40	120	150	1.5	150	30 (E)	60 (T)	TO-5
2N1711	NPN	800 (A)	200	75	50 (R)	100	300	150	1.5	150	50 (E)	70 (T)	TO-5
2N2695	PNP	360 (A)	200	25	25 (O)	30	130	50	0.25	50	25 (E)	100 T	TO-5
2N2696	PNP	360 (A)	200	25	25 (O)	30	130	50	0.25	50	25 (E)	100 (T)	TO-46
2N2845	NPN	360 (A)	200	60	30 (O)	30	120	150	0.4	150	—	250 (T)	TO-18
2N2846	NPN	800 (A)	200	60	30 (O)	30	120	150	0.4	150	—	250 (T)	TO-5
2N2847	NPN	360 (A)	200	60	20 (O)	40	140	150	0.4	150	—	250 (T)	TO-18
2N2848	NPN	800 (A)	200	60	20 (O)	40	140	150	0.4	150	—	250 (T)	TO-5
2N2890	NPN	800 (A)	200	100	80 (O)	30	90	1000	0.5	1000	30 (E)	30 (T)	TO-5
2N2891	NPN	800 (A)	200	100	80 (O)	50	150	1000	0.5	1000	50 (E)	30 (T)	TO-5
2N2892	NPN	30 (C)	200	100	80 (O)	30	90	1000	0.5	1000	30 (E)	30 (T)	TO-59
2N2893	NPN	30 (C)	200	100	80 (O)	50	150	1000	0.5	1000	50 (E)	30 (T)	TO-59
2N2894	NPN	360 (A)	200	12	12 (O)	40	150	30	0.15	10	—	400 (T)	TO-18
2N2894A	NPN	360 (A)	200	12	12 (S)	40	—	30	—	—	—	800 (T)	TO-18
2N2927	PNP	800 (A)	200	25	25 (O)	30	130	50	0.25	50	25 (E)	100 (T)	TO-5
2N2968	PNP	150 (A)	140	30	10 (O)	15	—	0.1	0.6	10	—	8.0 (T)	TO-5
2N2969	PNP	150 (A)	140	30	10 (O)	15	—	0.1	0.6	10	—	8.0 (T)	TO-18

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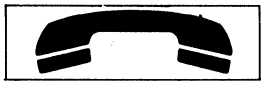
silicon transistors cont'd

silicon small signal transistors
medium speed switches — (cont'd)

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N2970	PNP	150 (A)	140	30	20 (O)	10	—	0.1	0.8	10	—	4.0 (T)	TO-5
2N2971	PNP	150 (A)	140	30	20 (O)	10	—	0.1	0.8	10	—	4.0 (T)	TO-18
2N3072	PNP	800 (A)	200	60	60 (O)	30	130	50	0.25	50	25 (E)	130 (T)	TO-5
2N3073	PNP	360 (A)	200	60	60 (O)	30	130	50	0.25	50	25 (E)	130 (T)	TO-18
2N3107	NPN	800 (A)	200	100	60 (O)	100	300	150	1.0	1000	60 (E)	70 (T)	TO-5
2N3108	NPN	800 (A)	200	100	60 (O)	40	120	150	0.25	150	—	60 (T)	TO-5
2N3109	NPN	800 (A)	200	80	40 (O)	100	300	150	1.0	1000	60 (E)	70 (T)	TO-5
2N3110	NPN	800 (A)	200	80	40 (O)	40	120	150	0.25	150	—	60 (T)	TO-5
2N3120	PNP	800 (A)	200	45	45 (O)	30	130	50	0.25	50	25 (E)	130 (T)	TO-5
2N3121	PNP	360 (A)	200	45	45 (O)	30	130	50	0.25	50	25 (E)	130 (T)	TO-18
2N3340	NPN	400 (A)	175	30	20 (O)	40	—	0.01	0.2	10	—	70 (T)	TO-46
2N3341	PNP	400 (A)	175	30	20 (O)	40	—	0.01	0.25	10	—	50 (T)	TO-46
2N4227	NPN	300 (A)	125	60	30 (O)	—	150	150	—	—	—	250 (T)	RO-11g

amplifiers

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N243	NPN	750 (C)	150	60	—	—	—	—	—	—	0.9 (B)	—	OV-1
2N244	NPN	750 (C)	150	60	—	—	—	—	—	—	0.961 (B)	—	OV-1
2N263	NPN	150 (A)	150	45	30 (O)	45	150	10	1.5	10	39 (E)	20 (B)	OV-9a
2N264	NPN	125 (A)	150	45	30 (O)	20	55	10	1.5	10	0.95 (B)	10 (B)	OV-1
2633ZA	NPN	500 (A)	175	45	45 (O)	—	—	—	1.0	5.0	0.9 (B)	2.5 (B)	TO-5
2N333A	NPN	500 (A)	175	45	45 (O)	—	—	—	1.0	5.0	0.948 (B)	2.5 (B)	TO-5
2N334A	NPN	500 (A)	175	45	45 (O)	—	—	—	1.0	5.0	0.948 (B)	8.0 (B)	TO-5
2N335A	NPN	500 (A)	175	45	45 (O)	—	—	—	1.0	5.0	0.973 (B)	2.5 (B)	TO-5
2N335B	NPN	500 (A)	175	60	60 (O)	28	90	1.0	1.0	5.0	37 (E)	2.5 (B)	TO-5
2N336A	NPN	500 (A)	175	45	45 (O)	—	—	—	—	5.0	0.987 (B)	2.5 (B)	TO-5
2N337A	NPN	500 (A)	175	45	—	20	55	10	—	—	19 (E)	15 (B)	TO-5
2N338A	NPN	500 (A)	175	45	—	45	150	10	—	—	39 (E)	25 (B)	TO-5
2N343B	NPN	750 (A)	175	65	65 (O)	—	—	—	—	—	28 (E)	—	TO-11
2N471	NPN	200 (A)	200	30	30 (O)	—	—	—	1.5	5.0	10 (E)	8.0 (T)	TO-5
2N471A	NPN	200 (A)	200	30	30 (O)	—	—	—	1.0	5.0	10 (E)	8.0 (T)	TO-5
2N472A	NPN	200 (A)	200	45	45 (O)	—	—	—	1.0	5.0	10 (E)	8.0 (T)	TO-5
2N473	NPN	200 (A)	200	15	15 (O)	—	—	—	1.5	5.0	20 (E)	8.0 (T)	TO-5
2N474	NPN	200 (A)	200	30	30 (O)	—	—	—	1.5	5.0	20 (E)	8.0 (T)	TO-5
2N474A	NPN	200 (A)	200	30	30 (O)	10	—	—	1.0	5.0	20 (E)	8.0 (T)	TO-5
2N475	NPN	200 (A)	200	45	45 (O)	—	—	—	1.5	5.0	20 (E)	8.0 (T)	TO-5
2N475A	NPN	200 (A)	200	45	45 (O)	10	—	—	1.0	5.0	20 (E)	8.0 (T)	TO-5
2N476	NPN	200 (A)	200	15	15 (O)	—	—	—	1.5	5.0	30 (E)	12 (T)	TO-5
2N477	NPN	200 (A)	200	30	30 (O)	—	—	—	1.5	5.0	30 (E)	12 (T)	TO-5
2N479A	NPN	200 (A)	200	30	30 (O)	10	—	—	1.0	5.0	40 (E)	20 (T)	TO-5
2N480A	NPN	200 (A)	200	45	45 (O)	10	—	—	1.0	5.0	40 (E)	20 (T)	TO-5
2N451	NPN	200 (A)	200	15	15 (U)	—	—	—	1.5	5.0	80 (E)	10 (T)	TO-5
2N542	NPN	200 (A)	200	30	30 (U)	—	—	—	1.5	5.0	80 (E)	10 (T)	TO-5
2N542A	NPN	200 (A)	200	30	30 (O)	20	—	—	1.0	5.0	80 (E)	10 (T)	TO-5
2N543	NPN	200 (A)	200	50	50 (U)	—	—	—	1.5	5.0	80 (E)	10 (T)	TO-5
2N543A	NPN	200 (A)	200	45	45 (O)	20	—	—	1.0	5.0	80 (E)	10 (T)	TO-5
2N730	NPN	500 (A)	175	60	40 (R)	20	60	150	1.5	150	—	40 (T)	TO-18
2N731	NPN	500 (A)	175	60	40 (R)	40	120	150	1.5	150	—	25 (T)	TO-18
2N734	NPN	500 (A)	175	80	60 (O)	15	50	5.0	1.0	10	20 (E)	—	TO-18
2N735	NPN	500 (A)	175	80	60 (O)	30	100	5.0	1.0	10	40 (E)	—	TO-5
2N735A	NPN	500 (A)	200	80	60 (O)	30	100	5.0	0.5	10	40 (E)	60 (T)	TO-18
2N736	NPN	500 (A)	175	80	60 (O)	60	200	5.0	1.0	10	80 (E)	—	TO-5
2N736B	NPN	500 (A)	200	80	60 (O)	60	200	5.0	0.5	10	80 (E)	100 (T)	TO-18
2N739	NPN	500 (A)	175	125	80 (O)	30	10	5.0	1.0	10	40 (E)	—	TO-5
2N739A	NPN	500 (A)	200	125	80 (O)	30	100	5.0	0.5	10	40 (E)	60 (T)	TO-5
2N740	NPN	500 (A)	200	125	80 (O)	60	200	5.0	—	—	80 (E)	—	TO-5
2N740A	NPN	500 (A)	200	125	80 (O)	60	200	5.0	0.5	10	80 (E)	100 (T)	TO-18
2N756	NPN	500 (A)	200	45	45 (O)	—	—	—	1.0	10	12 (E)	500 (B)	TO-18
2N757	NPN	500 (A)	200	45	45 (O)	—	—	—	1.0	10	18 (E)	50 (B)	TO-18
2N757A	NPN	500 (A)	200	60	60 (O)	—	—	—	1.0	10	18 (E)	50 (B)	TO-18
2N758	NPN	500 (A)	200	45	45 (O)	—	—	—	1.0	10	18 (E)	500 (B)	TO-5
2N758A	NPN	500 (A)	200	60	60 (O)	—	—	—	1.0	10	18 (E)	50 (B)	TO-5
2N758B	NPN	500 (A)	200	60	60 (O)	12	—	1.0	0.5	10	18 (E)	50 (B)	TO-18
2N759	NPN	500 (A)	200	45	45 (O)	—	—	—	1.0	10	36 (E)	50 (B)	TO-5
2N759A	NPN	500 (A)	200	60	60 (O)	—	—	—	1.0	10	36 (E)	50 (B)	TO-5
2N759B	NPN	500 (A)	200	60	60 (O)	25	—	1.0	0.5	10	36 (E)	50 (B)	TO-18



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silicon transistors cont'd

silicon small signal transistors amplifiers — cont'd.

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N760	NPN	500 (A)	200	45	45 (O)	—	—	—	1.0	10	76 (E)	50 (B)	TO-5
2N760A	NPN	500 (A)	200	60	60 (O)	—	—	—	1.0	10	76 (E)	50 (B)	TO-5
2N760B	NPN	500 (A)	200	60	60 (O)	50	—	1.0	0.5	10	76 (E)	50 (B)	TO-18
2N844	NPN	300 (A)	175	60	60 (R)	40	120	5.0	0.8	10	—	50 (T)	TO-18
2N845	NPN	300 (A)	175	180	80 (R)	40	120	5.0	0.8	10	—	50 (T)	TO-18
2N910	NPN	500 (A)	200	100	80 (R)	75	—	10	0.4	10	76 (E)	60 (T)	TO-5
2N911	NPN	500 (A)	200	100	80 (R)	35	—	10	0.4	10	36 (E)	50 (T)	TO-5
2N912	NPN	500 (A)	200	100	80 (R)	15	—	10	0.4	10	18 (E)	40 (T)	TO-18
2N929	NPN	600 (C)	175	45	45 (O)	40	120	.010	1.0	10	150 (E)	1.0 (E)	TO-5
2N929A	NPN	500 (A)	200	60	45 (O)	40	120	.010	0.5	10	60 (E)	45 (T)	TO-5
2N930	NPN	600 (C)	175	45	45 (O)	100	300	.010	1.0	10	150 (E)	1.0 (E)	TO-5
2N930A	NPN	500 (A)	200	60	45 (O)	100	300	.010	0.5	10	150 (E)	45 (T)	TO-5
2N1149	NPN	150 (A)	175	45	—	9	20	25	—	—	0.9 (B)	4.0 (B)	OV-9
2N1150	NPN	150 (A)	175	45	—	18	40	25	—	—	.948 (B)	5.0 (B)	OV-9
2N1151	NPN	150 (A)	175	45	—	18	90	25	—	—	.948 (B)	8.0 (B)	OV-9
2N1152	NPN	150 (A)	175	45	—	36	90	25	—	—	.973 (B)	6.0 (B)	OV-9
2N1153	NPN	150 (A)	175	45	—	76	333	25	—	—	.987 (B)	7.0 (B)	OV-9
2N1154	NPN	750 (C)	150	50	—	9	—	60	—	—	.9 (B)	—	OV-9
2N1155	NPN	750 (C)	150	80	—	9	—	50	—	—	.9 (B)	—	OV-9
2N1156	NPN	750 (C)	150	120	—	9	—	40	—	—	.9 (B)	—	OV-9
2N1247	NPN	30 (A)	150	6	6 (O)	15	—	.005	—	—	—	—	TO-5
2N1248	NPN	30 (A)	150	6	6 (O)	15	—	.020	—	—	—	—	TO-5
2N1249	NPN	30 (A)	150	6	6 (O)	20	—	.030	—	—	—	—	TO-5
2N1275	NPN	150 (A)	150	40	30 (O)	—	—	—	1.0	5.0	9 (E)	15 (B)	TO-5
2N1277	NPN	150 (A)	150	40	30 (O)	—	—	—	1.0	5.0	18 (E)	15 (B)	TO-5
2N1278	NPN	150 (A)	150	40	30 (O)	—	—	—	1.0	5.0	37 (E)	15 (B)	TO-5
2N1279	NPN	150 (A)	150	40	30 (O)	—	—	—	1.0	5.0	76 (E)	15 (B)	TO-5
2N1335	NPN	800 (A)	175	120	45 (O)	10	150	30	—	—	—	70 (T)	TO-5
2N1336	NPN	800 (A)	175	120	45 (O)	10	150	30	—	—	—	70 (T)	TO-5
2N1337	NPN	800 (A)	175	120	45 (O)	10	150	30	—	—	—	70 (T)	TO-5
2N1338	NPN	800 (A)	175	80	25 (O)	10	150	30	—	—	—	70 (T)	TO-5
2N1339	NPN	800 (A)	175	120	50 (O)	10	150	30	—	—	—	70 (T)	TO-5
2N1340	NPN	800 (A)	175	120	50 (O)	10	150	30	—	—	—	70 (T)	TO-5
2N1341	NPN	800 (A)	175	120	50 (O)	10	150	30	—	—	—	70 (T)	TO-5
2N1342	NPN	800 (A)	175	150	65 (O)	10	150	30	—	—	—	70 (T)	TO-5
2N1417	NPN	150 (A)	150	15	15 (O)	—	—	—	—	—	30 (E)	—	TO-5
2N1418	NPN	150 (A)	150	30	30 (O)	—	—	—	—	—	30 (E)	—	TO-5
2N1505	NPN	800 (A)	175	50	20 (O)	70	100	100	2.0	150	—	70 (T)	TO-5
2N1506	NPN	800 (A)	175	60	20 (O)	10	100	100	1.5	150	—	140 (T)	TO-5
2N1506A	NPN	800 (A)	200	80	50 (O)	10	100	100	0.6	150	—	140 (T)	TO-5
2N1586	NPN	125 (A)	85	15	10 (O)	5	27	1	1.5	5	9.0 (E)	5.0 (B)	OV-9
2N1587	NPN	125 (A)	85	30	20 (O)	5	27	1	1.5	5	9.0 (E)	5.0 (B)	OV-9
2N1588	NPN	125 (A)	85	60	40 (O)	5	27	1	1.5	5	9.0 (E)	5.0 (B)	TO-5
2N1589	NPN	125 (A)	85	15	10 (O)	20	75	1	1.5	5	25 (E)	5.0 (B)	OV-9
2N1590	NPN	125 (A)	85	30	20 (O)	20	75	1	1.5	5	25 (E)	5.0 (B)	OV-9
2N1591	NPN	125 (A)	85	60	40 (O)	20	75	1	1.5	5	25 (E)	5.0 (B)	OV-9
2N1592	NPN	125 (A)	85	15	10 (O)	40	210	1	1.5	5	70 (E)	5.0 (B)	OV-9
2N1593	NPN	125 (A)	85	30	20 (O)	40	210	1	1.5	5	70 (E)	5.0 (B)	OV-9
2N1594	NPN	125 (A)	85	60	40 (O)	40	210	1	1.5	5	70 (E)	5.0 (B)	OV-9
2N1647	NPN	267 (C)	175	80	80 (V)	15	45	500	3.0	1000	—	3.0 (T)	MT-11
2N1648	NPN	267 (C)	175	120	80 (O)	15	45	500	3.0	1000	—	2.0 (T)	MT-11
2N1649	NPN	267 (C)	175	80	80 (V)	30	90	500	3.0	1000	—	3.0 (T)	MT-11
2N1650	NPN	267 (C)	175	120	80 (O)	30	—	500	3.0	1000	—	2.0 (T)	MT-11
2N1674	NPN	200 (A)	200	45	45 (O)	—	—	—	1.5	5.0	50 (E)	200 (T)	TO-5
2N1972	NPN	600 (A)	175	60	30 (R)	110	350	50	2.0	50	40 (E)	50 (T)	TO-5
2N1973	NPN	800 (A)	200	100	80 (R)	75	—	10	1.2	50	76 (E)	60 (T)	TO-5
2N1974	NPN	800 (A)	200	100	80 (R)	35	—	10	1.2	50	36 (E)	50 (T)	TO-18
2N1975	NPN	800 (A)	200	100	80 (R)	15	—	10	1.2	50	18 (E)	40 (T)	TO-5
2N1983	NPN	600 (A)	150	50	25 (O)	—	—	—	—	—	70 (E)	40 (T)	TO-5
2N1984	NPN	600 (A)	150	50	25 (O)	—	—	—	—	—	35 (E)	40 (T)	TO-5
2N1985	NPN	600 (A)	150	50	25 (O)	—	—	—	—	—	15 (E)	40 (T)	TO-5
2N1986	NPN	600 (A)	150	50	25 (O)	60	240	150	1.5	150	—	40 (T)	TO-5
2N1987	NPN	600 (A)	150	50	25 (O)	20	80	150	1.5	150	—	40 (T)	TO-5
2N1988	NPN	600 (A)	150	100	45 (O)	35	120	2 20	2.0	30	20 (E)	40 (T)	TO-5
2N1989	NPN	600 (A)	150	100	45 (O)	20	60	30	2.0	30	10 (E)	40 (T)	TO-5
2N1990	NPN	600 (A)	150	100	—	20	—	30	0.5	2.0	—	—	TO-5
2N1991	PNP	600 (A)	150	30	20 (O)	15	60	150	1.5	150	—	40 (T)	TO-5
2N2008	NPN	800 (A)	200	175	110 (O)	30	90	10	2.5	25	20 (E)	40 (T)	TO-5
2N2017	NPN	1000 (A)	200	60	60 (O)	50	200	200	—	—	30 (E)	—	TO-5
2N2038	NPN	600 (A)	200	45	45 (O)	12	36	200	6.0	200	—	2.0 (T)	TO-5
2N2039	NPN	600 (A)	200	75	75 (O)	12	36	200	6.0	200	—	2.0 (T)	TO-5
2N2040	NPN	600 (A)	200	45	45 (O)	30	90	200	6.0	200	—	2.0 (T)	TO-5
2N2041	NPN	600 (A)	200	75	75 (O)	30	90	200	6.0	200	—	2.0 (T)	TO-5
2N2049	NPN	800 (A)	200	75	50 (R)	100	300	150	0.4	10	75 (E)	50 (T)	TO-5
2N2106	NPN	1000 (A)	150	60	60 (R)	12	36	200	5.0	200	—	—	TO-5

HUGHES SEMICONDUCTORS
HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION
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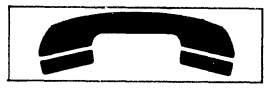
silicon transistors cont'd

silicon small signal transistors amplifiers — cont'd.

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N2107	NPN	1000 (A)	150	60	60 (R)	30	90	200	2.0	200	—	—	TO-5
2N2108	NPN	1000 (A)	150	60	60 (R)	75	200	200	2.0	200	—	—	TO-5
2N2309	NPN	600 (A)	200	30	30 (O)	25	125	200	—	—	40 (E)	—	TO-5
2N2310	NPN	350 (A)	200	60	60 (O)	12	36	200	5.0	200	—	—	TO-46
2N2312	NPN	350 (A)	200	60	60 (O)	30	90	200	5.0	200	—	—	TO-46
2N2313	NPN	350 (A)	200	100	100 (O)	30	90	200	5.0	200	—	—	TO-46
2N2314	NPN	350 (A)	200	60	40 (R)	20	60	150	5.0	150	15 (E)	40 (T)	TO-46
2N2315	NPN	350 (A)	200	60	40 (R)	40	120	150	1.5	150	25 (E)	50 (T)	TO-46
2N2316	NPN	350 (A)	200	120	80 (R)	40	120	150	5.0	150	30 (E)	50 (T)	TO-46
2N2317	NPN	350 (A)	200	75	50 (R)	40	120	150	1.5	150	30 (E)	60 (T)	TO-46
2N2349	NPN	150 (A)	200	40	24 (O)	120	250	10	1.5	10	60 (E)	—	TO-5
2N2370	PNP	200 (A)	200	15	15 (O)	15	—	.025	—	—	15 (E)	—	TO-5
2N2371	PNP	200 (A)	200	15	15 (O)	20	—	.025	—	—	20 (E)	—	TO-5
2N2372	PNP	150 (A)	200	15	15 (O)	15	—	.025	—	—	15 (E)	—	TO-5
2N2373	PNP	150 (A)	200	15	15 (O)	20	—	.025	—	—	20 (E)	—	TO-18
2N2460	NPN	400 (A)	200	100	60 (O)	20	—	100	0.3	10	70 (E)	120 (T)	TO-72
2N2461	NPN	400 (A)	200	100	60 (O)	40	—	100	0.3	10	115 (E)	140 (T)	TO-72
2N2462	NPN	400 (A)	200	100	60(O)	60	—	100	0.3	10	160 (E)	160 (T)	TO-72
2N2463	NPN	500 (A)	200	100	60 (O)	10	—	100	0.3	10	40 (E)	100 (T)	TO-18
2N2464	NPN	500 (A)	200	100	60 (O)	20	—	100	0.3	10	70 (E)	120 (T)	TO-18
2N2465	NPN	500 (A)	200	100	60 (O)	40	—	100	0.3	10	115 (E)	140 (T)	TO-18
2N2466	NPN	500 (A)	200	100	60(O)	60	—	100	0.3	10	160 (E)	160 (T)	TO-18
2N2483	NPN	360 (A)	200	60	60 (O)	40	120	0.01	0.35	1.0	80 (E)	12 (T)	TO-18
2N2484	NPN	360 (A)	200	60	60 (O)	100	500	0.01	0.35	1.0	150 (E)	15 (T)	TO-18
2N2509	NPN	360 (C)	200	125	80 (O)	25	—	10	1.0	5.0	—	45 (T)	TO-18
2N2510	NPN	350 (C)	200	100	65 (O)	150	500	10	1.0	5.0	—	45 (T)	TO-18
2N2511	NPN	350 (C)	200	80	50 (O)	250	750	10	1.0	5.0	—	45 (T)	TO-18
2N2515	NPN	400 (A)	200	80	60 (O)	30	100	5.0	0.5	10	40 (E)	60 (T)	TO-46
2N2516	NPN	400 (A)	200	80	60 (O)	60	200	5.0	0.5	10	80 (E)	100 (T)	TO-46
2N2518	NPN	400 (A)	200	125	80 (O)	30	100	5.0	0.5	10	40 (E)	60 (T)	TO-46
2N2519	NPN	400 (A)	200	125	80 (O)	60	200	5.0	0.5	10	80 (E)	100 (T)	TO-46
2N2520	NPN	400 (A)	200	60	60 (O)	12	—	1.0	0.5	10	18 (E)	50 (B)	TO-46
2N2521	NPN	400 (A)	200	60	60 (O)	50	—	1.0	0.5	10	36 (E)	50 (B)	TO-46
2N2522	NPN	400 (A)	200	60	60 (O)	50	—	1.0	0.5	10	76 (E)	50 (B)	TO-46
2N2523	NPN	400 (A)	200	60	45 (O)	40	120	1.0	0.5	10	60 (E)	45 (T)	TO-46
2N2524	NPN	400 (A)	200	60	45 (O)	100	300	10	0.5	10	150 (E)	45 (T)	TO-46
2N2586	NPN	300 (A)	175	60	45 (O)	120	360	1.0	0.5	10	150 (E)	1.5* (T)	TO-18
2N2590	PNP	400 (A)	200	100	60 (O)	10	—	0.1	0.4	10	40 (E)	50 (T)	TO-46
2N2591	PNP	400 (A)	200	100	60 (O)	20	—	0.1	0.4	10	70 (E)	70 (T)	TO-46
2N2592	PNP	400 (A)	200	100	60 (O)	40	—	0.1	0.4	10	115 (E)	90 (T)	TO-46
2N2593	PNP	400 (A)	200	100	60 (O)	60	—	0.1	0.4	10	160 (E)	110 (T)	TO-46
2N2595	PNP	400 (A)	200	80	60 (O)	15	60	5	0.5	10	20 (E)	30 (T)	TO-46
2N2596	PNP	400 (A)	200	80	60 (O	30	120	5	0.5	10	40 (E)	40 (T)	TO-46
2N2597	PNP	400 (A)	200	80	60 (O)	60	240	5	0.5	10	80 (E)	60 (T)	TO-46
2N2598	PNP	400 (A)	200	125	80 (O)	15	60	5	0.5	10	20 (E)	30 (T)	TO-46
2N2599	PNP	400 (A)	200	125	80 (O)	30	120	5	0.5	10	40 (E)	40 (T)	TO-46
2N2599A	PNP	400 (A)	200	125	100 (O)	30	120	5	0.5	10	40 (E)	40 (T)	TO-46
2N2600	PNP	400 (A)	200	125	80 (O)	60	240	5	0.5	10	80 (E)	60 (T)	TO-46
2N2600A	PNP	400 (A)	200	125	100 (O)	60	240	5	0.5	10	80 (E)	60 (T)	TO-46
2N2601	PNP	400 (A)	200	60	60 (O)	12	—	1.0	0.5	10	18 (E)	20 (T)	TO-46
2N2602	PNP	400 (A)	200	60	60 (O)	25	—	1.0	0.5	10	36 (E)	40 (T)	TO-46
2N2603	PNP	400 (A)	200	60	60 (O)	50	—	1.0	0.5	10	76 (E)	60 (T)	TO-46
2N2604	PNP	400 (A)	200	60	45 (O)	40	—	1.0	0.5	10	60 (E)	30 (T)	TO-46
2N2605	PNP	400 (A)	200	60	45 (O)	100	—	1.0	0.5	10	150 (E)	30 (T)	TO-46
2N2605A	PNP	400 (A)	200	60	45 (O)	50	200	1.0	0.25	10	200 (E)	45 (T)	TO-46
2N2610	NPN	150 (A)	150	45	40 (O)	—	—	—	1.0	5.0	4.5 (E)	—	TO-5
2N2615	NPN	300 (A)	200	30	15 (O)	20	200	3.0	0.5	3.0	—	500 (T)	TO-18
2N2616	NPN	300 (A)	200	30	15 (O)	20	200	3.0	0.4	10	—	600 (T)	TO-18
2N2861	PNP	300 (A)	200	25	20 (O)	30	120	10	0.2	10	50 (E)	60 (T)	TO-18
2N2862	PNP	300 (A)	200	25	20 (O)	12	120	10	0.2	10	25 (E)	45 (T)	TO-18
2N2936	NPN	300 (A)	175	60	55 (O)	100	300	0.01	0.3	2.0	150 (E)	30 (T)	TO-77
2N2937	NPN	300 (A)	175	60	55 (O)	100	300	0.01	0.3	2.0	150 (E)	30 (T)	TO-77
2N3045	NPN	250 (A)	200	45	45 (O)	100	300	0.01	1.0	10	130 (E)	30 (T)	TO-89
2N3049	PNP	250 (A)	200	25	20 (O)	20	120	0.01	0.2	10	30 (E)	60 (T)	TO-89
2N3050	PNP	250 (A)	200	25	20 (O)	20	120	0.01	0.2	10	30 (E)	60 (T)	TO-89
2N3058	PNP	400 (A)	200	6	6 (O)	40	120	0.0001	—	—	40 (E)	—	TO-46
2N3059	PNP	400 (A)	200	10	10 (O)	100	300	0.01	—	—	100 (E)	—	TO-46
2N3060	PNP	400 (A)	200	70	60 (O)	30	90	1.0	—	—	30 (E)	—	TO-46
2N3061	PNP	400 (A)	200	70	60 (O)	60	180	1.0	—	—	60 (E)	—	TO-46
2N3077	NPN	360 (A)	200	80	60 (O)	100	400	0.001	0.35	1.0	120 (E)	15 (T)	TO-18
2N3078	NPN	360 (A)	200	80	60 (O)	40	120	0.001	0.35	1.0	50 (E)	15 (T)	TO-18
2N3117	NPN	360 (A)	200	60	60 (O)	250	500	0.001	0.35	1.0	400 (E)	60 (T)	TO-18
2N3224	PNP	700 (A)	200	100	100 (O)	20	60	50	—	—	20 (E)	60 (T)	TO-5
2N3225	PNP	700 (A)	200	100	100 (O)	40	120	50	—	—	40 (E)	80 (T)	TO-5
2N3439	NPN	1000 (A)	200	450	350 (O)	40	160	20	—	—	25 (E)	15 (T)	TO-5

* KHz



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silicon transistors cont'd

silicon small signal transistors

amplifiers — (cont'd)

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N3440	NPN	1000 (A)	200	300	250 (O)	40	160	20	—	—	25 (E)	15 (T)	TO-5
2N3494	PNP	600 (A)	200	80	80 (O)	35	—	100	0.3	10	40 (E)	200 (T)	TO-5
2N3498	NPN	1000 (A)	200	100	100 (O)	40	120	150	0.2	10	50 (E)	150 (T)	TO-5
2N3499	NPN	1000 (A)	200	100	100 (O)	100	300	150	0.2	10	75 (E)	150 (T)	TO-5
2N3565	NPN	200 (A)	125	30	25 (O)	150	600	1.0	—	—	120 (E)	40 (T)	TO-106
2N3566	NPN	300 (A)	125	40	30 (O)	150	600	10	1.0	0.1	—	40 (T)	TO-105
2N3567	NPN	300 (A)	125	80	40 (O)	40	120	150	0.25	150	—	60 (T)	TO-105
2N3568	NPN	300 (A)	125	80	60 (O)	40	120	150	0.25	150	—	60 (T)	TO-105
2N3569	NPN	300 (A)	125	80	40 (O)	100	300	150	0.25	150	—	60 (T)	TO-105
2N3579	PNP	400 (A)	200	60	60 (O)	30	120	1.0	0.5	5.0	30 (E)	80 (T)	TO-46
2N3580	PNP	400 (A)	200	60	60 (O)	60	240	1.0	0.5	5.0	60 (E)	80 (T)	TO-46
2N3581	PNP	400 (A)	200	50	40 (O)	50	150	0.1	0.5	5.0	50 (E)	30 (T)	TO-46
2N3582	PNP	400 (A)	200	50	40 (O)	100	300	0.1	0.5	5.0	100 (E)	30 (T)	TO-46
2N3692	NPN	200 (A)	125	35	20 (O)	100	400	10	0.7	10	100 (E)	200 (T)	TO-106
2N3962	PNP	360 (A)	200	60	60 (O)	100	300	1.0	0.25	10	100 (E)	40 (T)	TO-106
2N3963	PNP	360 (A)	200	80	80 (O)	100	300	1.0	0.25	10	100 (E)	40 (T)	TO-18
2N3964	PNP	360 (A)	200	45	45 (O)	250	500	1.0	0.25	10	250 (E)	50 (T)	TO-18
2N3965	PNP	360 (A)	200	60	60 (O)	250	500	1.0	0.25	10	250 (E)	50 (T)	TO-18
2N4080	PNP	300 (A)	200	20	50 (O)	20	—	3.0	—	—	—	1** (T)	TO-5
2N4250	PNP	200 (A)	125	40	40 (O)	—	—	—	—	—	250 (E)	40 (T)	TO-106
2N4256	PNP	200 (A)	—	30	30 (S)	—	500	2.0	—	—	—	—	TO-98
2N4269	NPN	360 (A)	200	200	140 (O)	—	200	10	—	—	—	—	TO-18
2N4270	NPN	580 (A)	200	200	140 (O)	—	200	10	—	—	—	—	TO-5
2N4359	PNP	360 (A)	200	45	45 (O)	50	600	1.0	0.25	10	50 (E)	—	TO-18

** GHz

general purpose — switches & amplifiers

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N120	NPN	150 (C)	175	45	—	76	333	—	—	—	0.987 (B)	—	HL-11
2N332	NPN	150 (A)	175	45	—	9.0	20	—	—	—	0.9 (B)	—	TO-5
2N333	NPN	150 (A)	175	45	—	18	40	—	—	—	0.948 (B)	—	TO-5
2N334	NPN	150 (A)	175	45	—	18	86	—	—	—	0.948 (B)	—	TO-5
2N335	NPN	150 (A)	175	45	—	36	86	—	—	—	0.973 (B)	—	TO-5
2N336	NPN	150 (A)	175	45	—	76	333	—	—	—	0.987 (B)	—	TO-5
2N470	NPN	200 (A)	200	15	15 (O)	—	—	—	1.5	5.0	10 (E)	8.0 (T)	TO-5
2N472	NPN	200 (A)	200	45	45 (O)	—	—	—	1.5	5.0	10 (E)	8.0 (T)	TO-5
2N478	NPN	200 (A)	200	15	15 (O)	—	—	—	1.5	5.0	40 (E)	20 (T)	TO-5
2N479	NPN	200 (A)	200	30	30 (O)	—	—	—	1.5	5.0	40 (E)	20 (T)	TO-5
2N717	NPN	400 (A)	175	60	40 (R)	20	60	150	1.5	150	—	40 (T)	TO-18
2N718	NPN	400 (A)	175	60	40 (R)	40	120	150	1.5	150	—	50 (T)	TO-18
2N718A	NPN	500 (A)	200	75	50 (R)	40	120	150	1.5	150	30 (E)	60 (T)	TO-18
2N719	NPN	400 (A)	175	120	80 (R)	20	60	150	5.0	150	15 (E)	40 (T)	TO-18
2N720	NPN	400 (A)	175	120	80 (R)	40	120	150	5.0	150	35 (E)	50 (T)	TO-18
2N720A	NPN	500 (A)	200	120	100 (R)	40	120	150	5.0	150	30 (E)	50 (T)	TO-18
2N721	PNP	400 (A)	200	50	50 (R)	20	45	150	1.5	150	15 (E)	50 (T)	TO-18
2N721A	PNP	500 (A)	200	50	50 (R)	20	45	150	0.5	150	15 (E)	50 (T)	TO-18
2N722	PNP	400 (A)	175	50	50 (R)	30	90	150	1.5	150	25 (E)	60 (T)	TO-18
2N722A	PNP	500 (A)	200	50	50 (R)	30	90	150	0.5	150	25 (E)	60 (T)	TO-18
2N754	NPN	300 (A)	175	60	60 (R)	20	80	80	0.8	10	—	30 (T)	TO-18
2N755	NPN	300 (A)	175	100	80 (R)	20	80	5.0	0.8	10	—	30 (T)	TO-18
2N839	NPN	300 (A)	175	45	45 (O)	15	50	10	2.0	10	20 (E)	30 (T)	TO-18
2N840	NPN	300 (A)	175	45	45 (O)	30	100	10	2.0	10	40 (E)	30 (T)	TO-18
2N841	NPN	300 (A)	175	45	45 (O)	60	400	10	2.0	10	80 (E)	40 (T)	TO-18
2N842	NPN	300 (A)	175	45	45 (O)	20	55	10	1.2	10	20 (E)	30 (T)	TO-18
2N843	NPN	300 (A)	175	45	45 (O)	45	150	10	1.2	10	40 (E)	40 (T)	TO-18
2N869	PNP	360 (A)	200	25	18 (O)	20	120	10	1.0	10	—	100 (T)	TO-18
2N870	NPN	500 (A)	200	100	80 (R)	40	120	150	1.2	50	30 (E)	50 (T)	TO-18
2N871	NPN	500 (A)	200	100	80 (R)	100	300	150	1.2	50	50 (E)	60 (T)	TO-18
2N909	NPN	400 (A)	175	60	30 (R)	110	350	50	0.5	10	40 (E)	50 (T)	TO-18
2N915	NPN	360 (A)	200	70	50 (O)	50	200	10	1.0	10	50 (E)	250 (T)	TO-18
2N916	NPN	360 (A)	200	45	25 (O)	50	200	10	0.5	10	50 (E)	300 (T)	TO-18
2N916A	NPN	360 (A)	200	45	25 (O)	50	200	10	0.5	10	50 (E)	300 (T)	TO-18
2N917	NPN	200 (A)	200	30	15 (O)	20	200	3.0	0.5	3.0	—	500 (T)	TO-72
2N918	NPN	200 (A)	200	30	15 (O)	20	—	3.0	0.4	10	—	600 (T)	TO-72
2N956	NPN	500 (A)	200	75	50 (R)	100	300	150	1.5	150	50 (E)	70 (T)	TO-18
2N957	NPN	250 (A)	150	40	20 (O)	45	—	10	1.5	10	—	200 (T)	TO-18
2N978	PNP	330 (A)	150	30	20 (O)	15	60	150	1.5	150	—	40 (T)	TO-18
2N995	PNP	360 (A)	200	20	15 (O)	35	140	20	0.2	20	—	100 (T)	TO-18

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silicon small signal transistors

general purpose — switches & amplifiers — (cont'd)

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N996	PNP	360 (A)	200	15	12 (O)	35	—	20	0.3	60	—	100 (T)	TO-18
2N1116	NPN	600 (C)	200	60	60 (O)	40	150	506	5.0	500	—	6.0 (T)	TO-5
2N1117	NPN	600 (C)	200	60	60 (O)	40	150	200	4.0	200	—	4.0 (T)	TO-5
2N1206	NPN	3 (A)	200	60	60 (O)	20	80	—	—	—	25 (E)	10 (T)	TO-5
2N1207	NPN	3 (A)	200	125	125 (O)	20	80	—	—	—	25 (E)	10 (T)	TO-5
2N1420	NPN	600 (A)	175	60	30 (R)	100	300	150	1.5	150	—	50 (T)	TO-5
2N1420A	NPN	800 (A)	200	60	40 (R)	100	300	150	1.5	150	—	50 (T)	TO-5
2N1615	NPN	5.5 (A)	200	100	100 (O)	25	—	5	5	50	—	2.0 (T)	TO-5
2N1711A	NPN	1000 (A)	200	75	50 (R)	100	300	150	1.0	150	50 (E)	70 (T)	TO-5
2N1889	NPN	800 (A)	200	100	80 (R)	40	120	150	5.0	150	30 (E)	50 (T)	TO-5
2N1890	NPN	800 (A)	200	100	80 (R)	100	300	150	5.0	150	50 (E)	60 (T)	TO-5
2N1893	NPN	800 (A)	200	120	100 (R)	40	120	150	5.0	150	30 (E)	50 (T)	TO-5
2N2297	NPN	800 (A)	200	80	35 (O)	40	120	150	0.2	150	—	60 (T)	TO-5
2N2303	PNP	600 (A)	175	50	50 (R)	75	200	150	1.5	250	75 (E)	60 (T)	TO-5
2N2377	PNP	150 (A)	140	25	25 (O)	10	100	5.0	—	—	15 (E)	8.0 (T)	TO-18
2N2378	PNP	150 (A)	140	10	10 (O)	15	—	15	—	—	—	7.2 (T)	TO-18
2N2427	NPN	500 (A)	200	40	40 (O)	20	60	0.01	—	—	40 (E)	50 (T)	TO-18
2N2443	NPN	800 (A)	200	120	100 (O)	50	150	50	1.2	50	45 (E)	50 (T)	TO-5
2N2708	NPN	200 (A)	200	35	20 (O)	30	200	2.0	—	—	30 (E)	—	TO-72
2N2857	NPN	200 (A)	200	30	15 (O)	30	150	3.0	—	—	50 (E)	1** (T)	TO-72
2N2865	NPN	200 (A)	200	25	13 (O)	20	200	4.0	0.4	10	20 (E)	600 (T)	TO-72
2N3019	NPN	800 (A)	200	140	80 (O)	100	300	0.15	0.2	0.15	80 (E)	100 (T)	TO-5
2N3020	NPN	800 (A)	200	140	80 (O)	40	120	0.15	0.2	0.15	30 (E)	80 (T)	TO-5
2N3056	NPN	400 (A)	200	100	60 (O)	40	120	0.15	0.25	0.15	30 (E)	80 (T)	TO-46
2N3056A	NPN	400 (A)	200	140	80 (O)	40	120	0.15	0.2	0.15	30 (E)	80 (T)	TO-46
2N3057	NPN	400 (A)	200	100	60 (O)	100	300	0.15	0.25	0.15	80 (E)	100 (T)	TO-46
2N3057A	NPN	400 (A)	200	140	80 (O)	100	300	0.15	0.2	0.15	80 (E)	100 (T)	TO-46
2N3137	NPN	600 (A)	200	20	40 (O)	—	—	—	0.3	50	—	500 (T)	TO-5
2N3563	NPN	200 (A)	125	30	12 (O)	20	200	8.0	—	—	20 (E)	600 (T)	TO-106
2N3564	NPN	200 (A)	125	30	15 (O)	20	500	15	0.3	20	20 (E)	400 (T)	TO-106
2N3700	NPN	500 (A)	200	140	80 (O)	100	300	150	0.2	150	80 (E)	100 (T)	TO-18
2N3701	NPN	500 (A)	200	140	80 (O)	40	120	150	0.2	150	30 (E)	80 (T)	TO-18
2N4121	PNP	200 (A)	125	40	40 (O)	70	—	10	—	—	50 (E)	400 (T)	TO-106
2N4122	PNP	200 (A)	125	40	40 (O)	150	—	10	—	—	150 (E)	450 (T)	TO-106
2N4140	NPN	300 (A)	125	60	30 (O)	—	120	150	—	—	—	250 (T)	RO-110
2N4141	NPN	300 (A)	125	60	30 (O)	—	300	150	—	—	—	250 (T)	RO-110
2N4142	PNP	300 (A)	125	60	40 (O)	—	120	150	—	—	—	200 (T)	RO-110
2N4143	PNP	300 (A)	125	60	40 (O)	—	300	150	—	—	—	200 (T)	RO-110
2N4228	PNP	300 (A)	125	60	40 (O)	—	150	150	—	—	—	200 (T)	RO-110
2N4383	NPN	800 (A)	200	40	30 (O)	—	—	—	—	—	1000 (E)	120 (T)	TO-5
2N4384	NPN	500 (A)	200	40	30 (O)	—	—	—	—	—	1000 (E)	120 (T)	TO-18
2N4385	NPN	800 (A)	200	40	30 (O)	—	—	—	—	—	1000 (E)	120 (T)	TO-5
2N4386	NPN	500 (A)	200	40	30 (O)	—	—	—	—	—	1000 (E)	120 (T)	TO-18
2N4412	PNP	600 (A)	200	40	30 (O)	—	—	—	—	—	1000 (E)	100 (T)	TO-5
2N4412A	PNP	600 (A)	200	60	60 (O)	—	—	—	—	—	120 (E)	20 (T)	TO-5
2N4413	PNP	400 (A)	200	40	30 (O)	—	—	—	—	—	1000 (E)	100 (T)	TO-18
2N4413A	PNP	400 (A)	200	60	60 (O)	—	—	—	—	—	120 (E)	20 (T)	TO-18
2N4414	PNP	600 (A)	200	40	30 (O)	—	—	—	—	—	1000 (E)	100 (T)	TO-5
2N4414A	PNP	600 (A)	200	60	60 (O)	—	—	—	—	—	100 (E)	20 (T)	TO-5
2N4415	PNP	400 (A)	200	40	30 (O)	—	—	—	—	—	1000 (E)	100 (T)	TO-18
2N4415A	PNP	400 (A)	200	60	60 (O)	—	—	—	—	—	100 (E)	20 (T)	TO-18

** GHz

general purpose — alloy

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N327A	PNP	385 (A)	160	50	40 (O)	9.0	22	3.0	0.3	5.0	—	—	TO-5
2N327B	PNP	385 (A)	200	50	40 (O)	9.0	22	3.0	0.3	5.0	—	—	TO-5
2N328A	PNP	385 (A)	160	50	35 (O)	18	44	3.0	0.5	10	—	—	TO-5
2N328B	PNP	385 (A)	200	50	35 (O)	18	44	3.0	0.5	10	—	—	TO-5
2N329A	PNP	385 (A)	160	50	30 (O)	36	88	3.0	0.6	15	—	—	TO-5
2N329B	PNP	385 (A)	200	50	30 (O)	36	88	3.0	0.6	15	—	—	TO-5
2N330A	PNP	385 (A)	160	50	30 (O)	—	—	—	—				
2N923	PNP	250 (A)	200	40	25 (O)	—	—	—	0.5	5.0	12 (E)	0.8 (B)	TO-18
2N924	PNP	250 (A)	200	40	25 (O)	9.0	—	5.0	—	5.0	24 (E)	0.8 (B)	TO-18
2N925	PNP	250 (A)	200	50	40 (O)	—	—	—	0.5	5.0	10 (E)	0.8 (B)	TO-18
2N926	PNP	250 (A)	200	50	40 (O)	—	—	—	0.5	5.0	20 (E)	0.8 (B)	TO-18
2N927	PNP	250 (A)	200	70	60 (O)	—	—	—	0.5	5.0	8 (E)	0.8 (B)	TO-18
2N928	PNP	250 (A)	200	70	60 (O)					5.0	18 (E)	0.8 (B)	TO-18
2N935	PNP	250 (A)	160	50	40 (O)	9	22	—	0.3	5.0	—	—	TO-18
2N936	PNP	250 (A)	160	50	35 (O)	18	44	—	0.5	5.0	—	—	TO-18



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general purpose alloy—(cont'd)

Type	Polarity	Power Dissipation @ 25°C (mW) NOTE 1	T_J (°C)	BV_{CBO} (volts)	BV_{CE}— (volts) NOTE 2	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE\ (SAT)}$ @ I_C (volts)	$V_{CE\ (SAT)}$ @ I_C (mA)	hf— NOTE 3	f— (MHz) NOTE 4	Case Style
2N937	PNP	250 (A)	160	50	30 (O)	36	88	—	0.6	5.0	—	—	TO-18
2N938	PNP	250 (A)	175	40	35 (O)	—	—	—	0.3	5.0	9.0 (E)	1.0 (B)	TO-18
2N939	PNP	250 (A)	175	40	35 (O)	—	—	—	0.3	5.0	18 (E)	2.0 (B)	TO-18
2N940	PNP	250 (A)	175	40	35 (O)	—	—	—	0.3	5.0	36 (E)	2.0 (B)	TO-18
2N1024	PNP	250 (A)	175	18	15 (U)	—	—	—	—	—	9.0 (E)	1.0 (B)	TO-5
2N1025	PNP	250 (A)	175	40	35 (U)	—	—	—	—	—	9.0 (E)	1.0 (B)	TO-5
2N1026	PNP	250 (A)	175	40	35 (U)	—	—	—	—	—	18 (E)	2.0 (B)	TO-5
2N1027	PNP	250 (A)	175	18	15 (U)	—	—	—	—	—	18 (E)	4.0 (B)	TO-5
2N1028	PNP	250 (A)	175	12	10 (U)	—	—	—	—	—	9.0 (E)	7.2 (T)	TO-5
2N1118	PNP	150 (A)	140	25	25 (U)	—	—	—	—	—	15 (E)	8.0 (M)	TO-5
2N1118A	PNP	150 (A)	140	25	25 (U)	—	25	15	—	—	15 (E)	8.0 (M)	TO-5
2N1119	PNP	150 (A)	140	10	10 (U)	15	—	15	0.15	5.0	—	7.2 (T)	TO-5
2N1219	PNP	250 (A)	175	30	25 (O)	18	—	5.0	—	—	—	5.0 (B)	TO-5
2N1220	PNP	250 (A)	175	30	25 (O)	—	—	—	0.5	—	—	2.0 (B)	TO-5
2N1221	PNP	250 (A)	175	30	25 (O)	—	—	—	—	—	18 (E)	5.0 (B)	TO-5
2N1222	PNP	250 (A)	175	30	25 (O)	—	—	—	—	—	9.0 (E)	2.0 (B)	TO-5
2N1223	PNP	250 (A)	175	40	40 (O)	—	—	—	—	—	6.0 (E)	—	TO-5
2N1228	PNP	400 (A)	160	15	15 (O)	—	—	—	0.2	10	14 (E)	—	TO-5
2N1229	PNP	400 (A)	160	15	15 (O)	—	—	—	0.2	10	28 (E)	—	TO-5
2N1230	PNP	400 (A)	160	35	35 (O)	—	—	—	0.2	10	14 (E)	—	TO-5
2N1231	PNP	400 (A)	160	35	35 (O)	—	—	—	0.2	10	28 (E)	—	TO-5
2N1232	PNP	400 (A)	160	60	60 (O)	—	—	—	0.2	10	14 (E)	—	TO-5
2N1233	PNP	400 (A)	160	60	60 (O)	—	—	—	0.2	10	28 (E)	—	TO-5
2N1234	PNP	400 (A)	160	110	110 (O)	—	—	—	0.2	10	14 (E)	—	TO-5
2N1238	PNP	1000 (A)	160	15	15 (O)	—	—	—	0.2	10	14 (E)	—	X-3
2N1239	PNP	1000 (A)	160	15	15 (O)	—	—	—	0.2	10	28 (E)	—	X-3
2N1240	PNP	1000 (A)	160	35	35 (O)	—	—	—	0.2	10	14 (E)	—	X-3
2N1241	PNP	1000 (A)	160	35	35 (O)	—	—	—	0.2	10	28 (E)	—	X-3
2N1242	PNP	1000 (A)	160	60	60 (O)	—	—	—	0.2	10	14 (E)	—	X-3
2N1243	PNP	1000 (A)	160	60	60 (O)	—	—	—	0.2	10	28 (E)	—	X-3
2N1244	PNP	1000 (A)	160	110	110 (O)	—	—	—	0.2	10	14 (E)	—	X-3
2N1275	PNP	250 (A)	160	100	80 (O)	9	25	1.0	0.3	5.0	—	100* (B)	TO-5
2N1429	PNP	100 (A)	140	6	6 (O)	12	—	5.0	0.1	5.0	25 (E)	16 (T)	TO-5
2N1439	PNP	400 (A)	200	50	50 (O)	—	—	—	0.25	5.0	9.0 (E)	0.5 (B)	TO-5
2N1440	PNP	400 (A)	200	60	50 (O)	—	—	—	0.25	5.0	9.0 (E)	1.0 (B)	TO-5
2N1441	PNP	400 (A)	200	50	35 (O)	—	—	—	0.25	5.0	18 (E)	1.0 (B)	TO-5
2N1442	PNP	400 (A)	200	50	30 (O)	—	—	—	0.25	5.0	30 (E)	1.0 (B)	TO-5
2N1443	PNP	400 (A)	200	50	15 (O)	—	—	—	0.25	5.0	50 (E)	1.0 (B)	TO-5
2N1469	PNP	250 (A)	175	40	35 (U)	—	—	—	—	—	36 (E)	2.0 (B)	TO-5
2N1474	PNP	250 (A)	175	60	60 (U)	—	—	—	—	—	12 (E)	1.0 (B)	TO-5
2N1474A	PNP	250 (A)	175	60	60 (U)	—	—	—	—	—	18 (E)	2.0 (B)	TO-5
2N1475	PNP	250 (A)	175	60	60 (U)	—	—	—	—	—	36 (E)	1.0 (B)	TO-5
2N1476	PNP	250 (A)	175	100	100 (U)	—	—	—	—	—	12 (E)	1.0 (B)	TO-5
2N1477	PNP	250 (A)	175	100	100 (U)	—	—	—	—	—	30 (E)	1.0 (B)	TO-5
2N1623	PNP	250 (A)	160	50	20 (O)	9.0	40	1.0	0.3	5.0	—	100* (B)	TO-5
2N1643	PNP	250 (A)	160	25	25 (U)	10	25	.100	—	—	—	—	TO-5
2N1654	PNP	250 (A)	160	100	80 (O)	20	45	1.0	0.3	5.0	—	100* (B)	TO-5
2N1655	PNP	250 (A)	160	125	100 (O)	10	22	1.0	0.3	5.0	—	100* (B)	TO-5
2N1656	PNP	250 (A)	160	125	100 (O)	20	45	1.0	0.3	5.0	—	100* (B)	TO-5
2N2175	PNP	100 (A)	175	6	6 (O)	30	—	.020	—	—	—	10 (T)	TO-5
2N2176	PNP	100 (A)	175	6	6 (O)	30	—	.020	—	—	—	10 (T)	TO-18
2N2177	PNP	100 (A)	160	6	6 (O)	15	—	.005	—	—	50 (E)	8.0 (B)	TO-5
2N2168	PNP	100 (A)	160	6	6 (O)	15	—	.005	—	—	50 (E)	8.0 (B)	TO-18
2N3342	PNP	250 (A)	175	20	8 (O)	30	—	5.0	0.1	5.0	—	—	TO-5
2N3343	PNP	25 (A)	175	25	8 (O)	20	—	.25	—	—	—	2.0 (T)	TO-5
2N3344	PNP	250 (A)	175	30	30 (O)	25	—	1.0	—	—	—	2.0 (T)	TO-5
2N3345	PNP	250 (A)	175	50	50 (O)	15	—	1.0	—	—	—	2.0 (T)	TO-5
2N3346	PNP	250 (A)	175	50	50 (O)	25	—	1.0	—	—	—	2.0 (T)	TO-5

* KHz

PNP silicon alloy transistors—coaxial package (X-3) Hughes house types

Type	Power Dissipation $T_A = 25°C$ (mw)	Maximum Voltages BV_{CBO} (Volts)	BV_{CEO} (Volts)	BV_{EBO} (Volts)	I_{CBO}, I_{EBO} Max. (μA)	h_{fe} or h_{FE} Min.	Max.	@ I_C (mA)	V_{CE} (Volts)	$V_{CE\ (SAT)}$ Max. (Volts)	@ I_C (mA)	I_B (mA)	C_{obo} Max. (pf)
HA7520	1000	—35	—35	—35	—0.1	5	18	—1.0	—5.0	—2.0	—100	—50	95
HA7521	1000	—60	—60	—60	—0.1	5	18	—1.0	—5.0	—2.0	—100	—50	95
HA7522	1000	—15	—15	—15	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7523	1000	—35	—35	—35	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7524	1000	—60	—60	—60	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7525	1000	—110	—110	—110	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7526	1000	—15	—15	—15	—0.1	28	65	—1.0	—5.0	—2.0	—100	—25	95
HA7527	1000	—35	—35	—35	—0.1	28	65	—1.0	—5.0	—2.0	—100	—25	95
HA7528	1000	—60	—60	—60	—0.1	28	65	—1.0	—5.0	—2.0	—100	—25	95
HA7529	1000	—90	—90	—90	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7597	400	—50	—40	—20	—0.1	9	22	—0.1	—0.5	—0.3	—5	—2	95
HA7598	400	—50	—35	—20	—0.1	18	44	—0.1	—0.5	—0.5	—10	—2	95
HA7599	400	—50	—30	—20	—0.1	36	88	—0.1	—0.5	—0.6	—15	—2	95

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HUGHES AIRCRAFT COMPANY
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silicon transistors cont'd

silicon small signal transistors

PNP silicon alloy general purpose transistors—TO-5 case style

Hughes house types

Type	Power Dissipation $T_A = 25°C$ (mw)	Maximum Voltages BV_{CBO} (Volts)	BV_{CEO} (Volts)	BV_{EBO} (Volts)	I_{CBO}, I_{EBO} Max. (μA)	h_{fe} or h_{FE} Min.	Max.	@ I_C (mA)	V_{CE} (Volts)	$V_{CE\ (SAT)}$ Max. (Volts)	@ I_C (mA)	I_B (mA)	C_{obo} Max. (pf)
HA7530	400	—35	—35	—35	—0.1	5	18	—1.0	—5.0	—2.0	—100	—50	95
HA7531	400	—60	—60	—60	—0.1	5	18	—1.0	—5.0	—2.0	—100	—50	95
HA7532	400	—15	—15	—15	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7533	400	—35	—35	—35	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7534	400	—60	—60	—60	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7535	400	—110	—110	—110	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95
HA7536	400	—15	—15	—15	—0.1	28	65	—1.0	—5.0	—2.0	—100	—25	95
HA7537	400	—35	—35	—35	—0.1	28	65	—1.0	—5.0	—2.0	—100	—25	95
HA7538	400	—60	—60	—60	—0.1	28	65	—1.0	—5.0	—2.0	—100	—25	95
HA7539	400	—90	—90	—90	—0.1	14	32	—1.0	—5.0	—2.0	—100	—33	95

high speed switches & amplifiers

Type	Polarity	Power Dissipation @ 25°C (mw) NOTE 1	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts) NOTE 2	h_{FE} @ I_C (Min.)	(Max.)	(mA)	$V_{CE\ (SAT)}$ @ I_C (volts)	(mA)	hf— NOTE 3	f— (MHz) NOTE 4	Case Style
2N117	NPN	150 (C)	150	30	—	—	—	—	—	—	0.9 (B)	1.0 (B)	OV-9
2N118	NPN	150 (C)	150	30	—	—	—	—	—	—	0.95 (B)	2.0 (B)	OV-9
2N118A	NPN	150 (C)	150	45	—	—	—	—	—	—	—	—	OV-9
2N119	NPN	150 (C)	150	30	—	—	—	—	—	—	0.974 (B)	2.0 (B)	OV-9
2N560	NPN	500 (A)	150	—	60 (S)	20	—	100	0.5	10	—	—	TO-29
2N706	NPN	300 (A)	175	25	20 (R)	20	—	10	0.6	10	—	200 (T)	TO-18
2N706A	NPN	300 (A)	175	25	20 (R)	20	60	10	0.6	10	—	200 (T)	TO-18
2N708	NPN	360 (A)	200	40	20 (R)	30	120	10	0.4	10	—	300 (T)	TO-18
2N709	NPN	300 (A)	200	15	6.0 (O)	20	120	10	0.3	3.0	—	600 (T)	TO-18
2N709A	NPN	300 (A)	200	15	6.0 (O)	30	90	10	0.3	3.0	—	800 (T)	TO-18
2N710A	PNP	150 (A)	100	15	15 (S)	25	—	10	0.5	10	—	—	TO-18
2N728	NPN	4.0 (A)	175	15	15 (O)	20	200	10	0.7	10	—	100 (T)	TO-18
2N729	NPN	4.0 (A)	175	30	30 (O)	20	200	10	0.7	10	—	100 (T)	TO-18
2N743	NPN	300 (A)	200	20	12 (O)	20	60	10	0.35	10	—	200 (T)	TO-18
2N744	NPN	300 (A)	175	20	12 (O)	40	120	10	0.35	10	—	300 (T)	TO-18
2N753	NPN	300 (A)	175	—	20 (R)	40	120	10	0.6	10	—	200 (T)	TO-18
2N784	NPN	300 (A)	175	30	15 (R)	25	—	10	0.19	10	—	200 (T)	TO-18
2N834	NPN	300 (A)	175	40	30 (S)	25	—	10	0.25	10	—	350 (T)	TO-18
2N835	NPN	300 (A)	175	25	20 (O)	20	—	10	0.3	10	—	300 (T)	TO-18
2N914	NPN	360 (A)	200	40	20 (R)	30	120	10	0.7	200	—	300 (T)	TO-18
2N964	PNP	150 (A)	100	15	15 (S)	40	—	10	0.18	10	—	300 (T)	TO-18
2N976	PNP	100 (A)	100	15	10 (O)	30	—	20	0.17	20	—	249 (T)	TO-18
2N979	PNP	60 (A)	100	20	15 (O)	30	—	10	0.25	10	—	100 (T)	TO-18
2N980	PNP	60 (A)	100	20	12 (O)	30	—	10	0.25	10	—	100 (T)	TO-18
2N982	PNP	60 (A)	100	20	15 (O)	50	—	10	0.125	10	—	—	TO-18
2N983	PNP	60 (A)	100	15	15 (O)	40	—	10	0.15	10	—	—	TO-18
2N984	PNP	60 (A)	100	15	10 (O)	50	—	10	0.18	10	—	—	TO-18
2N1254	PNP	275 (A)	200	30	30 (O)	25	50	10	0.3	10	—	30 (T)	TO-5
2N1255	PNP	275 (A)	200	30	30 (O)	40	80	10	0.3	10	—	50 (T)	TO-5
2N1256	PNP	275 (A)	200	40	40 (O)	25	50	10	0.3	10	—	30 (T)	TO-5
2N1257	PNP	275 (A)	200	40	40 (O)	40	80	10	0.3	10	—	50 (T)	TO-5
2N1258	PNP	275 (A)	200	30	30 (O)	75	150	10	0.6	10	—	50 (T)	TO-5
2N1259	PNP	275 (A)	200	50	50 (O)	25	100	10	0.3	10	—	40 (T)	TO-5
2N1708	NPN	1000 (C)	175	25	12 (O)	20	—	10	0.22	10	—	200 (T)	TO-46
2N1837	NPN	800 (A)	300	80	30 (O)	40	120	150	0.8	150	—	140 (T)	TO-5
2N1837A	NPN	800 (A)	175	80	30 (O)	40	120	150	0.8	150	—	140 (T)	TO-5
2N1838	NPN	600 (A)	175	45	20 (O)	40	150	100	1.4	100	—	90 (T)	TO-5
2N1839	NPN	600 (A)	175	45	20 (O)	12	50	100	1.4	150	—	90 (T)	TO-5
2N1840	NPN	600 (A)	175	25	15 (O)	10	100	150	1.4	150	—	90 (T)	TO-5
2N1958	NPN	600 (A)	175	60	40 (R)	20	60	150	.45	150	—	100 (T)	TO-5
2N1958A	NPN	600 (A)	175	60	40 (R)	20	60	150	.45	150	—	100 (T)	TO-5
2N1959	NPN	600 (A)	175	60	40 (R)	40	120	150	.45	—	1.0 (E)	—	TO-5
2N2192	NPN	800 (A)	200	60	40 (O)	100	300	150	.35	150	—	—	TO-5
2N2192A	NPN	800 (A)	200	60	40 (O)	100	300	150	0.25	150	—	—	TO-5
2N2192B	NPN	800 (A)	200	60	40 (O)	100	300	150	.18	150	—	—	TO-5
2N2193	NPN	800 (A)	200	60	50 (O)	40	120	150	.35	150	—	—	TO-5
2N2193A	NPN	800 (A)	200	80	50 (O)	40	120	150	.25	150	—	—	TO-5
2N2193B	NPN	800 (A)	200	80	50 (O)	40	120	150	.18	150	—	—	TO-5
2N2194	NPN	800 (A)	200	60	40 (O)	20	60	150	.35	150	—	—	TO-5
2N2194A	NPN	800 (A)	200	40	60 (O)	20	60	150	.25	150	—	—	TO-5
2N2194B	NPN	800 (A)	200	60	40 (O)	20	60	150	1.8	150	—	—	TO-5
2N2195	NPN	800 (A)	200	45	25 (O)	20	—	150	.35	150	—	—	TO-5
2N2195A	NPN	800 (A)	200	45	25 (O)	20	—	150	.25	150	—	—	TO-5
2N2195B	NPN	800 (A)	200	45	25 (O)	20	—	150	.18	150	—	—	TO-5
2N2217	NPN	800 (A)	175	60	30 (O)	20	60	150	0.4	150	—	250 (T)	TO-5



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silicon transistors cont'd

silicon small signal transistors

high speed switches & amplifiers—(cont'd)

Type	Polarity	Power Dissipation @ 25°C (mw) NOTE 1	T_J (°C)	BV_{CBO} (volts)	BV_{CE}— (volts) NOTE 2	h_{FE} @ I_C (Min.)	(Max.)	(mA)	$V_{CE\ (SAT)}$ @ I_C (volts)	(mA)	hf— NOTE 3	f— (MHz) NOTE 4	Case Style
2N2218	NPN	800 (A)	175	60	30 (O)	40	120	150	0.4	150	—	250 (T)	TO-5
2N2218A	NPN	800 (A)	175	75	40 (O)	40	120	150	0.3	150	30 (E)	250 (T)	TO-5
2N2219	NPN	800 (A)	175	60	30 (O)	100	300	150	0.4	150	—	250 (T)	TO-5
2N2219A	NPN	800 (A)	175	75	40 (O)	100	200	150	0.3	150	50 (E)	300 (T)	TO-5
2N2220	NPN	500 (A)	175	60	30 (O)	20	60	150	0.4	150	—	250 (T)	TO-18
2N2221	NPN	500 (A)	175	60	30 (O)	40	120	150	0.4	150	—	250 (T)	TO-18
2N2221A	NPN	500 (A)	175	75	40 (O)	40	120	150	0.3	150	30 (E)	250 (T)	TO-18
2N2222	NPN	500 (A)	175	60	30 (O)	100	300	150	0.4	150	—	250 (T)	TO-18
2N2222A	NPN	500 (A)	175	75	40 (O)	100	300	150	0.3	150	50 (E)	300 (T)	TO-18
2N2243	NPN	800 (A)	200	120	80 (O)	40	120	150	0.35	150	—	50 (T)	TO-5
2N2243A	NPN	800 (A)	200	120	80 (O)	40	120	150	0.25	150	—	50 (T)	TO-5
2N2350	NPN	400 (A)	200	60	40 (O)	100	300	150	0.35	150	2.5 (E)	—	TO-46
2N2350A	NPN	400 (A)	200	60	40 (O)	100	300	150	0.25	150	2.5 (E)	—	TO-46
2N2351	NPN	400 (A)	200	80	50 (O)	40	120	150	0.35	150	2.5 (E)	—	TO-46
2N2351A	NPN	400 (A)	200	80	50 (O)	40	120	150	0.25	150	2.5 (E)	—	TO-46
2N2352	NPN	400 (A)	200	60	40 (O)	20	60	150	0.35	150	2.5 (E)	—	TO-46
2N2352A	NPN	400 (A)	200	60	40 (O)	20	60	150	0.25	150	2.5 (E)	—	TO-46
2N2353	NPN	400 (A)	200	45	25 (O)	20	—	150	0.35	150	2.5 (E)	—	TO-46
2N2353A	NPN	400 (A)	200	45	25 (O)	20	—	150	0.25	150	2.5 (E)	—	TO-46
2N2364	NPN	400 (A)	200	120	80 (O)	40	120	150	0.35	150	—	50 (T)	TO-46
2N2364A	NPN	400 (A)	200	120	80 (O)	40	120	150	0.25	150	—	50 (T)	TO-46
2N2368	NPN	360 (A)	200	40	40 (S)	20	60	10	0.25	10	—	400 (T)	TO-18
2N2369	NPN	360 (A)	200	40	40 (S)	40	120	10	0.25	10	—	500 (T)	TO-18
2N2369A	NPN	360 (A)	200	40	40 (S)	—	120	10	0.2	10	—	500 (T)	TO-18
2N2410	NPN	800 (A)	200	60	30 (O)	30	120	10	—	—	—	200 (T)	TO-5
2N2411	PNP	300 (A)	200	25	20 (O)	20	60	10	0.2	10	—	140 (T)	TO-18
2N2412	PNP	300 (A)	200	25	20 (O)	40	120	10	0.2	10	—	140 (T)	TO-18
2N2440	NPN	300 (A)	200	120	80 (O)	100	300	150	0.4	50	50 (E)	90 (T)	TO-18
2N2475	NPN	300 (A)	200	15	6 (O)	20	20	50	—	—	6 (E)	—	TO-18
2N2476	NPN	600 (C)	200	60	20 (O)	20	—	150	0.4	150	—	250 (T)	TO-5
2N2477	NPN	600 (C)	200	60	20 (O)	40	—	150	0.4	150	—	250 (T)	TO-5
2N2481	NPN	360 (C)	200	40	15 (O)	40	120	10	0.25	10	—	300 (T)	TO-18
2N2537	NPN	800 (A)	200	60	30 (O)	50	150	150	0.45	150	—	250 (T)	TO-5
2N2538	NPN	800 (A)	200	60	30 (O)	100	300	150	0.45	150	—	250 (T)	TO-5
2N2539	NPN	500 (A)	200	60	30 (O)	50	150	150	0.45	150	—	250 (T)	TO-18
2N2540	NPN	500 (A)	200	60	30 (O)	100	300	150	0.45	150	—	250 (T)	TO-18
2N2784	NPN	200) (C)	200	15	6 (O)	40	—	30	0.26	3.0	—	1.0* (T)	TO-18
2N2800	PNP	800 (A)	200	50	35 (O)	30	90	150	0.4	150	—	120 (T)	TO-5
2N2801	PNP	800 (A)	200	50	35 (O)	75	225	150	0.4	150	—	120 (T)	TO-5
2N2837	PNP	500 (A)	200	50	35 (O)	30	90	150	0.4	150	—	120 (T)	TO-18
2N2838	PNP	500 (A)	200	50	35 (O)	75	225	150	0.4	150	—	120 (T)	TO-18
2N2849	NPN	850 (A)	200	100	80 (O)	100	300	1.0	0.4	1.0	—	30 (T)	RO-61
2N2850	NPN	850 (A)	200	100	80 (O)	40	120	1.0	0.25	1.0	—	30 (T)	RO-61
2N2851	NPN	850 (A)	200	100	80 (O)	40	120	1.0	0.4	1.0	—	30 (T)	RO-61
2N2852	NPN	850 (A)	200	100	80 (O)	20	60	1.0	0.4	1.0	—	30 (T)	RO-61
2N2853	NPN	850 (A)	200	60	40 (O)	40	—	1.0	1.5	5.0	—	30 (T)	RO-61
2N2854	NPN	850 (A)	200	60	40 (O)	100	300	1.0	0.4	1.0	—	30 (T)	RO-61
2N2855	NPN	850 (A)	200	60	40 (O)	40	120	1.0	0.4	1.0	—	30 (T)	RO-61
2N2856	NPN	850 (A)	200	60	40 (O)	20	60	1.0	0.4	1.0	—	30 (T)	RO-61
2N2868	NPN	800 (A)	200	60	40 (O)	40	120	150	0.25	150	—	50 (T)	TO-5
2N2904	PNP	600 (C)	200	60	40 (O)	40	120	150	0.4	150	—	200 (T)	TO-5
2N2904A	PNP	600 (C)	200	60	60 (O)	40	120	150	0.4	150	—	200 (T)	TO-5
2N2905	PNP	600 (C)	200	60	40 (O)	100	300	150	0.4	150	—	200 (T)	TO-5
2N2905A	PNP	600 (C)	200	60	60 (O)	100	300	150	0.4	150	—	200 (T)	TO-5
2N2906	PNP	400 (C)	200	60	40 (O)	40	120	150	0.4	150	—	200 (T)	TO-18
2N2906A	PNP	400 (C)	200	60	60 (O)	40	120	150	0.4	150	—	200 (T)	TO-18
2N2907	PNP	150 (C)	200	60	40 (O)	100	300	150	0.4	150	—	200 (T)	TO-18
2N2907A	PNP	150 (C)	200	60	60 (O)	100	300	150	0.4	150	—	200 (T)	TO-18
2N2958	NPN	600 (C)	200	60	20 (O)	40	120	150	0.5	150	—	250 (T)	TO-5
2N2959	NPN	600 (C)	200	60	20 (O)	100	300	150	0.5	150	—	250 (T)	TO-5
2N3009	NPN	360 (A)	200	40	15 (O)	30	120	30	0.18	30	—	350 (T)	TO-52
2N3010	NPN	300 (A)	200	15	6 (O)	25	125	10	0.25	10	—	600 (T)	TO-18
2N3011	NPN	360 (A)	200	30	12 (O)	30	120	10	0.2	10	—	400 (T)	TO-18
2N3012	PNP	360 (A)	200	12	12 (O)	30	120	30	0.15	10	—	400 (T)	TO-18
2N3013	NPN	360 (A)	200	40	15 (O)	30	120	30	0.18	30	—	350 (T)	TO-52
2N3014	NPN	360 (A)	200	40	20 (O)	30	120	30	0.18	10	—	350 (T)	TO-52
2N3115	NPN	400 (A)	200	60	20 (O)	40	120	150	0.5	150	—	250 (T)	TO-18
2N3116	NPN	400 (A)	200	60	20 (O)	100	300	150	0.5	150	—	250 (T)	TO-18
2N3133	PNP	600 (A)	200	50	35 (O)	40	120	150	0.6	150	—	200 (T)	TO-5
2N3134	PNP	600 (A)	200	50	35 (O)	100	300	150	0.6	150	—	200 (T)	TO-5
2N3135	PNP	600 (A)	200	50	35 (O)	40	120	150	0.6	150	—	200 (T)	TO-18
2N3136	PNP	400 (A)	200	50	35 (O)	100	300	150	0.6	150	—	200 (T)	TO-18
2N3248	PNP	360 (A)	200	15	12 (O)	50	150	0.1	0.125	10	—	250 (T)	TO-18
2N3249	PNP	360 (A)	200	15	12 (O)	100	300	0.1	0.125	10	—	300 (T)	TO-18
2N3250	PNP	360 (A)	200	50	40 (O)	50	150	10	0.25	10	50 (E)	250 (T)	TO-18

HUGHES SEMICONDUCTORS
HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION
500 Superior Avenue • Newport Beach, California 92663

silicon transistors cont'd

silicon small signal transistors
high speed switches & amplifiers—(cont'd)

Type	Polarity	Power Dissipation @ 25°C (mw)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N3250A	PNP	360 (A)	200	60	60 (O)	50	150	10	0.25	10	50 (E)	250 (T)	TO-18
2N3251	PNP	360 (A)	200	50	40 (O)	100	300	10	0.25	10	100 (E)	300 (T)	TO-18
2N3251A	PNP	360 (A)	200	60	60 (O)	100	300	10	0.25	10	100 (E)	300 (T)	TO-18
2N3299	NPN	800 (A)	200	60	30 (O)	40	120	150	0.22	150	—	250 (T)	TO-5
2N3300	NPN	800 (A)	200	60	30 (O)	100	300	150	0.22	150	—	250 (T)	TO-5
2N3301	NPN	360 (A)	200	60	30 (O)	40	120	150	0.22	150	—	250 (T)	TO-18
2N3302	NPN	360 (A)	200	60	30 (O)	100	300	150	0.22	150	—	250 (T)	TO-18
2N3502	PNP	700 (A)	200	45	45 (O)	115	300	50	0.25	50	135 (E)	200 (T)	TO-5
2N3503	PNP	700 (A)	200	60	60 (O)	115	300	50	0.25	50	135 (E)	200 (T)	TO-5
2N3504	PNP	400 (A)	200	45	45 (O)	115	300	50	0.25	50	135 (E)	200 (T)	TO-18
2N3505	PNP	400 (A)	200	60	60 (O)	115	300	50	0.25	50	135 (E)	200 (T)	TO-18
2N3633	NPN	300 (A)	200	15	6 (O)	50	150	10	0.21	3.0	—	1.3*(T)	TO-18
2N3638	PNP	300 (A)	125	25	25 (O)	30	—	50	0.25	50	25 (E)	100 (T)	TO-105
2N3638A	PNP	300 (A)	125	25	25 (O)	100	—	50	0.25	50	100 (E)	150 (T)	TO-105
2N3639	PNP	200 (A)	125	6	6 (O)	30	120	10	0.16	10	—	500 (T)	TO-106
2N3640	PNP	200 (A)	125	12	12 (O)	30	120	10	0.2	10	—	500 (T)	TO-106
2N3641	NPN	350 (A)	125	60	30 (O)	40	120	150	0.22	150	—	250 (T)	TO-105
2N3642	NPN	350 (A)	125	60	45 (O)	40	120	150	0.22	150	—	250 (T)	TO-105
2N3643	NPN	350 (A)	125	60	30 (O)	100	100	150	0.22	150	—	250 (T)	TO-105
2N3644	PNP	300 (A)	125	45	45 (O)	115	300	50	0.25	50	—	200 (T)	TO-105
2N3645	PNP	300 (A)	125	60	60 (O)	115	300	50	0.25	50	—	200 (T)	TO-105
2N3646	NPN	200 (A)	125	40	15 (O)	30	120	30	0.2	30	—	350 (T)	TO-106
2N3647	NPN	400 (A)	200	40	10 (O)	25	150	150	0.25	10	20 (E)	450 (T)	TO-46
2N3648	NPN	400 (A)	200	40	15 (O)	30	120	150	0.25	10	20 (E)	450 (T)	TO-46
2N3671	PNP	600 (A)	200	60	50 (O)	75	225	150	0.4	150	—	200 (T)	TO-5
2N3672	PNP	400 (A)	200	60	50 (O)	75	225	150	0.4	150	—	200 (T)	TO-18
2N3673	PNP	350 (A)	200	60	50 (O)	75	225	150	0.4	150	—	200 (T)	TO-46
2N3724	NPN	800 (A)	200	50	30 (O)	60	150	100	0.2	100	—	300 (T)	TO-5
2N3725	NPN	800 (A)	200	80	50 (O)	60	150	100	0.26	100	—	300 (T)	TO-5
2N8362	NPN	360 (A)	200	50	20 (O)	50	150	10	0.25	10	—	600 (T)	TO-18
2N4013	NPN	360 (A)	200	60	40 (O)	—	150	100	—	—	—	300 (T)	TO-18
2N4014	NPN	360 (A)	200	80	50 (O)	—	150	100	—	—	—	300 (T)	TO-18
2N4034	PNP	360 (A)	200	40	40 (O)	70	200	10	0.13	1.0	50 (E)	400 (T)	TO-18
2N4274	NPN	280 (A)	125	30	12 (O)	18	—	100	—	—	—	400 (T)	TO-106
2N4275	NPN	280 (A)	125	40	15 (O)	18	—	100	—	—	—	400 (T)	TO-106

choppers

Type	Polarity	Power Dissipation @ 25°C (mw)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N941*	PNP	250 (A)	175	25	8 (U)	10	—	1.0	—	—	25 (E)	16 (T)	TO-18
2N942*	PNP	250 (A)	175	25	8 (U)	10	—	1.0	—	—	25 (E)	10 (T)	TO-18
2N943*	PNP	250 (A)	175	40	18 (O)	10	—	—	0.003	—	25 (E)	1.0 (B)	TO-18
2N944*	PNP	250 (A)	175	40	18 (O)	10	—	—	0.004	—	25 (E)	1.0 (B)	TO-18
2N945*	PNP	250 (A)	175	50	50 (O)	10	—	—	0.005	—	25 (E)	1.0 (B)	TO-18
2N946*	PNP	250 (A)	175	80	80 (O)	10	—	—	0.005	—	25 (E)	1.0 (B)	TO-18
2N1676	PNP	100 (A)	140	4.5	4.5 (U)	—	—	—	0.1	5.0	—	16 (T)	TO-5
2N1677	PNP	100 (A)	140	4.5	4.5 (U)	—	—	—	0.1	5.0	25 (E)	16 (T)	TO-5
2N1917*	PNP	250 (A)	175	25	8 (O)	—	—	—	—	—	25 (E)	16 (T)	TO-5
2N1918*	PNP	250 (A)	175	25	8 (O)	—	—	—	—	—	25 (E)	10 (T)	TO-5
2N1919*	PNP	250 (A)	175	40	18 (O)	—	—	—	.003	—	—	1.0 (B)	TO-5
2N1920*	PNP	250 (A)	175	40	18 (O)	—	—	—	.004	—	—	1.0 (B)	TO-5
2N1921	PNP	250 (A)	175	50	50 (O)	—	—	—	.005	—	—	1.0 (B)	TO-5
2N1922*	PNP	250 (A)	175	80	80 (O)	—	—	—	.005	—	—	1.0 (B)	TO-5
2N2002	PNP	250 (A)	200	30	5 (O)	—	—	—	—	—	—	—	TO-5
2N2003	PNP	250 (A)	200	30	5 (O)	—	—	—	—	—	—	—	TO-5
2N2004	PNP	250 (A)	175	50	15 (O)	12	—	1.0	—	—	15 (E)	.5 (B)	TO-5
2N2005	PNP	250 (A)	200	50	15 (O)	—	—	—	—	—	—	—	TO-5
2N2006	PNP	250 (A)	200	60	35 (O)	—	—	—	—	—	—	—	TO-5
2N2007	PNP	250 (A)	200	60	35 (O)	—	—	—	—	—	—	—	TO-5
2N2162	PNP	150 (A)	140	30	30 (O)	—	—	—	—	—	—	14 (T)	TO-5
2N2163	PNP	150 (A)	140	15	15 (O)	—	—	—	—	—	—	14 (T)	TO-5
2N2164	PNP	150 (A)	140	12	8 (O)	—	—	—	—	—	—	24 (T)	TO-5
2N2165	PNP	150 (A)	140	30	30 (O)	—	—	—	—	—	—	10 (T)	TO-5
2N2166	PNP	150 (A)	140	15	15 (O)	—	—	—	—	—	—	10 (T)	TO-5
2N2167	PNP	150 (A)	140	12	8 (O)	—	—	—	—	—	—	16 (T)	TO-5
2N2185	PNP	150 (A)	140	30	30 (O)	—	—	—	—	—	—	6.5 (T)	TO-18
2N2186**	PNP	150 (A)	140	30	30 (O)	—	—	—	—	—	—	6.5 (T)	TO-18
2N2187	PNP	150 (A)	140	30	30 (O)	—	—	—	—	—	—	6.5 (T)	TO-18
2N2274	PNP	150 (A)	140	25	25 (O)	10	—	5.0	—	—	—	6.0 (T)	TO-18

* Available in pairs
** Pair



hughes hot line
(800)854-3280 / in California (714)548-0671

silicon transistors cont'd

silicon small signal transistors

choppers — (cont'd)

Type	Polarity	Power Dissipation @ 25°C (mw)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N2275**	PNP	150 (A)	140	20	20 (O)	10	—	5.0	—	—	—	6.0 (T)	TO-18
2N2276	PNP	150 (A)	140	15	10 (O)	10	—	5.0	—	—	—	6.0 (T)	TO-18
2N2277**	PNP	150 (A)	140	15	10 (O)	10	—	5.0	—	—	—	6.0 (T)	TO-18
2N2278	PNP	150 (A)	140	15	15 (O)	—	—	—	—	—	—	7.6 (T)	TO-18
2N2279**	PNP	150 (A)	140	15	15 (O)	—	—	—	—	—	—	7.6 (T)	TO-18
2N2280	PNP	150 (A)	140	10	6 (O)	—	—	—	0.1	5.0	—	16 (T)	TO-18
2N2281**	PNP	150 (A)	140	10	6 (O)	—	—	—	0.1	5.0	—	16 (T)	TO-18
2N2330	NPN	800 (A)	150	30	20	50	—	10	—	—	—	100 (T)	TO-5
2N2331	NPN	500 (A)	150	30	20	50	—	10	—	—	—	100 (T)	TO-18
2N2332	NPN	800 (A)	200	15	15 (O)	—	—	—	—	—	—	—	TO-18
2N2333	NPN	150 (A)	200	15	5 (O)	—	—	—	—	—	—	—	TO-18
2N2334	NPN	150 (A)	200	30	15 (O)	—	—	—	—	—	—	—	TO-18
2N2335	NPN	150 (A)	200	30	15 (O)	—	—	—	—	—	—	—	TO-18
2N2336	NPN	150 (A)	200	50	35 (O)	—	—	—	—	—	—	—	TO-18
2N2337	NPN	150 (A)	200	50	35 (O)	—	—	—	—	—	—	—	TO-18
2N2432	NPN	300 (A)	175	30	30 (O)	50	—	1.0	0.15	10	—	20 (T)	TO-18
2N2432A	NPN	300 (A)	175	45	45 (O)	50	—	1.0	—	—	—	20 (T)	TO-18
2N2872	PNP	400 (A)	200	110	110 (O)	15	—	1.0	—	—	—	0.2 (T)	TO-77
2N2944	PNP	400 (A)	175	15	10 (O)	80	—	1.0	—	—	—	10 (T)	TO-46
2N2945	PNP	400 (A)	175	25	20 (O)	40	—	1.0	—	—	—	5.0 (T)	TO-46
2N2946	PNP	400 (A)	175	40	35 (O)	30	—	1.0	—	—	—	30.0 (T)	TO-46
2N3217	PNP	400 (A)	200	15	10 (O)	—	—	—	—	—	—	1.0 (T)	TO-46
2N3218	PNP	400 (A)	200	25	20 (O)	—	—	—	—	—	—	1.0 (T)	TO-46
2N3219	PNP	400 (A)	200	40	35 (O)	—	—	—	—	—	—	1.0 (T)	TO-46
2N3317	PNP	150 (A)	140	30	30 (O)	—	—	—	—	—	—	6.4 (T)	TO-18
2N3318	PNP	150 (A)	140	15	15 (O)	—	—	—	—	—	—	7.6 (T)	TO-18
2N3319	PNP	150 (A)	140	10	6 (O)	—	—	—	—	—	—	12 (T)	TO-18
2N3840	PNP	400 (A)	200	50	50 (O)	30	—	0.2	0.1	5.0	—	6.0 (T)	TO-46
2N3841	PNP	300 (A)	200	100	100 (O)	15	—	0.2	0.12	5.0	—	1.5 (T)	TO-18
2N3842	PNP	300 (A)	200	120	120 (O)	10	—	1.0	—	5.0	—	1.0 (T)	TO-72
2N3910	PNP	500 (A)	200	60	50 (O)	40	160	1.0	0.3	10.0	—	4.0 (T)	TO-46
2N3911	PNP	500 (A)	200	60	40 (O)	60	240	1.0	0.3	10.0	—	8.0 (T)	TO-46
2N3912	PNP	500 (A)	200	60	30 (O)	90	—	1.0	0.3	10.0	—	10 (T)	TO-46
2N3913	PNP	400 (A)	200	60	50 (O)	40	160	1.0	0.3	10.0	—	4.0 (T)	TO-18
2N3914	PNP	400 (A)	200	60	40 (O)	60	240	1.0	0.3	10.0	—	8.0 (T)	TO-18
2N3915	PNP	400 (A)	200	60	30 (O)	90	—	1.0	0.3	—	—	10 (T)	TO-18
2N3978	PNP	400 (A)	200	20	20 (O)	30	—	5.0	0.15	5.0	—	1.0 (T)	TO-46
2N3979	PNP	400 (A)	200	40	35 (O)	20	—	5.0	0.15	5.0	—	1.0 (T)	TO-46

* Available in pairs
** Pair

dual emitter integrated choppers
TO-72 case style

Type	Polarity	BV_{EEO} (volts)	BV_{CBO} (volts)	I_{EEO} (nA) @ V_{EE} (volts)	V_O Offset Voltage (μV) —25 to +100°C @ I_B, Base Current (mA)	V_O/T (μV/°C) @ I_B, Base Current (mA)	R_D (ohms) @ I_B, Base Current (mA)	Ceb (pf) @ V_{EB} (volts)
3N62	NPN	6	10	5 @ 5	200 @ 2	—	100 @ 2	5 @ 5
3N64	NPN	6	10	5 @ 5	100 @ 2	—	100 @ 2	5 @ 5
3N64	NPN	6	10	5 @ 5	50 @ 2	—	100 @ 2	5 @ 5
3N65	NPN	10	10	5 @ 5	200 @ 2	—	100 @ 2	5 @ 5
3N66	NPN	10	10	5 @ 5	100 @ 2	—	100 @ 2	5 @ 5
3N67	NPN	10	10	5 @ 5	50 @ 2	—	100 @ 2	5 @ 5
3N68	NPN	10	12	5 @ 5	200 @ 2	—	50 @ 2	5 @ 5
3N69	NPN	10	12	5 @ 5	100 @ 2	—	50 @ 2	5 @ 5
3N70	NPN	10	12	E @ 5	50 @ 2	—	50 @ 2	5 @ 5
3N71	NPN	8	15	5 @ 5	50 @ 2	—	15 @ 2	12 @ 0
3N72	NPN	8	15	5 @ 5	100 @ 2	—	15 @ 2	
3N73	NPN	8	15	5 @ 5	200 @ 2	—	25 @ 2	
3N74	NPN	18	50	2 @ 15	50 @ 1	.6 @ 1	40 @ 1	5 @ 5
3N75	NPN	18	50	2 @ 15	100 @ 1	1.0 @ 1	40 @ 1	5 @ 5
3N76	NPN	18	50	2 @ 15	200 @ 1	1.4 @ 1	50 @ 1	5 @ 5
3N77	NPN	12	40	5 @ 10	50 @ 1	.6 @ 1	50 @ 1	5 @ 5
3N78	NPN	12	40	5 @ 10	100 @ 1	1.0 @ 1	50 @ 1	5 @ 5
3N79	NPN	12	40	10 @ 10	200 @ 1	1.4 @ 1	60 @ 1	6 @ 5
3N87	NPN	10	20	.02 @ 5	50 @ 0.5	1.0 @ 0.5	100 @ 0.5	2 @ 5
3N90	PNP	30	30	1 @ 25	50 @ 1	—	100 @ 1	3 @ 6
3N91	PNP	30	30	1 @ 25	100 @ 1	—	100 @ 1	3 @ 6
3N92	PNP	30	30	1 @ 25	200 @ 1	—	100 @ 1	3 @ 6
3N100	PNP	10	20	0.3 @ 10	50 @ 1	—	50 @ 1	5 @ 5
3N101	PNP	20	30	0.3 @ 20	50 @ 1	—	50 @ 1	5 @ 5
3N102	PNP	30	40	0.3 @ 30	50 @ 1	—	50 @ 1	5 @ 5

HUGHES SEMICONDUCTORS
HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION
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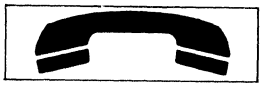
silicon transistors cont'd

dual emitter integrated choppers
TO-72 — case style (cont'd)

Type	Polarity	BV_{EEO} (volts)	BV_{CBO} (volts)	I_{EEO} (nA) @ V_{EE} (volts)	V_O Offset Voltage (μV) —25 to +100°C @ I_B, Base Current (mA)	$V_{O/T}$ (μV/°C) @ I_B, Base Current (mA)	R_D (ohms) @ I_B, Base Current (mA)	Ceb (pf) @ V_{EB} (volts)
3N103	PNP	40	50	0.3 @ 40	50 @ 1	—	50 @ 1	5 @ 5
3N105	PNP	15	20	5 @ 15	250 @ 1	—	100 @ 1	6 @ 5
3N106	PNP	30	40	5 @ 30	250 @ 1	—	100 @ 1	6 @ 5
3N110	PNP	30	50	0.5 @ 30	30 @ 1	—	50 @ 1	3 @ 6
3N111	PNP	30	50	0.5 @ 30	150 @ 1	—	50 @ 1	3 @ 6
3N114	PNP	12	30	1 @ 10	50 @ 1	—	50 @ 1	3 @ 6
3N115	PNP	12	30	1 @ 10	100 @ 1	—	50 @ 1	3 @ 6
3N116	PNP	12	30	1 @ 10	200 @ 1	—	50 @ 1	3 @ 6
3N117	PNP	20	50	1 @ 15	50 @ 1	—	50 @ 1	3 @ 6
3N118	PNP	20	50	1 @ 15	100 @ 1	—	50 @ 1	3 @ 6
3N119	PNP	20	50	1 @ 15	200 @ 1	—	50 @ 1	3 @ 6
3N123	PNP	25	30	1 @ 10	250 @ 1	—	100 @ 1	3 @ 6

silicon NPN small signal transistors
economy transistors — TO-98 case style

Type	Polarity	Power Dissipation @ 25°C (mW)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (mA)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (mA)	hf—	f— (MHz)
		NOTE 1			NOTE 2						NOTE 3	NOTE 4
2N2711	NPN	200 (A)	125	18	18 (O)	30	90	2	—	—	30 (E)	—
2N2712	NPN	200 (A)	125	18	18 (O)	75	225	2	—	—	80 (E)	—
2N2713	NPN	200 (A)	125	18	18 (O)	30	90	2	0.3	50	30 (E)	—
2N2714	NPN	200 (A)	125	18	18 (O)	75	225	2	0.3	50	80 (E)	—
2N2923	NPN	200 (A)	125	25	25 (O)	—	—	—	—	—	90 (E)	—
2N2924	NPN	200 (A)	125	25	25 (O)	—	—	—	—	—	150 (E)	—
2N2925	NPN	200 (A)	125	25	25 (O)	—	—	—	—	—	235 (E)	—
2N2926	NPN	200 (A)	125	18	18 (O)	—	—	—	—	—	35 (E)	—
2N3391	NPN	200 (A)	125	25	25 (O)	250	500	2.0	—	—	250 (E)	—
2N3391A	NPN	200 (A)	125	25	25 (O)	250	500	2.0	—	—	250 (E)	—
2N3392	NPN	200 (A)	125	25	25 (O)	150	300	2.0	—	—	150 (E)	—
2N3393	NPN	200 (A)	125	25	25 (O)	90	180	2.0	—	—	90 (E)	—
2N3394	NPN	200 (A)	125	25	25 (O)	55	110	2.0	—	—	55 (E)	—
2N3395	NPN	200 (A)	125	25	25 (O)	150	500	2.0	—	—	150 (E)	—
2N3396	NPN	200 (A)	125	25	25 (O)	90	500	2.0	—	—	90 (E)	—
2N3397	NPN	200 (A)	125	25	25 (O)	55	500	2.0	—	—	55 (E)	—
2N3398	NPN	200 (A)	125	25	25 (O)	55	800	2.0	—	—	55 (E)	—
2N3402	NPN	560 (A)	150	25	25 (O)	75	225	2.0	0.3	50	75 (E)	—
2N3403	NPN	560 (A)	150	25	25 (O)	180	540	2.0	0.3	50	180 (E)	—
2N3404	NPN	560 (A)	150	50	50 (O)	75	225	2.0	0.3	50	75 (E)	—
2N3405	NPN	560 (A)	150	50	50 (O)	180	540	2.0	0.3	50	100 (E)	—
2N3414	NPN	360 (A)	160	25	25 (O)	75	225	2.0	0.3	50	75 (E)	—
2N3415	NPN	360 (A)	160	25	25 (O)	180	540	2.0	0.3	50	180 (E)	—
2N3416	NPN	360 (A)	160	50	50 (O)	75	225	2.0	0.3	50	75 (E)	—
2N3417	NPN	360 (A)	160	50	50 (O)	180	540	2.0	0.3	50	180 (E)	—
2N3843	NPN	200 (A)	125	30	30 (O)	20	40	2.0	—	—	100 (E)	60 (T)
2N3843A	NPN	200 (A)	125	30	30 (O)	20	40	2.0	—	—	—	60 (T)
2N3844	NPN	200 (A)	125	30	30 (O)	35	70	2.0	—	—	—	90 (T)
2N3844A	NPN	200 (A)	125	30	30 (O)	35	70	2.0	—	—	—	90 (T)
2N3845	NPN	200 (A)	125	30	40 (O)	60	120	2.0	—	—	—	126 (T)
2N3845A	NPN	200 (A)	125	30	30 (O)	60	120	2.0	—	—	—	126 (T)
2N3854	NPN	200 (A)	150	18	18 (O)	35	70	2.0	—	—	—	100 (T)
2N3854A	NPN	200 (A)	150	30	30 (O)	35	70	2.0	—	—	—	100 (T)
2N3855	NPN	200 (A)	150	18	18 (O)	60	120	2.0	—	—	—	130 (T)
2N3855A	NPN	200 (A)	150	30	30 (O)	60	120	2.0	—	—	—	130 (T)
2N3856	NPN	200 (A)	150	18	18 (O)	100	200	2.0	—	—	—	140 (T)
2N3856A	NPN	200 (A)	150	30	30 (O)	100	200	2.0	—	—	—	140 (T)
2N3858	NPN	200 (A)	125	30	30 (O)	60	120	2.0	—	—	—	90 (T)
2N3859	NPN	200 (A)	125	30	30 (O)	100	200	2.0	—	—	—	90 (T)
2N3859A	NPN	200 (A)	100	60	60 (O)	75	—	1.0	—	—	—	90 (T)
2N3860	NPN	200 (A)	125	30	30 (O)	150	300	2.0	—	—	—	90 (T)
2N3877	NPN	200 (A)	150	70	70 (O)	20	250	2.0	—	—	—	—
2N3877A	NPN	200 (A)	150	85	85 (O)	20	250	2.0	—	—	—	—
2N3900	NPN	200 (A)	125	18	18 (O)	250	500	2.0	—	—	170 (E)	—
2N3900A	NPN	200 (A)	125	18	18 (O)	250	500	2.0	—	—	170 (E)	—
2N3973	NPN	360 (A)	150	60	30 (O)	35	100	10	0.3	150	—	200 (T)
2N3974	NPN	360 (A)	150	60	30 (O)	55	200	10	0.3	150	—	200 (T)
2N3975	NPN	360 (A)	150	60	30 (O)	35	100	10	0.3	150	—	200 (T)
2N3976	NPN	360 (A)	150	60	30 (O)	55	200	10	0.3	150	—	200 (T)
2N4424	NPN	360 (A)	150	40	40 (O)	—	—	—	—	—	180 (E)	—
2N4425	NPN	560 (A)	150	40	40 (O)	180	—	2	—	—	—	—
2N4951	NPN	360 —	—	—	30 —	60	200	150	0.3	150	—	250 (T)
2N4952	NPN	360 —	—	—	30 —	100	300	150	0.3	150	—	250 (T)
2N4953	NPN	360 —	—	—	30 —	200	600	150	0.3	150	—	250 (T)
2N4954	NPN	360 —	—	—	30 —	60	600	150	0.3	150	—	250 (T)



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silicon transistors cont'd

silicon power transistors

Type	Polarity	Power Dissipation @ 25°C (Watts)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (Amps)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (Amps)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N339	NPN	1.0 (C)	150	55	55 (O)	—	—	—	—	—	0.9 (B)	—	TO-11
2N339A	NPN	3.0 (A)	200	60	60 (O)	20	80	—	—	—	25 (E)	10 (T)	TO-11
2N340	NPN	1.0 (C)	150	85	85 (O)	—	—	—	—	—	0.9 (B)	—	TO-11
2N340A	NPN	3.0) (A)	200	85	85 (O)	20	80	—	—	—	25 (E)	10 (T)	TO-11
2N341	NPN	1.0 (C)	150	125	80 (O)	—	—	—	—	—	0.9 (B)	—	TO-11
2N341A	NPN	3.0 (A)	200	125	125 (O)	20	80	—	—	—	25 (E)	10 (T)	TO-11
2N342	NPN	1.0 (C)	150	60	60 (O)	—	—	—	—	—	0.9 (B)	—	TO-11
2N342A	NPN	1.0 (C)	150	85	85 (O)	—	—	—	—	—	0.9 (B)	—	TO-11
2N343	NPN	1.0 (C)	150	60	60 (O)	—	—	—	—	—	0.966 (B)	—	TO-11
2N343A	NPN	1.0 (C)	150	60	60 (O)	—	—	—	—	—	0.966 (B)	—	TO-11
2N389	NPN	85 (C)	200	—	60 (R)	12	60	1.0	—	—	—	—	TO-53
2N389A	NPN	85 (C)	200	—	60 (R)	12	60	1.0	0.75	1.0	—	1.0 (T)	TO-53
2N424	NPN	85 (C)	200	—	80 (R)	12	60	1.0	—	—	—	—	TO-53
2N424A	NPN	85 (C)	200	—	80 (R)	12	60	1.0	0.75	1.0	—	1.0 (T)	TO-53
2N497	NPN	4 (C)	200	60	60 (O)	12	36	0.2	—	—	—	—	TO-5
2N497A	NPN	5 (C)	200	60	60 (O)	12	36	0.2	—	—	—	—	TO-5
2N498	NPN	4 (C)	200	100	100 (O)	12	36	0.2	—	—	—	—	TO-5
2N498A	NPN	5 (C)	200	100	100 (O)	12	36	0.2	—	—	—	—	TO-5
2N545	NPN	5 (C)	200	60	60 (O)	15	80	0.5	5.0	0.5	—	—	TO-5
2N546	NPN	5 (C)	200	30	30 (O)	15	80	0.5	3.0	0.5	—	—	TO-5
2N547	NPN	5 (C)	200	60	60 (O)	20	80	0.5	5.0	0.5	—	4.0 (T)	TO-5
2N548	NPN	5 (C)	200	30	30 (O)	20	80	0.5	3.0	0.5	—	4.0 (T)	TO-5
2N549	NPN	5 (C)	200	60	60 (O)	20	80	0.2	4.0	0.2	—	4.0 (T)	TO-5
2N550	NPN	5 (C)	200	30	30 (O)	20	80	0.2	4.0	0.2	—	4.0 (T)	TO-5
2N551	NPN	5 (C)	200	60	60 (O)	20	80	0.05	2.0	0.05	—	3.0 (T)	TO-5
2N552	NPN	5 (C)	200	30	30 (O)	20	80	0.05	2.0	0.05	—	3.0 (T)	TO-5
2N656	NPN	4 (C)	200	60	60 (O)	30	90	0.2	—	—	—	—	TO-5
2N656A	NPN	5 (C)	200	60	60 (O)	30	90	0.2	—	—	—	—	TO-5
2N657	NPN	4 (C)	200	100	100 (O)	30	90	0.2	—	—	—	—	TO-5
2N657A	NPN	5 (C)	200	100	100 (O)	30	90	0.2	—	—	—	—	TO-5
2N1015A	NPN	150 (C)	150	60	60 (V)	10	—	2.0	1.5	2.0	—	—	MT-1
2N1015B	NPN	150 (C)	150	100	100 (V)	10	—	2.0	1.5	2.0	—	—	MT-1
2N1015C	NPN	150 (C)	150	150	150 (V)	10	—	2.0	1.5	2.0	—	—	MT-1
2N1015D	NPN	150 (C)	150	200	200 (V)	10	—	2.0	1.5	2.0	—	—	MT-1
2N1015E	NPN	150 (C)	150	250	250 (V)	10	—	2.0	1.5	2.0	—	—	MT-1
2N1016	NPN	150 (C)	150	30	30 (V)	10	—	5.0	2.5	5.0	—	—	MT-1
2N1016A	NPN	150 (C)	150	60	60 (V)	10	—	5.0	2.5	5.0	—	—	MT-1
2N1016B	NPN	150 (C)	150	100	100 (V)	10	—	5.0	2.5	5.0	—	—	MT-1
2N1016C	NPN	150 (C)	150	150	150 (V)	10	—	5.0	2.5	5.0	—	—	MT-1
2N1016D	NPN	150 (C)	150	200	200 (V)	10	—	5.0	2.5	5.0	—	—	MT-1
2N1016E	NPN	150 (C)	150	250	250 (V)	10	—	5.0	2.5	5.0	—	—	MT-1
2N1079	NPN	60 (C)	200	60	60 (S)	20	80	1.0	3.0	1.0	20 (E)	10 (T)	TO-53
2N1080	NPN	60 (C)	200	60	60 (S)	20	80	2.0	5.0	2.0	20 (E)	10 (T)	TO-53
2N1208	NPN	45 (C)	200	60	60 (O)	15	—	2.0	5.0	2.0	—	—	TO-61
2N1209	NPN	45 (C)	200	45	45 (O)	20	80	2.0	5.0	2.0	—	3.0 (T)	TO-61
2N1210	NPN	30 (C)	175	60	60 (O)	15	75	2.0	2.0	2.0	—	3.0 (T)	TO-53
2N1211	NPN	30 (C)	175	80	80 (V)	15	75	2.0	2.0	2.0	—	3.0 (T)	TO-53
2N1212	NPN	45 (C)	200	60	60 (O)	12	36	1.0	5.0	1.0	—	3.0 (T)	TO-61
2N1235	NPN	85 (C)	200	120	120 (R)	12	60	1.0	5.0	1.0	—	50* (E)	TO-53
2N1250	NPN	85 (C)	200	60	60 (O)	15	—	2.0	5.0	2.0	—	—	TO-53
2N1260	NPN	85 (C)	200	120	120 (R)	12	60	1.0	10.0	1.0	—	50* (E)	TO-61
2N1445	NPN	4 (C)	200	120	120 (O)	20	80	0.2	4.0	0.2	—	75* (E)	TO-5
2N1479	NPN	5 (C)	200	60	60 (V)	20	60	0.2	1.4	0.2	—	—	TO-5
2N1480	NPN	5 (C)	200	100	100 (V)	20	60	0.2	1.4	0.2	—	—	TO-5
2N1481	NPN	5 (C)	200	60	60 (V)	35	100	0.2	1.4	0.2	—	—	TO-5
2N1482	NPN	5 (C)	200	100	100 (V)	35	100	0.2	1.4	0.2	—	—	TO-5
2N1487	NPN	75 (C)	200	60	60 (V)	15	45	0.2	3.0	1.5	—	—	TO-3
2N1488	NPN	75 (C)	200	100	100 (V)	15	45	0.2	3.0	1.5	—	—	TO-3
2N1489	NPN	75 (C)	200	60	60 (V)	25	75	1.5	1.0	1.5	—	—	TO-3
2N1490	NPN	75 (C)	200	100	100 (V)	25	75	1.5	1.0	1.5	—	—	TO-3
2N1511	NPN	75 (C)	200	60	60 (V)	4	—	6.0	7.2	6.0	—	0.3 (T)	TO-36
2N1512	NPN	75 (C)	200	100	100 (V)	7	—	6.0	6.0	6.0	—	0.3 (T)	TO-36
2N1513	NPN	75 (C)	200	60	60 (V)	7	—	6.0	6.0	6.0	—	0.3 (T)	TO-36
2N1514	NPN	75 (C)	200	100	100 (V)	—	—	—	—	—	—	0.3 (T)	TO-36
2N1616	NPN	60 (C)	175	60	60 (O)	15	75	2	2	2	—	3.0 (T)	TO-53
2N1616A	NPN	85 (C)	200	60	60 (O)	20	60	2	1	2	—	3.0 (T)	TO-61
2N1617	NPN	60 (C)	175	80	80 (V)	15	75	2	2	2	—	3.0 (T)	TO-61
2N1617A	NPN	85 (C)	200	80	70 (O)	20	60	2	1	2	—	3.0 (T)	TO-61
2N1618	NPN	60 (C)	175	100	100 (V)	15	75	2	2	2	—	3.0 (T)	TO-61
2N1618A	NPN	85 (C)	200	100	80 (O)	20	60	2	1	2	—	3.0 (T)	TO-61
2N1620	NPN	60 (C)	175	100	100 (V)	15	75	2	2	2	—	3.0 (T)	TO-53
2N1644	NPN	2 (C)	175	60	40 (R)	40	120	0.15	1.5	1.5	—	50 (T)	TO-5
2N1651	PNP	100 (C)	110	60	60 (S)	35	140	10	0.65	25	20 (E)	—	TO-41
2N1690	NPN	40 (C)	200	80	80 (O)	20	60	0.5	7.5	0.5	—	90* (E)	TO-57
2N1691	NPN	40 (C)	200	120	120 (O)	20	60	0.5	7.5	0.5	—	90* (E)	TO-57

* KHz

HUGHES SEMICONDUCTORS
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HUGHES AIRCRAFT COMPANY
NEWPORT BEACH DIVISION

silicon transistors cont'd

silicon power transistors—(cont'd)

Type	Polarity	Power Dissipation @ 25°C (Watts) NOTE 1	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts) NOTE 2	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (Amps)	$V_{CE(SAT)}$ @ I_C (volts)	$V_{CE(SAT)}$ @ I_C (Amps)	hf— NOTE 3	f— (MHz) NOTE 4	Case Style
2N1700	NPN	5 (C)	200	60	60 (V)	20	80	0.1	12.5	2.5	—	0.4 (B)	TO-5
2N1702	NPN	75 (C)	200	60	60 (V)	15	60	0.8	20	5.0	—	0.3 (B)	TO-3
2N1703	NPN	75 (C)	200	60	60 (V)	15	60	0.8	—	—	—	0.3 (B)	TO-36
2N1709	NPN	15 (C)	175	75	30 (O)	7.5	75	0.35	5.0	1.0	—	175 (T)*	TO-8
2N1710	NPN	15 (C)	175	60	30 (O)	4.0	100	0.35	5.0	1.0	—	140 (T)	TO-8
2N1714	NPN	20 (C)	175	90	60 (O)	20	60	0.2	2.0	0.2	—	16 (T)	TO-5
2N1715	NPN	20 (C)	175	150	100 (O)	20	60	.20	2.0	.20	—	16 (T)	TO-5
2N1716	NPN	20 (C)	175	90	60 (O)	40	120	.20	2.0	.20	—	16 (T)	TO-5
2N1717	NPN	20 (C)	175	150	100 (O)	40	120	.20	2.0	.20	—	16 (T)	TO-5
2N1718	NPN	20 (C)	175	90	60 (O)	20	60	.20	2.0	.20	—	16 (T)	TO-5
2N1719	NPN	20 (C)	175	150	100 (O)	20	60	.20	2.0	.20	—	16 (T)	TO-59
2N1720	NPN	20 (C)	175	90	60 (O)	40	120	.20	2.0	.20	—	16 (T)	TO-59
2N1721	NPN	20 (C)	175	150	100 (O)	40	120	.20	2.0	.20	—	16 (T)	TO-5
2N1722	NPN	50 (C)	175	120	80 (O)	20	90	2.0	1.0	2.0	—	10 (T)	TO-53
2N1722A	NPN	50 (C)	175	180	120 (O)	30	90	2.0	0.6	2.0	—	10 (T)	TO-53
2N1723	NPN	50 (C)	175	120	80 (O)	50	150	2.0	1.0	2.0	—	10 (T)	TO-53
2N1724	NPN	50 (C)	175	120	80 (O)	20	90	2.0	1.0	2.0	—	10 (T)	TO-61
2N1724A	NPN	50 (C)	175	180	120 (O)	30	90	2.0	0.2	2.0	—	10 (T)	TO-61
2N1725	NPN	50 (C)	175	120	80 (O)	50	150	2.0	1.0	2.0	—	10 (T)	TO-61
2N1886	NPN	20 (C)	175	60	60 (O)	20	80	0.5	5.0	1.0	—	2.0 (T)	TO-59
2N1899	NPN	125 (C)	150	140	50 (O)	10	30	10	1.0	10	—	50 (T)	MT-38
2N1900	NPN	125 (C)	150	140	50 (O)	8.0	—	10	2.0	10	—	50 (T)	MT-38
2N1901	NPN	125 (C)	150	140	50 (O)	20	60	10	1.0	10	—	50 (T)	MT-38
2N1902	NPN	125 (C)	150	140	50 (O)	10	30	10	1.0	10	—	50 (T)	TO-61
2N1903	NPN	125 (C)	150	140	50 (O)	8	—	10	2.0	10	—	50 (T)	TO-61
2N1904	NPN	125 (C)	150	140	50 (O)	20	60	10	1.0	10	—	50 (T)	TO-61
2N1936	NPN	150 (C)	175	125	60 (O)	7	50	10	0.75	10	15 (E)	4.0 (T)	TO-63
2N1937	NPN	150 (C)	175	125	80 (O)	7	50	10	0.75	10	15 (E)	4.0 (T)	TO-63
2N2018	NPN	20 (C)	175	50	50 (V)	20	60	0.5	6.0	1.0	—	2.0 (T)	TO-63
2N2019	NPN	20 (C)	175	200	200 (V)	20	60	0.5	6.0	1.0	—	2.0 (T)	MT-11
2N2020	NPN	20 (C)	175	150	125 (O)	40	90	0.5	6.0	1.0	—	3.0 (T)	MT-11
2N2021	NPN	20 (C)	175	200	140(O)	40	90	0.5	6.0	1.0	—	3.0 (T)	MT-11
2N2032	NPN	45 (C)	200	45	45 (O)	20	—	2.0	5.0	2.0	—	3.0 (T)	TO-53
2N2033	NPN	5 (C)	200	80	60 (O)	20	60	0.5	0.4	0.5	—	1.0 (T)	TO-5
2N2034	NPN	14 (C)	200	80	60 (O)	20	60	1.0	0.3	1.0	—	1.0 (T)	TO-5
2N2035	NPN	17 (C)	200	80	60 (O)	20	60	1.5	0.45	1.5	—	1.0 (T)	TO-8
2N2102	NPN	5 (C)	200	120	80 (R)	35	—	0.01	0.5	0.15	35 (E)	—	TO-5
2N2102A	NPN	1 (A)	200	120	65 (O)	40	125	0.15	0.3	0.15	30 (E)	—	TO-5
2N2109	NPN	250 (C)	175	50	50 (V)	10	—	10	1.5	10	—	—	MT-17
2N2150	NPN	30 (C)	175	125	80 (O)	20	60	1.0	1.0	1.0	20 (E)	10 (T)	MT-21
2N2151	NPN	30 (C)	175	125	80 (O)	40	120	1.0	1.0	1.0	40 (E)	10 (T)	TO-59
2N2196	NPN	2 (A)	175	80	60 (R)	30	90	0.20	2.0	0.20	30 (E)	—	TO-5/c†
2N2197	NPN	2 (A)	175	80	60 (R)	75	200	0.20	2.0	0.20	30 (E)	—	TO-5/c†
2N2201	NPN	1 (C)	175	120	100 (O)	25	90	0.2	1.7	0.2	30 (E)	—	TO-5
2N2202	NPN	1 (C)	175	120	100 (O)	25	90	0.2	1.7	0.2	30 (E)	—	RO-45
2N2203	NPN	1 (C)	175	120	100 (O)	25	90	0.2	1.7	0.2	30 (E)	—	MT-19
2N2204	NPN	1 (C)	175	120	100 (O)	25	90	0.2	1.7	0.2	30 (E)	—	RO-119
2N2226	NPN	150 (A)	150	50	50 (V)	100	500	9.0	3.5	9.0	50 (E)	7.0*(E)	MT-1
2N2227	NPN	150 (A)	150	100	100 (V)	100	500	9.0	3.5	9.0	50 (E)	7.0*(E)	MT-1
2N2228	NPN	150 (A)	150	150	150 (V)	100	500	9.0	3.5	9.0	50 (E)	7.0*(E)	MT-1
2N2229	NPN	150 (A)	150	200	200 (V)	100	500	9.0	3.5	9.0	50 (E)	7.0*(E)	MT-1
2N2230	NPN	150 (A)	150	50	50 (V)	350	—	9.0	3.5	9.0	100 (E)	4.0*(E)	MT-1
2N2231	NPN	150 (A)	150	100	100 (V)	350	—	9.0	3.5	9.0	100 (E)	4.0*(E)	MT-1
2N2232	NPN	150 (A)	150	150	150 (V)	350	—	9.0	3.5	9.0	100 (E)	4.0*(E)	MT-1
2N2233	NPN	150 (A)	150	200	200 (V)	350	—	9.0	3.5	9.0	100 (E)	4.0*(E)	MT-1
2N2270	NPN	5 (C)	200	60	45 (O)	30	—	0.001	0.9	0.15	50 (E)	—	TO-5
2N2305	NPN	75 (C)	200	60	60 (V)	15	60	0.8	1.2	0.6	—	—	TO-3
2N2405	NPN	5 (C)	—	120	90 (O)	60	200	0.15	0.5	0.15	50 (E)	—	TO-5
2N2584	NPN	5 (C)	200	80	90 (R)	50	150	0.1	1.0	0.2	15 (E)	40 (T)	TO-5
2N2632	NPN	40 (C)	175	90	60 (O)	40	120	1.0	0.25	1.0	40 (E)	20 (T)	TO-62
2N2633	NPN	40 (C)	175	120	80 (O)	40	120	1.0	0.25	1.0	40 (E)	20 (T)	TO-62
2N2634	NPN	40 (C)	175	150	100 (O)	40	120	1.0	0.25	1.0	40 (E)	20 (T)	TO-62
2N2657	NPN	1.25 (A)	200	80	60 (O)	40	120	1.0	0.5	1.0	—	20 (T)	TO-5
2N2658	NPN	1.25 (A)	200	100	80 (O)	40	120	1.0	0.5	1.0	—	20 (T)	TO-5
2N2697	NPN	18 (C)	200	80	60 (O)	40	120	1.0	0.5	1.0	—	20 (T)	MT-9
2N2698	NPN	18 (C)	200	100	80 (O)	40	120	1.0	0.5	1.0	—	20 (T)	MT-9
2N2726	NPN	1 (A)	200	200	200 (R)	30	90	0.2	2.0	0.2	30 (E)	15 (T)	TO-5
2N2727	NPN	1 (A)	200	200	200 (R)	75	150	0.2	2.0	0.2	75 (E)	15 (T)	TO-5
2N2811	NPN	70 (J)	200	80	60 (O)	20	60	5	0.5	5	20 (E)	15 (T)	TO-61
2N2812	NPN	70 (J)	200	80	60 (O)	40	120	5	0.5	5	40 (E)	15 (T)	TO-61
2N2813	NPN	70 (J)	200	120	80 (O)	20	60	5	0.5	5	20 (E)	15 (T)	TO-61
2N2814	NPN	70 (J)	200	120	80 (O)	40	120	5	0.5	5	40 (E)	15 (T)	TO-61
2N2868	NPN	40 (C)	175	120	80 (O)	20	60	0.5	0.75	1.0	—	10 (T)	TO-59
2N2867	NPN	40 (C)	175	120	80 (O)	40	120	0.5	0.75	1.0	—	10 (T)	TO-59
2N2875	PNP	20 (C)	200	60	50 (O)	15	60	0.5	1.5	0.5	20 (E)	25 (E)	TO-59

* KHz
† with heat sink



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silicon transistors cont'd

silicon power transistors—(cont'd)

Type	Polarity	Power Dissipation @ 25°C (Watts)	T_J (°C)	BV_{CBO} (volts)	BV_{CE-} (volts)	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (Amps)	$V_{CE\ (SAT)}$ @ I_C (volts)	$V_{CE\ (SAT)}$ @ I_C (Amps)	hf—	f— (MHz)	Case Style
		NOTE 1			NOTE 2						NOTE 3	NOTE 4	
2N2877	NPN	53 (C)	100	80	60 (O)	20	60	1.0	0.25	1.0	20 (E)	30 (T)	TO-59
2N2878	NPN	53 (C)	100	80	60 (O)	40	120	1.0	0.25	1.0	40 (E)	50 (T)	TO-59
2N2879	NPN	53 (C)	100	100	80 (O)	20	60	1.0	0.25	1.0	20 (E)	30 (T)	TO-59
2N2880	NPN	53 (C)	100	100	80 (O)	40	120	1.0	0.25	1.0	40 (E)	50 (T)	TO-59
2N2951	NPN	3.0 (C)	175	60	60 (S)	20	150	0.01	0.5	0.15	—	200 (T)	TO-5
2N2952	NPN	1.8 (C)	175	60	60 (S)	20	150	0.01	0.5	0.15	—	200 (T)	TO-18
2N2983	NPN	1.0 (A)	175	155	80 (O)	20	60	0.5	0.6	1.0	20 (E)	60 (T)	TO-5
2N2984	NPN	1.0 (A)	175	185	120 (O)	20	60	0.5	0.8	0.2	20 (E)	60 (T)	TO-5
2N2985	NPN	1.0 (A)	175	155	80 (O)	40	120	0.5	0.8	0.2	40 (E)	60 (T)	TO-5
2N2986	NPN	1.0 (A)	175	185	120 (O)	40	120	0.5	0.8	0.2	40 (E)	60 (T)	TO-5
2N2987	NPN	1.0 (A)	200	95	80 (O)	25	75	0.2	0.8	0.2	25 (E)	30 (T)	TO-5
2N2988	NPN	1.0 (A)	200	155	100 (O)	25	75	0.2	0.8	0.2	25 (E)	30 (T)	TO-5
2N2989	NPN	1.0 (A)	200	95	80 (O)	60	120	0.2	0.8	0.2	50 (E)	30 (T)	TO-5
2N2990	NPN	1.0 (A)	200	155	100 (O)	60	120	0.2	0.8	0.2	50 (E)	30 (T)	TO-5
2N2991	NPN	2.0 (A)	200	95	80 (O)	25	75	0.2	0.8	0.2	25 (E)	30 (T)	MT-13
2N2992	NPN	2.0 (A)	200	155	100 (O)	20	—	0.2	0.8	0.2	25 (E)	30 (T)	MT-13
2N2993	NPN	2.0 (A)	200	95	80 (O)	60	120	0.2	0.8	0.2	50 (E)	30 (T)	MT-13
2N2994	NPN	2.0 (A)	200	155	100 (O)	60	120	0.2	0.8	0.2	50 (E)	30 (T)	MT-13
2N2995	NPN	1.5 (A)	175	120	100 (O)	25	90	0.2	1.7	0.2	30 (E)	10 (T)	MT-20a
2N3053	NPN	5.0 (C)	200	60	40 (O)	50	250	0.15	1.4	0.15	—	100 (T)	TO-5
2N3054	NPN	25 (C)	200	90	60 (R)	250	150	0.5	1.0	0.5	25 (E)	30* (E)	TO-66
2N3055	NPN	115 (C)	200	100	70 (R)	20	70	4.0	1.1	4.0	15 (E)	20* (E)	TO-3
2N3118	NPN	1.0 (A)	200	85	60 (O)	50	275	0.025	—	—	—	250 (T)	TO-5
2N3119	NPN	1.0 (A)	200	100	80 (O)	50	200	0.10	0.5	0.10	—	250 (T)	TO-5
2N3139	NPN	20 (C)	200	65	65 (O)	10	—	1.0	—	—	—	100 (T)	TO-62
2N3140	NPN	20 (C)	200	65	65 (O)	10	—	1.0	—	—	—	100 (T)	TO-62
2N3141	NPN	20 (C)	200	140	140 (O)	10	—	1.0	—	—	—	100 (T)	TO-62
2N3142	NPN	25 (C)	200	65	65 (O)	10	—	1.0	—	—	—	100 (T)	MT-46
2N3143	NPN	25 (C)	200	140	140 (O)	10	—	1.0	—	—	—	100 (T)	MT-46
2N3144	NPN	25 (C)	200	65	65 (O)	10	—	1.0	—	—	—	100 (T)	MT-46
2N3145	NPN	25 (C)	200	140	140 (O)	10	—	1.0	—	—	—	100 (T)	MT-46
2N3149	NPN	300 (C)	200	80	80 (O)	10	—	50	1.5	50	—	0.1 (T)	TO-114
2N3150	NPN	300 (C)	200	100	100 (O)	10	—	50	1.5	50	—	0.1 (T)	TO-114
2N3151	NPN	300 (C)	200	150	150 (O)	10	—	50	1.5	50	—	0.1 (T)	TO-114
2N3244	PNP	1.0 (A)	200	40	40 (O)	50	150	0.5	0.3	0.15	—	175 (T)	TO-5
2N3245	PNP	1.0 (A)	200	50	50 (O)	30	90	0.5	0.35	0.15	—	150 (T)	TO-5
2N3252	NPN	1.0 (A)	200	60	30 (O)	30	90	0.5	0.3	0.15	—	200 (T)	TO-5
2N3253	NPN	1.0 (A)	200	75	40 (O)	25	75	0.375	0.35	0.15	—	175 (T)	TO-5
2N3418	NPN	1.0 (C)	100	85	60 (O)	20	60	1.0	0.25	1.0	—	40 (T)	TO-5
2N3419	NPN	1.0 (C)	100	125	80 (O)	20	60	1.0	0.25	1.0	—	40 (T)	TO-5
2N3420	NPN	1.0 (C)	100	85	60 (O)	40	120	1.0	0.25	1.0	—	40 (T)	TO-5
2N3421	NPN	1.0 (C)	100	125	80 (O)	40	120	1.0	0.25	1.0	—	40 (T)	TO-5
2N3441	NPN	25 (C)	200	160	140 (O)	20	80	0.5	6.0	2.7	15 (E)	0.2 (T)	TO-66
2N3442	NPN	100 (C)	200	160	140 (O)	20	70	3.0	5.0	10	12 (E)	80* (T)	TO-3
2N3444	NPN	1.0 (A)	200	80	50 (O)	20	60	0.5	0.35	0.15	—	150 (T)	TO-5
2N3467	PNP	1.0 (A)	200	40	40 (O)	40	120	0.5	0.3	0.15	—	175 (T)	TO-5
2N3469	NPN	1.25 (A)	200	35	25 (O)	100	350	0.5	0.5	1.0	100 (E)	20 (T)	TO-5
2N3485	PNP	2.0 (C)	200	60	40 (O)	40	120	0.15	0.4	0.15	—	200 (T)	TO-46
2N3485A	PNP	2.0 (C)	200	60	60 (O)	40	120	0.15	0.4	0.15	—	200 (T)	TO-46
2N3486	PNP	2.0 (C)	200	60	40 (O)	100	300	0.15	0.4	0.15	—	200 (T)	TO-46
2N3486A	PNP	2.0 (C)	200	60	60 (O)	100	300	0.15	0.4	0.15	—	200 (T)	TO-46
2N3506	NPN	1.0 (A)	200	60	40 (O)	40	200	1.5	1.0	1.5	—	60 (T)	TO-5
2N3507	NPN	1.0 (A)	200	80	50 (O)	30	150	1.5	1.0	1.5	—	60 (T)	TO-5
2N3597	NPN	100 (C)	200	60	40 (O)	40	120	10	0.5	10	75 (E)	30 (T)	TO-63
2N3598	NPN	100 (C)	200	80	60 (O)	40	120	10	0.5	10	75 (E)	30 (T)	TO-63
2N3599	NPN	100 (C)	200	100	80 (O)	40	120	10	0.5	10	75 (E)	30 (T)	TO-63
2N3659	NPN	4.0 (C)	200	220	170 (O)	20	—	0.10	—	—	20 (E)	50 (T)	TO-5
2N3660	PNP	5.0 (C)	200	40	30 (O)	25	100	0.5	1.2	0.5	—	25 (T)	TO-5
2N3661	PNP	5.0 (C)	200	60	50 (O)	25	100	0.5	1.2	0.5	—	25 (T)	TO-5
2N3665	NPN	5.0 (C)	200	120	80 (O)	40	120	0.15	0.5	0.15	—	60 (T)	TO-5
2N3666	NPN	5.0 (C)	200	120	80 (O)	100	300	0.15	0.5	0.15	—	60 (T)	TO-5
2N3675	NPN	8.8 (C)	200	90	55 (O)	12	60	1.0	0.8	1.0	—	1.0 (T)	TO-5
2N3676	NPN	8.8 (C)	200	90	90 (O)	12	60	1.0	0.8	1.0	—	1.0 (T)	TO-5
2N3714	NPN	150 (C)	200	100	80 (O)	25	75	1.0	1.0	5.0	25 (E)	30* (E)	TO-3
2N3715	NPN	150 (C)	200	80	60 (O)	50	150	1.0	0.8	5.0	25 (E)	30* (E)	TO-3
2N3716	NPN	150 (C)	200	100	80 (O)	50	150	1.0	0.8	5.0	25 (E)	30* (E)	TO-3
2N3744	NPN	30 (C)	200	60	40 (O)	20	60	1.0	0.25	1.0	20 (E)	30 (T)	TO-59
2N3745	NPN	30 (C)	200	80	60 (O)	20	60	1.0	0.25	1.0	20 (E)	30 (T)	TO-59
2N3746	NPN	30 (C)	200	100	80 (O)	20	60	1.0	0.25	1.0	20 (E)	30 (T)	TO-59
2N3747	NPN	30 (C)	200	60	40 (O)	40	120	1.0	0.25	1.0	40 (E)	40 (T)	TO-59
2N3748	NPN	30 (C)	200	80	60 (O)	40	120	1.0	0.25	1.0	40 (E)	40 (T)	TO-59
2N3749	NPN	30 (C)	200	100	80 (O)	40	120	1.0	0.25	1.0	40 (E)	40 (T)	TO-59
2N3750	NPN	30 (C)	200	60	40 (O)	100	300	1.0	0.25	1.0	100 (E)	50 (T)	TO-59
2N3751	NPN	30 (C)	200	80	60 (O)	100	300	1.0	0.25	1.0	100 (E)	50 (T)	TO-59
2N3752	NPN	30 (C)	200	100	80 (O)	100	300	1.0	0.25	1.0	100 (E)	50 (T)	TO-59

* KHz

HUGHES SEMICONDUCTORS
HUGHES AIRCRAFT COMPANY
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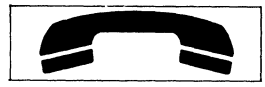
silicon power transistors—(cont'd)

Type	Polarity	Power Dissipation @ 25°C (Watts) NOTE 1	T_J (°C)	BV_{CBO} (volts)	BV_{CE}— (volts) NOTE 2	h_{FE} @ I_C (Min.)	h_{FE} @ I_C (Max.)	h_{FE} @ I_C (Amps)	$V_{CE\ (SAT)}$ @ I_C (volts)	$V_{CE\ (SAT)}$ @ I_C (Amps)	hf— NOTE 3	f— (MHz) NOTE 4	Case Style
2N3766	NPN	20 (C)	175	80	60 (O)	40	160	0.5	2.5	1.0	40 (E)	15 (T)	TO-66
2N3767	NPN	20 (C)	175	100	80 (O)	40	160	0.5	2.5	1.0	40 (E)	15 (T)	TO-66
2N3771	NPN	150 (C)	200	50	40 (O)	15	60	15	2.0	15	40 (E)	0.2 (T)	TO-3
2N3772	NPN	150 (C)	200	100	60 (O)	15	60	10	1.4	10	40 (E)	0.2 (T)	TO-3
2N3773	NPN	150 (C)	200	160	140 (O)	15	60	8	1.4	8	40 (E)	0.2 (T)	TO-3
2N3916	NPN	5.0 (C)	150	150	150 (O)	40	200	0.15	5.0	0.15	30 (E)	50 (T)	TO-5/c†
2N3917	NPN	20 (C)	150	80	40 (O)	30	120	1.0	1.2	1.0	15 (E)	50 (T)	TO-3
2N3918	NPN	20 (C)	150	80	40 (O)	100	300	1.0	1.2	1.0	30 (E)	50 (T)	TO-3
2N3919	NPN	15 (C)	150	120	60 (O)	40	120	2.0	1.2	10	—	80 (T)	TO-3
2N3920	NPN	15 (C)	150	120	60 (O)	100	300	2.0	1.2	10	—	80 (T)	TO-3
2N3945	NPN	5.0 (C)	200	70	50 (O)	40	250	0.15	0.5	0.15	—	60 (T)	TO-5
2N4000	NPN	1.0 (A)	200	100	80 (O)	30	120	0.5	0.3	0.5	—	40 (T)	TO-5
2N4001	NPN	1.0 (A)	200	120	100 (O)	40	120	0.5	0.3	0.5	—	40 (T)	TO-5
2N4070	NPN	115 (C)	200	100	80 (O)	40	120	5.0	1.5	5.0	40 (E)	10 (T)	TO-3
2N4071	NPN	115 (C)	200	200	150 (O)	40	120	5.0	1.5	5.0	40 (E)	10 (T)	TO-3
2N4150	NPN	5.0 (C)	—	100	80 (O)	40	120	5.0	—	—	—	15 (T)	TO-5
2N4210	NPN	100 (C)	—	80	60 (O)	20	100	10	—	—	—	10 (T)	TO-63
2N4211	NPN	100 (C)	—	100	80 (O)	20	100	10	—	—	—	10 (T)	TO-63
2N4237	PNP	5.0 (C)	175	50	40 (O)	40	160	0.5	2.5	1.0	40 (E)	10 (T)	TO-5
2N4238	PNP	5.0 (C)	175	80	60 (O)	40	160	0.5	2.5	1.0	40 (E)	10 (T)	TO-5
2N4239	PNP	5.0 (C)	175	100	60 (O)	40	160	0.5	2.5	1.0	40 (E)	10 (T)	TO-5
2N4242	PNP	105 (A)	—	80	60 (O)	40	80	5.0	—	—	—	500* (T)	TO-3
2N4243	PNP	105 (A)	—	60	45 (O)	40	80	5.0	—	—	—	500* (T)	TO-3
2N4244	PNP	105 (A)	—	40	30 (O)	40	80	5.0	—	—	—	500* (T)	TO-3
2N4245	PNP	105 (A)	—	80	60 (O)	60	120	5.0	—	—	—	500* (T)	TO-3
2N4246	PNP	105 (A)	—	60	45 (O)	60	120	5.0	—	—	—	500* (T)	TO-3
2N4247	PNP	105 (A)	—	40	30 (O)	60	120	5.0	—	—	—	500* (T)	TO-3
2N4271	NPN	5.0 (C)	—	175	140 (O)	20	140	0.2	—	—	—	20 (T)	TO-5
2N4272	NPN	5.0 (C)	—	175	140 (O)	20	140	1.0	—	—	—	10 (T)	TO-5
2N4273	NPN	25 (C)	—	175	140 (O)	20	140	1.0	—	—	—	10 (T)	TO-66
2N4300	NPN	15 (C)	—	100	80 (O)	30	120	1.0	—	—	—	30 (T)	TO-5
2N4305	NPN	1.5 (A)	—	120	80 (O)	50	150	1.0	—	—	—	—	TO-5
2N4307	NPN	1.5 (A)	—	100	60 (O)	50	150	1.0	—	—	—	—	TO-5
2N4309	NPN	1.5 (A)	—	120	80 (O)	50	150	1.0	—	—	—	—	TO-5
2N4311	NPN	1.5 (A)	—	100	60 (O)	40	120	1.0	—	—	—	—	TO-5
2N4350	NPN	7.0 (C)	—	65	40 (O)	10	200	0.35	—	—	—	300 (T)	TO-5
2N4387	PNP	20 (A)	200	40	40 (O)	25	100	0.5	—	—	—	—	TO-66
2N4388	PNP	20 (A)	200	60	20 (O)	10	200	0.1	—	—	—	500 (T)	TO-39
2N4427	NPN	3.5 (C)	—	40	120 (O)	50	150	0.5	0.2	0.5	—	50 —	TO-46
2N4862	NPN	4.0 (J)	—	140	120 (O)	50	150	0.5	0.2	0.5	—	50 —	TO-5
2N4863	NPN	4.0 (J)	—	140	120 (O)	50	150	0.5	0.2	0.5	—	50 —	TO-66
2N4864	NPN	4.0 (J)	—	140	80 (O)	10	40	70	2.5	70	—	10 —	MT-49
2N4865	NPN	200 (C)	100	100	120 (O)	10	40	70	2.5	70	—	10 —	MT-49
2N4866	NPN	200 (C)	100	140	60 (O)	100	300	2.0	1.0	5.0	4.0 (E)	—	TO-39
2N4895	NPN	4.0 (C)	200	120	60 (O)	40	120	2.0	1.0	5.0	2.0 (E)	—	TO-39
2N4896	NPN	4.0 (C)	200	120	80 (O)	40	120	2.0	1.0	5.0	2.5 (E)	—	TO-39
2N4897	NPN	4.0 (C)	200	150	40 (O)	25	100	2.5	1.0	2.5	20 (E)	4.0 (T)	TO-3
2N4913	NPN	87 (C)	200	40	60 (O)	25	100	2.5	1.0	2.5	20 (E)	4.0 (T)	TO-3
2N4914	NPN	87 (C)	200	60	40 (O)	20	80	1.0	0.4	1.0	20 (E)	4.0 (T)	TO-3
2N5067	NPN	87 (C)	200	40	60 (O)	20	80	1.0	0.4	1.0	20 (E)	4.0 (T)	TO-3
2N5068	NPN	87 (C)	200	60	80 (O)	20	80	1.0	0.4	1.0	20 (E)	4.0 (T)	TO-3
2N5069	NPN	87 (C)	200	80	80 (O)	15	—	2.0	0.85	2.0	—	50 —	TO-39
2N5147	PNP	6 (C)	50	—	80 (O)	15	—	2.0	0.85	2.0	—	50 —	TO-39
2N5148	NPN	6 (C)	50	—	80 (O)	30	—	2.0	0.85	2.0	—	60 —	TO-39
2N5150	NPN	6 (C)	50	—	80 (O)	30	—	2.0	0.85	2.0	—	60 —	TO-39
2N5151	PNP	10 (C)	50	—	80 (O)	20	—	5.0	1.5	5.0	—	60 —	TO-39
2N5152	NPN	10 (C)	50	—	80 (O)	20	—	5.0	1.5	5.0	—	60 —	TO-39
2N5153	PNP	10 (C)	50	—	80 (O)	40	—	5.0	1.5	5.0	—	70 —	TO-39
2N5154	NPN	10 (C)	50	—	80 (O)	20	—	5.0	1.5	5.0	—	60 —	TO-39
2N5218	NPN	50 (C)	—	220	200 (O)	15	120	5.0	—	—	—	40 —	TO-61
2N5250	NPN	200 —	—	125	100 (O)	15	60	40	1.0	40	—	10 —	TO-114
2N5312	PNP	3.0 (J)	200	80	80 (O)	30	90	10	1.5	10	—	30 —	TO-61
2N5314	PNP	3.0 (J)	200	100	100 (O)	30	90	10	1.5	10	—	30 —	TO-61
2N5316	PNP	3.0 (J)	200	80	80 (O)	30	90	5.0	0.6	5.0	—	30 —	TO-61
2N5318	PNP	3.0 (J)	200	100	100 (O)	30	90	5.0	0.6	5.0	—	30 —	TO-61
2N5404	PNP	1.0 —	—	80	80 (O)	20	60	2.0	0.6	2.0	—	40 —	TO-5
2N5405	PNP	1.0 —	—	100	100 (O)	20	60	2.0	0.6	2.0	—	40 —	TO-5
2N5406	PNP	1.0 —	—	80	80 (O)	40	120	2.0	0.6	2.0	—	40 —	TO-5
2N5407	PNP	1.0 —	—	100	100 (O)	40	120	2.0	0.6	2.0	—	40 —	TO-5
2N5408	PNP	3.3 —	—	80	80 (O)	20	60	2.0	0.6	2.0	—	40 —	TO-111
2N5409	PNP	3.3 —	—	100	100 (O)	20	60	2.0	0.6	2.0	—	40 —	TO-111
2N5410	PNP	3.3 —	—	80	80 (O)	40	120	2.0	0.6	2.0	—	40 —	TO-111
2N5411	PNP	3.3 —	—	100	100 (O)	40	120	2.0	0.6	2.0	—	40 —	TO-111

* KHz
† with heat sink



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(800)854-3280 / in California (714)548-0671

silicon transistors cont'd

silicon NPN power transistors

Hughes house types

Hughes Type No.	Rated Breakdown Voltages (volts) V_{CB}	V_{CE}	V_{EB}	h_{FE} @ $I_C = 1.0A$ $V_{CE} = 2.0V$ Min.	Max.	Sat. Voltages (Max.) $I_C = 1.0A$ $I_B = 0.1A$ V_{CE}	V_{BE}	I_{CBO} (μA) Max.	@ V_{CB}	P_D T_C @ 100°C (watts)	Case Style
HST1050	250	200	8	15	—	0.5	1.0	5.0	100	80	TO-3
HST1051	400	325	8	15	—	0.5	1.0	5.0	100	80	TO-3
HST1052	500	400	8	15	—	0.5	1.0	5.0	100	80	TO-3
HST1053	600	400	8	15	—	0.5	1.0	5.0	100	80	TO-3
HST1054	700	400	8	15	—	0.5	1.0	5.0	100	80	TO-3
HST1055	250	200	8	10	50	0.5	1.5	1.0	150	80	TO-3
HST1056	400	325	8	10	50	0.5	1.5	1.0	150	80	TO-3
HST1057	500	400	8	10	50	0.5	1.5	1.0	150	80	TO-3
HST1058	600	400	8	10	50	0.5	1.5	1.0	150	80	TO-3
HST1059	700	400	8	10	50	0.5	1.5	1.0	150	80	TO-3
HST1060	250	200	8	10	—	0.5	1.5	1.0	150	80	TO-3
HST1061	400	325	8	10	—	0.5	1.5	1.0	150	80	TO-3
HST1062	500	400	8	10	—	0.5	1.5	1.0	150	80	TO-3
HST1063	600	400	8	10	—	0.5	1.5	1.0	150	80	TO-3
HST1064	700	400	8	10	—	0.5	1.5	1.0	150	80	TO-3
HST1150	250	200	8	10	—	0.5	1.5	1.0	150	40	TO-66
HST1151	400	325	8	10	—	0.5	1.5	1.0	150	40	TO-66
HST1152	500	400	8	10	—	0.5	1.5	1.0	150	40	TO-66
HST1153	600	400	8	10	—	0.5	1.5	1.0	150	40	TO-66
HST1154	700	400	8	10	—	0.5	1.5	1.0	150	40	TO-66
HST1155	250	200	8	10	50	0.5	1.5	1.0	150	40	TO-66
HST1156	400	325	8	10	50	0.5	1.5	1.0	150	40	TO-66
HST1157	500	400	8	10	50	0.5	1.5	1.0	150	40	TO-66
HST1158	600	400	8	10	50	0.5	1.5	1.0	150	40	TO-66
HST1159	700	400	8	10	50	0.5	1.5	1.0	150	40	TO-66
HST1160	250	200	8	15	—	0.5	1.0	5.0	100	40	TO-66
HST1161	400	325	8	15	—	0.5	1.0	5.0	100	40	TO-66
HST1162	500	400	8	15	—	0.5	1.0	5.0	100	40	TO-66
HST1163	600	400	8	15	—	0.5	1.0	5.0	100	40	TO-66
HST1164	700	400	8	15	—	0.5	1.0	5.0	100	40	TO-66
HST1250	250	200	8	15	—	0.5	1.0	5.0	100	80	TO-61
HST1251	400	325	8	15	—	0.5	1.0	5.0	100	80	TO-61
HST1252	500	400	8	15	—	0.5	1.0	5.0	100	80	TO-61
HST1253	600	400	8	15	—	0.5	1.0	5.0	100	80	TO-61
HST1254	700	400	8	15	—	0.5	1.0	5.0	100	80	TO-61
HST1255	250	200	8	10	50	0.5	1.5	1.0	150	80	TO-61
HST1256	400	325	8	10	50	0.5	1.5	1.0	150	80	TO-61
HST1257	500	400	8	10	50	0.5	1.5	1.0	150	80	TO-61
HST1258	600	400	8	10	50	0.5	1.5	1.0	150	80	TO-61
HST1259	700	400	8	10	50	0.5	1.5	1.0	150	80	TO-61
HST1260	250	200	8	10	—	0.5	1.5	1.0	150	80	TO-61
HST1261	400	325	8	10	—	0.5	1.5	1.0	150	80	TO-61
HST1262	500	400	8	10	—	0.5	1.5	1.0	150	80	TO-61
HST1263	600	400	8	10	—	0.5	1.5	1.0	150	80	TO-61
HST1264	700	400	8	10	—	0.5	1.5	1.0	150	80	TO-61

Hughes house types

Hughes Type No.	Rated Breakdown Voltages (volts) V_{CB}	V_{CE}	V_{EB}	h_{FE} @I_C=0.5A V_{CE}=2.0V Min.	Max.	Sat. Voltages (Max.) $I_C = 5.0A$ $I_B = .05A$ V_{CE}	V_{BE}	I_{CBO} Max. (μA)	@ V_{CB}	P_D T_C @ 100°C (watts)	ft (Typ.) (MHz)	Case Style
HST5001	60	40	8	50	150	0.35	1.2	0.1	30	4	85	TO-46
HST5002	80	60	8	50	150	0.35	1.2	0.1	30	4	85	TO-46
HST5003	100	80	8	50	150	0.35	1.2	0.1	60	4	85	TO-46
HST5004	140	100	8	50	150	0.35	1.2	0.1	60	4	85	TO-46
HST5005	180	120	8	50	150	0.35	1.2	0.1	60	4	85	TO-46
HST5006	60	40	8	30	—	0.35	1.2	0.1	30	4	85	TO-46
HST5007	80	60	8	30	—	0.35	1.2	0.1	30	4	85	TO-46
HST5008	100	80	8	30	—	0.35	1.2	0.1	60	4	85	TO-46
HST5009	140	100	8	30	—	0.35	1.2	0.1	60	4	85	TO-46
HST5010	180	120	8	30	—	0.35	1.2	0.1	60	4	85	TO-46
HST5011	60	40	8	120	—	0.35	1.2	0.1	30	4	85	TO-46
HST5012	80	60	8	120	—	0.35	1.2	0.1	30	4	85	TO-46
HST5013	100	80	8	120	—	0.35	1.2	0.1	60	4	85	TO-46
HST5014	140	100	8	120	—	0.35	1.2	0.1	60	4	85	TO-46
HST5015	180	120	8	120	—	0.35	1.2	0.1	60	4	85	TO-46
HST5051	175	150	8	50	150	0.35	1.2	0.1	60	4	85	TO-46
HST5052	200	175	8	50	150	0.35	1.2	0.1	60	4	85	TO-46
HST5053	225	200	8	50	150	0.35	1.2	0.1	60	4	85	TO-46
HST5054	175	150	8	30	—	0.35	1.2	0.1	60	4	85	TO-46
HST5055	200	175	8	30	—	0.35	1.2	0.1	60	4	85	TO-46
HST5056	225	200	8	30	—	0.35	1.2	0.1	60	4	85	TO-46
HST5501	60	40	8	50	150	0.35	1.2	0.1	30	4	85	TO-5
HST5502	80	60	8	50	150	0.35	1.2	0.1	30	4	85	TO-5
HST5503	100	80	8	50	150	0.35	1.2	0.1	60	4	85	TO-5
HST5504	140	100	8	50	150	0.35	1.2	0.1	60	4	85	TO-5
HST5505	180	120	8	50	150	0.35	1.2	0.1	60	4	85	TO-5
HST5506	60	40	8	30	—	0.35	1.2	0.1	30	4	85	TO-5
HST5507	80	60	8	30	—	0.35	1.2	0.1	30	4	85	TO-5
HST5508	100	80	8	30	—	0.35	1.2	0.1	60	4	85	TO-5
HST5509	140	100	8	30	—	0.35	1.2	0.1	60	4	85	TO-5
HST5510	180	120	8	30	—	0.35	1.2	0.1	60	4	85	TO-5
HST5511	60	40	8	120	—	0.35	1.2	0.1	30	4	85	TO-5
HST5512	80	60	8	120	—	0.35	1.2	0.1	30	4	85	TO-5
HST5513	100	80	8	120	—	0.35	1.2	0.1	60	4	85	TO-5
HST5514	140	100	8	120	—	0.35	1.2	0.1	60	4	85	TO-5
HST5515	180	120	8	120	—	0.35	1.2	0.1	60	4	85	TO-5
HST5551	175	150	8	50	150	0.35	1.2	0.1	60	4	85	TO-5
HST5552	200	175	8	50	150	0.35	1.2	0.1	60	4	85	TO-5
HST5553	225	200	8	50	150	0.35	1.2	0.1	60	4	85	TO-5
HST5554	175	150	8	30	—	0.35	1.2	0.1	60	4	85	TO-5
HST5555	200	175	8	30	—	0.35	1.2	0.1	60	4	85	TO-5
HST5556	225	200	8	30	—	0.35	1.2	0.1	60	4	85	TO-5

Hughes house types

Hughes Type No.	Rated Breakdown Voltages (volts) V_{CB}	V_{CE}	V_{EB}	h_{FE} @I_C=5.0A V_{CE}=5.0V Min.	Max.	Sat. Voltages (Max.) I_C=0.5A I_B=0.5A V_{CE}	V_{BE}	I_{CBO} Max. (μA)	@ V_{CB}	P_D T_C @ 100°C (watts)	ft (Typ.) (MHz)	Case Style
HST4451	80	40	8	20	60	0.5	2.0	1.0	60	4	70	TO-5
HST4452	100	80	8	20	60	0.5	2.0	1.0	60	4	70	TO-5
HST4453	80	40	8	40	120	0.5	2.0	1.0	60	4	70	TO-5
HST4454	100	80	8	40	120	0.5	2.0	1.0	60	4	70	TO-5
HST4455	80	40	8	100	—	0.5	2.0	1.0	60	4	70	TO-5
HST4456	100	80	8	100	—	0.5	2.0	1.0	60	4	70	TO-5
HST4483	60	40	8	20	60	0.5	2.0	1.0	60	4	70	TO-5
HST4551	80	40	8	20	60	0.5	2.0	1.0	60	20	70	MT-9
HST4552	100	80	8	20	60	0.5	2.0	1.0	60	20	70	MT-9
HST4553	80	40	8	40	120	0.5	2.0	1.0	60	20	70	MT-9
HST4554	100	80	8	40	120	0.5	2.0	1.0	60	20	70	MT-9
HST4555	80	40	8	100	—	0.5	2.0	1.0	60	20	70	MT-9
HST4556	100	80	8	100	—	0.5	2.0	1.0	60	20	70	MT-9
HST4583	60	40	5	20	60	0.5	2.0	1.0	60	20	70	MT-9

Hughes house types

Hughes Type No.	Rated Breakdown Voltages (volts) V_{CB}	V_{CE}	V_{EB}	h_{FE} @I_C=5.0A V_{CE}=5.0V Min.	Max.	Sat. Voltages (Max.) I_C=5.0A I_B=0.5A V_{CE}	V_{BE}	I_{CBO} Max. (μA)	@ V_{CB}	P_D T_C @ 100°C (watts)	ft (Typ.) (MHz)	Case Style
HST5901	60	40	8	50	150	0.35	1.2	0.1	30	16.6	85	TO-66
HST5902	80	60	8	50	150	0.35	1.2	0.1	30	16.6	85	TO-66
HST5903	100	80	8	50	150	0.35	1.2	0.1	60	16.6	85	TO-66
HST5904	140	100	8	50	150	0.35	1.2	0.1	60	16.6	85	TO-66
HST5905	180	120	8	50	150	0.35	1.2	0.1	60	16.6	85	TO-66
HST5906	60	40	8	30	—	0.35	1.2	0.1	30	16.6	85	TO-66
HST5907	80	60	8	30	—	0.35	1.2	0.1	30	16.6	85	TO-66
HST5908	100	80	8	30	—	0.35	1.2	0.1	60	16.6	85	TO-66
HST5909	140	100	8	30	—	0.35	1.2	0.1	60	16.6	85	TO-66
HST5910	180	120	8	30	—	0.35	1.2	0.1	60	16.6	85	TO-66
HST5911	60	40	8	120	—	0.35	1.2	0.1	30	16.6	85	TO-66
HST5912	80	60	8	120	—	0.35	1.2	0.1	30	16.6	85	TO-66
HST5913	100	80	8	120	—	0.35	1.2	0.1	60	16.6	85	TO-66
HST5914	140	100	8	120	—	0.35	1.2	0.1	60	16.6	85	TO-66
HST5915	180	120	8	120	—	0.35	1.2	0.1	60	16.6	85	TO-66

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discrete devices

silicon transistors cont'd

silicon NPN power transistors

Hughes house types—(cont'd)

Hughes Type No.	Rated Breakdown Voltages (volts) V_{CB}	V_{CE}	V_{EB}	h_{FE} @ I_C=5.0A V_{CE}=5.0V Min.	Max.	Sat. Voltages (Max.) I_C=5.0A I_B=0.5A V_{CE}	V_{BE}	I_{CBO} (μA) Max.	@ V_{CB}	P_D T_C @ 100°C (watts)	f_t (Typ.) (MHz)	Case Style
HST5951	175	150	8	50	150	0.35	1.2	0.1	60	16.6	85	TO-66
HST5952	200	175	8	50	150	0.35	1.2	0.1	60	16.6	85	TO-66
HST5953	225	200	8	50	150	0.35	1.2	0.1	60	16.6	85	TO-66
HST5954	175	150	8	30	—	0.35	1.2	0.1	60	16.6	85	TO-66
HST5955	200	175	8	30	—	0.35	1.2	0.1	60	16.6	85	TO-66
HST5956	225	200	8	30	—	0.35	1.2	0.1	60	16.6	85	TO-66
HST6001	100	50	5	10	—	1.0	2.0	1.0	60	40	70	TO-62
HST6011	80	40	8	20	60	0.5	2.0	1.0	60	40	70	TO-62
HST6012	100	80	8	20	60	0.5	2.0	1.0	60	40	70	TO-62
HST6013	80	40	8	40	120	0.5	2.0	1.0	60	40	70	TO-62
HST6014	100	80	8	40	120	0.5	2.0	1.0	60	40	70	TO-62
HST6015	80	40	8	100	—	0.5	2.0	1.0	60	40	70	TO-62
HST6016	100	80	8	100	—	0.5	2.0	1.0	60	40	70	TO-62
HST6031	60	40	5	20	60	0.5	2.0	1.0	60	40	70	TO-62
HST6308	60	40	8	20	60	0.5	2.0	1.0	60	30	70	TO-111
HST6309	80	60	8	20	60	0.5	2.0	1.0	60	30	70	TO-111
HST6310	100	80	8	20	60	0.5	2.0	1.0	60	30	70	TO-111
HST6311	60	40	8	40	120	0.5	2.0	1.0	60	30	70	TO-111
HST6312	80	60	8	40	120	0.5	2.0	1.0	60	30	70	TO-111
HST6313	100	80	8	40	120	0.5	2.0	1.0	60	30	70	TO-111
HST6314	60	40	8	100	—	0.5	2.0	1.0	60	30	70	TO-111
HST6315	80	60	8	100	—	0.5	2.0	1.0	60	30	70	TO-111
HST6316	100	80	8	100	—	0.5	2.0	1.0	60	30	70	TO-111
HST6408	60	40	8	20	60	0.5	2.0	1.0	60	30	70	TO-111*
HST6409	80	60	8	20	60	0.5	2.0	1.0	60	30	70	TO-111*
HST6410	100	80	8	20	60	0.5	2.0	1.0	60	30	70	TO-111*
HST6411	60	40	8	40	120	0.5	2.0	1.0	60	30	70	TO-111*
HST6412	80	60	8	40	120	0.5	2.0	1.0	60	30	70	TO-111*
HST6413	100	80	8	40	120	0.5	2.0	1.0	60	30	70	TO-111*
HST6414	60	40	8	100	—	0.5	2.0	1.0	60	30	70	TO-111*
HST6415	80	60	8	100	—	0.5	2.0	1.0	60	30	70	TO-111*
HST6416	100	80	8	100	—	0.5	2.0	1.0	60	30	70	TO-111*

*with isolated collector.

Hughes house types

Hughes Type No.	Rated Breakdown Voltages (volts) V_{CB}	V_{CE}	V_{EB}	h_{FE} @ I_C=0.5A V_{CE}=2.0V Min.	Max.	Sat. Voltages (Max.) I_C=5.0A I_B=.05A V_{CE}	V_{BE}	I_{CBO} (μA) Max.	@ V_{CB}	P_D T_C @ 100°C (watts)	f_t (Typ.) (MHz)	Case Style
HST6901	145	125	8	20	60	0.5	1.5	1.0	60	20	70	TO-66
HST6902	170	150	8	20	60	0.5	1.5	1.0	60	20	70	TO-66
HST6903	195	175	8	20	60	0.5	1.5	1.0	60	20	70	TO-66
HST6904	220	200	8	20	60	0.5	1.5	1.0	60	20	70	TO-66
HST6905	145	125	8	40	120	0.5	1.5	1.0	60	20	70	TO-66
HST6906	170	150	8	40	120	0.5	1.5	1.0	60	20	70	TO-66
HST6907	195	175	8	40	120	0.5	1.5	1.0	60	20	70	TO-66
HST6908	220	200	8	40	120	0.5	1.5	1.0	60	20	70	TO-66
HST7011	60	40	5	20	60	0.5	1.5	1.0	60	50	60	TO-61
HST7012	80	60	5	20	60	0.5	1.5	1.0	60	50	60	TO-61
HST7013	100	80	5	20	60	0.5	1.5	1.0	60	50	60	TO-61
HST7014	60	40	5	40	120	0.5	1.5	1.0	60	50	60	TO-61
HST7015	80	60	5	40	120	0.5	1.5	1.0	60	50	60	TO-61
HST7016	100	80	5	40	120	0.5	1.5	1.0	60	50	60	TO-61
HST7017	60	40	5	100	—	0.5	1.5	1.0	60	50	60	TO-61
HST7018	80	60	5	100	—	0.5	1.5	1.0	60	50	60	TO-61
HST7019	100	80	5	100	—	0.5	1.5	1.0	60	50	60	TO-61
HST7140	120	100	8	40	120	0.6	1.5	0.1	60	50	60	TO-61
HST7141	200	150	8	40	120	0.6	1.5	0.1	100	50	60	TO-61
HST7150	140	120	8	20	60	0.5	1.5	0.5	60	50	60	TO-61
HST7151	170	150	8	20	60	0.6	1.5	0.5	100	50	60	TO-61
HST7152	220	200	8	20	60	0.6	1.5	0.5	100	50	60	TO-61
HST7154	140	120	8	40	120	0.5	1.5	0.5	60	50	60	TO-61
HST7155	170	150	8	40	120	0.6	1.5	0.5	100	50	60	TO-61
HST7156	220	200	8	40	120	0.6	1.5	0.5	100	50	60	TO-61
HST7201	225	200	8	20	60	0.5	1.2	1.0	100	65	50	TO-3
HST7202	250	225	8	20	60	0.5	1.2	1.0	100	65	50	TO-3
HST7203	275	250	8	20	60	0.5	1.2	1.0	100	65	50	TO-3
HST7204	325	300	8	20	60	0.5	1.2	1.0	100	65	50	TO-3
HST7205	350	325	8	20	60	0.5	1.2	1.0	100	65	50	TO-3
HST7206	150	150	8	10	—	0.5	1.2	10	100	65	50	TO-3
HST7207	200	200	8	15	—	0.5	1.2	10	100	65	50	TO-3
HST7208	250	250	8	15	—	0.5	1.2	10	100	65	50	TO-3
HST7209	300	300	8	15	—	0.5	1.2	10	100	65	50	TO-3

Hughes house types

Hughes Type No.	Rated Breakdown Voltages (volts) V_{CB}	V_{CE}	V_{EB}	h_{FE} @ I_C=5.0A V_{CE}=5.0V Min.	Max.	Sat. Voltages (Max.) I_C=5.0A I_B=0.5A V_{CE}	V_{BE}	I_{CBO} (μA) Max.	@ V_{CB}	P_D T_C @ 100°C (watts)	f_t (Typ.) (MHz)	Case Style
HST7401	60	40	5	40	120	0.5	1.5	1.0	30	5		TO-5
HST7402	80	60	5	40	120	0.5	1.5	1.0	60	5		TO-5
HST7403	100	80	5	40	120	0.5	1.5	1.0	60	5		TO-5
HST7411	60	40	5	20	60	0.6	1.5	1.0	30	5		TO-5
HST7412	80	60	5	20	60	0.6	1.5	1.0	60	5		TO-5
HST7413	100	80	5	20	60	0.6	1.5	1.0	60	5		TO-5
HST7414	60	40	5	40	120	0.6	1.5	1.0	30	5		TO-5
HST7415	80	60	5	40	120	0.6	1.5	1.0	60	5		TO-5
HST7416	100	80	5	40	120	0.6	1.5	1.0	60	5		TO-5
HST7417	60	40	5	100	—	0.6	1.5	1.0	30	5		TO-5
HST7418	80	60	5	100	—	0.6	1.5	1.0	60	5		TO-5
HST7419	100	80	5	100	—	0.6	1.5	1.0	60	5		TO-5
HST7601	60	40	8	40	120	0.5	1.5	0.5	30	65	60	TO-41
HST7602	80	60	8	40	120	0.5	1.5	0.5	30	65	60	TO-41
HST7603	100	80	8	40	120	0.5	1.5	0.5	60	65	60	TO-41
HST7604	140	120	8	40	120	0.5	1.5	0.5	60	65	60	TO-41
HST7605	170	150	8	40	120	0.6	1.5	0.5	100	65	60	TO-41
HST7606	220	200	8	40	120	0.6	1.5	0.5	100	65	60	TO-41
HST7607	60	40	8	20	60	0.5	1.5	0.5	30	65	60	TO-41
HST7608	80	60	8	20	60	0.5	1.5	0.5	30	65	60	TO-41
HST7609	100	80	8	20	60	0.5	1.5	0.5	60	65	60	TO-41
HST7610	140	120	8	20	60	0.5	1.5	0.5	60	65	60	TO-41
HST7611	170	150	8	20	60	0.6	1.5	0.5	100	65	60	TO-41
HST7612	220	200	8	20	60	0.6	1.5	0.5	100	65	60	TO-41
HST7801	225	200	8	20	60	0.5	1.2	1.0	100	50	50	TO-61
HST7802	250	225	8	20	60	0.5	1.2	1.0	100	50	50	TO-61
HST7803	275	250	8	20	60	0.5	1.2	1.0	100	50	50	TO-61
HST7804	325	300	8	20	60	0.5	1.2	1.0	100	50	50	TO-61
HST7805	350	325	8	20	60	0.5	1.2	1.0	100	50	50	TO-61
HST7806	150	150	8	10	—	0.5	1.2	10	100	50	50	TO-61
HST7807	200	200	8	15	—	0.5	1.2	10	100	50	50	TO-61
HST7808	250	250	8	15	—	0.5	1.2	10	100	50	50	TO-61
HST7809	300	300	8	15	—	0.5	1.2	10	100	50	50	TO-61

Hughes house types

Hughes Type No.	Rated Breakdown Voltages (volts) V_{CB}	V_{CE}	V_{EB}	h_{FE} @ I_C=5.0A V_{CE}=5.0V Min.	Max.	Sat. Voltages (Max.) I_C=5.0A I_B=0.5A V_{CE}	V_{BE}	I_{CBO} (μA) Max.	@ V_{CB}	P_D T_C @ 100°C (watts)	f_t (Typ.) (MHz)	Case Style
HST7901	225	200	8	20	60	0.5	1.2	1.0	100	25	50	TO-66
HST7902	250	225	8	20	60	0.5	1.2	1.0	100	25	50	TO-66
HST7903	275	250	8	20	60	0.5	1.2	1.0	100	25	50	TO-66
HST7904	325	300	8	20	60	0.5	1.2	1.0	100	25	50	TO-66
HST7905	350	325	8	20	60	0.5	1.2	1.0	100	25	50	TO-66
HST7907	200	200	8	15	—	0.5	1.2	10	100	25	50	TO-66
HST7908	250	250	8	15	—	0.5	1.2	10	100	25	50	TO-66
HST7909	300	300	8	15	—	0.5	1.2	10	100	25	50	TO-66
HST7910	150	150	8	10	—	0.5	1.2	10	100	25	50	TO-66
HST8002	80	60	8	40	120	1.0	1.7	100	60	100	35	TO-63
HST8003	100	80	8	40	120	1.0	1.7	100	60	100	35	TO-63
HST8012	80	60	8	20	60	0.6	1.5	10	60	100	35	TO-63
HST8013	100	80	8	20	60	0.6	1.5	10	60	100	35	TO-63
HST8015	80	60	8	40	120	0.6	1.5	10	60	100	35	TO-63
HST8016	100	80	8	40	120	0.6	1.5	10	60	100	35	TO-63
HST8045	40	25	5	40	—	1.5	2.0	10	25	100	35	TO-63
HST8070	80	60	8	100	—	0.6	1.5	10	60	100	35	TO-63
HST8071	100	80	8	100	—	0.6	1.5	10	60	100	35	TO-63
HST8105	80	60	8	40	120	1.0	1.7	100	60	65	35	X-15A
HST8106	100	80	8	40	120	1.0	1.7	100	60	65	35	X-15A
HST8110	80	60	8	100	—	0.6	1.5	10	60	65	35	X-15A
HST8111	100	80	8	100	—	0.6	1.5	10	60	65	35	X-15A
HST8112	80	60	8	20	60	0.6	1.5	10	60	65	35	X-15A
HST8113	100	80	8	20	60	0.6	1.5	10	60	65	35	X-15A
HST8114	40	25	5	40	—	1.5	2.0	10	25	65	35	X-15A
HST8115	80	60	8	40	120	0.6	1.5	10	60	65	35	X-15A
HST8116	100	80	8	40	120	0.6	1.5	10	60	65	35	X-15A
HST8301	80	60	8	40	120	0.6	1.5	10	60	100	35	TO-63
HST8302	100	80	8	40	120	0.6	1.5	10	60	100	35	TO-63
HST8303	80	60	8	100	—	0.6	1.5	10	60	100	35	TO-63

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2N109	2N501A	2N722	2N935	2N1132B	2N1608	2N1986	2N2217	2N2540	2N3020
2N128	2N502	2N722A	2N936	2N1135	2N1613	2N1987	2N2217A	2N2586	2N3072
2N207	2N502A	2N743	2N937	2N1135A	2N1623	2N1988	2N2218	2N2616	2N3073
2N207A	2N502B	2N744	2N938	2N1158	2N1639	2N1989	2N2218A	2N2645	2N3107
2N207B	2N503	2N753	2N939	2N1158A	2N1643	2N1990	2N2219	2N2651	2N3108
2N217	2N504	2N768	2N940	2N1177	2N1654	2N1991	2N2219A	2N2696	2N3109
2N223	2N534	2N770	2N941	2N1178	2N1655	2N2008	2N2220A	2N2697	2N3110
2N224	2N535	2N771	2N942	2N1179	2N1656	2N2048	2N2221	2N2710	2N3114
2N225	2N535A	2N772	2N943	2N1180	2N1663	2N2049	2N2221A	2N2784	2N3117
2N226	2N535B	2N773	2N944	2N1199	2N1676	2N2083	2N2222	2N2785	2N3120
2N227	2N536	2N774	2N945	2N1199A	2N1677	2N2086	2N2222A	2N2786	2N3121
2N231	2N581	2N775	2N946	2N1200	2N1708	2N2087	2N2274	2N2787	2N3133
2N232	2N582	2N776	2N947	2N1201	2N1711	2N2088	2N2275	2N2788	2N3134
2N240	2N583	2N777	2N956	2N1204	2N1726	2N2147	2N2276	2N2789	2N3135
2N269	2N584	2N778	2N960	2N1219	2N1727	2N2148	2N2277	2N2790	2N3136
2N300	2N588	2N779	2N961	2N1221	2N1728	2N2162	2N2280	2N2791	2N3137
2N301	2N589	2N783	2N962	2N1222	2N1742	2N2163	2N2281	2N2792	2N3209
2N301A	2N597	2N785	2N963	2N1223	2N1743	2N2164	2N2282	2N2801	2N3244
2N317A	2N598	2N794	2N964	2N1228	2N1744	2N2165	2N2297	2N2837	2N3245
2N327A	2N599	2N795	2N965	2N1229	2N1745	2N2166	2N2303	2N2838	2N3250
2N327B	2N600	2N796	2N966	2N1230	2N1746	2N2167	2N2360	2N2845	2N3251
2N328A	2N601	2N828	2N977	2N1231	2N1747	2N2168	2N2361	2N2846	2N3252
2N328B	2N647	2N834	2N978	2N1232	2N1748	2N2169	2N2362	2N2847	2N3253
2N329A	2N649	2N835	2N995	2N1233	2N1749	2N2170	2N2368	2N2848	2N3254
2N329B	2N656	2N846	2N1010	2N1252	2N1750	2N2175	2N2369	2N2868	2N3299
2N344	2N657	2N846A	2N1024	2N1253	2N1752	2N2176	2N2369A	2N2869	2N3301
2N345	2N670	2N858	2N1025	2N1267	2N1753	2N2177	2N2374	2N2870	2N3302
2N346	2N671	2N859	2N1026	2N1268	2N1754	2N2178	2N2375	2N2883	2N3304
2N352	2N672	2N860	2N1027	2N1269	2N1785	2N2180	2N2376	2N2884	2N3337
2N353	2N673	2N861	2N1028	2N1270	2N1786	2N2181	2N2380	2N2894	2N3338
2N386	2N696	2N862	2N1034	2N1271	2N1787	2N2182	2N2380A	2N2904	2N3339
2N387	2N697	2N863	2N1035	2N1272	2N1788	2N2183	2N2398	2N2904A	2N3342
2N393	2N698	2N864	2N1036	2N1275	2N1790	2N2184	2N2399	2N2905	2N3343
2N395	2N699	2N865	2N1037	2N1411	2N1864	2N2185	2N2410	2N2905A	2N3344
2N396	2N699A	2N869	2N1118	2N1416	2N1865	2N2186	2N2443	2N2906	2N3345
2N396A	2N699B	2N869A	2N1118A	2N1420	2N1866	2N2187	2N2475	2N2906A	2N3346
2N404	2N703	2N870	2N1119	2N1427	2N1867	2N2192	2N2476	2N2907	2N3730
2N406	2N706	2N871	2N1122	2N1428	2N1868	2N2192A	2N2477	2N2907A	2N3731
2N408	2N706A	2N910	2N1122A	2N1429	2N1889	2N2192B	2N2478	2N2930	2N3732
2N410	2N706B	2N911	2N1123	2N1436	2N1890	2N2193	2N2479	2N2954	
2N412	2N708	2N912	2N1124	2N1467	2N1893	2N2193A	2N2480	2N2966	
2N414	2N709	2N914	2N1125	2N1472	2N1905	2N2193B	2N2481	2N2967	
2N428	2N717	2N915	2N1128	2N1478	2N1917	2N2194	2N2483	2N3009	
2N495	2N718	2N916	2N1129	2N1494	2N1918	2N2194A	2N2484	2N3010	
2N496	2N719	2N918	2N1130	2N1494A	2N1973	2N2194B	2N2509	2N3011	
2N497	2N719A	2N926	2N1131	2N1499	2N1974	2N2195	2N2510	2N3012	
2N498	2N720	2N927	2N1131A	2N1499A	2N1975	2N2195A	2N2511	2N3013	
2N499	2N720A	2N928	2N1131B	2N1500	2N1983	2N2195B	2N2537	2N3014	
2N499A	2N721	2N929	2N1132	2N1606	2N1984	2N2199	2N2538	2N3015	
2N501	2N721A	2N930	2N1132A	2N1607	2N1985	2N2205	2N2539	2N3019	

CONSUMER — ENTERTAINMENT TYPES

2N207	2N225	2N502	2N499A	2N1743	2N1745	2N2361	2N1201
2N224	2N226	2N499	2N1742	2N1744	2N2360	2N2362	2N1267

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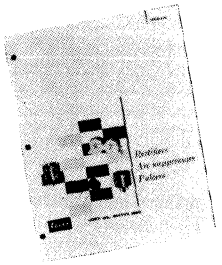
SILICON BRIDGE RECTIFIERS AND ARC SUPPRESSORS



Efficient, light, economical, and exceptionally reliable, Ledex transient protected silicon bridge rectifiers have built-in transient control. High voltage spikes on either AC or DC sides are automatically clipped at 200 volts, protecting the diode cells as well as other circuit components.

Stock models carry 7.5 amperes at intermittent duty, 1.8 amperes at continuous duty. Recommended for use with all Ledex electromechanical products and for any system subjected to high voltage spikes from solenoids, relays, or other inductive equipment sharing a common AC line. Storage and ambient temperature range is −55°C to +125°C.

RATINGS FOR 60 THROUGH 400 CPS*

	PIV	Input VRMS	Output VDC	Surge Amps
Nominal	Automatic Protection	115	100	—
Maximum	within design limits	130	116	25 amps 8 ms

* Sinusoidal input, resistive or inductive loads

CURRENT RATING BY DUTY CYCLE (20°C)

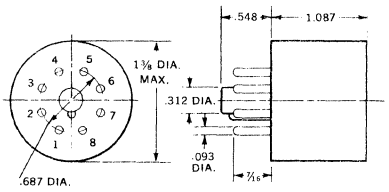
Duty Cycle	Continuous	¾	½	¼	1/10
Max. Current Rating (amps)	1.8	2.4	3.6	7.2	7.5
Max. Pulse Length (sec)	Continuous	115	100	43	20

* Duty cycle = $\frac{\text{pulse length}}{\text{pulse length + "off" time}}$

OCTAL PLUG-IN
MODEL NUMBER
A-46502-003

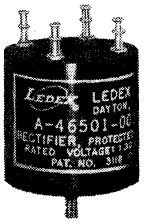
Weight: 1⅝ oz. Mates with standard octal tube socket such as Cinch-Jones 8AB or equal.

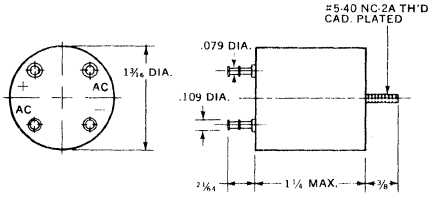




TURRET TERMINAL
MODEL NUMBER
A-46501-003

Weight: 1½ oz. Standard binding post type terminals, #5-40 x ⅜" mounting stud.

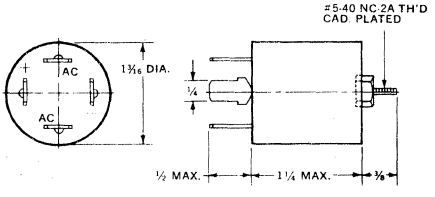


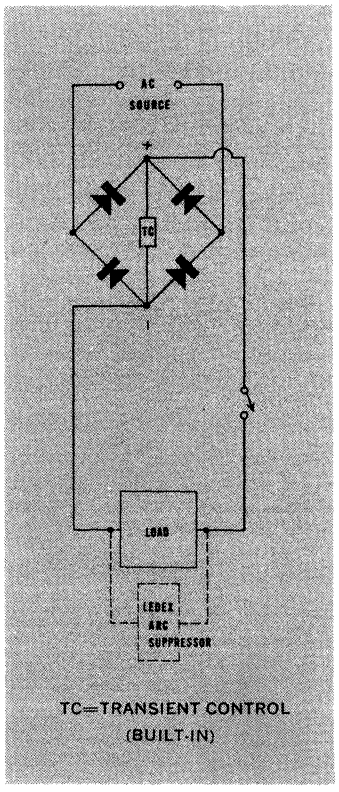


QUICK-CONNECT TERMINAL
MODEL NUMBER
121011-001

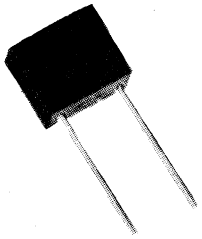
Weight: 1½ oz. Mates with A-AMP, Inc. Series 250 (Faston) or equivalent ¼" terminals.







ARC SUPPRESSORS

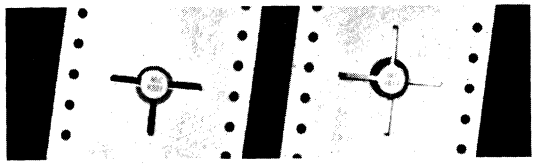


Ledex Arc Suppressors eliminate arcing caused by reverse voltage spikes produced when the circuit to an inductive load is disconnected. These reverse voltages, while of short duration, often reach high value. They can damage the contacts of the control circuit, cause shorts, radio interference, and eventual malfunction.

Stock models include diode/capacitor designs, with lowest peak reverse voltage rating — ideal for protection of solid state circuit components; and diode/capacitor/zener designs, which minimize armature drop-out time for applications in which operating speed is critical.



NEC ESAKI DIODES are recommended for high-speed switching applications. Specifications available upon request.



NEC MICROWAVE TRANSISTORS—enthusiastically approved by leading telecommunications and electronic data processing engineers. In complex communications systems, NEC Microwave Transistors provide consistently excellent performance under the most difficult ambient environmental conditions. Our Type V417 Microwave Transistor, which operates with NF 9dB at 4 GH_z, is well known. In this same group we also recommend our types V327 and V415 Microwave Transistors.

Specification inquiries and consultations cordially invited, without obligation.



NEC manufactures high quality **SCR, SR, TRIAC, DIAC,** Unijunction, Voltage Reference Diodes ($V_Z 7^V$ — 1S550 through 1SS552), and HF Zener Diodes (RD7H, 8H and 10H). NEC Silicon Controlled Rectifiers and Silicon Rectifiers are recommended for high current, high voltage applications. NEC also produces SCR and SR, tailored for a vast range of current/voltage requirements.

UNIJUNCTION TRANSISTORS

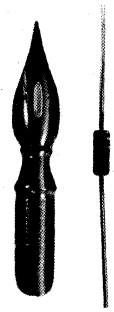
TYPE NO.	P (mW)	V_{BB} (V)
2SH11	450	35
2SH12	450	35
2SH16	200	25
2SH17	200	25

TRIACS

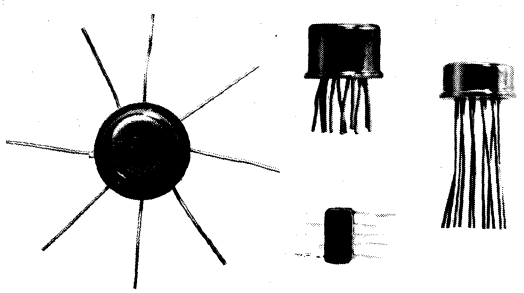
I_O (A)	V_{BLM} (V) 200	400	I_{GT} (mA)	V_{GT} (V)
6.0	AC06B	AC06D	±50	±3.0
6.0	AC06BS	AC06DS	±50	±3.0
10	AC10B	AC10D	±50	±3.0
10	AC10BS	AC10DS	±50	±3.0

DIAC

TYPE NO.	V_{BO_1} (V)	I_P (A)
V413	±26~40	±2.0



NEC "ESVAC" (Epitaxial Silicon Capacitance Diode) includes three groups: 1S1617, 1S1618 and 1S1619. Our outstanding Capacitance Diodes utilize "Hyper-Abrupt Junction," (the rate of junction capacitance varying with applied voltage). Especially recommended for use in automatic gain control, automatic frequency control, frequency modulation, phase modulation and voltage tuning circuits, with high reliability and excellent temperature characteristics.



INTEGRATED CIRCUITS: Nippon Electric **is Japan's foremost manufacturer of Integrated Circuits.** Recognizing the vital role of miniaturization in the electronic industry, NEC has perfected mini-microscopic IC's to insure maximum economy, function and durability.

FOR DESK CALCULATORS: The NEC MOS Series (μPD 9-15), now available in production quantities, offers high reliability with very stable performance. NEC will soon begin production of LSI (Large Scale Integration) to meet the industry's growing needs.

FOR INDUSTRIAL USE: NEC's new family of TTL, designated the μPB200 Series, provides total compatibility with standard U.S.A. products. Our μPC51 is designed for use in Operational Amplifiers, and the μPC71 for Comparator applications.

FOR CONSUMER PRODUCTS: The μPC16 is a linear IC for IF amplification in television audio circuits. Performance is excellent in limiting characteristics, linearity of detector and temperature stability. Advanced design concepts make the μPC16 significantly superior to circuits employing the usual discrete components.



NEC'S EXTENSIVE RANGE OF CAPACITORS ARE GUARANTEED TO MEET YOUR MOST EXACTING SPECIFICATIONS:

"BL" CAPACITORS. Special "Boundary Layer" ceramic semiconductor capacitors developed by NEC are based on a new principle enabling optimized by-passing applications in H F. and High Speed Pulse circuits, with improved temperature and frequency characteristics.

TANTALUM "E" SERIES. Small, rectangular, solid tantalum capacitors, transfer molded with plastic material, supplied with uni-directional leads for use in printed circuits.

TANTALUM "H" SERIES. Hermetically sealed in a metal case, designed expressly for communications equipment, industrial control systems and electronic computers.

"MICROSOLID" TANTALUM. Smaller size is more suitable for use in high density electronic circuits.

"MYLEX" (MYLAR FILM). More compact and lighter in weight than the polyester type, "Mylex" capacitors provide highly efficient operation at very low voltages.

NEC

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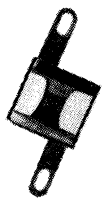
OTHER COUNTRIES PLEASE DIRECT INQUIRIES TO: *Nippon Electric Company, Limited*
P.O. BOX 1, TAKANAWA TOKYO, JAPAN

RECTIFIERS, DIODES and CARTRIDGES

DIODES FOR RE-CHARGING NICKEL-CADMIUM BATTERIES—TRANSFORMER TYPE CHARGERS

The Rect-A-Cell selenium diode is rugged, dependable and does not age. The mechanical construction includes a metal wrap plus a spring to insure positive contact to the selenium cell under all conditions. The diode may be included as a part of the transformer secondary winding assembly, and encapsulated without loss of contact. The transient-free characteristic of selenium makes this high density diode particularly well suited for low voltage battery chargers.



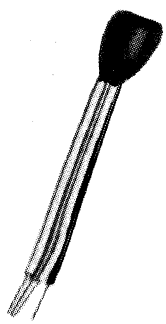
Part No. 302-123 5/16" x 3/16" x 13/16" overall length

AC Input: 33V RMS Max.

DC Output: 125-175 MA depending upon the heat transfer characteristics of the installation.

BRIDGE RECTIFIERS FOR TRANSFORMERLESS CHARGERS

Where the battery and charger are permanently connected, a capacitor plus the low voltage bridge rectifier may be used directly from the 125 volt AC line. The completely wired, four section bridge rectifier provides a small, efficient, long life device, protected from normal atmospheric conditions.

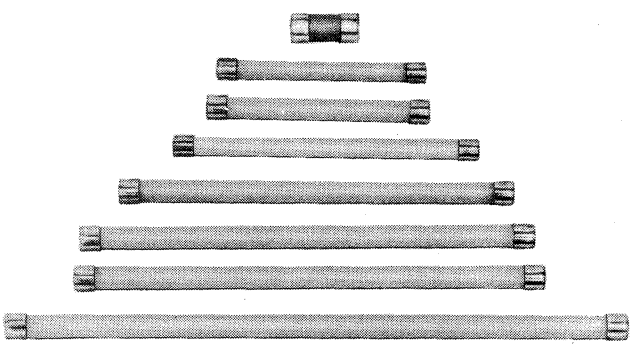


Part No. 301-173 33 V RMS AC
DC output: 50-150 MA.

Part No. 301-172 33 V RMS AC
DC output: 100-225 MA.

Larger sizes for higher charging rates are also available.

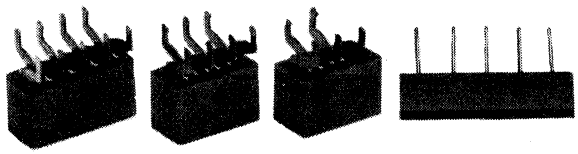
HIGH VOLTAGE SELENIUM CARTRIDGES



High Voltage Selenium Cartridges, which feature low leakage, high conductivity, stability and reliability.

Part No. 303-59	800 PIV	"Boost"	1 1/16" L x 9/32" Dia.
Part No. 303-248	6500 V	"Focus"	2 1/16" L x 9/32" Dia.
Part No. 303-351	7500 V		2 3/16" L x 9/32" Dia.
Part No. 303-352	10,000 V		2 15/16" L x 9/32" Dia.
Part No. 303-353	11,000 V		3 3/16" L x 9/32" Dia.
Part No. 303-354	12,000 V		3 5/8" L x 9/32" Dia.
Part No. 303-355	18,000 V		4 3/16" L x 9/32" Dia.
Part No. 303-356	20,000 V		5 5/8" L x 9/32" Dia.

COLOR TV CONVERGENCE RECTIFIERS

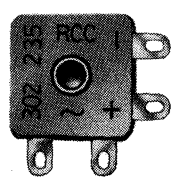


Selenium diodes with extra high conductivity and long life, epoxy encapsulated in Lexan cases, mechanically interchangeable with open plate construction rectifiers, and ready for application to printed circuit boards. Three types, covering 3, 4, and 5 cell devices are available. Other types may be made if required.

Part No. 301-58	3 cell	11/16" x 3/8" x 7/16"
Part No. 301-1	4 cell	11/16" x 3/8" x 7/16"
Part No. 301-261	5 cell	7/8" x 3/8" x 7/16"
Part No. 301-357	4 cell	

BRIDGE RECTIFIERS FOR SOLENOID, MOTOR AND RELAY OPERATION

A completely wired, single phase bridge rectifier, in a Lexan case, with center mounting and eyelet completely insulated.



Part No. 302-137
130 VAC RMS 100 MA DC 5/8" x 5/8" x 5/16"

Part No. 302-235
250 VAC RMS 80 MA DC 5/8" x 5/8" x 5/16"

Other ratings available upon request.

POWER RECTIFIERS — CONVENTIONAL CONSTRUCTION!

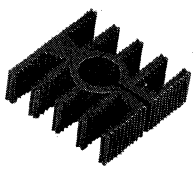
Rectifier cells from 0.7" x 0.7" to 8" x 16" are available as cells or stacks for convection cooling, fan-cooled or oil-cooled applications. The high efficiency, and long life expectancy (100,000 hours without aging) plus transient-free characteristics make this new selenium an economic device to be used in critical applications. The forward voltage drop at rated loads is less than silicon. Therefore, on all low voltage applications, the low voltage drop, high efficiency, long, non-aging life, and freedom from the need for transient suppressors or special mounting hardware, make the Rect-A-Cell rectifiers the most economical device for your applications.

RECTIFIER COMPONENTS CORPORATION
124 ALBANY AVENUE, FREEPORT, N.Y. 11520

GEORGE RISK INDUSTRIES

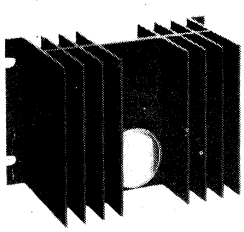
SEMICONDUCTOR COOLERS

SERIES 20 MILLIWATT COOLERS



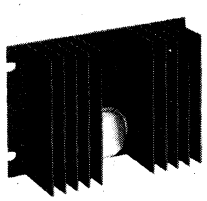
• New square design for greater cooling efficiency in smaller space • Four standard models: .50", .625", .75" and 1.00" square • Fit case diameters .177/.370" • Case temperature rise above ambient (25° C) is 20 to 50° C at 500 milliwatts.

NATURAL CONVECTION COOLERS



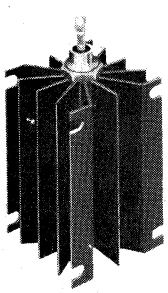
Power Type • 15 standard models • Dimensional range: 1.5" to 5.5" H; 4.5" to 4.81" W; .45" to 2.5" D • Case styles: TO-3 and TO-36, plus blanks with no mounting hole • Typical case temperature rise above ambient (25° C) = Model 13A0610 (3.0" x 4.5" x 1.25") 25° at 15 watts.

NATURAL CONVECTION COOLERS



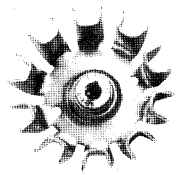
Flat Bottom Type • 12 standard models • Basic dimensions: 1.5" H x 2.75" W x 1.31" D; 3.0" H x 4.37" W x 1.31" D; 3.0" H x 5.9" W x 1.06" D • Case styles: TO-3 and TO-36 plus blanks with no mounting holes • Case temperature rise above ambient (25° C) at 15 watts is 18-36° depending on model.

RADIAL RECTIFIER COOLERS



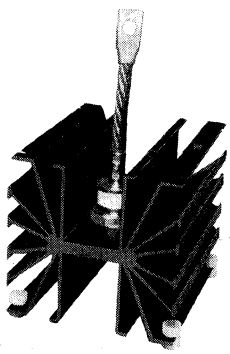
• 11 standard models • Dimensional range: 2" square x .75", 1.5 and 3" high. Standard mil. spec. black anodized finish • Furnished with semiconductor area and one mounting foot free of anodize • Will accommodate both stud mounted (up to 11/16" hex case) and press-fitted transistors and rectifiers • Temperature rise 40-70° above ambient (25° C) at 15 watts.

CIRCUIT BOARD COOLERS



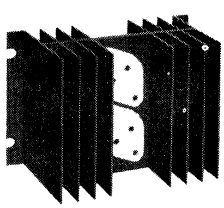
• For TO-3 and TO-36 transistors • Unique fin design provides unusually large surface area for natural convection cooling • Will dissipate up to 5 watts under 50 fpm forced air with only 50° C rise above ambient (25° C).

HIGH POWER MULTI-FIN HEAT SINKS



• Multi-fin design provides maximum surface area in minimum volume • Larger surface area permits operating at lower flow velocities for forced convection cooling • In applications where high power rectifiers are operated near upper limit of current rating, smaller, quieter fans may be used. NOTE: 3' and 6' lengths of raw extrusion are available for prototypes.

BERYLLIUM OXIDE INSULATING WAFERS



• Surface ground for maximum interface contact and heat transfer efficiency • Eliminate need for insulating heat sink from chassis • For case styles: TO-3, TO-36, TO-5, TO-8, TO-18, TO-53, TO-66.

COOLING ACCESSORIES

■ Insulation grommets ■ Baked-on isolation coating
■ Shroud assemblies

SPECIAL REQUIREMENTS

All the heat sinks shown here can be obtained in a number of variations and special design work can be carried out to meet your specifications. Send us your requirements. We will be happy to be of assistance in any way we can.

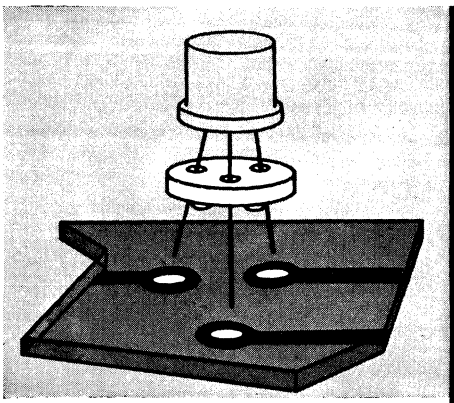
WRITE FOR: ☐ New Heat Sink Catalog
☐ New Forced-Air Cooler Catalog

WRITE FOR COMPLETE LITERATURE AND PRICES

GEORGE RISK INDUSTRIES, INC.
672 15th Avenue, Columbus, Nebr. 68601
Telephone: 402-564-2777 TWX: 910-626-0950

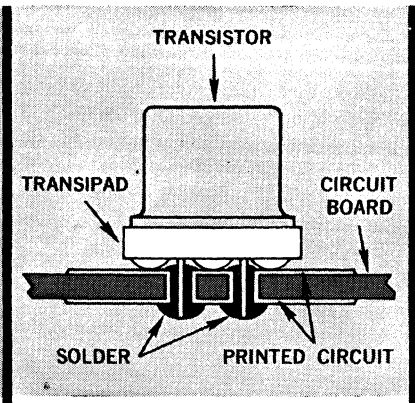
TRANSIPADS

TRANSISTOR MOUNTING PADS



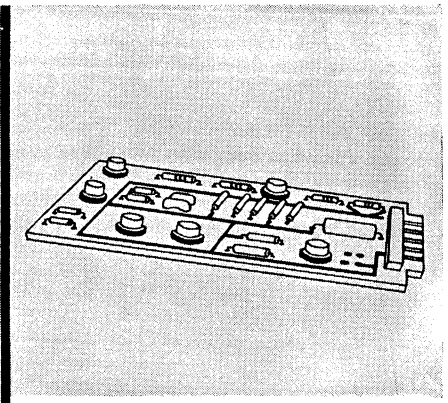
SIMPLIFY PC-BOARD ASSEMBLY

Transistor leads simply slip through molded-in holes. Transipads serve as lead-aligning jigs, give uniform above-the-board component spacing. Soldering of leads to board secures entire assembly.



PREVENT TRANSISTOR DAMAGE

Before mounting on the PC-board, the Transipad reinforces the transistor lead seal. After mounting, it protects against erratic soldering practices, provides longer lead length and a heat-dissipating air space.



ENHANCE PC RELIABILITY

Transipads provide rock-solid support, maintain lead-spacing, relieve leads of stress loads. The air space beneath a Transipad helps avoid moisture entrapment, permits solder-fillet inspection, allows thorough flushing of flux due.

Standard Transipads for Most Applications—At present, there are more than 150 standard Transipads. These meet the mounting requirements of the 24 most common transistor-case styles. For most TO types, you have a choice of several Transipads, in varying heights, and with standoffs on one side or both (or with no standoffs for minimum above-the-board silhouette).

Special-Purpose Transipads—Pads designed to widen lead spacing (e.g., from TO-18 to TO-5), change lead configuration, adapt 8, 10, 12 lead circuits, all available from stock. In addition, custom made mounting pads and converters can be supplied —with no tooling charge whatsoever on orders of 5,000 or more.



Choice of Materials — Milton Ross Transipads are precision-molded of glass-filled diallyl phthalate (DAP), or nylon, all of which have high dielectric strength. DAP is non-hygroscopic and withstands temperatures to 425°F.

Choice of Colors — Nylon pads are white; standard color for DAP is black. In addition, DAP pads can be supplied in red, grey, green, blue, or tan at slight extra cost.

THE MILTON ROSS COMPANY

511 Second St. Pike, Southampton, Pa. 18966 • 215-355-0200 • TWX 510-667-1702
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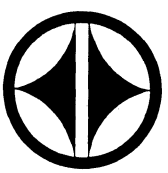
2900 W. Peterson Ave., Chicago, Ill. 60645 • 312-338-5141
14 New Road, Watford, Hertfordshire, England • Watford 24446/7

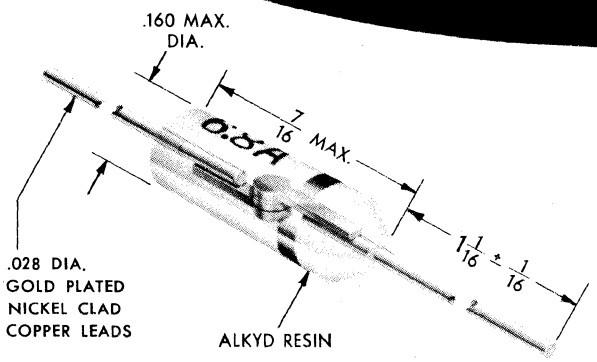
Look in the Yellow Section for Manufacturers' Sales Offices



Tell them you found them in **eem**

UNSURPASSED!

The Reliable SCHAUER® 1-Watt Zener is available at the Industry's lowest prices!



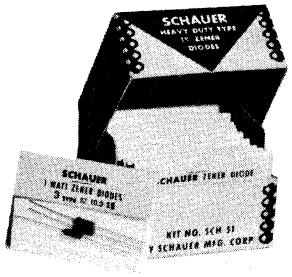
- No fragile nail heads.
- Silicon junction aligned between two parallel, offset tantalum heat sinks . . . great lead tension strength.
- All welded and brazed assembly.
- High pressure molded package.
- Banded and tapered cathode.

Schauer Type Note 1	Nominal V_{ZT} Volts	Typical Z_{ZT} Ohms at I_{ZT} = 20 ma T_a = 25°C	Temp. Coeff. % per °C
SZ2.4	2.4	14	−.054
SZ2.7	2.7	16	−.055
SZ3.0	3.0	17	−.055
SZ3.3	3.3	17	−.054
SZ3.6	3.6	17	−.050
SZ3.9	3.9	17	−.045
SZ4.3	4.3	17	−.037
SZ4.7	4.7	12	−.029
SZ5.1	5.1	10	−.019
SZ5.6	5.6	6.0	−.009
SZ6.2	6.2	2.0	+.018
SZ6.8	6.8	1.5	+.035
SZ7.5	7.5	1.5	+.044
SZ8.2	8.2	2.0	+.049
SZ9.1	9.1	4.0	+.053
SZ10.0	10.0	5.0	+.055
SZ11.0	11.0	6.0	+.057
SZ12.0	12.0	7.0	+.059
SZ13.0	13.0	7.0	+.061
SZ15.0	15.0	8.0	+.065
SZ16.0	16.0	8.0	+.066

PRICES—Mixed types receive total quantity price break.

1-99	100-499	500-999	1000-4999	5000 Up
		10% TOLERANCE		
.49	.38	.33	.29	.27
		OTHER TOLERANCES Note 1		
		5%		
.59	.47	.41	.37	.34
		2%		
.89	.81	.76	.72	.69
		1%		
1.07	.97	.91	.86	.82

Note 1: Type shown are 10% tolerances, add suffix "A" for 5% and suffix 20%, 2%, 1% for other tolerances. For intermediate voltages, insert voltage and tolerances, i.e.: SZ6.3 (1%).



SCHAUER 1% tolerance zener diode kit #SCH51. A $54.57 value for only $24.50!

A 51-piece assortment of 1% tolerance, 1 watt reliable Schauer zener diodes covering the voltage range of 2.7 to 16.0. Three diodes of each voltage are contained in reusable poly bags which are stored in a handy kit. Data sheet included.

May be used over and over in laboratory prototypes as well as in precision test equipment. Close tolerances mean fixed impedances and temperature coefficients and permit voltage range tests for optimum design.

SCHAUER silicon varistors

Consists of two matched silicon junctions connected in parallel and oppositely poled. The junctions are molded into one small package with axial gold plated nickel leads. Surge: 25 amps peak ½ cycle; dissipation: ¾ watt at 25°C.; TC of 2mv/°C. All have closely controlled forward conductance with log current characteristics.

Schauer Type	Uses	Forward Voltage Both Directions	PRICES 1-99	100-499	500-999	1000-4999	5000 Up
SV1	General purpose limiters, regulates above 100ua	.20 - .50 @ 10ua .78 - .90 @ 100ma	.41	.35	.29	.24	.20
SV1-LR	Log I extended down to 5ua osc. control, limiters	.35 - .50 @ 10ua .78 - .90 @ 100ma	.43	.37	.31	.26	.22
V64	Protection of 150-300mv meter movements. Max. surge, min. shunt error	.10 - .25 @ 0.1ua .78 - .90 @ 100ma	.45	.39	.33	.28	.24

SCHAUER stabistor forward reference diodes

One and two junction diodes with closely controlled forward conductance for low voltage regulation, non-linear bias, limiter and DC coupling applications. Surge: 20 amps peak ½ cycle; dissipation: ¾ watt at 25°C.

Schauer Type	Forward Voltage Drop 10ua	10ma	100ma	Minimum Rev. Voltage @ 10ua	PRICES 1-99	100-499	500-999	1000-4999	5000 Up
SS1	.2 - .5	.64- .72	.90 max.	3.0	.23	.18	.16	.14	.12
SS1-2	.70-1.0	1.30-1.40	1.75 max.	20.0	.50	.39	.35	.32	.29

Semiconductor Division

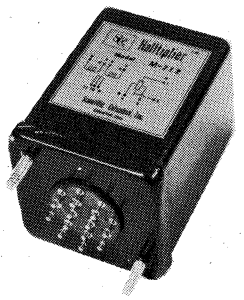
SCHAUER MANUFACTURING CORP.

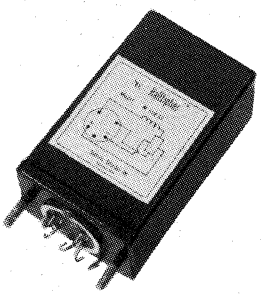
4516 Alpine Ave., Cincinnati, Ohio 45242

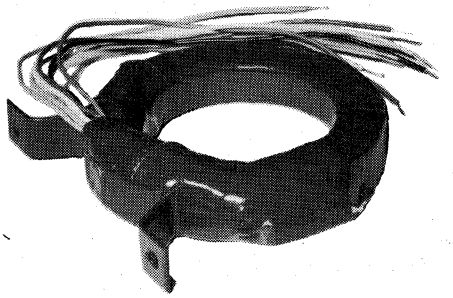
Telephone (513) 791-3030

HALLTIPLIER™ HALL EFFECT MULTIPLIERS

DESCRIPTION: These multipliers supply an output voltage proportional to the product of two a.c. or d.c. input currents. One input (I_c) is to the Hall generator; the other (I_m) is to the magnetic circuit. The output voltage is given by the expression $V_h = k\, I_c\, I_m$. In the table below the Hall generator input resistance is given by R_i and the output resistance by R_o.







Model	I_c Max. ma	R_i ohms Nominal	R_o ohms Nominal	I_m Peak Series connection ma	I_m Peak Parallel connection ma	Coil Resistance Series ohms	Coil Resistance Parallel ohms	Coil Inductance Series	Coil Inductance Parallel	Zero Field Voltage @ I_c = 100 ma mv	Linearity	Minimum Output mv	Price
M-1F	500	2.5	2.5	15	30	1100	275	20 h	5 h	<1.5	±1%	300	48.00
M-30	500	2.5	2.5	15	30	2000	500	60 h	15 h	<1.5	±1%	300	60.00
M-250	500	2.5	2.5	250	500	13	3.25	200 mh	50 mh	<1.5	±1%	300	48.00
M-500	500	2.5	2.5	500	1000	2.1	0.525	45 mh	11 mh	<1.5	±1%	300	48.00
M-7K	500	2.5	2.5	7 amp	14 amp	0.02	0.005	0.3 mh	0.075 mh	<1.5	±1%	300	48.00
M-25KL	500	2.5	2.5	300 amp pulse						<1.5	±1%	350 mv for 300 a pulse	60.00

Above units have a temperature coefficient of −0.15%°C

M-7T1	500	2.5	8	7 amp	14 amp	0.02	0.005	0.3 mh	0.075 mh	<1.5	±0.5%	50	75.00
M-7T2	500	2.5	8	7 amp	14 amp	0.02	0.005	0.3 mh	0.075 mh	<1.5	±0.25%	50	110.00

The M-7T1 and M-7T2 are temperature compensated over the range 0-40°C and the output must work into a 20 ohm load

Squaring Module $V_h = k\, I^2$ Temperature compensated over the range −55°C to +71°C and the output must work into a 25 ohm load

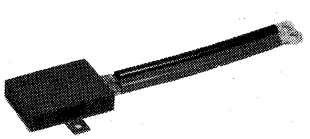
M-500ST	500	4.5	8					45 mh			±1%	400	95.00

High Current Ring Type Multiplier Max. conductor size 2″

1641B	500	2.5	2.5	1200 amps							±5%	900	75.00

HALLTIPLIER™ HALL GENERATORS

Model	Sensitivity Min. V_h	Output Resistance Ω	Input Resistance Ω	Control Current	Operating Temperature	Temperature Coefficient Output	Zero Field Voltage (I_c = 100 ma)	Dimensions (Inches)	Price
H-1	100 mv/A kg	2.5±1	2.5±1	500 ma max. 300 ma nom.	−35°C to +75°C	−.15% per °C	<100 uv	0.5 x 0.36 x 0.013	12.00
H-5	100 mv/A kg	2.5±1	2.5±1	500 ma max. 300 ma nom.	−35°C to +75°C	−.15% per °C	<500 uv	0.5 x 0.36 x 0.013	18.00



THERMOELECTRIC MODULES

Modules	Amps	Volt	Max. Δ T†	Max. Q.	Unit Price
305	30	0.55	60	13.0	18.00
308	30	0.90	60	21.0	29.00
3018	30	2.00	60	48.0	60.00
405	40	0.55	60	18.0	18.00
408	40	0.90	60	29.0	29.00

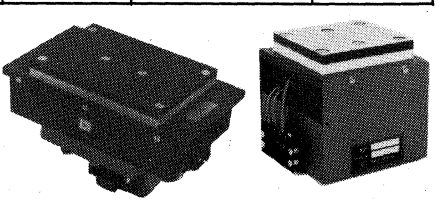
For mounting between two anodized aluminum plates add -E to the Model number and add $10.00 to the basic module price.
†Heat Pump = 0 Th = 30°C
For other SCI Electric Power Products See Pages 2842, 2843, Section 5500.



THERMOELECTRIC CASCADE MODULES

Model No.	Operating Current	Terminal Voltage	Max. Δ T†	T @ 1 Watt‡	Unit Price
3082	30 Amps	1.00	90°C	75°C	109.00

† Heat Pump = 0 Th = 30°C
‡ Heat Pump Th = 30°C



THERMOELECTRIC COOLING PACKAGE

Model No.	Input Current	Voltage	Max. Δ T†	Max. Heat Pump‡	Unit Price*
TCP-430F	30	2.40	40	35	225.00
TCP-630F	30	4.80	55	100	275.00
TCP-640F	40	4.80	40	150	275.00

Heat Exchanger fan 115 volts—60 cycle.
Finish (black) anodized aluminum.
* Heat Exchanger Fan supplied
† Heat Pump = 0 to 30°C Ambient
‡ In watts at 0°C T and 30°C Ambient

SCIENTIFIC COLUMBUS, INC.
1035 W. THIRD AVENUE, COLUMBUS, OHIO 43212 • TELEPHONE 614-291-4681

SEMIKRON
INTERNATIONAL·INC.
P.O.B. 323, Scarsdale, N. Y. 10583
CABLE: SEMIKRON SCARSDALE, N. Y.
TELEPHONE: (914) 725 - 2529

WORLD WIDE APPROVED SELENIUM & SILICON COMPONENTS

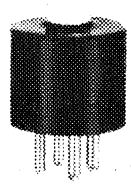
SEMIKRON

High Voltage Silicon Rectifier Stacks

with controlled avalanche up to 50 KV and 3,5 amperes output current

Type	PIV (KV)	Min. aval. voltage (KV)	Max. aver. current*) (A)	Max. ½**) cycle surge (A)
E 5000/2200—0,25	8	15	0,35	55
E 3500/1550—0,3	5	10	0,40	55
E 2500/1100—0,3	4	7,5	0,45	55
E 17000/7600—0,3	25	50	0,45	55
E 14000/6300—0,4	20	40	0,50	55
E 10000/4500—0,4	15	30	0,50	55
E 7500/3300—0,4	11	20	0,55	55
E 5000/2200—0,5	8	15	0,60	55
E 3500/1550—0,5	5	10	0,65	55
E 7500/3300—1,2	11	20	1,40	90
E 10000/4500—1,2	15	30	1,40	90
E 5000/2200—1,2	8	15	1,45	90
E 3500/1550—1,2	5	10	1,50	90
E 3500/1550—2,0	5	10	2,50	90
869 B	15	30	3,50	200





*) at T_A max. = 45°C **) at max. rated load

Silicon Controlled Rectifiers

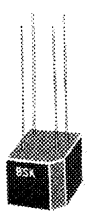
Types	Max. average forward current (A)	Min. forward and reverse blocking voltage (V)	Max. peak surge current (≦ 8 msec) for all types (A)	I^2t (A²sec)	Max. case temp. (°C)
SKT 45*) (SKT 46)	45 (45)	200—1600 (200—800)	800	2 600	85 (105)
SKT 70 (SKT 71)	70 (70)	200—1600 (200—800)	1700	11 000	85 (105)
SKT 90 (SKT 91)	90 (90)	200—1600 (200—800)	2200	20 000	85 (105)
SKT 110 (SKT 111)	110 (110)	200—1600 (200—800)	2800	30 000	85 (105)
SKT 140 (SKT 141)	140 (140)	200—1600 (200—800)	3900	60 000	85 (105)
SKT 170 (SKT 17)	170 (170)	200—1600 (200—800)	6600	180 000	85 (105)
SKT 220 (SKT 221)	220 (220)	200—1600 (200—800)	7800	250 000	85 (105)
SKT 310**)	310	800—1800	8400	280 000	—
SKT 340**)	340	800—1800	11500	530 000	—

*) Inverter types only up to 800 volts; types in ( ) are correlated.
**) disc-cell design

- dV/dt up to > 1000 V/µsec
- Max. operating junction temperature up to 150° C

Selenium Transient Voltage Suppressors

- 30 or 60 volts clamping voltage per cell
- Up to 800 A single pulse at 1 millisec
- High stability — no aging
- 550 volts max. RMS-input/stack
- △ -and Y-connected devices for 3-phase applications
- Highly reliable epoxy version up to 15 A single pulse at 1 millisec



Selenium High Density Cells, Type Z,

are available in voltage ratings from 20 to 36 Volts RMS in numerous sizes from 0.7" x 0.7" to 4" x 20 " with only 1 volt RMS forward voltage drop at 1000 mA/inch² which makes the cells extremely competitive. For low voltage applications Selenium rectifier assemblies are available up to several thousand of amperes.

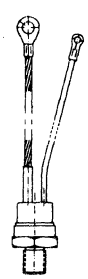
High Voltage Epoxy Silicon Diodes



Type	Max. aver. outp. curr. (A)	Max rep. peak rev. voltage (V)	Max. peak surge curr. (≦ 8 millisec) (A)	Max. I^2t (≦ 8 millisec) (A²sec)
ESK 1/06	1,5	600	50	10
ESK 1/10	1,5	1000	50	10
ESK 1/12	1,5	1200	50	10
ESK 1/16	1,5	1600	50	10

Silicon Rectifier Diodes

Type	Max. av. output current at T_c = 125°C (A)	PIV Range (V)	Peak surge current*) (≦ 8 msec) (A)	I^2t (A²sec)	Mounting
SKN 2,5	2,5	400-1600	130	70	lead
SKN 5	5,0	400-1600	180	130	lead
SKN 20	20	400-1600	300	360	stud
SKN 45	45	400-1600	650	1 800	stud
SKN 100	100	400-1600	1650	11 000	stud
SKN 130	130	400-1600	2200	20 000	stud
SKN 170	170	400-1600	3300	45 000	stud
SKN 240	240	400-1600	5500	125 000	stud
SKN 320	320	400-1600	8800	300 000	stud



Silicon Diodes

with controlled avalanche characteristics

Type	Max. average output current (A)	Range of controlled avalanche*) ...../10 ...../12 (V)
SKa 0,5	1,0	≧ 1300 ≧ 1700
SKa 1	1,5	≧ 1300 ≧ 1700
SKa 2,5	4,0	≧ 1300 ≧ 1700
SKa 5	10,0	≧ 1300 ≧ 1700
ESKa 1 plastic	1,5	≧ 1300 ≧ 1700

*) Min. aval. at 20°C, increasing voltage with increasing temperature

Compact Bridge Rectifiers

Bridge Type	Max. average output current (A)	Max. repetitive peak reverse voltage and transient voltage (V)	Max. amb. temperature (°C)
BSK B ...C 600	1,4	300 — 1200	45
BSK B.....C 2200/3500	5,2*)	300 — 1200	45
MSKa — E 500/220—0,75+0	1,5	≧ 1300 avalanche	45
—B 500/445—1,5	2,5	≧ 1300 avalanche	45

*) With mounting on heat sink of > 3,1 inch² effective area.

SEMIKRON
INTERNATIONAL·INC.
P. O. B. 323, Scarsdale, N. Y. 10583
Phone (914) 725-2529

THYRISTORS (SCR's) SSPI SHORT FORM PRODUCT DISPLAY

MILITARY AEROSPACE TYPES

All devices intended for Military/Aerospace usage receive 100% TX type processing including high temperature storage, temperature cycling, and fine and gross leak tests as a normal part of the manufacturing procedure. These devices conform completely to MIL-S-19500 and are capable of being exposed to the most stringent high reliability processing for demanding "man-rated" space applications.

- All devices Planar Passivated for the utmost in built-in reliability
- Voltage capability up to 400V.
- DC current ratings up to 6 amps.
- High speed and sensitivity for optimum design.
- Standard series in TO-46, TO-18, TO-5, TO-9, and TO-59 packages for a wide range of power and size requirements.

HIGH SPEED TYPES

SSPI's GA 200-GB 200 "Nanosecond Thyristors" are the fastest high current devices available on the market today. They offer a unique combination of nanosecond rise times and submicrosecond recovery times at pulse currents of up to 50 amps unmatched by any other devices. Applications include radar pulse modulator switches, solid state laser drivers, harmonic waveform generators, and as reliable replacements for avalanche transistors. Features include the following:

- Rise times of 10 n sec to 1 amp and 20 n sec to 30 amps.
- Recovery times of 0.5 μsec.
- Surge current to 50 amps.
- Anode voltages to 100 V extendable to over 1000 volts through "series stringing" techniques.
- TO-18 and TO-59 packages for DC currents up to 6 amps.

RADIATION HARD TYPES

The GA 100 and GB 100 series of radiation hard devices have been designed to provide significantly greater radiation tolerance than conventional SCR's or transistors with comparable current handling ability. These series are capable of operation after exposure to 10^{15}NVT and have post radiation limits specified after $3X10^{14}$NVT.

- TO-18 and TO-59 package for DC current levels of up to 3 amps.
- Surge currents up to 15 amps.
- V_F of 3V max at 1 amp after exposure to $3X10^{14}$NVT.
- Fully characterized for worst case design.

EL DRIVER TYPES

The AA series is specifically designed for operation as a driver device for electroluminescent displays requiring bi-directional switching of high voltage AC. A single polarity control signal can be used for turn on for both positive and negative anode voltage for simple control circuit design. Features include:

- Planar passivation for low leakage current.
- High reverse gain for low level control.
- Anode voltage to 400V.
- Operation to 20KC.
- Low anode capacitance.

MIL APPROVED TYPES

The JAN2N1870A, JAN and JANTX2N2323 series provide the utmost in assured reliability for off the shelf usage in a majority of military applications where a MIL qualified device is required. Planar passivation on all devices assures parameter stability while extensive lot acceptance testing guarantees a failure rate of less than .01%/1000 hours in conservatively designed applications.

- Anode voltages to 400V.
- Available as JANTX types.
- Pulse currents to 30 amps.
- DC currents up to 1.25 amps at 100°C case temp.
- TO-5 and TO-9 packages.

INDUSTRIAL THYRISTORS (SCR's)

- Continuous DC current ratings of up to 1.6 Amps for lead-mounted packages and up to 5.0 Amps for stud-mounted packages.
- Blocking voltage capability to 400 volts.
- Maximum gate trigger currents as low as 2.0 μsec.
- Turn-on times as low as 200 nanoseconds.
- TO-46, TO-52, TO-18, TO-5, TO-59 packages are standard. All are hermetically-sealed, metal cans.
- Low-cost commercial grade series available in TO-18 and TO-5 packages.

TRIGISTORS (Gate Turn-off SCR's)

Trigistors are PNPN switches characterized for turn-off by application of a negative gate pulse as well as for turn-on by a positive gate pulse.

- Turn-off gains of 10 (ratio of Anode current to negative gate current) at Anode currents in excess of 5.0 Amps.
- Blocking Voltage capability to 400V.
- Continuous DC current Ratings up to 5.0 Amps.

PHOTO SCR's

- Light activated SCR's are PNPN switches characterized for turn-on by light impulse in addition to electrical gate pulse.
- Maximum light trigger intensities as low as 10 foot-candles (0.13 mw/cm^2).
- Blocking voltage capability to 200 volts.
- Packages include round lens and flat lens TO-18 metal can as well as epoxy-covered micro-package.

For additional information or applications assistance, call or write: E. C. Mehm, General Sales Manager

SOLID STATE PRODUCTS SSPI DIVISION OF UNITRODE CORPORATION
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SHORT FORM PRODUCT DISPLAY (cont.)

POWER INTEGRATED CIRCUITS

- Standard power integrated circuits such as the PIC100 series Solid State AC Switch.
- Custom integrated circuit facility producing IC's to customer specifications utilizing Solid State Product's discrete semiconductor technology coupled with thick-film techniques.

Silicon Power Transistors

Power Switching

15 Watt Switching
- 2 Amp Ultra Fast
- 5 Amp High Speed
- 10 Amp High Speed

Features:
- Min. Current Gains to 100
- Saturated Switching times under 1 μsec.
- Saturation Voltages to .5V @ 5 A
- Packages (TO-5) and (Pancake TO-5)

15 Watt High Voltage Switching (2N5660)
- 3 Amp High Speed
- 10 Amp High Speed

- Collector Voltages to 400 volts
- Saturation Switching Times under 1 μsec.
- Saturation Voltages to .4V @ 3A
- Package (TO-5)

30 Watt Switching
- 20 Amp High Speed

- Isolated Collector Package Option
- Fast Switching
- Saturation Voltages to 1.0V @ 10 A
- Packages (TO-59) (TO-59 Isolated Collector)

High Current-Power

- 5 Amp 30 W
- 20 Amp 30 W
- 20 Amp 50 W
- 30 Amp 100 W
- 30 Amp 150 W

Features:
- Characterized for second breakdown
- Sustaining Voltages to 120V
- Min. Current Gains to 100
- Packages (TO-3, TO-59, TO-61, TO-63)

High Voltage Power-Switching (2N5664)

- 3 Amp 20 W
- 10 Amp 30 W

Features:
- Collector Voltages to 400V
- Fast Switching
- Package (TO-66)

2N545, 2N546, 2N547, 2N548, 2N549, 2N551, 2N876, 2N877, 2N878, 2N879, 2N880, 2N881, 2N882, 2N883, 2N884, 2N885, 2N886, 2N887, 2N888, 2N889, 2N890, 2N891, 2N892, 2N893, 2N894, 2N895, 2N896, 2N897, 2N898, 2N899, 2N900, 2N901, 2N948, 2N949, 2N950, 2N951, 2N1054, 2N1055, 2N1116, 2N1117, 2N1208, 2N1209, 2N1212, 2N1595, 2N1596, 2N1597, 2N1598, 2N1599, 2N1647, 2N1648, 2N1649, 2N1650, 2N1714, 2N1715, 2N1716, 2N1717, 2N1718, 2N1719, 2N1720, 2N1721, 2N1724, 2N1724A, 2N1725, 2N1869, 2N1870, 2N1870A, JAN2N1870A, 2N1871, 2N1871A, JAN2N1871A, 2N1872, 2N1872A, JAN2N1872A, 2N1873, 2N1874, 2N1874A, JAN2N1874A, 2N1875, 2N1876, 2N1877, 2N1878, 2N1879, 2N1880, 2N1881, 2N1882, 2N1883, 2N1884, 2N1885, 2N1886, 2N2009, 2N2010, 2N2011, 2N2012, 2N2013, 2N2014, 2N2150, 2N2151, 2N2322, 2N2322A, 2N2323, JAN2N2323, JAN TX2N2323, 2N2323A, JAN2N2323A, JAN TX2N2323A, 2N2324, JAN2N2324, JAN TX2N2324, 2N2324A, JAN2N2324A, JAN TX2N2324A, 2N2325, 2N2325A, 2N2326, JAN2N2326, JAN TX2N2326, 2N2326A, JAN2N2326A, JAN TX2N2326A, 2N2327, 2N2327A, 2N2328, JAN2N2328, 2N2328A, JAN2N2328A, 2N2329, JAN2N2329, 2N2344, 2N2345, 2N2346, 2N2347, 2N2348, 2N2657, 2N2658, 2N2679, 2N2680, 2N2681, 2N2682, 2N2683, 2N2684, 2N2685, 2N2686, 2N2687, 2N2688, 2N2689, 2N2690, 2N2811, 2N2812, 2N2813, 2N2814, 2N2828, 2N2829, 2N2849, 2N2850, 2N2851, 2N2852, 2N2853, 2N2854, 2N2855, 2N2856, 2N2858, 2N2859, 2N2877, 2N2879, 2N2878, 2N2880, 2N2890, 2N2891, 2N2892, 2N2893, 2N2995, 2N3001, 2N3002, 2N3003, 2N3004, 2N3005, 2N3006, 2N3007, 2N3008, 2N3027, 2N3028, 2N3029, 2N3030, 2N3031, 2N3032, 2N3254, 2N3255, 2N3256, 2N3257, 2N3258, 2N3259, 2N3273, 2N3274, 2N3275, 2N3276, 2N3418, 2N3419, 2N3420, 2N3421, 2N3469, 2N3487, 2N3488, 2N3489, 2N3490, 2N3491, 2N3492, 2N3555, 2N3556, 2N3557, 2N3558, 2N3559, 2N3560, 2N3561, 2N3562, 2N3597, 2N3598, 2N3744, 2N3745, 2N3746, 2N3747, 2N3748, 2N3749, 2N3750, 2N3751, 2N3752, 2N3850, 2N3851, 2N3852, 2N3853, 2N3878, 2N3879, 2N3996, 2N3997, 2N3998, 2N3999, 2N4000, 2N4001, 2N4002, 2N4003, 2N4075, 2N4076, 2N4096, 2N4097, 2N4108, 2N4109, 2N4110, 2N4144, 2N4145, 2N4146, 2N4147, 2N4148, 2N4149, 2N4150, 2N4212, 2N4213, 2N4214, 2N4215, 2N4216, 2N4217, 2N4218, 2N4219, 2N4301, 2N4863, 2N5038, 2N5039, 2N5487, 2N5488, 2N5552, 2N5658, 2N5659, 2N5660, 2N5661, 2N5662, 2N5663, 2N5664, 2N5665, 2N5666, 2N5667

For additional information or applications assistance, call or write: E. C. Mehm, General Sales Manager

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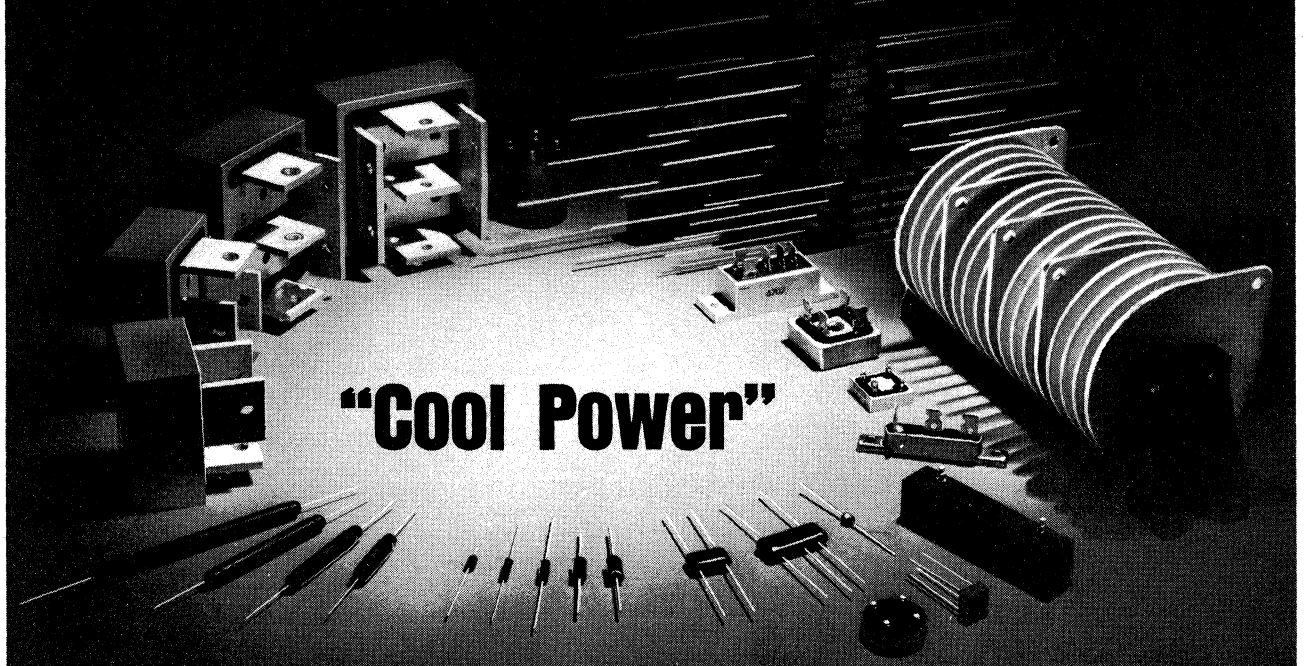
Semtech Silicon Rectifiers & Assemblies



Semtech Corporation manufactures a complete line of silicon rectifiers and devices. Offering unique packages — designed to solve old and new circuit problems efficiently, reliably and at low cost.

Semtech has a continuing research and development program, utilizing interrelated technologies, to guarantee state-of-the-art rectifiers and assemblies. The new "Metoxilite" rectifier is just such a device — the result of years of intensive materials research and testing. Fashioned from metal-oxides, this new device offers impermeable monolithic construction and advanced electrical characteristics.

Unique devices introduced by Semtech include: ■ SEMPAC® (100 to 1000V) ■ MINISTAC (1 to 7kV) ■ COMPAC (50 to 3000V) ■ MINISTIC (10 to 40kV) ■ SLIMPAC® (2.5 to 45kV) ■ ALPAC® (50 to 600V) ■ STACPAC (500V to 25kV) ■ "METOXILITE" (100 to 1000V) ■ A complete line of Multipliers (up to 50kV).

For complete information, contact your nearest representative and get your Free copy of Semtech's 1969 Silicon Rectifier Catalog. All products listed in our catalog are available for immediate delivery.

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FOR YOUR TRANSDUCING APPLICATIONS

PITRAN®
PRESSURE SENSITIVE TRANSISTORS

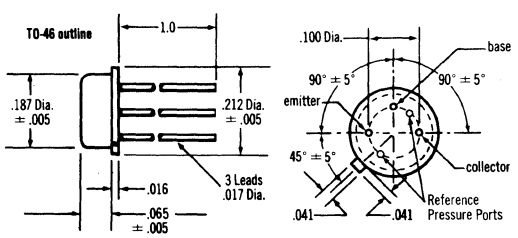
DESCRIPTION:

The PITRAN piezotransistor is a silicon NPN planar transistor that has its emitter-base junction mechanically coupled to a diaphragm located in the top of the TO-46 can. When a pressure or point force is applied to the diaphragm, a large reversible change is produced in the transistor's characteristics. An unamplified linear output of at least 20% of the supply voltage can be achieved with supply voltages from less than one volt to more than fifty volts.

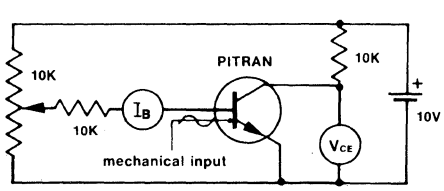
SPECIFICATIONS: (In standard circuit shown below)

Characteristic	Minimum	Typical	Maximum	Units
Linear Range PT-2/3	0.07	0.25	1	psid
PT-22/23	1	2	3	psid
(ΔV_{CE} = 2 V) PT-52/53	2.5	5	7.5	psid
Linearity (over ±1 volt range)		0.5	1	% Deviation from Best Straight Line
Hysteresis (over ±1 volt range)		0.5	1	% Deviation Between Same Point on Increasing and Decreasing Mech. Inputs
Temp. Coeff. (Zero Shift)				
PT-3/23/53	0	±50	±100	mV/°C
PT-2/22/52		±200	±400	mV/°C
Temp. Coeff. (Sens. Change)		−0.2	−0.5	%/°C
h_{FE} @ V_{CE} = 2 V, I_C = 800 μA	2	10	40	
I_{CBO} @ V_{CB} = 10 V		0.01	1	μA
BV_{CEO} @ I_C = 10 μA	50	120		Volts
Overload Range (No damage)	500	700		% of Full Linear Range
Mech. Resonance Frequency	100	150		kHz
Temp. Range	−40		75	°C

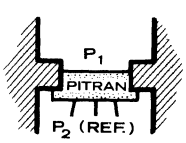
MECHANICAL DATA



STANDARD CIRCUIT



PITRAN Mounting



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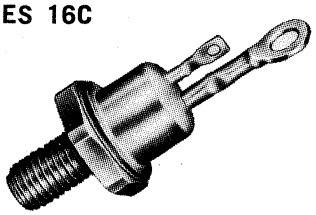
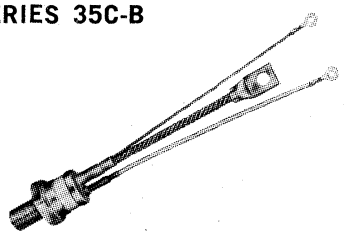
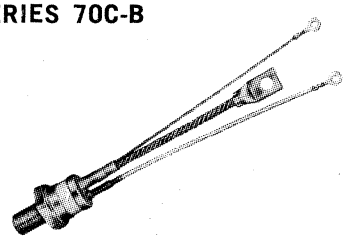
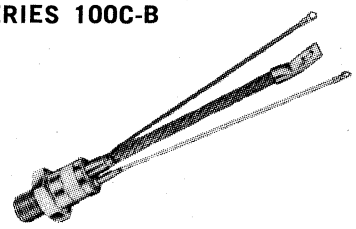
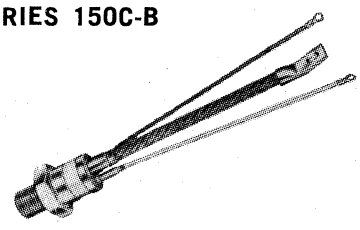
SYNTRON

SILICON CONTROLLED

SOLID STATE AC AND DC POWER CONTROL. Syntron Silicon Controlled Rectifiers are diffused, three junction, semiconductor units designed for use in medium and high power solid state control applications.

The Silicon Controlled Rectifiers shown on these pages are available in the popular standard JEDEC configurations from 25 amp rms to 235 amp rms with V_{BO} ratings to 1200 PRV repetitive, 1300 PRV transient.

The Syntron Silicon Controlled Rectifier is a rectifying device which exhibits the same reverse voltage avalanche characteristics found in all Syntron silicon diodes. The forward direction shows high resistance in the "off state," capable of blocking forward voltages. With a very small

	Catalog Numbers	PEAK VOLTAGE Forward & Reverse		ELECTRICAL CHARACTERISTICS
		Recurrent	Transient*	
SERIES 16C 	16C025 16C050 16C10 16C15 16C20 16C25 16C30 16C35 16C40 16C45 16C50 16C60 16C70 16C80	25 50 100 150 200 250 300 350 400 450 500 600 700 800	50 75 150 225 300 350 400 450 500 550 600 700 800 900	**It avg** — Average Forward Current .....16 A. **Vtm** — Maximum Peak Forward Voltage Drop at 25°C., at 50 A. Peak, 180° Conduction Angle .....2.0 V. **Itsm** — Maximum Peak One Cycle Surge Current....150 A. **Idm** — Maximum Forward Leakage Current at 125°C., Through 300 V. .....10 MA. Peak. 350 V. Through 1000 V. .....5 MA. Peak. **t off** — Typical Off Time at 125°C .....50 μSec. **dv/dt** — Minimum Critical Exponential Rate of Rise of Forward Blocking Voltage .....25 V./μSec. **Vgt** — Typical Gate Voltage to Trigger at 25°C. .....0.9 V. **Igt** — Typical Gate Current to Trigger at 25°C. ....20 MA. **Vgm** — Maximum Peak Vate Voltage (Forward) ....10.0 V. Maximum Peak Gate Voltage (Reverse) .... 5.0 V.
SERIES 35C-B 	35C025B 35C050B 35C10B 35C15B 35C20B 35C25B 35C30B 35C40B 35C50B 35C60B 35C70B 35C80B 35C90B 35C100B 35C110B 35C120B	25 50 100 150 200 250 300 400 500 600 700 800 900 1000 1100 1200	50 75 150 225 300 350 400 500 600 700 800 900 1000 1100 1200 1300	**It avg** — Average Forward Current .....35 A. **Vtm** — Maximum Peak Forward Voltage Drop at 25°C., at 220 A. Peak, 180° Conduction Angle .....2.5 V. **Itsm** — Maximum Peak One Cycle Surge Current....900 A. **Idm** — Maximum Forward Leakage Current at 125°C., and Recurrent Peak Voltage .....10 MA. **t off** — Typical Off Time at 125°C. .....40 μSec. **dv/dt** — Minimum Critical Exponential Rate of Rise of Forward Blocking Voltage .....100 V./μSec. **Vgt** — Typical Gate Voltage to Trigger at 25°C. ....1.5 V. **Igt** — Typical Gate Current to Trigger at 25°C. ..100 MA. **Vgm** — Maximum Peak Vate Voltage (Forward) ....10.0 V. Maximum Peak Gate Voltage (Reverse) .... 5.0 V.
SERIES 70C-B 	70C025B 70C050B 70C10B 70C15B 70C20B 70C25B 70C30B 70C40B 70C50B 70C60B 70C70B 70C80B 70C90B 70C100B 70C110B 70C120B	25 50 100 150 200 250 300 400 500 600 700 800 900 1000 1100 1200	50 75 150 225 300 350 400 500 600 700 800 900 1000 1100 1200 1300	**It avg** — Average Forward Current .....70 A. **Vtm** — Maximum Peak Forward Voltage Drop at 25°C., at 220 A. Peak, 180° Conduction Angle .....1.85 V. **Itsm** — Maximum Peak One Cycle Surge Current..1600 A. **Idm** — Maximum Forward Leakage Current at 125°C., and Recurrent Peak Voltage .....10 MA. **t off** — Typical Off Time at 125°C. ..... 40 μSec. **dv/dt** — Minimum Critical Exponential Rate of Rise of Forward Blocking Voltage .....100 V./μSec. **Vgt** — Typical Gate Voltage to Trigger at 25°C. ....1.5 V. **Igt** — Typical Gate Current to Trigger at 25°C. ....70 MA. **Vgm** — Maximum Peak Vate Voltage (Forward) ....10.0 V. Maximum Peak Gate Voltage (Reverse) .... 5.0 V.
SERIES 100C-B 	100C025B 100C050B 100C10B 100C15B 100C20B 100C25B 100C30B 100C40B 100C50B 100C60B 100C70B 100C80B 100C90B 100C100B 100C110B 100C120B	25 50 100 150 200 250 300 400 500 600 700 800 900 1000 1100 1200	50 75 150 225 300 350 400 500 600 700 800 900 1000 1100 1200 1300	**It avg** — Average Forward Current .....100 A. **Vtm** — Maximum Peak Forward Voltage Drop at 25°C., at 500 A. Peak, 180° Conduction Angle .....2.0 V. **Itsm** — Maximum Peak One Cycle Surge Current..2000 A. **Idm** — Maximum Forward Leakage Current at 125°C., and Recurrent Peak Voltage .....25 MA. **t off** — Typical Off Time at 125°C. .....40 μSec. **dv/dt** — Minimum Critical Exponential Rate of Rise of Forward Blocking Voltage .....100 V./μSec. **Vgt** — Typical Gate Voltage to Trigger at 25°C. ....2.0 V. **Igt** — Typical Gate Current to Trigger at 25°C. ..100 MA. **Vgm** — Maximum Peak Vate Voltage (Forward) ....10.0 V. Maximum Peak Gate Voltage (Reverse) .... 5.0 V.
SERIES 150C-B 	150C025B 150C050B 150C10B 150C15B 150C20B 150C25B 150C30B 150C40B 150C50B 150C60B 150C70B 150C80B 150C90B 150C100B 150C110B 150C120B	25 50 100 150 200 250 300 400 500 600 700 800 900 1000 1100 1200	50 75 150 225 300 350 400 500 600 700 800 900 1000 1100 1200 1300	**It avg** — Average Forward Current .....150 A. **Vtm** — Maximum Peak Forward Voltage Drop at 25°C., at 500 A. Peak, 180° Conduction Angle .....1.7 V. **Itsm** — Maximum Peak One Cycle Surge Current..3000 A. **Idm** — Maximum Forward Leakage Current at 125°C., and Recurrent Peak Voltage .....25 MA. **t off** — Typical Off Time at 125°C. .....40 μSec. **dv/dt** — Minimum Critical Exponential Rate of Rise of Forward Blocking Voltage .....100 V./μSec. **Vgt** — Typical Gate Voltage to Trigger at 25°C. ....2.0 V. **Igt** — Typical Gate Current to Trigger at 25°C. ..100 MA. **Vgm** — Maximum Peak Vate Voltage (Forward) ....10.0 V. Maximum Peak Gate Voltage (Reverse) .... 5.0 V.

* Maximum non-recurrent.

SYNTRON DIVISION, FMC CORPORATION • 264 Lexington, Homer City, Pa. 15748

RECTIFIER DATA

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Homer City, Pa. 15748
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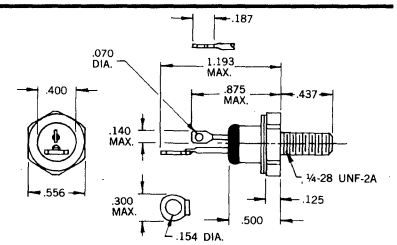
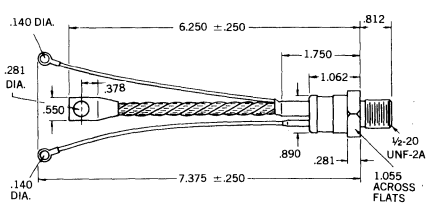
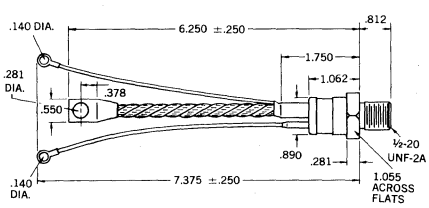
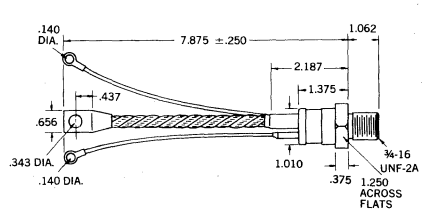
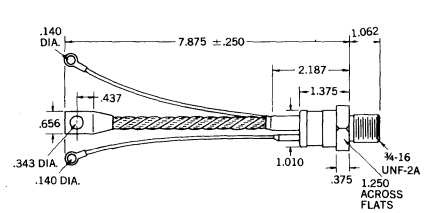
value of voltage and current applied to the gate, the forward direction changes to a very low resistance allowing high currents to be conducted. This change, termed "turn on," is a fast switching function occurring in only a few microseconds.

In a single element application, this device can be used for direct conversion and continuous control of AC to DC power requirements or it can be used as a DC switch to initiate current flow. For AC power control, two silicon controlled rectifiers are required in an inverse parallel connection.

Syntron's rigid quality control, developed through strict avalanche diode requirements and more than 5 years field testing, have yielded the most reliable silicon controlled rectifiers available for solid state power control.

MECHANICAL CHARACTERISTICS	THERMAL CHARACTERISTICS	DIMENSIONS
Base.....Hi Strength, Nickel Plated Copper with ¼-28 UNF 2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. **Header** .....Glass to metal construction, hermetically sealed to base. **Weight** .....Approximately .385 ounces. **Mounting Torque** .....30 in. lbs. maximum	θ **J-C** — Maximum Thermal Resistance, Junction to Case (DC)....1.7°C./W. **Tj** — Operating Junction Temperature 125°C. **Tstg** — Storage Temperature −65°C. to 150°C.	
Base.....Hi Strength, Nickel Plated Copper with ½-20 UNF 2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. **Header** .....Ceramic to metal construction, hermetically sealed to base. **Weight** .....Approximately 3.6 ounces (lead type); 3.24 ounces (flag type). **Mounting Torque** .....150 in. lbs. maximum **Note:** All Series 35 Silicon Controlled Rectifiers are available with either a lead terminal or flag terminal. When ordering a flag terminal device, add the suffix "F" to the catalog number.	θ **J-C** — Maximum Thermal Resistance, junction to Case (DC)..0.32°C./W. **Tj** — Operating Junction Temperature 125°C. **Tstg** — Storage Temperature −40°C. to 150°C.	
Base.....Hi Strength, Nickel Plated Copper with ½-20 UNF 2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. **Header** .....Ceramic to metal construction, hermetically sealed to base. **Weight** .....Approximately 3.6 ounces (lead type); 3.24 ounces (flag type). **Mounting Torque** .....150 in. lbs. maximum **Note:** All Series 70 Silicon Controlled Rectifiers are available with either a lead terminal or flag terminal. When ordering a flag terminal device, add the suffix "F" to the catalog number.	θ **J-C** — Maximum Thermal Resistance, junction to Case (DC)..0.28°C./W. **Tj** — Operating Junction Temperature 125°C. **Tstg** — Storage Temperature −40°C. to 150°C.	
Base.....Hi Strength, Nickel Plated Copper with ¾-16 UNF 2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. **Header** .....Ceramic to metal construction, hermetically sealed to base. **Weight** .....Approximately 7.44 ounces. **Mounting Torque** .....300 in. lbs. maximum	θ **J-C** — Maximum Thermal Resistance, junction to Case (DC)....0.2°C./W. **Tj** — Operating Junction Temperature 125°C. **Tstg** — Storage Temperature −40°C. to 150°C.	
Base.....Hi Strength, Nickel Plated Copper with ¾-16 UNF 2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. **Header** .....Ceramic to metal construction, hermetically sealed to base. **Weight** .....Approximately 7.44 ounces. **Mounting Torque** .....300 in. lbs. maximum	θ **J-C** — Maximum Thermal Resistance, junction to Case (DC)....0.2°C./W. **Tj** — Operating Junction Temperature 125°C. **Tstg** — Storage Temperature −40°C. to 150°C.	

SYNTRON

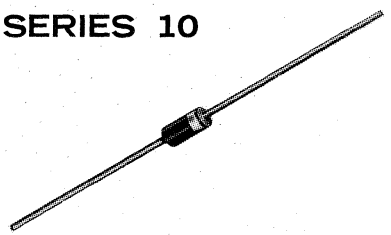
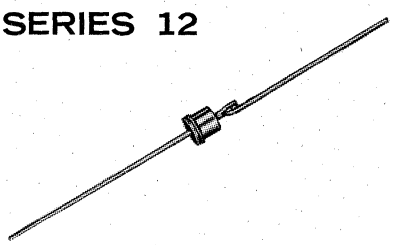
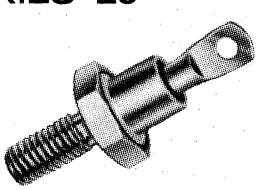
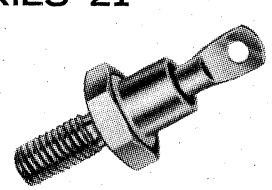
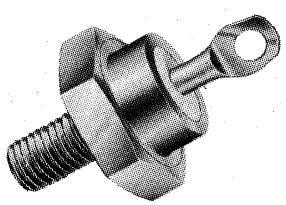
AVALANCHE SILICON

Inherent protection against voltage transients. All Syntron silicon diodes are manufactured using a unique diffusion process that takes full advantage of the avalanche characteristics inherent in silicon.

The avalanche characteristics provide built-in protection against voltage transients by limiting the voltage across the rectifying junction. This reduces the electrical stress which normally results in the surface breakdown typical of non-avalanche diodes.

The diodes are manufactured in either standard or reverse polarity with a rated peak reverse voltage range of 50 to 1600 volts. The current rating is determined by the ambient condition in which the diode operates. **All Syntron Avalanche**

RATINGS

	Catalog Number Standard Polarity	Catalog Number Reverse Polarity	Peak Reverse Voltage*	ELECTRICAL CHARACTERISTICS
SERIES 10 	S1010		100	Maximum Allowable DC Output Current: at 25°C Ambient Temperature ..... 1.0 Amp; at 100°C Ambient Temperature ..... 750 MA; at 150°C Ambient Temperature ..... 250 MA; Maximum Allowable One Cycle Surge Current: (60 CPS Single Phase Non-Recurrent at Rated PRV and No Load) ..... 60 Amps; At Rated Load ..... 35 Amps; Maximum Full Load Forward Voltage Drop: (150°C Full Cycle Average) ..... .5 Volts; Maximum Reverse Current at Rated PRV: (25°C Full Cycle Average) ..... 5 μA; (150°C Full Cycle Average) ..... .5 MA; Maximum Operating Frequency ..... 100 KC
	S1020		200	
	S1030		300	
	S1040		400	
	S1050		500	
	S1060		600	
	S1070		700	
	S1080		800	
	S1090		900	
	S10100		1000	
	S10110		1100	
	S10120		1200	
SERIES 12 	S1210		100	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 1.6 amperes; Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 35 amperes; Maximum Forward Voltage at 1.0 Amps (25°C. Case Temp.) .... 1.0 Volts Maximum; Rated Peak Reverse Voltage Range ..... 100 to 1500 Volts; Maximum *FCA Reverse Current at 100°C. Case Temperature ..... 100 micro amperes; Maximum Operating Frequency ..... 100,000 CPS; Maximum I^2t (less than 8 ms) ..... 5.0 Amp.² - Second; Reverse Power Rating ..... 0.05 Joules; *FCA = Full Cycle Average (measured with a DC meter)
	S1220		200	
	S1230		300	
	S1240		400	
	S1250		500	
	S1260		600	
	S1270		700	
	S1280		800	
	S1290		900	
	S12100		1000	
	S12110		1100	
	S12120		1200	
	S12130		1300	
	S12140		1400	
	S12150		1500	
SERIES 20 	S2005	R2005	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 16 amperes; Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 200 amperes; Peak Forward Voltage at 30 Amps (25°C. Case Temp.) .... 1.3 Volts Maximum; Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts; Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 1.0 Milliamps; Maximum Operating Frequency ..... 100,000 CPS; Maximum I^2t (less than 8 ms) ..... 165 Amps² - Second; Reverse Power Rating ..... 0.16 Joules; *FCA = Full Cycle Average (measured with a DC meter)
	S2010	R2010	100	
	S2015	R2015	150	
	S2020	R2020	200	
	S2025	R2025	250	
	S2030	R2030	300	
	S2035	R2035	350	
	S2040	R2040	400	
	S2045	R2045	450	
	S2050	R2050	500	
	S2060	R2060	600	
	S2070	R2070	700	
	S2080	R2080	800	
	S2090	R2090	900	
	S20100	R20100	1000	
SERIES 21 	S2105	R2105	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 22 amperes; Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 200 amperes; Peak Forward Voltage at 30 Amps (25°C. Case Temp.) .... 1.3 Volts Maximum; Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts; Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 1.0 Milliamps; Maximum Operating Frequency ..... 100,000 CPS; Maximum I^2t (less than 8 ms) ..... 165 Amps² - Second; Reverse Power Rating ..... 0.16 Joules; *FCA = Full Cycle Average (measured with a DC meter)
	S2110	R2110	100	
	S2115	R2115	150	
	S2120	R2120	200	
	S2125	R2125	250	
	S2130	R2130	300	
	S2135	R2135	350	
	S2140	R2140	400	
	S2145	R2145	450	
	S2150	R2150	500	
	S2160	R2160	600	
	S2170	R2170	700	
	S2180	R2180	800	
	S2190	R2190	900	
	S21100	R21100	1000	
SERIES 31 	S3105	R3105	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 30 amperes; Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 200 amperes; Peak Forward Voltage at 30 Amps (25°C. Case Temp.) .... 1.3 Volts Maximum; Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts; Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 1.0 Milliamps; Maximum Operating Frequency ..... 100,000 CPS; Maximum I^2t (less than 8 ms) ..... 165 Amps² - Second; Reverse Power Rating ..... 0.60 Joules; *FCA = Full Cycle Average (measured with a DC meter)
	S3110	R3110	100	
	S3115	R3115	150	
	S3120	R3120	200	
	S3125	R3125	250	
	S3130	R3130	300	
	S3135	R3135	350	
	S3140	R3140	400	
	S3145	R3145	450	
	S3150	R3150	500	
	S3160	R3160	600	
	S3170	R3170	700	
	S3180	R3180	800	
	S3190	R3190	900	
	S31100	R31100	1000	

*Diodes available with voltage ratings to 1600 PRV, except for Series 10 and 12 as listed.

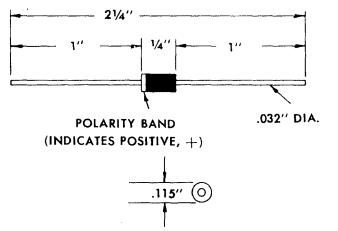
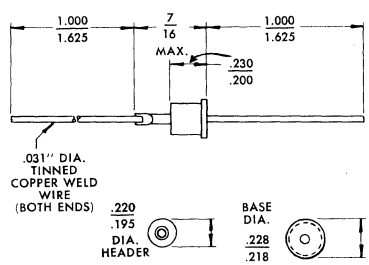
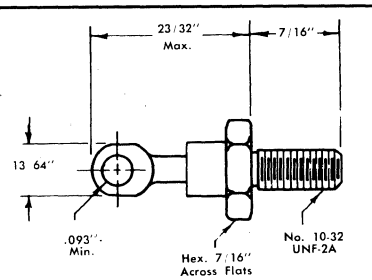
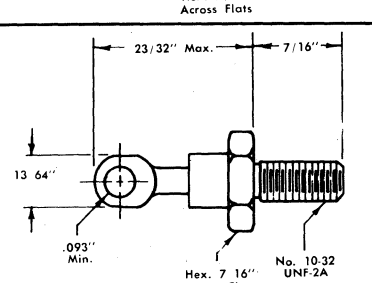
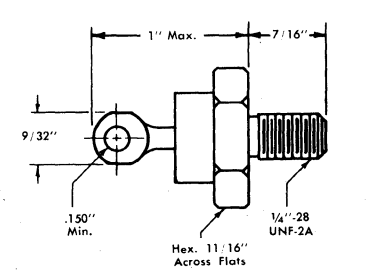
POWER RECTIFIERS

SYNTRON DIVISION
FMC Corporation
264 Lexington
Homer City, Pa. 15748
Cable Address: SYNTRON, HOMER CITY

silicon rectifiers will meet JEDEC specifications, yet all diodes that comply with the JEDEC specifications do not necessarily meet the capabilities of the Syntron Avalanche rectifiers.

The curves submitted include reverse power capabilities, typical single phase and three phase current ratings as well as the over-all surge current capabilities of the diodes. If the transient peak power exceeds the reverse power capabilities level, additional protection is required.

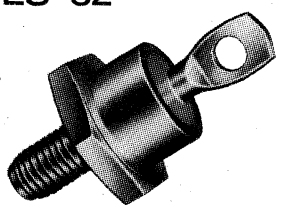
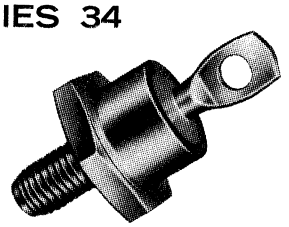
The quality is built in these devices and is controlled by rigid test procedures applied to each device before shipment. These test procedures are applied to the diode at a level that will insure its meeting the particular application for which it is intended.

MECHANICAL CHARACTERISTICS	THERMAL CHARACTERISTICS	DIMENSIONS
Construction: Epoxy Body; Silver Leads Mounting Position — Any	Storage Temperature: −65°C to +185°C Ambient Operating Temperature: −65°C to +175°C	
Case — Hermetically sealed with axial leads. Weight — Approximately 1.0 gram. Mounting position — Any.	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction .....−65°C. to +175°C. Impedance (°C/W), Junction to Case 5.0 Maximum	
Base .... Steel stud and base with a #10-32 UNF-2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. Header ..... Glass to metal construction. Hermetically sealed to base. Weight ..... Approximately 0.16 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 30 inch pounds maximum Dimensions .. In accordance with JEDEC DO-4 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction .....−65°C. to +175°C. Impedance (°C/W), Junction to Case 3.0 Maximum	
Base .... Steel stud and base with a #10-32 UNF-2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. Header ..... Glass to metal construction. Hermetically sealed to base. Weight ..... Approximately 0.16 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 30 inch pounds maximum Dimensions .. In accordance with JEDEC DO-4 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction .....−65°C. to +175°C. Impedance (°C/W), Junction to Case 3.0 Maximum	
Base .... Steel stud and base with a ¼"-28 UNF-2A thread for through mounting on a heat sink. Nickel plating of base produces low contact resistance and prevents corrosion. Header ..... Glass to metal construction. Hermetically sealed to base. Weight ..... Approximately 0.5 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 75 inch pounds maximum Dimensions .. In accordance with JEDEC DO-5 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction .....−65°C. to +175°C. Impedance (°C/W), Junction to Case 3.0 Maximum	

SYNTRON

AVALANCHE SILICON

RATINGS

	Catalog Number Standard Polarity	Catalog Number Reverse Polarity	Peak Reverse Voltage*	ELECTRICAL CHARACTERISTICS
SERIES 32 	S3205	R3205	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 37 amperes Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 600 amperes Peak Forward Voltage at 90 Amps (25°C. Case Temp.) .... 1.3 Volts Maximum Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 2.0 Milliamps Maximum Operating Frequency ..... 10,000 CPS Maximum I^2t (less than 8 ms) ..... 1500 Amps² - Second Reverse Power Rating ..... 0.60 Joules *FCA = Full Cycle Average (measured with a DC meter)
	S3210	R3210	100	
	S3215	R3215	150	
	S3220	R3220	200	
	S3225	R3225	250	
	S3230	R3230	300	
	S3235	R3235	350	
	S3240	R3240	400	
	S3245	R3245	450	
	S3250	R3250	500	
	S3260	R3260	600	
	S3270	R3270	700	
	S3280	R3280	800	
	S3290	R3290	900	
	S32100	R32100	1000	
SERIES 34 	S3405	R3405	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 50 amperes Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 600 amperes Peak Forward Voltage at 90 Amps (25°C. Case Temp.) .... 1.3 Volts Maximum Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 2.0 Milliamps Maximum Operating Frequency ..... 10,000 CPS Maximum I^2t (less than 8 ms) ..... 1500 Amps² - Second Reverse Power Rating ..... 0.60 Joules *FCA = Full Cycle Average (measured with a DC meter)
	S3410	R3410	100	
	S3415	R3415	150	
	S3420	R3420	200	
	S3425	R3425	250	
	S3430	R3430	300	
	S3435	R3435	350	
	S3440	R3440	400	
	S3445	R3445	450	
	S3450	R3450	500	
	S3460	R3460	600	
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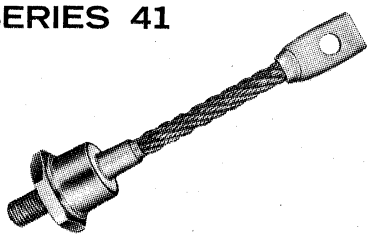
	S3480	R3480	800	
	S3490	R3490	900	
	S34100	R34100	1000	
SERIES 41 	S4105	R4105	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 104 amperes Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 1500 amperes Peak Forward Voltage at 200 Amps (25°C. Case Temp.) .. 1.3 Volts Maximum Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 5.0 Milliamps Maximum Operating Frequency ..... 7,500 CPS Maximum I^2t (less than 8 ms) ..... 9000 Amps² - Second Reverse Power Rating ..... 1.0 Joules *FCA = Full Cycle Average (measured with a DC meter)
	S4110	R4110	100	
	S4115	R4115	150	
	S4120	R4120	200	
	S4125	R4125	250	
	S4130	R4130	300	
	S4135	R4135	350	
	S4140	R4140	400	
	S4145	R4145	450	
	S4150	R4150	500	
	S4160	R4160	600	
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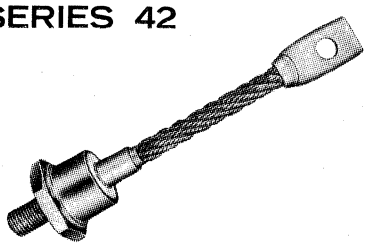
	S4180	R4180	800	
	S4190	R4190	900	
	S41100	R41100	1000	
SERIES 42 	S4205	R4205	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 104 amperes Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 1500 amperes Peak Forward Voltage at 200 Amps (25°C. Case Temp.) .. 1.3 Volts Maximum Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 5.0 Milliamps Maximum Operating Frequency ..... 7,500 CPS Maximum I^2t (less than 8 ms) ..... 9000 Amps² - Second Reverse Power Rating ..... 1.0 Joules *FCA = Full Cycle Average (measured with a DC meter)
	S4210	R4210	100	
	S4215	R4215	150	
	S4220	R4220	200	
	S4225	R4225	250	
	S4230	R4230	300	
	S4235	R4235	350	
	S4240	R4240	400	
	S4245	R4245	450	
	S4250	R4250	500	
	S4260	R4260	600	
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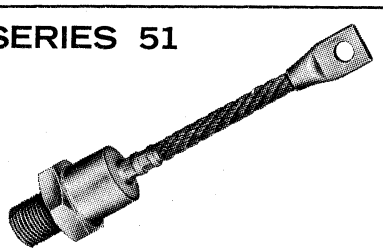
	S4280	R4280	800	
	S4290	R4290	900	
	S42100	R42100	1000	
SERIES 51 	S5105	R5105	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 160 amperes Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 2,200 amperes Peak Forward Voltage at 300 Amps (25°C. Case Temp.) .. 1.3 Volts Maximum Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 10 Milliamps Maximum I^2t (less than 8 ms) ..... 20,000 Amps² - Second Reverse Power Rating ..... 2.0 Joules *FCA = Full Cycle Average (measured with a DC meter)
	S5110	R5110	100	
	S5115	R5115	150	
	S5120	R5120	200	
	S5125	R5125	250	
	S5130	R5130	300	
	S5135	R5135	350	
	S5140	R5140	400	
	S5150	R5150	500	
	S5160	R5160	600	
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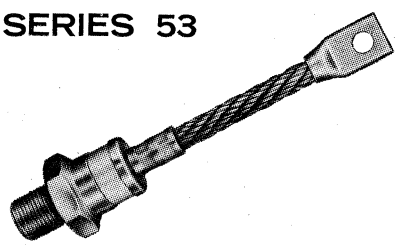
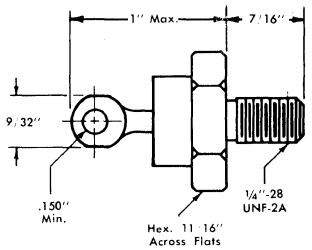
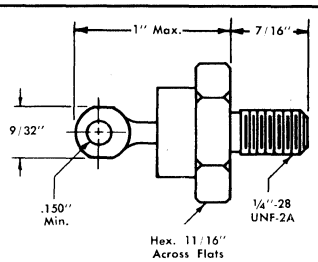
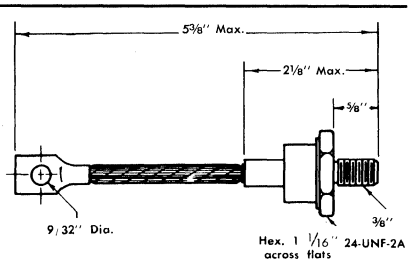
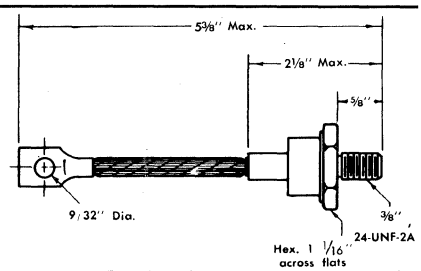
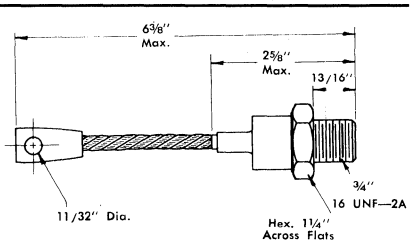
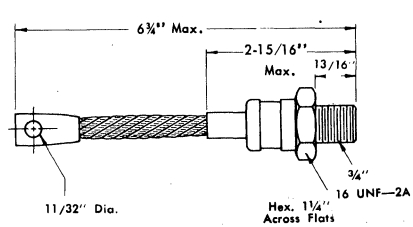
	S5190	R5190	900	
	S51100	R51100	1000	
SERIES 53 	S5305	R5305	50	Maximum Average Forward Current, Single Phase Half Wave DC Rating at 120°C. Case Temp. .... 250 amperes Maximum Surge Current (one cycle of 60 CPS sine wave) ..... 4,500 amperes Peak Forward Voltage at 300 Amps (25°C. Case Temp.) .. 1.2 Volts Maximum Rated Peak Reverse Voltage Range ..... 50 to 1600 Volts Maximum *FCA Reverse Current at 150°C. Case Temperature ..... 10 Milliamps Maximum I^2t (less than 8 ms) ..... 85,000 Amps² - Second Reverse Power Rating ..... 2.0 Joules *FCA = Full Cycle Average (measured with a DC meter)
	S5310	R5310	100	
	S5315	R5315	150	
	S5320	R5320	200	
	S5325	R5325	250	
	S5330	R5330	300	
	S5335	R5335	350	
	S5340	R5340	400	
	S5350	R5350	500	
	S5360	R5360	600	
	S5370	R5370	700	
	S5380	R5380	800	
	S5390	R5390	900	
	S53100	R53100	1000	

*Diodes available with voltage ratings to 1600 PRV.

POWER RECTIFIERS

SYNTRON DIVISION
FMC Corporation
264 Lexington
Homer City, Pa. 15748
Cable Address: SYNTRON, HOMER CITY

MECHANICAL CHARACTERISTICS	THERMAL CHARACTERISTICS	DIMENSIONS
Base .... Steel stud and base with a 1/4"-28 UNF-2A thread for through mounting on a heat sink. Nickel plating of base produces low contact resistance and prevents corrosion. Header ..... Glass to metal construction. Hermetically sealed to base. Weight ..... Approximately 0.5 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 75 inch pounds maximum Dimensions .. In accordance with JEDEC DO-5 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction ..... −65°C. to +175°C. Impedance (°C/W), Junction to Case 1.25 Maximum	
Base .... Steel stud and base with a 1/4"-28 UNF-2A thread for through mounting on a heat sink. Nickel plating of base produces low contact resistance and prevents corrosion. Header ..... Glass to metal construction. Hermetically sealed to base. Weight ..... Approximately 0.5 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 75 inch pounds maximum Dimensions .. In accordance with JEDEC DO-5 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction ..... −65°C. to +175°C. Impedance (°C/W), Junction to Case 1.25 Maximum	
Base .... Hi Strength Copper Stud and Base with a 3/8-24-UNF-2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. Header ..... Glass to metal construction. Hermetically sealed to base. Weight ..... Approximately 2.75 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 200 inch pounds maximum Dimensions .. In accordance with JEDEC DO-8 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction ..... −65°C. to +175°C. Impedance (°C/W), Junction to Case 0.5 Maximum	
Base .... Hi Strength Copper Stud and Base with a 3/8-24-UNF-2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. Header ..... Glass to metal construction. Hermetically sealed to base. Weight ..... Approximately 2.75 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 200 inch pounds maximum Dimensions .. In accordance with JEDEC DO-8 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction ..... −65°C. to +175°C. Impedance (°C/W), Junction to Case 0.5 Maximum	
Base .... Solid Copper Nickel Plated with 3/4"-16 UNF-2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. Header..... Ceramic header hermetically sealed to base. Weight ..... Approximately 8.5 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 600 inch pounds maximum 300 inch pounds minimum Dimensions .. In accordance with JEDEC DO-9 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction ..... −65°C. to +175°C. Impedance (°C/W), Junction to Case 0.3 Maximum	
Base .... Solid Copper Nickel Plated with 3/4"-16 UNF-2A thread for through mounting on a heat sink. Nickel plating produces low contact resistance and prevents corrosion. Header..... Ceramic header hermetically sealed to base. Weight ..... Approximately 8.5 ounces Mounting Position .. May be mounted in any position Mounting Torque ..... 600 inch pounds maximum 300 inch pounds minimum Dimensions .. In accordance with JEDEC DO-9 Outline	Storage Temperature Range: −65°C. to +200°C. Operating Temperature Range: Junction ..... −65°C. to +175°C. Impedance (°C/W), Junction to Case 0.25 Maximum	

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* Syntron Diodes not mechanically interchangeable with the JEDEC types.
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Index to Texas Instruments Integrated Circuits and Preferred Semiconductors and Components

The following 17 pages list Texas Instruments integrated circuits and the **preferred** line of semiconductors and components. While important parameters and characteristics are briefly presented for most of these devices, you may obtain complete specification on these units by writing to Technical Information Services, Texas Instruments Incorporated, Mail Station 308, P.O. Box 5012, Dallas, Texas 75222.

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1N457	2615
1N458	2615
1N482	2615
1N483	2615
1N484	2615
1N485	2615
1N645	2615
1N646	2615
1N647	2615
1N648	2615
1N649	2615

SWITCHING DIODES

1N914	2615
1N914B	2615
1N3064	2615
1N3070	2615
1N4148	2615
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TID21	2615
TID22	2615
TID23	2615
TID24	2615
TID25	2615
TID26	2615
TID29	2615
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TIV306	2614
TIV307	2614
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REGULATOR DIODES

1N746	2615
1N747	2615
1N748	2615
1N749	2615
1N750	2615
1N751	2615
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1N753	2615
1N754	2615
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TIC21	2616
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TIC23	2616
TI42A	2616
TI43A	2616
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2N3002	2616
2N3003	2616
2N3004	2616
2N3005	2616
2N3006	2616
2N3007	2616
2N3008	2616
2N3555	2616
2N3556	2616
2N3557	2616
2N3558	2616
2N3559	2616
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MC55	2616
MC55D	2616
MC60	2616
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TM1/8	2616
TM1/4	2616

About Preferred Semiconductors and Components . . .

PREFERRED SEMICONDUCTORS AND COMPONENTS is a bold, new concept designed to simplify discrete semiconductor selection. Nearly 70,000 discrete components are available today, making your choice difficult and risky. After months of computerized demand analysis, TI has pre-selected a line of 285 highly popular types (from our 1,500 "standards" and 13,000 "specials") that meet the vast majority of semiconductor requirements.

- All are in wide use today, known and proven.
- All are readily available from TI distributor and factory stocks.
- All are in volume production.
- All are recommended for either present or new designs.

PREFERRED semiconductors can pay off in simplified selection, faster delivery, lower costs, smaller inventories, and reduced testing.

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SERIES 54 AND 74 TTL DIGITAL

			High-Speed Circuits		Standard Circuits		Low-Power Circuits	
Typical Characteristics	Propagation Delay	Basic Gate	6 ns		10 ns		33 ns	
		Flip-Flop	17 ns		25 ns		47 ns	
	Power Dissipation	Basic Gate	22 mW		10 mW		1 mW	
		Flip-Flop	100 mW		40 mW		3.8 mW	
	D-C Noise Immunity		1 V		1 V		1 V	
Recommended Operating Conditions	Maximum Fan-Out		10 High-Speed TTL Loads 12 Standard TTL Loads		8 High-Speed TTL Loads 10 Standard TTL Loads 40 Low-Power TTL Loads		1 High-Speed TTL Load 10 Low-Power TTL Loads	
	Supply Voltage		4.5 to 5.5 V	4.75 to 5.25 V	4.5 to 5.5 V	4.75 to 5.25 V	4.5 to 5.5 V	4.75 to 5.25 V
	Operating Temperature Range		–55°C to 125°C	0°C to 70°C	–55°C to 125°C	0°C to 70°C	–55°C to 125°C	0°C to 70°C
Package (See Integrated Circuit Case Outlines, Pages 2607, 2608)			S Flat Package J and N Plug-In Packages		F Flat Package J and N Plug-In Packages		R Flat Package J and N Plug-In Packages	
Series			54H	74H	54	74	54L	74L
Functions	Quadruple 2-Input Positive NAND Gate		SN54H00	SN74H00	SN5400	SN7400	SN54L00	SN74L00
	Quad 2-Input Positive NAND Gate with Open-Collector Output		SN54H01	SN74H01	SN5401	SN7401		
	Quadruple 2-Input Positive NOR Gate				SN5402	SN7402		
	Triple 3-Input Positive NAND Gate		SN54H10	SN74H10	SN5410	SN7410	SN54L10	SN74L10
	Triple 3-Input Positive AND Gate		SN54H11	SN74H11				
	Dual 4-Input Positive NAND Gate		SN54H20	SN74H20	SN5420	SN7420	SN54L20	SN74L20
	Dual 4-Input Positive AND Gate		SN54H21	SN74H21				
	Dual 4-Input Positive NAND Gate with Open-Collector Output		SN54H22	SN74H22				
	8-Input Positive NAND Gate		SN54H30	SN74H30	SN5430	SN7430	SN54L30	SN74L30
	Dual 4-Input Positive NAND Buffer		SN54H40	SN74H40	SN5440	SN7440		
	BCD-to-Decimal Decoder/Driver				SN5441A[3]	SN7441A[3]		
	BCD-to-Decimal Decoder				SN5442[3]	SN7442[3]		
	Excess-3-to-Decimal Decoder				SN5443[3]	SN7443[3]		
	Excess-3-Gray-to-Decimal Decoder				SN5444[3]	SN7444[3]		
	BCD-to-Decimal Decoder/Driver (30-V Outputs)					SN7445[3]		
	BCD-to-Decimal Decoder/Driver (15-V Outputs)					SN74145[3]		
	BCD-to-Seven-Segment Decoder/Driver (30-V Outputs)				SN5446[3]	SN7446[3]		
	BCD-to-Seven-Segment Decoder/Driver (15-V Outputs)				SN5447[3]	SN7447[3]		
	BCD-to-Seven-Segment Decoder/Driver				SN5448[3]	SN7448[3]		
	BCD-to-Seven-Segment Decoder/Driver (Open-Collector Outputs)				SN5449[1]	SN7449[1]		
	Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate		SN54H50	SN74H50	SN5450	SN7450		
	Dual 2-Wide 2-Input AND-OR-INVERT Gate		SN54H51	SN74H51	SN5451	SN7451	SN54L51	SN74L51
	Expandable 4-Wide 2-2-2-3-Input AND-OR Gate		SN54H52	SN74H52				
	Expandable 4-Wide 2-Input AND-OR-INVERT Gate				SN5453	SN7453		
	Expandable 4-Wide 2-2-2-3-Input AND-OR-INVERT Gate		SN54H53	SN74H53				
	4-Wide 2-Input AND-OR-INVERT Gate		SN54H54	SN74H54	SN5454	SN7454		
	4-Wide 3-2-2-3-Input AND-OR-INVERT Gate						SN54L54	SN74L54
	Expandable 2-Wide 4-Input AND-OR-INVERT Gate		SN54H55	SN74H55			SN54L55[2]	SN74L55[2]
	Dual 4-Input Expander		SN54H60	SN74H60	SN5460	SN7460		
	Triple 3-Input Expander		SN54H61	SN74H61				
	3-2-2-3-Input AND-OR Expander		SN54H62	SN74H62				
	J-K Flip-Flop				SN5470	SN7470		
	J-K Flip-Flop with AND-OR Inputs		SN54H71	SN74H71				
	R-S Master-Slave Flip-Flop						SN54L71	SN74L71
	J-K Master-Slave Flip-Flop		SN54H72	SN74H72	SN5472	SN7472	SN54L72	SN74L72
	Dual J-K Master-Slave Flip-Flop		SN54H73	SN74H73	SN5473	SN7473	SN54L73	SN74L73
	Dual D-Type Edge-Triggered Flip-Flop				SN5474	SN7474		
	Quadruple Bistable Latch				SN5475	SN7475		
	Dual J-K Master-Slave Flip-Flop		SN54H76[3]	SN74H76[3]	SN5476[3]	SN7476[3]		
	Dual J-K Master-Slave Flip-Flop		SN54H78	SN74H78			SN54L78	SN74L78
	Gated Full Adder				SN5480	SN7480		
	16-Bit Active-Element Memory					SN7481		
	2-Bit Binary Full Adder				SN5482	SN7482		
	4-Bit Binary Full Adder					SN7483[3]		
	16-Bit Active-Element Memory (Gated Write Inputs)					SN7484[3]		
	Decade Counter				SN5490	SN7490		
	8-Bit Shift Register				SN5491A	SN7491A	SN54L91A	SN74L91A
	Divide-by-Twelve Counter				SN5492	SN7492		
	4-Bit Binary Counter				SN5493	SN7493		
	4-Bit Shift Register (Parallel-In, Serial-Out)				SN5494[3]	SN7494[3]		
	4-Bit Right-Shift/Left-Shift Register (Parallel-In, Parallel-Out)				SN5495	SN7495	SN54L95	SN74L95
	5-Bit Shift Register (Dual-Parallel-In, Parallel-Out)				SN5496[3]	SN7496[3]		

[1]Available in flat package only. [2]Not expandable [3]16-Pin function. Not available in F or S packages

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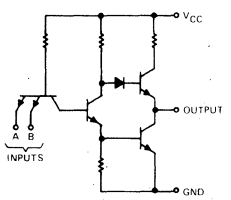
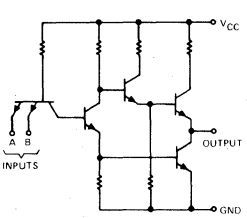
SERIES SNG/SNF TTL DIGITAL*

	Package (See Integrated Circuits Case Outlines on Pages 2607, 2608)	–55°C to 125°C J, N, and R	–55°C to 125°C J, N, and R	0°C to 75°C J, N, and R	0°C to 75°C J, N, and R
Functions	Dual 4-Input NAND/NOR Gates	SNG40	SNG41	SNG42	SNG43
	Expandable Quadruple 2-Input OR Gates	SNG50	SNG51	SNG52	SNG53
	8-Input NAND/NOR Gates	SNG60	SNG61	SNG62	SNG63
	Expandable Dual Output, Dual 2-Input AND/NOR Gates	SNG70	SNG71	SNG72	SNG73
	Dual Pulse Shaper/Delay AND Gates	SNG80	SNG81	SNG82	SNG83
	Exclusive-OR Gates (With Complement)	SNG90	SNG91	SNG92	SNG93
	Expandable Triple 3-Input OR Gates	SNG100	SNG101	SNG102	SNG103
	Expandable Dual 4-Input OR Gates	SNG110	SNG111	SNG112	SNG113
	Expandable 8-Input NAND/NOR Gates	SNG120	SNG121	SNG122	SNG123
	High Fan-Out Dual 4-Input Drivers‡	SNG130[1]	SNG131[2]	SNG132[3]	SNG133[4]
	Quadruple 2-Input NAND/NOR Gates	SNG140	SNG141	SNG142	SNG143
	Quadruple 2-Input OR Expanders	SNG150	SNG151	SNG152	SNG153
	Triple 2-Input Bus Drivers	SNG160	SNG161	SNG162	SNG163
	Dual 4-Input OR Expanders	SNG170	SNG171	SNG172	SNG173
	Dual 4-Input AND Expanders	SNG180	SNG181	SNG182	SNG183
	Triple 3-Input NAND/NOR Gates	SNG190	SNG191	SNG192	SNG193
	Expandable 8-Input NAND/NOR Gates	SNG200	SNG201	SNG202	SNG203
	Expandable AND/NOR Gates	SNG210	SNG211	SNG212	SNG213
	Quadruple 2-Input NAND/NOR Gates	SNG220	SNG221	SNG222	SNG223
	Quadruple 2-Input AND/NOR Expanders	SNG230	SNG231	SNG232	SNG233
	Dual 4-Input NAND/NOR Gates	SNG240	SNG241	SNG242	SNG243
	Expandable AND/NOR Gates	SNG250	SNG251	SNG252	SNG253
	8-Input NAND/NOR Gates	SNG260	SNG261	SNG262	SNG263
	Dual 4-Input AND/NOR Expanders	SNG270	SNG271	SNG272	SNG273
	Expandable Dual 4-Input AND/OR Gates	SNG280	SNG281	SNG282	SNG283
	Dual 2-3-Input Expanders	SNG290	SNG291	SNG292	SNG293
	Expandable AND/NOR Gates (3-Wide, 3-Input)	SNG300	SNG301	SNG302	SNG303
	Expandable Dual AND/NOR Gates (2-Wide, 2-Input)	SNG310	SNG311	SNG312	SNG313
	Set-Reset Flip-Flops	SNF10	SNF11	SNF12	SNF13
	Set-Reset Clocked Flip-Flops	SNF20	SNF21	SNF22	SNF23
	Single-Phase S-R-T Flip-Flops	SNF30	SNF31	SNF32	SNF33
	AND Input J-K Flip-Flops	SNF50	SNF51	SNF52	SNF53
	OR Input J-K Flip-Flops	SNF60	SNF61	SNF62	SNF63
	Dual J-K Flip-Flops (Separate Clocks)	SNF100	SNF101	SNF102	SNF103
	Dual J-K Flip-Flops (Common Clock)	SNF110	SNF111	SNF112	SNF113
	Dual J-K Flip-Flops (Separate Clocks)	SNF120	SNF121	SNF122	SNF123
	Dual J-K Flip-Flops (Common Clock)	SNF130	SNF131	SNF132	SNF133
	AND Input J-K Flip-Flops	SNF200	SNF201	SNF202	SNF203
	OR Input J-K Flip-Flops	SNF210	SNF211	SNF212	SNF213
	AND Input J-K Flip-Flops	SNF250	SNF251	SNF252	SNF253
	OR Input J-K Flip-Flops	SNF260	SNF261	SNF262	SNF263



SNG140 NAND/NOR Gate



SNG220 NAND/NOR Gate

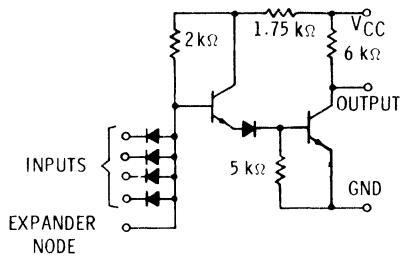
*Interchangeable with SUHL I† and SUHL II† TTL Circuits.
†Trademark of Sylvania Electric Products, Inc.
‡Recommended maximum fan-out is: [1]30; [2]15; [3]24; [4]12.

TEXAS INSTRUMENTS
INCORPORATED
Components Group / P.O. Box 5012 / Dallas, Texas 75222

integrated circuits

SERIES 15 930 AND 15 830 DTL DIGITAL

Typical Character.	Propagation Delay Time (Basic gate)	25 ns	
	Power Dissipation (each gate)	8 mW	
	D-c Noise Immunity	750 mV	
	Operating Temperature Range	−55°C to 125°C	0°C to 75°C
Package (See Integrated Circuit Case Outlines on pages 2607, 2608)		**F, J, N, and R** V_{CC} - Pin 14	Gnd - Pin 7
Functions	Dual 4-input NAND/NOR Gate	SN15930	SN15830
	Flip-flop with Set and Clear	SN15931	SN15831
	Dual 4-input NAND/NOR Buffer	SN15932	SN15832
	Dual 4-input Expander	SN15933	SN15833
	Hex Inverter	SN15936	SN15836
	Fast Rise-time Hex Inverter	SN15937	SN15837
	Dual 4-input NAND/NOR Power Gate	SN15944	SN15844
	Flip-flop with Set and Clear	SN15945	SN15845
	Quad 2-input NAND/NOR Gate	SN15946	SN15846
	Fast Rise-time Flip-flop with Set and Clear	SN15948	SN15848
	Quadruple 2-input NAND/NOR Fast Rise-time Gate	SN15949	SN15849
	Pulse-triggered Binary	SN15950	SN15850
	Monostable Multivibrator (One-shot)	SN15951	SN15851
	Dual 4-input NAND/NOR Fast Rise-time Gate	SN15961	SN15861
	Triple 3-input NAND/NOR Gate	SN15962	SN15862
	Triple 3-input NAND/NOR Fast Rise-time Gate	SN15963	SN15863
	Dual Flip-flop with Set	SN159093	SN158093
	Dual Fast Rise-time Flip-flop with Set	SN159094	SN158094
	Dual Fast Rise-time Flip-flop with Set and Clear	SN159097	SN158097
	Dual Flip-flop with Set and Clear	SN159099	SN158099



Typical Series 15930/15830 Circuit

LINEAR INTEGRATED CIRCUITS

Differential/Operational Amplifiers

- Low input and output offset characteristics
- High common-mode input capability
- Most circuits are available in economical plastic dual-in-line package

Series 52 700/5510/5511 (Operating Temperature Range −55°C to 125°C)

		TYPICAL CHARACTERISTICS														
		Open-loop voltage gain A_{vs}	Bandwidth (−3 dB) BW	Input Impedance z_{in}	Input capacitance C_{in}	Differential-input offset voltage V_{DI}	Differential-input offset current I_{DI}	Differential-input offset voltage temperature coefficient α_{VDI}	Maximum common-mode input voltage range V_{CMIM}	Common-mode output offset voltage V_{CMO}	Output impedance z_{out}	Maximum peak-to-peak output voltage V_{OM}	Common-mode rejection ratio CMRR	Total power dissipation P_T	Input current I_{in}	Package (See pages 2607, 2608)
		dB	kHz	kΩ	pF	mV	μA	μV/deg	V	V	Ω	V	dB	mW	μA	
SN52702	General-Purpose Op Amp	68	—	25	—	2	0.7	5	‡	—	200	10.6	80	70	4	F/L/N
SN52709	High-Performance Op Amp	93	—	400	—	3	0.05	—	±10	—	150	26	90	80	0.2	F/L/N
SN52710	Differential Comparator	64	—	—	—	2	1	5	—	—	200	—	—	110	25	F/L/N
SN52711	Dual Differential Comparator	64	—	—	—	1	0.5	5	—	—	200	—	—	130	25	F/L/N
SN5510	Wide-Band Video Amplifier	40	40,000	6	7	—	3	—	±1	3.1	35	4.5	85	165	40	F/L
SN5511	Wide-Band Diff Amp	63	3,000	5	—	1	0.6	4	±2.5	−0.2	700	5	95	165	6	F/L
Series 72 700/7510 (Operating Temperature Range 0°C to 70°C)																
SN72702	General-Purpose Op Amp	68	—	20	—	5	1.5	—	‡	—	200	10.6	80	80	5	F/L/N
SN72709	High-Performance Op Amp	93	—	250	—	2	0.1	—	±10	—	150	26	90	80	0.3	F/L/N
SN72710	Differential Comparator	62	—	—	—	2	1	7.5	—	—	200	—	—	110	25	F/L/N
SN72711	Dual Differential Comparator	64	—	—	—	1	0.5	5	—	—	200	—	—	130	25	F/L/N
SN72720	Dual Differential Comparator	62	—	—	—	2	1.8	7.5	—	—	200	—	98	220	25	N
SN7510	Wide-Band Video Amplifier	39	40,000	6	7	—	5	—	±1	3	35	4.5	85	165	50	F/L

‡0.5 to −4.

MOS INTEGRATED CIRCUITS*

Type Number	Brief Description	Type Number	Brief Description
TMS 1B 3016 LA	Dual 16-Bit Static Shift Register	TMS 7D 3300 LA	Dual 25-Bit Dynamic Shift Register
TMS 7B 3000 LA	Dual 25-Bit Static Shift Register	TMS 1A 1700 AA	Dual Full Adder
TMS 7B 3001 LA	Dual 32-Bit Static Shift Register	TMS 1A 1702 LA	Dual 3-Input NOR
TMS 7C 3002 LA	Dual 50-Bit Static Shift Register	TMS 1A 6009 AA	6-Channel Analog Switch
TMS 7C 3003 LA	Dual 100-Bit Static Shift Register	TMS 7A 6000 FB	10-Channel Analog Switch

*All circuits are in the L-package except TMS 1A 1702 LA and TMS 1A 6009 AA which are in the F-package, and TMS 7A 6000 FB which is in a 20-lead, circular, flat package.

integrated circuits

SYSTEMS INTERFACE CIRCUITS

Series 5520 and 7520 Sense Amplifiers

- Fast overload recovery time
- Narrow threshold uncertainty region
- Transistor f_T of over 1 GHz
- Two sense channels per package (Series 7520)
- Cycle times as low as 200 ns

Series 5520 (Operating Temperature Range –55°C to 125°C)

Series 7520 (Operating Temperature Range 0°C to 70°C)

		TYPICAL CHARACTERISTICS										
		V_T Differential-input threshold voltage	V_{CMF} Common-mode input firing voltage	$V_{out(1)}$ Logical 1 output voltage	$V_{out(0)}$ Logical 0 output voltage	$I_{in(1)}$ Logical 1 level input current (strobe or reset)	$I_{in(0)}$ Logical 0 level input current (strobe or reset)	I_{CC1} V_{CC1} supply current	I_{CC2} V_{CC2} supply current	I_{ref} V_{ref} supply current	$t_{cyc(min)}$ Minimum cycle time	Package (See pages 2607, 2608)
		mV	V	V	V	mA	mA	mA	mA	mA	μs	
SN5524	Sense Amplifier	±7	3	4	0.25	0.005	–1	25	–15	0.03	0.2	J
SN5525	Sense Amplifier	±5†	3	4	0.25	0.005	–1	25	–15	0.03	0.2	J
SN7520	Sense Amplifier (FF or Register-Type Output)	±4	3	4	0.25	0.005	–1	28	–14	0.03	0.2	N
SN7521	Sense Amplifier (FF or Register-Type Output)	±7	3	4	0.25	0.005	–1	28	–14	0.03	0.2	N
SN7522	Sense Amplifier (Open-Collector Output)	±4	3	4	0.2	0.005	–1	27	–15	0.03	0.2	N
SN7523	Sense Amplifier (Open-Collector Output)	±7	3	4	0.2	0.005	–1	27	–15	0.03	0.2	N
SN7524	Sense Amplifier (Separate AND Outputs)	±4	3	4	0.25	0.005	–1	25	–15	0.03	0.2	J/N
SN7525	Sense Amplifier (Separate AND Outputs)	±7	3	4	0.25	0.005	–1	25	–15	0.03	0.2	J/N
SN7528	Sense Amplifier (Separate AND Outputs)	±4	3	4	0.25	0.005	–1	25	–15	0.03	0.2	N
SN7529	Sense Amplifier (Separate AND Outputs)	±7	3	4	0.25	0.005	–1	25	–15	0.03	0.2	N

($15\ mV \leq V_{REF} \leq 40\ mV$) †At $T_A = 25°C$, $V_T = \pm 5\ mV$

Series 55 107/75 107 Line Circuits

- High Speed
- Standard Logic Supply Voltages
- TTL/DTL Compatible
- Dual Channels

Series 55 107 (Operating Temperature Range: –55°C to 125°C)

		V_{ID} Differential input voltage	V_{IH} High-level input voltage	V_{IL} Low-level input voltage	I_{IH} High-level input current	V_{ICM} Maximum common-mode input voltage range	P_D Total power dissipation	t_{plh} Propagation delay time (differential inputs)	Package (See pages 16, 17)
		mV	V	V	μA	V	mV	ns	
SN55107	Dual Line Receiver with SN5400 (TTL) Gate Output	3	—	—	30	±3	134	17	J
SN55108	Dual Line Receiver with SN5401 (Open-Collector) Gate Output	3	—	—	30	±3	134	19	J
SN55109	Dual Line Driver with 6-mA Typical Line Current	—	3.2	0.22	—	—	180	8	J
SN55110	Dual Line Driver with 12-mA Typical Line Current	—	3.2	0.22	—	—	285	9	J

Series 75 107 (Operating Temperature Range 0°C to 70°C)

SN75107	Dual Line Receiver with SN5400 (TTL) Gate Output	3	—	—	30	±3	134	17	J/N
SN75108	Dual Line Receiver with SN5401 (Open-Collector) Gate Output	3	—	—	30	±3	134	19	J/N
SN75109	Dual Line Driver with 6-mA Typical Line Current	—	3.2	0.22	—	—	180	8	J/N
SN75110	Dual Line Driver with 12-mA Typical Line Current	—	3.2	0.22	—	—	285	9	J/N

OTHER INTEGRATED CIRCUITS

The following families of digital circuits are available, dependent on customer requirements. For information contact your TI sales engineer.

- **Series 51 and 51R† RCTL Digital**
- **Series 53 and 73 Modified-DTL Digital**
- **Series 17900L and 17800L RTL Digital**

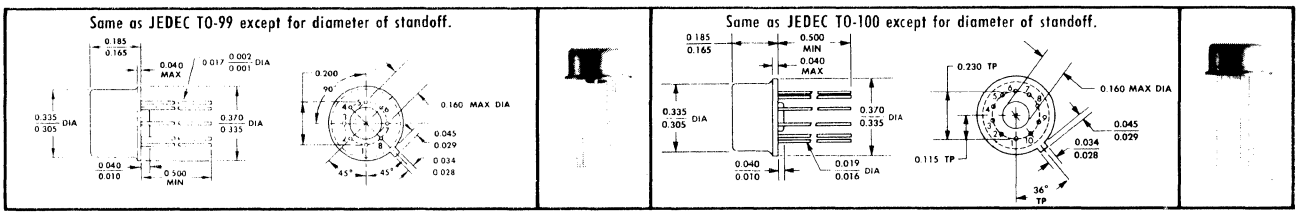
†Series 51R are standard units that have undergone special testing and processing for severe-environmental applications.

integrated circuits

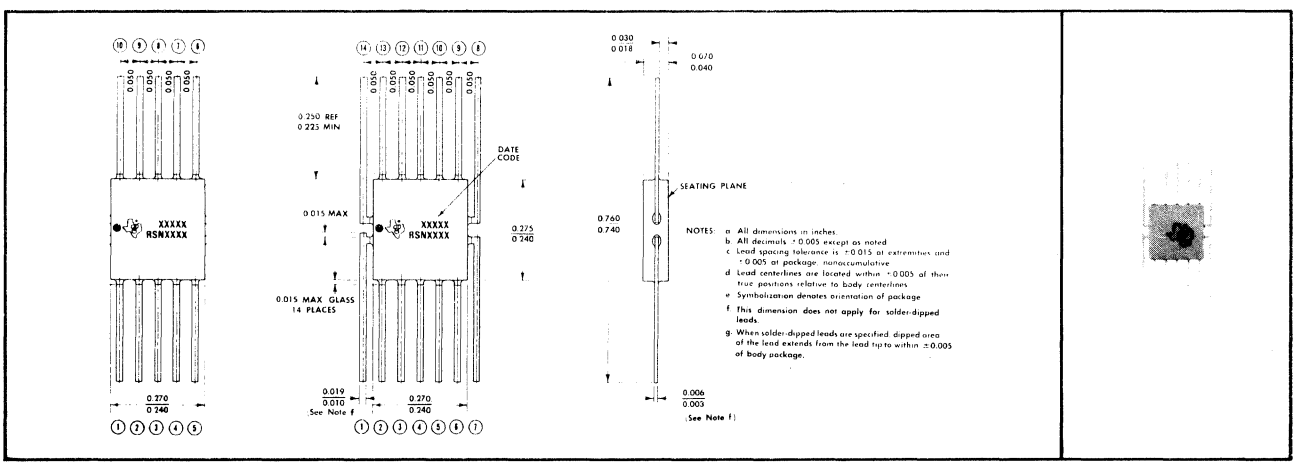
PACKAGING

The last suffix letter of the device number (e.g., SN74H10**N**) indicates the package designation. Variations in mechanical configuration of **F**, **R**, and **S** packages must be indicated when ordering by using the suffix numbers shown in the table at the right (e.g., SN521AF-**12**).

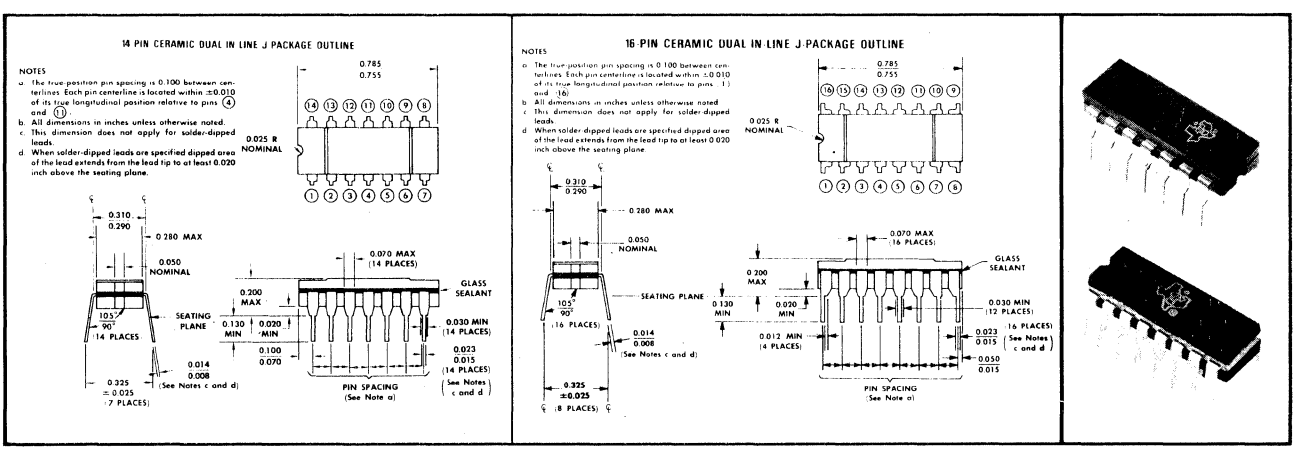
	MECH-PACKETTE CARRIER				MECH-PAK CARRIER			
Formed Leads	No	No	Yes	Yes	No	No	Yes	Yes
Insulators	No	Yes	No	Yes	No	Yes	No	Yes
Gold-plated Leads	–00	–06	–07	–01	–02	–03	–04	–05
Solder-dipped Leads	–10	–16	–17	–11	–12	–13	–14	–15



L — TO-99 AND TO-100 TYPES — Gold-plated F-15‡ Leads†



H — CERAMIC FLAT PACKAGES — Gold-plated F-15‡ Glass-sealing Alloy — 10 or 14 LONG Leads



J — CERAMIC DUAL-IN-LINE — Tin-plated Leads†

‡F-15 is the ASTM designation for an iron-nickel-cobalt alloy containing nominally 53% iron, 29% nickel, and 17% cobalt.
†For leads as described add suffix –00. For solder-dipped leads add suffix –10.

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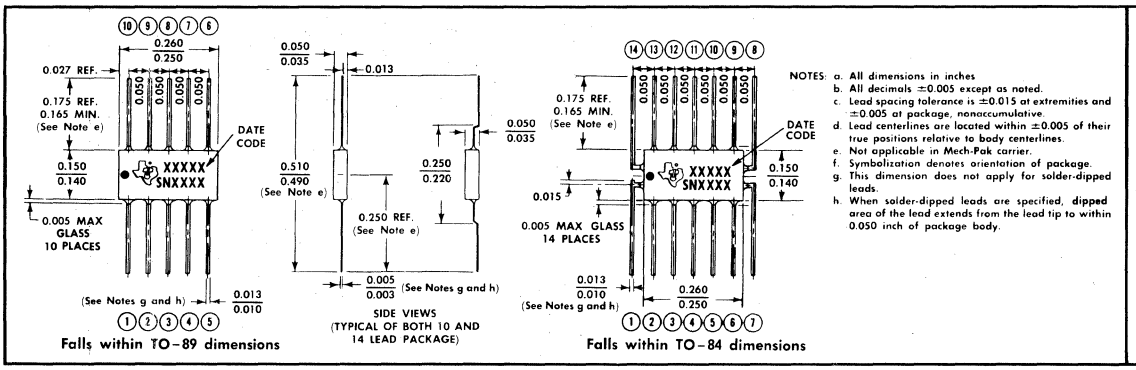
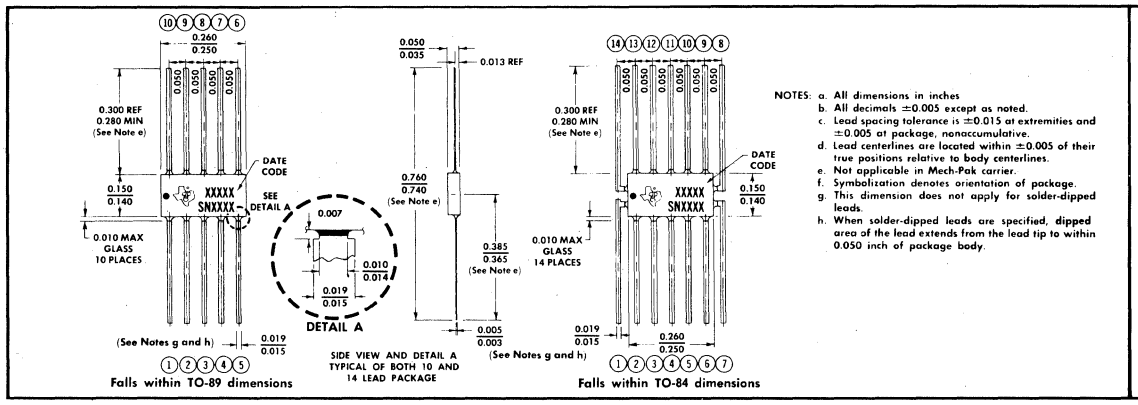
PACKAGING Cont.



NOTES: a. All dimensions in inches
b. All decimals ±0.005 except as noted.
c. Lead spacing tolerance is ±0.015 at extremities and ±0.005 at package, nonaccumulative.
d. Lead centerlines are located within ±0.005 of their true positions relative to body centerlines.
e. Not applicable in Mech-Pak carrier.
f. Symbolization denotes orientation of package.
g. This dimension does not apply for solder-dipped leads.
h. When solder-dipped leads are specified, dipped area of the lead extends from the lead tip to within 0.050 inch of package body.



F AND S* PACKAGES *Circuit substrate is in electrical contact with the case.



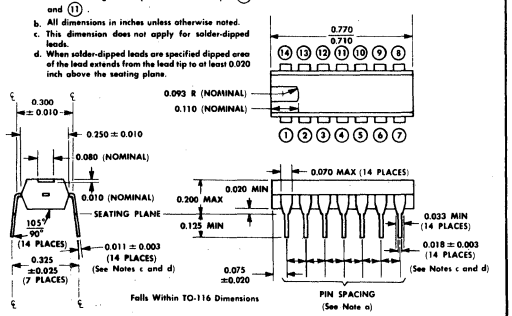
NOTES: a. All dimensions in inches
b. All decimals ±0.005 except as noted.
c. Lead spacing tolerance is ±0.015 at extremities and ±0.005 at package, nonaccumulative.
d. Lead centerlines are located within ±0.005 of their true positions relative to body centerlines.
e. Not applicable in Mech-Pak carrier.
f. Symbolization denotes orientation of package.
g. This dimension does not apply for solder-dipped leads.
h. When solder-dipped leads are specified, dipped area of the lead extends from the lead tip to within 0.050 inch of package body.



R — FLAT PACKAGES— Gold-plated F-15‡ Glass-sealing Alloy — 10 or 14 LONG Leads (for suffix, see table, page 2607)

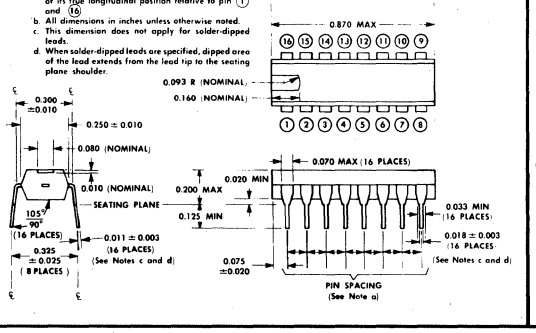
NOTES: a. The true-position pin spacing is 0.100 between centerlines. Each pin centerline is located within ±0.010 of its true longitudinal position relative to pin (4) and (11).
b. All dimensions in inches unless otherwise noted.
c. This dimension does not apply for solder-dipped leads.
d. When solder-dipped leads are specified dipped area of the lead extends from the lead tip to at least 0.020 inch above the seating plane.

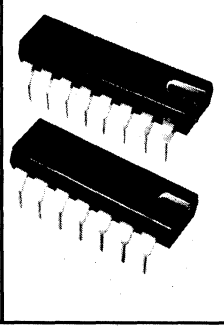
14-PIN PLASTIC DUAL-IN-LINE N-PACKAGE OUTLINE



NOTES: a. The true-position pin spacing is 0.100 between centerlines. Each pin centerline is located within ±0.010 of its true longitudinal position relative to pin (1) and (16).
b. All dimensions in inches unless otherwise noted.
c. This dimension does not apply for solder-dipped leads.
d. When solder-dipped leads are specified, dipped area of the lead extends from the lead tip to the seating plane shoulder.

16-PIN PLASTIC DUAL-IN-LINE N-PACKAGE OUTLINE





N — MOLDED PLASTIC PLUG-IN — Silver-plated Leads†

‡F-15 is the ASTM designation for an iron-nickel-cobalt alloy containing nominally 53% iron, 29% nickel, and 17% cobalt.

†For leads as described add suffix —00. For solder-dipped leads add suffix —10.

Applications guide to Preferred Semiconductors

APPLICATION	DEVICE RECOMMENDATION			
	BIPOLAR		FET	
	N-P-N	P-N-P	N-CHANNEL	P-CHANNEL
	Type No.	Type No.	Type No.	Type No.
Small-Signal Transistor:				
Amplifier:				
DC to 1 MHz	• TIS92 • TIS92M • TIS97 • TIS98 TIS99 2N697 2N718A 2N930 • 2N997 • 2N1302 • 2N1304 • 2N1306 • 2N1308 2N1893 • 2N2484 2N3707 2N3708 2N3709 2N3710 2N3711 • 2N4104 • 2N5449	• TIS93 • TIS93M 2N404 2N1303 2N1305 2N1307 2N1309 2N2000 2N2605 • 2N2905 • 2N2907 • 2N3486 • 2N3495 • 2N3964 • 2N4058-61 • 2N5447	TIS88 • 2N3819 • 2N3822	2N2386 • 2N2498 • 2N3330 2N3909 • 2N3820
1 MHz to 10 MHz	TIS63 2N697 2N930 2N1302 2N1304 2N1306 2N1308 2N1613 2N1893 • 2N2484 • 2N4104	• TIS37 2N404 2N1303 2N1305 2N1307 2N1309 2N1377 2N1997 2N2605 • 2N2905 • 2N3495	TIS88 • 2N3819 • 2N3822 • 2N3823 • 2N4416	2N2386 • 2N2498 • 2N3330 2N3909 • 2N3820
10 MHz to 50 MHz	TIS56 • TIS63 • TIS84 • TIS85 • TIS86 • TIS87 2N918 • 2N2219 • 2N2222 • 2N2243A 2N4252	• TIS37 • 2N3495 • 2N5043	TIS88 • 2N3819 • 2N3822 • 2N3823 • 2N4416	• 2N2498 • 2N3330
50 MHz to 100 MHz	• TIS63 • TIS84 • TIS85 • TIS86 • TIS87 2N918 • 2N2219 • 2N2222 2N4252 • 2N4875	• 2N2905 • 2N2907 • 2N3486 • 2N5043	TIS88 • 2N3823 • 2N4416	• 2N2498 • 2N3330
100 MHz to 5 GHz	2N918 • 2N3570 2N4252 • 2N4875	• 2N5043	TIS88 • 2N3823 • 2N4416	
Low-Noise Amplifier:				
0 to 10 MHz	• TIS97 2N930 • 2N2484 2N3707 • 2N4104	• TIS37 2N2605 • 2N4058-61	TIS88 • 2N3822 • 2N4416	• 2N2498 • 2N3330
10 MHz to 50 MHz	• TIS62 • TIS84 • TIS86 2N918 2N4252 • 2N4875	• TIS37	TIS88 • 2N3822 • 2N3823 • 2N4416	

APPLICATION	DEVICE RECOMMENDATION			
	BIPOLAR		FET	
	N-P-N	P-N-P	N-CHANNEL	P-CHANNEL
	Type No.	Type No.	Type No.	Type No.
50 MHz to 100 MHz	• TIS62 • TIS84 • TIS86 2N918 • 2N3570 2N4252 • 2N4875	• 2N5043	• TIS88 • 2N3823 • 2N4416	
100 MHz to 1 GHz	• TIS86 2N918 • 2N3570 • 2N4875	• 2N5043	• TIS88 • 2N3823 • 2N4416	
Mixer and Converter:				
0 to 10 MHz	2N918	• TIS37	• 2N3823 • 2N4416	• 2N2498 • 2N3330
10 MHz to 50 MHz	TIS56 • TIS63 • TIS85 • TIS86 2N4252 • 2N4875	• TIS37	• TIS88 • 2N3823 • 2N4416	• 2N3820
50 MHz to 100 MHz	• TIS63 • TIS85 • TIS86 • 2N3570 2N4252 • 2N4875	• 2N5043	• TIS88 • 2N3823 • 2N4416	
100 MHz to 5 GHz	• TIS86 2N918 • 2N3570 2N4252 • 2N4875	• 2N5043	• TIS88 • 2N3823 • 2N4416	
Oscillator:				
0 to 10 MHz	• TIS98 2N697 2N1613 • 2N2484 2N3711 • 2N5449	• TIS38 • 2N2905 • 2N3486 • 2N3495	• TIS88 • 2N3819 • 2N3822 • 2N3823 • 2N4416	• 2N2498 • 2N3330
10 MHz to 50 MHz	• TIS63 • TIS98 2N918 • 2N2219 • 2N2222 • 2N4875 • 2N5449	• TIS38 • 2N2905 • 2N2907 • 2N3486 • 2N5447	• TIS88 • 2N3822 • 2N3823 • 2N4416	
50 MHz to 100 MHz	• TIS63 • TIS86 2N918 • 2N4875 • 2N5449	• 2N5043 • 2N5447	TIS88 • 2N3823 • 2N4416	
100 MHz to 5 GHz	• TIS63 • TIS86 2N918 • 2N3570 • 2N4875	• 2N5043	TIS88 • 2N3823 • 2N4416	
Power Oscillator:	• 2N3866			
Power Amplifier:				
Radio Frequency	• 2N3866 • 2N4875			
Audio Frequency	• TIP29 • TIP29A • TIP31 • TIP31A • TIP33 • TIP33A • TIP35 • TIP35A 2N697 2N718A 2N1613 2N1711	• TIP30 • TIP30A • TIP32 • TIP32A • TIP34 • TIP34A • TIP36 • TIP36A 2N456A 2N1038 • 2N2905 • 2N2907 TI3027 • 2N3486 • 2N3495	• 2N4857	

• Devices especially recommended for new design.

Applications guide to Preferred Semiconductors

Continued

APPLICATION	DEVICE RECOMMENDATION BIPOLAR N-P-N Type No.	BIPOLAR P-N-P Type No.	OTHER DEVICES Type No.	OTHER DEVICES Classification
Switching: Multivibrator, Pulse Generator, Schmitt Trigger	2N1302 2N1304 2N1306 2N1308 •2N2219 •2N2222 •2N2369A •2N3010 •2N3013 •2N3725	2N404 2N1303 2N1305 2N1307 2N1309 2N1997 2N2000 2N2635 • 2N2894 • 2N2905 • 2N2907 • 2N3829	• 2N3980 • 2N3993 • 2N4416 • 2N4857	UJT P-FET N-FET N-FET
Ring Counter/ Latching Amplifier	2N930 •2N2369A •2N3010 •2N3013 •2N5449	• 2N2894 • 2N2905 • 2N3250 • 2N3304 • 2N3829 • 2N4058-61 • 2N5447	• TIC20-3 • 2N3001-4 • 2N3555-8 • 2N3993 • 2N4416 • 2N4857 • 2N5273-4 • TIS73	TRIAC SCR SCR P-FET N-FET N-FET TRIAC N-FET
Relaxation Oscillator			•TI42A •TI43A 2N1671B •2N3980 •2N4891	Trigger Diode Trigger Diode UJT UJT UJT
Pulse Amplifier	• 2N2243A • 2N2369A	2N1907 • 2N2894 • 2N2905 • 2N3304 • 2N3486 • 2N3829 • 2N5333 • 2N5384 • 2N5386	• 2N3993 • 2N4857	P-FET N-FET
Chopper	• 3N79 • 2N2432 • TIP29 • TIP29A • TIP31 • TIP31A • TIP33 • TIP33A • TIP35 • TIP35A	• 3N111 • 2N2945A • 2N3467 • TIP30 • TIP30A • TIP32 • TIP32A • TIP34 • TIP34A • TIP36 • TIP36A	• 2N3993 • 2N4857	P-FET N-FET
Computer Memory Driver	• 2N3013 • 2N3015 • 2N3725	• 2N3467	• 2N3993 • 2N4857 • TIS73	P-FET N-FET N-FET
Power Control/ Regulator	•TIP29, A •TIP31, A •TIP33, A •TIP35, A 2N1724 •2N2987-94 2N3055 •2N3418-21 •2N3551,2 •2N3713-16 •2N3996-9 •2N4000,1 •2N4002,3 •2N4300 •2N4301 •2N5387-9	•TIP30, A •TIP32, A •TIP34, A •TIP36, A 2N456A 2N1539 2N1907 TI3027 •2N5333 •2N5384,5 •2N5386	• TIC20-3 • TIC44-7 • 2N3001-4 • 2N3005-08 • 2N3555-8 • 2N3559-62 • 2N5273-4	TRIAC SCR SCR SCR SCR SCR TRIAC

APPLICATION	DEVICE RECOMMENDATION BIPOLAR N-P-N Type No.	BIPOLAR P-N-P Type No.	OTHER DEVICES Type No.	OTHER DEVICES Classification
Computer Logic Switch	2N797 2N1302 2N1304 2N1306 2N1308 •2N2369A •2N3010 •2N3013	2N404 2N964 2N1303 2N1305 2N1307 2N1309 2N1997 2N2635 • 2N2894 • 2N3250 • 2N3304 • 2N3829	• 2N3993 • 2N4857 • TIS73	P-FET N-FET N-FET
Series/Shunt Register	• TIP29 • TIP29A • TIP31 • TIP31A • TIP33 • TIP33A • TIP35 • TIP35A 2N1724 • 2N2987-94 2N3055 • 2N3418-21 • 2N3551,2 • 2N3713-16 • 2N3996-9 • 2N4000,1 • 2N4002,3 • 2N4300 • 2N4301 • 2N5387-9	• TIP30 • TIP30A • TIP32 • TIP32A • TIP34 • TIP34A • TIP36 • TIP36A 2N456A 2N1038 2N1539 2N1907 TI3027 •2N5333 •2N5384,5 •2N5386	• 2N3993 • 2N4857	P-FET N-FET
Lamp Driver (Nixie Driver) High Voltage	2N1893 • 2N2243A	2N398 •2N3495	• 2N4857	N-FET
Linear Application: Demodulator	• 3N79 • 2N2432	2N1907 • 2N2945A	• 2N4857	N-FET
Differential Amplifier	• 2N2060 • 2N2642 • 2N3043 • 2N3045 • 2N3680 • 2N3838	• 2N3049 • 2N3350 • 2N3351	• TIS69 • 2N5045	N-FET N-FET
Operational Amplifier	• 2N2060 • 2N2223 • 2N2642 • 2N3043 • 2N3045 • 2N3680	• 2N3049 • 2N3350 • 2N3351	• TIS69 • 2N4854 • 2N5045	N-FET NPN-PNP N-FET
Servo Amplifier	• 2N2060 • 2N2223 • 2N2642 • 2N3680	2N1038 2N1907 • 2N3350 • 2N3351	• TIS69 • 2N5045	N-FET N-FET
Sense Amplifier/ Comparator	• 2N2060 • 2N2642 • 2N3043 • 2N3680 • 2N3838	• 2N3049 • 2N3350 • 2N3351	TIS88 • 2N4416 • 2N5045	N-FET N-FET N-FET
Waveform Generator/ Clipper/Compressor	2N930 2N3707 2N3708 2N3709 2N3711 • 2N5449	• 2N5447	TIS88 •2N4416 •2N4857	N-FET N-FET N-FET
Diodes: Mixer/Converter			1N456-8 1N482-5 1N914	

OTHER APPLICATIONS AND DEVICES

Detector
1N456-8
1N914
• 1N4148
• 1N4448

Switch
1N914
• 1N3064
• 1N3070
• 1N4148
• 1N4448
• 1N4531

Tuning
• TIV306-08

Power Supply
• 1N645-9

Voltage Regulator
1N746-1N759
• 1N746A-1N759A
1N4370
• 1N4370A

Rectifier
1N456-1N458
1N482-5
• 1N645-9
• 1N4001-7

Computer
• TID21-24
• TID25-26
• TID29-30
1N914
• 1N3064

Transistor Biasing
• 1N746A-1N759A

TV "Color Killer"
• 1N3070

Light Sensor
•LS400
•LS600
•1N2175

Logarithmic
•1N645-9
•1N746A-1N759A

preferred silicon transistors

UNIJUNCTION

Type		Case	Mfg Process	Intrinsic Standoff Ratio	Static Interbase Resistance kΩ	Rated Static Interbase Voltage V	Peak Emitter Current A	Emitter Reverse Current μA
2N491A	★★	U	A	.56-.68	4.7-6.8	65	2	20
2N1671B		U	A	.47-.62	4.7-9.1	35	2	0.2
2N3980		OOO	P	.68-.82	4.0-8	35	1	0.01
2N4891		AAA	P	.55-.82	4.0-9.1	**	1	0.01

NPN GENERAL PURPOSE

Type		Case	Mfg Process	Rated V_{CBO} V	Pwr Diss 25°C Free Air (25°C Case) W	h_{FE}	$V_{CE(sat)}$ V
2N697	★	I-2‡ (TO-5)	P	60	0.6	40-120	1.5
2N718A	★★	R‡ (TO-18)	P	75	0.5	40-120	1.5
2N720A	★★	R‡ (TO-18)	P	120	0.5	40-120	5
2N1613	★★	I-2‡ (TO-5)	P	75	(0.8)	40-120	1.5
2N1711	★★	I-2‡ (TO-5)	P	75	0.8	100-300	1.5
2N1893	★★	I-2‡ (TO-5)	P	120	0.8	40-120	5
2N2219	★★	I-2‡ (TO-5)	EP	60	0.8	100-300	0.4
2N2222	★★	R‡ (TO-18)	EP	60	0.5	100-300	0.4
2N2243A		I-2‡ (TO-5)	EP	60	0.8	40-120	0.25

PNP GENERAL PURPOSE

Type		Case	Mfg Process	Rated V_{CBO} V	Pwr Diss 25°C Free Air mW	h_{FE}	$V_{CE(sat)}$ V
2N2905	★★	I-2‡ (TO-5)	EP	60	600	100-300	0.4
2N2907	★★	R‡ (TO-18)	EP	60	400	100-300	0.4
2N3486		MMM‡ (TO-46)	EP	60	400	100-300	0.4
2N3495		I-2‡ (TO-5)	EP	120	600	35 min	0.35

NPN MEMORY DRIVER

Type		Case	Mfg Process	f_T MHz Min	Pwr Diss 25°C Free Air mW	V_{BE} Base-Emitter Voltage V	Rated V_{CEO} V	Max. Storage Time (Turn-off time) ns	at I_C mA
2N3015		I-2‡ (TO-5)	EP	250	800	1.2 max	30	(60)	500
2N3725		I-2‡ (TO-5)	EP	300	800	1.5 max	50	60	500

PNP MEMORY DRIVER

2N3467	★	I-2‡ (TO-5)	EP	175	1000	0.8-1.2	40	60	500

NPN SWITCH

2N2369A	★★	R‡ (TO-18)	EP	500	360	0.70-0.85	15	13	10
2N3010		R‡ (TO-18)	EP	600	300	0.65-0.85	6	6	6
2N3013	★	RRR‡ (TO-52)	EP	350	360	0.75-0.95	15	18	10

PNP SWITCH

2N2894		R‡ (TO-18)	EP	400	360	0.78-0.98	12	(90)	30
2N3250		R‡ (TO-18)	EP	250	360	0.6 -0.9	40	175	10
2N3304		R‡ (TO-18)	EP	500	300	1 max	6	30	30
2N3829		RRR‡ (TO-52)	EP	350	360	0.75-0.85	20	50	10

NPN LOW-LEVEL AMPLIFIER

Type		Case	Mfg Process	I_C Range mA	Rated V_{CEO} V	Max Noise Figure dB	Min f_T MHz
2N930	★★	R‡ (TO-18)	P	0.01-30	45	4	30
2N2484		R‡ (TO-18)	P	0.001-10	60	2	60
2N4104		R‡ (TO-18)	P	0.001-50	60	1	60

PNP LOW-LEVEL AMPLIFIER

2N2605	MMM‡ (TO-46)	EP	0.01-10	45	3	30
2N3964	R‡ (TO-18)	EP	45	360	250-600	0.25

NPN HIGH-FREQUENCY AMPLIFIER/OSCILLATOR

Type		Case	Mfg Process	Min f_T MHz	Pwr Diss 25°C Free Air (25°C Case) mW	Max C_{obo} pF	Oscillator Pwr Out mW Min (Typ)	at f MHz
TIS56		VVV (TO-72)	P	500	200	0.32		
2N918	★★	VVV (TO-72)	EP	600	200	1.7	30	500
2N3570		VVV (TO-72)	EP	1500	200	0.75	(60)	1000
2N3866		PPP‡ (TO-39)	EP	500	(5000)	3		
2N4252		VVV	EP	600	200	0.45		
2N4875		PPP‡ (TO-39)	EP	800	(6000)	3.5	(9.5)*	400

★ Military versions available
★★ JAN TX version available
‡ The collector is in electrical contact with the case.
* Ampl G_{pe} in dB
** Limited solely by power dissipation.

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CHOPPER

Type	Case	Mfg Process	Polarity	$V_{EC(off)}$ Offset Voltage μV	$r_{ec(on)}$ On Resistance Ω	Min $V_{(BR)ECO}$ V	Max I_{EBO} nA	Min $h_{fe(inv)}$ @ I_E = 0.2 mA	Max C_{obo} pF
2N2432 ★★	R† (TO-18)	P	NPN	500	20	15	2.0	2	12
2N2945A ★★	MMM† (TO-46)	EP	PNP	500	6	20	0.2	30	10

DOUBLE-EMITTER CHOPPER

Type	Case	Mfg Process	Polarity	Offset Voltage μV	On Resistance Ω	Rated Emitter-1 to Emitter-2 Voltage V	Max 100°C I_{E1E2} nA	Max $\triangle V_{E1E2}/\triangle T_A$ μV	Max $C_{e1B} \cdot C_{e2B}$ pF
3N79	VVV (TO-72)	P	NPN	200	10-60	±12	±200	175	3
3N111	VVV (TO-72)	EP	PNP	150	10-50	±30	±50	150	3

NPN DARLINGTON

Type	Case	Mfg Process	h_{FE}	Rated V_{CBO} V	−55°C h_{FE}	$V_{CE(sat)}$ Max V	Pwr Diss Case 25°C W
2N997	R (TO-18)	EP	7000-70,000	75	1000 min	1.6	1.5

FOR CONSUMER CIRCUIT APPLICATIONS

Type	Case	Mfg Process	Polarity	Nearest Equivalent	Pwr Diss T_A = 25°C mW	Rated V_{CEO} V	Function
TIS37	LLL (TO-92)	EP	PNP		360	32	Automobile AM
TIS38	LLL (TO-92)	EP	PNP		360	32	Automobile AM
TIS62	AAA	EP	NPN	2N918	250	12	FM RF
TIS63	AAA	EP	NPN	2N918	250	12	FM Mixer, IF
TIS84	AAA	P	NPN	TIS56	250	30	AGC-RF Amp
TIS85	AAA	P	NPN	TIS56	250	30	AGC-IF Amp
TIS86	AAA	EP	NPN	2N4252	400	30	TV Mixer
TIS87	AAA	EP	NPN	2N4252	400	45	TV-IF
TIS92	AAA	EP	NPN	2N2219	625	40	Audio Output
TIS92M	AAA (Pair)	EP	NPN	2N2219	625	40	Audio Output
TIS93	AAA	EP	PNP	2N2905	625	40	Audio Output
TIS93M	AAA	EP	PNP	2N2905	625	40	Audio Output
TIS97	AAA	EP	NPN		360	40	Audio Amp
TIS98	AAA	EP	NPN		360	60	Audio Amp
TIS99	AAA	EP	NPN		360	65	Audio Amp
2N3707	LLL (TO-92)	P	NPN	2N929	360	30	LL Amplifier
2N3708	LLL (TO-92)	P	NPN	2N929	360	30	LL Amplifier
2N3709	LLL (TO-92)	P	NPN	2N929	360	30	LL Amplifier
2N3710	LLL (TO-92)	P	NPN	2N929	360	30	LL Amplifier
2N3711	LLL (TO-92)	P	NPN	2N929	360	30	LL Amplifier
2N4058	LLL (TO-92)	EP	PNP	2N2605	360	30	LL Amplifier
2N4059	LLL (TO-92)	EP	PNP	2N2604	360	30	LL Amplifier
2N4060	LLL (TO-92)	EP	PNP	2N2604	360	30	LL Amplifier
2N4061	LLL (TO-92)	EP	PNP	2N2604	360	30	LL Amplifier
2N4062	LLL (TO-92)	EP	PNP	2N2605	360	30	LL Amplifier
2N5447	AAA	EP	PNP	2N3702	360	25	PNP Audio
2N5448	AAA	EP	PNP	2N3703	360	30	PNP Audio
2N5449	AAA	EP	NPN	2N3704	360	30	NPN Audio
2N5450	AAA	EP	NPN	2N3705	360	30	NPN Audio
2N5451	AAA	EP	NPN	2N3706	360	20	NPN Audio

FIELD-EFFECT

Type	Case	Mfg Process	Polarity	I_{DSS} $I_{D(on)}$ mA	y_{fs} Transconductance μmho	Max Rated V_{GS} V	Max C_{iss} pF	Max $V_{GS(off)}$ $V_{GS(th)}$ V	Max 1 kHz NF dB	Max I_{GSS} nA
TIS88	AAA	EP	N-chan	5-15	4500-7500	30	4.5	6	4 (400 MHz)	1
2N2386	I-2† (TO-5)	P	P-chan		1000 min	20	50	8		10
2N2498	VVV (TO-72)	P	P-chan	2—6	1500-3000	20	32	6	3	10
2N3330	VVV (TO-72)	P	P-chan	2—6	1500-3000	20	20	6	3	10
2N3819	LLL (TO-92)	P	N-chan	2-20	2000-6500	25	8	8		2
2N3820	LLL (TO-92)	P	P-chan	0.3-15	800-5000	20	32	8		20
2N3822	VVV (TO-72)	EP	N-chan	2—10	3000-6500	50	6	6		0.1
2N3823	VVV (TO-72)	EP	N-chan	4—20	3500-6500	30	6	8		0.5
2N3909	VVV (TO-72)	P	P-chan	0.3—15	1000-5000	20	32	8		10
2N4416	VVV (TO-72)	EP	N-chan	5-15	4500-7500	30	4	6	4 (400 MHz)	0.1

FIELD-EFFECT CHOPPER

Type	Case	Mfg Process	Polarity	C_{iss} Input Capacitance max, pF	$r_{ds(on)}$ Drain-Source Resistance max, Ω	Max Rated V_{GS} V	Max $I_{D(off)}$ nA	y_{fs} mmho	Max I_{GSS} nA
TIS73	AAA	EP	N-chan	18	25	30	2		2
2N3993	VVV (TO-72)	P	P-chan	16	150	25	1.2	6-12	
2N4857	R† (TO-18)	EP	N-chan	18	40	40	0.25		0.25

DUAL FIELD-EFFECT

Type	Case	Mfg Process	Polarity	y_{fs} Transconductance μmho	y_{fs}, I_{DSS} Match %	Gate-source-voltage Differential max, mV	Max C_{iss} pF	Min $V_{(BR)GSS}$ V	Max I_{GSS} nA
TIS69	2-LLL (Pair)	EP	N-chan	1000-6000	10	16	8	25	2
2N5045	HHH (TO-71)	EP	N-chan	1500-6000	5	5	8	50	0.25

★★ JAN TX version available

† The gate is in electrical contact with the case.

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DUAL

Type	Case	Mfg Process	Polarity	Nearest Equivalent Triode	h_{FE} Match %	V_{BE} Match mV max	$\Delta(V_{BE1}-V_{BE2})\ \Delta T_A$ μV/deg max	h_{FE} @ 10 μA
2N2060 ★★	TTT	P	NPN	2N1711	10	5	10	25-75
2N2223	TTT	P	NPN	2N1711	20	15	25	15 min
2N2639	TTT	P	NPN	2N929	10	5	10	50-300
2N2642	TTT	P	NPN	2N930	10	5	10	100-300
2N2643	TTT	P	NPN	2N930	20	10	20	100-300
2N3350	TTT	EP	PNP	2N2605	10	5	10	100-300
2N3351	TTT	EP	PNP	2N2605	20	10	20	100-300
2N3680	TTT	P	NPN	2N2484	10	3	5	150-600
2N4854	V	EP	NPN/PNP	2N2222/2N2907		5		100 min @ 150 mA

MINIATURE DUAL — Flatpack

Type	Case	Mfg Process	Polarity	Nearest Equivalent (Dual/Single)	Function	Pwr Diss 25°C Free Air mW
2N3043	KKK (TO-89)	P	NPN	2N2642/2N930	Diff Amp	250 per triode
2N3045	KKK (TO-89)	P	NPN	2N2644/2N930	Dual	250 per triode
2N3049	KKK (TO-89)	E	PNP	2N2805/2N2412	Diff Amp	250 per triode
2N3051	KKK (TO-89)	EP	PNP	2N2807/2N2412	Dual	250 per triode
2N3838	KKK (TO-89)	EP	NPN/PNP	2N2222/2N2907	Compl Amp/Sw	250 per triode

NPN POWER

Type	Case	Mfg Process	Rated I_C(A)	Pwr Diss (W) 25°C Free-Air	25°C Case	100°C Case	$V_{(BR)CEO}$ ($V_{(BR)CER}$)	I_{CEX} Max mA	I_{CEX} V_{CE} V	T_C °C	h_{FE} Min	h_{FE} Max	h_{FE} @ I_C (A)
TIP29	GG	M	1	2	30	12	40	0.2	40	25	40	200	0.2
TIP29A	GG	M	1	2	30	12	60	0.2	60	25	40	200	0.2
TIP31	GG	M	3	2	40	16	40	0.3	40	25	20	100	1
TIP31A	GG	M	3	2	40	16	60	0.3	60	25	20	100	1
TIP33	H	M	10	3.5	80	32	40	0.4	40	25	12		3
TIP33A	H	M	10	3.5	80	32	60	0.4	60	25	12		3
TIP35	H	M	25	3.5	90	36	40	0.7	40	25	20	100	5
TIP35A	H	M	25	3.5	90	36	60	0.7	60	25	20	100	5
2N1724 ★★	N (TO-61)	M	5	3	50	50	80	2	60	150	20	90	2
2N2987	I (TO-5)	P	1	1	15	15	80	0.015	90	175	25	75	0.2
2N2988	I (TO-5)	P	1	1	15	15	100	0.015	150	175	25	75	0.2
2N2989	I (TO-5)	P	1	1	15	15	80	0.015	90	175	60	120	0.2
2N2990	I (TO-5)	P	1	1	15	15	100	0.015	150	175	60	120	0.2
2N2991	S	P	1	1	15	15	80	0.015	90	175	25	75	0.2
2N2992	S	P	1	1	15	15	100	0.015	150	175	25	75	0.2
2N2993	S	P	1	1	15	15	80	0.015	90	175	60	120	0.2
2N2994	S	P	1	1	15	15	100	0.015	150	175	60	120	0.2
2N3055	K (TO-3)	M	15		115	66	70	30	100	150	20	70	4
2N3418	I (TO-5)	EP	3	1	15	15	60	0.05	80	150	10	60	5
2N3419	I (TO-5)	EP	3	1	15	15	80	0.05	120	150	10	60	5
2N3420	I (TO-5)	EP	3	1	15	15	60	0.05	80	150	15	120	5
2N3421	I (TO-5)	EP	3	1	15	15	80	0.05	120	150	15	120	5
2N3551	DDD	EP	12	1.2	40	40	60	10	60	150	20	90	10
2N3552	DDD	EP	12	1.2	40	40	80	10	80	150	20	90	10
2N3713	K (TO-3)	M	10	4	150	85	60	10	60	150	25	75	1
2N3714	K (TO-3)	M	10	4	150	85	80	10	80	150	25	75	1
2N3715	K (TO-3)	M	10	4	150	85	60	10	60	150	50	150	1
2N3716	K (TO-3)	M	10	4	150	85	80	10	80	150	50	150	1
2N3996	BB (TO-111)	EP	5	2	30	30	80	0.05	90	150	40	120	1
2N3997	BB (TO-111)	EP	5	2	30	30	80	0.05	90	150	80	240	1
2N3998	DD (TO-111)	EP	5	2	30	30	80	0.05	90	150	40	120	1
2N3999	DD (TO-111)	EP	5	2	30	30	80	0.05	90	150	80	240	1
2N4000	I (TO-5)	EP	1	1	15	15	80	0.05	90	150	30	120	0.5
2N4001	I (TO-5)	EP	1	1	15	15	100	0.05	110	150	30	120	0.5
2N4002	P (TO-63)	EP	30	4	100	100	80	2	90	150	20	80	15
2N4003	P (TO-63)	EP	30	4	100	100	100	2	110	150	20	80	15
2N4301	N (TO-61)	EP	10	3.5	50	50	80	0.5	90	150	30	120	5
2N5387	N (TO-61)	M	7.5	3.5	100	100	200	10	100	150	25	100	2
2N5388	N (TO-61)	M	7.5	3.5	100	100	250	10	125	150	25	100	2
2N5389	N (TO-61)	M	7.5	3.5	100	100	300	10	150	150	25	100	2

PNP POWER

Type	Case	Mfg Process	Rated I_C(A)	Pwr Diss (W) 25°C Free-Air	25°C Case	100°C Case	$V_{(BR)CEO}$ ($V_{(BR)CER}$)	I_{CEX} Max mA	I_{CEX} V_{CE} V	T_C °C	h_{FE} Min	h_{FE} Max	h_{FE} @ I_C (A)
TIP30	GG	M	1	2	30	12	40	0.2	40	25	40	200	0.2
TIP30A	GG	M	1	2	30	12	60	0.2	60	25	40	200	0.2
TIP32	GG	M	3	2	40	16	40	0.3	40	25	20	100	1
TIP32A	GG	M	3	2	40	16	60	0.3	60	25	20	100	1
TIP34	H	M	10	3.5	80	32	40	0.4	40	25	12		3
TIP34A	H	M	10	3.5	80	32	60	0.4	60	25	12		3
TIP36	H	M	25	3.5	90	36	40	0.7	40	25	20	100	5
TIP36A	H	M	25	3.5	90	36	60	0.7	60	25	20	100	5
2N5333	I (TO-5)	EP	2	1	15	15	80	0.5	50	150	30	120	1
2N5384	BB (TO-111)	EP	5	2	30	30	80	0.5	50	150	20	80	2
2N5385	DD (TO-111)	EP	5	2	30	30	80	0.5	50	150	20	80	2
2N5386	N (TO-61)	EP	12	3.5	50	50	80	0.5	50	150	20	80	6

★★ JAN TX version available

preferred germanium transistors

PNP GENERAL PURPOSE

Type	Case	Mfg Process	Pwr Diss Free Air mW	Collector Current mA	Collector Voltage V	Emitter Voltage V	h_{FE} Min	h_{FE} Max	f_{hfb} MHz Min	f_{hfb} MHz Typ
2N1377	I-2 (TO-5)	A	250	200	45	25	75	150		5

NPN SWITCH

Type	Case	Mfg Process	Pwr Diss Free Air mW	Collector Current mA	Collector Voltage V	C_{obo} pF Typ	C_{obo} pF Max	h_{FE} Min	h_{FE} Max	f_{hfb} (f_T) MHz Min	f_{hfb} (f_T) MHz Typ
2N797	R (TO-18)	EM	150	150	20		4	40		(600)	
2N1302 ★	I-2 (TO-5)	A	150	300	25		20	20		3	
2N1304 ★	I-2 (TO-5)	A	150	300	25		20	40	200	5	
2N1306 ★	I-2 (TO-5)	A	150	100	25		20	60	300	10	
2N1308 ★	I-2 (TO-5)	A	150	300	25		20	80		15	

PNP SWITCH

Type	Case	Mfg Process	Pwr Diss Free Air mW	Collector Current mA	Collector Voltage V	C_{obo} pF Typ	C_{obo} pF Max	h_{FE} Min	h_{FE} Max	f_{hfb} (f_T) MHz Min	f_{hfb} (f_T) MHz Typ
2N404 ★	I-2 (TO-5)	A	150	100	25		20	30		4	
2N964 ★	R (TO-18)	EM	150	100	15		4	40		(300)	
2N1303 ★	I-2 (TO-5)	A	150	300	30		20	20		3	
2N1305 ★	I-2 (TO-5)	A	150	300	30		20	40	200	5	
2N1307 ★	I-2 (TO-5)	A	150	300	30		20	60	300	10	
2N1309 ★	I-2 (TO-5)	A	150	300	30		20	80		15	
2N1997	I-2 (TO-5)	A	250	500	45		20	40	200		6
2N2000	I-2 (TO-5)	A	300	1000	50		35	50		2	
2N2635	R (TO-18)	EM	150	100	30		5	45	300	(150)	

PNP HIGH-VOLTAGE SWITCH

Type	Case	Mfg Process	Pwr Diss Free Air mW	Collector Current mA	Collector Voltage V	Emitter Voltage V	h_{FE} Min	f_{hfb} MHz Min	f_{hfb} MHz Typ
2N398	I-2 (TO-5)	A	50	100	105	50	20		0.8

PNP HIGH-FREQUENCY SMALL-SIGNAL

Type	Case	Mfg Process	Pwr Diss Free Air mW	Maximum Collector Current mA	Maximum Collector Voltage V	C_{ob} (C_{cb}) pF	Noise Figure Freq MHz	Noise Figure Max dB (typ) dB	f_T Min MHz (typ MHz)
2N5043	VVV (TO-72)	EP	30	30	15	(1)	400	2.5	1500

PNP HIGH-FREQUENCY* POWER SWITCH

Type	Case	Mfg Process	Rated I_C(A)	Pwr Diss (W) 25°C Case	Pwr Diss (W) 25°C Free-air	$V_{(BR)CBO}$	I_{CBO} @ 25°C mA	I_{CBO} @ 25°C V_{CB}	h_{FE} Min	h_{FE} Max	h_{FE} @ I_C (A)
2N1907	K (TO-3)	AD	20	60	1.75	100	10	100	30	170	10

*$|h_{fe}|$ @ MHz > 1

GENERAL PURPOSE — POWER

Type	Case	Mfg Process	Rated I_C (A)	Pwr Diss (W) 25°C Case	Pwr Diss (W) 25°C Free-air	Rated V_{CBO}	I_{CBO} @ 25°C mA	I_{CBO} @ 25°C V_{CB}†	h_{FE} Min	h_{FE} Max	h_{FE} @ I_C (A)
2N456A	K (TO-3)	A	7	150		40	0.5	20	30	90	5
2N1038	E	A	3	20		40	0.125	20	20	60	1
2N1539	K (TO-3)	A	5	106		40	20		50	100	3
TI3027	K (TO-3)	A	7	150	2	45	1	30	40	250	3

† At rated V_{CBO} unless otherwise noted

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SILICON VOLTAGE-VARIABLE-CAPACITANCE DIODES

Type	Case	Mfg Process	@ V_R = 4V C_T (pF) Min	@ V_R = 4V C_T (pF) Max	Q* Min	$V_{(BR)}$ (V) Min
TIV306	QQQ	Si Planar	5	9	200	20
TIV307	QQQ	Si Planar	7	11	200	20
TIV308	QQQ	Si Planar	9	14	200	20

*Frequency of 50 MHz.
★ Military versions available

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SILICON COMPUTER DIODES

Type		Case	$V_{R(max)}$ V	$V_{(BR)}$ V	Max t_{rr} @ 25°C ns	Maximum I_R @ 25°C μA @ V_R	Maximum I_R @ Elev. Tmp. μA @ V_R	V_F @ I_F Max mA
TID21		TT (TO-89)	30	60	25††	0.1 @ 30		1 @ 100
TID22		TT (TO-89)	15	30	25††	0.1 @ 15		1.1 @ 100
TID23		TT (TO-89)	30	60	25††	0.1 @ 30		1 @ 100
TID24		TT (TO-89)	15	30	25††	0.1 @ 15		1.1 @ 100
TID25		TT (TO-89)	30	60	25††	0.1 @ 30		1 @ 100
TID26		TT (TO-89)	15	30	25††	0.1 @ 15		1.1 @ 100
TID29		YYY (TO-84)	30	60	25††	0.1 @ 30		1 @ 100
TID30		YYY (TO-84)	15	40	25††	0.1 @ 15		1 @ 100
1N914	★★	PP	75	100	4**	5 @ 75	50 @ 150°C	1 @ 10
1N914B		QQQ (DO-35)	75	100	4**	5 @ 75	50 @ 20	1 @ 100
1N3064		PP	50	75	4**	0.01 @ 50	100 @ 50	1 @ 10
1N3070	★★	PP	175	200	50‡‡	0.1 @ 175	100 @ 175	1 @ 100
1N4148		QQQ (DO-35)	75	75	4**	0.025 @ 20	50 @ 20	1 @ 10
1N4448		QQQ (DO-35)	75	75	4**	0.025 @ 20	50 @ 20	1 @ 100
1N4454	★★	QQQ (DO-35)	75	75	4*	0.1 @ 50	100 @ 50	1 @ 10
1N4531		GGG (DO-34)	75	75	4**	0.025 @ 20	50 @ 20	1 @ 10

††$I_F = I_R$ = 200 mA, recovery to 20 mA, R_L = 100Ω
**EGG Type 2236A (10 mA I_F, switched to V_R = 6V, recovery to 1 mA reverse)
‡‡Lumatron (30 mA I_F, switched to 30 mA I_R, recovery to 1 mA)

SILICON VOLTAGE REGULATOR DIODES

Type		Case	V_Z @ I_{ZT} Zener Breakdown Voltage V	Tol.	z_z @ I_{ZT} Small-signal Zener Impedance Max Ω	I_R @ $V_{R(1)}$ Static Reverse Current Max μA	Power Dissipation @ 25°C mW
1N746‡	★★	MM	3.3	± 10%‡	28	10	400
1N747‡	★★	MM	3.6	± 10%‡	24	10	400
1N748‡	★★	MM	3.9	± 10%‡	23	10	400
1N749‡	★★	MM	4.3	± 10%‡	22	2	400
1N750‡	★★	MM	4.7	± 10%‡	19	2	400
1N751‡	★★	MM	5.1	± 10%‡	17	1	400
1N752‡	★★	MM	5.6	± 10%‡	11	1	400
1N753‡	★★	MM	6.2	± 10%‡	7	0.1	400
1N754‡	★★	MM	6.8	± 10%‡	5	0.1	400
1N755‡	★★	MM	7.5	± 10%‡	6	0.1	400
1N756‡	★★	MM	8.2	± 10%‡	8	0.1	400
1N757‡	★★	MM	9.1	± 10%‡	10	0.1	400
1N758‡	★★	MM	10.1	± 10%‡	17	0.1	400
1N759‡	★★	MM	12.0	± 10%‡	30	0.1	400
1N4370‡	★★	MM	2.4	± 10%‡	30	100	400
1N4371‡	★★	MM	2.7	± 10%‡	30	75	400
1N4372‡	★★	MM	3.0	± 10%‡	29	50	400

‡On types 1N746 — 1N4372, add an "A" suffix for 5% devices.

SILICON RECTIFIERS

Type Number by Rated V_R								Rated I_O		Max I_R or $I_{R(av)}$*			Max V_F or $V_{F(av)}$*	
50 V	100 V	200 V	300 V	400 V	500 V	600 V	Case	A @	T_A† °C	μA @ 25°C	mA @	T_A† °C	V @	I_F A
1N4001	1N4002	1N4003		1N4004		1N4005	LL	1	75	10	0.05	100	1.1	1
						1N4006 (800 V)	LL	1	75	10	0.05	100	1.1	1
						1N4007 (1000 V)	LL	1	75	10	0.05	100	1.1	1

*Full-cycle average with rectifier operating at rated I_O.
†Case temperature for devices in DO-14 case.

GENERAL PURPOSE SILICON DIODES

Type		Case	$V_{R(max)}$ V	$V_{(BR)}$ @ 100 μA V	I_F Min Fwd Current @ 25°C mA @ 1 V	Maximum I_R @ $V_{R(max)}$ @ 25°C μA	Maximum I_R @ $V_{R(max)}$ @ 150°C μA	Pwr Diss 25°C mW
1N456		HH	25	30	40	0.025	5	200
1N457	★	HH	60	70	20	0.025	5	200
1N458	★	HH	125	150	7	0.025	5	200
1N482		HH	36	40	100*	0.25	30	250
1N483		HH	70	80	100*	0.25	30	250
1N484		HH	130	150	100*	0.25	30	250
1N485		HH	180	200	100*	0.25	30	250
1N645	★★	MM	225	275	400	0.2	15	600
1N646		MM	300	360	400	0.2	15	600
1N647		MM	400	480	400	0.2	20	600
1N648		MM	500	600	400	0.2	20	600
1N649		MM	600	720	400	0.2	25	600

*Measured at 1.1 V
★Military versions available.
★★JAN TX version available.

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preferred thyristors, trigger diodes, optoelectronic devices, and resistors

THYRISTORS

Type	Case	I_O Avg. Rect. Forward Current A	Working Volts (max) Fwd.-Rev.	I_{GT} Gate Current to Trigger @ 25°C mA (max)
TIC20	III	6	200	± 50
TIC21	III	6	300	± 50
TIC22	III**	6	200	± 50
TIC23	III**	6	300	± 50
TIC44	AAA	0.6	30	0.2
TIC45	AAA	0.6	60	0.2
TIC46	AAA	0.6	100	0.2
TIC47	AAA	0.6	200	0.2
2N3001	R (TO-18)	0.25	30	0.02
2N3002	R (TO-18)	0.25	60	0.02
2N3003	R (TO-18)	0.25	100	0.02
2N3004	R (TO-18)	0.25	200	0.02
2N3005	R (TO-18)	0.25	30	0.2
2N3006	R (TO-18)	0.25	60	0.2
2N3007	R (TO-18)	0.25	100	0.2
2N3008	R (TO-18)	0.25	200	0.2
2N3555	I (TO-5)	1	30	0.02
2N3556	I (TO-5)	1	60	0.02
2N3557	I (TO-5)	1	100	0.02
2N3558	I (TO-5)	1	200	0.02
2N3559	I (TO-5)	1	30	0.2
2N3560	I (TO-5)	1	60	0.2
2N3561	I (TO-5)	1	100	0.2
2N3562	I (TO-5)	1	200	0.2
2N5273	VV (TO-48)	25	200	150
2N5274	VV (TO-48)	25	400	150
2N5275	VV (TO-48)	25	600	150

**pressed into ¼" stud

THYRISTOR-TRIGGER DIODES

Type	Case	Avg. Pwr mW	I_{pk} (10 ms) A	$V_{(BR)}$†‡ V	$V_{(BR)1}$-$V_{(BR)2}$‡ V	$\triangle V$‡† V
TI42A	PP	100	1	32±4	2	8
TI43A	PP	100	1	32±4		8

†Breakdown and breakback voltage characteristics apply unilaterally to the TI42A, and bilaterally to the TI43A.
‡dv/dt = 12 V/ms

SILICON PLANAR AND PLANAR EPITAXIAL SENSORS

Type	Case	Light Current Min μA	Light Current Max μA	Light Current @ V	Dark Current Max μA	Dark Current @ V	Max Diss mW
LS400 (1N4378)	BBBB	1000*		5	0.025	±50	50
LS600	AAAA	800†		5	0.025	30	50
1N2175	ZZZ	100*		±10	0.5	±50	250

*H = 9 mW/cm², λ = 0.7 to 1 μm.
†H = 20 mW/cm². Source is an unfiltered tungsten linear-filament bulb operating at a color temperature of 2870°K.

HARD-GLASS HERMETIC PRECISION CARBON-FILM

TI type number	TI	wattage rating-watts MIL B	MIL D	MIL G	MIL desig-nation	standard resistance ranges	max. recom-mended voltage volts	body length* inches	body diameter (B) inches
CG⅛	⅛	—	⅛	1/10	RN55	10 Ω to 100 k	250	0.240 (+.010 −.020)	0.125 (±0.015)
CG¼	¼	⅛	¼	⅛	RN60	10 Ω to 1.0 Meg	350	0.360 (+.025 −.015)	0.140 (±0.020)
CG½	½	¼		¼	RN65	10 Ω to 2.0 Meg	500	0.560 (± .025)	0.225 (±0.020)

*Length of glass package. Fillets on leads extend 0.035 inch maximum beyond glass

EPOXY PRECISION METAL FILM

TI type number	wattage rating watts	MIL desig-nation	standard resistance ranges	max. working voltage volts	body length inches	body diameter inches
MC50C,E	½		49.9 Ω-100 kΩ	200	0.155(±0.015)	0.065(±0.010)
MC55D	⅛	RN55D,RL07	10 Ω-301 kΩ	200	0.250(±0.031)	0.095(±0.015)
MC60D	¼	RN60D	10 Ω-1 Meg	300	0.375(±0.031)	0.140(±0.015)
MC60C,E	⅛	RN60C,E	49.9 Ω-499 kΩ	250	0.375(±0.031)	0.140(±0.015)
MC65D	½	RN65D	10 Ω-1 Meg	350	0.575(±0.031)	0.171(±0.015)
MC65C,E,F	¼	RN65C,E	49.9 Ω-1 Meg	300	0.575(±0.031)	0.171(±0.015)

Available in 1/10, ¼, ½ and 1% tolerance
D = 100 ppm/°C; C = 50 ppm/°C; E = 25 ppm/°C

sensistor® SILICON RESISTORS

type number	wattage rating at 100°C	tolerance	resistance range	body dimensions length (inches)	body dimensions diameter (inches)
TM⅛	⅛	5 & 10%	10 Ω-10 kΩ	0.406(±0.015)	0.140(±0.015)
TM¼	¼	5 & 10%	10 Ω-10 kΩ	0.585(±0.015)	0.200(±0.015)
TG⅛†	⅛	5 & 10%	10 Ω-2.7 kΩ	0.285(±0.015)	0.095(±0.010)

†Hermetically sealed high-reliability package.

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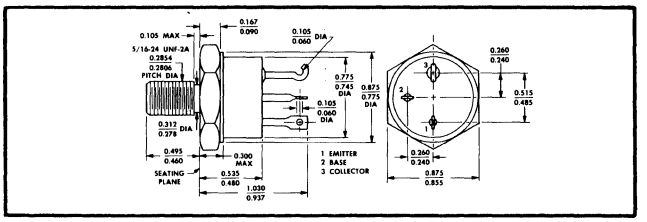
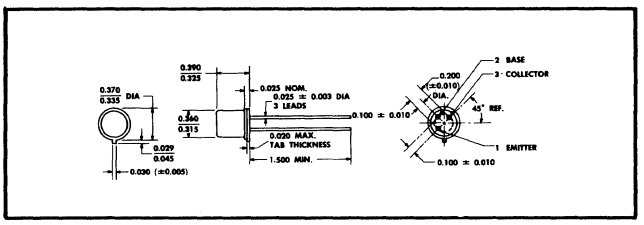
TEXAS INSTRUMENTS
INCORPORATED
Components Group / P.O. Box 5012 / Dallas, Texas 75222

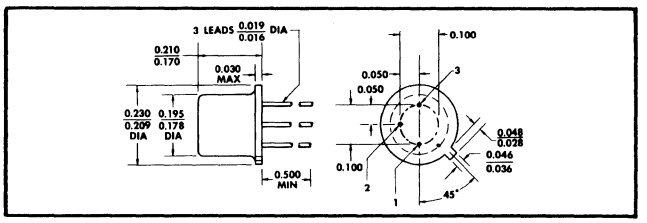
preferred semiconductor case outlines



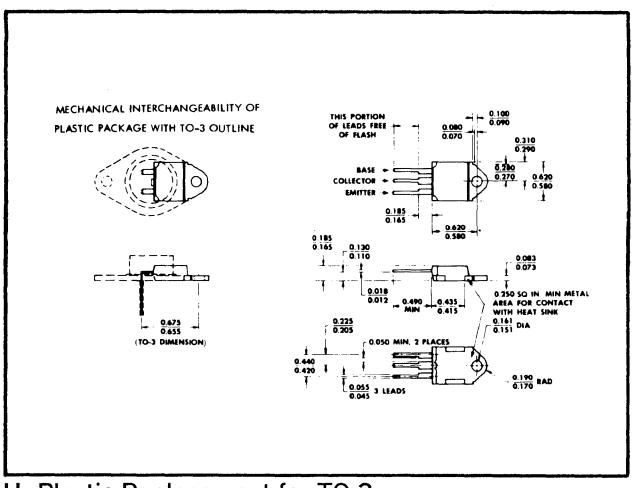
P TO-63



E Round Welded Triode with Internal Heat Sink



R TO-18



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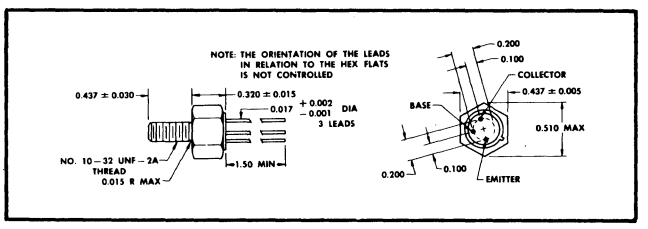
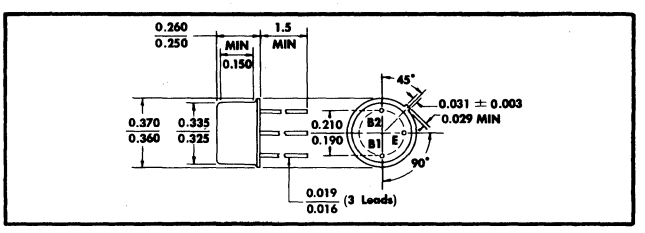


S Double-ended Stud THERMOSLUG* Silicon Power



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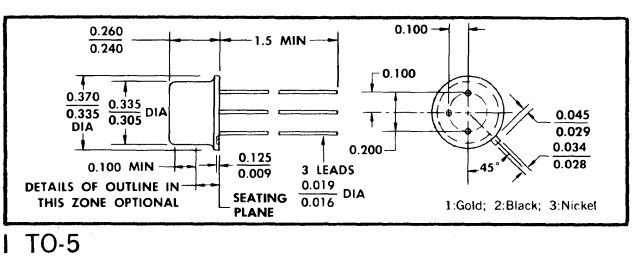
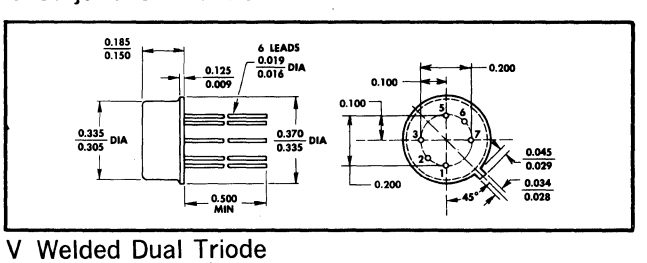
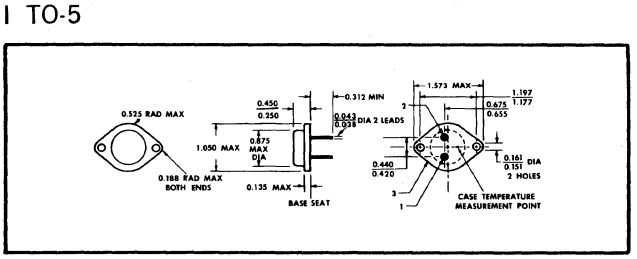


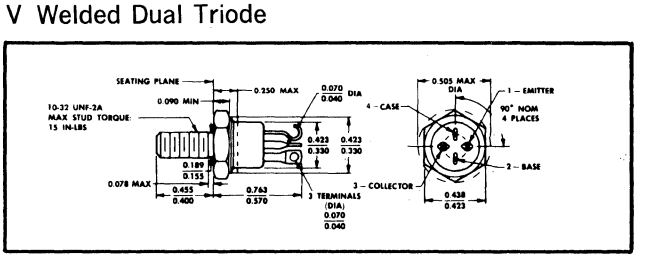
I TO-5



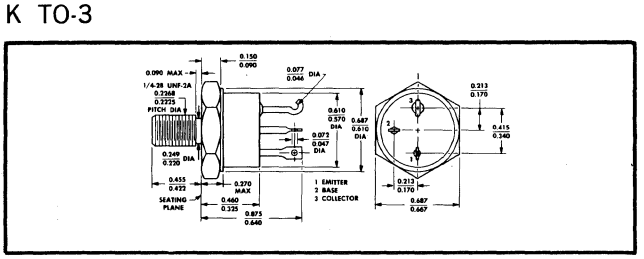
V Welded Dual Triode



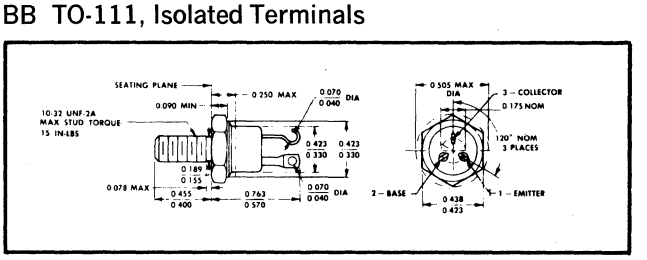
K TO-3



BB TO-111, Isolated Terminals

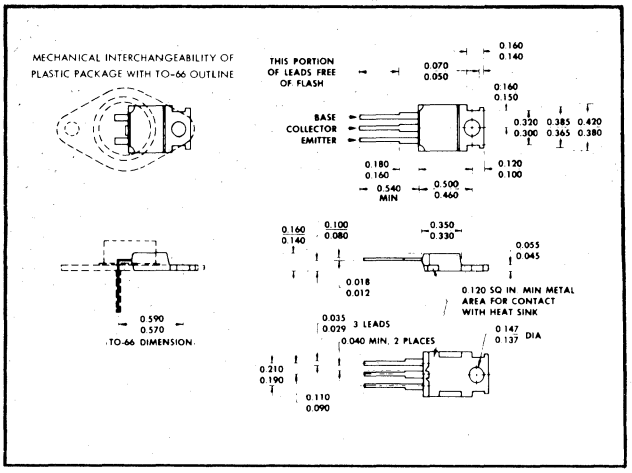


N TO-61



DD TO-111, Collector-to-Stud

preferred semiconductor/case outlines



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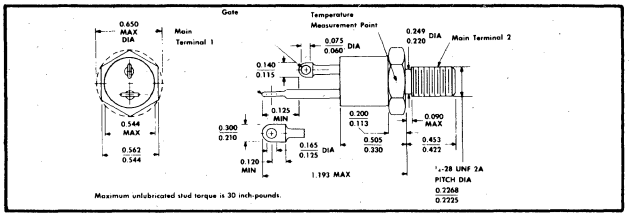
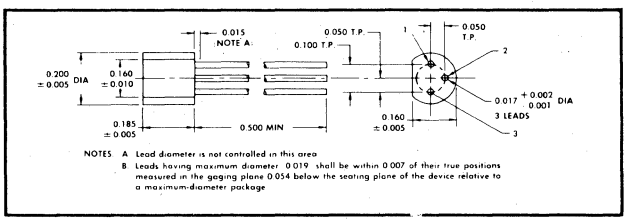
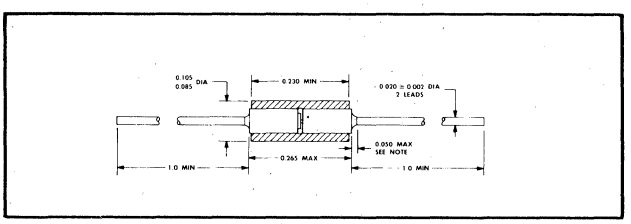


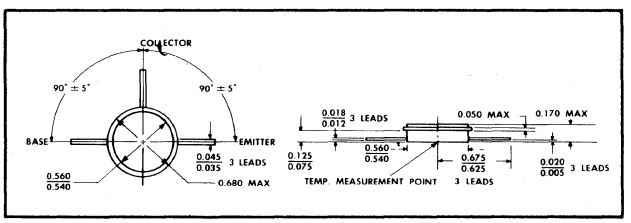
VV TO-48



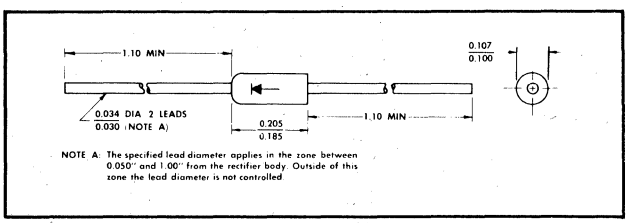
AAA Pin-circle SILECT* Plastic Encapsulation



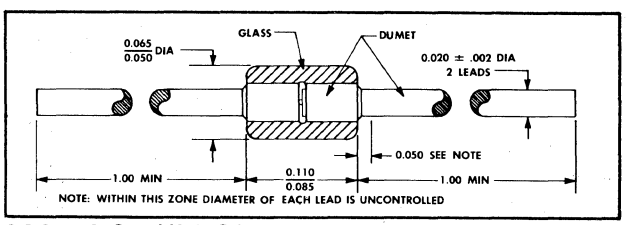
HH Double-Plug Diode



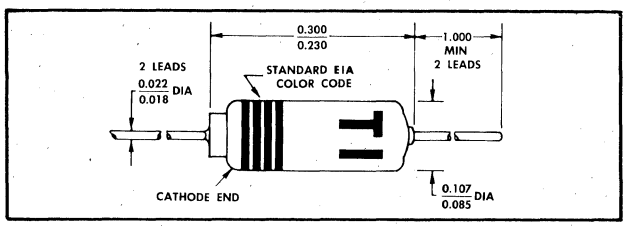
DDD Isolated THIN-PAC*



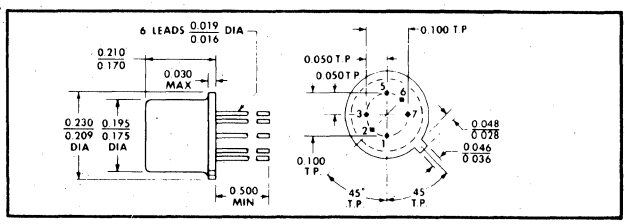
LL Axial Lead Rectifier



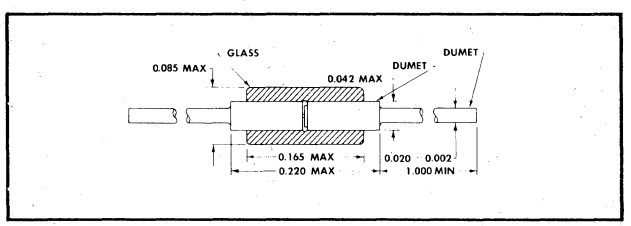
GGG DO-34 UNI/G*



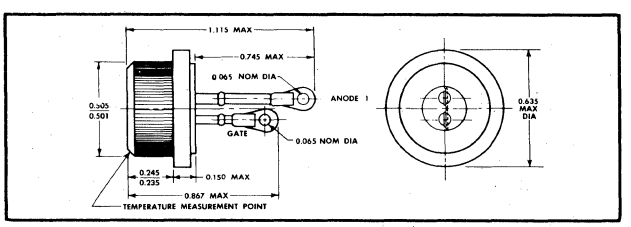
MM MOLY/G* Hard-Glass Diode



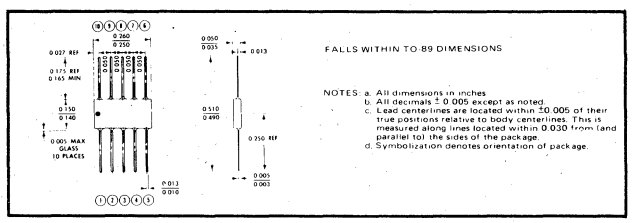
HHH TO-71



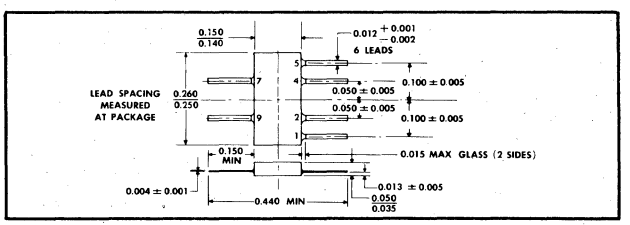
PP UNI/G* Glass Diode



III Press-fit Thyristor

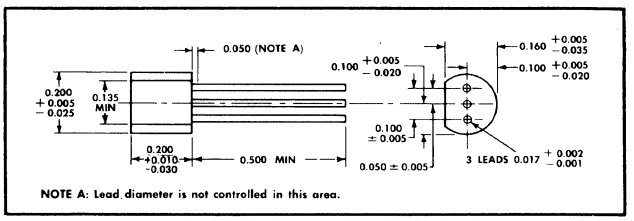


TT 10-lead Flatpack

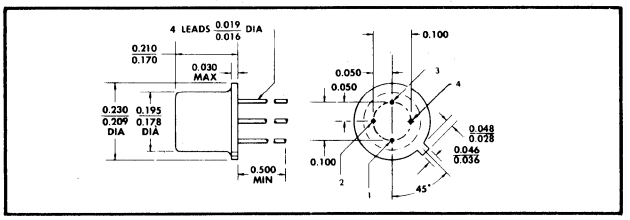


KKK Dual-Transistor Flatpack

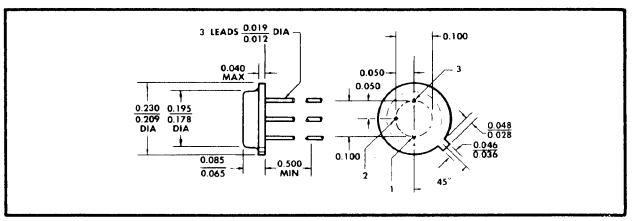
preferred semiconductor/case outlines



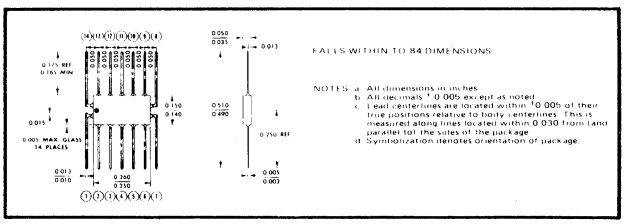
LLL TO-92 SILECT* Plastic Encapsulation



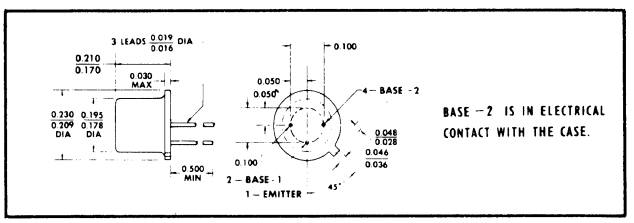
VVV TO-72



MMM TO-46



YYY 14-lead Flatpack



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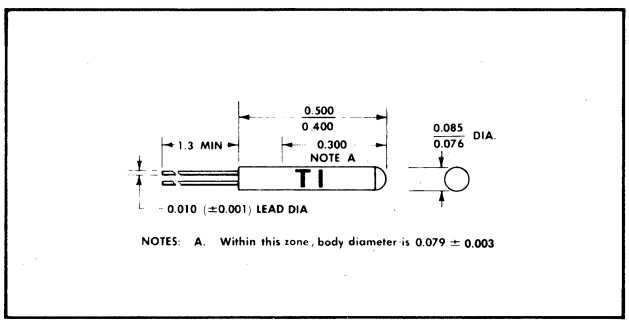
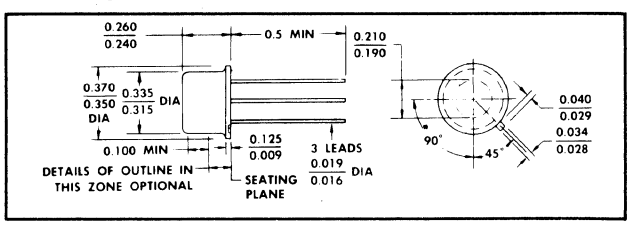
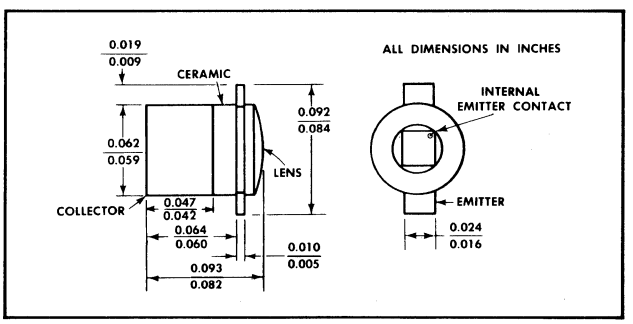


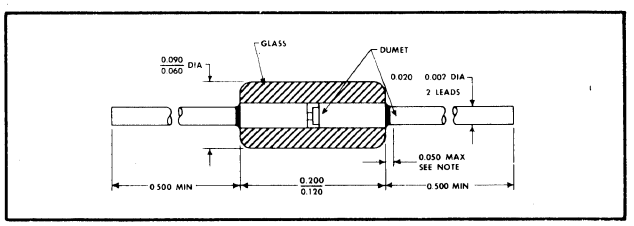
ZZZ Light Sensor



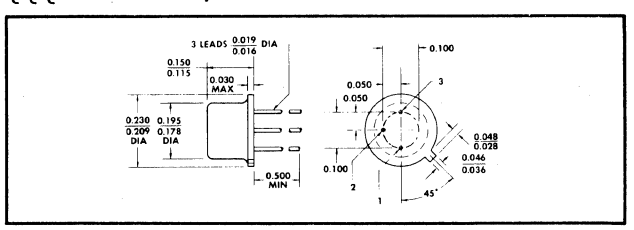
PPP TO-39



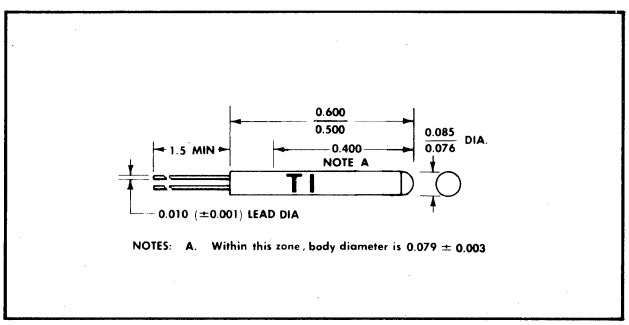
AAAA Light Sensor



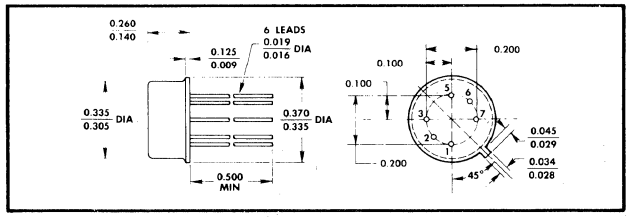
QQQ DO-35 UNI/G*



RRR TO-52



BBBB Light Sensor



TTT Welded Dual Triode

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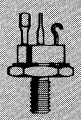
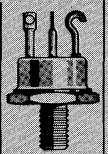
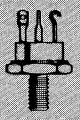
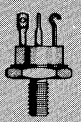
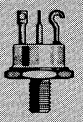
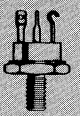
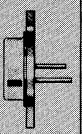
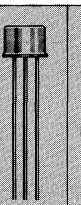
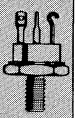
INCORPORATED
Components Group / P.O. Box 5012 / Dallas, Texas 75222

Transitron ELECTRONIC CORPORATION WAKEFIELD, MASS

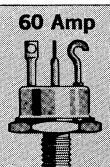
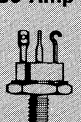
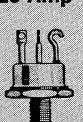
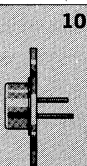
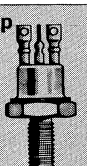
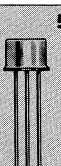
NPN SILICON PLANAR POWER TRANSISTORS

COLLECTOR VOLTAGE (VOLTS)

	80 to 100 Amp		60 Amp	40 Amp	30 Amp		20 Amp			10 Amp		
	 TO-63	 TO-114	 TO-63	TO-63	 TO-63	 TO-63	 TO-61	 TO-3	 TO-5	 TO-59†	 TO-61	 TO-63
60V								2N3713 2N3715				2N3597
80V	ST14026	2N3149	ST14031	ST15043	ST17060		2N5313	2N3714 2N3716		ST91057	2N5317	2N3598
100V	ST14027	2N3150	ST14030	ST15044	ST17061	2N4002	2N5315		2N4150	ST91058	2N4301 2N5319	2N3599
120V	ST14028	2N5250	ST14032	ST15045	ST17062	2N4003				ST91059		
150V		2N3151 2N4866 2N5251										
200V												
225V					ST18010						ST18014	
250V					ST18009						ST18013	
300V					ST18008	2N3846 2N3848					ST18012	
350V												
375V					ST18007						ST18011	
400V						2N3847 2N3849						

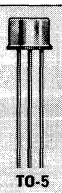
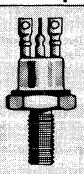
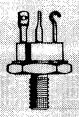
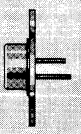
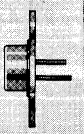
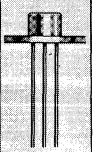
†Also available in TO-111 package. *isolated.

NPN & PNP COMPLEMENTARY SILICON PLANAR POWER TRANSISTORS

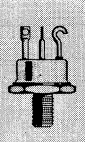
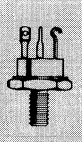
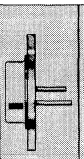
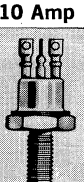
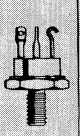
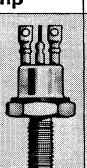
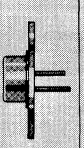
	60 Amp		40 Amp		30 Amp		20 Amp		10 Amp				5 Amp				2 Amp	
	 TO-63		 TO-63		 TO-61		 TO-61		 TO-3		 TO-59†		 TO-5		 TO-59†		 TO-5	
	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
60V									2N3713 2N3715	2N3789 2N3791								
80V	ST14031	ST40002	ST15043	ST54004	ST17060	ST10007	2N5313	2N5312	2N3714 2N3716	2N3790 2N3792	2N5317 ST91057	2N5316 ST76018	ST91054	ST72040	2N2878	ST72036	ST74049	ST75005
100V	ST14030	ST40003	ST15044	ST54005	ST17061	ST10008	2N5315	2N5314			2N5319 ST91058	2N5318 ST76019	ST91055	ST72039	2N2880	ST72037	ST74050	ST75004
120V	ST14032	ST40004	ST15045	ST54006	ST17062	ST10009					ST91059	ST76020	ST91056	ST70241			ST74051	ST75006

NPN SILICON PLANAR POWER TRANSISTORS continued

COLLECTOR VOLTAGE (VOLTS)

	5 Amp			2 Amp				1 Amp				
	 TO-5	 TO-59†	 TO-61	 TO-5	 TO-46	 TO-59†	 TO-66	TO-5	 TO-18	 TO-46	 TO-66	 MD-14
60V	2N2657	2N3744* 2N3747* 2N3750*				2N3852 2N3853						
80V	2N2658 2N3418 2N3420 ST91054	2N2877 2N2878 2N3745* 2N3748* 2N3751*	ST86020	ST74049		2N2150 2N2151 2N2892 ST92006	2N3766	2N2890 2N2891 2N3019 2N3020		2N3056	2N3054	
100V	2N3419 2N3421 ST91055	2N2879 2N2880 2N3746* 2N3749* 2N3752* 2N3850 2N3996* 2N3997* 2N3998 2N3999	2N1724 ST86021	ST74050		2N3851 ST92007	2N3767	2N3498 2N3499 2N4000		2N3057		
120V	ST91056		2N1724A ST86022	2N4863 ST74051	2N4862	ST92008	2N4864	2N4001 ST84027			2N3878	
150V								2N3500 2N3501 ST84028	2N3700 2N3701			
200V								2N2726 2N2727 ST84029				2N3589 2N3590
225V		ST18018										
250V		ST18017										
300V		ST18016										
350V		ST18015										
375V												
400V												

NPN SILICON PLANAR POWER TRANSISTORS

	60 Amp	40 Amp	30 Amp	20 Amp	10 Amp			5 Amp		2 Amp			1 Amp
	 TO-63	TO-63	 TO-61	TO-61	 TO-3	 TO-59†	 TO-61	 TO-5	 TO-59†	 TO-5	 TO-59†	 TO-66	 TO-5
60V					2N3789 2N3791					2N3719	ST72012	2N3740 2N4387	2N3868 2N4235
80V	ST40002	ST54004	ST10007	2N5312*	2N3790 2N3792	ST76018	2N5316*	2N5404 2N5406 ST72036	2N5408* 2N5410* ST72040	2N3720 ST75005	ST72013	2N3741 2N4388	2N4236
100V	ST40003	ST54005	ST10008	2N5314*		ST76019	2N5318*	2N5405 2N5407 ST72037	2N5409* 2N5411* ST72039	ST75004	ST72014		
120V	ST40004	ST54006	ST10009			ST76020		ST72038	ST72041	ST75006			

*isolated †Also available in TO-111 package.

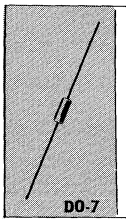
Transitron ELECTRONIC CORPORATION WAKEFIELD, MASS

GTOs / LASCRs / TRIACs

BLOCKING VOLTAGE (V_{DRM}, V_{RRM})

Current Ratings (RMS)	GTOs 400 mA TO-18	GTOs 800 mA TO-5	LASCRs 400 mA TO-18	TRIACs 1 to 6 Amp TO-5	TRIACs 3-10 Amp TO-66	TRIACs 3-15 Amp IG-111	TRIACs 6-25 Amp IG-114
15V	2N892 2N893		RTPC-0101 RTPC-0201				
30V	2N764 2N894 2N895 2N4320 2N4326	2N1686	RTPC-0103 RTPC-0203				
50V				BTD-0105 (1 Amp) BTD-0205 (3 Amp) BTD-0305 (6 Amp)	BTR-0205 (3 Amp) BTR-0305 (6 Amp) BTR-0405 (10 Amp)	BTS-0205 (3 Amp) BTS-0305 (6 Amp) BTS-0405 (10 Amp) BTS-0505 (15 Amp)	BTU-0305 (6 Amp) BTU-0405 (10 Amp) BTU-0505 (15 Amp) BTU-0605 (25 Amp)
60V	2N765 2N896 2N897 2N4321 2N4327	2N1687	RTPC-0106 RTPC-0206				
100V	2N766 2N898 2N899 2N4322 2N4328	2N1688	RTPC-0110 RTPC-0210	BTD-0110 (1 Amp) BTD-0210 (3 Amp)	BTR-0210 (3 Amp) BTR-0310 (6 Amp) BTR-0410 (10 Amp)	BTS-0210 (3 Amp) BTS-0310 (6 Amp) BTS-0410 (10 Amp) BTS-0510 (15 Amp)	BTU-0310 (6 Amp) BTU-0410 (10 Amp) BTU-0510 (15 Amp) BTU-0610 (25 Amp)
150V	2N4323 2N4329		RTPC-0115 RTPC-0215				
200V	2N767 2N900 2N901 2N4324 2N4330	2N1689	RTPC-0120 PTPC-0220	BTD-0120 (1 Amp) BTD-0220 (3 Amp)	BTR-0220 (3 Amp) BTR-0320 (6 Amp) BTR-0420 (10 Amp)	BTS-0220 (3 Amp) BTS-0320 (6 Amp) BTS-0420 (10 Amp) BTS-0520 (15 Amp)	BTU-0320 (6 Amp) BTU-0420 (10 Amp) BTU-0520 (15 Amp) BTU-0620 (25 Amp)
250V	2N4325 2N4331						
300V	RTGC-0130	RTGD-0130		BTD-0130 (1 Amp) BTD-0230 (3 Amp)	BTR-0230 (3 Amp) BTR-0330 (6 Amp) BTR-0430 (10 Amp)	BTS-0230 (3 Amp) BTS-0330 (6 Amp) BTS-0430 (10 Amp) BTS-0530 (15 Amp)	BTU-0330 (6 Amp) BTU-0430 (10 Amp) BTU-0530 (15 Amp) BTU-0630 (25 Amp)
350V							
400V				BTD-0140 (1 Amp) BTD-0240 (3 Amp)	BTR-0240 (3 Amp) BTR-0340 (6 Amp) BTR-0440 (10 Amp)	BTS-0240 (3 Amp) BTS-0340 (6 Amp) BTS-0440 (10 Amp) BTS-0540 (15 Amp)	BTU-0340 (6 Amp) BTU-0440 (10 Amp) BTU-0540 (15 Amp) BTU-0640 (25 Amp)
500V				BTD-0150 (1 Amp) BTD-0250 (3 Amp)	BTR-0250 (3 Amp) BTR-0350 (6 Amp) BTR-0450 (10 Amp)	BTS-0250 (3 Amp) BTS-0350 (6 Amp) BTS-0450 (10 Amp) BTS-0550 (15 Amp)	BTU-0350 (6 Amp) BTU-0450 (10 Amp) BTU-0550 (15 Amp) BTU-0650 (25 Amp)
600V				BTD-0160 (1 Amp) BTD-0250 (3 Amp) BTD-0260	BTR-0260 (3 Amp) BTR-0360 (6 Amp) BTR-0460 (10 Amp)	BTS-0260 (3 Amp) BTS-0360 (6 Amp) BTS-0460 (10 Amp) BTS-0560 (15 Amp)	BTU-0360 (6 Amp) BTU-0460 (10 Amp) BTU-0560 (15 Amp) BTU-0660 (25 Amp)

BIDIRECTONAL TRIGGER DODE (DIAC)



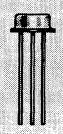
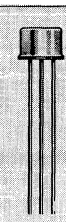
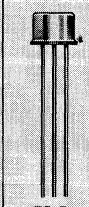
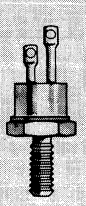
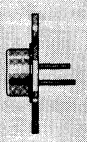
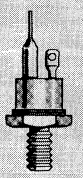
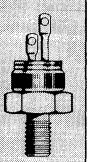
BDW26	BDW32	BDW38

26 TO 38 VOLTS DIACS IN DO-7 PACKAGE

V(BO)+ & V(BO)— MIN VOLTS	V(BO)+ & V(BO)— TYP VOLTS	V(BO)+ & V(BO)— MAX VOLTS	IBO MAX μA	V at I MIN VOLTS	V at I MIN MA	VSYM MIN VOLTS	PAVG MAX mW
22	26	30	250	5.0	10	5.0	400
28	32	36	250	5.0	10	5.0	400
34	38	42	250	5.0	10	5.0	400

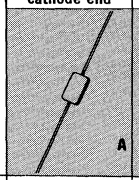
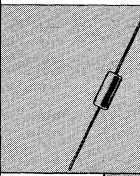
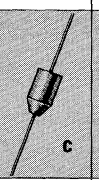
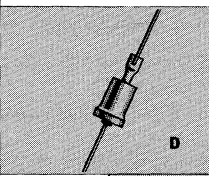
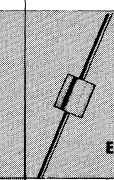
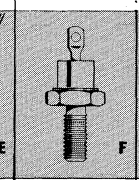
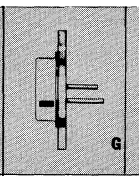
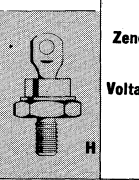
SILICON CONTROLLED RECTIFIERS (SCRs)

BLOCKING VOLTAGE (V_{DRM}, V_{RRM})

Current Ratings (RMS)	320 mA	400 mA			1.6 Amp	1.6 Amp	8.0 Amp			25 Amp	
	 IG-115	 TO-46	 TO-52	 TO-18	 TO-5	 TO-5 ISOLATED	 TO-64	 TO-66	 IG-111	 TO-48	 IG-114
15V	RTH-0101 RTH-0201 RTH-0301 RTH-0401 RTH-0501 RTH-0601	2N3254 2N3257	2N4144	2N876 2N884		2N1869 2N1869A 2N1875					
30V	RTH-0103 RTH-0203 RTH-0303 RTH-0403 RTH-0503 RTH-0603	2N3255 2N3258	2N4145 2N4332	2N877 2N885 2N948 2N2679 2N2683 2N2687 2N3001 2N3005	2N2322, 22A(1) 2N2344(1) 2N3555 2N3559 2N4212(1)	2N1870 2N1870A* 2N1876 2N1881 2N2009(1)	2N1770(1) 2N1770A	RTR-0102(1) RTR-0202 RTR-0302 RTR-0402 RTR-0502	RTS-0102(1) RTS-0202 RTS-0302 RTS-0402 RTS-0502	2N681(1) 2N1842(1) 2N1842A	RTU-0102(1) RTU-0202 RTU-0302 RTU-0402 RTU-0502 RTU-0602
50V			2N4096	2N4108	2N1595, 95A 2N2323*, 23A* 2N2345 2N4213	2N2010	2N1600 2N1771 2N1771A*	RTR-0105 RTR-0205 RTR-0305 RTR-0405 RTR-0505	RTS-0105 RTS-0205 RTS-0305 RTS-0405 RTS-0505	2N682 2N1843 2N1843A	RTU-0105 RTU-0205 RTU-0305 RTU-0405 RTU-0505 RTU-0605
60V	RTH-0106 RTH-0206 RTH-0306 RTH-0406 RTH-0506 RTH-0606	2N3256 2N3259	2N4146 2N4333	2N878 2N886 2N949 2N2680 2N2684 2N2688 2N3002 2N3006	2N3556 2N3560	2N1871 2N1871A* 2N1877 2N1882					
100V	RTH-0110 RTH-0210 RTH-0310 RTH-0410 RTH-0510 RTH-0610	RTA-0110	2N4097 2N4147 2N4334	2N879 2N887 2N950 2N2681 2N2685 2N2689 2N3003 2N3007 2N4109	2N1596, 96A 2N2324*, 24A* 2N2346 2N3273 2N3557 2N3561 2N4214	2N1872 2N1872A* 2N1878 2N1883 2N2011	2N1601 2N1772 2N1772A*	RTR-0110 RTR-0210 RTR-0310 RTR-0410 RTR-0510	RTS-0110 RTS-0210 RTS-0310 RTS-0410 RTS-0510	2N683 2N1844 2N1844A	RTU-0110 RTU-0210 RTU-0310 RTU-0410 RTU-0510 RTU-0610
150V	RTH-0115 RTH-0215 RTH-0315 RTH-0415 RTH-0515 RTH-0615	RTA-0115	2N4148 2N4335	2N880 2N888	2N2325, 25A 2N2347 2N4215	2N1873 2N1873A 2N1879 2N1884	2N1773 2N1773A			2N684 2N1845 2N1845A	
200V	RTH-0120 RTH-0220 RTH-0320 RTH-0420 RTH-0520 RTH-0620	RTA-0120	2N4098 2N4149 2N4336	2N881 2N889 2N951 2N2682 2N2686 2N2690 2N3004 2N3008 2N4110	2N1597, 97A 2N2326*, 26A* 2N2348 2N3558	2N1874 2N1874A* 2N1880 2N1885 2N2012	2N1602 2N1774 2N1774A*	2N3228 RTR-0120 RTR-0220 RTR-0320 RTR-0420 RTR-0520	RTS-0120 RTS-0220 RTS-0320 RTS-0420 RTS-0520	2N685 2N1846 2N1846A	RTU-0120 RTU-0220 RTU-0320 RTU-0420 RTU-0520 RTU-0620
250V	RTH-0125 RTH-0225 RTH-0325 RTH-0425 RTH-0525		2N4337	RTC-0125 RTC-0225 RTC-0325 RTC-0425 RTC-0525 RTC-0625	2N2327, 27A 2N4217	RTF-0125 RTF-0225 RTF-0325 RTF-0425 RTF-0525	2N1775 2N1775A			2N686 2N1847 2N1847A	
300V	RTH-0130 RTH-0230 RTH-0330 RTH-0430 RTH-0530		RTB-0230 RTB-0330 RTB-0430 RTB-0530 RTB-0630	RTC-0130 RTC-0230 RTC-0330 RTC-0430 RTC-0530 RTC-0630	2N1598, 98A 2N2328, 28A 2N3275 2N4218	2N2013 RTF-0130 RTF-0230 RTF-0330 RTF-0430 RTF-0530	2N1603 2N1776 2N1776A*	RTR-0130 RTR-0230 RTR-0330 RTR-0430 RTR-0530	RTS-0130 RTS-0230 RTS-0330 RTS-0430 RTS-0530	2N687 2N1848 2N1848A	RTU-0130 RTU-0230 RTU-0330 RTU-0430 RTU-0530 RTU-0630
350V					RTD-0135 RTD-0235 RTD-0335 RTD-0435 RTD-0535 RTD-0635	RTF-0135 RTF-0235 RTF-0335 RTF-0435 RTF-0535					
400V					2N1599, 99A 2N2329, 29A 2N3276 2N4219 RTD-0140 RTD-0240 RTD-0340 RTD-0440	2N2014 RTF-0140 RTF-0240 RTF-0340 RTF-0440 RTF-0540	2N1604 2N1777 2N1777A*	2N3525 RTR-0140 RTR-0240 RTR-0340 RTR-0440 RTR-0540	RTS-0140 RTS-0240 RTS-0340 RTS-0440 RTS-0540	2N688 2N1849 2N1849A	RTU-0140 RTU-0240 RTU-0340 RTU-0440 RTU-0540 RTU-0640
500V							RTN-0150 RTN-0250 RTN-0350 RTN-0450 RTN-0550	RTR-0150 RTR-0250 RTR-0350 RTR-0450 RTR-0550	RTS-0150 RTS-0250 RTS-0350 RTS-0450 RTS-0550	2N689 2N1850 2N1850A	RTU-0150 RTU-0250 RTU-0350 RTU-0450 RTU-0550 RTU-0650
600V							RTN-0160 RTN-0260 RTN-0360 RTN-0460 RTN-0560	RTR-0160 RTR-0260 RTR-0360 RTR-0460 RTR-0560	RTS-0160 RTS-0260 RTS-0360 RTS-0460 RTS-0560	RTT-0160 RTT-0260 RTT-0360 RTT-0460 RTT-0560	RTU-0160 RTU-0260 RTU-0360 RTU-0460 RTU-0560

(1) VDRM & VRRM = 25V *JAN and/or TX—JAN PARTS AVAILABLE

ZENER DIODES

Nominal Zener Voltage	125 MILLIWATT Cathode=red dot on lead nearest cathode end	250 MILLIWATT and 400 MILLIWATT Cathode=Color band		1 WATT Cathode=pointed end	1 WATT Cathode to Case		3 WATT Cathode=polarity mark	10 WATT Cathode to case for 1N3994 series anode to case for 1N2970 series	50 WATT Anode to Case		Nominal Zener Voltage
	 A	 B		 C	 D		 E	 F	 G	 H	
	Industrial (Note 1)	Industrial (Notes 1 & 2)	Meets Mil Std 19500/127 (1N746A—1N759A, 1N4372A) Mil Std 19500/117 (1N962B—1N973B)	Industrial (Note 2)	Industrial (Notes 1 & 2)	Meets Mil Std 19500/115	Industrial (Note 2)	Industrial (Notes 1, 2, 3)	Industrial (Note 2, 3)		
2.4		1N4370									2.4
2.7		1N4371									2.7
3.0		1N4372	1N4372A								3.0
3.3		1N746	1N746A								3.3
3.6		1N747	1N747A								3.6
3.9		1N748	1N748A								3.9
4.3		1N749	1N749A		1N3824			1N3994			4.3
4.7		1N750	1N750A		1N3825			1N3995			4.7
5.1	TMD 01	1N751	1N751A		1N3826			1N3996			5.1
5.6	TMD 02	1N752	1N752A		1N3827			1N3997			5.6
6.2	TMD 03	1N753	1N753A		1N3828			1N3998			6.2
6.8	TMD 04	1N754	1N754A	EVR6	1N3016	1N3016B	3VR6	1N2970&R	1N2804&R	1N3305&R	6.8
7.5	TMD 05	1N755	1N755A	EVR7	1N3017	1N3017B	3VR7	1N2971&R	1N2805&R	1N3306&R	7.5
8.2	TMD 06	1N756	1N756A	EVR8	1N3018	1N3018B	3VR8	1N2972&R	1N2806&R	1N3307&R	8.2
9.1	TMD 07	1N757	1N757A	EVR9	1N3019	1N3019B	3VR9	1N2973&R	1N2807&R	1N3308&R	9.1
10	TMD 08	1N758	1N758A	EVR10	1N3020	1N3020B	3VR10	1N2974&R	1N2808&R	1N3309&R	10
11	TMD 09	1N962	1N962B	EVR11	1N3021	1N3021B	3VR11	1N2975&R	1N2809&R	1N3310&R	11
12	TMD 10	1N759	1N759A	EVR12	1N3022	1N3022B	3VR12	1N2976&R	1N2810&R	1N3311&R	12
13	TMD 11	1N964	1N964B	EVR13	1N3023	1N3023B	3VR13	1N2977&R	1N2811&R	1N3312&R	13
15	TMD 12	1N965	1N965B	EVR15	1N3024	1N3024B	3VR15	1N2979&R	1N2813&R	1N3314&R	15
16	TMD 13	1N966	1N966B	EVR16	1N3025	1N3025B	3VR16	1N2980&R	1N2814&R	1N3315&R	16
18	TMD 14	1N967	1N967B	EVR18	1N3026	1N3026B	3VR18	1N2982&R	1N2816&R	1N3317&R	18
20	TMD 15	1N968	1N968B	EVR20	1N3027	1N3027B	3VR20	1N2984&R	1N2818&R	1N3319&R	20
22	TMD 16	1N969	1N969B	EVR22	1N3028	1N3028B	3VR22	1N2985&R	1N2819&R	1N3320&R	22
24	TMD 17	1N970	1N970B	EVR24	1N3029	1N3029B	3VR24	1N2986&R	1N2820&R	1N3321&R	24
27	TMD 18	1N971	1N971B	EVR27	1N3030	1N3030B	3VR27	1N2988&R	1N2822&R	1N3323&R	27
30	TMD 19	1N972	1N972B	EVR30	1N3031	1N3031B	3VR30	1N2989&R	1N2823&R	1N3324&R	30
33	TMD 20	1N973	1N973B	EVR33	1N3032	1N3032B	3VR33	1N2990&R	1N2824&R	1N3325&R	33
36	TMD 21	1N974		EVR36	1N3033		3VR36	1N2991&R	1N2825&R	1N3326&R	36
39	TMD 22	1N975		EVR39	1N3034		3VR39	1N2992&R	1N2826&R	1N3327&R	39
43	TMD 23	1N976		EVR43	1N3035		3VR43	1N2993&R	1N2827&R	1N3328&R	43
47		1N977		EVR47	1N3036		3VR47	1N2995&R	1N2829&R	1N3330&R	47
51		1N978		EVR51	1N3037		3VR51	1N2997&R	1N2831&R	1N3332&R	51
56		1N979		EVR56	1N3038		3VR56	1N2999&R	1N2832&R	1N3334&R	56
62		1N980		EVR62	1N3039		3VR62	1N3000&R	1N2833&R	1N3335&R	62
68		1N981		EVR68	1N3040		3VR68	1N3001&R	1N2834&R	1N3336&R	68
75		1N982		EVR75	1N3041		3VR75	1N3002&R	1N2835&R	1N3337&R	75
82		1N983		EVR82	1N3042		3VR82	1N3003&R	1N2836&R	1N3338&R	82
91		1N984		EVR91	1N3043		3VR91	1N3004&R	1N2837&R	1N3339&R	91
100				EVR100	1N3044		3VR100	1N3005&R	1N2838&R	1N3340&R	100
110				EVR110	1N3045		3VR110	1N3007&R	1N2840&R	1N3342&R	110
120				EVR120	1N3046		3VR120	1N3008&R	1N2841&N	1N3343&R	120
130				EVR130	1N3047		3VR130	1N3009&R	1N2842&R	1N3344&R	130
150				EVR150	1N3048		3VR150	1N3011&R	1N2843&R	1N3346&R	150
160					1N3049			1N3012&R	1N2844&R	1N3347&R	160
180					1N3050			1N3014&R	1N2845&R	1N3349&R	180
200					1N3051			1N3015&R	1N2846&R	1N3350&R	200

MILITARY TYPES

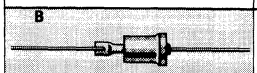
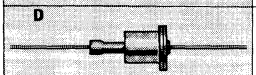
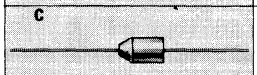
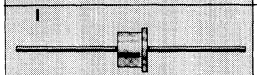
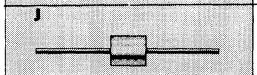
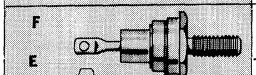
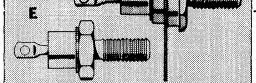
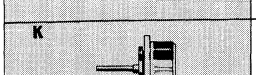
NOTES:

1. No suffix equals 10% tolerance, suffix "A" equals 5% tolerance (TMD01—TMD23, 1N4370—1N4372, 1N746—1N759, 1N3824—IN3828 and IN3994—1N3998)
2. No suffix equals 20% tolerance, suffix "A" equals 10% tolerance, suffix "B" equals 5% tolerance (1N962—1N984, EVR3—EVR150, 3VR3—3VR150, 1N3016—1N3051, 1N2970 & R—1N3015 & R, 1N2804 & R—1N2846 & R, 1N3305 & R—1N3350 & R)
3. Suffix "R" equals reverse polarity

TEMPERATURE COMPENSATED REFERENCE DIODES AVAILABLE AT 6.2V, 8.4V, 9.0V, 11.7V 12.6V & 19.0V
ALSO AVAILABLE CERTIFIED VOLTAGE REFERENCES AND SILICON MULTI-CHIP STABISTORS

Transitron ELECTRONIC CORPORATION WAKEFIELD, MASS

SILICON RECTIFIERS

0.200 TO 60 AMPS RATINGS	Average Forward Current (AMPS)	Temp. °C*	Pkg	50V	100V	150V	200V	300V	400V	500V	600V	800V	1000V
B 	.200	150A	B	1N3072	1N3073	1N3074	1N3075	1N3077	1N3079	1N3080	1N3081		
D 	.250	150A	D	1N536	1N537		1N538**	1N539	1N540**	1N1095	1N547**	1N1108	
C 	.750 1.0	25A 25A	C C	ER181	ER182		1N2069 ER183		1N2070 ER184		1N2071 ER185		
A 	1.0 1.0	75A 25A	A A		SGR100		1N4383		1N4384		1N4385	1N4585	1N4586
I 	3.0	75A	I	1N4719	1N4720		1N4721		1N4722		1N4723	1N4724	1N4725
J 	3.0	75A	J	1N4139	1N4140		1N4141		1N4142		1N4143		
F 	5A 12 A	150C 100C	F	1N1612	1N1613	1N1201	1N1614	1N1203	1N1615	1N1205	1N1616		
E 	5.0 12.0	150C 150C	E E	1N1612 1N1199	1N1613 1N1200	1N1201	1N1614 1N1202	1N1203	1N1615 1N1204	1N1205	1N1616 1N1206		
G 	12.0	150C	G	SMB4719	SMB4720		SMB4721		SMB4722		SMB4723	SMB4724	SMB4725
K 	18.0 25.0	150C 150C	K K	1N3491 1N3659	1N3492 1N3660		1N3493 1N3661	1N3494 1N3662	1N3495 1N3663	1N3664	1N3665		
H 	20.0 35.0 60.0	150C 150C 125C	H H H	1N248A 1N1183, A 1N2128A	1N249A 1N1184, A 1N2129A	TR152 1N1185 1N2130A	IN250A 1N1186 1N2131A	TR302 1N1187 1N2133A	TR402 1N1188 1N2135A	TR502 1N1189	TR602 1N1190	TR802	

MILITARY TYPES**

Transitron also manufacturers a complete line of Silicon Rectifier Stack Assemblies ranging from 0.200 amperes (for half-wave and doubler circuits) to 100 amperes (for three phase bridges). Write for Bulletins TE-1342 and TE-1343.

*Temperatures At Which Forward Current Rating Applies:
"A" Indicates Ambient Tempeature Rating Of A Lead Mounted Rectifier
"C" Indicates Maximum Allowable Case Or Stud Temperature At The Rated Current For Stud Mounted Units.

CONTROLLED AVALANCHE TYPES

Average Forward Current (AMPS)	Temp. C	Pkg.	Avalanche Voltage Min.	Avalanche Voltage Max.	Rated PRV (Volts)	Type
1.0	75A	A	250	500	200	SGR200A
1.0	75A	A	475	775	400	SGR400A
1.0	75A	A	675	900	600	SGR600A
1.0	25A	A	875	1200	800	SGR800A
1.0	25A	A	1100	1300	1000	SGR1000A
1.0	100C	E-F	60	300	50	TFR105Z
1.0	100C	E-F	120	400	100	TFR110Z
1.0	100C	E-F	240	500	200	TFR120Z
1.0	100C	E-F	480	800	400	TFR140Z
3.0	150C	E-F	60	300	50	TFR305Z
3.0	150C	E-F	120	400	100	TFR310Z
3.0	150C	E-F	240	500	200	TFR320Z
3.0	150C	E-F	480	800	400	TFR340Z
6.0	150C	E-F	60	300	50	TFR605Z
6.0	150C	E-F	120	400	100	TFR610Z
6.0	150C	E-F	240	500	200	TFR620Z
6.0	150C	E-F	480	800	400	TFR640Z
12.0	150C	E-F	60	300	50	TFR1205Z
12.0	150C	E-F	120	400	100	TFR1210Z
12.0	150C	E-F	240	500	200	TFR1220Z
12.0	150C	E-F	480	800	400	TFR1240Z

FAST RECOVERY RECTIFIERS

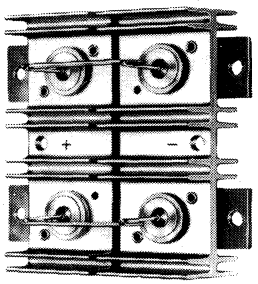
Average Forward Current (AMPS)	Temp. C*	Pkg.	Rec. Time (NSEC)	Peak Rev. Recovery Current (AMPS)	50V	100V	200V	400V
.500	100C	B	200		TKF5	TKF10	TKF20	TKF40
1.0	150C	E	200		TFR105	TFR110	TFR120	TFR140
3.0	150C	E	200		TFR305	TFR310	TFR320	TFR340
6.0	100C	E	200	2	1N3879	1N3880	1N3881	1N3883
6.0	100C	F	200	2	1N3874	1N3875	1N3876	1N3878
12.0	100C	E	200	2	1N3889	1N3890	1N3891	1N3893
12.0	100C	F	200	2	1N3884	1N3885	1N3886	1N3888
20.0	100C	H	200	3	1N3899	1N3900	1N3901	1N3903
30.0	100C	H	200	3	1N3909	1N3910	1N3911	1N3913

Note: Use Suffix "C" When Insulated Base Pkg. F Is Required In TFR Series.

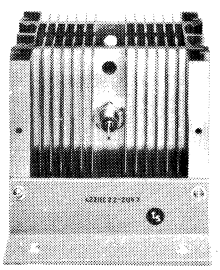
Transitron also manufactures the following type series or their essential equivalents. See Selection Charts for closest Transitron Standard Type, or write for details.

SERIES	PACKAGE	PIV RANGE	CURRENT RATING (NOM.)
1N316 thru 1N329A	D	50V to 1000V	200 mA at 100°C (Amb.)
1N359 thru 1N365A	D	50V to 1000V	100 mA at 100°C (Amb.)
1N550 thru 1N555	E	100V to 600V	500 mA at 100°C (Case)
1N1034 thru 1N1044	E	50V to 400V	500 mA at 150°C (Case)
1N1100 thru 1N1105	D	100V to 600V	250 mA at 150°C (Amb.)
1N1217 thru 1N1226	D	50V to 800V	250 mA at 130°C (Amb.)
1N1227 thru 1N1236	E	50V to 800V	250 mA at 130°C (Case)
1N1434 thru 1N1438	H	50V to 600V	30 Amp at 25°C (Case)
1N1487 thru 1N1492	D	100V to 600V	750 mA at 25°C (Amb.)
1N1551 thru 1N1560	E	100V to 500V	250 mA at 150°C (Amb.)
1N1692 thru 1N1695	D	100V to 400V	250 mA at 100°C (Amb.)
1N2128 thru 1N2137	H	50V to 500V	35 Amp at 100°C (Case)
1N2147 thru 1N2153	F	50V to 600V	6 Amp at 150°C (Case)
1N2154 thru 1N2160	H	50V to 600V	25 Amp at 150°C (Case)

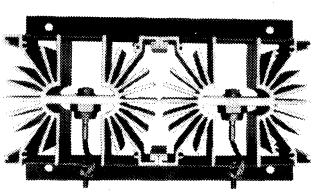
TUNG-SOL SILICON RECTIFIER STACKS AND ASSEMBLIES



LOW CURRENT STACKS—Simplicity, economy and efficiency are derived from the use of pressure-fit diodes. Units of both polarities are pressed directly into the heat sinks. Washers, spacers and other hardware common to stud-mounted units are eliminated. Supplied in compact modular assemblies for such standard rectifier circuits as: Single phase center tap; single phase bridge and three phase bridge. New designs utilizing "high current" pressfit rectifiers available.



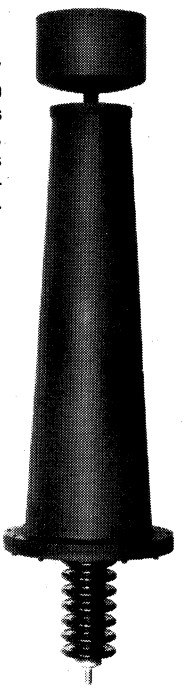
MEDIUM CURRENT STACKS—A newly designed extruded aluminum heat radiator is combined with silicon rectifiers of low thermal impedance to achieve new efficiencies in size, weight and power output. Flexibility of installation is enhanced by incorporating bolt grooves and interlock channels in the radiators. Assembly operation is simplified and the stack may be mounted in any desired plane. Made in such assemblies as: Single phase center tap; single phase bridge; three phase bridge and six phase star.

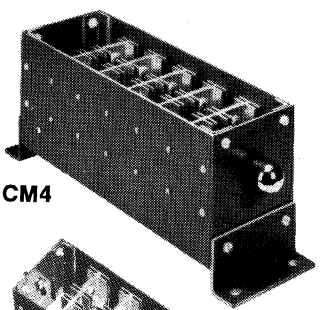


HIGH CURRENT STACKS—Improvements in size, weight and power output factors are achieved through the use of low impedance silicon rectifiers with a special extruded aluminum heat radiator having serrated fins. These have the same assembly and mounting features as the medium power stacks. Likewise made as single phase center tap; single phase bridge; three phase bridge and six phase star assemblies, as well as in non-standard configurations.

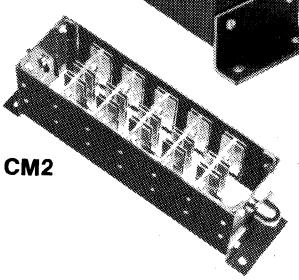
HIGH VOLTAGE ASSEMBLIES

VSC90—A 90 kv assembly designed for use in all high voltage diode applications including clipper, charging, inverse, or rectifier. Utilizes controlled avalanche diodes. Oil-sealed construction is of advanced design that provides both increased reliability and operational economy.



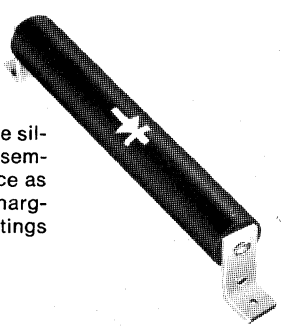


CM4



CM2

CM2, CM4 and CM5—Open lattice type assembly permits optimum cooling. Current ratings to 30 amperes half wave. For rectifier, clipper and charging diode applications at 5 kv and higher.



TM2—Controlled avalanche silicon diodes in low cost assemblies for high voltage service as rectifiers, clipping and charging. For use at current ratings to 5.5 amperes half wave.

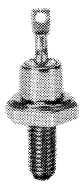
TUNG-SOL®
TUNG-SOL DIVISION
Wagner Electric Corporation
630 W. Mt. Pleasant Avenue, Livingston, N. J. 07039
TWX: 710-994-4865 Phone: (201) 992-1100; (212) 732-5426

TUNG-SOL SILICON POWER RECTIFIERS

Tung-Sol silicon power rectifiers offer distinct advantages over similar competitive types. Exclusive design features combine with Tung-Sol's historically rigid quality control to assure designers unmatched operational reliability. Wide interchangeability permits specification of these outstanding components for most commercial and military applications.

■ All the types shown are available in reverse polarity which may be ordered by the addition of the suffix 'R' to the indicated type number.

LOW CURRENT TYPES JEDEC DO-4 OUTLINE



Type	V_{RM} (wkg) V	1_o @ 150°C. case A	I_R (AV) mA	I_{FM} (surge) A
1N1199A	50	12.0	3.0	240
1N1200A	100	12.0	2.5	240
1N1201A	150	12.0	2.25	240
1N1202A	200	12.0	2.0	240
1N1203A	300	12.0	1.75	240
1N1204A	400	12.0	1.5	240
1N1205A	500	12.0	1.25	240
1N1206A	600	12.0	1.0	240
1N3670A	700	12.0	0.9	240
1N3671A	800	12.0	0.8	240
1N3672A	900	12.0	0.7	240
1N3673A	1000	12.0	0.6	240

CONTROLLED AVALANCHE

Type	V_{RM} (wkg) V	1_o @ 135°C. case A	I_R (AV) mA	I_{FM} (surge) A
1N4506	200	12.0	2.5	240
1N4507	400	12.0	2.5	240
1N4508	600	12.0	2.5	240
1N4509	800	12.0	2.0	240
1N4510	1000	12.0	1.75	240
1N4511	1200	12.0	1.5	240

MEDIUM CURRENT TYPES JEDEC DO-5 OUTLINE



Type	V_{RM} (wkg) V	1_o @ 150°C. case A	I_R (AV) mA	I_{FM} (surge) A
1N1183A	50	40	10	500
1N1184A	100	40	10	500
1N1185A	150	40	10	500
1N1186A	200	40	10	500
1N1187A	300	40	10	500
1N1188A	400	40	10	500
1N1189A	500	40	10	500
1N1190A	600	40	10	500
1N1191	50	18	5	250
1N1192	100	18	5	250
1N1193	150	18	5	250
1N1194	200	18	5	250
1N1195	300	18	5	250
1N1196	400	18	5	250
1N1197	500	18	5	250
1N1198	600	18	5	250
1N2154	50	25	5.0	350
1N2155	100	25	4.5	350
1N2156	200	25	4.0	350
1N2157	300	25	3.5	350
1N2158	400	25	3.0	350
1N2159	500	25	2.5	350
1N2160	600	25	2.0	350
1N3208	50	15	10	250
1N3209	100	15	10	250
1N3210	200	15	10	250
1N3211	300	15	10	250
1N3212	400	15	10	250
1N3213	500	15	10	250
1N3214	600	15	10	250

Type	V_{RM} (wkg) V	1_o @ 140°C. case A	I_R (AV) mA	I_{FM} (surge) A
1N4136	200	50	16	750
1N4137	400	50	12	750
1N4138	600	50	8	750

MEDIUM CURRENT TYPES JEDEC DO-21-OUTLINE



Type	V_{RM} (wkg) V	1_o @ 150°C. case A	I_R (AV) mA	I_{FM} (surge) A
1N3491	50	18	10	300
1N3492	100	18	10	300
1N3493	200	18	8	300
1N3494	300	18	6	300
1N3495	400	18	4	300
1N3659	50	25	5	400
1N3660	100	25	4.5	400
1N3661	200	25	4.0	400
1N3662	300	25	3.5	400
1N3663	400	25	3.0	400
1N3664	500	25	2.5	400
1N3665	600	25	2.0	400

CONTROLLED AVALANCHE

Type	V_{RM} (wkg) V	1_o @ 140°C. case A	I_R (AV) mA	I_{FM} (surge) A
PZ140B	200	25	4.0	400
PZ140D	400	25	3.0	400
PZ140F	600	25	2.0	400
PZ140H	800	25	2.0	400

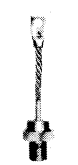
Type	V_{RM} (wkg) V	1_o @ 150°C. case A	I_R (AV) mA	I_{FM} (surge) A
127350Z	50	35.0	2.0	400
127350A	100	35.0	2.0	400
127351Z	50	44.0	2.0	400
127351A	100	44.0	2.0	400

HIGH CURRENT TYPES JEDEC DO-8 OUTLINE



Type	V_{RM} (wkg) V	1_o @ 150°C. case A	I_R (AV) mA	I_{FM} (surge) A
1N1396	50	70	15	1500
1N1397	100	70	15	1500
1N1398	150	70	15	1500
1N1399	200	70	15	1500
1N1400	300	70	15	1500
1N1401	400	70	15	1500
CH119Z	50	150	15	4000
CH119A	100	150	15	4000
CH119AZ	150	150	15	4000
CH119B	200	150	15	4000
CH119C	300	150	15	4000
CH119D	400	150	15	4000

HIGH CURRENT TYPES JEDEC DO-9 OUTLINE



Type	V_{RM} (wkg) V	1_o @ 120°C. case A	I_R (AV) mA	I_{FM} (surge) A
CS131Z	50	275	16	4000
CS131A	100	275	16	4000
CS131AZ	150	275	16	4000
CS131B	200	275	16	4000
CS131C	300	275	16	4000
CS131D	400	275	16	4000

I_{FM} (surge)—Peak one-cycle surge current, under same conditions as 1_o rating (μA—Microamperes).
1_o—Max. rectified avg. DC output current, resistive or inductive load, 60 cps sine wave input.
I_R(AV)—Max. avg. reverse current measured over full sine wave cycle with max. rated reverse voltage and forward current applied.

Full field technical consultation or complete up-to-date listings on all Tung-Sol products are available through: Atlanta, Ga.; Columbus, Ohio; Culver City, Calif.; Dallas, Texas; Detroit, Mich.; Melrose Park, Ill.; Newark, N. J.; Seattle, Wash. IN CANADA: Abbey Electronics, Toronto, Ont., Canadian Electronics Ltd., Edmonton, Alta.

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8719 DIPLOMACY ROW / DALLAS, TEXAS 75247
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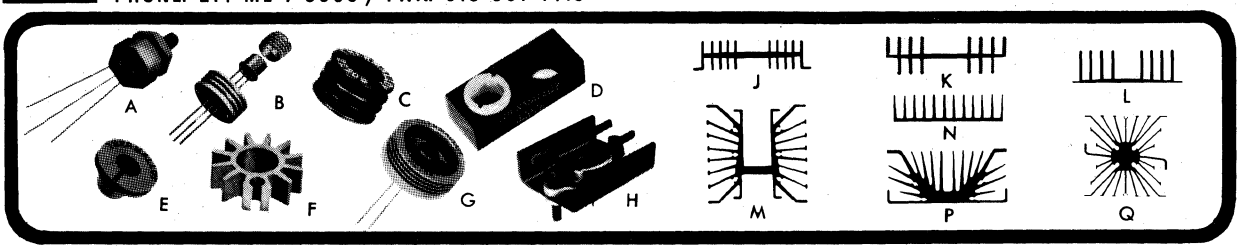
SEMICONDUCTOR ACCESSORIES



SMALL HEAT SINKS

High performance heat sinks. Finish denoted by manufacturer's number (A) Hard Anodize per Mil-F-14072, 400 volts insulation (B) Black Anodize per Mil-A-8625 Type II (C) Gold Chromate finish per Mil-C-5541.

Mfg's. Type	Fig.	Fits Case Type	Size, Inches L	W	H	Typ. RT Natural Convection °C/w
1101A	A	TO-5	.5	.5	.88	10
2207/PR11	B	TO-5	.81	.81	.34	26
2215B	C	TO-5	.750	.750	.375	39
3207B	D	TO-5	1.25	.5	.5	30
2225C	E	TO-5	.75	.75	.40	46
2230C-5	F	TO-5	.75	.75	.25	55
6166	H	TO-66	1.31	.87	.61	11
6103	H	TO-3	1.53	1.25	.516	7

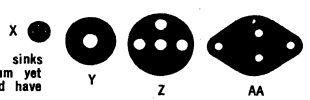
POWER HEAT SINKS

Flat sided as well as multi-finned offer a variety in convection cooling Heat Sinks. Have Black Anodized finish per Mil-A-8625 Type II.

Mfr's Type	Fig.	Size Inches L	W	H	Type RT Natural Convection °C/W
6403B	J	3	4.75	1.25	1.6
6137B	K	3	3.91	1.12	2.3
6145B	L	3	6.75	2	1.2
6450B	M	5	4	4	.68
6153B	N	3	8.3	2.0	.95
6771B	P	6	5	2.25	.435
6761B	Q	6	7	7	.31

BERYLLIUM OXIDE HEAT SINKS

High-purity beryllium oxide heat sinks conduct heat better than aluminum yet insulate better than porcelain and have low capacitance.



Mfr's Type	Fig.	For Case	Rated Volts	Size, Inches L	W	H
4018	X	TO-18	700	.22	.22	.03
4005	X	TO-5	700	.36	.36	.03
4003	AA	TO 3	800	1.56	1.05	.06
4066	AA	TO-66	800	1.25	.70	.06
4036	Z	TO-36	800	1.06	1.06	.06
B-470-235-40	Y	10-32 Stud	700	.47	.47	.04
B-800-260-62	Y	5/16" Stud	800	.80	.80	.06
B-800-320-62	Y	1/4" Stud	800	.80	.80	.06

THERMAFILM INSULATING WASHERS

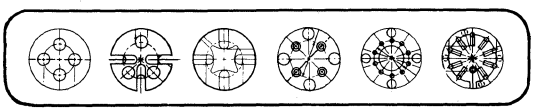
An improved replacment for mica washers. Homogeneous film will not chip, fracture, peel or break. Has dielectric strength of 7000 volts/mil with a useful temperature range of —260°C to +400°C.

Mfr's Type	Fig.	For Case	Size, Inches L	W	H
43-18-1	X	TO-18	.25	.25	.002
43-5-1	X	TO-5	.39	.39	.002
43-03-3	AA	TO-3	1.65	1.06	.002
43-66-1	AA	TO-66	1.31	.76	.002
43-36	Z	TO-36	1.06	1.06	.002
43-02-10	Y	10-32 Stud	.562	.562	.002
43-02-25	Y	1/4" Stud	.812	.812	.002
43-02-50	Y	1/2" Stud	1.38	1.38	.002

HARD-ANODIZED INSULATING WASHERS

6061-T4 Aluminum, hardcoated per Mil-A-8625 type III. Thermal resistance is 0.116 °C/watt per square inch of area.

Mfr's Type	Fig.	For Case	Size, Inches L	W	H
10235	AA	TO-66	1.32	.71	.02
10236	AA	TO-3	1.80	1.06	.02
10237-1	Y	#10 Stud	.56	.56	.02
10237-2	Y	1/4" Stud	.81	.81	.02
10238	Z	TO-36	1.09	1.09	.02
10239	Not Shown	Plastic Power	.75	.50	.02



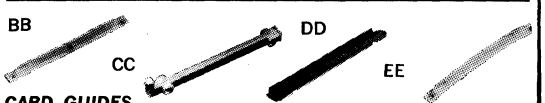
SEMICONDUCTOR MOUNTING PADS

Low cost Thermalloy color-coded mounting pads provide an economical way to protect transistors and integrated circuits from shock and vibration. Achieve uniform spacing above printed circuit boards. Available in Nylon per Mil-20693, Diallyl Phthalate per Mil-M-14F, Type SDG. N denotes Nylon; DAP denotes Diallyl Phthalate.

Mfg. Type	For Case	No. of Leads	Size OD	Inches Max. Thick.
7717-16	TO-18	4	.200	.020
7717-18	TO-18	3 or 4	.200	.060
7717-46	TO-18	4	.200	.060
7717-81	TO-18	6	.290	.125
7717-123	TO-18	4	.340	.120
7717-3	TO-5	3 or 4	.344	.075
7717-4	TO-5	4	.375	.075
7717-5	TO-5	3 or 4	.350	.125
7717-15	TO-5	3 or 4	.350	.020
7717-22	TO-5	3 or 4	.350	.125
7717-79	TO-5	3	.355	.038
7717-8	I/C	8 Lead TO5	.375	.075
7717-10	I/C	10 Lead TO5	.375	.075
7717-12	I/C	12 Lead TO5	.375	.075

SEMICONDUCTOR LEAD CONVERSION PADS

Mfr's No. 7717-	Converts Lead Spacing From	To	No. of Leads	Size Inches OD	Max. Thick.
7717-7	TO-18	TO-5	3 or 4	.250	.125
7717-26	TO-18	TO-5	3	.343	.120
7717-43	TO-18	TO-5	3 or 4	.275	.050
7717-44	TO-18	TO-5	3 or 4	.305	.125
7717-93	TO-18	.150 Circle	3 or 4	.195	.065
7717-106	Dual To-5	.050 Grid	6	.450	.160
7717-2	.100 Circle	.200 Circle	2	.305	.125
7717-19	.200 Circle	.400 Circle	8	.500	.275
7717-20	.200 Circle	.400 Circle	12	.500	.275
7717-21	.200 Circle	.400 Circle	10	.500	.275
7717-119	.200 Circle	.400 Circle	10	.500	.275
7717-120	.200 Circle	.400 Circle	8	.500	.275



CARD GUIDES

Precision circuit board card guides made from nylon per MIL-M-20693 snap into place with snap rivets or rods to provide easy spacing and flexibility in assembling Therma-Pak modules. Available in a variety of stock sizes or manufactured to specification.

Mfr's Type	Fig.	Fits System Number	Inches L	W	H
5005-01	DD	5005-102 5005-121	2.651	.375	.262
5005-02	DD	5005-106 5005-125	4.151	.375	.262
5005-03	DD	5005-110 5005-129	5.651	.375	.262
5005-04	DD	5005-114 5005-133	6.651	.375	.262
8701	CC		6.250	.670	.360
8702	CC		6.250	.670	.580
8825-2	BB		2.00	.230	.210
8825-3	BB		3.50	.230	.210
8825-5	BB		5.00	.230	.210
8828-3	EE		3.50	.230	.210
5008-08 card ejector	Not Shown				
5005-09 card puller	Not Shown				

CUSTOM HEAT SINKS® Let Thermalloy's wide experience help you in your custom heat sink requirements. Thermalloy will evaluate your thermal and mechanical requirements and custom engineer a product to meet your special needs. Our model shop specializes in meeting your prototype needs fast. Thermalloy's specialized production equipment designed for these products — results in high quality at a price normally below the cost of in-house fabrications. Contact Thermalloy for a no-obligation estimate.

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301-944-1900
303-757-6489
305-647-6929
312-283-0713
313-358-2020
314-726-2233
315-454-0761
317-359-5374
319-366-1591
412-242-0100
415-321-2950
416-742-6871
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312-421-6800
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314-726-2233
315-437-2641
404-355-2223
412-782-2684
412-361-7881
414-964-4321
415-321-5373
416-742-6871
513-298-0191
514-384-1420
516-221-1441
516-249-7262
602-944-1551
604-253-6396
607-723-6326
609-662-9337
612-332-1325
614-866-3493
614-299-4161
617-969-6100
617-329-2400
617-787-1200
704-372-3630
713-224-9131
714-278-7400
716-633-9110
716-884-3450
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815-963-6445
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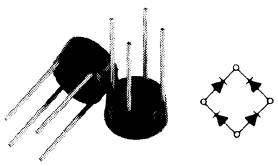
Very, very Varo.

(Very good. Very inexpensive.)

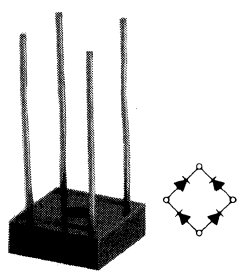
Each of these Varo epoxy bridge rectifiers has full-wave bridge, controlled avalanche, and 200V, 400V, and 600V ratings.



1 amp EBR. For printed circuit board mounting.

ONLY 91¢

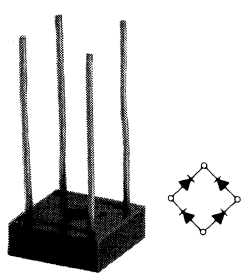
in 200V rating and quantity of 1,000.



2 amp EBR. For circuit board mounting.

ONLY 95¢

in 200V rating and quantity of 1,000.

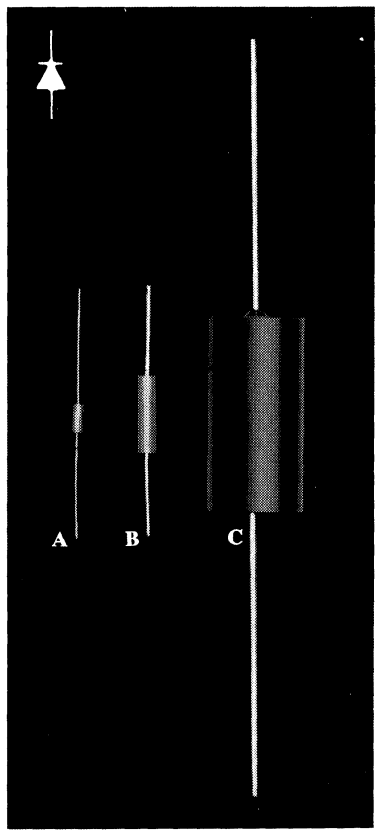


6 amp EBR. For chassis mounting.

ONLY $1.59

in 200V rating and quantity of 1,000.

High Voltage Rectifiers



Diffused High Voltage silicon rectifiers available with 300 nanosecond recovery time (optional) and in custom designed assemblies. Epoxy encapsulation.

A
.060 diameter.
.150 long.
1,000 to 3,500 volts PIV.
25 to 50 ma average rectified current.

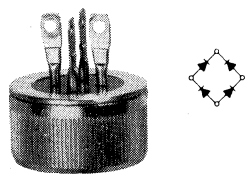
B
.100 diameter.
.400 long.
1,000 to 6,000 volts PIV.
50 to 100 ma average rectified current.

C
.500 diameter.
1 to 7 inches long.
3,000 to 70,000 volts.
15 to 75 ma average rectified current.

For use in diode-capacitor voltage multipliers, cathode ray tube power supplies, RF power supplies (up to 200 KC), precipitator power supplies, and photo multipliers. Also available in diode-capacitor multiplier assemblies.

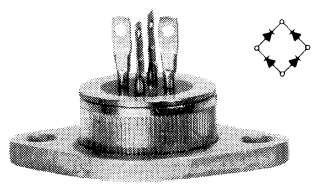
3 integrated bridge rectifiers with 3 mounting options

Each of these Varo Integrated Bridge Rectifiers is a controlled avalanche, full-wave bridge, and is electrically insulated for direct chassis mounting. Each offers three mounting options: Press mount. Single stud. TO-3 mounting adapter.



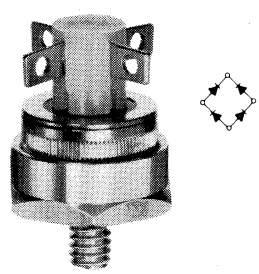
10 amp fast recovery IBR. Recovery time: 200 nanoseconds. 100V, 200V, and 400V ratings.

only $4.75 *



10 amp IBR. 200V, 400V, and 600V ratings.

only $2.35 *



25 amp IBR. 200V, 400V, and 600V ratings.

only $3.05 *

* In 200V rating and quantity of 1,000 (press mount).

For fast service contact Varo semiconductor sales manager.

VARO

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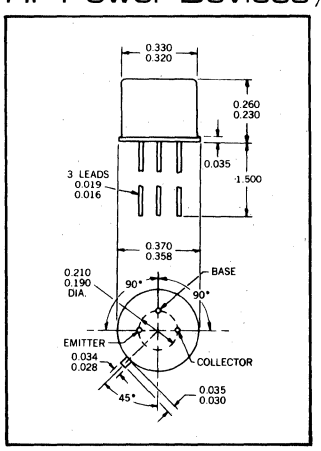
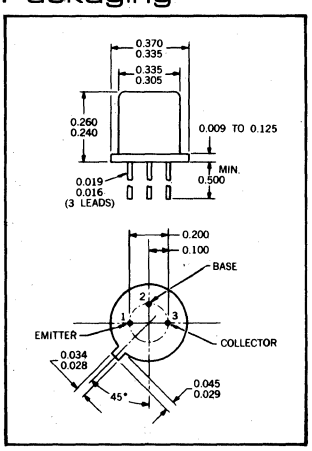
RF POWER DEVICES • HYBRID SEMICONDUCTORS CUSTOM HYBRID AND INTEGRATED CIRCUITS

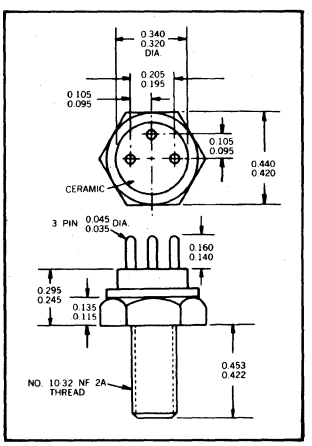
RF Power Devices / Packaging



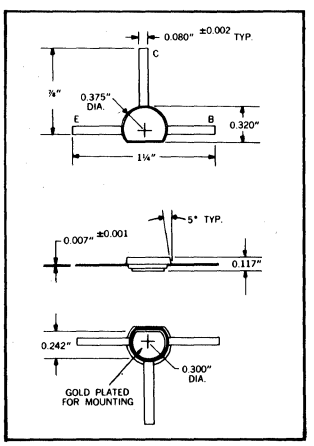
TO-5



TO-39



TO-60



VX

RF Power Devices / Electrical Characteristics

APPLICATION	DEVICE	FREQUENCY (MHz)	Power Out (Watts)	Power Gain Min. (db)	Efficiency Min. (%)	fr Typ (MHz)	Tj (centigrade)	Vcc	Case
VHF Power Amplifier	2N2631	150	3.0	4.8	40	200	200	28	TO-5
	2N2876		3.0	4.8	40	200	200		TO-60
VHF/UHF Oscillator/Amplifier	2N3553	175	2.5	10.0	50	500	200	28	TO-5
	2N3632	175	13.5	5.9	70	400	200	28	TO-60
Large Sig/Hi Power/Oscillator Amplifier	V409	260	40.0	6.0	50	300	200	28	TO-60
Large Sig/Med. Power/ Oscillator Amplifier	2N3866	400	1.0	10.0	45	800	200	28	TO-39
	S704	400	1.0	10.0	45	1000	200	28	TO-39
VHF/UHF Oscillator/Multiplier Amplifier	2N5090	400	1.0	10.0	45	500	200	28	TO-60
	2N3375	400	3.0	4.8	40	600	200	28	TO-60
Large Sig/Hi Power Oscillator Amplifier	2N3733	400	10.0	4.0	45	400	200	28	TO-60
	2N4440	400	5.0	4.7	45	600	200	28	TO-60
	2N5016	400	15.0	4.8	50	700	200	28	TO-60
	V410	400	20.0	5.5	50	700	200	28	TO-60
VHF/UHF Med. Power/ Oscillator/Amplifier	2N4428	500	0.75	10.0	35	900	200	28	TO-39
Frequency Multiplier (Tripler)	2N4012	1002	2.5	4.0*	25	600	200	28	TO-60

*Conversion Gain

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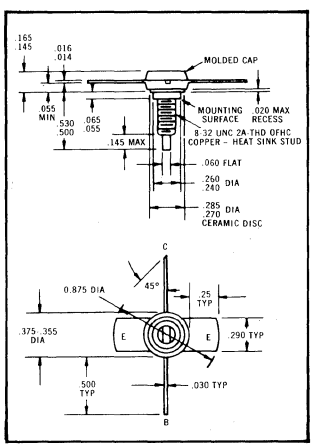
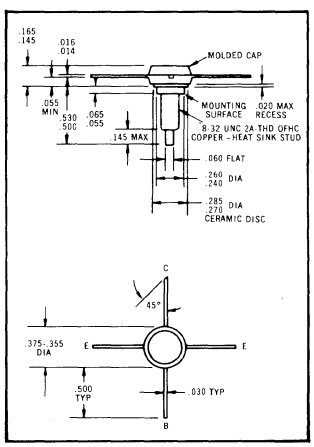
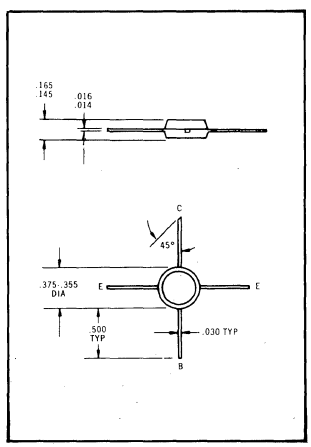
RF Power **Stripline** Devices / Packaging



MT-66



MT-59C



MT-59C
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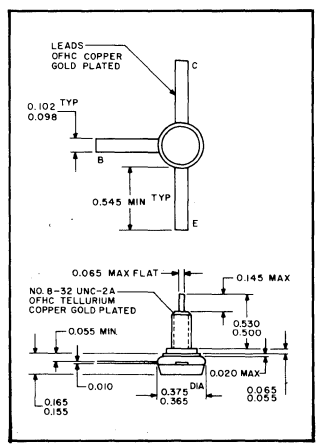

3L-PT

RF Power **Stripline** Devices / Electrical Characteristics

DEVICE TYPE	FREQUENCY (MHz)	Power Out (Watts)	Power Gain Min. (db)	Efficiency Min. (%)	fr Typ (MHz)	Tj (centigrade)	Vcc	Case
2N4429*	1000	1.0	5.2	35	1000	200	28	MT-59C
S-1000	1000	3.0	5.8	35	1200	200	28	MT-66
S-1050*	1000	10.0	5	50	1500	200	28	3L-PT
S-1051*	1000	9.0	4.8	50	1500	200	28	MT-66
2N4430*	1000	2.5	5.0	35	1000	200	28	MT-66
2N4431*	1000	5.0	5	35	1200	200	28	MT-66
S-3003	1000	1.0	5	40	1200	200	28	MT-59C Less Stud
S-3004	400	2.0	10	45	1200	200	28	X-48
S-3006	1000	1.0	10	45	1200	200	28	MT-66
S-3007	400	2.0	10	45	1200	200	28	MT-59C Less Stud
S-3010	400	1.0	10	45	1200	200	28	MT-59C
VX-3375	400	4.0	6.0	50	650	200	28	VX
VX-3733	400	10.0	4.0	45	400	200	28	VX
VX-3866	400	1.0	10.0	45	800	200	28	VX
S-3500	400	15.0	4.8	50	600	200	28	MT-66

*Also available in Hermetic **Stripline** packages with grounded or ungrounded emitter.

HYBRID SEMICONDUCTORS

To meet the growing requirements of hybrid circuit manufacturers, Electronic Components has geared its advanced epitaxial and diffusion capability to the production of premium high power — high frequency dice for communication applications.

This catalog provides detailed specifications for the procurement of family types of PNP and NPN transistor devices for use as switches, both high and low power amplifiers, and in oscillator applications. All devices supplied are 100% tested to the DC parameters listed in this catalog. Sample dice are taken from each lot and assembled for 100% compliance to listed electrical specifications.

PNP Transistors

Type	Dice Size (mil.)	BV_{CBO}	Test Conditions I_c I_e	BV_{CEO}	Test Conditions I_c I_b	BV_{EBO}	Test Conditions I_e I_c	H_{fe}	Test Conditions I_c V_{ce}	Family
ECS2907	25 x 25	−60	10μa 0	−40	10ma 0	−5	10μa 0	50	1ma −10	2N2907A 2N2907 2N2906 2N2906A
ECS2894	15 x 15	−12	10μa 0	−12	10ma 0	−4	10μa 0	150	30ma −5	2N2984
ECA2605	15 x 15	−60	10μa 0	−45	10ma 0	−6	10μa 0	150	500ma −5	2N2605

*Consult EC Engineering

NPN Switches

Type	Dice Size (mil.)	BV_{CBO}	Test Conditions I_c I_e	BV_{CEO}	Test Conditions I_c I_b	BV_{EBO}	Test Conditions I_e I_c	H_{fe}	Test Conditions I_c V_{ce}	Family
ECS914	15 x 15	40	10μa 0	15	30ma 0	5	10μa 0	120	10ma 1V	2N914 2N706
ECS2222	25 x 25	60	10μa 0	30	10ma 0	5	10μa 0	75	10ma 10V	2N2222 2N2221 2N2220 2N2219 2N2218
ECS2369	10 x 15	40	10μa 0	15	10ma 0	4.5	10μa 0	120	10ma 20V	2N3011 2N2369A 2N2369 2N2368
ECS2784	15 x 15	15	10μa 0	6	10ma 0	4.0	10μa 0	120	10ma 1V	2N3633 2N2784 2N709A 2N709

NPN Amplifiers

Type	Dice Size (mil.)	BV_{CBO}	Test Conditions I_c I_e	BV_{CEO}	Test Conditions I_c I_b	BV_{EBO}	Test Conditions I_e I_c	H_{fe}	Test Conditions I_c V_{ce}	Family
ECA918 ECA918 f_T = 1.1 GHz	15 x 15	30	10μa 0	15	3ma 0	3.0	10μa 0	250	3ma 1V	2N918 2N918 hi f_T 2N918
ECA930	15 x 15	45	10μa 0	45	10ma 0	5.0	10μa 0	150	500ma 5V	2N2484 2N2483 2N930 2N929
ECA916	15 x 15	45	10μa 0	25	10ma 0	5.0	10μa 0	200	10ma 1V	2N916 2N915
ECA3866 ECA3866 f_T = 1.0 GHz	15 x 15	55	100μa 0			3.5	100μa 0	200	50ma 5V 5V	2N3866 2N3866 hi f_T 2N3866
ECA3375	30 x 30	65	100μa 0			4.0	100μa 0	200	125ma 5V	2N3375 Family-2N3553 2N3375, 2N2632 2N3733 (Dual Chip)
ECA5016	35 x 45	65	100μa 0	30	100ma 0	4.0	20μa 0	10	100ma 4V	
ECA1000	20 x 23	50	100μa 0			3.5	10μa 0	20	100ma 5V	
ECA4429	15 x 15	55	10μa 0			3.5	10μa 0	20	50ma 5V	
ECA4430	20 x 30	55	100μa 0	40	200ma 0	3.5	10μa 0	20	100ma 5V	
ECA4431	20 x 30	55	100μa 0			3.5	100μa 0	20	100ma 5V	
ECA1050	20 x 30	45	100μa 0	45		3.5	100μa 0	20	1.0A 5V	

Diodes

TYPE	Dice Size (mil.)	B_v VOLTS	TEST CONDITIONS (μa)	V_f VOLTS	TEST CONDITIONS (ma)	Co pf.	TEST CONDITIONS	Qs PICO-COOLOMBS	T_j	REMARKS
S930	10 X 15	40	I_R=0.1	1.35	I_F=450	3.0	V_R=0	60	200	P-N Type
S931	15 X 15	40	I_R=0.1	1.35	I_F=450	5.0	V_R=0	—	200	N-P Type
S934	15 X 15	40	I_R=50	1.15 1.30	I_F=500 I_F=1A	2.5	V_R=0	40	200	Hi-Conductance
S938	15 X 15	15	I_R=5	1.94	I_F=10	1.3	V_R=0	—	200	Low C/Fast Recovery Trr=1.2ns

Zener Diodes

Dice Size (mil.)	Type No.	VZ Nom. ±5 (Volts)	IZ Test Current (ma)	Maximum Dynamic Resistance at IZ (Ohms)	VR Reverse Voltage (Volts)	Max. IR at VR Reverse Current 25°C (μA)	150°C (μA)	(Knee Impedance) ZW I_{dc}=0.25 ma $I=_{ac}$25 μa (Ohms)
15 X 15	1N753A	6.2	20.0	7.0	1.0	0.1	20.0	—
	1N754A	6.8	20.0	5.0	1.0	0.1	20.0	—
	1N755A	7.5	20.0	6.0	1.0	0.1	20.0	—
	1N756A	8.2	20.0	8.0	1.0	0.1	20.0	—
	1N757A	9.1	20.0	10.0	1.0	0.1	20.0	—
	1N758A	10.0	20.0	17.0	1.0	0.1	20.0	—
	1N759A	12.0	20.0	30.0	1.0	0.1	20.0	—
	1N962B	11.0	11.5	9.5	8.4	0.1		700
	1N963B	12.0	10.5	11.5	9.1	0.1		700
	1N964B	13.0	9.5	13.0	9.9	0.1		700
	1N965B	15.0	8.5	16.0	11.4	0.1		700
	1N966B	16.0	7.8	17.0	12.2	0.1		700
	1N967B	18.0	7.0	21.0	13.7	0.1		750
	1N968B	20.0	6.2	25.0	15.2	0.1		750
	1N969B	22.0	5.6	29.0	16.7	0.1		750
	1N970B	24.0	5.2	33.0	18.2	0.1		750
	1N971B	27.0	4.6	41.0	20.6	0.1		750
	1N973B	30.0	4.2	49.0	22.8	0.1		1000
	1N974B	36.0	3.4	70.0	27	0.1		1000
	1N975B	39.0	3.2	80.0	30	0.1		1000
	1N976B	43.0	3.0	93.0	33	0.1		1500
	1N977B	47.0	2.7	105.0	36	0.1		1500
	1N978B	51.0	2.5	125.0	39	0.1		1500

Silicon Dioxide Capacitors

*Range (pf)	Size (mils)	Breakdown Voltage	Tolerance	Temperature Coefficient	Max. Operating Temperature	Dissipation Factors
5.4-15	30 X 40	150	±5% ±1% within a lot	+ 35 ppm ±15 ppm/°C	200°C	0.0001 to 0.00025 from −20°C to +150°C
11-32.5	35 X 50	150				
20.5-61.5	55 X 55	150				
35- 125	70 X 70	150				
71.5- 210	80 X 90	150				
108- 320	100 X 100	150				
163- 440	140 X 100	150				
70- 500	120 X 120	150				
210- 625	120 X 145	150				
340-1000	180 X 145	150				
1360-1560	180 X 145	50				
1640-1800	180 X 145	50				

*Specify value desired within range.

INTEGRATED CIRCUIT CAPABILITY

TTL — high speed, compatible. Available in TO-116 dual-in-line and TO-85 flat packs.

POWER SWITCHES — 2.5 and 5 Amp (TO-60 Stud).

CONTROL LOGIC — high voltage, high noise immunity, high output for direct display and indicator drive.

CUSTOM HYBRID CIRCUITS

A wide variety of linear and digital circuits can be provided in: **THIN FILM • THICK FILM • HERMETIC FLATPACK • STACKED TO-5 AND TO-8 • MULTIPLAYER (MSI).**

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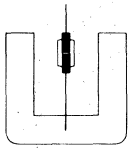

FUSED-IN-GLASS CONTROLLED AVALANCHE RECTIFIERS, ZENER DIODES and HIGH VOLTAGE ASSEMBLIES

UNITRODE

Rectifiers-12 amp. Series (Body C) †

Type‡	PIV	Max. Av. D.C. Current Output 100°C Case Temp.	Min. Forward Current at 1.0V 25°C	Max. Reverse Current at PIV 25°C	Max. Reverse Current at PIV 100°C	Max. Peak One Cycle Surge Sinusoidal 8.3 msec
UT 8105	50V	12.0A	8.0A	10μA	300μA	200A
UT 8110	100	12.0	8.0	10	300	200
UT 8120	200	12.0	8.0	10	300	200
UT 8140	400	12.0	8.0	10	300	200
UT 8160	600	12.0	8.0	10	300	200
UT 6105	50	9.0	6.0	10	300	175
UT 6110	100	9.0	6.0	10	300	175
UT 6120	200	9.0	6.0	10	300	175
UT 6140	400	9.0	6.0	10	300	175
UT 6160	600	9.0	6.0	10	300	175
UT 5105	50	7.5	5.0	10	300	150
UT 5110	100	7.5	5.0	10	300	150
UT 5120	200	7.5	5.0	10	300	150
UT 5140	400	7.5	5.0	10	300	150
UT 5160	600	7.5	5.0	10	300	150

†Also available with insulated stud. See data sheet ZR-150.
‡Polarity is cathode to stud. For reverse polarity, use suffix "R" with part numbers, e.g. UT 8105R.

Rectifiers-4 amp. Series (Body B)

Type	PIV	Max. Av. DC Output Current† 25°C	100°C	Fan Cooled 250 LFM 25°C	Min. Forward Current at 1.0V 25°C	Max. Reverse Current at PIV 25°C	100°C	Max. Peak One Cycle Surge Sinusoidal 8.3 msec
UT 4005	50V	4.0A	2.0A	6.0A	3A	5μA	100μA	100A
UT 4010	100	4.0	2.0	6.0	3	5	100	100
UT 4020	200	4.0	2.0	6.0	3	5	100	100
UT 4040	400	4.0	2.0	6.0	3	5	100	100
UT 4060	600	4.0	2.0	6.0	3	5	100	100
UT 3005	50	3.0	1.5	4.5	2	5	100	80
UT 3010	100	3.0	1.5	4.5	2	5	100	80
UT 3020	200	3.0	1.5	4.5	2	5	100	80
UT 3040	400	3.0	1.5	4.5	2	5	100	80
UT 3060	600	3.0	1.5	4.5	2	5	100	80
UT 2005	50	2.0	1.0	3.0	1	5	100	60
UT 2010	100	2.0	1.0	3.0	1	5	100	60
UT 2020	200	2.0	1.0	3.0	1	5	100	60
UT 2040	400	2.0	1.0	3.0	1	5	100	60
UT 2060	600	2.0	1.0	3.0	1	5	100	60

Rectifiers-2 amp. Series (Body A)

UT 261	100V	2.0A	1.0A	3.0A	900mA	2μA	75μA	30A
UT 262	200	2.0	1.0	3.0	900	2	75	30
UT 264	400	2.0	1.0	3.0	900	2	75	30
UT 265	500	2.0	1.0	3.0	900	2	75	30
UT 267	600	2.0	1.0	3.0	900	2	75	30
UT 268	800	2.0	1.0	3.0	900	2	75	30
UT 251	100	1.5	0.75	2.0	750	2	75	25
UT 252	200	1.5	0.75	2.0	750	2	75	25
UT 254	400	1.5	0.75	2.0	750	2	75	25
UT 255	500	1.5	0.75	2.0	750	2	75	25
UT 257	600	1.5	0.75	2.0	750	2	75	25
UT 258	800	1.5	0.75	2.0	750	2	75	25
UT 364	1000	1.5	0.75	2.0	750	2	75	25
UT 249	100	1.25	0.65	1.5	500	2	75	20
UT 242	200	1.25	0.65	1.5	500	2	75	20
UT 244	400	1.25	0.65	1.5	500	2	75	20
UT 245	500	1.25	0.65	1.5	500	2	75	20
UT 247	600	1.25	0.65	1.5	500	2	75	20
UT 362	800	1.25	0.65	1.5	500	2	75	20
UT 363	1000	1.25	0.65	1.5	500	2	75	20
UT 236	100	1.0	0.5	1.25	400	2	75	20
UT 234	200	1.0	0.5	1.25	400	2	75	20
UT 235	400	1.0	0.5	1.25	400	2	75	20
UT 237	500	1.0	0.5	1.25	400	2	75	20
UT 238	600	1.0	0.5	1.25	400	2	75	20
UT 361	800	1.0	0.5	1.25	400	2	75	20
UT 347	1000	1.0	0.5	1.25	400	2	75	20

Low Leakage — ¾ Amp (Body A)

Type	PIV	Max. Av. D.C. Output Current† 25°C	100°C	Min. Forward Current at 1.0V 25°C	Max. Reverse Current at PIV 25°C	100°C	Max. Peak One Cycle Surge Sinusoidal 8.3 msec
UT 211	225V	750mA	375mA	400mA	0.2μA	15μA	15A
UT 212	300	750	375	400	0.2	15	15
UT 213	400	750	375	400	0.2	15	15
UT 214	500	750	375	400	0.2	15	15
UT 215	600	750	375	400	0.2	15	15

General Purpose — ¾ Amp (Body A)

UT 111	50V	750mA	375mA	500 @ 1.2V	2μA	75μA	15A
UT 112	100	750	375	500	2	75	15
UT 113	200	750	375	500	2	75	15
UT 114	300	750	375	500	2	75	15
UT 115	400	750	375	500	2	75	15
UT 117	500	750	375	500	2	75	15
UT 118	600	750	375	500	2	75	15
UT 119	800	750	375	500	2	75	15
UT 120	1000	750	375	500	2	75	15

†Ratings are based on method of mounting shown in Catalog C159.

Fast Recovery Rectifiers-9 amp. Series (Body C) †

Type‡	PIV	Max. Av. D.C. Current Output 100°C Case Temp.	Min. Forward Current at 1.1V 25°C	Max. Reverse Current at PIV 25°C	Max. Reverse Current at PIV 100°C	Max. Reverse Recovery Time	Max. Peak One Cycle Surge Sinusoidal 8.3 msec.
UTR 6405	50V	9.0A	6.0A	10μA	300μA	*300nsec	150A
UTR 6410	100	9.0	6.0	10	300	300	150
UTR 6420	200	9.0	6.0	10	300	400	150
UTR 6440	400	9.0	6.0	10	300	500	150
UTR 5405	50	7.5	5.0	10	300	300	135
UTR 5410	100	7.5	5.0	10	300	300	135
UTR 5420	200	7.5	5.0	10	300	400	135
UTR 5440	400	7.5	5.0	10	300	500	135
UTR 4405	50	6.0	4.0	10	300	300	120
UTR 4410	100	6.0	4.0	10	300	300	120
UTR 4420	200	6.0	4.0	10	300	400	120
UTR 4440	400	6.0	4.0	10	300	500	120

†Also available with insulated stud. See data sheet ZR-150.
‡Polarity is cathode to stud. For reverse polarity, use suffix "R" with part numbers, e.g. UTR 6405R.

Fast Recovery Rectifiers-4 amp. Series (Body B)

TYPE	PIV	Max. Av. D.C. Output Current† 25°C	100°C	Min. Forward Current @ 1.1V 25°C	Max. Reverse Current at PIV 25°C	100°C	Max. Reverse Recovery Time	Max. Pek One Cycle Surge Sinusoidal 8.3 msec
UTR 4305	50V	4.0A	2.0A	4A	5μA	100μA	*250nsec	100A
UTR 4310	100	4.0	2.0	4	5	100	250	100
UTR 4320	200	4.0	2.0	4	5	100	250	100
UTR 4340	400	4.0	2.0	4	5	100	400	100
UTR 4350	500	4.0	2.0	4	5	100	400	100
UTR 4360	600	4.0	2.0	4	5	100	400	100
UTR 3305	50	3.0	1.5	3	5	100	250	80
UTR 3310	100	3.0	1.5	3	5	100	250	80
UTR 3320	200	3.0	1.5	3	5	100	250	80
UTR 3340	400	3.0	1.5	3	5	100	300	80
UTR 3350	500	3.0	1.5	3	5	100	350	80
UTR 3360	600	3.0	1.5	3	5	100	400	80
UTR 2305	50	2.0	1.0	2	5	100	250	60
UTR 2310	100	2.0	1.0	2	5	100	250	60
UTR 2320	200	2.0	1.0	2	5	100	250	60
UTR 2340	400	2.0	1.0	2	5	100	300	60
UTR 2350	500	2.0	1.0	2	5	100	350	60
UTR 2360	600	2.0	1.0	2	5	100	400	60

Fast Recovery Rectifiers-2 amp. Series (Body A)

UTR 02	50V	2.0A	1.0A	1000mA	3μA	100μA	**250nsec	25A
UTR 12	100	2.0	1.0	1000	3	100	250	25
UTR 22	200	2.0	1.0	1000	3	100	250	25
UTR 32	300	2.0	1.0	1000	3	100	300	25
UTR 42	400	2.0	1.0	1000	3	100	350	25
UTR 52	500	2.0	1.0	1000	3	100	400	25
UTR 62	600	2.0	1.0	1000	3	100	400	25
UTR 01	50	1.0	0.5	500	3	100	250	20
UTR 11	100	1.0	0.5	500	3	100	250	20
UTR 21	200	1.0	0.5	500	3	100	250	20
UTR 31	300	1.0	0.5	500	3	100	300	20
UTR 41	400	1.0	0.5	500	3	100	350	20
UTR 51	500	1.0	0.5	500	3	100	400	20
UTR 61	600	1.0	0.5	500	3	100	400	20
UTR 10	100	0.5	0.25	200	3	100	250	15
UTR 20	200	0.5	0.25	200	3	100	250	15
UTR 30	300	0.5	0.25	200	3	100	300	15
UTR 40	400	0.5	0.25	200	3	100	350	15
UTR 50	500	0.5	0.25	200	3	100	400	15
UTR 60	600	0.5	0.25	200	3	100	400	15

Ultra Fast Recovery Rectifiers-4 amp. series (Body B)

UTX 4105	50V	4.0	2.0	3.0A @ 1.0V	5μA	75μA	*100nsec	80A
UTX 4110	100	4.0	2.0	3.0	5	75	100	80
UTX 4115	150	4.0	2.0	3.0	5	75	100	80
UTX 4120	200	4.0	2.0	3.0	5	75	100	80
UTX 3105	50	3.0	1.5	2.0	5	75	100	60
UTX 3110	100	3.0	1.5	2.0	5	75	100	60
UTX 3115	150	3.0	1.5	2.0	5	75	100	60
UTX 3120	200	3.0	1.5	2.0	5	75	100	60

Ultra Fast Recovery Rectifiers-2 amp. Series (Body A)

UTX 205	50V	2.0A	1.0A	1.0A @ 1.0V	3μA	50μA	**75nsec	25A
UTX 210	100	2.0	1.0	1.0	3	50	75	25
UTX 215	150	2.0	1.0	1.0	3	50	75	25
UTX 220	200	2.0	1.0	1.0	3	50	75	25
UTX 225	250	2.0	1.0	1.0	3	50	75	25
UTX 105	50	1.0	0.5	0.5	3	50	75	20
UTX 110	100	1.0	0.5	0.5	3	50	75	20
UTX 115	150	1.0	0.5	0.5	3	50	75	20
UTX 120	200	1.0	0.5	0.5	3	50	75	20
UTX 125	250	1.0	0.5	0.5	3	50	75	20

*Measured in a reverse recovery circuit switching from 1A forward current to 1A reverse current recovery to ½ A.

**Measured in a reverse recovery circuit switching from 10mA forward current to 10mA reverse current recovery to 5mA.

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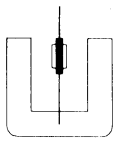

UNITRODE

Zener Diodes-10 Watt (Body C)†

Type ±10% Tolerance‡	Nominal Voltage Vz @ Iz @ 2500 mw V nom.	Max. Cont. Current I Max.	Max. Surge Current** Is	Max. Leakage Current Ir @ 25°C	Test Current Iz	Max. Zener Imped. Zz @ Iz	Typical Temp. Coeff. Tz @ Iz
UZ 7806	6.8V	1350mA	50A	1000μA	350mA	0.6 ohm	.04%/°C
UZ 7807	7.5	1250	41	800	325	0.7	.04
UZ 7808	8.2	1150	31	200	300	0.8	.05
UZ 7809	9.1	1020	29	150	275	1.0	.05
UZ 7810	10	950	26	100	250	1.0	.06
UZ 7812	12	770	23	75	200	1.3	.07
UZ 7813	13	700	21	50	200	1.5	.07
UZ 7814	14	640	20	40	175	1.5	.07
UZ 7815	15	600	17	30	150	2.0	.07
UZ 7816	16	550	15	20	150	2.5	.07
UZ 7818	18	500	13	20	130	3.5	.08
UZ 7820	20	440	12	20	120	4.0	.08
UZ 7822	22	390	11	20	100	4.5	.08
UZ 7824	24	360	10	20	100	5.0	.08
UZ 7827	27	310	9	20	90	6.0	.09
UZ 7830	30	280	8.5	20	80	8.0	.09
UZ 7833	33	260	7.5	10	70	10	.09
UZ 7836	36	240	7	10	60	12	.09
UZ 7840	40	210	6.4	10	60	15	.095
UZ 7845	45	180	5.5	10	50	20	.095
UZ 7850	50	170	4.6	10	50	22	.095
UZ 7856	56	160	4.15	10	40	30	.095
UZ 7860	60	150	3.7	10	40	35	.095
UZ 7870	70	130	3.3	10	35	40	.095
UZ 7875	75	120	3.1	10	30	45	.095
UZ 7880	80	110	2.9	10	30	60	.095
UZ 7890	90	100	2.6	10	25	75	.095
UZ 7210	100	90	2.3	10	20	90	.100

†Also available with insulated stud. See data sheet ZR-150.
‡Polarity is cathode to stud. For reverse polarity, use suffix "R" with part numbers, e.g. UZ 7818R.
**Figures shown are for a peak sinusoidal surge current of 8.3 msec.

Zener Diode-5 Watt (Body B)

Part No. ±10% Tol.*	VOLTAGE Vnom at Iz 1250 mW	Vz at 2 Iz 2500 mW	Vz at I max. 5000 mW	Max. Cont. Current†	Max. Surge Current††	Max. Leakage Current at 25°C	Test Current Iz	Max. Zener Imped. Zz at Iz	Typical Temp. Coeff. Tz at Iz
UZ 5806	6.8V	7.0V	7.4V	675mA	40A	500μA	175mA	1 ohms	.05%/°C
UZ 5807	7.5	7.7	8.1	620	32	400	175	1.5	.06
UZ 5808	8.2	8.4	8.8	570	24	200	150	1.5	.06
UZ 5809	9.1	9.4	9.8	510	22	100	150	2	.06
UZ 5810	10	10.3	10.8	470	20	75	125	2	.07
UZ 5812	12	12.4	13.0	385	18	50	100	2.5	.07
UZ 5813	13	13.4	14.2	350	16	25	100	3	.08
UZ 5814	14	14.5	15.5	320	14	20	100	3	.08
UZ 5815	15	15.5	16.8	300	12	15	75	3.5	.08
UZ 5816	16	16.5	18.0	275	10	10	75	3.5	.08
UZ 5818	18	18.8	19.5	255	9.0	10	65	4	.085
UZ 5820	20	21.2	23.0	220	8.0	10	65	4.5	.085
UZ 5822	22	23.5	25.5	195	7.0	10	50	5	.085
UZ 5824	24	25.5	28.0	180	6.5	10	50	5	.09
UZ 5827	27	28.5	32.0	155	6.0	10	50	6	.09
UZ 5830	30	32.0	35.0	140	5.5	10	40	8	.09
UZ 5833	33	35.0	38.0	130	5.0	5	40	10	.095
UZ 5836	36	38.0	42.0	120	4.5	5	30	11	.095
UZ 5840	40	42.5	47.0	105	4.0	5	30	14	.095
UZ 5845	45	47.5	52.5	95	3.5	5	30	20	.095
UZ 5850	50	52.5	58.0	85	3.0	5	25	25	.095
UZ 5856	56	59.0	64.5	80	2.8	5	20	35	.095
UZ 5860	60	63.0	68.5	75	2.5	5	20	40	.100
UZ 5870	70	73.5	79.0	65	2.3	5	20	50	.100
UZ 5875	75	78.5	84.0	60	2.0	5	15	55	.100
UZ 5880	80	83.5	89.0	55	1.8	5	15	80	.100
UZ 5890	90	93.5	99.5	50	1.6	5	15	90	.100
UZ 5210	100	104	110	45	1.4	5	10	90	.100
UZ 5211	110	114	120	40	1.2	5	10	125	.100
UZ 5212	120	124	131	38	1.0	5	10	170	.100
UZ 5213	130	134	142	35	.80	5	10	190	.105
UZ 5214	140	145	153	33	.80	5	8	230	.105
UZ 5215	150	156	164	31	.75	5	8	330	.105
UZ 5216	160	167	175	30	.70	5	8	350	.105
UZ 5217	170	177	186	27	.65	5	8	380	.105
UZ 5218	180	188	198	25	.60	5	5	450	.110
UZ 5219	190	198	210	24	.55	5	5	470	.110
UZ 5220	200	210	223	22	.50	5	5	500	.110
UZ 5222	220	231	247	20	.45	5	5	550	.115
UZ 5224	240	252	270	18	.40	5	5	650	.115
UZ 5226	260	272	292	17	.35	5	5	750	.120
UZ 5228	280	292	314	16	.30	5	4	850	.120
UZ 5230	300	313	336	15	.25	5	4	950	.120
UZ 5232	320	333	358	14	.24	5	4	1100	.120
UZ 5234	340	354	380	13	.23	5	4	1200	.120
UZ 5236	360	374	403	12	.22	5	3	1400	.120
UZ 5238	380	395	427	12	.21	5	3	1500	.120
UZ 5240	400	415	450	11	.20	5	3	1800	.120

*Specify 5% voltage tolerance by changing second numeral of type number from 8 to 7. (UZ 5809 becomes UZ 5709) or from 2 to 1 (UZ 5211 becomes UZ 5111).
Specify 20% voltage tolerance by changing second numeral of type number from 8 to 9. (UZ 5809 becomes UZ 5909) or from 2 to 3 (UZ 5211 becomes UZ 5311).
††Figures shown are for a peak sinusoidal surge current of 8.3 msec. duration using 60-cycle AC.
†For mounting vs. rating information see Catalog C159.

Zener Diodes-3 Watt (Body A)

Part No ±10% Tolerance*	Nominal Voltage at Test Current	Max. Cont. Current	Max. Surge Current	Max. Leakage Current at 25°C	Test Current	Max. Zener Impedance**	Typical Temp. Coeff.
UZ 806	6.8V	440mA	10.0A	500μA	75mA	2 ohms	.04%/°C
UZ 807	7.5	400	8.0	300	75	2	.04
UZ 808	8.2	360	7.0	200	75	3	.05
UZ 809	9.1	330	6.0	100	75	3	.05
UZ 810	10	300	5.0	40	75	4	.06
UZ 812	12	250	4.0	10	65	5	.07
UZ 813	13	230	4.0	10	50	6	.07
UZ 814	14	210	4.0	10	50	6	.07

Zener Diodes-3 Watt (Body A) (Cont.)

Part No. ±10% Tolerance*	Nominal Voltage at Test Current	Max. Cont. Current	Max. Surge Current	Max. Leakage Current at 25°C	Test Current	Max. Zener Impedance**	Typical Temp. Coeff.
UZ 815	15	200	3.0	10	50	6	.07
UZ 816	16	185	3.0	5	50	7	.07
UZ 818	18	170	2.0	5	40	8	.08
UZ 820	20	150	2.0	5	40	9	.08
UZ 822	22	135	2.0	5	30	10	.08
UZ 824	24	125	1.5	5	30	10	.08
UZ 827	27	110	1.5	1	25	12	.09
UZ 830	30	100	1.5	1	25	15	.09
UZ 833	33	90	1.2	1	20	21	.09
UZ 836	36	85	1.0	1	20	21	.09
UZ 840	40	75	1.0	1	20	27	.095
UZ 845	45	65	0.8	1	15	37	.095
UZ 850	50	60	0.8	1	15	50	.095
UZ 856	56	55	.70	1	10	70	.095
UZ 860	60	50	.60	1	10	70	.095
UZ 870	70	45	.60	1	10	90	.095
UZ 875	75	40	.50	1	10	100	.095
UZ 880	80	35	.40	1	10	115	.095
UZ 890	90	30	.40	1	8.0	150	.095
UZ 210	100	30	.40	1	5.0	175	.100
UZ 211	110	25	.30	1	5.0	250	.100
UZ 212	120	25	.20	1	5.0	325	.100
UZ 213	130	20	.20	1	5.0	375	.100
UZ 214	140	20	.20	1	5.0	550	.100
UZ 215	150	20	.20	1	5.0	650	.100
UZ 216	160	20	.15	1	4.0	700	.100
UZ 217	170	18	.15	1	4.0	750	.100
UZ 218	180	18	.10	1	4.0	850	.100
UZ 219	190	15	.10	1	4.0	900	.100
UZ 220	200	15	.10	1	4.0	950	.100
UZ 222	220	15	.09	1	3.0	1100	.100
UZ 224	240	12	.09	1	3.0	1300	.105
UZ 226	260	12	.08	1	3.0	1500	.105
UZ 228	280	10	.08	1	3.0	1700	.105
UZ 230	300	10	.07	1	3.0	1900	.105
UZ 232	320	9	.07	1	2.0	2100	.105
UZ 234	340	9	.06	1	2.0	2400	.110
UZ 236	360	8	.06	1	2.0	2700	.110
UZ 238	380	8	.06	1	2.0	3000	.110
UZ 240	400	7	.06	1	2.0	3500	.110

*Specify 5% voltage tolerance by changing first numeral of type number from 8 to 7. (UZ 809 becomes UZ 709) or from 2 to 1 (UZ 211 becomes UZ 111).
Specify 20% voltage tolerance by changing first numeral of type number from 8 to 9. (UZ 809 becomes UZ 909) or from 2 to 3 (UZ 211 becomes UZ 311).

MILITARY TYPE RECTIFIERS AND ZENER DIODES

JAN Rectifiers-2 amp. Meets MIL-S-19500/228 (Body A)

TYPE	PIV	Max. Av. D.C. Output Current T_A	100°C	Min. Forward Current at 25°C	Max. Reverse Current at PIV 25°C	100°C	Max. Peak One Cycle Surge Sinusoidal 8.3 msec
JAN 1N3611	200V	2.0A @ 25°C	1.0A	1.0A @ 1.2V	1μA	75μA	20A
JAN 1N3612	400	2.0	1.0	1.0	1	75	20
JAN 1N3613	600	2.0	1.0	1.0	1	75	20
JAN 1N3614	800	2.0	1.0	1.0	1	75	20

JAN & JAN TX Fast Recovery Rectifiers - 1 amp. Meets MIL-S-19500/359A (Body A)

150nsec max. recovery time

JAN & JAN TX 1N4942	200	1.0 @ 55°C	.75	1.0 @ 1.3V	1	200	15
JAN & JAN TX 1N4944	400	1.0	.75	1.0	1	200	15
JAN & JAN TX 1N4946	600	1.0	.75	1.0	1	200	15

JAN Zener Diodes-5 Watts 5% Tolerance Meets MIL-S-19500/356 (Body B)

Part No.	Voltage Vnom at Iz 1250 mW	Vz at 2 Iz 2500 mW	Vz at 1 max. 5000 mW	Max. Cont. Current*	Max. Surge Current†	Max. Leakage Current at 25°C	Test Current Iz	Max. Zener Imped. Zz at Iz	Typical Temp. Coeff. Tz at Iz
JAN 1N4958	10V	10.3V	10.8V	475mA	20A	25μA	125mA	2 ohms	.07%/°C
JAN 1N4959	11	11.4	12.0	430	19	10	125	2.5	.07
JAN 1N4960	12	12.4	13.0	395	18	10	100	2.5	.07
JAN 1N4961	13	13.4	15.5	365	16	10	100	3	.08
JAN 1N4962	15	15.5	16.8	315	12	5	75	3.5	.08
JAN 1N4963	16	16.5	18.0	294	10	5	75	3.5	.08
JAN 1N4964	18	18.8	19.5	264	9.0	5	65	4	.085
JAN 1N4965	20	21.2	23.0	237	8.0	2	65	4.5	.085
JAN 1N4966	22	23.5	25.5	216	7.0	2	50	5	.085
JAN 1N4967	24	25.5	28.0	198	6.5	2	50	5	.09
JAN 1N4968	27	28.5	32.0	176	6.0	2	50	6	.09
JAN 1N4969	30	32.0	35.0	158	5.5	2	40	8	.09
JAN 1N4970	33	35.0	38.0	144	5.0	2	40	10	.095
JAN 1N4971	36	38.0	42.0	132	4.5	2	30	11	.095
JAN 1N4972	39	41.5	46.0	122	4.0	2	30	14	.095
JAN 1N4973	43	45.5	50.5	110	3.5	2	30	20	.095
JAN 1N4974	47	49.5	54.5	100	3.2	2	25	25	.095
JAN 1N4975	51	53.5	59.0	92	3.0	2	25	27	.095
JAN 1N4976	56	59.0	64.5	84	2.8	2	20	35	.095
JAN 1N4977	62	65.0	70.5	76	2.5	2	20	42	.100
JAN 1N4978	68	71.5	77.0	70	2.2	2	20	50	.100
JAN 1N4979	75	78.5	84.0	63	2.0	2	20	55	.100
JAN 1N4980	82	85.5	91.0	58	1.8	2	15	80	.100
JAN 1N4981	91	94.5	100.5	52.5	1.6	2	15	90	.100
JAN 1N4982	100	104	110	47.5	1.4	2	12	110	.100
JAN 1N4983	110	114	120	43.0	1.2	2	12	125	.100
JAN 1N4984	120	124	131	39.5	1.0	2	10	170	.100
JAN 1N4985	130	134	142	36.5	.80	2	10	190	.105
JAN 1N4986	150	156	164	31.6	.75	2	8	330	.105
JAN 1N4987	160	167	165	29.4	.70	2	8	350	.105
JAN 1N4988	180	188	198	26.4	.60	2	5	430	.110
JAN 1N4989	200	210	223	23.6	.50	2	5	480	.110
JAN 1N4990	220	231	247	21.6	.50	2	5	550	.115

*Ratings are based on methods of mounting shown in Catalog C-159.
†Figures shown are for a peak sinusoidal surge current of 8.3 msec. duration using 60-cycle AC.

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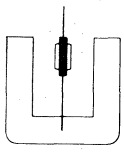

UNITRODE

High Voltage Stacks

TYPE	PIV	Max. Av. DC Output Current 25°C—Air	Max. Av. DC Output Current 50°C—Oil	Max. Forward Voltage Drop at 25°C	Max. Reverse Current at PIV 25°C	Max. Reverse Current at PIV 100°C	Peak Surge Sinusoidal 8.3 msec	Body Size
US 12	1200V	1000mA	2500mA	2.0V @ 400mA	2μA	100μA	20A	A
US 15	1500	800	2000	3.0V @ 400	2	100	20	A
US 18	1800	700	1750	3.0V @ 400	2	100	20	A
US 20	2000	600	1500	4.0V @ 400	2	100	20	A
US 25	2500	600	1500	5.0V @ 400	2	100	20	B
US 30	3000	500	1250	6.0V @ 400	2	100	20	B
US 35	3500	400	1000	7.0V @ 200	2	100	15	C
US 40	4000	350	850	7.0V @ 200	2	100	15	C
US 45	4500	300	750	8.0V @ 200	2	100	15	D
US 50	5000	300	750	9.0V @ 200	2	100	15	D
US 60	6000	200	500	10.0V @ 200	2	100	15	D
US 70	7000	200	500	12.0V @ 200	2	100	15	D
US 80	8000	150	375	14.0V @ 100	2	100	10	E
US 100	10000	150	375	17.0V @ 100	2	100	10	E
US 120	12000	150	375	21.0V @ 100	2	100	10	E
US 150	15000	100	250	26.0V @ 100	2	100	10	E
US 180	18000	80	200	31.0V @ 100	2	100	10	E
US 200	20000	80	200	34.0V @ 100	2	100	10	E

Fast Recovery Stacks

TYPE	PIV	Max. Av. DC Output Current 25°C—Air	Max. Av. DC Output Current 50°C—Oil	Max. Forward Voltage Drop at 25°C	Max. Reverse Recovery Time*	Max. Reverse Current at PIV 25°C	Max. Reverse Current at PIV 100°C	Peak Surge Sinusoidal 8.3 msec	Body Size
USR 12	1200V	750mA	1850mA	3.3V @ 400mA	500nsec	5μA	150μA	15A	A
USR 15	1500	600	1500	4.0V @ 400	500	5	150	15	A
USR 20	2000	500	1250	5.5V @ 400	500	5	150	15	B
USR 25	2500	400	1000	6.6V @ 400	500	5	150	15	B
USR 30	3000	400	1000	7.7V @ 400	500	5	150	15	C
USR 35	3500	350	850	8.8V @ 200	500	5	150	10	C
USR 40	4000	300	750	9.9V @ 200	500	5	150	10	D
USR 45	4500	250	625	11.0V @ 100	500	5	150	10	D
USR 50	5000	250	625	13.0V @ 100	500	5	150	10	D
USR 60	6000	150	375	15.4V @ 100	500	5	150	10	D
USR 70	7000	150	375	17.6V @ 100	500	5	150	10	E
USR 80	8000	125	300	20.0V @ 100	500	5	150	10	E
USR 100	10000	125	300	24.0V @ 100	500	5	150	10	E
USR 120	12000	100	250	31.0V @ 100	500	5	150	10	E
USR 150	15000	80	200	33.0V @ 100	500	5	150	10	E
USR 180	18000	75	175	35.0V @ 100	500	5	150	10	E

*Measured in a reverse recovery circuit switching from 10 mA forward to 10 mA reverse current recovery to 5 mA.

High Voltage Bridges - Single Phase

TYPE	PIV Per Leg	Max. Av. DC Output Current 25°C—Air	Max. Av. DC Output Current 50°C—Oil	Max. Forward Voltage Drop Per Leg at 25°C	Max. Reverse Current Per Leg at PIV 25°C	Max. Reverse Current Per Leg at PIV 100°C	Peak Surge Sinusoidal 8.3 msec	Body Size**
673-1	100V	1.5A	2.5A	1.1V @ 500mA	2μA	100μA	25A	G & S
673-2	200	1.5	2.5	1.1V @ 500	2	100	25	G & S
673-3	300	1.5	2.5	1.1V @ 500	2	100	25	G & S
673-4	400	1.5	2.5	1.1V @ 500	2	100	25	G & S
673-5	500	1.5	2.5	1.1V @ 500	2	100	25	G & S
673-6	600	1.5	2.5	1.1V @ 500	2	100	25	G & S
673-7	1200	.600	1.5	2.2V @ 400	2	100	15	H
673-75	1800	.500	1.25	3.3V @ 400	2	100	15	J
673-8	2400	.400	1.0	4.4V @ 400	2	100	15	K
673-85	3000	.300	.75	5.5V @ 300	2	100	15	L
673-9	3600	.200	.5	6.6V @ 200	2	100	15	M
673-10	4200	.180	.45	7.7V @ 200	2	100	15	N
673-11	4800	.160	.40	8.8V @ 150	2	100	15	O
673-12	5000	.160	.40	9.0V @ 150	2	100	15	O

Fast Recovery Bridges - Single Phase

TYPE	PIV Per Leg	Max. Av. DC Output Current 25°C—Air	Max. Av. DC Output Current 50°C—Oil	Max. Forward Voltage Drop Per Leg at 25°C	Max. Reverse Recovery Time nano-sec.*	Max. Reverse Current Per Leg at PIV 25°C	Max. Reverse Current Per Leg at PIV 100°C	Peak Surge Sinusoidal 8.3 msec	Body Size**
676-1	100V	1.0A	1.8A	1.1V @ 500mA	500	5μA	150μA	20A	G & S
676-2	200	1.0	1.8	1.1V @ 500	500	5	150	20	G & S
676-3	300	1.0	1.8	1.1V @ 500	500	5	150	20	G & S
676-4	400	1.0	1.8	1.1V @ 500	500	5	150	20	G & S
676-5	500	1.0	1.8	1.1V @ 500	500	5	150	20	G & S
676-6	600	1.0	1.8	1.1V @ 500	500	5	150	20	G & S
676-12	1200	.400	1.0	3.3V @ 300	500	5	150	10	J
676-18	1800	.350	.850	4.4V @ 200	500	5	150	10	K
676-24	2400	.325	.800	5.5V @ 200	500	5	150	10	L
676-30	3000	.250	.625	7.7V @ 200	500	5	150	10	M
676-36	3600	.175	.425	8.8V @ 150	500	5	150	10	N
676-42	4200	.150	.375	9.9V @ 150	500	5	150	10	O
676-48	4800	.135	.325	11.0V @ 150	500	5	150	10	P
676-50	5000	.125	.300	11.0V @ 150	500	5	150	10	P

Ultra Fast Recovery Bridges - Single Phase

677-1	50	1.0	1.8	1.1V @ 500	75	2	100	20	G & S
677-2	100	1.0	1.8	1.1V @ 500	75	2	100	20	G & S
677-3	150	1.0	1.8	1.1V @ 500	75	2	100	20	G & S
677-4	200	1.0	1.8	1.1V @ 500	75	2	100	20	G & S

*Measured in a reverse recovery circuit switching from 10 mA forward to 10 mA reverse current recovery to 5 mA.
**When specifying body size S, add suffix S, i.e. 673-1S

High Voltage Doorbell® Rectifier Modules

For both new equipment and rectifier tube replacement applications

Standard Modules

Type	Max. Av. D.C. Current Output 75°C Case Air	Max. Av. D.C. Current Output 60°C Case with Extender Plate-Air*	Max. Av. D.C. Current Output 50°C Oil	PIV	Max. Rev. Current at PIV	Max. Forward Voltage Drop	Max. Rev. Recovery Time†	Max. Rev. Transient Energy Absorption	Outline
200 amp. surge**									
UGE 2.5	6.6A	8.25A	10.0A	2.5KV	10μA	5V @ 3.3A	—	8 joules	G
UDE 2.5††	6.0	7.0	7.7	2.5	10	5 3.0	—	8	D
UGE 5	5.0	6.25	7.5	5	15	10 2.5	—	14	G
UDE 5††	4.5	5.0	5.5	5	10	10 2.2	—	14	D
UGE 7.5	3.3	4.1	5.0	7.5	10	13 1.6	—	20	G
100 amp. surge**									
UGB 5	4.4	5.5	6.6	5	5	9 2.2	—	7	G
UGB 7.5	3.0	3.75	5.0	7.5	5	13 1.5	—	10	G
UDB 2.5	3.0	3.75	5.0	2.5	5	4 1.5	—	4	D
UGB 10	2.3	2.85	3.5	10	5	17 1.1	—	14	G
UDB 5	2.0	2.5	2.75	5	5	8 1.0	—	8	D
UDB 7.5	1.33	1.65	2.0	7.5	5	12 0.7	—	12	D
30 amp. surge**									
UDA 5	1.65	2.0	2.2	5	2	8 .82	—	1.5	D
UDA 7.5	1.25	1.55	1.75	7.5	2	12 .60	—	2.5	D
UDA 10	1.0	1.25	1.40	10	2	16 .50	—	3	D
UDA 15	0.67	0.8	0.90	15	2	25 .33	—	5	D

Fast Recovery Modules

Type	Max. Av. D.C. Current Output 75°C Case Air	Max. Av. D.C. Current Output 60°C Case with Extender Plate-Air*	Max. Av. D.C. Current Output 50°C Oil	PIV	Max. Rev. Current at PIV	Max. Forward Voltage Drop	Max. Rev. Recovery Time†	Max. Rev. Transient Energy Absorption	Outline
150 amp. surge**									
UGF 2.5	5.0	6.25	8.0	2.5	10	6 2.5	500nsec	8	G
UDF 2.5††	4.5	5.0	5.3	2.5	10	6 2.2	500	8	D
UGF 5	3.75	4.7	6.0	5	10	11 1.8	500	14	G
UDF 5††	3.3	4.0	4.4	5	10	11 1.6	500	14	D
UGF 7.5	2.5	3.1	4.0	7.5	10	17 1.2	500	20	G
80 amp. surge**									
UGD 5	3.3	4.1	4.8	5	5	11 1.6	500	7	G
UGD 7.5	2.25	2.8	3.5	7.5	5	17 1.1	500	10	G
UDD 2.5	2.25	2.8	3.3	2.5	5	6 1.2	500	4	D
UGD 10	1.75	2.2	2.5	10	5	22 .85	500	14	G
UDD 5	1.5	1.85	2.0	5	5	11 .75	500	8	D
UDD 7.5	1.0	1.25	1.5	7.5	5	17 .50	500	12	D
25 amp. surge**									
UDC 5	1.2	1.5	1.7	5	2	10 .70	500	1.5	D
UDC 7.5	0.9	1.1	1.25	7.5	2	15 .50	500	2.5	D
UDC 10	0.75	0.9	1.0	10	2	20 .37	500	3	D
UDC 15	0.5	0.6	0.7	15	2	30 .25	500	5	D

†Reverse recovery time is measured in a circuit switching from 10mA forward current to 10mA reverse current recovering to 5mA.

*These ratings are based on using "extender plates" that provide additional surface area to radiate heat.

††Ratings are based on a case temperature of 100°C.

**Forward Surge Ratings: Single cycle peak surge rating for an 8.3msec sinusoidal surge is shown.

MAGNUM HIGH-CURRENT RECTIFIER ASSEMBLIES

25 Amp Three Phase Bridges

Part No.	PIV Per Leg	Average D.C. Output Current Io 55°C case temp	Average D.C. Output Current Io 100°C case temp	Max. Forward Voltage Drop Per Leg at 25° V_F	Max. Reverse Leakage Current Per Leg at PIV I_R 25°C	Max. Reverse Leakage Current Per Leg at PIV I_R 100°C	Non-Repetitive Sinusoidal Surge 8.3 msec I_S @ 100°C
678-1	100V	25A	18.5A	1.2V @ 10A	10μA	200μA	150A
678-2	200	25	18.5	1.2	10	200	150
678-3	300	25	18.5	1.2	10	200	150
678-4	400	25	18.5	1.2	10	200	150
678-5	500	25	18.5	1.2	10	200	150
678-6	600	25	18.5	1.2	10	200	150

25 Amp Single Phase Bridges

679-1	100V	25A	18.5A	1.2V @ 10A	10μA	200μA	150A
679-2	200	25	18.5	1.2	10	200	150
679-3	300	25	18.5	1.2	10	200	150
679-4	400	25	18.5	1.2	10	200	150
679-5	500	25	18.5	1.2	10	200	150
679-6	600	25	18.5	1.2	10	200	150

10 Amp Single Phase Bridges

680-1	100V	10A	6A	1.2V @ 2A	2μA	50μA	50A
680-2	200	10	6	1.2	2	50	50
680-3	300	10	6	1.2	2	50	50
680-4	400	10	6	1.2	2	50	50
680-5	500	10	6	1.2	2	50	50
680-6	600	10	6	1.2	2	50	50

12 Amp Doublers and Center Tap Rectifiers

681-1†	100V	15A	10A	1.2V @ 10A	10μA	200μA	150A
681-2	200	15	10	1.2	10	200	150
681-3	300	15	10	1.2	10	200	150
681-4	400	15	10	1.2	10	200	150
681-5	500	15	10	1.2	10	200	150
681-6	600	15	10	1.2	10	200	150

†Add suffix P, N, or D for terminal configuration P, N, or D. For example, for center tap configuration P, order 681-1P.

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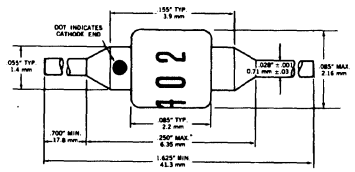
UNITRODE®

LEADED DIODE
Mechanical Outlines

BODY A



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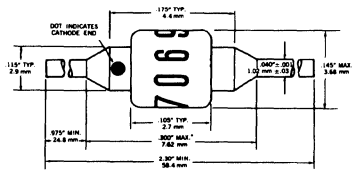
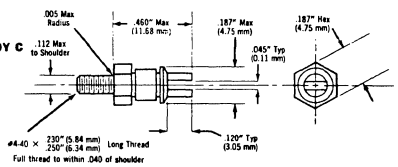
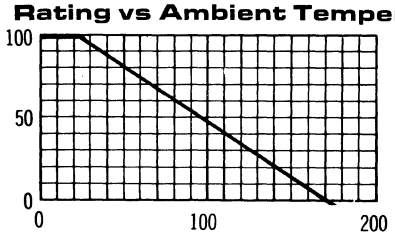


BODY C



Rating vs Ambient Temperature



Lead Information

Standard diodes are supplied with "Fine" grade solid silver leads for maximum solderability. For welding or other applications, consult your Unitrode representative for optimum lead material. Tinned copper, nickel clad silver (gold plated), and nickel (gold plated) are denoted by the following suffix letters:

Body	Lead Material	Lead Length	Lead Diameter	Suffix Letter
A	Silver (Standard)	0.7"	0.028"	None
	Copper-tinned	1.0"	0.028"	S
	Nickel-clad silver, gold plated	0.7"	0.028"	T
	Nickel-clad silver	0.7"	0.028"	U
	Nickel, gold plated	1.0"	0.020"	V
B	Silver (Standard)	1.0"	0.040"	None
	Copper, tinned	1.0"	0.040"	Q

UNITRODE
Technical Literature

The following is a listing of catalogs, data sheets, and application notes currently available from Unitrode. Send requests to Literature Dept. EEM, Unitrode Corp., 580 Pleasant Street, Watertown, Massachusetts 02172

Catalogs

C-146 Silicon Diodes, Rectifiers, Zeners and High Voltage Assemblies
C-159 Avalanche Rectifiers and Zener Diodes

Application Notes

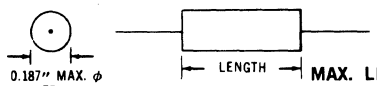
N-130B Doorbell Module Rectifier Tube-Replacement Application Data
N-136 Doorbell Module Application Data
M-139 Application of P.I.N. Diodes in Duplexer Applications

Data Sheets

T-126 Doorbell Rectifier Modules
Z-127 10 Watt High Surge Zener Diodes
R-128 Ultra Fast Recovery 4 Amp Rectifier
M-138 High Power P.I.N. Microwave Diodes
R-142 JAN1N3611 General Purpose 2 Amp Rectifiers
T-143 Miniature High Voltage Rectifier Bridges
R-144 JAN & JAN TX 1N4942 Fast Recovery 1 Amp Rectifiers
ZR-150 Insulated Stud Rectifiers and Zener Diodes
T-160 MAGNUM High Current Rectifier Assemblies

UNITRODE CORPORATION
582 PLEASANT STREET • WATERTOWN, MASSACHUSETTS 02172 •
TELEPHONE (617) 926-0404 • TWX (710) 327-1296 • TELEX 922-414

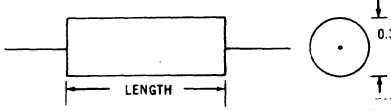
Rectifier Assembly Mechanical Outlines
High Voltage Stacks



MAX. LENGTHS

A	B	C
0.50" 12.70 mm	0.85" 21.60 mm	1.125" 28.60 mm

Body A Leads: .028" tinned copper, 0.75" (min.) long



MAX. LENGTHS

D	E
0.625" 18.88 mm	1.0" 25.40 mm

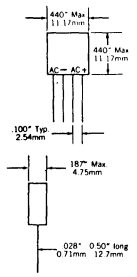
Body B three E leads: .028" tinned copper, 1.25" (min.) long.

High Voltage Bridges

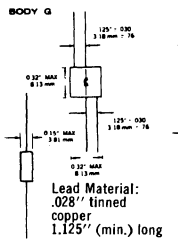
Lead Material Body G .028" diam. tinned copper (0.58 mm)

Lead Length 1.25" min. (31.8 mm)

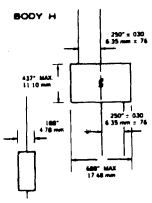
BODY S



BODY G



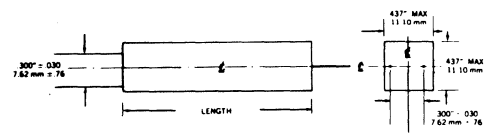
BODY H



Lead Material: .028" tinned copper 1.125" (min.) long

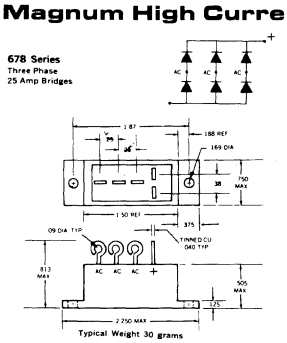
BODY J through P

Body H through P .032" diam. tinned copper (0.81 mm)



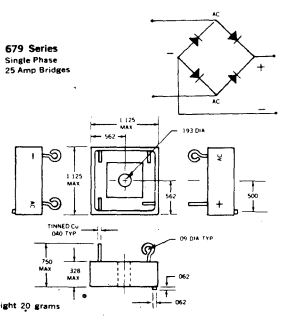
Magnum High Current Rectifier Assemblies

678 Series
Three Phase
25 Amp Bridges



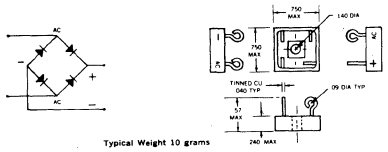
Typical Weight 30 grams

679 Series
Single Phase
25 Amp Bridges



Typical Weight 20 grams

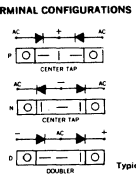
680 Series
Single Phase
10 Amp Bridges

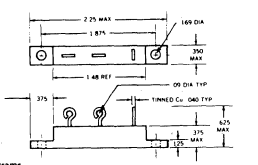


Typical Weight 10 grams

681 Series
15 Amp Doublers and Center Tap Rectifier

TERMINAL CONFIGURATIONS

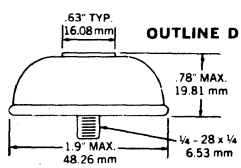




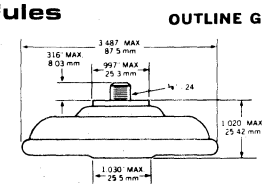
Typical Weight 10 grams

Doorbell® Rectifier Modules

OUTLINE D

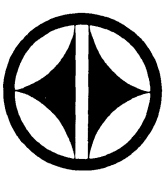


OUTLINE G



Polarity — Cathode connected to base

Look in the Yellow Section for Manufacturers' Sales Offices



Tell them you found them in **eem**

Semiconductor Products Rectifiers

Rectifiers

Westinghouse offers a full range of rectifier devices with current ratings from 1 through 500 amperes. JEDEC ratings have been further extended throughout the line. Epoxy is being used extensively to reduce costs to users.

Westinghouse medium and high power rectifiers feature high ambient temperature capability, long life, high efficiency, ruggedness, and freedom from thermal fatigue.

To obtain all the advantages of technical excellence, competitive prices, and guaranteed reliability, specify the Lifetime Guaranteed rectifier marked with this symbol ✚.

Rectifiers are grouped by half-wave average current ratings. Ratings shown apply at case temperatures indicated. All surge ratings are peak one-half cycle currents at 60 Hz. Surge ratings apply at maximum load. Voltage ratings shown are maximum repetitive peak reverse values. Most units have somewhat higher transient ratings. Reverse polarity. JEDEC types are designated "R". On non-JEDEC types, the second letter indicates reverse polarity devices are available.

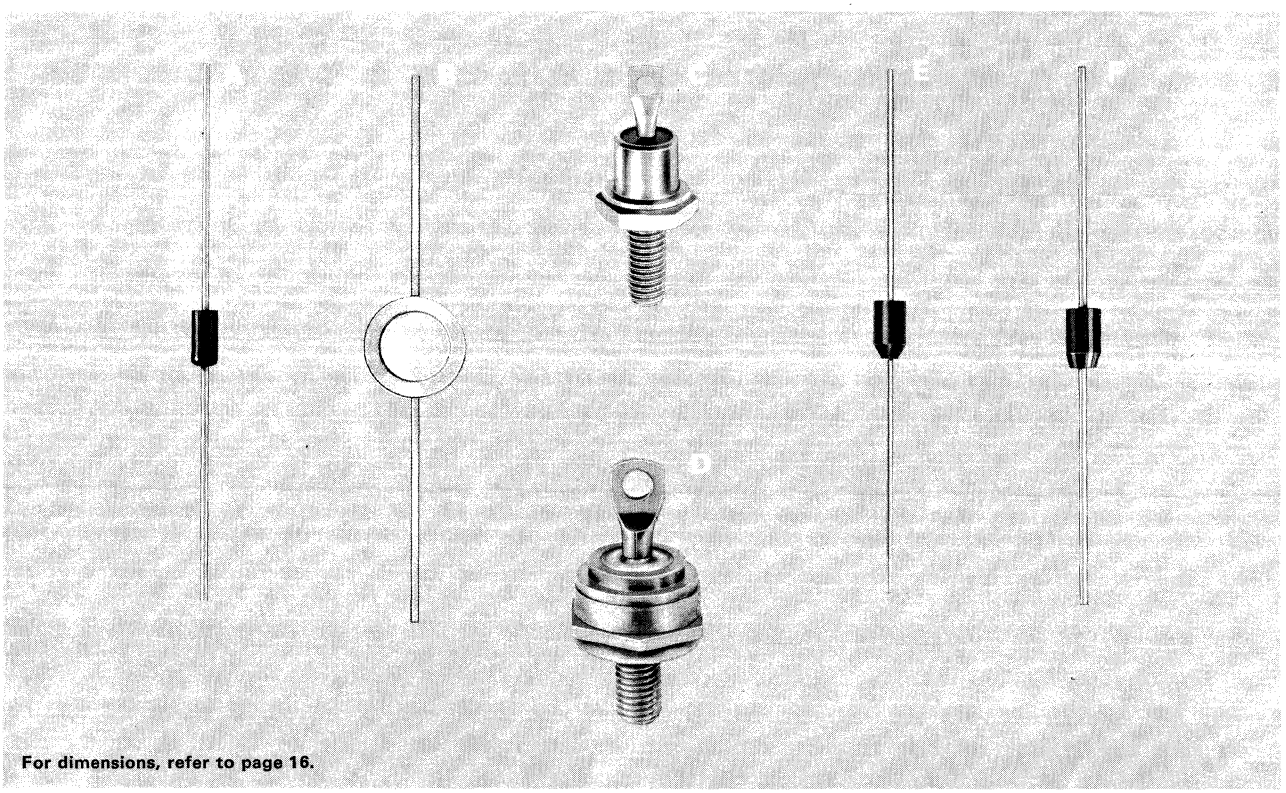
Fast Switching Rectifiers

Rating	1 Ampere	6 Amperes		12 Amperes		20 Amperes	35 Amperes
Photo	A	B	C	B	C	D	D
T_C	50°C (Amb.)	125°C	140°C	130°C	140°C	100°C	100°C
I_{surge}	35A	150A	200A	200A	240A	300A	500A
Recov. Time	120 ns	100 ns	200 ns	100 ns	200 ns	200 ns	200 ns
Type	388✚	3781✚	478✚	3791✚	479✚	425✚	424✚
50 Volts	388A	3781A	1N3879	3791A	1N3889●	1N3899, R	1N3909, R●
100	388B	3781B	1N3880●	3791B	1N3890●	1N3900, R	1N3910, R●
150	388C	3781C	478C	3791C	479C	425C, CR	424C, CR
200	388D	3781D	1N3881●	3791D	1N3891●	1N3901, R	1N3911, R●
300	388F	3781F	1N3882	3791F	1N3892●	1N3902, R	1N3912, R
400	388H	3781H	1N3883●	3791H	1N3893●	1N3903, R	1N3913, R
500	388K	.....	478K	.....	479K	425K, KR	424K, KR
600	388M	.....	478M	.....	479M	425M, MR	424M, MR
Data Sheet			54-162: 21, 22	54-162: 1, 2	54-162: 19, 20	54-164: 9, 10	54-164: 7, 8

● Military types available.

Low Power Rectifiers

Rating	1.5 Amperes		3 Amperes
Photo	E	A	F
$T_{ambient}$	40°C	40°C	50°C
I_{surge}	50A	50A	200A
Type	JEDEC✚	384✚	398✚
50 Volts	1N4816	1N5391	1N5400
100	1N4817	1N5392	1N5401
200	1N4818	1N5393	1N5402
300	1N4819	1N5394	1N5403
400	1N4820	1N5395	1N5404
500	1N4821	1N5396	1N5405
600	1N4822	1N5397	1N5406
700	1N5052	384P	398P
800	1N5053	1N5398	1N5407
1000	1N5054	1N5399	1N5408
Data Sheet	54-161: 3, 4	54-171: 1, 2	54-171: 3, 4



For dimensions, refer to page 16.

Westinghouse

Medium Power Rectifiers

Rating	5 Amperes	6 Amperes		12 Amperes		15 Amperes		
Photo	C	G	C	G	C	C	G	H
T_{case}	150°C	150°C	150°C	150°C	150°C	130°C	125°C	150°C
I_{surge}	150A	150A	150A	240A	240A	240A	250A	250A
Type	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	368	409①	703
50 Volts	1N1612	1N1341, R	1N1341A, AR	1N1199, R	1N1199A, AR	368A	409A	703A, AR
100	1N1613	1N1342, R	1N1342A, AR	1N1200, R	1N1200A, AR	368B	409B	703B, BR
150	.....	1N1343, R	1N1343A, AR	1N1201, R	1N1201	368C	409C	.....
200	1N1614 ●	1N1344, R	1N1344A, AR	1N1202, R	1N1202A ●, AR	368D	409D	.....
300	.....	1N1345, R	1N1345A, AR	1N1203, R	1N1203A, AR	368F	409F	.....
400	1N1615 ●	1N1346, R	1N1346A, AR	1N1204, R	1N1204A ●, AR	368H	409H	.....
500	.....	1N1347, R	1N1347A, AR	1N1205, R	1N1205A, AR	368K	409K	.....
600	1N1616 ●	1N1348, R	1N1348A, AR	1N1206, R	1N1206A ●, AR	368M	409M	.....
700	.....	.....	1N3987A, AR	.....	1N3670A, AR	368P	409P	.....
800	1N4458	.....	1N3988A, AR	.....	1N3671A, AR	368S	409S	.....
900	.....	.....	1N3989A, AR	.....	1N3672A, AR	368V	409V	.....
1000	1N4459	.....	1N3990A, AR	.....	1N3673A, AR	368Z	409Z	.....
Data Sheet		54-162: 3, 4	54-162: 9, 10	54-162: 5, 6	54-162: 11, 12	54-172: 1, 2	54-172: 7, 8	

● Military types available.

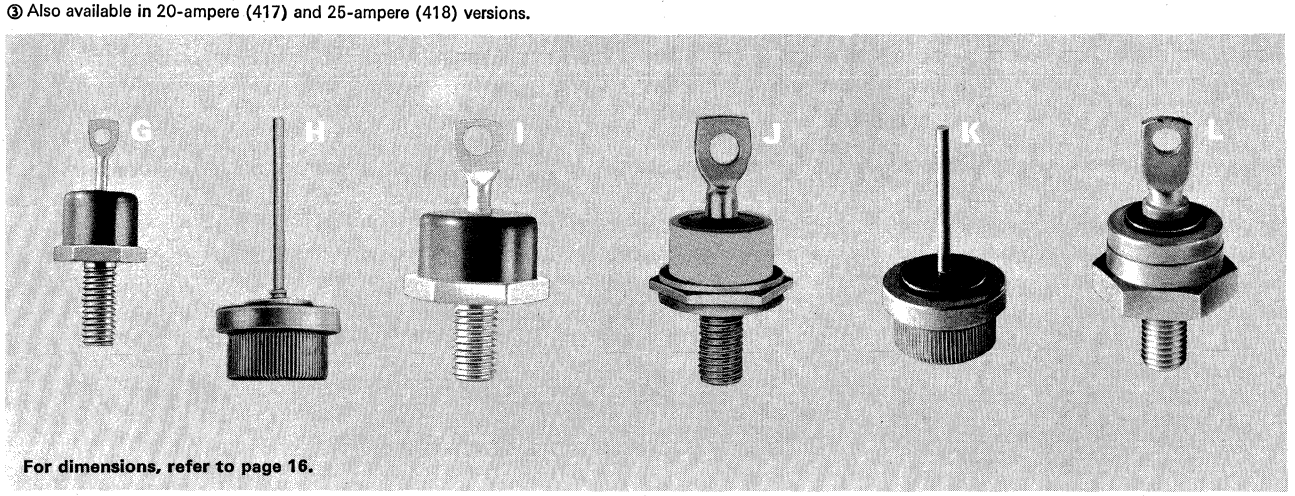
① Also available in 5-ampere (407) and 10-ampere (408) versions.

Rating	18 Amperes	20 Amperes		25 Amperes	35 Amperes			40 Amperes	
Photo	I	J	J	J	I	K	L	J	I
T_{case}	150°C	150°C	150°C	145°C	150°C	130°C	140°C	150°C	120°C
I_{surge}	220A	350A	500A	400A	500A	500A	500A	1000A	500A
Type	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	713②	714	JEDEC✚	419③
50 Volts	1N1191, R	1N248, A, B	1N1191A, R	1N2154, R	1N1183, R	713A, AR	714A, AR	1N1183A, AR	419A
100	1N1192, R	1N249, A, B ●	1N1192A, R	1N2155, R	1N1184, R	713B, BR	714B, BR	1N1184A ●, AR	419B
150	1N1193, R	.....	1N1193A, R	.....	1N1185, R	713C, CR	714C, CR	1N1185A, AR	419C
200	1N1194, R	1N250, A, B ●	1N1194A, R	1N2156, R	1N1186, R	713D, DR	714D, DR	1N1186A ●, AR	419D
300	1N1195, R	.....	1N1195A, R	1N2157, R	1N1187, R	713F, FR	714F, FR	1N1187A, AR	419F
400	1N1196, R	1N2135A ●	1N1196A, R	1N2158, R	1N1188, R	713H, HR	714H, HR	1N1188A ●, AR	419H
500	1N1197, R	.....	1N1197A, R	1N2159, R	1N1189, R	713K, KR	714K, KR	1N1189A, AR	419K
600	1N1198, R	1N1198A ●	1N1198A ●, R	1N2160, R	1N1190, R	713M, MR	714M, MR	1N1190A ●, AR	419M
700	.....	.....	.....	.....	.....	.....	.....	1N3765, R	419P
800	.....	.....	.....	.....	.....	.....	.....	1N3766, R	419S
900	.....	.....	.....	.....	.....	.....	.....	1N3767, R	419U
1000	.....	.....	.....	.....	.....	.....	.....	1N3768, R	419Z
Data Sheet	54-163: 1, 2				54-164: 1, 2			54-164: 3, 4	54-174: 7, 8

● Military types available.

② Also available in 15-ampere and 25-ampere versions.

③ Also available in 20-ampere (417) and 25-ampere (418) versions.



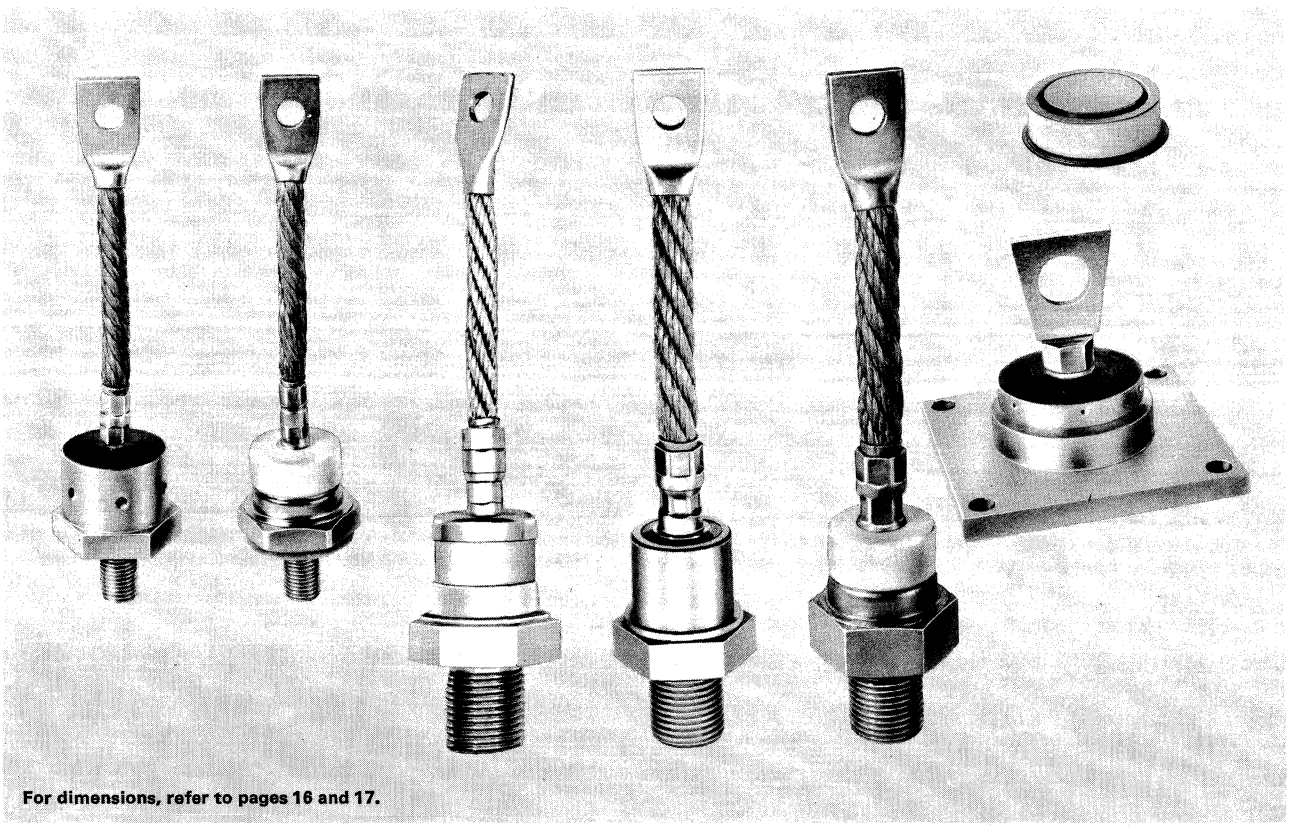
For dimensions, refer to page 16.

Semiconductor Products
Rectifiers

High Power Rectifiers

Rating	100 Amperes	150 Amperes			160 Amps	240 Amperes		275 Amps	300 Amps	400 Amps	500 Amps
Photo	M/N	N	M	M/N	O/P	O/P	Q	O/P	P	R	S
T_{case}	130°C	110°C	110°C	110°C	125°C	125°C	125°C	120°C	120°C	130°C	150°C
I_{surge}	2300A	3000A	3000A	3000A	2000A	3000A	4500A	5000A	5500A	5000A	8000A
Type	JEDEC✚	411✚	410✚	JEDEC✚	JEDEC✚	JEDEC✚	788✚	JEDEC✚	710✚	783✚	784✚
50 Volts	.....	.....	410A, R	.....	1N3260, R	1N3161, R	.....	1N4044, R	710A	.....	784A
100	1N3288A, AR	.....	410B, R	1N4587	1N3261, R	1N3162, R	.....	1N4045, R	710B	.....	784B
150	.....	.....	410C, R	.....	1N3262, R	1N3163, R	.....	1N4046, R	710C	.....	784C
200	1N3289A●, AR	.....	410D, R	1N4588	1N3263●, R	1N3164●, R	.....	1N4047, R	710D	.....	784D
250	.....	.....	410E, R	.....	1N3264, R	1N3165, R	.....	1N4048, R	710E	.....	.....
300	1N3290A, AR	.....	410F, R	1N4589	1N3265, R	1N3166, R	.....	1N4049, R	710F	.....	784F
350	.....	.....	.....	.....	1N3266, R	1N3167, R	.....	.....	.....	.....	.....
400	1N3291A●, AR	411H, R	410H, R	1N4590	1N3267●, R	1N3168●, R	.....	1N4050, R	710H	.....	784H
500	1N3292B, BR	411K, R	410K, R	1N4591	1N3268, R	1N3169, R	.....	1N4051, R	710K	.....	784K
600	1N3293A●, AR	411M, R	410M, R	1N4592	1N3269●, R	1N3170●, R	.....	1N4052, R	710M	783M	784M
700	.....	411P, R	.....	.....	1N3270, R	1N3171A, AR	.....	1N4053, R	710P	783P	784P
800	1N3294A●, AR	411S, R	.....	1N4593	1N3271, R	1N3172A, AR	.....	1N4054, R	710S	783S	784S
900	.....	411V, R	.....	.....	1N3272, R	1N3173A, AR	.....	1N4055, R	710V	783V	784V
1000	1N3295A, AR	411Z, R	.....	1N4594	1N3273, R	1N3174A, AR	.....	1N4056, R	710Z	783Z	784Z
1200	1N3296A, AR	411ZD, R	.....	1N4595	1N3274, R	.....	788ZD	.....	710ZD	783ZD	.....
1400	1N3297A, AR	411ZH, R	.....	1N4596	1N3275, R	.....	788ZH	.....	.....	783ZH	.....
1600	.....	.....	.....	.....	1N3276, R	.....	788ZM	.....	.....	783ZM	.....
1800	.....	.....	.....	.....	.....	.....	788ZS	.....	.....	783ZS	.....
2000	.....	.....	.....	.....	.....	.....	788ZZ	.....	.....	783ZZ	.....
Data Sheet	54-166: 1, 2	54-166: 1, 2	54-166: 1, 2	54-166: 3, 4	54-167: 1, 2	54-168: 5-8		54-168: 1, 2	54-168: 3, 4		

● Military types available.



For dimensions, refer to pages 16 and 17.

Westinghouse

Thyristors

Westinghouse thyristors are designed for reliable operation under severe operating conditions. All are 100% power-tested. They employ center-fire gate construction for faster turn-on time and lower switching losses. Most have exclusive Westinghouse compression-bonded encapsulation which eliminates solder fatigue. And, all standard thyristors carry the exclusive Westinghouse lifetime guarantee. In addition, full capacity devices give you increased current ratings, high surge current, high blocking voltage, and high dv/dt capabilities plus guaranteed repetitive di/dt ratings, low gate currents, and low thermal impedance.

The new high temperature series (40-175 amps) offers the above features in a device with a 150°C junction temperature. The fast-switching thyristors (40-300 amps) offer the fastest turn-off times available in the industry. These fast turn-off times in conjunction with our low dynamic forward voltage drop (dynamic turn-on) make these the best inverter devices on the market.

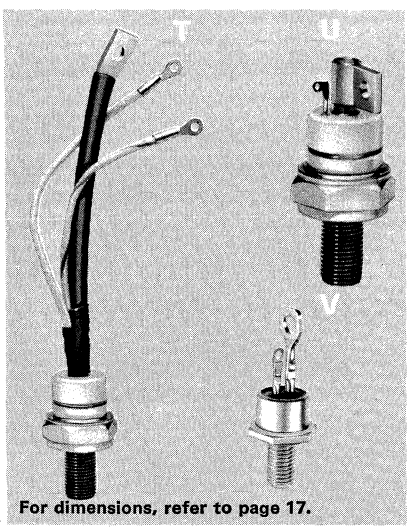
SCR types are listed by half sine-wave average current rating at 180 degree conduction angle. Surge ratings are peak one-half cycle currents at 60 Hz. Voltage ratings are maximum steady state blocking voltages. Transient voltage ratings and other design parameters are shown on the technical data sheets referenced at the bottom of the tables.

Fast Switching Thyristors①

Rating	40 Amperes			80 Amperes			125 Amperes				175 Amperes	
Photo	T/U	T/U	T/U	T/U	T/U	T/U	W	W	X	X	X	X
I_{rms}	63A	63A	63A	125A	125A	125A	200A	200A	200A	200A	275A	275A
t_{off} max	10 μs	15 μs	40 μs	10 μs	15 μs	40 μs	20 μs	30 μs	20 μs	30 μs	30 μs	40 μs
Type	2511✚	2512✚	2513✚	2501✚	2502✚	2503✚	2631✚	2632✚	2611✚	2612✚	2601✚	2602✚
50 Volts	2511A	2512A	2513A	2501A	2502A	2503A	2631A	2632A	2611A	2612A	2601A	2602A
100	2511B	2512B	2513B	2501B	2502B	2503B	2631B	2632B	2611B	2612B	2601B	2602B
200	2511D	2512D	2513D	2501D	2502D	2503D	2631D	2632D	2611D	2612D	2601D	2602D
300	2511F	2512F	2513F	2501F	2502F	2503F	2631F	2632F	2611F	2612F	2601F	2602F
400	2511H	2512H	2513H	2501H	2502H	2503H	2631H	2632H	2611H	2612H	2601H	2602H
500	2511K	2512K	2513K	2501K	2502K	2503K	2631K	2632K	2611K	2612K	2601K	2602K
600	2511M	2512M	2513M	2501M	2502M	2503M	2631M	2632M	2611M	2612M	2601M	2602M
700	2511P	2512P	2513P	2501P	2502P	2503P	2631P	2632P	2611P	2612P	2601P	2602P
800	2511S	2512S	2513S	2501S	2502S	2503S	2631S	2632S	2611S	2612S	2601S	2602S
900	.....	.....	2513V	.....	.....	2503V	2631V	2632V	2611V	2612V	2601V	2602V
1000	.....	.....	2513Z	.....	.....	2503Z	2631Z	2632Z	2611Z	2612Z	2601Z	2602Z
1100	.....	.....	.....	.....	.....	.....	.....	2632ZB	.....	2612ZB	.....	2602ZB
1200	.....	.....	.....	.....	.....	.....	.....	2632ZD	.....	2612ZD	.....	2602ZD

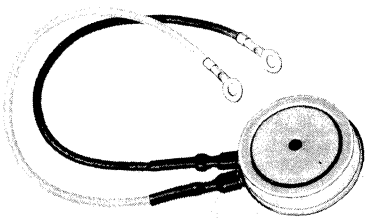
Rating	200 Amperes		300 Amperes					
Photo	W	W	W	W	Z	Z	AA	AA
I_{rms}	320A	320A	470A	470A	470A	470A	470A	470A
t_{off} max	30 μs	40 μs	30 μs	40 μs	30 μs	40 μs	30 μs	40 μs
Type	2731✚	2732✚	2721✚	2722✚	2761✚	2762✚	2781✚	2782✚
50 Volts	2731A	2732A	2721A	2722A	2761A	2762A	2781A	2782A
100	2731B	2732B	2721B	2722B	2761B	2762B	2781B	2782B
200	2731D	2732D	2721D	2722D	2761D	2762D	2781D	2782D
300	2731E	2732E	2721F	2722F	2761F	2762F	2781F	2782F
400	2731H	2732H	2721H	2722H	2761H	2762H	2781H	2782H
500	2731K	2732K	2721K	2722K	2761K	2762K	2781K	2782K
600	2731M	2732M	2721M	2722M	2761M	2762M	2781M	2782M
700	2731P	2732P	2721P	2722P	2761P	2762P	2781P	2782P
800	2731S	2732S	2721S	2722S	2761S	2762S	2781S	2782S
900	2731V	2732V	2721V	2722V	2761V	2762V	2781V	2782V
1000	2731Z	2732Z	2721Z	2722Z	2761Z	2762Z	2781Z	2782Z
1100	.....	2732ZB	.....	2722ZB	.....	2762ZB	.....	2782ZB
1200	.....	2732ZD	.....	2722ZD	.....	2762ZD	.....	2782ZD

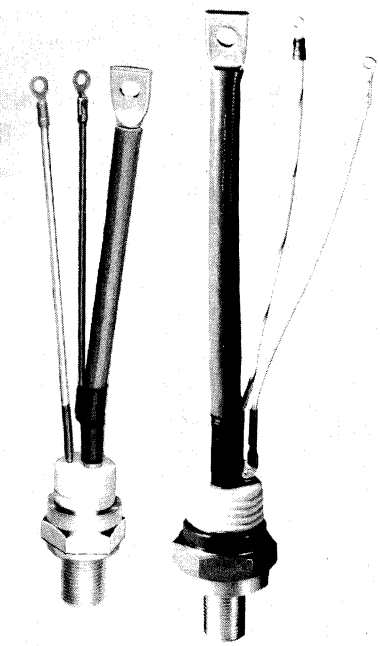
① These devices will be available after June 1, 1969. Refer to Types 2191-3, 2541-3, 2181-2, 2201-2, 2231-2 until June 1.

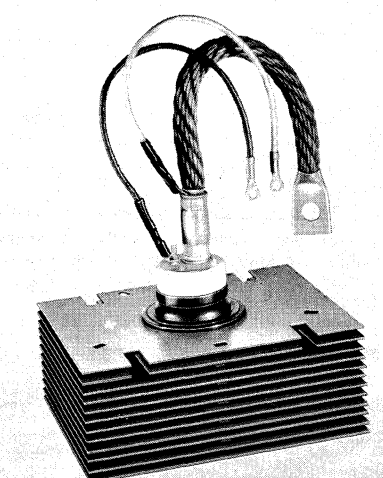


For dimensions, refer to page 17.

Semiconductor Products
Thyristors







For dimensions, refer to pages 17 and 18.

High Temperature Thyristors

Rating	40 Amperes	80 Amperes		125 Amperes	175 Amperes
Photo	T/U	T	T/U	X	X
I_{rms}	63A	110A	125A	200A	275A
I_{surge}	1200A	1200A	1600A	3000A	4500A
Type	2515✚	JEDEC✚	2505✚	2615✚	2605✚
25 Volts	.....	2N2023	.....	.....	.....
50	2515A	2N2024	2505A	2615A	2605A
100	2515B	2N2025	2505B	2615B	2605B
200	2515D	2N2027	2505D	2615D	2605D
300	2515F	2N2029	2505F	2615F	2605F
400	2515H	2N2030	2505H	2615H	2605H
500	2515K	.....	2505K	2615K	2605K
600	2515M	.....	2505M	2615M	2605M
700	2515P	.....	2505P	.....	.....
800	2515S	.....	2505S	.....	.....
900	2515V	.....	2505V	.....	.....
1000	2515Z	.....	2505Z	.....	.....
Data Sheet	54-565: 9, 10	54-566: 9, 10		54-567: 5, 6	54-568: 3, 4

Low Power Thyristors

Rating	10 Amperes			20 Amperes	
Photo	V	V	V	V	V
I_{rms} max	16A	16A	16A	25A	35A
I_{surge}	125A	125A	200A	150A	350A
Type	JEDEC✚	JEDEC✚	241✚①	JEDEC✚	240✚①
25 Volts	2N1842	2N1842A	241U	2N681	240U
50	2N1843	2N1843A	241A	2N682	240A
100	2N1844	2N1844A	241B	2N683	240B
150	2N1845	2N1845A	241C	2N684	240C
200	2N1846	2N1846A	241D	2N685	240D
250	2N1847	2N1847A	241E	2N686	240E
300	2N1848	2N1848A	241F	2N687	240F
400	2N1849	2N1849A	241H	2N688	240H
500	2N1850	2N1850A	241K	2N689	240K
600	.....	.....	241M	2N690	240M
700	.....	.....	241P	2N691	240P
800	.....	.....	241S	2N692	240S
900	.....	.....	241V	.....	240V
1000	.....	.....	241Z	.....	240Z
1100	.....	.....	241ZB	.....	240ZB
1200	.....	.....	241ZD	.....	240ZD
Data Sheet	54-563: 1, 2	54-563: 3, 4	①	54-564: 1-4	①

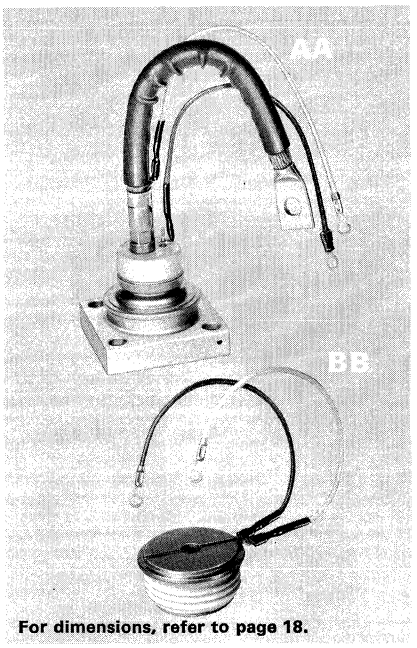
① Types 241 and 240 Thyristors will be available after July, 1969, replacing Types 202, 203 and 201.

Westinghouse

Medium Power Thyristors

Rating	Standard Series						OEM Series	
	40 Amperes	80 Amperes					40 Amperes	80 Amperes
Photo	T/U	T	U	T	U	T/U		
I_{rms}	63A	110A	110A	110A	110A	125A	63A	125A
I_{surge}	1200A	1000A	1000A	1600A	1600A	1600A	1000A	1600A
Type	251✚	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	250✚	205②	210②
25 V	.....	2N1909	.....	.....	.....	.....	205U	210U
50	251A	2N1910	2N1792	.....	.....	250A	205A	210A
100	251B	2N1911	2N1793	2N4361	2N4371	250B	205B	210B
150	251C	2N1912	2N1794	.....	.....	250C	205C	210C
200	251D	2N1913	2N1795	2N4362	2N4372	250D	205D	210D
250	251E	2N1914	2N1796	.....	.....	250E	205E	210E
300	251F	2N1915	2N1797	.....	.....	250F	205F	210F
400	251H	2N1916	2N1798	2N4363	2N4373	250H	205H	210H
500	251K	2N1805	2N1799	.....	.....	250K	205K	210K
600	251M	2N1806	2N1800	2N4364	2N4374	250M	205M	210M
700	251P	2N1807	2N1801	.....	.....	250P	....	....
800	251S	.....	2N1802	2N4365	2N4375	250S	....	....
900	251V	.....	2N1803	.....	.....	250V	....	....
1000	251Z	.....	2N1804	2N4366	2N4376	250Z	....	....
1100	251ZB	.....	.....	.....	.....	250ZB	....	....
1200	251ZD	.....	.....	2N4367	2N4377	250ZD	....	....
1300	251ZF	.....	.....	.....	.....	250ZF	....	....
1400	251ZH	.....	.....	2N4368	2N4378	250ZH	....	....
Data Sheet	54-565: 7, 8	54-566: 1, 2		54-566: 3, 4		54-566: 7, 8		

② Types 205 and 210 Thyristors will be available after May, 1969.



For dimensions, refer to page 18.

High Power Thyristors

Rating	125 Amperes		175 Amperes		200 Amps	250 Amps	300 Amperes			350 Amps	400 Amps	550 Amps
Photo	W	X	X	X	W	Y	W	Z	AA	Y	BB	BB
I_{rms}	200A	200A	275A	275A	320A	400A	470A	470A	470A	550A	625A	850A
I_{surge}	1600A	3500A	5000A	5000A	4000A	5500A	5500A	5500A	5000A	6500A	6500A	7000A
Type	263✚	261✚	260✚	JEDEC✚	273✚	271✚	272✚	276✚	2248✚	270✚	283✚	282✚
50 Volts	263A	261A	260A	2N3884	273A	271A	272A	276A	2248A	270A	283A	282A
100	263B	261B	260B	2N3885	273B	271B	272B	276B	2248B	270B	283B	282B
150	263C	261C	260C	.....	273C	271C	272C	276C	2248C	270C	283C	282C
200	263D	261D	260D	2N3886	273D	271D	272D	276D	2248D	270D	283D	282D
300	263F	261F	260F	2N3887	273F	271F	272F	276F	2248F	270F	283F	282F
400	263H	261H	260H	2N3888	273H	271H	272H	276H	2248H	270H	283H	282H
500	263K	261K	260K	2N3889	273K	271K	272K	276K	2248K	270K	283K	282K
600	263M	261M	260M	2N3890	273M	271M	272M	276M	2248M	270M	283M	282M
700	263P	261P	260P	2N3891	273P	271P	272P	276P	2248P	270P	283P	282P
800	263S	261S	260S	2N3892	273S	271S	272S	276S	2248S	270S	283S	282S
900	263V	261V	260V	2N3893	273V	271V	272V	276V	2248V	270V	283V	282V
1000	263Z	261Z	260Z	2N3894	273Z	271Z	272Z	276Z	2248Z	270Z	283Z	282Z
1100	263ZB	261ZB	260ZB	.....	273ZB	271ZB	272ZB	276ZB	2248ZB	270ZB	283ZB	282ZB
1200	263ZD	261ZD	260ZD	2N3895	273ZD	271ZD	272ZD	276ZD	2248ZD	270ZD	283ZD	282ZD
1300	263ZF	261ZF	260ZF	.....	273ZF	271ZF	272ZF	276ZF	2248ZF	270ZF	283ZF	282ZF
1400	263ZH	261ZH	260ZH	2N3896	273ZH	271ZH	272ZH	276ZH	2248ZH	270ZH	283ZH	282ZH
Data Sheet	54-570: 3, 4	.....	54-568: 5, 6	54-568: 1, 2	.....	.....	54-570: 7, 8	54-569: 3, 4	54-569: 1, 2	.....	.....	.....

Semiconductor Products
Power Transistors

Power Transistors

Westinghouse silicon transistors are designed for high power applications in industrial and high reliability military and space systems, industrial computers and communications equipment. They offer the outstanding advantages of freedom from thermal fatigue and second breakdown. Devices are 100% power tested. All production lots are tested in accordance with specification MIL-S-19500. Such careful testing is another reason why all JEDEC registered devices bear this Westinghouse Lifetime Guarantee symbol ✚.

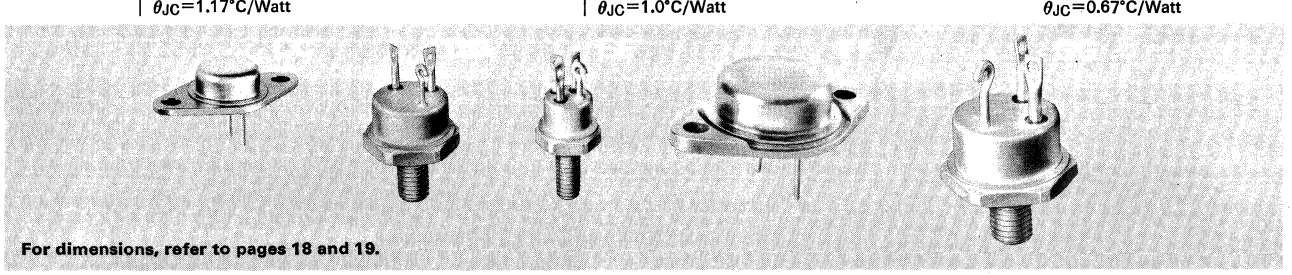
Transistors are grouped by maximum collector current ratings from 2A to 250A. V_{CEO} ranges from 30 to 300 volts. Gain and saturation resistance limits apply at the collector currents listed in the next line. With the addition of our epitaxial transistor we have gain bandwidth product, (f_T), in a range of .5MHz to 70MHz.

The Westinghouse line of low cost transistors is designed expressly to meet the needs of original equipment manufacturers of commercial electronic apparatus. Their low saturation resistance, high collector voltage, and high temperature characteristics make them ideally suited for use in regulators, power supplies, inverters, ignition systems, and amplifiers.

Fast Switching Transistors

Rating	10 Amperes		10 Amperes		10 Amperes		20 Amperes	
Photo	CC	CC	DD	DD	EE	EE	FF	FF
Type	1714	1714	1716	1716	1718	1718	1723	1723
I_C	2A	5A	2A	5A	2A	5A	5A	10A
h_{FE} min	20	20	20	20	20	20	20	20
$V_{CE\ (sat)}$ max	0.60V	0.75V	0.5V	0.6V	0.5V	0.6V	1.0V	1.25V
f_T typical	70 MHz	70 MHz	70 MHz	70 MHz	70 MHz	70 MHz	50 MHz	50 MHz
V_{CE} 40	1714-0402	1714-0405	.....	.....	.....	.....	1723-0405	1723-0410
60	1714-0602	1714-0605	1716-0602	1716-0605	1718-0602	1718-0605	1723-0605	1723-0610
80	1714-0802	1714-0805	1716-0802	1716-0805	1718-0802	1718-0805	1723-0805	1723-0810
100	1714-1002	1714-1005	1716-1002	1716-1005	1718-1002	1718-1005	1723-1005	1723-1010
120	1714-1202	1714-1205	1716-1202	1716-1205	1718-1202	1718-1205	1723-1205	1723-1210
140	1714-1402	1714-1405	1716-1402	1716-1405	1718-1402	1718-1405	1723-1405	1723-1410
160	1714-1602	1714-1605	1716-1602	1716-1605	1718-1602	1718-1605	1723-1605	1723-1610
180	1714-1802	1714-1805	1716-1802	.....	1718-1802	.....	1723-1805	1723-1810
200	.....	.....	.....	.....	.....	.....	1723-2005	.....
Maximum Ratings	V_{EB}=7V, I_B=2A T_J=−65° to +200°C P_D=35W @ T_C=25°C θ_{JC}=5.0°C/Watt		V_{EB}=7V, I_B=2A T_J=−65° to +200°C P_D=50W @ T_C=100°C θ_{JC}=2.0°C/Watt		V_{EB}=7V, I_B=2A T_J=−65° to +200°C P_D=33W @ T_C=100°C θ_{JC}=3.0°C/Watt		V_{EB}=7V, I_B=5A T_J=−65° to +200°C P_D=150W @ T_C=25°C θ_{JC}=1.17°C/Watt	

Rating	40 Amperes			40 Amperes			75 Amperes	
Photo	FF	FF	FF	GG	GG	GG	GG	GG
Type	1763	1763	1763	1768	1768	1768	1776	1776
I_C	10A	20A	30A	10A	20A	30A	40A	60A
h_{FE} min	20	20	20	20	20	20	15	15
$V_{CE\ (sat)}$ max	1.0V	1.25V	1.50V	1.0V	1.25V	1.50V	1.5V	1.5V
f_T typical	50 MHz	50 MHz	50MHz	50 MHz	50 MHz	50 MHz	35 MHz	35 MHz
V_{CE} 40	.....	.....	.....	.....	.....	.....	1776-0440	1776-0460
60	1763-0610	1763-0620	1763-0630	1768-0610	1768-0620	1768-0630	1776-0640	1776-0660
80	1763-0810	1763-0820	1763-0830	1768-0810	1768-0820	1768-0830	1776-0840	1776-0860
100	1763-1010	1763-1020	1763-1030	1768-1010	1768-1020	1768-1030	1776-1040	1776-1060
120	1763-1210	1763-1220	1763-1230	1768-1210	1768-1220	1768-1230	1776-1240	1776-1260
140	1763-1410	1763-1420	1763-1430	1768-1410	1768-1420	1768-1430	1776-1440	1776-1460
160	1763-1610	1763-1620	1763-1630	1768-1610	1768-1620	1768-1630	1776-1640	.....
180	1763-1810	.....	.....	1768-1810	.....	.....	.....	.....
Maximum Ratings	V_{EB}=7V, I_B=10A T_J=−65° to +200°C P_D=85W @ T_C=100°C θ_{JC}=1.17°C/Watt			V_{EB}=7V, I_B=10A T_J=−65° to +200°C P_D=100W @ T_C=100°C θ_{JC}=1.0°C/Watt			V_{EB}=7V, I_B=15A T_J=−65° to +200°C P_D=150W @ T_C=100°C θ_{JC}=0.67°C/Watt	



For dimensions, refer to pages 18 and 19.

Westinghouse

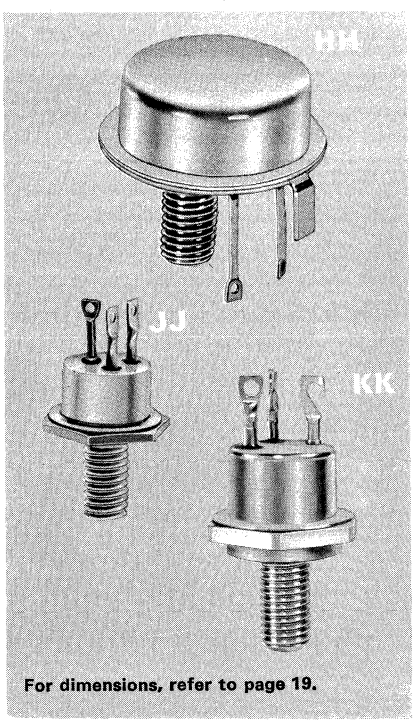
Medium Current Transistors

Rating	4 Amperes		6 Amperes		7.5 Amperes				
Photo	CC	CC	HH	HH	HH	HH	JJ	JJ	JJ
Type	1571	1571	151	152	JEDEC✚	JEDEC✚	JEDEC✚	153	154
I_C	4A	3A	1.5A	1.5A	2A	5A	5A	1.5A	1.5A
h_{FE} min	25	20	11	18	10	10	10	15	25
$V_{CE\ (sat)}$ max	1.0V	1.0V	1.3V	1.25V	1.5V	2.5V	1.0V	1.3V	1.25V
f_T typical	1.0 MHz	1.0 MHz	500 KHz	500 KHz	500 KHz	500 KHz	500 KHz	500 KHz	500 KHz
V_{CE} 40	1571-0425	1571-0420	151-04	152-04	2N1015▲	2N1016▲	.....	153-04	154-04
60	2N3054▲	1571-0620	151-06	152-06	2N1015A	2N1016A	2N3429▲	153-06	154-06
80	1571-0825	1571-0820	151-08	152-08	.....	.....	.....	153-08	154-08
100	1571-1025	1571-1020	151-10	152-10	2N1015B	2N1016B●	2N3430	153-10	154-10
120	1571-1225	1571-1220	151-12	152-12	.....	.....	.....	153-12	154-12
140	1571-1425	2N3441	151-14	152-14	.....	.....	.....	153-14	154-14
160	1571-1625	1571-1620	151-16	152-16	2N1015C▲	2N1016C●▲	2N3431▲	153-16	154-16
180	.....	.....	151-18	152-18	.....	.....	.....	153-18	154-18
200	.....	.....	151-20	152-20	2N1015D	2N1016D●	2N3432	153-20	154-20
220	.....	.....	151-22	152-22	.....	.....	.....	153-22	154-22
240	.....	.....	151-24	152-24	.....	.....	.....	153-24	154-24
260	.....	.....	151-26	152-26	2N1015E▲	2N1016E▲	2N3433▲	153-26	154-26
280	.....	.....	151-28	152-28	.....	.....	.....	153-28	154-28
300	.....	.....	151-30	152-30	.....	.....	.....	153-30	154-30
Maximum Ratings	V_{EB}=7V, I_B=2A T_J=−65° to +200°C P_D=29W @ T_C=25°C θ_{JC}=6°C/W		V_{EB}=25V, I_B=3A T_J=−65° to +150°C P_D=100W @ T_C=80°C θ_{JC}=0.7°C/W		V_{EB}=25V, I_B=5A T_J=−65° to +150°C P_D=150W @ T_C=45°C θ_{JC}=0.7°C/W	V_{EB}=25V, I_B=3A T_J=−65° to +175°C P_D=150W @ T_C=60°C θ_{JC}=0.75°C/W		V_{EB}=25V, I_B=3A T_J=−65° to +175°C P_D=200W @ T_C=25°C θ_{JC}=0.75°C/W	
Data Sheet	54-673: 11, 12		54-672: 1, 2		54-661: 1, 2	54-661: 3, 4		54-672: 3, 4	

● Military types available.
▲ Refer to data sheet for exact ratings.

Rating	10 Amperes (High Gain)				15 Amperes		
Photo	HH	HH	KK	KK	LL	LL	LL
Type	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	156	156
I_C	10A	10A	10A	10A	2A	4A	3A
h_{FE} min	100	400	100	400	20	20	18
$V_{CE\ (sat)}$ max	3.5V	3.5V	3.5V	3.5V	1.0V	1.1V	2.5V
f_T typical	300 KHz	300 KHz	300 KHz	300 KHz	1 MHz	1 MHz	1 MHz
V_{CE} 40	.....	.....	.....	.....	.....	156-044	156-043
60	2N2226▲	2N2230▲	2N3470▲	2N3474▲	.....	2N3055	2N3232▲
80	.....	.....	.....	.....	.....	156-084	156-083
100	2N2227	2N2231	2N3471	2N3475	.....	156-104	2N3233▲
120	.....	.....	.....	.....	2N4347▲	156-124	156-123
140	.....	.....	.....	.....	.....	156-144	2N3442▲
160	2N2228▲	2N2232▲	2N3472▲	2N3476▲	.....	156-164	2N3234
200	2N2229	2N2233	2N3473	2N3477	.....	.....	.....
Maximum Ratings	V_{EB}=15V, I_B=1A T_J=−65° to +150°C P_D=150W @ T_C=75°C θ_{JC}=0.5°C/W		V_{EB}=15V, I_B=1A T_J=−65°C to +150°C P_D=150W @ T_C=75°C θ_{JC}=0.5°C/W		V_{EB}=7V, I_B=7A T_J=−65° to 200°C P_D=115W @ T_C=25°C θ_{JC}=1.5°C/W		
Data Sheet	54-663: 1-4				54-673: 13, 14	54-673: 15, 16	

▲ Refer to data sheet for exact ratings.



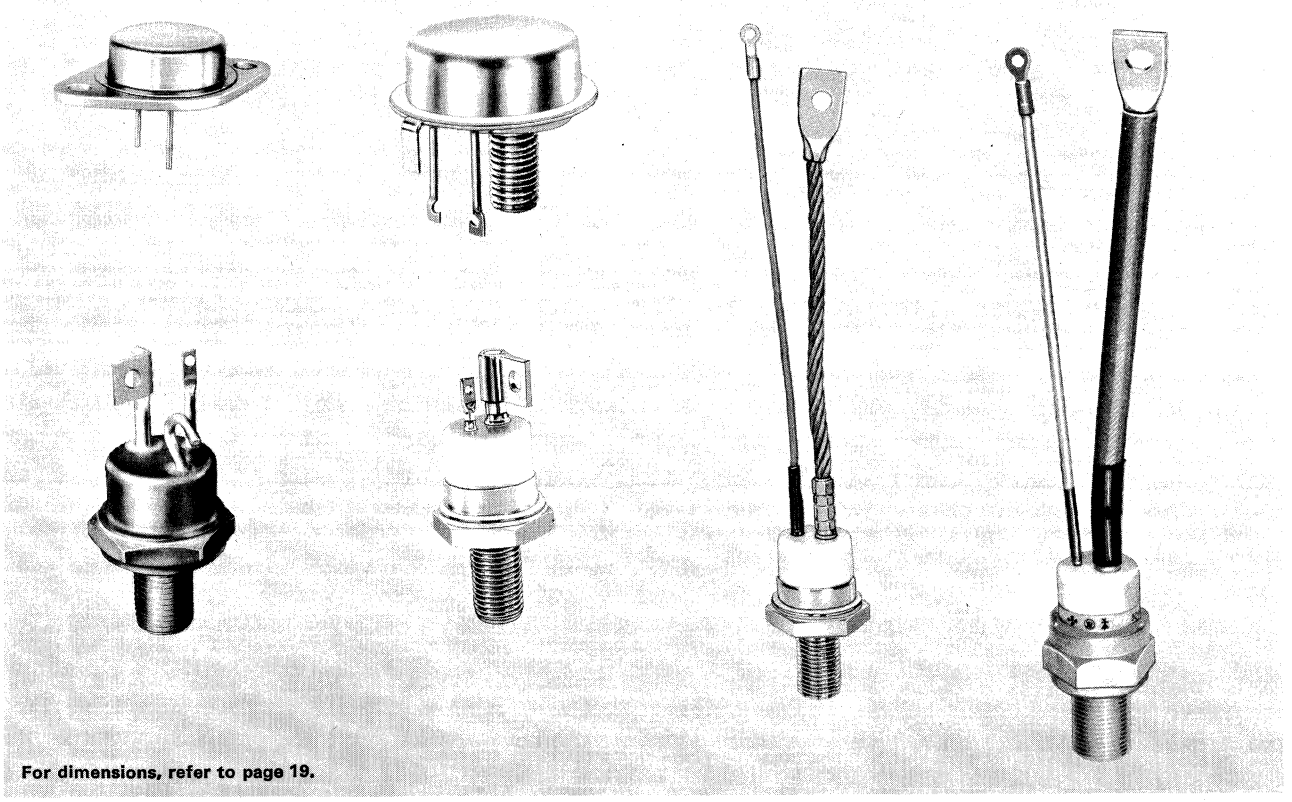
For dimensions, refer to page 19.

Semiconductor Products
Power Transistors

High Current Transistors

Rating	20 Amperes					30 Amperes			
Photo	MM	MM	MM	KK	KK	KK	KK	KK	KK
Type	JEDEC✚	JEDEC✚	JEDEC✚	163	164	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚
I_C	10A	15A	20A	5A	5A	10A	15A	20A	25A
h_{FE} min	10	10	10	15	25	10	10	10	10
$V_{CE\ (sat)}$ max	1.5V	1.5V	1.5V	1.1V	1.0V	1.5V	1.5V	1.5V	1.5V
f_T typical	500 KHz	500 KHz	500 KHz	500 KHz	500 KHz	500 KHz	500 KHz	500 KHz	500 KHz
V_{CE} 40	.....	.....	.....	163-04	164-04	.....	.....	.....	.....
60	2N2739▲	2N2745▲	2N2751▲	163-06	164-06	2N2757▲	2N2763▲	2N2769▲	2N2775▲
80	.....	.....	.....	163-08	164-08	.....	.....	.....	.....
100	2N2740	2N2746	2N2752	163-10	164-10	2N2758	2N2764	2N2770	2N2776
120	.....	.....	.....	163-12	164-12	.....	.....	.....	.....
140	.....	.....	.....	163-14	164-14	.....	.....	.....	.....
160	2N2741▲	2N2747▲	2N2753▲	163-16	164-16	2N2759▲	2N2765▲	2N2771▲	2N2777▲
180	.....	.....	.....	163-18	164-18	.....	.....	.....	.....
200	2N2742	2N2748	2N2754	163-20	164-20	2N2760	2N2766	2N2772	2N2778
220	.....	.....	.....	163-22	164-22	.....	.....	.....	.....
240	.....	.....	.....	163-24	164-24	.....	.....	.....	.....
260	.....	.....	.....	163-26	164-26	2N2761▲	.....	.....	.....
280	.....	.....	.....	163-28	164-28	.....	.....	.....	.....
300	.....	.....	.....	163-30	164-30	.....	.....	.....	.....
Maximum Ratings	V_{EB}=15V, I_B=7.5A T_J=−65° to +175°C P_D=200W @ T_C=75°C θ_{JC}=0.5°C/Watt			V_{EB}=15V, I_B=7.5A T_J=−65° to +175°C P_D=200W @ T_C=75°C θ_{JC}=0.5°C/Watt		V_{EB}=15V, I_B=7.5A T_J=−65° to +175°C P_D=200W @ T_C=75°C θ_{JC}=0.5°C/Watt			
Data Sheet	54-661: 9-12			54-672: 5, 6		54-662: 5-12			

▲ Refer to data sheet for exact ratings.



For dimensions, refer to page 19.

Westinghouse

High Current Transistors, Continued

Rating	30 Amperes							
Photo	OO/PP①	OO/PP①	OO/PP①	OO/PP①	LL	LL	LL	LL
Type	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	JEDEC✚	1582	1582	1582
I_C	10A	15A	20A	25A	10A	8A	10A	15A
h_{FE} min	10	10	10	10	8.5	15	15	15
V_{CE} (sat) max	1.5V	1.5V	1.5V	1.5V	1V	1.4V	1.4V	2V
f_T typical	500 KHz	500 KHz	500 KHz	500 KHz	1 MHz	1 MHz	1 MHz	1 MHz
V_{CE} 40	.....	.....	.....	.....	.....	1582-0508	1582-0510	2N3771
60	2N1809▲	2N1816▲	2N1823▲	2N1830▲	2N3236▲	1582-0608	2N3772	1582-0615
80	.....	.....	.....	.....	2N3238▲	1582-0808	2N3237▲	1582-0815
100	2N1810	2N1817	2N1824	2N1831	2N3239▲	1582-1008	1582-1010	1582-1015
120	.....	.....	.....	.....	2N4348▲	1582-1208	1582-1210	1582-1215
140	.....	.....	.....	.....	.....	2N3773	1582-1410	1582-1415
160	2N1811▲	2N1818▲	2N1825▲	2N1832▲	2N3240▲	1582-1608	1582-1610	1582-1615
200	2N1812	2N1819	2N1826	2N1833	.....	.....	.....	.....
250	2N1813	2N1820	.....	.....	.....	.....	.....	.....
300	2N1814	.....	.....	.....	.....	.....	.....	.....
Maximum Ratings	V_{EB}=15V, I_B=10A T_J=−65° to +175°C P_D=250W @ T_C=60°C θ_{JC}=0.45°C/W				V_{EB}=7V, I_B=5A T_J=−65° to 200°C P_D=150W @ T_C=25°C θ_{JC}=1.17°C/W			
Data Sheet	54-662: 1-4				54-673: 7-10			

① JEDEC numbers shown are case PP. For case OO substitute 2N21XX for 2N18XX.
▲ Refer to data sheet for exact ratings.

Rating	150 Amperes			250 Amperes		
Photo	NN	NN	NN	QQ	QQ	QQ
Type	1441	1441	1441	1401	1401	1401
I_C	50A	75A	100A	150A	200A	250A
h_{FE} min	10	10	10	10	10	10
V_{CE} (sat) max	1.5V	1.5V	2.0V	1.5V	2.0V	2.5V
f_T typical	0.5 MHz	0.5 MHz	0.5 MHz	0.5 MHz	0.5 MHz	0.5 MHz
V_{CE} 40	1441-0405	1441-0407	1441-0410	1401-0415	1401-0420	1401-0425
60	1441-0605	1441-0607	1441-0610	1401-0615	1401-0620	1401-0625
80	1441-0805	1441-0807	1441-0810	1401 0815	1401-0820	1401-0825
100	1441-1005	1441-1007	1441-1010	1401-1015	1401-1020	1401-1025
120	1441-1205	1441-1207	1441-1210	1401-1215	.....	.....
Maximum Ratings	V_{EB}=10V, I_B=25A P_D=350W @ T_C=80°C θ_{JC}=0.3°C/W			V_{EB}=10V, I_B=35A P_D=625W @ T_C=75°C θ_{JC}=0.2°C/W		

Semiconductor Products Assemblies

Molded Assemblies

Let Westinghouse help you reduce manufacturing and stocking costs with a durable and dependable encapsulated assembly. Buying a complete assembly versus discrete components offers these benefits:

1. Elimination of design, test and manufacturing time by using a complete one-package assembly;
2. A power tested assembly manufactured with proven components in an inexpensive package;
3. Reduction of heat sinks and interconnections to a reliable minimum;
4. "Off the Shelf" delivery.

All ratings at $T_{sink}=55°C$.

For additional curves, ratings and application information, see SA-10015.

Single-Phase Full-Wave Bridges

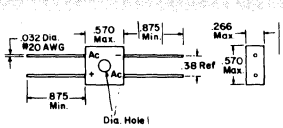
Rating	1.75 Amperes	2.0 Amperes	4.0 Amperes	6.0 Amperes	10.0 Amperes
	Case 010	Case 011	Case 012	Case 012	Case 012
PRV 100	MP010ABB	MP011BBB	MP012FBB	MP012HBB	MP012JBB
200	MP010ABD	MP011BBD	MP012FBD	MP012HBD	MP012JBD
400	MP010ABH	MP011BBH	MP012FBH	MP012HBH	MP012JBH
600	MP010ABM	MP011BBM	MP012FBM	MP012HBM	MP012JBM
800	MP010ABS	MP011BBS	MP012FBS	MP012HBS	MP012JBS
1000	MP010ABZ	MP011BBZ	MP012FBZ	MP012HBZ	MP012JBZ

Rating	15.0 Amperes	20.0 Amperes
	Case 013	Case 013
PRV 100	MP013MBB	MP013RBB
200	MP013MBD	MP013RBD
300	MP013MBF	MP013RBF
400	MP013MBH	MP013RBH
500	MP013MBK	MP013RBK
600	MP013MBM	MP013RBM

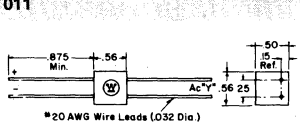
Rating	Single-Phase Doubler 3.0 Amperes	Single-Phase Center Tap (+) 6.0 Amperes	Single-Phase Center Tap (−) 6.0 Amperes	Three Phase Full Wave 6.0 Amperes
	Case 014	Case 014	Case 014	Case 016
PRV 100	MP014HDB	MP014HCB	MP014HNB	MP016HEB
200	MP014HDD	MP014HCD	MP014HND	MP016HED
400	MP014HDH	MP014HCH	MP014HNH	MP016HEH
600	MP014HDM	MP014HCM	MP014HNM	MP016HEM
800	MP014HDS	MP014HCS	MP014HNS	MP016HES
1000	MP014HDZ	MP014HCZ	MP014HNZ	MP016HEZ

Rating	Single-Phase Half-Wave High Voltage Cartridge 0.5 Amperes
	Case 020
PRV 5,000	MP020UHK
6,000	MP020UHM
7,000	MP020UHP
8,000	MP020UHS
9,000	MP020UHV
10,000	MP020UHZ

Case 010



Case 011



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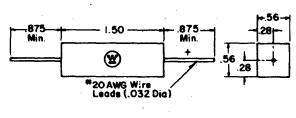
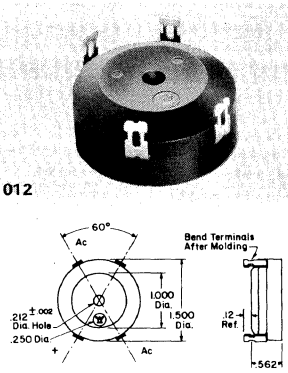
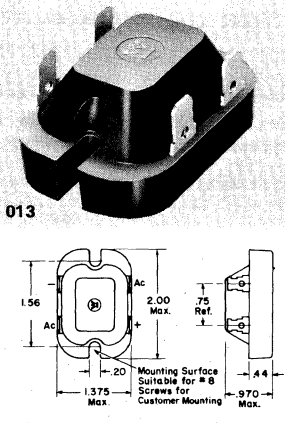


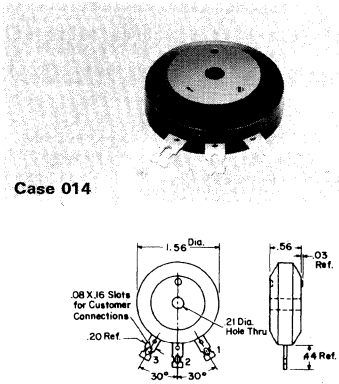
Case 012



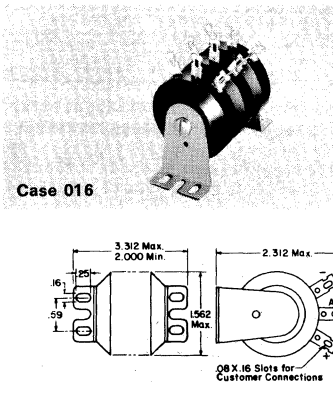
Case 013



Case 014



Case 016



Westinghouse

High Voltage Assemblies

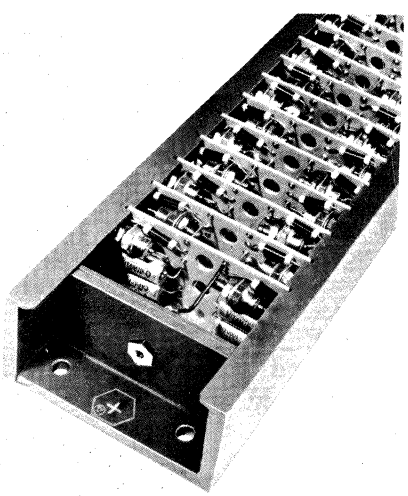
With voltage ratings to 208 Kv and three phase current ratings to 312 amperes, Westinghouse Silicon Rectifier Stacks have proven their outstanding reliability. Each cell is shunted with a capacitor and resistor which provide the optimum in steady state and transient voltage division. Stacks can be designed for cooling by oil, convection or forced air, and vapor atmospheres. Where required, assemblies can be supplied with mil-type capacitors and resistors which, combined with the high temperature characteristics of the hermetically sealed silicon rectifier cells, allows operation in ambients up to 110°C. Use of these stacks in place of vacuum tubes will increase equipment efficiency by as much as 25%.

Ratings are based on forced air cooling of 1000 lfpm at 25°C ambient. Oil cooling will increase ratings. Assemblies are designed to meet most standard military environmental conditions.

For very high voltage applications, corona shielding is available. Where voltage will allow, entire rectifier assemblies can be packed in one channel.

Maximum Voltage and Current for High-Voltage Assemblies – Stacks can be Combined in Series or Parallel

PRV, KV	1 Ph FW I_{DC}, Amps	3 Ph FW I_{DC}, Amps	Data Sheet
208	3	4.5	54-261
83.2	12	18	54-262
83.2	22	33	54-262
41.6	44	66	54-264
24.0	64	96	54-264
11.2	112	168	54-265
21.0	208	312	54-268

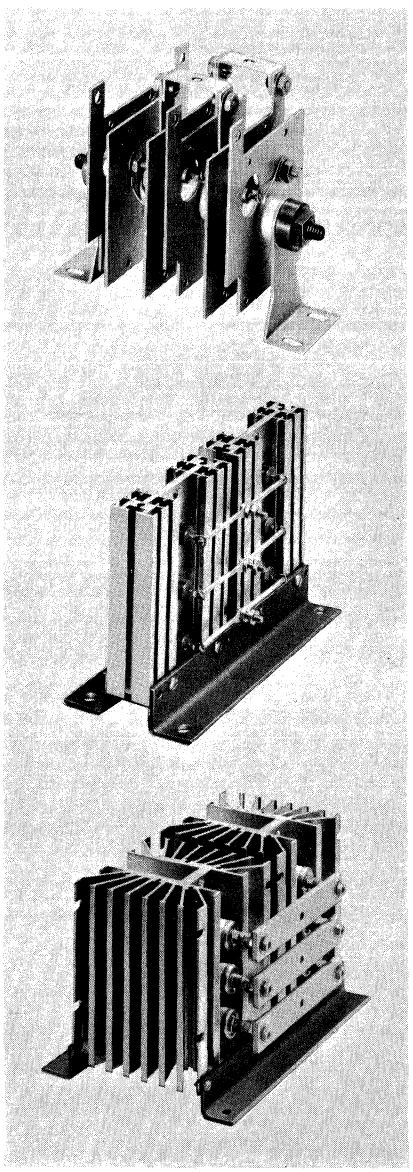


Typical High-Voltage Rectifier Assembly

Assemblies

Westinghouse rectifier and thyristor assemblies are available in all popular circuit configurations and in a wide range of ratings. Aluminum extrusions or nickel-plated copper plates are used to insure long operating life and extended reliability.

Gold-Line Rectifier Assemblies



The following tabulation covers all standard current ranges and the most popular peak inverse voltage ratings of Westinghouse assemblies in single phase full wave and three phase full wave configurations.

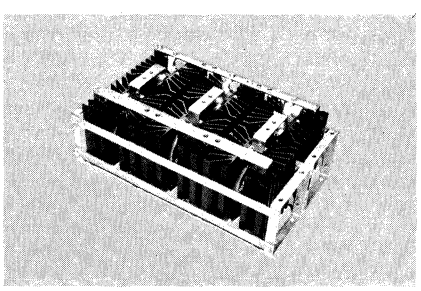
For your convenience, the listings are grouped by circuit configurations and listed in ascending order of output current and PRV. For additional curves, ratings and application information, see Catalog 54-300.

Dimensions in Inches

(See table on page 15)

	Length	Height	Width
1	4.438	4.500	3.062
2	5.750	4.500	3.062
3	5.188	6.500	5.062
4	6.875	6.500	5.062
5	8.750	5.750	3.875
6	8.750	5.750	3.875
7	8.750	5.750	4.125
8	8.750	5.750	4.125
9	8.750	5.750	6.625
10	8.750	5.750	6.625
11	13.375	5.750	6.625
12	10.750	6.750	7.625
13	10.750	6.750	7.625
14	16.375	6.750	7.625
15	10.750	6.750	12.625
16	16.375	6.750	12.625
17	11.250	8.375	9.688
18	15.875	8.375	9.750
19	11.250	8.375	9.688
20	15.875	8.375	9.750

Thyristor Assemblies



Semiconductor Products Assemblies

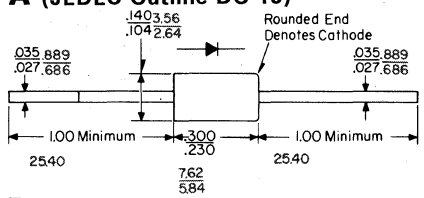
Rating Maximum Amperes	Maximum PRV Repetitive	Surge Amps.①	Single Phase Full Wave Average Forward Current Nat. Conv.②	Forced Air③	Catalog Number	Dimensions④	Three Phase Full Wave Average Forward Current Nat. Conv.②	Forced Air③	Catalog Number	Dimensions④
Gold Line Rectifier Assemblies										
61	200	250	25	44	R050BD	1	35	61	R050ED	2
	400	250	25	44	R050BH		35	61	R050EH	
	600	250	25	44	R050BM		35	61	R050EM	
	800	250	25	44	R050BS		35	61	R050ES	
	1000	250	25	44	R050BZ		35	61	R050EZ	
105	200	500	40	76	R051BD	3	55	105	R051ED	4
	400	500	40	76	R051BH		55	105	R051EH	
	600	500	40	76	R051BM		55	105	R051EM	
	800	500	40	76	R051BS		55	105	R051ES	
	1000	500	40	76	R051BZ		55	105	R051EZ	
140	200	500	60	120	R052BD	5	70	140	R052ED	6
	400	500	60	120	R052BH		70	140	R052EH	
	600	500	60	120	R052BM		70	140	R052EM	
	800	500	60	120	R052BS		70	140	R052ES	
	1000	500	60	120	R052BZ		70	140	R052EZ	
300	200	3000	90	270	R053BD	7	100	300	R053ED	8
	400	3000	90	270	R053BH		100	300	R053EH	
	600	3000	90	270	R053BM		100	300	R053EM	
	800	3000	90	270	R053BS		100	300	R053ES	
	1000	3000	90	270	R053BZ		100	300	R053EZ	
378	200	3000	155	326	R054BD	9	180	378	R054ED	10
	400	3000	155	326	R054BH		180	378	R054EH	
	600	3000	155	326	R054BM		180	378	R054EM	
	800	3000	155	326	R054BS		180	378	R054ES	
	1000	3000	155	326	R054BZ		180	378	R054EZ	
473	200	3000	...	...	.....	..	225	473	R055ED	11
	400	3000	...	...	.....		225	473	R055EH	
	600	3000	...	...	.....		225	473	R055EM	
	800	3000	...	...	.....		225	473	R055ES	
	1000	3000	...	...	.....		225	473	R055EZ	
542	200	5500	270	513	R061BD	12	285	542	R061ED	13
	400	5500	270	513	R061BH		285	542	R061EH	
	600	5500	270	513	R061BM		285	542	R061EM	
	800	5500	270	513	R061BS		285	542	R061ES	
	1000	5500	270	513	R061BZ		285	542	R061EZ	
704	200	5500	...	...	.....	..	370	704	R062ED	14
	400	5500	...	...	.....		370	704	R062EH	
	600	5500	...	...	.....		370	704	R062EM	
	800	5500	...	...	.....		370	704	R062ES	
	1000	5500	...	...	.....		370	704	R062EZ	
840	200	5500	385	615	R063BD	15	525	840	R063ED	16
	400	5500	385	615	R063BH		525	840	R063EH	
	600	5500	385	615	R063BM		525	840	R063EM	
	800	5500	385	615	R063BS		525	840	R063ES	
	1000	5500	385	615	R063BZ		525	840	R063EZ	
Thyristor Assemblies										
120	100	1200	68	91	509C512G61	17	86	120	509C546G21	18
(Ref.	200	1200	68	91	509C512G62		86	120	509C546G22	
TD 54-465,	300	1200	68	91	509C512G64		86	120	509C546G24	
pgs. 1, 2)	400	1200	68	91	509C512G66		86	120	509C546G26	
	500	1200	68	91	509C512G67		86	120	509C546G27	
	600	1200	68	91	509C512G68		86	120	509C546G28	
	800	1200	68	91	509C512G69		86	120	509C546G29	
	1000	1200	68	91	509C512G72		86	120	509C546G32	
168	100	1600	90	120	509C512G01	19	120	168	509C546G01	20
(Ref.	200	1600	90	120	509C512G02		120	168	509C546G02	
TD 54-466,	300	1600	90	120	509C512G04		120	168	509C546G04	
pgs. 1, 2)	400	1600	90	120	509C512G05		120	168	509C546G05	
	500	1600	90	120	509C512G07		120	168	509C546G07	
	600	1600	90	120	509C512G08		120	168	509C546G08	
	800	1600	90	120	509C512G09		120	168	509C546G09	
	1000	1600	90	120	509C512G10		120	168	509C546G10	

① Maximum allowable peak one cycle surge current at maximum rated conditions (60 Hz base).
② Maximum rating of assemblies @ 40°C ambient temperature with natural convection cooling.
③ Maximum rating of assemblies @ 40°C ambient temperature with 1,000 linear feet per minute forced air cooling.
④ See table on page 14 for actual dimensions.

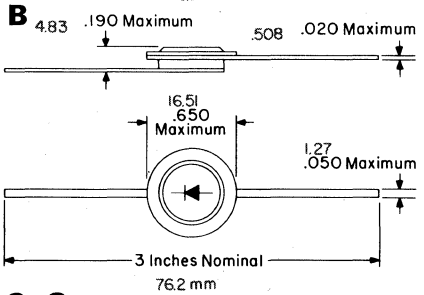
Westinghouse

Rectifier Dimensions in inches①

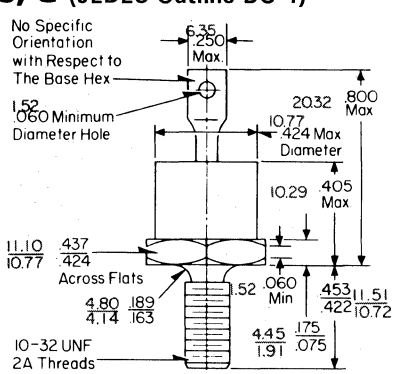
A (JEDEC Outline DO-15)



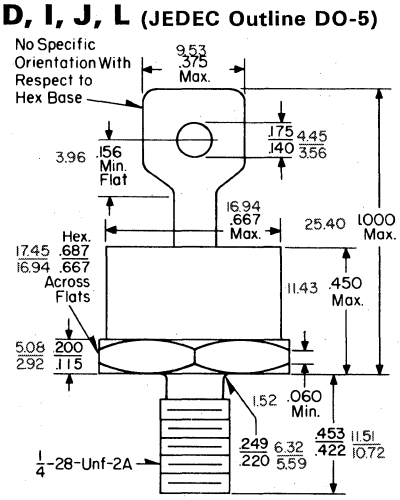
B



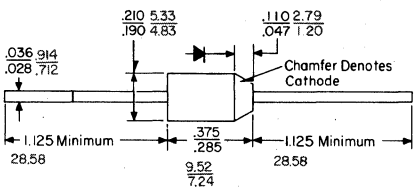
C, G (JEDEC Outline DO-4)



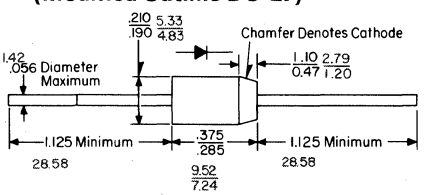
D, I, J, L (JEDEC Outline DO-5)



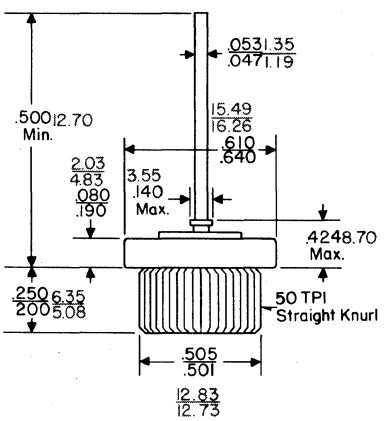
E (JEDEC Outline DO-27)



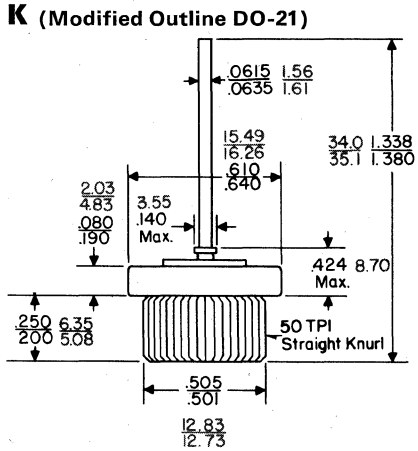
F (Modified Outline DO-27)



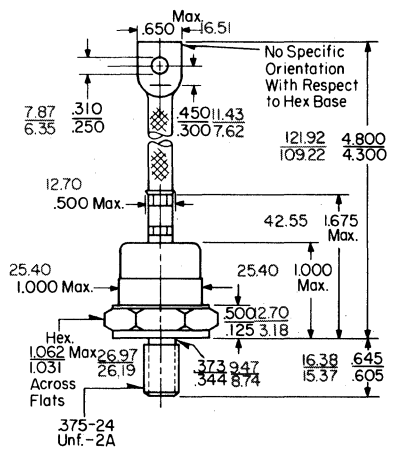
H (JEDEC Outline DO-21)



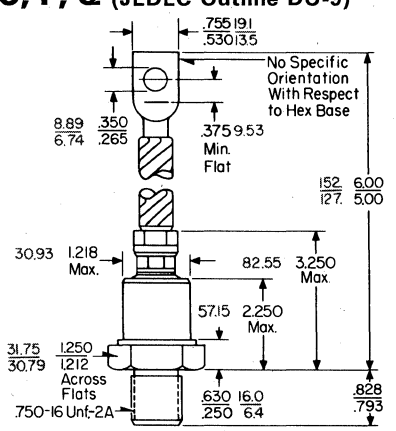
K (Modified Outline DO-21)



M, N (JEDEC Outline DO-8)



O, P, Q (JEDEC Outline DO-9)



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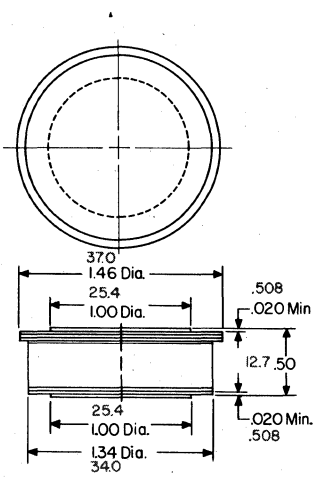
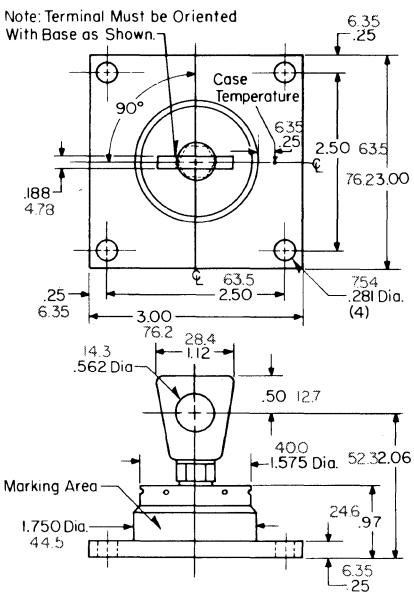


Dimensions are not to be used for construction purposes; refer to individual data sheets for more precise drawings.

① Dimensions in millimeters.

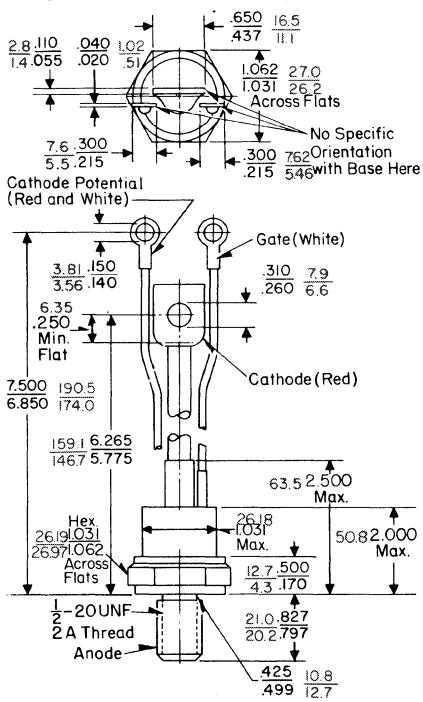
Semiconductor Products Dimensions

S

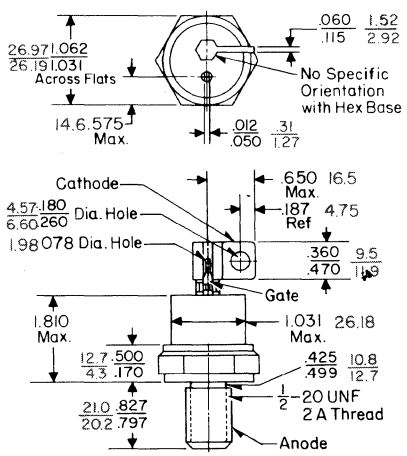


Thyristor Dimensions in inches①

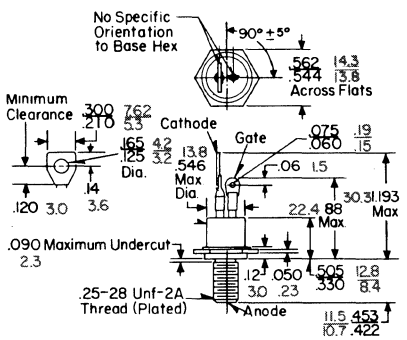
T (JEDEC Outline TO-94)



U (JEDEC Outline TO-83)



V (JEDEC Outline TO-48)



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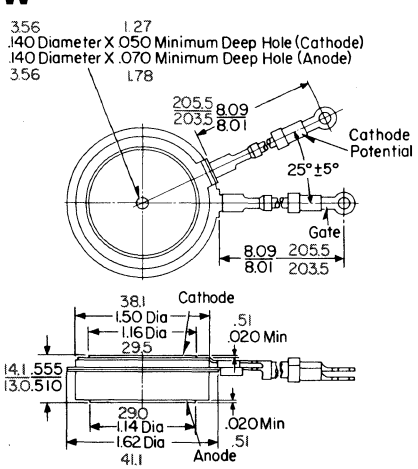
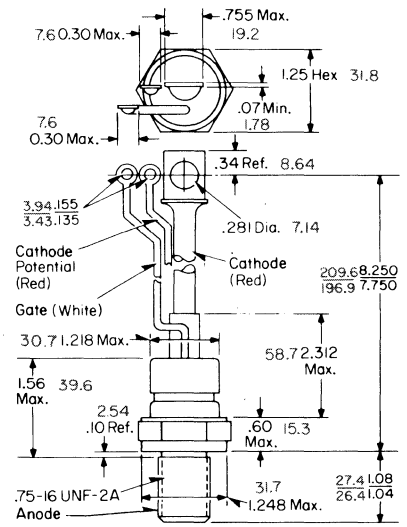


X (JEDEC Outline TO-93)



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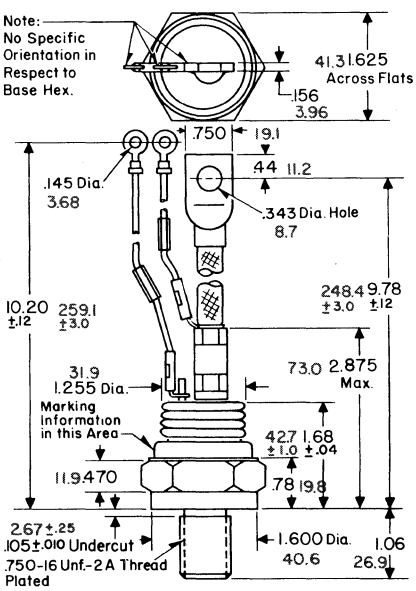


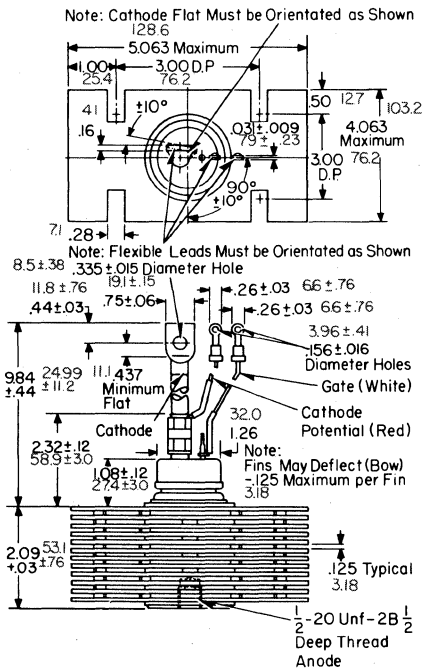
Dimensions are not to be used for construction purposes; refer to individual data sheets for more precise drawings.

① Dimensions in millimeters.

Westinghouse

Thyristor Dimensions in inches, Continued①

Z



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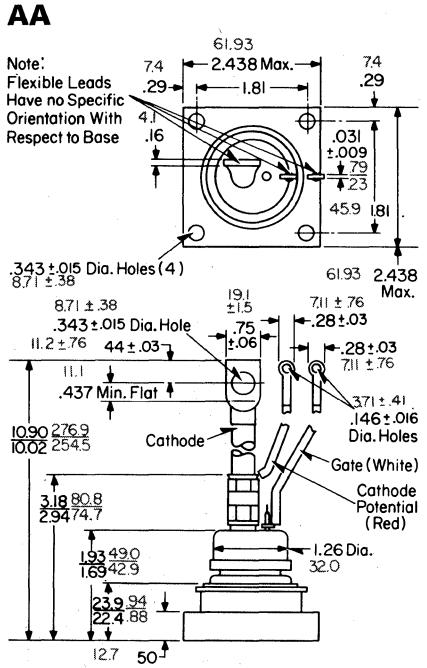

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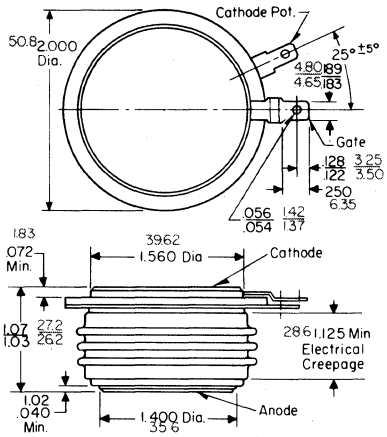
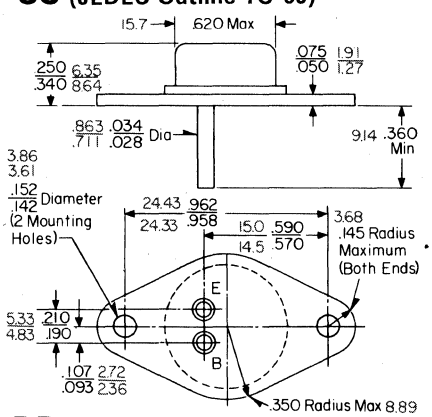
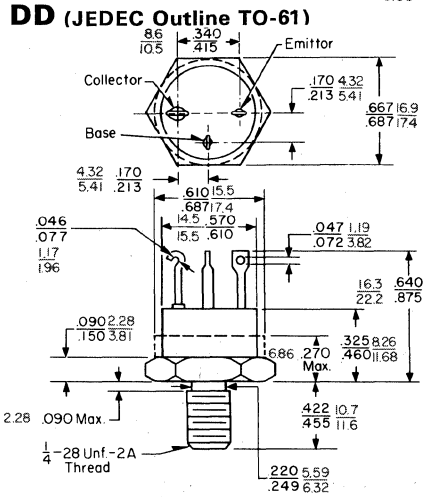


Transistor Dimensions in inches①

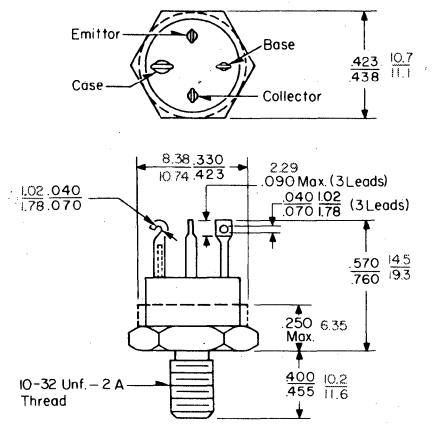
CC (JEDEC Outline TO-66)



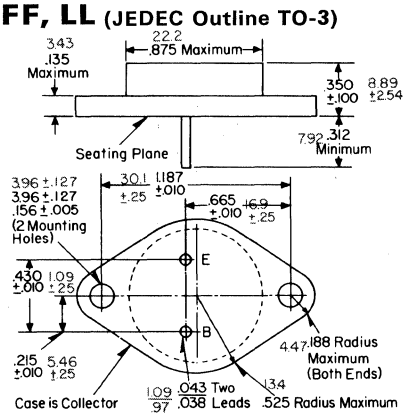
DD (JEDEC Outline TO-61)



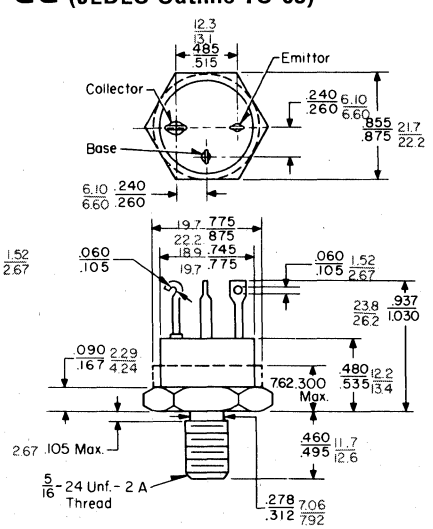
EE (JEDEC Outline TO-111)



FF, LL (JEDEC Outline TO-3)



GG (JEDEC Outline TO-63)

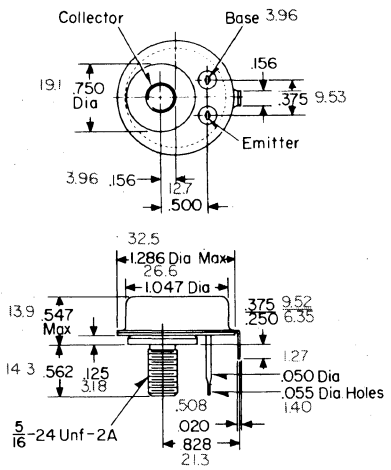


Dimensions are not to be used for construction purposes; refer to individual data sheets for more precise drawings.

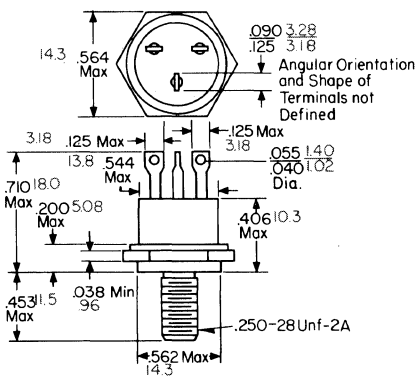
① Dimensions in millimeters.

Semiconductor Products Dimensions

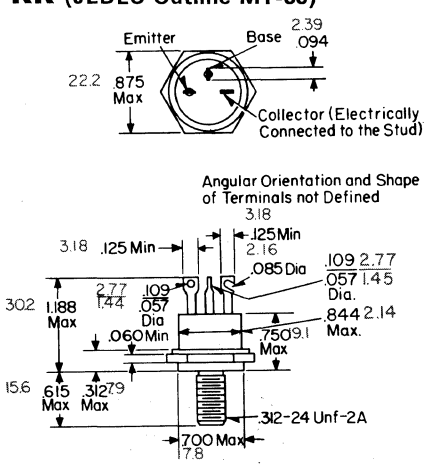
HH (JEDEC Outline MT-1)



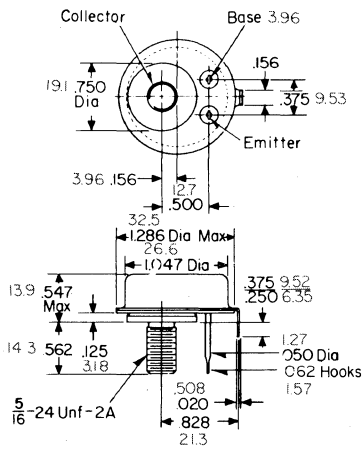
JJ (JEDEC Outline MT-52)



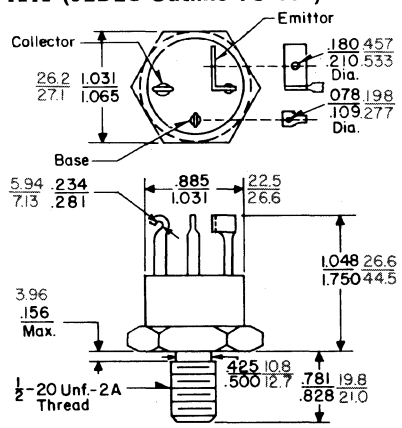
KK (JEDEC Outline MT-33)



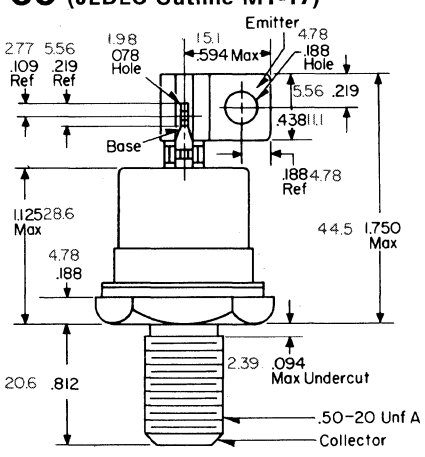
MM (JEDEC Outline MT-1A)



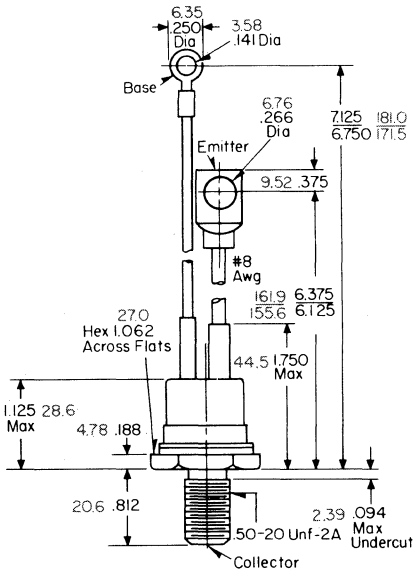
NN (JEDEC Outline TO-114)



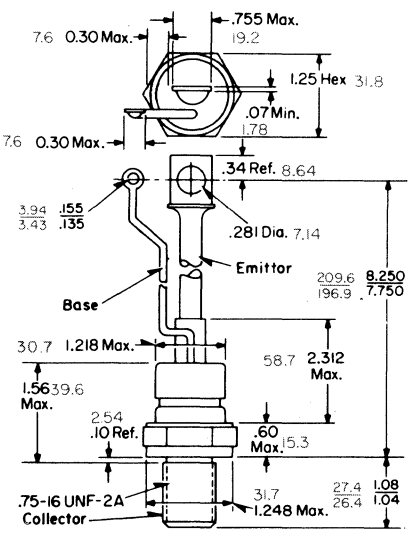
OO (JEDEC Outline TO-17)



PP (JEDEC Outline MT-14)



QQ (JEDEC Outline TO-93)



Dimensions are not to be used for construction purposes; refer to individual data sheets for more precise drawings.

① Dimensions in millimeters.

Semiconductor Products

Westinghouse Industrial Semiconductor Distributors

New England

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35 Dodge Avenue (203) 288-7771

Newton, Massachusetts 02164
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320 Needham Street (617) 969-7700

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Schweber Electronics
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Baltimore, Maryland 21234
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8809 Satyr Road (301) 668-4900

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Stack Industrial Electronics
45 Washington Street (607) 723-6326

Buffalo, New York 14202
Summit Distributors
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Arco Electronics, Inc.
Community Drive (516) 466-8440

Long Island, New York 11591
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Sterling/Atlas Electronics, Inc.
774 Pfeiffer Blvd. (201) HI 2-8000

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Cameradio Company
2801 Liberty Avenue (412) 391-4000

Rockville, Maryland 20850
Cramer Electronics, Inc.
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Cramer/Eastern
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Specialty Distributing
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Birmingham, Alabama 35233
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3101 Fourth Avenue South (205) 322-0588

Charleston, West Virginia 25329
Charleston Electrical Supply Company
312 MacCorkle Avenue, S. E. (304) 346-0321

Fort Lauderdale, Florida 33308
Cramer Electronics, Inc.
4141 N.E. Sixth Avenue (305) 566-7511

Southern, Continued

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Sheridan Sales
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Lenert Company
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Los Angeles, California 90230
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Los Angeles, California 90022
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Elmar Electronics, Inc.
2288 Charleston Road (415) 961-3611

Mountain View, California 94041
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340 Middlefield Road (415) 961-7000

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5563 Kearny Villa Road (714) 279-2421

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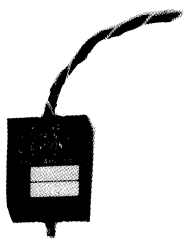
STANDARD STOCK ITEMS

Small quantities normally available for delivery in 24 hours



90% Efficient Hybrid Circuit

Model S 11330101



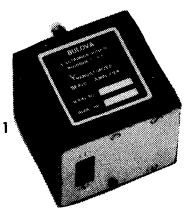
Sub-Miniature

Model S 21220101



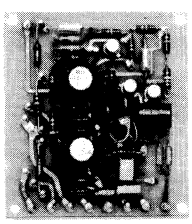
3-1/2 or 6 Watt

Model S 41220105 (Typical)



16 to 50 Watt

Model S 81720101 (Typical)



Card Amplifier

Model S 71230103 (Typical)

Model No.	Output Power (Watts)	Phase Shift (Degrees)	Input Impedance (Ohms)	Gain (V/V)	Package Size (inches)
S 11330101 (See S 12330101 Note 1)	3-1/2	0 ± 10 90 ± 10	10,000	2,500	.63 x .31 x 1.20
S 21220101 (See S 21240101 Note 2)	3-1/2	0 ± 10	10,000	1,000 5,000	.812 x .43 x 1.1
S 41220105 (See S 41230105 Note 2) S 41240105	3-1/2	0 ± 10	10,000	1,000 2,500 5,000	1 x 1 x 1
S 52220105 (See S 52230105 Note 2) S 52240105	3-1/2	90 ± 10	10,000	1,000 2,500 5,000	1 x 1 x 1.5
S 41320105 (See S 41330105 Note 2) S 41340105	6	0 ± 10	10,000	1,000 2,500 5,000	1 x 1 x 1
S 42320105 (See S 42330105 Note 2) S 42340105	6	90 ± 10	10,000	1,000 2,500 5,000	1 x 1 x 1.5
S 81720101 (See S 82720101 Note 2)	16	0 ± 10 90 ± 10	10,000	2,000	2-3/16 x 2-1/2 x 2-3/8
S 81920101 (See S 82920101 Note 2)	40-50	0 ± 10 90 ± 10	10,000	2,000	2-3/16 x 2-1/2 x 2-3/8
S 71230103 (See S 72230103 Note 3)	3-1/2	0 ± 10 90 ± 10	500	2,500	2.4 x 2.75 x .5
S 71330103 (See S 72330103 Note 3)	6	0 ± 10 90 ± 10	500	2,500	2.4 x 2.75 x .5
S 75210104 (See S 76210104 Note 4)	3-1/2	0 ± 10 90 ± 10	500	500	2.5 x 3.5 x .5
S 75310104 (See S 76310104 Note 4)	6	0 ± 10 90 ± 10	500	500	2.5 x 3.5 x .5

(All units operate from 28V DC line. Signal voltage 26V RMS max. All units have initial gain set ±1dB and ±2dB gain stability. Frequency 400 ±20 Hz except as noted.)

NOTES:

1. Unit is 90% efficient. Less than 1 ohm output impedance. Will drive motors without tuning capacitor.
2. These units available in many varied packages, consult factory for unit to meet your exact form factor.
3. These are low cost, 400 Hertz, card amplifiers and are available in varied gains from 100 to 5000.
4. These are low cost, 60 Hertz, card amplifiers and are available in varied gains from 100 to 2500.

Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

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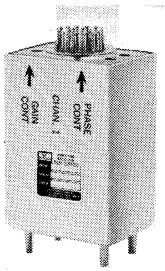
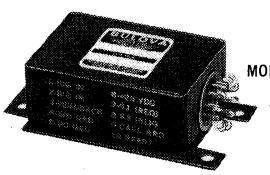
RESOLVER AMPLIFIERS



MODEL 310



MODEL 315

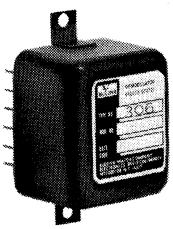


MODEL B61320104

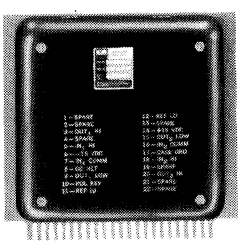
	Model 310	Model 315	Model 366	Model B61320104	Model B81320104
Number of Channels:	2	2	2	1	2
Inputs/Channel:	1	1–3	1	2	2
Voltage Gain: (Comp. Out/Signal In)	1.0000	1.0000	1.0000	.4995	.4995
Gain Stability:	±.1%	±.025%	±.1%	±.02%	±.02%
Phase Shift: (Degrees)	.0 ±.1	.0 ±.1	.0 ±.1	180 ±.1	180 ±.1
Max. Linear Output: (Volts RMS)	0–10	0–10	0–20	0–10	0–10
Summing Accuracy:	.03%	.025%	.03%	.03%	.03%
Input Impedance (ohms)	1 meg	200k	1 meg	200k	200k
Input Voltage (DC)	28	28	50	28	28
Type:	Series Summing	Parallel Summing	Series Summing	Universal	Universal
Load:	AEL 8RP6	Vernitron VRE23/41	AEL 8RP6	Size 8, 11 & 15	Size 8, 11 & 15
Package Size:	.938 diam. x 1.22	1.76 x 1.26 x 2.5	.938 diam. x 1.22	1.25 x 1.75 x .76	1.25 x 1.75 x .76

NOTE: Operating Frequency, all units 400 Hz.

MODULATORS/DEMODULATORS—400 Hz—800 Hz



MODEL 306



MODEL 468

	Model 307 Modulator	Model 306 Demodulator	Model 468 (Dual Channel) Demodulator*
Ref. Voltage:	26V RMS	26V RMS	10 Vrms
Input Signal:	±15V DC	0.30V RMS	0–1 Vrms
Output Voltage:	0–7V RMS	±7V DC	±5V DC
Gain:	.9 ±10%	1.0 ±10%	1 ±0.5%
Null:	30mV rms max.	30mV rms max.	.003%/C°
Freq. Response:	Flat +1 −3dB from DC to 200 Hz	Flat +1 −3dB from DC to 200 Hz	0–30 Hz
Linearity:	±10%	±10%	±.5%
Output Impedance:	4000 ohns	2000 ohms	500 ohms
Input Impedance:	—	6000 ohms min	500 K ohms
Package Size:	—	—	4.5 x 4.5 x 1.0 Card Plug In

*Has common mode rejection of 60 db or greater at 800 and 60 Hz.

AC Summing (Operational) Amplifiers

Gains up to 10. Summing inputs matched to .02%. Up to 4 inputs. Single or dual channel units available.

Quadrature Rejection Amplifiers

Available with gains of up to 10 and rejection ratios of up to 150:1. Units may be supplied with up to 3 summing inputs. Units operate from 28 or 40V DC.

DC Torquer Amplifiers

Up to 8 amp. power output units available with or without built-in gain adjust. High efficiency, small size, low drift. Units operate from 28V DC.

Error Signal Detectors

These solid state circuits are designed to drive external or built-in relays. Time delays built in to avoid tripping due to pickup signals, low hysteresis. Wide magnitude of voltage ranges available.

Gain Control Amplifiers

Automatic gain control for 400 Hz servo systems; with transfer function of 26 divided by the control voltage. Other transfer functions available on request.

Gyro Wheel Supplies

Gyro Wheel Supplies can be provided to drive gyro-motors ranging in frequency from 400 to 3200 Hz. Units are specifically designed to drive 2 phase gyro motors and their respective pick-off windings.

Phase shift between outputs are held to 90° ±1 degree. Oscillator stability is better than 10^5 per degree C.

Manufacturer of the widest range of Frequency Control Components: Crystals ● Crystal Oscillators ● Crystal Filters ● LC Filters ● Tuning Forks ● Fork Oscillators ● Ovens ● Coils ● Servo Amplifiers

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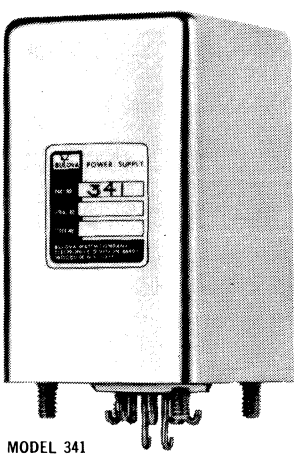
TORQUER AMPLIFIERS



MODEL 441

	Model 441 (100 watt)	Model 441A (300 watt)	Model 475 (40 watt)
Power Supply Requirements:	+28V DC ±5% at 6.6A max.; 500mV rms ripple max.; ±15V DC ±1.0% at 100mA max.; 10mV rms ripple maximum.	+28V DC ±5% at 18A max.; 500mV rms ripple max.; ±15V DC ±1.0% at 150mA max.; 10mV rms ripple maximum.	±15V DC ±10%
Power Output:	100 watts peak (Cont.)	300 watts peak (Cont.)	40 watts peak (Cont.)
Signal Input:	3 channels—summing, single ended		Single Channel (noninverting)
Input Resistance:	10k ohm each input		10k
Transfer Gain (Vo/Vin):	1000V/V; each channel	500V/V; each channel	10 V/V
Gain Adjustment:	BY EXT. RESISTOR	AVAILABLE ON REQUEST	Internal (10 to 100)
Gain Stability:	±15% in ambient temp. range		2% over temperature range −25 to +85°C
Signal Input Level:	±1mV DC to ±25V DC	±1mV DC to ±10V DC	±1mV DC to ±10V DC
Linear Output Current Range:	0-25 volts @ RL ≥ 6Ω	0-20 volts @ RL ≥ 1.5Ω	0-8 volts @ RL ≥ 2 ohms
Deadband:	100 uv maximum; referred to input		100 uv referred to input
Offset Voltage:	±1mV; referred to input @ Rs < 1k	±1mV; referred to input @ Rs < 1k	±1mV referred to input @ Rs < 1k
Drift	±1mV over ambient temp. range. AT INPUT	±3mV over ambient temp. range. AT INPUT	2.5 mV over ambient temp. range. AT INPUT
Current Limiting:	Output will limit at 6 +1.5A, −0A, @ 25°C	Output will limit at 16 +2.5A, −0A, @ 25°C	Output will limit at 4.5 amps (adjustable)
Linearity:	5% from best straight line in linear region		5% from best straight line in linear region
Symmetry:	5% in linear output region		5% in linear output region
Band Width:	20 Hz minimum		50 KC
Package Size:	2.34" x 6" x 3"	4.5" x 6" x 3"	4" x 4" x 2.75"

AC to DC POWER SUPPLIES



MODEL 341

	Model 341	Model 424	Model 423
Output Voltage:	✱1,32V DC (2 channels) ✱2,15.5V DC (2 channels)	±15V DC	✱1,50V DC ✱2,28V DC ✱3,3V DC ✱4,28V DC
Output Current:	✱1,25 ma ✱2,50 ma	100 ma	✱1,100 ma ✱2,1.0 Amps ✱3,2.0 Amps ✱4, 7.0 Amps
Regulation:	±15%	±1.0%	±10%
Input Power:	26V rms 400 H_z	115V rms 400 H_z	115V rms 400 H_z
Voltage Protection:	- -	Limits 130 ma ±15 ma	Over load protected 130 ±15% of load
Packaging:	Potted	Field Repairable	Field repairable
Package Size	1.45" x 1.89 x 2.5	2 x 2.8 x 3.8	7 x 9 x 4

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FACTORY STOCKED
PM STEPPING MOTORS · CONTROL CIRCUITS · GEAR MOTORS

STEPCON® STEPPING MOTORS†



Stepcon® Permanent Magnet Motor—Stepping motors feature: Speeds to 1500 pps, controlled variable speed, immediate reversal, no mechanical detents or brushes, no drift, minimum overshoot, no compensation networks or feedback required, no external damping required. Motors are digital actuators which operate bidirectionally in precise increments of 15°, 30°, 45°, or 90° per pulse. Variation in precise control increments can be achieved by use of available gear heads. Provides accurate shaft rotation without feedback or position pickoff to actuate counters, x-y plotters, potentiometers, transducers, switching mechanisms, and digital to analog and analog to digital converters. Shock-free magnetic detenting between pulses permits smooth no drift operation. Available from stock in frame sizes 8, 11, 13, 15, 17, 20, 23 with a wide variety of torque, inertia, pinion, size, and impedance specifications with 2ø or 3ø stators and permanent magnet rotors. Designed to meet applicable paragraphs of MIL-E-5272, MIL-M-7969, and MIL-E-5400. Bearings are double shielded and life lubricated; cases are stainless steel or aluminum construction; class H insulation standard; all units rated at 28 V DC. Custom units available to specification.

STEPPING MOTOR PART NUMBER	Frame Size	Frame Type	Step Angle (Deg.)	Motor Type	TWO HALF PHASE OPERATION* Min. Holding Torque (Oz-In)	Min. No. Load Speed (Steps per Sec) Synch Step	Slew	Typical Motor Power Input @28VDC (Watts)	Required Controller	FULL PHASE OPERATION* Min. Holding Torque (Oz-In)	Min. No Load Speed (Steps Per Sec) Synch Step	Slew	Typical Motor Power Input @28VDC (Watts)	Required Controller	Typical Stator Resistance Per Coil (Ohms)	Max. Rotor Inertia (GM-CM²)	Pinion or Shaft Size	DIMENSIONS (Inches) Diam.	Length	Reg. Diam.	Shaft Ext.	Max. Wt. of Motor (oz)
711-8-900-125	8	BW	90	6 Lead, 2ø PM	0.60	100	130	3.5	041,047	0.43	85	110	0.87	045, 062	450	0.70	13T 120P	0.750	1.135	0.5000	.375	1.77
713-8-325-125	8	BW	90	6 Lead, 2ø PM	0.60	230	440	9.7	041,047	0.43	210	400	2.4	045, 062	163	0.25	10T 96P	0.750	1.225	0.5000	.375	1.77
715-8-320-125	8	BW	90	6 Lead, 2ø PM	0.90	175	225	9.8	041,047	0.50	135	190	2.5	045, 062	160	0.70	10T 96P	0.750	1.135	0.5000	.340	1.77
2710-000	11	SC	90	8 Lead, 2ø PM	2.70	230	270	24.1	041,047	3.80	300	350	24.1	045, 062	65	1.36	.125 DIA	1.062	1.880	1.0000	.440	4.00
2710-002	11	SC	90	8 Lead, 2ø PM	2.70	230	270	24.1	041,047	3.80	300	350	24.1	045, 062	65	1.36	10T 96P	1.062	1.880	1.0000	.440	4.00
2711-000	11	SC	45	8 Lead, 2ø PM	2.40	365	400	19.6	041,047	3.40	430	470	19.6	045, 062	80	1.36	.125 DIA	1.062	1.880	1.0000	.440	4.00
2711-002	11	SC	45	8 Lead, 2ø PM	2.40	365	400	19.6	041,047	3.40	430	470	19.6	045, 062	80	1.36	10T 96P	1.062	1.880	1.0000	.440	4.00
2716-000	11	SC	15/30	6 Lead, 3ø PM	—	—	—	—	—	3.80	1350/830	1575/970	20.9	071/073	25	1.36	.125 DIA	1.062	1.880	1.0000	.440	4.00
2716-002	11	SC	15/30	6 Lead, 3ø PM	—	—	—	—	—	3.80	1350/830	1575/970	20.9	071/073	25	1.36	10T 96P	1.062	1.880	1.0000	.440	4.00
729-11-120-125	11	BW	90	6 Lead, 2ø PM	2.00	225	400	26.2	041,047	1.40	190	340	6.6	045, 062	60	1.20	10T 96P	1.062	1.800	1.0000	.400	5.60
2702-000	13	SC	90	8 Lead, 2ø PM	7.00	160	200	35.0	041,048	9.00	200	220	35.0	045, 049	45	7.05	.125 DIA	1.250	2.870	1.0000	.530	8.50
2702-002	13	SC	90	8 Lead, 2ø PM	7.00	160	200	35.0	041,048	9.00	200	220	35.0	045, 049	45	7.05	10T 96P	1.250	2.870	1.0000	.530	8.50
2703-000	13	SC	45	8 Lead, 2ø PM	7.00	275	300	35.0	041,048	9.00	318	350	35.0	045, 049	45	7.05	.125 DIA	1.250	2.870	1.0000	.530	8.50
2703-002	13	SC	45	8 Lead, 2ø PM	7.00	275	300	35.0	041,048	9.00	318	350	35.0	045, 049	45	7.05	10T 96P	1.250	2.870	1.0000	.530	8.50
2714-000	13	SC	15/30	6 Lead, 3ø PM	—	—	—	—	—	9.00	1080/610	1188/675	32.7	073/071	16	7.05	.125 DIA	1.250	2.870	1.0000	.530	8.50
2714-002	13	SC	15/30	6 Lead, 3ø PM	—	—	—	—	—	9.00	1080/610	1188/675	32.7	073/071	16	7.05	10T 96P	1.250	2.870	1.0000	.530	8.50
749-15-30-125	15	BW	90	6 Lead, 2ø PM	—	—	—	—	—	5.70	170	340	26.2	045, 049	15	5.00	15T 96P	1.437	2.100	0.8745	.360	10.50
2704-000	17	SC	90	8 Lead, 2ø PM	12.00	128	150	46.0	041,048	17.00	150	165	46.0	045, 049	34	22.40	.187 DIA	1.687	3.250	1.3750	.650	16.30
2704-002	17	SC	90	8 Lead, 2ø PM	12.00	128	150	46.0	041,048	17.00	150	165	46.0	045, 049	34	22.40	15T 96P	1.687	3.250	1.3750	.650	16.30
2705-000	17	SC	45	8 Lead, 2ø PM	12.00	220	250	46.0	041,048	17.00	260	280	46.0	045, 049	34	22.40	.187 DIA	1.687	3.250	1.3750	.650	16.30
2705-002	17	SC	45	8 Lead, 2ø PM	12.00	220	250	46.0	041,048	17.00	260	280	46.0	045, 049	34	22.40	15T 96P	1.687	3.250	1.3750	.650	16.30
2717-000	17	SC	15/30	6 Lead, 3ø PM	—	—	—	—	—	17.00	720/450	790/475	49.8	071/073	10.5	22.40	.187 DIA	1.687	3.250	1.3750	.650	16.30
2717-002	17	SC	15/30	6 Lead, 3ø PM	—	—	—	—	—	17.00	720/450	790/475	49.8	071/073	10.5	22.40	15T 96P	1.687	3.250	1.3750	.650	16.30

*Measured with motor windings at 25°C, and with specified ADC controller at 28 VDC.

NOTES: 1. These data are for reference purposes only.

2. The recommended motor case operating temperature range is −55°C to +185°C. The +185° maximum may be exceeded but bearing life will be shortened.

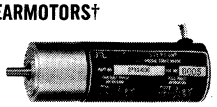
3. With typical mounting, a temperature rise of approx. 65°C above 25°C ambient can be expected. Heat radiators are available to reduce temperature rise.

4. For winding temperatures greater than 25°C, derate torque at 0.4%/degree C and stepping speed at 0.2%/degree C.

5. Inertia load decreases stepping rate. For inertia loads less than 50% of rotor inertia, derate no-load speed by the factor $\sqrt{\frac{\text{Rotor Inertia}}{\text{Rotor} + \text{Load Inertia}}}$

6. Gearheads are available for above motors.

STEPCON® GEARMOTORS†



Gear Motors—The STEPCON® Size 13 and 17 Gearmotors have been designed to provide an economical stepping motor/gearhead package which makes no compromise as regards performance or long life. Over 500 different ratios are available from stock in the range from 3/1 to over 800,000/1. Standard backlash is less than ±45 min. with a 2 in. oz. reversing load. Maximum static load is 150 in. oz., and maximum running load is 75 in. oz. The size 13 STEPCON® Gearhead can be adapted to either size 11 or size 15 motors on special order.

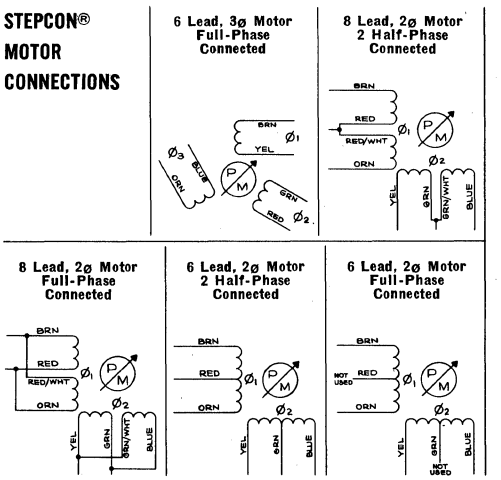
Gear Motor Part Number	Size	Motor Type	Two Half Phase Operation Max. No Load Sync Speed (Steps/Sec)	Two Half Phase Operation Required Controller	Full Phase Operation Max. No Load Sync Speed (Steps/Sec)	Full Phase Operation Required Controller	Step Angle Range (Degrees)	Max. Dimensions Inches Dia.	Lgth.	Reg. Dia.
2702-000-(Ratio)	13	90°, 8 Lead, 2ø, PM	160	041,048	190	045,049	.000102-30	1.250	4.800	1.000
2703-000-(Ratio)	13	45°, 8 Lead, 2ø, PM	275	041,048	318	045,049	.000051-15	1.250	4.800	1.000
2704-000-(Ratio)	17	90°, 8 Lead, 2ø, PM	128	041,048	150	045,049	.000102-30	1.678	5.100	1.375
2705-000-(Ratio)	17	45°, 8 Lead, 2ø, PM	220	041,048	260	045,049	.000051-15	1.678	5.100	1.375
2710-000-(Ratio)	13	90°, 8 Lead, 2ø, PM	230	041,047	300	045,062	.000102-18	1.250	4.025	1.000
2711-000-(Ratio)	13	45°, 8 Lead, 2ø, PM	365	041,047	430	045,062	.000051-9	1.250	4.025	1.000
2714-000-(Ratio)	13	15°/30°, 6 Lead, 3ø, PM	—	—	1080/610	073/071	.000017-10	1.250	4.800	1.000
2716-000-(Ratio)	13	15°/30°, 6 Lead, 3ø, PM	—	—	1350/830	073/071	.000017-6	1.250	4.025	1.000
2717-000-(Ratio)	17	15°/30°, 6 Lead, 3ø, PM	—	—	720/450	073/071	.000017-10	1.678	5.100	1.375

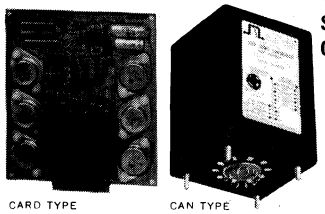
NOTES: 1. Gear ratios available between 3:1 and 886000:1. Specify tolerance allowed on desired ratio, or specify that ratio be exact.

2. Max. Running Torque is 75 in. oz. Max. static torque is 150 in. oz.

3. Max. Shaft Extension is 0.56 in. Max. Shaft diameter is 0.187 in.

STEPCON® MOTOR CONNECTIONS





STEPCON® CONTROLLERS†

† Patent 2809335; others issued and pending.

Stepping Motor Controller Part Number	Total Power Output @ 28 VDC (Watts)	Operating Temperature Range (Degrees C)	Controller Type	Type of Packaging	Dimensions (Inches Max.) W	D	H	Max. Weight Oz.	Pulse Current Input① (ma)	Max. Load Current Per Output CKT (Amps)
047-2P/2-120-125	36	−55 to +125	2 Half-Phase	Can	1.62	1.62	2.38	8	5-20	0.55
049-2P/2-40-125	109	−55 to +125	2 Half-Phase	Can	1.81	1.93	2.75	8	15-60	1.65
041-2P/2-15-65	146	−30 to +65	2 Half-Phase	Card	4.50	0.56	5.38	8	20-80	2.20
062-1P-30-125	37	−55 to +125	Full-Phase	Can	2.06	2.31	3.12	11	5-20	1.10
049-1P-17-125	65	−55 to +125	Full-Phase	Can	2.06	2.31	3.12	11	5-20	1.95
045-1P-17-65	65	−30 to +65	Full-Phase	Card	4.50	0.56	5.38	8	5-20	1.95
073-3P-17-65	65	−30 to +65	3 Phase Single Angle	Card	4.50	1.50	5.38	15	15	1.95
071-3P-17-65	65	−30 to +65	3 Phase Dual Angle②	Card	4.50	1.50	5.38	15	15	1.95

1. Nominal value based on 1 msec rise time.
2. Step angle selection determined by logic level input to controller during operation.

Stepcon® Controller—Required for use with stepping motors to obtain specified performance. Contains reliable solid-state transistor circuitry to accept pulse inputs from computer, tape, pulse-generating module, or other programmers. Determines sequential order of motor coil currents in response to input pulses, and provides magnetic detenting between pulses. Packaged in MIL-T-27A cans or plug-in printed circuit cards designed to meet applicable MIL-E-5272, MIL-E-4158, and MIL-E-5400 requirements. Power Requirements: All units rated at 28 ±5 VDC. Input Pulse Requirements: Amplitude: Positive going transition equal to at least 60% and no more than 100% of the controller supply voltage with a rise time of 1 μsec. or less. Pulse Width: Greater than 15 μsec. Controllers of the two half phase type provide simplified switching circuits and minimum cost. Full phase type controllers provide more efficient motor operation at slightly higher cost. Pulse adaptor circuits available to accept most any type of pulse or switching function. Controllers available from stock, or to customer specification to meet a wide variety of applications.

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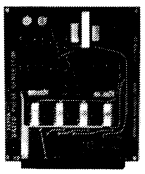
DIGITAL CONTROL EQUIPMENT

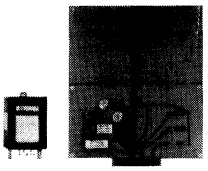
ADC offers a complete line of digital equipment building blocks compatable with ADC motors and controllers, allowing customer formulation of control systems to his unique requirements.



Model 503B Single Pulse Generator — This unit supplies exactly one pulse per push button activation, with characteristics to match the ADC controller requirements: Positive going pulse equal to unit supply voltage +0V, —1.8V with a rise time of 1 μsec max and a compatable pulse width. Rated at 28 VDC input. Mounts in 5/8" dia hole in panels up to 3/16" thick. A companion unit, the 1537A Switch Adapter supplies similar output when activated by an external SPST switch closure. This unit is particularly useful in masking contact-bounce inherent in reed-switches, snap action switches, relays, and other such mechanical switches, thus preventing false counts.

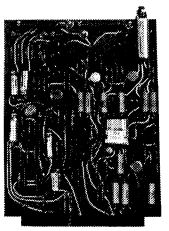


Model 1516A Gated Pulse Generator — This unit converts a single input pulse to a specified number of output pulses delivered at a specified rate. Pulse output characteristics match the ADC controller requirements: Positive going pulse equal to unit supply voltage +0V, —1.8V with a rise time of 1 μsec max and a pulse width of 15 to 75 μsec. Number of pulses out are variable from 0 to 256. Frequency range is variable within each of eleven standard ranges from 0.8 to 1600 Hz. Input pulse requirements: Amplitude positive going transition between 60% and 100% of the unit supply voltage with a rise time of 1 μsec max and a pulse width greater than 15 μsec. Unit rated at 28 ±5 VDC, 150 ma.

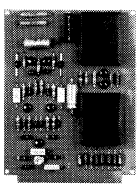


Model 576A and 1502A Pulse Generators — These units supply a string of pulses with output characteristics which match the ADC Controller requirements: Positive going pulse equal to unit supply voltage +0V, —1.8V with a rise time of 1 μsec max and a pulse width of 15 to 75 μsec. Frequency range is variable within each of eleven standard ranges from 0.8 to 1600 Hz. Pulse current output, 60 ma. Provision for controlling pulse rate remotely or inhibiting the pulse output are included. Supply voltage, 28± 5VDC. The 576A is card mounted and has a maximum operating temperature rating of 70°C, while the 1502A is mounted in a hermetically sealed can and has a maximum operating temperature of 125°C.





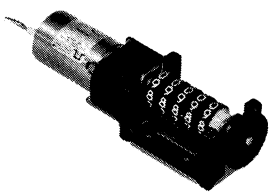
575A Analog to Pulse Rate Converter — Converts bi-polar analog input voltage to bi-directional pulse rate output which is compatible with ADC's Stepcon® Controllers. By adding a potentiometer to the stepper-motor shaft, a position servo can also be accomplished. The 575A can provide both angular position and step rate servo control, thus also accomplishing a DC motor function.



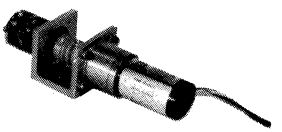
555A Digital Servo Comparator Series — Accepts DC analog voltage corresponding to a desired output shaft position. Using a Stepcon® driven potentiometer to supply feedback voltage, corresponding to the actual shaft position, the 555A provides pulses to a Stepcon® controller to drive the error voltage to a null. These pulses, which are the digital conversion of the analog input, may also be used to drive the Stepcon® counter at a remote location or used for data transmission.



Model 254A Power Saver — This unit automatically reduces power delivered to a stepping motor during non-stepping periods where full magnetic detent is not essential and minimum total power dissipation is required. The Power Saver is used in conjunction with the 048, 049, 062, 071 or 073 Stepcon® Controllers and their power supplies. Input requirements are compatable with ADC pulse generator outputs. Full power is delivered to the motor during the stepping period and reduced to an adjustable level of 3% to 70% during the non-stepping period. Hold-time, the period between removal of the stepping pulse and reduction to the standby power level, is adjustable between 15 and 500 msec. Available in both card and hermetically sealed can models.



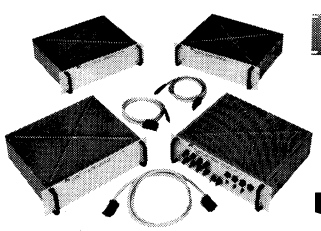
Model 1603A Stepcon® Driven Digital Counter — This unit provides readout on four or five digit wheels bi-directionally (addition or subtraction) at rates of 160 counts/second. Out-performs existing electro-mechanical and relay-operated devices. One pulse into controller advances last digit wheel one digit. Counter has mechanical reset, and each digit wheel can be set by hand to a predetermined number.



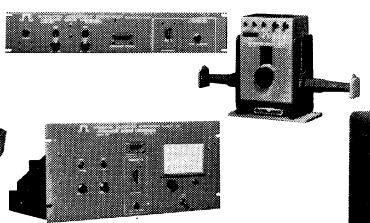
Stepcon® Driven Potentiometer Assembly — Illustrated is the 2711-000-45-1T2K/1T2K consisting of a 2711 Gearmotor with 45:1 reduction, a simple flexible coupling and a dual continuous turn 2K potentiometer. This assembly utilizes a 903A Servo Mount Adapter and provides a simple and inexpensive means for coupling Stepcon® Motors or Gearmotors to other components utilizing servo mounts. Adapters are available to mate size 8, 10, 11, and 13 components including potentiometers, synchros, resolvers, etc. Inexpensive slip-clutch coupling also available. Backlash, torque, speed, gear ratio, etc. are determined by components selected.

CONTROL SYSTEMS CAPABILITIES

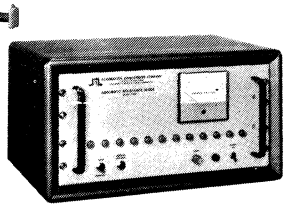
ADC can provide complete on-the-shelf, or custom designed control systems to your requirements.



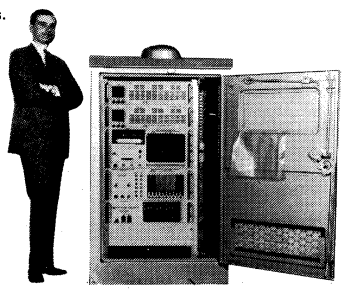
Model 850B Digital To Synchro-Analog Converter System — Converter system accepts 3 sets of 12-bit parallel binary input signals and strobe signals. These parallel binary inputs are converted to syncho positions within an overall RMS error of 0.12°. Conversion is accomplished by means of Stepcon® Controller and Motor drives. The Model 850B Digital to Analog Converter System consists of two Model 110A single output converters, one Model 110B dual output converter and a Model 214A Power Supply/Clock Generator. The 110A Contains a rotary single synchro digital to analog converter, i.e., the encoder is driven through the shortest path to null and may go through zero. The 110B contains a linear 2-speed synchro converter, i.e., the encoder is driven through the shortest path to null and may not go through zero.



833A Attenuator Remote Control System — Control system is designed to provide accurate, stable attenuation settings from 0 to 50 db when operated in conjunction with the Hewlett-Packard Model X382A Variable "X" Band Microwave Attenuator or equivalent. Digital-type control system provides a more accurate and reliable means of remote setting microwave attenuators without problems of stability and gain inherent in conventional servo systems. The Attenuator can be easily and accurately tuned or set at the Attenuator itself, or from the Master Controller, or from any Remote Controller Station. The Attenuator can be set to provide the desired attenuation in repetitive control increments of 0.5° (Average attenuation increment of 0.03 db) over the full range of 0 to 50 db. Power Required: 115V Single Phase, 100 Watt, 60 cps, AC.



Model 334A Automatic Resistance Tester — This equipment is representative of ADC's ability to custom design and produce automated test equipment for industry. It will test flash-cube lamps, twelve at a time, checking within specified limits at low resistance level without firing the lamps. If a lamp is out of limit, an appropriate indication is made and the automated test sequencing is halted until the lamp is rejected or an override is initiated. The entire cycle is completed in less than 2 seconds for all twelve lamps.



Traffic Analysis and Control Systems — Utilizing the latest in solid state circuitry, these systems offer improved factors of size, efficiency, accuracy and dependability to traffic engineering and maintenance personnel. Traffic Analyzers can be provided to offer continuously visible indications of vehicle count into and out of a test lane as well as differential count and vehicle-second occupancy accumulation. Automatic print-out is also available. Control Systems, designed to the specific application, can include electronic dial units, tone actuated encoders, master synchronizers, multiple background program cycles, and complex program timing and switching, all compatable with manual, preset, direct line, radio link and computer actuations.

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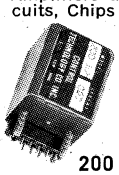
SERVO ELECTRONICS

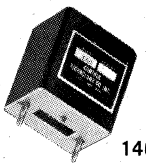
STANDARD AND CUSTOM DESIGNED

A.C. Servo Amplifiers | Demodulators
D.C. Servo Amplifiers | Modulators | Clutch Control Amplifiers | Resolver Booster Amplifiers
D.C. Torquer Amplifiers | Servo Valve Amplifiers | Relay Control Amplifiers | Isolation Amplifiers

- Standard units available which will meet applicable MIL Specs.
- Amplifiers available which utilize state of the art Integrated Circuits, Chips and Hybrids.
- Units for industrial applications available
- SPECIAL electronics designed to your detailed specification

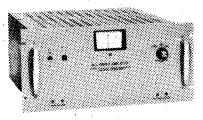

200 HP*


141*


140*


416-3


986 (Flat Pack)


980-1

*STOCK ITEMS Immediate Delivery	MODEL	Output Power	Output Voltage	Output Frequency	Input Signal Frequency	Input Impedance	Gain	Power Required	Temperature Range
AMPLIFIERS FOR A.C. SERVO MOTORS	*200-HP	3.5 W	40 VCT	400 CPS	400 CPS	10K	2,500	28 VDC	—55°C +125°C
	*200-5	3.5 W	40 VCT	400 CPS	400 CPS	10K	5,000	28 VDC	—55°C +125°C
	930	3.5 W	40 VCT	400 CPS	400 CPS	250K	2,000	28 VDC	—55°C +125°C
	*200-8	3.5 W	40 VCT	400 CPS	400 CPS	10K	2,500	115 V 400 CPS	—55°C +125°C
	211	3.5 W	40 VCT	400 CPS	400 CPS	200K	2,500	115 V 400 CPS	—55°C +100°C
	216B	6 W	40 VCT	60 CPS	60 CPS	10K	1,000	28 VDC	—55°C +85°C
	*140	6 W	40 VCT	400 CPS	400 CPS	50K	1,000	28 VDC	—55°C +125°C
	143	6 W	40 VCT	400 CPS	DC	20K	1,000	28 VDC 3.2 V 400 CPS	—55°C +125°C
	141	6 W (90°)	40 VCT	400 CPS	400 CPS	30K	1,000	28 VDC	—55°C +125°C
	416-3	16 W	40 VCT	400 CPS	400 CPS	10K	1,000	28 VDC	—55°C +71°C
	*416A	16 W	40 VCT	400 CPS	400 CPS (2)	10K	1,000	28 VDC	—55°C +100°C
	416D	16 W (90°)	40 VCT	400 CPS	400 CPS (2)	10K	1,000	28 VDC	—55°C +100°C
	*159	16 W	40 VCT	60 CPS	60 CPS	10K	1,000	28 VDC	—55°C +100°C
	*956B	40 W (90°)	40 VCT	400 CPS	400 CPS	10K	1,000	28 VDC	—55°C +100°C
	956C	40 W (90°)	40 VCT	400 CPS	DC	10K	500	28 VDC 115 V 400 PS	—55°C +100°C
	157-2	100 W (90°)	40 VCT	400 CPS	400 CPS	10K	800	28 VDC	—55C° +85°C
	MODIFICATIONS to gain, input impedance, signal frequency, and power level are available. Matching transformers for driving motors at other voltages in stock.								
AMPLIFIERS FOR D.C. TORQUERS	986	6W/100W (Flat Pack - Short Circuit Proof)	20 V	DC	DC (2)	10K	10	28 VDC	—55°C +100°C
	995-2	10 W	22V	DC	DC (2)	10K	50	28 VDC	—55°C +85°C
	996-3	20 W	22V	DC	DC (2)	10K	50	28 VDC	—55°C +85°C
	998-2	40 W	22V	DC	DC (2)	10K	50	28 VDC	—55°C +85°C
	912-6	125 W (Short Proof)	20V	DC	DC (2)	100K	200	28 VDC	—55°C +71°C
	914-3	220 W (Short Proof)	20V	DC	DC (2)	25K	200	28 VDC	—55°C +71°C
	980-1	500 W (Short Proof)	50V	DC	DC	10K	100	50-400 CPS 3 Phase (1 Phase Available.)	—55°C +71°C
	912-3	800 W	50V	DC	DC	10K	100	50-400 CPS 3 Phase (1 Phase Available.)	—55°C +71°C
	MODIFICATIONS to gain, input impedance, signal frequency, power level and operating temperature available.								
AMPLIFIERS FOR SERVO VALVES AND CLUTCHES	985	6.5 W	23 VDC	DC	DC	10K	20	28 VDC 115 V 400 CPS	—55°C +71°C
	Provisions for Balance and Null current adjustment. Will drive either a single center tapped coil or two separate coils.								
DEMODULATORS	312A	Full Wave	10V	DC	60 CPS	10K	10	28 VDC 115 V 60 PS	—55°C +125°C
	312	Full Wave	10V	DC	400 CPS	10K	10	28 VDC 115 V 400 PS	—55°C +125°C
	312B	Full Wave	10V	DC	.4 to 4KC	10K	10	28 VDC 115 V Reference	—55°C +125°C
	324	Full Wave	20V	DC	400 CPS	10K	30	28 VDC 6.3 V 400 CPS	—55°C +125°C
	MODIFICATIONS to gain, output voltage and input impedance available.								
RESOLVER BOOSTER AMPLIFIER	328	0.1% Accuracy	10V	400 CPS	400 CPS	200K	1 ±.1%	28 VDC	—55°C +125°C
	Available as single channel or dual channel unit. Will operate size 8 or size 11 resolvers. Amplifiers with modifications to above parameters available.								
ISOLATION AMPLIFIERS	250-1	0.2% Acc./ 10K Load	5 VRMS	400 CPS	400 CPS	1 MEG	1	28 VDC	—55°C +125°C
	260	0.05% Acc./ 5K Load	40 VRMS	400 CPS	400 CPS	20K	40	60 VDC	—55°C +100°C
	MODIFICATIONS to gain, input impedance, accuracy and voltage output available.								

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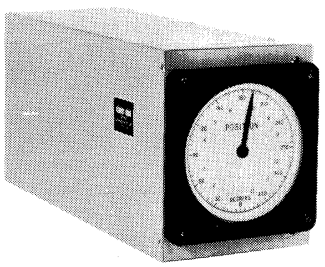
SERVO MECHANISMS

STANDARD AND CUSTOM DESIGNED

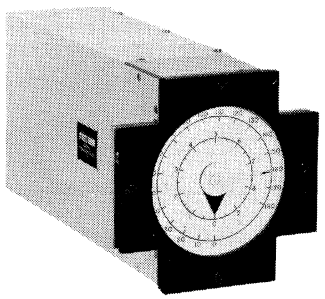
Servo Indicators
Servo Actuators
Servo Repeaters
Two Speed Servos
Servo Computers
Data Transmission Systems
Analogue to Digital Converters
Nuclear Control Rod Indicators
Process Controllers
Special Control Systems

- Units available which will meet applicable MIL Specifications
- Devices designed to operate with A.C., D.C., synchro or resolver command signals.
- All units feature self-contained transistorized high reliability electronics and power supplies.
- Units now in use on numerous systems involving:
  Simulators, Ground Support, Aircraft instrumentation, Fire Control, Missile Tracking, Missile instrumentation, ASW, High Accuracy Positioning, Stable Platforms
- Special systems can be designed in accordance to your detailed specifications. CTC will also design **"Interface"** equipment to integrate major control systems.

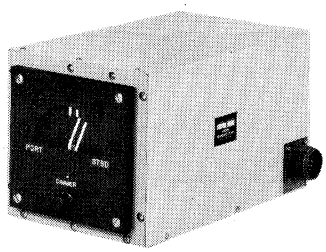
INDICATORS



CS-106 Single Pointer Indicator

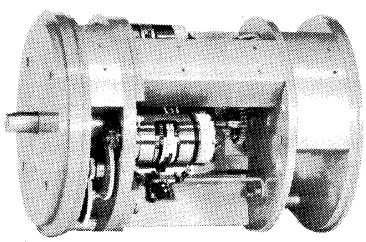


CS-109 Dual Pointer Indicator

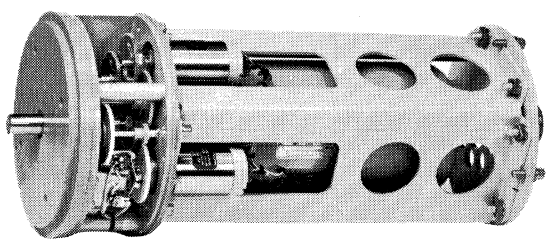


CS-211 Shipboard Indicator

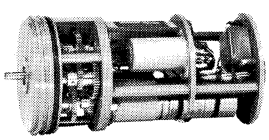
ACTUATORS



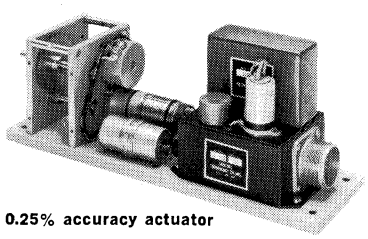
CS-202-2 300 lb. in. actuator



CS-202-1 Two speed synchro high accuracy actuator

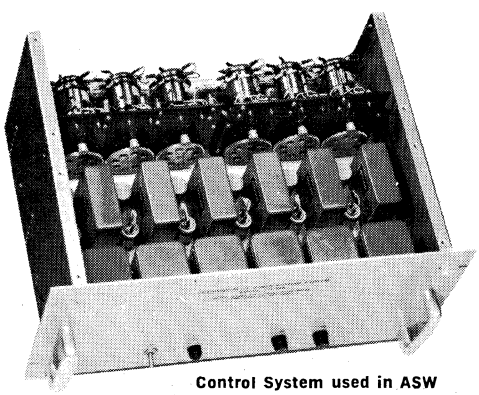


CS-198 250 oz. in. 0.1% accuracy actuator

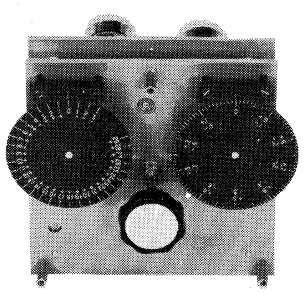


CS-133 0.25% accuracy actuator

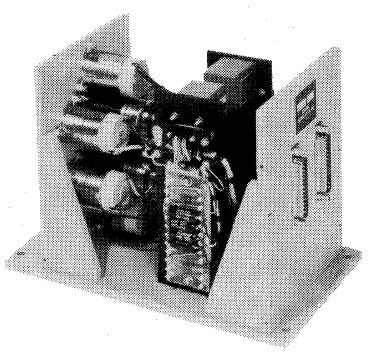
SPECIAL SYSTEMS



Control System used in ASW



Fine and Coarse data transmitter assembly



Dual Channel Resolver Angle Computer

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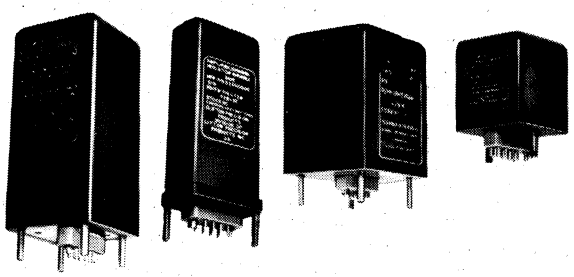
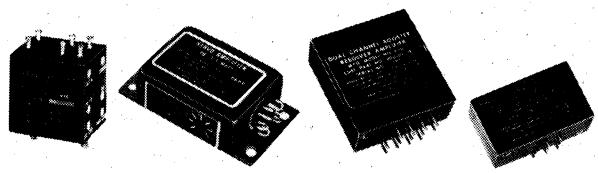
Buy CLIFTON QUALITY

ELECTRONIC MODULES



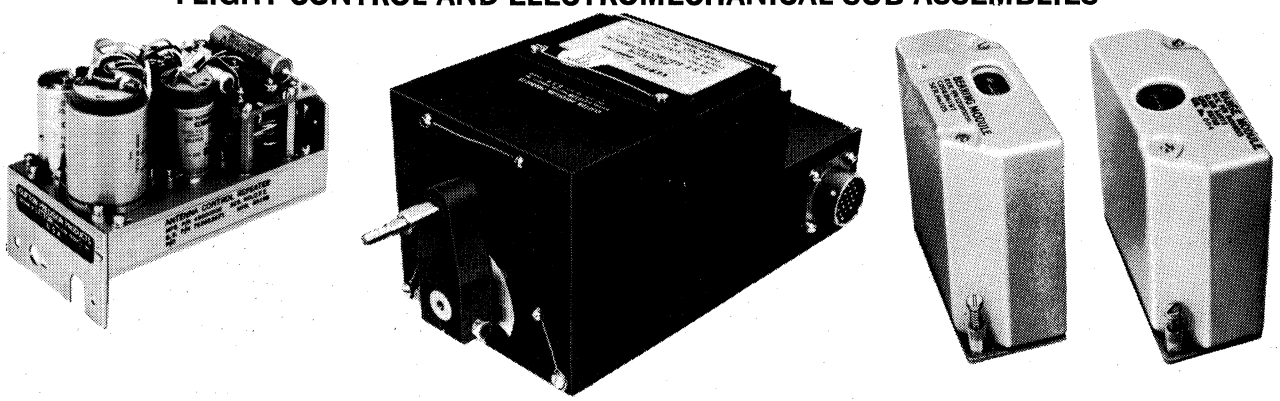
Clifton designs and manufactures power supplies (regulated and unregulated), signal comparators, summing and isolation amplifiers, single and dual channel amplifiers, amplifiers and resolvers chains, and a wide variety of similar items. Call Clifton for quality electronics.

SERVO AMPLIFIERS



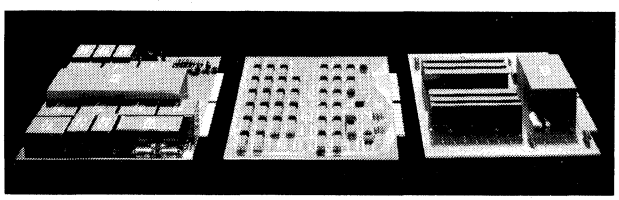
Clifton amplifiers include a wide variety of 0°-180° and 90° units, summing, isolation and booster amplifiers. Many of these have been especially designed to work compatibly with Clifton motors or resolvers. Call Clifton for sophisticated amplifier-resolver chains.

FLIGHT CONTROL AND ELECTROMECHANICAL SUB ASSEMBLIES

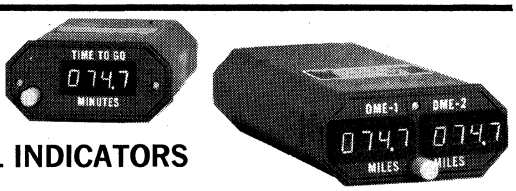


Clifton can custom design and manufacture servo packages to meet your special needs. As examples of our competence, shown above are (from left to right) a servo assembly in the F-111 aircraft, an automatic stabilization actuator used in the Sea Knight CH46A helicopter, and Tacan range and bearing couplers in use on a number of aircraft. Clifton also manufactures D/A and A/D converters, precise angle indicators, lat/long indicators. What's your special need?

S/D, D/S CONVERTERS



Composed of reliable, all solid state circuitry mounted on easily interchangeable printed circuit boards, these low cost converters can be used to interface any type of synchro outputs to digital computers, readouts, displays or printers. Or, conversely, they can convert a digital computer output to 3 or 4 wire synchro signals. Although designed especially for the process control and machine tool fields, this system can easily be modified for military applications.



DIGITAL INDICATORS

Using a serial BCD input signal, these indicators are designed to be used in conjunction with Air Transport Inertial Navigation System (INS) or Distance Measuring Equipment (DME) type equipment. All are fully compatible with the requirements of ARINC Specifications 561-2, 568 and those covering Air Transport Indicators.

In operation, each indicator recognizes the address of a specific function parameter, decodes the serial BCD data, and provides a digital display of the information. Important design advances in the areas of fault monitoring and detect circuitry plus central dimming capabilities are incorporated into the basic indicator design philosophy.

SEE SECTION 3500, page 1727 for a description of our wide line of Synchros, Servo Motors, and Torquers.

CLIFTON
DIVISION OF LITTON INDUSTRIES

GENERAL SALES OFFICE: 5050 State Rd., Drexel Hill, Pa.
215 622-1000 TWX: 510 669-8217

SERVO/SYNCHRO MODULES

DATA DEVICE CORPORATION / DEPT. 19
100 TEC STREET, HICKSVILLE, N. Y. 11801
TWX: 510-221-1874 • PHONE: 516-433-5330

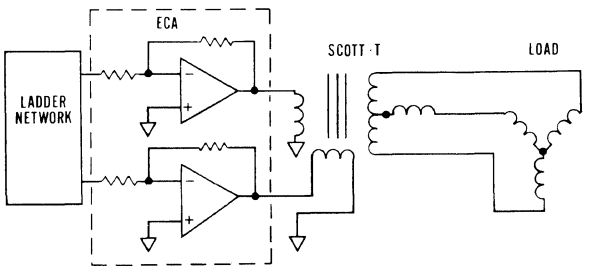
All specifications subject to change without notice

ECA 118 SERIES ELECTRONIC CONTROL AMPLIFIERS

The Model ECA 118-1 Electronic Control Amplifier provides the Systems Engineer with a new design tool. Particularly useful to airborne instrumentation, this unit obviates the classical servo methods of driving multiple synchro loads from a single source.

The Electronic Control Amplifier Series has been designed to withstand the rugged environmental extremes of MIL-E-5400. Common mode configuration, high open loop gain and power limiting circuitry provides extremely high accuracy and complete load-to-load, and load-to-source isolation. Completely solid-state (NO MOVING PARTS), these devices offer the extra dividends of high reliability and low maintenance.

TYPICAL APPLICATION

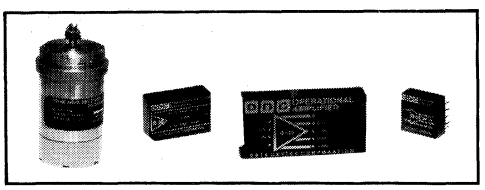


MODEL ECA 118-1 SPECIFICATIONS

PARAMETER	VALUE
ACCURACY	Three arc minutes
GAIN	Unity
PHASE SHIFT	Negligible
LOAD	Eight synchro servos (as low as 75 ohms)
INPUT IMPEDANCE	100K
OUTPUT IMPEDANCE	Negligible
INPUT VOLTAGE (1)	11.8 VAC line-to-line
INPUT POWER	115 VAC, 400 Hz; 10 VA Max.-MIL-STD-704 B
WEIGHT	1.5 pounds
OPERATING TEMP. RANGE	−55°C to 100°C

NOTES: (1) Also available 90 VAC line-to-line.

High Power Amplifiers	Model	RATED OUTPUT Volts Min.	RATED OUTPUT mA Min.	Open Loop Gain dB Min.	FREQUENCY RESPONSE Unity Gain MHz Min.	FREQUENCY RESPONSE FFO KHz Min.	FREQUENCY RESPONSE Slew Rate v/μs Min.	Input Voltage Drift vs Temp. μv/°C Max.	INPUT CURR. Initial Offset nA Max.	INPUT CURR. Drift vs Temp. nA/°C Max.	INPUT IMPED. Diff. MΩ Typ.	INPUT IMPED. CM MΩ Typ.	Case Size	Price (1-9)
100 mA Surge Capability	D-30	±18	60	84	1	15	1	10	25	0.8	1	100	1.2 x 1.8 x 0.6	$ 80.00
200 mA Surge Capability	D-31	±18	150	86	0.75	1.5	0.1	25	750	10	1	100	1.115 x 1.115 x 0.515	$ 95.00
65 mA Surge Capability	D-32	±11	40	88	0.8	2	0.1	25	750	10	.4	25	1.115 x 1.115 x 0.420	$ 67.00
200 mA Surge Capability	D-33	±11	110	88	0.8	2	0.1	25	750	10	.4	25	1.115 x 1.115 x 0.515	$ 67.00
650 mA Surge Capability	D-34	±18	280	86	1	4	0.3	50	750	10	.4	25	1.65 x 2.8 x 0.6	$125.00
1.5 A Surge Capability	D-35	±18	250	86	0.8	8	0.5	65	50	3	1	100	1.65 x 3.3 x 0.630	$110.00





14 BIT MINIATURE DIGITAL/SYNCHRO CONVERTERS
EDSC Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY (1)	±4 minutes
RESOLUTION	14 Bits
CODING	natural binary 'angle'
LOGIC	parallel, positive logic, TTL levels
OUTPUT (2) (3)	3 wire synchro 11.8V rms L-L 400 Hz driving up to 300 ohms L-L balanced
REFERENCE INPUT (2) (3)	26V rms 400 Hz
POWER SUPPLY REQUIREMENTS	+15V at 100mA, −15V at 80mA, +5V at 50 mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies, ±10% amplitude and frequency variation and up to 10% harmonic distortion of the reference and for any balanced load from no load to 300 ohms L-L.
(2) Other input and output voltages and frequencies available.
(3) Transformer isolated.

Price (1-9) from $495

13 BIT MINIATURE SYNCHRO/DIGITAL CONVERTERS
ESDC Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY (1)	±4 minutes ±0.5 LSB
RESOLUTION	13 Bits
CODING	natural binary 'angle'
DIGITAL OUTPUT	parallel, positive logic, TTL levels 13 angle data and 1 inhibit lines
SYNCHRO INPUT (2) (3)	11.8V rms L-L 400 Hz (ESDC-L), 90V rms L-L 400 Hz (ESDC-H)
REFERENCE INPUT (2) (3)	26V rms 400 Hz (ESDC-L), 115V rms 400 Hz (ESDC-H)
SYNCHRO INPUT RATES	0 to 360°/sec for full accuracy
POWER SUPPLY REQUIREMENTS	+15V at 40mA, −15V at 20mA, +5V at 200mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortion of synchro and reference inputs.
(2) Other input voltages and frequencies available.
(3) Transformer isolated.

Price (1-9) from $645

14 BIT MINIATURE DIGITAL/RESOLVER CONVERTERS
MDRC Series Specifications — Electrical

PARAMETER	VALUE
ACURACY (1)	±4 minutes
RESOLUTION	14 Bits
CODING	natural binary 'angle'
LOGIC	parallel, positive logic, TTL levels
OUTPUTS	10 $\sin\theta \sin\omega t$ and 10 $\cos\theta \sin\omega t$ volts at 5mA. where θ = digital input angle and ω = reference input frequency
REFERENCE INPUT (2)	26V rms 400 Hz transformer isolated
POWER SUPPLY REQUIREMENTS	+15V at 30mA, −15V at 10mA, +5V at 50mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortion of reference.
(2) Other input voltages and frequencies available.

Price (1-9) from $425

MINIATURE RESOLVER/SYNCHRO CONVERTERS
ERSC Series Specifications — Electrical

PARAMETER	VALUES
ACCURACY (1)	±2 minutes
INPUTS (2)	resolver voltages, ±10V peak at 400 Hz
INPUT IMPEDANCE	10 megohms min.; 50 pF max.
OUTPUT (2)	3-wire synchro voltages, 90V rms L-L no load, 400 Hz transformer isolated
OUTPUT IMPEDANCE	100 ohms L-L max. balanced to 5%
LOAD	any balanced load from no load to 2500 ohms L-L
POWER SUPPLY REQUIREMENTS	±15V at 550mA peak at full load

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortion of the inputs and for any balanced load from no load to 2500 ohms L-L.
(2) Other input and output voltages and frequencies available.

Price (1-9) from $295

14 BIT MINIATURE SOLID STATE CONTROL TRANSFORMER
SSCT Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY (1)	±4 minutes
RESOLUTION	14 Bits
CODING	natural binary 'angle'
DIGITAL INPUT	parallel, positive logic, TTL levels
SYNCHRO INPUT (2) (3)	11.8V rms L-L 400 Hz (SSCT-L) 90V rms L-L 400 Hz (SSCT-H)
REFERENCE INPUT (2) (3)	26V rms 400 Hz (SSCT-L); 115V rms 400 Hz (SSCT-H)
OUTPUTS	AC (3) and DC (3), output gradient controllable by an external resistor
POWER SUPPLY REQUIREMENTS	+15V at 30mA, −15V at 10mA, +5V at 50mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortion of synchro and reference inputs.
(2) Other input voltages and frequencies available.
(3) Transformer isolated.

Price (1-9) from $400

ELECTRONIC CONTROL DIFFERENTIAL TRANSMITTER
ECDX Series Specifications — Electrical

PARAMETER	VALUE
ACCURACY (1)	±4.5 minutes
RESOLUTION	14 Bits
CODING	natural binary 'angle'
LOGIC	parallel, positive logic, TTL levels
OUTPUTS	10 $\sin\theta \sin\omega t$ and 10 $\cos\theta \sin\omega t$ volts at 5mA. where θ = digital input angle and ω = reference input frequency
SYNCHRO INPUT (2)	11.8V rms 400 Hz transformer isolated
POWER SUPPLY REQUIREMENTS	+15V at 30mA, −15V at 10mA, +5V at 50mA

(1) Accuracy applies over operating temperature range, ±5% variation of power supplies and ±10% amplitude and frequency variation and up to 10% harmonic distortion of synchro input.
(2) Other input voltages and frequencies available.

Price (1-9) from $635

PLEASE SEE SECTIONS 1100 AND 2000

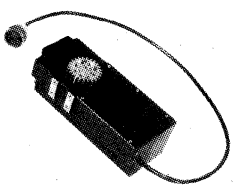
GAP
INSTRUMENT CORP.

COMPLETE SYSTEM CAPABILITY!

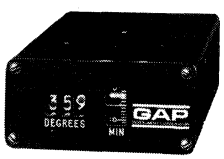
☐ SOLID STATE ☐ ELECTRO-MECHANICAL

SERVO

Pre-engineered Servo-Pax miniaturized modules which provide highly reliable, transistorized, high density servos for military and industrial systems.



ACTUATORS — A servo Rotary Actuator System for aircraft camera positioning that combines high torque and accuracy in its output. High density package with digital circuits capable of providing an increase in discrete output positions.

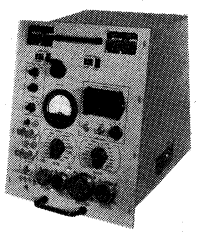


INDICATORS — To serve as inputs or outputs in the determination of distance, bearing or position and extremely useful as test equipment.

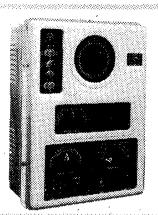
ANALOG

Generation of complete systems to meet all applicable MI6 specifications for • Navigation • ASW • Fire Control • Missile Tracking • Search • Computers • Simulators • Nuclear Controls.

RELATIVE VELOCITY COMPUTER TEST SET – A ground support equipment for testing a variety of inertial alignment computer systems with capability of complete self-test. A hybrid system employing analog and digital electro-mechanical and solid state circuitry.

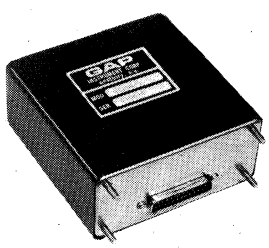


OWN SHIPS MOTION SIMULATOR A shipboard navigation and fire control training equipment using electro-mechanical computing techniques capable of simulating all surface maneuvers of ships of the fleet.



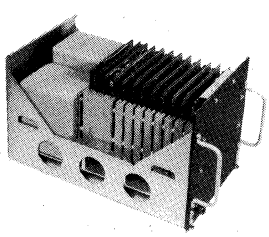
DIGITAL Converters

A to D... D to A To meet your interface requirements, GAP has a complete line of prototype converters which can be custom-designed for your individual application. Available as both solid state and electro-mechanical units, they feature multi-speed, multi-channel operation in a variety of visual displays. Two of the units are the Model S3262 and Model S3255.



DIGITAL/SYNCHRO CONVERTER SOLID STATE/MODEL S3262
A compact, low-cost unit for operation with digital computers associated with simulators, navigation and control applications. Logic levels and impedances are compatible with all present integrated circuits. Features — 3 wire synchro or 4 wire resolver output • 26V or 115V reference input • 60 or 400 Hz operation • 11.8V or 90V line to line output • Transformer output isolation • Non-standard input logic levels • Storage registers • Hermetic sealing.

8 CHANNEL SYNCHRO/ DIGITAL CONVERTER SOLID STATE/MODEL S3255
Converts synchro data to parallel digital data through the use of the dual phase shift technique, which features simple circuitry with few precision components. Variations in the reference frequency are compensated by means of a synchronized oscillator which tracks the reference frequency over the range of 380 to 420 Hz. Multiplexing of the 8 synchro channels is by means of a digital time gate so that no error is introduced by multiplexing.



GAP
INSTRUMENT CORP.

17 Brooklyn Avenue
Westbury, Long Island, New York
516/ED 3-8020

GAP INSTRUMENT CORP. is a designer/producer of precision electro-mechanical components, servo/digital/analog systems and remote-positioning devices for control, computation, display and simulation.

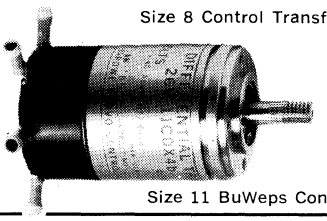
Harowe SYNCHROS, RESOLVERS & SERVO PACKAGES

STANDARD SYNCHROS & RESOLVERS

- All sizes: 5, 8, 10, 11, 15, 18, and 23 . . . 60 and 400 Hz
- All functions: control and torque transmitters and receivers; control transformers; differentials; induction pots; resolvers — including 4-wire and compensated types
- BuWeps and tandem models
- Typical accuracy ± 7 minutes; ± 3 minutes in hi-accuracy units
- Wide range of mechanical options: flanges, terminals, shafts
- **Throughbore** construction generates I.D. of stator, bearing cap, and housing in one pass for perfect alignment.



Size 8 Control Transformer



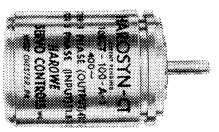
Size 11 BuWeps Control Differential

BRUSHLESS SYNCHROS & RESOLVERS

Brushless designs eliminate the wiping contact that normally couples signals to synchro rotors. Results are increased life, reduced friction error, vibration immunity, and reduced RFI emission. We make two types:

Full-Rotation HAROSYN® types use rotary transformers to couple signals to rotors; allow unlimited angular travel.

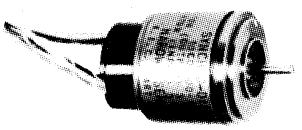
- Sizes 8, 10, and 11 standard; larger as special
- Full range of functions — including 4-wire resolvers
- Typical accuracies ± 7 minutes
- Rated for 175°C. continuous duty



Size 10 Full-Rotation Type

Limited-Rotation types use hairspring conductors to couple signals to rotors; have stops at ± 165° from electrical zero. Lower cost for limited-rotation applications.

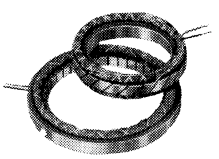
- Sizes 8 and 10 standard
- Full range of functions
- Typical accuracies ± 7 minutes
- Rated for 150°C. continuous duty



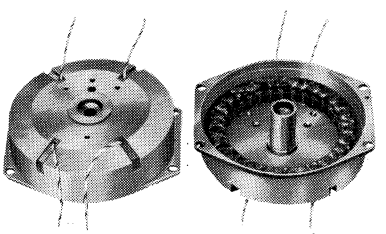
Size 10 Hairspring Type

PANCAKE SYNCHROS & RESOLVERS

- Custom-designed and built to your electrical and mechanical specifications
- Wide selection of stack heights, widths, and diameters
- Housed or unhoused; with or without integral bearings for gimbal support
- Housing materials include stainless steel, aluminum, beryllium, titanium
- Standard lamination dies on-hand for many common sizes



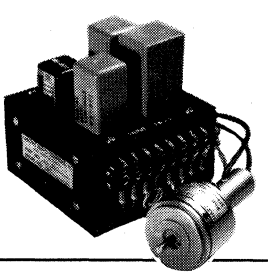
Unhoused for gimbal mounting



Titanium Housing

SERVO PACKAGES

Custom-built packages combine motors, synchros, and other rotating components with gear trains, clutches, and electronic logic to perform specific functions. Integrating, synchronizing, computing, and function generation are typical. We build to your prints or design to your input/output specs. You get uniform high performance because all rotating components — even gear trains — are built in-house.



Typical servo package integrates DC command signal to produce linear output speed. Linearity is ±0.1% over 1000:1 speed range. Used in tracking and fire control.

Write for complete specs.
Or call 215-692-2700
(TWX 510-663-0335)
for price and delivery.
You'll like the answers!

Harowe SERVO CONTROLS, INC.

48 WESTTOWN ROAD • WEST CHESTER, PA. 19380
Precision Servo Motors, Too — See Section 3500, Page 1741

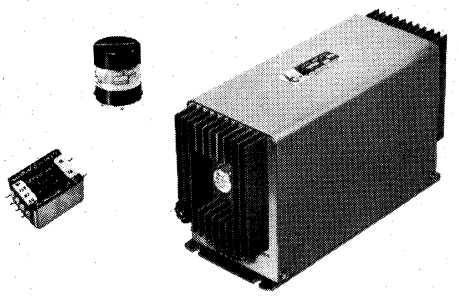
SERVO COMPONENTS

INSTRUMENTS, AMPLIFIERS *and* ACCESSORIES

FOR MILITARY AND INDUSTRIAL CONTROL SYSTEMS

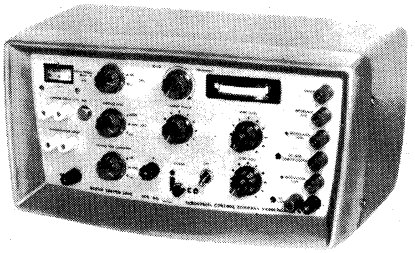
SERVO AMPLIFIERS

- *DC, pot and synchro inputs*
- *60 and 400 ∿ outputs*
- *Hybrid 972A (.5 cu in, 9 watts) to Triac 893A (800 watts)*
- *160 different models*



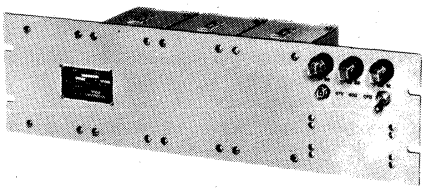
SERVO TESTERS

- *100C, general purpose use*
- *103A, prod and field test*
- *Frequency and transient response*
- *For DC and AC servos*



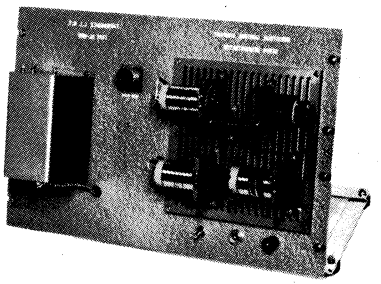
SYNCHRO AMPLIFIERS

- *929R, 90V./line, 400 ∿ stators*
- *820A, 90V./line, 60 ∿ stators*
- *Buffer CX's from CT and TR loads*
- *High accuracy and fast response*



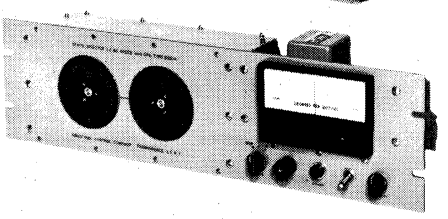
SERVO DEMONSTRATORS

- *Laboratory experiments*
- *Industrial training*
- *Synchro and pot data*
- *60 and 400 ∿ models*



SYNCHRO DIRECTORS

- *Generate 1 and 36 speed stator voltages*
- *Constant velocity and harmonic motion modes*
- *Computer programmed*
- *60 and 400 ∿ stator outputs.*



Write for Catalog of our COMPLETE Servo Line.

INDUSTRIAL CONTROL COMPANY

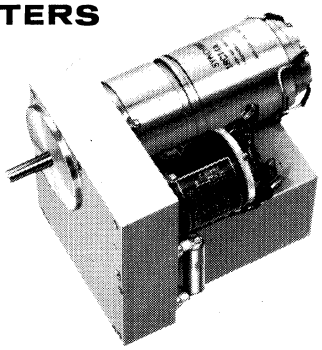
CENTRAL AVENUE AT PINELAWN ▪ FARMINGDALE, L.I., N.Y. 11735 ▪ 516-694-3000

STANDARD SERVOS

COMPACT PACKAGES *or* COMPLETE SYSTEMS

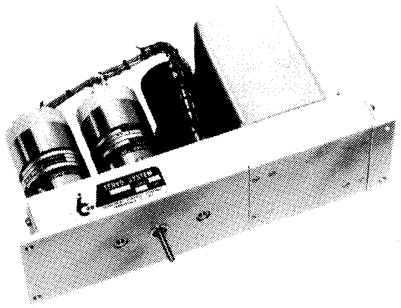
MIL-GRADE AND FAST DELIVERY

High Torque SYNCHRO REPEATERS



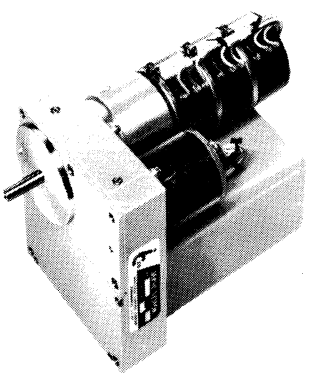
- *770 Series for 400 ∼*
- *847 Series for 60 ∼*
- *8′ error*
- *300 oz in shaft torque*
- *117V. line power*

Two Speed SYNCHRO REPEATERS



- *771 Series for 400 ∼*
- *921 Series for 60 ∼*
- *16, 25 and 36 speed*
- *Shaft at hi speed*
- *117V. line power*

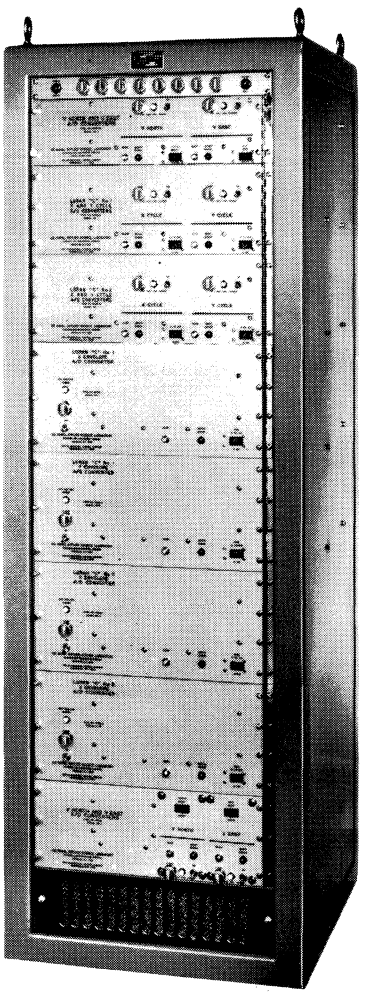
DC and AC POT FOLLOWERS



- *900 Series*
- *DC, 60 or 400 ∼ inputs*
- *1, 3 or 10 turn pots*
- *Torques to 300 oz in*
- *117V. 60 or 400 ∼ power*

12 Channel SERVO DIGITIZER

- *846B Series*
- *1, 1 & 10, 1 & 100 synchro data*
- *13 bit grey code output*
- *Rugged construction, shipboard use*



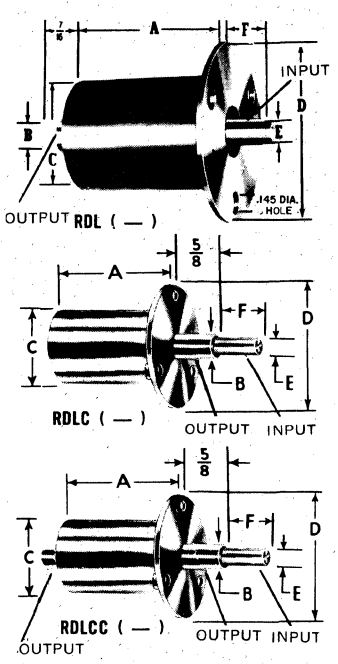
Modifications from Standards readily available.

INDUSTRIAL CONTROL COMPANY

CENTRAL AVENUE AT PINELAWN ▪ FARMINGDALE, L.I., N.Y. 11735 ▪ 516-694-3000

JAN HARDWARE MANUFACTURING COMPANY, INC.

47-27 36th St., Long Island City, N.Y. 11101 • (212) 361-0800



RATIO DRIVES

for FINE INSTRUMENT AND MACHINE CONTROLS

Ball Bearing Type **Compact, durable, exceptionally smooth action**

These unique ratio drives employ precision ball bearings. Used for rotary control of components in instruments, they provide unexcelled smooth motion. Ruggedly built, permanently sealed and lubricated, JAN Ratio Drives accommodate applications where miniaturization is essential.

Input and output shafts of these units operate in the SAME DIRECTION. Type "RDL" provides "in-line" input-output shafts. Type "RDLC" is supplied with **concentric** shafts whereby the output envelopes the input shaft. An added feature of type RDLCC is the output shaft in the rear.

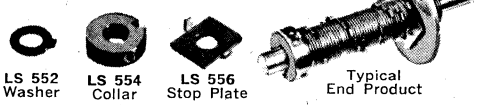
CAT. No.	RATIO	A	B O.D.	B I.D.	C	D	Input Shaft E	F	Bolt-Mtg. Dia.
RDL-1	2.6:1	1	3/8	1/4	1 1/8	1 13/16	1/4	3/4	1 15/32
RDL-2	7.0:1	1 13/32	3/8	1/4	1 1/8	1 13/16	1/4	3/4	1 15/32
RDL-3	17.0:1	1 13/16	3/8	1/4	1 1/8	1 13/16	1/4	3/4	1 15/32
RDLC-1	2.6:1	1	3/8	1/4	1 1/8	1 13/16	1/4	1 1/2	1 15/32
RDLC-2	7.0:1	1 13/32	3/8	1/4	1 1/8	1 13/16	1/4	1 5/64	1 15/32
RDLC-3	17.0:1	1 13/16	3/8	1/4	1 1/8	1 13/16	1/4	23/32	1 15/32
RDLCC-1	2.6:1	1 13/32	3/8	1/4	1 1/8	1 13/16	1/4	1 5/64	1 15/32
RDLCC-3	17.0:1	2 43/64	3/8	1/4	1 3/16	1 55/64	1/4	1 1/16	1 15/32

ALL RATIOS ARE ±10%

LIMIT STOP COMPONENTS

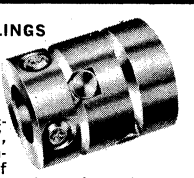
Designers can now consider the limit stop as a component to design with, such as potentiometers, capacitors, or other standard units. The simplicity of adjustment and the large number of available turns enables the stop range to be set with extreme precision. Conveniently located dual locking screws maintain settings under all conditions of shock and vibration.

Available for 1/4" and 3/16" shafts.
Specify — (3) for 3/16"
— (4) for 1/4"

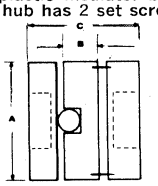


AUTOLINEAR (INSULATED) SHAFT COUPLINGS

2.5 - 5KV BREAKDOWN
Universal, miniature, self-aligning
Cat. No. AP-1530 & AP-1538



A unique series of shaft couplers that accommodate either similar or disimilar 1/8", 3/16" or 1/4" shafts. Permits offset misalignment to 1/16" and 5° angle. Operates free of backlash. Self-extinguishing low water absorption characteristic plastic insulator between precision cast aluminum hubs. Each hub has 2 set screws for firm attachment. Alodine finish.



PART NO.		DIA. HOLE "A"	"B"	"C"
AP-1530	-2	1/8"	1/2"	15/64"	5/64" ± 1/32"
	-3	3/16"			
	-4	1/4"			
AP-1538	-2	1/8"	1/2"	27/64"	17/64" ± 1/32"
	-3	3/16"			
	-4	1/4"			

TYPICAL PART NUMBERS:
AP-1530-34
AP-1538-22

VOLTAGE RATING:
AP-1530 — 2500 VOLTS
AP-1538 — 5000 VOLTS

RIGHT ANGLE RATIO DRIVES

Versatile, miniaturized, right angle rotary controls.

Featuring dual output stainless steel shafts at right angles to input, these engineered drives provide an ideal type of instrument control. Available with matched bevel or worm gears covering a wide range of ratios.

JAN'S RIGHT ANGLE DRIVES are especially useful for handling spring or gravity-loaded components since the output shaft automatically locks in any desired position yet remains free for smooth adjustment by the input shaft. Assembled in dust-proof housings, the gears are permanently pinned in place on stainless-steel shafts mounted in oilite bearings and held under constant pressure.

BEVEL GEAR RIGHT ANGLE DRIVES

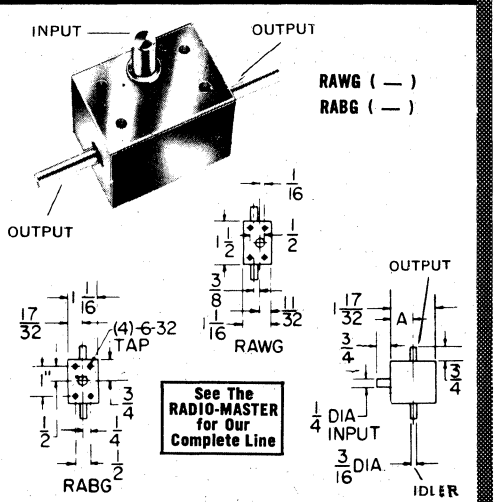


CAT. No.	RATIO	"A"
RABG-1	1:1	1/8
RABG-2	2:1	1/8
RABG-3	3:1	1/8

WORM GEAR RIGHT ANGLE DRIVES



CAT. No.	RATIO	"A"
RAWG-1	5:1	3/4
RAWG-2	10:1	3/4
RAWG-22	12:1	3/4
RAWG-3	20:1	3/4

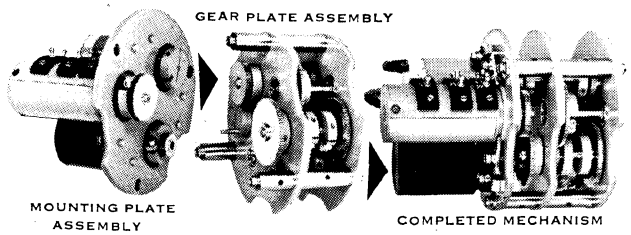


See The RADIO-MASTER for Our Complete Line

PMC SERVO MECHANISMS & COMPONENTS

PREDESIGNED MECHANISMS

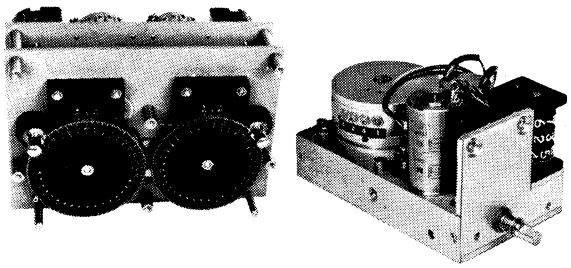
A complete line of off-the-shelf components for assembling an unlimited variety of geared mechanisms. Gear ratios to 78,125:1, zero-backlash spring-loaded gears and torque-limiting slip clutches are featured. Assembled units meet design and materials requirements of MIL-E-5400 and MIL-E-16400.



For complete data and catalog of stocked components, request Bulletin 102.

CUSTOM DESIGNS

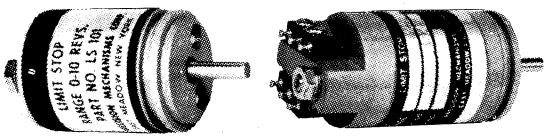
PMC specializes in design and manufacture servo mechanisms and mechanical modules to user requirements for airborne, ground support, communications, fire control and other critical applications. The units shown below are typical of the mechanisms designed and manufactured for military and industrial equipments.



Short lead time delivery on both prototypes and production quantities.

ADJUSTABLE LIMIT SWITCHES & STOPS

0-10, -20, -40 revolutions without snap action switch, 0-25 revolutions with snap action switches actuated just before mechanical stops. All models infinitely adjustable with single external screw. SPDT snap action switch rated 7A, 250V.



Limit Stop
Series LS 100
5/8 and 7/8" dia.

Limit Stop And Switch
Series LS 300
$1\frac{5}{16}$" dia.

For complete data, request Bulletins 103 and 104

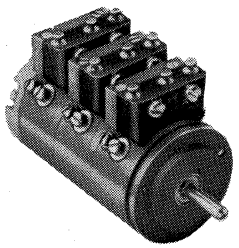
CAM SWITCHES

Adjustable-In-Motion

PMC's patented cam switch design incorporates in a single component all the functions of a conventional plate cam, cam follower and snap-action switch, eliminating the need for separately-mounted cam mechanisms and switches and their associated hardware. Externally-adjustable dwell angles can be set to any position with respect to the shaft. All models available as single- or multi-switch types, with ganged switches independently adjustable.

Model CS 402 Miniature Cam Switches

Miniature units designed and manufactured to military and aerospace specifications.

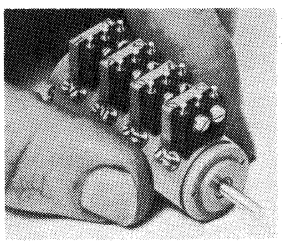


Diameter: 1-1/16", equivalent to to BuOrd Size 11
Length: 0.8", one switch, plus 0.5" per switch
Dwell Angle: 3° to 357°
Switch: SPDT
Rating: 5A, 250VAC, 30VDC
Multi-Switch Models: up to 10 switches
Shaft: 0.125" dia.

For complete data, request Bulletin 106

Model CS 601 Subminiature Cam Switches

Subminiature units for airborne, space vehicle and other applications where size and weight are critical.

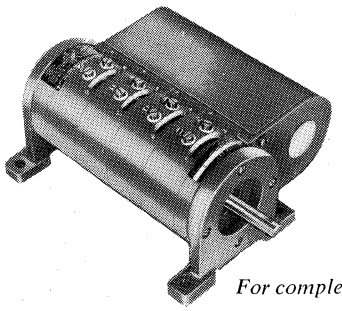


Diameter: 0.75", equivalent to BuOrd Size 8
Length: 0.730" one switch, plus 0.437" per switch
Dwell Angle: 3° to 357°
Switch: SPDT
Rating: 7A, 250VAC, 30VDC
Shaft: 0.125" dia.
Multi-Switch Models: up to 8 switches

For complete data, request Bulletin 109

Model CS 501 High-Power Cam Switches

Industrial types for control, cycling and sequencing of machine operations. End- or side-mounting, with or without switch covers. Dials permit visual adjustment of switching points and dwell angles.



Dwell Angle: 5° to 355°
Diameter: 3.5"
Length: 3" one switch, plus 1.5" per switch
Shaft: 0.5" dia.
Switches: SPDT, DPDT. Special types to requirements.
Ratings: to 25A and 600 V, inrush current to 75A.

For complete data, request Bulletin 108

PRECISION MECHANISMS CORPORATION
44 BROOKLYN AVENUE, WESTBURY, L.I., NEW YORK 11590 • (516) ED 3-5955

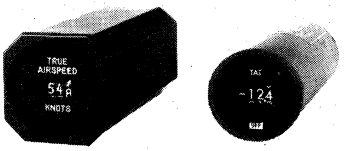
ELECTROMECHANICAL AND SOLID-STATE SYSTEMS

ABOUT SDC...

Servo Development Corporation specializes in the engineering, design, development and manufacture of sophisticated products from IC digital pulse generators to precision electro-mechanical servomechanisms.

SDC has pioneered the Microjuster®, an accurate manual input instrument for generating electrical signals proportional to a digital counter display.

The company has received recognition in the field of timers and intervalometers for navigation and weapons release systems. SDC brings its broad range of experience and engineering "know-how" to a variety of products for the aerospace field.



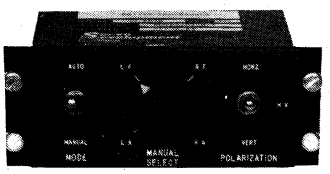
AIRCRAFT FLIGHT INSTRUMENTS

These servo indicators and digital data receivers are used in commercial jet transports and military aircraft. They are designed to meet ARINC and MIL-E-5400 standards.

Inputs can be analog voltages or synchro signals from a CADC or serial BCD information from a DADS computer. The temperature indicators can be driven by a resistance probe as part of their input bridge.

Digital, pointer or combination displays with red or white integral lighting are available.

Please write for our Aircraft Instrumentation Brochure which describes in detail our Servo Altimeter, SAT, RAT, Mach Number and other indicators.

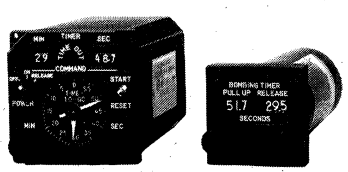


DIGITAL PRODUCTS

Digital solid-state pulse generators and programmers are custom designed for specific outputs and meet the standards of MIL-E-5400. Instrumentation is available to encode, decode and display digital signals.

The pulse generators are capable of accepting multiple input pulses, amplifying, limiting and/or shaping them to produce programmed signals. Outputs are available to the multi-ampere range and with rise and fall times down to the nanosecond region.

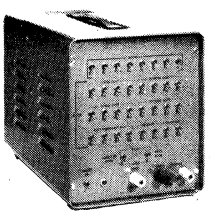
High current output pulses are shaped to eliminate R.F. generation. Techniques include the use of monolithic and discrete circuits.



INTERVALOMETERS AND TIMERS

This product line offers programmable intervalometers for weapons release systems and bombing and navigational timers, which have been designed and qualified to meet the requirements of MIL-E-5400. Digital solid-state/electro-mechanical techniques provide adjustable and fixed timing cycles from ten milliseconds to 24 hours with accuracies of .01% over the environmental range.

Electrical outputs in the form of relay closures, solid-state switching, single or repetitive spaced pulses are available to meet specified requirements. Timers featuring "Time-to-Go" displays are available with white and red integral lighting.

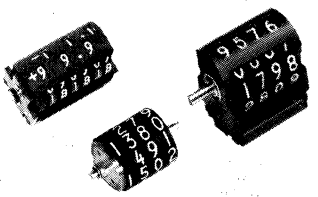


DIGITAL CODE GENERATORS

The Model No. 432A Code Generator is used for rapid testing of digital data receivers featuring digital readouts. It generates 2-wire, 32 bit digital serial data words compatible with the requirements of ARINC 575 and 576 DADS computer. The Code Generator is capable of simultaneously testing up to ten data receivers.

Four different modes of operation provide the capability for rapid automatic testing and scanning the digital data receivers and for generating repetitive 32 bit words for circuit trouble-shooting.

A similar instrument, Model No. 440 Code Generator is available for use in checking 6-wire ARINC 561 INS and DME equipment.



COUNTERS—LOW TORQUE

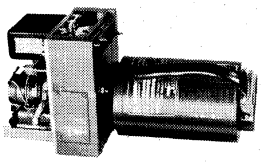
Revolution type instrument counters offer numeral sizes to 5/16 inch. They are available in internal and external pinion models. Variation counters display N-S, E-W, Lat.-Long., Plus-Minus.

MODEL NUMBER	30-152 (3 Drm) 30-154 (4 Drm)	30-156 (3 Drm) 30-157 (4 Drm)	30-163 (3 Drm) 30-164 (4 Drm)	30-167 Variation
Type Counter	Internal Pinion	Internal Pinion	External Pinion	External Pinion
NUMERAL SIZE (IN.)	.187	¼	.156	.125
DRUM DIA. (IN.)	.672	.875	—	—
NUMERAL SPACING (IN.)	.187 & .150	.187	.160	.320
SPEED: CONTINUOUS (rpm)	350	350	600	600
SPEED: INTERMITTENT (rpm)	600	750	1000	1000
TORQUE: ROOM TEMP.	0.1	0.1	0.1	0.25
—55°C to 71°C	0.25	0.25	0.2	0.5
MIN. OPER LIFE (Input Shaft Revs.)	10^6	$2x10^6$	10^7	10^7

Servo Development Corp. 2 Willis Court ▪ Hicksville, N. Y. 11802 ▪ (516) 681-4343

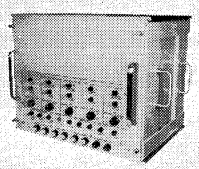
is there ONE SOURCE for

ANALOG DIGITAL CONVERSION EQUIPMENT



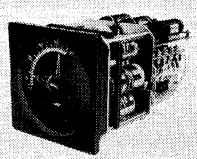
Electromechanical synchro to digital converter used on nuclear submarine.

COMPUTERS



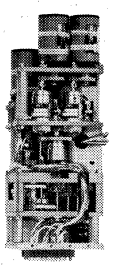
Coordinate converter used on missile tracking ship.

INDICATORS



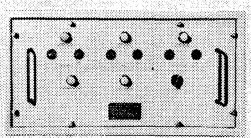
Antenna elevation indicator on space-vehicle tracking ship.

SERVO PACKAGES AND GEAR BOXES



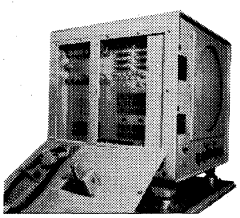
Compact electro-mechanical servomechanism assembly.

INSTRUMENTATION



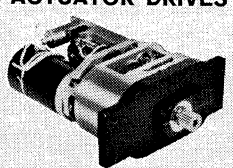
Repeater system for inertial-navigation system.

SIMULATION EQUIPMENT



Training simulator for air-to-ground missile.

ACTUATORS AND ACTUATOR DRIVES



Actuator for driving steering vanes of super-sonic drone missile.

AIRCRAFT INSTRUMENTATION



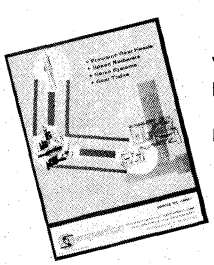
Weapons control panel for super-sonic aircraft.

SUPPORT & TEST EQUIPMENT



Analyzer for testing servo-systems.

yes . . . and it's superior



WRITE TODAY FOR SUPERIOR'S SERVO ENGINEERS HANDBOOK

Our entire organization is dynamically oriented to meet current and future equipment needs for AEROSPACE, SHIPBOARD, SUBMARINE, AIRCRAFT CONTROLS, GROUND SUPPORT, MISSILE PROGRAMS.

Superior offers complete facilities for research and development, engineering, production of a broad list of sophisticated instrumentation and systems; manufacturing from specs or prints.

A complete stock of standard precision servomechanism parts is available for fast economical manufacture of special purpose instrumentation.

superior MANUFACTURING AND INSTRUMENT CORPORATION

36-07 20th Av., Long Island City 5, New York (212) YEllowstone 2-1800 • TWX: 710-582-2626

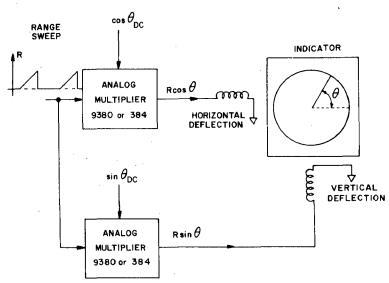
TRANSMAGNETICS INC.

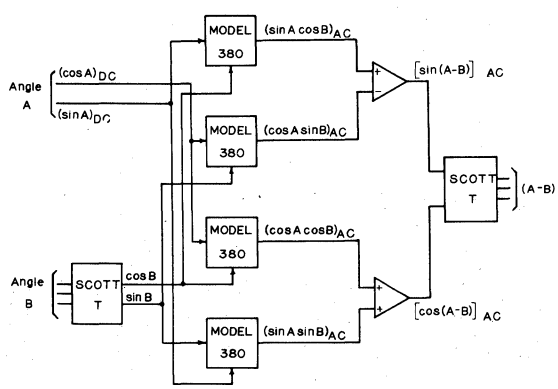


Solid State Servos

Transmagnetic solid state components and subsystems replace mechanical systems with moving parts, contain components including computing modulators and demodulators which are used in mechanical or solid state servos, and also interface systems with synchro, resolver, digital, AC or DC inputs and outputs. With many models off the shelf, you can have a working system in days.

TYPICAL APPLICATIONS





Synchro Input Devices

655 Series — SYNCHRO TO SIN-COS DC OUTPUT

Model	Freq.	3 Wire L.L. Ref. AC	Size
655MP4	400	11.8/26	0.58 x 2.03 x2.28
655MP2	400	11.8/26	0.78 x 2.53 x 3.22
*A655MP2	400	11.8/26	0.78 x 2.53 x 3.22
*655-NV-400M	400	11.8/26	1.84 x 3.19 x 3.44
655-90-MP2	400	90/115	0.78 x 2.53 x 3.22
655-60M	45 to 65	90/115	1.53 x 3.19 x 3.44
*655-NV-60M	45 to 65	90/115	2.75 x 3.25 x 5

***Buffered Outputs**

All models: Accuracy 5 minutes; outputs ±10V DC; operating temperature −55 to +85° (For lower cost 0-70°C replace M by C in model number; synchro and ref. a.c. inputs transformer isolated.

Line Variation: NV models; the sine and cosine DC outputs vary less than ½% for 10% amplitude variation in 3-wire synchro input. In all other models, outputs vary proportionately to line.

Output Impedance: Buffered units have less than 5 ohms. All others approximately 4K ohms with recommended load 100K ohms ±1%. Buffered units require ±15V DC and outputs are common to DC supply.

678 Series — SYNCHRO TO LINEAR DC

Model No.	Freq.	3 wire L.L. ref.	Input Imp. L.L. min.
678-26-M	400	11.8/26	40K ohms
678-115M	400	90/115	100K
678-60M	45-60	90/115	40K

SPECIFICATIONS

Accuracy: 6 minutes.

Line Variation: output invariant for ±10% AC line variation.

Output: −10 to +10V DC synchro angles from −180 to +180°.

Operating Temperature: −55 to +85°C. For lower cost 0 to 70°C replace M by C in model number.

1602 Series — SYNCHRO TO DIGITAL

All synchro inputs; 12 bit binary or 4 decade decimal output.

See section 2000 EEM for specifications.

Model 1620MP13 — SYNCHRO TO SYNCHRO

Description: This device is a power amplifier and synchro level translator accepting a 90V L.L. input and furnishing 11.8V L.L. out with capability of driving up to 3 Size 11 torque receivers plus control transformers.

OTHER SPECIFICATIONS

Accuracy: 6 minutes. **Frequency:** 400 Hz. **DC Supply:** ±25V. **Size:** 1.84 H x 3.19 x 3.44 max.

OTHER MODELS

Inputs and Outputs: 50, 60, 400 Hz L.L. 11.8, 90.

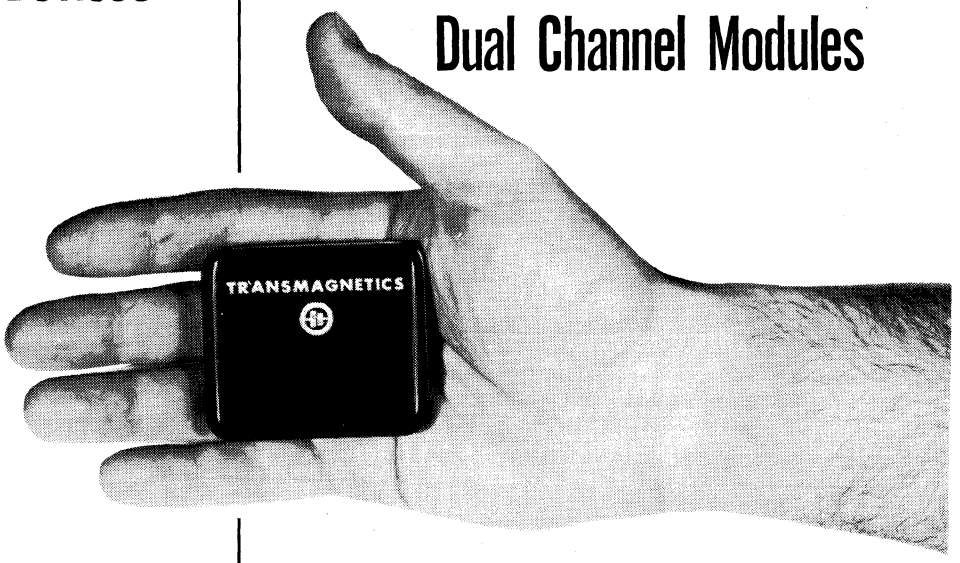
SEE EEM SECTIONS 2000 AND 2200 FOR MULTIPLIERS, DIVIDERS AND OTHER TRANSMAGNETICS MODULES.

TRANSMAGNETICS INC. 134-25 NORTHERN BLVD. / FLUSHING, N. Y. 11354
212-539-2750 • TWX: 710-582-2472

TRANSMAGNETICS INC.

Synchro Output Devices

Resolver Dual Channel Modules



SIN-COS DC TO 3-WIRE SYNCHRO

Model	Freq-Hz Out	3-Wire L.L.	Ref AC	Load Capability	Size — P.C. Card
650-31	400	11.8	26	3 Size 11 TR's	4½ x 8
A676-10	400	11.8	26	3 Size 11 TR's, CT's	4½ x 8
A676-20	400	11.8	26	2 Size 15 TR's	4½ x12
A676-90	400	90	115	1 Size 11 TR, CT's, CDX's	4½ x 8
A676-60	60	90	115	Size 23 TR, CT's, CDX's	4½ x12

INPUTS: 10 sin θ and 10 cos θ, DC voltages representing input angle.

TORQUE RECEIVER (TR) LOADS: TR's are difficult loads, drawing large currents under dynamic conditions, and may "hang up". All models are designed to drive sizes listed or equivalent and are short circuit proof.

CONTROL (CT) OR DIFFERENTIAL (CDX) TRANSFORMER: The 676 models will also drive CT's or CDX's. They are designed for a low null, preventing amplifier overload in follow-up systems.

1612 System — LINEAR DC TO 3-WIRE SYNCHRO

Description: This system consists of a model R670 followed by a 3-wire synchro output model above.

Ordering Information: Order 1612- followed by synchro output model. Example 1612-650-31.

1613 Series — DIGITAL ANGLE TO 3-WIRE SYNCHRO

12 bit binary angle input to 11.8 or 90V L.L. 60 or 400 Hz outputs.

See EEM Section 2000 for specifications.

Series 697 — RESOLVER (AC) TO SIN-COS DC

Model	Ref. Amp.	Size
697MP4	26V	.58 x 2.03 x 2.28
697MP2	26V	.78 x 2.53 x 3.22
697-115MP2	115V	.78 x 2.53 x 3.22

OTHER SPECIFICATIONS

Accuracy: 6 minutes. **Outputs:** −10 to +10V DC. **AC Inputs:** 0 to 11.8. **Input Imp.:** 40K ohms Min. **Isolation:** Inputs, outputs, excitation fully isolated. **Loads:** 100K ohms. **Operating Temperature:** −55 to +85°C. For lower cost 0-70°C replace M by C in model number.

FULL SCALE INPUTS 5 to 115V RMS UNITS AVAILABLE.

Series 1614 — DC SIN-COS TO RESOLVER (AC)

Model	Frequency	Outputs	Size — P.C. Card
1614-10C	400 Hz	0 to 15V RMS	4½ x 8
1614-90C	400 Hz	0 to 90V	4½ x 8
1614-60C	60 Hz	0 to 90V	4½ x 8

Accuracy: 6 minutes. **Operating Temperature:** 0 to 70°C. Replace "C" by "M" for −55 to +85°C.

Series 1613 — DIGITAL ANGLE TO RESOLVER (AC)

12 bit binary angle input and 0 to 115V RMS 400 or 60 Hz reference input. AC sine and cosine outputs.

See EEM Section 2000 for specifications.

TRANSMAGNETICS INC. 134-25 NORTHERN BLVD / FLUSHING, N. Y. 11354
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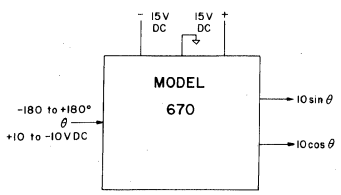
TRANSMAGNETICS INC.

Trigonometric Computing Servos

These solid state modules perform trigonometric computations and transformations which previously required mechanical moving parts. Together with solid state synchro, resolver, digital, ac or dc conversion modules manufactured by Transmagnetics, they make possible all solid state computing servos and interfacing.

Series 670 — LINEAR DC TO SIN-COS DC



SPECIFICATIONS

ACCURACY: 15 minutes.
SIZE: 1.84 x 3.18 x 3.43 max.
INPUT IMPEDANCE: 10K min.
DRAIN: 100 MA max. from ±15V DC.
MODELS AVAILABLE:
R670 0 to 50°C operating temperature.
670MP13 −55 to +85°C.

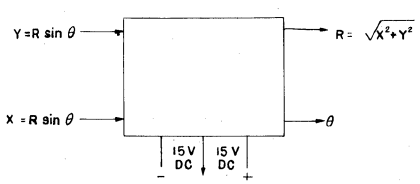
Series A678 — SIN-COS DC TO LINEAR DC



SPECIFICATIONS

ACCURACY: 6 minutes.
SIZE: 1.84 x 3.18 x 3.43.
INPUTS IMPEDANCE: 100K ohms.
CONVERSION TIME: 1 MS.
DRAIN: 125 MA max from ±15V DC.
MODELS AVAILABLE:
A678M −55 to +85°C operating temperature.
A678C 0 to 70°C.

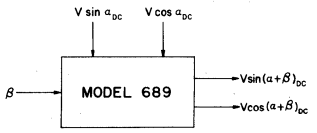
Series 695 — DC RECTANGULAR TO POLAR CONVERTER



SPECIFICATIONS

INPUTS RANGE: −10 to +10V.
OUTPUTS: R: .050 to 10V
θ: −10 to +10V.
ACCURACY: 6 minutes.
LINEARITY: 0.1%.
SIZE: 1.84 x 3.18 x 3.43.
CONVERSION TIME: 1 MS.
MODELS AVAILABLE:
695C 0 to 70°C operating temperature
695M −55 to +85°C.

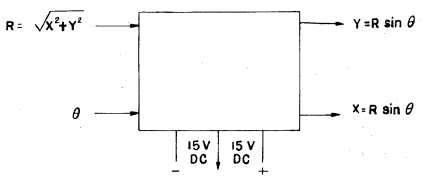
Series 689 — DC COORDINATE ROTATOR



SPECIFICATIONS

RECTANGULAR INPUTS: −10 to +10V DC
ANGLE INPUT: −10 to +10 for −180 to +180°C
RECTANGULAR OUTPUTS: −10 to +10V DC

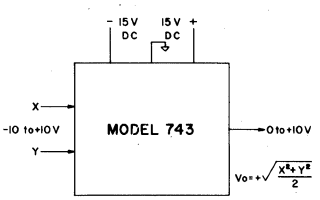
Series 1618 — DC POLAR TO RECTANGULAR CONVERTER



SPECIFICATIONS

R: 50 mv to 10V DC.
θ: −10 to +10V DC for θ −180 to +180°C.
ANGULAR ACCURACY: 15 minutes.
R LINEARITY: 0.1%.
MODELS AVAILABLE:
1618S 0 to 50°C
1618M −55 to +85°C.

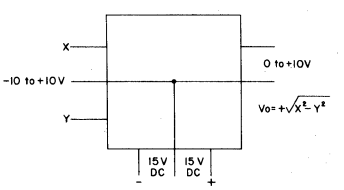
Series 743 — VECTOR SUMMER



SPECIFICATIONS

CONFORMITY: ½% F.S.
FULL POWER BW: 20K Hz.
9743 SERIES: recommended for square waves.
SIZE: .78 x 3.19 x 3.44.
MODELS AVAILABLE:
743CP5 0 - 70°C
9743CP5 0 - 70°C
743MP5 0 - 70°C
9743MP5 −55 to +85°C.

Series 749 — TRIANGLE SOLVER



SPECIFICATIONS

CONFORMITY: ½% F.S.
FULL POWER BW: 5K Hz.
SIZE: .58 x 3.19 x 3.44.
MODELS AVAILABLE:
749CP8 0 to 70°C
749MP8 −55 to +85°C.

TRANSMAGNETICS INC.

Computing Sine Wave Modulators

For DC to AC proportional conversion

These modulators offer high performance, small size and off the shelf delivery in military servo systems for radar, fire control, autopilots and navigation applications where precision DC to AC conversion is required. The 1102 Series are state of the art with phase constant to ¼° over 380 to 420 Hz, distortion less than ½%, and buffer amplifier output.

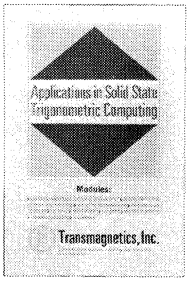
Model 1123 is a low cost modulator.

Modifications can be made for excitation inputs from 6 to 115V RMS and frequencies from 60 to 10K Hz.

The output of these models do not vary with a 10% line change. For "multiplying" modulators, see Section 2000.

	Series 1102	Series 152	Series 191	Series 1123
DC Input Volts	−10 to +10	−7 to +7	−5 to +5	−2 to +2
AC Output Volts RMS	0 to 6	0 to 1	0 to 5	0 to 0.7
AC Ref. Volts RMS	26	26	26	26
Frequency Hz	400	400	400	400
Null MV RMS	5 in phase	3	5	10
Phase Degrees	±1	±3	±5	±10
Size	.58x2.03 x2.28	1⅛ x 1¼ x 1⅞	1⅛ x 1¼ x 1⅞	0.7 x 1 x1.5

SEE EEM SECTIONS 2000 AND 2200 FOR MULTIPLIERS, DIVIDERS AND OTHER TRANSMAGNETICS MODULES.



DESIGN MANUAL

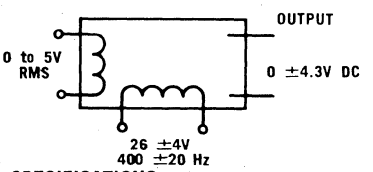
Send for your free copy of Transmagnetics' Design Manual 868. It describes and illustrates more than 45 applications for trigonometric modules. The "building block" modules, around which the manual is based, allow designers to develop all solid state computing systems.

Computing Demodulators

For AC to DC phase sensitive proportional conversion

These demodulators are companions of the modulators above for applications in the same types of systems. They are also used to condition ac signals from strain gauges, pressure and similar transducers to a dc format for telemetry and data processing.

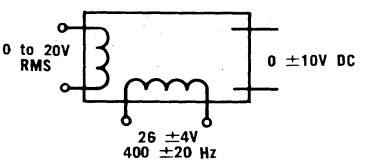
Model 840 — 0.1% LINEARITY



SPECIFICATIONS

NULL: 0.5 MV
LINEARITY: 0.1% FS
GAIN STABILITY: over −55 to +85°C: 1% or 20 MV
3 DB FREQ. RESPONSE: 150 Hz min.
RIPPLE: 1% or 20 MV rms
LOAD: 100KΩ (output impedance approx. 3KΩ)
INPUT IMPEDANCE: 50KΩ min.
SIZE: 1 x 1 x 1⅝ plus mounting studs and header.
WEIGHT: 2.5 oz.

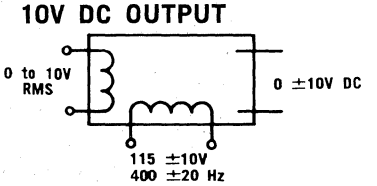
Model 854 — 10V DC OUTPUT



SPECIFICATIONS

NULL: ½ MV
LINEARITY: 0.1% FS
GAIN STABILITY: over −55 to +85°C: 1% or 40 MV
3 DB FREQ. RESPONSE: 150 Hz min.
RIPPLE: 1% or 50 MV rms
LOAD: 100KΩ (output impedance approx. 4KΩ)
INPUT IMPEDANCE: 50KΩ min.
SIZE: 1 x 1 x 1⅝ plus mounting studs and header.
WEIGHT: 2.5 oz.

Model 835 — 10V DC OUTPUT



SPECIFICATIONS

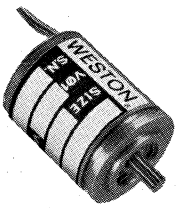
NULL: 50 MV
LINEARITY: 0.1% FS
GAIN STABILITY: over −55 to +85°C: 2% or 100 MV
3 DB FREQ. RESPONSE: 150 Hz min.
RIPPLE: 100 MV rms max.
LOAD: 100KΩ (output impedance approx. 5KΩ)
INPUT IMPEDANCE: 30KΩ min.
SIZE: 2⅛" H x 1⅛" sq. plus mounting studs & header.
WEIGHT: 4 oz.

TRANSMAGNETICS INC. 134-25 NORTHERN BLVD / FLUSHING, N. Y. 11354
212-539-2750 • TWX: 710-582-2472

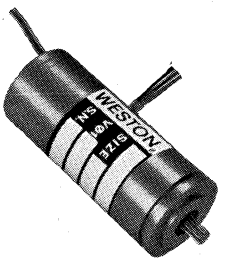
WESTON-TRANSICOIL

servo motors, generators, amplifiers & servo assemblies

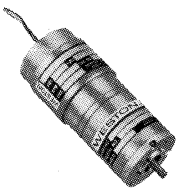
MOTORS *Sizes 5 thru 23, 60 & 400 cycles for military, commercial and industrial applications. Servo, synchronous, stepper, viscous or inertially damped. High temperature and high-torque types available. Versions to meet ARP 497 and MIL-S-22432 including QPL types. Integral gear heads, optional slip clutches. All units have vacuum impregnated windings, stainless steel shafts and bearings.*



Size 8
Servo Motor

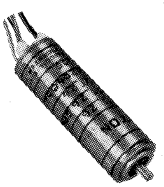


Size 8
Inertially-
Damped Servo Motor

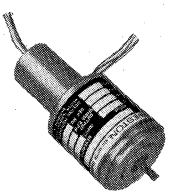


Industrial
Servo Motor
with Gear Head

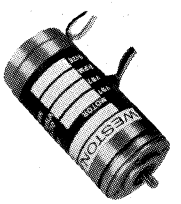
MOTOR—GENERATORS & TACHOMETERS *Sizes 5 thru 23, 60 & 400 cycles. Damping, rate and integrating (temperature compensated). Available in combination with servo motors or as separate units. Options include a range of short-housing, high-temperature and high-torque types. Low inertia motor tachometers have outputs up to 3.5 v/1000 rpm. Output voltage per 1000 rpm on temperature-compensated units within ± 0.5% from — 55C to 125C.*



Size 5
Motor-Generator

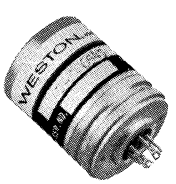


Size 18
Motor Tachometer

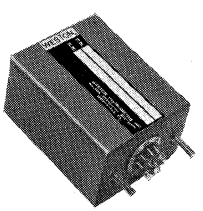


Size 11
Low-Null Motor-Generator

AMPLIFIERS & SPECIAL ELECTRONICS *Transistorized servo amplifiers designed to provide high linearity signal amplification to voltage and power levels required for driving motors up to and including size 23. Special features and extra inputs available on request. Stepper logic-driver programs field excitation to stepper motor windings for maximum response.*



Size 11
Servo Amplifier



Stepper
Logic Driver

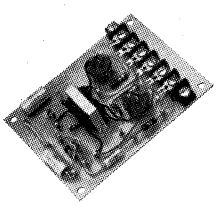
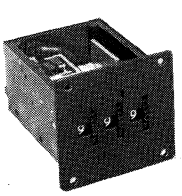


Plate
Amplifier

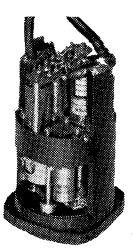
COMPLETE PACKAGES *Complete servo assemblies and sub-assemblies are designed, manufactured and tested by Weston-Transicoil to meet specific military, commercial and industrial application requirements. Included are data converters, incremental servos, indicators & display devices, function generators & computing servos.*



Stepper
Counter Assembly



Two Speed
Simulator



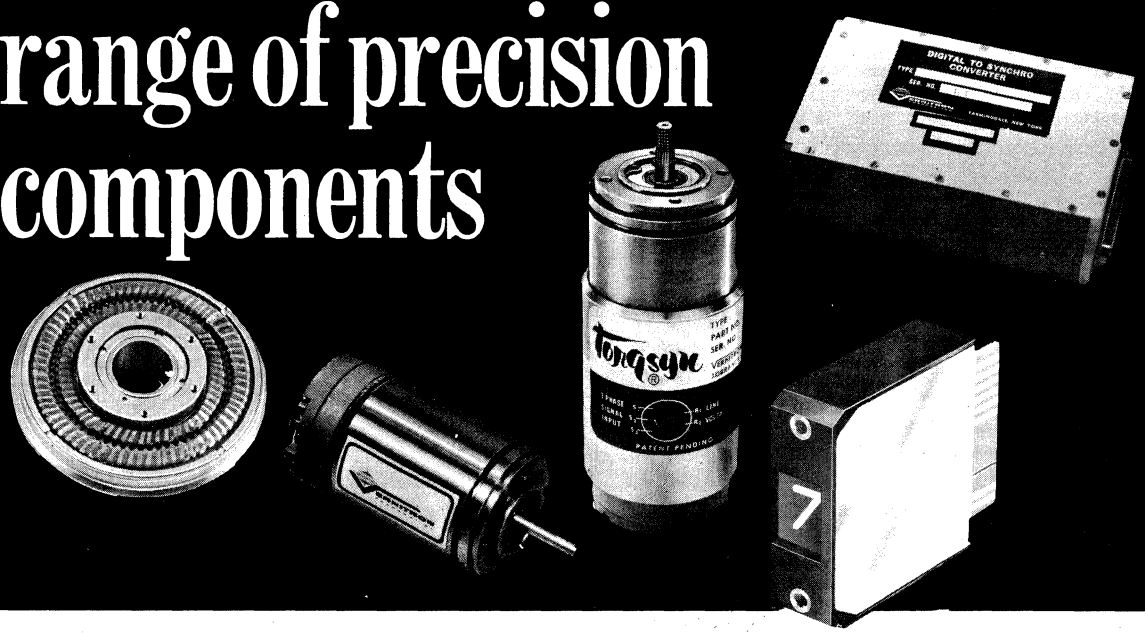
Tacan
Combined Coupler

Contact Weston Components Division, Worcester, Pennsylvania. Telephone (215) 277-1300.

WESTON®-TRANSICOIL

catalog digest

ONE SOURCE.... for America's broadest range of precision components



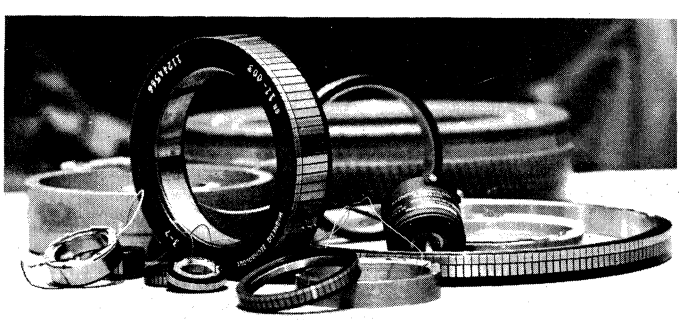
vernitron precision

- synchros
- resolvers
- servo motors
- motor generators
- tachometer generators
- damping devices
- gyro components
- stepper motors and logic
- dc torquers

and introducing Vernitron's new line

MAGTECH

DC TORQUE MOTORS and TACHOMETERS



The Quality Name in Precision Components

VERNITRON CORPORATION

MOTOR PRODUCTS DIVISION:
50 Gazza Boulevard, Farmingdale, New York • (516) 694-5002 • TWX: 510-224-6890
CONTROL COMPONENTS DIVISION:
1742 South Crenshaw Boulevard, Torrance, California • (213) 328-2504
TWX: 910-349-6250
DIGITAL PRODUCTS DIVISION:
59 Central Avenue, Farmingdale, New York • (516) 694-5002 • TWX: 510-224-6890
MAGNETIC TECHNOLOGY DIVISION:
21001 Kittridge Street, Canoga Park, California 91303 • (213) 887-7700 •
TWX: 910-494-1217
EASTERN REGIONAL SALES:
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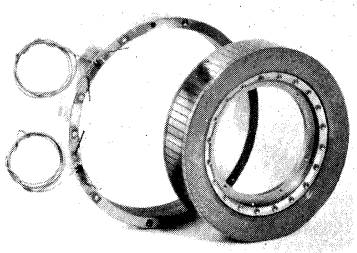
Cables: VERNITRON, Farmingdale, N.Y.

VERNITRON CATALOG DIGEST

MAGTECH

DC TORQUE MOTORS

D. C. Torque Motors are designed to produce high torque at low speeds, making them ideal for direct coupling to the driven load. Performance characteristics of torque motors provide significant system advantages:



- **DIRECT DRIVE**
  Elimination of gearing and associated backlash results in maximum servo coupling stiffness, increased torque to inertia ratio at the load shaft, and precise positioning resolution.

- **FAST RESPONSE**
  High flux density in the magnetic circuit results in low armature inductance and low electrical time constant.

- **PERMANENT MAGNET FIELD**
  Maximum torque with minimum input power and weight.

  Enables motors to be maintained under stand-by conditions without dissipation of power or generation of heat.

The selection chart lists basic D. C. Torque Motors and D. C. Tachometer Generators available from MAGTECH — Modifications to mechanical configutation or electrical operating characteristics can be provided to satisfy specific application requirements. Additional data is available upon request for torque motor ratings from six inch-ounce to 150 foot-pounds peak torque.

MODEL †		MOTOR PERFORMANCE					MECHANICAL DATA						TACH. PERFORMANCE	
		Peak Torque (oz-in.)	Power * @ Peak Torque (watts)	No. Load Speed (rad/sec)	L/R (sec)	K * (T/V watts)	O.D. (inches)	I.D. (inches)	WA (inches)	Weight (ounces)	Inertia (oz.-in.-sec²)	Total Breakaway (oz.-in.)	K_{tg} (volts/rad/sec)	r_a * (ohms)
1500C	–038	9	70	890	.0002	1.07	1.500	.625	.375	1.6	.0004	.4	.04	21
	–050	15	75	740	.0002	1.73	1.500	.625	.500	2.2	.0005	.5	.06	25
1937	–050	22	57	290	.0002	2.92	1.937	.625	.500	4.2	.00094	.75	.14	42
	–063	30	65	250	.0003	3.72	1.937	.625	.625	5.5	.0012	.95	.19	45
	–088	45	80	240	.0004	5.03	1.937	.625	.875	7.8	.0018	1.0	.26	56
	–130	75	150	220	.0004	6.11	1.937	.625	1.300	12.4	.003	1.0	.44	69
	–173	100	175	210	.0005	7.56	1.937	.625	1.730	16.7	.004	1.3	.55	90
1937B	–063	40	100	310	.0005	4.00	1.937	.625	.625	5.1	.0019	1.2	.24	71
	–088	55	90	220	.0006	5.80	1.937	.625	.875	7.6	.0029	1.5	.39	97
1937E	–040	15	40	320	.0003	2.38	1.937	.700	.400	2.7	.001	.8	.12	52
2125	–038	20	60	350	.0002	2.58	2.125	1.250	.375	2.4	.002	.9	.11	32
2375	–038	20	50	370	.00025	2.83	2.375	1.250	.380	3.5	.0022	.6	.15	58
	–050	35	75	250	.0003	4.04	2.375	1.250	.500	4.4	.0034	.8	.24	69
	–063	45	55	180	.0005	6.06	2.375	1.250	.625	6.0	.0042	1.2	.43	91
2625B	–040	30	50	200	.0003	4.24	2.625	1.500	.400	3.8	.005	1.1	.29	92
2813	–063	45	38	110	.0007	7.42	2.813	1.000	.625	9.2	.008	1.5	.70	180
	–088	75	43	72	.001	11.40	2.813	1.000	.875	15.5	.011	2.0	1.24	220
	–100	90	47	67	.0011	13.20	2.813	1.000	1.000	18.0	.013	2.6	1.48	230
	–133	170	110	88	.0013	16.20	2.813	1.000	1.325	25.0	.018	3.5	1.99	286
2910	–054	50	45	98	.0005	7.46	2.910	1.600	.540	6.3	.009	1.0	.98	200
	–064	90	75	86	.0006	10.40	2.910	1.600	.640	9.2	.012	1.2	1.11	210
	–100	145	80	60	.001	16.20	2.910	1.600	1.000	15.2	.019	2.0	2.14	300
3000B	–055	60	50	100	.0005	8.45	3.000	1.750	.550	6.8	.011	1.3	.85	180
	–065	90	75	110	.0005	10.40	3.000	1.750	.650	8.7	.013	1.5	1.05	190
3375	–057	80	100	160	.0002	8.00	3.375	2.250	.570	8.5	.017	2.0	.53	81
3375B	–076	100	35	45	.0007	16.9	3.375	1.688	.760	14.6	.028	2.8	2.7	460
3620	–042	80	70	100	.0003	9.57	3.620	2.180	.410	7.8	.017	1.7	.87	150
3625	–040	60	110	210	.0003	5.72	3.625	2.500	.400	5.4	.014	1.4	.50	120
	–080	180	150	100	.0005	14.70	3.625	2.500	.800	14.0	.034	3.0	1.39	160
3730	–110	200	115	68	.0016	18.7	3.730	1.640	1.074	24.0	.05	3.0	3.12	410
4090B	–100	300	70	33	.0015	35.8	4.090	2.000	1.000	30.7	.094	7.0	7.30	720
4590	–043	95	90	100	.0002	10.0	4.589	3.325	.420	9.4	.047	3.7	.90	160
4590B	–056	130	55	49	.0009	17.5	4.590	3.000	.560	14.3	.08	3.8	2.66	370
	–063	170	75	45	.001	19.6	4.590	3.000	.625	17.0	.09	4.5	3.00	390
4698	–030	60	100	160	.00013	6.00	4.698	3.800	.300	4.8	.027	3.0	.40	69
5125	–110	400	110	37	.002	38.1	5.125	2.390	1.100	48.0	.16	7	9.84	1240
	–160	700	160	31	.005	55.2	5.125	2.390	1.600	83.0	.25	10	14.60	1310
	–220	1000	170	20	.003	76.6	5.125	2.390	2.200	122.0	.36	20	27.20	2160
	–286	1500	180	15	.005	112	5.125	2.390	2.860	159.0	.48	24	37.5	2640
5125B	–058	115	105	130	.0003	11.2	5.125	4.000	.575	12.0	.08	2.0	1.10	200
	–072	200	120	84	.0004	18.2	5.125	4.000	.720	17.0	.11	3.0	1.87	240
5125C	–057	190	90	50	.0006	20.0	5.125	3.500	.562	15.5	.09	4.0	2.72	380
	–062	225	95	47	.0007	23.0	5.125	3.500	.610	18.0	.10	4.4	3.22	400
	–065	250	95	45	.0007	25.6	5.125	3.500	.650	19.0	.10	4.5	3.58	400
6980	–110	1000	105	14	.002	104	6.980	4.500	1.100	75.0	.89	18	33.50	2120
	–130	1200	100	11	.0025	120	6.980	4.500	1.300	92.0	1.10	25	43.00	2300
	–195	2000	125	8	.003	178	6.980	4.500	1.950	145.0	1.70	36	70.60	3300
7000	–065	300	75	31	.0006	34.6	7.000	5.380	.650	24.0	.30	8.5	7.50	860
11968	–060	1150	220	21	.0007	77.5	11.968	10.250	.600	45.0	2.00	25	23.30	1580
	–093	2050	270	15	.0005	125	11.968	10.250	.930	85.0	3.7	43	46.6	1940

† Note that the basic model number is derived from the motor O.D.: the first dash number indicates motor width. Example: model 1500C-050 has an O.D. of 1.500 inches and a width of 0.50 inch.
* at 75°F

VERNITRON CORPORATION

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Cables: VERNITRON, Farmingdale, N.Y.

VERNITRON CATALOG DIGEST

THRU-BORE MOTORS

VERNITRON TYPE NUMBER			05M4B-AA0-A0	08M4K-AA0-A0	08M4N-AB0-A0	08M4P-AA0-C0	10M4J-AA0-A0	11M4B-BE0-B0‡ 11M4B-BE0-B1*	11M4D-AB0-A0‡ 11M4D-AB0-A1*	11M4Q-AA0-B0	11M4R-AA0-A0	11M6B-AC0-B0‡ 11M6B-AC0-B1*
Figure Number			1	3	3	2	6	7	7	7	7	7
Weight	Units: oz	Symb.: —	.6	1.1	.75	1.5	1.7	4.0	4.6	4.0	3.3	4.0
Stalled Torque	oz-in	Ts	.10	.20	.20	.33	.33	.63	1.0	.35	.70	.80
No Load Speed	rpm	R	9500	9500	7000	6200	9700	6300	6200	10,000	6700	3100
Frequency	cps	—	400	400	400	400	400	400	400	400	400	60
Rotor Inertia	gm-cm²	J	.05	.40	.30	.20	.46	1.0	1.1	.16	.65	1.0
Volts Input (Fixed o)	volts	—	26	26	26	26	26	115	115	115	115	115
Volts Input (Control o)	volts	V	36/18	26	26	40/20	40/20	115/57.5	115/57.5	36/18	36CT	115
Stalled Impedance (Fixed o)	ohms	—	230+J200	190+J180	200+J175	90+J110	140+J115	1275+J1800	634+J987	2200+J3100	1160+J1640	2800+J1900
Stalled Impedance (Control o)	ohms	—	440+J380	190+J180	200+J175	210+J300	310+J270	1275+J1800	634+J987	215+J210	116+J164	2800+J1900
Power Input (Fixed o)	watts	—	1.8	1.9	1.9	3.0	3.0	3.5	6.5	2.0	3.7	3.5
Power Input (Control o)	watts	—	1.8	1.9	1.9	2.6	3.0	3.5	6.5	2.0	3.7	3.5
Acceleration @ Stall	rad/sec²	Ts/J	150,000	40,000	47,500	115,000	50,000	44,000	66,000	150,000	80,000	53,000
Figure of Merit	oz-in / sec²	Ts²/J	15,000	8,000	10,000	38,000	16,000	27,000	66,000	50,000	56,000	40,000
Motor Torque Constant	dyne-cm / volt	Ka=Ts/V	200	550	550	575	580	380	620	700	1400	450
Motor Damping Factor	dyne-cm-sec / radian	Kf	6.9	15	20	37	24	70	108	25	71	165
Motor Velocity Constant	radian / volt-sec	Km=Ka/Kf	29	36	27.5	15.5	24	5.5	5.8	28	20	2.7
Motor Corner Frequency	rad / sec.	w=Kf/J	138	37	68	185	52	70	100	156	110	165
Motor Time Constant	sec.	T=I/W	.0072	.027	.015	.0054	.019	.014	.010	.006	.010	.006
Reversing Time	sec.	t	.011	.043	.025	.009	.030	.023	.017	.010	.016	.010
Length (max.)			.967"L (w/leads)	.750"L (w/leads)	.625"L (w/leads)	.863"L (w/leads)	1.000"L (w/leads)	‡L=1.310" (w/leads) *Lt=1.74" (w/terminal block)	‡L=1.438" (w/leads) *1.938=Lt (w/terminal blocks)	L=1.340" (w/leads)	L=1.050" (w/leads)	‡L=1.310" (w/leads) *Lt=1.745" (w/terminal block)

VERNITRON TYPE NUMBER			11M6D-AA0-A0‡ 11M6D-AA0-A1*	15M4K-AA0-B0	15M6D-AE0-A0	18M4B-AB0-H0	18M4H-AB0-C0	18M4H-AB0-C8	18M6B-AB0-H0	18M6H-AB0-C0	23M4E-AA0-A0	23M6C-AB0-B0
Figure Number			7	9	9	12	12	12	12	12	16	16
Weight	Units: oz	Symb.: —	4.6	8.0	8.0	12	14	14	12	14	30	35
Stalled Torque	oz-in	Ts	1.0	2.5	2.0	2.7	5.0	6.5	3.8	8.0	6.0	18
No Load Speed	rpm	R	3450	10,000	3200	10,000	10,000	4700	3300	3300	10,000	3200
Frequency	cps	—	60	400	60	400	400	400	60	60	400	60
Rotor Inertia	gm-cm²	J	1.1	3.2	3.3	4.0	5.0	50	4.0	5.0	10.0	15
Volts Input (Fixed o)	volts	—	115	115	115	115	115	115	115	115	115	115
Volts Input (Control o)	volts	V	36CT	36CT	230/115	36/18	115/57.5	115/57.5	280/140	115/57.5	115/57.5	36/18
Stalled Impedance (Fixed o)	ohms	—	1700+J1700	385+J385	1300+J950	250+J390	120+J196	105+J225	715+J800	325+J390	150+J183	140+J190
Stalled Impedance (Control o)	ohms	—	221+J221	38+J38	5200+J3800	28+J39	120+J196	105+J225	4650+J4800	325+J390	150+J183	14+J19
Power Input (Fixed o)	watts	—	4.0	17	6.0	16	30	22	8.0	16	40	29
Power Input (Control o)	watts	—	4.0	17	6.0	16	30	22	8.0	16	40	29
Acceleration @ Stall	rad/sec²	Ts/J	66,000	55,000	53,000	48,000	70,000	92,000	67,000	110,000	50,000	85,000
Figure of Merit	oz-in / sec²	Ts²/J	66,000	140,000	133,000	130,000	350,000	600,000	256,000	900,000	300,000	1,500,000
Motor Torque Constant	dyne-cm / volt	Ka=Ts/V	2000	4900	760	5250	3000	4000	950	5700	4200	35,000
Motor Damping Factor	dyne-cm-sec / radian	Kf	216	190	550	190	300	953	800	1800	460	4000
Motor Velocity Constant	radian / volt-sec	Km=Ka/Kf	9.3	260	1.4	27	10	4.2	1.2	3.0	9	9.0
Motor Corner Frequency	rad / sec.	w=Kf/J	200	60	167	48	60	190	200	360	49	265
Motor Time Constant	sec.	T=I/W	.005	.016	.006	.021	.017	.005	.005	.028	.022	.003
Reversing Time	sec.	t	.008	.027	.010	.035	.028	.008	.008	.004	.037	.006
Length (max.)			‡L=1.438" (w/leads) *Lt=1.938" (w/terminal blocks)	L=1.562" (w/leads)	Lt=1.800" (w/terminal block)	Lt=2.015" (w/terminal blocks)	Lt=2.850" (w/terminal blocks)	Lt=2.850" (w/terminal blocks)	Lt=2.015" (w/terminal blocks)	Lt=2.850" (w/terminal blocks)	L=2.100" (w/leads)	L=3.000" (w/leads)

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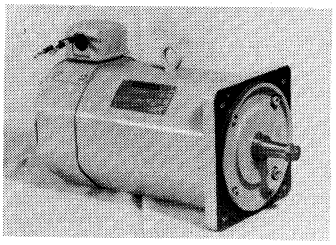
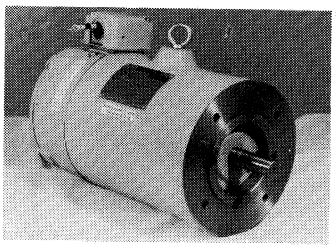


(A). Minertia Motor Standard Series
JKMM-25EM



(B). Minertia Motor Junior Series
JKCM-150EM

Minertia Motor®

HIGH PERORMANCE D-C SERVOMOTOR

"Slotless Armature"

CHARACTERISTICS:

1. Low armature inertia
2. High maximum torque
3. High torque to inertia ratio
4. High power rate
5. Low inertial time constant
6. Low inductive time constant
7. Smooth operation in wide speed range
8. Superior commutation performance
9. Superior linearity of torque vs. speed performance

APPLICATIONS:

1. Computer peripheral equipment
   - Magnetic tape transports capstan drive
   - Line printer paper feed
   - Card sorters
2. Machine Tools
   - N/C servo drive in milling machines, Lathes and drilling machines
   - Tracer system in milling machines, Lathes and drilling machines
3. General industrial machines
   - Radar and antenna drives
   - Edge position control for steel mill and textile
   - Electrode positioners

Characteristics & Ratings of *Minertia Motor*

JKSM: Minertia Motor Super Series — Inertial time constant is around one millisecond.

JKMM: Minertia Motor Standard Series — Inertial time constant is about 3 to 4 millisecond.

JKCM: Minertia Motor Junior Series — Moderate performance for general servo application.

Characteristics	MINERTIA MOTOR STANDARD SERIES									MINERTIA MOTOR JUNIOR SERIES					MINERTIA MOTOR SUPER SERIES			
	JKMM-6EM	JKMM-13EM	JKMM-25EM	JKMM-50SR	JKMM-100SR	JKMM-200SR	JKMM-500SR	JKMM-1000SR	JKMM-2000SR	JKCM-037EM	JKCM-075EM	JKCM-150EM	JKCM-220EM	JKCM-370EM	JKSM-10SM	JKSM-15SM	JKSM-20SM	JKSM-25SM
Rated Torque oz-in	83	180	350	695	1390	2780	453 lb-in	870	1740	286	580	1160	1710	2860	148	208	268	340
Max Torque oz-in	(1,000% of Rated Torque within one second)									1430 (500% of Rated Torque within 1 second)	2890	5800	8550	14300	445 (300% Rated Torque within 1 sec.)	625	805	1000
Rated Current Amp.	6.3	7.2	12.9	13.5	32	53	74	113	112	6.8	6.6	12.6	18.4	30	15.4	15.8	14.9	16.1
Max. Current Amp.	(1,000% of Rated Current within one second)									34 (500% of Rated Current within 1 second)	33	63	92	150	45 (300% Rated Current within 1 sec.)	47	44	48
Term. Voltage Volt	41	71	73	137	110	129	148	150	203	70	140	140	140	140	23	29	38	49
Rated Speed RPM (Max.)	3000 (5000)						2000	1500	1000	1750 (2900)					1020 (3000)	1200 (3000)	1180 (3000)	1500 (3000)
Rated Output Watt	180	390	750	1500	3000	6000	10kw	15kw	20kw	370	750	1500	2200	3700	110	180	230	375
Armature; J oz-in-s²	0.0078	0.0203	0.0444	0.083	0.21	0.75	0.175 lb-in-s²	0.54	1.41	0.345	0.81	2.22	3.45	9.07	0.00265	0.003	0.0036	0.00406
Torque Const. oz-in/Amp	13.9	26.2	27.8	54.2	45.1	54.2	5.85 lb-in/A	7.82	16.2	44.2	92.3	97.5	98.5	102	10.1	13.5	18.8	21.7
EMF Const. V/rad/s	0.0997	0.185	0.196	0.382	0.318	0.382	0.66	0.855	1.83	0.312	0.652	0.69	0.698	0.722	0.0708	0.0905	0.132	0.153
Mech. T. Const. ms	4.7	4.6	4.2	3.2	3.0	3.4	4.0	5.3	4.4	31	29	25	22	19	2.3	1.6	1.3	1.2
Armature; R Ohm	0.844	1.11	0.49	0.81	0.204	0.094	0.0913	0.0687	0.0944	1.3	2.4	0.76	0.43	0.15	0.61	0.66	0.87	0.97
Armature; L mh	0.80	1.1	0.95	1.4	0.52	0.43	0.76	0.90	1.8	0.15	0.70	0.30	0.15	0.23	0.4	0.54	0.65	0.75
Elec. T. Const. ms	0.95	1.0	1.9	1.7	2.6	4.6	8.3	13	19	0.12	0.29	0.4	0.35	1.5	0.7	0.82	0.7	0.77
Friction Torq. oz-in	1.5	2	4.5	15	23	44				13	21	24	27	61	2.8	3.1	3.4	3.3
Viscous Damp. C oz-in/RPM	0.00042	0.00083	0.0017	0.0021	0.0064	0.018				0.0054	0.0079	0.021	0.038	0.074	0.0024	0.0031	0.0046	0.0053
T/J Ratio x 10^3 rad/s²	10.7	8.9	7.8	8.5	6.6	3.7	2.6	1.6	1.25	0.83	0.72	0.53	0.50	0.32	56	69	75	83
Power Rate kw/s	6.3	11.3	19.5	42	65	73	133	160	224	1.68	2.94	4.28	6.05	6.36	59	102	141	200
Field Winding Amp/Ohm	PM			3.0/31	3.4/32	4.4/26	10/7.5	12.3/7.3	16/4	PM					PM			
Cooling Needed CFM/in.Aq	TENV			105/0.9	135/1	150/1.4				TENV					30/10	42/11	26/13	45/31
Motor Size L/D in.	6.8/4.8	9/5.5	11/6.7	11/7.1	14/8.3	17/9.1	25/12.5	35/15	41/17	9.3/5.7	11/6.5	12/7.4	14/8.3	18/10	7.1/4.5	7.6/5.0	9.0/5.0	10/5.0
Motor Weight lb.	20	28	55	88	130	200	795	1550	2210	33	51	73	110	199	18	22	28	32

YASKAWA ELECTRIC AMERICA, INC.
100 BLISS DRIVE OAK BROOK, ILLINOIS 60521
Telephone: (312) 654-3950

VERNITRON CORPORATION
CONTROL COMPONENTS DIVISION
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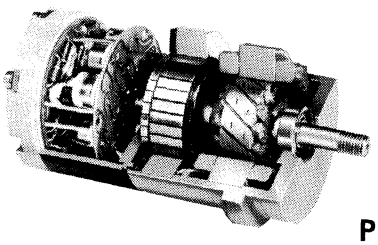
the quality name in control components

NEW TORQSYN® REMOTE POSITIONER ...A GEARLESS DIRECT DRIVE SERVOMECHANISM



Now, a complete gearless servo system in one small package. The Torqsyn® Remote Positioner is an integrated system available in Size 23, Size 16 and Size 11 housings, which converts input synchro data into accurate shaft position. High input impedance allows it to be driven by low power signal sources.

The Torqsyn® Remote Positioner may be used to drive Potentiometers, Encoders, Resolvers, Indicators, etc. In several models, either 60 Hz or 400 Hz signals may be accepted.

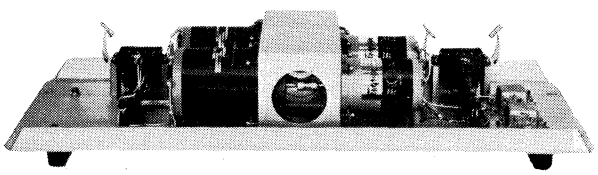
PERFORMANCE CHARACTERISTICS

MODEL	DIAM. (In)	LENGTH (In)	VOLTS Primary	VOLTS Signal	FREQ. (Hz)	STATIC ACC. (±Min.)	STALL Torque (Oz-In)	TORQUE Gradient (Oz-In)	POWER Stall (Watts)	POWER Quiescent (Watts)	NO LOAD Speed (Rpm)	INPUT Impedance (Ohms)	VELOCITY Constant (1/Sec)
VTSN11-4A1	1.062	4.500	26.0	11.8	400	15	2.2	10.0	7.5	3.0	1500	500	30,000
VTSN16-4A2	1.600	3.300	26.0	11.8	400	10	2.5	10.0	4.0	2.0	700	600	12,000
VTSN23-4A2	2.250	3.445	26.0	11.8	400	15	3.0	10.0	4.0	2.0	400	2200	6000
VTSN23-64C2	2.250	3.445	115	90	60/400	15	3.2	3.5/4.5	8.0	8.0	400	4600/24,500	1500/3000
VTSN23-64E2	2.250	3.445	115	90	60/400	10	4.0	15/25	11.0	5.0	500	4600/24,500	10,000/15,000

NOTE: Length does not include Shaft or Terminal Screws.

THE TORQSYN® REMOTE POSITIONER ...AS A BUILDING BLOCK

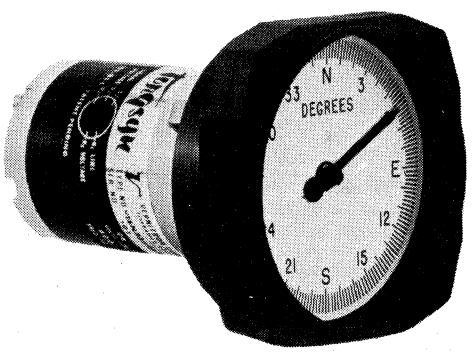
SYNCHRO SIGNAL AMPLIFIER



FEATURES:

- Accepts synchro signal from any transmitter
- High impedance input
- Drives large synchro transmitter
- Frequency change possible from driving to driven transmitter
- Can drive multiple receivers
- Single or multiple channels

INDICATOR PACKAGE



FEATURES:

- High impedance input
- High accuracy (10 minutes)
- No current feedback to source
- May be driven by low power source such as computer output.

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CONTROL COMPONENTS DIVISION
2440 West Carson Street • Torrance, Calif. 90501 • (213) 328-2504 • TWX: 910-349-6250

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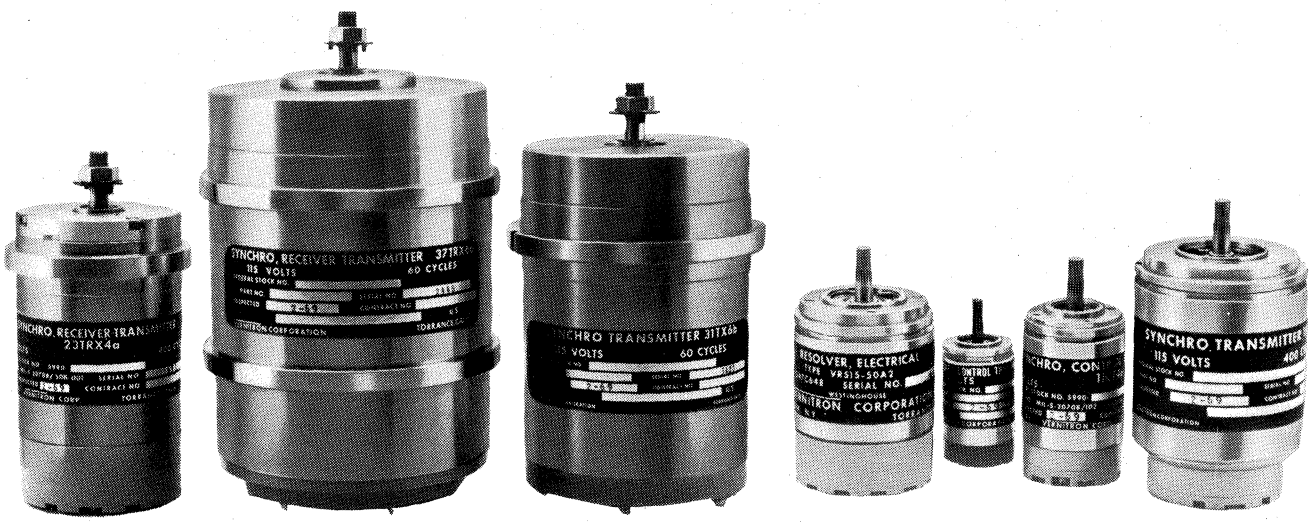

SYNCHROS

- ☐ Frame sizes 8 thru 45
- ☐ Latest Mil-Spec designs (modifications as you require)
- ☐ Accuracies down to 3 minutes
- ☐ Single and double ended shafts
- ☐ Stainless steel or aluminum housings
- ☐ Terminal block or lead types
- ☐ Brushless units
- ☐ Tandem units
- ☐ Transmitters, receivers, differentials, receiver/transmitters, linear synchros (induction pots)

RESOLVERS

- ☐ Bu Weps frame sizes 8, 11, 15 and 23
- ☐ Accuracies to .05% on computing types and 20 seconds on data transmission units
- ☐ Latest Mil-Spec designs (modifications as you require)
- ☐ Varying voltage, frequency and impedance levels
- ☐ Trimmed and Tuned Resolvers
- ☐ Phase Shifters
- ☐ Sweep Resolvers
- ☐ Temperature Compensated Units
- ☐ Brushless Resolvers
- ☐ Resolver Chains (booster and boosterless)

LO COST 3 • N SERIES

- ☐ A new series of Vernitron size 8 and size 11 **synchros and resolvers** designed for industrial control systems, flight instrumentation, etc. with **accuracies down to 5′.** High production quantity lines encompassing unique methods and in-process controls maintain strict quality standards at **new low cost levels.**
- ☐ 26 volt and 115 volt versions
- ☐ Variety of shaft configurations
- ☐ Hi and lo impedance
- ☐ Corrosion resistant housings
- ☐ Terminal boards or leads

ASK FOR THE SPECS ON OUR DESIGNS...
OR TELL US YOURS.
IT'S THE SURE WAY OF SATISFYING YOUR HARDWARE REQUIREMENTS.

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CONTROL COMPONENTS DIVISION

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PANCAKE SYNCHROS AND RESOLVERS FROM THE SOLVERE DEPARTMENT

Single Speeds — Accuracies to 10 seconds
Size Range — 1.2″ to 13.4″ O.D.

Multi-Speeds — Accuracies to 3 seconds
Size Range — 1.5″ to 13.4″ O.D.
Speeds — 2X to 72X

Dual Speeds — Available in wide range of sizes and speeds

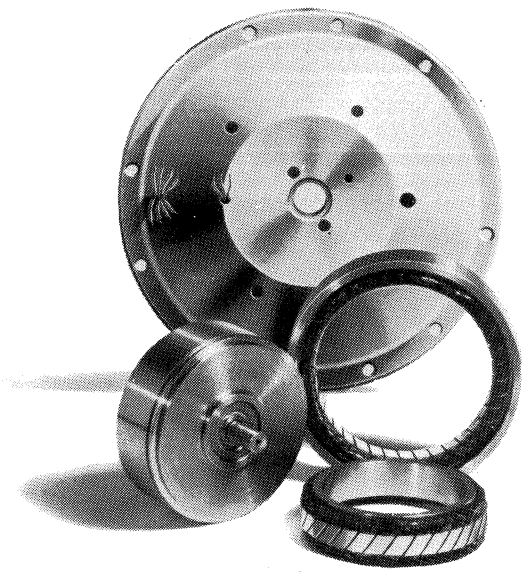
Tandem Assemblies — Dual, triple, combinations of speeds, also available with brushless torque motors

Brushless Designs — True brushless or flex lead designs, single or multi-speeds.

Housed Assemblies — Cartridge assemblies in stainless steel, aluminum, beryllium, or titanium to meet unique requirements.

Environment — Temperatures from −65°F. to +500°F. space applications—hard vacuum—10^{-14} Torr

Custom Designs — To your special requirements.



23-20 SERIES — 20 SECOND ACCURACY IN SIZE 23 HOUSING

SPECIFICATIONS

	SYNCHROS						RESOLVERS		
MODEL DESIGNATION	VCX23-4V13	VCX23-4S13	VCDX23-4S13	VCDX23-4T13	VCDX23-4T13	VCT23-4S13	VRR23-4AD13	VRR23-4AJ13	VRR23-4AC13
OPERATION	CONTROL TRANSMITTER	CONTROL TRANSMITTER	CONTROL DIFFERENTIAL	CONTROL DIFFERENTIAL	CONTROL TRANSFORMER	CONTROL TRANSFORMER	CONTROL TRANSMITTER	CONTROL DIFFERENTIAL	CONTROL TRANSFORMER
Primary	rotor	rotor	stator	stator	rotor	rotor	rotor	stator	stator
Input (volts)	115	26	90	20.4	90	20.4	115	57.5	57.5
Output (volts)	90	20.4	90	20.4	57.5	12.94	57.5	57.5	57.5
Frequency (Hz)	400	400	400	400	400	400	400	400	400
Null (mv/v)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
*Error (max.) (seconds)	20	20	20	20	20	20	20	20	20
Phase Shift (S/R) or (R/S)	2.8°	2.8°	2.0°	2.0°	2.0°	2.0°	3.5°	2.4°	2.2°
Zso	270 / 82°	270 / 82°	1,750 / 84°	1,750 / 84°	17,500 / 84°	17,500 / 84°	113 / 24°	1,200 / 84°	10,000 / 84°
Zss	33 / 31°	33 / 31°	187 / 36°	187 / 36°	1,830 / 33°	1,830 / 33°	13 / 32°	156 / 30°	1,200 / 32°
Zro	410 / 84°	410 / 84°	1,840 / 84°	1,840 / 84°	7,480 / 84°	7,480 / 84°	410 / 84°	1,260 / 84°	10,600 / 82°
Zrs	49 / 32°	49 / 32°	210 / 35°	210 / 35°	800 / 35°	800 / 35°	51 / 32°	163 / 30°	1,230 / 32°

NOTES: 1. For 3 phase windings, impedance is given as line to line.
2. All synchros designed to meet environmental requirements of MIL-R-20708.
3. All resolvers designed to meet environmental requirements of MIL-R-23417.

* 10 second accuracy also available.
Other parameters as specified above.

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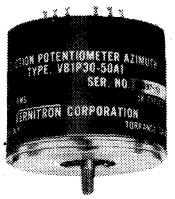
INDUCTION POTENTIOMETERS
(LINEAR TRANSFORMERS)



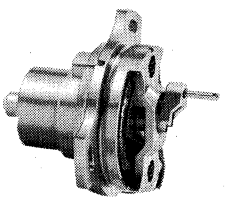
- Linearity to .25%
- Angular excursion to ±170°
- Standard housed sizes
- Pancakes — housed or unhoused

TRANSOLVERS



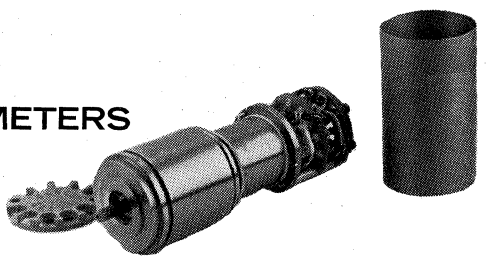
- Standard housed sizes
- Three wire in to four wire out
- Four wire in to three wire out

BRUSHLESS TRANSDUCER ACTUATOR



- Brushless DC torquer and multi-speed resolver
- Two minute accuracy to +500°F.
- 8 oz-in torque at +500°F.

INTEGRATING MOTOR TACHOMETERS



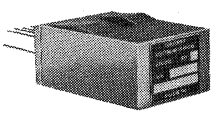
- Sizes 8, 11, 15, 18, 23
- Thermistor compensated
- Linearities of ±.05%

RESOLVER TACHOMETERS



- Provides position and rate information in navigation systems
- Size 11 resolver with integral tach generator. Less than 6′ angular accuracy

ELECTROMECHANICAL CONVERTERS



- Convert pulsed digital input to analog output
- Stepper motor and gear train drives size 8 precision resolver

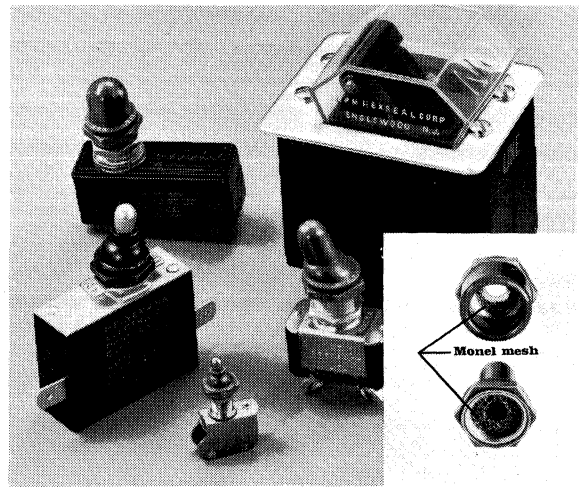
Ask for the specs on our designs... or tell us yours. It's the sure way of satisfying your hardware requirements.

VERNITRON CORPORATION
CONTROL COMPONENTS DIVISION
2440 West Carson Street • Torrance, Calif. 90501 • (213) 328-2504 • TWX: 910-349-6250

Environmental Switch Seals

APM Hexseals® keep out Gas, Liquids, Dust

APM Hexseal boots will seal any switch—pushbutton, toggle or rotary. Hexseals keep out air, gases and liquids and keep switches working longer and more reliably. Just replace the mounting nut with a Hexseal and you have a sealed switch for only pennies. For more data and prices, request Bulletin HEX-2.
APM Hexseals meet applicable Military applications including MIL-B-5423. Available in color.

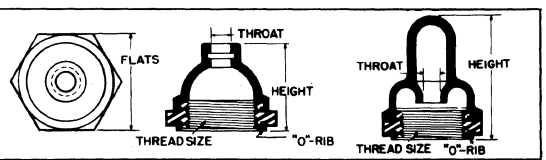


RFI Shielded Switches If Required

In addition to their normal sealing functions, Hexseals can now protect sensitive equipment from harmful radiated or received interference. A unique Monel metal wire, molded or "stuffed" into the boot, effectively eliminates RFI.

Material: Silicone rubber unless otherwise specified.
Availability: Most items available for immediate delivery from stock.

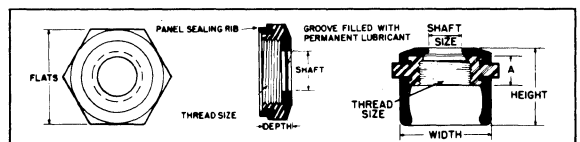
TOGGLE SWITCH BOOTS



Part No.	Thread Size	Throat	Height	Flats	Type of Switch
*N-1030B	15/32-32NS-2B	1/8″	35/64″	5/8″	Bushing Mounting
*N-5032B	1/4-40NS-2B	1/16″	17/64″	3/8″	Bushing Mounting
*PN-1030B	7/16-32NS-2B	1/8″	35/64″	5/8″	Bushing Mounting
*MN-1030B	1/2-20NF-2B	1/8″	35/64″	5/8″	Bushing Mounting
*N-5030B	1/4-40NS-2B	1/16″	17/64″	3/8″	Bushing Mounting
**N-1030	15/32-32NS-2B	1/8″	7/8″	5/8″	Bushing Mounting
**N-5030	1/4-40NS-2B	3/64″	7/16″	3/8″	Bushing Mounting
**N-5030L	1/4-40NS-2B	1/16″	1/2″	3/8″	Bushing Mounting
**N-5030R	1/4-40NS-2B	1/16″	25/64″	3/8″	Bushing Mounting

*Handle of switch protrudes **Completely covers bat handle

ROTARY SHAFT SEALS

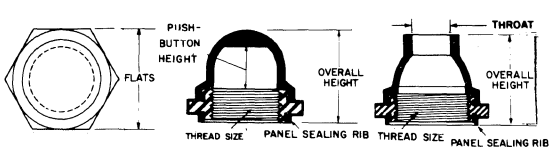


Part No*	Thread Size	Shaft Size	Depth-of Hexseal	Flats
N-9030-1/4	3/8-32NEF-2B	1/4″	7/32″	1/2″
N-9033-1/4	3/8-32NEF-2B	1/4″	23/64″	1/2″
N-9040-1/8	1/4-32NEF-2B	1/8″	7/32″	3/8″
N-9060-1/4	15/32-32NS-2B	1/4″	7/32″	5/8″
N-9065-3/8	5/8-24NEF-2B	3/8″	7/32″	3/4″

*Lubricant prevents "sticktion". If "sticktion" is desired due to vibration drift, specify anti-lubricant by adding AL after part number; specify no lubricant by adding WOL after part number.

Part No.	Thread Size	Shaft Size	Height	Width	A	Flats
NLK-9030-1/4	3/8-32NEF-2B	1/4″	17/32″	5/8″	13/64″	5/8″

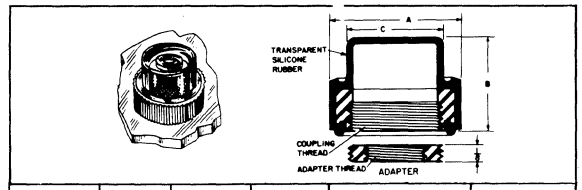
PUSH-BUTTON BOOTS



Part No.	Inside Thread Size	Switch Push-Button Height	Flats	Overall Height
N-3030	15/32-32NS-2B	1/8″ to 5/16″	5/8″	35/64″
NC-3030	15/32-32NS-2B	5/16″ to 7/16″	5/8″	23/32″
NH-3030	1/2-32NS-2B	1/8″ to 5/16″	5/8″	35/64″
N-5040	1/4-40NS-2B	9/64″	3/8″	5/16″
N-5040G	1/4-32NEF-2B	13/64″	3/8″	5/16″
*N-3030-B	15/32-32NS-2B	Plunger Protrudes	5/8″	35/64″

*Throat 1/4″

RUBRGLAS-SEEL™



Part No.	A	B	C	Coupling Thread	Fits Ind.
4080	1-1/8″	13/16″	27/32″	13/16-32NS-2B	AN-3157
4082	1″	3/4″	23/32″	11/16-32NS-2B	MS-25041
4086	1″	1″	23/32″	11/16-32NS-2B	

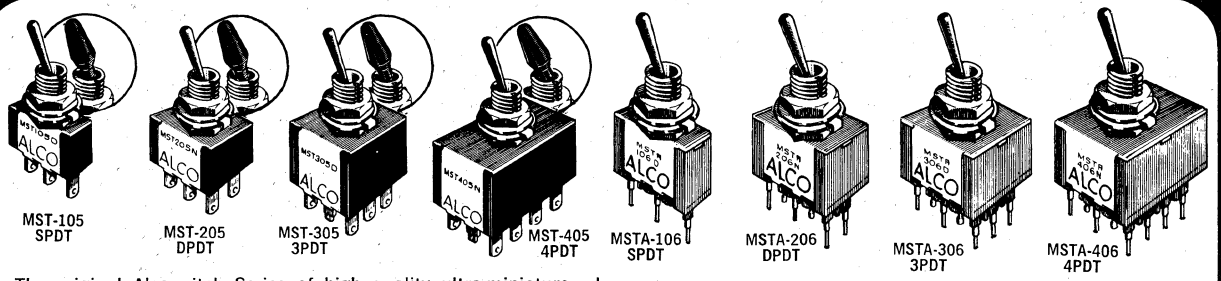
ADAPTER #	Inside Thread	Outside Thread
11	5/8-24NEF-2B	13/16-32NS-2B
7	15/32-32NS-2B	11/16-32NS-2B

ORDERING INSTRUCTIONS: Specify Boot Part Number and Adapter Number

APM HEXSEAL CORPORATION
44 Honeck Street, Englewood, New Jersey 07631 / (201) 569-5700

ALCOSWITCH

DIV. OF ALCO ELECTRONIC PRODUCTS, INC.



The original Alcoswitch Series of high quality ultra-miniature toggle switches combines high current capacity and long life in a ½" case. Slim, bat handle or optional plastic caps(*) are provided. Terminals and contacts are solid silver. Case material is black phenolic resin; 1/4-40 threaded bushing. Rated 5 amps at 115 VAC. SPDT and DPDT types have life cycle of over 80,000 on-off operations. High voltage barriers between terminals and contacts. Rated 5 amps @ 115 VAC.

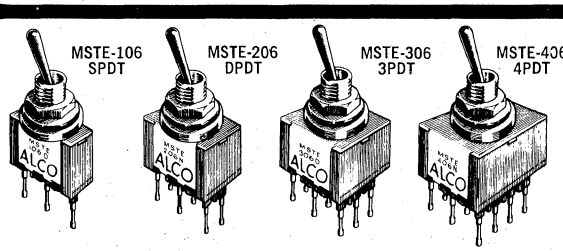
Model	Contacts	Description	One-24	25-99	100-499	500-999
MST-115D*	SPDT	On-None-On	1.70	1.16	1.02	.85
MST-105D	SPDT	On-None-On	1.65	1.12	.99	.83
MST-105E	SPDT	On-Off-On	1.95	1.33	1.17	.975
MST-105F	SPDT	None-On-(On)	1.95	1.33	1.17	.975
MST-105G	SPDT	(On)-Off-(On)	1.95	1.33	1.17	.975
MST-105H	SPDT	On-Off-(On)	1.95	1.33	1.17	.975
MST-215N*	DPDT	On-None-On	2.20	1.47	1.32	1.10
MST-205N	DPDT	On-None-On	2.15	1.43	1.29	1.08
MST-205P	DPDT	On-Off-On	2.55	1.72	1.53	1.28
MST-205R	DPDT	None-On-(On)	2.55	1.72	1.53	1.28
MST-205S	DPDT	(On)-Off-(On)	2.55	1.72	1.53	1.28
MST-205T	DPDT	On-Off-(On)	2.55	1.72	1.53	1.28
MST-205PA	DP3T	On-On-On	2.85	1.90	1.71	1.42
MST-205SA	DP3T	(On)-On-(On)	3.15	2.14	1.89	1.58
MST-205TA	DP3T	On-On-(On)	3.15	2.14	1.89	1.58
MST-315D*	3PDT	On-None-On	3.90	2.61	2.34	1.95
MST-305D	3PDT	On-None-On	3.85	2.57	2.31	1.925
MST-305E	3PDT	On-Off-On	4.15	2.82	2.49	2.075
MST-305F	3PDT	None-On(On)	4.15	2.82	2.49	2.075
MST-305H	3PDT	On-Off-(On)	4.15	2.82	2.49	2.075
MST-415N*	4PDT	On-None-On	4.90	3.33	2.94	2.45
MST-405N	4PDT	On-None-On	4.85	3.29	2.91	2.43
MST-405P	4PDT	On-Off-On	5.35	3.64	3.21	2.68

Hardware supplied mounted. (On) Indicates momentary positions.

This new Alcoswitch Series fills a need for those who want the best product possible at an optimum price. Similar in appearance and specs to the Alco "E" Series but without the waterproof feature. Has the important features wanted in a good miniature: turret terminals, extra-wide contacts, heavier current capabilities, low-loss, high heat and high impact case construction. "No Tear" shoulder on bushing. Overall dimension allows use in tight quarters. Rated 6 amps @ 125 VAC.

Model	Contacts	Description	One-24	25-99	100-499	500-999
MSTA-106D	SPDT	On-None-On	1.80	1.23	1.08	.90
MSTA-106E	SPDT	On-Off-On	2.25	1.53	1.35	1.125
MSTA-206N	DPDT	On-None-On	2.35	1.60	1.41	1.18
MSTA-206P	DPDT	On-Off-On	2.85	1.90	1.71	1.42
MSTA-206PA	DP3P	On-On-On	3.15	2.14	1.89	1.58
MSTA-306D	3PDT	On-None-On	4.05	2.75	2.43	2.03
MSTA-306E	3PDT	On-Off-On	4.45	3.03	2.67	2.23
MSTA-406N	4PDT	On-None-On	5.10	3.47	3.06	2.55
MSTA-406P	4PDT	On-Off-On	5.65	3.84	3.39	2.83
MSTA-406PA	4P3T	On-On-On	6.15	4.18	3.69	3.08
C-10*		Plastic cap for MST, A, E Series	.04	.028	.025	.022
C-17*		Flat top cap for MST, A, E Series	.04	.028	.025	.022
N-1A*		¼-40 "Perfect Fit" Nut	.06	.04	.036	.033

*Packaged in multiples of 25; when ordering caps specify red, white, black, blue, gray, green, yellow or pink.

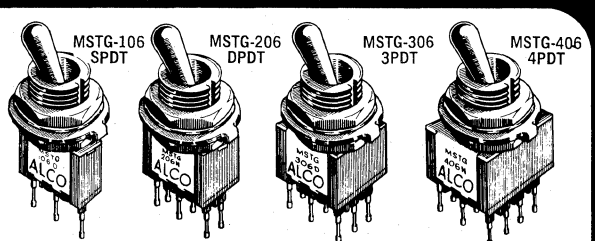


E SERIES

The new "E" Series has the most-wanted features in miniature switches. Waterproof 'O' rings are located inside the toggle and on the shoulder. A mechanical shoulder on the bottom of the bushing prevents "tear-offs" when a single mounting nut is employed. High voltage barriers between terminals inside as well as outside. Case has a new, superior plastic material capable of withstanding a higher impact; guards against accidental damage. Low-loss case has extremely high resistance between terminals and case ground, and its high temperature coefficient is ideally suited for prolonged soldering and printed circuits. Turret type terminals are used for simplified wiring or for P.C. Extra-wide, solid silver contacts are bonded, not riveted, on copper-silver plated terminals. Long-life cycle over 100,000 On-Off operations at operating conditions (SPDT). Rated 6 amps @ 125 VAC.

Model	Contacts	Description	One-24	25-99	100-499	500-999
MSTE-106D	SPDT	On-None-On	1.95	1.33	1.17	.975
MSTE-106E	SPDT	On-Off-On	2.55	1.72	1.53	1.28
MSTE-206N	DPDT	On-None-On	2.55	1.72	1.53	1.28
MSTE-206P	DPDT	On-Off-On	3.15	2.14	1.89	1.58
MSTE-206PA	DP3T	On-On-On	3.45	2.35	2.07	1.73
MSTE-306D	3PDT	On-None-On	4.25	2.89	2.55	2.13
MSTE-306E	3PDT	On-Off-On	4.75	3.23	2.85	2.38
MSTE-406N	4PDT	On-None-On	5.35	3.64	3.21	2.68
MSTE-406P	4PDT	On-Off-On	5.95	4.05	3.57	2.98

Hardware supplied mounted. Color-coded caps: see "A" Series story above



Mustang

The Mustang Series is for designers who prefer the feel of a larger toggle switch but have space limitations behind today's compact panel. The familiar ultra-miniature Alcoswitch ½" case is utilized, however the Mustang mounting requirements are the same as the larger switches with 15/32" bushings. This new Alcoswitch concept is a behind-the-panel space-saver in all Mustang models and it is especially true in the 3 Pole and 4 Pole Series where non-miniature switches are bulky in size. The Mustang switches have the most-wanted features as itemized in the "E" Series story (at left) with the exception of the waterproof 'O' rings. The case construction is of low-loss, high impact and high temperature materials with turret terminals and silver contacts. 6 amps @ 125 VAC.

Model	Contacts	Description	One-24	25-99	100-499	500-999
MSTG-106D	SPDT	On-None-On	2.15	1.43	1.29	1.08
MSTG-106E	SPDT	On-Off-On	2.75	1.87	1.65	1.38
MSTG-206N	DPDT	On-None-On	2.75	1.87	1.65	1.38
MSTG-206P	DPDT	On-Off-On	3.35	2.28	2.01	1.68
MSTG-206PA	DP3T	On-On-On	3.65	2.48	2.19	1.83
MSTG-306D	3PDT	On-None-On	4.45	3.03	2.67	2.23
MSTG-306E	3PDT	On-Off-On	4.95	3.37	2.97	2.48
MSTG-406N	4PDT	On-None-On	5.55	3.77	3.33	2.78
MSTG-406P	4PDT	On-Off-On	6.15	4.18	3.69	3.08
C-15*		Plastic cap for Mustang Series	.06	.04	.036	.033
N-1B*		15/32" "Perfect Fit" Nut	.08	.056	.05	.044

*Packaged in multiples of 25; when ordering caps specify, red, white, black, blue or gray.

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ALCOSWITCH

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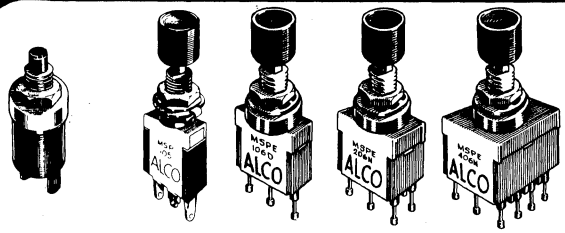


MSP-103 MSP-105 MSPE-106 MSPE-206 MSPE-406

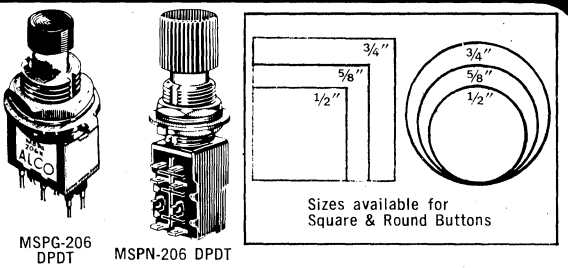
MSP Miniature Pushbutton Switches are of snap-action type capable of handling 5 amps @ 115 VAC. Solid silver contacts and terminals. Bushing size, ¼-40 with keyway. Black phenolic case. Life cycle well over 20,000 on-off operations.

MSPE Waterproof Pushbutton Switches rated 6 amps resistive and 2 amps inductive @ 125 VAC. Double "O" waterseals, low-loss "E" Series case with turret terminals. All are versatile "double-throw" models.

MSP-103 Economy Pushbutton Switches rated 3 amps @ 125 VAC. ow-pressure. Silverplated brass contacts and terminals. Plastic button plunger travels .098" overall. Depth needed behind panel less than ¾". One-piece ¼-40 mounting bushing.

Model	Contacts	Application	One-24	25-99	100-499	500-999
MSP-105D*	SPDT	Push on-off	1.95	1.33	1.17	.975
MSP-105F*	SPDT	Momentary	1.95	1.33	1.17	.975
MSP-205N*	DPDT	Push on-off	2.85	1.90	1.71	1.42
MSP-205R*	DPDT	Momentary	2.85	1.90	1.71	1.42
MSPE-106D*	SPDT	Push on-off	2.55	1.72	1.53	1.28
MSPE-106F*	SPDT	Momentary	2.55	1.72	1.53	1.28
MSPE-206N*	DPDT	Push on-off	3.45	2.35	2.07	1.73
MSPE-206R*	DPDT	Momentary	3.45	2.35	2.07	1.73
MSPE-406N*	4PDT	Push on-off	5.95	4.05	3.57	2.98
MSPE-406R*	4PDT	Momentary	5.95	4.05	3.57	2.98
C-12	Extra plastic button*		.05	.036	.032	.03
C-13	Large Button**		.09	.06	.054	.05
C-14L	Chrome button		.09	.06	.054	.05
MSP-103B†	SPST	Normally closed	.65	.44	.39	.33
MSP-103C°	SPST	Normally open	.65	.44	.39	.33

*Supplied with one red, green, or black plastic button; specify color.
**Specify red, green or black. † With black button. °With red button.



MSPG-206 DPDT MSPN-206 DPDT

MSPG Mustang Push Button Switches rated 6 amps @ 125 VAC (specs same as in Mustang story). Has 15/32 bushings.

Model	Contacts	Application	One-24	25-99	100-499	500-999
MSPG-206N*	DPDT	Push on-off	3.15	2.14	1.89	1.58
MSPG-206R*	DPDT	Momentary	3.15	2.14	1.89	1.58

*Supplied with one red or black plastic button; specify color.

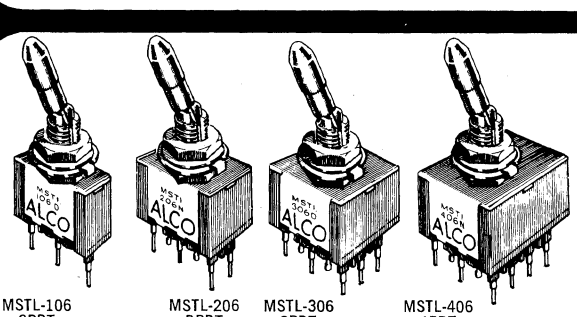
MSPN Illuminated Push Button Switches are snap-action types capable of handling a high current rating for its small size. DPDT action in a miniature case with separate connections to its replaceable T-1¾ grooved base lamps. Side terminals for simplified wiring or P.C. use. Metal construction, phenolic case, solid silver contacts. 6 amps @ 125 VAC. Mounts in 15/32" dia. hole. Wide choice of plastic buttons. **TRANSPARENT** colors: Red, Amber, Blue, Green, Clear. **TRANSLUCENT:** Red, Yellow, Green, White. Uses grooved base lamps.

Model	Contacts	Application	One-24	25-99	100-499	500-999
MSPN-206N	DPDT	Push on-off	4.80	3.26	2.88	2.40
MSPN-206R	DPDT	Momentary	4.80	3.26	2.88	2.40

Note: supplied less colored button and lamps, see listing below.

RS*	½" Round Button	.10	.068	.06	.05
RM*	⅝" Round Button	.12	.082	.072	.06
RL*	¾" Round Button	.15	.102	.09	.075
SS*	½" Square Button	.10	.068	.06	.05
SM*	⅝" Square Button	.12	.082	.072	.06
SL*	¾" Square Button	.15	.102	.09	.075
CG	½" Chrome Guard	.30	.204	.18	.15
379	6.3V @ 0.2A Lamps	.85	.57	.51	.43
386	14.0V @ 0.08A Lamps	.90	.60	.54	.45
388	28.0V @ 0.04A Lamps	.95	.63	.57	.47

*Specify Transparent or Translucent Type and Color.



MSTL-106 SPDT MSTL-206 DPDT MSTL-306 3PDT MSTL-406 4PDT

Lever-Lock Alcoswitch is the world's first "pull-to-unlock" toggle switch for use in hazardous applications. The toggle locks in position to safeguard against accidents. Optional interchangeable color-coded toggle tips available. Rated 6 amps @ 125 VAC.

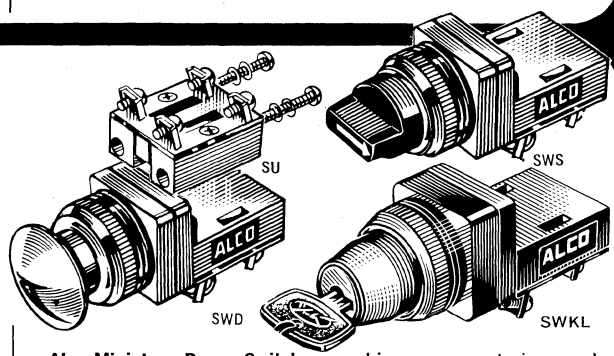
Model	Contacts	Description	One-24	25-99	100 499	500-999
MSTL-106D	SPDT	On-None-On	3.15	2.14	1.89	1.58
MSTL-106E	SPDT	On-Off-On	3.85	2.57	2.31	1.925
MSTL-206N	DPDT	On-None-On	3.85	2.57	2.31	1.925
MSTL-206P	DPDT	On-Off-On	4.45	3.03	2.67	2.23
MSTL-206PA	DP3T	On-On-On	4.75	3.23	2.85	2.38
MSTL-306D	3PDT	On-None-On	5.65	3.84	3.39	2.83
MSTL-406N	4PDT	On-None-On	6.95	4.73	4.17	3.48
C-16*	Color-Coded Caps		.18	.12	.11	.10

* Lever-lock switches are stocked with natural aluminum caps only. Extra caps available in anodized Red, Blue, and Black (specify color).

MSS-22 Miniature Slide Switch with unusual two-circuit N.O.-N.C. (useable as SPDT) anti-tease design. Rated 2 amps @ 120 VAC. Compact ½" case has corrosion-proof metal case and phenolic slide block. Gold on nickel on silver-plated brass contacts. Life cycle, 250,000 operations. Case size, .500" x .305" x .257"; mounts .687" centers.



Model	Description	One-24	25-99	100-499	500-999
MSS-22	SPDT, 2 circuit	1.75	1.17	.88	.73
MSS-44	DPDT	3.15	2.11	1.58	1.31



Alco Miniature Power Switches combine a compact size, modern appearance and functional flexibility to meet today's control needs and mount in a 1" hole. Rated to carry 6 amps @ 230 VAC. These switches may be used to control circuits independently or with optional relays. All models supplied with a single (N.O.-N.C.) contact block but have provisions for an additional (Model SU) block thereby convertible to DPDT units.

3-Way Selector Power Switch is the same basic model as above but instead has a bar knob with pointer. Electrical and physical specifications are the same. Available in black only.

Key-Lock Push Button type is an accident-proof power switch that has its own key lock to prevent unwanted operations of machines and controls. The switch functions only when the key disengages the lock. Same specs as the series described above.

Model	Description	One-24	25-99	100-499	500-999
SW-251*	Standard Button	2.95	1.97	1.77	1.48
SWD-251*	Mushroom Button	3.35	2.23	2.01	1.68
SWL-251*	Long Button	3.10	2.07	1.86	1.56
SWS-251	Selector ON-OFF-ON	3.25	2.17	1.95	1.63
SWKL-251	Key/Lock Switch	7.95	5.30	4.77	3.98
SU-251	N.O. — N.C. Block	1.85	1.23	1.11	.93

*Push button models are equipped with spare (snap-on) colored buttons offering a choice of use in red, black, or green.
†Standard snap-on legend buttons for SW-251 switch.

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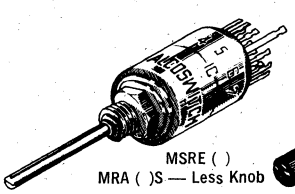


MSRE ( )
MRA ( )S — Less Knob

MRA ( )
with Knob

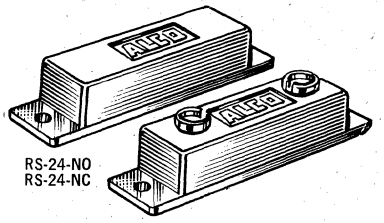
MRA Adjustable-Stop Rotary Switches are miniature types rated 500 mA @ 125 VAC. Features: adjustable-stop; non-shorting; 36° spacing; up to 4 poles on single deck; solid silver terminals and contacts. Types with suffix **S**, ⅛", dia. shaft less knob. Bushing, ¼-40.

MRA 12-Position Rotary Switches are slightly larger than standard MRA Series has ⅛" shaft and 30° spacing. Other specs similar to MRA Series. Knobs not included. Type MRA-1-12S can be converted to an adjustable-stop switch when used with KCVS-500 knob (see Alco knob listings).

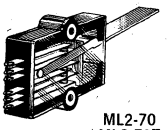
MSRE Waterproof Rotary Switches are non-adjustable. Similar to MRA Series but feature internal and external 'O' rings. One-piece metal case construction, and terminals are epoxy sealed. ⅛" shaft. Ideal for printed circuits. Supplied less knob. Rated 500 mA @ 125 VAC. Can be converted to an adjustable-stop switch when used with KCVS-500 knob (see knob listings).

MODEL	Pole	Positions	Knob Supplied	One-24	25-99	100-499	500 999
MRA-1-10	1	2-10	Yes	3.95	2.65	2.37	1.965
MRA-2-5	2	2-5	Yes	3.95	2.65	2.37	1.965
MRA-3-3	3	2-3	Yes	3.95	2.65	2.37	1.965
MSRA-4-2*	4	2	Yes	3.95	2.65	2.37	1.965
MRA-1-10S	1	2-10	No	3.85	2.57	2.31	1.925
MRA-1-10SC**	1	10	No	3.85	2.57	2.31	1.925
MRA-2-5S	2	2-5	No	3.85	2.57	2.31	1.925
MRA-3-3S	3	2-3	No	3.85	2.57	2.31	1.925
MSRA-4-2S*	4	2	No	3.85	2.57	2.31	1.925
MRA-1-12S	1	12	No	4.15	2.82	2.49	2.075
MRA-1-12SC**	1	12	No	4.15	2.82	2.49	2.075
MSRE-1-10*	1	10	No	4.85	3.29	2.91	2.43
MSRE-2-5*	2	5	No	4.85	3.29	2.91	2.43
MSRE-3-3*	3	3	No	4.85	3.29	2.91	2.43
MSRE-4-2*	4	2	No	4.85	3.29	2.91	2.43

* **Switches** are non-adjustable. **Continuous rotation.



RS-24-NO
RS-24-NC



ML2-70
ML2-70T

Proximity Switch and Magnet Assembly features the inherent simplicity of a basic dry reed switch to provide long life and reliability. Alnico-5 magnet is the force used to actuate the reed switch within distance of 1" centers. Reed switch provided is replaceable. Rated 0.5 amps break, 1.0 amps carry. Life cycle over 5-million operations. Sold in pairs only.

Model	Description	One-24	25-99	100-499	500-999
RS-24-NO	N.O. (Apart) Pair	2.85	1.90	1.71	1.42
RS-24-NC	N.C. (Apart) Pair	3.15	2.14	1.89	1.58

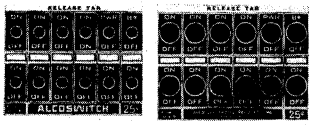
DPDT Snap Action miniature leaf switch capable of controlling two independent circuits for alternate or reversal operation. Solid silver contacts assure long operational life. Rated 3 amps @ 115/250 VAC. Lever length ⅝", half-million life cycle. Operating force: less than 100 grams.

Model	Contacts	Description	One-24	25-99	100-499	500-999
ML2-70T	DPDT	Positive-On-On	1.95	1.33	1.17	.975
ML2-70	DPDT	On-Momentary On	1.95	1.33	1.17	.975

Alco Foot Switch is compact and rugged for use where high speed and minimum operator fatigue are essential. SPDT momentary-contact switch has spring return and non-skid base. Rating 10 amps @ 250 VAC.
Size: 3¼" x 3¼" x 1".

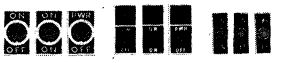
Model	Supplied	One-24	25-99	100-499
SKF	Less Cable	3.95	2.64	2.37
SKF-6	With 6-ft. Cable	4.95	3.37	2.97



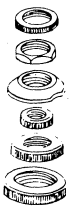


SP-1

SP-2



SP-3 SLP-4 SP-4



N-1
N-2
N-3
N-1A
N-1C
N-1B

SP1, SP2 Aluminum Foil, pressure-sensitive "ON-OFF" plates for ALCOSWITCH and other miniature switches which have a ¼" bushing; and for standard switches requiring 15/32" hole. Each card has 12 plates.

SP3, SP4 Stamped Aluminum Plates for use with miniature and standard toggle switches. Black anodized, raised letters. Each card has 5 plates: 3 ON-OFF, 1 ON-ON, 1 PWR-OFF.

SLP4 Stamped Aluminum Plates for ¼" dia. switch bushings and ⅜" pilot lights. Each card has 5 plates: 3 ON-OFF, 1 ON-ON, 1 PWR-OFF. ⅜" hole accepts our BND series pilots.

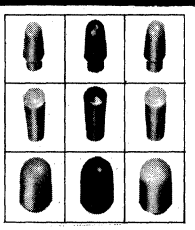
Model	Hole Size	No. Plates	One-24	25-99	100-499
SP-1	¼" Dia.	12	.25	.18	.17
SP-2	15/32" Dia.	12	.25	.18	.17
SP-3	¼" Dia.	5*	.75	.54	.51
SP-4	15/32" Dia.	5*	.75	.54	.51
SLP-4	¼" Dia. and ⅜" pilot	5*	.90	.65	.61

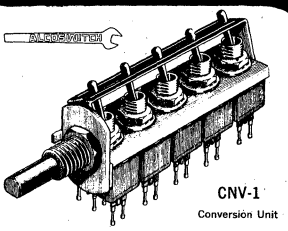
*3 ON-OFF, 1 ON-ON, 1 PWR-OFF.

Decorative Mounting Nuts — 4 styles are available for use with ALCOSWITCH and other miniature switches. Packaged in multiples of 25. **STANDARD** double chamfered knurled nuts for ¼-40 threaded bushings only. **"PERFECT FIT"** round bevel top with lip for automatic stop ¼-40, ⅜, and 15/32" bushings. Decorative is conical shape; ¼-40.

Model	Description	One-24	25-99	100-499	500-999
N-1	¼-40 Standard Knurl Nut	.04	.028	.025	.022
N-1A	¼-40 "Perfect Fit" Knurl Nut	.06	.04	.036	.033
N-1B	15/32" "Perfect Fit" Knurl Nut	.08	.056	.05	.044
N-1C	⅜" "Perfect Fit" Knurl Nut	.08	.056	.05	.044
N-2	¼-40 Standard Hex Nut	.03	.022	.02	.018
N-3	¼-40 Decorative Mounting Nut	.06	.04	.036	.033

C-10 Cap
C-17 Cap
C-15 Cap





CNV-1
Conversion Unit

Color-Coded Caps for miniature and standard toggle switches. The MST-115D, 215N, 315N, 415N switches are stocked with white caps only. Colored caps may be purchased separately for use on all ALCO bat handle switches for color identification. When ordering — specify color. Packaged in multiples of 25 (minimum).

Model	Description	One-24	25-99	100-499	500-999
C-10*	Plastic caps for "MST", "A" & "E" Series	.04	.028	.025	.022
C-15°	Plastic caps for Mustang Series	.06	.04	.036	.033
C-17*	Flat top caps for "MST", "A" & "E" Series	.04	.028	.025	.022

*Specify: Red, White, Black, Blue, Gray, Green, Yellow or Pink.
°Specify: Red, White, Black, Blue, or Green.

Conversion Unit For Rotary Switch Operation. Gangs miniature toggle switches (with ¼" bushings) for controlling multiple circuits simultaneously. Operating as a 2- or 3-position rotary switch, this unit is capable of ganging from 1 to as many as 5 toggle switch combinations that total up to 10 poles. Allows you to have enclosed contacts, and heavier current capabilities. Use with various types of switches to act as a 3-position rotary switch when used with CENTER-OFF or ON-ON-ON type toggle switches, or becomes a 2-position rotary when used with 1- or 2-pole toggle switches.

Model	Description	One-24	25-99	100-499	500-999
CNV-1	Conversion Unit	.95	.63	.57	.48

A Spanner Wrench designed expressly to expedite the proper installation of ALCOSWITCH. A long, tapered arm extends at a slight angle allowing the user to tighten the lower mounting nut.
Model No. W-1 ..... **Net 25¢ ea.**

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REED SWITCH OPERATED KEYBOARD BANKS

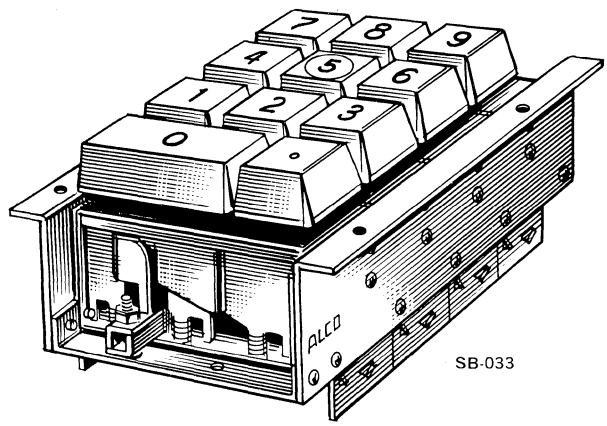
Now designers can be assured of highest reliability in data processing equipment. Short strokes provide a smooth operation of the switch plunger resulting in one of the finest keyboard actions obtainable. It is also suitable for test equipment, communication gear, and many other applications.

All details of this new switch line are designed for light pressure (5 ounces), operator's convenience, and positive input of data with long life under heavy office type of usage.

Highly efficient "single-pole open circuit" reed switches are used throughout assuring reliability and extremely long life expectancy. Square light grey buttons (19/32") have an industry standard 0-9 marking and format.

All switch positions contain a "positive lockout" between sections and rows. This feature prevents more than one position from operating at the same time. An extra "decimal" button is also provided to enhance design use.

This particular model shown is our standard SB-033 and is, therefore, available from stock without any design changes. This basic keyboard system is designed for flexibility and can be customized to meet the special needs of quantity users. Up to 12 switches may be installed in the basic module in any combination including momentary, locking maintained, or lockout design.



SB-033

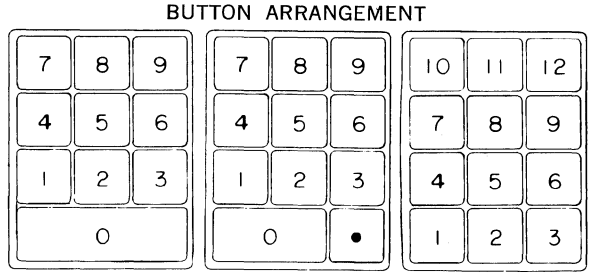
SPECIFICATIONS

Dimensions:	2.81" W. x 3.62" L. x 2.25" D.
Depth Requirements:	1-5/8"
Switch Contact:	Normally Open
Rating:	100 ma @ 48V
Operating Force:	5 Ounces
Mechanical Life:	1,000,000 Cycles
Reed Switch Life:	1,000,000 Cycles
Full Stroke Travel:	7/32"
Travel to Contact:	5/32"
Button Color:	*Light Grey
Symbols:	3/16" high, Black

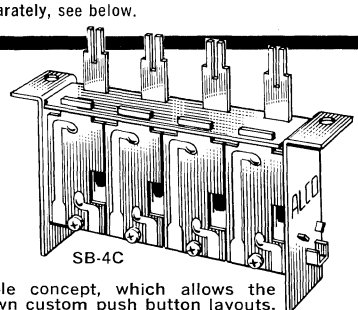
Model	Description	One-24	25-99	100-499
SB-032	Interlock 0-9 ("0" Triple Bar)	28.50	22.80	19.95
SB-033	Interlock 0-9 and Period	28.50	22.80	19.95
SB-034	Interlock 1-12 Numerals	29.95	23.96	20.97
SB-035	Momentary 1-12 Numerals	28.50	22.80	19.95

*Colored blank buttons available separately, see below.

BUTTON ARRANGEMENT



SB-032 SB-033 SB-034 & 035



SB-4C

PUSH BUTTON MODULES

This modular idea is a simple concept, which allows the design engineer to create his own custom push button layouts. Highly efficient single pole "normally-open" reed switches are used throughout thus assuring reliability and an extremely long life expectancy.

Light pressure (5 ounces) and short strokes result in optimum operators' convenience and positive input of data.

The basic module allows use of one to three switches in either momentary or alternate "push-ON-push-OFF" action. Stacking allows any number of these switch sections to be used in a group by themselves or with our mating 12 segment keyboard assemblies (SB-033, SB-034, etc.).

Standard size switch buttons are available separately in various colors, either single or extended buttons which span 2 or 3 switches. Note: that by use of longer buttons it is also possible to form 2 or 3 pole switch functions.

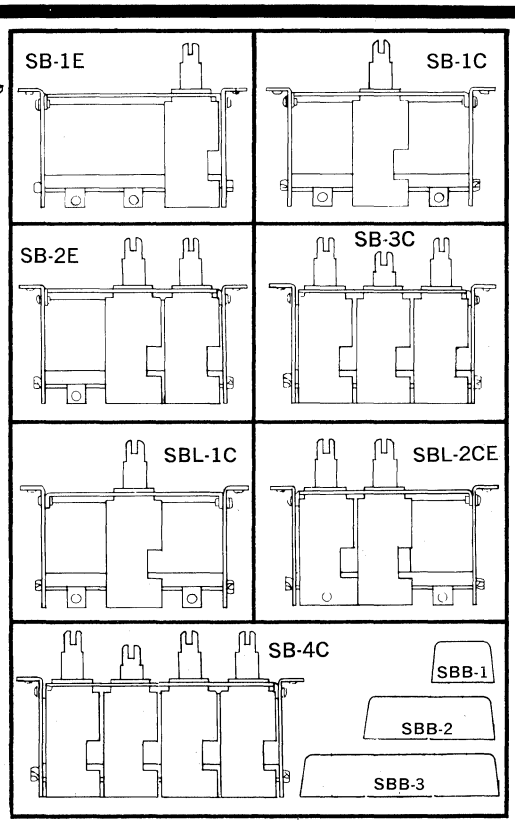
SPECIFICATIONS

Switch Contact:	Normally Open	**Full Travel:**	7/32"
Rating:	100 ma @ 48V	**Travel to Contact:**	5/32"
Life Expectancy:	1,000,000 cycles	**Depth Requirements:**	1-5/8"

Model	Description	One-24	25-99	100-499
SB-1E	Mod-Segment, 1 pole, end, mom.	2.90	2.32	2.03
SB-1C	Mod-Segment, 1 pole, center, mom.	2.90	2.32	2.03
SB-2E	Mod-Segment, 2 pole, end, mom.	4.90	3.84	3.36
SB-3C	Mod-Seg. 3 pole, ctr. & ends, mom.	6.70	5.36	4.69
SB-4C	Mod-Segment, 4 pole, momentary	8.60	6.88	6.02
SBL-1C	Mod-Segment, 1 pole, locking	3.90	3.12	2.73
SBL-2CE	Mod-Segment, 2 pole, lock & mom.	5.80	4.64	4.06
	Above switches are supplied less buttons; order below.			
SBB-1*	Button only	.15	.12	.105
SBB-2*	Button only	.25	.20	.175
SBB-3*	Button only	.35	.28	.245
SB-BKT	Mounting Brackets (pr.)	1.95	1.56	1.37

*Specify Color: Light Grey, Dark Grey, White, Blue, Red, Black.

SPDT AND NORMALLY CLOSED VERSIONS AVAILABLE UPON REQUEST.

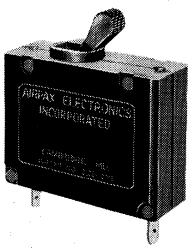


ALCO® ELECTRONIC PRODUCTS, INC.
MAILING ADDRESS: P. O. BOX 1348, LAWRENCE, MASSACHUSETTS 01842

CIRCUIT PROTECTORS & GLASS-TO-METAL SEALS

AIRPAX ELECTRONICS

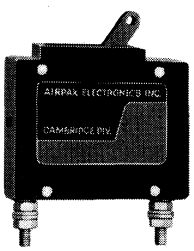
Type APG



TRIP TIME IN SECONDS (Normal Wall Mount Position)

	Delay	100%	125%	150%	200%	400%	600%	800%	1000%
400 Hz	41	No Trip	May Trip	.50 - 5.0	.15 - 1.9	.02 - .19	.006 - .08	.004 - .050	.004 - .035
	42	No Trip	May Trip	5.0 - 60.0	2.2 - 20.0	.40 - 3.2	.012 - .19	.006 - .060	.060 - .045
DC	50	No Trip	May Trip	.032 Max.	.024 Max.	.020 Max.	.018 Max.	.016 Max.	.015 Max.
	51	No Trip	.5 - 6.5	.3 - 3.0	.13 - 1.2	.031 - .220	.011 - .110	.004 - .050	.004 - .025
	52	No Trip	2.0 - 50.0	1.2 - 22.0	.62 - 8.0	.15 - 1.5	.03 - .50	.004 - .050	.004 - .025
60 Hz	60	No Trip	May Trip	.040 Max.	.035 Max.	.030 Max.	.025 Max.	.020 Max.	.018 Max.
	61	No Trip	.7 - 12	.35 - 4.0	.130 - 1.30	.030 - .220	.008 - .130	.003 - .070	.003 - .040
	62	No Trip	10 - 120	6.0 - 60	2.2 - 20.0	.300 - 2.00	.050 - .750	.007 - .130	.005 - .040

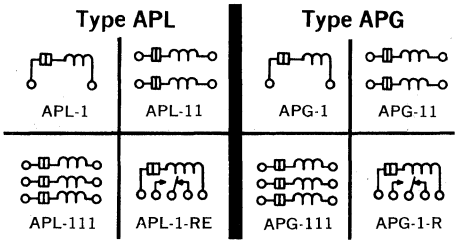
Type APL

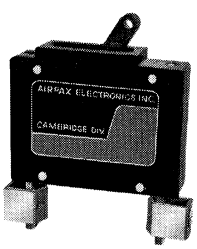


TRIP TIME IN SECONDS vs. PERCENT OF RATED CURRENT (25°C — Vertical Mount Position)

	Delay	100%	125%	150%	200%	400%	600%	800%	1000%
400 Hz	0	No Trip	May Trip	.050 Max.	.040 Max.	.030 Max.	.025 Max.	.020 Max.	.018 Max.
	1	No Trip	May Trip	.6 - 3.0	.2 - .8	.035 - .120	.012 - .060	.011 - .032	.010 - .030
	2	No Trip	May Trip	6.0 - 60.0	2.0 - 8.0	.4 - 1.5	.020 - .200	.011 - .032	.010 - .030
	3	No Trip	May Trip	70. - 400.	20. - 80.	2. - 7.	.020 - .150	.011 - .032	.010 - .030
	400	No Trip	May Trip	40. - 280.	9. - 70.	1.3 - 8.8	.44 - 3.15	.023 - .500	.010 - .050
DC	0	No Trip	May Trip	.032 Max.	.024 Max.	.020 Max.	.018 Max.	.016 Max.	.015 Max.
	1	No Trip	.70 - 4.0	.40 - 1.50	.160 - .600	.040 - .140	.010 - .055	.009 - .038	.008 - .030
	2	No Trip	10. - 60.	6. - 23.	2.5 - 8.0	.350 - 1.35	.125 - .500	.011 - .060	.010 - .030
	500	No Trip	80. - 600.	45. - 240.	16.5 - .70	1.8 - 9.5	.55 - 4.25	.030 - .600	.014 - .065
60 Hz	0	No Trip	May Trip	.040 Max.	.035 Max.	.030 Max.	.025 Max.	.020 Max.	.018 Max.
	1	No Trip	1. - 6.	.60 - 2.50	.240 - .800	.040 - .180	.020 - .070	.012 - .050	.010 - .040
	2	No Trip	15. - 70.	6.5 - 30.	3. - 9.	.300 - 1.50	.030 - .300	.018 - .080	.010 - .040
	600	No Trip	80. - 650.	20. - 150.	10. - 60.	1.9 - 8.	.6 - 2.5	.025 - .500	.015 - .060

INTERNAL CIRCUITRY





Type APL HI-AMP
has special terminals which accept #2 through #8 wire leads.

TRIP TIME IN SECONDS vs. PERCENT OF RATED CURRENT

	Delay	100%	125%	200%	400%	800%
DC	1	NO TRIP	.70 - 4.0	.160 - .600	.040 - .140	.009 - .038
	2	NO TRIP	10 - 60	2.5 - 8.0	.350 - 1.35	.011 - .060
60 Hz	1	NO TRIP	1-6	.240 - .800	.040 - .180	.012 - .050
	2	NO TRIP	15-70	3 - 9	.300 - 1.50	.018 - .080







GLASS-TO-METAL SEALS







Exacting customer specifications are met with quality, glass insulated terminals manufactured by Airpax.

A wide variety of terminals are producible and glass can be color coded for identification. Leads can be kovar, sleeved solid copper or tubular. A large choice of standardized pins and lugs permits quick delivery to your specific needs.

Our Engineering Department will assure a seal to meet your requirement with a detailed analysis of your seal problem.

A 90 page catalog giving technical details is yours for the asking.

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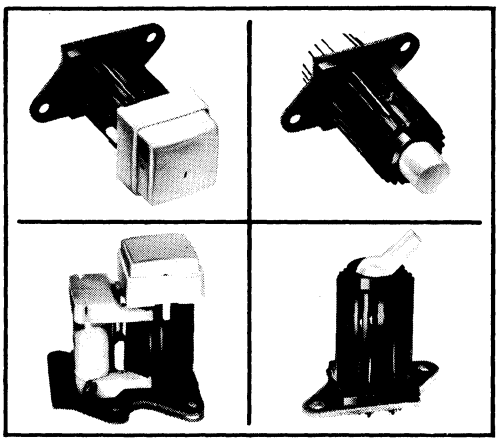
American Zettler, inc. | SWITCHES

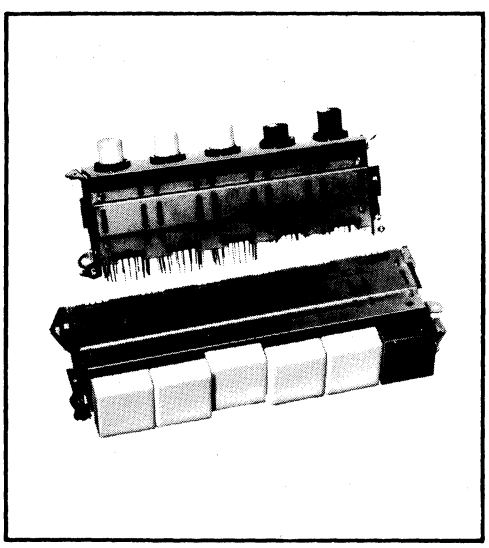
SERIES T-500 PUSHBUTTON AND TOGGLE SWITCHES

For chassis or PC board mounting only. No front panel screws. Six PDT fine silver self-cleaning slide-action contacts. Occupies less than one square inch of panel space. Only 1½" depth behind panel. Long-life special nylon parts used throughout. Pushbutton switches can be furnished with round ⅜" diameter or ¾" square buttons in white, black, red, yellow, green, or blue. Square buttons may be engraved or hot stamped. Illuminated pushbutton switches are available using T-1-¾ lamps, which are accessible from front. Prices from $1.00 to $7.00 (1-24 pcs).



BASIC SPECIFICATIONS

Contact Rating: 1 amp at 30 vdc or 0.2 amp at 115 vac.
Contact Arrangement: Two, four, and six form C contacts.
Life Expectancy: 10^6 mechanical; 5×10^4 at rated load.
Ambient Temperature Range: —20°C to +60°C.
Dielectric Strength: Under room conditions, 500v rms.
Insulation Resistance: Under room conditions, 10^9 ohms.
Terminals: Pierced solder lugs or PC pins.



PART NUMBERS FOR TOGGLE SWITCHES

(non-illuminated, white plastic toggles)

FUNCTION	PART NO.
Two-position	T 680
Three-position	T 681
Three-position: Lock, neutral, momentary	T 682

PART NUMBERS FOR PUSHBUTTON SWITCHES

FUNCTION	NON-ILLUMINATED		ILLUMINATED	
	round	square	round	square
Momentary	T 500	T 520	T 600	T 620
Push Lock, Push Release	T 540	T 560	T 640	T 660
Push Lock Reset Solenoid*	T 502	T 522	T 602	T 622

TO ORDER, add to the part number the color of button and contact arrangement.
*Standard solenoid is for 24 vac or vdc (200 ohms); other coils can be supplied to special order.

SERIES T-596 MULTIPLE SWITCHES

For front panel, chassis, or PC board mounting using 4-40 screws, single (T-500) pushbutton switches are frame-mounted. The above specifications apply; however, square button dimensions are ⅞" x 13/16" with 0.827" center-to-center spacing. Other versions, such as remote reset solenoid or heavy duty contacts for line switching, are also available.

Prices per station approximately $2.50 for non-illuminated; $4.50 for illuminated (1-9 pcs).

SWITCH CHARACTERISTICS

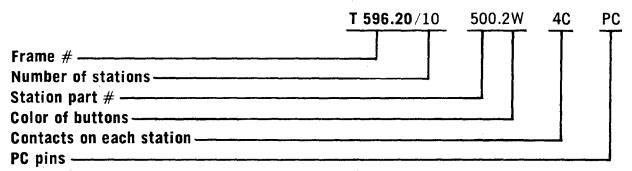
SWITCH FUNCTION	FRAME PART NUMBER	CAN BE COMBINED WITH THE FOLLOWING STATIONS	NUMBER OF STATIONS AVAILABLE
Non lock (momentary) Push lock, push release	T 596.10	Push lock, push release Non lock	3 to 11
Interlock	T 596.20	Non lock Push lock, push release	3 to 11
Interlock with one non-locking reset button	T 596.30	Non lock Push lock, push release	3 to 10 plus 1 RESET

STATION PART NUMBERS

FUNCTION	NON-ILLUMINATED		ILLUMINATED	
	round	square	round	square
Non-lock (momentary)	500.1	520.1	600.1	620.1
Interlock	500.2	520.2	600.2	620.2
All lock	500.3	520.3	600.3	620.3
Push lock, Push Release	540.4	560.4	640.4	660.4
Reset	500.0	520.0	600.0	620.0

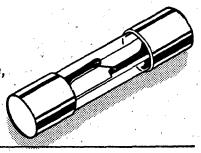
FOR EXAMPLE, TO ORDER:

A multiple-station pushbutton switch with: Ten interlock, non-illuminated stations with white round buttons, four form C contacts, and printed circuit terminals, the following part number would be developed: (See example at right)

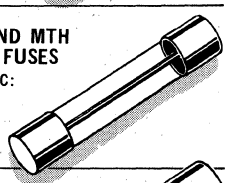


American Zettler, inc.
697 RANDOLPH AVE. ▪ COSTA MESA, CALIF. 92626 ▪ PHONE (714) 540-4190 ▪ TELEX: 67-8472

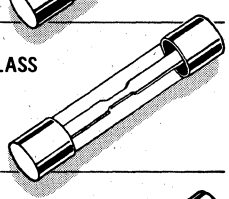
BUSS AGX FAST ACTING FUSES
¼ x 1 inch, glass tube, "quick-acting" type, 1/500 to 2 amp.



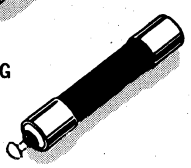
BUSS AGC AND MTH GLASS TUBE FUSES
¼ x 1¼ inch. AGC: 2½, 3 amps. MTH: 4, 5 or 6 amp.



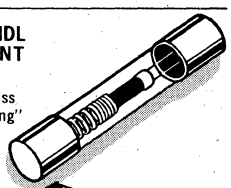
BUSS AGC GLASS TUBE FUSES
¼ x 1¼ inch. 4 to 30 amp.



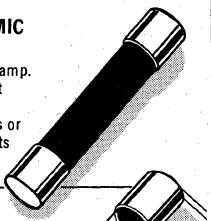
BUSS INDICATING FUSES
¼ x 1¼ inch, ¾ to 30 amp., and 13/32 x 1½ inch, 1/10 to 30 amp. Silverplated pin pops out when fuse is blown and provides quick, positive identification of faulted circuit . . . by visual signal, by activating an alarm, or both.



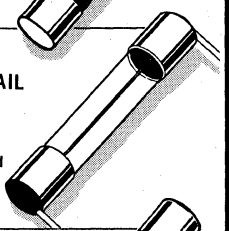
FUSETRON MDL DUAL-ELEMENT FUSES
¼ x 1¼ inch, glass tube "slow-blowing" 1/100 to 30 amp.



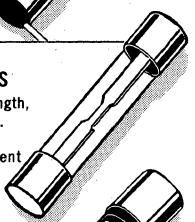
BUSS ABC CERAMIC TUBE FUSES
¼ x 1¼ inch, ¼ to 30 amp. For circuits having fault current capacity up to 25,000 amp. at 125 volts or 10,000 amps. at 250 volts



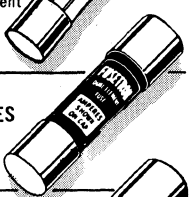
BUSS GJV PIGTAIL FUSES
¼ x 1½ inch, glass tube, with 1¼ inch leads of No. 20 tinned wire. 1/16 to 6 amp.



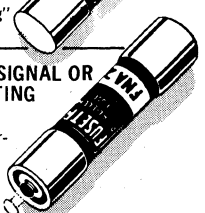
BUSS SFE STANDARD FUSES
5/8 to 1 7/16 inches in length, glass tube, 4 to 30 amp. Fuses of different amperages are of different lengths—to make it impossible to insert too large a size.



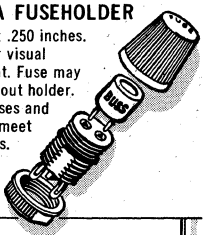
FUSETRON FNM FIBRE TUBE FUSES
13/32 x 1½ inch, dual-element "slow-blowing" 1/10 to 30 amp.



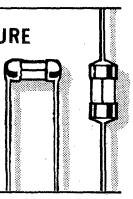
FUSETRON FNA SIGNAL OR VISUAL INDICATING FUSES
1/10 to 10 amp. Silver-plated pin pops out when fuse is blown and provides quick, positive identification of faulted circuit . . . by visual signal, by activating an alarm, or both.



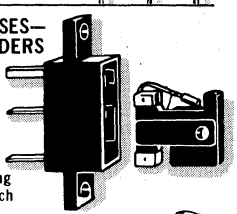
BUSS SUB-MINIATURE GMW FUSE AND HWA FUSEHOLDER
Fuse size only .270 x .250 inches. Fuse has window for visual inspection of element. Fuse may be used with or without holder. 1/200 to 5 amps. Fuses and holders available to meet military specifications.



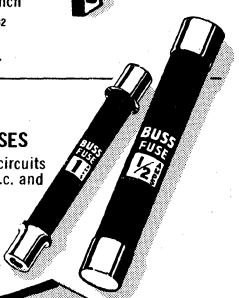
GFA TRON SUB-MINIATURE PIGTAIL FUSES
Body size only .145 x .300 inches. Glass tube construction permits visual inspection of element. Hermetically sealed. Twenty-three ampere sizes from 1/100 thru 15 amps.



BUSS GMT FUSES—HLT FUSEHOLDERS
Signal Indicating, Alarm Activating. For multiple circuit apparatus where space is at a premium. Holders take panel mounting space of only ¼ inch horizontal by 1 15/32 inches vertical. 18/100 to 10 amp.



BUSS HIGH VOLTAGE FUSES
For protection of circuits up to 20 KW on d.c. and 30KVA on a.c. 1/16 to 2 amp.



BUSS QUALITY
SMALL DIMENSION
FUSES and FUSEHOLDERS

FOR THE PROTECTION OF ALL TYPES OF ELECTRONIC & ELECTRICAL CIRCUITS & DEVICES

The complete BUSS line of fuses includes dual-element "slow-blowing," single-element "quick-acting" and signal or visual indicating types . . . in sizes from 1/500 amp. up—plus a companion line of fuse clips, blocks and holders.

Only a representative listing is shown here of the thousands of different types and sizes of fuses and holders available from BUSS.

All standard items are easily obtained through your BUSS distributor—but if you don't find what you want, get in touch with us.

When special fuses, fuse clips, fuse blocks or fuseholders are required, our staff of fuse engineers is at your service to help in selecting or designing the fuse or fuse mounting best suited to your requirements.

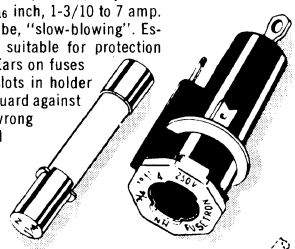
For detailed information on the complete BUSS line write for BUSS bulletin SFB.

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.,* **St. Louis, Mo. 63107**

For fuses and fuseholders of unquestioned high quality . . .

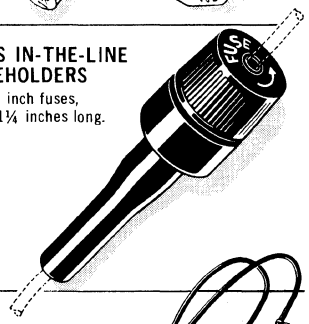
FUSETRON TYPE N FUSES AND FUSEHOLDERS

¼ x 1¼ inch, 0 to 1¼ amps. and ¼ x 1 13/16 inch, 1-3/10 to 7 amp. Glass tube, "slow-blowing". Especially suitable for protection of TV. Ears on fuses match slots in holder to safeguard against use of wrong size and type of fuse.



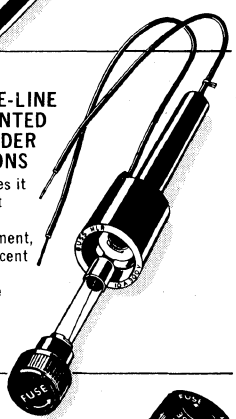
BUSS IN-THE-LINE FUSEHOLDERS

For ¼ inch fuses, ⅝ to 1¼ inches long.



BUSS IN-THE-LINE PANEL MOUNTED FUSE & HOLDER COMBINATIONS

HLR holder makes it simple to protect wide variety of devices or equipment, including fluorescent fixtures. Should fuse open, entire fuse-knob assembly is replaced.



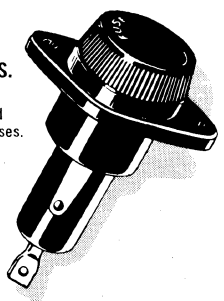
BUSS PANEL MOUNTED FUSEHOLDERS

Non-Indicating Series HJ, HK and HCM. For ¼ x 1, ¼ x 1¼ and 9/32 x 1¼ inch fuses.



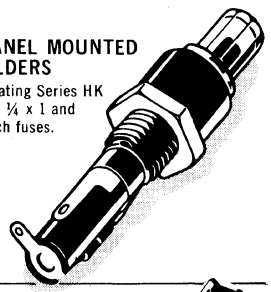
BUSS PANEL MOUNTED FUSEHOLDERS. SERIES HPC

For 13/32 x 1⅜ and 13/32 x 1½ inch fuses. Also available in military type.



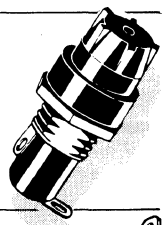
BUSS PANEL MOUNTED FUSEHOLDERS

Lamp Indicating Series HK and HJ. For ¼ x 1 and ¼ x 1¼ inch fuses.



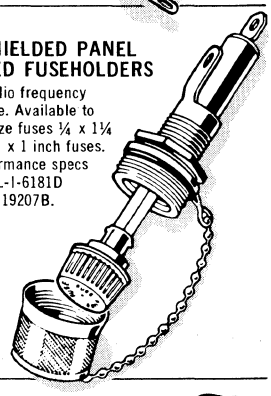
BUSS SPACE SAVER PANEL MOUNTED FUSEHOLDERS

Fuseholder only 1⅝ inches long . . . extends just 29/32 inch behind front of panel. Takes ¼ x 1¼ inch fuses. Holder rated at 15 ampere for any voltage up to 250.



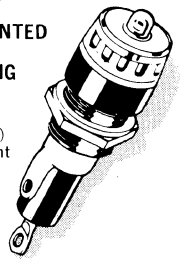
BUSS SHIELDED PANEL MOUNTED FUSEHOLDERS

Prevent radio frequency interference. Available to take two size fuses ¼ x 1¼ inch and ¼ x 1 inch fuses. Meet performance specs of both MIL-I-6181D and MIL-F-19207B.



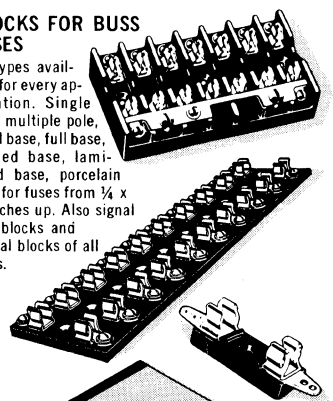
BUSS PANEL MOUNTED FUSEHOLDERS. VISUAL INDICATING SERIES HLD.

For ¼ x 1¼ inch BUSS GBA fuses (or GLD fuses) ¾ to 5 amps. Transparent knob permits visual indicating pin on open fuse to be seen.



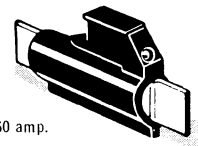
BLOCKS FOR BUSS FUSES

All types available for every application. Single pole, multiple pole, small base, full base, molded base, laminated base, porcelain base for fuses from ¼ x ⅝ inches up. Also signal fuse blocks and special blocks of all types.



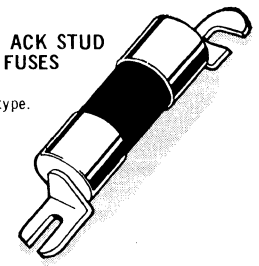
BUSS AIRCRAFT FUSES

Mechanical Indicating —Limiter type. Meet rigorous requirement of high speed, high performance aircraft. 1 to 60 amp.



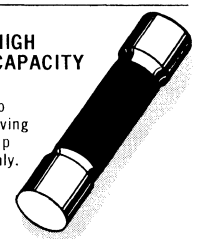
FUSETRON ACK STUD MOUNTED FUSES

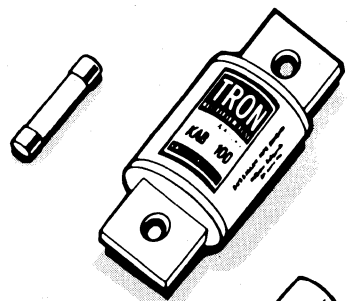
1 to 300 amp., dual-element type.



LIMITRON KTK HIGH INTERRUPTING CAPACITY FUSES

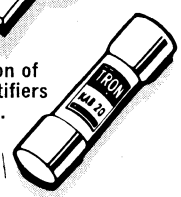
13/32 x 1½ inch, 1/10 to 30 amp. For circuits having fault current capacity up to 100,000 amps. AC only.

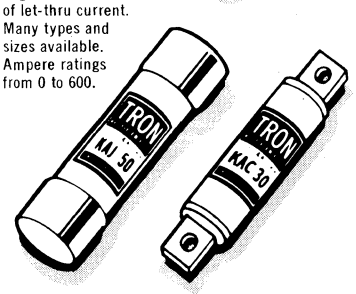




TRON RETCIFIER FUSES. For protection of Semi-Conductor Rectifiers and like applications.

Provide extremely fast opening on overload and fault currents, with a high degree of restriction of let-thru current. Many types and sizes available. Ampere ratings from 0 to 600.





for every protection need, insist on

SUPPLIED THE ECONOMICAL WAY ...THRU DISTRIBUTORS

BUSS QUALITY

Automatic Controls PRESSURE SWITCHES

DIAPHRAGM PRESSURE SWITCHES FOR ECONOMY AND FASTER DELIVERY

CUSTOM SET FOR PNEUMATIC AND HYDRAULIC APPLICATION

ENCLOSURES SOLVE ENVIRONMENT REQUIREMENTS

For absolute pressure requirement . . .
Cover is hermetically sealed and evacuated.

For gage pressure requirement in degrading environment . . .
Cover is hermetically sealed with standard atmosphere.

For differential pressure requirement . . .
Cover is vented to reference port.

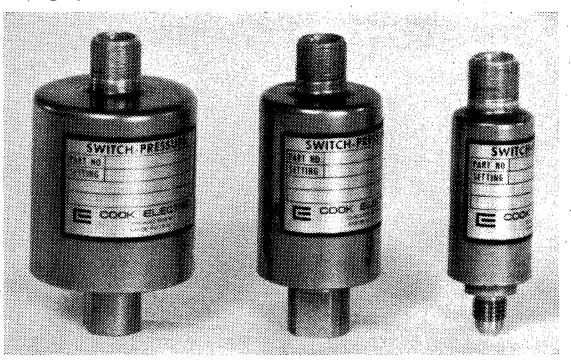
All covers are drawn non-corrosive stainless steel. On hermetically sealed units integrity is assured by glass-to-metal sealing of the connector.

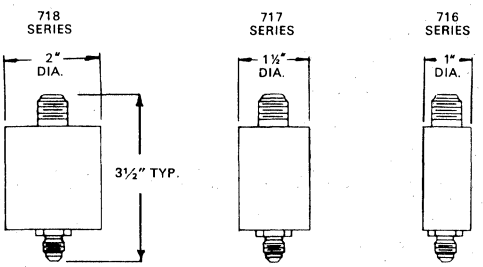
10SL-3P connectors are normally furnished. Other connectors can be provided on special order. A "commercial" protective cover is also available for even greater savings when the advantages of a sealed, stainless steel cover are not required.

Pressure Range of Setting	100 To 3000 PSIA	3 To 10 PSIA 20 To 500 PSIA	10 To 100 PSIA
Setting Tolerance	±3% at a specific temperature ±10% over ambient temperature range		
Dead Band Average	20% of setting		
Proof Pressure	4500 PSIA	2.5 x setting minimum	2.5 x setting minimum
Burst Pressure	7500 PSIA	5 x setting minimum	5 x setting minimum
Ambient Temperature	−65°F To 275°F		
Switch Contact Form	SPDT		
Current Rating	5 amp resistative at 28 VDC or 115 VAC		
Vibration	10G at 55 to 2000 CPS		
Shock	15G—11 MS MIL-E-5272C Procedure V		
Cycling Life	50,000 cycles minimum at .25 amp 25,000 cycles minimum at 5 amp.		
Weight	0.3 lb.	0.3 lb.	0.5 lb.

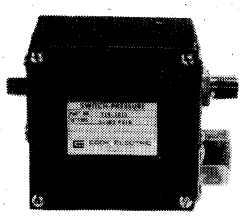
FEATURES

- Military reliability in accuracy and repeatability of setting.
- Zero leakage.
- Corrosion protection.
- Long system life.
- Versatility in your system design.
- New economy.
- Fast delivery.





PRESSURE SWITCHES



NEW OIL TIGHT SWITCH

The new Cook Electric oil tight pressure switch provides a combination of engineering advances that guarantee top performance for at least 20% longer than most other comparably-priced products in this field.

Three pressure ranges (0-500 psig), 15 AMP capacity, 50,000 operating cycles at rated load over ambient temperature ranges of —65°F to 180°F provide top performance.

Only three pressure ranges are required to cover a band of 0 to 500 psig. This means fewer switch variations to cover all of your pressure requirements — regardless of pressure media.

Direct panel mounting or direct on the pipe is another feature of this new pressure switch. Standard fittings are ¼" NPT, male or female.

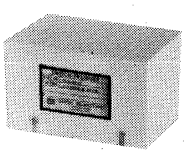
Both the pressure setting and deadband are adjustable using only a screwdriver.

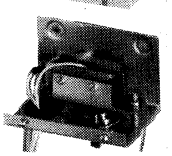
Part Number		Operate Pressure	Dead Band	Proof Pressure
Male Thread	Female Thread			
719-1031	719-1021	0-75	20-45	150
719-1032	719-1022	50-200	40-100	250
719-1033	719-1023	100-500	160-250	750

Life: 50,000 cycles minimum @ rated load. **Electrical Rating:** 15 amps @ 125, 250 or 480 vac.; ½ HP @ 125 vac, 1 HP @ 250 vac.; 0.8 amp @ 125 vdc, 0.4 amp @ 250 vdc. **Repeatability:** ±2% of maximum setting at fixed temperature. **Dielectric Strength:** 1500 VRMS 60 Hz terminal to case. **Ambient Temperature Range:** —65°F to +180°F. **Mounting:** Panel or direct to pipe. **Size:** Approximately 5" high x 3½" wide x 2½" deep. **Pressure Inlet:** ¼-18" NPT male or female.

OTHER FEATURES

- **Fusion-welded stainless steel pressure capsules prevent leakage, protect against corrosion, and guarantee a longer system life.**
- **Nickel chrome alloy diaphragms are used to assure complete accuracy and maximum repeatability at any pressure setting your particular system may require.**
- **Pressure switches can be pre-set to your specific requirement. The basic units are designed to fit a wide range of your pressure sensing needs. They may also be designed to conform to certain system fluctuations while maintaining peak performance levels.**
- **Fusion welding to the port mount produces a self-contained seal assembly. Maintenance is kept to a minimum.**
- **Gasketed die cast housing protects internal parts — oil tight.**





ADJUSTABLE PRESSURE SWITCH for INDUSTRIAL APPLICATIONS

A field proven pressure capsule has been adapted to a fully adjustable pressure switch.

Three pressure ranges are available to meet all requirements.

Adjusting the pressure setting can be done with a spin tight wrench, box wrench or similar tools. Settings in a range of 25:1 are possible with the lower range switch.

The sheet metal cover is held in place by two screws and is readily removed for either changing the pressure setting or connecting wires to the screw terminals on the snap switch. A rubber grommet is provided for open wiring or can be removed to accept ½" conduit fittings. Nothing interferes with the easy installation of the wiring to the pressure switch.

This compact switch may be panel mounted or mounted directly on the pipe. Standard fittings are ¼" NPT, male or female as desired.

Part Numbers		Nominal Setting	Setting Range - PSIG				Dead Band Max.	Proof Pressure
			Minimum		Maximum			
Female Thread ¼"-18 NPT	Male Thread ¼"-18 NPT	PSIG	Act	Deact	Act	Deact	PSIG	PSIG
719-0001	719-0011	10	3.5	0.5	25.0	22.0	6	100
719-0002	719-0012	60	21.0	1.0	125.0	105.0	30	200
719-0003	719-0013	250	120.0	70.0	500.0	450.0	50	1000

FEATURES

Wide Range of Adjustment: 25:1 in lower press. **Ease of Wiring. Ease of Mounting. Adjustment:** With spinner wrench with cover removed. **All Welded Construction:** (Pressure capsule). **Stainless Steel:** Pressure parts — accept all **gases and liquids. Repeatability. Compact.**

STANDARD SPECIFICATIONS

Life: 50,000 cycles minimum at rated load. **Electrical Rating:** 15 amps @ 125, 250 or 480V AC; ⅛ HP @ 125V AC, ¼ HP @ 250V AC; ½ amp @ 125V DC, ¼ amp 250V DC. **Dielectric:** 1500 v RMS 60 Hz. **Ambient:** —65°F to 180°F. **Repeatability:** ±5% at fixed temperature. **Mounting:** Direct to pipe or 2 - ¼" holes on 2¾" centers. **Size:** 4" wide, 2 1⁵⁄₃₂" high excluding pipe fitting, 2½" deep. **Pressure Part:** ¼" NPT male or female.

For further information, please write Cook Electric or contact your local representative.

Automatic Controls
Division
COOK ELECTRIC
200 East Daniels Rd. • Palatine, Ill. 60067 • 312/359-2100

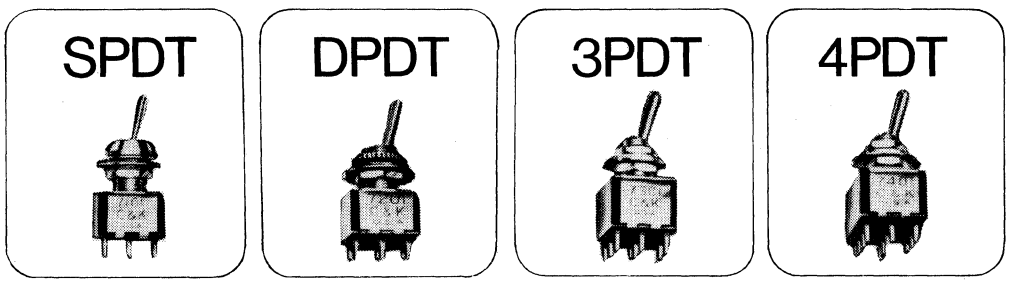
C&K SUBMINIATURE SWITCHES

Designed to meet the highest standards of quality and reliability. C & K's subminiature toggle and momentary pushbutton switches successfully combine maximum performance with minimum weight and small size. They are available in one, two, three, and four poles.

All of the switches feature rugged construction, simple mounting, excellent appearance, and long, trouble-free operation!

These subminiature toggle and pushbutton switches adapt to virtually any manual switching requirement in a very wide range of O.E.M. applications where space is at a premium!

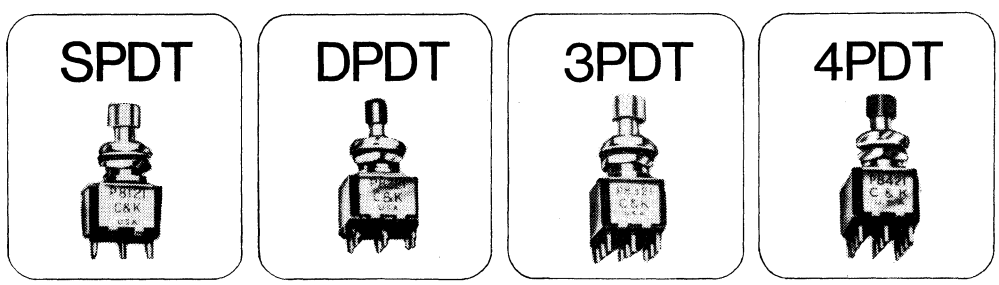
STANDARD CONFIGURATIONS — **TOGGLE SWITCHES**



General Specifications

Contact Rating: 5 Amperes resistive load @ 115 VAC — 28 VDC.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 1000 volts rms at sea level.
Electric Life: 100,000 make-and-break cycles minimum on all models ending in 01 only; all other models 40,000 cycles. 115 VAC — 28 VDC resistive load.
Initial Contact Resistance: 10 milliohms maximum at 2-4 VDC, 1 amp.
Contacts and Terminals: Working contacts Coin Silver
Operating Lever: Bright chrome plated brass toggle
Mounting Bushing: Nickel plated brass
Housing: Stainless steel
Case Material: General purpose phenolic.
Standard Hardware Supplied.
2 Hex mounting nuts
1 Internal tooth lockwasher
1 Keyed positioning ring

STANDARD CONFIGURATIONS — **PUSHBUTTON SWITCHES**



General Specifications

Contact Rating: 1 Ampere resistive load @ 115 VAC — 28 VDC. Designed for use in dry (very low energy) circuits.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 1000 volts rms at sea level.
Electric Life: 60,000 cycles minimum at full load.
Mechanical Life: 1,000,000 make or break cycles minimum.
Contacts: Gold
Terminals: Copper Alloy with gold plating. Epoxy sealed terminals standard.
Pushbutton: Nylon plunger and cap.
Mounting Bushing: Nickel plated brass, high torque to withstand 12 in-lb with no distortion or loosening of parts.
Housing: Stainless Steel
Case Material: General purpose phenolic.
Standard Hardware Supplied:
2 Hex mounting nuts
1 Internal tooth lockwasher

C&K COMPONENTS, INC.

quality electro-mechanical products

103 Morse Street/Watertown, Massachusetts 02172/Telephone: (617) 926-0800

ORDERING GUIDE—TOGGLE & PUSHBUTTON SWITCHES WITH OPTIONS

TOGGLE SWITCHES

TOGGLE LEVER POSITIONS AND CIRCUITS

BASIC OPTIONS FOR STANDARD CONFIGURATIONS (To Specify: Add Suffix Indicated to Model No.) (SEE PAGE 2)

SPECIAL CONFIGURATIONS

POLES & THROW	(1) MODEL NO.	KEYWAY			INDUSTRIAL NET PRICE SCHEDULE LESS THAN 25 (each)	INDUSTRIAL NET PRICE SCHEDULE 25 to 99 (each)	(2) TOGGLES SHORT	(2) TOGGLES LONG	(3) BUSHINGS SHORT	(3) BUSHINGS HIGH TORQUE	(4) TERMINALS PRINTED CIRCUIT	(4) TERMINALS WIRE WRAP	(5) CONTACTS & TERMS MAT'L & PLATING BRASS W/GOLD	(5) CONTACTS & TERMS MAT'L & PLATING SILVER W/GOLD	(6) TERM SEAL EPOXY	RIGHT ANGLE MOUNTING	FLATTED TOGGLE ASS'Y	15/32 BUSH. W/LARGE TOGGLE
SPDT	7101	ON	NONE	ON	$1.65	$1.10	M	L	D	H	C	W	B	G	E	A	P	T
	7103	ON	OFF	ON	1.95	1.30												
	7105	(ON)	OFF	(ON)	1.95	1.30												
	7107	ON	OFF	(ON)	1.95	1.30												
	7109	NONE	ON	(ON)	1.95	1.30												
DPDT	7201	ON	NONE	ON	2.15	1.43										NOTE: Bushing & Terminal Basic Options Do Not Apply. To Specify Add Suffix Indicated To Model No.	NOTE: Bushing & Toggle Basic Options Do Not Apply. To Specify: Add Suffix Indicated To Model No.	
	7203	ON	OFF	ON	2.55	1.70												
	7205	(ON)	OFF	(ON)	2.55	1.70												
	7207	ON	OFF	(ON)	2.55	1.70												
	7209	NONE	ON	(ON)	2.55	1.70												
	*7211	ON	ON	ON	2.85	1.90						W						
	*7213	ON	ON	(ON)	3.15	2.10												
	*7215	(ON)	ON	(ON)	3.45	2.30												
	Contacts Closed	2-3	2-3	1-2														
		5-6	4-5	4-5														
3PDT	7301	ON	NONE	ON	3.85	2.57						N/A				N/A		
	7303	ON	OFF	ON	4.80	3.20												
	7305	(ON)	OFF	(ON)	4.80	3.20												
	7307	ON	OFF	(ON)	4.80	3.20												
	7309	NONE	ON	(ON)	4.80	3.20												
4 PDT	7401	ON	NONE	ON	4.85	3.29												
	7403	ON	OFF	ON	6.05	4.10												
	7405	(ON)	OFF	(ON)	6.05	4.10												
	7407	ON	OFF	(ON)	6.05	4.10												
	7409	NONE	ON	(ON)	6.05	4.10												
	*7411	ON	ON	ON	6.90	4.30												
	*7413	ON	ON	(ON)	6.90	4.30												
	*7415	(ON)	ON	(ON)	6.90	4.30												
	Contacts Closed	2-3	2-3	1-2			M	L	D	H	C	N/A	B	G	E	N/A	P	T
		5-6	4-5	4-5														
		8-9	8-9	7-8														
		11-12	10-11	10-11	Add price indicated for options		N/C	N/C	N/C	N/C	10¢ Per Pole	10¢ Per Pole	N/C	25¢ Per Pole	10¢ Per Pole	35¢	50¢	75¢

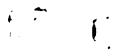
() Parenthesis Indicates Momentary Position *See Series 7200-7400 Outline Drawings (Page 2) for Terminal Designations N/A — Not Applicable N/C — No Charge

PUSHBUTTON SWITCHES

POLES & THROW	MODEL NO.	INDUSTRIAL NET PRICE SCHEDULE LESS THAN 25 (each)	INDUSTRIAL NET PRICE SCHEDULE 25 to 99 (each)	TERMS* PRINTED CIRCUIT
SPDT	P8121	2.55	1.70	C
DPDT	P8221	3.45	2.30	↕
3 PDT	P8321	4.80	3.20	↕
4 PDT	P8421	6.05	4.10	C

*Optional—use suffix to specify—add 10¢ per pole

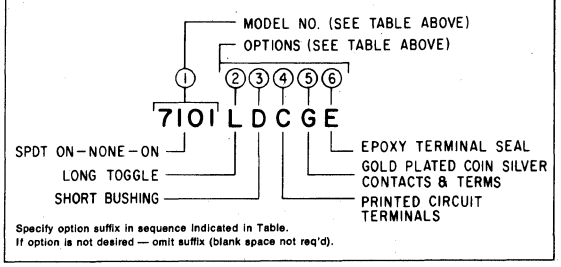
PRESS FIT CAPS FOR PUSHBUTTON SWITCHES



.200 Dia. or 3/8 Dia.
Colors: Black, White, Red, Orange, Yellow, Green, or Blue

Unless Otherwise Specified—.200 Dia. White Cap is Supplied.

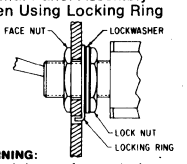
HOW TO ORDER: The following example illustrates how to specify complete part number



Specify option suffix in sequence indicated in Table.
If option is not desired — omit suffix (blank space not req'd).

TOGGLE AND PUSHBUTTON

Normal Panel Assembly When Using Locking Ring



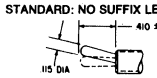
WARNING: Do not torque face nut when lock nut is not in place. (Except for high-torque bushing. See P5)

All prices F.O.B. Watertown, Mass. TERMS: net 30 days. Prices are subject to change without notice. Production quantity prices available on request.

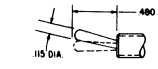
BASIC OPTIONS

TOGGLES

STANDARD: NO SUFFIX LETTER

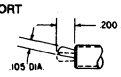


Std. Toggle W/Std. or Hi-Torque Bushing

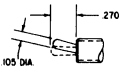


Std. Toggle with Short Bushing

M SHORT

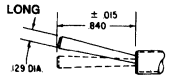


M Toggle W/Std. or Hi-Torque Bushing

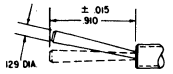


M Toggle with Short Bushing

L LONG



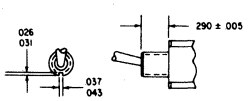
L Toggle W/Std. or Hi-Torque Bushing



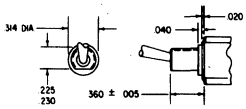
L Toggle with Short Bushing

BUSHINGS

D SHORT

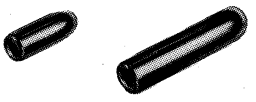


H HI-TORQUE



Bushing will withstand torque of 12 in-lb with no distortion or loosening of parts

COLOR CAPS



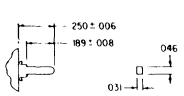
STANDARD LONG

Color-Caps (Vinyl Plastisol) available for standard and long toggles at no extra cost. Please specify: BROWN, BLACK, RED, ORANGE, YELLOW, GREEN, BLUE, VIOLET, GRAY, or WHITE.

C&K COMPONENTS, INC.
quality electro-mechanical products
103 Morse Street/Watertown, Massachusetts 02172/Telephone: (617) 926-0800

BASIC OPTIONS (Continued)

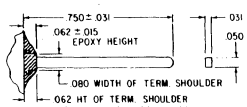
C PRINTED CIRCUIT



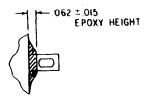
See P2 for Std. Configuration

TERMINALS

W WIREWRAP



E TERMINAL SEAL

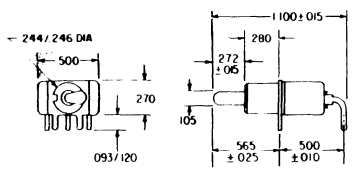


See P2 for Std. Configuration

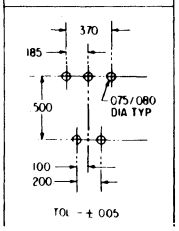
CONTACTS AND TERMINALS: MATERIALS, PLATING

B Contact (Terminal) Mat'l-½ Hd. Brass Comp. 22/QQ-B-626. Gold Plating 100 Millionths Over Copper Flash
G Std. Coin Silver Contact (Terminal) Mat'l. Gold Plating 100 Millionths Over Copper Flash

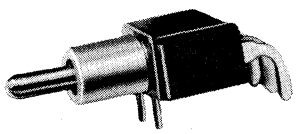
A RIGHT ANGLE MOUNTING
SPDT



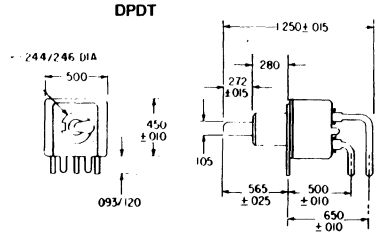
PRINTED CIRCUIT PANEL LAYOUT



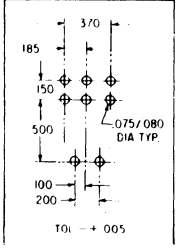
NOTES:
1. Contacts & Terms are Brass W/100 millionths Gold Pl.
2. Terminal Support is Brass W/Electrotin Plate.
3. Bright Chrome Plated Toggle is Standard.
4. Contacts make on Side Opposite Toggle Thrown.
5. Available In All SPDT Models. (See P4).



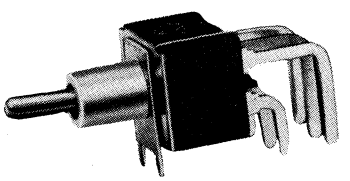
A RIGHT ANGLE MOUNTING
DPDT



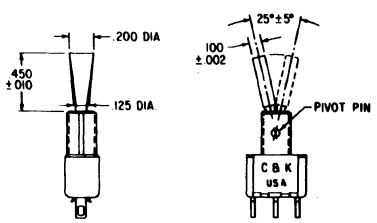
PRINTED CIRCUIT PANEL LAYOUT



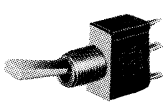
NOTES:
1. Notes 1 Thru 4 Above Apply.
2. Available In All DPDT Models. (See P4).



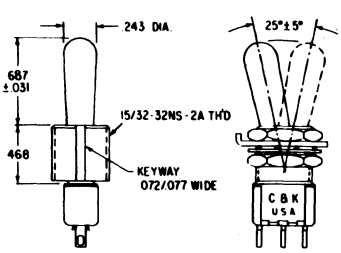
P FLATTED TOGGLE ASSEMBLY



NOTES:
1. See P2 For Other Dimensions.
2. Bright Chrome Plated Toggle Is Standard.
3. Mounting & Hardware — Same As Standard (See P5).
4. Available In All Models. (See P4).

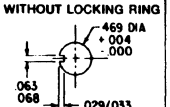


T 15/32 BUSHING W/LARGE TOGGLE

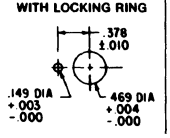


PANEL LAYOUTS

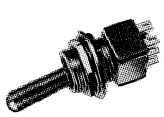
WITHOUT LOCKING RING



WITH LOCKING RING



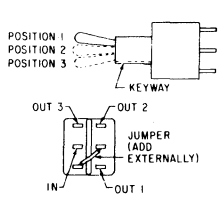
NOTES:
1. See P2 For Other Dimensions.
2. Bright Chrome Plated Toggle Is Standard.
3. Available In All Models (See P4).



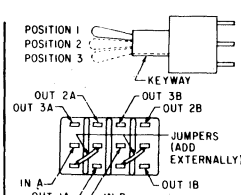
MISCELLANEOUS TOGGLE SWITCH INFORMATION

PANEL SEALS

Flexible Rubber Seal Boots are available from APM-Hexseal Corporation, 41 Honeck St., Englewood, New Jersey, and Multi-Flex Seals, Inc. 1811 First Avenue, New York, New York. These boots come in various styles and meet a number of MIL Specs for front panel switch seals.



WIRING FOR SINGLE POLE 3 POSITION SWITCH
(models 7211, 7213 & 7215)



WIRING FOR 2 POLE 3 POSITION SWITCH
(models 7411, 7413, & 7415)

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CTS CORPORATION ELKHART, INDIANA

Rotary Selector Switches

WHY ENGINEERS SPECIFY CTS ROTARY SWITCHES

CTS Reliability. The heart of selector switch reliability is the wafer. CTS offers two wafers with uniquely reliable characteristics. The CTS selector switch 212 wafer is of a molded, glass alkyd, rivet-free construction which will not break if dropped or jarred. It eliminates mechanical shifting of stator circuitry and terminals and allows the construction of more compact switches. Automated manufacture provides unprecedented uniformity. In each production run, all switches are identical, terminal placement is exact and permanent—the result is trouble-free assembly into your circuit. The CTS 216 wafer employs the more conventional "clip" terminals but utilizes unbreakable glass reinforced alkyd for both the rotor and stator. The precision molded stator incorporates strut spacers to evenly space the contacts and eliminate radial shifting as well as a rib design to increase insulation resistance. Tight quality control on both wafers and detents from the raw material stage through final assembly and packaging assures you of the fine quality and reliability associated with all CTS products.

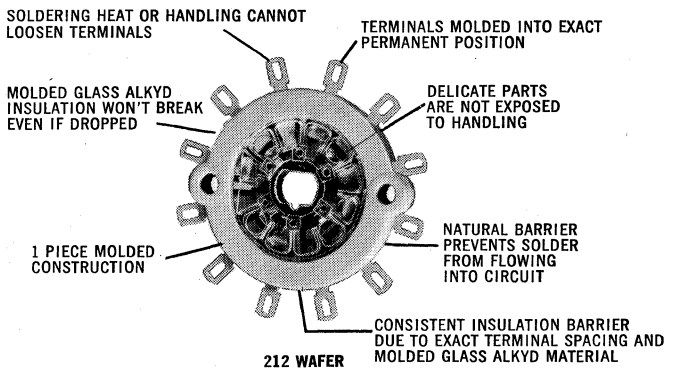
CTS Design Flexibility. CTS selector switches provide thousands of variations of shorting and non-shorting circuitry including mixed shorting and non-shorting circuit combinations within the same pole. Design flexibility's further enhanced by a wide selection of index assemblies, two wafer constructions which can be intermixed on the same switch and attached CTS manufactured power switches and variable resistors. CTS truly offers a one-source supply for the complete switch package.

CTS Military Switches. CTS types 211, 212 and 215 are available to meet the requirements of MIL-S-3786B, type SRO-3/C.

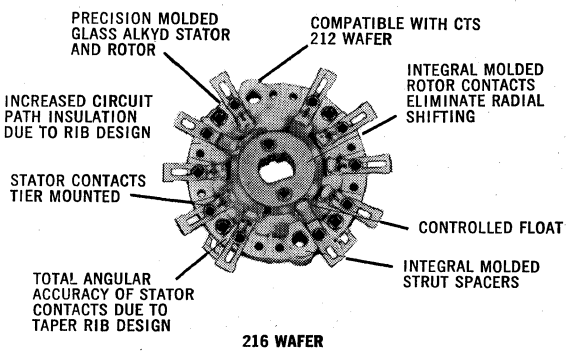
CTS Switches are Made to Your Exact Specifications. All orders received for CTS selector switches are handled individually and are custom manufactured to your exact specifications. The majority of applications can be met with switches which are custom designed from parts shown in this catalog, giving you the advantages of lower cost and faster delivery.

On special applications our engineering staff is at your disposal for designing the best and most economical switch to meet your exact requirements.

WAFERS



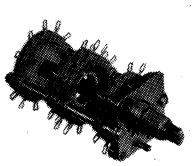
212 WAFER



216 WAFER

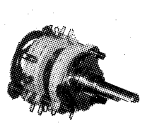
DETENTS

STAR WHEEL DETENT
Type 211



HIGHEST QUALITY • POSITIVE FEEL • 250,000 CYCLE LIFE • FREE FROM END AND SIDE THRUST • HIGH SWITCHING TORQUE 15—60" OZ.

DIE CAST DETENT
Type 212 ND



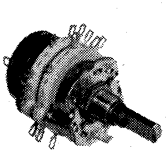
LOWEST COST OF ALL DETENTS • LOW COST STAKED CONSTRUCTION • AVAILABLE FOR 1 AND 2 WAFER SWITCHES • 20,000 CYCLE LIFE • SWITCHING TORQUE 18 — 40" OZ.

Adjustable stops on all detent except Type 212ND.

Description	Series	Data Sheet	Order From
1⅛" diameter rotary wafer switch with star wheel detent	211	4001	Calif.
1⅛" diameter rotary wafer switch with hill and valley detent	212	4001	Elkhart*
1⅛" diameter rotary wafer switch with double ball detent	215	4001	Elkhart*
1¼" diameter rotary wafer switch with hill and valley detent	216	4001	Elkhart*
1¼" diameter rotary wafer switch with star wheel index	217	4001	Calif.
1¼" diameter rotary wafer switch with double ball detent	218	4001	Elkhart*
1⅛" diameter rotary wafer switch with die cast detent	222	4001	Elkhart
1¼" diameter rotary wafer switch with die cast detent	226	4001	Elkhart

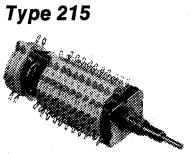
* West of the Mississippi River order from California.

HILL AND VALLEY DETENT
Type 212



LOW COST • DESIGNED FOR HOME ENTERTAINMENT AND LOW COST INSTRUMENT APPLICATIONS • 25,000 CYCLE LIFE • SWITCHING TORQUE 20—48" OZ.

DOUBLE BALL DETENT
Type 215



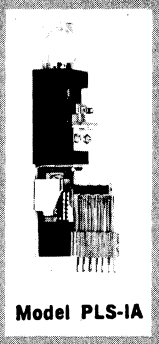
DESIGNED PRIMARILY FOR INSTRUMENT MARKET • HIGH QUALITY • CRISP FEEL • 25,000 CYCLE LIFE • SWITCHING TORQUE 6 —35" OZ.

ORDERING INFORMATION: Place orders at locations shown above, using the following addresses:

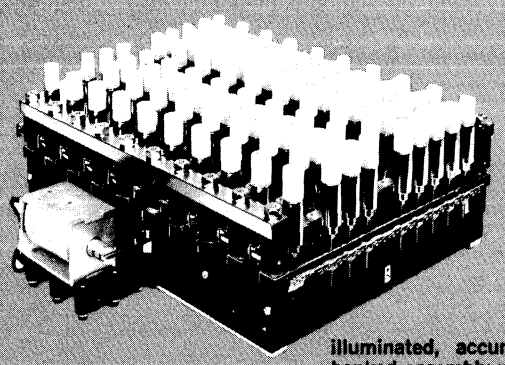
CTS of Elkhart, Div., 1142 W. Beardsley Ave., Elkhart, Indiana 46514 • Telephone 219-JA 3-0210 • TWX 810-294-2256

CTS Electronics, Inc., 1010 Sycamore Ave., South Pasadena, Calif. 91030 • Telephone 213-254-9141 • TWX 910-321-4060

one button... or many

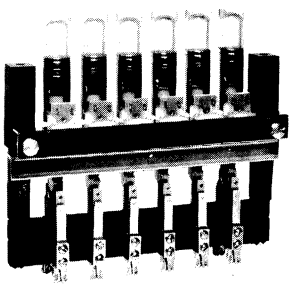


Model PLS-IA

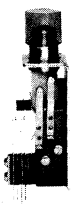


illuminated, accumulative banked assembly with solenoid release.

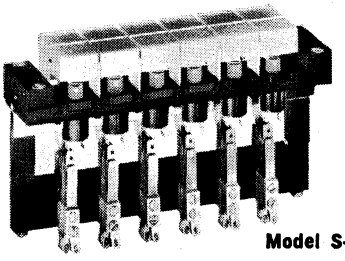
CAPITOL offers standard and special combinations of illuminated and non-illuminated pushbutton and lever switches TO SUIT YOUR NEEDS



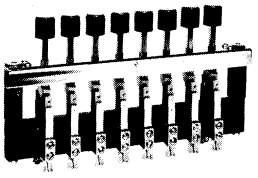
Model S-IA



Model PLH

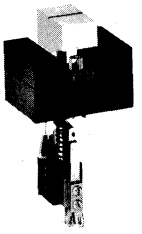


Model S-IC

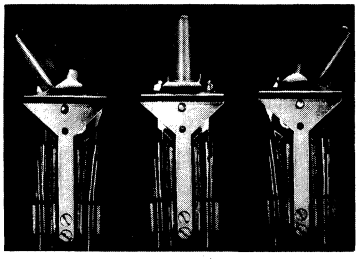


Model S



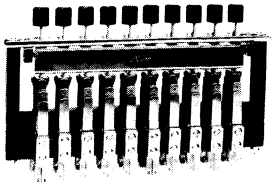


Model PLS-IC

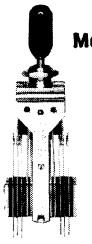


Model HLB

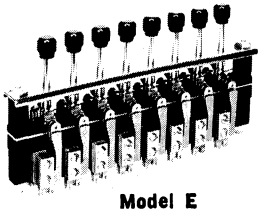
Model HLL illuminated multi-color coded lever switch



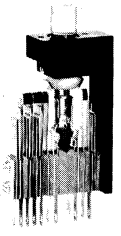
Model D



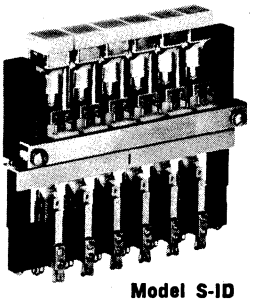
Model HLB-S



Model E



Model HPC



Model S-ID features New illuminated square button

CAPITOL SWITCHES are rated at 3 amps, 110 v. AC, non inductive.

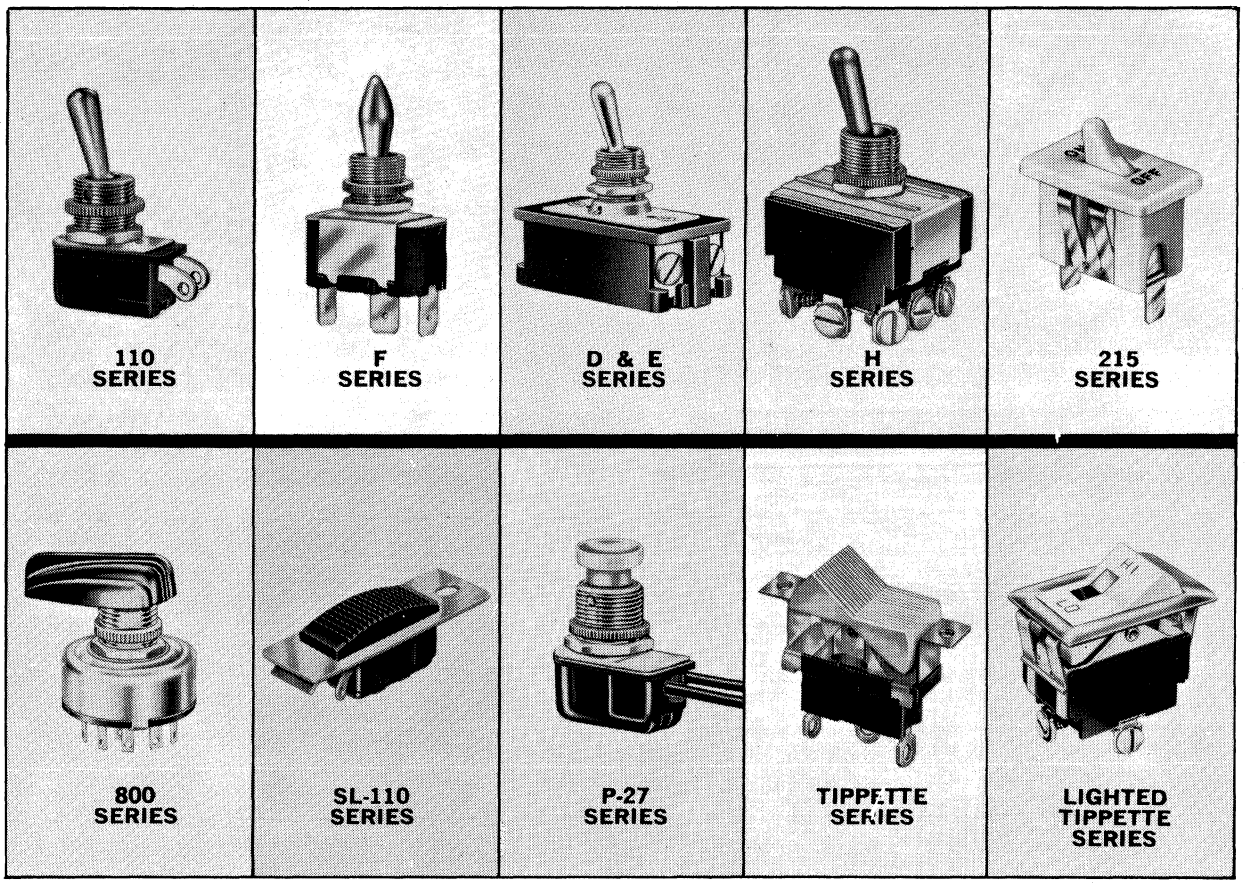
Capitol manufactures many standard and special switches in addition to those shown.

CAPITOL

THE CAPITOL MACHINE AND SWITCH CO.
87 Newtown Road, Danbury, Conn. 06810
Representatives in principal cities Tel: 203-744-3300 TWX:710-456-0365

CARLINGSWITCH

THE BIGGEST SINGLE NAME IN SWITCHES



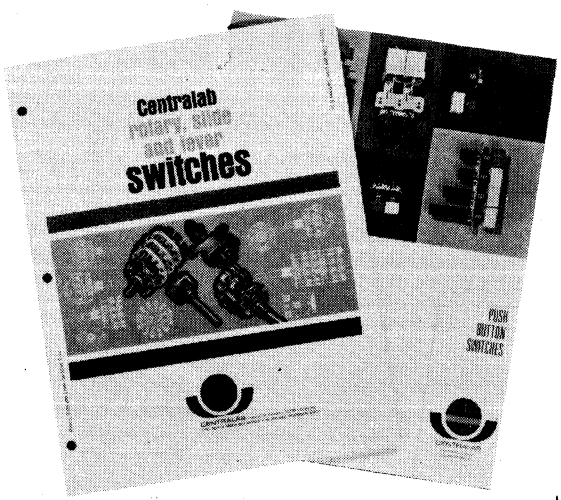
PUSH • SLIDE • TOGGLE • ROTARY • TRIGGER • TIPPETTE and LIGHTED TIPPETTE SWITCHES

for Appliance, Aircraft, Automotive, Electronic, Marine, Military, Motor Control, Special Applications

In addition to the items shown above are thousands of variations and adaptations designed for our customers' specific needs. We are constantly engaged in the development of new products and welcome the opportunity to serve your needs. Please contact one of our distributors to discuss your requirements in detail or write for our latest catalog.

Carling
ELECTRIC, INC.

505 New Park Avenue, West Hartford, Conn. 06110. Telephone: (203) 233-5551 TWX 710-425-0034



Switches, switches, and more Switches from Centralab!

Centralab has the industry's broadest line of rotary and special switches. A summary of the basic types is given below.

For complete design data, request your copy from Centralab's advertising department.

ROTARY SWITCHES	Diameter	Maximum No. of Positions	Minimum Index Life (cycles)	Insulation	Current Rating (make & break)	MIL-S-3786 SR Number
Miniature Series 020-090	1-1/2"	6 x 60° 12 x 30°	25,000	Phenolic Ceramic Glass Silicone	2.6 A. @ 28 VDC; 450 ma @ 115 VAC	SR 02
Subminiature Series 160	1"	4 x 90° 6 x 60° 8 x 45° 12 x 30°	25,000	Phenolic Glass Silicone Ceramic	335 ma @ 115 VAC; 1.1 A. @ 28 VDC	SR 05
Subminiature Series 140	1-1/2"	18 x 20°	25,000	Phenolic Silicone Glass	335 ma @ 115 VAC; 1.1 A. @ 28 VDC	—
Miniature Series 600	1-9/32"	6 x 60° 12 x 30°	25,000	Ceramic Mycalex Phenolic Glass Silicone	450 ma @ 115 VAC; 2.6 A. @ 28 VDC	SR 03
Series 240-290 and Series 010 Spring return	1-7/8"	2 x 180° 4 x 90° 6 x 60° 8 x 45° 12 x 30°	175,000 20,000 or 10,000	Ceramic Phenolic KEL-F	3.9 A. @ 28 VDC; 675 ma @ 115 VAC	SR 01
Series 300	1-7/8"		25,000	Ceramic Phenolic KEL-F	675 ma @ 115 VAC; 3.9 A. @ 28 VDC	SR 01
Series 650	2-5/16"	18 x 20°	25,000	Phenolic Glass Silicone	675 ma @ 115 VAC; 3.9 A. @ 28 VDC	SR 10
Series 670	2-5/16"	24 x 15°	25,000	Phenolic Glass Silicone	450 ma @ 115 VAC; 2.6 A. @ 28 VDC	SR 09
Series 230	2-13/16"	9 x 40° 18 x 20° 24 x 15°	25,000	Ceramic Durez	11 A. @ 28 VDC; 9 A. @ 115 VAC	—
ECONOMY SWITCHES Series 200	1-1/32"	2, 3, 4 x 30° 9 clips max.	10,000	Phenolic	450 ma @ 115 VAC; 2.6 A. @ 28 VDC	—
LEVER ACTION SWITCHES Series 222	1-1/2"	2, 3 x 30° 12 clips max.	25,000 Pos. or Spring return	Phenolic	450 ma @ 155 VAC; 2.6 A. @ 28 VDC	—

PUSH BUTTON SWITCHES*
BRAND NEW!

Ask for Centralab's all new 22 page catalog on this completely new product line.

SLIDE SWITCHES	Approximate Length (2 positions)	No. of Positions	Maximum No. of Clips	Index	Insulation	Current Rating (make & break)
Series 001, 002	1.4 to 5.7"	2, 3 or 4	3-20/side	Positive or none	Phenolic	675 ma @ 115 VAC; 3.9 A. @ 28 VDC
Series 003	1.3"	2	6/side	Spring return or none	Phenolic	450 ma @ 115 VAC; 2.6 A. @ 28 VDC
Series 005	1.4 to 5.8"	2	22	Spring return or none	Phenolic	450 ma @ 115 VAC; 2.6 A. @ 28 VDC
Series 125	3.6"	2	7/side	Spring return or none	Phenolic	335 ma @ 115 VAC; 1.1 A. @ 28 VDC

PRINTED CIRCUIT SWITCH
Series 020-090
Series 001, 002, 003, 005

Eliminate expensive wiring and possibility of wiring error; these switches are designed for printed circuit board insertion. Electrical and mechanical characteristics similar to 1-1/2" switches (Series 020, etc. above).
Slide switches above available for printed circuits.

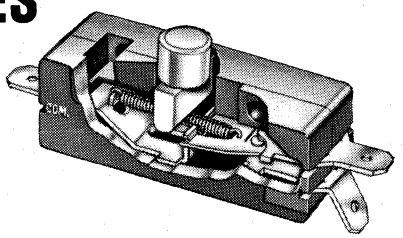
FOR IMMEDIATE DELIVERY
— many types are available from stock from Centralab Industrial Distributors.

CENTRALAB Electronics Division • GLOBE-UNION INC.
5757 NORTH GREEN BAY AVENUE • MILWAUKEE, WISCONSIN 53201

CHERRY®

LONG-LIFE PRECISION SWITCHES

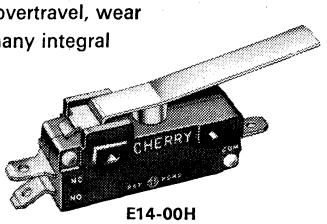
At the heart of every Cherry precision switch is the unique stainless steel coil spring that insures outstanding operating reliability and consistent performance. Precision-made, carefully assembled and tested, this rugged coil steel spring provides greater overtravel, greater repeatability of operating points in every Cherry Switch you specify.



GENERAL PURPOSE E-14 SERIES

A rugged switch with large overtravel, wear resistant nylon button and many integral hinged actuator variations.

Electrical Ratings—25 amps., 125-250 VAC—1 H.P., 125 VAC—2 H.P., 250 VAC

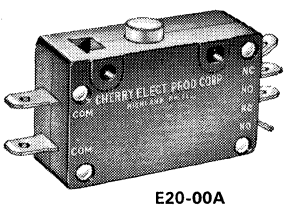


E14-00H

E-20 SERIES DOUBLE POLE SWITCH

Heavy-duty, yet extremely compact unit for double pole service, features wide range of actuator variations and large overtravel.

Electrical Ratings—20 amps., 125-250 VAC—1 H.P. 125 VAC—2 H.P., 250 VAC



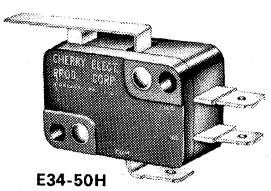
E20-00A

MINIATURE E-34 SERIES

Compact precision unit with high electrical capacity for heavy-duty miniature switch use. Available with QC, solder or screw terminals.

Electrical Ratings—15 amps., 1/2 H.P., 125-250 VAC

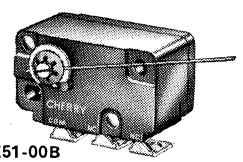
Miniature series available in a variety of electrical ratings with operating forces as low as 1-1/4 grams.



E34-50H

COIN SWITCHES

Low torque rotary action long life switch. Operating torque 4 inch-grams maximum.



E51-00B

Electrical Ratings—5 amps., 125-250 VAC

E51-00B Clockwise
.205 x .032 QC Terminals

Other coin switches available in variety of terminations and with counterclockwise actuation.

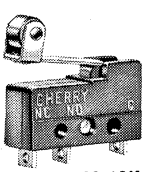
SUBMINIATURE E-62 SERIES

A high capacity subminiature switch with large overtravel and integral hinged actuators.

Electrical Ratings—10.1 amps., 125-250 VAC 1/4 H.P., 125 VAC

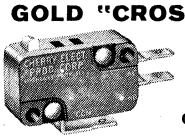
Switch Body—25/32" x 23/64" x 1/4"

Subminiature series available in light force version E-61 with electrical rating of 5 amps., 125-250 VAC.

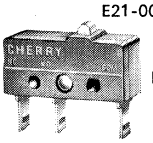


E62-10K

GOLD "CROSSPOINT" CONTACT SWITCHES



E21-00A



E63-00A

For positive switching of low energy solid state circuits. New Gold "Crosspoint" contacts provide high force per unit of contact area and virtually eliminate contact closure interference. Available in four basic cherry switches: E21 enclosed miniature; E63 subminiature; E53 low torque and S31 open type miniature.

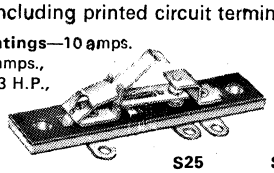
Electrical Ratings—0.1 amps., 125 VAC

Insertion Resistance—50 Milliohms Maximum

OPEN TYPE SWITCHES

Heavy-duty type for cam follower actuation. Can be ganged for multi-circuit control. Many actuator and terminal variations including printed circuit terminals on S30 type.

Electrical Ratings—10 amps. 125 VAC—5 amps., 250 VAC—1/3 H.P., 125-250 VAC

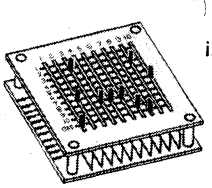


S25



S30

SELECTOR SWITCHES



C10-20A

So compact, one hundred sequencing positions are accommodated in 10 sq. inches of panel area. Cross-grid printed circuitboard eliminates soldering—no jungle of wires to cause problems either. Choose from eleven standard models with from 100 to 2780 switching positions.

CHERRY®

HENRY DAYMOND SALES LTD.
1064 S. Service Rd., Oakville, Ontario, Canada
Phone (416) 844-6721

CHERRY ELECTRICAL PRODUCTS CORP. 1650 Old Deerfield Road—Highland Park, Illinois 60035

ELIMINATE DOWN-TIME ON ROTARY & THUMBWHEEL SWITCHES

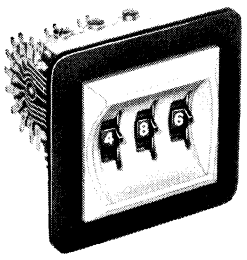
and also get accurate, precise control

UNLIMITED APPLICATIONS CDI switches offer fast sure settings and quick read-out for computer, automated and control equipment, and for test and programming applications, etc.

QUICK SERVICEABILITY Unique 5-second wafer replacement obsoletes other switches. Simply lift out old wafer, slip in new wafer. No unsoldering . . . no disassembling . . . no wire removing.

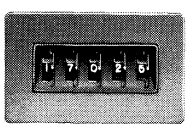
EXTREME VERSATILITY Regardless of size or shape needed CDI is well prepared to meet your every switch requirement.

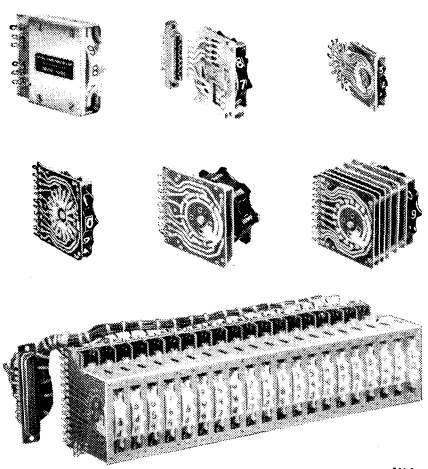
THUMBWHEEL SWITCHES



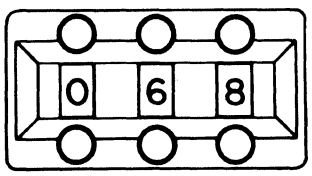
C•D•I

Digital and Binary. Meet MIL-S-22710. For critical reliability applications. Available with internal lighting MIL-L-25467A. Switch modules with panel and switching elements separately sealed for complete protection are available. Bezel types have no visible screws when rear mounted.





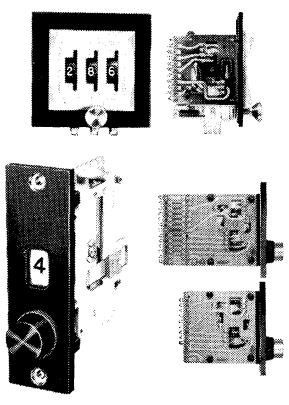
PUSHBUTTON SWITCHES



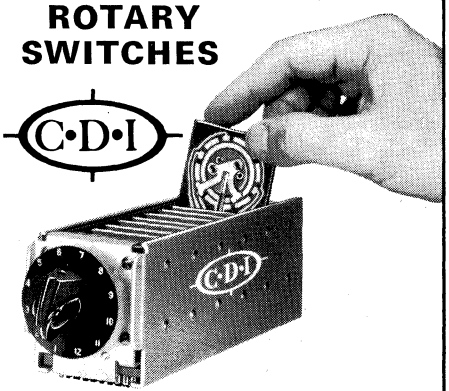
NEW MINI 10-POSITION ADD/SUBTRACT

Retrofits most miniature thumbwheel switch panel openings. 8 & 12 positions available. Simply push one button to add, the other to subtract. Each decade mounts on ½" centers. Over 1,000,000-operation service life.

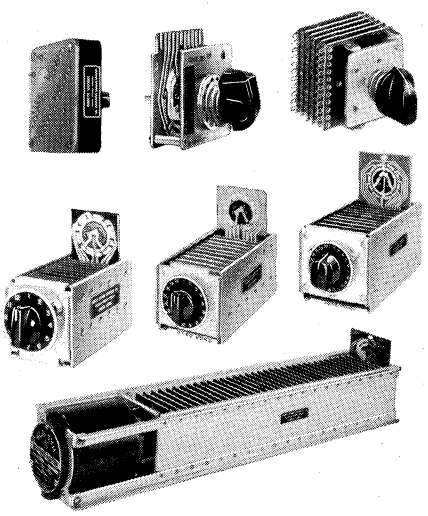
C•D•I



ROTARY SWITCHES



For critical reliability applications. Meet MIL-S-22710. Removable wafers permit quick changing of programs, configurations, circuits. CDI patented switches with dust covers available in sizes 2" x 2", 3" x 3" and 4" x 4" with lengths to accommodate up to 36 wafers. Operation may be manual, motor or solenoid.



Mfd. under Tabet U. S. Patents 2,841,660, 2,971,066, 3,015,000, 2,956,131, 2,988,607

C•D•I **CHICAGO DYNAMIC INDUSTRIES, INC.**

PRECISION PRODUCTS DIVISION 1725 Diversey Blvd., Chicago, Illinois 60614. Phone 312, 935-4600

CHICAGO SWITCH, INC.
2035 WABANSIA AVENUE
CHICAGO, ILL. 60647 • (312) 489-5500

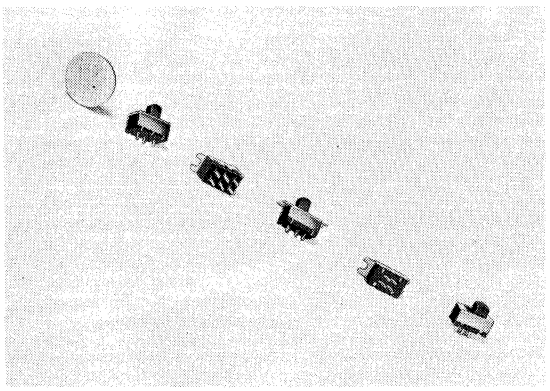
SWITCHES THAT MASTER JOB REQUIREMENTS CONCEPT THROUGH COMPLETION — YOUR DESIGN OR OURS

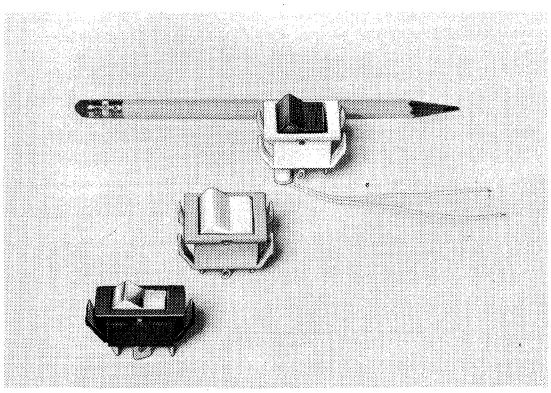
Chicago Switch, Inc., has special competence in microminiaturization, and the particular capability to expand production output severalfold rapidly (for that excellence in performance it was nominated for "Subcontractor of the Year").

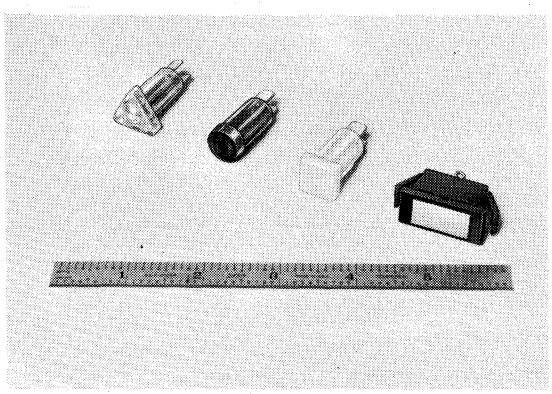
Principal product lines are microminiature control switches for ultra high quality portable electronic devices, modular leaf switches of various types, and slide, pushbutton and snap switches.

Company reputation as an outstanding supplier to Electronic Industry manufacturers is based on completely reliable delivery commitments, top quality control, ability to produce to even the most demanding requirements.

A highly creative engineering group, capable of exceptional technical flexibility, has produced many patented switch designs. Chicago Switch, Inc. is only a request away from putting the advantages of its alert staff to work for you. Make an advantageous management move — write or phone Chicago Switch today.







SUBMINIATURE SLIDE SWITCHES SOME WITH MILLION-CYCLE CAPABILITY

A growing family of mini-slides backed by more than five years of engineering and development; new hybrids continuously being born. Includes world's smallest slide switches with true snap (toggle-type) action in some of the SPDT and DPDT versions . . . in switch bodies measuring only ¼″ high x ½″ long x .300 wide.

Write and ask for data sheets No. 23-021.

SHARP ROCKER SWITCHES LIGHTED AND UNLIGHTED

The cleanest panel appearance, positive snap action, AND easy snap-in installation. Prices that "just can't be beat." Fine silver contacts standard.

Unlighted versions available in all circuits from SPDT to DPDT, maintained or momentary action, and 3-position/center-off, maintained or momentary on one or both sides.

Choice of any color in large quantity orders. Standard colors are: white, black, grey, red, and ivory. Button and bezel colors can be matched or mixed.

Lighted versions available in all circuits from SPST to SPST + SPDT, with buttons translucent red, amber, green or clear.

Lamps which can be assembled into these switches include 110V-250V neon with a choice of resistors, and 1V to 48V incandescent.

Ask for data sheets on the 26- and 27-Series rocker switches.

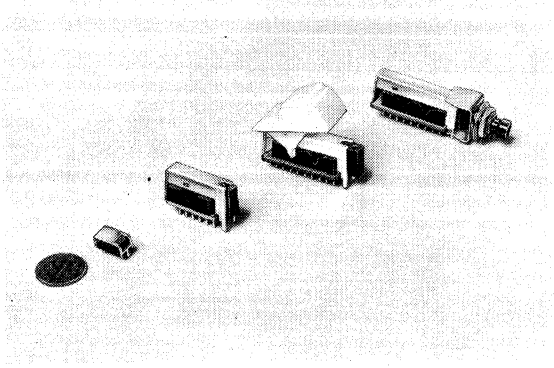
PANEL LIGHTS

- Permit coding of panel indicators by shape, as well as color.
- Available in red, amber, white, clear, and green lenses.
- Bezel of rectangular version and lens of any version can be hot-stamped with your legends, with bezel and hot-stamping colors to your specs. Standard bezel colors are white, black, red, gray, and ivory.
- All versions designed for fast snap-in installation, and available in 110V and 250V neon, 1V and 48V incandescent.

Refer to Series No. 15

CHICAGO SWITCH, INC.

2035 WABANSIA AVENUE
CHICAGO, ILL. 60647 • (312) 489-5500



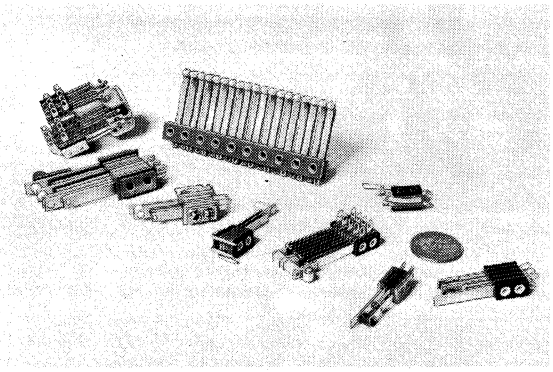
MULTI-POLE MINIATURE SLIDE SWITCHES AS MANY AS 5,000,000 ACTUATIONS

Top quality and service life for signal circuit P.C. applications — can even handle some power loads.

Shown are DPDT, Series No. 23-020; 4 PDT, Series No. 23-004; 6 PDT, Series No. 23-006. Thoroughly field proven in tape recorders, communication equipment, sensitive instrumentation.

"4C" and "6C" (4PDT and 6PDT)switches are available in push-on-push-off versions, as well as momentary versions. Options include half-rocker button (shown on a 6C), choice of any make-before-break or break-before-make combination of poles.

Panel-mount version also available (pictured on other 6C) for use with AMP terminal No. 42428-2 or equivalent.

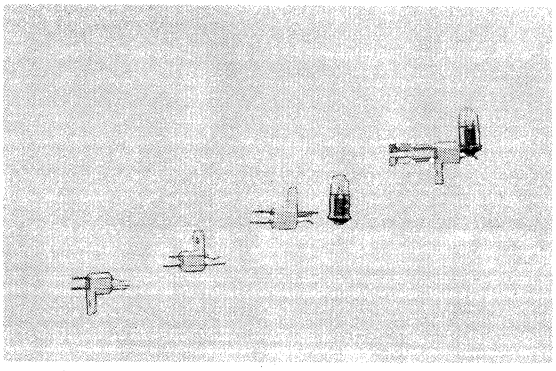


LEAF SWITCHES

- Designed to customer specs if desired, or quoted on existing customer design.
- Reliable delivery dates (customer references supplied on request).
- Versatile in-house tooling — will produce 90% of all existing leaf switches with no tooling charge.
- Special capabilities in extraordinary tooling needs.

Ask for the leaf switch capability brochure. Patented leaf switch with snap action, shown here, can be supplied in SPDT, DPDT, or 3PDT with an actuator blade, lifter blade or pushbutton bracket.

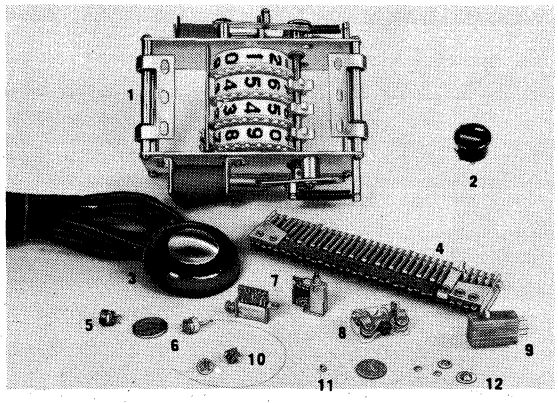
Ask for the 20,000 Series data sheet.



KLIPSOCKET™ FOR MIDGET-FLANGED BASED LAMPS

Finally there's a commercial connector for the T-1¾ M.F. based incandescent lamp. New Klipsocket™ (patent applied for) engages and disengages easily from the lamp base.

Two .093″ wide terminals accept AMP quick-connector No. 61005-1 or equivalent. Terminal material and the terminal holes are designed for easy soldering, if you wish.



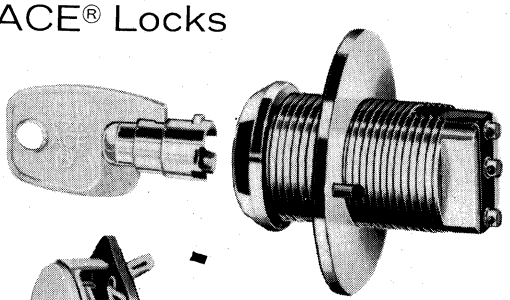
MISCELLANEOUS PRODUCTS OUT OF OUR "CUSTOM-ENGINEERING" GROUP

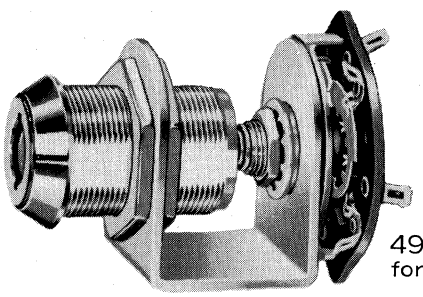
1. Add-and-Subtract Counters
2. SPST & SPDT Power Rotary Switches (Inset)
3. Foot Switches
4. Sustain Switches for Electric Organs
5. Pressure Switches
6. Pin Pull-out Switches
7. Printed Circuit-Integrated Switches
8. Carbon Brush Holders
9. Internal-leaf Stack Switches
10. Microminiature Metal Stampings and Microminiature Metal Welding
11. Disturb Switches
12. F.H.P. — Motor Brush Caps

CHICAGO LOCK... Your Complete Source For Switch Locks

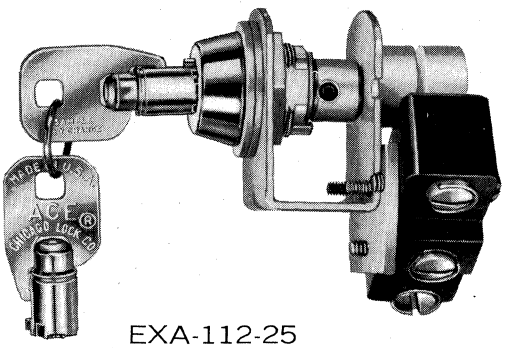
4900 SERIES Underwriters Listed ACE® Locks

No. 4901
SPDT Switch Lock



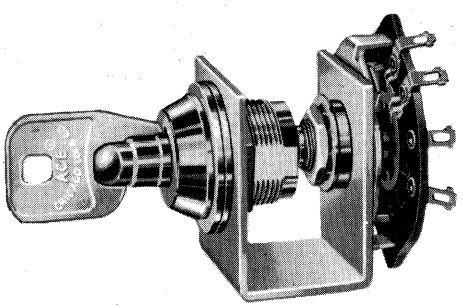


4903 Wafer switch lock for complex circuits



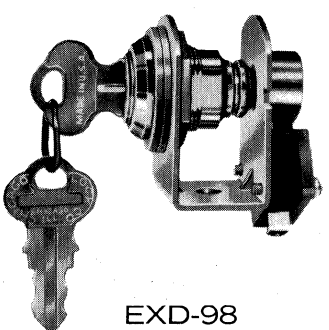
EXA-112-25
Heavy duty switch lock
Switch SPDT; 25 amps; 125, 250 or 480 VAC; UL and CSA listed.

Chicago ACE® Locks provide maximum security with registered key series if desired.

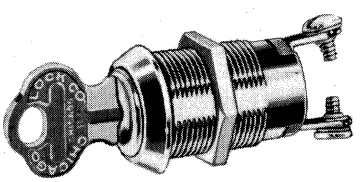


*4188 ACE® lock and wafer switch, can be furnished with double bitted lock Spec. 2242

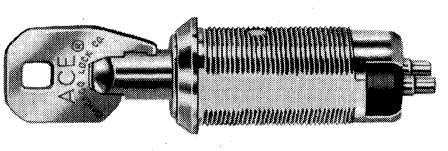
*Wafer switches will permit various circuit combinations



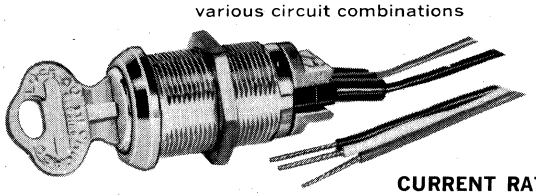
EXD-98
Heavy duty switch lock



2174 (SPST)
Double bitted lock with screw terminals
For momentary contact, spring return, specify 2174-70



4073 Basic ACE® (SPST) switch lock



3535 Double bitted lock with UL listed SPDT switch
Also furnish with ACE LOCK–Part No. 4235

SWITCH CONTACT RATINGS

CURRENT RATINGS		LOCK NUMBER
125-250V AC— 5 AMP	30V DC— 3 AMP	4901—4902
125-250V AC— 7 AMP	28V DC— 7 AMP	3535—3535A—4235
110-120V AC—10 AMP	10V DC—10 AMP	2174—2174-70—3039—4101—4073—4079
125-250V AC—10 AMP	125V DC—½ AMP	EXD-98—EXA-112

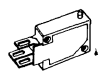
Engineering counsel is available upon request.

CHICAGO LOCK CO.
4275 W. Belmont Ave. • Chicago, Ill. 60641

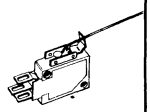
For further data on the above locks, write for catalog.

CEMCO *snap-action switches*

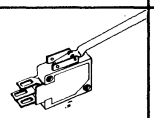
MAC-100
SUBMINIATURE
• Width, length, height-11/64" x 55/64" x 9/16" • Electrical capacity-5 amps 250 vac res. • Operating pressure max-30 grams at button • Overtravel-.015 min.



MAC-100-1
SUBMINIATURE
• Width, length, height-11/64" x 55/64" x 39/64" • Electrical capacity-5 amp 250 vac. res. • Operating pressure-4 gram inch • Any length or shape wire actuator



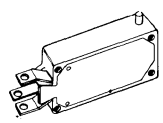
MAC-100-4
SUBMINIATURE
• Width, length, height-11/64" x 55/64" x 39/64" • Electrical capacity-5 amps 250 vac. res. • Operating pressure-4 gram inch • Any length or shape blade actuator



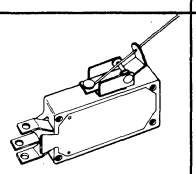
MAC-500
SUBMINIATURE
• Width, length, height-11/64" x 55/64" x 9/16" • Electrical capacity-5 amps 250 vac. res. • Operating pressure-3 oz. max. • Overtravel-.007 min. Movement diff.-.003 max.



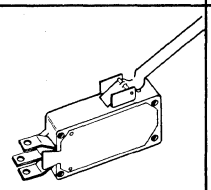
JMP-100
MINIATURE
• Width, length, height-17/64" x 15/8" x 61/64" • Electrical capacity-5 amp 125 vac. res. 3 amp 250 vac. res. • Operating pressure-27 grams max. • Extremely long life



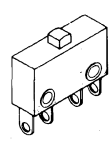
JMP-100-1
MINIATURE
• Width, length, height-17/64" x 15/8" x 13/64" • Electrical capacity-5 amp 125 vac. res. 3 amp 250 vac. res. • Operating pressure on wire actuator-5 gram inch • Any length or shape wire actuator



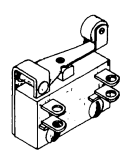
JMP-100-4
MINIATURE
• Width, length, height-17/64" x 15/8" x 13/64" • Electrical capacity-5 amp 125 vac. res. 3 amp 250 vac. res. • Operating pressure on blade 5 gram inch • Any length or shape blade actuator



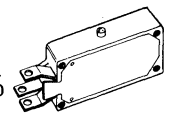
GM-100
SINGLE POLE, DOUBLE-BREAK
• Width, length, height-1/4" x 25/32" x 7/16" • Electrical capacity-10 amps 250 vac. • Operating force-8 oz. max. • Also available with end or out the cover terminals.



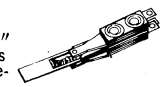
GM-320
SINGLE POLE, DOUBLE-BREAK, SIDE-MOUNTED ROLLER ACTUATOR
• Width, length, height including roller at rest-19/64" x 13/16" x 7/16" • Electrical capacity-10 amps 250 vac. • Also available with end or bottom terminals • Operating force-2 oz. at roller.



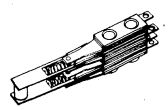
JMP-500
MINIATURE
• Width, length, height-17/64" x 15/8" x 59/64" • Electrical capacity-12 amps 125 vac. res. 6 amps 250 vac. res. • Operating force range-3 to 12 oz. • Move.diff.-.008 max.



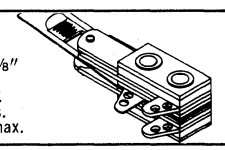
OBS-100
MINIATURE OPEN BLADE
• Width, length, height-3/16" x 15/8" x 5/16" • Electrical capacity-5 amps 250 vac. res. • Operating pressure-30 grams max.



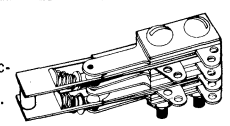
OBS-500
MINIATURE OPEN BLADE
• Width, length, height-3/16" x 15/8" x 43/64" • Operating force-70 grams max. • Electrical rating each pole-5 amps 250 vac. res.



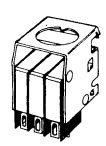
OBG-120
OPEN BLADE
• Width, length, height-3/8" x 21/16" x 1/2" • Electrical capacity-15 amp 125 vac. res. 7.5 amp 250 vac. res. • Operating force-4 oz. max.



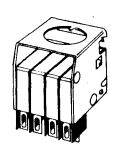
OBG-500
OPEN BLADE
• Width, length, height-3/8" x 21/16" x 13/16" • Electrical capacity each pole-15 amp 125 vac. res. 7.5 amp 250 vac. res. • Operating force-8 oz. max.



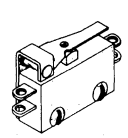
MOD-130
TRIPLE POLE, DOUBLE THROW
• Width, length, height-21/32" x 3/4" x 13/16" • Electrical capacity each pole-5 amps 250 vac. res. • Momentary action
• Meets mil specs.



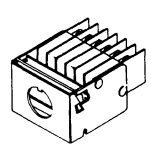
MOD-140
4 POLE, DOUBLE THROW
• Width, length, height-3/4" x 3/4" x 13/16" • Electrical capacity each pole-5 amps 250 vac. res. • Momentary action
• Meets mil specs.



GM-210
SINGLE POLE, DOUBLE-BREAK, SIDE-MOUNTED LEAF ACTUATOR
• Width, length, height including actuator-19/64" x 5/8" x 7/16" • Electrical capacity-10 amps 250 vac. • Operating force-2 oz. • Also with bottom or out the cover terminals.



MOD-160
6 POLE, DOUBLE-THROW
• Width, length, height-23/32" x 13/32" x 1.0" • Electrical capacity-5 amps 250 vac. each pole • Momentary action • Meets mil specs.



Check us for other switch modules

COLUMBUS ELECTRIC MANUFACTURING CO.
621 NORTH HAMILTON ROAD / COLUMBUS, OHIO / 43219

Cunningham Corporation

SUBSIDIARY OF GLEASON WORKS
HONEOYE FALLS, NEW YORK 14472
TELEPHONE 716-624-2000
TWX 510 254 4202

What's the top value in low cost matrix switching?

Try the Telefunken OHS individually selectable, 9 pole, 12 position ordinate holding switch. Distributed exclusively in the U. S. A. by Cunningham.

Ideal for educational systems, intercom systems, many other audio and control applications. Brings you: **1. Compact size.** Only 3½" x 2½" x 3½".
2. Magnetic latching. Gives fail-safe protection against power failure. **3. Low cost.** Because of compact design and modern manufacturing methods.
4. Modular construction. Plug-in units easily replaceable—simplifies maintenance, reduces downtime.

$57.75 ea.

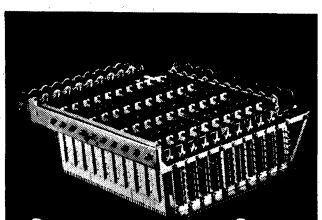


OHS (Telefunken)
Ordinate Holding Switch

Switching systems problems? Let our know-how in systems engineering work for you with: **OHS (Ordinate holding) switches; crossbar switches** for general purpose/high-performance requirements; **McKee random access matrices** for high voltage and current; **reed matrix switches** for high frequencies.

What do you expect from a high-performance matrix switch?

Probably perfection. And here's one that comes pretty close. The Cunningham general purpose, high-performance crossbar switch: **1. Versatile.** Covers the full range of data acquisition requirements. Handles voltages from 1 microvolt to 1000 volts—usable up to 30 MHz. **2. Reliable.** 20-million operations per crosspoint assured. Up to 100-million are common.
3. Readily Programmable. By every control device from tape to direct computer input.

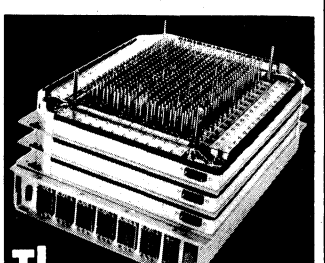


The Cunningham Crossbar Switch

Switching systems problems? Let our know-how in systems engineering work for you with: **Crossbar switches; McKee random access matrices** for high voltage and current; **reed matrix switches** for high frequencies; **Telefunken OHS (ordinate holding)** switches for low cost applications.

Looking for a "power house" random access switch?

You've got it with our McKee switch for harness and cable checking equipment, aircraft test systems, and engine test stands. It has: **1. High power capability.** Handles up to 2 amps at 4000 volts. **2. Programmability.** By every control device from tape to direct computer input.
3. Complete random access. Unique design permits signal to go in and come out at any point in the matrix.



The McKee Switch

Switching systems problems? Let our know-how in systems engineering work for you with: **McKee random access matrices: crossbar switches** for general purpose/high performance requirements; **reed matrix switches** for high frequencies; **Telefunken OHS (ordinate holding)** switches for low cost applications.

WIDEBAND CROSSBAR APPLICATIONS

Ultra reliable and exceptionally versatile Cunningham wideband crossbar switch matrices are particularly suitable for wideband high frequency switching and very low level, low impedance switching.

Cunningham wideband crossbars find application in the routing, distribution and accumulation of high speed data as well as audio video and analog switching systems.

TYPES

Cunningham wideband crossbar switch matrices are made in two patterns: One to provide group-to-group switching; the other for group-to-one switching. Either may be controlled by a coordinate electromagnetic or a direct electromagnetic actuator mechanism.

The electromagnetic actuator assembly is composed of a simple magnetic coil/armature mechanism or by a coil armature assembly wherein the magnetic core may be permanently magnetized to enable the mechanism to retain a connection in the absence of power. This latter technique is known as "magnetic latching" as related to Cunningham crossbar switches.

Either Type A or Type F switch is available with magnetically latched connections such that only momentary power is needed to coordinately operate the switch which will establish a connection at which time power may be removed. This results in exceptionally low operating power for a system as well as signal maintenance in the event of power failure. Both the group-to-group and group-to-one patterns are actuated by electromechanical assembly in one of two ways: by coordinate actuation and by direct actuation. In coordinate actuation a crosspoint is operated by energizing a select coil followed by operation of a hold coil which then closes six sets of contacts.* In direct actuation a crosspoint is operated by energizing an electromagnetic actuator located directly over the crosspoint. A separate coil is provided for each crosspoint.

FEATURES

- All Cunningham Wide Band Crossbars feature 20 million operations per crosspoint without adjustment.
- Typical life one hundred million operations per crosspoint.
- Excellent low level and dry circuit performance. Metallurgical symmetry results in exceptionally low (less than 0.1 microvolt per degree C.) thermal EMF's.
- Handles signals dc to 10 megacycles with high isolation.
- Gold contact, self wiping.
- Insulation resistance one million megohms.
- High speed operation 65 closures per second.
- Exceptionally high contact density.

*Six form A contacts are provided as standard. The various configurations of form C contacts and A and C combinations are available. Write for bulletin 114A.

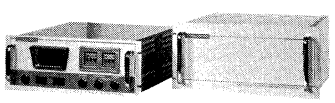
DATA ACQUISITION APPLICATIONS

The Cunningham Crossbar Scanner is basically a small switching system capable of connecting many signal circuits to one circuit, or distributing one signal circuit to many circuits sequentially or an accordance with BCD program signals from peripheral equipment.

The distinguishing characteristics of the Cunningham scanner in addition to its well-known crossbar matrix signal fidelity make it particularly suitable for handling low-level signals of less than 1 microvolt or high-level signals in excess of 500 volts. The wide band, high frequency capability of the Cunningham Crossbar Switch permits accurate routing and excellent fidelity in the transmission of analog or digital data particularly when such data is of the fast rise time, short duration type.

Cunningham scanners are also used in data logging applications, signal distribution systems, and automatic cable harness and printed circuit card continuity measuring systems. Cunningham Crossbar Scanners are suitable for 19" rack mounting and are powered from a nominal 117 volt 60 cycle AC line.

SCANNEX MODEL 309G



PRICE: $4295.00

The Model 309G features a permutation switch located on the back panel which permits selection of 600-1 wire channel configurations, 300-2 wire, 200-3 wire, and 100-4, 5 or 6 wire arrangements. Featured also on the Model 309G is complete remote random access, first and last channel selection, channel-path-complete signal output, end-of-scan signal output, BCD 1, 2, 4, 8 channel identification readout, internal and external drive selection, random-access, single scan or continuous scan control features.

Maximum channel sampling speed on the Model 309G is 60 per channels per sec.

MODEL 450 SCANNER



PRICE: $1695.00

The Model 450 is a 100 point crossbar scanner used for direct sampling of a wide dynamic range of signal voltages or currents. Four channel capacities are available as a factory wired option: 100-1 wire, 60-2 wire, 40-3 wire, and 20-6 wire channels are available. Operational modes include random access, single and continuous scan, clock pulse generator with speeds to 100 channels per second. For further details see Cunningham Bulletin 14450.

An IC Control for the Scannex Series is in development. It is compatible with DTL and TTL logic and will be available in mid-'69.

DESCRIPTIVE LITERATURE AVAILABLE

Short Form Catalog	#600	McKee Crossbar Data	#602
Crossbar Introduction	#601	OHS Data	#604
Crossbar Fundamentals	#130	Cunningham Type A Crossbar	#200
Crossbar Applications	#131	Cunningham Type F Crossbar	#201
Ordering Information	#119C	Cunningham Type P Crossbar	#202
Scanners	#309 & #450	Cunningham Type T Crossbar	#203

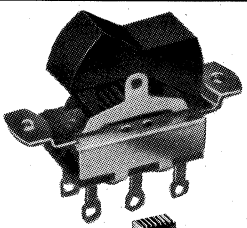
For technical and appilcations assistance consult your nearest Cunningham representative. He is listed in the yellow section of this catalog.

Cunningham Corporation

SLIDE SWITCHES

QUALITY PRODUCTS THROUGH CREATIVE ENGINEERING

CONTINENTAL-WIRT ELECTRONICS CORP., PHILA., PA. 19144

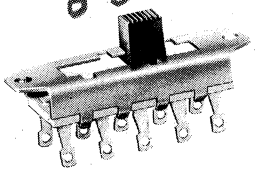


GR3-326
DPDT

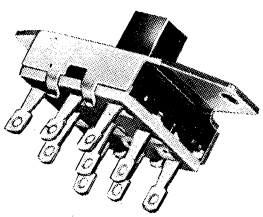
STANDARD SLIDE SWITCHES

WIDE RANGE OF BASIC TYPES AVAILABLE

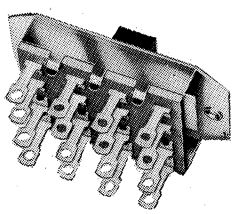
Rated up to 11.0 a. AC at 125v. Available with detent or spring return; printed circuit or solder terminals; clearance or extruded and tapped holes; choice of knob colors and heights. **Request Bulletin No. 2085-68**



G-338
2P, 4Pos



GF-361
3P, 2Pos



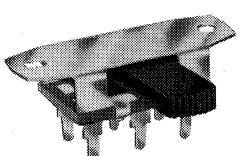
GH-360
4P, 3Pos

CURRENT CARRYING CAPACITY

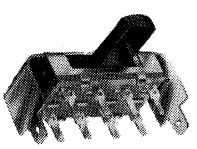
SWITCH TYPE	3.0 a. AC 0.5 a. DC @ 125v	6.0 a. AC 0.5 a. DC Max. 12.0 a. AC, 2.0 a. DC @ 125v	8.0 a./pole @ 12v DC Max. 16.0 a. @ 12v DC	10.0 a. AC @ 125v	11.0 a. AC @ 125v
SPST	*GF-323UL	GF-623 UL CSA	GF-823	*G-1023UL	GF-1123UL
SPST-SR	* G-331UL	G-631	G-831	*G-1031UL	—
SPDT	*GF-324UL	GF-624 UL CSA	GF-824	*G-1024UL	GF-1124UL
SPDT-SR	* G-332UL	G-632	G-832	*G-1032UL	—
DPST	*GF-325UL	GF-625UL	GF-825	—	—
DPDT	*GF-326UL	GF-626UL	GF-826	—	—
DPDT	GG-350UL	—	—	—	—
2P, 3Pos	GH-328UL	GH-628UL	GH-828	—	GH-1128UL
2P, 4Pos	G-338	G-638UL	G-838	—	—
3P, 2Pos	GF-361UL	GF-661UL	GF-861	—	—
3P, 3Pos	GH-368	GH-668	GH-868	—	—
4P, 2Pos	GF-342UL	GF-642UL	GF-842	—	—
4P, 3Pos	GH-360UL	GH-660UL	GH-860	—	—

*Available as Rocker Switches.

THE SYDEWYNDER® — WHERE KNOB ACTION AT RIGHT ANGLE IS REQUIRED

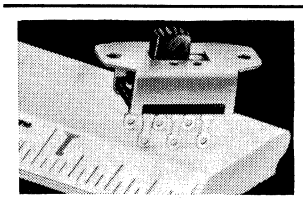


GG-350-PC DPDT
GG-351-PC SPDT
for printed circuit application. Mounts either with .140" dia. mounting holes or directly by p.c. terminals.



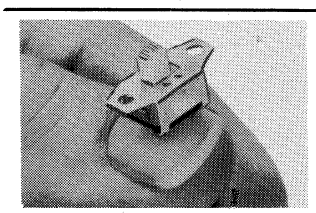
GG-372-PC SPDT
GG-387-PC DPDT
GG-386-PC 2P, 3Pos.
Housing has lances which snap on to .064" thick p.c. board.

U.L. listed 3.0 amps AC .5 amp DC at 125 volts. **Request Bulletin 2085-68**



"SWIDGET" MINIATURE SLIDE SWITCHES

Require only one-third the space of a standard slide switch. Rated at 0.5 a. AC-DC at 125v. UL listed. Only 1" long overall, with 0.812 mounting centers. Printed circuit and solder terminal options. Choice of mounting holes, knob colors and heights. Available as single-pole, double-pole and spring return with two-, three- or four-positions. **Request Bulletin No. 2079-68.**



"SWIDGET JR." SUB-MINIATURE SLIDE SWITCH

New G-111, SPDT, requires less than ⅕ the volume of a standard slide switch. Only .762" overall length, with 0.562" mounting centers. Rated at 0.5 amps AC-DC at 125v. UL listed. Available as G-111G with gold contacts for dry circuits. **Request Bulletin No. 2079-68.**

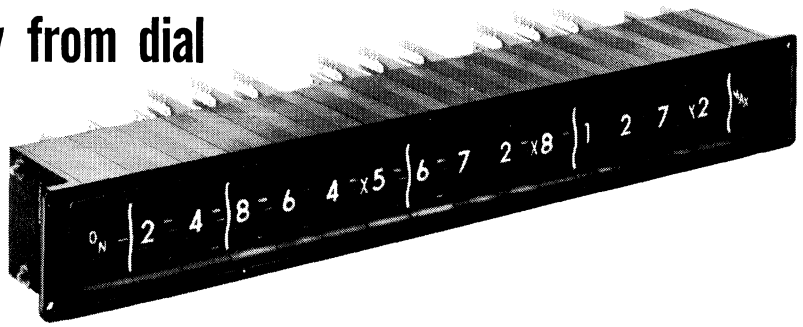
C-W products assure high reliability at reasonable prices. Full cooperation on custom engineering, field service, emergency stocking and special models.

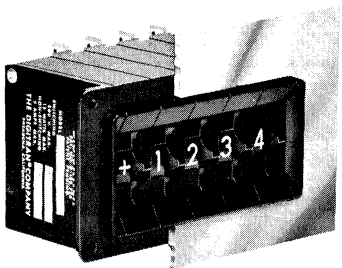
See Sec. 4700 for complete line of C-W-Resistors, Wire Wound, Potentiometers, and Specialties.

CONTINENTAL-WIRT ELECTRONICS CORP.
26 W. QUEEN LANE, PHILADELPHIA, PA. 19144
(AREA CODE 215) VI 8-7700
TWX 710-670-1230

DIGISWITCH®

Converts directly from dial setting to coded electrical outputs.



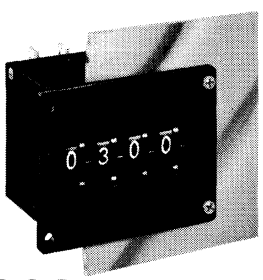


Series 300 general purpose Digiswitch

This is a compact, finger-actuated module only ½" wide, with 8, 10, 12 or 16 positions on the setting wheel. Stops may be inserted to limit the number of positions on the dial where required. More than 100 standard types of coded outputs are available, covering a wide range of capabilities such as the following:

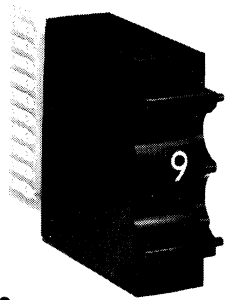
- Octal-to-binary conversion
- Decimal-to-binary conversion
- Conversion to binary with complement and provision for diodes
- Voltage divider
- Capacitance decade
- Resistance decade
- 8, 10, 12, 16 position "decimal" switches. Single pole and double pole, shorting and non-shorting

As many individual switch modules as required may be ganged into a single unitized assembly for simplicity of mounting. No separate escutcheon plate, secondary brackets or other special hardware is required—only four screws. Prices start at $5.00 per module.



Series 13000 front-mounted Digiswitch

The Series 13000 Digiswitch is identical in every way to the Series 300 except that the case is designed so that an entire assembly can be mounted from the front of the panel, completely covering the panel cut-out. No separate escutcheon plate or other hardware is required for mounting. The same codes, dial positions and other features available in the standard Series 300 Back-Mounted configuration are also available in the Series 13000 Digiswitch.



Series 9000 sealed and Series 19000 dust-sealed Digiswitches for industrial environments

The Series 9000 and 19000 Digiswitches are interchangeable in a panel mounting with the Series 400 shown on the next page. The basic difference between these two Series and the Series 400 is the extension of the printed circuit board from the rear of the switch case, providing direct component mounting on the printed circuit board. Output terminals can be directly soldered or will mate with standard printed circuit board connectors. Some modules in the Series 9000 and 19000 are available with wire-wrap or other special terminals.

The Series 9000 Digiswitch has the switch elements contained in a separate chamber within the switch case. An "O" Ring around the drive shaft and potting around the printed circuit board in the rear of the switch case provides a total seal as in the Series 400.

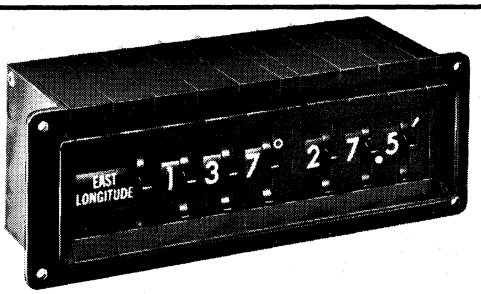
The construction of the Series 19000 is exactly the same except the potting of the printed circuit board at the rear of the case and the "O" Ring seal are left out. The Series 19000 provides an excellent dust seal in applications where total sealing is not important. Most of the codes available in the Series 300 are also available in the Series 9000 and 19000.

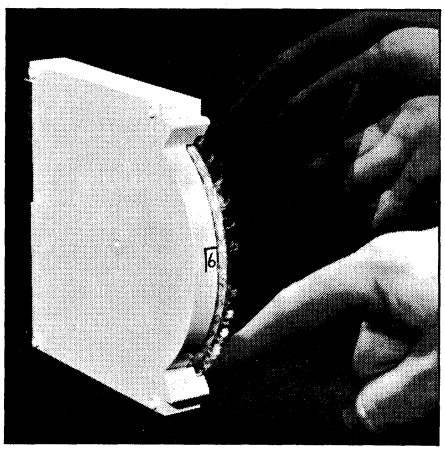
Turn page for additional units ▸

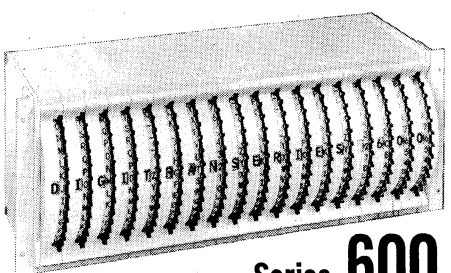
All DIGISWITCHES and MINISWITCHES are designed to meet the requirements of MIL-S-22710A

DIGISWITCH®

For accurate manual setting, visual readout and coded electrical outputs.







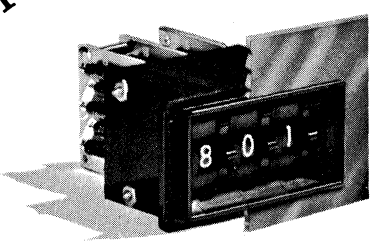
Series 600
Digiswitch for rapid setting

The Series 600 Digiswitch offers the operator the selection speed of a pushbutton, or slide bar switch, while it retains the in-line visual readout feature of a thumbwheel switch. All of the design characteristics of the Digiswitch line (modular construction, easy mounting, simple operation, savings in panel space) are retained. The setting wheel has up to 40 positions, yet all are readily available in no more than 4 wheel actuations.

The Series 600 offers extensive electrical output capabilities. For example, up to 6 bits of binary and 10 levels of output information can easily be obtained. The setting wheel consists of two parts: the right-hand side contains the operator selection positions and the left-hand side contains the in-line readout window positions. Provisions for the installation of diodes, resistors or other components directly on the circuit board can often be provided. Circuit board terminals allow the use of both standard-edge connectors or solder.

See Preceding Page

IT'S A POT!



DIGIVIDERS / DIGIDECADES
Thumbwheel operated voltage dividers and resistance decades.

Digividers and Digidecades are specifically designed for applications where precise digital setting of resistance or voltages are required. They are easy-to-read and operate, require little panel space, and give 10 times more accuracy than a potentiometer — at little added cost. In addition, the new units provide reliability, low contact resistance and repeatability of setting. For example, a change from 13 ohms to 913 ohms is made with one flick of a finger. Digividers are available with either Kelvin-Varley or Poggendorff circuits, a wide range of input impedances, and an accuracy of 0.1% of full scale. Digidecades resistance decades provide an accuracy at 25°C of 1% of setting.

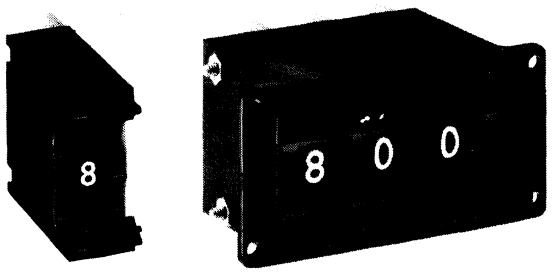
Features and options available in the various series

Description	SERIES 300	13000	200	700	8000	9000	19000	600	12000
Dial Positions (without stops)									
2, 8, or 10	✓	✓	✓	✓	✓	✓	✓	✓	✓
12, or 16	✓	✓	✓	✓		✓	✓	✓	
Up to 40								✓	
Dial Stops to Limit Dial Positions	✓	✓	✓	✓	✓	✓	✓	✓	
Assembly Spacers (Width)									
.400"						✓	✓		
.500"	✓	✓			✓				
.250"	✓		✓	✓	✓				
Marking of Symbols, Letter or Line on Spacer or Switch	✓	✓	✓	✓	✓	✓	✓	✓	
Special Dial Characters	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sealed			✓	✓		✓			✓
R.F.I. Shielding	✓		✓	✓	✓	✓	✓		✓
Double Modules (One Thumbwheel)	✓	✓	✓	✓					
Message Units	✓	✓	✓	✓		✓	✓		
Replaceable Lighting (For standard MS-lamps)	✓		✓	✓	✓	✓	✓		✓
Lighted Decimal Point on Case	✓				✓				
Lighted Decimal Point on Spacer	✓	✓	✓	✓	✓	✓	✓		
Provision for Mounting Components in Output Terminals	✓	✓		✓	✓	✓	✓	✓	✓
Wire Wrap Terminals	✓	✓				✓	✓	✓	
Taper-Tab Terminals	✓	✓				✓	✓		
Reset Dial (Manual or Solenoid Actuated)								✓	
Back Mounting (No separate Escutcheon Plate)	✓		✓	✓	✓	✓	✓	✓	✓
Front Mounting (No separate Escutcheon Plate)		✓							

THE DIGITRAN COMPANY
855 South Arroyo Parkway Pasadena, California 91105 Phone (213) 449-3110

MINISWITCH®

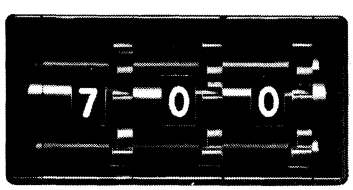
Where limited space presents a problem.

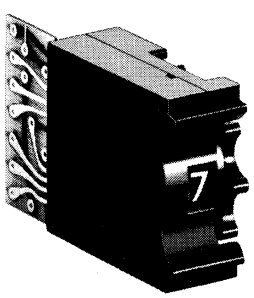


Series 8000 Miniswitch — standard

The Miniswitch is the smallest thumbwheel switch available. Compact and versatile, Series 8000 provides substantial savings in panel space. Each switch module requires a panel cutout only 0.96" high x 0.5" wide. Modular construction permits the ganging of any combination of switch modules into a single, unitized assembly. No separate escutcheon plates, special mounting brackets, or other hardware is required to mount an entire assembly.

All Miniswitches are available in two, eight or ten position—decimal or coded electrical output. Dial stops can be provided to limit the number of dial positions. Internal replaceable lighting is also available as an option in all Miniswitch Series. Some models in the Series 8000 Miniswitch have provisions for mounting components directly onto the printed circuit board.





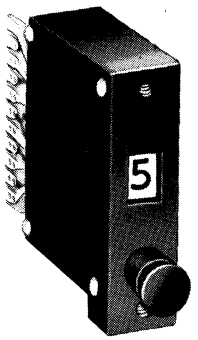
Series 700 Miniswitch — sealed

The Series 700 is constructed much the same as the Series 200 Miniswitch with the switching elements enclosed in a separate chamber, but the printed circuit board extends from the rear of the case. The Series 700 is totally sealed with an "O" Ring shaft seal and a window sealing the front of the case and potting around the back of the case and the printed circuit board. The extensions of the PCB provide for direct soldering and the mounting of components directly on the printed circuit board in some models. The Series 200 and 700 are interchangeable within the same assembly and conform to the same mounting dimensions.



Send for a FREE copy of the new Digiswitch-Miniswitch Catalog

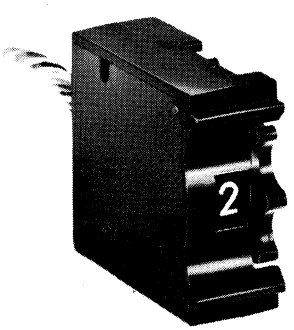
A new catalog describing all Digiswitch and Miniswitch units is available free on request. It includes complete technical data, truth tables showing codes and electrical output configurations, dimensional sketches, standard performance specification, prices, order blanks and typical applications. This catalog is reproduced in full in VSMF — The Microfilm Catalog File.



Series 12000 Miniature Pushbutton rotary switch

Series 12000 is a miniature pushbutton rotary switch which permits complete panel sealing to prevent contamination of switch and panel interior. Individual modules can be sealed from dust and moisture. Recommended for military communications and to meet requirements of MIL-S-22710A.

Series 12000 is available in all 8- and 10-position standard Octal and BCD Codes including complement and "true, not-true" functions. Width: .480 inch. Height: 1.30 inch. Weight: less than 0.4 oz. Low profile; button extends only 3/16" beyond the panel. Modules can be mounted on 0.5 inch centers. Metal case, sealed glass window, optional replaceable internal lighting, diodes may be mounted on PCB.

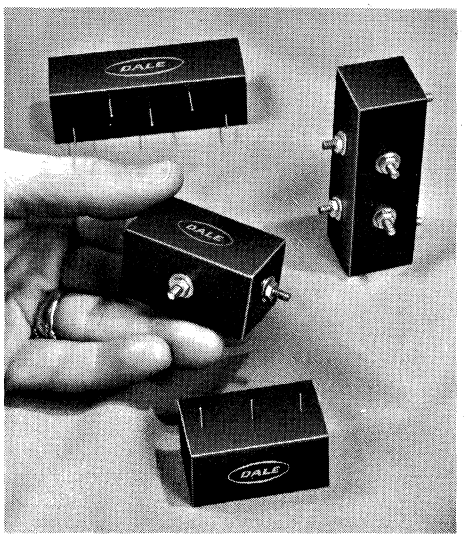


Series 200 Miniswitch—sealed

The Series 200 is the same miniature size and mounting conformity as the Series 8000 Miniswitch but is specifically designed for use in equipment which must operate in severe environments (sands, dust, salt spray, high humidity, temperature extremes, explosive atmosphere, etc.). All switching elements are enclosed in a sealed chamber within the switch case. No part of the printed circuit board is exposed. Wire leads serve as the output terminals.

All DIGISWITCHES and MINISWITCHES are designed to meet the requirements of MIL-S-22710A

DALE® SIOUX DIVISION SURGE ARRESTERS



■ SERIES LVP *Signal Line Protector*

Fail-safe design safeguards delicate solid-state receiving, amplifying and control circuitry against damaging transient voltages caused by lightning, capacitive coupling between signal and power lines, etc. Eliminates transient problems between the solid-state and electromechanical portions of switching circuits and control equipment.

PROTECTIVE CAPABILITIES

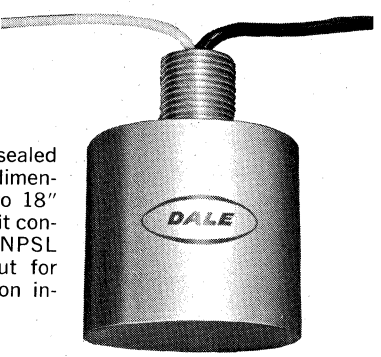
Clipping Voltage: 6-200 volts ±5% or ±10%. Voltage rise time can be as fast as 100 KV μsec. **Bypass Capability:** Will bypass repeated surges of up to 400 amperes with a 5x10 μsec. wave shape. Shorts permanently to ground with surges of greater magnitude. **Frequency Range:** 30Hz to 100KHz. **Shunt Capacity:** Less than 50 pf.

PHYSICAL SPECIFICATIONS

LVP-1 (for balanced lines): 1″x1″x1-7/8″; **LVP-3** (for unbalanced lines): 1″x1″x3-1/8″. **Terminals:** Printed circuit pins or 6-32 studs, LVP-1 = 3, LVP-3 = 5. **Housings:** Molded epoxy.

■ SERIES SPA *Secondary Power Arrester*

Designed for fuse or junction box mounting to protect against direct or indirect lightning and other transient voltages. Unit has hermetically sealed pre-ionized spark gap for increased sensitivity and stable breakdown voltage level. Exceeds all applicable NEMA, USAS, and IEEE standards.



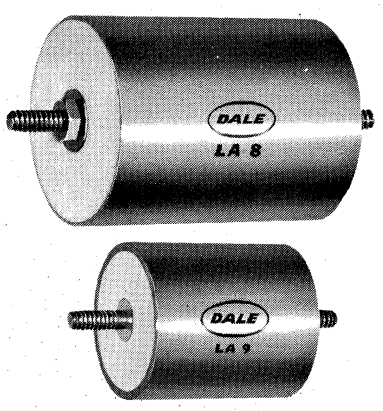
PROTECTIVE CAPABILITIES

DC Arc-Over Voltage: SPA-100 (120 VAC) 500-700 volts; SPA-200 (277 VAC) 600-800 volts. **Fast Rise Arc-Over Characteristics:** Typically 1500 volts with 10KV μsec. pulse applied; **Bypass Capability:** Will withstand repeated 10 KA (10x20 μsec.) current surges. Power follow current extinguished in 1/2 cycle or less. Voltage between terminals less than 2000 volts when conducting 20,000 amps of surge current. **Insulation Resistance:** Greater than 1,000 megohms initially, greater than 10 megohms after current pulses. **Shunt Capacity:** Less than 25 pf.

PHYSICAL SPECIFICATIONS

Spark gap hermetically sealed with soft solder. Overall dimensions: 1-3/4″Dx3″L. Two 18″ leads provided for circuit connection. Has 1/2″-14 NPSL conduit fitting with nut for mounting in any position indoors or outdoors.

■ SERIES LA *Miniature Size—Maximum Circuit Protection*



Patented design insures much greater reliability and repeatability than standard spark gap designs. Widely used to protect communications equipment from lightning and to guard industrial controls and radios from heavy transient spikes.

PROTECTIVE CAPABILITIES

Spark-Gap Arc-Over Voltage: LA8 = Factory adjustable from 1500 to 4000VDC ±20%; LA9 = Factory adjustable from 500 to 5000 VDC ±20% (10% available). **Bypass Capability:** LA8 = 10 current surges each rising to 15,000 amp peak in 5 μsec. and containing total charge of 21 coulombs; LA9 = 100 current surges of 300 amps peak with 2x4 millisecond wave shape. Both types will perform as stated without damage to arrester or equipment attached and with less than 20% change in original DC breakdown voltage. **Insulation Resistance:** Greater than 1000 megohms initially and greater than 10 megohms after rated current surges. **Shunt Capacity:** LA8 = 7.7 mmfd, LA9 = 3.5 mmfd.

PHYSICAL SPECIFICATIONS

LA8 = 2-1/2″ outside length. Body 1-55/64″ L x 1-1/4″ D. Weight 4 oz. LA9 = 1-5/8″ outside length. Body 1″ L x 3/4″ D. Weight 2 oz. **Mounting:** Clip, stud or flange; **Terminal:** LA8 = UHF female or "N" type coax connector, wire or 6-32 stud; LA9 = 4-40 stud or wire. **Seal:** LA8 = Dustproof; LA9 = Hermetic.

■ ADDITIONAL MODELS

- Aircraft lightning arresters of all types
- Arresters for high voltage circuits
- Miniature transient suppressors for circuit board mounting.

Submit your specifications to
DALE ELECTRONICS, INC., SIOUX DIVISION
Box 180, Yankton, South Dakota 57078

Complete lightning laboratory facilities and engineering assistance available to develop your applications.

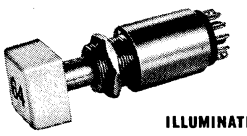
electro-mech

A SUBSIDIARY OF TRANSFORMER ENGINEERS

illuminated

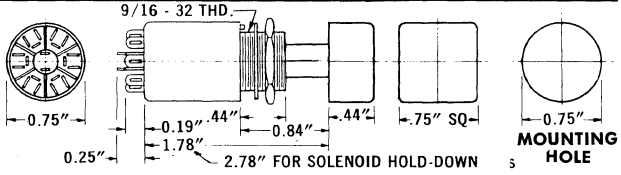
PUSHBUTTON SWITCHES

"switchline" STANDARD 6-POLE DOUBLE THROW



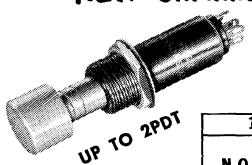
- **Ratings:** 30 volts DC or 115 volts AC 2 amps resistive; 1 amp inductive
- **Weight:** 0.8 oz. (approx.)
- **Operating Pressure:** 2 lbs. ±1 lb.
- **Plunger Travel:** 3/16" (approx.)
- **Actuations:** 100,000
- Accommodates all **"switchline"** standard lenses
- Uses one T1¾, AN3140-327, 328, 330 bulb or neon lamp. 3 actuation modes standard also in 2, 3, 4 and 5-pole configuration.

	ILLUMINATED				NONILLUMINATED			
	Mom.	Push On Push Off	Push On Remain In Push Off	Snap Feel Mom.	Mom.	Push On Push Off	Push On Remain In Push Off	Snap Feel Mom.
2 PDT	2650	2750	2850	2550	1650	1750	1850	1550
3 PDT	2651	2751	2851	2551	1651	1751	1851	1551
4 PDT	2652	2752	2852	2552	1652	1752	1852	1552
5 PDT	2653	2753	2853	2553	1653	1753	1853	1553
6 PDT	2654	2754	2854	2554	1654	1754	1854	1554



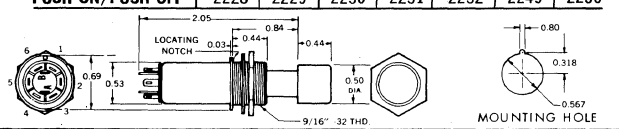
LENSES: Available in ½", ¾", 1" dia., ½", ⅜", ¾" square. Translucent Lexan in white, red, green, blue and yellow.

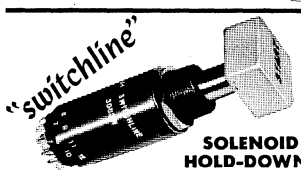
NEW Slimline by "switchline"



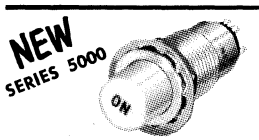
A new 2100 series Slimline version of our standard Illuminated Pushbutton Switch featuring silver slide bar action. Add BR after part number for mounting on ⅜" centers. Utilizes AN3140-T 1-¾ or ALC-100 bulb. All other specifications same as standard.

	1 PST		2 PST				
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.O. 1 N.C.	1 PDT	2 PDT
MOMENTARY	2128	2129	2130	2131	2132	2149	2150
PUSH ON/PUSH OFF	2228	2229	2230	2231	2232	2249	2250





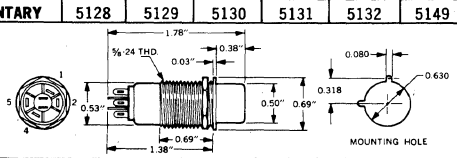
Switchline Illuminated Pushbutton switches with an integral hold-down coil which is activated with switch. Holds the pushbutton in the depressed position until coil is de-energized returning it to relaxed position. Available in all circuit configurations up to 6 PDT. Same secifications as standard model.

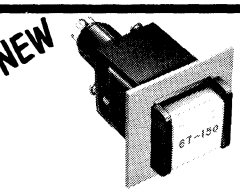


FRONT PANEL MOUNT MINIATURE MOMENTARY SWITCHES

An exceptionally short momentary switch available in circuit configurations up to 2 PDT. Clear anodized case. All specifications same as standard model except plunger travel which is 3/32".

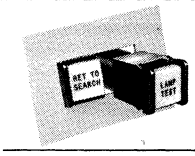
	1 PST		2 PST				
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.O. 1 N.C.	1 PDT	2 PDT
MOMENTARY	5128	5129	5130	5131	5132	5149	5150





60 SERIES LOW COST SELF MOUNTING SWITCH ASSEMBLY

This series features our 2100 switch incorporated as an integral part of the mounting hardware. All plastic, front mounting case with barriers. "U" shaped channel bracket is easily attached to back of panel and switch is installed with two screws. Same circuitry and specifications as 2100 series.

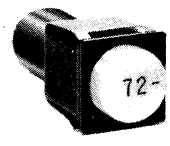


"switchline" MOUNTING ADAPTERS

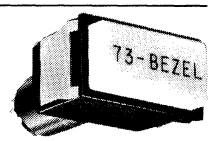
- Snaps in from front panel
- Mounts in panel thickness up to ⅛"; for thicker panel mounting add "Z" to Model No.
- Fingernail groove in lens for easy removal
- Bezel available in white, gray or black Lexan.



Model 65
0.94" sq. flange
0.75" sq. Lens

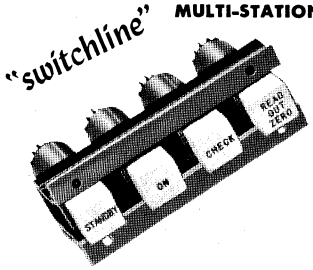


Model 72
0.75" dia.
Lens



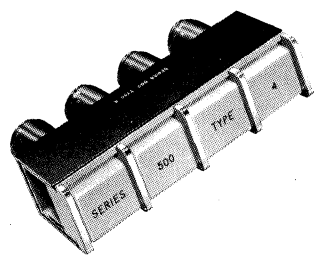
Model 73
0.75" x 1.50"
Lens

"switchline" MULTI-STATION ASSEMBLIES



SERIES 400

Multi-station switch assemblies designed for sub-panel mounting by means of a flanged "U" channel. All standard Switchline switches can be incorporated with several types of mechanical interlocking/lockout actions between stations. Up to 12 stations in one or two row configurations.

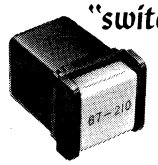


SERIES 500

A new line of front panel mounting assemblies featuring long-lasting chrome barriers between each switch. All standard Switchline switches in ten types of tracking action and switching sequences. Up to 12 switches in single or dual row on ⅞" or 1" centers.

TYPE I — Mounting frame only.
TYPE II — Momentary and lockout.
TYPE III — Independently maintain and locked out.
TYPE IV — Interlock and lockout.
TYPE V — Maintained with master release.
TYPE VI — Maintained with remote master release.
TYPE VII — Maintained with remote master release and master release lockout.
TYPE VIII — Interlock and lockout with master release.
TYPE IX — Interlock and lockout with remote master release.
TYPE X — Interlock and lockout with remote master release and master release lockout.

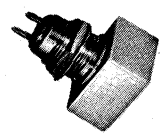
"switchline" INDICATOR LIGHTS



60 SERIES -210
1.57" length
0.75" sq. Lens
Channel mount



Model 3210
1.84" length
0.33" dia. shaft
0.75" dia. Lens
9/16 -32 THD.



Model 3220
1.81" length
0.75" sq. Lens
15/32 -32 THD.

Accommodates all **"switchline"** lenses. Utilizes AN3140-T 1-¾ or ALC-100 bulb.

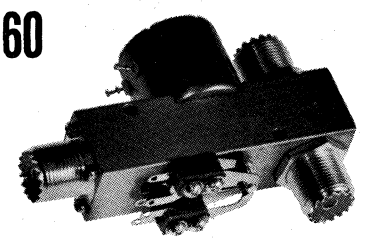
Write, wire or phone for complete literature. We invite your inquiries regarding our capabilities in custom switch design and production.

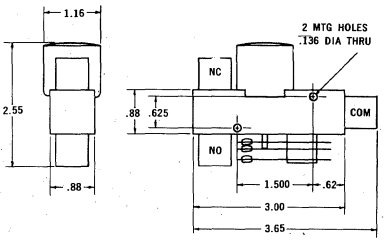
Also send for literature describing our complete line of encapsulated precision wire-wound resistors and custom networks capabilities.

electro-mech
1039 East Valley Blvd., San Gabriel, Calif. 91776
Phone: (213) 283-9213 • TWX: 910-589-3382

SPDT REMOTE

SERIES 60





FEATURES — The Series 60 are remote operation, ruggedly constructed, SPDT coaxial relays designed for operation from low-level to 1 KW. They are offered with or without 2 Form C auxiliary contacts. For transmitter-receive applications they are available with a special high isolation "G" connector at the NC or receive position. This "G" connector increased the isolation to greater than −100 db at frequencies up to 500 Mhz, although it reduces the power rating through this connector to 20 watts. "G" connectors will increase the listed VSWR above 400 Mhz.

Typical electrical characteristics are shown below when used in a 50 ohm transmission line. UHF connectors and solder terminals are not recommended above 400 Mhz.

ORDERING INFORMATION

Select coil voltage and replace the XX with the two digits for the complete part number. Example: 60-260442 is the SPDT relay with UHF connectors for 115V AC operation with 2C auxiliary contacts.

ELECTRICAL CHARACTERISTICS

Freq. Mhz	VSWR	Crosstalk —db.	Insertion Less —db.	RF Power Rating
0-50	1.05	45	.05	1 KW
100	1.06	40	.05	1 KW
400	1.12	30	.1	750 W
1000	1.3	25	.15	500 W

MODIFICATIONS

Available on special order:

1. Moisture sealing of all entrances to RF portions.
2. Microswitch type auxiliary contacts.
3. Gold finished RF contacts.

CONNECTORS AND PART NUMBERS

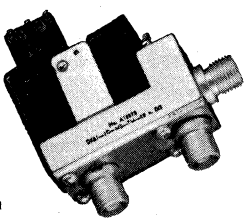
Connector Type	Std. SPDT	With 2C Aux. Contacts	With NC "G" Conn.	With 2C Aux. & NC "G"
UHF	60-XX04	60-XX0442	60-XX28	60-XX2842
50 ohm N	60-XX01	60-XX0142	60-XX25	60-XX2542
75 ohm N	60-XX14	60-XX1441	60-XX30	60-XX3042
BNC	60-XX02	60-XX0242	60-XX26	60-XX2642
TNC	60-XX03	60-XX0342	60-XX27	60-XX2742
C	60-XX05	60-XX0542	60-XX29	60-XX2942
Solder Terminals	60-XX19	60-XX1942	60-XX35	60-XX3542

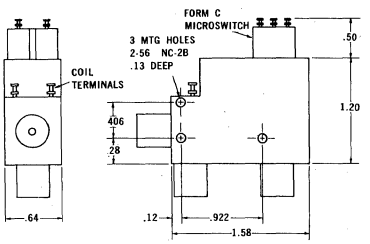
COIL CHARACTERISTICS & PART NO. DIGITS (1)

Part No. Digits	Nominal Volts	Voltage Range	Resistance Ohms ±10%
21	6 DC	5-7	12
22	12 DC	9.5-14	48
23	26 DC	19-31	245
24	48 DC	40-54	770
25	110 DC	90-125	4000
26	115 AC	100-125	245
27	220 AC	200-240	770
28	6 AC	5-7	.8
29	24 AC	20-28	12

SPDT REMOTE

SERIES 61





FEATURES — The Series 61 are small SPDT switches for military and severe environmental applications and designed to withstand the applicable requirements of specification MIL-S-3928B. The balanced armature actuator prevents contact chatter under high frequency vibration and severe shock. They are offered with many types of connectors and 1 or 2 Form C microswitch auxiliary contacts. Gold finished contacts provide reliable operation at low levels.

ORDERING INFORMATION

Select coil voltage and replace XX with the two digits for the complete ordering part number.

Example: 61-240312 is SPDT switch with TNC connectors 48 DC coil and 1 Form C microswitch.

ELECTRICAL CHARACTERISTICS

Typical high frequency measurements in a 50 ohm transmission line.

Freq. Mhz	VSWR	Crosstalk —db.	Insertion Less —db.	RF Power Rating
50	1.03	60	.03	150 W
100	1.05	52	.05	125 W
400	1.12	40	.1	100 W
1000	1.18	30	.15	75 W

SPECIFICATIONS

OPERATING TIME
15 ms. max.
AUX. CONTACT RATING
5 amps. 115V AC

MECHANICAL

LIFE EXPECTANCY
10^6 cycles
WEIGHT
3½ - 4½ oz.

FINISH
RF surfaces - silver plate
Magnetic parts - cadmium and olive chromate

ENVIRONMENTAL

TEMPERATURE
−55°C to +125°C
SALT SPRAY
48 hours per MIL-S-3928B

HUMIDITY
10 day test per MIL-S-3928B

VIBRATION
Test Cond. A, 10-2000 Hz per MIL-S-3928B

SHOCK
15 g's per MIL-S-3928B

MODIFICATIONS

Available on special order:

1. Other type small connectors.
2. Combinations of connectors.
3. Mounting holes on opposite side of block. Add suffix R to part number for this modification.
4. Attached small cables.

PART NUMBERS AND FUNCTION (1)

Connector Type	SPDT	With 1C Microswitch	With 2C Microswitch
BNC	61-XX02	61-XX0212	61-XX0222
TNC	61-XX03	61-XX0312	61-XX0322
TM	61-XX07	61-XX0712	61-XX0722
MIN. S50 SCREW TYPE	61-XX12	61-XX1212	61-XX1222
MIN. S70 SCREW TYPE	61-XX17	61-XX1712	61-XX1722
MIL-C-22557 50 ohm TYPE	61-XX10	61-XX1012	61-XX1022
MIL-C-22557 75 ohm TYPE	61-XX15	61-XX1512	61-XX1522
SOLDER TERMINALS	61-XX19	16-XX1912	61-XX1922

COIL CHARACTERISTICS & PART NO. DIGITS (1)

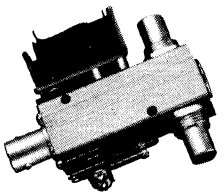
Part No. Digits	Nominal Volts	Voltage Range	Resistance Ohms ±10%
21	6 DC	4.5-7	12
22	12 DC	9-14	60
23	26 DC	19-31	275
24	48 DC	38-54	1030
25	110 DC	90-125	5000
26	115 AC	90-130	Diode Rect.

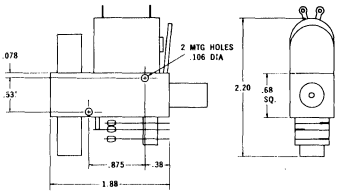
DOW - KEY

2260 Industrial Lane, Broomfield, Colorado 80020, Tel: 303 466-7303
• TELEX No. 4-5890

SPDT REMOTE

SERIES 77





FEATURES — The Series 77 are medium size, light weight, low priced coaxial switches for industrial and less critical military applications. The "T" shaped connector configuration has the common connector at one end and the NO and NC connectors 180° apart at the other end. They are available with or without 1 Form C auxiliary contacts.

ORDERING INFORMATION

(1) Select coil voltage and replace XX with the two digits for the complete ordering part number.

Example: 77-230932 is switch with phono conns, 1 C aux. contacts and 26 DC coil.

(2) Standard with 2 ft. cable lengths.

ELECTRICAL CHARACTERISTICS

Typical high frequency measurements in a 50 ohm transmission line (75 ohm for type F).

Freq. Mhz.	VSWR	Crosstalk —db.	Insertion Loss —db.	RF Power Rating
50	1.03	55	.03	150 W
100	1.05	51	.04	125 W
200	1.07	45	.05	100 W
400	1.1	40	.1	100 W
800	1.2	36	.15	80 W
1200	1.35	31	.2	60 W

SPECIFICATIONS

OPERATING TIME
15 ms.

MECHANICAL

LIFE EXPECTANCY
10^6 cycles

WEIGHT
3 oz.

FINISH
Connectors - silver plate
Block - irridite
Magnetic parts - cadmium and olive chromate

RF CONTACTS
Fine silver

ENVIRONMENTAL

TEMPERATURE
−55°C to +85°C

SALT SPRAY
48 hours per MIL-S-3928B

HUMIDITY
10 day test per MIL-S-3928B

VIBRATION
10-55 Hz per MIL-S-3928B

SHOCK
15 g's per MIL-S-3928B

PART NOS. & TYPES (1)

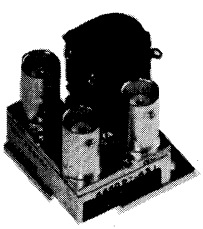
Connector Type	Standard SPDT	With 1C Aux. Contacts
BNC	77-XX0202	77-XX0232
TNC	77-XX0302	77-XX0332
Phono	77-XX0902	77-XX0932
CATV "F"	77-XX3202	77-XX3232
RG-58/U Cables (2)	77-XX2202	77-XX2232

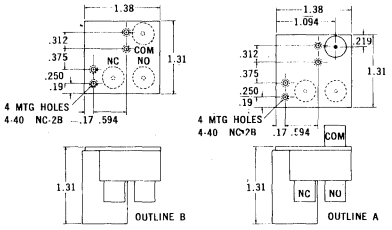
COIL CHARACTERISTICS & PART NO. DIGITS (1)

Part No. Digits	Nominal Volts	Voltage Range	Resistance Ohms ±10%
21	6 DC	4.5-7	20
22	12 DC	9-14	70
23	26 DC	19-31	290
24	48 DC	38-54	1000
25	110 DC	90-125	5000
26	115 AC	90-130	Diode Rect.

SPDT REMOTE

SERIES 163-164





FEATURES — These series are low priced general purpose coaxial switches for use up to 1000 Mhz and are intended for military and other applications where reliability is important. The Series 163 has the common connector passing through the mounting surface, while the Series 164 has all connectors opposite to the mounting surface. Gold diffused contacts are used for reliability at low signal levels. The unused connector is open circuited (non-shorting).

ORDERING INFORMATION

Select coil voltage and replace XX with the two digits for the complete ordering part number.

Example: 163-2632 is SPDT switch with "F" connectors and 115 AC coil.

ELECTRICAL CHARACTERISTICS

Typical high frequency measurements in a 50 ohm transmission line (75 ohm line for type F).

Freq. Mhz.	VSWR	Crosstalk —db.	Insertion Loss —db.	RF Power Rating
50	1.03	60	.03	150 W
100	1.05	52	.04	125 W
200	1.07	45	.05	100 W
400	1.12	40	.1	100 W
1000	1.25	30	.15	75 W

SPECIFICATIONS

OPERATING TIME
15 ms. max.

MECHANICAL

LIFE EXPECTANCY
10^6 cycles

WEIGHT
4 oz. approximately

FINISH
RF surfaces silver plate
Magnetic parts cadmium and olive chromate

RF CONTACTS
Gold finished fine silver

ENVIRONMENTAL

TEMPERATURE
−55°C to +85°C

SALT SPRAY
48 hours per MIL-S-3928B

HUMIDITY
10 day test per MIL-S-3928B

VIBRATION
10-500 Hz per MIL-STD-202

SHOCK
15 g's per MIL-S-3928B

MODIFICATIONS

Available on special order:

1. Other type small connectors.
2. Attached small cables.

CONNECTORS AND PART NUMBERS

Connector Type	Series 163 Outline A	Series 164 Outline B
BNC	163-XX02	164-XX02
TNC	163-XX03	164-XX03
MB	163-XX06	164-XX06
MIL-C-22557 50 ohm Type	163-XX10	164-XX10
CATV TYPE "F"	163-XX32	164-XX32

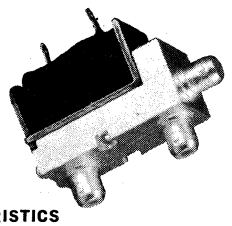
COIL CHARACTERISTICS & PART NO. DIGITS (1)

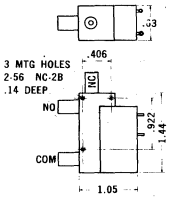
Part No. Digits	Nominal Volts	Voltage Range	Resistance Ohms ±10%
21	6 DC	4.5-7	20
22	12 DC	9-14	70
23	26 DC	19-31	290
24	48 DC	38-54	1000
25	110 DC	90-125	5000
26	115 AC	90-130	Diode Rect.

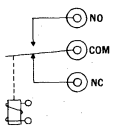
DOW - KEY
2260 Industrial Lane, Broomfield, Colorado 80020, Tel: 303 466-7303
• TELEX No. 4-5890

SPDT REMOTE

SERIES 169







FEATURES — The Series 169 are small, flat mount switches for use up to 1 Ghz. They are offered with a wide selection of connectors (TNC and smaller) and all standard coil voltages. Gold finished contacts provide reliable operation at low levels. The mounting holes are spaced the same as the Series 61, and they are interchangeable in most applications.

ORDERING INFORMATION

Select coil voltage and replace XX with the two digits for complete ordering part number.

Example: 169-2406 is the switch with MB connectors and 48 DC coil.

ELECTRICAL CHARACTERISTICS

Typical high frequency measurements in a 50 ohm transmission line.

Freq. Mhz	VSWR	Crosstalk —db.	Insertion Less —db.	RF Power Rating
50	1.05	55	.03	150 W
100	1.08	50	.05	125 W
400	1.15	42	.1	100 W
1000	1.3	32	.15	75 W

SPECIFICATIONS

OPERATING TIME
12 ms. max.

MECHANICAL

LIFE EXPECTANCY
10^6 cycles

WEIGHT
2.5 - 3.5 oz.

ENVIRONMENTAL

TEMPERATURE
−55°C to +85°C

SALT SPRAY
48 hrs. per MIL-S-3928B

HUMIDITY
10 day test per MIL-S-3928B

VIBRATION
10 g's 10-1000 Hz per MIL-STD-202

SHOCK
15 g's per MIL-S-3928B

MODIFICATIONS

Available on special order:

1. Other types of mounting.
2. Other types of connectors.
3. Attached cables up to .25 O.D.
4. 1 Form C microswitch.
5. Epoxy molded coils.

CONNECTORS AND PART NUMBERS

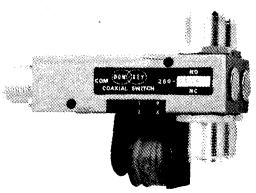
Connector Type	Part Numbers (1)
BNC	169-XX02
TNC	169-XX03
MB	169-XX06
MIN. S50 SCREW TYPE	169-XX12
MIN. S70 SCREW TYPE	169-XX17
MIL-C-22557 50 ohm Screw	169-XX10
MIL-C-22557 75 ohm Screw	169-XX15
CATV "F"	169-XX32

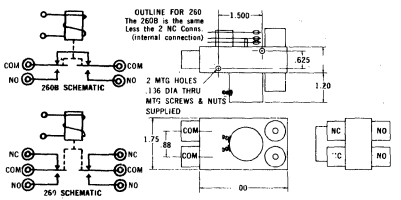
COIL CHARACTERISTICS & PART NO. DIGITS (1)

Part No. Digits	Nominal Volts	Voltage Range	Resistance Ohms ±10%
21	6 DC	4.5-7	20
22	12 DC	9-14	70
23	26 DC	19-31	290
24	48 DC	38-54	1000
25	110 DC	90-125	5000
26	115 AC	90-130	Diode Rect.

DPDT REMOTE

SERIES 260





FEATURES — These are remote operation, ruggedly constructed, coaxial switches designed for operation from low level to 1 KW. There are two basic types: The 260 is a standard DPDT switch with 6 connectors. The 260B is a similar item, except there is an internal connection between the NC contacts, leaving only 4 connectors. The latter type is widely used for inserting a circuit element, such as a power amplifier, between two normally connected elements, such as an exciter and antenna.

Both types are offered with a wide variety of connectors and coil voltages and with or without auxiliary contacts.

ORDERING INFORMATION

(1) Select coil voltage and replace XX with the two digits for the complete ordering part number.

Example: 260B-260442 is the 260B with UHF connectors, 115 AC coil and 2 Form C auxiliary contacts.

ELECTRICAL CHARACTERISTICS

Typical high frequency measurements are shown below with the switch in a 50 ohm transmission line. UHF connectors are not recommended above 400 Mhz.

Freq. Mhz	VSWR	Crosstalk —db.	Insertion Less —db.	RF Power Rating
0-50	1.05	45	.04	1 KW
100	1.06	40	.05	1 KW
400	1.12	30	.1	750 W
1000	1.3	25	.15	500 W

SPECIFICATIONS

RF and auxiliary contacts - Fine silver. Auxiliary contacts are rated 5 amps. 115 V AC

LIFE EXPECTANCY
1,000,000 cycles

OPERATING TIME
25 ms. approximately

WEIGHT
12 oz. approximately

MODIFICATIONS

Available on special order:

1. "G" type high isolation connectors on NO or NC.
2. Moisture sealing of all entrances to RF portions.
3. NC connectors on the 260B in place of the standard NO.
4. Microswitch type auxiliary contacts.
5. Gold finished RF contacts.

PART NUMBERS AND FUNCTION (1)

Connector Type	Series 260		Series 260B	
	Standard	With 2C Aux. Contacts	Standard	With 2C Aux. Contacts
UHF	260-XX04	260-XX0442	260B-XX04	260B-XX0442
50 ohm N	260-XX01	260-XX0142	260B-XX01	260B-XX0142
72 ohm N	260-XX14	260-XX1442	260B-XX14	260B-XX1422
BNC	260-XX02	260-XX0242	260B-XX02	260B-XX0242
TNC	260-XX03	260-XX0342	260B-XX03	260B-XX0342
C	260-XX05	260-XX0542	260B-XX05	260B-XX0542

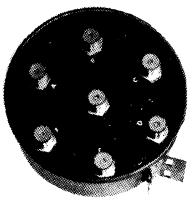
COIL CHARACTERISTICS & PART NO. DIGITS (1)

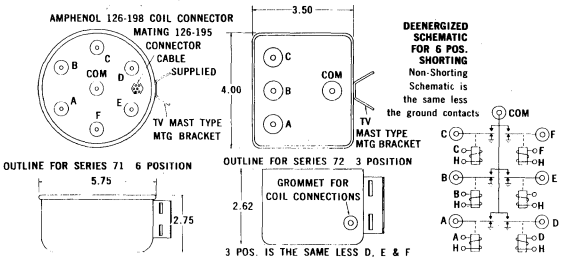
Part No. Digits	Nominal Volts	Voltage Range	Resistance Ohms ±10%
21	6 DC	5-7	12
22	12 DC	9.5-14	48
23	26 DC	19-31	245
24	48 DC	40-54	770
25	110 DC	90-125	4000
26	115 AC	100-125	Diode Rect.
27	220 AC	190-240	Diode Rect.
28	6 AC	5-7	Diode Rect.
29	24 AC	20-28	Diode Rect.

DOW - KEY *2260 Industrial Lane, Broomfield, Colorado 80020, Tel: 303 466-7303 • TELEX No. 4-5890*

MULTI-POSITION REMOTE

SERIES 71-72





FEATURES — The Series 71 and 72 are low priced, high power multi-position switches commonly used for switching antennas, transmitters or receivers at frequencies up to 500 Mhz. Both types are in weatherproof sealed cans and may be mast mounted. They are available with a wide selection of connectors, coil voltages, and shorting or non-shorting contacts. They have a separate actuating coil for each position. Any one or more inputs (outputs) may be connected to the common.

ORDERING INFORMATION

(1) Select coil voltage and replace XX with the two digits for the complete ordering part number.

Example: 72-230202 is a Series 72 3 position coaxial switch with BNC connectors, non-shorting contacts and 26 DC coil.

ELECTRICAL CHARACTERISTICS

Typical high frequency measurements in a 50 ohm transmission line.

Freq. Mhz	VSWR	Crosstalk — db Shtg.	Crosstalk — db Non-Shtg.	Insertion Loss — db	RF Power Rating
0-50	1.06	58	38	.05	1 KW
100	1.1	50	30	.08	1 KW
200	1.18	42	22	.15	1 KW
500	1.3	30	20	.25	750 W

SPECIFICATIONS

OPERATING TIME
25 ms approximately

LIFE EXPECTANCY
500,000 cycles per position

WEIGHT
Series 71 - 6 pos., approximately 3 lbs.
Series 72 - 3 pos., approximately 1.5 lbs.

CONTACTS
Fine silver

MODIFICATIONS

Available on special order:

1. Gold finished contacts
2. Special mounting brackets

PART NUMBERS (1) AND TYPE

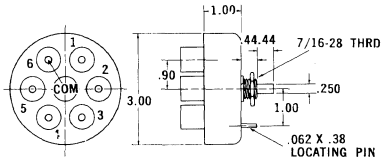
Connector Type	Series 72 - 3 Position Shorting	Series 72 - 3 Position Non-Shorting	Series 71 - 6 Position Shorting	Series 71 - 6 Position Non-Shorting
UHF	72-XX0401	72-XX0402	71-XX0401	71-XX0402
N	72-XX0101	72-XX0102	71-XX0101	71-XX0102
BNC	72-XX0201	72-XX0202	71-XX0201	71-XX0202
TNC	72-XX0301	72-XX0302	71-XX0301	71-XX0302
C	72-XX0501	72-XX0502	71-XX0501	71-XX0502

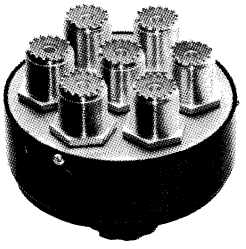
COIL CHARACTERISTICS & PART NO. DIGITS (1)

Part No. Digits	Nominal Volts	Voltage Range	Resistance Ohms ±10%
21	6 DC	5-7	12
22	12 DC	9.5-14	48
23	26 DC	19-31	245
24	48 DC	40-54	770
25	110 DC	90-125	4000
26	115 AC	100-125	245
27	220 AC	190-240	770
28	6 AC	5-7	.8
29	24 AC	20-28	12

MULTI-POSITION MANUAL

SERIES 78





FEATURES — The Series 78 are manually operated switches with true coaxial switching members (not wafer switches). They are offered in 2, 3, 4 and 6 position types, plus a transfer or crossover type and a DPDT type.

The useful frequency range is 0-1 Ghz except 500 Mhz with UHF connectors. The unused connectors are open circuited (non-shorting).

Switch is operated by pull-knob turn method.

ELECTRICAL CHARACTERISTICS

Typical electrical characteristics are shown below in a 50 ohm transmission line.

Freq. Mhz	VSWR	Crosstalk — db.	Insertion Less — db.	RF Power Rating
50	1.05	60	.03	1.5 KW
100	1.06	55	.04	1 KW
400	1.15	45	.05	1 KW
1000	1.3	30	.1	500 W

SPECIFICATIONS

WEIGHT
10 oz. approximately

MATERIALS
Connectors - silver plated brass
Body - black anodized aluminum
RF Contacts fine silver

MOUNTING
Clearance hole for 7/16 thread and 3/4 hole for locating pin supplied with mounting, nut, lock washer, knob, and escutcheon plate.

PART NUMBERS & FUNCTION

Connector Type	PART NUMBERS AND FUNCTION 1P2T	1P3T	1P4T	1P6T	2P27	Transfer
UHF	78-0204	78-0304	78-0404	78-0604	78-0704	78-0904
N	78-0201	78-0301	78-0401	78-0601	78-0701	78-0901
BNC	78-0202	78-0302	78-0402	78-0602	78-0702	78-0902
TNC	78-0203	78-0303	78-0403	78-0603	78-0703	78-0903
C	78-0205	78-0305	78-0405	78-0605	78-0705	78-0905

CONNECTOR LOCATIONS vs. FUNCTION

Function	Connector Location	Rotational Stops
1P2T	1, 2, & C	Yes
1P3T	1, 3, 5 & C	No
1P4T	1, 2, 3, 6 & C	Yes
1P6T	1, 2, 3, 4, 5, 6 & C	No
2P2T	1, 2, 3, 4, 5 & 6	Yes
Transfer	(1)	No

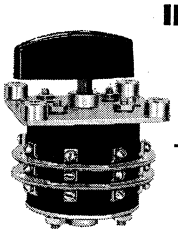
(1) Has 4 connectors spaced .90 c to c. Connectors 1-2 and 3-4 are closed in one position. 90° shaft rotation closes 1-3 and 2-4.

DOW - KEY *2260 Industrial Lane, Broomfield, Colorado 80020, Tel: 303 466-7303 • TELEX No. 4-5890*

MULTIPOLE ROTARY SWITCHES

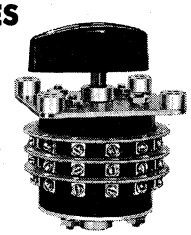
5 amperes to 200 amperes • 4, 8, 12, and 16 positions

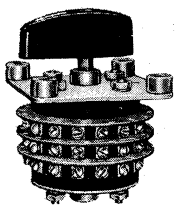
INDUSTRIAL TYPES



Type JR–10 amperes
Two to eight positions;
up to 30 sections.
Catalog E-1000.

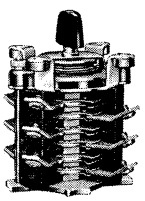
Type JM–7½ amperes
Two to twelve positions;
up to 25 sections.
Catalog E-1000.

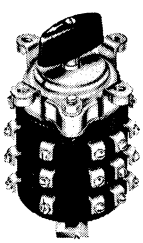




Type JK–5 amperes
Two to sixteen positions;
up to 15 sections.
Catalog E-1000.

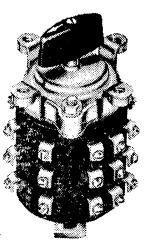
Type P–10 to 200 amp.
Two to four positions;
up to 13 sections.
Catalog E-5000.





Type JD–30 amperes
Two to eight positions;
up to six sections.
Catalog E-7000.

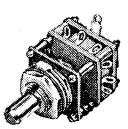
Type JS–30 amperes
Two to eight positions;
up to five sections.
Catalog E-7000.



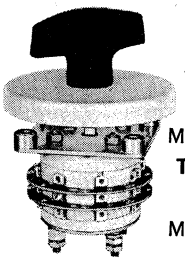


Type A–5 amperes
Two to eight positions;
up to 10 sections.
Catalog E-3000.

Type MA-12–½ ampere
Two to twelve positions;
up to five sections.
Catalog E-4000.

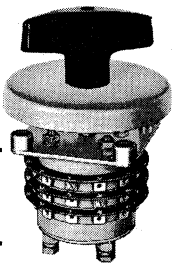


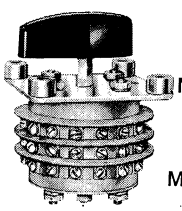
MILITARY TYPES



Type SJR–10 amperes
Two to eight positions;
up to 30 sections.
MIL-S-21604 • **Cat. E-2000.**

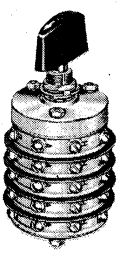
Type SJM–7½ amperes
Two to twelve positions;
up to 25 sections.
MIL-S-21604 • **Cat. E-2000.**





Type SJK–5 amperes
Two to sixteen positions;
up to 15 sections.
MIL-S-21604 • **Cat. E-2000.**

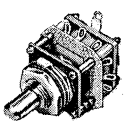
Type SJL–5 amperes
Two to eight positions;
up to 10 sections.
MIL-S-21604 • **Cat. E-3000.**

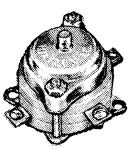




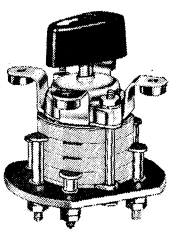
Type AF–5 amperes
Two to eight positions;
up to ten sections.
MIL-S-6807 • **Cat. E-3000.**

Type MAG-12–½ ampere
Two to twelve positions;
up to five sections.
MIL-S-3786 • **Cat. E-4000.**

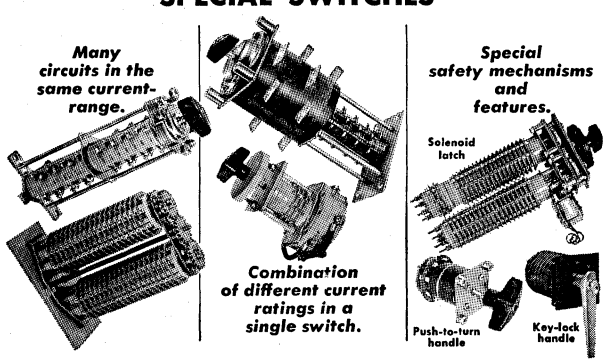




Type SR–10 to 200 amp.
Two to four positions;
up to twelve sections.
MIL-S-15291 • **Cat. E-6000.**



SPECIAL SWITCHES



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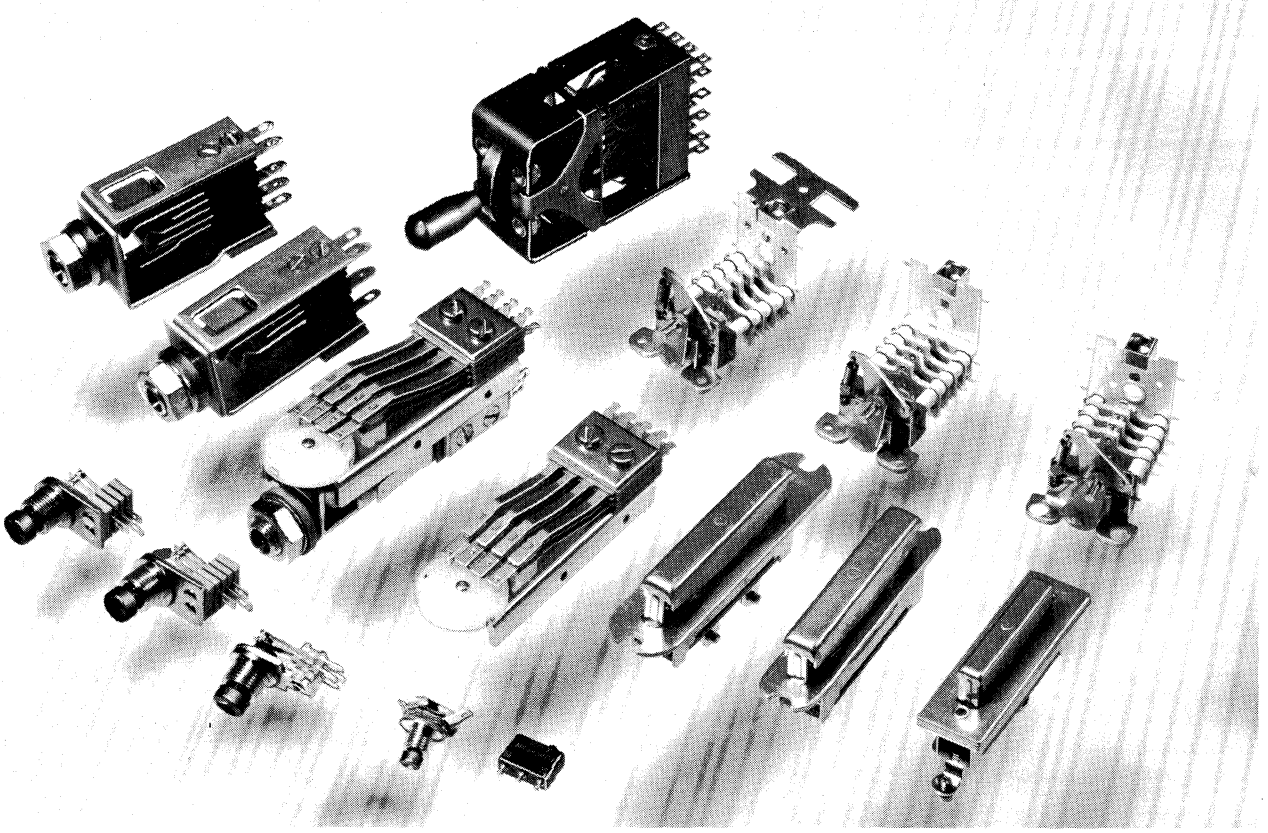

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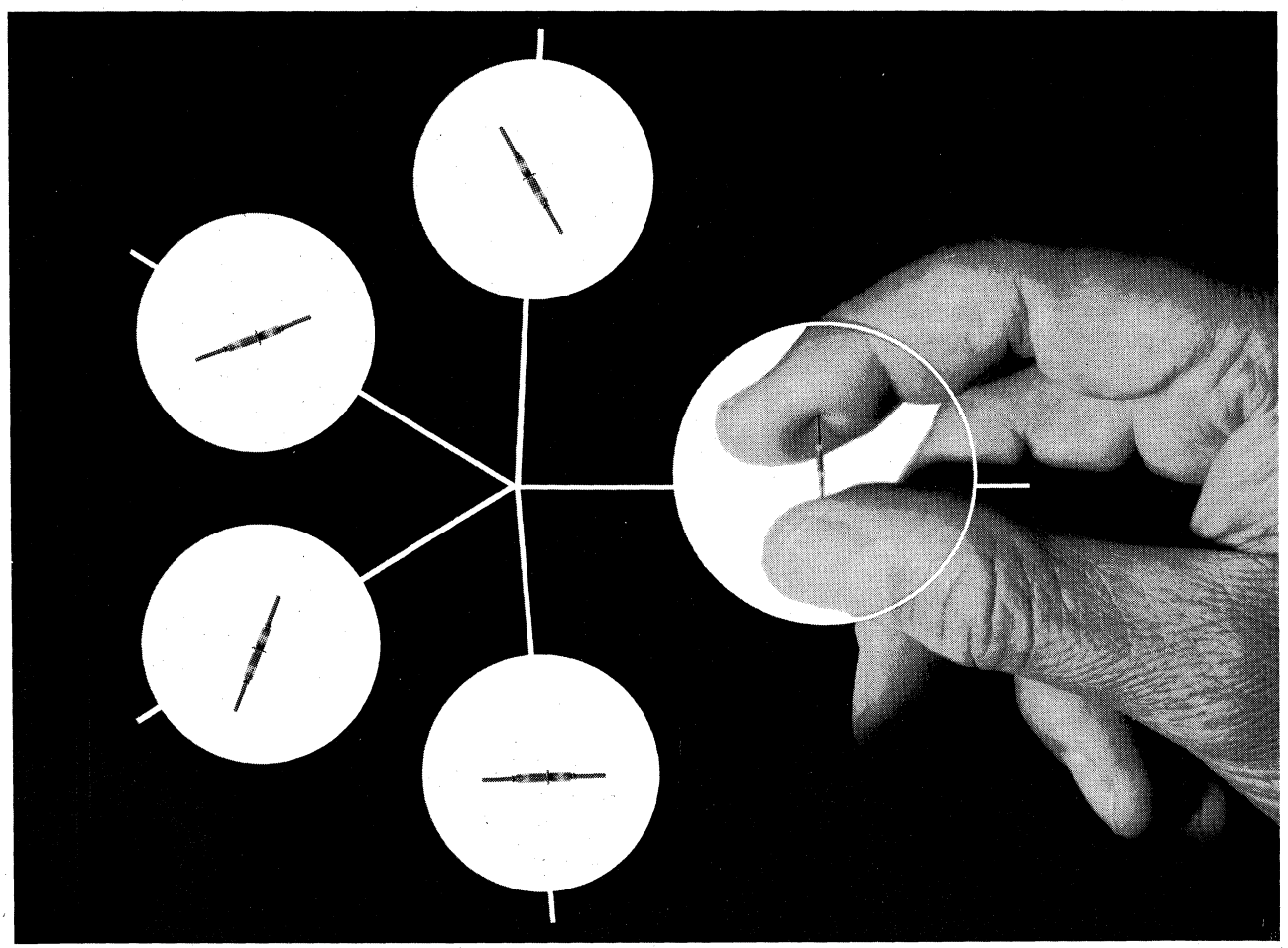

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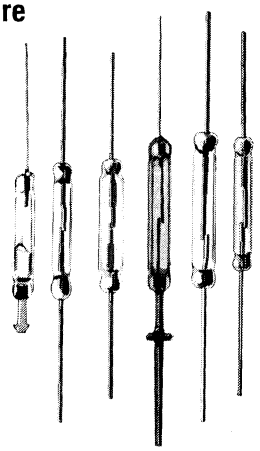
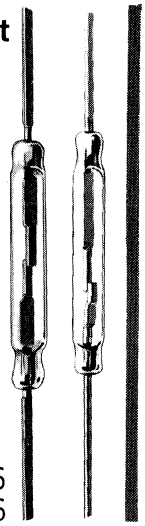
1 **Miniature**



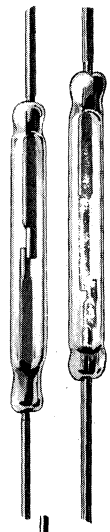
WR-126
MR-088
MR-108
MR-138
MR-308
MR-406
MR-456

2 **Compact**



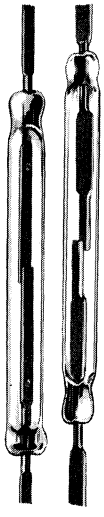
MR-506
MR-606

3 **Standard**



MR-706
MR-806

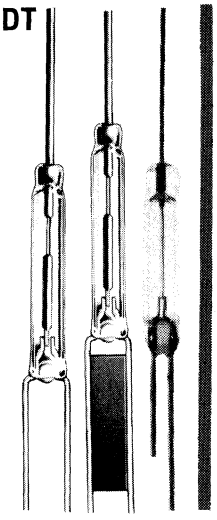
4 **Large**



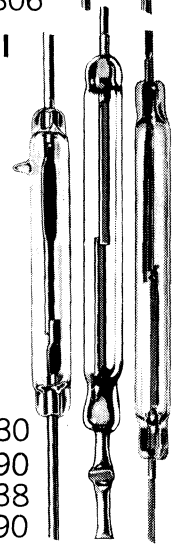
MR-906
MR-956

5 **SPDT**

MR-201
MR-200-1
MR-200-2
MR-203



6 **Special**



MR-830
MR-890
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MR-990

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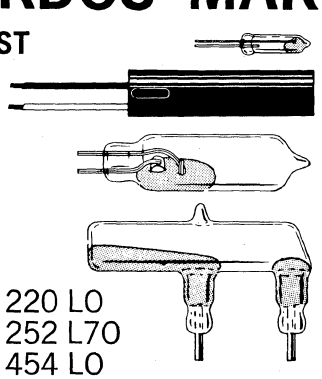
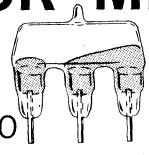
GORDOS MAKES YOUR MERCURY SWITCH.

1 **SPST**



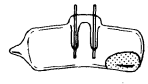
HG 220 LO
HG 252 L70
HG 454 LO
HG 721 LO

2 **SPDT**



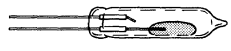
HG 461 LO

3 **Pulse**



HG 702 LO

4 **Snap (SPST)**



HG 803 LO

SPECIFICATIONS

Style	Amp. Rate	Action	Max. Diff. Angle	Nominal		
				H	L	Dia.
HG 220 LO	.1	SPST	10°	—	½	.155
HG 252 L70	2	Water-proof	14°	—	2	.400
HG 454 LO	10	SPST	5°	—	2¼	.600
HG 721 LO	25	SPST	8°	1 1/16	2⅛	.520
HG 461 LO	15	SPDT	14°	1½	1⅜	.450
HG 702 LO	3	Pulse	12°-20°	⅝	1½	.495
HG 803 LO	.2	SPST Snap	1.4°	—	1⅜	.325

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Representatives Throughout The World

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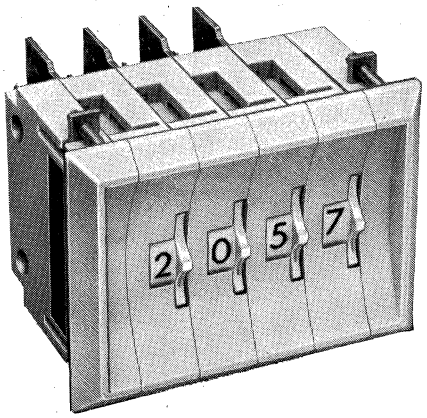
SWITCHES

CR103 TYPE F THUMBWHEEL SWITCHES



General Electric's CR103 Type F Thumbwheel Switch can save you panel space by replacing old "wafer"-type switches. It can be used wherever data are manually inserted into a machine or process — such as welding control, computer systems, and numerical control.

Each switch module is only ½-inch wide, 1¾-inches deep and 2-inches high. An assembly with 24 switch modules takes up only 12 13/16-inches in panel width.

The Switch is rated 3-amperes carrry, 150-volt a-c/d-c and is available in standard-duty and oiltight forms. Phenolic printed circuit boards are available in decimal, binary coded decimal, binary with complement, binary with oddbit parity and binary complement forms. Switch assemblies can be factory-assembled with up to 24 modules — up to 7 modules for oiltight forms.

FEATURES

- **True Oiltightness** — both for switch **and** for panel integrity. Never before offered in the industry!
- **Ordering Flexibility** — order the switches factory-assembled or purchase modules as individual units to be mounted and replaced separately. If you want to make up your own Standard-duty switches, you can order end blocks, spacers, shafts, and switch modules. Your choice of termination — plug-in, wire wrap, or taper tab/solder. Oiltight forms are available factory-assembled only.
- **Appearance Flexibility** — G.E. Thumbwheel Switches offer a wide selection of numeral color combinations. Wheels are also available with plus-minus coding. Housings ar offered in grey, black, white or beige.
- **Durable Construction** — tough, unbrekable Lexan® switch bodies, wear-resistant Delrin* wheel and Fairprene* gaskets (on oiltight forms) give this switch maximum operating life with low maintenance. The switch is easy to operate, even with a gloved hand.
- **Easy Mounting and Installation** — entire unit is assembled with four mounting shafts and eight screws at end of shafts — no matter how many switches in line. The Assembly is held snug to panel front by a simple bracket-screw design and can be mounted on any panel thickness up to ⅜-inch.
- **Neat Appearance** — large, easy-to-read numerals or symbols provide in-line visual readout of switch position. Modern switch design presents clean panel face — no screw heads on outside of panel. Spacers with solid front can be inserted to permit easy numeral or symbol series separation.

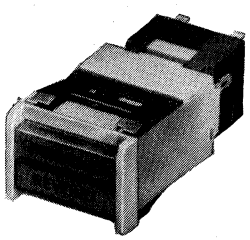
* Reg. trademark of Du Pont Company

CONTACT RATINGS

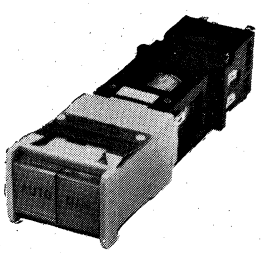
Carry continuously	3 ampere max., a-c/d-c
Voltage	150 volts max., a-c/d-c
Make	30 va a-c inductive 7.5 va d-c inductive 30 va a-c/d-c resistive
Break	15 va a-c inductive 7.5 va d-c inductive 30 va a-c/d-c resistive
Contact Resistance	100 milli-ohms max.

Write for Bulletin GEA-8124

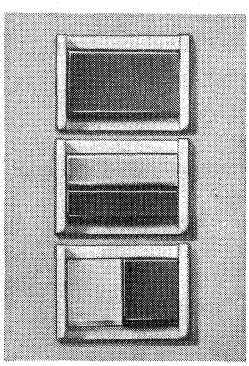
CR103 TYPE D ILLUMINATED PUSH-BUTTON SWITCHES



Illuminated push button/light with horizontal lens caps installed



Illuminated magnetically-held push button with vertical lens caps installed



Solid or split color fields give added flexibility. Colors can be mixed in the split field forms for even more combinations.

General Electric's new line of CR-103 Type D illuminated push buttons are designed for a wide variety of applications such as control and instrument panels, office machines, laboratory instruments, computers and other data processing equipment. Matching indicating lights are shown in Section 3900 on page of General Electric indicating lights.

Push buttons are rated 5 amp carry, 30 amp make at 125 volts a-c; 3 amp inductive at 30 volts d-c; 0.55 amp inductive at 125 volts d-c. Lamps are rated 28 volts maximum.

FEATURES

- Units snap into panels from front without tools, and can be gang-mounted horizontally to save space or for group functions.
- Convenient slide-on lens caps in five colors; four housing colors. Units are single button only, and have solid, horizontally- or vertically-split color fields.
- Legend inserts for all forms can be printed or engraved on acetate or similar material of 10 mils or less thickness.
- Three types of contact action are available: momentary contact with or without audible indication, maintained contact (push-on, push-off), and magnetically held contact with or without audible indication. Terminals are designed for either quick-connect or solder connections.
- Miniature flange-base incandescent lamps such as GE No. 327 (28 volts) or GE No. 328 (6 volts) are easily replaced without tools; without removing housing from panel. Lamps are supplied by customer.
- 2-lamp and 4-lamp forms are available.

Write for Bulletin GEA-7390

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

SWITCHES

Excellence in Miniaturized Push-Button Switches—Rotary Switches—Electronic Hardware

Excellence in Push Button Switches

Snap Action Switches (Momentary Contact)

	Series No.
 10 Amp., SPST and SPDT	2000

Wiping Contact Switches (Momentary Contact)

 1 Amp., SPST	4000
 ½ Amp., DPST	35
 ¼ Amp., SPST	23
 ¼ Amp., SPDT and DPDT	46

Butt Contact Switches (Momentary or Push-Pull Contacts)

 Lighted Push Button Switch — 1 Amp., SPST	40
 1 Amp., SPST	30
 Push-Pull — 1 Amp., SPST	30
 ½ Amp., SPST	39
Printed Circuit — SPDT (2 Circuit)	39

Excellence in Electronic Hardware

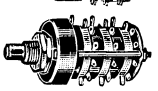
 Binding Posts	29
 "Push-Post® Terminals"	29
 Test Jacks	31
 Stand-Off Insulators	18
 Test Clips	2
 Sockets — Transistor, Pencil Tube, Bi-Pin Lamp, and Printed Circuit	22
 Module Cases, Headers and Terminal Boards	3



Full details are given in the Grayhill Engineering Catalog G-304-A.

Excellence in Rotary Switches

Standard Switches

	Series No.
 .500" Dia. O.D.–36°, 45° or 60° angles of throw–1 or 2 poles–1 deck	50
 .562" Dia. O.D.–30° angle of throw–1, 2, 3, or 4 poles–1 deck	51
 .687" Dia. O.D.–36° angle of throw–1 or 2 poles–1-12 decks	8
 .750" Dia. O.D.–30°, 45°, or 60° angles of throw–1-6 poles–1-12 decks	9
 1.01" Dia. O.D.–36° angle of throw–1 or 2 poles–1-10 decks	24
 1.015" Dia. O.D.–36° angle of throw–1 or 2 poles–1-12 decks	42
 1.170" Dia. O.D.–30°, 45°, 60°, or 90° angles of throw–1-6 poles–1-12 decks	44
 2.280" Dia. O.D.–30° angle of throw–rated at 15 Amps. at 125 VAC Resistive	19

The above standard switches are available with the following features:

	Series No.
Spring Return—a rotational force is required to maintain contact at one or more switch positions	8, 9, 24, 42 or 44
Isolated Position—one or more switch positions can be isolated from contact by normal rotation of shaft	9, 42 or 44
Printed Circuit Terminals—switch positions have printed circuit terminal for PC board mounting	8, 9, 24, 50 or 51
Concentric Shafts—two switches in one: both rotary; one rotary and one push button; or one rotary and an add-a-pot adapter	43 and 54
Panel Sealed—switches have shaft seals and panel seals to prevent moisture reaching behind panel	8, 9, 42, 44, 50 or 51
Military Type—switches have been tested and meet MIL-S-3786/4, and MIL-S-3786/20	42, 44, 50
Adjustable Stop—switches have stops which can be set and reset for any number of active positions	42, 44, 50 or 51
Keylock—using adapter switches can only be operated with key acting as shaft knob	42 or 44
Coded—switches convert decimal (10) inputs to computer codes	42
Homing Rotor—switch positions are all shorted except one	44
Progressively Shorting—each additional switch position is shorted as shaft is rotated 1 thru 6 positions	44
Unidirectional—switch shafts may be rotated in one direction only	24, 42, 44
Tap—30° angle rated at 15 amps. at 125 VAC resistive	19

WRITE Grayhill INC

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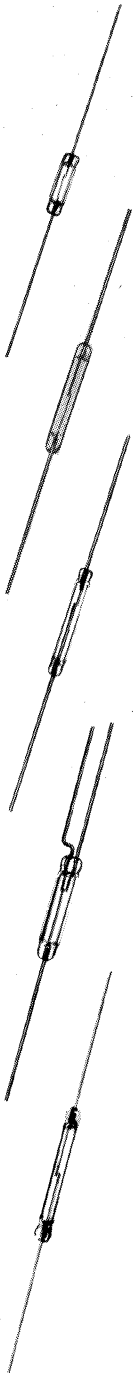
. . . the Difference Between Excellent and Adequate

HAMLIN

MICRO/MINI/TINY/SUB-MINIATURE MAGNETIC REED SWITCHES



MMRR-2
"The Grain of Wheat" — a micro-miniature Form A reed switch designed specifically for ultra-high speed, low level switching systems — extremely small in physical size for high density circuit packaging.

MINI-2
"The MINI-REED" — a low profile Form A reed switch designed specifically for low power, high speed switching with maximum sensitivity. Can be packaged into a completed relay with a finished height of .187 inches and with a relay operate power of around 150 milliwatts.

MTRR-2
A tiny Form A reed switch designed for compatibility with tiny Form C packaging. The off-center gap also makes it ideal for permanent magnet applications. Performs equally well at high or low electrical loads.

MTRF-2
A tiny Form A reed switch designed specifically for RF frequencies from 30-100 MC with negligible resistive losses. The physical dimensions is such that 52½ ohms impedance levels are obtainable with proper packaging.

MRH-DT
A tiny Form C reed switch designed specifically for high performance, instrument grade applications. Special manufacturing and inspection processes insure stable contact resistance at low level electrical loads.

MRG-DT
The first tiny Form C reed switch available commercially. Ideal for moderate current and voltage applications. Available from stock with standard terminal spacing or with other spacings optional.

MRL-DT
A tiny Form C reed switch with characteristics ideal for commercial grade applications where low cost is a requirement and broad tolerances are acceptable.

MSRH-2
A sub-miniature Form A reed switch designed specifically for high performance, instrument grade applications. Special manufacturing and inspection processes insure stable contact resistance at low level current.

MSRR-2
A sub-miniature Form A reed switch designed specifically for moderate current and voltage applications. Performs equally well at high or low levels.

MSRR-2CD
A sub-miniature Form A reed switch with a contact arrangement designed specifically for close differential operation. Ideal for permanent magnet applications where minimum magnet travel is required.

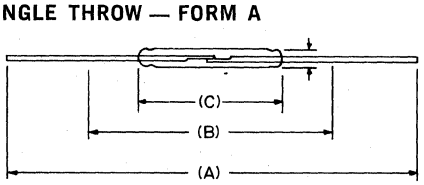
MSRR-2WD
A sub-miniature Form A reed switch with a contact arrangement designed specifically for wide differential. Ideal for applications where snap action or latching characteristics are required.

MSRL-2
A sub-miniature Form A reed switch with characteristics ideal for commercial grade applications where low cost is a requirement and broad tolerances are acceptable.

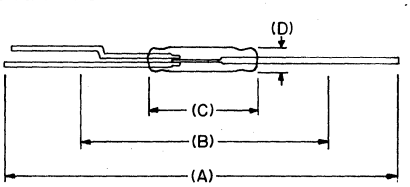
THE FOLLOWING SPECIFICATIONS ARE TYPICAL FOR 50 AT SWITCHES:

SPECIFICATIONS	MMRR-2	MINI-2	MTRR-2	MTRF-2	MRH-DT	MRG-DT	MRL-DT	MSRH-2	MSRR-2	MSRR-2CD	MSRR-2WD	MSRL-2
Contact Arrangement	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPDT Form C	SPDT Form C	SPDT Form C	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A
C = Center Gap O = Off-Center Gap	O	C	O	O	O	O	O	C	C	C	C	C
Contact Rating Watts—DC Max.	.3	3	10	.3	3	3	3	10	10	3	10	10
Switching Voltage Volts—DC Max.	28	28	100	28	28	28	28	28	200	200	200	100
Maximum Current Amps—DC Resistive	.010	.110	.250	.010	.250	.250	.250	.500	.500	.500	.500	.500
Initial Contact Resistance—Max. Ohms	.200	.200	.150	.150	.150	.150	.500	.100	.100	.200	.100	.250
Breakdown Voltage* DC Minimum	250	200	250	250	250	250	250	400	400	400	400	400
Capacitance—Pf	.25	0.2	0.2	0.2	0.8	0.8	0.8	0.2	0.2	0.2	0.2	0.2
Insulation Resistance Ohms—Internal	10^{10}	10^{10}	10^{10}	10^{10}	10^{9}	10^{9}	10^{9}	10^{10}	10^{10}	10^{10}	10^{10}	10^{10}
Stock Ampere Turn Pull-in Range	17.5 −52.5	7.5 −32.5	17.5 −52.5	27.5 −62.5	20 −60	20 −60	20 −70	17.5 −52.5	17.5 −52.5	17.5 −52.5	17.5 −52.5	20 −60
Normal Stocking Tolerance—AT	±7.5	±7.5	±7.5	±10	±7.5	±7.5	±10	±7.5	±7.5	±7.5	±7.5	±10
Drop Out Characteristics*	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Close	Wide	Normal
Actuating Time—Average Milliseconds—Incl. Bounce*	0.4	0.2	0.4	1.0	N.O. 1.0 N.C. 1.5	N.O. 1.0 N.C. 1.5	N.O. 1.0 N.C. 1.5	1.0	1.0	1.0	1.0	1.0
Engineering Bulletin No.	B-11001	B-11002	B-21102	B-21103	B-21152	B-21151	B-21154	B-31206	B-31207	B-31208	B-31209	B-31212
Standard Test Coil	L-4991	L-4991	L-4989	L-4989	L-4989	L-4989	L-4989	L-4989	L-4989	L-4989	L-4989	L-4989
Base Price—$	1.84	2.10	1.32	3.15	5.25	4.20	3.15	1.58	1.15	1.32	1.32	1.05
DIMENSIONS	* Ask for Engineering Bulletin for more specific information. • Not available at time of publication.											
(A) Overall Length—Nom.	2.000	2.000	2.125	2.125	2.125	2.125	2.125	2.250	2.250	2.250	2.250	2.250
(B) Trim Length—Min.	.500	.625	.690	.760	.735	.735	.735	.925	.925	.925	.925	.925
(C) Glass Length—Max.	.375	.500	.560	.635	.610	.610	.610	.800	.800	.800	.800	.800
(D) Glass Diameter—Max.	.090	.070	.092	.092	.130	.130	.130	.090	.090	.090	.090	.090

SINGLE POLE SINGLE THROW — FORM A



SINGLE POLE DOUBLE THROW — FORM C



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MAGNETIC REED SWITCHES • ASSOCIATED SWITCH PRODUCTS

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LAKE MILLS, WISCONSIN 53551
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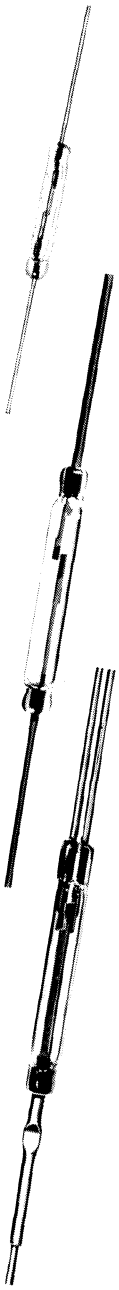
HAMLIN

MINIATURE AND COMPACT MAGNETIC REED SWITCHES



MRH-2
A miniature Form A reed switch designed specifically for high performance, instrument grade applications. Special manufacturing and inspection processes insure stable contact resistance at low level current.

MRR-2
A miniature Form A reed switch designed specifically for moderate current and voltage applications. Performs equally well at high or low electrical loads.

MRL-2
A miniature Form A reed switch with characteristics ideal for commercial grade applications where low cost is a requirement and broad tolerances are acceptable.

MRH-15
A miniature Form A reed switch designed specifically for applications requiring high insulation resistance.

MRMF-2
A miniature Form A reed switch with thermal EMF properties approximately 10% of the standard reed switch. Specifically designed for RF frequencies up to 30 MC, the physical dimensioning is such that 70 ohms impedance levels are obtained with proper packaging.

MRO-2
A miniature Form A reed switch featuring breakdown voltages to 2 KV without sacrificing any of the physical and performance criteria of the conventional miniature reed switch. Ideal for cryogenic environments.

MRR-5
A miniature Form A reed switch with a pressurized atmosphere. Designed specifically for applications requiring miniature sized packaging with high voltage breakdown at a reasonable cost.

SRR-2
A compact Form A reed switch designed specifically for moderate voltage and current applications. Performs equally well at high or low electrical loads.

SRT-2
A compact Form A reed switch designed specifically for direct operation of AC or DC relays and solenoids at switch loads up to 100 V.A. (AC). Unique contact arrangement separates the magnetic and electrical circuits to minimize bridging.

SRR-3
A compact Form A reed switch designed specifically to eliminate varying capacitance between contacts upon opening. Ideal for circuits where ringing is undesirable.

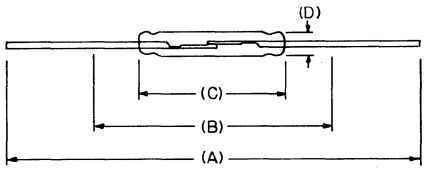
DRG-DT
A compact Form C reed switch designed specifically for moderate current and voltage applications. Performs equally well at high or low electrical loads.

DRG-DTH
A compact Form C reed switch with a pressurized atmosphere to increase the contact rating for higher electrical loads and insure a minimum contact resistance for completely reliable low level applications.

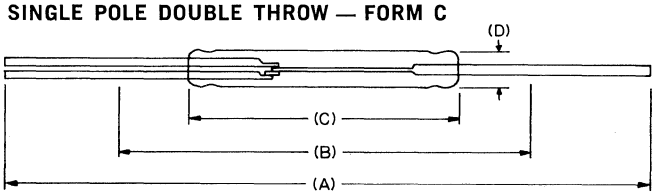
DRT-DTH
A compact Form C reed switch with a pressurized atmosphere and tungsten contacts. The atmosphere increases the contact rating while the contact material is ideal for inductive loads.

THE FOLLOWING SPECIFICATIONS ARE TYPICAL FOR 50 AT SWITCHES								...100 AT SWITCHES					
SPECIFICATIONS	**MRH-2**	**MRR-2**	**MRL-2**	**MRH-15**	**MRMF-2**	**MRO-2**	**MRR-5**	**SRR-2**	**SRT-2**	**SRR-3**	**DRG-DT**	**DRG-DTH**	**DRT-DTH**
Contact Arrangement	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPDT Form C	SPDT Form C	SPDT Form C
C = Center Gap O = Off-Center Gap	C	C	C	C	C	C	C	O	O	O	O	O	O
Contact Rating Watts—DC Max.	10	10	10	10	.3	1	10	15	100	10	3	10	20
Switching Voltage Volts—DC Max.	28	200	100	50	28	1,000	500	400	250	250	100	250	500
Maximum Current Amps—DC Resistive	.500	.500	.500	.500	.010	.001	.500	1.0	3.0	.500	.500	.500	1.5
Initial Contact Resistance—Max. Ohms	.100	.100	.250	.150	.100	.100	.100	.060	.500	.075	.075	.075	.150
Breakdown Voltage* DC Minimum	400	400	400	400	250	2,000	1,000	500	300	1,000	350	1,000	1,000
Capacitance—Pf	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.8	0.8	3.0	3.0	3.0	3.0
Insulation Resistance Ohms—Internal	10^{10}	10^{10}	10^{10}	10^{15}	10^{10}	10^{10}	10^{10}	10^{8}	10^{8}	10^{12}	10^{8}	10^{8}	10^{8}
Stock Ampere Turn Pull-in Range	17.5 −52.5	17.5 −52.5	20 −60	17.5 −52.5	27.5 −62.5	32.5 −62.5	27.5 −62.5	35 −115	57.5 −132.5	110 Max.	50 −115	50 −115	60 −115
Normal Stocking Tolerance—AT	±7.5	±7.5	±10	±7.5	±10	±10	±7.5	±7.5	±7.5	—	±7.5	±7.5	±7.5
Drop Out Characteristics*	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Wide	Close	Normal	Normal	Normal	Normal
Actuating Time—Average Milliseconds—Incl. Bounce*	1.0	1.0	1.0	1.0	1.0	1.0	0.4	2.0	3.0	1.0	N.O. 2.0 N.C. 4.0	N.O. 2.0 N.C. 4.0	N.O. 2.0 N.C. 4.0
Engineering Bulletin No.	B-41255	B-41256	B-41263	•	B-41262	B-41251	B-41258	B-51309	B-51310	B-51401	•	B-51403	B-51407
Standard Test Coil	L-4989	L-4989	L-4989	L-4989	L-4989	L-4989	L-4989	L-4990	L-4988	L-4990	L-4988	L-4988	L-4988
Base Price—$	1.58	1.15	1.05	2.10	3.15	6.30	2.10	.89	2.63	2.63	2.10	2.63	4.20
DIMENSIONS	* Ask for Engineering Bulletin for more specific information. • Not available at time of publication.												
(A) Overall Length—Nom.	2.250	2.250	2.250	2.250	2.250	2.250	2.230	3.375	3.375	3.185	3.375	3.375	3.375
(B) Trim Length—Min.	.925	.925	.925	.925	.955	.925	.925	1.875	1.960	2.012	2.012	2.012	2.012
(C) Glass Length—Max.	.800	.800	.800	.800	.830	.800	.800	1.425	1.610	1.562	1.562	1.562	1.562
(D) Glass Diameter—Max.	.130	.130	.130	.130	.130	.130	.130	.210	.195	.218	.218	.218	.218

SINGLE POLE SINGLE THROW — FORM A



SINGLE POLE DOUBLE THROW — FORM C



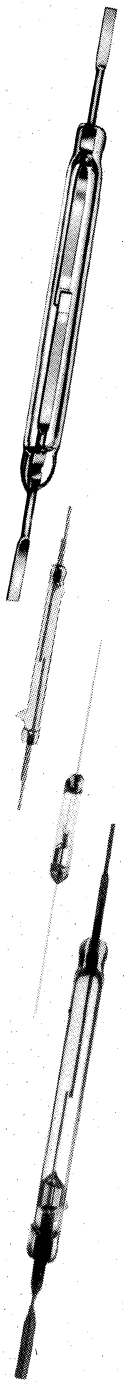
HAMLIN INC

MAGNETIC REED SWITCHES • ASSOCIATED SWITCH PRODUCTS

670 LAKE STREET
LAKE MILLS, WISCONSIN 53551
Phone Sales: 414/648-2361 • TWX: 910-260-3740

HAMLIN

STANDARD AND MERCURY-WETTED MAGNETIC REED SWITCHES



DRG-2
A competitively priced standard size Form A reed switch. Ideal for applications where the load is relatively small, and very exacting contact resistance is not a necessity.

DRR-1
A standard size Form A reed switch designed specifically for moderate current and voltage applications, performs equally well at high or low electrical loads.

DRS-2
A standard size Form A reed switch designed specifically for uniform contact resistance under dry circuit conditions or for high inrush loads.

DRR-5
A standard size Form A reed switch with a pressurized atmosphere. Designed specifically for applications requiring standard sized packaging with high voltage breakdown at a reasonable cost.

DRT-5
A standard size Form A reed switch with a pressurized atmosphere and tungsten contacts. The atmosphere increases the contact rating while the contact material is ideal for inductive loads.

DRS-5
A standard size Form A reed switch with a pressurized atmosphere designed specifically for applications with high inrush loads or high breakdown voltage requirements.

DRVT-5
A standard size Form A reed switch designed specifically for applications requiring breakdown voltage up to 5KV without sacrificing any of the physical and performance criteria of conventional reed switches.

DRVT-10
A standard size Form A reed switch designed specifically for applications requiring breakdown voltage up to 10KV without sacrificing any of the physical and performance criteria of conventional reed switches.

DRVT-15
A standard size Form A reed switch designed specifically for applications requiring breakdown voltage up to 15KV without sacrificing any of the physical and performance criteria of conventional reed switches.

DRVT-20
A standard size Form A reed switch designed specifically for applications requiring breakdown voltage up to 20KV without sacrificing any of the physical and performance criteria of conventional reed switches.

DRVT-25
A standard size Form A reed switch designed specifically for applications requiring breakdown voltage up to 25KV without sacrificing any of the physical and performance criteria of conventional reed switches.

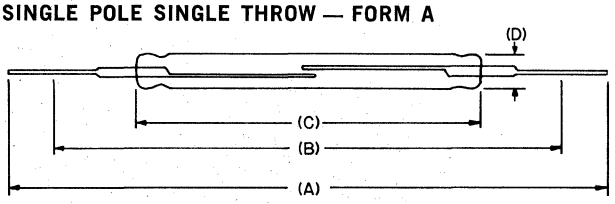
MRC-3
A miniature Form A reed switch with mercury-wetted contacts. Ideal for dry circuit or no contact bounce applications where the ultimate in reliability is required.

HRC-1
A standard size Form A reed switch with mercury-wetted contacts. Ideal for dry circuit applications or high inrush loads.

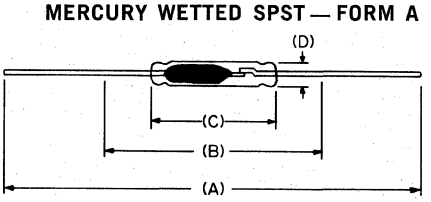
THE FOLLOWING SPECIFICATIONS ARE TYPICAL FOR 100 AT SWITCHES

SPECIFICATIONS	DRG-2	DRR-1	DRS-2	DRR-5	DRT-5	DRS-5	DRVT-5	DRVT-10	DRVT-15	DRVT-20	DRVT-25	MRC-3	HRC-1
Contact Arrangement	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A	SPST Form A
C = Center Gap O = Off-Center Gap	C	C	C	C	C	C	C	C	O	O	O	O	C
Contact Rating Watts—DC Max.	15	15	25	25	50	50	50	50	50	50	50	28	50
Switching Voltage Volts—DC Max.	250	400	250	1,000	1,000	500	3,500	7,500	12,500	17,500	20,000	100	400
Maximum Current Amps—DC Resistive	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0	3.0
Initial Contact Resistance—Max. Ohms	.075	.060	.050	.060	.100	.035	.080	.080	.100	.100	.100	.050	.050
Breakdown Voltage* DC Minimum	500	500	500	1,500	1,500	1,200	5,000	10,000	15,000	20,000	25,000	1,000	1,000
Capacitance—Pf	0.8	0.8	0.8	0.8	.08	0.8	0.8	0.8	0.2	0.2	0.2	0.3	•
Insulation Resistance Ohms—Internal	10^8	10^8	10^8	10^{10}	10^{10}	10^{10}	10^{10}	10^{10}	10^{10}	10^{10}	10^{10}	10^{12}	5×10^8
Stock Ampere Turn Pull-in Range	42.5 −132.5	42.5 −132.5	57.5 −132.5	52.5 −132.5	57.5 −132.5	57.5 −132.5	90 −150	100 −150	200 Max.	200 Max.	200 Max.	65 ±15	57.5 −132.5
Normal Stocking Tolerance—AT	±7.5	±7.5	±7.5	±7.5	±7.5	±7.5	±10	±10	—	—	—	—	±7.5
Drop Out Characteristics*	Normal	Normal	Close	Normal	Close	Normal	Normal	Normal	Normal	Normal	Normal	Wide	Wide
Actuating Time—Average Milliseconds—Incl. Bounce*	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	20.0	20.0	20.0	1.5	2.0
Engineering Bulletin No.	B-61302	B-61303	B-61307	•	B-61354	•	B-61355	B-61355	B-61355	B-61355	B-61355	B-71510	•
Standard Test Coil	L-4988	L-4988	L-4988	L-4988	L-4988	L-4988	L-4990	L-4990	L-4990	L-4990	L-4990	L-4989	L-4988
Base Price—$	.79	.89	1.32	1.58	2.10	2.10	3.15	4.20	8.40	12.60	16.80	4.20	2.10
DIMENSIONS	* Ask for Engineering Bulletin for more specific information. • Not available at time of publication.												
(A) Overall Length—Nom.	3.250	3.250	3.250	3.250	3.250	3.250	3.250	3.250	3.195	3.195	3.195	2.250	3.250
(B) Trim Length—Min.	2.250	2.550	2.400	2.400	2.400	2.400	2.400	2.400	2.400	2.400	2.400	.835	2.400
(C) Glass Length—Max.	2.100	2.100	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	.710	1.950
(D) Glass Diameter—Max.	.215	.215	.207	.210	.210	.210	.218	.218	.218	.218	.218	.130	.218

SINGLE POLE SINGLE THROW — FORM A



MERCURY WETTED SPST — FORM A



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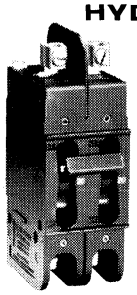
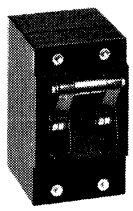
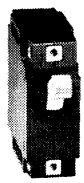
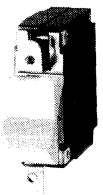
HEINEMANN

HYDRAULIC-MAGNETIC CIRCUIT BREAKERS


E-FRAME


SERIES AM12


SERIES JA


JC1

Heinemann breakers offer almost unlimited options: integral or fractional ratings from 10 milliamp to 100 amp, and in steps to 225 amp; single and multipole models (to six poles); breakers for 60 or 400 Hz AC, or DC service; breakers that meet Mil Specs; and models with special internal circuits like relay-trip and calibrating-tap for control functions. Hydraulic-magnetic actuation assures that ratings and trip points are unaffected by ambient temperature changes. A wide selection of time-delay characteristics permits close match of breaker to equipment requirements. Request the Heinemann Engineering Guide (Bulletin 202), or the Condensed Guide (303), or contact your Heinemann representative. Individual product bulletins listed below.

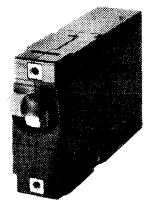
E-FRAME: Smaller than other E-Frame breakers, competitively priced. Approx. 5¾h x 2w x 2⅝"d (2-pole). Available in 1 to 4 poles.

SERIES AM12: 1 to 6 poles. Special circuits available. Approx. 2½h x 1½w x 2½"d (2-pole).

SERIES JA: Compact OEM breaker. Only 2.5 oz/pole. 1, 2, or 3 poles. Approx. 2h x ¾w x 1⅞"d (1-pole).

SERIES JA VARIANTS: Single-pole snap-in Model JB1 installs in rectangular panel cutout without need for screws or tools. Single-pole Model JC1 (shown) substitutes attractive white or gray rocker handle for standard toggle. Bulletins 3360 and 3380.

SOLID-STATE ELECTRONICS PROTECTORS



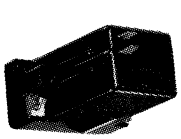
The new **Heinemann JA/Q™ Electronics Protector** provides security, in a single package, against three of the major causes of failure in solid-state components: voltage transients, overvoltage, and overcurrent. A solid-state voltage sensor detects overvoltages and transients on the supply line. If their amplitude exceeds a predetermined safe level, the detector fires, shunting the load (typically within 500 nanosec). The protected equipment never sees the full transient. The shunted current surge is then sensed, and the protector trips, disconnecting the equipment. Current ratings 0.5 to 10 amp DC, firing voltages 5 to 50 volts DC. 2h x .75w x 3.93"d. Bulletin 3370.

CONDENSED GUIDE TO HEINEMANN CIRCUIT BREAKERS

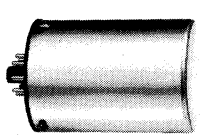
Type	Series	Bulletin	Poles	Maximum* Voltages	Interrupting Cap. (amp)	Current (amp)
PANEL MOUNTING	E-Frame	3104	1,2,3,4	240 AC 480 AC 240 AC (400~) 125 DC	10,000 5,000 5,000 5,000	0.01 to 100 0.01 to 100 0.15 to 100 0.05 to 50
	EH-Frame	3441	2,3	480 AC	15,000	0.5 to 100
	CJ	3111	2	120/240 AC	10,000	125 to 200
			3	240 AC	10.000	100 to 225
GENERAL PURPOSE	1163	3411	1,2,3	250 AC 125 DC	5,000 5,000	0.01 to 100 0.016 to 100
AUXILIARY	0111	3201	1	250 AC	1,500	0.01 to 50
AM SERIES	AM12	3305	1,2,3, 4,5,6	250 AC 250 AC (400~) 50 DC	1,000 1,000 2,000	0.02 to 50 0.10 to 50 0.02 to 50
	AM1000	3305	1,2,3	250 AC 250 AC (400~) 125 DC	1,500 1,500 2,000	0.01 to 70 0.15 to 65 0.015 to 100
MINIATURE	JA	3350	1,2,3	250 AC 250 AC (400~) 65 DC	1,000 1,000 1,000	0.020 to 30 0.100 to 30 0.020 to 20
SUBMINIATURE	SM	3504	1,2,3	250 AC 250 AC (400~) 50 DC	300 300 500	0.05 to 20 0.05 to 20 0.05 to 20

*AC voltages are 60 Hz unless marked with (400~).

TIME-DELAY AND OVERLOAD RELAYS

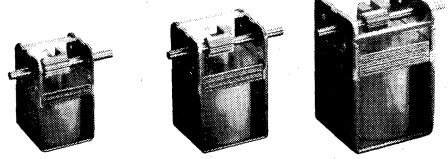






Silic-O-Netic® overload relays: close-tolerance overload protection. Always carry 100% of rated current, trip as low as 115% of load. Up to 70 amp. Bulletin 5103.
Silic-O-Netic time-delay relays: dependable, economical, for delays from ¼ to 120 seconds. Five models: open or enclosed contacts, dust-proof covers, hermetic, or trip-indication. Continuous-duty coils, DPDT contacts eliminate slave circuits, reduce equipment costs. Bulletin 5006.

STEPPING MOTORS



Roto-Netic® stepping motors operate on a totally new principle: simple linear force (solenoid-actuated) converted to discrete rotary motion. Starting torque from 1.4 to 25 oz-in. with avg. power consumption less than 12 watts. Eight, ten, or twelve steps per shaft revolution with no cumulative error. Minimum life 10 million steps, typical life 30 million steps. Priced substantially below motors of comparable performance. Bulletin 702.

HEINEMANN ELECTRIC COMPANY 2636 Brunswick Pike, Trenton, N.J. 08602

BUILDING BLOCK UNITIZED MODULAR PUSH BUTTON SWITCH SERIES C, CL, CC

New

Completely new and revolutionary unitized construction.

A Start with basic momentary switch.
B Add wire staple to convert to push-push action.
C Add release bar unit for interlocking action.
D Add lamp contact unit for illumination.
E Choice of four different snap fit buttons.
F Add blocking discs and pins for blocking action.

STANDARD FEATURES

Disengage plastic lock bar to remove plunger and bridging contacts from front for servicing or replacing. without disturbing position or connections. Solder lugs on top- PC terminals on bottom (2 amp. rating). Two, coil spring loaded, center pivoting, contact bridges for each PDT.

Non shorting contacts.

OPTIONAL FEATURES

Blocking action – no 2 buttons depressed at the same time.
Shorting contacts.
Timing contacts either leading or lagging.
Gold plated contacts.
Auxiliary solder lug switching contacts on top of switch module (1 amp.).

CONTACT SURFACES

Standard = Hard silver plating .0004 inches.
Special = Silver plated .0004 inches plus hard gold covering .00012 inches.

CONTACT SWITCHING

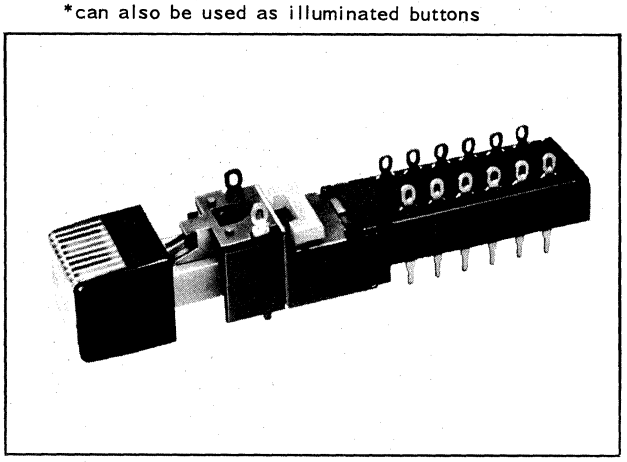
Standard = Non shorting

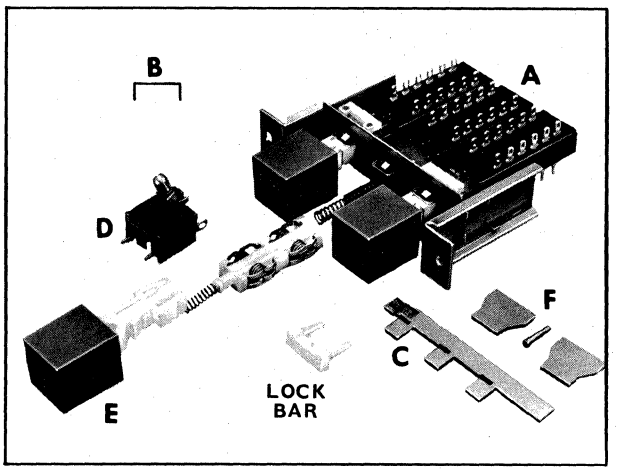
Shorting = ks
Leading = V
Lagging = N

CHASSIS AND STATION DATA

Model number	17.5	22.5
Center to center spacing	.690	.886
Number of stations	1-15	2-12
Standard buttons	CB CJ CQ* CR*	CH*

*can also be used as illuminated buttons





Switch modules in 4 different lengths

2PDT 4PDT 6PDT 8PDT
.197" solder lugs – top, .197" PC term. bottom.

+1no +1PDT/1no +2PDT/1no +3PDT/1no
.197" auxiliary contacts – top side only.

MECHANICAL ACTION

Gr = Interlocking

Gr_1 Gr_2 = Two or more independent interlocking groups.

oA = Momentary

AoR = Central release key Momentary action

EE = Push to make push to break

Z = Central release for independent interlocking groups, or individual latching.

Sp = Blocking action only one key down. Switching is delayed to increase margin of safety.

Series CC available in multiple banks up to 10x10.

Series CL available in multiple banks up to 10x10.

Series CL is illuminated – Slip on lamp holder L (uses type 4622 lamps). See lamp table.

ELECTRICAL DATA

Max. voltage 1000V
Max. current 2 A cos $\varphi = 0.8$
Max. rating 250W AC
Max. rating 100W DC
Test voltage between contacts & chassis 1500V
Insulation resistance $10^{10}\ \Omega$
Contact resistance 6m Ω

MECHANICAL DATA

Key travel = .315"
Contact travel = .197"
Key pressure 2&4PDT $\approx$ 35 OZ.
Key pressure 6&8PDT $\approx$ 49 OZ.
Life cycles $\approx$ 500,000 cycles under load.

IEE® WELCOMES YOUR INQUIRIES. Dimensional drawings and quotes on request. Quantity prices less than 65¢ per station.

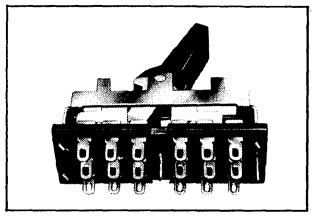
INTERNATIONAL ELECTRO EXCHANGE CORP. 6851 Oxford St., Minneapolis, Minn. 55426 PHONE: (612) 929-7875 TWX: 910-576-2469

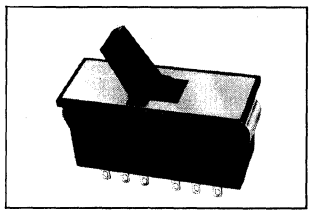
New

SPECIAL LEVER SWITCH SERIES Y

With two independent two or three P.D.T. contacts and three lever positions.

SCHADOW





Type of Contacts
standard: non-shorting

- ks — shorting
- V — timing contacts, leading
- N — timing contacts, lagging

Contact Arrangements

- 2u — two independent D.P.D.T.
- 3u — two independent 3 P.D.T.

Contact Material
standard: fixed terminals .0004 in. silver-coated bridging contacts .0004 in. solid silver plated

- 3Au — additional SELREX with gold plating .00012 in.

Mounting Facilities

- YA — for twist – tab mounting
- YB — for screw mounting
- YC — multiple sets (standard for screw mounting)
- YD — flush fitting switch for quick mounting in high impact – 1/8" thick panel plastic case hole size 1.582 x .578

Lever-stop Positions

- 3R — left, zero, right
- 1R — zero, momentary action on left and right
- 2R — zero and left (or zero and right), right (or left) momentary action

Terminals

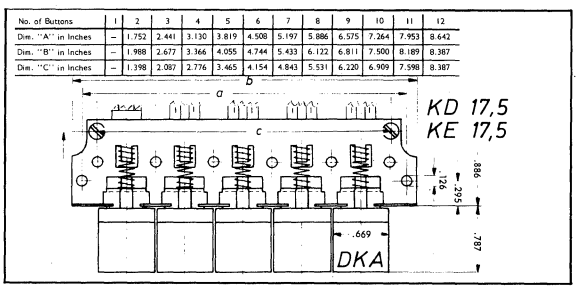
- L — soldering lugs
- S — P.C. terminals

Technical Data
max. current 1 A
max. voltage 300 V
max. rating 50 W
Test voltage 1500 V RMS
standard insulation resistance 5 x 10^{10} ohms (after 96 hrs., 70°F. 100% RH)
for special requirements up to 10^{12} ohms
contact resistance 10 m ohms

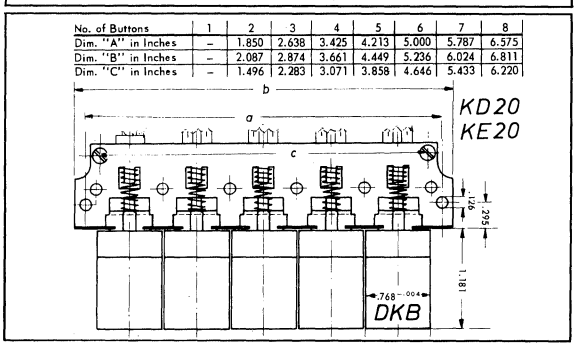
PIANO KEY SWITCHES SERIES KD AND KE

Features: Retains all the advantages of Series D&E switches. Key switch mechanism secures to switch chassis with only 2 screws. Switch terminals may be flow soldered to PC Board prior to assembly. Easy to service since the key can be withdrawn by simply disengaging a catch. The switch contact plungers are then removable from the front without disturbing the remainder of the assembly. Available .689" and .787" centers.

No. of Buttons	1	2	3	4	5	6	7	8	9	10	11	12
Dim. "A" in Inches	–	1.752	2.441	3.130	3.819	4.508	5.197	5.886	6.575	7.264	7.953	8.642
Dim. "B" in Inches	–	1.988	2.677	3.366	4.055	4.744	5.433	6.122	6.811	7.500	8.189	8.387
Dim. "C" in Inches	–	1.398	2.087	2.776	3.465	4.154	4.843	5.531	6.220	6.909	7.598	8.387



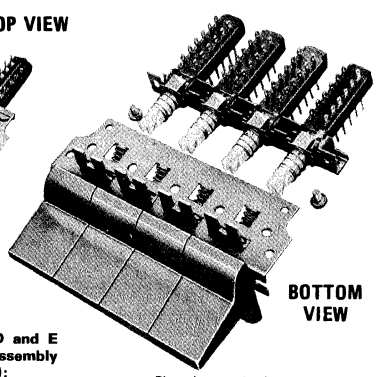
No. of Buttons	1	2	3	4	5	6	7	8
Dim. "A" in Inches	–	1.850	2.638	3.425	4.213	5.000	5.787	6.575
Dim. "B" in Inches	–	2.087	2.874	3.661	4.449	5.236	6.024	6.811
Dim. "C" in Inches	–	1.496	2.283	3.071	3.858	4.646	5.433	6.220





TOP VIEW

Piano key switch
4 x KD 20 DKB–4PDT
consisting of mechanism with button type DKB and push button switch 4 x D 20–4PDT



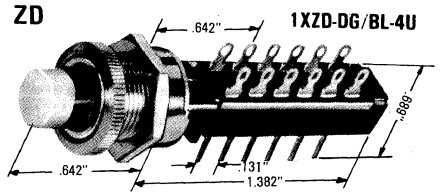
BOTTOM VIEW

Piano key mechanism separated from push button switch.

Additional cost to D and E prices for piano key assembly are (including buttons):
KD-KE 17.5 15¢ per station
KD-KE 20 18¢ per station

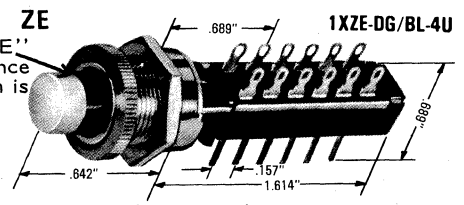
SERIES ZD ZE SINGLE HOLE MOUNT PUSH BUTTON SWITCHES

ZD — 1XZD-DG/BL-4U



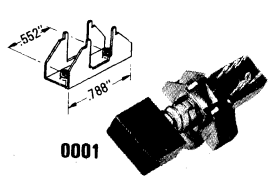
ZE — 1XZE-DG/BL-4U

"VISI-STRIPE" tells at a glance if the switch is on or off.

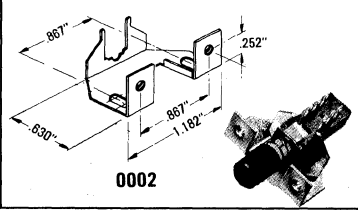


- Mount in .551" dia. hole
- Power switches available
- .125" maximum panel thickness

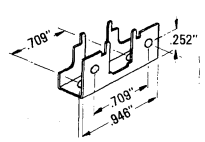
SINGLE STATION CHASSIS



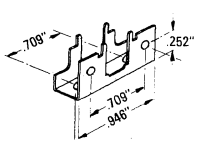
0001



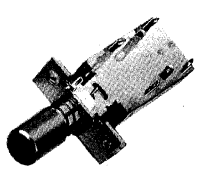
0002



0003-00



0003-01
Threaded Hole
Chassis Bottom



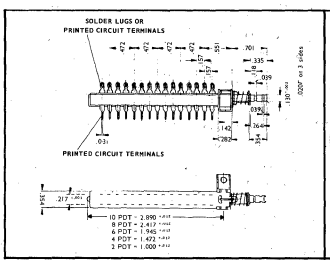
INTERNATIONAL ELECTRO EXCHANGE CORP. 6851 Oxford St., Minneapolis, Minn. 55426 PHONE: (612) 929-7875 TWX: 910-576-2469

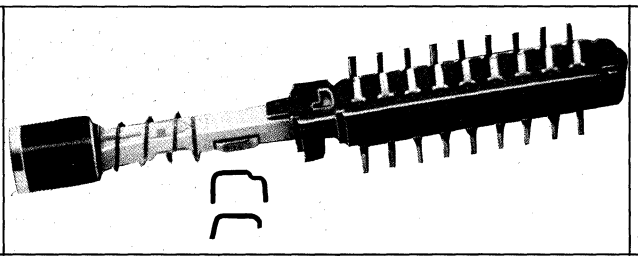
SECTION 5100

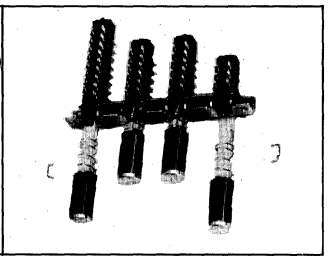
New MINIATURE MODULAR PUSH BUTTON SWITCH SERIES F

Uniquely designed to improve versatility and serviceability.

SCHADOW







Compress spring and lift out locking staple to remove plunger and bridging contacts from front of switch w/o disturbing switch position or electrical connections. Exchanging short staple for a long staple converts switch from momentary to push-push action.

Features: Inexpensive • Proven dependability • Modular design • Versatile • Completely enclosed • Up to 10 PDT • Infinite combinations • Solder lug or PC terminals • Smooth slide action • Largest selection of chassis spacings • Largest selection button styles and sizes • UL and CSA approved 4A 250VAC power switch • All dimensions permit retrofit with most competitively priced switches.

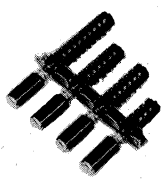
Available 2, 4, 6, 8 and 10 PDT. Power switch available w/2, 4, and 6 PDT integrated.

MINIATURE SERIES F PUSH BUTTON SWITCH KIT LIST PRICE $19.95

KIT CONTENTS



23 Switches
Non-shorting contacts
16 - 2PDT
4 - 4PDT
2 - 6PDT
1 - 8PDT



40 Assorted Buttons
All are push-on snap fit type – No epoxying necessary.

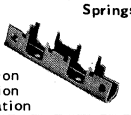
12 Chassis
2 - Single Station
2 - 2 Station
2 - 4 Station
2 - 6 Station
2 - 8 Station
2 - 10 Station

23 Wire staples to convert momentary to push push



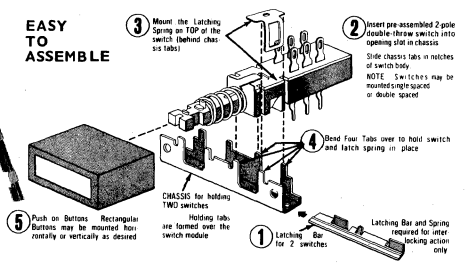
10 Assorted Latching and Release Bars

10 Latching Springs





EASY TO ASSEMBLE



CONTACT MATERIAL:
Fixed contact surfaces silver coated .0002"
Moving contact surfaces silver coated .0004"

TYPES OF CONTACTS AVAILABLE:
Solder lugs top, PC terminals bottom
PC terminals on top and bottom .197"
PC terminals top .539", PC terminals bottom .197"

SPECIAL TYPES:
oA = Momentary (spring return)
Gr = Interlocking
Gr_1, Gr_2 = Divided into independent interlocking groups
AoR = Operation w/o latching but releasing interlocking
EE = Push to make – push to break
NE 15 = Power switch 4A/250VAC DPDT (D or E Series)
NF 15 = Power switch 4A/250VAC DPDT (F Series)

TECHNICAL DATA:	Series D	Series E	Series F
Max. current	1 A	1 A	1 A
Max voltage	250 V	300 V	300 V
Max. rating	50 W	50 W	50 W
Contact resistance	3-6mΩ	5-7mΩ	5-7mΩ
Key pressure w/2 & 4 PDT	28 oz.	28 oz.	28 oz.
Key pressure w/6 PDT...	42 oz.	42 oz.	42 oz.
Key pressure w/8 PDT...	53 oz.	53 oz.	42 oz.
Key pressure w/10 PDT..			42 oz.
Key pressure w/Power switch		35 oz.	35 oz.
Cap. between contacts of a row	<0.7 pF	<0.6 pF	<0.6 pF
Cap. between moving contacts of adjacent rows..	<0.9 pF	<1.0 pF	<1.0 pF

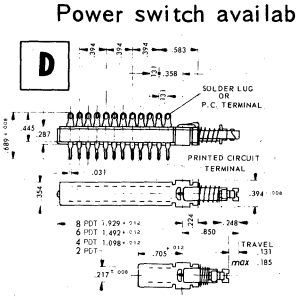
CHASSIS

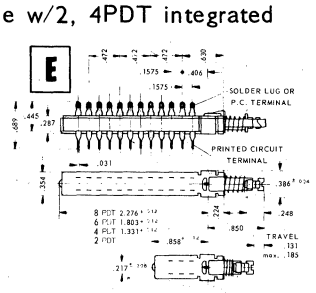
Chassis model	10	12.5	15	17.5	¾"	20
Center to Center	.394"	.492"	.591"	.689"	.750"	.787"
Number of Stations	2-15	2-11	2-12	2-12	2-12	2-10

MINIATURE PUSH BUTTON SWITCH

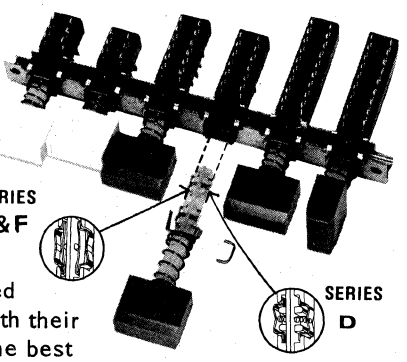
Series D and E

Available – 2PDT, 4PDT, 6PDT and 8PDT
Power switch available w/2, 4PDT integrated





IEE® WELCOMES YOUR INQUIRIES
Dimensional drawings and quotes on request.



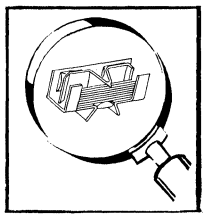
Enlarged view showing silver plated bridging contacts with their spring balance for the best contact pressure and durability.

INTERNATIONAL ELECTRO EXCHANGE CORP. 6851 Oxford St., Minneapolis, Minn. 55426 PHONE: (612) 929-7875 TWX: 910-576-2469

STANDARD PUSH BUTTON SWITCHES TYPE M, MM, ML

FEATURES: Novel patented design sliding contacts. Contacts silver plated Unique design positive action. Small dimension 500V rating. All standard action operations. Up to 4 PDT on wafer .79" deep. Up to 8 PDT on wafer 1.54" deep. Use double button to double capacity of contact per station. 15 stations maximum in one row. IEE fluorescent type button also available. Series MM provides double deck up to 30 stations. Wide selection of buttons. ML Series provides illumination. **FLOATING CONTACT** principle use short double sided solid contact plates with balanced steel spring. Guarantees: equal pressure at all contact points, extremely low resistance and self inductance plus smooth movement of keys.

Available 2, 4, 6 and 8 PDT.



CHASSIS GROUPING DATA

Model 17.5
Center to center .689"
No. of stations 1-15
MM Series up to 30 stations

MECHANICAL ACTION

Momentary (oA)
Push push (EE)
Interlocking (Gr)
Individual latching with central release key or solenoid (E+Z)
Blocking (SP) delayed switching to provide safety margin
Power switch* N 10/2a 2A/ 250V AC
Power switch available with 2PDT integrated

DIMENSIONS

Height (w/o contacts) .472"
Depth 2 & 4 PDT includes travel 1.063"
Depth 6 & 8 PDT includes travel 1.858"

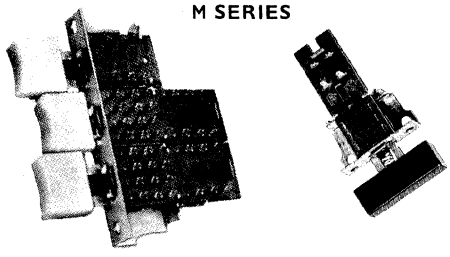
TYPES OF CONTACTS (STANDARD)

Solder lugs (non shorting)
PC Terminals (non shorting)
Shorting types available on request
Rhodinated and gold plated also available

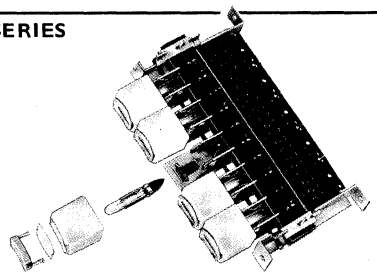
TECHNICAL DATA

Max current 1A
Max voltage 500 VAC
Max rating 100W
Contact resistance 3-6 M Ω

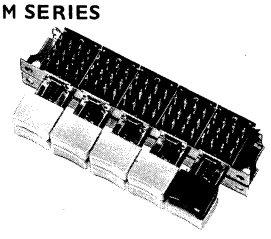
M SERIES



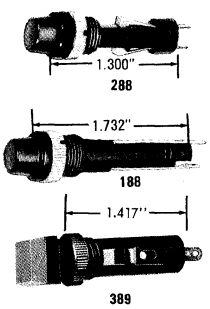
ML SERIES



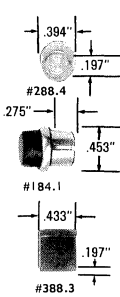
MM SERIES



IEE PILOT LAMP SOCKETS AND LENS



288.1 Single round pilot lamp socket uses #288-4 lens.
288.4 Round flat t ˅ plastic lens.
188.2 Single round pilot lamp socket uses #184.1.1, #79.2 or #288.4 lens.
184.1 Round flat top glass lens.
79.2 Same as above but convex top. (Both with plated metal ferrule)
389.1 Single square pilot lamp socket uses 388.3 lens.

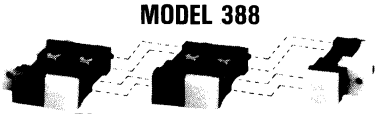


388.3 Square flat top, plastic lens.

All lens available in red, green, blue, yellow, clear and white.

All lamp sockets require .402" mounting hole. Use Type 5530 lamps as shown in miniature switchboard lamps table below.

PANEL LAMP INDICATOR ASSEMBLY MODEL 388



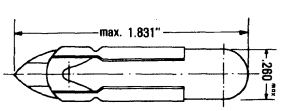
FEATURES:
- Modernistic building block design
- Removable colored lenses, square or round.
- Up to 10 modules may be locked together into one bank.
- Small space requires only 7/16" x 5" x 1½" (depth) for 10 lamp bank.

LAMP EXTRACTORS
#110 for Type 5530 lamps
#153 for Type 6844 lamps



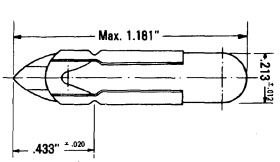
STANDARD SWITCHBOARD (TELECOMMUNICATION) LAMPS – Type 6844

6V - 20, 40, 80, 200 ..... mA
12V - 20, 40, 50, 120 ..... mA
18V - 20, 40, 100 ..... mA
24V - 25, 40, 50, 60, 80, 100 mA
30V - 20, 50 ..... mA
36V - 20, 50, 60 ..... mA
48V - 20, 40, 50, 60 ..... mA
50V - 20, 50, 60 ..... mA
60V - 20, 40, 50, 60 ..... mA



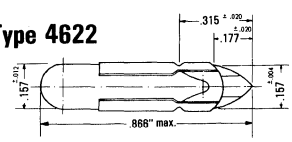
MINIATURE TELECOMMUNICATION "LILIPUT" – Type 5530

6V - 20, 40, 200 ..... mA
12V - 20, 50, 100 ..... mA
18V - 25 ..... mA
24V - 20, 30, 50 ..... mA
30V - 20, 40 ..... mA
36V - 20 ..... mA
48V - 20, 30 ..... mA
60V - 20 ..... mA



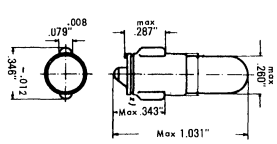
MINIATURE "LILIPUT" LAMPS – Type 4622

6V - 50 ..... mA
12V - 40 ..... mA
24V - 20 ..... mA



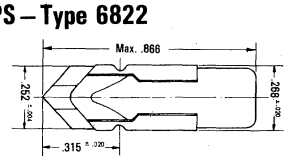
MINIATURE TELECOMMUNICATION LAMPS – Type 7110

6V - 40, 100 ..... mA
12V - 50 ..... mA
18V - 50 ..... mA
24V - 25, 40, 50, 70 ..... mA
30V - 30 ..... mA
36V - 20, 50 ..... mA
48V - 20, 50 ..... mA
60V - 20, 40 ..... mA



STANDARD SWITCHBOARD LAMPS – Type 6822

6V - 20, 40 ..... mA
12V - 20, 40, 50 ..... mA
24V - 25, 40, 50, 60 ..... mA
36V - 20, 50 ..... mA
48V - 20, 40, 50 ..... mA
60V - 20, 40 ..... mA



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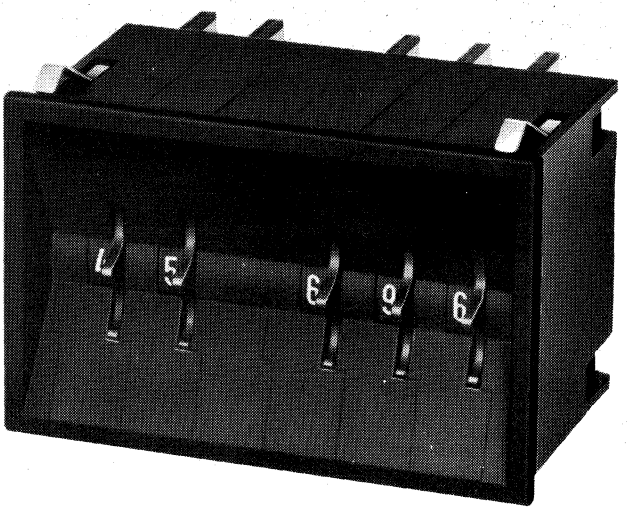
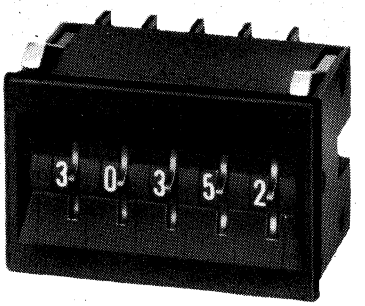
THUMBWHEEL SWITCHES





Get coded outputs from simple dial settings

Model B INTERSWITCH* MODULES

2.300" h. x 2.700" d. x 0.500" w. (per module)

Positive indexing, decimal input to binary or decimal output. Front mounting, simple rectangular cut-out. Cam spring retention. Matte black, matte tan.

Units Available:

2 position, double pole (0, 1 or +,—)
10 position, single pole
11 position, single pole
2 x 5 position, double pole
10 position, binary codes
11 position, binary codes
blind slave, with decimal carry
10 position, dial only module
end plates
spacers

Optional Features:

dial stops
make before break contacts
component mounting board
decimal point light conductor
illuminated dial
colored thumbwheels

Technical Data:

rated current 1 amp
contact rating (resist. switching) 0.1 amp
max. working volts 50 ac or dc.
contact resistance, including PC board $7 \times 10^{-2}\ \Omega$
temperature rating —20 to +60 C
operating life 1×10^{6} operations
wiring termination solder or edge connector

Model M INTERSWITCH* MODULES

1.300" h. x 1.500" d. x 0.315" w. (per module)

Feature ultra-thin modules. Positive indexing, decimal input to binary or decimal output. Front mounting, simple rectangular cut-out. Cam spring retention. Matte black, matte tan.

Units Available:

2 position, double pole (0, 1 or +,—)
10 position, single pole
11 position, single pole
2 x 5 position, double pole
10 position, binary codes
11 position, binary codes
10 position, dial only module
end plates
spacers

Optional Features:

dial stops
component mounting board
illuminated dial
colored thumbwheels

Technical Data:

rated current 1 amp
contact rating (resist. switch) 0.1 amp
max. working volts 50 ac or dc.
contact resistance, including PC board $7 \times 10^{-2}\ \Omega$
temperature rating —20 to +60 C
operating life 1×10^{6} operations
wiring termination solder or edge connector

Model T INTERSWITCH* MODULES

1.150" h. x 1.250" d. x 0.500" w. (per module)

Miniature modules are interchangeable mechanically and electrically with other similar thumbwheel switches. Any combination of these modules may be "ganged" into one complete, compact assembly that requires no special mounting brackets or hardware. Circuit board contained within switch case.

SWITCH ASSEMBLIES

Assemblies consisting of any combination of switches or options are available from stock, at Burlingame, Calif.

SPECIAL MARKINGS

Dials or switch bodies can be imprinted with any combination of numbers, letters, etc., to meet your needs.

MORE SWITCHES ...MORE DATA

Find out about our complete line of thumbwheel switches. We can furnish special switches for your particular designs—and we can deliver on schedule to solve your problems—to do your job.

2N-9102

INTERSWITCH

For fast engineering application assistance, complete specifications including binary coding, or ordering information, call (415) 347-8217 or TWX 910-374-2353 now. For more technical data and catalog information, write INTERSWITCH, 770 Airport Boulevard, Burlingame, Calif. 94010.

★Trademark

J-B-T 30th Year®

SWITCHES*

J-B-T INSTRUMENTS, INC.

J-B-T 30th Year®

TOGGLE SWITCHES

HEAVY DUTY TYPES, INCLUDING MS25068, MS35058, MS35059, ST40, 42, 50, 52 SERIES

NOMINAL RATINGS — 20 Amp. at 125 VAC, 10 Amp. at 250 VAC . . . **MIL-S-3950C** — MS35058 models with suffix -21 and above, similar MS35059 types, and the outstanding **4-POLE SERIES** exceed the rigorous electrical requirements of MIL-S-3950C, and are recommended for maximum performance. All MS models have bushing seal to meet sand and dust test and latest toggle seal splash test, also former MIL-S-3950B 15-foot head of water submersion test . . . **Bulletin TS-966A.**

MEDIUM DUTY TYPES, INCLUDING MS25098 AND MS25100 SERIES

NOMINAL RATINGS: 6 Amp. at 125 VAC, 3 Amp. at 250 VAC . . . Popular for communications circuits and many other uses. All MS medium-duty models use bushing seal plus case-to-terminal seal in meeting sand, dust, splash and submersion tests described above . . . **Bulletin TS-966A.**

NEW SUBMINIATURE TYPES, SINGLE, DOUBLE, 3-POLE AND 4-POLE

NOMINAL RATINGS: 5 Amp. resistive load at 125 VAC, 24VDC. Series JMT, with distinctive **Green** body, is manufactured by J-B-T in Connecticut. JMT series combines trouble-free construction of standard size J-B-T switches with drastic reduction in size and weight. Single pole types are ¼" thin and weigh only 0.19 oz. Other models are correspondingly compact and light . . . **Bulletin JMT-448, and Supplementary Sheets.**

ROTARY AND LEVER SWITCHES

STANDARD 14- AND 20-POSITION, AND A REMARKABLE NEW 12-POSITION

For dependable performance in instruments and test equipment, J-B-T makes space saving 14- and 20-position switches in both laminated and molded constructions. **NOMINAL RATING:** 1 Amp. inductive load at 125 VAC, 5 Amp. momentary (not make and break) **MULTIPOLE SERIES 20M** increases circuit versatility with up to 4 poles per deck. **MOLDED LEVER SWITCHES** in this series provide up to 5 live positions, 2 circuits per deck . . . **Catalog 568.**

NEW V/M SERIES fully enclosed $1\frac{13}{16}$" dia. switches, 12-position, carries 5 Amp. and breaks 2 Amp. at 115 VAC. Features of this remarkable switch include adjustable torque, initial contact resistance under .002 ohms, and parasitic thermal emf under one microvolt . . . **Catalog VM-68.**

SUB-MINIATURE, MIL-S-3786B, TYPE SR05

Made to many performance levels of MIL-S-3786B, the 1" dia. Style SR05 switches are precision built for low-current usage where size, weight and reliability are important. With patented wafer design, Series 7000, 1-6 decks can have full 12 live switching positions per deck; Series 5000, 1-4 decks, can have up to 11 live switching contacts on each side of each dual duty deck with a maximum of 8 poles per deck. Lever types, panel sealed, and general purpose variations available . . . **Catalog SM-33.**

QUICK GUIDE TO TYPICAL J-B-T PRODUCTS

To supplement the J-B-T catalogs listed below, typical prices, mechanical and electrical characteristics and other data have been included for your convenience, in Sections 2900 and 5100 of the Radio-Electronic MASTER. To save time . . .

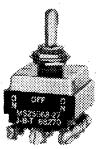
See J-B-T Catalog Pages in The Radio-Electronic MASTER



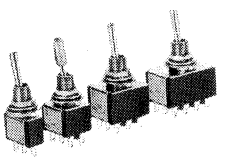
ST42D
SPDT Heavy-Duty



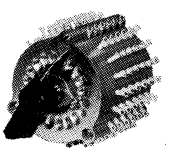
MS25100-23
Lever Seal Medium Duty



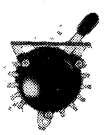
MS25068-27
4-Pole DT Heavy-Duty



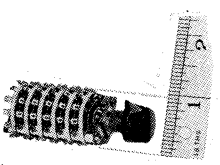
Series JMT
Sub-Miniature



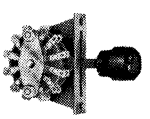
Series 20M
Enclosed, Ruggedized



MS-20-1L5A
5-Position Lever



Series 7000, 6 Deck
Sub-Miniature



VL Lever
Sub-Miniature

*J-B-T ALSO MANUFACTURES

VIBRATING REED FREQUENCY METERS AND ELAPSED TIME METERS

J-B-T Vibrating Reed Frequency Meters are made in a wide variety of case styles and sizes, standard and sealed, panel and portable; in many frequency ranges and reed groupings. Permanently accurate within ±0.3%, or better if required. Elapsed Time Meters are made in case styles compatible with other panel instruments, in 5- or 6-digit models, reading in hours and tenths at 60 cps. 110-125 volts. Variations for other frequencies and voltages available . . . **Catalog 568.**



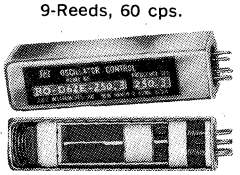
Model 34-FG
9-Reeds, 60 cps.



Model 31-EGW-5
0-9,999.9 hours

REED RELAYS AND OSCILLATOR CONTROLS

For selective calling mobile communication equipment, remote data transmission, or simultaneous sequential coding, the J-B-T D type illustrated has its operating mechanism isolated in all planes, and is designed for fast starting and excellent response-time factor . . . **Bulletin D-664A.**



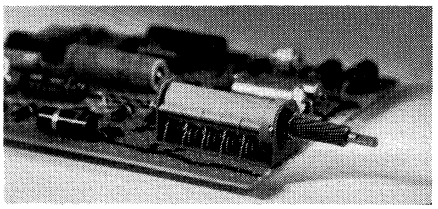
RO-D Type
Oscillator Control

J-B-T INSTRUMENTS, INC. • P.O. BOX 1818 • NEW HAVEN, CONN. 06508
(203) 772-2220 or 787-5824

JANCO

DESIGN VERSATILITY SOLVES APPLICATIONS PROBLEMS

MICRO-MINIATURE PRINTED CIRCUIT PLUG-IN ROTARY SWITCH

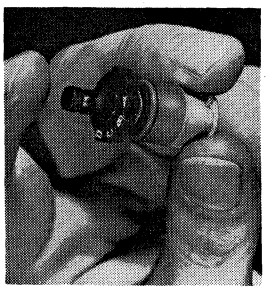


This new printed circuit plug-in rotary switch is available in 30° (2500), 36° (1-2500), and 45° (2-2500) indexing. The new printed circuit plug-in rotary switch features extended terminals and is especially designed to line up terminals with standard circuit board hole patterns. This feature lends itself to wave soldering instead of hand soldering of terminals.

For complete technical data, see Micro-Miniature Rotary Switches 2500 Series on opposite page.

MICRO-MINIATURE ROTARY SWITCH FEATURES A UNIQUE POSITIONING AND INSTANT RELEASE BUTTON

This new micro-miniature rotary switch has four positions with the unique ability to return to a predetermined position by pushing the button.



MODEL 1-2516

SPECIFICATIONS:

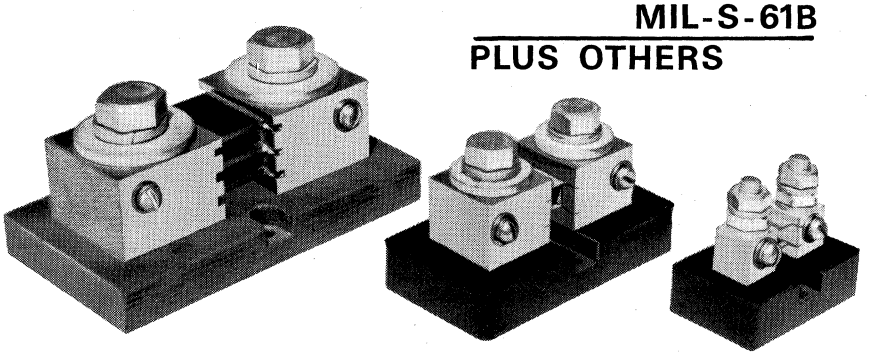
- Totally enclosed explosion-proof construction.
- Designed to meet and exceed MIL-S-3786.
- Electrical rating: make and break 100 MA at 6 VDC.
- Life characteristics: 25,000 cycles (one cycle being from Position 1 to Position 4).
- Shock and Vibration: shock rating of 125 G's; Vibration rating of 300 G's; 5 to 500 CPS.

For complete technical data see micro-miniature rotary switches 2500 Series on opposite page.

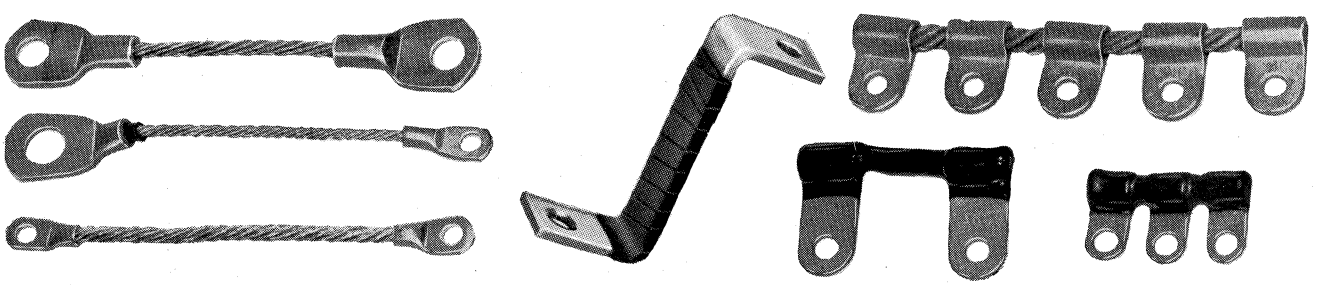
OTHER JANCO PRODUCTS

FOR AIRCRAFT AND MISSILE INDUSTRY

MIL-S-61B
PLUS OTHERS



EXTERNAL AMMETER SHUNTS • MSA • MSB • MSC



BONDING JUMPERS • FLEXIBLE ASSYS • BUS BARS

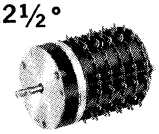
JANCO CORPORATION
Phones: (213) 845-7473 • (213) 849-2107
3111 Winona Ave. • P.O. Box 3038 • Glenoaks Station
Burbank, California 91504 • TWX 910-498-2701

PLUS: VARIOUS ELECTRO-MECHANICAL DEVICES TO MEET YOUR SPECIFIC REQUIREMENTS

ROTARY SELECTOR SWITCHES BY JANCO

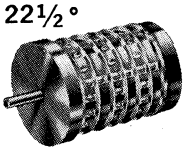
ROTARY SELECTOR SWITCHES MIL-S-6807B / MIL-S-3786B

SERIES 1211
22½°



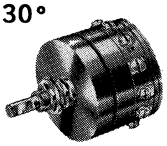
Max. Pos.: 16
Body Dia.: 3"
Electrical Rating:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
6 amps 28 v dc Ind.
Available in single pole per deck construction.
Solder lugs only.

SERIES 1272
22½°



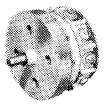
Max. Pos.: 16
Body Dia.: 3"
Electrical Rating:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
6 amps 28 v dc Ind.
Available in single pole only per deck construction.
Screw terminals only.

SERIES 1315
30°



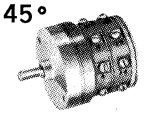
Max. Pos.: 12
Body Dia.: 2.180"
Electrical Rating:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.
Available in 1 and 3 poles per deck construction.

SERIES 1246
36°



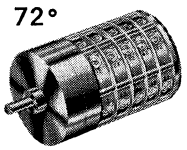
Max. Pos.: 10
Body Dia.: 2.375"
Electrical Rating:
6 amps 115 v ac Res.
6 amps 28 v dc Res.
3 amps 28 v dc Ind.
Available in single pole only per deck construction.

SERIES 1262
45°



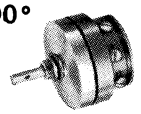
Max. Pos.: 8
Body Dia.: 1.93"
Electrical Rating:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.
Available in 1 and 2 poles per deck construction.

SERIES 1244
72°



Max. Pos.: 5
Body Dia.: 2.125"
Electrical Rating:
15 amps 115 v ac Res.
15 amps 28 v dc Res.
10 amps 28 v dc Ind.
Available in single pole only per deck construction.

SERIES 1302
90°



Max. Pos.: 4
Body Dia.: 2.125"
Electrical Rating:
15 amps Ind. 30 v dc
Available in 1 and 2 poles per deck construction.

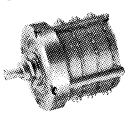
MODIFICATIONS AVAILABLE

The following modifications can be supplied on any of the basic switches shown on this page.

(1) Shorting or non-shorting contacts
(2) Bridging of contacts (miniature only)
(3) Momentary positions, whereby, the rotor contact, when released, returns to a predetermined position
(4) Isolated or guarded positions, whereby, the knob must be depressed or pulled out to enter or leave a particular position or positions
(5) Single or multi-pole construction
(6) Continuous rotation or the use of stops
(7) The use of a solenoid for remote switching applications
(8) The use of a key-lock feature
(9) The possibility of ganging various switches to be gear driven for an application requiring an unusual number of poles

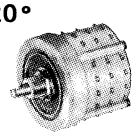
MINIATURE ROTARY SELECTOR SWITCHES / 1900 SERIES

SERIES 6-1900
15°



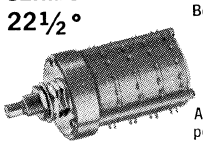
Max. Pos.: 24
Body Dia.: 2"
Electrical Rating:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.
Available in 1, 2, 4 and 6 poles per deck construction.

SERIES 12-1900
20°



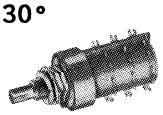
Max. Pos.: 18
Body Dia.: 2"
Electrical Rating:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.
Available in single pole per deck construction.

SERIES 3-1900
22½°



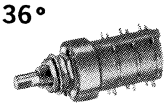
Max. Pos.: 16
Body Dia.: 1.5"
Electrical Rating:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.
Available in 1, 2 and 4 poles per deck construction.

SERIES 1905
30°



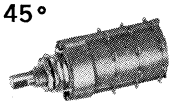
Max. Pos.: 12
Body Dia.: 1.036"
Electrical Rating:
2 amps 115 v ac Res.
1 amp 28 v dc Res.
0.5 amp 28 v dc Ind.
Available in 1, 2 and 3 poles per deck construction.

SERIES 1900
36°



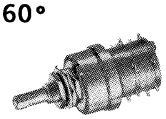
Max. Pos.: 10
Body Dia.: 1.036"
Electrical Rating:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.
Available in 1 and 2 poles per deck construction.

SERIES 1906
45°



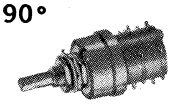
Max. Pos.: 8
Body Dia.: 1.036"
Electrical Rating:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.
Available in 1 and 2 poles per deck construction.

SERIES 1-1957
60°



Max. Pos.: 6
Body Dia.: 1.13"
Electrical Rating:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.
Available in single pole only per deck construction.

SERIES 1-1966
90°



Max. Pos.: 4
Body Dia.: 1.13"
Electrical Rating:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.
Available in single pole only per deck construction.

GENERAL SPECIFICATIONS/1900 series

ELECTRIC RATING: carry 10 amps continuous. Make & Break—see individual switch data

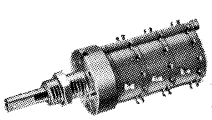
VOLTAGE DROP: 0.1 volt or less at rated amperage. Initial Contact Resistance .003 OHM

LIFE: 10,000 double cycles make and break rated amperage

TORQUE: 1 to 3 inch lbs.

SWITCHES DESIGNED AND BUILT IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS:
MIL-S-6807B (rotary switches enclosed)
MIL-S-3786B (rotary switches)
MIL-E-5272C (environmental testing)

MICRO-MINIATURE ROTARY SELECTOR SWITCH / 2500 SERIES



With unitized construction

Available in 30°, 36° and 45° indexing, with 12—10 and 8 pos. max.
Body Diameter: .623 inch.
Electrical rating continuous: 8 amps at 28 v dc.
Switching rate:
0 to 0.25 amp resistive 0 to 28 v dc.
0 to 0.25 amp resistive 0 to 115 v ac.
0 to 0.12 amp inductive 0 to 28 v dc.

Available in 1, 2, and 3 pole construction.
TORQUE: 5 to 9 inch ounces.
CONTACT RESISTANCE: .005 ohms average.
INSULATION RESISTANCE:
100,000 megohms minimum at 100 volts.
10,000 megohms minimum at 500 volts.
DESIGNED AND BUILT to meet the environmental and functional requirements of MIL-S-3786B.

JANCO CORPORATION
Phones: (213) 849-7473 • (213) 849-2107
3111 Winona Ave. • P.O. Box 3038 • Glenoaks Station
Burbank, California 91504 • TWX 910-498-2701

JOSLYN

FULL-LINE' SURGE PROTECTION

YOUR COMPLETE SOURCE OF TOP PERFORMANCE PROTECTORS . . . FOR PROTECTING ELECTRICAL/ELECTRONIC EQUIPMENT FROM: VOLTAGE TRANSIENTS · CURRENT TRANSIENTS · DIRECT LIGHTNING STRIKES · OVER-ILLUMINATION

PRECISION SPARK GAPS

Typical applications: used to protect against surges due to switching, breakers closing-opening, static, reflected waves, capacitive discharge, corona, system faults, contact with foreign circuits, EMP, fuse blowing, lightning (induced or conducted), ionization, motor starting, arc welding.

They protect solid state circuitry, computers, carrier circuits, relay coils, telephone circuits, microwave and radio equipment, sensitive equipment, open wire carriers, fire alarms, traffic controllers, rectifiers, modulators, traveling wave tubes, pyrotechnic devices.

They replace carbon block arresters, light sensitive gaps, open air gaps, high maintenance protection devices, fragile gaps, mechanically incompatible gaps, radioactivated gaps.

They may be used as activation devices in pyrotechnic devices, lamp starting circuits, laser pulsers.

msp® (miniature surge protector)



2001-01

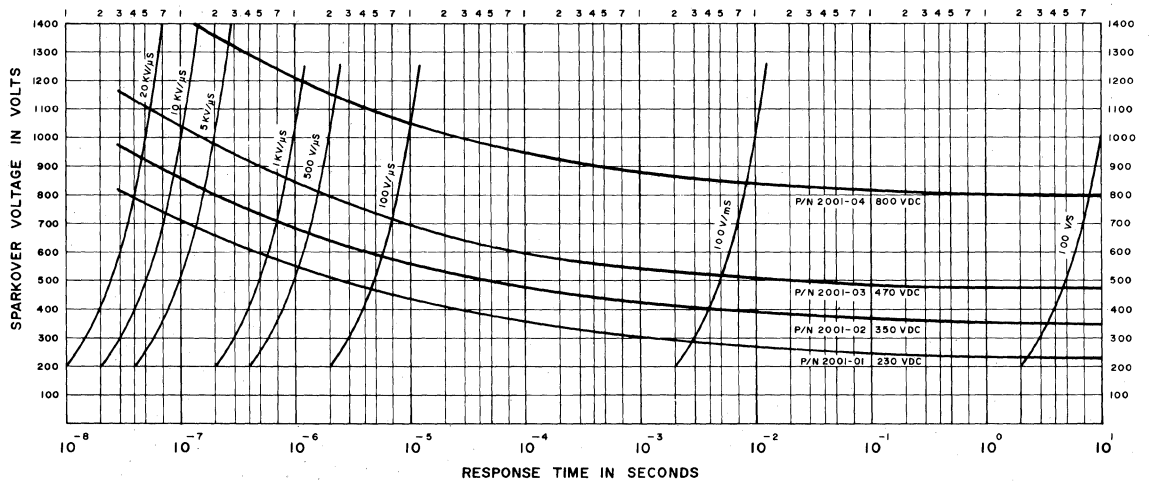


2001-06

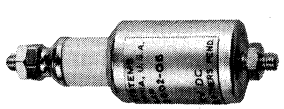
MSP® Model No.	Nominal DC Sparkover Voltage ±15%	Impulse Sparkover Voltage* at 10 kv/μs rate-of-rise	at 500 v/μs rate-of-rise	Minimum Holdover Voltage	Wire Leads	SIZE dia. x length
2001-01	230	730	540	115	none	5/16" x 11/32"
2001-02	350	870	670	175	none	5/16" x 11/32"
2001-03	470	1030	810	235	none	5/16" x 11/32"
2001-04	800	1390	1140	400	none	5/16" x 11/32"
2001-06	230	730	540	115	yes	5/16" x 11/32"
2001-07	350	870	670	175	yes	5/16" x 11/32"
2001-08	470	1030	810	235	yes	5/16" x 11/32"
2001-09	800	1390	1140	400	yes	5/16" x 11/32"

*Taken from volt-time curves below.
Note: Other ratings, terminal mountings, and configurations made to order. Consult factory.

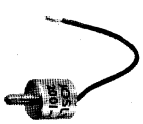
response curves for msp® gaps



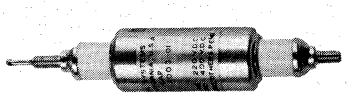
® Registered U.S. Patent Office, Joslyn Electronic Systems.



2002-06



2001-35



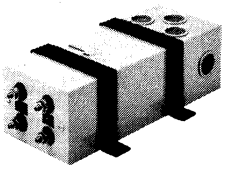
2003-01

Standard Model No.	Max. Surge Current ka 10 x 20/μs	DC Breakdown Volts ±15%	Impulse Sparkover Typical 10 kv/μs	Inter-Electrode Capacitance pf	Insulation Resistance m Ω	Max. space envelope dia. — h.
2001-28	1	> 750	< 2000*	< 2	> 10,000	1/2" x 1 3/16"
2001-29	1	> 1100	< 2000*	< 2	> 10,000	1/2" x 1 3/16"
2001-30	1	> 450	< 1200*	< 2	> 10,000	1/2" x 1 3/16"
2001-31	5	230	875	3.5 max.	> 1000	1/2" x 1/2"**
2001-32	5	350	1100	3.5 max.	> 1000	1/2" x 1/2"**
2001-33	5	470	1300	3.5 max.	> 1000	1/2" x 1/2"**
2001-34	5	800	1600	3.5 max.	> 1000	1/2" x 1/2"**
2001-35	5	1000	2000	3.5 max.	> 1000	1/2" x 1/2"**
2002-01	40	250	—	< 8	> 1000	7/8" x 2 1/2"
2002-06	40	2000	—	< 8	> 1000	7/8" x 2 1/2"
2003-01	40	L-L220 L-g400	— —	L-L< 5 L-g< 8	> 1000	7/8" x 2 1/2"
2003-02	40	L-L230 L-g275	— —	L-L< 5 L-g< 8	> 1000	7/8" x 2 1/2"
2008-02	20	250	—	< 4	> 1000	1 3/8" x 2 3/8"
2008-03	20	250	—	< 4	> 1000	1 3/8" x 2 3/8"

*50 kv/μs **with 6-32 gnd. stud., 5/16/g.
Note: Other voltage ratings up to 3000 v DC, terminal mountings, and configurations made to order. Consult factory.

SURGITRON® PROTECTORS

surgitron® dc protectors



1001-01

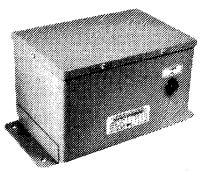
TYPICAL APPLICATIONS: used to eliminate transients on battery circuits; protect critical equipment on railroads, at microwave sites and public utilities.

Joslyn Model Number	Nominal Input DC Volts*	System Polarity	Max. Load Current	Voltage Drop at 20 amp	Max. Surge Current	Clamping Voltage	Max. Size H-W-L
1001-03	28	Neg. Gnd.	20 amp	1.5V	5,000 amp	45-50	3 3/8" x 4 3/8" x 11 1/4"
1001-04	28	Pos. Gnd.	20 amp	1.5V	5,000 amp	45-50	3 3/8" x 4 3/8" x 11 1/4"
1003-03	48	Neg. Gnd.	20 amp	1.5V	5,000 amp	70-80	3 3/8" x 4 3/8" x 11 1/4"
1003-04	48	Pos. Gnd.	20 amp	1.5V	5,000 amp	70-80	3 3/8" x 4 3/8" x 11 1/4"
1005-05	72	Neg. Gnd.	20 amp	1.5V	5,000 amp	95-105	3 3/8" x 4 3/8" x 11 1/4"
1005-06	72	Pos. Gnd.	20 amp	1.5V	5,000 amp	95-105	3 3/8" x 4 3/8" x 11 1/4"
1010-01	12	Neg. Gnd.	20 amp	1.0V	5,000 amp	15-22	3 3/8" x 4 3/8" x 11 1/4"
1010-02	12	Pos. Gnd.	20 amp	1.0V	5,000 amp	15-22	3 3/8" x 4 3/8" x 11 1/4"

*Other voltages available — consult factory.

surgitron® ac protectors

single phase, 60 cycles



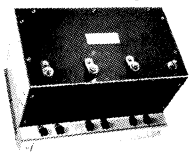
1201-02

TYPICAL APPLICATIONS: used to protect critical equipment operating from commercial power such as at missile installations, industrial plants, microwave repeater sites.

Joslyn Model No.	Voltage Rating rms	Power Rating kva	Extreme Discharge Capacity ka	Clamping Begins at rms Volts ±15%	Transient into Protector: Peak ka 1½x40 μs Wave	Transient into Protector: Peak ka 10x20 μs	Max. Output Volts	Max. Space Envelope L-W-H
1201-02	120	1	65	175	23	20	250	11½"x6"x5¾"
1202-01	120	5	100	193	10	10	1750	10¾"x8"x7¾"
1230-01	120	not restricted	65	175	10	10	2000	5½"x4"x6"
1235-01	120/240	not restricted	65	175 L-g	10	10	2000	9"x6"x6"
1245-01	120/240	not restricted	100	360 L-g	10	10	1000	13¼"x9⅝"x10"

surgitron® ac protectors

three phase, 60 cycles



1414-06

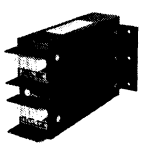
TYPICAL APPLICATIONS: same as for single-phase protectors. These units will limit voltage rise on a power distribution system counteracting effects of lightning and EMP.

1405-02	120/208	not restricted	65	175	10	10	2000	9"x6"x6"
1414-02	277/480	not restricted	100	372	10	10	——	14¼"x8"x10"
1414-06	277/480	not restricted	100	425	10	10	1000	14¼"x9⅝"x10"
1420-01	120/208	not restricted	65	175	10	10	1000	14¼"x9⅝"x10"

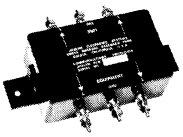
Note: Consult factory for full-line information.

communication protectors

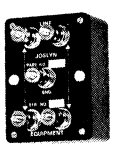
balanced pair*
frequency range—dc to 1 mhz



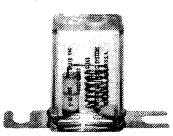
1603-01



1623-01



1633-01



VISI-GUARD® 2301-01

TYPICAL APPLICATIONS: used along railroad right-of-ways, in process control instrumentation, in conjunction with telephone and telemetry applications.

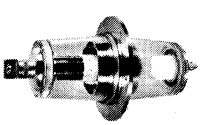
Joslyn Model No.	Max. Signal Peak Volts	Insertion Loss at Max. Signal db	Discharge Rating ka 10x20 μs	Transient into Protector: Peak kv	Transient into Protector: Peak ka 10x20 μs	Max. Output Volts	Max. Space Envelope L-W-H
1601-01	0.224	<1	40	10	10	<100@1μs	7"x2"x5"
1602-01	0.388	<1	40	10	10	<100@1μs	7"x2"x5"
1603-01	0.775	<1	40	10	10	<100@1μs	7"x2"x5"
1623-01	1	<0.5	40	10	10	<120@0.2μs	8.8"x6.4"x2.2"
1624-01	2	<0.5	40	10	10	<120@0.2μs	8.8"x6.4"x2.2"
1625-01	10	<0.5	40	10	10	<120@0.2μs	8.8"x6.4"x2.2"
1626-01	50	<0.5	40	10	10	<120@0.2μs	8.8"x6.4"x2.2"
1633-01	1	<0.5	10	10	5	<120@0.2μs	4"x2.9"x3"
1634-01	2	<0.5	10	10	5	<120@0.2μs	4"x2.9"x3"
1635-01	10	<0.5	10	10	5	<120@0.2μs	4"x2.9"x3"
1636-01	50	<0.5	10	10	5	<120@0.2μs	4"x2.9"x3"
2301-01	—	0	5	10	—	<200@0.25μs	3"x0.9"x1.4"

*For single-ended units contact factory. Note: Consult factory for full-line information.

® Registered tradename of Joslyn Electronic Systems.



1705-03



1908-01 (AD969-DMA)

ANTENNA ARRESTERS

receive only

Used in conjunction with precision spark gaps on receivers, to attentuate voltage spikes to negligible levels. Available in many models and frequencies. Consult factory for full listing.

ANTENNA LIGHTNING ARRESTERS

receive and/or transmit

Used on commercial and military aircraft for direct lightning diversion. Qualified per Mil-A-9094 (as amended). Frequency range from 40 kc/s to 36 mc/s. Consult factory for full-line offering and complete device specifications.

LOOK TO JOSLYN FOR ALL YOUR SURGE PROTECTION NEEDS

6868 Cortona Drive, Santa Barbara Research Park
Goleta, Calif., Phone (805) 968-3551 • Reply to:
P.O. Box 817, Goleta, California 93017

JOSLYN
ELECTRONIC SYSTEMS
A DIVISION OF JOSLYN MFG. AND SUPPLY CO.

As critical circuitry advances in sophistication, precision fuse protection becomes increasingly vital. For 40 years, Littelfuse has enjoyed a fine reputation as a manufacturer of top quality products in the electronic circuit protection field. Each and every Littelfuse product receives the ultimate in precision engineering, design know-how and quality craftsmanship. These are the reasons why the name Littelfuse has become the synonym for quality in the field of electronic circuit protection.

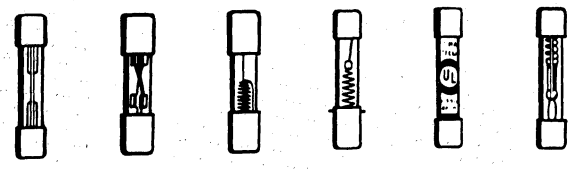
LITTELFUSE Picofuse.



Shown actual size

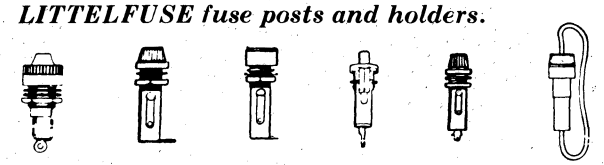
⅛ thru 5 amps. . . 125 v.
Also available with radial leads

LITTELFUSE fuses.



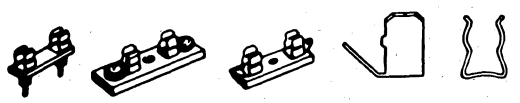
SFE Auto | 4AG Aircraft | 4AG Slo-Blo | LC Slo-Blo 125V Type N | 3AB U/L | 3AG Slo-Blo

LITTELFUSE fuse posts and holders.



3AG Indicating FUSE POST | 3AG Post Finger Operated | 3AG Post Screw-driver Operated | LC Fuse Holders | 4AG Finger Operated Post | In Line Fuse Retainers

LITTELFUSE fuse mountings.



Through Panel Mounting | Screw Terminal Mounting | Solder Terminal Mounting | Terminal Clip | Fuse Clip (earless)

LITTELFUSE Microfuse line.



New Transparent Capped Microfuse 1/500 thru 5 amps. @ 125 v. | Microfuse panel type holder | Indicating Microfuse Holder voltage ranges 2½-125 v.

Have an inconsequential short circuit

LITTELFUSE

DES PLAINES, ILLINOIS

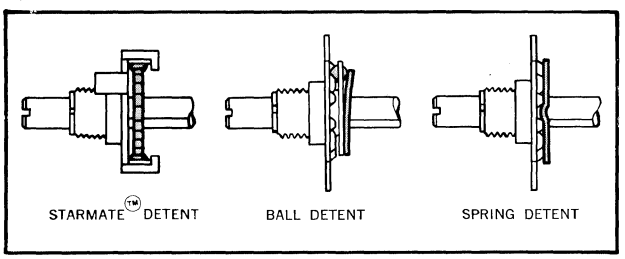
LEDEX

WILMINGTON CONTROLS DIVISION, LEDEX INC.
111 South Nelson Road, Wilmington, Ohio 45177 · phone (513) 382-0987

ROTARY SWITCHES

When it comes to selecting a source for rotary switches, you'll find Wilmington Controls fully equipped to service you in these important areas: (1) quick, competent response to engineering requirements, (2) fast prototype delivery, (3) dependable production scheduling, and (4) consistent quality levels.

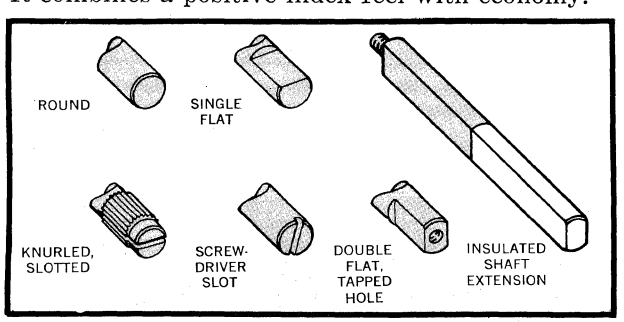
Our switch engineering experience dates back to 1947, when rotary switches were first applied with Ledex rotary solenoids to perform remote stepping and complex circuit programming functions. Over the years we have helped many customers to simplify their circuitry, reduce wiring requirements, and cut system costs. This experience we gladly share with you.



1. *Starmate detent:* Two bearing balls are spring loaded to operate against a precision indexing cam. The balls oppose each other with balanced pressure to eliminate side loading and extend switch life. This superior detenting concept is time proven in Ledex long-life stepping motors.

2. *Ball detent:* A spring loaded ball bearing rides in and out of the "hill and valley" positions in the front plate. The ball detent has a crisp detenting feel even more positive than that of the spring detent.

3. *Spring detent:* a formed stainless steel spring with a coined spherical surface rides in and out of "hill and valley" positions in the front plate. It combines a positive index feel with economy.



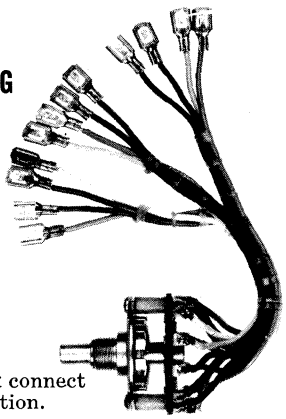
Commonly used shaft designs for commercial and military applications. Others made to specifications.

To meet your requirements for rapid delivery service, we stock a wide variety of standard parts which can be quickly modified. Our tooling is designed for quick setup and fast change-over, to further add to our ability to give you short delivery cycles. And to assure consistent quality, random production samples are regularly routed to automated test instrumentation for vigorous life and other quality verification tests.

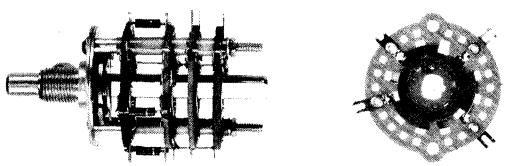
From the early design stages on through production runs we are geared to produce quality switches . . . **fast.** Whether you're concerned with new switching applications, or investigating new sources for existing ones, we welcome the opportunity to work with you.

IDEAS IN SWITCH ENGINEERING

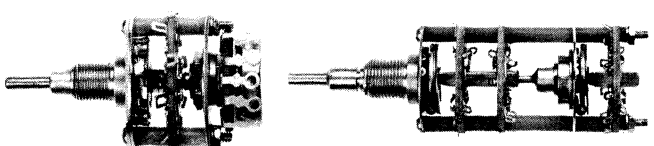
Supplying quality switch hardware is just one phase of our business. We take a special pride in our time-proven ability to simplify circuitry, upgrade the switch, and hold costs down. In most cases we can supply pre-wired assemblies with external components installed for less than it might cost you to purchase parts and assemble them in your plant.



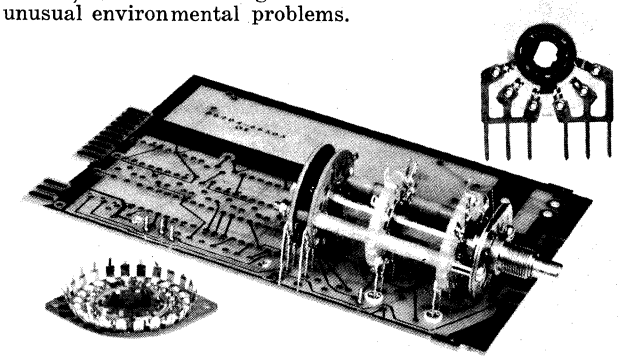
Switch pre-wired with quick connect terminals for simplified installation.



Slotted terminals permit resistors and other components to be inserted in place. They eliminate need for jumper wires, reduce soldering time, keep size down.



Concentric shafts, dual index mechanisms to drive potentiometers, snap switches and other loads. Special bushings, shields, brackets also engineered to solve unusual environmental problems.



Printed circuit terminals, available for perpendicular or parallel mounting (to PC board) expand switching versatility.

LEDEX
WILMINGTON CONTROLS DIVISION, LEDEX INC.
111 South Nelson Road, Wilmington, Ohio 45177 phone (513) 382-0987

ROTARY SWITCHES

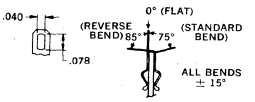
STANDARD SPECIFICATIONS

206, 208, 212	306, 312	406, 412	506, 512	524
CONSTRUCTION	Throughbolts			
SHAFT — Military*	¼" steel, cadmium plated, chromated per QQ-P-416, class 2, type II (50 hour salt spray).			
Commercial	¼" steel, cadmium plated.			
MOUNTING	Steel bushing, ⅜-32 thread, optional ¼ or ⅜ inch, standard length.			
SPACERS Ceramic, Grade L-5	Glass filled nylon, grade G 1/30.			
LOCATING LUG Standard fixed at .375" radius; or can be deleted.	Standard fixed at 17/32" radius; or can be deleted.	Variable at 15° increments except 75°, 90°, 105°, 255°, 270°, 285°.	Standard fixed at 17/32" radius; or can be deleted.	Variable at any angle ±2° at 17/32" radius, or can be deleted.
METAL PARTS	All metal parts cold rolled steel with cadmium plating for commercial applications. Chromate dip for 50 to 100 hour salt spray per MIL-S-3786 for military applications. Special materials such as passivated stainless steel or nickel plated brass parts are also available.			
INDEX MECHANISM Dual ball Starmate detent or single ball (hill and valley.	Spring or single ball detent		Single ball detent.	Single or dual ball detent.
STOPS Fixed or adjustable.	Fixed at positions specified. Adjustment possible by removing stop lugs, at specific and intermediate positions.			Fixed at positions specified
INSULATION MATERIALS Stator: Phenolic, Epoxy Glass, or Silcone Glass. Rotor: Kel-F.	Stator and rotor: Phenolic, Kel-F, Epoxy Glass, Ceramic, Mycalex†	Stator and rotor: Phenolic, Epoxy glass.	Stator and rotor: Phenolic, Kel-F Epoxy glass.	Stator and rotor: Phenolic, Epoxy Glass.
CONTACT RATINGS Make/Break				
Brass—Silver plated .5 ampere at 28 VDC, resistive; .25 ampere at 110 VAC, resistive.	**Brass—Silver plated** 1 ampere at 28 vdc, resistive; .5 ampere at 110 vac.	**Brass—Silver plated** 1 ampere at 28 vdc, resistive; .5 ampere at 110 vac.	**Brass—Silver plated** 1 ampere at 28 vdc, resistive; .5 ampere at 110 vac.	**Brass—Silver plated** 1 ampere at 28 vdc, resistive; .5 ampere at 110 vac.
Solid Silver 1 ampere at 28 VDC, resistive; .5 ampere. at 110 VAC, resistive.	**Solid Silver** 2 amperes at 28 vdc, resistive; 1 ampere at 110 vac.	**Solid Silver** 2 amperes at 28 vdc, resistive; 1 ampere at 110 vac.	**Solid Silver** 2 amperes at 28 vdc, resistive; 1 ampere at 110 vac.	**Solid Silver** 2 amperes at 28 vdc, resistive; 1 ampere at 110 vac.
Carry—5 amperes.	Carry—5 amperes.	Carry—5 amperes.	Carry—10 amperes.	Carry—5 amperes.
Dielectric—750 volts, contact to contact.	Dielectric—1,000 volts, contact to contact; 500 volts when contacts are insulated back to back.			
Contact resistance, in accordance with MIL-S-3786, will not exceed .010 ohms initially nor .020 ohms after rotational life tests.				

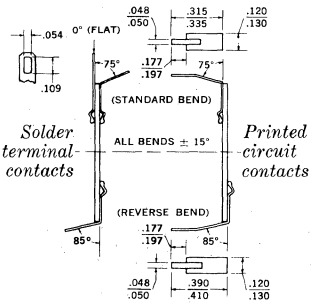
†Mycalex sections supplied with Kel-F rotors.

contacts

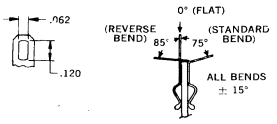
series 206 208 212



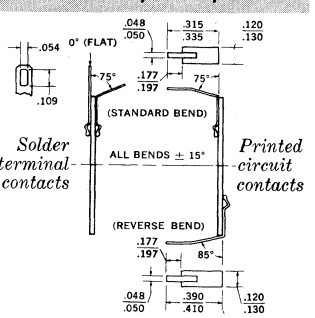
series 306 312 524



series 506 512

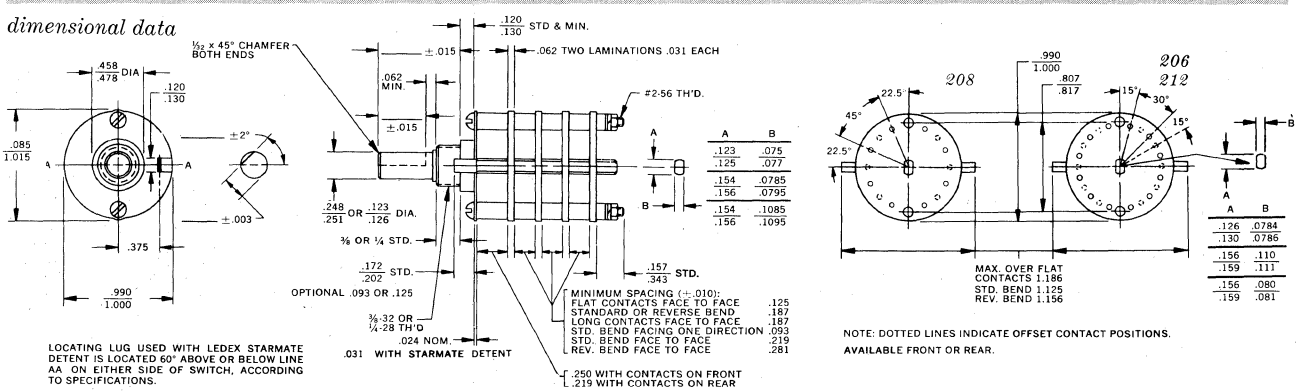


series 406 412



series 206 / 6 POSITION 60° THROW *208* / 8 POSITION 45 THROW *212* / 12 POSITION 30° THROW

dimensional data



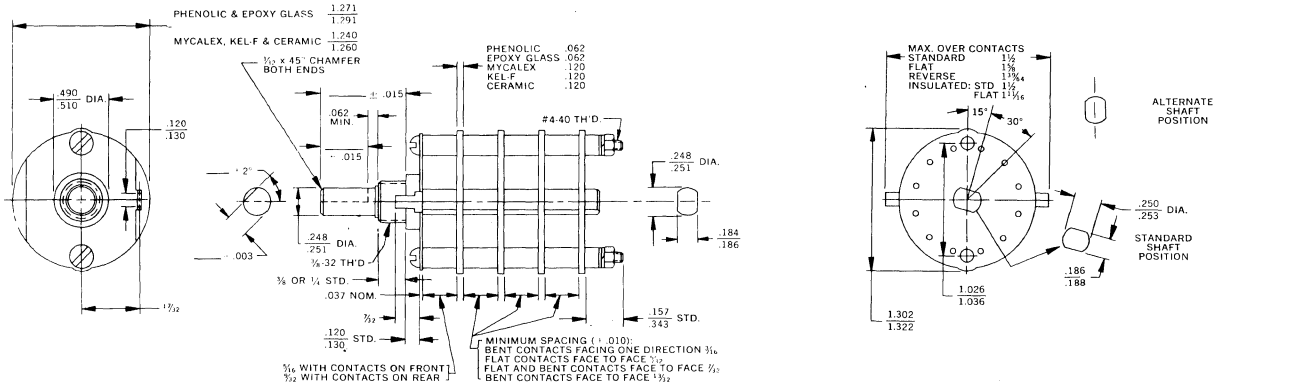
LOCATING LUG USED WITH LEDEX STARMATE DETENT IS LOCATED 60° ABOVE OR BELOW LINE AA ON EITHER SIDE OF SWITCH, ACCORDING TO SPECIFICATIONS.

NOTE: DOTTED LINES INDICATE OFFSET CONTACT POSITIONS.
AVAILABLE FRONT OR REAR.

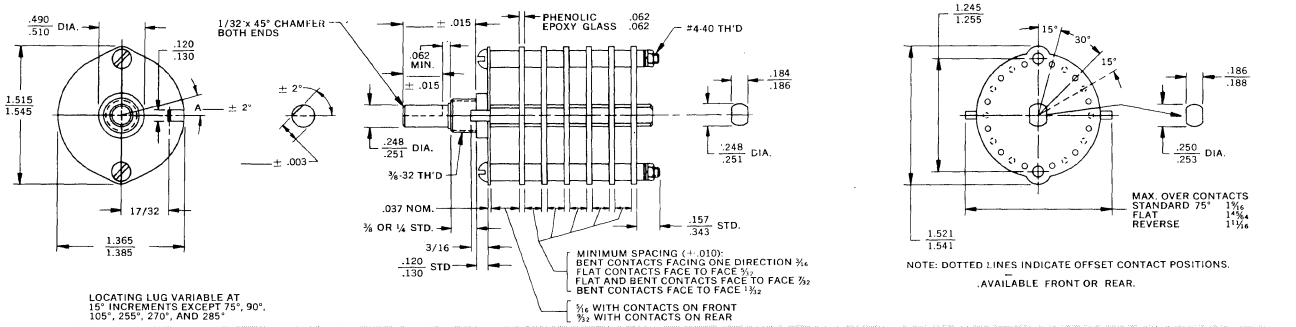
LEDEX
WILMINGTON CONTROLS DIVISION, LEDEX INC.
111 South Nelson Road, Wilmington, Ohio 45177 phone (513) 382-0987

ROTARY SWITCHES *dimensional data*

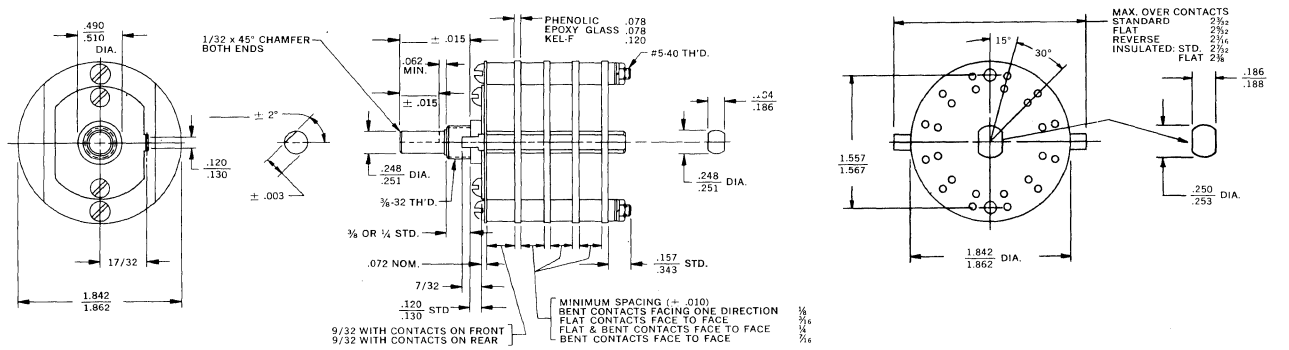
series 306 / 6 POSITION 60° THROW — *312* / 12 POSITION 30° THROW



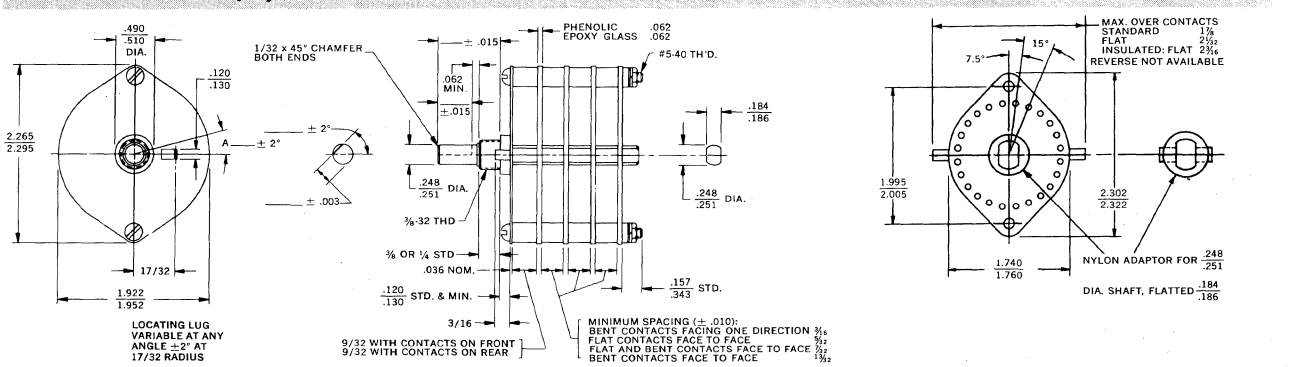
series 406 / 6 POSITION 60° THROW — *412* / 12 POSITION 30° THROW



series 506 / 6 POSITION 60° THROW — *512* / 12 POSITION 30° THROW



series 524 / 24 POSITION 15° THROW



SWITCH SECTION HIGHLIGHTS

contact and rotor blade materials

silver plated brass

Most economical. Has .0001″ minimum silver to assure silver-to-silver contact (low contact resistance) throughout life of most applications.

silver alloy

Used when consistent low contact resistance is required for minimum life expectancy of 200,000 contact flexures.

gold plated silver alloy

(a) .00003″ minimum gold; an economical way to assure positive solder contacts and prevent tarnish during long storage life.

(b) .0002″ minimum hard gold; assures gold-to-gold contact for over 50,000 contact flexures and then silver-to-silver contact for 150,000 additional contact flexures.

SILVER PROTECTION PROCESS	WHERE APPLIED	COMMENTS
Water Dip Lacquer	*On Contacts*	*Applied as standard on all silver alloy and silver plated brass contacts to retard tarnishing for soldering ease.*
.00003″ Gold Plate	*a) On Contacts and Rotors*	*An economical means to assure positive circuit make after extended shelf life; also offers soldering ease. Meets MIL specs.*
	b) On Contacts only	*Primarily used for soldering ease after extended shelf life. Meets MIL specs.*
Hot Tin Dip	*On terminal end of contacts only*	*Primarily to assure good contact solderability after extended shelf life. Meets MIL specs.*

STATOR INSULATION GUIDE

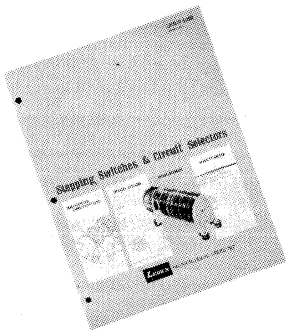
STATOR INSULATION	MIL SPEC.	USABLE TEMPERATURE LIMIT (°C)	MINIMUM INSULATION RESISTANCE (MEGOHMS)	
Phenolic	*MIL-P-3115, type PBE-P*	*100*	*1,000*	*Most economical, most commonly used. Though non-nutrient to fungi, varnish impregnation per MIL-V-173 is available. Meets most military and commercial application requirements.*
Epoxy-Glass	*MIL-P-18177, type GEB*	*125*	*10,000*	*Economical, excellent structural and dielectric strength. Lower moisture absorption rate than phenolic.*
Silicone Glass	*MIL-P-997C, type GSG*	*125*	*10,000*	*Good RF characteristics. Lower structural strength than epoxy glass, and slightly higher in cost.*
*Mycalex**	*MIL-I-10A, Grade L-411*	*150*	*10,000*	*Good structural and dielectric strength, lowest moisture absorption.*
Kel-F	*MIL-M-55028-A, Grade 3*	*125*	*20,000*	*Excellent structural and dielectric strength. Low moisture absorption.*
Ceramic	*MIL-I-10A, Grade L-422*	*150*	*10,000*	*Very low dielectric loss and moisture absorption.*

*Mycalex sections supplied with Kel-F rotors.

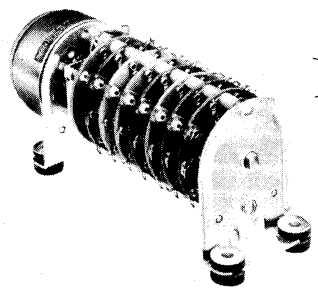
LEDEX

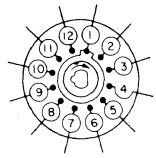
WILMINGTON CONTROLS DIVISION, LEDEX INC.
111 South Nelson Road, Wilmington, Ohio 45177 phone (513) 382-0987

STEPPING SWITCHES/CIRCUIT SELECTORS

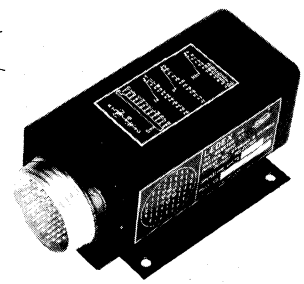


Thirty Six Stock Models
Choose from 36 stock models, 2, 4, 6, 8, 10, 12, 18, 20 and 24 positions; 28 and 100 VDC. "Stepping Switches and Circuit Selector" catalog lists complete specs on stock models plus useful engineering information on basic control switching and application of basics to solve complex problems. Also includes simplified building block approach to specifying pre-engineered stepping switches and circuit selectors.





Ledex Rotary Switches are used for transfer switching, remote control of predetermined circuit patterns, remote sequencing of complex switching arrangements, or in programming checkout and sequential operations. They are known best for their ability to perform multiple switching functions reliably, in limited space, and under severe operating and environmental conditions. Available in open construction, pre-wired modules or as packaged control solutions.

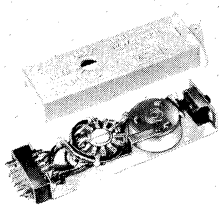


Ledex Hermetically Sealed Switches are engineered to withstand severe shock and vibration, such as encountered in aircraft, missile and military applications, and to provide added switching reliability in adverse environments. Used extensively in aero/space and underwater guidance controls, as mode selectors, in rocket firing devices, and in a variety of military control functions that demand a high degree of reliability.

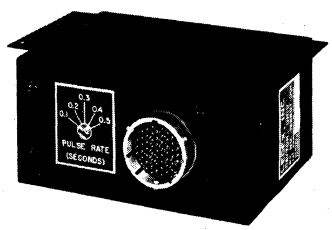
PACKAGED CONTROL SOLUTIONS

Here are examples of Ledex Stepping Switches designed into compact, reliable armament control packages, either solid state or electromechanical, or combining the best characteristics of both.

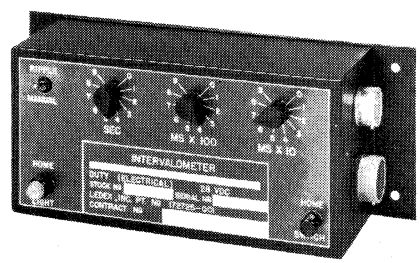
Whether your problem involves armament controls or commercial control functions, there's a good chance Ledex has already solved a similar problem.



Miniaturized Armament Control Intervalometer
A flat disc-shaped solenoid is used in the 12-position stepping switch. It is used to fire 19 rockets in pairs sequentially, in speeds ranging from 10 to 20 ms intervals.



40-position Intervalometer with single or optional 5-speed ripple fire control
40-position intervalometer has 5 adjustable control speeds for rocket firing at intervals of 100, 200, 300, 400 or 500 milliseconds. Hybrid design combines best characteristics of solid state and electromechanical products for optimum performance, minimum weight, maximum reliability and lowest cost. Firing time intervals are maintained at ±5% through a voltage range of 22 to 31 vdc.



Universal Stores Dispenser Intervals Variable on Digital Basis

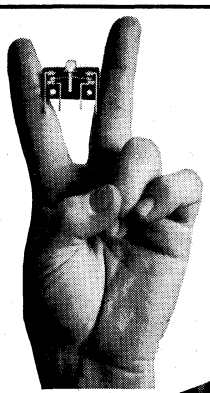
All solid state and among the most flexible of Ledex intervalometer designs, this one permits the pilot to vary release intervals to any rate ranging from 30 ms to 9.99 seconds in increments of 10 ms. It includes a stepping switch to distribute sequential fire commands. Timing tolerance is ±10% over a voltage range of 22 to 32 volts and temperature to −55°C to +85°C. The package includes built-in suppression to protect solid state circuitry when switching inductive loads.

For engineering assistance and technical literature, write or phone:

LEDEX

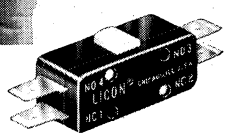
LEDEX DIVISION, LEDEX INC., 126 Webster St., Dayton, Ohio 45402
CUSTOM CIRCUITRY & CONTROLS *phone (513) 224-9891*

BASIC SWITCHES FROM LICON FASTEST GROWING FULL-LINE SWITCH SUPPLIER



BUTTERFLY® DOUBLE-BREAK SWITCHES

The unique Licon® Butterfly double-break switch design is built around two blades that flex simultaneously, then actuate with a positive snap. A full line of 2, 4 and 6-circuit miniature, subminiature and heavy-duty Butterfly switches meet every basic switch need.



TYPE II

High electrical rating and long mechanical life in one compact package. Ideal for a wide range of applications.

ELECTRICAL RATING
125/250 v AC: 10 Amps
125 v AC: ½ HP
250 v AC: ¾ HP
30 v DC: Form X or Y—15 Amps Res.
Form X or Y—10 Amps Ind.
Form Z— 10 Amps Res.
Form Z— 7 Amps Ind.



TYPE 16

Features two circuit control, direct cam operation with double bearing guided button plus high shock and vibration resistance.

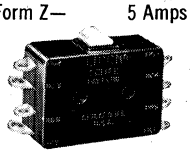
ELECTRICAL RATING
125/250 v AC: 10 Amps
28 v DC:
Form X or Y—10 Amps Res.
Form X or Y—7,5 Amps Ind.
Form Z— 10 Amps Res.
Form Z— 5 Amps Ind.

TYPE 18

Big switch rating in the smallest double-break switch—.200″ x .500″ x .350″.



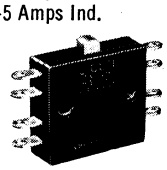
ELECTRICAL RATING
125/250 v. AC: 8 Amps
28 v DC:
Form X or Y—8 Amps Res.
Form X or Y—5 Amps Ind.



TYPE 22

Insures exacting double-break switch performance for 3-phase motors, permits simplified controls for multiple circuits.

ELECTRICAL RATING
125/250 v AC: 10 Amps
125 v AC: ½ HP
250 v AC: ¾ HP
30 v DC: Form XX or YY—15 Amps Res.
Form XX or YY—10 Amps Ind.
Form ZZ— 10 Amps Res.
Form ZZ— 7 Amps Ind.



TYPE 26

Provides simultaneous operation of two Licon Butterfly double-break mechanisms in one case. Eliminates the need for dual components and complicated actuators.

ELECTRICAL RATING
125/250 v AC: 8 Amps
28 v DC: Form XX or YY—10 Amps Res.
Form XX or YY—7.5 Amps Ind.
Form ZZ— 10 Amps Res.
Form ZZ— 5 Amps Ind.

TYPE 36

Simultaneous operation of three poles through a special linkage between mechanisms. Eliminates the need for three components and complementing actuators.



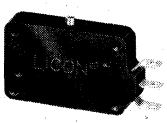
ELECTRICAL RATING
125/250 v AC: 8 Amps Res.
28 v DC: Form XXX or YYY—10 Amps Res.
Form XXX or YYY—7.5 Amps Ind.
Form ZZZ— 10 Amps Res.
Form ZZZ— 5 Amps Ind.

TYPE 25 THIN SWITCH

The thin switch is designed for commercial applications which require utmost reliability at low price. Typical applications include coin and vending machines, timers and counters.

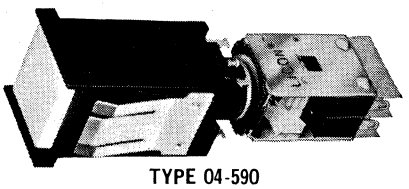
ELECTRICAL RATING

On-Center	Off-Center
12 Amps Res.	6 Amps Res.
7 Amps Ind.	3 Amps Ind.



LICON® LIGHTED SWITCHES

Widely used on computers, machine tools, office machines, guidance control and a wide variety of applications. Heart of Licon lighted switches are the ultra-reliable Butterfly® Double-breaks for long life and dependable performance. Wide selection of colors, sizes, mounts and actuators.



TYPE 04-590

Dressy panel appearance with four bulb illumination. Simple snap-on switch module, front-of-panel bulb service. Standard in black or clear anodizing.

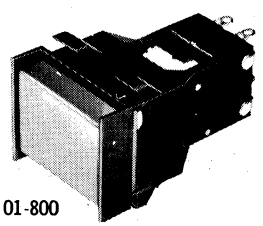


TYPE 04 BARRIER MOUNT

Remove one or more switches without disturbing other units. Serves as safety separator between ganged switches. Also aluminum matrix barriers.

TYPE 01-700

Low cost momentary 1-lite stationary bulb in one-piece molded housing. Cylindrical, square or round lens caps. Front-of-panel bulb servicing.



TYPE 01-800

Styled for maximum in function/appearance criteria. Has integral plastic housing that snaps in from front panel. Available in one and two pole, momentary and alternate action.

LICON® INDUSTRIAL SWITCHES

The most dependable machine tool and industrial switches on the market. Meet all OEM and replacement needs, and provide compatibility and interchangeability at the lowest possible cost. Wide selection of models, mountings, actuators.

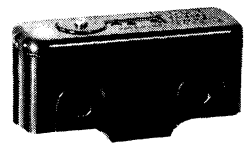
TYPE 30-100 OVERTRAVEL PLUNGER SWITCH

General purpose limit or push button switch for circuit controls of heavy duty applications. The overtravel plunger provides added switch protection and also permits greater flexibility of application. Other models feature roller arm, roller plunger, sealed plunger, sealed roller arm, sealed palm button for a wide variety of applications.

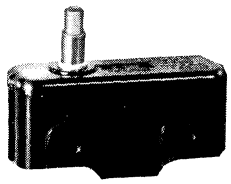
Operating force.....10 oz.±4 oz.
Release force.....3 oz. min.
Pretravel.....030 max.
Overtravel.....7/32 min.
Movement differential.....002 max.



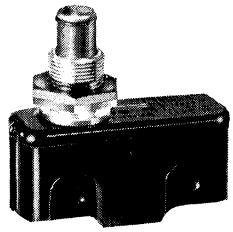
LICON TYPE 10 BASIC SWITCHES



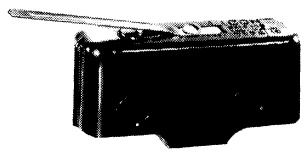
Type 10-122
Basic Switch



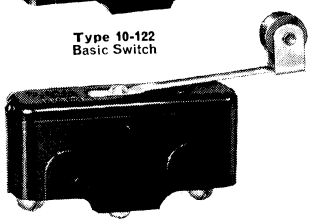
Type 10-222
Overtravel Plunger



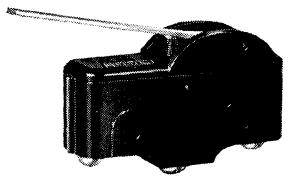
Type 10-322
Panel Mounting



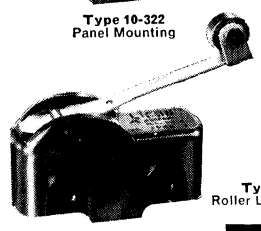
Type 10-422
Leaf Spring Actuator



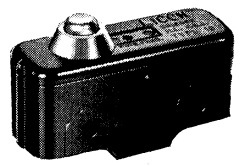
Type 10-522
Roller Leaf Actuator



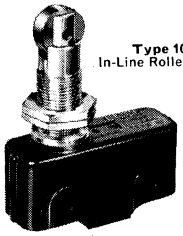
Type 10-622
Hinge-Type Lever



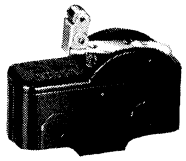
Type 10-722
Roller Lever Actuator



Type 10-822
Cam Actuation



Type 10-922
In-Line Roller Actuator

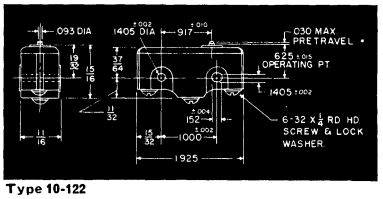


Type 10-72237
One Way Actuator

CHARACTERISTICS

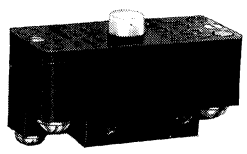
Electrical Rating 15A, 125/250 V a-c, 460 V a-c
15A Res 5A Ind. 5A motor, 30 V d-c
UL APPROVED CSA APPROVED

Splash-proof sealing against moisture, dirt, dust and other harmful elements can be provided for most models. Preloaded reverse action actuator available.

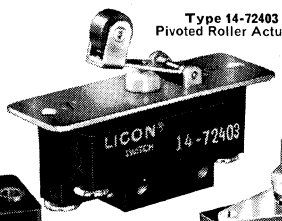


Type 10-122

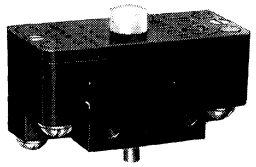
LICON TYPE 14 HEAVY DUTY BASIC SWITCHES



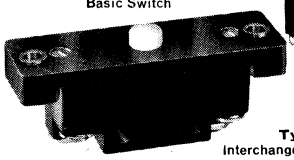
Type 14-124
Basic Switch



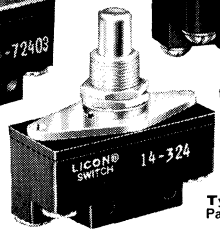
Type 14-72403
Pivoted Roller Actuator



Type 14-1241 Maintained Contact, Reset.



Type 14-128040
Interchangeable and economical



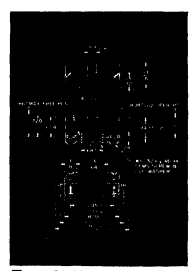
Type 14-324
Panel Mount

Movement differential available from .101" to over .040". 100 gram to 2 lb. operation force available. Terminals available with a No. 6 screw and cup washer, No. 6 screw and lockwasher or No. 8 screw with these same fastener choices. Custom terminal designs available. Auxiliary mounting plate available for panel mount.

ELECTRICAL RATING

Volts	A.C. Steady	A.C. In-Rush	D.C. D.T.	D.C. S.T.
30	20	80	10	25
110	20	80	.5	2.0
220	20	80	.2	.5
440	15	50		
600	5	10		

UL APPROVED



Type 14-124

Get the full story behind the switches you need from the fastest growing full-line switch supplier...LICON



BUTTERFLY® DOUBLE-BREAK SWITCHES

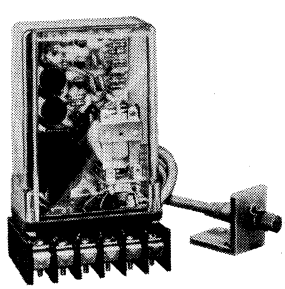
The theory behind the unique Licon Butterfly® Double-Break switch design, switch characteristics and ratings, and a catalog of the complete line.



LICON® LIGHTED SWITCHES

A complete description of the Licon Lighted switch line, physical and electrical properties, design considerations and a catalog of the 1-lite, 2-lite, and 4-lite series.

NEW!
70-700 PROXIMITY SWITCH



The 70-700 consists of two basic modules, a control module and a remote potted sensor. The control module contains a 10 amp relay and a transistor oscillator, both housing in a plastic plug-in case which mates with a 12 terminal heavy duty JIC style socket (supplied). A NEMA Class 1 metal enclosure is also available for housing both the control module and heavy duty socket.

SPECIFICATIONS

Accuracy — The circuit will actuate, at a given sensor to conductor spacing, within 0.0005".

Sensing Range — For the .750" diameter sensor .110" Min. — .261" Max., and for the .440" diameter sensor .048" Min. — .148" Max.

Speed — Up to 1000 operations per minute possible.

Ambient Temperature Ranges — 30° to + 250° F for the remote sensor, 0° to + 150° F for the control module.

For complete information about the full line of Licon switches, write for G105 catalog.

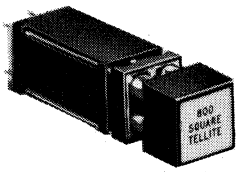
LICON
DIVISION ILLINOIS TOOL WORKS INC.
6615 WEST IRVING PARK ROAD — CHICAGO, ILLINOIS 60634

MSC Master Specialties Lighted Pushbutton Switches, Pilot Lites

For more than a quarter of a century, Master Specialties Company has specialized in the development and production of warning and display systems, word indicator lights, and illuminated pushbutton switches. Today, the company produces a broad line of information display and control devices for the nation's military and space programs and for commercial aviation, industrial process control, public utilities and commercial equipment of all types. This product selection guide will enable you to quickly select the right MSC product for your application.

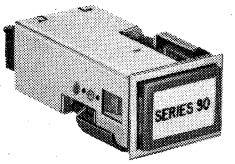
Series 800 Square Tellite® Switch

Miniature pushbutton switch with modular design and outstanding plug-in features. Reduces wiring installation time by 71% while increasing reliability. Available in standard matrices containing up to 144 channels.



Miniature Tellite® Series 90E Switch, Series 80E Pilot Lite

Companion pushbutton switches and indicators with matching panel cutout and front-of-panel appearance. Flush mount design, with positive hard mount from front of panel. Provide broad capabilities in minimum space. Half the size of equivalent competitive units. Provide two-lamp reliability, or separate lighted indication in one unit.



Comparative design and performance characteristics

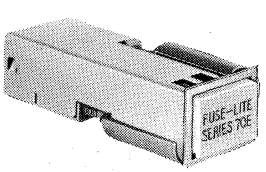
This tabulation of outstanding characteristics permits you to select quickly and easily the MSC product most suitable to your requirement. Once you have made your choice, we invite you to write for complete catalog information. Or, if you prefer, contact the nearest regional sales office or distributor where you will receive prompt attention to your request.

Characteristics	Series 800 Square Tellite® Switch	Miniature Tellite® Series 90E Switch, Series 80E Pilot Lite
Basic Unit Types Available	Indicator Lite, Switch Lite, Switch Lite with Holding Coil	Switch Lite, Switch Lite with Holding Coil, Pilot Lite
Switch Configurations and Actions	2PDT or 4PDT, momentary or alternate action	2PDT or 4PDT, momentary or alternate action
Overall Unit Size, H x W x L	.750" x .750" x 3-1/8" max.	1.000" x .750" x 3.093" max. (switch) 1.000" x .750" x 2.400" max. (pilot lite)
Lamp Type / Number of Lamps / Voltage	Four T-1-3/4 incandescent 6, 12, or 28 volt based lamps (115 VAC neon lamps available)	Two T-1-3/4 incandescent 6, 12, or 28 volt based lamps (115 VAC neon lamps available)
Lamp Circuits Available	Common ground, vertical or horizontal split	Common ground
Wiring Terminations	Crimp type (soldering possible)	Solder type (switch) Solder or screw type (pilot lite)
Switch Contact Ratings	5 amps resistive @ 115 to 250 VAC, 5 amps resistive, 2.5 amps inductive @ 30 VDC	3 amps resistive, 1-1/2 amp inductive, 1 amp lamp load N.A. for Series 80
Relamping	Front of panel without tools	Front of panel without tools
Display Screen Arrangements	Full display, vertical or horizontal split display, 3 and 4-way split display	Full display, 2-way horizontal or vertical split, two-color
Color Control Method	Silicone rubber slab filters in amber, blue, green, red, white. Projected color also available	Silicone rubber slab filter in amber, blue, green, red, white
Lens Types Available	Lighted letters or lighted background, letters either legible or not when unit is unlighted	Lighted letters or lighted background, letters either legible or not when unit is unlighted
Mounting Method	Units plug and lock into pre-fabricated mounted racks	Hard mount from front of panel with integral mounting sleeves
Unit Weight, Nominal	1 oz. (module); .7 oz. (mounting rack)	2 oz. (switch) 1-1/4 oz. (pilot lite)
Optional Features Available	RFI screens, two-color full display, panel plugs	RFI screen, drip-proof seal, spacer barriers, switch guard
Price, Basic Unit with 2-Pole Momentary Switch, 500 Pieces	$9.20	$6.30 (switch) $1.80 (pilot lite)

OTHER MSC INFORMATION DISPLAY AND CONTROL DEVICES

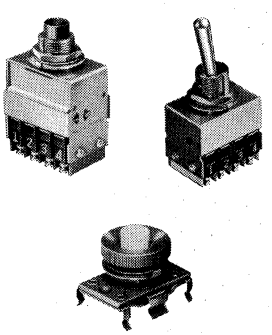
SERIES 70E WORD INDICATING TWO-LAMP FUSE HOLDER

Perfect for quick identification and replacement of open fuses. Provides easy panel front mounting and relamping. Choice of resistance limiter, isolated lamp/fuse, and 250V circuits. Accepts standard industry fuses. Features two-lamp reliability and rugged construction for further dependability. Available for MIL-F-19207 applications as Series 70H.



UNLIGHTED SWITCH ASSEMBLIES

Series 14. 2PDT or 4PDT unit with momentary or alternate action. Positive snap-action design assures instantaneous contact transfer. Also available for MIL-S-8805 applications as Series 14H. **Series 19.** Building block pushbutton switch. Removable color pushbuttons, facing nuts and switch modules provide design flexibility. **Series 16.** Precision two position toggle switch assembly. 2PDT or 4PDT maintained/maintained. Simultaneous transfer of all switch contacts. Also available for MIL-S-8805 applications as Series 16H. **Series 21.** three position toggle switch with three separate lever actions for positive contact transfer. **Series 22.** Precision sequence actuator. Programs four miniature SPDT switch modules for any combination of switching modes in up to twelve sequential steps.



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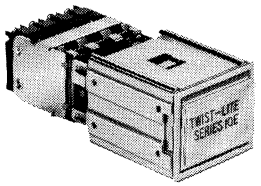
REGIONAL OFFICES AND DISTRIBUTORS CONVENIENTLY LOCATED THROUGHOUT THE UNITED STATES, CANADA AND EUROPE.

MSC Master Specialties Lighted Pushbutton Switches, Pilot Lites

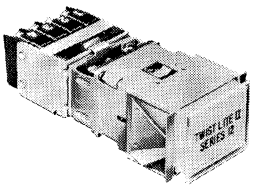
Series 10E Twist-Lite®

Features positive hard mount sleeve, individual lamp color control and four-way split display. Also functions as word indicator for design compatibility. Withstands extremes of shock and vibration due to hard mount feature. Available for MIL-S-22885 requirements as Series 10H.



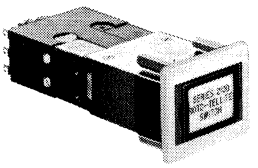
Series 12 Twist-Lite®

Versatile switch with simplified spring-clip mounting and numerous mounting configurations. Twelve different styling options available. Combination of features makes unit ideal for industrial, commercial and military control panels. Approved by Underwriters Laboratories.



Series 2100 Roto-Tellite®

Reliable lighted pushbutton switch designed for rigorous, versatile duty in military/aerospace airborne and ground support equipment. Available in a wide variety of channel configurations. Can be grouped in many combinations at factory, shipped ready to install.

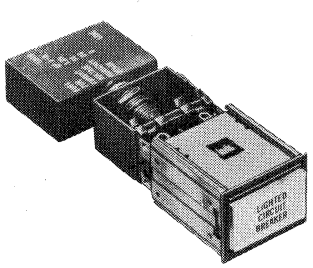


Characteristics	Series 10E Twist-Lite®	Series 12 Twist-Lite®	Series 2100 Roto-Tellite®
Basic Unit Types Available	Indicator Lite, Switch Lite, Switch Lite with Holding Coil	Indicator Lite, Switch Lite, Switch Lite with Holding Coil	Indicator Lite, Switch Lite, Switch Lite with Holding Coil
Switch Configurations and Actions	2PDT or 4PDT, momentary or alternate action	2PDT or 4PDT, momentary or alternate action	2PDT or 4PDT, momentary or alternate action
Overall Unit Size, H x W x L	.960" x 1.200" x 2.790" maximum (momentary)	.860" x 1.250" x 1.950" max.	1.515" x 1.812" x 3-5/8" max. (single unit with cover plate)
Lamp Type / Number of Lamps / Voltage	Four T-1-3/4 incandescent 6, 12, or 28 volt based lamps (115 VAC neon lamp available)	Four T-1-3/4 incandescent 6, 12, or 28 volt based lamp (115 VAC neon lamps available)	Four T-1-3/4 incandescent 6, 12, or 28 volt based lamps (115 VAC neon lamps available)
Lamp Circuits Available	Common ground, full display, vertical split or horizontal split; or each lamp separately grounded	Common ground, full display, vertical split or horizontal split; or each lamp separately grounded	Common ground, vertical or horizontal split
Wiring Terminations	Solder type	Solder type	Solder type
Switch Contact Ratings	Silver: 5 amps @ 125 to 250 VAC, 5 amps resistive, 3 amps inductive @ 30 VDC Gold: 1 amp resistive, 1/2 amp inductive @ 30 VDC	Silver: 5 amps @ 125 to 250 VAC, 5 amps resistive, 3 amps inductive @ 30 VDC Gold: 1 amp resistive, 1/2 amp inductive @ 30 VDC	5 amps @ 125 to 250 VAC, 3 amps inductive @ 30 VDC (sea level)
Relamping	Front of panel without tools	Front of panel without tools	Front of panel without tools
Display Screen Arrangements	Full display, vertical or horizontal split display, 3 and 4-way split display	Full display, vertical or horizontal split display, 3 and 4-way split display	Full display, vertical or horizontal split display, 3 and 4-way split display
Color Control Method	Silicone rubber bulb filters in amber, blue, green, red, white, yellow. Colored lenses also available	Silicone rubber bulb filters in amber, blue, green, red, white, yellow. Colored lenses also available	Silicone rubber slab filters in amber, blue, green, red, white
Lens Types Available	Lighted letters or lighted background, letters either legible or not when unit is unlighted	Lighted letters or lighted background, letters either legible or not when unit is unlighted	Lighted letters or lighted background, letters either legible or not when unit is unlighted
Mounting Method	Hard mount from front of panel with integral mounting sleeves	Spring clip, mounting barrier or spring clip with spacer barrier	Front of panel, with small screwdriver
Unit Weight, Nominal	3.1 oz.	3.1 oz.	4 oz.
Optional Features Available	Switch guard, drip proof seal, RFI screen, master test control capsule, four color "Full" display, quick connect and wire wrap terminals, Snap-on circuit breaker (see back cover)	Meets applicable requirements of MIL-S-22885 and CSA.	Circuitry (test and dimming), matrices with single cover plate, two-color.
Price, Basic Unit with 2-Pole Momentary Switch, 500 Pieces	$9.25	$5.00	$18.00

OTHER MSC INFORMATION DISPLAY AND CONTROL DEVICES

LIGHTED PUSHBUTTON CIRCUIT BREAKERS

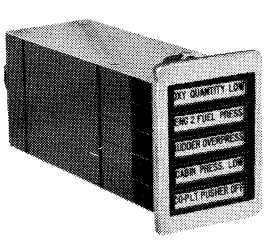
Assembly consists of snap-on circuit breaker, 4-lamp word indicator and re-set actuator assembly. Provides up to four-way split, word and color variety, styling compatibility with other MSC indicators. SPST breaker designed to meet military requirements. Flush mount design ensures operating safety. Offers 50 MA to 20 amp protection with choice of delay times.



WARNING AND DISPLAY SYSTEMS

Master Caution Systems. Complete warning systems for monitoring several functions and providing positive fault identification with illuminating word indicators. Meets exacting military requirements. Widely used in prominent military and commercial aircraft, missile ground support equipment and exacting industrial applications.

AVA — Audio/Visual Annunciator. Combination system with lighted word indicators and corresponding pre-recorded voice messages. Features small size. Ideal for fault identification in aircraft, ground support equipment and military applications. Also excellent for monitoring status in industrial or commercial process control installations.



TURN PAGE FOR SPECIFICATIONS ON MSC LIGHTED WORD INDICATORS . . .

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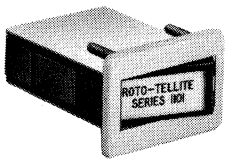
MSC Master Specialties Lighted Word Indicators

Comparative design and performance characteristics

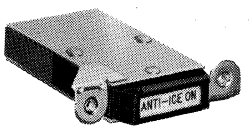
Series 100/1100 Roto-Tellite®

Flush mounted model available with two standard lens sizes (narrow 100, wider 1100) and a wide variety of matrix configurations. Ideal when application calls for rugged, dependable performance in environmental extremes.



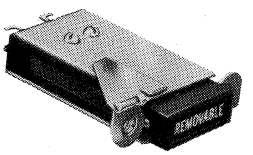
Series 6000/7000 Roto-Tellite®

Available in two sizes, the narrow 6000 and wider 7000 — mounts flush with front panel. Small size, low cost, high quality features are ideal for cockpit applications and numerous industrial, commercial and military requirements.



Series 4000/5000 Tellite®

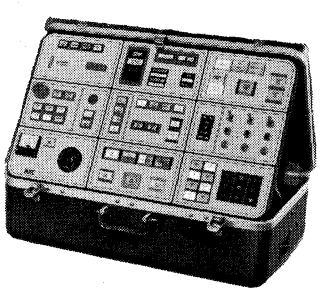
Push-to-relamp indicator offered in two sizes, the Series 4000 and the larger Series 5000. Both are ideal for numerous industrial, commercial and military applications. Relamping accomplished simply by depressing display face then pulling face forward on captive runners.



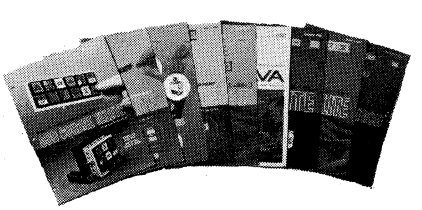
Characteristics	Series 100/1100 Roto-Tellite®	Series 6000/7000 Roto-Tellite®	Series 4000/5000 Tellite®
Basic Unit Types Available	Indicator	Indicator	Indicator
Overall Unit Size, H x W x L	1.050″ x 1.813″ x 1-15/16″ max. (Series 100 with cover plate) 1.216″ x 1.813″ x 1-15/16″ max. (Series 1100 with cover plate)	.373″ x 1.092″ x 1-7/8″ max. (Series 6000 excluding mounting brackets) .373″ x 1.467″ x 2-1/16″ max. (Series 7000 excluding mounting brackets)	.380″ x 1.000″ x 2.375″ max. (Series 4000) .380″ x 1.250″ x 2.375″ max. (Series 5000)
Lamp Type / Number of Lamps / Voltage	Two T-1-3/4 incandescent 6, 12, or 28 volt based lamps (115 VAC neon lamps available)	Two T-1-3/4 incandescent 6, 12, or 28 volt based lamps (115 VAC neon lamps available)	Two T-1-3/4 incandescent 6, 12 or 28 volt based lamps (115 VAC neon lamps available)
Lamp Circuits Available	Common and divided	Common and divided	Common and divided
Wiring Terminations	Solder type	Solder lugs	Solder lugs
Relamping	Front of panel without tools	Front of panel without tools	Front of panel, without tools
Display Screen Arrangements	Full display, vertical split display	Full display, vertical split display	Full display, vertical split display
Color Control Method	Silicone rubber slab filters in amber, blue, green, red, white	Silicone rubber slab filters in amber, blue, green, red, white	Silicone rubber slab filters in amber, blue, green, red, white
Lens Types Available	Lighted letters or lighted background, letters either legible or not when unit is unlighted	Lighted letters or lighted background, letters either legible or not when unit is unlighted	Lighted letters or lighted background, letters either legible or not when unit is unlighted
Mounting Method	From front of panel with mounting studs, cover plate provided covers mounting studs and panel cutout	From rear of panel	From rear of panel
Unit Weight, Nominal	2 oz.	1 oz.	1 oz.
Optional Features Available	Circuitry (test and dimming), matrix mount with single cover plate, drip proof seal	Circuitry (test and dimming); multiple channels, horizontal or vertical stacks	Multiple channels, horizontal or vertical stacks
Price, Basic Unit with 2-Pole Momentary Switch, 500 Pieces	$7.00 (Series 100) $8.00 (Series 1100)	$4.50 (both Series)	$5.25 (both Series)

See Master Specialties Co. Devices In Operation . . . In Your Own Office!

This operational demonstrator, including all devices listed in this catalog will be brought to your desk for a first hand examination of the product features. Just ask your Master Specialties Co. sales engineer.

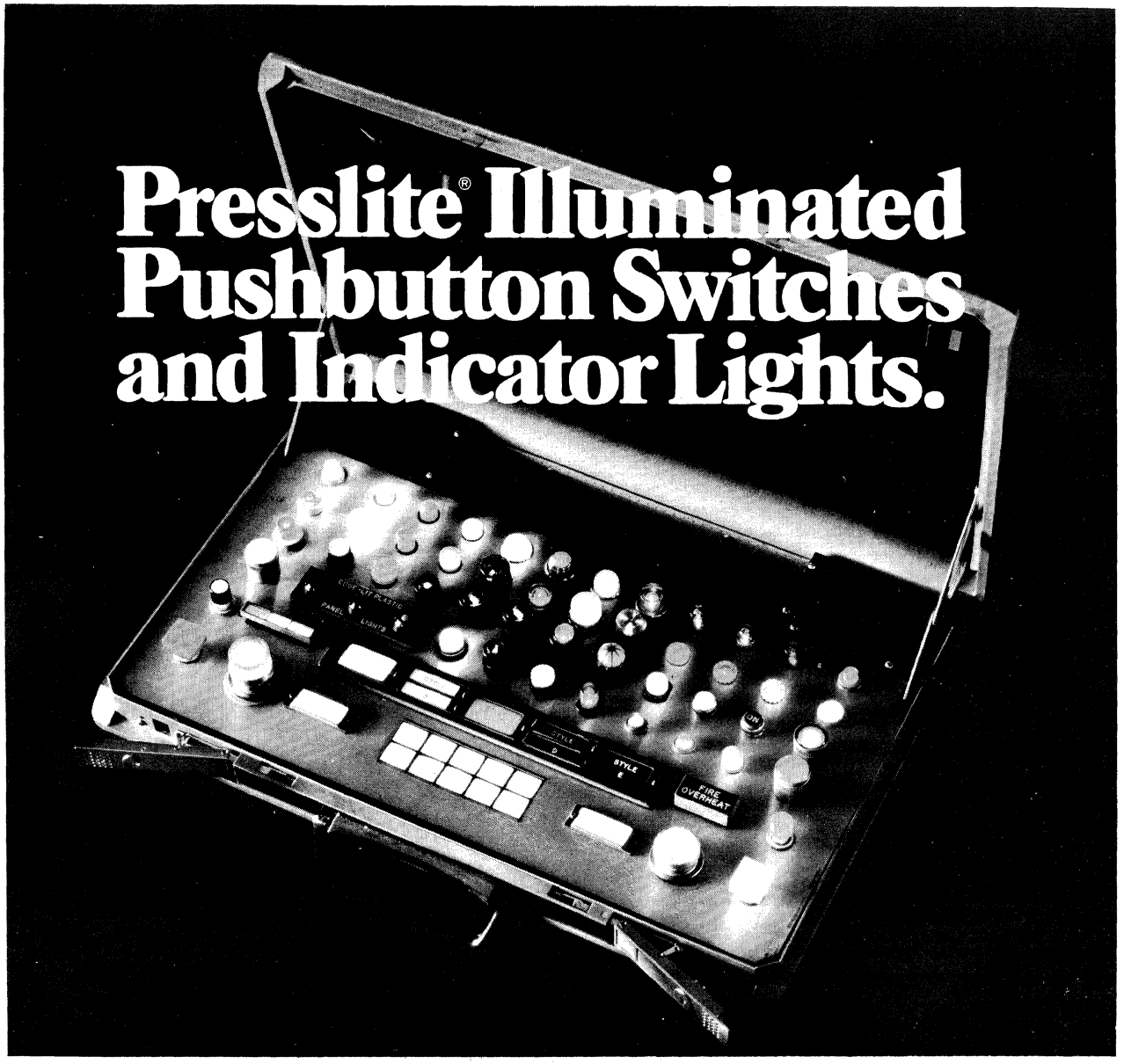


Write for Product Catalogs. If you need more information than appears in this product selection guide, contact our nearest sales office or write for descriptive literature. We have individual catalogs for each series in the Master Specialties line. They contain practically everything you will need to select, install and operate the unit which is most appropriate for your particular application.



MSC MASTER SPECIALTIES COMPANY 1640 MONROVIA, COSTA MESA, CALIFORNIA 92627 (714) 642-2427. TELEX: 678-433
REGIONAL OFFICES AND DISTRIBUTORS CONVENIENTLY LOCATED THROUGHOUT THE UNITED STATES, CANADA AND EUROPE.

Presslite® Illuminated Pushbutton Switches and Indicator Lights.



Whatever your panel problem, you'll find the solution with Marco-Oak's Presslite pushbutton switches and matching indicator lights. Here's why:

- **Versatile mounting**... broad line of hardware, ¼" to 1" mounting hole sizes
- **Environment-proof**... oil- and watertight in all types and sizes.
- **Securely-shielded**... against EMI/RFI transients.

Presslite Switches—Improved materials assure a long life of over a million cycles. And, they provide crisp appearance and safety features not previously available for front panel layout. Recessed types also available.

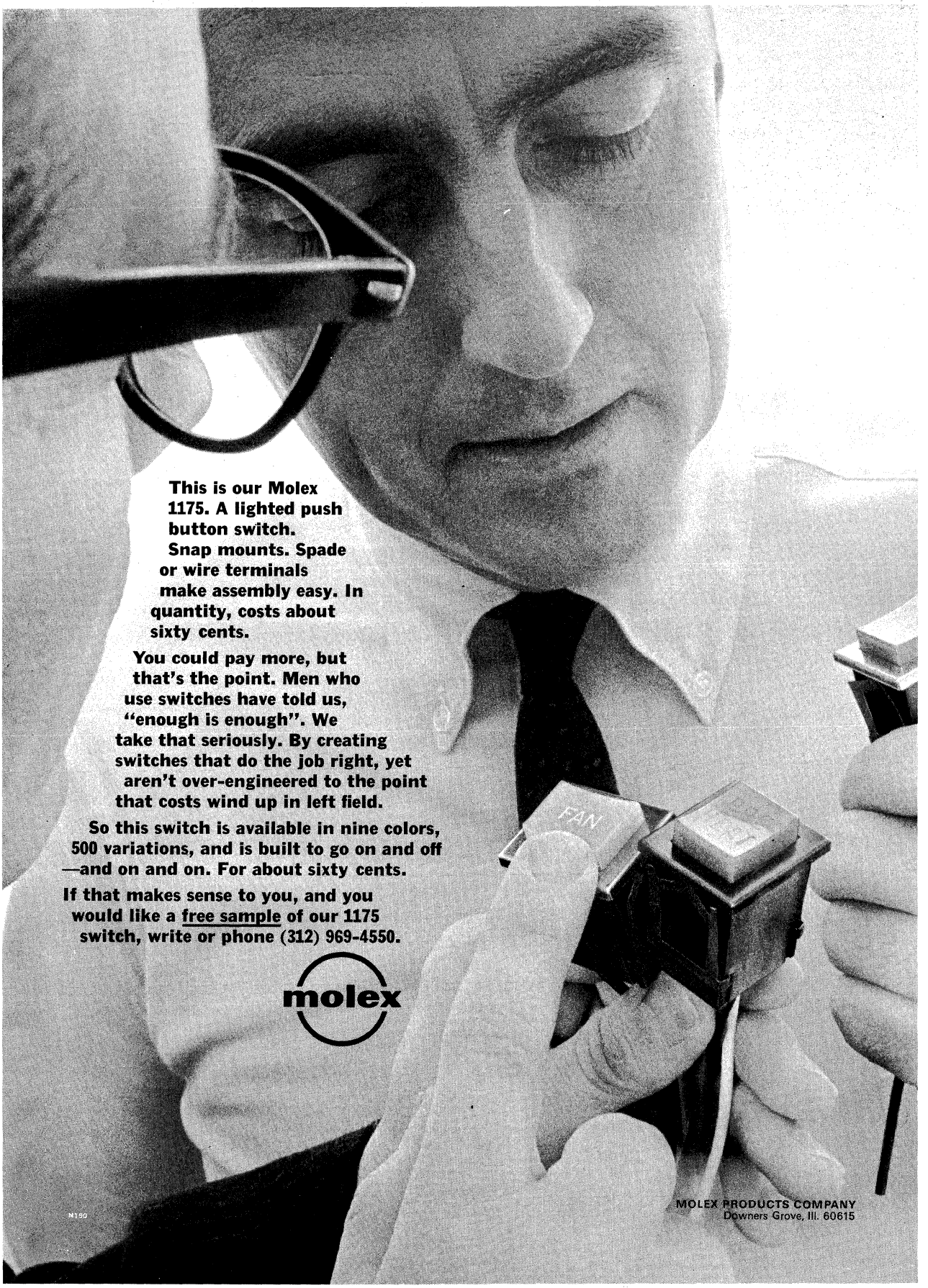
A new model has linear contacts (instead of snap-action) and a unique over travel mechanism to prevent contact damage from excessive operating force or arcing from insufficient operating force.

Indicator Lights—They're completely compatible with Presslite pushbuttons and adaptable to any panel. Press-to-test is a special feature offering you wide options of choices on lamps, lettering or legend markings.

And, these indicator lights exceed all commercial and military specs—including MIL-L-3661B and MIL-S-22885.

Presslite switches and indicator lights are the result of long years of experience in design and manufacturing. Special applications and difficult design problems are welcomed. For full details, write today for: Presslite Catalog S-68 or Indicator Light Catalog L-68.

MARCO-OAK
A DIVISION OF OAK ELECTRO/NETICS CORP
P. O. Box 4011 207 S. Helena Street
Anaheim, California 92803
PHONE: 714-535-6037 • TWX: 714-776-6111



This is our Molex 1175. A lighted push button switch. Snap mounts. Spade or wire terminals make assembly easy. In quantity, costs about sixty cents.

You could pay more, but that's the point. Men who use switches have told us, "enough is enough". We take that seriously. By creating switches that do the job right, yet aren't over-engineered to the point that costs wind up in left field.

So this switch is available in nine colors, 500 variations, and is built to go on and off —and on and on. For about sixty cents.

If that makes sense to you, and you would like a free sample of our 1175 switch, write or phone (312) 969-4550.

molex

MOLEX PRODUCTS COMPANY
Downers Grove, Ill. 60615

M199

Molex Connectors and Switches are also available from Electrical/Electronic Distributors through Waldom Electronics, Inc.

MICRO SWITCH Freeport, Illinois

A Division of Honeywell

TYPE "1SX" SUBMINIATURE BASIC SWITCHES

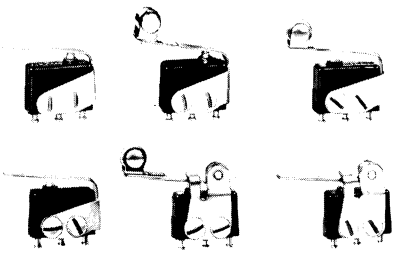


.50 x .35 x .20

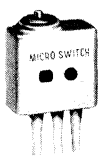
- Smallest SPDT switch.
- Weighs only 1/28 ounce.
- Temperature range: —100°F to +250°F or +375°F.
- Operating force as low as 3 oz. or as high as 5 oz.
- Differential travel as low as .002 inch to .005 inch.
- Contact arrangement is SPDT.
- High arc-resistance; high-impact case.
- Six auxiliary actuators.
- Turret terminals for easy soldering.
- UL and CSA listed.
- Military listed.

Electrical Rating:
Silver contacts: 7 amps, 125 or 250 vac; 4 amps ind. and 7 amps. res. 28 vdc.
Gold contacts: 28 vdc; 2 amps inrush; 0.5 amp ind.; 1 amp res.

AUXILIARY ACTUATORS



TYPE "XE" ENVIRONMENT-PROOF SWITCHES



.62 x .60 x .32

- Enclosed plastic basic "ISX" switch.
- Corrosion-resistant aluminum housing.
- Molded silicone rubber plunger seal.
- Terminals encased in epoxy resin.
- Operating temperature range is —65°F to +221°F.
- Auxiliary actuators available.

Electrical Rating: 7 amps, 115 vac or 28 vdc.

TYPE "SM" SUBMINIATURE BASIC SWITCHES

- Up to 10 ampere capacity.
- Standard temperature range: —100°F to +250°F.
- Several terminal variations.
- Gold or silver contacts.
- Integral or auxiliary actuators.
- Extra long life switches: 10,000,000 mechanical operations.
- Corrosion resistant levers.
- UL and CSA listed.
- Military listed.

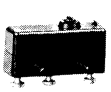
Electrical Ratings:
125-250 vac, 5 amps; specials to 10 amps, 125-250 vac. 30 vdc; inductive, 3 amps sea level and 2.5 amps 50,000 feet; resistive, 5 amps sea level and 50,000 feet.
Gold contacts: 30 vdc, inductive, 0.5 amp; resistive, 1 amp.



"SM"
BASIC SWITCH
.78 x .36 x .25



CENTER
PLUNGER

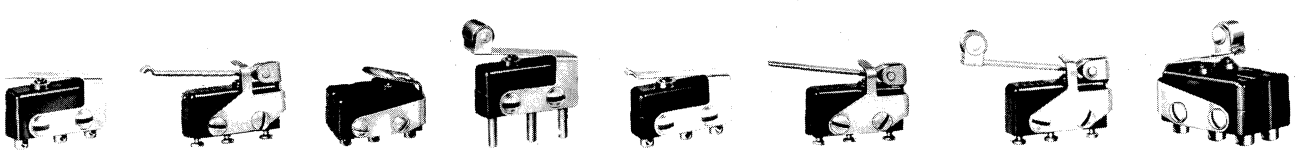




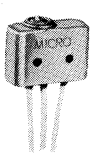
INTEGRAL LEVERS



AUXILIARY ACTUATORS



TYPE "SE" ENVIRONMENT-PROOF SWITCHES

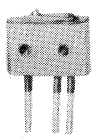


.88 x .60 x .35

- Enclosed plastic basic "SM" switch.
- Corrosion-resistant aluminum housing.
- Molded silicone rubber plunger seal.
- Terminals encased in epoxy resin.
- Operating temperature range is —65°F to +221°F.
- Auxiliary actuators available.

Electrical Rating:
5 amps, 115 vac or 28 vdc.

TYPE "HM" HERMETICALLY-SEALED SWITCHES



.79 x .50 x .25

- Metal-to-metal and glass-to-metal seals.
- Meet Military Specification for explosion-proof, and corrosion-resistance.
- Operating temperature ranges from —300°F to 500°F.
- Auxiliary actuators.
- Circuitry is SPDT.

Electrical Rating:
5 amps resis. and 3 amps ind., 28 vdc.

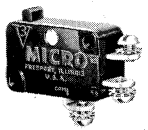
MICRO SWITCH Freeport, Illinois

A Division of Honeywell

TYPE "V3" MINIATURE HIGH CAPACITY SWITCHES

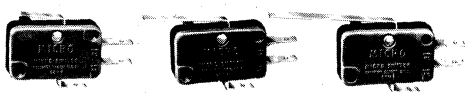
- Circuitry: SPDT, SPNO, SPNC.
- Operating Force: From 8 grams to 14 ounces.
- Differential Travel: .002 inch to .016 inch.
- Actuators: Auxiliary and integral as shown.
- Standard Temperature Range: —100° to +185°F., Specials to +600°F.
- Low Force
- Extra Long Life: 10,000,000 operations
- Terminals: Solder, screw or quick connect terminals.
- Ideal for gang mounting.
- UL and CSA listed.
- Military listed.

Electrical Rating:
30 vdc: Ind., 10 amps at sea level, 6 amps at 50,000 feet; res., 10 amps; motor load, 6 amps.
125-250 vac: 10 or 15 amps; gold contact designs for dry circuit use.

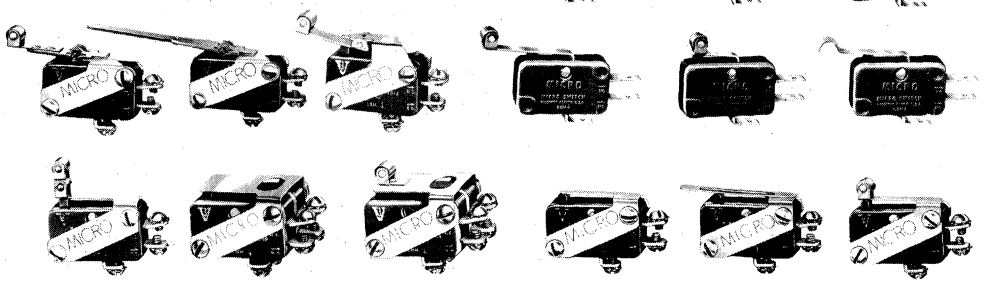


1.10 x .63 x .40

INTEGRAL LEVERS



AUXILIARY ACTUATORS



STANDARD SERIES "BZ", "BA", "BE", "BM", "MT", AND "DT" BASIC SWITCHES

- Circuitry: SPST, SPDT, DPDT, pulse or sequence action, momentary or maintained contact.
- Characteristics: Sensitive operating forces measured in grams; differental travels as small as .0002 inch.
- Temperature Range: Down to —65°F, up to 400°F.
- Terminals: Several variations of solder, screw and quick-connect types.
- Actuators: Hundreds of configurations tooled and available.
- UL and CSA listed.
- Accurate repeatability.

Electrical Ratings and Circuitry

BZ — SPDT
15 amps, 125, 250 or 480 vac

BA — SPDT
20 amps, 125, 250 or 480 vac

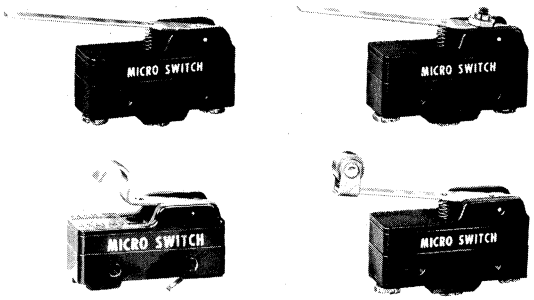
BM — SPDT
22 amps, 125, 250 or 480 vac

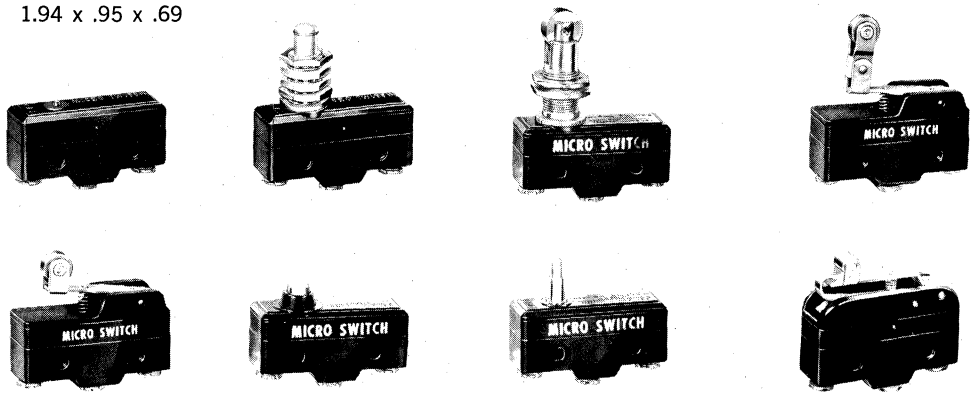
BE — SPDT
25 amps, 125, 250 or 480 vac

DT — DPDT
10 amps, 125 or 250 vac

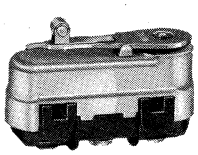
MT — SPDT
10 amps, 125 vac or vdc

1.94 x .95 x .69





TYPE "HS" HERMETICALLY-SEALED SWITCH



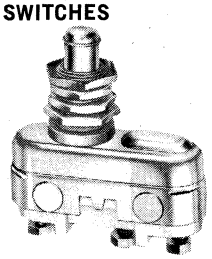
- Metal-to-metal and glass-to-metal seals.
- Meet Military Specification for ex-explosion-proof and corrosion-resistance.
- Operating temperature range is —65° to +180°F.
- Variety of actuators.
- Circuitry is SPDT.

Electrical Rating: 25 amps, resis., 10 amps, ind., 28 vdc. 1 amp resis. and ind.,125 vac.

"HT" HIGH TEMPERATURE SWITCHES

- Monel enclosure on a ceramic base.
- Meets Military Specifications for corrosion and shock resistance.
- Operating temperature range is —321°F to +1000°F.
- Variety of actuators.
- Circuitry is SPDT.

Electrical Rating: 10 amps resis., 5 amps ind., 4 amps motor load, 2.4 amps lamp load, 28 vdc.



MICRO SWITCH Freeport, Illinois

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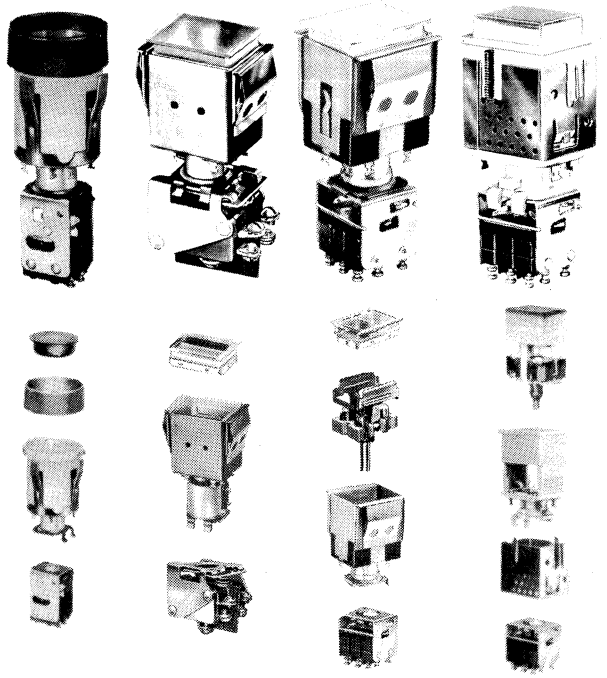
SERIES 2 LIGHTED PUSHBUTTON SWITCHES



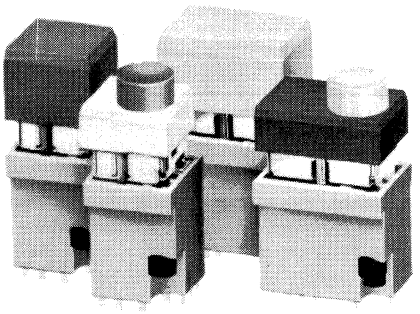
MODULAR LIGHTED PUSH BUTTON SWITCHES

Series 2 Rectangular and round display. Snap-in mount. Solenoid pull-in and/or hold-in coil for remote control.
Series 2C200 Snap-in mount. Relamp without tools. Available with RFI shield, and solenoid pull-in or hold-in coil for remote control.
Series 2N Shock-resistant spring lock mount. Hold-in coil. Relamp without tools. Colored housings.

GENERAL FEATURES:

in BUTTONS—Choice of 1, 2, 3, or 4-section buttons.
in COLOR—Wide selection of transmitted and projected (filtered) color schemes, and 1 to 4 lamps for up to 4-color display.
in CIRCUITRY—Up to 4-pole double-throw and 2-circuit double-break contact arrangements.
in RATINGS—Wide selection of modules for handling low energy to heavy duty electrical loads.
in WIRING—Solder, screw or quick connect wiring terminations.
in MOUNTING—Snap-in flange and barrier mountings or spring-lock panel attachment.
in REMOTE CONTROL—Only MICRO SWITCH has both remote actuation and release of switching contacts.

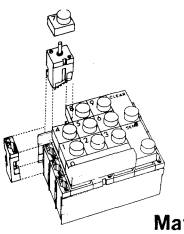
KB SWITCH/DISPLAY MATRIX



KB Switch/Display Matrix—makes it practical for you to design and assemble a custom man/machine interface for each individual panel. KB gives you a complete new set of modular keyboard components.

Included are: plug-in power switches with lighted display; plug-in lighted indicators; plug-in encoding switches with up to eight output bits in each. Unique mounting modules allow you to assemble a complete keyboard at the bench—complete with encoding, wiring, interlock or lockout system.

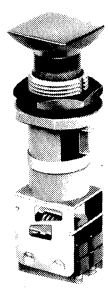
- Flexibility in pushbutton control and lighted display.
- Flexibility in arrangement of panel layouts.
- Flexibility in data entry (inputs).
- Introducing a new module-matrix mounting technique.
- Plug-in elements for fast assembly and easy field changes.
- "Add-on" modules provide mechanical interlock.



Matrix Mount

"KB" PUSHBUTTON SWITCHES

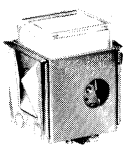
Lighted plug-in power switches have a 2 or 4-pole double-throw double-break circuitry, and momentary or alternate action. Electrical rating: 28 vac,, 3 amps, ind., 5 amps, resis.; 115 vac, 5 amps resis. or ind. Reed plug-in switches have 1 or 4 SPNO circuitry, in momentary or alternate-action versions. Hermetically-sealed reeds provide immunity to contact contamination. Ideal for dry circuits.



SERIES 50PB LIGHTED PUSHBUTTON SWITCHES

- Bushing mounting.
- One-lamp indication.
- Wide choice of button shapes and colors.
- Momentary or alternate action.
- Electromagnet maintained action.

Electrical Ratings:
SPDT—5 amps, 125-250 vac;
5 amps, res., 3 amps ind., 30 vdc.
2 CKT DB—10 amps, 125-250 vac;
½ hp, 125 vac.; 10 amps, 30 vdc.



SERIES 302PB LIGHTED PUSHBUTTON SWITCHES

- Miniature size—occupies less than one cubic inch.
- One or two-section display, two-lamp indication.
- Two single-pole double-throw switches.
- Momentary or alternate action.
- Snap-in mounting.
- UL and CSA listed.

Electrical Rating:
7 amps, 115-230 vac;
7 amps, res., 4 amps ind., 28 vdc.

MICRO SWITCH Freeport, Illinois

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UNLIGHTED PUSHBUTTON SWITCHES

- COMPACT DESIGN
- WIDE CHOICE OF OPERATIONAL CHARACTERISTICS
- AVAILABLE WITH OR WITHOUT SEALED CONSTRUCTION

Series PB bushing mount pushbutton switches find wide use on electronic and commercial-industrial panels. They are available with 1, 2, 3 or 4-pole double-throw contact arrangements, momentary or alternate action, with or without panel sealing, and in miniature size and low force designs.

Electrical Rating: (For all Series PB, except pushbuttons with hermetically sealed switch units.)

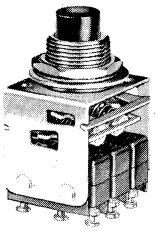
30 vdc-5 amps res. sea level or 50,000 ft., 3 amps ind. sea level, 2.5 amps ind. 50,000 ft., 24 amps max. inrush. UL and CSA listing for basic switch:

125 or 250 vac .....5 amps

Touch-Feedback Switches

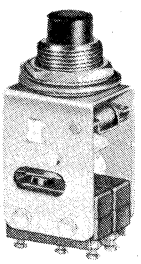
Momentary-Action (PB)

When the button is operated, a force is transmitted back to the finger, indicating that circuit transfer has taken place. There is a choice of black, red or green concave surface buttons. Switches have double turret solder type terminals.



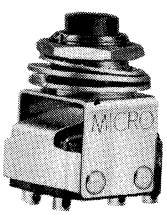
Alternate-Action Switches (PB)

Alternate-action "push-on push-off" switches transfer circuit each time the button is pushed and maintains the contact position until pushed again. Terminals are double turret solder type.



Short Travel Switches (PB)

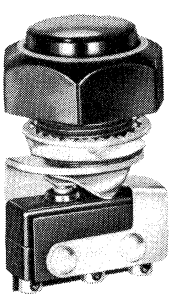
These switches are similar in appearance to the touch-feedback design, but have a leaf actuator for lower operating forces and shorter travel.



With Button and Panel Seals (PB)

Momentary-Action

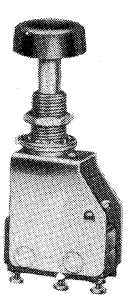
This two-piece design assembly enables the pushbutton to be separated from the switch unit and mounted in the panel. The switch unit is then easily wired and snapped into place from behind the panel. There is an elastomer seal bonded between the plunger and button collar and an "O" ring seals the button assembly to the panel front.



Low-Force Rapid Operating Action (PB)

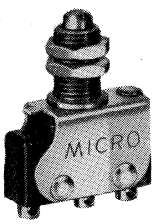
Developed for one-finger rapid-repeat operation, this switch is ideal for equipment requiring high-speed keyboard style control. Concave buttons are supplied detached for mounting.

Momentary-Action



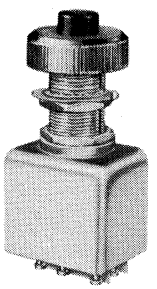
Miniature Size Switches (PB)

Catalog Listing 1PB5 is a single-pole double-throw miniature pushbutton switch, weighing only 0.3 oz. It has a steel button to enable use under hinged plates or paddle levers, in addition to manual operation.



Sealed at Bushing, Button, Panel and Switch Units (PB)

Catalog Listing 2PB901-T2 meets the submergence requirements of MIL-STD-108D (up to 10 p. s. i. water pressure for one hour). It is sealed facenut-to-panel, button-to-facenut, and bushing-to-facenut (prevents entry of water from back of panel. up and over bushing wall). The two SPDT switch units are potted in a corrosion-resistant metal enclosure. The knurled facenut is chrome finished to provide an attractive panel appearance with the black button.

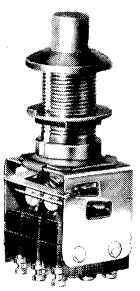


Series 6 Modular Pushbutton Switches

- Easy-to-assemble modules
- Choice of three facenut types, including one with Panel seal
- Wide array of switch modules

Pushbutton modules consist of an operating button, mounting bushing, two hexnuts and a keying washer. Mounting clips are provided at the base of the bushing for attachment of switch modules (or optional hold-in coil modules). They can be mounted in panels up to .312" thick.

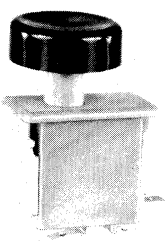
Electrical Rating: Depends on switching modules used. From milliamps to 20 amps, 125 vac.



"DM" Snap-In Mount Switches

Switch snaps in securely without tools. Adapts to panels .045" to .100" thick. Quick-connect terminals allow quick wiring.

Wide choice of actuators: four styles of pushbuttons, in red or black; push-pull (maintained) action; mechanical limit or interlock plunger. Available with single-pole double-throw or double-pole double-throw circuitry, momentary or maintained switching action. Rugged, corrosion-resistant plunger and case; high electrical capacity—UL and CSA listed at 10 amps, 125 or 250 vac; ⅓ HP, 125 or 250 vac.

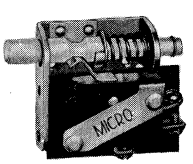


Door Interlocks

For use on hazardous electronic equipment. They automatically cut power when service door or drawer is opened, protecting personnel and equipment.

To test circuits with the power "on" the actuating rod can be manually set to a maintained-on-position. When the door or drawer is closed following test or service, the actuating rod automatically returns to the normal or reset position so that next time the door is opened, power is cut off. This feature eliminates the danger involved in "tying down" or wiring around conventional switches.

Electrical Rating: To 15 amps, 125, 250 or 480 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc.



MICRO SWITCH Freeport, Illinois

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TOGGLE SWITCH ASSEMBLIES

Toggle switch assemblies couple a toggle switch operator with one or more precision "SM" or "V3" type basic switches. In two position devices (type 6AT and 23AT), the normally open contacts of all basic switches are actuated when the toggle lever is located in the keyway position. In three position devices, such as the 22AT, one set of normally open contacts are actuated in each extreme position, while all switches in the center position are released, closing the normally closed contacts.

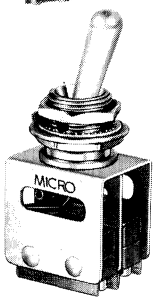
Electrical Ratings: Toggle switches with "V3" basics: 15 amps, ⅓ hp, 125-250 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc. 10 amps, ind. or resis., 30 vdc.

Toggle switches with "SM" basics: 5 amps, 125-250 vac; 3 amps ind., 5 amps resis., 30 vdc. Gold contacts: 1 amp, 125 vac. 0.5 ind., 1 amp resis., 30 vdc.



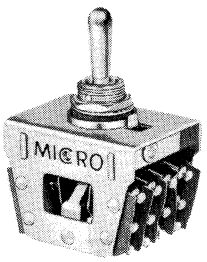
Type "6AT"

- Two bushing sizes—¼ in. and 15/32 in.
- Silver or gold contacts.
- UL and CSA listed.
- Short depth behind panel.
- Control 1, 2, or 3 pole, double-throw precision basic switches.
- Solder or turret terminals.
- "SM" basic switches.



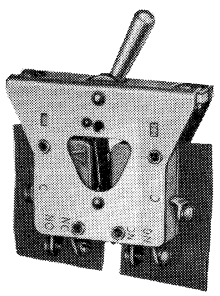
Type "13AT" and "23AT"

- Standard toggle, tab, or pull-to-unlock levers.
- Momentary and maintained level positions.
- 2, 3, and 4 pole versions.
- Silver or gold contacts.
- UL and CSA listed basic switches.
- Solder or turret terminals.
- "SM" basic switches.



Type "22AT"

- Panel and lever seals.
- Momentary and maintained poisitions.
- Contain 8 SPDT silver contact "SM" basic switches.
- UL and CSA listed basic switches.
- Single lever operates 4 basic switches in each extreme position.

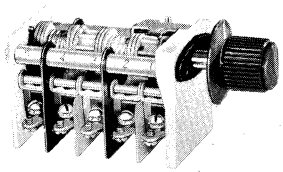


Type "AT" High Capacity

- 2, 4, 6, 8, or 10 switch control.
- High electrical capacity.
- Maintained and momentary positions.
- 3 hole mounting—rugged construction.
- "V3" basic switches.
- Two toggle lever lengths are offered.
- One of two banks of basic switches operated at each extreme position of the lever.

ROTARY SWITCHES

Rotary selector switches offer a means of switching as many as eight different circuits with one small, compact assembly. These switch assemblies are available with from one to eight switching units and from two to eight detent positions with a 45 degree angle between detents. The detent mechanism gives a positive "feel" of each position. Almost any desired switching sequence is possible.



Electrical Rating:
Up to 15 amps, 125 or 250 vac.
Up to 20 SPDT circuits.

TOGGLE SWITCHES

Manufactured and tested to meet military specifications — shock, vibration, corrosion, altitudes, etc. Provide excellent tactile feedback. One-hole mounting, with locking hardware—prevents switch rotation. Special circuitries include three-position multi-circuit ON-ON-ON operation. Solder, leadwire and screw terminals. Choice of bushing sizes. Varied toggle level configurations. Magnetic hole-in designs permit remote electrical release, with manual override option.

Electrical Rating (In Amperes):

Type "TL" and "TP"

30 Volts DC			125 VDC	250 VDC	115 Volts AC			220 VAC	Continuous
Ind.	Res.	Lamp	Res.	Res.	Ind.	Res.	Lamp	Res.	
15	25	7	0.75	0.5	10	15	3	6	40

Type "TW"

Electrical Rating: 5 amps res., 2 amps ind., 30 vdc and 115 vac.

Type "TS"

15 amps, 125-250 vac; ½ hp, 125 vac; 1 hp, 250 vac; 5 amps, 125 vac "L".

Type "TW"

- Miniature size, lightweight.
- Two- and three-position.
- Momentary and maintained operation.
- 1- and 2-pole.
- Molded-in solder terminals.
- ¼" bushing.



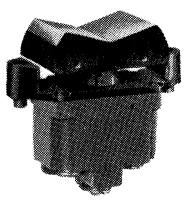
Type "TL"

- Completely sealed.
- Standard and pull-to-unlock toggle levers.
- Two- and three-position.
- Momentary and maintained operation.
- 1-, and 2-, and 4-pole.
- Tested to MIL-S-3950.
- Step terminal design.
- Screw terminals.
- 15/32" bushing.



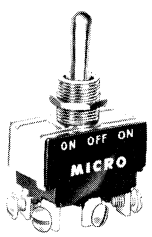
Type "TP"

- Rocker button actuator.
- Transparent and translucent, above panel and flush panel buttons (suitable for legending or edge lighting).
- Momentary and maintained operation.
- 1-, 2-, and 4-pole.
- Three hole mount.
- Screw terminals, step design.



Type "TS"

- Built to withstand military requirements of vibration and shock.
- Molded bushing seal.
- Keying washer and keyway prevent switch rotation.
- Optional panel seal.
- Solder, screw or quick-connect terminals.
- UL and CSA listed.



Type "ET" Magnetic Hold-in Switches

Built-in solenoid permits conversion from momentary to maintained contact and remote electrical release. "ET" switches offer several options in toggle configuration, circuitry, and terminal designs. Meet Military Specifications for explosion-proof and immersion-proof. Temperature range is −65°F to +158°F.
Toggle lever can be released manually.

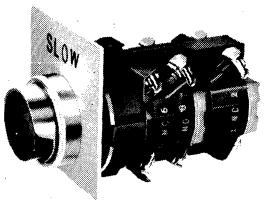
Electrical Rating:
From 4 to 10 amps resis., and 2.5 to 7 amps, ind., 28 vdc.



MICRO SWITCH Freeport, Illinois

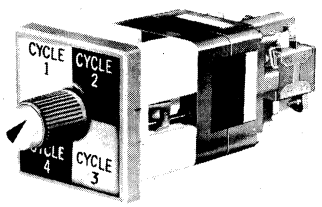
A Division of Honeywell

"PT" HEAVY DUTY OIL TIGHT PUSHBUTTON SWITCHES



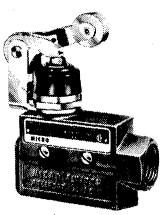
PT devices are used in a broad range of control applications where rapid operator identification of the control is necessary, oiltight construction is needed, and heavy duty (high inrush or reactive) loads are being driven. Choice of pushbuttons, lighted pushbuttons, indicators, selectors, selector-push, and potentiometers. May be ordered as components, units, or stations. Heavy duty and electronic duty contact blocks provide complete circuit flexibility. Contact blocks may be tandem mounted without mounting hardware.

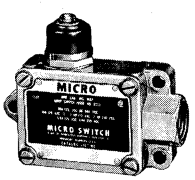
COORDINATED MANUAL CONTROL



Coordinated manual control. Line consists of 4 matching units, indicator, pushbutton, selector, and selector-push units. Distinctive and compatible panel appearance, legends on display field saves space on panel. Available with heavy duty or electronic duty contact blocks. Stacking of contact blocks increases circuitry.

ENCLOSED SWITCHES

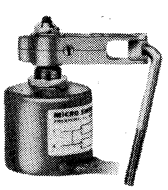




- Cast aluminum housing.
- Side or flange mount.
- Temperature Range −25°F to +160°F
- Sealed or unsealed actuators.
- Momentary contact.
- Captive cover screws.

Up to 20 amps, 125, 250 or 480 vac, 1 hp, 125 vac, ½ amp, 125 vdc.

TYPE "EN" LIMIT SWITCHES

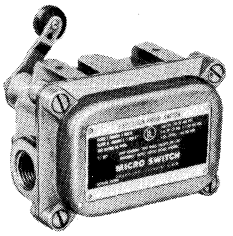


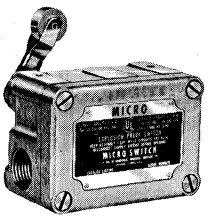


Type "EN" limit switches are the most versatile line of environment-proof switches available. Many combinations of actuators, circuitry, terminals and electrical ratings are offered to meet the demands of military/aerospace and commercial aircraft applications.

Electrical Ratings: 5 amps res. or ind., 115 vac. 5 amps res., 3 amps ind., 28 vdc.

EXPLOSION-PROOF SWITCHES

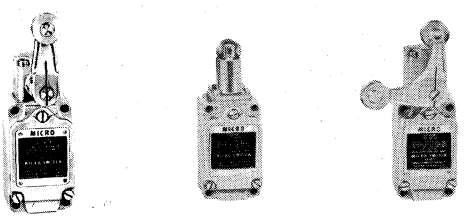




- Compact, rugged housing.
- Ample wiring space.
- Replaceable switching unit.
- Mounts from 4 sides.
- Roller arms adjustable through 360°
- Non-sparking rollers and plungers.
- These switches meet applicable portions of NEMA classifications 7 and 9.
- UL and CSA listed.

Electrical Rating: Up to 20 amps, 125, 250 or 480 vac.

"LS" LIMIT SWITCHES



- Sealed against oil, water and dust.
- Rugged cast aluminum housing.
- Temperature Range: Standard −20°F to +160°F. High temperature to +250°F.
- Interchangeable and replaceable parts.
- Easy wiring.
- Momentary or maintained contact.
- Wide variety of actuators.
- Surface or cavity mount.
- Variations include switches with: Low force and low pretravel. Lighted circuit-position indicator. Solvent resistant seals. Captive cover screws.
- Plug-in versions for quick, easy replacement.

Electrical Rating: 10 amps, 125, 250 or 480 vac.

PROXIMITY SYSTEMS





Proximity Switches are solid state electronic devices which, without physical contact, react to the presence of metal within their detection field. They generally consist of a sensor, an amplifier and a relay.

- Unaffected by vibration and shock.
- No moving parts to wear out.
- Versatility in mounting.
- Small size.
- Easy mounting.
- Centralized wiring and adjusting facilities.
- Immediate operation.
- No warm up.
- No moving parts.

MICRO SWITCH Freeport, Illinois

A Division of Honeywell

MERCURY SWITCHES



Mercury switch contacts are hermetically-sealed to resist effects of dust, dirt, oil, and corrosive fumes. They provide quiet, dependable, trouble-free operation. Contact arrangements may be SPST, SPDT, or 2-CKT.

Mercury switches are position sensitive, so may be actuated by natural movements of machine parts.

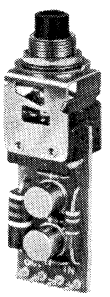
Some operating temperature ranges are —35°F to +500°F, 14°F to 221°F, and —65° to 221°F.

Current carrying capacity is as high as 70 amperes, 30 vac in some versions and as low as 0.3 ampere, 230 vdc in others.

ELECTRONIC CIRCUIT PACKAGES



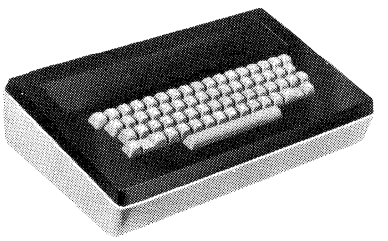
ED circuits provide shaped-wave and single-pulse output without contact bounce. There is a wide range of pulse widths and output voltages. These devices eliminate engineering time on components for electrical circuits. Pulse circuits are available as separate units or in switch circuit assemblies.



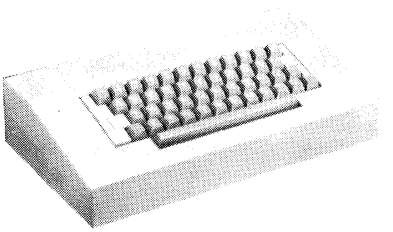
KEYBOARDS

MICRO SWITCH keyboards are completely wired and solid-state encoded keyboards. Pre-engineered options provide flexibility for factory modification of standard designs to meet custom requirements. There is a choice of keystyles and arrangements, legends, and number of keys. Any codes up to 8 bits may be provided. Interlock options prevent generating an erroneous code.

SOLID STATE KEYBOARD SWITCHING



REED SWITCH KEYBOARD SWITCHING



CATALOGS

Catalog 50—describes over 1000 types of small precision snap-action switches, enclosed switches, limit and proximity switches for commercial and industrial use.

Catalog 51—presents a complete line of manually-operated switches including lighted and unlighted pushbutton switches, toggle switches, and rotary switches.

Catalog 52—details a complete line of small precision switches for military, aerospace and mobile equipment. Included are hermetically sealed and environment-proof types.

Catalog 69—Panel controls for pilot duty or electronic and commercial use. Oil-tight indicators, pushbuttons, selectors and selector-push assemblies feature multi-function switching capabilities and up to four lighted legends.

Catalog 71—"PT" Series offer multi-circuit blocks for heavy-duty or electronic use; new square plates for maximum legend area; choice of operating options including push, push-pull, selector and selector-push.

Bulletin ED—presents a selection of electronic pulse circuits which provide a wide range of shaped-wave, single-pulse outputs without switch contact bounce.

MICRO SWITCH OFFERS:

1. The world's largest selection, and local availability—meaning we can provide the practical answer to your design requirements right off-the-shelf.

2. The world's largest research and development facilities devoted exclusively to switch design—meaning the answer you need may be on file waiting for a problem like yours to come along.

3. The world's largest group of trained field engineers specializing in precision switching—meaning we can add a switch specialist to your design team for the asking.

These benefits can be helpful to you in finding the right combination of switch design, quality and cost.

Call a Branch Office or Authorized Distributor (see Yellow Pages, "Switches, Electric"). Or, write for catalogs.

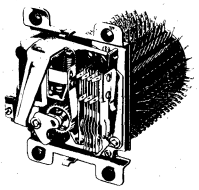
BRANCH OFFICES

Switch Selection and Application Assistance

Atlanta, Georgia 30324
Bettendorf, Iowa 52722
Binghamton, New York 13901
Boston, Massachusetts 02135
Chicago, Illinois 60646
Cleveland, Ohio 44103
Dallas, Texas 75206
Dayton, Ohio 45404
Englewood, Colorado 80110
Detroit, Michigan 48227
Hartford, Connecticut 06101
Houston, Texas 77042
Indianapolis, Indiana 46241
Kansas City, Missouri 64130
Long Island City, New York 11101
Los Angeles, California 90022
Milwaukee, Wisconsin 53222
Minneapolis, Minnesota 55408
Philadelphia, Pa. (Bala Cynwyd, Pa. 19004)
Phoenix, Arizona 85013
Portland, Oregon 97214
Rochester, New York 14611
St. Louis, Missouri 63139
San Diego, California 92110
San Francisco, California 94124
Seattle, Washington
(Mercer Island, N. J. 98040)
Syracuse, New York 13206
Union, New Jersey (Westfield, N. J. 07090)
Washington, D. C. (McLean, Va. 22101)
Wichita, Kansas 67216

MICRO SWITCH
FREEPORT, ILLINOIS 61032
A DIVISION OF HONEYWELL
IN CANADA: HONEYWELL CONTROLS LIMITED, TORONTO 17, ONTARIO

ROTARY STEPPING SWITCHES



SPECIFICATIONS

Ambient Temperature Range
−55° to +85°C.
Insulation Resistance
In excess of 1000 megohms at 500 V.D.C.
Dielectric Strength
Measured for one minute at sea level between conducting parts and grounded frame break down voltage is in excess of 750 volts R.M.S.
Contact Resistance
Measured between terminals with a short circuit current of 1 amp and open circuit voltage of 6 volts is less than 50 milliohms.
Contact Rating
standard—silver plated bank contacts with nickel silver wipers, rated one amp at rest; .05 amp non-inductive load when stepping; .05 inductive load with adequate spark suppression.
optional—gold plated bank contacts and wipers which should be specified for low level switching. *Off*—normal contacts—bifurcated springs with gold alloy contacts rated at .4 amp non-inductive. *interrupter contacts*—(Form B only) tungsten contacts rated at 2.5 amps non-inductive.
Finish
On all metal parts where practical, zinc plate, chromate treated to MIL-F-14072, is used to ensure maximum resistance to corrosion.

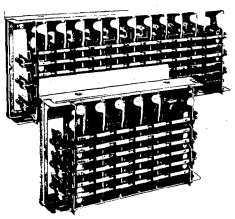
SWITCH, 30 PTS/LEVEL
SINGLE WIPER, BC OFF NORMAL

Nom. Opr. Volts (D.C.)	Coil Res. ± 10%	Number of Levels	Silver Plated Wiper and Bank Contacts Order Stock No.	Price	Gold Plated Wiper and Bank Contacts Order Stock No.	List Price
12	10	2	579672	$31.25	579687	$37.35
24	35	2	566256	32.95	579688	39.05
48	180	2	566252	32.35	579689	38.45
110	750	2	579673	31.30	579690	37.40
12	10	4	579674	35.40	579691	38.25
24	35	4	576432	37.10	579692	39.60
48	180	4	579675	36.50	579693	39.10
110	750	4	579676	35.45	579694	38.30
12	10	6	576954	38.65	579695	45.30
24	35	6	564288	40.35	579696	46.70
48	180	6	564287	39.75	579697	46.20
110	750	6	564291	38.70	579698	45.35

SWITCH, 15 PTS/LEVEL
DOUBLE WIPER, BC OFF NORMAL

12	8	4	579677	$35.15	579699	$41.60
24	30	4	566257	36.85	579700	43.30
48	125	4	566253	36.25	579701	42.70
110	550	4	579678	35.20	579702	41.65
12	8	8	579679	41.55	579703	43.90
24	30	8	579680	43.25	579704	45.30
48	125	8	579681	42.65	579705	44.80
110	550	8	579682	41.60	579706	43.95
12	8	12	579026	44.90	579707	51.10
24	30	12	564286	46.60	579708	52.50
48	125	12	564289	46.00	579709	52.00
110	550	12	564292	44.95	579710	51.15

CROSSBAR SWITCHES



North Electric Crossbar switches are the most economical means of providing maximum switching capacity (inputs to outputs) with telephone type reliability.

Standard 1200 point crossbar switch designed on matrix coordinate principle. 10 x 12 configuration with 10 contacts per crosspoint.

The compact crossbar unit provides a capacity of up to 600 switching points for many varied switching combinations. It has 5 x 12 coordinates with up to 10 contacts per crosspoint.

Both crossbar sizes can be obtained with 10 Form A, 9 Form B, or 5 Form C contacts.

Features include multi-path selection, double-wound hold coils, ball bearing pivot pins, no sliding actuators, and minimum maintenance. There are virtually no moving parts or mechanical wear.

SPECIFICATIONS

Size
1200 point crossbar
length 23 inches
weight 29 lbs.
600 point crossbar
length 14.3 inches; width 5.4 inches, height 8.7 inches
weight 18 lbs.
See additional specifications on page 3.
Contact Rating
Bank contacts are bifurcated silver, or gold which with adequate spark protection, are rated at 100 MA at 48 VDC or 110 VAC. They provide a life in excess of 50 x 10^6 operations. Off normal contacts are bifurcated silver, rated at 0.4 amperes at 48 VDC or 110 VAC with proper contact protection.
Contact Resistance
Less than 50 milliohms for silver or gold contacts.
Terminals
Can accommodate 2 No. 20 A.W.G. or 4 No. 24 A.W.G. on spring sets and 4 No. 24 A.W.G. on off-normal. Terminals will also accept AMP Faston No. 110 connector or equivalent.
Timing
Typical operate and release times.
operate of select bar —15 MS
delay required
for damping —15 MS
operate of hold bar —15 MS
total operate time is —45 MS
release time of
select bar is — 8 MS
delay time required before operation of new cycle is 30 MS, therefore, a complete typical cycle time is approximately 83 MS.
Insulation Resistance
Greater than 10^5 megohms at 500 VDC conductor to frame and between conductors with a 35% relative humidity at 25° C.
Ambient Temperature Range
−55° C to +85° C.
Dielectric Strength
Form A contacts 1200 V RMS conductor to frame and between conductors.
Form B and C contacts 1000 V RMS conductor to frame and between conductors.
Coil Data
Select and hold magnet coils are available for operation on 24, 48, and 100 volts D.C. Hold magnets require approximately 12 watts to operate and 1.5 watts per coil to hold.
Mounting
3 screws up to ¼" diameter are required, it is also recommended that spacing washers p/n 001070 are used to minimize vibration.
Enclosure
Dust cover provided over entire front of all switches which incorporates a transparent flame retardant observation panel.

"SELECT" COILS	"SELECT" OFF-NORMAL CONTACTS	"HOLD" COILS	"HOLD" OFF-NORMAL CONTACTS	CROSSPOINT MULTIPLE CONTACTS	CONTACT MATERIAL S — Norloy G — Gold	VOLTAGE D.C.	MAGNETIC LOCKING	STOCK NUMBER	LIST PRICE
12	2C	10	3C	10A	S	24		520977	$360.00
12	2C	10	3C	10A	S	48		514333	360.00
12	2C	10	3C	10A	S	100		520978	360.00
12	2C	10	3C	6A	G	24		520982	480.00
12	2C	10	3C	6A	G	48		520983	480.00
12	2C	10	3C	6A	G	100		520984	480.00
12	2C	10	3C	10A	G	24		520979	520.00
12	2C	10	3C	10A	G	48		520980	520.00
12	2C	10	3C	10A	G	100		520981	520.00
12	2C	10	3C	10A	5G/5S	24		521006	440.00
12	2C	10	3C	10A	5G/5S	48		521007	440.00
12	2C	10	3C	10A	5G/5S	100		521008	440.00
12	2C	5	3C	10A	5G/5S	24		521009	290.00
12	2C	5	3C	10A	5G/5S	48		521010	290.00
12	2C	5	3C	10A	5G/5S	100		521011	290.00
12	2C	5	3C	10A	S	24		520985	255.00
12	2C	5	3C	10A	S	48		520986	255.00
12	2C	5	3C	10A	S	100		520987	255.00
12	2C	5	3C	6A	G	24		520991	300.00
12	2C	5	3C	6A	G	48		520992	300.00
12	2C	5	3C	6A	G	100		520993	300.00
12	2C	5	3C	10A	G	24		520988	320.00
12	2C	5	3C	10A	G	48		520989	320.00
12	2C	5	3C	10A	G	100		520990	320.00
12	2C	10	2C	6A	S	24	X	520994	380.00
12	2C	10	2C	6A	S	48	X	520995	380.00
12	2C	10	2C	6A	S	100	X	520996	380.00
12	2C	10	2C	6A	G	24	X	521000	520.00
12	2C	10	2C	6A	G	48	X	521001	520.00
12	2C	10	2C	6A	G	100	X	521002	520.00
12	2C	5	2C	6A	S	24	X	520997	265.00
12	2C	5	2C	6A	S	48	X	520998	265.00
12	2C	5	2C	6A	S	100	X	520999	265.00
12	2C	5	2C	6A	G	24	X	521003	320.00
12	2C	5	2C	6A	G	48	X	521004	320.00
12	2C	5	2C	6A	G	100	X	521005	320.00
12	2C	10	3C	5C	G	24			510.00
12	2C	10	3C	5C	G	48		527356	510.00
12	2C	10	3C	5C	G	100			510.00
12	2C	5	3C	5C	G	24			315.00
12	2C	5	3C	5C	G	48		527355	315.00
12	2C	5	3C	5C	G	100			315.00

NORTH ELECTRIC
Electronetics Division/Galion, Ohio 44833/419-468-8100
A subsidiary of United Utilities, Incorporated

POTTER & BRUMFIELD

Division of American Machine & Foundry Company, Princeton, Indiana 47570

PRECISION SWITCHES

For more than a third of a century, we have been designing and manufacturing reliable relays. This engineering and production know-how is now being devoted to our new line of precision switches. These quality snap-action switches are designed to meet or exceed industry standards for electrical ratings and life characteristics. Operating forces, actuating characteristics and mounting dimensions makes these switches directly interchangeable with many competitive types. P&B precision switches meet Underwriters' Laboratories and Canadian Standards Association requirements.

PRECISION GENERAL PURPOSE SWITCHES — TYPES A1 G

Meet Underwriters' Laboratories and Canadian Standards Association Requirements

For Types A1 G1 — Contact arrangement: SPDT. Ratings: 15 amps, 125, 250, or 480 volts AC; ½ amp 125 volts DC; ¼ amp 250 volts DC; ⅛ HP 125 volts AC; ¼ HP 250 volts AC.

For Types A1 G2 — Contact arrangement: SPDT. Ratings: 20 amps, 125, 250, or 480 volts AC; 1 HP 125 volts AC; 2 HP 250 volts AC; 10 amps 125 volts when controlling tungsten filament lamp loads on AC circuits.

PRECISION MINIATURE SWITCHES TYPES A1 M

For Types A1 M1 — Contact arrangements: SPDT. Ratings: 30 volts DC; inductive: 10 amps at sea level, 6 amps at 50,000 feet; resistive: 10 amps; motor load: 6 amps.

Meet Underwriters' Laboratories requirements for 15 amps, 125, or 250 volts AC; ⅓ HP 125/250 volts AC; ½ amp 125 volts DC; ¼ amp 250 volts DC.

For Types A1 M2 (low operating force) — Contact arrangements: SPDT. Rating: 30 volts DC; inductive: 5 amps at sea level, 5 amps at 50,000 feet; resistive: 5 amps; motor load: 5 amps.

Meet Underwriters' Laboratories requirements for 10 amps, 125 or 250 volts AC; ½ amp 125 volts DC; ¼ amp 250 volts DC; ⅓ HP 125 volts AC.

For Type A1 M4 (low differential) — Contact arrangement: SPDT. Ratings: 30 volts DC; inductive: 1 amp at sea level, 1 amp at 50,000 feet; resistive: 2 amps; motor load: 1 amp.

Meet Underwriters' Laboratories requirements for 10 amps, 125 or 250 volts AC.

For Type A1 M5 (gold contacts)—Contact arrangement: SPDT. Rating: 28 volts DC; inductive: ½ amp; resistive: 1 amp; inrush: 2 amps.

PRECISION SUBMINIATURE SWITCHES TYPES A1 S

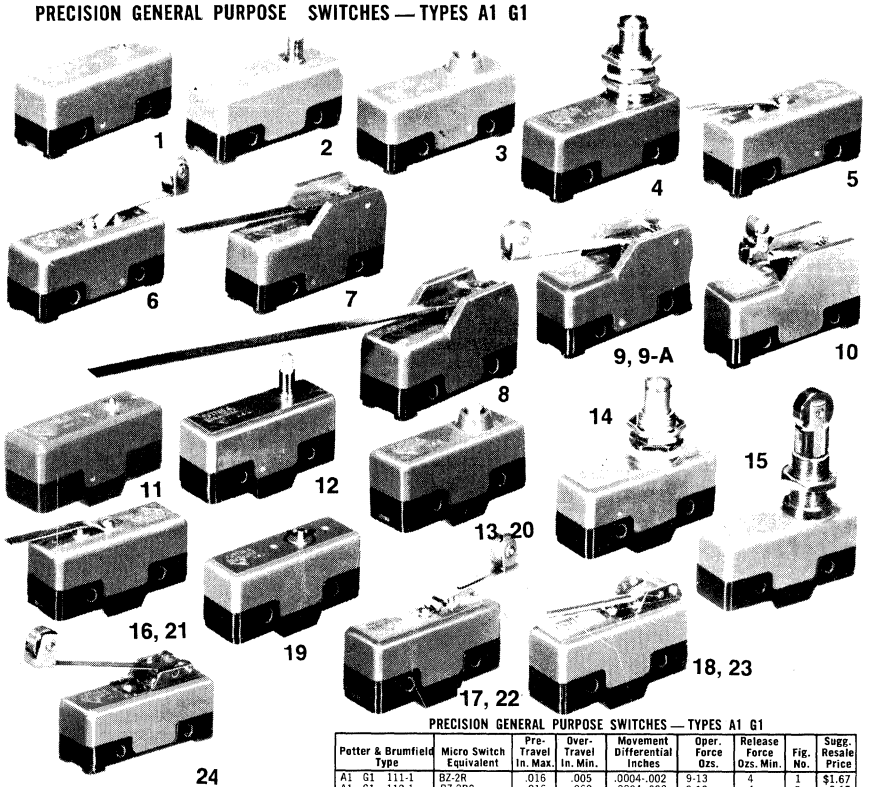
For Types A1 S1 — Contact arrangement: SPDT.

Rating:

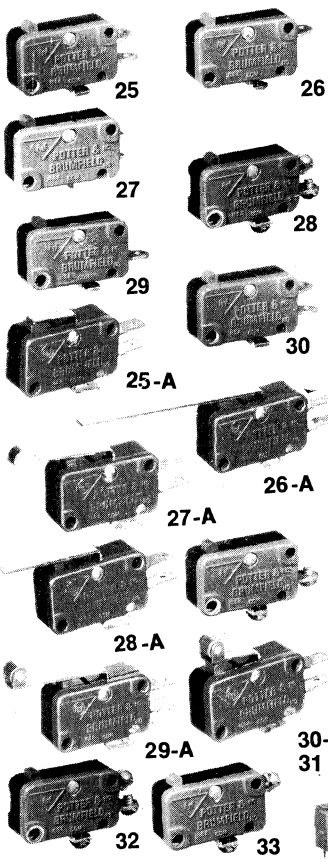
Meet Underwriters' Laboratories requirements for 5 amps, 125 or 250 volts AC. The 30 volt DC rating is as follows: inductive: 3 amps at sea level and 2.5 amps at 50,000 feet; resistive: 5 amps at sea level and 50,000 feet; maximum inrush: 24 amps.

For Types A1 S5 (gold contacts) — Contact arrangement: SPDT. Rating: 28 volts DC; inductive: ½ amp; resistive: 1 amp; inrush: 2 amps.

PRECISION GENERAL PURPOSE SWITCHES — TYPES A1 G1



PRECISION MINIATURE SWITCHES — TYPES A1 M



PRECISION GENERAL PURPOSE SWITCHES — TYPES A1 G1

Potter & Brumfield Type			Micro Switch Equivalent	Pre-Travel In. Max.	Over-Travel In. Min.	Movement Differential Inches	Oper. Force Ozs.	Release Force Ozs. Min.	Fig. No.	Sugg. Resale Price
A1	G1	111-1	BZ-2R	.016	.005	.0004-.002	9-13	4	1	$1.67
A1	G1	112-1	BZ-2RS	.016	.062	.0004-.002	9-13	4	2	2.15
A1	G1	113-1	BZ-2RD	.016	.062	.0004-.002	9-13	4	3	2.20
A1	G1	114-1	BZ-2RQ1	.015	.219	.0004-.002	9-13	4	4	3.75
A1	G1	115-1	BZ-2RL	.156	.062	.050	5 Max.	0.5	5	1.90
A1	G1	116-1	BZ-2RL2	.141	.062	.050	5 Max.	0.5	6	2.50
A1	G1	117-1	BZ-2RW80	.359	.219	.007 -.050	2½ Max.	0.5	7	2.15
A1	G1	117-1-3	BZ-2RW863	.907	.578	.018 -.140	1 Max.	—	8	2.40
A1	G1	1771-	BZ-2RW84	.203	.219	.007 -.050	1 Max.	.125	7	2.15
A1	G1	119-1	BZ-2RW822	.109	.094	.003 -.020	6 Max.	1.5	9	2.75
A1	G1	117-1-2	BZ-2RW825	.141	.109	.015	8 Max.	1.5	10	3.25
A1	G1	118-1	BZ-2RW82	.249	.156	.004 -.040	3½ Max.	.75	9-A	2.75
A1	G1	111-8	BZ-2R-A2	.016	.005	.0004-.002	9-13	4	11	1.80
A1	G1	112-8	BZ-2RS-A2	.016	.062	.0004-.002	9-13	4	12	2.30
A1	G1	113-8	BZ-2RD-A2	.016	.062	.0004-.002	9-13	4	13	2.25
A1	G1	114-8	BZ-2RQ1-A2	.015	.219	.0004-.002	9-13	4	14	3.85
A1	G1	114-8-1	BZ-2RQ18-A2	.015	.140	.0004-.002	9-13	4	15	6.65
A1	G1	115-8	BZ-2RL-A2	.156	.062	.050	5 Max.	0.6	16	2.10
A1	G1	116-8	BZ-2RL2-A2	.141	.062	.050	5 Max.	0.5	17	2.65
A1	G1	117-8	BZ-2RW80-A2	.359	.219	.007 -.050	2½ Max.	0.5	18	2.20
A1	G1	119-8	BZ-2RW822-A2	.109	.094	.003 -.020	6 Max.	1.5	9	2.80

PRECISION GENERAL PURPOSE SWITCHES — TYPES A1 G2

A1	G2	111-8	BA-2R-A2	.050	.010	.002 -.0075	14-22	10	19	$1.80
A1	G2	113-8	BA-2RB-A2	.050	.093	.002 -.0075	14-22	10	20	2.25
A1	G2	114-1	BA-2RQ1	.050	.219	.002 -.0075	14-22	10	4	4.10
A1	G2	114-8	BA-2RQ1-A2	.050	.219	.002 -.0075	14-22	10	14	3.85
A1	G2	115-1	BA-2RL	.344	.062	.065	9 Max.	1	5	2.25
A1	G1	115-8	BA-2RL-A2	.344	.062	.065	9 Max.	1	21	2.10
A1	G2	116-8	BA-2RL2-A2	.344	.062	.065	9 Max.	1	22	2.65
A1	G2	117-8	BA-2RV-A2	.625	.078	.109	2½ Max.	0.5	23	2.30
A1	G2	118-1	BA-2RV2	.469	.062	.085	2½ Max.	0.5	24	3.10
A1	G2	118-8	BA-2RV2-A2	.469	.062	.085	2½ Max.	0.5	24	2.90

PRECISION MINIATURE SWITCHES — TYPES A1 M

A1	M1	111-8	V3-1	.047	.031	.006 -.016	6-14	4	25	$1.10
A1	M1	111-1	VS-19	.047	.031	.006 -.016	6-14	4	25	1.04
A1	M1	211-1	V3-7	.047	.031	.006 -.016	6-14	4	26	.96
A1	M1	111-2	VS-15	.047	.031	.006 -.016	6-14	4	27	1.04
A1	M1	121-B	V3-29	.047	.031	.006 -.016	6-14	4	28	1.15
A1	M1	311-1	V3-32	.047	.031	.006 -.016	6-14	4	29	.96
A1	M1	181-1	V3-419	.047	.031	.006 -.016	6-14	4	30	2.04
A1	M1	117-6	V3L-1-D8	.060	.031	.016	14 Max.	3	25-A	1.05
A1	M1	117-6-1	V3L-2-D8	.125	.062	.050	8 Max.	1	28-A	1.05
A1	M1	117-6-2	V3L-5-D8	.125	.062	.050	8 Max.	1	27-A	1.05
A1	M1	117-6-3	V3L-6-D8	.260	.100	.090	4 Max.	0.5	26-A	1.05
A1	M1	118-6	V3L-4-D8	.125	.062	.050	8 Max.	1	29-A	1.25
A1	M1	119-6	V3L-3-D8	.060	.031	.016	14 Max.	3	30-A	1.25
A1	M1	311-B	V3-23	.047	.031	.006 -.016	6-14	4	31	1.00
A1	M4	191-B	V3-26	.047	.031	.002 -.006	7-12	5	28	1.25
A1	M1	131-B	VS-601	.047	.010-.024	.006 -.016	6-14	4	32	1.50
A1	M2	171-B	V3-101	.047	.031	.006 -.016	8 Max.	2	28	1.10
A1	M2	271-B	V3-121	.047	.031	.006 -.016	8 Max.	2	33	1.00
A1	M2	371-B	V3-123	.047	.031	.006 -.016	8 Max.	2	31	1.00
A1	M2	171-1	V3-119	.047	.031	.006 -.016	8 Max.	2	25	1.04
A1	M5	151-B	V3-75	.047	.031	.006 -.016	6-14	4	28	3.75

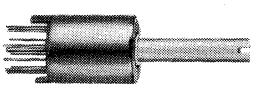
PRECISION SUBMINIATURE SWITCHES — TYPES A1 S

A1	S1	111-1	1SM1	.030	.005	.005	3-5	1	34	$1.20
A1	S1	111-3	1SM1-T	.030	.005	.004	3-5	1	35	1.20
A1	S1	131-1	11SM1	.020	.003	.004	3-5	1	36	1.25
A1	S5	151-1	1SM23	.030	.005	.004	3-5	1	34	2.20
A1	S5	161-1	11SM23	.020	.003	.004	3-5	1	36	2.20
A1	S1	131-3	11SM1-T	.020	.003	.004	3-5	1	37	1.20
A1	S1	115-1	111SM1	.219	.030	.030	7 Max.	2	38	1.65
A2	S1	116-1-1	111SM2	.219	.030	.025	7 Max.	2	39	2.00
A3	S1	116-3	111SM2-T	.219	.030	.025	7 Max.	2	39-A	2.00
A1	S1	121-1	1SM3	.030	.005	.004	3-5	1	34	1.20
A1	S1	141-1	11SM3	.020	.003	.004	3-5	1	36	1.20

Immediate action... Oak distributors' shelves stock the broadest line available

Hundreds of rotary, pushbutton and lever switches!

All switches have Oak-pioneered, double-wiping contacts—self-cleaning, longer lasting; brass, silver-plated with additional gold plating. Various insulations available—phenolic silicone-glass fiber, steatite, Kel-F, diallyl phthalate. Electrical rating: break 1 amp. at 28 vdc, or 0.5 amp. at 110 vac, resistive; carry 5 amps. Unique Oakote packaging assures long shelf life by protecting against tarnish and corrosion.

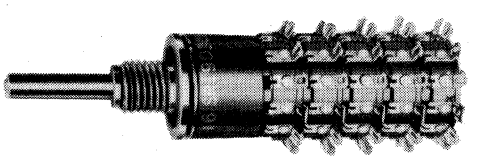


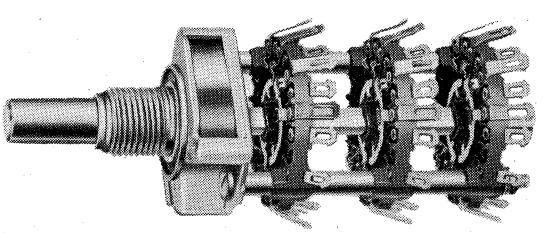
SMALL, BUT MIGHTY... ONLY .300" DIAM.

Small as it is, this rugged 10-position switch still performs at 23,000 G's, with vibrations conforming to MIL-S-3786. What's more, it's specially designed for freestanding mounting on printed circuit boards. Withstands military salt spray requirements as well as −65° to +85°C. environments.

SLIGHTLY BIGGER... BUT ONLY ½" DIAM.

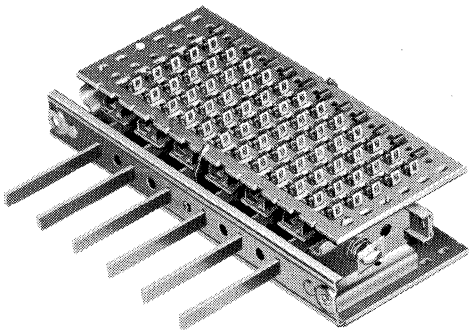
These compact rotary switches provide superior insulation and dimensional stability—even under severe environments, where small size is essential. Oak-pioneered double-wiping contacts are silver alloy (gold-plated to prevent tarnish) assure negligible contact noise and circuit resistance through rated life. Materials and finishes withstand 50-hour salt spray test.





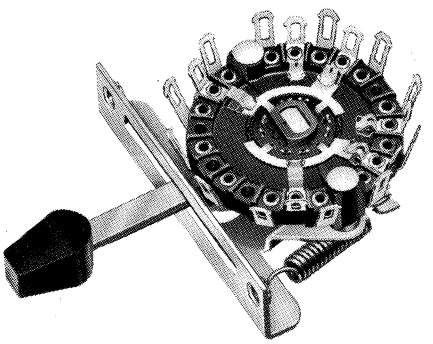
STILL BIGGER ROTARIES...

a wide variety of choices in 1" to 2 5/16" diam. sizes, 1-6 sections, 2-23 positions, 1-18 poles, 2 3/8" shafts grooved for break-off. They're also shorting and non-shorting, ball-type indexed, with one fixed and one adjustable stop per switch, and standard 50-hour salt spray (or special 200-hour) finishes.



PUSHBUTTONS GALORE...

...configurations of 2-12 buttons, 8-48 poles, positive latching, shorting and non-shorting, depress to engage or release. Type 130 adaptable to lighting—with DeLuxe Pushbuttons.



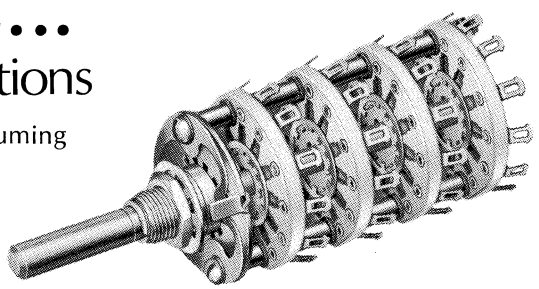
LEVER SWITCHES ALSO...

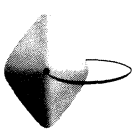
...2-6 poles, 2 or 3 position, shorting or non-shorting, positive indexing. Economy Type 189 and Type 184 with molded stators for miniaturized circuitry.

Moduline Switches...

Fast, in over 2 million variations

The Moduline™ system eliminates time-consuming designing for you. You simply order by the numbers, and parts are assembled from hundreds on file. It's a convenience type of switch—halfway between the Distributor line and Custom OEM—only much faster... in quantities of 1-99.





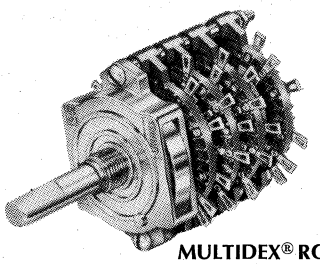
OAK MANUFACTURING CO.
A Division of OAK ELECTRO/NETICS CORP
Dept. EL, Crystal Lake, Illinois 60014
PHONE: 815-459-5000 TWX: 910-634-3353

SEE OUR CATALOG IN TM-C THOMAS MICRO-CATALOGS

ALA—Huntsville, Airwork Gulf Electronics Corp..837-6101
CAL—Glendale, R. V. Weatherford Co.....VI 9-3451
CAL—Inglewood, Newark Electronics Co.....OR 8-0441
CAL—Palo Alto, R. V. Weatherford Co.....DA 1-5373
CAL—San Carlos, Sterling/Moulton Electronics, Inc.....591-8292
COLO—Denver, Newark-Denver Electronic Supply Co.....SK 7-3351
CONN—New Haven, Connector-Corp. of America.624-0127
FLA—Miami, Airwork Gulf Electronics Corp.....885-2401
ILL—Chicago, Newark Electronics Corp.....638-4411
ILL—Rockford, J & M Electronics, Inc.....963-6445
IND—Ft. Wayne, Ft. Wayne Electronics.....742-4346
IND—Indianapolis, Graham Electronics Supply, Inc.....634-8486
KY—Owensboro, Ohio Valley Sound.....683-6727
LA—New Orleans, Electronic Products Corp....HU 6-3777
LA—New Orleans, Newark-New Orleans Electronic Corp.....834-9470
MD—Baltimore, Radio Electric Service Co.....539-3835
MD—Hyattsville, Milgray/Washington, Inc.....864-1111
MASS—Boston, DeMambro Electronics.....787-1200
MASS—N. Wilbraham, Industrial Components...596-3854
MASS—Waltham, Radio Shack Corp.....891-8700
MICH—Grand Rapids, Newark-Industrial Electronics Corp.....452-1411
MICH—Oak Park, Newark-Detroit Electronics, Inc.....548-0260
MINN—Minneapolis, Harry Stark's Inc.....332-1325
MINN—Minneapolis, Newark-Minneapolis Electronic Corp.....331-6350
MO—Kansas City, Radiolab, Inc.....561-9935
MO—St. Louis, Interstate Industrial Electronics.FL 3-8313
MO—St. Louis, Olive Industrial Electronics.....863-7800
NJ—Springfield, Federated Purchaser, Inc.....DR 6-8900
NY—Binghamton, Federated Electronics, Inc.....748-8211
NY—New York, Milgray Electronics, Inc.....YU 9-1600
NY—New York, Milo Electronics Corp.....924-5000
NY—New York, Newark-Electronics Center, Inc. AL 5-4600
OHIO—Cincinnati, Newark-Herrlinger Electronics Corp.....421-5282
OKLA—Tulsa, S & S Radio Supply.....LU 2-8242
PA—Philadelphia, Herbach & Rademan, Inc.....609-9500
PA—Philadelphia, Radio Electric Service Co....WA 5-6900
TEX—Dallas, Adak Electronic Co.....AN 4-1668
TEX—Ft. Worth, Adak Electronic Co.....CR 4-5551
TEX—Garland, Newark-Dallas Electronic Corp...271-2511
TEX—Houston, Harrison Equipment Co., Inc....CA 4-9131
TEX—Houston, Newark-Houston Electronic Corp..782-4800
WASH—Seattle, Radar Electric.....AT 2-2511
PUERTO RICO—Santurce, Electronic Center Corp.....

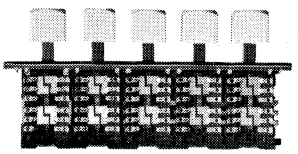
Oak Engineered custom OEM Switches

Oak offers you the broadest line of custom OEM switches available... engineered to give you the best switch that can be assembled to meet your design problems. Here are the customized variables—tailored to your needs: Insulations include phenolic, silicone-glass, ceramic, Mycalex, Kel-F and diallyl phthalate. Temperature ranges from Standard Commercial (−25° to +85°C.) to Military (−65° to +85° C.). Contacts are Oak-pioneered double-wiping to provide self-cleaning, long life. Five choices fit each application best, shorting and non-shorting, rated from 10,000 to 200,000 cycles. Finishes are Standard Commercial, 50- or 200-hour salt spray. Electrically, these switches break 1 amp. @ 28 vdc or 0.5 amp. @ 110 vac.



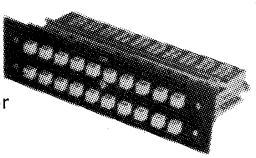
MULTIDEX® ROTARIES

...these universal rotary switches will put a lot of the older and bigger ones out of business. They're smaller, more economical and still offer all of the features and options of expensive custom-made OEM switches. What's more, they cut engineering design expenses.



PUSHBUTTONS GALORE

...single or multiple buttons and/or rows, lighted or unlighted, 1-12 buttons per row, latching or non-latching.



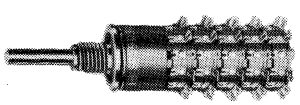
MOLDED PB'S

...designed especially for computers with fast response, short stroke, light touch. High reliability, optional actions, individual lighting options, pre-wired assemblies.

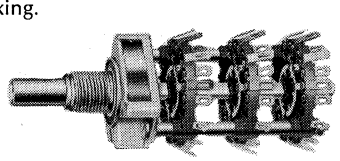


OAK'S TINY .300" diam. switch... this microminiature performs like a giant, at 23,000 G's with vibration conforming to MIL-S-3786.

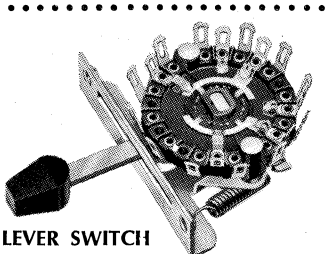
SUBMINIATURE ½" switch... also provides superior insulation and dimensional stability —even under severe environments, where small size is essential.



AND THE 1" ACORN SWITCH... an engineered combination of molded diallyl phthalate stators and Oak's exclusive Unidex™ indexing.

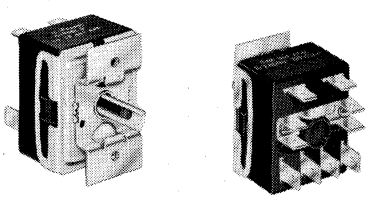


IF YOU NEED BIG ROTARIES... Custom switches up to 2 17/32" diam. are yours in variations from 3 positions 120° throw to 28 positions 12.85° throw. Five types of shafts with 57°-90° terminal bends.



NEW LEVER SWITCH

Oak's #184 lever switch gives you versatile miniaturization, with molded diallyl phthalate stator for improved dielectric properties and more clips. Many options available.



HEAVY-DUTY SWITCHES

...for appliances, vending machines, motors, heaters, etc. Three-wire or two, up to 35 amps., 240 volts and 250°F. Many positions, SP or DP.

Oak Rotary Solenoid Selectors

compact, rugged, reliable for remote actuation

Oak Solenoids are compact and lightweight as compared to the high actuating torques and flexibility they provide for remote switching. Virtually solid metal, their low residual flux means fast response and most efficient conversion of electrical to mechanical energy. Armature is supported by three ball bearings in inclined races to provide stable mechanical balance. Thus axial thrust from the energized solenoid coil is converted into rotary thrust with negligible friction.

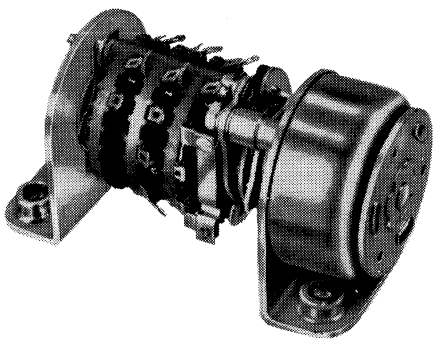
Typical uses: master-slave circuits, sequential timing circuits, counting applications.

Our engineers will help you design them into missiles, satellites, machine tools, scoreboards, computers, communications equipment and many other applications. Hermetically-sealed assemblies made to order for service in extremely adverse environments.

SUB-ASSEMBLY SERVICE...
time-saving, money-saving

Ease the load on your production facilities by letting Oak fabricate your rotary solenoid and switch subassemblies. These can be completely mounted and/or prewired. Components or leads can be added, plugs and sockets incorporated... all to your specs. These package units simplify assembly and maintenance. Let Oak engineers smooth out your production operations and save you time and money at the same time.

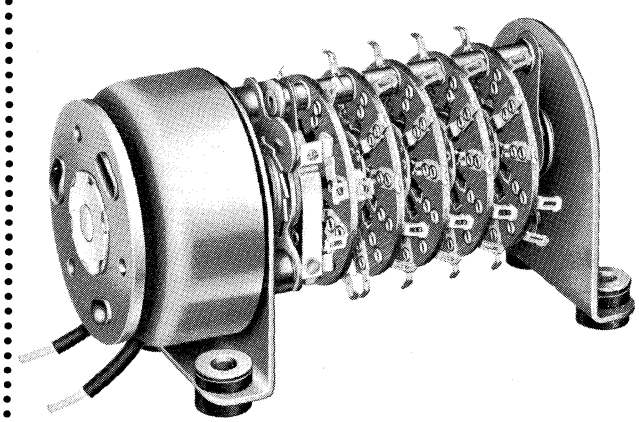
WIDE SELECTION AVAILABLE



Subminiature . . . for use where space and weight of components are of prime importance such as aerospace use. Small, but rugged and dependable at only 3.8 oz. weight. (as shown)

TO

Extra heavy-duty motor...produces high torque capable of driving standard switch sections, plus other external loads. Available in foot or flange mounting.



OAK MANUFACTURING CO.
A Division of OAK ELECTRO/NETICS CORP
Dept. EL, Crystal Lake, Illinois 60014
PHONE: 815-459-5000 TWX: 910-634-3353

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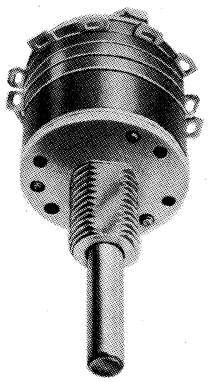
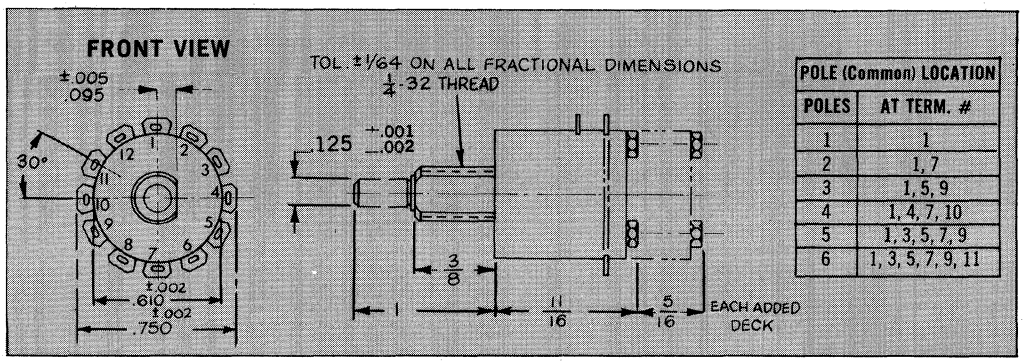
TM-C
THOMAS MICRO-CATALOGS

RCL *miniature rotary switches*

SERIES "C"

- Up to 12 active positions per deck shorting or non-shorting, with 30° spacing.
- Shorting **AND** non-shorting poles may be grouped on one deck in any combination.
- As many as 6 poles per deck.
- All individual deck parts are self-contained, and are permanently molded into place.
- Available with adjustable stops.





POLE (Common) LOCATION	
POLES	AT TERM. #
1	1
2	1, 7
3	1, 5, 9
4	1, 4, 7, 10
5	1, 3, 5, 7, 9
6	1, 3, 5, 7, 9, 11

"OFF-THE-SHELF DELIVERY"

U.S. Pat. #3352979

ELECTRICAL FEATURES

1. Initial contact resistance — .010 max.
2. Current carrying capacity — 5.5 amps.
3. Current breaking capacities
   ¼ amp — 115 V.A.C. resistive
   ¼ amp — 28 V.D.C. resistive
   ⅛ amp — 28 V.D.C. inductive.
4. Dielectric strength (voltage breakdown) —
   a. between any two adjacent positions — 800 v RMs (60 cycles).
   b. between any active position to ground 1500 V (60 cycles).
5. Insulation resistance (measured at 25°C, 50% RH at sea level) — 10^5 megohms.
6. Thermal EMF — 1 microvolt/°C maximum.
7. Capacitance — between adjacent active contacts .5 MMFD Max.

MECHANICAL FEATURES

1. Life expectancy — 200,000 mechanical operations.
2. Detent — positive stainless steel roller-type detent snaps from position to position. Detent housing made of special high-strength plastic, providing positive action and minimal wear.
3. Stop strength — Designed to withstand 10 inch-lbs. rotational force.
4. "Molded in" terminals give exceptional terminal strength.
5. Terminal locations clearly marked on rear cover plate.
6. "Wrap-around" turret-type solder lugs are integral with individual contacts.
7. On any one deck of a multi-pole switch, a variety of combinations of shorting (MBB) and non-shorting (BBM) actions may be obtained.
8. Materials and finishes:
   Rotor — Lexan
   Rotor blade — Beryllium copper (gold plated)
   Contacts & solder terminals — solid silver alloy
   Housing — Diallyl Phthalate
   Stator — Diallyl Phthalate
   Shaft — stainless steel
   All brass parts nickel plated
9. One piece contact terminal construction has holes large enough to accept two #22 AWG wires.
10. Shaft and panel seal may be specified by using prefix "S" before switch type numbers.

SINGLE DECK

Spacing: 30° between positions

SHORTING

SINGLE POLE

Positions	Type
2	11-CM-2
3	11-CM-3
4	11-CM-4
5	11-CM-5
6	11-CM-6
7	11-CM-7
8	11-CM-8
9	11-CM-9
10	11-CM-10
11	11-CM-11
12	11-CM-12 (with stops)

2 POLES PER DECK

Positions	Type
2	12-CM-2
3	12-CM-3
4	12-CM-4
5	12-CM-5
6	12-CM-6

3 POLES

Positions	Type
2	13-CM-2
3	13-CM-3
4	13-CM-4

4 POLES

Positions	Type
2	14-CM-2
3	14-CM-3

5 POLES

Positions	Type
2	15-CM-2

6 POLES

Positions	Type
2	16-CM-2

NON-SHORTING

SINGLE POLE

Positions	Type
2	11-CB-2
3	11-CB-3
4	11-CB-4
5	11-CB-5
6	11-CB-6
7	11-CB-7
8	11-CB-8
9	11-CB-9
10	11-CB-10
11	11-CB-11
12	11-CB-12 (with stops)

2 POLES PER DECK

Positions	Type
2	12-CB-2
3	12-CB-3
4	12-CB-4
5	12-CB-5
6	12-CB-6

3 POLES PER DECK

Positions	Type
2	13-CB-2
3	13-CB-3
4	13-CB-4

4 POLES PER DECK

Positions	Type
2	14-CB-2
3	14-CB-3

5 POLES PER DECK

Positions	Type
2	15-CB-2

6 POLES PER DECK

Positions	Type
2	16-CB-2

MULTI-DECK SWITCHES UP TO 9 DECKS AVAILABLE

For multi-deck version of these switches, indicate number of decks as follows. Merely change first number of coding as shown:

Number of decks	
One deck	1 1-CB-4
Two decks	2 1-CB-4
Three decks	3 1-CB-4

*"M" = Shorting action (MBB)
"B" = Non-shorting action (BBM)
* Supplied unless otherwise specified.

Code: 2 6—CM—2

- 2 — number of decks
- 6 — poles per deck
- CM — Series
- CB — non-shorting
- CM — shorting
- 2 — Positions per pole

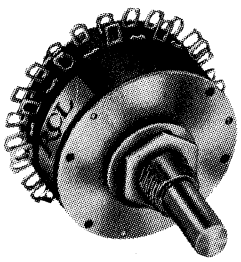
e.g. this is 2 decks, 6 poles per deck, Series "C" shorting action, 2 positions per pole.

RCL ELECTRONICS, INC.
General Sales Office:
700 South 21st Street, Irvington, N. J. (Area Code 201) 374-3311 • TWX 710-999-5511

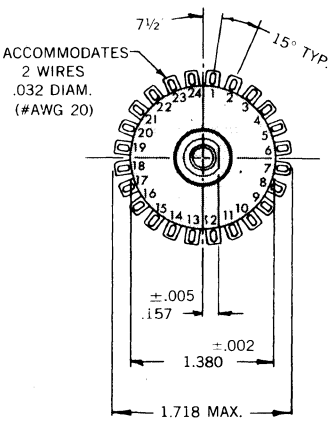
RCL *miniature rotary switches*

SERIES "E" 1⅜" BODY DIAMETER

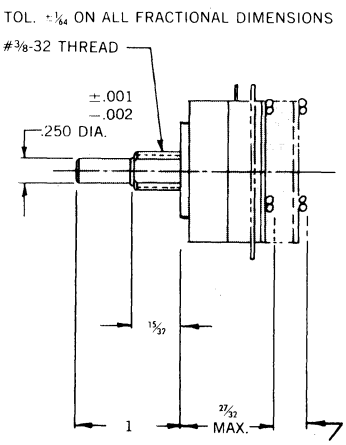
- Competeitively priced with many open deck wafer switches
- Exceeds the exacting specifications of most "instrument type" switches
- Up to 24 active positions per deck, **shorting or non-shorting,** and up to 12 poles per deck
- Meets all applicable requirements of Mil S-3786-B
- Available with concentric shaft
- Available with adjustable stops



Poles	Pole (Common) Location At Term. #
1	1
2	1, 13
3	1, 9, 17
4	1, 7, 13, 19
5	1, 5, 9, 13, 17
6	1, 5, 9, 13, 17, 21
7	1, 3, 5, 7, 9, 11
8	1, 3, 5, 7, 9, 11, 13
9	1, 3, 5, 7, 9, 11, 13, 15
10	1, 3, 5, 7, 9, 11, 13, 15, 17
11	1, 3, 5, 7, 9, 11, 13, 15, 17, 19
12	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21



FRONT VIEW



5/16 EACH ADDED DECK

ELECTRICAL FEATURES

- Contact resistance: .010 max. initial
- Current carrying capacity: 10 amps
- Current breaking capacity (rated load at 125°C):
  2 amps — 115 VAC Resistive
  1 amp — 28 VDC Resistive
  5 amps — 28 VDC Inductive

MECHANICAL FEATURES

- Life expectancy: 200,000 mechanical operations.
- Rotational Torque: 20 to 80 ounce-inches depending on number of poles per deck and number of decks.
- Stop Strength: 15 pound-inches.
- Solder terminals will accept two .032 diam. (AWG #20) wires.
- "Molded-in" terminals result in exceptionally high contact stability, completely eliminating movement.
- Shaft and Panel Seals may be specified by using Prefix "S" before Switch Type Numbers.
- Explosion Proof per paragraph 4.8.12 of Mil-S-3786B.
- Weight: 1 Deck Switch 1.75 oz. For each additional deck add .500 oz.

SINGLE DECK

SINGLE POLE

Positions	Shorting Type	Non-Shorting Type
2	11-EM-2	11-EB-2
3	11-EM-3	11-EB-3
4	11-EM-4	11-EB-4
5	11-EM-5	11-EB-5
6	11-EM-6	11-EB-6
7	11-EM-7	11-EB-7
8	11-EM-8	11-EB-8
9	11-EM-9	11-EB-9
10	11-EM-10	11-EB-10
11	11-EM-11	11-EB-11
12	11-EM-12	11-EB-12
13	11-EM-13	11-EB-13
14	11-EM-14	11-EB-14
15	11-EM-15	11-EB-15
16	11-EM-16	11-EB-16
17	11-EM-17	11-EB-17
18	11-EM-18	11-EB-18
19	11-EM-19	11-EB-19
20	11-EM-20	11-EB-20
21	11-EM-21	11-EB-21
22	11-EM-22	11-EB-22
23	11-EM-23	11-EB-23
24	11-EM-24	11-EB-24
*24	11-EM-24CR Continuous Rotation	11-EB-24CR Continuous Rotation

SPACING 15° BETWEEN POSITIONS

2 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	12-EM-2	12-EB-2
3	12-EM-3	12-EB-3
4	12-EM-4	12-EB-4
5	12-EM-5	12-EB-5
6	12-EM-6	12-EB-6
7	12-EM-7	12-EB-7
8	12-EM-8	12-EB-8
9	12-EM-9	12-EB-9
10	12-EM-10	12-EB-10
11	12-EM-11	12-EB-11
12	12-EM-12	12-EB-12

3 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	13-EM-2	13-EB-2
3	13-EM-3	13-EB-3
4	13-EM-4	13-EB-4
5	13-EM-5	13-EB-5
6	13-EM-6	13-EB-6
7	13-EM-7	13-EB-7
8	13-EM-8	13-EB-8

4 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	14-EM-2	14-EB-2
3	14-EM-3	14-EB-3
4	14-EM-4	14-EB-4
5	14-EM-5	14-EB-5
6	14-EM-6	14-EB-6

5 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	15-EM-2	15-EB-2
3	15-EM-3	15-EB-3
4	15-EM-4	15-EB-4

6 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	16-EM-2	16-EB-2
3	16-EM-3	16-EB-3
4	16-EM-4	16-EB-4

7 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	17-EM-2	17-EB-2
3	17-EM-3	17-EB-3

8 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	18-EM-2	18-EB-2
3	18-EM-3	18-EB-3

9 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	19-EM-2	19-EB-2

10 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	1-10-EM-2	1-10-EB-2

11 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	1-11-EM-2	1-11-EB-2

12 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	1-12-EM-2	1-12-EB-2

ALTHOUGH ONLY 1 DECK IS SHOWN FOR ILLUSTRATIVE PURPOSES, UP TO 9 DECKS ARE AVAILABLE.

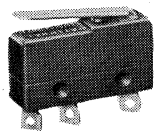
RCL ELECTRONICS, INC.
General Sales Office:
700 South 21st Street, Irvington, N. J. (Area Code 201) 374-3311 TWX 710-999-5511

REMVAC COMPONENTS, INC.

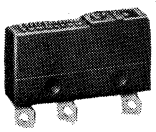
37-55 61st Street Woodside, New York 11377 (212) TW 9-6100

SUBMINIATURE PRECISION SWITCHES

- UL Approved
- Extra long life
- Easy wiring
- High quality



AM 6100
Pin-push button
SPDT
Solder terminal



AM 6101
Leaf spring
SPDT
Solder terminal

Switch	Terminal	Type	Rating
AM 1100	Solder	Pin-push button	AC 250V 10A; AC 125V 15A
AM 1101	Solder	Leaf spring	AC 250V 10A; AC 125V 15A
AM 1103	Solder	Roller leaf spring	AC 250V 10A; AC 125V 15A
AM 1300	Screw	Pin-push button	AC 250V 10A; AC 125V 15A
AM 1301	Screw	Leaf spring	AC 250V 10A; AC 125V 15A
AM 1303	Screw	Roller leaf spring	AC 250V 10A; AC 125V 15A
AM 5100	Solder	SPDT	AC 125V 10A; AC 250V 6A
AM 5200	Solder	SPNC	AC 125V 10A; AC 250V 6A
AM 5300	Solder	SPNO	AC 125V 10A; AC 250V 6A
AM 5600	Screw	SPDT	AC 125V 10A; AC 250V 6A
AM 5800	Screw	SPNO	AC 125V 10A; AC 250V 6A
AM 7690	Solder	SPDT	AC 125V 5A; AC 250V 3A
AM 7790	Solder	SPNC	AC 125V 5A; AC 250V 3A
AM 7890	Solder	SPNO	AC 125V 5A; AC 250V 3A

APPLIANCE SWITCHES

HIGH SNAP SWITCHES

FEATURES:

- Meets with JIS-C-6571, MIL & JAN standards
- High performance
- Long life
- Unique construction—6 patents

APPLICATIONS:

- High load (especially motor load, 550W 250V) machine tools, industrial machinery, electric tools, projectors, etc.
- High reliability & performance communication equipment, measuring equipment & instruments, medical equipment, electrical equipment for vehicles, ships, and aircraft, computers, office machines, etc.
- Electrical home appliances, optical instruments, lighting, disposal, air-conditioning, acoustical equipment, musical instruments, etc.
- Signal controls, broadcasting equipment, X-ray devices, telephones, radios, etc.

WD 1011
SPST
Solder term.



WD 1121
SPDT
Screw term.



WD 1711
4PDT
Solder term.



PROPERTIES:

Contact resistance ..... less than 10 megohm
Temp. rise ..... less than 30°C
Ins. Leak-down ..... more than 100 megohm
Voltage break-down ..... AC 1500, 1 min.

Single Pole	Double Pole	Three Pole	Four Pole	Characteristics
		Solder terminal		
WD 1011	WD 1211	WD 1411	WD 1611	ON-OFF
WD 1111	WD 1311	WD 1511	WD 1711	ON-ON
WD 1112	WD 1312	WD 1512	WD 1712	ON-OFF-ON
WD 1113	WD 1313			ON-Mom. ON
WD 1114	WD 1314			ON-OFF-Mom. ON
WD 1115	WD 1315			Mom. ON-OFF-Mom. ON
		Screw terminal		
WD 1021	WD 1221	WD 1421	WD 1621	ON-OFF
WD 1121	WD 1321	WD 1521	WD 1721	ON-ON
WD 1122	WD 1322	WD 1522	WD 1722	ON-OFF-ON
WD 1123	WD 1323			ON-Mom. ON
WD 1124	WD 1324			Mom. ON-OFF-Mom. ON
WD 1125	WD 1325			ON-OFF-Mom. ON

SNAP SWITCHES

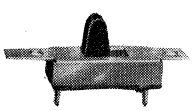
- Meets with JIS-C-6571
- Contact resistance—less than 20 megohm



WD 103
SPST

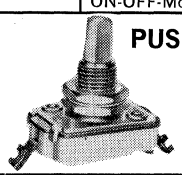
Solder terminal		
Single Pole	Double Pole	Characteristics
WD 1031	WD 1231	ON-OFF
WD 1131	WD 1331	ON-ON

SLIDE SWITCH



WD 4099
SPST
AC 1A 250V

PUSH SWITCH



WD 5080
SPST
AC 1A 125V

LIMIT SWITCHES

ENCLOSED GENERAL PURPOSE SWITCHES



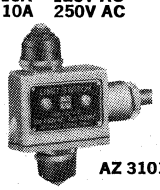
AZ 1102

Switch	Type	Mounting
AZ 1102	Roller, plunger	Side
AZ 1202	Roller, plunger	Bottom
AZ 2101	Sealed plunger, splash-dust proof	Side
AZ 2201	Sealed plunger, splash-dust proof	Bottom
AZ 2104	Sealed roller arm	Side
AZ 2204	Sealed roller arm	Bottom
AZ 2161	Plunger	Right-hand
AZ 2164	Roller arm	Right-hand
AZ 2171	Plunger	Left-hand
AZ 2174	Roller arm	Left-hand

Capacity/resistive load:
15A 125V AC
10A 250V AC

ENCLOSED MAINTAINED CONTACT SWITCHES

Capacity/resistive load:
15A 125V AC
10A 250V AC

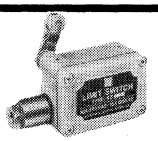


AZ 3101

Switch	Type	Mounting
AZ 3101	Sealed plunger, splash-dust proof	Side
AZ 3201	Sealed plunger, splash-dust proof	Bottom
AZ 3104	Sealed roller arm, splash-dust proof	Side
AZ 3204	Sealed roller arm, splash-dust proof	Bottom

ENCLOSED WEATHER-PROOF SWITCH

Capacity/resistive load:
15A 125V AC
10A 250V AC

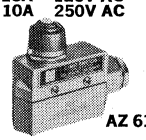


AZ 4304
Roller arm type

SPLITTED HOUSING GENERAL PURPOSE SWITCHES

Switch	Type	Mounting
AZ 6101	Sealed plunger	Side
AZ 6201	Sealed plunger	Bottom
AZ 6102	Roller plunger	Side
AZ 6202	Roller plunger	Bottom
AZ 6104	Sealed roller arm	Side
AZ 6204	Sealed roller arm	Bottom

Capacity/resistive load:
15A 125V AC
10A 250V AC



AZ 6101

SMALL TWO-CIRCUIT LIMIT SWITCHES

Switch	Type
AZ 5101	Plunger
AZ 5102	Roller Plunger
AZ 5104	Roller arm
AZ 5105	Yoke
AZ 5106	Flexible rod
AZ 5107	Adjustable rod
AZ 5108	Adjustable roller arm

Capacity/resistive load:
15A 125V AC
6A 260V AC



AZ 5101

REMVAC COMPONENTS, INC.
37-55 61st Street Woodside, New York 11377 (212) TW 9-6100

Sole agents for components manufactured by Matsushita Electric Works, Ltd.

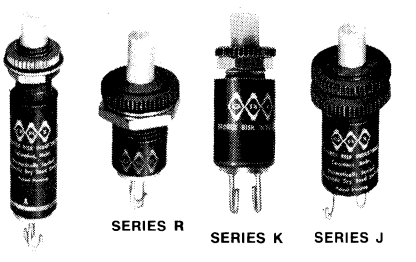
GEORGE RISK INDUSTRIES

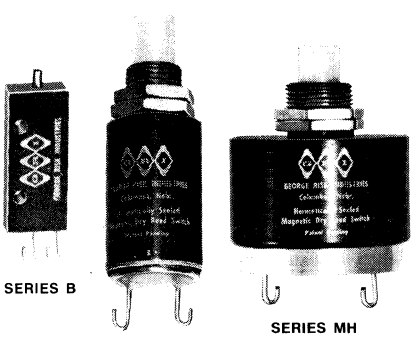
Dry Reed Type PUSH BUTTON SWITCHES

FEATURES

- ☐ Hermetically sealed contacts
- ☐ Low closed contact resistance
- ☐ Ideal for dry circuits or higher current application
- ☐ Exceeds Mil Specs.
- ☐ Momentary action
- ☐ Life expectancy in the millions
- ☐ Explosion proof
- ☐ Low bounce characteristics
- ☐ Terminals weldable and solderable







LENGTH OF ALL TERMINALS .300" MAX.

SERIES	Mfg. Type*	Switch Form	Resistive Current	Resistive Watts	Volts	Dimensions L x D
SERIES T Momentary Action	TI-HA4	4PST-NO	3	50	125	1.75 x .890
	TI-HB4	4PST-NC	3	50	125	
	TI-HA3	3PST-NO	3	50	125	
	TI-HB3	3PST-NC	3	50	125	
	TI HA2	2PST-NO	3	50	125	
	TI-HB2	2PST-NC	3	50	125	
	TE-HA4	4PST-NO	1	15	125	
	TE-HB4	4PST-NC	1	15	125	
	TE-HA3	3PST-NO	1	15	125	
	TE-HB3	3PST-NC	1	15	125	
	TE-HA2	2PST-NO	1	15	125	
	TE-HB2	2PST-NC	1	15	125	
	TB-HC4	4PDT Break-Make	.250	10	125	
	TB-HC3	3PDT Break-Make	.250	10	125	
	TB-HC2	2PDT Break-Make	.250	10	125	
SERIES W Momentary Action	WI-HA	SPST-NO	3	50	125	1.75 x .625
	WI-HB	SPST-NC	3	50	125	
	WE-HA	SPST-NO	1	15	125	
	WE-HB	SPST-NC	1	15	125	
	WB-HC	SPDT Break-Make	.250	10	125	
SERIES G Momentary Action	GC-HA4	4PST-NO	.5	12	125	.975 x .625
	GC-HB4	4PST-NC	.5	12	125	
	GC-HA3	3PST-NO	.5	12	125	
	GC-HB3	3PST-NC	.5	12	125	
	GC-HA2	DPST-NO	.5	12	125	
	GC-HB2	DPST-NC	.5	12	125	
	GC-HA	SPST-NO	.5	12	125	
	GC-HB	SPST-NC	.5	12	125	
	GB-HC2	DPDT Break-Make	.250	4	125	
	GB-HC	SPDT Break-Make	.250	4	125	
SERIES D Momentary Action	DC-HA	SPST-NO	.5	12	125	.850 x .330
	DC-HB	SPST-NC	.5	12	125	
	DB-HC	SPDT Break-Make	.250	3	125	
SERIES R Momentary Action	RB-HA	SPST-NO	.250	3	125	.625 x .375
	RB-HB	SPST-NC	.250	3	125	
	RB-HC	SPDT Break-Make	.250	3	125	
SERIES K Momentary Action	KB-HA	SPST-NO	.250	3	125	.750 x .300
	KB-HB	SPST-NC	.250	3	125	
	KB-HC	SPDT Break-Make	.250	3	125	
SERIES J Momentary Action	JC-HA	SPST-NO	.5	12	125	1.0 x .375
	JC-HB	SPST-NC	.5	12	125	
	JB-HC	SPDT Break-Make	.250	3	125	
SERIES B Momentary Action	BC-HA	SPST-NO	.5	12	125	1" L x .4 W x .170 Thick
	BC-HB	SPST-NC	.5	12	125	
SERIES MV Mercury-Wetted Reed Momentary Action	MVI-HA	SPST-NO	3	50	125	.975 x .625
	MVI-HB	SPST-NC	3	50	125	
SERIES MH Mercury-Wetted Reed Momentary Action	MHI-HA	SPST-NO	3	50	125	.750 x 1.225

***NOTE:** Series R, K, J, available with 15 oz. operating force only. All other Manufacturing Types listed are for 8 oz. Button operating force of 17 grams can be supplied, if needed. To specify, change letter "H" in "Mfg. Type" to "F". (Example: TI-**H**A4 to TI-**F**A4.)

BUTTONS & ACCESSORIES

Information on a complete range of button accessories (Delrin and Aluminum) can be obtained by contacting the factory. Colors available for standard buttons and accessories include: white, red, black, green, blue. Illuminated buttons also available.

NO-BOUNCE SWITCHES

GRI now offers mercury-wetted reed switches (momentary). Contact Bounce — none. Maximum contact resistance 50 milliohms after 10 million operations at full load. Mounting Position — 30° out of plane (horizontal or vertical). Write for full information.

WRITE FOR COMPLETE LITERATURE AND PRICES

GEORGE RISK INDUSTRIES, INC.
672 15th Avenue, Columbus, Nebr. 68601
Telephone: 402-564-2777 TWX: 910-626-0950

GEORGE RISK INDUSTRIES

Dry Reed Type ILLUMINATED KEYBOARD PUSHBUTTON SWITCHES & INDICATORS



SERIES KBDP



SERIES KB

- ☐ **Hermetically Sealed Contacts**
- ☐ **P.C. Board Mount**
- ☐ **Dry Circuits through .5 Amps**
- ☐ **High Reliability through Millions of Operations**

ELECTRICAL SPECIFICATIONS

Contact Rating:
KBDP—Illuminated and non-illuminated .5 amps, 125 volts, 10 watts max. (resistive)
KB —Non-illuminated .5 amps, 125 volts, 10 watts; illuminated .250 amps, 125 volts, 3 watts

Dielectric Strength: 500 VAC, terminals to case

Contact Bounce: 500 microseconds max.

Contact Resistance: 200 milliohms max.

Insulation Resistance: 100 Megohms

Life Expectancy: 20 million operations at full load
50 million operations at half load
(Resistive load at 28 VDC)

Each Pole Isolated

MECHANICAL SPECIFICATIONS

Internal Atmosphere: Inert gas

Mounting Position: Any plane

Reed Contact Material: Gold Alloy

Internal Terminal Construction: Welded

Terminal to Case Insulation: Glass-filled Nylon

Switch Case: Nory L

External Switch Terminals: "A" Nickel Alloy, weldable or solderable

Mounting Stud: 2-56 stainless steel (base of switch)

Identification:
Switches printed with model number, contact rating, schematic diagram, switch form

	KBDP	KB
Pre-Travel	.062 min.	.062 min.
Differential Travel	.062 max.	.062 max.
Total Travel	.175 ± .020	.175 max.
Basic Body Dimensions	1.30 L x .500 dia.	1.05 L x .68 dia.

TYPICAL ORDERING PATTERN* (with switch form, key top, lamp and pressure specifications)

KBDP KB **XX** **X** **X.XX** **X**

Switch Forms	
01	SPST-NO
02	SPST-NC
03	DPST-NO
04	DPST-NC
05	SPDT-BM
06	DPST-NO-NC

Key Tops KBDP	
—F	.95 x .70 x .50
—G	.75 x .75 x .50
—H	1.62 x .75 x .50
—I	.71 x .71 x .52

Key Tops KB	
—J	.50 x .50 x .50
—K	.75 x .50 x .50
—L	4.50 x .50 x .50

T-1¾ Lamp Voltage	Bi-Pin Lamp Voltage
1.35	10.0
2.5	14.0
2.7	18.0
3.0	24.0
6.0	28.0
6.3	—

Operating Pressure ± .5 oz.		
	KBDP	KB
—01	2.5 oz.	2.5 oz.
—02	5.0 oz.	—
—03	8.0 oz.	—

KEY TOP SPECIFICATIONS

Colors: Light Gray, Dark Gray, Red, White, Blue, Black—others on request

Materials:
Illuminated=polycarbonate**
Non-illuminated=ABS

**Available with snap-off, see-through top for inserting specific key information.

*Non-illuminated Switches, Indicators and Key Tops can be ordered using applicable areas of the above information.

FOR COMPLETE INFORMATION CONTACT:
George Risk Industries, Kimball Division
802 South Elm • Box 1035 • Kimball, Nebraska 69145
Phone 308-235-4645

WRITE FOR COMPLETE LITERATURE AND PRICES

GEORGE RISK INDUSTRIES, INC.
672 15th Avenue, Columbus, Nebr. 68601
Telephone: 402-564-2777 TWX: 910-626-0950

GEORGE RISK INDUSTRIES

SERIES 500 KEYBOARDS



The standard G.R.I. Model 573 alpha-numerical keyboard shown is housed in a modern-styled case with hand rubbed walnut ends.

There is a total of 73 keys arranged in a combination of the standard diagonal and in-line format. The 45 alpha-numeric and graphic symbol keys are in the standard diagonal arrangement. The other 28 keys which comprise the space bar, 2 shift keys, shift lock, carriage return, back space and 22 other functions are arranged in line.

The diode matrix board generates a 7 bit US ASCII code + parity and strobe.

An electronic interlock circuit prevents generation of an invalid code if 2 or more keys are depressed at the same time.

All code, strobe and function lines terminate through a 24" cable connected to an Amphenol connector #57-30360. The connector also receives the external voltages for the electronics.

Depressing and holding down either of the shift keys puts the 45 alpha-numeric and graphic symbol keys in upper case. The shift lock key holds these keys electronically in the upper case when depressed. Momentarily depressing the shift keys releases the shift lock.

HIGH RELIABILITY to meet your most exacting standards. Solid state encoding and dry reed switching assures long, trouble-free, dependable performance.

FLEXIBILITY—Unique design makes for easy modification to meet your needs.

ECONOMY—Most custom designs can be achieved at low prices because of the universal format design.

QUALITY ASSURANCE—Whether you buy any one of the 3 standard models or a complete new design, you can be assured your system's exact requirements will be met.

COMPLETE KEYBOARDS—Whether you choose any of the 3 standard models or a special keyboard to your own specifications, you can minimize your assembly and installation costs.

SOLID STATE ENCODING—Maximum uptime is assured through the use of proven trouble-free solid state encoding.

OFF-THE-SHELF—Any one of the 3 standard models are readily available for your prototype evaluation, eliminating time-consuming and expensive development costs.

OPTIONS—The Series 500 Keyboards have been carefully planned to offer you custom designs with a minimum of expense and a short lead time.

SPECIFICATIONS SERIES 500 KEYBOARDS

KEYBOARD

Number of alpha-numeric keys: 10 to 73
- Standard Model 573—73 keys
- Standard Model 556—56 keys
- Standard Model 547—47 keys

Data Lines: 7 lines ASCII + parity + strobe
Total 8 lines plus strobe

Electronic Interlock: On all coded keys. Strobe is inhibited if two keys are depressed at same time.

Keys: Magnetically operated dry reed

Shift and Shift Lock: Electronic

Keybutton Force Level: 2½ ± ½ oz.

Key Stroke: 3/16"

Key Bounce Characteristics: Less than ½ millisecond

Key Top Colors: Grey, dark blue. Other colors on special order.

Key Top Marking: Up to 15 characters (in three rows of 5 characters) engraved and paint filled.

Key Format: Diagonal and in-line combination.

ELECTRICAL

Input Power: 115 V. 60 Hz, 40 watts max.

Output: Into Amphenol connector #57-30360
- 7 parallel code lines plus parity
- Common key line + 5 V DC
- Strobe — 5 V
- Groundline
- +22 V DC
- Separate common to L.H. 5 function keys
- Separate common to bottom 6 function keys
- Separate common to R.H. 10 function keys
- Total of 21 coded function lines

Logic Output: • Logic 1 = +5 V • Logic 0 = 0 V

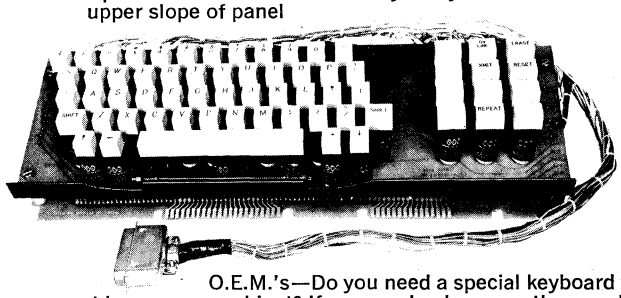
DIMENSIONS

15⅞" wide x 11½" deep x 4⅜" high

APPROXIMATE WEIGHT

Operating 12 lbs. Shipping 17 lbs.

OPTIONS
- Illumination on any key
- Any specified key arrangement from 10 to 73
- BCD or IBM code or any special code to customer specifications
- Internal power supply may be eliminated and customer can supply own power through wires provided for in connector
- May be supplied without diode matrix or electronic lockout
- May be supplied without case
- Up to 10 additional function keys may be mounted on upper slope of panel



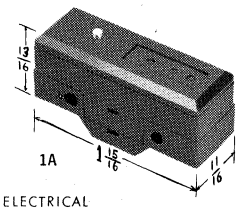
O.E.M.'s—Do you need a special keyboard to mount in your own cabinet? If you need only one or thousands, we will customize them for you at low cost. Fast service, too!

WRITE FOR COMPLETE LITERATURE AND PRICES

GEORGE RISK INDUSTRIES, INC.
672 15th Avenue, Columbus, Nebr. 68601
Telephone: 402 564-2777 TWX: 910 626-0950

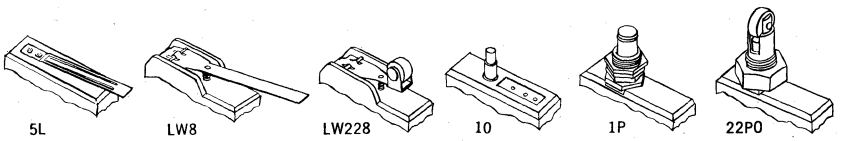
Robertshaw — PRECISION SNAP SWITCHES WITH PATENTED ROLLING SPRING

MODEL B — Long Life



ELECTRICAL
15 amps, 120-240-480 volts A.C.
½ amp, 120 VDC
¼ amp, 240 VDC
Listed by U.L. and C.S.A.

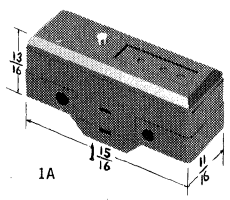
MECHANICAL LIFE
20 Million cycles.



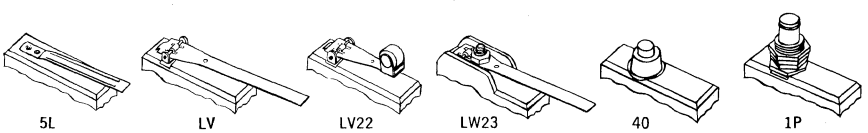
MODEL No.	OPERATING FORCE	RELEASE FORCE	PRETRAVEL	OVERTRAVEL	MOVEMENT DIFFERENTIAL	TERMINAL
BRD2-1A-1S	9-13 oz.	4 oz. Min.	.020 in. Max.	.005 in. Min.	.003 in. Max.	Screw
BRD2-5L-1S	5 oz. Max.	½ oz. Min.	.156 in. Max.	1/32 in. Min.	.050 in. Max.	Screw
BRD2-LW8-1S	2½ oz. Max.	½ oz. Min.	9/32-13/32 in.	.187 in. Min.	.016-.078 in.	Screw
BRD2-LW228-1S	6 oz. Max.	1½ oz. Min.	.045-.140 in.	.080 in. Min.	.006-.031 in.	Screw
BRD2-1O-1S	9-13 oz.	4 oz. Min.	.010-.025 in.	1/16 in. Min.	.003 in. Max.	Screw
BRD2-1P-1S	9-13 oz.	4 oz. Min.	.010-.025 in.	7/32 in. Min.	.003 in. Max.	Screw
BRD2-22PO-1S	9-13 oz.	4 oz. Min.	.010-.025 in.	.140 in. Min.	.003 in. Max.	Screw

TOTAL OF 18 ACTUATORS AVAILABLE.
To order solder terminal, drop "1S" from Model number.

MODEL F — Horsepower Rated



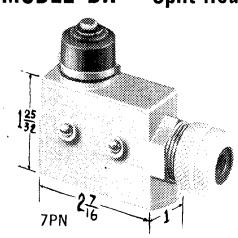
ELECTRICAL
21 amps, 120-240-480 VAC
1 Hp. 120 VAC
2 Hp. 240 VAC
Listed by U.L. and C.S.A.



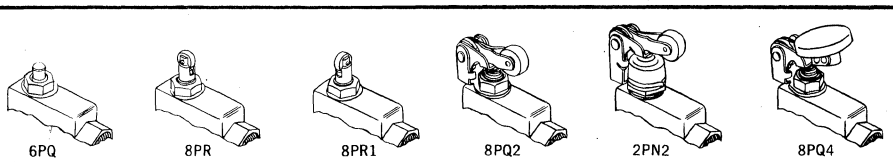
MODEL No.	OPERATING FORCE	RELEASE FORCE	PRETRAVEL	OVERTRAVEL	MOVEMENT DIFFERENTIAL	TERMINAL
FAD2-1A-1S	10-18 oz.	6 oz. Min.	.050 in. Max.	.005 in. Min.	.0075 in. Max.	Screw
FAD2-5L-1S	9 oz. Max.	1 oz. Min.	1 1/32 in. Max.	1/32 in. Min.	.065 in. Max.	Screw
FAD2-LV-1S	2½ oz. Max.	½ oz. Min.	5/8 in. Max.	.078 in. Min.	.109 in. Max.	Screw
FAD2-LV22-1S	6 oz. Max.	1 oz. Min.	¼ in. Max.	1/32 in. Min.	3/64 in. Max.	Screw
FAD2-LW23-1S	2½ oz. Max.	½ oz. Min.	.375 in. Max.	.093 in. Min.	.007-.050 in.	Screw
FAD2-40-1S	10-18 oz.	6 oz. Min.	.050 in. Max.	3/32 in. Min.	.0075 in. Max.	Screw
FAD2-1P-1S	10-18 oz.	6 oz. Min.	.050 in. Max.	.219 in. Min.	.0075 in. Max.	Screw

TOTAL OF 13 ACTUATORS AVAILABLE.
To order solder terminal, drop "1S" from Model number.

MODEL BH — Split Housing



ELECTRICAL
15 amps, 120-240-480 VAC
The combination of metal enclosure and switch is U.L. and C.S.A. listed.

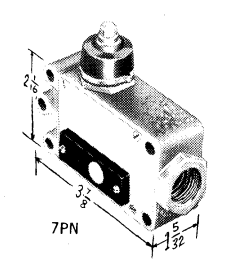


MODEL No.	OPERATING FORCE	RELEASE FORCE	PRETRAVEL	OVERTRAVEL	MOVEMENT DIFFERENTIAL
SBHT-7PN	9-24 ozs.	4 ozs. Min.	.078 in. Max.	.219 in. Min.	.003 in. Max.
SBH-6PQ	9-13 ozs.	4 ozs. Min.	.020 in. Max.	.219 in. Min.	.003 in. Max.
SBH-8PR	9-13 ozs.	4 ozs. Min.	.020 in. Max.	.140 in. Min.	.003 in. Max.
SBH-8PR1	9-13 ozs.	4 ozs. Min.	.020 in. Max.	.140 in. Min.	.003 in. Max.
SBH-8PQ2	10-18 ozs.	6 ozs. Min.	3/16 in. Max.	.219 in. Min.	.006 in. Max.
SBH-2PN2	10-20 ozs.	6 ozs. Min.	.188 in. Max.	.219 in. Min.	.006 in. Max.
SBH-8PQ4	10-18 ozs.	6 ozs. Min.	3/16 in. Max.	.219 in. Max.	.006 in. Max.

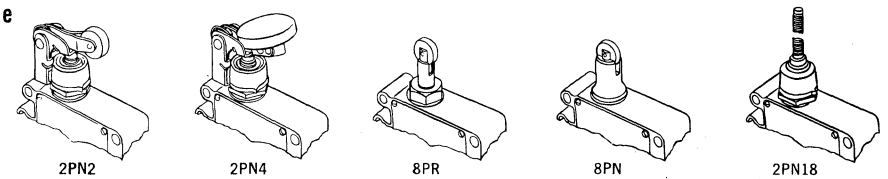
10 ACTUATORS AVAILABLE

"T" designates externally threaded housing. These are available with 7PN, 2PN2, 2PN28, and 2PN4 actuators. Split-housing is available with internally threaded housing. One-piece externally threaded housing models are available with same 10 actuators.

MODEL FH — Mounts Either Side



ELECTRICAL
21 amps at 120-240-480 VAC
1 Hp — 120 VAC
2 Hp — 240 VAC



MODEL No.	OPERATING FORCE	RELEASE FORCE	PRETRAVEL	OVERTRAVEL	MOVEMENT DIFFERENTIAL
• L-FHD2-7PN	2½ lbs. Max.	8 oz. Min.	.094 in. Max.	.219 in. Min.	.010 in. Max.
FHD2-2PN2	2 lbs. Max.	8 oz. Min.	.219 in. Max.	.218 in. Min.	.020 in. Max.
FHD2-2PN4	2 lbs. Max.	8 oz. Min.			
FHD2-8PR	2½ lbs. Max.	8 oz. Min.	.094 in. Max.	.156 in. Min.	.010 in. Max.
FHD2-8PN	8 lbs. Max.	2 lbs. Min.	.125 in. Max.	.175 in. Max.	.0075 in. Max.
# FHD2-2PN18	Above characteristics do not apply to this model switch.				

6 ACTUATORS AVAILABLE.

•Switch with one Acrolite. Silicone boot for 0°F to 200°F range is available.
#Switch operates by moving flexible actuator 15° or more in any direction, except a direct pull.

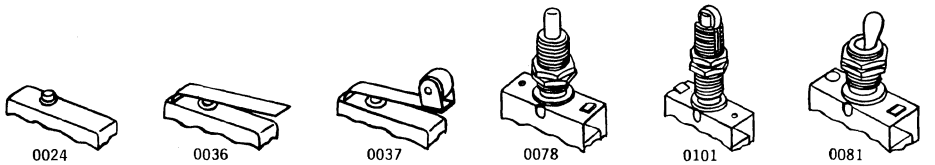
WRITE FOR CATALOG — Robertshaw Controls Company, Acro Division
Columbus, Ohio 43216

21 MODELS

- SUBMINIATURE
- MINIATURE
- GENERAL PURPOSE
- METAL CLAD

Robertshaw MR CONTROLS

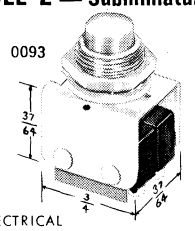
MODEL Z — Subminiature



MODEL No.	OPERATING FORCE	RELEASE FORCE	PRETRAVEL	OVERTRAVEL	MOVEMENT DIFFERENTIAL
ZD-0024	85-140 gms.	1 oz. Min.	.008-.020 in.	.010 in. Min.	.001-.004 in.
ZLD-0036	2 oz. Max.	½ oz. Min.	3/32 in. Max.	.045 in. Min.	.015 in. Max.
ZLD-0037	2 oz. Max.	½ oz. Min.	3/32 in. Max.	.045 in. Min.	.015 in. Max.
ZPD-0078	10 oz. Max.	2 oz. Min.	.050 in. Max.	.125 in. Min.	.030 in. Max.
ZPD-0101	10 oz. Max.	2 oz. Min.	.050 in. Max.	.125 in. Min.	.030 in. Max.
ZTD-0081	(Hand operated and these characteristics do not apply)				
ZPD-0093	20 oz. Max.	5 oz. Min.	.010 in. Max.	.010 in. Min.	.010 in. Max.

13 ACTUATORS AVAILABLE.

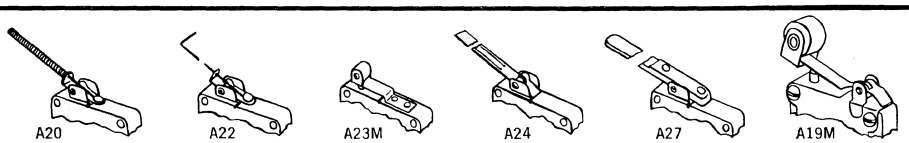
Available with these terminals: Turret, Double Turret, Post, Baton, and Tab.



ELECTRICAL
5 amp, 120-240 VAC
3 amp sea level and 2.5 amp 50,000 ft., 30 VDC inductive
4 amp sea level and 4 amp 50,000 ft., 30 VDC resistive
U.L. listing, 5 amp., 120-240 VAC

MECHANICAL LIFE
One million cycles with .010 gap and .005 overtravel

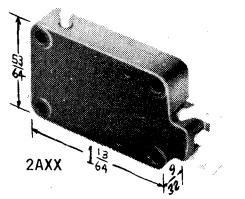
MODEL CM — Low Force



MODEL No.	OPERATING FORCE	RELEASE FORCE	PRETRAVEL	OVERTRAVEL	MOVEMENT DIFFERENTIAL
1CMD1-2AXX	20-27 gms.	12 gms. Min.	.040 in. Max.	.050 in. Max.	.030 in. Max.
1CMD1-18AXX-A20	8 gms. Max.		.400 in. Max.		
1CMD1-2AXX-A22	2.5 gms. Max.	Above characteristics are not applicable to this switch			.500 in. Max.
1CMD1-1AXX-A23M	5-8 oz.	2 oz. Min.	.040 in. Max.	.050 in. Max.	.030 in. Max.
1CMD1-2AXX-A24	2.5 gms. Max.	Above characteristics are not applicable to this switch			.500 in. Max.
*1CMD1-18AXX-A27	6 gms. Max.	Above characteristics are not applicable to this switch			.233 in. Max.
1CMD1-2AXX-A19M	20-27 gms.	12 gms. Min.	.040 in. Max.		.030 in. Max.

8 ACTUATORS AVAILABLE

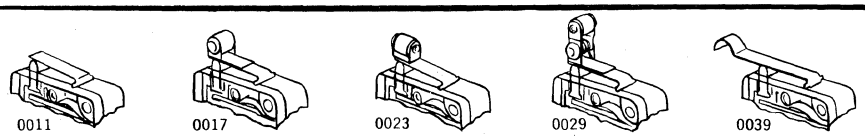
*Actuator bracket and switch are shipped separately.



ELECTRICAL
3 amp, 125-250 VAC
3 amp, 28 VDC
U.L. listing, 3 amp, 125-250 VAC

MECHANICAL LIFE
50 Million cycles.

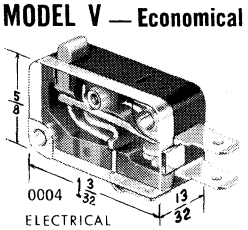
MODEL V — Economical



MODEL No.	OPERATING FORCE	RELEASE FORCE	PRETRAVEL	OVERTRAVEL	MOVEMENT DIFFERENTIAL
VD-0004	14 oz. Max.	4 oz. Min.	.047 in. Max.	.031 in. Min.	.014 in. Max.
VLD-0011	14 oz. Max.	2 oz. Min.	.062 in. Max.	.031 in. Min.	.016 in. Max.
VLD-0017	14 oz. Max.	2 oz. Min.	.062 in. Max.	.031 in. Min.	.016 in. Max.
VLD-0023	14 oz. Max.	2 oz. Min.	.062 in. Max.	.031 in. Min.	.016 in. Max.
VLD-0029	14 oz. Max.	2 oz. Min.	.062 in. Max.	.015 in. Min.	.016 in. Max.
VLD-0039	8 oz. Max.	1 oz. Min.	.125 in. Max.	.062 in. Min.	.050 in. Max.

10 ACTUATORS AVAILABLE.

Available with these terminals: Quick Connect, Solder and Screw.
Actuators are also available with 8 oz. operating force on pin plunger.



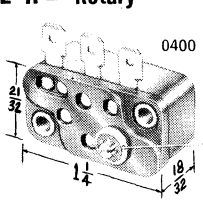
ELECTRICAL
15 amps, 125-250 volts A.C.
10 amps, 30 VDC
Listed by U.L. and C.S.A.

MECHANICAL LIFE
20 Million cycles.

MODEL H — Rotary

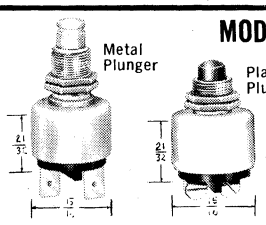
ELECTRICAL
5 amp. — 120-240 VAC
U.L. and C.S.A. listed.
Hi-pot tested 1250 VAC terminal to exposed rivet head.

MECHANICAL LIFE
Minimum operating life of one million cycles. Static load of 15 inch ounces will not change switch characteristics when applied at full travel or start positions and in a direction opposite to normal movement.
Axial movement of shaft will not exceed .010 inch.



MODEL No.	ROTATION	OPERATING FORCE	OPERATING LIMITS DOWN STROKE	AFTER TRAVEL	MOVEMENT DIFFERENTIAL	TERMINAL
HD-0200	CW	3 gms. in. Max.	15-21°	5° Min.	8° Min.	Solder
HD-0300	CW	3 gms. in. Max.	15-21°	5° Min.	8° Min.	Tab .187
HD-0400	CW	3 gms. in. Max.	15-21°	5° Min.	8° Min.	Tab .205
HD-0500	CCW	4 gms. in. Max.	15-21°	5° Min.	8° Min.	Solder
HD-0600	CCW	4 gms. in. Max.	15-21°	5° Min.	8° Min.	Tab .187
HD-0700	CCW	4 gms. in. Max.	15-21°	5° Min.	8° Min.	Tab .205

MODEL D — Panel Mounted



U.L. ELECTRICAL RATING
12 amps — 125 VAC
6 amps — 230 VAC

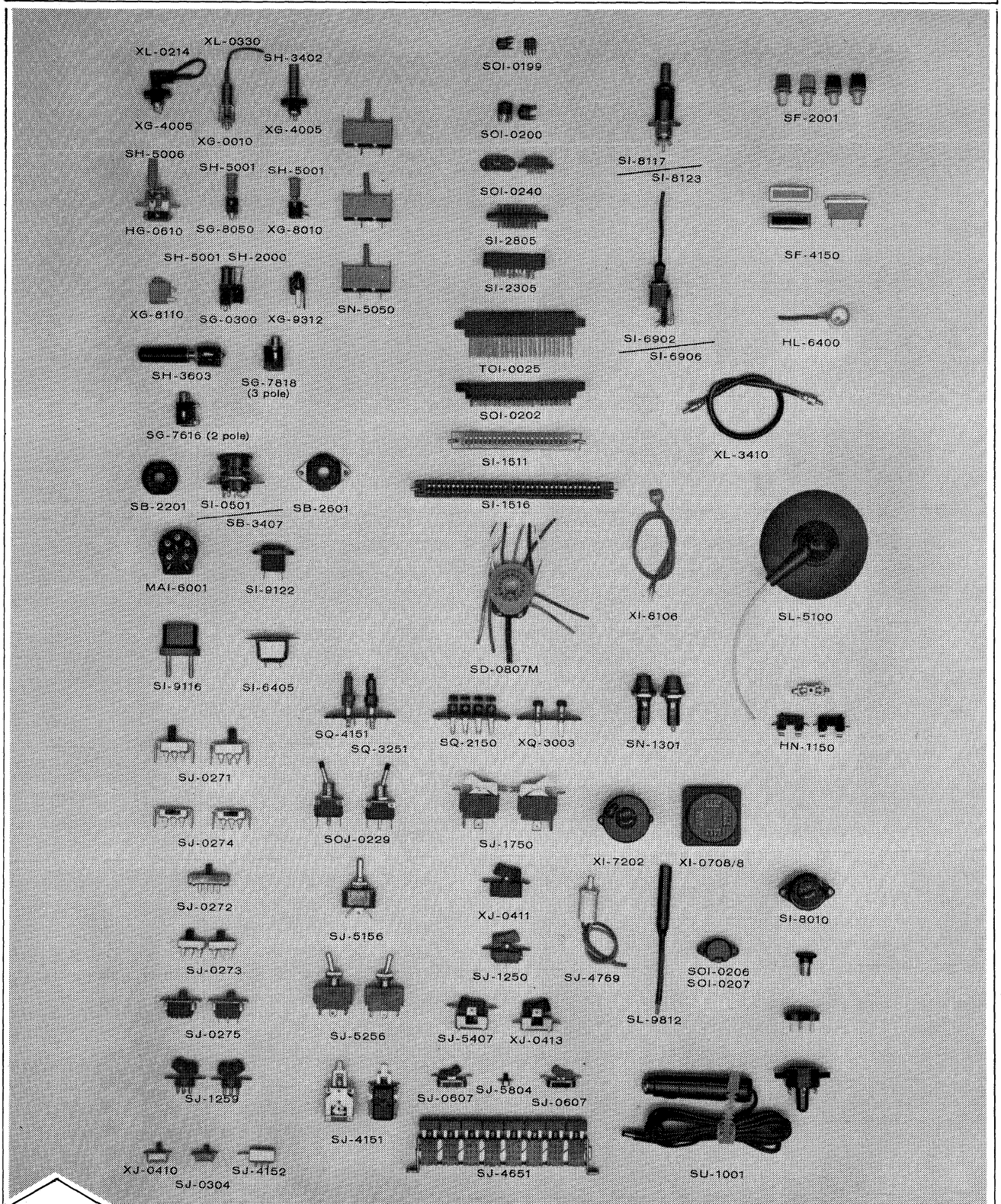
MECHANICAL LIFE
250,000 cycles

MODEL No.	CIRCUIT	PRETRAVEL	OPERATING FORCE
3DO5-5P	N.O.	.100 in. Max.	10-15 oz.
3DO5-5P-4T	N.O.	.100 in. Max.	10-15 oz.
3DC5-5P	N.C.	.070 in. Max.	10-15 oz.
3DC5-5P-4T	N.C.	.070 in. Max.	10-15 oz.
3DO5-8P	N.O.	.100 in. Max.	10-15 oz.
3DO5-8P-4T	N.O.	.100 in. Max.	10-15 oz.
3DC5-8P	N.C.	.070 in. Max.	10-15 oz.
3DC5-8P-4T	N.C.	.070 in. Max.	10-15 oz.

4T=Tab.

NATIONWIDE SALES ASSISTANCE THROUGH LOCAL DISTRIBUTOR OR FACTORY ENGINEER

High Reliability! Electronic Components



SMK

SHOWA MUSEN KOGYO CO., LTD.

5-5, 6-chome, Togoshi, Shinagawa-ku, Tokyo, 141 Japan Telephone: (783)1171 Cable: "SHOWAMUSEN" Tokyo

OMRON *Precision Snap-Action Switches*

SIGMA



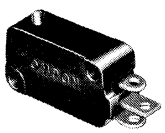
Z-15G

General Purpose Basic Switch for use in a wide variety of applications. Compact, lightweight and accurate. Many actuators available.



S-5G

Subminiature Basic Switch for small instruments and appliances. Long life and sealed types available.



VV-15-1A

Miniature Basic Switch. Identical to "V" type, except will make and break 15 Amps AC. Can be supplied for low-force and low capacity operation.



WL-10FCA32-TS

Two Circuit Double Break Limit Switch. Available in standard or plug-in, and flanged or flush mounting models. Die-cast case for drip-, dust-, and oil-proof operation.



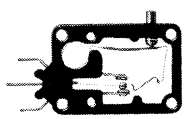
Z-15GS55

Sealed Basic Switch for operation in adverse environment of dust and/or moisture. Covered plunger assembly and adhesive bonded case.



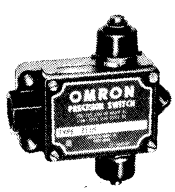
J-5

Sub-subminiature Basic Switch. 100,000 minimum mechanical operations. For use as an operating and controlling switch of electronic circuits and where mounting space is limited.



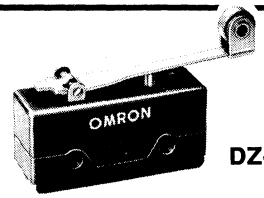
VF-5-1A

Low-force Flare Basic Switch. Extremely thin, compact switch to make and break 5 Amps, AC. Where space is limited, these switches can be readily ganged.



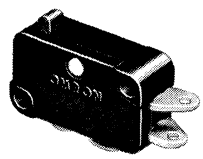
ZF-15ENRN-RS

Precision Switch. Basic Switch enclosed in rugged case for increased mechanical strength. This enclosed switch can be replaced without removing the case assembly from its mounting.



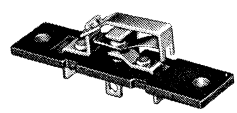
DZ-10GV2

DPDT Basic Switch. Suitable for controlling two independent circuits or two circuits of different voltage. Will make and break 10 Amps AC.



V-15-1B

Miniature Basic Switch for industrial and consumer appliance use. Available in heatproof, long life and low force operation types. Will make and break 10 Amps AC.



VN-10

Skeleton Switch. Light and inexpensive switch suitable for consumer appliances. Its snap action mechanism will make or break 5 Amps AC.



C-5

Low Torque Basic Switch. A compact switch requiring less than 4 gram-inches to make or break 5 Amps AC. Many actuators available.

ACTUATORS:

Made of high quality, stainless steel for direct push, rotary cam and linear action operation. Auxiliary actuators available to satisfy any specifications regarding switch direction, place of installation, position and operating force.

FEATURES:

U. L. Listed — Approved by Underwriters' Laboratories, Inc. (File E-32667).

Economical — Low initial cost and long service life.

Compatible — Can be used interchangeably with leading competitive types.

Rugged Construction — Highly resistant to abuse, eliminating the expense of frequent replacement.

The Sigma line of Omron precision, snap-action switches are the most economical and reliable switches available for automatic and semi-automatic controls. They are constructed to meet or exceed all existing industrial standards and military specifications for electrical capacity and service life. A wide selection of actuators, contact gap, terminal specifications and mounting configurations make these switches directly interchangeable with the leading competitive types. For further information concerning Omron snap-action switches, contact your nearest Sigma representative.

Sigma also markets a wide range of relays (see section 4500) and a complete line of instruments and controls (see section 2900).

SIGMA
INSTRUMENTS INC
Braintree, Massachusetts 02185

STACKPOLE SLIDE SWITCHES

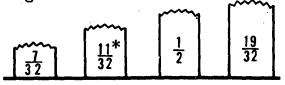
SS-	Action	UL-CSA Listings AC	DC	Schematic	Case
SINGLE POLE-SINGLE THROW					
26	Slide, with detent	4A 125V 2A 250V	1.0		A
36	Slide, with detent	6A 125V 3A 250V	1.0		A
37 *	Slide, with detent	10A 125V 5A 250V			A
47	Slide, with detent	10A 125V 5A 250V			A
15-1	Push button, momentary contact, normally open, no detent	3.0	0.5		A
9-2	Slide, spring return, no detent, normally open	6A 125V 3A 250V	1.0		A
40 *	Slide, spring return, no detent, normally open	3.0			A
SINGLE POLE-DOUBLE THROW					
26-1	Slide, with detent	4A 125V 2A 250V	1.0		A
36-1	Slide, with detent	6A 125V 3A 250V	1.0		A
37-1 *	Slide, with detent	10A 125V 5A 250V			A
40-1 *	Slide, spring return, no detent	3.0			A
9-3	Slide, spring return, no detent	6A 125V 3A 250V	1.0		A
SINGLE POLE-THREE POSITION					
31	Slide, with detent	6A 125V 3A 250V	1.0		A
43	Slide, with "skid proof" center detent	5A 125V 3A 250V	1.0		A
44 *	Slide, with detent	6.0			A
DOUBLE POLE-DOUBLE THROW					
50	Slide, with detent	3A 125V 1.5A 250V	0.5		A
20	Slide, plunger, spring return, with latch	6.0	0.5		B
5	Slide, momentary contact, spring return, no detent	6.0	0.5		B
33	Slide, with detent	6A 125V 3A 250V	0.5		B
DOUBLE POLE-THREE POSITION					
16	Slide, with detent	6.0	0.5		B
38	Slide, with "skid proof" center detent	6.0	0.5		B
42	Slide, maintained in two position, spring return to center from third	6.0	0.5		B

*SS-37 Series available with special quick-connect terminal horizontal to base only.

SS-	Action	UL-CSA Listings AC	DC	Schematic	Case
DOUBLE POLE-FOUR POSITION					
18	Slide, with detent	3.0	0.5		B
TRIPLE POLE-DOUBLE THROW					
76	Slide, with detent				D
6	Slide, spring return, no detent	6.0	0.5		B
34	Slide, with detent	6.0	0.5		B
DOUBLE POLE-THREE POSITION					
54	Slide, with detent	3.0	0.5		C
TRIPLE POLE-THREE POSITION					
74	Slide, with detent				D
FOUR POLE-DOUBLE THROW					
12	Slide, with detent	6A 125V 3A 250V	1.0		B

SLIDE TRIGGERS

Triggers are available in four heights.



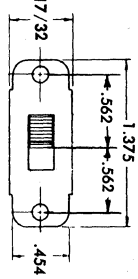
*Standard

NOTE: Types SS-74, SS-76 supplied with special 5/16", 1/2" or 3/4" trigger heights only.

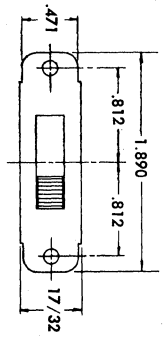
MOUNTING HOLES

.136/.140" clearance holes. Extruded or extruded and tapped mounting holes (4-40 or 6-32) also available.

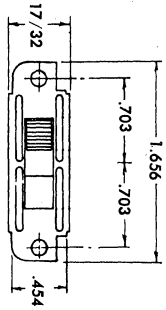
CASE A



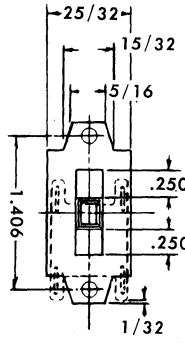
CASE B

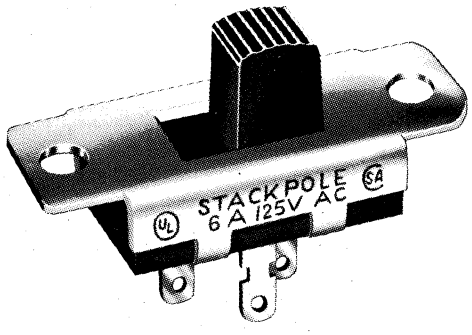


CASE C



CASE D





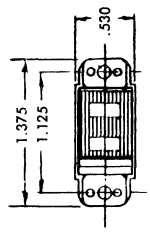
ROCKER SWITCHES

RS-	Action	UL-CSA Listings AC	DC	Schematic	Case
SINGLE POLE-SINGLE THROW					
9-2	Spring return, no detent, normally open	6A 125V 3A 250V	1.0		1 or 2
26	With detent	4A 125V 2A 250V	1.0		1 or 2
36	With detent	6A 125V 3A 250V	1.0		1 or 2
37 *	With detent	10A 125V 5A 250V			1 or 2
47	With detent	10A 125V 5A 250V			1 or 2
40 *	Spring return, no detent, normally open	3.0			1 or 2
SINGLE POLE-DOUBLE THROW					
9-3	Spring return, no detent	6A 125V 3A 250V	1.0		1 or 2
26-1	With detent	4A 125V 2A 250V	1.0		1 or 2
36-1	With detent	6A 125V 3A 250V	1.0		1 or 2
37-1 *	With detent	10A 125V 5A 250V			1 or 2
40-1 *	Spring return, no detent	3.0			1 or 2
SINGLE POLE-THREE POSITION					
31	With detent	6A 125V 3A 250V	1.0		1 or 2
43	With "skid proof" center detent	6A 125V 3A 250V	1.0		1 or 2
DOUBLE POLE-DOUBLE THROW					
50	With detent	3A 125V 1.5A 250V	0.5		1 or 2
5	Spring return, no detent	6.0	0.5		3
33	With detent	6A 125V 3A 250V	1.0		3

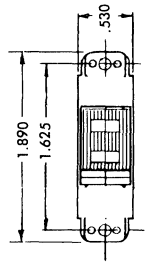
* RS-37 Series available with special quick-connect terminal horizontal to base only.

RS-	Action	UL-CSA Listings AC	DC	Schematic	Case
DOUBLE POLE-THREE POSITION					
16	With detent	6.0	0.5		3
38	With detent	6.0	0.5		3
42	With detent in two positions. Spring return to center from third position. (Flat bracket only)	6.0	0.5		3
TRIPLE POLE-DOUBLE THROW					
34	With detent	6.0	0.5		3
6	Spring return, no detent	6.0	0.5		3
FOUR POLE-DOUBLE THROW					
12	With detent	6A 125V 3A 250V	1.0		3

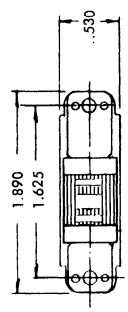
CASE 1
Small Case
Flat Bracket



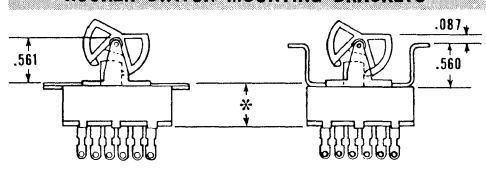
CASE 2
Small Case
Offset Bracket



CASE 3
Large Case
Flat Bracket and
Offset Bracket



ROCKER SWITCH MOUNTING BRACKETS

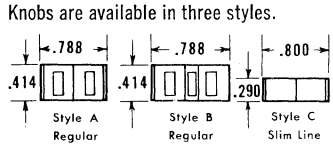


FLAT BRACKET OFFSET BRACKET

*For case dimension see comparable slide switch. (i.e., SP-ST rocker switch case depth, see SP-ST side switch drawing under Case Dimensions column)

ROCKER KNOBS

Knobs are available in three styles.



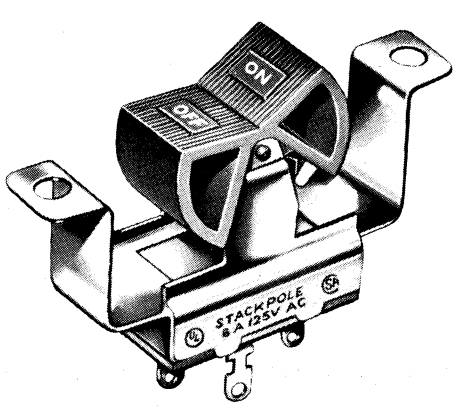
Style A Regular 2 Position — Style B Regular 3 Position — Style C Slim Line 2 Position

PANEL PIERCING

Dimensional details on recommended panel piercing supplied upon request.

MOUNTING HOLES

.136/.140" clearance hole supplied unless other mounting arrangement specified.



STACKPOLE
COMPONENTS COMPANY
A Subsidiary of Stackpole Carbon Company
P. O. Box 14466, Raleigh, North Carolina 27610
Phone: 919-828-6201, TWX: 510-928-0520

STACKPOLE ROTARY SWITCHES

SPECIALLY DESIGNED TO GUARD AGAINST EXPOSURE— CONTACT CONTAMINATION—PRODUCTION DAMAGE

-FEATURES-

COMPLETELY ENCLOSED — Both index mechanism and electrical sections are completely enclosed, providing an environment proof assembly.

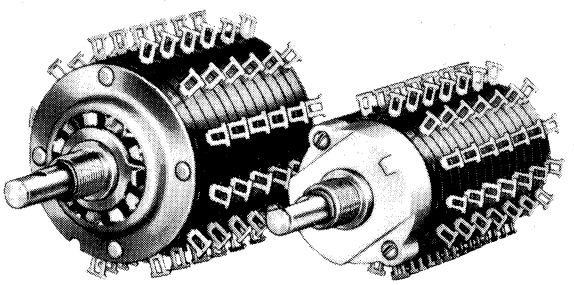
EXPOSURE AND CONTAMINATION PROOF — Corrosive atmospheres, dust, dirt and moisture are permanently sealed out, while lubricants are sealed in.

PRODUCTION DAMAGE ELIMINATED — Solder and flux cannot get into vital switch parts. Rugged integral terminals and contacts are permanently molded in position and will not loosen or move even under extreme soldering heat. Accidental production damage is eliminated.

FIELD PERFORMANCE ASSURED — Switch assemblies are torsionally rigid and rugged to withstand rough usage. Field tampering is abolished.

UNIQUE MODE OF SWITCHING — Reliable and long life switching, with low and consistent contact resistance, is assured under extremes of shock and vibration by a self-centering, spring loaded, silver alloy wiper. Complex switching arrangements, with intermixed shorting and non-shorting functions, are attainable not only on single sections, but also between sections. Standard index angles include 15°, 30°, 36°, 60° and 90°. Special angles available on request.

VERSATILITY — Enclosure maintaining spacers may be incorporated between sections to facilitate hardware mounting and special space requirements. Additional standard variations include electrostatic shields, dual concentric switches with attached line switches or potentiometers, gasket sealed construction, coded output and hi-voltage applications.



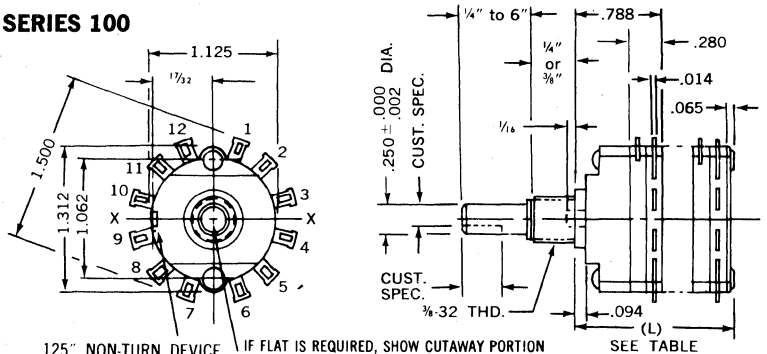
Series 600 1⅝" Dia. and Series 100 1⅛" Dia.
Environment Proof Rotary Switches

EXPLOSION PROOF — Standard enclosed construction is inherently explosion proof in accordance with Mil-S-3786B, paragraph 4.8.12.

VIBRATION — Conforms to low frequency vibration test Mil-S-3786B, paragraph 4.8.4.

SHOCK — Conforms to shock test type M, Mil-S-3786B, paragraph 4.8.5.1.

SERIES 100



MAXIMUM LENGTH (L) INCHES

DECKS	(L)
1	.853
2	1.133
3	1.413
4	1.693
5	1.973
6	2.253

Add 0.28 per additional deck

materials

Terminals (Stationary Contacts) —Brass, Silver Pl. (Standard) or Silver Alloy

Wiper—Silver Alloy

Insulation—Phenolic (Standard) or Diallyl Phthalate

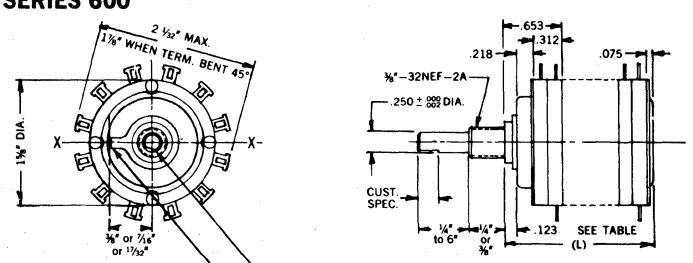
Front Plate—Delrin

Rear Plate—Steel, Ni. Pl.

Bushing—Brass, Unplated (Standard) or Brass, Plated

Shaft—Brass, Unplated (Standard) or Brass, Plated

SERIES 600



MAXIMUM LENGTH (L) INCHES

DECKS	(L)
1	.728
2	1.040
3	1.352
4	1.664
5	1.976
6	2.288

Add .312" per additional deck

materials

Terminals (Stationary Contacts)— Brass, Silver Pl. (Standard) or Silver Alloy

Wiper—Silver Alloy

Insulation—Phenolic (Standard) or Diallyl Phthalate

End Plates—Steel, Cad. Pl. Yel. Chromate Fin.

Bushing—Brass, Unplated (Standard) or Brass, Plated

Shaft—Brass, Unplated (Standard) or Brass, Plated

STACKPOLE COMPONENTS COMPANY
P. O. BOX 14466
RALEIGH, N. C. 27610
PHONE: 919-828-6201
TWX: 510-928-0520

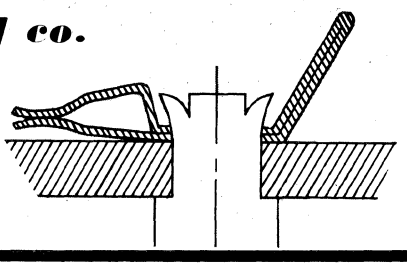
Look in the Green Section for Products and their Manufacturers



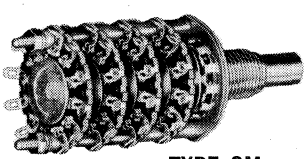
Tell them you found them in **eem**

standard grigsby co.

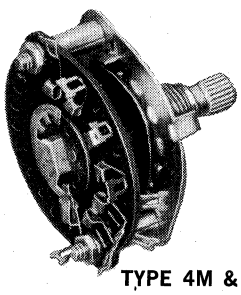
*"Wedgelock" is the exclusive patented construction of Standard Grigsby Switches. All electrical contacts are fastened to the insulating stators or wafers by means of the "T" slug. This forced fit prevents any loosening of the contacts as often happens in conventional rivet construction when solder heat is applied. The unique shape of the "T" slug design also eliminates rotation and twisting of contacts thus assuring maintenance of accurate timing throughout switch life.



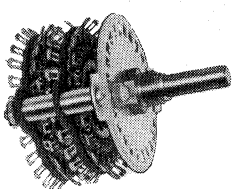
Rotary Switches



TYPE SM

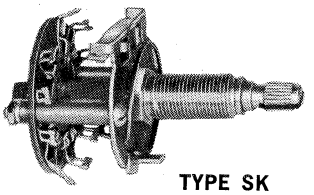


TYPE 4M & 42LR

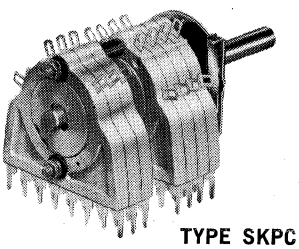


TYPE 7M

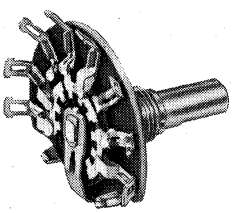
Type	Size	Max. Positions	Detent Angle	Insulation	Mil Designation	Additional Data
SM	13/16 x 7/8" — 3/4" Strut Centers	8 10 12	45° 36° 30°	Phenolic and Glass Epoxy	SRO 5	150 ma @ 125 VAC Spring return available. Dual concentric shafts. Rear mounted AC switch or potentiometer.
SK	1 1/4 x 1 7/8" 1 1/32" Strut Centers	4 6 8 12	90° 60° 45° 30°	Phenolic and Glass Epoxy	SRO 3	500 ma @ 125 VAC Spring return available. Dual concentric shafts. Rear mounted AC switch or potentiometer.
SKPC	1 17/32 Ht. Above P.C. Boards 1 41/64" Wide 1 1/32" Strut Centers	12	30°	Glass Alkyd	None	900 ma @ 125 VAC Spring return available. Dual concentric shafts. Rear mounted AC switch or potentiometer.
4M/42 LR	1 1/16 x 1 1/4" 1 1/4" Strut Centers	6 8 10 12 14	60° 45° 36° 30° 25° 42′	Phenolic — Glass Epoxy — Ceramic	SRO 2	500 ma @ 125 VAC Spring return available. Dual concentric shafts. Rear mounted AC switch or potentiometer.
7M	2 5/16 x 1 3/4" 2" Strut Centers — 2 17/32 x 1 5/8" 2 1/32" Strut Centers	14 18 20 24 28	25° 42′ 20° 18° 15° 12° 51′	Phenolic — Glass Epoxy — Ceramic	SRO 9	500 ma @ 125 VAC Dual concentric shafts. Rear mounted AC switch or potentiometer.
5M	Varied Irregular Shapes From 13/16" To 1 3/8"	3	30°	Phenolic	None	500 ma @ 125 VAC Spring return available. 2 and 3 post only. Maximum 9 stationary clips.



TYPE SK

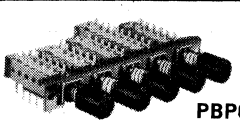


TYPE SKPC

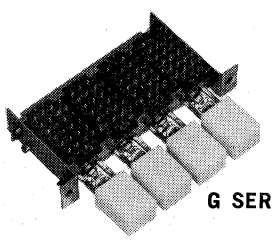


TYPE 5M

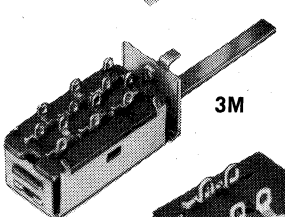
Pushbutton Switches



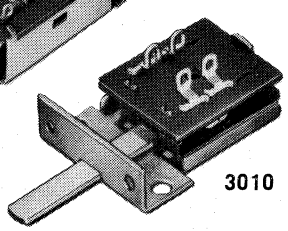
PBPC 400



G SERIES



3M



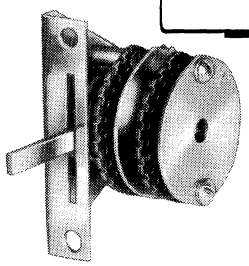
3010

Standard Grigsby has the linear action answer to your switching needs. A complete range of push button switches designed to meet a variety of performance requirements, from single button switches to multi-button modular assemblies.

Type	Poles Per Button	Button Spacing	Terminal Type	Contact Type	Insulation	Life Expectancy To	Electrical Rating	Mechanical Action
G Series 1 to 20 Buttons	2 to 12	15mm .590") 18mm (.708") 20mm (.787")	Printed Circuit or Solder Lug	High Reliability Double Wiping	Best Grade Phenolic	500,000 Cycles	5 Amp @ 125 VAC	Spring-return, push-push and inter-locking action in various combinations, with or without block-out.
PBPC 400 1 to 10 Buttons	2, 4, 6 or 8 Poles, Double Throw, Per Button	10mm 12.5mm 15mm 17.5mm 20mm	Printed Circuit	Single Wiping	Glass Filled Alkyd Stator	25,000 Cycles Minimum	4 Amp @ 125 VAC	Spring-return, push-push and inter-locking action.
3010 and 3M	Switching From 1 Pole, On-Off to 4 Pole, 2 Position	Designed Primarily for Single Button Applications	Printed Circuit or Solder Lug	Single Wiping	Best Grade Phenolic	25,000 Cycles Minimum	1 Amp @ 125 VAC	Normally spring-return action; push-push optional.

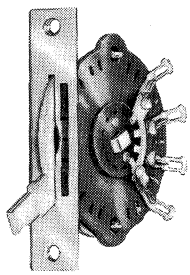
standard grigsby co.

Lever Switches



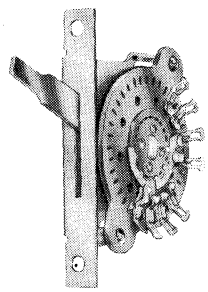
TYPE SMLR

- 1¼" Mounting Centers
- Insulation — phenolic or epoxy glass
- 2 to 4 positions With 30° throw (Max. 3 pos.) or 22½° throw (Max. 4 pos.)
- Spring return available from either side to a center position. Electrostatic shields are available
- A.C. Line Switch available in 30° throw
- Electrical Rating (Resistive) .150 MA. at 125 Volts; Maximum voltage—125 Volts; Maximum Current —2.5 Amps @ 6 V RMS



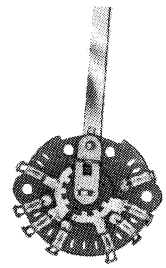
TYPE 6MLR

- 1⅝" Mtg. Centers
- Insulation—phenolic
- 3 positions
- 30° throw
- Electrical Rating (Resistive) .5 Amps at 125 Volts; Maximum Voltage—450 Volts; Maximum Current —3.5 Amps @ 6 V RMS



TYPE 6050LR

- 2³⁄₃₂" Mounting Centers
- Insulation—phenolic or epoxy glass
- 5 positions
- 20° Throw
- Electrical Rating (Resistive) .5 Amps @ 125 Volts; Maximum Voltage—450 Volts; Maximum Current —3.5 Amps @ 6 V RMS



TYPE 612LR

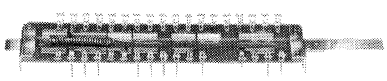
- Economical lever switch where detent is incorporated as part of a single wafer
- Available with or without mounting bracket
- Insulation—phenolic
- Available in 25.7 or 30° throw
- Electrical Rating (Resistive) .5 Amps at 125 Volts; Maximum Voltage—450 Volts; Maximum Current —3.5 Amps at 6 V RMS

Slide Switches



TYPE 150SL

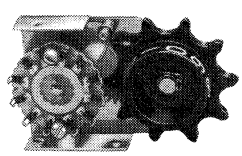
- 2 position with 2 to 12 poles
- Available with 9 to 21 contacts
- Insulation—phenolic
- Solder lug or printed circuit terminals
- Double throw—manual or spring return
- Contacts staked to base with "Wedgelock" construction
- Electrical Ratings (Resistive) .5 Amps at 125 Volts; Maximum Voltage—450 Volts RMS; Maximum Current —3.5 Amps @ 6 V RMS



TYPE 300SL

- Two position with 3 to 18 contacts on each side
- Insulation — phenolic
- Solder lug or printed circuit terminals
- Double throw — either manual or spring return
- Contacts staked to stator with "Wedgelock" construction
- Electrical Ratings (Resistive) .5 Amps at 125 Volts Maximum Voltage — 450 Volts RMS Maximum Current — 3.5 Amps @ 6 V RMS

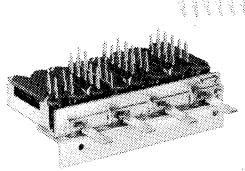
Thumbwheel Switches

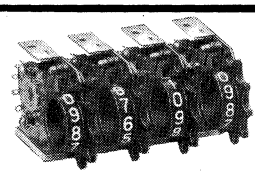


SMT switches are the latest of the Standard Grigsby thumbwheel family and are in keeping with the trend towards subminiaturization. These switches utilize the sub-miniature SM type stators and may be produced with either one or multi-wafer assemblies driven by a common thumbwheel. T-101 thumbwheel switches are available with either single or double wafer sections, and utilize a stator equivalent in size to the 4M series.

Ganged Switches







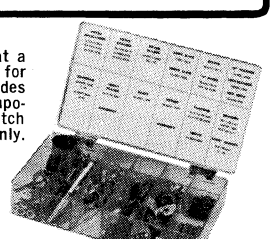
Most Standard Grigsby switches may be supplied ganged. Standard and custom made brackets are available. Write or phone for details.

Comparative Data

STANDARD GRIGSBY				OAK	CENTRALAB	MILITARY
	ENVELOPE SIZE					
SWITCH TYPE	Hgt.	W.	Strut Centers	Switch Type	Switch Type	SRO Types
SM	15⁄16"	7⁄8"	3⁄4"	A	100	SR05
SK	1 3⁄32"	1 3⁄32"	1 3⁄32"	F	PA-600	SR03
42LR	1 23⁄64"	1 3⁄8"		N, J, K (STAKED)	PA-1000, PA-2000 (STAKED)	
2M	1 5⁄16"	1 3⁄32"		50		
4MLR	1 9⁄16"	1 3⁄8"	1 1⁄4"	N, J, K	PA-1000, PA-2000	SR02
700 2"	2 5⁄16"	1 5⁄8"	2"	L, MF, GK	PA650 PA670	SR09
700	2 17⁄32"	1 5⁄8"	2 7⁄32"	RH, CH, GK	SERIES 230	SR10 SR12
5M			Varies	50, 20	SERIES 200	
6MLR	1 7⁄8"	1 27⁄64"		187, 189	SERIES 700	
6050LR	2 1 1⁄16"	1 13⁄16"		185		
6100				188		
612-614LR	1 9⁄16"	1 3⁄8"	1 1⁄4"	189		
SMT	1 1⁄4"	1 35⁄64"				
3010				80, 170		
3M				130, 131		
150SL					001, 002, 003 & 125 SERIES	
300SL				150		
SMLR	1 15⁄32"	1 3⁄64"	3⁄4"			

Sample Switch Kit

Standard Grigsby Switch Kits are available for most types at a nominal charge for use by laboratories and Design Engineers for prototype assembly. The basic kit for each switch type includes detent assemblies, wafers, clips, strut-screws, and other components required to produce a minimum of (25) switches. The switch kits are intended to be used in making prototype assemblies only.





LET US SAMPLE YOUR SPECIFIC REQUIREMENTS

standard grigsby co.

A DIVISION OF STANDARD KOLLSMAN INDUSTRIES INC.

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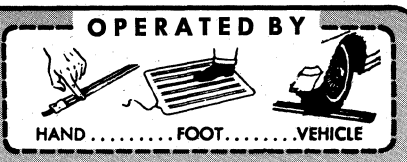
TAPESWITCH®

PRESS-AT-ANY-POINT RIBBON type & MAT type SENSING SWITCHES

OPERATED BY



BUY THE RIBBON SWITCH IN THE SIZE YOU NEED!

SUCCESSFULLY PROVEN IN ALL INDUSTRIES. PATENTED CONSTRUCTION WITHSTANDS MANY TONS OF FORCE YET CLOSES ON LIGHT FINGER PRESSURE. TAPESWITCHES ARE UNEXCELLED FOR—SAFETY . . . AUTOMATION . . . ANTIBURGLAR SYSTEMS . . . COUNTING . . . TIMING . . . DOOR CONTROL . . . LIGHT SWITCHING . . . MACHINE CONTROL . . . MATERIAL HANDLING INSTRUMENTATION . . . COMPUTER AND CONSOLE SWITCHING . . . AND MANY OTHER APPLICATIONS.

These versatile sensing switches may be used directly with **electro-mechanical devices** and **solid state devices.**

Pressure at any point from hand, foot, or vehicle will cause contact. These are ideal for instrumentation and control tasks because of their **flat configuration, "Press-at-any-Point" operation,** and **sealed** qualities.

TAPESWITCHES are designed in accordance with the best principles of switch and cable design, with jacketing and insulation meeting the requirements of MIL-C-9154 and MIL-I-631C respectively. Results are exceptional stand-by reliability (required in alarms) as well as excellent contact performance.

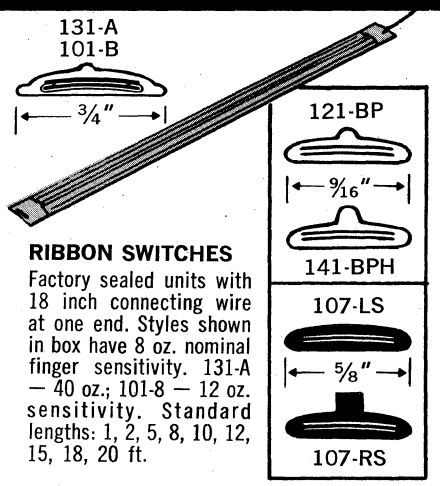
Typical life tests with repeated impacts at ONE POINT on a Tapeswitch have given over three million operations without failure. (24 Volt AC relay coil 0.3 Amperes)

RATINGS: All Tapeswitch products are rated 117 VAC, at 1 Ampere. However for floor switching, 30 VAC or less is recommended.

NOTE: U.L. classification for Ribbon Switches does not presently exist.

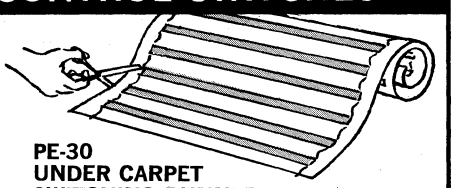
CALL OR WRITE FOR OUR COMPLETE CATALOG C4-E.

A FEW TAPESWITCH CONTROL SWITCHES



RIBBON SWITCHES

Factory sealed units with 18 inch connecting wire at one end. Styles shown in box have 8 oz. nominal finger sensitivity. 131-A — 40 oz.; 101-8 — 12 oz. sensitivity. Standard lengths: 1, 2, 5, 8, 10, 12, 15, 18, 20 ft.

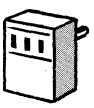


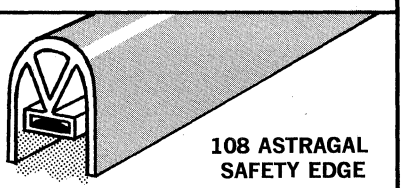
PE-30 UNDER CARPET SWITCHING RUNNER

30 inches wide x 3/32 inches thick and can be cut to any length from 25 ft. or 5 ft. roll. For indoor use under carpeting. Tapeswitches in parallel between Polyethylene sheets. Tinned wires for easy twisting or soldering connections.

TAPESWITCH RELAY R-1

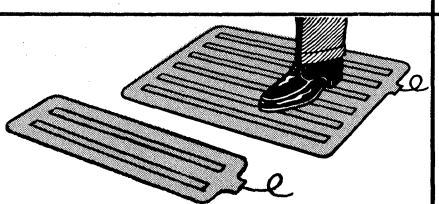
FOR NORMALLY CLOSED OR NORMALLY OPEN OPERATION OF ANY TAPESWITCH. Plug-in unit gives NC or NO control of 117 Volts AC, 5 Amperes. Built-in low voltage transformer.





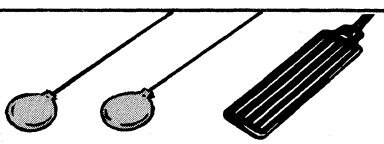
108 ASTRAGAL SAFETY EDGE

Unique patented design universal safety cushion switch for leading edge of doors, machinery, etc. Responds to side thrust and head-on thrust. Std. lengths: 6, 8, 10, 12, 15, 20, 25, 30 ft. OTHER STYLES ALSO AVAILABLE. Mounts on edges 1" to 2½" wide. Cushion depth 1⅞".



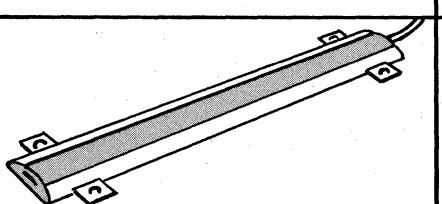
CVP SWITCHING MATS

CVP style mats are durable yet flexible, and only ⅛ inch thick (approx.). Available in sizes 20 x 32 inches, 17 x 23 inches and 6 x 23 inches. Very popular items.



NC-3 NO-1 FOOTSWITCH 111

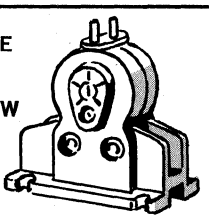
NC-3 is a unique normally closed wafer style switch 1⅛" diameter, by 3/16" thick. Designed to sound alarm when object is lifted off switch. NO-1 similar form but normally open. 20 oz. nominal sensitivity. Footswitch 111 normally open flat rugged, sealed switch, 2" x 5" x ¼" thick.



RBMA ROAD SWITCH

Successful, rugged roadway switch for counting, timing, controlling by vehicles. Replaceable sealed switch element. 2" wide, 7/16" thick. Std. lengths: 2, 3, 5, 8, 10 ft. Cast iron end protectors available.

SENSITIVE AIRWAVE SWITCH MODEL AW





Pneum. push button

High quality diaphragm switch with adjustable sensitivity. For operation by **tubing squeeze** / impact, air motion, vacuum. Remote push-buttons for explosive environments, etc. Silver contacts operate normally open or normally closed.



TAPESWITCH CORPORATION OF AMERICA

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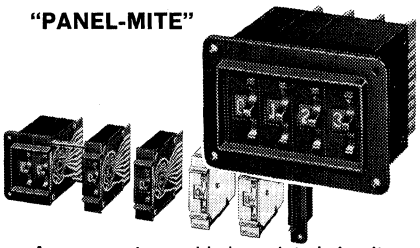
THUMBWHEEL SWITCHES

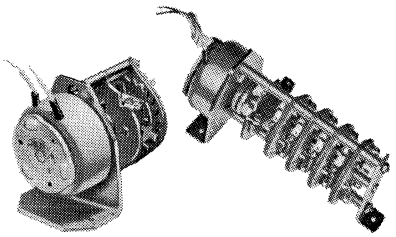
"PANEL-MITE"



A compact, molded, printed-circuit wafer switch for limited space and in line readout. **Modular type for either front or back of panel mounting:** modules ½" between center lines, height 2". Single or double pole, 10 position, binary or complementary codes, standard. Other codes available on request. Adjustable stops available.

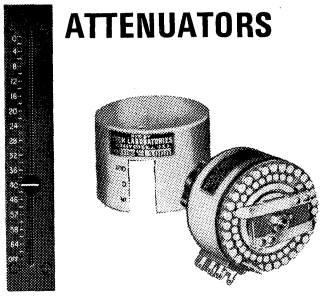
Delivery from stock!

STEPPING SWITCHES



TECH LABS switches are now standard equipment in missiles as well as in ground controls. Furnished sealed to meet all specs. Write for details. Prices on request.

ATTENUATORS



A complete line of audio and r.f. attenuators with both manual and REMOTE CONTROL. We will design components to meet your specific requirements, if standard units are inadequate. Please write for catalogue and send us your specs for estimate.

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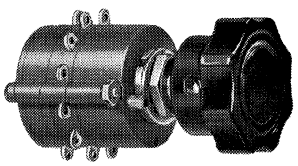
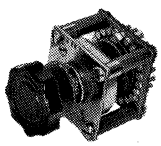
TAP SWITCHES



TYPE 3A MINIATURE TAP SWITCH

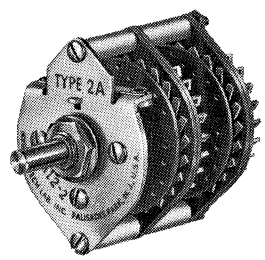
Molded from Diallyl Phthalate
Has adjustable stop

Specifications
Size: 1" diameter. 1¼" with terminals. 1 deck, 1-1/16" long. ½" for each additional deck.
Rating: 1200 volts rms, 2000 VDC, 5 amps. (carrying) 115 V.
Insulating resistance: 100 megohms minimum at 500 volts DC.
Life: 1.5—2 million revolutions.
Temperature range: —65°C to 100°C.
Mounting: single hole.



TYPE 10A TAP SWITCH

A multi-deck switch of small dimensions, 1-5/16" sq. This is a precision switch designed to meet high requirements in smallest possible space. Up to 24 positions, shorting. Adjustable stop available.



TYPE 2A & 2M

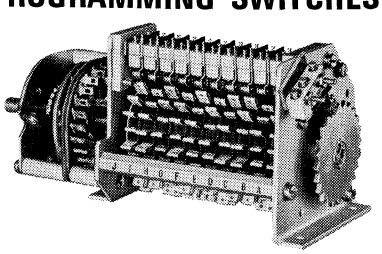
The Type 2A, a standard control switch for precision instruments and equipments, comes in 2-24 positions and 1-4 poles per deck, with phenolic insulation. The 2M is identical except for Melamine insulation. Both are rated for 3 AMP and have adjustable stops. Code "S" denotes "shorting" and "N" "non-shorting".

Type	Code	No. Pos.	No. Decks	Poles /Deck
2A	1S24	24	1	1
2A	4S5	4	1	5
2A	1N10-2	10	2	1
2M	1S24	24	1	1
2M	4N3	3	1	4

DELIVERY FROM STOCK.

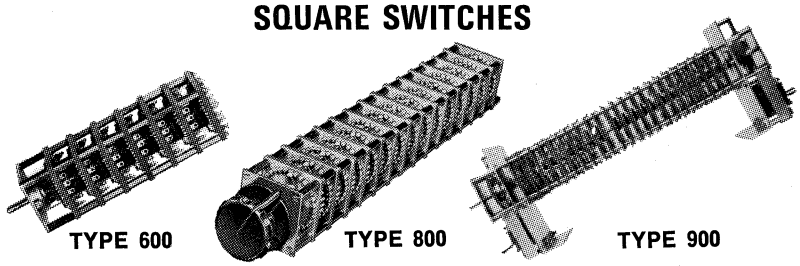
ASK ABOUT OUR POWER CONTROL SWITCHES

PROGRAMMING SWITCHES



Adjustable programming switches, 24 or more positions. Available in MBB and BBM; manual, motor or solenoid driven. Contact ratings from dry circuit to 20 amps.

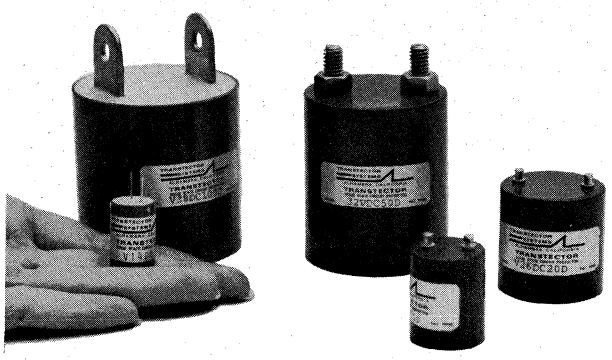
SQUARE SWITCHES



TYPE 600 **TYPE 800** **TYPE 900**

These standard rugged control switches are the standby for equipment calling for dependable switches in a hurry. Will meet all standard government specs. All parts carried in stock. An infinite number of combinations possible. Teletype your specs.

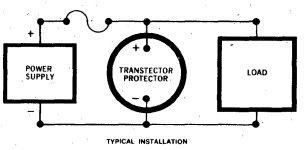
Type	Size	Rating	Max. Pos. Short.	Max. Pos. Non-Short.
600	1¾" sq.	5A.	24	12
800	2¼" sq.	5A.	32	16
900	2¾" sq.	10A.	48	24



TRANSTECTOR. PROTECTORS

protect IC's, equipment, systems . . . against accidental shorting, excessive voltages or currents!

Now you can have absolute protection in ≤50 nanosec. Standard unit operates like typical SCR crowbar circuit, but gives higher reliability, accuracy and surge capacity. Solid state. Fail/Safe. Inexpensive. Can meet Mil. Specs. Select from the most complete line of models, trip points and optional features.



VOLTAGE PROTECTORS (Pat. Pend.)

1 MODELS	2 STANDARD TRIP POINT VOLTAGES	3 TYPE	4 OPERATING CURRENT LEVELS	5 OPTIONAL FEATURES	6 CONTINUOUS POWER DISSIPATION	7 STANDBY POWER LOSS	8 OPER. TEMP.
V OVERVOLTAGE	AVAILABLE ALL MODELS ±5% tolerance, standard; ±1% available	AC or DC	0 - 5 amps **5** Series 5 - 10 amps **10** Series 10 - 20 amps **20** Series 20 - 50 amps **50** Series 50 - 100 amps **100** Series 100 - 150 amps **150** Series	**A** AUTO-SWITCH **R** MULTI-SENSE **E** VARI-ADJUST **L** LIGHT INDICATING	1 watt **5** Series 2.5 watts **10** Series 5 watts **20** Series 15 watts **50** Series 30 watts **100** Series 30 watts **150** Series	1 mw/volt across Protector terminals	−55° to +125° C
UV UNDERVOLTAGE Typical time delay: 30 millisec from power turn-on.	3 5 6.5 7 11 12 14 22 26 30 32 38 50 60 70	DC only					
UOV UNDER/OVERVOLTAGE Typical time delay: 30 millisec from power turn-on. Two trip points.	80 90 125 160 200 Non-standard and trip points over 200 V available on request.	DC only					
HV HIGHVOLTAGE Specific specifications on request.	**600-10,000 VDC** **300-800 VAC**	AC or DC	**1-10** amps **1-100** amps				

CASES *Sizes and Weights*

CASE 1 .88″ x .63″ dia. weight: 11 gms.	CASE 2 1.25″ x 1.0″ dia. weight: 40 gms.	CASE 3 1.5″ x 1.5″ dia. weight: 100 gms.	CASE 4 2.5″ x 2.17″ dia. weight: 400 gms.	CASE 5 2.5″ x 2.5″ dia. weight: 500 gms.

MODELS	SERIES						
FROM 0-200V	**5**	**10**	**20**	**50**	**100**	**150**	
OVERVOLTAGE	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 5	DC UNITS
UNDERVOLTAGE	CASE 3	CASE 3	CASE 4	CASE 4	CASE 5	CASE 5	DC UNITS
UNDER/OVERVOLTAGE	CASE 3	CASE 3	CASE 4	CASE 4	CASE 5	CASE 5	DC UNITS
MULTI-SENSE	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 5	DC UNITS
VARI-ADJUST	CASE 3	CASE 3	CASE 3	CASE 4	CASE 5	CASE 5	DC UNITS
AUTO-SWITCH	CASE 3	*	*	*	*	*	DC UNITS
AC UNITS	CASE 3	CASE 4	CASE 5	*	*	*	
HIGHVOLTAGE	Available on request						

* For case dimensions not specified and for custom units, contact factory.

HOW TO SELECT

1 SELECT MODEL REQUIRED — MODEL ☐

2 SELECT TRIP POINT VOLTAGE — VOLTAGE ☐

TRIP POINT should be at maximum "safe" voltage level your circuit can handle without damage, and should be as close to your regulated voltage as possible, yet high enough to prevent nuisance tripping. Be certain to allow for regulation tolerance of power supply and nominal trip tolerance of Protector.

AC trip points are selected by choosing a point between *peak* voltage (not RMS) and circuit failure level.

3 SPECIFY AC OR DC — TYPE ☐

4 SELECT OPERATING CURRENT LEVEL — SERIES ☐

Choose SERIES within which circuit's nominal current range falls.

5 SELECT OPTIONAL FEATURES — OPTIONS ☐

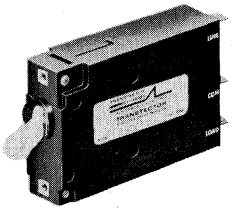
6 IF USING CURRENT LIMITING POWER SUPPLY

Verify the maximum CONTINUOUS POWER DISSIPATION of the Series selected. If power to be dissipated exceeds specified wattage, select next higher Series. Assume maximum voltage drop across protector to be 1.25VDC at rated temperature.

PART NUMBER ☐ ☐ ☐ ☐ ☐
1 2 3 4 5

COMBINATION CIRCUIT PROTECTORS

Protect against transient voltages, currents and shorts with one unit. Overvoltage, undervoltage, under/overvoltage, multi-sense, vari-adjust options. Operating temperature −55° to +85° C. Complete unit dimensions: 3.25″ L x .75″ W x 2.0″ H. Custom trip points available.



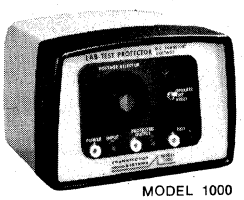
CURRENT TRIP POINTS
Instantaneous trip breaker is standard. Time delay available.

VDC MODELS (50 VDC Max.)	VAC MODELS (250 VAC Max.)
AMPS 1, 2, 3, 5, 7, 10, 15, 20	AMPS (60 cps operation) 0.5, 1, 2, 3, 5, 7, 10, 15, 20 (400 cps operation) 2, 5, 10, 15, 20

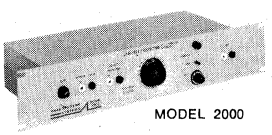
VOLTAGE TRIP POINTS

VDC MODELS	VAC MODELS
VOLTS 3, 5, 7, 11, 12, 14, 22, 26, 30, 32, 38, 50	VOLTS Up to 400 VAC on request

LAB-TEST PROTECTORS



MODEL 1000



MODEL 2000

Protect against accidental shorting, application of excessive voltages, or production wiring errors when testing. Gives transient voltage and reverse polarity protection. Protects in ≤50 nanosec. 23 easily selected voltage protection levels.

	MODEL 1000	MODEL 2000
PROTECTION VOLTAGE RANGE (23 steps)	5-50 VDC 5-12, 1 volt steps 12-40, 2 volt steps 45 and 50 volts	
OPERATING CURRENT LEVEL	10 amps	
MALFUNCTION INDICATION	Panel Lights	Flashing Light
MOUNTING	Bench	Std. 19″ Panel 3-1/2″ high
LIST PRICE	$165.00	$135.00

You name the protection problem
. . . we'll provide the answer!

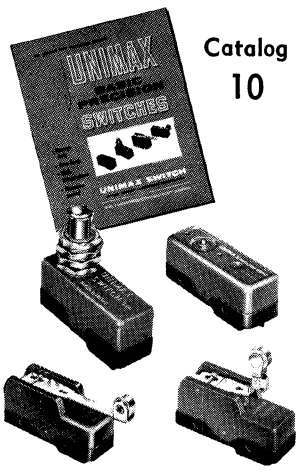
TRANSTECTOR. SYSTEMS — ABSOLUTE TRANSIENT PROTECTION
a division of M & T Chemicals Inc., subsidiary of American Can Company

3025 W. Mission Road
Alhambra, Calif. 91803
(213) 283-9278

UNIMAX SWITCH

The **complete** line of snap-acting switches for military and commercial applications. For detailed information about electrical ratings, dimensions, mountings, actuators, and operating characteristics, refer to these catalogs.

BASIC PRECISION



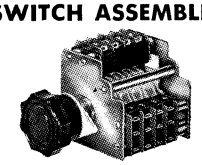
Catalog 10

covers basic-precision, heavy-duty, high-current, high-sensitivity, high-temperature, moisture-sealed, and direct-current switches. Gives operating characteristics of switches with plunger, lever, and roller actuators. Shows terminal and switch enclosures and attachable actuators. Includes electrical and mechanical life data.

Electrical ratings

up to 25 amperes
2 horsepower
250 volts
UL and CSA listing

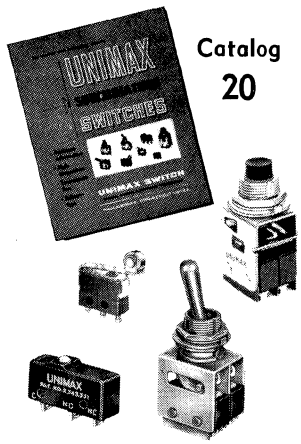
SWITCH ASSEMBLIES



8-pole sequence-selector switch

Our switch application department will work with you in designing special mountings and actuators for single switches or combinations of switches to meet your design and performance requirements.

SUBMINIATURE



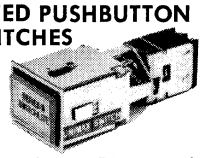
Catalog 20

covers subminiature and miniature-subminiature switches and switch assemblies in basic, moisture-sealed, high-temperature, and environment-free types. Gives operating characteristics of switches with integral or auxiliary actuators. Shows designs to dimensional and test requirements of MIL-S-6743 and MIL-S-8805.

Electrical ratings

up to 7 amperes
250 volts a-c or
28 volts d-c

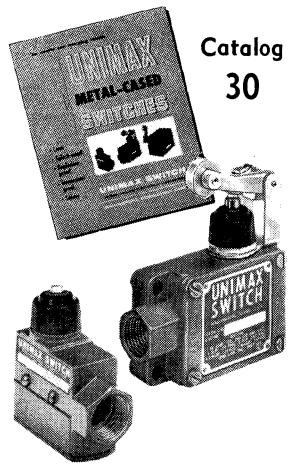
LIGHTED PUSHBUTTON SWITCHES



Unimax Series 9 LPB controls are designed to meet the requirements of MIL-S-22885. Choose from a wide range of display styles and color coding, 2, 3 or 4 pole, momentary or alternate switching. Features include front-panel mounting with a single screw, internally bussed lamp circuits and simple pull-push relamping. Exclusive spring-loaded lamp sockets eliminate usual terminal-to-lamp continuity problems.

Ask for Catalog 50-1.

METAL-CASED



Catalog 30

covers switches in cast metal housings that protect the basic switch against mechanical damage as well as against environments common in industry. Shows housings and actuators particularly suited to industrial safety and automation services. Constructions include splash-proof, explosion-proof, and immersion-proof enclosures.

Electrical ratings

up to 20 amperes
480 volts a-c and
2 hp, 250 v. a-c.
UL and CSA listings

MINIATURE SUB-MINIATURE SWITCHES

with integral actuators



Exceptionally compact SPDT switches meet MS2457-1 per MIL-S-6743. Turret terminals molded into housing of high strength phenolic. Integral actuators permit wide choice of operating means and simplify installation. Can be stacked five to the inch. 28 v.d-c.

Ask for Catalog 20.

GENERAL-PURPOSE



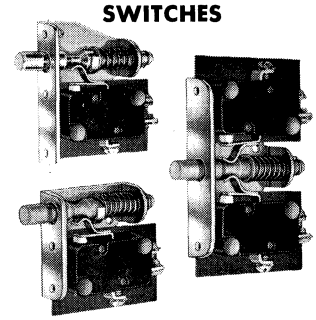
Catalog 40

covers miniature, general-purpose, open-blade, and moisture-sealed switches widely used for automatic control in household appliances, office machines, vending machines, and other electrical apparatus. Includes double-pole and high-current designs with lever, roller, plunger, and pushbutton actuators.

Electrical ratings

up to 25 amperes
1½ horsepower
250 volts a-c
UL and CSA listings

AUTOMATIC-RESET SWITCHES



Break circuit when door opens; allow manual closing for live-circuit tests; automatically restore safety inter-lock on reclosing. SPDT or DPDT action at 15 amperes 250 volts a-c.

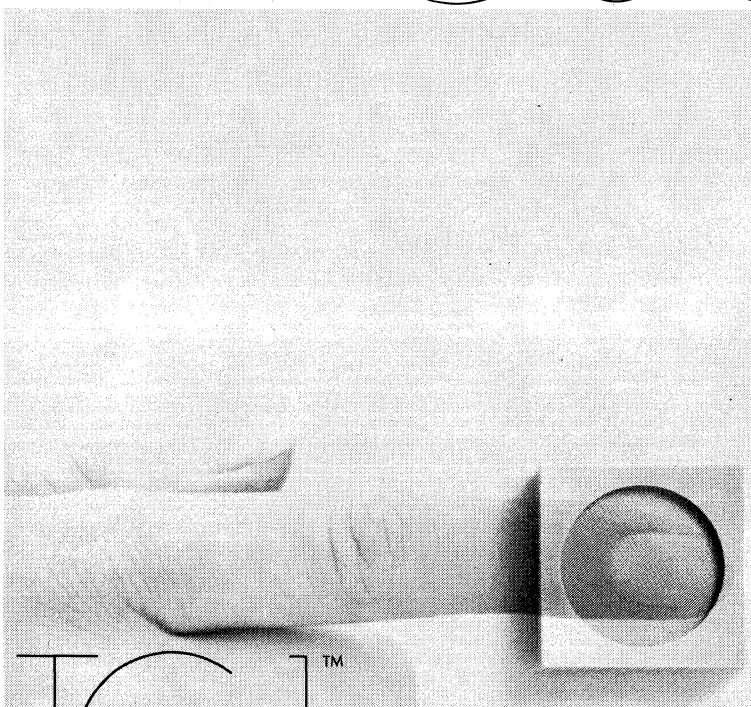
Ask for Bulletin No 412

Unimax Switch

DIVISION MAXSON ELECTRONICS CORPORATION / WALLINGFORD, CONNECTICUT 06492

Tel: 203-269-8701 TWX: 710-476-1397

INTRODUCING TOUCH



TC-1™

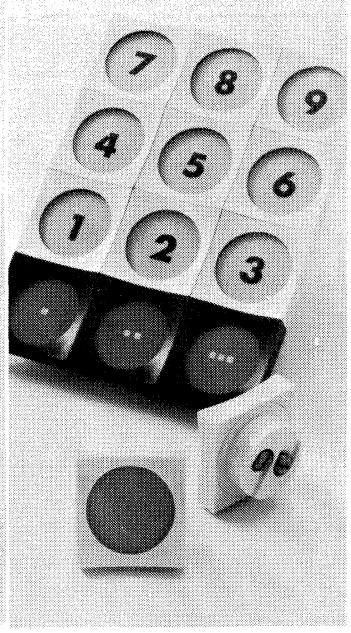
THE TOUCH CONTROL YOU CAN AFFORD TO USE... ANYWHERE

A true retrofit for virtually any momentary switch... Nothing seems to move, yet switch function is fulfilled. The new TC-1 works when you touch it! Breaks the barriers for cost, size and durability of touch operation... breaks the ceiling on efficiency enforced by the limits of any visible-action switch.

Utilizing departures in operating concept, the TC-1 touch control offers all the characteristics of good contact practice with outstanding features:

- ☐ Currently available 120 VAC, 28 VDC, 200 Watts... TC-1 offers a potential for a wide range of voltages and current ratings.
- ☐ Long, trouble-free operation.
- ☐ Rugged, sealed-unit construction with a case of unbreakable Lexan®—weather and moisture resistant.
- ☐ Compact size and simple mounting.
- ☐ Excellent appearance with varied colors and legendizing.

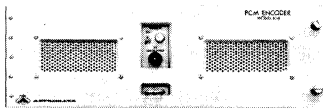
The TC-1 can be used alone, in tandem, or as a keyboard. Possibilities are unlimited. It's a new technological concept in switching that calls for a new way of looking at things. And it's from a new source... Wild Rover Corporation... people determined to find better ways to do things. For more information and catalog, call 201 768-8436 (collect!) or write: WILD ROVER CORPORATION, Herbert Avenue, Closter, N.J. 07624.

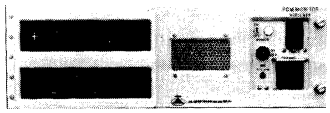


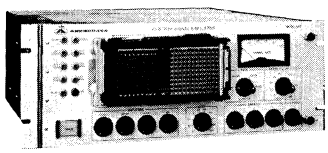
ASTRODATA

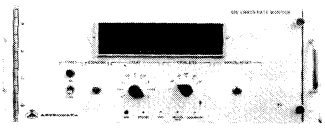
A Complete Line of PAM/PDM and PCM Telemetry Products

PCM Telemetry









Model 630 Airborne PCM Encoder

- Digital or analog input to any channel
- Bit rate up to 100k Hz
- NRZ-M and NRZ-L outputs
- Up to 45 words per frame
- Up to 13 bits (plus parity) per word
- Automatic offset and scale factor calibration

Model 635 PCM Monitor

- Accepts up to 13 encoder inputs
- Displays in both binary and scaled and offset decimal units
- Records and reproduces post-detected telemetry signals
- Separates multiplexed FM video signals
- Decommutates PCM, PDM and PAM signals
- Presents selected demultiplexed and decommutated data on display devices

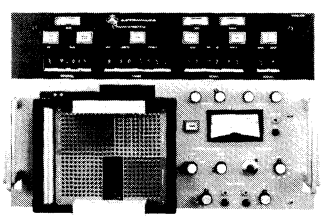
Model 600 PCM Signal Simulator

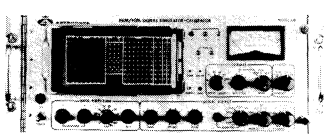
- Five independently programmed words
- Any frame length — 2 to 512 words
- Any word length — 2 to 32 bits
- ID mode subframe synchronization

Model 620 Bit Error Rate Monitor

- Five-digit decimal Nixie display — direct reading in bit error rate
- Selectable test length from 10^3 to 10^7 bits
- Compares source data bit-for-bit to test data
- 0 to 4 bits range delay in increments of ½ bit to compensate for delay in unit under test

PAM / PDM Telemetry





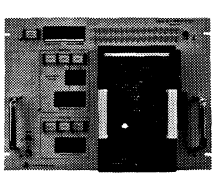
Model 604 PAM / PDM Decommutator / Subdecommutator

- Versatility and Performance Offered in the Model 603, plus Subdecommutator Features
- Digital outputs in binary and/or BCD formats
- Auto-set and auto-slice / gain capability for completely automatic set-up

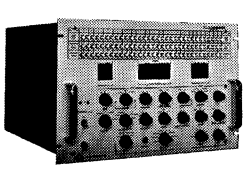
Model 611 PAM / PDM Signal Simulator / Calibrator

- 130 Channels
- Independently Programmed Data Level for Each Channel Allows Simulation of Virtually Any Format
- Remotely Controllable

PCM

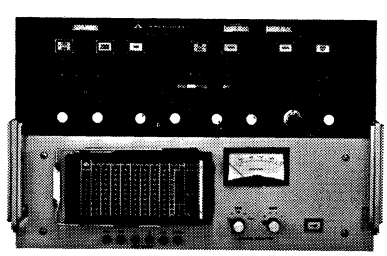


Model 612
PCM DECOMMUTATOR
- Up to 512 words per main frame
- Up to 512 words per subframe
- Up to 32 bits per word
- ID mode subframe synchronization
- Up to 8 syllables per word

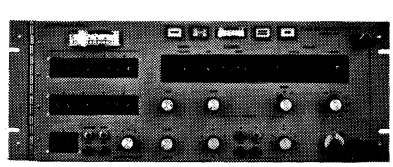


Model 613
PCM SIGNAL SIMULATOR
- Three independently programmed words
- Incrementing ID subframe sync word
- Built-in noise generator
- Any frame length — 1 to 799 words
- Any word length — 1 to 32 bits

PAM/PDM



Model 603
PAM/PDM DECOMMUTATOR
- Wide capture range ±30% from preset center rate
- Rates from 1 channel/sec to 10,000 channels/sec—continuously selectable without changing plug-ins
- Frame lengths up to 130 channels
- Pattern recognition technique employed with selectable automatic IRIG frame or programmable frame synchronization



Model 607
PAM DECOMMUTATOR
- Up to 90 channels per main frame
- Up to 10,000 channels per second
- Pattern recognition for frame synchronization
- Accepts PAM (RZ), PAM (NRZ) or PDM time multiplex input formats

ASTRODATA INC. P. O. BOX 3003 • 240 E. PALAIS ROAD, ANAHEIM, CALIF. • (714) 772-1000

HELIX RESEARCH ASSOCIATES, INC.
8384 HERCULES STREET, LA MESA
CALIFORNIA 92041 (714) 465-3557

SIGNAL CONDITIONING EQUIPMENT

Short Form Catalog

INDUSTRIAL

If you have a tough, tricky or unusual problem, the Engineering and Management Team at HRA is the key to its solution. We have the facilities, the talent and the desire to provide you with perfection through miniaturization — small, lightweight, and rugged reliability describes HRA components.

HRA's manufacturing facilities utilize the most advanced techniques known to solve its customers unique problems. With rigidly enforced Quality Assurance and Quality Control procedures HRA's customers are assured high production of the best possible quality on schedule.

MILITARY

The components on these pages represent a few HRA solutions to unique customer problems, but HRA's capabilities are by no means limited to the manufacture of stock items . . . our facilities are available to you for the development of equipment of highest reliability for the most specialized applications. Check us out, find out how we can provide prototypes when **you** need them, schedule production units to meet **your** schedule, to **your** exact specifications, at the greatest possible savings in cost.

SERIES 1300 STANDARD OSCILLATORS

Type	Frequency Range	Temperature Range	Temperature Coefficint	Input VDC	Output Waveform	Size Volumle
RC	100 Hz to 1 MHz	−40°C to +85°C	50 ppm/°C	+4 to +40 or ±Voltages	Sine or Square	½ cu. in.
LC	1KHz to 100 MHz	−40°C to +85°C	50 ppm/°C	+4 to +40	Sine or Square	½ cu. in.

SERIES 1400 CRYSTAL OSCILLATORS

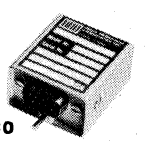
Type	Frequency Range	Temperature Range	Temperature Coefficient	Input VDC	Output Waveform	Size Volume
Xtal	100 Hz to 10 KHz	−40°C to + 70°C	10 ppm/°C	+4 to +40	Sine or Square	1.5 cu. in
Xtal	10 KHz to 1 MHz	−40°C to + 85°C	10 ppm/°C	+4 to +40	Sine or Square	1.0 cu in.
Xtal	100 KHz to 10 MHz	−40°C to +105°C	5 ppm/°C	+4 to +40	Sine or Square	½ cu. in.
Xtal	10 MHz to 125 MHz	−55°C to +105°C	5 ppm/°C	+4 to +40	Sine	½ cu. in.

SERIES 1500 VOLTAGE CONTROLLED OSCILLATORS

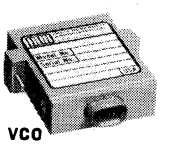
Type	Deviation	Frequency Range	Temperature Range	Temperature Coefficient	Input VDC	Input Sensitivity	Output Waveform	Size Volume
RC	Up to ±40%	100 Hz to 3 MHz	−40°C to +85°C	50 ppm/°C	+4 to +40 or ±Voltages	50 mv and up	Square	1 cu. in.
RC	up to ±20%	100 Hz to 3 MHz	−40°C to +85°C	50 ppm/°C	+4 to +40 or ±Voltages	10 mv and up	Sine or Square	½ to 1.5 cu. in.



INDUSTRIAL VCO



MINIATURE VCO



MICROMINIATURE VCO

SERIES 1600 AMPLIFIERS

Type	Input Sensitivity	Frequency Response	Voltage Gain	Temperature Range	Input VDC	Stability	Common Mode	Size Volume
Mixer Amplifier	Above 250 mv	within ±0.5 DB from 100 Hz to 200 KHz	Adjustable from 1 to 20	−20°C to +85°C	+28 VDC ±10%	±0.5%	N/A	½ to 2 cu. in.
Differential DC Amplifier	Down to 50 mv	DC to 5 KHz	Up to 100	−20°C to +85°C	+28 VDC	±0.5%	±7v	½ cu. in.
Differential DC Amplifier	Down to 100 mv	DC to 5 KHz	50	−20°C to +85°C	+28 VDC	±0.5%	±50v	½ cu. in.

SERIES 1700 POWER SUPPLIES

Type	Input Voltage	Output Voltage	Temperature Range	Ripple	Stability	Load	Size Volume
DC - DC Regulated Supply	+28 VDC 20%	Fixed or Adjustable 5 volts up to 40 volts	−40°C to +85°C	0.5% Peak to Peak	Up to ±0.5%	Milliamperes up to 5 amps	1 cu. in. Depending on Load
DC - DC Regulated Supply	+5 VDC ±20%	Fixed or Adjustable 5 volts up to 40 volts	−40°C to +85°C	0.5% Peak to Peak	Up to ±0.5%	Milliamperes up to 5 amps	1 cu. in. Depending on Load

SPECIAL VOLTAGE CONTROLLED OSCILLATORS

Type	Deviation	Frequency Range	Temperature Range	Temperature Coefficient	Input Sensitivity	Output Wave Form	Input Voltage	Size
FM Record Amplifiers, up to 7 speed	Up to ±40%	Up to 1 MHz	Ambient up to full MIL Spec.	Down to 50 ppm	20 mv and up	Square or Sine	+4 to +40 or ± Voltages	Case or card down to 1″ x 2″ x 0.3″

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COMMUNICATIONS DIVISION

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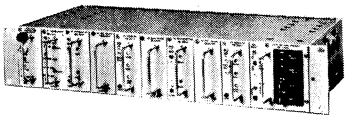
AM and FS Voice

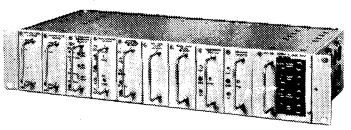


The 2056 Series represents the ultimate in tone channel design in as much as a single packaging concept is employed to accommodate all tone channel requirements for any application.

AM channels may be intermixed with FS channels and various combinations of both types of receivers and transmitters are accommodated.

Basic modules are provided which are common to all applications. Special requirements which are peculiar to particular systems and applications are provided by accessory modules mounted on plug-in cards similar to the basic modules and connected at the rear of the mounting shelf. This packaging concept provides for maximum economy and versatility since basic modules are common to all applications encountered in telemetering, control and telegraph applications.

SSB Voice



The Model 2710 SSB Terminal was designed to provide a high quality voice channel for voice communication or data transmission for application to microwave, static, power line and radio system basebands. Two basic groups, one of 14 channels, and occupying the frequency spectrum 4-60 kHz, the other of 12 channels, and occupying the frequency spectrum from 60-108 kHz are available. The channels may be applied singly or in groups without common equipment. Since the 2710 is particularly suitable to low density requirements no attempt has been made to overcrowd components which would reduce system flexibility and complicate system and maintenance procedures. All basic circuitry including channel filters are provided with front panel test points and controls for convenience in system monitoring and servicing. By dual translation, channels up to 300 kHz are available.

High Speed Data



RFL Data Sets are compatible with and will transmit into Bell Sets (103A-103B-103F-202B-202D). Recent FCC changes allow customer owned data sets to directly connect to standard telephones at great cost savings.

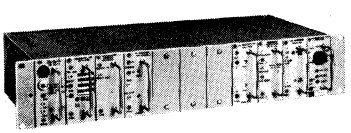
The Model 2056 operates at any speed up to 2400 bits per second on a non-synchronous basis on standard bands, and much higher, with wider bands.

The new coherent modem, Model 3227, is capable of transmitting high speed binary coded data and clock information simultaneously. There is no need for expensive synchronized clocks in end-equipment. The need for accurate timing is also eliminated, permitting operation through adverse conditions.

The Model 4000 data channel provides its own synchronized output at both the receiver and transmitter. It is capable of high-speed rates for both clock and data information and operates at discrete bit rates of 600, 1200, 1800 and 2400.

The newly designed Model 25400 Adjustable Delay Equalizer is totally compatible with all RFL data sets as well as all other data transmission facilities. This variable system provides precise equalization of communication paths with respect to either phase or amplitude, or both, which is essential to high-speed data transmission. Resultant flat response and amplitude attenuation insures distortion-free transmissions over minimum grade voice lines.

Analog Telemeter

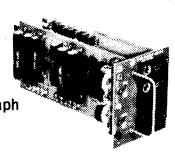


The Model 2203 Variable Frequency Telemeter system provides complete circuitry for telemetering DC or low frequency AC voltages by means of an audio frequency shift carrier which is modulated at a sub-audio frequency rate of 10 to 30 Hz or by polar current pulsed at 10 to 30 Hz. Full-scale span of the measured DC quantity is represented by the 10 to 30-cycle modulation frequency which is directly proportional to the EMF applied to the transmitter. At the receiver, the telemeter signals are demodulated, and the output DC potential or current is directly proportional to the modulated signal. This output may be used to operate potentiometer recorders and DC milliammeters. Modified modules are also available for modulation frequencies of 7.5 to 15 Hz for use over narrow band transmission facilities. Other frequencies are also available.

Any DC input voltage range of 20-millivolt to 1000-millivolt span is available as standard. Modules are also available for slide-wire and higher voltage inputs. Output current from the receiver has a 2-milliampere span into 2500 ohms maximum for 10 to 30-Hz modulation frequency variation. Output current up to 50 ma also available.

All terminals are fully transistorized and miniaturized using modular type construction for minimum space requirements and ease of maintenance, allowing a maximum of channels to be installed without sacrificing versatility, performance and system adaptability. All units are standard 19" rack mounted with other mounting options available.

DC Loop Option Module

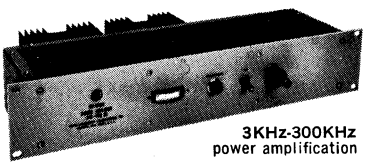


Provides all common telegraph options

Accessories

A wide range of accessory units are available for all systems. Some include a 2, 10 or 50 watt power amplifier. Compandors for improved signal to noise ratio. System regulators for wide line attenuation changes. Matrix systems for economical transmission of numerous control functions. Special mounting shelves and weatherproof enclosures.

10-Watt Amplifier



3KHz-300KHz power amplification

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See page 1473 **Thermocontrol Division** Temperature Measurement Control

See page 1472 **Instrumentation Division** Metrology, Magnetics

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MODULES & VISUAL READOUTS

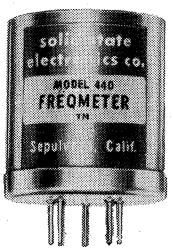

FIG. 1

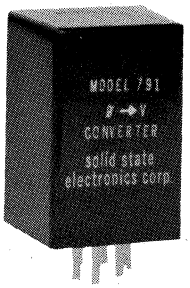

FIG. 2

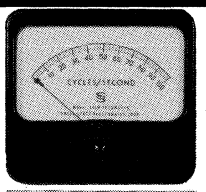
FIG. 3

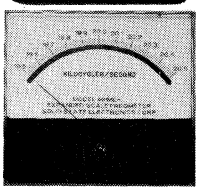
FIG. 4

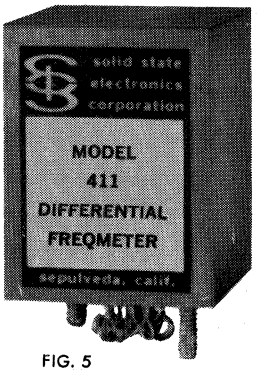

FIG. 5

microminiature lightweight | **low power low level** | **high speed high efficiency** | **rugged linear** | **indefinitely long life temperature stable**

FREQMETERS, DISCRIMINATORS, PHASEMETERS

Solid state frequency-to-dc converters and discriminators will linearly convert frequency or repetition rate of signals to a proportional dc output. Waveforms can be sine, square, pulse, sawtooth or triangular. Standard models are available to cover a wide range from zero to 300 kcps. Expanded scale, differential frequency, under/over frequency and phase detectors are available (meter, meter relay and relay types are also available). These units have been designed for applications where stability, ruggedness, long life, efficiency and freedom from maintenance are prime requisites. Miniature, stable and rugged designs make these units ideal for military, aerospace, industrial and portable applications.

Only the Models 400 to 440 Freqmeters are basic f-dc converters, the output being proportional to the product of frequency and peak input voltage. The 410KF to 440KF are solely frequency dependent (independent of peak input voltage). 450KF to 480KF units require lower drive (millivolts). 410M to 440M units have a visual panel meter readout. The 410MR to 440MR have a visual panel meter relay readout with external min-max adjustments. The 486E is an expanded scale Freqmeter while the 491ME is a mirrored-scale visual panel meter version. The 411 and 421 units are difference Freqmeters. The 401 series FM discriminators are for IRIG channel telemetering. The 471 is a Hi-Lo pass frequency sensitive relay suitable for under/over frequency and speed detection and control. The 476 frequency detector is a narrow bandpass frequency sensitive relay. The 791 Phasemeter is a phase-to-voltage converter.

You'll find microfilm data sheets and application notes in VSMF or the Thomas Supplementary File.

If you have a special requirement, phone, wire or write for an immediate reply or catalog. Shipments can be same day, if you call early.

COMPARATIVE TABLE OF SPECIFICATIONS FOR FREQMETERS, DISCRIMINATORS & PHASEMETERS

		INPUT			OUTPUT						SUPPLY		ENVIRONMENTAL				MECHANICAL		
Model	Type	Freq. kcps	Volts pk-pk	Z kΩ	Volts DC	Ripple %	Drift %/°C	Z kΩ	Resp. msec	Linear %	V Volt	I ma	Temp. °C	Shock G	Vib. G	Acc. G	Size inches	Wt. grams	Fig.
410	Basic Freqmeter	0-0.1	5-18	2	0-5	2	.01	10	500	0.5	−28	1	−55 to +85	5K	100	5K	2 x .88 Dia.	60	1
420	Basic Freqmeter	0-1	5-18	2	0-5	2	.01	10	50	0.5	−28	1	−55 to +85	5K	100	5K	1.3x.88 Dia.	38	1
430	Basic Freqmeter	0-10	5-18	2	0-5	2	.01	10	5	0.5	−28	1	−55 to +85	5K	100	5K	1.3x.88 Dia.	38	1
440	Basic Freqmeter	0-100	5-18	2	0-5	2	.01	10	0.5	0.5	−28	1	−55 to +85	5K	100	5K	1 x .88 Dia.	30	1
410KF	Normal Freqmeter	0-0.1	2-18	40	0-5	2	.01	10	500	1.0	+28	25	−55 to +80	1K	100	1K	.9 x .9 x 1.3	100	2
420KF	Normal Freqmeter	0-1	2-18	40	0-5	2	.01	10	50	1.0	+28	25	−55 to +80	1K	100	1K	.9 x .9 x 1.3	100	2
430KF	Normal Freqmeter	0-10	2-18	40	0-5	2	.01	10	5	1.0	+28	25	−55 to +80	1K	100	1K	.9 x .9 x 1.3	100	2
440KF	Normal Freqmeter	0-100	2-18	40	0-5	2	.01	10	0.5	1.0	+28	25	−55 to +80	1K	100	1K	.9 x .9 x 1.3	100	2
450KF	Hi Sens Freqmeter	0-0.1	.02-2	1 & 40	0-5	1	.01	10	500	1.0	+28	25	0 to +70	1K	100	1K	.9 x .9 x 1.3	100	2
460KF	Hi Sens Freqmeter	0-1	.02-2	1 & 40	0-5	1	.01	10	50	1.0	+28	25	0 to +70	1K	100	1K	.9 x .9 x 1.3	100	2
470KF	Hi Sens Freqmeter	0-10	.02-2	1 & 40	0-5	1	.01	10	5	1.0	+28	25	0 to +70	1K	100	1K	.9 x .9 x 1.3	100	2
480KF	Hi Sens Freqmeter	0-100	.02-2	1 & 40	0-5	1	.01	10	0.5	1.0	+28	25	0 to +70	1K	100	1K	.9 x .9 x 1.3	100	2
410M	Visual Freqmeter	0-0.1	2-18	40	0-5	2	.05	10	500	1.0	+28	25	+10 to +40	—	—	—	4.2x4.7x3.8	450	3
420M	Visual Freqmeter	0-1	2-18	40	0-5	2	.05	10	50	1.0	+28	25	+10 to +40	—	—	—	4.2x4.7x3.8	450	3
430M	Visual Freqmeter	0-10	2-18	40	0-5	2	.05	10	5	1.0	+28	25	+10 to +40	—	—	—	4.2x4.7x3.8	450	3
440M	Visual Freqmeter	0-100	2-18	40	0-5	2	.05	10	0.5	1.0	+28	25	+10 to +40	—	—	—	4.2x4.7x3.8	450	3
410MR	Visual Freqmeter-Relay	0-0.1	2-18	40	0-5	2	.05	10	500	1.0	+28	25	+10 to +40	—	—	—	4.2 x 4.7 x 4	450	3
420MR	Visual Freqmeter-Relay	0-1	2-18	40	0-5	2	.05	10	50	1.0	+28	25	+10 to +40	—	—	—	4.2 x 4.7 x 4	450	3
430MR	Visual Freqmeter-Relay	0-10	2-18	40	0-5	2	.05	10	5	1.0	+28	25	+10 to +40	—	—	—	4.2 x 4.7 x 4	450	3
440MR	Visual Freqmeter-Relay	0-100	2-18	40	0-5	2	.05	10	0.5	1.0	+28	25	+10 to +40	—	—	—	4.2 x 4.7 x 4	450	3
486E	Expanded Freqmeter	.01-300	5-10	40	±5	1	.01	0.1	—	1.0	±15	±25	0 to +70	100	30	200	2.8x2.4x3.8	500	5
491ME	Visual Distriminator	.01-300	5-10	40	±5	0	.05	—	—	1.0	+28	40	+10 to +40	—	—	—	4 x 4.6 x 4	450	4
411	Differential Freqmeter	.05-50	5-10	0.6	0-5	1	.01	—	500	1.0	+28	25	−55 to +80	50	25	100	1.3x1.3x1.8	115	5
421	Differential Freqmeter	.05-50	5-10	0.6	0-5	1	.01	—	50	1.0	+28	25	−55 to +80	50	25	100	1.3x1.3x1.8	115	5
401	IRIG Discriminator	0.4-80	8-28	50	±5	1	.05	0.1	—	0.5	±15	±75	−55 to +85	50	25	100	2.8x2.4x3.8	500	5
471	Freq. Sens. Relay	.05-100	15-30	2	—	—	.05	0/∞	—	—	+28	20	−30 to +80	50	50	75	1.3x1.3x1.8	115	5
476	Freq. Sens. Relay	.05-250	15-30	10	—	—	.05	0/∞	—	—	+28	20	−30 to +80	50	50	75	1.3x1.3x1.8	115	5
791	Phasemeter	0.3-20	0-10	0.5	±5	1	0.3	3	7	1.0	No	No	−55 to +85	1K	100	1K	.9 x .9 x 1.3	100	2

Phone, wire or write for specifications and application literature describing above units or consult your microfilm files (VSMF or Thomas Supplementary)

OTHER PRODUCTS—SEE EEM SECTIONS 4500 & 5900

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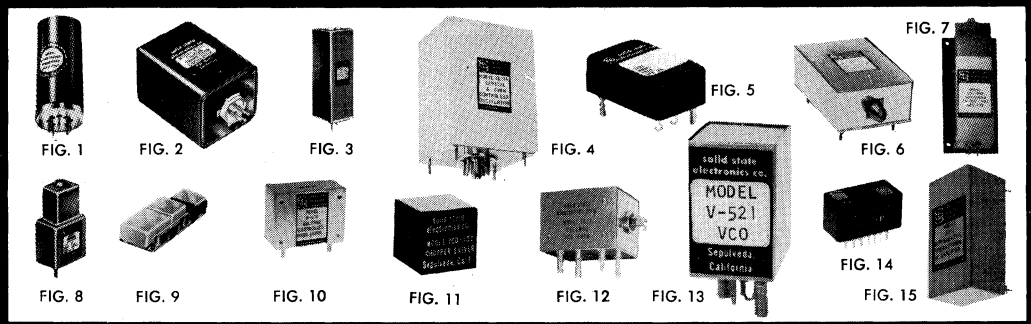


microminiature lightweight | low power low level | high speed high efficiency | rugged linear | indefinitely long life temperature stable

OSCILLATORS, CONVERTERS & OPERATIONAL AMPLIFIERS

DESCRIPTION

Solid state oscillators and converters are available in many types (MIL-SPEC too). S-100, S-200 are LC sine oscillators (rugged and stable). The S-300 is tuneable, not as rugged, but excellent for ground support equipment. C-110, CH-114 (400 cps reference) are heater-crystal controlled, fully encapsulated for ruggedness. PG-111, PG-112 and PG-113 are crystal controlled, (no heater) square wave generators, ruggedized and miniature for airborne, military and space applications. The TF-120 is a tuning fork reference sine oscillator. Series 300VF Voltage-To-Frequency converters change analog signals to the frequency (time) or digital domain (use electronic counter) and are perfectly matched to our Series 400KF Freqmeters. The V-510, V-513 (20 millivolt input) Voltage Controlled Oscillators (VCO) are designed for IRIG FM telemetering. The V-521 is a micro-version of the V-510 (without output bandpass filter). AD-551, AD-552 (20 millivolts input) are Voltage-To-Frequency Converters with sine wave output. PF-1001, PF-1007 are Pressure-To-Frequency Converters (potentiometer type) respectively matched to a V-510 VCO and a 300 VF V-to-F converter. The OS-1005 converts Pressure-to-Frequency directly via varying inductance (diaphragm type). The 5001 FM Transmitter and the 5002 VCO go together for a single channel miniature telemeter. The 5021 TELEMOD combines the two in a single micro-package. The TCD-101 is a solid state chopper or demodulator driver (square wave inverter) with 4 isolated output windings. The Model 3001 differential operational amplifier is a workhorse and you can assign it to a multitude of analog functions. The Model 3051 is an isolated single-supply (28 VDC) version of the 3001 (dual-supply). The Model 3002 op-amp is superlative in its capabilities, i.e. microvolt input, 0.6 microvolts/°C. and 2 picoamps/°C. drift, 300 megohm input impedance, short-circuit proof, no compensation required, no latch-up, zero offset adjustable, wide temperature range, microminiature, replaces chopper-stabilized amplifiers. You'll find microfilm data sheets and application notes in VSMF or the Thomas Supplementary File. Phone, wire or write our engineering department for a quick considered quote on your specifications or for our catalog. Shipments can be same day if you call early.

COMPARATIVE TABLE OF SPECIFICATIONS FOR OSCILLATORS, CONVERTERS & OPERATIONAL AMPLIFIERS

		INPUT		OUTPUT						SUPPLY		ENVIRONMENTAL				MECHANICAL		
Model	Type	Volts-*Pressure	Z MΩ	Freq. kcps	Wave Form	Volts Min.	Load kΩ	Drift %/°C	Accuracy %	V Volt	I ma	Temp. °C	Shock G	Vib. G	Acc. G	Size inches	Wt. grams	Fig.
S-100	LC Fix Tuned Oscillator	—	—	.025-50	sine	2Vrms	35	0.05	0.50	28	1	0 to +80	500	35	700	2.32x0.94 Dia.	30	1
S-200	LC Fix Tuned Oscillator	—	—	.025-50	sine	2Vrms	35	0.05	0.50	28	1	0 to +80	500	35	700	1.32x1.32x1.69	60	2
S-300	LC Tuneable Oscillator	—	—	.025-100	sine	2Vrms	35	0.10	1	28	2	0to+ 80	15	10	200	0.97x1.60x3.40	65	8
C-110	Xtal-Heater Oscillator	—	—	15-125	sine	2Vrms	10	0.0005	.002	3-28	100	−55 to +85	50	15	200	1.37x1.37x3.90	200	3
CH-114	Xtal-Heater Oscillator	—	—	.001-20000	sine	2Vrms	5	0.0001	.001	10-35	100	−55 to +85	15	10	20	2.38x2.75x3.81	500	4
PG-111	Xtal Cont. Pulse Generator	—	—	2-500	square	10Vp-p	5	0.0005	.003	28	50	−55 to +85	50	15	200	1.00x1.55x0.56	100	2
PG-112	Xtal Cont. Pulse Generator	—	—	500-20000	square	10Vp-p	5	0.0005	.003	28	50	−55 to +85	50	15	200	1.25x2.00x1.75	40	5
PG-113	Xtal Cont. Pulse Generator	—	—	16-500	square	10Vp-p	5	0.0005	.005	15	20	−55 to +85	50	15	200	1.00x1.55x0.56	40	5
TF-120	Tuning Fork Cont. Osc.	—	—	.06-7	sine	1Vrms	0.6	0.005	.01	20-35	8	−55 to +85	—	—	—	1.37x1.37x3.90	225	3
310VF	Volt-To-Freq Converter	0-10	15	0-0.1	pulse	10Vp-p	10	0.05	1	±10	±20	0 to +50	250	25	500	1.31x1.31x1.75	100	4
320VF	Volt-To-Freq Converter	0-10	15	0-1	pulse	10Vp-p	10	0.05	1	±10	±20	0 to +50	250	25	500	1.31x1.31x1.75	100	4
330VF	Volt-To-Freq Converter	0-10	15	0-10	pulse	10Vp-p	10	0.05	1	±10	±20	0 to +50	250	25	500	1.31x1.31x1.75	100	4
340VF	Volt-To-Freq Converter	0-10	15	0-100	pulse	10Vp-p	10	0.05	1	±10	±20	0 to +50	250	25	500	1.31x1.31x1.75	100	4
V-510	Volt Controlled Oscillator	0-5	0.5	0.3-80	sine	2Vrms	100	0.003	0.25	−28	− 7	0 to +80	125	25	200	1.06x2.25x1.66	50	10
MV-514	Volt Controlled Oscillator	0-0.2	0.5	0.3-12	sine	2Vrms	100	0.003	1	±28	±25	0 to +85	125	25	200	1.06x2.25x1.66	50	10
V-521	Volt Controlled Oscillator	0-5	0.5	0.3-12	square	2Vp-p	10	0.003	0.50	−28	− 2	0 to +71	500	50	1000	0.75x0.75x1.13	20	13
AD-551	Volt-To-Freq Converter	0-5	0.5	0-1	sine	1Vrms	10	0.02	0.25	−28	−25	0 to +50	100	15	150	2.38x2.75x3.81	500	4
AD-552	Hi Gain Volt-To-Freq Conv.	0-0.2	0.5	0-1	sine	1Vrms	10	0.04	1	±28	±25	0 to +50	100	15	150	2.38x2.75x3.81	500	4
PF-1001	Lo Pressure-To-Freq Conv.	*0-5000	—	0.3-12	square	5Vp-p	25	0.01	1	28	5	−55 to +85	50	15	200	2.31x3.38x1.19	115	6
PF-1007	Pressure-To-Freq Conv.	*0-5000	—	0-100	pulse	10Vp-p	10	0.05	1	±10	±20	0 to +50	50	15	200	2.31x3.38x1.19	115	6
OS-1005	Pressure-To-Freq Conv.	*0-10000	—	1.3-22	sine	3Vrms	25	0.01	0.50	28	2	0 to +100	400	60	500	1.72x3.82x1.22	300	7
5001	FM Transmitter	0-5	0.5	88K-100K	sine	0.5Vrms	100	0.10	3	−9	−4	+10 to +80	600	50	800	1.28x1.43x0.70	50	9
5002	Volt Controlled Oscillator	0-5	0.5	0.3-80	square	2Vp-p	10	0.003	0.50	−9	−4	0 to +75	600	50	800	1.28x1.43x0.70	50	9
5021	VCO-FM Transmitter	0-5	.005	88K-100K	sine	0.5Vrms	100	0.10	0.50	28	5	+10 to +40	500	50	1000	1.00x1.00x1.38	40	12
TCD-101	Chopper Driver-Inverter	—	—	2-10	square	3-10Vp-p	3	0.10	2-10	10	40	−55 to +100	1000	100	2000	0.89x0.84x0.75	25	11
3001	Diff Op-Amp	0 to ±.01	1	2000	dc	±10	1	0.01	0.1	±15	± 7	−55 to +100	300	50	500	0.89x0.84x0.75	25	11
3002	Diff Op-Amp (Microvolt)	0 to ±.001	1000	2000	dc	±14	1	0.0006	0.1	±15	±20	−55 to +125	10000	100	5000	0.50x0.95x0.47	8	14
3051	Diff Op-Amp (Isolated)	0 to ±.01	0.5	2000	dc	±10	1	0.01	0.1	28	50	−55 to +100	500	50	700	1.41x1.75x1.06	115	15

Phone, wire or write for specifications and application literature describing above units or consult your microfilm files (VSMF or Thomas Supplementary)

OTHER PRODUCTS — SEE EEM SECTIONS 4590 & 5900

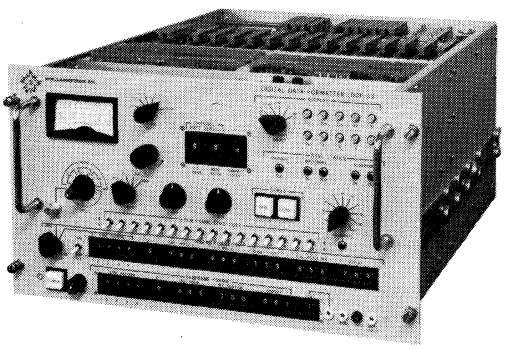
FREQMETERS (MODULAR & VISUAL)
DC DIFFERENTIAL OPERATIONAL AMPLIFIERS
XTAL PULSE GENERATORS
TRANSFORMERS
RELAYS (SOLID STATE, TIME DELAY, REED, LIGHT)
MINIATURE TELEMETER SYSTEMS
PRESSURE TRANSDUCERS
DIGITAL LOGIC MODULES
SOLID STATE CHOPPERS

SOLID STATE ELECTRONICS CORP.
15321 RAYEN STREET
SEPULVEDA, CALIFORNIA 91343
Area Code 213 — 894-2271 • 785-4473

STELLARMETRICS

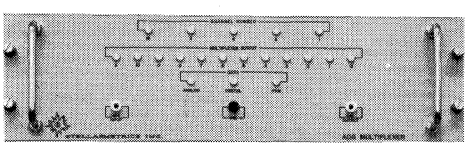
an AYDIN COMPANY

ANALOG PRODUCTS



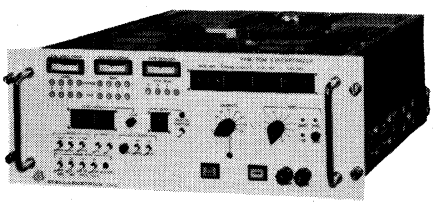
PAM-to-PCM CONVERTER DECOMMUTATOR

The DDF-13 Digital Data Formatter is a versatile telemetry synchronizer which provides signals, conditioned and formatted, for use with PCM decommutation equipment, digital processors and ancillary D-A units. The DDF-13 will function with input signals having up to 999 channels per main/prime frame and up to 999 channels per sub-frame, at channel rates from 1 to 12,000 channels per second. The DDF-13 is completely compatible with requirements of IRIG 106-66 and industrial formats.



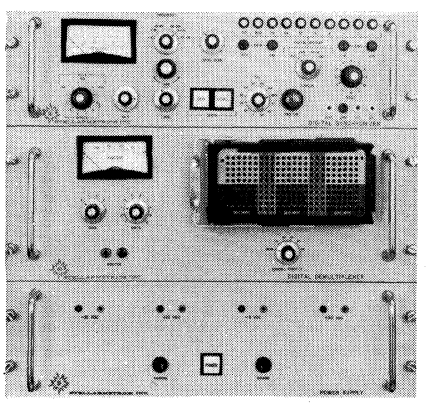
MULTIPLEXER/A-D CONVERTER

Series MADC Multiplexer/Converters are self contained multiplexers with sample-and-hold amplifier, analog-to-digital converter, power supplies and control logic in a single unit. Operations performed by the MADC include multiplexing of up to 400 high, low or mixed level analog inputs, amplification, sample-and-hold operation, and analog-to-digital conversion with serial or parallel binary or BCD digital word output. Throughput rates range up to 100 Kilosamples per second with a resolution up to 12 bits.



100 KHz PAM DECOMMUTATOR

The APS-1000 PAM and PDM Decommutation System provides for input signal conditioning, synchronization (frame and pulse) for PAM RZ/NRZ and PDM normal or differentiated signals with pulse rates from 1 Hz to 100 KHz. The system provides both parallel analog and parallel digital (10-bit) data for recording and processing. The APS-1000 is completely compatible with requirements or IRIG 106-66 and industrial formats. All controls are settable from the front panel, with toggle switches and thumbwheels used as applicable for setup and operation ease. The unit is of modular solid state design, and uses DTL integrated circuits in digital sections.

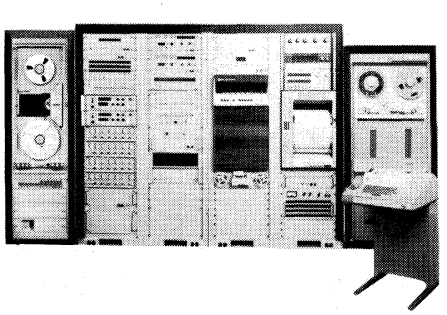


10 KHz PAM DECOMMUTATOR

The DD-1024 PAM/PDM Decommutation System is a general purpose system that allows reliable decommutation of complex PAM formats in several environments of high noise and missing channels. The system will accommodate all IRIG 106-66 formats plus special formats, and is composed of the following individual Stellarmetrics units:

DS-10 Synchronizer
*DD-XX Demultiplexer
DP-10 Power Supply

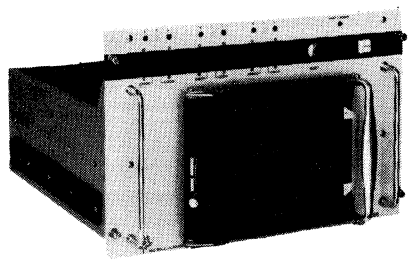
*Available with a choice of demultiplexers to accommodate a 90 or 130 channel main frame.

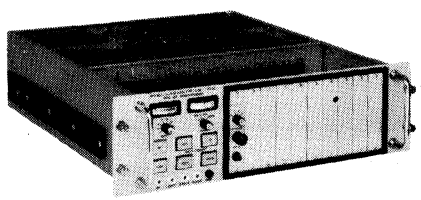


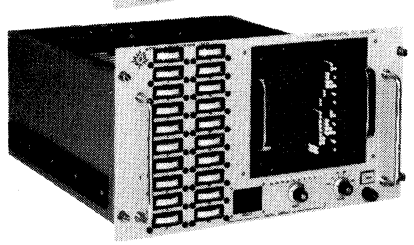
TELEMETRY PROCESSOR SYSTEMS

The Omega IV Telemetry Processor, one of the 4024 series of production telemetry ground stations that operate simultaneously on several frequency modulated and time-division-multiplexed inputs, with frequency responses totaling 100 KHz. Synchronization and processing are accomplished with up to 100 KHz PAM inputs. Under complete program control for all functional parameters, including signal routing, subcarrier discrimination, PAM/PDM synchronization, tape search and control, multiplexer sequencing, data compression, D-A addressing and oscillograph control, the system throughputs processed and identified data to magnetic tape and oscillograph recorders.

DATA SYSTEMS and COMPONENTS





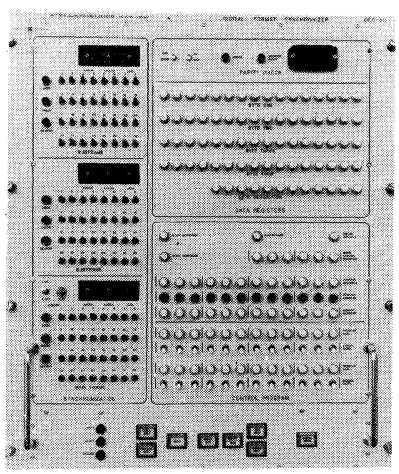


PATCH PROGRAM PCM DECOMMUTATOR

The Model DD-2024 PCM Decommutation System is a general purpose system permitting reliable decommutation of complex PCM formats in the most severe noise environments. The system is composed of three self-powered Stellarmetrics units.

Model DBS-20 Digital Bit Synchronizer
Model DFS-20 Digital Format Synchronizer
Model DDA-20 Digital-to-Analog Display

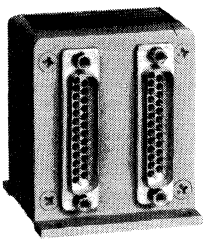
The system uses solid-state plug-in modules to provide total flexibility. Integrated circuits are used in the system for all digital functions.



STORED PROGRAM PCM DECOMMUTATOR

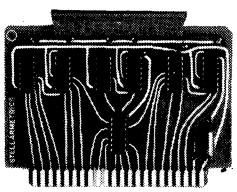
Series DFS-30 Digital Format Synchronizer provides the functions of serial-to-parallel conversion, sync-pattern recognition, format synchronization, word or channel identification, data routing to digital-to-analog converters and bi-level storage flip-flops. The DFS-30 will accept many types of format strategies, since each input PCM data word in the format is under direct control of a specific core memory word programmed for its use. The memory used is an integrated circuit interface, 1.5 microsecond cycle time, 32 bit by 2048 word, random access magnetic core memory.

DIGITAL PRODUCTS



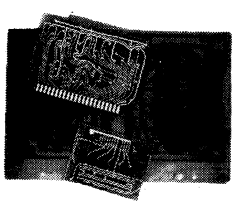
AIRBORNE COMMUTATORS

These airborne solid state commutators are versatile, rugged units designed to provide an accurate, stable telemetry pulse train in standard IRIG or special formats. Modular design flexibility permits PAM or PDM outputs, RZ or NRZ, or hybrid units utilizing either Junction FET designs (Series 251) or new flexible MOS FET designs (Series 300) in a wide variety of channel quantity and rate combinations with or without internal power ground isolation. Stellarmetrics commutators may be ordered in standard or special configurations to meet ordnance, missile, or satellite telemetry applications, and special ordnance design techniques permit shock protection up to 43,000 Gs. Small size, light weight, expandable channel capacity, and flight-qualified solid state circuitry make Stellarmetrics electronic commutators ideal for aerospace telemetry programs.



DIGITAL LOGIC CARDS

Stellarmetrics offers a complete line of high performance, multi-function digital logic and analog interface cards, power supplies, and associated packaging hardware. Logic cards are available in DTL integrated circuits or in compatible discrete component configuration. Standard cards encompass more than 100 different circuit functions.



PRINTED CIRCUIT BOARDS

Stellarmetrics has the complete in-house capability to produce fast, quality prototype or volume production of printed circuit boards. These capabilities include: ☐ complete art work and photo service ☐ photo engraving and silk-screening ☐ commercial or military grade base material ☐ plating of nickel, rhodium, gold through hole and solder coating ☐ precision quad-drilling, contour routing and precision sanding ☐ hardware installation of eyelets, funnelets, terminals and connectors ☐ processes in accordance with MSFC-STD-154 ☐ quality control system in accordance with MIL-Q-9858A Stellarmetrics also has the capability for assembling of printed circuit boards and flow soldering.

STELLARMETRICS
an AYDIN COMPANY

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Telephone (805) 963-3566 / TWX 910 334-1187

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999 Sepulveda Blvd. / El Segundo, California 90245
Telephone (213) 322-9484

BORG WARNER
Borg-Warner Thermoelectrics
DEPARTMENT OF BORG-WARNER CORPORATION
WOLF AND ALGONQUIN ROADS, DES PLAINES, ILLINOIS 60018, PHONE 312/827-3131

THERMOELECTRIC COOLERS

INTRODUCTION TO THERMOELECTRIC PRODUCTS

Thermoelectric cooling units have many unique advantages over other types of coolers in their application area.

SIZE

They can be tailored to fit the application by easy addition or subtraction of modules to fill the need accurately and avoid waste.

POWER INPUT

Due to tailored modular construction, power requirements can be reduced to a minimum. Power is provided through a single pair of leads.

RELIABILITY

There are no parts that wear or clog, and no delicate moving parts. Gases, corrosive liquids or chemicals that will leak or dissipate with age are also eliminated. These features result in greatly reduced maintenance requirements.

LOGISTICS

There are no requirements at the load for pumping refrigerant or for a source of coolant such as liquid nitrogen to be added during operation of the system.

REMOTE CONTROL

The unit and heat sink are required in the cooling area; the power supply and most other control equipment can be mounted and operated remotely.

COOLING RANGE

Thermoelectric coolers are capable of operating from any heat-sink temperature from +100°C to —100°C.

TEMPERATURE CONTROL

Simple electronic control schemes allow control within a fraction of a degree of desired load temperatures above or below ambient.

APPLICATION OF THERMOELECTRIC PRODUCTS

ELECTRONIC COMPONENTS

Cold traps for vacuum chambers
Crystals
Discrete silicon components
Inertial guidance systems
Infrared detectors
Integrated circuits
Lasers
Masers
Nuclear radiation detectors
Parametric amplifiers
Photomultiplier tubes
Vidicon tubes

TEMPERATURE CONTROL UNITS

Constant temperature chambers
Environment chambers
Integrated circuit test chambers
Temperature baths

COMMERCIAL REFRIGERATION

Aircraft water coolers
Cream coolers
Display cabinets
Ice cube makers
Photo developing solution coolers
Picnic baskets
Restaurant service-stand coolers

MEDICAL AID LABORATORY INSTRUMENTS

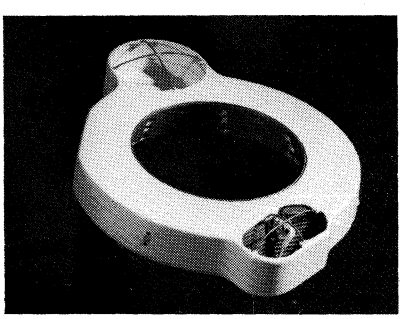
Blood coagulators
Cold probes
Dew point hygrometers
Microscope cold plates
Mobile drug coolers
Surgical instrument-coolers
Test tube coolers

CUSTOM DESIGN

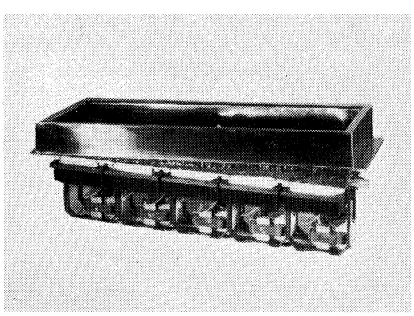
Engineering back-up is available for designs to meet customer specifications

SPECIAL ASSEMBLY

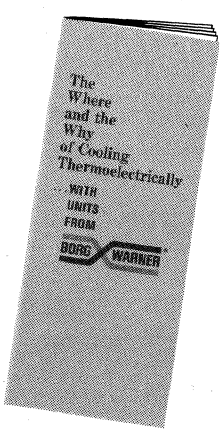
Ring type cooler to stabilize the inertial navigation system at 40°C and pump 280 watts with an input power of 338 watts.



This system cools one gallon of chemical solution to 40°F below ambient with 850 watts of input power. Load capability 450 watts to 0 △T.



The principles, applications, and design possibilities of thermoelectric cooling are discussed in this booklet.



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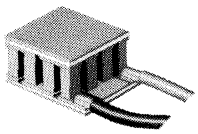
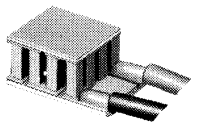
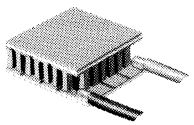
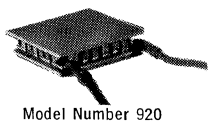
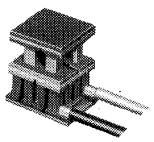
STANDARD THERMOELECTRIC DEVICES

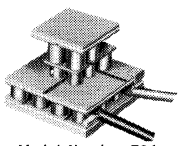

Model Number 492

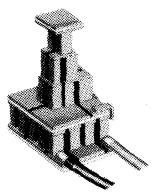

Model Number 837


Model Number 840


Model Number 920


Model Number 447
(2 Stage)


Model Number 724
(3 Stage)


Model Number 670
(4 Stage)


Model Number 1010
Heat Pump

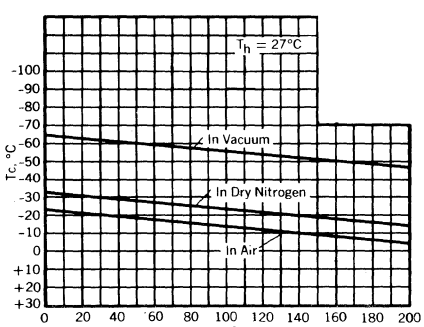
Borg-Warner Model 1010. Power requirements are 115 volts AC for the fan and 25 volts, 6.5 amperes DC for the thermoelectric assembly.

SPECIFICATION CHART— DATA TAKEN AT TH-27C° IN VACUUM

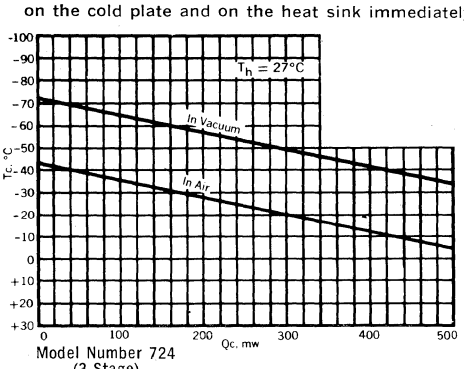
Cooler Model #	Max. △T Qc=0	Max Qc △T=0	Max. Voltage	Max. Current	Coldplate Size	Hotplate Size	Height
SINGLE STAGE							
492	69°C	2.6w	.8v	3.5a	.500″	.500″	.347″
837	69°C	1.2w	1.0v	1.75a	.250x.250″	.350x250″	.160″
838	69°C	1.5w	1.0v	2.75a	.250x.250″	.350x.250″	.120″
840	69°C	3.3w	3.5v	1.0a	.528″	.528x.600″	.188″
920	69°C	19w	3.5v	8.5a	15/32″	15/32″	7/32″
930	69°C	19w	8.5v	3.7a	15/32″	15/32″	13/64″
940	69°C	30w	3.6v	14a	15/32″	15/32″	11/64″
950	69°C	30w	9.2v	6a	15/32″	15/32″	5/32″
CASCADE							
2 Stage							
447	90°C	200mw	1.1v	3.5a	1/2″	1/2x5/8″	.562″
618	88°C	150mw	.2v	9a	.222x.12″	1/2x1/2″	.484″
638	90°C	800mw	1v	6a	.200x.200″	5/8x5/8″	.440″
922-4	86°C	90w	37.5v	7a	2.25″	5x4.125″	1.250″
932-1	92°C	4.0w	9.0v	3.5a	0.5x0.5″	1.17x1.17″	.375″
3 Stage							
623	117°C	140mw	.94v	8a	.22x.12″	.600x.600″	.672″
724	100°C	900mw	1v	12a	.500 Dia.	1x1″	.800″
4 Stage							
670	119°C	200mw	1.4v	4.5a	.250x.250″	1/2x5/8″	1.085″
HEAT PUMP							
1010	45°C	100w	25v	6.5a	5 7/8x4″	4x8″	5 3/8″

CONTACT FACTORY FOR VARIATIONS OF THE ABOVE DEVICES

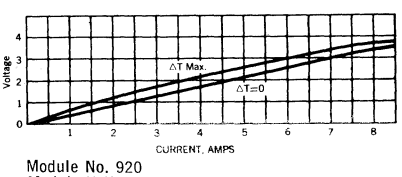
OPERATING CONDITIONS The above data was taken in a vacuum with thermocouples placed on the cold plate and on the heat sink immediately adjacent to the hot plate.



Model Number 447
(2 Stage)

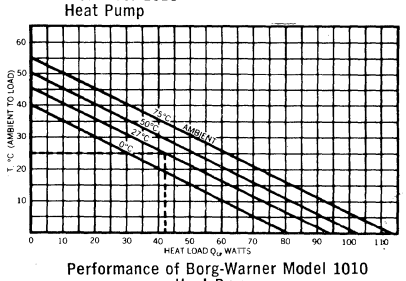


Model Number 724
(3 Stage)



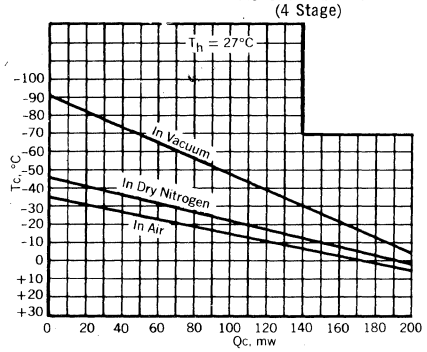
Module No. 920
Module Voltage

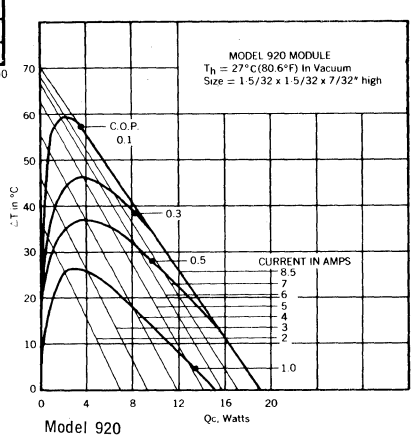
Model Number 1010
Heat Pump



Performance of Borg-Warner Model 1010
Heat Pump.

Model Number 670
(4 Stage)





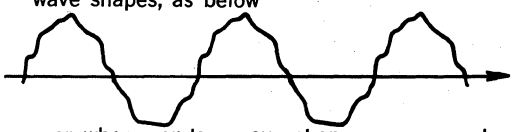
Model 920
Module ΔT vs. Module Heat Pumping Capacity for Various COP and Current Values.

BORG WARNER
Borg-Warner Thermoelectrics
DEPARTMENT OF BORG-WARNER CORPORATION
WOLF AND ALGONQUIN ROADS, DES PLAINES, ILLINOIS 60018, PHONE 312/827-3131

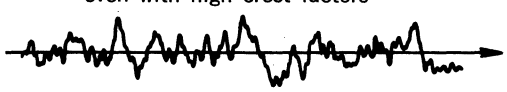
Guide to types, models and applications of BEST vacuo-junction THERMOCOUPLES as used by leading instrument manufacturers for:

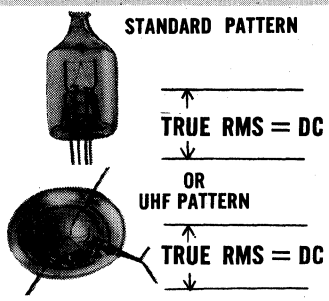
TRUE RMS MEASUREMENT

—where the signal is periodic with distorted wave shapes, as below



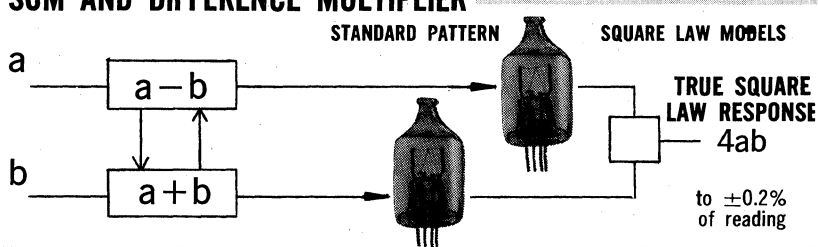
—or where random wave shapes are present, even with high crest factors





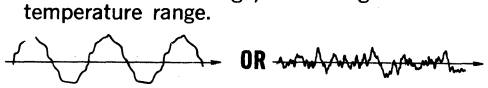
(Use either standard or UHF pattern, depending upon frequency)

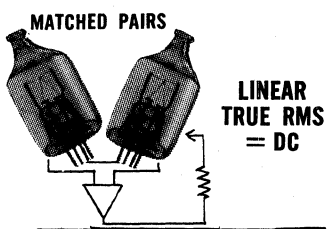
SUM AND DIFFERENCE MULTIPLIER



LINEAR TRUE RMS MEASUREMENT

Tracking errors are in percent of reading over a 10:1 current range, including a ±20°C temperature range.





Matched pairs available from stock:

	MODEL MP1S7	MODEL MP219	MODEL MP219-1
Tracking accuracy	0.5%	0.5%	0.2%
Response time (0-90%)	3 sec.	200ms	200ms
Nominal current	5mA	6.67mA	6.67mA



Fast response models minimize flicker in last digit

Standard patterns for 5mA and higher, usable to −65 Mc/s; for less than 5mA, usable to 10 Mc/s
U.H.F. types usable to 500 Mc/s
Temperature coefficient of output available from −0.2% per °C down to 0.005% per °C in some models
Reversal error, standard, 0.2%. All models available with R/E down to 0.01%, some models to 0.005%

Special features available: short time constants to 50 ms; double heater devices, ultra miniature sizes

Under development for early introduction are
— compatible amplifiers,
— true RMS to DC linear converters,
— high output models.

Write on company letterhead for application notes and full line catalog

BEST ELECTRICS DIVISION
HARRY LEVINSON COMPANY
1211 E. Denny Way, Seattle, Wash. 98122 • Tel. (206) 323-5100 • TWX 910-444-2154

Partial list of BEST STANDARD PATTERNS, INSULATED

*Preferred units, available from stock.

Model No.	Range mA	Heater ohms Resistance ±10%	Couple ohms Resistance ±10%
Following models have O/C E.M.F. of 7mV ±12%. Maximum permissible load, 250% of nominal.			
*S1	1.0	1750	13
S2	1.25	1600	13
S3	1.5	1000	13
*S4	2.0	800	12
*S5	2.5	400	8
S6	3.0	200	8
*S7	5.0	90	8
*S8	7.5	45	8
*S9	10.0	25	8
S10	15.0	20	4
S11	20.0	15	4
S12 thru S23	25.0 thru 1000.0	10.0 thru 0.15	4
Following have O/C E.M.F. of 20mV ±12%. Maximum permissible load, 200% of nominal.			
S45	2.0	2000	13
S46	2.5	1600	13
S47	3.0	800	13
*S48	5.0	250	8
S49	7.5	180	8
*S50	10.0	125	8
S51	15.0	50	4
S52	20.0	30	4
S53 thru S64	25.0 thru 1000.0	25.0 thru 0.25	4
Following models have O/C E.M.F. of 10mV ±12%. Maximum permissible load, 200% of nominal.			
S98	1.25	1600	13
S99	2.0	800	13
S100	2.5	400	8
S101	3.0	300	8
*S102	5.0	125	8
S103	7.5	70	8
*S104	10.0	40	8
S105	15.0	25	4
S106	20.0	20	4
S107 thru S118	25.0 thru 1000.0	15.0 thru 0.15	4

BEST U.H.F. UNITS, INSULATED

*Preferred units, available from stock.

Capacitance	0.3 mfd
Inductance, approx.	0.02 uH

Following models have O/C E.M.F. of 7 mv ±12%. Maximum permissible load, 250% of nominal.			
*U1	5	90	8
*U2	10	25	8
U3	15	20	4
U4	20	15	4
U5	25	10	4
U6	50	3	4
U7	100	1.5	4
U8	150	1.0	4
U9	200	0.7	4
U10	250	0.6	4
U11	500	0.3	4
U12	1000	0.15	4
U27	2.5	200	8

(Max. Perm. Load, Model U27, 150% of nominal)

PHYSICAL DATA, STANDARD PATTERNS

Height of envelope	0.900 inch
Diameter of envelope	0.437
Length of lead from envelope	2 ± ¼ inches
Length of sleeve from envelope	1¾ ± ¼ inches
Heater leads:	
Up to 400 milliamps	0.012 ± 0.002 inch diameter
500 milliamps and over	0.020 ± 0.002 inch diameter
Couple leads—all ranges	0.012 ± 0.002 inch diameter

PHYSICAL DATA, U.H.F. PATTERNS

Height of envelopes	0.750 inch
Diameter of envelope	0.800 inch
Width across heater leads	1.500 inches
Diameter of heater and couple wires	0.020 inch

Positive indicated by spot of red lacquer.

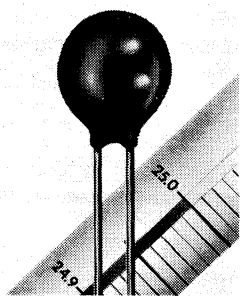
Specifications subject to change without notice.

CAL-R, INC.

thermonetics THERMISTOR DIVISION

Thermistors produced by the **CAL–R** Thermonetics Division provide circuit designers with a significant advance in thermal sensing devices. By employing proprietary metallurgical engineering concepts . . . a new thermal sensing material has resulted, with the name of THERMOCERAM.[T.M.] Performance characteristics provided by this new material not only permit improved design flexibility . . . but make possible closer tolerances in applications for MILITARY–AEROSPACE and INDUSTRIAL ELECTRONIC systems.

pt 100 series

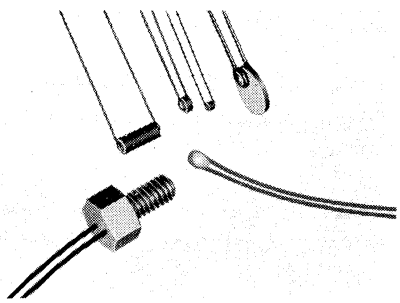


The PT–100 series thermistors are precision matched to 1% (0.2°C) resistance tolerance over the temperature range of 0° C to 80° C. These thermal sensors are designed especially for precision and semi-precision measurement and control applications.

Being preaged, the PT–100 Series demonstrates exceptional stability and repeatability. They are coated with thermal conductive epoxy to insure fast time response. Additionally, they display uniform operating characteristics because of rigid quality control procedures during each manufacturing process.

All PT–100 Series thermistors conform to AQL and confidence levels as specified in MIL-T-23648 as outlined by tables V & VI.

b series

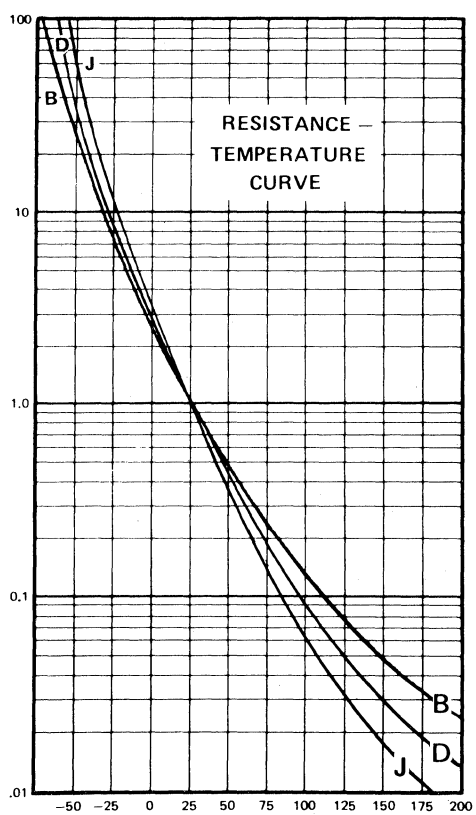


The "B" composition offers a broad range of resistance values. This permits the design engineer to select values of 2.5 thru 500 Ω from the same basic type of thermistor. In addition to this wide range of values, the "B" Series is an excellent, highly stable, broad application thermal sensor that finds use in innumerable heat sensing designs.

All "B" Series thermistors conform to AQL and confidence levels as specified in MIL-T-23648 as outlined by tables V & VI.

Coatings, encapsulation markings, probes and resistor/thermistor networks . . . are also available to meet specific requirements by contacting our application engineering department.

Resistance tolerances of ± 1% thru ± 20% are available and may be specified at 25° C, or any temperature within the operating range.



d series

Composition "D" Thermistors are part of a family of thermal sensors representing a new breakthrough in materials engineering. Resistance values from 25 to 5,000 Ω with tolerances of ± 1% thru ± 20% are available and may be specified at 25° C or any temperature within the operating range. The highly stable "D" Series thermistors conform to the AQL and confidence levels specified in MIL-T-23648 as do all **CAL–R** Thermonetics thermal sensing devices.

j series

Composition "J" Disc Thermistors have been designed utilizing a new thermal sensing material called THERMOCERAM.[T.M.] This composition offers a wide range of resistance values (200 to 30,000 Ω) allowing the design engineer condiserable latitude in selecting the specific device required to solve his heat sensing problem.

High stability and a wide range of tolerances to choose from are just two of the many outstanding features of this thermal sensing device.

For additional information please contact factory . . .

CAL-R, INC.
a subsidiary of **CapTech Inc.**
thermonetics *DIVISION*

1601 Olympic Boulevard
Santa Monica, California 90404
(213) 451-9761
TWX 910-343-6966

SPECIAL APPLICATIONS –
CAL–R thermonetics delivers special thermistors to solve unique packaging problems. For more information about special thermistor designs contact your local representative or **CAL–R** thermonetics directly.

CARBORUNDUM® THERMISTORS

MEDIUM SENSITIVITY, NTC RODS

Carborundum thermistors are non-linear (pos. or neg. temperature coefficient) resistors which offer a wide range of temperature-coefficient characteristics. The coefficients available are approximately .3% per degree C to 10% per degree C at 25°C. Carborundum thermistors are bonded ceramically through a high-temperature firing process into disc and rod-shaped bodies in a wide range of sizes to provide the desired resistance values, thermal time and dissipation constants, and temperature coefficients for a wide variety of electrical and electronic circuits.

Our long experience in the design of special resistance devices, together with wide experience in the field of ceramic technology, assures a stable and uniform product to meet your thermistor requirements. All materials used in the manufacture of Carborundum thermistors are of the highest quality. Strict quality control is maintained over all stages of manufacture and a minimum of two calibrations at the specified reference temperature and/or load current is standard.

SPECIFICATIONS	F-1	F-2	F-3	F-4	F-5	F-6	F-7
Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$, nominal	2.82	3.26	3.64	4.37	5.00	5.95	6.84
"B" value (37.8°C—73.5°C) ±10%	1250	1400	1550	1750	1900	2100	2250
Temperature coefficient @ 25°C, per °C	1.40%	1.56%	1.72%	1.97%	2.11%	2.40%	2.50%

PHYSICAL SPECIFICATIONS

Type	Fig.	Dimensions A	B	C	Lead Wire Ga.	Dissipation Constant MW°/C	Time Constant Seconds	Remarks
0325F	I	.12	.30	1	24	6.0	10	Coated
0525F	I	.22	.375	1⅛	24	8.0	22	Coated
0550F	I	.22	.63	1⅜	20	11.0	25	Coated
0599F	I	.22	1.125	1⅜	20	15.0	50	Coated
1099F	I	.375	1.125	1⅜	20	24.0	90	Coated
0650F	II	.20	.50	1⅜	20	11.0	27	Uncoated

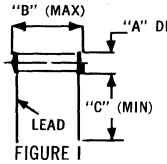


FIGURE I

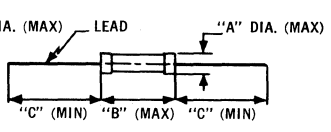


FIGURE II

TYPE "F-1" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

RESISTANCE OHMS ±10% at 25°C	CARBORUNDUM PART NUMBER 0325F	0525F	0550F	0599F	0650F	1099F
2.0	—	100	—	—	—	—
2.5	—	101	—	—	—	—
3.0	—	102	—	—	—	—
3.5	—	103	—	—	—	—
4.0	—	104	—	—	—	—
4.5	—	105	100	—	—	—
5.0	—	—	101	—	—	—
7.5	100	—	—	100	—	—
10.0	101	—	—	101	—	—
15.0	102	—	—	102	—	—

Order by Type number and subdesignation. Example: 0550F-100 identifies the 4.5-ohm version of Type 0550F.

TYPE "F-2" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

RESISTANCE OHMS ±10% at 25°C	CARBORUNDUM PART NUMBER 0325F	0525F	0550F	0599F	0650F	1099F
5.0	—	106	—	—	—	100
7.5	—	107	102	—	—	101
10.0	—	108	103	—	100	102
15.0	—	109	104	—	101	—
20.0	103	—	105	103	—	—
25.0	104	—	—	104	—	—
30.0	105	—	—	105	—	—

Order by Type number and subdesignation. Example: 0550F-102 identifies the 7.5-ohm version of Type 0550F.

TYPE "F-3" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

RESISTANCE OHMS ±10% at 25°C	CARBORUNDUM PART NUMBER 0325F	0525F	0550F	0599F	0650F	1099F
25	—	110	106	—	102	103
50	—	111	107	—	103	104
75	106	—	108	106	—	—
100	107	—	—	107	—	—
125	108	—	—	108	—	—
150	109	—	—	109	—	—
200	110	—	—	110	—	—

Order by Type number and subdesignation. Example: 0599F-106 identifies the 75-ohm version of Type 0599F.

TYPE "F-4" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

RESISTANCE OHMS ±10% at 25°C	CARBORUNDUM PART NUMBER 0325F	0525F	0550F	0599F	0650F	1099F
75	—	112	—	—	104	—
100	—	113	109	—	105	105
125	—	114	110	—	106	—
150	—	115	111	—	107	—
200	—	116	112	—	108	106
250	111	117	113	111	109	107
500	112	118	114	112	110	108
750	113	—	115	113	—	—
1,000	114	—	—	114	—	—
1,500	115	—	—	115	—	—
2,000	116	—	—	116	—	—

Order by Type number and subdesignation. Example: 0525F-117 identifies the 250-ohm version of Type 0525F.

TYPE "F-5" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

RESISTANCE OHMS ±10% at 25°C	CARBORUNDUM PART NUMBER 0325F	0525F	0550F	0599F	0650F	1099F
750	—	119	—	—	111	109
1,000	—	120	116	—	112	110
1,500	—	121	117	—	113	—
2,000	—	122	118	—	114	—
2,500	117	123	119	117	115	111
5,000	118	124	120	118	116	112
7,500	119	—	121	119	—	—
10,000	120	—	—	120	—	—

Order by Type number and subdesignation. Example: 0525F-123 identifies the 2500-ohm version of Type 0525F.

TYPE "F-6" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

RESISTANCE OHMS ±10% at 25°C	CARBORUNDUM PART NUMBER 0325F	0525F	0550F	0599F	0650F	1099F
7,500	—	125	—	—	117	113
10,000	—	126	122	—	118	114
25,000	121	127	123	121	119	115
50,000	122	128	124	122	120	116
75,000	123	—	125	123	—	—
100,000	124	—	—	124	—	—
125,000	125	—	—	125	—	—
150,000	126	—	—	126	—	—
200,000	127	—	—	127	—	—

Order by Type number and subdesignation. Example: 0599F-122 identifies the 50,000-ohm version of Type 0599F.

TYPE "F-7" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

RESISTANCE OHMS ±10% at 25°C	CARBORUNDUM PART NUMBER 0325F	0525F	0550F	0599F	0650F	1099F
75,000	—	129	—	—	121	—
100,000	—	130	126	—	122	—
150,000	—	131	127	—	123	—
200,000	—	132	128	—	124	—
250,000	128	133	129	128	125	—
500,000	129	134	130	129	126	—
750,000	130	135	131	130	127	—
1,000,000	131	—	132	131	128	—
1,500,000	132	—	133	132	—	—
2,000,000	133	—	—	133	—	—

Order by Type number and subdesignation. Example: 0650F-121 identifies the 75,000-ohm version of Type 0650F.

Stock Item

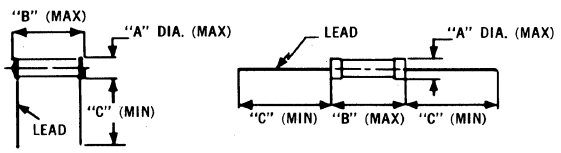
CARBORUNDUM® THERMISTORS

HIGH SENSITIVITY, NTC RODS

Specifications	H-1	H-2	H-3	H-4	H-5	H-6	H-7	H-8
Ratio R at 25°C / R at 125°C	11.5	13.5	18.0	23.0	30.0	36.0	44.0	52
"B" Value (37.8°—73.5°C ±5%	2800	3000	3400	3700	4000	4200	4400	4600
Temperature coefficient @ 25°C per °C	3.1%	3.4%	3.8%	4.1%	4.4%	4.7%	4.9%	5.1%

PHYSICAL SPECIFICATIONS

Type	Dimensions A	B	C	Lead Wire Gauge	Dissipation Constant MW/°C	Time Constant Seconds	Remarks
0325H	.12	.30	1	24	6.0	10	Coated
0525H	.22	.375	1⅛	24	8.0	22	Coated
0550H	.22	.63	1⅜	20	11.0	25	Coated
0599H	.22	1.125	1⅜	20	15.0	50	Coated
0650H	.20	.50	1⅜	20	11.0	27	Uncoated



0650H ONLY

TYPE "H-1" NEGATIVE TEMPERATURE COEFFICIENT THEMISTORS STANDARD VALUES

Resistance Ohms at 25°C ±10%	CARBORUNDUM PART NUMBER 0325H	0525H	0550H	0599H	0650H
750	—	100	—	—	100
1000	—	101	100	—	101
1500	—	102	101	—	102
2000	—	—	102	—	—
2500	100	—	103	100	—
3750	101	—	—	101	—
5000	102	—	—	102	—

Order by Type number and sub-designation. Example: 0650H-101 identifies the 1,000 ohm version of Type 0650H.

TYPE "H-2" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

Resistance Ohms at 25°C ±10%	CARBORUNDUM PART NUMBER 0325H	0525H	0550H	0599H	0650H
2000	—	103	—	—	103
2500	—	104	—	—	104
3750	—	105	104	—	105
5000	—	—	105	—	—
7500	103	—	—	103	—
10000	104	—	—	104	—
12500	105	—	—	105	—

Order by Type number and sub-designation. Example: 0650H-104 identifies the 2,500 ohm version of Type 0650H.

TYPE "H-3" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

Resistance Ohms at 25°C ±10%	CARBORUNDUM PART NUMBER 0325H	0525H	0550H	0599H	0650H
7500	—	106	—	—	106
10000	—	107	106	—	107
12500	—	108	107	—	108
15000	—	—	108	—	—
25000	106	—	—	106	—
35000	107	—	—	107	—
45000	108	—	—	108	—

Order by Type number and sub-designation. Example: 0650H-107 identifies the 10,000 ohm version of Type 0650H.

TYPE "H-4" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

Resistance Ohms at 25°C ±10%	CARBORUNDUM PART NUMBER 0325H	0525H	0550H	0599H	0650H
12500	—	—	—	—	—
15000	—	109	—	—	109
25000	—	110	109	—	110
35000	—	—	110	—	—
45000	—	—	—	—	—
60000	109	—	—	109	—
75000	110	—	—	110	—

Order by Type number and sub-designation. Example: 0650H-110 identifies the 35,000 ohm version of Type 0650H.

TYPE "H-5" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

Resistance Ohms at 25°C ±10%	CARBORUNDUM PART NUMBER 0325H	0525H	0550H	0599H	0650H
25000	—	—	—	—	—
35000	—	114	—	—	114
45000	—	115	111	—	115
60000	—	116	112	—	116
75000	—	—	113	—	—
100000	111	—	—	111	—
150000	112	—	—	112	—
200000	113	—	—	113	—

Order by Type number and sub-designation. Example: 0650H-113 identifies the 25,000 ohm version of Type 0650H.

TYPE "H-6" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

Resistance Ohms at 25°C ±10%	CARBORUNDUM PART NUMBER 0325H	0525H	0550H	0599H	0650H
60000	—	—	—	—	—
75000	—	117	—	—	117
100000	—	118	114	—	118
150000	—	119	115	—	119
200000	—	—	116	—	—
250000	114	—	117	114	—
500000	115	—	—	115	—

Order by Type number and sub-designation. Example: 0650H-119 identifies the 100,000 ohm version of Type 0650H.

TYPE "H-7" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

Resistance Ohms at 25°C ±10%	CARBORUNDUM PART NUMBER 0325H	0525H	0550H	0599H	0650H
200000	—	120	—	—	120
250000	—	121	—	—	121
500000	—	—	—	—	—
750000	116	—	—	116	—
1000000	117	—	—	117	—

Order by Type number and sub-designation. Example: 0650H-121 identifies the 250,000 ohm version of Type 0650H.

TYPE "H-8" NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS STANDARD VALUES

Resistance Ohms at 25°C ±10%	CARBORUNDUM PART NUMBER 0325H	0525H	0550H	0599H	0650H
200000	—	122	—	—	122
250000	—	123	—	—	123
500000	—	124	119	—	124
750000	118	125	120	118	125
1000000	119	126	121	119	126
1500000	120	—	—	120	—
2000000	121	—	—	121	—

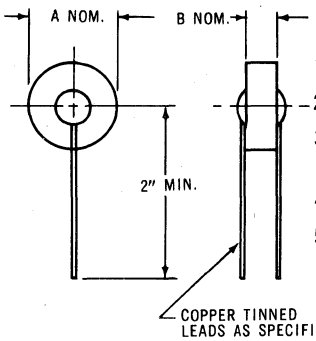
Order by Type number and sub-designation. Example: 0650H-122 identifies the 200,000 ohm version of Type 0650H.

Stock Item

CARBORUNDUM® THERMISTORS

HIGH SENSITIVITY, NTC DISCS

TYPE "A" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

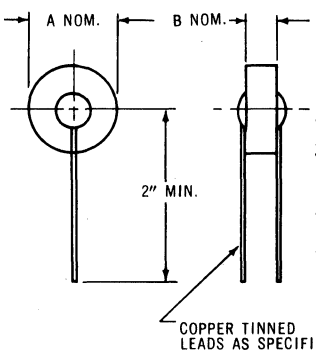


1. Ratio $\frac{R \text{ at } 25°C}{R \text{ at } 125°C} = 28.5 \pm 10\%$
2. "B" Value (37.8°C–73.5°C) 3980
3. Temperature Coefficient at 25°C 4.4%/°C
4. Thermistors are not insulated.
5. Resistance vs Temperature characteristic curves are average value.

STANDARD VALUES

Resistance Ω at 25°C ±10%	Nominal Dimension A	B	Lead Wire Gage	Dissipation Contant-MW/°C	Time Constant Seconds	Carborundum Part Number
50	.82	.08	18	29.0	150	A3308H
75	.82	.11	18	29.0	150	A3311H
100	.40	.03	22	9.0	35	A1603H
125	.40	.04	22	9.0	35	A1604H
150	.30	.03	24	8.0	35	A1203H
175	.30	.03	24	8.0	35	A1203H
200	.30	.03	24	8.0	35	A1203H
250	.30	.05	24	8.0	40	A1205H
300	.30	.06	24	8.0	40	A1206H
500	.20	.04	24	6.5	12	A0804H
600	.20	.04	24	6.5	12	A0804H
750	.20	.05	24	6.5	12	A0805H
900	.20	.06	24	7.0	24	A0806H
1000	.20	.07	24	7.0	24	A0807H
1250	.20	.08	24	7.5	30	A0808H
1500	.20	.10	24	7.5	30	A0810H

TYPE "B" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

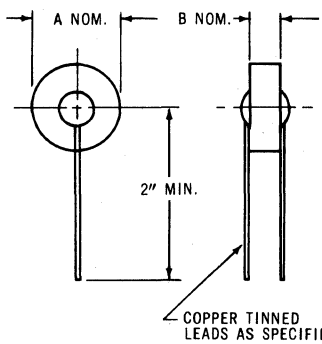


1. Ratio $\frac{R \text{ at } 25°C}{R \text{ at } 125°C} = 14.2 \pm 10\%$
2. "B" Value (37.8°C–73.5°C) 3070
3. Temperature Coefficient at 25°C 3.4%/°C
4. Thermistors are not insulated.
5. Resistance vs Temperature characteristic curves are average value.

STANDARD VALUES

Resistance Ω at 25°C ±10%	Nominal Dimension A	B	Lead Wire Gage	Dissipation Contant-MW/°C	Time Constant Seconds	Carborundum Part Number
2.0	.65	.05	22	17.0	90	B2605H
2.5	.65	.06	22	17.0	90	B2606H
3.0	.65	.07	22	17.0	90	B2607H
5.0	.40	.04	22	9.0	35	B1604H
7.0	.40	.06	22	9.0	35	B1606H
10.0	.30	.05	24	8.5	38	B1205H
15.0	.30	.06	24	8.5	43	B1206H
20.0	.20	.04	24	7.0	22	B0804H
25.0	.20	.04	24	7.0	22	B0804H
50.0	.20	.08	24	7.5	22	B0808H

TYPE "C" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

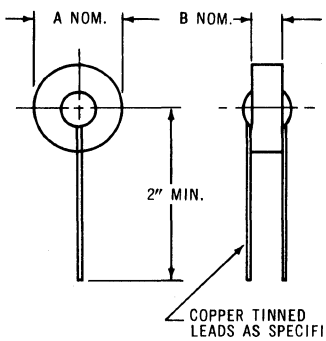


1. Ratio $\frac{R \text{ at } 25°C}{R \text{ at } 125°C} = 18.7 \pm 10\%$
2. "B" Value (37.8°C–73.5°C) 3415
3. Temperature Coefficient at 25°C 3.8%/°C
4. Thermistors are not insulated.
5. Resistance vs Temperature characteristic curves are average value.

STANDARD VALUES

Resistance Ω at 25°C ±10%	Nominal Dimension A	B	Lead Wire Gage	Dissipation Contant-MW/°C	Time Constant Seconds	Carborundum Part Number
10	.65	.045	22	15.0	90	C2605H
15	.45	.03	22	9.0	35	C1803H
25	.40	.04	22	9.0	35	C1604H
50	.30	.04	24	8.5	40	C1204H
75	.30	.05	24	8.5	40	C1205H
100	.20	.03	24	6.5	12	C0803H
125	.20	.03	24	6.5	12	C0803H
150	.20	.06	24	7.0	22	C0806H
175	.20	.04	24	6.5	12	C0804H
200	.20	.06	24	7.0	22	C0806H
225	.20	.05	24	6.5	12	C0805H
250	.20	.04	24	6.5	12	C0804H
300	.20	.05	24	6.5	12	C0805H

TYPE "D" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS



1. Ratio $\frac{R \text{ at } 25°C}{R \text{ at } 125°C} = 35.3 \pm 10\%$
2. "B" Value (37.8°C–73.5°C) 4200
3. Temperature Coefficient at 25°C 4.7%/°C
4. Thermistors are not insulated.
5. Resistance vs Temperature characteristic curves are average value.

STANDARD VALUES

Resistance Ω at 25°C ±10%	Nominal Dimension A	B	Lead Wire Gage	Dissipation Contant-MW/°C	Time Constant Seconds	Carborundum Part Number
125	.82	.08	18	26.0	135	D3308H
150	.82	.09	18	26.0	135	D3309H
200	.40	.03	22	9.0	35	D1603H
250	.40	.03	22	9.0	35	D1603H
300	.40	.04	22	9.0	35	D1604H
500	.30	.04	24	8.0	38	D1204H
750	.30	.05	24	5.0	38	D1205H
1000	.20	.03	24	7.0	18	D0803H
1250	.20	.03	24	7.0	18	D0803H
1500	.20	.03	24	7.0	18	D0803H
2000	.20	.04	24	7.0	18	D0804H
2500	.20	.05	24	7.0	18	D0805H
3000	.20	.06	24	7.0	18	D0806H

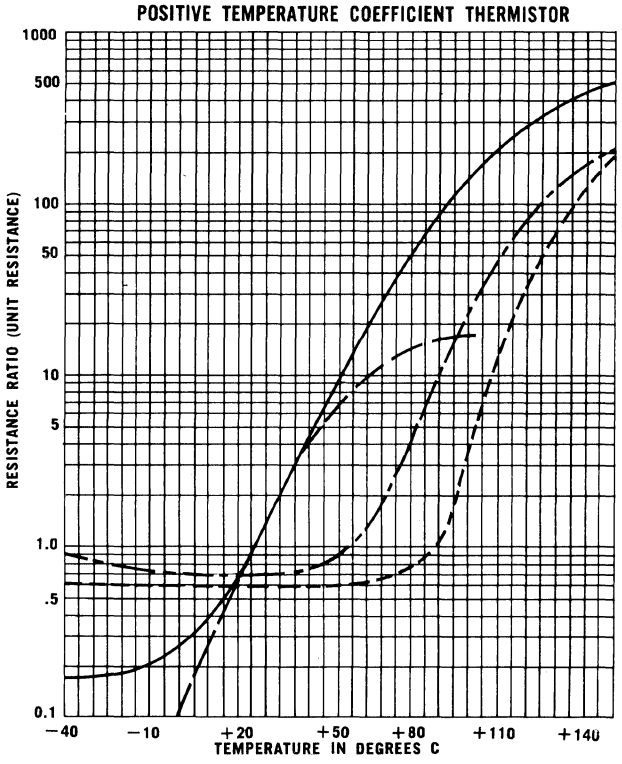
CARBORUNDUM® THERMISTORS

POSITIVE TEMPERATURE COEFFICIENT UNITS

Carborundum's "PTC's" permit simplification of circuit designs, cost reductions or improved systems reliability in applications involving: temperature compensation, time delay, current limiting, over heat protection, temperature control, or level/flow control for industrial, entertainment or military electronics and for industrial or appliance controls.

GENERAL SPECIFICATIONS

Type	Resistances Ohms	Calibration Temperature	Tolerances	RATIO	Temperature Coefficient
A	190-250-325-330-450-600-625-850-1150-1450-2000-2650	25°C	±10% to ±20%	R60°C/R25°C = 14 ±6	8%/°C @ 37.8°C
B	12-20-28-38	90°C	±2.5 ohms to ±13 ohms	R125°C/R90°C = 45 ±15	10%/°C @ 125°C
D	5.9-8K-10.7K 17.5K-24K-32K-36.5K-50K-66.5K-100K-125K	25°C	±10% to ±20%	R25°C/R0°C = 7.2 ±2.5	8%°C @ 25°C
E	28-38-53-80-115-160	60°C	±12.5 ohms to ±40 ohms	R90°C/R60°C + 14 ±6	8.5%/°C @ 90°C



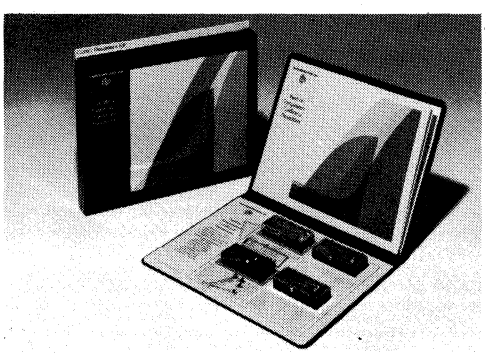
SELF LIMITING HEATERS

PTC Thermistors maintain optimum operational temperatures in communications equipment, operational amplifiers, airborne computers, and similar temperature critical devices. PTC Thermistors are available from Carborundum in a variety of configurations for self-regulating heater applications. In areas where small amounts of heating, fast-response, and noise-less operation are required, these solid-state heaters may be used. Due to the resistance-temperature characteristic of the PTC, additional circuitry is not required to maintain a constant temperature or compensate for ambient changes.

ENGINEERING DATA:

Diameter	.375 to .750 inches
Thickness	.90 to .250 inches
Power Ratings	.25 to 5 watts
Temperature	to 125°C

THERMISTOR SAMPLE ASSORTMENT



Convenient file folder kit contains 16 PTC Thermistors, complete specifications and suggested circuits. The kit includes the most popular PTC characteristics and resistance ranges.

Complete Designer's Kit — $20. Money back if not completely satisfied. Order today from The Carborundum Company Electronics Plant, Niagara Falls, N. Y. 14302.

CONTROL PRODUCTS CORPORATION
4431 WEST DIVISION ST., CHICAGO, ILLINOIS 60651 • (312) 235-2340

THERMOCOUPLE SELECTION GUIDE

QC Thermocouples can be ordered quickly and easily by using the step by step procedure outlined on the following pages. If a component is not required, omit that step and proceed to the next. Material selection tables along with technical data should be used when making specific selections. If requirements are known, only the corresponding QC part number needs to be determined.

Our QC application engineers will be happy to select a thermocouple for you based on a complete description of your requirements.

A JUNCTION

When choosing a thermocouple junction, the required response time, compatibility with measured environment and electrical circuits must be considered.

B THERMOCOUPLE WIRE (SENSOR CONDUCTOR MATERIAL)

The thermocouple wire for a specific application is determined by the temperature to be sensed, compatibility of T/C wires with readout equipment, electrical resistance of probe and type of environment. When response time is not critical, larger diameter wires ensure longer life. (See table)

C INSULATION MATERIAL

Standard QC Thermocouples are manufactured with Magnesium Oxide (MgO) which should be used unless special conditions are present. Other insulations available include Aluminum Oxide ($A1_2O_3$) Beryllium Oxide (BeO) and Thorium Oxide (ThO). Insulation resistance and operating temperature are of major importance in choosing the correct insulation material. Other factors include thermal conductivity, compactability and melting point. (See table)

D SHEATH MATERIAL

The maximum operating temperature of a thermocouple, and the environment surrounding it, must be considered when choosing the sheath material. The mechanical requirements and structural rigidity are important aspects of design requirements.

CONTROL PRODUCTS CORPORATION stocks numerous stainless steel alloys, inconel, precious and exotic metal tubing. (See table) Any material that can be made into tubing can be used for sheath material.

E PHYSICAL DIMENSIONS OF SHEATH & WIRE

E1 Standard physical dimensions are listed in table. Other wire sizes and sheath conductor diameters are available upon request.

E2 Required length. Specify inches or feet.

F MOUNTING FITTINGS

F1 The use of any specific mounting fitting depends on application. Stock mounting fittings are listed in table.

F2 Immersion depth. Specify inches or feet.

G TRANSITION OR TERMINATION

Standard terminations are listed. Other terminations are available upon request. The application dictates which is used. Temperature, environment and mechanics are considerations.

H LEAD OR EXTENSION WIRE

H1 The choice of wire depends on ambient temperature, calibration, environmental conditions and the degree of mechanical protection required. Thermocouple LEAD wire is supplied with ISA Standard Limits of Error, the same accuracy as the thermocouple conductors. It should be used whenever lead ambient is in excess of 400°F. Thermocouple EXTENSION wire is supplied with ISA tolerances. It is recommended for low ambient temperatures and in the case of precious metal thermocouples its use substantially reduces the cost of extension cable. Stock lead wires are listed in table. Other lead wires are available on request.

H2 Required length. Specify inches or feet.

J WIRE TERMINATION

Standard terminations available for the thermocouple extension/lead wire are listed on following pages of this catalog. Other terminations are available upon request.

K EXTENSION WIRE

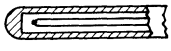
K1 The choice of wire depends on ambient temperature, calibration, environmental conditions and the degree of mechanical protection required. Thermocouple LEAD wire is supplied with ISA Standard Limits of Error, the same accuracy as the thermocouple conductors. It should be used whenever lead ambient is in excess of 400°F. Thermocouple EXTENSION wire is supplied with ISA tolerances. It is recommended for low ambient temperatures and in the case of precious metal thermocouples its use substantially reduces the cost of extension cable. Stock lead wires are listed in table. Other lead wires are available on request.

K2 Required length. Specify inches or feet.

to order specify...

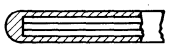
A	B	C	D	E1	E2	F1	F2	G	H1	H2	J	K1	K2
Junction	Thermocouple Wire	Insulation Material	Sheath Material	Sheath O.D.	Sheath Length Specify in. or ft.	Mounting Fitting Code	Immersion Depth Specify in. or ft.	Transition or Termination Code	Wire Code	Wire Length Specify in. or ft.	Wire Termination Code	Wire Code	Length Specify in. or ft.

A JUNCTIONS



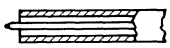
CODE A1 UNGROUNDED JUNCTION

Comparatively long response time. Measuring circuit electrically isolated from measured medium. Allows maximum life under conditions of vibration, shock and corrosive conditions.



CODE A2 GROUNDED JUNCTION

Faster response time. Long life in corrosive gas, liquids and solids. Good for high pressure application.



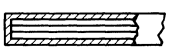
CODE A3 EXPOSED JUNCTION

Fastest response time. Recommended for gas or for solid surface measurement in non-corrosive atmosphere.



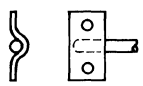
CODE A4 NECKDOWN THERMOCOUPLE

Fast response with physical strength. Available with above junctions; code becomes A-41, A-42 or A-43. Allows seating for accurate location; specify "L" in inches.



CODE A5 FLAT END THERMOCOUPLE

Tip machined to reduce mass and improve response time. Available with types A-1 and A-2 above; code becomes A-51 or A-52.



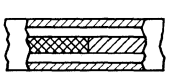
CODE A6 PAD THERMOCOUPLE

For surface attachment. Intimate contact with measured medium. Normally supplied with grounded junction.



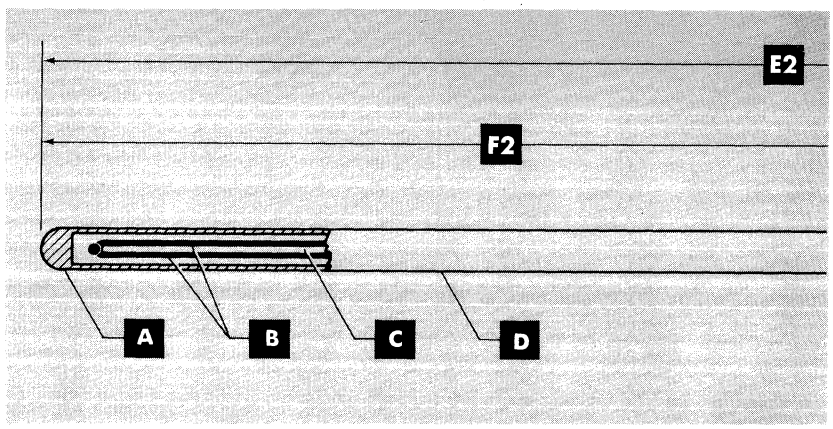
CODE A7 MECHANICAL AND FUSED JUNCTION

Recommended for use with high temperature (4600 F.) refractory metal thermocouples. Available with types A-1 and A-2 above; code becomes A-71 or A-72.



CODE A8 SINGLE CONDUCTOR

Designed for extreme temperature, pressure, corrosion and physical stress. Allows maximum thermocouple wire diameter.



B THERMOCOUPLE WIRE (SENSOR CONDUCTOR MATERIAL)

CODE	TYPE	TEMPERATURE RANGE	
		MINIMUM	MAXIMUM
BT	Copper/Constantan	—450°F	752°F
BJ	Iron/Constantan	—420	1600
BK	Chromel/Alumel	—420	2500
BE	Chromel/Constantan	—450	1830
BS	Platinum/Platinum—10% Rhodium	0	3215
BR	Platinum/Platinum—13% Rhodium	0	3100
BP6	Platinum—6% Rhodium/Platinum—30% Rhodium	37	3300
BI	40% Iridium—60% Rhodium/Iridium	0	3600
BAW	Tungsten/Tungsten—26% Rhenium	100	4200
BW3	Tungsten—3% Rhenium/Tungsten—25% Rhenium	100	4200
BW5	Tungsten—5% Rhenium/Tungsten—26% Rhenium	100	4200
BG	Geminal P/Geminal N	0	2300
BC	Copper/Gold—2.1% Cobalt	—425	32

C INSULATION MATERIAL

CODE	MATERIAL	MAXIMUM RECOMMENDED OPERATING TEMPERATURE
CM	MgO	3500°F
CA	Al_2O_3	2300
CB	BeO	4000
CT	ThO_2	5000

D SHEATH MATERIAL

CODE	METAL	MAXIMUM RECOMMENDED OPERATING TEMPERATURE	MELTING TEMPERATURE	CODE	METAL	MAXIMUM RECOMMENDED OPERATING TEMPERATURE	MELTING TEMPERATURE
D11	Copper	600°F	1981°F	D22	Inconel 600	2100°F	2600°F
D12	Titanium	1000	2900	D23	Hastalloy X	2300	2350
D13	Cupro-Nickel	1400	2260	D24	Nickel	2300	2650
D14	304 SS	1650	2600	D25	Inconel 702	2400	2570
D15	316 SS	1650	2500	D26	Platinum	3050	3212
D16	321 SS	1650	2600	D27	Pt—10% Rh	3200	3370
D17	347 SS	1650	2550	D28	Pt—20% Rh	— —	3450
D18	348 SS	1650	2550	D29	Columbium	— —	4474
D19	446 SS	1800	2550	D30	Molybdenum	4000	4752
D20	310 SS	2000	2550	D31	Tantalum	4500	5425
D21	Hastalloy C	2000	2320				

E1 PHYSICAL DIMENSIONS OF SHEATH AND WIRE

CODE	SHEATH O.D.	SHEATH WALL	CONDUCTOR DIAMETER*	MAXIMUM UNSPLICED LENGTH IN FEET SPECIFY DESIRED LENGTH E2 BELOW
E1	.010	.002	.002	10
E2	.025	.005	.004	150
E4	.040	.008	.006	500
E6	.062	.012	.010	500
E12	.125	.020	.022	400
E18	.188	.028	.034	170
E25	.250	.036	.048	95
E31	.312	.046	.060	60
E38	.375	.055	.070	45
E44	.437	.065	.083	34

FOR PRECIOUS METAL THERMOCOUPLES

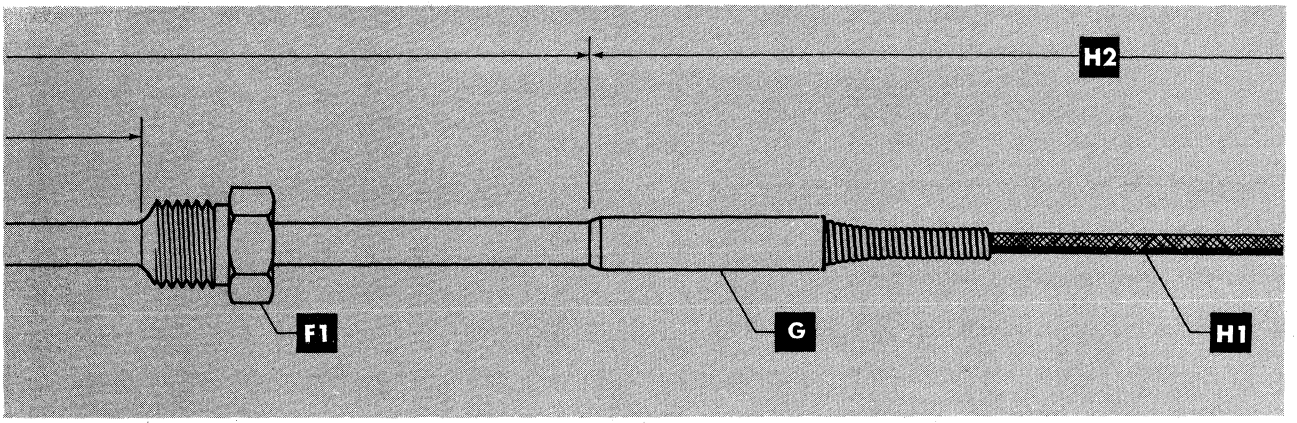
E91	.010	(TO BE SPECIFIED AS REQUIRED)		
E92	.025			
E94	.040	.006	.005	20
E96	.062	.010	.010	20
E912	.125	.015	.020	25
E918	.188	.015	.025	30
E925	.250	.022	.032	30
E931	.312	(TO BE SPECIFIED AS REQUIRED)		
E938	.375			
E944	.437			

*See reference data for resistance values.

OTHER WIRE AND SHEATH DIAMETER COMBINATIONS AVAILABLE ON REQUEST.

E2 SPECIFY ACTUAL LENGTH IN FEET OR INCHES

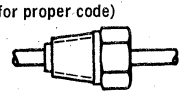
CONTROL PRODUCTS CORPORATION
4431 WEST DIVISION ST.
CHICAGO, ILLINOIS 60651
(312) 235-2340



F MOUNTING FITTINGS

(See chart for proper code)

FIXED FITTING



Used for mounting thermocouple assembly for fixed immersion. Fitting brazed to sheath.

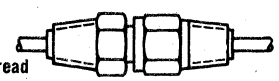
Available in brass and stainless steel.

ADJUSTABLE FITTINGS

Single Thread



Double Thread



ONE-TIME ADJUSTABLE COMPRESSION FITTING BRASS

Used where resistance to high temperature and corrosion are not required. Can be used to mount a thermocouple assembly at a given depth or mount a thermocouple head on a thermocouple assembly.

STAINLESS STEEL

Pressure rated to 10,000 PSI. Single or double thread. Single thread can be used for mounting a thermocouple assembly at a given depth, or to connect a thermocouple head to a thermocouple assembly. The double thread can be used for both purposes.

RE-ADJUSTABLE COMPRESSION FITTING

Pressure rated to 10,000 PSI.

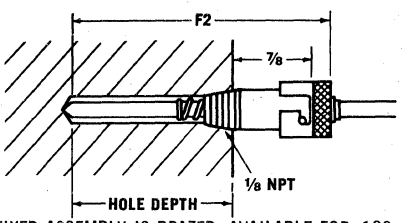
Single or double thread.

Can be reset at different positions along sheath. Neoprene is furnished as standard gland, lava and teflon furnished when specified.

BAYONET FITTING

Includes lockcap, spring and 7/8" long, 1/8" NPT adaptor. Holds thermocouple hot junction firmly against surface to be measured and permits thermal expansion of probe without damage to measuring junction.

Fixed assembly is brazed; available for .188 sheath only.



FIXED ASSEMBLY IS BRAZED; AVAILABLE FOR .188 SHEATH ONLY.

ADJUSTABLE ASSEMBLY USES COMPRESSION FITTINGS — AVAILABLE FOR .125 SHEATH ONLY.

FITTING SELECTION GUIDE

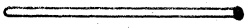
Sheath O.D.	Male N.P.T. Thread	Fixed		One-Time Adjustable			Re-adjustable		Bayonet Fittings	
		Brass Code No.	Stainless Steel Code No.	Brass Single Thread	Stainless Steel Single Thread	Stainless Steel Double Thread	Stainless Steel Single Thread	Stainless Steel Double Thread	Fixed	Adjustable
.062	1/8	F1	F11	F21	F31	F41	F51	F61	—	—
.125	1/8	F2	F12	F22	F32	F42	F52	F62	—	F82*
.188	1/8	F3	F13	F23	F33	F43	F53	F63	F73*	—
.250	1/8	F4	F14	F24	F34	F44	F54	—	—	—
.250	1/4	F5	F15	F25	F35	—	F55	F65	—	—
.312	1/4	F6	F16	F26	F36	—	F56	F66	—	—
.375	1/4	F7	F17	F27	F37	—	F57	F67	—	—

NOTES: *Add "A" to Code No. if adapter is required.

F2 SPECIFY IMMERSION LENGTH IN FEET OR INCHES

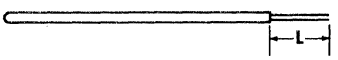
G TRANSITIONS OR TERMINATIONS

CODE G1 GLOB WELD TERMINATION



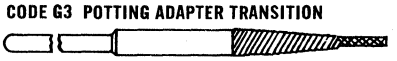
TIG welded seal allows long storage life. Weld can be removed easily and conductor stripped for use with any standard termination.

CODE G2 PLAIN STRIP



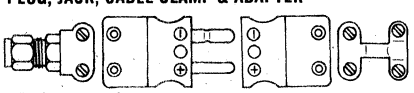
Standard strip on QC thermocouples will accommodate any type of termination. 1" long for diameters larger than .040. 5/8" long for diameters .040 and smaller. End sealed with silicone compound.

CODE G3 POTTING ADAPTER TRANSITION



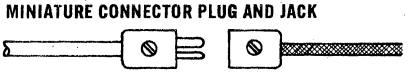
Provides protected transition and strain relief. Thermocouple wires are attached to leads. Available for all probe diameters up to 3/8". Epoxy potting used for temperatures to 400°F. Ceramic cement used for temperatures from 400°F. to 1000°F.

CODE G4—P, J, C & A PLUG, JACK, CABLE CLAMP & ADAPTER



Plug (G4P) and Jack (G4J) constructed of phenolic. Suitable for temperatures to 350°F. ISA color coded and calibration identified. Adapter (G4A) used with sheath conductor and Clamp (G4C) used with lead wire.

CODE G5P, G5J MINIATURE CONNECTOR PLUG AND JACK

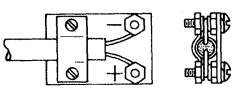


Designed for small diameter thermocouples up to .125 Dia.

Use where space is limited.

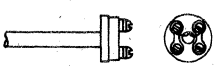
ISA color and polarity coded.

CODE G6 OPEN CONNECTOR BOARD



Phenolic block with hardware for mechanical connection. Polarity identified. For ambient temperatures to 250°F. Inexpensive for lab, test and OEM applications.

CODE G7 CERAMIC CONNECTOR

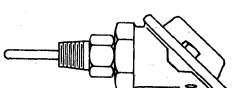


Ambient temperatures to 1000°F.

Available for 1/16, 1/8 and 1/4 diameter sheath.

CODE G8, G9, G10, G11 INDUSTRIAL THERMOCOUPLE HEADS



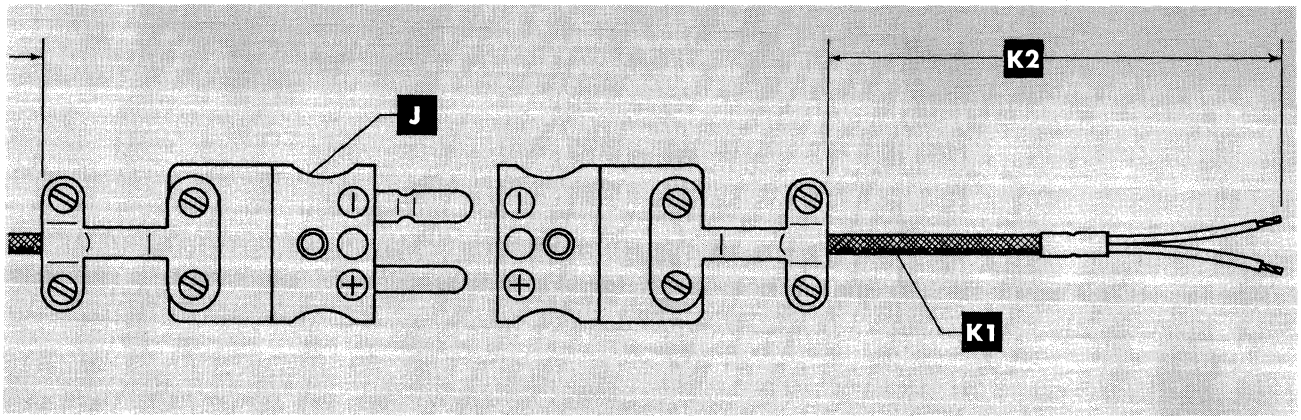


Aluminum or Cast Iron base with gasketed cover. Gasket is heat and moisture resistant.

SCREW COVER TYPE

Recommended for refineries, chemical plants, power generating stations and applications where protection is required against weather or high-temperature corrosive effects. Aluminum or Cast Iron.

	Screw Cover Head	General Purpose Head
Aluminum	G8	G10
Cast Iron	G9	G11



H1 and K1 LEAD AND EXTENSION WIRE

WIRE CONDUCTOR

The most accurate results are obtained when using the same type of lead wire as in the thermocouple. In many applications, as well as in precious metal thermocouples, extension wire may be used.

The most commonly used insulated solid wire is listed in the table below. Stock wire is indicated. Other wire can be furnished upon request.

INSULATIONS PVC/PVC

Polyvinyl is extruded on each bare conductor. A polyvinyl jacket is extruded over the insulated conductors. Offers good resistance to abrasion and moisture absorption. Can be used in temperatures from −20°F to +221°F. Used for outdoor and underground installation.

FELTED ASBESTOS/ASBESTOS BRAID (Asbestos/Asbestos)

Asbestos is woven over parallel insulated conductors. Bare conductors are covered with felted asbestos and asbestos braid jacket. Good for temperatures to 300°F.

SILICONE IMPREGNATED GLASS BRAID/SILICONE IMPREGNATED GLASS BRAID (Glass/Glass)

Each conductor is covered with glass yarn braid then impregnated with modified silicone resin. A silicone impregnated glass braid is applied overall. Moisture absorption resistance is retained to 400°F. Will withstand temperatures to 1000°F.

VITREOUS SILICA FIBER/VITREOUS SILICA FIBER (H-T Glass/H-T Glass)

A braid of vitreous silica fiber is applied to each conductor and overall. For use up to 1600°F. depending upon temperature limit of the wire. Will withstand temperature to 1800°F. if not subjected to flexing and abrasion.

OVERBRAID OR WRAP

Additional physical protection can be supplied by applying an overbraid or spiral metal wrap. Common materials used for this metallic shielding are stainless steel overbraid and stainless steel spiral wrap. Other available insulations include: Polyvinyl-Weatherproof Braid, Teflon-Teflon, Nylon-Nylon and Polyvinyl-Rip Cord construction.

ALL OTHER COMBINATIONS AVAILABLE

INSULATED LEAD WIRE

Code	ISA Calibration	Wire		Insulation		Nominal Size
		Gauge	Diameter	Each Wire	Overall	
H1	K	14	.064	Asbestos	Asbestos	.178 x .286
H2	K	20	.032			.142 x .214
H3	K	20	.032		Glass	.053 x .094
H4	K	20	.032	H.T. Glass	H.T. Glass	.102 x .174
H5	K	20	.032	Glass	Glass	.057 x .102
H6	K	24	.020			.045 x .078
H7	J	14	.064	Asbestos	Asbestos	.190 x .300
H8	J	20	.032	Asbestos	Glass	.065 x .120
H9	J	20	.032			.057 x .102
H10	J	24	.020			.045 x .078
H11	T	20	.032			.057 x .102
H12	T	24	.020			.045 x .078

INSULATED EXTENSION WIRE

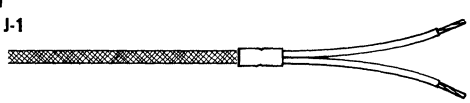
Code	ISA Calibration	Wire		Insulation		Nominal Size
		Gauge	Diameter	Each Wire	Overall	
H31	KX	14	.064	Asbestos	Asbestos	.178 x .286
H32	KX	14	.064	PVC	PVC	.136 x .236
H33	KX	16	.051			.123 x .210
H34	KX	20	.032			.100 x .165
H35	JX	14	.064	Asbestos	Asbestos	.178 x .286
H36	JX	14	.064	PVC	PVC	.136 x .236
H37	JX	16	.051			.123 x .210
H38	JX	20	.032			.100 x .165
H39	TX	16	.051			.123 x .210
H40	TX	20	.032			.100 x .165
H41	WX*	24	.020	Asbestos	Glass	.062 x .112
H42	SX-RX**	16	.051	Asbestos	Asbestos	.160 x .260

*Tungsten 5% Tungsten 26% Rhenium compensating extension wire.
**Platinum/Platinum–10% Rhodium or Platinum/Platinum–13% Rhodium.

H2 and K2 SPECIFY ACTUAL LENGTH IN INCHES OR FEET

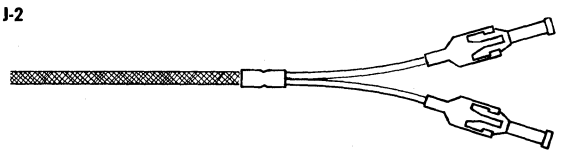
J WIRE TERMINATIONS

CODE J-1



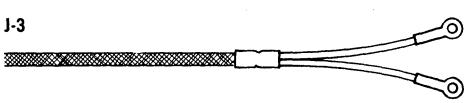
Each conductor extends 2″ beyond the overall insulation and has exposed wire lead. The insulation ends are protected with heat shrinkable tubing.

CODE J-2



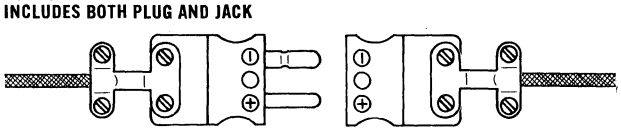
Terminal Lugs—Quick Connect Type crimped to stripped lead wire provides inexpensive connection.

CODE J-3



Ring Tongue for #8-10 screw.

CODE J-4
INCLUDES BOTH PLUG AND JACK



The standard plug and jack described in G-4 may be used with lead wire for connecting to an instrument panel. A cable clamp will be supplied in place of the tube adapter. Advise at time of ordering if plug or jack is not required.

to order specify...

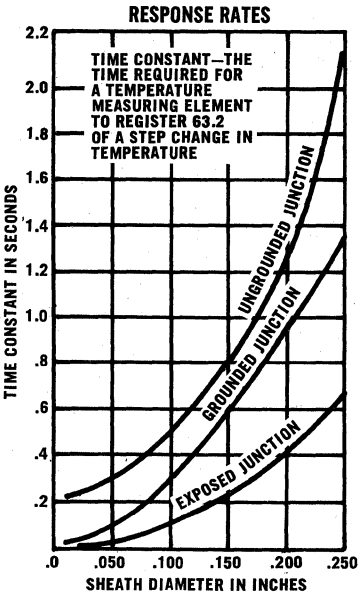
A	B	C	D	E1	E2	F1	F2	G	H1	H2	J	K1	K2
Junction	Thermocouple Wire	Insulation Material	Sheath Material	Sheath O.D.	Sheath Length Specify in. or ft.	Mounting Fitting Code	Immersion Depth Specify in. or ft.	Transition or Termination Code	Wire Code	Wire Length Specify in. or ft.	Wire Termination Code	Wire Code	Length Specify in. or ft.

THERMOCOUPLE REFERENCE DATA

THERMOCOUPLE WIRE SELECTION

ISA Code	Conductor Characteristics: Positive	Conductor Characteristics: Negative	Temperature Range (°F)	Limits of Error: Standard	Limits of Error: Special	Application Notes
J	Iron (Magnetic)	Constantan (Non-Magnetic)	0 to 530	±4°F	±2°F	Reducing atmosphere recommended.
			530 to 1400	±¾%	±⅜%	
T	Copper	Constantan (Silver metal)	−75 to 200	±1½°F	±¾°F	Can be used in oxidizing or reducing atmospheres; corrosion resistant.
			200 to 700	±¾%	±⅜%	
K	Chromel (Non-Magnetic)	Alumel (Magnetic)	0 - 530	±4°F	±2°F	Oxidizing atmosphere recommended.
			530 to 2300	±¾%	±⅜%	
E	Chromel	Constantan	0 - 600	±3°F		Oxidizing atmosphere recommended. Highest emf output.
			600 to 1600	±½%	±⅜%	
S	Platinum-10% Rhodium	Platinum	0 - 1000	±5°F	±2½°F	Oxidizing atmosphere recommended. Easily contaminated.
			1000 - 2700	±½%	±¼%	
R	Platinum-13% Rhodium	Platinum	0 - 1200	±5°F	±2½°F	Same conditions as 10% above but has slightly higher emf.
			1200 - 2700	±½%	±¼%	
P6	Platinum-30% Rhodium	Platinum-6% Rhodium	1000 to 3175	±½%	—	Higher strength alloys than type S or R. Reduces drift in emf.
I	40% Iridium-60% Rhodium	Iridium	to 3600	—	—	Inert or vacuum atmospheres. Limited life in oxygen carrying atmospheres.
W	Tungsten	Tungsten-26% Rhenium	32 to 800	±8°F	—	Needs protective atmosphere such as hydrogen, inert gas or vacuum.
			800 to 4200	±1%		
W3	Tungsten-3% Rhenium	Tungsten-25% Rhenium	to 4350	±2%	—	Similar to Type W except greater ductility in positive leg.
W5	Tungsten-5% Rhenium	Tungsten-26% Rhenium	32 to 800	±8°F		Higher mechanical strength than Type W. Higher emf to 3400°F.
			to 4100	±1%		
G	Geminol P	Geminol N	0 to 2300	±¾%		Better stability of emf at high temperature.
C	Copper	Gold 2.1% Cobalt	−425 to 32	—		

JUNCTION RESPONSE TIME COMPARISON

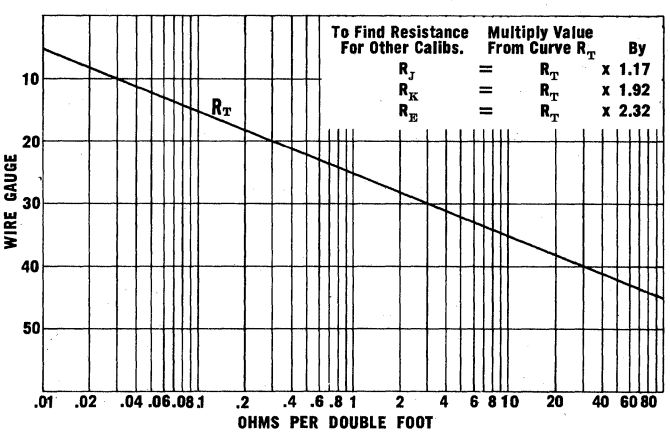


SHEATH SELECTION GUIDE

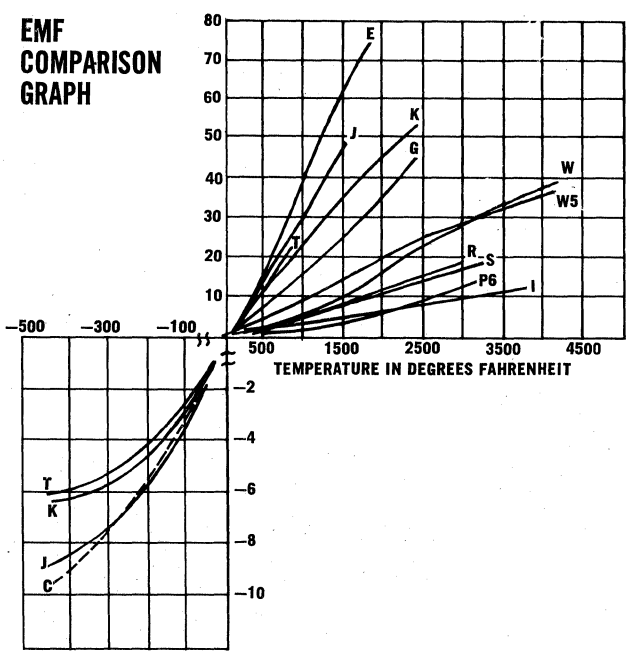
Material	Recommended Max. Temperature °F	Environment: Oxidizing	Environment: Hydrogen	Environment: Inert	Environment: Vacuum
Titanium	1000	Good to 800°F	Poor	Good	Good
304SS	1650	Very Good	Good	Very Good	Very Good
316SS					
347SS					
446SS	1800				
310SS	2000				
Inconel 600	2100				
Inconel 702	2400				
Platinum	3050		Poor		Poor
Tantalum	4500	Poor		Good	Very Good

WIRE RESISTANCE IN OHMS PER DOUBLE FOOT

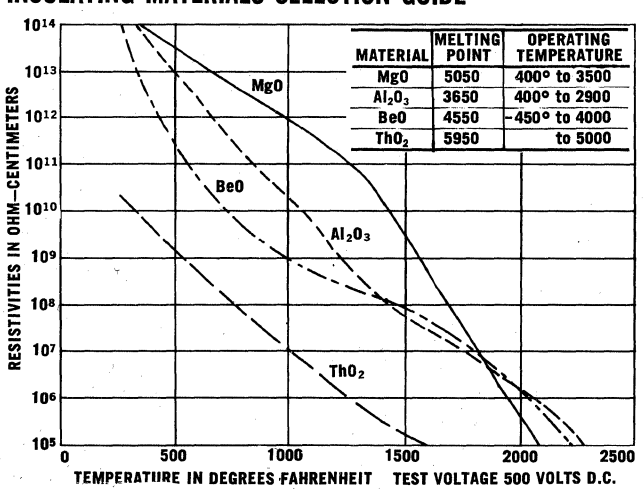
AT 70°F. SHOWN FOR "T" CALIBRATION (R_T)



EMF COMPARISON GRAPH



INSULATING MATERIALS SELECTION GUIDE



MATERIAL	MELTING POINT	OPERATING TEMPERATURE
MgO	5050	400° to 3500
Al_2O_3	3650	400° to 2900
BeO	4550	450° to 4000
ThO_2	5950	to 5000

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QC SHEATH CONDUCTOR FOR THERMOCOUPLES AND LEAD WIRES

QC SHEATH CONDUCTOR consists of metal conductors surrounded by mineral insulation and covered by a metal sheath. QC is drawn to size and annealed producing an assembly with circular cross-section wires, hard packed high resistance insulation with maximum di-electric strength, high thermal conductivity and an outer metal sheath with the heaviest wall thickness available. Only the finest quality materials are used in making QC SHEATH CONDUCTOR to ensure long service life.

EASILY USED

- QC can be formed about a minimum radius twice its sheath diameter without changing the electrical characteristics of the conductor.
- QC can be brazed or welded.
- QC can be used with standard tube or compression fittings.
- QC conductors can be held to specific wire diameters or resistance.
- QC can be flattened without impairing electrical qualities.
- QC can be spliced for longer lengths.

ADVANTAGES

QC SHEATH CONDUCTOR is available in an almost infinite number of combinations of materials and conductor configurations. Many of the more common are shown in Table. A list of common sheath material, insulation material and conductors is shown in Tables.

QC SHEATH CONDUCTOR offers the following outstanding advantages:

- A heavier wall resulting in increased life of sheath in corrosive or high temperature applications.
- Can be used at temperatures above 1000°F.
- Can be used without additional protection.

These tables contain standard materials and configurations. QC is available in any diameter from .010 to .437. Any sheath and wire material that is malleable can be used in constructing QC. Configurations including square and rectangular cross sections can be provided. QC has been fabricated with as many as 24 conductors. QC can be made with the number of conductors and configurations to meet any requirement.

TABLE I

PHYSICAL DIMENSIONS OF SHEATH AND WIRE FOR TWO CONDUCTOR QC (CO-AX) FIGURE 1

Code	Sheath O.D.	Sheath Wall	Conductor Diameter*	Maximum Unspliced Length in Feet
E1	.010	.002	.002	10
E2	.025	.005	.004	150
E4	.040	.008	.006	500
E6	.062	.012	.010	500
E12	.125	.020	.022	400
E18	.188	.028	.034	170
E25	.250	.036	.048	95
E31	.312	.046	.060	60
E38	.375	.055	.070	45
E44	.437	.065	.083	34

FOR PRECIOUS METAL THERMOCOUPLES

E91	.010		(TO BE SPECIFIED AS REQUIRED)	
E92	.025		(TO BE SPECIFIED AS REQUIRED)	
E94	.040	.006	.005	20
E96	.062	.010	.010	20
E912	.125	.015	.020	25
E918	.188	.015	.025	30
E925	.250	.022	.032	30
E931	.312		(TO BE SPECIFIED AS REQUIRED)	
E938	.375		(TO BE SPECIFIED AS REQUIRED)	
E944	.437		(TO BE SPECIFIED AS REQUIRED)	

*See reference data for resistance values.
OTHER WIRE AND SHEATH DIAMETER COMBINATIONS AVAILABLE ON REQUEST.

TABLE II CONFIGURATION TABLE

OTHER CONFIGURATIONS AVAILABLE ON REQUEST.

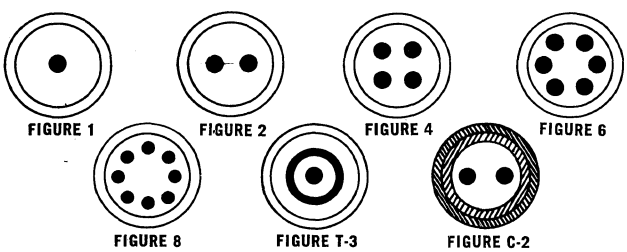


TABLE III QC CONDUCTOR

T/C Wire Material Code	T/C Wire Material Type	Other Wire Material Code	Other Wire Material Type
BT	Copper/Constantan	B10	Stainless Steel
BJ	Iron/Constantan	B11	Nickel Clad Copper
BK	Chromel/Alumel	B12	Nichrome
BE	Chromel/Constantan	B13	Inconel
BS	Platinum/Platinum–10% Rhodium	B14	Precious Metals
BR	Pt/Pt–13% Rh	B15	Nickel
BP6	Pt–6% Rh/Pt–30% Rh	B16	Copper
BI	40% Iridium–60% Rh/Iridium	B17	Magnesium
BAW	Tungsten/Tungsten–26% Rhenium	B18	Aluminum
BW3	W–3% Re/W–25% Re	B19	Cobalt
BW5	W–5% Re/W–26% Re	B20	Tantalum
BG	Geminal P/Geminal N	B21	Zirconium
BC	Copper/Gold–2.1% Cobalt	B22	Vanadium
		B23	Manganin
		B24	Nickel-Iron Alloy

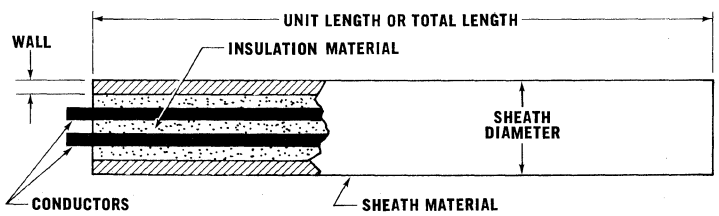
TABLE IV INSULATION MATERIAL

Code	Material	Maximum Recommended Operating Temperature
CM	MgO	3500°F
CA	Al_2O_3	2300
CB	BeO	4000
CT	ThO_2	5000

TABLE V SHEATH MATERIAL

Code	Metal	Code	Metal	Code	Metal
D11	Copper	D18	348 SS	D25	Inconel 702
D12	Titanium	D19	446 SS	D26	Platinum
D13	Cupro-Nickel	D20	310 SS	D27	Pt–10%Rh
D14	304 SS	D21	Hastalloy C	D28	Pt–20% Rh
D15	316 SS	D22	Inconel 600	D29	Columbium
D16	321 SS	D23	Hastalloy X	D30	Molybdenum
D17	347 SS	D24	Nickel	D31	Tantalum

HOW TO ORDER QC SHEATH CONDUCTOR



to order specify...

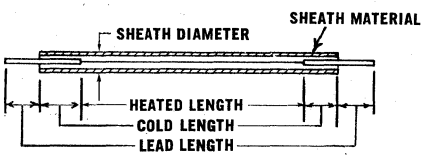
- SHEATH O.D. (TABLE I)
- CONDUCTOR CONFIGURATION (TABLE II)
- CONDUCTOR MATERIAL (TABLE III)
- INSULATION MATERIAL (TABLE IV)
- SHEATH MATERIAL (TABLE V)
- TOTAL AMOUNT (SPECIFY ACTUAL DIMENSIONS IN FEET OR INCHES) (SEE TABLE I)
- MINIMUM ACCEPTANCE LENGTH
- SPECIAL TESTS (DESCRIBE)

QC HEATING ELEMENTS

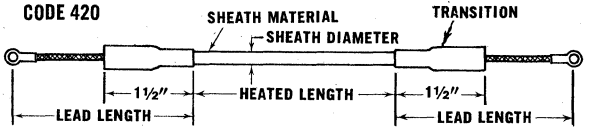
QC HOTWATT heaters are manufactured with the highest quality material and techniques producing elements that have long, dependable operating life with more heat in less space. The densely compacted assembly offers the most efficient heat transfer with the lowest possible temperature gradient between wire and sheath. QC heaters are available in virtually unlimited lengths, in a variety of diameters from .040 up to .430 and in any watt-density required.

SINGLE CONDUCTOR ELEMENTS

CODE 410

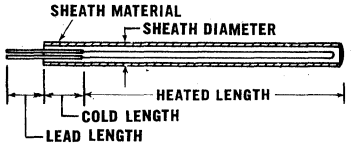


CODE 420

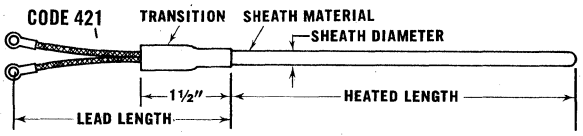


TWO CONDUCTOR ELEMENTS

CODE 411



CODE 421



APPLICATIONS

Typical applications for QC HOTWATT heaters include:

- Heat tracing of pipe lines
- Heating valve mechanisms and other flow controls
- Heating vessels—interior and exterior
- Heating extrusion molding nozzles
- Heating plastic forming machinery
- De-icing of weather instruments
- De-icing of weather-exposed surfaces including sidewalks, roadways and bridges

MATERIALS

Stainless Steel or Inconel sheath, Magnesium Oxide insulation and Resistance wires are the choice materials for most QC heater applications. However, the basic construction is available in whatever materials suit your application. Our engineers will suggest appropriate materials to solve any specific application.

WORKABILITY

- QC HOTWATT Elements can be brazed, welded, clamped or staked in place.
- QC HOTWATT Elements can be formed, coiled and flattened when attached to irregular shaped objects for improved heat transfer.
- QC HOTWATT Elements can be cast, molded and imbedded in machined assemblies, concrete and plastics.

to order specify...

CODE _____ QUANTITY _____

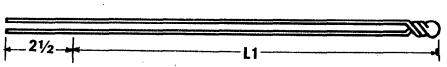
- SHEATH MATERIAL
- SHEATH DIAMETER
- HEATED LENGTH
- COLD LENGTH
- LEAD LENGTH
- WATTS
- VOLTS
- REQUIRED WATT DENSITY
- APPROXIMATE OPERATING TEMPERATRUE
- BRIEF DESCRIPTION OF APPLICATION

WE SUGGEST YOU GIVE US A BRIEF DESCRIPTION OF YOUR REQUIREMENT. OUR ENGINEERS MAY BE ABLE TO OFFER SATISFACTORY ALTERNATIVE MATERIALS FOR YOUR APPLICATION WHICH WILL RESULT IN A MORE ECONOMICAL HEATER FOR YOU.

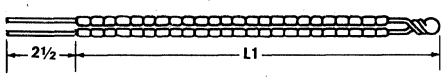
QC REPLACEMENT THERMOCOUPLE ELEMENTS

CONTROL PRODUCTS CORP. supplies all types of General Purpose replacement thermocouple elements and also special purpose assemblies built to exacting customer specifications. QC base metal thermocouples have a junction that is twisted and welded for mechanical strength and long life. QC precious metal thermocouples have butt-welded hot junctions. Standard limits of error will apply to all assemblies unless otherwise specified.

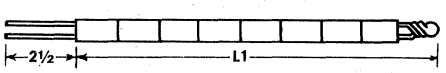
CODE 1—BARE WIRE ELEMENTS



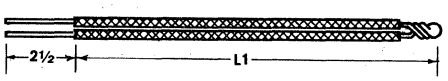
CODE 2—ELEMENTS WITH SINGLE HOLE INSULATORS



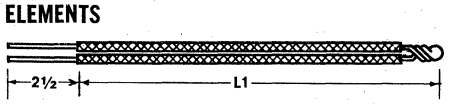
CODE 3—ELEMENTS WITH DOUBLE HOLE INSULATORS



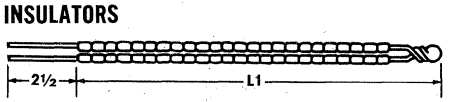
CODE 4—FIBERGLASS COVERED ELEMENTS



CODE 5—ASBESTOS TUBING COVERED ELEMENTS



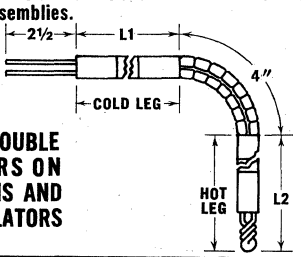
CODE 6—ELEMENTS WITH FISH SPINE INSULATORS



AVAILABILITY CHART

		WIRE TYPE									ASSEMBLY TYPE								
		BARE WIRE BASE METALS				BARE WIRE EXOTIC AND PRECIOUS METALS					ELEMENTS								
Wire Gauge	Diameter	Chromel/Alumel	Chromel/Constantan	Iron/Constantan	Copper/Constantan	W/W–26% Re	W–3%/W–25% Re	W–5%/W–26% Re	Pt/Pt–10% Rh	Pt/Pt–13% Rh	Bare Wire	Single Hole	Double Hole	Fiberglass	Asbestos	Fish Spine	Comb. Bond Type	Diameter	Wire Gauge
Wire	Code →	BK	BE	BJ	BT	BAW	BW3	BW5	BS	BR	1	2	3	4	5	6	7	← Assembly Code	
56	.0005	All Sizes Available On Special Order									Standard Insulators With Wire Sizes Other Than Shown May Be Combined for Special Assemblies							.0005	56
50	.001																	.001	50
44	.002																	.002	44
40	.003																	.003	40
36	.005																	.005	36
32	.008																	.008	32
30	.010	•	•	•	•	•	•	•	•	•	•							.010	30
28	.012	•	•	•	•						•							.012	28
26	.015	•	•	•	•						•							.015	26
24	.020	•	•	•	•	•	•	•	•	•	•		•					.020	24
22	.025	•	•	•	•						•	•	•					.025	22
20	.032	•	•	•	•						•	•	•	•	•			.032	20
18	.040	•	•	•	•						•							.040	18
16	.051	•	•	•	•						•					•	•	.051	16
14	.064	•	•	•	•						•	•	•	•	•	•	•	.064	14
12	.081	•	•	•	•						•							.081	12
10	.102	•	•	•	•						•							.102	10
8	.128	•	•	•	•						•		•	•	•	•	•	.128	8
6	.162	•	•	•	•						•	•						.162	6

The foregoing illustrations and chart show combinations of stock materials available for replacement thermocouple assemblies.



CODE 7 — WITH DOUBLE HOLE INSULATORS ON STRAIGHT SECTIONS AND FISH SPINE INSULATORS AT BEND

to order specify...

- ASSEMBLY CODE
- GAUGE
- WIRE TYPE CODE
- LENGTH:
  - L1.....(INCHES)
  - L2.....(INCHES) CODE 7 ONLY
- QUANTITY

QC THERMOCOUPLE COMPONENTS

QC THERMOCOUPLE WIRE

CONTROL PRODUCTS CORPORATION offers a wide variety of bare and insulated thermocouple wire from stock for 24 hour delivery. These wires are stocked in matched pairs to ISA Standard Limits of Error. Individual bare wires are available, matched pairs to ISA special Limits of Error are available.

AVAILABILITY CHART

		Bare Wire									Insulated Thermocouple Wire							
		Base Metals				Exotic & Precious Metals					Lead				Extension			
		WIRE TYPE AND CODE																
		BK	BE	BJ	BT	BAW	BW5	BW3	BS	BR	H2	H3	H4	H5	K13	K14		
Wire Gauge	Diameter	Chromel/Alumel	Chromel/Constantan	Iron/Constantan	Copper/Constantan	Tungsten/Tungsten—26% Rhenium	W—5% Re/W—26% Re	W—3% Re/W—25% Re	Platinum/Platinum—10% Rhenium	Pt/Pt—13% Rh	Felted Asbestos/Asbestos Braid	Felted Asbestos/Glass Braid	Vitreous Silicone Fiber Braid/Vitreous Silicone Fiber Braid	Glass Braid/Glass Braid	Felted Asbestos/Asbestos Braid	PVC/PCV	Diameter	Wire Gauge
30	.010	•	•	•	•	•	•	•	•	•							.010	30
28	.012	•	•	•	•												.012	28
26	.015	•	•	•	•												.015	26
24	.020	•	•	•	•	•	•	•	•	•				K,J,T			.020	24
22	.025	•	•	•	•												.025	22
20	.032	•	•	•	•						K	K,J	K	K,J,T		KX,TX JX	.032	20
18	.040	•	•	•	•												.040	18
16	.051	•	•	•	•											KX,TX JX	.051	16
14	.064	•	•	•	•						K				KX,JX	KX,JX	.064	14
12	.081	•	•	•	•												.081	12
10	.102	•	•	•	•												.102	10
8	.128	•	•	•	•												.128	8
6	.162	•	•	•	•												.162	6

COMPENSATING EXTENSION WIRE

Code	Diameter	Type	Used With
H41	.020	Felted Asbestos/Glass Braid	W—5% RE/W—26% Re
H42	.051	Felted Asbestos/Asbestos Braid	Pt/Pt—10% Rh
			Pt/Pt—13% Rh

to order specify...

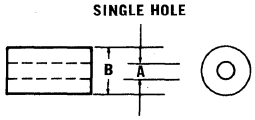
- GAUGE (OR CODE FOR COMPENSATING EXTENSION WIRE)
- CALIBRATION LETTER (FOR INSULATED WIRE ONLY)
- WIRE TYPE CODE
- TOTAL QUANTITY (FEET, INCHES OR POUNDS)

QC INSULATORS

QC insulators are made of high quality ceramic and are available in the shapes and sizes shown below. These insulators may be used with any thermocouple wires. Insulators may be used to 2500°F., except those with asterisk (*), which may be used to 3000°F.

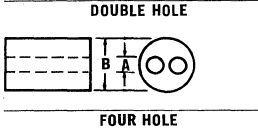
NOMINAL DIMENSIONS IN INCHES

SINGLE HOLE



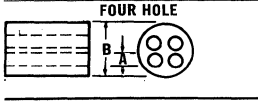
Wire Size Ga.	Wire Size Dia.	A Bore	B OD	Length	Code
* 6	.162	.187	.352	1	C10
*14	.064	.093	.144	1	C11
*14	.064	.093	.144	3	C12
*14	.064	.078	.125	12	C13
20	.032	.046	.073	2	C14
*22	.025	.031	.062	12	C15
*22	.025	.028	.058	3	C16

DOUBLE HOLE



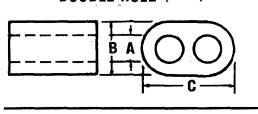
8	.128	.154	.490	1	C20
14	.064	.073	.245	1	C21
14	.064	.073	.245	2	C22
14	.064	.073	.245	6	C23
*20	.032	.040	.250	12	C24
*22	.025	.031	.125	1	C25
*22	.025	.031	.125	12	C26

FOUR HOLE



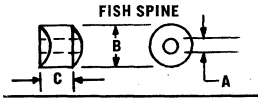
*14	.064	.085	.312	1	C40
*16	.051	.046	.187	1	C41

DOUBLE HOLE (Oval)



Wire Size Ga.	Wire Size Dia.	A	B	C	Length	Code
8	.128	.156	.284	.500	1	C30
14	.064	.080	.188	.313	1	C31
14	.064	.080	.188	.313	2	C32
20	.032	.042	.118	.172	1	C33
22	.025	.028	.091	.144	1	C34
24	.020	.028	.091	.144	3	C35

FISH SPINE



Wire Size Ga.	Wire Size Dia.	A	B	C	Approx. Quantity per lb.	Code
8	.128	.156	.40	.40	360	C50
14	.064	.092	.20	.20	3100	C51
16	.051	.068	.17	.17	5200	C52

QC SHEATH THERMOCOUPLE CONDUCTOR

QC Sheath Conductor is stocked for "Off The Shelf" delivery with Inconel or Type 304 Stainless Steel Sheath and Magnesium Oxide (Mg 0) insulation. 15 foot minimum random lengths and ISA Standard Limits of Error will be supplied unless otherwise specified.

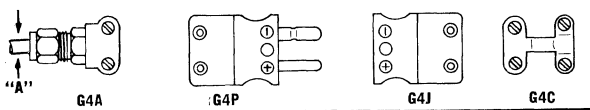
STOCKED QC SHEATH CONDUCTOR

CALIBRATION		SHEATH MATERIAL		DIMENSIONS		
Code	Type	Code	Type	Code	Outside Dia.	Nom. Dia. of Wire
BT	Copper/Con	D14	304SS	E1	.010	.002
BJ	Iron/Con	D22	Inconel 600	E2	.025	.004
BK	Chrom/Alum			E4	.040	.006
				E6	.062	.010
				E12	.125	.022
				E18	.188	.034
				E25	.250	.048
				E31	.312	.060
				E38	.375	.070
				E44	.437	.083

to order specify...

- TOTAL QUANTITY OR FEET
- CALIBRATION CODE
- SHEATH MTL. CODE
- DIA. CODE
- UNIT LENGTH IF REQUIRED

PLUGS AND JACKS



Tube Adapter CODE	Tube Adapter "A"	Plug and Jack ISA Calibration Code G4P-G4J	Cable Clamp Code 64C
G4A1	1/16	J, K or T	G4C Universal size
G4A2	1/8		
G4A3	3/16		
G4A4	1/4		

to order specify...

PLUG G4P
- CALIBRATION
- QUANTITY

JACK G4J
- CALIBRATION
- QUANTITY

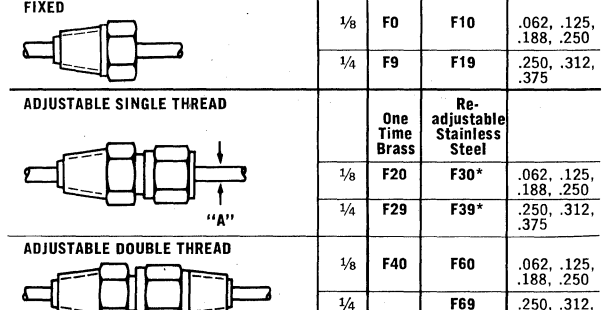
TUBE ADAPTER G4A
- CODE
- CALIBRATION
- QUANTITY

CABLE CLAMP G4C
- CODE
- QUANTITY

QC FITTINGS

QC Fixed and Adjustable fittings are available in stainless steel and brass. Consult factory for special requirements.

	NPT	Code Brass	Code Stainless Steel	Specify "A" Available in
FIXED	1/8	F0	F10	.062, .125, .188, .250
	1/4	F9	F19	.250, .312, .375
ADJUSTABLE SINGLE THREAD		One Time Brass	Re-adjustable Stainless Steel	
	1/8	F20	F30*	.062, .125, .188, .250
	1/4	F29	F39*	.250, .312, .375
ADJUSTABLE DOUBLE THREAD	1/8	F40	F60	.062, .125, .188, .250
	1/4		F69	.250, .312, .375



*Add suffix "R" for re-adjustable fitting.

to order specify... • CODE • "A" DIMENSION

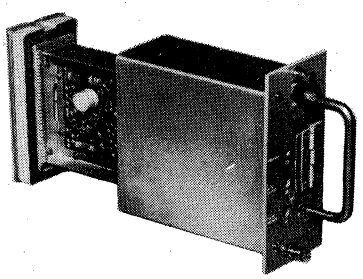
CONTROL PRODUCTS CORPORATION
4431 WEST DIVISION ST.
CHICAGO, ILLINOIS 60651
(312) 235-2340

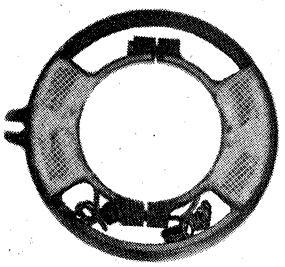
THERMAL ENGINEERING FOR MILITARY AND AEROSPACE REQUIREMENTS

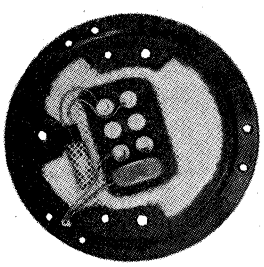


COX & COMPANY, INC. is the largest manufacturer of custom made heating elements and temperature control systems for the aerospace industry. Whatever your problem in temperature control of instruments, electronic equipment, devices, and components, for aerospace and military usage, Cox has probably already solved a similar one. Over 8,500 different designs have been produced, ranging from tiny thermostat anticipator heaters to large fiber glass air inlets for jet engines with integral anti-icing heaters and temperature sensors.

Special oven to hold 60° ±2°C in any ambient from -5 +55°C. Warm-up time 20 minutes max. Designed for plug-in service and immediate access to circuit board for repairs.





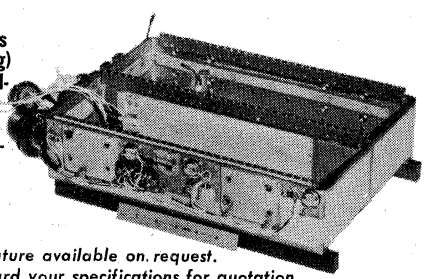


Gyro supports, mass produced for a critical missile program. The metalwork is also supplied by Cox & Company, Inc.

Heater resistance tolerance ±3%

Temperature sensor; resistance tolerance ±.064% at 133°F.

Missile telemetering system chassis (less outer-housing) for 22 plug-in modules maintains temperature stability despite accidental spillage of liquid oxygen.



Literature available on request. Forward your specifications for quotation.

HEATING ELEMENTS

Thermowire(P) and **Thermopatch**(P) heaters afford the maximum reliability for lowest cost and weight.

Over a million heaters have been put in military usage with no reported failures in normal service. These elements are usually cemented on components with Cox Heating Element Adhesive No. 28 (a special epoxy formulation). Designs can be made to fit any shape including compound curvatures and any desired wattage distribution.

Thermolastic heaters are made from a wide variety of special formulations of silicone, neoprene, urethane, and other elastomers, each developed to meet special requirements. For example, Cox Spec. 4500 is specially formulated for use in sealed systems where silicones would be detrimental to slip rings and electrical contacts. They are vulcanized to customers' parts, or furnished flat, or molded-to-shape as required for installation by customers. Under suitable conditions, wattages can be as high as 50/sq. in.

(P) Patented

TEMPERATURE SENSORS

Cox & Company, Inc. produces custom resistance-type sensors of the highest accuracy and stability. They are designed to be cemented in place and can be integrally combined with a heating element, if desired.

TEMPERATURE CONTROL SYSTEMS

Cox & Company, Inc. has the most experienced personnel and the finest facilities for the evaluation of special heating problems. The wealth of accumulated knowledge (over 8,000 designs) enables Cox to meet the most difficult specifications quickly and economically.

OVENS FOR CRYSTALS AND COMPONENTS

Cox & Company, Inc. is a major source of special ovens, custom designed to meet otherwise unobtainable performance requirements. Fast warm-ups, down to 2 minutes from any ambient, and stability within ±.003°C over an ambient range of -65°C to +140°C are examples of performance Cox has designed and produced in large volume.

COX & COMPANY, INC.

ENGINEERS AND MANUFACTURERS OF ELECTRICAL HEATING EQUIPMENT

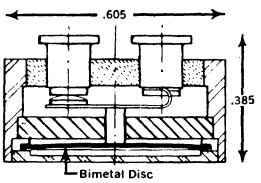
215 PARK AVENUE SOUTH • NEW YORK, N.Y. 10003 • (212) OR 4-4727 TWX: 710-581-2839

ELMWOOD® SUB-MINIATURE SNAP-ACTION THERMOSTATS

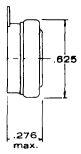
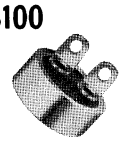
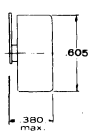
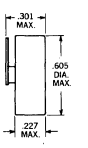
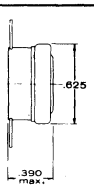
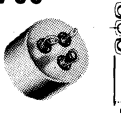
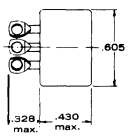
Elmwood thermostats are engineered for quick thermal response. Their heart is the bimetallic snap-acting disc which has proven highly reliable and serviceable over hundreds of thousands of cycles. Elmwood precision thermostats are manufactured and tested to conform to military specifications MIL-E-5272. Nickel plating is standard; other plating available. A variety of brackets and studs, as shown, are standard.

- Many mounting arrangements
- Thermal Range from —65° to +550°F
- Proven Military and Civilian Performance Record
- Narrow or Wide Differential
- Rated to 15 Amps.
- Immediate Delivery
- Custom Packaging

When contacts are closed, current passes from terminal to terminal through the stationary contact to the movable contact, which is actuated by the snap movement of bimetal disc. This disc, which is fully insulated from the switch chamber by the pin and disc retainer, is affected by surface or ambient temperature changes only. Upon reaching the opening temperature, the disc snaps from a concave to a convex shape, releasing the pin which opens the contacts. The open circuit allows the temperature to drop and causes the disc to snap to its original position, closing the contacts. A thermostat which closes on a rise in temperature operates in a similar manner, but in reverse action.



ELMWOOD #3100

DESCRIPTION		ELECTRICAL RESISTIVE VOLTS	AMPS	THERMAL EXPOSURE	DIFF.	TOL.
3001   **Terminal T-123**	Precise, reliable unit for electronic communications, missile and aircraft controls, heater blanket controls and crystal ovens. This inexpensive unit is factory-calibrated, has the highest quality operating parts, a phenolic base and metal closure. These assure maximum dust protection and high thermal and electrical dependability. It is available with a variety of mountings and terminals.	30 AC/DC	6	−65°F to +350°F	Wide 12°F or more STD	Wide ±5°F STD
		125 AC	6		Narrow 6°F Max.	Narrow ±3°F Min.
		250 AC	3		Avail. 80 to 200°F	
3100   **Terminal T-116**	This thermostat is hermetically sealed with high compression glass and heliarc welded steel case. It is so constructed as to withstand the severest environmental conditions such as altitude, shock, vibration and corrosive atmosphere. It has been extensively tested by government agencies, and has been used for many government and civilian purposes, such as aircraft warning controls, de-icing equipment, etc. Ideal for packaging in special enclosures.	30 AC/DC	6	−65°F to +550°F	Wide 12°F or more STD	Wide ±5°F STD
		125 AC	6		Narrow 6°F Max.	Narrow ±3°F Min.
		250 AC	3		Avail. 80 to 200°F	
3150   **Terminal T-109**	Low silhouette SPST switch, hermetically sealed, available narrow or wide differential as standard. Temperature calibrations pre-set at factory, 100% inspected. Open or close on temperature rise. Heliarc welded in steel housing, glass-to-metal seal at terminal junction. Maximum resistance to shock and vibration. Ideal for use in heater blankets, computers, crystal ovens, electronic and radar equipment, gyros, airborne de-icers, etc.	30 AC/DC	4	−65°F to +350°F	Narrow 6°F Max. Avail. 50 to 225°F	Narrow ±3°F STD
		125 AC	4		Wide 12°F or more STD	Wide ±5°F STD
3450   **Terminal T-101**	This inexpensive control unit is designed with either phenolic (up to 300°F) or ceramic base, and has a tight-fitting dust-proof metal closure. It is recommended for applications where its heavy electric construction makes it ideal to control high amperage uses.	30 AC/DC	15	−65°F to +350°F	10°F Min.	±5°F STD
		125 AC	15			
		250 AC	8			
3700   **Terminal T-130**	A precision, single-pole double-throw, hermetically glass sealed, heliarc welded thermostat that is engineered to instantaneously reverse a signal from one circuit to another. Airborne and ground control equipment are ideal uses for this highly reliable thermal switch.	30 AC/DC	2	−65°F to +350°F	12°F Min.	±5°F Min.
		125 AC	3			
		250 AC	2			

AVAILABLE MOUNTING BRACKETS

FIG. B208

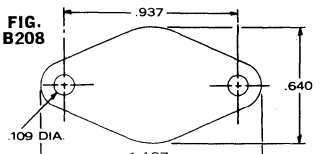


FIG. B209

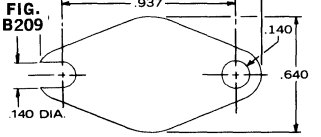


FIG. B210

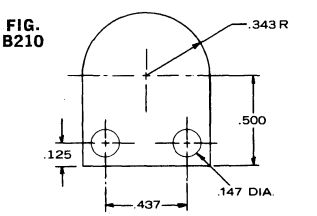


FIG. B211

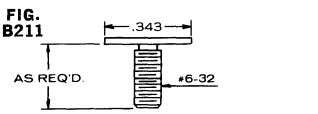


FIG. B212

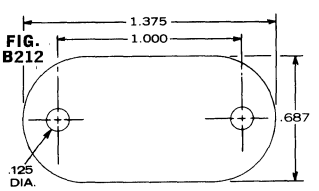
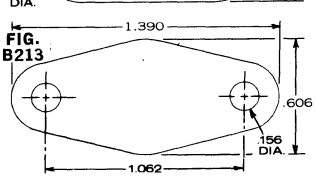
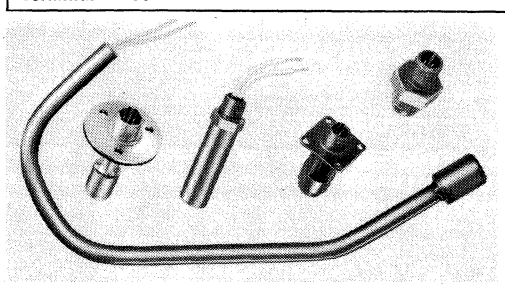


FIG. B213





EXAMPLES OF CUSTOM PACKAGING

Write or phone for individual consultation with Elmwood's thermal engineers for special applications.

SAMPLES AND ORDERING In order to facilitate furnishing of proper samples, the following information will be required:

APPLICATION
Description — military, electronic, commercial
Function — limit, control
Environmental conditions — moisture, shock, vibration, etc.

TEMPERATURE EXPOSURE
Maximum, minimum

LOADS, MOUNTING
Resistive or inductive
Amperage and voltage
Mounting — see diagrams above

CALIBRATION
Normal operating temperature
Opening tolerance
Differential
Closing tolerance

Elmwood also features a U.L. approved line of low-cost thermostats for Commercial Applications. Ask for Folder.

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THERMISTORS from FENWAL ELECTRONICS

Broadest Thermistor Line Available Anywhere

1. GLASS COATED BEADS — used where small size, fast response, high precision, stability, and temperatures to 600°F are required.

2. GLASS PROBES — medium-small in size. Many of the advantages of beads but rugged, more easily mounted, useful in liquid media.

3. ISO-CURVE* INTERCHANGEABLE THERMISTORS—these units available in bead or glass probe configuration, follow standard curves over wide temperature range, and are completely interchangeable. Units match standard curves as close as ±½% of resistance or as required.

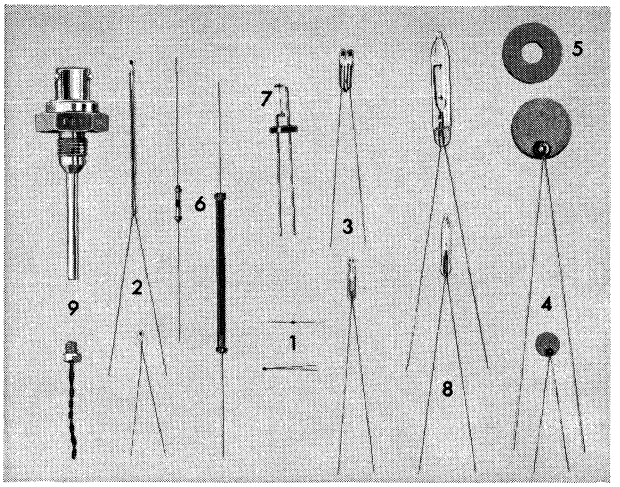
4. DISCS — used where medium power dissipation is a requirement and space not a problem. Useful to 300°F.

5. WASHERS — used where high power dissipation is a prime requirement.

6. RODS — these units have power dissipation intermediate between discs and washers and are also used where their physical shape is an asset.

7. MOUNTED BEADS — provide ease in using glass beads in such applications as gas chromatography, flow and vacuum measurement, etc.

8. VACUUM AND GAS FILLED ASSEMBLIES — high power sensitivity for specialized circuit applications.



9. PROBE ASSEMBLIES — standard catalog types or built to specific military or commercial requirements. We are experienced in design of probe assemblies for all fields of application including industrial control and indication, aerospace — specializing in telemetry applications, and oceanographic — featuring fast response, very high pressure, and interchangeability using our Iso-curve Thermistors.

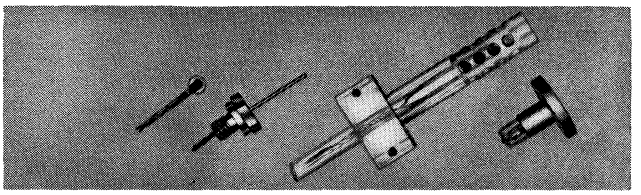
ISO-CURVE® Interchangeable Thermistors

F.E.I. Iso-curve* thermistors are special bead and glass probe thermistors that have been precision matched at the factory to standardized resistance-temperature curves. They have the unique and valuable characteristic of complete electrical interchangeability. In addition they offer all of the functional advantages associated with standard thermistors, including large resistance change per degree of temperature change which provides high accuracy and resolution.

Thermistors are normally rated by the value of their resistance at 77°F Standard units having the same rated resistance, however, will not exhibit identical resistance-versus-temperature characteristics over their full temperature range. Iso-curve thermistors, on the other hand, will match a specified R-T curve over full temperature range required. Iso-curve thermistors are available at the present time in five standardized R-T curve values, 370, 2K, 4K, 15K, and 100K. These standard curves represent permanent specifications and an F.E.I. Iso-curve thermistor purchased five years from now will be perfectly interchangeable with one of the same value purchased today.

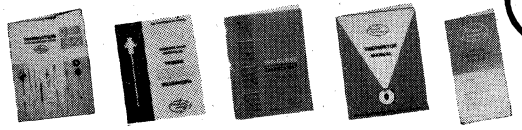
*MADE UNDER PAT. 3109227 AND OTHERS. ISO-CURVE IS A TRADEMARK OF F.E.I.

Thermistor Probe Assemblies



Standardized thermistor assemblies, provided in complete, ready-to-mount housings, enable you to take advantage of the precision and interchangeability of Fenwal Electronics thermistors. A complete line of thermistor probes is available for a variety of missile, aircraft, and industrial applications, including liquid level indication and control, temperature measurement and control of fluids and gases and many other applications. Precise calibration can be supplied with individual probes at all desired temperatures. Completely interchangeable probes with identical resistance-temperature curves are available to any desired tolerance down to 0.1°C over the full temperature range. Most of these housings can be made to meet military specifications if required.

Here's help in applying F.E.I. Thermistors . . .



"Thermistors: Their Characteristics and Uses." Detailed bulletin gives basic information and many applications. Bulletin L-1.

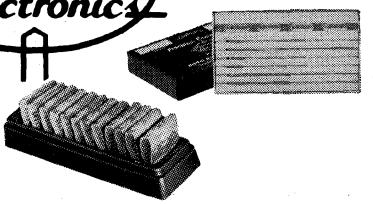
Thermistor Housing Manual (L-5). Detailed information on how Fenwal Electronics, Inc. can build thermistor sensor assemblies to fit your requirements.

Iso-Curve Thermistors (L-2). Complete data on patented interchangeable units with identical resistance/temperature curves.

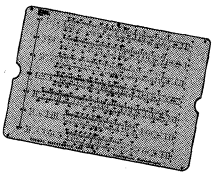
Thermistor Manual (EMC-5). Most complete up-to-date listing of thermistors available. Theory, engineering data, complete specifications.

New 24-page Capsule Thermistor Course Book. A complete primer on thermistors, their characteristics and uses.

Fenwal Electronics



Thermistor Experimental Kits — to help you expedite operations at the breadboard stage. Left: G-200 kit containing 12 different thermistors with complete specs. PRICE $19.95. Right: G-700 containing four. PRICE $4.95.



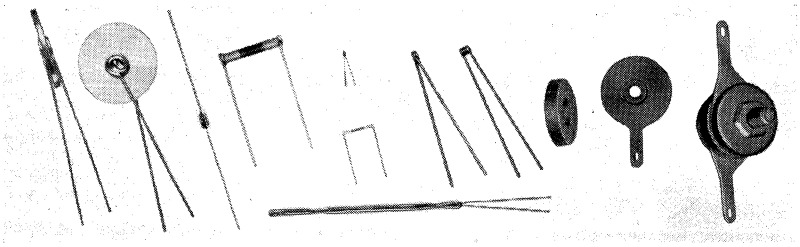
Thermistor Data & Curve Computer — (G300A) Provides resistance temperature characteristics for all F.E.I. Thermistors. Simplifies selection of the right thermistor for every application. PRICE $1.50.

FENWAL ELECTRONICS, INC. 63 FOUNTAIN STREET, FRAMINGHAM, MASS. 01701 • (617) 872-8841

THERMISTORS

- *For Temprature Measurement*
- *For Temperature Compensation*
- *For Temperature Control*
- *For Time Delay*

Thermistors are thermally sensitive resistors for the automatic detection, measurement, and control of physical energy. They are electronic semiconductors whose electrical resistance varies with temperature, and lies between that of conductors and insulators. An important distinction between Thermistors and other variable resistance materials is their extreme sensitivity to relatively minute temperature changes. Catalog standard grades are available in sensitivities from 3.37% per degree C to 5.06% per degree C at 25 C.



TYPICAL THERMISTOR UNITS

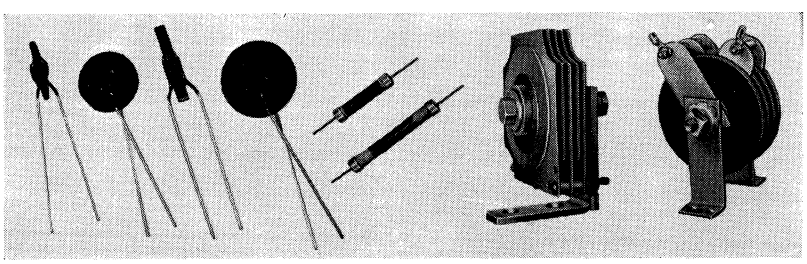
Type	Diameter in Inches	Resistance Ohms at 25 C	Resistance Ratio R25/R125	Max Operating Temp. Degrees C
Disks	0.050—1.0	1—200,000	12.95—48.78	150
Rods—Standard	.050—.173	200—1,000,000	12.95—48.78	150
Washers	.75	1—4,150	12.95—48.78	150
Washer Assemblies	.75	1—4,150	12.95—48.78	150
Beads	.043	2,000—1 megohm	29.85—51.5	275
"H"-Series (Hermetic Seal)	.070	2,000—1 megohm	19.80—48.78	275
Probes—Bead	.1	2,000—1 megohm	29.85—51.5	275
"H" Series	.150	2,000—1 megohm	19.80—48.78	275
PTC	.070	47—470	0.5	150
Diamond Thermistor	.070	3,685-40, 150 at 125°C	2.35 at 125°C/200°C	450/650

Write for Short Form Catalog GEC-1082

THYRITE® VARISTORS

- *For protection against voltage surges.*
- *As a stabilizing influence on circuits supplied by rectifiers.*
- *As a potentiometer (the division of voltage can be made substantially independent of load current).*
- *For the control of voltage-selective circuits, either independent of, or in combination with, electronic devices.*

Thyrite is a nonlinear resistance material in which the current varies as a power of the applied voltage. Because of this notable electrical property, Thyrite has found important applications in the electric-power, communications, and electronic industries.



TYPICAL THYRITE VARISTOR UNITS

Type	Diameter in Inches	Continuous D-C Voltage	Continuous Power Rating, Watts	Discharge Capacity, Watt-Seconds
Disks	0.5—1.125	15—300	0.250—1.5	30—275
Rods	.250	150—3,300	.25—.4	—
Washers	3—6	7—1,500	3—10	1100— 22,500
Washer Assemblies	3—6	6—600	3—240	1100—540,000
Medium Voltage Assemblies	3	1,500—10,500	3.5—24.5	9250— 64,750

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GENERAL ELECTRIC

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ALNICO AND LODEX® PERMANENT MAGNETS . . . THERMISTORS . . . THYRITE® VARISTORS

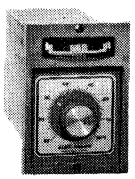
HARREL PRECISION TEMPERATURE CONTROLS

PROPORTIONAL TEMPERATURE CONTROLLERS

★ **RELIABLE: Completely solid state. No tubes, moving parts, or relays to wear out.**
★ **TRUE PROPORTIONAL CONTROL: Steady flow of power to heater. True stepless control.**
★ **HIGH EFFICIENCY: Efficiency in excess of 96% at full load.**
★ **THERMAL LOOP COMPENSATION: High sensitivity and proportional-plus-automatic-reset, or proportional-plus-rate-plus-reset action eliminates "droop" and permits closer temperature control.**
★ **HIGH POWER: From a few watts to 300 KW; single phase or three phase; 115, 230, or 480 volts.**
★ **ANY TEMPERATURE RANGE: Control either heaters or coolers from −200° to +1100°C.**

PANEL MOUNT CONTROLLERS

General purpose controllers arranged for easy front panel mounting in packaging machinery, plastics machinery, test fixtures, etc.



SINGLE TURN DIAL: Convenient direct reading dial for general purpose use.

TEN-TURN, DIRECT READING DIAL: Higher sensitivity than above plus 10-turn setting potentiometer for even closer temperature control. Direct read-out of temperature on large, 4½" dial.





DIGITAL DIAL: Ten-turn potentiometer plus digital dial with 15/32" high numerals readable from 30 ft. away! Includes front panel on-off switch, pilot light and power output meter.

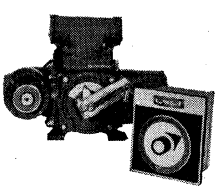
HEAVY DUTY PROCESS CONTROLLERS

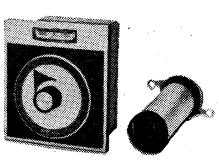


Heavy duty, three mode controllers offering proportional-plus-rate-plus-reset action. For chemical processing, large furnaces, etc., where long time lags are involved.

PROPORTIONAL VALVE CONTROLS

For process control applications where temperature is varied by means of motor-driven proportional valves. Three mode, heavy duty construction.



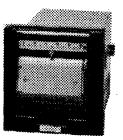


INFRARED SENSING

Where temperature must be controlled without touching the controlled body. Temperature ranges 25°C to 3000°C.

RECORDING CONTROLLERS

Provide permanent record of controlled temperature.





PROGRAMMABLE TEMPERATURE CONTROLLERS

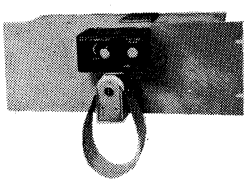


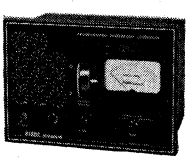
COMPUTER PROGRAMMED CONTROLLERS

Temperature set and monitored by a digital Computer.

TAPE PROGRAMMED CONTROLLERS

Temperature stored on punched tape. May follow any arbitrary program.





ARBITRARY FUNCTION PROGRAMMER

Program set on front panel dials.

Plus Cam Programmers, Switching Type Programmers, and Slope Generator Type Programmers.

FIXED TEMPERATURE CONTROLLERS HIGH RELIABILITY MILITARY TYPES



A-C OPERATED: Precision temperature control to a single selected temperature. Ideal for close temperature control of floated gyros, delay lines, or other military or industrial applications.

D-C OPERATED: For aircraft or missile operation, where the primary power source is d-c.





D-C OUTPUT: Output is pure d-c for applications such as gyro test tables where noise output of relay or standard proportional controller is objectionable.

RFI-FREE CONTROLLERS

Entirely solid state. Unique circuitry ensures freedom from radio frequency interference.



ADJUSTABLE, INDICATING: For use wherever nearby communications and low-level measuring equipment makes elimination of conducted and radiated interference essential.



FIXED TEMPERATURE: For military applications where elimination of RFI is required.

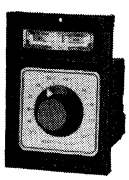
SPECIAL PURPOSE CONTROLLERS



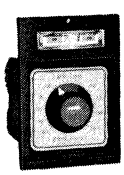
HEATING AND COOLING CONTROLLERS: Bidirectional, time proportioning for control of both heating and cooling by use of solenoid valves or mechanical refrigeration. Entirely solid state.



CONTROLLERS FOR THERMOELECTRIC COOLING: Bidirectional controllers for control of heating and cooling using thermoelectric elements.

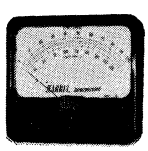


HUMIDITY CONTROLS: Precision control of humidity in test chambers, environmental equipment, etc.

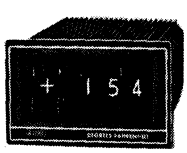


RELAY STYLE CONTROLLERS: Completely solid state except for output relay. Off-on or time proportioning. For minimum initial cost.

TEMPERATURE INDICATORS



PANEL STYLE INDICATORS: Available either as temperature indicator or temperature deviation indicator.



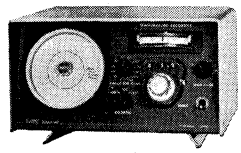
DIGITAL STYLE: Direct digital read-out of temperature in large, 5/16" numerals. Automatic polarity change. BCD electrical output optional.

TEMPERATURE ALARMS

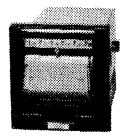
Continuous monitoring of temperature at a remote point. Initiates high or low alarm whenever temperature deviates more than a prescribed amount.



TEMPERATURE RECORDERS



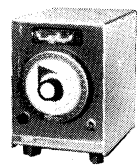
LABORATORY TYPE: Expanded scale readout spreads ranges as small as 2/3°C over entire scale. Eleven ranges give 0.02% accuracy.



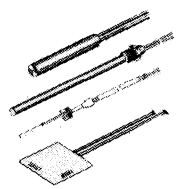
PANEL MOUNT, STRIP CHART TYPE: For continuous indication and recording of temperature at remote points.

CABINET STYLE CONTROLLERS

All Harrel controllers are available in an attractive, two-tone gray cabinet, complete with pilot light, on-off switch, & fuse. Convenient tilting bail for easy bench viewing.

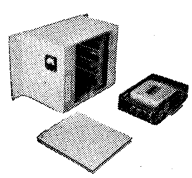


TEMPERATURE SENSORS



Wire type resistance sensors provide maximum sensitivity, linearity, & long term stability. Available in patch type for surface measurement, tubular styles, bayonet mount styles, or for air sensing.

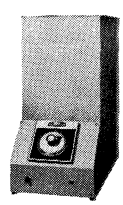
TEMPERATURE CONTROLLED ENCLOSURES



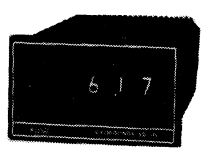
Complete oven systems including controller, sensor, heaters, and enclosure. Ideal for maintaining constant temperature of filters, crystals, delay lines, transistor amplifiers, or other critical electronic equipment.

OIL BATHS

Highest precision, reference grade oil baths for calibration or for maintaining temperature of standard cells, zener references, etc.



PRESSURE INSTRUMENTATION



A complete line of pressure indicators, pressure recorders, pressure alarms, and pressure sensors.

PLUS . . . complete temperature control systems and consoles. SEND US YOUR REQUIREMENTS.

ALL UNITS COMPLETELY SOLID STATE

HARREL, incorporated 16 FITCH STREET, EAST NORWALK, CONNECTICUT; PHONE: (203) 866-2573

Keystone CARBON COMPANY THERMISTORS

DISC, ROD & BEAD TYPES

THERMISTOR DIVISION • ST. MARYS, PA.

Keystone manufactures thermistors in a wide range of resistance values, temperature coefficients and physical sizes. Over 400 standard types are described on the following pages. Ranging from small beads to large discs, these thermistors provide a broad selection for every application.

In addition to the units shown on these pages, Keystone can help you in your special requirements. Stainless steel, silver, nickel or ceramic probes can be designed to fit your specifications.

Keystone can work with you to provide a wide variety of lead configurations.

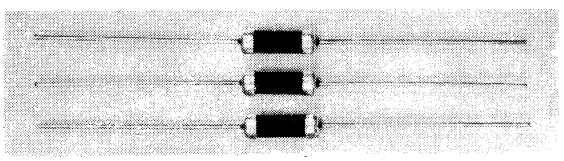
Thermistors may be mounted on plates, clips, mounting tabs or heat sinks.

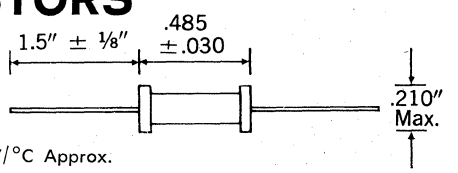
Glazes, silicone varnishes, enamels or durez may be applied when a particular situation calls for a coating.

If the maximum operating temperature in your application exceeds the limit of the units shown, call Keystone. Many of the units shown here are available in versions capable of higher operating temperatures.

If your requirements cannot be met by a unit on the following five pages, call us. We have over 2,000 more types from which to choose and make a recommendation.

ROD TYPE THERMISTORS





Leads: T.C. AWG #20
Dissipation..Constant: 9MW/°C Approx.
Time Constant: 45 seconds approx.
Tolerance: ±10% at 25°C

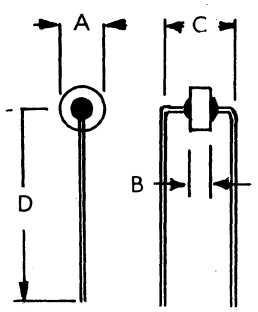
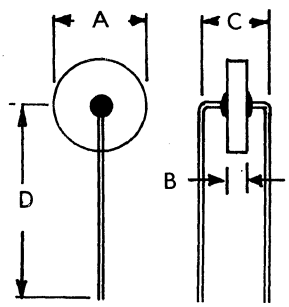
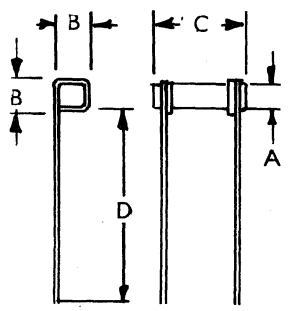
Max. Operating Temperature: 125°C

TYPE	RESISTANCE AT °C							BETA ±10% (37.8-104, 4°C)	R@25°C / R@125°C..	Neg. Temp. Coef.@25°C
	0	25	37.8	50	75	104.4	125			
LOW/MEDIUM TEMPERATURE COEFFICIENT										
15-10-32-S1	15.0	10	8.31	7.05	5.18	3.76	3.08	1400	3.2	1.50
15-20-35-S1	30.6	20	16.4	13.8	9.90	7.01	5.65	1500	3.5	1.59
15-50-42-S1	80.6	50	40.1	32.9	22.6	15.3	11.9	1700	4.2	1.78
15-100-42-S1	161	100	80.2	65.8	45.3	30.6	23.8	1700	4.2	1.78
15-200-42-S1	322	200	160	132	90.6	61.2	47.7	1700	4.2	1.78
15-500-50-S1	847	500	391	314	206	133	100	1900	5.0	1.98
15-1K-50-S1	1690	1K	782	628	413	266	201	1900	5.0	1.98
15-2K-52-S1	3430	2K	1560	1240	808	515	387	1950	5.2	2.03
15-5K-54-S1	8680	5K	3860	3060	1980	1240	924	2000	5.4	2.07
15-10K-54-S1	17.4K	10K	7730	6130	3950	2480	1850	2000	5.4	2.07
15-20K-59-S1	35.6K	20K	15.3K	12K	7560	4640	3400	2100	5.9	2.17
15-50K-62-S1	90K	50K	37.9K	29.5K	18.5K	11.2K	8120	2150	6.2	2.22
HIGH TEMPERATURE COEFFICIENT										
15-1K-139-S1	2500	1K	656	451	227	111	71.9	3150	13.9	3.38
15-2K-139-S1	4990	2K	1310	902	454	222	144	3150	13.9	3.38
15-5K-181-S1	13.7K	5K	3150	2100	979	450	276	3425	18.1	3.74
15-10K-192-S1	28.2K	10K	6240	4100	1890	855	520	3500	19.2	3.83
15-20K-292-S1	67.2K	20K	11.6K	7140	2920	1190	685	4000	29.2	4.46
15-50K-292-S1	168K	50K	28.9K	17.8K	7320	2980	1710	4000	29.2	4.46
15-100K-404S1	372K	100K	55K	32.4K	12.2K	4540	2080	4400	40.4	4.86
15-200K-424-S1	753K	200K	109K	63.9K	23.9K	8740	4720	4450	42.4	4.91
15-500K-482-S1	1.95meg	500K	268K	154K	55.6K	19.7K	10.4K	4600	48.2	5.03
15-1meg-583-S1	4.06meg	1meg	523K	294K	100K	33.7K	17.1K	4830	58.3	5.22

Keystone CARBON COMPANY

KEYSTONE LOW-COEFFICIENT THERMISTORS

For applications such as coil compensation which require a low temperature coefficient thermistor Keystone offers the low coefficient, series 2 group of thermistors listed below. To specify a unit on this list, specify the code number followed by the resistance at 25°C. For example, a 1RS1-100 is a disc, .2" diameter, and .1" thick having a resistance of 100 ohms ±10% at 25°C. Various coatings, tolerance patterns and lead configurations are available on request.

CODE NUMBER		1RS1	2RS1	3RS1
TYPE		DISC	DISC	RECT. ROD
STANDARD LEAD CONFIGURATION				
Leads		AWG 20 (.032 Dia.)	AWG 20 (.032 Dia.)	AWG 24 (.020 Dia.)
Material		Tinned Copper	Tinned Copper	Tinned Copper
Diss. Constant		10 mw/°C	16 mw/°C	10 mw/°C
Time Constant		55 Sec.	85 Sec.	75 Sec.
Max. Watt Rating		1¼ Watts	2 Watts	1¼ Watts
Dimensions in Inches	A	.200 ± .020	.500 ± .025	.150 ± .025
	B	.100 ± .020	.100 ± .020	.260 Maximum
	C	.375 ± Nominal	.375 ± Nominal	.500 ± .050
	D	1½ Minimum	1½ Minimum	1½ Minimum

BETA* Degrees Kelvin	Negative Temperature Coefficient %/°C @ 25°C	1RS1 R @ 25°C	2RS1 R @ 25°C	3RS1 R @ 25°C
1000	1.14	5	.75	20
1050	1.18	10	1.5	45
1100	1.23	15	2.5	70
1600	1.69	275	45	1200
1700	1.78	425	70	1900
1800	1.88	650	100	2900
1900	1.98	1000	150	4200
2000	2.07	1400	220	6000
2100	2.17	2000	330	9000

*BETA is calculated between the temperatures of 37.8 and 104.4°C. Tolerance on Beta is ±15% for Betas of 1000°K to 1100°K and ±10% for Betas of 1600°K to 2100°K.

Standard Resistance Tolerance is ±10% @ 25°C. Other Tolerances are available upon request.

Standard Thermistors are supplied without coating.

Maximum Operating Temperature: 150°C.

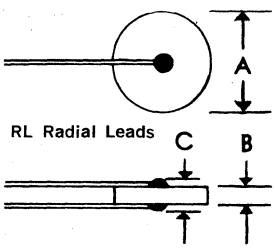
Lead Lengths conforming to printed circuit requirements are available on request.

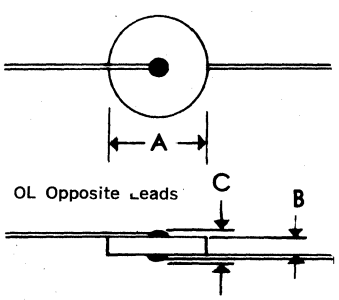
Keystone CARBON COMPANY Thermistor Division • St. Marys, Pa. • (Area 814) 834-1591
TWX 510-693-4510

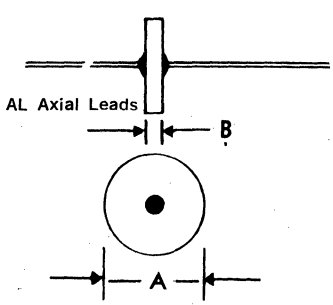
Keystone CARBON COMPANY Disc Type THERMISTORS SERIES NO. 1

TYPE		E	S	F	B	G
MAX. WATTAGE RATING (WATTS)		0.36	0.82	0.88	1.00	1.25
DISSIPATION CONSTANT (MW/°C)		2.9	6.6	7.0	8.0	10
TIME CONSTANT (SECONDS)		10	45	50	60	70
THERMISTOR DIA. (IN.) A		.10 ±.010	.12 ±.010	.20 ±.020	.30 ±.020	.40 ±.020
THERMISTOR THK. (IN.) B		.03 ±.010	.15 ±.025	.06 ±.015	.06 ±.015	.05 ±.015
MAX. THK. OVER LEADS (IN.) C		.100	.260	.150	.150	.140
LEAD SIZE (A.W.G.)		30	24	24	24	24

TEMPERATURE °C		37.8	25	37.8	25	37.8	25	37.8	25	37.8	25
	1	196	311.0	682	1082	98.0	155.4	43.6	69.1	20.4	32.35
	2	248	397.5	862	1382	124	198.8	55.0	88.2	25.8	41.4
	3	304	492	1060	1717	152	246.0	67.5	109.4	31.6	51.2
	4	356	581	1240	2020	178	290.5	79.0	128.8	37.0	60.3
	5	432	712	1500	2470	216	356.0	95.9	158.0	45.0	74.2
	6	489	811	1700	2820	244	405	109	180.8	50.9	84.4
	7	600	1006	2090	3500	300	503	133	223.0	62.5	104.7
	8	718	1215	2500	4230	359	607	160	270.5	74.8	126.6
	9	860	1469	2990	5110	430	734	191	326.0	89.6	153.0
	10	993	1712	3460	5970	497	857	221	381.0	103	177.6
	11	1070	1850	3720	6430	535	925	238	412	111	191.9
	12	1340	2330	4650	8100	668	1163	297	517	139	242.0
	13	1550	2710	5390	9430	774	1354	344	602	161	281.5
	14	1930	3400	6730	11850	966	1701	429	755	201	354.0
	15	2240	3960	7800	13800	1120	1981	498	881	233	412
	16	2600	4620	9040	16060	1300	2310	577	1025	271	481
	17	3010	5370	10500	18730	1510	2695	669	1193	314	560
	18	3490	6250	12200	21850	1740	3115	776	1390	364	652
	19	4050	7280	14100	25350	2020	3630	899	1616	421	757
	20	5050	9140	17600	31850	2520	4560	1120	2025	526	952
	21	5860	10640	20400	37050	2930	5320	1300	2360	610	1108
	22	7310	13350	25500	46600	3660	6680	1620	2960	762	1391
	23	8470	15520	29500	54000	4240	7770	1880	3445	883	1618
	24	10600	19510	36800	67700	5290	9740	2350	4330	1100	2025
	25	13200	24400	46000	85100	6600	12210	2940	5440	1380	2555
	26	16500	30650	57400	106700	8240	15320	3660	6800	1720	3195
	27	20600	38450	71600	133700	10300	19230	4570	8530	2140	3995
	28	25700	48200	89400	167600	12800	24000	5710	10710	2680	5020
	29	32100	60400	112000	211000	16000	30100	7130	13420	3340	6290
	30	40000	75600	139000	263000	20000	37800	8900	16830	4170	7880
	31	46400	88000	162000	307000	23200	44000	10300	19530	4840	9180
	32	53800	102300	187000	355500	26900	51100	12000	22800	5600	10640
	33	62300	118700	217000	414000	31200	59500	13900	26500	6500	12390
	34	77900	149000	271000	518000	38900	74400	17300	33100	8110	15510







Units on this list are available in the three lead configurations shown above. Standard tolerance is ±10% at 37.8°C, with ±10% @ 25°C also available. Tolerance on resistance ratio is ±.3. Maximum operation temperature is 150°C. To specify a unit on this list, first indicate RL, OL or AL for lead configuration. Next list the row number, the column number and the number 1 for series "1". If the tolerance is to be at 25 rather than 37.8, add a "T". For example, an RL23SIT is a unit having radial leads and a resistance of 54000 ohms ±10% at 25°C.

Disc Type THERMISTORS SERIES NO. 1

Keystone CARBON COMPANY

ROW NUMBER	D		J		M		R		H		RESISTANCE RATIO	NEGATIVE TEMPERATURE COEFFICIENT
	1.75		2.00		2.50		2.75		4.00			
	14		16		20		22		32			
	85		110		115		190		215			
	.45 ±.025		.47 ±.025		.66 ±.030		.82 ±.035		1.00 ±.035			
	.07 ±.020		.15 ±.025		.06 ±.015		.12 ±.025		.12 ±.025			
	.180		.265		.190		.285		.295			
	20		20		20		20		18			
	37.8	25	37.8	25	37.8	25	37.8	25	37.8	25	37.8°C/ 104.4°C	%/°C @25°C
1	22.6	35.85	44.4	70.4	8.05	12.77	10.4	16.49	7.04	11.16	7.0	3.74
2	28.5	45.7	56.0	89.8	9.59	15.37	12.4	19.88	8.38	13.43	7.3	3.83
3	35.0	56.7	68.8	111.5	11.4	18.47	14.8	24.00	9.96	16.14	7.6	3.92
4	41.0	66.9	80.5	131.3	12.8	20.90	16.6	27.05	11.2	18.27	7.8	3.98
5	49.7	81.9	97.7	161.0	15.1	24.90	19.6	32.30	13.2	21.75	8.1	4.06
6	56.3	93.4	111	184.1	17.0	28.20	22.0	36.50	14.8	24.55	8.3	4.12
7	69.1	115.8	136	228.0	20.0	33.50	25.9	43.40	17.4	29.15	8.6	4.20
8	82.7	139.9	163	276.0	23.4	39.60	30.4	51.40	20.5	34.70	8.9	4.28
9	99.0	169.1	195	333.0	27.5	47.0	35.6	60.8	24.0	41.0	9.2	4.35
10	114	196.5	225	388.0	31.5	54.3	40.9	70.5	27.5	47.4	9.5	4.43
11	123	212.5	242	418	35.0	60.5	45.4	78.5	30.6	52.9	9.7	4.46
12	154	268.0	302	526	44.4	77.3	57.6	100.3	38.8	67.6	10.0	4.51
13	178	311.5	350	612	52.0	90.9	67.5	118.0	45.5	79.6	10.2	4.55
14	223	392.5	438	771	66.0	116.2	85.6	150.7	57.7	101.6	10.5	4.60
15	258	456	507	897	77.4	136.9	100	176.9	67.7	119.8	10.7	4.63
16	299	531	588	1044	90.7	161.1	118	209.5	79.3	140.8	10.9	4.67
17	347	619	682	1217	106	189.1	138	246.0	92.9	165.7	11.1	4.70
18	402	720	790	1415	125	224.0	162	290.0	109	195.2	11.3	4.73
19	466	838	916	1647	146	262.5	189	340.0	128	230.0	11.5	4.76
20	582	1053	1140	2060	185	334.5	240	434	162	293.0	11.8	4.81
21	675	1226	1330	2415	217	394.0	281	510	188	341.5	12.0	4.84
22	842	1537	1660	3030	275	502	357	652	241	440	12.3	4.88
23	976	1788	1920	3515	323	592	419	768	282	517	12.5	4.91
24	1220	2245	2400	4420	410	755	531	978	358	659	12.8	4.94
25	1520	2810	2990	5530	520	962	674	1247	454	840	13.1	4.98
26	1900	3530	3730	6930	659	1225	855	1589	576	1071	13.4	5.01
27	2370	4420	4660	8700	836	1561	1080	2015	731	1365	13.7	5.05
28	2960	5550	5820	10910	1060	1988	1380	2585	928	1740	14.0	5.08
29	3690	6950	7260	13670	1350	2540	1750	3295	1180	2220	14.3	5.11
30	4610	8720	9060	17130	1710	3235	2220	4200	1490	2820	14.6	5.14
31	5350	10140	10500	19910	2000	3790	2600	4930	1750	3320	14.8	5.16
32	6200	11790	12200	23200	2350	4470	3040	5780	2050	3895	15.0	5.18
33	7180	13680	14100	26850	2750	5240	3570	6800	2400	4570	15.2	5.20
34	8970	17160	17600	33650	3490	6680	4520	8650	3050	5830	15.5	5.22

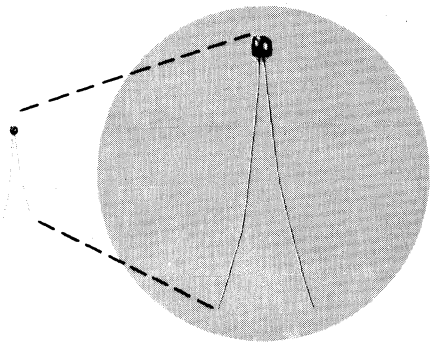
Keystone CARBON COMPANY

MOLDED-IN-LEAD BEAD AND ROD THERMISTORS

Using a technique developed at Keystone, these units feature leads which are molded directly into the body of the thermistor. This technique yields a more reliable thermistor and by eliminating several operations permits lower prices. These units are particularly intended for applications where small size and fast response are major requirements.

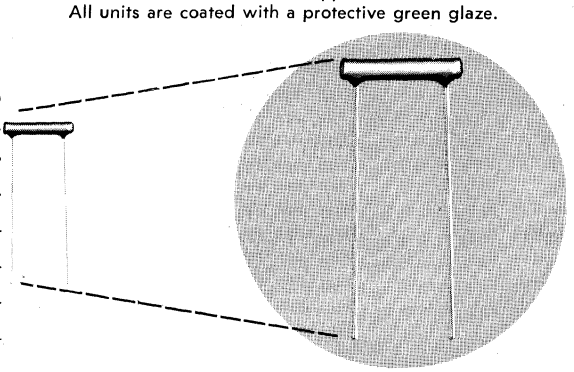
TYPE	RESISTANCE AT °C:						
	0	25	37.8	75	104.4	150	260
L0504-329-59-M2	1245	500	329	114	56	22.4	*
L0504-550-71-M2	2480	878	550	169	77	29	5.5
L0504-1220-81-M2	6210	2000	1220	344	151	53	9
L0504-1248-73-M2	5520	1984	1248	376	171	62	*
L0504-1500-85-M2	8010	2515	1500	409	176	61	10.5
L0504-5000-95-M2	27.7K	8560	5000	1290	526	168	23.4
L0504-33.3K-125-M2	221K	60.4K	33.3K	7380	2665	711	70.6
L0504-55K-120-M2	360K	100K	55K	12.5K	4.58K	1246	127.6

* These units processed for operation to 150°C maximum; All others, to 260°C Max.



Physical size: .055″ dia. max., .075″ long max.
Leads: .004″platinum, ½″ long
Dissipation Constant: 0.6 MW/°C Approx.
Time Constant: 7.5 seconds Approx.
All units are coated with a protective green glaze.

TYPE	RESISTANCE AT °C:						
	0	25	37.8	75	104.4	150	260
L060637-6K-85-M2	31.8K	10.1K	6000	1640	706	242	40.7
L060637-10K-85-M2	52.2K	16.7K	10K	2750	1175	403	67.8
L060637-22K-95-M2	122K	37.5K	22K	5700	2315	739	104
L060637-45K-103-M2	266K	78.2K	45K	11.1K	4370	1314	166
L060637-60K-103-M2	355K	104K	60K	14.8K	5830	1750	222
L060637-200K-120-M2	1.3 meg	363K	200K	45K	16.7K	4520	520
L060637-350K-125-M2	2.35 meg	637K	350K	76.5K	28K	7630	793
L060637-1.4 meg-145-M2	10.2 meg	2.62 meg	1.4 meg	284K	96.6K	23.8K	2070



Physical size: .120″ dia. max. .420″ long max.
Leads: .010″ platinum, ¾″ long
Dissipation Constant: 2.8 MW/°C Approx.
Time Constant: 35 seconds Approx.
Maximum Operating Temperature: 260°C.
All units are coated with a protective green glaze.

CRYOGENIC THERMISTORS

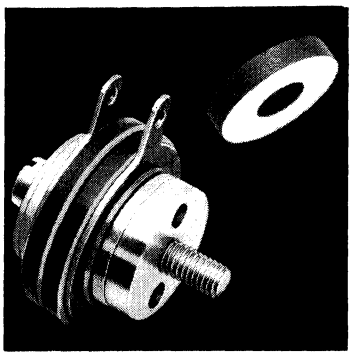
TYPE	For Operation In Liquids	Resistance	Temperature Coefficient
RL10X04-10K-315-S5	Oxygen	10K	− 8.4%/°C
	Nitrogen	31.5K	−10.4%/°C
RL06X0628-31.7K-315-S5	Oxygen	31.7K	− 8.4%/°C
	Nitrogen	100K	−10.4%/°C
L0904-6.6K-H-T2	Hydrogen	6.6K	−13.0%/°C
L0904-125K-H-T2	Hydrogen	125K	−17.0%/°C
L0904-180K-H-T2	Hydrogen	180K	−18.0%/°C
L0904-100K-HE-T2	Helium	100K	−275 %/°C
L0904-3meg-HE-T2	Helium	3 meg.	−300 %/°C

Physical size of these units is approximately .1″ diameter, and .04″ thick, except the RL06X0628, which is a rod, .06″ square and .28″ long.

Low Temperature Types — Designed for operation in various cryogenic liquids these units are especially useful for liquid level detection. In this type of application the thermistor is slightly self heated by passing a small current through the unit. The heat developed in the unit is dissipated more rapidly in the liquid than when the thermistor is above the liquid. The resulting change in body temperature results in a change in resistance which is easily detected because of the high temperature coefficient of the thermistor. The units listed in the table are standard low temperature thermistors.

Keystone CARBON COMPANY Thermistor Division • St. Marys, Pa. • (Area 814) 834-1591
TWX 510-693-4510

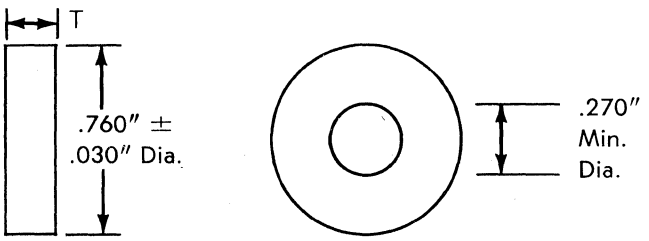
Keystone
CARBON COMPANY



WASHER THERMISTORS

In situations where a thermistor is required to handle a relatively large amount of power, Keystone washer type thermistors provide a means of obtaining high power handling capability in a small, economical package. In addition, washer type thermistors are also very useful where mounting conditions do not permit the use of conventional component mounting methods.

Maximum operating temperature 150°C.
Standard units are supplied without leads.
Units are uninsulated.



KCC PART NUMBER	RESISTANCE @ 25°C ±10%	TEMP. COEF. %/°C @ 25°C	RATIO R @ 37.8°C / R @ 104.4°C	BETA °K R @ 37.8°C / R @ 104.4°C	DIMENSION "T"
7604-W28-6.24-73-S1	10	−3.83	7.3	3505	0.040"
7611-W28-19.65-73-S1	31.5	−3.83	7.3	3505	0.110"
7605-W28-58.2-97-S1	100	−4.40	9.7	4005	0.050"
7615-W28-183.2-97-S1	315	−4.40	9.7	4005	0.150"
7611-W28-1K-131-S1	1850	−4.98	13.1	4535	0.110"
7611-W28-2580-141-S1	4840	−5.09	14.1	4665	0.110"
7611-W28-5230-155-S1	10K	−5.22	15.5	4830	0.110"

RESISTANCE RATIO CHARACTERISTICS

RATIO 37.8 / 104.4		−58°F −50°C	−6.70°F −21.5°C	32°F 0°C	77°F 25°C	100°F 37.8°C	122°F 50°C	167°F 75°C	220°F 104.4°C	257°F 125°C	302°F 150°C
7.3	R_T/R_{25}	39.00	7.84	2.815	1.000	.624	.410	.1890	.0855	.0520	.03045
9.7	R_T/R_{25}	68.5	10.88	3.290	1.000	.582	.3600	.1484	.0599	.03415	.01851
13.1	R_T/R_{25}	116.5	14.65	3.835	1.000	.540	.3135	.1149	.0412	.02195	.01108
14.1	R_T/R_{25}	126.7	15.44	3.945	1.000	.532	.3045	.1081	.03775	.01967	.00968
15.5	R_T/R_{25}	139.8	16.47	4.06	1.000	.523	.2935	.1005	.03370	.01714	.00815

To find R at any temperature, multiply R_{25} by the appropriate R_T/R_{25} ratio from above table. (T ranges from −50°C to 150°C)

SPECIAL APPLICATIONS

Thermistors may be processed with special resistance values and tolerances. Special mounting assembly or lead attachment may be supplied to individual specifications. Consult us directly concerning your specific application.

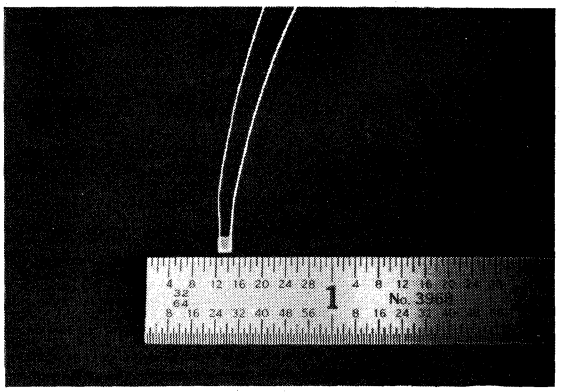
Keystone CARBON COMPANY Thermistor Division • St. Marys, Pa. • (Area 814) 834-1591
TWX 510-693-4510

Gulton THERMISTORS

3 good reasons to look to Gulton for Thermistors

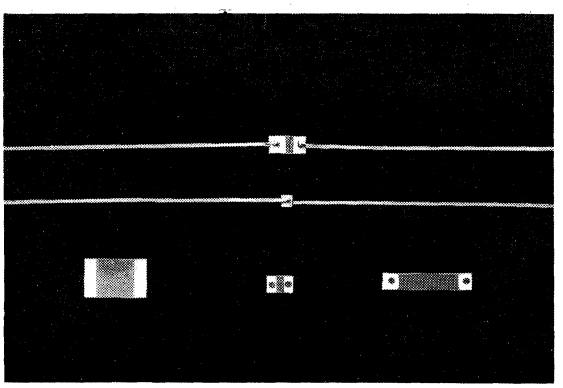
The broadest line of Interchangeable Thermistors

- Values from 1 through 100 K yield precision tracking from -55°C to +150°C



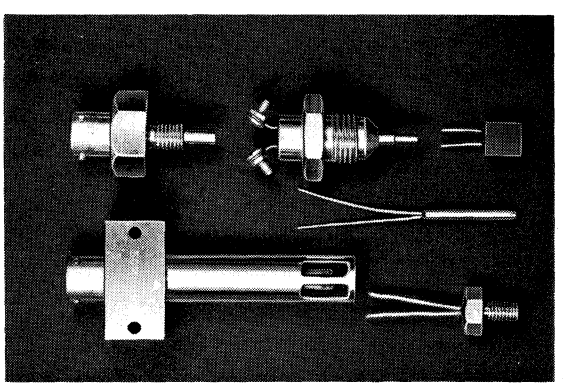
The only manufacturer of Chip Thermistors

- Small in size . . . ideal for tomorrow's microcircuits
- Values from 10 ohms to 10 megohms
- Terminations. . . Kovar tabs, gold plated nickel ribbon or silver



The greatest variety of Thermistor Probe Assemblies

- Standard or custom designed to your specifications
- For aerospace to medical applications
- From oceanography to lunar landings

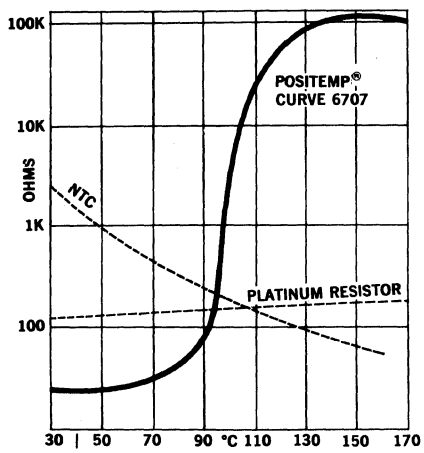


Gulton manufactures a complete line of thermistors. . . beads, beads-in-bulbs, beads-in-probes, discs, rods and wafers. For information on Gulton thermistors, write to the Thermistor Department at the address below. In addition, Gulton engineers are available to discuss your thermistor requirements, and when necessary, to custom design thermistors and probes for your unique application.

Gulton Industries, Inc. **Microceramics Division**
Metuchen, New Jersey 08840
Phone: 201-548-2800 • TWX-710-998-0592

SOLID STATE Temperature Control Elements, Temperature Sensors, Current Limiting Devices and Self-Regulating Heaters

POSITEMP® THERMISTORS



Curve 6707 compares the functional behavior of three basic types of temperature sensors. The "switch" point – point at which resistance rapidly increases – of *POSITEMP® thermistors* gives circuit designers *more accurate control* in simplified circuitry with high reliability.

Designers may select their own switch point in 10°C increments throughout the temperature range of −15°C through +195°C.

Simple to use and reliable for the most critical design applications, *POSITEMP devices* are finding increasing use as *self-regulating heaters*. THERMOFUZE *current limiters* and *automatically recoverable fuses* also utilize this same novel materials phenomena.

Special for Designers

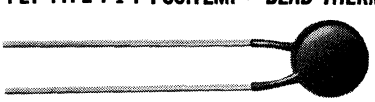
You can try three of any standard type PET devices for our minimum order charge of $10.00. Pick your operating temperature 10°C increments from −15°C to +195°C.



PET TYPE 81-T POSITEMP® HEATER



PET TYPE 71-T POSITEMP® BEAD THERMISTOR



PET TYPE 1-T POSITEMP® CIRCUIT ELEMENT



PET TYPE TP-01 POSITEMP® PROBE

APPLICATIONS FOR POSITEMP® AND THERMOFUZE DEVICES

Solid State Heaters – Self-regulating heaters for a wide variety of applications. May be attached directly to electronic components. Ratings ½W, 1W, to as much as 10 Watts.

Temperature Measurement and Control – Built-in over temperature protection with excellent stability and extremely good accuracy and reliability.

Flow Detection – Unique properties of PET devices makes them ideally suited for air flow or liquid flow detectors.

Current Limiting – THERMOFUZE and POSITEMP® devices may be used to limit current, or may be used as automatically recoverable fuses, in electronic circuits. Voltages to 250 volts. Switching times of 100ms to 30 seconds.

Liquid Level or Temperature Control – POSITEMP® sensors enclosed in metal sheaths or probes are used for liquid level detection and control, and for temperature control of liquid systems.

Join the growing body of designers who are looking to PET devices for simpler and more reliable solutions to their design problems. **Call our representative in your area, or call the factory for design assistance.**

Where Ideas become Products...

PENNSYLVANIA ELECTRONICS TECHNOLOGY INCORPORATED

1397 Frey Road, Pittsburgh, Pennsylvania 15235

Phone: 412-351-0890 ☐ Cable: PETELEX

American Beauty

SOLDERING IRONS AND SOLDERING ACCESSORIES

Specify voltage, wattage and other options on each order. If your plug needs differ from standard — plug cap on 2-wire cords, NEMA-type plugs on 3-wire cords — specify plug manufacturer's name and catalog number.

LITTLE DANDY



The economy-priced miniature iron that stands up to production line conditions. Steel cored heating element with non-ceramic insulator. Molded handle, aerated finger grip (impervious to oil, perspiration). Balanced, non-roll design. Plug type tips.

Cat. No.	Wattage Std.	Wattage Spec.	Tip Dia.	Shpg. Wt.	Net
3108	20	25/30	1/8"	1/2 lb.	$4.70
3110	25	30/35	3/16"	1/2 lb.	4.70
3112	40	50/60	1/4"	1/2 lb.	6.25

NOTES: Three wattage options each model (3108: 20, 25, 30. 3110: 25, 30, 35. 3112: 40, 50, 60.) For 3-wire cord with NEMA plug, add "S3" to catalog number and $0.70 to price.

BANTAMS



Small irons of traditional American Beauty quality in various inputs and tip diameters.

Cat. No.	Wattage	Tip Dia.	Shpg. Wt.	Net
3114	60	1/4"	1 lb.	$8.00
3118	30	1/8"	3/4 lb.	6.35
3118-X	50	1/8"	3/4 lb.	7.15
3118-XP	50	1/8"	3/4 lb.	7.15
3118-SC	30	1/8"	3/4 lb.	6.35
3118-SCP	30	1/8"	3/4 lb.	6.35
3120	30	3/16"	3/4 lb.	6.35
3120-X	50	3/16"	3/4 lb.	7.15
3120-XP	50	3/16"	3/4 lb.	7.15
3120-SC	30	3/16"	3/4 lb.	6.35
3120-SCP	30	3/16"	3/4 lb.	6.35

NOTES: In above catalog numbers, "X" means "extra heat for continuous duty only; "SC" means "short casing"; "P" means "pencil type handle". For 3-wire cord with NEMA plug, add "S3" to catalog number and $1.40 to price.

B-SERIES IRONS



Best miniature at any price. Advanced design. Precise balance, floating element for fast heat recovery. Boxed with 3 assorted tips.

Cat. No.	Wattage	Tip Point Diameter	Shpg. Wt.	Net
B-2000L	22.5	*	1/2 lb.	$10.25
B-2000P	22.5	1/8"	1/2 lb.	10.25
B-2000PM	22.5	1/16"	1/2 lb.	$10.25
B-2000C	22.5	1/16"	1/2 lb.	10.25
B-2000B	22.5	1/8"	1/2 lb.	10.25
B-2500-L	30	*	1/2 lb.	10.25
B-2500-C	30	3/16" Csl.	1/2 lb.	10.25
B-2500-D	30	3/16" Cone	1/2 lb.	10.25
B-2500-B	30	1/32" Cone	1/2 lb.	10.25
B-2500-PM	30	3/32" Csl.	1/2 lb.	10.25

NOTES: *1 each 1/8" chisel, 1/16" chisel, 1/8" cone. For 3-wire cord with NEMA plug, add "S3" to catalog number and $0.70 to price.

STANDARD IRONS

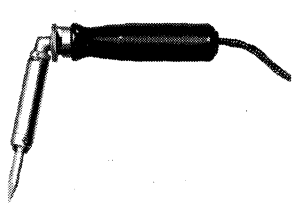


Production lines around the world use hundreds of thousands of these proven American Beauties.

Cat. No.	Wattage Std.	Wattage Spec.	Tip Dia.	Shpg. Wt.	Net
3125	60	75	1/4"	1 lb.	$ 8.00
3128	60	75	1/4"	1 lb.	7.20
3138	100	130/150	3/8"	2 lbs.	10.35
3138-X	175	—	3/8"	2 lbs.	11.55
3138-Y	100	130/150	1/4"	2 lbs.	10.35
3138-XY	175	—	1/4"	2 lbs.	11.55
3158	200	—	5/8"	3 lbs.	12.75
3158-X	250	300	5/8"	3 lbs.	13.95
3178	300	—	7/8"	4 lbs.	16.75
3178-X	300	400	7/8"	4 lbs.	17.90
3198	550	675	1 1/8"	5 3/4 lbs.	20.75

NOTES: "X" in catalog number means "extra hot, for continuous duty only." For 3-wire cord with NEMA plug, add "S3" to catalog number and $1.40 to price.

ANGLE TYPE IRONS

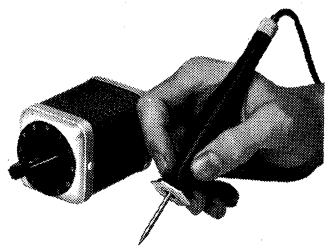


Same quality as American Beauty Standard Irons but angled for soldering hard-to-reach connections.

Cat. No.	Wattage Std.	Wattage Spec.	Tip Dia.	Shpg. Wt.	Net
3118-A	30	40	1/8"	3/4 lb.	$7.20
3118-XA	50	40	1/8"	3/4 lb.	8.00
3120-A	30	40	3/16"	3/4 lb.	7.20
3120-XA	50	40	3/16"	3/4 lb.	8.00
3125-A	60	75	1/4"	1 lb.	8.70
3128-A	60	75	1/4"	1 lb.	8.00
3138-A	100	130/150	3/8"	1 1/4 lb.	11.20

NOTES: "X" in catalog number means "extra hot, for continuous duty only." For 3-wire cord with NEMA plug, add "S3" to catalog number and $1.40 to price.

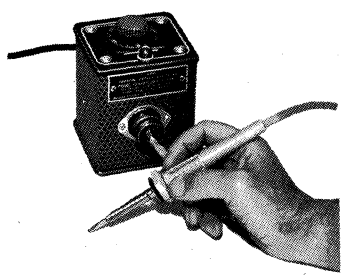
TRANSFORMER TYPE IRONS



Use these American Beauties where isolation from line voltage is necessary. Heating elements in tips for quick tip heat changes. T-6 has variable heat dial. T-12 and T-30, non-variable.

Cat. No.	Wattage Std.	Wattage Spec.	Tip Dia.	Shpg. Wt.	Net
T-6	Variable		9/64"	1 1/2 lbs.	$22.75
T-12E/W T-1216	17	20.	1/16"	1 1/2 lbs.	15.50
T-12E/W T-1218	17	20	1/8"	1 1/2 lbs.	15.50
T-12E/W T-1225	17	20	1/4"	1 1/2 lbs.	15.50
T-12E/W T-1232	12	—	3/32"	1 1/2 lbs.	15.50
T-30E/W T-3016	30	25	1/16"	2 lbs.	17.40
T-30E/W T-3018	30	25	1/8"	2 lbs.	17.40
T-30E/W T-3025	30	25	1/4"	2 lbs.	17.40
T-30E/W T-3032	12	—	3/32"	2 lbs.	17.40

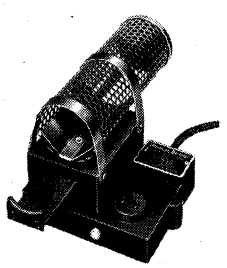
V-3000 SYSTEM



New type system dependably dials and maintains any tip temperature from 350° to 750°. High reserve for fast recovery. Iron is 40-watt, uses any 3/16" plug type tip.

Cat. No.	Wattage	Shpg. Wt.	Net
V-3000	Variable	5 lbs.	$42.00

TEMPERATURE REGULATING STANDS



Maintain soldering iron at preset temperature during idle and intermittent use. Minimizes warmup, prevents over-

American Beauty

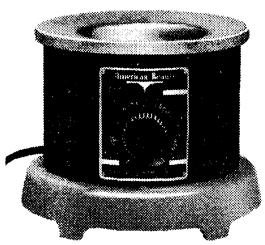
SOLDERING IRONS AND SOLDERING ACCESSORIES

heating, saves current. Pilot light. Adjustable to length of iron.

Cat. No.	Use	Shpg. Wt.	Net
475	For 100W-600W irons	3¼ lbs.	$10.35
476	For 30W-85W irons	3¼ lbs.	10.35

NOTES: For perforated guard (as shown) add "SG" to catalog number and $1.40 to price. Standard cord is HPD; if you want either 2-wire or 3-wire SJO cord specify on order.

GENERAL PURPOSE SOLDER POTS

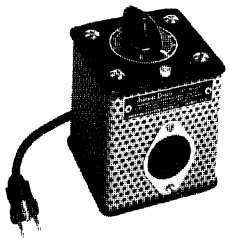


Crucibles of cast iron, chemically stable to keep solder pure. Center tapped for dross skimmer or extra fixturing. Wide lipped for extra fixture mounting. Shallow; 1½" deep. Heat solder to 400° in 15 minutes — 750° in 25 minutes. Adjustable, direct reading thermostat.

Cat. No.	Solder Capacity	Shpg. Wt.	Net
300	1 lb.	6½ lbs.	$30.40
301	(Same as NO. 300, with dross skimmer)	6½ lbs.	33.40
600	2½ lbs.	9 lbs.	31.90
601	(Same as NO. 600, with dross skimmer)	9 lbs.	34.90

NOTES: Standard cords are 2-wire SJO; for 3-wire cord, add "S3" to catalog number and $1.40 to price.

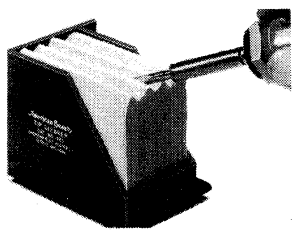
INFINITELY VARIABLE POWER CONTROL UNIT



Dials and accurately controls soldering iron tip heat. (Also reliably controls small motor speeds.) Wattage: zero to 125W; infinitely variable, stepless. Fused. Pilot lighted.

Cat. No.	Shpg. Wt.	Net
477	3¾ lbs.	$17.00

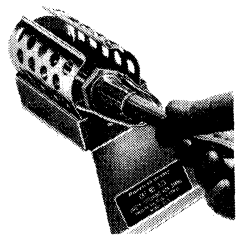
ONE-PASS TIP CLEANERS



Cleans all sides of tip in one motion. Eliminates tip damage, linting, stray solder pellets. Rubberized base, bored for mounting.

Cat. No.	Descrip.	Shpg. Wt.	Net
480	Complete set	½ lb.	$2.25
480-S	Sponges only (ea.)	3 oz.	.16

SAFETY SOLDERING IRON STAND



Gravity controlled. Opens, closes automatically. Operator doesn't look up from work. Accommodates all miniature irons.

Cat. No.	Descrip.	Shpg. Wt.	Net
575	Soldering Stand	1 lb.	$3.00

PARAGON QUALITY SOLDERING TIPS

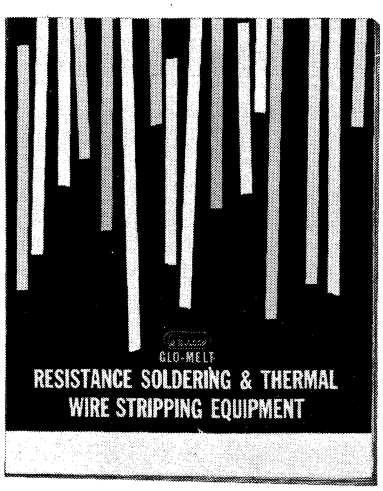


Iron clad tips. Outlast unclad tips many times. Pretinned; point retins self as it works. Clad shank does away with pitting, scaling. Overall chromecoat and minute tapering make tip drip-proof, freeze-free.

ORDERING: Use American Beauty Catalog No. TC-2. Or order tips by carefully specifying shank diameter, overall length, and style of point (diamond, chisel, screwdriver, cone).

PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

RESISTANCE-TYPE SOLDERING & THERMAL WIRE STRIPPING EQUIPMENT



Complete, single source for newest equipment from simplest to most sophisticated

RESISTANCE-TYPE SOLDERING

Power units, control consoles, handpieces, accessories . . . Basic building blocks for your automated soldering systems

THERMAL WIRE STRIPPING

Combinations of power and control units, handpieces and accessories for fast, nick free stripping of thermoplastics and other heat strippable insulations

NEW CATALOGS AND PRICING NOW READY

Ask for "American Electrical Heater Company publication Nos. 25PSW & 37WCP"

AMERICAN ELECTRICAL HEATER COMPANY

BURNDY

INSTALLATION TOOLING

Tooling is a final and very important consideration in the selection of a connection or termination method. So that the user may utilize the full quality designed into a Burndy connector or terminal, Burndy has designed tools to accomplish a connection or termination to the optimum degree.

Dependent upon his needs, a customer may order a hand tool, a semiautomatic tool, or a high-speed automatic tool. Burndy installation tooling is designed for utmost versatility. Hand tools as well as semiautomatic tools with removable dies permit work on a variety of contacts. Our automatic tools permit the same flexibility with a minimum amount of down-time required for changeover.

In the course of the last thirty years, Burndy has developed tools and dies to connect everything from #32 to 3,000,000 circular mil wire in production quantities from the occasional to well into the millions. The result: a tooling diversity which can satisfy the requirements of any customer.

Hand Tools

Some hand tools are designed with fixed dies and some with removable dies which increase the wire range accommodated by the tool. Installation rates up to 750 crimps per hour are possible with Burndy hand tools.

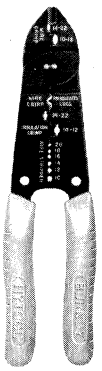
Semiautomatic Tools

All Burndy semiautomatic tools are designed with removable dies. Many types of compression terminations, therefore, can be made with the same basic tool. Installation rates up to 1500 crimps per hour are possible with Burndy semiautomatic tools.

Automatic Tools

Burndy automatic tools also are designed with removable dies to permit them to accommodate a variety of contacts. These tools provide high-speed, reliable installations and require little maintenance. Installation rates exceeding 3000 crimps per hour are possible with Burndy automatic tools.

Hand Tools

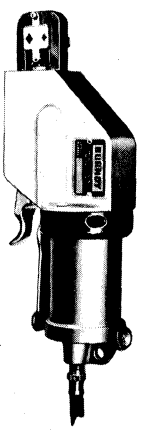


HYTOOL® Y10ME-4
Lightweight, plier-type tool. Two clearly marked crimp grooves: 22-14; 12-10.



HYTOOL Y-MRE
Lightweight, manual, rachet-controlled. Color-coded handle. Y16MRE crimps wire range 22-16; Y14MRE crimps wire range 16-14.

Semiautomatic Tools



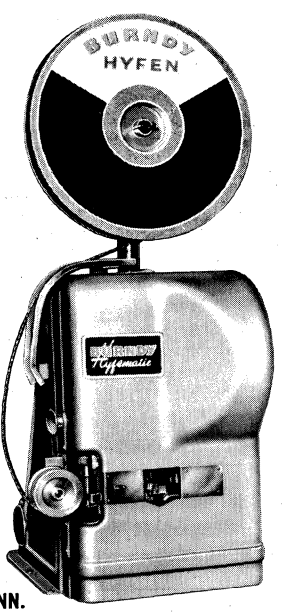
HYPRESS® Y8ND
Lightweight, pneumatic tool with full-cycling control. Removable dies interchangeable with **HYTOOL** M8ND.

Automatic Tools

AVM
Automatically installs strip-form **VINYLUG** terminals. High production rates equal reduced installed cost.

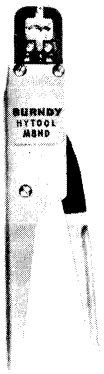


HYFEMATIC™
machine — automatically installs strip-fed contacts. Installation rates exceed 3000 contacts per hour.



BURNDY, NORWALK, CONN.

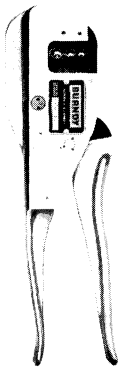
BURNDY



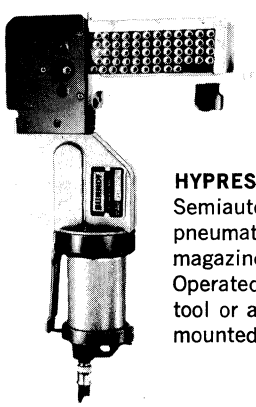
HYTOOL M8ND
Lightweight, manual, rachet-controlled. Removable dies interchangeable with **HYPRESS** Y8ND.



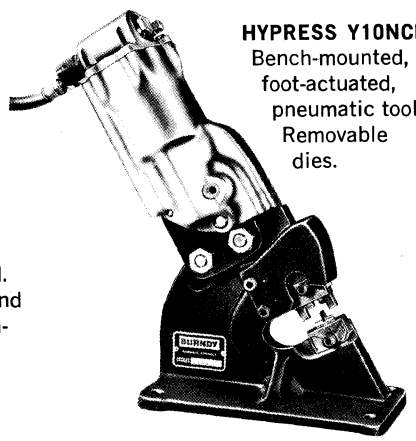
HYTOOL M10S
Lightweight, manual, rachet-controlled. Removable dies conform to requirements of **MIL-T-22520.**



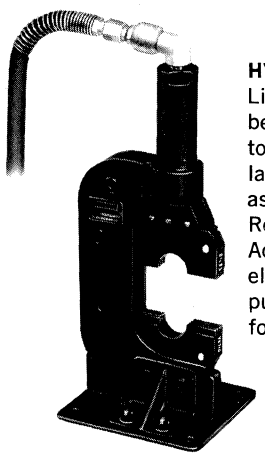
HYTOOL MR8
Lightweight, manual, rachet-controlled. Designed with grooved jaw.



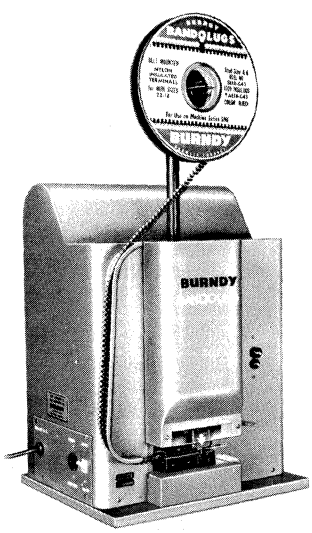
HYPRESS YD
Semiautomatic, pneumatic, magazine-loaded. Operated as hand tool or as bench-mounted tool.



HYPRESS Y10NCP
Bench-mounted, foot-actuated, pneumatic tool. Removable dies.



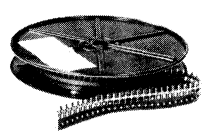
HYPRESS Y40LH
Lightweight, bench-mounted tool to install large **HYRING** assemblies. Removable dies. Actuated by electric hydraulic pump or by foot pump.



BANDOLUG®
machine — automatically installs insulated terminals for wire sizes #26 - #10.



BANDOMATIC™
machine — semiautomatically installs wide variety of contacts. Installation rates average 1500 contacts per hour.



BURNDY, NORWALK, CONN.

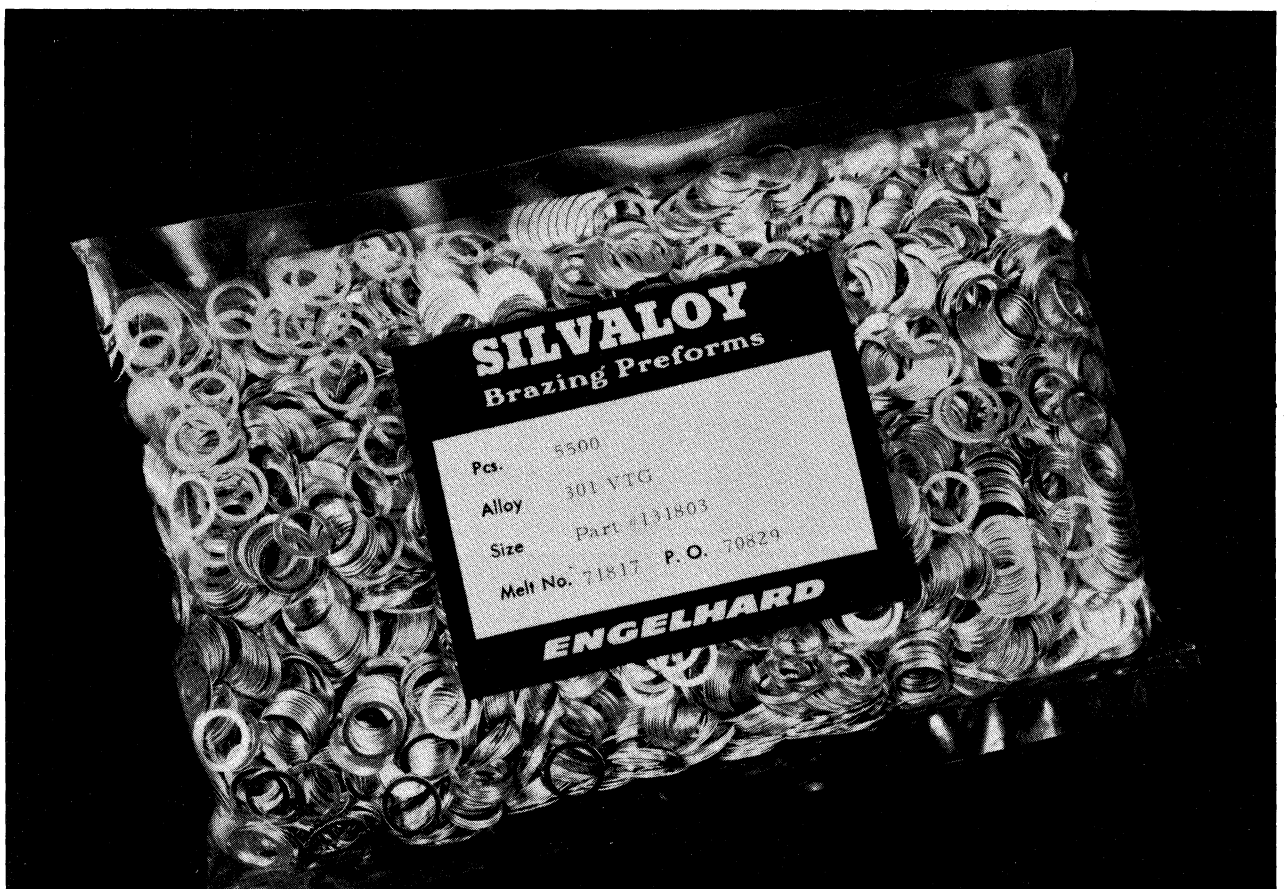
Shape up your brazing operation.

. . . with technical assistance from Engelhard. Let us show you how Engelhard Pre-Forms can make your brazing operation faster, more efficient and more economical. Experienced brazing experts will give you the engineering assistance you need to determine the best materials and methods for your brazing. They'll show you how Engelhard Pre-Forms will help minimize your inventory. How, by pre-packaging, we can supply brazing materials adjusted to your product sizes and requirements.

At Engelhard the latest in precision, high-speed production equipment enables us to produce pre-forms quickly and to the most exacting standards. This, plus our modern quality control system, assure you of brazing materials that meet your specifications precisely.

This combination of engineering know-how and long experience with a variety of customers enables us not only to offer better brazing materials, but also excellent delivery schedules as well.

For further information on this and the complete Silver Products line, write Silver Products Technical Service Department.



ENGELHARD

ENGELHARD INDUSTRIES DIVISION
ENGELHARD MINERALS & CHEMICALS CORPORATION
231 NEW JERSEY RAILROAD AVENUE, NEWARK, N.J. 07105

Norseman ELECTRONIC TOOLS

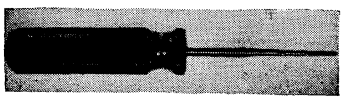
REVERSIBLE RATCHETS



A rugged ratcheting box wrench. No buttons, no levers—just turn it over to reverse the ratchet.

1/4" x 5/16"	$2.60 net	5/8" x 11/16"	$4.25 net
3/8" x 7/16"	2.90 net	5/8" x 3/4"	4.25 net
1/2" x 9/16"	3.90 net	3/4" x 7/8"	4.80 net

TRI-TAPS

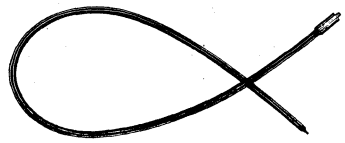


The original 3-in-1 tool with 6/32", 8/32" and 10/32" taps to clean or cut three of the most common threads used in electronic work.

T-3 ..... $2.50 net T-24 tap only for HT-24 .... $1.65 net

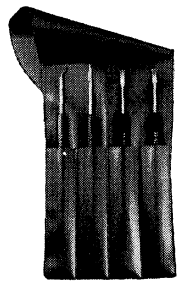
HT-24 with replaceable tap ..... $3.00 net

TIPPY STICKS



Flexible alignment tools of tenite II with a non-magnetic stainless steel tip. Permits snaking around obstructions and still turn screws and slugs

ST-186	6" long	$.50 net
ST-1810	10" long	.55 net
ST-1814	14" long	.60 net



SOLDERING AID KITS

TNSA-4 regular soldering aid kit with 4 tools

TN-22, TN-33, TN-44, TN-55 in vinyl kit complete $4.50

MTSA-4 miniature soldering aid kit with 4 tools M2T, M3T, M4T, M5T in vinyl kit complete $4.50

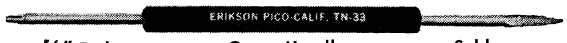
NORSEMAN SOLDERING AIDS



5/32" Fork	Red Handle	Circuit Tracer	
TN-22		7 5/8" Long	$.90 net
M2T	1/8" Fork	5 1/4" Long	.90 net



1/8" Fork	Black Handle	Stainless Steel Wire Brush*	
TN-44		7 1/2" Long	$1.05 net
M4T		5 1/4" Long	1.05 net



5/32" Fork	Green Handle	Solder Reamer	
TN-33		7 5/8" Long	$.90 net
M3T	1/8" Fork	5 1/4" Long	.90 net



Knife & Scraper	Blue Handle	Stainless Steel Wire Brush*	
TN-55		6 3/4" Long	$1.05 net
M5T		5 1/4" Long	1.05 net

HANDLES—are color coded of translucent Tenite II, hex and won't roll off the work bench. Shock-proof and will stand rough use on production lines.

METAL ENDS—(separated from each other) non-magnetic stainless steel, to which solder won't adhere. Are firmly seated in handles and are twist-proof.

FORKED END—straddles the wire and with a slight twist, grips it for easy unwinding and removal, or guides it into another lug for soldering. Since handles act as insulation, there is no danger of shock when working on units in operation. 1/8" forks are made especially for use on printed cidcuits and transistors.

SPADE END—is a reamer to clean lug holes of solder.

CURVED END—can be used as a scriber for marking chassis. As a circuit tracer when looking for loose connections. As a dial cord stringer. Hook can be bent to a 90 degree angle if desired.

WIRE BRUSH—has approx. 200 bristles of stainless steel wire .0035 in dia. For use in cleaning connections before soldering, brushing out splattered solder and in repairing printed circuits. *Separate wire brushes available on 2" shafts, .35 net.

KNIFE & SCRAPER—for cutting and repairing printed circuits.

NOTE—all four **TN** aids also made with unbreakable aluminum alloy handles for use on industrial production lines. (AL-22, AL-33, AL-44, AL-55)



STAINLESS STEEL WIRE BRUSHES

on steel shaft approximately 2" long overall. Can be used in a regular pin vise. .35 net

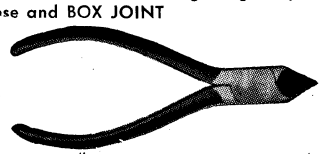
Packed 25 or 50 per box

Berg SWEDISH STEEL PLIERS

MADE IN ESKILSTUNA, SWEDEN, BY E. A. BERG MFG. CO. LTD. • ST. 1880

Only the best Swedish Charcoal Steel is used in the manufacture of Berg Pliers. Produced under exacting standards of control, they embody the most modern techniques of heat treatment and manufacture. Each plier is carefully engineered and designed to afford the greatest practical utility; lightness and ease of operation; and strength coupled with durability.

Special Electronic Diagonal Cutting Pliers with extra thin cutting edges, pointed nose and BOX JOINT



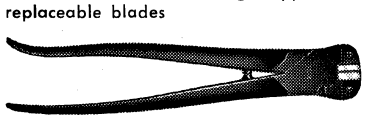
No. 525 - 5" $4.95



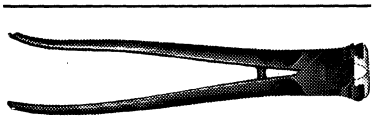
ANGLE NOSE Diagonal Cutting Pliers

No. 2528 ..... 6 1/2" $4.75 7 1/2" $5.50

PIANO WIRE Side Cutting Nippers with replaceable blades



No. 1518	9"	$7.50	10"	$8.50
Extra Blades	9"	2.30	10"	2.55



PIANO WIRE End Cutting Nippers with replaceable blades

No. 1519 - 9" $9.50

Extra Blades 2.90

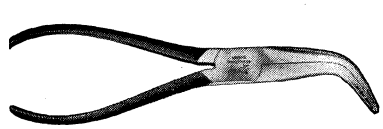
52 OTHER SIZES AND TYPES AVAILABLE



Straight Cutting Pliers with extended jaws

No. 1529 - 6 1/2" $4.50

Special Bent Nose Pliers



No. 2533-B - 8" $5.50

ERIKSON SPECIALIZED TOOL COMPANY P. O. Box 424 Pico-Rivera, Calif. 90660

SOLDERING IRONS

Irons up to 1250 watts are available

PENLINE-120 SOLDERING IRONS — 120 VOLTS; 25, 30, 40 AND 45 WATTS



Lowest cost GE iron; ideally suited for light to medium production in electronics, communications, and allied industries, for repair and maintenance operations, and by the "do-it-yourself" electronics kit builder.

Description	Cat. No.
Handle and Cordset	
Two-conductor*	6D400
Three-conductor, with NEMA standard plug	6D400G2
Heater Assemblies for Threaded Tips	
25W, 6D415; 30W, 6D414; 40W, 6D413*	

Description		Cat. No.
Tip and Heater Assemblies-Ironclad		
1/8" Chisel Tip	30 watts	6D410*
3/32" Chisel Tip	30 watts	6D411*
5/32" Chisel Tip	45 watts	6D412*
Use interchangeable threaded tips.		
* U.L. listed.		

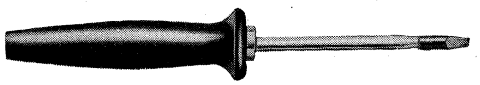
INTERCHANGEABLE THREADED TIPS

For Penline-120, Pistol-Grip, Midget, and Lightweight Heater Assemblies

Description	Cat. No.
Chisel Tips	
1/16" Dia—Copper	6D4P5
3/32" Dia—Ironclad	6D4P6
1/8" Dia—Copper	6D4P7
5/32" Dia—Ironclad	6D4P8
3/16" Dia—Copper	6D4P9
1/4" Dia—Ironclad	6D4P10
5/32" Dia—Copper	6D4P11
3/16" Dia—Ironclad	6D4P12
Pyramid Tips	
1/8" Dia—Copper	6D4P15
5/32" Dia—Ironclad	6D4P16
11/32" Dia—Copper	6D4P17
3/8" Dia—Ironclad	6D4P18

Description	Cat. No.
Spade Tips	
1/16" Dia—Copper	6D4P1
1/16" Dia—Ironclad	6D4P21
3/32" Dia—Ironclad	6D4P2
1/8" Dia—Ironclad	6D4P22
1/8" Dia—Copper	6D4P3
5/32" Dia—Ironclad	6D4P4
Long Chisel Tips	
3/16" Dia—Copper	6D4P13
7/32" Dia—Ironclad	6D4P14
Cone Tips	
1/8" Dia—Copper	6D4P19
5/32" Dia—Ironclad	6D4P20

LIGHTWEIGHT SOLDERING IRONS — 120 VOLTS; 40 AND 60 WATTS



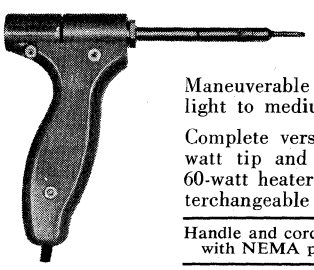
Ideal for light and medium production-line soldering and maintenance and repair operations in electronics and communications industries. Tip and heater assemblies can be changed in seconds.

* U.L. listed.

Complete Iron - Includes handle and 6-foot cordset, and 60-watt tip and heater assembly	
7/32" Ironclad Chisel Tip*	6A273
3/16" Ironclad Pyramid Tip*	6A283
3/16" Ironclad Chisel Tip	6A283G23
Handle and Cordset	
Two conductor	6A273G62
Three-conductor with NEMA standard plug	6A273G63

Tip and Heater Assemblies - 60 watts	
7/32" Ironclad Chisel Tip	6A300
3/16" Ironclad Pyramid Tip	6A301
7/16" Ironclad Chisel Tip	6A301G4
Heater Assemblies for Threaded Tips (Use Interchangeable Tips listed above)	
40 watts	6A304
60 watts	6A301G7

PISTOL-GRIP SOLDERING IRONS - 120V; 40, 60W



Maneuverable and comfortable, excellent for light to medium production.

Complete versatility with choice of three 60-watt tip and heater assemblies; or 40- and 60-watt heater assemblies with 20 different interchangeable ironclad or copper threaded tips.

Handle and cordset, three-wire with NEMA plug	6A303

Can be used with Lightweight tip and heater assemblies or with Lightweight heater assemblies and interchangeable tips.

MIGHTY MIDGET SOLDERING IRON - 12V; 100W



A lightweight iron with high heat capacity for heavy soldering where larger irons, up to 200 watts, prove unwieldly for rapid repetitive soldering.

Tip and Heater Assembly	Handle and Cordset	
1/2" Ironclad Chisel Tip — for 60 w, 6A211G54; 80 w, 6A211G50; 100 w, 6A211G33.	Two-conductor	6A210G61
	Transformer - 115-volt primary	
	Four Tap — for 55/70/85/100 watts	6A364G7

MIDGET SOLDERING IRONS — 6 VOLTS; 25 and 45 WATTS (Also tapped transformers)



A versatile iron for light production in electronics, and communication industries — handles like a pencil, weighs but 1¾ oz. Tip renewal is easy and fast — complete tip and heater assembly can be changed in a few seconds.

Handle and Cord Set			
For single-and 4-tap transformers	6A203	For transformer with 3-heat switch	6A203G2

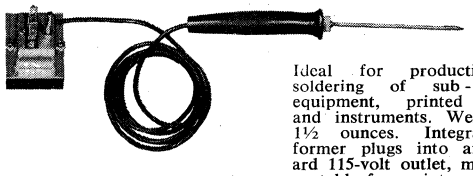
Tip and Heater Assemblies - All ironclad tips		
5/32" Chisel Tip	25 watts	6A211
1/8" Cone Tip	25 watts	6A213
3/16" Pyramid Tip	25 watts	6A215
1/8" Chisel Tip	25 watts	6A217
3/16" Chisel Tip	45 watts	6A211G31

Heater Assembly for Threaded Tips (Use Interchangeable Tips)	
25 watts	6A221
Transformers - 115-volt Primary¶	
Single Tap 35 watts	6A362G2
Four Tap —for 26/29/32/35 watts	6A364G2
With Three-heat Switch† —18 to 35 watts	6A434

¶Single- and four-tap transformers are available with 240-volt primary in quantities of 36 or more.

†Suitable for use only with Handle and Cordset 6A203G2.

MINIATURE SOLDERING IRONS — 6 VOLTS; 12 VOLTS



Ideal for production line soldering of sub-miniature equipment, printed circuits, and instruments. Weighs only 1½ ounces. Integral transformer plugs into any standard 115-volt outlet, makes iron portable for maintenance work.

Complete Iron - Includes handle and 6-foot cordset, tip and heater assembly, and transformer		
1/8" Chisel Tip	3" Shank	6A428G3
1/8" Chisel Tip	6" Shank	6A428G4
1/8" Pyramid Tip	3" Shank	6A428G7
1/8" Pyramid Tip	6" Shank	6A428G8

Complete Iron Less Transformer		
1/8" Chisel Tip	3" Shank	6A428G5
1/8" Chisel Tip	6" Shank	6A428G6
Renewal Tip and Heater Assembly		
1/8" Chisel Tip	3" Shank	6A429G3
1/8" Chisel Tip	6" Shank	6A429G4
1/8" Pyramid Tip	3" Shank	6A429G5
1/8" Pyramid Tip	6" Shank	6A429G6

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For complete information contact nearest Sales Representative above, nearest authorized GE Distributor or nearest GE Sales Office listed on inside front cover.

GENERAL ELECTRIC

ERSIN

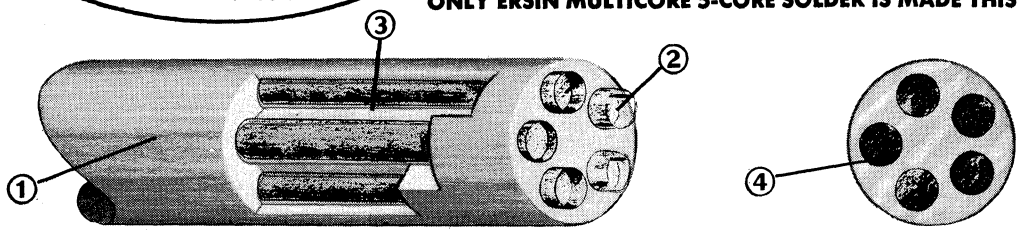
Multicore

5-core wire rosin solder

Available in 1-lb. and 7-lb. reels

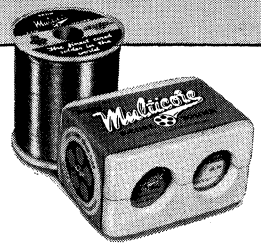
This is no ordinary solder!

ONLY ERSIN MULTICORE 5-CORE SOLDER IS MADE THIS WAY



These illustrations show the construction of ERSIN Multicore 5-Core Solder. Multicore solder is made only from pure virgin metals (1) with 5 cores of exclusive extra-active, non-corrosive ERSIN Flux (2). Multicore's special manufacturing process locates the 5 cores of ERSIN Flux close to each other and at the perimeter, so that there is only an ultra-thin wall of solder between the cores of flux and the work (3). This unique core configuration (4) also keeps the flux near the heat source, to melt faster—wet the metal more effectively. This enables ERSIN Multicore solder to produce the consistently reliable joints for which it is known.

Conforms to Federal Specification QQ-S-571



EXCLUSIVE PACKAGING IN POLYSTYRENE AND SKIN-WRAP FOR UTMOST PROTECTION IN SHIPPING AND STORAGE

STANDARD TIN/LEAD ALLOYS AND GAUGES

Available from stock: 63/37; 60/40; 50/50; 40/60; Savbit; Special Alloys—H.M.P. (High Melting Point, 565° F.); L.M.P. (Low Melting Point, 354° F.). Other alloys upon request.

Gauges: 14 s.w.g. (.080") through 24 s.w.g. (.022"). NOTE: Soldering iron tips should always be 108° F. above melting point of alloy.

NEEDLE FINE GAUGES

For microminiaturization, integrated circuits and other similar requirements. Off-the-shelf delivery in alloys 63/37 and 60/40, in even gauges from 28 s.w.g. (.014") through 34 s.w.g. (.009").

COPPER LOADED SAVBIT ALLOY

Copper-loaded SAVBIT stops the wear and erosion of copper soldering iron tips...increases tip life by 1,000%.

Characteristics and specifications: Savbit Alloy is available in Ersin Multicore 5-core solder containing non-corrosive extra-fast Ersin Flux in 14, 16, 18, 20, 22 and 24 gauge. Melting point: Virtually the same as standard tin/lead alloys. Excellent conductivity, tensile and shear strength.



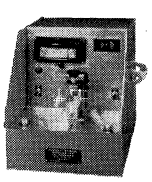
HIGH PURITY EXTRUDED BAR SOLDER

The same superior quality solder as in Multicore 5-Core Wire Rosin solder. Highest purity is achieved by advanced quality control, possible only with the Extrusion process. Extreme uniformity and smooth texture, without the cross-graining of cast bars. Virgin metals. Conforms to Federal Specification QQ-S-571d with respect to alloy composition in Sn60 (60/40), Sn63 (63/37), and Sn50 (50/50). Skin wrapped for distributors; bulk-packed for manufacturers. Also, low antimony "EXTRUSOL" Commercial Bar Solder—bulk packed.

ERSIN LIQUID FLUXES

Made to the high quality standards of Ersin Multicore. Three formulas. No. 5380 meets Military Specification MIL-F-14256C, Type A (Activated). No. 0360 meets Military Specification MIL-F-14256C, Type W (Non-activated). Other commercial liquid fluxes available such as: No. 4370 highly activated commercial flux. Foam, water soluble, protective coatings and cleaners upon request.

NEW SOLDERABILITY TEST MACHINE



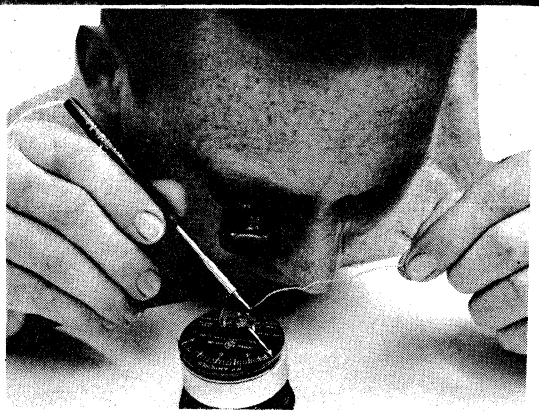
A precision instrument to determine the solderability of component termination wires that operates on a principle entirely different from, and superior to, the immersion method—electronic digital timing. Accurate, positive, totally reliable, yet economical because no technician is needed to operate it, and tests are run with great rapidity. Developed in association with I.E.C. Built in England by Multicore Solders, Ltd. Complies with I.E.C. Publication 68-2 Test T. Descriptive literature available on request.

FREE evaluation test samples, "Modern Solders" technical booklet, and fully detailed information on any of these products will be sent promptly. Address request, on company letterhead, to: Multicore Sales Corp., Dept. RY399, Westbury, N.Y. 11590.

MULTICORE SALES CORP., WESTBURY, N.Y. 11590, Div. British Industries Co.

ORYX

PRECISION SOLDERING EQUIPMENT



WHY PRODUCTION MANAGERS CHOOSE ORYX SOLDERING IRONS

1. MINIATURE SIZE

ORYX soldering irons are small and easy to handle as pencils. Their miniature size helps to speed any precision soldering operation. Damage to adjacent components is eliminated. If you can see it, you can solder it with ORYX!

2. FEATHER WEIGHT

A standard, utility-type 100 watt soldering iron weighs about 2 lbs. The so-called pencil-type irons typically weigh between 2 and 6 ounces. ORYX soldering irons, by contrast, weigh as little as ¼ ounce. This true feather weight virtually eliminates hand fatigue. Workers can turn out many more joints per hour with fewer rejects.

3. HIGH EFFICIENCY

All ORYX soldering irons utilize a unique element-in-the-tip design principle. By generating the heat **within** the tip, far fewer watts are needed to achieve results comparable to much larger irons. This principle also provides quicker heat recovery because the heat path between element and joint is so very short. The need for large insulating handles is eliminated.

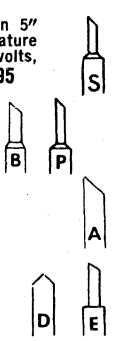
LOW-VOLTAGE SOLDERING IRONS

MODEL 5-S—(As shown in photograph). Eyepiece model less than 5" long, for precise finger control. Weighs 7 grams. Nominal temperature 575°F. Furnished with 1/16" S tip. Also takes T and U tips. 4.5-volts, 4.5-watts (Use 54204-T tapped transformer for 4.5 volts)....Net **$5.95**

MODEL 6A—The most popular Oryx soldering iron. Designed for printed circuit soldering. Weighs only ¼ oz. Nominal temperature 690°F. Furnished with 3/32" removable B tip. Also takes 1/16" P tip and new long-life V tip. 6-volts, 6-watts... Net **5.95**

MODEL 9-6—Similar to model 6A, but greater heat capacity. Weighs ¼ ounce. Nominal temperature 750°F. Furnished with 5/32" A tip. Also takes B tip. 6-volts, 8.3 watts. **5.95**

MODEL 11-6—Special model for high-temperature solders. Temperature 835° F. Weighs ¼ oz. Furnished with 3/32" solid nickel E tip. Also takes the 5/32" D tip. Nickel tips provide long life at high temperatures. 6-volts, 10-watts ..... Net **7.45**

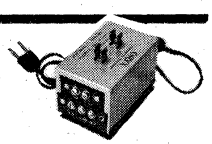


REPLACEMENT TIPS for low-voltage soldering irons.

Type	Material	Plating	Diameter	For Model	Net Ea.
A	Copper alloy	Nickel	5/32"	9-6	$ .54
B	Copper alloy	Nickel	3/32"	6A, 9-6	.54
D	Solid nickel	—	5/32"	11-6	1.80
E	Solid nickel	—	3/32"	11-6	1.80
P	Copper alloy	Nickel	1/16"	6A	.60
S	Copper alloy	Nickel	1/16" (short)	5-S	.60
T	Gold end, copper body	Nickel	1/25"	6A	2.35
U	Gold end, nickel body	—	1/25"	6A	2.35
V-PL	Copper alloy	Iron	3/32"	6A, 9-6	1.50

TRANSFORMER

for low-voltage soldering irons.



TAPPED TRANSFORMER—Output 4½ to 6-volts in ½ v. steps. For exact temperature control on all ORYX 6-volt tools. Operates on 115 V. AC—ready to plug in. Model 54204-T.....Net **$6.50** ea.

TELVAC

LABORATORY TOOLS / APPARATUS

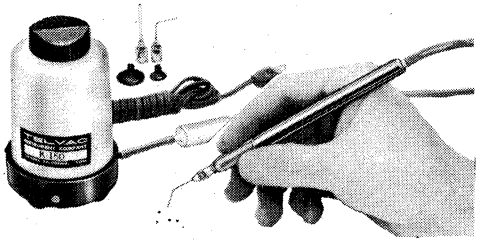
VACUUM TWEEZER SYSTEM

This new parts-handling system positively and precisely lifts parts varying in size from microscopic to those weighing several ounces. Parts are handled without damage or contamination. Defects caused by pinching, scratching, or marring are eliminated. Critical surfaces are protected. Vacuum is turned on and off with forefinger. For 115 V. A.C. Complete system, ready to plug in.

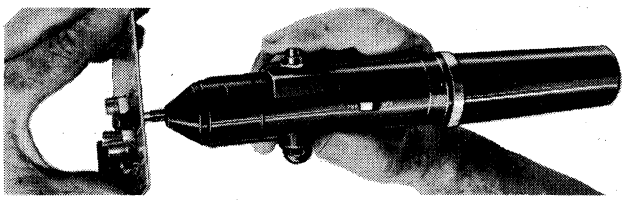
Complete System K-150

Net ea.

$34.50



"IN-CIRCUIT" TRANSISTOR TESTER



A new test instrument for the circuit designer or test technician. Makes rapid "go-no go" evaluations of semiconductors while they are still in the circuit. Checks cut-off and conduction on PNP and NPN transistors and diodes without the need for costly unsoldering. To use, the operator sets the selector switch to NPN or PNP. He then presses the tester's sharp spring-loaded pins (arranged in TO-5 configuration) against the transistor's printed circuit connections. Open and shorted transistors are readily identified by noting the condition of the tester's pilot light. Diodes and unmounted transistors are similarly tested using a set of extruding leads and clips. An optional 7-position diode adapter may be used to test diodes in the circuit. Furnished complete with extending leads and alkaline battery, ready to operate.

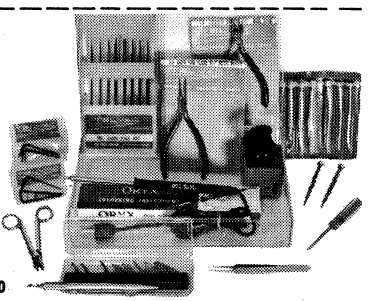
MODEL SC-4 TESTER .....Net **$72.50** ea.

MODEL 1330 DIODE ADAPTER .....Net **16.50** ea.

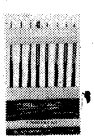
INSTRUMENT REPAIR KIT

A 35-piece kit of fine precision tools for the instrument shop or laboratory. Includes miniature soldering iron, taper-jaw diagonal cutter, needle-nose plier, precision screwdriver kit, tiny stub-nose scrissors, eye loupe, needle-file set, 11-piece knife set, hex wrench set, spline-key set, soldering aid set, and a precision Dumont-type tweezer.

MODEL K-50.....Net **$49.50**



NEEDLE FILES



Precision Swiss needle files with vinyl cushion finger grips.

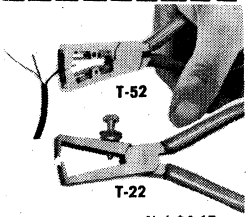
Set of 8 precision Telvac files in plastic case. No. 3 cut.

Cat. No. 2000 (4" styles) .....Net **$5.75** ea.

Cat. No. 2100 (6¼" styles) .....Net **6.95** ea.

WIRE STRIPPERS

Unique wire-stripping pliers for wires #8 through #24. Just squeeze and pull! T-52 has 11 narrow cutting blades that close in around the wire to automatically provide the correct stripper opening and cutting tension. No operator adjustments required when changing from one wire size to another! T-22 is set to required wire size by operator. Tool steel heads have razor-sharp edges. Both models have red vinyl cushion handle grips.



T-52 .....Net **$6.95** ea. **T-22** .....Net **$4.15** ea.

ORYX-TELVAC tools available from distributors everywhere. Write for complete catalog.

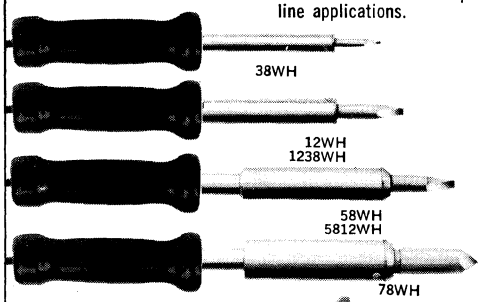
TELVAC INSTRUMENT CO. 18531-E VENTURA BLVD., TARZANA, CALIFORNIA 91356

SINCE 1864

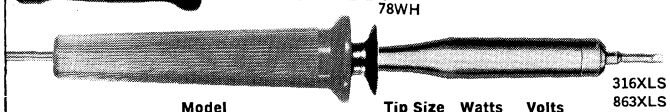
WALL BRAND

SOLDERING PENCILS, IRONS, GUNS AND HOLDERS

WallBrand pencils and irons are engineered for highest efficiency with handles designed to be cooler, lightweight and balanced perfectly. WH models have triple-life resistance wire wound on pure mica for continuous heavy duty soldering requirements; constant tip temperature with extra fast recovery. 120 volts AC-DC. Other voltages are available on request. Wall's own plating facilities produce long-life tips to meet the demanding applications of micro-circuitry, high density packaging, precision work on solid state devices, printed circuits and continuous precision soldering for production line applications.



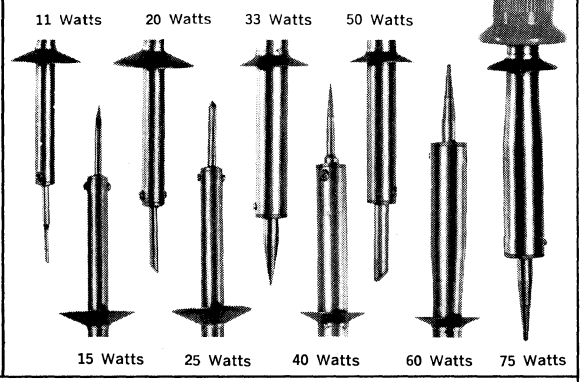
Model	Watt Input	Tip Size	Length W/O Tip	Volts
38WH	80	3/8"	10½"	120
38WH	100	3/8"	10½"	120
1238WH	125	3/8"	10½"	120
1238WH	150	3/8"	10½"	120
12WH	125	½"	10½"	120
12WH	150	½"	10½"	120
5812WH	200	½"	12¼"	120
58WH	200	5/8"	12¼"	120
58WH	250	5/8"	12¼"	120
78WH	300	7/8"	12¾"	120
78WH	375	7/8"	12¾"	120

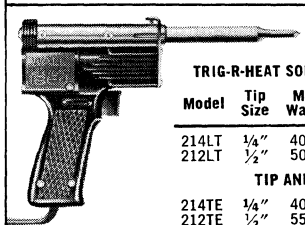


Model	Tip Size	Watts	Volts
316XLS (Comm. Duty)	3/16"	30	120
863XLS (Comm. Duty)	3/16"	40	120

NEWEST!
XLS pencil iron — Versatile Molded Handle fits 9 elements

New pencil iron featuring element interchangeability and highest performance. Handle fits nine heating elements from 11 to 75 watts. Quickly and easily changed by operator. XLS molded handle is cool, lightweight and made of high impact, soft blue colored polycarbonate. Available with either 2 or 3 wire cord. Wall's full line of regular and long-life iron plated tips are available for the 9 easy-to-change heating elements.



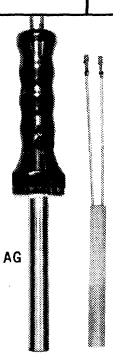


214LT

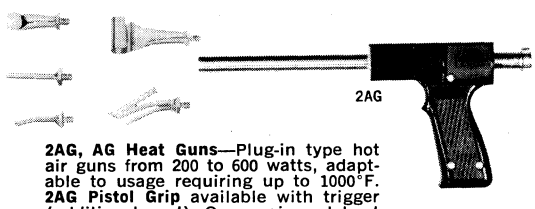
TRIG-R-HEAT SOLDERING GUN SPECIFICATIONS

Model	Tip Size	Max. Watts	Min. Watts	Voltage AC or DC	Weight W/O Cord
214LT	¼"	400	150	120	14 oz.
212LT	½"	500	300	120	24 oz.
TIP AND ELEMENT ASSEMBLY					
214TE	¼"	400	150	120	
212TE	½"	550	300	120	

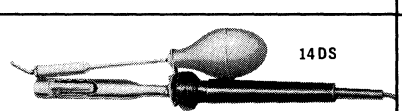
Trig-R-Heat Soldering Gun—Feather light, 14 oz., no heavy transformer. Reaches hard-to-get-at spots; tip will not deform. Heats and recovers instantly. Rugged, precision-built. Easily changed tip and element assemblies.



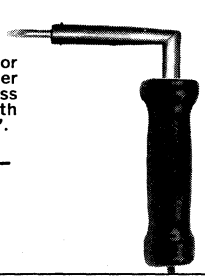
AG



2AG, AG Heat Guns—Plug-in type hot air guns from 200 to 600 watts, adaptable to usage requiring up to 1000°F. **2AG Pistol Grip** available with trigger (additional cost). Opens air and heat at the same time. **AG Handle Grip.** One heating element fits both guns. All five tip styles interchangeable. Special tips on request. Three-wire cord assembly. Hundreds of uses — shape, form, weld and seal thermoplastics. Gun includes neoprene air hose, hose fittings, pressure regulator and gauge.

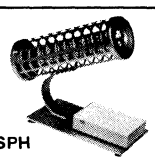


14DS Desoldering Tool—Keeps solder in a molten state in reservoir, operated with one hand, fits existing Wall 14HD Iron. Replaceable tip, .080 opening. Other sizes by special request.



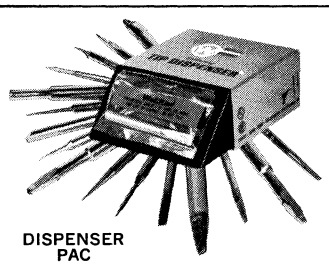
Hatchet Irons—New high reserve models that enable user to make more solder connections faster. Reduces operator fatigue, with better quality control and higher production. ¼" and ⅜" tips available. Unless otherwise specified, irons are equipped with 2-wire HPN cords and Wallbrand Tip Style "C".

Model	Tip Size	Watts	Volts
714-60	¼ in.	60	120
714-75	¼ in.	75	120
738-80	⅜ in.	80	120
738-100	⅜ in.	100	120



SPH

SPH Soldering Pencil Holder for units up to 5/8" diameter shaft — **SIH Soldering Iron Holder** for units up to 1" diameter shaft. Can be mounted on top, in front or below bench. Adjusts to any angle. Bench models include tip cleaning sponge.



DISPENSER PAC

Soldering Tip Dispenser Pac—Iron-plated or copper tips, ⅛" through ⅜", are available in handy tip dispenser pac. Keeps tips individually sealed in color-coded, continuous belting, plastic envelope. Ideally suited for production line station or stock distribution.

Soldering Tips for Pencils and Irons—Three grades: **Anniversary:** Industrial, highest quality. Copper core, special iron coating. Anti-seize life for rigorous production line demand. **WallKlad**—Industrial, copper core, iron coating chrome plated. Production line and critical laboratory use. **WallBrand**—Commercial, copper, nickel plated. All commercial applications. Tip sizes from ⅛" through ⅞". Special tips to specifications designed on request.

Send for illustrated catalog I-1265 about Wall's tips, irons, pencils, and holders.

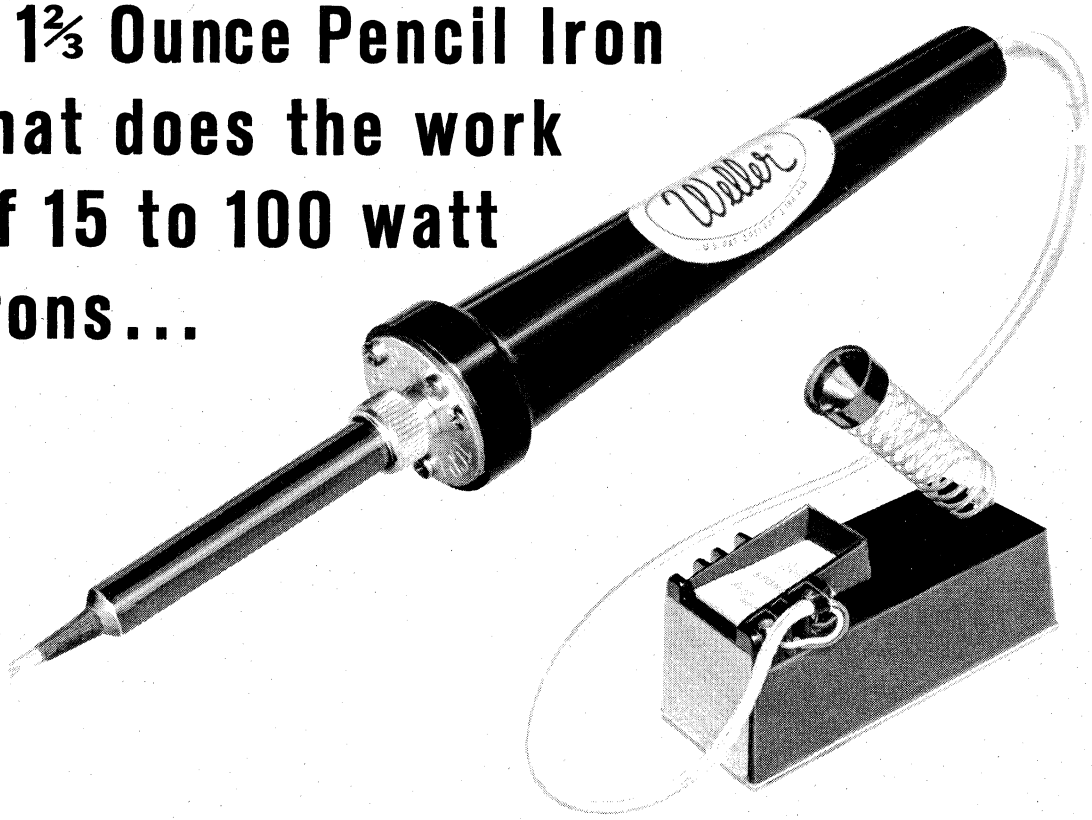
Send to Dept. EEM-69

WALL MANUFACTURING CO., BOX 3349, KINSTON, N. C., 28501 TEL(919)527-4186

Industrial Soldering Pencils are built to exceed federal specification W-S-570a as amended. WallBrand soldering products are UL and CSA listed.

Weller INDUSTRIAL SOLDERING TOOLS

A 1⅔ Ounce Pencil Iron that does the work of 15 to 100 watt irons...



and does it faster and better!

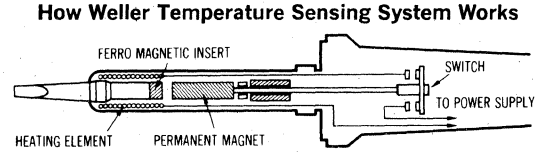
The new low voltage W-TCP Soldering Pencil automatically adjusts to every soldering job in the range usually covered by 15 watt to 100 watt irons. Operators can go from delicate component soldering to heavy ground lugs, and never switch irons! Weller's controlled energy reserve delivers the extra heat as it is needed.

Despite its phenomenal capacity range, the Weller W-TCP never overheats. A foolproof, magnetic control accurately senses tip temperature moment-by-moment, and regulates power input, virtually eliminating cold solder joints or excess heat.

The Weller Soldering Pencil and Power Unit are an unbeatable production team. Low voltage design means a more rugged heating element and much longer tip life. Premium plated tips are available in a wide range of shapes and temperatures.

Write or phone for the new Weller Catalog of production soldering equipment and name of your nearest Weller technical representative.

How Weller Temperature Sensing System Works



Magnet is attracted to ferromagnetic tip insert when iron is cold, holding switch contacts closed. As tip heats, approaching selected Curie point of insert, attraction is reduced causing magnet to retract and open switch. As tip cools slightly, magnet is again attracted to tip insert sensor, maintaining tip temperature within close limits.

Model W-TCP — Temperature controlled Low Voltage Soldering Pencil with 3/16" 700°F tip and power unit. Weight with tip, less power unit and cord, 1⅔ oz., overall length 7½". Supplied with burn-proof silicone rubber cord and 120 V., 50/60 cycle transformer with pencil holder and cleaning sponge. Secondary isolated for operator's protection. Tips available for 500°, 600°, 700°, 800° idling temperature.

Model TCP-1 — Soldering Pencil only, with silicone covered cord, 3/16" 700°F Tip. May be operated from any 24 volt power source.

Model PU-1 — Power Unit only, as described under W-TCP. 120 V., 50/60 cycles. (Also available for 230-250 V.)

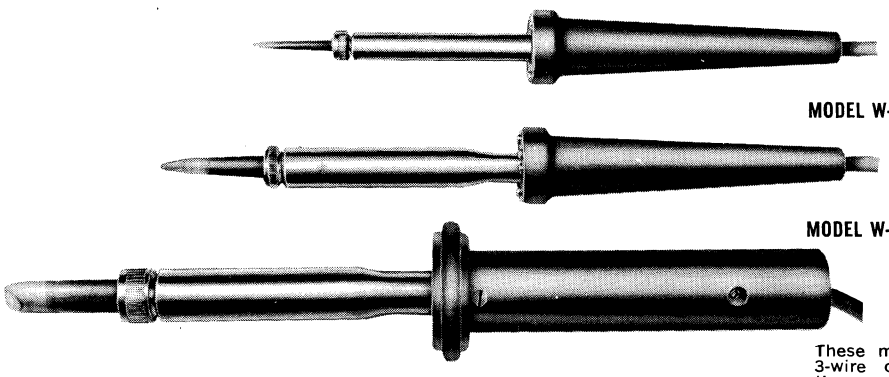
WELLER OFFERS A COMPLETE LINE OF SOLDERING TOOLS FOR PRODUCTION, MAINTENANCE AND SERVICING.

with Energy Reserve and Temperature Control

9320

TEMPERATURE-CONTROLLED INDUSTRIAL SOLDERING TOOLS

. . . with Energy Reserve



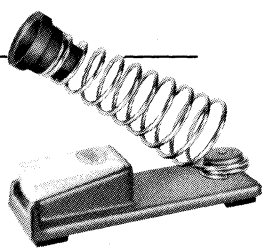
MODEL W-60 Covers 15 Watt to 100 Watt spectrum with one tool. 60 Watts, 120 V., Wgt. 2½ ozs., 7¼" long. With 800°F. ⅛" screwdriver tip.

MODEL W-100 Covers 50 Watt to 150 Watt spectrum with one tool. 100 Watts, 120 V., Wgt. 3½ ozs., 8¼" long. With 800°F. ¼" screwdriver tip.

MODEL W-200 Covers 150 Watt to 300 Watt spectrum with one tool. 200 Watts, 120 V., Wgt. 10 ozs., 9½" long. With 800°F. 7/16" chisel tip.

These models can be supplied with 2-wire or 3-wire cords. (Weller "Temperature Sensing" tips are available in standard industrial configurations at 500°, 600°, 700° and 800°F. for the model W60; and in 600°, 700° and 800°F. for models W100, W200's).

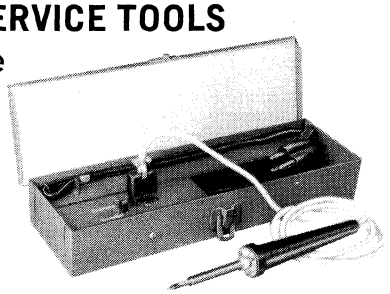
SOLDERING TOOL STAND



Model PH-60—Stand will accommodate W-60 and W-100 tools, with interchangeable funnels. Includes tip cleaning sponge. Heavy cast base. Spring guard protects operator from contact with heated tip.

TEMPERATURE-CONTROLLED FIELD SERVICE TOOLS

. . . with Energy Reserve

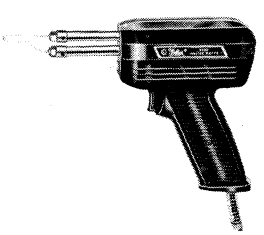


We invite inquiries concerning your field service soldering equipment needs. We offer to develop soldering kits adapted to meet your special requirements.

TCP-12 12-14 volt operation PB-6 Self contained,
TCP-24 24-28 volt operation battery powered

Weller "Temperature Sensing" tips available in standard industrial configurations at 500°, 600°, 700° and 800°F.

WORLD FAMOUS *Weller* DUAL-HEAT GUNS



The original soldering gun. Available in three dual-heat models.

PRODUCTION SOLDERING TOOLS FOR ELECTRONIC MANUFACTURING

Weller® INDUSTRIAL PRODUCTS DIVISION

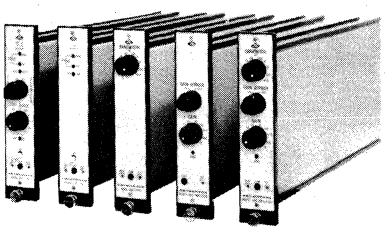
WELLER ELECTRIC CORPORATION • 100 WELLCO ROAD, EASTON, PA. 18042 • 215 • 258-5371

KINGSTON, ONTARIO, CANADA • HORSHAM, SUSSEX, U. K. • BESIGHEIM, WEST GERMANY

SERIES 889 SIGNAL CONDITIONERS

A Family of Interchangeable Signal Conditioning Modules

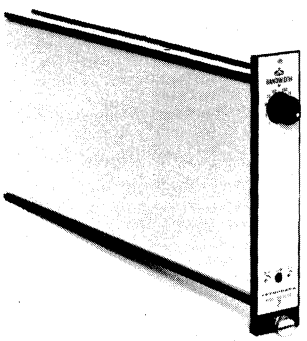
ASTRODATA



The Astrodata 889 family includes DC differential data amplifiers, biophysical amplifiers, strain gage power supplies and input signal conditioners, active filters, and hi-lo level VCOs. This family of products has the unique trait of being compatible modules which can be interchanged to provide a total solution to the requirements of system instrumentation.

The 889 DC differential data amplifier is a chopperless, high-performance unit with single or dual outputs. It is available in 32 different configurations starting at $330. The 889 amplifier is very compact. 12 amplifiers can be housed in 7-inches of rack space.

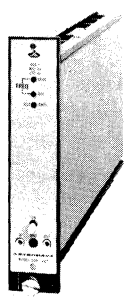
The 889 amplifier is described in detail in section 1100 of EEM. The balance of the 889 instruments are described below.



ELECTRONIC FILTER

Model 889-900 is an active 3-pole (18 db/octave) linear phase low-pass filter having a response to dc. 3 db point frequency steps are 1Hz, 3Hz, 10Hz, 30 Hz, 100Hz, 300Hz, 1KHz, 3KHz, 10KHz and wideband selectable by a front panel control. The 889-900 features a high input impedance, obtained through the use of an input buffer amplifier, an isolated wide band output and a filtered output. The bandwidth of the wideband output is greater than 150 KHz at 10 volts peak-to-peak A wideband position is also provided on the filter switch which places only a non-inverting isolating amplifier in the signal path to the filter amplifier output.

Twelve 889-900 filters can be packaged in a standard 19-inch rack. Dimensions are 7 inches high by 21 inches deep including fuses and mating connectors for filters.

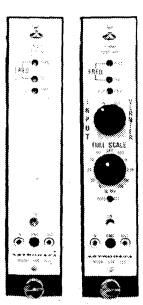


SIGNAL CONDITIONERS

Model 889-600 DC Bridge Signal Conditioner offers the ultimate in stability and isolation when used with strain gages and other resistive type transducers. It combines in a single integral package, a precision isolated constant current-constant voltage power supply for transducer excitation plus a signal conditioner designed for use with 1,2, or 4-active arm bridges.

Bridge completion and calibration resistors are changed by simply removing the small printed circuit cards which plug into the main signal conditioning card. ±4 point remote calibration as well as electrical zero calibration is provided.

Twelve channels can be mounted in a standard 19-inch rack, requiring just 7-inches of rack height.

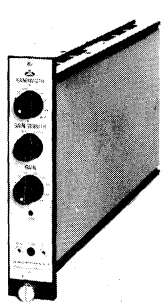


HI/LO VOLTAGE CONTROLLED OSCILLATOR

Model 506 High/Low Voltage Controlled Oscillator is a high-performance, all solid state unit designed for applications involving thermocouples, resistance bridges, potentiometers, and other low-level signal sources as well as medium-level and high-level signal sources. A plug-in channel selector enables the center frequency and deviation sensitivity of the 506 to be readily changed. Channel selectors are available for all IRIG, and AIA FM subcarrier channels.

The low-level version of the 506 provides full scale input ranges of ±5, 10, 25, 50, 100, 250, 500, 1000, 2500, 5000 and 10,000 millivolts. The high level version has an input voltage range of ±2.5 volts full scale. An optional internal switch permits operation of 2 full scale inputs from ±0.5 to ±5 volts.

Twelve Model 506 VCOs require only 7-inches of rack space.



BIOPHYSICAL AMPLIFIER

Model 890-500 Biophysical Amplifier was designed specifically to fill the needs for an amplifier that will accept signals from living active elements with a high source impedance. The 889-500 Amplifier will work with source impedances up to 10 megohms without degradation in specifications. The amplifier features both a low pass and a high pass filter.

The 889-500 will recover from overloads instantaneously when a front-panel RESTORE button is depressed. Usable gain range between 50 and 5000 is provided in gain steps of 50, 100, 200, 500, 1,000 and 2,000. Input circuitry is balanced, differential, isolated from ground and outputs.

Twelve amplifiers require only 7-inches of 19-inch rack space.

ASTRODATA INC. P. O. BOX 3003 • 240 E. PALAIS ROAD, ANAHEIM, CALIF. • (714) 772-1000

HALL GENERATORS, WATTMETER TRANSDUCERS & WATTMETERS also Hall Effect Multipliers

BELL INC.

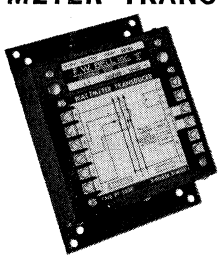
"Hall-Pak" HALL GENERATORS

		OPEN CIRCUIT HALL VOLTAGE V_{HOC}, mV ±25% (AT NOMINAL I_C, B=10kG)	RESISTIVE NULL VOLTAGE V_M, μV MAX (B=0, I_C=100mA)	INPUT RESISTANCE R_{IN}, Ω (INCLUDING LEADS)	OUTPUT RESISTANCE R_{OUT}, Ω (INCLUDING LEADS)	NOMINAL CONTROL CURRENT I_C, mA	LENGTH/WIDTH/THICK. OR DIAM./LENGTH (inch)	SINGLE QUANTITY PRICE
BH200	General Purpose Transverse	150	100	1.5	1.0	150	.500/.130/.019	$ 34.00
BH201	Ultra-Thin Transverse	120	250	2.3	1.8	100	.625/.135/.006	200.00
BH202	Small Axial	100	100	2.6	1.8	100	.130 diam./.150	75.00
BH203	General Purpose Axial	100	100	1.9	1.3	100	.195 diam./.175	34.00
BH204	Midget Axial	110	200	2.3	1.9	100	.100 diam./.150	100.00
BH205	Midget Transverse	130	100	2.1	1.4	125	.375/.080/.015	100.00
BH206	High Sensitivity Transverse	550	500	5	3.5	200	.750/.225/.030	15.75
BH207	High Resolution Tangential	160	200	2	1.5	150	.500/.145/.045	125.00
BH208	Ultra Midget Axial	100	250	2.7	1.9	100	.063 diam./.170	300.00
BH700	Low Cost Transverse	500	750	5	4	200	.200/.250/.023	10.75
BH701	High Linearity Transverse (Note 1)	75	75	2	1.5	100	.625/.230/.040	100.00
BH702	Ferrite Imbedded	(Note 2)	250	3.5	3	200	.300/.200/.083	35.00
BH703	3-Axis	75	100	1.5	1.5	100	.285 diam./.750	575.00

Note 1: Hall voltage (V_H) vs. B field, { ±.25% of reading from −10 kG to +10kG ; ±1% of reading from −30 kG to +30kG } Linearity curves furnished for −10 kG to +10kG and −30 kG to +30kG. Optimized curves for other ranges available on special order.

Note 2: In a free field of 100 gauss the open circuit Hall voltage is 9 mV min. In a closed magnetic circuit, minimum sensitivity is 3.2 mV/ampere-turn.

WATTMETER TRANSDUCERS PT-2000 Series



A choice of five (5) fundamental types is available for measurement of 50-60 Hz power in single phase, 3 phase-3 wire, and 3 phase-4 wire systems. The series includes models which can accept 240, 380 or 480 V input permitting direct hook-up to motor power lines, without need for external transformers. All models offer ±0.25% FS linearity as well as ±0.25% FS power factor influence at 50% PF, leading or lagging. Coupled with a response time of 100μs, these performance characteristics make this series suitable for accurate measurement on SCR controlled circuits. The series is packaged in a ruggedized industrial steel case with 20A barrier blocks. All units are designed for direct mounting in standard NEMA and JIC enclosures, permitting complete protection in a plant environment. Each wattmeter transducer is furnished with wiring diagram attached to facilitate installation. Rating of each model is shown on the nameplate.

Power System	Standard 50-60 Hz Models And Ratings*		Calibrated Output At Nominal Power Rating	Price (Qty. 1-9)
Single Phase	PT-2103	120/240V 5/10 A	50mV dc at 0.5kW	$112.00
3-phase 3-wire Uniform Voltages	PT-2207	240/480V 6A	50mV dc at 2.0kW	149.00
3-phase 3-wire Unbalanced	PT-2301	120V 5A	100mV dc at 1.0kW	150.00
3-phase 4-wire Uniform Voltages	PT-2401	120V 6A	100mV dc at 2.0kW	150.00
3-phase 4-wire Unbalanced	PT-2501	120V 5A	150mV dc at 1.5kW	206.00

***Complete specifications for these models available upon request. Units for different ranges of frequency, current and voltage, and transducers for dc power can be supplied.**



$375.00

WIDEBAND WATTMETER — MODEL HPM-501

A versatile instrument to measure power at audio and ultrasonic frequencies with an accuracy of ±2% FS. The external output voltage is instantaneously proportional to real power and can be used for recording, oscilloscope display or control purposes.

Frequency ranges:	40 Hz to 4000 Hz 0.5 kHz to 50 kHz
Power ranges:	100, 300, 1000, 3000 W
Voltage ranges:	100 V and 300 V rms
Current ranges:	1 A and 10 A rms
External output:	10 mV FS
Dimensions:	6¼″ x 9¼″ x 4¾″
Shipping weight:	6 lbs.

Complete specifications on multipliers and transducers available on request.

Prices and specifications are subject to change without notice.

Leaders in Hall Effect Components, Instruments and Systems

BELL INC.

1356 Norton Avenue, Columbus, Ohio 43212
Phone 614-294-4906 TWX 810-482-1716

ELECTRO MAGNETIC PICKUPS

a new approach to TACHOMETRY, POSITIONING, CONTROL, COUNTING, TRIGGERING, TELEMETERING, SYNCHRONIZATION and other actuation.



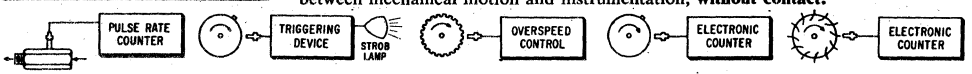
Model 3080 Magnetic Pickup
World's smallest—weighs only .05 oz. 10 volt output is higher than many larger models.

MAGNETIC PICKUPS SOLVE SPEED MEASUREMENT AND CONTROL PROBLEMS

What They Do . . . generate voltage/frequency from mechanical motion (without contact) in proportion to speed of ferrous metal objects interrupting their magnetic fields. They require no external power supplies, and additional amplification is usually not required.

When a gear tooth, blade or any other magnetic metal projection interrupts the external magnetic field surrounding the sensing head, a voltage and frequency are generated that may be used to: indicate, actuate instruments, synchronize, control, provide accurate data for telemetering.

What They Are . . . a self-generating input device providing the connecting link between mechanical motion and instrumentation, **without contact.**



Measuring rate of flow | For motion study | Safety device | Counting revolutions | Measuring turbine speed

MAGNETIC PICKUP REFERENCE TABLE

Model No.	Temp. Range	Test Voltage Volts-Peak To Peak Limits	Resistance Ohms Limits	Inductance Millihenrys Limits	Output Connection	EPL Mating Cable	Pickup Net Weight
3010-AN	−100°F +225°F	40-70 Note 2	114-140	30-43	Mates with MS3106A-10SL-4S	30N	1.66 Oz. Avg.
3010-HTB	−100°F +450°F	30-50 Note 2	125-160	27-45	Mates with Amphenol 97-3106A-10SL-4S (496) or Cannon CA 3106HR-10SL-4S	30HTN	1.85 Oz. Avg.
3014†	−100°F +225°F	17-30	90-110	26-40	Supplied with Two 6″ Vinyl Insulated Flexible Leads	NONE	0.35 Oz. Avg.
3015-A	−100°F +225°F	18-32 Note 4	90-110	26-40	Supplied with Two 6″ Vinyl Insulated Flexible Leads	NONE	0.35 Oz. Avg.
3015-HTB	−100°F +450°F	15-26 Note 4	90-110	22-31	Supplied with Two 6″ Teflon Insulated Flexible Leads	NONE	0.43 Oz. Avg.
3016	−100°F +225°F	20-34 Note 5	90-110	26-40	Mates with Microdot Group "A" Series S-50	MD	0.56 Oz. Avg.
3025	−100°F +225°F	55-85 Note 4	575-660	165-225	Supplied with Two 6″ Vinyl Insulated Flexible Leads	NONE	0.35 Oz. Avg.
3024	−100°F +225°F	50-75	575-660	165-225	Supplied with Two 6″ Vinyl Insulated Flexible Leads	NONE	0.35 Oz. Avg.
3029†	−100°F +225°F	150-240	1190-1450	380-540	Mates with MS 3106A-10SL-4S	30N	1.69 Oz. Avg.
3030-AN	−100°F +225°F	190-290 Note 2	1190-1450	380-540	Mates with MS3106A-10SL-4S	30N	1.69 Oz. Avg.
3030-HTB	−100°F +450°F	125-195 Note 2	1150-1400	350-470	Mates with Amphenol 97-3106A-10SL-4S (496) or Cannon CA 3106HR-10SL-4S	30HTN	1.74 Oz. Avg.
3040-A	−100°F +225°F	70-110 Note 3	170-200	65-85	Mates with MS3106A-10SL-4S	30N	1.73 Oz. Avg.
3045-A	−100°F +225°F	400-600 Note 2	1100-1280	380-460	Mates with MS3106A-10SL-4S	30N	2.10 Oz. Avg.
3055-A	−100°F +450°F	4.7-9 Note 4	105-130	6.5-9	Supplied with Two 6″ Teflon Insulated Flexible Leads	NONE	.123 Oz. Avg.
3056	−100°F +225°F	4.7-9 Note 5	105-125	6-8	Mates with Microdot Group "A" Series S-50	MD	.177 Oz. Avg.
3070*	−100°F +200°F	60-100 Note 1	195-215	70-80	UL listed. Supplied with two 18″ AWG #18 flexible leads.	NONE	5 Oz. Avg.
3080†	−65°F +225°F	10-16	134-145	11-16	Supplied with Two 6″ Teflon Insulated Flexible Leads	NONE	0.05 Oz. Avg.
3110-A	−300°F +800°F	35-52 Note 4	170-200	32-52	Mates with Cannon CAO Series, 10-SL-4S	NONE	1.75 Oz. Avg.

Note 1—Tested at 1,000 inches/sec. with 8-pitch, 12-tooth gear at 0.005 inch clearance and a load of 100,000 ohms.

Note 2—Tested at 1,000 inches/sec. with 20-pitch, 30-tooth gear at 0.005 inch clearance and a load of 100,000 ohms shunted by 250 mmf cable capacity.

Note 3—Tested at 1,000 inches/sec. with 8-pitch, 12-tooth gear at 0.005 inch clearance and a load of 1250 ohms shunted by 250 mmf cable capacity.

Note 4—Tested at 1,000 inches/sec. with 20-pitch, 30-tooth gear at 0.005 inch clearance and a load of 100,000 ohms.

Note 5—Tested at 1,000 inches/sec. with 20-pitch, 30-tooth gear at 0.005 inch clearance and a load of 100,000 ohms shunted by 290 mmf cable capacity.

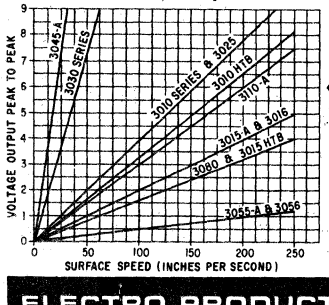
GENERAL NOTES:

Material of shell and pole piece, type 416 stainless steel, except for shell material of models 3040-A, 3045-A and 3070 which are 303 stainless steel.

Insulation resistance to shell 100 megohms minimum, dielectric strength to shell 500 volts rms minimum for 1 minute. These specifications reflect design at revision date and may be changed to incorporate improvements without prior notice.

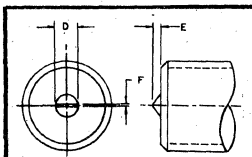
*Listed with Underwriters' Laboratories.

† Indicates chisel-type pole to provide high resolution sensing for high speed, small toothed gear detection.

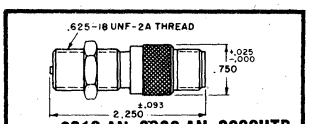


TYPICAL VOLTAGE OUTPUT CURVES

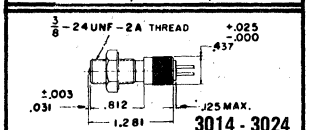
Typical voltage output curves of standard magnetic pickups show relative outputs under identical conditions. All pickups connected by 10′ Belden #8401 cable to a 100,000 ohm load with clearance between pole-piece and a 20-pitch, 30-tooth ferro-magnetic gear. Changes in load, clearance, cable length, gear teeth size, or gear material will produce different results. Measurements are in peak-to-peak volts rather than rms.



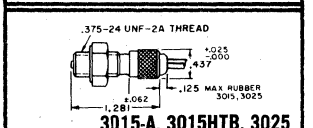
MODEL	D	E	F
3014	.093	.046	.030
3024	.093	.031	.010
3029	.106	.031	.010
3045	.187	.010	.042



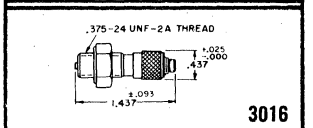
3010-AN, 3030-AN, 3030HTB



3014 - 3024



3015-A, 3015HTB, 3025



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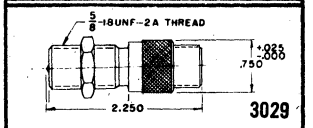

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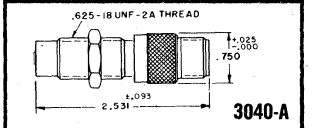
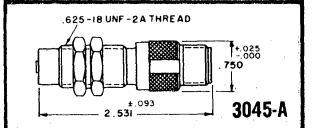
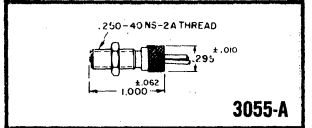


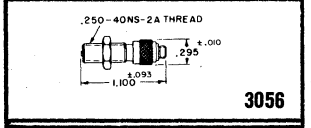
3040-A



3045-A



3055-A



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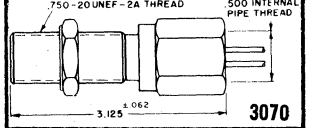

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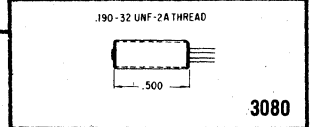

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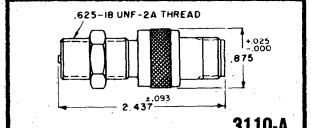


3110-A

METRIX

VIBRATION / PRESSURE INSTRUMENTATION

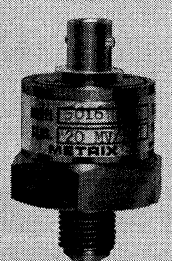
SENSORS



Series 500 Accelerometer

Utilizes unique piezoelectric cantilever sensing element mounted in lightweight (6 gms.), low silhouette case to provide unusually high out-put for driving an oscilloscope or VTVM directly in many applications. Containing an integral MICRODOT low noise cable, Series 500 Units may be mounted with cement, adhesive transfer tape or with optional magnetic or threaded adapters.

Model	502	512
Voltage Sensitivity (mv/g)	25	6
Charge Sensitivity (pcmb/g)	150	20
Capacitance (pf)	6,000	3,300
Resonance (Hz)	>3,000	>10,000

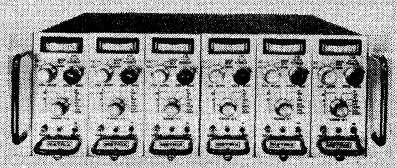


Model 5016 Dynamic Pressure Transducer

A high output piezoelectric transducer, this unit is ideal for measuring dynamic pressures in liquids and gases. Stainless steel pressure chamber, entirely sealed from the sensing element, allows use with corrosive fluids. Signal is taken out through a standard BNC coax connector.

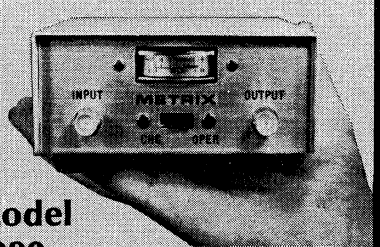
Voltage Sens .....20 mv/psi
Charge Sens .....120 pcmb/psi
Pressure Range ..... 0-3000 psi
First Resonance .....>3,000 Hz
Temp. Range .....−40°F to +300°F.

SIGNAL CONDITIONERS



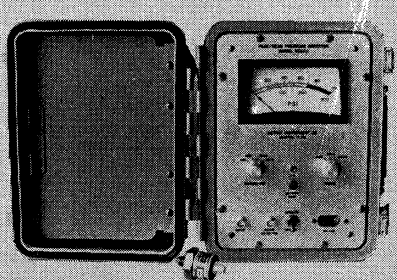
Model 5072 Charge Amplifier

Conditions signals from piezoelectric transducers and provides direct meter readout of forcing function (g's, psi, etc.). Stable high gain circuit accepts full scale inputs from 1 to 50,000 pcmb over bandwidth 2Hz to 20 KHz. Front panel control normalizes gain to match transducer. Plug in filters. Internal oscillator for calibration. Operates from 115 VAC. Rack accommodates six channels.



Model 5080 Charge Amplifier

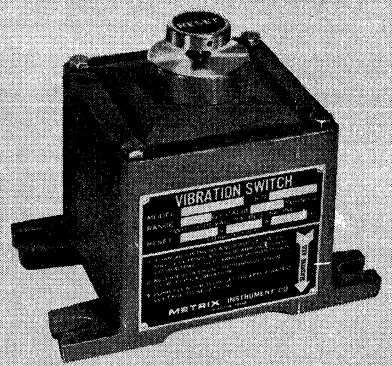
Portable rechargeable battery operated unit accepts full scale inputs from 100 to 10^6 pcmb in four ranges. Bandwidth: 0.1Hz to 10 KHz. Calibration input allows precise gain adjustment. Full scale output is 1 volt from 20 ohms.



Model 5065 Peak/Mean Pressure Indicator

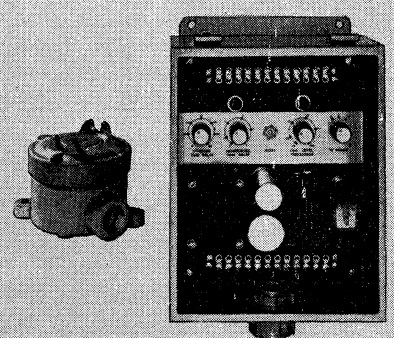
Portable rechargeable battery operated unit operates with Model 5016 Pressure Transducer to provide peak to peak or mean readings of dynamic pressure variations. Full scale pressures selectable from 100 to 3000 psi. Scope output provided for waveform analysis.

CONTROLS



Model 5078 Vibration Switch

Provides reliable vibration and shock protection for rotating and reciprocating equipment by actuating and latching a switch if vibration or shock exceeds a predetermined set point. A knurled calibrated knob allows precise set point adjustment. When tripped, the unit can be reset manually with the reset button, or electrically by applying a voltage to the reset coil. Available in weatherproof or explosion proof housing.



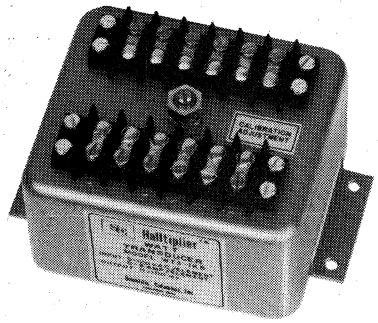
Model 007 Vibration Sentinel

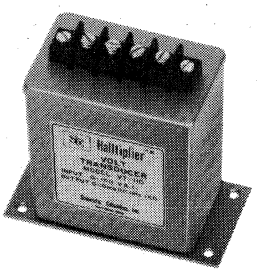
Protects costly equipment against severe damage when excessive vibrations occur. The unit consists of explosion proof Pickup and solid state Monitor Unit, which can be mounted 1000 feet from the pickup. An adjustable starting time delay prevents high starting vibration from tripping the shut-down relay. An adjustable monitoring time delay prevents non-recurring shocks from causing a shut-down. Scope and DC Recorder outputs provided. Meter readout available.

P. O. BOX 36501—HOUSTON, TEXAS 77036
TEL.: (713) 668-2386

METRIX
INSTRUMENT CO.

Instrumentation to Measure All Electric Power Parameters





Halltiplier (TM) Watt Transducers

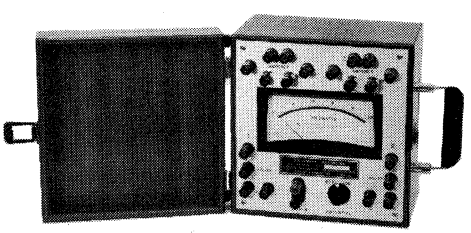
- Utility Tested and Approved
- Voltage or Current Outputs
- Minimal Space Requirements
- Calibrated Output

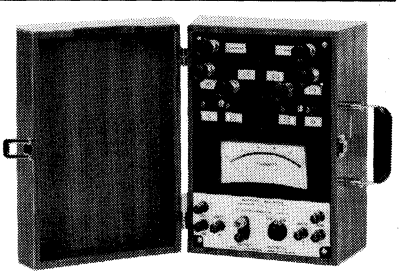
Scientific Columbus Halltiplier (TM) Transducers are the most complete selection of Hall Effect Watt Transducers available. Known for sturdiness and high reliability, Halltiplier (TM) transducers also feature such advantages as calibration adjustment, choice of filtered or unfiltered outputs and measurement of forward or reverse power flow.

(Calibration instructions, typical characteristic curves and application assistance are available on request).

	Full Scale	Nominal Voltage Input	Voltage Range	Voltage Overload	Voltage Burden	Nominal Current Input	Current Overload	Current Burden	Frequency Range (HZ)	Power Factor Range	Temperature Range (°C)	Maximum Temperature Effects on Accuracy	Accuracy/ Linearity @ 25°C (% of F.S.)	Output at Full Scale (d.c.)	Output Load Required	A.C. Component (peak)	Response Time (to 99%)	Calibrate Adjustment	Zero Adjustment	External Amplifier Power Required	Dielectric Test	Unit Price
6512	500/1000/2000 W	120/240V	135/270V	50%	1VA	5/10A	100A/1 Sec.	3VA	60	.0-1-.7	− 0°/+50°	±1%	±1%	110 MV	100 Ω	100%	<5 MS	NONE	NONE	NONE	1500 VRMS	60.00
WT5C5	500 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	50 MV	100 Ω	100%	<5 MS	±10%	NONE	NONE	1500 VRMS	98.00
WT5C5A1	500 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	50 MV	≥50 K Ω	<1%	<400 MS	0-110%	NONE	NONE	1500 VRMS	128.00
WT5C5A2	500 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	±10%	±2%	85-135V/60HZ 2W	1500 VRMS	175.00
WT5C5A3	500 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	0-110%	±2%	85-135V/60HZ 2W	1500 VRMS	185.00
WT5C5A4	500 W	120V	85-135V	150V	4VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	±10%	±2%	NONE	1500 VRMS	175.00
WT5C5A5	500 W	120V	85-135V	150V	4VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	0-110%	±2%	NONE	1500 VRMS	185.00
WT3-1K5	1000 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	100 MV	100 Ω	up to 100%	<5 MS	±10%	NONE	NONE	1500 VRMS	165.50
WT3-1K5A1	1000 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	100 MV	≥50 K Ω	<1%	<400 MS	0-110%	NONE	NONE	1500 VRMS	195.50
WT3-1K5A2	1000 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	±10%	±2%	85-135V/60HZ 2W	1500 VMRS	224.00
WT3-1K5A3	1000 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	0-110%	±2%	85-135V/60HZ 2W	1500 VRMS	234.00
WT3-1K5A4	1000 W	120V	85-135V	150V	4VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	±10%	±2%	NONE	1500 VRMS	224.00
WT3-1K5A5	1000 W	120V	85-135V	150V	4VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	0-110%	±2%	NONE	1500 VRMS	234.00
WT3-1K5 2½	1000/1500 W	120V	0-135V	150V	3VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	66.7/100 MV	100 Ω	up to 100%	<5 MS	±10%	NONE	NONE	1500 VRMS	196.00
WT3-1K5 2½A1	1000/1500 W	120V	0-135V	150V	3VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	66.7/100 MV	≥50 K Ω	<1%	<400 MS	0-110%	NONE	NONE	1500 VRMS	226.00
WT3-1K5 2½A2	1000/1500 W	120V	0-135V	150V	3VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	0.667/1 MA	0-10 K Ω	<1%	<400 MS	±10%	±2%	85-135V/60HZ 2W	1500 VRMS	268.50
WT3-1K5 2½A3	1000/1500 W	120V	0-135V	150V	3VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	0.667/1 MA	0-10 K Ω	<1%	<400 MS	0-110%	±2%	85-135V/60HZ 2W	1500 VRMS	278.50
WT3-1K5 2½A4	1000/1500 W	120V	85-135V	150V	4VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	0.667/1 MA	0-10 K Ω	<1%	<400 MS	±10%	±2%	NONE	1500 VRMS	268.50
WT3-1K5 2½A5	1000/1500 W	120V	85-135V	150V	4VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	0.667/1 MA	0-10 K Ω	<1%	<400 MS	0-110%	±2%	NONE	1500 VRMS	278.50
WT34-2K5	1500 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	150 MV	100 Ω	up to 100%	<5 MS	±10%	NONE	NONE	1500 VRMS	226.00
WT34-2K5A1	1500 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	150 MV	≥50 K Ω	<1%	<400 MS	0-110%	NONE	NONE	1500 VRMS	256.00
WT34-2K5A2	1500 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	±10%	±2%	85-135V/60HZ 2W	1500 VRMS	313.00
WT34-2K5A3	1500 W	120V	0-135V	150V	2VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	0-110%	±2%	85-135V/60HZ 2W	1500 VRMS	323.00
WT34-2K5A4	1500 W	120V	85-135V	150V	4VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	±10%	±2%	NONE	1500 VRMS	313.00
WT34-2K5A5	1500 W	120V	85-135V	150V	4VA	5A	100A/1 Sec.	2VA	50-60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0-10 K Ω	<1%	<400 MS	0-110%	±2%	NONE	1500 VRMS	323.00

Power Instruments





GENERAL DESCRIPTION OF WATTMETERS

Wattmeters with ANALOG OUTPUT to feed:

- Digital voltmeters or printer
- Oscilloscopes
- Strip chart or tape recorders
- X-Y plotters
- Data Acquisition systems

The wattmeters with intelligence have a brain consisting of two Halltiplier (TM) solid state watt transducers. These instruments compute real power ($EI\cos\Theta$) and furnish a 0-50 mv d-c analog output signal (intelligence) with simultaneous display of watts on the meter. The wattmeter is ±0.5% accurate and, the output signal features ±0.25% accuracy, except for model 325K605-P.

— NO EXTERNAL POWER SOURCE REQUIRED —

- STANDARD MODIFICATIONS (CONSULT FACTORY)
  RELAY RACK PANEL MOUNT
  DIGITAL READOUT
  400 HZ MODELS AND OTHER FREQUENCIES
  WIDE POWER FACTOR RANGE

WATTMETER SPECIFICATIONS

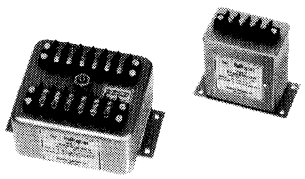
	Model 310K605-P $715.00 SPECIFICATIONS	Model 5000-P $385.00 SPECIFICATIONS
POWER RANGES: Single phase Polyphase	0-0.5, 1, 2, 4, 5, 10 Kilowatts 0-1, 2, 4, 5, 10 Kilowatts	500/1000/2000/2500/5000 watts
Potential inputs, Nominal	0-100, 200, 500 Volts, RMS	0-100/200/500 volts
Current inputs, Nominal	0-5, 10 amperes, RMS	0-5/10 amps
ACCURACY: Overall instrument including meter	±0.5% of full scale on each range	±0.5% of f.s.
Output signal	±0.25% of full scale on each range	±0.25% of f.s.
Transducer Output signal	0-50 MV D.C. on each range	0-25 mv d.c.
Load Power Factor Range (For No Decrease in Accuracy)	Unity to lead or lag 0.5	Unity to lead or lag 0.5
Compensated Fundamental frequency range (For stated accuracies at all power factors)	50-70 CRS	50-70 Hz
Current overload	100% continuous, 1000% for 3 seconds without damage	100% continuous, 1000% for 3 seconds
Enclosure	19″ relay rack panel 7″ high—8¼″ deep with dust cover, or wood formica case 7″ x 9″ x 9¼″	

Model 325K605-P $935.00
SPECIFICATIONS

For measurement of single phase two wire, single phase three wire and polyphase three wire loads
1.5/3.0/6.0/7.5/15.0/30.0 kilowatts
3.0/6.0/12.0/15.0/30.0/60.0 kilowatts
0-150/300 volts
0-10/20/50/100 amperes
±1% of full scale
±0.5% of full scale
0-50 mv d.c.
Unity to lead or lag 0.5 (50%)
50-70 Hz
50% continuous; 100% for 3 sec.
Portable formica cabinet with binding post terminations. Lid has clearance port for leads when locked.

SCIENTIFIC COLUMBUS, INC.
1035 W. THIRD AVENUE, COLUMBUS, OHIO 43212 • TELEPHONE 614-291-4681

Instrumentation to Measure All Electric Power Parameters



Halltiplier (TM) Var, Current, Volt, Frequency and Power Factor Transducers

- Utility Tested and Approved
- Voltage or Current Output
- Calibrated Output
- Filtered or Unfiltered

Scientific Columbus Halltiplier (TM) Transducers offer the finest selection of Hall Effect var, current, volt, frequency and power factor transducers available. Combining sturdiness and excellent performance, Halltiplier (TM) transducers also feature such advantages as calibration adjustment, measurement of positive or negative vars and minimal space requirements.

(Calibration instructions, typical characteristic curves and application assistance are available on request.)

VAR TRANSDUCERS

	Full Scale	Nominal Voltage Input	Voltage Range	Voltage Overload	Voltage Burden	Nominal Current Input	Current Overload	Current Burden	Frequency HZ	Power Factor Range	Temperature Range (°C)	Maximum Temperature Effects on Accuracy	Accuracy/ Linearity @ 25°C (% of F.S.)	Output at Full Scale (d.c.)	Output Load Required	A.C. Component (peak)	Response Time	Calibrate Adjustment	Zero Adjustment	External Amplifier Power Required	Dielectric Test	Unit Price
VT5C5	500 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	50 MV	100 Ω	100%	<5 MS	±10%	NONE	NONE	1500VRMS	103.00
VT5C5A1	500 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	50 MV	~50 K Ω	<1%	<400 MS	0 to 110%	NONE	NONE	1500VRMS	133.00
VT5C5A2	500 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	±10%	±2%	85-135V/60 HZ 2W	1500VRMS	185.00
VT5C5A3	500 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	0 to 110%	±2%	85-135V/60 HZ 2W	1500VRMS	195.00
VT5C5A4	500 VARS	120V	85-135V	150V	4 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	±10%	±2%	NONE	1500VRMS	185.00
VT5C5A5	500 VARS	120V	85-135V	150V	4 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	0 to 110%	±2%	NONE	1500VRMS	195.00
VT3-1K5	1000 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	100 MV	100 Ω	up to 100%	<5 MS	±10%	NONE	NONE	1500VRMS	173.00
VT3-1K5A1	1000 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	100 MV	~50 K Ω	<1%	<400 MS	0 to 110%	NONE	NONE	1500VRMS	194.00
VT3-1K5A2	1000 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	±10%	±2%	85-135V/60 HZ 2W	1500VRMS	260.00
VT3-1K5A3	1000 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	0 to 110%	±2%	85-135V/60 HZ 2W	1500VRMS	270.00
VT3-1K5A4	1000 VARS	120V	85-135V	150V	4 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	±10%	±2%	NONE	1500VRMS	260.00
VT3-1K5A5	1000 VARS	120V	85-135V	150V	4 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	0 to 110%	±2%	NONE	1500VRMS	270.00
VT34-2K5	1500 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	150 MV	100 Ω	up to 100%	<5 MS	±10%	NONE	NONE	1500VRMS	236.00
VT34-2K5A1	1500 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	150 MV	~50 K Ω	<1%	<400 MS	0 to 110%	NONE	NONE	1500VRMS	268.00
VT34-2K5A2	1500 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	±10%	±2%	85-135V/60 HZ 2W	1500VRMS	323.00
VT34-2K5A3	1500 VARS	120V	0-135V	150V	2 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	0 to 110%	±2%	85-135V/60 HZ 2W	1500VRMS	333.00
VT43-2K5A4	1500 VARS	120V	85-135V	150V	4 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	±10%	±2%	NONE	1500VRMS	323.00
VT34-2K5A5	1500 VARS	120V	85-135V	150V	4 VA	5A	100 A/1 Sec.	0.5 VA	60	0-1-0	−20°/+60°	±1%	±0.5%	1 MA	0 to 10 K Ω	<1%	<400 MS	0 to 110%	±2%	NONE	1500VRMS	333.00

CURRENT AND VOLTAGE TRANSDUCERS

	Full Scale	Nominal Voltage	Overload	Burden @ 120 v	Frequency Range HZ	Temperature Range (°C)	Maximum Temperature Effects on Accuracy	Accuracy/ Linearity @ 25°C	Output at Full Scale (D.C.)	Output Load Required	A.C. Component	Response Time	Calibration Adjustment	Dielectric Test	Unit Price
CT-510	5a	—	100A/1 Sec.	1 va	50-500	−20°/+60°	±1% of F.S.	±0.5%	10 volts	1 K Ω	48%	5 ms	NONE	1500 rms	58.50
CT-510A2	5a	—	100A/1 Sec.	1 va	50-500	−20°/+60°	±1% of F.S.	±0.5%	1 ma	0 to 10 K Ω	<1%	400 ms	±10%	1500 rms	61.00
CT-510A3	5a	—	100A/1 Sec.	1 va	50-500	−20°/+60°	—	±0.5%	3 ma	0 to 10 K Ω	<1%	400 ms	±10%	1500 vrms	64.50
VT-110	150 v	120 v	180 v	4 va	50-500	−20°/+60°	±1%	±0.5%	10 volts	1 K Ω	48%	5 ms	NONE	1500 vrms	58.50
VT-110A2	150 v	120 v	180 v	2.5 va	50-500	−20°/+60°	±1%	±0.5%	1 ma	0 to 10 K Ω	<1%	400 ms	±10%	1500 vrms	61.00
VT-110A3	150 v	120 v	180 v	2.5 va	50-500	−20°/+60°	±1%	±0.5%	3 ma	0 to 10K Ω	<1%	400 ms	±10%	1500 vrms	64.50

FREQUENCY TRANSDUCERS

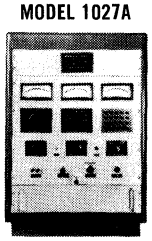
	Full Scale	Nominal Voltage	Voltage Range	Voltage Overload	Voltage Burden	Nominal Current	Current Overload	Current Burden	Freq. Range (HZ)	Temp. Range (°C)	Max. Temp. Effects on Accuracy	Accuracy/ Linearity @ 25°	Output @ Full Scale (D.C.)	Output Load Required	A.C. Component (peak)	Response Time (to 99%)	Calibration Adj.	Zero Adj.	Unit Price
FT-50B	47-50-53 HZ	115 v	104-127	150	<2 watts				47-53	0°-50°		±0.12 HZ	−0.50/+0.5 ma	100 Ω	6 mv	300 ms	Yes	47-53 HZ	120.00
FT-60B	56-60-64 HZ	115 v	104-127	150	<2 watts				56-64	0°-50°		±0.16 HZ	−0.50/+0.5 ma	100 Ω	6 mv	300 ms	Yes	56-64 HZ	120.00
FT-60-1B	55-60-65 HZ	115 v	104-127	150	<2 watts				55-65	0°-50°		±0.20 HZ	−0.50/+0.5 ma	100 Ω	6 mv	300 ms	Yes	55-65 HZ	120.00
FT-400B	380-400-420 HZ	115 v	104-127	150	<2 watts				380-420	0°-50°		±0.80 HZ	−0.50/+0.5 ma	100 Ω	6 mv	300 ms	Yes	380-420 Hz	120.00

POWER FACTOR/PHASE ANGLE (1 ϕ) TRANSDUCER

PF-1/PF-2/PF-3	±0.3/0.5/0.7P.F.	115 v	85-130v RMS	150 v	<2 va	0.25-5 RMS	7 amps RMS cont.	2v,0 to peak sq. wave, drop	60	−20°C to +60°C	±0.5% of span	±2% of span	0 to ±0.5 mav d.c.	100 Ω	Maximum deviation from D.C. level is 100 mv	<10 ms	Yes	Yes	115.50

POWER TEST CONSOLES / TRANSDUCER CALIBRATOR

POWER TEST CONSOLE MODEL 1027A



Power test consoles are used to measure watts, volts, and amperes simultaneously during tests of single and three phase 3 wire loads such as motors, transformers, appliances, etc.

These units feature range switching of current voltage. The resultant wattmeter ranges are automatically displayed on an annunciator. The instrument and the load being measured are protected from overload damage by an automatic built-in current overload circuit.

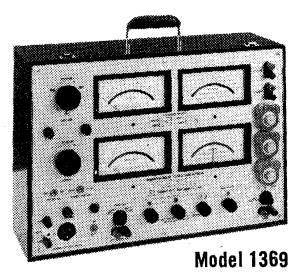
All parameters are displayed on taut band meters with linear scales. The unit is available with digital meters. A d.c. analog output signal for each parameter can be supplied for auxiliary or control circuits.

TYPICAL SPECIFICATIONS

Function	Power test console to measure watts, volts and amperes simultaneously during electric motor tests.
Full Scale Power	25 watts to 40 kilowatts
Full Scale Potential	50/100/200/400 volts RMS nominal 75/150/300/600 volts RMS maximum
Full Scale Current	0.5/1/2/5/10/20/50 amperes RMS
Analog Output Signals Watts, Volts and Amperes	0-50 mv d.c. for full scale on each range, into 10K ohms. Termination on rear panel.
Accuracy	±1% of full scale for meters. ±0.5% of full scale for analog output signals.

This instrument is designed for easy field checking of calibration of watt, volt and amp transducers. It may also be used for incoming inspection. The Model 1369 is completely self contained and requires no external loads. It requires only 120 v 60 Hz power.

The calibrator compares the output signal from the transducer being tested with the output from a standard in the instrument. The percent deviation from the standard output is read directly on a % error meter. Independent current and voltage linearities can be determined. The calibrator will test transducers with full scale outputs ranging from 25 mv to 10 v d.c. and specified load resistance up to 100 K ohms.



Model 1369

SPECIFICATIONS

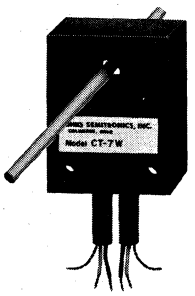
Ranges	0-150 volts 0-5 amperes 0-500 watts/element 0-500 vars/element
Power Factor	Unity and 0.5 lag
Metering and Accuracy	Volt and amp indicator ±0.75% of f.s. Percent of full scale output ±0.5% of f.s. Percent of full scale error ±0.25% of f.s.
Transducer Load Resistance	0 to 100 K ohm
Transducer Output Level	25 mv d.c. to 10 v d.c.

SCIENTIFIC COLUMBUS, INC.
1035 W. THIRD AVENUE, COLUMBUS, OHIO 43212 • TELEPHONE 614-291-4681

Monitoring, measuring and control materials devices and equipment utilizing Hall effect-magnetic structures and thermoelectric modules . . .

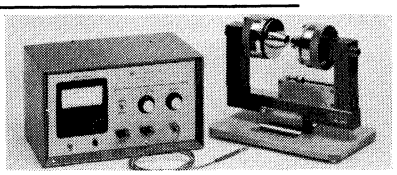
WIDEBAND — d.c. TO MEGAHERTZ — CURRENT TRANSDUCERS

The CT-series current transducers provide an output voltage which is independent of frequency from d.c. to the megahertz range. Source to output isolation is provided since no physical or electrical connection is necessary to the conductor threaded through the window. Monitoring, sampling, or analysis of d.c., steady-state, or transient currents, having rise times of 1 microsecond or less, is now feasible using the CT units.



MODEL	PEAK CURRENT AMPERES	BIAS CURRENT MILLIAMPERES	FULL SCALE OUTPUT MILLIVOLTS
CT-7W	30	100	60
CT-100W	100	100	60
CT-200W	200	100	100
CT-600W	600	100	60
CT-1000W	1000	100	60

HALL EFFECT TEST SET MODEL 1000



The Model 1000 Hall effect test set is a versatile instrument for accurate determination of the properties of semiconducting materials or magnetic devices. Magnetic fields from a few hundred to over 10,000 gauss may be accurately set through the use of the high linearity calibrated Halltron probe furnished with the test set. The regulated power supply provides current to the material or device in a continuous range, adjustable from less than 1 milliampere to over 1 ampere.

HALLTRON, MAGNETIC FIELD SENSORS

Stocks are maintained of a wide variety of Hall effect probes capable of fitting most known gaussmeter and magnetic sensing requirements as well as for exploratory studies. Units are designed to provide the high-linearity, low-noise and stable operation essential in applications.

MODEL	TYPE	CONTROL CURRENT MILLI-AMPERES	OUTPUT IN 10 Kg, MILLIVOLTS	DIMENSIONS INCHES
HP-325	Miniature	25	200	.187/.075/.015
HP 330	Micro	25	150	.040/.040/.012
HP 340	Gaussmeter	100	100	.280/.125/.020
HR 36	High-linearity	350	350	.500/.375/.025
HR 38	High-sensitivity	25	200	.500/.375/.025
HR 66	Low-cost	200	500	.200/.250/.028
HS 84	Low Temperature*	350	30,000	.500/.375/.015

* The HS-84 is designed for high sensitivity at −196°C.

THERMOELECTRIC DEVICES FOR COOLING AND TEMPERATURE CONTROL

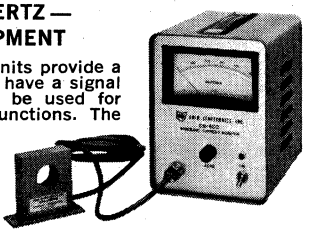
The controllable, reversible heat pumping properties of thermoelectric cooling devices make them ideal for many environmental control, precise temperature control, and heat-pumping applications. O.S.I. offers a variety of units ranging from the TC series, which can provide a temperature depression of 115 degrees Centigrade in a vacuum, to the TA series which can remove 85 watts from a heat source.

MODEL	△T DEG. C.	HEAT PUMP WATTS	INPUT CURRENT AMPERES
TM-12	65	3	30
TM-20	65	20	30
TM-20M	65	20	30
TC-44	90	6	30
TC-1851	115	3	25
TA-6F	55*	85	30

* Specified as cold plate temperature depression from ambient air temperature.

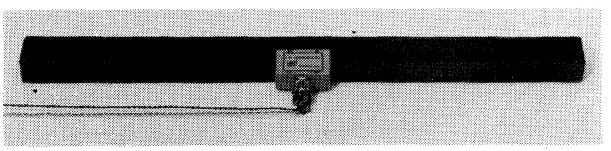
WIDEBAND — d.c. TO MEGAHERTZ — CURRENT MEASURING EQUIPMENT

The CM-series current measuring units provide a meter display of direct current and have a signal output of 0 to 1 volt which can be used for monitoring, analysis, or control functions. The output signal waveform is a replica of the current through the window with faithful reproduction of microsecond transient characteristics. Operation is from 110 volt, 60 cycle source.



MODEL	PEAK CURRENT AMPERES	METER RANGE AMPERES	OUTPUT - VOLTS
CM-30	30	0 - 30	0 - 1
CM-100	100	0 - 100	0 - 1
CM-200	200	0 - 200	0 - 1
CM-600	600	0 - 500	0 - 1
CM-1000	1000	0 - 1000	0 - 1

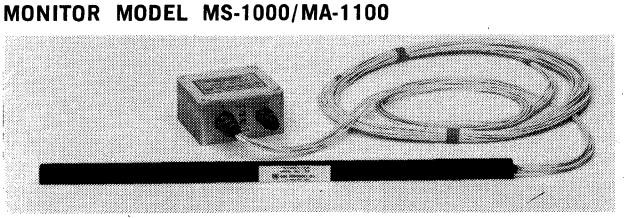
WIDEBAND HALLTRON MAGNETIC ANTENNA MS-1000



BROADBAND R.F.I AND E.M.C MAGNETIC ANTENNAS AND MAGNETOMETERS

O.S.I. has designed the MS-1000 magnetic antenna for application in interference reduction, testing and measurement of magnetic fields in the d.c to Megahertz range. Sensitivities of 100 millivolts per gauss, unamplified, from the basic antenna with output independent of frequency, illustrates performance. Vector Magnetometer units, providing an output of 10 volts in the earth's field, can be provided for particular applicational requirements.

MAGNETIC DISPLACEMENT AND PROXIMITY MONITOR MODEL MS-1000/MA-1100



MS-1100/MA-1100 Magnetic Displacement and Proximity monitor provide non-contacting measurement of displacement over a 20 inch range. The amplifier-power supply unit (MA-1100) can be remotely located and provides a 0-5 volt output for telemetry on control applications.

ENERGY CONVERSION MATERIALS

Optimized energy conversion materials of the following and elements are available.

TYPES:

Indium arsenide and indium antimonide for magnetic sensors and infrared filters.

Bismuth telluride alloys; N & P type, for thermoelectric cooling and specialized power generation modules.

Lead telluride for high quality optical infrared coatings.

High purity arsenic trichloride for exceptional growth of intermetallic arsenides.

Research grade bismuth, indium, arsenic, tellurium and antimony.

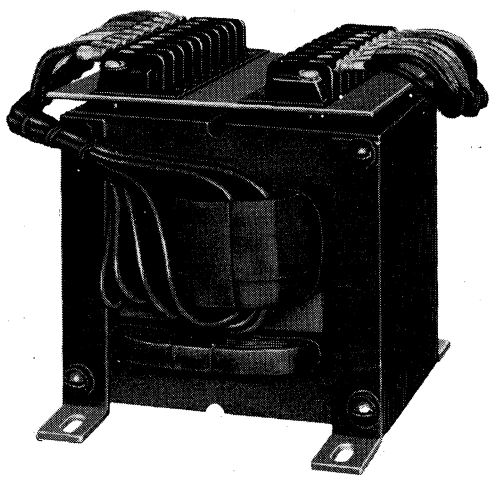
OHIO SEMITRONICS, INC.
1205 CHESAPEAKE AVENUE • COLUMBUS, OHIO 43212 • PHONE: 614-486-9561
PIONEER IN SOLID STATE ENERGY CONVERSION MATERIALS, DEVICES and SYSTEMS

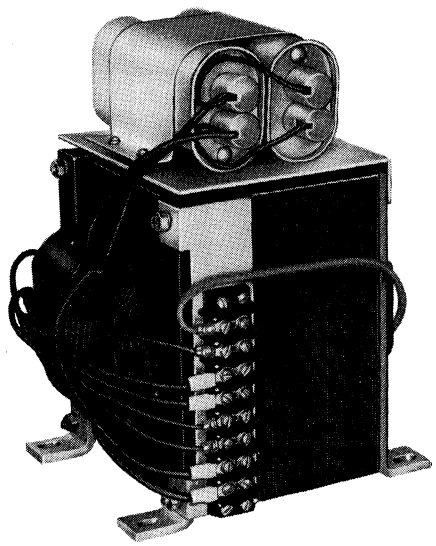
Need custom constant voltage transformers? Acme Electric can design and build to your specs.

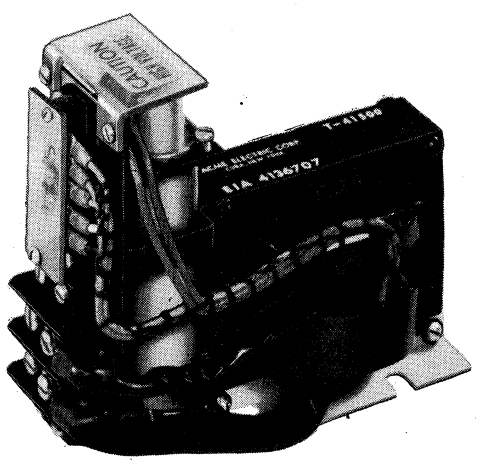
Acme Electric's engineering and experience have developed thousands of custom-designed constant voltage transformers for a variety of industrial markets. These areas of production and development include such industries as: data processing, communications, automation, instrumentation, office copying equipment, medicine, photography, to name but a few. And, each unit has been designed to meet the customer's exact requirements.

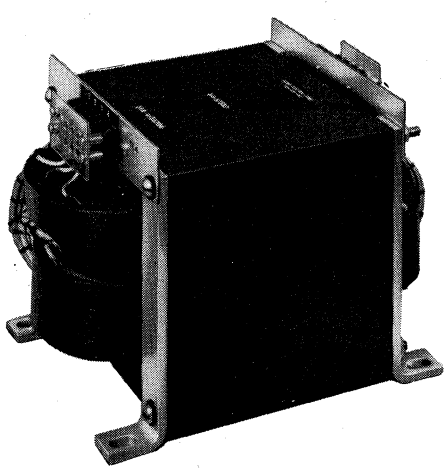
Does your equipment or system require a regulated AC voltage for maximum performance? If so, draw on the engineering know-how of Acme Electric Corporation to solve your problem. Our business is to satisfy the functions of power control, conversion and/or regulation, whatever the industry or application.

Acme Electric
Acme Electric Corporation Cuba, New York

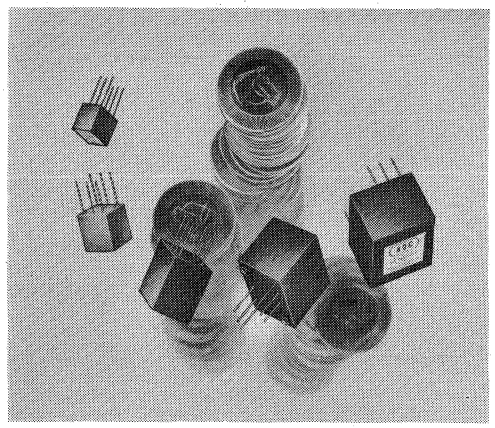








ADC Blue Chip Transformers



81 TYPES — 7 DIFFERENT SIZES

Tiny, plastic cased, Blue Chip transformers for printed circuit applications, are available for a wide choice of power ratings.

Seven different sizes, from .0156 to 1.2 cubic inches with a total of 81 ratings are listed below to indicate the available power levels for both voice frequency range and extended frequency operation. These ratings take into account not only power handling capacities at minimum frequencies, but also total harmonic distortion under stated conditions. Within the limits shown on the rating charts, variations in both power and distortion levels are possible depending upon the minimum operating frequency.

Blue Chip transformers meet Mil-T-27, Grade 5, Class S requirements. Unique design and construction features give ultra-reliability.

Special versions of these standard types are available upon request. For critical shielding applications, these units are supplied with a mu metal case over the standard plastic case providing the magnetic shielding specified.

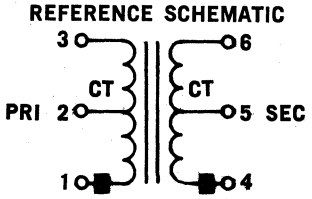
CASE SIZE	GENERAL SPECIFICATIONS	CATALOG NUMBER	PRIMARY (1-3) IMPEDANCE	SECONDARY (4-6) OHMS	PRIMARY - SECONDARY DC RESISTANCE - OHMS ± 25% @ 25° C.		MAXIMUM UNBALANCED DC IN PRIMARY-MA	REFERENCE SCHEMATIC
8	RESPONSE: ± 1 DB 400 to 100 K Hz. except for 324-8A ±1 DB 400 to 50 K Hz. DISTORTION: 5% at 1 mw, 400 to 100 K Hz. or 10% at 6 mw, 400 to 100 K Hz. and maximum unbalanced DC in primary. PIN MATERIAL: Nickel WEIGHT: 1.5 grams	324-8A	1000 CT	100K CT	120	4000	0.0	A
		324-8B	1000 CT	25K CT	120	1550	2.0	A
		324-8C	600 CT	25K CT	85	1550	2.0	A
		324-8D	10K CT	10K CT	1500	1200	.50	A
		324-8E	10K CT	1500 CT	1000	250	.50	A
		324-8F	10K CT	600 CT	1000	80	.50	A
		324-8G	2500 CT	2500 CT	250	300	1.0	A
		324-8H	600 CT	1000 CT	90	105	2.0	A
		324-8J	600 CT	600 CT	90	90	2.0	A
		324-8K	60 CT	600 CT	8	90	6.0	A
7	RESPONSE: ± 2 DB 300 to 100 K Hz. except for 324-7A ± 3 DB at high end. DISTORTION: 17% at 30 mw, 300 to 100 K Hz. and maximum unbalanced DC in primary, except as noted.* PIN MATERIAL: Nickel WEIGHT: 0.09 Oz.	324-7A*	100K CT	1000 CT	6800	110	.2	A
		324-7B	25K CT	1000 CT	4300	140	1.2	A
		324-7C	25K CT	600 CT	4300	90	1.2	A
		324-7D	10K CT	10K CT	1350	1350	2.0	A
		324-7E	10K CT	1500 CT	1350	170	2.0	A
		324-7G	10K CT	600 CT	1350	90	2.0	A
		324-7J	1K CT	600 CT	140	90	6.0	A
		324-7K	600 CT	600 CT	90	90	8.0	A
		324-7L	600 CT	60 CT	90	10	8.0	A

* Maximum Power Level: 10 mw

CASE SIZE	GENERAL SPECIFICATIONS	CATALOG NUMBER	PRIMARY (1-3) IMPEDANCE	SECONDARY (4-6) OHMS	PRIMARY - SECONDARY DC RESISTANCE - OHMS ± 25% @ 25° C.		MAXIMUM UNBALANCED DC IN PRIMARY-MA	REFERENCE SCHEMATIC
6	RESPONSE: ± 2 DB 300 to 100 K Hz. DISTORTION: 10% at 30 mw, 300 to 100 K Hz., and maximum unbalanced DC in primary, except as noted.* PIN MATERIAL: Nickel Alloy, Tin Plated. WEIGHT: 0.15 Oz.	324-6A*	100K CT	1000 CT	2900	60	0	A
		324-6B	25K CT	1000 CT	2500	140	0	A
		124-6C	10K CT	10K CT	1000	1300	1	A
		324-6D	10K CT	1500 CT	1000	165	1	A
		324-6E	10K CT	600 CT	1000	65	1	A
		224-6F	4000 CT	10K CT	440	1300	1.5	A
		324-6G	1000 CT	600 CT	100	65	3	A
		324-6H	1000 CT	4	100	.45	3	B
		224-6J	600 CT	25K CT	65	3300	4	A
		124-6K	600 CT	600 CT	65	65	4	A
		324-6L	600 CT	60	65	7	4	B
		324-6M	600 CT	4	65	.45	4	B

* Maximum Power Level: 10 mw

A
REFERENCE SCHEMATIC



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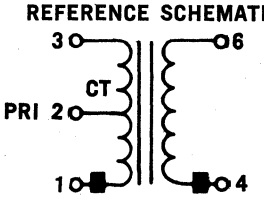

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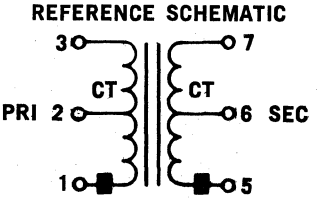

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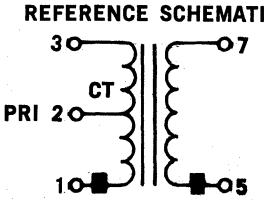
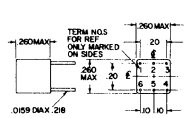


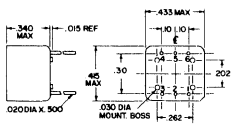
Blue Chip Transformers

ADC

8 SIZE CASE DATA



7 SIZE CASE DATA



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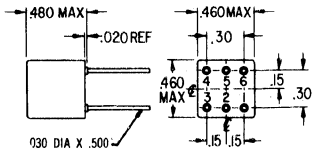

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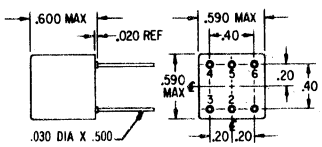

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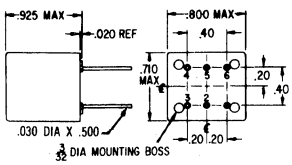

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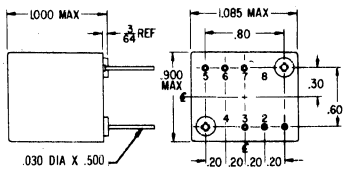
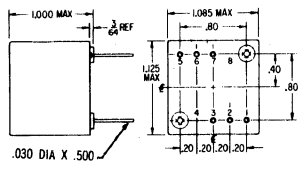


2 SIZE CASE DATA

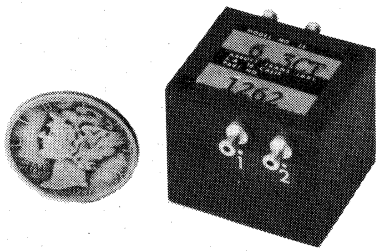


Case size information for units with magnetic shields will be provided upon receipt of the specific shielding requirements. The size may vary since the shield thickness depends on the specified amount of shielding.

CASE SIZE	GENERAL SPECIFICATIONS	CATALOG NUMBER	PRIMARY (1-3) IMPEDANCE	SECONDARY (4-6) OHMS	PRIMARY - SECONDARY DC RESISTANCE - OHMS ± 25% @ 25° C.		MAXIMUM UNBALANCED DC IN PRIMARY-MA	REFERENCE SCHEMATIC
5	RESPONSE: ± 1 DB 200 to 50 K Hz. DISTORTION: 10% at 150 mw, 200 to 50 K Hz., and maximum unbalanced DC in primary, except as note.* PIN MATERIAL: Nickel Alloy, Tin Plated. WEIGHT: 0.4 Oz.	324-5A*	100K CT	1000 CT	5300	55	0	A
		324-5B	25K CT	1000 CT	2600	130	0	A
		124-5C	10K CT	10K CT	1000	1300	1	A
		324-5D	10K CT	1500 CT	1000	200	1	A
		324-5E	10K CT	600 CT	1000	65	1	A
		224-5F	4000 CT	10K CT	350	1300	1.5	A
		324-5G	1000 CT	600 CT	90	65	3	A
		324-5H	1000 CT	4	90	0.5	3	B
		224-5J	600 CT	25K CT	50	3200	4	A
		124-5K	600 CT	600 CT	50	65	4	A
		324-5L	600 CT	60	50	6.5	4	B
		324-5M	600 CT	4	50	0.5	4	B
* Maximum Power Level: 60 mw								
4	RESPONSE: ± 1 DB 200 to 20 K Hz. DISTORTION: 10% at 750 mw, 200 to 20 K Hz. and maximum unbalanced DC in primary. PIN MATERIAL: Nickel Alloy, Tin Plated. WEIGHT: 0.9 Oz.	324-4B	25K CT	1000 CT	2700	150	0	A
		124-4C	10K CT	10K CT	1100	1200	1	A
		324-4D	10K CT	1500 CT	1100	180	1	A
		324-4E	10K CT	600 CT	1100	75	1	A
		324-4F	10K CT	4	1100	0.5	1	B
		224-4G	4000 CT	10K CT	440	1200	1.5	A
		324-4H	1500 CT	15	170	1.8	2.5	B
		324-4J	1000 CT	600 CT	105	75	3	A
		324-4K	1000 CT	4	105	0.5	3	B
		224-4L	600 CT	25K CT	65	3700	4	A
		124-4M	600 CT	600 CT	65	75	4	A
		324-4N	600 CT	60	65	7	4	B
		324-4P	600 CT	15	65	2	4	B
		324-4Q	600 CT	4	65	0.5	4	B
		224-4R	250 CT	600 CT	30	75	7	A
3	RESPONSE: ± 1 DB 100 to 10 K Hz. DISTORTION: 1.5% at 60 mw, 100 to 10 K Hz., or 10% at 3.5 W, 200 to 10 K Hz. and maximum unbalanced DC in primary, except as noted.* PIN MATERIAL: Nickel Alloy, Tin Plated WEIGHT: 1.5 Oz. MOUNTING: 2 — 4 x 40 inserts, 0.6" x 0.8"	124-3A	10K CT	10K CT	700	1000	1	C
		324-3B	10K CT	600 CT	700	60	1	C
		324-3C	10K CT	4	700	0.4	1	D
		324-3D	1500 CT	15	105	1.5	2.5	D
		324-3E	1000 CT	600 CT	70	60	3	C
		324-3F	1000 CT	4	70	0.4	3	D
		224-3G*	600 CT	25K CT	42	2600	4	C
		124-3H	600 CT	600 CT	42	60	4	C
		324-3J	600 CT	60	42	6	4	D
		324-3K	600 CT	15	42	1.5	4	D
		324-3L	600 CT	4	42	0.4	4	D
		224-3M	250 CT	600 CT	17	60	7	C
* Maximum Power Level: 2.5 W								
2	RESPONSE: ± 1 DB 60 to 10 K Hz. DISTORTION: 5% at 250 mw, 60 to 10 K Hz. or 10% at 7.5 W, 200 to 10 K Hz. and maximum unbalanced DC in primary, except as noted.* PIN MATERIAL: Nickel alloy, Tin Plated. WEIGHT: 2.5 oz. MOUNTING: 2 - 4 x 40 inserts, 0.8" x 0.8"	124-2A*	10K CT	10K CT	700	900	1	C
		324-2B*	10K CT	600 CT	700	50	1	C
		324-2C*	10K CT	4	700	0.4	1	D
		324-2D	1500 CT	15	93	1.2	2.5	D
		324-2E	1000 CT	600 CT	65	50	3	C
		324-2F	1000 CT	4	65	0.4	3	D
		124-2H	600 CT	600 CT	40	50	4	C
		324-2J	600 CT	60	40	5	4	D
		324-2K	600 CT	15	40	1.2	4	D
		324-2L	600 CT	4	40	0.4	4	D
		224-2M	250 CT	600 CT	15	50	7	C
* Maximum Power Level: 6 W								

6405 CAMBRIDGE STREET ▒ MINNEAPOLIS, MINNESOTA 55426 ▒ TELEPHONE: (612) 929-7881
TWX 910-576-2832 ▒ TELEX 029-5234

abbott 400 transformers



specifications

Input Primary
115V, 400 Hz ±20 Hz, 1 phase

Regulation
10% no load to full load

Secondary Voltage Tolerance
Within 5% when measured at full load and 115 VAC input

Insulation Test
2500 VDC or 150% of secondary voltage (whichever is higher)

Construction
To MIL-T-27B, grades: 2and 5, class: "S", life: "X" (10,000 hrs.) case: smaller (see drawing)

Environment
Encapsulated to meet MIL-E-5272C, including vibration to Proc. XII, temperature to 105°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum)

Output Secondary
See voltage and current of specific models listed

features

- Hermetically sealed
- 105°C operation
- To meet MIL-T-27B
- Designed exclusiverly for 400 Hz
- For aerospace application
- Molded diallyl phthalate

MODEL TYPE	WEIGHT lbs. (max)	PRIMARY DCR ohms (typical)	EXCITATION CURRENT amps (max)
2E	0.06	201	0.020
6E	0.12	83	0.020
15E	0.26	14	0.040
24E	0.29	12	0.040
80E	0.75	2.0	0.100
175E	1.84	0.7	0.100

DELIVERY IS NORMALLY FROM STOCK

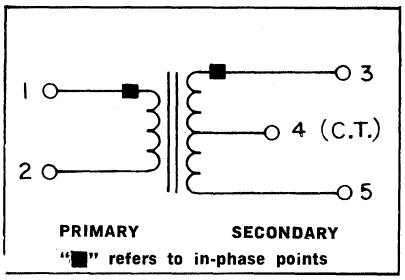
Output Volt (at F.L.)	Output Current (Amps)	Size (See Dwg.)	Sec. DCR ohms	Model Number	Price 1 Pc.	Price 2-4 pcs.
5.0	0.400	A	0.60	2E5CT	$28.80	$24.00
5.0	1.200	B	0.22	6E5CT	26.40	22.00
5.0	3.000	C	0.046	15E5CT	24.00	20.00
5.0	4.800	D	0.040	24E5CT	31.20	26.00
5.0	16.000	E	0.009	80E5CT	33.60	28.00
5.0	35.000	F	0.012	175E5CT	72.00	60.00
6.3	0.317	A	1.06	2E6.3CT	28.20	23.50
6.3	0.950	B	0.38	6E6.3CT	25.90	21.60
6.3	2.380	C	0.088	15E6.3CT	23.50	19.60
6.3	3.800	D	0.107	24E6.3CT	30.60	25.50
6.3	12.800	E	0.016	80E6.3CT	32.90	27.40
6.3	27.800	F	0.019	175E6.3CT	70.60	58.80
8.0	0.250	A	1.63	2E8CT	27.60	23.00
8.0	0.750	B	0.58	6E8CT	25.30	21.10
8.0	1.880	C	0.135	15E8CT	23.00	19.20
8.0	3.000	D	0.140	24E8CT	30.00	25.00
8.0	10.000	E	0.017	80E8CT	32.30	26.90
8.0	22.000	F	0.010	175E8CT	69.10	57.60
10	0.200	A	2.50	2E10CT	27.10	22.60
10	0.600	B	0.97	6E10CT	24.80	20.70
10	1.500	C	0.20	15E10CT	22.60	18.80
10	2.400	D	0.180	24E10CT	29.30	24.40
10	8.000	E	0.024	80E10CT	31.60	26.30
10	17.500	F	0.020	175E10CT	67.70	56.40
12.6	0.158	A	4.10	2E12.6CT	26.50	22.10
12.6	0.475	B	1.27	6E12.6CT	24.20	20.20
12.6	1.180	C	0.32	15E12.6CT	22.10	18.40
12.6	1.900	D	0.225	24E12.6CT	28.70	23.90
12.6	6.350	E	0.03	80E12.6CT	31.00	25.80
12.6	13.900	F	0.021	175E12.6CT	66.20	55.20
14	0.142	A	5.59	2E14CT	25.90	21.60
14	0.428	B	1.56	6E14CT	23.80	19.80
14	1.070	C	0.35	15E14CT	21.60	18.00
14	1.720	D	0.32	24E14CT	28.10	23.40
14	5.600	E	0.04	80E14CT	30.20	25.20
14	12.500	F	0.022	175E14CT	64.80	54.00
16	0.125	A	6.63	2E16CT	25.30	21.10
16	0.375	B	2.34	6E16CT	23.30	19.40
16	0.940	C	0.42	15E16CT	21.10	17.60
16	1.500	D	0.35	24E16CT	27.50	22.90
16	5.000	E	0.05	80E16CT	29.50	24.60
16	10.900	F	0.025	175E16CT	63.40	52.80
18	0.111	A	9.00	2E18CT	24.70	20.60
18	0.333	B	3.34	6E18CT	22.70	18.90
18	0.832	C	0.60	15E18CT	20.60	17.20
18	1.330	D	0.40	24E18CT	26.90	22.40
18	4.450	E	0.08	80E18CT	28.90	24.10
18	9.700	F	0.027	175E18CT	61.90	51.60
20	0.100	A	10.9	2E20CT	$24.20	$20.20
20	0.300	B	3.65	6E20CT	22.20	18.50
20	0.750	C	0.84	15E20CT	20.20	16.80
20	1.200	D	0.48	24E20CT	26.20	21.80
20	4.000	E	0.09	80E20CT	28.20	23.50
20	8.750	F	0.020	175E20CT	60.50	50.40
22	0.091	A	14.6	2E22CT	23.60	19.70
22	0.273	B	4.10	6E22CT	21.60	18.00
22	0.680	C	0.92	15E22CT	19.70	16.40
22	1.090	D	0.63	24E22CT	25.60	21.30
22	3.630	E	0.12	80E22CT	27.60	23.00
22	7.900	F	0.020	175E22CT	59.00	49.20
25	0.080	A	20.4	2E25CT	23.00	19.20
25	0.240	B	5.5	6E25CT	21.10	17.60
25	0.600	C	1.05	15E25CT	19.20	16.00
25	0.900	D	0.68	24E25CT	25.00	20.80
25	3.200	E	0.13	80E25CT	26.90	22.40
25	7.000	F	0.042	175E25CT	57.60	48.00
28	0.071	A	22.8	2E28CT	22.40	18.70
28	0.214	B	8.20	6E28CT	20.60	17.20
28	0.535	C	1.48	15E28CT	18.70	15.60
28	0.855	D	0.98	24E28CT	24.40	20.30
28	2.850	E	0.14	80E28CT	26.20	21.80
28	6.250	F	0.043	175E28CT	56.20	46.80
31	0.064	A	25.6	2E31CT	21.80	18.20
31	0.192	B	8.50	6E31CT	20.00	16.70
31	0.485	C	1.62	15E31CT	18.20	15.20
31	0.772	D	1.27	24E31CT	23.80	19.80
31	2.470	E	0.18	80E31CT	25.60	21.30
31	5.650	F	0.061	175E31CT	54.70	45.60
35	0.057	A	29.5	2E35CT	21.40	17.80
35	0.171	B	10.3	6E35CT	19.60	16.30
35	0.428	C	2.28	15E35CT	17.80	14.80
35	0.685	D	1.70	24E35CT	23.00	19.20
35	2.280	E	0.28	80E35CT	24.80	20.70
35	5.000	F	0.098	175E35CT	53.30	44.40
39	0.051	A	38.6	2E39CT	20.80	17.30
39	0.154	B	14.2	6E39CT	19.00	15.80
39	0.384	C	2.54	15E39CT	17.30	14.40
39	0.615	D	2.20	24E39CT	22.40	18.70
39	2.050	E	0.32	80E39CT	24.20	20.20
39	4.480	F	0.110	175E39CT	51.80	43.20
43	0.046	A	44.3	2E43CT	20.20	16.80
43	0.139	B	15.8	6E43CT	18.50	15.40
43	0.348	C	2.85	15E43CT	16.80	14.00
43	0.556	D	2.42	24E43CT	21.80	18.20
43	1.860	E	0.35	80E43CT	23.50	19.60
43	4.060	F	0.114	175E43CT	50.40	42.00
48	0.041	A	57	2E48CT	$19.60	$16.30
48	0.125	B	21.6	6E48CT	18.00	15.00
48	0.312	C	4.05	15E48CT	16.30	13.60
48	0.500	D	3.27	24E48CT	21.20	17.70
48	1.660	E	0.40	80E48CT	22.80	19.00
48	3.650	F	0.160	175E48CT	49.00	40.80
55	0.036	A	89	2E55CT	19.00	15.80
55	0.109	B	26.0	6E55CT	17.40	14.50
55	0.262	C	5.50	15E55CT	15.80	13.20
55	0.435	D	3.83	24E55CT	20.60	17.20
55	1.450	E	0.67	80E55CT	22.20	18.50
55	3.170	F	0.196	175E55CT	47.50	39.60
63	0.031	A	100	2E63CT	18.40	15.30
63	0.095	B	35.0	6E63CT	16.90	14.10
63	0.238	C	6.51	15E63CT	15.40	12.80
63	0.380	D	5.35	24E63CT	19.90	16.60
63	1.270	E	0.71	80E63CT	21.50	17.90
63	2.770	F	0.20	175E63CT	46.10	38.40
70	0.028	A	139	2E70CT	17.90	14.90
70	0.085	B	50.5	6E70CT	16.30	13.60
70	0.214	C	9.4	15E70CT	14.90	12.40
70	0.342	D	8.10	24E70CT	19.30	16.10
70	1.140	E	0.80	80E70CT	20.90	17.40
70	2.500	F	0.25	175E70CT	44.60	37.20
80	0.025	A	163	2E80CT	17.30	14.40
80	0.075	B	55.9	6E80CT	15.80	13.20
80	0.198	C	13.4	15E80CT	14.40	12.00
80	0.300	D	9.0	24E80CT	18.70	15.60
80	1.000	E	0.92	80E80CT	20.20	16.80
80	2.180	F	0.34	175E80CT	43.20	36.00
90	0.022	A	218	2E90CT	16.70	13.90
90	0.067	B	89.9	6E90CT	15.40	12.80
90	0.166	C	15.9	15E90CT	13.90	11.60
90	0.267	D	12.5	24E90CT	18.10	15.10
90	0.890	E	1.08	80E90CT	19.40	16.20
90	1.940	F	0.38	175E90CT	41.80	34.80
100	0.020	A	283	2E100CT	16.10	13.40
100	0.060	B	113	6E100CT	14.80	12.30
100	0.150	C	16.8	15E100CT	13.40	11.20
100	0.240	D	14.4	24E100CT	17.50	14.60
100	0.800	E	1.64	80E100CT	18.80	15.70
100	1.750	F	0.52	175E100CT	40.30	33.60
110	0.018	A	392	2E110CT	15.60	13.00
110	0.054	B	122	6E110CT	14.30	11.90
110	0.136	C	22.1	15E110CT	13.00	10.80
110	0.218	D	19.5	24E110CT	16.80	14.00
110	0.728	E	2.03	80E110CT	18.10	15.10
110	1.590	F	0.72	175E110CT	38.90	32.40

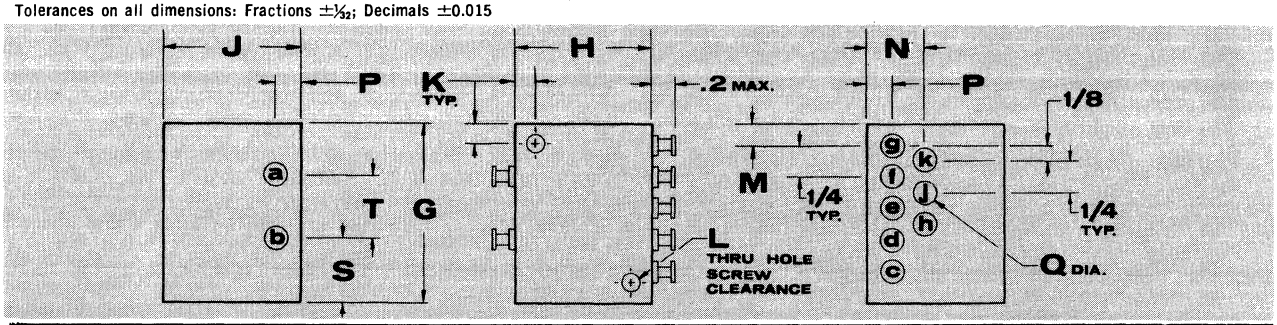
NOTE: These transformers are designed to operate at 400 Hz. For Abbott's 60 Hz transformers, see page 2850.

SIZE	G	H	J	K	L	M	N	P	Q	S	T	†TERMINALS USED (1) (2) (3) (4) (5)
A	.87	.74	.78	3/32	4-40	3/16	1/4	1/8	.062	3/16	1/4	a b f k g
B	1.25	1.19	.88	1/8	4-40	1/4	3/8	3/16	.062	—	—	e f g h j
C	1.43	1.24	1.27	1/8	4-40	1/4	3/8	3/16	.062	—	—	d e f g h
D	1.47	1.28	1.40	1/8	4-40	1/4	3/8	3/16	.062	—	—	d e f g h
E*	2.31	1.52	1.75	1/4	8-32	1/2	—	3/16	.080	—	—	c d e f g
E2	2.31	1.52	1.75	1/4	8-32	1/2	—	3/16	.080	3/4	1/2	a b c e g
F*	2.75	2.71	2.31	1/4	8-32	3/4	—	3/16	.080	—	—	c d e f g
F2	2.75	2.71	2.31	1/4	8-32	3/4	—	3/16	.080	1	1/2	a b c e g

* Special Terminal Placement Used on Units with Current 10 Amps or Greater.
† Letters Indicate Terminal Placement Only. Terminals are Numbered (1) Thru (5). See Diagram.
Tolerances on all dimensions: Fractions ±1/32; Decimals ±0.015

TYPICAL CIRCUIT DIAGRAM





Output Volt (at F.L.)	Output Current (Amps)	Size (See Dwg.)	Sec. DCR ohms	Model Number	Price 1 pc.	Price 2-4 pcs.
123	0.016	A	495	2E123CT	$15.00	$12.50
123	0.048	B	178	6E123CT	13.70	11.40
123	0.122	C	30.7	15E123CT	12.50	10.40
123	0.195	D	21.9	24E123CT	16.20	13.50
123	0.650	E	2.35	80E123CT	17.50	14.60
123	1.420	F	0.81	175E123CT	37.40	31.20
138	0.014	A	550	2E138CT	14.40	12.00
138	0.043	B	203	6E138CT	13.20	11.00
138	0.108	C	36.0	15E138CT	12.00	10.00
138	0.174	D	30.3	24E138CT	15.60	13.00
138	0.580	E	3.17	80E138CT	16.80	14.00
138	1.260	F	1.14	175E138CT	36.00	30.00
157	0.038	B	287	6E157CT	14.50	12.10
157	0.095	C	53	15E157CT	13.20	10.50
157	0.152	D	36.1	24E157CT	16.40	13.70
157	0.508	E	3.60	80E157CT	17.60	14.70
157	1.100	F	1.31	175E157CT	37.80	31.50
175	0.034	B	335	6E175CT	14.50	12.10
175	0.085	C	56	15E175CT	13.20	11.00
175	0.136	D	49.5	24E175CT	17.20	14.30
175	0.455	E	5.50	80E175CT	18.50	15.40
175	1.000	F	1.87	175E175CT	39.60	33.00
200	0.030	B	391	6E200CT	15.20	12.70
200	0.071	C	65	15E200CT	13.80	11.50
200	0.120	D	57	24E200CT	18.00	15.00
200	0.400	E	5.60	80E200CT	19.30	16.10
200	0.875	F	2.65	175E200CT	41.40	34.50
220	0.027	B	530	6E220CT	15.80	13.20
220	0.068	C	91.5	15E220CT	14.40	12.00
220	0.109	D	79	24E220CT	18.70	15.60
220	0.364	E	8.1	80E220CT	20.20	16.80
220	0.790	F	2.92	175E220CT	43.20	36.00
250	0.024	B	596	6E250CT	16.60	13.80
250	0.060	C	141	15E250CT	15.00	12.50
250	0.096	D	114	24E250CT	19.60	16.30
250	0.320	E	11.2	80E250CT	21.00	17.50
250	0.700	F	3.95	175E250CT	45.00	37.50
275	0.021	B	680	6E275CT	17.20	14.30
275	0.054	C	146	15E275CT	15.60	13.00
275	0.087	D	120	24E275CT	20.30	16.90
275	0.290	E	13.6	80E275CT	21.80	18.20
275	0.635	F	4.65	175E275CT	46.80	39.00
310	0.019	B	886	6E310CT	$17.90	$14.90
310	0.048	C	160	15E310CT	16.20	13.50
310	0.077	D	180	24E310CT	21.10	17.60
310	0.266	E	14.1	80E310CT	22.70	18.90
310	0.565	F	6.80	175E310CT	48.60	40.50
350	0.017	B	953	6E350CT	18.50	15.40
350	0.042	C	232	15E350CT	16.80	14.00
350	0.068	D	200	24E350CT	21.80	18.20
350	0.217	E	21.2	80E350CT	23.50	19.60
350	0.500	F	8.0	175E350CT	50.40	42.00
387	0.038	C	310	15E387CT	17.40	14.50
387	0.062	D	225	24E387CT	22.70	18.90
387	0.206	E	22.7	80E387CT	24.40	20.30
387	0.450	F	10.0	175E387CT	52.20	43.50
433	0.034	C	457	15E433CT	18.00	15.00
433	0.055	D	300	24E433CT	23.40	19.50
433	0.184	E	31.6	80E433CT	25.20	21.00
433	0.404	F	11.2	175E433CT	54.00	45.00
486	0.049	D	340	24E486CT	24.20	20.20
486	0.164	E	35.6	80E486CT	26.00	21.70
486	0.360	F	16.0	175E486CT	55.80	46.50
550	0.043	D	484	24E550CT	25.00	20.80
550	0.145	E	41.0	80E550CT	26.90	22.40
550	0.316	F	18.0	175E550CT	57.60	48.00
630	0.126	E	73.0	80E630CT	27.70	23.10
630	0.277	F	25.8	175E630CT	59.40	49.50
700	0.114	E	83.0	80E700CT	28.60	23.80
700	0.250	F	28.5	175E700CT	61.20	51.00
800	0.100	E	112	80E800CT	29.40	24.50
800	0.217	F	41.5	175E800CT	63.00	52.50
900	0.088	E	158	80E900CT	30.20	25.20
900	0.194	F	46.4	175E900CT	64.80	54.00
1000	0.080	E	176	80E1000CT	31.10	25.90
1000	0.175	F	53.0	175E1000CT	66.60	55.50
1100	0.072	E2	198	80E1100CT	31.90	26.00
1100	0.158	F2	71.0	175E1200CT	68.40	57.00
1200	0.066	E2	216	80E1200CT	32.80	27.30
1200	0.145	F2	78.5	175E1200CT	70.20	58.50
1400	0.056	E2	300	80E1400CT	$33.60	$28.00
1400	0.125	F2	117	175E1400CT	72.00	60.00
1600	0.050	E2	335	80E1600CT	34.40	28.70
1600	0.109	F2	168	175E1600CT	73.80	61.50
1800	0.044	E2	530	80E1800CT	35.30	29.40
1800	0.097	F2	192	175E1800CT	75.60	63.00
2000	0.040	E2	575	80E2000CT	36.10	30.10
2000	0.087	F2	214	175E2000CT	77.40	64.50
2200	0.036	E2	810	80E2200CT	37.00	30.80
2200	0.079	F2	304	175E2200CT	79.20	66.00
2400	0.033	E2	910	80E2400CT	37.80	31.50
2400	0.072	F2	333	175E2400CT	81.00	67.50
2600	0.030	E2	1310	80E2600CT	38.60	32.20
2600	0.067	F2	356	175E2600CT	82.80	69.00
2800	0.028	E2	1425	80E2800CT	39.50	32.90
2800	0.062	F2	394	175E2800CT	84.60	70.50
3000	0.026	E2	1440	80E3000CT	40.30	33.60
3000	0.058	F2	530	175E3000CT	86.40	72.00
3200	0.054	F2	560	175E3200CT	88.20	73.50
3400	0.051	F2	740	175E3400CT	90.00	75.00
3600	0.048	F2	790	175E3600CT	91.80	76.50
3800	0.046	F2	836	175E3800CT	93.60	78.00
4000	0.043	F2	1115	175E4000CT	95.40	79.50
4200	0.041	F2	1175	175E4200CT	97.20	81.00
4400	0.039	F2	1352	175E4400CT	99.00	82.50
4600	0.038	F2	1357	175E4600CT	100.80	84.00
4800	0.036	F2	1730	175E4800CT	102.60	85.50
5000	0.035	F2	2240	175E5000CT	104.40	87.00

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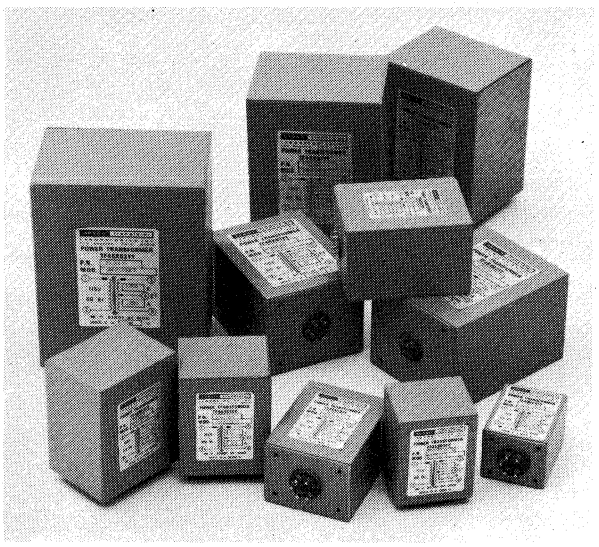
LABORATORIES, INCORPORATED (213) WEbster 6-8185 Cable: ABTLABS

abbott 60 ~ transformers



DELIVERY IS NORMALLY FROM STOCK

features

- Quality MIL-spec 60 Hz power transformers
- Hermetically sealed
- to meet MIL-T-27B
- 105°C ambient operation
- 5 to 5000 volts
- 5 to 300 watts

specifications

INPUT PRIMARY: 115 VRMS, 60 Hz ±5 Hz, 1 phase

INSULATION TEST: 1750 VRMS or 150% of secondary voltage (whichever is higher)

CONSTRUCTION: To MIL-T-27B, grades: 4 and 5, class: "S", life: "X" (10,000 hrs.) case: (see drawing)

ENVIRONMENT: 105°C maximum ambient temperature. Encapsulated to meet MIL-E-5272C and MIL-E-5400H for vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion and altitude (to a vacuum)

WORKING VOLTAGE: 1000 VAC for all transformers with secondary voltages up to and including 1200 VAC; 80% of rated secondary voltage for all others

SECONDARY VOLTAGE TOLERANCE: Within 3% of listed output voltage when measured at full load and 115 VAC input

OUTPUT SECONDARY: See voltage and current of specific models listed in the following pages.

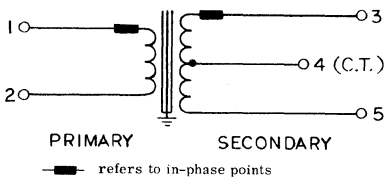
Output Volt (at F.L.)	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
5.0	1.00	A1	1.0	5P5CT	$34.50	$28.80
5.0	2.00	A2	1.5	10P5CT	31.60	26.40
5.0	3.00	A3	2.0	15P5CT	28.80	24.00
5.0	4.00	A4	2.5	20P5CT	31.60	26.40
5.0	6.00	A5	3.0	30P5CT	37.40	31.20
5.0	8.00	A6	3.3	40P5CT	39.20	32.70
5.0	16.00	A7	5.0	80P5CT	46.10	38.40
6.3	0.79	A1	1.0	5P6.3CT	33.70	28.10
6.3	1.58	A2	1.5	10P6.3CT	31.10	25.90
6.3	2.38	A3	2.0	15P6.3CT	28.20	23.50
6.3	3.16	A4	2.5	20P6.3CT	31.00	25.80
6.3	4.76	A5	3.0	30P6.3CT	36.60	30.50
6.3	6.35	A6	3.3	40P6.3CT	38.40	32.00
6.3	12.70	A7	5.0	80P6.3CT	45.60	38.00
6.3	19.00	A8	6.5	120P6.3CT	52.70	43.90
8.0	0.67	A1	1.0	5P8CT	33.10	27.60
8.0	1.25	A2	1.5	10P8CT	30.30	25.20
8.0	1.88	A3	2.0	15P8CT	27.60	23.00
8.0	2.50	A4	2.5	20P8CT	30.40	25.30
8.0	3.76	A5	3.0	30P8CT	36.00	30.00
8.0	5.00	A6	3.3	40P8CT	37.70	31.40
8.0	10.00	A7	5.0	80P8CT	44.60	37.20
8.0	15.00	A8	6.5	120P8CT	51.60	43.00
8.0	20.00	A9	8.2	160P8CT	58.50	48.80
10.0	0.50	A1	1.0	5P10CT	32.50	27.10
10.0	1.00	A2	1.5	10P10CT	29.70	24.80
10.0	1.50	A3	2.0	15P10CT	27.00	22.50
10.0	2.00	A4	2.5	20P10CT	29.70	24.80
10.0	3.00	A5	3.0	30P10CT	35.10	29.20
10.0	4.00	A6	3.3	40P10CT	36.80	30.70
10.0	8.00	A7	5.0	80P10CT	43.60	36.40
10.0	12.00	A8	6.5	120P10CT	54.30	45.20
10.0	16.00	A9	8.2	160P10CT	57.30	47.70
10.0	20.00	A10	10.5	200P10CT	64.10	53.40
12.6	0.40	A1	1.0	5P12.6CT	31.70	26.40
12.6	0.79	A2	1.5	10P12.6CT	29.00	24.20
12.6	1.19	A3	2.0	15P12.6CT	26.40	22.00
12.6	1.59	A4	2.5	20P12.6CT	29.00	24.20
12.6	2.38	A5	3.0	30P12.6CT	34.30	28.60
12.6	3.18	A6	3.3	40P12.6CT	36.00	30.00
12.6	6.35	A7	5.0	80P12.6CT	42.70	35.60
12.6	9.53	A8	6.5	120P12.6CT	49.40	41.20
12.6	12.70	A9	8.2	160P12.6CT	56.00	46.70
12.6	15.90	A10	10.5	200P12.6CT	62.70	52.30
14	0.36	A1	1.0	5P14CT	$31.10	$25.90
14	0.72	A2	1.5	10P14CT	28.50	23.70
14	1.07	A3	2.0	15P14CT	25.90	21.60
14	1.43	A4	2.5	20P14CT	28.50	23.70
14	2.15	A5	3.0	30P14CT	33.60	28.00
14	2.86	A6	3.3	40P14CT	35.30	29.40
14	5.72	A7	5.0	80P14CT	41.80	34.80
14	8.59	A8	6.5	120P14CT	48.30	40.30
14	11.40	A9	8.2	160P14CT	54.90	45.70
14	14.30	A10	10.5	200P14CT	61.40	51.20
16	0.34	A1	1.0	5P16CT	30.30	25.20
16	0.68	A2	1.5	10P16CT	27.90	23.20
16	0.94	A3	2.0	15P16CT	25.30	21.10
16	1.25	A4	2.5	20P16CT	27.80	23.20
16	1.87	A5	3.0	30P16CT	32.90	27.40
16	2.50	A6	3.3	40P16CT	34.50	28.80
16	5.00	A7	5.0	80P16CT	40.80	34.00
16	7.50	A8	6.5	120P16CT	47.30	39.40
16	10.00	A9	8.2	160P16CT	53.60	44.70
16	12.50	A10	10.5	200P16CT	60.00	50.00
16	18.70	A11	17.0	300P16CT	76.00	63.30
18	0.28	A1	1.0	5P18CT	29.60	24.70
18	0.56	A2	1.5	10P18CT	27.10	22.60
18	0.83	A3	2.0	15P18CT	24.70	20.60
18	1.11	A4	2.5	20P18CT	27.20	22.70
18	1.67	A5	3.0	30P18CT	32.20	26.80
18	2.21	A6	3.3	40P18CT	33.70	28.10
18	4.44	A7	5.0	80P18CT	40.00	33.30
18	6.68	A8	6.5	120P18CT	46.20	38.50
18	8.89	A9	8.2	160P18CT	52.40	43.60
18	11.10	A10	10.5	200P18CT	58.60	48.80
18	16.70	A11	17.0	300P18CT	74.30	61.90
20	0.25	A1	1.0	5P20CT	29.00	24.20
20	0.50	A2	1.5	10P20CT	26.50	22.10
20	0.75	A3	2.0	15P20CT	24.10	20.10
20	1.00	A4	2.5	20P20CT	26.50	22.10
20	1.50	A5	3.0	30P20CT	31.30	26.10
20	2.00	A6	3.3	40P20CT	32.90	27.40
20	4.00	A7	5.0	80P20CT	38.90	32.40
20	6.00	A8	6.5	120P20CT	45.10	37.60
20	8.00	A9	8.2	160P20CT	51.10	42.60
20	10.00	A10	10.5	200P20CT	57.30	47.70
20	15.00	A11	17.0	300P20CT	72.50	60.40
22	0.23	A1	1.0	5P22CT	$28.30	$23.60
22	0.45	A2	1.5	10P22CT	25.90	21.60
22	0.68	A3	2.0	15P22CT	23.60	19.60
22	0.91	A4	2.5	20P22CT	25.90	21.60
22	1.36	A5	3.0	30P22CT	30.60	25.50
22	1.82	A6	3.3	40P22CT	32.10	26.80
22	3.64	A7	5.3	80P22CT	38.10	31.70
22	5.45	A8	6.5	120P22CT	44.00	36.70
22	7.27	A9	8.2	160P22CT	50.00	41.60
22	9.10	A10	10.5	200P22CT	55.90	46.60
22	13.60	A11	17.0	300P22CT	70.80	59.00
25	0.20	A1	1.0	5P25CT	27.60	23.00
25	0.40	A2	1.5	10P25CT	25.30	21.10
25	0.60	A3	2.0	15P25CT	23.00	19.20
25	0.80	A4	2.5	20P25CT	25.30	21.10
25	1.20	A5	3.0	30P25CT	29.90	24.90
25	1.60	A6	3.3	40P25CT	31.30	26.10
25	3.20	A7	5.0	80P25CT	37.10	30.90
25	4.80	A8	6.5	120P25CT	43.00	35.80
25	6.40	A9	8.2	160P25CT	48.70	40.60
25	8.00	A10	10.5	200P25CT	54.50	45.40
25	12.00	A11	17.0	300P25CT	69.10	57.60
28	0.18	A1	1.0	5P28CT	26.80	22.40
28	0.36	A2	1.5	10P28CT	24.70	20.60
28	0.54	A3	2.0	15P28CT	22.40	18.70
28	0.71	A4	2.5	20P28CT	24.60	20.50
28	1.07	A5	3.0	30P28CT	29.10	24.30
28	1.43	A6	3.3	40P28CT	30.60	25.50
28	2.86	A7	5.0	80P28CT	36.20	30.20
28	4.29	A8	6.5	120P28CT	41.90	34.90
28	5.72	A9	8.2	160P28CT	47.50	39.60
28	7.10	A10	10.5	200P28CT	53.10	44.30
28	10.70	A11	17.0	300P28CT	67.30	56.10
31	0.16	A1	1.0	5P31CT	26.20	21.80
31	0.32	A2	1.5	10P31CT	24.00	20.00
31	0.48	A3	2.0	15P31CT	21.80	18.20
31	0.64	A4	2.5	20P31CT	24.00	20.00
31	0.97	A5	3.0	30P31CT	28.50	23.70
31	1.29	A6	3.3	40P31CT	29.80	24.80
31	2.58	A7	5.0	80P31CT	35.30	29.40
31	3.87	A8	6.5	120P31CT	40.80	34.00
31	5.17	A9	8.2	160P31CT	46.30	38.60
31	6.40	A10	10.5	200P31CT	51.80	43.20
31	9.67	A11	17.0	300P31CT	65.60	54.70

NOTE: These units are capable of 400 Hz operation; however, see Abbott's distinct line of miniature 400 Hz transformers on page 2848.

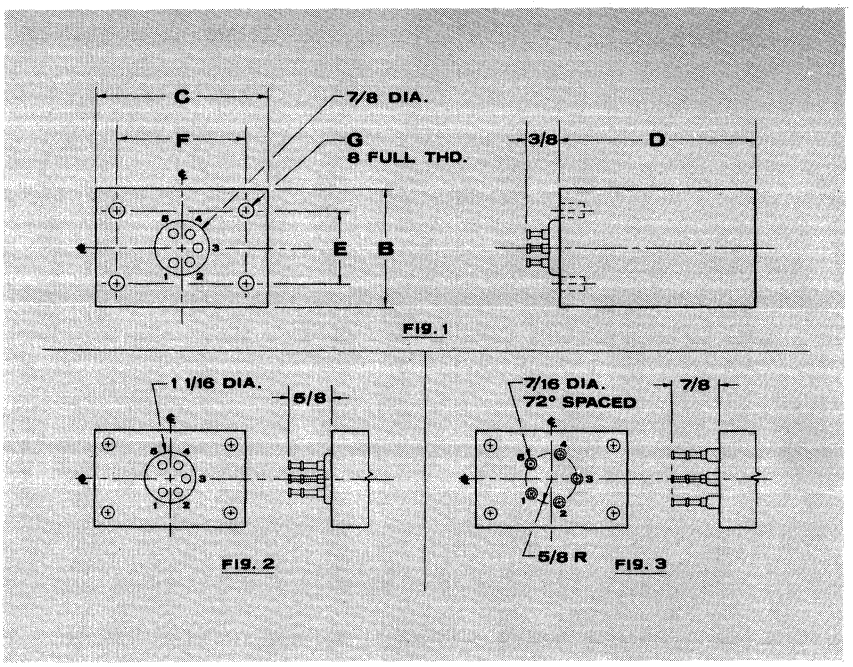
FIG. 1 SIZE CHART

SIZE	B	C	D	E	F	G
A1	1½	1¾	2⅜	1¼	1¼	6-32
A2	1¾	2 1/16	2¾	1¼	1½	6-32
A3	1⅞	2⅜	3⅛	1¼	1¾	8-32
A4	2	2⅜	3⅛	1½	1¾	8-32
A5	2⅛	2 11/16	3½	1½	2	8-32
A6	2¼	2 11/16	3½	1⅝	2	8-32
A7*	2⅝	3⅛	4⅛	2	2¼	8-32
A8*	2⅞	3 7/16	4½	2¼	2½	10-32
A9*	3⅛	3¾	4⅞	2 7/16	2¾	10-32
A10*	3⅞	4 1/16	5¼	2⅝	3	¼-20
A11*	3⅞	4 11/16	6	2¾	3½	¼-20

TYPICAL CIRCUIT DIAGRAM



—■— refers to in-phase points



* SEE FIG. 2 FOR HEADER CONFIGURATION USED ON UNITS WITH CURRENT GREATER THAN 10 AMPS.
SEE FIG. 3 FOR HEADER CONFIGURATION USED ON UNITS WITH VOLTAGE GREATER THAN 1200 VOLTS.

Output Volt (at F.L.)	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
35	0.14	A1	1.0	5P35CT	$25.60	$21.30
35	0.29	A2	1.5	10P35CT	23.40	19.50
35	0.43	A3	2.0	15P35CT	21.30	17.70
35	0.57	A4	2.5	20P35CT	23.40	19.50
35	0.86	A5	3.0	30P35CT	27.60	23.00
35	1.14	A6	3.3	40P35CT	28.90	24.10
35	2.28	A7	5.0	80P35CT	34.30	28.60
35	3.43	A8	6.5	120P35CT	39.70	33.10
35	4.57	A9	8.2	160P35CT	45.10	37.60
35	5.71	A10	10.5	200P35CT	50.40	42.00
35	8.59	A11	17.0	300P35CT	63.90	53.20
39	0.13	A1	1.0	5P39CT	24.80	20.70
39	0.26	A2	1.5	10P39CT	22.70	18.90
39	0.38	A3	2.0	15P39CT	20.70	17.20
39	0.51	A4	2.5	20P39CT	22.70	18.90
39	0.77	A5	3.0	30P39CT	26.80	22.40
39	1.03	A6	3.3	40P39CT	28.20	23.50
39	2.05	A7	5.0	80P39CT	33.40	27.80
39	3.07	A8	6.5	120P39CT	38.60	32.20
39	4.10	A9	8.2	160P39CT	43.80	36.50
39	5.12	A10	10.5	200P39CT	49.00	40.80
39	7.69	A11	17.0	300P39CT	62.20	51.80
43	0.12	A1	1.0	5P43CT	24.10	20.10
43	0.23	A2	1.5	10P43CT	22.10	18.40
43	0.35	A3	2.0	15P43CT	20.10	16.80
43	0.46	A4	2.5	20P43CT	22.10	18.40
43	0.70	A5	3.0	30P43CT	26.20	21.80
43	0.93	A6	3.3	40P43CT	27.40	22.80
43	1.85	A7	5.0	80P43CT	32.50	27.10
43	2.79	A8	6.5	120P43CT	37.60	31.30
43	3.70	A9	8.2	160P43CT	42.60	35.50
43	4.64	A10	10.5	200P43CT	47.70	39.70
43	6.95	A11	17.0	300P43CT	60.40	50.40
48	0.10	A1	1.0	5P48CT	23.40	19.50
48	0.21	A2	1.5	10P48CT	21.60	18.00
48	0.31	A3	2.0	15P48CT	19.50	16.30
48	0.42	A4	2.5	20P48CT	21.50	17.90
48	0.63	A5	3.0	30P48CT	25.40	21.20
48	0.83	A6	3.3	40P48CT	26.60	22.20
48	1.63	A7	5.0	80P48CT	31.50	26.30
48	2.50	A8	6.5	120P48CT	36.40	30.40
48	3.33	A9	8.2	160P48CT	41.40	34.50
48	4.17	A10	10.5	200P48CT	46.30	38.60
48	6.26	A11	17.0	300P48CT	58.70	48.90
55	0.09	A1	1.0	5P55CT	$22.70	$18.90
55	0.18	A2	1.5	10P55CT	20.80	17.30
55	0.27	A3	2.0	15P55CT	19.00	15.80
55	0.36	A4	2.5	20P55CT	20.90	17.40
55	0.55	A5	3.0	30P55CT	24.70	20.60
55	0.73	A6	3.3	40P55CT	25.90	21.60
55	1.46	A7	5.0	80P55CT	30.70	25.60
55	2.18	A8	6.5	120P55CT	35.40	29.50
55	2.91	A9	8.2	160P55CT	40.20	33.50
55	3.64	A10	10.5	200P55CT	45.00	37.50
55	5.46	A11	17.0	300P55CT	57.00	47.50
63	0.08	A1	1.0	5P63CT	21.90	18.30
63	0.16	A2	1.5	10P63CT	20.20	16.80
63	0.24	A3	2.0	15P63CT	18.40	15.30
63	0.32	A4	2.5	20P63CT	20.20	16.80
63	0.48	A5	3.0	30P63CT	23.90	19.90
63	0.64	A6	3.3	40P63CT	25.00	20.80
63	1.27	A7	5.0	80P63CT	29.60	24.70
63	1.91	A8	6.5	120P63CT	34.30	28.60
63	2.52	A9	8.2	160P63CT	38.90	32.40
63	3.18	A10	10.5	200P63CT	43.50	36.30
63	4.76	A11	17.0	300P63CT	55.20	46.00
70	0.071	A1	1.0	5P70CT	21.40	17.80
70	0.143	A2	1.5	10P70CT	19.50	16.30
70	0.212	A3	2.0	15P70CT	17.80	14.80
70	0.286	A4	2.5	20P70CT	19.50	16.30
70	0.429	A5	3.0	30P70CT	23.10	19.20
70	0.572	A6	3.3	40P70CT	24.20	20.20
70	1.140	A7	5.0	80P70CT	28.80	24.00
70	1.720	A8	6.5	120P70CT	33.30	27.70
70	2.280	A9	8.2	160P70CT	37.70	31.40
70	2.860	A10	10.5	200P70CT	42.20	35.20
70	4.290	A11	17.0	300P70CT	53.50	44.60
80	0.067	A1	1.0	5P80CT	20.70	17.20
80	0.125	A2	1.5	10P80CT	19.00	15.80
80	0.187	A3	2.0	15P80CT	17.20	14.40
80	0.250	A4	2.5	20P80CT	19.00	15.80
80	0.375	A5	3.0	30P80CT	22.40	18.70
80	0.500	A6	3.3	40P80CT	23.50	19.60
80	1.000	A7	5.0	80P80CT	27.80	23.20
80	1.500	A8	6.5	120P80CT	32.10	26.80
80	2.000	A9	8.2	160P80CT	36.50	30.40
80	2.500	A10	10.5	200P80CT	40.80	34.00
80	3.750	A11	17.0	300P80CT	51.80	43.20
90	0.055	A1	1.0	5P90CT	$19.90	$16.60
90	0.111	A2	1.5	10P90CT	18.40	15.30
90	0.167	A3	2.0	15P90CT	16.70	13.90
90	0.222	A4	2.5	20P90CT	18.30	15.20
90	0.332	A5	3.0	30P90CT	21.60	18.00
90	0.445	A6	3.3	40P90CT	22.70	18.90
90	0.890	A7	5.0	80P90CT	26.90	22.40
90	1.340	A8	6.5	120P90CT	31.20	26.00
90	1.780	A9	8.2	160P90CT	35.40	29.50
90	2.220	A10	10.5	200P90CT	39.60	33.00
90	3.320	A11	17.0	300P90CT	50.10	41.70
100	0.050	A1	1.0	5P100CT	19.20	16.00
100	0.100	A2	1.5	10P100CT	17.60	14.70
100	0.150	A3	2.0	15P100CT	16.10	13.40
100	0.200	A4	2.5	20P100CT	17.70	14.80
100	0.300	A5	3.0	30P100CT	21.00	17.50
100	0.400	A6	3.3	40P100CT	21.90	18.30
100	0.800	A7	5.0	80P100CT	26.00	21.60
100	1.200	A8	6.5	120P100CT	30.00	25.00
100	1.500	A9	8.2	160P100CT	34.00	28.40
100	2.000	A10	10.5	200P100CT	38.10	31.70
100	3.000	A11	17.0	300P100CT	48.30	40.30
110	0.045	A1	1.0	5P110CT	18.70	15.60
110	0.091	A2	1.5	10P110CT	17.00	14.20
110	0.136	A3	2.0	15P110CT	15.50	12.90
110	0.182	A4	2.5	20P110CT	17.00	14.20
110	0.272	A5	3.0	30P110CT	20.10	16.80
110	0.364	A6	3.3	40P110CT	21.10	17.60
110	0.726	A7	5.0	80P110CT	25.00	20.80
110	1.090	A8	6.5	120P110CT	28.90	24.10
110	1.450	A9	8.2	160P110CT	32.80	27.30
110	1.820	A10	10.5	200P110CT	36.70	30.60
110	2.720	A11	17.0	300P110CT	46.60	38.80
123	0.040	A1	1.0	5P123CT	17.90	14.90
123	0.081	A2	1.5	10P123CT	16.40	13.60
123	0.122	A3	2.0	15P123CT	14.90	12.40
123	0.162	A4	2.5	20P123CT	16.40	13.60
123	0.244	A5	3.0	30P123CT	19.30	16.10
123	0.325	A6	3.3	40P123CT	20.30	16.90
123	0.650	A7	5.0	80P123CT	24.00	20.00
123	0.970	A8	6.5	120P123CT	27.90	23.20
123	1.300	A9	8.2	160P123CT	31.60	26.40
123	1.620	A10	10.5	200P123CT	35.40	29.50
123	2.440	A11	17.0	300P123CT	44.90	37.40

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abbott transistor LABORATORIES, INCORPORATED
5200 W. Jefferson Blvd. / Los Angeles 90016
(213) WEbster 6-8185 Cable: ABTLABS

abbott 60 transformers

Output Volt (at F.L.)	Output Current (Amps)	Size (See Dwg.)	Wt. lbs.	Model Number	Price 1 pc.	Price 2-4 pcs.
138	0.036	A1	1.0	5P138CT	$17.20	$14.40
138	0.073	A2	1.5	10P138CT	15.80	13.20
138	0.108	A3	2.0	15P138CT	14.40	12.00
138	0.145	A4	2.5	20P138CT	15.80	13.20
138	0.217	A5	3.0	30P138CT	18.70	15.60
138	0.289	A6	3.3	40P138CT	19.50	16.30
138	0.580	A7	5.0	80P138CT	23.20	19.30
138	0.870	A8	6.5	120P138CT	26.80	22.40
138	1.150	A9	8.2	160P138CT	30.50	25.40
138	1.450	A10	10.5	200P138CT	34.10	28.40
138	2.170	A11	17.0	300P138CT	43.20	36.00
157	0.064	A2	1.5	10P157CT	16.70	13.90
157	0.096	A3	2.0	15P157CT	15.00	12.50
157	0.127	A4	2.5	20P157CT	16.60	13.80
157	0.191	A5	3.0	30P157CT	19.60	16.40
157	0.254	A6	3.3	40P157CT	20.60	17.20
157	0.510	A7	5.0	80P157CT	24.40	20.40
157	0.760	A8	6.5	120P157CT	28.20	23.50
157	1.020	A9	8.2	160P157CT	32.00	26.70
157	1.270	A10	10.5	200P157CT	35.90	29.90
157	1.910	A11	17.0	300P157CT	45.30	37.70
175	0.057	A2	1.5	10P175CT	17.30	14.40
175	0.086	A3	2.0	15P175CT	15.80	13.20
175	0.114	A4	2.5	20P175CT	17.30	14.40
175	0.171	A5	3.0	30P175CT	20.50	17.10
175	0.228	A6	3.3	40P175CT	21.60	18.00
175	0.457	A7	5.0	80P175CT	25.50	21.20
175	0.685	A8	6.5	120P175CT	29.50	24.60
175	0.914	A9	8.2	160P175CT	33.50	27.90
175	1.140	A10	10.5	200P175CT	37.50	31.20
175	1.710	A11	17.0	300P175CT	47.50	39.60
200	0.050	A2	1.5	10P200CT	18.20	15.20
200	0.075	A3	2.0	15P200CT	16.50	13.70
200	0.100	A4	2.5	20P200CT	18.20	15.20
200	0.150	A5	3.0	30P200CT	21.60	18.00
200	0.200	A6	3.3	40P200CT	22.65	18.80
200	0.400	A7	5.0	80P200CT	26.70	22.30
200	0.600	A8	6.5	120P200CT	30.90	25.70
200	0.800	A9	8.2	160P200CT	35.00	29.20
200	1.000	A10	10.5	200P200CT	39.10	32.60
200	1.500	A11	17.0	300P200CT	49.60	41.30
220	0.045	A2	1.5	10P220CT	19.00	15.80
220	0.068	A3	2.0	15P220CT	17.20	14.40
220	0.091	A4	2.5	20P220CT	19.00	15.80
220	0.136	A5	3.0	30P200CT	22.40	18.70
220	0.182	A6	3.3	40P220CT	23.50	19.60
220	0.364	A7	5.0	80P220CT	27.80	23.20
220	0.546	A8	6.5	120P220CT	32.10	26.80
220	0.728	A9	8.2	160P220CT	36.50	30.40
220	0.914	A10	10.5	200P220CT	40.80	34.00
220	1.360	A11	17.0	300P220CT	51.80	43.20
250	0.060	A3	2.0	15P250CT	17.90	14.90
250	0.080	A4	2.5	20P250CT	19.70	16.40
250	0.120	A5	3.0	30P250CT	23.40	19.50
250	0.160	A6	3.3	40P250CT	24.50	20.40
250	0.320	A7	5.0	80P250CT	29.00	24.20
250	0.480	A8	6.5	120P250CT	33.60	28.00
250	0.640	A9	8.2	160P250CT	38.20	31.80
250	0.800	A10	10.5	200P250CT	42.70	35.60
250	1.200	A11	17.0	300P250CT	53.90	44.90
275	0.055	A3	2.0	15P275CT	$18.70	$15.60
275	0.073	A4	2.5	20P275CT	20.50	17.10
275	0.109	A5	3.0	30P275CT	24.20	20.20
275	0.146	A6	3.3	40P275CT	25.50	21.20
275	0.292	A7	5.0	80P275CT	30.20	25.20
275	0.437	A8	6.5	120P275CT	34.90	29.10
275	0.581	A9	8.2	160P275CT	39.60	33.00
275	0.728	A10	10.5	200P275CT	44.30	36.90
275	1.090	A11	17.0	300P275CT	56.10	46.80
310	0.065	A4	2.5	20P310CT	21.40	17.80
310	0.097	A5	3.0	30P310CT	25.30	21.10
310	0.130	A6	3.3	40P310CT	26.40	22.00
310	0.258	A7	5.0	80P310CT	31.30	26.10
310	0.387	A8	6.5	120P310CT	36.20	30.20
310	0.516	A9	8.2	160P310CT	41.10	34.30
310	0.645	A10	10.5	200P310CT	46.00	38.40
310	0.967	A11	17.0	300P310CT	58.20	48.50
350	0.057	A4	2.5	20P350CT	22.10	18.40
350	0.086	A5	3.0	30P350CT	26.20	21.80
350	0.114	A6	3.3	40P350CT	27.40	22.80
350	0.229	A7	5.0	80P350CT	32.50	27.10
350	0.343	A8	6.5	120P350CT	37.60	31.30
350	0.457	A9	8.2	160P350CT	42.60	35.50
350	0.571	A10	10.5	200P350CT	47.70	39.70
350	0.857	A11	17.0	300P350CT	60.40	50.40
387	0.077	A5	3.0	30P387CT	27.10	22.60
387	0.103	A6	3.3	40P387CT	28.50	23.70
387	0.203	A7	5.0	80P387CT	33.70	28.10
387	0.310	A8	6.5	120P387CT	39.00	32.50
387	0.414	A9	8.2	160P387CT	44.20	36.80
387	0.517	A10	10.5	200P387CT	49.50	41.20
387	0.775	A11	17.0	300P387CT	62.50	52.10
433	0.069	A5	3.0	30P433CT	28.00	23.30
433	0.093	A6	3.3	40P433CT	29.30	24.40
433	0.185	A7	5.0	80P433CT	34.80	29.00
433	0.277	A8	6.5	120P433CT	40.30	33.60
433	0.370	A9	8.2	160P433CT	45.70	38.10
433	0.463	A10	10.5	200P433CT	51.20	42.70
433	0.693	A11	17.0	300P433CT	64.80	54.00
486	0.062	A5	3.0	30P486CT	29.00	24.20
486	0.082	A6	3.3	40P486CT	30.40	25.30
486	0.164	A7	5.0	80P486CT	36.00	30.00
486	0.246	A8	6.5	120P486CT	41.60	34.70
486	0.329	A9	8.2	160P486CT	47.30	39.40
486	0.411	A10	10.5	200P486CT	52.80	44.00
486	0.618	A11	17.0	300P486CT	66.90	55.70
550	0.073	A6	3.3	40P550CT	31.30	26.10
550	0.145	A7	5.0	80P550CT	37.10	30.90
550	0.218	A8	6.5	120P550CT	43.00	35.80
550	0.291	A9	8.2	160P550CT	48.70	40.64
550	0.364	A10	10.5	200P550CT	54.50	45.40
550	0.546	A11	17.0	300P550CT	69.10	57.60
630	0.064	A6	3.3	40P630CT	32.40	27.00
630	0.127	A7	5.0	80P630CT	38.40	32.00
630	0.191	A8	6.5	120P630CT	44.30	36.90
630	0.254	A9	8.2	160P630CT	50.30	41.90
630	0.318	A10	10.5	200P630CT	56.20	46.80
630	0.477	A11	17.0	300P630CT	71.20	59.30
700	0.114	A7	5.0	80P700CT	39.40	32.80
700	0.172	A8	6.5	120P700CT	45.60	38.00
700	0.229	A9	8.2	160P700CT	51.70	43.10
700	0.286	A10	10.5	200P700CT	57.80	48.20
700	0.429	A11	17.0	300P700CT	73.40	61.20
800	0.100	A7	5.0	80P800CT	$40.70	$33.90
800	0.150	A8	6.5	120P800CT	47.00	39.20
800	0.200	A9	8.2	160P800CT	53.30	44.40
800	0.250	A10	10.5	200P800CT	59.70	49.70
800	0.375	A11	17.0	300P800CT	75.50	62.90
900	0.089	A7	5.0	80P900CT	41.80	34.80
900	0.133	A8	6.5	120P900CT	48.30	40.30
900	0.178	A9	8.2	160P900CT	54.90	45.70
900	0.222	A10	10.5	200P900CT	61.40	51.20
900	0.333	A11	17.0	300P900CT	77.70	64.80
1000	0.080	A7	5.0	80P1000CT	43.10	35.90
1000	0.120	A8	6.5	120P1000CT	49.80	41.50
1000	0.160	A9	8.2	160P1000CT	56.50	47.10
1000	0.200	A10	10.5	200P1000CT	63.20	52.70
1000	0.300	A11	17.0	300P1000CT	79.80	66.50
1100	0.109	A8	6.5	120P1100CT	50.80	42.40
1100	0.145	A9	8.2	160P1100CT	58.20	48.50
1100	0.182	A10	10.5	200P1100CT	64.80	54.00
1100	0.272	A11	17.0	300P1100CT	82.00	68.40
1200	0.100	A8	6.5	120P1200CT	52.20	43.50
1200	0.133	A9	8.2	160P1200CT	59.80	49.80
1200	0.167	A10	10.5	200P1200CT	66.50	55.40
1200	0.250	A11	17.0	300P1200CT	84.10	70.10
1400	0.114	A9	8.2	160P1400CT	61.30	51.10
1400	0.143	A10	10.5	200P1400CT	68.20	56.80
1400	0.214	A11	17.0	300P1400CT	86.40	72.00
1600	0.125	A10	10.5	200P1600CT	69.90	58.30
1600	0.187	A11	17.0	300P1600CT	88.50	73.70
1800	0.167	A11	17.0	300P1800CT	90.70	75.60
2000	0.150	A11	17.0	300P2000CT	92.80	77.30
2200	0.073	A11	17.0	160P2200CT	95.00	79.20
2400	0.067	A11	17.0	160P2400CT	97.15	80.90
2600	0.061	A11	17.0	160P2600CT	99.30	82.80
2800	0.057	A11	17.0	160P2800CT	101.40	84.50
3000	0.053	A11	17.0	160P3000CT	103.60	86.40
3200	0.050	A11	17.0	160P3200CT	105.70	88.10
3400	0.047	A11	17.0	160P3400CT	108.00	90.00
3600	0.045	A11	17.0	160P3600CT	110.10	91.70
3800	0.042	A11	17.0	160P3800CT	112.30	93.60
4000	0.040	A11	17.0	160P4000CT	114.40	95.30
4200	0.038	A11	17.0	160P4200CT	116.60	97.20
4400	0.036	A11	17.0	160P4400CT	118.70	98.90
4600	0.035	A11	17.0	160P4600CT	120.90	100.80
4800	0.003	A11	17.0	160P4800CT	123.00	102.50
5000	0.032	A11	17.0	160P5000CT	125.20	104.40

abbott transistor
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(213) WEbster 6-8185 Cable: ABTLABS
LABORATORIES, INCORPORATED

A. Industrial Control Transformer — Machine Tool and Industrial Control applications. 50 VA thru 15 KVA, 50 and 60 or 50/60 Hz. All NEMA primary and secondary voltages or special voltages.

B. Linear Reactor Load Bank—Load Bank for testing industrial electrical equipment. Up to 1000 KW . . . single and multi-phase. Voltages to 10 KV . . . hi-pot to 50 KV.

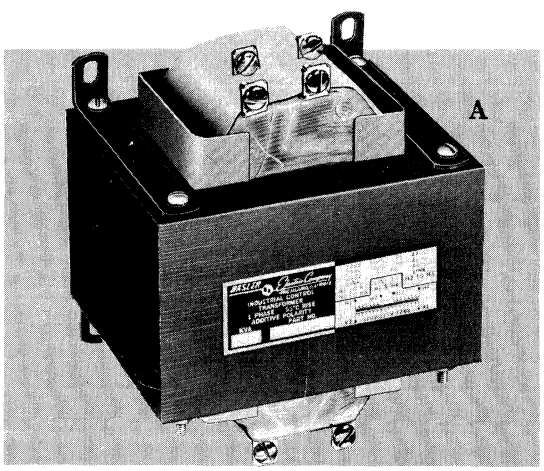
C. Encapsulated Magnetic Amplifier — To MIL-T-27 for military guidance systems . . . toroidal and laminated core types.

D. Saturable Reactor—Used in Control of industrial electrical equipment. Basler capability range to 1000 KVA, to 8.6 KV class, Hi-Potted to 19 KV.

E. Power Transformer — Transformer for use on submarines . . . withstands high shock and vibration. We build step-up, step-down and Auto Transformers in power ranges from milliwatts to 1000KVA . . . millivolts to 15KV. Hi-Pot to 31 KV.

BASLER Electric Company
HIGHLAND, ILLINOIS
Box 269 Zip 62249—Phone 618-654-2341

Manufacturers of Magnetic Components, Power Control Equipment and Systems.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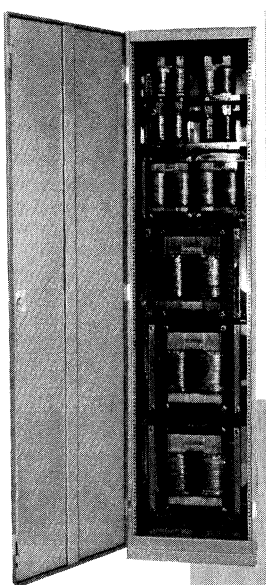
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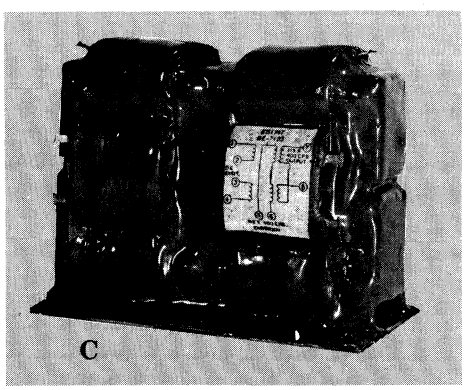
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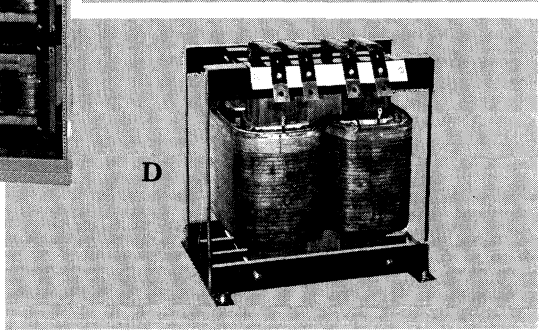
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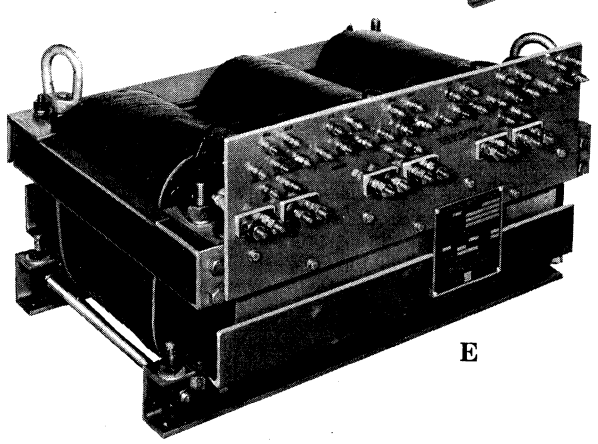

E

At Basler Electric, product capabilities are more than a mere possibility . . . they're a reality.

Quality "input" from engineering, design and manufacturing experience make Basler your obvious supplier of Magnetic Components, Power Control Equipment and Electronic Systems.

The units illustrated here are only representative of the broad range of electric and electronic products "on line" at Basler Electric.

For detailed information on these and other products by Basler, write for bulletins.

BASLER ELECTRIC TRANSFORMERS

PULSE TRANSFORMERS



OPEN FRAME PACKAGING

A Contemporary Exclusive! Open coils in a mechanically secure mounting. Inexpensive and small in size.

DIP PACKAGES

As many as four transformers may be enclosed in an integrated circuit dual-in-line package 0.125 inches high. Over 50,000 coils per week are being produced in the package at present.

STRONG CAPABILITIES— TOP FACILITIES

Contemporary is currently producing over 200,000 pulse transformers per month in *three* modern, climate-controlled plants...in Minneapolis and Marshall, Minnesota; and in Juncos, Puerto Rico. Fast delivery, highest quality and extra grade service are Contemporary standards—not just extras.

You're assured of wide selection of package styles, because Contemporary maintains its own moulding facilities for the production of pulse transformer packages. Currently, tooling is available for 19 popular case styles. Custom packages are delivered quickly and at low tooling charges. Write for data sheet 202 for complete details on available packages. *219 standard designs!*

Want engineering help? Contemporary Electronics' applications engineers are always available to assist you with pulse transformer selection and specification problems. Write for the following application notes:

AN 602 Pulse Transformer Parameters—their definition, measurement, specification.

If you don't see what you need in the standard line remember—

CONTEMPORARY ELECTRONICS PRODUCES OVER 300 CUSTOM PULSE TRANSFORMERS!

Call us for custom design, fast service . . .
Phone 612/920-6444, Minneapolis

CONTEMPORARY ELECTRONICS

EXTRA SERVICE TO THE DATA PROCESSING INDUSTRY

4838 West 35th Street, Minneapolis, Minnesota 55416
Phone 612/920-6444

See YELLOW SECTION for local offices, phones

MINIATURE TRANSFORMERS

FERROTRAN

Extremely Small Rectifier Transformers — Single or Dual Secondary Windings

FOR USE IN SOLID STATE POWER SUPPLIES

SUB-MINIATURE UNITS

Channel-frame (1⅜"x1⅛"x1"W) or AH Case.

Model	Sec. D.C., Volts	Sec. D.C., Current	Price
SM-1	10	80ma.	$11.50
SM-2	15	60	11.50
SM-3	20	50	12.00
SM-4	30	30	12.00
SM-5	12, 12	30	16.00
SM-6	15, 15	25	16.00
SM-7	40	25	12.00
SM-8	50	20	12.00
SM-9	60	17	12.00
SM-10	70	15	12.00

MINIATURE UNITS

Channel-frame (1⅝"Lx1⅜"Hx1⅛"W) or EB Case.

Model	Sec. D.C., Volts	Sec. D.C., Current	Price
R-1	40	35ma.	$10.50
R-2	30	50	10.50
R-3	20	75	10.00
R-4	10	160	10.00
R-5	20, 20	50	13.00
R-6	15, 15	50	13.00
R-7	10, 10	75	13.00
R-8	6, 6	100	13.00
R-9	50	30	10.50
R-10	60	27	11.00
R-11	70	22	11.00
R-12	80	20	11.00
R-13	90	18	11.00
R-14	100	15	11.00

INTERMEDIATE UNITS

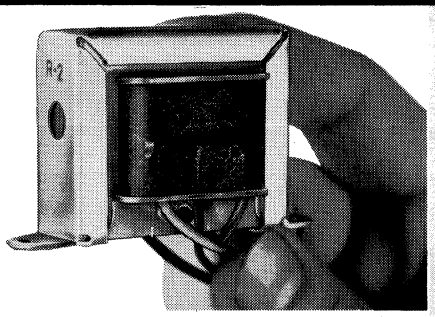
Channel-frame (2"Lx1⅝"Hx1¼"W) or AJ Case.

Model	Sec. D.C., Volts	Sec. D.C., Current	Price
I-1	10	300ma.	$9.00
I-2	15	250	9.00
I-3	20	200	9.00
I-4	25	175	9.50
I-5	30	140	9.50
I-6	40	125	9.50
I-7	20, 20	125	12.50
I-8	15, 15	125	12.50
I-9	10, 10	150	12.50
I-10	50	80	10.50
I-11	75	60	11.00
I-12	100	35	11.50
I-13	150	30	11.50

SUB-MINIATURE PRINTED CIRCUIT UNITS

Epoxy-encapsulated transformers mounted on rigid epoxy forms; incorporates pins for direct soldering to printed circuit boards. (1⅝"x1¼"x 1¼").

Model	Sec. D.C., Volts	Sec. D.C., Current	Price
SM-1A	10	80ma.	$12.50
SM-2A	15	60	12.50
SM-3A	20	50	13.00
SM-4A	30	30	13.00
SM-5A	12, 12	30	16.00



R-2 TRANSFORMER (CHANNEL-FRAME)

STANDARD UNITS

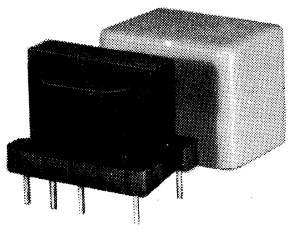
Channel-frame (2¼"Lx2"Hx1⅝"W) or FB Case.

Model	Sec. D.C., Volts	Sec. D.C., Current	Price
S-1	10	670ma.	$9.50
S-2	15	500	9.50
S-3	20	300	10.00
S-4	30	225	10.00
S-5	50	125	10.50
S-6	20, 20	150	13.50
S-7	15, 15	200	13.50
S-8	10, 10	300	13.00
S-9	75	120	11.50
S-10	100	70	11.50
S-11	120	60	12.00
S-12	150	45	12.00
S-13	200	35	12.00

CM SERIES

Channel-frame (2⅝"x2 3/16"x1¾") or GB Case.

Model	Sec. D.C., Volts	Sec. D.C., Current	Price
CM-1	10	1.0a	$10.50
CM-2	15	.75	10.50
CM-3	20	.60	10.75
CM-4	30	.40	10.75
CM-5	40	.3a	10.75
CM-6	80	.14	11.50
CM-7	100	.12	11.50
CM-8	120	.10	11.50
CM-9	150	.07	12.00
CM-10	175	.06	12.00
CM-11	200	.05	12.00



SM-1A TRANSFORMER FOR PRINTED CIRCUIT BOARDS (SHOWN OPEN)

HIGH CURRENT UNITS

Channel-frame (3"Lx2½"Hx2"W) or GA Case.

Model	Sec. D.C., Volts	Sec. D.C., Current	Price
H-1	10	1.3amp	$11.50
H-2	15	1.3	11.50
H-3	20	1.0	11.50
H-4	30	0.7	11.50
H-5	40	0.4	11.50
H-6	20, 20	0.5	14.00
H-7	15, 15	0.7	14.00
H-8	10, 10	1.0	14.00
H-9	80	.225	11.50
H-10	100	.180	11.50
H-11	120	.150	12.50
H-12	150	.130	12.50
H-13	175	.110	13.00
H-14	200	.100	13.00
H-15	225	90ma.	13.00
H-16	250	80	13.50
H-17	275	70	13.50
H-18	300	65	13.50
H-19	400	50	14.00
H-20	500	40	14.50

DESIGN INFORMATION

NOMINAL INPUT VOLTAGE—115 Volts.
FREQUENCY—60 to 400 cycles.
CIRCUIT—Voltages shown are D.C. outputs with a condenser input.
CENTER TAP—All units are center tapped. The ratings, therefore, are for a full-wave circuit. Models I-10 to I-13, S-9 to S-13 and H-9 to H-20 are designed for a bridge circuit.
TEST VOLTAGE—1000 V., D.C. between primary and secondary, and between secondary windings.
INSULATION—Nylon bobbin; insulating paper between each layer; Mylar outer wrap between primary and secondary.
LEADS—Flexible leads rated for 105°C.
DUAL SECONDARIES — Transformers shown with two output units give indicated current from each tap.

220 VOLT A.C. INPUT TRANSFORMERS

All transformers listed may be wound for 220 v.a.c. input.

CHANNEL FRAME DIMENSIONS

Type	Distance Bet. Cent. Mtg. Holes	Overall Lgth. of Base	Hole Size
SM	1¾"	2 1/16"	3/16"
R	2 1/16"	2⅜"	3/16"
I	2⅜"	2 13/16"	3/16"
S	2 13/16"	3¼"	3/16"
H	3 1/16"	4"	3/16"

ENCASED TRANSFORMERS

All listed transformers are available fully encapsulated in a MIL-T-27 can, designed to withstand shock, vibration and temperature extremes.

The cost of such units is an additional $11.00 for single secondary transformers and $13.00 additional for dual secondary units.

Standard connectors are of the hooked solder pin type (0.900" in dia.), mounted dead center on the stud side of the case.

FERROTRAN ELECTRONICS COMPANY, INC.

683 BROADWAY • NEW YORK, N.Y. 10012 • PHONE: (212) AL 4-5810

FREED TRANSFORMER CO., INC.

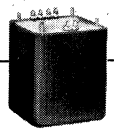
STANDARD MILITARY TRANSFORMERS

The group comprises audio and power units designed to meet MIL-T-27 A specifications.
The functional characteristics of these transformers were established by the Armed Service Standardization Program. These units are supplied in standard MIL cases.

CASE DIMENSIONS



AJ CASE
Height: 2⅜"
Width: 1⅝"
Depth: 1⅝"
Mtg. Cen.: 1⅜"x1 3/16"
Studs: 4 6-32
Cut Out: 1⅛" D



HA CASE
Height: 4¼"
Width: 3 1/16"
Depth: 2⅝"
Mtg. Cen.: 2 1/64"x1 55/64"
Studs: 4 8-32

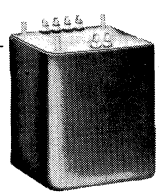
LB CASE
Height: 4½"
Width: 4 5/16"
Depth: 3 11/16"
Mtg. Cen.: 3 5/16"x2 11/16"
Studs: 4 10-32

JB CASE
Height: 3⅞"
Width: 3 9/16"
Depth: 3 1/16"
Mtg. Cen.: 2⅝"x2⅛"
Studs: 4 8-32

MB CASE
Height: 4 15/16"
Width: 4 11/16"
Depth: 4"
Mtg. Cen.: 3 11/16"x3"
Studs: 4 ¼-20

KB CASE
Height: 4 5/16"
Width: 3 13/16"
Depth: 3⅜"
Mtg. Cen.: 3"x2 7/16"
Studs: 4 10-32

NB CASE
Height: 5½"
Width: 5 1/16"
Depth: 4 5/16"
Mtg. Cen.: 4 1/16"x3 5/16"
Studs: 4 ¼-20



EB CASE
Height: 2 7/16"
Width: 1 15/16"
Depth: 1 13/16"
Mtg. Cen.: 1⅜"x1¼"
Studs: 4 6-32

FB CASE
Height: 2½"
Width: 2 5/16"
Depth: 2 1/16"
Mtg. Cen.: 1 11/16"x1 7/16"
Studs: 4 6-32

GB CASE
Height: 2 13/16"
Width: 2¾"
Depth: 2⅜"
Mtg. Cen.: 2⅛"x1¾"
Studs: 4 6-32

HB CASE
Height: 3 3/16"
Width: 3 1/16"
Depth: 2⅝"
Mtg. Cen.: 2 19/64"x1 55/64"
Studs: 4 8-32

Transformers meeting MIL-T-27A specifications Grade 1 through 6 with temperature characteristics of Class S, T, or U can be supplied on special order.
Encapsulated units using either Epoxy-Resins or Fosterite can be supplied for Grade 2 and 5.
Class U components can be supplied molded in special high temperature Freed resin.

STANDARD MILITARY AUDIO TRANSFORMERS

Frequency Response 300-10,000 C.P.S. ±2 DB

Catalog No.	Application	Type Designation	Impedance Level in Ohms Primary	Secondary	Ratio	Max. Power Level DBM	Pri. D.C. Per Side in Ma	Max. D.C. unbalance	Case
MGA 1	Transformer; interstage, single or P.P. plates to single or P.P. grid	TF4RX15AJ	10,000 C.T.	90,000 split and C.T.	1:3 overall	+15	10	10	AJ
MGA 2	Transformer; matching 600 ohm line to voice coil.	TF4RX16AJ	600 split	4, 8, 16	6.12:1 overall	+33	0	0	AJ
MGA 3	Transformer; input, 600 ohm line to single or P.P. grids.	TF4RX10AJ	600 split	135,000 C.T.	1:15	+15	0	0	AJ
MGA 4	Transformer; matching, 600 ohm line to 600 ohm line.	TF4RX16AJ	600 split	600 split	1:1	+15	0	0	AJ
MGA 5	Transformer; output, single plate 7,600 ohm, 4,800 ohm to 600 ohm line.	TF4RX13AJ	7,600 tap @ 4,800	600 split	3.56:1	+33	40	40	AJ
MGA 6	Transformer; output, single plate 7,600 ohm, 4,800 ohm to voice coil.	TF4RX13AJ	7,600 tap @ 4,800	4, 8, 16	21.8:1	+33	40	40	AJ
MGA 7	Transformer; output, single or P.P. plates to 600 ohm line.	TF4RX13AJ	15,000 C.T.	600 split	5:1	+33	10	10	AJ
MGA 8	Transformer; output, P.P. plates to 600 ohm line.	TF4RX13AJ	24,000 C.T.	600 split	6.32:1	+30	10	1	AJ
MGA 9	Transformer; output, P.P. plates to 600 ohm line.	TF4RX13AJ	60,000 C.T.	600 split	10:1	+27	10	1	AJ

STANDARD MILITARY POWER TRANSFORMERS

Primary 105/115/125V 60~

SINGLE PHASE 400 CPS, AND THREE PHASE 60 AND 400 CPS TRANSFORMERS CAN BE SUPPLIED ON SPECIAL ORDER.

Catalog No.	MIL-T-27 Type Designation	Hi Volt	D.C. Volts	D.C. Amps	Fil. No. 1	Fil. No. 2	Case
MGP 1	TF4RX03HA001	200/100/0/100/200	185	.070	5/6. 3V @ 2A	6. 3V @ 3A	HA
MGP 2	TF4RX03JB002	650 C.T.	260	.070	5/6. 3V @ 2A	6. 3V @ 4A	JB
MGP 3	TF4RX03KB006	650 C.T.	245	.150	6. 3V @ 5A	5V @ 3A	KB
MGP 4	TF4RX03LB003	800 C.T.	318	.175	5V @ 3A	6. 3V @ 8A	LB
MGP 5	TF4RX03MB004	900 C.T.	345	.250	5V @ 3A	6. 3V @ 8A	MB
MGP 6	TF4RX02KB001	700 C.T.	255	.250			KB
MGP 7	TF4RX02LB002	1100 C.T.	419	.250			LB
MGP 8	TF4RX02NB003	1600 C.T.	640	.250			NB

STANDARD MILITARY FILAMENT TRANSFORMERS

Primary 105/115/125V 60~

SINGLE PHASE 400 CPS, AND THREE PHASE 60 AND 400 CPS TRANSFORMERS CAN BE SUPPLIED ON SPECIAL ORDER.

Catalog No.	MIL-T-27 Type Designation	Secondary Volts	Secondary Current Amps	Secondary Test Volts RMS	Case
MGF 1	TF4RX01EB002	2.5	3.0	2,500	EB
MGF 2	TF4RX01GB003	2.5	10.0	2,500	GB
MGF 3	TF4RX01FB004	5.0	3.0	2,500	FB
MGF 4	TF4RX01HB005	5.0	10.0	2,500	HB
MGF 5	TF4RX01FB006	6.3	2.0	2,500	FB
MGF 6	TF4RX01GB007	6.3	5.0	2,500	GB
MGF 7	TF4RX01JB008	6.3	10.0	2,500	JB
MGF 8	TF4RX01KB009	6.3	20.0	2,500	KB
MGF 9	TF4RX01JB012	2.5	10.0	10,000	JB
MGF 10	TF4RX01KB013	5.0	10.0	10,000	KB

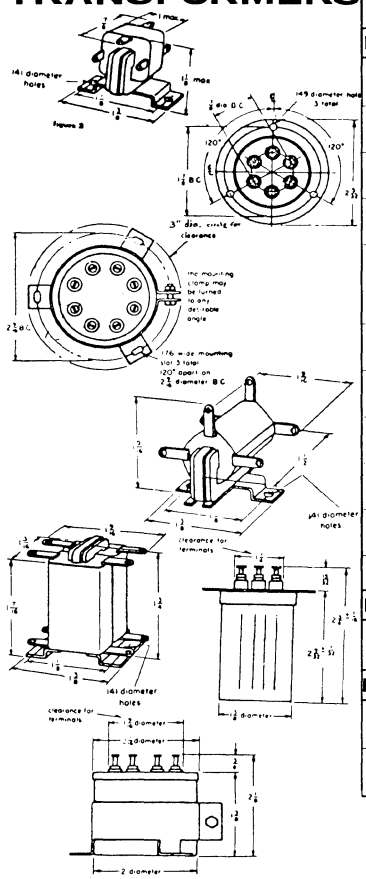
*Standard Military Filament and Power Transformers are also available in Grade 4.

See our complete listing in Radio Electronic Master. In addition to standard items, Freed has extensive facilities for the design and production of transformers and reactors as follows:

- Power
- Audio
- Pulse
- Reference
- Toroid
- Constant Voltage
- Magnetic Amplifiers
- Ultrasonic
- Filters
- Sub-Miniature
- Control
- Molded
- Encapsulated
- High Temp
- Saturable

FREED TRANSFORMER CO., INC.

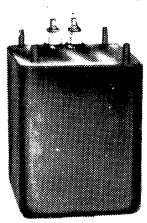
PULSE TRANSFORMERS



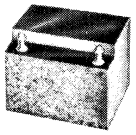
Freed No.	Radiation Laboratory No.	Westinghouse No.	Dimension Figure	GUIDANCE VALUES				Test Voltage (60 Cycle RMS)
				Pulse Voltage (KV)	Pulse Duration (Microseconds)	Maximum Duty Ratio	Load Impedance (Ohms)	
BLOCKING OSCILLATOR, REGENERATIVE DRIVER OR COUPLING TRANSFORMERS								
MPT-13C	132AW2	1P1	1					
MPT-13M	132AW2F	7P1	1	1.0/1.0/1.0	0.3 to 1.5	0.002	250	1000
MPT-13H	132AW2P	4P101	4					
MPT-14C	132BW2	1P2	1					
MPT-14M	132BW2F	7P2	1	0.5/0.5/0.5/0.15	0.3 to 1.5	0.002	200	1000
MPT-14H	132BW2P	4P102	5					
MPT-15C	132DW2	1P3	1					
MPT-15M	132DW2F	7P3	1	0.5/0.5/0.5	0.1 to 0.5	0.002	300	1000
MPT-15H	132DW2P	4P103	4					
MPT-16C	134BW2	1P4	3	2.5/2.5; 2.5/1.25	1 to 2.5	0.002	1500	1500
MPT-16M	134BW2F	7P4	3	1.5/1.5; 1.5/0.75	1 to 5	0.002	1500	
MPT-16H	134BW2P	4P104	5					
MPT-17C	134CW2	1P5	1	2.0/2.0/1.0	1 to 2.5	0.002	1200	1000
MPT-17M	134CW2F	7P5	1	1.5/1.5/0.75	1 to 5	0.002	1200	
MPT-17H	134CW2P	4P105	4					
MPT-18C	134EW2	1P6	2	2.0/2.0/1.0	0.3 to 1	0.002	800	750
MPT-18M	134EW2F	7P6	2	1.5/1.4/0.75	0.3 to 1.5	0.002	800	
MPT-19C	145CW2	1P7	1					
MPT-19M	145CW2F	7P7	1	0.5/0.5/0.5	1.0 to 5	0.002	500	1000
MPT-19H	145CW2P	4P107	4					
MPT-20C	145EW2	1P8	1					
MPT-20M	145EW2F	7P8	1	1.0/1.0/1.0	1.0 to 5	0.002	800	1000
MPT-20H	145EW2P	4P108	4					
MPT-21C	166AW2	1P9	1					
MPT-21M	166AW2F	7P9	1	1.0/0.67/0.67	1.0 to 5	0.002	800	1000
MPT-21H	166AW2P	4P109	4					
MPT-22C	176AW2	1P10	1	2.0/1.0/1.0		0.002	1000	
MPT-22M	176AW2F	7P10	1	1.5/0.75/0.75	1 to 2.5	0.002	1000	1000
MPT-22H	176AW2P	4P110	4					
MPT-23C	187AW2	1P11	1					
MPT-23M	187AW2F	7P11	1	1.0/0.5/0.5	0.5 to 2	0.002	400	1000
MPT-23H	187AW2P	4P111	4					
MPT-24C	224AW2	1P12	2	1.0/1.0/1.0/0.3	0.1 to 0.5	0.002	1000	750
MPT-24M	224AW2F	7P12	2					
PULSE TRIGGERING OR CURRENT TRANSFORMERS								
MPT-25C	139DW2	1P13	1					
MPT-25M	139DW2F	7P13	1		0.25 to 5	0.002		1000
MPT-25H	139DW2P	4P113	4					
PULSE OUTPUT TRANSFORMERS								
MPT-26C	148CW2	1P14	3	0.2/2.0	0.6 to 3	0.002	1600	
MPT-26M	148CW2F	7P14	3	0.4/2.0	0.25 to 1.25	0.002	1000	1500
MPT-26H	148CW2P	4P114	5	0.4/2.0	0.5 to 2.5	0.002	2000	
MPT-27C	148DW2	1P15	3	0.29/2.0	0.5 to 2.5	0.002	1200	
MPT-27M	148DW2F	7P15	3	0.57/2.0	0.2 to 1.0	0.002	800	1500
MPT-27H	148DW2P	4P115	5	0.57/2.0	0.4 to 2.0	0.002	1500	

C Indicates—varnish impregnated commercial construction.
M Indicates—encapsulated or molded construction to MIL-T-27A Grade 5 Class R.
H Indicates—hermetically sealed to MIL-T-27A Grade 4 Class R.

HERMETICALLY SEALED FILTER REACTORS



Case	Height	Depth	Width	Mtg. Centers	Studs
AJ	2 3/8	1 5/8	1 5/8	1 3/16 x 1 3/16	4 6-32
EB	2 7/16	1 13/16	1 13/16	1 3/16 x 1 1/4	4 6-32
FA	3 1/8	2 1/16	2 5/16	1 11/16 x 1 7/16	4 6-32
GA	3 13/16	2 3/8	2 1/4	2 1/8 x 1 3/4	4 6-32
HB	3 3/16	3 1/16	2 5/8	2 1/64 x 1 55/64	4 8-32
JA	3 5/16	3 1/16	4 7/8	2 5/8 x 2 1/8	4 8-32
JB	3 7/8	3 1/16	3 5/16	2 5/8 x 2 1/8	4 8-32
KB	4 5/16	3 3/8	3 13/16	3 x2 7/16	4 10-32
LA	5 5/16	3 11/16	4 5/16	3 5/16 x 2 11/16	4 10-32
LB	4 1/2	3 11/16	4 5/16	3 5/16 x 2 11/16	4 10-32
MB	4 13/16	4	4 11/16	3 11/16 x 3	4 1/4-20



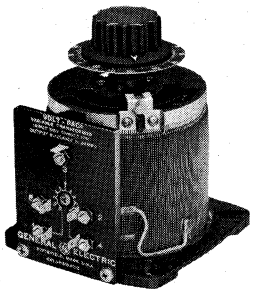
MC-10 CASE
Height: 13/16"
Width: 1 1/4"
Depth: 13/16"
Mtg. Cen.: 5/16" x 7/8"
Mtg.: 2 4-40 threaded inserts

MEET MIL-T-27A SPECIFICATIONS

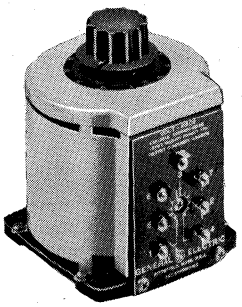
Catalog No.	MIL Type	Inductance Henry	Rat. Current DC Ma.	DC Res. Ohms	Test Volt Kilovolts	Case No.
MGC 1	TF4RX04AJ	100	10	3,500	1.	AJ
MGC 2	TF4RX04AJ	4	50	230	1.	AJ
MGC 3	TF4RX04EB	10	50	325	1.	EB
MGC 4	TF4RX04FA	20	50	475	1.5	FA
MGC 5	TF4RX04FA	30	50	650	1.5	FA
MGC 6	TF4RX04AJ	3	75	175	1.	AJ
MGC 7	TF4RX04EB	6	75	235	1.5	EB
MGC 8	TF4RX04FA	12	75	265	1.5	FA
MGC 9	TF4RX04EB	3.5	100	145	1.	EB
MGC 10	TF4RX04FA	8	100	180	1.5	FA
MGC 11	TF4RX04GA	12	100	190	2.	GA
MGC 12	TF4RX04EB	2	150	92	1.5	EB
MGC 13	TF4RX04FA	4	150	115	1.5	FA
MGC 14	TF4RX04GA	8	150	125	2.	GA
MGC 15	TF4RX04JB	11	150	120	2.5	JB
MGC 16	TF4RX04FA	2.5	200	70	1.5	FA
MGC 17	TF4RX04GA	4	200	80	2.	GA
MGC 18	TF4RX04HB	7	200	135	2.	HB
MGC 19	TF4RX04JA	10	200	125	2.5	JA
MGC 20	TF4RX04GA	2.5	300	50	2.	GA
MGC 21*	TF4RX04HB	4	300	62	2.5	HB
MGC 22	TF4RX04JB	6	300	85	2.5	JB
MGC 23*	TF4RX04KB	8	300	65	2.5	KB
MGC 24	TF4RX04LA	10	300	100	2.5	LA
MGC 25*	TF4RX04HB	2	400	37	2.5	HB
MGC 26	TF4RX04KB	6	400	60	2.5	KB
MGC 27*	TF4RX04JA	2	500	35	2.5	JA
MGC 28	TF4RX04KB	4	500	45	2.5	KB
MGC 29*	TF4RX04MB	7	500	50	2.5	MB
MGC 30*	TF4RX04LB	2	700	20	2.5	LB
MGC 31*	TF4RX04MB	1.75	1,000	12.5	2.5	MB

*Not stocked, available on short delivery.
Above units available in Grade 4.

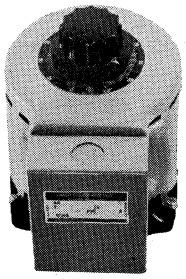
volt-pac® VARIABLE TRANSFORMERS



Manual uncased unit—exposed terminals



Manual cased unit—exposed terminals



Manual cased unit—enclosed terminals

The Volt-Pac variable transformer is a control device which provides continuously adjustable output voltage from a fixed line input to vary the voltage applied to a particular electrical load. With Volt-Pac units, output voltage is changed by flux transformation . . . in the unsaturated range of the magnetic core. The results . . . low cost, versatility, reliability, simplicity, and no wave form distortion.

Volt-Pac units, for surface or back-of-panel mounting, are designed for operation in ambients of —20C to +40C at full rated load, and under all load conditions have low electrical losses.

* When Overvoltage Connection is used, rated current should not be exceeded. Output kva for Overvoltage Connection is maximum output voltage times rated current.

† When using extended tap connections, operation is for 60 hertz per second only.

‡ Output at Overvoltage Connection is 0-132 volts.

§ When operated on lower input-voltage tap, rated current must be reduced when output voltage exceeds 140 percent of input voltage.

¶ For Line-voltage Connection only — No Overvoltage Connection provided.

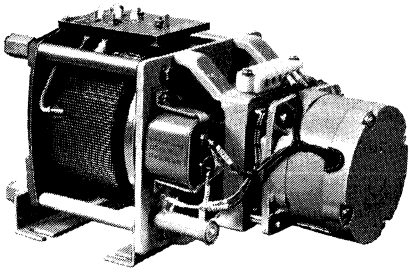
■ For 240-volt input, 0-240-volt output, application only.

• For 480-volt input, 0-480-volt output, application only.

ϕ 60 hertz only.

Line-voltage Connection		Overvoltage Connection,	UNCASED MODELS Exposed Terminals		CASED MODELS Exposed Terminals		Enclosed Terminals	
Rated Amp	Max Amp	Amp*	Model Number	List Price	Model Number	List Price	Model Number	List Price
MANUAL — SINGLE-PHASE, 50/60 HERTZ								
120 VOLT INPUT: OUTPUT — 0-120 VOLT (LINE VOLTAGE CONN.) 0-140 VOLT (OVERVOLTAGE CONN.)								
2.5‡	3.2	2.5	9T92A1	$11.00	.....	.....	.....	.....
4.5†	6.5	4.0	9T92Y5	16.00	.....	.....	.....	.....
7.5†	10.8	7.5	9T92Y7	20.00	9T92Y7G2	$25.00	9T92Y7G3	$26.00
9.0†	11.5	9.0	9T92Y9	21.00	9T92Y9G2	26.00	9T92Y9G3	27.00
10.0ϕ	13.0	None	9T92Y8¶	21.00	9T92Y8G2¶	26.00	9T92Y8G3¶	27.00
11.5ϕ	14.5	None	9T92Y10¶	23.00	9T92Y10G2¶	28.00	9T92Y10G3¶	29.00
15.0†	19.0	15.0	9T92Y27	39.00	9T92Y27G2	44.00	9T92Y27G3	47.00
18.0†	21.7	18.0	9T92Y28	49.00	9T92Y28G2	54.00	9T92Y28G3	57.00
30.0†	34.0	30.0	9T92Y37	93.00	9T92Y37G2	99.00	9T92Y37G3	104.00
37.0†	37.0	37.0	9T92Y38	114.00	9T92Y38G2	120.00	9T92Y38G3	125.00
50.0	55.0	50.0	9T92Y49	140.00	9T92Y49G2	146.00	9T92Y49G3	154.00
60.0	60.0	60.0	9T92Y50	215.00	9T92Y50G2	221.00	9T92Y50G3	229.00
74.0†	74.0	74.0	9T92Y41	256.00	9T92Y41G2	268.00	9T92Y41G3	278.00
100.0	110.0	100.0	9T92Y53	311.00	9T92Y53G2	323.00	9T92Y53G3	339.00
120.0	120.0	120.0	9T92Y54	460.00	9T92Y54G2	472.00	9T92Y54G3	488.00
150.0	165.0	150.0	9T92Y55	543.00	9T92Y55G2	561.00	9T92Y55G3	585.00
180.0	180.0	180.0	9T92Y56	710.00	9T92Y56G2	728.00	9T92Y56G3	752.00
240.0	240.0	240.0	9T92Y57	1010.00	9T92Y57G2	1034.00	9T92Y57G3	1068.00
300.0	300.0	300.0	9T92Y58	1260.00	9T92Y58G2	1290.00	9T92Y58G3	1332.00
360.0	360.0	360.0	9T92Y59	1560.00	9T92Y59G2	1596.00	9T92Y59G3	1646.00
120/240 VOLT INPUT§ OUTPUT 0-240 VOLT (LINE VOLTAGE CONN.) 0-280 VOLT (OVERVOLTAGE CONN.)								
4.0†	5.0	4.0	9T92Y13	$25.00	9T92Y13G2	$30.00	9T92Y13G3	$31.00
4.0ϕ	5.8	None	9T92Y12■	25.00	9T92Y12G2■	30.00	9T92Y12G3■	31.00
5.0ϕ	6.8	None	9T92Y14■	27.00	9T92Y14G2■	32.00	9T92Y14G3■	33.00
7.0†	10.1	7.0	9T92Y29	39.00	9T92Y29G2	44.00	9T92Y29G3	47.00
8.5†	11.0	8.5	9T92Y30	49.00	9T92Y30G2	54.00	9T92Y30G3	57.00
14.0†	14.0	14.0	9T92Y39	93.00	9T92Y39G2	99.00	9T92Y39G3	104.00
16.0†	16.0	16.0	9T92Y40	114.00	9T92Y40G2	120.00	9T92Y40G3	125.00
30.0	33.0	30.0	9T92Y51	140.00	9T92Y51G2	146.00	9T92Y51G3	154.00
35.0	35.0	35.0	9T92Y52	215.00	9T92Y52G2	221.00	9T92Y52G3	229.00
60.0	66.0	60.0	9T92Y60	357.00	9T92Y60G2	369.00	9T92Y60G3	385.00
70.0	70.0	70.0	9T92Y61	460.00	9T92Y61G2	472.00	9T92Y61G3	488.00
90.0	99.0	90.0	9T92Y62	580.00	9T92Y62G2	598.00	9T92Y62G3	622.00
105.0	105.0	105.0	9T92Y63	710.00	9T92Y63G2	728.00	9T92Y63G3	752.00
120.0	132.0	120.0	9T92Y5021	830.00	9T92Y5021G2	854.00	9T92Y5021G3	888.00
140.0	140.0	140.0	9T92Y64	1025.00	9T92Y64G2	1049.00	9T92Y64G3	1083.00
175.0	175.0	175.0	9T92Y65	1260.00	9T92Y65G2	1290.00	9T92Y65G3	1332.00
210.0	210.0	210.0	9T92Y66	1560.00	9T92Y66G2	1596.00	9T92Y66G3	1646.00
240/480 VOLT INPUT§ OUTPUT 0-480 VOLT (LINE VOLTAGE CONN.) 0-560 VOLT (OVERVOLTAGE CONN.)								
4.0†	5.0	4.0	9T92Y17	$64.00	9T92Y17G2	$74.00	9T92Y17G3	$76.00
4.0ϕ	5.8	None	9T92Y16•	66.00	9T92Y16G2•	76.00	9T92Y16G3•	78.00
5.0ϕ	6.8	None	9T92Y18•	68.00	9T92Y18G2•	78.00	9T92Y18G3•	80.00
7.0†	10.1	7.0	9T92Y31	86.00	9T92Y31G2	96.00	9T92Y31G3	102.00
8.5†	11.0	8.5	9T92Y32	118.00	9T92Y32G2	128.00	9T92Y32G3	134.00
14.0†	14.0	14.0	9T92Y42	202.00	9T92Y42G2	214.00	9T92Y42G3	224.00
16.0†	16.0	16.0	9T92Y43	236.00	9T92Y43G2	248.00	9T92Y43G3	258.00
30.0	33.0	30.0	9T92Y67	311.00	9T92Y67G2	323.00	9T92Y67G3	339.00
35.0	35.0	35.0	9T92Y68	440.00	9T92Y68G2	452.00	9T92Y68G3	468.00
60.0	66.0	60.0	9T92Y69	810.00	9T92Y69G2	834.00	9T92Y69G3	868.00
70.0	70.0	70.0	9T92Y70	990.00	9T92Y70G2	1014.00	9T92Y70G3	1048.00
90.0	99.0	90.0	9T92Y71	1230.00	9T92Y71G2	1266.00	9T92Y71G3	1316.00
105.0	105.0	105.0	9T92Y72	1530.00	9T92Y72G2	1566.00	9T92Y72G3	1616.00
MANUAL — THREE-PHASE, 50/60 HERTZ								
240 VOLT LINE TO LINE INPUT: OUTPUT — 0-240 VOLT (LINE VOLTAGE CONN.) 0-280 VOLT (OVERVOLTAGE CONN.)								
2.5ϕ	3.2	None	9T92Y3¶	$60.00	.....	.....	.....	.....
4.5ϕ	6.5	None	9T92Y6¶	71.00	.....	.....	.....	.....
7.5	10.8	7.5	9T92Y19	75.00	9T92Y19G2	$90.00	9T92Y19G3	$93.00
9.0	11.5	9.0	9T92Y21	77.00	9T92Y21G2	92.00	9T92Y21G3	95.00
10.0ϕ	13.0	None	9T92Y20¶	70.00	9T92Y20G2¶	85.00	9T92Y20G3	88.00
11.5ϕ	14.5	None	9T92Y22¶	77.00	9T92Y22G2¶	92.00	9T92Y22G3	95.00
15.0	19.0	15.0	9T92Y33	138.00	9T92Y33G2	153.00	9T92Y33G3	162.00
18.0	21.7	18.0	9T92Y34	175.00	9T92Y34G2	190.00	9T92Y34G3	199.00
30.0	34.0	30.0	9T92Y44	307.00	9T92Y44G2	325.00	9T92Y44G3	340.00
37.0	37.0	37.0	9T92Y45	368.00	9T92Y45G2	386.00	9T92Y45G3	401.00
50.0	55.0	50.0	9T92Y74	517.00	9T92Y74G2	535.00	9T92Y74G3	559.00
60.0	60.0	60.0	9T92Y75	680.00	9T92Y75G2	698.00	9T92Y75G3	722.00
74.0	74.0	74.0	9T92Y48	830.00	9T92Y48G2	866.00	9T92Y48G3	896.00
100.0	110.0	100.0	9T92Y78	1120.00	9T92Y78G2	1156.00	9T92Y78G3	1206.00
120.0	120.0	120.0	9T92Y79	1530.00	9T92Y79G2	1566.00	9T92Y79G3	1616.00
240/480 VOLT LINE TO LINE INPUT§ OUTPUT — 0-480 VOLT (LINE VOLTAGE CONN.) 0-560 VOLT (OVERVOLTAGE CONN.)								
4.0	5.0	4.0	9T92Y25	$89.00	9T92Y25G2	$104.00	9T92Y25G3	$107.00
4.0ϕ	5.8	None	9T92Y24•	86.00	9T92Y24G2•	101.00	9T92Y24G3	104.00
5.0ϕ	6.8	None	9T92Y26•	90.00	9T92Y26G2•	115.00	9T92Y26G3	118.00
7.0	10.1	7.0	9T92Y35	138.00	9T92Y35G2	153.00	9T92Y35G3	162.00
8.5	11.0	8.5	9T92Y36	175.00	9T92Y36G2	190.00	9T92Y36G3	199.00
14.0	14.0	14.0	9T92Y46	307.00	9T92Y46G2	325.00	9T92Y46G3	340.00
16.0	16.0	16.0	9T92Y47	368.00	9T92Y47G2	386.00	9T92Y47G3	401.00
30.0	33.0	30.0	9T92Y76	520.00	9T92Y76G2	538.00	9T92Y76G3	562.00
35.0	35.0	35.0	9T92Y77	680.00	9T92Y77G2	693.00	9T92Y77G3	722.00
60.0	66.0	60.0	9T92Y80	1120.00	9T92Y80G2	1156.00	9T92Y80G3	1206.00
70.0	70.0	70.0	9T92Y81	1530.00	9T92Y81G2	1566.00	9T92Y81G3	1616.00

volt-pac® VARIABLE TRANSFORMERS



Motor uncased unit — exposed terminals

MOTOR-OPERATED—SINGLE-PHASE, 50/60 HERTZ

120 VOLT INPUT: OUTPUT 0-120 VOLT (LINE VOLTAGE CONN) 0-140 VOLT (OVERVOLTAGE CONN)

Line Voltage Connection Rated Amp	Line Voltage Connection Max Amp	Overvoltage Connection Amp*	UNCASED MODELS Exposed Terminals Model Number (For 28-second Operation Only△)	UNCASED MODELS Exposed Terminals List Price	CASED MODELS Enclosed Terminals Model Number (For 28-second Operation Only△)	CASED MODELS Enclosed Terminals List Price
2.5‡	3.2	2.5	9T92A1G51	$117.00	.....	.....
4.5†	6.5	4.5	9T92Y5G51	122.00	.....	.....
7.5†	10.8	7.5	9T92Y7G51	130.00	9T92Y7G54	$136.00
9.0†	11.5	9.0	9T92Y9G51	131.00	9T92Y9G54	137.00
10.0ϕ	13.0	None	9T92Y8G51¶	131.00	9T92Y8G54¶	137.00
11.5ϕ	14.5	None	9T92Y10G51¶	133.00	9T92Y10G54¶	139.00
15.0†	19.0	15.0	9T92Y27G51	175.00	9T92Y27G54	183.00
18.0†	21.7	18.0	9T92Y28G51	185.00	9T92Y28G54	193.00
30.0†	34.0	30.0	9T92Y37G51	229.00	9T92Y37G54	240.00
37.0†	37.0	37.0	9T92Y38G51	250.00	9T92Y38G54	261.00
50.0	55.0	50.0	9T92Y49G51	276.00	9T92Y49G54	280.00
60.0	60.0	60.0	9T92Y50G51	351.00	9T92Y50G54	359.00
74.0†	74.0	74.0	9T92Y41G51	392.00	9T92Y41G54	414.00
100.0	110.0	100.0	9T92Y53G51	447.00	9T92Y53G54	475.00
120.0	120.0	120.0	9T92Y54G51	576.00	9T92Y54G54	624.00
150.0	165.0	150.0	9T92Y55G51	679.00	9T92Y55G54	721.00
180.0	180.0	180.0	9T92Y56G51	846.00	9T92Y56G54	888.00
240.0	240.0	240.0	9T92Y57G51	1146.00	9T92Y57G54	1204.00
300.0	300.0	300.0	9T92Y58G51	1396.00	9T92Y58G54	1468.00
360.0	360.0	360.0	9T92Y59G51	1696.00	9T92Y59G54	1782.00

120/240 VOLT INPUT§: OUTPUT 0-240 VOLT (LINE VOLTAGE CONN) 0-280 VOLT (OVERVOLTAGE CONN)

Rated Amp	Max Amp	Overvoltage Connection Amp*	UNCASED Exposed Terminals Model Number (For 28-second Operation Only△)	UNCASED Exposed Terminals List Price	CASED Enclosed Terminals Model Number (For 28-second Operation Only△)	CASED Enclosed Terminals List Price
4.0†	5.0	4.0	9T92Y13G51	$135.00	9T92Y13G54	$141.00
4.0ϕ	5.8	None	9T92Y12G51■	135.00	9T92Y12G54■	141.00
5.0ϕ	6.8	None	9T92Y14G51■	137.00	9T92Y14G54■	143.00
7.0	10.1	7.0	9T92Y29G51	175.00	9T92Y29G54	183.00
8.5†	11.0	8.5	9T92Y30G51	185.00	9T92Y30G54	193.00
14.0†	14.0	14.0	9T92Y39G51	229.00	9T92Y39G54	240.00
16.0†	16.0	16.0	9T92Y40G51	250.00	9T92Y40G54	261.00
30.0	33.0	30.0	9T92Y51G51	276.00	9T92Y51G54	290.00
35.0	35.0	35.0	9T92Y52G51	351.00	9T92Y52G54	365.00
60.0	66.0	60.0	9T92Y60G51	493.00	9T92Y60G54	521.00
70.0	70.0	70.0	9T92Y61G51	596.00	9T92Y61G54	624.00
90.0	99.0	90.0	9T92Y62G51	716.00	9T92Y62G54	758.00
105.0	105.0	105.0	9T92Y63G51	846.00	9T92Y63G54	888.00
120.0	132.0	120.0	9T92Y5021G51	966.00	9T92Y5021G54	1024.00
140.0	140.0	140.0	9T92Y64G51	1161.00	9T92Y64G54	1219.00
175.0	175.0	175.0	9T92Y65G51	1396.00	9T92Y65G54	1468.00
210.0	210.0	210.0	9T92Y66G51	1696.00	9T92Y66G54	1782.00

240/480 VOLT INPUT§: OUTPUT 0-480 VOLT (LINE VOLTAGE CONN) 0-560 VOLT (OVERVOLTAGE CONN)

Rated Amp	Max Amp	Overvoltage Connection Amp*	UNCASED Exposed Terminals Model Number (For 28-second Operation Only△)	UNCASED Exposed Terminals List Price	CASED Enclosed Terminals Model Number (For 28-second Operation Only△)	CASED Enclosed Terminals List Price
4.0†	5.0	4.0	9T92Y17G51	$174.00	9T92Y17G54	$186.00
4.0ϕ	5.8	None	9T92Y16G51•	176.00	9T92Y16G54•	188.00
5.0ϕ	6.8	None	9T92Y18G51•	178.00	9T92Y18G54•	190.00
7.0†	10.1	7.0	9T92Y31G51	222.00	9T92Y31G54	238.00
8.5†	11.0	8.5	9T92Y32G51	254.00	9T92Y32G54	270.00
14.0†	14.0	14.0	9T92Y42G51	338.00	9T92Y42G54	360.00
16.0†	16.0	16.0	9T92Y43G51	372.00	9T92Y43G54	394.00
30.0	33.0	30.0	9T92Y67G51	447.00	9T92Y67G54	475.00
35.0	35.0	35.0	9T92Y68G51	576.00	9T92Y68G54	604.00
60.0	66.0	60.0	9T92Y69G51	946.00	9T92Y69G54	1004.00
70.0	70.0	70.0	9T92Y70G51	1126.00	9T92Y70G54	1184.00
90.0	99.0	90.0	9T92Y71G51	1366.00	9T92Y71G54	1452.00
105.0	105.0	105.0	9T92Y72G51	1666.00	9T92Y72G54	1752.00
140.0	140.0	140.0	9T92Y73G51	2320.00	9T92Y73G54	2435.00

△ Time to change output from 0 to 100%. Other times, from 2.5 to 60 sec, are available.

○ When operated on 120-volt input taps, rated current must be reduced when output voltage exceeds 168 volts.

For other footnotes, see opposite page.

MOTOR-OPERATED—THREE-PHASE, 50/60 HERTZ†

240 VOLT LINE TO LINE INPUT: OUTPUT 0-240 VOLT (LINE VOLTAGE CONN) 0-280 VOLT (OVERVOLTAGE CONN)

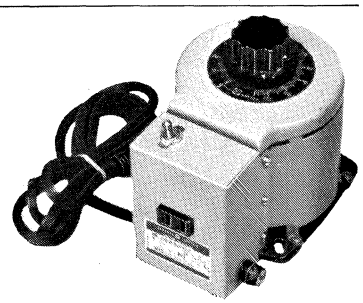
Line Voltage Connection Rated Amp	Line Voltage Connection Max Amp	Overvoltage Connection Amp*	UNCASED Exposed Terminals Model Number (For 28-second Operation Only△)	UNCASED Exposed Terminals List Price	CASED Enclosed Terminals Model Number (For 28-second Operation Only△)	CASED Enclosed Terminals List Price
2.5ϕ	3.2	None	9T92A3G51	$166.00	.....	.....
4.5ϕ	6.5	None	9T92Y6G51	177.00	.....	.....
7.5	10.8	7.5	9T92Y19G51	185.00	9T92Y19G54	$203.00
9.0	11.5	9.0	9T92Y21G51	187.00	9T92Y21G54	205.00
10.0ϕ	13.0	None	9T92Y20G51¶	180.00	9T92Y20G54¶	198.00
11.5ϕ	14.5	None	9T92Y22G51¶	187.00	9T92Y22G54¶	205.00
15.0	19.0	15.0	9T92Y33G51	274.00	9T92Y33G54	298.00
18.0	21.7	18.0	9T92Y34G51	311.00	9T92Y34G54	335.00
30.0	34.0	30.0	9T92Y44G51	442.00	9T92Y44G54	476.00
37.0	37.0	37.0	9T92Y45G51	504.00	9T92Y45G54	537.00
50.0	55.0	50.0	9T92Y74G51	653.00	9T92Y74G54	695.00
60.0	60.0	60.0	9T92Y75G51	816.00	9T92Y75G54	858.00
74.0	74.0	74.0	9T92Y48G51	966.00	9T92Y48G54	1032.00
100.0	110.0	100.0	9T92Y78G51	1256.00	9T92Y78G54	1342.00
120.0	120.0	120.0	9T92Y79G51	1666.00	9T92Y79G54	1752.00
150.0	165.0	150.0	9T92Y82G51	1905.00	9T92Y82G54	2035.00
180.0	180.0	180.0	9T92Y83G51	2500.00	9T92Y83G54	2630.00

240/480 VOLT LINE TO LINE INPUT§: OUTPUT 0-480 VOLT (LINE VOLTAGE CONN) 0-560 VOLT (OVERVOLTAGE CONN)

Rated Amp	Max Amp	Overvoltage Connection Amp*	UNCASED Exposed Terminals Model Number (For 28-second Operation Only△)	UNCASED Exposed Terminals List Price	CASED Enclosed Terminals Model Number (For 28-second Operation Only△)	CASED Enclosed Terminals List Price
4.0	5.0	4.0	9T92Y25G51	$199.00	9T92Y25G54	$217.00
4.0ϕ	5.8	None	9T92Y24G51•	196.00	9T92Y24G54•	214.00
5.0ϕ	6.8	None	9T92Y26G51•	200.00	9T92Y26G54•	228.00
7.0	10.1	7.0	9T92Y35G51	274.00	9T92Y35G54	298.00
8.5	11.0	8.5	9T92Y36G51	311.00	9T92Y36G54	335.00
14.0	14.0	14.0	9T92Y46G51	442.00	9T92Y46G54	476.00
16.0	16.0	16.0	9T92Y47G51	504.00	9T92Y47G54	537.00
30.0	33.0	30.0	9T92Y76G51	656.00	9T92Y76G54	698.00
35.0	35.0	35.0	9T92Y77G51	816.00	9T92Y77G54	858.00
60.0	66.0	60.0	9T92Y80G51	1256.00	9T92Y80G54	1342.00
70.0	70.0	70.0	9T92Y81G51	1666.00	9T92Y81G54	1752.00
90.0	99.0	90.0	9T92Y84G51	1905.00	9T92Y84G54	2035.00
105.0	105.0	105.0	9T92Y85G51	2500.00	9T92Y85G54	2630.00

PLUG-IN SETS

For laboratory or shop source of adjustable a-c voltage. Provides output voltage of 0-117% of input voltage. Equipped with a line switch and a fuse for overload protection.



Cord is 6 feet long.

120 VOLT INPUT: OUTPUT 0-120 VOLT (LINE VOLTAGE CONN) 0-140 VOLT (OVERVOLTAGE CONN)

Connection† Line Voltage Rated Amp†	Connection† Line Voltage Max Amp	Overvoltage Connection Amp*	New Model Number	List Price	Type Plug and Rec	Receptacle Configuration Fig. No.
7.5	10.8	7.5	9T92Y90	$27.00	Ungrounded	Fig. 2
7.5	10.8	7.5	9T92Y86	31.00	Grounded	Fig. 1
9.0	11.5	9.0	9T92Y91	28.00	Ungrounded	Fig. 2
9.0	11.5	9.0	9T92Y87	33.00	Grounded	Fig. 1
15.0	19.0	15.0	9T92Y88	54.00	Grounded	Fig. 1
18.0	21.7	18.0	9T92Y89	70.00	Grounded	Fig. 3

120/240 VOLT INPUT○: OUTPUT 0-240 (LINE CONN) 0-280 VOLT (OVERVOLTAGE CONN)

Rated Amp	Max Amp	Overvoltage Connection Amp*	New Model Number	List Price	Type Plug and Rec	Receptacle Configuration Fig. No.
4.0	5.0	4.0	9T92Y93	$33.00	Ungrounded	Fig. 2
4.0	5.0	4.0	9T92Y95	39.00	Grounded	Fig. 4
7.0	10.1	7.0	9T92Y96	53.00	Grounded	Fig. 4
8.5	11.0	8.5	9T92Y97	70.00	Grounded	Fig. 4

RECEPTACLE CONFIGURATIONS



Fig. 1



Fig. 2



Fig. 3



Fig. 4

Prices subject to change without notice.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

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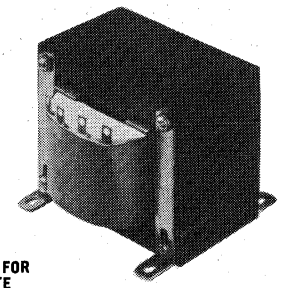
POWER TRANSFORMERS AND HIGH CURRENT CHOKES



STOCKED FOR IMMEDIATE DELIVERY

- Available Immediately From Stock
- Secondary Voltages Between The Standard Units Available At No Additional Cost
- Primary Voltage = 115V RMS, 60 HZ (Will Operate To 400 HZ)
- Capacitance and Inductance Values Shown For E_{ripple} (P-P) ≤ 3% of E_{dc}.
- Allow Two Weeks For Non-Standard Voltage Transformers
- Nomenclature of Part Number 1000 - 56 Secondary Power Rating in VA RMS Voltage
- Transformer Regulation is 5% No Load to Full Load

1. Transformers Rated For 45°C Temperature Rise. Rated For Class B Performance Per MIL-T-27B.
2. All Transformers Have Two Secondary Windings. They Can Be Connected For Parallel or Series Operation

- Bleeder Current = 10% of I_{dc}.
- V_f of Rectifiers Will Affect D.C. Output Voltage
- Choke Connections: P - Parallel S - Series

VOLTAGE AND CURRENT TABLE FOR THE DIFFERENT CIRCUIT CONFIGURATION

Power Rating Watts	Transformer Part Number	Secondary E_s Volts RMS	Secondary RMS Amps	Fig. 1 E_{dc} Volts	Fig. 1 I_{dc} Amps	Fig. 1 C_1 Farad	Fig. 2 E_{dc} Volts	Fig. 2 I_{dc} Amps	Fig. 2 C_1 UF	Fig. 3 E_{dc} Volts	Fig. 3 I_{dc} Amps	Fig. 3 L_1 Part No.	Fig. 3 C_1 UF	Fig. 4 E_{dc} Volts	Fig. 4 I_{dc} Amps	Fig. 4 L_1 Part No.	Fig. 4 C_1 UF
100	100-12.8	12.8	8	6.0	8.0	.300	13.0	4.0	100,000	4.0	12.0	100-8LP	60,000	9.0	6.0	100-8LS	15,000
100	100-28	28	4	16.0	4.0	.050	33.5	2.0	17,000	11.0	6.0	100-40LP	8,000	23.0	3.0	100-40LS	2,000
100	100-36	36	3	22.0	3.0	.035	44.0	1.5	12,500	14.3	5.0	100-60LP	6,000	29.0	2.5	100-60LS	1,500
100	100-56	56	2	34.0	2.0	.020	70.0	1.0	7,500	22.0	3.3	100-160LP	2,500	44.5	1.6	100-160LS	750
250	250-12.8	12.8	20	5.8	20.0	.700	13.0	10.0	250,000	3.7	30.0	250-4LP	80,000	9.0	15.0	250-4LS	20,000
250	250-28	28	9	15.5	10.0	.150	32.5	5.0	60,000	10.5	16.0	250-16LP	25,000	22.5	8.0	250-16LS	6,000
250	250-36	36	7	21.5	8.0	.100	43.5	4.0	25,000	14.0	12.0	250-28LP	12,500	29.0	6.0	250-28LS	3,000
250	250-56	56	4.5	33.5	5.0	.030	68.0	2.5	15,000	22.0	8.0	250-60LP	6,000	44.5	4.0	250-60LS	1,500
500	500-12.8	12.8	40	5.5	42.0	1.000	12.7	21.0	400,000	3.5	68.0	500-2LP	160,000	9.0	34.0	500-2LS	40,000
500	500-28	28	18	15.0	20.0	.250	32.0	10.0	95,000	10.0	30.0	500-8LP	50,000	22.5	15.0	500-8LS	12,500
500	500-36	36	14	21.0	16.0	.150	42.0	8.0	60,000	14.0	24.0	500-16LP	36,000	28.5	12.0	500-16LS	10,000
500	500-56	56	9	33.0	10.0	.070	66.0	5.0	25,000	22.0	16.0	500-28LP	12,500	44.5	8.0	500-28LS	3,000
1000	1000-28	28	36	15.0	40.0	.500	31.0	20.0	200,000	10.0	60.0	1000-4LP	80,000	22.0	30.0	1000-4LS	20,000
1000	1000-36	36	28	20.5	32.0	.250	41.0	16.0	120,000	13.5	50.0	1000-6LP	50,000	28.0	25.0	1000-6LS	12,500
1000	1000-56	56	18	32.5	20.0	.150	65.0	10.0	50,000	21.5	34.0	1000-16LP	25,000	44.0	17.0	1000-16LS	6,000

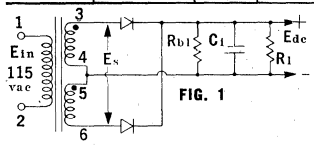


FIG. 1

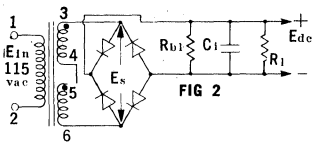


FIG 2

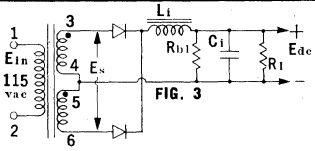


FIG. 3

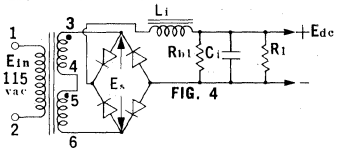
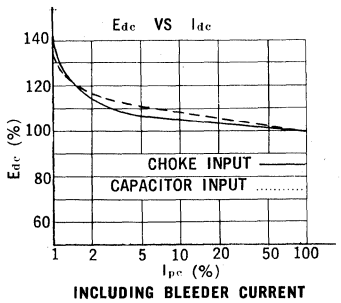
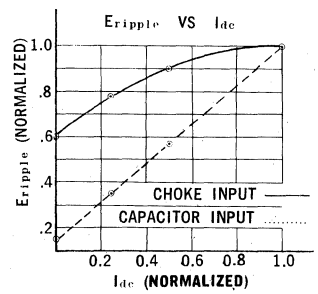


FIG. 4



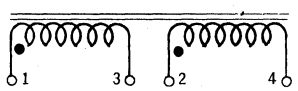
INCLUDING BLEEDER CURRENT

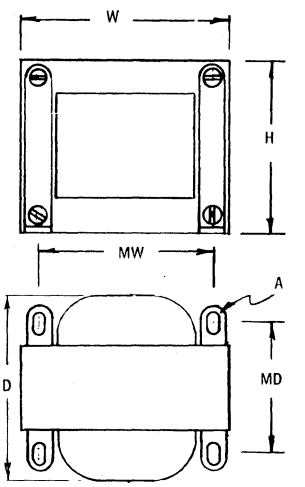


INDUCTANCE TABLE FOR SERIES AND PARALLEL CONNECTION

Part Number	Inductance In Series Millihenries	Current DC Amps	DC Res. Series OHM	Inductance In Parallel Millihenries	Current DC Amps	DC Res. Parallel OHM
100-8L	8	6.0	.06	2	12	.015
100-40L	40	3.0	.35	10	6	.09
100-60L	60	2.5	.56	15	5	.14
100-160L	160	1.6	1.35	40	3.3	.34
250-4L	4	15.0	.037	1	30.0	.009
250-16L	16	8.0	.146	4	16	.037
250-28L	28	6.0	.20	7	12.0	.05
250-60L	60	4.0	.50	15	8.0	.125
500-2L	2	34.0	.16	0.5	68.0	.04
500-8L	8	15.0	.05	2	30.0	.012
500-16L	16	13.0	.09	4	26.0	.022
500-28L	28	8.0	.22	7	16.0	.055
1000-4L	4	30.0	.026	1	60.0	.007
1000-6L	6	25.0	.038	1.5	50.0	.01
1000-16L	16	17.0	.10	4	34	.025

- **All Chokes Rated For Class B.**
- **All Chokes Have Two Identical Coils. They Can Be Connected in Parallel or Series.**





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CHOKES

VA RATING 100 - 8L SERIES INDUCTANCE IN MILLIHENRIES

DIMENSIONS TRANSFORMERS

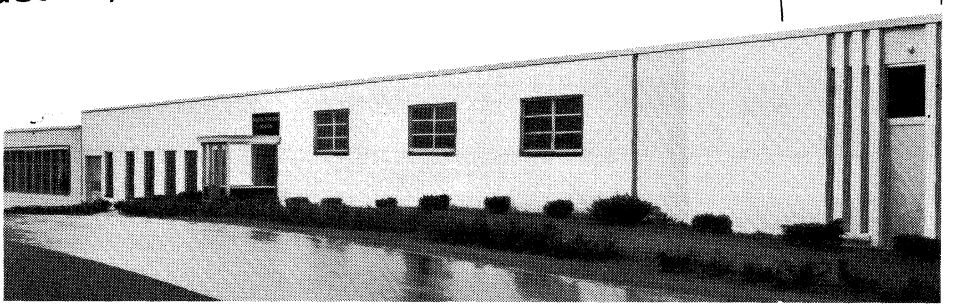
MINIMUM ORDER • $25.00 — F.O.B. • PASADENA, CALIF.

Power Rating VA	W in	H in	D in	MW in	MD in	A in	WT LB	Quantities for Unit Price 1-5	6-11	12-24	25-49	50-99	100-249
100	3⅜	2 13/16	3½	2 13/16	2 31/32	7/32 x 5/16	5	10.00	9.50	9.15	8.90	8.50	8.25
250	4½	3¾	3⅞	3¾	3 3/4	"	10	17.50	16.75	15.30	14.55	13.00	12.25
500	5¼	4⅜	4½	4⅜	3 5/16	9/32 x 13/32	16	23.00	22.00	21.00	20.00	18.50	18.00
1000	6⅜	5 5/16	6	5 5/16	4½	9/32 x ½	30	43.00	38.00	34.00	32.00	31.00	30.00
CHOKES													
100	3⅜	2 13/16	3⅛	2 13/16	2 45/64	7/32 x 5/16	5	9.50	9.00	8.75	8.50	8.25	8.10
250	4⅛	3 7/16	4 5/16	3 7/16	3 29/64	"	10	15.00	14.00	13.00	12.50	12.00	11.50
500	5¼	4⅜	4½	4⅜	3⅜	9/32 x 13/32	16	22.00	21.00	20.00	19.50	19.00	18.50
1000	6⅜	5 5/16	6	5 5/16	4¼	9/32 x ½	27	39.00	37.00	36.50	35.00	33.50	31.00

NEWS

MELVILLE, NEW YORK
FEBRUARY 20, 1969

Lambda acquires 44,000 square foot manufacturing facility for the production of five-year guaranteed transformers and magnetic components for industrial, military and commercial use.



Lambda's new 44,000 square foot Industrial Transformer Division at Gouldsboro, Pa.

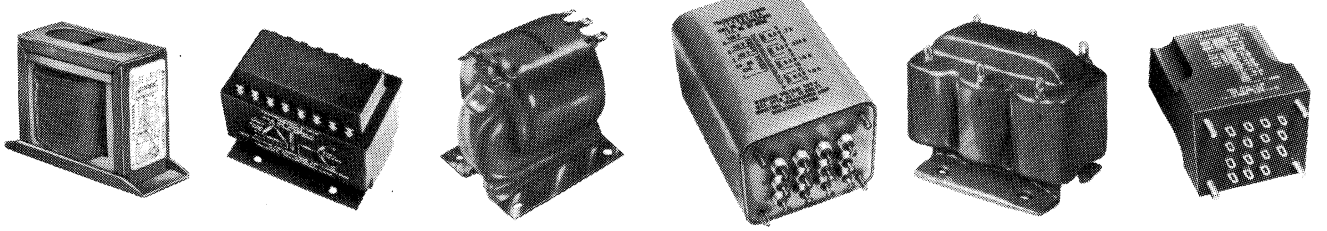
Lambda announces its entry into the transformer business with the acquisition of Industrial Transformer Corp., an established manufacturer of custom-made, commercial, industrial and military transformers.

Now, for the first time, Lambda is able to offer customers:

- Highest quality transformers *fully guaranteed for 5 years* for both materials and labor.
- Custom-engineered transformers to meet military, commercial and industrial applications.
- An in-house QPL capability.
- A total of 180,000 square feet of modern manufacturing facilities offering a single source of supply for high reliability Power Components, Power Instruments and Power Systems.

Lambda's experienced, nationally-based field sales and service organization is able to offer immediate assistance to customers in meeting their specific transformer requirements.

TYPICAL LAMBDA TRANSFORMERS



OPEN-FRAME | POWER | HIGH TEMPERATURE | HERMETICALLY CASED | ENCAPSULATED | MOLDED

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Military grade transformers are designed and qualified to meet all parameters of MIL-T-27C, all grades, all classes, all groups.

Lambda is a qualified QPL vendor of MIL-T-27C Transformers

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GRADES

Grade 4 Metal Cased	Grade 5 Encapsulated	Grade 6 Open-Type

CLASSES

Symbol	Q	R	S	V	T	U
Max. Operating Temp. °C	85	105	130	155	170	170 as specified

See Section 4000 for Lambda Power Supplies

MCE MINIATURE TRANSFORMERS

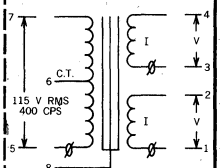
400 CYCLE • 60 CYCLE • MULTI-PURPOSE

Forwards they're for isolation and stepdown — backwards they're for converters and inverters. This built-in bi-directional capability is only one of the many values designed into MCE's miniature standard transformer line. These unique parts are listed below in our easy to find "by size" sequence. As is the case with all MCE standard lines, any component can be ordered in a variety of packaging, mounting, and termination configurations.

In addition to a wide selection of electrical specifications and packaging options, MCE standard components offer high value (quality/price). Request Catalogue for more information.

115V - 400 CYCLE RT SERIES

This RT line of miniature transformers has been designed for use in 400 cycle power supply and control applications. They are also useful for inverter and converter applications in the popular 400 cycle to 2Kc frequency range. Each part has a nominal 115 Volt RMS center-tapped primary and two equal and separate step-down secondaries. Total power ratings are from 2.4 to 215 VA. This is based upon a regulation of 10% or a temperature rise of 25°C above ambient of 25°C. Power ratings and secondary voltage ratings are for both secondaries carrying rated current. The secondary voltages given in the tables are for **each** separate secondary. The two secondaries may be connected in series to give twice the rated voltage (V) at rated current with a center tap available.



RT SERIES

SIZE 37

P = 12.6 VA Reg = 10%

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
37RT21	3.15	2
37RT23	5	1.26
37RT24	6.3	1
37RT25	8	.79
37RT26	10	.63
37TR27	12.6	.5
37RT28	16	.39
37RT29	20	.32
37RT30	25	.25
37RT31	32	.20
37RT32	40	.16
37RT33	50	.13
37RT34	64	.10

SIZE 62

P = 50 VA Reg = 4.3%

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
62RT16	5	5
26RT17	6.3	4
62RT18	8	3.1
62RT19	10	2.5
62RT20	12.6	2
62RT21	16	1.6
62RT22	20	1.25
62RT23	25	1
62RT24	32	.78
62RT25	40	.63
62RT26	50	.5
62RT27	64	.4

SIZE 87

P = 120 VA Reg = 1.7%

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
87RT16	20	3
87RT17	25	2.4
87RT18	32	1.9
87RT19	40	1.5
87RT20	50	1.2
87RT21	64	.95

SIZE 25

P = 2.4 VA Reg 10%

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
25RT23	1.57	.77
25RT26	3.15	.38
25RT28	5	.24
25RT29	6.3	.19
25RT30	8	.15
25RT31	10	.12
25RT32	12.6	.10
25RT33	16	.075
25RT34	20	.060
25RT35	25	.048
25RT36	32	.038
25RT37	40	.030
25RT38	50	.024
25RT39	64	.019

SIZE 50

P = 25 VA Reg = 6.3%

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
50RT17	3.15	4
50RT19	5	2.5
50RT20	6.3	1.95
50RT21	8	1.56
50RT22	10	1.25
50RT23	12.6	1
50RT24	16	.78
50RT25	20	.63
50RT26	25	.5
50RT27	32	.39
50RT28	40	.31
50RT29	50	.25
50RT30	64	.20

SIZE 75

P = 70 VA Reg = 2.4%

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
75RT16	10	3.5
75RT17	12.6	2.8
75RT18	16	2.2
75RT19	20	1.75
75RT20	25	1.4
75RT21	32	1.13
75RT22	40	.88
75RT23	50	.70
75RT24	64	.55

SIZE 100

P = 215 VA Reg = 1.6%

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
100RT15	25	4.3
100RT16	32	3.5
100RT17	40	2.7
100RT18	50	2.15
100RT19	64	1.7

HERMETIC SEALED CAN—LOW PROFILE TYPE YY GRADE IV

SIZE	WT/LBS.	A	B	C	D	E
25	.16	1.25	1.25	1.00	.88	.88
37	.30	1.50	1.38	1.31	1.13	1.00
50	.52	1.88	1.50	1.56	1.50	1.13
62	.83	2.13	1.75	1.81	1.75	1.38
75	1.3	2.50	2.00	2.13	2.13	1.63
87	1.9	2.88	2.25	2.44	2.50	1.88
100	2.8	3.25	2.50	2.75	2.88	2.13

MINIATURE LINE

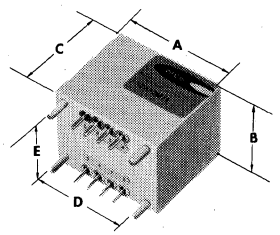
DIMENSIONS AND PACKAGING

MCE miniature standard parts are available in the 7 packages listed below. The 2 letter alpha code of the desired package must be added as a prefix to the Electrical Part Number to completely identify the part.

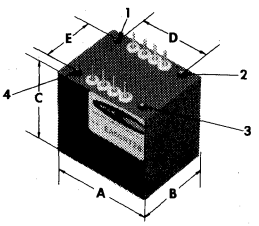
CA (Canned) Studs with terminals on same surface
CB (Canned) Inserts with terminals on same surface
CC (Canned) Studs with terminals on opposite surface
CD (Canned) Inserts with terminals on opposite surface

OA (Open) Terminals, strap bracket and hard epoxy coating
OB (Open) Flex leads, strap bracket, moisture resistant coating.

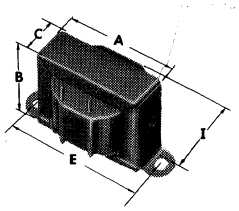
EA (Encapsulated) Terminals with thru holes at corners.



LOW PROFILE HERMETIC SEALED CAN (CA EXAMPLE)



ENCAPSULATED WITH THRU-HOLE MOUNTING (EA EXAMPLE)



OPEN FRAME WITH EPOXY COATING (OA EXAMPLE)

ENCAPSULATED DIMENSIONS—TYPE ZZ GRADE V

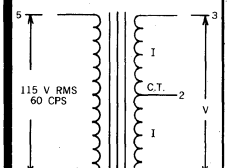
SIZE	WT/LBS	A	B	C	D	E
25	.15	1.34	1.16	.94	1.000*	.828*
37	.26	1.60	1.32	1.28	1.157*	.875*
50	.51	1.95	1.57	1.56	1.500	1.125
62	.78	2.17	1.70	1.81	1.688	1.250
75	1.3	2.57	1.95	2.12	2.000	1.438
87	2.1	2.98	2.19	2.44	2.438	1.625
100	2.8	3.33	2.42	2.81	2.688	1.750

*Thru Holes 1 and 3 Only

115V - 60 CYCLE CT SERIES

These miniature 60 cycle transformers are especially designed for small DC power supply and other control applications, where a voltage step down and/or isolation from the standard 115 volts is required at relatively low power levels. All secondary windings have center taps and are Bi-Filar wound for balanced resistance and voltage. Rated secondary current (I) is based upon regulation of 15%. Maximum secondary current (I Max.) is determined by a temperature rise of 100°C from an ambient of 25°C or the short circuit current indicated by (*). Secondary load voltage (V) is at rated current (I).

FREQ. RANGE 50-400 CPS



CT SERIES

SIZE 25

P = 0.05 VA I Max. = 10 x I (*)

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
25CT48	100	0.0005
25CT45	50	0.001
25CT44	40	0.00125
25CT42	25	0.002
25CT41	20	0.0025
25CT39	12.6	0.004
25CT38	10	0.005
25CT36	6.3	0.008
25CT33	3.12	0.016
25CT30	1.56	0.032

SIZE 37

P = 0.35 VA I Max. = 8.1 x I (*)

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
37CT42	100	0.0035
37CT39	50	0.007
37CT38	40	0.0088
37CT36	25	0.014
37CT35	20	0.0175
37CT33	12.6	0.028
37CT32	10	0.035
37CT30	6.3	0.056
37CT27	3.12	0.112
37CT24	1.56	0.224

SIZE 50

P = 1.5 VA I Max. = 6 x I (*)

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
50CT38	100	0.015
50CT35	50	0.030
50CT34	40	0.038
50CT32	25	0.060
50CT31	20	0.075
50CT29	12.6	0.120
50CT28	10	0.150
50CT26	6.3	0.240
50CT23	3.12	0.480
50CT20	1.56	0.960

SIZE 62

P = 3 VA I Max. = 4.3 x I

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
62CT36	100	0.030
62CT33	50	0.060
62CT32	40	0.075
62CT30	25	0.120
62CT29	20	0.150
62CT27	12.6	0.240
62CT26	10	0.300
62CT24	6.3	0.480
62CT21	3.12	0.960
62CT18	1.56	1.920

SIZE 75

P = 6.0 VA I Max. = 3.8 x I

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
75CT33	100	0.060
75CT30	50	0.120
75CT29	40	0.150
75CT27	25	0.240
75CT26	20	0.300
75CT24	12.6	0.480
75CT23	10	0.600
75CT21	6.3	0.960
75CT18	3.12	1.92
75CT15	1.56	3.84

SIZE 87

P = 16 VA I Max. = 2.5 x I

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
87CT30	100	0.16
87CT27	50	0.32
87CT26	40	0.40
87CT24	25	0.64
87CT23	20	0.80
87CT21	12.6	1.28
87CT20	10	1.60
87CT18	6.3	2.56
87CT15	3.12	5.12

SIZE 100

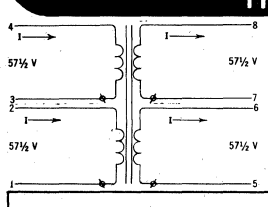
P = 30 VA I Max. = 2.3 x I

ELECT. PART NO.	V-RMS VOLTS	I-RMS AMPS
100CT27	100	0.30
100CT24	50	0.60
100CT23	40	0.75
100CT21	25	1.20
100CT20	20	1.50
100CT18	12.6	2.40
100CT17	10	3.00
100CT15	6.3	4.80

OPEN FRAME DIMENSIONS

SIZE	WT/LBS.	A	B	C	E	I
25	.078	1.10	.86	.40	1.38	.98
37	.16	1.37	1.20	.57	1.84	1.09
50	.35	1.76	1.46	.70	2.00	1.37
62	.55	2.02	1.74	.84	2.39	1.46
75	.96	2.38	2.04	.96	2.81	1.73
87	1.8	2.76	2.35	1.09	3.12	2.10
100	2.3	3.15	2.68	1.23	3.56	2.23

115V 400 CYCLE/20KC MULTI-PURPOSE TRANSFORMERS - MT1 SERIES



This line of utility transformers offers the design engineer a valuable tool for proving design concepts at minimum cost. Because they are lightweight and built to Mil-Spec they can be used equally as well as final design components. Primaries and secondaries both have two 57½ Volt windings. Built for a basic 400CPS operation, they will operate effectively—and with small phase shift-up to 20KC. Specifications are at 25°C at rated voltage, 400 cycle. For suggested circuit applications, write for product bulletin MT-1.

Elect. Part No.	I MAX - RMS AMPS @ 100°C	@ 25°C	WINDING RESISTANCE — OHMS ±20% 1-2	3-4	5-6	7-8
25MT1	.021	.087	100	120	140	160
37MT1	.11	.24	19	22	25	28
50MT1	.22	.56	6.0	6.7	7.6	8.5
62MT1	.43	1.0	2.1	2.3	2.5	2.8
75MT1	.61	1.9	.89	1.0	1.1	1.2
87MT1	1.0	3.3	.36	.38	.42	.45
100MT1	1.9	4.5	.23	.24	.26	.28

ORDERING INFORMATION

1. Order by complete part number. For example: OA75CT21; CA87MT1; CD25FL26; EA62RT24.
2. Price breaks at 2, 3, 5, 10, 25, plus six more to 1000. Contact factory for 1-9 quantity price list and larger quantity quotations.

MAGNETIC CIRCUIT ELEMENTS INC
DEL MONTE RESEARCH PARK
2455A GARDEN ROAD, MONTEREY, CALIFORNIA 93940
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MCE MINIATURE FILTER INDUCTORS

mce

APPLICATION FEATURES

Miniature inductors, primarily for use in DC power-supply smoothing-filter applications, are offered in two series (1) the linear FL SERIES and (2) the "swinging" NL SERIES.

The FL SERIES inductors are especially suited for requirements where the DC will be 50 to 100% of I-DC rated. They will provide the most inductance in this range.

The NL SERIES inductors are generally more suitable where the DC will vary between 10 to 100% of I-DC rated. The inductance at rated I-DC is approximately ¼ of the value at I-DC = 0.

Both SERIES are listed by size in the tables of specifications. The V, I-DC, and R are the same for similar part numbers, only the inductance values and characteristics are different.

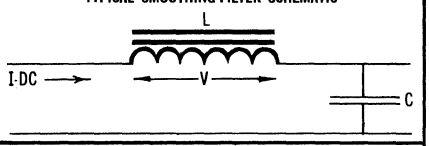
All parts are available in any of the MCE Miniature Line package options (OA, OB, EA, CA, etc.).

SIZE 25

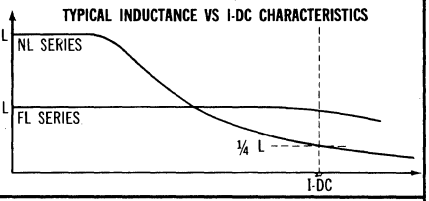
FL SERIES ELEC. PART NO.	L ±25% HENRIES	V-RMS VOLTS 60 CPS	I-DC MA	R OHMS ±20%	NL SERIES L MIN. HENRIES	NL SERIES ELEC. PART NO.
25FL20	.00083	.240	2040	.09	.0017	25NL20
25FL21	.0013	.310	1620	.15	.0027	25NL21
25FL22	.0021	.385	1280	.23	.0044	25NL22
25FL23	.0033	.485	1020	.36	.0069	25NL23
25FL24	.0053	.600	808	.59	.011	25NL24
25FL25	.0083	.800	641	.91	.017	25NL25
25FL26	.013	1.00	508	1.4	.028	25NL26
25FL27	.021	1.25	403	2.2	.044	25NL27
25FL28	.033	1.55	320	3.5	.070	25NL28
25FL29	.053	1.95	253	5.4	.11	25NL29
25FL30	.083	2.45	201	8.7	.18	25NL30
25FL31	.13	3.10	159	14	.28	25NL31
25FL32	.21	3.90	126	22	.45	25NL32
25FL33	.33	4.95	100	36	.71	25NL33
25FL34	.53	6.00	80	57	1.1	25NL34
25FL35	.83	8.00	63	89	1.8	25NL35
25FL36	1.3	10.0	50	140	2.9	25NL36
25FL37	2.1	12.5	40	220	4.6	25NL37
25FL38	3.3	16	31	360	7.2	25NL38
25FL39	5.3	20	25	570	11.	25NL39

FL & NL SERIES INDUCTORS

TYPICAL SMOOTHING-FILTER SCHEMATIC



TYPICAL INDUCTANCE VS I-DC CHARACTERISTICS



SIZE 37

FL SERIES ELEC. PART NO.	L ±25% HENRIES	V-RMS VOLTS 60 CPS	I-DC MA	R OHMS ±20%	NL SERIES L MIN. HENRIES	NL SERIES ELEC. PART NO.
37FL18	.0010	.465	3250	.059	.0019	37NL18
37FL19	.0016	.600	2580	.092	.0031	37NL19
37FL20	.0025	.750	2040	.150	.0048	37NL20
37FL21	.0040	.900	1620	.23	.0077	37NL21
37FL22	.0063	1.15	1280	.36	.012	37NL22
37FL23	.010	1.45	1020	.59	.019	37NL23
37FL24	.016	1.85	808	.93	.031	37NL24
37FL25	.025	2.35	641	1.5	.049	37NL25
37FL26	.040	2.95	508	2.3	.078	37NL26
37FL27	.063	3.70	403	3.5	.12	37NL27
37FL28	.10	4.70	320	5.8	.20	37NL28
37FL29	.16	6.00	253	9.2	.31	37NL29
37FL30	.25	7.50	201	15	.50	37NL30
37FL31	.40	9.5	159	23	.79	37NL31
37FL32	.63	12	126	37	1.3	37NL32
37FL33	1.0	15	100	58	2.0	37NL33
37FL34	1.6	19	80	92	3.2	37NL34
37FL35	2.5	24	63	150	5.1	37NL35
37FL36	4.0	30	50	230	8	37NL36
37FL37	6.3	38	40	380	13	37NL37
37FL38	10	48	31	570	20	37NL38
37FL39	16	60	25	930	32	37NL39

SIZE 50

FL SERIES ELEC. PART NO.	L ±25% HENRIES	V-RMS VOLTS 60 CPS	I-DC MA	R OHMS ±20%	NL SERIES L MIN. HENRIES	NL SERIES ELEC. PART NO.
50FL17	.0021	1.00	4100	.066	.0027	50NL17
50FL18	.0033	1.25	3250	.11	.0043	50NL18
50FL19	.0052	1.55	2580	.17	.0068	50NL19
50FL20	.0083	1.95	2040	.26	.011	50NL20
50FL21	.013	2.45	1620	.41	.017	50NL21
50FL22	.021	3.10	1280	.66	.027	50NL22
50FL23	.033	3.90	1020	1.1	.043	50NL23
50FL24	.052	4.90	808	1.6	.068	50NL24
50FL25	.083	6.00	641	2.6	.11	50NL25
50FL26	.13	8.00	508	4.3	.17	50NL26
50FL27	.21	10.0	403	6.7	.28	50NL27
50FL28	.33	12.5	320	11	.44	50NL28
50FL29	.52	15.5	253	17	.70	50NL29
50FL30	.83	20.0	201	28	1.1	50NL30
50FL31	1.3	25.0	159	45	1.8	50NL31
50FL32	2.1	31.5	126	68	2.8	50NL32
50FL33	3.3	39.5	100	110	4.5	50NL33
50FL34	5.2	50	80	190	7.1	50NL34
50FL35	8.3	65	63	270	11	50NL35
50FL36	13	80	50	430	18	50NL36
50FL37	21	100	40	670	29	50NL37
50FL38	33	125	31	1100	45	50NL38
50FL39	52	160	25	1700	72	50NL39

SIZE 62

FL SERIES ELEC. PART NO.	L ±25% HENRIES	V-RMS VOLTS 60 CPS	I-DC MA	R OHMS ±20%	NL SERIES L MIN. HENRIES	NL SERIES ELEC. PART NO.
62FL16	.0023	1.40	5170	.059	.0035	62NL16
62FL17	.0036	1.75	4100	.093	.0056	62NL17
62FL18	.0058	2.20	3250	.14	.0087	62NL18
62FL19	.0091	2.75	2580	.22	.014	62NL19
62FL20	.015	3.50	2040	.35	.022	62NL20
62FL21	.023	4.40	1620	.56	.035	62NL21
62FL22	.036	5.50	1280	.89	.056	62NL22
62FL23	.058	7.0	1020	1.4	.088	62NL23
62FL24	.091	9.0	808	2.2	.14	62NL24
62FL25	.15	11.0	641	3.6	.22	62NL25
62FL26	.23	14.0	508	5.7	.36	62NL26
62FL27	.36	17.5	403	8.9	.57	62NL27
62FL28	.58	22.5	320	14	.9	62NL28
62FL29	.91	28.0	253	22	1.4	62NL29
62FL30	1.5	35.5	201	36	2.3	62NL30
62FL31	2.3	45	159	59	3.6	62NL31
62FL32	3.6	55	126	90	5.7	62NL32
62FL33	5.8	70	100	150	9.2	62NL33
62FL34	9.1	90	80	240	15	62NL34
62FL35	15	115	63	360	23	62NL35
62FL36	23	140	50	580	37	62NL36
62FL37	36	180	40	940	59	62NL37
62FL38	58	225	31	1500	93	62NL38
62FL39	91	285	25	2200	150	62NL39

SIZE 75

FL SERIES ELEC. PART NO.	L ±25% HENRIES	V-RMS VOLTS 60 CPS	I-DC MA	R OHMS ±20%	NL SERIES L MIN. HENRIES	NL SERIES ELEC. PART NO.
75FL15	.0029	2.25	6510	.066	.0041	75NL15
75FL16	.0047	2.85	5170	.10	.0064	75NL16
75FL17	.0076	3.60	4100	.16	.010	75NL17
75FL18	.012	4.55	3250	.25	.016	75NL18
75FL19	.019	5.50	2580	.39	.026	75NL19
75FL20	.030	7.0	2040	.62	.041	75NL20
75FL21	.048	9.0	1620	1.0	.065	75NL21
75FL22	.076	11.5	1280	1.5	.10	75NL22
75FL23	.12	14.5	1020	2.5	.16	75NL23
75FL24	.19	18.0	808	4.0	.26	75NL24
75FL25	.30	23.0	641	6.2	.42	75NL25
75FL26	.48	29.0	508	9.9	.66	75NL26
75FL27	.76	36.5	403	16	1.1	75NL27
75FL28	1.2	46	320	25	1.7	75NL28
75FL29	1.9	60	253	39	2.7	75NL29
75FL30	3.0	75	201	64	4.2	75NL30
75FL31	4.8	90	159	100	6.7	75NL31
75FL32	7.6	115	126	160	11	75NL32
75FL33	12	145	100	260	17	75NL33
75FL34	19	185	80	420	27	75NL34

SIZE 87

FL SERIES ELEC. PART NO.	L ±25% HENRIES	V-RMS VOLTS 60 CPS	I-DC MA	R OHMS ±20%	NL SERIES L MIN. HENRIES	NL SERIES ELEC. PART NO.
87FL15	.0073	5.10	6510	.12	.010	87NL15
87FL16	.012	6.40	5170	.19	.016	87NL16
87FL17	.018	8.10	4100	.30	.025	87NL17
87FL18	.029	10.2	3250	.47	.040	87NL18
87FL19	.046	12.8	2580	.74	.063	87NL19
87FL20	.073	16.2	2040	1.2	.10	87NL20
87FL21	.12	20.4	1620	1.8	.16	87NL21
87FL22	.18	25.7	1280	2.9	.26	87NL22
87FL23	.30	32.4	1020	4.6	.41	87NL23
87FL24	.47	40.5	808	7.3	.65	87NL24
87FL25	.74	51	641	12	1.0	87NL25
87FL26	1.2	64	508	19	1.7	87NL26
87FL27	1.8	81	403	30	2.6	87NL27
87FL28	3.0	102	320	47	4.2	87NL28
87FL29	4.7	128	253	74	6.5	87NL29
87FL30	7.4	162	201	120	11	87NL30
87FL31	12	204	159	190	17	87NL31
87FL32	18	257	126	300	26	87NL32
87FL33	30	324	100	480	42	87NL33

SIZE 100

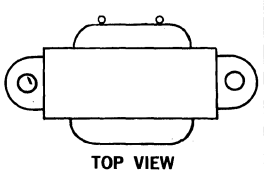
FL SERIES ELEC. PART NO.	L ±25% HENRIES	V-RMS VOLTS 60 CPS	I-DC MA	R OHMS ±20%	NL SERIES L MIN. HENRIES	NL SERIES ELEC. PART NO.
100FL15	.012	8.80	6510	.18	.016	100NL15
100FL16	.018	11.1	5170	.29	.026	100NL16
100FL17	.029	13.9	4100	.45	.041	100NL17
100FL18	.046	17.5	3250	.71	.066	100NL18
100FL19	.074	22.0	2580	1.1	.10	100NL19
100FL20	.12	27.7	2040	1.7	.16	100NL20
100FL21	.19	35.0	1620	2.7	.26	100NL21
100FL22	.30	44.0	1280	4.3	.42	100NL22
100FL23	.47	55.5	1020	6.9	.66	100NL23
100FL24	.74	70	808	11	1.1	100NL24
100FL25	1.2	88	641	17	1.7	100NL25
100FL26	1.9	111	508	28	2.7	100NL26
100FL27	3.0	139	403	45	4.2	100NL27
100FL28	4.8	175	320	73	6.8	100NL28
100FL29	7.5	220	253	110	11	100NL29
100FL30	12	277	201	190	17	100NL30
100FL31	19	350	159	290	28	100NL31
100FL32	30	440	126	450	42	100NL32

NOTES:

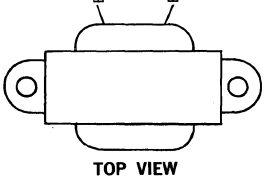
1. *The inductance values given are at the corresponding V-RMS 60 CPS voltages and I-DC = 0. For test purposes, it is recommended that inductance measurements be made by impedance, or E-I method. This is preferable to bridge type instruments because of the relatively high AC voltage levels and low Q values at 60 CPS.*
2. *For canned parts (CA, etc.) with very small resistance values (R≦1.0), the total resistance at the terminals is slightly higher than the table values. If required, request this data giving complete part number.*
3. *Dielectric withstanding voltage: 500 V-RMS 60 CPS.*
4. *Insulation resistance ≧1000 megohms @ 500 V-DC.*
5. *All electrical data is @ 25 ±5°C.*
6. *For complete packaging information refer to appropriate Package Bulletins (OA, OB, EA, & CA).*
7. *Sizes 25 and 37 encapsulated parts (EA) have only 2 thru holes.*
8. *All OB type parts with part numbers ending with 15, 16, or 17 have self leads (solid) with sleeving.*
9. *Specify complete part number, e.g. OA25FL20, OB37NL18, EA50FL17.*

TERMINAL/LEAD LOCATION

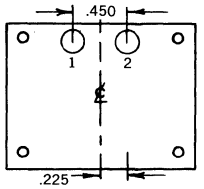
OA



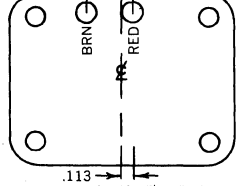
OB



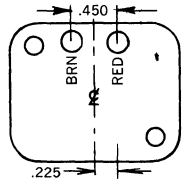
CA



EA SIZES 50-100



EA SIZES 25-37



ORDERING INFORMATION

1. Order by complete part number. For example: OA75CT21; CA87MT1; CD25FL26; EA62RT24.
2. Price breaks at 2, 3, 5, 10, 25, plus six more to 1000. Contact factory for 1-9 quantity price list and larger quantity quotations.

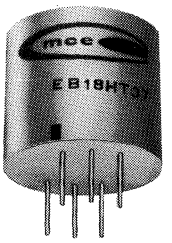
MAGNETIC CIRCUIT ELEMENTS INC
DEL MONTE RESEARCH PARK
2455A GARDEN ROAD, MONTEREY, CALIFORNIA 93940
TELEPHONE (408) 373-0456

MCE PRODUCT BULLETIN — SUB-MINIATURE LINE — EB18HT

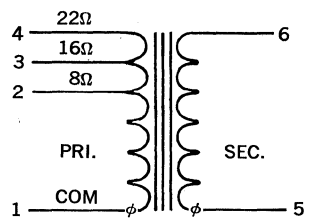
INTEGRATED CIRCUIT AUDIO OUTPUT TRANSFORMERS

APPLICATION FEATURES

MATCH INTEGRATED CIRCUITS — Specifically designed to provide isolation and impedance matching for popular power integrated circuits in ½ to 1 watt power output range.
CHOICE OF SINGLE-ENDED and PUSH-PULL INPUTS
PACKAGING FOR P.C. BOARDS — Epoxy Encapsulated unit at moderate cost for plug in on Standard 0.1 inch grid spacing.



HT SERIES — SINGLE ENDED INPUT

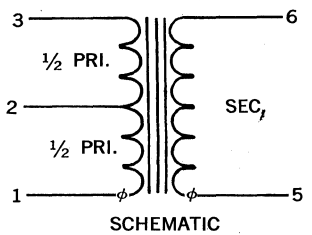


SCHEMATIC

SPECIFICATIONS & FEATURES
1. Primary impedance — matching taps for 8, 16 or 22 ohms.
2. Insertion loss — less than 1 db under matched conditions.
3. Input power capability — 1 watt.
4. Primary unbalance DC — 10 milliampere capability.
5. Primary DCR — 1.78 ohms ±20%.

PART NUMBER	SECONDARY IMPEDANCE OHMS	TURNS RATIO PRI (1-4) :SEC (5-6)	SECONDARY DCR ± 20% OHMS
EB18HT27	4.8	2:1	.46
EB18HT28	7.5	1.58:1	.73
EB18HT29	12	1.26:1	1.2
EB18HT30	19	1:1	1.8
EB18HT31	30	1:1.26	2.9
EB18HT32	48	1:1.58	4.6
EB18HT33	75	1:2	7.3
EB18HT34	120	1:2.52	12
EB18HT35	190	1:3.16	18
EB18HT36	300	1:4	29

FT SERIES — PUSH PULL INPUT

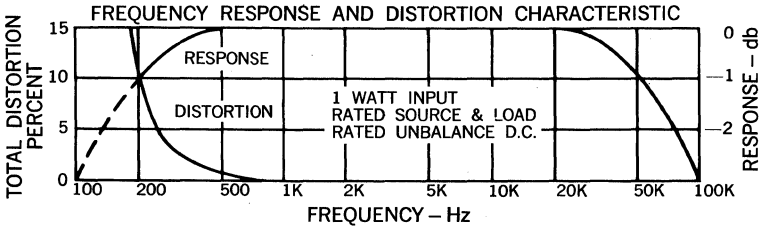


SCHEMATIC

SPECIFICATIONS & FEATURES
1. Center tapped primary — Class B collector-collector matching impedance 220/260 ohms.
2. Inseration loss — less than 2 db under matched conditions.
3. Input power capability — 1 watt.
4. Primary unbalance DC — 6 milliampere capability.
5. Primary DCR — 7.9 ohms ±20% each half (1-2 or 2-3).

PART NUMBER	SECONDARY IMPEDANCE OHMS	TURNS RATIO ½ PRI (1-2) :SEC (5-6)	SECONDARY DCR ± 20% OHMS
EB18FT29	4.8	3.16:1	.79
EB18FT30	7.5	2.52:1	1.3
EB18FT31	12	2:1	2.0
EB18FT32	19	1.58:1	3.2
EB18FT33	30	1.26:1	5.0
EB18FT34	48	1:1	7.9
EB18FT35	75	1:1.26	13
EB18FT36	120	1:1.58	20
EB18FT37	190	1:2	32
EB18FT38	300	1:2.52	50

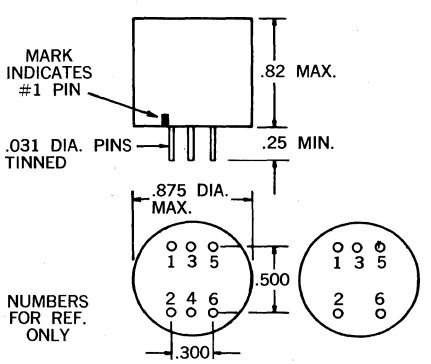
FREQUENCY RESPONSE AND DISTORTION CHARACTERISTIC



Note: When driven from a 'stiff" source or at reduced power, both low frequency response and distortion characteristics are considerably improved. The degree of improvement is dependent upon the characteristics of the driving amplifier employed.

ADDITIONAL SPECIFICATIONS
1. Maximum Temperature Rating = 130°C.
2. Dielectric withstanding voltage = 500V-RMS 60 Hz.
3. Insulation resistance ≧ 1000 megohms @ 500 V-DC.
4. All electrical data is at 20 ±5°C.

MECHANICAL SPECIFICATIONS



WT. = .042 lbs HT SERIES FT SERIES

MAGNETIC CIRCUIT ELEMENTS INC 2455A GARDEN ROAD, MONTEREY, CALIFORNIA 93940
DEL MONTE RESEARCH PARK TELEPHONE (408) 373-0456

MAGNETICO, INC.

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Tel: 516 - 261-4502

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LET MAGNETICO'S EXPERT ENGINEERING STAFF TACKLE YOUR SPECIAL REQUIREMENTS FOR:

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- INVERTER TRANSFORMERS
- DC - DC CONVERTER TRANSFORMERS
- DIGITALLY TAPPED TRANSFORMERS
- PRECISION RATIO TRANSFORMERS
- MAGNETIC AMPLIFIERS
- PRECISION REFERENCE TRANSFORMERS
- PULSE TRANSFORMERS
- WIDE BAND TRANSFORMERS

CONDENSED PERFORMANCE DATA — PRIMARY VOLTAGE 115 VRMS

ALL UNITS DESIGNED TO MEET MIL-T-27B, GRADE 4, CLASS S. LIFE EXPECTANCY X, MILITARY DESIGNATION TF4SX01YY

Catalog Number	VA Rating	Secondary Voltage (RMS)	O.D. ±1/32	Height ±1/32	Nominal Weight	Nom. Reg.	Nom.* Temp. Rise	Price
9600	2	6-300 V	1″	19/32″	1 oz/ 30 gm	18%	10°C	$19.00
9601	4	6-300 V	1″	11/16″	1.2 oz/ 35 gm	15%	12°C	19.00
9602	6	6-300 V	1″	7/8″	1.6 oz/ 45 gm	10%	18°C	19.00
9603	9	6-300 V	1″	1 1/16″	2.1 oz/ 60 gm	8%	20°C	19.00
9604	30	6-300 V	1″	1 1/2″	5.3 oz/150 gm	7%	23°C	19.00
10648	75	10-300 V	2″	1 5/16″	10 oz	±3%	30°C	40.00
10649	150	10-300 V	2 1/4″	1 7/16″	18 oz	±3%	40°C	60.00

* Approximately 3° less on 2 x 2 x 1/8″ aluminum plate

IMMEDIATE DELIVERY FOR PROTOTYPE QUANTITIES

HOW TO ORDER:

Order Magnetico Standard Units directly by using the Magnetico Part Number.

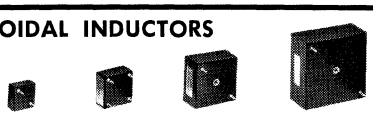
VA RATING	SECONDARY VOLTAGE	SCHEMATIC	SHIELD
Catalog Number	6.0 thru 300 (VRMS)	X — No Tap T — Center Tap	N — No Shield S — Electrostatic Shield

EXAMPLE:

To order a 115 V 400 Hz to 26 V center tapped, 6 VA power transformer with no shield. Order Magnetico Number: **9602-26-T-N.**

VA RATING	SECONDARY VOLTAGE
9602	26
SCHEMATIC	**SHIELD**
T	N

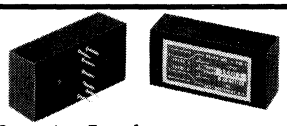
MINIATURE TOROIDAL INDUCTORS



- 5 mh to 5 H
- Unequalled Temperature Stability
- −55 to +125°C operation
- Military Designation TF5RX20ZZ
- PC Board Mounting
- Maximum Q—Minimum Size
- Available from stock
- Unit price — $9.00 - $16.00

SCOTT-T-TRANSFORMERS

***For Use in* SOLID STATE SYNCHRO SYSTEMS**



Typical 400 Hz Resolver To Synchro Converter Transformers

Part NO.	Input Voltage 2 Phase 4 Wire	Output Voltage 3 Phase 3 Wire (L-L)	Load Typical Min. Ohms (L-L)	Input Z Typical Ohms Open CKT	Accuracy Arc Minutes	Size Inches
10084	11.8	11.8	150	2K	2	1 x 2 x .65H
10085	11.8	11.8	150	2K	5	1 x 2 x .65H
10086	6.0	11.8	150	1K	2	1 x 2 x .65H
10087	6.0	11.8	150	1K	5	1 x 2 x .65H
10088	9.0	11.8	300	2K	1.5	1 3/8 x 2 3/4 x .65H
10089	9.0	11.8	300	2K	5	1 3/8 x 2 3/4 x .65H
10090	9.0	90	2500	2K	1.5	1 3/8 x 2 3/4 x 7/8H
10091	9.0	90	2500	2K	5	1 3/8 x 2 3/4 x 7/8H

Typical 400 Hz Synchro To Resolver Converter Transformers

Part No.	Input Voltage (Volts) (L-L)	Z* In (Ohms)	Z Out (Ohms)	Null (MV)	Output (RMS) Voltage (Volts)	Secd'y D.C. Res. (Ohms)	Transformation Accuracy**	Wt. (Oz.)	Size Inches
9652	11.8	100K	11	< 1	5	6	30 sec. of arc	5	2 3/4 x 1 3/8 x 7/8 H
9514	90	1Meg	11	< 1	4.25	7	30 sec. of arc	5	2 3/4 x 1 3/8 x 7/8 H
9561	11.8	10K	4	< 1	1.75	4	2 min. of arc	3	1 x 2 x 5/8 H
10472	11.8	2K	25	< 10	6	15	5 min. of arc	0.6	3/4 x 1.5 x 3/8 H

* TYPICAL @ RATED VOLTAGE. ** DEPENDENT ON LOAD.

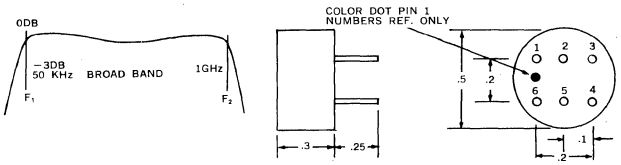
SPECIAL UNITS AVAILABLE ON REQUEST

IMP-TRANZ

WIDE BAND IMPEDANCE MATCHING TRANSFORMERS

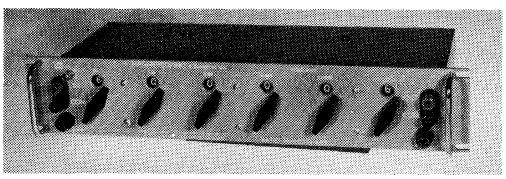
FOR USE IN:

- impedance matching
- antenna matching
- balanced mixers
- input, output, and interstage coupling
- D.C. isolation
- pulse and reflectometry devices
- voltage/current, step up, step down



				PRICE
10721A B C	50 ohm/ 50 ohm 75 ohm/ 75 ohm 100 ohm/100 ohm	Unbalanced/Unbalanced		$15
10722A B C	50 ohm/ 50 ohm 75 ohm/ 75 ohm 100 ohm/100 ohm	Unbalanced/Unbalanced	Phase Reversing	15
10723A	50 ohm/ 50 ohm	Unbalanced/Balanced	Symmetrical	15
10724D E	50 ohm/200 ohm 75 ohm/300 ohm	Unbalanced/Balanced Unbalanced/Balanced	Unsymmetrical Unsymmetrical	15
10725D E	50 ohm/200 ohm 75 ohm/300 ohm	Unbalanced/Balanced Unbalanced/Balanced	Symmetrical Symmetrical	15
10726A B	50 ohm/ 50 ohm 75 ohm/ 75 ohm	Unbalanced/Unbalanced	Reversing, D.C. Isolated	15

MAGNETICO DIGITAL RATIO TRANSFORMERS



Model	Ratio Range	Accuracy 10V to Max Input	Frequency Range	Input Impedance	Max Input Voltage	Nom. Out. Res.	Resolution	Size	Wt	Price
M450	0.000000 to 1.111110	1 part per million at 50 to 3000 Hz	50 to to 10,000 Hz	200K @ 400 Hz	.35 x f (f in Hz) not to exceed 350V	4 ohm	Continuous	3 1/2″ H x 19″ W x 8 1/2″ D	7 3/4 lbs.	$425.00
M460	0.000000 to 1.111110	1 part per million at 30 to 400 Hz	30 to to 1,000 Hz	250K @ 60 Hz	2.5 x f (f in Hz) not to exceed 350V	8 ohm	Continuous	3 1/2″ H x 19″ W x 8 1/2″ D	9 lbs.	$500.00

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TRANSFORMERS
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ISOLATION AUDIO/DRIVER
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MICROPHONE
MINIATURE
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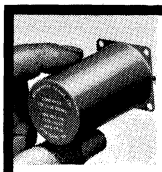
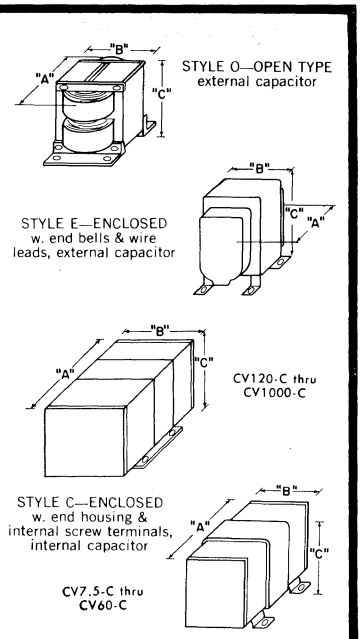


NEW MINIATURE TYPE MCV-1

118 or 5 V output ±1% at 0.6 VA with 95-130 V, 60 cycle input. Only 2 7/16" by 1 25/64" dia including built-in capacitor. $12.75 net. (Also made in any voltage & current combination to max of 0.6 VA @ 60 cy., 5 VA @ 400 cy.)



NTC CONSTANT VOLTAGE TRANSFORMERS

STATIC-MAGNETIC VOLTAGE REGULATING TRANSFORMERS

NORMAL HARMONIC TYPES

- Output capacity from 0.5 to 3,000 VA
- Instantaneous, continuous voltage regulation
- No tubes or manual adjustments
- Ratings made to order at low cost
- Compact, single-unit design
- Low-cost open types for component applications
- Heavy-duty, enclosed types for accessory uses
- Single or multiple secondaries

NTC constant voltage transformers maintain output voltages within one percent with input voltage fluctuations up to 15 percent. Regulation is instantaneous, continuous and completely automatic. Operating on principles of ferroresonance, the transformers have no tubes, moving parts or separate saturable reactors.

Most important, the design of NTC constant voltage transformers enables their outputs to be made exactly to your specifications — and at decidedly low cost even in small quantities. With only a few basic lamination configurations and windings, virtually any output voltage/current combination can be obtained. *Since the transformers are designed to your specific requirements they often eliminate costly circuitry and expensive components.*

POWER SUPPLIES, too . . . Neshaminy's engineering skills are at your service for the design and quantity production of complete, regulated power supplies in any capacity and rating. Let us discuss your next requirement.

Model	Net User Price	Regulated Output Voltage	Input Voltage Range (60 cycles)	VA Output	Nominal Mounting Centers	Approx. Overall Dimensions, Inches A B C	Approx. Net Wt., lbs.	Style
MCV—1	$ 12.75	5 or 118	95—130	0.6	1 3/16 x 1 3/16	1 25/64 dia x 2 7/16	6 oz	—
CV7.5—E	12.00	6.3 or 118	95—130	7.5	2 3/8 x 1 3/8	2 1/2 x 2 3/4 x 3 7/8	3	E
CV7.5—C	15.00	6.3 or 118	95—130	7.5	3 x 1 5/8	4 x 2 3/4 x 3 7/8	4	C
CV15—E	14.00	6.3 or 118	95—130	15	2 3/8 x 1 3/4	2 7/8 x 2 3/4 x 3 7/8	4	E
CV15—C	16.50	6.3 or 118	95—130	15	3 x 2	4 3/8 x 2 3/4 x 3 7/8	5	C
CV30—E	16.75	6.3 or 118	95—130	30	2 3/8 x 2 1/2	3 5/8 x 2 3/4 x 3 7/8	6	E
CV30—C	19.00	6.3 or 118	95—130	30	3 x 2 3/4	5 1/8 x 2 3/4 x 3 7/8	7	C
CV60—E	20.25	6.3 or 118	95—130	60	2 3/8 x 3 1/4	4 3/8 x 2 3/4 x 3 7/8	8	E
CV60—C	22.50	6.3 or 118	95—130	60	3 x 3 1/2	5 7/8 x 2 3/4 x 3 7/8	9	C
CV120—O	27.80	6.3 or 118	95—130	120	2 1/4 x 5 1/4	3 3/8 x 6 x 6 1/4	12	O
CV120—C	33.50	6.3 or 118	95—130	120	5 x 5	9 1/4 x 6 x 7 1/8	14	C
CV150—O	35.00	6.3 or 118	95—130	150	2 5/8 x 5 1/4	3 3/4 x 6 x 6 1/4	14	O
CV150—C	42.00	6.3 or 118	95—130	150	5 x 5	9 5/8 x 6 x 7 1/8	16	C
CV250—O	44.00	118	95—130 or 190—260	250	3 1/4 x 5 1/4	4 3/8 x 6 x 6 1/4	24	O
CV250—C	51.00	118	95—130 or 190—260	250	5 x 5	10 1/4 x 6 x 7 1/8	27	C
CV500—O	69.00	118	95—130 or 190—260	500	4 1/4 x 5 1/4	5 3/8 x 6 x 6 1/4	35	O
CV500—C	76.00	118	95—130 or 190—260	500	5 x 5	11 1/4 x 6 x 7 1/8	38	C
CV1000—O	115.00	118	95—130 or 190—260	1000	7 5/8 x 5 1/4	8 3/4 x 6 x 6 1/4	52	O
CV1000—C	126.00	118	95—130 or 190—260	1000	5 x 7 1/4	15 7/8 x 6 x 7 1/8	56	C

TYPICAL STANDARD MODELS

1% output regulation. Closer regulation to order. Output contains approx 14% total rms harmonic content. SPECIAL MODELS can be made quickly to exact requirements in any step-up or step-down ratio of voltage to current within the desired VA rating and with single or multiple secondaries, with or without centertaps. CV models also available for 50 cycles, and MCV models for 50 or 400 cycles.

NOTES

1. Cord/Receptacle kits, similar to that shown in illustration are available on all "C" style transformers of 118 VAC output rating.
2. Specify required input voltage range on CV transformers from 250 to 1000 VA.
3. To specify output voltage required (6.3 or 118 VAC) add voltage to model number (Example — 15 VA cased transformer with 118 VAC output would be model #CV15-118).
4. "C" style units have built-in capacitors. Styles "E" and "O" have external capacitors.

Send us your requirements for a prompt quotation.

NESHAMINY TRANSFORMER COMPANY

Furlong, Penna. (215) 794-7411

NTC is a division of the Neshaminy Electronic Corporation, manufacturers of JansZen Electrostatic high fidelity speaker systems and components. NTC input and power transformers are used in the high voltage bias supply of the JansZen Electrostatic.

Prices and specifications subject to change without notice

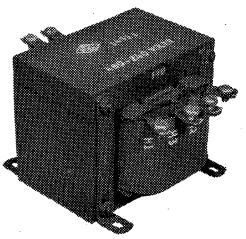
SPECIALISTS IN SPECIAL TRANSFORMERS

POWER & ELECTRONIC

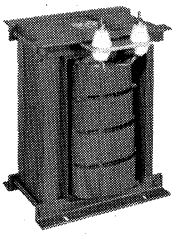
Your one source for all types...designed and manufactured to your specifications or actual requirements

NWL designs and manufactures transformers:

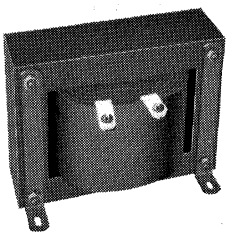
FURNACE
FILAMENT
HEATING
LIGHTING
SCR CONTROLS
PLATE
HIGH FREQUENCY
INSTRUMENT
PHASE CHANGING
WELDING
HIGH VOLTAGE
TESTING
HIGH REACTANCE
OUTPUT
also
SATURABLE CORE REACTORS
CHOKES
AC REACTORS
PACKAGED CONTROLS
AIR CORE REACTORS



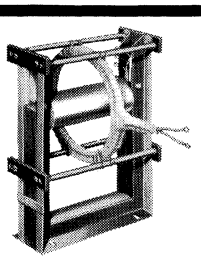
Instrument transformers, current and potential, 1-10,000 amperes, 1-50,000 volts. High accuracy, through type, bus bar, indoor and outdoor.



Plate, audio and modulation transformers in sizes from 50 VA to 100 KVA and up to 100,000 volts.



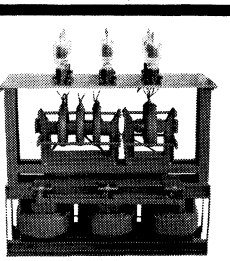
Chokes, linear and swinging. 0.1 millihenry to 10 henry.



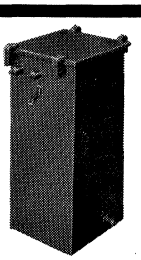
Filament transformers, single and multiple. Up to 100,000 volts, dry and oil types.



Saturable Core Reactors, from 50 VA to 500 KVA. Single and 3 phase.



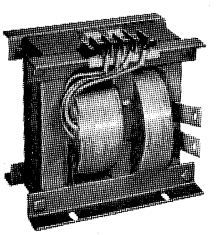
Rectifying transformers and supplies, 1, 2 or 3 phase. 1 to 3,000 amperes, up to 500 KVA.



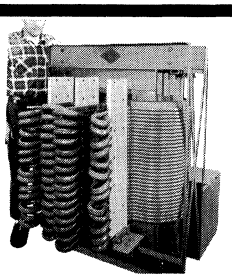
Oil filled specialty and high voltage transformers up to 300 KVA.



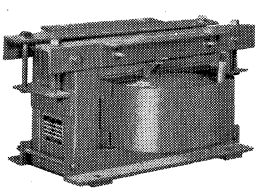
Heating transformers for resistance and induction furnaces. All types. Up to 1200 KVA.



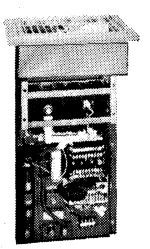
High impedance type transformers, from 50 VA to 50 KVA and up to 10,000 volts.



High power and high current water-cooled transformers.



Reactors, 50 VA to 500 KVA. AC and DC. Linear and swinging.



Solid State SCR Power Controllers.

NWL INCORPORATED

NWL

NOTHELFER WINDING LABORATORIES, INC.

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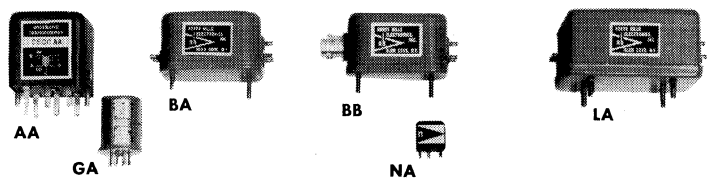
"Call us for quotes or specs."

NORTH HILLS ELECTRONICS, INC.
GLEN COVE, L.I., N.Y. 11542 • PHONE (516) 671-5700

WIDEBAND TRANSFORMERS — PULSE AND CW 20 Hz TO 400 MHz

OVERALL DIMENSIONS (In.)

Case Style	W	L	H	Package
AA	1.4	1.4	1.4	Aluminum Can
BA	1.3	2.3	1.1	Hermetically Sealed Steel Can
BB	1.3	2.6	1.1	Hermetically Sealed Steel Can
FA	0.9	0.9	1.0	Hermetically Sealed Steel Can
GA	0.9 Dia.		1.1	Hermetically Sealed Steel Can
HB	0.9	0.9	0.7	Hermetically Sealed Steel Can
JA	0.8	2.0	0.8	Hermetically Sealed Steel Can
LA, LB	1.7	2.8	1.2	Hermetically Sealed Steel Can
NA	0.56	0.56	0.3	Molded Case
MD	2.9	3.0	2.0	Hermetically Sealed Steel Can



1 Watt Series in AA, BA, BB, FA, GA, HB Cases

Unbalanced to Balanced Designs. Secondaries are center-tapped and dc isolated.

Type No.	Impedance Ratio-Ω	Bandwidth MHz	Type No.	Impedance Ratio-Ω	Bandwidth MHz
0001	50:50	.1-125	1300	75:100	.1-100
0101	50:75	.1-125	1302	75:124	.1-100
0200	50:90	.1-125	1400	75:150	.1-100
0300	50:100	.1-100	1500	75:200	.1-100
0307	50:124	.1-100	1501	75:300	.1-100
0400	50:150	.1-100	1600	75:450	.1-60
0500	50:200	.1-100	1700	75:600	.1-60
*0503	50:200	.5-250	1701	75:600	.3-100
0501	50:300	.1-100	1702	75:600	.007-8
0600	50:450	.1-65	1800	75:800	.1-30
0700	50:600	.1-65	1900	75:1200	.1-30
0800	50:800	.1-60	1901	75:1850	.01-10
0900	50:1200	.1-30	7700	600:600	.1-30
1100	75:75	.1-100			* No dc isolation.

Unbalanced to Unbalanced Designs (No dc Isolation)

0103	50:75	.1-200	0504	50:200	.1-200

25 Watt Series in BA and BB Cases

Unbalanced to Balanced Designs. Secondaries are center-tapped and dc isolated.

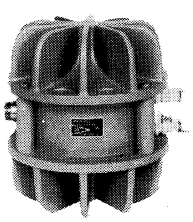
0106	50:75	30-80	1303	75:100	30-80
0305	50:100	30-80	1304	75:100	.1-30
0308	50:100	.1-30	1401	75:150	.1-30
0402	50:150	.1-30	1402	75:150	30-80
0403	50:150	30-80	1509	75:300	30-80
0507	50:200	30-80	1510	75:300	.1-30
0512	50:200	.1-30	1703	75:600	.1-30
0701	50:600	.1-30			

100 Watt Series in BA and BB Cases

Unbalanced to Balanced Designs. Secondaries are center-tapped and dc isolated.

0105	50:75	.5-30	0506	50:300	.5-30
0304	50:100	.5-30	1403	75:150	.5-30
0404	50:150	.5-30	1505	75:300	.5-30

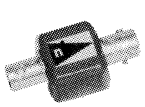
1 kW Series in KA Case — 2 to 32 MHz



Type No.	Impedance Unb/Bal (Ω)
0107	50: 75
0513	50:300
0702	50:600
1108	75: 75
1511	75:300
1705	75:600

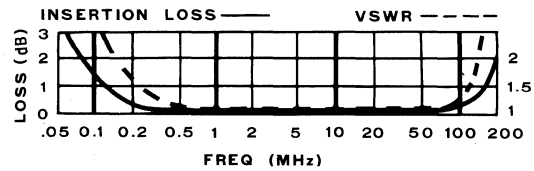
Special — Specify ratio, bandwidth, power

Type 0102 JA Wide Band Adapter



50Ω Unbalanced to 75Ω Unbalanced
Low VSWR
Flat 1 dB, 0.08 to 400 MHz
BNC Connectors.

TYPICAL CHARACTERISTICS



Subminiature Series in NA Case

Unbalanced to Unbalanced Designs

Type No.	Impedance Ratio-Ω	Bandwidth MHz
Non-inverting		
0002	50:12.5	.06-400
0508	50:200	.06-400
1506	75:300	.06-400
Phase reversing		
0003	50:50	.06-400
1106	75:75	.06-400
2200	90:90	.06-400
Phase-reversing, dc isolated		
0007	50:50	.06-400
1107	75:75	.06-400
2201	90:90	.06-400

Unbalanced to Balanced Designs
Balanced side center-tapped

Type No.	Impedance Ratio-Ω	Bandwidth MHz
0004	50:50	.06-400
0509	50:200	.06-400
1101	75:75	.06-400
1507	75:300	.06-400

Balanced to Balanced Designs
center-tapped

0510	50:200	.06-400
1508	75:300	.06-400

Video Series in LA Case

Unbalanced to Balanced Designs. Secondaries are center-tapped and dc isolated.

0306	50:124	.001-20	1704	75:600	.001-10
0511	50:200	.001-15	1902	75:1200	.001-9
1301	75:124	.001-20	1903	75:1850	.001-6
1502	75:300	.001-15	2300	90:124	.001-15

Unbalanced to Unbalanced Designs — dc Isolated.

0005	50:50	.001-20	1103	75:75	.001-15
0505	50:200	.001-15	1504	75:300	.001-10

Extended Video Series — 20 Hz to 5 MHz

Unbalanced to Balanced Designs, dc Isolated center-tapped secondaries, LB case.

Type No. 1307 75:110 | Type No. 1706 75:600

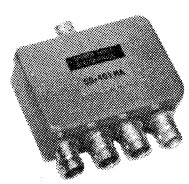
75Ω Line Isolation Transformer — High rejection of noise between isolated "LO" sides of input and output. MD case, insulated BNC connectors.

Type No. 1109 75:75

Hybrids — Power Dividers and Adders



50-201 BD (50Ω)
75-201 BD (75Ω)



50-401 MA (50Ω)
75-401 MA (75Ω)

50 and 75Ω ports; 1:2 and 1:4 division; 1 to 50 MHz bandwidth, 35 dB isolation, 0.25 dB insertion loss, 1.2 VSWR, 0.5° phase and 0.2 dB amplitude balance.

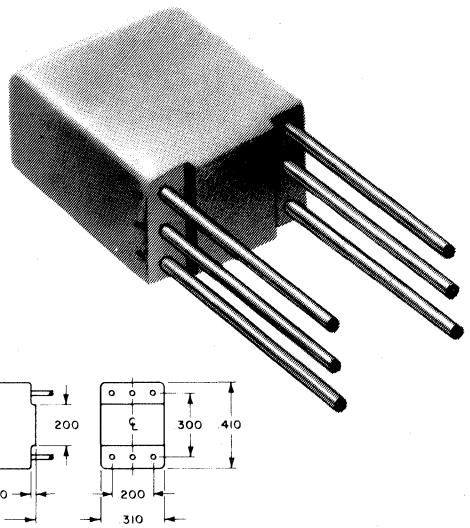
See Page 739 for Coils. See Page 1426 for Voltage/Current Calibrators and Lab Potentiometers.

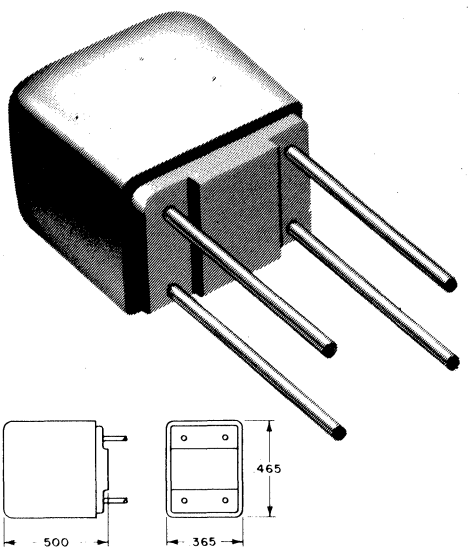
NYTRONICS, INC.

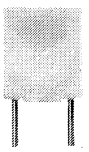
Transformer Division
THIRD AVENUE ■ ALPHA, NEW JERSEY 08866 ■ (201) 454-1143 ■ TWX: 510-235-2918

NYTRAN — Miniature Transformers for Printed Circuit Board Applications

Designed to Meet MIL-T-27, Grade 5, Class R, Life X.






ACTUAL SIZE

- **Small size ■ Inexpensive ■ High Performance**
- **Excellent Response ■ Stands Off PC Board**
- **Epoxy-Sealed ■ Magnetic Shielding Optional**

Nytran miniature transformers are designed specifically for PC board and transistor applications. With impedances from 200,000 ohms to 3.2 ohms, these standard transformers match almost every circuit requirement. Encapsulated into tiny .310 x .410 x 465" high epoxy cases, Nytran transformers include gold plated leads for ease in soldering. A small step holds the lead exit above the circuit board for inspection, cleaning and ease of soldering. An optional mu metal cover is also offered to protect the Nytran from stray magnetic fields.

ELECTRICAL CHARACTERISTICS:

Power:	50 milliwatts (300 Hz), 750 mw at 1000 Hz
Frequency Response:	±2 db from 300 Hz to 100 KHz
Useful Frequency Range:	To 100 Hz at reduced power
Operating Voltage:	100 vdc to ground
Test Voltage:	500 vac, rms

PHYSICAL & ENVIRONMENTAL CHARACTERISTICS:

Case Dimensions:	.310" x .410" x .465"
With Mu Metal Shield:	.365 x .465 x .500"
Lead Wire Diameter:	.020" (nominal)
Lead Wire Length:	¾" standard
Weight:	0.1 oz. (approx.)
Environmental:	Designed to meet MIL-T-27, Grade 5, Class R, Life X.

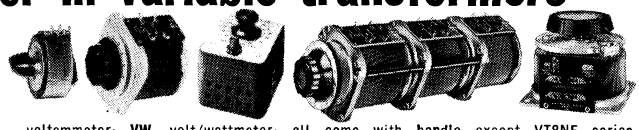
NYTRONICS Part Number	Application	Matching Impedance, Ohms Primary	Matching Impedance, Ohms Secondary	Maximum dc Unbalance In Primary Milliamps	dc Resistance, Ohms Primary	dc Resistance, Ohms Secondary
3141-1*	Input	200,000 CT	1,000 CT	0	5,300	110
3141-2†	Input	200,000 CT	1,000	0	5,300	110
3141-3‡	Input	50,000 CT	1,000 CT	0	3,800	75
3141-4	Interstage	25,000 CT	1,000 CT	0.5	1,700	115
3141-5	Interstage	25,000	1,000	0.25	1,700	115
3141-6	Isolation	10,000 CT	10,000 CT	1	1,050	1,300
3141-7	Driver	10,000 CT	2,000 CT	1	1,050	300
3141-8	Driver	10,000 CT	1,500 CT	1	1,050	225
3141-9	Driver	10,000 CT	1,200 CT	1	1,050	200
3141-10	Driver	10,000 CT	500 CT	1	1,050	77
3141-11	Output	10,000	3.2	0.5	1,050	0.70
3141-12	Output	8,000 CT	3.2	1	780	0.70
3141-13	Output	7,500 CT	12	1	750	2.5
3141-14	Output	5,000 CT	500 CT	1.3	480	78
3141-15	Output	2,500 CT	300 CT	1.8	265	48
3141-16	Output	1,600	3.2	2.5	170	0.70
3141-17	Output	1,500 CT	600	3	165	85
3141-18	Output	1,500 CT	12	3	165	2.6
3141-19	Output	1,200 CT	3.2	3	120	0.75
3141-20	Output	1,200	3.2	3	120	0.75
3141-21	Output	1,000 CT	50	3	105	8
3141-22	Output	1,000 CT	12	3	105	2.7
3141-23	Output	900 CT	600	4	100	85
3141-24	Output	800 CT	3.2	4	100	0.77
3141-25	Isolation	600 CT	600 CT	4.5	66	85
3141-26	Output	600 CT	12	4.5	66	2.6
3141-27	Output	600 CT	3.2	4.5	66	0.75
3141-28	Output	500 CT	600	4.5	60	85
3141-29	Output	500	50	3	60	8
3141-30	Output	320 CT	3.2	6	38	0.70
3141-31	Output	300 CT	600	6	38	85
3141-32	Output	300 CT	12	6	38	2.6
3141-33	Isolation	150 CT	150 CT	10	18	21
3141-34	Isolation	150 CT	12	10	18	2.6
3141-35	Isolation	120 CT	3.2	10	16	0.70

NYTRONICS Part Number	Application	Inductance, Henries	Maximum dc Unbalance, Milliamps	dc Resistance, Ohms
3141-75	Audio Choke	6.0	2	1,700
3141-76	Audio Choke	3.5	2	1,040
3141-77	Audio Choke	2.0	2	610
3141-78	Audio Choke	1.2	2	160
3141-79	Audio Choke	0.80	2	100
3141-80	Audio Choke	0.45	3	70
3141-81	Audio Choke	0.30	4	45
3141-82	Audio Choke	0.10	5	15

NOTES: *10 milliwatts at 300 Hz. †25 milliwatts at 300 Hz. ‡40 milliwatts at 300 Hz. CT=Centertap

OHMITE has the answer in variable transformers

Seven basic physical types meet most industrial requirements with long, maintenance-free life. Excellent regulation at any point within rated load; free from wave-form distortion. Direct-reading 2-scale (1 per side) dial supplied; CCW also available. New space-saving low power types VT1, VT02 and VT3 have adjustable shaft independent of brush assembly, 3-way terminals, instantly replaceable brush contacts and improved heat dissipation. **Mounting:** Easily replace other brands: VT2LN, VT1, VT02 and VT3 have 3/8-32 thd. bushing; VT8 and VT20, 4-hole bolt mount; VT4, 3-hole bolt mount convertible to 4-hole with adapter plate. **Enclosed Types:** Gray hammertone-finish cases. Units with suffix **B** have exposed terminal panel and mounting base; **E**, fixed type for table or panel mounting; **F**, portable with cord, outlet socket and fuse; **G**, deluxe portable with handle, circuit breaker and switch for overvoltage selection. Final suffix: **V** indicates with voltmeter; **VA**, voltammeter; **VW**, volt/wattmeter; all come with handle except VT8NF series. **Other Options:** All types except VT2LN offer shafts, extendable from brush or base side; ganged versions have thru-shaft with same flexibility. Final suffix **C** types come with 3-cond. input and output with one grounded to case. **UL Listing:** Most single and tandem VT4, VT8 and VT20 units for 120 volt operation are U/L Listed. Consult factory.



SINGLE TRANSFORMERS

Ohmite Number	Input Volts	Max. Output Amps	Max. Output Volts	Feature or Connection	Size, Inches W. x D.↓ x H.	Net Each 1-9
UNCASED, SINGLE-PHASE				**60 CPS***		
VT1†	120	1.0	0-120/132	Low power, space saver	2⅞ dia. x 1 13/16 d.	$8.00
VT1N	120	1.2	0-120	Same, no overvoltage	2⅞ dia. x 1 13/16 d.	8.00
VT02†	120	1.75	0-120/132	Low power, space saver	2⅞ dia. x 2 5/16 d.	9.00
VT02N	120	2.0	0-120	Same, no overvoltage	2⅞ dia. x 2 5/16 d.	9.00
VT2LN	40	5.0	0-40	High amps, low volts	2 13/16 dia. x 2⅛ d.	11.00
VT3†	120	2.6	0-120/132	Low power, space saver	2⅞ dia. x 2 13/16 d.	10.50
VT3N	120	3.0	0-120	Same, no overvoltage	2⅞ dia. x 2 13/16 d.	10.50
				50 CPS*		
VT4	120	3.5	0-120/132	Basic, 3.5-amp model	4 5/32 x 4¾ x 4 13/16	14.00
VT4N	120	4.75	0-120	Same, no overvoltage	4 5/32 x 4¾ x 4 13/16	14.00
VT4LN	40	12.0	0-40	High amps, low volts	4 5/32 x 4¾ x 4 13/16	16.00
VT8	120	7.5	0-120/140	Basic, 7.5-amp model	4⅞ x 5⅝ x 5 11/16	18.00
VT8N	120	10.0	0-120	Same, no overvoltage	4⅞ x 5⅝ x 5 11/16	18.00
VT8LN	40	22.0	0-40	High amps, low volts	4⅞ x 5⅝ x 5 11/16	20.00
VT8H	240‡	3.0	0-240/480	240 V input, 120 V tap	4⅞ x 5⅝ x 5 11/16	20.00
VT8HN	240‡	4.0	0-240	Same, no overvoltage	4⅞ x 5⅝ x 5 11/16	20.00
VT20	120	20.0	0-120/140	Basic 20-amp model	7½ x 5⅝ x 8 1/16	50.00
VT20N	120	25.0	0-120	Same, no overvoltage	7½ x 5⅝ x 8 1/16	50.00
VT20H	240‡	9.0	0-240/280	240 V input, 120 V tap	7½ x 5⅝ x 8 1/16	52.00
VT20HN	240‡	11.0	0-240	Same, no overvoltage	7½ x 5⅝ x 8 1/16	52.00
CASED, SINGLE-PHASE				**60 CPS***		
VT1E†	120	.8	0-120/132§	Fixed mounting	3⅜ x 2½ x 4¼	$13.00
VT1NE	120	1.0	0-120	Fixed mounting	3⅜ x 2½ x 4¼	13.00
VT1F†	120	1.0	0-132 #	Portable	3⅜ x 2½ x 4¼	14.50
VT1NF	120	1.2	0-120	Portable	3⅜ x 2½ x 4¼	14.50
VT02E†	120	1.4	0-120/132§	Fixed mounting	3⅜ x 2½ x 4¼	14.00
VT02NE	120	1.6	0-120	Fixed mounting	3⅜ x 2½ x 4¼	14.00
VT02F†	120	1.75	0-132 #	Portable	3⅜ x 2½ x 4¼	15.50
VT02NF	120	2.0	0-120	Portable	3⅜ x 2½ x 4¼	15.50
				50 CPS*		
VT4E	120	2.8	0-120/140§	Fixed mounting	4½ x 4½ x 6 3/16	19.00
VT4NE	120	3.8	0-120	Fixed mounting	4½ x 4½ x 6 3/16	19.00
VT4F	120	3.5	0-140 #	Portable	4⅞ x 4½ x 6¼	20.50
VT4NF	120	4.75	0-120	Portable	4⅞ x 4½ x 6¼	20.50
VT4FC	120	3.5	0-140 #	In/out grounded VT4F	4⅞ x 4½ x 6¼	23.50
VT4NFC	120	4.75	0-120	In/out grounded VT4NF	4⅞ x 4½ x 6¼	23.50
VT8E	120	6.0	0-120/140§	Fixed mounting	5 5/16 x 5¼ x 7 5/16	23.00
VT8NE	120	8.0	0-120	Fixed mounting	5 5/16 x 5¼ x 7 5/16	23.00
VT8F	120	7.5	0-140 #	Portable	5 17/32 x 5¼ x 7⅜	24.50
VT8NF	120	10.0	0-120	Portable	5 17/32 x 5¼ x 7⅜	24.50
VT8FC	120	7.5	0-140 #	In/out grounded VT8F	5 17/32 x 5¼ x 7⅜	27.50
VT8NFC	120	10.0	0-120	In/out grounded VT8NF	5 17/32 x 5¼ x 7⅜	27.50
VT8G	120	6.0	0-120/140 •	Deluxe portable, handle	5 5/16 ¶ x 5¼ x 7⅜■	28.00
VT8GC	120	6.0	0-120/140 •	In/out grounded VT8G	5 5/16 ¶ x 5¼ x 7⅜■	31.00
VT20B	120	20.0	0-120/140	Basic case model	7⅝ x 8 1/16 x 4⅞ ↓	55.00
VT20NB	120	25.0	0-120/140	No overvoltage	7⅝ x 8 1/16 x 4⅞ ↓	55.00
VT20E	120	20.0	0-120/140§	Fixed mounting	7¾ x 5½ x 10 13/16	67.50
VT20NE	120	25.0	0-120	No overvoltage	7¾ x 5½ x 10 13/16	67.50
VT20FC	120	20.0	0-140	Portable	8¼ x 5½ x 11¼	75.50
VT20NFC	120	25.0	0-120	Portable	8¼ x 5½ x 11¼	75.50
VT20GC	120	20.0	0-120/140 •	In/out grounded	7¾ θ x 5½ x 11¼■	88.00
VT20HB	240‡	9.0	0-240/280	Basic Case model	7⅝ x 8 1/16 x 4⅞ ↓	57.00
VT20HNB	240‡	11.0	0-240	Same, no overvoltage	7⅝ x 8 1/16 x 4⅞ ↓	57.00
VT20HE	240‡	9.0	0-240/280§	Fixed mounting	7¾ x 5½ x 10 13/16	69.50
VT20HNE	240‡	11.0	0-240	Same, no overvoltage	7¾ x 5½ x 10 13/16	69.50
VT20HFC	240‡	9.0	0-240/280	Portable	8¼ x 5½ x 11¼	77.50
VT20HNFC	240‡	11.0	0-240	Portable	8¼ x 5½ x 11¼	77.50
CASED WITH METERS, SINGLE-PHASE				**50 CPS***		
VT8GCV	120	6.0	0-120/140 •	Voltmeter, grnd. conn.	7 x 5¼ x 10½ ■	$58.00
VT8GCVA	120	6.0	0-120/140 •	Volt/ammeter, grounded	7 x 5¼ x 10½ ■	88.00
VT8GCVW	120	6.0	0-120/140 •	Volt/wattmeter, grnd.	7 x 5¼ x 10½ ■	118.00
VT8NFCV	120	10.0	0-120	Voltmeter, grnd. conn.	7⅜ x 5¼ x 10½	54.50
VT8NFCVA	120	10.0	0-120	Volt/ammeter, grounded	7⅜ x 5¼ x 10½	84.50
VT8NFCVW	120	10.0	0-120	Volt/wattmeter, grnd.	7⅜ x 5¼ x 10½	114.50
VT20GCV	120	20.0	0-120/140 •	Voltmeter, grnd. conn.	8¼ x 5½ x 14 ■	126.00
VT20GCVA	120	20.0	0-120/140 •	Volt/ammeter, grounded	8¼ x 5½ x 14 ■	156.00
VT20GCVW	120	20.0	0-120/140 •	Volt/wattmeter, grnd	8¼ x 5½ x 14 ■	224.00
VT20NFCV	120	25.0	0-120	Voltmeter, grnd. conn.	8¼ x 5½ x 14 ■	113.50
VT20NFCVA	120	25.0	0-120	Volt/ammeter, grounded	8¼ x 5½ x 14 ■	143.50
VT20NFCVW	120	25.0	0-120	Volt-wattmeter,grnd.	8¼ x 5½ x 14 ■	211.50

MULTIPLE, IN-TANDEM TRANSFORMER ASSEMBLIES

Ohmite Number	Input Volts	Max. Output Amps	Max. Output Volts	Feature or Connection	Size, Inches W. x D.↓ x H.	Net Each 1-4
SINGLE-PHASE, TWO-IN-TANDEM						
Normally wired for series connection; when so connected, load cannot be grounded. Standard CW dial 240/280 volts except VT02 tandems where 240/264 V dial is supplied; on VT8H-2, 480/560 volt dial is standard. Other dials available as listed elsewhere on these pages.						
				60 CPS*		
VT1-2†	240	1.0	0-240/264	Uncased, series conn.	2⅞ x 4 7/32 x 4¼	$25.00
VT1N-2	240	1.2	0-240	Same, no overvoltage	2⅞ x 4 7/32 x 4¼	25.00
VT02-2†	240	1.75	0-240/264	Uncased, series conn.	2⅞ x 5 7/32 x 4¼	27.00
VT02N-2	240	2.0	0-240	Same, no overvoltage	2⅞ x 5 7/32 x 4¼	27.00
VT3-2†	240	2.6	0-240/264	Uncased, series conn.	2⅞ x 6 17/32 x 4¼	30.00
VT3N-2	240	3.0	0-240	Same, no overvoltage	2⅞ x 6 17/32 x 4¼	30.00
VT4-2	240	3.5	0-240/280	Uncased, series conn.	4 5/32 x 7 13/16 x 4 13/16	38.50
				50 CPS*		
VT4N-2	240	4.75	0-240	Same, no overvoltage	4 5/32 x 7 13/16 x 4 13/16	38.50
VT8-2	240	7.5	0-240/280	Uncased, series conn.	4⅞ x 9 5/16 x 5 11/16	46.50
VT8N-2	240	10.0	0-240	Same, no overvoltage	4⅞ x 9 5/16 x 5 11/16	46.50
VT8H-2	480‡	3.0	0-480/560	480 V input VT8-2	4⅞ x 9 5/16 x 5 11/16	50.50
VT8HN-2	480‡	4.0	0-480	Same, no overvoltage	4⅞ x 9 5/16 x 5 11/16	50.50
VT20-2	240	20.0	0-240/280	Uncased, series conn.	7½‡* x 10 x 8 1/16	113.00
VT20N-2	240	25.0	0-240	Same, no overvoltage	7½‡* x 10 x 8 1/16	113.00
VT20-2B	240	20.0	0-240/280	B-cased version VT20-2	7½ x 10½ x 8 1/16	123.00
VT20N-2B	240	25.0	0-240	Same, no overvoltage	7½ x 10½ x 8 1/16	123.00
VT20H-2	480‡	9.0	0-480/560	480 V input VT20-2	7½‡* x 10 x 8 1/16	117.00
VT20HN-2	480‡	11.0	0-480	Same, no overvoltage	7½‡* x 10 x 8 1/16	117.00
THREE-PHASE, TWO-IN-TANDEM						
Supplied with 240/280 volt CW dial, except VT02 (204/264 V). Other dials available as listed elsewhere on these pages.						
				60 CPS*		
VT1-2†	120	1.0	0-120/132	Uncased, open delta con.	2⅞ x 4 7/32 x 4¼	$25.00
VT1N-2	120	1.2	0-120	Same, no overvoltage	2⅞ x 4 7/32 x 4¼	25.00
VT02-2†	120	1.75	0-120/132	Uncased, open delta con.	2⅞ x 4 7/32 x 4¼	27.00
VT02N-2	120	2.0	0-120	Same, no overvoltage	2⅞ x 4 7/32 x 4¼	27.00
VT3-2†	120	2.6	0-120/132	Uncased, open delta con.	2⅞ x 6 17/32 x 4¼	30.00
VT3N-2	120	3.0	0-120	Same, no overvoltage	2⅞ x 6 17/32 x 4¼	30.00
				50 CPS*		
VT4-2	120	3.5	0-120/140	Uncased, open delta con.	4 5/32 x 7 13/16 x 4 13/16	38.50
VT4N-2	120	4.75	0-120	Same, no overvoltage	4 5/32 x 7 13/16 x 4 13/16	38.50
VT8-2	120	7.5	0-120/140	Uncased, open delta con.	4⅞ x 9 5/16 x 5 11/16	46.50
VT8N-2	120	10.0	0-120	Same, no overvoltage	4⅞ x 9 5/16 x 5 11/16	46.50
VT8H-2	240‡	3.0	0-240/280	240 V input VT-2	4⅞ x 9 5/16 x 5 11/16	50.50
VT8HN-2	240‡	4.0	0-240	Same, no overvoltage	4⅞ x 9 5/16 x 5 11/16	50.50
VT20-2	120	20.0	0-120/140	Uncased, open delta con.	7½‡* x 10 x 8 1/16	113.00
VT20N-2	120	25.0	0-120	Same, no overvoltage	7½‡* x 10 x 8 1/16	113.00
VT20-2B	120	20.0	0-120/140	B-case version VT20-2	7½ x 10½ x 8 1/16	123.00
VT20N-2B	120	25.0	0-120	Same, no overvoltage	7½ x 10½ x 8 1/16	123.00
VT20H-2	240‡	9.0	0-240/280	240 V input VT20-2	7½‡* x 10 x 8 1/16	117.00
VT20HN-2	240‡	11.0	0-240	Same, no overvoltage	7½‡* x 10 x 8 1/16	117.00
THREE-PHASE, THREE-IN-TANDEM						
Normally wired for Y-connection. Standard CW dial 240/280 volts except VT02 types where 240/264 V dial is supplied, and VT8H-3, where 480/560 volt dial is standard. Other dials available as listed elsewhere on these pages.						
				60 CPS*		Net Each 1-3
VT1-3	240	1.0	0-240**	Uncased, Y-connection	2⅞ x 6 17/32 x 4¼	$36.50
VT02-3	240	1.75	0-240**	Uncased, Y-connection	2⅞ x 8 1/32 x 4¼	39.50
VT3-3	240	2.6	0-240**	Uncased, Y-connection	2⅞ x 9 27/32 x 4¼	44.00
VT4-3†	240	3.5	0-240/280	Uncased, Y-connection	4 5/32 x 11 7/8 x 4 13/16	56.00
VT8-3†	240	7.5	0-240/280	Uncased, Y-connection	4⅞ x 14 1/8 x 5 11/16	68.00
VT8-3E†	240	6.0	0-240/280	Uncased, Y-connection	5 5/16 x 15 3/4 x 7 3/16	83.00
VT8H-3†	480‡	3.0	0-480/560	Uncased, Y-connection	4⅞ x 14 1/8 x 5 11/16	74.00
VT20-3†	240	20.0	0-240/280	E-case version VT8-3	7½‡* x 15 1/16 x 8 1/16	167.50
VT20N-3	240	25.0	0-240	No overvoltage VT20-3	7½‡* x 15 1/16 x 8 1/16	167.50
VT20-3B†	240	20.0	0-240/280	B-case version VT20-3	7½ x 15 13/16 x 8 1/16	182.50
VT20N-3B	240	25.0	0-240	Same, no overvoltage	7½ x 15 13/16 x 8 1/16	182.50
VT20H-3	480‡	9.0	0-480/560	480 V input VT20-3	7½‡* x 15 1/16 x 8 1/16	173.50
VT20HN-3	480‡	11.0	0-480	Same, no overvoltage	7½‡* x 15 1/16 x 8 1/16	173.50

*Minimum; max. up to 1000 cps for all models. †Use also at 50 cps if connected at no overvoltage output. ‡With 120V input tap at which the max. current output rating applies up to 120 volts, but reduces approx. 50% at max. output voltage shown. In tandem units, the use of low voltage inputs would halve the rated input and output voltages. §User wires for desired output; dial normally calibrated for overvoltage. #Factory-connected for overvoltage output; easily re-connected by user for no overvoltage. •Switch selects overvoltage or no overvoltage. ¶5¾" including handle. ■Case height only, excluding handle. ↓Depth behind panel: add 1" for knob thickness for VT8 types; ⅞", VT02 or VT4 types; 1¼" for VT20 types. θ9" including handle. ††Includes knob, dial and hardware. **Must not be connected for overvoltage. ‡ For mounting bracket, add 1¼" w. x 7/16" d.

TRANSFORMER ACCESSORIES

Extra Dials, Extra Knobs for Uncased Units, Adjustable Stops, Brush Contact Assemblies, and Special Mounting Adapters are available for Ohmite Variable Transformers. See Radio Master for Complete Details.

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company • 3635 HOWARD STREET, SKOKIE, ILLINOIS 60076 • PHONE (312) 675-2600 • TWX 910-223-0805

PEERLESS ELECTRICAL PRODUCTS

CUSTOM TRANSFORMERS

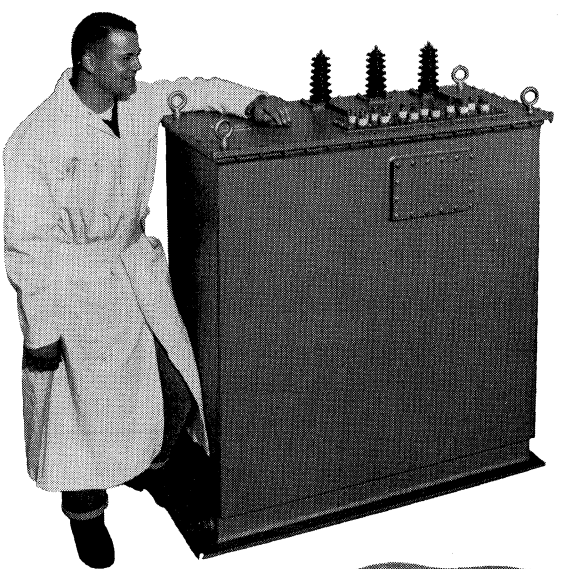
Designed to any specification; manufactured in any quantity

SINCE 1935, Peerless has designed and manufactured transformers of highest reliability to meet exacting specifications in electronic applications. Peerless is a leader in size reduction, rugged packaging, and in establishing industry standards for performance of broadband transformers.

Today, Peerless offers design and production capabilities that are virtually unlimited. Peerless experience covers a remarkably wide spectrum of types and functions. For example, transformers engineered and built by Peerless include sizes from 1/10th of a cubic inch to more than 20 cubic feet; from fractional voltages to 30,000; from less than one cycle to approximately ½ megacycle; and in one-two-three-phase and phase-changing configurations. Construction categories cover the entire range from open-frame to potted, hermetically sealed and vacuum impregnated units. Peerless transformers can be varnished, fosterited, epoxy or silastic impregnated, and encapsulated. Hermetically sealed units can be compound, resin, mineral or silicone oil filled.

Whatever your transformer needs, Peerless can design to any grade, class, or temperature range of military specifications or to commercial specifications and manufacture in any quantity. Your inquiries are invited.

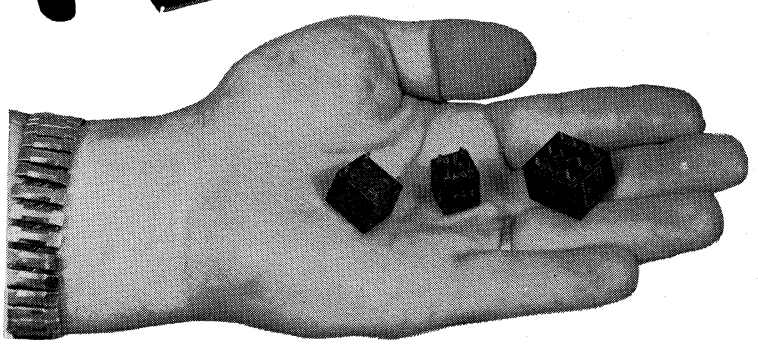
Typical examples of Peerless solutions to unique transformer requirements:



EXAMPLE 1

PLATE TRANSFORMER, 3-PHASE 60 CYCLE, OIL IMMERSED

- **Continuous Rating:** 250 KVA
- **Primary:** 2400/4160 v, Wye connected
- **Hipot Test:** 10 KV, RMS
- **Secondary:** 11,100 v, Delta connected
- **Hipot Test:** 45 KV, RMS
- **Dimensions:** 47" H x 20" W x 47" L

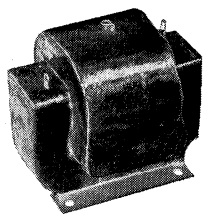


EXAMPLE 2

MINIATURIZED 400 CYCLE TRANSFORMERS

- **Primary:** 26 v, RMS, 400 cps
- **Secondary #1:** 16 v, RMS, C.T. @ 3 ma
- **Secondary #2:** 16 v, RMS, C.T. @ 3 ma
- **Primary O.C.L.:** 2 H
- **MIL-T-27A,** Grade 5, Class R
- **Dimensions** (largest shown): .75" H x .875" W x .47" L

PEERLESS ELECTRICAL PRODUCTS

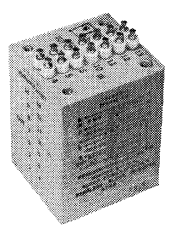


*EXAMPLE 4 (Peerless 17101)

MINIATURIZED CHARGING REACTOR

- **Inductance:** 4.85 henrys ± 5% @ 150 ma, DC
- **Linearity:** 10%
- **Operating Voltage:** DC = 8000
- **Test Voltage RMS:** 22,000
- **Usable at F up to:** 2,000 cps
- **Maximum Temp. Rise:** 85°C
- **Ambient Temperature:** 85°C
- **Max. Effective Cap.:** 51 micromicrofarads (measured at 20-25 megacycles)
- **Weight:** 2¾ lbs.
- **Dimensions, nominal:** 3½" H + ⅜" terminal, 2⅞" W, 3 13/16" L

Conforms to requirements of MIL-T-27B, Grade 5, Class T, Life Y

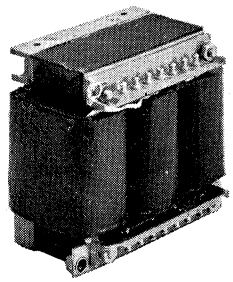


*EXAMPLE 16 (Peerless 4755)

MULTI-UNIT AUDIO TRANSFORMER
(consists of an input and output transformer in one case)

- **Input Transformer—Frequency Response:** 100 cps-5,000 cps, ± 1 db
- **Primary, Longitudinal Balance:** 35 db min., 20 cps-3,500 cps
- **Primary Impedance:** 1,800 ohms, C.T.
- **Secondary Impedance:** 248,000 ohms (total of two windings)
- **Secondary Resonant Frequency:** 75 KC min.
- **Output Transformer—Frequency Response:** 100 cps-5,000 cps, ± 1 db
- **Primary Impedance:** 5,300 ohms, C.T.
- **Secondary Impedance:** 1,000 ohms, C.T.
- **Secondary, Longitudinal Balance:** 35 db min., 20 cps-3,500 cps
- **Primary Resonant Frequency:** 75 KC min.
- **Weight:** 1 lb., max.
- **Dimensions:** 2 1/16" H x 1 15/16" W x 1 13/16" D

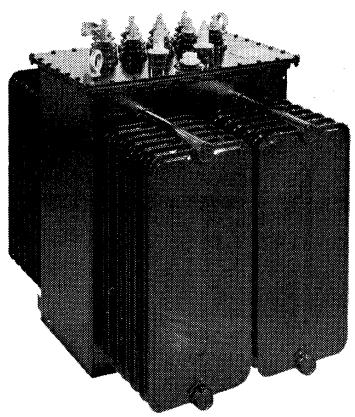
Conforms to requirements of MIL-T-27B, Grade 4, Class R, Life X
Environmental test data on file.



EXAMPLE 19

POWER TRANSFORMER
3-PHASE, MIL-T-27, GRADE 5, CLASS U

- **Primary:** 3-phase "Y" connected, 380-420 cps, tapped for 110, 112.5, 115, 117.5, and 120 v
- **Secondary:** "Y" connected to deliver 4,541 v, DC (full-wave rectification) at 165 ma
- **Ambient Temp.:** 100°C
- **Temperature Rise:** 70°C
- **Dimensions:** 3 13/16" H x 2 23/32" W x 4 17/32" L



EXAMPLE 18

IMPEDANCE MATCHING TRANSFORMER

- **Primary Impedance:** 4 ohms
- **Sec. Imped. Terms:** 16 ohms C.T. 6-7-8, 32 ohms C.T. 5-7-9, 64 ohms C.T. 4-7-10, 128 ohms C.T. 3-7-11
- **Frequency Response:** ± 0.5 db, 300-2,000 cps
- **Power Level:** 175 KVA continuous
- **Ambient Temperature:** 90°F
- **Askarel Filled**
- **Dimensions:** 41" Max. H (over spark gap) x 25¾" Max. W x 42" Max. L (over radiators)
- **Approx. Weight:** 1800 lbs. including askarel
- **Percent Regulation:** Approx. 0.5% no load to full load

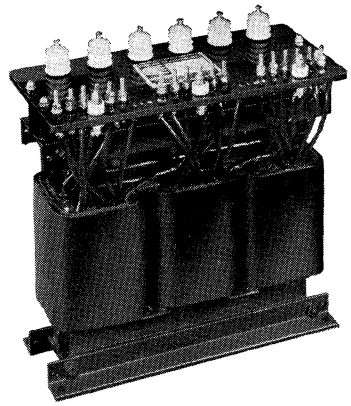


PLATE SUPPLY TRANSFORMERS
3-PHASE, 60 CYCLE, DRY TYPE

EXAMPLE 9

- **Rating:** 7.5 KVA
- **Primary:** 480 volts Delta, tapped at 460 v, 440 v, 420 v
- **Secondary:** 85 volts Delta
- **Dimensions:** 14" H x 7½" W x 15" L
- **Weight:** 170 lbs.

EXAMPLE 10

- **Rating:** 10 KVA
- **Primary:** 500 volts Delta, tapped at 480 v, 460 v, 420 v
- **Secondary:** 2570 volts Delta, or 4450 volts "Y"
- **Dimensions:** 18" H x 8" W x 17½" L
- **Weight:** 200 lbs.

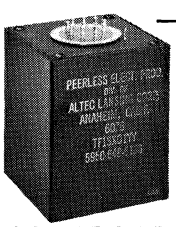
EXAMPLE 11

- **Rating:** 30 KVA
- **Primary:** 500 volts Delta, tapped at 480 v, 460 v, 440 v, 420 v
- **Secondary:** "Y", 3850 to ground or 6660 v between lines
- **Dimensions:** 27½" H x 11" W x 30" L
- **Weight:** 550 lbs.

EXAMPLE 12

- **Rating:** 45 KVA
- **Primary:** 480 volts "Y", tapped at 460 v, 440 v, 420 v
- **Secondary:** 165 volts Delta
- **Dimensions:** 21" H x 10½" W x 22½" L
- **Weight:** 625 lbs.

Complete environmental test results are on file. Information will be furnished on request.

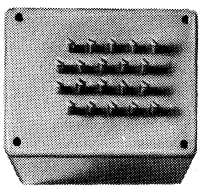


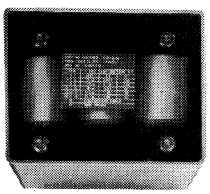
*EXAMPLE 22 (Peerless 6076) **400 CYCLE POWER TRANSFORMER**

- **Secondary:**
  - **Section 1:** 480 V./C.T. ± 3% @ 0.05A
  - **Section 2:** 6.3 V. ± 3% @ 3.0A
  - **Section 3:** 6.3 V. ± 3% @ 2.0A
- **Primary:** 115 Volts, 400 CPS
- **Weight:** 1.5 lbs.
- **Dimensions:** 2.75" H plus 0.6" for terminal x 2.25 W x 2.25 L

Conforms to requirements of MIL-T-27B, Grade 4, Class S, Life X

PEERLESS ELECTRICAL PRODUCTS



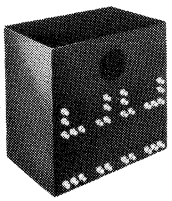


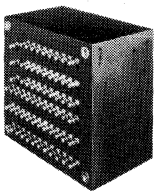
EXAMPLE 101

POWER TRANSFORMER

3-PHASE, MIL-T-27, GRADE 5, CLASS R

- **Rating:** 177 VA
- **Primary:** 3-phase "Y" connected 380-420 cps, 208 V, L to L.
- **Secondary 1:** Delta connected, 177 V, L to L, 0.023 A, RMS, per phase.
- **Secondary 2:** Delta connected, 177 V, L to L, 0.130 A, RMS, per phase.
- **Secondary 3:** Delta connected, 44 V, L to L, 0.87 A, RMS, per phase.
- **Secondary 4:** Delta connected, 11.2 V, L to L, 1.25 A, RMS, per phase.
- **Secondary 5:** Delta connected, 21.7 V, L to L, 1.05 A, RMS, per phase.
- Electrostatic shields between each secondary and between secondary and primary.
- Designed to operate over temperature range of −40°C to +58°C.
- **Dimensions:** 3-13/16" x 3" x 2¼" H approx.
- **Weight:** 3¼ lbs. approx.



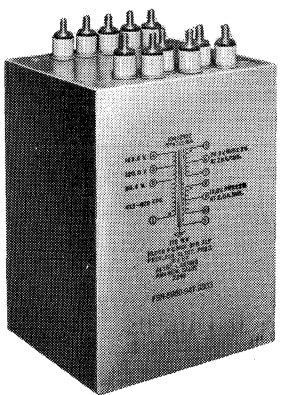


EXAMPLE 102

POWER TRANSFORMER

3-PHASE, MIL-T-27, GRADE 5, CLASS S

- **Rating:** 493 VA
- **Primary:** 3-phase, Delta connected, 380-420 cps, 200 V, L to L.
- **Secondary 1:** "Y" connected. 18.2 V, L to L, 0.021 A, RMS, per phase.
- **Secondary 2:** "Y" connected. 18.2 V, L to L, 0.021 A, RMS, per phase.
- **Secondary 3:** "Y" connected. 9.6 V, L to L, 2.53 A, RMS, per phase.
- **Secondary 4:** "Y" connected, 9.6 V, L to L, 4.22 A, RMS, per phase.
- **Secondary 5:** "Y" connected, 15.6 V, L to L, 2.80 A, RMS, per phase.
- **Secondary 6:** "Y" connected, 26.6 V, L to L, 3.48 A, RMS, per phase.
- **Secondary 7:** "Y" connected, 26.6 V, L to L, 3.70 A, RMS, per phase.
- **Maximum ambient temperature:** 65°C.
- **Dimensions:** 4½" x 4¾" x 2-13/16" H approx.
- **Weight:** 6½ lbs. approx.

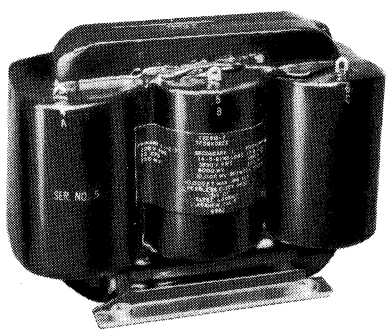


EXAMPLE 103

POWER TRANSFORMER

MIL-T-27, GRADE 4, CLASS S

- **Primary:** Single phase, 123.6 V, tapped at 120.0 V and 116.4 V, RMS, 47.5 cps to 420 cps.
- **Secondary 1:** 28.0 V, RMS at 7.8 A.
- **Secondary 2:** 12.6 V, RMS, 2.0 A.
- **Ambient Temperature:** 65°C.
- **Temperature Rise:** 65°C max.
- **Dimensions:** 3⅜" x 3-15/16" x 5¼" H approx.
- **Weight:** 7 lbs. approx.



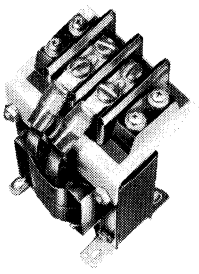
EXAMPLE 104

POWER TRANSFORMER

3-PHASE, MIL-T-27, GRADE 5, CLASS S

- **Primary:** 3-phase, delta connected, 60 cps, 208 V, RMS, L to L.
- **Secondary 1:** "Y" connected, 3850 V, RMS, L to L @ 0.5 ma.
- **Secondary 2:** "Y" connected, 3850 V, RMS, L to L @ 2.0 ma.
- **Ambient Temperature:** 75°C.
- **Temperature Rise:** 50°C max.
- **Dimensions:** 6" x 2⅞" x 4-13/16" H approx.
- **Weight:** 6½ lbs. aprox.

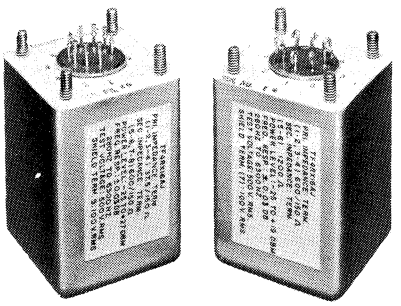
PEERLESS ELECTRICAL PRODUCTS



EXAMPLE 105

FILTER REACTOR

- **Inductance:** 0.1 MHY ±10%
- **Rated DC:** 26.5 A
- **Test Condition:** 0.1 MHY ±10% at 1V 60 cps superimposed on 26.5 A, DC.
- **Ambient Temperature:** 50°C.
- **Temperature Rise:** 45°C. max.
- **Dimensions:** 3⅛" x 3-3/16" x 4⅛" H approx. (over terminal block).
- **Weight:** 2¾ lbs. approx.



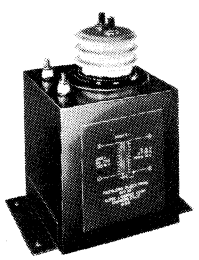
EXAMPLES 106 and 107

AUDIO TRANSFORMERS OUTPUT AND INPUT MIL-T-27, GRADE 4, CLASS R.

	EXAMPLE 106 Output Trans.	EXAMPLE 107 Input Trans.
Primary	150 ohms (two windings)	600 ohms (two windings)
Secondary	600 ohms (two windings)	1200 ohms
Insertion Loss:	0.85 db. max.	1.5 db. max.

This pair of transformers is designed to send into and receive from a 600 ohm transmission line. The following characteristics are common to both transformers.

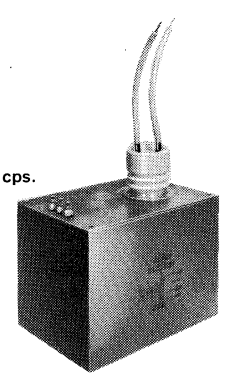
- **Power level:** +14 dbm max.
- **Frequency Response:** ±0.03 db from 280 cps to 6300 cps.
- **Longitudinal Balance, Line Side:** 55 db min.
- **Return Loss, Line Side:** 37 db min.
- **Harmonic Distortion:** 70 db below 0 dbm.
- **Intermodulation Products:** 65 db below +14 dbm.
- **Envelope Delay Distortion:** 7 μ sec. max.
- **Dimensions:** 1⅝" x 1⅝" x 2⅜" approx.
- **Weight:** 12 oz. approx.



EXAMPLE 108

FILAMENT TRANSFORMER MIL-T-27, GRADE 4, CLASS R

- **Primary:** Single phase 208 V, 60 cps.
- **Secondary:** 3.5 V @ 10 A RMS, insulated for a working voltage of 15,000 above ground.
- **Ambient Temperature:** 60°C.
- **Temperature Rise:** 15°C.
- **Dimensions:** 5-1/16" plus mounting flanges, x 5¼" x 5⅝" H plus terminals.



EXAMPLE 109

FILAMENT TRANSFORMER, HERMETICALLY SEALED

- **Primary:** 120 V, tapped at 115 V, 60 cps.
- **Secondary:** 13 V, RMS, at 36A, operating at 22,000 V, RMS, above ground.
- **Ambient Temperature:** 75°C.
- **Temperature Rise:** 30°C.
- **Dimensions:** 7¼" x 10-7/16" x 8" H (plus terminals) approx.
- **Weight:** 70 lbs. approx.



EXAMPLE 110

MINIATURIZED PULSE TRANSFORMER MADE TO CUSTOMER SPECIFICATIONS

1:1 Ratio 8 V transformer for operation in the 5 mc region.

BASIC GUIDE TO CUSTOM TRANSFORMER ESTIMATES

For prompt estimates on design and construction of custom transformers to meet your specifications, please submit the following information, as applicable. This information is intended only as a guide, and appears in abridged version. Convenient estimating specification forms will be mailed to you on request.

GENERAL

1. If military, show applicable specification. For MIL-T-27 show Grade, Class, Life, Family.
2. If commercial, state whether fully potted, exposed core with end shells, or open with brackets.
3. Ambient temp. °C. min, °C. max. Temp. rise °C. max.
4. Duty cycle. If intermittent, indicate time on, time off.
5. Mounting; terminal end, opposite end; inserts, studs, flanges.
6. Terminals, stand-off, feed-through, lugs, flex leads, other.
7. Size limit. Weight limit. Mounting centers.

BROADBAND, AUDIO AND LOW R.F. TRANSFORMERS

1. Input.
2. Interstage or Driver. Class A, AB, or B.
3. Output. Class A, AB, or B.
4. Modulation. Class A, AB, or B.
5. Impedance matching.
6. Other.
7. Frequency response ___Hz to ___Hz within ± ___dB.
8. Power rating watts in midrange, or at Hz. Watts at Hz (low frequency), Watts at Hz (high frequency).
9. Magnetic shielding dB min.
10. Primary OCL hys. min. at volts RMS and Hz, with MA of DC in winding.
11. Insertion loss, midrange dB, or midrange efficiency %.
12. Electrostatic shielding dB min. If other than nominal or conventional electrostatic shielding is required, list details.
13. Leakage inductance in mhys. max. referred to high imp. winding. Other windings short circuited.
14. Short circuited resonant frequency, referred to high imp. winding. Hz min.
15. Other.
16. Tabulation: Source impedance, ohms/Load impedance, ohms/Operating volts above ground (show AC or DC)/Max. DC in winding, MA/Unbalance DC in winding, MA/Polarity, referred to primary/Check windings which are loaded simultaneously/Longitudinal balance desired, dB, @ Hz. Taps as wanted.
17. Schematic of application. Give as much information as possible, including power source.

POWER TRANSFORMERS

1. Power (combination plate and filament)
2. Plate
3. Filament
4. Other
5. Regulation %. Specified voltages desired at full, no load, and at °C. ambient temp.
6. Frequency Hz to Hz.
7. Phase, one, two, or three. (If three phase, show in tabulation whether windings to be Y or △), or phase changing.
8. Rectifier types. Half wave, full wave, bridge, or voltage doubler.
9. Filter input. Condenser mfd, choke hy or resistance ohms.
10. Primary—Volts, tapped at. If 3ø, Y or △. Max. Exciting Current, Max. Core Loss, or Min. Primary X_L ohms, at volts and Hz.
11. Electrostatic shield is, is not required.
12. Other.
13. Tabulation: Show Secondaries Volts, RMS/Tapped at Load current RMS/Load R, ohms/Working volts from ground (show AC or DC)/Rectifier type/DC volts out of rectifier/Max. capacitance to other windings and ground, mmfd./Other.
14. Schematic of application. Give as much information as possible, showing transformer, filter schematic, and load.

INDUCTORS, REACTORS OR CHOKES

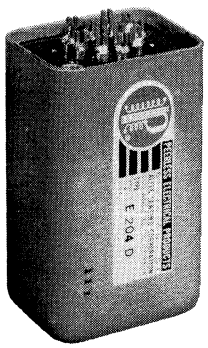
A. Filter Choke, Power. Furnish data below for items 1, 3, 5, 6, 7, 8.
B. Filter Choke, Audio. Furnish data below for items 1, 3, 4, 5, 6, 7, 8, 9, 11, 12.
C. Charging Choke. Furnish data below for items 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
D. Swinging Choke. Furnish data below for items 2, 5, 6, 7, 8.

1. State Hys., min. or ±%.
2. Hys., max. or ±% at min. amps. DC, and hys. min. or ±% at max. amps. DC.
3. Amperes DC.
4. Amperes RMS.
5. Volts DC above ground.
6. Volts RMS, ripple or working.
7. Ohms max., or ±%.
8. Hz, ripple or working.
9. Q min. at RMS volts and Hz.
10. Charging rate.
11. MMFD max. effective C.
12. Linearity. Limits, electrical and environmental.
13. Other.
14. Schematic of application. Give as much information as possible. (Separate sheet attached.)

EXAMPLE 23

E-204-D IMPEDANCE MATCHING TRANSFORMER (20-20 PLUS)

It will attenuate longitudinal currents 80 db in a balanced circuit up to 20 Kc, and 70 db up to 80 Kc.



- **Primary Impedances (ohms):** 500 C.T.-125 C.T. or 600 C.T.-150 C.T.
- **Secondary Impedances (ohms):** 500 C.T.-125 C.T. or 600 C.T.-150 C.T.
- **Frequency Response:** ± 1 db 5 to 80,000 CPS
- **Power Level Primary DC:** + 23 dbm, maximum 100 ma, maximum 0 ma, unbalanced

(As Hybrid)

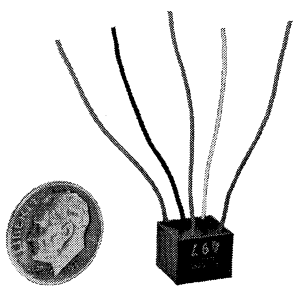
- **Total Primary Impedance (ohms):** 500 or 600 Primary 1: 250 or 300 Primary 2: 250 or 300 Secondary: 500-125 or 600-150
- **Power Level:** + 23 dbm, maximum
- **Weight:** 1¼ lbs.
- **Dimensions:** 3¼" H x 1½" D x 2" W

EXAMPLE 24

K-241-D INPUT TRANSFORMER (20-20 PLUS)



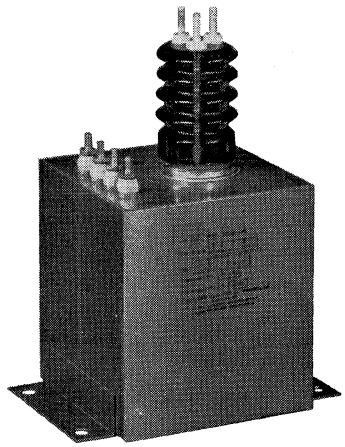
- **Primary Impedance (ohms):** 500-280-125-31 or 600-240-150-37.5
- **Secondary Impedance (ohms):** 70,000 or 84,000
- **Frequency Response:** ± 1 db, 10 to 25,000 CPS
- **Insertion Loss:** 1.25 dbm
- **Maximum Level:** + 8 dbm
- **Primary DC Max.:** 0
- **Weight:** 1 lb.
- **Dimensions:** 2¾" H x 1½" D x 2" W



EXAMPLE 25

400 CYCLE INTERSTAGE TRANSFORMER

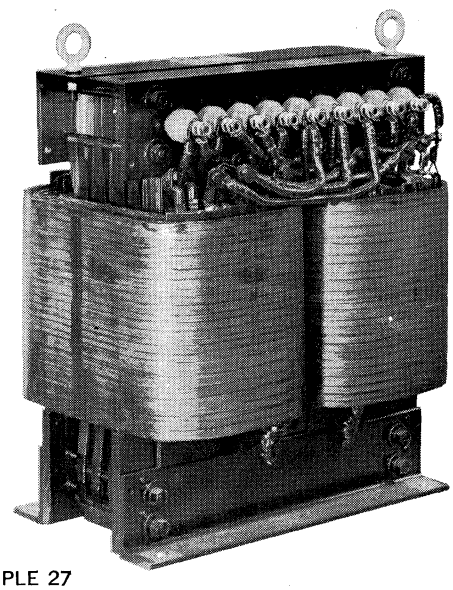
- **Primary Impedance:** 10,000 ohms
- **Secondary Impedance:** 1,200 ohms C.T.
- **Frequency:** 400 cycles
- **Primary Voltage:** 19.5V
- **Secondary Voltage:** 6.1V ± 5% at full load
- **Dimensions:** .385 max. H x .43 max. W x .46 max. L



EXAMPLE 26

HERMETICALLY SEALED 50-60 CYCLE FILAMENT TRANSFORMER

- **Primary:** 440, 460, 480 volts
- **Secondary:** 5 volts C.T. @ 10 amp.
- **Secondary Test Voltage:** 30,000 volts R.M.S.
- **Dimensions:** 10" H over terminal x 5" max. W x 7 1/16" max. L over flanges



EXAMPLE 27

AUDIO STEPDOWN MATCHING TRANSFORMER

- **Primary Impedances (ohms):** 0.52, 0.76, 1.07, 1.4, 1.7, 2.0, 2.7, 3.4
- **Secondary Impedance:** 0.1 ohm
- **Frequency Response:** ½ DB 40-5000 CPS
- **Rating Power Level:** 76.5 KVA
- **Weight:** Approx. 1,650
- **Dimensions:** 29 max. H x 17 max. W x 25 max. L

FOR COMPLETE INFORMATION, PLEASE WRITE:

PEERLESS

ELECTRICAL PRODUCTS

A Division of LTV Ling Altec, Inc.

1515 SOUTH MANCHESTER AVENUE, ANAHEIM, CALIFORNIA

Peschel Components, Inc.

HIGH VOLTAGE SPECIALISTS

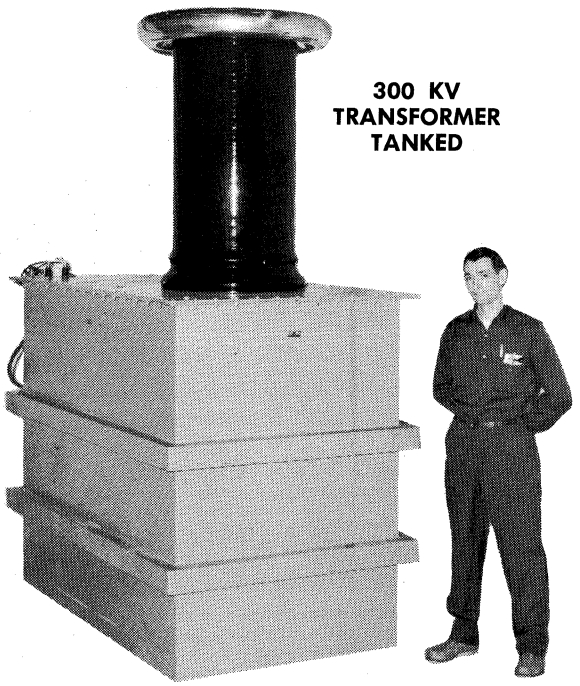
Peschel Components, Inc., division of Peschel Instruments, Inc., who for 20 years have specialized in High Voltage equipment, offers their modern production and test facilities to fill your custom high voltage transformer needs. You will find our optimized, yet conservative designs, offer enhanced efficiency, reliability and economy.

Efficient utilization of modern insulation materials permits drastic size reduction, yet we can provide corona free operation in air or oil for extreme life. Write for a R.F.Q. form, facilities report and catalog of stock transformers, bushings, corona balls and related HV components. Special electro-static shielding available.

SEND FOR CATALOG AND RFQ FORM

CUSTOM MAGNETIC COMPONENTS

- HIGH VOLTAGE & CORONA FREE
- POWER/PLATE REACTORS
- CHOKES
- FILAMENT
- MULTI-PHASE
- HIGH IMPEDANCE



300 KV TRANSFORMER TANKED

STANDARD STOCK COMPONENTS

TRANSFORMERS
(Air Insulated for FWB)

KV	AC MA	EACH
1	30	$ 6
2.5	30	8
5	5	16
5	30	20
10	5	24
10	30	30
16	30	50
21	30	64

CORONA BALLS
(Nickel-plated threaded)

DIAMETER	LEVEL - KV	NET EACH
1	40	$2.10
2	75	2.70
3	100	3.50
4	150	4.40

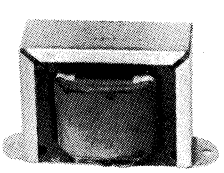
Send for complete catalog

FEED-THRU BUSHINGS AIR TO OIL
(Corona Free)

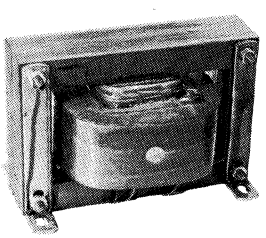
KV	EACH
30	$ 35
50	65
75	110
100	150

1 to 9 — Net, 10 to 49 — 10%, 50 to 99 — 16⅔%

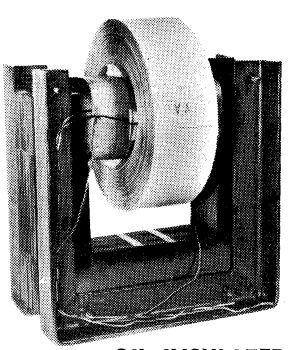
AVAILABLE AS . . .



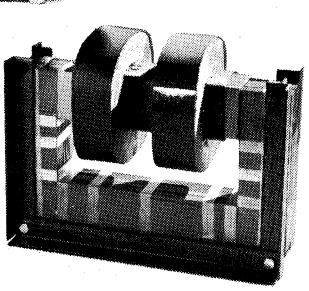
COIL/CORE



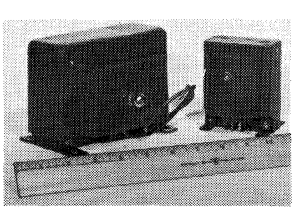
AIR INSULATED



OIL INSULATED



INSULATING GAS INSULATED (SF)



EPOXY ENCAPSULATED

. . . OR TANKED W/BUSHINGS OR COMPLETE DC ASSEMBLIES W/RECTIFYING AND FILTER ELEMENTS

PESCHEL COMPONENTS, Inc., Cape Coral Industrial Park
Box 847, Cape Coral, Florida 33904 • (813) LI 2-3164

SOLA ELECTRIC SB

DIVISION OF SOLA BASIC INDUSTRIES

CV Transformers

Constant-voltage Sola transformers provide a stabilized output voltage even though the input voltage varies over a considerable range. Their applications are numerous and varied. CV's are especially ideal for high-accuracy requirements such as in computers and data-processing equipment.

Another advantage in CV transformers is their ability to prolong the life of electronic components by eliminating injurious over- and under-voltages. The Sola transformer's current-limiting factor protects semi-conductors and other components from excessive inrush and fault currents.

Write for catalog CV-100 for complete listings including 50 and 400 Hz models.

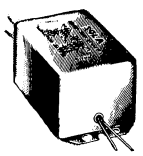
Sola Sinusoidal Type (CVS)

LESS THAN 3% HARMONIC CONTENT
SPECIFICATIONS • 60 CYCLE SINGLE PHASE

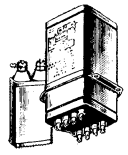
Voltage Rating						
Regulated Output	Input Range	VA	Catalog Number	Price Ind'l & Govt. Users	Approx. Ship. Wt. Lbs.	Structure Code
118	95-130	30	23-13-030-2	$ 28.35	8	W
	95-130	60	23-13-060-2	33.60	10	W
	190-260X 380-520	60	23-23-060-2	36.75	10	W
	95-130X 190-260	120	23-22-112-2	43.05	14	W
	190-260X 380-520	120	23-23-112-2	46.20	14	W
	95-130X 190-260	250	23-22-125	58.80	28	W
	190-260X 380-520	250	23-23-125	63.00	29	W
	95-130X 190-260	500	23-22-150	91.35	45	W
	190-260X 380-520	500	23-26-150	97.65	46	W
	95-130X 175-235X	750	23-25-175	126.00	54	W
	190-260	1000	23-25-210	153.30	72	W
	190-260X 380-520	1000	23-26-210	153.30	72	W
	95-130X 175-235X	1500	23-25-215	204.75	128	W
	190-260	2000	23-25-220	278.25	140	W
	190-260X 380-520	2000	23-26-220	278.25	148	W
118x236	95-130X 175-235X 190-260	3000	23-25-230-3	373.80	194	W
	190-260X 380-520	3000	23-26-230	373.80	192	W
	95-130X 175-235X 190-260	5000	23-25-250	583.80	335	Y*
	190-260X 380-520	5000	23-26-250	583.80	342	Y*
	190-260X 380-520	7500	23-28-275	867.30	502	7**

*Same as W, but duplex. **Same as W, but triplex.

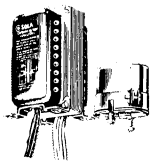
AUTOMATIC, INSTANTANEOUS VOLTAGE REGULATION FOR A WIDE VARIETY OF ELECTRIC AND ELECTRONIC DEVICES



D — Drawn case; integral capacitor unit; flex leads.



S — Hermetically-sealed case; separate capacitor; solder lugs.



E—Exposed core; end bells; separate capacitor; flex leads.



W—Exposed core; end housings; screw-type terminals in outlet box.

Normal Harmonic Type (CVN)

SPECIFICATIONS • 60 CYCLE SINGLE PHASE

Voltage Rating						
Output Regulated	Input Range	VA	Catalog Number	Price 1-4 pcs.	Ship. Wt. (Lbs.)	Structure Code
118	95-130	15	20-10-015	$ 16.80	4	D
			20-11-015	23.10	4	S
			20-14-015	15.75	3	E
		30	20-14-030	17.85	5	E
			20-13-030-2	23.10	7	W
		60	20-13-060-2	28.35	10	W
			20-14-060	24.15	8	E
118	95-130	120	20-14-112	32.55	11	E
			20-13-112-2	37.80	12	W
236	190-260	120	20-21-112-2	37.80	13	W
118	95-130	150	20-13-115	45.15	22	W
		250	20-13-125	55.65	25	W
	95-130X 190-260	250	20-22-125	55.65	25	W
	190-260X 380-520	250	20-23-125	55.65	25	W
	95-130	500	20-13-150	87.15	36	W
	95-130X 190-260	500	20-22-150	87.15	36	W
	190-260X 380-520	500	20-23-150	87.15	36	W
236	190-260X 380-520	500	20-24-150	87.15	38	W
118x236	190-260X 380-520	500	20-26-150	93.45	37	W
118	95-130	1000	20-13-210	144.90	48	W
	190-260		20-20-210	144.90	48	W
118	95-130X 190-260	1000	20-22-210	144.90	48	W
118x236	95-130X 175-235X	2000	20-25-220	263.55	128	W
	190-260	3000	20-25-230	357.00	170	W
	190-260X	5000	20-27-250	555.45	290	W
	380-520	10000	20-26-310	1048.95	590	Y

Electronic-Power Types ±1% REGULATION FOR FILAMENT TYPE, ±3% FOR PLATE-FILAMENT TYPE

The electronic-power type of Sola transformer is designed as a component for simple assembly into many kinds of electronic equipment. The filament type (CVF) provides 6.0 or 6.3 volts of output regulated within ± 1% over line variations of ± 15%; the combination plate-and-filament type (CVE) regulates within ± 3%.



D — Drawn case; integral capacitor unit; flex leads.



E — Exposed core; end bells; separate capacitor; flex leads.

for filament service (Type CVF)

SPECIFICATIONS • 60 CYCLE SINGLE PHASE

Voltage Rating Regulated ±1% Output	Input Range	Output Capacity in Amps.	Catalog Number	Approx. Net Price Each to Industrial Users	Approx. Ship. Wt. in Lbs.	* Structure Code
6.0	95-130	2.50	20-01-015	$16.80	4	D
			20-06-015	15.75	3	E
6.3	95-130	2.38	20-02-015	16.80	4	D
			20-03-015	23.10	4	S
			20-04-015	15.75	3	E
	95-130X 190-260	5.0	20-04-030	17.85	6	E
		10.0	20-04-065	23.10	8	E
		15.0	20-04-095	27.30	11	E
		25.0	20-04-116	39.90	23	E

for plate filament service (Type CVE)

SPECIFICATIONS • 60 CYCLE SINGLE PHASE
Input range, 100-130 volts

Typical Rectifier Tube	Average D.C. Input Volts to Filter*	Filament Windings 6.3 Volts	Filament Windings 5.0 Volts	Catalog Number	Approx. Net Price Each to Industrial Users	Approx. Ship. Wt. in Lbs.	* Structure Code
5Y3	275v D.C. @ 50 M.A.	2.5 amps C.T.	2.0 amps	7104	$14.04	6	E
5Y3	385v D.C. @ 110 M.A.	3.0 amps C.T.	2.0 amps	7106	17.28	8	E
5U4	380v D.C. @ 250 M.A.	No. 1: 4.0 amps No. 2: 8.0 amps unregulated	3.0 amps	7107	32.40	19	E

*Voltage values are taken at output of 5Y3GT rectifier for No. 7104 and No. 7106 transformers and at output of 5U4GA-GB for No. 7107. Guaranteed regulation of ±3% on plate voltage output is contingent on the use of Sola-regulated 5.0μ filament supply winding for the rectifier tube.

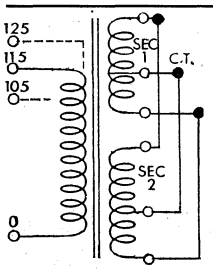
For more information on SOLA CVDC Power Supplies, see page 2091, Section 4000.

SHIPPED FROM STOCK IMMEDIATELY

HIGH & LOW CURRENT TRANSFORMERS

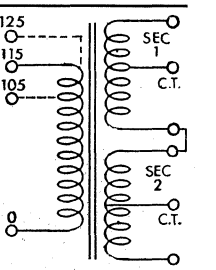
OPEN FRAME • EPOXY ENCAPSULATED (GRADE 5) • HERMETICALLY SEALED (GRADE 4)

SECONDARY VOLTS	Part No.	Primary Volts	SECONDARY AMPS Series	SECONDARY AMPS Parallel	OPEN FRAME OR EPOXY ENCAPSULATED* Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.	HERMETICALLY SEALED IN STEEL CASE‡ L	W	H	ML	MW	Mtg. Stud
10 or 5 V C.T. Series 0 - 2.5 - 5 - 7.5 - 10 V Parallel 0 - 2.5 - 5 V @ 2 x Current	10-0.1	115	0.1	0.2	C	2	1½	1¾	1 23/32	—	#8	0.3	1⅝	1⅝	2 3/16	1 3/16	1 3/16	6-32 x ⅜
	10-0.25	115	0.25	0.5	C	2⅜	1½	2	2	—	#8	0.5	1 15/16	1 13/16	2 7/16	1⅜	1¼	6-32 x ⅜
	10-0.5	115	0.5	1.0	C	2⅜	1¾	2	2	—	#8	0.8	1 15/16	1 13/16	2 7/16	1⅜	1¼	6-32 x ⅜
	10-1	115	1	2	C	2⅞	1¾	2 5/16	2⅜	—	#8	1.0	2 1/16	2 1/16	2½	1 7/16	1 7/16	6-32 x ⅜
	10-2	115	2	4	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5	2¾	2⅜	2⅞	2⅛	1¾	6-32 x ⅜
	10-4	115	4	8	C	3 9/16	2⅜	3 1/16	3⅛	—	#8	2.3	3¼	2¾	2⅞	2½	2	8-32 x ⅜
	10-6	115	6	12	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3	3⅝	3	3¼	2 13/16	2⅛	8-32 x ⅜
	10-8	115	8	16	B	3⅜	3⅛	2 13/16	2 13/16	2½	#8	4.0	3⅝	3⅜	3¼	2 13/16	2⅜	8-32 x ⅜
	10-12	115	12	24	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0	4⅛	3¾	3½	3⅛	2½	10-32 x ½
	10-25	115	25	50	B	4½	3¾	3¾	3¾	2¾	#10	8.7	4¾	5¼	4¼	3¾	4¼	10-32 x ½
	10-50	105, 115, 125	50	100	B	5¼	5½	4⅜	4⅜	3⅝	¼	17.0	5½	7	5½	4⅜	5⅞	¼-20 x ⅝
	10-100	105, 115, 125	100	200	B	6⅜	7¼	5⅝	5 5/16	4⅜	¼	34.5	6¾	8¾	6½	5 5/16	6¼	¼-20 x ⅝
12.8 or 6.4 C.T. Series 0 - 3.2 - 6.4 - 9.6 - 12.8 V Parallel 0 - 3.2 - 6.4 V @ 2 x Current	12.8-0.1	115	0.1	0.2	C	2	1½	1¾	1 23/32	—	#8	0.3	1⅝	1⅝	2 3/16	1 3/16	1 3/16	6-32 x ⅜
	12.8-0.25	115	0.25	0.5	C	2⅜	1½	2	2	—	#8	0.5	1 15/16	1 13/16	2 7/16	1⅜	1¼	6-32 x ⅜
	12.8-0.5	115	0.5	1	C	2⅞	1⅝	2 5/16	2⅜	—	#8	0.8	2 1/16	2 1/16	2½	1 7/16	1 7/16	6-32 x ⅜
	12.8-1	115	1	2	C	2⅞	2	2 5/16	2⅜	—	#8	1.2	2 5/16	2 1/16	2½	1 11/16	1 7/16	6-32 x ⅜
	12.8-2A	115	2	4	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5	2¾	2⅝	2⅞	2⅛	1¾	6-32 x ⅜
	12.8-2	115	2	4	B	3	2½	2½	2½	2	#8	2.3	3¼	2¾	2⅞	2½	2	8-32 x ⅜
	12.8-4	115	4	8	B	3	2⅞	2½	2½	2⅜	#8	2.8	3¼	3⅛	2⅞	2½	2⅜	8-32 x ⅜
	12.8-6	115	6	12	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0	3⅝	3⅜	3¼	2 13/16	2⅜	8-32 x ⅜
	12.8-8	115	8	16	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5	4⅛	3½	3½	3⅛	2¼	10-32 x ½
	12.8-12	115	12	24	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	6.0	4½	3¾	3⅞	3 7/16	2⅜	10-32 x ½
	12.8-25	115	25	50	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.5	5½	5¾	5¼	4⅜	4⅝	¼-20 x ⅝
	12.8-50	105, 115, 125	50	100	B	5¼	6	4⅜	4⅜	4⅛	¼	20.7	5½	7½	5½	4⅜	6⅜	¼-20 x ⅝
	12.8-100	105, 115, 125	100	200	B	6⅜	7¼	5⅝	5 5/16	4⅜	¼	34.5	6¾	8¾	6½	5 5/16	6¼	6-20 x ⅝
16 or 8 V C.T. Series 0 - 4 - 8 - 12 - 16 V Parallel 0 - 4 - 8 @ 2 x Current	16-0.1	115	0.1	0.2	C	2	1⅝	1¾	1 23/32	—	#8	0.4	1⅝	1⅝	2 3/16	1 3/16	1 3/16	6-32 x ⅜
	16-0.25	115	0.25	0.5	C	2⅜	1¾	2	2	—	#8	0.7	1 15/16	1 3/16	2 7/16	1⅜	1¼	6-32 x ⅜
	16-0.5	115	0.5	1	C	2⅞	1⅝	2 5/16	2⅜	—	#8	0.8	2 1/16	2 1/16	2½	1 7/16	1 7/16	6-32 x ⅜
	16-1	115	1	2	C	2⅞	2	2 5/16	2⅜	—	#8	1.2	2 5/16	2 1/16	2½	1 11/16	1 7/16	6-32 x ⅜
	16-2	115	2	4	C	3⅛	2¼	2¾	2 13/16	—	#8	1.7	2¾	2⅜	2⅞	2⅛	1¾	6-32 x ⅜
	16-4	115	4	8	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3	3⅝	3	3¼	2 13/16	2⅛	8-32 x ⅜
	16-6	115	6	12	B	3¾	3⅛	3⅛	3⅛	2¼	#10	4.5	4⅛	3½	3½	3⅛	2¼	10-32 x ½
	16-8	115	8	16	B	3¾	3½	3⅛	3⅛	2⅝	#10	5.4	4⅛	3¾	3½	3⅛	2½	10-32 x ½
	16-12	115	12	24	B	4⅛	3⅞	3⅝	3 7/16	3	#10	7.9	4½	4½	3⅞	3 7/16	3	10-32 x ½
	16-25	115	25	50	B	4½	5⅜	4	3¾	4	#10	14.5	4¾	6½	4¼	3¾	5½	10-32 x ½
	16-50	105, 115, 125	50	100	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5	6¾	6⅝	6	5 5/16	5⅛	¼-20 x ⅝
	16-100	105, 115, 125	100	200	B	7½	7½	6⅜	6¾	4⅝	¼	50.0	8	8½	7	6¾	7¼	¼-20 x ⅝
24 or 12 C.T. Series 0 - 6 - 12 - 18 - 24 V Parallel 0 - 6 - 12 V @ 2 x Current	24-0.1	115	0.1	0.2	C	2⅜	1½	2	2	—	#8	0.5	1 15/16	1 13/16	2 7/16	1⅜	1¼	6-32 x ⅜
	24-0.25	115	0.25	0.5	C	2⅞	1¾	2 5/16	2⅜	—	#8	1.0	2 1/16	2 1/16	2½	1 7/16	1 7/16	6-32 x ⅜
	24-0.5	115	0.5	1	C	2⅞	2	2 5/16	2⅜	—	#8	1.2	2 5/16	2 1/16	2½	1 11/16	1 7/16	6-32 x ⅜
	24-1A	115	1	2	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5	2¾	2⅜	2⅞	2⅛	1¾	6-32 x ⅜
	24-1	115	1	2	B	3	2½	2½	2½	2	#8	2.3	3¼	2¾	2⅞	2½	2	8-32 x ⅜
	24-2	115	2	4	B	3	2⅞	2½	2½	2⅜	#8	2.9	3¼	3⅛	2⅞	2½	2⅜	8-32 x ⅜
	24-4	115	4	8	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5	4⅛	3½	3½	3⅛	2¼	10-32 x ½
	24-6	115	6	12	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	5.8	4½	3¾	3⅞	3 7/16	2⅜	10-32 x ½
	24-8	115	8	16	B	4⅛	3⅞	3⅝	3 7/16	3	#10	7.9	4½	4½	3⅞	3 7/16	3	10-32 x ½
	24-12	105, 115, 125	12	24	B	4½	4½	3¾	3¾	3⅜	#10	11.0	4¾	5⅜	4¼	3¾	4⅜	10-32 x ½
	24-20	105, 115, 125	20	40	B	5¼	4¾	4⅜	4⅜	3⅜	¼	15.3	5½	5½	5¼	4⅜	3½	¼-20 x ⅝
	24-25	105, 115, 125	25	50	B	5¼	5⅝	4⅜	4⅜	4⅛	¼	19.5	5½	6½	5¼	4⅜	5⅜	¼-20 x ⅝
	24-50	105, 115, 125	50	100	B	6⅜	6¼	5⅜	5 5/16	4⅜	¼	31.3	6¾	7½	6	5 5/16	6	¼-20 x ⅝
	24-100	115/230	100	200	B	7½	7	6⅜	6¾	4⅛	¼	43	8	8	7	6¾	6¾	¼-20 x ⅝
36 or 18 V C.T. Series 0 - 9 - 18 - 27 - 36 V Parallel 0 - 9 - 18 V @ 2 x Current	36-0.1	115	0.1	0.2	C	2⅜	1⅝	2	2	—	#8	0.5	1 15/16	1 13/16	2 7/16	1⅜	1¼	6-32 x ⅜
	36-0.25	115	0.25	0.5	C	2⅞	1⅝	2 5/16	2⅜	—	#8	0.8	2 1/16	2 1/16	2½	1 7/16	1 7/16	6-32 x ⅜
	36-0.5	115	0.5	1	C	3⅛	2	2¾	2 13/16	—	#8	1.3	2¾	2⅜	2⅞	2⅛	1¾	6-32 x ⅜
	36-1A	115	1	2	C	3 9/16	2⅜	3 1/16	3⅛	—	#8	2.3	3¼	2¾	2⅞	2½	2	8-32 x ⅜
	36-1	115	1	2	B	3	2¾	2½	2½	2¼	#8	2.6	3¼	3⅛	2⅞	2½	2⅜	8-32 x ⅜
	36-2	115	2	4	B	3⅜	2 13/16	2 13/16	2 13/16	2⅜	#8	3.8	3⅝	3⅜	3¼	2 13/16	2⅜	8-32 x ⅜
	36-4	115	4	8	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8	4½	3¾	3⅞	3 7/16	2⅜	10-32 x ½
	36-6	115	6	12	B	4½	3¾	3¾	3¾	2¾	#10	8.7	4¾	4¼	4¼	3¾	2⅞	10-32 x ½
	36-8	105, 115, 125	8	16	B	4½	4½	4⅛	3¾	3⅜	#10	11.0	4¾	5	4⅜	3¾	3⅜	10-32 x ½
	36-12	105, 115, 125	12	24	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0	5½	5½	5¼	4⅜	3½	¼-20 x ⅝
	36-20	105, 115, 125	20	40	B	6⅜	5⅜	5 5/16	5 5/16	3⅜	¼	22.8	6¾	5¾	5¾	5 5/16	4¼	¼-20 x ⅝
	36-25	105, 115, 125	25	50	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5	6¾	6⅝	6	5 5/16	5⅛	¼-20 x ⅝
	36-30	105, 115, 125	30	60	B	6⅜	6	5 5/16	5 5/16	4⅜	¼	31.5	6¾	7½	6	5 5/16	6	¼-20 x ⅝
	36-50	115/230	50	100	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	40.0	6¾	8	6	5 5/16	6½	¼-20 x ⅝
	36-100	115/230	100	200	B	7½	9	6¼	6¾	5 7/16	¼	63.5	8	10	7	6¾	8¾	¼-20 x ⅝
56 or 28 V C.T. Series 0 - 14 - 28 - 42 - 56 V Parallel 0 - 14 - 28 V @ 2 x Current	56-0.1	115	0.1	0.2	C	2⅜	1¾	2	2	—	#8	.8	1 15/16	1 13/16	2 7/16	1⅜	1¼	6-32 x ⅜
	56-0.25	115	0.25	0.5	C	2⅞	2	2 5/16	2⅜	—	#8	1.2	2 5/16	2 1/16	2½	1 11/16	1 7/16	6-32 x ⅜
	56-0.5	115	0.5	1	C	3⅛	2¼	2¾	2 13/16	—	#8	1.7	2¾	2⅜	2⅞	2⅛	1¾	6-32 x ⅜
	56-1	115	1	2	B	3⅜	2⅞	2 13/16	2 13/16	2¼	#8	3.5	3⅝	3⅜	3¼	2 13/16	2⅜	8-32 x ⅜
	56-2	115	2	4	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0	4⅛	3¾	3½	3⅛	2½	10-32 x ½
	56-4	115	4	8	B	4⅛	3¾	3 7/16	3 7/16	3	#10	7.7	4½	4½	3⅞	3 7/16	3	10-32 x ½
	56-6	115	6	12	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.0	5½	4¾	5	4⅜	3	¼-20 x ⅝
	56-8	105, 115, 125	8	16	B	5¼	5	4⅜	4⅜	3⅝	¼	17.0	5½	5½	5¼	4⅜	3½	¼-20 x ⅝
	56-12	105, 115, 125	12	24	B	6⅜	5¼	5 5/16	5 5/16	3⅜	¼	22.0	6¾	5¾	5¾	5 5/16	4¼	¼-20 x ⅝
	56-25	105, 115, 125	25	50	B	6⅜	7⅛	5 5/16	5 5/16	5⅛	¼	38.0	6¾	8	6	5 5/16	6½	¼-20 x ⅝
	56-50	115/230	50	100	B	7½	7½	6¼	6¾	4⅞	¼	56.3	8	8½	7	6¾	7¼	¼-20 x ⅝
	56-100	115/230	100	200	B	7½	11¼	6¼	6¾	8¼	¼	95.0	8	13	7	6¾	11¾	¼-20 x ⅝



PARALLEL CONNECTED SECONDARIES

SERIES CONNECTED SECONDARIES



All transformers are designed conservatively for a max of 45°C rise above ambient, for use on 115V power line from 50-500 cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers and chokes are rugged in construction, well-insulated, and have a consistently uniform appearance. All ratings are at full load current continuous operation.

Electrical ratings have been chosen to cover a wide range of applications. All transformers have two center-tapped secondary windings.

SIGNAL TRANSFORMER CO., INC

FACTORY: 1 JUNIUS STREET, BROOKLYN, NEW YORK 11212 — (212) 498-5111

HIGH & LOW CURRENT TRANSFORMERS

OPEN FRAME • EPOXY ENCAPSULATED (GRADE 5) • HERMETICALLY SEALED (GRADE 4)

0.1 to 200 Amps
2.5 to 300 Volts

IDEAL FOR USE IN SINGLE OR DUAL DC POWER SUPPLIES

SECONDARY VOLTS	Part No.	Primary Volts	SECONDARY AMPS Series	SECONDARY AMPS Parallel	OPEN FRAME OR EPOXY ENCAPSULATED* Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.	HERMETICALLY SEALED IN STEEL CASE‡ L	W	H	ML	MW	Mtg. Stud
68 or 34 C.T. Series 0 - 17 - 34 - 51 - 68 V Parallel 0 - 17 - 34 V @ 2 x Current	68-0.1	115	0.1	0.2	C	2 7/8	1 5/8	2 5/16	2 3/8	—	#8	0.8	2 1/16	2 1/16	2 1/2	1 7/16	1 7/16	6-32 x 3/8
	68-0.25	115	0.25	0.5	C	2 7/8	2	2 5/16	2 3/8	—	#8	1.2	2 5/16	2 1/16	2 1/2	1 11/16	1 7/16	6-32 x 3/8
	68-0.5A	115	0.5	1	C	3 1/8	2 1/4	2 3/4	2 13/16	—	#8	1.7	2 3/4	2 3/8	2 7/8	2 1/8	1 3/4	6-32 x 3/8
	68-0.5	115	0.5	1	B	3	2 3/4	2 1/2	2 1/2	2 1/4	#8	2.7	3 1/4	3 1/8	2 7/8	2 1/2	2 3/8	8-32 x 3/8
	68-1	115	1	2	B	3 3/8	2 15/16	2 13/16	2 13/16	2 3/8	#8	3.8	3 5/8	3 3/8	3 1/4	2 13/16	2 3/8	8-32 x 3/8
	68-2	115	2	4	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8	4 1/2	3 3/4	3 7/8	3 7/16	2 3/8	10-32 x 1/2
	68-4	115	4	8	B	4 1/2	4 1/2	4 1/8	3 3/4	3 3/8	#10	11.5	4 3/4	5	4 3/8	3 3/4	3 3/8	10-32 x 1/2
	68-6	105, 115, 125	6	12	B	5 1/4	5	4 3/8	4 3/8	3 3/8	1/4	15.0	5 1/2	5 1/2	5 1/4	4 3/8	3 1/2	1/4-20 x 5/8
	68-8	105, 115, 125	8	16	B	5 1/4	5 1/2	4 3/8	4 3/8	3 7/8	1/4	19.0	5 1/2	6	5	4 3/8	3 7/8	1/4-20 x 5/8
	68-12	105, 115, 125	12	24	B	6 3/8	5 3/4	5 5/16	5 5/16	3 3/4	1/4	26.5	6 3/4	6 5/8	6	5 5/16	5 1/8	1/4-20 x 5/8
	68-25	115/230	25	50	B	6 3/8	7 1/4	5 5/16	5 5/16	5 1/8	1/4	39.7	6 3/4	8	6	5 5/16	6 1/2	1/4-20 x 5/8
	68-50	115/230	50	100	B	7 1/2	9	6 1/4	6 3/4	5 7/16	1/4	58.5	8	10	7	6 3/4	8 3/4	1/4-20 x 5/8
80 or 40 C.T. Series 0 - 20 - 40 - 60 - 80 V Parallel 0 - 20 - 40 V @ 2 x Current	80-0.1	115	0.1	0.2	C	2 7/8	1 5/8	2 5/16	2 3/8	—	#8	0.8	2 1/16	2 1/16	2 1/2	1 7/16	1 7/16	6-32 x 3/8
	80-0.25	115	0.25	0.5	C	3 1/8	2	2 3/4	2 13/16	—	#8	1.3	2 3/4	2 3/8	2 7/8	2 1/8	1 3/4	6-32 x 3/8
	80-0.5A	115	0.5	1	C	3 5/16	2 3/8	3 1/16	3 1/8	—	#8	2.2	3 1/4	2 3/4	2 7/8	2 1/2	2	8-32 x 3/8
	80-0.5	115	0.5	1	B	3	2 3/4	2 1/2	2 1/2	2 1/4	#8	2.8	3 1/4	3 1/8	2 7/8	2 1/2	2 3/8	8-32 x 3/8
	80-1	115	1	2	B	3 3/8	3 1/16	2 13/16	2 13/16	2 1/2	#8	4.0	3 5/8	3 3/8	3 1/4	2 13/16	2 3/8	8-32 x 3/8
	80-2	115	2	4	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8	4 1/2	3 3/4	3 7/8	3 7/16	2 3/8	10-32 x 1/2
	80-4	115	4	8	B	5 1/4	4 1/4	4 3/8	4 3/8	2 7/8	1/4	12.3	5 1/2	4 3/4	5	4 3/8	3	1/4-20 x 5/8
	80-6	105, 115, 125	6	12	B	5 1/4	5 1/2	4 5/8	4 3/8	3 7/8	1/4	19.0	5 1/2	6	5	4 3/8	3 7/8	1/4-20 x 5/8
	80-8	105, 115, 125	8	16	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	20.5	6 3/4	5 3/4	5 3/4	5 5/16	4 1/4	1/4-20 x 5/8
	80-12	105, 115, 125	12	24	B	6 3/8	6	5 5/16	5 5/16	4 1/8	1/4	29.0	6 3/4	6 5/8	6	6 5/16	5 1/8	1/4-20 x 5/8
	80-25	115/230	25	50	B	7 1/2	6 1/2	6 1/4	6 3/4	3 7/8	1/4	40.3	8	7	7	6 3/4	6 3/4	1/4-20 x 5/8
	80-50	115/230	50	100	B	7 1/2	9	6 1/4	6 3/4	6 1/2	1/4	78.0	8	10	7	6 3/4	8 3/4	1/4-20 x 5/8
88 or 44 C.T. Series 0 - 22 - 44 - 66 - 88 V Parallel 0 - 22 - 44 V @ 2 x Current	88-0.1	115	0.1	0.2	C	2 7/8	1 3/4	2 5/16	2 3/8	—	#8	1.0	2 1/16	2 1/16	2 1/2	1 7/16	1 7/16	6-32 x 3/8
	88-0.25	115	0.25	0.5	C	3 1/8	2 1/8	2 3/4	2 13/16	—	#8	1.5	2 3/4	2 3/8	2 7/8	2 1/8	1 3/4	6-32 x 3/8
	88-0.5	115	0.5	1	C	3 5/16	2 3/8	3 1/16	3 1/8	—	#8	2.2	3 1/4	2 3/4	2 7/8	2 1/2	2	8-32 x 3/8
	88-1	115	1	2	B	3 3/4	3	3 1/8	3 1/8	2 1/4	#8	4.5	4 1/8	3 1/2	3 1/2	3 1/8	2 1/4	10-32 x 1/2
	88-2	115	2	4	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8	4 1/2	3 3/4	3 7/8	3 7/16	2 3/8	10-32 x 1/2
	88-4	115	4	8	B	5 1/4	4 1/2	4 3/8	4 3/8	3 1/8	1/4	13.4	5 1/2	4 3/4	5	4 3/8	3	1/4-20 x 5/8
	88-6	105, 115, 125	6	12	B	5 1/4	5 1/2	4 3/8	4 3/8	3 7/8	1/4	19.0	5 1/2	6	5	4 3/8	3 7/8	1/4-20 x 5/8
	88-8	105, 115, 125	8	16	B	6 3/8	5 3/8	5 5/16	5 5/16	3 3/8	1/4	22.8	6 3/4	5 3/4	5 3/4	5 5/16	4 1/4	1/4-20 x 5/8
	88-12	105, 115, 125	12	24	B	6 3/8	6 1/2	5 5/16	5 5/16	4 5/8	1/4	35.0	6 3/4	7	5 3/4	5 5/16	5 1/2	1/4-20 x 5/8
	88-25	115/230	25	50	B	7 1/2	8	6 1/4	6 3/4	5 5/8	1/4	62.0	8	10	7	6 3/4	8 3/4	1/4-20 x 5/8
	88-50	115/230	50	100	B	7 1/2	11	6 1/4	6 3/4	8 5/8	1/4	100.0	8	13	7	6 3/4	11 3/4	1/4-20 x 5/8
120 or 60 C.T. Series 0 - 30 - 60 - 90 - 120 V Parallel 0 - 30 - 60 V @ 2 x Current	120-0.5	115	0.5	1.0	B	3 3/8	2 7/8	2 13/16	2 13/16	2 1/4	#8	3.2	3 5/8	3 3/8	3 1/4	2 13/16	2 3/8	8-32 x 3/8
	120-1	115	1	2	B	3 3/4	3 3/8	3 1/8	3 1/8	2 3/4	#8	5.8	4 1/8	4	3 1/2	3 1/8	2 7/8	10-32 x 1/2
	120-2	115	2	4	B	4 1/2	3 3/4	3 3/4	3 3/4	2 3/4	#10	8.5	4 3/4	4 1/4	4 1/4	3 3/4	2 7/8	10-32 x 1/2
	120-4	115	4	8	B	5 1/4	5 1/2	4 3/8	4 3/8	3 7/8	1/4	17.0	5 1/2	6	5	4 3/8	3 7/8	1/4-20 x 5/8
	120-6	105, 115, 125	6	12	B	6 3/8	6	5 5/16	5 5/16	3 7/8	1/4	27.0	6 3/4	6 5/8	6	5 5/16	5 1/8	1/4-20 x 5/8
	120-8	105, 115, 125	8	16	B	6 3/8	6 1/2	5 5/16	5 5/16	4 5/8	1/4	34.0	6 3/4	7	5 3/4	5 5/16	5 1/2	1/4-20 x 5/8
	120-12	105, 115, 125	12	24	B	6 3/8	7 1/4	5 5/16	5 5/16	5 3/8	1/4	42.0	6 3/4	8	6	5 5/16	6 1/2	1/4-20 x 5/8
	120-20	105, 115, 125	20	40	B	7 1/2	8	6 1/4	6 3/4	5 3/8	1/4	57.0	8	9	7	6 3/4	7 3/4	1/4-20 x 5/8
160 or 80 C.T. Series 0 - 40 - 80 - 120 - 160 V Parallel 0 - 40 - 80 V @ 2 x Current	160-0.5	115	0.5	1	B	3 3/8	3 1/16	2 13/16	2 13/16	2 1/2	#8	4.0	3 5/8	3 3/8	3 1/4	2 13/16	2 3/8	8-32 x 3/8
	160-1	115	1	2	B	4 1/8	3 5/8	3 7/16	3 7/16	2 5/8	#10	6.5	4 1/2	3 3/4	3 7/8	3 7/16	2 3/8	10-32 x 1/2
	160-2	115	4	8	B	4 1/2	4 3/8	3 3/4	3 3/4	3 3/8	#10	11.0	4 3/4	5	4 3/8	3 3/4	3 3/8	10-32 x 1/2
	160-4	105, 115, 125	4	8	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0	6 3/4	5 3/4	5 3/4	5 5/16	4 1/4	1/4-20 x 5/8
	160-8	105, 115, 125	8	16	B	6 3/8	6 3/4	5 5/16	5 5/16	4 7/8	1/4	36.0	6 3/4	7 1/2	6	5 5/16	6	1/4-20 x 5/8
	160-12	115/230	12	24	B	7 1/2	6 1/2	6 1/4	6 3/4	3 7/8	1/4	39.8	8	8	7	6 3/4	6 3/4	1/4-20 x 5/8
180 or 90 C.T. Series 0 - 45 - 90 - 135 - 180 V Parallel 0 - 45 - 90 @ 2 x Current	180-0.5	115	0.5	1	B	3 3/4	3 3/8	3 1/8	3 1/8	2 3/4	#8	5.8	4 1/8	4	3 1/2	3 1/8	2 3/8	10-32 x 1/2
	180-1	115	1	2	B	4 1/8	3 7/8	3 5/8	3 7/16	3	#10	8.2	4 1/2	4 1/2	3 7/8	3 7/16	3	10-32 x 1/2
	180-2	115	2	4	B	5 1/4	5	4 3/8	4 3/8	3 5/8	1/4	15.8	5 1/2	5 1/2	5 1/4	4 3/8	3 1/2	1/4-20 x 5/8
	180-4	115	4	8	B	6 3/8	5 3/4	5 5/16	5 5/16	3 3/4	1/4	27.0	6 3/4	6 5/8	6	5 5/16	5 1/8	1/4-20 x 5/8
	180-6	105, 115, 125	6	12	B	6 3/8	7 1/4	5 5/16	5 5/16	5 1/8	1/4	37.0	6 3/4	8	6	5 5/16	6 1/2	1/4-20 x 5/8
	180-8	105, 115, 125	8	16	B	6 3/8	7 3/4	5 5/16	5 5/16	5 5/8	1/4	42.0	6 3/4	8	6	5 5/16	6 1/2	1/4-20 x 5/8
	180-12	105, 115, 125	12	24	B	7 1/2	8 1/4	6 1/4	6 3/4	5 5/8	1/4	62.0	8	9	7	6 3/4	7 3/4	1/4-20 x 5/8
230 or 115 C.T. Series 0-57 1/2-115-172 1/2-230 V Parallel 57 1/2 - 115 V @ 2 x Current	230-0.5	115	0.5	1	B	3 3/4	3 5/8	3 1/8	3 1/8	3	#8	6.5	4 1/8	4	3 1/2	3 1/8	2 7/8	10-32 x 1/2
	230-1	115	1	2	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4	4 3/4	4 1/4	4 1/4	3 3/4	2 7/8	10-32 x 1/2
	230-2	115	2	4	B	5 1/4	4 3/4	4 3/8	4 3/8	3 3/8	1/4	14.5	5 1/2	5 1/2	5 1/4	4 3/8	3 1/2	1/4-20 x 5/8
	230-4	105, 115, 125	4	8	B	6 3/8	6	5 5/16	5 5/16	4 1/8	1/4	28.4	6 3/4	6 3/8	6	5 5/16	5 1/8	1/4-20 x 5/8
	230-6	105, 115, 125	6	12	B	6 3/8	7 1/4	5 5/16	5 5/16	5 1/8	1/4	38.0	6 3/4	8	6	5 5/16	6 1/2	1/4-20 x 5/8
300 or 150 C.T. Series 0-75-150-225-300 V Parallel 0 - 75 - 150 V @ 2 x Current	300-0.5	115	0.5	1	B	4 1/2	3 1/2	3 3/4	3 3/4	2 1/2	#10	7.0	4 3/4	4 1/4	4 1/4	3 3/4	2 7/8	10-32 x 1/2
	300-1	115	1	2	B	5 1/4	4 1/8	4 3/8	4 3/8	3	1/4	12.8	5 1/2	4 3/4	5	4 3/8	3	1/4-20 x 5/8
	300-2	115	2	4	B	5 1/4	5 3/4	4 3/8	4 3/8	4 1/2	1/4	21.0	5 1/2	6 1/4	5	4 3/8	5 1/8	1/4-20 x 5/8
	300-4	105, 115, 125	4	8	B	6 3/8	5 3/4	5 5/16	5 5/16	3 7/8	1/4	27.5	6 3/4	6 3/8	6	5 5/16	5 1/8	1/4-20 x 5/8

AVAILABLE IN 3 STYLES

FOR OPEN FRAME USE PART NUMBERS SHOWN

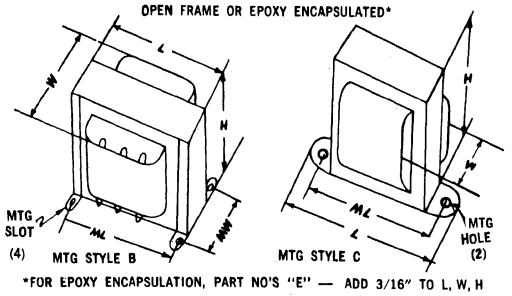
* For epoxy encapsulation add prefix "E-" to Part No., e.g., E-36-1 add 3/16 to L, W, H Dim. Grade 5.
‡ For hermetically sealed units add prefix "H-" to Part No., e.g., H-36-1. Grade 4.

AVAILABLE IN 3 STYLES

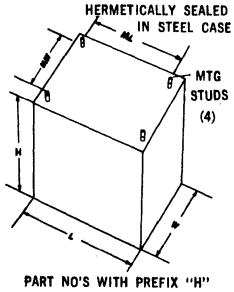
METHOD OF DETERMINING SECONDARY CURRENT RATINGS

RECTIFIER TYPE	FILTER TYPE	RMS SECONDARY CURRENT
Full Wave Center-Tap	Choke Input	.7 × DC amps
Full Wave Center-Tap	Capacitor Input	1.2 × DC amps
Full Wave Bridge	Choke Input	= to DC amps
Full Wave Bridge	Capacitor Input	1.8 × DC Amps

OPEN FRAME OR EPOXY ENCAPSULATED*



HERMETICALLY SEALED IN STEEL CASE



*FOR EPOXY ENCAPSULATION, PART NO'S "E" — ADD 3/16" TO L, W, H

PART NO'S WITH PREFIX "H"

SIGNAL TRANSFORMER CO., INC
ENGINEERS • DESIGNERS • MANUFACTURERS
FACTORY: 1 JUNIUS STREET, BROOKLYN, NEW YORK 11212 — (212) 498-5111

HIGH & LOW CURRENT CHOKES 0.1 to 1000 AMPS

OPEN FRAME • EPOXY ENCAPSULATED (GRADE 5) • HERMETICALLY SEALED (GRADE 4)

Signal's line of High and Low Current Chokes is the most extensive available. It is designed to complement the selection of High and Low Current Transformers so that a set may be specified for power supplies using inductive filters.

The inductance ratings given are minimum values guaranteed at full DC current. All resistance ratings are maximum values.

Special variations or intermediate values of inductance, current, or resistance can be supplied promptly and accurately.

FOR MECHANICAL DIMENSIONS REFER TO TRANSFORMER OUTLINES ON PREVIOUS PAGE

				OPEN FRAME OR EPOXY ENCAPSULATED*								HERMETICALLY SEALED IN STEEL CASE‡					
PART No.	IND. (MHY)	CURR. (Amps)	RES. (Ohms)	MTG. STYLE	L	W	H	ML	MW	MTG. SCREW	APPR. LBS.	L	W	H	ML	MW	MTG. STUD
CH-0.1	1000	0.1	25	C	2	1½	1¾	1 23/32	—	#8	0.3	1⅝	1⅝	2 3/16	1 3/16	1 3/16	6-32 x ⅜
CH-0.2	800	0.2	15	C	2⅜	1⅝	2	2	—	#8	0.7	1 15/16	1 13/16	2 1/16	1⅜	1¼	6-32 x ⅜
CH-0.25	800	0.25	10.0	C	2⅞	1¾	2 5/16	2⅜	—	#8	1.0	2 1/16	2 1/16	2½	1 7/16	1 7/16	6-32 x ⅜
CH-0.5	400	0.5	4.0	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5	2¾	2⅜	2⅞	2⅛	1¾	6-32 x ⅜
CH-1	100	1	1.5	B	3	2½	2½	2½	2	#8	2.3	3¼	2¾	2⅞	2½	2	8-32 x ⅜
CH-2	70	2	0.9	B	3⅜	2¾	2⅞	2 13/16	2⅛	#8	3.2	3⅝	3	3¼	2 13/16	2⅛	8-32 x ⅜
CH-4	70	4	0.6	B	3¾	3⅛	3¼	3⅛	2½	#8	5.3	4⅛	3½	3½	3⅛	2½	8-32 x ⅜
CH-6	40	6	0.4	B	3¾	3⅝	3¼	3⅛	3	#8	6.5	4⅛	4	3½	3⅛	2⅞	8-32 x ⅜
CH-8	30	8	0.3	B	4⅛	3⅝	3½	3 7/16	3	#10	8	4½	4	3⅞	3 7/16	3	10-32 x ½
CH-12	15	12	0.1	B	5¼	4	4 7/16	4⅜	3⅛	#10	13.7	5½	4½	5	4⅜	3⅛	10-32 x ½
CH-16	15	16	.08	B	5¼	4⅝	4 7/16	4⅜	3⅝	#10	17.5	5½	5⅛	5	4⅜	3⅝	10-32 x ½
CH-20	7	20	.05	B	5¼	4	4 7/16	4⅜	3⅛	#10	13.3	5½	4¾	5	4⅜	3⅛	10-32 x ½
CH-25	5	25	.025	B	5¼	4¾	4 7/16	4⅜	3⅞	#10	17.8	5½	5⅜	5	4⅜	3⅞	¼-20 x ⅝
CH-30	4	30	.01	B	6⅜	5	5⅜	5 5/16	3⅜	¼	24.4	6¾	5¼	5⅞	5 5/16	3⅜	¼-20 x ⅝
CH-50	1.4	50	0.01	B	6⅜	5¼	5⅜	5 5/16	3¾	¼	26.7	6¾	5¼	5⅞	5 5/16	3¾	¼-20 x ⅝
CH-100	0.5	100	0.005	B	6⅜	6¼	5⅜	5 5/16	4⅛	¼	31.4	6¾	6⅝	5⅞	5 5/16	4⅛	¼-20 x ⅝
CH-200	0.3	200	0.0025	B	7½	7	6⅜	6¾	4⅛	¼	48.0	NOT AVAILABLE					
CH-500	0.055	500	0.00027	B	7½	6½	6⅜	6¾	4⅛	¼	50.0	NOT AVAILABLE					
CH-1000	0.015	1,000	0.000065	B	7½	6½	6¾	6¾	4⅜	¼	70.0	NOT AVAILABLE					

AVAILABLE IN 3 STYLES

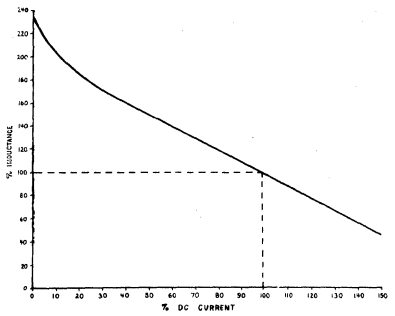
FOR OPEN FRAME USE PART NUMBERS SHOWN

* For epoxy encapsulation add prefix "E-" to Part No., e.g., E-CH-1 add 3/16 to L, W, H W, H Dim. Grade 5.

‡ For hermetically sealed units add prefix "H" to Part No., e.g., H-CH-1, Grade 4.

AVAILABLE IN 3 STYLES

INDUCTANCE VARIATION WITH DC CURRENT



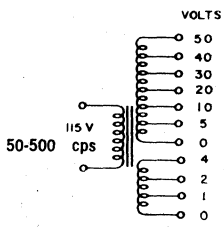
The curve shown applies to the whole line of chokes. It allows the user to determine the value of inductance which will be obtained at intermediate and overload values of DC current. The values on the curve are stated in generalized coordinates of % inductance versus % DC current.

For example, the CH-100 at 50 amperes (50% DC Current) will have an inductance of 0.75 MHY (150% of rating, the CH-25 at 31 amperes (125% DC current) will have an inductance of 3.5 MHY (70% of rating).

It is not recommended that chokes be used at over 100% of rated current since temperature rise will then be excessive. However, if load current is intermittent, and RMS current is less than maximum rated current, it is permissible.

Special "swinging chokes" can be supplied where the slope of this characteristic is emphasized. Specify minimum inductance required at two current values (usually maximum and minimum current) and we will furnish prompt quotations.

MULTI-VOLT 1 to 54 VOLTS in 1 VOLT STEPS



"MV" LINE

MV (multi-voltage) secondaries may be series connected for any output from 1 to 54 volts, in 1 volt steps, at rated current. This is accomplished by using the small buck-boost secondary.

Part No.	Secondary Amps.	DIMENSIONS L	W	H	ML	MW	Appr. Wt.
MV-1	1	3⅜	2¾	2 13/16	2 13/16	2⅛	3.2
MV-2	2	3¾	3⅛	3⅛	3⅛	2⅜	5.0
MV-4	4	4½	3⅝	3¾	3¾	2½	7.5
MV-6	6	5¼	4	4⅜	4⅜	2⅞	12
M-12	12	5¼	6	4⅜	4⅜	4⅝	23

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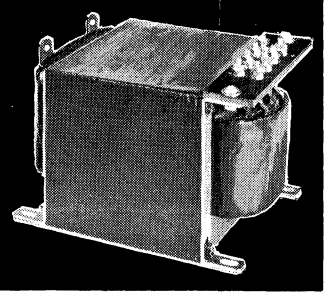
VERY HIGH CURRENT

TRANSFORMERS & CHOKES

500 to 1400 AMPERES

NEVER AVAILABLE BEFORE

STOCKED FOR SAME DAY SHIPMENT

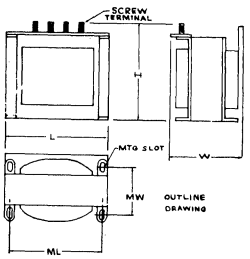


TRANSFORMERS

Part No.	Secondary Volts	Secondary Amps. Nominal (45°C rise)	Secondary Amps. Max. (100°C rise)	Dimensions L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.
6-500	6	500	700	7½	6	7¼	6¾	4⁹⁄₁₆	¼	40
9-500	9	500	700	7½	7½	7¼	6¾	6⅛	¼	60
12-500	12	500	700	7½	9	7¼	6¾	7⁹⁄₁₆	¼	80
3-1000	3	1000	1400	7½	6	7¼	6¾	4⁹⁄₁₆	¼	40
6-1000	6	1000	1400	7½	9	7¼	6¾	7⁹⁄₁₆	¼	80

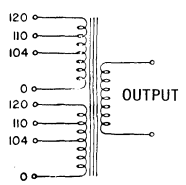
CHOKES

Part No.	Inductance (Milli-hy)	Current (Amperes)	Resis. (Ohms)	L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.
CH-500	.055	500	.00027	7½	6½	6¼	6¾	4⅛	¼	50
CH-1000	.015	1000	.000065	7½	7½	6¼	6¾	5⅛	¼	70

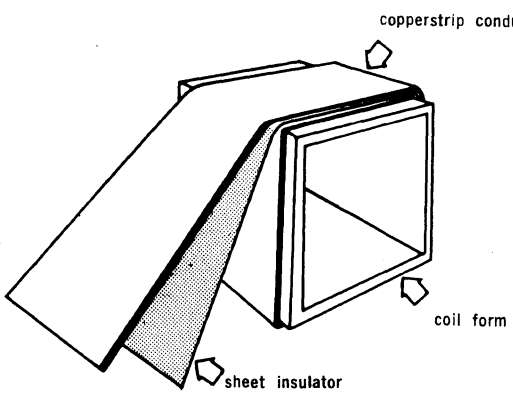


As shown on the schematic diagram dual primaries are provided. This permits parallel connection for 104, 110, or 120 volts or series connection for 208, 214, 220, 230, and 240 volts. Frequency range is 50 to 500 cps.

It is important to note that primary taps may be used to adjust the secondary voltages. Line voltages up to 125V (parallel) or 250V (series) may be used on the lowest primary tap. Nickel plated screw terminals are provided on a heavy phenolic board for easy primary connections.



WINDINGS OF HEAVY COPPER STRIP



STRIP-WOUND SECONDARIES

At the heavy current used in this line it becomes practical and desirable to use wide copper strip (as wide as the coil itself) for windings. Besides the obvious advantages of excellent winding space factor, the heat dissipation of the coil is improved. This improvement is due to the fact that the heat generated in the windings has a pure copper path to the coil ends, where it can be dissipated. In conventional windings of many turns per layer this heat flow is impeded by wire insulation and air spaces between turns. Therefore, the use of copper strip windings yields a dramatic reduction in size and weight.

GRAIN-ORIENTED STEEL CORE

These cores permit the use of higher peak flux densities for the same core loss. This results in a lower number of turns required and therefore, a smaller, more compact transformer.

CLASS F INSULATION USED THROUGHOUT

Class F insulation is rated for unlimited life at a total temperature of 155°C (ambient plus temperature rise).

Class A insulation has a maximum temperature rating of 105°C. The "nominal" current ratings given to this series are for a temperature rise of 45°C above 55°C ambient (Class A). Since Class F insulation is used it is permissible to increase these ratings by 40% (700 and 1400 amperes) without reducing the reliability of the transformer. The temperature rise will be 100°C over a 55°C ambient. The only limitation is not the transformer, but the temperature rating of surrounding components which may be affected by the additional heat radiated by the transformer.

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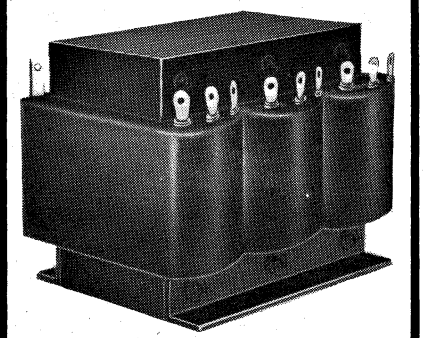
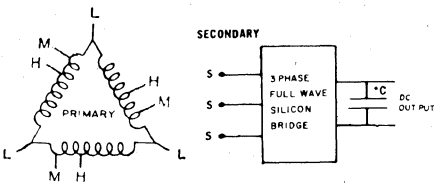
3 PHASE HIGH CURRENT RECTIFIER TRANSFORMERS

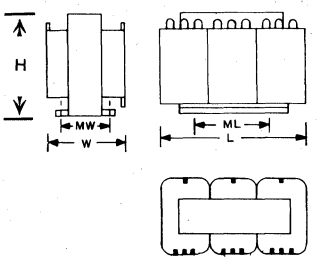


SCHEMATIC DIAGRAM



*C — Optional, no capacitor will give DC output shown at approx. 5% ripple.

MECHANICAL DIMENSIONS



DC OUTPUT VOLTAGE

PART NO.	PRI TAP "L" SUPPLY VOLTAGE 208	PRI TAP "L" SUPPLY VOLTAGE 220	PRI TAP "M" SUPPLY VOLTAGE 208	PRI TAP "M" SUPPLY VOLTAGE 220	PRI TAP "H" SUPPLY VOLTAGE 208	PRI TAP "H" SUPPLY VOLTAGE 220	DC RATED AMPS	APPROX. DIMENSIONS L	W	H	ML	MW	APX. LBS.
3PH 24-50	24	25	26	27.5	28	30	50	7¾	6	5½	4.8	4⅞	35
3PH 24-100	24	25	26	27.5	28	30	100	11½	5	8¼	7.2	4	42
3PH 24-200	24	25	26	27.5	28	30	200	11½	8⅝	8¼	7.2	6¼	90
3PH 48-30	42	44	47	50	52	55	30	7¾	6	5½	4.8	4⅞	35
3PH 48-60	42	44	47	50	52	55	60	11½	5	8¼	7.2	4	42
3PH 48-120	42	44	47	50	52	55	120	11½	8⅝	8¼	7.2	6¼	90

At higher power loads (above 2-3 KVA) it becomes inefficient to use single phase 115 or 230 volt standard lines. With this in mind, our engineering staff has developed a line of 3 phase transformers for use off 208 or 220V 3 phase power lines. These offer the significantly higher conversion efficiency and lighter power line drain of 3 phase systems.

Since the principal application of these items is in high power dc power supplies, output ratings are given in dc voltage and current assuming the use of a 3 phase full wave rectifier.

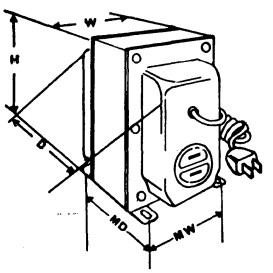
AUTO TRANSFORMERS

STEP-DOWN 230 TO 115 V
"SD" SERIES — LINE CORD & RECEPTACLE

VA Rating	Part No.	W	D	H	MW	MD	Mtg. Screw	Appr. Lbs.
100	SD-100	2⅝	2⅞	3⅛	2	1 13/16	#8	2.3
150	SD-150	2⅝	3½	3⅛	2	2 1/16	#8	3.6
250	SD-250	3⅞	3½	4⅝	3	2⅜	#8	6.2
350	SD-350	3⅞	4¼	4⅝	3	3 1/16	#8	8.3
500	SD-500	3⅞	4¾	4⅝	3	3 5/16	#8	10.5
750	SD-750	4⅝	5⅜	5⅜	3½	3¾	¼	14.5
1000	SD-1000	4⅝	5⅞	5⅜	3½	4¼	¼	18
1500	SD-1500	4⅝	6⅝	5⅜	3½	5	¼	22
2000	SD-2000	4⅝	7⅛	5⅜	3½	5½	¼	26

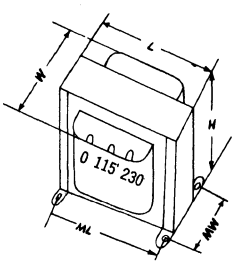
(100-2000 VA)
TYPE SD

Low Regulation • Fully encased — Black Wrinkle Finish • 45°C Temperature Rise • U/L Approved 2 prong line cord and receptacle.



STEP-UP OR DOWN 115/230 OR 230/115 V
"SDO" SERIES — OPEN FRAME • SOLDER LUGS

VA Rating	Part No.	L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.
100	SDO-100	3	2½	2½	2½	2⅛	#8	2.3
150	SDO-150	3	3¼	2½	2½	2¾	#8	3.6
250	SDO-250	4½	2¾	3¾	3¾	2	#10	6.2
350	SDO-350	4½	3¾	3¾	3¾	2¾	#10	8.3
500	SDO-500	4½	4¼	3¾	3¾	3¼	#10	10.5
750	SDO-750	5¼	4½	4⅜	4⅜	3⅜	¼	14.5
1000	SDO-1000	5¼	5	4⅜	4⅜	3⅞	¼	18
1500	SDO-1500	5¼	5¾	4⅜	4⅜	4⅝	¼	22
2000	SDO-2000	5¼	6¼	4⅜	4⅜	5⅛	¼	26



TYPE SDO

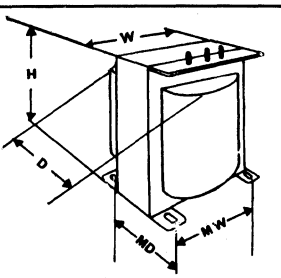
Same Electrically as Type SD. Open Frame • Black Enamel Finish • Solder Lugs • Inexpensive Version for Use in Equipment.

STEP-UP OR DOWN 115/230 OR 230/115
"HSD" SERIES
RUGGED • HEAVY DUTY • PHENOLIC TERMINAL BOARDS

VA Rating	Part No.	W	D	H	MW	MD	Mtg. Screw	Appr. Lbs.
3000	HSD-3000	7½	6	6¾	6¾	4⅛	¼	40
4000	HSD-4000	7½	6½	6¾	6¾	4⅝	¼	46
5000	HSD-5000	7½	7	6¾	6¾	5⅛	¼	52
6000	HSD-6000	7½	8	6¾	6¾	6⅛	¼	65

(3000-6000 VA)
TYPE HSD

Very low Regulation • 45°C Temperature Rise • Black High Gloss Enamel Fnish • Screw type terminals on phenolic board.



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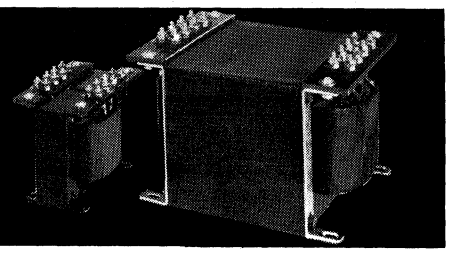
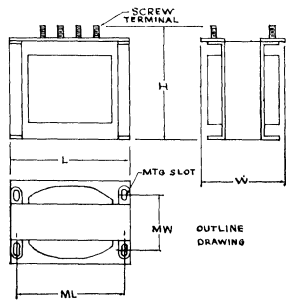
INDUSTRIAL GRADE
STEP-UP OR STEP-DOWN
POWER ISOLATION OR AUTO-TRANSFORMERS
HIGH DEGREE OF VERSATILITY OFFERS MANY POSSIBLE VOLTAGE RATINGS



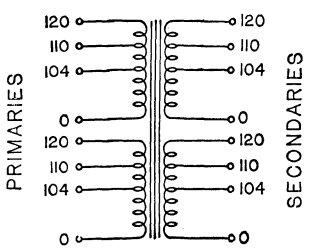
AVAILABLE FROM STOCK FOR IMMEDIATE SHIPMENT

The "DU" and "UP" lines are designed for a maximum of 55°C rise above ambient, for use on standard power lines from 50 to 500 Cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers are rugged in construction, well-insulated, and have a consistently uniform appearance. All ratings are at full load current, continuous operation.

Heavy ¼ inch phenolic terminal boards are provided with plated brass screws and flat washers. Connections can be easily made with a nut driver. It is also simple to alter the inter-connections to change transformer ratings.



"DU SERIES" 110/220 Dual Primary To 110/220 Dual Sec.

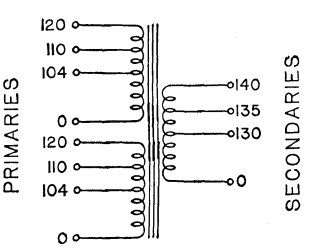


As shown on the schematic diagram the "DU" line is designed with dual primaries and secondaries. All four windings are identically rated at 0/104/110/120 volts. This permits series or parallel connections on either primary or secondary. Therefore, a nominal 110 to 110 volt, 220 to 220 volt, 110 to 220 volt, or 220 to 110 volt transformer can be set up. The winding taps permit intermediate series ratings such as 208, 214, or 230 volts.

It is also possible to make auto-transformer connections by connecting a primary group in series with a secondary group. Such nominal ratings as 440 to 220 volts or 220 to 440 volts can be set-up, in addition to the standard ratings described above. A further advantage to auto-transformer connection is the fact that the KVA rating of a particular type is **doubled.**

Part No.	KVA	Series Secondaries Volts	Max. Amps	Parallel Secondaries Volts	Max. Amps	Mechanical Dimensions L (Max.)	W (Max.)	H (Max.)	ML ± 1/32	MW ± 1/16	Mtg. Screw	Appr. Lbs.
DU-¼	¼	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4¼	5¼	4⅜	2½	#10	12
DU-½	½	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
DU-1	1	0/208/220/240	4.5	0/104/110/120	9	7 9/16	6¼	7¼	6¾	4⅛	¼	33
DU-2	2	0/208/220/240	9	0/104/110/120	18	7 9/16	8¼	7¼	6¾	6	¼	56
DU-3	3	0/208/220/240	14	0/104/110/120	28	7 9/16	9¼	7¼	6¾	7	¼	70
DU-5	5	0/208/220/240	23	0/104/110/120	46	7 9/16	10¾	7¼	6¾	8½	¼	89
DU-7.5	7.5	0/208/220/240	31	0/104/110/120	62	9	9	8	7½	6½	¼	105
DU-10	10	0/208/220/240	41	0/104/110/120	83	9	12	8	7½	9	¼	150

"UP SERIES" 110/220 Dual Primary To 0/130/135/140 V. Sec.



The "UP" line utilizes the same dual primary as the "DU" line. It has, however, a single secondary rated at 0/130/135/140 volts.

This type is quite useful to boost low line voltages or raise line voltages to compensate for drops in series elements. It also finds application in bridge rectifiers for DC voltage outputs of approximately 115 to 130 volts.

Part No.	KVA	Secondary Volts	Max. Secondary Amps	L (Max.)	W (Max.)	H (Max.)	ML ± 1/32	MW ± 1/16	Mtg. Screw	Appr. Lbs.
UP-2	¼	0/130/135/140	2	5 5/16	4¼	5¼	4⅜	2½	#10	12
UP-4	½	0/130/135/140	4	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
UP-8	1	0/130/135/140	8	7 9/16	6¼	7¼	6¾	4⅛	¼	33
UP-15	2	0/130/135/140	15	7 9/16	8¼	7¼	6¾	6	¼	56
UP-25	3	0/130/135/140	25	7 9/16	9¼	7¼	6¾	7	¼	70
UP-40	5	0/130/135/140	40	7 9/16	10¾	7¼	6¾	8½	¼	89

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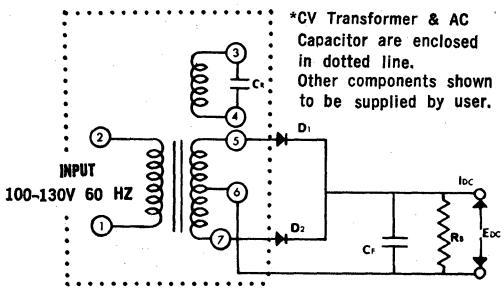
CONSTANT VOLTAGE TRANSFORMERS

FOR USE IN DC POWER SUPPLIES (TYPE CDC)



SCHEMATIC DIAGRAM *

CDC CONSTANT VOLTAGE TRANSFORMERS

Signal's CDC Regulating Transformers are specifically manufactured for use in DC Power Supplies. They are designed and rated for use with a full wave center-tapped silicon rectifier. CDC transformers are operated in ferro-resonance and are used in conjunction with an AC **tuning capacitor** (Cr in schematic diagram), which is supplied with the transformer.

In order to construct a regulated power supply the only other parts necessary are two diodes (D_1 and D_2), an electrolytic computer grade capacitor (C_f) and a bleeder resistor (R_b). These are standard shelf items.

The specification chart lists specific outputs available and the recommended auxiliary components. Part numbers are coded in terms of DC outputs, e.g., CDC-15-2 will give an output of 15V DC at 2 amps DC.

Electrical performance is completely specified. The DC voltage is constant to ±1% over the line voltage range of 100 to 130V at 60 HZ. The nominal output is held to ±2%. Closer tolerance on nominal output (±1%) can be obtained on special order at slightly higher cost.

Load regulation is specified as the rise in dc voltage output (increase in E_{dc}) from full load to the no load, ¼ load, and ½ load points. The filter capacitor (C_f) specified should be used and will yield the values of ripple voltage shown.

A significant protection feature is the fact that the DC short circuit current is limited to a maximum of 2 times rated current (3 times in size "C-6" units). This protects the entire circuit against shorts.

OUTPUT D.C. VOLTS	DC Amps I_{dc}	Part Number	Load Regulation (Rise in DCV from FL) NL-FL	¼-FL	½-FL	Ripple Volts (RMS)	Recommended Diodes (D_1 & D_2) P.I.V.	I/Cell	Filter Cap. (C_f) MFD.	DCWV	Bleeder‡ Resistor (R_b) Ohms	Watts	Style* & Size
6 vdc	0.8	CDC-6-0.8	2.0	1.5	0.8	0.3	50	1	3K	10	50	2	C-6
	4.5	CDC-6-4.5	1.0	0.7	0.5	0.4	50	6	15K	10	10	5	B-25
	9.0	CDC-6-9	1.0	0.7	0.5	0.4	50	16	25K	10	6	10	B-50
	16	CDC-6-16	1.0	0.7	0.4	0.4	50	16	75K	10	5	10	B-120
	40	CDC-6-40	0.7	0.4	0.2	0.4	50	60	150K	10	3	20	B-250
	75	CDC-6-75	0.8	0.6	0.4	0.4	50	100	200K	10	1	40	B-500
12 vdc	0.4	CDC-12-0.4	3.0	2.2	1.1	0.3	100	1	2K	15	150	2	C-6
	2.2	CDC-12-2.2	1.5	1.0	0.6	0.4	100	3	8K	15	25	10	B-25
	4.5	CDC-12-4.5	1.2	0.7	0.5	0.4	100	6	15K	15	25	10	B-50
	9.0	CDC-12-9	1.0	0.7	0.4	0.4	100	16	40K	15	10	20	B-120
	20	CDC-12-20	0.8	0.5	0.3	0.3	100	40	75K	15	5	40	B-250
	38	CDC-12-38	0.9	0.7	0.4	0.4	100	60	120K	15	4	50	B-500
15 vdc	0.35	CDC-15-0.35	3.5	2.3	1.3	0.3	100	1	1.5K	20	200	2	C-6
	2.0	CDC-15-2	1.6	1.0	0.6	0.4	100	2	7K	20	50	5	B-25
	3.5	CDC-15-3.5	1.3	0.8	0.6	0.3	100	6	15K	20	25	10	B-50
	8	CDC-15-8	1.5	0.9	0.6	0.4	100	16	30K	20	15	20	B-120
	16	CDC-15-16	1.0	0.8	0.5	0.3	100	16	75K	20	10	30	B-250
	30	CDC-15-30	1.0	0.6	0.4	0.3	100	40	120K	20	5	50	B-500
18 vdc	0.32	CDC-18-0.32	3.7	2.3	1.3	0.4	100	1	1K	20	300	2	C-6
	1.8	CDC-18-1.8	2.0	1.2	0.7	0.4	100	2	7K	20	100	5	B-25
	3	CDC-18-3	1.7	1.2	0.7	0.3	100	3	12K	20	50	10	B-50
	6	CDC-18-6	1.7	0.9	0.6	0.3	100	6	30K	20	25	20	B-120
	13	CDC-18-13	1.3	1.0	0.7	0.3	100	16	50K	20	15	30	B-250
	26	CDC-18-26	1.5	0.6	0.5	0.3	100	40	120K	20	10	50	B-500
24 vdc	0.25	CDC-24-0.25	4.0	3.4	1.5	0.3	200	1	1K	25	350	2	C-6
	1.2	CDC-24-1.2	2.0	1.2	0.7	0.4	200	2	5K	25	100	10	B-25
	2.1	CDC-24-2.1	1.8	1.5	1.0	0.3	200	3	10K	25	50	20	B-50
	4.5	CDC-24-4.5	2.0	1.0	0.7	0.3	200	6	25K	25	50	20	B-120
	11	CDC-24-11	1.3	1.0	0.5	0.3	200	16	50K	25	25	30	B-250
	20	CDC-24-20	1.5	0.7	0.3	0.3	200	40	75K	25	15	50	B-500
28 vdc	0.22	CDC-28-0.22	5.6	4.0	2.3	0.3	200	1	1K	35	500	2	C-6
	1.0	CDC-28-1	2	1.5	0.6	0.3	200	1	5K	35	100	10	B-25
	2.0	CDC-28-2	2.5	1.5	1.0	0.3	200	2	10K	35	100	10	B-50
	4.0	CDC-28-4	2.0	1.2	0.8	0.3	200	6	25K	35	50	20	B-120
	9.0	CDC-28-9	1.3	1.0	0.5	0.3	200	16	50K	35	25	40	B-250
	16	CDC-28-16	1.7	0.8	0.3	0.3	200	16	75K	35	15	60	B-500
36 vdc	0.18	CDC-36-0.18	7.0	5.5	3.5	0.3	200	1	1K	50	1K	2	C-6
	0.9	CDC-36-0.9	2.0	1.4	0.8	0.3	200	1	5K	50	150	10	B-25
	1.8	CDC-36-1.8	3.0	2.0	1.3	0.3	200	2	8K	50	100	20	B-50
	3.2	CDC-36-3.2	2.5	1.4	0.7	0.3	200	3	20K	50	100	20	B-120
	6	CDC-36-6	2.0	1.5	1.0	0.3	200	16	25K	50	25	60	B-250
	12	CDC-36-12	1.8	1.0	0.7	0.3	200	16	50K	50	25	60	B-500
48 vdc	0.12	CDC-48-0.12	8.0	6.0	4.0	0.2	200	1	1K	50	1.5K	2	C-6
	0.6	CDC-48-0.6	2.5	2.0	1.0	0.3	200	1	3K	50	300	10	B-25
	1.5	CDC-48-1.5	3.0	1.5	1.0	0.3	200	2	6K	50	250	10	B-50
	2.5	CDC-48-2.5	3.0	1.5	1.0	0.2	200	2	15K	50	200	20	B-120
	5.0	CDC-48-5	2.0	1.0	0.6	0.3	200	6	15K	50	50	50	B-250
	10	CDC-48-10	2.0	1.0	0.5	0.4	200	16	25K	50	50	50	B-500
60 vdc	0.1	CDC-60-0.1	8.0	6.0	4.0	0.2	400	1	1K	75	2.5K	2	C-6
	0.5	CDC-60-0.5	3.0	2.0	1.2	0.4	400	1	2K	75	500	10	B-25
	1.2	CDC-60-1.2	4.2	3.0	2.0	0.3	400	2	5K	75	400	10	B-50
	2.0	CDC-60-2	3.5	2.0	1.0	0.3	400	2	10K	75	300	20	B-120
	4	CDC-60-4	1.5	1.2	1.0	0.4	400	6	12K	75	75	50	B-250
	8	CDC-60-8	3.0	2.0	0.6	0.4	400	16	20K	75	75	50	B-500
120 vdc	0.05	CDC-120-0.05	9.0	8.0	5.0	0.2	400	1	0.5K	150	10K	2	C-6
	0.3	CDC-120-0.3	6.0	4.0	2.5	0.3	400	1	2K	150	2K	10	B-25
	0.6	CDC-120-0.6	5.5	3.5	2.5	0.3	400	1	3K	150	1.5K	10	B-50
	1.0	CDC-120-1	5.5	3.2	2.0	0.4	400	1	4K	150	1K	20	B-120
	2	CDC-120-2	4.0	3.0	2.0	0.3	400	2	9K	150	250	60	B-250
	4	CDC-120-4	4.0	2.0	0.8	0.4	400	6	15K	150	150	100	B-500

* See mechanical dimensions on opposite page.

‡ Bleeder resistor may be eliminated if load current does not fall to zero. DC amp rating may be increased accordingly.

SIGNAL TRANSFORMER CO., INC
ENGINEERS • DESIGNERS • MANUFACTURERS
FACTORY: 1 JUNIUS STREET, BROOKLYN, NEW YORK 11212 — (212) 498-5111

CONSTANT VOLTAGE TRANSFORMERS

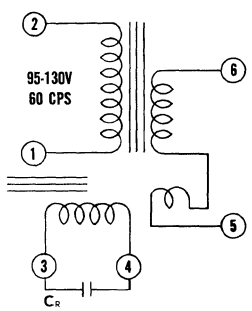
FOR USE IN AC APPLICATIONS (TYPE ACV)

Signal ACV transformers are manufactured for use with AC loads. They are simple and rugged designs and will regulate to within plus or minus 1% for input variations from 95-130V at 60 cps. If regulation of plus or minus ½% or better is desired, special units can be made to your order. ACV transformers will regulate with loads that are not unity power factor.

Full regulation is maintained at any load from about 20% to 100%. Overload current is limited to a maximum of 200% of rated current at short circuit. The 6.4 and 12.8V ratings are ideal for use with tube or lamp loads since the short circuit current rating limits the inrush current to cold filaments. Stabilization of the voltage results in longer filament life.

ACV transformers are "normal" harmonic type with approximately a square wave output.

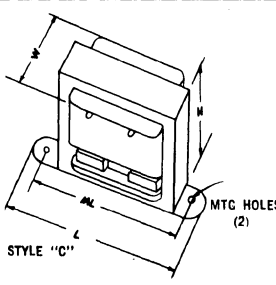
PART NO.	VOLTS AC	AMPS AC	STYLE & SIZE
6 ACV-6.4	6.4	1	C-6
6 ACV-12.8	12.8	0.5	C-6
6 ACV-26	26	0.25	C-6
6 ACV-118	118	0.05	C-6
25 ACV-6.4	6.4	4	B-25
25 ACV-12.8	12.8	2	B-25
25 ACV-26	26	1	B-25
25 ACV-118	118	0.25	B-25
50 ACV-6.4	6.4	8	B-50
50 ACV-12.8	12.8	4	B-50
50 ACV-26	26	2	B-50
50 ACV-118	118	0.43	B-50
120 ACV-6.4	6.4	20	B-120
120 ACV-12.8	12.8	10	B-120
120 ACV-26	26	5	B-120
120 ACV-118	118	1	B-120
250 ACV-12.8	12.8	20	B-250
250 ACV-26	26	10	B-250
250 ACV-118	118	2.2	B-250
500 ACV-118	118	4.5	B-500

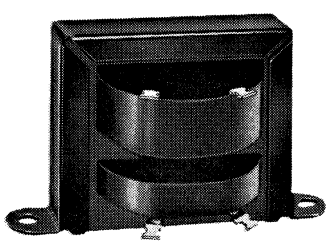


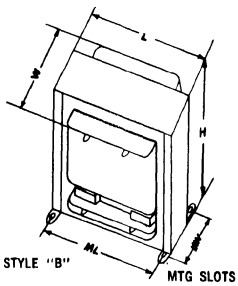
CAPACITOR WINDING SCHEMATIC DIAGRAM

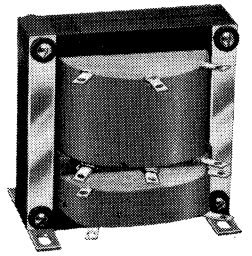
MECHANICAL DIMENSIONS

STYLE & SIZE	L	W	H	ML	MW	MTG. SCREW
C-6	3¼	1⅞	1 15/16	2 13/16	—	#8
B-25	3	2⅝	3⅛	2⅝	1 15/16	#8
B-50	3	3⅝	3⅛	2⅝	2 1/16	#8
B-120	4	3⅞	4 1/16	3½	2⅜	#10
B-250	4	5¾	4 1/16	3½	3 15/16	#10
B-500	5	5¾	5 1/16	4⅜	3 15/16	#10









ADVANTAGES OF CONSTANT VOLTAGE TRANSFORMERS

REGULATION — output regulated to plus or minus 1% for line voltage variations of 95 to 130V at 60 cps.

SELF-PROTECTION — against output short circuit. Current limited to a maximum of 2 times rated current.

MECHANICALLY RUGGED — as resistant to mechanical shock as conventional power transformers.

NO MOVING PARTS — no adjustment or maintenance necessary.

SQUARE WAVE OUTPUT — ideal for use in rectifier circuits — little filtering needed.

HIGH DEGREE OF ISOLATION — between input and output circuits — both physical and electrical isolation, electro-static shields not necessary.

RESONATING CAPACITOR — supplied with transformers.

EPOXY IMPREGNATION — minimizes acoustic noise.

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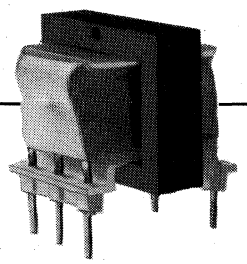
SHIPPED FROM STOCK IMMEDIATELY

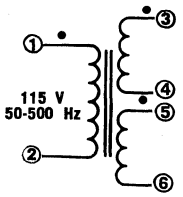
MINIATURE PLUG-IN POWER TRANSFORMERS

FOR PRINTED CIRCUIT APPLICATIONS

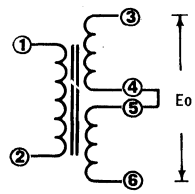
low profile • low regulation • 50-500 Hz



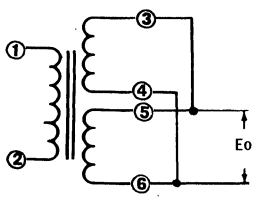
IDEAL FOR — SINGLE OR DUAL OUTPUT DC SUPPLIES
— ISOLATED CONTROL CIRCUIT AND REFERENCE SUPPLIES.



BASIC SCHEMATIC



SERIES CONNECTED

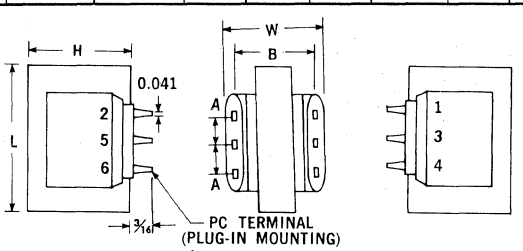


PARALLEL CONNECTED

SECONDARY VOLTS	Part No.	Secondary Milliamps Series	Secondary Milliamps Parallel	DIMENSIONS L	W	H	A	B	Approx. Oz.
20 V.C.T. or 10 V. SERIES 20 V.C.T. PARALLEL 10 V @ 2 x CURRENT	PC-20-60	60	120	1⅜	1⅛	1 3/16	0.312	1.00	3
	PC-20-220	220	440	1⅝	1¼	1⅜	0.400	1.10	5
	PC-20-500	500	1,000	1⅞	1 7/16	1⅝	0.400	1.30	9
24 V.C.T. or 12 V. SERIES 24 V.C.T. PARALLEL 12 V @ 2 x CURRENT	PC-24-50	50	100	1⅜	1⅛	1 3/16	0.312	1.00	3
	PC-24-180	180	360	1⅝	1¼	1⅜	0.400	1.10	5
	PC-24-450	450	900	1⅞	1 7/16	1⅝	0.400	1.30	9
34 V.C.T. or 17 V. SERIES 34 V.C.T. PARALLEL 17 V @ 2 x CURRENT	PC-34-35	35	70	1⅜	1⅛	1 3/16	0.312	1.00	3
	PC-34-125	125	250	1⅝	1¼	1⅜	0.400	1.10	5
	PC-34-300	300	600	1⅞	1 7/16	1⅝	0.400	1.30	9
40 V.C.T. or 20 V. SERIES 40 V.C.T. PARALLEL 20 V @ 2 x CURRENT	PC-40-30	30	60	1⅜	1⅛	1 3/16	0.312	1.00	3
	PC-40-110	110	220	1⅝	1¼	1⅜	0.400	1.10	5
	PC-40-250	250	500	1⅞	1 7/16	1⅝	0.400	1.30	9
88 V.C.T. or 44 V. SERIES 88 V.C.T. PARALLEL 44 V @ 2 x CURRENT	PC-88-15	15	30	1⅜	1⅛	1 3/16	0.312	1.00	3
	PC-88-50	50	100	1⅝	1¼	1⅜	0.400	1.10	5
	PC-88-120	120	240	1⅞	1 7/16	1⅝	0.400	1.30	9
120 V.C.T. or 60 V. SERIES 120 V.C.T. PARALLEL 60 V @ 2 x CURRENT	PC-120-10	10	20	1⅜	1⅛	1 3/16	0.312	1.00	3
	PC-120-35	35	70	1⅝	1¼	1⅜	0.400	1.10	5
	PC-120-85	85	170	1⅞	1 7/16	1⅝	0.400	1.30	9

METHOD OF DETERMINING SECONDARY CURRENT RATINGS

RECTIFIER TYPE	FILTER TYPE	RMS SECONDARY CURRENT
Full Wave Center-Tap	Choke Input	.7 X DC amps
Full Wave Center-Tap	Capacitor Input	1.2 X DC amps
Full Wave Bridge	Choke Input	= to DC amps
Full Wave Bridge	Capacitor Input	1.8 X DC amps



MECHANICAL OUTLINE

Signal's PC Transformers are constructed of prime raw materials using Class S insulation and nylon bobbins with PC pins molded directly in the bobbin wall. They are vacuum varnish impregnated and 100% tested for all parameters before shipment.

Primaries are rated at 115 V. 50 to 500 Hz. Dual secondaries provide two outputs, or secondaries may be series or parallel connected. This results in a wide variety of output combinations. Load regulation is limited to a maximum of 20%.

AVAILABLE ON SPECIAL ORDER

- Special output voltages and/or currents
- PC filter Chokes
- Encapsulated versions

SPECIAL PC TRANSFORMERS OR CHOKES — PROMPT QUOTATIONS

SIGNAL TRANSFORMER CO., INC

FACTORY: 1 JUNIUS ST., BROOKLYN, N. Y. 11212 • (212) 498-5111

SIGNAL TRANSFORMER PRICE LIST

Part No.	User Net
10-01	3.40
10-0.25	3.60
10-05	3.75
10-1	4.15
10-2	5.20
10-4	6.50
10-6	8.40
10-8	9.00
10-12	10.50
10-25	18.20
10-50	26.50
10-100	43.00
12.8-0.1	3.40
12.8-0.25	3.65
12.8-0.5	4.00
12.8-1	4.45
12.8-2A	5.15
12.8-2	6.35
12.8-4	7.70
12.8-6	9.00
12.8-8	9.60
12.8-12	11.00
12.8-25	22.40
12.8-50	30.50
12.8-100	44.00
16-0.1	3.50
16-0.25	3.70
16-0.5	3.95
16-1	4.30
16-2	5.35
16-4	8.10
16-6	9.50
16-8	10.30
16-12	12.75
16-25	24.00
16-50	38.00
16-100	64.00
24-0.1	3.50
24-0.25	4.10
24-05	4.50
24-1A	4.90
24-1	6.35
24-2	7.30
24-4	9.15
24-6	11.00
24-8	15.20
24-12	17.80
24-20	22.40
24-25	30.00
24-50	44.00
24-100	70.00
36-0.1	3.60
36-0.25	4.00
36-0.5	4.55
36-1A	5.65
36-1	6.60
36-2	7.80
36-4	10.90
36-6	15.60
36-8	16.70
36-12	20.00
36-20	33.70
36-25	39.60
36-30	44.00
36-50	55.00
36-100	108.00
56-0.1	3.80
56-0.25	4.45
56-0.5	5.00
56-1	8.00
56-2	8.90
56-4	14.90
56-6	21.50
56-8	26.50
56-12	35.00
56-25	57.00
56-50	102.00
56-100	151.00
68-0.1	3.90
68-0.25	4.40
68-0.5A	5.10
68-0.5	6.75
68-1	7.90
68-2	10.00
68-4	18.80
68-6	21.50
68-8	25.80
68-12	38.00
68-25	57.00
68.50	103.00
80-01	4.00
80-0.25	4.60
80-0.5A	5.60
80-05	6.75
80-1	8.50
80-2	12.70
80-4	21.00
80-6	27.00
80-8	32.50
80-12	41.00
80-25	69.50
80-50	124.00
88-0.1	4.10
88-0.25	4.80
88-0.5	5.70
88-1	8.80
88-2	12.90
88-4	22.00
88-6	27.50
88-8	33.50
88-12	42.00
88-25	72.00
88-50	128.00
120-0.5	8.20
120-1	10.40
120-2	14.70
120-4	28.00
120-6	34.00
120-8	42.50
120-12	52.50
120-20	76.50
160-0.5	8.70
160-1	12.90
160-2	18.00
160-4	31.00
160-8	48.50
160-12	65.00
180-0.5	9.10
180-1	14.20
180-2	20.00
180-4	36.00
180-6	42.50
180-8	52.00
180-12	78.00
230-0.5	10.50
230-1	15.00
230-2	21.50
230-4	42.00
230-6	50.00
300-0.5	11.00
300-1	19.70
300-2	31.00
300-4	48.50
CH-0.1	2.25
CH-0.2	2.60
CH-0.25	3.00
CH-0.5	3.80
CH-1	5.70
CH-2	6.60
CH-4	8.80
CH-6	11.00
CH-8	14.00
CH-12	18.00
CH-16	20.00
CH-20	19.50
CH-25	27.50
CH-30	33.00
CH-50	38.00
CH-100	43.00
CH-200	68.00
CH-500	92.00
CH-1000	102.00
E-10-0.1	5.10
E-10-0.25	5.43
E-10-0.5	5.80
E-10-1	6.35
E-10-2	8.00
E-10-4	11.10
E-10-6	13.00
E-10-8	14.00
E-10-12	16.55
E-10-25	28.80
E-10-50	42.20
E-10-100	69.00
E-12.8-01	5.10
E-12.8-0.25	5.51
E-12.8-0.5	6.05
E-12.8-1	6.75
E-12.8-2A	7.85
E-12.8-2	9.75
E-12.8-4	11.85
E-12.8-6	13.90
E-12.8-8	14.90
E-12.8-12	17.20
E-12.8-25	35.40
E-12.8-50	48.60
E-12.8-100	70.50
E-16-0.1	5.25
E-16-0.25	5.57
E-16-0.5	5.96
E-16-1	6.52
E-16-2	8.16
E-16-4	12.45
E-16-6	14.70
E-16-8	16.05
E-16-12	20.00
E-16-25	38.00
E-16-50	61.00
E-16-100	102.00
E-24-0.1	5.25
E-34-0.25	6.20
E-24-0.5	6.85
E-24-1A	7.50
E-24-1	9.77
E-24-2	11.22
E-24-4	14.20
E-24-6	17.05
E-24-8	23.60
E-24-12	27.80
E-24-20	35.00
E-24-25	47.10
E-40-50	69.50
E-24-100	111.00
E-36-0.1	5.40
E-36-0.25	6.03
E-36-0.5	6.88
E-36-1A	8.55
E-36-1	10.05
E-36-2	11.90
E-36-4	16.80
E-36-6	24.20
E-36-8	26.00
E-36-12	31.20
E-36-20	52.80
E-36-25	62.20
E-36-30	69.50
E-36-50	87.50
E-36-100	173.00
E-56-0.1	5.70
E-56-0.25	6.70
E-56-0.5	7.55
E-56-1	12.10
E-56-2	13.50
E-56-4	22.80
E-56-6	33.10
E-56-8	41.10
E-56-12	54.50
E-56-25	89.50
E-56-50	161.00
E-56-100	240.00
E-68-0.1	5.85
E-68-0.25	6.62
E-68-0.5A	7.70
E-68-0.5	10.22
E-68-1	12.00
E-68-2	15.30
E-68-4	28.80
E-68-6	33.10
E-68-8	40.00
E-68-12	59.50
E-68-25	90.00
E-68-50	165.00
E-80-0.1	6.00
E-80-0.25	6.95
E-80-0.5A	8.50
E-80-0.5	10.30
E-80-1	13.10
E-80-2	19.60
E-80-4	32.60
E-80-6	42.00
E-80-8	51.00
E-80-12	64.70
E-80-25	110.00
E-80-50	198.00
E-88-0.1	6.15
E-88-0.25	7.23
E-88-0.5	8.65
E-88-1	13.45
E-88-2	19.90
E-88-4	34.10
E-88-6	42.80
E-88-8	52.50
E-88-12	66.30
E-88-25	114.00
E-88-50	204.00
E-120-0.5	12.30
E-120-1	15.70
E-120-2	22.40
E-120-4	43.10
E-120-6	52.60
E-120-8	65.80
E-120-12	83.00
E-120-20	122.00
E-160-0.5	13.05
E-160-1	19.50
E-160-2	27.40
E-160-4	47.70
E-160-8	75.60
E-160-12	103.00
E-180-0.5	13.65
E-180-1	21.40
E-180-2	30.40
E-180-4	55.50
E-180-6	65.80
E-180-8	81.00
E-180-12	123.00
E-230-0.5	15.75
E-230-1	22.80
E-230-2	33.00
E-230-4	65.00
E-230-6	77.50
E-300-0.5	16.50
E-300-1	30.00
E-300-2	48.00
E-300-4	75.60
E-CH-0.1	2.90
E-CH-0.2	3.40
E-CH-0.25	3.95
E-CH-0.5	5.00
E-CH-1	7.60
E-CH-2	8.80
E-CH-4	11.80
E-CH-6	14.80
E-CH-8	18.90
E-CH-12	24.50
E-CH-16	27.40
E-CH-20	26.80
E-CH-25	38.00
E-CH-30	45.70
E-CH-50	52.70
E-CH-100	60.00
E-CH-200	96.00
E-CH-500	132.00
E-CH-1000	148.00
H-10-0.1	9.85
H-10-0.25	10.50
H-10-0.5	10.95
H-10-1	12.10
H-10-2	15.25
H-10-4	19.30
H-10-6	25.20
H-10-8	27.10
H-10-12	31.70
H-10-25	55.20
H-10-50	77.80
H-10-100	133.00
H-12.8-0.1	9.85
H-12.8-0.25	10.60
H-12.9-05	11.65
H-12.8-1	13.00
H-12.8-2A	15.10
H-12.8-2	18.75
H-12.8-4	22.80
H-12.8-6	26.70
H-12.8-8	28.80
H-12.8-12	33.20
H-12.8-25	68.30
H-12.8-50	93.70
H-12.8-100	137.00
H-16-0.1	10.20
H-16-0.25	10.75
H-16-0.5	11.50
H-16-1	12.60
H-16-2	15.70
H-16-4	23.80
H-16-6	28.00
H-16-8	30.50
H-16-12	38.00
H-16-25	72.00
H-16-50	114.00
H-16-100	192.00
H-24.01	10.20
H-24-0.25	11.90
H-24-0.5	13.10
H-24-1A	14.35
H-24-1	18.70
H-24-2	21.50
H-24-4	27.20
H-24-6	32.80
H-24-8	45.70
H-24-12	53.50
H-24-20	67.40
H-24-25	90.50
H-24-50	134.00
H-24-100	214.00
H-36-0.1	10.45
H-36-0.25	11.60
H-36-0.5	13.25
H-36-1A	16.50
H-36-1	19.35
H-36-2	22.90
H-36-4	32.10
H-36-6	46.00
H-36-8	49.50
H-36-12	59.40
H-36-20	100.00
H-36-25	118.00
H-36-30	131.00
H-36-50	165.00
H-36-100	326.00
H-56-0.1	11.00
H-56-0.25	12.90
H-56-0.5	14.55
H-56-1	23.30
H-56-2	26.00
H-56-4	43.60
H-56-6	63.10
H-56-8	78.40
H-56-12	104.00
H-56-25	170.00
H-56-50	305.00
H-56-100	455.00
H-68-0.1	11.30
H-68-0.25	12.78
H-68-0.5A	14.90
H-68-0.5	19.70
H-68-1	23.00
H-68-2	29.30
H-68-4	55.50
H-68-6	63.80
H-68-8	77.00
H-68-12	113.50
H-68-25	174.00
H-68-50	316.00
H-80-0.1	11.60
H-80-0.25	13.35
H-80-0.5A	16.45
H-80-05	20.00
H-80-1	25.10
H-80-2	37.70
H-80-4	62.50
H-86-6	81.00
H-80-8	97.80
H-80-12	124.00
H-80-25	212.00
H-80-50	380.00
H-88-01	11.90
H-88-0.25	13.95
H-88-0.5	16.75
H-88-1	26.00
H-88-2	38.30
H-88-4	65.50
H-88-6	82.50
H-88-8	101.00
H-88-12	127.00
H-88-25	219.00
H-88-50	392.00
H-120-0.5	23.80
H-120-1	30.40
H-120-2	43.20
H-120-4	83.00
H-120-6	100.00
H-120-8	127.00
H-120-12	157.00
H-120-20	232.00
H-160-0.5	25.20
H-160-1	37.70
H-160-2	52.80
H-160-4	92.00
H-160-8	145.00
H-160-12	195.00
H-180-0.5	26.40
H-180-1	41.50
H-180-2	58.70
H-180-4	106.00
H-180-6	126.00
H-180-8	155.00
H-180-12	234.00
H-230-0.5	30.50
H-230-1	43.80
H-230-2	63.10
H-230-4	124.00
H-230-6	149.00
H-300-0.5	31.90
H-300-1	57.50
H-300-2	91.00
H-300-4	143.00
H-CH-0.1	6.50
H-CH-0.2	7.55
H-CH-0.25	8.75
H-CH-0.5	11.10
H-CH-1	16.70
H-CH-2	19.50
H-CH-4	26.20
H-CH-6	33.00
H-CH-8	42.20
H-CH-12	54.50
H-CH-16	60.80
H-CH-20	59.30
H-CH-25	83.80
H-CH-30	101.00
H-CH-50	117.00
H-CH-100	133.00
6-500	98.00
9-500	127.00
12-500	158.00
3-1000	104.00
6-1000	168.00
MV-1	13.50
MV-2	16.00
MV-4	21.00
MV-6	29.00
MV-12	40.00
3PH-24-50	90.00
3PH-24-100	127.00
3PH-24-200	207.00
3PH-48-30	90.00
3PH-48-60	127.00
3PH-48-120	207.00
SD-100	7.30
SD-150	8.60
SD-250	10.00
SD-350	13.00
SD-500	15.10
SD-750	19.25
SD-1000	23.00
SD-1500	27.00
SD-2000	35.00
SDO-100	5.00
SDO-150	6.00
SDO-250	7.40
SDO-350	10.50
SDO-500	12.40
SDO-750	16.50
SDO-1000	20.20
SDO-1500	23.50
SDO-2000	31.80
HSD-3000	55.00
HSD-4000	60.00
HSD-5000	69.00
HSD-6000	76.00
DU-¼	27.80
DU-½	34.50
DU-1	55.00
DU-2	75.00
DU-3	107.00
DU-5	144.00
DU-7½	185.00
DU-10	235.00
UP-2	28.00
UP-4	32.50
UP-8	53.00
UP-15	77.00
UP-25	99.00
UP-40	138.00
CDC-6-0.8	14.00
CDC-6-4.5	19.90
CDC-6-9	23.50
CDC-6-16	29.50
CDC-6-40	44.40
CDC-6-75	68.00
CDC-12-0.4	13.95
CDC-12-2.2	19.80
CDC-12-4.5	23.40
CDC-12-9	29.40
CDC-12-20	44.10
CDC-12-38	67.80
CDC-15-0.35	13.90
CDC-15-2	19.70
CDC-15-3.5	23.30
CDC-15-8	29.20
CDC-15-16	43.90
CDC-15-30	67.60
CDC-18-0.32	13.85
CDC-18-1.8	19.60
CDC-18-3	23.20
CDC-18-6	29.10
CDC-18-13	43.90
CDC-18-26	67.50
CDC-24-0.22	13.80
CDC-24-1.2	19.50
CDC-24-2.1	23.10
CDC-24-4.5	29.00
CDC-24-11	43.80
CDC-24-20	67.30
CDC-28-0.25	13.75
CDC-28-1	19.40
CDC-28-2	23.00
CDC-28-4	28.90
CDC-28-9	43.70
CDC-28-16	67.20
CDC-36-0.18	13.65
CDC-36-0.9	19.30
CDC-36-1.8	22.90
CDC-36-3.2	28.80
CDC-36-6	43.50
CDC-36-12	67.00
CDC-48-0.12	13.60
CDC-48-0.6	19.20
CDC-48-1.5	22.80
CDC-48-2.5	28.70
CDC-48-5	43.40
CDC-48-10	66.80
CDC-60-0.1	13.40
CDC-60-0.5	19.10
CDC-60-1.2	22.70
CDC-60-2	28.50
CDC-60-4	43.30
CDC-60-8	66.70
CDC-120-0.05	13.40
CDC-120-0.3	19.00
CDC-120-0.6	22.60
CDC-120-1	28.40
CDC-120-2	43.20
CDC-120-4	66.50
6ACV-6.4	14.10
6ACV-12.8	13.90
6ACV-26	13.70
6ACV-118	13.40
25ACV-6.4	20.00
25ACV-12.8	19.80
25ACV-26	19.50
25ACV-118	19.00
50ACV-6.4	23.60
50ACV-12.8	23.20
50ACV-26	22.70
50ACV-118	22.20
120ACV-6.4	29.10
120ACV-12.8	28.90
120ACV-26	28.60
120ACV-118	28.20
250ACV-12.8	44.00
250ACV-26	43.00
250ACV-118	41.90
500ACV-118	68.00
PC-20-60	2.85
PC-20-220	3.00
PC-20-500	3.20
PC-24-50	2.95
PC-24-180	3.10
PC-24-450	3.30
PC-34-35	3.05
PC-34-125	3.20
PC-34-300	3.40
PC-40-30	3.10
PC-40-110	3.25
PC-40-250	3.45
PC-88-15	3.15
PC-88-50	3.30
PC-88-120	3.50
PC-120-10	3.20
PC-120-35	3.35
PC-120-85	3.55

OEM DISCOUNT SCHEDULE

QTY.	DISCOUNT	QTY.	DISCOUNT
1-9	NET	50-99	33⅓%
10-24	15%	100-199	40%
25-49	25%	200 Over	QUOTE

TERMS: NET 30 DAYS ON APPROVED CREDIT
FOB: FACTORY, BROOKLYN, N. Y.

SIGNAL TRANSFORMER CO., INC
ENGINEERS • DESIGNERS • MANUFACTURERS
FACTORY: 1 JUNIUS STREET, BROOKLYN, NEW YORK 11212 — (212) 498-5111

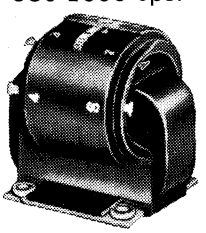
STERLING TRANSFORMER

ENCAPSULATED 400 cps transformers

CLIPPER SERIES

Fig.	Cat. No.	Sec. Volts	Sec. Amp	Insul. Volts (RMS)	Pri. Volts	Mold Size	Net Price
19	4C1	6.3 CT	0.8	1500	115	SM3	13.80
19	4C2	6.3 CT	1.2	1500	115	SM2	13.80
19	4C3	6.3 CT	6.8	1500	110/115/120	2	22.15
20	4C4	6.3 6.3	4.9 2.7	1500	115	3	19.80
19	4C5	6.3 CT	7.2	1500	115	35	23.00
21	4C6	6.3 6.3 6.3	7 7 1.5	1500 1500 1500	120	35	22.40
22	4C7	6.3 CT 6.3 CT	7 7	1500 1500	120	4	26.65
21	4C8	6.3 6.3 6.3	13.7 2.9 0.3	1500 1500 1500	115	4	26.65
19	4C9	6.3 CT	12.3	1500	115	5	24.65
21	4C11	6.3 6.3 6.3	2.4 2.5 2.7	1500	115	3	24.65
19	4C26	6.3 CT	2	1500	115	SM1	17.55
19	4C27	6.3 CT	3	1500	115	1A	18.25
19	4C28	6.3 CT	5	1500	115	2	18.90
19	4C29	5 CT	3	2500	115	SM1	17.55
19	4C30	5 CT	6	2500	115	2	18.90
19	4C31	8.5 CT	12	1500	115	5	24.63
19	4C32	8.5 CT	23	1500	115	7	27.30
19	4C33	8.5 CT	35	1500	115	8	29.75
19	4C34	8.5 CT	45	1500	115	9	35.90
19	4C12	14.1	3	1500	115	3	18.79
19	4C35	21 CT	4.5	1500	115	5	24.63
19	4C13	21 CT	9	1500	115	7	21.30
19	4C36	21 CT	18	1500	115	9	35.90
19	4C10	20 CT	0.6	1500	115	SM1	17.55

FREQUENCY
380-1000 cps.



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27B Specifications

MIL Type TF5SX01ZZ

85°C Max. Ambient Operating Temp.

HIGH SHOCK EXTREME ENVIRONMENT CONDITIONS
LIGHT WEIGHT FOR AIRBORNE USE
10,000 HOUR PLUS-LIFE
SERVO APPLICATIONS
ISOLATION POWER SUPPLIES
AIRBORNE CONTROL CIRCUITS
MISSILE CIRCUITS

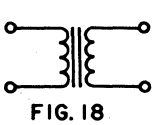


FIG. 18

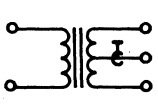


FIG. 19

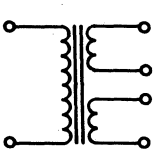


FIG. 20

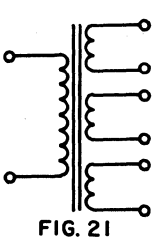


FIG. 21

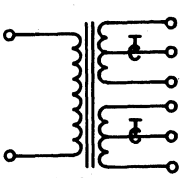


FIG. 22

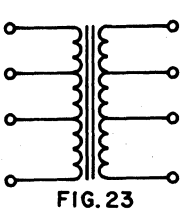


FIG. 23

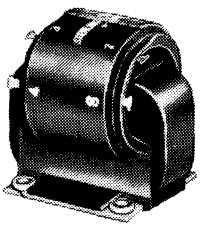
STERLING TRANSFORMER

ENCAPSULATED 400 cps transformers

CLIPPER SERIES

Fig.	Cat. No.	Sec. Volts	Sec. Amp.	Insul. Volts (RMS)	Pri. Volts	Mold Size	Net Price
19	4C37	21 CT	24	1500	115	10	43.10
19	4C38	24 CT	4	1500	115	5	24.63
19	4C39	24 CT	8	1500	115	7	27.30
19	4C40	24 CT	16	1500	115	9	35.90
19	4C41	24 CT	21	1500	115	10	43.10
19	4C14	26	0.5	1500	115	SM1	17.12
19	4C15	26 CT	1.5	1500	115	3	18.79
19	4C23	26 CT	3	1500	115	4	21.30
19	4C24	26 CT	5	1500	115	6	24.85
19	4C16	28 CT 6.3 CT	0.8 7	1500	115	3	26.62
19	4C42	41 CT	2.3	1500	115	5	24.63
19	4C43	41 CT	4.5	1500	115	7	27.30
19	4C44	41 CT	9	1500	115	9	35.90
19	4C45	41 CT	12	1500	115	10	43.10
19	4C46	48 CT	2	1500	115	5	24.63
19	4C47	48 CT	4	1500	115	7	27.30
19	4C48	48 CT	8	1500	115	9	35.90
19	4C49	48 CT	10	1500	115	10	43.10
19	4C25	52 CT	2	1500	115	5	24.63
19	4C17	52 CT	0.2	1500	115	SM1	18.99
19	4C18	90 CT	4.5	1500	115	9	35.90
18	4C19	115	.05	1500	115	SM2	14.10
18	4C21	115	2.8	1500	115	8	29.23
23	4C20	105/115/125	0.4	1500	105/115/125	2	20.30
23	4C50	105/115/125	1	1500	105/115/125	6	25.75
23	4C51	105/115/125	2.4	1500	105/115/125	8	30.20
23	4C52	105/115/125	3.2	1500	105/115/125	9	36.40
23	4C53	105/115/125	4	1500	105/115/125	10	43.70
23	4C22	334	0.3	1500	115	SM1	16.12

FREQUENCY
380-1000 cps.



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27B Specifications

MIL Type TF5SX01ZZ

85°C Max. Ambient Operating Temp.

HIGH SHOCK EXTREME ENVIRONMENT CONDITIONS
LIGHT WEIGHT FOR AIRBORNE USE
10,000 HOUR PLUS-LIFE
SERVO APPLICATIONS
ISOLATION POWER SUPPLIES
AIRBORNE CONTROL CIRCUITS
MISSILE CIRCUITS

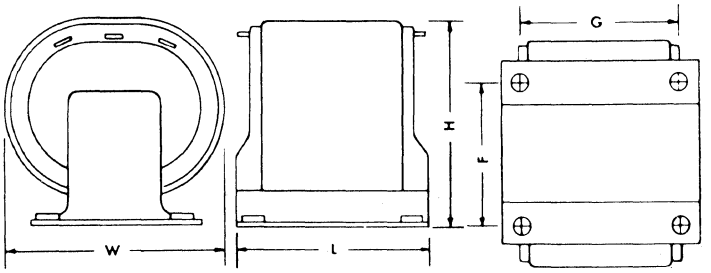
MOLD NO.	OVERALL DIMENSIONS L	W	H	MTG. DIMENSIONS F	G	APP. WT. (LBS.)	MTG. METH.
SM3	1	1-1/4	1-3/16	1	Note 1	0.06	Note 1
SM2	1-1/2	1-1/4	1-11/16	1	Note 1	0.10	Note 1
SM1	1-1/2	1-1/2	1-11/16	1-1/8	Note 1	0.16	Note 1
1	1-13/16	1-7/8	1-13/16	1-1/4	1-7/16	0.25	Note 2
1A	1-11/16	1-17/32	1-13/16	1-5/32	1-1/8	0.25	Note 2
2	2	1-15/16	2-1/8	1-9/32	1-1/4	0.40	Note 2
3	2-5/16	1-13/16	2-1/8	1-9/32	1-7/16	0.45	Note 2
3S	2-1/16	2-3/8	2-3/16	1-17/32	1-11/16	0.70	Note 2
4	2-5/16	2-3/8	2-9/16	1-17/32	1-11/16	0.90	Note 2
5	2-3/4	2-3/8	2-7/8	1-17/32	2-3/16	1.20	Note 2
6	2-3/4	2-5/8	3-1/8	1-17/32	2-3/16	1.50	Note 2
7	3	2-7/8	3-3/8	1-25/32	2-1/2	2.00	Note 2
8	3-3/8	2-7/8	3-3/8	1-25/32	2-1/2	2.50	Note 2
8S	3-3/4	3-1/4	3-3/8	2-1/4	3	3.25	Note 3
8A	3-3/4	3-3/4	3-3/8	2-3/4	3-1/8	4.25	Note 3
9	4-1/16	3-3/8	3-7/8	2-3/16	3-1/2	5.00	Note 3
10	4-1/2	3-15/16	3-15/16	2-3/4	3-1/8	6.00	Note 3

Note 1—SM series are two hole mounting with holes on center line. #4-40 Pem nuts are fastened to the bracket.

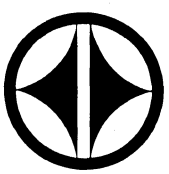
Note 2—#6-32 Pem nuts on bracket are standard.

Note 3—#8-32 Pem nuts on bracket are standard.

- All primaries 380-1000 cps
- Dielectric test voltages:
  PRIMARIES 1500 Volts RMS
  SECONDARIES 1500 Volts RMS
- Epoxy resin used as encapsulant
- Prices subject to change without notice

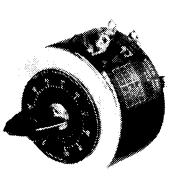
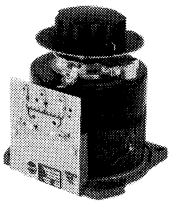
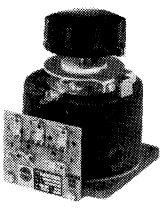
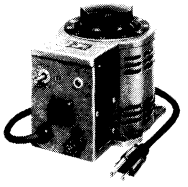
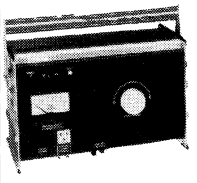
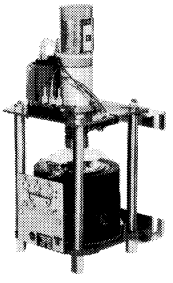


Look in the Yellow Section for Manufacturers' Sales Offices



Tell them you found them in **eem**

STACO® Variable Autotransformers

STACO Variable Autotransformers are precision built to exacting tolerances from the finest materials available.

Staco's new improved design provides long life with negligible maintenance, high efficiency and regulation, greater power to size ratio. Staco designs permit replacement of competitive equipment or previous Staco models without modification.

Models are available in various configurations from 1.75 to 300 amperes output. Choose from panel mounted units, cord and plug types or deluxe fully enclosed portable models, with or without metering. Staco products represent 25 years experience in providing safe and dependable control of power.

Contact your local representative for full details or write the factory for our new Product Guide.

STACO® INCORPORATED
2240 East 3rd St. • Dayton, Ohio 45403
Phone: 513/253-1191 • TWX: 513/944-0432

120 VOLT SINGLE PHASE PANEL MOUNTING

Cased and uncased units designed for mounting on panels 1/4" thick to 5/8" thick. Most panel mounting units can also be bench mounted.

Mfr's Type No.	Volts	Output Amps	KVA	Size	Weight (Lbs.)	Price
171	*0-132	1.75	.23	$2^{13}/_{16} \times 2^{3}/_{32}$	3	10.50
241	0-120/140	2.4	.33	$3¼ \times 3¼ \times 3^{15}/_{16}$	4	17.50
251	*0-132	2.5	.33	$2^{13}/_{16} \times 2^{9}/_{16}$	3.5	11.25
371	*0-120/140	3.75	.53	$3¾ \times 3¾ \times 3¼$	5	15.75
501	0-120/140	5.0	.70	$3¾ \times 3¾ \times 3^{5}/_{16}$	6	16.00
601	0-120/140	6.0	.84	$4½ \times 4½ \times 3^{15}/_{16}$	7	21.00
1010	0-120/140	10.0	1.4	$5^{5}/_{16} \times 5 \times 4^{7}/_{16}$	12	21.00
1010CT	0-120/140	*10.0	1.4	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12	28.00
1210	**0-120	12.5	1.4	$5^{5}/_{16} \times 5 \times 4^{3}/_{16}$	12	23.00
1210CT	**0-120	12.5	1.4	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12	29.00
1510	0-120/140	15.0	2.1	$6^{1}/_{8} \times 6^{5}/_{8} \times 4^{3}/_{8}$	20	39.00
2510	0-120/140	25.00	3.5	$8^{3}/_{16} \times 7^{5}/_{8} \times 4^{1}/_{8}$	23	57.00
2510CT	0-120/140	25.0	3.5	$9^{5}/_{8} \times 7^{5}/_{8} \times 4^{1}/_{8}$	23	66.00
5010	0-140	50.0	7.0	$12½ \times 12½ \times 6½$	60	140.00
5010CT	0-140	50.0	7.0	$15^{5}/_{8} \times 14 \times 6½$	60	155.00

*60 cycle operation only at overvoltage.
**60 cycle operation only.

120 VOLT SINGLE PHASE MODELS WITH CORD & RECEPTACLE

All models housed in rugged cases include pilot light, switch fuse, line cord, plug and matching receptacle.
2 PF models are equipped with 2-wire cords, plugs and receptacles.
3PN models are equipped with 3-wire grounded cords, plugs, and receptacles.

Mfr's Type No.	Volts	Output Amps	KVA	Size	Weight (Lbs.)	Price
2PF171	**0-132	1.75	.23	$3^{7}/_{8} \times 3^{7}/_{8} \times 3½$	3.5	20.00
3PN171	**0-132	1.75	.23	$3^{7}/_{8} \times 3^{7}/_{8} \times 3½$	3.5	22.00
2PF371	*0-120/140	3.75	.53	$6½ \times 6^{1}/_{8} \times 6½$	7.0	22.00
3PN371	*0-120/140	3.75	.53	$6½ \times 6^{1}/_{8} \times 6½$	7.0	24.00
2PF501	0-120/140	5.0	.70	$6½ \times 6^{1}/_{8} \times 6½$	9.0	24.00
3PN501	0-120/140	5.0	.70	$6½ \times 6^{1}/_{8} \times 6½$	9.0	26.00
3PN601	0-140	6.0	.84	$4^{7}/_{8} \times 4^{3}/_{8} \times 6½$	11.0	33.00
2PF1010	0-120/140	10.0	1.4	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	29.00
3PN1010	0-120/140	10.0	1.4	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	33.00
2PF1210	**0-120	12.5	1.4	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	34.00
3PN1210	**0-120	12.5	1.4	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	36.00
3PN2210	0-140	22.0	2.4	$10¾ \times 7^{5}/_{8} \times 4^{1}/_{8}$	23.0	79.00

*60 cycle operation only on overvoltage. **60 cycle operation only.

240 VOLT SINGLE PHASE PANEL MOUNTING

Cased and uncased units designed for mounting on panels 1/4" thick to 5/8" thick. Most panel mounting units can also be benched mounted.

Mfr's Type No.	Volts	Output Amps	KVA	Size	Weight (Lbs.)	Price
1020	0-240/280	3.5	.98	$5^{5}/_{16} \times 5 \times 4^{3}/_{16}$	12.0	24.00
1020CT	0-240/280	3.5	.98	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	32.00
1220	0-240	5.0	1.2	$5^{5}/_{16} \times 5 \times 4^{3}/_{16}$	12.0	26.00
1220CT	0-240	5.0	1.2	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	34.00
1520	0-240/280	9.5	2.7	$6^{1}/_{8} \times 6^{5}/_{8} \times 4^{13}/_{16}$	20.0	39.00
2520	0-240/280	10.0	2.8	$8^{3}/_{8} \times 7^{5}/_{8} \times 4^{1}/_{8}$	23.0	57.00
2520CT	0-240/280	10.0	2.8	$9^{5}/_{8} \times 7^{5}/_{8} \times 4^{1}/_{8}$	23.0	66.00
5020	0-240/280	28.0	7.8	$12½ \times 12½ \times 6½$	60.0	140.00
5020CT	0-240/280	28.0	7.8	$15^{5}/_{8} \times 14 \times 6½$	60.0	155.00

120 VOLT VARIABLE ISOLATION TRANSFORMERS

All models housed in rugged cases include pilot light, switch, fuse, line cord, plug and matching receptacle.
2 PF models are equipped with 2-wire cords, plugs and receptacles.
3 PN models are equipped with 3-wire grounded cords, plugs, and receptacles.

Mfr's Type No.	Volts	Output Amps	KVA	Size	Weight (Lbs.)	Price
2PF1020	0-280	3.5	.98	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	33.00
3PN1020	0-280	3.5	.98	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	37.00
2PF1220	**0-240	5.0	1.2	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	38.00
3PN1220	**0-240	5.0	1.2	$6^{7}/_{8} \times 5 \times 4^{7}/_{16}$	12.0	40.00
3PN2520	0-240	10.0	2.8	$9^{5}/_{8} \times 7^{5}/_{8} \times 4^{1}/_{8}$	23.0	79.00

**60 cycle operation only.

240 VOLT SINGLE PHASE MODELS WITH CORD & RECEPTACLE

STACO isolated variable autotransformers provide a means for smooth control of an electrically isolated AC voltage output. Uncased models offer isolated, non-isolated voltage doubler, and series connections with proper external hook-up. Cased models feature circuit breaker, switch pilot light, output voltmeter 3-wire grounded cord, plug, and matching receptacles. Cased models available in isolated connection only. Ratings shown are for isolated connections.

Mfr's Type No.	Volts	Output Amps	KVA	Size	Weight (Lbs.)	Price
J201	0-140	2.0	.28	$4½ \times 4½ \times 4^{7}/_{16}$	17.0	34.00
J401	0-140	4.0	.56	$6^{1}/_{8} \times 6^{5}/_{8} \times 4^{7}/_{8}$	13.0	46.00
J901	0-140	9.0	1.26	$8^{9}/_{32} \times 7¾ \times 5^{1}/_{8}$	25.0	65.00
EJ201V	0-140	2.0	.28	$7^{3}/_{8} \times 15^{7}/_{16} \times 5^{7}/_{8}$	13.0	79.00
EJ401V	0-140	4.0	.56	$9½ \times 12^{15}/_{16} \times 6^{3}/_{8}$	26.0	89.00
EJ901V	0-140	9.0	1.26	$11¼ \times 14^{9}/_{16} \times 6^{5}/_{8}$	36.0	105.00

EJ201V, EJ401V, EJ901V have a 0-140 VAC and 0-120 VDC at full rated current available at isolated banana receptacles.

DELUXE VARIABLE AUTOTRANSFORMERS

STACO offers a selected group of variable autotransformers with new style, broad applications, and a unique combination of practical features. Suitable for use in any industrial application, classroom or laboratory. All units provide continuous voltage control over a wide range, and all are protected against short circuit. Convenient controls provide error-free operation and distortionless adjustment of AC voltage.

Mfr's Type No.	Input Volts	Output Volts	Output Amps	KVA	Size	Weight (Lbs.)	Price
E171	120	0-132	1.75	.23	$5^{7}/_{8} \times 9^{9}/_{16} \times 3^{5}/_{8}$	8.0	25.50
E371	120	0-140	3.75	.52	$7^{3}/_{8} \times 11^{3}/_{16} \times 4^{7}/_{8}$	11.0	27.00
E501	120	0-140	5.0	.7	$7^{3}/_{8} \times 11^{3}/_{16} \times 4^{7}/_{8}$	12.0	32.00
E501V	120	0-140	5.0	.7	$7^{3}/_{8} \times 15^{7}/_{16} \times 5^{7}/_{8}$	13.0	58.00
E501VA	120	0-140	5.0	.7	$11¼ \times 12^{9}/_{16} \times 5^{7}/_{8}$	17.0	95.00
E501VAW	120	0-140	5.0	.7	$11¼ \times 14^{9}/_{16} \times 5^{7}/_{8}$	18.0	156.00
E1010	120	0-140	10.0	1.4	$7^{3}/_{8} \times 11^{15}/_{16} \times 5^{7}/_{8}$	18.0	40.50
E1010V	120	0-140	10.0	1.4	$7^{3}/_{8} \times 15^{7}/_{16} \times 5^{7}/_{8}$	19.0	73.00
E1010VA	120	0-140	10.0	1.4	$11¼ \times 12^{9}/_{16} \times 5^{7}/_{8}$	23.0	114.00
E1010VAW	120	0-140	10.0	1.4	$11¼ \times 14^{9}/_{16} \times 5^{7}/_{8}$	23.0	184.00
E1210	120	0-120	12.0	1.44	$7^{3}/_{8} \times 11^{15}/_{16} \times 5^{7}/_{8}$	18.0	48.00
E1020	240	0-280	3.5	.98	$7^{3}/_{8} \times 11^{15}/_{16} \times 5^{7}/_{8}$	18.0	48.50
E1710	120	0-140	17.0	2.38	$11¼ \times 14^{9}/_{16} \times 5^{7}/_{8}$	31.0	84.00
E1720	240	0-280	10.0	2.8	$11¼ \times 14^{9}/_{16} \times 5^{7}/_{8}$	30.0	86.00

E501V, E501VA, E501VAW, E1010V, E1010VA, E1010VAW have isolated AC and DC outputs of 10% of the output current rating of the unit. Outputs are available at isolated banana receptacles.
V = Voltmeter A = Ammeter W = Wattmeter

POWERSTAT® Variable Transformers now

New epoxy-coated POWERKOTE Coils make the POWERSTAT line the most outstanding value in variable transformers today. *Without increase in price, size or weight,* only POWERSTAT Variable Transformers give an average of 20% higher current ratings, 10:1 greater overload capability, longer life, greater resistance to fungus, salt spray and other contaminating atmospheres. POWERKOTE Coil commutator bars are embedded in place preventing steady-state operating temperature and severe overloads from distorting the commutator.

POWERSTAT Variable Transformers are designed to deliver continuously adjustable voltage from a-c power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types listed in the charts except the 10B-12, EN116B-EN216B and EN117B-EN217B Series are available with motor drives if desired. Motor-driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types having -4, -5, or -6 suffixes which do not offer the 5-second speed. Single types in the 116B-216B, 117B-217B, 126-226 and 136B-236B Series are also offered with 2- or 3-wire cord-plug sets. 1156D-1256D Series types are available in ratings to 244 kva.



ADJUSTABLE SPEED DRIVES

All motor-driven units in the 116B-216B, 117B-217B, 126-226, 136B-236B and 146-246 Series are available with adjustable speed drives which permit the output voltage of the transformer to be controlled over the full range of zero to maximum output voltage at speeds ranging from 5 seconds to 200 seconds. All control circuitry is solid-state and adaptable for present speed systems. The Adjustable Speed Control Potentiometer BHP65455-G1 can be remotely located from the variable transformer.

RATINGS AND SPECIFICATIONS

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Cycles	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
10B-12 SERIES								
Single Phase								
120	60	0-132	1	0.13	—	—	2PF10	3½
120	50/60	0-120	2.25*	0.27	3‡	0.36	10B	2½
120	60	0-132	2.25*	0.30	—	—		
240	50/60	0-240	0.7*	0.17	0.9‡	0.22	12	2½
240	50/60	0-264	0.5**	0.13	—	—		
240	50/60	0-240	2.25*	0.54	3‡	0.72	10B-2	6
240	60	0-264	2.25*	0.59	—	—		
480	50/60	0-480	0.7*	0.34	0.9‡	0.43	12-2	6
480	50/60	0-528	0.5**	0.26	—	—		
Three Phase								
120	50/60	0-120	2.25*	0.47	3‡	0.62	10B-2	6
120	60	0-132	2.25*	0.51	—	—		
240	50/60	0-240	0.7*	0.29	0.9‡	0.37	12-2	6
240	50/60	0-264	0.5**	0.23	—	—		
240	60	0-240	2.25*	0.94	3‡	1.2	10B-3	8½
480	50/60	0-480	0.7*	0.58	0.9‡	0.75	12-3	8½
480	60	0-528	0.5**	0.46	—	—		
21-22 SERIES								
Single Phase								
120	50/60	0-120	4.5	0.54	6.5	0.78	21	6
120	50/60	0-140	4.5	0.63	—	—		
240	50/60	0-240	2.25	0.54	3.25	0.78	22	6
240	50/60	0-280	2.25	0.63	—	—		
240	50/60	0-240	4.5	1.1	6.5	1.6	21-2	13½
240	50/60	0-280	4.5	1.3	—	—		
480	50/60	0-480	2.25	1.1	3.25	1.6	22-2	13½
480	50/60	0-560	2.25	1.3	—	—		
Three Phase								
120	50/60	0-120	4.5	0.94	6.5	1.4	21-2	13½
120	50/60	0-140	4.5	1.1	—	—		
240	50/60	0-240	2.25	0.94	3.25	1.4	22-2	13½
240	50/60	0-280	2.25	1.1	—	—		
240	50/60	0-240	4.5	1.9	6.5	2.7	21-3	19
240	60	0-280	4.5	2.2	—	—		
480	50/60	0-480	2.25	1.9	3.25	2.7	22-3	19
480	60	0-560	2.25	2.2	—	—		

*Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 1.75 amp., 12 Series to 0.5 amp.
‡Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 2.5 amp., 12 Series to 0.75 amp.
**0.7 amp. maximum in range from 0 to line voltage when mounted on metal panel.

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Cycles	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
116B-216B and 117B-217B SERIES†								
Single Phase								
120	50/60	0-120	10	1.2	13	1.6	116B	12
120	50/60	0-140	10	1.4	—	—		
120	60	0-120	12	1.4	15	1.8	117BT	12
240	50/60	0-240	3.5	0.84	5	1.2	216B	12
240	50/60	0-280	3.5	0.98	—	—		
240	60	0-240	5	1.2	7	1.7	217BT	12
240	50/60	0-240	10	2.4	13	3.1	116BT-2	24
240	50/60	0-280	10	2.8	—	—		
240	60	0-240	12	2.9	15	3.6	117BT-2	24
480	50/60	0-480	3.5	1.7	5	2.4	216BT-2	24
480	50/60	0-560	3.5	2.0	—	—		
480	60	0-480	5	2.4	7	3.4	217BT-2	24
Three Phase								
120	50/60	0-120	10	2.1	13	2.7	116BT-2	24
120	50/60	0-140	10	2.4	—	—		
120	60	0-120	12	2.5	15	3.1	117BT-2	24
240	50/60	0-240	3.5	1.5	5	2.1	216BT-2	24
240	50/60	0-280	3.5	1.7	—	—		
240	60	0-240	5	2.1	7	2.9	217BT-2	24
240	50/60	0-240	10	4.2	13	5.4	116BT-3	36
240	60	0-280	10	4.8	—	—		
240	60	0-240	12	5.0	15	6.2	117BT-3	36
480	50/60	0-480	3.5	2.9	5	4.2	216BT-3	36
480	60	0-560	3.5	3.4	—	—		
480	60	0-480	5	4.2	7	5.8	217BT-3	36
EN116B-EN216B and EN117B-EN217B SERIES								
Single Phase								
120	50/60	0-120	8	0.96	13	1.6	EN116B	15
120	50/60	0-140	8	1.1	—	—		
120	60	0-120	10	1.2	14.5	1.7	EN117B	15
240	50/60	0-240	3	0.72	4.5	1.1	EN216B	15
240	50/60	0-280	3	0.84	—	—		
240	60	0-240	4.4	1.1	5.8	1.4	EN217B	15
240	50/60	0-240	8	1.9	13	3.1	EN116B-2	28
240	50/60	0-280	8	2.2	—	—		
240	60	0-240	10	2.4	14.5	3.5	EN117B-2	28
480	50/60	0-480	3	1.4	4.5	2.2	EN216B-2	28
480	50/60	0-560	3	1.7	—	—		
480	60	0-480	4.4	2.1	5.8	2.8	EN217B-2	28
Three Phase								
120	50/60	0-120	8	1.7	13	2.7	EN116B-2	28
120	50/60	0-140	8	1.9	—	—		
120	60	0-120	10	2.1	14.5	3.0	EN117B-2	28
240	50/60	0-240	3	1.2	4.5	1.9	EN216B-2	28
240	50/60	0-280	3	1.5	—	—		
240	60	0-240	4.4	1.8	5.8	2.4	EN217B-2	28
240	50/60	0-240	8	3.3	13	5.4	EN116B-3	39
240	60	0-280	8	3.9	—	—		
240	60	0-240	10	4.2	14.5	6.0	EN117B-3	39
480	50/60	0-480	3	2.5	4.5	3.7	EN216B-3	39
480	60	0-560	3	2.9	—	—		
480	60	0-480	4.4	3.7	5.8	4.8	EN217B-3	39

†Also available with open construction. Suffix U when ordering.

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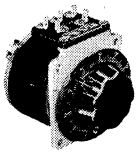
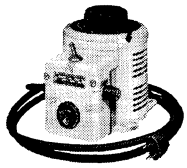
with POWERKOTE® COILS



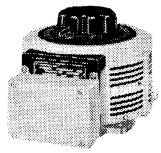
TYPE 10B



TYPE 21



TYPE 116B

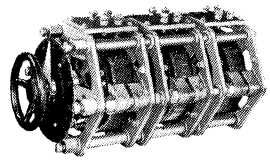


TYPE 136BT

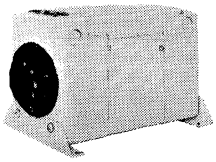
HIGH FREQUENCY TYPES ➧



TYPE 5-1011



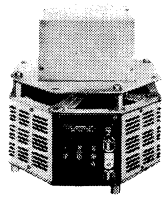
TYPE 2HL15UK-3Y



TYPE EN216B-2



TYPE 3PN126



TYPE 5MB1156D

Standard manually-operated types designed to meet applicable military specifications are available for 28, 120, 240 and 480 volt, 400/800 hertz single and three phase operation in ratings from 56 va to 7.3 kva; for 115 volt, 400/800 hertz single phase service with outputs of 0-28 volts, 2.5 or 8 amperes and 0-5 volts, 6 or 12 amperes; for 400/1600 hertz service as limited range variable transformers, low voltage output variable transformers or line correctors.

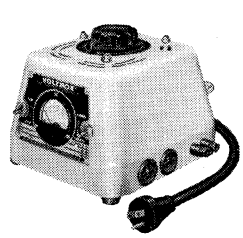
INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			Ship.
Volts	Cycles	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Wt. Lbs.
126-226 SERIES†								
Single Phase								
120	50/60	0-120	15	1.8	20	2.4	126	17
120	50/60	0-140	15	2.1	—	—		
240	50/60	0-240	7.5	1.8	10	2.4	226	17
240	50/60	0-280	7.5	2.1	—	—		
240	50/60	0-240	15	3.6	20	4.8	126-2	32
240	50/60	0-280	15	4.2	—	—		
480	50/60	0-480	7.5	3.6	10	4.8	226-2	32
480	50/60	0-560	7.5	4.2	—	—		
Three Phase								
120	50/60	0-120	15	3.1	20	4.2	126-2	32
120	50/60	0-140	15	3.6	—	—		
240	50/60	0-240	7.5	3.1	10	4.2	226-2	32
240	50/60	0-280	7.5	3.6	—	—		
240	50/60	0-240	15	6.2	20	8.3	126-3	49
240	60	0-280	15	7.3	—	—		
480	50/60	0-480	7.5	6.2	10	8.3	226-3	49
480	60	0-560	7.5	7.3	—	—		
136B-236B SERIES†								
Single Phase								
120	50/60	0-120	22	2.6	28	3.4	136B	25
120	50/60	0-140	22	3.1	—	—		
120	50/60	0-120	44	5.3	56	6.7	136B-2§	52
120	50/60	0-140	44	6.2	—	—		
240	50/60	0-240	10	2.4	13	3.1	236B	25
240	50/60	0-280	10	2.8	—	—		
240	50/60	0-240	22	5.3	28	6.7	136B-2	52
240	50/60	0-280	22	6.2	—	—		
480	50/60	0-480	20	4.8	26	6.2	236B-2	52
480	50/60	0-560	20	5.6	—	—		
Three Phase								
120	50/60	0-120	22	4.6	28	5.8	136B-2	52
120	50/60	0-140	22	5.3	—	—		
240	50/60	0-240	10	4.2	13	5.4	236B-2	52
240	50/60	0-280	10	4.8	—	—		
240	50/60	0-240	22	9.1	28	11.6	136B-3	76
240	60	0-280	22	10.7	—	—		
480	50/60	0-480	10	8.3	13	10.8	236B-3	76
480	60	0-560	10	9.7	—	—		
146-246 SERIES†								
Single Phase								
120	50/60	0-120	30	3.6	35	4.2	146	38
120	50/60	0-140	30	4.2	—	—		
120	50/60	0-120	60	7.2	70	8.4	146-2§§	83
120	50/60	0-140	60	8.4	—	—		
240	50/60	0-240	15	3.6	19	4.6	246	38
240	50/60	0-280	15	4.2	—	—		
240	50/60	0-240	30	7.2	35	8.4	146-2	83
240	50/60	0-280	30	8.4	—	—		
480	50/60	0-480	15	7.2	19	9.1	246-2	83
480	50/60	0-560	15	8.4	—	—		

†Also available with open construction. Suffix U when ordering.
§Requires also one paralleling choke type T5000.
§§Requires also one paralleling choke type T6053.

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			Ship.
Volts	Cycles	Volts	Max. Amps.	Max. KVA	Max. Amps.	Max. KVA	TYPE	Wt. Lbs.
146-246 SERIES† (contd.)								
Three Phase								
120	50/60	0-120	30	6.2	35	7.3	146-2	83
120	50/60	0-140	30	7.3	—	—		
240	50/60	0-240	15	6.2	19	7.9	246-2	83
240	50/60	0-280	15	7.3	—	—		
240	50/60	0-240	30	12.5	35	14.5	146-3	125
240	60	0-280	30	14.5	—	—		
480	50/60	0-480	15	12.5	19	15.8	246-3	125
480	60	0-560	15	14.5	—	—		
1156D-1256D SERIES†								
Single Phase								
120	50/60	0-120	50	6.0	55	6.6	1156D	82
120	50/60	0-140	50	7.0	—	—		
120	50/60	0-120	100	12.0	110	13.2	1156D-2P	169
120	50/60	0-140	100	14.0	—	—		
120	50/60	0-120	150	18.0	165	19.8	1156D-3P	272
120	50/60	0-140	150	21.0	—	—		
240	50/60	0-240	28	6.7	28	6.7	1256D	82
240	50/60	0-280	28	7.8	—	—		
240	50/60	0-240	50	12.0	55	13.2	1156D-2S	156
240	50/60	0-280	50	14.0	—	—		
240	50/60	0-240	56	13.4	56	13.4	1256D-2P	169
240	50/60	0-280	56	15.7	—	—		
240	50/60	0-240	84	20.2	84	20.2	1256D-3P	272
240	50/60	0-280	84	23.5	—	—		
240	50/60	0-240	100	24.0	110	26.4	1156D-4PS	361
240	50/60	0-280	100	28.0	—	—		
480	50/60	0-480	28	13.4	28	13.4	1256D-2S	156
480	50/60	0-560	28	15.7	—	—		
480	50/60	0-480	56	26.9	56	26.9	1256D-4PS	361
480	50/60	0-560	56	31.4	—	—		
Three Phase								
120	50/60	0-120	50	10.4	55	11.4	1156D-2D	155
120	50/60	0-140	50	12.1	—	—		
240	50/60	0-240	28	11.6	28	11.6	1256D-2D	155
240	50/60	0-280	28	13.6	—	—		
240	50/60	0-240	50	20.8	55	22.9	1156D-3Y	230
240	60	0-280	50	24.2	—	—		
240	50/60	0-240	100	41.6	110	45.7	1156D-6Y	507
240	50/60	0-280	100	48.5	—	—		
480	50/60	0-480	28	23.3	28	23.3	1256D-3Y	235
480	60	0-560	28	27.2	—	—		
480	50/60	0-480	56	46.6	56	46.6	1256D-6Y	507
480	60	0-560	56	54.3	—	—		

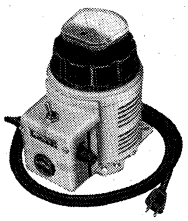
VOLTBOX® A-C POWER SUPPLY

Contains POWERSTAT Variable Transformer, voltmeter, three output receptacles, two 5-WAY Binding Posts, "on-off" switch, line-load meter switch, fuse and six-foot cord-plug. Type UC1MB ratings are 120 volt, single phase 50/60 hertz input and 0-140 volt 10 ampere, 1.4 kva output.

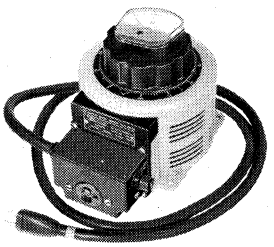


IN SECTIONS 2100, 3500 AND 4000

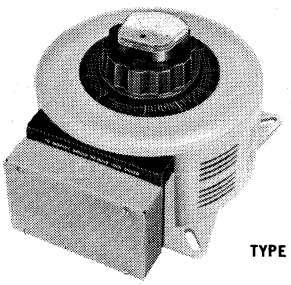
STATIONARY METERED KNOB POWERSTAT® Variable Transformers

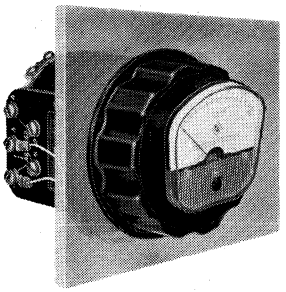


TYPE VS116B



TYPE VS3PN126





TYPE VS146T

GENERAL UTILITY MOUNTING – Single units (those listed in charts without -2 or -3 suffixes) in the 116B-216B, 117B-217B, 126-226, 136B-236B and 146-246 series are also available with knobs incorporating direct-reading voltmeters. Voltmeters remain stationary as the knob rim is turned, have an accuracy of ±3% of full scale and are insensitive to stray magnetic fields. When ordering, add VS prefix to the type number given in the charts.

BACK-OF-PANEL MOUNTING – Standard cataloged POWERSTAT Variable Transformers in the 21-22 through the 146-246 series designed or adaptable for back-of-panel mounting can be combined with Metered Knob Assemblies. Models for 120 volt service require Metered Knob Assembly VS150 having a 0-150 volt scale and units for 240 volt use require Metered Knob Assembly VS300 having a 0-300 volt scale. Existing models can be retrofitted also.

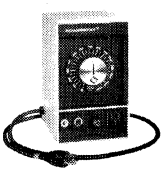
ENCLOSED LABORATORY POWERSTAT® Variable Transformers



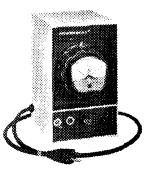
TYPE N10B



TYPE N21



TYPE N116B



TYPE N116BK

Portable, single phase units having grounded NEMA cord-plug assembly, on-off switch, output receptacle, pilot light and fuse. The handle is integrally designed and the panel controls are recessed. A slot is provided at the rear of each unit to accept wall hanger brackets supplied with the assembly. Types N21, N116B, N116BK, N116BL and N116BLK have POWERKOTE Coils.

METERED KNOB types N116BK and N116BLK have metered knobs to conveniently measure load voltage without the necessity of providing a separate voltmeter. The knob is designed so that the voltmeter remains stationary as the knob is turned to vary the voltage, assuring accurate readings and maximum meter visibility.

INPUT		OUTPUT					
			CONSTANT CURRENT LOAD		CONSTANT IMPEDANCE LOAD		
VOLTS	HERTZ	VOLTS	MAX. AMP.	MAX. KVA	MAX. AMP.	MAX. KVA	TYPE
120	60	0-132	2.25	0.30	—	—	N10B
120	50/60	0-140	4.5	0.63	—	—	N21
120	50/60	0-140	10	1.4	—	—	N116B N116BK
120	50/60	0-120	10	1.2	13	1.6	N116BL N116BLK

FLEXIFORMER® Packaged Transformer Primaries



TYPE TP150

When used as a source of a-c voltage, the center opening permits hand-threading the correct number of secondary winding turns to obtain the desired output voltage. When used as a current transformer, the unit winding is shuted by an ammeter which indicates the current flow in a conductor hand-threaded through the center opening. For 50/60 hertz duty.

RATINGS AS A SOURCE OF A-C VOLTAGE

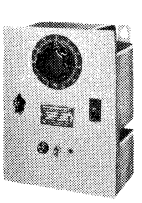
TYPE	NORMAL PRIMARY VOLTS	Hertz	MAXIMUM VA	VOLTS PER SECONDARY TURN	REGULATION AT MAXIMUM OUTPUT
TP150	120	50/60	150	0.3	25%
TP1000	120	50/60	1000	0.75	10%
TP152	240	50/60	150	0.3	25%
TP1020	240	50/60	1000	0.75	10%

RATINGS AS A CURRENT TRANSFORMER

TYPE	INPUT/ OUTPUT RATIO	MAXIMUM PRIMARY AMPERES	MAXIMUM SECONDARY AMPERES	ACCURACY AT 60 Hertz
TP150	400/1	400	1.0	1%
TP1000	160/1	800	5.0	1%
TP152	800/1	400	0.5	1%
TP1020	320/1	800	2.5	1%

POWERSTAT DC Motor Speed Controllers

Continuously adjustable speed control of d-c shunt-wound motors from a-c power lines. Full rated torque available at any speed. Instantaneous start, stop and reverse, tubeless transient-protected circuitry. Rated for 120 volt, 60 hertz single phase input. Type MSC16 for motors to 1/8 hp, type MSC33 to 1/3 hp and type MSC75 to 3/4 hp. NEMA frame 1725 rpm, dc motors in 1/6, 1/3 and 3/4 hp also available.

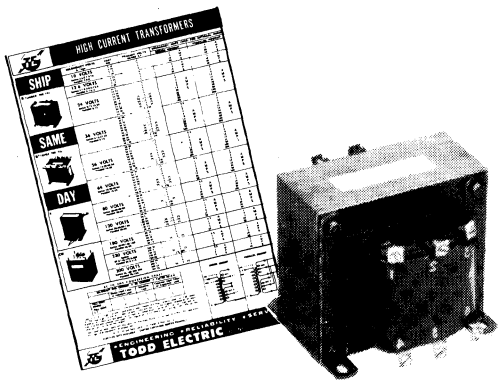


TYPE MSC33

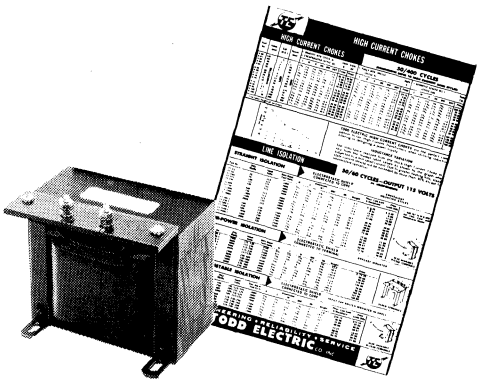
THE SUPERIOR ELECTRIC COMPANY
1000 MIDDLE STREET, BRISTOL, CONNECTICUT 06010

SEE OTHER SUPERIOR ELECTRIC PRODUCT IN SECTIONS 2100, 3500 AND 4000

TRANSFORMERS



HIGH CURRENT TRANSFORMERS

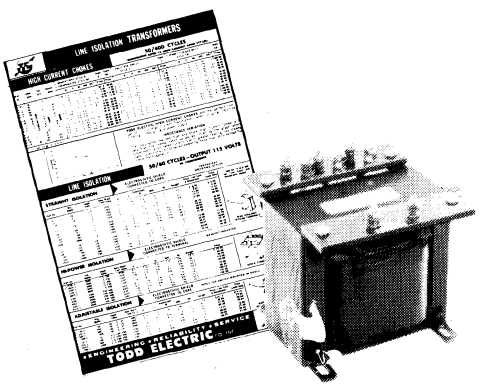


HIGH CURRENT CHOKES

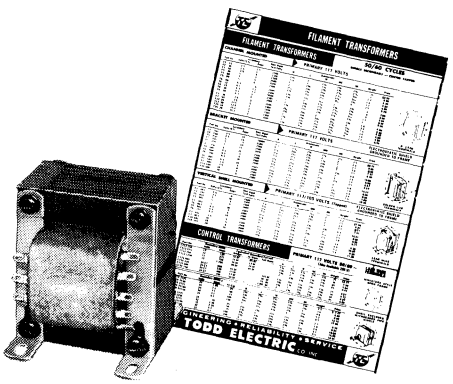
SHIP SAME DAY

SEND FOR COMPLETE CATALOG

SHIP SAME DAY



ISOLATION TRANSFORMERS

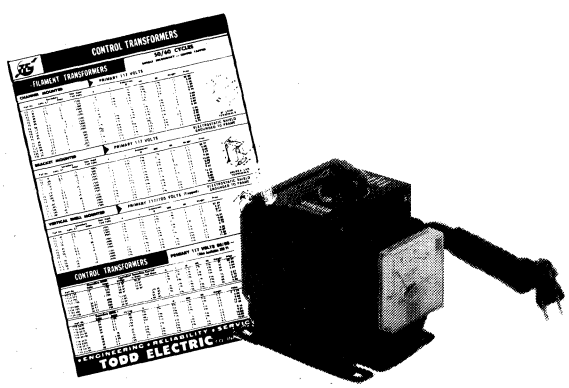


FILAMENT TRANSFORMERS

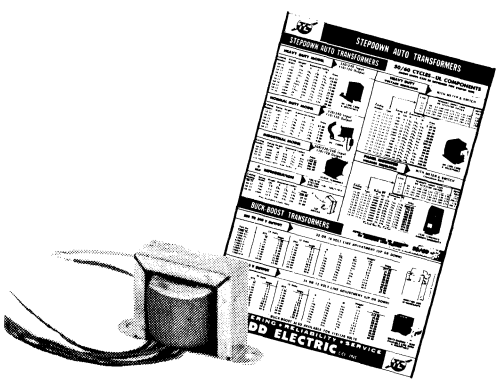
CUSTOM VARIATIONS

SEE OUR CATALOG IN THE RADIO MASTER

PROMPT QUOTATIONS



STEPDOWN AUTO TRANSFORMERS



CONTROL TRANSFORMERS

• ENGINEERING • RELIABILITY • SERVICE

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Yonkers, N. Y. 10705
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TOROTEL INC

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030

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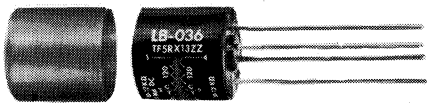
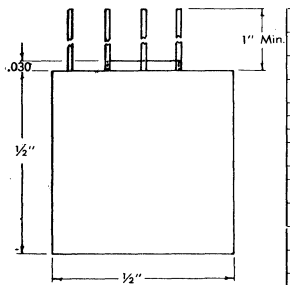
MINIATURE AUDIO TRANSFORMERS — L.B. SERIES

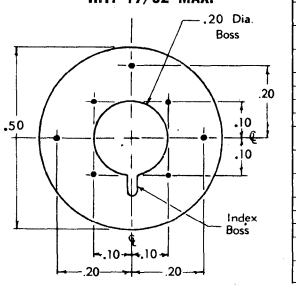


Torotel "LB" Transformers are Manufactured to MIL-T-27B, Grade 5, Class S Specifications. This Series of "LB" Transformers have 0.1 Grid Spacing for Printed Circuit Applications and .030 Mounting Surface to Avoid a Moisture Trap. Leads are made of 20AWG Tinned Hard Drawn Copper. Units Utilizing Dumet Wire are Available on Special Request.

DELIVERY AVAILABLE FROM STOCK



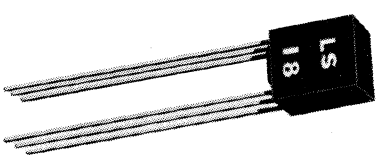
DIMENSIONS WITH SHIELD
O.D. 9/16 MAX.
H.T. 17/32 MAX.



LB #	Mil Type	Application	Pri. Imp.	D.C. MA In Pri.	Sec. Imp.	Nom. Pri. Res.	MW Lev @1KC
001	TF5SX13ZZ	Interstage	20,000 30,000	.5 .5	800 1200	850	50
002	TF5SX17ZZ	Output	500 600	3 3	50 60	60	100
003	TF5SX13ZZ	Output	1000 1200	3 3	50 60	115	100
004	TF5SX17ZZ	Output	600	3	3.2	60	100
005	TF5SX13ZZ	Output	1200	2	3.2	115	100
006	TF5SX13ZZ	Output	10,000	1	3.2	790	100
007	TF5SX16ZZ	Input Other Applications	200,000 500	0 0	1000 100,000	8500 —	25
008	TF5SX20ZZ	Reactor 3.5HY @ 2MADC, 1HY @ 5MADC				630	
009	TF5SX13ZZ	Output or Driver	10,000 12,000	1 1	500CT 600CT	800	100
010	TF5SX13ZZ	Driver	10,000 12,000	1 1	1200CT 1500CT	800	100
011	TF5SX13ZZ	Driver	10,000 12,000	1 1	2000CT 2500CT	800	100
012	TF5SX17ZZ	Single or PP Output	150CT 200CT	10 10	12 16	11	500
013	TF5SX17ZZ	Single or PP Output	300CT 400CT	7 7	12 16	20	500
014	TF5SX17ZZ	Single or PP Output	600CT 800CT	5 5	12 16	43	500
015	TF5SX17ZZ	Single or PP Output	800CT 1070CT	4 4	12 16	51	500
016	TF5SX13ZZ	Single or PP Output	1000CT 1330CT	3.5 3.5	12 16	71	500
017	TF5SX13ZZ	Single or PP Output	1500CT 2000CT	3 3	12 16	108	500
018	TF5SX13ZZ	Single or PP Output	7,500CT 10,000CT	1 1	12 16	505	500
019	TF5SX17ZZ	Output to Line	300CT	7	600	19	500
020	TF5SX17ZZ	Output or Line to Line or Mixing	500CT	5.5	600	31	500
021	TF5SX17ZZ	Output to Line	900CT	4	600	53	500
022	TF5SX13ZZ	Output to Line	1500CT	3	600	86	500
023	TF5SX13ZZ	Interstage	20,000CT 30,000CT	.5 .5	800CT 1200CT	850	100
024	TF5SX16ZZ	Input Other Application	200,000CT 500CT	0 0	1000CT 100,000CT	8500 —	25
025	TF5SX13ZZ	Interstage	10,000CT 12,000CT	1 1	1500CT 1800CT	800	100
026	TF5SX20ZZ	Reactor 6HY @ 2MADC 1.5HY @ 5MADC				2100	
027	TF5SX20ZZ	Reactor 1.25HY @ 2MADC, .5HY@ 11MADC				100	
028	TF5SX20ZZ	Reactor .3HY @ 4MADC, .15HY @ 20MADC				31	
029	TF5SX17ZZ	Single or PP Output	120CT 150CT	10 10	3.2 4	10	500
030	TF5SX17ZZ	Single or PP Output	320CT 400CT	7 7	3.2 4	20	500

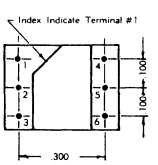
LB #	Mil Type	Application	Pri. Imp.	D.C. MA In Pri.	Sec. Imp.	Nom. Pri. Res.	MW Lev @1KC
031	TF5SX17ZZ	Single or PP Output	640CT 800CT	5 5	3.2 4	43	500
032	TF5SX17ZZ	Single or PP Output	800CT 1000CT	4 4	3.2 4	51	500
033	TF5SX13ZZ	Single or PP Output	1060CT 1330CT	3.5 3.5	3.2 4	71	500
034	TF5SX13ZZ	Single or PP Output	1600CT 2000CT	3 3	3.2 4	109	500
035	TF5SX13ZZ	Single or PP Output	8000CT 10,000CT	1 1	3.2 4	505	100
036	TF5SX13ZZ	Isolation or Interstage	10,000CT 12,000CT	1 1	10,000CT 12,000CT	950	100
037	TF5SX13ZZ	Driver	10,000CT 12,000CT	1 1	1200CT 1500CT	800	100
038	TF5SX13ZZ	Driver	10,000CT 12,000CT	1 1	2000CT 2500CT	800	100
039	TF5SX13ZZ	Driver	10,000CT 12,000CT	1 1	500CT 600CT	800	100
040	TF5SX16ZZ	Input	100,000	0	1000	1700	70
041	TF5SX13ZZ	Driver	20,000	.5	1000	1000	100
042	TF5SX13ZZ	Driver	20,000	.5	1200CT	1000	100
043	TF5SX17ZZ	Output	1000	3	50	60	100
044	TF5SX17ZZ	Output	400	3	50	30	100
045	TF5SX17ZZ	Output	400	3	11	30	100
046	TF5SX17ZZ	Single or PP Output	400CT	3	11	30	500
047	TF5SX20ZZ	Reactor 10HY @ 0 MADC 8HY @ .5MADC				650	
048	TF5SX13ZZ	Isolation or Interstage Ratio 1:1:1	2000CT 2500CT	3 3	8000 split 10,000 split	195	100
049	TF5SX13ZZ	Interstage	10,000CT 12,000CT	1 1	2000 split 2400 split	560	100
050	TF5SX13ZZ	Interstage	20,000CT 30,000CT	.5 .5	1000 split 1500 split	800	100
051	TF5SX13ZZ	Interstage	40,000CT 50,000CT	.25 .25	400 split 500 split	1700	50
052	TF5SX17ZZ	Interstage or Output	400CT 500CT	8 6	400 split 500 split	46	500
053	TF5SX17ZZ	Interstage	400CT 500CT	8 6	120 split 150 split	46	500
054	TF5SX17ZZ	Interstage	400CT 500CT	8 6	40 split 50 split	46	500
055	TF5SX17ZZ	Interstage	80CT 100CT	12 10	32 split 40 split	9.8	500
056	TF5SX16ZZ	Input	50,000CT	.3	1000CT	1900	50
057	TF5SX17ZZ	Output	600CT 750CT	4.5	3.2 4.0	40	500
058	TF5SX13ZZ	Output	1200CT 1500CT	3	3.2 4	100	500
500		Magnetic Shielding Case					

SUB-MINIATURE AUDIO TRANSFORMERS — L.S. SERIES

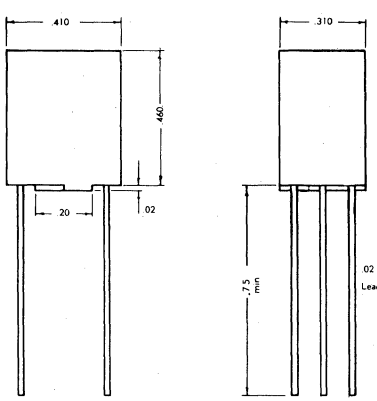


The LS series has successfully met and passed the rigid requirements of MIL-T-27B, class R, grade 5.

Subminiature in size and weighing less than 0.1 ounce, these transformers have grid spacing and are ideally suited for transistor application which utilizes printed circuit board design.



MOUNTING TEMPLATE



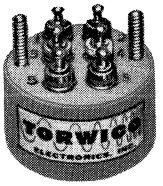
Type No.	Type	MIL-T-27 Designation	Primary Impedance	D.C. Res. Pri. Ohms	D.C. Ma. Pri.	Secondary Impedance	Max. Power MW.	Term. Lay-out
LS-1	Input	TF5RX16ZZ	200000 c.t.	5300	0	1000 c.t.	10	E
LS-2	Input	TF5RX16ZZ	50000 c.t.	3800	.2	1000 c.t.	25	E
LS-3	Input	TF5RX16ZZ	200000	5300	0	1000	10	B
LS-4	Interstage	TF5RX13ZZ	20000/30000	1700	.5	800/1200	40	B
LS-5	Interstage	TF5RX13ZZ	20000/30000 c.t.	1700	.5	800/1200 c.t.	40	E
LS-6	Interstage	TF5RX13ZZ	10000/12000 c.t.	1050	1	1500/1800 c.t.	50	E
LS-7	Driver	TF5RX13ZZ	10000/12000 c.t.	1050	1	1200/1500 c.t.	50	E
LS-8	Driver	TF5RX13ZZ	10000/12000 c.t.	1050	1	2000/2500 c.t.	50	E
LS-9	Driver	TF5RX13ZZ	10000/12000 c.t.	1050	1	500/600 c.t.	50	E
LS-10	Output	TF5RX17ZZ	500/600	60	3	50/60	50	B
LS-11	Output	TF5RX17ZZ	1000/1200	145	3	50/60	50	B
LS-12	Output	TF5RX17ZZ	600	70	3	3.2	50	B
LS-13	Output	TF5RX13ZZ	1200	120	2	3.2	50	B
LS-14	Output	TF5RX13ZZ	10000	1160	1	3.2	50	B
LS-15	Output	TF5RX17ZZ	150/200 c.t.	18	10	12/16	50	D
LS-16	Output	TF5RX17ZZ	300/400 c.t.	38	7	12/16	50	D
LS-17	Output	TF5RX17ZZ	600/800 c.t.	75	4.5	12/16	50	D
LS-18	Output	TF5RX17ZZ	1000/1330 c.t.	120	3.5	12/16	50	D
LS-19	Output	TF5RX13ZZ	1500/2000 c.t.	180	3	12/16	50	D
LS-20	Output	TF5RX13ZZ	7500/10000 c.t.	820	1	12/16	50	D
LS-21	Output	TF5RX13ZZ	300 c.t.	37	7	600	50	D
LS-22	Output	TF5RX17ZZ	500 c.t.	60	3	600	50	D
LS-23	Output	TF5RX17ZZ	900 c.t.	100	4	600	50	D
LS-24	Output	TF5RX17ZZ	1500 c.t.	170	3	600	50	D
LS-25	Output	TF5RX17ZZ	120/150 c.t.	15	10	3.2/4	50	D
LS-26	Output	TF5RX17ZZ	320/400 c.t.	40	6	3.2/4	50	D
LS-27	Output	TF5RX17ZZ	600/750 c.t.	70	4.5	3.2/4	50	D
LS-28	Output	TF5RX17ZZ	800/1000 c.t.	100	4	3.2/4	50	D
LS-29	Output	TF5RX13ZZ	1200/1500 c.t.	125	3	3.2/4	50	D
LS-30	Output	TF5RX13ZZ	1600/2000 c.t.	190	2.5	3.2/4	50	D
LS-31	Output	TF5RX13ZZ	8000/10000 c.t.	820	1	3.2/4	50	D
LS-32	Output	TF5RX13ZZ	10000 c.t.	1000	1	10000 c.t.	50	E
LS-33	Driver	TF5RX13ZZ	10000/12000	1050	1	500/600 c.t.	50	C
LS-34	Driver	TF5RX13ZZ	20000	1700	.3	1000	50	B
LS-35	Output	TF5RX17ZZ	1000	135	3	50	50	B
LS-36	Output	TF5RX17ZZ	400 c.t.	40	3	11	50	D
LS-37	Driver	TF5RX13ZZ	10000/12000	1050	1	2000/2500 c.t.	50	C
LS-101	Choke	TF5RX20ZZ	6 hy. @ 2 ma.	1700				A
LS-102	Choke	TF5RX20ZZ	1.25 hy. @ 2 ma.	180				A
LS-103	Choke	TF5RX20ZZ	3.5 hy. @ 2 ma.	1100				A
LS-104	Choke	TF5RX20ZZ	.3 hy. @ 4 ma.	42				A

TORWICO ELECTRONICS

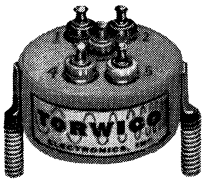
LEADER IN MAGNETIC COMPONENTS

TINYMAX

Miniature 400 Cycle Power Transformers



This Case style available in 1.5 through 250 VA



This Case style available in 1.5 through 9 VA

TINYMAX

CONDENSED PERFORMANCE DATA FOR STANDARD TINYMAX 400 CYCLE POWER TRANSFORMERS

VA Rating	Secondary Voltage-VRMS* (Choose any one voltage within limits listed)	O.D. ±1/32	Height ±1/32	Nominal Weight	Nominal Regulation	Nominal Temp. Rise MIL-T-27 (with no heat sink)
1.5	6.0 to 300	1"	15/32"	0.89 oz.	20%	13°C
1.5 (with electrostatic shield)	6.0 to 300	1"	19/32"	1.1 oz.	15%	13°C
3	6.0 to 300	1"	19/32"	1.1 oz.	15%	15°C
3 (with electrostatic shield)	6.0 to 300	1"	13/16"	1.5 oz.	10%	15°C
6	6.0 to 300	1"	13/16"	1.5 oz.	10%	18°C
6 (with electrostatic shield)	6.0 to 300	1"	1 1/16"	2 oz.	8%	18°C
9	6.0 to 300	1"	1 1/16"	2 oz.	8%	23°C
9 (with electrostatic shield)	6.0 to 300	1 3/8"	1 1/8"	3.5 oz.	7%	23°C
16	6.0 to 300	1 3/8"	1 1/8"	3.5 oz.	7%	25°C
25	6.0 to 300	1 3/8"	1 3/8"	4.5 oz.	6%	36°C
50	6.0 to 300	2"	1 1/2"	10 oz.	2.5%	26°C
75	10 to 300	2"	1 3/4"	12 oz.	2.5%	32°C
100	12 to 300	2 1/4"	2"	17 oz.	2%	35°C
250	26 to 300	2 7/8"	2"	27.5 oz.	1.5%	47°C

*with primary 115V, 400 cps

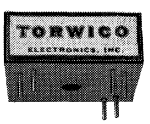
TINYMAX Power Transformers are hermetically sealed in drawn steel cases and shall meet all requirements of MIL-T-27; Military Designation: TF4S01YY.

24 hour delivery for prototype quantities. Don't settle for less — Prices on these custom-engineered transformers equal those of competitive shelf items — Phone today for your comprehensive TINYMAX catalog.

TINYMAX

POWER TRANSFORMERS FOR PRINTED CIRCUIT APPLICATIONS





VA Rating	Secondary Voltage—VRMS* (Choose any one voltage within limits listed)	Dimensions ±1/32"	Nominal Weight	Nominal Regulation	Nominal Temp. Rise
1.5	6.0 to 300	1 1/16" square x 7/16" tall	0.75 oz.	20%	13°C
3	6.0 to 300	1 1/16" square x 9/16" tall	1.0 oz.	15%	15°C
6	6.0 to 300	1 1/16" square x 3/4" tall	1.25 oz.	10%	18°C
9	6.0 to 300	1 1/16" square x 1" tall	1.63 oz.	8%	23°C

*with primary 115V, 400 cps

TINYMAX Power Transformers for printed circuit applications are hermetically sealed in thermoset plastic and shall meet all requirements of MIL-T-27; Military Designation: TF5SX01ZZ.

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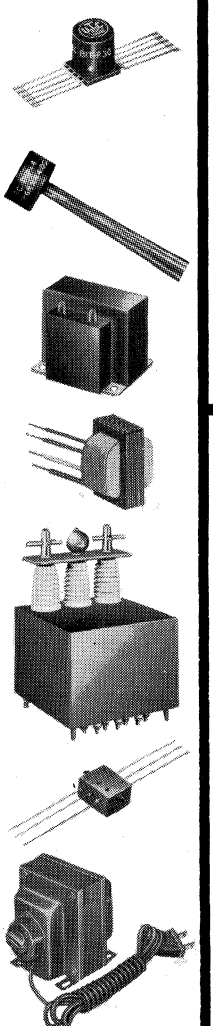
TRANSFORMERS

Concerted attention, for almost forty years, to engineering, quality and reliabilty has made UTC a pioneer in the design and manufacture of iron core components. Physical constructions include metal cased, molded, encapsulated, potted, or open type units as required. Special and stock units for both transistor and tube applications are available for industrial requirements and military requirements to MIL-T-27C specifications. In addition, these units are unprecedented for ham, hi-fi, broadcast and replacement purposes. Ranges are: power transformers, milliwatts to 100 KVA; audio units, 0.1 Hz to 400 MHz . . . microwatts to 50 KW; pulse transformers, microwatts to 10 megawatts.

ADJUSTABLE VOLTAGE
BIAS
BOOSTER
BRIDGING
CHOPPER
CURRENT LIMITING
DRIVER
FILAMENT
FOUR HUNDRED HERTZ
HIGH TEMP. (Class "S")
HYBRID
INPUT
INTERSTAGE
ISOLATION
LOW CAPACITY
LOW FREQUENCY
MATCHING
MIXING
MILITARY STANDARD
MINIATURE POWER
MODULATION
MOLDED
OUTPUT
PHOTOFLASH
PLATE
PLATE TO LINE
POWER
PRECISION REFERENCE
PRINTED CIRCUIT
PULSE
SIGNAL
STEP DOWN
THREE PHASE
TRANSISTOR
TRANSISTOR INVERTER
TRANSISTOR SUPPLY



INDUCTORS

UTC's capabilities in range run from fractions of microhenries to many thousands of henries, limited only by the physical size of the unit. Almost forty years of specialization in the design and production of iron core components have resulted in UTC being a first source of supply for difficult units. Military to (MIL-T-27C) and commercial types are available in all standard UTC case configurations, plus units to your specifications. Metal cased, molded, encapsulated, open, and potted units of the highest quality and reliability are available. The largest engineering staff of its kind is supported by the most modern, fully equipped materials and test laboratories. In addition, extensive life testing and rigid quality control measures assure the advanced designing and high reliability associated with UTC products.

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MAGNETIC AMPLIFIERS

UTC has manufactured virtually thousands of special types of magamps, saturable reactors and reference transformers tailored to a variety of unique applications. Included are units both hermetically sealed to MIL-T-27C specifications, and of the commercial type. Power gains of over 400,000 are not unusual. Physical construction including metal cased, molded, encapsulated, potted, or open type units are designed and produced to your specifications. A new stock line of magamps include compact, exceptionally stable, magnetically shielded units with an amplification of 40:1. These stock components, specifically designed for transistor application, are hermetically sealed to MIL-T-27C; one application is for control of 2 phase, 115 V., 400 Hz servo motors. Another new stock line, the "MAS" magamps operate on an input of 115 V 400 Hz with an output of ± 7.5 V DC, 1000 ohm load and have 2 isolated control inputs. These magnetic amplifiers afford a power gain of approximately 30,000.

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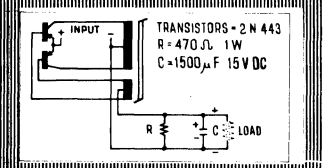
DC TO DC CONVERTER TRANSFORMERS

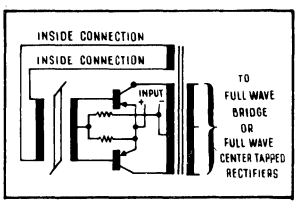
Permits conversion of low voltage direct current to high voltage for operating mobile electronic equipment.

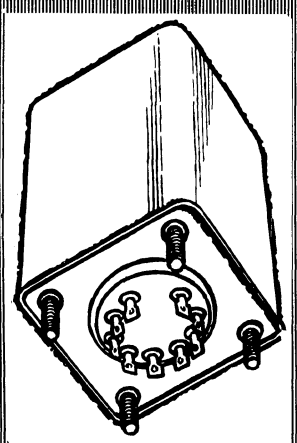


CATALOG NO.	DC INPUT VOLTS	DC OUTPUT VOLTS	DC LOAD AMPS
DD01001	6	12	4
DD01002	9	12	4
DD01003	6	9	4

These transformers are used in an efficient circuit using minimum components as it can be seen from the circuit diagram. Transformer used with this circuit gives a safe operation within −60° C to +70° C. The circuit remains highly efficient in either full load or fractional full load operation.

CATALOG NO.	DC INPUT VOLTS	TOTAL VA OUTPUT	TRANSISTORS	OUTPUT Bridge Volt	Bridge mA	CT Volt	CT mA	CONSTRUCTION
DD02004	28	125	Delco 2N174	500	250	250	420	GA
DD02005	12	125	Delco 2N442	500	250	250	420	GA
DD02006	12	40	Delco 2N442	450	90	225	155	FA

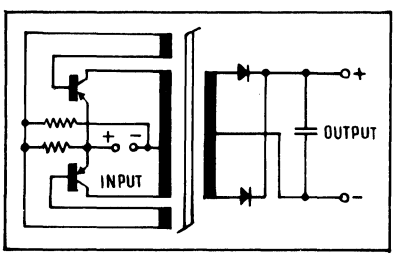


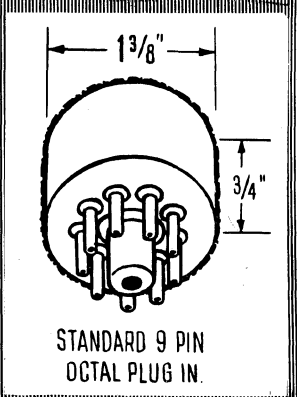


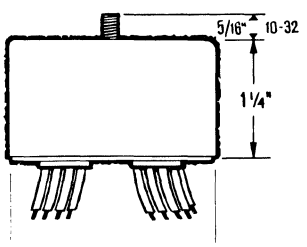
These transformers are used with relatively high load currents. With a low power saturating transformer the high power transformer can be linear so the circuit will prevent high collector current spikes. Recommended transistors are listed in the table. Feed back and starting resistor values will be supplied with every transformer.

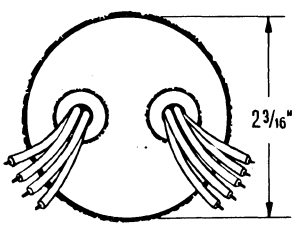
These transformers are hermetically sealed and meet MIL-T-27B TF4RX09, electrical schematic diagram is legible on gray finished cans.

CATALOG NO.	DC INPUT VOLTS	DC OUTPUT VOLTS	DC LOAD mA	TRANSISTORS	CONSTRUCTION
DD02007	6.3	250	10	2N1038	Fig. A
DD02008	6.3	200	15	2N1038	Fig. A
DD02009	6.3	150	20	2N1038	Fig. A
DD02010	6.3	120	30	2N1038	Fig. A
DD02011	6.3	250	50	2N1038	Fig. A
DD02012	6.3	200	70	2N1038	Fig. A
DD02013	6.3	150	85	2N1168	Fig. B
DD02014	6.3	120	125	2N1168	Fig. B
DD02015	12.6	250	10	2N1168	Fig. B
DD02016	12.6	200	15	2N1168	Fig. B
DD02017	12.6	150	20	2N1168	Fig. B
DD02018	12.6	120	30	2N1168	Fig. B
DD02019	12.6	250	50	2N1168	Fig. B
DD02020	12.6	200	70	2N1168	Fig. B
DD02021	12.6	150	85	2N1168	Fig. B
DD02022	12.6	120	125	2N1168	Fig. B
DD02023	28	250	10	2N174	Fig. C
DD02024	28	200	15	2N174	Fig. C
DD02025	28	150	20	2N174	Fig. C
DD02026	28	120	30	2N174	Fig. C
DD02027	28	250	50	2N174	Fig. C
DD02028	28	200	70	2N174	Fig. C
DD02029	28	150	85	2N174	Fig. C
DD02030	28	120	125	2N174	Fig. C
DD02031	6	12	500	2N1168	Fig. A
DD02032	6	24	250	2N1168	Fig. B
DD02033	12	24	250	2N1168	Fig. B
DD02034	6	12	1000	2N1168	Fig. C
DD02035	6	24	500	2N1168	Fig. C
DD02036	6	28	500	2N1168	Fig. C
DD02037	12	24	250	2N1168	Fig. C









Amperex Industrial, Communication

TUBE TYPE
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0G3
0Z4
0Z4A
1A3/DA90
1AB6
1AC6
1AD2
1AH5
1AJ4
1AN5
1AY2
1B3GT
1BC2
1BG2
1BH2
1BL2
1G3GT/1B3GT
1K3/1J3
1L4/DF92
1M3/DM70
1N3/DM71
1R5
1S2A/DY87
1S5
1T4
1U4/DF904
1U5
1V2
1X2A/1X2B
2AF4
2AF4B/2DZ4
2AH2
2AS2
2AV2
2BN4A
2C39A
2C39BA
2CN3A
2CW4
2CY5
2D21
2D21W
2ER5/XC95
2FH5
2FY5/XC97
2FS5
2GK5/2FQ5A
2GU5
2HA5
2J42
2J51
2J51A
2J55
2K25
3-400Z
3A2
3A3
3A3A/3AW3/3B2
3A4/DL93
3A5/DCC90
3AF4A/3AF4B
3AF4B/3DZ4
3AL5
3AT2
3AV6
3AW2
3B28
3BH2
3BN2
3BN4
3BN6
3BS2
3BSA
3BU8
3BZ6
3C4/DL96
3CB6/3CF6
3CE5/3BC5
3CN3
3CN3A
3CS6
3CX3
3CY5
3DG4
3DK6
3DT6
3EH7/XF183
3EJ7/XF184
3ER5
3FS5
3GK5
3GS8/3BU8
3HA5/LC900

TUBE TYPE
3HM5/3HA5
3HQ5
3NP4/MW6-2
3Q4/DL95
3S4/DL92
3V4/DL94
4-65A
4-125A/4D21
4-250A/5D22
4-400A
4AU6
4B32
4BC8
4BL8/XCF80
4BN6
4BQ7A/4BZ7
4BS8
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4C35
4CB6
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4CX250FG
4CX250R
4CX350A
4CX350F
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4DK6
4DT6
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4GS8/4BU8
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4HA5/PC900
4HA7/4HC7
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4JC6
4JD6
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4X150D
4X150D JAN
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5AQ5
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5AT8
5AU4
5AV8
5B8
5BC3
5BK7A
5BQ7A
5BR8
5BT8
5BW8
5CG8
5CL8A
5CQ8
5DH8
5DJA
5EA8
5EU8
5EW6
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5GH8
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5GX7
5HA7
5HG8/LCF86
5J26
5J6
5JK6
5KE8
5KZ8
5LJ8
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5R4GYB
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5U9/LCF201
5V3/5AU4
5V4GA
5V6GT

TUBE TYPE
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6AB8
6AC7
6AC10
6AD10
6AF3
6AF4
6AF4/6DZ4
6AF9
6AF11
6AG5
6AG7
6AG9
6AG11
6AH4GT
6AJ8/ECH81
6AK5/EF95
6AK5W
6AK8
6AL3
6AL5/EAA91
6AL5W
6AL7GT
6AL11
6AM4
6AM5
6AM6
6AM8A
6AN8A
6AQ4
6AQ5
6AQ5A/6HG5
6AQ5A/EL90MP
6AQ6
6AQ7GT
6AQ8/ECC85
6AR5
6AR8
6AR11
6AS5
6AS8
6AS11
6AT6/EBC90
6AT8A
6AU4GTA
6AU5GT
6AU6
6AU6A
6AV6
6AV11
6AW8A
6AX3
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6AX4GTB
6AX5GT
6AX8
6AY3B/6BS2A
6AY11
6AZ8
6B10
6BA6/EF93
6BA8A
6BA11
6BC7
6BC8/6BZ8
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6BE6
6BE7
6BF6
6BF8
6BF11
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6BH6
6BH8
6BH11
6BJ3
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6BJ7
6BJ8
6BK4B
6BK5
6BK7B
6BL7GTA
6BL8/ECF80
6BM8/ECL82
6BN4A
6BN5
6BN6/6KS6
6BN8

TUBE TYPE
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6BQ6GA/6CU6
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6BQ7A/6BZ7
6BR5/EM80
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6CG8A
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6CJ6
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6CK5
6CK6
6CL6
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6CM7
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6CN7
6CQ4
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6CQ8
6CS6
6CS7
6CT7
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6CU6
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6CU8
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6CW4
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6CY5
6CY7
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6DE4/6CQ4
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6DG6GT
6DJ8/ECC88
6DK6
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6DR8
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TUBE TYPE
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6EJ7/EF184
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6ES6
6ES8/ECC189
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6EV7
6EW6
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6GE5
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6GF7A
6GH8A
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6GK5/6FQ5A
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6GM6
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6GN8/6EB8
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6GU5
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6GV5
6GV8/ECL85
6GW8/ECL86
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6GY5
6GY6/6GX6/6HZ6
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6HF8
6HG5
6HG8/ELF86
6HJ8
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6HQ5
6HR5
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6HS6
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6HU6/EM87
6HU8/ELL80

TUBE TYPE
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6JV8
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6JX8/ECH84
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6LH6A
6LJ6
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6LT8
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6LX8/LCF802
6LY8
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6ME8
6MJ8
6N3
6N7
6N8
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6R4/EC22
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6S2A
6S4A
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6SL7GT
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6SQ7
6T8A
6T9
6T10
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6U8A
6U9/ECF201
6U10
6V3A
6V4/EZ80
6V6
6V6GTA
6V9/ECH200
6W4GT
6W4GTA
6W6GT
6X2
6X4/EZ90
6X5GT
6X8A
6X9/ECF200

TUBE TYPE
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6Z10/6J10
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7AU7
7C34
7DJ8
7ES8
7EY6
7GV7
7HG8/PCF86
7XQ
8AR11
8AU8
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8B10
8BA11
8BM11
8BN11
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8BQ11
8BU11
8CM7
8CS7
8CW5/XL86
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8EM5
8ET7
8FQ7/8CG7
8GJ7/PCF801
8GN8/8EB8
8JU8A
8JV8
8LT8
8MB6
8MG6
8MY6
8U9/PCF201
8X9/PCF200
9A8/PCF80
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9AK8
9AQ8/PCC85
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12AQ5
12AT6
12AT7/ECC81
12AU6
12AU7/ECC82
12AU7A
12AU7WA/6189
12AV5GA
12AV6/HBC91

AMPEREX ELECTRONIC CORPORATION
A NORTH AMERICAN PHILIPS COMPANY
Hicksville, Long Island, New York 11802

Amperex®

TOMORROW'S THINKING IN TODAY'S PRODUCTS

and Receiving Tubes. . . .

TUBE TYPE
12AV7
12AX3
12AX4GTB
12AX7A/6681
12AX7A/ECC83
12AY3A/12BS3A
12AZ7A
12B4A
12BA6
12BD6
12BE3
12BE6/HK90
12BF6
12BF11
12BH7A
12BK5
12BL6
12BN6
12BQ6GA/12CU6
12BQ6GTB
12BR7
12BS3A
12BT3
12BV7
12BY7A
12C5
12CA5
12CT8
12CU5/12C5
12D4
12DB5
12DQ6B/12GN6
12DQ7
12DS7
12DS7A
12DT5
12DT8
12ED5
12EK6/12DZ6/12EA6
12F8
12FQ8
12FX8A
12GC6
12GE5
12GN7A
12HE7
12HG7
12HL7
12J5
12JN6
12JN8
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12L6GT
12R5
12S7
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12SG7
12SJ7
12SK7
12SL7GT
12SN7GTA
12SQ7
12T10
12V6GT
12W6GT
12X4
13DE7
13DR7
13EM7/15EA7
13FD7
13GB5/XL500
13GF7A
13V10
13Z10/13J10
14BL11
14BR11
14GT8
14GW8
14JG8
14K7
14L7
15A6
15AF11
15BD11
15CW5/PL84
15DQ8/PCL84
15FM7/13FM7
15FY7
15LE8
16A5
16A8/PCL82
16AQ3/XY88
16GK6
16GY5
16KA6
16Y9/PFL200

TUBE TYPE
17AX3
17AX4GTA
17AY3A/17BS3A
17BE3
17BF11
17BS3A
17BZ3
17C5/17CU5
17C8
17C9
17D4/17DM4A
17DE4
17DM4A
17DQ6B/17GH6
17EW8/HCC85
17GV5
17H3
17JB6A
17JM6A
17JN6A
17JZ8
17X10/17AB10
17Z3
18A5
18FW6
18FX6
18FY6
18GB5/LL500
18GV8
19AU4GTA
19BG6GA
19BR5
19CG3
19CL84
19D8
19EA8
19EZ8
19FL8
19GQ7
19HV8
19JN8
19KF6
19KG8
19T8
19X3
19Y3
20AQ3/LY88
20EZ7
21A6
21GY5
21HB5
21HB5A
21JV6
21JZ6
21KA6
21LU8
22BH3A
22BW3
22DE4
22JG6A
23Z9
24BF11
24JZ8
25AV5GA
25AV5GT
25AX4GT
25BQ6GA/25CU6
25BQ6GTB
25C5
25CD6GB
25DN6
25E5
25EC6
25EH5
25F5A
25L6GT/25W6GT
25W4GT
25W6GT
25Z6GT
27GB5/PL500
30A5
30AE3
30AG11
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31JS6A
32ET5A
33GT7
33GY7
33GY7A
33JV6
34GD5
35C5
35EH5
35L6GT
35W4
35Z5GT

TUBE TYPE
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38A3
38HE7
38HK7
40KD6
40KG6
42EC4
45A5
45B5/UL84
45B5/UL84MP
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53CG
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55HK7
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56P17/3
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56UVP
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58CV
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90NB4
92AV
100LB
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117Z3
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150UVP
153AVP
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161G
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417A
500N

TUBE TYPE
501RA
504R
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560N
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833A JAN
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5586 JAN
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5654/6AK5W
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5726/6AL5W
5727/2D21W
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TUBE TYPE
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5842 JAN
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5876A
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6076/QY5-300A
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6211A
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6360A
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6375/DC70
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6681/12AX7A
6686
6687
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6688A
6688B
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TUBE TYPE
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6907 JAN
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6939 JAN
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7025
7034/4X150A
7034/4X150A JAN
7035/4X150D
7035/4X150D JAN
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7189A
7189 AMP
7203/4CX250B
7203/4CX250B JAN
7204/4CX250F
7237
7247
7308
7308 JAN
7316
7320/E84L
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7459
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7580
7580W/4CX250R
7580W/4CX250R JAN
7581A
7591A
7609
7609 JAN
7643
7645
7650
7693
7694
7695
7699
7721/D3A
7722/E280F
7737
7737 JAN
7753
7788
7788 JAN
7800
7804
7805
7806
7807
7843
7844
7854
7899
7900
7983
7986/5866A
8008A
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8032
8032A
8042
8078
8108/EC157
8116A
8117A
8118
8136
8163
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8179
8223/E288CC
8228
8233

TUBE TYPE
8233 JAN
8254/EC1000
8255/E88C
8268
8269
8270
8278/EL503
8298A
8300
8321/4CX350A
8322/4CX350F
8348
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8416
8425A/6AU6A
8426A/12AU6
8436/EC158
8438/4-400A
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8458
8463
8482
8505A
8509
8552
8556
8560A
8577
8579
8580
8591
8592
8593
8594
8595
8603
8608
8621/4CX250FG
8621 JAN
8624
8637
8639
8639 JAN
8643
8647
8654
8666
8667
8668
8669
8670
8679
8680
8683
8731
8732
8733
8734
8735
8736
8737
8744
8752
8753
8867
8801
13201AE
18042
18045
18503
18504
18505
18506
18509
18515
18526
18529
18536
18545
18546
18550
18552
55032 thru 55092
55309
55310
55335/DX184
55340
55875
55875L
55875R
55875G
55875B
55876
56001

(continued)

AMPEREX ELECTRONIC CORPORATION
A NORTH AMERICAN PHILIPS COMPANY
Hicksville, Long Island, New York 11802

Amperex®

TOMORROW'S THINKING IN TODAY'S PRODUCTS

Amperex Industrial, Communication and Receiving Tubes....

TUBE TYPE
AB2
ABC1
AF3
AF7
AGR9950
AGR9951
AK2
AL4
AX50
AX150/FG105
AX260
AZ1
AZ4
AZ11
AZ12
AZ31
AZ41
C3JA
C3M
C6JA
C8
CCTV101
CCTV111
CF3
CF50
CK1
CL4
CY1
CY2
D3A/7721
D7-11GH
D7-190GH
D10-11GH
D10-12GH
D10-160GH
D10-170GH
D13-24GH
D13-26GH
D13-27GH
D13-450GH
D13-480GH
D13-500GH
D14-120GH
DA90
DAF40
DAF41
DAF91
DAF92
DAF96
DC70/6375
DC90
DCC90
DF21
DF22
DF91
DF92
DF96
DF97
DF904
DCG4/1000G
DCG5/5000EG
DG7-32
DH3-91
DK21
DK40
DK91
DK92
DK96
DL41
DL92
DL93
DL94
DL95
DL96
DLL21
DM70
DM70/1M3
DM71
DM71/1N3
DX206

TUBE TYPE
DX247
DX249/YJ1170
DX260
DX267
DX276
DX278
DX285/YJ1180
DX287
DX290
DY86
DY87
DY87/1S2A
E1T/6370
E10-12GH
E55L/8233
E80CC/6085
E80CF/7643
E80F/6084
E80L/6227
E80T/6218
E81CC/6201
E81L/6686
E82CC/6189
E83CC/6681
E83F/6689
E84L/7320
E86C
E88C/8255
E88CC/6922
E90CC/5920
E90F/7693
E91AA/5726
E91H/6687
E91N/5727
E92CC
E95F/5654
E99F/7694
E130L/7534
E180CC/7062
E180F/6688
E182CC/7119
E182F/5847
E186F/7737
E188CC
E280F/7722
E288CC/8223
EA52
EA53
EA76
EAA91
EABC80
EAF42
EB34
EB41
EB91
EBC3
EBC33
EBC41
EBC81
EBC90
EBC91
EBF2
EBF32
EBF80
EGF83
EBF89
EBL1
EBL21
EC50
EC55/5861
EC80
EC81
EC86
EC88
EC90
EC91
EC92
EC95
EC97
EC157/8108

TUBE TYPE
EC158/8436
EC900
EC1000/8254
EC8010
ECC33
ECC34
ECC35
ECC40
ECC81
ECC82
ECC83
ECC84
ECC85
ECC86
ECC88/6DJ8
ECC91
ECC189
ECC2000
ECF1
ECF80
ECF82
ECF86
ECF200
ECF201
ECF801
ECF802
ECH3
ECH4
ECH21
ECH35
ECH41
ECH42
ECH81
ECH83
ECH84
ECH200
ECL80
ECL82
ECL83
ECL84
ECL85
ECL86
EEP1
EF6(N)
EF9
EF22
EF36
EF37A
EF39
EF40
EF41
EF42
EF43
EF50
EF55
EF80
EF83
EF85
EF86
EF89
EF91
EF92
EF93
EF94
EF95
EF97
EF98
EF183
EF184
EFF51
EFL200
EPF60
EH90
EK2
EK90
EL2
EL3(N)
EL6
EL11
EL12

TUBE TYPE
EL33
EL34
EL34MP
EL36
EL37
EL37MP
EL38
EL41
EL42
EL50
EL51
EL60
EL81
EL83
EL84
EL84MP
EL85
EL86
EL90
EL90MP
EL91
EL95
EL95MP
EL360
EL500
EL503
EL821
EL822
ELL80
EM4
EM34
EM80
EM81
EM84
EM87
EQ80
EY51
EY80
EY81
EY82
EY86
EY87
EY88
EZ2
EZ40
EZ41
EZ80
EZ81
EZ90
FG17/5557
FG95
FG105
GZ30
GZ32
GZ33
GZ34
HBC90
HBC91
HCC85
HCH81
HF94
HF200
HF300
HK90
HL92
HL94
HZ90
JP90-01
JP9-2.5B
JP9-2.5B/YJ1100
JP9-7B
JP9-7D
JP9-15
JP9-250
JPT9-01
K50A
K51A
K81A
KS7-85
KS7-85A

TUBE TYPE
KS9-20
KS9-20A
KS9-20D
KS9-40D
LB6-40
LC900
LCF80
LCF86
LCF200
LCF201
LCF801
LCF802
LCL84
LFL200
LL86
LL500
LY88
ORP30
ORP50
ORP60
ORP61
ORP62
ORP63
PABC80
PC900
PCC84
PCC85
PCC88
PCC189
PCF80
PCF82
PCF86
PCF200
PCF201
PCF801
PCH200
PCL82
PCL84
PCL85
PCL86
PE05/25
PE06/40E
PE06/40N
PE06/40P
PF86
PFL200
PL21
PL36
PL81
PL82
PL83
PL84
PL150
PL500
PL6574
PL6755
PY80
PY81
PY82
PY88
QY5/3000A
RPY13
RPY17
RPY18
RPY19
RPY20
RPY27
RPY41
SD513
SD560
U30
UABC80
UAF42
UB41
UBC41
UBC81
UBF80
UBF89
UBL21
UC92

TUBE TYPE
UCC85
UCH4
UCH21
UCH41
UCH42
UCH81
UCL11
UCL82
UCL82MP
UCL83
UF41
UF42
UF80
UF85
UF86
UF89
UL41
UL84
UL84MP
UM4
UM80
UY1(N)
UY11
UY41
UY42
UY82
UY85
UY89
XC95
XC97
XCC189
XCF80
XCL85
XF183
XF184
XL84
XL86
XL500
XL7900
XP1000
XP1001
XP1002
XP1003
XP1004
XP1005
XP1010
XP1011
XP1015
XP1016
XP1021
XP1023
XP1030
XP1031
XP1032
XP1040
XP1110
XP1111
XP1113
XP1114
XP1115A, B, C
XP1116
XP1117
XP1118
XP1120
XP1121
XP1122
XP1123
XP1130
XP1131
XP1143
XP1180
XP1210
XQ1020
XQ1020AC
XQ1020AL
XQ1020B
XQ1020G
XQ1020L
XQ1020R
XQ1021

TUBE TYPE
XQ1023L
XQ1023R
XQ1024
XY88
YJ1010/7008
YJ1011/7111
YJ1020
YJ1021
YJ110
YJ1120
YJ1160
YJ1162
YJ1190
YJ1191
YK1000
YK1001
YK1002
YK1003
YK1010/DX151
YK1090
YK1091
Z70
Z70U/7710
Z71U/7711
Z303C
Z502S
Z504S
Z505S
Z550M/8453
Z803U/6779
Z805U/7714
Z900T/5823
ZB3200
ZC1050
ZM1000
ZM1001
ZM1020
ZM1021
ZM1022
ZM1023
ZM1024
ZM1025
ZM1030
ZM1031
ZM1032
ZM1033
ZZ1000/8228

AMPEREX ELECTRONIC CORPORATION
A NORTH AMERICAN PHILIPS COMPANY
Hicksville, Long Island, New York 11802

Amperex®

TOMORROW'S THINKING IN TODAY'S PRODUCTS

- *High Vacuum Rectifiers — Clipper Diodes*
- *High Vacuum Amplifiers*
- *Gas & Mercury Vapor Thyratrons*
- *Gas & Mercury Vapor Rectifiers*
- *Hydrogen Thyratrons*

HIGH VACUUM AMPLIFIERS

E.E. TYPE NUMBER	CATHODE VOLTS	CATHODE AMPS	MAX. PLATE RATINGS C.C.S. CLASS C VOLTS	INPUT WATTS	DISSIPATION WATTS	AMP FACTOR	MAX. OPERATING FREQ. (MC)	MAX. OVERALL HEIGHT	MAX. DIAM.
3C24	6.3	3.0	2000	100	25	21	100	4 3/8	1 7/16
100TH	5.0	6.3	3000	600	100	37	40	7 3/4	3 3/16
572-B	6.3	4.0	2000	300	75	170	30	6 1/16	3 1/16
250TH	5.0	10.5	4000	800	250	36	40	10 1/8	3 13/16
250TL	5.0	10.5	4000	800	250	14	40	10 1/8	3 13/16
809	6.3	4.0	1500	100	30	50	40	6 1/16	2 7/16
811A	6.3	4.0	1500	260	65	160	60	6 1/16	2 7/16
811AW	6.3	4.0	1500	260	65	160	60	6 1/16	2 7/16
812	6.3	4.0	1500	260	65	29	60	6 1/16	2 7/16
812AW	6.3	4.0	1500	260	65	29	60	6 1/16	2 7/16
812HD	6.3	4.0	2000	300	75	30	60	6 1/16	2 7/16
826	7.5	4.0	1250	175	75	31	250	3 11/16	2 3/8
E.E. 300	11.0	4.0	3000	800	200	23	30	10 1/4	3 1/16

GAS & MERCURY VAPOR THYRATRONS

E.E. TYPE NUMBER	CATHODE VOLTS	CATHODE AMPS	TYPE FILL	MAX. ANODE RATINGS PEAK INV. VOLTS	PEAK AMPS	AVE. AMPS	TUBE DROP	MAX. OVERALL HEIGHT	MAX. DIAM.
3C23*	2.5	7.0	GAS & HG	1250	6.0	1.5	12	6 5/8	2 1/16
FG-17	2.5	5.0	HG	5000	2.0	0.5	12	6 5/8	2 7/16
393-A*	2.5	7.0	GAS & HG	1250	6.0	1.5	15	6 5/8	2 1/16
323-B*	2.5	7.0	GAS & HG	1250	6.0	1.5	15	6 5/8	2 1/16
394-A	2.5	4.0	GAS & HG	1250	2.5	0.64	15	5 1/4	1 25/32
873*	5.0	7.0	HG	10,000	5.0	1.25	15	8 3/4	2 5/16
7410	5.0	7.0	GAS	1700	6.0	1.5	15	6 5/8	2 1/16

GAS & MERCURY VAPOR RECTIFIERS

E.E. TYPE NUMBER	CATHODE VOLTS	CATHODE AMPS	TYPE FILL	MAX. ANODE RATINGS PEAK INV. VOLTS	PEAK AMPS	AVE. AMPS	TUBE DROP	MAX. OVERALL HEIGHT	MAX. DIAM.
3B28	2.5	5.0	GAS	10 KV	1.0	0.25	10	6 5/32	2 1/16
4B32	5.0	7.0	GAS	10 KV	5.0	1.25	15	8 3/4	2 5/16
816	2.5	2.0	HG	7.5 KV	0.5	0.125	15	4 11/16	1 5/8
866A	2.5	5.0	HG	10 KV	1.0	0.25	10	6 1/16	2 7/16
872A	5.0	7.0	HG	10 KV	5.0	1.25	15	8 1/2	2 5/16
8008	5.0	7.0	HG	10 KV	5.0	1.25	15	8 3/4	2 5/16
8008XE	5.0	7.0	GAS	10 KV	5.0	1.25	15	8 3/4	2 5/16

HIGH VACUUM RECTIFIERS—CLIPPER DIODES

E.E. TYPE NUMBER	CATHODE VOLTS	CATHODE AMPS	MAX. ANODE RATINGS PEAK INV. K-VOLTS	PEAK AMPS	AVE. AMPS	MAX. OVERALL HEIGHT	MAX. DIAM.
3B24WB-A	5.0 2.5	3.0	20	.30 .15	.060 .030	3 1/2	1 1/2
3B29W	2.5	5.0	16	.25	.065	5 3/8	1 5/16
4B31	5.0	5.0	16	10	.150	7.0	2 5/16
250R	5.0	10.0	60	1.0	.250	10 1/4	3
371-B	5.0	10.3	25	1.5	.300	8 3/4	2 17/32
576-A	5.0	14.0	25	2.5	.500	7 3/4	2 17/32
577	5.0	10.3	25	1.5	.300	7 1/2	2 1/16
577W	5.0	10.3	25	1.5	.300	7 1/2	2 1/16
578	5.0	6.0	40	.75	.100	6 1/2	2 1/16
705WA	5.0	5.0	30	.40	.100	5 1/16	2 5/16
719A*	7.0	7.0	25	10	.150	5 7/8	2 1/4
836	2.5	5.0	5	1.0	.250	6 1/16	2 1/16
8020	5.0	6.0	40	.60	.100	8.0	2 17/32
8020W	5.0	6.0	40	.60	.100	8.0	2 17/32

* RECOMMENDED FOR CLIPPER SERVICE ONLY.

HYDROGEN THYRATRONS

E.E. TYPE NUMBER	HEATER* AMPS	MAX. RATINGS P.O. M.W.	Pb ×10³	epy KV	Ebb KV DC (MIN)	ib Aa	Ib Adc	MAX. OVERALL LENGTH	MAX. DIAM.
3C45	2.5	0.52	0.3	3.0	.80	35	.045	5 13/64	1 1/16
3C45W	2.7	0.52	0.3	3.0	.80	35	.045	3 7/8	1 5/16
4C35A	6.7	.350	2.0	8.0	1.5	90	.100	6 7/8	2 5/16
5C22	11.6	2.00	3.2	16.0	4.5	325	.200	8 3/4	2 5/16
KU-17	6.7	.330	2.5	8.0	1.5	83	.100	4 7/8	1 5/16
KU-25	11.6	1.5	3.8	12.0	3.5	300	.200	8 3/4	2 5/16
5956	6.7	.330	2.5	8.0	1.5	83	.100	4 3/4	1 5/16
5957	6.7	.330	2.5	8.0	1.5	83	.100	4 3/8	1 5/16
6130	2.5	0.52	0.3	3.0	.80	35	.045	5 3/16	1 5/16
8370	6.7	.330	2.5	5.0	.30	83	.100	4 7/8	1 5/16

* ALL EEI THYRATRONS HAVE 6.3 VOLT HEATERS.

1969 CATALOG

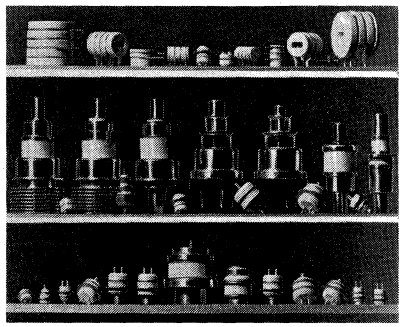
ELECTRONIC ENTERPRISES INC.

ELECTRONIC ENTERPRISES INC.

65 SEVENTH AVENUE, NEWARK, N.J. 07104 / (201) 485-8500

ELECTRON TUBES AND DEVICES

METAL-CERAMIC PLANAR TUBES



General Electric offers an extensive line of planar tubes in diode and triode designs for oscillators, amplifiers, mixers, detectors, and many other high-reliability applications from d-c to 10 gc. Unsurpassed tolerance to environment as adverse as 3000 G's impact at 3-5 ms, 30,000 G's centrifuge, up to 48 G's RMS vibration (100-2000 cps, 3 min each plane) and −55 C to +400 C temperature. Have also withstood 10^{18} NVT and 10^{7} R/sec nuclear radiation. Minimum noise, in fractions of a db. Power outputs from low mw to 8kw peak. Tailored for CW, plate-pulsed, and grid-pulsed applications. Highest available ratio of power, efficiency, and gain-bandwidth to size and weight.

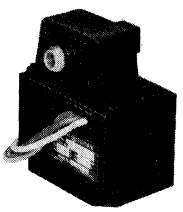
VTM's



Miniaturized shielded

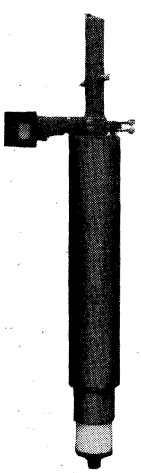


Magnetic and RFI shielded



Magnetic shielding and integral isolator

Voltage Tunable Magnetrons (VTM's) are high frequency, continuous wave oscillators operating in the microwave region. GE VTM's cover a wide range of frequencies — from 700 to over 5600 megacycles, with feasibility existing in X-band and down to 100 mc. Low power (up to 1 watt) for low-noise local oscillators, signal generators. Medium power (1-10 watts) for altimetry, telemetry. High power (over 10 watts up to 100's of watts) for broadband transmitters, barrage jamming, airborne applications. Also magnetically shielded VTM's at 1000-2000 mc and 2000 to 4000 mc (1 watt) for driver applications.

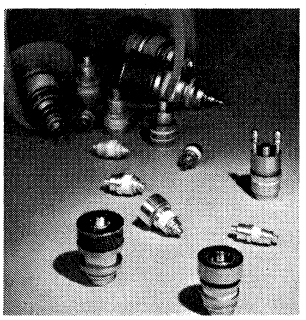


KLYSTRONS

GE has over 10 years experience in custom design, manufacture and repair of high-power, multiple resonator, amplifier klystrons and capability to produce klystrons for **specific** applications. The units, constructed of metal and ceramic, use ion pumps to maintain excellent vacuum conditions. Tunable types are designed so each cavity tunes at the same rate for perfect gang-tune tracking across frequency band. Broadband types are tunerless; flat freqency responses are rigidly, permanently determined during manufacture. Tunable and broadband pulsed ampilfier klystrons available in L, S bands. GE has the competence for expeditious and economic extrapolation of all frequencies from UHF-X band over a wide range of power levels.

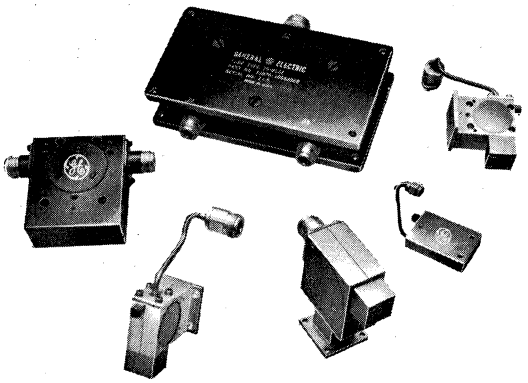
This L-band klystron is just one of a complete family that includes MBK's and TWK's.

METAL-CERAMIC COAXIAL TUBES



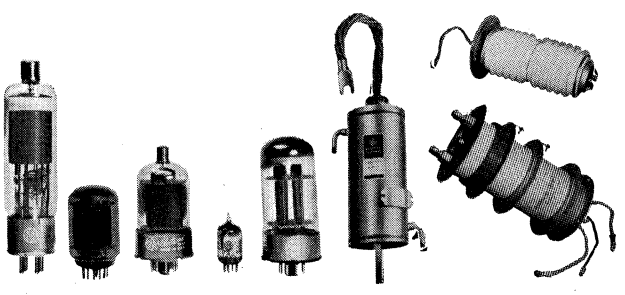
GE has the exact coaxial triodes and tetrodes for advanced VHF-UHF, RF power amplifiers, oscillators, or broad varieties of transmitter equipments to meet your most demanding application requirements. Advantages: high power gain, efficiency, voltage hold-off, duty factor; broad electronic bandwidth; long pulse-width life; reliable grid-pulsed amplifier or oscillator service.

CIRCULATORS AND ISOLATORS



GE coaxial, stripline circulators and isolators offer the systems manufacturer maximum design flexibility and assurance of systems-component compatibility and performance . . . in radar, electronic countermeasures, communications, aircraft control, fusing systems, signal generators, test equipment, and many other modern microwave systems. They can handle 100 to 500 watts CW and more in small-size units capable of operating under severe environmental conditions. And continuing developments have produced units that will operate at peak powers of 5 kw in L and S Band. All frequencies from 0.3 to 5.5 GHz are covered, and typical bandwidth in these frequency ranges is approximately 20 percent with greater bandwidth available. Magnetically shielded and miniaturized units are available, with unique terminations and connections a specialty.

INDUSTRIAL AND SPECIAL-PURPOSE TUBES



General Electric offers an extensive line of reliability-proven industrial and special-purpose tubes including the following popular types: camera, ceramic, industrial and military cathode ray, communication, Five-Star, glow tubes, ignitrons, industrial receiving, rectifier, thyratrons, transmitting tubes and triggered vacuum gaps.

For complete information contact nearest GE Sales Office listed on inside front cover, or write to General Electric Co., Section 998-50, Schenectady, N. Y. 12305.

GENERAL ELECTRIC

Look in the Yellow Section for Manufacturers' Sales Offices



Tell them you found them in **eem**

IEC Mullard

INDUSTRIAL and SPECIAL PURPOSE TUBES

An extensive range of dependable Special Purpose tubes for virtually every industrial application. Vast manufacturing resources, including the world's most modern research laboratories, are your assurance of guaranteed tube design advantages for maximum performance in electronic equipment.

MULLARD TYPE	CROSS REF.
AF31-10	
AL13-36	
AL22-10	9RP33
AL31-10	
AN1	
AW13-36	
AW17-20	
AW21-80	
AW22-10	
AW36-48	
AW36-48P	
BA3-30	
BA9-20	7635
BA16-10	7636
	1CP11
	3ALP11
	3WP11
DB7-91	3AFP11
DB10-94	4EP11
	5CP11A
DB13-10	5CLP11
DB13-97	5BKP11
DB16-22	7AHP11
DBM9-11	3AZP11
DBM10-93	4LP11
DC70	6375
DF60	5678
DF61	6611
DF62	1AD4
DF63	
DG7-5	3ALP1
DG7-6	5269
DG7-32/01	3AMP1A
DG7-36	3WP1
DG13-2	5CP1A
DG13-34	5ADP1
DG16-22	7AHP1
DH3-91	1CP1/1CP31
DH7-10	
DH10-94	4EP31
DH13-10	5CLP31
	5CBP31
	5BMP31
DH13-97/	
5BKP1	5BKP31
DHM9-11	3AZP31
DHM10-93	4LP31
DL69	
DL70	6373
DL73	
DL98	3B4
DL620	5672
DM160	6977
DNM9-11	
	5CBP2
	3ALP7
DP10-94	4EP7
	5CP7A

MULLARD TYPE	CROSS REF.
DP13-10	5CLP7
DP13-34	5ADP7
DP13-97	5BKP7
DP16-22	7AHP7
DPM9-11	3AZP7
DPM10-93	4LP7
DY70	5642
EIT	6370
E55L	8233
E80CC	6085
E80CF	7643
E80F	6084
E80L	6227
E80T	
E81L	6686
E83F	6689
E88CC	6922
E88CC/01	
E90CC	5920
E91H	6687
E92CC	
E180CC	7062
E180F	6688
E182CC	7119
E186F	
E188CC	
E810F	7788
EA52	6923
EA76	6489
EC70	6778
EC71	5718
EC157	8108
EC158	
EC1000	
ECC70	6021
EF70	6487
EF71	
EF72	
EF73	6488
EF730	5636
EF731	5899
EF732	5840
EF734	6205
EL71	5902
EL360	
EL822	
EN32	6574
EN70	5643
EN91	2D21
EN92	5686
EN93	6D4
ET51	6700
JNT1-500W	5526
JP2-0.2	7090
JP2-2.5H	7091
JP2-2.5W	7292
JP2-5W	

MULLARD TYPE	CROSS REF.
JP5-04	
JP5-04B	
JP8-02	
JP9-01	
JP9-02	
JP9-2.5	7028
JP9-04C	
JP9-5	
JP9-7	2J42
JP9-7A	
JP9-7B	
JP9-7D	
JP9-15	2J42A
	2J56
JP9-75	6972
JP9-80	4J52A
JP9-80A	
JP9-180	
	4J50
	4J78
JP9-250B	
JP9-250C	
JP9-250D	
JP9-250E	
JP16-10	
JP16-40	
	7093
	8153
JPG5-01	
JPG6-01	
JPG8-01	
JPG8-01B	
JPG9-01	
JPG9-01B	
JPG9-02	
JPG9-02B	
JPG9-02C	
JPT5-01	
JPT5-04	
JPT6-01	
JPT6-02	
JPT8-01	
JPT8-01B	
JPT8-01C	
JPT9-01	
JPT9-01B	
JPT9-01C	
JPT9-02	
JPT9-60	2J51A
KB9-150W	
	2K26
KS7-85A	5976
KS7-1000A	
KS7-1000B	
KS7-1000C	
KS7-1000Z	

MULLARD TYPE	CROSS REF.
KS9-20	723A/B
KS9-20A	2K25
KS9-20D	
	6975
LA6-3	
LA6-200	
LA9-3	7638
LA16-2	
LA16-2C	7639
LB3-250	
LB6-12	
M8079	6058
M8080/	
6C4WA	6100
M8081/	
6J6WA	6101
M8082	6516
M8083	6064
M8091	6443
M8096	6062
M8097	
M8098	
M8099	
M8100/	
6AK5W	6096-5654
M8136/	
12AU7WA	6189
M8137	6057
M8161	6065
M8162	12AT7WA
M8163	
M8190/	
85A3	5783WA
M8196/	
6A56W	5725
M8204/	
2D21W	5727
M8206	
M8207	
M8212/	
6AL5W	6097-5726
M8223	0A2WA
M8224	0B2WA
M8248	6J4WA
ME1200AA	
ME1200AG	
ME1201AA	
ME1201AG	
ME1401	
ME1401/	
4065	5802
ME1402/	
4066	
ME1403/	
4068/58A9	5886
ME1404/	
4069	
MF13-1	5FP7A
MF22-75	



MULLARD TYPE	CROSS REF.
MF31-22	
MF31-55	
MF31-95	
MF41-10	16AFP19
MG13-11	
ML31-22	
ML43-67	
MM13-10	
MW13-35	5FP4A
MW13-38	
MW22-22	
MW36-67	
MW43-67	
MY3-275	
MZ2-200	
QQV02-6	6939
QQV03-10	6360
QQV03-20A	6252
QQV04-16	7377
QQV06-40A	5894
QQV07-40	829B
QQV5-P10	3E29
QQ203-10	
QQ203-20	
QV04-7	
QV03-12X	5763
QV04-7R	
QV05-10	2E26
QV05-25	807
QV06-20	6146
QV06-20B	6883
QV06-20C	6159
QV08-100	7378
QV1-150A	4X150A
QV1-150D	4X150D
QV2-250B	4X250B
QV12-P10	

MULLARD TYPE	CROSS REF.
QV20-P18/	
4PR60A	
QY3-65	4-65A
QY3-125	6156
QY3-1000A	
QY4-250	6156
QY4-400	7527
QY4-500A	LX500A
QY5-500	6079
QY4-800	
QY5-800	
QY5-3000A	6076
QY5-3000W	6075
QYS50-P40	
QZ06-20	8042
RG1-240A	
RG3-250	
RG3-250A	
RG3-1250	
RG4-1250	
RG4-3000	6693
RR3-250	3B28
RR3-1250	4B32
RR3-1250A	
RR3-1250B	
RY12-100	8020
TD03-5	
TD03-10/	
EL55	5861
TD03-10C	
TD03-10E	
TD03-10F	
TD04-20	
TD1-100A	2C39A
TD3.5-12	
TD4.5-10	
TX10-4000	
TX12-12W	
TY2-125/5866	
TY3-250/5867	
TY4-250	
TY4-350/833A	
TY4-500/5868	
TY6-800/7902	
TY6-1250A/ 7752	
TY6-5000A/5924A	
TY6-5000B/ 5762	
TY6-5000W	
TY7-6000A/ 6961	
TY7-6000W/6960	
TY8-15A/ 7804	
TY8-6000A/ 8269	
TY8-6000W/ 8268	
TY8-7805	

MULLARD TYPE	CROSS REF.
TY12-20A/ 7806	
TY12-20W/ 7807	
TY12-25A/ 6618	
TY12-50A/ 6078	
TY12-50W/ 6077	
TYS2-250	
TYS4-500	
TYS5-1000	
TYS5-2000	
TYS5-3000	
XG1-2500	5559
XG2-6400	
XG5-500/	
FG17	5557
XG15-12	
XH3-045	3C45
XH8-100/	
6268	4C35
XH16-200/	
6279	5C25
XH25-500/	
5949	1907
XR1-12	5855
XR1-1600A	8063
XR1-3200	5544
XR1-3200A	7981
XR1-6400	5545
XR1-6400A	6807
Z300T	1267
Z302C	
Z303C	
Z500E	
Z502S	
Z503M	
Z504S	
	6844
Z550M	
Z700U	7710
	7709
	7711
Z803U	6779
Z8040	7713
Z806W	
Z900T	5823
ZT1000/ 8270	
6AS6	
75C1	
83A1	7980
85A1	0E3
85A2	0G3
85A3/ M8190	
90C1	
95A1	
108C1	0B2
150B2	6354
150B3	

MULLARD TYPE	CROSS REF.
150C2	
150C3	
150C4	0A2
872A	
4687-A	
5551A	5551A
5552A	5552A
5553B	5553B
	5555
5636	5636
5642	5642
5644	5644
5718	5718
	5820
5840	5840
5899	
5902/5640	5902
6021/6BF7	6021
6080/6AS7	6080
6205	6205
	6211
6463	6463
7475	
BPY10	
OAP12	
OCP71	
ORP10	7632
ORP11	7633
ORP13	
ORP30	6957
ORP50	
ORP60	
ORP61	
ORP90	
ORP93	
20CG	
20CV	
30CG	
50CG	
53CG	
55CG	
58CG	
58CV	
61RV	
61SV	
62SV	
63TV	
90AG	
90AV	
90CG	
90CV	
91AG	
92AG	
92AV	

10M ELECTRON TUBES



6AB8	6AU6A	6DJ8	6HG8	12AX7
6AJ8	6AV6	6DL5	6J6	12AX7A
6AK5	6BA6	6DX8	6J6A	12DW7
6AK8	6BE6	6EH7	6T8A	150W5
6AL5	6BL8	6EJ7	7HG8	6267
6AQ5	6BQ5	6ER5	9A8	7025
6AQ5A	6BQ5A	6ES8	12AT7	7247
6AQ8	6C4	6EU7	12AU7	
6AT6	6DA6	6FY5	12AU7A	
6AU6	6DC8	6GK5	12AV6	

The quality of 10M electron tubes can be attributed to their design and manufacture . . . for built into each tube, at the very outset, are basic components and features which will insure long life and performance . . . engineering achievements such as coiled heaters, unique grid designs, and special cathode materials.

Each 10M tube is guaranteed for 10,000 hours within two years from date of purchase, and subjected, individually, to a comprehensive laboratory test procedure based on extremely tight and stringent parameters to assure long life tube-to-tube and section-to-section uniformity.

TUBE TYPE	CROSS REF.
1M3	DM70
1N3	DM71
2HA5	XC900
3EH7	XF182
3EJ7	XF184
3HA5	LC900
4BL8	XCF80
4EH7	LF183
4EJ7	LF184
4ES8	XCC189
4GJ7	XCF801
4HA5	PC900
5AR4	GZ34
5AZ4	GZ30
5GJ7	LCF801
5V4G	GZ32
6AB8	ECL80
6AJ8	ECH81
6AK5	EF95
6AK8	EABC80
6AL5	EB91
6AQ5	EL90
6AQ5A	
6AQ8	ECC85
6AT6	EBC90
6AU6	EF94

TUBE TYPE	CROSS REF.
6AU6A	
6AV6	EBC91
6BA6	EF93
6BD7A	EBC81
6BE6	EK90
6BL8	ECF80
6BM8	ECL82
6BQ5	EL84
6BX6	EF80
6BY7	EF85
6BZ6	
6C4	EC90
6CA4	EZ81
6CA7	EL34
6CB6	
6CJ6	EL81
6CM5	EL36
6CW5	EL86
6DA5	EM81
6DA6	EF89
6DC8	EBF89
6DJ8	ECC88
6DL5	EL95
6DR8	EBF83
6DS8	ECH83
6DX8	ECL84
6EH7	EF183
6EJ7	EF184

TUBE TYPE	CROSS REF.
6ES6	EF97
6ES8	ECC189
6ET6	EF98
6EU7	
6FG6	EM84
6GJ7	ECF801
6GK5	
6GV8	ECL85
6GW8	ECL86
6HA5	EC900
6HG8	ECF86
6HU6	EM87
6U8	ECF82
6V4	EZ80
6W4GT	
6W6GT	
6X4	EZ90
8GJ7	PCF801
9A8	PCF80
9AK8	PABC80
12AT7	ECC81
12AU7	ECC82
12AU7A	
12AV6	HBC91
12AX7	ECC83
12AX7A	
12BA6	HF93

TUBE TYPE	CROSS REF.
12BE6	HK90
15CW5	PL84
15DQ8	PCL84
16A8	PCL82
17Z3	PY81
18GV8	PCL85
19D8	UCH81
19FL8	UBF89
21A6	PL81
25E5	PL36
35W4	HY90
38A3	UY85
45B5	UL84
50BM8	UCL82
50C5	HL92
6267	EF86
7025	
7189	
7247	
DM70	1M3
DM71	1N3
EABC80	6AK8
EB91	6AL5
EBC81	6BD7A
EBC90	6AT6
EBC91	6AV6
EBF83	6DR8

TUBE TYPE	CROSS REF.
EBF89	6DC8
EC90	6C4
EC900	6HA5
ECC81	12AT7
ECC82	12AU7
ECC83	12AX7
ECC85	6AQ8
ECC88	6DJ8
ECC91	6J6
ECC189	6ES8
ECF80	6BL8
ECF82	6U8
ECF86	6HG8
ECF801	6GJ7
ECH81	6AJ8
ECH83	6DS8
ECL80	6AB8
ECL82	6BM8
ECL84	6DX8
ECL85	6GV8
ECL86	6GW8
EF80	6BX6
EF85	6BY7
EF86	6267
EF89	6DA6
EF93	6BA6
EF94	6AU6
EF95	6AK5

TUBE TYPE	CROSS REF.
EF97	6ES6
EF98	6ET6
EF183	6EH7
EF184	6EJ7
EK90	6BE6
EL34	6CA7
EL36	6CM5
EL81	6CJ6
EL84	6BQ5
EL86	6CW5
EL90	6AQ5
EL95	6DL5
EM81	6DA5
EM84	6FG6
EM87	6HU6
EZ80	6V4
EZ81	6CA4
EZ90	6X4
GZ30	5AZ4
GZ32	5V4G
GZ34	5AR4
HBC91	12AV6
HF93	12BA6
HK90	12BE6
HL92	50C5
HY90	35W4

RECEIVING TUBES



A comprehensive range for television, AM-FM, high fidelity, industry and foreign replacement.

TUBE TYPE	CROSS REF.
LC900	3HA5
LCF801	5GJ7
LF183	4EH7
LF184	4EJ7
PABC80	9AK8
PC900	4HA5
PCC85	9AQ8
PCC88	7DJ8
PCF80	9A8
PCF86	7HG8
PCF801	8GJ7
PCL82	16A8
PCL84	15DQ8
PCL85	18GV8

TUBE TYPE	CROSS REF.
PCL86	14GW8
PL36	25E5
PL81	21A6
PL84	15CW5
PY81	17Z3
UBF80	17C8
UBF89	19FL8
UCH81	19D8
UCL82	50BM8
UL84	45B5
UY85	38A3
XC900	2HA5
XCF80	4BL8
XCF801	4GJ7

IEC Mullard

INTERNATIONAL ELECTRONICS CORPORATION
316 SOUTH SERVICE ROAD, HUNTINGTON STA., MELVILLE L. I., N. Y., 11749
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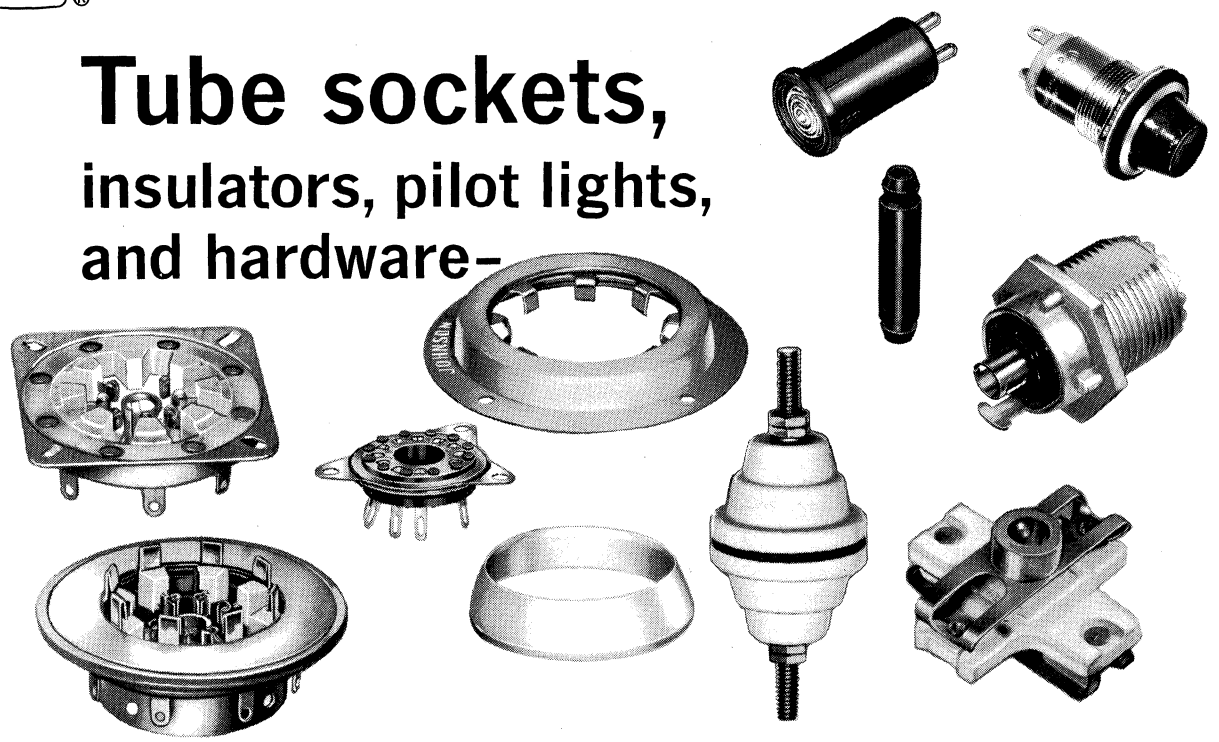
E. F. JOHNSON COMPANY
1923 Tenth Ave. S.W., Waseca, Minnesota 56093

Detailed components catalog free . . . Write today on company letterhead

Tube sockets,

insulators, pilot lights, and hardware–



Standard, industrial, military

Whatever the choice . . . steatite wafer, bayonet or low-loss Kel-F sockets for high power transmitting tubes . . . time and time again design and development engineers specify Johnson tube sockets! Sockets have been categorized under a socket standardization program, reducing the number of variations in each socket type. Standardization and immediately available stock shortens delivery cycles—permits fast selection of a Johnson socket for almost any application!

ULTRA HIGH FREQUENCY TYPES—Continuous heat resistance to 500° F. with low loss, glass filled silicone base and heat treated beryllium copper contacts. Low inductance screen by-pass capacitor available for VHF and UHF operation. For RCA 8072, 8121, 8122, 8462 and similar tubes.

KEL-F SERIES—Molded of low dielectric loss-factor Kel-F plastic—designed for use with a wide selection of high power transmitting tubes such as: 4X150A; 4X150D; 4X250B; 4CX250B; 4X250F,7034; 7035. Basic sockets are available in several designs—with or without screen grid by-pass capacitors, mounting saddles, or steatite chimney to direct air flow through tube cooling fins. Control grid contact "guide" is machined for greater alignment accuracy, and tapped for 6-32 machine screw. All contacts are low resistance silver-plated beryllium copper. Tube pin contacts are heat treated to provide positive contact pressure as well as extended life. Annealed soldering tabs may be easily bent or formed.

STEATITE WAFER TYPES—Available in 4, 5, 6, 7, and 8-pin standard socket types, as well as Super Jumbo 4-pin for tubes with E.I.A. Base Nos. A4-15, A4-16, and A4-18. Giant 5 and 7-pin models for tubes with E.I.A. Base Nos. A5-19 and A7-17. Septar Sockets for tubes such as the 7094 with E.I.A. Base No. E7-2; and VHF Septar Sockets for tubes such as 5894, 6524, 6252, with E.I.A. Base No. E7-20; and 826, 832, 4D32 and E.I.A. Base No. E7-2.

SPECIAL PURPOSE TYPES—Includes sockets for special purpose tubes such as the: 204A and 849; the 833 and 833A; 152TL; 304TL; 750TL; 1500T; 2-2000A; 5D21; 705A and others.

Note: For detailed specifications, request Socket Standardization Booklet 536 on your company letterhead.

Manufacturer of more than 5,000 items for all segments of the electronic industry, in addition to a wide line of connectors, tube sockets, and air variable capacitors, Johnson offers the hardware items described below: In addition, a complete line of heavy-duty RF components is available for broadcast transmitting, RF heating, antenna phasing, and other commercial applications.

Equipment in this line includes: fixed and variable inductors; antenna phase sampling loops, isolation filter inductors; feed-thru bowl insulators; static drain chokes; RF contactors; and heavy-duty make-before-break switches. For information on the Johnson RF component line, write for Catalog 560a.

INSULATORS—Low loss, high-voltage breakdown in either steatite or porcelain. High quality with heavy nickel-plated brass hardware—suitable for exposed applications. A complete line for immediate delivery from stock includes: Thru-panel Bushings and Insulators; Antenna Strain and Feeder Types; Cone and Stand-off Insulators; Lead-in Bushings; and Feed-Thru Bowl Assemblies.

PILOT LIGHTS—Over 47 separate assemblies immediately available from parts distributors throughout the country for original equipment or in-the-field replacement. Continuous indication neon types; models for high and low voltage incandescent bulbs; standard or wide angle glass; and lucite jewels. New RIB-LOC pilot light offers convenient press-in mounting. Specials, including types meeting military specifications, also available in production quantities. Detailed specifications listed in Pilot Light catalog 751—write today for your copy.

PC SPACERS—Snap-in polyamide spacers provide rapid mounting of PC boards with choice of stand-off height. **COAXIAL RECEPTACLES**—Convenient panel mounting. **PANEL BEARINGS**—For use on ¼" shafts and panels up to ⅜" thick. **CRYSTAL SOCKETS**—For low capacity, high voltage and high temperature operation. Glazed steatite. Grade L-423 or better. DC-200 impregnated. **RF CHOKES**—High quality construction. For 1.7 to 30 mc range and VHF.

CAPACITORS • TUBE SOCKETS • CONNECTORS • PILOT LIGHTS • INSULATORS • TERMINALS • INDUCTORS • HARDWARE

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1923 Tenth Ave. S.W., Waseca, Minnesota 56093

JAN HARDWARE MANUFACTURING COMPANY, INC.

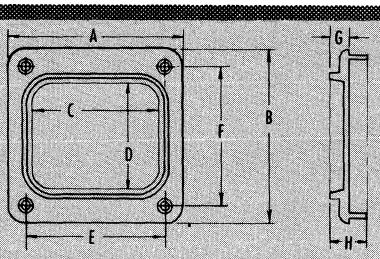
47-27 36th St., Long Island City, N.Y. 11101 • (212) 361-0800

JAN's Bezels enhance the appearance of the instruments on which they are used. These units are functionally designed to provide OPTIMUM UTILIZATION OF THE CRT SCREEN, as well as safety against tube breakage and danger to operating personnel.

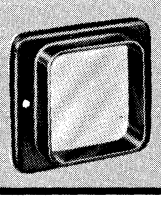
JAN Bezel Assemblies are supplied with a bezel, calibrated graticule, (where applicable) **light filter** and **CRT cushion. Bezels are finished in a smooth dull black** non-reflecting surface. **These units fit JAN Mu-Metal Shields.**

Edge-lit Bezels (E.L.B.A.)** These Bezels are designed to provide edge lighting of the engraved scale-calibrated graticule by means of pilot lights.

Camera Mount Bezel These units provide an integral cast mounting flange that fits all standard 3", 5" and 7" CRT cameras.



	Catalog No.	CRT Face	Material	Type	Panel Opening	A Overall Width	B Overall Height	C D Visible Area (Bezel) Width	Height	E F Mounting Holes Width	Height	G- H- Thickness (Face Only)	(Incl. Flange)	Visible Area (Cushion) Height	Width
For 3" C.R.T.	CP-1328-P-1 CP-1328-P-2	Curved Flat	Plastic*	Standard	3 33/64"	3 3/4"	3 3/4"	2 5/8"	2 3/16"	3"	3"	3/8"	45/64"	2 1/2"	2 1/16"
For 4" C.R.T.	CP-1533-P-‡		Plastic*	Camera Mt.	3 1/32"	4 37/64"	3 61/64"	3"	3"	4"		1 3/32"	1 3/32"	No Cushion	
For 5" C.R.T.	CP-19495-1** CP-19495-2**	Curved Flat	Alum.	Camera Mt. E.L.B.A.**	5 7/16"	6 1/4"	6 1/4"	5 1/4" Dia.		4 15/16"	4 15/16"	1 5/32"	—	4 3/4" Dia.	
For 7" C.R.T.	CP-7330-1 CP-7331-2**	Curved Flat	Alum.	Standard E.L.B.A.**	7 13/32"	7 13/16"	7 13/16"	6 5/16" Dia.		6 3/16"	6 3/16"	3/4"	3/4"	6 3/8" Dia.	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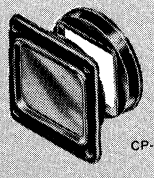
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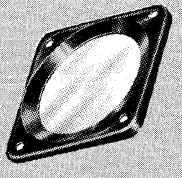
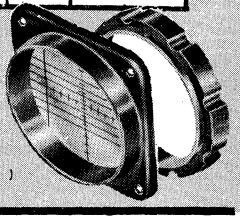

CP-7330


CP-19495-( )

MAGNETIC SHIELDS

JAN'S MAGNETIC SHIELDS are made of MU-Metal or equal and are hydrogen annealed by a special process to assure optimum orientation of the molecular structure of the alloy for best magnetic shielding. JAN'S MAGNETIC SHIELDS prevent distortion and intensity modulation of the electron beam due to stray magnetic fields.

In addition, the use of these shields protect personnel against the dangers of accidental tube breakage. Mounting holes are tapped for No. 6-32 screws as shown. These shields are designed to fit JAN'S standard bezels as listed below. See preceding pages for specifications on JAN'S BEZEL ASSEMBLIES.

SHIELD CAT. NO.	FOR USE WITH C.R.T. NO.	MATCHING JAN BEZEL	
S3001 adaptable for edge-lighting graticule using S3010 with Bezel CP1428✱	3RP 3RPA	CP1328-P-1 CP1427-1 CP1429-1 CP1328-P2 CP1427-2 CP1429-2 CP3430-1 CP3430-2	✱ A=8 1/4 B=1 5/8
S3004—12 (less anode hole) —22 (with anode hole) adaptable for edge-lighting graticule using S3012 with Bezel CP1428✱	3BP 3JP 3ACP	Same as S3003 Same as S3005	Same type as S-3001, except A=8 3/8 B=2 3/8
S5002 adaptable for edge-lighting	5BP 5CP 5ABP 5ADP	Same as S5001 Same as S5006	
S5017 adaptable for edge-lighting	5ABP 5ADP	CP1465-2 CP19636-2	
S7006	7AEP	CP7330 CP7445 CP7331 CP7550 CP7420	

See The RADIO-MASTER for Our Complete Line

JAN HARDWARE
MANUFACTURING COMPANY, INC.
47-27 36th St., Long Island City, N.Y. 11101 • (212) 361-0800

U.S. PATENT NO. 2,681,378

HI-VOLTAGE INSULATED COUPLINGS

MEETS MIL SPECS: TEMPERATURE - HUMIDITY - SHOCK - VIBRATION - FUNGUS

HI-VOLTAGE INSULATED COUPLINGS

15 KV Breakdown 10 inch pounds torque

Series No. AK-5079 & No. AK-5164

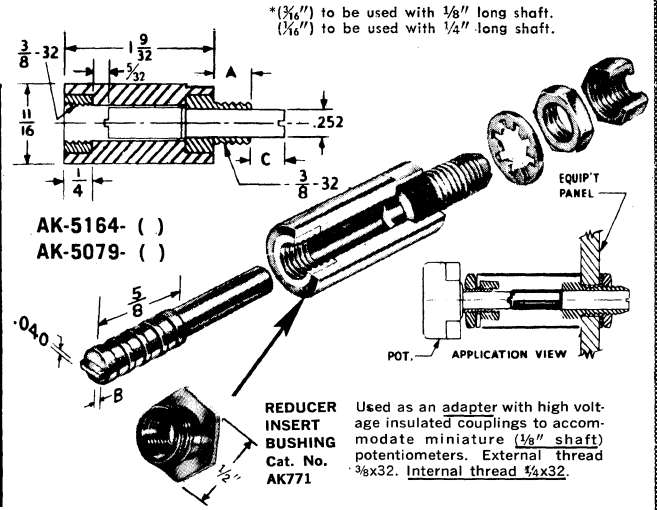
Engineered with stainless steel shaft and precision, screw-driver tip molded-integrally with Diallyl Phthalate Material in accordance with Military Specifications. Completely shock, vibration and fungus proof, they operate with ease over an ambient temperature range of —75 to +175° C. Supplied complete with nickel plated mounting hardware.

Stainless steel screw driver tip fits all standard slotted shafts (potentiometer, etc.) without need for further machining. Ideally suited to adjust high voltage controls thus protecting operating personnel against danger. They are also used to reduce ground capacitance on other types of sensitive instrument controls.

For Commercial Instrument Applications . . .
These couplings are available in general Purpose Black Bakelite.
Cat. No. 6164-(X or B)-( ) For Standard Type
Cat. No. 6079-(X or B)-( ) with Locking Type Bushing.
Dimensions are identical with 5000 series, in chart above.

	CAT No.	"A"	"B" *	SHAFT	"C"
STANDARD TYPE	AK-5164-X-1	3/8"	3/16"	Slotted	5/16"
	AK-5164-B-1	3/8"	1/16"	Slotted	5/16"
	AK-5164-X-2	3/8"	3/16"	Slotted	15/32"
	AK-5164-B-2	3/8"	1/16"	Slotted	15/32"
	AK-5164-X-3	3/8"	3/16"	No Slot	15/16"
	AK-5164-B-3	3/8"	1/16"	No Slot	15/16"
	AK-5164-X-4	3/8"	3/16"	No Slot	17/16"
	AK-5164-B-4	3/8"	1/16"	No Slot	17/16"
	AK-5164-X-5	3/8"	3/16"	Slotted	Minus 1/16"
	AK-5164-B-5	3/8"	1/16"	Slotted	Minus 1/16"
WITH LOCKING TYPE BUSHING	AK-5079-X-1	9/16"	3/16"	Slotted	1/8"
	AK-5079-B-1	9/16"	1/16"	Slotted	1/8"
	AK-5079-X-2	9/16"	3/16"	Slotted	9/32"
	AK-5079-B-2	9/16"	1/16"	Slotted	9/32"

*(3/16") to be used with 1/8" long shaft.
(1/16") to be used with 1/4" long shaft.

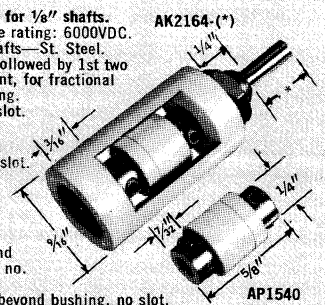


REDUCER INSERT BUSHING Cat. No. AK771

Used as an adapter with high voltage insulated couplings to accommodate miniature (1/8" shaft) potentiometers. External thread 3/8x32. Internal thread 1/4x32.

Hi-Voltage Insulated Couplings for 1/8" shafts.
White Cycalac material. Voltage rating: 6000VDC.
Hubs—Brass, Nickel Plted.; Shafts—St. Steel.
*Insert letter "S" or "N" followed by 1st two numbers of decimal equivalent, for fractional length of shaft beyond bushing.
"S" = with slot. "N" = no slot.

Typical part number:
AK2164-N31 = 5/16" long shaft beyond bushing (standard), no slot.
If length is 1" use "X"
Typical part numbers:
AK2164-SX = 1" long shaft beyond bushing, slotted.
If length exceeds 1", use "X" and decimal equivalent for balance of no.
Typical part numbers:
AK2164-NX31 = 1 5/16" long shaft beyond bushing, no slot.



SLIP-CLUTCH SAFETY KNOBS

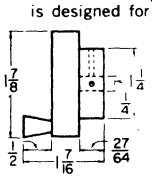
With Fixed or Retractable Spinners

Cat. Nos. K-1375 & K-1376 (For 1/4" shafts)

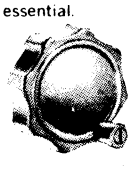
Designed for driving devices such as variable capacitors, inductors, potentiometers, etc., these knobs are based upon the principle of the "slip-clutch";* automatically disengaging and slipping when a pre-determined torque has been exceeded. JAN'S SLIP-CLUTCH SAFETY KNOBS are fluted to aid in sensitive adjustments and are equipped with either a fixed or retractable spinner for fast turning. Insert-molded-to-Bakelite construction provide durable, backlash-free units to safeguard delicate and costly instruments against careless or inadvertent cranking beyond their normal stops.

Normally set for 3-6" lbs. Can be modified for other requirements.

Model No. K-1376 is identical with No. K-1375 but has the additional feature of a retractable spinner. Spring loading provides positive, toggle-type action to lock spinner in either open or closed position. Model No. K-1376 is designed for use where economy of space is essential.







SPINNER KNOBS

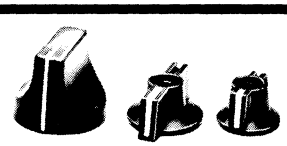
With Fixed or Retractable Spinners | **Standard: glossy finish. (Matte finish available on special order).**

Cat. Nos. K-1275 & K-1276 (For 1/4" shafts)

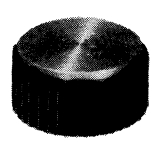
In appearance, these knobs are identical with No. K-1375 and No. K-1376 but without JAN'S Slip-Clutch mechanism. Made with single-unit, molded Bakelite-to-metal-insert construction, with two set screws for firm attachment to shafts.

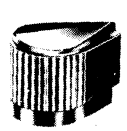
. . . and

Die Cast and Plastic Knobs to Commercial and Military Specifications

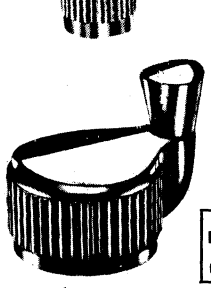


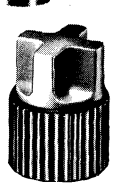
Die cast aluminum and zinc alloy knobs manufactured in accordance with applicable military specifications.

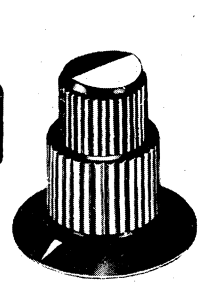












See The RADIO-MASTER for Our Complete Line

MACHLETT Electron tubes for broadcasting, communications, navigation, radar, industry. Standard and special-purpose types.

POWER TRIODES

TYPE	CATHODE VOLTS	CATHODE AMPS	MU	MAXIMUM ANODE RATING VOLTS	AMPS	INPUT WATTS	DISS. WATTS	FULL INPUT FREQ. MHz	COOLING
ML-356	7.5	170	20	12500	6.0	60000	22500	25	W
ML-880	12.6	315	20	10500	6.0	60000	20000	25	W
ML-892	22.0	60	50	15000	2.0	30000	10000	1.6	W
ML-892R	22.0	60	50	12500	2.0	18000	4000	1.6	F-A
ML-5530	5.0	55	26	5000	1.75	8750	4000	110	F-A
ML-5530-H	5.0	55	26	8500	1.75	10000	4000	30	F-A
ML-5531	6.3	92	24	10500	3.75	30000	10000	30	F-A
ML-5541	7.5	57	26	8500	2.75	23000	10000	110	F-A
ML-5604	11.0	176	20	12500	3.0	32500	10000	25	F-A
ML-5606	22.0	60	50	14000	2.0	25000	10000	1.6	W
ML-5658	12.0	310	20	12500	5.0	60000	20000	15	W
ML-5667	11.0	120	21	10000	2.0	20000	7500	22.5	F-A
ML-5668	22.0	60	50	14000	2.0	28000	20000	5	W
ML-5669	22.0	60	50	14000	2.0	28000	10000	5	F-A
ML-5681	12.0	220	25	15000	12.0	150000	75000	30	W
ML-5682	16.5	325	30	16000	20.0	300000	120000	30	W
ML-6256	12.6	29	20	5500	1.5	7000	5000	110	W
ML-6257	12.6	29	20	5500	1.5	7000	5000	110	W
ML-6258	12.6	29	20	5500	1.5	7000	3000	110	F-A
ML-6420	7.0	85	20	10000	2.2	20000	12500	30	W
ML-6421	7.0	85	20	10000	2.2	20000	10000	30	F-A
ML-6422	7.0	85	90	12500	2.5	30000	20000	30	W
ML-6423	7.0	85	90	12500	2.5	30000	12500	30	F-A
ML-6424	7.0	120	20	12500	3.5	40000	20000	30	W
ML-6425	7.0	120	20	12500	3.5	40000	12500	30	F-A
ML-6426	8.0	200	20	12500	8.0	80000	40000	30	W
ML-6427	8.0	200	20	12500	8.0	80000	20000	30	F-A
ML-6576	7.5	170	5.5	12000	5.0	45000	22500	25	W
ML-6696	13.0	205	20	16000	11	120000	60000	30	W
ML-6697	13.0	205	20	16000	11	120000	35000	30	F-A
ML-7479	8.0	200	20	12500	8.0	90000	50000	30	V
ML-7482	16.5	450	55	20000	30.0	600000	200000	30	V
ML-7560	16.5	450	55	20000	30.0	600000	175000	30	W

POWER TETRODES

ML-7007	5.0	180	10	7500	4	24000	12000	220	F-A
ML-8170	7.5	75	4.5	7500	3	22000	5000	30	F-A
ML-8171	7.5	75	4.5	7500	3	22000	10000	30	F-A
ML-8281	6.3	160	4.5	10000	5	50000	15000	30	F-A
ML-8545	12.0	400	5.0	18000	25	450000	150000	50	V
ML-8546	12.0	400	5.0	18000	25	450000	150000	50	W
ML-8618	7.5	320	25	17000	20.0		80000	30	W
ML-8661	7.5	75	4.5	7500	3	22000	12000		W
ML-8785	15.0	400	5.0	18000	25	450000	175000	50	V
ML-8786	15.0	400	5.0	18000	25	450000	175000	50	W

UHF PLANAR TRIODES

ML-2C39A	6.3	1.0	100	1000	0.100	100	2500	F-A
ML-2C39WA	6.0	1.0	100	1000	0.100	100	2500	F-A
ML-6442	6.3	0.9	50	3000†	2.5†	8	5000	C
ML-6771	6.3	0.57	90	300	0.025	6.25	4000	C
ML-7209	6.0	1.0	100	3500*	3.0*	35	3000	F-A
ML-7210	6.3	0.85	75	3500†	2.8†	25	3000	F-A
ML-7211	6.3	1.3	80	1000	0.150	100	2500	F-A
ML-7289	6.0	1.0	100	1000	0.100	100	2500	F-A
ML-7698	6.3	1.3	80	3500*	5.0*	10	3000	C
ML-7815	6.0	1.0	100	3500*	3.0†	10	3000	C
ML-7855	6.0	1.0	80	1000	0.100	100	2500	F-A
ML-8403	6.0	1.25	80	3500*	5.0	58	3000	F-A
ML-8533	6.0	1.3	90	10000	5.0	100	3000	F-A
ML-8534	6.3	1.3	80	3500*	5.0	10	3000	C
ML-8536	6.0	1.0	80	3500*	3.0	10	3000	C
ML-8538	6.3	1.3	90	8000	5.0	10	3000	C
ML-8629	6.3	.85	90	3000	3.0	100	5000	C
ML-8630	6.3	.57	90	2500	1.5	50	6000	C
ML-8631	6.3	.85	145	3000	3.0	100	5000	C
ML-8741	6.3	1.3	80	3500*	5.0	10	3000	C

HARD PULSE MODULATOR TUBES

	CATHODE VOLTS	CATHODE AMPS	MAXIMUM RATINGS MU	VOLTAGE Peak-kv	CURRENT Pulse-amps	PLATE Diss-kw	COOLING
ML-8038	13.0	210	125	125	300	30	W
ML-6544	6.0	60	90	25	75	1	F-A
ML-7248	6.3	11.7	—	125	2.0	0.2	R-C
ML-7560	16.5	450	55	55	550	175	W
ML-7668	12.6	29	—	150	15	0.75	R-C
ML-7715	6.0	60	400	70	90	3	F-A

HIGH VACUUM RECTIFIER and/or CLIPPER DIODES

TYPE	CATHODE VOLTS	CATHODE AMPS	ANODE RATINGS INV. PKV	PEAK MA	INSULATION	COOLING
ML-102A	20	19.0	75	750	Air	C
ML-141	5.5	6.5	125	750	Oil	R-C
ML-142	3.8	6.6	100	300	Oil	R-C
ML-199	12	23	110	10000	Air	C
ML-322	6.3	.95	.8	600	Air	C
ML-5575/100	20	24	150	1000	Air	C
ML-5576/200	20	32	150	2500	Air	C
ML-6908	12	23	150	10000	Oil	R-C
ML-8224	5.5	6.5	150	1000	Oil	R-C

LEGEND:
R-C . . . Radiation and Convection
W . . . Water
F-A . . . Forced Air
C . . . Convection
V . . . Vapor
‡ . . . D-C Cathode Current
* . . . Duty Cycle: 0.0033
† . . . Duty Cycle: 0.0025 max.
§ . . . Hold-Off Voltage

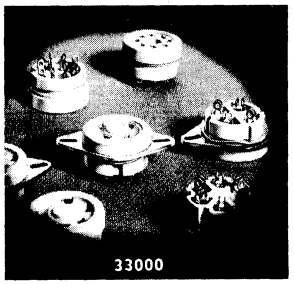
For a catalog and literature describing the complete line of Machlett tubes, write: **The Machlett Laboratories, Inc., 1063 Hope Street, Stamford, Connecticut 06907.**

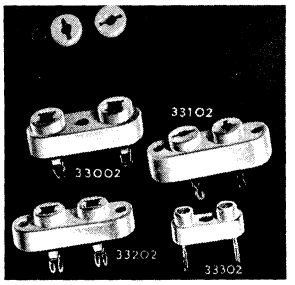
RAYTHEON

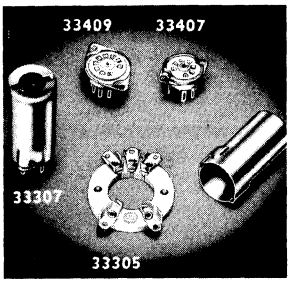
THE MACHLETT LABORATORIES, INC.

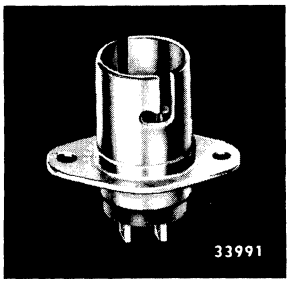
A SUBSIDIARY OF RAYTHEON COMPANY

MILLEN TUBE SOCKETS DESIGNED FOR APPLICATION









Long Flashover path to chassis permits use with transmitting tubes, 866 rectifiers, etc. Long leakage path between contacts. Contacts are type proven by hundreds of millions already in government, commercial and broadcast service, to be extremely dependable. Sockets may be mounted either with or without metal flange. Mounts in standard size chassis hole. All types have barrier between contacts and chassis. All but octal and crystal sockets also have barriers between individual contacts in addition.

Voltage regulator dual contact bayonet socket, 33991 black phenolic insulation and 33992 with low loss mica filled phenolic insulation.

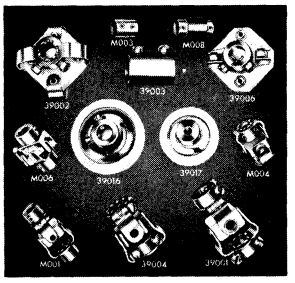
MILLEN TUBE SOCKETS

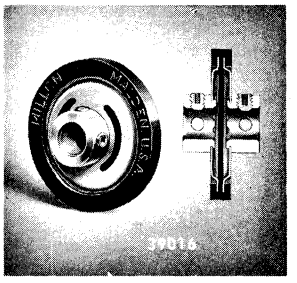
No.	Description	No.	Description
33002	Crystal Socket ¾" x .125"	33004	4 Pin Tube Socket
33102	Crystal Socket .487" x .095"	33005	5 Pin Tube Socket
33202	Crystal Socket ½" x .125"		
33302	Crystal Socket .487" x .050"	33008	8 Pin Tube Socket
33407	Miniature Socket only, ceramic	33991	Socket for 991
33409	Noval Socket only, ceramic	33992	Socket for 991
33307	Miniature Socket, Shield, ceramic	33207	829 Socket
33309	Noval Socket, Shield, ceramic	33305	Acorn Socket

FLEXIBLE COUPLINGS — The No. 39000 series of Millen "Designed for Application" flexible coupling units include, in addition to improved versions of the conventional types, also such exclusive original designs as the No. 39001 insulated universal joint and the No. 39006 "slide-action" coupling (in both steatite and bakelite insulation). The No. 39006 "slide-action" coupling permits longitudinal shaft motion, eccentric shaft motion and out-of-line operation, as well as angular drive.

The No. 39005 and 39005-B (high torque) are similar to the No. 39001, but are not insulated. The steatite insulated No. 39001 has a special anti-backlash pivot and socket grip feature. All of the above illustrated units are for ¼" shaft and are standard production type units.

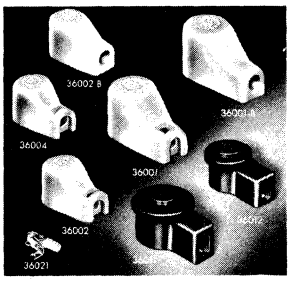
The No. 39016 incorporates features which have long been desired in a flexible coupling. No Backlash — High Flexibility — Higher Breakdown Voltage — Smaller Diameter — Shorter Length —

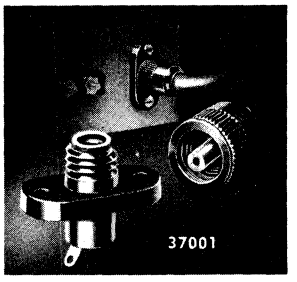




CERAMIC PLATE OR GRID CAPS — Soldering lugs and contact one-piece. Lug ears annealed and solder dipped to facilitate "mechanical plus soldered" connection of cable.

No. 36001—$\frac{9}{16}$" ..... No. 36002—⅜" ..... No. 36004—¼" .....

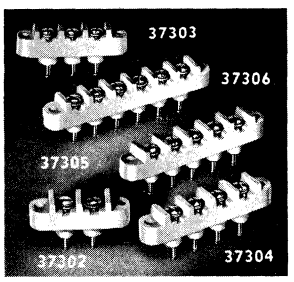


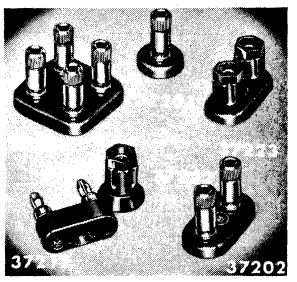


SAFETY TERMINAL — Combination high voltage terminal and thru-bushing. Tapered contact pin fits firmly into conical socket providing large area, low resistance connection. Pin is swivel mounted in cap to prevent twisting of lead wire.

No. 37001, Black or Red ..... No. 37501, Low loss .....

STEATITE TERMINAL STRIPS — Terminal and lug are one piece. Lugs are turret type and are free floating so as not to strain L522 ceramic on wide temperature variations. Easy to mount with series of round holes. 1400 volt and 3500 volt series.



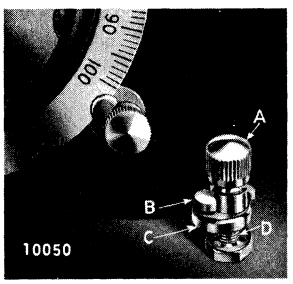


POSTS, PLATES, AND PLUGS — The No. 37200 series, including both insulated and non-insulated binding posts with associated plates and plugs, provide various combinations to meet most requirements. The posts have captive heads and keyed mounting. The No. 37291 on No. 37223 are standard in black or red with other colors on special order. No. 37201, No. 37202, and No. 37204 are available in black, red, or low loss. The No. 37202 is also available in steatite.

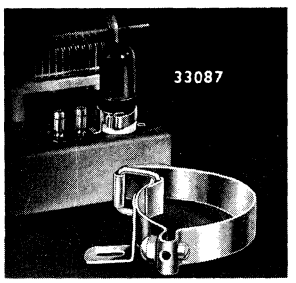
No.	Description	No.	Description
37201	Single plates, pr.	37204	Double dual plates, pr.
37291	Single plates (tapered), pr.	37212	Dual plug
37202	Dual plates, pr.	37222	Non-insulated binding post
		37223	Insulated binding post

DIAL LOCK — Compact, easy to mount, positive in action, does not alter dial setting in operation! Rotation of knob "A" depresses finger "B" and "C" without imparting any rotary motion to Dial. Single hole mounted.

No. 10050 .....

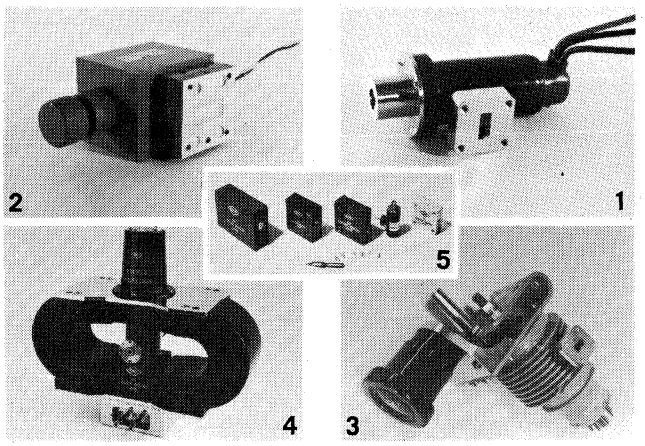


TUBE CLAMP — No. 33087 is easy to use, easy to install, effective in function. Available in special sizes for all types of tubes. Single hole mounting. Spring steel, cadmium plated.



JAMES MILLEN MFG. CO., INC.
MAIN OFFICE AND FACTORY 150 EXCHANGE ST., MALDEN, MASSACHUSETTS, U. S. A.

OKI Microwave Products



OKI STANDARD MILLIMETER KLYSTRONS

OKI MODEL NR.	TYPICAL FREQUENCY RANGE IN GHz	TYPICAL OUTPUT AT MIDBAND (Milliwatts)	RESONATOR VOLTAGE (V)	RESONATOR CURRENT (A)
17V10	15.5/18.5	100	2000	.012
20V10	18.0/22.0	160	2000	.012
22V10	20.0/24.0	165	2000	.012
24V10A	22.0/26.0	250	2000	.012
24V11	22.0/26.0	600	1800	.035
30V10	27.0/32.0	75	2000	.012
30V11	27.0/32.0	225	2000	.025
30V12	27.0/32.0	450	2300	.035
30V16	29.5/31.5	250	2000	.025
33V10	31.0/36.0	75	2000	.012
35V10	32.0/37.0	75	2000	.012
35V11	32.0/37.0	220	2000	.025
35V12	32.0/37.0	400	2300	.035
40V10	37.0/42.0	90	2300	.025
40V12	37.0/42.0	350	2500	.035
45V10	43.0/48.0	85	2300	.025
45V12	43.0/48.0	250	2500	.035
47V10	44.0/51.0	80	2300	.025
47V11	44.0/51.0	160	2300	.025
47V12	44.0/51.0	200	2500	.035
50V10	46.0/54.0	60	2500	.025
55V10	50.0/60.0	65	2500	.025
55V11	50.0/60.0	130	2500	.025
60V10	55.0/65.0	65	2500	.025
60V12	55.0/65.0	120	2500	.035
70V10	66.0/76.0	65	2700	.025
70V11A	66.0/76.0	130	2700	.025
75V10	70.0/80.0	45	2700	.025
80V10A	75.0/85.0	40	2500	.025
90V10	85.0/95.0	30	2500	.025
90V11	85.0/95.0	60	2500	.020
100V10A	95.0/105.0	25	2500	.020
120V10	107.0/122.0	10	2500	.017

OKI AVALANCHE DIODE OSCILLATORS

TYPE	60 mW MIN. MODEL	100 mW MIN. MODEL
Coaxial Output	ADC-10A	ADC-10B
Waveguide Output	ADW-10A	ADW-10B
Low Noise Units	ADS-10A	ADS-10B

All models designed to operate at X-band with a mechanical tuning range ±250 MHz.

Write for detailed information and prices to: OEA.

(1) MINIATURE LOW VOLTAGE KLYSTRON

(2) AD-10-SERIES LOW NOISE AVALANCHE DIODE OSCILLATOR

(5) AVALANCHE DIODE OSCILLATORS

(3) OKI REFLEX KLYSTRON

(4) OKI LADDERTRON

OKI MINIATURE LOW VOLTAGE KLYSTRONS

OKI MODEL NO.	FREQUENCY RANGE (GHz)	OPERATING VOLTAGE & CURRENT	TYPICAL MIDBAND POWER
KL-23	22.5±1	500V 40 ma.	80 mw. min.
KL-24	24.0±1	500V 40 ma.	80 mw. min.
KL-24	24.0±1	700V 50 ma.	200 mw. min.
KL-35	35.0±1	500V 40 ma.	50 mw. min.

HIGH POWERED KLYSTRONS AND LADDERTRONS

OKI MODEL NO.	TYPICAL FREQUENCY RANGE (GHz)	TUBE TYPE	TYPICAL OUTPUT POWER	RESONATOR VOLTAGE (V)	RESONATOR CURRENT (A)
KC31A	30.0/32.0	KLYSTRON	7 Watts	2700	.120
KCT31B	30.5-31.5	KLYSTRON	3 Watts	2700	.120
34LV20	33.2-34.8	LADDERTRON	10 Watts	1800	.095
45LV10	44.3-45.7	LADDERTRON	5 Watts	2000	.130
KC55B	53.0/57.0	KLYSTRON	10 Watts	3600	.180
KF35P	34.5-35.5	LADDERTRON	50 Watts	3800	.330

OKI MM-WAVE BACKWARD-WAVE OSCILLATORS

OKI MODEL NO.	FREQ. SPREAD (GHz)	TYPICAL LIMITS POWER RANGE	COOLING METHOD
BA47F	43.0/52.0	30/150 milliwatts	Air
BA50G	45.0/54.0	30/150 milliwatts	Air
BA55B	50.0/59.0	20/120 milliwatts	Air
BA60C	54.0/65.0	20/120 milliwatts	Air
BA47H	45.0/52.0	150/600 milliwatts	Water
BA50H	45.0/50.5	150/600 milliwatts	Water
BA48H	48.0/55.0	300/700 milliwatts	Water
BA54H	51.5/55.0	500/700 milliwatts	Water
BA55H*	50.0/56.0	300/600 milliwatts	Water
BA60H*	54.0/62.0	100/600 milliwatts	Water
BA70H*	65.0/75.0	500/3,000 milliwatts	Water
BA85B*	80.0/90.0	40/100 milliwatts	Air
BA85H*	80.0/90.0	80/150 milliwatts	Water
BA94H*	89.0/99.0	Up to 600 milliwatts	Water
BA100H*	84.0/110.0	Up to 600 milliwatts	Water
BA150H*	145.0/155.0	Up to 300 milliwatts	Water

***NOTE:** These models available on special order. The OKI Model BWS-104, BWO power supply is recommended for the above tubes and is available either in rack or cabinet versions. All tubes operate at 1500-4000 volts on delay lines.

OKI MM-WAVE MAGNETRONS

OKI M-10 SERIES MM-WAVE MAGNETRONS are available at any seelcted frequency in the 5.58 GHz to 95.5 GHz range. Peak power outputs to 50 KW are attainable. Please contact us directly for price and delivery information.

OKI ELECTRONICS OF AMERICA INC.

THE OKI BUILDING, 500/506 S.E. 24th STREET

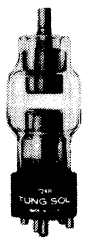
FORT LAUDERDALE, FLORIDA 33316

AREA CODE - 305
TEL. 523-7202
523-6571

TWX: 510-955-9837

TUNG-SOL ELECTRON TUBES
Industrial-Military

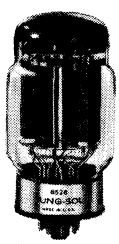
The performance characteristics of Tung-Sol tubes provide a wide safety margin over the most stringent specifications. Let us supply complete technical information about Tung-Sol tubes for your military or industrial application.



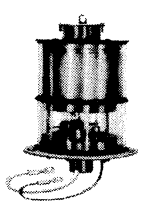
VACUUM PULSE TUBES
Partial list of types available: 3D21WB, 6889, 7248, 7403.



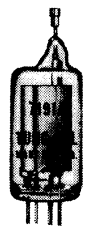
RECTIFIERS
Partial list of types available: 1Z2, 6H6WGT, 6X4WA, 25Z6WGT, 26Z5W.



POWER TRIODES
Partial list of types available: 5998, 6080, 6080WA, 6080WB, 6082, 6082WA, 6082WB, 6336A, 6528, 6877, 7236, 7241, 7242, 6336B, 6528A.



HYDROGEN DIODES
Partial list of types available: 7789, 7790, 7791, 7792, 7793, 8434, 8435. Ceramic: 8275, 8376, 8377.



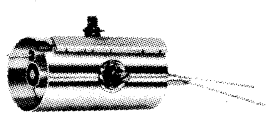
HYDROGEN THYRATRONS
Partial list of types available: 1257, 1257A, 1258, 5948A, 5949A, 6587, 7190, 7191, 7191A, 7192, 7240, 7871, 7872, 8253.



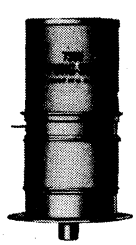
VOLTAGE REGULATORS
Partial list of types available: OC3W, OD3W, 5787, 5787WA.



PENTODES
Partial list of types available: 5636, 6AH6WA, 6AU6WB, 5702WB, 5749, 5784WB, 6AJ5, 6AK5WB, 6AS6, 6028, 6136, 8517, 8522.



PENCIL TUBES
Partial list of types available: 6263A, 6562, 7533, 5675, 5876, 5876A, 6264A.



CLIPPER TUBES
Partial list of types available: 8191, 8036, 7390, 8326, 7890, 8301, 8492.



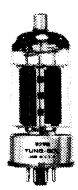
INDICATOR TUBES
Partial list of types available: 8569.



TELEPHONE TUBES
Partial list of types available: 408A, 426A, 6028.



TWIN TRIODES
Partial list of types available: 6SU7GTY, 5687, 5744WB, 6188/6SU7WGT.



TRANSMITTING TUBES
Partial list of types available: 2E22, 8150, 8236.



VOLTAGE REFERENCE TUBES
Partial list of types available: 5651, 5651WA, 5783, 5783WA.



POWER PENTODES
Partial list of types available: 2E22, 26E6WG, 5A6, 5881, 6AR6, 6098/6AR6WA, 6L6WGB, 6384, 6550, 6889, 6094.

ELECTRON MULTIPLIER TUBES

Multi-stage secondary emission tubes supply peak power pulses with negligible input power. Extremely fast rise time, low delay time with positive or negative going output pulse. Excellent for modulating traveling wave tubes and hydrogen thyratrons.



5 STAGE

8428—600v. peak pulse output at 4 amps. Load—150 ohms.

8455—1000v. peak pulse output at 4 amps. Load—250 ohms.



2 STAGE

DT1527A—50v. peak pulse output at 1 amp. Load—50 ohms.

TUNG-SOL®
TUNG-SOL DIVISION
Wagner Electric Corporation
630 W. Mt. Pleasant Avenue, Livingston, N. J. 07039
TWX: 710-994-4865 Phone: (201) 992-1100; (212) 732-5426

High Vacuum Amplifiers

Tube Type	RATINGS		
	Anode KV	Input KW	Diss. KW
WL-2E26	600V	30W	10W
WL-207	15	30	10
WL-813	2.25	0.36	100W
WL-891	15	20	7.5
WL-891R	10	15	4
WL-892	15	30	10
WL-892R	12.5	18	4
WL-895	17	150	40
WL-895R	17	110	20
WL-5604	12.5	32.5	10
WL-5606	14	25	10
WL-5619	12.5	32.5	20
WL-5668	14	28	20
WL-5669	14	28	10
WL-5682	16	300	120
WL-5736	5	5	2.5
WL-5918A	17.5	300	70
WL-5936	18	180	70
WL-5986A	17.5	220	90
WL-6146	600V	67.5W	20W
WL-6146A	600V	67.5W	20W
WL-6146B	600V	90W	27W
WL-6159	600V	25W	20W
WL-6379	17.5	150	70
WL-6420	10	20	12.5
WL-6421	10	20	10
WL-6421F	10	20	7.5
WL-6422	12.5	30	20
WL-6423	12.5	30	12.5
WL-6423F	12.5	30	10
WL-6424	12.5	40	20
WL 6425	12.5	40	12.5
WL-6425F	12.5	40	11
WL-6426	12.5	80	40
WL-6427	12.5	80	20
WL-6623	5	5	2.5
WL-6696	16	120	60
WL-6697	16	120	35
WL-6893	600V	30W	10W
WL-7215	9.2	18	9
WL-7255	9.2	18	9
WL-7328A(1)	10	50	20
WL-7464(1)	8	18	8
WL-7482	20	600	200
WL-7482V	20	600	200
WL-7540(1)	15	70	35
WL-7560	20	600	175
WL-7560V	20	600	175
WL-7565(1)	8	8	4
WL-7604(2)	4	1.5	0.6
WL-7685(2)	4	1.5	0.6
WL-7748	12.5	80	35
WL-7982(1)	10	75	35
WL-8032	600V	75W	20W
WL-8161/ 3CX2500A3	6	12	2.5
WL-8251/ 3CX2500F3	6	12	2.5
WL-8298	600V	75W	20W
WL-22759	9.2	18	9
WL-22789	9.3	21	9
WL-23063	25	1000	375
WL-23165	15	150	90

The tube types listed here represent only a small fraction of the tube designs available from the Westinghouse Electronic Tube Division. These listings are intended to present the breadth and depth of the Westinghouse Tube Line.

High Vacuum Switch Tubes

Tube Type	RATINGS		
	Anode KV	Diss. KW	Anode PK Amps
WL-4852	60	375	1400
WL-6424	35	20	40
WL-6425	35	12.5	40
WL-6425F	35	11	40
WL-6696	45	60	150
WL-6697	45	35	150
WL-6920	40	10	100
WL-7328A	20	20	88
WL-7413	55	70 (4)	400
WL-7560	55	175	450
WL-7560V	55	175	450
WL-7691	55	10	400
WL-7750	25	8	80
WL-7982	20	35	88
WL-8044	25	20	80
WL-8461	60	200	600

NOTES:

(1) Ratings are based on CCS Class C Telegraphy service unless otherwise shown.

(2) Designed for audio and ultra-sonic service. Ratings are single tube Class AB.

(3) Ratings and Performance are for Class AB r-f amplifier service.

(4) For all immersion, cooling value is 14 kilowatts.

Thyratrons

Tube Type	RATINGS		
	Anode Volts	Peak Amps	Avg. Amps
KU-610	500	0.4	0.1
WL-624	2500	80	6.4
WL-627	5000	2.5	0.64
WL-629	350	0.2	0.04
WL-632B	1500	30	2.5
WL-672A	2500	40	3.2
WL-676	2500	40	6.4
WL-677	10000	16	4.0
WL-678	15000	6.0	1.6
WL-5796	1500	20	1.6
WL-6860	1250	77	6.4
WL-7306A	1250	30	2.5
WL-7307A	1500	30	2.5
WL-7321	1250	77	6.4
WL-7363	1500	20	1.6
WL-7509A	1500	30	2.5
WL-7556A	1250	30	2.5
WL-8043	21000	7.5	2.5
WL-22994/5877	1500	40	3.2
WL-23052/7297	1500	40	3.2

High Vacuum Rectifiers

Tube Type	RATINGS		
	Inverse KV	Peak MA	Max. MA
WL-102A	75	750	240
WL-456	140	500	60
WL-481B	25	150	30
WL-579B	20	270	25
WL-5575	150	1000	330
WL-5576	150	2500	834
WL-5859/5860	140	—	100
WL-5973	75	5000	1000
WL-7658	125	750	150
WL-8094/199	110	10000	1300
WL-22800	50	60A	20A
WL-22801	30	30A	10A
WL-22802	50	60A	20A
WL-23095	30	—	3.5A
WL-23102/102A	75	750	240
WL-23178	15	—	2A

Ignitrons

Continuous Duty A.C. Control Ignitrons

Tube Type	Size	MAX.	
		RMS Line Volts	Demand KVA
WL-23011	B	250-600	600
WL-23012	C	250-600	1200
WL-23013	D	250-600	2400
WL-23014	B Coax	250-600	600
WL-23015	C Coax	250-600	1200
WL-23016	C ½	250-600	1800
WL-23017	D Coax	250-600	2400
WL-23018	C ½ Coax	250-600	1800

Capacitor Discharge & Crowbar Ignitrons

Tube Type	Hold-OffV K	Peak Amp.
WL-6228	60	30,000
WL-7171	60	35,000
WL-7703	20	100,000
WL-7740	20	35,000
WX-4681	20	75,000
WX-30216	15	35,000

A.C. Welder Control Ignitrons

Tube Type	Size	MAX.	
		RMS Line Volts	Demand KV
WL-5550	A	250-600	300
WL-5551A WL-5551A (PC)	B	250-600	600
WL-5552A WL-5552A (PC)	C	250-600	1200
WL-5553B WL-5553B (PC)	D	250-600	2400
WL-5554/679	C	2400	1200
WL-5555/653B WL-5555A	D	2400	2400
WL-7669 WL-7669 (PC)	B Coax	250-600	600
WL-7671 WL-7671 (PC)	C Coax	250-600	1200
WL-7681	C ½	250-600	1800

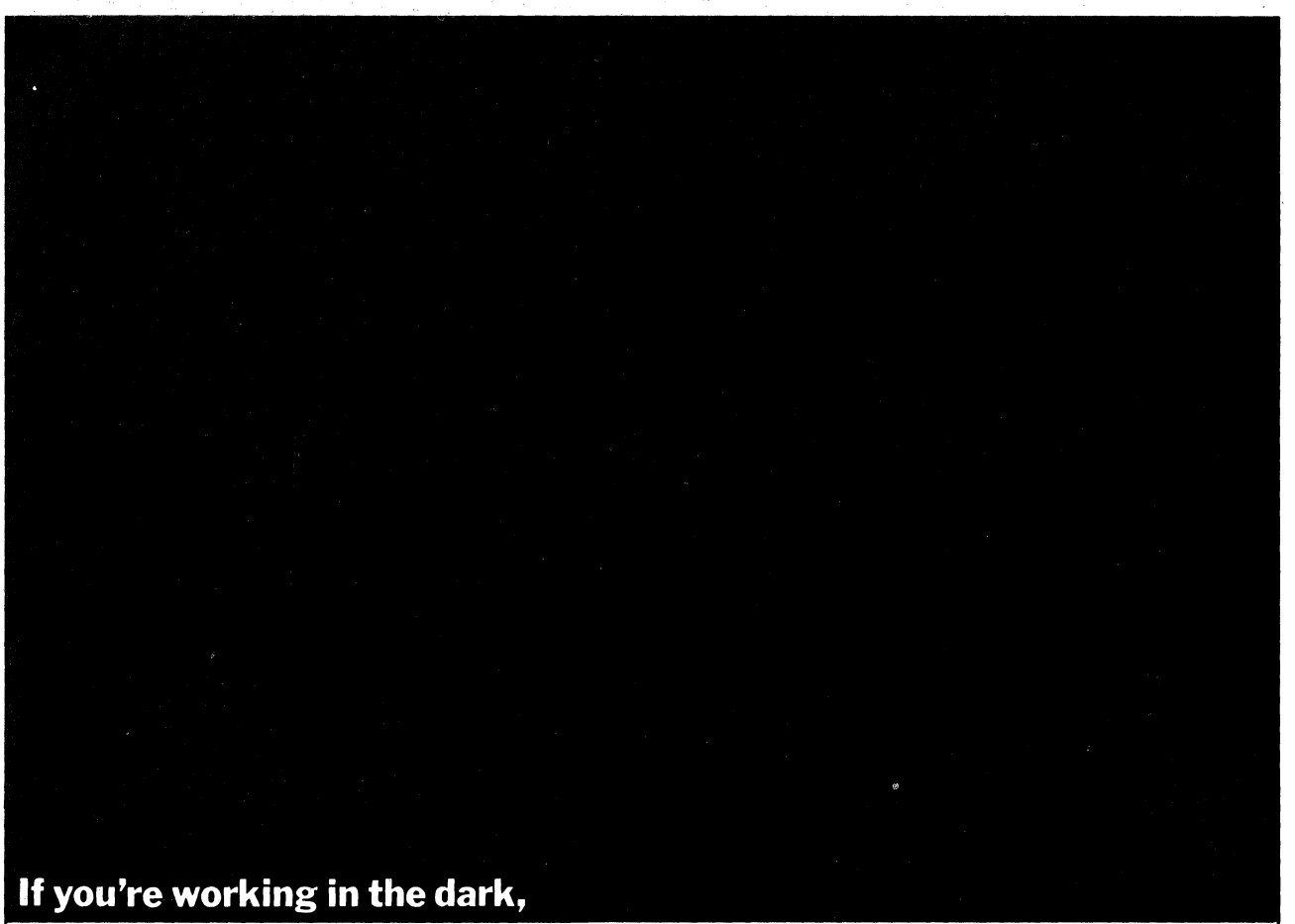
Ionization Gauges

Tube Type	Tube Class	Range Torr	Tubulation Size Mat'l
WL-5966	Bayard-Alpert(2)	10^{-3} to 10^{-10}	½″ Nonex
WL-7676	Schulz-Phelps	$5x10^{-1}$ to 10^{-5}	½″ Pyrex
WL-7903	Schulz-Phelps	$5x10^{-1}$ to 10^{-5}	½″ Pyrex
WL-7904	Bayard-Alpert(2)	10^{-3} to 10^{-9}	½″ Pyrex
WL-8057	Bayard-Alpert(3)	10^{-3} to 10^{-9}	¾″ Nonex
WL-22612	Bayard-Alpert(2)	10^{-3} to 10^{-10}	½″ Pyrex
WL-22613	Bayard-Alpert(2)	10^{-3} to 10^{-10}	¾″ Pyrex
WL-22614	Bayard-Alpert(2)	10^{-3} to 10^{-10}	1″ Pyrex
WL-22618	Bayard-Alpert(2)	10^{-3} to 10^{-10}	½″ Pyrex
WL-22619	Bayard-Alpert(2)	10^{-3} to 10^{-10}	¾″ Pyrex
WL-22620	Bayard-Alpert(2)	10^{-3} to 10^{-10}	1″ Pyrex
WL-22627	Bayard-Alpert(2)	10^{-3} to 10^{-10}	¾″ Pyrex
WL-22637	Bayard-Alpert(3)	10^{-3} to 10^{-9}	¾″ Pyrex
WL-22640	Bayard-Alpert(3)	10^{-3} to 10^{-9}	¾″ Kovar
WL-22643	Bayard-Alpert(3)	10^{-3} to 10^{-9}	¾″ Pyrex
WL-22754	Bayard-Alpert(4)	10^{-3} to 10^{-9}	¾″ Nonex
WL-22868	Bayard-Alpert(4)	10^{-3} to 10^{-9}	¾″ Pyrex
WL-22869	Bayard-Alpert(4)	10^{-3} to 10^{-9}	¾″ Kovar
WL-22923	Schulz-Phelps	$5x10^{-1}$ to 10^{-5}	½″ Kovar
WL-22947	Bayard-Alpert(4)	10^{-3} to 10^{-9}	¾″ Nonex
WL-22948	Bayard-Alpert(4)	10^{-3} to 10^{-9}	¾″ Pyrex
WL-22949	Bayard-Alpert(4)	10^{-3} to 10^{-9}	¾″ Kovar

NOTES:
(1) Excluding flexible leads. Length and diameter describe space to contain tube.
(2) Grid outgassed by electron bombardment.
(3) Grid outgassed by a-c current conduction.
(4) Non-burn-out filament and grid outgassed by a-c current construction.

Pirani Tubes

Tube Type	Filament		Tubulation		Range Torr
	Material	Amps.	Size	Glass	
WL-762	Platinum	0 to 0.3	⅜″	Nonex	1 to $5x10^{-4}$
WL-765	Platinum	0 to 0.3	⅝″	Nonex	1 to $5x10^{-4}$
WL-765A	Platinum	0 to 0.3	None	None	1 to $5x10^{-4}$



If you're working in the dark,

Varo can help you see the light.

If you work in the dark or in areas requiring low light levels, Varo can literally help you see the light.

In less than ten years, our Electron Devices Division has become one of the world's major suppliers of image conversion and image intensification components for night vision equipment.

We got started in night vision when we foresaw the tremendous potential for image devices in both scientific and technological applications.

Our capability in the design and production techniques necessary for volume production of image tubes has grown rapidly. Currently, Varo produces both active and passive image tubes and modules for use in a variety of military, scientific, and industrial applications.

This includes production of standard lines of 18 MM and 25 MM image converter tubes for active devices, and 18 MM, 25 MM and 40 MM image intensification assemblies and modules for passive viewing systems.

In addition to producing standard tube types in volume, the design and development engineers of the Electron Devices Division are involved in a continuous program of advanced generation devices and are, of course, improving current generation types to include a complete line of zoom and gated intensifiers.

This program is backed up by Varo's fully integrated production capability in the manufacturing of complete night vision systems. That includes viewing devices, illumination systems, optics, and power supplies.

The aggregate experience of our image intensification and conversion assembly design group is unexcelled in the industry. In fact, many members of the group have been with the program since image intensification was first seen as a practical approach to night vision applications. Many of them were responsible for the design and production of the original units. Research, design and production of Varo devices is conducted in Electron Devices Division's 60,000 square foot facility under rigid temperature, humidity and contamination controls. The division is headquartered in Garland, Texas.

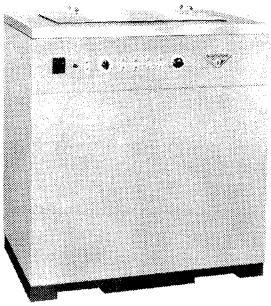
If you have any questions about image conversion or intensification devices, call or write.

VARO

ELECTRON DEVICES DIVISION 2203 WALNUT STREET, P. O. BOX 1437, GARLAND, TEXAS 75040, (214) 272-3561 or 272-4642 TWX 910-860-5194 TELEX 75-2449

BLACKSTONE has the ULTRASONIC ANSWERS

ULTRASONIC VAPOR DEGREASER



MODEL VE 6.5-2
300 Series stainless steel tanks. 6.5 gal. cap.

Automatically tuned, solid state generator.
Frequency: 23 KHz
0-100% power control optional

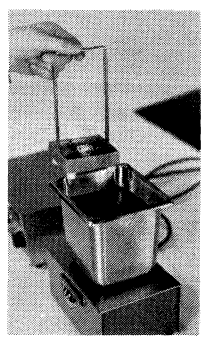
Ultrasonic Scrubbing and Vapor Rinsing Insures Thorough, Fast and Economical Cleaning of Complete Assemblies or Individual Components.

Model VE 6.5-2 is ideal for intermittent cleaning of miniaturized items as well as continuous cleaning of production parts. Power and temperature can be controlled to provide for a wide range of cleaning applications in a single unit.

Blackstone cleaners are available singly with tank capacities of 1.9, 6.5 and 30 gallons. Other sizes available on special order.

ULTRASONIC KIT





The BPO Probe is ideally suited for cell disruption of small biological samples, dispersal of steroids, degassing and de-aeration of oils and other viscous fluids, emulsification of liquids and acceleration of chemical reactions.

The CT.5 Cleaning Tank enables precision ultrasonic scrubbing for contaminated small parts and instruments in aqueous solutions.

Individual units may be purchased separately or together as a complete system.

ULTRASONIC CLEANER



MODEL SP-100
Stainless steel
1-5/8 quart tank
100 watt output
34 ± 2 KHz frequency

ALL PURPOSE CLEANER FOR INDUSTRIAL APPLICATIONS, R&D, SCIENTIFIC, MEDICAL AND DENTAL LABS

Model SP-100 is a self contained unit producing high intensity ultrasonic action for rapid and efficient cleaning in continuous duty cycle.

The Blackstone line of Ultrasonic Equipment includes:

- Vapor Degreasers, 1.9 to 30 gal. capacity
- Heated Tanks, 1.9 to 30 gal. capacity
- Immersible Transducers
- Biological and Industrial Probes
- Specialized Units

As a pioneer in Ultrasonics, Blackstone is happy to supply recommendations and engineering assistance to help solve your specific cleaning problem.

The services of our complete Research and Development facility are available. As a first step we invite you to take advantage of the following FREE OFFER!

Send a sample of your work and describe your cleaning process. We will precision clean it and show you how to lower your cleaning cost.

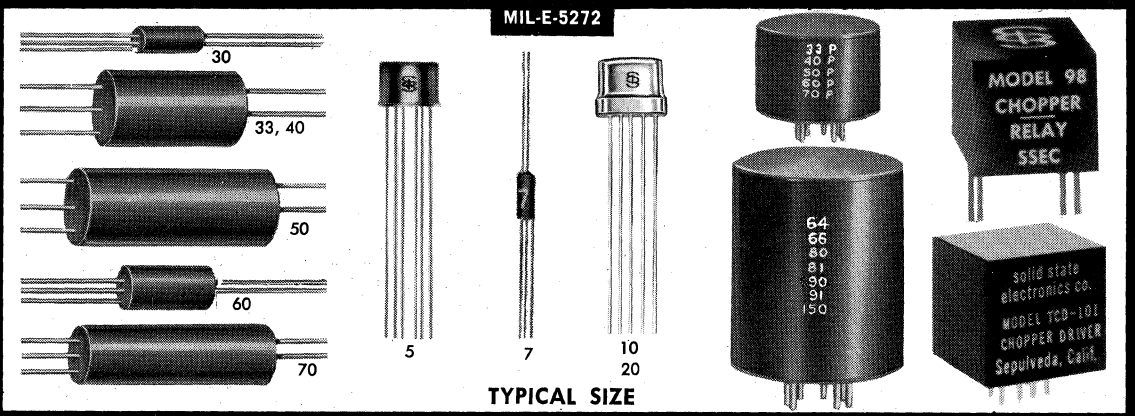
UCON® SOLVENTS

BLACKSTONE ULTRASONICS, INC.

820 CENTER ST., SHEFFIELD, PA. 16347 • PHONE 814-968-3221

THE MOST COMPREHENSIVE LINE OF SOLID STATE CHOPPERS, RELAYS & ANALOG SWITCHES

MIL-E-5272



TYPICAL SIZE

microminiature	lightweight	low power	high speed	rugged	indefinitely long life
non-mechanical	inertialess	low level	high efficiency	linear	temperature stable

The transistor chopper (or modulator) is a solidly encapsulated unit designed to alternately connect and disconnect a load from a signal source. It may also be used as a demodulator to convert an a.c. signal to d.c It is capable of linearly switching or chopping voltages over a wide dynamic range which extends down to a fraction of a millivolt and up to 150 volts or more. Unlike mechanical choppers which can only be designed to operate over a narrow and comparatively low frequency range due to mechanical limitations, the transistorized chopper is an inertialess device that can be driven from d.c. to hundreds of kilocycles.

The switching circuitry used operates the transistors in a manner which provides stability and freedom from drift over a wide temperature range. Only carefully selected and matched transistors are utilized.

The Models 5, 6, 10, 20, 30, 33, 33P, 40, 40P, 50, 50P, 60, 60P, 70 and 70P are direct-coupled so as to provide the circuit designer with the most basic chopper from which to synthesize solutions to special circuit problems. The Models 33 and 33P are basic field-effect chopper-relays providing exceptional linearity, stability, low noise and offset. The Models 64, 65, 66, 75 and 150 are transformer-coupled for isolation purposes. The Model 150 is for high-level signals. The Models 64 and 66 are for operation from 400 cps and 60 cps sine wave drive at 115 volts a.c. The Models 80, 81, 90 and 91 VIBRACHOPPERS are unique since they require d.c. rather than a.c. contacts, even with d.c. drive. The Model TCD-101 Transistor Chopper Drive drive. The Model 98 has complete isolation and insulation between drive and provides suitable square wave drive voltages for transistorized choppers and synchronous demodulators.

These units are immune to the effects of shock and vibration making them ideal for military, space vehicle and portable applications; or where power conservation, miniaturization and elimination of maintenance are a necessity. Shipments can be same day if you call early.

CHOPPER MODEL SPECIFICATIONS

Model	Type	Max. Signal Voltage (Volts)	Max. Signal Current (MA)	Drive Frequency Range	Max. Drive Voltage (600Ω Source) (AC Volts)	Drive Input Impedance (Ohms)	Ambient Temp. Range (°C)	Size (Inches)	Weight (Grams)
5	Shielded Micro-Min	±5	±10	DC to 100 kcps	25 pk-pk	600	−55 to +150	.260 x .362 Dia.	1
6	Hi-Temp Micro-Min	±5	±10	DC to 100 kcps	25 pk-pk	600	−55 to +150	.2 x 2 x .1 Dia.	0.5
7	Hi-Temp Micro Hi-Freq.	±40	±10	DC to 250 kcps	25 pk-pk	600	−65 to +125	.25 x .1 Dia.	0.5
10	Shielded Micro-Min	±5	±10	DC to 100 kcps	25 pk-pk	600	−55 to +150	.210 x .315 x .405	1
20	Shielded Micro-Min	±10	±10	DC to 100 kcps	25 pk-pk	200	−55 to +90	.210 x .315 x .405	1
26	RF Micro-Min	±5	±3	400 kc to 5 mc	25 pk-pk	400	−55 to +130	.88 x .32 Dia.	2
30	Micro-Min Hi-Freq	±10	±10	DC to 100 kcps	25 pk-pk	200	−55 to +90	.38 x .16 Dia.	½
33	FET, Lo-Offset Hi-Temp	±7	±5	DC to 500 kcps	30 pk-pk	10M	−55 to +175	.7 x .44 Dia.	2
33P	FET, Lo-Offset Hi-Temp	±7	±5	DC to 500 kcps	30 pk-pk	10M	−55 to +175	.5 x .75 Dia.	8
40	Sub-Min Hi-Temp	±15	±40	DC to 50 kcps	40 pk-pk	600	−55 to +150	.7 x .44 Dia.	2
40P	Plug-in Hi-Temp	±15	±40	DC to 50 kcps	40 pk-pk	600	−55 to +150	½ x ¾ Dia.	8
50	Sub-Min Hi-Freq	±10	±10	DC to 100 kcps	25 pk-pk	600	−55 to +90	1¼ x .44 Dia.	3
50P	Plug-in Hi-Freq	±10	±10	DC to 100 kcps	25 pk-pk	600	−55 to +90	½ x ¾ Dia.	8
60	Micro-Min Hi-Freq	±10	±50	DC to 100 kcps	50 pk-pk	600	−55 to +90	½ x ¼ Dia.	1
60P	Plug-in Hi-Freq	±10	±50	DC to 100 kcps	50 pk-pk	600	−55 to +90	½ x ¾ Dia.	8
64	115V/400 cps Xfmr-in	±10	±50	.04 to 12 kcps	300 pk-pk	10K	−55 to +90	1¼ x 1 Dia.	44
65	Xfmr-in Plug-in	±2	±50	0.27 to 30 kcps	50 pk-pk	100	−55 to +90	¾ x ¾ Dia.	12
66	115V/60 cps Xfmr-in	±5	±50	.02 to 12 kcps	300 pk-pk	7K	−55 to +90	1¼ x 1 Dia.	44
70	Hi-Freq Hi-Temp	±10	±40	DC to 100 kcps	4 pk-pk	600	−55 to +150	1⅛ x 5/16 Dia.	2
70P	Plug-in Hi-Freq	±10	±40	DC to 100 kcps	4 pk-pk	600	−55 to +150	½ x ¾ Dia.	8
71	Xfmr-in Plug-in	±10	±5	.04 to 70 kcps	10 pk-pk	300	−55 to +150	.84 x .84 x .75	30
75	Xfmr-in Hi-Temp	±2	±30	0.27 to 100 kcps	10 pk-pk	100	−55 to +150	¾ x ¾ Dia.	12
80	DC-Drive Plug-in	±15	±50	1.5 to 6.5 kcps	6 to 32 DC	2K	−55 to +90	1¼ x 1 Dia.	32
81	DC-Drive DPDT	±15	±50	1.5 to 6.5 kcps	6 to 32 DC	2K	−55 to +90	1¼ x 1 Dia.	32
90	DC-Drice Plug-in	±6	±50	1.2 to 3.0 kcps	12 to 32 DC	2K	−55 to +150	½ x 1 Dia.	40
91	DC-Drive Hi-Temp DPDT	±6	±50	1.2 to 3.0 kcps	12 to 32 DC	2K	−55 to +150	1¾ x 1 Dia.	40
98	DC or AC Isolated Drive	±20	±2	DC to 5.0 kcps	6 to 12 pk-pk	850	−55 to +100	.75 x .75 x .84	16
150	Hi-Volt Hi-Temp Xfmr-in	±150	±40	0.27 to 30 kcps	20 pk-pk	100	−55 to +150	1¼ x 1 Dia.	30
171	Full-Wave Xfmr In-out	±1	±5	.2 to 50 kcps	10 pk-pk	100	−55 to +150	.9 x 9 x 1.25 Dia.	30
TCD-101	Sq Wave Chopper Driver	—	—	2 to 10 kcps	20 pk-pk	—	−55 to +100	.84 x .84 x .75	25

Phone, wire or write for specifications and application literature describing above units or consult your microfilm files (VSMF or Thomas Supplementary)

OTHER PRODUCTS—SEE EEM SECTIONS 4500 & 5200

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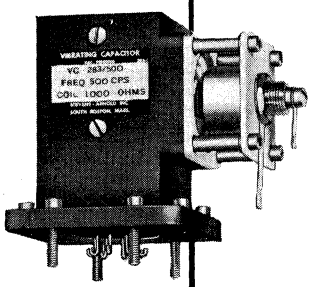
VIBRATING CAPACITORS

A vibrating-reed type capacitance modulator used to measure currents as low as 10^{-16} amperes. Drift never exceeds ± 0.2 millivolts per day, noncumulative. Thus it is ideal where stable performance without recalibration is required for periods of a month or more.

Please write for Catalog 523.



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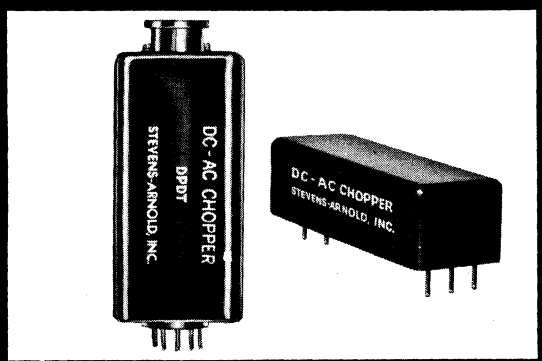

DC-AC CHOPPERS For 50/60/94/120 CPS

These miniature Choppers are outstanding. Long life is assured by our exclusive twin-contact construction. Noise level is less than 1 microvolt into 100,000 ohms with circuit capabilities of .01 microvolt. Packaged two ways, as shown. Built to rigid commercial specifications, there is a selection of types for all applications. Single pole, double pole, make-before-break, break-before-make, AC or DC drive.

DC DRIVEN CHOPPERS

For portable and transistorized instruments. A modification of our service proven AC driven type, these have a 94 cycle chopping rate to eliminate offsets in DC amplifiers and null-seeking equipment. Drive Unit operates from 12 volts DC.

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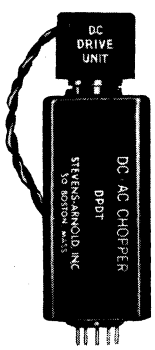

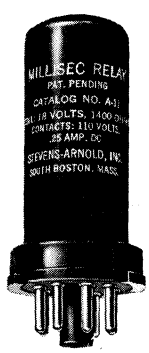

MILLISEC RELAYS

Amazingly fast, from 200 microseconds to 1 millisecond. Available in both commercial and military models, single-pole and double-pole, with shielded or unshielded coils. They are factory sealed and may be mounted in any position.

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NEW

TONE REEDS

Miniature components for frequency stabilizing and frequency sensing. Used to construct lifetime encoders and decoders. Frequencies from 300-3000 Hz.

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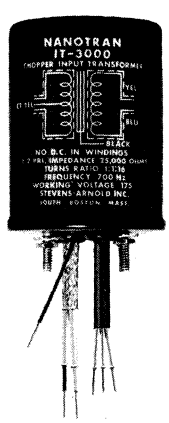

NANOTRAN ISOLATION TRANSFORMERS

Have −190 dB common mode rejection capabilities plus all other special features needed to minimize thermal noise and microphonics. Highest levels of magnetic shielding supplied. For less exacting applications, less expensive types are available.

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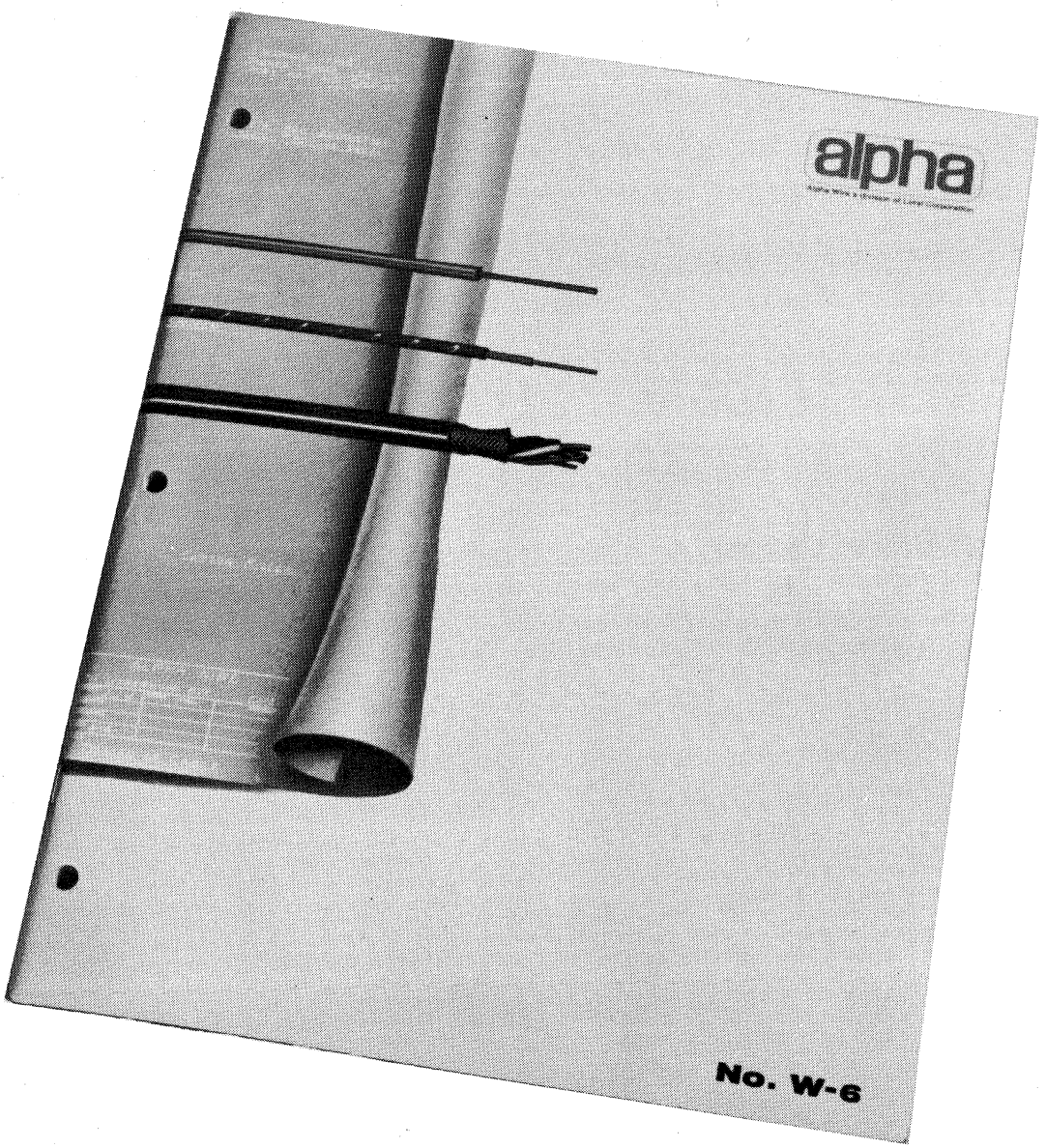

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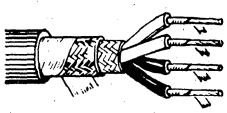
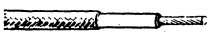
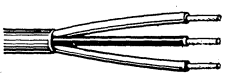
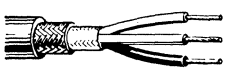
Miniaturized Cables

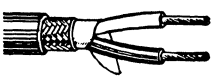

Shielded Power Supply Cables—Rubber or Vinyl

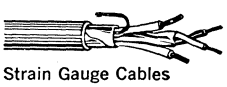

Grid Wires


Multi-Conductor Cables

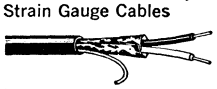

Plastic Microphone Cables

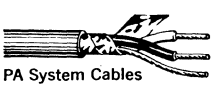

Shielded Interconnecting Cables

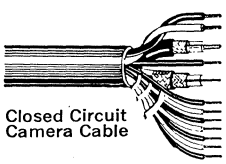

Low Impedance Lines

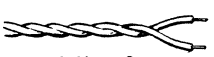

Strain Gauge Cables


Call System Cables

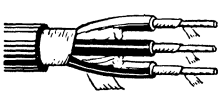

Broadcast Audio Cables

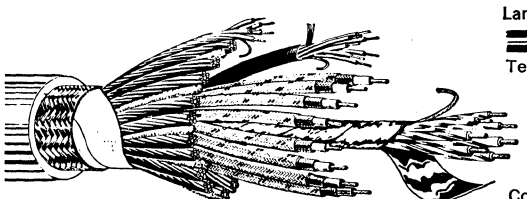

PA System Cables

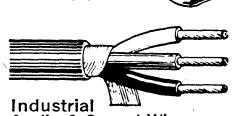

Closed Circuit Camera Cable

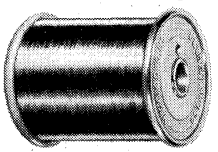

Sound & Alarm System Cables

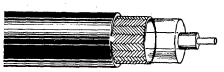

75-Ohm Video Cable


Power Supply Cordage

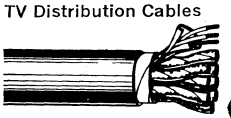

Color, Studio, Camera Cables


Industrial Audio & Sound Wires

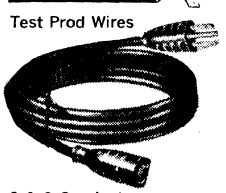

Magnet Wire

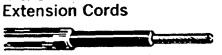

High Voltage Cable

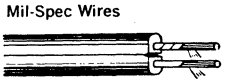

TV Distribution Cables

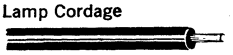

Multiple Pair Individually Shielded RF Cables

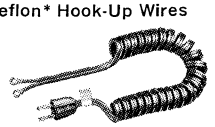

Test Prod Wires

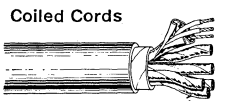

2 & 3 Conductor Extension Cords

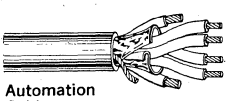

Mil-Spec Wires


Lamp Cordage


Teflon* Hook-Up Wires


Coiled Cords

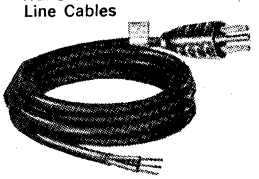

Multiple Pair Individually Shielded Audio and Data Cables


Automation Cable

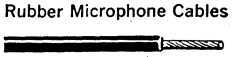

Language Lab Cables


Miniature Coaxial Cables

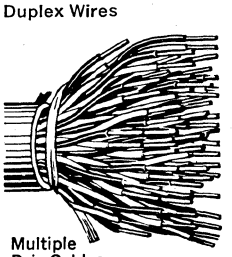

RG/U Transmission Line Cables


3-Conductor Power Cords


Rubber Microphone Cables


Hook-Up Wires


Duplex Wires


Multiple Pair Cables


Shielding & Bonding Cable

Miniature Microphone Cables

Control Cables

Unshielded Audio Cables

Shielded Control Cables

Coiled Test Prod Wire

RG/U Cables

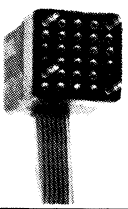
Shielded Cables

Miniature Audio Cables

Special Sound Cables

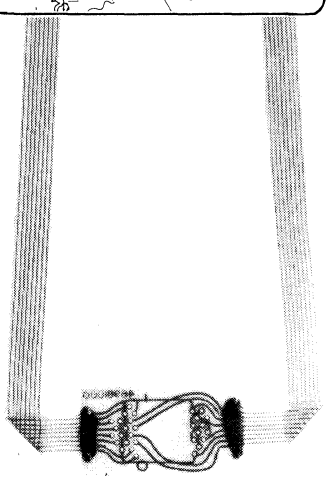
*DuPont Trademark 8-1-4A

CICOIL super-flex harness assemblies

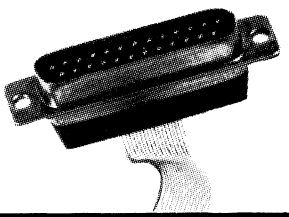


flexible

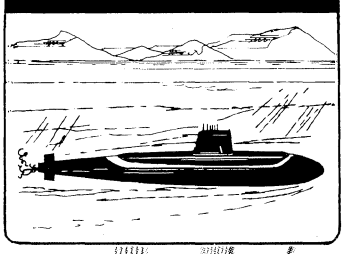




Cicoil Harness Assemblies allow the combination of various types of conductors (24AWG to 50AWG) in a single, flat cable, which utilizes the finest translucent silicone-rubber insulation. Highly capable for a wide variety of critical applications, such as astronaut space suit instrumentation and electronic computers.



reliable

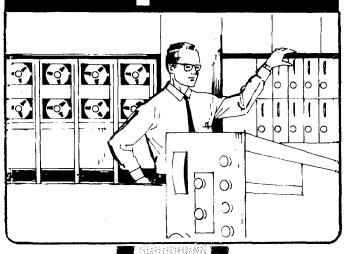


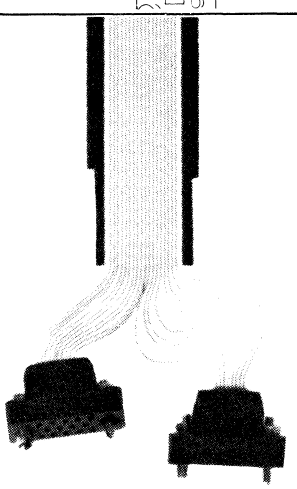


Tested to 70 million flexes without damage, Super-Flex Harnesses are ideal for applications under extreme temperatures −300°F to +500°F, and rigid environmental conditions. They have proven far superior to slip ring assemblies on guidance and navigation platforms, also low torque gyro applications for missiles.



adaptable





Cicoil offers a single resource from connector-to-connector, with up to 75% size and weight reduction. Our engineering department will assist you with your special problems. Take advantage of this complete design service, tailored to your exact requirements on military, commercial and medical electronic applications.

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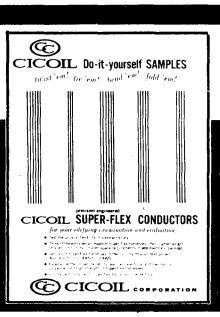

CICOIL CORPORATION

9324 Topanga Canyon Blvd., Chatsworth, Calif. 91311

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Cimco TEFLON* INSULATED HIGH TEMPERATURE WIRE, CABLE AND TUBING

Cimco manufactures both standard and custom-made wire and cable for aircraft, missiles, computers, electronic assemblies, and many other applications using TEFLON* insulated cable, tubing and hook-up wire.

BONDING TREATMENT — Surface treatment to increase bondability for use with potting compounds.

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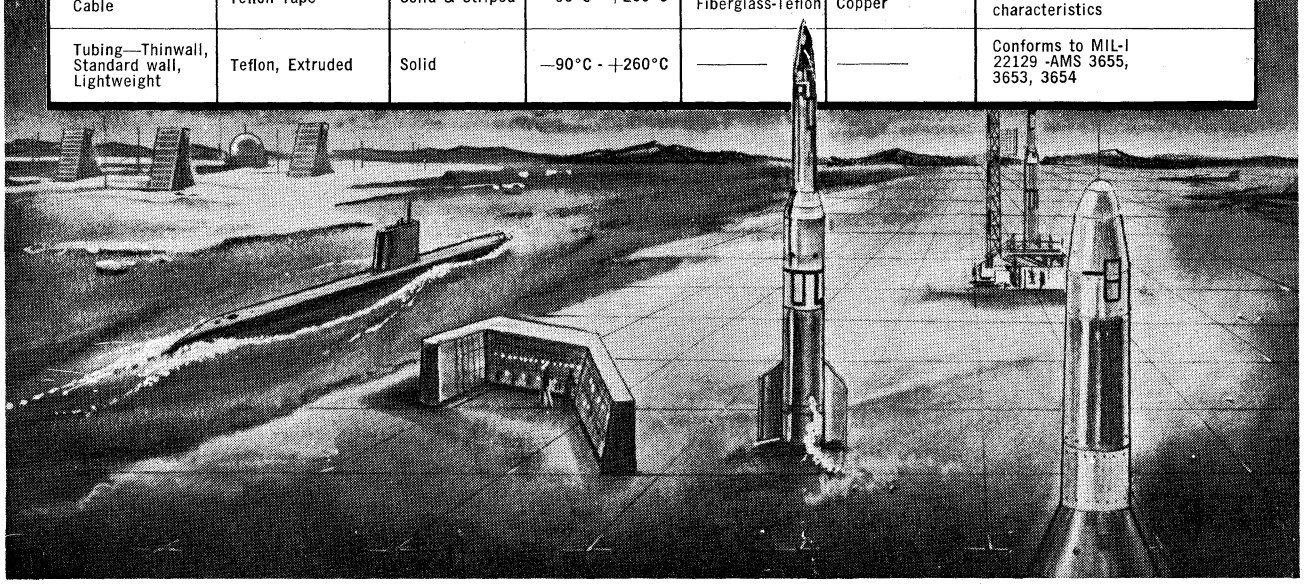
Cimco wire & cable co. 250 W. CRESCENT AVE., ALLENDALE, N. J. 07401 PHONE 201-327-2522

SPECIFICATIONS

WIRE, CABLE OR TUBING	PRIMARY INSULATION	COLORS MIL-STD-104	OPERATING TEMPERATURE	JACKETS	SHIELDING	REMARKS
High Temperature Hook-up Wire	Teflon, Extruded	Solid & Striped	—90°C - +260°C	———	Nickel Plated Silver Plated or Tinned Copper	Conforms to MIL-W-16878 Types E, EE & ET or other special specifications as required.
Cables A	Teflon, Extruded Teflon Tape Wrapped	Solid & Striped	—54°C - +105°C	PVC	Silver Plated or Tinned Copper	Any combinations of conductors and shielding required.
Cables B	Teflon, Extruded Teflon Tape Wrapped	Solid & Striped	—54°C - +120°C	Nylon Braid Nylon Extruded	Silver Plated or Tinned Copper	Any combinations of conductors and shielding required.
Cables H	Teflon, Extruded Teflon Tape Wrapped	Solid & Striped	—90°C - +260°C	Fiberglass-Teflon	Silver Plated Copper	Any combinations of conductors and shielding required.
Cables C	Teflon, Extruded Teflon Tape Wrapped	Solid & Striped	—90°C - +260°C	Teflon Tape	Silver Plated Copper	Any combinations of conductors and shielding required.
Airframe Wire	Teflon Tape Plus Impregnated Glass	Solid Only	—60°C - +260°C	———	———	MIL-W-7139B
Miniature Coaxial Cable	Teflon, Extruded	Jackets Only Solid & Striped	—90°C - +260°C	Teflon Tape, Fiberglass-Teflon Nylon & PVC	Silver Plated or Tinned Copper	Conforms to MIL-C-17B
Low Capacitance Cable	Teflon Air-weave	Natural	—90°C - +260°C —90°C - +260°C —54°C - +105°C —54°C - +120°C	Teflon Tape, Fiberglass-Teflon PVC Nylon	Silver Plated or Tinned Copper	Special constructions as low as 8.0 mmf/ft.
High Voltage Cable	Teflon Tape	Solid & Striped	—90°C - +260°C	Teflon Tape, Fiberglass-Teflon	Silver Plated Copper	High voltage lead wire or cable excellent corona resistance characteristics
Tubing—Thinwall, Standard wall, Lightweight	Teflon, Extruded	Solid	—90°C - +260°C	———	———	Conforms to MIL-I 22129 -AMS 3655, 3653, 3654





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Metallurgists and Manufacturers... Since 1901

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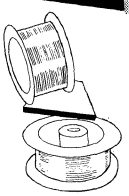

Potentiometer Wire . . . A series of precious metal alloys resistance range 29 to 550 ohms per circular mil foot. High **corrosion resistance,** assuring potentiometers of great reliability, and freedom from noise. Bare or enameled.

Platinum, Platinum-Rhodium Thermocouple Wires . . . Calibrated to match the emf values given in National Bureau of Standards circular #561 of April 27, 1955. In two qualities, Standard Grade matching NBS values within limits of ±0.25% and Reference Grade ±0.1%.

Iridium, Iridium-Rhodium Thermocouple Wires . . . Temperatures as high as 2000°C. may be measured, even in an oxidizing atmosphere. Also available in strips and foil.

Platinum Wire for Resistance Thermometers . . . Platinum wire having a temperature coefficient of resistance — (when fully annealed) — at .003926 per degree C. (0-100°C.).

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Taut-Band Ribbon . . . An alloy of **Nickel-Platinum** for rugged, bearing-free electrical measuring instruments.

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Bridge Wires for Electro Explosive Devices . . . Made from Noble metals, Noble metal alloys, and base metals to very fine sizes. Resistance and degree of hardness closely controlled. In MIL standards and commercial requirements.

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Rhodium . . . Rhodium produces a hard, thin, white and highly reflective electrodeposit, with excellent corrosion resistance. Used for wave guides, electrical contacts, other applications.

Gold Potassium Cyanide is supplied either as a **dry salt** or in **aqueous solution,** for various plating baths.

Write for comprehensive bulletins containing detailed information on each specific product.

SPECIAL WIRES



Enameled Aluminum Wire . . . Very small sizes to .0006"; for light-weight galvanometer coils and similar applications. Also available bare.

Electroplated Wire and Ribbon . . . We specialize in continuous electroplating of wire. Regularly electroplate Gold, Silver Platinum, Indium, and Tin onto base wire or ribbon, such as, Molybdenum, Nickel, Copper and Clad Wires. Gold Plating to MIL-G-45204.

Enameled Wire . . . Our enameling process consists in applying multiple coats of a baked thermosetting resin, either Class A, B or H. It is thinner than most commercial enamel coating; smooth, uniform, free from beads. Excellent for **potentiometers.**

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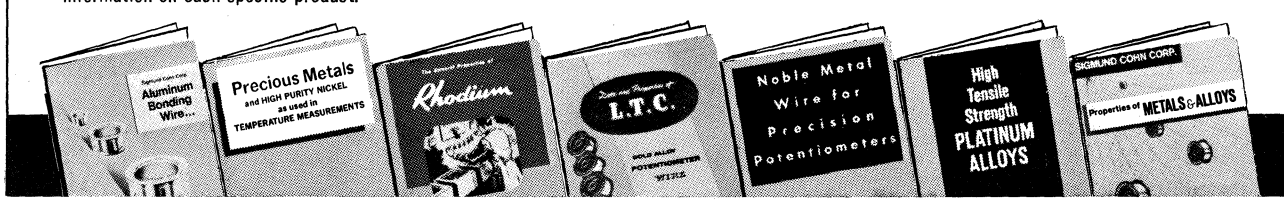
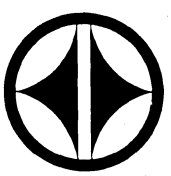


Look in the Green Section for Products and their Manufacturers



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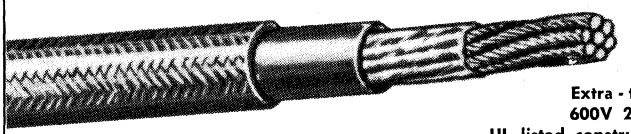

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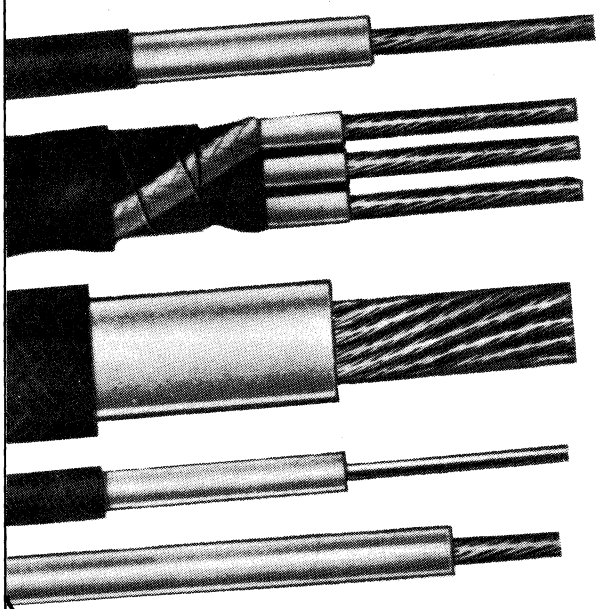

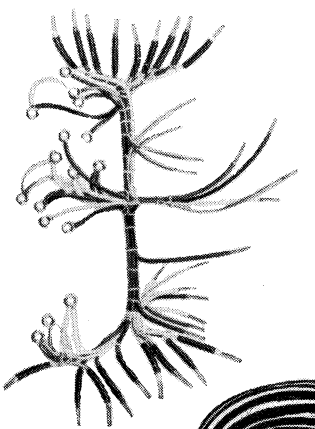



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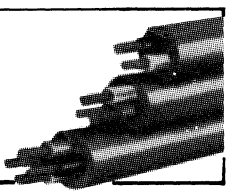
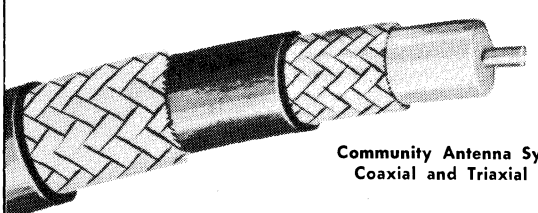
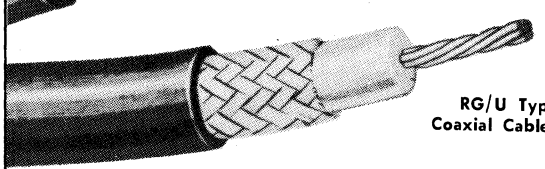
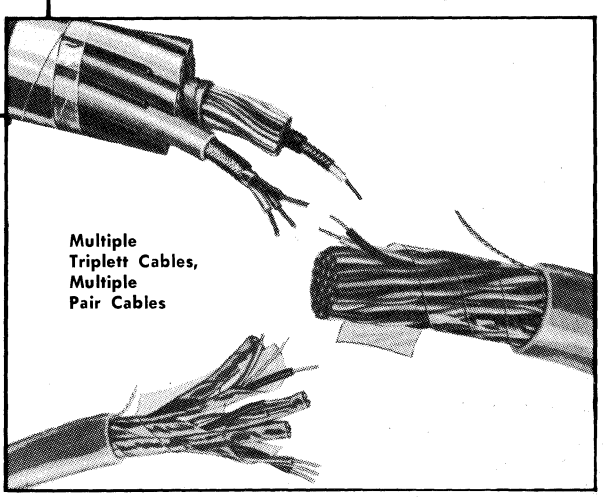




Community Antenna Systems,
Coaxial and Triaxial Cables



RG/U Type
Coaxial Cables



Multiple
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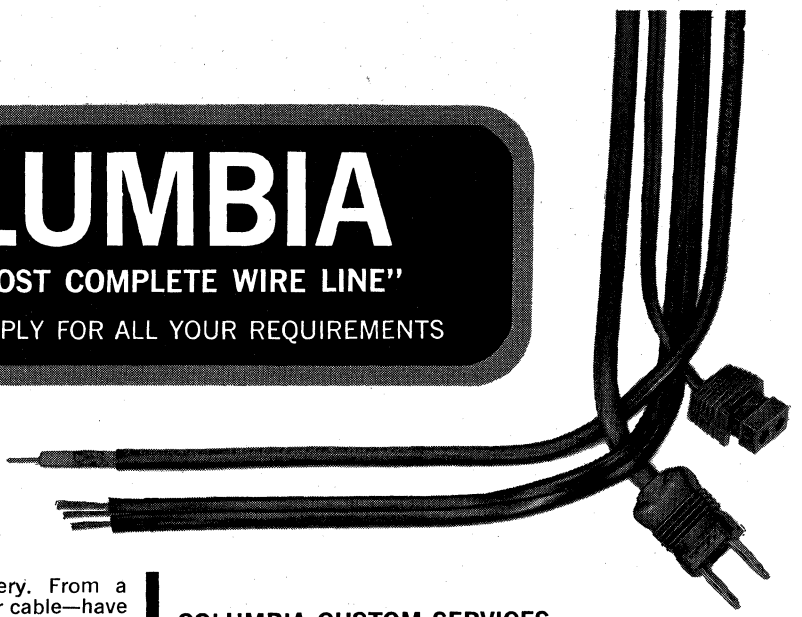

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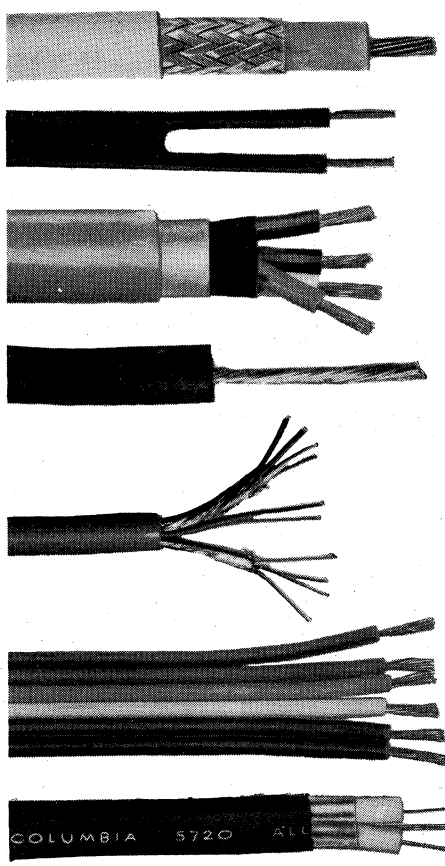
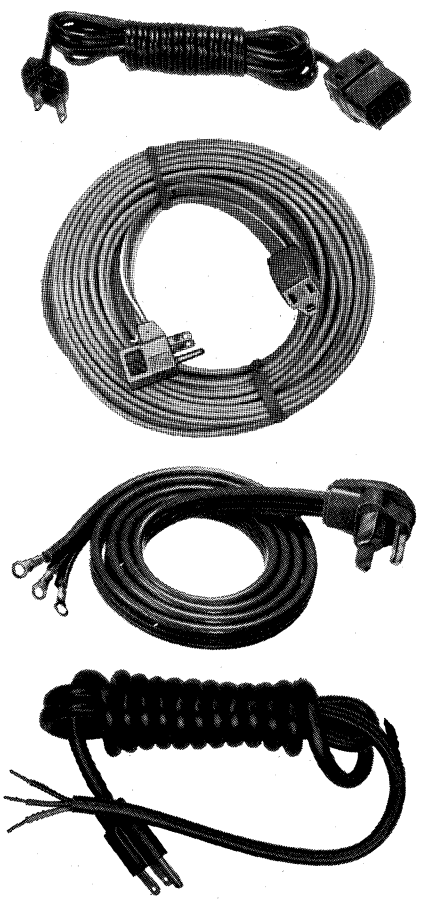


braiding,
shielding,
cabling,
cutting,
stripping,
termination,
striping,
custom cord
molding
with our
own production
facilities . . .



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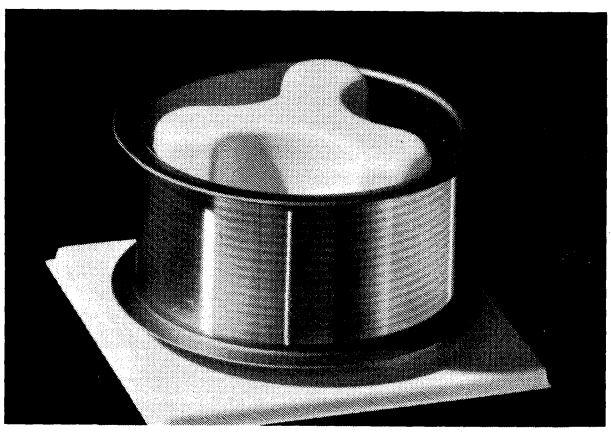
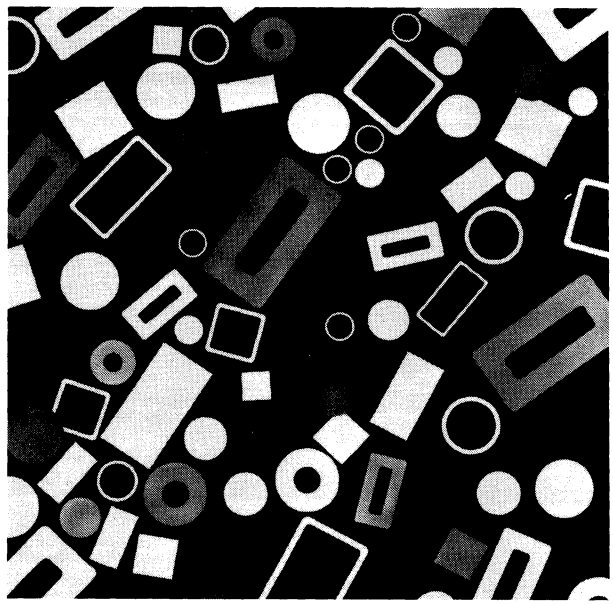
CRM specializes in the manufacture of precision wire and preforms for use in electronic components and semiconductor devices. In order to assure conformance to the most rigid specifications, even metals purification and alloying are done within CRM's own plant. Hundred of stock dies supplement extensive tool-making facilities, permitting fast and inexpensive fabrication of custom sizes and shapes. Appropriate physical, chemical, and performance tests are used at all stages of production to assess and certify both the quality and usability of CRM products. CRM preforms and wire are available from stock or are custom fabricated to meet all your specifications.



WIRE from CRM is available in all varieties required for electronics, semiconductors, and electrical instruments to any specification. Thus, pure Gold may be obtained in 5-9's purity for vapor deposition or lower purity for bonding. Tensile strength and other physical properties can also be varied, even to match particular wire bonding machines. Various doped Gold wires are also available. Similarly, standard and custom wire of pure metals and special alloys are produced by CRM for other semiconductor applications, resistance thermometers, potentiometers, strain gauges, galvanometers, thermocouples, and for experimental applications. All wire can be supplied with any type of enamel or plated, or bare.

Gold bonding wire • silicon-aluminum bonding wire • pure vapor deposition wire • potentiometer wire • platinum resistance thermometer wire • fuse wire • strain gauge wire • enameled wire • plated wire

CRM WIRE CAN HELP YOU MAKE A BETTER PRODUCT.



PREFORMS from CRM range from simple solder washers to precisely sized perfect spheres of high purity gold for semiconductor mounting and special frames for flatpack assembly. Quality is controlled at every processing step to meet customer specifications. For example, Gold spheres are available in either 4-9's or 5-9's purity in sizes from .008″ to .040″ with sphericity controlled to ±.001″. All spheres are checked optically to assure perfect surface finish; they are weighed to assure uniform density, and they are rolled down an inclined plane which automatically rejects all spheres which are out of round. CRM makes preforms from precious metals and alloys, Aluminum and Aluminum alloys, brazing alloys, and soft solders. Over 300 stock dies are on hand to permit custom fabrication without tooling charges.

Discs • rectangles • washers • frames • solder • braze • eutectic gold alloys

CRM PREFORMS CAN HELP YOU MAKE A BETTER PRODUCT.

Call or Write for a useful Data Book and Catalog of CRM Fine Wire and Precision Preforms, and for a quotation on your special requirements.

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CONSOLIDATED

See our catalog pages in this year's edition of
The Radio-Electronic MASTER

FOR EVERY ELECTRONIC and ELECTRICAL WIRE or CABLE
PRECISION DESIGNED and RELIABLY MANUFACTURED

CONSOLIDATED OFFERS THE PROPER WIRE OR CABLE
For an Infinite Variety of Applications

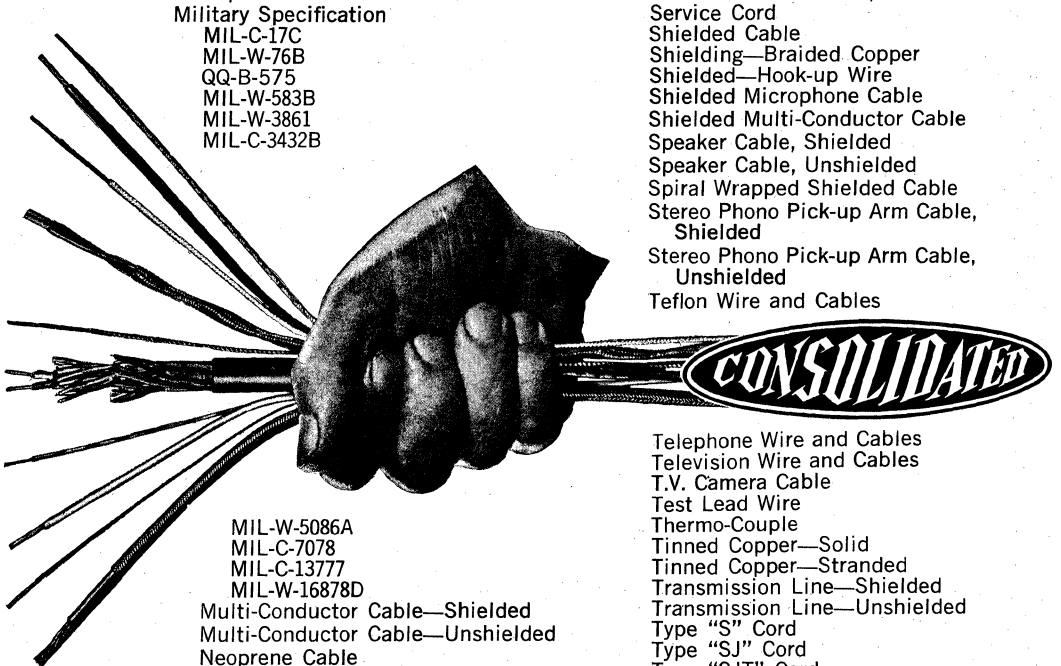
• Computing Systems • Radar • Navigational
• Missiles • Communications • Nuclear
• Aircraft • Radio • Television • Instrumentation

Aerial Wire
Air Conditioner Cable
Annunciator Wire
Audio Cable
Automotive Cable
Bare Copper Wire
Bonding Strap
Braided Copper
Broadcast Studio Cable
Bronze Wire
Bus Bar Wire
Camera T.V. Cable
Cathode Ray Tube Cable
Coaxial Cable
Copper—Bare
Copper—Braided Tinned
Copper—Solid Tinned
Copper—Stranded Bare
Copper—Stranded Tinned
Cord—Power, Service
Cord Sets
Direct Burial Cable
Electrical Cordage
Heavy Formvar Magnet Wire
Hi-Fi Interconnecting Cable
Hi-Temp Wire
Hi Voltage Wire
Hook-up Wire
- General Purpose
- Plastic
- Cotton
- Glass
- Nylon

Ignition Wire
Inter-Communication Cable
Juke Box Speaker Cable
Lamp Cord
Lead Covered Communication Cable
Lead Sheathed Cable

Magnet Wire
Microphone Cable—Plastic
Microphone Cable—Rubber
Military Specification
- MIL-C-17C
- MIL-W-76B
- QQ-B-575
- MIL-W-583B
- MIL-W-3861
- MIL-C-3432B
- MIL-W-5086A
- MIL-C-7078
- MIL-C-13777
- MIL-W-16878D

Multi-Conductor Cable—Shielded
Multi-Conductor Cable—Unshielded
Neoprene Cable
Phono Pick-up and Grid Wire—Shielded
Phono Pick-up and Grid Wire—Unshielded
Plain Enameled Magnet Wire
Plastic Hook-up Wire
Plastic Jacketed Cable, Shielded
Plastic Jacketed Cable, Unshielded
R.G. Coaxial Cables



Resistance Wire
Rubber Covered Cable, Shielded
Rubber Covered Cable, Unshielded
Service Cord
Shielded Cable
Shielding—Braided Copper
Shielded—Hook-up Wire
Shielded Microphone Cable
Shielded Multi-Conductor Cable
Speaker Cable, Shielded
Speaker Cable, Unshielded
Spiral Wrapped Shielded Cable
Stereo Phono Pick-up Arm Cable, Shielded
Stereo Phono Pick-up Arm Cable, Unshielded
Teflon Wire and Cables
Telephone Wire and Cables
Television Wire and Cables
T.V. Camera Cable
Test Lead Wire
Thermo-Couple
Tinned Copper—Solid
Tinned Copper—Stranded
Transmission Line—Shielded
Transmission Line—Unshielded
Type "S" Cord
Type "SJ" Cord
Type "SJT" Cord
Type "ST" Cord
U/L Lamp Cord—Plastic
U/L Lamp Cord— Rubber
U/L Service Cord—Neoprene
U/L Service Cord—Rubber
Underground—Plastic Covered Cable
Underground—Lead Covered Cable

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INFORMATION ON SPECIAL ITEMS AS WELL AS BASIC VARIETIES FROM WHICH YOU CAN SELECT DIFFERENT COMBINATIONS OF CHARACTERISTICS TO MEET YOUR EXACT REQUIREMENTS

CONSOLIDATED WIRE AND ASSOCIATED CORPORATIONS

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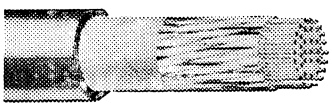
DYNATRONIC CABLE ENGINEERING CORP.

(a division of NATIONAL WIRE & CABLE CORPORATION)
Los Angeles, Calif. • Dept. EEM • Phone: (213) 225-5611, TWX: 910-321-4155

Specialists in the data & instrumentation cable field.

We speak your language on Z_0, capacitance, velocity, crosstalk, attenuation, rise-time, SWR and other technical topics: Contact Dynatronic Cable Engineering Corp. for technical information or assistance on your instrumentation cable problem. Many standard cables are carried in stock. Catalog upon request.



DIGITAL DATA CABLES

Z_0 to your requirements

Standard Constructions of Data Pairs For Fast Signals. Guaranteed Z_0.

STANDARD DATA CABLE CONSTRUCTIONS ALL POLYOLEFIN-INSULATED CONDUCTORS

Part No.	No. of Pairs	Zo	Delay ns/ft	Cond. AWG	Cable Diam.	Sheath
D-200-15	15	110.	1.61	24	.500	PVC
D-200-20	20	110.	1.61	24	.550	PVC
D-200-24	24	110.	1.61	24	.680	PVC
D-200-27	27	110.	1.61	24	.690	PVC
D-200-30	30	110.	1.61	24	.710	PVC
D-200-33	33	110.	1.61	24	.750	PVC
D-200-42	42	110.	1.61	24	.850	PVC
D-200-48	48	110.	1.61	24	.890	PVC
D-200-50	50	110.	1.61	24	.910	PVC

Dynatronic Cable Engineering Corp. offers a series of multi-pair cables specifically designed for fast-rise digital-data signals. Surge impedance is carefully controlled. All pairs in a cable have a Z_0 within 5% of specified impedance. Anti-crosstalk techniques such as contra-rotation of adjacent layers, and different lay lengths for adjacent pairs and layers are used in all cables. Pairs are not individually shielded. Designed for either balanced (110. ohm) or unbalanced (77. ohm) transmission, with very low crosstalk. Suitable for use up to several thousand feet. Impedances of 95, 100, 105, 110 & 120 ohms available. Detailed application notes on request, or contact our Engineering Dept. for information.



LOW NOISE CABLES

Suitable for μ-Volt Signal Levels

STANDARD LOW FLEXURE-NOISE CABLES. ALL CONDUCTORS ARE POLYETHYLENE INSULATED.

PART NO.	NO. OF CONDUCTORS	AWG	CAPACITANCE W-S	CAPACITANCE W-W	JACKET	O.D.
D-100	1	26 Solid T.C.	22.5	—	105°C PVC	.142
D-101	1 Triaxial	26 Solid T.C.	22.5	120. Shld-Shld	105°C PVC	.195
D-102	2	22 Solid T.C.	42.	21.	105°C PVC	.210

Dynatronic Cable Engineering Corp. has developed a flexible conductive surface coating for these insulations which reduces self-generated noise voltage from 20 to 200 times* that of untreated constructions. Additionally the electrostatic shielding provided by this treatment approaches the performance of a solid metal tube. Excellent for microvolt level signals, high impedance circuits, high vibration environments. Suitable for use with BNC-type connectors.

*Dependent on load impedance and cable type.

DYNATRONIC ALSO OFFERS:

Foil and conductive plastic shielded cable.
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Strain Gauge Cables.
Ultra-Flexible Cables.

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NEW

HI-VOLT CORONA RESISTANT TEFLON* CABLE

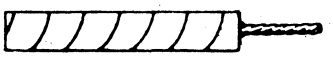
Voltage Rating at Sea Level • Voltage Rating at 80,000 feet, approximately 1/3 lower
• Minimum life expectancy: 10,000 hours.

SMALL SIZE:
You do not need bulky, thick, insulation jacketing as used wtih silicone rubber and polyethylene insulations to get your hi-voltage requirements. Wire used is MIL-SPEC QQ-W-343 and MIL-W-16878D. insulation used conforms and surpasses MIL-SPEC-W-16878D

AVOID CORONA PROBLEMS:
Corona resistant Teflon construction is specifically designed to retard and prevent corona penetration.
Temperature variations from −60° to +300°C have no life effect on the corona resistant Teflon. In addition, there is no stress or crack failure under severe, adverse conditions including mechanical strain, moisture, corona or chemical conditions.

DESCRIPTION:
Single Conductor, Stranded Silver Plated Copper, Corona Resistant Teflon* Insulation.

TEMPERATURE RATING:
−90°C to +250°C.

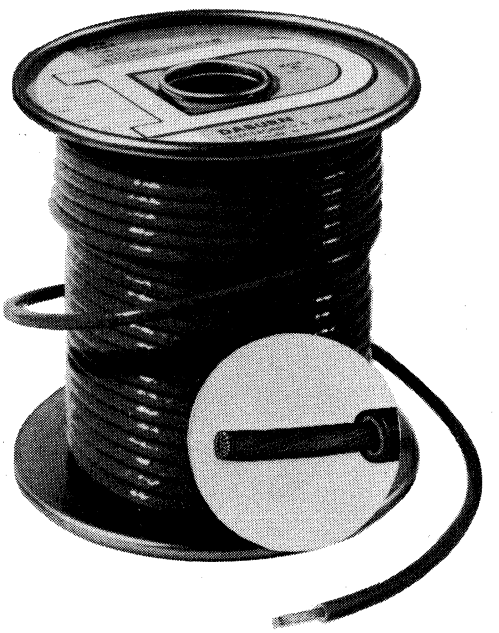


VOLTAGE RATING:
Based on insulation thickness.

AVAILABLE COLORS:
White, Black, Red, Green, Yellow, Lt. Blue, Brown, Orange, Gray, Violet. (Also available in tracer colors)

PUT-UP: 250′, 500′, 1000′

* DUPONT



DABURN No.	AWG Size	Strand	Voltage Rating AC	Voltage Rating DC	Nom. O.D.
CRT-12-2	12	19/25	2500	10,000	.142″
CRT-12-2.5	12	19/25	3750	12,500	.152″
CRT-12-3	12	19/25	4500	15,000	.162″
CRT-12-3.5	12	19/25	5300	17,500	.172″
CRT-12-4	12	19/25	6000	20,000	.182″
CRT-12-5	12	19/25	7500	25,000	.202″
CRT-12-6.5	12	19/25	10,000	32,500	.232″
CRT-12-8	12	19/25	12,000	40,000	.262″
CRT-12-10	12	19/25	15,000	50,000	.302″
CRT-14-2	14	19/27	2500	10,000	.124″
CRT-14-2.5	14	19/27	3750	12,500	.134″
CRT-14-3	14	19/27	4500	15,000	.144″
CRT-14-3.5	14	19/27	5300	17,500	.154″
CRT-14-4	14	19/27	6000	20,000	.164″
CRT-14-5	14	19/27	7500	25,000	.184″
CRT-14-6.5	14	19/27	10,000	32,500	.214″
CRT-14-8	14	19/27	12,000	40,000	.244″
CRT-14-10	14	19/27	15,000	50,000	.284″
CRT-16-2	16	19/29	2500	10,000	.109″
CRT-16-2.5	16	19/29	3750	12,500	.119″
CRT-16-3	16	19/29	4500	15,000	.129″
CRT-16-3.5	16	19/29	5300	17,500	.139″
CRT-16-4	16	19/29	6000	20,000	.149″
CRT-16-5	16	19/29	7500	25,000	.169″
CRT-16-6.5	16	19/29	10,000	32,500	.199″
CRT-16-8	16	19/29	12,000	40,000	.229″
CRT-16-10	16	19/29	15,000	50,000	.269″
CRT-18-2	18	19/30	2500	10,000	.102″
CRT-18-2.5	18	19/30	3750	12,500	.112″
CRT-18-3	18	19/30	4500	15,000	.122″
CRT-18-3.5	18	19/30	5300	17,500	.132″
CRT-18-4	18	19/30	6000	20,000	.142″
CRT-18-5	18	19/30	7500	25,000	.162″
CRT-18-6.5	18	19/30	10,000	32,500	.192″
CRT-18-8	18	19/30	12,000	40,000	.222″
CRT-18-10	18	19/30	15,000	50,000	.272″
CRT-20-2	20	19/32	2500	10,000	.092″
CRT-20-2.5	20	19/32	3750	12,500	.102″
CRT-20-3	20	19/32	4500	15,000	.112″
CRT-20-3.5	20	19/32	5300	17,500	.122″

DABURN No.	AWG Size	Strand	Voltage Rating AC	Voltage Rating DC	Nom. O.D.
CRT-20-4	20	19/32	6000	20,000	.132″
CRT-20-5	20	19/32	7500	25,000	.152″
CRT-20-6.5	20	19/32	10,000	32,500	.192″
CRT-20-8	20	19/32	12,000	40,000	.212″
CRT-20-10	20	19/32	15,000	50,000	.252″
CRT-22-2	22	19/34	2500	10,000	.084″
CRT-22-2.5	22	19/34	3750	12,500	.094″
CRT-22-3	22	19/34	4500	15,000	.104″
CRT-22-3.5	22	19/34	5300	17,500	.114″
CRT-22-4	22	19/34	6000	20,000	.124″
CRT-22-5	22	19/34	7500	25,000	.144″
CRT-22-6.5	22	19/34	10,000	32,500	.174″
CRT-22-8	22	19/34	12,000	40,000	.204″
CRT-22-10	22	19/34	15,000	50,000	.244″
CRT-24-2	24	19/36	2500	10,000	.077″
CRT-24-2.5	24	19/36	2750	12,500	.087″
CRT-24-3	24	19/36	4500	15,000	.097″
CRT-24-3.5	24	19/36	5300	17,500	.107″
CRT-24-4	24	19/36	6000	20,000	.117″
CRT-24-5	24	19/36	7500	25,000	.137″
CRT-24-6.5	24	19/36	10,000	32,500	.167″
CRT-24-8	24	19/36	12,000	40,000	.197″
CRT-24-10	24	19/36	15,000	50,000	.237″
CRT-26-2	26	7/34	2500	10,000	.071″
CRT-26-2.5	26	7/34	3750	12,500	.081″
CRT-26-3	26	7/34	4500	15,000	.091″
CRT-26-3.5	26	7/34	5300	17,500	.101″
CRT-26-4	26	7/34	6000	20,000	.111″
CRT-26-5	26	7/34	7500	25,000	.131″
CRT-26-6.5	26	7/34	10,000	32,500	.161″
CRT-26-8	26	7/34	12,000	40,000	.191″
CRT-26-10	26	7/34	15,000	50,000	.231″
CRT-28-2	28	7/36	2500	10,000	.067″
CRT-28-2.5	28	7/36	3750	12,500	.077″
CRT-28-3	28	7/36	4500	15,000	.087″
CRT-28-3.5	28	7/36	5300	17,500	.097″
CRT-28-4	28	7/36	6000	20,000	.117″
CRT-28-5	28	7/36	7500	25,000	.127″
CRT-28-6.5	28	7/36	10,000	32,500	.157″
CRT-28-8	28	7/36	12,000	40,000	.187″
CRT-28-10	28	7/36	15,000	50,000	.227″

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DABURN ELECTRONICS & CABLE CORP.

WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

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HOOK-UP WIRE



HI VOLTAGE TEFLON* WIRE

- Aircraft Wire to MIL-W-5086A and MIL-C-7078A
- Business Machine
- High Voltage — Polyethylene — Rulan
- High Voltage — Corona Resistant Teflon
- Plastic Wire to MIL-W-76B
- Plastic Wire to MIL-W-16878D
- H Film & Kapton*
- High Temperature
- Instrumentation Hook-Up Wire
- Military Wire
- Shielded Lead and Hook-Up Wire
- Teflon* Hook-Up Wire to MIL-16878D Types B, C, D, E, EE, ET, F, FF, K, KK
- Teflon* Hook-Up Wire to MIL-W-7139B
- Teflon* Multi Cables
- Test Lead Wire — Retractile
- Thermocouple

INDUSTRIAL WIRE PRODUCTS



- Bus Bar — Solid Tinned Copper to QQ-W-343 type S
- Braid — Bonding Strap — Shielding — Flat Tinned Copper
- Braid — Tubular Tinned Copper to QQ-B-575
- Coiled Cords — Retractile Cables
- Cord Sets (Special Constructions)
- Control Cables
- Copperweld Wire
- Industrial — Audio & Sound
- Magnet Wire to MIL-W-583B
- Lacing Cord Tape MIL-T-713A
- Shielding & Bonding
- Silicone Rubber Wire
- Silicone Bronze Wire
- Telephone — Burial
- Test Lead Wire to MIL-W-13169
- Teflon Wire
- UL Wire, Cable

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- Daflex & Daflon Insulated Tubing in Stock to UL-MIL-Industrial Specifications
- Polyvinylchloride-PVC-Polyethylene Plastic Tubing to UL and MIL-I-631D, MIL-I-18057A, MIL-21557A
- Vinyl Coated Fiberglass Tubing to MIL-I-3190B
- Plastic Tubing to MIL-I-7444B, MIL-I-22076B
- Fiberglass Sleeving
- Teflon* Tubing to MIL-I-221129C Thin Wall, Standard Wall, Industrial
- Shrinkable Tubing — Polyolefin, PVC, Teflon Tubing, MIL Specs To MIL-I-631C, MIL-I-22129C, MIL-I-23053A
- Also Wire Cable Cutting & Stripping

* DUPONT

MULTI-CONDUCTOR CABLES

Audio & Data	Hi-Fi & Stereo	Wire & Cables to
Audio-Intercom	Language Lab	MIL-C-3432B
Automation	Miniaturization	MIL-W-16878D
Broadcast-Studio Cables	Power-UL	MIL-W-76B
Coaxial	Ribbon — Flat	MIL-W-5086A
Cord Sets	Shielded	MIL-C-7078A
Data-Digital	Strain Gauge	MIL-W-7139
Microphone	Subminiature	MIL-C-17D
Low Capacity	Telephone	MIL-W-8777B
Multi-Conductors	Teflon* Cables	MIL-W-13169B
Phono	Thermocouple	MIL-W-81381
Retractile	Speaker Extension shielded-unshielded	MIL-C-13777
Control Cables		
Instrumentation		

WE MAINTAIN HUGE INVENTORIES IN DEPTH

WIRE SPECIALTIES

Your special cable requirements can be fabricated for custom cabling and short or long runs.

See our catalog pages in this year's edition of The Radio-Electronic MASTER

RETRACTILE CORDS

FROM 1 THRU 37 CONDUCTORS

- POWER
- TEST LEAD
- CORD SETS
- MINIATURE
- COMMUNICATION Shielded — Unshielded
- "SUPA" HEAVY DUTY POWER
- 4 YEAR RETRACTABILITY GUARANTEE FOR DURABILITY
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- SPECIAL CONSTRUCTIONS TO ORDER



WRITE FOR COMPLETE CATALOG

ELECTRONIC COMPONENT DIV.

- Cable Clamps, Clips, Ties
- Captive Hardware
- Ceramic Insulators
- Clamps
- Component Clips
- Feed-Thru Insulators
- Insulating Harness
- Heat Sinks
- Insulators: Ceramic, Steatite, Beads, Nylon, Teflon*
- Jacks & Plugs: Banana, Phone Tip
- Lacing Cord/Tapes to MIL-T-713A & MIL-T-43435 including Teflon*, Dacron & Nylon Tapes
- Spiral Harness Wrap
- Solderless Terminals
- Stand Offs
- Switches — Proximity
- Terminal Strips
- Test Leads
- Test Prods, Jacks
- Transistor Heat Sinks
- Transistors Retainers
- UL Cord-Cables

HEAT SHRINKABLE TUBING

TO MIL-INDUSTRIAL SPECIFICATIONS MIL-I-23053 POLYOLEFIN, PVC, TEFLON* TUBING

DEARBORN

MIL SPEC MIL-W-76B HOOKUP WIRE

Single conductor, stranded or solid tinned copper.

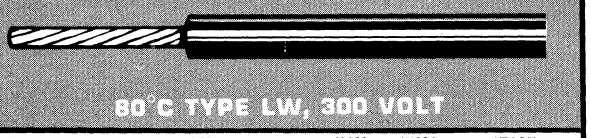
Insulation: PVC. **Temperature rating:** −40°C to +80°C (90°C with nylon jacket). Resistant to acids, alkalis, oils, flame, moisture, solvents and fungus.

TYPE LW
Insulation thickness .010". Voltage rating 300 volts.

TYPE MW
Insulation thickness .016". Voltage rating 1000 volts.

TYPE MW — NYLON JACKET
Insulation thickness .016". Nylon jacket .002" to .005" depending on conductor size. Voltage rating 1000 volts.

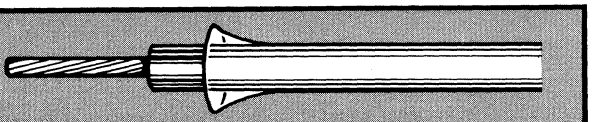
TYPE MW — SHIELDED
Insulation thickness .016". Braided shield overall, 90% coverage. Voltage rating 1000 volts.



80°C TYPE LW, 300 VOLT

DEARBORN NO.	TYPE DESIGNATION AND SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
STRANDED CONDUCTOR					
283007	LW-C30 (7) U	7/38	.034	.010	0-9 & 90-98
282807	LW-C28 (7) U	7/36	.037	.010	0-9 & 90-98
282607	LW-C26 (7) U	7/34	.041	.010	0-9 & 90-98
282407	LW-C24 (7) U	7/32	.046	.010	0-9 & 90-98
282207	LW-C22 (7) U	7/30	.053	.010	0-9 & 90-98
282007	LW-C20 (7) U	7/28	.060	.010	0-9 & 90-98
SOLID CONDUCTOR					
283001	LW-C30 (1) U	1/30	.031	.010	0-9 & 90-98
282801	LW-C28 (1) U	1/28	.035	.010	0-9 & 90-98
282601	LW-C26 (1) U	1/26	.038	.010	0-9 & 90-98
282401	LW-C24 (1) U	1/24	.042	.010	0-9 & 90-98
282201	LW-C22 (1) U	1/22	.047	.010	0-9 & 90-98
282001	LW-C20 (1) U	1/20	.054	.010	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK



90°C TYPE MW, NYLON JK'T. (.003"), 1000 V.

DEARBORN NO.	TYPE DESIGNATION AND SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
312407	MW-C24 (7) J	7/32	.063	.016	0-9
312207	MW-C22 (7) J	7/30	.071	.016	0-9
312010	MW-C20 (10) J	10/30	.078	.016	0-9
311816	MW-C18 (16) J	16/30	.086	.016	0-9
311619	MW-C16 (19) J	19/29	.098	.016	0-9
311419	MW-C14 (19) J	19/27	.113	.016	0, 2, 9
311219	MW-C12 (19) J	19/25	.134	.016	0, 2, 9

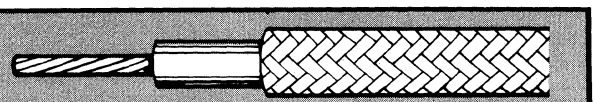
STOCK PUT UP: 100 FT., 1000 FT., AND BULK



80°C TYPE MW, 1000 VOLT

DEARBORN NO.	TYPE DESIGNATION AND SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
STRANDED CONDUCTOR					
302407	MW-C24 (7) U	7/32	.058	.016	0-9 & 90-98
302207	MW-C22 (7) U	7/30	.065	.016	0-9 & 90-98
302010	MW-C20 (10) U	10/30	.072	.016	0-9 & 90-98
301816	MW-C18 (16) U	16/30	.080	.016	0-9 & 90-98
301619	MW-C16 (19) U	19/29	.091	.016	0-9 & 90-98
301419	MW-C14 (19) U	19/27	.105	.016	0-9 & 90-98
301219	MW-C12 (19) U	19/25	.124	.016	0-9 & 90-98
SOLID CONDUCTOR					
302401	MW-C24 (1) U	1/24	.055	.016	0-9 & 90-98
302201	MW-C22 (1) U	1/22	.059	.016	0-9 & 90-98
302001	MW-C20 (1) U	1/20	.066	.016	0-9 & 90-98
301801	MW-C18 (1) U	1/18	.074	.016	0-9 & 90-98
301601	MW-C16 (1) U	1/16	.085	.016	0-9 & 90-98
301401	MW-C14 (1) U	1/14	.098	.016	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK



80°C TYPE MW, SHIELDED, 1000 VOLT

DEARBORN NO.	TYPE DESIGNATION AND SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
332407	MW-C24 (7) S	7/32	.080	.016	9 Only
332207	MW-C22 (7) S	7/30	.087	.016	9 Only
332010	MW-C20 (10) S	10/30	.094	.016	9 Only
331816	MW-C18 (16) S	16/30	.102	.016	9 Only
331619	MW-C16 (19) S	19/29	.113	.016	9 Only
331419	MW-C14 (19) S	19/27	.121	.016	9 Only
331219	MW-C12 (19) S	19/25	.146	.016	9 Only

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White
90—White/Black • 91—White/Brown • 92—White/Red • 93—White/Orange • 94—White/Yellow • 95—White/Green • 96—White/Blue • 97—White/Violet • 98—White/Gray
OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

DEARBORN

MIL SPEC MIL-W-76B HOOKUP WIRE

Single conductor stranded tinned copper.

Insulation: PVC with and without shield, with and without lacquered glass braid or nylon jacketing. **Temperature rating:** −40°C to +80°C (90°C with nylon jacket). Resistant to acids, alkalis, oils, flame, moisture, solvents and fungus.

TYPE MW — GLASS BRAID
Insulation thickness .016 with glass braid overall. Voltage rating 1000 volts.

TYPE MW — SHIELDED — NYLON
PVC insulation .016", braided shield 90% coverage, and clear nylon jacket overall.

TYPE MW — GLASS BRAID — SHIELD
Insulation thickness .016 with glass braid and shield overall. Voltage rating 1000 volts.

TYPE HW
Insulation thickness .031 on sizes No. 22 thru No. 16, .045 on sizes No. 14 thru No. 6. For voltage rating see chart.

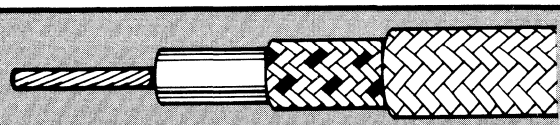
TYPE HW — GLASS BRAID
Same as HW with addition of lacquered glass braid overall.



80°C TYPE MW, GLASS BRAID, 1000 VOLT

DEARBORN NO.	TYPE DESIGNATION AND SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
322407	MW-C24 (7) B	7/32	.068	.016	0-9, 90 & 92
322207	MW-C22 (7) B	7/30	.075	.016	0-9, 90 & 92
322010	MW-C20 (10) B	10/30	.082	.016	0-9, 90 & 92
321816	MW-C18 (16) B	16/30	.090	.016	0-9, 90 & 92
321619	MW-C16 (19) B	19/29	.101	.016	0-9, 90 & 92
321419	MW-C14 (19) B	19/27	.115	.016	9, 90, 92
321219	MW-C12 (19) B	19/25	.134	.016	9, 90, 92

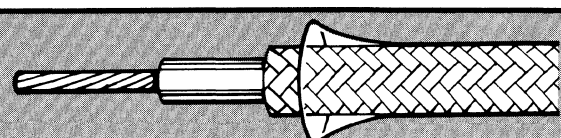
STOCK PUT UP: 100 FT., 1000 FT., AND BULK



80°C TYPE MW, GLASS BRAID, SHIELDED, 1000 VOLT

DEARBORN NO.	TYPE DESIGNATION AND SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
352407	MW-C24 (7) BS	7/32	.091	.016	9 Only
352207	MW-C22 (7) BS	7/30	.097	.016	9 Only
352010	MW-C20 (10) BS	10/30	.105	.016	9 Only
351816	MW-C18 (16) BS	16/30	.117	.016	9 Only
351619	MW-C16 (19) BS	19/29	.129	.016	9 Only
351419	MW-C14 (19) BS	19/27	.143	.016	9 Only
351219	MW-C12 (19) BS	19/25	.162	.016	9 Only

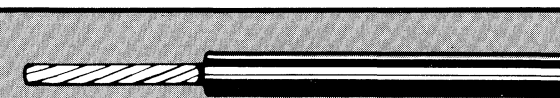
STOCK PUT UP: 100 FT., 1000 FT., AND BULK



80°C TYPE MW, SHIELDED, NYLON JACKET, 1000 VOLT

DEARBORN NO.	TYPE DESIGNATION AND SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
342407	MW-C24 (7) SJ	7/32	.086	.016	9 Only
342207	MW-C22 (7) SJ	7/30	.094	.016	9 Only
342010	MW-C20 (10) SJ	10/30	.101	.016	9 Only
341816	MW-C18 (16) SJ	16/30	.110	.016	9 Only
341619	MW-C16 (19) SJ	19/29	.122	.016	9 Only
341419	MW-C14 (19) SJ	19/27	.137	.016	9 Only
341219	MW-C12 (19) SJ	19/25	.157	.016	9 Only

STOCK PUT UP: 100 FT., 1000 FT., AND BULK



80°C TYPE HW

Nos. 22, 20, 18, 16—2500 VOLTS • Nos. 14, 12, 10, 8, 6—600 VOLTS

DEARBORN NO.	TYPE DESIGNATION AND SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
362207	HW-C22 (7) U	7/30	.095	.031	0-9
362010	HW-C20 (10) U	10/30	.102	.031	0-9
361816	HW-C18 (16) U	16/30	.110	.031	0-9
361619	HW-C16 (19) U	19/29	.121	.031	0, 2, 9
361419	HW-C14 (19) U	19/27	.163	.045	0, 2, 9
361219	HW-C12 (19) U	19/25	.182	.045	0, 2, 9
361037	HW-C10 (37) U	37/26	.205	.045	0, 2, 9
368133	HW-C8 (133) U	133/29	.262	.045	0, 2, 9
366133	HW-C6 (133) U	133/27	.305	.045	0, 2, 9
80°C TYPE HW, GLASS BRAID, 600 VOLT					
371037	HW-C10 (37) B	37/26	.218	.045	9, 90, 92
378133	HW-C8 (133) B	133/29	.275	.045	9, 90, 92
376133	HW-C6 (133) B	133/27	.318	.045	9, 90, 92

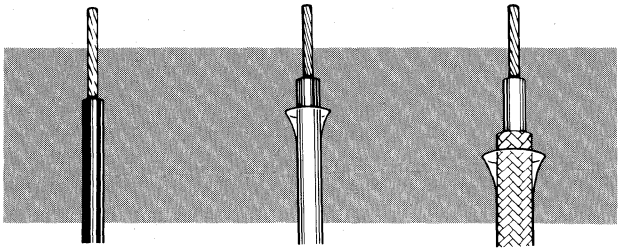
STOCK PUT UP: 100 FT., 1000 FT., AND BULK

COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White
90—White/Black • 91—White/Brown • 92—White/Red • 93—White/Orange • 94—White/Yellow • 95—White/Green • 96—White/Blue • 97—White/Violet • 98—White/Gray
OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

DEARBORN

MIL SPEC MIL-W-16878D HOOKUP WIRE-TYPES B & C

Single conductor, stranded tinned copper



TYPE B & C
TYPE B, PRE-BONDED

TYPE B, NYLON
TYPE C, NYLON

TYPE C, SHIELDED
& NYLON JACKET

TYPE B
Insulation PVC .010″ wall thickness, color coded. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 600 volts.

TYPE B — NYLON
Same as above but with clear nylon jacket (.003″ wall) over PVC insulation increasing temperature rating to +115°C.

TYPE B — PREBONDED
Double tinned strands are heated which fuses the individual strands together in order to prevent fraying.. Allows easy stripping and insertion in holes in lugs, circuit boards, etc. Color coded .010″ PVC insulation to MIL-W-16878D. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 600 volts.

TYPE C
Insulation PVC .017″ wall thickness. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 1000 volts.

TYPE C — NYLON
Same as above but with clear nylon jacket which increases temperature rating to +115°C.

TYPE C — SHIELD AND NYLON JACKET
Basic type C with 90% coverage braided tinned copper shield and clear nylon .005″ jacket overall.

105°C TYPE B, 600 VOLT

DEARBORN NO.	TYPE	SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
173207	B-32	32	7/40	.028	.010	0-9 & 90-98
173007	B-30	30	7/38	.032	.010	0-9 & 90-98
172807	B-28	28	7/36	.034	.010	0-9 & 90-98
172607	B-26	26	7/34	.038	.010	0-9 & 90-98
172619	B-26	26	19/38	.038	.010	0-9 & 90-98
172407	B-24	24	7/32	.044	.010	0-9 & 90-98
172419	B-24	24	19/36	.044	.010	0-9 & 90-98
172207	B-22	22	7/30	.051	.010	0-9 & 90-98
172219	B-22	22	19/34	.051	.010	0-9 & 90-98
172007	B-20	20	7/28	.058	.010	0-9 & 90-98
172019	B-20	20	19/32	.058	.010	0-9 & 90-98
171807	B-18	18	7/26	.068	.010	0-9 & 90-98
171819	B-18	18	19/30	.068	.010	0-9 & 90-98
171619	B-16	16	19/29	.077	.010	0-9 & 90-98
171419	B-14	14	19/27	.091	.010	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

105°C TYPE C, 1000 VOLT

DEARBORN NO.	TYPE	SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
202407	C-24	24	7/32	.058	.017	0-9 & 90-98
202419	C-24	24	19/36	.058	.017	0-9 & 90-98
202207	C-22	22	7/30	.065	.017	0-9 & 90-98
202219	C-22	22	19/34	.065	.017	0-9 & 90-98
202007	C-20	20	7/28	.072	.017	0-9 & 90-98
202019	C-20	20	19/32	.072	.017	0-9 & 90-98
201807	C-18	18	7/26	.082	.017	0-9 & 90-98
201819	C-18	18	19/30	.082	.017	0-9 & 90-98
201619	C-16	16	19/29	.092	.017	0-9 & 90-98
201419	C-14	14	19/27	.105	.017	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

115°C TYPE B, NYLON JACKET (.003″), 600 V.

DEARBORN NO.	TYPE	SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
183207	B-32	32	7/40	.035	.010	0-9 & 90-98
183007	B-30	30	7/38	.039	.010	0-9 & 90-98
182807	B-28	28	7/36	.041	.010	0-9 & 90-98
182607	B-26	26	7/34	.044	.010	0-9 & 90-98
182619	B-26	26	19/38	.044	.010	0-9 & 90-98
182407	B-24	24	7/32	.050	.010	0-9 & 90-98
182419	B-24	24	19/36	.050	.010	0-9 & 90-98
182207	B-22	22	7/30	.057	.010	0-9 & 90-98
182219	B-22	22	19/34	.057	.010	0-9 & 90-98
182007	B-20	20	7/28	.064	.010	0-9 & 90-98
182019	B-20	20	19/32	.064	.010	0-9 & 90-98
181807	B-18	18	7/26	.074	.010	0-9 & 90-98
181819	B-18	18	19/30	.074	.010	0-9 & 90-98
181619	B-16	16	19/29	.085	.010	0-9 & 90-98
181419	B-14	14	19/27	.099	.010	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

105°C TYPE B, BONDED CONDUCTOR, 600V.

DEARBORN NO.	TYPE	SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
192407	B-24	24	7/32	.043	.010	0-9 & 90-98
192207	B-22	22	7/30	.050	.010	0-9 & 90-98
192007	B-20	20	7/28	.058	.010	0-9 & 90-98
191807	B-18	18	7/26	.068	.010	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

115°C TYPE C, NYLON JACKET (.003″), 1000 V.

DEARBORN NO.	TYPE	GAUGE SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
212407	C-24	24	7/32	.064	.017	0-9 & 90-98
212419	C-24	24	19/36	.064	.017	0-9 & 90-98
212207	C-22	22	7/30	.071	.017	0-9 & 90-98
212219	C-22	22	19/34	.071	.017	0-9 & 90-98
212007	C-20	20	7/28	.079	.017	0-9 & 90-98
212019	C-20	20	19/32	.079	.017	0-9 & 90-98
211807	C-18	18	7/26	.090	.017	0-9 & 90-98
211819	C-18	18	19/30	.090	.017	0-9 & 90-98
211619	C-16	16	19/29	.100	.017	0-9 & 90-98
211419	C-14	14	19/27	.113	.017	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

115°C TYPE C, SHIELDED, NYLON JACKET, 1000 V.

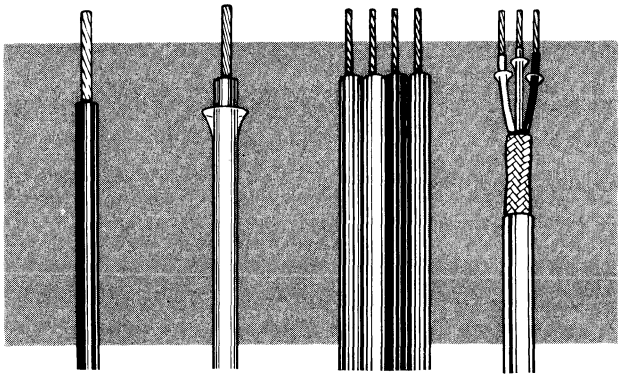
DEARBORN NO.	TYPE	GAUGE SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
222407	C-24	24	7/32	.102	.017	9 Only
222207	C-22	22	7/30	.109	.017	9 Only
222007	C-20	20	7/28	.120	.017	9 Only
221819	C-18	18	19/30	.132	.017	9 Only
221619	C-16	16	19/29	.144	.017	9 Only
221419	C-14	14	19/27	.159	.017	9 Only

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White
90—White/Black • 91—White/Brown • 92—White/Red • 93—White/Orange • 94—White/Yellow • 95—White/Green • 96—White/Blue • 97—White/Violet • 98—White/Gray
OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

DEARBORN

MIL-SPEC MIL-W-16878D HOOKUP WIRE AND CABLE



TYPE D | TYPE D—NYLON | TYPE C—FLAT RIBBON | TYPE B, NYLON. SHIELDED, PVC JACKET

TYPE D AND D-NYLON

Stranded tinned copper with color coded PVC insulation. Temperature rating: −55°C to +105°C (+115°C with nylon type jacket). Voltage rating: 3000 volts.

MULTI-CONDUCTOR CABLES, TYPE C, FLAT RIBBON

Each conductor to MIL-W-16878D Type C. All conductors bonded together to form ribbon type cable. All conductors color coded and easily separated for ease in terminating.

MULTI-CONDUCTOR, TYPE B, NYLON, SHIELDED AND JACKETED WITH WHITE PVC JACKET

Stranded tinned copper conductors with .010 PVC insulation, color coded. .003″ nylon jacket on each conductor, 90% coverage braided tinned copper shield and white PVC jacket overall.

105°C TYPE D, 3000 VOLT

DEARBORN NO.	TYPE	GAUGE SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
232407	D-24	24	7/32	.082	.031	0, 2, 9
232419	D-24	24	19/36	.082	.031	0, 2, 9
232207	D-22	22	7/30	.089	.031	0, 2, 9
232219	D-22	22	19/34	.089	.031	0, 2, 9
232007	D-20	20	7/28	.097	.031	0, 2, 9
232019	D-20	20	19/32	.097	.031	0, 2, 9
231807	D-18	18	7/26	.107	.031	0, 2, 9
231819	D-18	18	19/30	.107	.031	0, 2, 9
231619	D-16	16	19/29	.116	.031	0, 2, 9
231419	D-14	14	19/27	.130	.031	0, 2, 9
231219	D-12	12	19/25	.162	.037	0, 2, 9
231037	D-10	10	37/26	.183	.037	9 Only
238133	D-8	8	133/29	.247	.040	9 Only
266133	D-6	6	133/27	.291	.040	9 Only
234133	D-4	4	133/25	.355	.045	9 Only
232665	D-2	2	665/30	.423	.045	9 Only
231817	D-1	1	817/30	.480	.050	9 Only
230001	D-0	0	1045/30	.530	.052	9 Only

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

115°C TYPE D, NYLON JACKET, 3000 VOLT

DEARBORN NO.	TYPE	GAUGE SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
242407	D-24	24	7/32	.090	.031	0, 2, 9
242207	D-22	22	7/30	.097	.031	0, 2, 9
242007	D-20	20	7/28	.105	.031	0, 2, 9
241807	D-18	18	7/26	.115	.031	0, 2, 9
241619	D-16	16	19/29	.124	.031	0, 2, 9
241419	D-14	14	19/27	.140	.031	0, 2, 9
241219	D-12	12	19/25	.172	.037	0, 2, 9
241037	D-10	10	37/26	.195	.037	9
248133	D-8	8	133/29	.265	.040	9
246133	D-6	6	133/27	.310	.040	9

115°C TYPE D, WHITE NYLON BRAID, 3000 V.

244133	D-4	4	133/25	.375	.045	9
242665	D-2	2	665/30	.447	.045	9
241817	D-1	1	817/30	.502	.050	9
240001	D-0	0	1045/30	.552	.052	9

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

105°C TYPE C, FLAT MULTI-CONDUCTOR, 1000 V.

DEARBORN NO.	NO. OF COND.	GAUGE SIZE	STRANDING	NOM. WALL	NOM. THICKNESS	NOM. WIDTH
382204	4	22	7/30	.016	.065	.260
382208	8	22	7/30	.016	.065	.520
382212	12	22	7/30	.016	.065	.780
382216	16	22	7/30	.016	.065	1.040
382220	20	22	7/30	.016	.065	1.300

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

MULTI-CONDUCTOR, TYPE B, NYLON, SHIELD AND JACKET

DEARBORN NO.	NO. OF COND.	GAUGE SIZE	STRANDING	NOM. WALL	NOM. JACKET THICKNESS	NOM. O.D.
262601	1	26	7/34	.010	.010	.087
262602	2	26	7/34	.010	.014	.138
262603	3	26	7/34	.010	.014	.142
262604	4	26	7/34	.010	.016	.162
262401	1	24	19/36	.010	.010	.092
262402	2	24	19/36	.010	.016	.152
262403	3	24	19/36	.010	.016	.161
262404	4	24	19/36	.010	.017	.164
262201	1	22	19/34	.010	.010	.100
262202	2	22	19/34	.010	.016	.168
262203	3	22	19/34	.010	.017	.178
262204	4	22	19/34	.010	.019	.184
262001	1	20	19/32	.010	.010	.106
262002	2	20	19/32	.010	.019	.186
262003	3	20	19/32	.010	.019	.196
262004	4	20	19/32	.010	.021	.203
261801	1	18	19/30	.010	.012	.120
261802	2	18	19/30	.010	.021	.210
261803	3	18	19/30	.010	.022	.227
261804	4	18	19/30	.010	.023	.238
261601	1	16	19/29	.010	.016	.137
261602	2	16	19/29	.010	.023	.236
261603	3	16	19/29	.010	.023	.240
261604	4	16	19/29	.010	.025	.274

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

← FOR COLOR CODING ON HOOK-UP WIRE, SEE OPPOSITE PAGE

COLOR CODE ON MULTI-CONDUCTOR CABLES: 1—White • 2—Black • 3—Red • 4—Green • 5—Yellow • 6—Light Blue • 7—Brown • 8—Orange • 9—Gray (Slate) • 10—Violet (Purple) • 11—White/Black • 12—White/Red • 13—White/Green • 14—White/Yellow • 15—White/Blue • 16—White/Brown • 17—White/Orange • 18—White/Gray • 19—White/Violet • 20—White/Black/Red.

DEARBORN

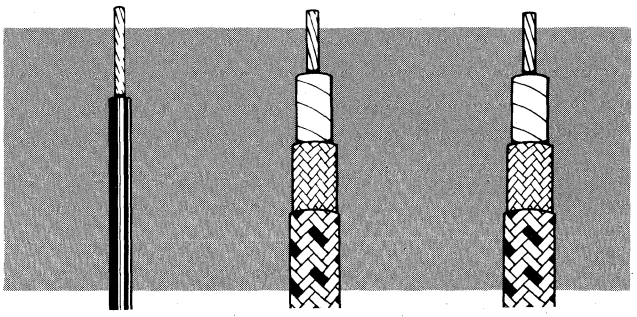
TEFLON INSULATED AIRCRAFT, MISSILE AND ELECTRONIC WIRE AND CABLE

MIL-W-16878D, TYPE ET
Voltage rating: 250 volts. **Temperature rating:** −65°C to +200°C. Single conductor stranded silver plated copper, extruded TFE Teflon insulation.

MIL-W-7139B, CLASS I WIRE
Voltage rating: 600 volts. **Temperature rating:** −65°C to +200°C. Silver plated copper, insulated with layers of TFE Teflon, interspersed with layers of Teflon impregnated fiberglass. Color is white with blue tracer. Teflon impregnated fiberglass braid overall.

MIL-W-7139B, CLASS II, WIRE
Voltage rating: 600 volts. **Temperature rating:** −65°C to +260°C. Nickel coated copper, insulated with layers of TFE Teflon, interspersed with layers of Teflon impregnated fiberglass. Color is white with orange tracer. Teflon impregnated fiberglass braid overall.

- **All Teflon wire and cable listed here is resistant to acids, alkalis, oil, flame, moisture, solvents, fungus, aircraft fuels, hydraulic fluid, skydral, ethylene glycol and alcohol.**



MIL-W-16878D TYPE ET | MIL-W-7139B CLASS I | MIL-W-7139B CLASS II

MIL-W-16878D, TYPE ET, TEFLON

DEARBORN P/N	TYPE & AWG SIZE	CONDUCTOR & STRAND.	NOM. WALL THICKNESS	NOM. O.D.	STOCK P.U. (FT.)	STOCK COLORS
33207	ET-**32**	7/40	.006	.021	100 & 1000	1-9
33219	ET-**32**	19/44	.006	.023	100 & 1000	1-9
33007	ET-**30**	7/38	.006	.024	100 & 1000	1-9
33019	ET-**30**	19/42	.006	.024	100 & 1000	1-9
32807	ET-**28**	7/36	.006	.027	100 & 1000	1-9
32819	ET-**28**	19/40	.006	.027	100 & 1000	1-9
32607	ET-**26**	7/34	.006	.031	100 & 1000	1-9
32619	ET-**26**	19/38	.006	.031	100 & 1000	1-9
32407	ET-**24**	7/32	.006	.036	100 & 1000	1-9
32419	ET-**24**	19/36	.006	.036	100 & 1000	1-9
32207	ET-**22**	7/30	.006	.042	100 & 1000	1-9
32219	ET-**22**	19/34	.006	.042	100 & 1000	1-9
32007	ET-**20**	7/28	.006	.050	100 & 1000	1-9
32019	ET-**20**	19/32	.006	.050	100 & 1000	1-9

MIL-W-7139B, CLASS I WIRE

DEARBORN P/N	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOMINAL O.D. FINISHED WIRE	STOCK PUT UP (FT.)
82219	**22**	19/34	.087	100 & 1000
82019	**20**	19/32	.097	100 & 1000
81819	**18**	19/30	.112	100 & 1000
81619	**16**	19/29	.132	100 & 1000
81419	**14**	19/27	.147	100 & 1000
81219	**12**	19/25	.167	100 & 1000
81037	**10**	37/26	.197	100 & 1000
88133	**8**	133/29	.250	100 & 1000
86133	**6**	133/27	.293	100 & 1000
84133	**4**	133/25	.350	100 & 1000
82665	**2**	665/30	.435	100 & 1000
81817	**1**	817/30	.480	100 & 1000
80001	**0**	1045/30	.540	100 & 1000
80002	**00**	1330/30	.590	100 & 1000
80003	**000**	1665/30	.654	100 & 1000
80004	**0000**	2109/30	.743	100 & 1000

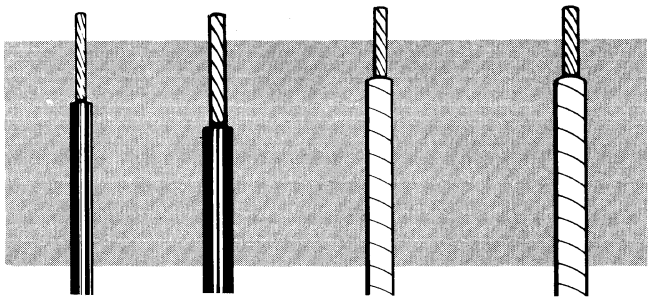
MIL-W-7139B, CLASS II WIRE

DEARBORN P/N	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOMINAL O.D. FINISHED WIRE	STOCK PUT UP (FT.)
82219N	**22**	19/34	.087	100 & 1000
82019N	**20**	19/32	.097	100 & 1000
81819N	**18**	19/30	.112	100 & 1000
81619N	**16**	19/29	.132	100 & 1000
81419N	**14**	19/27	.147	100 & 1000
81219N	**12**	19/25	.167	100 & 1000
81037N	**10**	37/26	.197	100 & 1000
88133N	**8**	133/29	.250	100 & 1000
86133N	**6**	133/27	.293	100 & 1000
84133N	**4**	133/25	.350	100 & 1000
82665N	**2**	665/30	.435	100 & 1000
81817N	**1**	817/30	.480	100 & 1000
80001N	**0**	1045/30	.540	100 & 1000
80002N	**00**	1330/30	.590	100 & 1000
80003N	**000**	1665/30	.654	100 & 1000
80004N	**0000**	2109/30	.743	100 & 1000

COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White
OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

DEARBORN

MIL-W-16878D TEFLON* HOOKUP WIRE



TYPE E | TYPE EE | TYPE E SPIRAL WRAPPED FUSED TEFLON | TYPE EE SPIRAL WRAPPED FUSED TEFLON

*DuPont Trademark

TYPE E, 600 VOLT
Single conductor, stranded or solid silver plated copper, extruded TFE Teflon insulation. **Voltage rating:** 600 volts. **Temperature rating:** −65°C to +200°C.

TYPE EE, 1000 VOLT
Same as Type E, except for insulation thickness and voltage rating of 1000 volts.

TYPE E, SPIRAL WRAPPED FUSED TEFLON
Same as Type E — 600 volt but with spiral wrapped fused Teflon insulation.

TYPE EE, SPIRAL WRAPPED FUSED TEFLON
Same as Type EE, but with spiral wrapped fused Teflon insulation.

TYPE E, 600 VOLT

DEARBORN NO.	TYPE & CONDUCTOR AWG SIZE & STRAND'G		NOM. WALL THICKNESS	NOM. O.D.	STOCK COLORS 100′	STOCK COLORS 1000′
13207	E-32	7/40	.010	.029	1-9	1-9 & 90-98
13007	E-30	7/38	.010	.032	1-9	1-9 & 90-98
12807	E-28	7/36	.010	.036	1-9	1-9 & 90-98
12619	E-26	19/38	.010	.040	1-9	1-9 & 90-98
12607	E-26	7/34	.010	.039	1-9	1-9 & 90-98
12419	E-24	19/36	.010	.045	1-9	1-9 & 90-98
12407	E-24	7/32	.010	.044	1-9	1-9 & 90-98
12219	E-22	19/34	.010	.052	1-9	1-9 & 90-98
12207	E-22	7/30	.010	.050	1-9	1-9 & 90-98
12019	E-20	19/32	.010	.060	1-9	1-9 & 90-98
12007	E-20	7/28	.010	.058	1-9	1-9 & 90-98
11819	E-18	19/30	.010	.070	1-9	1-9 & 90-98
11807	E-18	7/26	.010	.068	1-9	1-9 & 90-98
11619	E-16	19/29	.011	.077	1-9	1-9 & 90-98
11419	E-14	19/27	.011	.094	1-9	1-9 & 90-98
11219	E-12	19/25	.012	.113	1-9	1-9 & 90-98
11037	E-10	37/26	.012	.135	1-9	1-9 & 90-98
SOLID CONDUCTOR						
13201	E-32	1/32	.010	.029	1-9	1-9 & 90-98
13001	E-30	1/30	.010	.032	1-9	1-9 & 90-98
12801	E-28	1/28	.010	.035	1-9	1-9 & 90-98
12601	E-26	1/26	.010	.039	1-9	1-9 & 90-98
12401	E-24	1/24	.010	.044	1-9	1-9 & 90-98
12201	E-22	1/22	.010	.050	1-9	1-9 & 90-98
12001	E-20	1/20	.010	.058	1-9	1-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

**Not MIL Spec.

TYPE E, SPIRAL WRAPPED FUSED TEFLON

DEARBORN NO.	TYPE & CONDUCTOR AWG SIZE & STRAND'G		NOM. WALL THICKNESS	NOM. O.D.	STOCK COLORS 100′	STOCK COLORS 1000′
13207W	E-32	7/40	.010	.029	1-9	1-9 & 90-98
13007W	E-30	7/38	.010	.032	1-9	1-9 & 90-98
12807W	E-28	7/36	.010	.035	1-9	1-9 & 90-98
12619W	E-26	19/38	.010	.040	1-9	1-9 & 90-98
12607W	E-26	7/34	.010	.039	1-9	1-9 & 90-98
12419W	E-24	19/36	.010	.045	1-9	1-9 & 90-98
12407W	E-24	7/32	.010	.044	1-9	1-9 & 90-98
12219W	E-22	19/34	.010	.052	1-9	1-9 & 90-98
12207W	E-22	7/30	.010	.050	1-9	1-9 & 90-98
12019W	E-20	19/32	.010	.060	1-9	1-9 & 90-98
12007W	E-20	7/28	.010	.058	1-9	1-9 & 90-98
11819W	E-18	19/30	.010	.070	1-9	1-9 & 90-98
11807W	E-18	7/26	.010	.068	1-9	1-9 & 90-98
11619W	E-16	19/29	.011	.077	1-9	1-9 & 90-98
11419W	E-14	19/27	.011	.094	1-9	1-9 & 90-98
11219W	E-12	19/25	.012	.113	1-9	1-9 & 90-98
11037W	E-10	37/26	.012	.135	1-9	1-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

TYPE EE, 1000 VOLT

DEARBORN NO.	TYPE & CONDUCTOR AWG SIZE & STRAND'G		NOM. WALL THICKNESS	NOM. O.D.	STOCK COLORS 100′	STOCK COLORS 1000′
23207	EE-32	7/40	.015	.039	1-9	1-9 & 90-98
23007	EE-30	7/38	.015	.042	1-9	1-9 & 90-98
22807	EE-28	7/36	.015	.045	1-9	1-9 & 90-98
22607	EE-26	7/34	.015	.049	1-9	1-9 & 90-98
22619	EE-26	19/38	.015	.050	1-9	1-9 & 90-98
22407	EE-24	7/32	.015	.054	1-9	1-9 & 90-98
22419	EE-24	19/36	.015	.055	1-9	1-9 & 90-98
22207	EE-22	7/30	.015	.060	1-9	1-9 & 90-98
22219	EE-22	19/34	.015	.062	1-9	1-9 & 90-98
22007	EE-20	7/28	.015	.068	1-9	1-9 & 90-98
22019	EE-20	19/32	.015	.070	1-9	1-9 & 90-98
21819	EE-18	19/30	.015	.088	1-9	1-9 & 90-98
21619	EE-16	19/29	.016	.089	1-9	1-9 & 90-98
21419	EE-14	19/27	.017	.105	1-9	1-9 & 90-98
21219	EE-12	19/25	.017	.124	1-9	1-9 & 90-98
21037	EE-10	37/26	.017	.145	1-9	1-9 & 90-98
28133	EE-8	133/29	.020	.207	1-9	1-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

TYPE EE, SPIRAL WRAPPED FUSED TEFLON

DEARBORN NO.	TYPE & CONDUCTOR AWG SIZE & STRAND'G		NOM. WALL THICKNESS	NOM. O.D.	STOCK COLORS 100′	STOCK COLORS 1000′
23207W	EE-32	7/40	.015	.039	1-9	1-9 & 90-98
23007W	EE-30	7/38	.015	.042	1-9	1-9 & 90-98
22807W	EE-28	7/36	.015	.045	1-9	1-9 & 90-98
22607W	EE-26	7/34	.015	.049	1-9	1-9 & 90-98
22619W	EE-26	19/38	.015	.050	1-9	1-9 & 90-98
22407W	EE-24	7/32	.015	.054	1-9	1-9 & 90-98
22419W	EE-24	19/36	.015	.055	1-9	1-9 & 90-98
22207W	EE-22	7/30	.015	.060	1-9	1-9 & 90-98
22219W	EE-22	19/34	.015	.062	1-9	1-9 & 90-98
22007W	EE-20	7/28	.015	.068	1-9	1-9 & 90-98
22019W	EE-20	19/32	.015	.070	1-9	1-9 & 90-98
21819W	EE-18	19/30	.015	.088	1-9	1-9 & 90-98
21619W	EE-16	19/29	.016	.089	1-9	1-9 & 90-98
21419W	EE-14	19/27	.017	.105	1-9	1-9 & 90-98
21219W	EE-12	19/25	.017	.124	1-9	1-9 & 90-98
21037W	EE-10	37/26	.017	.145	1-9	1-9 & 90-98
28133W	EE-8	133/29	.020	.207	1-9	1-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

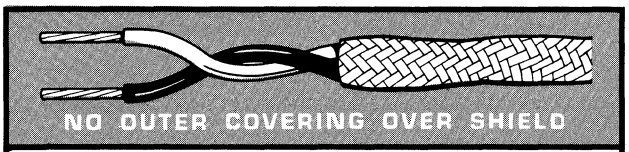
COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White
90—White/Black • 91—White/Brown • 92—White/Red • 93—White/Orange • 94—White/Yellow • 95—White/Green • 96—White/Blue • 97—White/Violet • 98—White/Gray
OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

MIL-W-16878D SHIELDED TEFLON* CABLES

DEARBORN

Each conductor stranded silver plated copper, Type E extruded TFE Teflon .010" color coded insulation. Braided silver plated copper shield, 90% coverage. **Voltage rating:** 600 volts. **Temperature rating:** −65°C to +200°C. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus. *Dupont T.M.

- **NO OUTER COVERING OVER SHIELD.**
- **TEFLON IMPREGNATED BRAID OVER SHIELD**
  Braided natural or white Teflon impregnated fiberglass braid overall.
- **FEP EXTRUDED JACKET OVER SHIELD**
  Tough abrasion resistant extruded white FEP Teflon jacket overall.
- **TEFLON TAPE WRAP JACKET OVER SHIELD**
  Sintered wrapped white Teflon tape jacketed overall.



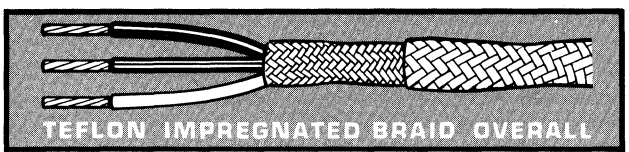
NO OUTER COVERING OVER SHIELD

DEARBORN NO.	NO. OF COND.	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOM O.D. AT MAX. WIDTH HIGH POINT	PUT UP (FT.)
42401	1	24	19/36	.069	100 & 1000
42402	2	24	19/36	.112	100 & 1000
42403	3	24	19/36	.120	100 & 1000
42404	4	24	19/36	.132	100 & 1000
42201	1	22	19/34	.075	100 & 1000
42202	2	22	19/34	.124	100 & 1000
42203	3	22	19/34	.132	100 & 1000
42204	4	22	19/34	.146	100 & 1000
42001	1	20	19/32	.083	100 & 1000
42002	2	20	19/32	.142	100 & 1000
42003	3	20	19/32	.153	100 & 1000
42004	4	20	19/32	.168	100 & 1000
41801	1	18	19/30	.093	100 & 1000
41802	2	18	19/30	.162	100 & 1000
41803	3	18	19/30	.172	100 & 1000
41804	4	18	19/30	.192	100 & 1000
41601	1	16	19/29	.103	100 & 1000
41602	2	16	19/29	.184	100 & 1000
41603	3	16	19/29	.200	100 & 1000
41604	4	16	19/29	.230	100 & 1000



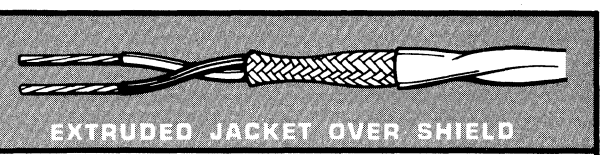
TEFLON TAPE WRAP OVERALL

DEARBORN NO.	NO. OF COND.	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOM O.D. AT MAX. WIDTH HIGH POINT	PUT UP (FT.)
62401	1	24	19/36	.095	100 & 1000
62402	2	24	19/36	.140	100 & 1000
62403	3	24	19/36	.147	100 & 1000
62404	4	24	19/36	.159	100 & 1000
62201	1	22	19/34	.102	100 & 1000
62202	2	22	19/34	.154	100 & 1000
62203	3	22	19/34	.162	100 & 1000
62204	4	22	19/34	.176	100 & 1000
62001	1	20	19/32	.110	100 & 1000
62002	2	20	19/32	.170	100 & 1000
62003	3	20	19/32	.175	100 & 1000
62004	4	20	19/32	.213	100 & 1000
61801	1	18	19/30	.120	100 & 1000
61802	2	18	19/30	.190	100 & 1000
61803	3	18	19/30	.219	100 & 1000
61804	4	18	19/30	.237	100 & 1000
61601	1	16	19/29	.130	100 & 1000
61602	2	16	19/29	.230	100 & 1000
61603	3	16	19/29	.240	100 & 1000
61604	4	16	19/29	.270	100 & 1000



TEFLON IMPREGNATED BRAID OVERALL

DEARBORN NO.	NO. OF COND.	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOM O.D. AT MAX. WIDTH HIGH POINT	PUT UP (FT.)
52401	1	24	19/36	.081	100 & 1000
52402	2	24	19/36	.126	100 & 1000
52403	3	24	19/36	.133	100 & 1000
52404	4	24	19/36	.144	100 & 1000
52201	1	22	19/34	.088	100 & 1000
52202	2	22	19/34	.137	100 & 1000
52203	3	22	19/34	.144	100 & 1000
52204	4	22	19/34	.158	100 & 1000
52001	1	20	19/32	.097	100 & 1000
52002	2	20	19/32	.154	100 & 1000
52003	3	20	19/32	.163	100 & 1000
52004	4	20	19/32	.180	100 & 1000
51801	1	18	19/30	.106	100 & 1000
51802	2	18	19/30	.174	100 & 1000
51803	3	18	19/30	.185	100 & 1000
51804	4	18	19/30	.205	100 & 1000
51601	1	16	19/29	.117	100 & 1000
51602	2	16	19/29	.196	100 & 1000
51603	3	16	19/29	.225	100 & 1000
51604	4	16	19/29	.255	100 & 1000



EXTRUDED JACKET OVER SHIELD

DEARBORN NO.	NO. OF COND.	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOM O.D. AT MAX. WIDTH HIGH POINT	PUT UP (FT.)
72401	1	24	19/36	.085	100 & 1000
72402	2	24	19/36	.130	100 & 1000
72403	3	24	19/36	.135	100 & 1000
72201	1	22	19/34	.091	100 & 1000
72202	2	22	19/34	.150	100 & 1000
72203	3	22	19/34	.158	100 & 1000
72001	1	20	19/32	.100	100 & 1000
72002	2	20	19/32	.168	100 & 1000
72003	3	20	19/32	.178	100 & 1000
71801	1	18	19/30	.110	100 & 1000
71802	2	18	19/30	.188	100 & 1000
71803	3	18	19/30	.207	100 & 1000
71601	1	16	19/29	.123	100 & 1000
71602	2	16	19/29	.220	100 & 1000
71603	3	16	19/29	.235	100 & 1000

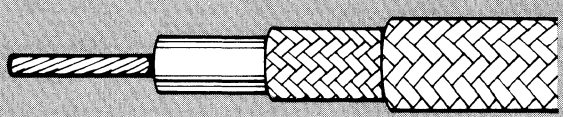
COLOR CODE OF CONDUCTORS: 1st Conductor—White • 2nd Conductor—Black • 3rd Conductor—Red • 4th Conductor—Green

DEARBORN

MIL SPEC AIRCRAFT WIRE

MIL-W-8777B - MS 25471 SILICONE AIRCRAFT WIRE

These wires are intended for installation in aircraft electrical systems where potential does not exceed 600 volts (RMS). Temperature limits are −55°C to +150°C. Single conductor silver plated copper, silicone rubber insulation, glass and dacron braid impregnated with high temperature lacquer and a white dacron braid and high temperature lacquer overall. Resistant to aircraft fuels, hydraulic fluid, oils, water, skydral, ethyleneglycol, dilute acids, alcohol, alkalis, fungus and abrasion.



MIL-W-8777B - MS 25471
SILICONE AIRCRAFT WIRE

DEARBORN P/N	MS P/N	AWG SIZE	STRANDING	NOM. O.D.	PUT UP (FT.)
162219	MS 24571-22	22	19/34	.085	100 & 1000
162019	MS 24571-20	20	19/32	.095	100 & 1000
161819	MS 24571-18	18	19/30	.110	100 & 1000
161619	MS 24571-16	16	19/29	.125	100 & 1000
161419	MS 24571-14	14	19/27	.143	100 & 1000
161219	MS 24571-12	12	19/25	.163	100 & 1000
161049	MS 24571-10	10	49/27	.193	100 & 1000
168133	MS 24571-8	8	133/29	.248	100 & 1000
166133	MS 24571-6	6	133/27	.303	100 & 1000
164133	MS 24571-4	4	133/25	.360	100 & 1000

ALSO AVAILABLE

MIL-W-5086A — TYPE III
MIL-W-5274A — TYPE I, CLASS A
MIL-W-5274A — TYPE II, CLASS A
MIL-W-22759 — TYPE I
MS — 21985
MS — 21986
NAS 702, TYPES U AND S, CLASSES A, B, C
NAS 703, TYPES U, S, SJ, CLASSES A AND C

CALL DEARBORN ON ALL YOUR WIRE REQUIREMENTS

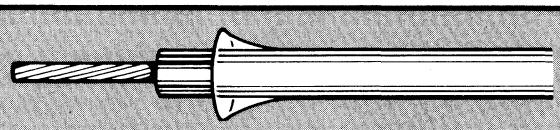
MIL-W-5086A UNSHIELDED AIRCRAFT WIRE

For use as airframe wire at temperatures within the range of −55°C to +105°C. Voltage rating is 600 volts. Both types are resistant to water, aircraft fuels, hydraulic fluid, oils, skydral, ethyleneglycol, dilute acids, alcohol, alkalis, fungus and abrasion.

TYPE I — AN-22 THRU AN-12
Single conductor stranded tinned copper with white PVC insulation and a clear (polyamide) nylon jacket overall.

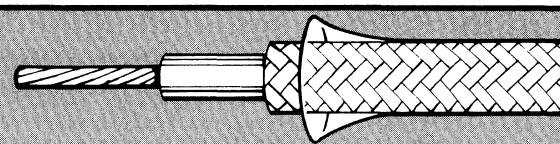
TYPE II — AN-22 THRU AN-12
Single conductor stranded tinned copper with white PVC insulation, white glass braid and a clear nylon jacket overall.

TYPE II — AN-10 THRU AN-0000
Single conductor stranded tinned copper with white PVC insulation, white glass braid, flame retardant nylon lacquered nylon braid overall.



MIL-W-5086A TYPE I

DEARBORN P/N	MIL P/N	AWG SIZE	STRANDING	NOM. O.D.	PUT UP (FT.)
102219	AN-22	22	19/34	.068	100 & 1000
102019	AN-20	20	19/32	.078	100 & 1000
101819	AN-18	18	19/30	.088	100 & 1000
101619	AN-16	16	19/29	.098	100 & 1000
101419	AN-14	14	19/27	.117	100 & 1000
101219	AN-12	12	19/25	.137	100 & 1000



MIL-W-5086A TYPE II

DEARBORN P/N	MIL P/N	AWG SIZE	STRANDING	NOM. O.D.	PUT UP (FT.)
AN-22 THROUGH AN-12					
112219	AN-22	22	19/34	.075	100 & 1000
112019	AN-20	20	19/32	.085	100 & 1000
111819	AN-18	18	19/30	.095	100 & 1000
111619	AN-16	16	19/29	.105	100 & 1000
111419	AN-14	14	19/27	.125	100 & 1000
111219	AN-12	12	19/25	.143	100 & 1000
AN-10 THROUGH AN-0000					
111049	AN-10	10	49/27	.189	100 & 1000
118133	AN-8	8	133/29	.240	100 & 1000
116133	AN-6	6	133/27	.293	100 & 1000
114133	AN-4	4	133/25	.355	100 & 1000
112665	AN-2	2	665/30	.425	100 & 1000
111817	AN-1	1	817/30	.470	100 & 1000
110001	AN-0	0	1045/30	.525	100 & 1000
110002	AN-00	00	1330/30	.590	100 & 1000
110003	AN-000	000	1661/30	.645	100 & 1000
110004	AN-0000	0000	2104/30	.715	100 & 1000

DEARBORN

MIL-W-5086A-MIL-C-7078A SHIELDED AIRCRAFT WIRE FOR ELECTRICAL SYSTEMS

BASE WIRE, MIL-W-5086A, TYPE I, MIL-C-7078A, TYPE I
Stranded tinned copper conductors, with color coded Polyvinylchloride insulation and a clear Nylon jacket on each conductor; cabled, with a braided tinned copper shield (85% coverage) overall.

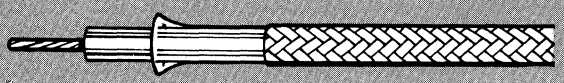
BASE WIRE, MIL-W-5086A, TYPE II, MIL-C-7078A, TYPE I
Stranded tinned copper conductors, insulated with white PVC, color coded glass braid on each conductor. Each conductor has clear Nylon jacket over glass braid insulation. Conductors are cabled and have braided tinned copper shield (85% coverage) overall.

BASE WIRE, MIL-W-5086A, TYPE I, MIL-C-7078A, TYPE II
Same as MIL-C-7078A, Type I, Base Wire, MIL-W-5086A, Type I, with addition of a clear Nylon jacket over the shield.

BASE WIRE, MIL-W-5086A, TYPE II, MIL-C-7078A, TYPE II
Same as MIL-C-7078A, Type I, Base Wire, MIL-W-5086A, Type II, with addition of clear Nylon jacket over the shield.

GENERAL CHARACTERISTICS—Temperature rating: 55°C to +105°C. **Voltage rating:** 600 Volts. Resistant to effects of oil, water, hydraulic fuel, skydrol, aircraft fuels, ethyleneglycol, alcohol, dilute acids, alkalis, fungus, and abrasion.

UNJACKETED SHIELDED CABLE MIL-C-7078A/TYPE I



BASE MIL-W-5086A, TYPE I

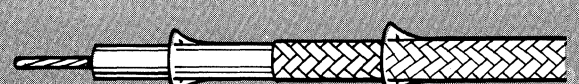
DEARBORN NO.	NO. COND.	MILITARY DESIG. & SIZE	STRANDING	NOM. O.D.	STOCK PUT UPS (FT.)
122201	1	AN-22	19/34	.090	100 & 1000
122202	2	AN-22	19/34	.160	100 & 1000
122203	3	AN-22	19/34	.170	100 & 1000
122001	1	AN-20	19/32	.100	100 & 1000
122002	2	AN-20	19/32	.180	100 & 1000
122003	3	AN-20	19/32	.190	100 & 1000
121801	1	AN-18	19/30	.110	100 & 1000
121802	2	AN-18	19/30	.200	100 & 1000
121803	3	AN-18	19/30	.210	100 & 1000
121601	1	AN-16	19/29	.120	100 & 1000
121401	1	AN-14	19/27	.140	100 & 1000
121201	1	AN-12	19/25	.160	100 & 1000



BASE MIL-W-5086A, TYPE II

DEARBORN NO.	NO. COND.	MILITARY DESIG. & SIZE	STRANDING	NOM. O.D.	STOCK PUT UPS (FT.)
132201	1	AN-22	19/34	.095	100 & 1000
132202	2	AN-22	19/34	.170	100 & 1000
132203	3	AN-22	19/34	.180	100 & 1000
132001	1	AN-20	19/32	.105	100 & 1000
132002	2	AN-20	19/32	.190	100 & 1000
132003	3	AN-20	19/32	.200	100 & 1000
131801	1	AN-18	19/30	.115	100 & 1000
131802	2	AN-18	19/30	.210	100 & 1000
131803	3	AN-18	19/30	.224	100 & 1000
131601	1	AN-16	19/29	.125	100 & 1000
131401	1	AN-14	19/27	.150	100 & 1000
131201	1	AN-12	19/25	.165	100 & 1000

NYLON JACKETED SHIELDED CABLE MIL-C-7078A/TYPE II



BASE MIL-W-5086A, TYPE I

DEARBORN NO.	NO. COND.	MILITARY DESIG. & SIZE	STRANDING	NOM. O.D.	STOCK PUT UPS (FT.)
142201	1	AN-22	19/34	.100	100 & 1000
142202	2	AN-22	19/34	.170	100 & 1000
142203	3	AN-22	19/34	.180	100 & 1000
142001	1	AN-20	19/32	.110	100 & 1000
142002	2	AN-20	19/32	.190	100 & 1000
142003	3	AN-20	19/32	.200	100 & 1000
141801	1	AN-18	19/30	.120	100 & 1000
141802	2	AN-18	19/30	.210	100 & 1000
141803	3	AN-18	19/30	.220	100 & 1000
141601	1	AN-16	19/29	.130	100 & 1000
141401	1	AN-14	19/27	.150	100 & 1000
141201	1	AN-12	19/25	.170	100 & 1000



BASE MIL-W-5086A, TYPE II

DEARBORN NO.	NO. COND.	MILITARY DESIG. & SIZE	STRANDING	NOM. O.D.	STOCK PUT UPS (FT.)
152201	1	AN-22	19/34	.105	100 & 1000
152202	2	AN-22	19/34	.180	100 & 1000
152203	3	AN-22	19/34	.190	100 & 1000
152001	1	AN-20	19/32	.115	100 & 1000
152002	2	AN-20	19/32	.200	100 & 1000
152003	3	AN-20	19/32	.210	100 & 1000
151801	1	AN-18	19/30	.125	100 & 1000
151802	2	AN-18	19/30	.220	100 & 1000
151803	3	AN-18	19/30	.234	100 & 1000
151601	1	AN-16	19/29	.135	100 & 1000
151401	1	AN-14	19/27	.160	100 & 1000
151201	1	AN-12	19/25	.175	100 & 1000

COLOR CODE: 1 Conductor — White • 2 Conductors — 1 White/Blue, 1 White/Red • 3 Conductors — 1 White/Blue, 1 White/Red, 1 White/Yellow.

MIL-SPEC QQ-B-575
TINNED COPPER BRAID

TUBULAR BRAID

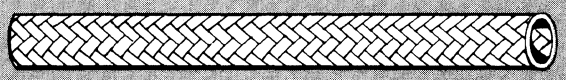
Tinned copper braid woven in completely round configuration as outlined in MIL-SPEC QQ-B-575. All strands soft drawn tinned copper. Shielding is 95% or more when placed over equivalent diameter mandrel to the inside diameter of the tubular braid.

Used as both shielding and protective covering. While the larger sizes shown in second table below are not listed in the spec, they are manufactured to the same standards.

FLAT BRAID

Tinned copper strands, woven and rolled flat to specific width depending on construction, number of strands, etc.

Used for bonding straps, grounding, or connecting moving parts. Recommeded for high current usage.



TINNED COPPER TUBULAR BRAID

DEARBORN P/N	SIZE I.D. INCHES	TOTAL NO. INDIVDUAL STRANDS	SIZE EACH STRAND AWG	NOM. CIRCULAR MIL AREA	STOCK PUT UPS (FT.)
92160	1/32	24	36	600	100
92162	1/16	48	36	1200	100
92164	7/64	96	36	2400	100
92166	1/8	120	36	3000	100
92168	11/64	168	36	4200	100
92170	13/64	192	34	7630	100
92171	1/4	384	36	9600	100
92172	3/8	384	36	9600	100
92174	1/2	528	36	13,200	100
92175	9/16	480	30	48,240	100
92176	25/32	864	36	21,600	100

EXTRA LARGE T.C. TUBULAR BRAID

DEARBORN P/N	SIZE I.D. INCHES	TOTAL NO. INDVIDUAL STRANDS	SIZE EACH STRAND AWG	NOM. CIRCULAR MIL AREA	STOCK PUT UPS (FT.)
92177	7/8	336	30	33,700	50 & 100
92178	1	384	30	38,600	50 & 100
92179	1-1/8	432	30	43,330	50 & 100
92180	1-1/4	480	30	48,150	50 & 100
92181	1-3/8	528	30	53,000	50 & 100
92182	1-1/2	576	30	57,775	50 & 100



*FLAT TINNED COPPER BRAID

DEARBORN NO.	NOM. FLAT WIDTH (INCHES)	TOT. NO. INDIV. STRANDS	SIZE EACH STRAND AWG	NON. CIRCULAR MIL AREA	STOCK (PUT UPS (FT.)
91221	.025	8	36	200	100, 500 & 1000
91222	1/32	16	36	400	100, 500 & 1000
91223	3/64	24	36	600	100, 500 & 1000
91224	3/32	48	36	1200	100, 500 & 1000
91229	1/8	72	36	1800	100, 500 & 1000
91230	3/16	120	36	3000	100, 500 & 1000
91231	1/4	168	36	4200	100, 500 & 1000
91232	3/8	288	36	7200	100, 500 & 1000
91233	1/2	384	36	9600	100, 500 & 1000
91234	3/4	832	36	20,800	100, 500 & 1000
91235	1	832	36	20,800	100, 500 & 1000
91239	1-3/8	336	30	33,700	100, 500 & 1000
91240	1-1/2	528	30	53,064	100, 500 & 1000
91241	1-3/4	1248	30	125,424	100, 500 & 1000
91242	2	1536	30	154,368	100, 500 & 1000

*Commercial Type.

DEARBORN

MIL-W-3861 TYPE S, QQ-W-343 TYPE S, ASTM B-33 UNINSULATED TINNED COPPER WIRE

SOFT DRAWN SOLID WIRE

Properly annealed, pure electrolytic soft, drawn, solid, tinned copper wire used for applications such as point to point wiring, component leads, and ground wire.



UNINSULATED TINNED COPPER WIRE

DEARBORN NO.	CONDUCTOR SIZE	NOM. CIRCULAR MIL AREA	NOM. O.D.	STOCK PUT UPS (FT.)
938	38	16.0	.004	100 & 1000
936	36	25.0	.005	100 & 1000
934	34	39.7	.006	100 & 1000
932	32	64.0	.008	100 & 1000
930	30	100.5	.010	100 & 1000
928	28	159.8	.013	100 & 1000
926	26	254.1	.016	100 & 1000
924	24	404.0	.020	100 & 1000
922	22	642.4	.025	100 & 1000
920	20	1,022.0	.033	100 & 1000
918	18	1,642.0	.040	100 & 1000
916	16	2,583.0	.051	100 & 1000
914	14	4,107.0	.065	100 & 1000
912	12	6,530.0	.082	100 & 1000
910	10	10,380.0	.103	100 & 1000
908	8	16,510.0	.129	100 & 1000
906	6	26,250.0	.162	100 & 1000

ALSO AVAILABLE

- **Silver Plated Tubular Braid to MIL-SPEC-QQ-B-575**
- **Commercial, Oval Tinned Copper Braid**

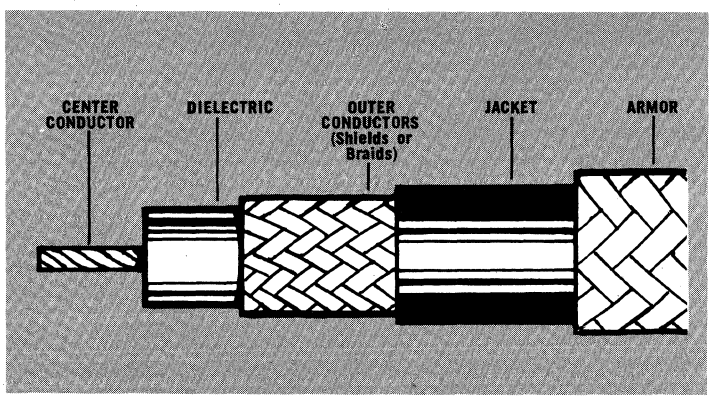
CALL . . . DEARBORN FOR YOUR COMPLETE WIRE REQUIREMENTS

DEARBORN

RG COAXIAL CABLE

Dearborn has the most complete selection of RG Coaxial Cable in the nation, manufactured to meet the needs of government and industry... backed by America's most dependable quality warranty.

Nomenclature



Operating Temperature Limits for Cable Jackets

MILITARY DESIGNATION	JACKET TYPE	TEMPERATURE LIMITS
TYPE I	Black Polyvinylchloride	−40°C to +80°C
TYPE II	Grey Polyvinylchloride	−25°C to +80°C
TYPE IIa	Black or Grey Polyvinylchloride	Under ¼" O.D. −55°C to +90°C Over ¼" O.D. −40°C to +90°C
TYPE IIIa	Black Polyethylene	−55°C to +85°C
TYPE IV	Black Synthetic Rubber	Under ½" −55°C to +80°C Over ½" −40°C to +80°C
TYPE V	Fiberglas Braid	−55°C to +250°C
TYPE VI	Silicon-Rubber Dacron Braid	−55°C to +175°C
TYPE VII	Teflon (PTFE)	−55°C to +250°C
TYPE VIII	Synthetic Rubber	−55°C to +75°C
TYPE IX	Teflon (FEP)	−55°C to +200°C

EXPLANATION OF NOMENCLATURE

CENTER CABLE CONDUCTORS

Center cable conductors may be solid or stranded wires, or in some cases, a tube. Selection is made on the mechanical and electrical properties desired. Solid wires result in lowest cable attentuation. Stranding permits increased cable flexibility but also increases attenuation. Bare, tinned, or silver plated copper wire is usually used for center conductors. Other materials are Copperweld, Cadmium Bronze, Aluminum, Nichrome and Karma.

DIELECTRICS (CABLE)

EXTRUDED POLYETHYLENE

Low cost, flexibility, ease of application, high dielectric strength and low dielectric constant make it well suited for RF applications. It is the most commonly used low temperature cable dielectric.

FOAM CORE (CELLULAR POLYETHYLENE)

An excellent low temperature dielectric formed by expanding polyethylene with millions of bubbles of an inert gas. Its low dielectric constant of 1.5 for Foam Core compared to 2.26 for solid polyethylene permits the design of lower attenuation and low capacity cables.

TEFLON

Teflon will withstand high temperature applications. It has high dielectric strength and a very low dielectric constant. Its ability to withstand exposure to gases and liquids makes it the dielectric selected where other materials would be inadequate.

CABLE OUTER CONDUCTORS

SHIELDS† OR BRAID

The outer conductor is usually made of a metal braid but it can be a solid tube. The braid is used where flexibility is a vital factor; the tubular construction is used where a high degree of shielding is required. Tubular construction also provides lower cable attenuation. Two adjacent braids offer better shielding action than one braid. Generally speaking braids are either copper, tinned copper or silver plated copper.

† Armor

CABLE JACKET TYPES

TYPE I (MIL-C-17)—Decription: Black Polyvinylchloride. **Characteristics:** Excellent weathering and abrasion properties, but is of the contaminating type and will cause cable attenuation to increase with age. Can be used for direct burial.

TYPE II (JAN-C-17A)—Description: Grey Polyvinylchloride. **Characteristics:** A semi-noncontaminating jacket.

TYPE IIA (MIL-C-17)—Description: Black or Grey Polyvinylchloride. **Characteristics:** Noncontaminating. Good weathering and abrasion resistant properties. Can be used for direct burial.

TYPE IIIA (MIL-C-17)—Description: Black Polyethylene. **Characteristics:** Moisture resistant, abrasion resistant, defies ultra violet damage. Noncontaminating; recommended for direct burial.

TYPE IV (MIL-C-17)—Description: Black Synthetic Rubber. **Characteristics:** This jacket material is used only on high voltage pulse cables. The basic material is polymerized chloroprene.

TYPE V (MIL-C-17)—Description: Fiberglas Braid. **Characteristics:** Impregnated with silicone varnish to provide abrasion resistance and a moisture seal.

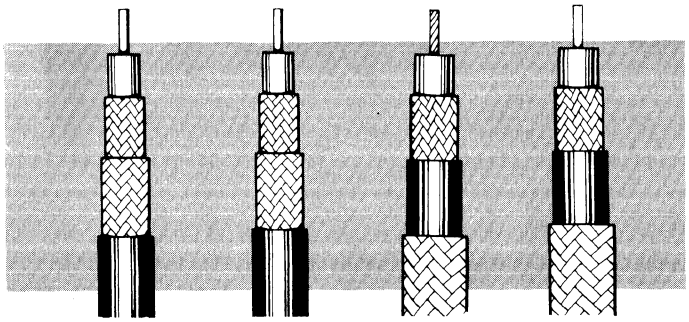
TYPE VI (MIL-C-17)—Description: Silicone Rubber Dacron Braid. **Characteristiscs:** Two wraps of silicone rubber impregnated fiberglass tape which is fused into a homogeneous layer. A dacron braid is applied, followed by a high temperature fluorocarbon lacquer.

TYPE VII (MIL-C-17)—Description: Teflon (Polytetrafluordethyene). **Characteristics:** Either extruded or tape wrapped. Withstands high temperatures; chemically inert; insoluble in liquids and gases.

TYPE VIII (MIL-C-17)—Description: Synthetic Rubber. **Characteristics:** This material is a polychloroprene compound and is used with only a few pulse cables. Its primary use is as a jacket material for multiconductor cables.

TYPE IX (MIL-C-17)—Description: Teflon (Fluorinated Ethylene Propylene). **Characteristics:** Excellent weathering properties and chemically inert. Maximum operating temperature of 200°C.

REPRESENTATIVE CONSTRUCTION



RG-5B/U RG-6A/U RG-10A/U RG-18A/U

DEARBORN

RG COAXIAL CABLE POLYETHYLENE DIELECTRIC

PHYSICAL PROPERTIES

ELECTRICAL PROPERTIES

RG/U No.	Dearborn No.	Armor O.D.	Jkt. O.D.	Jkt. Type	Outer Shields	Inner Shields	Dielectric O.D. & Type	Center Cond.	Lbs. Per 1000 Ft.	Nom. Imped. Ohms	Nom. Cap. Mmfd/ft.	Max. Operating Volt.(Rms)	V.P. %	Engineering Data
5	6005	—	.332*	I	C	C	.185P	16C	83	52.5	28.5	3000	65.9	—
5A	6005A	—	.338*	II	S	S	.181P	16S	83	50.5	28.5	3000	65.9	Replaced by 212/U
5B	6005B	—	.328*	IIa	S	S	.181P	16S	83	50.0	28.5	3000	65.9	Now designated as 212/U
6	6006	—	.332*	II	C	S	.185P	21CW	80	75.0	20,0	2700	65.9	Replaced by 6A
6A	6006A	—	.332*	IIa	C	S	.185P	21CW	80	75.0	20.0	2700	65.9	Small video cable
7	6007	—	.370*	I	—	C	.250ASP	19C	80	97.0	12.5	1000	84.0	Replaced by 63B/U
8	6008	—	.405*	I	—	C	.285P	7/21C	105	52.0	29.5	5000	65.9	—
8A	6008A	—	.405*	IIa	—	C	.285P	7/21C	105	52.0	29.5	5000	65.9	Now designated as 213/U
9	6009	—	.420*	II Grey	C	S	.280P	7/21S	128	51.0	30.0	5000	65.9	—
9A	6009A	—	.420*	II Grey	S	S	.280P	7/21S	128	51.0	30.0	5000	65.9	—
9B	6009B	—	.405*	IIa	S	S	.280P	7/21S	127	50.0	30.0	5000	65.9	Now designated as 214/U
10	6010	.475*	.405	II	—	C	.285P	7/21C	129	52.0	29.5	5000	65.9	Replaced by 10A/U
10A	6010A	.475*	.405	IIa	—	C	.285P	7/21C	129	52.0	29.5	5000	65.9	84/U with armor now desig. 215/U
11	6011	—	.405*	I	—	C	.285P	7/26TC	92	75.0	20.5	5000	65.9	Medium flexible video cable
11A	6011A	—	.405*	IIa	—	C	.285P	7/26TC	92	75.0	20.5	5000	65.9	—
12	6012	.475*	.405	II Grey	—	C	.285P	7/26TC	116	75.0	20.5	5000	65.9	Replaced by 12A/U
12A	6012A	.475*	.405	IIa	—	C	.285P	7/26TC	114	75.0	20.5	5000	65.9	11A/U with armor
13	6013	—	.420*	I	C	C	.280P	7/26TC	121	74.0	20.5	5000	65.9	—
13A	6013A	—	.420*	IIa	C	C	.280P	7/26TC	121	74.0	20.5	5000	65.9	Now designated as 216/U
14	6014	—	.545*	II Grey	C	C	.370P	10C	205	52.0	29.5	7000	65.9	Replaced by 14A/U
14A	6014A	—	.545*	IIa	C	C	.370P	10C	205	52.0	29.5	7000	65.9	Now designated as 217/U
15	6015	—	.545*	I	C	C	.370P	15CW	197	75.0	20.5	5000	65.9	Replaced by 11A/U & 12A/U
17	6017	—	.870*	II Grey	—	C	.680P	.188C	463	52.0	29.5	11,000	65.9	—
17A	6017A	—	.870*	IIa	—	C	.680P	.188C	460	52.0	29.5	11,000	65.9	Now designated as 218/U
18	6018	.945*	.870	IIa	—	C	.680P	.188C	515	52.0	29.5	11,000	65.9	Replaced by 18A/U
18A	6018A	.945*	.870	II	—	C	.680P	.188C	515	52.0	29.5	11,000	65.9	Now designated as 219/U
19	6019	—	1.120*	II	—	C	.910P	.250C	740	52.0	29.5	14,000	65.9	Replaced by 19A/U
19A	6019A	—	1.120*	IIa	—	C	.910P	.250C	740	52.0	29.5	14,000	65.9	Now designated as 220/U
20	6020	1.195*	1.120	II	—	C	.910P	.250C	800	52.0	29.5	14,000	65.9	Replaced by 20A/U
20A	6020A	1.195*	1.120	IIa	—	C	.910P	.250C	800	52.0	29.5	14,000	65.9	Now designated as 221/U
21	6021	—	.332*	II	S	S	.185P	16N	87	53.0	29.0	2700	65.9	Replaced by 21A/U
21A	6021A	—	.332*	IIa	S	S	.185P	16N	80	53.0	29.0	2700	65.9	Now designated as 222/U
22	6022	—	.405*	I	—	TC	.285P	Two 7/.0152C	103	95.0	16.0	1000	65.9	—
22A	6022A	—	.420*	II	TC	TC	.285P	Two 7/.0152C	131	95.0	16.0	1000	65.9	Replacd by 22B/U
22B	6022B	—	.420*	IIa	TC	TC	.285P	Two 7/.0152C	130	95.0	16.0	1000	—	Twin cond. bal. cable (paired)
23	6023	—	.650 .945*	I	C	C	Two Cores .380P	Two 7/21C	380	125.0	12.0	3000	—	Replaced by 23A/U
23A	6023A	—	.650 .945*	IIa	C	C	Two Cores .380P	Two 7/21C	360	125.0	12.0	3000	—	—
24	6024	.735* 1.034	.650* .945*	I	C	C	.380P	Two 7/21C	430	125.0	12.0	3000	—	Replaced by 24A/U
24A	6024A	.735* 1.034	.650* .945*	IIa	C	C	Two Cores .380P	Two 7/21C	410	125.0	12.0	3000	—	Replaced by 23A/U with armor
29	6029	—	.184*	III	—	TC	.116P	20C	21	53.0	28.5	1900	65.9	Replaced by 58/U
34	6034	—	.625*	I	—	C	.455P	7/.21C	230	71.0	21.5	5200	65.9	Replaced by 34B/U
34A	6034A	—	.630*	IIa	—	C	.460P	7/.0249	224	75.0	20.5	6500	65.9	Replaced by 34B/U

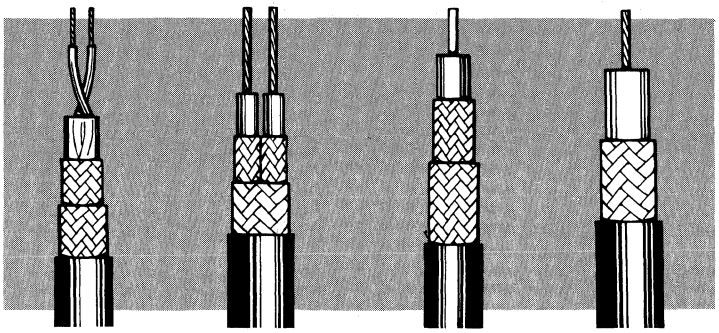
* Nominal Overall Diameter.

KEY TO ABBREVIATIONS:
C—Bare Copper **S**—Silvered Copper **P**—Polyethylene **CW**—Copperweld **TC**—Tinned Copper **N**—Nichrome **ASP**—Air Spaced Polyethylene **SSP**—Semi-Solid Polyethylene **CCP**—Conductive Coated Polyethylene **T**—Teflon **TT**—Teflon Tape **AST**—Air Spaced Tetrafluorethylene **K**—KARMA **SCW**—Silvered Copperweld **SCB**—Silver Plated Cadmium Bronze

DEARBORN

RG COAXIAL CABLE POLYETHYLENE DIELECTRIC

REPRESENTATIVE CONSTRUCTION



RG-22B/U RG-23A/U RG-177/U RG-34B/U

PHYSICAL PROPERTIES

ELECTRICAL PROPERTIES

RG/U No.	Dearborn No.	Armor O.D.	Jkt. O.D.	Jkt. Type	Outer Shields	Inner Shields	Dielectric O.D. & Type	Center Cond.	Lbs. Per 1000 Ft.	Nom. Imped. Ohms	Nom. Cap. Mmfd/ft.	Max. Operating Volt.(Rms)	V.P. %	Engineering Data
34B	6034B	—	.630*	IIa	—	C	.460P	7/.0249	224	75.0	21.5	6500	65.9	Hi-power, low atten. flexible cable
35	6035	.945*	.870	II	—	C	.680P	9c	458	71.0	—	10,000	65.9	Replaced by 35B/U
35A	6035A	.945*	.870	IIa	—	C	.680P	9c	454	71.0	—	10,000	65.9	Replaced by 35B/U
35B	6035B	.945*	.870	IIa	—	C	.680P	.1045C	454	75.0	—	10,000	65.9	Hi-pow. low atten. Same as 164/U armored
54	6054	—	.275*	I	—	C	.185P	7/26C	41	58.0	21.0	2500	—	Replacd by 54A/U
54A	6054A	—	250*	III	—	TC	.178P	7/.0152C	40	58.0	27.0	3000	—	—
55	6055	—	.206*	III	TC	TC	.116P	20C	36	53.0	28.5	1900	65.9	Replaced by 55B/U
55A	6055A	—	.216*	IIa	S	S	.116P	.035S	34	50.0	30.5	1900	65.9	Replaced by 223/U
55B	6055B	—	.206*	IIIa	TC	TC	.116P	20S	34	53.5	28.5	1900	65.9	—
57	6057	—	.625*	I	—	TC	.472P	Two 7/21C	248	95.0	16.0	3000	65.9	Replaced by 57A/U
57A	6057A	—	.625*	IIa	—	TC	.472P	Two 7/21C	225	95.0	16.0	3000	65.9	—
58	6058	—	.195*	I	—	TC	.116P	20C	28	53.5	28.5	1900	65.9	—
58A	6058A	—	.195*	I	—	TC	.116P	19/.0071 TC	29	52.0	28.5	1900	65.9	—
58B	6058B	—	.195*	IIa	—	TC	.116P	20C	25	53.5	28.5	1900	65.9	—
58C	6058C	—	.195*	IIa	—	TC	.116P	19/.0071 TC	25	50.0	28.5	1900	65.9	—
59	6059	—	.242*	I	—	C	.146P	22CW	32	73.0	21.0	2300	65.9	Video cable
59A	6059A	—	.242*	IIa	—	C	.146P	.023CW	32	75.0	20.5	2300	65.9	Replaced by 59B
59B	6059B	—	.242*	IIa	—	C	.146P	.023CW	32	75.0	21.5	2300	65.9	—
62	6062	—	.242*	I	—	C	.146ASP	22CW	38	93.0	13.5	750	84.0	—
62A	6062A	—	.242*	IIa	—	C	.146ASP	22CW	37	93.0	13.5	750	84.0	Low capacitance cable
62B	6062B	—	.242*	IIa	—	C	.146ASP	7/32CW	30	93.0	13.5	750	84.0	Similar to 62A/U
63	6063	—	.405*	I	—	C	.285ASP	22CW	88	125.0	10.0	1000	84.0	Replaced by 63B/U
63B	6063B	—	.405*	IIa	—	C	.285ASP	22CW	84	125.0	10.0	1000	84.0	Low capacitance air spaced cable
71	6071	—	.250*	I	TC	C	.146ASP	22CW	46	93.0	13.5	750	84.0	Replaced by 71B/U
71A	6071A	—	.250*	I	TC	TC	.146ASP	22CW	46	93.0	13.5	750	84.0	—
71B	6071B	—	.250*	IIIa	TC	TC	.146ASP	22CW	45	93.0	13.5	750	84.0	—
74	6074	.615*	.545	II	C	C	.370P	10C	234	52.0	29.5	5500	65.9	Replaced by 74A/U
74A	6074A	.615*	.545	IIa	C	C	.370P	10C	236	52.0	29.5	7000	65.9	New designated as 224/U
79	6079	.475*	.405	I	—	C	.285ASP	22CW	136	125.0	10.0	1000	84.0	Replaced by 79B/U
79A	6079A	.415*	.405	I	—	C	.285P	22CW	114	125.0	11.0	1000	—	Replaced by 79B/U
79B	6079B	.475*	.405	IIa	—	C	.285ASP	22CW	111	125.0	10.0	1000	84.0	63B/U with armor
83	6083	—	.405*	I	—	C	.240P	10C	122	35.0	44.0	2000	—	—
85A	6085A	Ld. Shth. Armor 1.565	.870	IIa	—	C	.680P	9C	2,910	75.0	21.5	10,000	65.9	RG84A/U with armor special
88A/U	6088A	—	.515*	IV	4 TC			19/.0117TC	180	45.0	50.0	—	—	Pulse cable formerly 88B/U
100	6100	—	.242*	I	—	C	.146P	19/.0147C	74	35.0	44.0	2,000	—	—
108	6108	—	.235*	II	—	TC	Over Ea. Cond. .079P	Two 7/28TC	31	78.0	24.5	1000	68.0	Replaced by 108A/U
108A	6108A	—	.235*	IIa	—	TC	Over Ea. Cond. .079P	Two 7/28TC	30	78.0	20.0	1000	68.0	Shielded twisted pair
111	6111	.490*	—	II	TC	TC	.285P	Two 7/.0152C	146	95.0	16.0	1000	65.9	22A/U with armor
111A	6111A	.490*	.420	IIa	TC	TC	.285P	Two 7/.0152C	145	95.0	16.0	1000	65.9	22B/U with armor

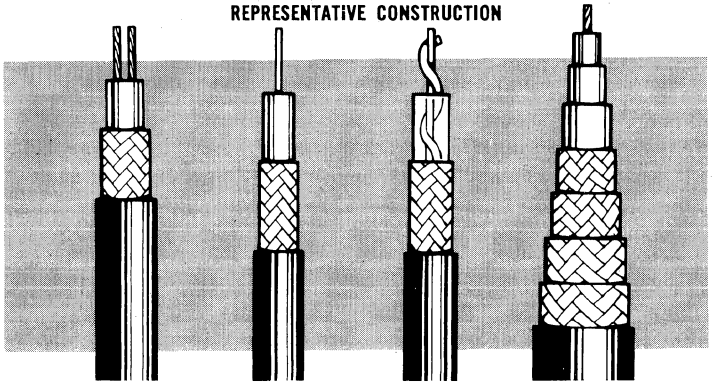
KEY TO ABBREVIATIONS:
C—Bare Copper P—Polyethylene
S—Silvered Copper CW—Copperweld
TC—Tinned Copper
N—Nichrome
ASP—Air Spaced Polyethylene
SSP—Semi-Solid Polyethylene
CCP—Conductive Coated Polyethylene
T—Teflon
TT—Teflon Tape
AST—Air Spaced Tetrafluorethylene
K—KARMA
SCW—Silvered Copperweld
SCB—Silver Plated Cadmium Bronze

* Nominal Overall Diameter.

DEARBORN

RG COAXIAL CABLE POLYETHYLENE DIELECTRIC

REPRESENTATIVE CONSTRUCTION



RG-57A/U RG-59B/U RG-62A/U RG-88A/U

PHYSICAL PROPERTIES / ELECTRICAL PROPERTIES

RG/U No.	Dearborn No.	Armor O.D.	Jkt. O.D.	Jkt. Type	Outer Shields	Inner Shields	Dielectric O.D. & Type	Center Cond.	Lbs. Per 1000 Ft.	Nom. Imped. Ohms	Nom. Cap. Mmfd/ft.	Max. Operating Volt.(Rms)	V.P. %	Engineering Data
114	6114	—	.405*	I	—	C	.285ASP	33CW	87	185.0	6.8	1000	88.0	Low capacitance cable
114A	6114A	—	.405*	IIa	—	C	.285SSP	33CW	87	185.0	6.5	1000	88.0	Special low capacitance cable
122	6122	—	.160*	IIa	—	TC	.096P	27/36TC	20	50.0	29.5	1900	65.9	Similar to 58A/U except smaller
130	6130	—	.625*	I	—	TC	.472P	Two 7/.0285C	220	95.0	17.0	8000	—	Same as 57A/U except more flexible
131	6131	.710*	.625*	I	—	TC	.472P	Two 7/.0285C	295	95.0	17.0	8000	—	130/U with armor
133	6133	—	.405*	I	—	C	.280P	21C	94	95.0	16.2	4000	—	Replaced by 133A/U
133A	6133A	—	.405*	IIa	—	C	.280P	21C	89	95.0	16.2	4000	—	—
149	6149	—	.405	I	—	TC	.285CCP	7/26TC	92	75.0	20.5	5000	65.9	11/U low noise
150	6150	.475	.405	I	—	TC	.285CCP	7/26TC	116	75.0	20.5	5000	65.9	149/U with armor
164	6164	—	.870	IIa	—	C	.680P	.1045C	389	75.0	21.0	10,000	65.9	35B/U less armor
174	6174	—	.100	I	—	TC	.060P	7/34CW	7.5	50.0	30.0	1500	65.9	—
177	6177	—	.895	IIa	S	S	.680P	.195C	460	50.0	30.5	1100	65.9	—
181	6181	—	.640	IIa	—	C	.210P	Two 7/26C	200	12.5	12.0	3500	—	Unbalanced cable
212	6212	—	.332	IIa	S	S	.185P	.0556S	83	50.0	29.5	3000	65.9	Formerly 5B/U
213	6213	—	.405	IIa	—	C	.285P	7/.0296C	120	50.0	29.5	3000	65.9	Formerly 8A/U
214	6214	—	.425	IIa	S	S	.285P	7/.0296S	127	50.0	29.5	3000	65.9	Formerly 9B/U
215	6215	.475	.405	IIa	—	C	.285P	7/.0296C	149	50.0	29.5	3000	65.9	Formerly 10A/U
216	6216	—	.425	IIa	C	C	.285P	7/26TC	130	75.0	20.5	5000	65.9	Formerly 13A/U
217	6217	—	.545	IIa	C	C	.370P	.106C	220	50.0	29.5	7000	65.9	Formerly 14A/U
218	6218	—	.870	IIa	—	C	.680P	.195C	467	50.0	29.5	11,000	65.9	Formerly 17A/U
219	6219	.945	.870	IIa	—	C	.680P	.195C	515	50.0	29.5	11,000	65.9	Formerly 18A/U
220	6220	—	1.120	IIa	—	C	.910P	.260C	740	50.0	29.5	14,000	65.9	Formerly 19A/U
221	6221	1.195	1.120	IIa	—	C	.910P	.260C	800	50.0	29.5	14,000	65.9	Formerly 20A/U
222	6222	—	.332	IIa	S	S	.185P	.0556N	84	50.0	29.0	2700	65.9	Formerly 21A/U
223	6223	—	.216	IIa	S	S	.116P	.035S	36	50.0	29.5	1900	65.9	Formerly 55A/U
224	6224	.615	.545	IIa	C	C	.370P	.106C	236	50.0	29.5	7000	65.9	Formerly 74A/U
264	6264	—	.750 .245	I	C	Over Ea. C	.176P	Four 19/27C	340	40.0	38.0	—	65.9	Four individ'l coaxials cabled together
264A	6264A	—	.750	IIa	C	Over Ea. C	.176P	Four 19/27C	340	40.0	38.0	—	65.9	Four individ'l coaxials cabled together
298	6298	—	.650	Poly Foamed	—	—	.115P	7/24CW	108	—	—	—	—	MIL-C-22667A
307A	6307A	—	.270	Poly Foamed	S	S	—	19/.0058S	51	—	75.0	—	—	Special triaxial

* Nominal Overall Diameter.

COAXIAL CABLE WITH (FOAM) CELLULAR POLYETHYLENE DIELECTRIC

LOW LOSS FOAM COAXIAL CABLE

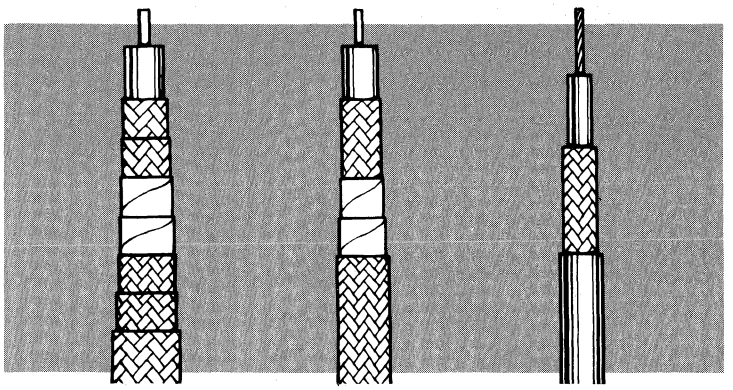
Compared to ordinary RG/U cable of similar size, the attenuation of cellular polyethylene (Foam Core) dielectric cable is reduced by as much as 35%. These cables are well suited for CATV, Closed Circuit or MATV; ideal for use in amateur commercial or citizen band installations. All are made to adapt to unusual terrain problems and resist damage from weather extremes.

RG/U Type	Dearborn No.	Jacket O.D.	Jacket Type	Shield	Dielectric O.D. & Type	Center Conductor	ILBS/1000 Ft.	Nom. Imps. Ohms	Nom. Cap. MMFD/Ft.	Max. Oper. Volts RMS.	VP %
8	6008F	.405	I	C	.285 FC	7/19C	93	50	24.5	1500	80
11	6011F	.405	I	C	.285 FC	7/26C	88	75	16.5	1300	80
58	6058F	.195	I	C	.116 FC	20C	21.5	50	17.0	1000	80
59	6059F	.242	I	C	.146 FC	20C	32	75	17.3	1000	80

DEARBORN

RG COAXIAL CABLE TEFLON† DIELECTRIC

REPRESENTATIVE CONSTRUCTION



RG-120/U TEFLON | RG140/U TEFLON | RG-187/U TEFLON

† TM - Dupont

PHYSICAL PROPERTIES / ELECTRICAL PROPERTIES

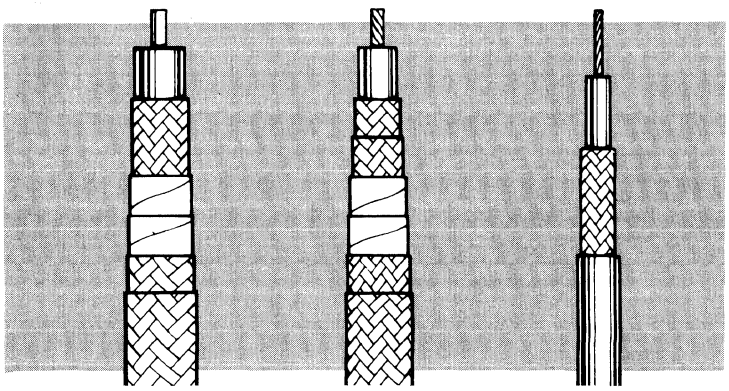
RG/U No.	Dearborn No.	Armor O.D.	Jkt. O.D.	Jkt. Type	Outer Shields	Inner Shields	Dielectric O.D. & Type	Center Cond.	Lbs. Per 1000 Ft.	Nom. Imped. Ohms	Nom. Cap. Mmfd/ft.	Max. Operating Volt.(Rms)	V.P. %	Engineering Data
62C	6062C	—	.242	V	—	S	.146AST	22SCW	36	93.0	13.5	750	84.0	Reasisgned 210/U
87A	6087A	—	.425	V	S	S	.280T	7/20S	174	50.0	29.5	5000	69.5	Replaced by 225/U
94	6094	—	.445	V	C	C	.292TT	19/.0225S	247	50.0	27.0	7000	70.0	Replacement only, new design 226/U
94A	6094A	—	.500	V	C	C	.370TT	19/.0224S	445	50.0	27.0	7000	—	Reassigned 226/U
115	6115	—	.375	V	S	S	.250TT	7/21S	139	50.0	29.5	5000	70.0	Used where expan. & contrac. are prob.
115A	6115A	—	.415	V	S	S	.250TT	7/21S	159	50.0	29.5	5000	70.0	—
116	6116	.475	.425	V	S	S	.280T	7/20S	224	50.0	29.5	5000	69.5	Replaced by 227/U
117	6117	—	.730	V	—	C	.620T	.188C	450	50.0	29.0	7000	69.5	Replaced by 211/U
117A	6117A	—	.730	V	—	C	.620T	.188C	450	50.0	29.0	7000	69.5	Replaced by 211A/U
118	6118	.795	.730	V	—	C	.620T	.188C	610	50.0	29.0	7000	69.5	Replaced by 228/U
118A	6118A	.780	.730	V	—	C	.620T	.188C	600	50.0	29.5	7000	69.5	Replaced by 228A/U
119	6119	—	.465	V	C	C	.332T	.102C	225	50.0	29.5	6000	69.5	—
120	6120	.525	.465	V	C	C	.332T	.102C	282	50.0	29.5	6000	69.5	119/U with armor
126	6126	—	.280	V	—	K	.185T	7/24K	76	50.0	28.5	3000	68.5	High attenuation
140	6140	—	.233	V	—	S	.146T	.025SCW	45	75.0	21.0	2300	69.5	High temperature similar to 59A/U
141	6141	—	.190	V	—	S	.116T	.0359SCW	35	50.0	28.5	1900	69.5	—
141A	6141A	—	.190	V	—	S	.116T	.039SCW	32	50.0	28.5	1900	69.5	High temperature similar to 58C/U
142	6142	—	.206	V	S	S	.116T	.0359SCW	45	50.0	28.5	1900	69.5	—
142A	6142A	—	.206	V	S	S	.116T	.039SCW	45	50.0	28.5	1900	69.5	High temperature similar to 55A/U
142B	6142B	—	.195	IX	S	S	.116T	.039SCW	42	50.0	28.5	1900	69.2	—
143	6143	—	.325	V	S	S	.185T	.057SCW	102	50.0	28.5	3000	69.5	—
143A	6143A	—	.325	V	S	S	.185T	.059SCW	102	50.0	28.5	3000	69.5	High temperature similar to 58/U
144	6144	—	.410	V	—	S	.285T	7/25SCW	120	75.0	20.5	5000	69.5	High temperature similar to 11/U
146	6146	—	.375	V	—	C	.285AST	.007CW	108	190	6.0	1000	—	High temperature, low capacitance
161	6161	—	.082	External Nylon Blk	—	S	.057T	7/.004SCB	6.1	70.0	20.0	1000	69.5	—
165	6165	—	.410	V	—	S	.285T	7/.032S	140	50.0	29.5	5000	69.5	—
166	6166	.460	.410	V	—	S	.285T	7/.032S	172	50.0	29.5	5000	69.5	165/U with armor
178	6178	—	.079	KEL-F	—	S	.036T	7/.0039S	5.4	50.0	27.9	1000	69.5	Replacement only, new design 178B/U
178A	6178A	—	.075	KEL-F	—	S	.034T	7/.004SCW	6	50.0	27.9	1000	69.5	Replacement only, new design 178B/U
178B	6178B	—	.075	IX	—	S	.034T	7/.004SCW	6.2	50.0	28.5	1000	69.5	—
179	6179	—	.090	KEL-F	—	S	.056T	7/.004SCW	8	70.0	19.5	1000	69.5	Replacement only, new design 179A/U
179A	6179A	—	.105	KEL-F	—	S	.063T	7/.004SCW	9.6	75.0	19.5	1200	69.5	Replacement only, new design 179B/U

* Nominal Overall Diameter.

DEARBORN

RG COAXIAL CABLE †TEFLON DIELECTRIC

REPRESENTATIVE CONSTRUCTION



RG-211A/U TEFLON | RG-225/U TEFLON | RG-301/U TEFLON

† TM - Dupont

PHYSICAL PROPERTIES / ELECTRICAL PROPERTIES

RG/U No.	Dearborn No.	Armor O.D.	Jkt. O.D.	Jkt. Type	Outer Shields	Inner Shields	Dielectric O.D. & Type	Center Cond.	Lbs. Per 1000 Ft.	Nom. Imped. Ohms	Nom. Cap. Mmfd/ft.	Max. Operating Volt.(Rms)	V.P. %	Engineering Data
179B	6179B	—	.105	IX	—	S	.063T	7/.004SCW	9.6	75.0	19.5	1200	69.5	High temperature miniaturized cable
180	6180	—	.141	KEL-F	—	S	.103T	7/.004SCW	18	93.0	15.5	1500	69.5	—
180A	6180A	—	.145	KEL-F	—	S	.102T	7/.004SCW	19	95.0	15.0	1800	69.5	Replacement only, new design 180B/U
180B	6180B	—	.145	IX	—	S	.102T	7/.004SCW	19	95.0	15.0	1500	69.5	—
187	6187	—	.110	VII	—	S	.063T	7/.004SCW	11	75.0	19.5	1200	69.5	Replacement only, new design 187A/U
187A	6187A	—	.110	VII	—	S	.060T	7/.004SCW	11	75.0	19.5	1200	69.5	High temperature miniaturized cable
188	6188	—	.110	VII	—	S	.060T	7/.0067SCW	11	50.0	29.0	1200	69.5	Replacement only, new design 188A/U
188A	6188A	—	.110	VII	—	S	.060T	7/.0067SCW	11	50.0	29.0	1200	69.5	High temperature miniaturized cable
195	6195	—	.155	VII	—	S	.102T	7/.004SCW	21	95.0	15.0	1500	69.5	Same as 189B/U excpt H.O. conductor
195A	6195A	—	.155	VII	—	S	.102T	7/.004SCW	21	95.0	15.0	1500	69.5	FEP jacket type, refer to 180B/U
196	6196	—	.080	VII	—	S	.034T	7/.004SCW	5.8	50.0	28.5	1000	69.5	High temperature miniaturized cable
196A	6196A	—	.080	VII	—	S	.034T	7/.004SCW	5.9	50.0	28.5	1000	69.5	FEP jacket type, refer to 178B/U
209	6209	—	.745	VI	S	S	.500AST	19/.0378S	432	50.0	26.5	3200	84.0	High power, high flex coaxial
210	6210	—	.242	V	—	S	.146AST	22SCW	40	93.0	14.5	750	84.0	Replaces 62C/U
211	6211	—	.730	V	—	C	.620T	.190C	450	50.0	29.0	7000	69.5	Formerly 117/U
211A	6211A	—	.730	V	—	C	.620T	.190C	450	50.0	29.5	7000	69.5	Formerly 117A/U
225	6225	—	.430	V	S	S	.285T	7/.0312S	174	50.0	29.5	5000	69.5	Formerly 87A/U
226	6226	—	.500	V	C	C	.370TT	19/.0254S	247	50.0	29.5	7000	70.0	Formerly 94A/U
227	6227	.490	.430	V	S	S	.285T	7/.0312S	224	50.0	29.5	5000	69.5	Formerly 116/U
228	6228	.795	.730	V	—	C	.620T	.190C	625	50.0	29.5	7000	69.5	Formerly 118/U
228A	6228A	.784	.730	V	—	C	.620T	.190C	625	50.0	29.5	7000	69.5	Formerly 118A/U
235	6235	—	.470	VI	S	S	.255TT	7/.028S	180	50.0	29.5	5000	70.0	115A/U with Type VI jacket
280	6280	—	.480	IIa	S	S	.327AST	.114C	119	50.0	27.5	4000	—	—
281	6281	—	.750	VI	S	S	.500AST	19/.0378S	400	50.0	29.0	4000	—	—
301	6301	—	.245	IX	—	K	.185T	7/.0203K	65	50.0	29.0	3000	—	Same as 126/U except for FEP jacket
302	6302	—	.206	IX	—	S	.146T	.025SCW	45	75.0	21.0	2300	69.5	Same as 140/U except for FEP jacket
303	6303	—	.170	IX	—	S	.116T	.039SCW	35	50.0	28.5	1900	69.5	Same as 141A/U except for FEP jkt.
304	6304	—	.280	IX	S	S	.185T	.059SCW	102	50.0	28.5	3000	69.5	Same as 143A/U except for FEP jkt.
316	6316	—	.102	IX	—	S	.060T	7/.0067SCW	11	50.0	29.0	1200	69.5	Same as 188/U except for FEP jacket

* Nominal Overall Diameter.

KEY TO ABBREVIATIONS:

C—Bare Copper
S—Silvered Copper
P—Polyethylene
CW—Copperweld
TC—Tinned Copper
N—Nichrome
ASP—Air Spaced Polyethylene
SSP—Semi-Solid Polyethylene
CCP—Conductive Coated Polyethylene
T—Teflon
TT—Teflon Tape
AST—Air Spaced Tetrafluoroethylene
K—KARMA
SCW—Silvered Copperweld
SCB—Silver Plated Cadmium Bronze

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"WE SPECIALIZE IN SMALL OR LARGE QUANTITIES OF JACKETED AND/OR SHIELDED TEFLON CABLE"

MIL-W-16878D • SHIELDED TEFLON* CABLES

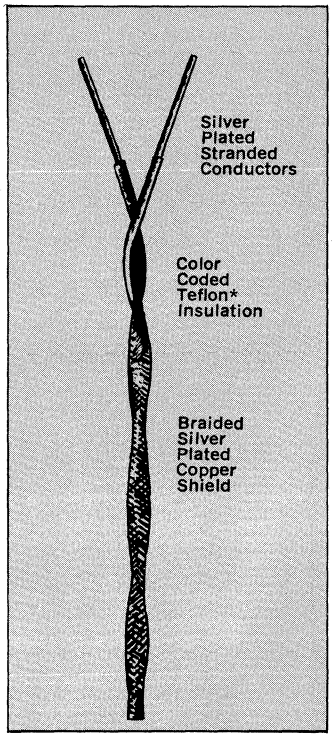
No Outer Covering Over Shield

DESCRIPTION

Each conductor stranded silver plated copper, Type E extruded TFE .010" insulation, braided silver plated copper shield over conductor(s), 90% coverage.

CHARACTERISTICS

Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acid, alkalis, oil, flame, moisture, solvents and fungus.



GARRETT NO.	NO. OF COND.	CONDUCTOR SIZE	CONDUCTOR STRAND	NOM. O.D.	NOM. CAP. IN MMF SHIELD TO COND.	NOM. CAP. IN MMF COND. TO COND.
1624ES	1	24	19/36	.069"	45	—
1624ES/2	2	24	19/36	.112"	35	25
1624ES/3	3	24	19/36	.120"	35	20
1624ES/4	4	24	19/36	.132"	35	20
1622ES	1	22	19/34	.075"	55	—
1622ES/2	2	22	19/34	.124"	45	25
1622ES/3	3	22	19/34	.132"	35	25
1622ES/4	4	22	19/34	.146"	35	25
1620ES	1	20	19/32	.083"	55	—
1620ES/2	2	20	19/32	.142"	95	25
1620ES/3	3	20	19/32	.151"	85	25
1620ES/4	4	20	19/32	.168"	140	30
1618ES	1	18	19/30	.093"	70	—
1618ES/2	2	18	19/30	.162"	60	35
1618ES/3	3	18	19/30	.172"	60	35
1618ES/4	4	18	19/30	.192"	55	35

MIL-W-16878D • SHIELDED TEFLON* CABLES

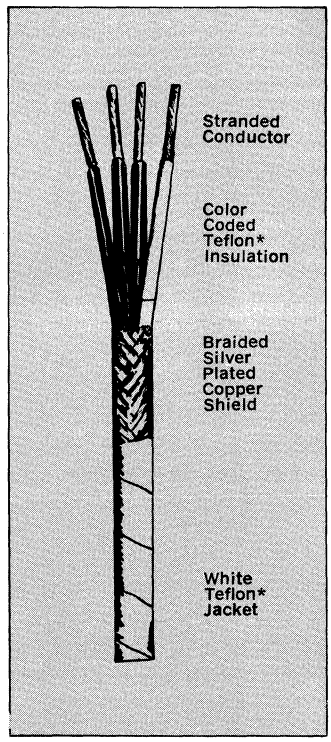
Teflon* Tape Wrap Jacket Over Shield

DESCRIPTION

Each conductor stranded silver plated copper, Type E extruded .010" TFE Teflon* insulation, color coded, cabled, braided silver plated copper shield 90% coverage, sintered wrapped white Teflon* tape jacketed overall.

CHARACTERISTICS

Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, akalis, oil, flame, moisture, solvents and fungus.



GARRETT NO.	NO. OF COND.	CONDUCTOR SIZE	CONDUCTOR STRAND	NOM. JKT. THICKNESS	NOM. O.D. AT HIGH POINT	NOM. CAP. IN MMF SHIELD TO COND.	NOM. CAP. IN MMF COND. TO COND.
1624ESJ	1	24	19/36	.010"	.095"	45	—
1624ESJ/2	2	24	19/36	.010"	.140"	35	25
1624ESJ/3	3	24	19/36	.010"	.147"	35	20
1624ESJ/4	4	24	19/36	.014"	.159"	35	20
1622ESJ	1	22	19/34	.010"	.102"	55	—
1622ESJ/2	2	22	19/34	.014"	.154"	45	25
1622ESJ/3	3	22	19/34	.014"	.162"	35	25
1622ESJ/4	4	22	19/34	.014"	.176"	35	25
1620ESJ	1	20	19/32	.010"	.110"	55	—
1620ESJ/2	2	20	19/32	.014"	.170"	95	25
1620ESJ/3	3	20	19/32	.014"	.175"	85	25
1620ESJ/4	4	20	19/32	.018"	.213"	140	30
1618ESJ	1	18	19/30	.010"	.120"	70	—
1618ESJ/2	2	18	19/30	.014"	.190"	60	35
1618ESJ/3	3	18	19/30	.018"	.219"	60	35
1618ESJ/4	4	18	19/30	.018"	.237"	55	35

*Dupont's Trade Name for Polytetrafluorethylene

GARRETT ELECTRONICS & CABLE CORPORATION
A DIVISION OF INSTRUMENT SYSTEMS CORP.
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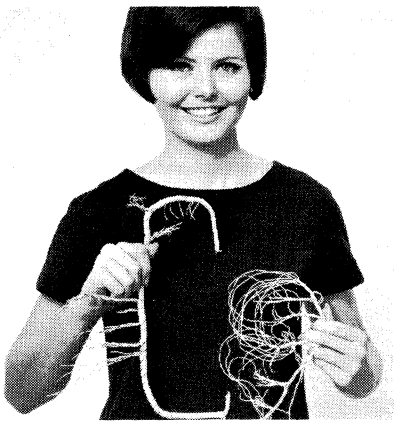

SPIRAL WRAP—Spirally Cut Tubing

CAT. NO.		
	SWP	Polyethylene—general purpose—Sizes ⅛" to 1" for bundle sizes ½" to 8". Black for outdoor use.
	SWN	Nylon—top mechanical strength—Sizes ⅛" to 1".
	SWR	Flame Retardant (Rulan)—self extinguishing—Sizes ⅛" to ½".
	SWT	Teflon—High temperature—Sizes ⅛" to 1" for bundle sizes ½" to 6".



HEATRAX®—Heat Shrinkable Tubing

CAT. NO.		
	HIX	Irradiated Polyolefin—Shrink ratio 2 to 1—general purpose—Sizes 3/64" to 4"—Conforms to MIL-I-23053
	HRX	Semi-Rigid Irradiated Polyolefin—Shrink ratio 2 to 1—strain relief applications—Sizes 3/64" to ½"—Color coded by size. Conforms to MIL-I-23053
	HCX	Irradiated Flexible Vinyl—Shrink ratio 2 to 1—irradiation enhances flexibility and crack resistance—Sizes 3/64" to 2"—Conforms to MIL-I-23053
	HVX	Flexible Vinyl—low cost—Shrink ratio 2 to 1—Sizes 1/16" to 2". Available in color and clear. Conforms to MIL-I-23053
	HTX	Thin Wall Teflon—Shrink ratio 1½ to 1—Sizes AWG 30 to 0—Conforms to MIL-I-23053
	HSX	Standard Wall Teflon—Shrink ratio 1½ to 1—Sizes AWG 24 to 0—Conforms to MIL-I-23053
	HFX	Fractional Sizes Teflon—Shrink ratio 4 to 1—Sizes 5/64" to 1¼"—Conforms to MIL-I-23053
	HKX	Kynar—Shrink ratio 2 to 1—Sizes ⅛" to 1" clear. Extremely tough, cut-through and abrasion resistance.
	HCS	Vinyl—Shrinkable outside, sticky meltable inside. Adheres to form waterproof seal. Sizes ¼", ½", ¾". Color—black.
	HIM	Polyolefin—Sizes from ⅛" to 1"—Shrinkable outside, meltable inside. Does not adhere but forms tight mechanical seal. Color-coded by size.

VINYL, FIBERGLASS & TEFLON TUBING

CAT. NO.		
	SLV-105	Vinyl, Temperature to 105°C. Class A—Sizes AWG 24 to 2½"—Conforms to MIL-I-631D, Grade C, Class 1 & 2.
	SLV-40	Vinyl, Low Temperature down to —65°C—Sizes AWG 24 to 2½"—Conforms to MIL-I-7444B; MIL-I-22076.
	SLV-130	Fiberglass High Temperature to 130°C Class B, Grade B—Sizes AWG 24 to 1"—Conforms to MIL-I-3190B; NEMA-VS1.
	SLV-1200	Fiberglass High Temperature to 650°C, Class C—Sizes AWG 24 to 1"—Conforms to NEMA-VS1.
	STT	Teflon Thin Wall—Sizes AWG 30 to 0—Conforms to AMS 3651B, 3655; MIL-I-22129B.
	STS	Teflon Standard Wall—Sizes AWG 24 to 0—Conforms to AMS 3651B, 3653; MIL-I-22129B.
	STL	Teflon (Extra Thin) Lightweight—Sizes AWG 28 to 0—Conforms to AMS 3651B, 3654.
	TTF	Teflon (Heavy Wall) fractional sizes—Conforms to MIL-I-22129B, AMS-3651B.

ZIPPER TUBING

CAT. NO.		
	Z63	General Purpose Vinyl—Temperature to 105°C—Conforms to MIL-I-631D, Class C.
	Z74	Low Temperature, Flexible Vinyl for applications down to —70°C. Conforms to MIL-I-7444B.
	ZHN	Nylon with aluminum foil. Excellent RFI shielding—Conforms to MIL-C-20696, Type I, Class 2, MIL-A-148A.

LACING TAPE & CORD

CAT. NO.		
	LTN	Flat Braided Nylon—Widths, .250", .125", .090", .062", .045". Conforms to MIL-T-43435, Type I; MIL-T-713A, Type P.
	LTD	Flat Braided Dacron—Width .090"; Conforms to MIL-T-43435, Type II; MIL-T-713A, Type D.
	LTT	Flat Braided Teflon Tape—Width .090"—Conforms to MIL-T-43435, Type III; MIL-T-713A, Type PTFE.
	LCN	Round Twisted Nylon Cord—Diameter .050", .035", .030". Conforms to MIL-T-713C, Type P.
	LCL	Round Twisted Linen Cord—Diameter .035"—Conforms to MIL-T-713C, Type N.
	LCV	Round Vinyl Cord—Diameter .065"; material Virgin PVC, Type A.

CABLE CLAMPS

CAT. NO.		
	CLE	Ethyl Cellulose—General Purpose—Sizes ⅛" to 1½"—Conforms to 7-21-44 Army-Navy Aeronautical AN742.
	CLN	Nylon—Temperature to 135°C, Sizes ⅛" to 1½"—Conforms to.....
	CLT	Teflon—High temperature to 260°C, Sizes ⅛" to 1¼".

GROMSTRIP®—Continuous Extruded Grommet

CAT. NO.		
	GSP	Polyethylene for general application, sizes for thicknesses #24 gauge to ½".
	GSN	Nylon for excessive abrasion, sizes for thicknesses #24 gauge to ½".

GROMMETS

	GV	Vinyl for general application—Sizes for edge protection of holes from ⅛" to 1 1/16" diameter. Black and White.

CABLE TIES

CAT. NO.		
	CTN	Self-locking virgin Nylon, no metal parts. Conforms to MS-17821, MS-18034 and MIL-S-23190. Apply by hand or any standard assembly tool.

PLASTIC ROD, SHEET & TUBING

A wide selection of plastic materials available in standard cut lengths.



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ITT IRRAVIN™ Insulated Military and U/L Hook-up Wire and Cable

IRRAVIN, irradiation cross-linked insulation developed by ITT Wire and Cable, meets the tough requirements of today's electronic, aerospace, airframe and data processing industries. Through precisely controlled electronic bombardment a PVC compound becomes solder-iron resistant, abrasion resistant, cut-through and crush resistant IRRAVIN insulation. It has the desired characteristics of other high temperature wires with the **added** advantage of low cost, continuous long lengths, ease of handling and universal application.

IRRAVIN insulated wires can be used for internal circuit hook-up, harnesses bundles as well as being advantageously used with automatic wire wrapping machinery. For those applications, the tough IRRAVIN insulation possesses superior electrical, mechanical and thermal characteristics as compared to conventional PVC.

HEAT RESISTANCE — Withstands high ambient temperatures. Resists solder iron damage. Eliminates shrink-back, flowing and dripping of insulation.

ABRASION AND CUT-THROUGH RESISTANCE — IRRAVIN insulation has improved mechanical properties. Eliminates the need for outer jacketing. This results in superior space and weight savings advantages.

CRUSH RESISTANCE — IRRAVIN insulation has 50% more crush resistance than PVC insulation... 200% more than TFE insulation. This means extra reliability in wire bundles and harnesses, because ties and lacings will not cut through the insulation.

LONG LENGTHS — Long continuous lengths of IRRAVIN insulated wire are available at no extra cost... Fewer shipping spools, less storage space needed, and fewer automatic machine set-ups.

UNIVERSAL APPLICATIONS — IRRAVIN insulated wire conforms to military specification MIL-W-16878, types B, C and D, and is listed by Underwriters' Laboratories, Inc. for styles 1429, 1430 and 1431.

LOW COST — Saves you up to two-thirds the cost of other high temperature wire. Its universality reduces inventories especially if used with in-house striping machinery for color coding.

IRRAVIN WIRE CAN BE PRINTED, PAINTED, POTTED AND STRIPED USING CONVENTIONAL PROCESSING EQUIPMENT.

U/L STYLE 1429 80°C BUSINESS MACHINE WIRE

Description: Thin wall IRRAVIN B insulation on tinned copper or overcoated tinned copper stranded or solid conductor. Resistant to deformation and hot solder iron damage.

Application: Internal wiring of business machines, computers and maintenance of equipment.

Temperature: −55° to +80°C.

Rating: 300 Volts r.m.s.

Available: **Stranded:** Sizes AWG 28 through 16 in a selection of strandings. **Solid:** Sizes AWG 26 through 20.

See illustration Ⓐ *or* Ⓑ

U/L STYLE 1430 APPLIANCE WIRE

Description: 1/64 inch wall of IRRAVIN C insulation on tinned copper or overcoated tinned copper stranded or solid conductor. The only type 1430, 300 Volt appliance wire without a nylon jacket, yet resistant to abrasion, deformation and cut through.

Temperature: −55°C to +105°C. Can be used to 125°C for intermittent service.

Rating: 300 Volts r.m.s. for appliances 600 Volts for electronic equipment.

Available: **Stranded:** Sizes AWG 26 through 16 in a selection of strandings. **Solid:** Sizes AWG 24 through 16.

See illustration Ⓐ *or* Ⓑ

600 VOLT MIL-SPEC HOOK-UP WIRE

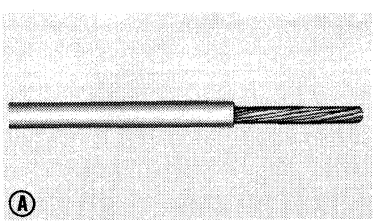
Description: Thin wall IRRAVIN B insulation on tinned copper conductor.

Certified to: MIL-W-16878 Type B.

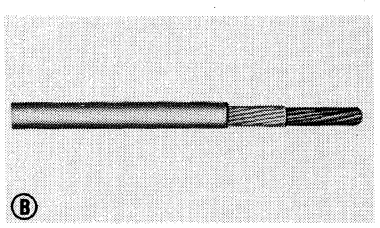
Temperature: −55°C to +105°C. Intermittent service at higher temperatures.

Available: 30 AWG through 14 AWG stranded.

See illustration Ⓐ.



IRRAVIN insulation over stranded tinned copper conductor



IRRAVIN insulation with overcoated tinned copper conductor

1000 VOLT MIL-SPEC HOOK-UP WIRE

Description: Medium wall IRRAVIN C insulation over tinned copper conductor. Has outstanding resistance to corona attack at high peak A.C. voltages.

Certified: MIL-W-16878 Type C.

Temperature: −55°C to +105°C. Intermittent service at higher temperatures.

Available: 26 through 12 AWG stranded.

See illustration Ⓐ

600 & 1000 VOLT MIL-SPEC HOOK-UP WIRE WITH OVERCOATED TINNED CONDUCTOR

Description: Insulated with IRRAVIN B for 1000 Volt application with overcoated tinned copper stranded conductors. Eliminates tinning operation after stripping away insulation. Prevents wire ends from fraying.

Certified: MIL-W-16878 Types B and C.

Temperature: −55°C to +105°C. Intermittent service at higher temperatures.

Available: 24, 22, and 16 AWG stranded.

See illustration Ⓑ

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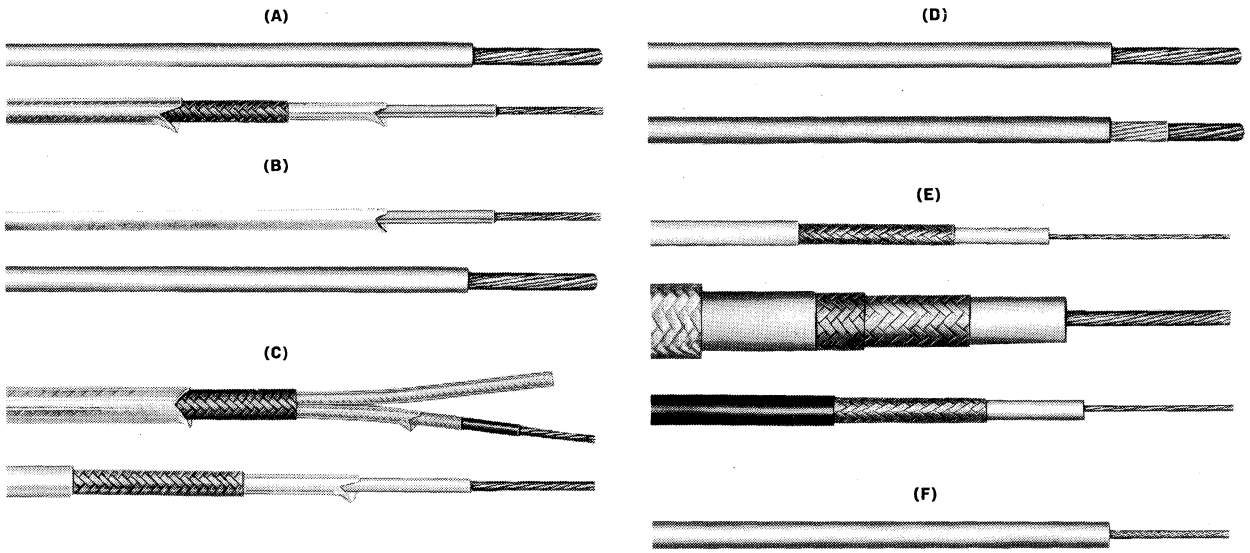

(A) MILITARY HOOK-UP WIRE

Military specification MIL-W-16878D is universally accepted for general purpose hook-up wire. It covers performance requirements for wires insulated with polyethylene, PVC, Silicone, TFE Teflon and FEP Teflon and IRRAVIN™ insulation. ITT Wire and Cable manufactures all of these constructions as listed in MIL-W-16878D. Polyethylene and PVC insulated wires can be ordered with nylon jacketing over the insulation.

Wires can also be manufactured to the following military specifications:

MIL-W-76B	MIL-W-81044	MIL-C-27500
MIL-W-22759	MIL-C-7078	

(B) UNDERWRITERS' LABORATORIES, INC. LISTED HOOK-UP WIRE

Hook-up wire, as listed by U.L. specifications and the Canadian Standards Association, requires a heavier wall thickness for equivalent voltage rating as compared to military specifications.

ITT Wire and Cable manufactures a broad line of U.L. wires and maintains a stock of the following U.L. styles:

1007	1015	1429
1010	1061	1430
1011		1431

(C) AIR FRAME WIRE

ITT Wire and Cable is a major producer of wire for the aviation and aerospace industries. Here are a few of the military specification wires manufactured for airframe and aerospace applications.

MIL-W-81044	MIL-W-22759
MIL-W-5086 All Types	MIL-W-8777

(D) AUTOMATIC WIRE WRAP WIRES

ITT Wire and Cable offers two types of wire insulation for automatic wire wrapping of computer back-panel assemblies.

SURFLENE B—A modified fluorocarbon insulation tough enough to resist cut through but flexible enough to prevent "pop-up" problems that often occur in wires used on automatic wire wrapping machines. It has outstanding thermal and chemical characteristics, and is rated at −40°C to +135°C. Manufactured in 24 through 30 AWG sizes.

IRRAVIN B — This irradiation cross-linked polyvinyl chloride compound provides increased mechanical toughness even when applied in a thin wall of 0.0065". It is extremely hard, slick, and crush resistant. Solder iron contact will not melt or deform this insulation. It is especially suitable for wire wrap machine applications because of low cost, stable electrical characteristics, small diameter, and longer lengths. Manufactured in 24 through 30 AWG sizes. (See IRRAVIN information)

Please contact the ITT Wire and Cable Division for specific technical assistance.

(E) COAXIAL CABLES

ITT Wire and Cable designs and manufactures coaxial cables with special alloys, solid or stranded conductors and uniquely compounded dielectric materials which possess low loss factors. There are endless varieties of conductors, dielectric materials, shieldings and jacketings available to the design engineer who requires a particular coaxial cable. RG/U tables of the ITT manufactured standard line coaxial cables are listed in catalog CP-1 available on request.

(F) SILICONE RUBBER HIGH VOLTAGE WIRE

ITT Silicone rubber insulated wire for high voltage applications has a superior resistance to high temperature and corona. Silicon rubber remains flexible at −65°C and can be subjected to 175°C temperature for short periods without detrimental effects. High voltage cables for 10-30 KV D.C. use are also offered. These cables are listed in catalog CP-3 available on request.

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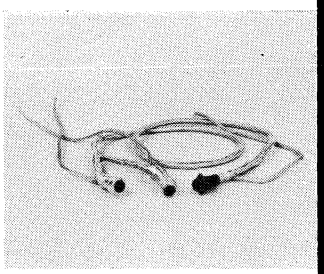
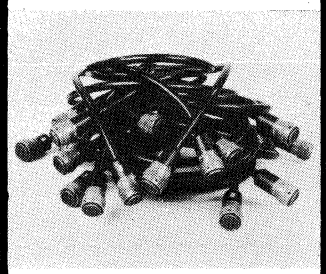
INTERCONTINENTAL

SPECIALIZES IN PRODUCING CABLES TO SPECIFIC REQUIREMENTS AND SPECIFICATIONS. ADVANCED CABLE TECHNOLOGY FACILITATES THE DELIVERY OF QUALITY PRODUCTS AT EQUITABLE COSTS.



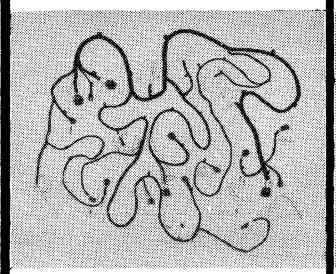
RFI BRAIDED SHIELDING

This unique process generates optimum abrasive resistance and reduces the size by 40% of the cable diameter. Braided shielding provides maximum coverage at minimum cost. The braided shielding technique conforms to all commercial, military and NASA requirements.



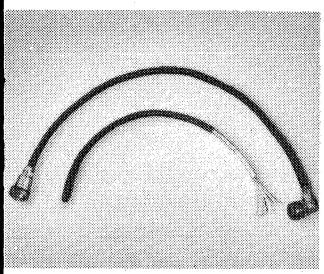
MOLDED CABLES

An advanced process developed to provide reliability in the performance of sophisticated applications. Cable ends and tee breakouts may be molded from various polyurethane, epoxy and rubber compounds.



BRAIDED CABLES

Braided cables are utilized by the aerospace telecommunication and associated industries. Owing to its superior ability to be economical in adhering to intricate and complex requirements, cables may be braided with dacron, nylon, glass or other braided materials.

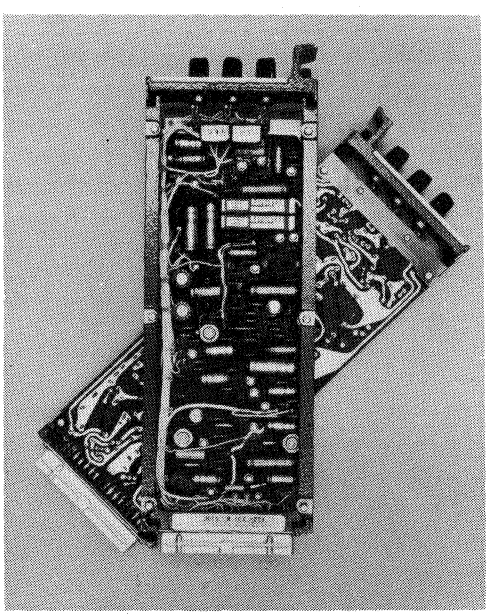


JACKETED CABLES

A highly individualized form of cable assembly which allows customized selection of wire. An economical class of cable assembly when reduced quantities and varied applications are involved.

INTERCONTINENTAL

SPECIALIZES IN THE MANUFACTURE OF PRINTED CIRCUIT BOARDS FROM CONCEPT TO MODULE ASSEMBLIES



SIGNIFICANT FEATURES

- ARTWORK PREPARATION
- PRINTED CIRCUIT BOARD MFG.
- AUTOMATIC COMPONENT FORMING
- AUTOMATIC WAVE SOLDERING

SIGNIFICANT SAVINGS

- SINGLE SUPPLIER
- COST REDUCTION
- MINIMUM PAPER WORK AND FOLLOW-UP
- PLANNED DELIVERY

INTERCONTINENTAL HARNESS & CABLE CO.

31 WEST MALL, PLAINVIEW, N.Y. 11803
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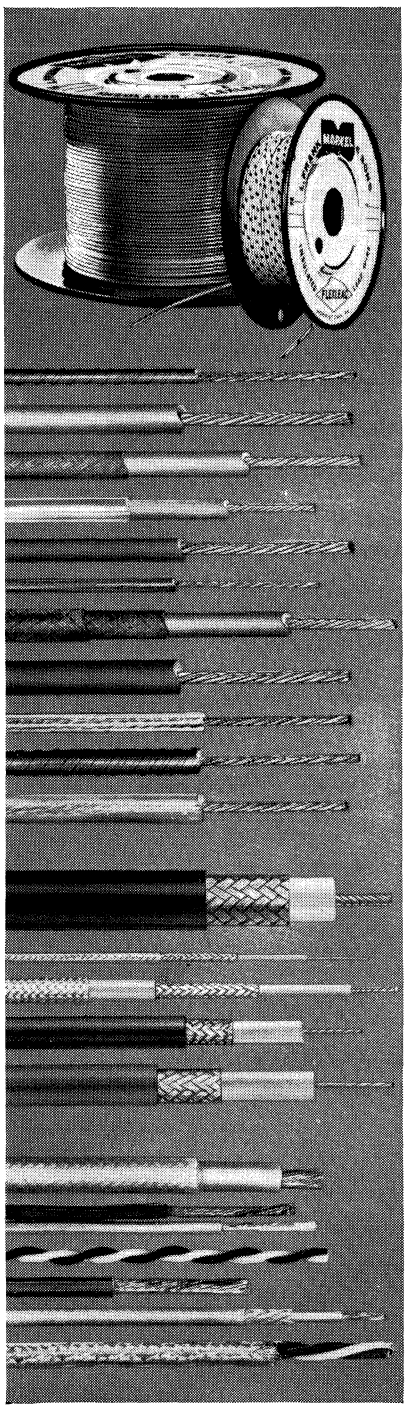
MARKEL
SINCE 1922

Insulating Tubings and Sleevings- High Temperature Wire and Cable



FLEXLEAD®

High temperature Wire and Cable insulated with Teflon (TFE or FEP) or silicone rubber. You can select a numbered FLEXLEAD type listed below, or let Markel quote, to your specifications, on a custom FLEXLEAD construction.

MIL-W-16878D

Type E—600 v. Stranded silver-plated copper insulated with extruded DuPont Teflon TFE
Type E—600 v. Stranded silver-plated copper insulated with wrapped and sintered Teflon TFE tape
Type EE—1000 v. Stranded silver-plated copper conductor insulated with extruded Teflon TFE
Type EE—1000 v. Stranded silver-plated copper insulated with wrapped and sintered TFE tape
Type ET—300 v. Stranded silver-plated copper conductor insulated with extruded Teflon TFE
Type ET—300 v. Stranded silver-plated copper insulated with wrapped and sintered TFE tape
Type K—600 v. Stranded silver-plated copper conductor insulated with extruded Teflon FEP
Type KK—1000 v. Stranded silver-plated copper conductor insulated with extruded Teflon FEP
Type KT—300 v. Stranded silver-plated copper conductor insulated with extruded Teflon FEP
Type F—600 v. Stranded tin-coated copper conductor insulated with extruded silicone rubber
Type F—600 v. Same as Type F above, jacketed with silicone resin-impregnated fiberglass braid
Type FF—1000 v. Stranded tin-coated copper conductor insulated with extruded silicone rubber
Type FF—1000 v. Same as Type FF above, jacketed with silicone resin-impregnated fiberglass braid

U/L APPROVED

Extruded Teflon Wires, sizes 10-28 AWG; 80°C to 200°C ratings; 300 and 600 volt ratings: U/L Style Nos. **1164, 1180, 1198, 1199, 1212, 1213.**

Extruded Silicone Rubber Wires, various constructions, with and without fiberglass jackets; sizes 10-32 AWG; 150°C and 200°C ratings; 300 and 600 volt ratings: U/L Style Nos. **3066, 3067, 3068, 3069, 3070, 3071, 3074, 3075, 3101, 3113, 3122, 3123, 3132, 3133, 3134, 3135, 3136, 3137, 3138, 3139, 3140,** 3141, 3142, 3143, 3144, **3145, 3180, SF-1, SF-2, SFF-1, SFF-2.**

Ask for data sheets, prices, and samples of these FLEXLEAD wire constructions

FLEXLEAD Coaxial Cables. Markel manufactures a complete line of both standard and special RG/U coaxial cables. In accordance with specifications, types are available with silver-plated copper, plated or unplated copper-covered steel, or bare copper center conductor; one or two braided shields; tape-wrapped Teflon shield guards; and outer jacketing of impregnated fiberglass braid or Teflon (extruded or tape-wrapped). For complete data, ask for a FLEXLEAD Coaxial Cable Specifications folder.

FLEXLEAD Special Constructions. Because wiring problems cannot always be solved with standard materials, Markel's capacity for engineering high temperature wire and cable constructions to meet particular needs has grown steadily with the demand. We can combine insulations—Teflon, silicone rubber, fiberglass, nylon-shielding, fillers, liners, and jacket materials—with single, twisted pair or multiple conductors—to provide a special cable construction for any temperature range from —90° to 260°C.

FLEXLEAD Fused Twisted Pair. This unique Teflon-insulated twisted pair construction finds wide application in computers and similar circuitry. The fusing, which will withstand predetermined pulls to separate the individual wires, keeps the wires evenly twisted for easier assembly and uniform capacitance and inductance. Ask for a test sample and prices.

FLEXLEAD MB Bondable Teflon. The Markel MB process can be factory-applied to any of the FLEXLEAD Teflon wires, extruded or tape-wrapped, and renders the surface bondable with commonly used elastomeric and epoxy-base potting and encapsulating compounds. Without affecting the color or electrical properties of the insulation, the MB treatment provides a bond with up to 150 psi pull-out strength, and a surface that is receptive to marking and printing.

1 SOURCE *for* EXCELLENCE *in Insulating Tubings and Sleevings • High Temperature Wire and Cable*

L. FRANK MARKEL & SONS

NORRISTOWN, PENNSYLVANIA 19404
Telephone: 215-272-8960 • TWX: 510-660-0190

NATIONAL LOS ANGELES, CALIF.

WIRE & CABLE CORPORATION

SPECIAL SHIELDED DATA & INSTRUMENTATION CABLES

Designed for Low Level or Low Capacitance Needs
All feature extremely low dielectric leakage both in insulation and outer sheath.
Suitable for very long runs in tray or conduit. (1000. ft and up).

SINGLE CONDUCTOR SHIELDED



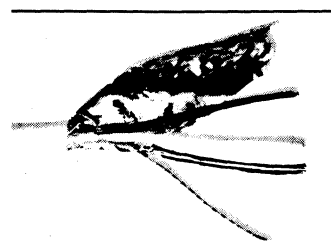
Part Number	AWG & Stranding	Drain AWG & Str.	Insulation & Thickness	Jacket Thickness	Nom. O.D.	Shld % Coverage	Cap. mmfd/ft	Working Voltage	Surge Impedance Ohms	Temp. °F
S10-516	28(7 x 38)	—	.086" NAFOAM	.015" pvc	.242"	TC Braid 90%*	12.	3000.	120.	+180
S10-328-1	22(19 x 34)	—	.042" NAFOAM	.020" pvc	.182"	(1) 90% Braid*	20.7	1000.	60.	+180
S10-328-2						(2) 100% NAFOIL & Braid	20.7	1000.		
S10-680	22(19 x 34)	22 7 x 30	.032" poly	.016" pvc	.135"	NAFOIL & DRAIN	30.	3000.	—	+180
S10-679	22(19 x 34)	24 7 x 32	.010" pvc .002" nylon	.015" pvc	.091"	100% NAFOIL & DRAIN	100.	600.	25.	+221

TWO CONDUCTOR SHIELDED



S10-010-1 S10-010-2 S10-010-3	22(19 x 34)	—	.042" NAFOAM	.020" pvc	.295"	(1) 90% Braid (2) 100% NAFOIL + Braid (3) NAFOIL only	10.6 W-W	1000.	120.	+180
S10-681	22(19 x 34)	22 7 x 30	.025" NAFOAM	.020" poly	.210"	100% NAFOIL & Drain	15. W-W	600.	84.	+180
S10-686	22(19 x 34)	22 7 x 30	.018" NAFOAM	.020" poly	.178"	100% NAFOIL & Drain	20.	600.	63.	+180
S10-362	22(19 x 34)	22 7 x 30	.010" pvc .002" nylon	.020" poly	.166"	100% NAFOIL & Drain	40. W-W	600.	52.	+180

THREE CONDUCTOR SHIELDED



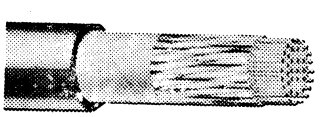
S10-683	22(19 x 34)	18 19 x 30	.042" NAFOAM	.020" pvc	.297"	100% NAFOIL & Drain	10.	1000.	—	+180
S10-684	22(19 x 34)	20 19 x 32	.018" NAFOAM	.020" pvc	.185"	100% NAFOIL & Drain	20.	600.	—	+180

TRIAXIAL CABLES (Low Noise)



S10-685	22(19 x 34)	—	.042" NAFOAM	Inner: .020" poly Outer: .020" pvc	.253"	NAFOIL 100% + Braid Inner & Outer (Suitable for Microvolt Signals)	20. 130.	600.	60.	+180

MULTI-CONDUCTOR DATA CABLES (Specify Polyethylene sheath if used for direct burial.)

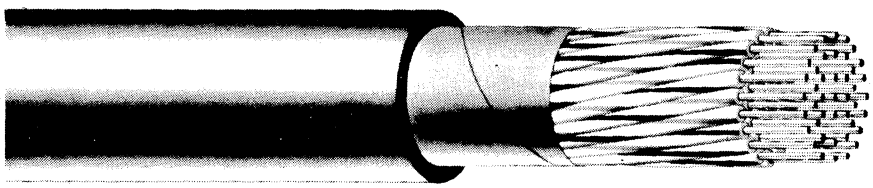


ALL SHIELDED PR.	PART NUMBER	NO. OF SUBCABLES	SUBCABLE TYPE	SHEATH THICKNESS	NOM. O.D.	WT./ M FT.
Digital Data	NW-12-362 NW-19-362	12 19	S10-362 S10-362	.060" pvc .065" pvc	.800" .960"	320. 480.
Cabled 110. ohm TW. Pairs	NW-2424P NW-3024P NW-4824P	24 TW PR 30 TW PR 48 TW PR	24 AWG TW PAIR Z = 110. Ω	.040" pvc .050" pvc .055" pvc	.660" .704" .890"	160. 200. 275.
Shld. Pr.	NW-12-010	12	SD-010-2	.125" neo.	1.50"	390.
Lo-Capac Coaxials	NW-12-328 NW-19-328	12 19	S10-328-2 S10-328-2	.060" pvc .070" pvc	.870" 1.05"	270. 420.

CODE: poly (polyethylene), pvc (polyvinyl chloride). * Not preferred for microvolt signals.

NATIONAL WIRE & CABLE CORP.
TWX: 910-321-4155

Dept. eem SERVICE DIVISION
136 SAN FERNANDO ROAD
LOS ANGELES, CALIF. 90031
PHONE (213) 225-5611



In Stock MIL-SPEC

Multiple Conductor Cables!

National Wire & Cable Corporation manufactures a complete line of multiple conductor control cables. Conductors are of tinned copper strand with primary insulation for use up to 105°C per MIL-W-16878D Type C. Insulated for 1000 volts working voltage. Conductors are color coded using 10 standard basic colors, plus spiral tracers on white per MIL-STD. 122.

All conductors are planetary cabled and contra-helically laid with a Mylar tape serve over the cable bundle. The overall jacket is a 105°C black Thermoplastic or may be Neoprene to MIL-R-6855 Class 2 Grade 60 specification.

SHIELDED CABLES

National Multiple Conductor SHIELDED CABLES are to the same specifications as above with addition of tinned copper braided shield over cable complex with 85-90% coverage to MIL-C-7078A. STANDARD PUT-UPS: 500 ft. and 1000 ft. No-deposit reels.

TECHNICAL DATA (all cables)

Insulation Breakdown Voltage:	Greater than 8000 volts AC RMS, 60 cps.
Capacitance:	Nominal capacitance from a wire to all else in the cable ranges from 40 to 65 mmfd per ft., @ 1000 cps; dependent on cable construction.
Insulation Leakage Res.:	200. megohms/1000 ft. min. at 500 VDC from any conductor to all else in cable.
Sheath Leakage Res.:	10. megohms/1000 ft. min. at 500 VDC from overall shield through sheath to outside world.
Useable Temp. Range:	Suitable for continuous use from +105°C to −55°C.
Cold Bending Capability:	All cables are suitable for flexing to a circle diam. of approx. 6 cable diameters from +105°C to −20°C; Recommended flex diameter should be greater than 20 cable diam. for flexing at −40°C., or for continuous flexing service to −55°C, specify our neoprene sheath, in lieu of plastic sheath.

MULTI-CONDUCTOR STOCK CABLES

Conductor sizes 22, 20, 18, 16, 14 & 12 gauge. 22 AWG is 7 strand. All others 19 strand.

UNSHIELDED

PART NO.	NO. COND.	COND. AWG	JKT. THICK	CABLE O.D.	WEIGHT PER M'
NW-722 J	7	22	.040	.295	40 Lbs.
NW-1222J	12	22	.050	.390	70 Lbs.
NW-1922J	19	22	.060	.460	110 Lbs.
NW-2722J	27	22	.060	.530	160 Lbs.
NW-3722J	37	22	.060	.600	200 Lbs.
NW-4822J	48	22	.060	.670	245 Lbs.
NW-6022J	60	22	.060	.730	300 Lbs.
NW-7222J	72	22	.060	.775	360 Lbs.
NW-8822J	88	22	.060	.835	425 Lbs.
NW-10222J	102	22	.060	.880	485 Lbs.
NW-720 J	7	20	.040	.300	50 Lbs.
NW-1220J	12	20	.050	.400	105 Lbs.
NW-1920J	19	20	.060	.470	160 Lbs.
NW-2720J	27	20	.060	.560	210 Lbs.
NW-3720J	37	20	.060	.610	280 Lbs.
NW-4820J	48	20	.060	.700	360 Lbs.
NW-6020J	60	20	.060	.750	435 Lbs.
NW-7220J	72	20	.060	.840	485 Lbs.
NW-8820J	88	20	.060	.900	580 Lbs.
NW-10220J	102	20	.060	.975	670 Lbs.
NW-718 J	7	18	.040	.350	75 Lbs.
NW-1218J	12	18	.050	.460	135 Lbs.
NW-1918J	19	18	.060	.560	225 Lbs.
NW-2718J	27	18	.060	.650	300 Lbs.
NW-3718J	37	18	.060	.730	390 Lbs.
NW-4818J	48	18	.060	.820	510 Lbs.
NW-6018J	60	18	.060	.900	600 Lbs.
NW-7218J	72	18	.060	1.100	720 Lbs.
NW-716 J	7	16	.040	.370	95 Lbs.
NW-1216J	12	16	.050	.500	155 Lbs.
NW-1916J	19	16	.060	.600	230 Lbs.
NW-2716J	27	16	.060	.700	320 Lbs.
NW-3716J	37	16	.060	.785	430 Lbs.
NW-4816J	48	16	.060	.900	625 Lbs.
NW-6016J	60	16	.060	.980	750 Lbs.
NW-714 J	7	14	.050	.450	150 Lbs.
NW-1214J	12	14	.050	.560	240 Lbs.
NW-1914J	19	14	.060	.675	370 Lbs.
NW-2714J	27	14	.060	.800	515 Lbs.
NW-512 J	5	12	.050	.480	175 Lbs.
NW-712 J	7	12	.050	.525	225 Lbs.
NW-1212J	12	12	.060	.700	375 Lbs.
NW-1912J	19	12	.060	.820	560 Lbs.

O'ALL SHIELDED

PART NO.	NO. COND	COND AWG	T.C. SHIELD	JKT. THICK	CABLE O.D.	WEIGHT PER M'
NW-722 SJ	7	22	No. 36	.040	.320	55 Lbs.
NW-1222SJ	12	22	No. 34	.050	.420	90 Lbs.
NW-1922SJ	19	22	No. 34	.060	.490	145 Lbs.
NW-2722SJ	27	22	No. 34	.060	.560	200 Lbs.
NW-3722SJ	37	22	No. 34	.060	.630	245 Lbs.
NW-4822SJ	48	22	No. 34	.060	.700	300 Lbs.
NW-6022SJ	60	22	No. 34	.060	.760	355 Lbs.
NW-7222SJ	72	22	No. 34	.060	.810	425 Lbs.
NW-8822SJ	88	22	No. 34	.060	.870	500 Lbs.
NW-10222SJ	102	22	No. 34	.060	.915	560 Lbs.
NW-720 SJ	7	20	No. 34	.040	.335	68 Lbs.
NW-1220SJ	12	20	No. 34	.050	.435	125 Lbs.
NW-1920SJ	19	20	No. 34	.060	.500	195 Lbs.
NW-2720SJ	27	20	No. 34	.060	.595	250 Lbs.
NW-3720SJ	37	20	No. 34	.050	.650	325 Lbs.
NW-4820SJ	48	20	No. 34	.060	.735	415 Lbs.
NW-6020SJ	60	20	No. 34	.060	.785	500 Lbs.
NW-7220SJ	72	20	No. 34	.060	.875	555 Lbs.
NW-8820SJ	88	20	No. 34	.060	.935	660 Lbs.
NW-10220SJ	102	20	No. 34	.060	1.010	750 Lbs.
NW-718 SJ	7	18	No. 34	.040	.380	95 Lbs.
NW-1218SJ	12	18	No. 34	.050	.490	170 Lbs.
NW-1918SJ	19	18	No. 34	.060	.590	265 Lbs.
NW-2718SJ	27	18	No. 34	.060	.680	350 Lbs.
NW-3718SJ	37	18	No. 34	.060	.760	445 Lbs.
NW-4818SJ	48	18	No. 34	.060	.850	575 Lbs.
NW-6018SJ	60	18	No. 34	.060	.935	680 Lbs.
NW-7218SJ	72	18	No. 34	.060	1.135	820 Lbs.
NW-716 SJ	7	16	No. 34	.040	.400	125 Lbs.
NW-1216SJ	12	16	No. 34	.050	.535	195 Lbs.
NW-1916SJ	19	16	No. 34	.060	.635	275 Lbs.
NW-2716SJ	27	16	No. 34	.060	.735	375 Lbs.
NW-3761SJ	37	16	No. 34	.060	.820	500 Lbs.
NW-4816SJ	48	16	No. 34	.060	.935	700 Lbs.
NW-6016SJ	60	16	No. 34	.060	1.015	830 Lbs.
NW-714 SJ	7	14	No. 34	.050	.485	180 Lbs.
NW-1214SJ	12	14	No. 34	.050	.600	280 Lbs.
NW-1914SJ	19	14	No. 34	.060	.710	420 Lbs.
NW-2714SJ	27	14	No. 34	.060	.835	575 Lbs.
NW-512 SJ	5	12	No. 34	.050	.515	210 Lbs.
NW-712 SJ	7	12	No. 34	.050	.560	265 Lbs.
NW-1212SJ	12	12	No. 34	.060	.735	430 Lbs.
NW-1912SJ	19	12	No. 34	.060	.850	625 Lbs.

NATIONAL WIRE & CABLE CORP.
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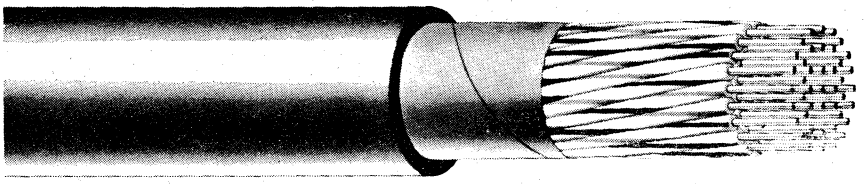
PHONE (213) 225-5611



In Stock
U. L. APPROVED
COMPUTER GRADE

MINIATURE SIGNAL & CONTROL CABLES

National Wire & Cable Corp. manufactures a complete line of MINIATURE low voltage signal and control cable. Available as cabled pairs or cabled singles, with optional overall shield. Conductors are stranded tinned copper with .010" wall of vinyl primary insulation for use of to 105°C. per MIL-W-16878 Type B. Insulated for 600 volts working voltage. (Also meets U.L. AWM Type 1061; 300 volt, 80°C.) all are coded using 10 standard colors plus stripes on white per MIL-STD-681.

All conductors are planetary cabled and contra-helically laid for optimum flexibility, with a Mylar tape barrier under shields. Shielded cables have a tinned copper braid overall, of 85-90% coverage per MIL-C-7078; and braid angles below 40° for easy pushback.

The outer jacket is black abrasion-resistant 105°C vinyl meeting MIL-I-631 Type F. All materials are self-extinguishing and fungus resistant. All items are U.L. APPROVED STYLE 2343 COMPUTER CABLE; rated 300 volt, 80°C. (Higher temp. ratings apply for any non-U.L. service.)

Standard Putups: 500 & 1000. No-deposit reels.

*denotes UL Style 2344

TECHNICAL DATA (all cables)

Insulation Breakdown Voltage: Greater than 5000 volts AC RMS, 60 cps.

Capacitance: Nominal capacitance from a wire to all else in a cable ranges from 45 to 70 pf/ft at 1 kc, depending on gauge and position.

Insulation Leakage: 200 megohms/1000 ft. min. @ 500 VDC from any conductor to all else in cable.

Sheath Linkage: 10 megohms/1000 ft. min. @ 500 VDC from shield or conductor group through sheath to ground.

Temperature Range: Suitable for continuous use from −40°C to +105°C. (U.L. Service limited to +80°C.)

Bending Characteristics: All cables are suitable for flexing to a circle diameter of 6 cable diameters from +105°C to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°C.

MULTI-CONDUCTOR STOCK CABLES (Singles) Cond: 22, 24 are 7 strand; 20 AWG is 19 str.

UNSHIELDED							OVERALL SHIELDED							
Part No.	No. Cond.	Cond. AWG	Cond. O.D.	Jkt Wall	Cable O.D.	Weight lb/m′	Part No.	No. Cond.	Cond. AWG	Cond. O.D.	Jkt Wall	Shld AWG	Cable O.D.	Weight lb/m′
NX 524J	5	24	.045	.062	.220	32	NX 524SJ	5	24	.045	.062	36	.245	44
NX 724J	7	24	.045	.062	.250	40	NX 724SJ	7	24	.045	.062	36	.275	55
NX 1224J	12	24	.045	.062	.300	53	NX 1224SJ	12	24	.045	.062	36	.325	68
NX 1524J	15	24	.045	.062	.330	65	NX 1524SJ	15	24	.045	.062	36	.350	80
NX 1924J	19	24	.045	.062	.340	73	NX 1924SJ	19	24	.045	.062	36	.365	88
NX 2724J	27	24	.045	.062	.390	85	NX 2724SJ	27	24	.045	.062	36	.415	102
NX 3724J	37	24	.045	.062	.420	120	NX 3724SJ	37	24	.045	.062	36	.445	140
NX 4824J	48	24	.045	.062	.470	142	NX 4824SJ	48	24	.045	.062	36	.495	172
NX 6024J	60	24	.045	.062	.510	170	NX 6024SJ	60	24	.045	.062	36	.535	205
NX 522J	5	22	.050	.062	.260	40	NX 522SJ	5	22	.050	.062	36	.285	50
NX 722J	7	22	.050	.062	.270	48	NX 722SJ	7	22	.050	.062	36	.295	58
NX 1222J	12	22	.050	.062	.330	72	NX 1222SJ	12	22	.050	.062	36	.355	87
NX 1522J	15	22	.050	.062	.350	85	NX 1522SJ	15	22	.050	.062	36	.380	101
NX 1922J	19	22	.050	.062	.370	96	NX 1922SJ	19	22	.050	.062	36	.395	111
NX 2722J	27	22	.050	.062	.430	130	NX 2722SJ	27	22	.050	.062	36	.455	150
NX 3722J	37	22	.050	.062	.480	163	NX 3722SJ	37	22	.050	.062	34	.510	193
NX 4822J	48	22	.050	.062	.530	210	NX 4822SJ	48	22	.050	.062	34	.560	245
NX 6022J	60	22	.050	.062	.570	255	NX 6022SJ	60	22	.050	.062	34	.600	295
NX 520J	5	20	.057	.062	.275	49	NX 520SJ	5	20	.057	.062	36	.300	59
NX 720J	7	20	.057	.062	.290	59	NX 720SJ	7	20	.057	.062	36	.315	69
NX 1220J	12	20	.057	.062	.360	90	NX 1220SJ	12	20	.057	.062	36	.385	105
NX 1520J	15	20	.057	.062	.390	110	NX 1520SJ	15	20	.057	.062	36	.415	137
NX 1920J	19	20	.057	.062	.410	128	NX 1920SJ	19	20	.057	.062	36	.435	158
NX 2720J	27	20	.057	.062	.490	166	NX 2720SJ	27	20	.057	.062	36	.515	196
NX 3720J	37	20	.057	.062	.520	220	NX 3720SJ	37	20	.057	.062	34	.550	255
NX 4820J	48	20	.057	.062	.580	275	NX 4820SJ	48	20	.057	.062	34	.610	320
NX 6020J	60	20	.057	.062	.640	335	NX 6020SJ	60	20	.057	.062	34	.670	385

MULTI-CONDUCTOR STOCK CABLED PAIRS

Part No.	No. Pairs	Cond. AWG	Cond. O.D.	Jkt Wall	Cable O.D.	Weight lb/m′	Part No.	No. Pairs	Cond. AWG	Cond. O.D.	Jkt Wall	T.C. Shield	Cable O.D.	Weight per M′
NXP 524J	5	24	.045	.062	.330	52	NXP 524SJ	5	24	.045	.062	#36	.355	67
NXP 724J	7	24	.045	.062	.350	60	NXP 724SJ	7	24	.045	.062	#36	.375	75
NXP 1224J	12	24	.045	.062	.435	90	NXP 1224SJ	12	24	.045	.062	#36	.460	115
NXP 1524J	15	24	.045	.062	.485	110	NXP 1524SJ	15	24	.045	.062	#36	.510	140
NXP 1924J	19	24	.045	.062	.505	126	NXP 1924SJ	19	24	.045	.062	#36	.530	161
NXP 2724J	27	24	.045	.062	.590	167	NXP 2724SJ	27	24	.045	.062	#34	.620	211
NXP 3724J	37	24	.045	.062	.660	216	NXP 3724SJ	37	24	.045	.062	#34	.690	266
NXP 4824J	48	24	.045	.062	.745	270	NXP 4824SJ	48	24	.045	.062	#34	.775	330
NXP 6024J	60	24	.045	.062	.815	325	NXP 6024SJ*	60	24	.045	.062	#34	.845	390
NXP 522J	5	22	.050	.062	.365	56	NXP 522SJ	5	22	.050	.062	#36	.390	77
NXP 722J	7	22	050	.062	.390	82	NXP 722SJ	7	22	.050	.062	#36	.415	110
NXP 1222J	12	22	.050	.062	.470	120	NXP 1222SJ	12	22	.050	.062	#36	.495	150
NXP 1522J	15	22	.050	.062	.545	145	NXP 1522SJ	15	22	.050	.062	#34	.575	185
NXP 1922J	19	22	.050	.062	.550	170	NXP 1922SJ	19	22	.050	.062	#34	.580	210
NXP 2722J	27	22	.050	.062	.670	230	NXP 2722SJ	27	22	.050	.062	#34	.600	280
NXP 3722J	37	22	.050	.062	.750	300	NXP 3722SJ	37	22	.050	.062	#34	.780	357
NXP 4822J*	48	22	.050	.080	.850	375	NXP 4822SJ*	48	22	.050	.080	#34	.880	445
NXP 6022J*	60	22	.050	.080	.930	460	NXP 6022SJ*	60	22	.050	.080	#34	.960	535
NXP 520J	5	20	.057	.062	.395	82	NXP 520SJ	5	20	.057	.062	#36	.420	102
NXP 720J	7	20	.057	.062	.440	108	NXP 720SJ	7	20	.057	.062	#36	.465	123
NXP 1220J	12	20	.057	.062	.540	163	NXP 1220SJ	12	20	.057	.062	#34	.570	203
NXP 1520J	15	20	.057	.062	.600	196	NXP 1520SJ	15	20	.057	.062	#34	.630	241
NXP 1920J	19	20	.057	.062	.630	235	NXP 1920SJ	19	20	.057	.062	#34	.660	280
NXP 2720J	27	20	.057	.062	.745	320	NXP 2720SJ	27	20	.057	.062	#34	.775	380
NXP 3720J	37	20	.057	.062	.820	420	NXP 3720SJ*	37	20	.057	.080	#34	.850	490
NXP 4820J*	48	20	.057	.080	.950	530	NXP 4820SJ*	48	20	.057	.080	#34	.980	605
NXP 6020J*	60	20	.057	.080	1.040	650	NXP 6020SJ*	60	20	.057	.080	#34	1.070	735

NATIONAL WIRE & CABLE CORP.
TWX: 910-321-4155

Dept. eem SERVICE DIVISION
136 SAN FERNANDO ROAD
LOS ANGELES, CALIF. 90031
PHONE (213) 225-5611



In Stock MIL-SPEC

Multiple Pair SIGNAL & CONTROL CABLES

Identical to National's NW-Series Cables except offered as twisted pairs.

National Wire & Cable Corporation manufactures a complete line of multiple pair control cables. Conductors are of tinned copper strand with 1/64" vinyl primary insulation for use up to 105° C per MIL-W-16878D Type C. Insulated for **1000** volts working voltage. Conductors are color coded using 10 standard basic colors, plus spiral tracers on white per table below.

All pairs are planetary cabled and contra-helically laid with a Mylar tape serve over the cable bundle. The overall jacket is a 105°C black vinyl plastic per MIL-I-631; or may be Neoprene to MIL-R-6855 Class 2 Grade 60 specification. (Neoprene at added cost).

SHIELDED CABLES

National Multiple Conductor SHIELDED CABLES are to the same specifications as above with addition of tinned copper braided shield over cable complex with 85-90% coverage to MIL-C-7078A. STANDARD PUT-UPS: 500 ft. and 1000 ft. No-deposit reels.

For shielded pairs see pg. 37 or consult factory.

TECHNICAL DATA (all cables)

Insulation Breakdown Voltage: Greater than 8,000 volts AC RMS, 60 cps.

Capacitance: Nominal capacitance wire to wire for a pair ranges from 27. to 40. mmfd/ft. Capacitance from both wires tied together measured to all else in common ranges from 35. to 60. mmfd/ft. dependent on gauge and position. Overall shield has negligible effect on W-W capacitance.

Insulation Leakage Res.: 200. megohms / 1000 ft. min. at 500 VDC from any conductor to all else in cable.

Sheath Leakage Res.: 10. megohms / 1000 ft. min. at 500 VDC from overall shield through sheath to outside world.

Usable Temp. Range: Suitable for continuous use from +105°C to −55°C.

Cold Bending Capability: All cables are suitable for flexing to a circle diam. of approx. 6 cable diameters from +105°C to −20°C; Recommended flex diameter should be greater than 20 cable diam. for flexing at −40°C., or for continuous flexing service to −55°C, specify our neoprene sheath, in lieu of plastic sheath.

MULTIPLE PAIR STOCK CABLES

UNSHIELDED OVERALL

PART NO.	NO. OF PAIRS	COND. GA.	JKT. THICK	O.D.	WEIGHT
NWP-722 J	7	22	.045	.470	90 Lbs.
NWP-1222J	12	22	.050	.600	150 Lbs.
NWP-1922J	19	22	.050	.700	200 Lbs.
NWP-2722J	27	22	.055	.830	280 Lbs.
NWP-3722J	37	22	.060	.960	370 Lbs.
NWP-4822J	48	22	.060	1.080	470 Lbs.
NWP-6022J	60	22	.060	1.200	560 Lbs.
NWP-720 J	7	20	.050	.520	120 Lbs.
NWP-1220J	12	20	.050	.660	200 Lbs.
NWP-1920J	19	20	.050	.800	290 Lbs.
NWP-2720J	27	20	.060	.960	420 Lbs.
NWP-3720J	37	20	.060	1.100	500 Lbs.
NWP-4820J	48	20	.060	1.240	620 Lbs.
NWP-6020J	60	20	.060	1.380	750 Lbs.
NWP-718 J	7	18	.050	.580	150 Lbs.
NWP-1218J	12	18	.050	.740	290 Lbs.
NWP-1918J	19	18	.060	.920	400 Lbs.
NWP-2718J	27	18	.060	1.080	560 Lbs.
NWP-3718J	37	18	.060	1.240	750 Lbs.
NWP-4818J	48	18	.060	1.400	900 Lbs.
NWP-716 J	7	16	.050	.640	180 Lbs.
NWP-1216J	12	16	.060	.840	300 Lbs.
NWP-1916J	19	16	.060	1.020	430 Lbs.
NWP-2716J	27	16	.060	1.200	720 Lbs.
NWP-3716J	37	16	.060	1.380	1000 Lbs.

MULTIPLE PAIR STOCK CABLES

OVERALL SHIELDED

PART NO.	NO. OF PAIRS	COND. GA.	JKT. THICK	O.D.	WEIGHT
NWP-722 SJ	7	22	.045	.495	135 Lbs.
NWP-1222SJ	12	22	.050	.630	206 Lbs.
NWP-1922SJ	19	22	.050	.730	260 Lbs.
NWP-2722SJ	27	22	.055	.860	358 Lbs.
NWP-3722SJ	37	22	.060	.990	460 Lbs.
NWP-4822SJ	48	22	.060	1.110	570 Lbs.
NWP-6022SJ	60	22	.060	1.230	675 Lbs.
NWP-720 SJ	7	20	.050	.550	170 Lbs.
NWP-1220SJ	12	20	.050	.690	260 Lbs.
NWP-1920SJ	19	20	.050	.830	355 Lbs.
NWP-2720SJ	27	20	.060	.990	510 Lbs.
NWP-3720SJ	37	20	.060	1.130	603 Lbs.
NWP-4820SJ	48	20	.060	1.270	735 Lbs.
NWP-6020SJ	60	20	.060	1.410	880 Lbs.
NWP-718 SJ	7	18	.050	.610	205 Lbs.
NWP-1218SJ	12	18	.050	.770	360 Lbs.
NWP-1918SJ	19	18	.060	.950	487 Lbs.
NWP-2718SJ	27	18	.060	1.110	660 Lbs.
NWP-3718SJ	37	18	.060	1.270	865 Lbs.
NWP-4818SJ	48	18	.060	1.430	1030 Lbs.
NWP-716 SJ	7	16	.050	.670	240 Lbs.
NWP-1216SJ	12	16	.060	.870	377 Lbs.
NWP-1916SJ	19	16	.060	1.050	520 Lbs.
NWP-2716SJ	27	16	.060	1.230	830 Lbs.
NWP-3716SJ	37	16	.060	1.410	1330 Lbs.

COLOR CODING USED ON TWISTED PAIRS

PR #	PAIR COLORS	PR #	PAIR COLORS	PR #	PAIR COLORS	PR #	PAIR COLORS	PR #	PAIR COLORS	PR #	PAIR COLORS
1.	WHITE WITH BLACK	11.	BLACK WITH RED	21.	BROWN WITH GREEN	31.	ORANGE WITH YELLOW	41.	GREEN WITH VIOLET	51.	WHT/BLK WITH GREEN
2.	WHITE WITH BROWN	12.	BLACK WITH ORANGE	22.	BROWN WITH BLUE	32.	ORANGE WITH GREEN	42.	GREEN WITH GRAY	52.	WHT/BLK WITH BLUE
3.	WHITE WITH RED	13.	BLACK WITH YELLOW	23.	BROWN WITH VIOLET	33.	ORANGE WITH BLUE	43.	BLUE WITH VIOLET	53.	WHT/BLK WITH VIOLET
4.	WHITE WITH ORANGE	14.	BLACK WITH GREEN	24.	BROWN WITH GRAY	34.	ORANGE WITH VIOLET	44.	BLUE WITH GREY	54.	WHT/BLK WITH GRAY
5.	WHITE WITH YELLOW	15.	BLACK WITH BLUE	25.	RED WITH ORANGE	35.	ORANGE WITH GRAY	45.	VIOLET WITH GRAY	55.	WHT/BRN WITH BLACK
6.	WHITE WITH GREEN	16.	BLACK WITH VIOLET	26.	RED WITH YELLOW	36.	YELLOW WITH GREEN	46.	WHT/BLK WITH BLACK	56.	WHT/BRN WITH BROWN
7.	WHITE WITH BLUE	17.	BLACK WITH GRAY	27.	RED WITH GREEN	37.	YELLOW WITH BLUE	47.	WHT/BLK WITH BROWN	57.	WHT/BRN WITH RED
8.	WHITE WITH VIOLET	18.	BROWN WITH RED	28.	RED WITH BLUE	38.	YELLOW WITH VIOLET	48.	WHT/BLK WITH RED	58.	WHT/BRN WITH ORANGE
9.	WHITE WITH GRAY	19.	BROWN WITH ORANGE	29.	RED WITH VIOLET	39.	YELLOW WITH GRAY	49.	WHT/BLK WITH ORANGE	59.	WHT/BRN WITH YELLOW
10.	BLACK WITH BROWN	20.	BROWN WITH YELLOW	30.	RED WITH GRAY	40.	GREEN WITH BLUE	50.	WHT/BLK WITH YELLOW	60.	WHT/BRN WITH GREEN

NATIONAL WIRE & CABLE CORP.
TWX: 910-321-4155

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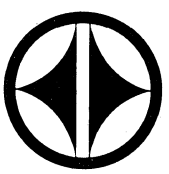
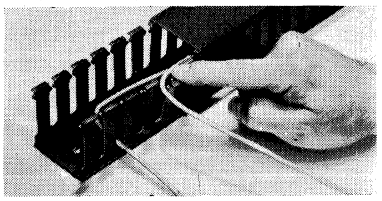
Look in the Yellow Section for Manufacturers' Sales Offices



Tell them you found them in eem

PANDUIT® wiring components



Type E — Open Slot

PART NUMBER SYSTEM

Channel Only

Example: E 1.5 x 2 DG 6

E — Type; 1.5 — 1.5" Wide; 2 — 2" High; DG — Dark Gray; 6 — 6' Long

Cover Only

Example: C 1.5 DG 6

C — Cover; 1.5 — 1.5" Wide; DG — Dark Gray; 6 — 6' Long

Color Code: Dark Gray (DG); Light Gray (LG); White (WH).

PANDUCT® CHANNEL ONLY

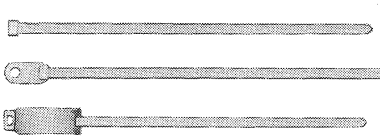
Types Avail.	Nominal Width x Height (Inches)	Approx. Shpg. Wt. Per 100'	Price/Foot Under 200 ft.	200 to 1999 ft.	2000 to 4999 ft.
E	.5x.5	11 lbs.	$0.43	$0.34	$0.31
E	.5x.62	12 lbs.	.45	.36	.34
E	.5x1	16 lbs.	.49	.39	.37
E	.5x1.25	16 lbs.	.56	.44	.40
E	.5x1.75	16 lbs.	.58	.47	.44
E	.75x.75	14 lbs.	.48	.38	.36
E	.75x1	16 lbs.	.49	.39	.37
E	.75x1.5	19 lbs.	.58	.46	.43
E	.75x2	23 lbs.	.71	.57	.52
E	1x1	16 lbs.	.49	.40	.37
E	1x1.5	18 lbs.	.65	.53	.49
E	1x2	21 lbs.	.69	.55	.51
E	1x3	31 lbs.	.88	.71	.65
E	1.5x1.5	20 lbs.	.69	.56	.50
E	1.5x2	20 lbs.	.75	.60	.55
E	1.5x3	30 lbs.	.95	.76	.70
E	1.5x4	40 lbs.	1.21	.97	.89
E	2x1	18 lbs.	.68	.55	.49
E	2x2	23 lbs.	.76	.61	.56
E	2x3	36 lbs.	.98	.78	.72
E	2x4	48 lbs.	1.26	1.01	.93
E	2.5x3	41 lbs.	1.04	.83	.77
E	3x1	20 lbs.	.82	.65	.61
E	3x2	33 lbs.	.89	.71	.65
E	3x3	43 lbs.	1.07	.85	.78
E	3x4	53 lbs.	1.32	1.06	.97
E	4x1.5	33 lbs.	.94	.75	.70
E	4x2	38 lbs.	.96	.77	.71
E	4x3	48 lbs.	1.14	.92	.84
E	4x4	58 lbs.	1.42	1.13	1.04

CORRESPONDING COVER ONLY

Nominal Width (Inches)	Approx. Shpg. Wt./100'	Price/Foot Under 200 ft.	200 to 1999 ft.	2000 to 4999 ft.
.5	4 lbs.	$0.10	$0.08	$0.07
.75	6 lbs.	.11	.09	.08
1	9 lbs.	.14	.11	.10
1.5	10 lbs.	.16	.13	.12
2	12 lbs.	.20	.16	.14
2.5	14 lbs.	.24	.20	.17
3	17 lbs.	.28	.23	.21
4	22 lbs.	.36	.28	.26

Order by Total No. of Ft. Req'd. (must be multiple of length per part). Standard Mounting Holes: No Charge — Supplied Only if Specified — See Duct Catalog For Dimensions.
NOTE: Standard Length: 6 ft. Other lengths available. Standard Color: Dark Gray. White and Light Gray available.
NOTE: Total length of all sizes of duct and cover, ordered for shipment at one time to one location, determines price columns.

STA-STRAP® CABLE TIES AND CLAMPS



SST — Cable Ties

SSC — Clamps

SSM — Markers

**** Part Number System:**

SST 2 M-6

SST — Type; 2 — Size; M — Pkg. Size; 6 — Color

STANDARD PKG. OF 100 (C)

**Part Number	Maximum Bundle Diameter	Approx. Shpg. Wt. lbs./1000	Price Per 100 Base Price 100 - 400	500
SST1C	3/4"	1	$ 3.60	$ 2.85
SST1.5C	1 1/4"	1.5	3.75	3.00
SST2C	1 3/4"	2.6	4.30	3.40
SST3IC	3"	2.6	7.00	5.65
SST3C	3"	3.5	7.60	6.05
SST4C	4"	4.5	9.80	7.80
SST4HC	4"	12	14.50	11.50
SST8HC	8"	24	22.50	18.00
SSC2C	1 3/4"	3.2	4.90	3.90
SSC4C	4"	5.5	10.80	8.60
SSC4HC	4"	14	17.00	13.60
SSM2C	1 3/4"	3.3	8.60	6.80
SSM4C	4"	6	14.10	11.20

Order by Number of Pieces Required.
Colors: Standard Color — Natural Nylon White.
Other Colors — 10% additional price.

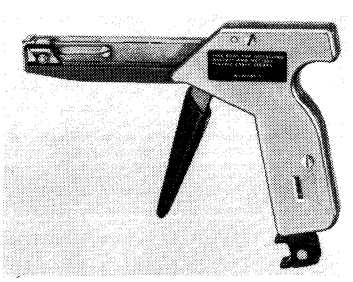
BULK PACKAGING*

These items available in bulk packaging quantities only as designated.

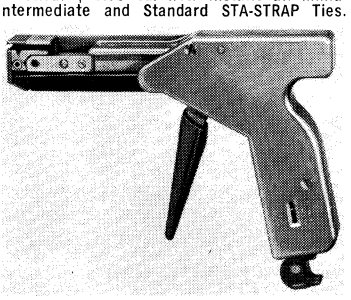
**Part Number	Approx. Shpg. Wt. lbs./1000	Price Per M (1000) 1M-24.5M	25M-49.5M	50M
SST1M	1	$ 23.00	$ 21.85	$ 20.70
SST1.5M	1.5	24.00	22.80	21.60
SST2M	2.6	27.00	25.65	24.30
SST3IM	2.6	45.00	42.75	40.50
SST3M	3.5	48.50	46.00	43.70
SST4M	4.5	60.00	57.00	54.00
SST4HD	12	93.00	88.35	83.70
SST8HD	24	140.00	136.00	126.00
SSC2M	3.2	30.00	28.50	27.00
SSC4M	5.5	66.00	62.70	59.40
SSC4HD	14	111.80	106.20	100.75
SSM2D	3.3	55.00	52.25	49.50
SSM4D	6	87.50	83.15	78.25

*Bulk packaging quantities indicated by letter suffix in part no. D = 500; M = 1000.
Order by Number of Pieces Required.

STA-STRAP® Installation Tools



GS2B — Manual $19.00 ea. net. Installs all Miniature, Intermediate and Standard STA-STRAP Ties.



GS4H — Manual $40.00 ea. net. Heavy Duty — installs all Standard and Heavy STA-STRAP Ties.

In Canada: Add 37% plus Canadian sales tax for F.O.B. local stocking distributor prices.

Delivery: F.O.B. Tinley Park, Ill. Minimum Billing: $25.00 net, each customer-designated shipment. Terms: Cash Discount 2%, 10th prox. FREIGHT ALLOWED via Panduit routing on domestic shipments of $300.00 or more net billing. All prices subject to change without notice.

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Coaxial Cable, Hook-up Wire, Shipboard Cable, Silicone Rubber Wire and Cable, Custom-engineered Multi-Conductor Cable. For prices, samples and technical data, contact your nearest Plastoid representative. (See list in manufacturers' section).

PLASTOID CORPORATION Plants: HAMBURG, NEW JERSEY — FRANKLIN, NEW JERSEY — LOS ANGELES, CALIF. Offices: LONG ISLAND CITY, N. Y.

CAA-SIGNAL & CONTROL CABLE
(Thermoplastic Insulation & Jacket)

COAXIAL CABLES
Spec JAN-C-17A & MIL-C-17C
Including Low-Temperature, Non-Contaminating Jackets
Double Shielded & Jacketed Coaxial Cable
Foam Polyethylene Insulated Community TV Coaxial Cables

SPECIAL PURPOSE CABLES
Meteorological Survey Cable
Underwater Sound Equipment Cable
Geophysical Cable
Fire Control Wire & Cable
Electronic Computer Wire & Cable
Inside Telephone Cable
Special Design High Frequency Cable
Thermostat Cable 2-7 conductors (Twisted & Thermoplastic Jacketed)
Microphone Cables
Sound & Intercommunication Wire & Cable
Rotor Antenna Cable

TEFLON INSULATED WIRE & CABLE
MIL-W-16878D TYPES "E" & "EE", "ET", "K", "KK", "KT"
Multi-conductor Cables
Teflon Coaxial Cables
MIL-W-7139B

RADIO AND ELECTRONIC HOOK-UP WIRE
MIL-W-76B (types MW, LW, HW)
MIL-W-16878D (types B, C, D, J) with and without Nylon jackets. All types can be supplied with braided, shielded and jacketed outer coverings or combinations thereof.
Underwriters Laboratory — 80°; 90°; 105° PVC insulation, nominal walls of .008; .015; .031; .047 & with braided outer or extruded nylon jacket

AIRCRAFT WIRE & CABLE
MIL-W-5086B MIL-W-5274A
MIL-C-7078B MIL-W-7072A
MIL-W-8777B

NAVY SHIPBOARD CABLE
MIL-C-915C, MIL-C-2194D & MIL-C-24145A

ELECTRICAL SHIPBOARD CABLE
AIEE-45

REA TELEPHONE CABLE
SPEC PE-14, PE-15, PE-17, PE-27, PE-28

MULTI PAIR RURAL DISTRIBUTION WIRE TRAFFIC CONTROL CABLES
(Specs IMSA 19 & 20)

POWER CONTROL CABLES
(Specs IPCEA & IMSA)
(Thermoplastic Insulation & Jacket)

AIRPORT LIGHTING CABLE
COMMUNITY TV COAXIAL CABLE
(Wire Shield, Flat Ribbon Shield, Corrugated Copper Tape Shield, Aluminum Sheath.)

SILICONE RUBBER INSULATED WIRE & CABLE
MIL-W-16878D types "F", "FF", "FFW"
MIL-W-8777B
Underwriters Laboratory type SF-1, SF-2, SFF-1, SFF-2
High temperature, high voltage hook-up wire
Motor lead wire

HOOK-UP & AIRCRAFT WIRE

MIL-W-1687D, MIL-W-7139A, MIL-W-7139B (Extruded Teflon*)



MIL-W-7139B

Manufactured to conform to Dept. of Defense requirements.
600 Volts Temperature Rating +200°C & +260°C.
Class 1—Silver Coated Copper Conductor for +200°C Operation.
Class 2—Nickel Coated Copper Conductor for +260°C Operation.
*DuPont Trade Mark

SILICONE WIRE & CABLE

EXTRUDED SILICONE RUBBER

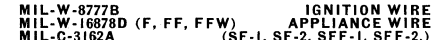
Outstanding performance, under difficult operating conditions rapidly expand applications for these constructions.

ADVANTAGES

1. Electrical properties remain constant from —130°F to +500°F.
2. Remains flexible even after long exposure to temperatures from —130°F to +500°F.
3. Resists ozone and corona.
4. Can be soldered without melting or destroying insulation.
5. Non-Flammable.
6. High Dielectric strength (450 to 550 volts/mil)
7. High Insulation resistance (1000 to 20,000 megohms-/1000 ft.)
8. Low dissipation factor (.001-.02)
9. Low Dielectric Constant (2.98-3.6)
10. Low water absorption (1 to 2%)
11. High Tensile Strength (750 to 1500 PSI)
12. High Elongation (100-550%)

The most prominent silicone rubber insulated wires and cables are detailed by the following specifications:

MIL-W-8777B	IGNITION WIRE
MIL-W-16878D (F, FF, FFW)	APPLIANCE WIRE
MIL-C-3162A	(SF-1, SF-2, SFF-1, SFF-2.)
MIL-C-8817 (ASG)	MOTOR LEAD WIRE



GLASS BRAID | SILICONE RUBBER | TINNED COPPER

MOTOR LEAD WIRE

(600 Volts Class "H" +200°C)

Lead wire failures can be ractically eliminated with the use of silicone rubber insulations. In many instances the equipment can be baked with lead wire in place.

MIL-W-8777B (ASG)

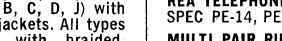
Dated 1 August 1960—Superseding MIL-W-8778A—10 July 1956. Voltage Rating 600 Volts. Temperature Rating —55°C +150°C.
Construction Details:
(a) Conductor—Concentric stranded or rope—lay stranded silver copper conductors as required by specification. (b) Primary Insulation—Silicone Rubber. (c) Protective Cover—Fiberglas Braid impregnated with heat-resistant lacquer. (d) Outer Protective Coating—1. Polyester Jacket, impregnated with heat resistant lacquer. 2. Extruded FEP Jacket. (e) Print—Outer surface printed as required by specification.

Per Military Standards—
MS 25471 (ASG) Polyester Jacket Impregnated with High Temperature Finisher MS 27110 (USAF) Extruded Clear FEP Jacket.

HIGH TEMPERATURE — HIGH VOLTAGE HOOK-UP WIRE

Class "H" Insulation for —65°C to +200°C Max.
Silicone Rubber and extruded Teflon* 100 (FEP).

Description:
a. Conductor — Copper stranded, silver plated — 40 micro-inches min.
b. Primary Insulation — High strength silicone rubber.
c. Jacket — Teflon* (Perfluorocarbon resin 100) extruded.
For operation between —65°C and +175°C at 2000 Volts RMS (sea-level).



TYPES SF-1, SF-2, SFF-1, SFF-2
For appliances where high temperature wiring is mandatory.
*DuPONT TRADE MARK



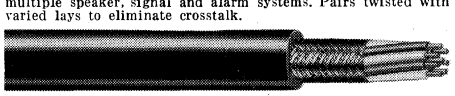
MULTI-CONDUCTOR, UNSHIELDED, JACKETED CABLES

These cables can be supplied in various AWG sizes, insulation types, number of conductors and jacket types. Used for unbalanced intercom systems, low voltage control systems, public address systems, electronic computers, indoor and outdoor sound and signal systems.



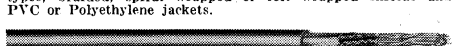
MULTI-PAIR, UNSHIELDED, JACKETED CABLES

This cable type can be supplied in a variety of sizes, insulations and jackets to meet individual needs and requirements. For use in balanced intercom systems, annunciators, telephones, nurses call systems, control circuits, electronic computers, multiple speaker, signal and alarm systems. Pairs twisted with varied lays to eliminate crosstalk.



MULTI-CONDUCTOR, SHIELDED JACKETED CABLES

Cables of this type are used for indoor and outdoor public address and sound systems, installations in schools, hospitals, and institutions, recording studios, transmitters, paging and call systems, and wherever required to prevent interference pickup. Can be supplied in various AWG sizes, insulation types, braided, spiral wrapped or foil wrapped shields and PVC or Polyethylene jackets.



MULTI-PAIR, SHIELDED JACKETED CABLES

These cables are designed to provide maximum performance in eliminating interference and crosstalk in public address and sound systems, broadcast studios and indoor and outdoor telephone and intercom systems. Can be supplied in various AWG sizes. Insulations, shield types and jackets.

AIRCRAFT WIRE



MIL-W-5086B — Type 1

(Dated March 19, 1968)

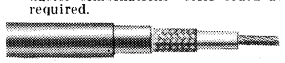
600 Volts Temp. Rat. —55°C +105°C Synkote insulated electrical aircraft wire manufactured to conform to Military Specification MIL-W-5086-A
1. Construction Details:
   (a) Concentric stranded tinned copper conductor
   (b) Synthetic resin insula. (105°C)
   (c) Extruded clear nylon jacket
2. This construction available with tinned copper shield and/or with extruded nylon jacket over shield. Identified as Type 1 or Type 2 per specification MIL-C-7078B.
3. Standard Color: White.
4. May be furnished in multiple conductor combinations—color coded as required.



MIL-W-5086B — Type 2

(Dated March 19, 1968)

600 Volts Temp. Rat. —55°C +105°C
1. Construction Details:
   (a) Concentric stranded or rope-lay stranded tinned copper conductors as required by specification
   (b) Synthetic resin insula. (105°C)
   (c) Glass braid — saturated.
   (d) Extruded clear nylon jacket sizes AN-22 thru AN-12; braided nylon, impregnated with nylon lacquer sizes AN-10 thru AN-4/0.
2. This construction available with tinned copper shield in all sizes. Also with extruded nylon jacket over shield in sizes AN-22 thru AN-12 per specification MIL-C-7078A — Type 1 or 2.
3. Standard Color: White.
4. May be furnished in multiple conductor combinations—color coded as required.



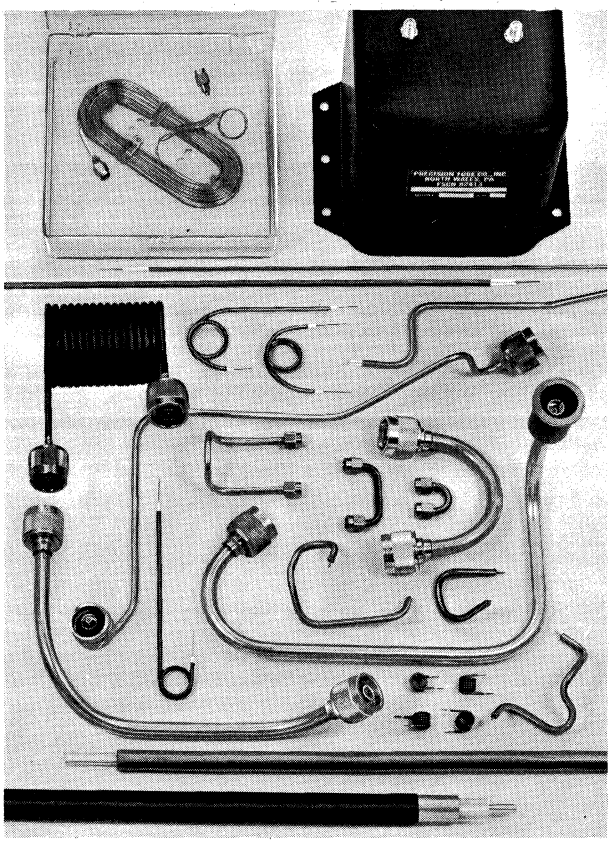
MIL-W-5086B — Type 3

(Dated March 19, 1968)

600 Volts Temp. Rat. —55°C +105°C
1. Construction Details:
   (a) Concentric stranded or rope-lay stranded tinned copper conductors as required by specification
   (b) Synthetic resin insula. (105°C)
   (c) Glass braid — saturated.
   (d) Secondary synthetic resin insulation.
   (e) Extruded clear nylon Jacket sizes AN-22 thru AN-12; braided nylon, impregnated with nylon lacquer sizes AN-10 thru AN-4/0.
2. This construction available with tinned copper shield in all sizes. Also with extruded nylon jacket over shield in sizes AN-22 thru AN-12 per specification MIL-C-7078A — Type 1 or 2.
3. Standard Color: White.
4. May be furnished in multiple conductor combinations—color coded as required.

PRECISION TUBE COAXITUBE

Semi-Rigid Coaxial Cable



To meet the demand for fast delivery of 50-ohm semi-rigid coaxial cables, Precision now stocks the most commonly used types, listed below, for immediate off-the-shelf shipment. Fifty-foot coils of these constructions can be shipped within two working days; cut straight lengths, to your specification, take only a little longer. All of these standard cables employ dielectric of solid polytetrafluoroethylene, with seamless copper or aluminum outer conductors. All exhibit nominal electrical characteristics as follows: $Z_0 = 50$ ohms; propagation velocity = 69.5%; and capacitance = 29.3 pf/ft.

In addition to these standard cables, Precision manufactures more than 40 special Coaxitube constructions with impedances ranging from 12 to 125 ohms, and outer diameters from .020 to .500 inches. Custom outer finishes, including plating on aluminum and plastic jacketing, are available to order. Precision's Pre-Fab Department can provide complete cable assemblies, coaxial delay lines, and other custom Coaxitube constructions to your exact specifications, including testing where required. Call or write for prompt attention and quotations.

Standard sizes in 50-foot coils for immediate delivery!

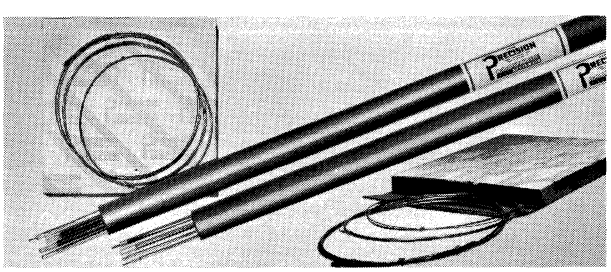
Part Number	O.D.	Outer Conductor Material & Finish	Safe Bend Radius
MA50056	.056 ± .002	Copper	.125
AA50085	.085 ± .001	Copper	.125
BA50085	.085 ± .001	Copper	.125
BC50085	.085 ± .001	Silvered Copper	.125
AA50141	.141 ± .001	Copper	.125
AC50141	.141 ± .001	Silvered Copper	.125
AD50141	.141 ± .001	Cadmium Plated Copper	.125
AE50141	.141 ± .001	Tinned Copper	.125
CA50215	.215 ± .003	Copper	.375
CH50215	.215 ± .003	Aluminum	.375
BA50250	.250 ± .002	Copper	.375
NA50325	.325 ± .005	Copper	.500
NH50325	.325 ± .005	Aluminum	.500

NOTES: (1) All dimensions are in inches. (2) Silverplating on outer conductor is Type II, Grade B, QQ-J-365, .0003 inch minimum thick. (3) Tinplating on outer conductor is Type I, MIL-T-10727, .001 to .00025 inch thick. (4) Cadmium plating on outer conductor is Class 2, Type I, QQ-P-416.

For breadboarding or prototype production, small quantities of Coaxitube Cable are available in these four Coax-i-kits, priced at $20 each, FOB destination, with next-day shipment. Select the kits which fit your needs, then call in your order.

Kit	Contents	Ship Via
A	One 10-foot coil each of MA50056, DA50085 and CA50141	1st Class Mail
B	Two 4-foot straight lengths each of CA50215 and NA50325	Parcel Post
C	One 10-foot coil each of BA50085 and AA50141	1st Class Mail
D	Two 4-foot straight lengths each of CH50215 and NH50325	Parcel Post

DA50085 and CA50141 are identical to BA50085 and AA50141, respectively, except for OD tolerance of ± .003 inches and a greater impedance tolerance.



PRECISION TUBE COMPANY, INC.
NORTH WALES, PA. 19454
Phone—215-699-5801 • Telex—84-6439 • TWX—510-661-8427

We will gladly send additional data, samples and prices. Call, write or wire for prompt action.

WIRE & CABLE

FROM STOCK OR FABRICATED TO ORDER

WE INSULATE WITH — Polyethylene - Polypropylene - PVC (Polyvinyl Chloride) - Silicone - Rubber - Nylon - Polyethylene Foam and Teflon.

WE FABRICATE — Single or Multi-Conductor Cables - Microphone - Audio - Braid or Wrap Shielded Constructions - Speaker Wire - Coaxial and Open Wire Transmission Lines - Rotor - Telephone and Coil Cord Constructions, as well as many others.

WE USE — Copper (bare, tinned, enameled or silver plated). Steel — (tinned or zinc plated), aluminum, phosphor bronze, and Copperweld.

WE CAN — Efficiently twist, bunch, insulate, tin, cut, strip, notch, lug, hank, coil, shield, stripe, cable and, in fact, do almost anything with wire.

WE STOCK — In addition to the MIL Specs listed below, Thermocouple Wire - TFE Tubing - Heat Shrinkable Tubing - Telephone Cable - Tubular, Oval & Flat Braid - Coaxial Cables - etc.

SOME OF THE MIL SPECS WE USUALLY HAVE IN STOCK ARE AS FOLLOWS:

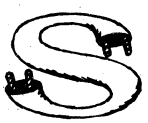
MIL-W-76B
MIL-W-16878D
Types B C D E EE ET
MIL-C-3432A B & C
MIL-C-3883
MIL-W-13169
MIL-W-3861
MIL-W-5086A
MIL-W-7078A
MIL-W-7139B
MIL-W-583B
MIL-C-3849
MIL-C-5756
MIL-C-10392B
MIL-W-13077
MIL-W-8777B
QQW-343
MIL-C-8817
MIL-C-17B
MIL-I-631C
MIL-C-915A
MIL-W-1511A
MIL-C-2194D
MIL-C-2486C
MIL-W-3093
MIL-W-3104
MIL-C-3162A
MIL-I-3190B
MIL-W-5845
MIL-W-5846
MIL-C-5898A
MIL-W-5908
MIL-C-6940
MIL-C-5765
MIL-W-17211
MIL-W-18242
MIL-W-22283
MIL-C-5424

WE are able to help most of the time. Why not call us now, COLLECT.
We may be able to save you a great deal of time and effort.

SHORT, LONG OR SPECIAL RUNS

Write for Catalog or see our pages in Radio-Electronic MASTER

saxton
WIRE & CABLE DIVISION
215 N. ROUTE 303, CONGERS, N. Y. 10920





CALL COLLECT:
914 - CO 8-6846 or 212 - 933-6262



WIRE & CABLE FOR PRODUCTION.. RESEARCH... PROTOTYPE.....

Government Military Specifications . . . Commercial Specifications or Approved Manufacturers Specifications.

IMMEDIATE DELIVERY

- Most Military Specifications
- High Temperature Wire & Cable
- Telemetering Supervisory Control Cable
- Complex Instrument Cable
- Telephone & Inter-Communicating Cable
- Electrical & Electronic Instrument Wire
- Coaxial Cables
- Thermocouple Wire
- Multiple Pair Control Cable
- Microphone Cable
- Computer Cable
- Many more

Complete line of Wire, Cable & Cord in stock . . . or we will custom Cable to your design.

SEND FOR COMPLETE CATALOG
Write Dept. E-1

Abbreviated sample headings of some pages of our catalog. Each page is 8½" x 11" and contains a complete range of sizes, all specifications and other pertinent information for its specific type of wire or cable.

Page 2

AIRCRAFT WIRE (Unshielded) 600 VOLT 22 AWG to 4/0 AWG

STRANDED TINNED COPPER — POLYVINYL INSULATION (White) — NYLON JACKET



AWG SIZE	Stranding	Catalog No.	Nominal Diameter (Inches)	Nominal Weight (Lbs./M')	Catalog No.	Nominal Diameter (Inches)	Nominal Weight (Lbs./M')	Catalog No.	Nominal Diameter (Inches)	Nominal Weight (Lbs./M')
22	19 x 34	107-1	.066	3.96	107.1A	.075	4.55	107-1B	.085	5.45

Page 7

HIGH TEMPERATURE WIRE MIL-W-8777 B (ASG) MS 25471 (ASG) 200°C 600 VOLT

SILVER COATED COPPER — POLYESTER FIBER BRAID HEAT RESISTANT FINISHER — EXTRUDED SILICONE



Size	Catalog No.	Stranding	Cir. Mil. Area	Max. Bare Diam. (Inches)	Max. Resist. @ 20°C Ohms/1000 ft.	Max. Fin. Diam. (Inches)	Max. Wt. Lbs./1000 ft.
22	1105-3	19 x 34	755	0.033	15.2	.090	5.8

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ANTENNA WIRE



CATALOG NO.	MILITARY TYPE	AWG SIZE	DIELECTRIC	NOMINAL DIAMETER	MIN. LBS. CONDUCTOR BREAKING STRENGTH
801-175	6370-2	16 Solid CW	Poly	.183	250

SWC STANDARD WIRE & CABLE CO.

3440 OVERLAND AVE., LOS ANGELES, CALIF. 90034
PHONE: (213) 870-9231 (213) 870-4647
TWX 910 340-6758 TELEX 65-3423

Tensolite HIGH TEMPERATURE WIRE & CABLE

SUMMARY OF STANDARD MIL SPECIFICATION COMPONENT WIRES

Specification	Type	AWG	Nom. Wall Thick.	Conductor	Insulation	Temp. Rating °C.	Voltage Rating, Vrms	Usage
MIL-W-16878	ET (/6A)	32-20	.006	SPC/NPC	Teflon®-TFE	200/260	250	Miniature Wall Hook-Up
	E (/4A)	32-10	.010	SPC/NPC	Teflon-TFE	200/260	600	Hook-Up
	EE (/5A)	32-8	.015	SPC/NPC	Teflon-TFE	200/260	1000	Heavy Wall Hook-Up
	KT (/13)	32-20	.006	TPC/SPC	Teflon-FEP	200	250	Miniature Wall Hook-Up
	K (/11)	32-10	.010	TPC/SPC	Teflon-FEP	200	600	Hook-Up
	KK (/12B)	32-4/0	.015	TPC/SPC	Teflon-FEP	200	1000	Heavy Wall Hook-Up
MIL-W-22759	MS21985	28-16	.009	SPC	Extruded TFE	200	600	Hook-Up
	MS21986	28-16	.009	NPC	Extruded TFE	260	600	Hook-Up
	MS18113	28-8	.014-.017	SPC	Extruded TFE	200	1000	Heavy Wall Hook-Up
	MS18114	28-8	.014-.017	NPC	Extruded TFE	260	1000	Heavy Wall Hook-Up
	MS18000	24-4	.019-.031	SPC	Mineral Filled Extruded TFE	200	600	Airframe, Medium Wall
	MS18001	24-4	.019-.031	NPC	Mineral Filled Extruded TFE	260	600	Airframe, Medium Wall
	MS90294	22-2/0	.021-.060	SPC	TFE/Glass + FEP	200	600	Airframe, Medium Wall
	MS17411	24-4	.025-.044	SPC	Mineral Filled Extruded TFE	200	600	Airframe, Heavy Wall
	MS17412	24-4	.025-.044	NPC	Mineral Filled Extruded TFE	260	600	Airframe, Heavy Wall
	22759/1	22-4/0	.025-.065	SPC	TFE/Glass Tape & Braid	200	600	Airframe, Heavy Wall
	22759/2	22-4/0	.025-.065	NPC	TFE/Glass Tape & Braid	260	600	Airframe, Heavy Wall
	22759/3	22-2/0	.020-.055	NPC	TFE Tape/ Glass Braid	260	600	Airframe, Medium Wall
MIL-W-81381	/1	26-10	.007	SPC	** Kapton®	200	600	Lightweight Hook-Up
	/2	26-10	.007	NPC	Kapton®	200	600	Lightweight Hook-Up
	/3	26-2	.012-.016	SPC	Kapton®	200	600	Airframe or Hook-Up
	/4	26-2	.012-.016	NPC	Kapton®	200	600	Airframe or Hook-Up
MIL-W-7139B	Class 1	22-4/0	.027-.070	SPC	TFE/Glass Tape or Extruded	200	600	Airframe, Heavy Wall
	Class 2	22-4/0	.027-.070	NPC	TFE/Glass Tape or Extruded	260	600	Airframe, Heavy Wall

TPC — Tin Plated Copper SPC — Silver Plated Copper NPC — Nickel Plated Copper ®Dupont **Polyimide/FEP Type F Film

Above component wires available in shielded & jacketed multiconductor cables. Typical cable specs are: MIL-C-7078 & MIL-C-27500

UL APPROVED HIGH TEMPERATURE APPLIANCE AND EQUIPMENT WIRE

MATERIAL	NOMINAL WALL	UL STYLE NO.	MATERIAL	NOMINAL WALL	UL STYLE NO.
TFE	.0055	1371	FEP (cont.)	1/64	1333
	.010	1212		1/32	1330
	.010	1213		1/32	1331
	1/64	1164	Kynar	.004	1423
	1/64	1180		.005	1422
	1/32	1198		.006	1426
	1/32	1199		.010	1327
TFE or FEP	Coaxial Cable	1354		.010	1351
FEP/Nylon	.006/.003	1292	Polysulfone	.004	1425
FEP	.010	1226		.005	1424
	.010	1227		.006	1432
	1/64	1332		.007	1433
	.0055	1371			

Other styles & constructions on request. CSA approvals also available.

RG/U TFE DIELECTRIC COAXIAL CABLE

PER — MIL-C-17D

MINIATURE Max. OD .075" - .155"	MEDIUM Max. OD .175" - .335"	HEAVY Max. OD .420" - .525"
178B/U*	140/U	87A/U*
179B/U*	141A/U*	116/U
180B/U*	142B/U*	119/U
187A/U*	143A/U	120/U
188A/U*	302/U	144/U
195A/U*	303/U	165/U
196A/U*	304/U	166/U
316/U		225/U
		227/U

* Off-the-shelf Delivery.

OTHER HIGH TEMPERATURE WIRE AND CABLE PRODUCTS FOR MILITARY AND COMMERCIAL USAGE

1. Thermoplastic Wire & Cable	Insulations: Kynar, FEP, Polysulfone and other melt extrudable material	6. Parallel Wrapped PVC and TFE Insulations	Increased flexibility for phonograph tone arms and hearing aids. High dielectric strength for TV and radio wiring.
2. Ultra-Thin Hook-up Wire	250 Vrms Type UT wire, sizes 36 through 26 in solid conductors, and 28 through 36 in stranded conductors. Wall thickness from .0015" to .004".	7. Computer Wire	Wide variety of insulation and conductors for use in automatic wiring equipment.
3. Instrumentation and Control Cables	Fluorocarbon, polyimide or high temperature thermoplastic insulated multi-conductor cables for instrumentation, signal, and control cable applications.	8. Tufflite™ Polyimide Insulated Wires	Medium and heavy wall constructions to MIL-W-81381. Thin wall, .0045", construction also available.
4. Heater Cables	TFE and Polyimide insulated resistance alloy conductors. Ratings to 500°F.	9. Ribbon Cables	Bonded and woven high temperature Teflon, Kapton, and thermoplastic components.
5. Power Cables	600 and 1000 Vrms ratings in sizes AWG 22 through 4/0.	10. Teflon Tape	Extruded, unsintered tape in widths from 1/8" to 12".

For more complete data and technical assistance, contact the Tensolite man in your area, or call us directly.

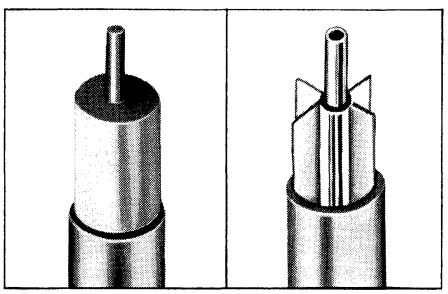
March 1969

Tensolite

TENSOLITE Division of Carlisle Corporation
WEST MAIN ST., TARRYTOWN, N. Y. 10591
(914) 631-2300 • TWX 710-567-1202

Times interconnection products solve a broad spectrum of transmission problems

Solid metal tube sheathed coaxial cable



ALUMIFOAM® ALUMISPLINE®

What ordinary flexible coaxial cable won't do . . . Times semiflexible will! Here are 7 reasons why: More isolation—at least 80 db more than ordinary coaxial cable. Uniformity average—VSWR 1.1 or less. Stability—10 times better. Lower loss—30% less. Pulse reflection—less than 1%. Less distortion.

Available in three standard versions:

ALUMIFOAM®—Foam polyethylene dielectric where pressurizing isn't practical.

ALUMISPLINE®—Air dielectric where pressurizing is practical. Superior because the dielectric is uniformly extruded directly on the center conductor, guaranteeing lowest attenuation, VSWR, and good nanosecond pulse response.

ALUMISOL®—Solid dielectric
All semiflexibles are available for high temperature applications.

Write or phone for technical data.

Coaxial cable

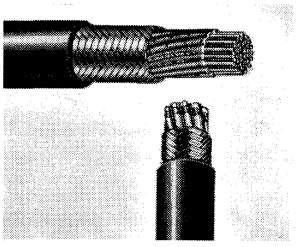


RG/U. Over 50 Teflon insulated—and over 125 polyethylene insulated—to MIL-C-17. Over 120 types available from stock. T-Line—Improved RG cable equivalents—specially designed, improved characteristic cable equivalent to RG cables.

Miniaturized low capacitance, low attenuation cables; shielded, low capacitance twisted pairs. Special: Custom engineered coaxial cable is a Times specialty.

Write or phone for technical data.

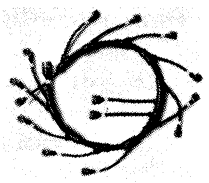
Multi-conductor cable



High and medium temperature cables with up to 198 conductors have been designed and manufactured by TIMES to over 9000 customer and military specifications.

Write or phone for technical data.

Cable assemblies



Times' custom engineering service is qualified to design cable assemblies for the most critical applications, using any combinations of wire and connector constructions. We can take over the complete systems capability from layout to complete construction of cable assembly, which often results in lower engineering, shipping and installation costs.

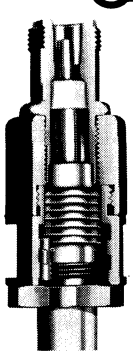
Write or phone for technical data.

New TIMATCH® connector with COILGRIP® CLAMP

- Ready for instant termination
- Re-usable
- Fits most metal tube sheathed coaxial cable
- Has the exclusive CoilGrip Cable Clamp

A major advance in the connector field that virtually makes all other connectors obsolete. Makes it a simple one-step operation to attach connector to semiflex cable without any further connector assembly. Unpack the connector and it's ready for instant use.

Write or phone for technical data.



Coaxial delay lines



Usually the most critical cable components of an interconnection system. Though VSWR, attenuation, or pulse distortion are important, the electrical length or time delay is the most significant factor. Times gives the most serious consideration to the error tolerances assigned to the delay lines, as tight tolerances can significantly affect costs. We are in an excellent position to guarantee precision quality because we use coaxial cable and connectors that we ourselves manufacture in the construction of these delay lines.

Write or phone for technical data.

TIMES WIRE & CABLE
DIVISION OF THE INTERNATIONAL SILVER CO.
Wallingford, Conn.

TRANSMISSION SYSTEM DESIGN AND ENGINEERING • STANDARD & SPECIAL COAXIAL CABLE • MULTICONDUCTOR CABLE • COMPLETE CABLE ASSEMBLIES • TEFLON* HOOK-UP WIRE

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*A DU PONT TRADEMARK

MicroCoax

Close-Tolerance Miniature Solid-Jacketed Coaxial Cables

Uses of close-tolerance MicroCoax cables include:

- Microwave transmission and delay lines
- Totally shielded connections (mixers, klystrons, stripline)
- High-speed computer leads
- Audio crosstalk suppression
- Low-noise amplifier isolation

Advantages:

- Low loss
- Essentially total RF shielding
- Easily soldered, stripped and connected
- Close tolerance, resulting in a high degree of uniformity and reliability, both mechanically and electrically
- Comprehensive mechanical and electrical test data available

Specifications and Technical Data—10, 25, 50, 70, and 93 Ohm MicroCoax Cables

CABLE TYPE	Impedance, ohms	Outside Diam. ±.001"	Jacket Material	Dielectric Diam. ±.001"	Dielectric Material	Center Cond. AWG (in.)	Center Cond. Material	Capacitance pF/ft.	Max. Temp. °C	Min. Bend Radius (in.)	Typical Attenuation db/100 ft. .5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	Weight (Pounds/100 ft.)
UT-8	50	.008	Copper	.004	TFE	.002	C	29.3	85	1/16	154	222	550	810	<0.1
UT-13	50	.013	Copper	.010	FEP	.0025	SPCW	29.3	85	1/16	105	152	381	592	<0.1
UT-20	50	.023	Copper	.017	FEP	#37(.0045)	SPCW	29.3	85	1/16	50	76	—	—	.10
UT-34	50	.034	Cooper	.028	TFE	#32(.008)	SPCW	29.3	100	1/8	28	44	100	—	.13
UT-47	50	.047	Copper	.037	TFE	#29(.0113)	SPCW	29.3	150	1/8	26	36	87	130	.53
UT-701	50	.070	Copper	.059	TFE	#25(.0179)	SPC	29.3	150	1/8	14.7	19.9	45.5	66.2	.75
UT-85	50	.0865	Copper	.0658	TFE	#24(.0201)	SPCW	29.3	150	1/8	12.0	17.0	42.0	62.0	1.4
UT-85C	50	.0865	Copper	.0658	TFE	#24(.0201)	SPC	29.3	150	1/8	12.0	17.0	42.0	62.0	1.4
UT-85FC	50	.0865	Copper	.0658	FEP	#24(.0201)	SPCW	29.3	150	1/8	17	26	55	90	1.4
UT-141	48.8	.141	Copper	.116	TFE	#19(.0359)	SPCW	29.5	200	1/4	5.8	8.8	24.5	38	3.2
UT-141A	50	.141	Copper	.119	TFE	#19(.0359)	SPCW	29.3	200	1/4	5.8	8.8	24.5	38	3.2
UT-141B	50	.141	Copper	.119	TFE	#19(.0359)	BeCu	29.3	200	1/4	6.0	9.1	26.3	41.0	3.2
UT-141C	50	.141	Copper	.119	TFE	#19(.0359)	SPC	29.3	200	1/4	5.8	8.8	24.5	38	3.2
UT-141L	50	.141	Copper	.119	TFE	#19(.0359)	T	29.3	200	1/4	45.0	65.0	154.0	250.0	3.2
UT-141P	50	.141	Copper	.119	IP	#19(.0359)	C	29.3	200	1/4	6.0	9.1	26.3	41.0	3.1
UT-141FC	50	.141	Copper	.119	FEP	#19(.0359)	SPC	29.3	200	1/4	8.0	12.0	30.0	47.5	3.2
UT-250	50	.250	Copper	.214	TFE	#14(.064)	SPC	29.3	200	3/8	3.7	5.8	16.2	25.0	10.0
UT-10	10	.043	Copper	.036	TFE	#21(.0285)	C	146.5	100	1/4	—	—	—	—	—
UT-25	25	.034	Copper	.024	TFE	#28(.0126)	SPCW	58.5	100	1/8	—	—	—	—	—
UT-70	70	.085	Copper	.056	TFE	#29(.0113)	SPCW	19.3	175	1/4	13.0	19.0	42.0	63.0	1.4
UT-851	93	.085	Copper	.073	TFE	#32(.008)	SPCW	15.5	150	1/4	15.0	21.5	51.0	76.0	1.4
UT-93	93	.130	Copper	.1055	TFE	#29(.0113)	SPCW	15.5	175	1/4	9.6	14.0	34.0	50.0	2.6
UT-20-SS	50	.020	304SS	.015	FEP	#37(.0045)	SPCW	29.3	150	1/8	—	—	—	—	.10
UT-85-SS	50	.0865	304SS	.0658	TFE	#24(.0201)	SPCW	29.3	200	1/4	26.5	39.0	95.0	—	1.2
UT-141-SS	50	.141	304SS	.119	TFE	#19(.0359)	SPCW	29.3	250	1/2	17.0	25.0	57.0	84.0	3.1
UT-141-SSC	50	.141	304SS	.119	TFE	#19(.0359)	SPC	29.3	250	1/2	17.0	25.0	57.0	84.0	3.1
UT-141AL	50	.141	Aluminum	.119	TFE	#19(.0359)	SPCW	29.3	200	1/4	6.8	10.0	29.7	45.0	1.9
UT-250AL	50	.250	Aluminum	.214	TFE	#14(.064)	SPC	29.3	200	3/8	5.0	7.5	20.0	34.0	6.4
UT-325	50	.325	Copper	.285	TFE	#7X(.0312)	SPC	29.3	200	1/2	3.6	5.5	14.3	22.0	15.0
UT-852	75	.085	Copper	.067	TFE	#29(.0113)	SPCW	19.3	150	1/8	13.0	19.0	42.0	63.0	1.4

NOTES: SPCW = Silver Plated Copperweld Wire, SPC = Silver Plated Copper Wire, C = Copper Wire, T = Tophet(1) C Wire, BeCu = Beryllium Copper Wire, 304SS = Stainless Steel, Type 304, TFE = Teflon TFE Resin, FEP = Teflon(2) FEP Resin, IP = Irradiated Polyethylene. (1) = Trade Name W. B. Driver, (2) = Trade Name E. I. Du Pont.

CONDUCTOR MATERIALS

Alloys or Pure Aluminum, Copper, Beryllium Copper, Iron, Nickel, Gold, Silver, Columbium (Niobium), Stainless Steel.

DIELECTRICS

ORGANICS: Teflon (TFE and FEP), KEL-F, PVC, RTV, Polystyrene, Polyethylene.

INORGANICS: Titanite, Alumina, Magnesium Oxide, Beryllium Oxide.

CABLE ASSEMBLIES

Fabricated from any of the standard MicroCoax cables, these assemblies are fully tested for VSWR and attenuation characteristics. A large stock of connectors assures the engineer rapid delivery of either straight or formed units. Comprehensive VSWR and attenuation test data is also available on request.

CUSTOM DELAY LINES

The fabrication of any of the MicroCoax cables listed in the above table into delay elements is one of our specialties. Obtaining the best combination of attenuation, size, shape, cost and weight can be best accomplished by discussing your delay requirements with our engineering staff.

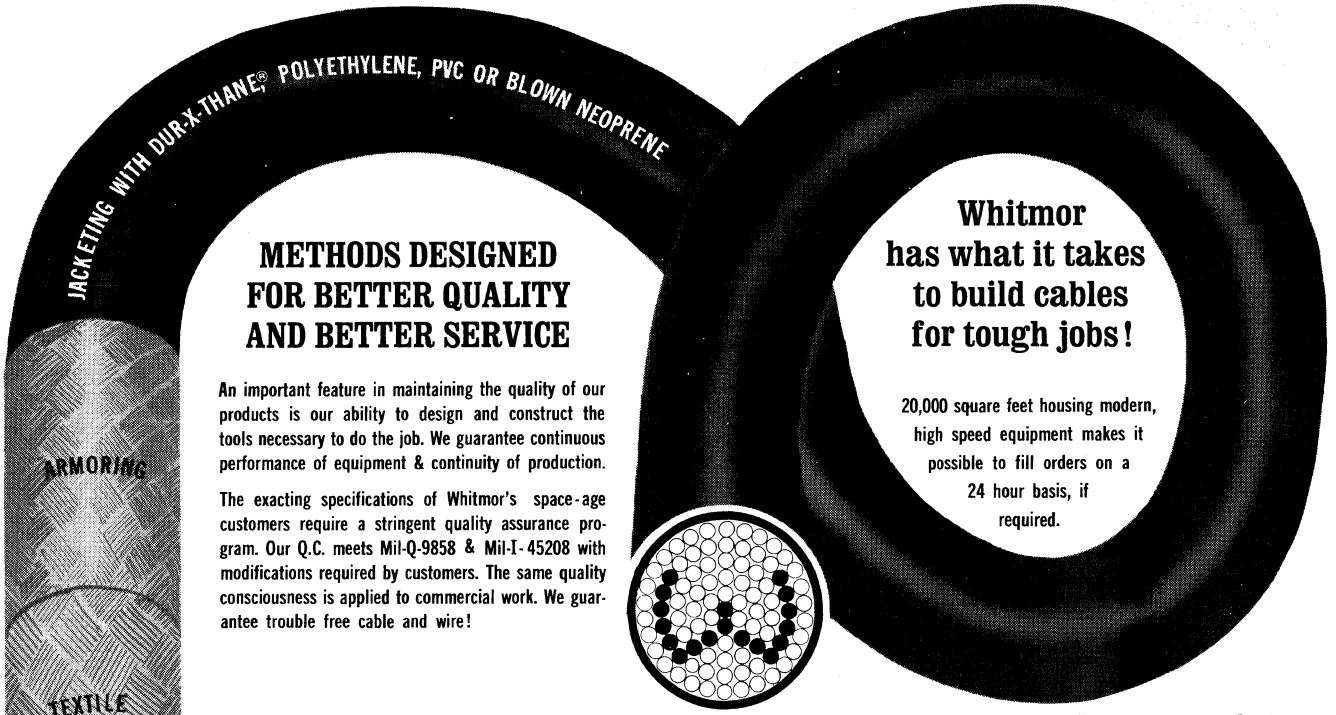
STANDARD DELAY LINES

Stock delivery of delay elements is available for prototype or production requirements. Cable sizes include UT-250, UT-141-A, UT-85, UT-34 and UT-20. Delay values of 5, 10, 25, 50 and 100 nanoseconds allow the cascading of these elements to obtain specific delay and attenuation characteristics.

For further and more complete information, request Bulletin 203 from the MicroDelay Division.

703R

UNIFORM TUBES, INC.
Collegeville, Pa. 19426
PHONE: (215) 489-7293 ■ TWX: 510-660-6107 ■ TELEX: 84-6428



METHODS DESIGNED FOR BETTER QUALITY AND BETTER SERVICE

An important feature in maintaining the quality of our products is our ability to design and construct the tools necessary to do the job. We guarantee continuous performance of equipment & continuity of production.

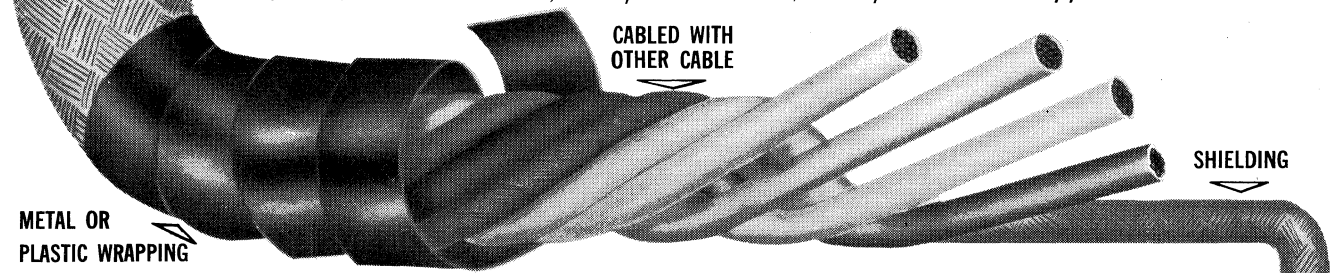
The exacting specifications of Whitmor's space-age customers require a stringent quality assurance program. Our Q.C. meets Mil-Q-9858 & Mil-I-45208 with modifications required by customers. The same quality consciousness is applied to commercial work. We guarantee trouble free cable and wire!

Whitmor has what it takes to build cables for tough jobs!

20,000 square feet housing modern, high speed equipment makes it possible to fill orders on a 24 hour basis, if required.

WHITMOR WIRE AND CABLE CORPORATION

Manufacturers of custom, multiple conductor, Mil-Spec and U.L. approved cables.



UNSHIELDED							SHIELDED**			
MULTI-CONDUCTOR STOCK CABLES / All wire 19 strand					DUR-X-THANE®		STOCK		DUR-X-THANE®	
PART NO.	COND. AWG	NO. COND.	JKT. THICK.	CABLE O.D.	JKT. THICK.	CABLE O.D.	JKT. THICK.	CABLE O.D.	JKT. THICK.	CABLE O.D.
W-227*	22	7	.040	.280	.030	.260	.040	.305	.030	.285
W-2212*	22	12	.050	.380	.030	.340	.050	.405	.030	.365
W-2219*	22	19	.060	.450	.040	.410	.060	.475	.040	.435
W-2227*	22	27	.060	.530	.040	.490	.060	.555	.040	.515
W-2237*	22	37	.060	.580	.040	.540	.060	.605	.040	.565
W-2248*	22	48	.060	.660	.050	.640	.060	.685	.050	.665
W-2261*	22	61	.060	.710	.050	.690	.060	.735	.050	.715
W-2272*	22	72	.060	.775	.060	.775	.060	.800	.060	.800
W-207*	20	7	.040	.300	.030	.280	.040	.325	.030	.305
W-2012*	20	12	.050	.400	.030	.360	.050	.425	.030	.385
W-2019*	20	19	.060	.475	.040	.435	.060	.500	.040	.460
W-2027*	20	27	.060	.560	.040	.520	.060	.585	.040	.545
W-2037*	20	37	.060	.610	.040	.570	.050	.640	.040	.595
W-2048*	20	48	.060	.700	.050	.680	.060	.725	.050	.705
W-2061*	20	61	.060	.750	.060	.750	.060	.775	.060	.775
W-2072*	20	72	.060	.840	.060	.840	.060	.865	.060	.865
W-187*	18	7	.040	.335	.030	.315	.040	.360	.030	.340
W-1812*	18	12	.050	.450	.040	.430	.050	.475	.040	.455
W-1819*	18	19	.060	.550	.040	.510	.060	.575	.040	.535
W-1827*	18	27	.060	.650	.050	.630	.060	.675	.050	.655
W-1837*	18	37	.060	.720	.050	.700	.060	.745	.050	.725
W-1848*	18	48	.060	.820	.060	.820	.060	.845	.060	.845
W-1861*	18	61	.060	.890	.060	.890	.060	.915	.060	.915
W-1872*	18	72	.060	.995	.060	.995	.060	1.020	.060	1.020
W-167*	16	7	.040	.370	.030	.350	.040	.395	.030	.375
W-1612*	16	12	.050	.500	.040	.480	.050	.525	.040	.505
W-1619*	16	19	.060	.600	.040	.560	.060	.625	.040	.585
W-1627*	16	27	.060	.685	.050	.665	.060	.710	.050	.590
W-1637*	16	37	.060	.755	.060	.755	.060	.780	.060	.780
W-1648*	16	48	.060	.865	.060	.865	.060	.890	.060	.890
W-1661*	16	61	.060	.935	.060	.935	.060	.960	.060	.960
W-147*	14	7	.050	.420	.040	.400	.050	.445	.040	.425
W-1412*	14	12	.050	.550	.040	.530	.050	.575	.040	.555
W-1419*	14	19	.060	.645	.050	.625	.060	.670	.050	.650
W-1427*	14	27	.060	.775	.060	.775	.060	.800	.060	.800
W-125*	12	5	.050	.445	.040	.400	.050	.470	.040	.425
W-127*	12	7	.050	.480	.040	.460	.050	.505	.040	.485
W-1212*	12	12	.060	.650	.050	.650	.060	.675	.050	.675
W-1219*	12	19	.060	.820	.060	.820	.060	.845	.060	.845

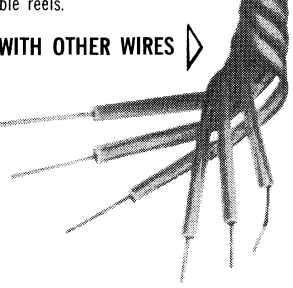
*Designate jacketing desired as follows: V=vinyl X=Dur-X-thane P=polyethylene N=neoprene - Mil-S-6855 - Class 2 - Grade 60
EXAMPLE: W-1827P=Cable w/27 conductors, 18 gauge wire, w/polyethylene jacketing. **Add "S" to PART NO. for Shielded cable.
Other constructions available on request using 1/32" PVC insulation (3000 V, Military Type D); (600 V, Style 1015 U.L. Commercial)

TECHNICAL DATA

Whitmor Wire and Cable Corporation manufactures a complete line of multiple conductor control cables. All conductors are Type C per MIL-W-16878, insulated for 1000 V and 105° C. Conductors are color coded per MIL-STD 681. All conductors are planetary cabled and contra-helically laid with Mylar tape over the cable bundle.

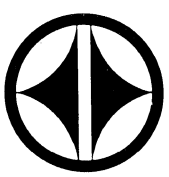
® Dur-X-thane is Whitmor's Registered T.M. for extruded Polyurethane.

SHIELDED CABLES: Same specifications as above with additions of tinned copper braided shield over cable complex with 85%-95% coverage to MIL-C-7078A, cables shipped on non-returnable reels.



WHITMOR WIRE AND CABLE CORPORATION
13161 SHERMAN WAY ■ NORTH HOLLYWOOD, CALIFORNIA 91605 ■ TELEPHONE: (AREA CODE 213) 764-6296

Look in the Green Section for Products and their Manufacturers



Tell them you found them in **eem**

electronic engineers master **eem 69|70**

MANUFACTURERS AND SALES OFFICE DIRECTORY INCLUDING TRADE NAMES

An alphabetical listing of more than 6,000 manufacturers supplying electronic equipment, instrumentation, components, materials and fabrication services. Included are addresses, telephone numbers and key sales executives. Local Sales Offices are shown for those manufacturers who have product information in the Catalog Section (white pages).

Trade Names (preceded by asterisk*), with descriptions of the products and names of their manufacturers, are intermixed alphabetically.

Federal Supply Code (FSC) numbers follow the names of those manufacturers who are currently supplying electronic equipment to the Federal Government.

Bold Face listings preceded by a large black square indicate manufacturers who have product information in the Catalog Section (white pages). Their page numbers are included.

eem — Electronic Engineers Master, containing the catalogs of 871 manufacturers, is the only annual containing completely **verified** listings of sales offices and/or sales representatives. Sales offices are listed by state and city under each manufacturer. Look for the sales office nearest you. Be sure to ask the sales office if there is a parts distributor nearby who handles the line in which you are interested.

* A-LUM-O-AIRE air filters - Carey Elctrn. Eng. Co.
*A-SCOPE interferometer - Varian Associates
AAI CORP., P.O. Box 6767, Baltimore, Md. 21204, Tel: 301-666-1400, TWX: 710-232-1800; Sls. Mgr: R.M. Glucksman ..... FSC No. 97384
A C ELCTRNS. CO., 11766 W. Pico Blvd., Los Angeles, Calif., Tel: 213-478-4288; Sls.Mgr: D.Balos ..... FSC 04203
AC ELCTRNS. DIV., General Motors Corp., 7929 S. Howell Ave., Milwaukee, Wisc. 53201, Tel: 414-762-7000, TWX: 414-322-8370; Sls. Mgr: A.E. Wasserman ..... FSC No. 99974
AC TRANSFORMER CORP., 89 Madison St., Newark, N.J. 07105, Tel: 201-642-7574; Vice Pres: A.C. Greyson ..... FSC No. 95339
■ **ACDC ELCTRNS., INC., 2979, N. Ontario St., Burbank, Calif. 91504, Tel: 213 - 849-2414, TWX: 910-498-2201; Sls. Mgr: J. Hull.....FSC No. 08742 .....Pgs. 1818-1829**
Cal San Francisco, W.J. Purdy Co., 312 Seventh St., St., 415-863-3300
Colo Denver, Waugaman Assoc., 2785 N. Speer Blvd., 303-255-5000
Conn Milford, Measurement Equip. Co., Inc., Box #272, 203-874-9222
Fla Ft. Lauderdale, Beacon Elctrn. Assocs., Inc., Box 10212, 305-564-4298
" Maitland, Beacon Elctrn. Assoc., Inc., Box 1278, 305-647-3498
Ill Mt. Prospect, Cain & Co., Ironwood Dr., 312-253-3575
Ind Indianapolis, G & H Sls., Box #71, 317-637-5048
Md Bladensburg, G.L. Brown Assocs., 5801 Annapolis Rd., 301-779-1500
Mass Wakefield, Measurement Equip. Co., Inc., 591 North Ave., 617-245-4870
Mich Southfield, G & H Sls., 24001 Southfield Rd., 313-358-1910
Minn St. Paul, Engineering Prods. Assoc., 2119 Grand Ave., 612-698-5531
NY Great Neck, H.J. Krasner Assoc., 33 Great Neck Rd., 516-487-0690
" Liverpool, Cain & Co., 324 First St., 315-457-4871
NC Jamestown, Beacon Elctrn. Assocs., Box #503, 919-454-1010
Ohio Cincinnati, G & H Sls., Box #37416, 513-761-6185
" Cleveland, G & H Sls., 13690 Fox Hill Dr., 216-338-1122
Pa Bala Cynwyd, Cain & Co., One Bala Cynwyd Bldg., 215-664-3797
Tex Bellaire, R. Martin Assocs., Box 1002, 713-668-3877
" Dallas, R. Martin Assoc., 2626 W. Mockingbird La., 213-358-3704
Wash Seattle, J.J. Backer Co., Box #9327, 206-283-6470
* ACEMHO potentiometer - Ace Elctrns. Assocs., Inc.
ACI INCORPORATED, 206 Industrial Ctr., Princeton, N.J. 08540, Tel: 609-924-3800, TWX: 609-921-2077; Sls. Mgr: D. Byers
ACR ELCTRNS. CORP., 160 5th Ave., New York, N.Y. 10010, Tel: 212-675-5520; Sls. Mgr: N.C. Bates
*ACU-MIN miniature labels - Brady W. H. Co.
*ACU-RAM electrical discharge mach. - Siltronics, Inc.
■ **A.D. DATA SYSTEMS, INC., 830 Linden Ave., Rochester, N. Y. 14625, Tel: 716 - 381-2370; Sls. Mgr: N. J. Webb ..Pgs. 758, 759**
Ala Huntsville, Technical Assocs., Inc., Box 1443, 205-881-8494
Cal Cupertino, W.K. Geist Co., Box 746, 415-968-1608
" Glendale, W.K. Geist Co., Box 5004, 213-245-9501
Conn New Haven, Datech Assocs., 955 Dixwell Ave., 203-865-1365
Fla Orlando, Technical Assocs., Inc., 2319 E. South St., 305-424-5681
Iowa Cedar Rapids, Engineering Services, 1026 Third Ave., S.E., 319-366-1591
Kans Prairie Village, Engineering Services, 7924-A State Line, (913) MI 9-4000
La New Orleans, IBL Engrg. & Sls., 1444 Calhoun St., 504-895-4793
Md Wheaton, Eastronics, 2401 Blueridge Ave., 301-942-2363
Mass Newtonville, Datech Assocs., 815 Washington St., 617-527-5304
Mich Farmington, Carter, McCormic & Peirce, Inc., 23995 Freeway Pk. Dr., 313-477-7700
Mo St. Louis, Engineering Services, 6717 Vernon Ave., 415-968-1608
NJ Mountainside, JJS Assocs., Box 1205, 201-233-4562
NY Lyons Falls, A & D Devices, Box 365, 315-348-6631
" Rochester, A & D Devices, 830 Linden Ave., 716-586-8033
Ohio Cleveland, Carter, McCormic & Peirce, Inc., 3691 Lee Rd., 216-921-1360
" Dayton, Carter, McCormic & Peirce, Inc., 3406 N. Main St., 513-278-5873
Okla Tulsa, IBL Engrg. & Sls., 5149 East 31st St., (918) WE 6-6305
Ore Beaverton, Northwest Instr. Co., 460 N.W. Cedar St., 503-644-8285
Pa King of Prussia, JJS Assocs., Box 241
Tex Dallas, IBL Engrg. & Sls., Inc., 219 Preston Royal Ctr. 6, 214-363-2921
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Colo Boulder, Straube Assocs., Box 1649, 303-443-8600
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" Maitland, Beacon Elctrn. Assoc., 540 S. Maitland Ave., 305-647-3498
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NJ Ft. Lee, R.T. Reid Assocs., 530 Main St., 201-944-9323
NM Albuquerque, Electronic Enterprises, 1900 Washington St., 505-256-1585
" Las Cruces, Electronic Enterprises, 2605 Calle de Rosa, 505-524-0126
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" Medina, McShane Co., Box 523, 216-725-4283
Okla Tulsa, T.J. Ray Co., Box 45191, 918-627-1515
Pa Devon, B & A Assocs., 237 Lancaster Ave., 215-688-5173
Tex Dallas, Gillett Ind., 5635 Yale Blvd., 214-363-0107
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Wash Seattle, J.J. Backer Co., 221 W. Galer St., 206-283-6470
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Cal Burbank, Barry Controls, 2323 Valley St., 213-843-1000
" Encino, Ledbetter Assocs., 16618 Ventura Blvd., 213-789-8115
" San Carlos, L. Warren Assocs., 601 603 County Rd., 415-593-7688
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Ga Atlanta, Black Engrg. Sls. Co., Box 28737, 404-252-2523
Ill Villa Pk., Barry Controls, 122 W. Charles Rd., 312-834-2502
Mass Burlington, Schaal Assocs., Inc., 4A St.
Mich Southfield, Barry Controls, 28165 Greenfield Rd., 313-358-3871
Minn St. Paul, E. Melius & Assocs., 3758 N. Dunlap St., 612-484-8541
NJ Hillside, Barry Controls, 1219 Liberty Ave., 201-289-5152
NM Albuquerque, Vinson Assocs., 2329 Wisconson, N.E., 505-298-7442
NY Great Neck, E.R.A., Inc., 330 Great Neck Rd., 516-482-9320
" Rochester, T. Ferguson Sls. Co., Inc., Box 3893, 716-482-7757
Ohio Cleveland, Barry Controls, 2000 Lee Rd., 296-932-1150
" Dayton, Barry Controls, 1825 Webster St., 513-222-8931
Pa Malvern, Barry Controls, 288 Lancaster Ave., 215-644-0990
Tex Dallas, Blair Engrg. Sls. Co., 10034 Monroe St., 214-352-2556
" Houston, Blair Engrg. Sls. Co., 2400 W. Loop, S., 713-621-0818
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" Mt. View, Tech-Ser, Inc., 477 Castro St., 415-969-9020
" San Diego, Tech-Ser, Inc., Box 10544, 714-222-1121
Ill Maywood, Basic Ceramics, 1311 S. First Ave.
Mo Kansas City, R.F. Farris Co., Inc., 1715 Baltimore
" Maryland Hgts., Dipro, Inc., Box 1428
NJ Haddonfield, Gray-Williams Assocs., 8 E. Mt. Vernon Ave.
NC Rosman, Mitchell-Bissell Co., Box 518
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" Dayton, H.W. Ruge Co., 349 W. First St.
Pa Pittsburgh, Industrial Specialties, 300 Mt. Lebanon Blvd., 412-341-4000
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Tex Dallas, Tech-Ser, Inc., 10210 Monroe Dr., 214-358-2504
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Ariz Scottsdale, Bennewitz Assoc., Inc., 532 N. Brown Ave., 602-947-7379
Cal Los Angeles, Nolan Assocs., 1041 Macy St., 213-222-8133
" Palo Alto, Abbott Engrg. Co., 2600 El Camino Real, 415-327-0830
" Pasadena, R.T. Puelicher, 901 Laguna Rd., 213-682-3050
Colo Denver, Bennewitz Assoc., Inc., 2801 E. Colfax Ave., 303-399-1132
Conn Wolcott, Selmark Assoc., Inc., Box 6243
Fla Ft. Lauderdale, Reynolds & Assoc., Inc., 161 Southwest 75th Ave., 305-581-6611
" Melbourne, Reynolds & Assoc., Inc., 408 Strawbridge, 305-727-3205
" Orlando, Reynolds & Assocs., Inc., Box 8877, 305-424-3836
Ga Atlanta, Reynolds & Assoc., Inc., 175 W. Wieuca Rd., 404-252-5360
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Md Glen Burnie, Faion Lott Co., Box 534, 301-744-4611
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Minn Minneapolis, White Sls. Co., Box 4530, 612-929-4661
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" St. Louis, H.J. Weisler & Assoc., 2050 Woodson Rd., 314-428-3934
NJ Cherry Hill, L.H. Walke Co., 18 Dunbarton Rd., 609-424-3766
NM Albuquerque, Bennewitz Assoc., Inc., 9720 Candelaria, N.E., 505-298-6775
NY Liverpool, Aero Sls. Co., 600 Oswego St., 315-457-6378
" Roslyn, Seidel Assoc., Inc., 113 Ursula Dr., 516-621-1117
Ohio Dayton, A.H. Baier Co., 3300 S. Dixie Dr., 513-298-9897
" Willoughby, A.H. Baier Co., 4399 Industrial Pkwy., 216-946-6080
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Kans	Overland Pk., Penzner Assocs., Inc., Box 6264, 913-381-0004
Md	Rockville, Gawler-Knoop Co., 1751 Rickville Pike, 301-427-3950
Mass	Newtonville, H.J. Schuft Co., Inc., 815 Washington Ave., 617-527-5304
Mo	St. Louis, Penzner Assocs., Inc., Box 1912, Bechtold Sta., 314-351-1547
NJ	Roseland, Gawler-Knoop Co., 14 Beaufort Ave., 201-226-4545
NM	Albuquerque, Williams-Assocs., 420 Washington, S.E., 505-255-1638
NY	Liverpool, RJC Assocs., 219 Oakridge Terr., 315-457-3220
Ore	Portland, R. Legg Co., Box 25327, 503-292-8824
Pa	Pittsburgh, K.J. Lesker Co., 5635 Horning Rd., 512-892-2996
"	Richboro, Gawler-Knoop Co., Box 414, 215-925-7550
Tex	Dallas, Crockett Engrg. Co., Box 47287, 214-637-6120
Utah	Salt Lake City, Williams-Assocs., 2469 S. Main St., 801-466-8709
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Ga	Atlanta, Murphy & Cota, 586 Armour Cir., N.E., 404-875-2525
Ill	Chicago, Magnuson Assocs., 5639 W. Fullerton Ave., 312-622-6322
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Mass	Newton Highlands, Compar New England, 88 Needham St., 617-969-7140
Mich	Lathrup Village, Sheridan Assocs., Inc., Box 128, 313-358-3333
Minn	St. Paul, Magnuson Assocs., 1246 West 7th St., 612-227-8495
Mo	St. Louis, Sheridan Assocs., Inc., 10137 W. Florissant Ave., 314-524-4800
NJ	Moorestown, Beckman Instrs., Inc., Pleasant Valley Ave., 609-235-3314
"	Mountainside, Beckman Instrs., Inc., U.S. Hwy. #22 at Summit Rd., 201-232-7600
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NY	Red Hook, Ossmann Comp. Sls. Corp., 77 Kelly Rd., 914-297-7773
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"	Vestal, Ossmann Component Sales Corp., 1901 Vestal Pkwy., E., 607-785-9949
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Colo	Denver, Electronic Comp. Sls., Inc., Box 22011, 303-771-6200
Conn	Farmington, R. Perron & Co., Inc., 10 Briarwood Rd., 203-673-4825
"	Trumbull, R. Perron & Co., Inc., 36 Louis St., (203) AM 8-9631
Fla	Orlando, Components Sales Corp., Box 14523, 305-277-1510
"	St. Petersburg, Components Sales Corp., Box 9545, 813-360-7460
Ill	Skokie, Saffro & Assoc., 3736 Dempster St., (312) JU 8-0905
Iowa	Marion, Thomas & Modrcin Assoc., Inc., 890 17th Ave., 319-377-6261
Kans	Shawnee Mission Thomas & Modrcin Assoc., Inc., 5450 Buena Vista Dr., (913) HE 2-2131
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Minn	Minneapolis, Wenco Sales, 7728 Morgan Ave., S., 612-866-3639
Mo	Hazelwood, Thomas & Modrcin Assoc., Inc., 47 Village Sq., 314-838-6446
NH	Dover, R. Perron & Co., Inc., 1 Elm St., 603-742-2321
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"	Valley Stream, Levison Sls. Co., Inc., 5 Sunrise Plaza, 516-561-9696
"	Vestal, Ossmann Comp. Sales Corp., 1901 Vestal Pkwy., E., 607-785-9949
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Cal	Glendale, Instrument Specialists, Inc., 1109 S. Central 213-245-9404
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Fla	Orlando, Currie Aerospace Assoc., Inc., Box 13229, 305-855-0843
Ill	Rosemont, Cozzens & Cudahy, Inc., 9501 Devon Ave., 312-825-1144
Ind	Indianapolis, Cozzens & Cudahy, Inc., 647 Mulford Ct., 317-244-2456
Mass	Acton, Applied Meas., Inc., Box 316, 617-263-2766
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Minn	Minneapolis, Cozzens & Cudahy, Inc., 7710 Computer, 612-920-1022
Mo	Edmundson, Cozzens & Cudahy, Inc., 10534 Natural Bridge Rd., 314-423-1234
NJ	Hillsdale, Instrument Mktg. Assoc., Box 303, 201-664-4088
NM	Albuquerque, Hytronic Meas., Inc., 205 San Pablo, S.E., 505-268-3941
NY	Smithtown, Instrument Mktg. Assoc., Box 213, 516-751-5159
NC	Winston Salem, Currie Aerospace Assoc., Inc., 614 Nissen Bldg., 919-725-1927
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Pa	King of Prussia, Letronix, 251 W. DeKalb Pike, 215-265-1020
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BLACK LIGHT PRODS., Box 45278, Chicago, Ill. 60645, Tel: 312-561-4046; Sls. Mgr: J. Richardson
BLACK & WEBSTER, INC., 281 Winter St., Waltham, Mass. 02154, Tel: 617-891-8100, TWX: 710-324-1959; Sls. Mgr: J.E. Barber ..... FSC No. 89389
BLACKBURN, P.W., INC., 67 Main St., Dobbs Ferry, N.Y. 10522, Tel: (914) OW 3-2620; Pres: P.W. Blackburn

■ **BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., Janesville, Wisc. 53545, Tel: 608 - 752-8701; Sls. Mgr: R. W. Brandt. Pg. 1069**

Ill	Chicago, E. Schmeichel Co., 5968 W. Chicago Ave., 312-378-2070
Mass	Needham, DeVeer Sls. Engrg. Co., 1492 Highland Ave., 617-444-4200
EXP:	Wisc, Milwaukee, Dummann World Trade Co., 6833 W. Fond Du Lac Ave., 414-464-0100

■ **BLACKSTONE ULTRASONICS, INC., 820 Center St., Sheffield, Pa. 16347, Tel: 814 - 968-3221; Sls. Mgr: T. J. Korn .....Pg. 2919**

Ark	Little Rock, M. Robinson Co., Box 1134, 501-374-8495
Cal	Redwood City, Bearings, Seals & Gears, Inc., 1650 Broadway, 415-365-5444
Conn	Bridgeport, Technical Instrs., 575 Broad St., 203-368-4582
Fla	Ft. Lauderdale, Beacon Elctrn. Assocs., Inc., Box 10212, 305-564-4298
"	Maitland, Beacon Elctrn. Assocs., Inc., 540 S. Maitland Ave., 305-647-3498
Ga	Atlanta, Beacon Elctrn. Assoc., Inc., 2285 Peach Tree Rd., N.E., 404-351-3654
Ill	Chicago, E M F Co., 6135 W. Belmont Ave., 312-889-8323
Mass	Wilmington, Technical Instrs., Inc., 122 West St., 617-944-3930
Mich	Dearborn, Measurement Instrs., 14217 Michigan Ave. 313-278-4744
"	Grand Rapids, Measurement Instrs., 822 Cherry St., S.E.
NY	Clarence, D. Montanino, 4200 Gunnville Rd., 716-759-8000
"	New York, J.A. Adler, 663 Fifth Ave., 212-355-5633
Ohio	Columbus, Measurement Instrs., Inc., 2074 Arlington Ave., 614-488-9753
Pa	Allison Pk., Mktg. & Sls. Couns. Assocs., 4701 Hampton Farms Dr., 412-781-0412
SC	Greenville, Beacon Elctrn. Assoc., Inc., Box 115, 803-244-4552
Tex	Dallas, Teamwork, Inc., Box 14465, (214) FL 2-7747
Va	Virginia Beach, Crotts & Saunders Eng., Inc., Box 4206, 703-428-8081
Wash	Mercer Island, Bearings, Seals & Gears, 6867 84th Ave., S.E., 206-232-6070
WVa	Charleston, Measurement Instrs., Inc., 1216 Quarrier St., 304-344-9431

* BLACO graphite dispenser - Serwell Prods. Co.
* BLAKBLACK black dye - Colonial Alloys Co.
BLAKE ELCTRNS., INC., Muskego, Wisc. 53150, Tel: 414-422-0040; Sls. Mgr: J.A. Blake
BLAND CO., Precision Threaded Prods. Div., 95 Granby St., Bloomfield, Conn. 06002, Tel: 203-242-0755; Sls. Mgr: J. Livingston
BLASS ANTENNA ELCTRNS. CORP., Div. Engelhard Minerals & Chemicals Corp., 500 Willow Tree Rd., Leonia, N.J., Tel: 201-947-9000; Sls. Mgr: M.J. Carbotti ..... FSC No. 73620
*BLEND-OHM screenable resistance paste - Methode Electronics
*BLENDALLOY alloys - Magnetics, Inc.
*BLENDEX resin powder - Marbon Div.
*BLENDMASTER metering, mixing, dispensing machines - Hull Corporation
BLICKMAN, S., INC., 201 Gregory Ave., Weehawken, N.J. 07087, Tel: (201) UN 3-0800; Sls. Mgr: T.B. Lanahan ..... FSC No. 07657

■ **BLILEY ELECTRIC CO., 2545 W. Grandview Blvd., Erie, Pa. 16512, Tel: 814 - 838-3571, TWX: 510-696-6886; Sls. Mgr: G. E. Wright.....FSC No. 71034 .....Pgs. 1070-1076, 1145**

Cal	Los Angeles, Elsner-Rambo Co., 2526 Hyperion Ave., 213-664-2928
Ill	Hinsdale, Hill-Gray Assocs., Inc., 2 Salt Creek La., 312-325-4810
Iowa	Cedar Rapids, J. Vrbik Co., 2818 A Ave., N.E., 319-365-0461
Mich	Detroit, G. Shaffer Co., 16530 Greenview Rd., 313-535-8448
Mo	Kansas City, M.E. Bettis Co., Inc., 3706 Broadway, 816-561-0772
NY	Buffalo, R.W. Mitscher Co., Inc., 496 Ellicott Sq. Bldg., 716-854-2517
"	Elmont, F.E. Schmitt Co., Inc., 311 Meacham Ave., 516-437-8150
Ohio	Columbus, McFadden Sls. Co., 150 E. Broad St., 216-221-3363
Ore	Portland, C.K. Shanks & Assocs., Box 25375, 503-292-5656
Pa	Pittsburgh, R.E. Tanner Co., 486 Broadmoor Ave., 412-561-4687
Tex	Grand Prairie, Howell Sls., Inc., 235 Southeast 14th St., 214-262-5153

EXP:	NY, New York, Telesco Int'l. Corp., 171 Madison Ave., 212-683-9420
FOR:	Can, Winnipeg, Man., C.M. Robinson Agencies, Ltd., 1550 Erin St., Tel: 774-1855

(Glass Delay Lines Representatives)

NY	Jericho, J.J. Wild, Inc., 400 Jericho Tpke., 516-921-7100
EXP:	Conn, Stamford, Dage Corp., 757 Main St., 203-324-3123

*BLIND BOLTS, BLIND NUTS bolts & nuts - Hi-Shear Corp.
*BLIND-SERT inserts - Hi-Shear Corp.
BLINN, DELBERT CO., P.O. Box 2007, Pomona, Calif. 91766, Tel: 714-623-1257; Sls. Mgr: H.A. Manning ..... FSC No. 08289
BLISS ELCTRN. CORP., P.O. Box 366, Sussex, N.J. 07461, Tel: 201-875-3800; Sls. Mgr: R. Kaiser
*BLISTER DETECTOR testing equipment - Automation Inds. Inc.
*BLO-MASTER portable ventilators - Cincinnati Fan & Ventilator
* BLOC-LITE lighted displays - Co-Ord Switch
* BLOCK-STOR buffer storage devices - Remex Elctrns.
BLOCKSOM & CO., P.O. Box 300, Michigan City, Ind. 46360, Tel: (219) TR 4-3231, TWX: 810-296-3982; Sls. Mgr: C.F. Westman
BLONDER-TONGUE LABS., INC., 9 Alling St., Newark, N.J. 07102, Tel: 201-622-8155; V.P. Mktg: L.J. Knize
BLUDWORTH MARINE DIV., States Electronics Corp., 10 Adams St., Linden, N.J. 07036, Tel: 201-925-8650; Sls. Mgr: A. Stiansen ..... FSC No. 71053
*BLUE CHIP resistor - Erie Technological Products
*BLUE DOT coaxial connector - Maury Microwave Corp.
*BLUE DOT flashcubes - flashbulbs - Sylvania Electric Prods.
* BLUE FLASH grinding wheel - Avco Bay State Abrasives
* BLUE LINE switches - American Solenoid Co., Inc.

■ **BLUE M ENGRG. CO., Div. Blue M Electric Co., 138th & Chatham Sts., Blue Island, Ill. 60406, Tel: 312 - 385-9000, TWX: 910-689-3398; Sls. Mgr: A. Lazzara .....Pg. 1245**

Ariz	Scottsdale, 44 E. Indian School Rd., 602-947-7026
Cal	El Monte, 9650 Telstar Ave., 213-442-6672
"	Los Altos, 4898 El Camino Real, 415-969-9384
Conn	Milford, 1340 Boston Post Rd., 203-878-5937
Ga	Atlanta, 2989 N. Fulton Dr., N.E., 404-237-7644
Mass	Natick, 9 Mercer Rd., 617-235-8320
Mich	Oak Park, 21590 Greenfield Rd., 313-399-4660
NY	New Rochelle, 271 North Ave., 914-632-1465
Pa	Ardmore, 219 E. Lancaster, (215) MI 9-1448
Wash	Seattle, 1836 Westlake Ave., N., (206) AT 2-0606

*BLUE POLY 2, BLUE POLY 3 photographic screen - Ulano Prods.
*BLUE RIBBON connectors - Bunker-Ramo Corp.
*BLUE TOP-TRU-BEAM projector lamps - Sylvania Electric
*BLUE TOP-TRU-FLECTOR projector lamps - Sylvania Electric
*BLUE TOP-TRU-FOCUS projector lamps - Sylvania Electric
BLUM JULIUS & CO., INC., P.O. Box 292, Carlstadt, N.J. 07072, Tel: 201-438-4600, TWX: 710-989-0112
*BOARDMASTER drafting machines - Universal Drafting Machine
* BOBBIN CORES magnetic cores - Infinetics, Inc.
BODINE ELEC. CO., 2500 W. Bradley Pl., Chicago, Ill. 60618, Tel: 312-478-3515; Sls. Mgr: H.M. Fulmer ... FSC 07829
BODNAR PRODS. CORP., 30 Grove Ave., New Rochelle, N.Y. 10801, Tel: 914-636-4664; Pres: J. Hebron
BOEHME, H.O., INC., 200 Shames Dr., Westbury, N.Y. 11590, Tel: 516-333-6340; Sls. Mgr: R. Reinhardt; FSC 07835
BOGEN COMMUNICATIONS DIV., Lear Siegler, Inc., P.O. Box 500, Paramus, N.J. 07652, Tel: 201-343-5700, TWX: 201-488-8109; Pres: J.T. Morgan
BOGUE ELECTRIC MFG. CO., 52 Iowa St., Paterson, N.J., Tel: 201-525-2200, TWX: 710-482-7500; Sls. Mgr: T.C. Spencer ..... FSC No. 07860
BOKER MFG. CO., In-Dus-Tronic Div., 200 Burnett Ave., Maplewood, N.J., Tel: 201-761-6900; Sls. Mgr: C.B. Bergren
* BOLOMISTOR thermoelectric detector - MSI Elctrns., Inc.
BOLT BERANEK & NEWMAN, INC., Data Equipment Div., 2126 S. Lyon St., Santa Ana, Calif. 92705, Tel: 714-546-5300; Sls. Mgr: S.H. Zuck
*BOMB-TAIL closed-end splice - Amp Inc.
*BONDAID teflon etchant - Shamban W. S. & Co.

■ **BOOKER AND WALLESTAD, 1202 South 5th St., Hopkins, Minn. 55343 .....Pgs. 1237-1242**

(Refer to Thermotech Coil Forms & Components Div. for sales representatives.)

■ **BOONSHAFT & FUCHS — See EMR-Hatboro**

■ **BOONTON ELCTRNS. CORP., Rte. 287 at Smith Rd., Parsippany, N. J. 07054, Tel: 210 - 887-5110, TWX: 710-986-8241; Automation Prods. Sls. Mgr: R. Sierk, Instruments Sls. Mgr: J. Garthwaite .....FSC No. 04901 .....Pgs. 1346-1349**

Ala	Huntsville, J.L. Highsmith & Co., 3322 S. Memorial Pkwy., 205-881-3294
Ariz	Phoenix, O'Halloran Assoc., 4747 North 16th St., 602-277-3223
Cal	N. Hollywood, O'Halloran Assocs., 10700 Ventura Blvd., 213-877-0173
"	Palo Alto, O'Halloran Assocs., 3921 E. Bayshore, 415-326-1493
"	San Diego, O'Halloran Assocs., 3760 Midway Dr., 714-224-2824
Colo	Denver, J.F. Hurlbut Co., 2240 S. Adams St., 303-756-2046
Fla	Orlando, J.L. Highsmith & Co., 2543 Industrial Blvd., 305-293-5202
Ill	Chicago, K.W. Meyers Co., 7256 W. Touhy Ave., 312-774-6440
Iowa	Cedar Rapids, Engineering Servs. Co., 1026 Third Ave., S.E., 319-366-1591
Kans	Prairie Village, Engineering Services Co., 7924 A State Line, 913-649-4000
Md	Silver Spring, Paddock - Joslow Co., 721 Ellsworth Dr., 301-589-6554
Mass	Natick, G. Gregory Assocs., 7 Erie Dr., 617-655-1330

Mich Ypsilante, Micro Sales Corp., 650 Greenlawn Ave., 313-482-1229
Minn Minneapolis, K.W. Meyers Co., 4725 Excelsior Blvd., 612-920-7080
Mo St. Louis, Engineering Services Co., 6717 Vernon Ave., 314-726-2233
NJ E. Orange, Measurements Unlimited, Inc., 19 N. Harrison St., 201-677-0100
NM Albuquerque, C. Schmidt Sls., 9611 Acoma Rd., S.E., 505-298-2415
NY Hicksville, Measurements Unlimited, Inc., 11 Sleepy La., 516-735-2432
" Pleasantville, SBM Assocs., 28 Hobby St., 914-769-1811
" Rochester, S B M Assocs., 800 Linden Ave., 716-381-8330
" Syracuse, S B M Assocs., 5858 E. Molloy Rd., 315-454-9377
NC Charlotte, J.L. Highsmith & Co., 3733 Monroe Rd., 704-333-7743
Ohio Cleveland, Micro Sales Corp., 2000 Lee Rd., 216-371-0522
" Dayton, Micro Sales Corp., 1250 W. Dorothy La., 513-298-3033
Pa Philadelphia, Measurements Unlimited, 529 Shoemaker Rd., 215-224-1663
Tex Dallas, Airep Elctrns., 6300 N. Central Pkwy., 214-363-5291
" Houston, Airep Elctrns., 4901 Richmond Ave., 713-621-0955
" San Antonio, Airep Elctrns., 6936 San Pedro, 512-828-1488
Va Richmond, J.L. Highsmith & Co., 5003 Brook Rd., 703-266-2060
Wash Seattle, H. Levinson Co., 1211 E. Denny Way, 206-323-5100
EXP: NY, Parsippany, Boonton Elctrns. Corp., Rte. 287 at Smith Rd.
FOR: Can, Montreal, Que., Canadian-Marconi Co., 2442 Trenton Ave., 514-738-9441

BOONTON MOLDING CO., INC., 300 Myrtle Ave., Boonton, N.J. 07005, Tel: 201-334-4400, TWX: 201-334-6366; Sls. Mgr: K.R. Broo ..... FSC No. 85454

*BOOSTIVAC sublimation pumping & accessories - Ultek Div.
* BORALLOY pyrolytic boron nitride - Union Carbide Corp.

BORDEN CHEMICAL CO., Krylon Dept., Ford & Washington, Box 390, Norristown, Pa. 19401, Tel: 215-279-1950; Pres: J.W. Bampton

BORDEN, INC., Chemical Div., 350 Madison Ave., New York, N.Y. 10017, Tel: 212-573-4000, TWX: 212-867-6270; Pres: H.C. Wechsler

BORG-WARNER CONTROLS, 3300 S. Halladay, Santa Ana, Calif., Tel: 714-545-5585; Sls. Mgr: W.T. Brummett; FSC No. 80135

■ **BORG-WARNER THERMOELECTRICS, Dept. of Borg-Warner Corp., Wolf & Algonquin Rds., Des Plaines, Ill. 60018, Tel: 312-827-3131; Sls. Mgr: C. J. Phetteplace .....Pgs. 2796, 2797**

Cal Burbank, Weightman & Assocs., 1226 W. Olive Ave., 213-849-7711
" Menlo Park, Weightman & Assocs., 120 Santa Margarita, 415-325-2885
Colo Denver, Waugaman & Assocs., 2785 N. Speer Blvd., 303-255-5000
Conn Newton, R.P. Mahan Co., Inc., Box 506, 203-426-5910
Ill Chicago, Olson Engrg. & Sls. Corp., 1921 N. Harlem Ave., 312-622-9777
Md Towson, Leff Sls. Assocs., 408 York Rd., 301-823-0774
Mass Wellesly, R.P. Mahan Co., Inc., 572 Washington St., 617-237-1040
Minn Minneapolis, Olson Engrg. & Sls. Corp., 5535 Warden Ave., 612-929-7979
Mo Kansas City, H. Hanson Co., 7916 Paseo St., 816-444-9494
" St. Louis, Harris-Hanson Co., 2814 S. Brentwood Blvd., 314-647-4350
NJ Pennsauken, Leff Sls. Assocs., 5900 Westfield Ave., 609-663-4024
" Somerville, Kenbar Inds., 14 E. Main St., 201-725-9470
Okla Tulsa, J.A. Green Co., Box 3209, 918-742-4657
Tex Dallas, J.A. Green Co., Box 47206, 214-631-7450
" Houston, J.A. Green Co., Box 66506, 713-526-2959
Wash Seattle, G.M. Gillett & Assocs., Box 99035, 206-284-3344
EXP: Ill, Chicago, Borg-Warner Int'l. Corp., 36 S. Wabash Ave., 312-663-2111

* BOSS metal enclosures - Superior Switchboard & Devices

BOSSERT MFG. CORP., 1030 Oswego St., Utica, N.Y. 13503, Tel: 315-797-1600, TWX: 315-797-1261; Sls. Mgr: D.R. Samson

BOSTITCH, Div. of Textron, Inc., Briggs Dr., E. Greenwich, R.I. 02818, Tel: (401) TU 4-2500; O.J. Pender

BOSTON DIGITAL CORP., 21 Main St., Ashland, Mass. 01721, Tel: 617-881-1600; Sls. Mgr: H.A. Williams

* BOSTRON belts - American Biltrite Rubber Co., Inc.

BOURNS, INC., Instrument Div., 6135 Magnolia, Riverside, Calif. 92506, Tel: 714-684-1700, TWX: 910-332-6103; Sls. Mgr: R. Spitsnaugle ..... FSC No. 80294

BOURNS, INC., Magnetic Operations, P.O. Box 1398, Romoland, Calif. 92380, Tel: 714-657-5195; Sls. Supv: R.K. Jabs

■ **BOURNS, INC., Trimpot Div., 1200 Columbia Ave., Riverside, Calif. 92506, Tel: 714 - 684-1700, TWX: 714-682-9582; Dir. of Sls: R. C. McCulloch .....Pgs. 2452-2454**

Cal Inglewood, Bourns, Inc., 708 E. Manchester Blvd., 213-678-7811
" Los Altos, Bourns, Inc., 745 Distel Dr., 415-961-7687
Colo Denver, Electro-Rep, Inc., 1051 S. Platte River Dr., 303-744-2821
Fla Orlando, Bourns, Inc., 1325 W. Colonial Dr., 305-241-9525
Ill Barrington, Bourns, 550 W. Northwest Hwy., 312-381-6490
Kans Wichita, Florence & Meyer, Inc., 2900 Woodland, 316-838-7226
Md Landover Hills, Bourns, Inc., 6200 Annapolis Rd., 301-772-3233
Mass Hingham, Bourns, Inc., 10 Industrial Pk. Rd., 617-749-5800
Mich Dearborn, Villani-Pitcher, Inc., 20233 Ann Arbor Trail, 313-271-4600
Minn Minneapolis, M. Foster Co., Inc., 228 S. Cedar Lake Rd., 612-374-2612
Mo Kansas City, Florence & Meyer, Inc., 406 West 34th St., 816-561-7282
" St. Louis, Florence & Meyer, Inc., 8650A Airport Rd., 314-521-6800
NJ Cherry Hill, Bourns, Inc., 905 N. Kings Hwy., 609-667-1510
" Union, Bourns, Inc., 2414 Morris Ave., 201-688-5200
NM Albuquerque, Electro-Rep, Inc., 1415 Richmond Dr., N.E., 505-256-1749
NY Camilus, Bourns, Inc., 5100 W. Genesee St., 315-488-3286
" New York, Bourns, Inc., 212-227-8488
Ohio Dayton, Neal Bear Co., 1563 E. Dorothy La., 513-299-3566
" W. Richfield, Neal Bear Corp., 3435 Streetsboro Rd., 216-659-3331
Pa Monroeville, Nebco Assocs., Inc., 1974 Gregory Ave., 412-824-2111
" Philadelphia, Bourns, Inc., (215) WA 3-0859
Tex Dallas, Allied Comps., Inc., Box 38009, 214-348-6660
" Houston, Allied Components, Inc., 4234 Richmond Ave., 713-664-4203
Wash Seattle, J.J. Backer Co., Box 9327, 206-283-6470
WVa Charleston, Nebco Assocs., Inc., 1 Spotswood Ct.
FOR: Can, Toronto, Ont., Bourns, Ltd., 36 Cranfield Rd., 416-751-3880

BOW SOLDER PRODS. CO., INC., 25 Amsterdam St., Newark, N.J., Tel: 201-621-6996; Sls. Mgr: S. Turkus

BOWMAR CANADA, LTD., Sub. Bowmar Instr. Corp., Rideau River Rd., Ottawa, Ont., Canada, Tel: 613-822-0463, TWX: 610-562-1916; Sls. Mgr: W. Ratcliffe

■ **BOWMAR INSTR. CORP., 8000 Bluffton Rd., Ft. Wayne, Ind. 46809, Tel: 219 - 747-3121, TWX: 810-332-1510; Sls. Mgr: C. W. Jackson.....FSC No. 99479 .....Pg. 1021**

Ariz Phoenix, Gramer & Co., 110 W. Camelback Rd., 602-279-1221
Cal Burbank, Bowmar Instr. Corp., 3407 W. Olive St., 213-843-4545
" Palo Alto, Testco, Inc., 941 Charleston Rd., #2, 415-326-5320
Ga Atlanta, Bowmar Instr. Corp., 2551 Dresden Dr., N.E. 404-457-1686
Ill Chicago, M Q & Assocs., 6713 N. Oliphant Ave., 312-774-8844
Ind Ft. Wayne, Bowmar Instr. Corp., 8000 Bluffton Rd., 219-747-3121
Mass Acton, Bowmar Instr. Corp., 531 Main St., 617-263-7715
Minn St. Paul, H.A. Cullen & Assoc., 1595 Selby Ave., 612-646-7371
Mo St. Louis, PEM Sls. Co., 9537 Lackland Rd., 314-427-7200
NJ Matawan, Bowmar Instr. Corp., 13 Incline Pl., 201-526-0400
NY Fayetteville, R.P. Kennedy Co., Inc., Box 56, 315-637-9531
" Hyde Park, R.P. Kennedy Co., Inc., Greentree Dr., N., 914-471-4430
" Manhasset, G.F. McCarthy Corp., 75 Plandome Rd., (516) MA 7-8790
" Rochester, R.P. Kennedy Co., 39 Saginaw, 716-271-6322
Tex Dallas, Bowmar Instr. Corp., 14220 Haymeadow Dr., 817-277-6911
" Houston, Brice Co., 1402 Dunlavy, (713) JA 6-3197
Wash Seattle, Testco, Inc., Boeing Fld., Admin. Bldg., 206-762-8220
Va McLean, Bowmar Instr. Corp., 1801 Sheridan Ct., 703-356-3915
FOR: Can, Markam, Ont., Bowmar Instr. Corp., 73 Drakefield Rd., 416-294-2187
Can, Ottawa, Ont., Bowmar Can., Ltd., Box 4076, Sta. "E", 613-822-0463

*BOX SWITCH push button switches - Switchcraft Inc.

*BOYD BOLT self-retained bolts - Tridair Industries

BOZAK, R.T. MFG. CO., Box 1166, Darien, Conn. 06820, Tel: 203-838-6521; Sls. Mgr: P.A. Stone

■ **BRADENBERG — See Whitttaker Corp.**

BRADFORD COMPONENTS, INC., 65 South Ave., Box 107, Salamanca, N.Y. 14779, Tel: 716-945-2340; Sls. Mgr: R.H. Muntz ..... FSC No. 06457

BRADLEY INDS., Div. Richardson-Merrell, Inc., 11040 King St., Franklin Park, Ill. 60131

BRADLEY SEMICONDUCTOR CORP., 275 Welton St., New Haven, Conn. 06506, Tel: 203-787-7181; Pres: C.D. Bradley ..... FSC No. 73506

BRADY, W.H. CO., 710 W. Glendale Ave., Milwaukee, Wisc. 53201, Tel: 414-332-8100, TWX: 910-262-3151; Sls. Mgr: P.G. Vienot

*BRADYLITE luminous markers - Brady W. H. Co.

BRAININ, C.S. CORP., 320 Washington St., Mt. Vernon, N.Y. 10553, Tel: 914-668-5500; Sls. Mgr: D.A. Calder

* BRALOY silver-cadmium oxide alloys - Brainin, C.S. Corp.

BRAM METALLURGICAL-CHEMICAL CO., 245 W. Chelten Ave., Philadelphia, Pa. 19144, Tel: (215) GE 8-4900; Sls. Mgr: H.H. Bram

■ **BRAMCO CONTROLS DIV., Ledex, Inc., College & South Sts., Piqua, Ohio 45356, Tel: 513 - 773-8271; Sls. Mgr: D. H. Karstens .....Pg. 1303, 2286**

Cal Palo Alto, O'Donnell Assocs., 1955B El Camino Real, 415-327-9260
" Torrance, O'Donnell Assocs., 18053 Crenshaw Blvd., 213-323-9243
Fla Clearwater, W.B. Wimberly Co., 532 S. Ft. Harrison Ave., 813-446-7072
" Orlando, W.B. Wimberly Co., 500 S. Osceola St., 305-425-3083
Ill LaGrange, Bierhaus Sls., Inc., 1013 East 31st St., 312-354-5100
Mass Lexington, K.C. Stevens & Co., Inc., Box 24, 617-862-1812
Mich Lathrup Village, R.C. Nordstrom & Co., Box 32, 313-444-4417
Minn Excelsior, Component Sls., Inc., 18827 Kingswood Terr., 612-474-9100
Mo Kansas City, Automatic General Elctrn. Sls., Inc., 6550-E Troost Ave., 816-333-8206
" St. Louis, Automatic General Elctrn. Sls., 4253 Westminster Pl., 314-652-5366
NY Liverpool, L.P. Garner & Assocs., Box 56, 315-652-7911
" Lynbrook, Bittan Assocs., 381 Sunrise Hwy., 516-593-3833
NC Raleigh, A.B. Andrews & Co., 333 Fayetteville St., 919-833-5565
Ohio Dayton, Dynel Co., Box 7, Centerville Br., 513-434-6467
Pa Philadelphia, V.S. Malta, Box 4007, 215-836-5122
" Pittsburgh, R.F. Clark Co., Inc., 10517 Lindberg Ave., 412-242-9500
Tex Richardson, Automatic General Elctrn. Sls., Inc., Box 1006, 214-235-3577

BRAND DIELECTRICS, INC., Route 203, N. Windham, Conn. 06256, Tel: 203-423-6321; Sls. Mgr: P.B. Harvey .... FSC No. 05585

BRAND-REX DIV., American Enka Corp., P.O. Box 498, Willimantic, Conn. 06226, Tel: 203-423-7771, TWX: 710-440-2247; Sls. Mgr: C.M. Walker .... FSC 71124

BRANDYWINE FIBRE PRODS. CO., 1501 Popular St., Wilmington, Del. 19805, Tel: (302) OL 4-2431; Sls. Mgr: M.R. Stokes

BRANSON CORP., Box 845, Denville, N.J. 07834, Tel: 201-625-0600, TWX: 710-987-8466 ..... FSC No. 99928

BRANSON INSTRS. CO., 76 Progress Dr., Stamford, Conn., Tel: 203-324-6721, TWX: 710-474-0893; Sls. Mgr: K.P. Hayes ..... FSC No. 89878

BRAUN, H., TOOL & INSTR. CO., 140 Fifth Ave., Hawthorne, N.J., Tel: 201-427-1773, TWX: 710-988-4136; Sls. Mgr: R.C. Boderck ..... FSC No. 04640

*BRAZALOY flux - All-State Welding Alloys Co., Inc.

BREEZE CORPS., INC., 700 Liberty Ave., Union, N.J. 07083, Tel: (201) MU 6-4000; Sls. Mgr: A.C. Crossen; FSC 08484

BRELONIX, INC., 106 North 36th St., Seattle, Wash. 98103, Tel: (206) ME 3-1964; Sls. Mgr: H.W. Blake

BREVEL PRODS. CORP., Broad & 16th St., Carlstadt, N.J. 07072, Tel: 201-933-0220; Sls. Mgr: R.O. Soman

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Mo Hazelwood, Impala, Inc., 47 Village Sq., 314-831-5454
NJ Riverton, Given Assocs., Box 183, 609-829-7249
" Union City, Bressler Assocs., Inc., 4808 Bergenline Ave., 201-864-9577
NY New York, Bressler Assocs., Inc., 212-695-3727
" Rochester, W.A. Franklin Sls. Corp., 179 Hillary, 916-889-4849
" Syracuse, W.A. Franklin Sls. Corp., 2 Standish Terr., 315-446-1120
" Whitesboro, W.A. Franklin Sls. Corp., 42 Glenridge Rd., 315-736-5460
NC Greensboro, Murphy & Cota, Box 6365, 919-288-1923
" Winston-Salem, Murphy & Cota, 1106 Burke St., 919-723-1001
Tex Dallas, M. Loss Co., 7919 Royal La., 214-368-2758
FOR: Can, Scarborough, Ont., D. Randall, Ltd., 1710 Midland Ave., 416-751-7911

CHICOPEE MFG. CO., Cornelia, Ga. 30531, Tel: 404-778-2281, TWX: 404-778-4450; Sls. Mgr: M.J. Green

CHINALAK varnishes - John C. Dolph Co.

CHISSO CORP., 3-2, Marunouchi, 2-Chome, Chiyoda-ku, Tokyo 100, Japan, Tel: Tokyo (231) 4571; Pres: K. Mayeda

■ **CHOMERICS, INC., 85 Mystic St., Arlington, Mass. 02174, Tel: 617 - 648-8650, TWX: 710-348-0446 .....Pgs. 1639-1642**

Ala Huntsville, Young & Lawrence Assoc., Inc., 2907 Governors Dr., S.W., 205-539-6575
Ariz Scottsdale, Bennewitz Assoc., 532 N. Brown Ave., 602-947-7379
Cal San Carlos, Lo Dan, Inc., 1710 Industrial Rd., 415-592-4600
" Sun Valley, Kowal Assoc., Box 1048, 213-768-0378
Colo Denver, Bennewitz Assoc., 2801 E. Calfax Ave., 303-399-1132
Conn Branford, W. McCoy Co., Box 387, 203-488-2012
Fla St. Petersburg, Young & Lawrence Assoc., Inc., 300 31st St., N., 813-894-0026
" Winter Park, Young & Lawrence Assoc., Inc., 601 N. New York Ave., 305-647-6929
Ill Chicago, Croydon Elctrns., 1915 N. Harlem Ave., 312-237-4343
Ind Ft. Wayne, Croydon Elctrns., Box 2624, Sta. D, 219-422-7617
Iowa Cedar Rapids, Ensco, 1026 3rd Ave., S.E., 319-366-1591
Kans Prairie Village, Ensco, 7924A State Line, 913-649-4000
Md Chevy Chase, Andco Sls-Engrg., Inc., 4700 Davidson Dr., 301-654-6065
Mass Holliston, W. McCoy Co., 55 Prospect St., 617-429-2369
Minn Minneapolis, D.G. Perry & Co., 5010 France Ave., S., 612-920-3212
Mo St. Louis, Ensco, 6717 Vernon Ave., 314-726-2233
NM Albquerque, Bennewitz Assoc., 9720 Candelaria, N. E., 505-298-6775
NY Rochester, Smith Rubber Co., Inc., Box 1002, 716-342-6610
" Rockville Center, Willgold Elec. Sls. Corp., 100 N. Village Ave., 516-764-4022
NC Bethania, Candor Co., 919-924-1480
Ohio Cincinnati, Luebbe Sls. Co., Inc., Box 8955, 513-871-4211
Ore Portland, Houston Co., 411 Northeast 12th Ave., 503-235-4174
Pa Philadelphia, Andco Sls. -Engrg., Inc., 10 E. School House La., 215-844-9100
Tenn Bristol, Candor Co., Box 3204, 615-764-6215
Tex Dallas, V.J. Skyes Assoc., 13333 N. Central Expwy., 214-235-5289
Va Charlottesville, Candor Co., 413 Burwick Ct., 703-973-3789
Wash Seattle, Houston Co., 1738 4th Ave., S., 206-622-0750

CHRISTIAN PRECISION MFG. CO., INC., 12th & Federal Sts., Camden, N.J., Tel: (609) WO 3-3289; V.P. Sls: N. Weiner

■ **CHRISTIE ELEC. CORP., 3404A West 67 St., Los Angeles, Calif. 90043, Tel: 213 - 750-1151, TWX: 910-321-3867; Sls. Mgr: F. Benjamin.....FSC No. 02294 .....Pgs. 1894, 1895**

Ala Huntsville, Ridge Instr. Co., 7220 Governors Dr., W., 205-837-1761
Ariz Phoenix, R.A. Mayes Co., 4747 North 16th St., 602-279-5243
Cal Los Angeles, Halbar Assocs., 1805 W. Third St., 213-387-8283
Colo Broomfield, R.A. Mayes Co., Box 9, 303-421-0706
Fla Orlando, Ridge Instr. Co., 2227 Seely Dr., 305-293-4711
Ga Atlanta, Ridge Instr. Co., 3094 McCully Dr., N.E., 404-939-1554
Haw Honolulu, V. Kim Elctrns., 623-25 South St., Tel: 507-132
Ill Chicago, K.W. Meyers Co., 7256 W. Touhy Ave., 312-774-6440
Ind Indianapolis, K.W. Meyers Co., 3512 Rockville Rd., 317-243-6681
Iowa Cedar Rapids, Engineering Services Co., 1026 Third Ave., S.E., 319-366-1591
Kans Prairie Village, Engineering Services Co., 7924-A State Line, 913-649-4000
Md Silver Spring, L.G. White & Co., 1110 Fidler La., 301-585-3141
Mass Lexington, W.M. Hague Co., 10 Muzzey St., 617-862-5700
Mich Farmington, Carter, McCormic & Peirce, Inc., 23995 Freeway Pk. Dr., 313-477-7700
Mo St. Louis, Engineering Services Co., 6717 Vernon Ave., 314-726-2233
NJ Ridgewood, Instrumentation Sls. Co., Box 403, 201-445-5210
NM Albuquerque, R.A. Mayes Co., 8016 Zuni Rd., S.E., 505-265-7989
NY Clarence, Rep Tech, Inc., Box 156, 716-684-6250
" Syracuse, Rep Tech, Inc., Box 98, 315-454-0761
" Vestal, Rep Tech, Inc., 1905 Vestal Rd., 607-785-5979
NC Winston-Salem, L.G. White & Co., Box 2356, 919-725-3612
Ohio Cleveland, Carter, McCormic & Pierce, Inc., 3691 Lee Rd., 216-921-1360
" Dayton, Carter, McCormic & Pierce, Inc., 3406 N. Main St., 513-278-5873
Pa Narberth, L.G. White & Co., 100 Essex Ave., 215-664-6505
" Pittsburgh, Carter, McCormic & Pierce, Inc., 201 Penn Center Blvd., 412-824-3760
Tenn Oak Ridge, Ridge Instr. Co., 140 E. Division Rd., 615-483-1311

Tex Richardson, Applied Engrg. Sls., First Bank & Trust Bldg., 214-231-1322
Va Arlington, Gans-Fryling, Inc., 2030 - 16th St., N., 703-527-3262
Wash Bellevue, A. Smith Co., 405 - 166 S.E., 206-746-6770
*CHROM-O -SCOPE color monitor - Milletron, Inc.
*CHROMALEX electric heaters - Wiegand Co.
* CHROMEL alloys - Hoskins Mfg. Co.
*CHROMICOAT coating - Oakite Products, Inc.

■ **CHRONETICS, 500 Nuber Ave., Mt. Vernon, N. Y. 10550, Tel: 914 - 699-4400, TWX: 710-560-0014; Sls. Mgr: T. Berg..Pg. 1360**
Ala Huntsville, W.A. Brown & Assocs., Inc., 1314 Buford St., N.W., 205-536-8393
Ariz Phoenix, T.L. Snitzer Co., 15 North 40th Pl., 602-273-1673
Cal Del Mar, T.L. Snitzer Co., 317-14th St., 714-454-2191
" Los Angeles, T.L. Snitzer Co., 9005 Exposition Blvd., 213-836-6170
" Palo Alto, T.L. Snitzer Co., 1020 Corporation Way
Colo Denver, D.E. Bond Assoc., 2149 S. Clermont St., 303-756-1234
Fla Ft. Lauderdale, W.A. Brown & Assocs.., Inc., 3039 Northeast 32nd Ave., 305-243-6424
" Ft. Walton, W.A. Brown & Assocs., Inc., 212 Bradley Dr., N.E., 305-243-6424
" Orlando, W.A. Brown & Assocs., Inc., 222 Weber Ave., 305-425-5505
Ga Tucker, W.A. Brown & Assocs., Inc., 1590 Cooledge Rd., N.W., 404-939-1674
Ill Mt. Prospect, Contemporary Science, Inc., Box 205, (312) CL 5-3793
Md Silver Spring, Q.E.D. Elctrns., Inc., 880 Bonifant St., (301) JU 8-8134
Mass Waltham, J & J Assocs., 225 Cresent St., 617-899-0160
Mich Detroit, Technitron, Inc., 13657 Grand River Ave., 313-838-7324
Minn Minneapolis, L.F. Green Assoc., 6225 University Ave., N.E., 612-781-1611
Mo Kansas City, Harris-Hanson Co., 7916 Paseo St., 816-444-9494
" St. Louis, Harris-Hanson Co., 2814 S. Brentwood Blvd., (314) MI 7-4350
NJ Camden, Q.E.D. Elctrns., Inc., 2916 Federal St., (215) WA 5-8711
NM Albuquerque, D.E. Bond Assoc., Box 11331, 505-756-1234
NY DeWitt, DB Assocs., Box 14, (315) GI 6-0220
" Mt. Vernon, Q.E.D. Elctrns., Inc., 500 Nuber Ave., (914) YO 8-2200
NC Winston-Salem, W.A. Brown & Assocs., 1108 Burke St., 919-725-5384
Ohio Dayton, Technitron, Inc., 1250 W. Dorothy La., 513-298-7324
" N. Olmsted, Technitron, Inc., 23203 Lorain Rd., 216-734-0960
Pa Pittsburgh, Technitron, Inc., 114 Spring Grove Rd., 412-371-1231
Tex El Paso, D.E. Bond Assoc., Box 12293
FOR: Can, Don Mills, Ont., Applied Technology, Box 272, 416-444-1264

CHRONETICS, INC., Intercontinental Instrs., Inc., 500 Nuber Ave., Mt. Vernon, N.Y. 10550, Tel: 914-699-4400, TWX: 710-560-0014; Sls. Mgr: T. Berg ..... FSC No. 15072
* CHRONISTOR elapsed time indicators - Bergen Labs., Inc.

■ **CHRONO-LOG CORP., 2583 W. Chester Pike, Broomall, Pa. 19008, Tel: (215) EL 6-6771; Sls. Mgr: A. Freilich.....FSC No. 11963 .....Pg. 767**
Ala Huntsville, Reynolds & Assoc., 904 Bob Wallace Ave., S.W., 205-536-1941
Ariz Phoenix, R.A. Mayes Co., 4747 North 16th St., 602-279-5243
Cal Los Angeles, Thorson Co., 6824 Melrose Ave., (213) WE 7-0790
" Palo Alto, Thorson Co., 2443 Ash St., (415) DA 1-2414
" San Diego, Thorson Co., 444 Olive St., (714) CY 8-8385
" Santa Ana, Thorson Co., 2114 N. Broadway, 714-547-6206
Colo Broomfield, R.A. Mayes Co., Box 9, 303-421-0706
Fla Eau Gallie, Reynolds & Assocs., Box 1043, 305-727-3205
" Ft. Lauderdale, Reynolds & Assocs., 161 Southwest 75th St., 305-581-6611
" Orlando, Reynolds & Assocs., Box 8877, 305-424-3836
Ga Atlanta, Reynolds & Assoc., 175 W. Wieuca Rd., 404-252-5360
Kans Leawood, Leemark Engrs., Box 6175, (913) NI 8-0124
Mass Needham, Wild & Assocs., 570 Hillside Ave., (617) HI 4-2366
Mich Ypsilanti, Ohio Instr. Co., 8928 Nottingham Dr., 313-769-1177
Minn St. Paul, Engineering Prods. Assoc., 2119 Grand Ave., (612) MI 8-5531
Mo St. Louis, Leemark Engrs., 2001 Big Bend Blvd., (314) MI 7-4545
NJ Ramsey, Wild & Assocs., Box 300, 201-327-4244
NM Albuquerque, R.A. Mayes Co., 8016 Zuni Rd., 505-265-7989
NY Hastings on Hudson, Wild & Assocs., Box 266, 914-963-3803
" New York, Common Market-Pantronics, 500 Fifth Ave., (212) CH 4-2855
" Syosset, Wild & Assocs., 200 Michael Dr., (516) WA 1-7100
Ohio Worthington, Ohio Instr. Co., 505 Whitney Ave., 614-885-0743
Pa Southampton, Wild & Assocs., 80 Second St. Pike, (215) EL 7-6645
Va Arlington, H.J. Heffernan Co., 1123 N. Irving St., (703) JA 2-6666
Wash Seattle, Thorson Co., 1767 Fifteenth Ave., S., (206) EA 5-5000
FOR: Can, Don Mills, Ont., York Instrs., 1262 Don Mills Rd., 416-445-1255
* CHRONO-SPRAY time control - Paragon Elec. Co., Inc.
*CHRONODYNE resonator - Armec, Corp.
CHRYSLER CORP., Huntsville Space Operations, 1312 N. Meridan St., Huntsville, Ala. 35807, Tel: 205-842-4716; Sls. Mgr: I.L. DeYoung
CHU ASSOCS., INC., P.O. Box 387, Littleton, Mass. 01460, Tel: 617-456-3282; Sls. Mgr: I.M. Fairgen
CHUO ELCTRNS. CO., LTD., No. 21, Motohongomachi, Hachiojishi, Tokyo, Japan, Tel: (0426)-22-9106; Sls. Mgr: M. Yoshiwara

■ **CICOIL CORP., 9324 Topanga Canyon Blvd., Chatsworth, Calif. 91311, Tel: 213 - 882-2021, TWX: 910-494-1921; Sls. Mgr: W. Kish .....Pg. 2925**
Ariz Scottsdale, F. Schoeffler Assocs., 6912 E. Horseshoe Rd., 602-948-3470
Cal Hayward, Straube Assoc., 98 W. Jackson St., 415-783-6750
" Menlo Pk., Straube Assocs., Inc., 483 Willow Rd., 415-323-2476
" Sacramento, Staube Assoc., 2110 "K" St., 916-443-5392
Colo Boulder, Straube Assoc., 1123 Spruce St., 303-443-8600
Conn Guilford, R.H. Whitehead Assocs., Box 345, 203-453-3762
Ind Huntington, D. Steffen & Assocs., 737 N. LaFontaine St., 219-356-5124
Mass Boston, Whitehead Assocs., Rm. 481, Statler Office Bldg., 617-542-7676
Mich Grand Rapids, Elko Sls. Co., 3119 Midland Dr., S.E., 616-949-1451
" Grosse Point Woods, Elko Sls. Co., 80-970 N. Oxford Rd., 313-884-7893
Minn St. Paul, R.G. Ragon, Inc., 1136 W. Larpenteur Ave., 612-488-6634
NY Huntington, Par Distributors, Box 668, 516-271-0330
Ohio Cleveland, D. Steffen & Assoc., 904 East 222nd St., 216-261-5055
" Dayton, D. Steffen & Assoc., 1201 Heurstead Rd., 513-293-3145
CIMASTRA DIV., Cincinnati Milling Machine Co., 4760 Marburg Ave., Cincinnati, Ohio 45209, Tel: 513-731-2121; Sls. Mgr: J.A. Fulmer

■ **CIMCO WIRE & CABLE CO., 250 W. Crescent Ave., Allendale, N. J. 07401, Tel: (201) DA 7-2522; Pres: W. J. Indoe .....Pg. 2926**
Cal Hawthorne, Falmat, Inc., 13666 Hawthorne Blvd.
" S. San Francisco, Electrical Specialty Co., 213 E. Harris Ave., 415-589-9611
Ill Chicago, Kennedy Engrg., 6713 N. Oliphant Ave.
Mass Weston, F.C. Talbot Co., Box 366
Mich Birmingham, Component/Insulation Corp., 610 N. Woodward Ave.
Minn St. Paul, E. Hoffman Co., 180 N. Snelling Ave.
" St. Paul, E. Hoffman Co., 1573 Selby Ave.
Mo Kansas City, Suor Sales Corp., 8115 Troost, 816-444-2871
NJ Haddonfield, Keefe Elctrn. Sls. Co., 15 S. Haddon Ave.
" Montclair, E.B. Hinck, Box 201, 201-716-2625
NY Rochester, Telesco Assocs., Inc., 3254 Winton Rd., S., 716-275-9200
Ohio Cleveland, Component/Insulation Corp., 14235 Detroit Ave.
Pa Pittsburgh, J.W. Kight Co., 4 Longfellow Rd.
Tex Dallas, R.E. Nesbitt Co., 2930 Merrell Rd.
CIMRON DIV., Lear Siegler, Inc., 1152 Morena Blvd., San Diego, Calif. 92110, Pres: J.J. Kope, Jr.

■ **CINCH ELECTRNS. GROUP, 1501 Morse Ave., Elk Grove Village, Ill. 60007 .....Pgs. 888, 889**
Ariz Scottsdale, Cinch Elctrns. Group, 77 Third Ave., W., 602-946-3421
Cal Monterey Pk., Cinch Elctrns. Group, 887 S. Atlantic Blvd., 213-283-7224
" Mt. View, Cinch Elctrns. Group, 2680 Bayshore Frontage Rd., 415-969-2252
" Tustin, Cinch Elctrns. Group, 325 West 4th St., 714-838-4392
Fla Orlando, Cinch Elctrns. Group, 5360 Diplomat Cir., 305-645-2503
Ga Atlanta, Cinch Elctrns. Group, 349A Peachtree Hills Ave., N.E., 404-233-1017
Ill Chicago, Cinch Elctrns. Group, 312-569-2130
" Elk Grove Village, Cinch Elctrns. Group, 1982 Lunt Ave., 312-437-5110
Ind Indianapolis, Cinch Elctrns. Group, 2511 East 46th St., 317-547-2300
Mass Reading, Cinch Elctrns. Group, 100 Main St., 617-944-3020
Mich Detroit, Cinch Elctrns. Group, 2832 E. Grand Blvd., 313-873-9500
Minn Minneapolis, Cinch Elctrns. Group, 7615 Metro Blvd., 612-941-4353
Mo Kansas City, Cinch Elctrns. Group, 809 West 39th St., 816-531-6650
" St. Louis, Cinch Elctrns. Group, 8000 Bonhomme, 314-727-7370
NJ Ft. Lee, Cinch Elctrns. Group, 530 Main St., 201-947-7600
NY Millbrook, Cinch Elctrns. Group, Box 425, 914-677-3488
" New York, Cinch Elctrns. Group, 212-563-2980
" Syracuse, Cinch Elctrns. Group, Pickard Bldg., E. Molloy Rd., 315-454-9268
Ohio Dayton, Cinch Elctrns. Group, 3300 S. Dixie Ave., 513-299-1972
Pa Glenside, Cinch Elctrns. Group, 1601 Church Rd., 215-887-7520
Tex Dallas, Cinch Elctrns. Group, 1066 W. Mockingbird La., 214-637-6650
" Houston, Cinch Elctrns. Group, 1405 S. Post Oak Rd., 713-622-3723

■ **CINCH-GRAPHIK DIV., United Carr, Inc., 200 S. Turnbull Canyon Rd., City of Industry, Calif. 91744, Tel: 213 - 333-1201, TWX: 910-584-1861; Pres: G. C. Morse .....Pgs. 888, 889**
(Refer to Cinch Elctrns. Group for Sales Office Information.)

■ **CINCH MFG. CO., 1501 Morse Ave., Elk Grove Village, Ill. 60007, Tel: 312 - 921-6151, TWX: 910-222-1796; V.P. Sls: A. C. Olsen .....Pgs. 888, 889**
(Refer to Cinch Elctrns. Group for Sales Office Information.)

■ **CINCH-MONADNOCK, 18300 E. Valley Blvd., City of Industry, Calif. 91747, Tel: 213 - 964-6581, TWX: 910-584-1303; Gen'l. Mgr: C. M. Miller .....Pgs. 888, 889**
(Refer to Cinch Elctrns. Group for Sales Office Information.)

■ **CINCH-NU LINE, 1015 South 6th St., Minneapolis, Minn. 55415, Tel: 612 - 339-8301, TWX: 910-576-2748; Gen'l. Sls. Mgr: E. R. Schmidt .....Pgs. 888, 889**
(Refer to Cinch Elctrns. Group for Sales Office Information.)

CINCINNATI DEVELOPMENT & MFG. CO., 5614 Wooster Pike, Cincinnati, Ohio, Tel: 513-271-7280; Sls. Mgr: E. Mooney
CINCINNATI FAN & VENTILATOR CO., 6516 Wiehle, Cincinnati, Ohio 45237, Pres: G.B. Klee
CINCINNATI SUB-ZERO PRODS., INC., 2612 Gilbert Ave., Cincinnati, Ohio 45206, Tel: 513-751-8810; Sls. Mgr: L.M. Doherty ..... FSC No. 99920
*CINTICON camera tubes - ITT Electron Tube Div.
CINTRA PHYSICS INTERNATIONAL CO., 440 Logue Ave., Mt. View, Calif. 94040, Tel: 415-969-9230; Sls. Mgr: H. Reider
CIPHER DATA PRODS., INC., 1219 Morena Blvd., San Diego, Calif.
CIRCLE "F" INDS., P.O. Box 591, Trenton, N.J., Pres: E.A. Ring
CIRCLE SEAL PRODUCTS CO., INC., Circle Seal Center, P.O. Box 3666, Anaheim, Calif. 92803, Tel: 714-774-6110; Sls. Mgr: C. Siebert, Jr.

■ **CIRCON COMPONENT CORP., Santa Barbara Airport, Goleta, Calif. 93017, Tel: 805 - 967-1113; Sls. Mgr: C. M. Spafford..... FSC No. 04264 .....Pg. 1319**
Ariz Phoenix, R.V. Weatherford, 1917 North 25th Dr., 602-272-7144
Cal Anaheim, R.V. Weatherford Co., 1651 S. State College Blvd., Tel: 532-6741
" Glendale, R.V. Weatherford Co., 6921 San Fernando Rd., Tel: 849-3451
" Palo Alto, R.V. Weatherford Co., 3240 Hillview Ave., Tel: 321-5373
" Pomona, R.V. Weatherford Co., 1095 E. Third St., Tel: 623-1261
" San Diego, R.V. Weatherford Co., 7930 S. Balboa Ave., Tel: 278-7400
NY Binghamton, Stack Industrial Elctrns., Inc., 45-49 Washington St., Tel: 3-6326
" Hempstead, Davis Elctrns. Corp., 204 Main St., Tel: 183-9200
" New York, Terminal-Hudson Elctrns., Inc., 236 West 17th St., 212-243-5200
*CIRCUIT GAURD MONITOR test equipment - Dearborn Wire
*CIRCUIT GROUND computer ground planes - Flexible Circuits
*CIRCUIT MASTER automation control - Wintriss Controls
CIRCUIT STRUCTURES LAB., Div. Lincoln Instr. Co., Inc., 3200 N. San Fernando Blvd., Burbank, Calif. 91504, Tel: 213-849-6341; Sls. Mgr: F. Criswell .... FSC 17069
* CIRCUITESTER audio facilities checker - Ultra Audio Prods.
*CIRCUITFLEX circuits - Flexible Circuits Inc.
*CIRCUITIP level tips for printed-circuit components - Amp Inc.
*CIRCUITRACER continuity tester - Desco Mfg., Co.
CIRCUITS, INC., 59 Deming Rd., Berlin, Conn. 06037, Tel: 203-828-3526; Sls. Mgr: J.J. Adams
*CIRCUITSTRIP cable - Flexible Circuits Inc.
*CIRCUPAKS encapsulation cups and boards - U. S. Dielectric
CISIN, HARRY G. PUBLISHER, Oak La., Amagansett, N.Y. 11930, Tel: 516-267-3852; Sls. Mgr: H.G. Cisin
CITY CHEMICAL CORP., 132 West 22nd St., New York, N.Y. 10011, Tel: 212-929-2723; Sls. Mgr: E.W. Colle

■ **CLAIREX ELCTRNS., INC., 1239 Broadway, New York, N. Y. 10001, Tel: (212) MU 4-5512; Sls. Mgr: R. A. Farrall.....FSC No. 03911 .....Pg. 1773**
Ariz Scottsdale, E.V. Roberts & Assoc., Inc., 77 Third Ave., W., 602-947-7695
Cal Culver City, E.V. Roberts & Assoc., Inc., 9601 W. Jefferson Blvd., 213-870-9561
" Palo Alto, E.V. Roberts & Assoc., Inc., 800 San Antonio Rd., 415-324-1671
Ind Indianapolis, Scott Elctrns., Inc., 911 N. Pennsylvania Ave., 317-635-8951
Mass S. Braintree, Bordewieck Sls. Engrg. Co., 221 Grove St., 617-843-0845
Mich Detroit, Hilltronics, Inc., 13720 Puritan Ave., 313-342-3243
Minn Minneapolis, Heimann Co., Inc., 5603 Lyndale Ave., S., 612-827-5457
Ohio Cleveland, Scott Elctrns., Inc., 1836 Euclid Ave., 216-861-2626
Pa Pittsburgh, Scott Elctrns., Inc., 313 Empire Bldg., 412-471-5233
Wash Bellevue, Western Tech. Sls., Box 902, (206) GL 4-3906
EXP: NY, New York, S. Ginsbury, Ltd., 72 West 45th St., (212) MU 7-3213
*CLAMPANEL shielded enclosure - Amerind - MacKissic Inc.
* CLAMPIPE ground clamp - Mueller Elec. Co.
CLARAGE FAN CO., One Clarage Pl., Kalamazoo, Mich. 49001, Tel: 616-349-1541, TWX: 616-381-2967; Sls. Mgr: A.L. Otis ..... FSC No. 12546

* CLARCO unit heaters - Clarage Fan Co.

■ **CLARE, C. P. & CO., 3101 Pratt Blvd., Chicago, Ill. 60645, Tel: 312 - 262-7700; Sls. Mgr: R. I. Smith.....FSC No. 71482.....Pgs. 2208-2216**

Ariz Phoenix, C.P. Clare & Co., 4710 North 16th St.
Cal Mt. View, C.P. Clare & Co., 2680 Bayshore Frontage Rd.
" Santa Ana, C.P. Clare & Co., Box 11240
Fla Orlando, C.P. Clare & Co., 601 N. Fern Creek Ave., 305-424-9508
Ill Des Plaines, C.P. Clare & Co., 2590 Devon Ave., 312-827-0151
Kans Mission, Haigh Sls., 5460 Buena Vista, 913-722-2441
Md Baltimore, C.P. Clare & Co., 6229 N. Charles St., 301-377-8010
" Bethesda, Byrne Assocs., 4853 Cordell Ave., 301-654-8814
Mass Needham, DeVeer Sls. Engrg. Co., 1492 Highland Ave., 617-444-4200
Minn Minneapolis, C.P. Clare & Co., 4725 Excelsior Blvd., 612-920-3125
Mo St. Charles, C.P. Clare & Co., 10 Willowbrook Ct.
NY Great Neck, C.P. Clare & Co., 525 Northern Blvd., 516-466-2100
" Syracuse, C.P. Clare & Co., 499 S. Warren St., 315-422-0347
Ohio Cincinnati, Baehr, Greenleaf & Assoc., Inc., 9505 Montgomery Rd., 513-891-3827
" Cleveland, Baehr, Greenleaf & Assoc., Inc., 14700 Detroit Ave., 216-221-9030
" Columbus, Baehr, Greenleaf & Assoc., Inc., Box 5722, 614-486-4046
" Xenia, Baehr, Greenleaf & Assoc., Inc., 3350 Maplewood Dr., 513-426-9485
Pa Philadelphia, C.P. Clare & Co., 101 North 33rd St., 215-386-3385
Tex Dallas, R.E. Nesbitt Co., 2930 Merrell Rd., 214-357-4601
" Houston, R.E. Nesbitt Co., 4208 Mt. Vernon, 713-528-3811
Wash Bellevue, C.P. Clare & Co., 400 108th St., N.E., 206-455-2410
FOR: Can, Toronto, Ont., C.P. Clare Canada, Ltd., 61 Industry St., 416-762-8154

CLARE-ELECTROSEAL CORP., 946 North Ave., Des Plaines, Ill. 60016, Tel: 312-824-6173; Sls. Mgr: W.W. Kribble .... FSC No. 83532

CLARE-PENDAR CO., P.O. Box 785, Post Falls, Idho. 83854, Tel: 208-773-4541; Sls. Mgr: J.D. McElwain

* CLARIFUGE centrifugal clarifier - Barrett, Leon J. Co.

CLARK CONTROL DIV., A.O. Smith Corp., 1146 East 152nd St., Cleveland, Ohio 44110, Tel: 216-851-2000, TWX: 216-486-5680; Sls. Mgr: G.J. Deutsch

■ **CLARK CRYSTAL CORP., 344 Boston Post Rd., Marlborough, Mass. 01752, Tel: 617 - 481-0821; Sls. Mgr: F. L. Nobles.....FSC No. 98881 .....Pg. 1103**

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Md Silver Spring, R. Davies Assocs., 11215 Oak Leaf Dr., 301-593-4900
" Towson, T.H. Closs Co., 21 W. Pennsylvania Ave., 301-825-4445
Mass Acton, Applied Meas., 86 Hayward Rd., 617-263-2766
" Burlington, Mancib Co., Middlesex Tpke. at "A" St., 617-272-9450
Mich Livonia, Chandler Assocs., Inc., 32401 W. Eight Mile Rd., 313-476-5800
" Royal Oak, Satullo Co., 4514 N. Woodward Ave., 313-566-2375
Minn Minneapolis, Pinkney & Assocs., Inc., 1925 Nicollet Ave., 612-338-0523
Mo Hazelwood, Impala, Inc., 47 Village Sq. Shopp. Ctr., 314-831-5454
NM Albuquerque, Bowden Engrg. Sls., 2631-35 Texas, N.E., 505-299-0473
" Albuquerque, Electronic Enterprises, 1900 Washington St., N.E., 505-256-1585
" Las Cruces, Electronic Enterprises, Box 116, 505-524-0126
NY Mamaroneck, Cane Tech. Sls., Inc., 555 E. Boston Post Rd., 914-698-4411
" Monroe, Ossmann Comp. Sls. Corp., 17 Round Lake Park Rd., 914-297-7773
" Rochester, Ossmann Comp. Sls. Corp., 39 Saginaw Dr., 716-442-3290
" Roslyn Hgts., Travco Assocs., 142 Mineola Ave., 516-621-3223

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" Syracuse, Ossmann Comp. Sls. Corp., 5858 Molloy Rd., E., 315-454-4477
" Vestal, Ossmann Comp. Sls. Corp., 1901 Vestal Pkwy., E., 607-785-9949
NC Charlotte, Electro-Tech, Inc., 3107 Cullman Ave., 704-333-0326
Ohio Cleveland, Pioneer Standard Elctrns., Inc., 5403 Prospect Ave., 216-432-0010
" Dayton, Satullo Co., 2801 Far Hills Ave., 513-293-7061
" Dayton, Srepco Elctrns., 314 Leo St., 513-224-0871
Pa Fairview Village, Acromatix Assocs., Inc., 3118 Germantown Pike, 215-279-0377
" Media, W. Reeves Assocs., Inc., 2973 N. Providence Rd., 215-566-6709
Tex Dallas, P. Kreager Co., 9230 Cliffmere Dr., 214-348-3521
" Houston, E. Smith Sls. Co., 7007 Gulf Frwy., 713-649-5756
Wash Seattle, Eicher-Richards Co., 2727 N.E. Blakeley St., 206-523-7888

CONTROL DATA CORP., Magsense Prods. Operation, 775 Colorado Ave., S., Minneapolis, Minn. 55416, Tel: 612-544-8851, TWX: 910-576-2978; Sls. Mgr: W.L. Ness

■ **CONTROL ELCTRNS. CO., INC., 153 Florida St., Farmingdale, N. Y. 11725, Tel: 516 - 694-0125; Sls. Mgr: H. Goldstein..... FSC No. 95924 .....Pg. 1154**

Cal Sherman Oaks, R.T. Assocs., 213-788-7588
Ill Chicago, PGM Components, 5642 W. Diversey Ave., 312-622-8183
Md Glen Burnie, VPI, 561 Dorsey Rd., 301-768-0550
Mass W. Medway, J. Gallagher, Box 343, 617-533-7064
NJ E. Brunswick, VPI, 44 Fresh Pond Rd., 201-821-8977
NY Syracuse, Nycom, Inc., 2002 Teall Ave., 315-437-8343
Tex Dallas, Texas Avionics Co., 4515 Prentice St., EM 8-3566
Wash Seattle, J.J. Backer Co., 221 W. Galer St., AT 3-6470
EXP: NY, Plainview, Emec, Inc., 160 Terminal Dr., (516) WE 1-3700

■ **CONTROL EQUIP. CORP., 32 Kearney Rd., Needham Hgts., Mass. 02194, Tel: 617 - 444-7550; Sls. Mgr: H. E. Adams.....FSC No. 27574 .....Pg. 770**

Ala Huntsville, J.L. Highsmith & Co., 3322 S. Memorial Pkwy., 205-881-3294
Cal Garden Grove, WesTec Co., Box 875, 714-636-2930
" Mt. View, GBH Assocs., Box 1150, 415-969-9770
Colo Golden, Applied Engrg. Prods. Co., Box 88, 303-279-4608
Fla Orlando, J.L. Highsmith & Co., Box 7835, 305-293-5202
Ill Chicago, Scientific Sls. Corp., 7132 N. Harlem Ave., 312-775-7594
Ind Indianapolis, Scientific Sls. Corp., 5555 N. Tacoma Ave., 317-253-4606
Md Rockville, Tek Rep, Inc., 1075 Rockville Pike, 301-762-7777
Minn Minneapolis, Scientific Sls. Corp., 5100 Edina Industrial Blvd., 612-941-2215
Mo St. Louis, Scientific Sls. Corp., 1760 S. Brentwood Blvd., 314-968-1133
NY Hicksville, Salsbury Assocs., 331 W. John St., 516-938-1080
NC Charlotte, J.L. Highsmith & Co., Box 9367, 704-333-7743
Onio Cleveland, Data-Tron, 7016 Euclid, 216-391-8421
Pa Bala Cynwyd, Rivco, Box 52, 215-667-5110
Utah Salt Lake City, Applied Engrg. Prods. Co., 6375 Emigration Canyon, 801-364-4942
Va Richmond, J.L. Highsmith & Co., Box 9225, 703-266-2060

■ **CONTROL LOGIC, INC., 3 Strathmore Rd., Natick, Mass. 01760, Tel: 617 - 655-1170, TWX: 710-386-6677; Sls. Mgr: G. R. Grumbles .....Pg. 771**

Ala Huntsville, R. Attaway Co., 900 Bob Wallace Ave., 205-534-2811
Cal Burlingame, Compar San Francisco, 1817 Bayshore Hwy., 415-347-8244
" Downey, Wieler & Co., 10842 S. Paramount Blvd., 213-923-6611
Colo Boulder, Straube Assocs., Box 1649, 303-443-8600
Conn Glastonbury, Instrument Reps., Inc., Box 165, 203-633-0777
DC Washington, Sonco, 4720 Montgomery La., 301-654-5226
Fla Orlando, R. Attaway Co., 57 E. Robinson St., 305-424-9983
Ill Chicago, Brisky Assocs., 11734 S. Western Ave., 919-722-9671
Ind Ft. Wayne, R.O. Whitesell & Assoc., Inc., 6620 E. Washington St., 219-743-4411
" Indianapolis, R.O. Whitesell & Assoc., Inc., 6620 E. Washington St., 317-359-5374
Iowa Cedar Rapids, Engineering Servs. Co., 1026 Third Ave., S.E., 319-366-1591
Kans Prairie Village, Engineering Servs. Co., 7924-A State Line, 913-649-4000
Ky Louisville, R.O. Whitesell & Assoc., Inc., 3620 Lexington Rd., 502-893-7303
Mass Arlington, Instrument Reps., Inc., 1046 Massachusetts Ave., 617-646-1034
Mich Benton Harbor, R.O. Whitesell & Assoc., Inc., 303 Fidelity Bldg., 616-927-2041
" Southfield, R.O. Whitesell & Assoc., Inc., 25100 Evergreen Rd., 313-358-2020
Mo St. Louis, Engineering Servs. Co., 6717 Vernon Ave., 314-726-2233
NJ Eatontown, Sonco, 42 R Monmouth Rd., 201-542-1441
NY Ithaca, B. Dean, Inc., 714 W. Clinton St., 607-272-2187
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" Cleveland, R.O. Whitesell & Assoc., Inc., 21139 Lorain Ave., 216-333-2585
" Dayton, R.O. Whitesell & Assoc., Inc., 4133 S. Dixie Ave., 513-298-9546
Pa Camp Hill, Sonco, Park Pl. Office Bldg., 717-761-0577
" King of Prussia, Sonco, 107 Town Center Rd., 215-265-3250
" Pittsburgh, R.O. Whitesell & Assoc., Inc., 201 Penn Ctr. Bldg., 412-242-0100
Tex Houston, A. Barnes Co., 3230 Mercer St., 713-622-3620
" Richardson, A. Barnes Co., 740 S. Sherman St., 214-235-4541
" San Antonio, A. Barnes Co., 104 E. Petroleum Ctr., 512-828-1323
Utah Morgan, Staube Assocs., Box 1649, 801-829-6448
Va Richmond, Sonco, Ross Bldg., 703-643-5225

* CONTROL-O-MATIC battery chargers - Pedtro, Inc.

■ **CONTROL PANEL CORP. — See Control Products Corp.**

* CONTROL PLUS counters, electronic - MKC Elctrns.

■ **CONTROL PRODS. CORP., 4431 W. Division St., Chicago, Ill. 60651, Tel: 312 - 235-2340; Pres: H. A. Hart .....Pgs. 2804-2811**

Ala Huntsville, R. Steckmesser Assoc., Box 4006, 205-881-1750
Cal Cupertino, B.J. Wolfe Enterprises, Box 718, 408-252-5010
" N. Hollywood, B.J. Wolfe Enterprises, 10760 Burbank Blvd., 213-877-5518
Ill Chicago, Olson Engrg. & Sls., 1921 N. Harlem Ave., 312-622-9777
Ind Indianapolis, Delta Sls., Inc., 1407 N. Illinois St., 317-631-4136
Minn Minneapolis, Olson Engrg. & Sls., 6121 Excelsior Blvd., 612-921-1833
Ohio Cleveland, Van Hala Industrial Co., 14812 Detroit Ave., 216-521-6283
Pa McKeesport, Bidler Energies, Inc., 600 Market St., 412-678-6194

CONTROL PRODS., INC., Box #72, Hanover, N.J. 07936, Tel: 201-887-9400; Sls. Mgr: J.R. Nile ..... FSC No. 81901

CONTROL SCIENCE CORP., 4810 Beauregard St., Alexandria, Va. 22312, Tel: 703-354-1500; Sls. Mgr: E.R. Hommet ..... FSC No. 20452

■ **CONTROL TECHNOLOGY CO., INC., 41-16 29th St., Long Island City, N. Y. 11101, Tel: (212) EM 1-2133; Sls. Mgr: H. Copper .....FSC No. 14545 .....Pgs. 2662, 2663**

Cal Van Nuys, Blaine Line Corp., 14547 Titus St., (213) ST 2-6303
NY New York, E. Haber Corp., 2315 Broadway, 212-799-4040

CONTROLLED ENVIRONMENT EQUIP. CORP., 160 Pleasant St., Brockton, Mass. 02401, Tel: 617-588-6177; Sls. Mgr: R.D. Peck

CONTROLOMAG LABS., 2459 Susquehanna, Roslyn, Pa. 19001, Tel: 215-884-8098; Sls. Mgr: R. Patterson

CONTROLOTRON CORP., 35 Central Ave., Farmingdale, N.Y. 11735, Tel: 516-249-4400; Sls. Mgr: J. Segall ..... FSC No. 21614

CONTROLS CO. OF AMERICA, 9655 Soreng Ave., Schiller Pk., Ill. 60176, Tel: (312) NA 5-9000; Sls. Mgr: G.A. Heinemann ..... FSC No. 05402

CONTROLS CO. OF AMERICA, Control Switch Div., 1420 Delmar Dr., Folcroft, Pa. 19032, Tel: (215) LU 6-7500, TWX: 510-669-2136; Sls. Mgr: G.M. Ballee

CONTROLS & INSTRS., ITT, 2000 S. Wolf Rd., Des Plaines, Ill. 60016

CONVERSION CHEMICAL CORP., 210 E. Main St., Rockville, Conn., Tel: 203-872-0541, TWX: 710-435-2336; Dir. Mktg: C.L. Alderuccio

* CONVERTA-BALLAST fluorescent ballasts - Jefferson Elec.

*CONVERTI-FUSE panelboards, safety switches, switchboards - General Electric Co.

COOK ELEC. CO., 200 E. Daniels Rd., Palatine, Ill. 60067

COOK ELEC. CO., Data-Stor Div., 6401 W. Oakton, Morton Grove, Ill. 60053, Tel: 312-967-6600, TWX: 910-223-3654; Sls. Mgr: D. Hutchinson ..... FSC 71688

COOK, T.N., INC., 3520 E. Fulton St., Columbus, Ohio 43227, Tel: 614-235-3491; Sls. Mgr: H.M. Hall

COOKE ENGRG. CO., 735 N. Saint Asaph St., Alexandria, Va. 22314, Tel: 703-548-3889 ..... FSC No. 02002

COOKE VACUUM PRODS., INC., 13 Merritt St., S. Norwalk, Conn. 06854, Tel: 203-853-9500; Sls. Mgr: J.P. Santucci

* COOLERMET tri-layer contact tape - Improved Seamless Wire Co.

* COOLSHIELD welding headshield - Lincoln Elec. Co.

* COOLTONG electrode holder - Lincoln Elec. Co.

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*COPACO-125 electrical insulating paper - Cottrell Paper Co.

*COPAD coaxial attenuator - Sage Labs., Inc.

*COPALAM electrical insulaton - Cottrell Paper Co.

*COPALUM terminals & splices - Amp Inc.

COPAR CORP., 5744 West 77th St., Oak Lawn, Ill. 60459, Tel: 312-581-1133; Sls. Mgr: R.W. Schmidt

*COPAREX electrical insulating paper - Cottrell Paper Co.

*COPATH numerical measuring sys. - Ferranti-Packard Ltd.

* COPEL copper-nickel alloy - Hoskins Mfg. Co.

*COPPER GARD shielded coaxials - Superior Continental

COPPER RANGE, 630 5th Ave., New York, N.Y. 10020

* COPPERPLY lead wire - National-Standard Co.

* COPPERWELD copper covered steel - Crown Metal Prods.

COPPERWELD STEEL CO., Flexo Wire Div., 422 Frick Bldg., Pittsburgh, Pa. 15219; Sls. Mgr: C.S. Allen

COPPERWELD STEEL CO., Wire & Cable Div., Glassport, Pa. 15045, Tel: 412-664-7131, TWX: 710-794-4806; Gen'l. Mgr. of Sls: M.E. Brown

*COR-BOND vinyl pipe coatings - Polymer Corp.

*COR-GARD memory plane - Indiana General Corp.

CORD SPECIALTIES CO., 9239 Cherry St., Franklin Pk., Ill. 60131, Tel: 312-625-8323; Sls. Mgr: R.H. Stellman

*CORD-SWITCH push button switches - Switchcraft Inc.

*CORDEC coatings & sealants - Standard Brands Chemical Ind.

*CORDETTER push button switches - Switchcraft Inc.

* CORDEX reenforced paper - Mosinee Paper Mills Co.

*CORDMASTER push button switches - Switchcraft Inc.

CORDOVER, CARL & CO., 104 Liberty Ave., Mineola, N.Y., Tel: (516) PI 7-5150; Sls. Mgr: C. Cordover

*CORE-THANE impregnated packings - Houghton & Co.

CORE-TRONICS, INC., 241 N. Day St., Orange, N.J. 07050, Tel: 201-673-7660; Sls. Mgr: G. Sossin

*COREX chemically strengthened lab products - Corning Glass

CORKPAK CO., INC., 70 Argyle Ave., New Rochelle, N.Y. 10804, Tel: (914) NE 2-1713; Sls. Mgr: F.H. Paulmann, Sr.

CORNELL-DUBILIER ELCTRNS., Div. Federal Pacific Elec. Co., 50 Paris St., Newark, N.J., Tel: 201-624-7500; Sls. Mgr: J.M. Glynn

■ **CORNING GLASS WORKS, Electronic Prods. Div., Houghton Pk., Corning, N. Y. 14830, Tel: 607 - 962-4444, TWX: 510-252-1384; Sls. Mgr: R. E. Rahill .....Pgs. 646, 647, 2364, 2365**

Cal Orange, Corning Glass Works, 500 S. Main St., 714-541-5275
" Palo Alto, Corning Glass Works, 260 Sheridan Ave., 415-328-7400
Fla Maitland, Corning Glass Works, 2351 Hunterfield St., 305-838-7125
Ill Chicago, Corning Glass Works, 1470 Merchandise Mart, 312-337-6600
Md Bladensburg, Lowery Assocs. Co., 4508 Annapolis Rd., 301-864-4722
NY New York, Corning Glass Works, 717 Fifth Ave., 212-752-1100
NC Raleigh, Corning Glass Works, 3900 Electronics Dr., 919-828-0511
Pa Bradford, Corning Glass Works, 550 High St., 814-362-5571
" Broomall, Lowery Assocs. Co., 2801 W. Chester Pike, 215-356-5300
EXP: Fla, Coral Gables, Corning Glass Int'l., S.A., 4685 Ponce de Leon Blvd., 305-666-3334
NY, Corning Glass Int'l., S.A., Box 2000, 607-962-4444
FOR: Can, Leaside, Ont., Corning Glass Works Canada, Ltd., 416-421-1500

CORNING GLASS WORKS, Fluidic Prods. Dept., Corning, N.Y. 14830, Tel: 607-962-4444; Sls. Mgr: T. Brown

CORNING GLASS WORKS, Laboratory Prods. Dept., Corning, N.Y. 14830, Tel: 607-962-4444, TWX: 510-252-1384; Sls. Mgr: M. Van Gessel

CORNING GLASS WORKS, Memory Prods. Dept., 3900 Electronics Dr., Raleigh, N.C. 27602, Tel: 919-828-0511

CORNING GLASS WORKS, Technical Prods. Div., Corning, N.Y. 14830, Tel: 607-962-4444, TWX: 510-252-1384

CORNING GLASS WORKS, Television Prods. Div., Corning, N.Y. 14830, Tel: 607-962-4444, TWX: 510-252-1384; Sls. Mgr: C.A. Francik

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*COROTRON high voltage regulator - Victoreen, Inc.

*CORRGARD polyester film - Superior Continental

*CORRIB resistors - Ohmite Manufacturing Co.

CORRUGATED PAPER PRODS., INC., 300 Babylon Tpke., Roosevelt, N.Y. 11575, Tel: 516-379-8200; Sls. Mgr: L.S. Wagner

CORSON ELECTRIC MFG. CORP., Watrous St., E. Hampton, Conn., Tel: 203-267-2547; Sls. Mgr: D.E. Corson

CORVAIR DIODE, Div. Corvair Elctrns., Inc., 150 - 5th Ave., New York, N.Y. 10011, Tel: 212-255-7007, TWX: 710-581-4309; Sls. Mgr: L. Van Hoff

CORVAIR ELCTRNS., INC., 150 Fifth Ave., New York, N.Y. 100111, Tel: 212-255-7007; Sls. Mgr: S. Kass

*CORVEL plastic coating powders - Polymer Corporation

COSMIC PLASTICS, INC., 12314 Gladstone St., San Fernando, Calif. 91342, Tel: 213-365-3249; Sls. Mgr: C.H. Luh

COSMIC RADIO CO., 853 Whittier St., New York, N.Y. 10474, Tel: (212) LU 9-3360; Sls. Mgr: I. Rosenwasser

COSMICAR OPTICAL CO., LTD., 568, 2-chome, Shimoochiai, Shinjuku-ku Tokyo, Japan, Tel: (03) 953-1264; Sls. Mgr: N. Amano

COSMO PLASTICS CO., 3239 West 14th St., Cleveland, Ohio 44109, Tel: 216-861-5594, TWX: 810-421-8444; Sls. Mgr: B. Gordon ..... FSC No. 05616

COSMODYNE CORP., 2920 Columbia St., Torrance, Calif. 90509

*COSMOLINE rust preventives - Houghton & Co.

*COSMOLUBRIC lubricant - Houghton & Co.

* COTERM coaxial self-terminating jack - Cooke Engrg. Co.

■ **COTO-COIL CO., INC., 57 Pavilion Ave., Providence, R. I. 02905, Tel: 401 - 941-3355; Sls. Mgr: L. S. Bellem, Jr.....FSC No. 71707 .....Pg. 2218**

Cal Palo Alto, P. Nurches Co., 941 Charleston Rd., (415) DA 6-7842
" Pasadena, P. Nurches Co., 2396 E. Foothill Blvd., (213) MU 1-8957
Conn Greenwich, J. Hammond, 34 Lincoln Ave., 203-661-9410
Ohio Cincinnati, J. Olsen Co., 5539 Stokeswood Ct., 513-922-2176
" Cleveland, J. Olsen Co., 16201 Shaker Blvd., 216-752-5444

* Trade Name — See Mfr. Listing

Pa Pittsburgh, J. Olsen Co., 104 Elatan Dr., 412-279-2550
RI Providence, M. Paisner Assoc., 532 Elmgrove Ave., 401-831-4539
Wash Seattle, H. Levinson Co., 1211 E. Denny Way, 206-323-5100
EXP: NY, New York, Coto-Coil Co., Inc., 13 East 40th St.

COTTRELL PAPER CO., INC., 10 Purchase St., Fall River, Mass. 02720, Tel: 518-885-7510; Sls. Mgr: J.T. Cottrell, Jr.

■ **COUCH, S. H. Div., ESB, Inc., 3 Arlington St., N. Quincy, Mass. 02171, Tel: 617 - 298-4147; Sls. Mgr: B. W. Gray.....FSC No. 05587 .....Pg. 2219**

Ala Huntsville, R. Attaway Co., 900 Bob Wallace Ave., S.W., 205-534-2811
Cal Saratoga, Townsend Technical Sls., Box 265, 408-252-3478
" Van Nuys, R.J. Homer & Assocs., 14436 Sherman Way, 213-781-1236
Conn Essex, Connecticut Valley Enterprises, Box 188, 203-767-1128
Fla Orlando, R. Attaway Co., 51-53 E. Robinson St., 305-424-9983
Ill Skokie, H. Grubb & Co., 8039 N. Lawndale Ave., 312-677-0080
Minn Minneapolis, International Sls. Co., 8703 Beard Rd., 218-881-6683
Mo St. Louis, Pem Sls. Co., 9537 Lackland Rd., 314-427-7200
NJ Ridgewood, Electrical Mfrs. Service, Box 102, 201-471-6900
NY Bohemia, Electrical Mfrs. Services, 3170 Veteran's Memorial Hwy., 516-585-3100
" Syracuse, C.W. Floring & H.R. Murray, Inc., 6585 Kinne Rd., 315-446-5555
NC Winston-Salem, Radco Co., 614 Nissen Bldg., 919-722-9671
Ohio Mentor, R.R. Stone & Assocs., Box 47, 216-946-6766
Ore Portland, J.W. Eckersley, 3150 S.W. Hamilton St., Tel: 246-3183
Pa Philadelphia, Technicraft Co., 7028 RidgeAve., 215-483-4700
Tex Dallas, Hillman Enterprises, 3505 Turtle Creek, 214-521-9907
FOR: Can, Port Credit, Ont., Leonard Elec., Ltd., 1008 Rangeview Rd., Tel: 274-3454

COULTER ELCTNS., INC., 590 West 20th St., Hialeah, Fla. 33010, Tel: 305-887-8131; Pres: J.R. Coulter, Jr.

*COUNTER FACTS parts replacement listings - Sams, Howard W.

COUNTING INSTRS., LTD., 5, Elstree Way, Boreham Wood, Hertfordshire, England, 01-953-4151; Sls. Mgr: J. White

COUNTIS INDS., Box 1444, San Luis Obispo, Calif. 93401, Tel: 805-544-1770; Sls. Mgr: T.J. Countis

* COWECO coil winding machines & access. - Coil Winding Equip.

■ **COX & COMPANY, INC., 215 Park Ave., S., New York, N. Y. 10003, Tel: (212) OR 4-4727, TWX: 710-581-2839; Sls. Mgr: E. V. Cox, Jr. .....FSC No. 98085 .....Pg. 2812**

Cal N. Hollywood, J. Edwards Co., 4101 Lankershim Blvd., 213-877-9603
Mo Overland, E. Hitt & Assoc., 9537 Lackland Rd., 314-426-2322
NJ Moorestown, A.A. Foley Assocs., Box 155, (201) NO 3-4545
NY Jericho, Electro-Rep, Inc., 366 N. Broadway, 516-938-0540
" Syracuse, Lenard Co., 132 Burnet Ave., (315) GR 9-9191
Ohio Cincinnati, P.C. Bach Corp., 2209 Losantiville Rd., 513-731-3822
Tex Dallas, B. McClung & Co., Box 34447, 214-241-3655
Vt. Vergennes, M. Benton, 802-877-2656
Wash Seattle, Associated Inds., 3711 S. Hudson St., 206-723-5600

COX, C.E. CO., 1514-C. N. Harper St., Santa Ana, Calif. 92703, Tel: 714-531-2935

COX INSTR., Div. Lynch Corp., 15300 Fullerton, Detroit, Mich. 48227, Tel: 313-838-5780, TWX: 810-243-6444; Mktg. Mgr. Svcs: J.L. Mac Nair

* CRADLE relays - Allied Control Co., Inc.

*CRADLECLIP wire/cable harness - Electrovert, Inc.

CRAIG CORP., Prods. Div., 2302 East 15th St., Los Angeles, Calif., Tel: 213-623-2421; Sls. Mgr: H.F. Bowmaster

* CRAIG film editing equip. - Kalart Co., Inc.

CRAIG SYSTEMS CORP., 360 Merrimack St., Lawrence, Mass. 01842, Tel: 617-688-6961, TWX: 710-342-0765; V.P. Mktg: P.L. Nies ..... FSC No. 81902

CRAMER DIV., Conrac Corp., Old Saybrook, Conn. 06475, Tel: 203-388-3574, TWX: 710-471-0350; Sls. Mgr: R. A. Lorentson

* CRAMOLIN contact cleaner - Caig Labs., Inc.

CRANE PACKING CO., 6400 Oakton St., Morton Grove, Ill. 60053, Tel: (312) YO 6-6400; Sls. Mgr: R.S. Campbell; FSC No. 71724

CRATEX RUBBERIZED ABRASIVES, 1600 Rollins Rd., Burlingame, Calif. 94010, Tel: 415-697-1600; Sls. Mgr: J.C. Craven, Jr. ..... FSC No. 86297

CRESCENT NIAGARA CORP., 70 Niagara St., Buffalo, N.Y. 14202, Tel: 716-853-5100, TWX: 710-522-1829; Gen'l. Sls. Mgr: J.L. Lewis

* CRESCENT rings - Waldes Kohinoor, Inc.

■ **CRESTRONICS, 744 Rocky Loop, P.O. Box "S," Crestline, Calif. 92325, Tel: 714 - 338-1722; Sls. Mgr: R. W. Torell .....Pg. 1903**

* CRICKET audible digital monitor - Industrial Inventions, Inc.

*CRICKET subminiature switch - Illinois Tool Works

CRIMPCO ENGRG., 7341 Canoga Ave., Canoga Pk., Calif. 91304, Tel: 213-884-0540

*CRIMPCON crimp type terminals - Molex Prods., Co.

* CRITERION electrical meters - Canadian Res. Inst.

*CRITIC IC test equipment - Motorola Semiconductor

* CROMIR rear view mirror - Liberty Mirror Div.

*CROPICO electrical instr. - R.H. Nichols Co. Ltd.

*CROSS-CRIMP crimp configuration - Amp Inc.

CROSS, H. CO., 365 Park Ave., Weehawken, N.J. 07087, Tel: 201-863-1134; Sls. Mgr: G. McClary

* CROSSFLO transverse flow blower - Torrington Mfg. Co.

■ **CROVEN, LTD., Div. W. Kidde & Co., Inc., 500 Beech St., Whitby, Ont., Can., Tel: 416 - 668-3324, TWX: 610-384-2750; Sls. Mgr: R. E. Dix .....Pg. 1114**

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" Sepulveda, R.L. Assocs., Box 2255
" Van Nuys, R.L. Assocs., 14401 Gilmore St.
Fla Winter Park, J.J. Smith & Assocs., 935 Orange Ave., 305-644-4316
Ill Chicago, T.B. Hunter Assoc., 5653 W. Irving Pk. Rd., (312) SP 7-2500
Ind Ft. Wayne, G & H Sls. Co., Box 2268, 219-744-3072
Md Baltimore, C. Emrich, Rolling Rd. & Wilkens Ave.
Mass Natick, G. Rosen Co., Inc., 563 Worcester Rd.
Mich Southfield, G & H Sls. Co., 24001 Southfield Rd., 313-358-1910
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Ill Chicago, Stevens Engrg. Co., 312-725-4400
La New Orleans, Glidden Engrg. & Equip. Co., 504-737-0642
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Kans	Prairie Village, Thunderbird Engrg. Sales & Services Inc., 4014A West 95th St., 913-642-7220
"	Wichita, Thunderbird Engrg. Sales & Services Inc., 7707 E. Osie, 316-684-3941
La	Slidell, Noakes Engrg., Box 940
Md	Beltsville, C.E. Snow Co., 10442 Baltimore Ave., 301-345-2211
Mass	Canton, New England Elctrn. Sls. Corp., 590 Washington St., 617-828-4835
Mo	Hazelwood, Thunderbird Engrg. Sales & Services, Inc., 400 Brookes Dr., (314) PE 1-4343
NJ	Ft. Lee, K.E. Hughes Co., 2175 Lemoine Ave., 201-944-1600
Pa	Ambler, C.E. Snow Co., 258 N. Main St., 215-646-9451
Tex	Houston, Noakes Engrg., Box 36258, 713-529-6213
"	Irving, Noakes Engrg., Box 968, 214-255-0441

ELASTIC STOP NUT DIV., Amerace Esna Corp., 2330 Vauxhall Rd., Union, N.J. 07083, Tel: 201-686-6000, TWX: 710-985-4677; Sls. Mgr: D.B. Sorenson
* ELASTO-COTE protective covering - Kingsley Machine Co.
*ELASTO-PRENE "b" cord - Plastic Wire & Cable Corp.
*ELASTO-SYN rubber cord - Plastic Wire & Cable Corp.
*ELASTOSEAL o-ring - Shamban W. S. & Co.
* ELBIT digital computers - Elron, Inc.

■ **ELCO CORP., Maryland Rd. & Computer Ave., Willow Grove, Pa. 19090, Tel: 215 - 659-7000, TWX: 510-665-5573; Sls. Mgr: W. McKay.....FSC No. 91662** ..... **Pgs. 898, 899**

Ala	Hazelgreen, Grady-Duckett Sls. Co., Box 537, 205-828-3475
Ariz	Phoenix, J. Berman, Inc., 2101 W. Shangri La Rd., 602-944-3361
Cal	El Segundo, Elco Pacific, 2209 Park Pl., 213-675-3311
"	La Mesa, J. Berman, Box 453, 714-583-6457
"	Los Angeles, J. Berman Co., 8295 S. LaCienega Blvd., 213-678-1281
"	Oakland, F.W. Moulthrop & Assoc., 1530 East 12th St., (415) AN 1-7676
Colo	Denver, McLoud & Raymond, Box 22044, 303-756-1589
Conn	Colebrook, Elco, Box 12, 203-379-0287
DC	Washington, Mechtronics Sls., Inc., 7600 Georgia Ave., N.W., 202-291-6004
Fla	Miami, J.J. Smith & Assocs., Box 573, 305-374-6784
"	Winter Pk., J.J. Smith Assocs., 935 Orange Ave., 305-644-4316
Ga	Atlanta, Grady-Duckett Sls. Co., Box 29067, 404-451-3529
Ill	Chicago, D. Dolin Sls. Co., 3525 W. Peterson Ave., 312-588-3738
Ind	Indianapolis, Morris-Cunningham Co., 720 East 65 St., 317-255-2458
Md	Silver Springs, MIL, Inc., 817 Silver Springs Ave., 301-587-1134
Mass	Waltham, Elco, 181 West St., 617-899-6510
Mich	Lathrup Village, Sheridan Assocs., Box 128, 313-358-3333
Minn	St. Paul, Countryman, Wagner & Behnen Co., 1821 University Ave., 612-645-9151
Mo	Kansas City, R.W. Farris Co., 1715 Baltimore Ave., (816) HA 1-1751
"	Maryland Hgts., Dipro, Inc., Box 1428, 314-432-3780
NM	Albuquerque, McLoud & Raymond Co., 1415 Richmond Dr., N.E., 505-256-1749
NY	Manhasset, Win-Cor Elec. Sls., 75 Plandome Rd., 516-627-9474
"	Rochester, Telesco Assocs., 3254 Winton Rd., S., 716-275-9200
"	Vestel, Telesco Assocs., 609 Harvard St., 607-729-6339
NC	Greensboro, Grady-Duckett Co., Box 22002, 919-273-4617
Ohio	Cincinnati, Baehr-Greenleaf & Assoc., 9505 Montgomery Rd., 513-891-3826
"	Cleveland, Baehr-Greenleaf & Assoc., 14700 Detroit Ave., (216) AC 1-9030
"	Upper Arlington, Baehr-Greenleaf & Assoc., Box 5722, 614-486-4046
"	Xenia, Baehr-Greenleaf & Assoc., 3350 Maplewood, 513-426-5485
Okla	Oklahoma City, Ammon & Champion Co., Box 12274, 405-942-8222
"	Tulsa, Ammon & Champion, Box 4682, (918) NA 7-7670
Ore	Portland, Almac/Stroum Elctrns., Box 25444, 503-292-3534
Pa	Jenkintown, Hilliard Co., Old York Rd. at Noble Sta., (215) TU 4-6100
"	Pittsburgh, Lowry-Dietrich Assoc., 90 Clairton Blvd., 412-892-2992
Tex	Dallas, Ammon & Champion, Box 35263, (214) FL 7-8441
"	Houston, Ammon & Champion, Box 35552, 713-729-1233
Wash	Seattle, Almac/Stroum Elctrns., 5811 Sixth Ave., S., 206-763-2300
EXP:	NY, New York, Genex Corp., G.P.O. 1124, 212-524-2557

ELCO TOOL & SCREW CORP., 1111 Samuelson Rd., Rockford, Ill. 61101, Tel: 815-964-8611, TWX: 910-631-3420; V.P. Sls: J. Rathke ..... FSC No. 83486
*ELCON counters - Hecon Corp.
* ELCON tv pick up tubes - English Elec. Valve Co., Ltd.

■ **ELCOR, Div. Halliburton Co., 2431 Linden La., Silver Spring, Md. 20910, Tel: 301 - 589-6614; Sls. Mgr: R. K. Hothem.....FSC No. 09460** ..... **Pg. 1919**

Ala	Huntsville, Reynolds & Assoc., 904 Bob Wallace Ave., 205-536-1941
Cal	Los Altos, T. Whychell, 580 Spargur Dr., 415-948-0355
"	Sherman Oaks, Gee Assoc., 14474 Dickens St., 213-788-5961
Colo	Denver, Electro Rep, 1051 S. Platte River Dr., 303-744-2821
Fla	Eau Gallie, Reynolds & Assocs., Inc., Box 1043, 305-727-3205
"	Ft. Lauderdale, Reynolds & Assoc., Inc., 161 Southwest 75th Ave., 305-581-6611
"	Orlando, Reynolds & Assocs., Box 8877, 305-424-3836
Ga	Atlanta, Reynolds & Assocs., Inc., 175 W. Wiecua Rd., N.E., 404-255-8955
Ill	Wheaton, D. Hausten Co., 614 Arbor Ave., (312) MO 8-7312
Mass	Manchester, Applied Technology, 7 Vine St., (617) CA 7-2700
NM	Albuquerque, Electronic Enterprises, 1900 Washington, N.E., 505-256-1585
"	Las Cruces, Electronic Enterprises, Box 116, 505-524-0126
NY	Bronx, Bradley Assoc., Inc., 130 Van Cortlandt Ave., W., 212-549-8500
Ohio	Cleveland, Electro Sls. Assoc., 335 East 200th St., 216-486-1140
"	Dayton, Electro Sls. Assoc., Overlook Br., Box 3122, 513-426-5551
Pa	King of Prussia, Letronix, 251 W. DeKalb Pike, 215-265-1020
"	Pittsburgh, Electro Sls. Assoc., 201 Penn Center Blvd., 412-371-9449
Tex	Henderson, E.G. Miller Co., Box 929, 214-657-5049
Va	Falls Church, Jay Co., 2914 Annandale Rd., 703-534-7800
EXP:	NY, New York, Henley & Co., 202 East 44th St., (212) YU 6-5544
FOR:	Can, Ontario, Ont., York Instrs., 1262 Don Mills Rd., Tel: 445-1255

■ **ELDEMA DIV., Genisco Tech. Corp., 18435 Susana Rd. Compton, Calif. 90221, Tel: 213 - 774-1850, TWX: 910-346-6773; Sls. Mgr: T. Moore** ..... **Pgs. 1786-1791**

Ariz	Phoenix, W.B. Knight Co., Inc., Box 11394, 602-264-3578
Ark	El Dorado, D. Bellew Sls., Inc., Box 1835, 501-863-8325
Cal	Burlingame, W.J. Purdy Co., 770 Airport Blvd., 415-347-7701
"	Inglewood, W.B. Knight Co., Inc., 112 Glasgow Ave., 213-678-4711
"	Sacramento, W.J. Purdy Co., 4110 Stillmeadow Way, 916-481-0971
Colo	Littleton, W.J. Purdy Co., 1449 W. Littleton
Conn	Milford, P.R. Sturgeon Co., Inc., Box 170, 203-874-6080
DC	Washington, S.K. MacDonald, Inc., 217 Riggs Bank Bldg., 202-265-3938
Fla	Maitland, Geartner Assocs., Inc., 2101 Mohawk Trail, 305-647-4000
"	Miami Beach, Geartner Assocs., Inc., 350 Lincoln Rd., 305-531-0200
Ga	Atlanta, Electro-Rep Assocs., Inc., Box 29-353, 404-633-7011
Ill	Chicago, W.S. Patterson Co., Inc., 5604 N. Western Ave., 312-271-3774
La	Metairie, D. Bellew Sls., Inc., 3017 "D" 18th St., 504-833-6496
Md	Baltimore, S.K. MacDonald, Inc., 5500 Harford Rd., 301-254-3380
Mass	Chestnut Hill, P.R. Sturgeon Co., Inc., 1330 Boylston St., 617-734-7710
Mich	Detroit, ABM Sls., Inc., 5604 N. Western Ave., 313-862-1300
Minn	Minneapolis, F.B. Hill Co., 6110 Excelsior Blvd., 612-929-6727
NM	Albuquerque, C.T. Carlberg & Assocs., Box 3177, 505-265-1579
NY	Buffalo, R.W. Mitscher Co., Inc., 496 Ellicott Sq. Bldg., 716-854-2517
"	Manhassett, F. Spellman Co., 1295 Northern Blvd., 516-627-3399
NC	Charlotte, Electro-Rep Assocs., Inc., 128 West 30th St., 704-333-0451
"	Raleigh, Electro-Rep Assocs., Inc., Box 852, 919-834-3398
Ohio	Columbus, McFadden Sls. Co., 150 E. Broad St., 614-221-3363
Pa	Philadelphia, S.K. MacDonald, Inc., 1531 Spruce St., 215-545-1205
"	Pittsburg, S.K. MacDonald, Inc., 7805 McKnight Rd., 412-366-2643
Tex	Dallas, R.E. Nesbitt Co., Box 20816, 214-357-4601
"	Houston, R.E. Nesbitt Co., Box 66831, 713-528-3811
Wash	Seattle, J.J. Backer Co., 221 W. Galer St., 206-283-6470

ELDEN MFG. CORP., 2712 N. Elston Ave., Chicago, Ill. 60647, Tel: 312-276-2192

■ **ELDORADO ELCTRNS., 601 Chalomar Rd., Concord, Calif. 94520, Tel: 415 - 686-4200, TWX: 910-481-9476; Sls. Mgr: R. P. Swift .....FSC No. 14814** ..... **Pg. 1369**

Ala	Huntsville, Gentry Assocs., 2109 Clinton Ave., 205-534-9771
Ariz	Phoenix, T.L. Snitzer Co., 15 North 40th Pl., 602-273-1673
Cal	Del Mar, T.L. Snitzer Co., 1150 Camino Del Mar, 714-454-2191
"	Los Angeles, T.L. Snitzer Co., 9005 Exposition Blvd., 213-836-6170
"	Palo Alto, T.L. Snitzer Co., 1020 Corporation Way, 415-968-8304
Colo	Englewood, Aztec Enterprises, 3385 S. Bannock Dr., 303-761-0101
Conn	Hamden, Applied Meas., Inc., 2531 Whitney Ave., 203-288-5288
Fla	Orlando, Gentry Assocs., 550 N. Bumby Ave., 305-841-7740
Ga	Atlanta, Gentry Assocs., Box 13513, Sta. K, 404-874-4661
Ill	Northfield, Torkelson Assocs., 540 W. Frontage Rd., 312-446-8450
Ind	Indianapolis, Torkelson Assocs., 3512 Rockville Rd., 317-241-0725
Kans	Leawood, Leemark Engrs., Box 6175, (913) NI 8-0124
Md	Laurel, Scientific Mktg. Assocs., 8817 Hunting La., 301-776-5130
Mass	Acton, Applied Meas., Inc., 86 Hayward Rd., 617-263-2766
Mich	Detroit, Anderson Elctrns., 19471 James Couzens Hwy., (313) DI 2-7133
Minn	Minneapolis, Torkelson Assocs., 4820 West 77th St., 612-920-1046
Mo	St. Louis, Leemark Engrs., Inc., 9623 St. Charles Rock Rd., 314-423-8700
NJ	Pennsauken, Megargel-Himmelstein Assocs., 8070 C Rte. 130, 609-662-3081
"	Union, SBM Assocs., Inc., 1519 Stuyvesant Ave., 201-687-8737
NM	Albuquerque, Aztec Enterprises, 3202 Candelaria Rd., 505-345-3441
NY	Pleasantville, SBM Assocs., Inc., 28 Hobby St., (914) RO 9-1811
"	Syracuse, SBM Assocs., Inc., 5858 Molly Rd., 315-
"	Rochester, SBM Assocs., Inc., 800 Linden Ave., 716-381-8330 454-9377
NC	Burlington, Gentry Assocs., 116 E. O'Neal Ave., 919-227-2581
Ohio	Dayton, Instrumentation Sys., Inc., 3480 Office Park Dr., 513-293-8095
Tex	Dallas, Crockett Engrg., Inc., 1115 Brookhollow Dr., (214) ME 7-6120
Wash	Bellevue, Brennan Assocs., 208 Carlson Bldg., (206) GL 4-9332

ELDRE COMPONENTS, INC., 1239 University Ave., Rochester, N.Y. 14607, Tel: 716-244-2570, TWX: 716-235-4253; Sls. Mgr: J.A. Erdle ..... FSC 19648
ELEC-TROL, INC., 21018 Soledad Canyon Rd., Saugus, Calif., Tel: 805-259-7570; Sls. Mgr: K.E. Doriot; FSC 15636
*ELECTRA-LAB elect. training sys. - Electraid, Inc.
ELECTRA MFG. CO., 800 North 21, Independence, Kans. 67301

■ **ELECTRA/MIDLAND CORP., Cermetrik Div., 3347 Industrial Ct., San Diego, Calif. 92121, Tel: 714 - 453-0353; Sls. Mgr: C. T. Chleboski.....FSC No. 30983 .....Pg. 2469**

(Refer to Electra/Midland Corp., Midland Div. for sales office information.)

■ **ELECTRA/MIDLAND CORP., Electra Div., Box 760, Mineral Wells, Tex. 76067, Tel: 817 - 325-7871 .....Pgs. 648, 2376, 2377**

(Refer to Electra/Midland Corp., Midland Div. for sales office information.)

■ **ELECTRA/MIDLAND CORP., Midland Div., 3151 Fiberglas Rd., Kansas City, Kans. 66115, Tel: 913 - 342-7950; V.P. Mktg: M. J. Mulvihill .....Pgs. 1090-1095**

Ariz	Scottsdale, Runyon Co., 6825 E. Thomas Rd., 602-947-5711
Cal	Inglewood, Electra/Midland, 3402 W. Century Blvd., 213-678-2531
"	Los Angeles, Black & Strong, 1728 S. La Cienega Blvd., 213-870-9191
"	Oakland, F.W. Moulthrop, 1530 East 12th
Colo	Littleton, Simpson Assoc., 8000 S. Kendall Blvd., 303-798-8439
Fla	Oviedo, Conley-May, W. Broadway, 305-365-3283
Ill	Oak Park, Electra/Midland, 6641 W. North Ave., 312-848-0390
Ind	Ft. Wayne, Jedco, Inc., 4727 Foxgrove Ave., 219-483-4126
Md	Baltimore, Component Sls., 7 Church La., 301-484-3647
Mass	E. Boston, Electra/Midland, 144 Addison St., 617-567-6146
Mich	Southfield, G & H Sales, 24001 Southfield, 313-358-1910
Minn	St. Paul, Wagner Comp. Consultants, 542 S. Snelling Ave., 612-698-0331
NY	Endicott, Tech Mark, Inc., 101 Jefferson Ave., 607-748-7473
"	New York, Sprung/Nussbaum, 254 West 31st St., 212-565-1820
NC	Bethania, Candor, 919-924-1480
Ohio	Medina, J.C. Hofstetter Co., 5168 Valley View Dr., 216-241-4880
Pa	Narberth, J. Bresson, 107 Forest Ave., 215-839-6770
Tex	Mineral Wells, Electral Midland, Box 760, 817-325-7871
Wash	Bellevue, Wester Tech. Sls., 10843 Northeast 8th, 206-454-3906

ELECTRAC, INC., 1614 Orangethrope Way, Anaheim, Calif. 92801, Tel: 714-879-6021; Sls. Mgr: M.P. Marsh

*ELECTRACE recording chart paper - Gubelman Chart Division

ELECTRAID, INC., P.O. Box 53, Cambridge, Mass. 02141, Tel: (617) BR 2-4288; Gen'l. Mgr: R.R. Lewis

ELECTRALAB DIV./TYCO, Box 548, Encinitas, Calif. 92024, Tel: 714-753-6261, TWX: 910-322-2130; Dir. Mktg: P.L. Simpson ..... FSC No. 18944

ELECTREY, S.A. Apartado 1393, Monterrey, Mexico, Tel: 9181-75-1222; Sls. Mgr: J. Diaz

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ELECTRI-WIRE ASSEMBLIES CO., INC., 700 W. Virginia St., Milwaukee, Wisc. 53204, Tel: 414-272-4323; Sls. Mgr: J. Mulvanny

ELECTRIC INDICATOR CO., INC., 195 Danbury Rd., Wilton, Conn., Tel: 203-762-8655; Sls. Mgr: W.L. Sly .....FSC 73693

*ELECTRIC LACQUER lacquer - John C. Dolph Co.

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ELECTRIC PARTS CORP., Box 234, Georgetown, Ky. 40324, Tel: 502-863-3321; Sls. Mgr: D.E. Summers

ELECTRIC SOLDERING IRON CO., INC., P.O. Box 247, Deep River, Conn. 06417, Tel: 203-526-5361; Sls. Mgr: A.H. Meyers

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ELECTRIC THERMOMETERS, INC., 10 Glover Ave., Norwalk, Conn. 06850, Tel: 203-847-7265; Sls. Mgr: K. Bissing

ELECTRICAL INDS., Div. Philips Elctrns. & Pharmaceutical Inds. Corp., 691 Central Ave., Murray Hill, N.J. 07974, Tel: 201-464-3200, TWX: 201-464-1553; Sls. Mgr: D.V. Wilson ..... FSC No. 20093

ELECTRICAL INSTR. SERVICE, INC., 25 Dock St., Mt. Vernon, N.Y. 10550, Tel: 914-699-9717; Sls. Mgr: F.P. Johnston

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* ELECTRIDUCT over-the-floor extension cord - Ideas, Inc.

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ELECTRO-ALARM SAFETY DEVICES, 745 N. Pleasant, Fresno, Calif. 93728, Tel: (209) AM 4-6894; Sls. Mgr: V. Chambler ..... FSC No. 36623

ELECTRO-APPLICATIONS, INC., P.O. Drawer 401, Canonsburg, Pa. 15317, Tel: 412-745-7730; Sls. Mgr: J.D. Lahosky

ELECTRO ASSEMBLIES, INC., 4338 W. Montrose Ave., Chicago, Ill. 60641, Tel: 312-282-1266; Sls. Mgr: D.P. Stewart ..... FSC No. 09250

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* ELECTRO-CRIMP electrn. crimping machine - Crimpco Engrg.

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■ **ELECTRO/DATA, INC., 3121 Benton St., Garland, Tex. 75040, Tel: 214 - 276-6167; Sls. Mgr: J. D. Short.....FSC No. 25802 .....Pg. 1666**

Ariz	Phoenix, Hyer Assocs., 301 Indian School Rd., 602-264-0291
Cal	Los Altos, Wright Engrg., 175 S. San Antonio Rd., 415-941-4405
"	Pasadena, Wright Engrg., 180 E. California Ave., 213-681-2651
Colo	Englewood, Hyer Assocs., 7895 E. Prentice Ave., 303-771-5354
Md	Bethesda, Byrne Assocs., 4853 Cordell Ave., 301-654-8814
Mass	Lexington, W.M. Hague Co., 10 Muzzey St., 617-862-5700
Mich	Ypsilanti, Ohio Instr. Co., 8928 Nottingham Dr., 313-769-1177
NJ	Englewood, Central Assocs., 44 N. Dean St., 201-568-0808
NM	Albuquerque, Hyer Assocs., 130 Alvarado, 505-265-5961
NY	Plainview, Central Assocs., 11 Commercial St., 516-433-0808
Ohio	Worthington, Ohio Instr. Co., 505 Whitney Ave., 614-885-0743
Tex	Richardson, C. Hoffman Assocs., 777 S. Central Expwy., 214-235-3600
Utah	Salt Lake City, Hyer Elctrns., 1425 South 2nd West
FOR:	Can, Stittsville, Ont., Instronics Techno-Prods. Ltd., Box 100, 613-836-4411

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ELECTRO-DEVICES, INC., 4-6 Godwin Ave., Paterson, N.J. 07509

ELECTRO FIBEROPTICS CORP., 45 Water St., Worcester, Mass. 01604, Tel: 617-791-7391; Sls. Mgr: R. Poulin

*ELECTRO FLASHCOTE steel sheet - Republic Steel Corporation

ELECTRO-FLEX HEAT, INC., Northwood Industrial Pk., Bloomfield, Conn. 06002, Tel: 203-242-6287, TWX: 710-425-2978; Sls. Mgr: R. Ravenscroft .....FSC No. 02728

* ELECTRO-FLO air filter - Cambridge Filter Corp.

*ELECTRO-GRAPH oil and greases - Electrofilm, Inc.

*ELECTRO GUARD transformer - James Electronics Inc.

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Cal	Los Angeles, R.F. Assocs., Inc., 1621 Pontius Ave., 213-478-1586
"	Palo Alto, R.F. Assocs., Inc., 800 San Antonio Rd., 415-327-5531
Md	Laurel, Scientific Mktg. Assocs., 8817 Hunting La., 301-776-5130
Mass	Ashland, Atlantic Assocs., Inc., 224 Cordaville Rd., 617-881-4060
NJ	Pennsaucken, Megargel-Himmelstein, 8070C Rte. 130, 609-662-3081
NY	Syracuse, Lightstone Corp., 155 Pickard Bldg., E. Molloy Rd., 315-454-3209
"	Tuckahoe, Williams & Rotondi, 16 Fisher Ave., 914-961-4338
Tex	Richardson, C. Hoffman Assocs., Inc., 777 S. Central Expwy., 214-235-3600
EXP:	NY, New York, Rocke Int'l., 13 East 40th St., 212-689-0200
FOR:	Can, Weston, Ont., Conway Elctrns. Enterprises, Ltd., 88-90 Arrow Rd.

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* ELECTRO-LITE indicators - Electro Devices, Inc.

ELECTRO MAGNETIC FILTER CO., 231 S. Whisman Rd., Mt. View, Calif. 94040, Tel: 415-969-1050; Mktg. Mgr: P.E. Gagner

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Cal Sherman Oaks, Windsor Dynamics, Inc., Box 550, 213-387-8224
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*FULSCOPE controller - Taylor Instrument Process Control
*FUME-MASTER fume exhauster - Cincinnati Fan & Ventilator Co.
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*HEATRAX heat shrinkable tubing - ICO/RALLY
HEATRON, INC., P.O. Box 54, York, Pa. 17405
* HEATZONE high temp. wire - Cerro Wire & Cable Co.

HECHT RUBBER CORP., 482-484 Riverside Ave., Jacksonville, Fla. 32202, Tel: 904-355-3401; Sls. Mgr: M. Hecht

■ **HECON CORP., 31 Park Rd., New Shrewsbury, N. J. 07724, Tel: 201 - 542-9200; Sls. Mgr: R. M. Groll .....Pg. 1041**
Cal Sherman Oaks, Hecon Western, 15130 Ventura Blvd., 213-788-3931

HEDQUIST MACHINE & TOOL CO., 13110 Dericx Dr., Mt. View, Calif. 94040, Tel: 415-967-0265; Sls. Mgr: W. Hedquist
HEEGER, INC., 729 Ceres Ave., Los Angeles, Calif. 90021, Tel: 213-627-9319
* HEEMCO entire line - Hill Electronics, Inc.
*HEETSTRIP heating element - Therm-O-Lab Corp.

■ **HEINEMANN ELECTRIC CO., 2636 Brunswick Pike, Trenton, N. J. 08602, Tel: 609-882-4800; Dir. of Mktg: E. Bromberg.....FSC No. 74193 .....Pg. 2731**
Ala Birmingham, J. Spader Co., Box 6074, 205-879-1366
Ariz Phoenix, Benndorf Assocs., Inc., 1606 E. Catalina Dr., 602-264-5814
Cal Burlingame, Campbell & George Co., 840 Mahler Rd., 415-697-2965
" Encino, Porter Co., 17000 Ventura Blvd., 213-788-2350
" Sacramento, Campbell & George Co., 1331 "T" St., 916-442-4631
Colo Denver, P.A. Douden & Co., 1645 Wazee St., 303-534-6798
Fla Oviedo, Conley-May Assoc., Inc., Box 668, 305-365-3283
" Pompano Beach, Conley-May Assocs., Inc., 721 South east 6th Terr., 305-943-8284
" Tampa, Conley-May Assocs., Inc., 1054 S. Clearview, 813-822-0161
Ga Atlanta, Hooker Reid Co., Inc., Box 11754, 404-237-9385
Ill Chicago, D. Dolin Sales Co., 3525 W. Peterson Ave., (312) JU 8-3738
Ind Sandy Hills, O.H. Bromberg & Assocs., Inc., 1723 Overlook Dr., 317-664-5384
La New Orleans, Glidden Engrg. & Equip. Co., 221 Diane Ave., 504-737-0642
Md Towson, McCourt Co., Inc., 28 W. Pennsylvania Ave., (301) VA 3-3455
Mass Boston, Electrical Apparatus Co., Inc., 1200 Soldiers Field Rd., (617) ST 2-7440
Mich Dearborn, G.R. Horne & Co., 1140 N. Telegraph Rd., (313) LO 1-1360
Minn Minneapolis, H.P. Smith Co., 224 W. Franklin Ave., (612) FE 5-8911
Mo St. Louis, Hill & Co., 915 Buder Bldg., (314) MA 1-1818
NJ Ridgewood, Ballou, Inc., 51 N. Broad St., (201) GI 4-6990
" Trenton, Kriegner Sls. Co., 1602 Pennington Rd., (609) TU 2-6330
NY Buffalo, Canavan-Scanlon Assoc., 564 Ellicott Sq. Bldg., (716) TL 2-1122
" New York, Ballou, Inc., (212) WO 4-4640
" Syracuse, Canavan-Scanlon Assoc., Box 142, Eastwood Sta., (315) HO 3-9161
NC Raleigh, Hooker Reid Co., Inc., Box 10941, 919-828-8669
Ohio Cincinnati, O.H. Bromberg & Assocs., Inc., 561 Reading Rd., 513-381-5728
" Cleveland, Brown Electrical Equip. Co., 1900 Euclid Ave., (216) TO 1-0114
" Toledo, W.J. Ash & Assocs., 4110 Templar Rd., (419) CH 1-1141
Okla Tulsa, Components, Inc., 1526 East 4th St., (918) LU 3-9149
Ore West Linn, Northwestern Agencies, 3950 S. Elmran Dr., 503-636-5777
Pa Philadelphia, Kriegner Sls. Co., Enterprise 6105
" Pittsburgh, Brown Electrical Equip. Co, 1612 Potomac Ave., 412-563-4444
Tenn Memphis, Southland Sls., Inc., 300 Poplar Bldg., (901) JA 5-0142
" Nashville, Southland Sls., Inc., 3063 Jenry Dr., (615) TU 3-7356
Tex Dallas, Glidden Engrg. & Equip. Co., 8609 Northwest Plaza, (214) EM 3-6539
" Houston, Glidden Engrg. & Equip. Co., 7728 Long Point Rd., 713-681-1415
Wash Seattle, Northwestern Agencies, 4130 First Ave., S., (206) MA 3-8882
Wisc Milwaukee, E.A. Dickinson & Assocs., Inc., 3612 N. Green Bay Ave., (414) CO 4-1080
FOR: Can, Edmonton, Alb., F.D. Bolton, Ltd., 10187 104th St., (403) GA 2-6954
Can, Islington, Ont., D.T. Shaw Co., Ltd., 5150 Dundas St., W., 416-231-2706
Can, Montreal, Que., D.T. Shaw Co., Ltd., 1966 Graham Blvd., 514-735-1541
Can, Vancouver, B.C., F.D. Bolton, Ltd., 1300 West 6th Ave., 604-736-0351
Can, Winnipeg, Man, F.D. Bolton, Ltd., 1129 Sanford St., 204-774-5708

HEINTZ & KAUFMAN, LTD., 3650 Hayden Ave., Culver City, Calif., Tel: (213) VE 7-0753; Sls. Mgr: C.A. Tepper
HEITZ, KARL, INC., 979 Third Ave., New York, N.Y. 10022, Tel: 212-421-5220; Sls. Mgr: S. Rosen
*HELECON luminescent pigments - U. S. Radium Corp.
HELENOR METALS CORP., 60 Marbledale Rd., Tuckahoe, N.Y. 10707, Tel: 914-337-7373; Pres: H. Ament
* HELI-CAL shaft coupling - Helical Prods. Co., Inc.
HELI-COIL CORP., Shelter Rock La., Danbury, Conn. 06810, Tel: 203-743-7651, TWX: 710-456-0336; Sls. Mgr: H.W. Hall ..... FSC No. 91767
*HELI-TUBE spiral cable wrap - M. M. Newman Corp.
*HELIAX cable & waveguide - Andrew Corporation
* HELIBLOC block - Helitronics Corp.

HELICAL PRODS. CO., INC., P.O. Box 4, Hermosa Beach, Calif., Tel: 213-374-9941, TWX: 213-320-5372; Pres: C.M. Merrell ..... FSC No. 13201
*HELICON connector - Amp Inc.
* HELICORDER multistylus paper recorder - Geotech
*HELIFLUX magnetometers-magnetic sensing devices - Schonstedt Instrument Co.
* HELINUT nut - Helitronics Corp.
HELIOTEK, Textron Co., 12500 Gladstone Ave., Sylmar, Calif., Tel: 213-365-4611, TWX: 910-496-1488; Mktg. Mgr: F. Woodward
* HELISHAFT shaft - Helitronics Corp.
*HELISPHERE spherical bearings - Industrial Tectonics, Inc.

■ **HELITRONICS CORP., 916 McCarter Hwy., Newark, N. J. 07102, Tel: 201 - 621-7773 .....Pg. 1220**

■ **HELIX RESEARCH ASSOCS., INC., 8384 Hercules St., La Mesa, Calif. 92041, Tel: 714 - 465-3557, TWX: 910-332-1344; Sls. Mgr: G. A. Burns.....FSC No. 30135 .....Pgs. 1292, 2790**
Ala Huntsville, W.A. Brown & Assocs., Inc., 1314 Buford St., N.W., 205-536-8393
Ariz Phoenix, Williams-Assocs., Inc., 1110 E. McDowell Rd., 602-254-6085
Cal Burbank, Tech-Ser, Inc., 2435 N. Naomi St., 213-846-9631
" Mt. View, Tech-Ser, Inc., 477 Castro St., 415-969-9020
" San Diego, Tech-Ser, Inc., Box 10544, 714-222-1121
Colo Denver, Williams-Assocs., Inc., 4971 Jackson St., 303-388-4391
Fla Ft. Lauderdale, W.A. Brown & Assocs., Inc., 3039 Northeast 32nd Ave., 305-564-8000
" Ft. Walton Beach, W.A. Brown & Assocs., Inc., 212 Bradley Dr., N.E., 904-243-6424
" Orlando, W.A. Brown & Assocs., Inc., 222 Weber Ave., 305-425-5505
Ga Tucker, W.A. Brown & Assocs., Inc., 1590 Cooledge Rd., N.W., 404-939-1674
Ill Chicago, Electro-Tech Mktg. Assocs., 2535 N. Ashland Ave., 312-342-1600
Kans Wichita, G. Fixman Engrg., 6631 E. Kellogg
Md Bethesda, Mount & Co., 4853 Cordell Ave., 301-652-5612
Mass Waltham, Electronic Components & Services, 611 Trapelo Rd., 617-894-6921
Mich Ypsilanti, Micro Sls. Corp., 650 Greenlawn, 313-483-1229
Mo St. Louis, G. Fixman Engrg. Co., 8160 Stanford Ave., 314-725-5219
NJ Pine Brook, J.W. Richardt Co., Rte. No. 46, 201-228-0600
" Whippany, J.W. Richardt Co., Box 267
NM Albuquerque, Williams-Assocs., Inc., 420 Washington St., S.E., 505-255-1638
NC Winston-Salem, W.A. Brown & Assocs., Inc., 1108 Burke St., 919-725-5384
Ohio Cleveland, Micro Sls. Corp., 2000 Lee Rd., 216-371-0522
" Dayton, Micro Sls. Corp., 1250 W. Dorothy La., 513-298-3033
Pa Jenkenstown, Mount & Co., 706 Benjamin Fox Pavillion, 215-886-0383
Tex Dallas, Tech-Ser, Inc., 10210 Monroe Dr., 214-358-2504
Utah Salt Lake City, Williams-Assocs., Inc., 2469 S. Main St., 801-466-8709
FOR: Can, Montreal, Consolidated Cybernetics Controls, Ltd., 1549 De Maisonneuve Blvd., W., 514-932-3008

HELIX SPRING CORP., 35-10 10 St., Long Island City, N.Y. 11106, Tel: (212) YE 2-0303; Sls. Mgr: S. Treibish
HELLER, G.K. CORP., Box 14746, Las Vegas, Nev. 89114, Tel: 702-735-8081; Sls. Mgr: T. Picarelli
HELLER INDS., INC., 30 North 15th St., E. Orange, N.J. 07017, Tel: 201-678-4131; Sls. Mgr: L. Dennis
HELM INSTR. CO., INC., 4216 W. Alexis Rd., Toledo, Ohio
*HELMER gauge - Varian Associates
HELWIG CARBON PRODS., INC., 2550 North 30th St., Milwaukee, Wisc., Tel: 414-372-3113; Sls. Mgr: J.E. Koenitzer
HENES MFG. CO., 4301 E. Madison St., Phoenix, Ariz. 85034, Tel: 602-275-4126; Sls. Mgr: J.E. Hill
HENRITE PRODS. CORP., Morristown Molding Div., P.O. Box 1196, Morristown, Tenn. 37814, Tel: 615-586-3282; Sls. Mgr: J.L. Baker
HENRY & THOMAS, LTD., Yeo St., London E. 3, England, Tel: 01-987-4545; Sls. Mgr: A.A. Asbury
HENSCHEL CORP., 14 Cedar St., Amesbury, Mass. 01913, Tel: 617-388-1103; Sls. Mgr: N.H. Coorssen
HEPPNER MFG. CO., P.O. Box Q, Round Lake, Ill. 60073, Tel: (312) KI 6-2161, TWX: 910-651-0900; Sls. Mgr: R.F. Cuny
HERAEUS-ENGELHARD VACUUM, INC., Seco Rd., Monroeville, Pa. 15146, Tel: 412-372-8800; Sls. Mgr: D. Meyers
* HERCO gaskets, packings, adhesives, tubing - Hecht Rubber
HERCULES, INC., 910 Market St., Wilmington, Dela. 19899, Pres: H.A. Thouron
*HERCULOY sheets, rolls, strips & tubing - Revere Copper
HERLEY INDS. INC., 175 Eileen Way, Syosset, N.Y. 11791, Tel: 516-333-8090; Sls. Mgr: L.N. Blatt ..... FSC 24469
*HERMEFLEX hermetic rotary seals - Singer-General Precision
HERMES PLASTICS, INC., 20 Cooper Sq., New York, N.Y. 10003, Tel: 212-533-5100; Vice Pres: Z. Kozak
HERMETIC SEAL CORP., 4232 Temple City Blvd., Rosemead, Calif. 91770
HERMETIC SEAL DIV., Carr Fastener Co., 317 Main St., Box L, Wilmington, Mass. 01887, Tel: 617-658-6122; Sls. Mgr: A. Spear, Jr.
*HERRINGBONE sheet metal lath - Republic Steel Corporation

■ **HERTZ FILTER CORP., 50 Washington Ave., Garden City, Park, N. Y. 11040, Tel: (516) PI 7-7250; Sls. Mgr: C. Starr.....FSC No. 28477 .....Pg. 1289**

HERZOG MINIATURE LAMP WORKS, INC., 50-17 5th St., Long Island City, N.Y. 11101, Tel: (212) ST 4-2275; Pres: C. Perrenod ..... FSC No. 73869

HEWLETT-PACKARD CO., 1501 Page Mill Rd., Palo Alto, Calif. 94304, Tel: 415-326-7000, TWX: 910-373-1267; Sls. Mgr: J. Petrak ..... FSC No. 28480

■ **HEWLETT-PACKARD CO., New Jersey Div., 110 Locust Ave., Berkeley Hgts., N. J. 07922, Tel: 201 - 464-1234 ..Pgs. 1961-1964**

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Ariz	Scottsdale, 3009 N. Scottsdale Rd., 602-945-7601
"	Tucson, 5737 E. Broadway, 602-298-2313
Cal	N. Hollywood, 3939 Lankersnim Blvd., 213-877-1282
"	Palo Alto, 1101 Embarcadero Rd., 415-327-6500
"	Sacramento, 2591 Carlsbad Ave., 916-482-1463
"	San Diego, 1055 Shafter St., 714-223-8103
Colo	Englewood, 7965 E. Prentice, 303-771-3455
Conn	E. Hartford, 508 Tolland St., 203-289-9394
"	Norwalk, 111 East Ave., 203-853-1251
Fla	Miami Shore, 9999 Northeast 2nd Ave., 305-754-4565
"	Orlando, 621 Commonwealth Ave., 305-841-3970
"	St. Petersburg, 410 150th Ave., 813-391-0211
Ga	Atlanta, 450 Interstate N., 404-436-6181
Ill	Skokie, 5500 Howard St., 312-677-0400
Ind	Indianapolis, 4002 Meadows Dr., 317-546-4891
La	Kenner, 1942 Williams Blvd., 504-721-6201
Md	Baltimore, 6707 Whitestone Rd., 301-944-5400
"	Rockville, 2 Choke Cherry Rd., 301-948-6370
Mass	Lexington, 32 Hartwell Rd., 617-861-8960
Mich	Southfield, 24315 Northwestern Hwy., 313-353-9100
Minn	St. Paul, 2459 University Ave., 612-645-9461
Mo	Kansas City, 9208 Wyoming Pl., 816-333-2445
"	St. Louis, 2812 S. Brentwood Blvd., 314-962-5000
NJ	Cherry Hill, 1060 N. Kings Hwy., 609-677-4000
"	Paramus, W. 120 Century Rd., 201-265-5000
NM	Albuquerque, 6501 Lomas Blvd., N.E., 505-255-5586
"	Las Cruces, 156 Wyatt Dr., 505-526-2485
NY	Albany, 1702 Central Ave., 518-869-8462
"	Endicott, 1219 Campville Rd., 607-754-0050
"	Poughkeepsie, 82 Washington St., 914-454-7330
"	Rochester, 39 Saginaw Dr., 716-473-9500
"	Roslyn, 1025 Northern Blvd., 516-869-8400
"	Syracuse, 5858 E. Molloy Rd., 315-454-2486
NC	High Point, 1923 N. Main St., 919-882-6873
Ohio	Cleveland, 25575 Center Ridge Rd., 216-835-0300
"	Dayton, 3460 S. Dixie Dr., 513-298-0351
Okla	Oklahoma City, 2919 United Founders Blvd., 405-848-2801
Ore	Portland, 4475 S.W. Scholls Ferry Rd., 503-292-9171
Pa	Monroeville, 2500 Moss Side Blvd., 412-271-0724
"	W. Conshohocken, 144 Elizabeth St., 215-248-1600
Tex	Houston, 4242 Richmond Ave., 713-667-2407
"	Richardson, 201 E. Arapahoe Rd., 214-231-6101
"	San Antonio, 225 Billy Mitchell Rd., 512-434-4171
Utah	Salt Lake City, 2890 S. Main St., 801-486-8166
Va	Richmond, 2111 Spencer Rd., 703-282-5451
Wash	Bellevue, 433-108th N.E., 206-454-3971
FOR:	Can, Edmonton, Alb., Hewlett-Packard, 11745 Jasper Ave., 403-482-5561
	Can, Halifax, N.S., Hewlett-Packard, 7001 Mumford Rd., 902-455-0511
	Can, Ottawa, Ont., Hewlett-Packard, 880 Lady Ellen Pl., 613-722-4223
	Can, Pointe Claire, Que., Hewlett-Packard, 275 Hymus Blvd., 514-697-4232
	Can, St. James, Man., Hewlett-Packard Canada, Ltd., 511 Bradford Ct., 204-786-7581
	Can, Toronto, Ont., Hewlett-Packard, 1415 Lawrence Ave., W., 416-249-9196
	Can, Vancouver, B.C., 304-1037 W. Broadway, 604-738-5301

HEXACON ELEC. CO., 161 W. Clay Ave., Roselle Pk., N.J. 07204, Tel: (201) CH 5-6200; Sls. Mgr: J.B. Jackson ..... FSC No. 28493

*HEXSEALS switch boots - Multi-Flex Seals, Inc.

HEYMAN MFG. CO., E. Michigan Ave., Kenilworth, N.J., Tel: 201-245-2345; V.P. Sls: J.L. Holder ... FSC 28520

* HI-AMP welding accessories - Lenco, Inc.

*HI-BREAK electric circuit breakers - General Electric Co.

*HI-BRITE paints - Shannon Luminous Materials Co.

*HI-BUTE/60 butyl gum, for insulation - General Electric Co.

* HI-CAP air filter - Cambridge Filter Corp.

*HI-CAP fuses - McGraw-Edison Company

*HI-COR organic flux filled solder - Alpha Metals, Inc.

*HI-DAMP elastomer with strong damping characteristics - Barry Controls

*HI-ETCH capacitors - General Electric Co.

* HI-FIELD demagnetizers - Annis, R.B. Co.

* HI-FLO air filter - Cambridge Filter Corp.

* HI-FLUX magnetic equip. - Annis, R.B. Co.

■ **HI-G, INC., Spring St. & Rt. 75, Windsor Locks, Conn. 06096, Tel: 203 - 623-2481, TWX: 710-420-0592; Sls. Mgr: R. A. Carroll .....FSC No. 02289 .....Pgs. 2258-2272**

Ala	Huntsville, Young & Lawrence, 2907 Governors Dr., S.W.
Ariz	Phoenix, Barnhill Assocs., 4900 E. Indian School Rd., 602-959-2115
Cal	Mt. View, Winco Sls., Inc., Box 881
"	N. Hollywood, Brooks & Day, 10700 Ventura Blvd., 213-877-3357
Colo	Denver, Barnhill Assocs., 1170 S. Sheridan Blvd., 303-934-5505
Conn	Branford, J.E. Boeing Co., 225 Montowese St., 203-488-8301
Fla	Oviedo, Conley-May Assocs., Box 668
Ill	Chicago, Engineered Sls. Co., Inc., 4738 N. Harlem Ave., 312-867-8434
Ind	Ft. Wayne, JEDCO, 4727 Fox Grove, 219-483-4126
Md	Timonium, Heller-Freedman Assoc., Box 293
Mass	Lexington, J.E. Boeing Co., Inc., Box 5, 617-862-2500
Mich	Southfield, S. Sterling Co., 21250 10 1/2 Mile Rd.
Minn	St. Paul, R.G. Ragon, Inc., 1136 W. Larpenteur Ave.
Mo	St. Charles, Buse Sls. Co., 610A S. Main St., 314-739-1613
NJ	Teaneck, Electra Mec Assocs., Inc., 1258 Teaneck Rd., 201-837-4262
NM	Albuquerque, Barnhill Assocs., 827 Pennsylvania, N. E., 505-265-7766
NC	Bethania, Candor Co., 919-924-1480
Ohio	Cincinnati, Components, Inc., 11820 Knoll Springs, 513-721-2997
"	Cleveland, Components, Inc., 7461 N. Linden La., 216-842-2737
Pa	Ardmore, Heller-Freedman Assoc., Box 391
Tex	Dallas, Blackburn Assoc., Box 20073
Wash	Seattle, Allied Agencies, 1818 Westlake, N., 206-284-4082
FOR:	Can, Ile Perrot, Que., Anbak Sls. Can., Ltd., Box 101, 514-453-6375
	Can, Toronto, Ont., Anbak Sls. Can., Ltd., 3208 Lenworth Dr., 416-625-1061

■ **HI-G INDUSTRIAL PRODS., 112 Parkway Dr., S., Hauppauge, N. Y. 11787, Tel: 516 - 543-6700; Sls. Mgr: W. Green..... .....Pgs. 2270, 2271**

Ala	Huntsville, Young & Lawrence Assoc., Inc., 2907 Governors Dr., S.W., 205-539-6575
Ariz	Phoenix, Barnhill Assocs., 4900 E. Indian School Rd., 602-959-2115
Cal	Mt. View, Winco Sls., Inc., 1901 E. Middlefield Rd., 415-961-8510
"	N. Hollywood, Brooks & Day, Inc., 10700 Ventura Blvd., 213-877-3357
Colo	Denver, Barnhill Assoc., 1170 S. Sheridan Blvd.
Conn	Branford, J.E. Boeing Co., Inc., 225 Montowese St., 203-488-8301
Fla	Oviedo, Conley May Assoc., Inc., Box 668, 305-365-3283
"	Pompano Beach, Conley May Assoc., Inc., 721 Southeast 6th Terr., 305-943-8284
"	Tampa, Conley May Assoc., Inc., 1054 S. Clearview, 813-822-0161
"	Winter Pk., Young & Lawrence Assoc., 601 N. New York Ave.
Ill	Chicago, Engineered Sls., Inc., 4738 N. Harlem Ave.
Ind	Ft. Wayne, JEDCO, 4727 Fox Grove, 219-483-4126
Md	Lutherville, Naudain Assocs., Box 1, 301-252-5378
Mass	Lexington, J.E. Boeing Co., Inc., 18 Muzzey St.
Mich	Southfield, S. Sterling Co., 21250 10 1/2 Mile Rd., 313-357-3700
Minn	St. Paul, R.G. Ragon, Inc., 1136 W. Larpenteur Ave., 612-488-6634
Mo	St. Charles, Kuhlman & Assocs., Inc., 306 McDonough St., 314-291-1150
NJ	Teaneck, Electra-Mec Assoc., 1258 Teaneck Rd.
NM	Albuquerque, Barnhill Assocs., 827 Pennsylvania N.E., 505-265-7766
NY	Buffalo, Canavan-Scanlon Assoc., Inc., 564 Ellicott Sq. Bldg., 716-852-1122
"	Fishers, Canavan-Scanlon Assoc., Inc., 705 Phillips Rd., 716-924-3266
"	Syracuse, Canavan-Scanlon Assoc., Inc., 23 Eastern Ave., 315-463-9161
NC	Bethania, Candor Co., Inc.
Ohio	Cleveland, S. Sterling Co., 5827 Mayfield, 216-442-8080
"	Dayton, P. Montplaisir, 5637 Mark-Dale Dr., 513-434-4316
"	Dayton, S. Sterling Co., 2673 Culver Ave., 513-298-7573
Pa	Philadelphia, Naudain Assoc., 1032 Suburban Sta. Bldg.
Tex	Dallas, Blackburn Assocs., 137 Walnut Hill Village, 214-351-9991
Va	Charlottesville, Candor Co., Inc., 413 Berwick Ct.
Wash	Seattle, D. Miller Sls. Co., Inc., 2323 North 45 St., (206) ME 2-7070
FOR:	Can, Cooksville, Ont., Anbak Sls., Ltd., 3208 Lenworth Dr., 416-625-1061
	Can, Ile Perrot Sud., Que., Anbak Sls., Ltd., Box 101, 514-453-6375

* HI-JUL energy capacitors - Dearborn Elctrns., Inc.

*HI-KOK blind nuts & bolts - Hi-Shear Corp.

*HI-LO EYE liquid level indicator - Illinois Tool Works, Inc.

*HI-LO fasteners - Illinois Tool Works, Inc.

HI-LO MFG. CORP., 1122 W. Newport, Chicago, Ill. 60657, Tel: 312-477-1890; Sls. Mgr: A. Klancnik

*HI-LOK fasteners - Hi-Shear Corporation

*HI-MEG insulator - John C. Dolph Co.

* HI-N-DRI ballasts - Jefferson Elec.

* HI POW high power dummy loads - Electronautics

* HI-POWER mercury relay - Ebert Elctrns. Corp.

* HI-Q pushback wire - Consolidated Wire & Assoc. Corps.

*HI-RANGE saturable reactor - NWL Incorporated

HI-SHEAR CORP., 2600 Skypark Dr., Torrance, Calif. 90509, Tel: 213-326-8110, TWX: 213-325-0684; V.P. Sls: G. Nash ..... FSC No. 73197

HI-SPEC ELCTRNS. CORP., 1000 Lawrence Dr., Newbury Park, Calif. 91320, Tel: 805-498-6671, TWX: 910-336-1269; Sls. Mgr: D.J. Parry ..... FSC No. 07684

HI-SPEC ELCTRNS. CORP., E. Church & 2nd Sts., Frederick, Md. 21701, Tel: 301-663-5141, TWX: 710-862-0901; Sls. Mgr: B.L. Reeder ..... FSC No. 07684

HI-TEK CORP., Electronics Div., 2220 S. Anne St., Santa Ana, Calif. 92704, Tel: 714-540-3520; Sls. Mgr: R.S. Williams ..... FSC No. 27233

*HI-TEMP high temperature oils - Houghton & Co.

HI-TEST CHEMICAL CORP., Div. Compounders, Inc., 40 Blanchard St., Newark, N.J. 07105,

*HI-THERM varnish - John C. Dolph Co.

*HI-TORQUE bolts - Hi-Shear Corporation

*HI-VOLT voltage testers - Industrial Devices, Inc.

* HI-Z voltmeter & accessories - Ross Engrg. Corp.

■ **HICKOK ELECTRICAL INSTR. CO., 10514 Dupont Ave., Cleveland, Ohio 44108, Tel: 216 - 541-8060, TWX: 810-421-8286; Pres: R. D. Hickok, Jr.....FSC No. 28569 .....Pgs. 1394-1396**

Cal	Burbank, Hickok Electrical Instr. Co., 1124 W. Magnolia Blvd., 213-842-2145
"	Hayward, Hickok Electrical Instr. Co., 1079 "B" St., (415) LU 2-7179
Colo	Greeley, G. Moss Elctrns., 1530 - 13th Ave., 303-353-1452
Fla	Orlando, Hollingsworth & Still, 1010 Executive Ctr. Dr., 305-241-5401
Ga	Atlanta, Hollingsworth & Still, 3098 Piedmont Rd., N.E., 404-261-5838
Haw	Honolulu, G. Piety Factors, Inc., 160 Mokauea St., Tel: 837-185
Ill	Chicago, Hickok Electrical Instr. Co., 7416 W. Belmont Ave., 312-237-1373
Ind	Indianapolis, Morris-Cunningham Assocs., 6208 N. College Ave., (317) CL 5-2458
Kans	Overland Pk., Lowell, Kangas & Assoc., Inc., 9107 Larsen Dr., (913) TU 8-3200
Md	Rockville, D. Kocher, 503 Edmonston Dr., 202-296-8259
Mass	Wellesley, Johnson Assoc., 471 Washington St., 617-235-3977
Minn	Minneapolis, N.J. Laub Co., 3749 Broadway, W., (612) JU 8-4663
Mo	St. Louis, Kelly-Schmitz-Winkeler, 2319 Hampton Ave., (314) ST 1-6111
NJ	Paramus, Hickok Electrical Instr. Co., 117 Gertrude Ave., 201-843-2070
NY	Buffalo, R.W. Mitscher Co., Inc., 496 Ellicott Sq. Bldg., (716) TL 4-2517
NC	Charlotte, Hollingsworth & Still, 6717 Woodstock, 704-523-3327
Tex	Houston, H. Lieberman Sls. Co., 3022 Lake St., 713-523-9545
"	Richardson, Hays Co., Box "E", 214-231-1426
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IMC MAGNETICS CORP., Arizona Div., 1900 East 5th St., Tempe, Ariz. 85281, Tel: 602-967-7851; Sls. Mgr: P.J. Chase ..... FSC No. 04320

■ **IMC MAGNETICS CORP., Eastern Div., 570 Main St., Westbury, N. Y. 11591, Tel: 516 - 334-7070, TWX: 510-222-4469; Sls. Mgr: G. Egan.....FSC No. 92702 .....Pg. 1745**

Cal Los Altos, Recht Assocs., 175 S. San Antonio Rd., 415-941-0336
" Los Angeles, Elcom Sls. Co., 3600 Motor Ave., 213-870-4707
Colo Denver, Lindberg Co., 2654 S. Krameria, 303-757-6489
Conn New Haven, Gerber Sls. Co., Inc., 29 Whalley Ave., 203-777-6279
Fla Clearwater, Perrott Assocs., Inc., Box 4532, 813-446-2535
" Orlando, Perrott Assoc., Inc., 1607 Forsyth Rd., 305-275-1132
" W. Palm Beach, Perrott Assoc., Inc., Box 6277, 305-585-7761
Ill Chicago, Berndt Assocs., 6414 W. Belmont Ave., 312-283-0713
Ind Ft. Wayne, McNabb-Brase Assoc., 424 W. Ludwig Rd., 219-484-8558
" Indianapolis, McNabb-Brase Assoc., 4002 Meadows Dr., 317-545-8167
Kans Mission, Inland Assocs., 6047 Howe Dr., 913-362-2366
Md Baltimore, Burgin-Kreh Assocs., 1600 White Oak Ave., 301-661-1120
Mass Waltham, Gerber Sls. Co., Inc., 176 Second Ave., 617-891-8040
Minn Minneapolis, Wenco Sls., Inc., 7728 Morgan Ave., S., 612-866-3639
Mo Creve Coeur, Inland Assocs., 453 N. Lindberg, 314-993-0301
NJ Haddonfield, Mesa Tech. Assocs., 70 Tanner St., 609-429-9531
NY New York, Ellis Haber Ramp, 2315 Broadway, 212-799-4040
" Rochester, Marchese Davis Assocs., 97 Park Ave., 716-442-9120
NC Charlotte, B. Henry Assocs., 1043 Providence Rd., 704-375-8958
Ohio Columbus, Mulligan & Mathias, 2011 Riverside Dr., 614-485-2976
Ore Portland, Shaffer & Nelson, Inc., 1001 S.E. Water Ave., 503-234-7437
Tex Dallas, Hillman Enterprises, Inc., 3505 Turtle Creek Blvd., (214) LA 1-2070
Va Lynchburg, Burgin-Kreh Assocs., 2600 Memorial Ave., 703-845-5600
Wash Seattle, Shaffer & Nelson, Inc., 314 Northeast 72nd St., (206) LA 3-0664
FOR: Can, Willowdale, Ont., F.P. Taylor, Ltd., 12 Howard Dr., 416-222-6924

■ **IMC MAGNETICS CORP., New Hampshire Div., Rte. 16B, Rochester, N. H. 03867, Tel: 603 - 332-5300; Sls. Mgr: J. Guinan .....FSC No. 28875 .....Pg. 1745**

Cal Los Angeles, Elcom Sls. Co., 3600 Motor Ave., 213-870-4707
" Mt. View, Poltronics, Box 807, 415-969-9200
Colo Denver, Lindberg Co., 2654 S. Krameria, 303-757-6489
Conn New Haven, Gerber Sls. Co., Inc., 31 Broadway, (203) SP 7-6279
Fla Orlando, Duay Enterprises, 1515 Ensenada Dr., 305-277-3296
Ill Chicago, B. Anderson & Assoc., 5969 N. Elston, 312-774-8989
Ind Ft. Wayne, B. Anderson & Assoc., 5324 Kyle Rd., 219-747-0402
Kans Mission, Inland Assocs., 6047 Howe Dr., 913-362-2366
Md Towson, Carroll McCourt & Co., 610 Washington Ave., 301-823-3455

Mass E. Longmeadow, Gerber Sls. Co., Inc., Box 447, 413-525-3059
" Waltham, Gerber Sls. Co., Inc., 176 Second Ave., 617-891-8040
Minn Minneapolis, Wenco Sls., Inc., 7728 Morgan Ave., S., 612-866-3639
NJ Haddonfield, Mesa Technical Assoc., Box 466, 609-429-9531
NY New York, Ellis Haber Ramp Corp., 2315 Broadway 212-799-4040
" Rochester, Marchese Assocs., 999 Ridge Rd., E., 716-342-7664
" Utica, Davis Assocs., 107 James St., 315-733-8850
Ohio Columbus, Mulligan & Mathias, 2011 Riverside Dr., 614-486-2976
Ore Portland, Shaffer & Nelson, Inc., 1001 S.E. Water Ave., 503-234-7437
Pa Pittsburg, G. S. Root & Co., 809 Wainwright Dr., 412-561-4125
Tex Dallas, Hillman Enterprises, 3505 Turtle Creek Blvd., (214) LA 1-2070
Wash Seattle, Shaffer & Nelson, Inc., 314 Northeast 72nd St., (206) LA 3-0664
FOR: Can, Willowdale, Ont., F.P. Taylor, Ltd., 12 Howard Dr.

■ **IMC MAGNETICS CORP., Western Div., 6058 Walker Ave., Maywood, Calif. 90270, Tel: 213 - 583-4785, TWX: 910-321-3089; Sls. Mgr: B. Blair.....FSC No. 99743 .....Pg. 1745**
Ariz Tempe, IMC Magnetics Corp., 1900 East 5th St., 602-967-7851
Cal Los Altos, Recht Assocs., 900 N. San Antonio Rd., 415-941-0336
" Los Angeles, Elcom Sls. Co., 3600 Motor Ave., 213-870-4707
Colo Denver, Lindberg Co., 2654 S. Krameria, 303-757-6489
Fla Miami, Duay Enterprises, 4230 Southwest 15th St.
" Orlando, Duay Enterprises, 1515 Ensenada Dr., 305-277-3296
Ill Chicago, Communications Engrs., 7106 N. Western Ave., 312-761-0548
Kans Mission, Inland Assocs., 6047 Howe Dr., 913-362-2366
Md Bethesda, W.F. Drake, 4924 St. Elmo Ave., 301-657-1778
" Towson, Burgin-Kreh Assocs., 202 W. Pennsylvania Ave., (301) VA 5-3212
Mass Waltham, Gerber Sls. Co., Inc., 176 Second Ave., 617-891-8040
Minn Minneapolis, Wenco Sls., Inc., 7728 Morgan Ave., 612-866-3639
Mo Creve Coeur, Inland Assocs., 453 N. Lindberg, 314-993-0301
NJ Haddonfield, Mesa Technical Assoc., Box 466, 609-429-9531
" Westwood, Clarfield-Stollmack Assocs., 175 Westwood Ave., 201-666-8989
NY Rochester, Marchese-Davis Assocs., 97 Park Ave., 716-442-9120
" Utica, Marchese-Davis Assocs., 107 James St., 315-724-5773
NC Charlotte, B. Henry Assocs., 1043 Providence Rd., 704-375-8958
Ohio Dayton, Bek Assocs., 330 Salem Ave., (513) CR 8-1343
Ore Portland, Shaffer & Nelson, Inc., 1001 S.E. Water Ave., 503-234-7437
Tex Dallas, J. Oechsner, Box 35391, (214) ME 1-0402
Wash Seattle, Shaffer & Nelson, Inc., 314 Northeast 72nd St., (206) LA 3-0664
FOR: Can, Willowdale, Ont., F.P. Taylor, Ltd., 12 Howard Dr., 416-222-6924

*I-N RINGS rings - Eaton Yale & Towne, Inc.
I.R.A. SYS., INC., 332 Second Ave., Waltham, Mass. 02154, Tel: 617-891-7300, TWX: 710-324-6699; Sls. Mgr: R.A. Fredrickson
* I-RAD radiation sources - American Atomics Corp.

■ **IRC DIVISION OF TRW INC., 1100 Glendon Ave., Los Angeles, Calif. 90024, Tel: 213 - 477-6061; V.P. Mktg: K. E. Heller .....Pgs. 1172, 2379-2393, 2474-2481, Back Cover**

■ **IRC BOONE DIV. OF TRW INC., P.O. Box 393, Boone, N. C. 28607, Tel: 704 - 264-8861, TWX: 510-936-3241; Sls. Mgr: S. Wilson..... FSC No. 11502 .....Pgs. 2384-2393**
Ariz Scottsdale, C. Hower & Co., Box 1627, 602-947-4204
Cal Burlingame, J. Logan & Assoc., 801-D Mahler Rd., 415-697-6100
" N. Hollywood, Bassett & Moore, 12045 Magnolia Blvd., 213-877-7129
" Sherman Oaks, IRC, 14827 Ventura Blvd., 213-981-7722
Colo Denver, Electronic Component Sls. Co., Box 22011, 303-771-6200
Fla Orlando, IRC, 1000 Woodcock Rd., 305-841-2982
Ill Chicago, IRC, 6020 W. Diversey Ave., 312-889-5800
Ind Indianapolis, IRC, Box 40508, 317-846-7314
Iowa Cedar Rapids, Halgin Sls. Co., 4403 First Ave., S.E., 319-363-5119
Kans Mission, Halgin Sales Co., Box 1245, 913-722-2441
Md Baltimore, IRC, 301-377-9020
Mass Waltham, IRC, 1345 Main St., 617-899-6100
Mich Southfield, S. Sterling Co., 21250 10 1/2 Mile Rd., 313-357-3700
Minn St. Paul, Northport Engrg., Inc., 2027 Grand Ave., 612-698-3841
Mo Clayton, Halgin Sls. Co., 201 S. Central St., 314-721-4415
NM Albuquerque, Electronic Comp. Sls. Co., Box 3087, Sta. D., 505-256-3663
NY New York, IRC, 1967 Turnbull Ave., 212-597-5500
Ohio Cincinnati, Baehr-Greenleaf & Assoc., Inc., 9505 Montgomery Rd., 513-891-3827
" Cleveland, Baehr-Greenleaf & Assoc., Inc., 14700 Detroit Ave., 216-221-9030
" Columbus, Baehr-Greenleaf & Assoc., Inc., Box 5722, 614-486-4046
" Xenia, Baehr-Greenleaf & Assoc., Inc., 3550 Maplewood Dr., 513-426-5485
Ore Portland, C.K. Shanks & Assoc., Box 25375, 503-292-5656
Pa Philadelphia, IRC, 401 N. Broad St., 215-922-8900
" Pittsburgh, Covert & Newman Co., 300 Mt. Lebanon Blvd., 412-563-0303
Tex Houston, Vista Engrg. Assoc., 1614 S. Post Oak Rd., 713-622-5680
" Richardson, Vista Engineering Assoc., 777 Central Expwy., 214-235-4547
Utah Salt Lake City, Electronic Component Sales Co., Box 2066, 801-278-6044

■ **IRC BURLINGTON DIV. OF TRW INC., P.O. Box 887, Burlington, Iowa 52601, Tel: 319 - 754-8491, TWX: 910-525-1135; Sls. Mgr: S. Deiling.....FSC No. 07716 .....Pgs. 2380-2383**
Ariz Scottsdale, C. Hower & Co., Box 1627, 602-947-4204
Cal Burlingame, J. Logan & Assoc., 801-D Mahler Rd., 415-697-6100
" N. Hollywood, Bassett & Moore, 12045 Magnolia Blvd., 213-877-7129
" Sherman Oaks, IRC, 14827 Ventura Blvd., 213-981-7722
Colo Denver, Electronic Component Sls. Co., Box 22011, 303-771-6200
Fla Orlando, IRC, 1000 Woodcock Rd., 305-841-2982
Ill Chicago, IRC, 6020 W. Diversey Ave., 312-889-5800
Ind Indianapolis, IRC, Box 40508, 317-846-7314
Iowa Cedar Rapids, Halgin Sales Co., 4403 First Ave., S.E., 319-363-5119
319-363-5119
Kans Mission, Halgin Sales Co., Box 1245, 913-722-2441
Md Baltimore, IRC, 301-377-9020
Mass Waltham, IRC, 1345 Main St., 617-899-6100
Mich Southfield, S. Sterling Co., 21250 10 1/2 Mile Rd., 313-357-3700
Minn St. Paul, Northport Engrg., Inc., 2027 Grand Ave., 612-698-3841
Mo Clayton, Halgin Sls. Co., 201 S. Central St., 314-721-4415
NM Albuquerque, Electronic Comp. Sls. Co., Box 3087, Sta. D., 505-256-3663
NY New York, IRC, 1967 Turnbull Ave., 212-597-5500
Ohio Cincinnati, Baehr-Greenleaf & Assoc., Inc., 9505 Montgomery Rd., 513-891-3827
" Cleveland, Baehr-Greenleaf & Assoc., Inc., 14700 Detroit Ave., 216-221-9030
" Columbus, Baehr-Greenleaf & Assoc., Inc., Box 5722, 614-486-4046
" Xenia, Baehr-Greenleaf & Assoc., Inc., 3550 Maplewood Dr., 513-426-5485
Ore Portland, C.K. Shanks & Assoc., Box 25375, 503-292-5656
Pa Philadelphia, IRC, 401 N. Broad St., 215-922-8900
" Pittsburgh, Covert & Newman Co., 300 Mt. Lebanon Blvd., 412-563-0303
Tex Houston, Vista Engrg. Assoc., 1614 S. Post Oak Rd., 713-622-5680
" Richardson, Vista Engrg. Assoc., 777 Central Expwy., 214-235-4547
Utah Salt Lake City, Electronic Component Sales Co., Box 2066, 801-278-6044

■ **IRC PHILADELPHIA DIV. OF TRW INC., 401 N. Broad St., Philadelphia, Pa. 19108, Tel: 215 - 922-8900, TWX: 710-670-2286; Sls. Mgr: R. A. Glover.....FSC No. 75042 .....Pg. 2379**
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" Sherman Oaks, IRC, 14827 Ventura Blvd., 213-981-7722
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Fla Orlando, IRC, 1000 Woodcock Rd., 305-841-2982
Ill Chicago, IRC, 6020 W. Diversey Ave., 312-889-5800
Ind Indianapolis, IRC, Box 40508, 317-846-7314
Iowa Cedar Rapids, Halgin Sls. Co., 4403 First Ave., S.E., 319-363-5119
Kans Mission, Halgin Sales Co., Box 1245, 913-722-2441
Md Baltimore, IRC, 301-377-9020
Mass Waltham, IRC, 1345 Main St., 617-899-6100
Mich Southfield, S. Sterling Co., 21250 10 1/2 Mile Rd., 313-357-3700
Minn St. Paul, Northport Engrg., Inc., 2027 Grand Ave., 612-698-3841
Mo Clayton, Halgin Sls. Co., 201 S. Central St., 314-721-4415
NM Albuquerque, Electronic Comp. Sls. Co., Box 3087, Sta. D., 505-256-3663
NY New York, IRC, 1967 Turnbull Ave., 212-597-5500
Ohio Cincinnati, Baehr-Greenleaf & Assoc., Inc., 9505 Montgomery Rd., 513-891-3827
" Cleveland, Baehr-Greenleaf & Assoc., Inc., 14700 Detroit Ave., 216-221-9030
" Columbus, Baehr-Greenleaf & Assoc., Inc., Box 5722, 614-486-4046
" Xenia, Baehr-Greenleaf & Assoc., Inc., 3550 Maplewood Dr., 513-426-5485
Ore Portland, C.K. Shanks & Assoc., Box 25375, 503-292-5656
Pa Philadelphia, IRC, 401 N. Broad St., 215-922-8900
" Pittsburgh, Covert & Newman Co., 300 Mt. Lebanon Blvd., 412-563-0303
Tex Houston, Vista Engrg. Assoc., 1614 S. Post Oak Rd., 713-622-5680
" Richardson, Vista Engrg. Assoc., 777 Central Expwy., 214-235-4547
Utah Salt Lake City, Electronic Component Sales Co., Box 2066, 801-278-6044

■ **IRC ST. PETERSBURG DIV. OF TRW INC., 2801 72nd St., N. St. Petersburg, Fla. 33733, Tel: 813 - 347-2181, TWX: 810-863-0357; Mktg. Mgr: G. J. Wilson.....FSC No. 84048 .....Pgs. 1172, 2474-2481**
Ariz Scottsdale, C. Hower & Co., Box 1627, 602-947-4204
Cal Los Altos, E. Recht Assoc., 900 N. San Antonio Rd., 415-941-0336
" N. Hollywood, Bassett & Moore, 12045 Magnolia Blvd., 213-877-7129
" Sherman Oaks, IRC, 14827 Ventura Blvd., 213-981-7722
Colo Denver, Electronic Component Sls. Co., Box 22011, 303-771-6200
Fla Orlando, IRC, 1000 Woodcock Rd., 305-841-2982
Ill Chicago, IRC, 6020 W. Diversey Ave., 312-889-5800
Ind Indianapolis, IRC, Box 40508, 317-846-7314
Iowa Cedar Rapids, Halgin Sls. Co., 4403 First Ave., S.E., 319-363-5119
Kans Mission, Halgin Sales Co., Box 1245, 913-722-2441
Mass Waltham, IRC, 1345 Main St., 617-899-6100
Mich Southfield, S. Sterling Co., 21250 10 1/2 Mile Rd., 313-357-3700
Minn St. Paul, Northport Engrg., Inc., 2027 Grand Ave., 612-698-3841
Mo Clayton, Halgin Sls. Co., 201 S. Central St., 314-721-4415
NM Albuquerque, Electronic Comp. Sls. Co., Box 3087, Sta. D., 505-256-3663
NY New York, IRC, 1967 Turnbull Ave., 212-597-5500
Ohio Cincinnati, Baehr-Greenleaf & Assoc., Inc., 9505 Montgomery Rd., 513-891-3827
" Cleveland, Baehr-Greenleaf & Assoc., Inc., 14700 Detroit Ave., 216-221-9030
" Columbus, Baehr-Greenleaf & Assoc., Inc., Box 5722, 614-486-4046
" Xenia, Baehr-Greenleaf & Assoc., Inc., 3550 Maplewood Dr., 513-426-5485
Ore Portland, C.K. Shanks & Assoc., Box 25375, 503-292-5656
Pa Philadelphia, IRC, 401 N. Broad St., 215-922-8900
" Pittsburgh, Covert & Newman Co., 300 Mt. Lebanon Blvd., 412-563-0303
Tex Houston, Vista Engrg. Assoc., 1614 S. Post Oak Rd., 713-622-5680
" Richardson, Vista Engrg. Assoc., 777 Central Expwy., 214-235-4547
Utah Salt Lake City, Electronic Component Sales Co., Box 2066, 801-278-6044
* I/S SYSTEMS sys. for memory devices - ACI, Inc.
ISC/TELEPHONICS DIV., Instrument Systems Corp., 770 Park Ave., Huntington, N.Y. 11743, Tel: 516-423-6200, TWX: 510-226-6983; V.P. Mktg: J.W. Partridge
I-TEL, INC., 10504 Wneatley St., Kensington, Md. 20795, Tel: 301-946-1800; Sls. Mgr: R.A. Wainwright
ITI ELCTRNS., INC., 369 Lexington Ave., Clifton, N.J. 07011, Tel: 201-473-0900; Sls. Mgr: D.P. Baker
ITT AVIONICS DIV., 390 Washington Ave., Nutley, N.J. 07110, Tel: 201-284-0123, TWX: 201-667-1146; Sls. Mgr: F. Lucisano

■ **ITT CANNON ELECTRIC, 3208 Humboldt St., Los Angeles, Calif. 90031, Tel: 213 - 225-1251, TWX: 910-321-4267; Dir. Mktg: W. R. Cranford.....FSC No. 71468 .....Pgs. 907-911**
Ariz Phoenix, ITT Cannon Elec., 3625 North 16th St., 602-264-5056
Cal Anaheim, ITT Cannon Elec., 1845 S. Manchester Ave., 714-638-0770
" Los Angeles, ITT Cannon Elec., 2636 N. Figueroa St., 213-225-1251
" Palo Alto, ITT Cannon Elec., 960 San Antonio Rd., 415-323-9057
Colo Englewood, ITT Cannon Elec., 300 E. Hampden Ave., 303-761-1474
Conn Windsor, ITT Cannon Elec., 61 Cook Hill Rd., 203-688-6205
Fla Orlando, ITT Cannon Elec., 999 Woodcock Rd., 305-841-4862
Ga Atlanta, ITT Cannon Elec., 1447 Peachtree St., N.E., 404-892-7676
Haw Honolulu, Dougherty Enterprises, 1164 Waimanu St.
Ill Chicago, ITT Cannon Elec., 5245 N. Elston Ave., 312-282-3410
Md Baltimore, ITT Cannon Elec., 5202 Baltimore Nat'l. Pike, 301-744-5965
Mass Wakefield, ITT Cannon Elec., 591 North Ave., 617-245-3850
Minn Minneapolis, ITT Cannon Elec., 4725 Excelsior Blvd., 612-920-2911
Mo Olivette, ITT Cannon Elec., 9369 Olive Blvd., 314-991-1630
NJ Union, ITT Cannon Elec., 640 Rahway Ave., 201-687-9500
NY Melville, ITT Cannon Elec., 150 Broad Hollow Rd., 516-549-5454
" New York, ITT Cannon Elec., 212-227-6520
" Syracuse, ITT Cannon Elec., E. Molloy Rd., 315-454-9241
NC Charlotte, Dula Assocs., Inc., 1321 E. Morehead St., 704-334-7090
" Winston-Salem, Dula Assocs., Inc., 3389 Nottingham Rd., 919-723-4205
Ohio Kettering, ITT Cannon Elec., 5335 Far Hills Ave., 513-434-8181
" Twinsburg, ITT Cannon Elec., 9810 Ravenna Rd., 216-425-4251

Pa Bryn Mawr, ITT Cannon Elec., Two Bryn Mawr Ave., 215-527-1120
Tex Dallas, ITT Cannon Elec., Braniff Airways Bldg., 214-357-8171
Wash Bellevue, ITT Cannon Elec., 225 108th Ave., N.E., 206-454-3903

ITT ELECTRON TUBE, Box 100, Easton, Pa. 18042, Tel: 215-252-7331, TWX: 510-651-4908; Sls. Mgr: A.W. McEwan

ITT GILFILLAN, INC., 7821 Orion Ave., Van Nuys, Calif. 91409, Tel: 213-988-2600, TWX: 910-495-1787; Deputy Dir. Mktg: J.W. Burge ..... FSC No. 24930

ITT INSTRS., ITT Aerospace/Optical Div., 15191 Bledsoe St., San Fernando, Calif. 91342, Tel: 213-367-6161, TWX: 910-496-1526; Sls. Mgr: E.E. Bielicki

■ **ITT JENNINGS, Div. International Telephone & Telegraph Corp., 970 McLaughlin Ave., San Jose, Calif. 95108, Tel: 408 - 292-4025, TWX: 910-338-0159; Sls. Mgr: R. E. Johnston.....FSC No. 73905 .....Pgs. 669, 2273**

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Ariz Phoenix, R.A. Strassner Co., Inc., 55 E. Thomas Rd., 602-277-3921
Cal Arcadia, J. Fiske, Box 585, 213-447-7655
" Ellicott City, H. Leake, Box 537, 202-737-0797
" La Jolla, F.W. Falck Co., Box 1733, 714-233-3341
" Los Altos, W.W. Posey Co., 175 S. San Antonio Rd., 415-948-7771
" Los Angeles, R.A. Strassner Co., Inc., 3003 Glendale Blvd., 213-666-4040
Colo Boulder, B. Marsh & Assocs., 1842 Canyon Blvd., 303-443-1749
Conn North Haven, Forsberg Sls., 22 Broadway, 203-239-5111
Fla Melbourne, Tech Rep Assocs., Inc., Box 2095, 305-723-9140
" St. Petersburg, Tech Rep Assocs., Inc., Box 8218, 813-391-0008
Ga Jonesboro, Tech Rep Assocs., Inc., Box 955, 404-753-0111
Ill Chicago, J.R. Sls. Engrg., Inc., 7132 N. Harlem Ave., 312-774-8550
Ind Indianapolis, Schroeder & Loomis, Inc., Box 20071, 317-251-4571
Iowa Cedar Rapids, J.R. Sls. Engrg., Inc., 3550 Cottage Grove Ave., S.E., 319-365-5259
Kans Kansas City, Impala, Inc., 3141 Merriam La., 913-831-3933
Md Baltimore, Burgin-Kreh Assoc., Inc., Box 9787, 301-661-1120
Mass Brockton, Forsberg Sls., 646 Summer St., 617-522-6300
Minn Minneapolis, Furber Sls. Co., 5237 Third Ave., S., 612-825-1491
Mo Clayton, ITT Jennings, 230 S. Bemiston St., 314-862-1560
" Hazelwood, Impala, Inc., 47 Village Sq. Shpg. Ctr., 314-831-5454
NJ Ridgewood, ITT Jennings, Box 646, 201-447-0277
NY E. Aurora, Harries & Kershaw, 15 Canterbury La., 716-652-1221
" Fayetteville, Harries & Kershaw, 110 Fayette Cir., 315-637-9871
" Webster, Harries & Kershaw, 216 Shorewood Dr., 716-671-6365
Ohio Dayton, Whelan Corp., 2600 Far Hills Ave., 513-298-9997
Ore Portland, R. Merritt Co., 2035 Southwest 58th Ave., 503-292-8762
Pa Waterford, Whelan Corp., Box 231, 216-442-8340
Tex Dallas, Titan Reps., Inc., 6434 Maple Bldg., 214-357-8266
Va Alexandria, ITT Jennings, Box 7045, 202-737-0797
" Lynchburg, Burgin-Kreh Assoc., Inc., 2600 Memorial Ave., 703-845-5600
Wash Seattle, R. Merritt Co., 1320 Prospect Rd., (206) MU 2-7337

ITT, Residential & Industrial Controls, 801 Allen Ave., Glendale, Calif. 91201

ITT SEMICONDUCTORS, 3301 Electronics Way, W. Palm Beach, Fla. 33407, Tel: 305-842-2411, TWX: 510-952-6667; Sls. Mgr: J.B. McDowell

ITT TELECOMMUNICATIONS, Apparatus Dept., Fulton Dr., Corinth, Miss. 38834, Tel: 601-286-6921; Sls. Mgr: R. Schuessler

ITT TELECOMMUNICATIONS, Transmission Dept. 2912 Wake Forest Rd., Raleigh, N.C. 27602, Tel: 919-828-4441, TWX: 510-928-0500; Sls. Mgr: A. Ursano; FSC 13626

■ **ITT WIRE & CABLE DIV., 172 Sterling St., Clinton, Mass. 01510, Tel: 617 - 365-6331, TWX: 710-347-1736; Sls. Mgr: D. E. Johnson .....Pgs. 2954, 2955**

Ala Huntsville, Brandel-Stephens & Co., Inc., Byrdspring Rd., 205-883-0445
Cal Commerce, ITT Wire & Cable, 2117 S. Yates Ave., 213-723-9611
" San Jose, ITT Wire & Cable, 970 McLaughlin Ave., 408-293-2866
Fla Orlando, Brandel-Stephens & Co., Inc., 132 E. Colonial Dr., 305-425-3202
Ga Atlanta, Brandel-Stephens & Co., Inc., 3110 Maple Dr., 404-261-7579
Haw Honolulu, Dougherty Enterprises, 1164 Waimanu St.
Ind Ft. Wayne, Menze Sls., 6010 Lower Huntington Rd., 219-747-5616
Md Towson, Burgin-Kreh Assocs., Inc., Box 9789, 301-661-1120
Mass Natick, G. Rosen Co., 563 Worcester Rd., 617-655-2211
Minn Minneapolis, W.L. Ruth & Assocs., Inc., 700 S. Third St., 612-339-8901
Mo St. Louis, A.E. Petsche Co., 8444 Florissant Rd., 314-521-3120
NJ Caldwell, ITT Wire & Cable, 60 Roseland Ave., 201-228-2023
NY Long Island City, R.W. Noel & Co., Inc., 45-26 Vernon Blvd., 212-786-1919
" Syracuse, Floring & Murray, Inc., 6585 Kinne Rd., 315-446-5555
Ohio Twinsburg, ITT Wire & Cable, 9810 Revenna Rd., 216-425-4214
Pa Monroeville, Robinson-Kopp Co., Inc., 2300 Eldo Rd., 412-372-1327
" Paoli, ITT Wire & Cable, Box Q, 215-644-1450
Tex Arlington, A.E. Petshe Co., Inc., 1325 E. Abram, 817-277-1379
Utah Salt Lake City, Hyer Assocs., 445 East 2nd St., S., 801-363-6773
Wash Seattle, ITT Wire & Cable, 5013 Barton Pl., 206-723-8152

*IATRON storage tubes - ITT Electron Tube Div.
*ICEM coaxial magnetron - SFD Laboratories, Inc.

■ **ICON CORP., 156 Sixth St., Cambridge, Mass. 02146, Tel: 617 - 868-5400 .....Pg. 1042**

Ariz Phoenix, BFA Corp., 4710 North 16th St., 602-264-6536
Cal Los Altos, V.T. Rupp Co., 1182 Los Altos Ave., 415-948-1483
" Los Angeles, V.T. Rupp Co., 307 Parkman Ave., 213-387-8224
Colo Denver, BFA Corp., 1309 S. Inca St., 303-744-3301
Conn W. Hartford, Components & Controls, Box 223, 203-233-0655
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EXP:	NY, Hicksville, EMEC, Inc., 55 E. Old Country Rd., 516-931-3700

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* LDS-500 damping material - Lord Mfg. Co.

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"	Palo Alto, 611 Hansen Way, Tel: 326-4000
"	Santa Monica, 2901 Wilshire Blvd., Tel: 828-5588
Fla	Tampa, 314 S. Missouri, Tel: 446-8513
Ga	Atlanta, 3110 Maple Dr., Tel: 261-4572
Ill	Park Ridge, 205 W. Touhy Ave., Tel: 825-6686
Mass	Waltham, 400 Wyman St., Tel: 891-4560
NJ	Cherry Hill, 1500 Kings Hwy., Tel: 428-6800
"	Springfield, N. 25 Rte. 22, Tel: 376-6600
NM	Albuquerque, 9000 Menaul Blvd., N.E., Tel: 296-1248
NY	Melville, 900 Walt Whitman Rd., Tel: 549-5422
"	Syracuse, 113 Twin Oaks Dr., Tel: 437-2568
Ohio	Dayton, 10 Southmoor Cir., Tel: 298-7318
Tex	Richardson, 811 S. Central Pkwy., Tel: 235-2385
Va	Alexandria, 714 Church St., Tel: 549-8205

LEM INSTR. CORP., 20 Sarah Dr., Farmingdale, N.Y. 11735, Tel: 516-293-7240; Sls. Mgr: F. Lowell

LFE ELCTRNS. Div. Laboratory for Elctrns., Inc., Instr. Div., 1075 Commonwealth Ave., Boston, Mass. 02115

* LGH leads & receptacles - AMP, Inc.

*LGH high voltage lead - Amp Inc.

LGM ELCTRNS., INC., 4304 La Branch St., Houston, Tex. 77004, Tel: 713-524-8383

L & L MFG. CO., 166 Conchester Rd., Twin Oaks, Pa., Tel: (215) HU 5-6334; Sls. Mgr: S. Lewicki

* LM spot welders - Price & Rutzebeck

LMB HEEGER, INC., 729 Ceres Ave., Los Angeles, Calif. 90021, Tel: 213-627-9310; Sls. Mgr: O.L. Heeger

LP ASSOCS., INC., 11830 W. Pico Blvd., Los Angeles, Calif. 90064, Tel: 213-477-2762; Sls. Mgr: L. Pincus ..... FSC No. 17865

L & R MFG. CO., 577 Elm St., Kearny, N.J. 07032, Tel: 201-991-5330; Sls. Mgr: S.L. Goldfarb

*LQ valves - Lunkenheimer Co.

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LTV ELECTROSYSTEMS, INC., Garland Div., P.O. Box 6118, Dallas, Tex. 75222, Tel: (214) BR 6-7111, TWX: 214-276-8576; Mgr. Mkt. Plan: D. Dirks

■ **LTV ELECTROSYSTEMS, INC., Memcor Div., Components Operation, 1320 Flaxmill Rd., Huntington, Ind. 46750, Mktg. Mgr: T. Ure .....Pgs. 2406, 2407**

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"	San Carlos, D.H. Ross & Co., 534 El Camino Real, 415-591-4411
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"	Miami Beach, Geartner Assocs., Inc., 350 Lincoln Rd., 305-531-0200
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"	Baltimore, Brothers & Conneen Assocs., 6302 Lincoln Ave., 301-764-7189
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Mo	Hazelwood, Thomas-Modrcin Assocs., Inc., 47 Village Sq., 314-838-6446
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"	Pittsford, M.P. Andrews, Inc., Box 26, 716-586-6159
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" Springfield, Brothers & Conneen Assocs., 131 Harned Rd., 215-543-8641
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Ga Atlanta, H.P. Whitehead, Box 28662, 404-252-5977
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LAKE CHEMICAL CO., 250 N. Washtenaw Ave., Chicago, Ill. 60612, Tel: 312-826-1700; Sls. Mgr: C. Kleiman
LAKE MFG. CO., 909 King St., Oakland, Calif. 94606, Sls. Mgr: W.E. Howe
LAKETOWN MFG. CORP., Box 27A, RFD 1, Waconia, Minn. 55387, Tel: 612-442-4045; Sls. Mgr: N.S. Field

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Fla Clearwater, 1770 Thames St., 813-446-6505
Ill Schiller Pk., 4849 N. Scott St., 312-671-0182
Ind Indianapolis, 7401 N. Central Ave., 317-631-9557
Md Rockville, 1075R Rockville Pike, 301-424-2010
Mass Lexington, 49 Waltham St., 617-861-8585
Minn Minneapolis, 612-332-6714
NJ Old Bridge, 18 D Cottonwood La.
NY Beacon, 6 Crossway Rd.
" Canandaigua, 152 Howell St., 716-454-6770
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" Houston, 1823 Maux, 713-464-6554
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" S. El Monte, J.N. Dupree Co., Inc., 1710 N. Potrero Ave.
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" Richardson, Southland Engrg. & Sls., Inc., 777 S. Central Expwy., (214) AD 1-2373

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"	San Mateo, Halbar Assoc., 118A West 36 Ave., 415-349-4700
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Ill	Northfield, Torkelson Assoc., 540 W. Frontage Rd., 312-446-9085
Md	Timonium, Billis Sls. Co., 110 Gorsuch Rd., (301) CL 2-0779
Mass	Waltham, Leach Corp., 235 Bear Hill Rd., (617) TW 9-1930
Minn	Minneapolis, Torkelson Assocs., 4820 West 77th St., 612-920-1046
Mo	Ferguson, Leach Corp., Box 10938, 314-524-2880
NJ	Cherry Hill, Billis Sls. Co., 14 Galway La., (609) HA 8-3651
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Ohio	Dayton, Leach Corp., 5335 Far Hills Ave., 513-434-8151
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Wash	Seattle, Leach Corp., Rm. 201, S. Annex Bldg., Boeing Fld., (206) RO 7-3660
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Minn	Minneapolis, L.F. Murphy, 730 Chicago Ave., Tel: 333-4511
Mo	Kansas City, Automatic General Elctrn. Sales, 6550-E Troost Ave., DE 3-8206
"	St. Louis, Automatic General Elec. Sls., 4523 Westminister Pl., 314-652-5366
NJ	Haddonfield, Gray-Williams Assocs., 8 E. Mt. Vernon Ave., 609-429-5300
"	Westwood, Clarfield-Stollmack Assoc., 175 Westwood Ave., 201-666-8989
NY	Pompey, S.F. Foster Co., Inc., 2806 Hennaberry Rd., 315-677-3333
"	Rochester, H.C. Wager, 386 Culver Pkwy., 716-288-9912
Ohio	Dayton, Midwest Mktg. Assocs., 137 Lakeview Dr., 513-433-2511
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Tex	Dallas, R.F. Kimball Co., 5531 Dyer St., EM 1-6067
Wash	Seattle, M.K. Widdekind Co., 815 W. Ewing St., AT 4-8020
EXP:	NY, New York, S. Ginsbury, Ltd., 72 West 45th St., (212) MU 7-3213
FOR:	Can, Aurora, Ont., Oak-Hart Mfg. Co., Tel: 727-4231

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Cal	Del Mar, T. L. Snitzer Co., 1150 El Camino Real, 714-454-2191
"	Los Angeles, T.L. Snitzer Co., 9005 Exposition Blvd., 213-836-6170
"	Palo Alto, T.L. Snitzer Co., 1020 Corporation Way, 415-968-8304
Colo	Englewood, PLS Assocs., 7895 E. Prentice Ave., 303-771-0140
Conn	Bridgeport, Technical Instrs., Inc., 575 Broad St., (203) FO 8-4582
Fla	Ft. Lauderdale, W.A. Brown & Assocs., Inc., 3039 Northeast 32 Ave., (305) LO 4-8000
"	Ft. Walton Beach, W.A. Brown & Assocs., 18 Chelsea Dr., Tel: 243-6424
"	Orlando, W.A. Brown & Assocs., Inc., 222 Weber Ave., 305-425-5505
Ill	Chicago, Bauman & Bluzat, 2925 W. Touhy Ave., 312-761-3603
Kans	Leawood, Poly-Onics, Inc., 4434 West 90th Terr., (913) NI 8-4173
Mass	Wilmington, Technical Instrs., Inc., 122 West St., 617-658-9171
Mich	Southfield, S. Sterling Co., 21250 10 1/2 Mile Rd., 313-357-3700
Minn	Minneapolis, Scott Elctrn. Sls., 5209 West 60th St., 612-929-2985
Mo	Hazelwood, Poly-Onics, Inc., 47 Village Sq. Shopping Ctr., (314) TE 7-0597
NJ	Ft. Lee, K.E. Hughes Co., 2175 Lemoine Ave., 201-944-1600
NM	Albuquerque, PLS Assocs., 4200B Silver Ave., 505-255-2330
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"	Binghamton, J.A. Reagan Co., Inc., 52B Crestmont Rd., 607-723-9661
"	New Hartford, J.A. Reagan Co., Inc., 41 Woodberry Rd., 315-732-3775
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NC	Winston-Salem, W.A. Brown & Assocs., Inc., 1108 Burke St., 919-725-5384
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"	Dayton, S. Sterling Co., 2673 Culver Ave., (513) AX 8-7573
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Pa	Pittsburgh, S. Sterling Co., 2 Parkway Ctr., 412-922-5720
Tex	Dallas, J.A. Green Co., 7118 Envoy Ct., (214) ME 1-7450
"	Houston, J.A. Green Co., 3400 Montrose, (713) JA 6-2959
Va	Alexandria, W.A. Brown & Assocs., Inc., 325 First St., (703) TE 6-1800
Wash	Seattle, N.R. Schultz Co., 305 - 112th Ave., 206-454-5224
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MC NALLY BROTHERS MACHINE & GEAR CO., INC., 1145 East 79th St., Minneapolis, Minn. 55420, Tel: 612-888-8419; Sls. Mgr: A.B. Sorensen ..... FSC No. 96953

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Md	Baltimore, Engineering Assoc., 1406 Shoemaker Rd., 301-825-2385
Mass	Burlington, Lancer Assocs., 16 Adams St., 617-862-7782
Ohio	Columbus, Ohio Instr. Co., 505 Whitney Ave., 614-885-0743
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MEASUREMENT TECHNOLOGY CORP., 7124 Owensmouth Ave., Canoga Park, Calif. 91303, Tel: 213-887-9300; Sls. Mgr: M.C. Asnes

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Ariz	Tempe, F.Y. Gates Co., 3300 S. Mill Ave., 602-966-5441
Cal	Los Angeles, IFM-South, 3455 Cahuenga Blvd., 213-469-1641
"	Mt. View, IFM-North, 2269 Old Middlefield Rd., 415-961-2828
Colo	Denver, F.Y. Gates Co., 1930 S. Navajo, 303-761-0591
Conn	Farmington, R. Perron & Co., 10 Briarwood Rd., 203-673-4825
"	Trumbull, R. Perron & Co., 36 Louis St., 203-268-9631
Fla	Orlando, Murphy & Cota, 712 W. Vassar St., 305-424-2407
Ga	Atlanta, Murphy & Cota, 586 Armour Cir., N.E., 404-875-2525
Ill	Chicago, Midwest Elctrns. Sls., 5707 W. Division St., 312-626-0030
Ind	Indianapolis, Midwest Elctrns. Sls., 5462 East 40th St., 317-547-3259
Md	Rockville, Gawler-Knoop Co., 1751 Rockville Pike, 301-427-3950
Mass	Norwood, R. Perron & Co., 159 Morse St., 617-762-8114
Mich	Ferndale, Tiby Co., 380 Hilton Rd., 313-547-3550
NH	Dover, R. Perron & Co., 1 Elm St., 603-742-2321
NJ	Roseland, Gawler-Knoop Co., 14 Beaufort Ave., 201-226-4545
NM	Albuquerque, F.Y. Gates Co., 2631 Texas, N.E., 505-298-1875
NY	New York, Gawler-Knoop Co., 212-344-2997
NC	Winston-Salem, Murphy & Cota, 1106 Burke St., 919-723-1001
Ohio	Cleveland, Tiby Co., 2245 Warrensville Ctr. Rd., 216-371-5335
"	Dayton, Tiby Co., 1960 N. Main St., 513-277-3822
Ore	Portland, Tarbell Communications, 312 Standard Plaza, 503-228-4111
Pa	Richboro, Gawler-Knoop Co., Box 414, 215-925-7550
Utah	Salt Lake City, F.Y. Gates Co., 455 East 4th South, 801-359-1101
Wisc	Waukesha, Midwest Elctrns. Sls., 1317 Garfield Ave., 414-542-5129
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MECHANICAL PRODS., Div. Aiken Inds., Inc., 1824 River St., Box 729, Jackson, Mich. 49202, Tel: 517-782-0391, TWX: 517-787-1962; Sls. Mgr: R.W. Robson; FSC 76374

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*MECL-A linear integrated circuits - Motorola Semiconductor

*MECL II emitter-coupled logic IC's - Motorola Semiconductor

* MEDICALL intercom sys. - Nelson-Hershfield Elctrns.

* MEDISTAT annunciator sys. - Nelson-Hershfield Elctrns.

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" Trumbull, R. Perron & Co., Inc., 36 Louis St., 203-268-9631
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" Melbourne, Tech-Rep Assocs., Inc., Box 2095, 305-723-9140
Ga Jonesboro, Tech-Rep Assocs., Inc., Box 955, 404-753-0111
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Kans Prairie Village, Engineering Servs. Co., 7924A State Line, (913) MI 9-4000
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NH Dover, R. Perron & Co., Inc., 1 Elm St., 603-742-2321
NY Endicott, Tech-Mark, Inc., Professional Bldg., 607-748-7473
" Fairport, Tech-Mark, Inc., 19 Valley Brook Dr., 716-377-5531
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Md Silver Spring, MCW, Inc., 422 Burnt Mills Ave., 301-593-6121
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NY Bronx, Bradley Assoc. Corp., 130 Van Cortlandt St., 212-549-8500
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* MICROSTICK ic packaging technique - Electronic Engrg. Co.

*MICROSTICK ic packaging technique - Elctrn. Engrg. of Calif.

■ **MICROSONICS, INC., 60 Winter St., Weymouth, Mass. 02188, Tel: 617 - 337-4200; Sls. Mgr: B. P. O'Sullivan.....FSC No. 11869 .....Pg. 1164**

Cal	Los Angeles, Tech Reps., Box 64212, 213-838-4100
"	Sunnyvale, Waldman Assocs., 1094 W. Evelyn St., 408-245-2500
Fla	Ft. Lauderdale, Burgin-Kreh Florida, Inc., Box 8457, 305-587-6063
Ind	Mishawaka, C. Given, 921 East 3rd St., 219-255-6439
Md	Towson, Burgin-Kreh Assocs., Inc., Box 9787, 301-661-1120
NY	Great Neck, E.A.C. Assocs., Inc., 55 Northern Blvd., 516-466-9798
"	Rochester, F. Young Assoc., Inc., 555 Winton Rd., N., (716) HU 2-1555
Ohio	Dayton, Whelan Corp., 2600 Far Hills Ave., 513-298-9997
Pa	Philadelphia, Data Engrg. Co., 500A E. Godfrey Ave., 215-725-9000
Tex	Richardson, P.J. Scanlon Co., Inc., Box 70, (214) AD 1-4661
Va	Louisa, Burgin-Kreh Assocs., Inc., Box 218, 703-296-2976
EXP:	NY, Brooklyn, JFD Elctrns., 15th Ave. & 62nd St., 212-331-1000
FOR:	Can, Islington, Ont., D.T. Shaw Co., Ltd., 5150 Dundas St., W., 416-231-2706
	Can, Montreal, Que., D.T. Shaw Co., Ltd., 1966 Graham Blvd., 514-735-1541

MICROTECH, Div. Ovitron Corp., 1425 Millidale Rd., Cheshire, Conn. 06410, Tel: 203-272-3234, TWX: 710-455-3729; Sls. Mgr: A.D. Shaebutenas ..... FSC No. 04647

MICROTEK ELCTRNS., INC., 138 Alewife Brook Pkwy., Cambridge, Mass. 02140

* MICROTEL microwave radio - Lenkurt Elec. Co., Inc.

* MICROTEMP thermal fuse - Micro Devices Corp.

*MICROTESTERS testers - Simpson Electric Co.

*MICROTHIN spaghetti tubing - Shamban W, S, & Co.

* MICROTIME circuit protector - Micro Devices Corp.

■ **MICROTRAN CO., INC., 145 E. Mineola Ave., Valley Stream, N. Y. 11582, Tel: (516) LO 1-6050, TWX: 510-225-8412; Sls. Mgr: W. Benscher.....FSC No. 00348 .....Pg. 2866**

Ala	Huntsville, F.C. Nickerson Co., Box 1463, 205-881-9565
Ariz	Scottsdale, F. Schoeffler Assoc., 6912 E. Horseshoe Rd., 602-948-3470
Cal	Los Altos, Westec Elctrns., Inc., 110 First St., 415-948-8880
"	Hollywood, Microtran Co., Box 405, 213-770-0610
Colo	Denver, Gossard & Assocs., 12159 W. Dakota Dr., 303-985-0602
Fla	Maitland, H. Geartner, Inc., 2101 Mohawk Trail, 305-647-4000
"	Miami Beach, Geartner Assocs., Inc., 350 Lincoln Rd., 305-531-0200
Ga	Decatur, F.C. Nickerson Co., 1244 Clairmont Ave., 404-377-1575
Ill	Glen Ellyn, J.H. Kleker Co., 177 Sunset Ave., 312-469-2297
Ind	N. Webster, W.H. Myers Sales Co., Inc., Thomas & Main Sts., 219-834-2570
Kans	Overland Park, Penzner Assocs., Inc., 5600 West 95th St., 913-381-0004
Mass	Newtonville, C. Segel Co., 799 Washington St., 617-969-6900
Mich	Lathrup Village, R.C. Nordstrom & Co., Box 32, 313-444-4417
Minn	Hopkins, Beta Engrg. Co., 128 Jackson Ave., N., 612-938-2551
Mo	St. Louis, Penzner Assocs., Inc., Box 1912, 314-351-1547
NY	Jamaica, A. Friedman Assocs., 189-19 Jamaica Ave., 212-776-4800
"	Manlius, A.L. Perkins Co., Inc., Kinloch Plaza, 315-682-5005
"	New York, E. Glass Assocs., 250 West 57th St., (212) JU 6-8440
Ohio	Cincinnati, J.O. Olsen Co., 5539 Stokeswood Ct., 513-885-3722
"	Cleveland, J.O. Olsen Co., 16201 Shaker Blvd., 216-752-5444
"	Dayton, R.G. Siff & Assoc., Box 7035, Sta. B, 513-278-4779
Pa	Cheltenham, Arnold Assocs., 528 Ryers Ave., (215) PI 2-0600
"	Pittsburgh, J.O. Olsen Co., 104 Elatan Dr., 412-279-2550
"	Pittsburgh, J.O. Olsen Co., 1843 Maydell St., 412-341-8391
SC	Greenville, F.C. Nickerson Co., Salters Rd., Rte. 6, 803-242-5259
Tex	Grand Prairie, Howell Sales, Inc., Box 747, (214) AN 2-5153
Wash	Seattle, H. Levinson Co., 1211 E. Denny Way, 206-323-5100
FOR:	Can, St. Laurent, Que., Lake Engrg. Co., Ltd., 3380 Toupin Blvd., 514-331-4884
	Can, Scarborough, Ont., Lake Engrg. Co., Ltd., 123 Manville Rd., 416-751-5980

*MICROTRODE microelectrode - Transidyne-General Corp.

*MICROTRON cooking tubes - Litton Industries

*MICROTRON modules & assemblies - Delta Semiconductors

MICROWAVE ASSOCS., INC., Northwest Ind. Pk., Burlington, Mass., Tel: 617-272-3000, TWX: 710-332-6789; V.P. Sls: R.T. DiBona

■ **MICROWAVE CAVITY LABS., INC., 10 N. Beach Ave., La Grange, Ill. 60525, Tel: 312 - 354-4350; Sls. Mgr: R. E. Morgan.....FSC No. 16469 .....Pgs. 1686, 1687**

Cal	Orange, Smith & Assoc., Box 1525, 714-541-2629
Colo	Denver, D.E. Bond Assocs., 2149 S. Clermont St., 303-756-1234
Fla	Ft. Lauderdale, Beacon Elctrn. Assoc., Box 10212, 305-564-4298
"	Maitland, Beacon Elctrn. Assoc., Box 1278, 350-647-3498
Ga	Atlanta, Beacon Elctrn. Assoc., 2285 Peachtree Rd., 404-351-3654
Ill	Mt. Prospect, Cain & Co., 1203 Ironwood Dr., 312-253-3578
Iowa	Cedar Rapids, Engineering Services Co., 1026 3rd Ave., S.E., 319-366-1591
Kans	Prairie Village, Engineering Services Co., 7924 A State Line, 913-649-4000
Md	Baltimore, Stemler Assocs., Inc., 6707 Whitestone Rd., 301-944-8262
Mass	Bedford, Reptron, Inc., 110 Great Rd., 617-275-8585
Mo	St. Louis, Engineering Services Co., 6717 Vernon, 314-726-2233
NJ	Cherry Hill, Stemler Assocs., Box 287, 609-428-7903
NM	Albuquerque, D.E. Bond Assocs., Box 11331, 505-247-3442
NY	Jericho, Dal-Tech Devices, Inc., 366 N. Broadway, 516-433-7448
"	Rochester, J.D. Ryerson Assoc., Box 8369, 716-442-1900
"	Syracuse, J.D. Ryerson Assoc., Box 1400, 315-656-7419
NC	Jamestown, Beacon Elctrn. Assoc., Box 503, 919-454-1010
Ohio	Columbus, Cain & Co., 2485 Lipton Rd., 614-861-2119
Pa	Paoli, Stemler Assocs., Box 711, 215-644-3477
Tex	Richardson, Lear Assocs., Box 1266, 214-231-1696
Va	Alexandria, Stemler Assocs., 206 N. Washington, 703-548-7818

MICROWAVE CHEMICALS LAB., INC., 282 Seventh Ave., New York, N.Y. 10001, Tel: (212) WA 4-6725; Sls. Mgr: B. Kramarsky

MICROWAVE DEVELOPMENT LABS., INC., 87 Cresent Rd., Needham Hgts., Mass. 02194, Tel: 449-0700, TWX: 710-325-1739; Sls. Mgr: R. Tucker

■ **MICROWAVE DEVICES DIV., Bendix Corp., Hurricane Rd., Franklin, Ind. 46131, Tel: 317 - 736-6136, TWX: 810-260-2600; Sls. Mgr: W. P. Whallon.....FSC No. 95712.....Pgs. 877, 1214, 1656**

Ala	Huntsville, Bendix/Dage Sls., 3322 Memorial Pkwy., S., 205-881-9700
Ariz	Scottsdale, Jewett Co., 602-945-9711
Cal	N. Hollywood, Jewett Co., 13111 Ventura Blvd., 213-789-8103
"	Palo Alto, Bendix/Dage Sls., 800 San Antonio Rd., 415-327-4511
Colo	Denver, Gossard & Assocs., 12159 W. Dakota Dr., 303-985-0602
DC	Washington, Bendix/Dage Sls., 1730 "K" St., N.W., 202-333-8200
Fla	Orlando, Bendix/Dage Sls., 2122A E. Colonial, 305-241-6559
Ill	Oak Park, Wasson-Gallagher, 1024 North Blvd., 312-383-6572
Ind	Indianapolis, A.N. Strickland, 6811 Grosvenor Pl., 317-632-3321
La	Metairie, J.F. McKinney Sls. Co., 2012 Condon Ave., 504-887-1723
Mass	Lexington, Bendix/Dage Sls., 9 Meriam St., 617-862-7650
Mich	Jackson, E.H. Jordan, 2024 Glen Dr., 517-782-0694
Minn	Minneapolis, F.B. Hill Co., 6110 Excelsior Blvd., 612-929-6727
Mo	Florissant, Bendix/Dage Sls., 3026 Aberdeen Pl., 314-839-2287
NY	Buffalo, E.E. Harries & Co., 15 Canterbury La., 716-652-1221
Okla	Tulsa, J.F. McKinney Sls. Co., Box 3958, 918-724-4595
Ore	Portland, C.K. Shanks & Assoc., 3104 Southwest 87th Ave., 503-292-5656
Tex	Bellaire, J.F. McKinney Sls. Co., 5458 Edith St., 713-985-0602
"	Dallas, J.F. McKinney Sls. Co., 1303 Chemical St., 214-631-9450
EXP:	NY, New York, Bendix Int'l., 605 Third Ave., 212-973-2121
FOR:	Can, Hamilton, Ont., Simmonds Aerocessories of Canada, Ltd., 637 Parkdale Ave., N., 416-547-1248

MICROWAVE DIV., Sanders Assocs., Inc., Ledge St., Nashua, N.H. 03060, Tel: 603-885-2445, TWX: 710-228-1887; Sls. Mgr: J. Cushman ..... FSC No. 94117

MICROWAVE ELCTRNS., Teledyne Co., 3165 Porter Dr., Palo Alto, Calif. 94304, Tel: 412-321-1770, TWX: 910-373-1746 ..... FSC No. 11312

MICROWAVE FILTER CO., INC., 135 W. Manlius St., E. Syracuse, N.Y., Tel: 315-437-4529; Sls. Mgr: G. Bostick

MICROWAVE INSTRS. CO., 3111 Second Ave., Corona del Mar, Calif., Tel: 714-673-7688; Gen'l. Mgr: R. Botsco

MICROWAVE LABS. OF AMERICA, P.O. Box 13, Bay Sta., Brooklyn, N.Y. 11235, Sls. Mgr: H. Gindins

MICROWAVE MAGNETICS, INC., 183 Newburyport Tpke., Danvers, Mass. 01923, Tel: 617-774-1072; Pres: C.R. Buffler

MICROWAVE PRODS. GROUP, Div. Consolidated Airborne Systems, Inc., 115 Old Country Rd., Carle Pl., N.Y. 11514, Tel: (516) PI 1-1500, TWX: 510-222-3789; Sls. Mgr: R. Pizzutiello

MICROWAVE PRODS., INC., 9533 Irondale Ave., Chatsworth, Calif. 91311, Tel: 213-882-3434; Sls. Mgr: C. Troesken ....., FSC No. 16798

MICROWAVE/SYSTEMS, INC., 1 Adler Dr., E. Syracuse, N.Y. 13057, Tel: 315-437-9951; Sls. Mgr: C.D. Rasmussen ..... FSC No. 26058

*MICROZONE electrophoresis apparatus - Beckman Instruments

MID-CONTINENT LAB., INC., 840 North 48th St., Lincoln, Neb. 68504, Tel: 402-434-7488; Pres: R. Salestrom

■ **MID-EASTERN INDS., Div. Eanco, Inc., 660 Jerusalem Rd., Scotch Plains, N. J. 07076, Tel: 201 - 233-5900; Sls. Mgr: D. R. Ellenback .....FSC No. 06179 .....Pgs. 2046-2049**

Cal	Cupertino, B.J. Wolfe Enterprises, Box 718, 408-252-5010
"	N. Hollywood, B.J. Wolfe Enterprises, 10760 Burbank Blvd., 213-877-5518
Fla	Clearwater, Willett & Ellis-Brown, 1260A S. Highland Ave., 813-446-0075
Ill	Evanston, Mauer & Co., Inc., 3308 Noyes St., 312-869-1644
Iowa	Ft. Dodge, Heimann Co., 236 Seventh Ave., N.
Kans	Leawood, Leemark Engrs., Inc., Box 6175, 913-648-0124
Mass	Wellesley Hills, R.H. Sturdy Co., 204 Worcester St., 617-235-2330
Mich	Detroit, Lowyr-Dietrich Co., 600 Michigan Bldg., 313-961-4540
Minn	Minneapolis, Heimann Co., 5603 Lyndale Ave., S., 612-827-5457
Mo	St. Louis, Leemark Engrs., 9623 St. Charles Rock Rd., 314-647-4545
NY	Huntington, C.R. Mayer Co., Inc., Box 152, (516) WA 1-7876
Ohio	Cleveland, Lowry Dietrich Co., 316 Marion Blvd., 216-781-1855
"	Dayton, Lowry Dietrich Co., 333 West 1st St., 513-223-6042
Pa	Pittsburgh, Lowry Dietrich Co., 90 Clairton Blvd., 412-892-2992
"	Valley Forge, J.E. Cuesta Co., 215-265-5800
Tex	Dallas, Bellingham Sales Co., 1002 Burlington Ave., (214) WH 2-6595
Wash	Seattle, Eicher-Richards Co., 2727 N.E. Blakeley St., (206) LA 3-7888
FOR:	Can, Dorval, Que., Technitron Assoc., Inc., 769 Lajoie Ave., 514-631-6859
	Can, Vancouver, B.C., Canadian Dynamics, Ltd., 8264 St. George St., Tel: 325-6014

*MIDA miniature integral diode assemblies - Motorola Semi.

*MIDGI-CODER bcd to numeric decoder/driver - Pinlites, Inc.

*MIDGI-COUNTER decade counter, encoder - Pinlites, Inc.

*MIDGI-DIAL dial assy. Theta Instrument Corp.

*MIDGI-LITE digital readout - Pinlites, Inc.

* MIDNIGHT carbon paper - Carters Ink Co.

MID-WEST COIL & TRANSFORMER CO., 1642 N. Halstead St., Chicago, Ill. 60614, Tel: (312) MI 2-4055; Sls. Mgr: G. Ortaggio

MID-WEST METAL PRODUCTS, INC., 450 E. Donovan Rd., Kansas City, Kans. 66115, Tel: (913) MA 1-1980, TWX: 913-553-9260; Mgr: J.H. Minzey, Jr. ..... FSC 09970

MIDDLETOWN MFG. CO., 27 Stack St., Middletown, Conn. 06457, Tel: 203-346-8659

MIDGET LOUVER CO., 800 Main Ave., Norwalk, Conn. 06901

MIDLAND WRIGHT CORP., 3151 Fiberglass Rd., Kansas City, Kansas, 66115

MIDSIL CORP., 27 Bland St., Emerson, N.J. 07630, Tel: 201-262-2340; Sls. Mgr: R.T. Temple

MIDTEX/AEMCO, 10 State St., Mankato, Minn. 56001, Tel: 507-388-6288, TWX: 507-890-8129; Sls. Mgr: R.K. Else

MIDWEC CORP., Industrial Div., P.O. Box 417, Scottsbluff, Neb. 69361, Tel: 308-632-4127, TWX: 910-627-0061; Sls. Mgr: J. Carwile ..... FSC No. 13934

MIDWEST AUDIO CORP., 5707 W. Division, Chicago, Ill. 60651, Tel: 312-626-0030; Sls. Mgr: B.A. Menarik

MIDWEST AUTOMATIC, INC., 510 Third St., Des Moines, Iowa, Tel: 515-244-3103; Sls. Mgr: H. Frankle

■ **MIDWEST CIRCUITS, INC., 1111 E. Excelsior Blvd., Hopkins, Minn. 55343, Tel: 612 - 935-3341; Sls. Mgr: M. W. Farmer** ..... Pg. 712

Cal	Newport Beach, West, Inc., 3825 Birch St., 714-540-9040
Colo	Arvada, Arrowhead Sls. Corp., 5460 Brentwood, 303-798-0319
Fla	Clearwater, R.F. Willett Co., 1260A S. Highland, 813-446-0075
Iowa	Cedar Rapids, Halgin Sls., 4403 1st Ave., S.E., 319-363-5119
Kans	Mission, Halgin Sls., Box 1245, 913-722-2441
Mass	Wellesley, E.A. Janse Assocs., 892 Worcester St., 617-235-1623
Mich	Grand Rapids, Elko Sls. Corp., 3119 Midland Dr., S.E.
Minn	St. Paul, Wagner Component Consultants, 542 S. Snelling Ave., 612-698-0331
Mo	Clayton, Halgin Sls., 201 S. Central, 314-721-4415
NM	Albuquerque, Arrowhead Sls. Corp., Box 243, 505-268-9706
NY	Great Neck, E.R.A., INC., 330 Great Neck Rd., 516-482-9320
"	Rochester, T. Ferguson Sls. Co., Inc., 228 Winton Rd., N., 716-482-7757
Pa	Philadelphia, K.B. Erdman Co., 7906 Montgomery Ave., 215-224-1833
Tex	Richardson, Vista Engrg. Assocs., Central Expwy., Ste. 5E, 214-235-4547
Utah	Salt Lake City, Arrowhead Sls. Corp., 1966 West 6255, S., 801-298-2751

MIDWEST ELECTRIC PRODS., INC., P.O. Box 910, Mankato, Minn. 56002, Tel: 507-388-2919; Sls. Mgr: J.R. Habinger

MIDWEST MOLDING & MFG. CO., Gurnee, Ill., Tel: (312) ON 2-1320; Sls. Mgr: T.E. Richards ..... FSC No. 76473

MIDWESTERN INSTRS., INC., 6422 East 41st, Tulsa, Okla. 74135, Tel: 918-627-1111, TWX: 918-627-6030; Sls. Mgr: P. Gilbody

*MIGHTY MITE motor protectors - Thermal Eng'g. & Design

* MIKROVAN wax - Humble Oil & Refining Co.

* MIL-KOTE paint & coatings - Zophar Mills, Inc.

MILES REPRODUCER CO., INC., 598 Broadway, New York, N.Y. 10012, Tel: 212-925-6985; Sls. Mgr: J.M. Kuhlik

MILFORD RIVET & MACHINE CO., 857 Bridgeport Ave., Milford, Conn. 06460, Tel: 203-878-4631, TWX: 710-462-0538; V.P. Sls: D.W. Clark

MILGO ELCTRN. CORP., 7620 Northwest 36th Ave., Miami, Fla. 33147, Tel: 305-691-1220, TWX: 810-848-6588; Sls. Mgr: D. Crane ..... FSC No. 06602

*MILIPOT potentiometer - Voak Engineering, Co., Inc.

*MILITAN mil. spec. type solid tantalum capacitors - Components

* MILITAN mil spec capacitors - Components, Inc.

■ **MILLEN, JAMES MFG. CO., INC., 150 Exchange St., Malden, Mass. 02148, Tel: 617-324-4108; Sls. Mgr: W. Caywood ... FSC No. 76487** ..... **Pgs. 682, 740, 1174, 1175, 1226, 1227, 1442, 1443, 2913**

Cal	Culver City, W. Alderson Co., 8548 Washington Blvd., 213-837-1398
"	Los Angeles, W.S. Harmon Co., 6118 Venice Blvd., 213-937-1460
"	San Francisco, Moulthrop, Polach & Bensinger, Inc. 165 Eleventh St. 415-861-6958
Conn	New Haven, Gerber Sales Co., Inc., Box 2917, 203-777-6279
DC	Washington, L.D. Lowery, Inc., (202) UN 4-4722
Ill	Chicago, Carlson Elctrn. Sales Co., 7448 N. Harlem Ave., (312) SP 4-0277
Ind	Indianapolis, Schroeder & Loomis, 714 East 65th St., 317-251-4571
Iowa	Des Moines, Kelly-Schmitz-Winkeler Assoc., 3831 43rd St. 515-279-9235
Md	Hyattsville, L.D. Lowery, Inc., 6200 Annapolis Rd., (301) EN 9-4722
Mass	E. Longmeadow, Gerber Sales Co., Inc., 26 Maple Ct., 413-525-3059
"	Waltham, Gerber Sales Co., Inc., 176 Second Ave., 617-891-8040
Minn	Minneapolis, Carlson Elctrn. Sales Co., 2500-39th Ave., N.E., 612-788-4111
Mo	Kansas City, Kelly-Schmitz-Winkeler Assoc., 7546 Troost Ave., (816) EM 1-5651
NY	Port Washington, J. DiBlasi Assoc., Inc., 14 Vanderventer Ave., (516) PO 7-0470
"	Syracuse, J.V. Costello, 2030 Erie Blvd., E., 315-472-0322
Pa	Broomall, L.D. Lowery, Inc., 2801 W. Chester Pike, (215) EL 6-5300
"	Harrisburg, L.D. Lowery, Inc., 1501 Allison St., (717) TR 7-1212
Tex	Dallas, J. Yount Co., Box 17270, Pleasant Grove Sta., (214) EX 1-4125
EXP:	NJ, Iselin, Technical Equip. Co., 487 Lincoln Hwy., 201-283-2340
FOR:	Can, Markham, Ont., H.R. Gray Co., Ltd., 14 Laidlaw Blvd., 416-297-1476

MILLER ASSOCS., Mercersburg Academy, Mercersburg, Pa. 17236, Pres: R.R. Miller

MILLER DIAL & NAME PLATE CO., 4400 N. Temple City Blvd., El Monte, Calif. 91731, Tel: 213-283-5111; Sls. Mgr: J.F. Buck

*MILLER welders - Miller Electric Mfg., Co.

MILLER ELEC. CO., Box 231, Woonsocket, R.I. 02895, Tel: 401-767-2800; Sls. Mgr: L.F. Wilkinson

MILLER ELEC. MFG. CO., 718 S. Bounds, Appleton, Wisc. 54911, Tel: 414-734-9821, TWX: 414-739-3395; Sls. Mgr: K.M. Ligare

MILLER ELECTRO-RESEARCH LABS., 14800 W. Grange, New Berlin, Wisc., Tel: 414-425-6303; Sls. Mgr: A.W. Miller ..... FSC No. 98919

MILLER, HARRY CORP., 4th & Bristol Sts., Philadelphia, Pa., Tel: (215) DA 4-4000; Sls. Mgr: R.W. Allen

■ **MILLER, J. W. CO., 5917 S. Main St., Los Angeles, Calif. 90003, Tel: 213 - 233-4294; Sls. Mgr: L. G. Crawford, Jr. ..... FSC No. 76493** ..... Pg. 738

Ariz	Phoenix, H.A. Moore Sls. Co., 4142 North 18th St., 602-274-0060
Cal	Gardena, Osborne & Bidwell, Inc., 17525 S. Broadway, 213-770-0300
"	Redwood City, Logan Sls. Co., 463 Brewster Ave., 415-369-6726
Colo	Denver, R.G. Bowen Co., Inc., 1440 S. Santa Fe, 303-722-4641
Fla	Winter Park, Millar-Hutto Assocs., Inc., Box 1603, 305-647-7407
Ga	Atlanta, Millar-Hutto Assocs., Inc., 3110 Maple Dr., N.E., 404-261-6160
Ill	Chicago, Markal Sls. Co., 5787 N. Lincoln Ave., 312-561-7290
Ind	Ft. Wayne, B.F. Homsher, 418 E. Berry St., 219-432-1164
Md	Reisterstown, Par-Nell Sls. Co., 69 Main St., 301-833-6444
Mass	N. Scituate, W.A. Hendrickson Co., 766 Country Way, 617-545-0652
Minn	Minneapolis, C.R. Gibb Co., 1311 West 25th, 612-377-1200
Mo	Kansas City, H.A. Roes & Co., 2601 Cherry St., 816-221-0866
NJ	Union City, J.J. Bressler, Inc., 4808 Bergenline Ave., 201-864-9577
NY	DeRuyter, LSM Assocs., 218 E. Lake Rd., 315-852-3374
"	Hamburg, LSM Assocs., 54 Puritan Pl., 716-649-8380
"	Phelps, LSM Assocs., Orchard Pk., 315-548-4891
NC	Raleigh, Millar-Hutto Assoc., Inc., North Hill Office Mall, 919-787-9564
Ohio	N. Bremen, T. Shelby Co., Inc., 17 S. Walnut St., 419-629-6511
Ore	Portland, Earl & Brown Co., Inc., 2041 Southwest 58th St., 503-292-9145
Pa	Feasterville, Par-Nell Sls. Co., 1135 Bustleton Pike, 215-357-7230
Tex	Dallas, Maynard Sls. Co., 158 Express St., 214-742-2384
Utah	Salt Lake City, R.G. Bowen Co., Inc., 1580 W. N. Temple, 801-364-4632
Wash	Seattle, Earl & Brown Co., Inc., 422 First Ave., W., 206-284-1121
EXP:	NY, New York, Roburn Agencies, Inc., 431-435 Greenwich St., 212-966-2130
FOR:	Can, Toronto, Ont., Atlas Radio Corp., 50 Wingold Ave., (416) RU 1-6174
	Can, Vancouver, B.C., Atlas Radio Corp., Ltd., 909 Beach Ave., (604) MU 3-5848

MILLER, K. TOOL & MFG. CO., INC., 857 Elm St., W. Springfield, Mass., Tel: 413-733-1360; Pres: K.T. Miller

MILLER, L.C. CO., 717 Monterey Pass Rd., Monterey Park, Calif. 91754, Tel: (213) AN 8-3611; Sls. Mgr: E.J. Thompson ..... FSC No. 09260

MILLER, R.A. INDS., INC., 1525 Marion, Grand Haven, Mich., Tel: 616-842-9450; Pres: R.A. Miller .... FSC 05211

MILLER, SANFORD CORP., 89 Throop Ave., Brooklyn, N.Y. 11206, Tel: 212-387-0600; Sls. Mgr: I.E. Iserson

MILLER-STEPHENSON CHEMICAL CO., INC., 16 Sugar Hollow Rd., Danbury, Conn. 06810, Tel: 203-743-4447; Sls. Mgr: H.J. Robertson ..... FSC No. 86961

*MILLERMATIC welding equip. - Miller Electric Mfg. Co.

MILLETRON, INC., 540 Alpha Dr., Pittsburgh, Pa. 15238, Tel: 412-781-5300; Sls. Mgr: D.S. Pappas

MILLI-SWITCH CORP., P.O. Box 67, Gladwyne, Pa. 19035, Tel: (215) MI 2-9222; Sls. Mgr: B.W. Chandler; FSC 00099

MILLIKEN, D.B., Teledyne Co., 131 N. Fifth Ave., Arcadia, Calif. 91006, Tel: 213-359-6691

MILLITEST CORP., 88 Madison Ave., Hempstead, N.Y. Tel: (516) IV 3-8200, TWX: 516-485-1592; Dir. of Mktg: P.N. Kaplan ..... FSC No. 98659

*MILLITORR ionization gauge - Varian Associates

■ **MILLIVAC INSTRS., P. O. Box 997, Schenectady, N. Y. 12301, Tel: 518 - 355-8300; Sls. Mgr: D. P. Morey ..... FSC No. 85711** ..... Pg. 1441

Ala	Huntsville, Mekco Assocs., Inc., Holiday Office Ctr., 205-881-3721
Ariz	Phoenix, Newtronics Co., 8514 North 36th Dr., 602-939-0265
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Ariz	Phoenix, Southwest Engrg., 8341 North 7th St., Tel: 944-1521
Cal	Palo Alto, Components Unlimited, 1020 Corporation Way, 415-961-9064
"	Santa Monica, G. Shane, 1150-18th St., 213-393-0072
Colo	Denver, Walter-Powers Assocs., 880 Bonnie Brae Blvd., 303-777-5585
Conn	Milford, Todino Engrg. Sls., Inc., 132 New Haven Ave., 203-874-6643
Ill	Addison, T.H. Herlache, Box 74, 312-543-7712
Mass	Needham Hgts., Todino Engrg. Sls., Inc., 50 Kearney Rd., 617-444-7925
Mich	Farmington, W.R. Hummon & Assocs., Box 501, 313-474-0661
NJ	Collingswood, E.L. Bowman, Box 192, 609-546-5750
"	Pompton Plains, J. Principotta, Box 124, 201-839-1221
NY	Syracuse, Carlen Reps., 3605 James St., 315-437-2921
Ohio	Dayton, N. Bear Corp., 1563 E. Dorothy La., 513-299-3566
"	W. Richfield, N. Bear Corp., 3435 Streetsboro Rd., 216-659-3331
Ore	Portland, R. Legg Co., Box 25327, 503-292-8824
Tex	Ft. Worth, W.P. Fralia Co., Box 12625, 817-738-2002
Utah	Salt Lake City, Walter-Powers Assocs., 2422 Camino Way, 801-277-5174

NEW YORK COIL CO., 40-48 Second Ave., Phoenixville, Pa. 19460, Tel: 215-933-8851; Sls. Mgr: J.R. Zikmund, Jr. ..... FSC No. 10587

NEW YORK SOLDER CO., 684 East 133rd St., Bronx, N.Y. 10454, Tel: (212) CY 2-3740 ..... FSC No. 86623

NEW YORK TESTING LABS., INC., 81 Urban Ave., Westbury, N.Y. 11590, Tel: (516) ED 4-7770; Vice Pres: R. Schultz

NEWARK WIRE CLOTH CO., 351 Verona Ave., Newark, N.J., Tel: 201-483-7700, TWX: 710-995-4500; Sls. Mgr: P.A. McGuire, Jr.

NEWBURY INDS., INC., 10975 Kinsman Rd., Newbury, Ohio 44065, Tel: 216-564-2285; Sls. Mgr: P. Sorensen

NEWCOMB AUDIO PRODS. CO., 12881 Bradley Ave., Sylmar, Calif. 91342, Tel: 213-367-1921; Sls. Mgr: R. Newcomb

NEWCOMB SPRING OF CONN., INC., 2 Spring St., Southington, Conn., Tel: 203-628-5581, TWX: 710-473-0611; Sls. Mgr: G. Albert

* NEWDAMP balancing fluid - Bacon Inds., Inc.

NEWMAN, M.M. CORP., 85 Clifton Ave., Marblehead, Mass. 01945, Tel: 617-631-7100; Pres: M.M. Newman

■ **NEWPORT LABS, INC., 630 E. Young St., Santa Ana, Calif. 92705, Tel: 714 - 540-4914; V.P. Mktg: P. A. Turnquist .....Pg. 1454**

Ariz	Phoenix, Measurement Consultants, Ltd., Box 11099, 602-264-1279
Cal	Burlingame, Dynamic Assocs., 1011 Cadillac Way, 415-344-2521
"	Los Angeles, Dynamic Assocs., 2500 S. La Cienega Blvd., 213-837-0123
"	San Diego, Dynamic Assocs., 3235 Hancock St., 714-291-1391
Colo	Denver, Measurement Consultants, Ltd., 2785 N. Spear Blvd., 303-433-8457
Ill	Northfield, Torkelson Assocs., 540 W. Frontage Rd., 312-446-8450
Ind	Indianapolis, Torkelson Assocs., 3512 Rockville Rd., 317-244-7867
Kans	Overland Pk., Palatine Engrg. Sls., Inc., 7520 West 63rd St., 913-262-5643
Md	Silver Spring, Electronic Sls. Assocs., 12050 Tech Rd., 301-622-2246
Mass	N. Billerica, Electronic Sls. Assocs., 1A Chelmsford Rd., 617-667-1331
Mich	Southfield, Twin Region Elctrn. Sls., Inc., 29563 Northwestern Hwy., 313-358-4480
Minn	Minneapolis, Torkelson Assocs., 4820 West 77th St., 612-920-1046
Mo	St. Louis, Palatine Engrg. Sls., Inc., 2050 Woodson Rd., 314-426-7055
NM	Albuquerque, Measurement Consultants, Ltd., 3707 B Fourth St., N.W., 505-344-3575
NY	Great Neck, Measurement Technology, Inc., 295 Northern Blvd., 516-482-3500
Ohio	Cleveland, Twin Region Elctrn. Sls., Inc., 21010 Center Ridge Rd., 216-331-7650
"	Dayton, Twin Region Elctrn. Sls., 3864 Kettering Blvd., 513-434-8000

NEY, J.M. CO., Maplewood Ave., Bloomfield Conn. 06002, Tel: 203-242-2281; Dir. of Mktg: D.V. Landmann ..... FSC No. 43710

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* NEYORO elec. contact alloys - Ney, J.M. Co.

NICHOLS ALUMINUM CO., 15 Spinning Wheel Rd., Hinsdale, Ill. 60521, Tel: 312-325-5000; V.P. Sls: H. Jacobsen

NICHOLS PRODUCTS CO., 325 W. Main St., Moorestown, N.J. 08057, Tel: 609-235-0877; Sls. Mgr: R. Ericson ..... FSC No. 86637

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* NICKELPLY steel wire - National-Standard Co.

*NICORO brazing alloys - Western Gold & Platinum Company

*NICUSIL 3 brazing alloys - Western Gold & Platinum Co.

NIELSEN HARDWARE CORP., 770 Wethersfield Ave., Hartford, Conn. 06101, Tel: 203-522-8145, TWX: 203-278-1085; Sls. Mgr: G.E. Swanson ..... FSC No. 98003

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NILSEN MFG. CO., 920 Hwy. 27, Haines City, Fla. 33844, Tel: 813-422-1197; Sls. Mgr: M. Zamzow

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Ill	Chicago, Nippon Elec. N.Y., Inc., 500 N. Michigan, 312-828-9494
NY	New York, Nippon Elec. N.Y., Inc., 200 Park Ave., 212-661-3420

■ **NIPPON ELECTRIC CO., LTD., 33-7, 5 Chome, Minato-ku, Tokyo, Japan .....Pg. 2580**

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*NOBRUSH permanent magnet generators - Georator Corp.

NOEL MFG. CO., INC., 1415 Blondell Ave., Bronx, N.Y. 10461

NOLD, WALTER, CO., 24 Birch Rd., Natick, Mass. 01760, Tel: 617-653-1635; Sls. Mgr: W. Nold ..... FSC 86644

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* NOKORODE soldering flux - Dunton, M.W. Co.

NOLLER CONTROL SYSTEMS, INC., 150 E. Standard Ave., Richmond, Calif., Tel: 415-233-8220, TWX: 415-236-8935; Sls. Mgr: B.W. Mayer

* NOLTE flow meas. prods. - Kingmann-White, Inc.

*NO-MAR special set screw - Pic Design Corp.

■ **NON-LINEAR SYS., INC., Box N, Del Mar, Calif. 92014, Tel: 714 - 755-1134, TWX: 910-322-1132; Sls. Mgr: R. F. Schull.....FSC No. 03626 .....Pgs. 1449-1451**

Ala	Huntsville, W.A. Brown & Assocs., Inc., 1314 Buford St., N.W., 205-539-6884
Ariz	Phoenix, Measurement Consultants, Ltd., 2535 W. Camelback Rd., 602-264-1279
Cal	Dublin, Non-Linear Sys., Inc., 7390 Newcastle La., 415-828-7220
"	Mt. View, Non-Linear Sys., Inc., 721 Independence Ave., 415-969-0973
"	San Jose, Non-Linear Sys., Inc., 1857 Foxworthy Ave., 408-377-5223
"	S. Pasadena, QPL, Inc., 1015 Fremont Ave., 213-682-3705
Colo	Denver, Measurement Consultants, Ltd., 2785 N. Speer Blvd., 303-433-8457
Fla	Ft. Lauderdale, W.A. Brown & Assocs., Inc., 3039 Northeast 42nd Ave., 305-565-3885
"	Ft. Walton Beach, W.A. Brown & Assocs., Inc., 18 Chelsea Dr., 904-243-6424
"	Orlando, W.A. Brown & Assocs., Inc., 222 Weber Ave., 305-425-5505
Ga	Tucker, W.A. Brown & Assocs., Inc., 1590 Cooledge, 404-939-1674
Ill	Chicago, Carter Elctrns., Inc., 7203 S. Western Ave., 312-776-1601
Ind	Indianapolis, Carter Elctrns., Inc., 6333 Hollister Dr., 317-293-0696
Kans	Overland Pk., Palatine Engrg. Sls., 7520 West 63rd St., 913-262-5643
Md	Silver Spring, Electronic Sls. Assoc., 12050 Tech Rd., 301-622-2246
Mass	N. Billerica, Electronic Sls. Assoc., 1-A Chelmsford Rd., 617-677-1331
Mich	Detroit, B. Hocker & Assocs., 26847 Grand River Ave., 313-531-1403
Minn	Minneapolis, Carter Elctrns., Inc., 2401 West 66th St., 612-869-3261
Mo	St. Louis, Palatine Engrg. Sls., 2050 Woodson Rd., 314-426-7055
NJ	Fairfield, KLS Assocs., Inc., 387 Passaic Ave., 201-228-2525
"	Willingboro, M.G. Assocs., 4 Edgemont La., 609-877-6773
NM	Albuquerque, Measurement Consultants, Ltd., 3707 Fourth St., N.W., 505-344-3575
NY	Liverpool, Non-Linear Sys., Inc., 102 Woodside La., 315-652-2068
"	Pleasant Valley, Non-Linear Sys., Inc., Box 452, 914-635-3556
NC	Winston-Salem, W.A. Brown & Assocs., Inc., 1108 Burke St., 919-725-5384
Ohio	Aurora, B. Hocker & Assocs., 221 Garfield Rd., 216-734-4433
"	Dayton, B. Hocker & Assocs., 1400 Devereux, 513-298-8638
Okla	Tulsa, Data Engrg. Corp., 4580 East 50th St., 918-622-3753
Tex	Houston, Data Engrg. Corp., 2120 S. Post Oak Rd., 713-622-2820
"	Richardson, Data Engrg. Corp., 777 S. Central Expwy., 214-231-4846
"	San Antonio, Data Engrg. Corp., 411 E. Martin St., 512-226-4342
Wash	Bellevue, Brennan Assocs., Inc., 208 Carlson Bldg., 206-454-9332

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NOPCO CHEMICAL DIV., Diamond Shamrock Chemical Co., 60 Park Pl., Newark, N.J. 07102, Tel: 201-484-8400, TWX: 710-995-4585; Sls. Mgr: J. Holmes

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* NORBARATIO pyrometer - Norbatrol Elctrns. Corp.

* NORBARAY pyrometer - Norbatrol Elctrns. Corp.

* NORBATHERM controller - Norbatrol Elctrns. Corp.

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NORCROSS CORP., 255 Newtonville Ave., Newton, Mass., Tel: 617-969-7020; Sls. Mgr: R.A. Norcross

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NORRICH PLASTICS CORP., 206 Babylon Tpke., Roosevelt, N.Y., Tel: (516) MA 3-3100; Sls. Mgr: R. Thaw

NORRMAN, ERNST LABS., 200 Elkhorn Rd., Williams Bay, Wisc. 53191, Tel: 414-245-5516; Sls. Mgr: H.E. Kashuta ..... FSC No. 93325

* NORSAT thermostats - Norwalk Thermostat Co.

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Ala	Huntsville, International Scientific Instr., Box 2091, 205-536-9686
Ariz	Phoenix, Measurement Consultants, 4428 North 19th Ave., 602-264-1279
Cal	Los Angeles, Instrument Specialists, Inc., 1109 S. Central Ave., 213-245-9404
"	San Diego, Instrument Specialists, Inc., 1909 State St., 714-232-2017
Colo	Denver, Measurement Consultants, 2785 N. Speer Blvd., 303-433-8457
Conn	Glastonbury, Instrument Reps., Inc., Box 165, 203-633-0777
Ill	Chicago, P. Lind Elctrns. Co., 5483 N.W. Hwy., 312-774-1246
Ind	Indianapolis, P. Lind Elctrns. Co., ENterprise 7711
Kans	Olathe, Technical Reps., Inc., 809 Sheridan Cir., 913-782-3775
"	Wichita, Technical Reps., Inc., 6814 Farmview La., 316-682-4140
Md	Silver Spring, R. Davies Assocs., 11215 Oak Leaf Dr., 301-593-4900
Mass	Arlington, Reps., Inc., 1046 Massachusetts Ave., 617-646-1034
Mich	Detroit, WKM Assocs., 1474 E. Outer Dr., 313-892-2500
Minn	Circle Pines, P. Lind Elctrns. Co., 10104 Sunset Blvd., 612-786-5770
Mo	Florissant, Technical Reps., Inc., 525 St. Francois St., 314-838-9100
NM	Albuquerque, Measurement Consultants, Box 6081, 505-344-3575
NY	Buffalo, Labtronics, Inc., 716-695-1001
"	Syracuse, Labtronics, Inc., 130 Pickard Bldg., 315-454-9314
NC	Raleigh, International Scientific Instr., 5100 N. Glenn Dr.
Ohio	Cleveland, WKM Assocs., 6741 Ridge Rd., 216-885-5616
"	Dayton, WKM Assocs., 5335 Far Hills Ave., 513-434-7500
Pa	Fairview Village, Acromatix Assoc., Inc., 3118 Germantown Pike, 215-279-0377
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"	Richardson, Scientific Sls. Co., 777 S. Central Expwy., 214-231-6542
Wash	Seattle, Instrument Specialists, Inc., 5950 Sixth Ave., S., 206-767-4260
Wisc	Milwaukee, P. Lind Elctrns. Co., ENterprise 1611
EXP:	NY, Plainview, N. Atlantic Ind., 200 Terminal Dr., 516-681-8600

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Ala	Huntsville, Winfield Southeast Co., 2005-C Colony Dr.
Cal	Long Beach, Kirk-Anderson Sls. Co., 666 E. Ocean Blvd., 213-436-9756
"	San Francisco, Artwell Elec., Inc., 1485 Bayshore Rd., 415-467-1880
Colo	Westminster, Electro-Tek Sls., Inc., Box 395, 303-255-4566
Fla	N. Miami, Winfield Elctrn. Sls. Co., 666 Northeast 125th St., 305-751-5566
Ga	Atlanta, Winfield Southeast Co., 2991-D N. Druid Hills Rd., N.E., 404-636-3023
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"	Williston Pk., Garrettson Co., Inc., 99 Hillside Ave., 516-747-6610
NC	Raleigh, Winfield Southeast Co., 4909 Carteret Dr., 919-787-2841
Ohio	Cleveland, D. Steffen & Assoc., Inc., Box 3157, 216-261-5055
"	Dayton, D. Steffen & Assoc., Inc., 1201 Hempstead Rd., 513-293-3146
Pa	Newtown Sq., Kaufholz Assocs., Box 227, 215-356-5000
Tex	Dallas, Jacobson Co., Box 9702, 214-363-7584
Wash	Seattle, Fleehart & Sullivan, Inc., 3826 Woodland Park Ave., N., 206-633-4979

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Md	Silver Spring, Zenatronix Assocs., 11215 Oak Leaf Dr., 301-588-5677
Mass	Dedham, Calcotron, Box 507, 617-329-3270
NJ	Lodi, Engineered Prods., Inc., 28 Essex St., 201-845-6668
Pa	Philadelphia, W.F. Assocs., Box 8821, (215) KI 6-4121

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Cal	Burbank, Tech-Source Unlimited, 2104 W. Magnolia, 213-849-6863
Fla	St. Petersburg, Components Sls. Corp., Box 9545, 813-360-7460
Ill	Chicago, E. Schmeichel Co., 5968 W. Chicago Ave., 312-378-2070
Mass	Needham, DeVeer Sls. Engrg. Co., Inc., 1492 Highland Ave., 617-444-4200
NJ	Bergenfield, H. Gray Assocs., 20 Foster St., 201-384-3643
Ohio	Cleveland, S. Hojnowski, 20010 Sumpter Rd., 216-662-3569

NORTHERN PRECISION LABS., INC., 202 Fairfield Rd., Fairfield, N.J. 07006, Tel: 201-227-4800, TWX: 710-734-4301; Sls. Mgr: T. Monaco ..... FSC No. 14742

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Cal	Palo Alto, Nickerson-Gray & Assoc., 2434 Park Blvd., 415-326-0152
"	Van Nuys, Nortronics Co., Inc., 7120 Hayvenhurst Ave., 213-988-4290
Colo	Colorado Springs, Norris & Co., 2-6th St., 303-635-9319
Conn	Essex, J. Stawicki Assoc., Westbrook Rd., 203-767-8566
Fla	Orlando, Murphy & Cota, 712 Vassar St., 305-424-2407
Ga	Atlanta, Murphy & Cota, 586 Armour Cir., N.E., 404-875-2525
Ill	Chicago, I.W. Rose & Assoc., 4734 N. Austin Ave., 312-282-6835
Iowa	Des Moines, KSW Assocs., 3831 43rd St., 515-279-9235
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Minn	Minneapolis, J. Perling, 8947 Terrace Rd., N.E., 612-927-8465
Mo	Kansas City, Kelly-Schmitz-Winkler Assoc., 7546 Troost Ave., 816-363-5651
"	St. Louis, Kelly-Schmitz-Winler Assoc., 2319 Hampton, 314-781-6111
NJ	Cherry Hill, Trinkle Sls., Inc., 500 N. Kings Hwy., 609-667-3500
"	Montclair, Component Marketers, Inc., 151 Valley Rd., 201-746-6717
NC	Greensboro, Murphy & Cota, Box 6365, 919-288-1923
"	Winston-Salem, Murphy & Cota, 1106 Burke St., 919-723-1001
Ohio	Cleveland, P. Lohse & Co., 537 Richmond Rd., 216-381-7788
"	Cleveland, Schroeder Sales Co., 2254 Euclid Ave., 216-621-5074
Ore	Portland, Earl & Brown Co., Inc., 2041 Southwest 58th Ave., 503-292-9145
Pa	Feasterville, Par-Nell Sls., 421 Bustleton Pike, 215-357-7230
Tex	Dallas, Techno Assoc., 2324 Shorecrest Dr., 214-357-9213
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NOVATRONICS, INC., P.O. Box 878, Pompano Beach, Fla. 33060, Tel: 305-942-5200; Sls. Mgr: J. Cianciarulo ..... FSC No. 97953

*NOVEL batteries - Fua Metectrochemical Co. Ltd.

* NOX-RUST rust preventives - Daubert Chemical Co.

* NO. 8 soldering flux - Farrelloy Co.

*NU-BLAC ceramic products - Star Porcelain Co.

* NU GLU cement - Carters Ink Co.

* NU-WAY terminals - Marshall, John Assoc., Inc.

*NUCARB solid carburizers - Houghton & Co.

NUCLEAR CORP. OF AMERICA, Nuclear Div., 2 Richwood Pl., Denville, N.J. 07834, Tel: 201-627-4200; Sls. Mgr: S.T. Hudson..... FSC No. 06442

NUCLEAR DATA, INC., 100 W. Golf Rd., Palatine, Ill. 60067, Tel: 312-529-4600; Sls. Mgr: C.J. Long, Jr.

NUCLEAR DEVELOPMENT LABORATORY, INC., P.O. Box 7034, Kansas City, Mo. 64113, Tel: (816) DE 3-7692; Pres: M.J. Test

NUCLEAR DIODES, INC., P.O. Box 135, Praire View, Ill. 60069, Tel: 312-634-3870; Sls. Mgr: J.W. Orth

NUCLEAR ELEMENT CORP., 420 S. McKean St., Butler, Pa. 16001, Tel: 412-287-4731; Sls. Mgr: D. Uphoff

NUCLEAR EQUIP. CHEMICAL CORP., 165 Marine St., Farmingdale, N.Y., Tel: (516) CH 9-8454; Sls. Mgr: E. Backstrom

NUCLEAR MEASUREMENTS CORP., 2460 N. Arlington Ave., Indianapolis, Ind. 46218, Tel: 317-546-2415; Sls. Mgr: L.G. Vaughn

*NUCLEAR & NUBLACK varnishes - Sterling Varnish Co.

NUCLEAR PRODS. CO., P.O. Box 1178, El Monte, Calif. 91734, Tel: 213-283-2603; Sls. Mgr: R.M. Evleth; FSC 07818

NUCLEAR RESCH. CORP., Street Rd. & Second St. Pike, Southampton, Pa. 18966, Tel: (215) EL 7-5015; Sls. Mgr: D.S. Pollock ..... FSC No. 96696

NUCLEAR SUPPLIES, P.O. Box 312, Encino, Calif. 91316, Tel: 213-985-6190; Sls. Mgr: M.R. Solomon

NUCLEONIC PRODS. CO., INC., 3133 East 12th St., Los Angeles, Calif. 90023, Tel: 213-268-3464, TWX: 910-321-3077; Sls. Mgr: C.G. Smith

NUCLEONIC PRODS. CO., INC., Molded National Resistor Group Div., 3133 East 12th St., Los Angeles, Calif. 90023, Tel: 213-268-3464, TWX: 910-321-3077; Sls. Mgr: C.G. Smith

NUCLIDE CORP., AGV Div., 914 Main St., N. Acton, Mass. 01720, Tel: 617-263-2936; Gen'l. Mgr: D.J. Marshall

* NUCOM loudspeakers - Micro Magna Elctrns. Corp.

*NUCOR power components - Nuclear Corp of America

*NUDEEA anti-static cleaner - Harry Miller Corp.

*NURL-LOC terminals, test jacks, sockets - Electronic Molding

NUTMEG SCREW MACHINE PRODS., P.O. Box 1470, Waterbury, Conn. 06720, Tel: 203-879-1496; Sls. Mgr: T.J. Iorio

■ **NUTRONICS MFG. CO., 1703 Peoria Rd. Springfield, Ill. 62702, Tel: 217 - 544-9821; Pres: A. Darran** .....**Pg. 713**

Ala	Huntsville, Systems Engrg. Co., Inc., 2109 W. Clinton Bldg., 205-534-1035
Ariz	Scottsdale, Coronado Elctrns. Assocs., 8134 E. Granada Rd., 602-947-9060
Colo	Englewood, E.J. Robinson, 3231 S. University Blvd., 303-781-2457
Md	Crownsville, Tomco Sls. Co., Box 420A, Rte. 2, 301-849-2401
Mass	Lowell, Associated Elctrns., Inc., 45-47 Kirk St., 617-454-4206
Mich	Lathrup Village, Affiliated Metal Prods. Co., 28880 Southfield Rd., 313-353-7866
Minn	Minneapolis, White Sls. Co., Box 4530, 612-929-4661
Mo	St. Louis, Fitzgerald Sls. Co., 4 North 8th St., 314-241-4066
NJ	Mt. Freedom, Fletchers & Assocs., Box 133, 201-584-7853
NY	New York, Tower Sls. Engrg. Co., 550 Fifth Ave., 212-246-7611

*NUTSERT insert fasteners - Avdel, Inc.

* NYCO coils & transformers - New York Coil Co., Inc.

NYE, WILLIAM F., INC., P.O. Box G-927, New Bedford, Mass. 02742, Tel: 617-992-1327; Sls. Mgr: G.B. Mock

*NYGRADE fabric base sleevings - Markel, Frank & Sons

*NYLAFLOW nylon pressure tubing and reinforced hose - Polymer Corp.

*NYLASINT sintered nylon parts - Polymer Corp.

* NYLATCH panel fastener - Hartwell Corp.

*NYLATINT nylon dye - Polymer Corporation

*NYLATRON nylon stock shapes and molding compounds - Polymer Corporation

*NYLAWELD nylon to nylon adhesive - Polymer Corporation

*NYLOBOND connectors - Amp Inc.

NYLOGRIP PRODS. CO., 281 Winter, Waltham, Mass. 02154, Pres: E.A. Black

NYLOK CO., DIV., USM Corp., 611 Industrial Ave., Paramus, N.J. 07652, Tel: 201-261-9400, TWX: 201-262-2243; Sls. Mgr: R.W. Rundle ..... FSC No. 02615

NYLOMATIC CORP., 137 Nolan Ave., Morrisville, Pa. 19067, Tel: 215-295-4151; Sls. Mgr: C. Engel

* NYLON-ZIP slide fasteners - Waldes Kohinoor, Inc.

*NYLOX adhesive composition for nylon, etc. - Hardman Inc.

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NYLTITE CORP. OF AMERICA, 3451 S. Clinton Ave., S. Plainfield, N.J. 07080, Tel: 201-561-1300; Sls. Mgr: C. Gould

*NYPOLY magnet wire; polyurethant-nylon - Hudson Wire Co.

*NYSTAGMOTRAC optical stimulator - Beckman Instruments

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*NYTRAN miniature transformer - Nytronics, Inc.

*NYTRIM variable resistor - Nytronics, Inc.

NYTRON, INC., 795 San Antonio Rd., Palo Alto, Calif. 94303, Tel: 415-327-0490, TWX: 910-373-1187; Sls. Mgr: L.E. Watson ..... FSC No. 24192

■ **NYTRONICS, INC., Custom Components Group, Third Ave., Alpha, N. J. 08866, Tel: 201 - 454-1143 TWX: 510-235-2918; Exec. Vice Pres: L. J. Valle.....FSC No. 43543 .....Pgs. 1304, 2870**

Ala	Huntsville, Massey Assoc., Inc., Box 3361, 205-852-0991
Cal	Encino, Cardinal Assoc., Inc., 16024 Ventura Blvd., 213-788-4540
"	Menlo Park, Bell Elctrns. Corp., 1070 O'Brien Dr., 415-323-9431
Colo	Denver, Robbins & Assoc., 700 Poplar St., 303-399-6618
Conn	North Haven, Kitchen & Kutchen, Inc., 22 Broadway, 203-239-0212
DC	Washington, Mechtronics Sales, Inc., 7600 Georgia Ave., N.W., 202-291-6004
Fla	St. Petersburg, Massey Assoc., Inc., Box 13577, 813-347-6183
"	Winter Park, Massey Assoc., Inc., Box 1201, 305-855-4510
Ill	Chicago, Croydon Elctrns., Inc., 1915 N. Harlem Ave., 312-237-4343
Mass	Lexington, Kitchen & Kutchen, Inc., 17 Waltham St., 617-862-8230
NY	Geneva, E. Badway, 1126 Lochland Rd., 315-789-2718
"	New York, Sprung/Nussbaum, Inc., 254 West 31st St., 212-565-1820
Ohio	Cincinnati, S.A.R.G.E., Inc., 4201 Victory Pkwy., 513-751-1313
Okla	Tulsa, Southwest Elec. Inds., 2015-C S. Lakewood, 918-835-2481
Pa	Ambler, Humes-Quinlan Sls., Inc., 242 E. Butler Ave., 215-646-7250
Tex	Dallas, Southwest Elec. Inds., 621 Meadows Bldg., 214-363-1671
"	Houston, Southwest Elec. Inds., 1405 S. Post Oak Rd., 713-621-3760
Va	Chesapeake, F B D Sales, 4316 Greenleaf Dr., 703-484-3162
EXP:	NY, New York, National Atlantic Corp., 50 East 42nd St., 212-697-2584

■ **NYTRONICS, INC., Standard Components Group, 550 Springfield Ave., Berkeley Hgts., N. J. 07922, Tel: 201 - 464-9300, TWX: 710-984-7977; Group Vice Pres: R. D. Hallock.....FSC No. 72259**

■ **NYTRONICS, INC., Capacitor Div., Orange St., Darlington, S. C. 29532, Tel: 803 - 393-5421, TWX: 710-995-4589; Sls. Mgr: M. J. Davis .....Pgs. 685-687**

Ariz	Phoenix, Howe & Howe Sls., Inc., 4109 North 18th St., 602-264-7971
Cal	Belmont, Nor Cal Sls. Assoc., Box 129, 408-739-4465
"	Woodland Hills, Interstate Mktg. Assoc., 22030 Ventura Blvd., 213-883-7606
Colo	Denver, Electronic Comp. Sls., Inc., 4783 S. Quebec St., 303-771-6200
Conn	N. Haven, Comp. Rep. Assoc., Inc., 14 Bowling Green Dr., 203-239-9762
Fla	N. Palm Beach, Markey Sls. Corp., 321 Northlake Blvd., 305-852-5259
Ill	Chicago, Balhorn & Welch, Inc., 1925 N. Harlem Ave., 312-889-5011
Ind	Ft. Wayne, Croydon Elctrns., Inc., Box 2624, Sta. D, 219-422-7617
Kans	Wichita, Thunderbird Tech. Sls. & Services, Inc., 7707 E. Osie, 316-684-3941
La	Metairie, J.F. McKinney Sls. Co., 2012 Condon Ave., 504-887-1723
Md	Timonium, Barnhill & Assoc., Inc., 1931 Greenspring Dr., 301-252-5610
Mass	Needham, Comp. Rep. Assoc., Inc., 1116 Great Plain Ave., 617-444-2484
Mich	Southfield, G & H Sls. Co., 24001 Southfield Rd., 313-358-1910
Minn	Minneapolis, Industrial Comp., Inc., 4004 West 78th St., 612-927-9991
Miss	Meridian, C.R. Herron, Jr., 4394 18th Ave., 601-482-1878
NJ	Leonia, Kohl-Camber, 201 Crescent Ave., 201-944-6488
NY	New York Kohl-Camber, 1700 York Ave., 212-369-4222
Ohio	Cincinnati, G & H Sls., Box 37416, 513-761-6185
"	Novelty, G & H Sls. Co., 13690 Fox Hill Dr., 216-247-4446
Okla	Tulsa, J.F. McKinney Sls. Co., Box 3958, 918-622-1401
Pa	Narberth, J. Bresson Assoc., 107 Forrest Ave., 215-839-6770
Tenn	Chattanooga, C.R. Herron, Jr., Box 1521, 615-698-4188
Tex	Bellaire, J.F. McKinney Sls. Co., 5458 Edith St., 713-665-3653
"	Dallas, J.F. McKinney Sls. Co., 1303 Chemical St., 214-631-9450
Utah	Salt Lake City, Electronic Comp. Sls., Inc., Box 2066, 801-278-6044
Va	Lynchburg, Barnhill & Assoc., Inc., Box 1104, 703-384-2062
Wash	Seattle, L. Reeve Mktg. Assoc., 210 North 171st St., 206-542-5889
FOR:	Can, Montreal, Que., Can-AM Elctrns. Co., 5775 Ferrier St., 514-735-4193

■ **NYTRONICS, INC., Electro-Mec Instr. Corp., 183 Commercial St., Watertown, Conn. 06795, Tel: 203 - 274-5431, Sls. Mgr: S. Lieber .....FSC No. 97235 .....Pgs. 2484, 2485**

Ala	Huntsville, Component Sales Corp., Box 899, 205-539-6973
Ariz	Phoenix, Robbins & Assoc., 2652 North 19th Ave., 602-254-0836
Cal	N. Hollywood, Crown Elctrns., Box 4741, 213-877-3550
"	Palo Alto, Nor-Cal Assoc., 999 Commercial St., 415-328-6616
Colo	Denver, Robbins & Assoc., 700 Poplar St., 303-399-6618
Conn	Waterbury, Astro-Tek Assoc., Diane Terr., 203-753-4129
Fla	Orlando, Component Sls. Corp., Box 14523, 305-277-1510
"	St. Petersburg, Component Sls. Corp., Box 9545, 813-360-7460
Ill	Grayslake, R. Klipp Assocs., Box 226, 312-223-4837
Iowa	Council Bluffs, W.E. Pfeiffer, Sr., 615 Stutsman St., 712-322-8280
Minn	St. Paul, Carl-M Co., 1926 Wellesley Ave., 612-699-8004
NY	Liverpool, RJC Assoc., 219 Oakridge Terr., 315-457-3220
"	New York, Sprung/Nussbaum, Inc., 254 West 31st St., 212-565-1820
NC	Raleigh, Component Sls. Corp., Box 6401, 919-832-1897
Ohio	Cincinnati, J.O. Olsen Co., 5539 Stokeswood Ct., 513-922-2176
"	Cleveland, J.O. Olsen Co., 16201 Shaker Blvd., 216-752-5444
Okla	Tulsa, Southwest Elec. Inds., 2015-C S. Lakewood, 918-835-2481
Pa	Paoli, Representation, Inc., Box 300, 215-692-5770
"	Pittsburgh, J.O. Olsen Co., 104 Elatan Dr., 412-279-2550
Tex	Dallas, Southwest Elec. Inds., 621 Meadows Bldg., 214-363-1671
"	Houston, Southwest Elec. Inds., 1405 S. Post Oak Rd., 713-621-3760
Wash	Bellevue, Willis Sls. Co., 2805 124th Pl., N.E., 206-885-4903
FOR:	Can, Trenton, Ont., Nytronics of Canada, Ltd., 68 Wall St., 613-392-6544

■ **NYTRONICS, INC., Essex Elctrns. Div., 550 Springfield Ave., Berkeley Hgts., N. J. 07922, Tel: 201 - 464-9300, TWX: 710-984-7977; Gen. Sls. Mgr: P. W. Shatusky.....FSC No. 72259 .....Pgs. 684, 741**

Ala	Huntsville, Massey Assoc., Inc., Box 3361, 205-852-0991
Ariz	Phoenix, Santa Monica Bell Elec., 3408 W. Rosewood Ave., 602-942-5417
Cal	Gardena, Santa Monica Bell Elec., 306 E. Alondra Blvd., 213-321-5802
"	Menlo Park, Bell Elctrns. Corp., 1070 O'Brien Dr., 415-323-9431
"	San Diego, Bell Elctrns., 8072 Engineer Rd., 714-278-4350
Colo	Denver, Robbins & Assoc., 700 Poplar St., 303-399-6618
DC	Washington, Mechtronics Sales, Inc., 7600 Georgia Ave., N.W., 202-291-6004
Fla	St. Petersburg, Massey Assoc., Inc., Box 13577, 813-347-6183
"	Winter Park, Massey Assoc., Inc., Box 1201, 305-855-4510
Ill	Chicago, Balhorn & Welch, Inc., 1925 N. Harlem Ave., 312-889-5011
"	Chicago, Croydon Elctrns., Inc., 1915 N. Harlem Ave., 312-237-4343
Ind	Ft. Wayne, Croydon Elctrns., Inc., Box 2624, Sta. D, 219-422-7617
Iowa	Cedar Rapids, Balhorn & Welch, Inc., Box 1521, 319-363-9970
Ky	Louisville, G & H Sls., Box 18178, 502-239-1162
Mass	Bedford, F.R. Lesser, 20 Haydon La., 617-275-7558
Mich	Birmingham, H.C. Heym Assoc., 1688 Buckingham Rd., 313-644-9166
Minn	Minneapolis, M. Foster Co., Inc., 228 S. Cedar Lake Rd., 612-374-2612
Mo	St. Louis, Thunderbird Tech. Sls. & Services, Inc., Box 6156, 314-838-6688
NY	New York, Sprung/Nussbaum, Inc., 254 West 31st St., 212-565-1820
"	Rochester, Telesco Assoc., Inc., 3254 Winton Rd., S., 716-275-9200
"	Vestal, Telesco Assoc., Inc., 609 Harvard St., 607-729-6339
Ohio	Brecksville, A. Nace Co., Inc., Box 156, 216-526-4323
"	Cincinnati, G & H Sls., Box 37416, 513-761-6185
"	Dayton, A. Nace Co., Inc., Box 93, Forest Pk. Brch., 513-277-8215
"	Galion, A. Nace Co., Inc., Rte. 3, 419-468-7641
Okla	Tulsa, Southwest Elec. Inds., 2015-C S. Lakewood, 918-835-2481
Pa	Ambler, Humes-Quinlan Sls., Inc., 242 E. Butler Ave., 215-646-7250
"	Pittsburg, A. Nace Co., Inc., 1725 Washington Rd., 412-561-3544
Tex	Dallas, Southwest Elec. Inds., 621 Meadows Bldg., 214-363-1671
"	Houston, Southwest Elec. Inds., 1405 S. Post Oak Rd., 713-621-3760
Wash	Bellevue, Bell Farwest Elec., 12410 Southeast 32nd St., 206-747-1515
EXP:	NY, New York, National Atlantic Corp., 50 East 42nd St., 212-697-2584
FOR:	Can, Trenton, Ont., Nytronics of Canada, Ltd., 68 Wall St., 613-392-6544

*NYZIN battery - Yardney Electric Corp.

*"O-PF" transistors - Motorola Semiconductor

O & S RESEARCH, INC., 1912 Bannard St., Riverton, N.J. 08077, Tel: 609-829-2800, TWX: 609-829-2836; Pres: E.R. Sanders ..... FSC No. 04716

OECO CORP., 712 S.E. Hawthorne Blvd., Portland, Ore. 97214, Tel: 503-232-0161, TWX: 910-464-6146; Sls. Mgr: K. Hubbard ..... FSC No. 95266

* OPK tape preparation unit - Excellon Inds.

■ **OAK MFG. CO., Div. Oak Electro/Netics Corp., Dept. EL, Crystal Lake Ave., Crystal Lake, Ill. 60014, Tel: 815 - 459-5000, TWX: 910-634-3353; Sls. Mgr: P. M. Hassett.....FSC No. 76854 ....Pgs. 2764-2767**

Ariz	Phoenix, Shefler-Kahn Co., 2017 North 7th St., 602-258-7893
Cal	Anaheim, Marco, Box 4011, (714) KE 5-6037
"	Los Altos, Oak Electro/Netics Corp., 960 N. San Antonio Rd., 415-941-1237
"	Northridge, P. Dooley Co., 18826 Devonshire St., 213-360-2231
Colo	Denver, I.W. Strong & Assocs., 635 Canosa Ct., 303-292-6900
Fla	Ft. Lauderdale, D. Green, 1040 Bayview Dr., 305-563-2681
La	Metairie, J.F. McKinney Sls. Co., 2012 Condon Ave., 504-887-1723
Md	Baltimore, J.W. Sheffer, 4609 Old Frederick Rd., (301) CE 3-0606
"	Silver Spring, Oak Mfg. Co., 1110 Fidler La., 301-585-3141
Mass	Lexington, R. Purinton, Inc., 11 Muzzey St., 617-862-8300
Mich	Stevensville, C. Desmet, 5830 Red Arrow Hwy., 616-925-5112
Minn	Minneapolis, L.F. Murphy & Assocs., Inc., 730 Chicago Ave., 612-333-4511
NJ	Clifton, Oak Mfg. Co., Box 514, 201-473-0381
"	Haddonfield, Gray-Williams Assocs., 8 E. Mt Vernon Ave., 609-429-5300
"	Mountainside, H.G. Richter, Inc., 608 Sherwood Pkwy., (201) AD 3-4615
NY	Fayetteville, H.G. Richter, Inc., Box 251, 315-637-6713
"	New York, H.G. Richter, Inc., (212) WO 2-5820
"	Rochester, E.J. Schomburg Co., 3100 Monroe Ave., (716) LU 6-0725

Ohio Cincinnati, L. Grabinger, 8613 Winton Rd., 513-521-5689
" Cleveland, B. Jones, 3540 Ridge Rd., 216-631-3240
Okla Tulsa, J.F. McKinney Sls. Co., Box 3958, 918-622-2967
Tenn Chattanooga, H.R. Miles Association, Box 172, 615-265-3862
" Nashville, H.R. Miles Association, 2500 - B Franklin Rd., 215-291-8188
Tex Bellaire, J.F. McKinney Sales Co., Box 1026, 713-665-3653
" Dallas, J.F. McKinney Sls. Co., 1303 Chemical St., 214-631-9450
Wash Seattle, Oak Mfg. Co., 3827 Stoneway, N., 206-634-1200
EXP: Ill. Crystal Lake, Oak Electro/Netics Corp., 815-459-5000
" St. Louis, J.P. Carlson, 2316 Putter La., (314) CH 1-4351

OAKITE PRODS., INC., 50 Valley Rd., Berkeley Hgts., N.J. 07922, Tel: 201-464-6900; Sls. Mgr: F. McNally

*OAKOMETER solution testing instrument - Oakite Products

OAKTRON INDS., INC., Monroe, Wisc. 53566, Tel: 608-325-2121; Sls. Mgr: C.E. Matthews

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OGDEN TECHNOLOGY LABS., INC., 573 Monterey Pass Rd., Monterey Pk., Calif., Tel: 213-289-4425, TWX: 213-288-3123; Sls. Mgr: J.P. Seider

OGDEN TECHNOLOGY LABS., INC., 100 Smith St., Farmingdale, N.Y. 11736, Tel: 516-694-8616; Sls. Mgr: A. Davis

O'HARA METAL PRODS. CO., 540 Brannan St., San Francisco, Calif., Tel: 415-989-5390; Sls. Mgr: C.V. O'Hara

OHIO CARBON CO., 12508 Berea Rd., Cleveland, Ohio 44111, Tel: (216) CL 2-6100; Sls. Mgr: D.I. Stoffel ..... FSC 76868

■ **OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, Ohio 43212, Tel: 614 - 486-9561; Sls. Mgr: A. G. Smith..... FSC No. 12066 ..... Pgs. 1047, 2844**

Ala Huntsville, M.D. Anderson, Box 1466, 205-536-8484
Ariz Tempe, Windsor Dynamics, Inc., 3300 S. Mill Ave., 602-967-3222
Cal Sherman Oaks, Windsor Dynamics, Inc., Box 5500, 213-789-2421
Conn Meriden, Abbott-Allison Co., Box 467, 203-237-9232
Fla Clearwater, Brennan Assocs., Inc., Box 5006, 813-446-5006
Ill Lombard, Quadtron, Box 306, 312-627-6800
Minn Minneapolis, Furber Sls. Co., 5237 Third Ave., S., 612-825-1491
Mo St. Louis, R.D. Sebright Co., 7120 W. Florissant, 314-261-0055
Ohio Cleveland, Control Design Assoc., 7333 Fair Oaks, 216-439-2299

OHIO STEEL TUBE DIV., Copperweld Steel Co., Shelby, Ohio 44875, Tel: 419-347-2424, TWX: 810-490-2480; Sls. Mgr: J.E. Horner

OHMART CORP., 4241 Allendorf Dr., Cincinnati, Ohio 45209, Tel: 513-272-0131; Sls. Mgr: S. Rowe

■ **OHMITE MFG. CO., 3635 Howard St., Skokie, Ill. 60076, Tel: 312 - 675-2600, TWX: 910-223-0805; Sls. Mgr: F. Maiale..... FSC No. 44655 ..... Pgs. 2300, 2409, 2486, 2871**

Ariz Phoenix, Shefler-Kahn Co., Box 1587, (602) AL 8-7893
Cal Hollywood, Ohmite Mfg. Co., 6115 Selma Ave., 213-466-3434
" Palo Alto, Ohmite Mfg. Co., 201 Town & Country Village, (415) DA 1-6953
Colo Denver, McLoud & Raymond Co., Box 22044, (303) SK 6-1589
DC Washington, S.K. Macdonald, Inc., 3308 14th St., N.W., 202-265-3938
Fla Lutz, S.K. Wallace Assocs., Inc., Box 67, 813-949-1817
Ill Skokie, Ohmite Mfg. Co., 3601 Howard St., (312) OR 5-2600
Md Baltimore, S.K. Macdonald, Inc., 5500 Harford Rd., 301-254-3380
Mass Burlington, Ohmite Mfg. Co., 99 Cambridge St., 617-272-6060
Mich Birmingham, Ohmite Mfg. Co., 725 S. Adams St., 313-642-6040
Minn Minneapolis, F.B. Hill Co., 6110 Excelsior Blvd., 612-929-6727
Mo Kansas City, H.A. Roes & Co., 2601 Cherry St., (816) AB 1-0866
NJ Palisades Park, Ohmite Mfg. Co., Box 148, (201) WI 7-1777
NY Rochester, Ohmite Mfg. Co., 3700 East Ave., (716) (716) DU 1-1890
Ohio Cleveland, Ohmite Mfg. Co., 25000 Euclid Ave., 216-261-6000
Pa Philadelphia, S.K. Macdonald, Inc., 1531 Spruce St., KI 5-1205
" Pittsburgh, S.K. Macdonald, Inc., 7805 McKnight Rd., 412-366-2643
Tenn Memphis, Cartwright & Bean, Box 4760, Crosstown Sta., 901-276-4442
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■ **OHR-TRONICS, INC., Sub. Mohawk Data Sciences Corp., Box 630, Herkimer, N. Y. 13350, Tel: 315 - 866-6800 ..... Pg. 792**

Cal Los Angeles, Mohawk Data Sciences Corp., 6252 Telegraph Rd., 213-685-5165
" San Francisco, Mohawk Data Sciences Corp., 139 Mitchell Ave., 415-761-0750
Fla Winter Park, Mohawk Data Sciences Corp., 2429 Whitehall Cir., 305-423-3591
Ga Atlanta, Mohawk Data Sciences Corp., 2964 Peachtree Rd., N.W., 404-261-8036
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Md Baltimore, Mohawk Data Sciences Corp., 305 W. Chesapeake Ave., 301-821-6400
Mass Waltham, Mohawk Data Sciences Corp., 440 Totten Pond Rd., 617-891-4430
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* SABER 3200 dc motor speed control - Allis, Louis Co.

* SAC air conditioner - Airflow Co.

* SAF-T-CHLOR degreaser - Colonial Alloys Co.

* SAF-T-CUT grinding wheel - Avco Bay State Abrasives

* SAFE-PAK solid-state controlling device - Gems Co., Inc.

*SAFE-T-KLIP test clip - Industrial Devices, Inc.

*SAFE-T-KORD test cord - Industrial Devices, Inc.

*SAFE-T-LINE rubber tubing - Shamban W. S. & Co.

* SAFE-T-MIKE ac motor start capacitor - STM Corp.

* SAFE-T-OHM ground detector - Anderson, W.E., Inc.

* SAFE-T-TAGS valve & switch markers - Seton Name Plate

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*SAFETY-VALVE heat limiters - McGraw-Edison Company

* SAFE-VUE smoke candles - Hill, E. Vernon, Inc.

SAFEWAY HEAT ELEMENTS, INC., Middlefield St., Middletown, Conn. 06457, Tel: 203-346-6601, TWX: 710-428-1655; Sls. Mgr: C.K. Gensler

SAG HARBOR INDS., INC., Bayview St., Sag Harbor, N.Y. 11963, Tel: 516-725-0440; Sls. Mgr: S.A. Miller

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Ala	Birmingham, F.C. Nickerson Co., Inc., 1148 Cheyenne Blvd., 205-853-3181
Ariz	Phoenix, Hecht-Henschen & Assocs., Box 21166, 602-275-0635
Cal	Los Angeles, M.A. Stolaroff Co., Inc., 4622 W. Slausen Ave., 213-295-7781
"	San Mateo, J. Pyle Co., 1611 Borel Pl., 415-349-1266
Colo	Denver, S-L Assocs., 11481 West 29th Pl., 303-238-1807
Conn	Milford, Tesco, Inc., 132 New Haven Ave., (203) TR 4-6643
Fla	Ft. Lauderdale, F.C. Nickerson Co., Inc., 611 Northwest 73rd Terr., 305-524-4331
"	Tampa, F.C. Nickerson Co., Inc., 4513 S. Cameron Ave., 813-833-4321
Ga	Decatur, F.C. Nickerson Co., Inc., Box 33185, 404-377-1575
Ill	Chicago, J.G. Twist Co., Inc., 5222 W. Diversey Ave., 312-777-2250
Ind	Angola, Southern Sales Co., 105 Lakeshore Dr., 219-665-3961
"	Indianapolis, Southern Sls. Co., 6216 Carrollton Ave., 317-253-3359
Kans	Mission, Technical Mktg. Assoc., Inc., 5827 Outlook, 913-831-2888
Ky	Louisville, Southern Sales Co., 212 Republic Bldg., 502-583-6902
Md	Baltimore, McCourt Co., Inc., 28 W. Pennsylvania Ave., 301-823-3455
Mass	Needham Hgts., Tesco, Inc., Box 201, Kearney Rd., 617-444-7925
Mich	Detroit, D. Poulin Co., 17222 E. Warren Ave., 313-886-4990
"	Kentwood, D. Poulin Co., 1635 Pembroke Dr., S.E., 616-452-7408
Minn	St. Paul, E. Melius & Assocs., Inc., 3758 N. Dunlap St., 612-484-8541
Mo	St. Louis, Technical Mktg. Assocs., 2050 Woodson Rd., 314-427-3600
NY	Liverpool, Reed Elctrns., 229 W. Woodland Dr., 315-4759
"	New York, E. Glass Assocs., 250 West 57th St., 212-586-8440
"	Rochester, Reed Elctrns., Inc., 2815 Monroe Ave., 716-473-2767
"	Vestal, Reed Elctrns., Inc., Vestal Pkwy., E., 607-748-7391
NC	Kinston, F.C. Nickerson Co., Inc., 1001 Parrott Ave., 919-527-4911
Ohio	Dayton, W.J. Brauer & Assocs., Inc., Box 3085, 513-426-1692
"	Wickliffe, W.J. Brauer & Assoc., Inc., Box 305, 216-943-0601
Pa	Ardmore, W.K. Metz, Box 309, 215-649-3966
"	Pittsburgh, W.J. Brauer & Assoc., Inc., Box 8466, 412-921-3213
SC	Greenville, F.C. Nickerson Co., Inc., Rte. 6, Salters Rd., 803-242-5259
Tex	Dallas, Solid State Sales Co., Box 20054, 214-352-2601
Wash	Seattle, Electronics Sls. Corp., 5606 California Ave., S.W., 206-932-0330
Wisc	Waukesha, J.G. Twist Co., Inc., 540 Catskill Rd., 414-786-6330
FOR:	Can, Agincourt, Ont., Electromechanical Prods., Markham Rd., 416-293-7011

SAGE ELCTRNS. CORP., Micromagnetics Prods., Box 3926, Rochester, N.Y. 14610, Tel: 716-586-8010, TWX: 510-254-2861

SAGE INSTRS., INC., 2 Spring St., White Plains, N.Y. 10601, Tel: 914-949-4121; Sls. Mgr: J. Schwartz

SAGE LABS., INC., Instrument Div., 14 Huron Dr., Natick, Mass. 01760, Tel: 617-653-0844, TWX: 710-346-0390; Sls. Mgr: P. Pollins

*ST. JAMES screwdrivers - Rosenberg Bros. & Co.

ST. MARYS CARBON CO., 1939 State Rd., St. Marys, Pa. 15857, Tel: 814-434-2844; Sls. Mgr: E.W. Smith

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Cal	Los Angeles, Halbar Assocs., 1805 W. Third St., 213-387-8283
Colo	Littleton, Simpson Assocs., 8000 S. Kendall Blvd., 303-798-8439
Iowa	Cedar Rapids, Sneider Sls. Co., 2042 Franklin Ave., 319-362-4410
Md	Silver Spring, Globe Assocs., 8121 Georgia Ave., 301-587-0060
Mass	Acton, NEECCO, 700 Main St., 617-263-7566
Mo	St. Louis, Boweng, 10414 Oak Ave., 314-429-7327
NJ	Englewood Cliffs, Power Conversion & Control Co., Box 1251, 201-569-0015
NY	Syracuse, Midstate Resch., Inc., 327 Wellesley Rd., Tel: 478-8314
Ohio	Cleveland, M. Roth Sls., 678 S. Green Rd., 216-382-9090
Pa	Media, W. Reeves Assocs., Inc., 2973 N. Providence Rd., 215-566-6709
Tex	Dallas, Stasco, 13310 Spring Grove Ave., 213-239-5054
FOR:	Can, Scarborough, Ont., Banke Elctrns., Ltd., 767 Warden Ave., 416-751-7484

SAMPSON ELCTRN. PRODS. DIV., 2244 S. Western Ave., Chicago, Ill. 60608, Tel: (312) VI 7-6363, TWX: 312-265-1384; Sls. Mgr: J. Alschuler

SAMS, HOWARD W. & CO., INC., 4300 West 62 St., Indianapolis, Ind. 46268, Tel: 317-291-3100; Dir. Sls: T.V. Surber

*SAMTRAC tracking sys. - Canoga Electronics Corp.

■ **SAN FERNANDO ELEC. MFG. CO., 1501 First St., San Fernando, Calif. 91341, Tel: 213 365-9411, TWX: 213-764-5963; Sls. Mgr: L. R. Smith.....FSC No. 96733 .....Pg. 689**

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Cal	San Fernando, Ruby Sales Co., Box 511, 213-361-1201
"	Santa Clara, Ruby Sales Co., Box 487, 408-243-1694
Colo	Denver, Ruby Sales Co., 1200 S. Alton, 303-755-1714
Conn	Stamford, Dage Corp., 757 Main St., 203-324-3123
"	Stratford, G. Rosen Co., Inc., 194 Plymouth St., 203-375-5456
Fla	Clearwater, Perrott Assoc., Inc., Box 4532, 813-531-5513
"	Orlando, Perrott Assocs., Inc., 1607 Forsyth Rd., 305-275-1132
"	W. Palm Beach, Perrott Assocs., Inc., 7515 W. Lake Dr., 305-967-1770
Ill	Park Ridge, San Fernando Elec., Box 391, 312-763-2255
"	Park Ridge, H. Wyeth, Box 391, 312-763-2255
Ind	Huntington, San Fernando Elec., Box 184, 219-356-7391
Md	Baltimore, Hamilton Electro, 8809 Satyr Hill Rd., 301-668-4900
Mass	Natick, G. Rosen Co., Inc., 563 Worcester Rd., 617-655-2211
Minn	St. Paul, Smith Engrg. Assoc., 2278 Como Ave., 612-646-4851
NJ	Cherry Hill, F. Tiole, Box 279, 609-667-0800
NY	Rochester, Fowler-Beach Corp., 3700 East Ave., 716-586-0468
Ohio	Cleveland, R.G. Sidnell & Co., Inc., 14701 Detroit Ave., 216-221-1313
"	Dayton, R.G. Sidnell & Co., Inc., 3400 S. Dixie Dr., 513-293-1194
Tex	Dallas, Ruby Sales Co., Box 9894, 214-827-6630
Wash	Seattle, B. Hirsh Co., 4013 Leary Way, N.W., 206-783-3423
EXP:	NY, Ogdensburg, Whittaker Elctrns., Ltd., Ogdensburg Bridge Bldg.
FOR:	Can, Ottawa, Ont., Whittaker Elctrns., Ltd., 42 Howden Ave., 613-224-1221
	Can, Roxboro, Que., Whittaker Elctrns., Ltd., Box 216, 514-683-3621
	Can, Weston, Ont., Whittaker Elctrns., Ltd., 1885 Wilson Ave., 416-247-7454

SAN-EI INSTR. CO., LTD., Enoki Bldg., 2-chome 223-2 Nishi-Okubo, Shinjuku-ku, Tokyo 160, Japan

*SANDAC 200 programmable comm. processor - Sanders Assoc.

SANDERS ASSOCS., INC., Daniel Webster Hwy., S., Nashua, N.H. 03060, Tel: 603-885-6660, TWX: 710-228-1894; Sls. Mgr: P. Sipe ..... FSC No. 94117

SANDERS ASSOCS., Inc., Data & Display Dept., Daniel Webster Hwy., S., Nashua, N.H. 03060, Tel: 603-885-5827, TWX: 710-228-1896; Sls. Mgr: T. Burgess .... FSC No. 94117

SANDERS ASSOCS., INC., Data Sys. Div., Daniel Webster Hwy., S., Nashua, N.H. 03060, Tel: 603-885-4211, TWX: 710-228-1896; Sls. Mgr: R. Valicenti ..... FSC 94117

SANDERS ASSOCS., INC., Flexprint Prods. Div., Grenier Field, Manchester, N.H. 03103, Sls. Mgr: N. Kingston

SANDERS ASSOCS., INC., Ocean Sys. Div., Simon St., Nashua, N.H. 03060, Tel: 603-885-6629, TWX: 710-228-6954; Sls. Mgr: R. Crisp ..... FSC No. 94117

SANDERS NUCLEAR CORP., 95 Canal St., Nashua, N.H. 03060, Tel: 603-885-2230, TWX: 710-228-1894; Sls. Mgr: N. Van Dine

SANDS, LEO G. & ASSOCS., INC., 250 Park Ave., New York, N.Y., Tel: 212-661-8997; Sls. Mgr: L.G. Sands

■ **SANGAMO ELECTRIC CO., Capacitor Div., P.O. Box 128, Pickens, S. C. 29671, Tel: 803 - 878-6311, TWX: 810-397-2496; Sls. Mgr: W. C. Bakes.....FSC No. 00853 .....Pg. 692**

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Cal	Santa Monica, El-Kap Co., 2808 Santa Monica Blvd., 213-451-9881
"	Sunnyvale, Sangamo Elec. Co., 155 San Lazaro Ave., 408-739-0500
Fla	Miami, J.J. Smith & Assocs., Box 537, 305-374-5784
"	Winter Pk., J.J. Smith & Assoc., Inc., 935 Orange Ave., 305-644-4316
Ill	Melrose Pk., Sangamo Elec. Co., 1400 Winston Plaza, 312-344-3275
Mass	Braintree, Sangamo Elec. Co., 817 Washington St., 617-848-0532
Mich	Detroit, D.E. Poulin Co., 17222 E. Warren Ave., 313-886-4990
Minn	Minneapolis, S. Clothier Co., 7400 Lyndale, S., 612-869-3231
NJ	Cherry Hill, Sangamo Elec. Co., 1103 N. Kings Hwy., 609-667-4848
NY	DeWitt, Sangamo Elec. Co., Box 6, 315-446-2299
"	Elmont, F.E. Schmitt Co., 311 Meacham Ave., 516-437-8150
Ohio	Columbus, Sangamo Elec. Co., 1646 W. Lane Ave., 614-486-1508
Ore	Portland, C.K. Shanks & Assocs., Box 25375, 503-292-5656
Tex	Dallas, R.E. Nesbitt Co., 2930 Merrell Rd., 214-357-4601

" Houston, R.E. Nesbitt Co., 4208 Mt. Vernon, 713-528-3811
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SANTA FE MFG. CO., 2343 Jerome Ave., Bronx, N.Y. 10468, Tel: (212) LU 4-8900; Sls. Mgr: V.J. Sarrica

SANWA ELEC. INSTR. CO. LTD., Dempa Bldg. 2 Chome Sotokanda, Chiyoda-Ku, Tokyo, Japan

* SAPHIRITE blast nozzles - Diamonite Prods. Mfg. Co.

SARA SCIENTIFIC CO., P.O. Box 321, San Francisco, Calif. 94101, Tel: 415-421-3172; Sls. Mgr: S. Fishman

SAREX CORP., 1001 Roosevelt Ave., Carteret, N.J. 07008, Tel: 201-969-2440; Sls. Mgr: R. Baker

SARKES TARZIAN, INC., Semiconductor Div., 415 N. College Ave., Bloomington, Ind. 47402, Tel: 812-332-1435, TWX: 810-351-1384; Sls. Mgr: F. Lucas ..... FSC 84970

SARTRON, INC., 114 N. Main St., Newberg, Ore. 97132, Tel: 503-538-3191, TWX: 503-531-7030; Sls. Mgr: J.W. Johnson

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SATURN ELCTRNS. CORP., 3111 Benton St., Garland, Tex., Tel: (214) BR 6-7104; Sls. Mgr: R. Routsong... FSC 16481

*SATUROL solvent detergent - Oakite Products

SAUEREISEN CEMENTS CO., 160 Gamma Dr., Pittsburgh, Pa. 15238, Tel: 412-781-2323; Sls. Mgr: G.W. Read

SAVANT ENGRG., INC., 825 N. Second St., St. Charles, Mo. 63301, Tel: 314-291-5205; Sls. Mgr: J. Schroy

* SAWCAT circular saws - Black & Decker Mfg. Co.

■ **SAWYER INDS., INC., 5445 Peck Rd., Arcadia, Calif. 91006, Tel: 213 - 442-5981, TWX: 910-587-3534; Gen'l. Mgr: J. J. Marino** .....**FSC No. 18098** .....**Pg. 1762**

Cal Arcadia, Transco Motor Mfg., Inc., 5445 Peck Rd., 213-442-5981
" Lafayette, Persons & Assocs., 32 Diablo Rd., 415-283-3760
Ill Chicago, Ellinger Sls. Corp., 6580 Northwest Hwy., 312-763-1570
NJ Livingston, Transco Prods., Inc., 89 W.N. Field Rd., 201-992-1796
" Teaneck, Budd-Tronics, Inc., 71 Grayson Pl., 201-837-1660
Ohio Middletown, Transco Prods., Inc., Box 129, 513-423-0332
Pa Newtown, Transco Prods., Inc., Box 255, 215-968-2911
Tex Ft. Worth, Carey-Wolf Co., Box 12425, 817-738-1702

SAWYER RESEARCH PRODS., INC., 35400 Lakeland Blvd., Eastlake, Ohio 44094, Tel: 216-942-8747; V.P. Sls: D.P. Larsen

SAXONBURG CERAMICS, INC., 1045 Oliver Bldg., Pittsburgh, Pa. 15222

*SAXONY transistor radios - Trans-Aire Electronics, Inc.

■ **SAXTON WIRE & CABLE DIV., 215 N. Rte. 303, Congers, N. Y. 10920, Tel: 914 - 268-6846; Sls. Mgr: M. Kleiner** .....**Pg. 2966**

Cal Los Angeles, L. Gould, 339 1/2 N. Gardner, 213-463-3123
" Oakland, Sinclair Elctrns., 1085 Clarendon Crescent, 415-451-3428
Conn Hartford, J. Colavecchio, 122 Grant, 203-52-0596
Fla Pompano Beach, D. King, 1630 Southeast 3rd St., 305-941-4067
Ill Chicago, D. Abo, 6211 Kenmore St., 312-262-1718
NY Flushing, I. Gudin, 156-34 71st Ave., 212-591-5030
Pa Philadelphia, L. Feinstein, 1601 Griffith St., (215) CU 9-4893
Tex Ft. Worth, T. Davis, Box 16038, (817) AX 2-3332

* SCAICO tempswitch - Wavetronics Inds., Inc.

SCAICO DIV., 211 Warren St., W. Pittston, Pa. 18643, Pres: H.M. Real ..... FSC No. 00906

SCALA RADIO CORP., 1970 Republic Ave., San Leandro, Calif. 94577, Tel: 351-3792; Sls. Mgr: B. Zucconi

SCAM INSTR. CORP., 7401 N. Hamlin Ave., Skokie, Ill. 60076, Tel: 312-675-2500, TWX: 910-223-3606; Sls. Mgr: G.P. Mitchell ..... FSC No. 04585

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* SCANAFAX recording paper - International Scanatron Sys.

■ **SCANBE MFG. CORP., 1161 Monterey Pass Rd., Monterey Pk., Calif. 91754, Tel: 213 - 264-2300, TWX: 910-321-4336; Sls. Mgr: J. Rose**.....**FSC No. 18677** .....**Pgs. 586, 587**

Cal Los Angeles, Premmco, 5470 Valley Blvd., 213-222-0167
" Menlo Park, McKnight Co., Box 36, 415-325-2844
Fla Orlando, Perrott Assocs., 1607 Forsyth Rd., 305-275-1132
Ill Chicago, J.C. Angel Co., 2743 W. Peterson Ave., 312-878-0653
Kans Wichita, Simpson Enterprises, 3809 W. Port Dr., 316-943-0502
Mass Wellesley, R.P. Mahan Co., 617-237-1040
Minn St. Paul, H. Cullen & Assocs., 1595 Selby Ave., 612-646-7372
NY Great Neck, Krasner Assocs., 33 Great Neck Rd., 516-487-0690
" Whitesboro, KLM Assocs., 9 Hollywood Dr., 315-736-2450
Ohio Akron, A. Natalino Assocs., 209 Harmony Hills, 216-666-1447
Pa Newton Sq., Kaufholz Assoc., Box 227, 215-356-5000
Tex Dallas, Techno Assocs., 2324 Shorecrest Dr., 214-357-9213
Wash Seattle, Associated Ind., 3711 S. Hudson St., 206-723-5600

SCANIVALVE, INC., Box 20005, San Diego, Calif. 92120, Tel: 714-283-0010; Sls. Mgr: J.C. Pemberton

* SCANOMARK digital encoders - Leupold & Stevens Instrs., Inc.

* SCENADAPTER oscilloscope adapter - Optical Elctrns., Inc.

* SCENOSCOPE 3-D oscilloscope - Optical Elctrns., Inc.

■ **SCHAUER MFG. CORP., 4516 Alpine Ave., Cincinnati, Ohio 45242, Tel: 513 - 791-3030; Sls. Mgr: S. E. Wright** .....**Pg. 2585**

Cal Mt View, G.B. Ellis Co., 2425 Leghorn St., Tel: 967-5531
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Colo Englewood, Cummings & Assocs., 4472 Kalamath St., 303-789-3449
Conn Meriden, H. Lavin Assocs., Inc., Box 921, Tel: 237-5527
Fla Orlando, Floyd Fausett & Co., Inc., 711 N. Magnolia Ave.
Ga Smyrna, Floyd Fausett & Co., Inc., Box 278, 404-436-5169
Ill Chicago, Ellinger Sls. Corp., 6580 N. Northwest Hwy., 312-763-1570
Ind Ft Wayne, J. Winkelblech, 5214 Forest Ave.
Iowa Clarion, D. Sharp, 309 Fourth Ave., S.E.
Mass Needham, H. Lavin Assocs., Inc., 52 Pickering St., Tel: 444-3446
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" Woodside, D.F. Tobias & Co., Inc., 49-01 31st Ave., 212-726-4551
Ohio Cleveland, J.O. Olsen Co., 16201 Shaker Blvd., Tel: 752-5444
Pa Elkins Park, K.B. Erdman Co., 7906 Montgomery Ave., Tel: 224-1833
" Pittsburgh, E.A. Snefsky, 104 Elatan Dr., Tel: 179-2550
" Pittsburgh, R.A. Stone, 1843 Maydell St., Tel: 241-8391
SC Greenwood, D. Hawthorne, Stony Point Hwy., Tel: 753-3104
Tex Dallas, J.Y. Schoonmaker Co., Inc., 2995 Ladybird La., 214-357-8481

SCHAVITZ ENGRG., U.S. Rte. 130 & Union Ave., Pennsauken, N.J. 08110

*SCHENCK balancing machines - Schenck Trebel Corp.

SCHENCK TREBEL CORP., 120 Finn Ct., Farmingdale, N.Y. 11735, Tel: 516-694-7965; Sls. Mgr: N. Vetsch

SCHENECTADY CHEMICALS, INC., P.O. Box 1046, Schenectady, N.Y. 12301, Tel: 518-346-8711; Sls. Mgr: A.C. Sheals

SCHERMA, F.A. MFG. CO., INC., 424 Broome St., New York, N.Y. 10013, Tel: (212) WA 5-2077; Sls. Mgr: M. Scherma ..... FSC No. 05612

SCHINDLERS, 195 Greenfield Ave., Los Angeles, Calif. 90049, Tel: (213) GR 2-0146

SCHIRMER NATIONAL ALARM CO., 100 Portland Ave., Bergenfield, N.J. 07621, Tel: 201-385-1200; Sls. Mgr: R. Zapernick

*SCHJEL-BOND adhesive tape - G. T. Schjeldahl Co.

*SCHJEL-CLAD copper clad - G. T. Schjeldahl Co.

SCHJELDAHL, G.T. CO., Electrical Prods. Div., Box 170, Northfield, Minn. 55057, Tel: 507-645-5633, TWX: 910-565-2180; Sls. Mgr: E.J. Beavan

SCHLUMBERGER OVERSEAS GMBH, c/o E.F. Assocs., Inc., 211 Park Ave., Scotch Plains, N.J. 07076, Tel: 201-322-6471; Sls. Mgr: G.B. Egert

* SCHMIDT tension meters - Electromatic Equip. Co.

SCHNEIDER INSTR. CO., 8115 Camargo Rd., Madeira, Cincinnati, Ohio 45243, Tel: 513-561-6803

SCHOEFFEL INSTR. CORP., 24 Booker St., Westwood, N.J. 07675, Tel: 201-664-7263; Bus. Mgr: D.A. Keller

SCHONSTEDT INSTR. CO., 1775 Wiehle Ave., Reston, Va. 22070, Tel: 703-471-1050; Sls. Mgr: M. Wickman

■ **SCHRACK ELECTRICAL SALES CORP., 1140 Broadway, New York N. Y. 10001, Tel: (212) MU 3-0790; Sls. Mgr: H. Siegell** .....**Pgs. 2324, 2325**

Ariz Phoenix, Electronic Mfg'ts. Consultants, Inc., 1112 W. Mission La., 602-997-8049
Cal San Carlos, Lebell, Warren & Hickey, Inc., Box 246, 415-493-7688
" Sherman Oaks, R.S. Hopkins Co., 15016 Ventura Blvd 213-788-5501
Colo Colorado Springs, Electronic Mfg'ts. Consultants, Inc. 1619 N. Royer, 303-636-5131
Conn Milford, P.R. Sturgeon Co., Inc., 117 Broad St., 203-874-6080
Fla Ft. Lauderdale, Sproch Sls. Co., Inc., 3520 W. Broward Blvd., 305-587-3792
" Winter Pk., Sproch Sls. Co., Inc., Box 850
Ga Atlanta, V. Avis McCorvey Co., 2187 Braircliff Rd., N.E., 404-636-2502
Ill Chicago, Actronic Sls. Engrg., Inc., 4750 N. Milwaukee Ave., 312-286-1037
Kans Wichita, M.E. Bettis Co., 423 N. Fountain, 316-685-7441
Md Silver Spring, H.R. Sieber Co., 1005 Bonifant St., 301-589-9110
Mass Chestnut Hill, P.R. Sturgeon Co., Inc., 1330 Boylston St., 617-734-7710
Mich Detroit, Alpha Assocs., Inc., 20441 J. Couzens Hwy., 313-935-5200
Mo Kansas City, M.E. Bettis Co., 3706 Broadway, 816-561-0772
" St. Louis, M.E. Bettis Co., 9103 Bessemer, 314-429-2099
NJ Nutley, S. Glassman Assocs., 326 Hillside Ave., 201-667-0653
" Trenton, F. Kriegner Sls. Co., 1602 Pennington Rd., 609-882-6330
NY Glen Cove, S. Glassman Assocs., 28 Prestwick Terr., 516-676-1039
" Sodus, A.E. DeCew Agency, Inc., 27 State St., 315-483-3261
Ohio Dayton, R.P. Calhoun & Assocs., 40 Southmoor Cir., 513-299-4144
Tex Dallas, Unidyne, 4350 N. Central Expwy., 214-824-0900
" Houston, Unidyne, 5700 Savoy La., 713-782-0218
FOR: Can, Toronto, Ont., Data Comp. Elctrns., Ltd., 1477 Eglinton Ave., W., 416-789-5732

SCHWEITZER, PETER J. DIV., Kimberly Clark Corp., Lee, Mass. 01238, Tel: 413-243-1000, TWX: 413-243-2121; Sls. Mgr: D.L. Kahl, Jr.

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Ill	Chicago, Carlson Elctrn. Sls., 7448 N. Harlem Ave., 312-774-0277
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Ind	Indianapolis, Scott Elctrns., 1327 N. Pennsylvania Ave., (317) ME 5-8951
Ky	Louisville, Scott Elctrns., 366 Francis Bldg., (502) JU 3-3220
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Mass	Waltham, Westwood Assocs., 181 West St., 617-891-7810
Mich	Farmington, A.K. Davis, 22725 Orchard Lake Rd., 313-474-8300
Minn	Minneapolis, S. Clothier Co., 7400 Lyndale Ave., S., 612-869-3231
NJ	Hillsdale, M. Klein Assoc., Box 92, 201-664-8711
NY	DeWitt, Bowser & Sapecky, 4317 E. Genessee St., (315) GI 6-5920
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"	Cleveland, Scott Elctrns., 1836 Euclid Ave., (216) TO 1-2626
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DC	Washington, Eastern Instrumentation, Inc., 2600 Virginia Ave., 202-333-8880
Fla	Clearwater, Brennan Assocs., Inc., Box 5006, 813-446-5006
Ill	Chicago, Berndt Assocs., Inc., 6414 W. Belmont Ave., 312-283-0713
Kans	Olathe, Technical Reps., Inc., 809 Sheridan Cir., 913-782-3775
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Md	Baltimore, Eastern Instrumentation, Inc., 1002 Ingleside Ave., (301) RI 4-3675
Mass	Needham, Addelco Corp., 56 Pickering St., 617-444-4754
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"	Albuquerque, A.L.S. Elctrns., 209 San Pablo, S.E., 505-268-9600
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NY	Great Neck, EAC Assocs., 55 Northern Blvd., 516-466-9798
Ohio	Dayton, C & D Assocs., 47 W. Whipp Rd., 513-434-3030
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Mass	Salem, Forbes Engr. Co., 19 Flint St., (617) PI 4-1693

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Pa Philadelphia, Sprague Elec. Co., 215-467-5252
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Wash Seattle, Sprague Elec. Co., 4601 Aurora Ave., N., 206-632-7761

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" Melbourne, Tech Rep Assocs., Box 2095, 305-723-9140
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Cal	Arcadia. Ash Wood Co., Box 1A. 213-283-1201
"	Los Altos, Pritchard & Haney Co., Box 102, 415-961-8218
Fla	Oviedo, Conley-May Assoc., Box 668, 305-365-3283
Ill	Chicago, J.R. Sales Engrg. Co., 7132 N. Harlem Ave., 312-774-8550
Iowa	Cedar Rapids, J.R. Sls. Engrg., 3550 Cottage Grove Ave., S.E., 319-365-2864
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Md	Towson, Burgin-Kreh Assoc., Inc., Box 9787, 301-661-1120
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Wash	Seattle, B. Hirsh Co., 4013 Leary Way, N.W., 206-783-3423
EXP:	Wisc. Milwaukee, I.I. Aaron & Assocs., 829 N. Marshall St., (414) BR 6-8515
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Colo	Colorado Springs, Electronic Mfrs. Consultants, Inc., Box 503, 303-636-5131
Ga	E. Point, P. Hayden & Assocs., Box 331, (404) PO 6-0261
Ill	Chicago, Audio Sound Sls. Co., 2531 N. Ashland Ave., 312-528-8422
Ind	Indianapolis, R.M. Crandall & Assocs., 4225 E. Kessler Blvd., 317-251-7800
Mass	Braintree, Bordewieck Engrg. Sls. Co., 221 Grove St., 617-843-0845
Mich	Grosse Point Pk., J.L. Miner Assocs. Co., 15318 Mack Ave., 313-886-5878
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Ore	Portland, W.C. Wells Co., 6055 N.E. Glisan, (503) BE 5-2437
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Ill	Norridge, Gianaras Sls., 7051 W. Wilson Ave., 312-774-4600
Ind	Ft. Wayne, Hoemig Sls., Butler Ct., 219-483-6913
Mass	Brockton, Forsberg Sls., 646 Summer St., 617-522-6300
NJ	Cherry Hill, H.S. Bancroft Corp., Rockhill Rd., (609) UL 4-8000
"	Ft. Lee, K. Hughes Co., 2175 Lemoine Ave., 201-944-1600
NY	Hauppauge, Box 193, 212-227-5816
Ohio	Wickliffe, W.J. Brauer Assoc., Inc., 29029 Euclid Ave., 216-943-0601
Pa	Pittsburgh, W.J. Brauer Assoc., Inc., Box 8466, 412-921-3213
Tex	Houston, R. Clarke, Box 13231, 713-526-4908

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"	N. Hollywood, Brooks & Day, 10700 Ventura Blvd., 213-877-3357
Colo	Englewood, Compar, 300 E. Hampden Ave., 303-781-0912
Fla	Oviedo. Conley May Assoc., Box 668, 305-865-3520
Ill	Chicago, Engineered Sls., Inc., 4738 N. Harlem Ave., (312) UN 7-8434
Mass	Lexington, J.E. Boeing, Box 5, 617-862-2500
Minn	St. Paul, R.G. Ragon, 1136 W. Larpenteur Ave., 612-488-6634
NJ	Teaneck, Electra-Mac Assoc., 1258 Teaneck Rd., 201-837-4262
NM	Albuquerque, Compar, 2129 San Mateo Blvd., N.E., 910-989-1659
NY	Syracuse, Canavan-Scanlon Assoc., 23 Eastern Ave., 315-463-9161
NC	Bethania, Candor Co., Inc., 919-924-1480
Ohio	Cleveland, Components, Inc., 7461 N. Linden La., 216-842-2737
Tex	Dallas, Blackburn Assoc., Box 20073, 214-351-9991
Wash	Seattle, Allied Agencies, 1818 Westlake N., (206) AT 4-4082

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Mass	Waltham, Selmark Asoc., Inc., 195 West St., 617-899-8110
Minn	Minneapolis, R.J. Siedare Assoc., 4724 42nd Ave., N., 612-533-2294
Mo	St. Charles, M.L. Seyffert & Assoc., 901 Jefferson St., 314-723-1185
NJ	Haddonfield, F.W. Churchill, Box 43, 609-429-7871
NY	Syracuse, J.K. Savage, 124 Kinne Rd., 315-682-6663
"	White Plains, E. Nachman Assoc., 37 Park Cir., 914-946-2477
Ohio	Cleveland, Midwest Sls. Co., 3219 West 117 St., 216-941-2700
Pa	Pittsburgh, R.F. Clark Co., 10517 Lindberg Ave., 412-242-9500
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Conn	Stratford. G. Rosen Co., 194 Plymouth St., 203-375-5456
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Ill	Chicago, J.C. Angel & Co., 2743 W. Peterson Ave., 312-878-0653
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Mass	Natick, G. Rosen Co., Inc., 563 Worcester Rd., 617-655-2211
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"	Indianapolis, 1560 Stadium Dr., 317-632-3301
"	S. Bend, 2015 Western Ave., 219-287-1051
Iowa	Cedar Rapids, 210 Dows Bldg., 319-366-0781
"	Davenport, 1531 W. River Dr., 319-323-2761
"	Des Moines, 101 12th St., 515-283-2081
Kans	Wichita, Box 967, 316-591-3411
Ky	Louisville, 1941 Bishop La., 502-459-5440
La	Baton Rouge, 440 3rd St., 504-348-5759
"	New Orleans, Box 19657, 504-486-6141
"	New Orleans, Industrial Instrs. Works, 3305 Tchoupitoulas St., 504-895-5621
"	Shreveport, Box 1661, 318-425-2435
Me	Augusta, 9 Bowman St., 207-623-4571
Md	Baltimore, Instrument Specialties, Inc., 3100 Washington Blvd., 301-644-0200
"	Towson, 1055 Taylor Ave., 301-828-5400
Mass	Boston, Prudential Tower Bldg., 617-542-0600
"	Burlington, Mancib Co., A St. at Middlesex Tpke., 617-272-9450
"	Springfield, Box 1611, 413-734-4936
"	Worcester, 3 Rockdale St., 617-853-2680
Mich	Detroit, 5757 Trumbull Ave., 313-872-7010
"	Ferndale, Ram Meter, Inc., 1100 Hilton Rd., 313-547-1000
"	Grand Rapids, 281 Leonard, N.W., 616-459-4664
"	Jackson, 715 W. Michigan Ave., 517-787-3630
"	Saginaw, 4855 State St., 517-793-5100
Minn	Duluth, 330 S. First Ave., E., 218-727-1541
"	Minneapolis, 3501 S. Highway 100, 612-927-6551
Miss	Jackson, Box 2168, 601-354-2373
Mo	Kansas City, 1215 West 12th St., 816-421-7122
"	St. Louis, 411 North 7th St., 314-421-6911
Mont	Butte, 949 S. Montana St., 406-792-2301
Neb	Omaha, 117 North 13th St., 402-345-8700
NJ	E. Orange, 67 Evergreen Pl., 201-465-0222
"	Newark, Byram Labs., 535 S. Orange Ave., 201-375-3198
NM	Albuquerque, 5301 Central Ave., N.E., 505-265-6647
NY	Albany, 17 Warehouse Row., 518-459-1820
"	Buffalo, 700 Ellicott Sq., 716-854-3966
"	Buffalo, Electrical Instr. Labs., Inc., 932 Hertel Ave., 716-876-0880
"	Glendale, A & D Electrical Instrs. Co., 73-07 88th St., 212-275-6516
"	Great Neck, A & M Instr., Inc., Community Dr., 516-487-0330
"	Mt. Vernon, Electrical Instr. Service, Inc., 25 Dock St., 914-699-9717
"	New York, 200 Park Ave., 212-692-3211
"	Olean, 309 Exchange Nat'l. Bank Bldg., 716-372-0040
"	Rochester, 711 Exchange St., 716-232-4380
"	Syracuse, 4030 New Court Rd., 315-463-9581
"	Vestal, Box 148, 607-729-2258
"	Watertown, 32 The Arcade, 315-788-2071
NC	Charlotte, 2001 W. Morehead St., 704-377-3471
"	Charlotte, Electro-Tech, Inc., 5141 Belhaven Blvd., 704-392-7451
"	Greensboro, 1020 E. Wendover Ave., 919-273-5551
"	Raleigh, Box 10386, 919-834-4375
Ohio	Akron, 158 E. Voris St., 216-376-2171
"	Cincinnati, 7710 Reading Rd., 513-475-7400
"	Cleveland, 55 Public Sq., 216-579-2121
"	Cleveland, Weschler Elec. Corp., 4250 West 130th St., 216-251-4609
"	Columbus, 940 Williams Ave., 614-294-5261
"	Dayton, 1306 Farr Dr., 513-461-3720
"	Toledo, 245 Summit St., 419-248-6681
"	Youngstown, 246 W. Wood St., 216-744-8911
Okla	Oklahoma City, 120 N. Robinson St., 405-528-2911
"	Tulsa, 915 Enterprise Bldg., 918-583-3191
Ore	Eugene, 1345 Olive St., 503-342-3083
"	Medford, Box 1487, 503-773-1845
"	Portland, Box 12265, 503-224-4200
Pa	Allentown, Box 59, 215-432-6841
"	Bala Cynwyd, One Decker Sq., 215-878-1300
"	Erie, 1107 Hess Ave., 814-452-4867
"	Johnstown, 107 Station St., 814-288-1559
"	Philadelphia, Sunshine Scientific Instr., Inc., 1810 Grant Ave., 215-673-5600
"	Pittsburgh, Box 1017, 412-255-3800
"	Pittsburgh, Cameradio Co., 1121 Penn Ave., 412-391-4000
"	Wilkes Barre, 267 N. Pennsylvania Ave., 717-825-7337
"	Williamsport, 202 Basin St., 717-322-6183
SC	Columbia, 1710 Gervais St., 803-256-1511
"	Greenville, 292 Pleasantburg Bldg., 803-232-5695
Tenn	Chattanooga, 305 Provident Bldg., 615-267-4361
"	Kingsport, 433 E. Center St., 615-247-5167
"	Knoxville, 808 Campbell Ave., S.E., 615-522-8101
"	Memphis, 1520 First National Bank Bldg., 901-526-8546
"	Nashville, 110-21st Ave., S., 615-242-3505
Tex	Amarillo, 502 Amarillo Bldg., 301 Polk St., 806-372-3259
"	Beaumont, 1103 Beaumont Savings Bldg., 713-838-6333
"	Corpus Christi, Corpus Christi State Nat'l. Bldg., 512-883-9236
"	Dallas, 8400 John W. Carpenter Frwy., 214-631-2811
"	El Paso, 300 E. Main St., 915-542-1744
"	El Paso, Border Machinery Co., 1710 E. Pasiano Dr., 915-533-7565
"	Houston, 507 Dallas Ave., 713-224-7791
"	Houston, D.H. Dashiell Co., 6161 Washington Ave., 713-869-4878
"	Lubbock, Box 6399, 806-792-2811
"	Odessa, 300 N. Jackson St., 915-337-1822
"	San Antonio, 201 N. St. Mary's St., 512-223-9181
Utah	Salt Lake City, 1680 S. Redwood Rd., 801-486-8751
Va	Richmond, 4000 W. Broad St., 703-649-9061
"	Roanoke, Box 2547, 703-342-8925
Wash	Seattle, 19 W. Harrison, 206-623-7001
"	Spokane, Box 2987, 509-535-3521
WVa	Bluefield, 704 Bland St., 304-325-7215
"	Charleston, 1204 Kanawha Blvd., E., 304-346-9606
"	Fairmont, 10th & Beltline, 304-363-0400
"	Huntington, 1029 7th Ave., 304-529-7146
"	Wheeling, Box 431, 304-232-4100
Wisc	Appleton, 315 W. Wisconsin Ave., 414-739-2313
"	Madison, Box 3099, 608-257-4517
"	Milwaukee, Box 1207, 414-276-1800
"	Milwaukee, Taylor Elec. Co., 4080 N. Port Washington Rd., 414-964-4321

■ **WESTINGHOUSE ELEC. CORP., Semiconductor Div., Youngwood, Pa. 15697, Tel: (412) WA 5-7272, TWX: 412-679-2783; Sls. Mgr: N. F. Spear** ..... **Pgs. 2639-2656**

Ala	Huntsville, 87 Holiday Office Ctr., 205-881-2591
Ariz	Phoenix, 2200 N. Central Ave., 602-258-7211
Cal	Compton, 18020 S. Santa Fe Ave., 213-636-0111
"	Los Angeles, 600 St. Paul Ave., 213-482-9660
"	Sunnyvale, Bldg., 73, Hendy Ave., 408-735-2191
Colo	Denver, 55 W. Fifth Ave., 303-534-8121
Conn	Hartford, 360 Market St., 203-249-5792
DC	Washington, 1625 K St., N.W., 202-628-8843
Fla	Orlando, 1010 Executive Ctr. Dr., 305-841-3421
Ga	Atlanta, 1299 Northside Dr., N.W., 404-351-5200
Ill	Chicago, 10 S. Riverside Plaza, 312-416-7200
"	Rockford, 2121 15th St., 815-398-3591
Ind	Ft. Wayne, Anthony Wayne Bank Bldg., 219-742-0221
"	Indianapolis, 1560 Stadium Dr., 317-632-3301
Md	Baltimore, 1055 Taylor Ave., 301-828-5400
Mass	Boston, 800 Boylston St., 617-542-0600
Mich	Detroit, 5757 Trumbull Ave., 313-872-7010
"	Grand Rapids, 281 Leonard St., 616-456-1531
Minn	Minneapolis, 3501 S. Highway 100, 612-927-6551
Mo	Kansas City, 1215 West 12th St., 816-421-7122
"	St. Louis, 411 North 7th St., 314-421-6991
NJ	Newark, 67 Evergreen Pl., 201-465-0222
NY	Johnson City, 4301 Old Vestal Rd., 607-729-2258
"	Mineola, 1501 Franklin Ave., 516-248-9810
"	Rochester, 711 Exchange St., 716-232-4380
"	Syracuse, 4030 New Court Rd., 315-463-9581
Ohio	Cincinnati, 7710 Reading Rd., 513-475-7400
"	Cleveland, Illuminating Bldg., 216-579-2174
"	Dayton, 1306 Farr Dr., 513-461-3720
Pa	Philadelphia, One Decker Sq., 215-878-1300
"	Pittsburgh, Box 1017, 412-255-3800
Tex	Dallas, 8400 John Carpenter Frwy., 214-631-2811
"	Houston, 507 Dallas Ave., 713-224-7791
Wash	Seattle, 19 W. Harrison Ave., 206-623-7001
Wisc	Milwaukee, 731 N. Jackson, 414-276-1800

WESTINGHOUSE ELEC. CORP., Specialty Elctrns. Div., 7800 Susquehanna St., Pittsburgh, Pa. 15221, Tel: 412-256-7303

WESTINGHOUSE ELEC. CORP., Specialty Metals Div., R.D. #2, Box 45, Blairsville, Pa. 15717, Tel: 412-459-9400; Sls. Mgr: J.F. Fleming

WESTINGHOUSE ELEC. CORP., Specialty Transformer Div., P.O. Box 231, Greenville, Pa. 16125, Tel: 412-981-1611; Sls. Mgr: J. Basista, Jr.

WESTINGHOUSE ELEC. INT'L. CO., 200 Park Ave., New York, N.Y., Tel: 212-692-3211; Gen'l. Mgr: W.L. Borden

WESTLAKE PLASTICS CO., 133 W. Lenni Rd., Lenni, Pa. 19052, Tel: (215) GL 9-1000, TWX: 215-459-1025; Sls. Mgr: W.F. Noonan, Jr.

WESTLINE PRODS., 220 S. Rose St., Los Angeles, Calif. 90054, Tel: (213) MA 7-2641; Sls. Mgr: M.A. Conteras

WESTMORELAND PLASTICS CO., 135 Gertrude St., Latrobe, Pa., Tel: 412-539-1612; Sls. Mgr: E.R. Hatfield

■ **WESTON-BOONSHAFT & FUCHS — See EMR-Hatboro**

■ **WESTON COMPONENTS DIV., Weston-Archbald, Archbald, Pa. 18403, Tel: 717-876-1500, TWX: 717-770-2919** ..... **FSC No. 94271** ..... **Pgs. 2504, 2505**

Ala	Huntsville, Rep, Inc., 8100 S. Memorial Pkwy., 205-881-9270
Ariz	Scottsdale, Vinson Assocs., Inc., 44 E. Indian School Rd., 602-947-7371
Cal	Monterey Pk., Weston Instrs., Inc., 736 Monterey Pass Rd., 213-268-9271
"	Redwood City, Held & Mollard, Inc., 1494 Oddstad Dr., 415-369-4871
Colo	Englewood, Vinson Assocs., Inc., 3600 S. Lincoln St., 303-789-2203
Fla	Orlando, Scott & Assocs., 1010 Executive Ctr. Dr., 305-841-4840
Ga	Atlanta, Rep, Inc., 1483 Monroe Dr., 404-876-1591
Ill	Chicago, Whitmore Assocs., Inc., 535 N. Michigan Ave., 312-321-1503
Md	Silver Spring, QED Elctrns., Inc., 880 Bonifant St., 301-588-8134
Mass	Lexington, Weston Instrs., Inc., 17 Hartwell Ave., 617-861-8950
Mich	Detroit, Weston Instrs., Inc., 17700 W. McNichols Rd., 313-532-5546
Minn	St. Paul, R.G. Ragon, Inc., 1136 W. Larpenteur Ave., 612-488-6634
Mo	Kansas City, R.R. Burton Sls. Co., 7546 Troost Ave., (816) JA 3-7865
"	St. Louis, R.R. Burton Sales Co., 10414 Oak Ave., 314-429-7327
NJ	Camden, QED Elctrns., Inc., 2916 Federal St., 215-925-8711
NM	Albuquerque, Vinson Assocs., Inc., 2329 Wisconsin, N.E., 505-298-7442
NY	Mt. Vernon, QED Elctrns., Inc., 500 Nuber Ave., 914-968-2200
NC	Charlotte, J.L. Highsmith & Co., 3733 Monroe Rd., 704-333-7743
Ohio	Dayton, Weston Instrs., Inc., 3300 S. Dixie Dr., 513-298-7511
Pa	Pittsburgh, Weston Instrs., Inc., 875 Greentree Rd., 412-922-4545
Tex	Dallas, Kemp Engrg. Co., 2618 Manana Dr., (214) FL 7-6663
Wash	Seattle, Weston Instrs., Inc., 314 First Ave., W., 206-282-3388

■ **WESTON-HATBORO — See EMR-Hatboro**

WESTON HYDRAULICS, Div. Borg-Warner Corp., 7500 Tyrone Ave., Van Nuys, Calif., Tel: 213-781-4000, TWX: 910-495-1726; Sls. Mgr: D.G. Sherman ..... FSC 79294

WESTON INSTRS. DIV., Weston Instrs., Inc., 614 Frelinghuysen Ave., Newark, N.J. 07114

WESTON INSTRS., INC., Weston-Lexington Div., 17 Hartwell Ave., Lexington, Mass. 02173, Tel: 617-861-9000, TWX: 710-326-0596; Sls. Mgr: R.H. Leeman ..... FSC 11842

WESTON MAGNETICS, 14617 Keswick Ave., Van Nuys, Calif., Tel: 213-782-1974; Sls. Mgr: W.D. Stone ..... FSC 05934

■ **WESTON-TRANSICOIL, Weston Components Div., Worcester, Pa. 19490, Tel: 215-277-1300, TWX: 510-660-0132; Dir. Mktg: L. Eslinger** ..... **FSC No. 82686** ..... **Pg. 2678**

Ariz	Scottsdale, Runyon Co., 6825 E. Thomas, 602-947-5711
Colo	Denver, Peterson Co., 4949 Colorado Blvd., 303-333-5434
Fla	Orlando, Aerodyne Engrg., Box 17057, 305-295-4440
Ill	Chicago, Whitmore Assocs., 535 N. Michigan Ave., 312-321-1503
Md	Baltimore, T.W. Sprecher, 1423 Harberson Rd., 301-744-2679
Mo	Clayton, Fen-Co. Engrg. Co., 8003 Forsyth, 314-721-4378

NJ Cherry Hill, J.C. Miller, 801 Pennsylvania Ave., 609-429-7668
" Pt. Pleasant, F.C. Helies, 800 South St., 201-899-0298
NY Webster, G. Giocondo, 1476 Schlegel Rd., 716-872-5480
Ohio Dayton, A.H. Baier Co., 3300 S. Dixie Dr., 513-298-9897
" Willoughby, A.H. Baier Co., 4399 Industrial Pkwy., 216-946-6080
Pa Worcester, Weston-Transicoil, Trooper Rd., 215-277-1300
Tex Richardson, J. Tennison, 777 S. Central Expwy., 214-231-9811
Utah Salt Lake City, Peterson Co., 521 W. Fourth, N., 801-355-7464

WESTRONICS, INC., Sub. Tracor, Inc., 3605 Mc Cart St., Ft. Worth, Tex. 76110, Tel: 817-926-2621; Sls. Mgr: S.T. Holub

* WESTWOOD tools - Waldes Kohinoor, Inc.

* WETCAL jet engine tester - Howell Instrs., Inc.

WHARFEDALE, Div. British Inds. Co., Westbury, N.Y. 11590, Tel: (516) ED 4-7450; Sls. Mgr: L.J. Epstein ... FSC 08279

WHARTON UNITOOLS, 8-10 Lake St., Moosup, Conn. 06354, Tel: (203) LO 4-2254; Sls. Mgr: R.H. Rich

WHEELABRATOR CORP., Wheelabrator Div., 1478 S. Byrkit St., Mishawaka, Ind. 46544, Tel: 219-255-2141; V.P. Sls: L.J. Kohlmeyer

WHEELER LABS., INC., 122 Cutter Mill Rd., Great Neck, N.Y. 11021, Tel: 516-482-7876; Pres: H.L. Bachman ..... FSC No. 13073

■ **WHEELOCK SIGNALS, INC., 273 Branchport Ave., Long Branch, N. J. 07740, Tel: 201 - 222-6880, TWX: 201-222-7091; Sls. Mgr: C. C. Applegate** ..... **Pg. 2333**

Ala Huntsville, Bostick & Assocs., Box 4165, 205-881-3677
Ariz Scottsdale, Portis & Assoc., 132 E. Stetson, 602-945-4925
Cal Palo Alto, Wheelock Signals, Inc., 230 West 40th Ave., 415-967-4938
" Pasadena, Wheelock Signals, Inc., Box 2724, 213-799-5452
Conn Wethersfield, COM/PAK, Box 37, 203-563-4784
Fla Orlando, Gra-Mar, Inc., 3113 Lawton Rd., 305-841-2330
Ga Atlanta, Bostick & Assocs., Box 28378, 404-252-1958
Ill Chicago, Electro-Comp Sls., 5129 W. Devon, (312) RO 3-3636
Iowa Cedar Rapids, J.R. Sls. Engr., 3550 Cottage Grove Ave., S.E., 319-365-5259
Mass Needham, Com/Pak, 14 Oak St., (617) HI 4-1259
Minn Mound, Macnamara Assocs., Box 38, 612-472-4919
Mo St. Louis, Richter Equip. Co., 9567 Page Blvd., (314) HA 7-0990
NJ Camden, J.N. Barrett Assoc., Inc., 812 Federal, (609) EM 5-2680
NY Ithaca, B. Dean, Inc., 714 W. Clinton, (607) AR 2-2187
" Newark, B. Dean, Inc., 220 Elmwood Ave.
" Queens Village, F.T. Battista Co., 223-46 Hempstead Ave., (212) GR 9-3550
Ohio Dayton, Midwest Mktg. Assocs., 137 Lakeview, 513-433-2511
Tex Dallas, Ruby Sls. Corp., Box 9894, 214-827-6630
Utah Salt Lake City, Cannon Engr. & Sls., 2250 East 17th St., 801-485-9253
Wash Kirkland, R.R. Chase & Assocs., 12422 68th Ave., N. E.
FOR: Can, Port Credit, Ont., Leonard Elec., 1008 Rangeview Rd., 416-274-3454

*WHIRLCLAD fluidized bed coating sys. - Polymer Corp.

* WHIRLPOOL MIXERS chemical agitators - Standard Elec. Mfg.

* WHIRLWIND wire brushes - Black & Decker Mfg. Co.

WHISTLER ELCTRNS., INC., 8613 Yolanda Ave., Northridge, Calif. 91324, Tel: 213-349-7100; Sls. Mgr: H.C. Hunt ..... FSC No. 18617

* WHIT screen press - Etchomatic, Inc.

WHITAKER CABLE CORP., 1301 Burlington St., N. Kansas City, Mo. 64116, Tel: 816-471-4640; Sls. Mgr: C.J. Owen

* WHITE DOT pumice cleaner - Etchomatic, Inc.

WHITE ELECTROMAGNETICS, INC., 656 Lofstrand La., Rockville, Md., Tel: 301-424-2900; Sls. Mgr: D.R.J. White

WHITE INSTRS., INC., P.O. Box 698, Austin, Tex. 78767, Tel: 512-892-0752; Sls. Mgr: W. Robertson ..... FSC 03945

WHITE METAL ROLLING & STAMPING CORP., 443 Park Ave., S., New York, N.Y. 10016

WHITE, S.S. INDUSTRIAL, Div. Pennsalt Chem. Corp., 201 East 42nd St., New York, N.Y. 10017

WHITEWATER ELCTRNS., INC., 136 W. Main St., Whitewater, Wisc., Tel: 414-473-5700; V.P. Sls: R. Grenn

WHITMAN SADDLE MFG. CO., Instrument Case Div., 1725 Powers St., Cincinnati, Ohio 45223, Tel: 513-541-3223; Sls. Mgr: S. Erhardt

■ **WHITMOR WIRE & CABLE CORP., 13161 Sherman Way, Unit B, N. Hollywood, Calif. 91605, Tel: 213 - 764-6296; Sls. Mgr: J. J. Jerago**.....**FSC No. 15851** ..... **Pg. 2971**

WHITNEY BLAKE CO., 1565 Dixwell Ave., New Haven, Conn.,

WHITNEY METAL TOOL CO., 2833 Huffman Blvd., Rockford, Ill. 61101, Tel: 815-962-3011; Sls. Mgr: G. Plumb

WHITSO, INC., 9330 Byron St., Schiller Pk., Ill. 60176, Tel: 312-678-5200, TWX: 312-678-2672; Gen'l. Sls. Mgr: A. Paloian ..... FSC No. 92825

WHITTAKER CORP., 9229 Sunset Blvd., Los Angeles, Calif. 90069, Tel: 213-274-0771, TWX: 213-273-4192

■ **WHITTAKER CORP., Gencom Div., 80 Express St., Plainview, N. Y. 11803, Tel: 516 - 433-5900; Sls. Mgr: F. Belasco**.....**FSC No. 24053** ..... **Pg. 1954**

Ala Huntsville, Physimetrics, Box 4108, Farley Sta., 205-881-4965
Ariz Phoenix, O'Halloran Assocs., 4747 North 16th St., 602-277-3223
Cal N. Hollywood, O'Halloran Assocs., 10700 Ventura Blvd., (213) TR 7-0173
" Palo Alto, O'Halloran Assocs., 3921 E. Bayshore, (415) DA 6-1493
Colo Denver, D.E. Bond Assoc., 2149 S. Clermont St., 303-756-1234
Fla Orlando, Physimetrics, 999 Woodcock Rd., 305-841-4956
Ga Atlanta, Physimetrics, Inc., 3376 Peachtree Rd., N. E., 404-261-8720
Ill Chicago, Carter Elctrns., 7203 S. Western Ave., 312-776-1601
Ind Indianapolis, Carter Elctrns., 6333 Hollister Dr., (317) AX 3-0696
Md Beltsville, C.E. Snow Co., 10442 Baltimore Ave., 301-345-2211
Mass Needham, Addelco Corp., 56 Pickering St., 617-444-4754
Mich Farmington, Carter, McCormic & Peirce, 23995 Freeway Pk. Dr., 313-477-7700
Minn Minneapolis, Carter Elctrns., 2401 West 66th St., 612-869-3261
NJ E. Orange, Friedman Assocs., 110 Halsted St., 201-673-2500
NM Albuquerque, D.E. Bond Assocs., 1st National Bank Bldg. E, 505-255-7634
NY Fayetteville, M.P. Andrews, Inc., 319 Mott Rd., (315) NE 7-3144
NC Charlotte, Physimetrics, Inc., 500 E. Morehead St., 704-372-3179
Ohio Cleveland, Carter, McCormic & Peirce, Inc., 3691 Lee Rd., 216-921-1360
" Dayton, Carter, McCormic & Peirce, Inc., 3406 N. Main St., 513-278-5873
Ore Beaverton, N.R. Schultz Co., Box 156, 503-646-1345
Pa Ambler, C.E. Snow Co., 258 N. Main St., 215-646-9451
" Pittsburgh, Carter, McCormic & Peirce, Inc., Penn Center Bldg. #1, 412-824-3760
Tex Dallas, Southwestern Engrg. & Equip. Co., 6300 N. Central Expwy., (214) EM 3-6501
" Houston, Southwestern Eng. & Equip. Co., 4242 Richmond Ave., 713-666-2313
Wash Bellevue, N.R. Schultz Co., 305-112th Ave., N.E., 206-454-5224

WHITTAKER CORP., Industrial Prods. Div., 12838 Saticoy St., N. Hollywood, Calif. 91605, Tel: 213-765-8211, TWX: 213-273-4192; Sls. Mgr: D.T. Kerr ..... FSC 79318

WHITTAKER CORP., Instrument Systems Div., 9601 Canoga Ave., Chatsworth, Calif. 91311

*WHIZ-LOCK locknut - MacLean Fogg Lock Nut Co.

WIDE RANGE ELCTRNS. CORP., 12200 Dorsett Rd., Maryland Hgts., Mo., Tel: (314) HE 2-6103; Pres: O. Rauhut

*WIDE-VUE panel meters - Simpson Electric Co.

*WIDE WINDOW laminations - Thomas & Skinner, Inc.

*WIDGET welder - Silver, G.H. & Assoc., Inc.

WIEGAND, EDWIN L. CO., Div. Emerson Elec. Co., 7705 Thomas Blvd., Pittsburgh, Pa. 15208, Tel: 412-242-6400, TWX: 710-664-4449; V.P. Ind. Div: W.S. Eyth ..... FSC No. 65586

*WIG-O-FLEX tube connector - E.B. Wiggins, Inc.

WIGGINS, E.B., INC., 5000 Triggs St., Los Angeles, Calif., Tel: 213-269-9181, TWX: 910-321-3573; Sls. Mgr: W.R. Martin ..... FSC No. 79326

*WILBRAZE brazing alloys - Wilkinson Co.

*WILCLEAN hand cleaner - Amerace-Esna Corp.

*WILCO all products - Engelhard Minerals & Chemicals

WILCO CORP., 4030 W. Tenth St., Indianapolis, Ind. 46222, Tel: 317-244-2516

*WILCOLOY E copper spring material - Engelhard Minerals and Chemical Corp.

■ **WILCOX PRODS. CO., Sub. Thermotech Inds., Inc., 1202 South 5th St., Hopkins, Minn. 55343, Tel: 612 - 938-7671; Sls. Mgr: E. Ostergard** ..... **Pg. 1237-1242**

Ariz Tucson, D.V. Hamilton, 9800 N. Oracle Rd., 602-297-2279
Cal Burbank, Secana Co., 1613 W. Burbank Blvd., 213-849-6848
" San Carlos, B. Provence, Box 963, 415-591-6715
Conn W. Hartford, D. Kelley, 28 Whiting La., 203-233-0870
Fla St. Petersburg, Thermotech Ind., 3200 Tyrone Blvd., 813-347-2191
Ill Des Plaines, D. Anderson, 3158 Des Plaines Ave., 312-824-4129
" Chicago, J. Robinson & Assoc., 1721 W. Division St., 312-525-3400
Ind Ft. Wayne, R. McCampbell, 3715 Nokomis Rd., 219-747-9696
Iowa Des Moines, F. Wilcox Co., Inc., Box 1056, 515-255-8416
Ky Mt. Sterling, M.F. Eubank Sls. Co., Box 402, 606-498-5709
Md Baltimore, R. Matarazzo, 322 S. Eden St., (301) EA 7-3907
Mich Detroit, G. Hall, 10432 W. McNichols Rd., (313) UN 4-1368
" Farmington, L. George, 32500 Grand River Ave., 313-474-1505
Minn Minneapolis, W.J. Houlihan, 6030 Wayzata Blvd., 612-545-2538
Mo St. Louis, D.A. James, 7116 Oakland Ave., (314) MI 4-0411
NJ Bloomfield, A.J. Orsi, 39 Lackawanna Pl., 201-743-7940
NY Manhasset, Kaelber & Mack, Inc., 75 Plandome Rd., (516) MA 7-6620
" Rochester, P. Schumacher, Box 8399, 716-235-2123
NC Greensboro, C.S. Woods, Box 20005, 919-274-2474
Ohio Maple Hgts., J. Barto, 17090 Broadway Ave., 216-663-6595
Ore Portland, C.E. Riggs, Inc., 422 Northwest 8th Ave., 503-226-3286
Tex Dallas, M. Gillett, 5635 Yale Blvd., (214) EM 3-0107
Wisc Milwaukee, V. Ove, 1348 North 37th St., 414-342-7220

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Aaron B. D. & Co., 55 Northern Blvd., (516) 621-0630
Aaron D. Assoc. Box 511, Port Washington, N.Y. (516) 767-8480, TWX: 510-223-0810
Abbott Inst. & Engrg. Co., 1736 Westwood Blvd., Los Angeles, Calif., (213) 474-5310
Abbott-Allison Co., Inc., Box 467, Meriden, Conn., (203) 237-9232, Branch Office: Box 96, N. Andover, Mass.
Abbott-Gordon Assoc., 3939 Wicks Ave., Seaford, N. Y., (516) 781-5256, Branch Office: Teaneck, N. J.
ACE Assoc., S.W. 153rd St., Seattle, Wash., (206) CH 4-9391
Acromatix Assoc., Inc., Box 271, 3118 Germantown Pke, Fairview Village, Pa., (215) 279-0377
Adams & Assoc., Inc., Box 9256, Greensboro, N.C., (919) 272-6838, Branch Offices: Orlando, Fla.; Decatur, Ga.; Knoxville, Tenn.
Adams-McGregor Inc., 66 Lakeview Rd., Lincoln, R.I., (401) 726-1300, Branch Offices: Wallingford, Conn.; Quincy, Mass.
Addelco Corp., 56 Pickering St., Needham, Mass., (617) 444-4754, TWX: 617-444-1931, Branch Office: New Haven, Conn.
Adelman-Pinz Sales Corp., 570 Yonkers Ave., Yonkers, N.Y., (914) 423-4747
Adtek Assoc., 201 Town and Country Village, Palo Alto, Calif., (415) 323-5414
Aeroconomy Agency, 1079 Lexington Ave., Schenectady, N.Y. (518) 372-8426
Aerol Assocs., Inc., 400 Jericho Tpke., Jericho, N.Y., (516) 822-0800, TWX: 510-221-1847, Branch Offices: Torrance, Calif.; Essex, Conn.; Arlington, Va.; Northfield, Ill.; Wichita, Kansas; Baltimore, Md.; Braintree, Mass.; Anoka, Minn.; Clifton, N.J.; Jericho, L.I., N.Y.; Avon Lake, Ohio; Cincinnati, Ohio; Southampton, Pa.; New Cumberland, Pa.; Dallas, Texas.
Aerospace Sales Corp., 12140 So. Atlantic Ave., Lynwood, Calif., (213) 537-1856
Aertronic Assoc., Inc., 5899 Huberville Ave., Dayton, Ohio (513) 253-8144, Branch Office: Ruffsdale, Pa.
Agress, M. C., 891 Fulton St., Valley Stream, N.Y. (516) 825-8955
Airep Elctrn., Inc., 6300 N. Central, Dallas, Tex., (214) 363-5291, Branch Offices: Houston, Tex.; San Antonio, Tex.
Alderson W. Co. Inc., 8548 Washington Blvd., Culver City, Calif., (213) UP 0-9286, TWX: 910-340-6354
Allen Assoc., 55 W. 1st Ave., Scottsdale, Ariz., (602) 946-4903
Allen D. Co., 7969 Engineer Rd., San Diego, Calif., (714) 278-9250
Allen, R. W. Box 7142 Sta., "C", Atlanta, Ga., (404) 233-2361
Allgood Assoc., 1621 Centinella Ave., Inglewood, Calif., (213) 776-5820 TWX: 910-328-6195, Branch Offices: Mt. View, Calif.; Albuquerque, N.M.
Allied Components Inc., 10464 E. Northwest Hwy., Dallas, Tex., (214) 348-6660, TWX: 910-861-4925, Branch Office: Houston, Tex.
Allied Enterprises Inc., 7281 Pearl Rd., Cleveland, Ohio, (216) 234-2606
Allied Northwest Machine Tool Corp., 3525 SE 17th, Portland, Ore., (503) 234-7513
Almac/Stroum Elctrn., 5811 6th Ave., S., Seattle, Wash., (206) 763-2300, TWX: 910-444-2067, Branch Office: Portland, Ore.
Andco Sales Engrg., Inc., 10 E. School House La., Philadelphia, Pa., (215) VI 4-9100, Branch Office: Chevy Chase, Md.
Anderson B. & Assoc., Inc., 5969 N. Elston Ave., Chicago, Ill., (312) 774-8989, TWX: 910-221-5036, Branch Offices: Minneapolis, Minn.; Ft. Wayne, Ind.
Anderson Elctrn., Inc., 30785 Grand River Ave., Farmington, Mich., (331) 476-9161
Anderson J. B. Co., Inc., 59 E. Spring St., Columbus, Ohio, (614) 221-6385
Anderson J. E. M. Co., 5231 Humboldt Ave., S., Minneapolis, Minn., (612) 823-6459
Anderson/Kruse Assoc., Box 1225, Canoga Park, Calif., (213) 341-3020
Andrew-Douglas Corp., 222 Beach 145 St., Neponsit, N.Y., (212) 474-6000
Andrews & Andrews, Inc., 140 E. Main St., Huntington, N.Y., (516) 692-8686, Branch Office: Englewood, N.J.
Andrews A. B. Co., 1401 Branch Banking & Trust Co. Bldg., Box 2627, Raleigh, N. C., (919) 833-5565, Branch Office: Miami, Fla.
Andrews, M. P., Inc., 319 Mott Rd., Fayetteville, N. Y., (315) 637-3144, 6405, TWX: 710-545-0242
Angel J. C., & Co., 2743 W. Peterson, Chicago, Ill., (312) 878-0653 TWX: 910-221-5688
Anger Assoc., Inc., 13126 Michigan Ave., Dearborn, Mich., (313) 584-9853, Branch Offices: Chicago, Ill.; Lakewood, Ohio; Dayton, Ohio
Ansell Engr., Co., 816 Thayer Ave., Silver Spring, Md., (301) 588-4222
Antle-Smith Sales, Box 20361, Dallas, Tex., (214) 357-7279
Appell L. W., Co., Inc., 11 Warren St., New York, N.Y., (212) WO 4-4255

Appleton H., Co., 136 San Fernando Rd., Los Angeles, Calif., (213) 225-5611, TWX: 910-321-4155, Branch Offices: Scottsdale, Ariz.; San Diego, Calif.; San Mateo, Calif.; Denver, Colo.; Orlando, Fla.; Elmhurst, Ill.; Mission, Kan.; Glen Burnie, Md.; Needham, Mass.; Minneapolis, Minn.; Pine Brook, N.J.; Rochester, N.Y.; Cleveland, Ohio; Pittsburgh, Pa.; Wynnewood, Pa.; Fort Worth, Tex.; Salt Lake City, Utah

Applied Science Associates, 3707 Rawlins, Dallas, Tex., (214) 526-8316 Branch Offices: Tulsa, Okla.; Houston, Tex.

Arenstrup F. G. Co., 250 Hudson Rd., Sudbury, Mass., (617) 443-2992

Arnold Assoc., Inc., 2 Ryers Ave., Cheltenham, Pa., (215) 742-0600, Branch Office: Arlington, Va.

Arrowhead Sales Corp., 1966 W. 6255 S., Salt Lake City, Utah, Branch Offices: Arvada, Colo., Albuqueque, N. M.

Ash W. J., & Assoc., 4110 Templar Rd., Toledo, Ohio, (419) 474-1313

Ashby G. L., Assoc., Inc., 4130 Linden Ave., Dayton, Ohio, (513) 252-5627

Atkind I., 821 Burman Ave., Trotwood, Ohio, (513) 837-4750

Aurich, F. W., & Co., 3601 Gilman Ave., W., Seattle, Wash., (206) 284-5561 TWX: 910-444-1333. Branch Offices: San Bruno, Calif.; Portland, Ore.

Audio Sound Sales Co., 2535 N. Ashland, Chicago, Ill., (312) 528-8422

Automatic General Elec., Sales, Inc., 6550-E Troost Ave., Kansas City, Mo., (816) 333-8206, Branch Office: Richardson, Tex.

Automation Sales, Inc., Box 448, Huntington, N.Y., (516) 692-6207

Avionics Liaison, Inc., 6770 Perimeter Rd., S., Seattle, Wash., (206) RO 7-3870, TWX: 910-444-2013

Aymond Co., Inc., Box 64917, 4340 N. Central Expy., Dallas Tex., (214) 827-8043, Branch Office: Bellaire, Tex.

Aztec Enterprises, Inc., 3202 Candelaria Rd. NE, Albuquerque, N.M., (505) 345-3441, Branch Office: Englewood, Colo.

B

B. & A. Assoc., 237 Lancaster Ave., Devon, Pa., (215) MU 8-5173

BCS Assoc., Inc., 940 N. Ferncreek Ave., Orlando, Fla., (305) 843-1510, TWX: 810-850-0185, Branch Offices: Huntsville, Ala.; Greensboro, N.C.

B. E. K. Assoc., 1700 Needmore Rd., Dayton, Ohio, (513) 278-1343

BFA, 1309 S. Inca, Denver, Colo., (303) 744-3301, Branch Offices: Phoenix, Ariz.; Albuquerque, N.M.; Tulsa, Okla., Euless, Tex.; Friendswood, Tex.; San Antonio, Tex.

B & W Assoc., B St., Burlington, Mass., (617) 275-9177

Bach, P., Elec., 1233 N.W. 12th Ave., Portland, Ore., (503) 227-2173, Branch Office: Bellevue, Wash.

Bach Sales Corp., 78 Wellington Rd., Garden City, N.Y., (516) 741-0570

Backer J. J., Co., 221 W. Galer, Seattle, Wash., (206) AT 3-6470, TWX: 910-444-1646

Baehr-Greenleaf & Assocs., Inc., 14700 Detroit Ave., Cleveland, Ohio, (216) 221-9030, Branch Offices: Cincinnati, Ohio, Columbus, Ohio, Xenia, Ohio

Bahr Sales Co., 91 Woodsley Rd., Longmeadow, Mass., (413) 567-3488

Baier, A. H. Co. & Assocs, 4399 Industrial Pkwy., Willoughby, Ohio, (216) 946-6080. Branch Office: Dayton, Ohio

Balhorn & Welch, Inc., 1925 N. Harlem Ave., Chicago, Ill., (312) 889-5011. Branch Office: Cedar Rapids, Iowa

Ballard, T. Co., Inc., 556 Clay, San Francisco, Calif., (415) 781-1781

Ballou, Inc., 51 N. Broad St., Ridgewood, N.J., (201) 444-6990

Bangh, C. R., 524 W. O. W. Bldg., Omaha, Nebr., (402) 341-4232

Banks, R A., Sales Corp., 1029 Corporation Way, Palo Alto, Cal., (415) 964-4464, TWX: 910-379-6498

Bard Assocs. Inc., La Grange Industrial Park, La Grange, Ill., (312) 354-0660, TWX: 910-683-1894. Branch Offices: Indianapolis, Ind.; Minneapolis, Minn.

Barnhart, L. E., 1003 Gunka Rd., Jacksonville, Fla. (305) 725-5226

Barnes, A. Co., 740 S. Sherman St., Richardson, Texas, (214) 235-4541. TWX: 910-867-4170. Branch Offices: Houston, Tex., San Antonio, Tex.

Barnhill & Assocs., Inc., 1931 Greenspring Dr., Timonium, Md., (301) 252-5610. Branch Office: Lynchburg, Va.

Barrett, J. N. Assocs. Inc., 812 Federal St., Camden, N.J., (609) 365-2680, TWX: 710-891-7379

Barron, W J. Co., 1406 S. Grand Ave., Los Angeles, Calif., (213) 748-6191

Barstow & Doran, Inc., 1406-08 S. Grand Ave., Los Angeles, Calif., (213) 749-0438

Barton, C. K. Assocs. Inc., 343 New London Tpke., Glastonbury, Conn. (203) 633-9417. Branch Office: Auburndale, Mass.

Bassett & Moore, 12045 Magnolia, No. Hollywood, Calif., (213) 769-7201.

Bassin Technical Sales Co., 52 Fayette Rd., Scarsdale, N.Y., (914) SC 3-3334

Beacon Elec. Assocs., P.O. Box 1278, Maitland, Fla., (305) 647-3498. Branch Offices: Ft. Lauderdale, Fla.; Atlanta, Ga., Jamestown, N.C.

Bear, N. Corp., 3435 Streetsboro Rd., West Richfield, Ohio, (216) 659-3331. Branch Office: Dayton, Ohio.

Beedle Equip. Co., 6900 Silverton Ave., Cincinnati, Ohio, (513) 793-0140

Beemer Engrg. Co., Ft. Washington, Pennsylvania, (215) MI 6-8440, TWX: 510-661-1654. Branch Offices: New York, N.Y.; Springfield, N.J.; Buffalo, N.Y.; Fayetteville, N.Y.; Severna Park, Md.

Bell & Whitaker, Inc., 3623 Jacksonwald Ave., Reading, Pa., (215) 779-2610. Branch Offices: Allentown, Pa.; Harrisburg, Pa.

Belfer, W., 387 6th St., San Francisco, Cal., (415) 781-0392

Bell, J. W., 601 S. Vermont Ave., Los Angeles, Calif., (213) 388-7104

Bennewitz Assoc., Inc., 9720 Candelaria NE, Albuquerque, N.M., (505) 298-6775, TWX: 910-989-0610. Branch Offices: Denver, Colo.; Scottsdale, Ariz.

Benson Engrg. Co., 9884 Monroe Dr., Dallas, Texas, (214) FL 2-7541. Branch Offices: Wichita, Kans.; Shawnee Mission, Kans.

Berg, S., Inc., Box 4500, Pittsburgh, Pa., (412) 923-1911.

Berliant Assoc., 1024 Garden Place, Baldwin, N.Y. (516) BA 3-6298. Branch Office: Allentown, Pa.

Berman, J. Co., Inc., 8295 S. LaCienega Blvd., Inglewood, Calif., (213) 678-1281, TWX: 910-328-6184. Branch Offices: Phoenix, Ariz.; LaMesa, Calif.

Bermann, M. Sales, 8631 E. Prairie Rd., Skokie, Ill., (312) 675-3740

Berndt Assocs., Inc., 6414 W. Belmont Ave., Chicago, Ill., (312) 283-0713, TWX: 910-221-2515. Branch Office: Ft. Wayne, Ind.

Berthold Sales Co., 4411 Maple Ave., Dallas, Texas (214) 526-8329

Bettan, M. Sales Inc., 77-15 164th St., Flushing, N.Y. (212) 657-6659

Bettis, M. E. Co., 3706 Broadway, Kansas City, Mo., (816) LO 1-0772. Branch Offices: Wichita, Kan.; St. Louis, Mo.

Bialek, S. Assocs. Inc., 42-15 Crescent St., Long Island City, N.Y., (212) 786-5562

Bieberich, W. W. Inc., 801 Leesburg Rd., Fort Wayne, Ind., (219) 432-2537

Biechler Assocs. Inc., Box 414, Narberth, Pa., (215) 667-1827, TWX: 510-662-4844. Branch Offices: Rockville, Md.; Towson, Md.

Bishop Enterprises, Inc., 126 Del Mar Circle, Aurora, Colo., (303) 364-7361. Branch Offices: Albuquerque, N.M.; Phoenix, Ariz.; El Paso, Tex.

Bittan Assocs, Inc., 381 Sunrise Hghwy., Lynbrook, N.Y., (516) 593-3833, TWX: 510-225-8429. Branch Office: New York, N.Y.

Biztek Co., Inc., 10639 Riverside Dr., Toluca Lake, Calif., (213) 766-4890. Branch Offices: San Francisco, Calif.; Scottsdale, Ariz.

Black & Strong, Inc., 1728 S. La Cienega, Los Angeles, Calif., (213) 870-9191, TWX: 910-340-6369. Branch Office: San Diego, Calif.

Blaker, S. C. Co., 6416 N. Central Ave., Chicago, Ill., (312) 774-8252

Blind & Assocs. Inc. 1635 N. Gent Ave., Indianapolis, Ind., (317) 635-6291

Boeing, J. E. Co., Inc., 18 Muzzey St., Lexington, Mass., (617) 862-2500. Branch Office: Branford, Conn

Bohlig, C. E. Co., Box 16095, Minneapolis, Minn., (612) 922-7011

Bollinger & Bradford, Box 8088, Pittsburgh, Pa., (412) 561-2340

Bolton, A. L. Co., 1174 Chestnut St., Menlo Park, Calif., (415) 322-6244

Bonn Assocs. Inc., 266 Lake Ave., Metuchen, N.J., (201) 549-9573

Booth, C. & Assoc. Inc., 1921 N. Harlem, Chicago, Ill., (312) 237-7910

Bordewieck Engrg. Sales, 221 Grove St., Braintree, Mass., (617) 843-0845.

Bowen, R. G., Co., Inc., 1440 S. Sante Fe, Denver, Colo., (303) 722-4641, Branch Office: Salt Lake City, Utah.

Braddock Assoc., Box 305, Haddonfield, N.J., (609) 429-0087. Branch Office: Bowie, Md.

Bragar, N Co., Inc., 1060 Broad St., Newark, N.J., (212) 622-4300.

Bradley Assocs. Corp., 130 Van Cortlandt Ave., Bronx, N.Y., (212) 549-8500, TWX: 710-593-6505

Brandt, E. W. Co., Box 538, San Rafael, Calif., (415) 454-0840

Branom Instr. Co., 2137 Second Ave., Seattle, Wash., (206) 622-7320, TWX: 206-032-333. Branch Office: Portland, Ore.

Branum Sales Co., Box 516, Lake Zurich, Ill., (312) 438-2356

Branum Sales, Inc., Box J, Richardson, Texas, (214) 231-6148

Brase, W. T. Co., Box 5011, Fort Wayne, Ind., (219) 483-1656

Brauer, W. J. & Assocs. Inc., Box 305, Wickliffe, Ohio, (216) 943-0601. Branch Offices: Dayton, Ohio; Pittsburgh, Pa.

Braun, W. M. & Assocs. Inc., 316 E. Silver Spring Dr., Milwaukee, Wisc., (414) 332-1040

Brede, H W. Co., Inc., 689 Greenvale-Glen Cove Rd., Glen Head, N.Y., (516) 676-4900. Branch Office: Syracuse, N.Y.

Brennan Assocs, Inc., 208 Carlson Bldg., Bellevue, Wash., (206) 454-9332, TWX: 910-443-2319

Bressler Assocs. Inc., 4808 Bergenline Ave., Union City, N.J., (201) 864-9577

Bressler, J. Inc., 4808 Bergenline Ave., Union City, N.J., (201) 864-9577. Branch Office: New York, N.Y.

Bresson, J. Assoc., 107 Forrest Ave., Narberth, Pa., (215) TE 9-6770. TWX: 215-667-0557. Branch Office: Elkridge, Md.

Breuer, R E. Co., Inc., 1 Barstow Rd., Great Neck, N.Y., (516) 466-3030, TWX: 510-223-0886

Brimberg Assoc. Inc., 814 Thayer Ave., Silver Spring, Md., (301) 588-7790, TWX: 710-825-9625

Brogan Assocs. Inc., 80 Urban Ave., Westbury, N.Y., (516) 333-6683, TWX: 510-222-4555. Branch Offices: Rye, N.Y.; Totowa, N.J.; Waltham, Mass.; Conshohocken, Pa.; Bethesda, Md.; Syracuse, N.Y.; Rochester, N.Y.

Brooks & Day, 10700 Ventura Blvd., N. Hollywood, Cal., (213) 877-3357.

Brothers & Conneen Assoc., 6302 Lincoln Ave., Baltifore, Md., (301) 764-7189. Branch Office: Springfield, Pa.

Brouillette, W. G. & Assoc. Inc., 9855 Roosevelt Rd., Westchester, Ill., (312) 345-6500.

Brown-Frederick & Assocs. Inc., 88 Penna Ave., Oreland, Pa., (215) 887-1325

Brown, I. Co., Inc., 401 Kingston Ave., Brooklyn N.Y., (212) 493-1379

Brown, H. R. Sales, 3400 Indian Rd., Cedar Rapids, Iowa, (319) 366-0635.

Brown, J. Elctrn Sales Reps. Inc., 207 Rosedale Rd., Yonkers, N.Y., (914) 779-3330. Branch Offices: Rochester, N.Y.; Brooklyn, N.Y.

Brown & Morrison, Box 4307, Charlotte, N.C., (704) 333-0774, Telex 575-5220

Brown, W. A., & Assocs, Inc., 222 Weber Ave., Orlando, Fla., (305) 425-5505, TWX: 810-850-0146. Branch Offices: Ft. Lauderdale, Fla.; Huntsville, Ala.; Winston-Salem, N.C.; Tucker, Ga.; Ft. Walton Beach, Fla.; Alexandria, Va.; Newport News, Va.

Bruno, L. D. Co., Box 2044, Kettering Br., Dayton, Ohio, (513) 434-1847

Brust, C. K., Box 182, Mt. Clemens, Mich., (313) 463-7386

Bryer-Assocs., Box 35841, Dallas, Texas, (214) 351-4350

Buchanan & Abrams Assocs. Inc., Box 6026, Orlando, Fla., (305) 423-8995

Budd-Tronics Inc., 71 Grayson Pl., Teaneck, N.J., (201) 837-1660

Buerger Co., Inc., 33 Limekiln Pke., Glenside, Pa., (215) 887-5030. Branch Offices: E. Meadow, N.Y.; Pittsburgh, Pa.

Bullock & Bullock, 934 Boiliyana Rd., Hillsborough, Calif., (415) 342-3848

Burcaw Co. & Assoc., 18236 W. McNichols Rd., Detroit, Mich.

Burgin-Kreh Assocs, Inc., Box 9787, Towson, Md., (301) 661-1120, TWX: 710-862-0878. Branch Office: Lynchburg, Va.

Burgoyne, W. E., 7001 N. Clark St., Chicago, Ill., (312) 465-2112

Burke, E. F. Inc., 5010 Mayfield, Cleveland, Ohio, (216) 382-3646

Burlingame Assocs. Ltd., 510 S. Fulton Ave., Mount Vernon, N.Y., (914) 664-7530, TWX: 710-562-0105. Branch Offices: Rockville, Md.; Bala Cynwyd, Pa.; Syracuse, N.Y.; Waltham, Mass.

Burton, R. R., Sales Co., Inc., 1016 Baltimore Ave., Kansas City, Mo. (816) 471-2850

Buse Sales Co., 214 N. 2nd St., St. Charles, Mo., (314) 739-1613, TWX: 910-760-1720

C

CDH Associates, 18075 Ventura Blvd., Encino, Calif., (213) 345-1644.

C & L Sales Co., Box 159, Denton, Texas, (817) 387-8000.

Cady, J. F., 1485 Bayshore Blvd., San Francisco, Calif., (415) 467-8656.

Cain & Co., 15720 Ventura Blvd., Encino, Cal., (213) 783-4700. Branch Offices: Los Altos, Calif.; San Diego, Calif.; Mt. Prospect, Ill.; Hyattsville, Md.; Melrose, Mass.; Little Neck, N.Y.; Liverpool, N.Y.; Bala-Cynwyd, Penna.; Dallas, Texas; Columbus, Ohio; South Amboy, N.J.; Tampa, Fla.

Callahan-Ferguson Co., 107 Greenhedge Dr., Camillus, N.Y., (315) 488-5518.

Calhoun, R. P., & Assocs., Box 2275, Dayton, Ohio, (513) 299-4144. Branch Office: Cleveland, Ohio.

Camber, M., 1700 York Ave., New York, N.Y., (212) 369-4222.

Campbell & George Co., 840 Mahler Rd., Burlingame, Calif., (415) 697-2965. Branch Office: Sacramento, Calif.
Cambell, H. D., 3827 Stone Way N., Seattle, Wash. (206) 643-1200.
Campion Sales Co., Box 396, Addison, Texas, (214) 239-9196.
Campisano F. J., & Assocs., Box 11043, Cincinnati, Ohio, (513) 662-1616. TWX: 810-461-2578. Branch Office: Indianapolis, Ind.
Cane Technical Sales, Inc., 555 E. Boston Post Rd., Mamaroneck, N.Y., (914) 698-4411.
Candor Co., Inc., Bethania, N.C., (919) 924-1480.
Capell, R., Co., Box 723, Tarzana, Calif., (213) 987-2233.
Carbone Assocs., Box 181, Little Falls, N.J., (201) 256-9191.
Carduner Sales Co., Jericho Tpke., Westbury N.Y., (516) 333-8170., TWX: 510-222-6356.
Carey-Wolf Co., Box 12425, Fort Worth, Texas, (817) PE 8-1702, TWX: 910-893-5072. Branch Office: Houston, Texas.
Carlson Elctrn. Sales, 7448 N. Harlem Ave., Chicago, Ill., (312) 774-4812, TWX: 910-221-5017. Branch Office: Minneapolis, Minn.
Carmine, F. S., Co., 14 Knickerbocker Dr., Newark, Dela., (302) 368-7603.
Carrier & Gable, 15565 Northland Dr., Southfield, Mich., (313) 444-8980.
Carse, T., Sales Co., Inc., Box 71, Latham, N.Y., (518) 785-5844.
Carter J., Assoc., 2600 W. Olive Ave., Burbank, Calif., (213) 843-3292, TWX: 910-498-2235.
Carter, McCormic & Peirce, Inc., 23995 Freeway Park Dr., Farmington, Mich., (313) 477-7700, TWX 810-242-2986. Branch Offices: Cleveland, Ohio; Dayton, Ohio; Pittsburgh, Pa.
Cartwright & Bean, Inc., 560 S. Cooper St., Memphis, Tenn., (901) 276-4442. Branch Offices: Huntsville, Ala.; Miami Beach, Fla.; Orlando, Fla.; Ormond Beach, Fla.; Atlanta, Ga.; Metairie, La.; Charlotte, N.C.; Raleigh, N.C.
Cascade Chapter of E R A, 4206 Rainier Ave., Seattle, Wash., (206) 723-5150
Cathey, R. E., Co., 200 Garrison St., Denver, Colo., (303) 238-1506.
Central Assoc., Inc., 44 N. Dean St., Englewood, N.J., (201) 568-0808. Branch Office: Plainview, N.Y.
Cerf, A., & Co., 512 Bloomfield, Ave., Caldwell, N.J., (201) 226-2263. Branch Offices: Ellicott City, Md.; Willow Grove, Pa.; Hillsdale, N.J.
Chamberlin, H. A., Hascom Field Air Terminal, Bedford, Mass., (617) 274-0044.
Champion, E. T., & Assocs., 4828 Main St., Skokie, Ill., (312) 676-3960.
Champlin, D., Co., Inc., 12347 Lake City Way N.E., Seattle, Wash., (206) EM 2-0401.
Chapman, C., & Co., 301 E. 10th Ave., Hialeah, Fla., (305) 885-4681.
Chapman, R. W., Co., Box 4430, Charlotte, N.C., (704) 375-4495.
Chilcote Sales Co., 2940 W. Lincolnshire, Toledo, Ohio, (419) 536-6606.
Christie, S. D., Assocs., Inc., 175 Fifth Ave., N.Y., N.Y., (212) 674-9010.
Church, L. F., Co., 655 Folsom St., San Francisco, Calif., (415) 781-1897.
Churchill, F. W., 50 Upland Way, Haddonfield, N.J., (609) 429-7871.
Clagett Engrg. Sales Co., 420 Ellis Ave., Rockford, Ill., (815) 965-4555.
Clancy, J., & Co., Inc., Box 269, Angola, Ind. (219) 665-2561.
Clare Elctrn., 24431 Oak Hill Dr., Cleveland, Ohio.
Clarfield-Stollmack Assocs., 175 Westwood Ave., Westwood, N.J., (201) 666-8989.
Clark, R. F., Co., 10517 Lindberg Ave., Pittsburgh, Pa., (412) 242-9500.
Clark Sales Co., Box 708, Cleveland, Ohio, (216) 991-2000. Branch Office: Chagrin Falls, Ohio.
Cleland & Co., 1263 Westwood Blvd., Los Angeles, Calif., (213) 477-0551, TWX: 910-342-6883. Branch Office: Los Altos, Calif.
Clemenson-Larrabee Co., 3709A Summit, Kansas City, Mo., (816) 931-0657. Branch Office: Bridgeton, Mo.
Closs, T. H., Co., 21 W. Penna., Ave., Towson, Md., (301) 825-4445. Branch Office: Beltsville, Md.
Cluphf, S., & Assocs., 1268 W. Nevada Pl., Denver, Colo. (303) 744-6329.
Coakley, Boyd & Abbett, Inc., 1424 Highland Ave., Needham, Mass., (617) 444-5470. Branch Office: Waterbury, Conn.
Cohn & Shane, Inc., 1323 Venice Blvd., Los Angeles, Calif., (213) 388-9374. Branch Offices: Menlo Park, Calif.; Phoenix, Ariz.; Bellevue, Wash.
Colavecchio, V., 14 Daffodil La., Cos Cob, Conn., (203) 869-3945.
Cole, G. MsL., Co., 6514 W. Higgins Rd., Chicago, Ill., (312) 774-3535. Branch Office: Madison, Wis.
Col-lins-Co., Inc., Box 13189, Orlando, Fla., (305) 423-7615, TWX: 810-850-0134. Branch Offices: Huntsville, Ala.; Marietta, Ga.; Winston Salem, N.C.
Collins Carlson Hempe Lectroreps, Inc., Box 10719, Kansas City, Mo., (816) GL 3-3203. Branch Offices: Des Moines, Iowa; E. St. Louis, Ill.
Colucci, R. A., Co., 230 Mineola Blvd., Mineola, N.Y., (516) 746-0397.
Commercial Plastics & Supply Corp., 2200 Vantage, Dallas, Texas, (214) 631-8170. TWX: 73-2532.
Compar Albany, Inc., 6 Highland Ave., Albany, N.Y., (518) 489-7408, TWX: 710-441-8224. Branch Offices: Endwell, N.Y.; Fairport, N.Y.; N. Syracuse, N.Y.
Compar Chesapeake, Inc., 7 Church La., Baltimore, Md., (310) 484-5400,
Compar New England, 88 Needham St., Newton Highlands, Mass., (617) 969-7149, TWX: 710-335-1686. Branch Office: Hamden, Connecticut.
Compar New York, 335 Crossman Pk. Dr., Woodbury, N.Y., (516) 921-9393, TWX: 510-221-2170.
Compar Philadelphia, 15 Potter St., Haddonfield, N.J., (609) 429-0679, TWX: 710-896-0679.
Compar Rocky Mountain, 84 W. First St., Scottsdale, Ariz., (602) 947-4336, TWX: 910-950-1293. Branch Offices: Albuquerque, N.M.; Englewood, Colo.
Compar Southwest, 8609 N.W. Plaza Dr., Dallas, Texas, (214) 363-1526, TWX: 910-861-4249. Branch Office: Houston, Texas.
Compar Twin Cities, Box 16095, Minneapolis, Minn., (612) 922-7011.
Component/Insulation Corp., 14235 Detroit St., Cleveland, Ohio, (216) 521-3570. Branch Office: Birmingham, Mich.
Component Marketers, Inc., 151 Valley Rd., Montclair, N.J., (201) 746-6717. Branch Office: Teaneck, N.J.
Components for Elctrn., Inc., 60 Midvale Rd., Mountain Lakes, N.J., (201) TWX: 710-987-8395.
Components, Inc., Box 50277, Tulsa, Okla., (918) 583-9149.
Components Inc., 7461 N. Linden La., Cleveland, Ohio, (216) 842-2737, TWX: 810-427-9151. Branch Office: Cincinnati, Ohio.
Components for Indus., 416 Franklin St., Fayetteville, N.Y., (315) 637-9601.
Components Sales Calif.; Inc., 11484 Oxnard St., N. Hollywood, Calif., (213) 980-3400, TWX: 910-499-2174.
Components Sales Corp., 221 E. Hartsdale Ave., Hartsdale, N.Y., (914) 725-1050. Branch Office: Lexington, Mass.
Comptronics 3220 16th Ave. W., Seattle, Wash., (206) AT 4-4842, TWX: 910-444-1638.
Comtronic Assocs., 1551 Franklin Ave., Mineola, N.Y., (516) PI 1-8966.
Connors, Inc., 2241 Stacey Dr., Denver, Colo., (303) 428-1575.
Conover, C. E., & Co., Inc., 333 Passaic Ave., Fairfield, N.J. (201) 288-1400, TWX: 710-734-4342. Branch Offices: Framingham, Mass.; Cornwell Hgts., Pa.; E. Farmingdale, N.Y.; Miami Springs, Fla.
Conover, L. C., Assocs., Chester Springs, Penna., (215) 827-7261.
Conrow Co., 3300 Wyoming, Kansas City, Mo., (816) 531-6065.
Control Equip. Co., Inc., 3166 Maple Dr., N.E. - Rm. 134, Atlanta, Ga. (404) 237-1688. Branch Offices: Birmingham, Ala.; Daytona Beach, Fla., Memphis, Tenn.
Control Equip. Co., 265 Cross Rd. Sq., Salt Lake City, Utah, (801) 487-7741.
Controlcraft Co., 211 Main St., W. Chicago, Ill., (312) 653-4010.
Cook X-Ray Co., Box 10105, Tampa, Fla., (813) 839-5561. Branch Office: Largo, Fla.
Cooper Clement Assoc., 835 Glenside Ave., Wyncote, Pa., (215) 548-5450.
Cooper, H. D., Co., 7634 N. Eastlake, Chicago, Ill., (312) 274-5566.
Costello, Little & Co., 8737 Venice Blvd., Los Angeles, Cal., (213) 870-5951. Branch Offices: Palo Alto, Calif.; Dallas, Texas; Aylesbury, Bucks. Eng.
Countryman Assocs. Co., 1821 University Ave. - Ste. 220 South, St. Paul, Minn., (612) 645-9151, TWX: 910-563-3564.
Covert & Newman Co., 310A, 300 Mt., Lebanon Blvd., Pittsburgh, Pa., (412) 563-0303.
Cowperthwait & Brodhead, 570 Hillside Ave., Needham Heights, Mass., (617) 444-9410.
Cozzens & Cudahy, Inc., 9501 W. Devon Ave., Rosemont, Ill., (312) 825-1144, TWX: 910-253-1820. Branch Offices: Medina, Ohio,; Indianapolis, Ind.; Royal Oak, Mich.; Minneapolis, Minn.; St. Louis, Mo.
Craft Assocs. Co., Box 11716 Atlanta, Ga., (404) 237-2282. Branch Offices: Huntsville, Ala.; Maitland, Fla.
Crane & Egert Corp., 146 Meacham Ave., Elmont, N.Y., (516) 488-2100, TWX: 510-223-0417.
Crest Assocs., Inc., 7001 N. Clark St., Chicago, Ill., (312) 274-2640.
Crockett Engrg. Co., Box 47287, Dallas, Texas, (214) ME 7-6120.
Crockett Sales Co., 2204 Griffin, Dallas, Texas. (214) 748-8209.
Cuesta, J. E., & Co., Inc., Valley Forge, Pa., (215) 265-5800, TWX: 510-660-1484. Branch Office: Greenbelt, Md.
Cullen, H. A., & Assocs., 1595 Selby, St. Paul, Minn. (612) 646-7371, TWX: 910-576-2740.
Cummings & Assocs., 4772 So. Kalamath St., Englewood, Colorado, (303) 789-3449.
Cunningham, W. L., & Assocs., 435 Addison, Elmhurst, Ill., (312) 832-0905.

D

DB Assocs., Inc., 3307 Erie Blvd., Dewitt, N.Y., (315) 446-0220. Branch Offices: Buffalo, N.Y.; Syracuse, N.Y.
D & O Engrg. Co., Inc., Box 1800, Wichita, Kansas, (316) AM 4-7358, TWX: 910-741-6916. Branch Office: Dallas, Texas.
Dage Corp., 757 Main St., Stamford, Conn., (203) 324-3123, TWX: 710-474-2490.
Dailey, R. G., Co., Inc., 2801 S. State, Ann Arbor, Mich., (313) 668-6908.
Dahlin Assocs., Box 2375, Dallas, Texas, (214) 521-2939.
Dal-Tech Devices, Inc., 366 N. Broadway, Jericho, N.Y., (516) 433-7448.
Dannemiller-Smith, Inc., Box 20956, Dallas, Texas, (214) 357-8247, TWX: 910-861-4534. Branch Office: Houston, Tex.
Darbury Corp., 437 Cherry St., W. Newton, Mass., (617) 244-2053, TWX: 710-325-6758.
Darger Co., 211 S. 2nd W., Salt Lake City, Utah, (801) 355-2873.
Darnold, D. H., Box 582, Downers Grove, Ill., (312) 969-7612.
Data Engrg. Corp., 777 S. Central Exp., Richardson, Texas, (214) 231-4846. Branch Offices: Houston, Texas; Tulsa, Okla.; San Antonio, Texas.
Data-Rep Assocs., Inc., Box 645, Ridgewood, N.J., (201) 447-0660. Branch Offices: Huntington Sta., N.Y.; Norristown, Pa.
Datacom Assocs., Box 4321, San Fernando, Calif., (213) 367-9111.
Daugherty, F. A., Co., 6025 Mayfield Rd., Cleveland, Ohio, (216) 449-1122. Branch Office: McMurray, Pa.
Davidson Assocs., Inc., 2920 Nebraska, Santa Monica, Cal., (213) 451-5761, TWX: 910-343-6869.
Dean, B., Inc., 714 W. Clinton, Ithaca, N.Y., (607) 272-2187, TWX: 510-255-5876
Dearie, J. P., Co., 239 Boulevard, Mountain Lakes, N.J., (201) 344-4848. Branch Offices: Philadelphia, Pa.; Syracuse, N.Y.
DeBeck Assocs., Inc., 2119 Grand, St. Paul, Minn., (612) 690-1557.
DeCew, A. E., Agency, Inc., Box F, Sodus, N.Y., (315) 483-3261.
Deere Elctn., Inc., 20440 Town Center La., Cupertino, Cal. (408) 257-3040.
Del Bucchia, R., & Assocs., 15 Southgate Ave., - Ste. 225, Daly City, Calif., (415) 756-8414.
Delaney, H. R., Sales, 78 Sweetbriar Dr., Apt. 6, Clark, N.J., (201) 382-7643.
Delta Sales Inc., 1407 N. Illinois St., Indianapolis, Ind., 631-4136.
Denco Inc., - Data Engrg. Co., 500A E. Godfrey Ave., Philadelphia, Pa., (215) 725-9000, TWX: 710-670-9394.
Denning Assoc., Box 491, Wakefield, Mass., (617) 245-4986. Branch Office: E. Orange, N.J.
Deskin, A., Sales Corp., 1565 Louvain St. W., Montreal, Que., Canada, (514) 384-1420, TWX: 610-421-3793. Branch Offices: Toronto, Ont., Can.; Vancouver, B.C., Can.
Detwiler, L. K., 443 Broad St., Newark, N.J., (201) 621-9080.
DeVoe, L. M., Co., 665 E. 61st St., Indianapolis, Ind., (317) 257-1227, TWX: 810-341-3284.
DeVos-Prinz Sales Corp., 1819 E. Kenilworth, Milwaukee, Wisc., (414) 272-0356.
Dewar & Assocs., 6361 First Ave. S., Seattle, Wash., (206) 763-2233.
Dewco Sales, Inc., 6915 San Fernando Rd., Glendale, Calif., (213) 894-6101, TWX: 910-498-2223. Branch Office: Palo Alto, Calif.
DiBlasi, J., Assoc., Inc., 14 Vanderventer Ave., Port Washington, N.Y., (516) 767-0470.
Dickelman, L. H., Co., 13331 Puritan St., Detroit, Mich., (313) 273-0806. Branch Office: Cleveland, Ohio.
Diethert, R., Co., Inc., 2030 W. Montrose Ave., Chicago, Ill., (312) 561-7627, TWX: 910-221-2916. Branch Offiices: Waukesha, Wisc.; Gastonia, N.C.; Indianapolis, Ind.

Dillon Stevens & Co., 1610 S. Bonnie Brae St., Los Angeles, Calif., (213) 747-9221. Branch Office: Burlingame, Calif.
Dipro, Inc., 115 Progress Pkwy., Maryland Hghts, Mo., (314) 432-3780.
Director, M., Assocs., 115-62 237 St., Elmont, N.Y., (516) 285-6823.
Diversified Devices, Box 241, King Of Prussia, Penna., (215) 265-7925.
Dolfuss, C. H., Jr., & Co., 2108 Payne Ave., Cleveland, Ohio, (216) 771-1270. Branch Office: Dayton, Ohio.
Dorado Elctrn., Inc., 13615 Victory Blvd., Van Nuys, Calif., (213) 873-4124, TWX: 910-495-1803. Branch Office: San Diego, Calif.
Dorton Enterprises, Inc., Box 1297, Scottsdale, Ariz., (602) 946-6213.
Doss Elctrn., Inc., 6660 Security Blvd., Baltimore Md., (301) 994-1900, TWX: 710-862-9162. Branch Offices: Vienna, Va.; Severna Pk., Md.
Dougherty, J. A., Sales Co., 320 Hillen Rd., Towson, Md., (301) 823-0431.
Douglas, C H., 1110 S. Brentwood Blvd., St. Louis, Mo.
Dowell, T. L., Inc., 7208 W. 80th, Overland Park, Kans., (913) 649-6069. Branch Offices: Des Moines, Iowa; St. Louis, Mo.
Dowers, A. A., Co., 2918 E. Florence Ave., Huntington Park, Calif., (213) 582-5105, TWX: 910-321-4275. Br. Offices: Daly City, Calif.; Phoenix, Ariz.
Doyle, W. J., Co., 7426 N. Western Ave., Chicago, Ill., (312) 274-6685
Drake, R. S., Assocs., Inc., 6133 Maynard Ave. S., Seattle, Wash., (206) 763-2755, TWX: 910-444-2030
Drew, B., & Assocs., 6712 Central Ave., St. Petersburg, Fla., (813) 345-0181.
Drury, D. W., Co., 16621 Mark Twain, Detroit, Mich., (313) 836-3732.
Duckett, G., Sales Co., Box 29067, Atlanta, Ga., (414) 451-3529. Branch Offices: Greensboro, N.C.; Miami, Fla.; Huntsville, Ala.; Orlando, Fla.
Dudek, R. C., & Co., Inc., 10546 W. Pico Blvd., Los Angeles, Calif., (213) 836-0335, TWX: 910-340-6435. Br. Offices: Palo Alto, Calif.; Portland, Ore.
Dynamic Assocs.,/LeasaMetric, Inc., 2500 S. La Cienega Blvd., Los Angeles, Calif., (213) 837-0123. Branch Office: Burlingame, Calif.
Dynamic Sales Co., Box 834, Red Bank, N.J., (201) 747-5353.
DynaSales Co., 5331 E. Olympic Blvd., Los Angeles, Cal., (213) 268-1175.
DynaRep Tech. Services. 5070 Lee Hghwy., Arlington, Va., (703) 536-5088.

E

E-A, Inc., 1406 Shoemaker Rd., Baltimore, Md., (301) 825-2385. Branch Offices: District of Columbia; Philadelphia, Pa.
E. C. I. Div., Eastern Components, Inc., 1349 W. Cheltenham Ave., Philadelphia, Pa., (215) 927-6262. Branch Office: Landover Hills, Md.
E. E. Enterprises, Inc., 5901 Noble Ave., Van Nuys, Calif., (213) 787-5360, TWX: 910-495-1759.
E. E. Specialists, Inc., Box 956 Acton, Mass., (617) 259-9200., Branch Office: Bristol, Conn.
E. R. A., Inc., 330 Great Neck Rd., Great Neck, N.Y., (516) 482-9320, TWX: 510-223-0836
Earl Assocs, 1638 Kona St., Honolulu, Hawaii, (808) 949-6953.
Earl & Brown Co., Inc., 422 First Ave. W., Seattle, Wash. (206) 284-1121. Branch Office: Portland, Ore.
East Coast Liaison, Inc., Box 243, Lutherville, Md., (301) 252-1288.
Eastronics, 2401 Blueridge Ave., Wheaton, Md., (301) 942-2363.
Eckersley, J. W., 3150 S.W. Hamilton St., Portland, Ore., (503) 246-3183.
Edcom, Inc., 815 Washington St., Newtonville, Mass., (617) 969-9710, TWX: 710-335-6767. Branch Office: New Haven, Conn.
Egbert Eng. Assoc., 801 Welch Rd. - Ste. 214, Palo Alto, Calif., (415) 326-1387, TWX: 910-373-1278.
Egert S. S., Co., Inc., 146 Meacham Ave., Elmont, N.Y., (516) 488-2255, TWX: 510-223-0417
Eicher-Richards Co.,2727 N.E. Blakeley St., Seattle, Wash., (206) LA. 3-7888.
Electric Sales Corp., 9 E. 22nd St., Minneapolis, Minn., (612) 335-7734, TWX: 910-576-2755.
Electrical Apparatus Co., Inc., 1200 Soldiers Field Rd., Boston, Mass., (617) 782-7440.
Electrical Components, Inc., 355 Crider Ave., Moorestown, N.J., (609) 235-3012.
Electro Comp Sales, Inc., 5129 W. Devon Ave., Chicago, Ill., (312) 763-3636, TWX: 910-221-5674.
Electro Sales Assoc., 851 E. 222 St., Cleveland, Ohio, (216) 261-5440. Branch Offices: Dayton, Ohio; Detroit, Mich.; Pittburgh, Pa.
Electro-Mation Assocs., 1137 Cole St., Birmingham, Mich., (313) 564-6517.
Electro-Mechanical Insts., Inc., 1388 E. Walnut St., Pasadena, Calif., (213) 681-2748.
Electro-Plast, Inc., 2 Radnor Station Bldg., Radnor, Pa., (215) MU 8-5581.
Electronic Apparatus Co., Box 7403, Minneapolis, Minn., (612) 588-1752.
Electronic Components & Servcs., 611 Trapello Rd., Waltham, Mass., (617) 894-6921.
Electronic Devices & Controls Co., 1016 Black Horse Pike, Glendora, N.J., (609) 939-2200.
Electronic Fasteners Co., 10 Center Place, Yonkers, N.Y., (914) 423-2900.
Electr. Mfgrs. Consultants, Inc., 1619 N. Royer, Colorado Springs, Colo., (303) 636-5131. Branch Offices: Scottsdale, Ariz.; Salt Lake City, Utah.
Electronic Mktg Assocs., 11501 Huff Ct., Kensington, Md., (301) 946-0300, TWX: 710-325-9645. Branch Office: King of Prussia, Pa.
Electronic Rep. Assoc., 600 S. Michigan Ave., Chicago, Ill., (312) 427-0100.
Electronics Mktg. Assocs., Box 5199, San Mateo, Cal. (415) 341-6666.
Elliott C. P., Co., 6617 Delaware St., Denver ,Colo., (303) 255-2844.
Elliot, G., Inc., 13615 Victory Blvd., Van Nuys, Calif., (213) 873-6862.
Elliott, L., Co., Inc., Box 428, Missouri City, Texas. (713) 499-1571. Branch Offices: Addison, Texas; Kansas City, Mo.
Ellis D., Co., 123 N. Marengo, Pasadena, Calif., (213) 681-9108.
Ellis-Haber-Ramp Corp., 2315 Broadway, New York, N.Y., (212) 799-4040.
Ellis, G. B., Sales Co., 2425 Leghorn, Moutain View, Calif., (415) 967-5531.
Elsner-Rambo Co., 2526 Hyperion Ave., Los Angeles, Calif., (213) 664-2928, TWX: 910-321-4257.
Emlen-Peterson Co., 34 West Ave., Wayne, Pa., (215) 687-3535.
Engel G. C., & Assocs., Inc., 40 W. Ridgewood Ave., Ridgewood, N.J., (201) 444-1400, TWX: 710-988-5611. Branch Office: Hatboro, Pa.
Engelbretson, W., Co., 906 Ottawa Ave., St. Paul, Minn., (612) 222-2338.
Engle, K. D., Co., Inc., 3621 W. Devon Ave., Chicago, Ill., (312) 539-1820, TWX: 910-221-5351. Branch Office: Indianapolis. Ind.
Engelman, A. Co., Box 12091, Memphis, Tenn., (901) 458-6263.
Engineered Prods., Inc., 28 Essex St., Lodi, N.J., (201) 845-6668.
Engineered Sales Co., Inc., 4738 N. Harlem, Chicago, Ill., (312) 867-8434, TWX: 910-221-0223.
Engineering Assocs, Inc., 2912 Stanley, Fort Worth, Texas.
Engineering Sales Assocs., Box 544, Scottsdale, Ariz., (602) 945-5781.
Engineering Services Co., 6717 Vernon Ave., St. Louis, Mo., (314) 726-2233. Branch Offices: Prairie Village, Kan.; Cedar Rapids, Iowa.
Equipment Sales Co., Inc., Box 5396, Hamden, Conn., (203) 248-5581. Branch Offices: Bedford, Mass.; Cooperstown, N.Y.
Erdman, K. B., Co., Inc., 7906 Montgomery Ave., Philadelphia, Pa., (215) CA 4-1833.
Erde-Haviland, 333 Hempstead Ave., Malverne, N.Y., (516) 599-6500.
Erlanger Sales Co., 4217 W. Jefferson Blvd., Los Angeles, Calif., (213) 731-2238.
Ernest. R. D., 12818 Puritan Ave., Detroit, Mich., (313) UN 1-7311.
Eschner & Keranen, Inc., 20 N. Wacker Dr., Chicago, Ill., (312) 236-1533.
Estersohn Assocs., Inc., 541 Willow Grove, Pa., (215) 657-1414.
Ewing-Foley, Inc., Box 1107, Los Altos, Cal.

F

Fact-Tronics, Box 745, Casselberry, Fla., (305) 838-5607.
Fairbanks, H. J., Co., Box 124, Wynnewood, Pa., (215) 642-5816.
Fairlane Elctrn., Inc., Box 335 Long Valley, N.J., (212) 691-2530.
Falck, F. W., Co., Box 1733 La Jolla, Calif., (714) 233-3341.
Falk-Baker Assocs., 382 Franklin Ave., Nutley, N.J., (201) 661-2430.
Fara, R., Assocs., 1295 Northern Blvd., Manhasset, N.Y., (516) MA 7-6428. Branch Office: Cranford, N.J.
Farris, R. W., Co., Inc., 1715 Baltimore, Kansas City, Mo., (816) 421-1751. Branch Office: Maryland Hghts., Mo.
Fausett, F., & Co.. Inc., Box 278, Smyrna, Georgia, (404) 436-5169. Branch Offices: Orlando, Fla.; Salem, Va.; Greenwood, S.C.; Memphis, Tenn.
Featherstone Saies Co., Box 726, Sunnyvale, Calif., (408) 734-2663.
Fedotin, L. S., 3680 Dorset Dr., Dayton, Ohio, (513) 275-9345.
Feinberg J. L., Assoc., Inc., 33 Shirley La., New London, Ct. Branch Office: Reading, Mass.
Feldman, G., Assocs., 523 Norton P'kway, New Haven, Conn. (203) 776-7843.
Feldman, H. Co., Box 66367, Los Angeles, Calif., (213) 870-5973.
Fenole, J. E., Co., inc., Box 128, Goleta, Cal., (805) 964-5811.
Ferguson, T., Sales Co., Inc., Box 3893, Rochester, N.Y., (716) 482-7757. Branch Office: DeWitt, N.Y.
Ferris, F. R. Co., Box 42067, Los Angeles, Calif., (213) 254-6161
Fetty/Schoenduve Inc., 7407 Melrose Ave., Los Angeles, Calif., (213) 651-4050, TWX: 910-321-2385. Branch Office: Palo Alto, Calif.
Fieldtec, Inc., 4242 Campus Dr., Newport Beach, Calif., (714) 540-4000. Branch Office: Palo Alto, Calif.
Finlay Sales Co., Inc., 45 North Broad St., Ridgewood, N.J., (201) 652-0088
Fish Assocs., 149 Roosevelt Dr., Utica, N.Y., (315) 732-1008. Branch Office: Rochester, N.Y.
Fisher Sales, Inc., 4820 W. 77th St., Minneapolis, Minn., (612) 920-6577, TWX: 910-576-2712
Fisher, S. Sales Corp., 161 Cedar La., Teaneck, N.J., (201) 836-6661
Fishman Assocs., 2060 E. 54th St., Indianapolis, Ind., (317) 251-2401
Fistell, H. Mfg. Rep., 1812 S. Halsted St., Chicago, Ill., (312) HA 1-6563
Fitz, L. R. Co., 6038 N. Newburg Ave., Chicago, Ill., (312) 631-5488
Fitzsimmons Assocs. Inc., 6774 N. W. Hghwy, Chicago, Ill., (312) 775-6990
Fixman, G. Engrg. Co., 8160 Stanford Ave., St. Louis, Mo.
Flaxman, E. Co., 52 James Ct., Glenview, Ill., (312) 729-1880
Flora, J. M. Inc., 165 W. Liberty, Plymouth, Mich., (313) 453-4296
Florence & Meyer, Inc., 406 W. 34th St., Kansas City, Mo., (816) 561-7282, TWX: 910-771-3058. Branch Offices: Berkeley, Mo.; Wichita, Kan.
Floring, C. W. & Murray, H. R. Inc., Box 11, Syracuse, N.Y., (315) 446-5555. Branch Office: Webster, N.Y.
Foley, A. A., Assocs., Box 155, Moorestown, N.J., (609) 663-4545.
Forsberg Sales, 646 Summer St., Brockton, Mass., (617) 522-6300, TWX: 710-345-0194. Branch Office: N. Haven, Conn.
Foster, M., Co., Inc., 228 S. Cedar Lake Rd., Minneapolis, Minn., (612) FR 4-2612
Franklin, R E. Co., 3007 S. Post Oak Rd., Houston, Texas, (713) 621-5861
Franklin Sales Co., 2149 S. Clermont, Denver, Colo.
Franklin, W. A. Sales Corp., 2 Standish Terr., Syracuse, N.Y. (315) 446-1120, TWX: 710-541-0433. Branch Offices: Rochester, N:Y.; Whitesboro, N.Y.
Frauman Assocs., Box 969, Menlo Park, Calif., (415) 322-8461, TWX: 910-373-1166
Frederick & Meily Corp., 1601 S. Hanna St., Fort Wayne, Ind., (219) 745-2461
Freed, L. & Co., Box 417, Larchmont, N.Y., (914) TE 4-6510
Freeman, L. C. & Assoc., 484 Bloomfield Ave., Montclair, N.J.
Friedman Assocs. Inc., 110 Halsted St., E. Orange, N.J., (201) 673-2500. Branch Office: Garden City, N.Y.
Friedman-Smith Electrn Sales Inc., 519 S. 5th Ave., Mt. Vernon, N.Y., (914) 664-4866
Fuller, L. C. Jr., & Co., 32 Rittenhouse Pl., Ardmore, Pa., (215) MI 2-2468
Furman, C. W. Co., Box 4208, Charlotte, N.C.

G

G & H Sales Co., Box 37416, Cincinnati, Ohio, (513) 761-6185, TWX: 513-577-1239. Branch Offices: Novelty Ohio; Indianapolis Ind.; Fort Wayne Ind.; Southfield Mich.; Louisville, Ky.
Gallagher Co., 15 Ritchie Ave., Cincinnati, Ohio, (513) 761-1288.
Gans-Fryling, Inc., 2030 16th St. No., Arlington, Va., (703) 527-3262
Gardner, R. M. Co., 26940 Lyndon St., Detroit, Mich., (313) KE 1-1658
Garrettson Co. Inc., 99 Hillside Ave., Williston Park, N.Y., (516) 747- 610, TWX: 510-222-4232. Branch Offices: Philadelphia, Pa.; Needham, Mass.
Garten, L. & Assocs., 375 Passaic Ave., Fairfield, N.J., (201) 226-7800, TWX: 710-734-4348. Branch Office: Abington, Pa.
Gassner & Clark Co., 6644 N. Western Ave., Chicago, Ill., (312) 764-6121, TWX: 910-221-0107
Gates, A. W., 60 Ansaldi Rd., Manchester, Conn.
Gates, F. Y. Co., Inc., 455 E. 4 S., Salt Lake City, Utah, (801) 359-1101. Branch Offices: Albuquerque, N.M.; Denver, Colo.; Tempe, Ariz.
Gawler-Knoop Co., 14 Beaufort Ave., Rosetand, N.J., (201) CA 6-4545. Branch Offices: Richboro, Pa.; Rockville, Md.

Gay, G. J. Inc., Box 124, Brockport, N.Y., (716) 637-3162. Branch Offices: Fulton, N.Y.; Willoughby, Ohio; Marlton, N.J.
Geartner Assocs. Inc., 350 Lincoln Rd., Miami Beach, Fla., (305) 531-0200. Branch Office: Maitland, Fla.
Gee Assocs. Inc., 14474 Dickens St., Sherman Oaks, Calif., (213) 788-5961
Geist, W. K. Co., 1205 Air Way, Glendale, Calif.,(213) 245-9501. Branch Office: San Jose. Calif.
Gentry Assocs. Inc., 550 N. Bumby Ave., Orlando, Fla., (305) 841-7740, TWX: 810-850-0136. Branch Offices: Huntsville, Ala.; Burlington, N.C.; St. Petersburg, Fla.; Melbourne Beach. Fla.; Atlanta, Ga.
George, J. W. & Chase, T. S., 2903 Montfichet Ln., Winter Park, Fla., (305) 671-5954. Branch Office: Pinellas Park, Fla.
Gerber Sales Co., Inc., 176 Second Ave., Waltham, Mass., (617) 891-8040, TWX: 710-324-1937. Branch Offices: New Haven, Conn.; Longmeadow, Mass.
Gianaras Sales, 7051 W. Wilson Ave., Chicago, Ill., (312) 774-4600, TWX: 910-221-5223
Gibb, C. R. Co., 1311 W. 25th St., Minneapolis, Minn., (612) 377-1200
Gilbert, J. M. Co., 131 E. 70th St., Kansas City, Mo.
Gilbert Sales Assoc., 70 Glenwood Rd., Ridgewood, N.J., (201) GI 4-2604
Gillett, G. M., & Assocs., Box 99035, Seattle, Wash., (206) 284-3344.
Gilway Sales Co., Box 584, Newburyport, Mass., (617) 465-7568
Ginsbury, S. Ltd., 72 W. 45th St., New York, N.Y., (212) 687-3213
Gislason Sales, Inc., 617 Case Bldg., Rochester, N.Y., (716) 454-4741, TWX: 510-253-2932
Glass, E. Assoc., 250 W. 57th St., New York, N.Y., (212) JU 6-8440
Glassman, S. Assoc. Inc., 28 Prestwick Terr., Glen Cove, N.Y., (516) 676-1039. Branch Office: Nutley, N.J.
Glidden Engrg. & Equip. Co., 8609 Northwest Plaza Dr., Dallas, Texas, (214) 363-6539. Branch Office: Houston, Texas
Golten, J. Co. Inc., 4319 W. Irving Park Rd., Chicago, Ill., (312) 725-7870
Goode, J. E. Sales Co., 325 W. Huron, Chicago, Ill., (312) MI 2-2022
Goode, J. J. Assoc., 44 Ledgewood Rd., Weston, Mass., (617) 235-3900
Goory Sales Co., 19555 Henry Rd., Cleveland, Ohio, (216) 331-2055
Goudy, W. H. Assocs., Box 70, Centerport, N.Y., (516) 271-8830
Graham, W. Assoc., 610 Latham Dr., Wynnewood, Pa., (215) 649-3027/9822
Gramer & Co., 110 W. Camelback Rd., Phoenix, Ariz.
Grant Sales Co., 1415 S. Second St., Minneapolis, Minn., (612) 332-6955
Gray, H. Assoc. Inc., 20 Foster St., Bergenfield, N.J., (201) 384-3643, TWX: 710-991-9772
Gray & Reed Assocs. Inc., 9 Dunford St., Huntington Sta., N.Y., (516) GE 3-3333. Branch Office: Westfield, N.J.
Graydon-Sherman, Inc., 230 Madison Ave., Morristown. N.J., (201) 538-9246, TWX: 710-541-0241. Branch Offices: Fayetteville, N.Y.; Great Neck, N.Y.; Philadelphia, Pa.
Greene, D. Organization, Inc., Box 290, Bedford, Mass., (617) 275-6400, TWX: 710-326-1644 7
Green, J. A. Co., 7118 Envoy Ct., Dallas, Texas, (214) 631-7450. Branch Offices: Houston, Texas; Tulsa, Okla.
Green, L. F. & Assocs., 5218 W. Diversey Ave., Chicago, Ill., (312) 286-6824. Branch Offices: Minneapolis, Minn.; Waukesha, Wisc.
Greenleaf, H. Co., 20412 Center Ridge Rd., Cleveland, Ohio, (216) 333-5480. Branch Office: Cincinnati, Ohio
Gregory, G. Assoc., 7 Erie Dr., Natick, Mass., (617) 235-9070. Branch Office: Cheshire, Conn.
Griffin-Campbell, Inc., 25 Skippack Pike, Ambler, Pa., (215) 646-7535
Griffin, T. Co., 46 Darby Rd., Paoli, Pa., (215) 647-1550
Grimm, Siegel Assocs. Inc., 246 Clifton Ave., Clifton, N.J., (201) 773-5010
Gross, H. R. & Co., Box 4607, Clearwater, Fla., (813) 446-6649
Grossman, H. Assocs., 519 S. Fifth Ave., Mount Vernon, N.Y.
Grossman Sales Co. Inc., 339 Auburn St., Auburndale, Mass., (617) 527-7753
Guenther, J. B. Inc., 4533 N. Central Expwy., Dallas, Texas, (214) 528-6286. Branch Office: Houston, Texas

H

H. A. F. Spectrum Assocs. Inc., 35 Broadfield Rd, New Rochelle, N.Y. (914) NE 2-3800
H K Sales Inc., Box 2087, Menlo Park, Calif., (415) 369-6244
HMR, Inc., 9 E. 22nd St.. Minneapolis, Minn., (612) 335-7734, TWX: 910-576-2755
HRC Assocs., 390 Plandome Rd., Manhasset, N.Y., (516) 627-4644, TWX: 510-223-0821
Hahn Sales Co., Box 52798, Baton Rouge, La., (504) 356-2596
Haight, F. H., Co., 3212 Eastlake Ave., E. Seattle, Wash.
Halinton, H. Engrg. Assts. Inc., 6418 N. Central Ave., Chicago, Ill., (312) 763-2131
Hamilton, Grayden & Flemmer, Inc.. Hamilton Rd., Hopkins, Minn., (612) 941-1120, TWX: 910-576-2861
Hammond Assocs., 34 Lincoln Ave., Greenwich, Conn., (203) 661-9410
Hanna, R. L. Co., Box 202, Palatine, Ill., (312) 358-3940
Hansen Assocs. Inc., 215 Brookside Ave., Ho-Ho-Kus, N.J., (201) 652-7055
Hansen, C. A., 1406 S. Grand Ave., Los Angeles, Calif., (213) 748-6191
Harmon, W. S. Co., 6118 Venice Blvd., Los Angeles, Calif., (213) 937-1460, TWX: 213-937-3438
Harris & Aldrich Sales, Inc., 320 Northern Blvd., Great Neck, N.Y., (516) 466-4122
Harris, B. Co., 3440 Overland Ave., Los Angeles, Calif., (213) 870-9231, TWX: 910-340-6758. Branch Offices: Palo Alto, Calif.; Bellevue, Wash.; Phoenix, Ariz.
Harris, S. A. Co., 945 Great Plain Ave., Needham, Mass., (617) 444-4780
Harris-Hanson Co., 2814 S. Brentwood Blvd., St. Louis, Mo., (314) 962-9895, TWX: 910-760-1650. Branch Office: Kansas City, Mo.
Harriss, L. H. Co., 204 E. Hillsdale, San Mateo, Calif., (415) 341-2909
Hart, F. H., 114 Pond St., Nahart, Mass., (617) 581-0381
Hasco, 8940 Ellis, Los Angeles, Calif., (213) 870-6664
Hasse & Assocs. Inc., 3825 York Ave. N., Minneapolis, Minn., (612) 588-0551
Hatch, E. B. Co. Inc., 43 Upham St., Melrose, Mass., (617) 665-0055
Hatfield, R. E. Co., 2680 Lititz Pk., Neffsville, Pa., (717) 569-2621
Hayden, P. Assoc., Box 90668, East Point, Ga., (404) 766-0261. Branch Offices: Huntsville, Ala.; Riviera Beach, Fla.
Hays Co., Inc., 777 S. Central Expwy, Richardson, Texas, (214) 231-1426
Heaton, J. S. Co., Box 2087, Menlo Park, Calif., (415) 369-4671, TWX: 910-378-5415
Hecht, Henschen and Assocs. Inc., 2435 E. University Dr., Phoenix, Ariz., (602) 275-4411, TWX: 910-951-0635. Branch Office: Palo Alto, Calif.
Heffernan, H. J. Co., 1123 N. Irving St., Arlington, Va., (703) 522-6666. Branch Offices: Hicksville, N.Y.; Fort Washington, Pa.
Heim & Smolen, Inc., 3360 Barham Blvd., Hollywood, Calif., (213) 462-7357, TWX: 910-321-4042
Heimann Co., Inc., 5603 Lyndale Ave. S., Minneapolis, Minn. (612) 827-5457. Branch Office: Fort Dodge, Ia.
Heller Freedman Assocs., Box 391, Ardmore, Pa., (215) 649-3679
Heller Freedman Assoc., Box 293, Timonium, Md., (301) 252-4780
Helmor Co., 217-18 48th Ave., Bayside. N.Y., (212) BA 4-5361
Henberger, J. C.. Co., 3661 Voltaire St., San Diego, Calif., (714) 223-7114.
Hendrickson, W. A. Co., 766 Country Way, No. Scituate, Mass., (617) 545-0652
Henriks, R. E. & Assocs., 4900 Double Dr., El Monte, Calif., (213) 442-1820, TWX: 910-587-3433
Henry B. Assocs., 1043 Providence Rd., Charlotte, N.C., (704) 375-8958, TWX: 810-621-0515. Branch Offices: Winston Salem, N.C.; Metairie, La.
Herrick, G. L. Co., 845 Canterbury, Westlake, Ohio, (216) 871-8855. Branch Office: Cincinnati, Ohia
Herrmann, C. Assoc., Box 1179, Palo Alto, Calif., (415) 322-4561. Branch Office: Pasadena, Calif.
Hevner, D. S. Co., 1528 Spring Mill Rd., Gladwyne, Pa.
Heyda, B., Co., 3830 Rustic Place, St Paul, Minn., (612) 484-8531.
Hicks, W. M. Inc., 4 Spruce Drive, Roslyn, N.Y., (516) 627-6150
Highsmith, J. L. & Co., 3733 Monroe Rd., Charlotte, N.C., (704) 333-7743. Branch Offices: Huntsville, Ala.; Orlando, Fla.; Richmond, Va.
Hilderbrand, R. H., Fairview Village, Box 166, Montgomery, Pa., (215) 247-6225, TWX: 510-660-0985
Hill & Co., 915 Buder Bldg., St. Louis, Mo., (314) 621-1818
Hill, F. B., Co., 6110 Excelsior Blvd., Minneapolis, Minn., (612) 929-6727, TWX: 910-576-2924
Hill-Blare, Inc., 4570 Campus Dr., Newport Beach, Calif., (714) 546-9030
Hill-Gray Assocs. Inc., 2 Salt Creek La., Hinsdale, Ill., (312) 325-4810
Hilliard Assocs. Inc., Box 186, Abington, Pa., (215) 884-6100
Hilltronics Inc., 13720 Puritan Ave., Detroit, Mich., (313) 342-3242, TWX: 810-243-4069
Hirsh, B. Co., 4013 Leary Way, N.W., Seattle, Wash., (206) 783-3423
Hitchcock, E. R. & Assoc., 1629-K St. NW, Washington, D.C. (202) 296-6899
Hoemig Sales Co., 3405 Butler Court, Fort Wayne, Ind., (219) 483-6913
Hoffman, C. Assocs. Inc., 777 S. Central Exp., Richardson, Tex., (214) 235-3600, TWX: 910-867-4727
Holden, H. A. Inc., 1208 Harmon Pl., Minneapolis, Minn., (612) 336-5353
Holdsworth & Co., Inc., Box 298, Newtown Square, Pa., (215) 356-8550, TWX: 510-662-9028
Holmes, C. E. Co., 107 North Ave., Los Angeles, Calif., (213) 256-2255, TWX: 910-321-3937
Holmes, E. G., & Assoc., 4185 Clairmont Rd., Chamblee, Ga., (404) 451-6161. Branch Offices: Orlando, Fla.; Huntsville, Ala.; Greensboro, N.C.
Homsher, B. F. Co., 418 E. Berry St., Fort Wayne, Ind., (219) 432-1164
Honkamp Sales Co, 11120 W Ruby Ave., Milwaukee, Wisc., (414) 463-2530
Honn, G. E. Co. Inc., 171 King St., San Francisco, Calif., (415) 781-7352
Hooker, S. C. Inc., 2 Winchester Pl., Winchester, Mass., (617) 729-5482, TWX: 710-348-1067. Branch Office: W Hartford, Conn.
Hotze, I. A. Co., Inc., 112 Dewitt St., Syracuse, N.Y, (315) 479-6641, TWX: 710-541-1572
Hopkins, R. S. Co., 15016 Venture, Sherman Oaks, Calif., (213) 788-5501
Houser Assoc. Inc., 188 Water St., Perth Amboy, N.J., (201) 442-3159
Howe & Howe Sales Inc., 4109 N. 18th St., Phoenix, Ariz., (602) 264-7971. TWX: 910-951-1308
Hoyt Sales Corp., 440 Barell Ave., Carlstadt, N.J., (201) 935-0045
Huddleston, F. Assocs. Inc., 408 So. Rosemead Blvd., Pasadena, Calif., (213) 681-3751, TWX: 910-588-3785
Hughes, K. E. Co. Inc., 2175 Lemoine Ave., Fort Lee, N.J., (201) 944-1600, TWX: 710-991-9785
Hughes, R. S. Co. Inc., 5301 E. Sheila St., Los Angeles, Calif., (213) 268-2501. Branch Offices: Los Angeles, Cal.; San Diego, Cal.; Mountain View, Cal.; Berkeley, Cal.; Seattle. Wash.
Humes-Quinlan Sales Co., 242 E. Butler Ave., Ambler, Pa., (215) 646-7250, TWX: 510-661-1585
Hundley Co. Inc., 3282 Fletcher Dr., Los Angeles, Calif., (213) 255-7111. Branch Office: San Francisco, Calif.
Hunt Assocs. Inc., Box 98, Cherry Hill, N.J., (609) 428-6666. Branch Office: Towson, Md.
Hunter, T. B. Assocs., 5653 W. Irving Park Rd., Chicago, Ill., (312) 777-2500. Branch Office: Cedarburg, Wis.
Huntoon, V. J. Assocs. Inc., 908 Belmont Ave., Springfield, Mass, (413) 788-8516. Branch Office: Newton, Mass
Hurlbut, J F. Co., 2240 S. Adams St., Denver, Colo., (303) 756-2046. Branch Office: Granger, Utah
Hutmacher, R. R., Assoc., Inc., 6668 Northwest Hghwy, Chicago, Ill., (312) NE 1-3248. TWX: 910-221-5561.
Hyde Elctrn. Co. Inc., 888 S. Lipan St., Denver, Colo., (303) 936-3456
Hyer Assocs., Inc., 8101 E. Prentice Ave., Englewood, Colo., (303) 771-5424, TWX: 910-935-0706. Branch Offices: Albuquerque, N.M.; Tempe, Ariz.; Salt Lake City, Utah
Hy-Rel Elctrn. Sales Co. Inc., 753 Bergen Blvd., Ridgefield, N.J., (201) 945-7511, TWX: 710-992-8970
Hytronic Measurements, Inc., 4940 E. 39th Ave., Denver, Colo., (303) 388-4081, TWX: 910-931-2597. Branch Offices: Albuquerque, N.M.; Phoenix, Ariz.; Salt Lake City, Utah

I

IBL Engineering & Sales, 219 Preston Royal, Dallas, Texas, (214) 363-2921. Branch Offices: Houston, Texas; Austin, Texas; New Arleans, La.; Tulsa, Okla.; Shawnee Mission, Kans.; Albuquerque, N.M.
I F M—North, 2269 Old Middlefield Way, Mt. View, Calif., (415) 961-2828.
I F M—South, 3455 Cahuenga Blvd., Hollywood, Cal.
I T M Assocs., Box 385, Sudbury, Mass., (617) 443-8414
Ingber. L. K., 842 Commonwealth Ave., Newton Centre, Mass., (617) 332-8574.
Inland Assocs., 6047 Howe Dr., Mission, Kans., (913) 362-2366. Branch Offices: Creve Coeur, Mo.; Boulder, Colo.

Interdom, 4570 Campus Dr., Newport Beach, Calif., (714) 546-9030
Instrument Assocs. Inc., 30 Park Ave., Arlington, Mass., (617) 648-2922, TWX: 710-389-0464. Branch Offices: Hartford, Conn.; Natick, Mass.
Instrument Consultant, Inc., Microwave Div., Box 25, Waban, Mass., (617) 969-3372. Branch Office: Hamden, Conn.
Instrument Consultant, Inc., Box 25, Waban, Mass., (617) 969-3372. Branch Office: Hamden, Conn.
Instrument Dynamics Inc., Wakefield Ind. Pk., Wakefield, Mass., (617) 245-5100, TWX: 710-348-0428. Branche Office: W. Hartford, Conn.
Instrument Lab. Inc., 934 Elliott Ave. W., Seattle, Wash., (206) AT 3-5850. Branch Office: Portland, Ore.
Instrument Lab., 1323 W. 130th St., Gardena, Calif., (213) 770-0650. Branch Office: Palo, Alto, Calif.
Instrument Sales Corp., 221 E. Hartsdale Ave., Hartsdale, N.Y., (914) 725-0800. Branch Office: Lexington, Mass.
Instrumentation Sales Co., Box 403, Ridgewood, N.J., (201) 445-5210, TWX: 710-988-5609
Instrument Specialists, Inc., 1109 Central Ave.. Glendale, Calif. (213) 245-9404, TWX: 910-497-2086. Branch Offices: Santa Clara, Cal.; San Diego, Cal.; Seattle, Wash.
Interstate Marketing Assoc., Box 487, Woodland Hills, Cal., (213) 883-7606, TWX: 910-494-1239. Br. Offices: Phoenix, Ariz.; San Diego, Calif.

J

JD Inds., 226 Faust La., Houston, Texas, (713) HO 5-8278
J. H. Elctn. Sales Co., Box 6844, Towson, Md., (301) 825-4440, TWX: 710-232-1816. Branch Offices: Cherry Hill, N.J.; Poughkeepsie, N.Y.
J & J Assocs. Inc., 225 Crescent St., Waltham, Mass., (617) 899-0160, TWX: 710-324-6356. Branch Offices: Hamden, Conn.; Thompsonville, Conn.
J. R. Sales Engrg, Inc., 7132 N. Harlem Ave., Chicago, Ill., (312) 774-8550, TWX: 910-221-1370
Jackson Elctn. Sales Corp., 71 Valley St., So. Orange, N.J., (201) 763-7900, TWX: 710-999-5517
Jackson, R. W. Co. Inc., 4446 Main St.. Buffalo. N.Y., (716) 389-0200 Branch Office: Fayetteville, N.Y.
Jacobs, M. F. Co., 4160 N. Oakland Ave., Milwaukee, Wisc., (414) 962-7070
JADElectronics Assocs. Inc., Box 5735, Philadelphia, Pa., (215) GL 5-3355. Branch Office: Greenbelt, Md.
Janse, E. A. Assocs., 892 Worcester St., Wellesley, Mass., (617) 235-1623
Jay Co. Inc., 2914 Annandale Rd., Falls Church, Va., (703) 534-7800
Jeffries, S. A., Inc., 105 Forrest Ave., Narberth, Pa., (215) 664-8500. Branch Offices: Pittsburgh, Pa.; Baltimore, Md.; Washington, D.C.
Jensen Inst. Co., 1919 Beverly Blvd., Los Angeles, Calif., (213) 388-9525. Branch Office: San Francisco, Calif.
Jewett Co., 13111 Ventura Blvd., N. Hollywood, Calif, (213) 789-8103, TWX: 910-499-2196
Jobe & Co., 2508 Grenoble Rd., Richmond, Va., (703) 282-6508. Branch Offices: Baltimore, Md.; Norfolk, Va.; Roanoke, Va.
Johnson Assoc., Inc., 471 Washington St., Wellesley Hills, Mass., (617) 235-3977. Branch Office: Stony Creek, Conn.
Johnson Assocs., 5455 Wilshire Blvd., Los Angeles, Calif., (213) 934-0700. Branch Office: Palo Alto, Calif.
Johnson, H. C., Agencies, 111 Mt. Hope Ave., Rochester, N.Y., (715) 232-2688. Br. Offices: Williamsville, N.Y.; Fayetteville, N.Y.; Ballston Lake, N.Y.
Johnson, J. P. Co., Box 8162, 3535 Dell Trail, Chattanooga, Tenn., (615) 624-4128
Johnson, N. Sons, 2801 Far Hills Ave., Dayton, Ohio, (513) 298-0011
Johnston, R., Co., Inc., 1001 Northeast 69th St., Seattle Wash., (206) 524-5170, TWX: 910-444-2258
Jones, D. K. & Assocs., 2026 Maryland Ave., Baltimore, Md., (301) 752-0577. Branch Office: Philadelphia, Pa.
Jones, W. M.. Co., Box 5490, Towson, Md., (301) 823-5721, TWX: 710-232-1838. Branch Offices: Maple Shade, N.J.; Atlanta, Ga.; Orlando, Fla.
Jordan, E. H. & Assocs. Inc., 2024 Glen Dr., Jackson, Mich., (517) 782-0694. Branch Office: Indianapolis, Ind
Joseph Assocs., 6 Grace Ave., Great Neck, N.Y., (516) HU 7-9395
Jubell Assoc., 23760 Miles Ave., Cleveland, Ohio, (216) 662-2884. Branch Office: Dayton, Ohio

K

KLS Assocs., Inc., 387 Passaic Ave., Fairfield, N.J.. (201) 228-2525. Branch Office: New York, N.Y.
K & M Sales Co., 1627 Main St., Kansas City, Mo., (816) 471-1355.
KSE, Inc., Box 35184, Dallas, Texas, (214) 352-8431
KaDell Sales Assocs., 6134 Milwaukee Ave., Chicago, Ill., (312) 774-6815.
Kaelber & Mack Inc., 75 Plandome Rd., Manhasset, N.Y., (516) 627-6620. Branch Office: Wakefield, Mass.
Kagan, H. Assocs., 18 Tilghman Dr., Wayne, N.J., (201) 684-7682. Branch Office: Jamaica, N.Y.
Kahgan Sales Corp., 556 Peninsula Blvd., Hempstead, N.Y., (516) 538-2300
Kahsar, F. E. Sales, Inc., 5229 Glenway Ave., Cincinnati, Ohio, (513) 471-9011. Branch Office: Hudson, Ohio
Kantenberger Co., 1900 Chamber of Commerce Bldg., Houston, Texas, (713) 223-3637. Branch Office: Dallas Texas
Kasrel. J., Sales, 7341 South Kingston Ave., Chicago, Ill., (312) 955-5246.
Kaub, H. & Co., 4970 Jackson St., Denver, Colo., (303) 399-1520
Kaufholz Assocs., Box 227, Newtown Sq., Pa., (215) 356-5000. Branch Office: Baltimore, Md.
Kay Sales Co., 2600 Grand Ave., Kansas City, Mo., (816) 221-8586
Kearns, J. L. Co., 6055 N. E. Glisan St., Portland, Ore., (503) 236-1165
Keefe Elctn. Sales, 15 S. Haddon Ave.. Haddonfield, N.J., (609) 429-4650.
Keene Sales Co., 156 Broad St., Lynn, Mass., (617) 595-1001
Kelley Enterprises, 336 E. Fourth St., Loveland, Colo., (303) 667-1376. Branch Office: El Paso, Texas
Keller Ind. Prods., Inc., 70 Mt. Hope Ave., Rochester, N.Y., (716) 546-4313. Branch Offices: Buffalo, N.Y.; Syracuse, N.Y.
Keller, L. W., & Assocs., 1680 Newbridge Rd., N. Bellmore, N.Y., (516) 785-2826. Branch Offices: Bayside, N.Y.; Flushing, N.Y.; Edison N.J.
Kelly-Schmitz-Winkeler Assocs., 7546 Troost Ave., Kansas City, Mo., (816) 363-5651. Branch Offices: St. Louis, Mo.; Des Moines, Iowa
Kemco, Inc., 2520 W. Irving Blvd., Irving, Texas, (214) 637-0163, TWX: 214-253-0952. Br. Offices: Houston, Texas; Wichita, Kans.; St. Louis, Mo.
Kemp Engrg. Co., Inc., 2618 Manana Dr., Dallas, Texas, (214) FL 7-6663. Branch Offices: Houston, Texas; St. Louis, Mo.; Huntsville, Ala.
Kencar Co., Bo 6770, Fort Worth, Texas, (814) 923-4476
Kennedy Engrg. Inc., 6713 N. Oliphant Ave., Chicago, Ill., (312) 631-8283, TWX: 910-221-5282
Kennedy, R. P. Co., Inc., 39 Saginaw Dr., Rochester, N.Y., (716) 271-6322 Branch Offices: Fayetteville, N.Y.; Hyde Park, N.Y.
Kent Assocs., 40 W. Deerhaven Rd., Mahwah, N.J., (201) 327-7878
Kerrigan, J. E. Co., 5933 W. Madison St., Chicago, Ill., (312) 379-4030
Key Representation, Box 523, Wilmington. Cal., (213) 549-1770. Branch Offices: Scottsdale, Ariz.; Los Altos, Cal.; Boulder, Colo.
Keyco Assocs., Box 357, Farmington, Conn., Branch Office: Needham. Mass.
Kilfoil, J. F. Co., 9415 Montgomery Rd., Cincinnati, Ohio, (513) 791-6151. Branch Office: Ft. Wayne, Ind.
Kilroy, J. Corp., Box 365, Chagrin Falls, Ohio, (216) 247-8997
Kimberly-James, 1422 Chestnut St., Philadephia, Pa., (215) LO 3-6761.
King Engrg. Co., 15720 Ventura Blvd., Encino, Cal., (213) 981-0161. Branch Offices: San Mateo, Calif.; Phoenix, Ariz.; La Jolla, Calif.
Kirsch Sales Co., 107 Wabash Ave., LaFontaine, Ind., (317) 981-2801
Kirsh, P. L. Assoc., 223 Windemere Rd., Rochester, N.Y., (716) 288-0705
Kitchen & Kutchin, Inc., 17 Waltham St., Lexington, Mass., (617) 862-8230, TWX: 710-326-0597. Branch Office: No. Haven, Conn.
Kittleson Co., 416 N. La Brea Ave., Los Angeles, Calif., (213) 933-7371, TWX: 213-937-0239. Branch Office: Mountain View, Calif.
Kirkeby, 821—2nd Ave.. N., Minneapolis, Minn., (612) 377-3239.
Kleker, J. H. Co., 177 Sunset Ave., Glen Ellyn, Ill., (312) 469-2297
Klicpera, M. F., Box 2668, Houston, Texas, (713) 747-3868. Branch Offices: Dallas, Texas,; Tulsa, Okla.
Knight, W. B., Co., Inc.. Box 400, Inglewood Calif., (213) 678-4711, TWX: 910-328-6116. Branch Office: Phoenix, Ariz.
Knoblock & Assocs. Inc., 4902 Tollview Dr., Rolling Meadows, Ill.
Koch Engrg. & Sales Co., 309 Meadows Bldg., Dallas, Texas, (214) 369-5136
Koenig-Myers Assoc. Inc., 5500 Buena Vista Dr., Shawnee Mission, Kans., (913) 432-8300. Branch Offices: Bridgeton, Mo.: Atlantic. Iowa
Koessler Sales Co., Inc., 2010 W. Burbank, Burbank, Calif., (213) 849-5716. Branch Office: Phoenix, Ariz.
Koether-Cox Co., 1327 S. Inca St., Denver, Colo., (303) 733-5561
Kosowicz, F., 2 Madsen Rd., W. Hartford, Conn.
Kraft Elctrn. Sales, Inc., 510 Woodbine Ave., Towson, Md., (301) 828-5838
Krasner, H. J. Assocs. Inc:, 33 Great Neck Rd., Great Neck, N.Y., (513) 487-0690, TWX: 510-223-0823
Kriegner Sales, 1602 Pennington Rd., Trenton, N.J., (609) 882-6330.
Krotozyner, J M., 420 Market St., San Francisco, Calif., (415) 982-4636.
Krueger, R. M., 5755 W. Irving Park Rd.. Chicago, Ill., (312) 282-8444.
Ksander, G., Co., Box 803, Danville, Calif., (415) 837-4669.
Kubrick, D., 456 S. Franklin St., Hempstead, L.I., N.Y., (516) IV 3-7230.
Kunze, J., Assoc., 29 Jefferson St., Glen Cove., N.Y., (516) OR 1-2376.

L

L-C-A Sales, Inc., 76 Main St., Tuckahoe, N.Y., (914) WO 1-4700. Branch Offices: Ardmore, Pa.; Annandale, Va.
L & M Assoc., 511 Victor St., Saddle Brook, N.J., (201) 843-8700. Branch Offices: Andalusia, Pa.; Brentwood, N.Y.
L & M Sales, 2404 S. Redwood Dr., Anaheim, Calif., (714) 774-0492.
LSM Assocs., Orchard Pk., Phelps, N.Y., (315) 548-5891. Branch Offices: DeRuyter, N.Y.; Hamburg, N.Y.
La Moree, C. D., 2433 Birkdale St., Los Angeles, Calif., (213) CA 5-5666. Branch Office: Berkeley, Calif.
Labronics, Inc., 130 Pickard Bldg., Syracuse, N.Y., (315) 454-9314. Branch Offices: North Tonawanda, N.Y.; Kingston, N.Y.
Lackritz & Quehl, 3691 Lee Rd., Cleveland, Ohio, (216) 561-6660. Branch Office: Cincinnati, Ohio.
Laird Equip. Co., 1029 Twining Rd., Dresher, Pa., (215) 824-8198.
Lake, H. G., Co., 1521 N. Main St., Dayton, Ohio, (513) 277-8181. Branch Office: Cincinnati, Ohio.
Lamb, R.F., 1865 Kenmore Ave.. Kenmore, N.Y., (716) 874-4900, TWX: 710-522-1808. Branch Offices: Rochester, N.Y.; Syracuse, N.Y.; Kingston, N.Y.
Lancer-Kneeland, Inc., 359 Main St., Haverhill, Mass., 373-1313.
Landa, E., Co., 2288 Westwood, Los Angeles. Calif., (213) 272-9525, TWX: 910-342-6343. Branch Office: Los Altos, Calif.
Landfear Enterprises, Box 68, Nutley, N.J., (201) 667-2900.
Landis, C., Sales, 34-28 80th St., Jackson Heights. N.Y., (212) 485-7900.
Lanphear, W. R., 4031 Stoneway N., Seattle, Wash., (206) 633-4900.
Lanzendorf, O. G. Co., 513 Cumberland Ave., Syracuse, N.Y. (315) 472-4195.
Laub Engineering, Box 8 · 466 Central St., Northfield, Ill., (312) 446-4166.
Laub N. J., Co., 3749 W. Broadway, Minneapolis, Minn., (612) 588-4663.
Lavin H., Assocs., Inc., Box 921, Meriden, Conn., (203) 237-5527. Branch Office: Needham, Mass.
Lawrence Sales Co., Box 1038, Richardson, Texas, (214) 235-5504. TWX: 910-867-4715.
Lawson, R., Assocs., Box 206, Wenonah, N.J., (609) 468-5115.
Lazarus, N., 80-43 190th St., Jamaica, N.Y., (212) HO 5-2573.
Lazor, J., Assocs., Inc., 39 Saginaw Dr., Rochester, N.Y., (716) 473-8337. Branch Offices: Syracuse, N.Y.; Buffalo, NY.
Leban, A. D., Assocs., 218 Lloyd La., Philadelphia, Pa., (215) 642-9047.
Lebell-Warren Assocs., Box 246, San Carlos, Cal., (415) 593-7688.
Ledbetter, Box 528 Encino, Calif., (213) 789-8115, TWX: 213-783-3345.
Lee Assoc., Inc., 200 E. Marks, Orlando, Fla., (305) 241-4445, TWX: 810-850-0105. Huntsville, Ala.; Winston-Salem, N.C.; Rockville, Md.
Lee, Ltd., Bethania, North Carolina, (919) 924-8245.
Lee, J., Co., 4241 S. Toledo Ave., Minneapolis, Minn., (612) 920-1525.
Leemark Engineers, Inc., Box 6175, Leawood, Kansas, (913) NI 8-0124. Branch Office: St. Louis, Mo.
Lee-Noonan Co., 4575 West 77th St., Minneapolis, Minn., (612) 920-7851.
Leff Sales Assocs., 5900 Westfield Ave., Pennsauken, N.J., (609) 663-4025. Branch Offices: Somerville, N.J.; Towson, Md.
Legg, R., Box 25327, Portland, Ore., (503) 292-8824, TWX: 910-464-1520.
Leser, J. W., 4408 W. Jefferson Blvd., Los Angeles, Calif., (213) 731-4173.

Lesser, F. R., Box 241, Bedford, Mass., (617) 275-7558.
LEtronix, 251 W. DeKalb Pike, King of Prussia, Pa., (215) 265-1020.
Levinson, H., Co., 1211 E. Denny Way, Seattle, Wash., (206) 323-5100, TWX: 910-444-2154.
Levison Sales Co, Inc., Box 242, Valley Stream, N.Y., (516) 561-9696.
Lewis, H., Co., 1801 J.F. Kennedy Blvd., Philadelphia, Pa., (215) LO 7-2068. Branch Office: Willow Grove, Pa.
Lichtenstein Sales. 1226 Franklin Circle, Atlanta, Ga., (404) 634-0798.
Lieberman, H., Sales Co., Box 66216, Houston, Tex., (713) 526-3431. Branch Offices: Richardson, Texas; Metairie, La.
Lienau Assocs, Inc., 11411 Amherst Ave., Wheaton, Md., (301) 949-6464. Branch Offices: Philadelphia, Pa.; New Britain, Pa.
Lightstone, Pickard Bldg., E. Molloy Rd., Syracuse, N.Y., (315) 454-3209.
Lincoln, Hodges & Assocs., 5875 N. Lincoln Ave., Chicago, Ill., (312) 561-8440. Branch Office: Waukesha, Wisc.
Lindberg Co., 2654 S. Krameria St., Denver, Colo., (303) 757-6489, TWX: 810-931-2579.
Linz, D. S., 238 Shelmire St., Philadephia, Pa., (215) 379-0734.
Linz, W. M., 4001 W. Devono Ave., Chicago, Ill.. (312) 685-6060.
Little, S., Co., Box 308, East Point, Ga., (404) 761-5353.
Littrell Western Sales, Inc., 3121 E. Twelfth St., Los Angeles, Calif., (213) AN 1-0164. Branch Office: San Francisco, Calif.
Lobdell Sales Co., Candlewood Lake Rd., Brookfield, Conn., (203) 775-2253.
Loeb, E. R., Co., Box 3643, Milwaukee, Wisc., (414) 964-2155.
Logan, J., & Assocs., 801 Mahler Rd., Suite D, Burlingame, Calif., (415) 697-6100, TWX: 910-375-3382.
Logan & Logan Co., Box 4, Redwood City, Calif., (415) 365-1303.
Lohmann, R. S., Co., 19326 W. McNichols, Detroit, Mich., (313) 535-6144.
Long & Assocs., Inc., 505 Middlefield, Rd., Redwood City, Calif., (415) 369-3324, TWX: 910-378-5429.
Lowell-Kangas & Assoc., Box 4116, Overland Park, Kans., (913) TU 8-3200.
Lowry Dietrich Co., 90 Clairton Rd., Pittsburgh, Pa., (412) 892-2992. Branch Offices: Cleveland, Ohio; Dayton, Ohio; Detroit, Mich.
Lowery, L. D., Inc., 2801 W. Chester Pike, Broomall, Pa., (215) EL 6-5300. Branch Offices: Hyattsville, Md.; Harrisburg, Pa.
Luce, R. P., & Co., Inc., 30 Locust Ave., Berkeley Hghts., N.J. (201) 464-6440, TWX: 710-984-7965. Branch Offices: New Hyde Park, N.Y.; Philadelphia, Pa.; Baltimore, Md.
Lund & Co., Box 35566, Dallas, Texas, (214) 358-4335. Branch Office: Houston, Texas.
Luscombe Engrg., Co., 610 S. Arroyo Pkwy., Pasadena, Cal., (213) 684-2000, TWX: 910-588-3285. Branch Offices: San Mateo, Calif.; Phoenix, Ariz.
Lynch, T., Co., 1125 Singingwood Drive, Arcadia, Calif., (213) 355-1753.
Lynch-Gentry Assocs., Inc., Box 13248, St., Petersburg, Fla., (813) 347-5131.
Lynn & Brooks 3055 Wilshire Blvd., Los Angeles, Calif., (213) 382-2255. Branch Offices: San Francisco., Calif.; Portland, Ore.

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MGR Products, Inc., 26 Duffy Pl., San Rafael, Calif., (415) 454-5214.
M & S Assocs., Inc., Box 185, Haddonfield, N.J., (609) 429-7055. Branch Office: Sellersville, Pa.
M Q & Assocs., 6713 N. Oliphant, Chicago., Ill., (312) 774-8844. Branch Office: Oak Creek, Wis.
MacDonald, B. C., & Co., 1265 Research Blvd., St. Louis, Mo., (314) 993-2833. Branch Offices: Kansas City, Kans.; Wichita, Kans.; Little Rock, Ark.
MacDonald, S. K., Inc., 1531 Spruce St., Philadelphia, Pa., (215) KI 5-1205. Branch Offices: Washington, D.C.; Pittsburgh, Pa.; Baltimore, Md.
Madison Overseas, Inc., 433 Liberty St., Schenectady, N.Y., (518) 372-5841.
Magnuson Assoc., 5639 W. Fullerton Ave., Chicago, Ill., (312) 622-6322, TWX: 910-221-5239. Branch Office: St. Paul, Minnesota.
Maguire, J. A., & Co., 726 Cooper St., Camden, N.J., (609) 966-3118, TWX: 710-891-7081. Branch Offices: Baltimore, Md.; Plainfield, N.J.; Winston-Salem, N.C.
Mahan, R. P., Co., Inc., 572 Washington St., Wellesley, Mass., (617) 237-1040. Branch Offices: Watertown, Conn,; Newtwon. Conn.
Maher Engrg. Co., 13 Broadway, Des Plaines, Ill., (312) 824-2124. Branch Office: Mt. Clemens, Mich.
Maher, F., Sales Co., 175 Brookside Rd., Newington, Conn. (203) 247-7474.
Magnuson, E., Co., 3347 W. Irving Park Rd., Chicago, Ill., (312) 588-2613.
Malta, V. S., Co., Box 4007, Philadephia, Pa., (215) 836-5122.
Mandell, H. Co., Box 24, Revere, Mass., (617) 289-3787. Branch Office: Hamden, Conn.
Manhattan Sales Co., 17 East 16th St., New York, N.Y., (212) 242-8262.
Manufacturing Assocs, 1738, Colorado, Santa Monica, Calif., (213) 479-8884. Branch Office: Palo Alto, Calif.
Mark Elctrn., Sales Co., Box 291, N. Miami, Fla., (305) 947-5080.
Marketek, Inc., One First St., Los Altos, Calif., (415) 941-0882, TWX: 910-370-7969.
Mark-Lund Assocs., 2828 Mary St., Falls Church, Va., (703) 560-8400.
Markman Co., 4142 Lankershim Blvd., N. Hollywood, Calif., (213) 877-3368.
Marlow Assocs., Inc., 1500 S. Green Rd., Cleveland, Ohio, (216) 381-4500.
Mars Sales Tronics, 220 Jericho Tpke., Mineola, N.Y., (516) 741-1270.
Marsey Sales, Inc., 206 Park Ave., Rochester, N.Y., (716) 442-9700.
Marsh, J. W., 4216 W. Jefferson Blvd., Los Angeles. Calif., (213) 732-0145.
Marshall, R. W., 6106 Excelsior Blvd., Minneapolis, Minn., (612) 929-0457.
Marshank Sales Co., 7422 Melrose Ave., Los Angeles, Calif., (213) 938-2591, TWX: 213-937-2789.
Marsland Assocs., Inc., 1000 Executive Way, Des Plaines, Ill., (312) 755-1309, TWX: 910-233-4022. Branch Offices: Indianapolis, Ind.; Florissant, Mo., Minneapolis, Minn.
Martigs,Inc., 5741 N.E. Glisan St., Portland, Ore., (503) 232-1949. Branch Office: Seattle, Wash.
Martin Electric Co., 118 Valley Rd., Ardmore, Pa., (215) 649-6332.
Martin-Rettger, Inc., 11955 Shaker Blvd., Cleveland, Ohio, (215) 791-8787.
Martin, R., Assocs., Inc., Box 1002, Bellaire, Texas, (713) 468-3877, TWX: 910-881-3680. Branch Office: Dallas, Texas.
Massey Assocs., #1 Thomas Circle, NW, Washington, D.C., (202) 628-1023.
Massey Assocs, Inc., 1325 W. Chester Pike, Havertown, Pa., (215) 789-2320. Branch Offices: St. Petersburg, Fla.; Maitland, Fla.
Masin, O. S., Inc., 140 Boston Post Rd., Larchmont, N.Y., (914) 834-7500.
Mates, H., 5508 Hobart St., Pittsburgh, Pa., (412) 421-8998.
Mauer Co., Inc., 3308 Noyes St, Evanston, Ill., (312) 869-1644.
Mauldin Company, 437 California Ave., Palo Alto, Calif., (415) 326-5291.
Maydwell & Hartzell, Inc., 870 Tennessee St.. San Francisco, Calif., (415) 826-6900, TWX: 415-393-9157. Branch Offices: Phoenix, Ariz.; Los Angeles, Calif.; San Diego, Calif.; Seattle.; Wash, Portland, Ore.
Mayer, C. R., Co., Inc., Box 152, Huntington, N.Y., (516) 921-7876.
Maynard Sales Co., 158 Express, Dallas, Texas, (214) 742-2384.
Maytnier, D. M., 2510 Gross Point Rd., Evanston, Ill., (312) 475-4334.
McBride, J. J., Sales, Inc., 6054 Touhy Ave., Chicago, Ill., (312) 775-1080.
McCarthy-Kelly, 279 N. Bayshore Blvd., San Mateo, Calif., (415) 343-8748.
McCorvey V. Avis, Co., 2187 Briarcliff Rd. N.E., Atlanta, Ga., (404) 636-2502.
McCoy, Box 20, Cherry Hill, N.J., (609) 428-3444.
McDavitt Sales Corp., Box 308, Drexel Hill, Pa., (215) 544-2588.
McDonald Sales Co., Box 2848, Ft. Wayne, Ind., (219) 745-9214.
McDonough, J., Assoc., Inc., 4541 Main St., Buffalo, N.Y., (716) 839-2044.
McFadden Sales, Inc., 150 E. Broad St., Columbus, Ohio, (614) 221-3363, TWX: 810-482-1623.
McKay Assoc., 60 Park Pl., Newark, N.J., (201) 642-3930.
McKeown, R., Co., Inc., 99 Dorsa Ave., Livingston, N.J., (201) 992-0700. Branch Offices: Trumbull, Conn.; New York, N.Y.
McKinney, J. F., Sales. 1303 Chemical, Dallas, Texas, (214) 631-9450, TWX: 810-861-4232. Br. Offices: Metairie, La.; Tulsa, Okla.; Bellaire, Texas.
McKnight, G. R., Co., Inc., 115 Spruce Ave., Menlo Park, Cal., (415) 325-2844, TWX: 910-373-1172.
McMillian Elctrn., 16679 S.W. Maple Circle, Lake Oswego, Ore., (503) 636-6257.
McSweeney, F. J., 4123 N. Keystone, Indianapolis. Ind., (317) 547-2112.
McTaggart, L. J., Assocs., 2451 Wehrle Drive, Buffalo, N.Y.., (716) 634-2030. Branch Office: Grand Island, N.Y.
Measurement Technology, Inc., 295 Northern Blvd., Great Neck, N.Y., (516) 482-3500, TWX: 510-223-0846.
Measurement Equip. Co., Inc., 591 North Ave., Wakefield, Mass., (617) 245-4870, TWX: 710-348-6717. Branch Office: E. Hartford, Conn.
Measurements Unlimited, Inc., 529 Shoemaker Rd., Elkins Park, Pa., (215) 224-1663. Branch Offices: Hicksville, N.Y.; East Orange, N.J.
Mech-Elec Sales Co., Inc., 16 S. Main, Medford, N.J., (609) 654-8209.
Melchior Assocs., Inc., 820B Cherry, San Carlos, Cal., (415) 591-7383, TWX: 910-376-4404.
Melius, E., & Assocs., Inc., 3758 Dunlap St., N., St. Paul, Minn., (612) 484-8541, TWX: 910-563-3672.
Melvin Sales Co., 113 El Camino Real, Millbrae, Calif., (415) 697-6922, TWX: 910-375-3832.
Memac Sales Co., Inc., 4740 N. Austin Ave., Chicago, Ill., (312) 545-1033.
Merchant, R. C., & Co, Inc., 18411 W. McNichols Rd., Detroit, Mich., (313) 535-6000. Branch Office: St. Joseph, Mich.
Merican, J. C., 546 Anchor Dr., Joppa, Md., (301) 679-6969.
Merritt, J. W., 2525 Knollwood Dr., Indianapolis, Ind., (317) 291-9674.
Merritt, R. Co., 1320 Prospect St., Seattle, Wash., (206) 682-7337, TWX: 910-444-2022. Branch Offices: Anchorage, Alaska.; Portland, Ore.
Metro Technical Sales Corp., 103 Pinewood La., Massapequa Park, N.Y., (516) 798-1066. Branch Office: Harrington Pk., N.J.
Metropolitan Sales Co., 110 Jericho Tpke., Floral Park, N.Y., (516) 328-0120.
Metrorep, Inc., Box 782, Freehold, N.J., Branch Offices: New York, N.Y.; Washington, D.C.
Meussdorffer, R., 13441 Ventura, Sherman Oaks, Calif., (213) 788-0771.
Meyer, Ross & Fleming, 113 Tenth St., San Francisco, Cal., (415) 431-0652.
Meyers, K. W., Co., 7256 W. Touhy Ave., Chicago, Ill., (312) 774-6440. Branch Offices: Minneapolis, Minn.; Indianapolis, Ind.
Michael, C., Inc., Box 666, Glendale, Calif.. (213) 245-8401, TWX: 910-497-2089. Branch Offices: Mountain View, Calif.; San Diego, Calif.; Farmingdale, N.Y.; Dallas, Texas; Phoenix, Ariz.
Michaelson, B. L., Co., 1053 Arlington, Dr., Xenia, Ohio, (513) 372-5496. Branch Office: Cleveland, Ohio.
Mid-Eastern Assocs., Inc., 1759 Country Club Dr., Cherry Hill, N.J.
Midland Elect. Co., 2125 Superior Ave., Cleveland, Ohio, (216) 861-3200.
Mid-Lantic Chapter Electr. Rep. Assoc., 315 Harrison Ave., Glenside, Pa., (215) TU 4-0139.
Midstate Research, Inc., 327 Wellesley Rd., Syracuse, N.Y. Branch Office: Marietta, N.Y.
Midwest Elctrn. Sales., 5707 W. Division St., Chicago, Ill., (312) 626-0030, TWX: 910-221-5247. Branch Offices: Waukesha, Wisc.; Indianapolis, Ind.; Cedar Rapids, Iowa.
Miller & Dietz Co., 2122 Meetinghouse Rd., Cinnaminson, N.J., (609) 829-9291. Branch Office: York, Pa.
Miller & Miller, Box 36, Grosse Ile, Mich., (313) 386-0900.
Miller, B., Box 72, Little Neck, N.Y., (212) 229-4673.
Miller, E. G., Co., Inc., Box 929, Henderson, Texas, (214) 657-5049.
Miller, G. E., Assoc., 47 Birchwood Park Dr., Jericho, L.I., N.Y. (212) 586-4780. Branch Office: Stamford, Conn.
Miller, H., Sales Co., 4087 Meadowbrook, Cleveland, Ohio, (216) 321-3900. Branch Offices: Sabina, Ohio; N. Madison, Ohio.
Miller, J., Co., 1 Continental Ave., Forest Hills, N.Y., (212) 263-4446.
Miller, R. S., Box 1185, Torrance Airpt., Torrance, Calif., (213) 326-1610.
Mills, T. M., Co., 13 Tanner St., Haddonfield, N.J., (609) 429-1005.
Mills, W S., 2 Wilburtha Rd., Trenton, N.J., (609) TU 2-4111.
Milsk, R., Co., 19375 James Couzens Hwy., Detroit, Mich., (313) 342-6660. Branch Offices: Grand Rapids, Mich.; Indianapolis, Ind.
Minthorne Intl., 2200 Shames Dr., Westbury, L.I., N.Y., (516) 334-3303.
Minthorne, R. M., 6565 S.W. Macadam Ave., Portland, Ore., (503)-246-4556.
Mitchell, C. H., Co., 18531 Ventura Blvd., Tarzana, Calif., (213) 881-2626.
Mitscher, R. W., Co., Inc., 496 Ellicott Sq. Bldg., Buffalo, New York, (716) 854-2517, TWX: 710-522-1225. Branch Offices: Virginia Beach, Va.; Raleigh, N.C.; Fayettesville, N.Y.; Pittsford, N.Y.; Nashville, Tenn.; Salt Point, N.Y.
Moch, G. M., Co., 595 Broad Ave., Ridgefield, N.J., (201) 945-0080. Branch Office: New York, N.Y.
Moler-Eader Assocs., Box 240, Haddonfield, N.J., (609) 428-2440. Branch Office: Baltimore, Md.
Montague Assocs., 404 Jerusalem Rd., Cohassat, Mass., (617) 383-0634.
Montgomery Bros., Inc., 1831 Bayshore, Burlingame, Calif.. (415) 697-6500. Branch Offices: Los Angeles, Calif.; Portland, Ore.; Seattle, Wash.; Salt Lake City, Utah; San Diego Calif.
Montgomery, J. L., Inc., 24001 Southfield, Rd., Southfield, Mich., (313) 358-2616.
Moore, E. A., Assocs., Box 871, Aiken, S.C., (803) 648-4100. Branch Office: Ocala, Fla.
Moore, H A., Sales Co., Box 7245, Phoenix, Ariz., (602) 274-0060.
Moore Sales Co., 401 Margaret W., Detroit, Mich., (313) 883-0218.

Morehouse, R., 2609 Ave., Brooklyn, N.Y., (212) 375-0567.
Morgan C. T., Co., Inc., 500 Maple St., Hathorne, Mass., (617) 774-3215. Branch Office: Waterville, Me.
Morhan Exporting Corp., 458 Broadway, New York, N.Y., (212) 925-1257.
Morris-Cunningham & Assocs., Inc., 720 East 65th St., Indianapolis, Ind, (317) 255-2458. Branch Office: Fort Wayne, Ind.
Morse Assocs., 1721 Chestnut St., San Francisco, Calif., (415) 567-6871.
Morse, I., Sales, 150 Broadway, New York, N.Y., (212) CO 7-2913.
Morton, G. E., 161 Summer St., Scituate, Mass., (617) 545-0155.
Moss, G., Elctrn., Inc., Drawer "J", Greeley, Colo., (303) 353-1452. Branch Offices: Denver Colo.; Albuquerque, N.M.
Moulthrop, F. W., & Assocs., 1530 E. 12th St., Oakland, Calif., (415) 261-7676, TWX: 910-366-7206.
Moulthrop, Polach & Bensinger, Inc., 165 11th St., San Francisco, Calif., (415) 861-6958.
Mount, W., Co., 7735 Old Georgetown Rd., Bethesda, Md., (301) 657-9312, TWX: 710-824-0090. Branch Office: Jenkintown, Pa.
Moxon Elctn., Corp., 2311 Pontius Ave., Los Angeles, Calif., (213) 272-9311, TWX: 910-342-6345. Branch Offices: San Diego, Calif.; San Mateo, Calif.; Hackensack, N.J.; Cherry Hill, N.J.; Phoenix, Ariz.
Moyer-Johnson Co., 220 Haddon Ave., Haddonfield, N.J. Branch Office: Annandale, Va.
Muir, D., 2909 N. Lake Ave., Altadena, Cal., (213) 681-2516.
Mullingan & Mathias, 2011 Riverside Dr., Columbus, Ohio, (614) 486-2976.
Mulvin & Co., 3843 E. Colorado Blvd., Pasadena, Calif. (213) 681-4591.
Mureen, R. W., Co., 5523 Dyer St., Dallas, Texas, (214) 369-7561. Branch Office: Houston, Texas.
Murphy & Cota, 586 Armour Circle, NE, Atlanta, Ga., (404) 875-2525. Branch Offices: Greensboro, N.C.; Huntsville, Ala.; Orlando, Fla.; Winston-Salem, N.C.
Murphy & Dickey, 537 S. Dearborn St., Chicago, Ill., (312) 427-7953.
Murphy, L. F., & Assoc., Inc., 730 Chicago S., Minneapolis, Minn., (612) 333-4511. TWX: 910-576-3417.
Murray, T. F., & Assocs., 4421 Riverside, Burbank, Cal., (213) 849-6497. Branch Office: Santa Ana, Cal.
Murray C., 25 W. Northfield Rd., Livingston, N.J., (201) 992-3169. Branch Office: Newton, Pa.
Mustico, J. Co., Box 624, Havertown, Pa., (215) HI 6-1961.
Myers, R. E., & Son, 504 Loudermon Bldg., St. Louis, Mo., (314) 621-2743.

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N.B.S., Inc., 4150 S.W. 23rd St., Ft. Lauderdale, Fla., (305) 584-0650. Branch Offices: Winter Haven, Fla.; Huntsville, Ala.; Marietta, Ga.
NLR Assoc., 31 Round Top Rd., Warren, N.J., (201) 647-3390.
N.P.N. Assocs., Inc., 522 E. Putman Ave., Greenwich, Conn. (203) 869-4955.
Nace, A, Co., Inc., Box 156, Brecksville, Ohio, (216) 526-4323, TWX: 810-427-9161. Branch Offices: Dayton, Ohio; Galion, Ohio; Pittsburgh, Pa.
Naco Elctrn., 119 Luther Ave., Liverpool, N.Y., (315) 474-7481 TWX: 710-541-0439 Branch Offices: Rochester, N.Y.; Utica, N.Y.; Poughkeepsie, N.Y.
Natalino, A., Assocs., 209 Harmony Hills, Akron, Ohio, (216) 666-1447, TWX: 216-666-1200. Branch Offices: Dayton, Ohio; Pittsburgh, Pa.
National Sales Dev. Co., 676 Stratford Rd., Baldwin, N.Y., (516) BA 3-0038.
Naudain Assocs., 1032 Surburban Sta. Bldg., Philadelphia, Pa., (215) 564-3194. Branch Offices: Lutherville-Timonium, Md.; Lynchburg, Va.
Near, Inc., 99 Highland Ave., Somerville, Mass., (617) 776-2262.
Needler Sales Co., Sta. C - Box 2407, Fort Wayne, Ind., (219) 447-2123. Branch Office: Indianapolis. Ind.
Neff, J. R., 5349 Hedgerow Dr., Indianapolis, Ind., (317) 546-5824.
Nelson Co., Inc., 1294 So. Bannock, Denver, Colo., (303) 733-5528.
Nelson, W. K., Co., 807 13th Ave., S., Minneapolis. Minn., (512) 333-7203.
Nemeth, E., Assocs., 13-08 Morlot Ave., Fair Lawn, N.J., (201) 797-7500.
Nesbitt, R. E., Co., 2930 Merrell Rd., Dallas, Tex., (214) FL 7-4601. Branch Office: Houston, Texas.
New England Component Sales, Box 656, Newton Lower Falls, Mass., (617) 969-9523.
N.Y. Chapter of Elctrn. Rep. Assoc., Box 357, Pine Brook, N.J.
Newman-Krause Co., 5451 W. Lawrence, Chicago, Ill., (312) 736-6800.
Newson, C. H., & Assocs., Inc., 627 Bethlehem Pike, Philidelphia, Pa., (215) 248-3377. Branch Offices: Baltimore, Md.; Washington, D.C.
Nickerson, F. C., Co., Inc., Box 33185, Decatur, Ga., (404) 377-1575. Branch Offices: Tampa, Fla.; Kinston, N.C.; Birmingham, Ala.; Ft. Lauderdale, Fla.
Nolan, J. J., 314 W. Sparks St., Philadelphia, Pa., (215) 924-1595
Nordstrom R. C., & Co., Box 32. Lathrup Village, Mich., (313) 444-4417, TWX: 810-232-4928.
Norman, H C., Sales, Box 5185, Sta B, Greenville, S.C., (803) 244-6254
Normell Assoc., 10 Day St., Newton, Mass., (617) 969-5478.
Northeast Engrg., Inc., 3013 Dixwell Ave., Hamden, Conn., (203) 248-4481. Branch Offices: Danvers, Mass.; Manhasset, N.Y.
Northern States Sls, 1109 W. 78½ St., Minneapolis, Minn., (612) 866-3468.
Northwest Sales & Engrg. Svc., 809 Terminal Sales Bldg., Seattle, Wash., Branch Office: San Francisco, Calif.
Northwestern Agencies, Inc., 4130 1st Ave., South, Seattle, Wash., (206) MA 3-8882. Branch Office: W. Linn, Ore.
Norton, J., 60 Midvale Rd., Mt. Lakes, N.J., (201) 334-2921, TWX: 710-987-8395.
Norvell Assocs., Inc., 10210 Monroe Dr., Dallas, Texas, (214) 357-6451, TWX: 910- 861-4512. Branch Office: Houston, Texas.
Nurches, P., Co., 2396 E. Foothill Blvd., Pasadena, Calif., (213) 681-8957. Branch Office: Palo Alto, Cal.

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OEM Sales Co., Box 68, Birmingham, Mich.
O.E.M. Sales Co., Inc., Box 55232, Indianapolis, Ind., (317) 545-1267. Branch Offices: Florissant, Md.; South Bend, Ind.
O'Donnell Assoc., Inc., 18053 Cranshaw Bl., Torrance, Cal., (213) 323-9243. Branch Office: Palo Alto, Calif.
O'Halloran Assocs., 10700 Ventura Blvd., N. Hollywood, Calif., (213) 877-0713, TWX: 910-499-2190. Branch Offices: Palo Alto, Calif.; San Diego; Calif.; Phoenix, Ariz.; Las Vegas, Nevada.
O'Hare, B., 4952 Wynnefield Ave., Philadelphia, Pa., (215) 473-3654.
Ohio Assocs., Box 728, Lima, Ohio, (419) 646-3495.
Ohio Instr. Co., The, 505 Whitney Ave., Worthington. Ohio, (614) 885-0743. Branch Office: Ypsilanti, Mich.
Olander, R., Box 1485, Burbank, Cal., 213) 843-5200, TWX: 910-498-2720
Olsen, J. O., Co., 16201 Shaker Blvd., Cleveland, Ohio, (216) 752-5444. Branch Offices: Cincinnati, Ohio; Pittsburgh, Pa.
Onyx, W. M., Co., Box 4, Mattydale, N.Y., (315) 479-6561, Branch Office: DeWitt, N.Y.
Orbe, Inc, 4110 Central Ave., St. Petersburg, Fla., (813) 894-0687, TWX: 810-863-0370. Branch Offices: Orlando, Fla.; Lauderhill, Fla.
Ormsby, S., Sales Co., 7121 Catina St., New Orleans, La.
Osborne & Bidwell, 17525 S. Broadway, Gardena, Calif., (213) 770-0300
Ossmann Component Sales Corp., 39 Saginaw Dr., Rochester, N.Y.,(716) 442-3290, TWX: 510-253-7685. Branch Offices: Syracuse, N.Y.; Vestal, N.Y.; Red Hook, N.Y.
Oszman, E.W., 932 W. Montana Ave., St. Paul, Minn., (612) 488-1811.
Ozark Elctrn. Mktg., 2573 Woodson Rd., St. Louis, Mo., (314) 423-7200

P

P. J. Engrg. Sales, 360 No. Beacon St., Boston, Mass., (617) 783-5010
PLS Assocs., Inc., 7895 E. Prentice Ave., Englewood, Colo., (303) 771-0140. Branch Offices: Albuquerque, N.M.; Phoenix, Ariz.
Pacent Engrg. Corp., 300 Northern Blvd., Great Neck, N.Y., (516) 482-4678.
Pacific Elec. Sales Co., 140 S.E. 28th Ave., Portland, Ore., (503) 235-4137.
Packard Assocs., Inc., Box 20825, Dallas, Texas, (214) 357-5713.
Paddock-Joslow Co., Inc., Box 192, Silver Spring, Md., (301) 589-6554.
Pan-Tech Engrg., Box 22491, Houston, Texas, (713) 666-0248. Branch Offices: Arlington, Texas; Baton Rouge, La.
Paragon Sales Co., 111 S. 22nd St., Philadelphia. Pa., (215) 563-7060
Paratech, 2208 N.W. Market St., Seattle, Wash., (206) 783-3900, TWX: 910-444-2002.
Par-Nell Sales Co., 1135 Bustleton Pike, Feasterville, Pa., (215) 357-7230. Branch Office: Reisterstown. Md.
Parsons, C. B., & Co., 5319 4th Ave. S., Seattle, Wash., (206) 762-7373.
Paston-Hunter Co, Inc., 2002 Teall Ave., Syracuse, N.Y., (315) 437-2992.
Patterson, W. S., Co., Inc., 5604 N. Western Ave., Chicago, Ill., (312) 271-3774, TWX: 910-221-3029
Pattis, B., Co., 4761 W. Touhy Ave., Lincolnwood, Ill., (312) 679-1000. Branch Office: Cleveland, Ohio.
Paul Sales Co., 3501 Fairfield, Fort Wayne, Ind., (219) 744-0589.
Pearson M., & Co., 1860 S. Acoma, Denver, Colo., (303) 744-2323, TWX: 910-931-0494. Branch Office: Salt Lake City, Utah.
Pearson, R. T., Sales, 1125 Old York Rd., Abington, Pa., (215) 887-0186
Peck, G. V., Co., 210 Casa Linda Plaza, Dallas, Texas, (214) DA 8-3511. TWX: 910-861-4148. Branch Offices: New Orleans, La.; Tulsa, Okla.; Houston, Texas.
Peddlers Unltd., 641 N. Minnesota Ave., Glendora, Cal., (213) 963-5868
Peirce, G. H., 715 Camp St., New Orleans, La., (504) 522-1888.
Pelletier, M. J., 403 Napco Ave. N., Minneapolis, Minn., (612) 332-4369
Penwarden Assoc., 14547 Titus, Van Nuys, Calif., (213) 782-4920, TWX: 910-495-1729.
Perkins, A. L., Co., Kinlock Plaza, Manlius, N.Y., (315) 682-5005.
Perron, R., & Co., Inc., 159 Morse St., Norwood, Mass., (617) 762-8114, TWX: 710-336-6347. Branch Offices: Trumbull, Conn.; Farmington, Conn.; Dover, N.H.
Peters R. W., Co., 630 E. 222, Cleveland, Ohio, (216) 261-2330.
Peters, J., 10031 W. Lisbon Ave., Milwaukee, Wisc., (414) 463-9660.
Peters-de Laet, Inc., 1606 Rollins Rd., Burlingame, Calif., (415) 697-1800. Branch Offices: Hawthorne, Calif.; Portland, Ore.; Seattle, Wash., Sacramento, Calif.; Denver, Colo.; Salt Lake City, Utah; Spokane, Wash.
Peterson, A. H., Sales, 3647 W. 62nd St., Chicago, Ill., (312) 735-0846.
Peterson, F., Co., 4501 Minnetonka Blvd., Minneapolis, Minn., (612) 927-4453, TWX: 910-576-2835.
Peterson-Rudnick Assocs., Box 822, West Caldwell, N.J.; (201) 226-4363. Branch Office: Brooklyn, N.Y.
Pettigrew, R. S., & Co., Inc., 10 N. Main St., West Hartford, Conn., (203) 233-8533. Branch Office: W. Newton, Mass.
Petitt, G. Co. Inc., 349 Ashland Ave., River Forest, Il., 369-8940. Branch Offices: East Peoria, Ill.; Pewaukee, Wisc.
Pfeiffer, W. E., 615 Stutsman St., Council Bluffs, Iowa, (712) 322-8280 Branch Office: Council Bluffs, Iowa
Phister Equip. Co. Inc., 922 Federal Reserve Bank Bldg., Cincinnati, Ohio, (513) 421-3850
Piedmont Equip. Co. Inc., Box 10037, Charlotte, N.C., (704) 334-6823
Pinkney, 957 Winnetka Ave. N., Minneapolis, Minn., (612) 544-3628
Piper Assocs. Inc., 10 Haven St., Dover Mass., (617) 449-1144. Branch Offices: S. Duxbury, Mass.; Framingham, Mass.
Pivan Engrg. Co., 3535 W. Peterson Ave., Chicago, Ill., (312) 539-4838, TWX: 910-221-0177. Branch Offices: Indianapolis, Ind.; Cedar Rapids, Ia.; Mission, Kans.; Minneapolis, Minn.; Hazelwood, Mo.; Brookfield, Wisc.
Plageman, L. C., 3334 Meyer Pl., Cincinnati, Ohio, (513) 621-1678
Plasencia, J. Inc., 521 Fifth Ave., New York, N.Y., (212) 867-8084
Podeyn & Schmidt, Box 174, Woodridge, N.J., (201) 438-2780. Branch Office: Great Neck, N.Y.
Podolny, J. H. Co., 5912 Penn Ave., Pittsburgh, Pa., (412) 441-0800
Polacheck, C. S., 4027 N. Downer Ave., Milwaukee, Wisc., (414) 964-5565
Polich, A. L., Inc., 5940 S.W. Hood, Portland, Ore., (503) 246-5451. Branch Office: Seattle, Wash
Poly-Onics, Inc., 4434 W. 90 Terr., Leawood, Kans., (913) NI 8-4173, TWX: 910-749-6479. Branch Office: Hazelwood, Mo.
Porter Co., 17000 Ventura Blvd., Encino, Calif., (213) 788-2350
Positive Consultants, Inc., Box 453, Bellmore, N.Y., (516) 221-2262. Branch Office: Freeport, N.Y.
Potter, N. Assocs., 191 Shotwell Rd., Woodstock, N.Y., (914) OR 9-6074
PREMMCO/PH, 3351 59th St., Long Beach, Calif., (213) 636-9205. Branch Office: Alameda, Calif.
Pro Marketing Corp., 451 E. 58th Ave., Denver, Colo., (303) 266-2571
Pugh, C. L. & Assocs. Inc., 2144 Riverside Dr., Columbus, Ohio, (614) 486-9678. Branch Offices: Pittsburgh, Pa.; Berea, Ohio
Puleo Elctrn. Inc., 39 Hutcheson Pl., Lynbrook, N.Y., (516) 599-4875
Punt, W. R. Co., 66 So. Tyson Ave., Floral Park, N.Y.
Purinton, R., Inc., 11 Muzzey St., Lexington, Mass., (617) 862-8300, TWX: 710-326-0524

Pyle, J. Co., 1611 Borel Pl., San Mateo, Calif., (415) 349-1266, TWX: 910-374-2354

Q

Q.E.D. Elctrn Inc., 500 Nuber Ave., Mount Vernon, N.Y., (914) 664-0080, TWX: 710-560-0014. Branch Offices: Camden, N.J.; Silver Spring, Md.
Quadtron Assocs. Inc., Box 306, Lombard, Ill., (312) 627-6800
Quick, H. L. Co., 8167 LaJolla Shores, LaJolla, Calif., (714) 459-7006

R

RDP Instr. Inc., 999 Commercial St., Palo Alto, Calif., (415) 328-6666. Branch Offices: Los Angeles, Calif.; San Diego, Calif.
REP, 5 Sadore La., Yonkers, N.Y., (914) 793-4200
R F Assocs. Inc., 1621 Pontius Ave., Los Angeles, Calif., (213) 478-1586, TWX: 910-342-6884. Branch Office: Palo Alto, Calif.
RJC Assocs., 219 Oakridge Terr., Liverpool, N.Y., (315) 457-3220
R-J Sales & Engrg., 7100 S. France Ave., Minneapolis, Minn., (612) 922-1425, TWX: 910-576-3411
R. L., Assocs., 14401 Gilmore St., Van Nuys, Calif., (213) 782-7826, TWX: 910-495-1733
R. L. Assocs., Box 2255, Sepulveda, Calif., (213) 782-7826, TWX: 910-495-1733
Radco Co., 310 W. Fourth St., Winston Salem, N.C., (919) 722-9671
Ragon, R. G. Inc., 1136 W. Larpenteur Ave., St. Paul, Minn., (612) 488-6634, TWX: 910-563-3736
Randall, K. Co., Box 100, Collingwood, N.J., (609) 854-3323. Branch Office: Towson, Md.
Ranson, Wallace, 116½ E. 4th St., Charlotte, N.C., (704) 334-4244
Ray, T. J. Co., Box 45191, Tulsa, Okla., (918) 627-1515
Raymarg, Box 515, Santa Clara, Calif., (408) 248-5199
Reagan, J. A. Co., Inc., 6 Highland Ave., Albany, N.Y., (518) 489-4777, TWX: 710-441-8224. Branch Offices: New Hartford, N. Y.; Binghamton, N.Y.; Rochester, N.Y.; Syracuse, N.Y.
Recht Assocs., 900 N. San Antonio Rd., Los Altos, Calif., (415) 941-0336
Ridgway Assocs. Inc., 9420 W. Foster Ave., Chicago, Ill., (312) 992-2150. Branch Office: Minneapolis, Minn.
Reed Electrn. Inc., 2815 Monroe Ave., Rochester, N.Y., (716) 473-2767, TWX: 510-253-3246. Branch Office: Vestal, N.Y.
Reichold Assocs., 14 Weston St., S.E., Grand Rapids, Mich., (616) 459-4445
Reid Assocs. Inc., 526 Merchants Nat'l. Bank Bldg., Cedar Rapids, Iowa, (319) 362-6302
Reidy, K. Assocs., Box 1062, Acton, Mass., (617) 263-7146
Reiss, R. S. Assoc., 70 Jessie Dr., W. Haven, Conn., (203) 933-8542. Branch Office: Sharon, Mass.
Reizes, H. N., 1473 Sylvia La., East Meadow, N.Y.
Rep Assocs., 1645 S. LaCienega Blvd., Los Angeles, Calif., (213) 274-8485. Branch Office: Anaheim, Calif.
Repex, Box 807, Mountain View, Calif., (415) 969-9200, TWX: 910-379-6477
Representatives Corp., 10 High St., Boston, Mass., (617) 426-0541. Branch Office: Bethany, Conn.
Research Instr. Inc., 87 Terrace Hall Ave., Burlington, Mass., (617) 272-1800
Retzloff, W. A. Co., Box 1786, San Antonio, Texas, (512) LE 3-7839
Reutlinger, R. W. & Assoc., 1755 Big Hill Rd., Dayton, Ohio, (513) 293-2155, TWX: 810-459-1756
Reynolds & Assocs. Inc., Box 1043, Eau Gallie, Fla., (305) 727-3205, TWX: 510-959-6003. Branch Offices: Huntsville, Ala.; Ft. Lauderdale, Fla., Orlando, Fla.; Atlanta, Ga.; Greensboro, N.C.
Ribble, C. H. Co., Inc., 31 Di Carolis Ct., Hackensack, N.J., (201) 342-2602
Richards Assocs., 900 San Antonio, Los Altos, Calif., (415) 941-3226
Richardt, J. W. Co., Rt. 46, Pine Brook, N.J., (201) 227-0600. Branch Office: Whippany, N.J.
Richter, H. G. Inc., 608 Sherwood Pkwy, Mountainside, N.J., (201) 233-4615, TWX: 710-997-9581. Br. Offices: Fayetteville, N.Y.; Clearwater, Fla.
Rider, W. N., Co., 6211 Denton, Dallas, Texas, (214) 357-2246
Ridley, Assocs., Box 370, Williams Bay, Wisc., (414) 245-5543
Riedel, M. W. & Co., 2215 W. Valley, Alhambra, Calif., (213) 283-7694, TWX: 910-589-3375. Branch Offices: Delmar, Calif.; Palo Alto, Calif.;
Riggs, C. E. Inc., 422 Northwest 8th, Portland, Ore., (503) 226-3286. Branch Offices: Seattle, Wash.; Spokane, Wash.
Riley & Petchell Sales, Inc., 16515 Schoolcraft Ave., Detroit, Mich., (313) 838-9100. Branch Office: Buchanan, Mich.
Ringer, R. L., Co., Box 114, Glen Rock, N.J., (201) 444-1434
Ripley, R., 11040 Goodrich Circle, Minneapolis, Minn., (612) 881-8282
Rissi Sales, 1817 S. San Gabriel Blvd., San Gabriel, Cal., (213) 283-7614
Roberts, P. V., 247 Pelhamdale Ave., Pelham, N.Y., (914) 738-2710
Roberts Assocs., 1624 Souvenir Dr., Clearwater, Fla., (813) 447-3712
Roberts, E. V. & Assocs. Inc., 9601 W. Jefferson Blvd., Culver City, Calif., (213) 870-9561, TWX: 910-340-6363. Branch Offices: Palo, Alto, Calif.; Scottsdale, Ariz.; San Diego, Calif.
Robertson, E. B. Inc., 1339 Plowman Ave., Dallas, Texas, (214) 942-8486, TWX: 910-861-4357. Branch Office: Houston, Texas
Robinson, C. A. Co., Inc., 5010 Mayfield Rd., Cleveland, Ohio, (216) 381-9049. Branch Office: Dayton, Ohio
Robinson, R. H. Co., Box 368, Coventry, Conn., (203) 742-7323. Branch Offices: Norwood, Mass., Grafton, Vt.
Roburn Agencies, 431-435 Greenwich St., New York, N.Y., (212) 966-2130
Rockford Controls Ohio, 2077 Embury Pk. Rd., Dayton, Ohio, (513) 274-1911, TWX: 810-459-1983. Br. Offices: Cleveland, Ohio; Pittsburgh, Pa.
Rocke Int'l. Corp., 13 East 40th St., New York, N.Y., (212) 689-0200. Branch Offices: Bruxelles, Belgium; Surrey, England; Paris, France; Munchen, Germany; Rome, Italy; Copenhagen, Denmark; Madrid, Spain; Lisbon, Portugal; Tokyo, Japan; Stockholm, Sweden; San Jose, Costa Rica; Bogota, Colombia; Sao Paulo, Brazil; Mexico, D.F., Mexico; Caracas, Venezuela; Manila, Philippines
Rockford Controls Co., 21 W. 181 Hill Ave., Glen Ellyn, Ill.
Rockwell Engrg. Co., 2143 E. 45th St., Indianapolis, Ind., (317) 251-9453
Roes, H. A. & Co., 2601 Cherry, Kansas City, Mo., (816) 221-0866
Rogell Assocs., Inc., Box 797, Norwalk, Conn., (203) 853-4141
Root, G. S. & Co., 809 Wainwright Dr., Pittsburgh, Pa., (412) 561-4125
Ropek-Cahill, Inc., 5439 W. Division St., Chicago, Ill., (312) 287-7292, TWX: 910-221-5219
Rosen, G., 9501 Wadsworth Dr., Methesda, Md., (301) 365-5113
Rosen, G. Co., Inc., 563 Worcester Rd., Natick, Mass., (617) 655-2211, TWX: 710-386-5983. Branch Office: Stratford, Conn.
Ross, D. H. Co., 534 El Camino Real, San Carlos, Calif., (415) 591-4411, TWX: 910-376-4392
Roth, M., Sales Co., 678 S. Green Rd., Cleveland, Ohio, (216) 382-9090
Rothenheber & Co., Inc., 53 Cricket Ave., Ardmore, Pa., (215) 642-6911. Branch Office: Rockville, Md.
Rouzer Sales Co., 2355 Louisiana Ave., Minneapolis, Minn., (612) 544-3145
Rowland, E. W. Assocs., 90 West St., New York, N.Y., (212) 964-7188
Royelec Elctrn. Rep., 605 Krise Bldg., Lynchburg, Va., (703) 846-7117
Rudisill, J., Assoc. Inc., 1225 Harding Pl., Charlotte, N.C., (704) 377-6901
Runyon, Co., Inc., 6825 E. Thomas, Scottsdale, Ariz., (602) 947-5711, TWX: 910-950-1290.
Rush, C. B., 1830 W. Olympic Blvd., Los Angeles, Calif., (213) 388-7111
Rushin, E. Co., Box 486, Roswell, Ga., (404) 993-6498
Rutt, W., Inc., 475 White Plains Rd., Eastchester, N.Y., (914) 779-4100
Ryaby Assocs., 38 Wall St., Passaic, N.J. Branch Office: Ocean Beach, N.J.
Ryan & Assocs., Box 48086, Chicago, Ill., (312) 775-5717
Ryan Assocs., 60 Roger Dr., Port Washington, N.Y., (516) 767-7958
Ryerson, J. D., Assoc. Inc., 1672 Monroe Ave., Rochester, N.Y., (716) 442-1900, TWX: 510-253-0293. Branch Office: Syracuse, N.Y.
Rywel Sales, Inc., 100 N. Village Ave., Rockville Centre, N.Y., (516) 764-2666. Branch Office: New York, N.Y.

S

S.A.M. Assocs Inc., 150-08 87th Ave., Jamaica, N.Y., (212) 658-8881 Branch Office: Wayne, N.J.
SBM Assocs. Inc., 800 Linden Ave., Rochester, N.Y., (716) 381-8330, TWX: 510-253-6145. Branch Offices: Union, N.J.; Pleasantville, N.Y.; Plainview, N.Y.; Syracuse, N.Y.
S-J Sales Assocs. Inc., 148-05 Archer Ave., Jamaica, N.Y., (212) 291-3232, TWX: 710-582-2635
S-L Assocs., Box 15096, Denver, Colo., (303) 238-1807
S & S Assocs., Inc., Boro Line Rd., King of Prussia, Pa., (215) 265-3450. Branch Offices: Bethesda, Md.; Baltimore, Md.
STEPCO, Inc., Box 9836, El Paso, Texas, (915) 772-5274
Saffro & Assocs., 3736 Dempster St., Skokie, Ill., (312) JU 8-0905
Saftler, P. Assoc., Inc., 157 W. 57th St., New York, N.Y., (212) 247-3855, TWX: 710-581-5887. Branch Office: Pittsford, N.Y.
Sales Engrg. Co., Baker Ave., W. Concord, Mass., (617) 369-3943. Branch Office: Hartford, Conn.
Sales, Gene F. Co., 4750 N. Milwaukee Ave., Chicago, Ill., (312) 545-5562. TWX: 265-1496
Salsbury Assocs. Inc., 331 W. John St., Hicksville, N.Y., (516) 938-1080
Sanford, L. C., 1994 Kansas Ave. N.E., St. Petersburg, Fla., (813) 525-4553
Satterthwaite, W. F. & Co., Box 191, Lansdowne, Pa., (215) 623-5100
Satullo Co., 4514 N. Woodward, Royal Oak, Mich., (313) 549-3910. Branch Offices: Cleveland, Ohio; Dayton, Ohio; Pittsburgh, Pa.
Sawtelle, C. E., 2068 E. Maplewood Ave., Abington, Pa., (215) OL 9-0742
Saxon, C. W. & Assocs., Box 517, El Segundo, Calif., (213) EA 2-2111
Scanlon, P. J. Co., Inc., 724 S. Sherman St., Richardson, Texas, (214) AD 1-4661, TWX: 910-867-4713
Scanlon, R. B., Co., 10 Halliwell Dr., Stamford, Conn., (203) 325-2718
Schaal, Four A St., Burlington, Mass., (617) 272-3250, TWX: 710-332-0246
Scheffler, C. Co., 1133 Navajo Trail, Indianapolis, Ind., (317) 253-6337
Schibley Assocs. Inc., 10604 Warwick Ave., Fairfax, Va., (703) 591-3008. Branch Office: Cherry Hill, N.J.
Schlemmer, 1172 W. Galbraith Rd., Cincinnati, Ohio, (513) 522-8340.
Schmeichel, S. Co., 5968 W. Chicago Ave., Chicago, Ill., (312) 378-2070
Schmidt & Assocs., 1419 Deveraux Dr., Dayton, Ohio, (513) 293-6652
Schmidt, C. H., 16405 W. 8 Mile Rd., Detroit, Mich., (313) BR 3-8500
Schmitt, F. E. Co., Inc., 311 Meacham Ave., Elmont, N.Y. (516) 437-8150
Schmitz Bros., Inc., 82 St. Paul St., Rochester, N.Y., (716) 546-7628
Schoeffler, F., 6912 E. Horseshoe Rd., Scottsdale, Ariz., (602) 948-3470.
Schomburg, E. J. Co., 3100 Monroe Ave., Rochester, N.Y., (716) 586-0725
Schoonmaker, J Y. Co., Inc., Box 20840, Dallas, Texas, (214) 357-8481. Branch Offices: Magnolia, Ark.; San Antonio, Texas, Houston, Texas
Schroeder & Loomis, Inc., 714 E. 65th St., Indianapolis, Ind., (317) 251-4571, TWX: 810-341-3296
Schroeder Sales, 2084 Noble Rd., Cleveland, Ohio, (216) 268-3636
Schuft, H. J. Co., Inc., 815 Washington St., Newtonville, Mass., (617) 527-5304, TWX: 710-335-6767. Branch Office: New Haven, Conn.
Schulz, E. A. Co., 721 Sherwood Dr., Indianapolis, Ind., (317) 255-1993
Schultz, N. R. Co., Box 159, Belleview, Wash., (206) 454-5224. Branch Office: Beaverton, Ore.
Scientific Sales Corp., 7132 N. Harlem Ave., Chicago, Ill., (312) 775-7594. Branch Offices: Indianapolis, Ind.; Minneapolis, Minn.; St. Louis, Mo.
Scott, M. Co., Inc., 20 Walnut St., Wellesley Hills, Mass., (617) 235-0102
Scott, G. G. Co., 6 W. Stuart Dr., Glen Cove, N.Y., (516) 676-2088
Seatronics Inc., 5616 4th Ave. S., Seattle, Wash., (206) 767-4330, TWX: 910-444-2073
Seay, H. H. Co., 1350 Crestwood Ave., Columbus, Ohio, (614) 235-0265
Sebright, R. D. & Co., 7120 W. Florissant, St. Louis, Mo., (314) 261-0055
Seco Inds., Inc., 87-66 150th St., Jamaica, N.Y., (212) 297-1135. Branch Office: East Brunswick, N.J.
Segel, C. Co., Box 106, Newtonville, Mass., (617) 969-6900
Segel, H. P., 386 Washington St., Brookline, Mass., (617) 232-7525
Sencor, Inc., 2222 Glendale St., Phila., Pa., (215) 342-0223, TWX: 710-670-7570. Branch Office: Syosset, N.Y.
Shaffer, G. Co., 16530 Greenview Rd., Detroit, Mich., (313) 535-8448
Shalco, Inc., 23529 Woodward Ave., Ferndale, Mich., (313) 547-4771, TWX: 810-232-1514. Branch Office: Grand Rapids, Mich.
Shannon Assocs., One First St., Los Altos, Cal., (415) 941-2217
Sharp, F. R. Co., Inc., 12417 Cedar Rd., Cleveland, Ohio, (216) 647-8744. Branch Offices: Cincinnati, Ohio; Middleville, Mich.; Dayton, Ohio
Shaw, R., Co., 2831 Hampton Ave., St. Louis, Mo., (314) 647-8866
Shaw, S. A. Co., Inc., 361 Central Park Ave., Yonkers, N.Y.
Sheffer, J W. Co., 4609 Old Frederick Rd., Baltimore, Md., (301) 233-0606
Shefler-Kahn Co., Inc., 2017 N. 7th St., Phoenix, Ariz., (602) 258-7893, TWX: 910-951-0659. Branch Office: Albuquerque, N.M.
Shelby, T. & Co. Inc., 17 S. Walnut, New Bremen, Ohio (419) 629-6511
Shelmar Elctrn. Corp., Box 254, Glenside, Pa., (215) 885-0800
Shelps, G. A. Co., Box 254, Glenside, Pa., (215) 885-0800
Shephard-Stern Co., 4109 Burbank Blvd., Burbank, Cal., (213) 849-6671, TWX: 910-498-2208

Sheridan Assocs. Inc., Box 37646, Cincinnati, Ohio, (513) 761-5432, TWX: 810-461-2670. Branch Offices: Cleveland, Ohio; Dayton, Ohio; Lathrup Village, Mich.; St. Louis, Mo.; Pittsburgh, Pa.
Shields, W. D. Co., Box 9093, Pittsburgh, Pa., (412) 471-6946
Shiell, T. J. Assocs., Box 504, Menlo Park, Calif., (415) 323-6404
Shoemaker, Frame, 1800 N. Argyle, Hollywood, Cal., (213) 464-3019
Shprentz, H. Co., 126 Deertrack La., Irvington, N.Y., (914) 591-7970
Siclari, V., 949 51st St., Brooklyn, N.Y., (212) GE 6-4567
Sidnell, R. G. & Co., Inc., 14701 Detroit Ave., Cleveland, Ohio, (216) 221-1313. Branch Offices: Dayton, Ohio; Pittsburgh, Pa.
Siff, R. G., 22 Oxford Ave., Dayton Ohio, Branch Office: Sarasota, Fla.
Silvers, M M. & Assocs., 4403 Sheridan Rd., Chicago, Ill., (312) 561-7300
Simberkoff Sales, Inc., 71 Valley St., S. Orange, N.J., (201) 763-7900, TWX: 710-999-5517. Branch Offices: Lockport, N.Y.; Kenmore, N.Y.; Syracuse, N.Y.; Albany, N.Y.; Philadelphia, Pa.; Arlington, Va.
Simplex West Inc., 2901 E. Val Verde Crt., Compton, Calif., (213) 774-3170. Branch Offices: San Francisco, Calif.; Seattle, Wash.
Simpson Enterprises, Box 18066, Wichita, Kans., (316) WH 3-0502. Branch Office: Kirkwood, Mo.
Sinai-Johnson, Inc., 817 Douglas St., Redwood City, Cal., (415) 365-6263, TWX: 910-378-5427
Sinclair Elctrn., 1085 Clarendon Crescent, Oakland, Calif., (415) 451-1835
Sir Sales Inc., 35 Powerhouse Rd., Roslyn Heights, N.Y., (516) MA 1-7485. Branch Office: Yonkers, N.Y.
Slater, R R. Co., 713 Terminal Sales Bldg., Seattle, Wash., (206) 622-3860. Branch Office: San Francisco, Calif.
Slubin, L. & Co., 2305 Fairmount Ave., Philadelphia, Pa., (215) CE 6-2072
Smith Co., Box 85, S. Orange, N.J., (201) 763-1770
Smith, A. Co., 405 166th S.E., Bellevue, Wash., (206) 746-6770
Smith, D. Sales Co., 2320 N. 45th St., Seattle, Wash., (206) ME 3-3160
Smith, D. & Assoc., Inc., 32 S. River St., Aurora, Ill., (312) 896-0828
Smith, H. P., 224 W. Franklin Ave., Minneapolis, Minn., (612) 335-8911
Smith, H. F., 259 W. 14th St., New York, N.Y., (212) CH 2-2398
Smith, J. E. Co., Inc., 1353 Chemical, Dallas, Texas, (214) 631-1727. Branch Office: Houston, Texas
Smith, J. J. & Assocs. Inc., Box 460, Winter Park, Fla., (305) 644-4316. Branch Office: Miami, Fla.
Smith, L., 219 Pitney Pl., Morristown, N.J., (201) 267-3151
Smith, M. K., Inc., 1605 Chatham Ave., Charlotte, N.C., (704) 372-1026. Branch Offices: Birmingham, Ala.; Chamblee, Ga.; Ft. Lauderdale, Fla.
Smith, O. H., Co., 5255 N. Lawler, Chicago, Ill., (312) 286-4476
Smith, R., Co., 59 Verndale St., Brookline, Mass., (617) 277-0017. Branch Office: W. Hartford, Conn.
Snitzer, T L. Co., 9005 Exposition Blvd., Los Angeles, Calif., (213) 836-6170, TWX: 910-340-6768. Branch Offices: Cupertino, Calif.; Del Mar, Calif.; Phoenix, Ariz.
Snow, C. E. Co., 10442 Baltimore Ave., Beltsville, Md., (301) 345-2211. Branch Offices: Ambler, Pa.; Ft Lauderdale, Fla.
Snyder, L. G. Co., 1418 N. Highland Ave., Hollywood, Calif., (213) 469-6278
Snyder Sales Co., 102 S. Washington St., Hinsdale, Ill., (312) 323-9191
Sodaro Co., 3753 S. Robertson Blvd., Culver City, Calif., (213) 383-5272
Somers, J. F. Co., 527 S. Main St., Geneva, N.Y., (315) 789-2238 Branch Office: Gibsonia, Pa.
Somner, W. L. Co., Inc., Box 82, Shreveport, La., (318) 422-9291. Branch Offices: Tinsley, Miss.; Brookhaven, Miss.; Houma, La.; Metairie, La.; Odessa, Texas; Pampa, Texas; Houston, Texas; Corpus Christi, Texas; Tu'sa, Okla.
Sonkin, D. Assocs., Inc., 10 Fiske Pl., Mt. Vernon, N.Y., (914) MO 8-9809.
Sosine, E. H., Co., 3618 39th Ave. W., Seattle, Wash., (206) 283-9017
Southland Engrg. & Sales Inc., 5810 Schumacher La., Houston, Texas, (713) 782-4575. Branch Offices: Richardson, Texas; Tulsa, Okla.
Southwest Elctrn. Inds. Inc., 621 Meadows Bldg., Dallas, Texas, (214) EM 3-1671. Branch Offices: Houston, Texas; Tulsa, Okla.
Southwest Scientific Co., 912 Marguerita Ave., Santa Monica, Calif., (213) 870-8332. Branch Office: San Mateo, Calif.
Southwestern Controls, Box 22351, Houston, Texas, (713) MO 6-2801. Branch Offices: Dallas, Texas, Tulsa, Okla.
Space Age Sales Co., Box 35625, Dallas, Texas, (214) 357-5714
Space Engrg., 491 N. Los Robles Ave., Pasadena, Calif., (213) 681-4421, TWX: 213-449-3456
Spacetronics Co., 4515 Prentice St., Dallas, Texas, (214) 368-1215
Spears, M. Co., 3881 S. Hills Cir., Fort Worth, Texas, (817) 923-4657. Branch Offices: Dallas, Texas.; Houston, Texas; San Antonio, Texas; New Orleans, La.
Spectrum Sales, 14106 Ventura Blvd., Sherman Oaks, Calif., (213) 788-9911
Spellman, F. Co., 1295 Northern Blvd., Manhasset, N.Y., (516) MA 7-3399, TWX: 510-223-0812
Spenser, W. Co., 21500 Greenfield Rd., Oak Park, Mich., (313) 398-8005. Branch Office: Windsor, Ont. Canada
Spivey, T. Co., Inc., Box 12321, Houston, Texas, (713) 649-1221
Springel Sales Co., 325 N. Franklin St., Philadelphia, Pa., (215) WA 5-7831.
Sproch Sales, Inc., 3520 W. Broward Blvd., Ft. Lauderdale, Fla., (305) 587-3792. Branch Office: Tampa, Fla.
Sprung-Nussbaum, Inc., 254 W. 31st St., New York, N.Y., (212) 565-1820, TWX: 710-581-6116.
Squibb, R K., Inc., 655 N.E. Northlake Pl., Seattle, Wash., (206) 632-2450.
Stahl, W. C., Box 262, Marlton, N.J., (609) 983-1122.
Stampress Comp., Inc., 834 Linden Ave., Rochester, N.Y., (716) 381-2620.
Stein Instrumentation, 413 Johnson St., Jenkintown, Pa., (215) 885-2370.
Stang Sales Corp., 271 Columbus Ave., Tuckahoe, N.Y., (914) 779-6868.
Stemm, R. E., Inc., 17W480 Lake St., Addison, Ill., (312) 279-2440. Branch Office: Minneapolis, Minn.
Sterling, S., Co., 21250 10½ Mile Rd., Southfield, Mich., (313) 357-3700. Branch Offices: Cleveland, Ohio; Dayton, Ohio; Pittsburgh, Pa.; Park Ridge, Ill.; St. Louis, Mo.
Stevens, A. E., Trailer Estates, Box 6066, Bradenton, Fla., (813) 755-7654.
Stevens, K. C., & Co., Inc., Box 24, Lexington, Mass., (617) 862-1812.
Stevens Engrg., 5306 W. Lawrence Ave., Chicago, Ill., (312) 725-4400.
Stickel-McAllister, 4357 Melrose, Los Angeles, Calif., (213) 665-6621.
Still, P., 9415 Old Bonhomme Rd., St. Louis, Mo., (314) 993-2077.
Stinson Assocs., 227 Haverford Ave., Narberth, Pa., (215) MO 4-5511-2
Stobbart, A. J., 4980 State Rd., Drexel Hill, Pa., (215) 259-3881.
Stolaroff, M. A., Co., 4622 W. Slauson Ave., Los Angeles, Calif., (213) 295-7781, TWX: 213-296-1053.
Stone, J., & Assoc., 330 Second St., Los Altos, Calif., (415) 948-4563. TWX: 910-370-7953.
Stone, J. L., 110 Terrace Circle, Dewitt, N.Y., (315) 446-5127.
Stone, R. R., & Assocs., Inc., Box 47, Mentor, Ohio. Branch Office: Dayton, Ohio.
Strassner E. E., Co., 3121 Los Feliz Blvd., Los Angeles, (213) 666-1511, TWX: 910-321-4468.
Strassner, R. A., Co., Inc., 3003 Glendale Blvd., Los Angeles, Cal., (213) 666-4040, TWX: 910-321-3990. Br. Offices: Los Altos, Calif.; Phoenix, Ariz.
Stratton, C. H., 7720-A Stenton Ave., Philadelphia, Pa., (215) 247-7869.
Striker, J. E., Co., 1319 Howard Ave., Burlingame, Cal., (415) 342-1425.
Sturdy, R. H., Co., Inc., 204 Worcester St., Wellesley Hills, Mass., (617) 235-2330, TWX: 710-383-6519.
Sturgeon, P. R., Co., Inc., 1330 Boylston St., Chestnut Hill, Mass., (617) 734-7710. Branch Office: Milford, Conn
Sunday-O'Brien, 15 Potter St., Hadonfield, N.J., (609) 429-4013, TWX: 710-896-0679.
Surratt, S., Mfgrs. Sales, 231 Cedar St., Jackson, Tenn., (901) 442-3623
Swedgal, 258 Broadway, New York, N.Y., (212) WO 2-5485.
Swenson, E. V., & Assocs., 1112 Talbott Tower, Dayton, Ohio.
Swinke, W. F. & Assocs., 3014 Colfax St., Evanston, Ill., (312) 248-4343.
Sylvester, F. F., Assocs., 649 Morris Ave., Springfield, N.J., (201) 376-3324, TWX: 710-983-4439. Branch Office: Great Neck, N.Y.
Sykes, V. J., 13333 N. Central Expwy., Dallas, Texas, (214) 235-5289.
Systems Engrg., 8633 Harrison S., Minneapolis, Minn., (612) 881-6386.
Systems Engrg. Assocs., Box 526, Waukesha, Wisc., (414) 782-3388.
Systems Engrg. Assocs., 5505 N. Menard Ave., Chicago, Ill., (312) 774-1452.
Systems Engrg. Assocs., 1010 E. 86th, Indianapolis, Ind., (317) 846-2593.

T

TAW Assocs., 4455 Ventura Ave., Sherman Oaks, Calif., (213) 784-2765.
TESCO Assocs., 2002 Teall Ave., Syracuse, N.Y., (315) 463-4566.
TIBY Co., 2245 Warrensville Center Rd., Cleveland, Ohio, (216) 371-5335. Branch Offices: Dayton, Ohio; Ferndale, Mich.
TMC Sales Corp., 2465 Lemoine Ave., Fort Lee, N.J.
TUCUL Engrg., 6402 Crenshaw Blvd., Los Angeles, Calif., (213) 750-0338.
Tak Instruments Assocs., Box 226 Palisades Park, N.J., (201) 944-3337.
Talbe Co., Inc., 19 Sylvan Ave., Englewood Cliffs, N.J., (201) 947-5038. Branch Offices: Dayton, Ohio; Des Plaines, Ill.; Stamford, Conn.; Binghamton, N.Y.; Monsey, N.Y.; Hollywood, Fla.; Maitland, Fla.
Talbot Assocs., Inc., 11 Cleveland Pl., Springfield, N.J., (201) 376-9570.
Talcomp Co., Inc., 19 Sylvan Ave., Englewood Cliffs, N.J., (201) 947-5038.
Tauber, W., Co., 151 Fayette Blvd., Syracuse, N.Y., (315) 446-7094.
Taylor, B. B., Corp., 2270 Grand Ave., Baldwin, N.Y., (516) 233-8000, TWX: 510-225-7504.
Taylor, D. A., 2019 Hudson Ave., Rochester, N.Y., (716) 342-8881.
Taylor, F. W., Co., Inc., 4455 E. Genesee St., Dewitt, N.Y., (315) 446-0422.
Taylor, J. A., Sales, 5410 Julmar Dr., Cincinnati, Ohio, (513) 471-5750.
Taylor, M. F., Co., Inc., Box 111, Silver Spring, Md., (301) 589-4002. Branch Offices: Birmingham, Ala.; Casselberry, Fla.; Winter Haven, Fla.; Marlton, N.J.; Baltimore, Md.; Charlotte, N.C.; Camp Hill, Pa.; Philadelphia, Pa.
Teamwork, Inc., 2646 Andjon Dr., Dallas, Texas, (214) 352-7747.
Tec Sales, 9906 Chicago Ave. S., Minneapolis, Minn., (612) 884-1180.
Tech Marketing Assocs., 355 W. Olive Ave., Sunnyvale, Calif., (408) 736-3687, TWX: 910-339-9227.
Tech-Rep Assocs., Inc., Box 2095, Melbourne, Fla., (305) 723-9140. Branch Offices: St. Petersburg, Fla.; Jonesboro, Ga.
Tech-Ser, Inc., Box 3255, Burbank, Calif., (213) 846-9631, TWX: 910-498-2709. Branch Offices: Mt. View, Calif.; San Diego, Calif.; Dallas, Texas.
Technical Assoc., Box 388, Fairborn, Ohio. Branch Office: Rocky River, Ohio.
Technical Assocs., Inc., 2319 E. South St., Orlando, Fla., (305) 424-5681. Branch Offices: Huntsville, Ala.; Spartanburg, S.C.
Technical Elctrn., Inc., 335 Crossways Park Dr., Woodbury, N.Y., (516) 921-9393, TWX: 516-221-2170.
Technical Enterprises, 181 West St., Waltham, Mass., (617) 891-5300.
Technical Instruments, Inc., 122 West St., Wilmington, Mass., (617) 944-3930. Branch Office: Bridgeport, Conn.
Technical Marketing Assocs., Inc., 2050 Woodson Rd., St Louis, Mo., (314) 427-3600, TWX: 910-765-0938. Branch Office: Mission, Kans.
Technical Marketing, Inc., 1511 E. Robinson, Orlando, Fla., (305) 843-2500., TWX: 810-850-0161. Branch Offices: Birmingham, Ala.; Huntsville, Ala.; Cocoa Beach, Fla.; Ft. Lauderdale, Fla.; Hallandale, Fla.; Largo, Fla.; St. Petersburg, Fla.; Marietta, Ga.
Technical Sales, 1485 Bayshore Blvd., San Francisco, Calif., (415) 467-1434.
TechniSales Co., 3820 E. Colorado Blvd., Pasadena, Calif., (213) 792-5111.
Technical Sales Co., Inc., 4619 W. Marginal Way, S.W., Seattle, Wash., (206) 523-4063.
Technicraft Co., 7028 Ridge Ave., Philadelphia, Pa., (215) IV 3-4700.
Technitron Instr., Inc., 23203 Lorain Rd., North Olmstead, Ohio, (216) 734-0960, TWX: 810-421-8694. Branch Offices: Dayton, Ohio; Detroit, Mich.; Pittsburgh, Pa.
Techno Assocs., 2324 Shorecrest Dr., Dallas, Texas, (214) 357-9213.
Tek-Rep, Inc., 1075 Rockville Pike, Rockville, Md., (301) 762-7777.
Tek-Sel, Inc., 440 No. Midland Ave., Saddle Brook, N.J., (201) 791-5545, TWX: 710-988-2288.
Temco, Inc., 118 S. Rogers St., Bloomington, Ind., (812) 332-3377.
Teplitz, H., & Co., Inc., 3718 Salem Ave., Dayton, Ohio, (513) 277-9178. Branch Offices: Cleveland, Ohio; Detroit, Mich.
Test Equip. Sales, 4447 N. Bodine St., Philadelphia, Pa., (215) 329-1822.
TESTCO, Room 219 Admin. Bldg., Boeing Field, Seattle, Wash., (206) RO 2-8220, TWX: 910-444-2148. Branch Offices: Palo Alto, Calif.; Fullerton, Calif.
Texas Avionics Co., 4515 Prentice St., Dallas, Texas, (214) 368-3566.
Texas Sales Rep. Co., 3311 Montrose Blvd., Houston, Texas, (713) 523-1675.
Texport Co., 2411 Farrington, Dallas, Texas, (214) 631-6270. Branch Offices: Houston, Texas; Memphis, Tenn.; Baton Rouge, La.
Thal-Mor Assoc., 3232 Encrete La., Dayton, Ohio, (513) 298-9939.
Thomas & Modrcin Assocs., Inc., 5450 Buena Vista Dr., Shawnee Mission, Kans., (913) 432-1231. Branch Offices: Hazelwood, Mo.; Marion, Iowa.
Thomas & Sukup, Inc., 2060 E. 54th St., Indianapolis, Ind., (317) 251-4574, TWX: 317-635-8075.
Thompson, J. F., Co., 322 Riverside Dr., Ormond Beach, Fla., (904) 677-2298. Branch Office: Jensen Beach, Fla.

Thompson, R. W., Assocs., Inc., 4135 El Camino Way, Palo Alto, Calif., (213) 677-6104. Branch Office: Inglewood, Calif.
Thornwell, E. A., 1537 Howell Mill Rd. N.W., Atlanta, Ga., (404) 351-6535.
Thorpe, J. M., Co., 640 Hidden La., Detroit, Mich., (313) 884-4360.
Thorson Co., 6824 Melrose Ave., Los Angeles, Calif., (213) 937-0790, TWX: 910-321-4024. Branch Offices: Palo Alto, Calif.; Seattle, Wash.; San Diego, Calif.; Denver, Colo.; Phoenix, Ariz.; Dallas, Texas; Santa Ana, Calif.; Houston, Texas; Albuquerque, N.M.
3 DBM, Inc., 7424 Greenbush Ave., N. Hollywood, Calif., (213) 875-0876, TWX: 910-499-2670.
Thro Industrial Sales Co., Box 7244, Kansas City, Mo., (913) 362-2533.
Titan Reps, Inc., 6434 Maple Bldg., Dallas, Texas, (214) 357-8266.
Tobias & Co., Inc., 49-01 31st Ave., Flushing, N.Y., (212) 726-4551.
Todino Engrg. Sales, Inc., 50 Kearney Rd., Needham Hghts, Mass., (617) 444-7925, TWX: 710-325-0126, Branch Office: Milford, Conn.
Toneline Mfg. Co., 1812 S. Halsted, Chicago, Ill., (312) CA 6-6114.
Tools for Electronics, Box 173, Waltham, Mass., (617) 894-7080.
Tower Sales Engrg. Co., 550 Fifth Ave., New York, N.Y., (212) 246-7611.
Townsend Technical Sales, Box 265, Saratoga, Calif., (408) 252-3478.
Travco Assocs., Inc., 142 Mineola Ave., Roslyn Hghts., N.Y., (516) 621-3223.
Tri-State Marketing, Inc., 1717 Section Rd., Cincinnati, Ohio, (513) 631-5060, TWX: 810-461-2697. Br. Offices: Cleveland, Ohio; Fort Wayne, Ind.
Trier, J. S., & Assoc., 2906 Fairchild Apron, Torrance Municipal Airport, Torrance, Calif., (213) 326-1385.
Trinkle Sales Inc., 500 N. Kings Hwy., Cherry Hill, N.J., (609) 667-3500, TWX: 710-892-0749.
Truex Assocs., Inc., 3165 McCrory Pl., Orlando, Fla., (305) 841-8931.
Tudor, J. A., & Assocs., Inc., 2605 Western Ave., Seattle, Wash., (206) 682-7444. Branch Offices: Portland, Ore.; Spokane, Wash.; Eugene, Ore.
Twist, J. G., Co., 5222 W. Diversey Ave., Chicago, Ill., (312) 777-2250, TWX: 910-221-1313. Branch Office: Waukesha, Wisc.
Tylinski, F., Co., 338 Northern Blvd., Great Neck, N.Y., (516) 446-9070.

U

Ungar Sales Assocs., 317 Glasgow Ave., Inglewood, Calif., (213) 678-5371.
United Export Corp., Box 147, South Bend., Ind., (219) 282-2375.
Universal Components, Box 112, Kenilworth, N.J.

V

VPI Assocs., 130001 Mistletoe Rd., Laurel, Md., (301) 792-7631, Branch Offices: Farmingdale, N.Y.; Roslyn, N.Y.; Abington, Pa.
Val-Skol Sales, Inc., 10515 Margate Terr., Cincinnati, Ohio, (513) 793-4082. Branch Offices: Cleveland Hts., Ohio; Indianapolis, Ind.; Columbus, Ohio; Ft. Wayne, Ind.
Varrelman-Gorman Co., Box 206, Livingston, N.J., (201) 922-2505. Branch Office: Liverpool, N.Y.
Vaughn, G. H., 2366 E. Foothill Blvd., Pasadena, Calif., (213) 681-4511.
Vaux, G, 320 Caversham Rd., Bryn Mawr, Pa., (215) LA 5-4517.
Venn, R. W., Co., Route 2, Box 660, Lake Villa, Ill., (312) 395-5353.
Vereb, S. J., & Assoc., Box 4424, Cleveland, Ohio, (216) 271-2066.
Verter Sales Co., 2352 E. 66th St., Brooklyn, N.Y., (212) 444-3880.
Vidal Elctrn. Co., 3403 High Bluff Dr., Dallas, Texas, (214) 241-4491.
Vignola, C. A., Assoc., 2611 Schellridge Rd., Jefferson City, Mo., (314) 635-1023. Br Offices: Kansas City, Mo.; St. Louis, Mo.; Bellevue, Neb.
Villani-Pitcher, Inc., 20233 Ann Arbor Trail, Dearborn,Mich., (313) 271-4600, TWX: 810-221-7003.
Vines & Co., Box 1025, Denver, Colo., (303) 825-4471.
Vinson Assocs., Inc., 3600 S. Lincoln, Englewood, Colo., (303) 789-2203, TWX: 910-933-0187. Branch Offices: Albuquerque, N.M.; Scottsdale, Ariz.
Vogt, M., 2817 Bamlet Rd., Royal Oak, Mich., (313) 549-3355.
Volente, D., & Assoc., 2440 Eaglehurst, Toledo, Ohio, (419) 882-2830.
Vrbik, J., Co., 2818 A. Ave. N.E., Cedar Rapids, Iowa, (319) 365-0461.

W

WC Sales, Inc., Box 109, Easton, Pa., (215) 252-8300.
WKM, 6741 Ridge Rd., Cleveland, Ohio, (216) 885-5616, TWX: 810-421-8453
WKM, 90 Clairton Blvd., Pittsburgh, Pa., (412) 892-2953, TWX: 710-667-4858
WKM, 1474 E. Outer Dr., Detroit, Mich, (313) 892-2500, TWX: 810-243-4110
WKM Assocs., Inc., 5335 Far Hills Ave., Dayton, Ohio, (513) 434-7500.
Wadsworth Mfg. Assocs., Inc., 183 Buckley Rd., Liverpool, N.Y., (315) 652-2865. Branch Offices: Atherton, Calif.; Pacific Palisades, Calif.; Chicago, Ill.; Liverpool, N.Y.; Plainview, N.Y.; Williamsville, N.Y.; Eddystone, Pa.; Richardson, Texas.
Wagner, D. Assoc., Box 485, Altadena, Calif., (213) 681-4060.
Wahl, A. C., & Assocs., Inc., Box 15220, Cincinnati, Ohio, (513) 821-3270, TWX: 513-577-1068. Branch Offices: Cleveland, Ohio; Columbus, Ohio; Dayton, Ohio; Evansville, Ind.; Indianapolis, Ind.; Richmond, Ind.
Waldman Assocs., 1094 W. Evelyn Ave., Sunnyvale, Calif., (408) 245-2500.
Waldrip, Blankenburg, 7650 Chippewa Rd., Brecksville, Ohio, (216) 526-1100
Wall Assocs., Box 195, DeWitt, N.Y., (315) 446-4100.
Wallace & Wallace, 1206 Maple Ave., Los Angeles, Calif., (213) 747-0401.
Wallace, S. K., Assoc., Inc., Box 67, Lutz, Florida, (813) 949-1817. Branch Offices: Montgomery, Ala.; Miami, Fla.; Tampa, Fla.; Atlanta, Ga.; Kernersville, N.C.; Matthews, N.C.; Memphis, Tenn.
Walsh, J. V., & Assocs., Box 59 Teaneck, N.J., (201) 836-5700.
Walter, Box AN, Los Altos, Cal., (415) 941-3141, TWX: 910-370-7458.
Ware, J. A., & Assoc., 301 W. G St., San Diego, Calif., (714) 232-8578. Branch Office: Phoenix, Ariz
Warner, A. J., Co., 4927 34th Ave. So., Minneapolis, Minn., (612) 729-7371.
Ward/Davis Assocs., 770 S. Arroyo Pky., Pasadena, Calif., (213) 684-2840, TWX: 910-588-3755. Branch Offices: Palo Alto, Calif.; San Diego, Calif.
Warriner, D. A., Instr. Sales & Svc., 7920 Zimple St., New Orleans, La. Branch Office: Metairie, La.
Wasson-Gallagher, 1024 N. Boulevard, Oak Park, Ill.
Waugaman Assocs., 2785 N. Speer Blvd., Denver, Colo., (313) 255-5000.
Webb, H. R., Assoc., Box 13201, Orlando, Fla., (305) 855-5257.
Wells, W. C., Co., 6055 N.E. Glisan, Portland, Ore., (503) 235-2437.
Web Elctrn. Assocs., 18039 Crenshaw Blvd., Torrance, Calif., (213) 323-8676.
Weber, J. L., 8150 Westfield Blvd., Indianapolis, Ind., (317) 255-4117. Branch Offices: Seattle, Wash.; Spokane, Wash.
Weber, J. L., Agency, 8150 Westfield Blvd., Indianapolis, Ind., (317) 255-4117.
Weber, J., 2700 Henry Hudson Pkwy., Bronx, N.Y., (212) 546-8306.
Weeton, W. E., Co., Box 77 Needham Mass., (617) 444-1012.
Weightman & Assoc., 1226 W. Olive., Burbank, Calif., (213) 849-7711. Branch Office: Menlo Park, Calif.
Weinberg, M., 1122 E. Clivden St., Philadelphia, Pa., (215) 549-1122.
Weinreich, G., 11554 E. Northwest Hwy., Dallas, Texas, (214) 321-2800.
Weiss, W. W., & Associates, 1780 Broadway, New York, N.Y.
Weller Elctrn. Sales, Inc., Box 212, Worthington, Ohio, (614) 885-7819.
Wes-K Assocs., 5917 Noble Ave., Van Nuys, Cal., (213) 989-3070, TWX: 910-495-1770.
Wenco Sales, 7728 Morgan Ave. S., Minneapolis, Minn., (612) 866-3639.
Westaironics, Inc., 1800 N. Highland Ave., Hollywood, Calif., (213) 466-6201, TWX: 910-321-4226.
West, J., 6747 N. Octavia Ave., Chicago, Ill., (312) 763-3500.
Wesrep Corp., 339 S. Robertson Blvd, Beverly Hills, Calif., (213) 655-9784.
Wetterhahn, M., Co., Inc., 4420 Crescent Blvd., Pennsauken, N.J., (609) 662-1611, TWX: 710-892-0762. Branch Office: Towson, Md.
Wheelock, C. F., & Assoc., Inc., Box 1290, Birmingham, Ala., (205) 595-1172, TWX: 810-733-4481. Branch Offices: Fairhope, Ala.; Huntsville, Ala.
Wheeler, R. J., Griggs-Midway Bldg., St. Paul, Minn., (612) 644-9557.
Whelan, 2600 Far Hills Ave., Dayton, Ohio. Branch Office: Waterford, Pa.
Whitcomb Assocs., 730 Deepdene Rd., Balimore, Md., (301) 889-1245, TWX: 202-737-0763. Branch Office: Washington, D.C.
White & Co., 777 N. First St., San Jose, Calif., (408) 292-8229.
White, B., & Co., Inc., 7 Church La., Baltimore, Md., (301) 484-5400.
White, H. J., Co., Inc., 302 W. Marlton Pk., Cherry Hill, N.J., (609) 428-2304. Branch Office: Towson, Md.
White, L. G., & Co., Inc., 1110 Fidler La., Silver Spring, Md., (301) 585-3141, TWX: 710-825-9535. Branch Office: Winston-Salem, N.C.
White, L. G., Keystone, Inc., Box 246, Narberth, Pa., (215) MO 4-6505, TWX: 215-667-3949.
White Sales Co., Inc., 20 Chestnut St., Needham, Mass., (617) 444-3676. Branch Office: Berlin, Conn.
Whitehead, J. F., Co., Box 177, Guilford, Conn., (203) 453-3855.
Whitesell, R. O., & Assocs., 6691 E. Washington St., Indianapolis, Ind., (317) 359-5374, TWX: 317-635-9766. Branch Offices: Ft. Wayne, Ind.; Louisville, Ky.; Benton Harbor, Mich.; Southfield, Mich.; Cincinnati, Ohio; Cleveland, Ohio; Dayton, Ohio; Pittsburgh, Pa.
Whitmore Assocs., Inc., 535 N. Michigan, Chicago, Ill., (312) 321-1503. Branch Offices: Minneapolis, Minn.; Fort Wayne, Ind.
Whitney, M. E., Assocs., 1400 N. Uhle St., Arlington, Va., (703) 524-5642.
Widdekind, M. K., Co., Inc., 815 W. Ewing, Seattle, Wash., (206) 284-8020.
Wieler & Co., Box 708, Downey, Calif., (213) 861-9223. Branch Office: Sunnyvale, Calif.
Wild, J. J., Inc., 400 Jericho, Tpke., Jericho, N.Y., (516) 921-7100: Branch Offices: Laurel, Md.; Needham, Mass.; Ramsey, N.J.; Hastings-on-Hudson, N.Y.; Southampton, Pa.
Wiley, P. F., Co., 1632 Silverlake Blvd., Los Angeles, Calif., (213) 663-8028, TWX: 910-321-4166.
Wilkinson, R. L., Inc., 707 Stevenson La., Towson, Md., (301) 377-7800. Branch Office: Glenside, Penna.
Wilks, E. L., Co., Box 34466, Dallas, Texas, (214) 242-5321.
Willgold Elctrn. Sales Corp., 100 N. Village Ave., Rockville Centre, N.Y., (516) 764-4022.
Willams-Assocs. Inc., 4971 Jackson St., Denver, Colo., (303) 388-4391, TWX: 303-292-3249. Branch Offices: Salt Lake City, Utah; Albuquerque, N.M.; Phoenix, Ariz.
Williams, H. R. Assocs. Inc., Box 344, Ridgewood, N.J., (201) 444-5392. Branch Office: Weirsdale, Fla.
Williams, J. Assocs., Box 2644, Califon, N.J., (212) 691-2430. Branch Office: New York, N.Y.
Willoughby-Fowler-Wright, Box 486, Richardson, Texas, (214) 235-3664
Wimberly, W. Co., 532 S. Fort Harrison, Clearwater, Fla., (813) 446-7072. Branch Office: Orlando, Fla.
Winfield Elctrn. Sales Co., 666 N. E. 125th St., N. Miami, Fla., (305) 751-5566, TWX: 810-848-8772. Branch Office: Atlanta, Ga.
Winslow, D. Co., 24 California St., San Francisco, Calif., (415) 982-8644
Winslow, E. A., 206 North Clay Ave., St. Louis, Mo., (314) 965-5880. Branch Office: Kansas City, Mo.
Wolff, A L., Co., 2485 Huntington Dr., San Marino, Calif., (213) 793-9149
Wood, A. M., Box 1-A. Arcadia, Calif., (213) 283-1201, TWX: 910-589-3368
Woods, G. E. Assocs. Inc., 2415 S. Manchester Ave., Anaheim, Calif., (714) 633-9370. Branch Offices: Los Altos, Calif.; San Diego, Calif.
Wright Engrg., 180 E. California Blvd., Pasadena, Calif., (213) 681-2651, TWX: 910-588-3753. Branch Office: Los Altos, Calif.
Wyborny Sales Co., Box 17070, Dallas, Texas, (214) 381-4645
Wyncote Instrumentation, 365 E. Butler Ave., Ambler, Pa., (215) 643-2440

Y

Yale Assocs., Cherry Valley Rd., Gilford, N.H., (603) 293-2285
Yarbrough Sales Co., 5808 Monterey Rd., Los Angeles, Calif., (213) 254-5101, TWX: 910-321-3577
Yarussi, E. P. Co., 312 Rockfield Rd., Pittsburgh, Pa., (412) 221-4676
Young, F. Assocs., 555 Winton Rd. N., Rochester, N.Y., (716) 482-1555
Yount, J. Co., Box 17270, Dallas, Texas, (214) 391-4125

Z

Zak & Assocs. Inc., 230 S. Bemiston, St. Louis, Mo., (314) 727-8559
Zang, H. C. Agency, 64 Prairie Ave., Buffalo, N.Y., (716) 877-3677
Zaslow Sales, 6 Newberry Rd., Bloomfield, Conn., (203) 242-7781, TWX: 710-425-5418. Branch Offices: Milford, Conn.; Lowell, Mass.; Northboro, Mass.
Zimmerman, W. E. Co., 15443 Cabrito Rd., Van Nuys, Calif., (213) 787-4240
Zimmerman, W. H. Inc., 112 DeWitt St., Syracuse, N.Y., (315) 474-4889, TWX: 710-541-1572. Branch Office: Rochester, N.Y.
Zlowe, L. Co., Inc., 16 North Central Ave., Hartsdale, N.Y., (212) MU 7-7282

DIRECTORY OF SALES REPRESENTATIVES

GEOGRAPHICAL SECTION (For alphabetical listing see pages 3213 - 3223)

Main office listings arranged alphabetically within each state and city, with phone and TWX numbers. Listings also include:

- Branch office addresses, phone and TWX numbers. Branch offices are also listed geographically with a cross-reference to the main office listing for complete information.
- Manufacturers represented.
- Types of accounts served.
- Facilities and services.
- Number of salesmen. (Parentheses indicate number of salesmen who are engineers.)

This is the most complete list available of independent sales representatives selling electronic equipment, components and materials.

GEOGRAPHICAL SECTION

ALABAMA

Birmingham

CONTROL EQUIPT. CO., INC. (See Atlanta, Ga.)

NICKERSON, F. C. CO., INC. (See Decatur, Ga.)

SMITH, M. K. INC. (See Charlotte, N.C.)

TAYLOR, M. F. CO., (See Silver Springs, Md.)

TECHNICAL MARKETING, INC. (See Orlando, Fla.)

WHEELOCK, C. F. & ASSOC., INC., Box 1290, (205) 595-1172. TWX: 810-733-4481.
Branches: P.O. Box 515, Fairhope, Ala., (205) 928-9892; 2809 Newby Rd. SW, Huntsville, Ala., (205) 539-0631.
Factories: Allenair; Atkomatic Valve; Cross Mfg.; Gresen Mfg.; Houdaille Hydraulics; Post Electrn.; Rex Hanna Co.; Tuthill Pump Co.; Veeder-Root; Versa Prod.; Young Radiator.
Selling To: ★ I. **Salesmen:** 4 (eng 4)
Services: Warehouse

Huntsville

BCS ASSOCS., INC. (See Orlando, Fla.)

BROWN, W. A. & ASSOCS., INC. (See Orlando, Fla.)

CARTWRIGHT & BEAN, INC. (See Memphis, Tenn.)

COL-INS-CO., INC. (See Orlando, Fla.)

CRAFT ASSOCS. CO. (See Atlanta, Ga.)

DUCKETT, C. SALES CO. (See Atlanta, Ga.)

GENTRY ASSOCS., INC. (See Orlando, Fla.)

HAYDEN, A. ASSOC. (See East Point, Ga.)

HIGHSMITH, J. L. & CO. (See Charlotte, N.C.)

HOLMES, E. G. & ASSOCS. (See Chamblee, Ga.)

KEMP ENGRG. CO., INC. (See Dallas, Texas)

LEE ASSOC., INC. (See Orlando, Fla.)

MURPHY & COTA (See Atlanta, Ga.)

N. B. S. INC. (See Ft. Lauderdale, Fla.)

REYNOLDS & ASSOCS., INC. (See Eau Gallie, Fla.)

TECHNICAL ASSOCS., INC. (See Orlando, Fla.)

TECHNICAL MARKETING, INC. (See Orlando, Fla.)

WHEELOCK, C. F. & ASSOC. (See Birmingham, Ala.)

Fairhope

WHEELOCK, C. F. & ASSOC. (See Birmingham, Ala.)

Montgomery

WALLACE, S. K. ASSOC., INC. (See Lutz, Fla.)

ALASKA

Anchorage

ARVA, INC. (See Seattle, Wash.)

MERRITT, R. CO. (See Seattle, Wash.)

ARIZONA

Phoenix

BFA (See Denver, Colo.)

JACK BERMAN CO., INC. (See Inglewood, Calif.)

BISHOP ENTERPRISES, INC. (See Aurora, Colo.)

COHN & SHANE, INC. (See Los Angeles, Calif.)

DOWERS, A. A. CO. (See Huntington Park, Calif.)

GRAMER & CO., 110 W. Camelback Rd.
Factories: Ackerman Engravers; Acton Labs.; Adams, F. P. Co.; Amco Engrg.; Bowmar Inst.; EEMCO Div.; Hysol Div.; Industrial Elctrn. Engrs.; N/P Co.; National Beryllia Corp.; Shaw Insulator Co.; Sparta Mfg.; Technology Inst.; U.S. Components; U.S. Terminals; Victory Engrg.; Ward Leonard Elec.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

HARRIS, B. CO. (See Los Angeles, Calif.)

HECHT, HENSCHEN AND ASSOC., Inc., 2435 E. University Dr., (602) 275-4411. TWX: 910-951-0635. Branch: 3997 E. Bayshore Rd., Palo Alto, Calif., (415) 969-3131.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 2)
Services: Warehouse

HOWE & HOWE SALES INC., 4109 N. 18th St., (602) 264-7971. TWX: 910-951-1308.
Factories: APM Hexseal; Chicago Miniature Lamp; Daven Co.; ETC Terminals; Goe Engrg.; Insulectro; Philco Ford; Potter & Brumfield; Sealol; Thermal American Fused Quartz; Thermolab; Vanguard; Viking Ind.; Virginia Panel; Weckesser Co.; Zero Mfg. Co.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 1)

HYTRONIC MEASUREMENTS, INC. (See Denver, Colo.)

IFM-SOUTH (See Hollywood, Calif.)

INTERSTATE MARKETING ASSOC. (See Woodland Hills, Calif.)

KING ENGRG. CO. (See Encino, Calif.)

KNIGHT, W. B. CO., INC. (See Inglewood, Calif.)

KOESSLER SALES CO., INC. (See Burbank, Calif.)

LUSCOMBE ENGRG. CO. (See Pasadena, Calif.)

MAYDWELL & HARTZELL (See San Francisco, Calif.)

MICHAEL, C. INC. (See Glendale, Calif.)

MOORE, H. A. SALES CO., Box 7245, (602) 274-0060.
Factories: Jontz Mfg. Co.; E. F. Johnson; Littelfuse, Inc.; Lowell Mfg. Co.; Marden Electrn.; Mercury Elctrn.; J. W. Miller Co.; Pomona Elctrn.; Sprague Prod. **Salesman:** 1
Selling To: ★ A,D,I. **Services:** Warehouse

MOXON ELCTRNS. CORP. (See Los Angeles, Calif.)

O'HALLORAN ASSOCS. (See N. Hollywood, Calif.)

PLS ASSOCS., INC. (See Englewood, Colo.)

SHEFLER-KAHN CO., INC., 2017 N. 7th St., (602) 258-7893. TWX: 910-951-0659.
Branch: 408 San Mateo Blvd. N.E., Albuquerque, N. Mex., (505) 265-7077.
Factories: Alpha Wire; Bobrick Aero Missile Prod.; Budd-Polychem Div.; Fusite Corp.; Hydra Elec. Co.; Jensen Mfg.; Kulka Elec.; Ohmite Mfg.; H. H. Scott; Triplett Electrical Inst.
Selling To: ★ A,M,D,I. **Salesmen:** 6 (eng 2)
Services: Warehouse

SNITZER, T. L. CO. (See Los Angeles, Calif.)

STRASSNER, R. A. CO., INC. (See Los Angeles, Calif.)

THORSON CO. (See Los Angeles, Calif.)

WARE, J. A. & ASSOC. (See San Diego, Calif.)

WILLIAMS-ASSOCIATES, INC. (See Denver, Colo.)

Scottsdale

AR/TEC, INC., Box 727, (602) 947-6304.
Factories: Andersen Labs.; Avanti R&D; Circuit Structures; D-Cemco; Electrro-Mech Comp.; Excellon Ind.; Giannini Voltex; Kleer-Vu Ind., Inc.; L. Frank Markel & Sons; Macronetics; Multisonic Sys.; National Wire & Cable; Pacific Resistor; Power Sys.; Precision Arc; Product Improvement; Protronics Ind.; Sonobond; Sturdilite Prod.; TMC Sys.; Torkon Fastener; Transformer Engr.; Wells Elctrn.; Whistler Elctrn. **Salesmen:** 2
Selling To: ★ M,D,I. **Services:** Warehouse

ALLEN ASSOC., 55 W. 1st Ave., (602) 946-4903.
Factories: Affiliated Mfg.; Ace Engrg.; Danex; Electro Materials; Hughes Welders; Integrated Circuit Engrg.; Metex Corp.; Moorlee Mfg.; Speed Feed Sys.; Tenney Engrg.; Transistor Automation.
Selling To: ★ I. **Salesman:** 1 (eng 1)
Services: Repair

APPLETON, H. CO. (See Los Angeles, Calif.)

BENNEWITZ ASSOCS., INC. (See Albuquerque, N.M.)

BIZTEK CO., INC. (See Toluca Lake, Calif.)

COMPAR ROCKY MOUNTAIN, 84 W. First St., (602) 947-4336. TWX: 910-950-1293.
Branches: 2129 San Mateo Blvd., N.E., Albuquerque, N.M., (505) 265-1020. TWX: 910-989-1659; 300 E. Hampden Ave., Ste. 401, Englewood, Colo., (303) 781-0912. TWX: 910-933-0183.
Factories: Acopian; Bissett-Berman; Coron; Denes Co.; Eagle Signal; Electro Materials Corp.; Electronized Chemicals Corp.; Deutsch Filtors; Hathaway Instr.; Microdot; N. E. Instr.; Paktron; Powercube; Signetics; Stow Labs.; Tec Magnetics; Unitrode. **Salesmen:** 4 (eng 4)
Selling To: ★ M,I. **Services:** Warehouse

DORTON ENTERPRISES, INC., Box 1297, (602) 946-6213.
Factories: Automatic Elec.; Carstedt Res.; Circuitronics; Continental Device; Electro Techniques; Electronic Measurements; Fenwal Elctrn.; G-V Cont.; General Time; HFS Mfg.; Infinetics, Inc.; International Electro Exchange; Midwec Corp.; Orange County Nameplate; Omtronics Mfg.; Preferred Elctrn.; Paris Precision Prod.; RCL Elctrn.; Stackpole; Tachtronics Inst.; Times Wire & Cable Div.
Selling To: ★ D,I. **Salesmen:** 3 (eng 2)

ELECTR. MFGRS. CONSULTANTS INC. (See Colorado Springs, Colo.)

ENGINEERING SALES ASSOCIATES, Box 544, (602) 945-5781.
Factories: Associated Res.; Associated Testing Labs.; Atlas Chemical Ind.; Axion Corp.; Burnes and Towne, Inc.; C & K Components; Eldre Components; Eraser Co.; Essex Wire; Film Microelctrn.; Gordos Corp.; Magnecraft Elec.; Polyphase Inst.; United Aircraft; Wells Elctrn.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)
Services: Warehouse, Display Area

KEY REPRESENTATION (See Los Angeles, Calif.)

ROBERTS, E. V. & ASSOCS. (See Culver City, Calif.)

RUNYON CO., INC., 6825 E. Thomas, (602) 947-5711. TWX: 910-950-1290.
Factories: Advance Circuits; Barry Contls.; Dynamic Inst.; Electra/Midland Corp.; Glasseal Prod.; Glenair; Glentronics; Hopkins Engrg.; Isofilm Intl.; Joy Mfg.; National Connector Corp.; SR Engrg.; G. T. Schjeldahl Co.; Scott Elctrn.; Skydyne, Inc.; Voltronics Corp.; Wabash Magnetics; Weston. **Services:** Warehouse, Mailing List
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

SCHOEFFLER, F. ASSOCS., 6912 E. Horseshoe Rd., (602) 948-3470.
Factories: Cicoil Corp.; Elctron. Specialty Co.; Electro Film; Microtran Co.
Selling To: ★ I. **Salesman:** 1 (eng 1)

VINSON ASSOCS., INC. (See Englewood, Colo.)

Tempe

GATES, F. Y. CO., INC. (See Salt Lake City, Utah)

HYER ASSOCS. INC. (See Englewood, Colo.)

ARKANSAS

Little Rock

MacDONALD, B. C. & CO. (See St. Louis, Mo.)

Magnolia

SCHOONMAKER, J. Y. CO. (See Dallas, Texas)

CALIFORNIA

Alameda

PREMMCO/PH (See Long Beach, Calif.)

Alhambra

RIEDEL, M. W. & CO., 2215 W. Valley, (213) 283-7694. TWX: 910-589-3375.
Branches: 1812 Santa Fe, Delmar, Calif., (714) 459-6473; 941 E. Charleston Rd., Palo Alto, Calif., (415) 327-5652.
Factories: American Comp.; Andersen Labs.; Aztec Elctrn.; Columbia Technical Corp.; International Electro Exchange; Microfab, Inc.; Phelps Dodge Elctrn. Prod.; Physical Sciences; R.C.L. Elctrn.; Sanders Assocs.; Voak Engrg.
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 3)
Services: Warehouse
(See Advertisement This Page)

Altadena

MUIR, D., 2909 N. Lake Ave., (213) 681-2516.
Selling To: ★ A,D,I.
Services: Warehouse, Technical Service

WAGNER, D. ASSOC., Box 485, (213) 681-4060.
Factories: Ajax Condenser; Alpha Comp.; Artted Co., Inc.; Clad-Rex Div.; Connector Corp.; Digital Inst.; Flight Sys.; Greenray Ind.; Marvel Elctrn.; M.C.I. Elctrn.; Metric Engrg.; Neshaminy Transformer; Oaktron Ind.; Oven Ind.; Piezo Crystal Co.; Plastic Ware; RFL Ind.; Stampede, Inc.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Mailing Listings

Anaheim

L & M SALES, 2404 S. Redwood Dr., (714) 774-0492.
Factories: Crimpco Engrg.; Device Seals, Inc.; Diversified Elctrn.; Elmag Corp.; Optomechanisms, Inc.; Milton Ross Co.
Selling To: ★ M,D,I. **Salesmen:** 2

REP ASSOCS. (See Los Angeles, Calif.)

WOODS, G. E. ASSOCS., INC., 2415 S. Manchester Ave., (714) 633-9370.
Branches: 1184 Los Altos Ave., Los Altos, Calif., (415) 941-3343; Box 11308, San Diego, Calif., (714) 279-7120.
Factories: Crest Ultrasonics Corp.; Dexon, Inc.; Flotron Ind.; Headway Res.; Henes Mfg.; Hughes Aircraft; Kleer-Vu Ind.; Product Improvement; Protronics Ind.; Sonobond Corp.; Tekform; G. E. Woods Co. **Services:** Warehouse, Direct Mail
Selling To: ★ I. **Salesmen:** 5 (eng 5)

Arcadia

LYNCH, T. CO., 1125 Singingwood Drive, (213) 355-1753.
Factories: Dictation Prod.; Dow-Key Co.; Electra Corp.; Erie Technological Prod.; Gentec Inc.; I E Mfg.; Oneida Elctrn Mfg.; Pageant; Rola Div.; Tele-Cassette; Telephone Dynamics Corp.
Selling To: ★ D,I.

WOOD, A. M. CO., Box 1-A, (213) 283-1201. TWX: 910-589-3368.
Factories: E-Z-Hook Test Prod.; Langevin Div.; Robinson-Nugent; Reeves-Hoffman; Syntronic Instr.; Tansitor Elctrn.; Westport Dev. & Mfg. Co.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)

Atherton

WADSWORTH MFG. ASSOC., INC. (See Liverpool, N.Y.)

Berkeley

HUGHES, R. S. CO., INC. (See Los Angeles, Calif.)

LA MOREE, C. D. (See Los Angeles, Calif.)

Beverly Hills

WESREP CORP., 339 S. Robertson Blvd., (213) 655-9784.
Factories: Apache Ceramics; Dial Prod.; National Laminating Mfg.; Sauereisen Cements; Thermoflex.
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)
Services: Warehouse, Direct Mail Adv.

Burbank

CARTER, J. ASSOC., 2600 W. Olive Ave., (213) 843-3292. TWX: 910-498-2235.
Factories: Electro Voice; Electrovert; JFD Elctrn.; Javelin Elctrn.; McMartin Ind.; Mercury Elctrn.; Daktron Ind.; Triad Distr.; VPI Vari-Prod.
Selling To: ★ A,D. **Salesmen:** 4
Services: Warehouse

KOESSLER SALES CO., INC., 2010 W. Burbank, (213) 849-5716.
Branch: 4614 N. 7th St., Phoenix, Ariz., (602) 264-4031.
Factories: Audio Access.; Audio Devices; R. T. Bozak Mfg.; Elpa Marketing Inds.; McIntosh Audio; McIntosh Lab; Magnecord Div.-Telex; Mortronics; Picker-Briggs; Telex Acoustics Prods.; Viking Div.-Telex; Worner Elctrn. Devices.
Selling To: ★ A,D,I. **Salesmen:** 4
Services: Warehouse
(See Advertisement This Page)

MURRAY, T. F. & ASSOCS., 4421 Riverside, (213) 849-6497.
Branch: 1624 E. Maywood Ave., Santa Ana, Calif., (714) 836-5911.
Factories: ACI Inc.; A. Ansley Mfg.; Digital Sensors, Inc.
Selling To: ★ I. **Salesmen:** 5 (eng 4)

OLANDER, R. & CO., Box 1485, (213) 843-5200. TWX: 910-498-2720.
Factories: American Astrionics; Computer Measurements; Ferranti Elec.; Ferranti-Packard Ltd.; Greibach Inst.; Newell Ind.; NJE; Sparton Southwest; Texas Inst.; Universal Ad-Yu Elctrn.; Xetex Elctrn. **Services:** Repair, Warehouse
Selling To: ★ A,M,I. **Salesmen:** 28 (eng 8)

M. W. RIEDEL & CO.
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Specializing in Components and Machines
Covering California, Arizona and Nevada
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GOVERNMENT AGENCIES
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2010 W. Burbank Blvd.
Burbank, Calif. 91506
Phone: 213 - 849-5716
Branch Office
4614 North Seventh Street
Phoenix, Arizona 85014
Phone: 602 - 264-4031

SHEPHARD-STERN CO., 4109 Burbank Blvd., (213) 849-6671. TWX: 910-498-2208.
Factories: Amperex Elctrn; Better Coil & Transformer; Continental-Wirt Elctrn.; Electronic Res.; Lenox-Fugle Elctrn.; National Tel-Tronics; Rayonic Tube Co.; Rotating Components; TDK Elctrn.
Selling To: ★ D,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

TECH-SER, INC., Box 3255, (213) 846-9631. TWX: 910-498-2709.
Branches: 477 Castro St., Mountain View, Calif., (415) 969-9020. TWX: 910-379-6495; Box 10544, San Diego, Calif., (714) 222-1121; 10210 Monroe Dr., Dallas, Texas, (214) 358-2504.
Factories: Basic Ceramics Inc.; J. G. Biddle; Burroughs; Computer Logic; Dytro Corp.; Electronic Res. Assocs.; Lorlin Ind.; Modular Circuits; RC-95, Inc.; Redcor Corp.; Rohde & Schwarz Sales; Signatron Corp.; Trio-Tech, Inc.; Wall Elctrn.; Zeltex, Inc.
Selling To: ★ M,I. **Salesmen:** 10 (eng 9)
Services: Repair, Warehouse, Modification Capability

WEIGHTMAN & ASSOC., 1226 W. Olive, (213) 849-7711.
Branch: 120 Santa Margarita Ave., Menlo Park, Calif., (415) 385-2885.
Factories: Borg-Warner Thermoelec.; Bourns, Inc.; BTU Engrg.; Chicago Dynamic Ind.; Comco Supply; J. Fluke Mfg.; Johanson Mfg.; Parker Inst.; Precision Sys.; Stevens-Arnold, Inc.; Transistor Elctrn.; USM Corp.
Selling To: ★ I. **Salesmen:** 9 (eng 4)

(See Advertisement Page 3225)

Burlingame

CAMPBELL & GEORGE CO., 840 Mahler Rd., (415) 697-2965.
Branch: 1331 T St., Sacramento, Calif., (916) 442-4631.
Factories: Eagle Signal Div.; Firing Circuits; Furnas Elec.; Healy-Ruff Co.; Heinemann Elec.; Lexington Elec.; Sola Elec. Div.; Transtector Sys.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 5)
Services: Warehouse

DILLON STEVENS & CO. (See Los Angeles, Calif.)

DYNAMIC ASSOCS./LEASEAMETRIC, INC. (See Los Angeles, Calif.)

LOGAN, J. & ASSOCS., 801 Mahler Rd., Suite D, (415) 697-6100. TWX: 910-375-3382.
Factories: APM-Hexseal; Central Transformer; Compac Engrg.; Consolidated Wire Corp.; Controls Switch Div.; CTS Corp.; CTS-Knights; Dickson Elctrn.; Gowanda Elctrn.; Griffith Plastic Prod.; IERC Div.; IRC Div.; Methode Elctrn.; Phaostron; Potter Co.; Sterling Inst.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 3)
Services: Direct Mail

MONTGOMERY BROS., INC., 1831 Bayshore, (415) 697-6500.
Branches: 4800 District Blvd., Los Angeles, Calif., (213) 589-6321; 1632 N.W. Johnson St., Portland, Ore., (503) 223-4197; 911 Western Ave., Seattle, Wash., (206) 624-7297; Box 6079, Salt Lake City, Utah, (801) 484-8871; 3530 Addison St., San Diego, Calif., (714) 224-4513.
Factories: AquaMatic; Athena Cont.; Badger Meter Mfg. Co.; Chromalox, Inc.; Commercial Filters Corp.; Cycle-Dyne, Inc.; Gelman Inst. Co.; Gruenberg Elec.; Kanthal Corp.; Mott Metallurgical Corp.; Pacific Chromalox; Pereny Equip.; Sta-Warm Elec.; Weco Division; L. Wiegand; Zeston.
Selling To: ★ M,D,I. **Salesmen:** 30 (eng 5)
Services: Warehouse

PETERS-DE LAET, INC., 1606 Rollins Rd., (415) 697-1800.
Branches: 13845 S. Hawthorne Blvd., Hawthorne, Calif., (213) 772-4226; 5937 North Greeley, Portland, Ore., (503) 285-7703; 1703 Nagle Pl., Seattle, Wash., (206) 322-2215; 910 15th St., Sacramento, Calif., (916) 442-0769; Hilton Office Bldg., Denver, Colo., (303) 255-2171; 323 W. 1410 South, Salt Lake City, Utah, (801) 484-7649; 11 South Jefferson, Spokane, Wash., (509) 624-0137.
Factories: Avdel Corp.; Bic, Inc.; Budwig, Mfg.; Cole-Hersee; D & B Elctrn.; ETC, Inc.; Electrovert, Inc.; Icore Prod.; Marson Fasteners Corp.; Molex Prod. Co.; 3M Co.; Tyton Co.; Virginia Panel; Wik-It Elctrn. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 20

STRIKER, J. E. CO., 1319 Howard Ave., (415) 342-1425.
Factories: Calif. Etching Corp.; Circuit Structures Lab.; Clark Crystal Corp.; D-Cemco, Inc.; Eastron Corp.; Flight Sys., Inc.; Greenray Ind.; Metric Engr. Co.; Oven Ind.; Plastic Ware; R F L Ind.
Selling To: ★ A,M,I. **Salesmen:** 2 (eng 2)

Canoga Park

ANDERSON/KRUSE ASSOC., Box 1225, (213) 341-3020.
Factories: American Monarch; Dorann Co.; Hoagland Instr.; Kessler-Ellis Prod.; Printact Relay Div., Staffall.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

Compton

SIMPLEX WEST INC., 2901 E. Val Verde Ct., (213) 774-3170.
Branches: 1255 Post St., San Francisco, Calif., (415) 673-7873; 2450 Sixth Ave. S., Seattle, Wash., (206) 623-0123.
Factories: S. H. Couch Co.; PLM Products; Simplex Wire & Cable Co.
Selling To: ★ D,I. **Salesmen:** 8 (eng 1)
Services: Warehouse

Culver City

ALDERSON, W. CO. INC., 8548 Washington Blvd., (213) UP 0-9286. TWX: 910-340-6354.
Factories: Argos Prod.; California Chassis; Federal Sign & Signal; Jensen Mfg. Div.; J. Millen Mfg.; Perma-Power Co.; Trippe Elctrn.; Turner Microphone.
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 1)
Services: Warehouse

SODARO CO., 3753 S. Robertson Blvd., (213) 838-5272.
Factories: Digital Elctrn.; Electrospace Corp.; T T Electrn.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

ROBERTS, E. V. & ASSOC., INC., 9601 W. Jefferson Blvd., (213) 870-9561. TWX: 910-340-6363.
Branches: 800 San Antonio Rd., Palo Alto, Calif., (415) 324-1671; 77 Third Ave. W., Scottsdale, Ariz., (602) 947-7695; 4379 30th St., San Diego, Calif., (714) 282-7691.
Selling To: ★ M,I. **Salesmen:** 12 (eng 12)
Services: Repair, Warehouse, Direct Mail Facility

Cupertino

DEERE ELCTRN., INC., 20440 Town Center La., (408) 257-3040.
Factories: Hughes; Intl. Elctrn. Ind., Inc.; Division of Callins Industries, Inc.; Kelvin Assoc.; Precision Elctrn. Co.; Quest Elctrn. Dev.; Standard Condenser; Vanguard Elctrn.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

SNITZER, T. L. CO. (See Los Angeles, Calif.)

Danville

KSANDER, G. CO., Box 803, (415) 837-4669.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

Daly City

DEL BUCCHIA R. & ASSOC., 15 Southgate Ave., Ste. 225, (415) 756-8414.
Factories: Alco Elctrn.; Irad Inc.; Jackson Elec.; Keystone Elctrn.; Kings Elctrn.; Mercury Elctrn.; Resistance Prod. Co.; Sonotone Corp.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

DOWERS, A. A. CO. (See Huntington Park, Calif.)

Del Mar

RIEDEL, M. W. CO. (See Alhambra, Calif.)
SNITZER, T. L. CO. (See Los Angeles, Calif.)

Downey

WIELER & CO., Box 708, (213) 861-9223.
Branch: 405 So. Sunnyvale Ave., Sunnyvale, Calif., (408) 736-6098.
Factories: Acopian Corp.; American Elctrn. Lab.; Cabtron Corp.; Control Logic; Dalmo Victor; Dytronics; GPS Inst.; Measurement Cont. Devices; Miracle-Hill Elctrn.; Program Elctrn.; Specific Prod.; Star Parts Co.; Time Sys.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Repair, Warehouse

El Monte

HENRIKS, R. E. & ASSOC., 4900 Double Dr., (213) 442-1820. TWX: 910-587-3433.
Factories: Cermetron Corp.; de Haart Inc.; Electroglas, Inc.; Electro Materials Corp.; Navan; Semimetals; South Bay Tech.; Taft-Peirce Mfg.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)
Services: Sales only

El Segundo

SAXON, C. W. & ASSOC., Box 517, (213) EA 2-2111.
Factories: Ceramaseal; Concord; Cooke Vacuum; Radio Comp.; Rowe Industries; Technical Comp.; Whitso. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

Encino

CDH ASSOC., 18075 Ventura Blvd., (213) 345-1644.
Factories: Acton Lab.; Elctrn. Measurements; Fairchild Cont.; Kinetic Technology.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Repair

CAIN & CO., 15720 Ventura Blvd., (213) 783-4700.
Branches: 175 S. San Antonio Rd., Los Altos, Calif., (415) 948-6533; 3595 Mt. Acadia Blvd., San Diego, Calif., (714) 278-1031; 1203 Ironwood Dr., Mt. Prospect, Ill., (312) 253-3578; 7515 Annapolis Rd., Hyattsville, Md., (301) 459-6400; 45 Essex St., Melrose, Mass., (617) 665-8600; 253-16 Northern Blvd., Little Neck, N. Y., (212) 428-3636; 324 First St., Liverpool, N. Y., (315) 457-4871; Bala-Cynwyd, Penna., (215) 664-3797; 8609 Northwest Plaza Dr., Dallas, Texas, (214) 369-2897; 2485 Lipton Rd., Columbus, Ohio, (614) 861-2119; P. O. Box 261, South Amboy, N. J., (201) 727-1900; 3112 W. Kennedy Blvd., Tampa, Fla., (813) 876-1233.
Factories: Alto Scientific Co.; General Atronics; Hylectronics; Physical Elctrn. Labs.; Raytheon Computer; RHG Elctrn. Lab; Sperry Microwave Elctrn. Div.; Unitron; Vector/Teledyne.
Selling To: ★ M,I. **Salesmen:** 25 (eng 25)

KING ENGRG. CO., 15720 Ventura Blvd., Ste. 608, (213) 981-0161.
Branches: 525 S. Grant, San Mateo, Calif., (415) 342-9645; 5045 N. 12th St., Phoenix, Ariz., (602) 266-3485; 2260 Calle Frescota, La Jolla, Calif., (714) 459-7444.
Factories: Advanced Dev.; Airpax Elctrn.; Dynamic Sys. Elctrn.; Electronic Assocs.; Federal Scientific Corp.; Litton Memory Prod. Div.; Memory Technology; Sanders Assocs.; Sanders Data Storage; Tri-Data, Inc.
Selling To: ★ A,M,D,I. **Salesmen:** 7
Services: Warehouse, Sales

LEDBETTER ASSOCS., Box 528, (213) 789-8115.
Factories: Display Controls; Dynamic Controls; Engineered Magnetics Div.; W. & L. E. Gurley; Luminator; Struthers-Dunn.
Selling To: ★ M,I. **Salesmen:** 5 (eng 5)

PORTER, 17000 Ventura Blvd., (213) 788-2350.
Factories: Aero Res. Inst.; APM Hexseal; Fifth Dimension; Heinemann Elec.; Monrovia Inst.
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)

(See Advertisement This Page)

Fullerton

TESTCO (See Seattle, Wash.)

Gardena

INSTRUMENT LAB., 1323 W. 130th St., (213) 770-0650.
Branch: 644 Emerson, Palo Alto, Calif.
Factories: Conax Corp.; Electro-Mechano; Jones Motrola Corp.; L. H. Marshall; Pillar Corp.; Slaughter Co.; West Inst. **Services:** Repair
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 2)

OSBORN & BIDWELL, INC., 17525 S. Broadway, (213) 770-0300.
Factories: Alpha Metals; Duotone Co.; Globe Elect. Mfg.; Integrated Motor Cont.; International Rectifier; Judson Res. & Mfg.; J. W. Miller



PORTER COMPANY

17000 Ventura Boulevard
Encino, California 91316
Telephone 213 788-2350

component *sales and engineering representatives*

Co.; Minneapolis Speaker Co.; Philmore Mfg. Co.; Randolph Ind.; Russell Ind.; S & A Elctrn.; University Sound; Vaco Prod.; Wall Mfg.
Selling To: ★ A,M,D,I. **Salesmen:** 4
Services: Warehouse

Glendale

DEWCO SALES, INC., 6915 San Fernando Rd., (213) 849-6101. TWX: 910-498-2223.
Branch: 3240 Hillview Ave., Palo Alto, Calif., (415) 321-2950. TWX: 910-373-1743.
Factories: Fairchild/Du Mont; G-V Cont.; Ideal Precision Meter; Jac-Par; PMP Precision Metal Prod.; Richco Plastics; Tech-Trans; Thermalloy.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Mfg. Repair

GEIST, W. K. CO., 1205 Air Way, (213) 245-9501.
Branch: 7267 Bark La., San Jose, Calif., (415) 968-1608.
Factories: A. D. Data Sys.; Brookdeal of America; Computer Prod.; Computer Telephone; Data Inst.; Datascan; Eppley Lab.; Gibbs Mfg. & Res.; Lockheed Elctrn.; London Co.; H. H. Scott, Inc.; Signal Analysis Ind.; Scientific Columbus; Stable Dynamics; Test Equipt. Corp.; TRF, Inc.; Wagner Digital Elctrn.; Waveforms; Wayne Kerr Corp.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Repair, Warehouse, Mailing facilities & Mobile Bus.

INSTRUMENT SPECIALISTS, 1109 S. Central Ave., (213) 249-9404. TWX: 910-497-2086.
Branches: 2359 De La Cruz Blvd., Santa Clara, (408) 244-1505. TWX: 910-338-0121; 1909 State St., San Diego, (714) 232-2017; 5950 6th Ave. S., Seattle, Wash., (206) 767-4260. TWX: 910-444-1636.
Factories: Burr-Brown Res.; Darcy Ind.; Data Royal Corp.; Datum, Inc.; Daymarc Corp.; EG&G, Inc.; J. Fluke Mfg. Co.; NH Res.; North Atlantic Ind.; PEMCO; Teradyne, Inc.; Varian Electrographics Div. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 16 (eng 16)

MICHAEL, C. INC., Box 666, (213) 245-8401. TWX: 910-497-2089.
Branches: 2634 Frontage Rd., Mountain View, Calif., (415) 326-6884; 7990 Engineer Rd., San Diego, Calif., (714) 278-2102; 195P Central Ave., Farmingdale, N. Y., (516) 293-4120. TWX: 510-224-6486; 2607 Andjon, Dallas, Texas, (214) 358-4401. TWX: 910-861-4934; 15 N. 40th Pl., Phoenix, Ariz., (602) 273-7376.
Factories: L. B. Allen Co.; American Electrical Heater; Avtron; Bausch & Lomb; Beauchaine Sales Corp.; Bruno-New York Ind.; By-Buk Co.; Cerro Sales; Clauss Cutlery; Colbert Die Cast Co.; Contact Inc.; Crown Ind. Prod.; Dee Elec.; Diamond Tool & Horseshoe; Division Lead Co.; William Dixon; DuMaurier Co.; Edsyn; Electric Soldering Iron Co.; Engineering & Elctrn. Devices; ETM; Fidelity; General Electric; Hammel Riglander & Co.; Handy & Harman; Heller; Hexacon Elec.; Hunter Tools; Hysol of Calif.; Ideal Ind.; Johnson Mfg.; Kester Solder; Kimberly Clark Corp.; Kinetics Corp.; M. P. Kirk; London Chemical; Linemaster Switch; Luxo Lamp Corp.; MacDonald & Co.; Master Appliance; Menda Scientific; Multicore Sales; Plato Prod.; Ruby Chemical; Superior Flux & Mfg.; Swiss American Precision Imports; Ungar Electric Tools; Utica Tool Co.; Waage Elec.; Weller Elec.; Xacto Precision Tools; Xcelite.
Selling To: ★ M,I. **Salesmen:** 20 (eng 6)
Services: Repair, Warehouse

Glendora

PEDDLERS UNLTD., 641 N. Minnesota Ave., (213) 963-5868.
Factories: Hallmark Metals; Marquardt Ind. Prod.; Microdot Magnetics.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Goleta

FENOLE, J. E. CO., INC., Box 128, (805) 964-5811.
Factories: AGM, Inc.; Astro-Geo-Marine.
Selling To: ★ M,I. **Services:** Warehouse

Hawthorne

PETERS-DE LAET, INC. (See Burlingame, Calif.)

Hillsborough

BULLOCK & BULLOCK, 934 Boiliyana Rd., (415) 342-3848.
Factories: Berkeley Dynamics; Cartesian, Inc.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

Hollywood

HEIM & SMOLEN, INC., 3360 Barham Blvd., (213) 462-7357. TWX: 910-321-4042.
Factories: Imetra, Inc.; Melray Mfg.; Milton Ross; National Beryllia Corp.; Oberg Mfg.; Philco-Ford; Precision Phenolics; Quartz Products; Secon Metals; Steel Ind.; Stewart Stamping; Sibley Co.; Vitta Corp.
Selling To: ★ I. **Salesmen:** 4 (eng 4)

IFM - SOUTH, 3455 Cahuenga Blvd.
Branches: San Diego, Calif., ZE 2-2010; Phoenix, Ariz.. EN 1252.
Factories: Associated Testing; Atec, Inc.; Baird-Atomic; CML, Inc.; Hyperion Ind.; K & M Elctrn.; RFL Ind.; Ragen Precision Ind.; Techni-Rite Elctrn.; Texas Inst.; Waveline, Inc.
Selling To: ★ M,I. **Salesmen:** 5 (eng 5)
Services: Warehouse, Mailing Campaigns

SHOEMAKER, FRAME & ASSOCS., 1800 N. Argyle, (213) 464-3019.
FACTORIES: Spray Prod. **Services:** Warehouse
Selling To: ★ D. **Salesmen:** 2

SNYDER, L. G. CO., 1418 N. Highland Ave., (213) 469-6278.
Factories: AVA Elctrn. & Machine; Dow-Key Co.; E. U. Naybor, Lab.; High Energy, Inc.; James Elctrn.; Keystone Carbon Co.; Pak-Tronics; Penn Resistor; P. M. F. Elctrn.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)
Services: Test Lab.

WESTAIRONICS, INC., 1800 N. Highland Ave., (213) 466-6201. TWX: 910-321-4226.
Factories: Crystalonics; Harowe Servo Contr.; Hi-Spec Elctrn.; Price Elec.; Sanders Assoc.; United Transformer.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

Huntington Park

DOWERS, A. A. CO., 2918 E. Florence Ave., (213) 582-5105. TWX: 910-321-4275.
Branches: 15 Southgate Ave., Daly City, Calif., (415) 756-8414; 305 E. Indian School Rd., Phoenix, Ariz., (602) 264-4761.
Factories: Kings Elctrn.; Resistance Prod.; Sonotone. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 4)

Inglewood

ALLGOOD ASSOCS., 1621 Centinella Ave., (213) 776-5820. TWX: 910-328-6195.
Branches: 2680 Bayshore Frontage Rd., Mountain View, Calif., (415) 961-9686; 1623 Eubank St., N.E., Albuquerque, N. Mex., (505) 296-6600.
Factories: Aertech Ind.; Applied Elctrn.; Brand Rex Div.; Colbuk Div.; Conductron; Fairchild MW; Gianinni-Voltex; Keltec; Melabs; New London Instr.; Quantatron; Radar Relay; Sensor Sys.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)

BERMAN, J. CO., INC., 8295 S. LaCienega Blvd., (213) 678-1281. TWX: 910-328-6184.
Branches: 2101 W. Shangri La Rd., Phoenix, Ariz., (602) 944-3361; Box 453, LaMesa, Calif., (714) 583-6457.
Factories: Allied Control; Amperex Elctrn.; British Ind.; Bud Radio; Circuit Technology; Clarostat Mfg.; Dialight Corp.; Elco Corp.; Harman-Kardon; JBT Instr.; Jerrold Elctrn.; Koss Elctrn.; Littelfuse; Phalo Corp.; Quam-Nichols; Radio Materials; Raytheon Co. Div.; Shure Bros.; Shurite; Systron-Donner; Triplett Elec. Inst.
Selling To: ★ A,M,D,I. **Salesmen:** 15

KNIGHT, W. B. CO., INC., Box 400, (213) 678-4711. TWX: 910-328-6116.
Branch: Box 11394, Phoenix, Ariz., (602) 264-3578.
Factories: Allen-Bradley; All Star Prod.; Ammon Inst.; Components; Genisco Technology; General Ind.; McCoy Elctrn.; H. W. Sams & Co.; Solitron Devices; Stancor Elctrn.; Wakefield Engrg.
Selling To: ★ M,D,I. **Salesmen:** 8 (eng 5)

THOMPSON, R. W. ASSOCS. (See Palo Alto, Calif.)

UNGAR SALES ASSOCS., 317 Glasgow Ave., (213) 678-5371.
Factories: Ducati; Imtra Corp.; Rosenthal; Standard Radio; Ungar Elec. Tools, Inc.; United Mineral & Chemical; Waldom Elctrn.
Selling To: ★ D,I. **Salesmen:** 3 (eng 1)
Services: Repair, Warehouse

La Jolla

FALCK, F. W. CO., Box 1733, (714) 233-3341.
Factories: Electro Connective Sys.; HiTemp Wires; ITT Jennings; Key Ind.; Precise Metal Prod.; Rotaco; Spatron Inc.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

KING ENGRG. CO. (See Encino, Calif.)

QUICK, H. L. CO., 8167 La Jolla Shores, (714) 459-7006.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

Lamesa

BERMAN, J. CO., INC. (See Inglewood, Calif.)

Long Beach

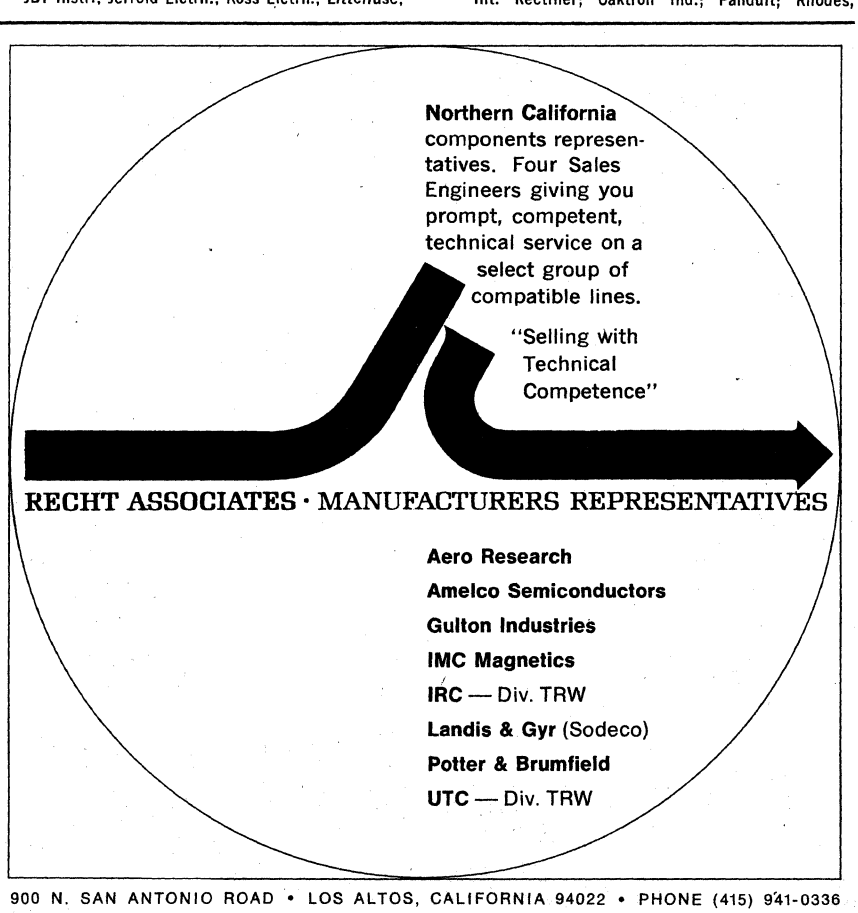
PREMMCO/PH, 3351 59th St., (213) 636-9205.
Branch: 2406 Lincoln Ave., Alameda, Calif., (415) 523-9495.
Factories: Ectron Corp.; Heli-Coil Corp.; James Elctrn.; Micro-Measurements; Molly Co.; Photolastic, Inc.; USM Fastener Co.; Warren Fastener.
Selling To: ★ M,I. **Salesman:** 8 (eng 2)

Los Altos

CAIN & CO. (See Encino, Calif.)

CLELAND & CO. (See Los Angeles, Calif.)

EWING-FOLEY, INC., Box 1107.
Factories: Aladdin Elctrn.; Carter Motor Co.; C & K Components; Curtis Dev.; Hunter Tools; Int. Rectifier; Oaktron Ind.; Panduit; Rhodes,



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Selling To: ★ M,D,I. **Salesmen:** 3

KEY REPRESENTATION (See Los Angeles, Calif.)

LANDA, E. CO. (See Los Angeles, Calif.)

MARKETEK, INC., One First St., (415) 941-0882. TWX: 910-370-7969.
Factories: Federal Stampings, Inc.; Joy Mfg.; Prestolite Div.; Sanders Assocs.; Uniform Tubes.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Warehouse

RECHT ASSOCS., 900 N. San Antonio Rd., (415) 941-0336.
Factories: Aero Res.; Amelco Semiconductor; Gulton Ind.; IMC Magnetics; IRC Div.; Landis & Gyr; Potter & Brumfield; UTC.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)
(See Advertisement Page 3227)

RICHARDS ASSOCS., 900 San Antonio, (415) 941-3226.
Factories: American Semiconductor; Balco Capacitors; Gralex Ind.; Hycal Engrg.; Inca Engrg.; Powertec; Transducers Inc.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)
Services: Repair, Warehouse, Direct Mail

SHANNON ASSOCS., One First St., (415) 941-2217.
Factories: Digitran; Lear Siegler; L. A. Miniature Prod.; Oak Electronetics; Whittaker.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

STONE, J. & ASSOC., 330 Second St., (415) 948-4563. TWX: 910-370-7953.
Factories: Aertech; Anadex Inst.; Applied Microwave Lab.; Cober Elctrn.; Custom Materials; Doric Scientific; Dynage, Inc.; F A M Engrg.; M. G. Microwave; Micro Inst.; Microwave Elctrn.; Peninsula Microwave Lab.; Quan Tech. Labs.; Weinschel Engrg.; Zehntel.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

STRASSNER, R. A. CO. (See Los Angeles, Calif.)

WALTER ASSOCS., INC., BOX AN, (415) 941-3141. TWX: 910-370-7458.
Factories: Ace Engrg.; Danex Corp.; Micro-Tel; Nelco Microwave; Omni Spectra; Rodda Co.; Waltronic; Zeta Labs.
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)
Services: Repair, Warehouse, Direct Mail
(See Advertisement This Page)

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WEIGHT ENGRG. (See Pasadena, Calif.)

WOODS, G. E. ASSOCS., INC. (See Anaheim, Calif.)

Lynwood

AEROSPACE SALES CORP., 12140 So. Atlantic Ave., (213) 537-1856.
Factories: Delru Co.; Equi-Tech; Isotronics; Kentucky Metals; National Moldite Co.; Penn Keystone; Printex.
Selling To: ★ I. **Salesmen:** 2 (eng 1)

Los Angeles

ABBOTT INST. & ENGRG. CO., 1736 Westwood Blvd., (213) 474-5310.
Factories: Alfa Crystal; J. Chatillon & Sons; Dynasil; Engis Equipt. Co.; Lenox Instr.; Thermonetics; Peschel Instr.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

APPLETON, H. CO., 136 San Fernando Rd., (213) 225-5611. TWX: 910-321-4155.
Branches: Box 727, Scottsdale, Ariz., (602) 947-6304; 7969 Engineer Rd., San Diego, Calif., (714) 278-9260; Box 226, San Mateo, Calif., (415) 344-3066; 2149 S. Clermont St., Denver, Colo., (303) 757-1371; Box 14205, Orlando, Fla., (305) 277-2857; 663 Fairview Ave., Elmhurst, Ill., (312) 279-5681; 6047 Howe Dr., Mission, Kan., (913) 362-2366; Box 534, Glen Burnie, Md., (301) 744-4611; 14 Oak St., Needham, Mass., (617) 444-1259; 6121 Excelsior Blvd., Minneapolis, Minn., (612) 929-6721; Rte. 46, Pine Brook, N. J., (201) 227-0600; 410 N. Goodman St., Rochester, N. Y., (716) 473-2230; 6510 Farnsworth Dr., Cleveland, Ohio, (216) TU 5-1324; 814 Wainright Dr., Pittsburgh, Pa., (412) 341-6611; Box 124, Wynnewood, Pa., (215) MI 2-5816; Box 16040, Fort Worth, Texas, (817) AX 2-1065; 143 S. 4th East, Salt Lake City, Utah, (801) 328-8173; 2 Tycos Dr., Toronto, Canada.
Factories: California Wire & Cable; Dynatronic Cable Engrg.; L. F. Markel & Sons; National Wire & Cable.
Selling To: ★ A,M,I. **Services:** Warehouse

BARRON, W. J. CO., 1406 S. Grand Ave., (213) 748-6191.
Factories: Memcor Div.; Redgray Ind.
Selling To: ★ M,D,I. **Salesmen:** 2
Services: Warehouse

BARSTOW & DORAN, INC., 1406-08 S. Grand Ave., (213) 749-0438.
Factories: Comm Ind.; Gold Line Connector; James Elctrn.; Kepro; Midland Inter.; Mosley Elctrn.; Pioneer Elctrn.; Quincy Prod.; Regdon Corp.; Rush Engrg.; Sound Craft Sys.; Swing O Lite; Terado Corp. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 5

BELL, J. W., 601 S. Vermont Ave., (213) 388-7104.
Factories: Newage Ind.; Numberall Stamp & Tool Co.; Portland Company; Sonicor Inst.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 1)

BLACK & STRONG, INC., 1728 S. La Cienega, (213) 870-9191. TWX: 910-340-6369.
Branch: 444 Olive St., San Diego, Calif., (714) 298-4711.
Factories: Amco Engrg.; Amelco Semiconductor; American Micro-Sys.; Defiance Printed Circuit; Diodes, Inc.; Potter & Brumfield; Solid State Prod.; Stackpole Division. **Salesmen:** 8 (eng 8)
Selling To: ★ M,D,I. **Services:** Warehouse
(See Advertisement This Page)

CLELAND & CO., 1263 Westwood Blvd., (213) 477-0551. TWX: 910-342-6883.
Branch: Box 58, Los Altos, Calif., (415) 948-9349.
Factories: Giannini-Voltex; Precision Cable & Assembly; Sivers Lab; Stoddart Electro Sys.; Technical Plastics; U. S. Dynamics.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

COHN & SHANE, INC., 1323 Venice Blvd., (213) 388-9374.
Branches: 1245 Rosefield Way, Menlo Pk., Calif., (415) 325-9091; 3822 W. Belmont, Phoenix, Ariz., (602) 934-6027; 3001 Hunts Point Circle, Bellevue, Wash., (206) 454-7581.
Factories: Approved Prod.; Eaton Yale & Towne; Murphy Ind.; Realflex Prod.; Universal Tool & Stamping; Upland Ind.
Selling To: ★ D. **Salesmen:** 12 (eng 2)
Services: Warehouse

COSTELLO, LITTLE & CO., 8737 Venice Blvd., (213) 870-5951.
Branches: 575 Middlefield Rd., Palo Alto, Calif., (415) 321-3745; 2653 Tarna Dr., Dallas, Texas; Chiltern House, Oxford Rd., Aylesbury, Bucks, Eng., Aylesbury 4778.
Factories: Collectron; Computer Peripherals; Concord Control; Datacraft; Digital Devices; Elgin Electronics; General Design; Ikor; Mac Panel; Rixon Electrn.; Texas Instr.
Selling To: ★ I. **Salesmen:** 5 (eng 5)

DILLON STEVENS & CO., 1610 S. Bonnie Brae St., (213) 747-9921.
Branch: 833 Mahler Rd., Burlingame, Calif., (415) 697-3022.
Factories: Clauss Cutlery Co.; Devcon Corp.; Hexacon Elec.; Utica Tool Co.; Weiler Brush Co.
Selling To: ★ D. **Salesmen:** 5 (eng 1)
Services: Warehouse

DUDEK, R. C. & CO., INC., 10546 W. Pico Blvd., (213) 836-0335. TWX: 910-340-6435.
Branches: Box 11199, Sta. A, Palo Alto, Calif., (415) 321-2430; Box 4383, Portland Ore.
Factories: Gries Reproducer Co.; Penn Engineering & Mfg.; Positive Connector Co.; Spyraflo, Inc.; Wenco Mfg. Co.; Zagora Gear Prod.
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 2)
Services: Warehouse

DYNAMIC ASSOCIATES/LEASEAMETRIC, INC., 2500 S. La Cienega Blvd., (213) 837-0123.
Branch: 1011 Cadillac Way, Burlingame, Calif.
Factories: AVCO; Calma; Chassis Trak; Datatron; Digitec; Kruse Storke; MicroTest; Monsanto Electrn. Inst.; Newport Labs.; Optimation; Power Designs; Statham Inst.; Sturdilite Prod.; Theta Inst.; United Sys.
Selling To: ★ M,I. **Salesmen:** 6 (eng 6)
Services: Repair, Warehouse

DYNASALES CO., 5331 E. Olympic Blvd., (213) 268-1175.
Factories: Barnes Corp.; Co-Ord Switch; I.B. Inst.; Milli-Switch; Photomechanisms; Servo Dev.; Vero Elctrn. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)
(See Advertisement This Page)

ELSNER-RAMBO CO., 2526 Hyperion Ave., (213) 664-2928. TWX: 910-321-4257.
Factories: Bliley Elec.; Branson Corp.; Lundey Assoc.; Penta Labs.; Sealtron Corp.; Tech Labs.; Techno-Components; United Elctrn.; Waters Mfg.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

ERLANGER SALES CO., 4217 W. Jefferson Ave., (213) 731-2238.
Factories: All Channel Prod.; Andi Antenna Designs; Eico Elctrn. Inst.; Fiberglass Inc.; Hitachi-Maxell Inc.; Jersey Specialty; Mellotone; Maxell Batteries; Ronette USA; Trans Atlantic Elctrn.; Vokar Prod.
Selling To: ★ A,D. **Salesmen:** 3
Services: Billing Service, Warehouse, Display

FELDMAN, H. CO., Box 66367, (213) 870-5973.
Factories: Barker Prod. Sales; Enterprise Dev.; Hamilton Hall; Lectrotech; Weller Elec.
Selling To: ★ D. **Salesmen:** 2
Services: Warehouse

FERRIS, F. R. CO., Box 42067, (213) 254-6161.
Factory: Orbit of Calif. **Salesmen:** 5
Selling To: ★ M,I. **Services:** Warehouse

FETTY/SCHOENDUVE INC., 7407 Melrose Ave., (213) 651-4050. TWX: 910-321-2385.
Branch: 253 Town & Country Village, Palo Alto, Calif., (415) 321-7041. TWX: 910-373-1189.
Factories: Acromag, Inc.; Clevite/Piezoelec. Div.; Electronic Specialty; Giannini; Hart/Advance Relay Div.; Haydon Switch & Inst.; Industrial Electronetics Corp.; Metra Inst.; Micro Radionics, Inc.; Philamon Labs.; Philco-Ford; Pickering & Co.; Structural Tech.; Superior Mfg. & Inst.; Vectron Labs.; Victory Eng.
Selling To: ★ D,I. **Salesmen:** 7 (eng 7)

HANSEN, C. A., 1406 S. Grand Ave., (213) 748-6191.
Factories: Keil Engrg. Prod.; Kepro Circuit Sys.; R-Columbia Prod.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

HARMON, W. S. CO., 6118 Venice Blvd., (213) 937-1460. TWX: 213-937-3438.
Factories: Advance Ross Elctrn.; Air-O-Tronics Prod.; Anchor Plastics Co.; Carter Precision Elec.; E.M.C. Plastics Div.; Gavitt Wire & Cable Div.; G.E.; Grigsby-Barton; Hobson Bros.; Lab-Tronics Prod.; Mel-Rain Corp.; Millen, J. Mfg.; Resistors; Rohden Mfg.; Ty-Car Mfg.; Waterbury Pressed Metal. **Services:** TWX & FAX
Selling To: ★ I. **Salesmen:** 2 (eng 1)

HARRIS, B. CO., 3440 Overland Ave., (213) 870-9231. TWX: 910-340-6758.
Branches: 644 Emerson St., Palo Alto, Calif., (415) 328-3082; 10701 N.E. 4th Ave., Bellevue, Wash., (206) 454-0095; Box 14707, Phoenix, Ariz., (602) 272-0571.
Factories: Autac, Inc.; Lynn Elctrn.; Mohawk Wire and Cable; Poly Cable; Rockland Insulated Wire and Cable; Spargo Wire Co.; Standard Wire Co.; Thermatics. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 15 (eng 2)
(See Advertisement This Page)

HASCO, 8940 Ellis, (213) 870-6664.
Factories: R. D. Brew & Co.; Fredericks Co.; Industrial Refrigeration; Vacuum Res.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse

HOLMES, C. E. CO., 107 North Ave., (213) 256-2255. TWX: 910-321-3937.
Factories: Cal-R; Electro-Mechanical Inst.; Elec-Trol; Hamlin; Pennsylvania Elctrn. Tech.; Philips-Elmet; G. Risk Ind.; Syntron Div.; Thermonetics; Vacuum Ceramics; WABCO.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 2)

HUGHES, R. S. CO., INC., 5301 E. Sheila St., (213) 268-2051.
Branches: 346 N. State College Blvd., Los Angeles, Calif., (714) 639-4444; 3606 Midway Dr., San Diego, Calif., (714) 224-2431; 620 National Ave., Mountain View, Calif., (415) 961-3700; 2802 Eighth St., Berkeley, Calif., (415) 841-0522; 6520 Sixth Ave. S., Seattle, Wash., (206) 767-4463.

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HUGHES, R. S. CO., INC. (Cont.)
Factories: C-Lec Plastics; Carmer Ind.; Crown Prod.; Conap, Inc.; Danco; Du Pont; Electronized Chemicals Corp.; Formica Corp.; Garlock; General Electric; W. L. Gore & Assocs., Inc.; Halocarbon Prod.; A. L. Hyde Co.; Jaco Corp.; Loctite Corp.; Permacel; Saunders Corp.; Sperex Corp.; Trimflex.
Selling To: ★ M,I. **Salesmen:** 10 (eng 3)
Services: Warehouse

HUNDLEY CO., INC., 3282 Fletcher Dr., (213) 255-7111.
Branch: 754 Natoma St., San Francisco, Calif., (415) 552-3414.
Factories: Bliss/Eagle Signal; Ebert Elctrn.; Gemco Electric; Healy Ruff Co.; Lexington Elec. Prod.; Photoswitch Div.; Winko Matic Signal.
Selling To: ★ D,I. **Salesmen:** 8 (eng 4)
Services: Repair, Warehouse, Engineering

JENSEN INST. CO., 1919 Beverly Blvd., (213) 388-9525.
Branch: 429 Bryant St., San Francisco, Calif.
Factories: Ellison Div.; Jo Bell Prod. Inc.; Lumenite Elctrn.; Mercoid; Moeller Inst.; Scan Inst.
Selling To: ★ M,D,I **Salesmen:** 7
Services: Warehouse

JOHNSON ASSOCS., Ste. 1800, 5455 Wilshire Blvd., (213) 934-0700.
Branch: Ste. 414, 260 Sheridan Ave., Palo Alto, Calif., (415) 327-1700.
Factories: Avco Everett Res. Labs.; Carson Labs.; Electro Powerpacs; Eltek Corp.; Glass Craft Inc.; Holobeam; Karl Lambrecht Corp.; Laser Optics; Pacific Photometric Inst.; Seed Elctrn.; University Labs. Inc. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

KEY REPRESENTATION, Box 523, Wilmington, P.O., (213) 549-1770.
Branches: 45 W. First Ave., Scottsdale, Ariz., (602) 946-7458; Box A-1211, Los Altos, Calif., (415) 941-2127; 1842 Canyon Bl., No. 103, Boulder, Colo., (303) 443-1749.
Factories: Barry Instr.; Digitran; G-L Inds.; I-M-C Transducers & Tel.; Intl. Microwave; ITT Jennings; KMS Engrg.; Oak Elctrns.; Telemetry Assocs. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 6 (eng 4)
(See Advertisement This Page)

KITTLESON CO., 416 N. La Brea Ave., (213) 933-7371. TWX: 213-937-0239.
Branch: 2680 Bayshore Frontage Rd., Mountain View, Calif., (415) 326-7410.
Factories: Comtronix-Microtech Div.; Dynamics Res.; Eastron Corp.; S. Himmelstein & Co.; Infra-Red Ind. Sys. Div.; Parzen Res.; Saturn Elctrn.; Semikron Intl.; Spencer-Kennedy Labs.; Stop Comp. Inc.; Tyco Inst. Div.; Wade Co.; Warnecke Electron Tubes.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

LA MOREE, C. D., 2433 Birkdale St., (213) CA 5-5666.
Branch: 2210 4th St., Berkeley, Calif., (415) TH 1-0601.
Factories: Bentley Harris Mfg. Co.; Brown Bridge Mills; Conolite Corp.; Dilectrix; Dow Corning; Haysite Corp.; Hope Webbing Co.; A. L. Hyde; Jordan Mfg.; Masonite; Macallen Mica; N. J. Woodfinishing; Owens Corning Fibreglas; Permacel Tape; Sterling Varnish.
Selling To: ★ A,M,I.
Services: Warehouse, Fabrication

LANDA, E. CO., 2288 Westwood, (213) 272-9525. TWX: 910-342-6343.
Branch: One First St., Los Altos, Calif., (415) 948-0788. TWX: 910-370-7969.
Factories: Arvin Frequency Devices; Babcock Relays; Barden Co.; Columbia Components Corp.; Fenwal Elctrn.; Microsonics; National Connector; Parko Elctrn.; Pyrofilm Resistor Corp.; Robintech; Sensing Sys.; UOP Inst.
Selling To: ★ D,I. **Salesmen:** 10 (eng 10)
Services: Warehouse

LESER, J. W. CO., 4408 W. Jefferson Blvd., (213) 731-4173.
Factories: Defiance Machine & Tool; Popper & Sons, Inc. **Services:** Repair, Warehouse
Selling To: ★ M,D,I. **Salesmen:** 3

LITTRELL WESTERN SALES, INC., 3121 E. Twelfth St., (213) AN 1-0164.
Branch: 1325 Egbert Ave., San Francisco, Calif., (415) 822-5595.
Factories: Balcrank Div.; Bernard Engraving; Dahlstrom Mfr.; H. Davies Molding; Diebel Mgr. Co.; G C Elctrn.; S. S. White. **Salesmen:** 6
Selling To: ★ A,M,D,I. **Services:** Warehouse

LYNN & BROOKS, 3055 Wilshire Blvd., (213) 382-2255.
Branch: 1485 Bayshore Blvd., San Francisco, Calif., (415) 467-3100; 48 S.W. Second, Portland, Ore. (503) 227-7412.
Factories: Jet Line Prod., Inc.; Killark Mfg. Co.; Union Insulating Co.; R. C. Winthrop, Ltd.
Selling To: ★ D,I. **Salesmen:** 7
Services: Use Public Warehousing

MARSH, J. W. CO., 4216 W. Jefferson Blvd., (213) 732-0145.
Factories: Alliance Mfg.; Audio Book Co.; Heppner Mfg.; Merit Coil and Transformer Corp.; Sonotone; V-M Corp.
Selling To: ★ A,D,I. **Salesmen:** 5

MARSHANK SALES CO., 7422 Melrose Ave., (213) 938-2591.
Factories: A.K.G.; AMD Elctrn.; Bauer Elctrn.; Bogen Communications Div.; Calcon Mfg.; D. Clark Co.; Concord Comm. Sys.; Crown Intl.; Elite Elctrn.; Metal Works; Recoton Corp.; Rye Ind.; Tandberg of America.
Selling To: ★ A,D. **Salesmen:** 3
Services: Warehouse, Repair on Tandberg only

MAYDWELL & HARTZELL (See San Francisco, Calif.)

MONTGOMERY BROS., INC. (See Burlingame, Calif.)

MOXON ELECTRONICS CORP., 2311 Pontius Ave., (213) 272-9311. TWX: 910-342-6345.
Branches: 2054 Garnet St., San Diego, Calif., (714) 274-6525. TWX: 910-335-1236; No. 15 41st Ave., San Mateo, Calif., (415) 345-7961. TWX: 910-374-2355; 151 Hackensack Ave., Hackensack, N.J., (201) 343-9490. TWX: 710-990-5130; 40 Coles Ave., Cherry Hill, N.J., (609) 665-5444; 15 N. 40th Pl., Phoenix, Ariz., (602) 273-7363.
Factories: Alfred Elctrn.; Astrodata/Comcor; Beckman Inst.; Birtcher Corp.; Crescent Technology; Data Equip.; Dartex/Div. Tally; Datatotal, Inc.; ITT Inst.; Frequency Engrg.; Marconi Inst.; Matrix; Philco-Ford Corp.; Rantec; SRC/Div. Moxon Elec.; Tally Corp.; Trygon/Trymetrics; Ultronic Sys.; Video Sys.
Selling To: ★ M,I. **Salesmen:** 27 (eng 5)
Services: Repair

RDP INSTRS. INC. (See Palo Alto, Calif.)

R F ASSOCS., INC., 1621 Pontius Ave., (213) 478-1586. TWX: 910-342-6884.
Branch: 800 San Antonio Rd., Palo Alto, Calif., (415) 327-5531. TWX: 910-373-1223.
Factories: Advanced Microwave Labs.; Alford Mfg. Co.; C-Cor Elctrn.; De Mornay Bonardi Div.; Energy Sys.; General Microwave Corp.; Lorch Elctrn.; Microphase Corp.; Microwave Assocs.; Nelson-Ross Elctrn.; Sage Elctrn.; Texscan Corp.; TRAK Microwave Corp.
Selling To: ★ M,I. **Salesmen:** 6 (eng 6)
Services: Repair, Warehouse

REP ASSOCS., 1645 S. LaCienega Blvd., (213) 274-8485.
Branch: 1744 W. Lincoln Blvd., Anaheim, Calif., (714) 828-1344.
Factories: American Zettler, Inc.; Hi Vacuum Elctrn.; Hudson Lamp Co.; Inso Elctrn. Prod.; KSC Semiconductors; RF Interonics; Signalite.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

RUSH, C. B. & ASSOCS., 1830 W. Olympic Blvd., (213) 388-7111.
Factories: Armel Elctrn.; Cambridge Scientific; Commercial Plastics; General Cont. Co.; Multiflex Seals; E. H. Titchener Co.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)

SNITZER, T. L. CO., 9005 Exposition Blvd., (213) 836-6170. TWX: 910-340-6768.
Branches: 10320 Saratoga-Sunnyvale Rd., Cupertino, Calif., (408) 257-8333. TWX: 910-338-0212; 1150 Camino Del Mar, Del Mar, Calif., (714) 454-2191; 15 N. 40th Pl., Phoenix, Ariz., (602) 273-1673.
Factories: Business Info. Technology; Century Elctrn. & Inst.; Chronetics; Cimron Div.; Cunningham Corp.; Eldorado Elctrn.; Elgar Corp.; Emcor-Borg-Warner; Guildline Inst.; Hallmark Std.; Interdyne Co.; McLean Engrg. Labs.; PRD Elctrn.; Polarad Elctrn. Inst.; Sierra Elctrn.; Singer Co.; Telonic Inst. & Engrg.
Selling To: ★ M,I. **Salesmen:** 11 (eng 11)

STICKEL-McALLISTER, 4357 Melrose, (213) 665-6621.
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 1)
Services: Repair, Warehouse

STOLAROFF, M. A. Co., 4622 W. Slauson Ave., (213) 295-7781.
Factories: ASM Corp.; Brown Engrg.; Custom Elctrn.; Electronic Devices; General Resistance; G. V. Contls.; Parelco; Sage Elctrn.; Specialty Connector; Transitron-Precision Conn.; Unimax Switch.
Selling To: ★ D,I. **Salesmen:** 4 (eng 4)

STRASSNER, E. E., Co., 3121 Los Feliz Blvd., (213) 666-1511. TWX: 910-321-4458.
Factories: Calabro Plastics, Inc.; Components Corp.; Koiled Kords; Kulka Elec.; H. H. Smith; United Transformer; Whitney Blake Co.; Miconics Ind.
Selling To: ★ A,M,D,I. **Salesmen:** 5
Services: Warehouse

STRASSNER, R. A., Co., Inc., 3003 Glendale Blvd., (213) 666-4040. TWX 910-321-3990.
Branches: 885 N. San Antonio Rd., Los Altos, Calif., (415) 948-3334. TWX 910-370-7954; 55 E. Thomas Rd., Phoenix, Ariz., (602) 277-3921.
Factories: Airflow Co.; Astrodyne, Inc.; Beauchaine & Sons, Inc.; Control Knobs, Inc.; Electro-Fiberoptics; ITT-Jennings Div.; National Union Elec.; Plastic Capacitors; Sealectro Corp.; Zenith Transformer Co. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 8

TUCUL ENGRG. CO., 6402 Crenshaw Blvd., (213) 750-0338.
Factories: Automation Prod. Mfg.; Chadwick-Helmuth Co.; HH Controls; Industrial Solid State Controls; JMR Elctrn.; L.A.B. Mfg.; M.T.I. Instr.; Poly Optics; Practical Automation; Presin Co.; Techno Prod.; Tenor Co.; Thermosen, Inc.; Truco.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Warehouse

THORSON CO., 6824 Melrose Ave., (213) 937-0790. TWX 910-321-4024.
Branches: 2443 Ash St., Palo Alto, Calif., (415) 321-2414. TWX: 910-373-1226; 1767 Fifteenth Ave. S., Seattle, Wash., (206) 325-5000. TWX: 910-444-2187; 444 Olive St., San Diego, Calif., (714) 298-8385. TWX: 910-335-2011; 300 E. Hampden Ave., Denver, Colo., (303) 789-1841. TWX: 910-933-0183; 2505 E. Thomas Rd., Phoenix, Ariz., (602) 956-5300. TWX: 910-951-0653; 7700 Carpenter Freeway, Dallas, Tex., (214) 631-5440. TWX: 910-861-4423; 2114 N. Broadway, Santa Ana, Calif., (714) 547-6206. TWX: 910-595-1541; 3312 Marquart, Houston, Tex., (713) 621-0990. TWX: 910-881-3707; 5921 Lomas Blvd. N.E., Albuquerque, N.M., (505) 265-5655. TWX: 910-989-1174.
Factories: Applied Magnetics Corp.; Automatic Business Systems, Div. Litton Indus.; Autronics Corp.; Avantek Corp.; ChronoLog Corp.; Cognitronics Corp.; Conic Corp.; Control Data Corp.; Genisco Technology Corp. Data Div.; Inland Motor Corp.; Information Control Corp.; Microwave Elctrn. Corp.; Sage Labs., Inc.; Scientific Data Systems, Inc.; Sequential Information Systems.
Selling To: ★ I. **Salesmen:** 22 (eng 22)
(See Advertisement Page 3231)

WALLACE & WALLACE, 1206 Maple Ave., (213) 747-0401.
Factories: Bendix; C/P Corp.; Conant Labs; Contex, Inc.; Cush Craft; Dolinko & Wilkens; Electronic Measurements; Geo Space Corp.; Goldsman Co.; Injectorall Elctrn.; E. F. Johnson Co.; E. A. Lindgren & Assoc.; Telephone Comp.; Tri-Ex Tower; Vibroplex Co. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 1)

WILEY, PAUL F., CO., 1632 Silverlake Blvd., (213) 663-8028. TWX: 910-321-4166.
Factories: Augat, Inc.; Electro-Miniatures; Elmwood Sensors; Fairchild Controls; Girard-Hopkins; Int'l. Instrs. (S. Cal., S. Nev. only); ITT Gremar; Landis & Gyr, Inc.; Sarkes Tarzian Inc.; Sigma Instrs.; Switchcraft Inc.
Selling To: ★ D,I. **Salesmen:** 6 (eng 4)
(See Advertisement Page 3231)

YARBROUGH SALES CO., 5808 Monterey Rd., (213) 254-5101. TWX: 910-321-3577.
Factories: Algo/Hamilton Elctrn.; Amuneal Mfg.; Automatic Locking Devices; Bead Chain Mfg.; Ceram Corp.; Custom Comp.; Fusite Corp.; Kenyon Elctrn.; Lee Spring Co.; Pekay Tool Co.; Pellfacs,

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Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

SALES, H. K., INC., Box 2087, (415) 369-6244.
Factories: Benjamin Elctrn. Sound; Calcon Wire; Marantz, Inc.; Pioneer Elctrn.; Stanton Magnetics; Superscope, Inc.
Selling To: ★ A. **Salesmen:** 2
Services: Warehouse (some lines only)

HEATON, J. S., Co., Box 2087, (415) 369-4671. TWX: 910-378-5415.
Factories: Dale Elctrn.; Electro Connective Sys.; Electronic Res.; Filters & Capacitors; Hitemp Wires Div.; N. E. Instr.; Parelco; Technical Wire Prods.; Vitramon.
Selling To: ★ I. **Salesmen:** 4 (eng 1)

McKNIGHT, G. R., CO. INC., 115 Spruce Ave., (415) 325-2844. TWX: 910-373-1172.
Factories: Accuride Div.; Ammon Instr.; Branson Corp.; Computer Components; E S C Elctrn.; Fenwal Elctrn.; Fenwal Inc.; GM Nameplate; J B Elctrn. Transformers; Janco Corp.; Licon Div.; Midwec Corp.; NCI Capacitor Div.; Omega Elec. Div.; Q C I Corp.; Scanbe Mfg.; Techno-Components Corp.; Transistor Elctrn.; TRW Crystal Plant.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)
Services: Warehouse, Industrial Design

SHIELL, T. J. ASSOCS., Box 504, (415) 323-6404.
Factories: Applied Peripheral Sys.; Gamma Machining Co.; Lee Richard Co.; Micom Corp.; Moser Jewel; Post Elctrn. Prod.; Precision Prod. & Controls; Staver Co.; Siks Mfg. Co.; Venus Scientific. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

WEIGHTMAN & ASSOC. (See Burbank, Calif.)

Millbrae

MELVIN SALES CO., 113 El Camino Real, (415) 697-6922. TWX: 910-375-3832.
Factories: Airborn, Inc.; Cambion; Industro Transistor Corp.; Croven, Ltd.; Filtaire; Ovenaire; Piezo Technology; Portchester Instr.; Premier Microwave; Reon Resistor; R. F. Interonics; Stettner-Trush, Inc.; Ward Leonard Elec.
Selling To: ★ I. **Salesmen:** 2 (eng 1)

Mountain View

ALLGOOD ASSOCS. (See Inglewood, Calif.)

ELLIS, G. B. CO., 2425 Leghorn, (415) 967-5531.
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Services: Repair, Warehouse

HUGHES, R. S. CO., INC. (See Los Angeles, Calif.)

IFM—NORTH, 2269 Old Middlefield Way, (415) 961-2828.
Factories: Associated Testing Labs.; Atec, Inc.; Beta Inst.; CML, Inc.; Hyperion Ind.; Incre-Data Corp.; Inst. Prods. 3M; Melcor Elctrn.; RFL Ind.; RLC Elctrn.; Waveline.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse

KITTLESON CO. (See Los Angeles, Calif.)

MICHAEL, C. INC. (See Glendale, Calif.)

TECH-SER., INC. (See Burbank, Calif.)

REPEX, Box 807, (415) 969-9200. TWX: 910-379-6477.
Factories: Airflyte Elctrn.; Artisan Elctrn.; Biocom Inc.; Computer Devices; Electric Thermometers; Electronic Devices; Gaylord Rives Co.; Grant Pulley & Hardware; Hytek Corp.; IMC Magnetics; Industrial Devices Inc.; K&M Elctrn.; Lenox Fugle Elctrn.; Lion Research; Loyola Ind.; Magnuson Engrs.; Maurey Inst.; Maxwell Lab Inc.; Printed Motors Inc. **Service:** Warehouse
Selling To: ★ D,I. **Salesmen:** 5 (eng 4)

Newport Beach

FIELDTEC, INC., 4242 Campus Dr., (714) 540-4000.
Branch: Box 11794, Palo Alto, Calif., (415) 321-7410.
Factories: Aero Vac Corp.; Aquarium Sys., Inc.; Cryolab Div.; Envirco; Genarco, Inc.; Heraeus-Engelhard Vacuum; High Vacuum Equip.; Hotpack; Redford; T-M Vacuum Prod.; Thomson Elec. Welder; Vacuum Inst.
Services: Repair **Salesmen:** 3 (eng 3)

HILL-BLARE, INC., 4570 Campus Dr., Ste. 8, (714) 546-9030.
Factories: Associated Res., Inc.; Sherwood Elctrn. Labs.; Thermolyne Corp.
Selling To: ★ A,M,D. **Salesmen:** 4
Services: Repair, Warehouse

INTERDOM, INC., 4570 Campus Dr., Ste. 8, (714) 546-9030.
Factories: Empire Scientific; Frazier, Inc.; Sherwood Elctrn. Labs., Inc.
Selling To: ★ A. **Salesmen:** 4
Services: Repair, Warehouse

North Hollywood

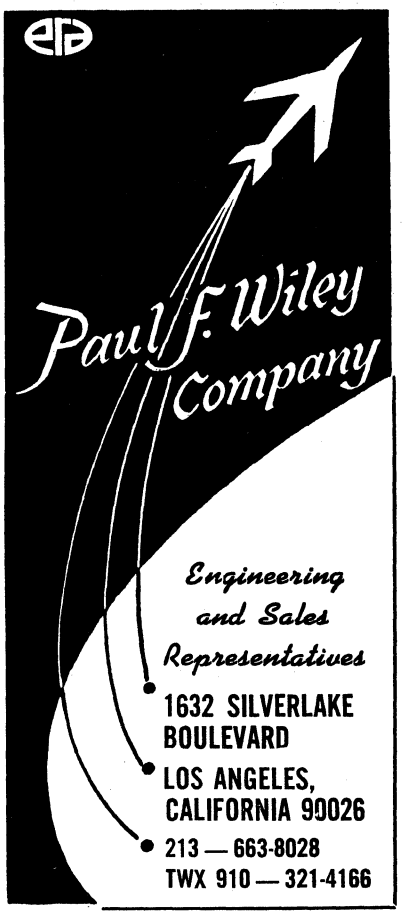
BASSETT & MOORE, INC., 12045 Magnolia, (213) 769-7201.
Factories: Antenna Specialists; Astatic; Atlas Sound; Auricord; Bussmann Mfg.; CTS Knights; Cornell Dubilier Elctrn.; Controlonics; Gertsch; IRC, Inc.; Lowell Mfg.; Nova-Tech Elctrn.; Martel Elctrn.; Pace Comm.; Standard Components; Utah Elctrn.; Westinghouse Elec.
Selling To: ★ A,D,I. **Salesmen:** 4
Services: Warehouse, Showroom

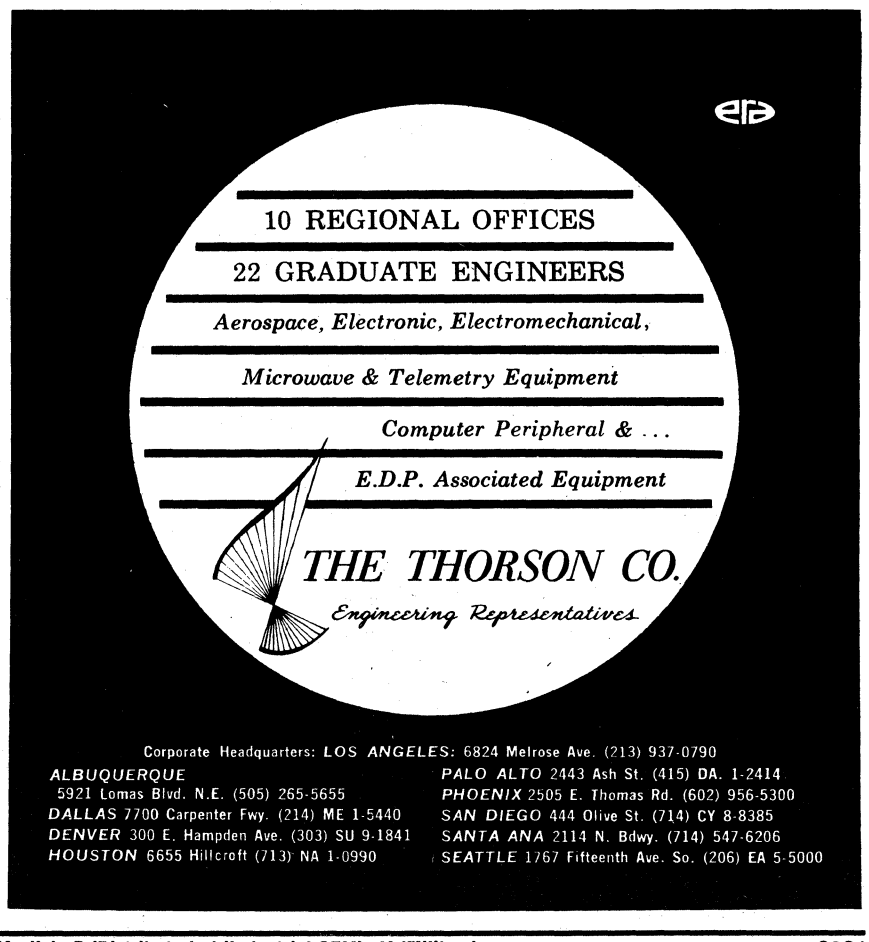
BROOKS & DAY INC., 10700 Ventura Blvd., (213) 877-3357.
Factories: Angstrohm Precision, Inc.; Film Microelctrn.; Hi-G; Monolithic Dielec.; Piconics; Premier Microwave; Semicon; Tec-Magnetics; Tresco.
Selling To: ★ M,I. **Salesmen:** 5 (eng 3)
Services: Warehouse, Distributor Branch

COMPONENTS SALES CALIF., INC., 11484 Oxnard St., (213) 980-3400. TWX: 910-499-2174.
Factories: Computer Instr.; Delta-Corders; Digitronics; Invac Corp.; IKL, Inc.; Instrumentation Technology Corp.; Millitest; Precision Mechanisms.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

JEWETT CO., 13111 Ventura Blvd., (213) 789-8103. TWX: 910-499-2196.
Factories: Abrams Inst.; Microwave Devices Div.; Damon Engrg.; Gombos Microwave; Hastings-Raydist; Int'l. Scientific Ltd.; Olektron Corp.; Roanwell.
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)

MARKMAN CO., 4142 Lankershim Blvd., (213) 877-3368.
Factories: BSR; Dynaco; Fanon; GBC; IDI; IEC; Motorola; Playtape; H. H. Scott; Tenna; Walco.
Selling To: ★ A,D. **Salesmen:** 4 (eng 2)
Services: Warehouse





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Factories: Adtec Labs.; Beckman Inst.; Boonton Elctrn.; EMI; Gencom Div.; Hitachi Millimeter; Hughes Aircraft; Narda Microwave; Norelco/Philips Elctrn.; Panasonic Oscilloscopes; Products for Research.
Selling To: ★ M,I. **Salesmen:** 11 (eng 11)
Services: Repair, Warehouse, Direct Mail, Showroom, Seminars.

3 DBM INC., 7424 Greenbush Ave., (213) 875-0876. TWX: 910-499-2670.
Factories: Anaren Microwave; Applied Res.; Cober Elctrn.; E & M Labs.; FAM Engrg.; Frequency Sources; OKI Elctrn.; Relcom; Trio Labs.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

Oakland

MOULTHROP, F. W. ASSOCIATES, 1530 E. 12th St., (415) 261-7676. TWX: 910-366-7206.
Factories: Alpha Wire; Dialight Corp.; Diodes, Inc.; Elco Corp.; Electrovert; Electra/Midland; Federal Screw; JBT Inst.; Magnecraft; Stantron.
Selling To: ★ A,M,D,I. **Salesmen:** 7
Services: Warehouse

SINCLAIR ELCTRN. ASSOCS., 1085 Clarendon Crescent, (415) 451-1835.
Factories: Gold Line Connector, Inc.; Hammarlund Mfg.; Marden Elctrn.; Mosley Elctrn.; Pearce-Simpson; Saxton Prod.; Thurow Elctrn.; Tristao Tower Co.; Unimetrics; Vokar Prod.; Ward Prod.
Selling To: ★ D. **Salesman:** 1
Services: Warehouse

Pacific Palisades

WADSWORTH MFG. ASSOC. (See Liverpool, N.Y.)

Palo Alto

ADTEK ASSOCS., 201 Town and Country Village, (415) 323-5414.
Factories: Allen Avionics; Ballastran; Bendix Mosaic; Mark Prod.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)
Services: Application Engineering

(See Advertisement This Page)

BANKS, R. A. SALES CORP., 1029 Corporation Way, (415) 964-4464. TWX: 910-379-6498.
Factories: Barnes Corp.; Isotronics; Jonathan Mfg.; Marin Controls Co.; Semcor Div.; Sloan Co.; Thermal Sys.; U. S. Terminals; Varo, Inc.; Wac-Line.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

(See Advertisement This Page)

COSTELLO, LITTLE & CO. (See Los Angeles, Calif.)

DEWCO SALES, INC. (See Glendale, Calif.)

DUDEK, R. C. & CO., INC. (See Los Angeles, Calif.)

EGBERT ENG. ASSOC., 801 Welch Rd., Ste. 214, (415) 326-1387. TWX: 910-373-1278.
Factories: Edcliff Inst.; Electro Dev. Corp.; Kinelogic; Monitor Sys.; Standard Contls.
Salesmen: 2 (eng 2)

FETTY/SCHOENDUVE, INC. (See Los Angeles, Calif.)

FIELDTEC, INC. (See Newport Beach, Calif.)

HARRIS, B. CO. (See Los Angeles, Calif.)

HECHT, HENSCHEN & ASSOCS. (See Phoenix, Ariz.)

HERRMANN, C. ASSOC., Box 1179, (415) 322-4561.
Branch: 1245 E. Walnut St., Pasadena, Calif., (213) 681-5111.
Factories: Advanced Technology & Sys.; CHA Ind.; Durasonics Corp.; Int'l. Sales. Assoc.; Sloan Inst.; Vacuum Equip. Comp.; Vacuum Products.
Services: Repair, Warehouse **Salesmen:** 3 (eng 3)

INSTRUMENT LAB. (See Gardena, Calif.)

JOHNSON ASSOCS. (See Los Angeles, Calif.)

MAULDIN COMPANY, 437 California Ave., (415) 326-5291.
Factories: Alpha Data; Argonaut Assocs.; Astro-Metrix Corp.; Coast Coil; Electronics Specialty, Electronics Div.; Exact Elctrn.; Ferritronics Ltd.; Greibach Inst.; Medistor Inst.; Riedon Avionics; Sterling Transformer; Time Sys.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Repair

MFG. ASSOCS. (See Santa Monica, Calif.)

NURCHES, R. CO. (See Pasadena, Calif.)

O'HALLORAN ASSOCS. (See N. Hollywood, Calif.)

RDP Inst., Inc., 999 Commercial St., (415) 328-6666.
Branches: 1338 S. Atlantic Blvd., Los Angeles, Calif., (213) 263-9441; Box 10449, San Diego, Calif., (714) 224-3521.
Factories: Advanced Measurement Inst.; Bio-Medical Elctrn.; California Inst.; Intronics; Kevlin Mfg. Co.; Semiconductor Circuits; Sherold Crystals; Velonex.
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)
Services: Minor Repairs

R. F. ASSOCS., INC. (See Los Angeles, Calif.)

RIEDEL, M. W. & CO. (See Alhambra, Calif.)

ROBERTS, E. V. & ASSOCS. (See Culver City, Calif.)

TESTCO (See Seattle, Wash.)

THORSON CO. (See Los Angeles, Calif.)

WARD/DAVIS ASSOCS. (See Pasadena, Calif.)

THOMPSON, R. W. ASSOCS., INC., 4135 El Camino Way, (213) 677-6104.
Branch: 5005 W. Century Blvd., Inglewood, Calif., (213) 677-6104.
Factories: Amperex Elctrn. Corp.; Berkeley Nucleonics; Datametrics, Inc.; Digital Automation; Hammarlund Mfg.; Kicksort, Inc.; LeCroy Research Sys.; Ludlum Measurements; Maxi-Switch Co.; National Inst. Labs.; Nuclear Measurements; Princeton Gamma Tech; Science Accessories; Spacetac; Tedford Crystal Labs.; Underwriters Safety Device Co.
Selling To: ★ M,I. **Salesmen:** 3 (eng 1)
Services: Direct Mail

Pasadena

A-F SALES ENGRG., INC., 94 South Los Robles Ave., (213) 681-5631. TWX: 910-588-3761.
Factories: Airtron; Beta Inst.; Coherent Radiation Labs.; Control Prod.; Electro-Optics Assocs.; Jan Hardware; Kaye Scientific; Lancaster Glass; Laser Optics; Maxwell Labs.; Optic-Elctrn.; PEK, Inc.; Quan-Tech Labs.; Thomas Elctrn.; Tropel.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

ELECTRO-MECHANICAL INSTS., INC., 1388 E. Walnut St., (213) 681-2748.
Factories: Dynamic Inst.; Northfield Precision Inst.; Phenotron Corp.; Superite Gear & Inst.; Wilmore Elctrn.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

ELLIS, D. CO., 123 N. Marengo, (213) 681-9108.
Factories: Alco Elctrn. Prod.; Alcoswitch; World Magnetics.
Selling To: ★ A,M,D,I. **Salesmen:** 2 (eng 2)

HERRMANN, C. ASSOC. (See Palo Alto, Calif.)

HUDDLESTON, F. ASSOCS., INC., 408 So. Rosemead Blvd., Ste 10, (213) 681-3751. TWX: 910-588-3785.
Factories: Canseat Corp.; Caton Inds.; Chemelec, Inc.; Grayhill; Grayhill-Moitronics; Omtronics Mfg.; Schauer Mfg.; Torotel.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 2)

LUSCOMBE ENGRG. CO., 610 S. Arroyo Pkwy., (213) 684-2000. TWX: 910-588-3285.
Branches: 330 E. Third Ave., San Mateo, Calif., (415) 342-7057. TWX: 910-374-2866; 222 W. Osborn Rd., Phoenix, Ariz., (602) 274-1542.
Factories: American Aerospace; Analogic; Data Device Corp.; Industrial Test Equip.; Northern Precision Labs.; Patwin Elctrn.; Technipower, Inc.; Trump-Ross. **Services:** Repair, Warehouse
Selling To: ★ M,I. **Salesmen:** 12

MULVIN & CO., INC., 3843 E. Colorado Blvd., (213) 681-4591.
Factories: Aerotronic Assocs.; Textool Prod.
Selling To: ★ A,M,D,I. **Salesmen:** 2 (eng 1)
Services: Repair, Warehouse

NURCHES, P. CO., 2396 E. Foothill Blvd., (213) 681-8957.
Branch: 999 Commercial St., Palo Alto, Calif., (213) 326-7842.
Factories: Austron, Inc.; F. W. Bell, Inc.; Buckeye Stamping; Coto-Coil Co.; Electronic Contr. Inc.; Gordos Corp.; Integrated Circuit Elctrn.; Pomona Elctrn.; Spar Elctrn.; Transistor Devices; Western Elctrn. Prod.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 5)
Services: Warehouse

SPACE ENGRG., 491 N. Los Robles Ave., (213) 681-4421. TWX: 213-449-3456.
Factories: Condor Ind.; Eagle Signal Div.; Eastern Rotorcraft; RTA Prod.; Rogers Corp.
Selling To: ★ M,I.
Services: Application Engineering

TECHNISALES CO., 3820 E. Colorado Blvd., (213) 792-5111.
Factories: Discon Corp.; Electro-Craft Corp.; Electro Products Labs; Kinelogic Corp.; Machinery Electrification.
Selling To: ★ M,D,I. **Salesmen:** 2

VAUGHAN, G. H. CO., 2366 E. Foothill Blvd., (213) 681-4511.
Factories: Accurate Elctrn.; Fastscan Sys.; Heat Sys.; Infinetics, Inc.; Northeast Scientific Corp.; Shandon Scientific; Waters Corp.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Repair

WARD/DAVIS ASSOC., 770 S. Arroyo Pky., (213) 684-2840. TWX: 910-588-3755.
Branches: 3941 E. Bayshore, Palo Alto, Calif., (415) 968-7116. TWX: 910-379-6935; 3442 Hancock St., San Diego, Calif., (714) 297-4619. TWX: 910-335-2006.
Factories: Beckman Inst.; Dana Labs.; Datapulse; Data Technology; Kennedy Co.; Micom, Inc.; Midwestern Inst.; Philbrick/Nexus Res.; Singer Co.; Sorensen Prod.; Systron-Donner; Topaz, Inc.; Wavetek.
Selling To: ★ M,I. **Salesmen:** 25 (eng 21)
Services: Repair, Stock Philbrick/Nexus, Sorensen & Systron-Donner

WRIGHT ENGRG., 180 E. California Blvd., (213) 681-2651. TWX: 910-588-3753.
Branch: 175 S. San Antonio Rd., Los Altos, Cal., (415) 941-4405.
Factories: Airborne Inst. Lab.; Ampar Div.; Anzac Elect.; Bielski Memory Sys.; Diamond Antenna & Microwave; Electro/Data; Microwave Prod.; Minax Devices; Shepard Lab.; Wayne-George; Wiltek, Inc.
Selling To: ★ M,I. **Salesmen:** 6 (eng 5)

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Factories: Lektrostat Corp.; Major Elctrn.; S & A Elctrn.
Selling To: ★ A,D. **Salesman:** 1

LONG & ASSOCS., INC., 505 Middlefield Rd., (415) 369-3324. TWX: 910-378-5429.
Factories: Automation Dev.; Barber-Colman; CEA; Delevan Elctrns.; Dexon; Fredericks; General Time; Hurst; Portescap; Thomas Elctrns; Trompeter Elctrns.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)
Services: Warehouse, Demo Room, Printing Plant, Projection Eqpt., Conference Rooms

(See Advertisement This Page)

SINAI-JOHNSON, INC., 817 Douglas St., (415) 365-6263. TWX: 910-378-5427.
Factories: Action Sys.; B&K Mfg.; Blonder Tongue Labs; Bomar Crystal Co.; BSR McDonald; Electronic Pub.; Enterprise Dev.; Harmon Kardon; Int'l. Wire & Cable Co.; Jensen Mfg.; Lance Antenna Corp.; Loral Distb. Prod.; Merit Coil & Trans. Corp.; Micro-Ohm Corp.; Pickering & Co.; Precision Apparatus Inc.; Rek-O-Kut Div.; Terado Co.; Texas Inst.; Turner Co.; Weller Elec.; Workman Elctrn. Inc. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 2)

Sacramento

CAMPBELL & GEORGE CO. (See Burlingame, Calif.)
PETERS-DE LAET, INC. (See Burlingame, Calif.)

San Bruno

AURICH, F. W. & CO. (See Seattle, Wash.)

San Carlos

LEBELL-WARREN ASSOCS., Box 246, (415) 593-7688.
Factories: Barry Controls; Beede Electrical Inst.; Birtcher Corp.; Chicago Condenser Corp.; Electro-Mechanisms; Kulka Elec.; Precision Timer Co.; Schrack Elec. Sales; H. H. Smith Inc.; Zenith Transformer Co. **Services:** Mallings
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

MELCHIOR ASSOC., INC., 820B Cherry, (415) 591-7383. TWX: 910-376-4404.
Factories: Gulton Ind.; Hansen Mfg.; Hevi-Duty Elec.; Hutson Optical; Stackpole Carbon; Syntron Co.; Thomas & Skinner; Vishay Resistor Prod. **Services:** Warehouse
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

ROSS, D. H. CO., 534 El Camino Real, (415) 591-4411. TWX: 910-376-4392.
Factories: Augat Inc.; Bud Radio; Comar Elec.; Electro-Mechanical Inst.; E.M.C. Plastics Div.; Fisher Radio; Gavitt Wire & Cable; Gremar Inc.; Memcor Component; Switchcraft; TACO Div.; United Audio; Weckesser.
Selling To: ★ A,D,I. **Salesmen:** 8 (eng 3)
Services: Warehouse

(See Advertisement This Page)

San Diego

AD ELCTRN. CO., 7969 Engineer Rd., Ste. 106, (714) 278-9260.
Factories: Continental Device; CTS; National Wire & Cable; Parelco, Inc.; Semtech.
Selling To: ★ I. **Salesmen:** 4 (eng 2)

ALLEN, D. CO., 7969 Engineer Rd., Ste. 106, (714) 278-9250.
Factories: ADC Elctrn.; Electro Cube; Fesco; Kelvin; Vanguard Elctrn.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

APPLETON, H. CO. (See Los Angeles, Calif.)
BLACK & STRONG, INC. (See Los Angeles, Calif.)
CAIN & CO. (See Encino, Calif.)
DORADO ELCTRNS. INC. (See Van Nuys, Calif.)
HUGHES R. S. Co., Inc. (See Los Angeles, Calif.)

HENBERGER, J. C. CO., 3661 Voltaire St., (714) 223-7114.
Factories: Amerace-ESNA; Browning, Mfg.; Buchanan Elec. Prod.; Cobehn, Inc.; Electro-Dynamics, Div.; Helland Torq Tender; Philadelphia Gear Corp.; Solar, Div.; Veeder-Root.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)
Services: Warehouse

IFM—SOUTH (See Hollywood, Calif.)
INSTRUMENT SPECIALISTS (See Glendale, Calif.)
INTERSTATE MARKETING (See Woodland Hills, Calif.)
MAYDWELL & HARTZELL (See San Francisco, Calif.)
MICHAEL, C. INC. (See Glendale, Calif.)
MONTGOMERY BROS., INC. (See Burlingame, Calif.)
MOXON ELCTRNS. CORP. (See Los Angeles, Calif.)
O'HALLORAN ASSOCS. (See N. Hollywood, Calif.)
RDP INSTRS. INC. (See Palo Alto, Calif.)
ROBERTS, E. V. & ASSOCS. (See Culver City, Calif.)
TECH-SER, INC. (See Burbank, Calif.)
THORSON CO. (See Los Angeles, Calif.)
WARD/DAVIS ASSOCS. (See Pasadena, Calif.)

WARE, J. A. & ASSOC., 301 W. G St., (714) 232-8578.
Branch: 1400 North 32nd St., Phoenix, Ariz., (602) 273-7309.
Factories: Anaconda, Metal Hose Div.; Crouse-Hinds Co.; Hunt Elctrn.; E. F. Guth Co.; Moldcast Mfg. Co.; Par Light Div.; Paramount Ind., Inc.; Prescolite Div. **Selling To:** ★ D.

WOODS, G. E. ASSOCS., INC. (See Anaheim, Calif.)

San Fernando

DATACOM ASSOCS., Box 4321, (213) 367-9111.
Factories: Calif. Sys. Components; Chalco Engrg. Corp.; Mil Assocs., Inc.; Instr. Components.
Selling To: ★ M,I. **Salesmen:** 2

San Francisco

BALLARD, I. CO., INC., 556 Clay, (415) 781-1781.
Factories: Dormeyer Ind.; Mack Elec. Devices; Muckle Mfg. Co.; Quicksilver Prod. Co.; Sonar Radio; Waber Elctrn.
Selling To: ★D,I. **Salesmen:** 3 (eng 1)
Services: Repair, Warehouse

BELFER, W., 387 6th St., (415) 781-0392.
Selling To: ★ A,D. **Salesmen:** 2 (eng 1)
Services: Warehouse

BIZTEK CO., INC. (See Toluca Lake, Calif.)

CADY, J. F., 1485 Bayshore Blvd., (415) 467-8656.
Factories: Bodine Elec. Co.; Stearns Elec. Corp.

CHURCH, L. F. CO., 655 Folsom St., (415) 781-1897.
Factories: DeBothezat Fans Div.; Ward Leonard Elec. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

HONN, G. E. CO., INC., 171 King St., (415) 781-7352.
Factories: Adalet Mfg.; Beta Corp.; Economy Cable Grip Co.; Gladding Ceramic Insulator Co.; Harlo Corp.; Lightalarms Elctrn.; Mineralac Elec.; Nife, Inc.; P.L.M. Prod.; P.S.I. Prod.; Remke; Scientific Columbus; States Co.
Selling To: ★ D. **Salesmen:** 5 (eng 3)
Services: Warehouse

HUNDLEY CO., INC. (See Los Angeles, Calif.)
JENSEN INSTR. CO. (See Los Angeles, Calif.)

KROTOZYNER, J. M., 420 Market St., (415) 982-4636.
Factories: Autotron, Inc.; Carbon Engrg.; Linemaster Switch Corp.
Selling To: ★ M,D,I. **Salesman:** 1

LITTRELL WESTERN SALES (See Los Angeles, Calif.)
LYNN & BROOKS (See Los Angeles, Calif.)

MAYDWELL & HARTZELL, INC., 870 Tennessee St., (415) 826-6900. TWX: 415-393-9157.
Branches: 120 S. 29th St., Phoenix, Ariz., (602) 275-7644; 6400 Corvette St., Los Angeles, Calif., (213) 685-6310; 30 South 13th St., San Diego, Calif., (714) 233-6661; 2318 N.W. Vaughn St., Portland, Ore., (503) 226-1441; 1216 Poplar Pl. S., Seattle, Wash., (206) 323-1270.
Factories: Elastimold Div.; Kearney Co.; Kuhlman Elec.; Power Conversion Products; Ross Engrg.; Superior-Continental.
Selling To: ★ A,M,D,I. **Salesmen:** 17 (eng 8)
Services: Warehouse

MEYER, ROSS & FLEMING, 113 Tenth St., (415) 431-0652.
Factories: Acoustone; Argos; Audio Devices; Audio Dynamics Corp.; David Clark Co.; Electro-Voice; Fanon; Hi Lo; Sherwood.
Selling To: ★ A,D,I. **Salesmen:** 5 (eng 1)
Services: Warehouse

MORSE ASSOCS., 1721 Chestnut St., (415) 567-6871.
Factories: Acoustica Assocs.; Agac-Derritron; American Elctrn.; Chadwick-Helmuth; Conn. Environmental R. & D.; Discon.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

MOULTHROP, POLACH & BENSINGER, INC., 165 11th St., (415) 861-6958.
Factories: Antennacraft; Cornell Dubilier Elctrn.; Datak Corp.; Dutrex Ind.; Essex Wire; Fairchild Contls.; J. Millen Mfg. Co.; Sarkes Tarzian; Stancor; Triplett Elec. Inst.
Selling To: ★ D,I. **Salesmen:** 3 (eng 1)

NORTHWEST SALES & ENGRG. SVC. (See Seattle, Wash.)
SIMPLEX WEST INC. (See Compton, Calif.)
SLATER, R. R. CO. (See Seattle, Wash.)

TECHNICAL SALES ASSOCS., 1485 Bayshore Blvd., (415) 467-1434.
Factories: AKG Microphones; Aerotron; Chemtronics; Columbia Elctrn. Cables; Fourjay Ind.; Oxford Elec.; Perma Power; Temple Sound; Texas Crystals.
Selling To: ★ A,D. **Salesmen:** 2
Services: Warehouse

WINSLOW, D. CO., 24 California St., (415) 982-8644.
Factories: Danco.
Selling To: ★ D,I. **Salesmen:** 2

San Gabriel

RISSI SALES CO., 1817 S. San Gabriel Blvd., (213) 283-7614.
Factories: Aerovox; Austincraft Co.; Barker & Williamson; Daburn Elctrn. & Cable; G/L Tab Books; Gowanda Elctrn.; Pausan Co.; Pomona Elctrn.; Premax Prod.; Premier Metal Prod.; Superex Elctrn. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 3

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San Jose

GEIST, W. K., CO. (See Glendale, Calif.)

WHITE & CO., 777 N. First St., (408) 292-8229.
Factories: Cablemaster Sls.; Eckel Ind.; Heat-Sys. Ultrsonics; E. A. Lindgren; Northwest Scientific; Planprint. **Services:** Repair
Selling To: ★ A,M,I,Medical.

San Marino

WOLFF, A. L. CO., 2485 Huntington Dr., (213) 793-9149.
Factories: Ferber Assocs.; Physiological Training Co.; Ward Assocs.
Selling To: ★ Medical. **Salesmen:** 2 (eng 2)

San Mateo

APPLETON, H. CO. (See Los Angeles, Calif.)

ELECTRONICS MKTK. ASSOCS., Box 5199, (415) 341-6666.
Factories: Amertest; Bell Furniture Mfg.; Bogen Comm.; Bowman Elctrn.; Daburn Elect. & Cable Corp.; Grado Labs., Inc.; Indl. Devices; Javelin Elctrn.; J.B.L. Intl.; Recoton Corp.; Robins Ind.; Sarex Corp.; Superex Elect.; Toujay-Multicube.
Selling To: ★ A,D. **Salesmen:** 2

HARRISS, L. H. CO., 204 E. Hillsdale, (415) 341-2909.
Factories: Antronic Corp.; Antenna Designs Corp.; Bell PA Prod.; Cornish Wire; I.E. Mfg.; N.T.T. Sales; Planet Capacitors; Seco Elctrn.; Semitronics; Standard-Grigsby Co.; Utah Elctrn.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

KING ENGRG. CO. (See Encino, Calif.)

LUSCOMBE ENGRG. CO. (See Pasadena, Calif.)

McCARTHY-KELLY & ASSOC., 279 N. Bayshore Blvd., (415) 343-8748.
Factories: R. A. Boehm Co.; International Inst.; Lear Siegler; Seco Elctrn.; Sigma Inst.; Simplatrol Prod.; Wer Industrial.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

MOXON ELECTRNS. CORP. (See Los Angeles, Calif.)

PYLE, J. Co., 1611 Borel Pl., (415) 349-1266. TWX: 910-374-2354.
Branches: Cedar Engrg.; Cermetek, Inc.; Collins Radio Co.; Duncan Elctrn.; Electronic Arrays; General Resistance; Gulton Ind.; Sage Elctrn.; Warnecke Electron Tubes.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

SOUTHWEST SCIENTIFIC (See Santa Monica, Calif.)

San Rafael

BRANDT, E. W., Co. Box 538, (415) 454-0840.
Factories: Adler Mfg.; Dyna Co.; Sansui Elctrn.
Selling To: ★ A. **Salesman:** 1
Services: Warehouse

MGR PRODS., INC. 26 Duffy Pl., (415) 454-5214.
Factories: BASF Tapes; Lectracal; Penta Labs.; View-All.
Selling To: ★ A,I. **Salesmen:** 3 (eng 2)

Santa Ana

MURRAY, T. F. & ASSOCS. (See Burbank, Calif.)

THORSON CO. (See Los Angeles, Calif.)

Santa Clara

INSTRUMENT SPECIALISTS (See Glendale, Calif.)

RAYMARG, Box 515, (408) 248-5199.
Factories: Alac, Inc.; Anchor Alloys, Inc.; Controlonics Corp.; Electronic Cooling Devices; Ionetics Corp.; Larsen Elctrn.; Radio Specialty Mfg.; Techform Labs.; Torsion Balance Co.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse, Selective Direct Mail

Santa Monica

DAVIDSON ASSOCS., INC., 2920 Nebraska, (213) 451-5761. TWX: 910-343-6869.
Factories: Automation Dev. Co.; Control Data; Globe Ind.; Herley Ind.; Hutson Corp.; Intrex Syst., Inc.; Magtrol, Inc.; Machine Components Corp.; H. K. Porter Co.; Power Inst.; Trojan Ind.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)

(See Advertisement This Page)

MANUFACTURING ASSOCIATES, 1738 Colorado, (213) 479-8884.
Branch: 770 Welch Rd., Rm. 166, Palo Alto, Calif, (415) 323-0295.
Factories: American Radar Components; Applied Engrg. Prods.; EMC Technology; E-Z Way Prods.; Gabriel Elctrn.; Horton-Angell Co.; Meca Elctrn.; Washington Aluminum.
Selling To: ★ I. **Salesmen:** 4 (eng 3)
Services: Warehouse

SOUTHWEST SCIENTIFIC CO., 912 Marguerita Ave., (213) 870-8332.
Branch: 800 Polhemus Rd., San Mateo, Calif., (415) 345-0885.
Factories: British Radio Elctrn.; Janis Res.; Magnion Div.; Milletron Inc.; Rawson Elect'l Inst.; Simtec Ltd.; United Technical Corp.
Selling To: ★ Medicine, Research
Services: Repair **Salesmen:** 2 (eng 2)

Saratoga

TOWNSEND TECHNICAL SALES, Box 265, (408) 252-3478.
Factories: Couch Ordnance; Kahn & Co.; Meca Elctrn.; Mills Resistor Co.; N-H Microwave; Printact Relay Div.; Tek Wave, Inc.; Washburn.
Selling To: ★ M,I. **Salesmen:** 2

Sepulveda

R. L. ASSOCS., Box 2255, (213) 782-7826. TWX: 910-495-1733.
Factories: Airborn, Inc.; Communications Prod. Div.; Control Switch Div.; General Reed Co.; Utah Elctrn.; Victor Elec. Wire & Cable; Voltronics Corp.; Whale Elctrn.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

Sherman Oaks

GEE ASSOCS., INC., 14474 Dickens St., (213) 788-5961.
Factories: Dorsett Elctrn.; Elcor, Inc.; Fairchild Cont. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

HOPKINS, R. S. CO., 15016 Ventura, (213) 788-5501.
Factories: Carter Motor Co.; General Ind.; H-B Inst.; Hansen Mfg.; Protective Controls; Schrack Elec. Sales.
Selling To: ★ I. **Salesman:** 1 (eng 1)

MEUSSDORFFER R. & ASSOC., 13441 Ventura, (213) 788-0771.
Factories: Barber-Colman Co.; Dayton Superior Prod.; Electro-Mel Ind.; Hermaseal; Zero-Max.
Selling To: ★ I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse

SPECTRUM SALES CO., 14106 Ventura Blvd., (213) 788-9911.
Factories: Aemco Divn., Midtex; Controls Res.; Giannini-Voltex; Magnafile; Western Magnetics.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 2)

TAW ASSOCS., 4455 Ventura Ave., (213) 784-2765.
Factories: General Astronics; Ionetics Corp.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse.

Sunnyvale

FEATHERSTONE SALES CO., Box 726, (408) 734-2663.
Factories: Gibbs Special Prod.; Hamilton Hall; Javex Elctrn.; Jayell Mfg. Co.; Midland Int'l. Corp.; Perry-Briggs Co.; Royal Radio Corp.; SPEMCO.
Selling To: ★ A,D,I. **Salesmen:** 2
Services: Warehouse

TECH MARKETING ASSOCS., 355 W. Olive Ave., (408) 736-3687. TWX: 910-339-9227.
Factories: Borg-Warner Cont.; Data-Control Sys.; RdF Corp; RdF/West; Signalite; Tele-Dynamics.
Selling To: ★ M. **Salesman:** 1 (eng 1)

WALDMAN ASSOCS., 1094 W. Evelyn Ave., (408) 245-2500.
Factories: Anaren Microwave; Arvin Frequency Devices; E & M Labs; Electrac; Frequency Sources; Microsonics.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

WIELER & CO. (See Downey, Calif.)

Tarzana

CAPELL, R. CO., Box 723, (213) 987-2233.
Factories: Caddock Elctrn.; Component Res.; Digilog Elctrn.; Gentronics; Hamby; Quest Elctrn. Dev.; Torwico Elctrn.
Selling To: ★ M,I. **Salesmen:** 3

MITCHELL, C. H. CO., 18531 Ventura Blvd., (213) 881-2626.
Factories: Integrated Elctrn.; Mura Corp.; Petersen Radio Co.; Telvac Inst. **Salesmen:** 3
Selling To: ★ D,I. **Services:** Warehouse

Toluca Lake

BIZTEK CO., INC., 10639 Riverside Dr., Ste. 103, (213) 766-4890.
Branches: Box 3091, Scottsdale, Ariz., (602) 945-5781; Box 321, San Francisco, Calif., (415) 421-3172.
Factories: Commander Labs.; Coretronics; Datak; Electro-Science Lab.; Fossman Co.; Glenmarc Mfg.; Hi-Grade Alloy; Virginia Elctrn.; Weltek Elctrn.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)
Services: Warehouse, Direct Mail

Torrance

AEROL ASSOCS., INC. (See Jericho, New York)

MILLER, R. S. CO., Box 1185, (213) 326-1610.
Factories: Clayton Mfg. Co.; Milcon Hinge Corp.; Romilco Corp.; Spactronics Co.
Selling To: ★ M,I. **Salesmen:** 4 (eng 2)
Services: Warehouse, Mfg. Representatives

O'DONNELL ASSOC. INC., 18053 Crenshaw Blvd., (213) 323-9243. TWX: 910-346-6732.
Branch: 1955 "B" El Camino Real, Palo Alto, Calif., (415) 327-9260.
Factories: Carborundum Co.; Cherry Electrical Prod.; Duramark, Inc.; Guardian Elec.; Hill Elctrn.;



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• Brakes	• Gearmotors	• Positioning Devices	• Servo Motors	• Torque Meters
• Clutches	• IC Testers	• Pots, Motorized	• Servo Systems	• Variable Speed Drives
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2920 NEBRASKA AVE., SANTA MONICA, CALIFORNIA 451-5761

Ledex Inc.; Reeves Inst.; Self-Organizing Sys.; Walden Elctrn.; Wanlass Elec.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 5)

TRIER, J. S. & ASSOC., 2906 Fairchild Apron, Torrance Municipal Airport, (213) 326-1385.
Factories: Dodge Machine Co.; Gorman Machine Corp.; International Dynamics.
Selling To: ★ M.I. **Salesmen:** 3 (eng 3)
Services: Repair, Warehouse, Display Rooms & Labs.

WEB ELCTRN. ASSOCS., 18039 Crenshaw Blvd., (213) 323-8676.
Factories: Coilform Co.; Phipps Precision Prod.; Quality Transformers; Welwyn Int.; Wilco Corp.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

Van Nuys

DORADO ELCTRN. INC., 13615 Victory Blvd., (213) 873-4124. TWX: 910-495-1803.
Branch: 6692 Bonnie View Dr., San Diego, Calif., (714) 234-2034.
Factories: Dorado-Cal Corp.; Fairchild Cont.; Industro Transistor; International Circuit Tech.; Stewart Warner Microcircuits; Superior Circuits Corp.; Union Carbide Elctrn.; Vanguard Elctrn.; Vitramon Inc.; Wesco Elec.
Selling To: ★ M,D,I. **Salesmen:** 8 (eng 7)
Services: Direct Mail

E. E. ENTERPRISES, INC., 5901 Noble Ave., (213) 787-5360. TWX: 910-495-1759.
Factories: E-Tronics; Eldre Components; Indiana General; Maurey Inst.; Planet Inst.; Tachtronics Inst.; Vogue Inst.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

(See Advertisement This Page)

ELLIOTT, G., INC., 13615 Victory Blvd., (213) 873-6862.
Factories: Multisonic Corp.; Nova Elec.; Parabam; Raytheon; Senflex; Scionics; Texas Inst.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

PENWARDEN ASSOC., 14547 Titus, (213) 782-4920. TWX: 910-495-1729.
Factories: Curtis Development; Drake Mfg.; Foster Transformer; Globe-Union; Hurst Mfg.; McGill Mfg.; Nucleonic Prods.; Precision Elctrn.; Sigma Inst.; Standard Grigsby.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 5)

(See Advertisement Page 3234)

R. L. ASSOCS., 14401 Gilmore St., (213) 782-7826. TWX: 910-495-1733.
Factories: Airborn, Inc.; Control Switch Div.; Communication Prod. Div.; General Reed Co.; Hamilton-Hall Resistor; Utah Elctrn.; Voltronics; Victor Electric Wire & Cable; Whale Elctrn.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

WES-K ASSOCS., 5917 Noble Ave., (213) 989-3070. TWX: 910-495-1770.
Factories: Ceramics Tech.; Dictograph Prod.; Kelvin; Int'l Components; Mid-Continent Lab.; Vamistor Corp.; Western Gold & Platinum.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 3)

ZIMMERMAN, W. E. CO., 15443 Cabrito Rd., (213) 787-4240.
Factories: Electronic Cooling Devices; General RF Fittings; Torsion Balance.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

Woodland Hills

INTERSTATE MARKETING ASSOC., Box 487, (213) 883-7606. TWX: 910-494-1239.
Branches: 3803 E. Thomas, Phoenix, Ariz., (602) 275-5157; 4440 Rainier Ave., San Diego, Calif., (714) 283-7519.
Factories: Aavid Engrg.; Airco-Speer; Cal-R; ESC; General Semi.; LRC; MIAL; Nytronics; Phoenix Transformer; SSS, STM; Varadyne; Vari-L.
Selling To: ★ A,M,D,I. **Salesmen:** 6 (eng 6)
Services: Warehouse

COLORADO

Arvada

ARROWHEAD SALES CORP. (See Salt Lake City, Utah)

Aurora

A-E-S, INC., 12891 E. Nevada Circle, (303) 366-0208.
Factories: Atlas Publ.; Consolidated Wire; C/P Corp.; Cush/Craft Corp.; Electronical Chemical; Heeger, Inc.; L.M.B.; Marden Elctrn.; Newcastle Fabrics; Perma Power; Pomona Electrn.; Private Telecomm.; Rayline; Sonar Radio; Terado; Ward Products.
Selling To: ★ A,M,D,I. **Salesmen:** 2 (ehg 1)

BISHOP ENTERPRISES, INC., 126 Del Mar Circle, "C", (303) 364-7361.
Branches: 1805 San Pedro, N. E., Albuquerque, N.M., (505) 255-9042; 2929 E. Thomas, Ste. 127, Phoenix, Ariz., (602) 265-8747; 8888 Dyer, Ste. 412, El Paso, Tex., (915) 755-3377.
Factories: Atec; California Instr.; T. L. Faul Assocs., Inc.; General Resistance; Kruse-Storke Elctrn.; Landis & Gyr; Spatial Data Sys.; Vema; Wang Labs., Inc.; Weinschel Engrg.
Selling To: ★ M,I. **Salesmen:** 7 (eng 4)
Services: Repair

Boulder

INLAND ASSOCS. (See Mission, Kansas)
KEY REPRESENTATION (Los Angeles, Calif.)

Colorado Springs

ELECTR. MFGRS.' CONSULTANTS, INC., 1619 N. Royer, (303) 636-5131.
Branches: 6633 E. Palo Verde, Scottsdale, Ariz., (602) 946-6350; 511 E. 7th S., Salt Lake City, Utah, (801) 467-6738.
Factories: Cramco Solder Alloys; Elec. Soldering Iron; GC Electrn.; New Jersey Semi; Power Comp.; Precision Thermometer Instr. Co.; Printact Div.; Schrack Elect. Sles.; Taurus Corp.; Technology; Tingstol; Transcriber; Vigor Div.
Selling To: ★ D,I. **Salesmen:** 3 (eng 1)
Services: Warehouse, Stocking

Denver

APPLETON, H. CO. (See Los Angeles, Calif.)

BENNEWITZ ASSOC., INC. (See Albuquerque, N.M.)

BFA, 1309 So. Inca, (303) 744-3301.
Branches: 4710 N. 16th St., Phoenix, Ariz., (602) 264-6536; 1238 Ortiz, S. E., Albuquerque, N. M., (505) 268-4387; 3216 E. 21st St., Tulsa, Okla., (918) 936-5295; Box 429, Euless, Texas, (817) 267-1505; Box 50, Friendswood, Texas, (713) 482-7563; Box 16065, San Antonio, Texas, (512) 828-0164.
Factories: American Std.; Aero Research Inst.; Analogic; Astrodata; Bolt Beranek & Newman; Bourns; Cimron Div.; DATALOG Div.; Digitran; Electronic Enclosures; Entex; Esterline-Angus Instr.; Incre-Data Corp.; Interdata; Microdot, Inc.; Midwestern Instr.; Precision Instr.; Spectrol Electrn.; Systems Res.; Tally Corp.; Tracor; Wavetek; Wyle Sys. **Services:** Repair
Selling To: ★ M,D,I. **Salesmen:** 14 (eng 8)

BOWEN, R. G. CO., INC., 1440 S. Santa Fe, (303) 722-4641. Telex: 045-728.
Branch: 1380 W. N. Temple, Salt Lake City, Utah, (801) 364-4632.
Factories: Atlantic Semiconductor; Bud Radio; Cornell Dubilier; Dialight; Essex Wire; Methode Electrn.; J. W. Miller; Potter & Brumfield; Rohn Mfg.; Simpson Elec.; Stancor Electrn.; Wakefield Engrg.
Selling To: ★ D,I. **Salesmen:** 4

CATHEY, R. E. CO., 200 Garrison St., (303) 238-1506.
Factories: Edison, Thos. A. Ind.; Grayhill; Grayhill Moldtronics; Reliance Inst. Mfg.; Sensor Precision Ind. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

CLUPHF, S. & ASSOCS., 1268 W. Nevada Pl., (303) 744-6329.
Factories: Andrea Television; Bell & Howell; Oelrich Publ.; United Audio Prod.
Selling To: ★ A. **Salesmen:** 2

CONNORS, INC., 2241 Stacey Dr., (303) 428-1575.
Factories: Aerovox; Astatic; IRC Inc.; International Rectifier; Raytheon; Seco; Tenna; Thordarson-Meissner; Waldom; Weller; Xcelite.
Selling To: ★ A,D. **Salesmen:** 3
Services: Warehouse

ELLIOTT, C. P. CO., 661 Delaware St., (303) 255-2844.
Factories: Automatic Switch; Sterling Elec. Motors.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

FRANKLIN SALES CO., 2149 S. Clermont.
Factories: Cambridge Scientific Ind.; Capitol Machine & Switch Co.; Chicago Dynamics Ind.; Colform-Div.; East Moline Metal Prod.; Electo Flex Heat; Electro-mech; Fiddletone; Harowe Servo Contls.; Hengstler Numerics; Hurst Mfg.; Kester Solder; Metcom; National Wire & Cable; Parelco; Parker Inst.; Saki Magnetics.
Selling To: ★ M,D,I. **Salesmen:** 2

GATES, F. Y. CO., INC. (See Salt Lake City, Utah)

GORDON MOSS ELECTRNS., INC. (See Greeley, Colo.)

HURLBUT, J. F. CO., 2240 S. Adams St., (303) 756-2046.
Branch: 3817 W. 3280 South St., Granger, Utah, (801) 299-4321.
Factories: American Zettler, Inc.; Barnes Engrg.; Boonton Elctrn.; Computer Logic; Cunningham Corp.; Electronic Molding Corp.; Elron Elctrn. Ind.; G-L Ind.; G-V Contls.; General Illumination; IRA Sys.; Kepco; MIAL, USA; Quan-Tech Labs.; Varo.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

HYDE ELECTRN. CO., INC., 888 S. Lipan St., (303) 936-3456.
Factories: Abbey Elctrn.; Alliance Mfg.; Dynaco; Erie Technological; Greibach Inst.; Hammarlund Mfg.; IEC; Lafayette Radio Electrn.; Omni Spectra Inc.; Oxford Transducer; Resistor Wholesalers; Sonotone; Soundolier; Symphonic Radio & Elec.; Texas Crystals; UOP Inst.
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 2)
Services: Warehouse, Direct Mail

HYTRONIC MEASUREMENTS, INC., 4940 E. 39th Ave., (303) 388-4081. TWX: 910-931-2597.
Branches: 1017 N. Third St., Phoenix, Ariz., (602) 253-6104; 205 San Pablo S.E., Albuquerque, N.M., (505) 268-3941; 2022 S. Main St., Salt Lake City, Utah, (801) 466-4924.
Factories: Aerovox Corp.; Airborne Inst.; Alco Elctrn. Prod.; AMPEX Corp.; API Inst.; Atohm Elctrn.; Datapulse; De Mornay Bonardi; E.G.&G.; Elctrn. Engrg.; B. F. Goodrich; Int'l Rectifier; Kings Elctrn. Co.; Marconi Inst.; Minco Prod.; Phalo Corp.; Phelps Dodge Elctrn. Prod.; Philbrick/Nexus Research; Power Designs; Radar Design; Unimax Switch; Vidar Corp.
Selling To: ★ M,D,I. **Salesmen:** 8 (eng 4)
Services: Repair, Warehouse

KAUB, H. & CO., 4970 Jackson St., (303) 399-1520.
Factories: Eaton, Yale & Towne; Electric Prod.; Euclid Elec. Mfg.; Ikor Inc.; Machinery Electrification Inc.; Marathon Elec. Mfg.; Reuland Elec.; Seco Elctrn.; Telemotive Div.; Zero-Max.
Selling To: ★ I. **Salesmen:** 3 (eng 1)
Services: Warehouse

LINDBERG CO., 2654 S. Krameria St., (303) 757-6489. TWX:910-931-2579.
Factories: Collins Radio; Cushman Elctrn.; Hitemp Wires; IMC; Kelvin; Panduit Corp.; Thermalloy Co.; Union Carbide-Kemet.
Selling To: ★ D,I. **Salesmen:** 3 (eng 3)

NELSON CO., INC., 1294 S. Bannock, (303) 373-5528.
Selling To: ★ D,I.

PEARSON, M. & CO., 1860 S. Acoma, (303) 744-2323. TWX: 910-931-0494.
Branch: 288 Canyon Rd., Salt Lake City, Utah, (303) 744-2323. TWX: 910-931-0494.
Factories: Amperex Elctrn.; North American Philips. **Services:** Warehouse
Selling To: ★ A,I. **Salesmen:** 5 (eng 1)

PETERS-DE LAET, INC. (See Burlingame, Calif.)

PRO MARKETING CORP., 451 E. 58th Ave., (303) 266-2571.
Selling To: ★ D. **Salesmen:** 3 (eng 1)

S-L ASSOCS, Box 15096, (303) 238-1807.
Factories: Barber-Colman Co.; Gudeman Co.; Gulton Ind.; Industro Transistor; Kidco, Inc.; Sage Elctrn.; Standard Elctrn.; Transformer Technicians; WacLine. **Services:** Direct Mail
Selling To: ★ M,D,I. **Salesman:** 1

THORSON CO. (See Los Angeles, Calif.)

VINES & CO., Box 1025, (303) 825-4471.
Factories: Barker Prod.; Graphite Prod.; Kedman Co.; Knapp Mfg.; Moody Machine Prods.; S & A Elctrn.; Twin Specialty Oil Co.; Unival Corp.; Wald Sound. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 2

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WAUGAMAN ASSOCS, INC., 2785 N. Speer Blvd., (303) 255-5000.
Factories: ACDC Elctrn.; Andersen Labs.; Borg-Warner Thermoelectrics Dept.; Clevite Corp.; Defiance Printed Circuit Corp.; Diodes Inc.; Duncan Elctrn.; Foster Transformer; Glasseal Prod.; Gordos Inc.; KSC Semiconductor; M. S. Transistor; Magnecraft Elec.; RCL Elctrn.; G. T. Schjeldahl Co.; Silicon Transistor; Stewart-Warner Microcircuits; TRW Capacitor Div.; TRW Elctrn. Div.; Victoreen Inst.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

WILLIAMS-ASSOCS, INC., 4971 Jackson St., (303) 388-4391.
Branches: 1110 E. McDowell Road, Phoenix, Ariz., (602) 254-6085; 420 Washington St. S.E., Albuquerque, N.M., (505) 255-1638. TWX: 910-989-0622; 2469 S. Main St., Salt Lake City, Utah, (801) 466-8709.
Factories: Burr-Brown Res.; Cohu Elctrn.; Cramer Div.; Dale Elctrn.; Globe Ind.; Hastings-Raydist; Rustrak Inst.; Sierra Elctrn.; Signalite, Inc.; Singer Co.; Systron-Donner; Varian Assoc.; Whittaker Corp.
Selling To: ★ M,D,I. **Salesmen:** 10 (eng 7)
Services: Repair, Warehouse

Englewood

AZTEC ENTERPRISES, INC. (See Albuquerque, N.M.)

COMPAR ROCKY MOUNTAIN (See Scottsdale, Ariz.)

CUMMINGS & ASSOCS., 4772 S. Kalamath St., (303) 789-3449.
Factories: Circuitronics; Electronic Res.; Electro Switch; E-T-A Prod.; Howard Ind.; Hudson Lamp; Hy-Gain Elec.; Moody Machine Prod.; Regency Electrn.; Reon Resistor.
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

HYER ASSOCS., INC., 8101 E. Prentice Ave., (303) 771-5424. TWX: 910-935-0706.
Branches: 3300 S. Mill Rd., Tempe, Ariz., (602) 275-7524. TWX: 910-950-4691; 130 Alvarado N.E., Albuquerque, N.M., (505) 265-5961. TWX: 910-989-1679; 1425 S. 2nd W., Salt Lake City, Utah, (801) 487-7747. TWX: 910-925-5607.
Factories: Applied Measurements; Astroscience; Cober Elctrn.; Dumont Oscillograph Labs.; EG&G Inc.; Electro/Data; E & M Labs.; Fairchild Microwave; Fairchild Inst.; Field Emission; Gulton Ind.; Industrial Elctrn. Eng.; Maxwell Labs.; Microdyne Corp.; NJE; PEC; Pneumafil Corp.; Radix Telemtry; Geo. Risk Ind.; Sippican Corp.; Stellarmetrics; TRG Microwave Div.; TRG Electro-Optics Div.; University Labs. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 7 (eng 5)

PLS ASSOCS., INC., 7895 E. Prentice Ave., (303) 771-0140.
Branches: 4200 B Silver Ave., S.E., Albuquerque, N.M., (505) 255-2330; 901 W. McDowell Rd., Phoenix, Ariz., (602) 258-0067.
Factories: Avtel Corp.; Daytronic; Digi-Data; Electronic Measurements Div.; Fairchild Contrls.; Keltec Fla.; Kilovolt Corp.; Kistler Inst.; Lebow Assocs.; McLean Engrg. Labs.; Micro-Power; Microwave/Sys.; PRD Elctrn.; Pacific Measurements; Powertec; Reccor Corp.; Spencer-Kennedy Labs.; Texas Inst., Inc.; Weston Inst.; Wiltron.
Selling To: ★ I. **Salesmen:** 3 (eng 3)

VINSON ASSOCS., INC., 3600 S. Lincoln, (303) 789-2203. TWX: 910-933-0187.
Branches: Box 3295, Sta. D, Albuquerque, N.M., (505) 298-7442. TWX: 910-989-1170; 44 E. Indian School Rd., Scottsdale, Ariz., (602) 947-7371. TWX: 910-950-1288.
Factories: Airpax Elctrn.; American Comp.; ASM Corp.; Barry Controls; Beckman Inst.; Callins Ind.; CEA Div.; Control Switch Div.; Datatron, Inc.; Durant Mfg.; Henes Mfg.; Heraeus-Engelhard Vacuum; Hy-Cal Engrg.; IERC; Inst. for Industry; MM Elctrn. Enclosures; Neff Inst.; Ray Proof; Sandefur Engrg.; Sparton Southwest; Statham Inst.; Struthers-Dunn, Inc.; Weldmatic Div.; Weston—Comp. Div.
Selling To: ★ M,I. **Salesmen:** 5 (eng 4)

Loveland

KELLEY ENTERPRISES, 336 E. Fourth St., (303) 667-1376.
Branch: 5432 Vancouver St., El Paso, Tex., (915) 751-3843.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

CONNECTICUT

Berlin

WHITE SALES CO., INC. (See Needham, Mass.)

Bethany

REPRESENTATIVES CORP. (See Boston, Mass.)

Bloomfield

ZASLOW SALES CO., INC., 6 Newberry Rd., (203) 242-7781. TWX: 710-425-5418.
Branches: 49 Clark St., Milford, Conn., (203) 878-1094; 339 Middlesex St., Lowell, Mass., (617) 458-8452; 371 Howard St., Northboro, Mass., (617) 393-8150.
Factories: Artisan Elctrn.; Electro-Therm, Inc.; Franke Gear Works; Harowe Servo Cont.; Helical Prod.; Humphrey; Ingraham Co.; Langevin Div.; Leecraft Mfg.; Maurey Instr.; Molon Motor & Coil; Ogden Mfg.; Power Contrl.; Standard Inst.; Unimax Switch; Western Gear.
Selling To: ★ A,M,D,I. **Salesmen:** 6 (eng 6)
Services: Sales Office

Branford

BOEING, J.E. CO., INC. (See Lexington, Mass.)

Bridgeport

TECHNICAL INSTRUMENTS (See Wilmington, Mass.)

Bristol

E. E. SPECIALISTS, INC. (See Acton, Mass.)

Brookfield

LOBDELL SALES CO., Candlewood Lake Rd., (203) 775-2253. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)

Cheshire

GREGORY, G. ASSOC. (See Natick, Mass.)

Cos Cob

COLAVECCHIO, V., 14 Daffodil La., (203) 869-3945.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Coventry

ROBINSON, R. H. CO., Box 368, (203) 742-7323.
Branches: 1420 Providence Highway, Norwood, Mass., (617) 762-3511; Grafton, Vt., (802) 869-3656.
Factories: Brand Dielec.; Brand-Rex Div.; Electro Circuits; JPM Co.; Quinn-Berry Div.; G. T. Schjeldahl Co.
Selling To: ★ M,I. **Salesmen:** 5 (eng 1)

E. Hartford

MEASUREMENT EQUIPMENT (See Wakefield, Mass.)

Essex

AEROL ASSOCS., INC. (See Jericho, New York)

Farmington

KEYCO ASSOCS., INC.,Box 357.
Branch: 1329 Highland Ave., Needham, Mass., (617) 449-2600.
Factories: Clark Crystal Co.; Coale Photo Prod.; Flight Sys.; Greenray Ind.; Inland Elctrn.; Mandex Mfg.; Metric Engrg.; National Semiconductors; Oven Ind.; Paktron Div.; Protective Controls; RFL Ind.; Senflex.
Selling To: ★ M,D,I. **Salesmen:** 2
Services: Warehouse, Direct Mail

PERRON, R. & CO., INC. (See Norwood, Mass.)

Glastonbury

BARTON, C. K. ASSOCS., INC., 343 New London Tpke., (203) 633-9417.
Branch: 440 Lexington St., Auburndale, Mass., (617) 332-2021.
Factories: Branson Corp.; Braun Tool & Instr.; CTS-Knights; Carter Mfg.; Columbus Elec. Mfg.; Hopkins Engrg.; Janco Corp.; Jones Motrola; Marco-Oak Ind.; Panduit.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)
Services: Warehouse

Greenwich

HAMMOND ASSOCS., 34 Lincoln Ave., (203) 661-9410.
Factories: Coto-Coil Co.; Hamlin; Reed Switch Dev.
Selling To: ★ I. **Salesman:** 1

N.P.N. ASSOCS., INC., 522 E. Putman Ave., (203) 869-4955.
Factories: Auricord Inc.; Develco Inc.; Elec-Trol Inc.; Gauss Electrophysics; Saki Magnetics.
Selling To: ★ A,M,I. **Salesmen:** 2 (eng 2)

Guilford

WHITEHEAD, J. F. CO., Box 177, (203) 453-3855.
Factories: Electro-Craft Corp.; H & M Magnet Wire; Kanthal; Saxonburg Ceramics.
Selling To: ★ I. **Salesmen:** 3 (eng 1)

Hamden

COMPAR NEW ENGLAND (See Newton Highlands, Mass.)

EQUIPMENT SALES CO., INC., Box 5396, (203) 248-5581.
Branches: Bedford, Mass., (617) 275-7730; Cooperstown, N. Y., (607) 547-8968.
Factories: Avco Elctrn. Div.; Chadwick-Helmuth Co.; Dalmo Victor; Diamond Power Specialty; Glentronics; Kahn & Co.; MB Elctrn.; Marshall

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Offices in New Haven, Boston, Cooperstown

EQUIPMENT SALES CO. INC.

P.O. Box 5396 3013 Dixwell Ave., Hamden, Conn. 06518 (203) 248-5581

ELECTRONIC REPRESENTATIVES ASSOCIATION

MEMBER MANA MANUFACTURER'S AGENTS NATIONAL ASSOCIATION

Res. & Dev.; Schaevitz Engrg.; Special Operations; Spectrolab; TEAM Corp.; Tenney Engrg.
Selling To: ★ M,I. **Salesmen:** 6 (eng 5)

(See Advertisement Pages 3236, 3250)

MANDELL, H. CO. (See Revere, Mass.)

J. & J. ASSOC., INC. (See Waltham, Mass.)

INSTRUMENT CONSULTANTS INC. (See Waban, Mass.)

NORTHEAST ENGRG., INC., 3013 Dixwell Ave., (203) 248-4481.
Branches: 5 Elm St., Danvers, Mass., (617) 774-3010; 124 Trumbull Rd., Manhasset, N. Y., (516) 365-9633.
Factories: Aircraft Porous Media, Inc.; Cox Insts.; Environmental Control Sys.; Gems Co.; General Oceanology; Glassco Inst.; Industrial Hydraulic Div.; Mectron Ind.; Planet Prod.; H. E. Sostman & Co.; Spectral Dynamics; Technology/Versatronics; Televac Div.; Tescom Corp.
Selling To: ★ M,I. **Salesmen:** 7 (eng 7)
Services: Engrg. Assistance

Hartford

INSTRUMENT ASSOCS., INC. (See Arlington, Mass.)

SALES ENGRG. CO. (See W. Concord, Mass.)

Manchester

GATES, A. W., 60 Ansaldi Rd.
Factories: Magnus Organ Corp.; G. Hobbs Inc.
Selling To: ★ A,D. **Salesman:** 1

Meriden

ABBOTT-ALLISON CO., INC., Box 467, (203) 237-9232.
Branch: Box 96, N. Andover, Mass., (617) 245-0250.
Factories: AM & F; MF Elctrn.; Magnetic Shields; Robicon; Skan-A-Matic; Spedcor Elctrn.; Technipower; Tranducer Controls.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Mailing Lists

LAVIN, H. ASSOCS., INC., Box 921, (203) 237-5527.
Branch: Box 223, Needham, Mass., (617) 444-3446.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)

Milford

STURGEON, P. R. CO. (See Chestnut Hill, Mass.)

TODINO ENGRG. SALES. (See Needham Hgts., Mass.)

ZASLOW SALES CO., INC. (See Bloomfield, Conn.)

New Haven

ADDELCO CORP. (See Needham, Mass.)

EDCOM, INC. (See Newtonville, Mass.)

FELDMAN, ASSOCS., 523 Norton P'kway, (203) 776-7843.
Factory: Eastern Insulated Wire Div.
Selling To: ★ I.

SCHUFT, H. J. CO., INC. (See Newtonville, Mass.)

FORSBERG SALES (See Brockton, Mass.)

GERBER SALES CO., INC. (See Waltham, Mass.)

KITCHEN & KUTCHIN, INC. (See Lexington, Mass.)

Newington

MAHER, F. SALES CO., 175 Brookside Rd., (203) 247-7474.
Factories: Audio Designs; Dexter Chemical; Deltex.
Selling To: ★ A,D. **Salesmen:** 2 (eng 2)
Services: Warehouse

New London

FEINBERG, J. L. ASSOC. INC., 33 Shirley La.
Branch: 114 Eaton St., Reading, Mass., (617) 944-1510.
Factories: Control Corp.; Nobex Div.; Panel Graphic Corp.; Tower Mfg.; Truco, Inc.; Victor Electric Wire & Cable.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)
Services: Warehouse

Newton

MAHAN, R. P. CO. (See Wellesley, Mass.)

Norwalk

ROGELL ASSOCS., INC., Box 797, (203) 853-4141.
Factories: Mosaic Fabrications Div.; Sippican.
Selling To: ★ I. **Salesman:** 1 (eng 1)

Stamford

DAGE CORP., 757 Main St., (203) 324-3123. TWX: 710-474-2490.
Factories: Allied Contl.; Americon Corp.; Barnes Corp.; Bliley Elec.; Bundy Elctrn.; Chu Assocs.; Contronix-Microtech; Crystalonics; Dielectric Prod. Engrg.; Digital Devices; Electronautics; Energy Sys.; Engelmann Microwave; Ferrotec; Intronics; LRC Elctrn.; Merrimac Res. & Dev.; Metcom Inc.; Mica Corp.; Microtech; Microwave Prod. Group; N. E. Inst. Co.; Nuclear Tube; Omega Labs; Pyrofilm Resistor; Quantatron; Ray Proof Corp.; San Fernando Elec. Mfg.; Scanwell Labs.; Sealtron Corp.; Solid State Prod.; Spectron; Stanwyck Winding; Tachtronic Inst.; Trans-Tech; Ultronix, Inc.; Unitrode. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 7 (eng 7)

MILLER, G. E. ASSOCS. (See Jericho, N. Y.)

SCANLON, R. B. CO., 10 Halliwell Dr., (203) 325-2718.
Factories: Gowanda Elctrn.; Hisonic Inc.; Mereco Prod. Div.; Morris & Broms Inc.
Selling To: ★ D,I. **Salesman:** 1 (eng 1)
Services: Office

TALBE CO., INC. (See Englewood Cliffs, N. J.)

Stony Creek

JOHNSON ASSOC., INC. (See Wellesley Hills, Mass.)

Stratford

ROSEN, G. CO., INC. (See Natick, Mass.)

Thompsonville

J. & J. ASSOCS., INC. (See Waltham, Mass.)

Waterbury

COAKLEY, BOYD & ABBETT (See Needham, Mass.)

Trumbull

McKEOWN, R. CO., INC. (See Livingston, N. J.)

PERRON, R. & CO., INC. (See Norwood, Mass.)

Wallingford

ADAMS-McGREGOR INC. (See Lincoln, R. I.)

Watertown

MAHAN, R. P. CO. (See Wellesley, Mass.)

W. Hartford

HOOKER, S. C. INC. (See Winchester, Mass.)

INSTRUMENT DYNAMICS INC. (See Wakefield, Mass.)

KOSOWICZ, F., 2 Madsen Rd.
Factories: Aero-Guardian Contrls; M. H. Rhodes Inc.; Rogan Bros.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

PETTIGREW, R. S. & CO., INC., 10 N. Main St., (203) 233-8533.
Branch: 950 Watertown St., Newton, Mass., (617) 969-5770.
Factories: Ceramics Int'l., Div.; Clevepak; Fair-Rite Prod. Corp.; Furane Plastics Corp.; Hamilton Precision Metals Div.; Malco Mfg. Co.; Mayfair Molded Prod.; Mideast Aluminum Corp.; Phila. Insulated Wire; Quality Comp.; Troy Tool Prod.; U.O.P. Norplex.
Selling To: ★ I. **Salesmen:** 6 (eng 5)

SMITH, R. CO. (See Brookline, Mass.)

West Haven

REISS, R. S. ASSOC., 70 Jessie Dr., (203) 933-8542.
Branch: 199 E. Foxboro St., Sharon, Mass., (617) 784-3439.
Factories: Elpa Marketing; Game Ind.; JBL Int.; Leader Inst.; Mellotone; Monarch Int.; Pomona Elctrn.; RMS Elect.; Worner Elect.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 1)

DELAWARE

Newark

CARMINE, F. S. CO., 14 Knickerbocker Dr., (302) 368-7603.
Selling To: ★ A,D. **Salesman:** 1

DISTRICT OF COLUMBIA

Washington

E.-A. Inc. (See Baltimore, Md.)

HITCHCOCK, E. R. & ASSOC., 1629-K St. N.W., (202) 296-6899.
Factories: Barry Contls. Div.; Churchill Corp.; New England Trawler Equip. Co.; Phillips-Foscue Corp.; Scott Paper; Vibro Dynamics Corp.
Selling To: ★ M,I. **Salesmen:** 3
Services: Local Stock

JEFFERIES, S. A. INC. (See Narberth, Pa.)

MacDONALD, S. K. INC. (See Philadelphia, Pa.)

MASSEY ASSOCS., INC., #1 Thomas Circle, N.W., (202) 628-1023
Selling To: ★ A,M,D,I. **Salesmen:** 3

(See Advertisement This Page)

METROREP, INC. (See Freehold, N.J.)

NEWSON, G. H. & ASSOCS. (See Philadelphia, Pa.)

WHITCOMB ASSOCS. (See Baltimore, Md.)

FLORIDA

Brandenton

STEVENS, A. E., Trailer Estates, Box 6066, (813) 755-7654.
Factory: United Technical Publications Inc.
Selling To: ★ D. **Services:** Consultation Sales

Casselberry

FACT-TRONICS, Box 745, (305) 838-5607.
Factories: Datascan; General Resistance; N-H Res.; Optical Elctrn.; MetroPhysics; SEG Elctrn.; Siemens America; Trio Labs.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Repair

TAYLOR, M. F. CO., INC. (See Silver Springs, Md.)

Clearwater

GROSS, H. R. & CO., Box 4607, (813) 446-6649.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 2)
Services: Repair, Warehouse, Direct Mail

RICHTER, H. G., INC. (See Mountainside, N.J.)

ROBERTS ASSOCS., 1624 Souvenir Dr., (813) 447-3712.
Factories: Metrotech Inc.; Teltron Inc.
Selling To: ★ M,I, Television Stations, Radio am/FM Stations. **Salesmen:** 2 (eng 2)

WIMBERLY, W. B. CO., 532 S. Fort Harrison, (813) 446-7072.
Branch: 500 S. Osceola St., Orlando, Fla., (305) 425-3083.
Factories: Adams & Westlake; Conrad-Missimers; Dearborn Elctrn.; Electric Indicator Co.; Electro-Mechanisms; Equipto Enclosure Sys.; General Semiconductors; Grant Pulley & Hardware; Hafstrom Technical Prod.; Ledex, Inc.; Licon Div.; Parelco, Inc.; Stow Labs.; Technical Devices; Vishay Resistor Prod.; Wakefield Engrg.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Direct Mail

(See Advertisement Page 3238)

Cocoa Beach

TECHNICAL MARKETING, INC. (See Orlando, Fla.)

Daytona Beach

CONTROL EQUIPT., CO., INC. (See Atlanta, Ga.)

Eau Gallie

REYNOLDS & ASSOCS., INC., Box 1043, 727-3205. TWX: 510-959-6003.
Branches: 904 Bob Wallace Ave., Huntsville, Ala., (205) 536-1941; 161 S.W. 75th Ave., Ft. Lauderdale, Fla., (305) 581-6611; Box 8877, Orlando, Fla., (305) 424-3836; 175 W. Wieuca Road, N.E., Atlanta, Ga., (404) 252-5360; 412 W. Market St., Greensboro, N.C., (919) 275-3725.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 5)
Services: Direct Representation

Representing Manufacturers in the Electronics Industry

MASSEY ASSOCIATES, INC.

NO. 1 THOMAS CIRCLE, N.W.
Washington, D.C. 20005

Telephone Area Code (202) 628-1023

Ft. Lauderdale

BEACON ELEC. ASSOCS. (See Maitland, Fla.)

BROWN, W. A. ASSOCS., INC. (See Orlando, Fla.)

N.B.S. INC., 4150 S.W. 23rd St., (305) 584-0650.
Branches: Box 1343, Huntsville, Ala., (205) 881-3175; Box 2147, Winter Haven, Fla., (305) 423-4856; 893 Church St., N.W., Marietta, Ga. (404) 422-6067.
Factories: Acton Labs.; Alco; American Elctrn. Labs.; A.M.F. Elect. Prod. Co.; C.T.S. Corp.; C.T.S. Knights Co.; Electro-Connective Sys., Inc.; Electronic Specialty Co.; Hitemp Div.; Gulton Data Sys.; Keystone Carbon; Korry Mfg.; Printed Circuits; Ultronix.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

NICKERSON, F. C. CO., INC. (See Decatur, Ga.)

REYNOLDS & ASSOCS., INC. (See Eau Gallie, Fla.)

SMITH, M. K., INC. (See Charlotte, N.C.)

SNOW, C. E. CO. (See Beltsville, Md.)

SPROCH SALES INC., 3520 W. Broward Blvd., (305) 587-3792.
Branch: Box 1186, Tampa, Fla., (813) 935-6876.
Factories: Autotron Inc.; Boker Mfg.; C/P Corp.; Chemtronics Inc.; Electro Voice Inc.; Int'l. Wire & Cable Co.; Linear Sys.; National Tel Tronics; Perry-Briggs Co.; Sencore Inc.; TA Mfg.; Tape Athon Corp.; Waters Mfg.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 1)
Services: Direct Mailing

TECHNICAL MARKETING, INC. (See Orlando, Fla.)

Ft. Walton Beach

BROWN, W. A. & ASSOCS., INC. (See Orlando, Fla.)

Hallandale

TECHNICAL MARKETING, INC. (See Orlando, Fla.)

Hialeah

CHAPMAN, C. & CO., 301 E. 10th Ave., (305) 885-4681. TWX: 5-1524.
Factories: Carol Cable; Empire Tube Sales; Taylor Tape Co.; U. S. Elctrn. Prod. **Salesmen:** 4
Selling To: ★ D. **Services:** Warehouse

Hollywood

TALBE CO., INC. (See Englewood Cliffs, N.J.)

Jacksonville

BARNHART, L. E., 1003 Gunka Rd., (305) 725-5226.
Selling To: ★ A,D,I. **Salesman:** 1

Jensen Beach

THOMPSON, J. F. CO. (See Ormond Beach, Fla.)

Largo

COOK X-RAY CO. (See Tampa, Fla.)

TECHNICAL MARKETING, INC. (See Orlando, Fla.)

Lauderhill

ORBE, INC. (See St. Petersburg, Fla.)

Lutz

WALLACE, S. K. ASSOC., INC., Box 67, (813) 949-1817.
Branches: 1871 Grove Hill La., Montgomery, Ala.; 3115 N.W. 81st Terr., Miami, Fla.; 11010 Carrollwood Dr., Tampa, Fla.; 715 Flamingo Dr., Atlanta, Ga.; Box 526, Kernersville, N.C.; Box 215, Matthews, N.C.; 5960 Brierdale Cove, Memphis, Tenn.
Factories: Aerovox Corp.; Antenna Craft; Beauchaine & Son; Bowman; Consolidated Wire Co.; Hamlin Inc.; Hollingsworth; Lowell; Martel Elctrn.; Mellowtone; Mercury Elctrn.; Merit Transformer; Ohmite; Sonotone Inc.; Talk-A-Phone.
Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 3)

Maitland

BEACON ELEC. ASSOCS., Box 1278, (305) 647-3498.
Branches: Box 10212, Ft. Lauderdale, Fla., (305) 564-4298; 2285 Peachtree Road N.E., Atlanta, Ga., (404) 351-3654; Box 503, Jamestown, N.C., (919) 454-1010.
Factories: Aerotronics Assocs.; Analogic; ACDC Elctrn.; Barnes; Betatronix; CMC; Dynisco; Dytronics; E & M Labs.; Electronic Contrls.; Exact Elctrn.; George Risk Ind.; General Monitors; Greenray Ind.; ISO Film Int'l.; Julie Research Labs.; Kooltronic Fan Co.; NUS Corp.; Ruska Instr.; Symbolic Displays, Inc.; Teledyne Telemetry; United Detector Tech.; Waveline.
Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 7)
Services: Repair, Warehouse

CRAFT ASSOCS. CO. (See Atlanta, Ga.)

GEARTNER ASSOCS., INC. (See Miami Beach, Fla.)

MASSEY ASSOCS., INC. (See Havertown, Pa.)

TALBE CO., INC. (See Englewood Cliffs, N.J.)

Melbourne

TECH REP ASSOC., INC. (See Madeira Bch., Fla.)

TECH-REP ASSOCS., INC., Box 2095, (305) 723-9140.
Branches: Box 8218, Madeira Bch., St. Petersburg, Fla., (813) 391-0008; Box 955, Jonesboro, Ga., (404) 753-0111.
Factories: Ceramic Magnetics; Chemplast; Connecting Devices; Diehl Div.; Engelmann Microwave; Fairchild Conts.; Harowe Servo Controls; ITT/Jennings; Larago Elctrn.; MM Elctrn. Enclosures; Monitor Products; Phaostron Inst.; RF Interonics; Robinson Elctrn.; Rosan; Scheidl; Semiconductor Products; Shelly Assocs.; Standard Wire & Cable; Stewart-Warner Microcircuits; Vernitron Signal Data Conversion.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Direct Mail

Melbourne Beach

GENTRY ASSOCS., INC. (See Orlando, Fla.)

Miami

ANDREWS, A. B. & CO. (See Raleigh, N.C.)

DUCKETT, C. SALES CO. (See Atlanta, Ga.)

SMITH, J. J. ASSOC., INC. (See Winter Park, Fla.)

WALLACE, S. K. ASSOC., INC. (See Lutz, Fla.)

Miami Beach

CARTWRIGHT & BEAN, INC. (See Memphis, Tenn.)

GEARTNER ASSOCS., INC., 350 Lincoln Rd., (305) 531-0200.
Branch: 2101 Mohawk Trail, Maitland, Fla., (305) 647-4000.
Factories: Allied Contrls. Co.; Conductorlab; Continental Wire; Crystalonics; Eldema; Electrical Ind.; ETC Inc.; Grayhill, Inc.; Grayhill Moldtronics; Indiana General; Memcor; Microdot; Mictrotran; Technitrol; Times Wire & Cable.
Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 3)
Services: Warehouse, Direct Mail

Miami Springs

CONOVER, C. E. & CO., INC. (See Fairfield, N.J.)

N. Miami

MARK ELCTRN. SALES CO., Box 291, (305) 947-5080.
Factories: Connolly & Co.; Dakota Engrg.; Delta Coils Inc.; Electronic Crystals; Magnecraft Elec.; National Circuits; Omtronics Mfg.; Plastic Capacitors; Telcor Elctrn.; Welwyn Intl.
Selling To: ★ M,D,I. **Salesmen:** 2
Services: Direct Mail

WINFIELD ELCTRN. SALES CO., 666 N.E. 125th St., (305) 751-5566. TWX:810-848-8772.
Branch: 2991D N. Druid Hills Rd. N.E., Atlanta, Ga., (404) 636-3023. TWX: 810-751-3325.
Factories: D. Clark Co.; Columbia Wire; Deltrol Cont.; Drake Mfg.; Elco Electronic Inst.; Fanon Elctrn. Inst.; Fisher Radio; North American Philips; North Electric; Oaktron Ind.; Pickering; J. Pollok Co.; Raytheon; Sprague Prod.; Thordarson-Meissner; United Audio. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 6 (eng 2)

Ocala

MOORE, E. A. ASSOCS. (See Aiken, S. C.)

Orlando

ADAMS & ASSOCS., INC. (See Greensboro, N. C.)

APPLETON, H. CO. (See Los Angeles, Calif.)

BCS ASSOCS., INC., 940 N. Ferncreek Ave., (305) 843-1510. TWX: 810-850-0185.
Branches: 2317 Bob Wallace Ave., SW, Huntsville, Ala., (205) 534-1648. TWX: 810-726-2109; 1039 E. Wendover Ave., Greensboro, N. C., (919) 273-1918. TWX: 510-925-1173.
Factories: BLH Elctrn.; Burr-Brown Res.; Cohu Elctrn.; Datapulse; J. Fluke Mfg.; Kruse-Storke Elctrn.; Microwave Assocs.; Optimation; Philco-Ford; Raytheon; Robinson-Halpern; Sangamo Elec.; Spectral Dynamics; Teradyne; United Sys.; Varian Assocs.; Weinschel Engrg.
Selling To: ★ M,I. **Salesmen:** 11 (eng 10)
Services: Repair, Warehouse, Calibration

BROWN, W. A. & ASSOCS., INC., 222 Weber Ave., (305) 425-55-5. TWX: 810-850-0146.
Branches: 3039 N.E. 32nd Ave., Ft. Lauderdale, Fla., (305) 564-8000; 1314 Buford St., N.W., Huntsville, Ala., (205) 539-6884. TWX: 810-726-2114; 1108 Burke St., Winston-Salem, N. C., (919) 725-5384; 1590 Cooledge Rd., Tucker, Ga., (404) 939-1674; 18 Chelsea Dr., N.E., Ft. Walton Beach, Fla., (904) 243-6424; 325 First St., Alexandria, Va., (703) 836-1800. TWX: 710-832-9813; 82 Huxley Pl., Newport News, Va., (703) 245-8272.
Factories: Amelco Semiconductor; Applied Microwave Elctrn.; B.B. & N.; Birtcher Corp.; Brush Inst.; Chronetics; Data West; Datalog Div., Litton Ind.; Data General; Dee Electric Co.; Delta Design; DeMornay-Bonardi; Digi-Data Corp.; Elgar;

W.A. BROWN & Associates, Inc.



222 WEBER AVE., ORLANDO, FLA. 32803
325 FIRST ST., ALEXANDRIA, VIRGINIA 22314
1590 COOLEDGE RD., TUCKER, GEORGIA 30083
1314 BUFORD ST., N.W., HUNTSVILLE, ALA. 35801
1108 BURKE ST., WINSTON-SALEM, N. C. 27101
3039 N.E. 32nd AVE., FT. LAUDERDALE, FLA. 33308
18 CHELSEA DR., N.E., FT. WALTON BEACH, FLA. 32548
82 HUXLEY PLACE, NEWPORT NEWS, VIRGINIA 23606

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Selling To: ★ M,D,I. **Salesmen:** 17 (eng 17)
Services: Repair, Warehouse

(See Advertisement Page 3238)

BUCHANAN & ABRAMS ASSOCS. INC., Box 6026, (305) 423-8995.
Factories: APM-Hexseal Corp.; Cedar Engrg. Co.; Century Fasteners; Control Switch Div.; Curtis Development & Mfg.; Del Elctrn.; Electrical Plastics; Electro Switch; Fusite Corp.; General Reed Co.; Heyman Mfg.; International Components Corp.; Magnetika Ind.; Varo.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

CARTRIGHT & BEAN, INC. (Memphis, Tenn.)

COL-INS-CO., INC., Box 13189, (305) 423-7615. TWX: 810-850-0134.
Branches: Box 4246, Huntsville, Ala., (205) 539-1771; 200 Carrington Way, Marietta, Ga., (404) 422-8327; Box 5597, Winston-Salem, N. C., (919) 765-3650.
Factories: Aero Res. Inst.; J. G. Biddle Co.; Elctrn. Engrg. Co.; Fenwal Elctrn.; Krohn-Hite; Memory Technology; NJE; Technical Prod. Co.; Transformer Elctrn.; Whittaker Pace; Zero Mfg.
Selling To: ★ M,I. **Salesmen:** 5 (eng 5)
Services: Repair, Warehouse

(See Advertisement This Page)

DUCKETT, C. SALES CO. (See Atlanta, Ga.)

FAUSETT, F. & CO., INC. (See Smyrna, Ga.)

GENTRY ASSOCS., INC., 550 N. Bumby Ave., (305) 841-7740. TWX: 810-850-0136.
Branches: 2109 W. Clinton Bldg., Huntsville, Ala., (205) 534-9771. TWX: 810-726-2220; 116 E. O'Neal Ave., Burlington, N. C., (919) 227-2581; 4152 49th Ave. S., St. Petersburg, Fla., (813) 867-7820; 304 Oak St., Melbourne Beach, Fla., (305) 773-3411; Box 13513, Sta. K, Atlanta, Ga., (404) 233-3816.
Factories: Acopian Corp.; Alford Mfg.; Alfred Elctrn.; Automated Measurements; Ballantine Labs; Cober Elctrn.; Cunningham Corp.; Data Technology; Dorne & Margolin; Dumont Oscilloscope; Eldorado Elctrn.; General Microwave; Melabs; Omni Spectra; Scientific-Atlanta; Stoddart Electro Sys.; Telonic Inst. & Engrg.; TRG, Inc.; Wanlass Elec.; Watkins-Johnson.
Selling To: ★ M,I. **Salesmen:** 6 (eng 5)
Services: Stocking Rep. for 2 Companies

HIGHSMITH, J. L. & CO. (See Charlotte, N. C.)

HOLMES, E. G. & ASSOCS. (See Chamblee, Ga.)

JONES, WM. W. CO., INC. (See Towson, Md.)

LEE ASSOC., INC., 200 E. Marks, (305) 241-4445. TWX: 810-850-0105.
Branches: #5 Traylor Island, Huntsville, Ala., (205) 539-0761; 825 Burke St., Winston-Salem, N. C., (919) 765-7677; 12250 Wilkins Ave., Rockville, Md., (301) 949-4800. TWX: 710-828-9690.
Factories: Airborne Inst. Lab.; Astrodata; Austron; B&K Inst.; Calma Company; Computer Logic; Darcy Ind.; Data Disc, Inc.; DI/AN Controls; Interdata; IRA Sys.; James Elctrn.; Marconi Inst.; Marshall Res. & Dev.; Matrix; MB Elctrn.; Midwestern Inst.; Monsanto; M. P. Odell; Optron Corp.; PEMCO; Physio-Control Corp.; Rowan Ind.; Siemens America Inc.; Texas Inst.; Zeltex.
Selling To: ★ A,M,I. **Salesmen:** 9 (eng 8)
Services: Repair, Warehouse, Limited Stock

MURPHY & COTA (See Atlanta, Ga.)

ORBE, INC. (See St. Petersburg, Fla.)

REYNOLDS & ASSOCS., INC. (See Eau Gallie, Fla.)

TECHNICAL ASSOCS., INC., 2319 E. South St., (305) 424-5681.
Branches: Box 4088, Huntsville, Ala., (205) 881-8494; Box 5583, Spartanburg, S. C., (803) 585-3864.
Factories: A. D. Data Sys.; Atec; California Inst.; Electro Optics Assoc.; Electronic Assoc.; Ferranti-Packard; Guildline Ltd.; Hallmark Std.; Keithley Inst.; Nelson-Ross Elctrn.; Princeton Applied Res.; Techni-Rite Elctrn.; Theta Inst.
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)

TECHNICAL MARKETING, INC., 1511 E. Robinson, (305) 843-2500. TWX: 810-850-0161.
Branches: Box 5971, Birmingham, Ala., (205) 871-5431; Box 1001, Huntsville, Ala., (205) 534-2487; Box 866, Cocoa Beach, Fla., (305) 632-1150; Box 10196, Ft. Lauderdale, Fla., (305) 563-8585; Box 127, Hallandale, Fla., (305) 563-8585; Box 237, Largo, Fla., (813) 446-6192; Box 13196, St. Petersburg, Fla., (813) 446-6192; Box 1152, Marietta, Ga., (404) 435-0079; Box 6664, Greensboro, N. C., (919) 274-2570.
Factories: ACS Ind.; Allied Control Co.; Circuit Technology Inc.; Glentronics Inc.; Haydon Switch & Inst.; Hermetic Seal Corp.; Humphrey Inc.; Integrated Circuit Elctrn.; Intersil Inc.; Micro Devices Corp.; Micro Semiconductor Corp.; Milwaukee Transformer; Motorola Com. & Elctrn.; Philadelphia Insulated Wire; Pyrofilm Resistor; Rubber Teck Inc.; Sahagen Ind. Inc.; Skydyne; Spectrol Elctrn.; Stackpole Carbon Co.; UOP Inst.; Viking Ind.; WacLine Inc.
Selling To: ★ M, I. **Salesmen:** 12 (eng 5)

TRUEX ASSOC., INC., 3165 McCrory Pl., (305) 841-8931.
Factories: B & F Inst.; Bemco, Inc.; Davidson Optronics; Deltron; Diamond Antenna & Microwave; EMR-Hatboro; Energy Sys.; FKS; Frequency Elctrn.; Micromega, Bunker-Ramo Corp.; Northern Precision Labs.; Preston Scientific; Stellarmetrics; Trans-Sonics; Wyle Labs.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Direct Mail

(See Advertisement This Page)

WEBB, H. R. ASSOC., Box 13201, (305) 855-5257.
Factories: Colonial Gasket; Electrocal; Electro-Flex Heat; Jan Hardware; G. A. Keats; Micro Computer Prods.

WIMBERLY W. B. CO. (See Clearwater, Fla.)

Ormond Beach

CARTWRIGHT & BEAN, INC. (See Memphis, Tenn.)

THOMPSON, J. F. CO., 322 Riverside Dr., (904) 677-2298.
Branch: N. Indian River Dr., Jensen Beach, Fla., (305) 287-0198.
Factories: Alliance Mfg.; Antennacraft Co.; Calcon Mfg.; Consolidated Mdse.; Erie Technological Prod.; Game Ind.; Hudson Lamp Co.; McMartin Ind.; Oneida Elctrn.; Oxford Transducer; Philmore Mfg.; Robins Ind.; Specialties Mfg.; Standard Kollsman Ind.; Superex Elctrn.; Ward Prod.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 2)

Pinellas

GEORGE, J. W. & CHASE, T. S. (See Winter Park, Fla.)

Riviera Beach

HAYDEN P. ASSOC. (See E. Point, Ga.)

St. Petersburg

DREW, B. & ASSOC., 6712 Central Ave., (813) 345-0181.
Factories: Dormeyer Corp.; Webcor.
Selling To: ★ D. **Salesmen:** 2
Services: Warehouse

GENTRY ASSOCS., INC. (See Orlando, Fla.)

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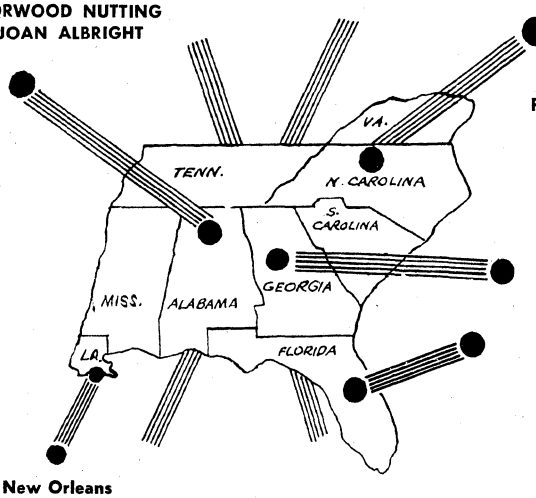

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Factories: Helipot Div.; Georator Corp.; TMC Sys.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

MASSEY ASSOCS., INC. (See Havertown, Pa.)

ORBE, INC., 4110 Central Ave., (813) 894-0687. TWX: 810-863-0370.
Branches: Box 7777, Orlando, Fla. (305) 425-9004; 4431 N.W. 13th Ct., Lauderhill, Fla., (305) 584-4749.
Factories: Accuride; Babcock Relays Div.; Bradley Semiconductor; Components, Inc.; Control Syst. Res.; Discon Corp.; Duncan Elctrn.; Electronic Res.; Reon Resistor Corp.; Sensor Technology; Sterling Inst. Div.; U.S. Capacitor Corp.; United Aircraft Corp.; Vernitron Corp.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 3)

SANFORD, L. C. ASSOCS., 1994 Kansas Ave. N.E., (813) 525-4553.
Factories: Advanced Devices Lab.; Radar Devices.

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SIFF, R. G. & ASSOC., INC. (See Dayton, Ohio)

Tampa

COOK X-RAY CO., Box 10105, (813) 839-5561.
Branch: 2617 Lions Club Rd., Largo, Fla., (813) 531-4066.
Factories: Eureka X-Ray Tube; H. G. Fischer & Co.; R. A. Fischer & Co.; R. J. Lindquist & Co.; Wolf X-Ray Corp. **Services:** Repair
Selling To: ★ D. **Salesmen:** 2

NICKERSON F. C. CO., INC. (See Decatur, Ga.)

SPROCH SALES, INC. (See Ft. Lauderdale, Fla.)

WALLACE, S. K. ASSOC., INC. (See Lutz, Fla.)

Weirsdael

WILLIAMS H. R. ASSOCS., INC. (See Ridgewood, N.J.)

Winter Haven

N. B. S. INC. (See Ft. Lauderdale, Fla.)

TAYLOR, M. F. CO., INC. (See Silver Spring, Md.)

Winter Park

GEORGE, J. W. & CHASE, T. S., 2903 Montfichet Ln., (305) 671-5954.
Branch: Box 423, Pinellas Park, Fla., (813) 544-4348.
Factories: Acme Scientific Co.; Hermes Plastics; P. A. Sturtevant Co.; New Hermes Engraving Machine; Ocala Saw & Tool Corp.
Selling To: ★ M,I. **Salesmen:** 2

SMITH, J. J. & ASSOCS., Box 460, (305) 644-4316.
Branch: Box 573, Biscayne Annex, Miami, Fla., (305) 374-6784.
Factories: Advance Circuits, Inc.; Bussco Engrg.; Croven Ltd.; Elco Corp.; Filtaire, Inc.; J.F.D. Elctrn. Co.; Jefferson Wire & Cable; Keystone Elctrn.; Ovenaire; Sangamo Elec.; Star-tronics.
Selling To: ★ M,I. **Salesmen:** 2
Services: Direct Mail

GEORGIA

Atlanta

ALLEN, R. W., Box 7142 Sta. "C", (404) 233-2361.
Factories: Ajax Elec.; Alloy Engrg.; Lake Shore Elec.; Michigan Oven; Sanford Miller; Ward Leonard Elec.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

BEACON ELEC. ASSOCS. (See Maitland, Fla.)

CARTWRIGHT & BEAN, INC. (See Memphis, Tenn.)

CONTROL EQUIP. CO., INC., 3166 Maple Dr., N.E., Rm. 134, (404) 237-1688.
Branches: Box 6044, Birmingham, Ala., (205) 879-8211; Box 1857, Daytona Beach, Fla., (904) 252-7086; Box 18535, Memphis, Tenn., (901) 324-4525.
Factories: Automatic Timing & Contls.; Beta Corp.; Conax Corp.; Chemcon; Crescent Ins. Wire & Cable; DeZurik Corp.; A. H. Emery Co.; Farris Engrg.; ITT/Barton Instr.; ITT/Hammel-Dahl; Johns-Manville; Precision Prod. & Contls.; Robertshaw Contls. Co.; Transmation.
Selling To: ★ M,D,I. **Salesmen:** 5
Selling To: ★ D,I. **Salesman:** 1 (eng 1)
Services: Repair, Warehouse

TECHNICAL MARKETING, INC. (See Orlando, Fla.)

TECH-REP ASSOCIATES, INC. (See Melbourne, Fla.)

CRAFT ASSOCS. CO., Box 11716, (404) 237-2282.
Branches: Box 1053, Huntsville, Ala., (205) 837-0221; Box 986, Maitland, Fla., (305) 645-2242.
Factories: Avtron Mfg., Inc.; Cambridge Sys.; Consolidated Airborne Sys.; Custom Component Switches; Ideal-Aerosmith, Inc.; Ideal Elect. & Mfg.; Leach Corp.; R-I Controls; Rosemount Engrg.; Thermo-Sys.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)

DUCKETT, G. SALES CO., Box 29067, (404) 451-3529.
Branches: Box 22002, Greensboro, N.C., (919) 273-4617; Box 310, Ulefa Bra., Miami, Fla., (305) 947-3974; Huntsville, Ala., (404) 451-3529; Orlando, Fla., (404) 451-3529.
Factories: Bristol Co.; Crystek; Del Elctrn.; Discon Corp.; Electrovert; Electro Circuits; Jersey Specialty; JFD Elctrn.; Licon Div.; Mallory Contls.; Mura Corp.; Specialty Connector; Syncro Capacitor; U. S. Terminals; Varo, Inc.
Selling To: ★ M,D,I. **Salesmen:** 5
Services: Warehouse, Mailing

GENTRY ASSOCS., INC. (See Orlando, Fla.)

JONES, WM. M. CO., INC. (See Towson, Md.)

LICHTENSTEIN SALES CO., 1226 Franklin Circle, N.E., (404) 634-0798.
Factories: B & B Elctrn. Prod.; Magnetic Media; Shakespeare Corp. **Services:** Direct Mail
Selling To: ★ A,D. **Salesman:** 1 (eng 1)

McCORVEY, V. A. CO., 2187 Briarcliff Rd. N.E., (404) 636-2502.
Factories: Cleveland Elctrn.; Diamonite; Dow Key; Electrical Plastics; Johnson Elec. Coil; Lectrotech; Line Master; Pomona; Schrack; Sloan.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

MURPHY & COTA, 586 Armour Circle, N.E., (404) 875-2525.
Branches: Box 6365, Greensboro, N.C., (919) 288-1923; 904 Bob Wallace Ave., S.W., Huntsville, Ala., (205) 539-8476; 712 W. Vassar St., Orlando, Fla., (305) 424-2407; 1106 Burke St., Winston-Salem, N.C., (919) 723-1001.
Selling To: ★ A,M,D,I. **Salesmen:** 10 (eng 5)
Services: Warehouse

REYNOLDS & ASSOCS., INC. (See Eau Gallie, Fla.)

THORNWELL, E. A., INC., 1537 Howell Mill Rd., N.W., (404) 351-6535.
Factories: Borden Metal Prod.; Helical Line Prod.; Knopp, Inc.; Lapp Insulator; Moloney Elec.; Radiation, Inc. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 3 (eng 1)

WALLACE, S. K. ASSOC., INC. (See Lutz, Fla.)

WINFIELD ELCTRN. SALES CO. (See N. Miami, Fla.)

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HOLMES, E. G. & ASSOC., 4185 Clairmont Rd., (404) 451-6161.
Branches: 316½ S. Bumby St., Orlando, Fla., (305) 241-2128; 4862 Governors' Dr., W., Huntsville, Ala., (205) 837-6900; 430 W. Friendly Ave., Greensboro, N.C., (919) 275-0897.
Factories: Cimron Div.; Barnes Engrg.; Data Royal; Heraeus Englehard Vacuum; Fairchild/EMC; Fairchild Microwave Prod.; Hydro Prod.; ITT, Indl. Prod.; Inland Contls.; Micro Power; Multimetrics; Narda Microwave Corp.; Northern Scientific; Redcor Corp.; Power Designs; Systron Donner.
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 7)

(See Advertisement This Page)

SMITH, M. K. INC. (See Charlotte, N.C.)

Decatur

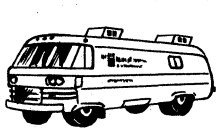
ADAMS & ASSOC., INC. (See Greensboro, N.C.)

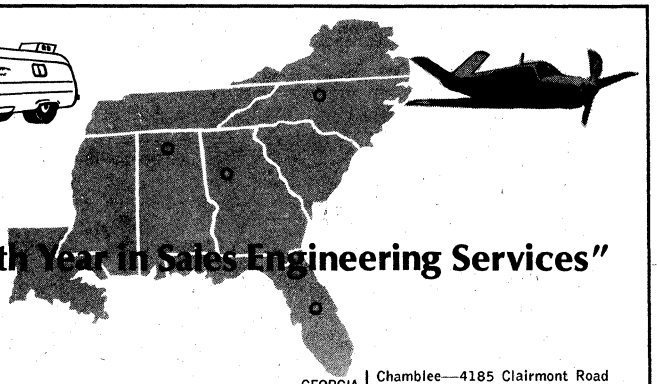
NICKERSON, F. C. CO., INC., Box 33185, (404) 377-1575.
Branches: Box 13126, Tampa, Fla., (813) 833-4321; 1001 Parrott Ave., Kinston, N.C., (919) 527-4911; Box 9679, Birmingham, Ala., (205) 853-2352; 611 N.W. 73rd Ter., Ft. Lauderdale, Fla., (305) 524-4331.
Factories: American Feldmuehle, American Zettler; Daburn Elects.; Dyonics, Inc.; Elec-Trol; Film Capacitors; Grayline, Inc.; Gavin Inst.; Hughes Aircraft; Intl. Elctrn.; Kappa Networks; Littelfuse; Microminiature Technology; Microtran Co.; Midwest Audio Corp.; Milwaukee Resistor Co.; Muirhead Inst. Ltd.; Sage Elects. Corp.; Skottie Electrn.; Vacuum Ceramics, Inc.; Vitrohm Elctrn.; WABCO; Wall Mfg.; Whale Elctrn.; Xcelite, Inc.
Selling To: ★ A,M,D,I. **Salesmen:** 5 (eng 5)
Services: Sales Serv. Engr.

East Point

HAYDEN, P. ASSOC., Box 90668, (404) 766-0261.
Branches: 512 Lanier Rd. S.W., Huntsville, Ala., (205) 536-0857; Box 9688, Riviera Beach, Fla.
Factories: Bomar Crystal Co.; Gramer Halldorson Elctrn.; Leader Inst.; Penn Resistor; Tapeswitch Corp.; Vaco Prod. **Services:** Warehouse
Selling To: ★ A,D. **Salesmen:** 5

LITTLE, S. CO., Box 308, (404) 761-5353.
Selling To: ★ A,D. **Salesmen:** 3 (eng 1)
Services: Warehouse





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TECHNICAL MARKETING, INC. (See Orlando, Fla.)

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RUSHIN, E. CO., Box 486, (404) 993-6498.
Factories: American Time Prod.; Anderson Power Products; Auto-Valve; Bergen Wire Rope Co.; Brand-Rex Div.; Forbes & Wagner; NSK Corp.; Uniform Tubes.
Selling To: ★ M,D,I. **Salesmen:** 2 (Eng 2)

Smyrna

FAUSETT, F. & CO., Box 278, (404) 436-5169. Branches: 711 N. Magnolia Ave., Orlando, Fla., (305) 424-0701; Greenwood, S.C.; Memphis, Tenn., 1338 Pulaski St., Salem, Va., (703) 389-6669.
& Switch Co.; Carter Motor; Equipto Enclosure Sys.; Freed Transformer Co.; International Inst.; Patwin Elctrn.; Petersen Radio; Technipower, Inc.; Vogue Inst. Corp.; Wesco Elec.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 3)
Services: Warehouse, Direct Mail
(See Advertisement Page 3240)

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BROWN, W. A. & ASSOCS., INC. (See Orlando, Fla.)

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EARL ASSOC., 1638 Kona St., (808) 949-6953.
Factories: Amphenol; Antenna Specialists; BSR (USA); Elpa Mktg. Ind.; Harman Kardon; Jerrold Elctrn.; Kahn Res. Lab.; Lear Jet Ind.; P. R. Mallory & Co.; Mercury Record Corp.; Midland Int.; Perma Power Co.; Positive Connector Co.; Radio Specialty Mfg. Co.; Raytheon; Reeves Soundcraft; Setchell Carlson,Inc.; Simpson Elec.; H. H. Smith, Inc.; Sorensen; Stancor Elctrn.; Tenatronics Ltd.; University Sound; Worner Elctrn. Devices; Waters Conley Co. **Services:** Warehouse Limited
Selling To: ★ A,D. **Salesman:** 1

ILLINOIS

Addison

STEMM, R. E., 17W480 Lake St., (312) 279-2440.
Branch: 2713 Lyndale Ave. So., Minneapolis, Minn., (612) 822-7404.
Factories: Aerometric Div.; Autotron, Inc.; F. W. Bell; Cycle Equip. Co.; Data Inst.; Datascan, Inc.; Digital Devices Div.; Information Displays; Mechanics for Elctrn.; Monroe Elctrn.; Ray Proof Corp.; Sippican Corp.; Stoddart Electro Syst.; Taber Inst.; Transducer Syst.; Watkins-Johnson
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 4)
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Selling To: ★ D,I. **Salesmen:** 3 (eng 2)

Chicago

ANDERSON, B. & ASSOCS., INC., 5969 N. Elston Ave., (312) 774-8989. TWX: 910-221-5036.
Branches: 4660 W. 77th St., Minneapolis, Minn., (612) 922-7400. TWX: 910-576-2450.; 5324 Kyle Rd., Ft. Wayne, Ind., (219) 747-0402.
Factories: Chicago Dynamic Ind.; IMC Magnetics; JFD Elctrn.; Johanson Mfg.; Kelvin; Landis & Gyr; Litton; Magtrol; Parelco; Parker; Printed Motors; Teledyne; Texas Inst.; Wakefield.
Selling To: ★ I. **Salesmen:** 6 (eng 6)
Services: Warehouse

ANGEL, J. C. & CO., 2743 W. Peterson, (312) 878-0653. TWX: 910-221-5688.
Factories: ADC Prod.; Cambridge Thermionic; Chemical Micro Milling; Dahlstrom Mfg. Corp.; Electric Terminal; Hughes Aircraft; Omega Elec.; Physical Sciences; Protronic Inc.; Quality Name Plate; R. B. & W. Power Metal Parts; Scanbe Mfg.; Technical Wire Prods.; Ultronix.
Selling To: ★ D,I. **Salesmen:** 5 (eng 2)
Services: Direct Mail
(See Advertisement This Page)

ANGER ASSOCS., INC. (See Dearborn, Mich.)

AUDIO SOUND SALES CO., 2535 N. Ashland, (312) 528-8422.
Factories: Dentronics; Ecco Elctrn.; Fullmer Elctrn.; K & M Elctrn.; L-Tran Engrg.; MCG Elctrn.; Micro-Ohm; Pioneer Magnetics; Spar Elctrn.; Tapeswitch Corp.; Tele-Pro Ind.; Terra Corp.; Transmagnetics; United Mineral & Chemical. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 3)

BALHORN & WELCH, INC., 1925 N. Harlem Ave., (312) 889-5011. TWX: 910-221-5368.
Branch: Box 1521, Cedar Rapids, Iowa, (319) 363-9970.
Factories: Diehl Div.; Elesco Ind.; Intellux; Maurey Inst.; Nytronics; Potter & Brumfield; Roanwell; Wanlass Elec. **Services:** Engineering
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 7)

BERNDT ASSOC., INC., 6414 W. Belmont Ave., (312) 283-0713. TWX: 910-221-2515.
Branch: 605 Ft. Wayne Bank Bldg., Ft. Wayne, Ind., (219) 743-1844.
Factories: Control Data; IMC Magnetics; Shallcross; Stewart-Warner Microcircuits; Thermalloy; WABCO Signal & Comm. Div.
Selling To: ★ A,M,I. **Salesmen:** 4 (eng 4)
Services: Engineering

BLAKER, S. C. CO., 6416 N. Central Ave., (312) 774-8252.
Factories: Bean Rubber Mfg.; Bradley Semiconductor; Crane Elctrn.; Extrudapak; Kidco, Inc.; Protolab; Ripley Co.; Robinson Comp.; Valor Elctrn.; Valor Inst.
Selling To: ★ A,M,I. **Salesmen:** 2 (eng 2)

BOOTH, C. & ASSOC., INC., 1921 N. Harlem, (312) 237-7910.
Factories: Brockway Pressed Metals; Communication Prod.; Consolidated Prod.; Elctrn. Circuit Assoc.; Phelps Dodge Elctrn. Prod.; Poly Cable; Precision Timer; Thermatics.
Selling To: ★ M,I. **Salesmen:** 2

BURGOYNE, W. E., 7001 N. Clark St., (312) 465-2112.
Factories: Aerovox; Metachem Resins; F.A. Scherma Mfg. Co.
Selling To: ★ I. **Salesmen:** 2

CARLSON ELCTRN. SALES, 7448 N. Harlem Ave., (312) 774-4812. TWX: 910-221-5017.



CARLSON ELCTRN. SALES (Cont.)
Branch: 2500 39th Ave. N.E., Minneapolis, Minn., (612) 788-4111.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 3)
Services: Warehouse, Direct Mail

COLE, G. McL. CO., 6514 W. Higgins Rd., (312) 774-3535. TWX: 910-221-2929.
Branch: 150 S. Marquette, Madison, Wis., (608) 244-1623.
Factories: Argos Prods. Co.; Barker & Williamson; Bureau of Engraving; Continental-Wirt Elctrn.; Drake Mfg.; Hallicrafters; Russell Ind.; Sarkes Tarzian; Swing-O-Lite; Ungar Elec. Tools.
Selling To: ★ D,I. **Salesmen:** 6 (eng 1)
Services: Warehouse

COOPER, H. D., 7634 N. Eastlake, (312) 274-5566.
Selling To: ★ I.

CREST ASSOC., 7001 N. Clark St., (312) 274-2460.
Factories: Data Device; Electronic Contls.; Modutec, Inc.; Patwin Elctrn.; Technipower.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

DIETHERT, R. CO., INC., 2030 W. Montrose Ave., (312) 561-7627. TWX: 910-221-2916.
Branches: 217 Wisconsin, Waukesha, Wisc., (414) 547-6575; 903 E. 2nd St., Gastonia, N.C., (704) 865-3771; 5420 N. College, Indianapolis, Ind., (317) 255-6169.
Factories: Electronized Chemicals; Instrument Specialties; JBL Corp.; Lake Center Ind.; Neff-Perkins Co.; Northwest Plastics; Sealectro Corp.; J. H. Winn Co. **Services:** Warehouse
Selling To: ★ I. **Salesmen:** 8

DOYLE, W. J. CO., 7426 N. Western Ave., (312) 274-6685.
Factories: Buckeye Stamping; Computron, Inc.; Rye Ind.; Tenna Corp.; Thurow Elctrn.; Utah Elctrn.
Selling To: ★ A,D,I. **Salesmen:** 2

ELECTRO COMP SALES, INC., 5129 W. Devon Ave., (312) 763-3636. TWX: 910-221-5674.
Factories: Aladdin Elctrn.; Cimastra Div., Fusite Corp.; Hamilton Precision Metal; National Beryllin; Saxonberg Ceramics; 3M Plastiform.
Selling To: ★ I. **Salesmen:** 3 (eng 3)

ELECTRONIC REP. ASSOC., 600 S. Michigan Ave., (312) 427-0100.

ENGINEERED SALES CO., INC., 4738 N. Harlem, (312) 867-8434. TWX: 910-221-0223.
Factories: Bliss-Gamewell; Helical Prod.; Hi-G; Jonathan Mfg.; Kappa Networks; L. A. Miniature Prod.; D. P. Mossman; Photologic; Relay Co. of America; Riedon Avionics; Sloan Co.; Tec-Magnetics Div.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

ENGLE, K. D. CO., INC., 3621 W. Devon Ave., (312) 539-1820. TWX: 910-221-5351.
Branch: 5072 E. 10th St., Indianapolis, Ind., (317) 356-3001.
Selling To: ★ I. **Salesmen:** 4

ESCHNER & KERANEN, INC., 20 N. Wacker Dr., (312) 236-1533.
Factories: Exmet Corp.; Gettig Engrg.; Metallized Prod.; Ohio Carbon Co.; Technical Flurocarbons Engrg.; Trimflex Corp.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

FISTELL, H. MFG. REP., 1812 S. Halsted St., (312) HA 1-6563.
Factories: Electronic Strobe Light, Lambert Mfg.; Lowenthal Mfg.; R. A. Moog Co.; Naren Ind. Inc.; Toneline Mfg.; Veda Enterprises.
Selling To: ★ D.

FITZ, L. R. CO., 6038 N. Newburg Ave., (312) 631-5488.
Factories: Delavan Mfg.; G. K. Heller Corp.; Raytek, Inc.; Welco Ind. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 3 (eng 2)

FITZSIMMONS ASSOCS., INC., 6774 N.W. Hghwy., (312) 775-6990.
Factories: Audio Book Co., Audio Devices; Bell P.A. Corp.; VM Corp.
Selling To: ★ A,D. **Salesmen:** 2

GASSNER & CLARK CO., 6644 N. Western Ave., (312) 764-6121. TWX: 910-221-0107.
Factories: Dow Key; Dickson; DuMont; Kilovac; Hitemp; International Inst.; Microwave Assoc.; Perkin Elmer; RCL; Rotron Mfg. Co.; Star Tronics; Torotel; Viking; Vitramon; Voltronics.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 3)
(See Advertisement This Page)

GENE F. SALES CO., 4750 N. Milwaukee Ave., (312) 545-5562.
Factories: Bead Chain Mfg.; General Mfg.; Lundey Assocs.; Wilco Corp.
Selling To: ★ M, I. **Salesman:** 1 (eng 1)

GIANARAS SALES, 7501 W. Wilson Ave., (312) 774-4600. TWX: 910-221-5223.
Factories: Davis Elec.; Euphonics Corp.; General Inst.; Nytronics Inc.; Oxford Elec.; Taurus Corp.; Transformer Mfgrs.
Selling To: ★ I. **Salesmen:** 4 (eng 2)

GOLTEN, J. CO., INC., 4319 W. Irving Park Rd., (312) 725-7870.
Factories: Astatic Corp.; Brevel Prod.; Bristol Motors; Electrical Ind.; Electrical Plastics; Industrial Mica; Motron Elec. Mfg.; National Ceramic; National Moldite; Penntube Plastics; Tape Cable; Tensolite Insulated Wire.
Selling To: ★ I. **Salesmen:** 4 (eng 4)

GOODE, J. E. SALES CO., 325 W. Huron, (312) MI 2-2022.
Factories: Aro Ind.; Austin Inst.; Bel Fuse Co.; C-F Networks, Inc.; Dialight Corp.; Industrial Circuits; Mectronics Ind.; Saratoga Ind.; Sherold Filter Div. **Services:** Warehouse
Selling To: ★ M. **Salesmen:** 3 (eng 3)

GREEN, L. F. & ASSOCS., 5218 W. Diversey Ave., (312) 286-6824.
Branches: 6225 University Ave. N.E., Minneapolis, Minn., (612) 781-1611; 830 Plateau, Waukesha, Wisc., (414) 786-2180.
Factories: Airborne Inst. Lab.; Burr-Brown Res.; CML Inc.; Century Elctrn. & Inst.; Digitronics Corp.; General Resistance; Micom Inc.; Millivac Inst.; Nelson-Ross Elctrn.; Power Designs; Rohde & Schwarz Sls.; Standard Memories; Telex Comm. Div.
Selling To: ★ A,M,D,I. **Salesmen:** 8 (eng 6)
(See Advertisement Page 3243)

HALINTON, H. ENGRG. ASSTS., INC., 6418 N. Central Ave., (312) 763-2131.
Factories: Birtcher Corp.; Esico; Globe Plastics; Hysol Corp.; Mica Corp.; Selectrons Ltd.
Selling To: ★ I. **Salesmen:** 3 (eng 2)
Services: Warehouse, Billing

HUNTER, T. B. ASSOCS., 5653 W. Irving Park Rd., (312) 777-2500.
Branch: Rte 2, Cedarburg, Wis., (414) 377-7040.
Factories: Aerovox Hi-Q; Alliance Mfg.; American Plastic Prod. Div.; Carborundum; Croven; Filtaire; Ovenaire; Quality Components; Rola Div.; Stewart Stamping; Vactec Inc.
Selling To: ★ I. **Salesmen:** 4

HUTMACHER, R. R. ASSOC., INC., 6668 Northwest Hwy., (312) NE 1-3248. TWX: 910-221-5561.
Factories: Bogen Comm. Div.; Coleman Cable & Wire Co.; IRC Div.; Jerrold Elctrn.; Robins Ind.; Shure Bros.; Oxford Transducer; Soundolier; Tandberg of America.
Selling To: ★ A,D,I. **Salesmen:** 5 (eng 3)

J. R. SALES ENGRG., INC., 7132 N. Harlem Ave., (312) 774-8550. TWX: 910-221-1370.
Factories: Aavid Engrg.; Bulova Watch Co.; Harris Mfg.; ITT Jennings; Precision Elctrn. Comp.; Solitron Devices; Tansitor Elctrn; Victory Engrg.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Direct Mail

KADELL SALES ASSOCS., INC., 6134 Milwaukee Ave., (312) 774-6815.
Factories: Mura Corp.; Pac Elctrn.; Ramsgate.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

KASREL, J. SALES AGENCY, 7341 S. Kingston Ave., (312) 955-5246.
Factories: Bennett Mfg.; Champion Paint Co.; Collis Co.; Schaefer Brush Mfg. Co.; Spartan Saw Works. **Services:** Warehouse
Selling To: ★ D. **Salesman:** 1

KENNEDY ENGRG., INC., 6713 N. Oliphant Ave., (312) 631-8283. TWX: 910-221-5282.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)
Services: Coil Engineering Service

KERRIGAN, J. E. CO., 5933 W. Madison St., (312) 379-4030.
Factories: Bardes Corp.; Reynolds Foundry & Mfg. Corp.; Underwriters Safety Device Co.
Selling To: ★ I. **Salesman:** 1 (eng 1)

KRUEGER, R. M. CO., INC., 5755 W. Irving Park Rd., (312) 282-8444.
Factories: Augat; Burton-Rogers Co.; Chassis Trak; Metex Corp.; Technical Devices; Ventrak.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

LINCOLN, HODGES & ASSOCS., 5875 N. Lincoln Ave., (312) 561-8440.
Branch: 217 Wisconsin Ave., Waukesha, Wisc.
Factories: Burgess Switch Co.; Deltrol Contls.; Dimco-Gray Co.; Electro-Cube; Grigsby-Barton; Hamlin, Inc.; Kessler-Ellis Prod.; Pic-Air, Inc.; Transistor Elctrn.
Selling To: ★ D,I. **Salesmen:** 3

LINZ, W. M. ASSOC., INC., 4001 W. Devon Ave., (312) 685-6060.
Factories: Electro-Voice, Inc.; Electronic Chemical; Hy Gain Elctrn.; Kraeuter & Co.; Lloyd's Elctrn.; Perma Power; Pomona Elctrn.; Turrett Elctrn.; Ward Prod.; Wen Prod.
Selling To: ★ A,M,D,I. **Salesmen:** 4

McBRIDE, J. J. SALES, INC., 6054 Touhy Ave., (312) 775-1080.
Factories: D M Semiconductor; Forbes & Wagner; FotoFab Parts; Hunter Tools; Orrtronics, Inc.; S & A Elctrn.; H. H. Smith; Staver Co.; Trans Atlantic Elctrn.; Unimetrics.
Selling To: ★ A,D,I. **Salesmen:** 3

MAGNUSON ASSOC., 5639 W. Fullerton Ave., (312) 622-6322. TWX: 910-221-5239.
Branch: 1246 W. Seventh St., St. Paul, Minn., (612) 227-8495. TWX: 910-563-3554.
Factories: Bristol Co.; Dow Corning Corp.; Electronic Res. Assocs.; Helipot Div.; Industrial Elctrn. Engrs.; International Elctrn. Res.; Master Specialties Co.; Planet Inst.
Selling To: ★ M,I. **Salesmen:** 9 (eng 4)
Services: Warehouse

MAGNUSON, E. CO., 3347 W. Irving Park Rd., (312) 588-2613.
Factories: Green Inst.; Lockheed Elctrn.; Mechmetals Corp.; Skydyne, Inc.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

MEMAC SALES CO., INC., 4740 N. Austin Ave., (312) 545-1033.
Factories: American Elec. Cable; Barron Controls & Relay; Battery Corp.; Bel Fuse, Inc.; Components; Dictograph Products; Industro Transistor; U.S. Thermo-Plastics; Wilbrecht Elctrn.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

MEYERS, K. W. CO., 7256 W. Touhy Ave., (312) 774-6440.
Branches: 4725 Excelsior Blvd., Minneapolis, Minn., (612) 920-7080; 3512 Rockville Rd., Indianapolis, Ind., (317) 243-6681.
Factories: Alban Elctrn.; Alford Mfg. Co.; Boonton Elctrn.; J. G. Biddle; Christie Elec.; Marconi Inst.; Monsanto; Power/Mate Corp.; PRD Elctrn.; Quantech Labs.; Universal Voltronics; Waveforms
Selling To: ★ I. **Salesmen:** 5 (eng 5)

MIDWEST ELCTRN. SALES, 5707 W. Division St., (312) 626-0030. TWX: 910-221-5247.
Branches: 1317 Garfield Ave., Waukesha, Wis., (414) 542-5129; 5462 E. 40th St., Indianapolis, Ind., (317) 547-3259; 2042 Franklin Ave., N.E., Cedar Rapids, Iowa, (319) 362-4410.
Factories: Associated Testing Labs.; CMC, Computer Measurements; Cober Elctrn.; Curtis Inst.; Electrovert, Inc.; E.T.A. Products, Co.; Fenwal Elctrn.; Kepco, Inc.; Measurements, Inc.; H. H. Scott; Wall Mfg.; Western Reserve Elctrn.
Selling To: ★ M,I. **Salesmen:** 6 (eng 5)
Services: Repair, Warehouse

M Q & ASSOC., 6713 N. Oliphant, (312) 774-8844.
Branch: 6312 So. 27th St., Oak Creek, Wis., (414) 761-2120.
Factories: Airflyte Elctrn.; Bowmar Inst.; Dytronics Div.; Electro Fiberoptics; Hill Elctrn.; Standard Wire & Cable; Technology Instr.; Wesco Elec. Co.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)
Services: Engineering

MURPHY & DICKEY, 537 S. Dearborn St., (312) 427-7953.
Factories: R. B. Annis Co.; Columbia Elec. Mfg.; Constant Voltage Corp.; Esterline Angus Div.; Norcross Corp.; Radiation Inc.; Ranarex Dept.; H. H. Sticht Co.
Selling To: ★ I. **Salesmen:** 3 (eng 3)

NEWMAN-KRAUSE CO., 5451 W. Lawrence, (312) 736-6800.
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(For alphabetical listing see page 3213)

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Selling To: ★ A,D. **Services:** Repair, Warehouse

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Selling To: ★ M,I. **Salesmen:** 16 (eng 16)
Services: Repair, Warehouse

RIDGWAY ASSOCS., INC., 9420 W. Foster Ave., (312) 992-2150.
Branch: 4901 Garfield, Minneapolis, Minn., (612) 825-9059.
Factories: Bytrex, Inc.; Dynamics Res.; Holt Inst.; Houston Inst.; Janus Cont.; Pacific Electro Magnetics; Wyle Labs.
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Services: Repair

ROPEK-CAHILL, INC., 5439 W. Division St., (312) 287-7292. TWX: 910-221-5219.
Selling To: ★ I. **Salesmen:** 3 (eng 3)

RYAN & ASSOCS., Box 48086, (312) 775-5717.
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Selling To: ★ M,I. **Salesmen:** 2

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Factories: American Comp.; Bartlett-Emery Inst.; Bel-Tronics Corp.; Blackhawk Networks; Collins Radio Comp.; Diceon Elctrn.; Dolinko & Wilkens; Electro-Techniques; Elpac, Inc.; Hillburn Relay; Northern Engrg. Labs.; Power Comp.; Rotating Comp.; Standard Rectifier; United Elctrn.; Wescoil Co., Inc.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

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Service: Repair, Design Service

SILVERS, M. M. Assocs., 4403 Sheridan Rd., (312) 561-7300.
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Selling To: ★ D. **Salesmen:** 3

SMITH, O. H. CO., 5255 N. Lawler, (312) 286-4476.
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Selling To: ★ A,D,I. **Salesmen:** 3

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Selling To: ★ I. **Salesmen:** 6 (eng 4)

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Services: Repair, Warehouse

(See Advertisement This Page)

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TWIST, J. G. CO., 5222 W. Diversey Ave., (312) 777-2250. TWX: 910-221-1313.
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WADSWORTH MFG. ASSOC., (See Liverpool, N.Y.)

WEST, J., 6747 N. Octavia Ave., (312) 763-3500.
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Branches: 7710 Computer Ave., Minneapolis, Minn., (612) 926-2855; 3139 Fairfield Ave., Fort Wayne, Ind., (219) 744-2317.
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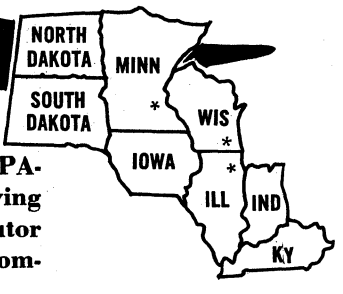

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Selling To: ★ A,M,I. **Salesmen:** 5 (eng 4)

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Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 7)

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E. St. Louis

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Selling To: ★ I. **Salesmen:** 6 (eng 3)

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Services: Repair, Warehouse

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Selling To: ★ D,I. **Salesmen:** 2

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Services: Repair, Warehouse

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Services: Direct Mail

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Salesmen: 9

Lombard

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Mt. Prospect

CAIN & CO. (See Encino, Calif.)

Northfield

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Selling To: ★ D,I. **Salesmen:** 4 (eng 2)
(See Advertisement This Page)

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Services: Repair, Warehouse
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Selling To: ★ M,D,I. **Salesman:** 1

Rosemont

COZZENS & CUDAHY, INC., 9501 W. Devon Ave., (312) 825-1144. TWX: 910-253-1820.
Branches: 735 S. Court St., Medina, Ohio, (216) 725-5660; 647 Mulford Court, Indianapolis, Ind., (317) 244-2456; 127 Edmund St., Royal Oak, Mich., (313) 585-5159; 7710 Computer Ave., Minneapolis, Minn., (612) 920-1022. TWX: 910-576-2740; 10534 Natural Bridge Rd., St. Louis, Mo., (314) 423-1234. Telex: 314-044-7353.
Factories: Computer Automation; Darcy; Data Royal; Daymarc Corp.; Graphic Sys.; Fluke Mfg.; Kruse-Storke Elctrn. Corp.; Litton Encoder; Marquette Elctrns.; Microwave Elctrns.; Optima; Redcor Corp.; Siliconix; Teradyne; Weinschel Engrg.
Selling To: ★ M,I. **Salesmen:** 14 (eng 14)
Services: Repair, Warehouse

Skokie

BERMANN, M. SALES, 8631 E. Prairie Rd., (312) 675-3740.
Factories: Ameco; Endeco; Easy-Up; Game Ind.; Kepro Circuit Sys.; Mercury Elec.; Newtronics; Era Acoustics; H. W. Sams.
Selling To: ★ A,D. **Services:** Direct Mail

CHAMPION, E. T. & ASSOCS., 4828 Main St., (312) 676-3960.
Factories: Goldline Connector; Leader Inst.; Milwaukee Resistor.
Selling To: ★ A,M,D,I. **Salesmen:** 2
Services: Warehouse

SAFFRO & ASSOCS., 3736 Dempster St., (312) JU 8-0905.
Factories: Beede Elect. Inst.; Consolidated Dist.; Guildline Inst.; Hallmark Stds.; Staco, Inc.; Sterling Mfg.; United Mineral & Chem.; Vacuum Prod.; Vari-Ohm.
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 3)
Services: Repair, Warehouse

W. Chicago

CONTROLCRAFT CO., 211 Main St., (312) 653-4010.
Factory: Post Elctrn.
Selling To: ★ I. **Services:** Repair

Westchester

BROUILLETTE, W. G., & ASSOC., INC., 9855 Roosevelt Rd., (312) 345-6500.
Factories: Angstrohm Precision; Cleveland Elctrn.; Hoagland Instr.; Magnetic Shield Div.; Olympic Controls Corp.; PCA Elctrn.; Victoreen Instr.
Selling To: ★ I. **Salesmen:** 2 (eng 1)

INDIANA

Angola

CLANCY, J. & CO., INC., Box 269, (219) 665-2561.
Selling To: ★ A,D,I. **Salesmen:** 2

Bloomington

TEMCO INC., 118 S. Rogers St., (812) 332-3377.
Factories: Breyer Molding; Carbon City Prod. Co.; Hobson Bros.; Leyse Aluminum; Madison Kipp Co.; TRW Inc.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

Evansville

WAHL, A. C. & ASSOC., INC. (See Cincinnati, Ohio)

Fort Wayne

ANDERSON, B. & ASSOCS. INC. (See Chicago, Ill.)

BERNDT ASSOCS., INC. (See Chicago, Ill.)

BIEBERICH, W. W. INC., 801 Leesburg Rd., (219) 432-2537.
Factories: Ceramics Int'l; Delevan Elctrn.; Deltrol Contr.; Drake Mfg.; Isotronics; J. B. T. Inst.; James Elctrn.; Milwaukee Resistor; Plastic Capacitors; Shurite Meters; Triplett Elec. Instr.; WABCO.
Selling To: ★ M,D,I. **Salesmen:** 2
(See Advertisement This Page)

BRASE, W. T. CO., Box 5011, (219) 483-1656.
Factories: National Coil Co.; York Tape & Label.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

FREDERICK & MEILY CORP., 1601 S. Hanna St., (219) 745-2461.
Factories: American Zettler; Arjay Mfg. Co.; El-Rad Mfg. Co.; Electri Cord; Hamilton-Hall Mfg.; Leyse Aluminum; Malco Mfg. Co.; Mandex Mfg.; Mid-West Coil & Transformer; Nax; Tingstol.
Selling To: ★ I. **Salesmen:** 2
Services: Direct Mail

G. & H. SALES CO. (See Cincinnati, Ohio)

HOEMIG SALES CO., 3405 Butler Court, (219) 483-6913.
Factories: Blonder-Tongue Labs.; Easy-Up; Eico Electronic Inst.; Electro-Sonics; Electrovert; Licon Div.; Lowell Mfg.; Perma-Power Co.; Pic Design Corp.; Taurus Corp.; Tech Labs.; Reeves Soundcraft.
Selling To: ★ A,M,D,I. **Salesmen:** 2 (eng 1)

HOMSHER, B. F., CO., 418 E. Berry St., (219) 432-1164.
Factories: Chemtronics; Chicago Miniature Lamp; Clarostat Mfg.; Electric Soldering Iron; Guardian Elec. Mfg.; Irish Magnetic Tape; Kulka Elec.; J. W. Miller; NTT Sales; Precision Metal Prod.; Triad Dist. Div.; Utah Elctrn.
Selling To: ★ A,M,D,I. **Salesmen:** 2

KILFOIL, J. F. CO. (See Cincinnati, Ohio)

McDONALD SALES CO., Box 2848, (219) 745-9214.
Factories: Harowe Servo Conts.; Bodnar Prod.; Curtis Inst.; Planet Inst.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

MORRIS-CUNNINGHAM & ASSOC., INC. (See Indianapolis, Ind.)

NEEDLER SALES CO., Sta. C, Box 2407, (219) 447-2123.
Branch: Mapleton Sta., Box 88153, Indianapolis, Ind., (317) 255-8056.
Factories: Bartlett Mfg.; Clarostat Mfg. Co.; General Inst.; Guardian Elec.; Ren Elctrn.; Skottie Elctrn.
Selling To: ★ M,I. **Salesmen:** 2

PAUL SALES CO., 3501 Fairfield, (219) 744-0589.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 1)

TRI-STATE MARKETING, INC. (See Cincinnati, Ohio)

VAL-SKOL SALES, INC. (See Cincinnati, Ohio)

WHITESELL, R. O. & ASSOC. (See Indianapolis, Ind.)

WHITMORE ASSOCS., Inc. (See Chicago, Ill.)

Indianapolis

BARD ASSOCS., INC. (See La Grange, Ill.)

BLIND & ASSOCS., INC., 1635 N. Gent Ave., (317) 635-6291.
Factories: British Ind. Corp.; Carpenter Mfg.; Computron, Inc.; Consolidated Wire Co.; Electro-Voice, Inc.; Keystone Elctrn.; Stanton Magnetics; G. Stevens Mfg. **Services:** Direct Mail
Selling To: ★ A,M,D,I. **Salesmen:** 2

CAMPISANO, F. J. & ASSOCS. (See Cincinnati, Ohio)

COZZENS & CUDAHY, INC. (See Rosemont, Ill.)

DELTA SALES, 1407 N. Illinois St., (317) 631-4136.
Factories: Ablestick Adhesive; Antenna Designs, Inc.; Birnbach Radio Co.; Components Specialties; Borden Chemical; Cramer Div.; Diamond Electrons; Industro Transistors; Infrared Inds.; Inland Testing Labs.; Phalo Wire & Cable; Power Instr.; Powertron Div.; Ramney; Robicon; Specialty Connectors; Statham Instr.; United Mineral & Chemical Services.
Selling To: ★ A,M,D,I. **Salesmen:** 4
Services: Warehouse, Direct Mail

DeVOE, L. M. CO., 665 E. 61st St., (317) 257-1227. TWX: 810-341-3284.
Factories Amphenol; Centralab; Littelfuse; RCL Corp.; Sigma Inst.; Union Carbide Elctrn; Weller.
Selling To: ★ D,I. **Salesmen:** 7 (eng 5)

DIETHERT, R. CO., INC. (See Chicago, Ill.)

ENGLE, K. D. CO., INC. (See Chicago, Ill.)

FISHMAN ASSOCS., 2060 E. 54th St., (317) 251-2401.
Factories: Acoustone; Clevite; Electro; J. B. Lansing; Norelco; Precision; Sonar; Tenatronics.
Selling To: ★ A,D. **Salesman:** 1 (eng 1)
Services: Warehouse

G. & H. SALES CO. (See Cincinnati, Ohio)

JORDAN, E. H. & ASSOCS., INC. (See Jackson, Mich.)

MARSLAND ASSOCS., INC. (See Des Plaines, Ill.)

McSWEENEY, F. J. & ASSOCS., 4123 N. Keystone, (317) 547-2112.
Factories: Ampex; Columbia Elctrn. Cables; Mosley Elctrn.; Soundolier; Ungar Elec. Tools Inc.; University Sound. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 2

MERRITT, J. W. & CO., 2525 Knollwood Dr., (317) 291-9674.
Factories: Finney Co.; Harman-Kardon, Inc.; Superex; Waldom Elctrn.; Delta Int'l.; Telephone Dynamics.
Selling To: ★ A,D,I. **Salesmen:** 2

MEYERS, K. W. CO. (See Chicago, Ill.)

MIDWEST ELCTRN. SALES (See Chicago, Ill.)

MILSK, R. CO. (See Detroit, Mich.)

MORRIS-CUNNINGHAM & ASSOC., INC., 720 E. 65th St., (317) 255-2458.
Branch: 4425 Maple Terrace Pkway., Fort Wayne, Ind., (219) 485-3612.
Factories: Automatic Mfg. Div.; Daven Div.; Elco Corp.; Better Coil & Transformer; Jensen Mfg. Div.; Sampson Co.; F. W. Sickles Div.; P. Smith Inc.; Turner Co.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

NEEDLER SALES CO. (See Ft. Wayne, Ind.)

NEFF, J. R., 5349 Hedgerow Dr., (317) 546-5824.
Selling To: ★ M,I. **Salesman:** 1

O.E.M. SALES CO., INC., Box 55232, (317) 545-1267.
Branches: 101 Lafayette Bldg., South Bend, Ind., (219) 233-7419; Box 252, Florissant, Mo., (314) 838-6600.
Factories: Balseal Engrg.; Bergen Wire Rope Co.; E.T.C. Inc.; Microdot Inc.; Nylok Co., Div. USM; Simonds Machine.
Selling To: ★ I. **Salesmen:** 3 (eng 1)

PIVAN ENGRG. CO. (See Chicago, Ill.)

ROCKWELL ENGRG. CO., 2143 E. 45th St., (317) 251-9453.
Factories: Automatic Timing & Controls; Standard Inst.; Weston Inst.
Selling To: ★ I. **Salesman:** 1 (eng 1)
Services: Repair, Warehouse, Modification

SCHEFFLER, C., 1133 Navajo Trail, (317) 253-6337.
Factories: American Tape Duplicators; Certron Corp.; Craig Prod.; Duotone; Dynaco; Fasco; Hudson Lamps; Int'l. Elctrn.; Industrial Devices; Loral Dist. Prod.; Mura; Oxford; Philmore; Roberts Elctrn.; S & A Elctrn.; Sansui; United Audio Products.
Selling To: ★ A,D. **Salesmen:** 2

SCHROEDER & LOOMIS, INC., 714 E. 65th St., (317) 251-4571. TWX: 810-341-3296.
Factories: Alladin Elctrn.; Electra Corp.; Hammarlund Mfg.; Hughes Aircraft; IRC; I.T.T. Jennings; Millen Mfg.; Union Carbide Co.; United Mineral & Chemical; Vanguard Elctrn. Tools; Ward-Leonard. **Services:** Sales Only
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 1)

SCIENTIFIC SALES CORP. (See Chicago, Ill.)

SCHULZ, E. A., 721 Sherwood Dr., (317) 255-1993.
Factories: Astatic Corp.; Robins Elctrn.; Sherwood Elctrn. Labs.; Workman Elctrn. Prod.
Selling To: ★ A,D,I. **Salesmen:** 2

SYSTEMS ENGRG. ASSOCS., 1010 E. 86th St., (317) 846-2593.
Factories: Analog Devices Inc.; Atec Inc.; Cal. Inst.; Cimron Div.; Elctrn. Assoc.; Flo-Tron; S.

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Selling To: ★ M,I. **Salesmen:** 10 (eng 10)
Services: Repair, Warehouse

THOMAS & SUKUP, INC., 2060 E. 54th St., (317) 251-4574.
Factories: Alpha Wire; Amperex Elctrn.; Chassis-Trak/Vent-Rak; Pamotor, Inc.; Simpson Elec.; Switchcraft; Uniform Tubes.
Selling To: ★ A,M D,I. **Salesmen:** 5 (eng 3)
Services: Warehouse, Direct Mail

VAL-SKOL SALES, INC. (See Cincinnati, Ohio)

WAHL, A. C. & ASSOCS., INC. (See Cincinnati, Ohio)

WEBER, J. L. AGENCY, 8150 Westfield Blvd., (317) 255-4117.
Factories: Holly Coil; Indium Corp.; Nibot Corp.; UID Elctrn.
Selling To: ★ I. **Salesmen:** 5 (eng 3)

WHITESELL, R. O. & ASSOCS., 6691 E. Washington St., (317) 359-5374.
Branches: Central Bldg., Fort Wayne, Ind., (219) 743-441; 3620 Lexington Rd., Louisville Ky., (502) 893-7303; 303 Fidelity Bldg., Benton Harbor, Mich., (616) 927-2041; 25100 Evergreen Rd., Southfield, Mich., (313) 358-2020; 1172 W. Galbraith, Cincinnati, Ohio, (513) 521-2290; 21139 Lorain Ave., Cleveland, Ohio, (216) 333-2585; 4133 S. Dixie Ave., Dayton, Ohio, (513) 298-9546; 201 Penn Center Blvd., Pittsburgh, Pa., (412) 242-0100.
Selling To: ★ M,I. **Salesmen:** 18 (eng 16)
(See Adv. This Page, 3254, 3275)

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Factories: Chicago Condenser Corp.; Co-Tronics; Ionetics; Ramsgate, Inc.; Wilco Corp.
Selling To: ★ A,M,D,I. **Salesman:** 1 (eng 1)

Richmond

WAHL, A. C. & ASSOC., INC. (See Cincinnati, Ohio)

South Bend

O. E. M. SALES CO., INC. (See Indianapolis, Ind.)

UNITED EXPORT CORP., Box 147, (219) 282-2375.
Factories: Accurate Parts; American Grease Stick Co.; Arno Adhesive Tapes; Atlas Press Co.; Badger Fire Extinguisher Co., Inc.; Barker Engrg.; Channellock, Inc.; Clausing Div.; Cornwell Quality Tools; Covel Mfg. Co.; Delta Electric Div.; Electro Engrg. Prod.; Elkhart Brass Mfg.; Esmay Prod. Inc.; Fastener Corp.; Gast Mfg.; Huffman Mfg.; Kal Equip. Co.; King Bee Mfg.; King Elctrn. Mfg.; Marvel Ind., Inc.; Midwest Tool & Cutlery Co.; Milwaukee Tool & Equip.; National Fire Hose; Piqua Machine & Mfg.; Plymouth Products; Quality Tools Corp.; Ronk Electrical Ind.; Saylor Beall Mfg.; Shavex Corp.; Sullair Corp.; Toolkraft Corp.; Tuthill Pump Co.; Uni-Motive Chassis Parts; Valco Guitars, Inc.; Wells Mfg. Corp.
Selling To: ★ D,I. **Salesmen:** 6 (eng 1)

IOWA

KOENIG-MYERS ASSOC. (See Shawnee Mission, Kans.)

Cedar Rapids

BALHORN & WELCH, INC. (See Chicago, Ill.)

BROWN, H. R. SALES CO., 3400 Indian Rd. S.E., (319) 366-0635.
Branches: Atohm Elctrn.; Anderson Labs.; Brush Inst.; Clevite Corp.; Digitran Co.; General Inst. Corp.; High Vacuum Elctrn.; Keystone Carbon; Mepco; Philips Elect. Equip. Ltd.; Piconics; SR Engrg.
Selling To: ★ M,D,I. **(Salesmen:** 2 (eng 1)

ENGRG. SERVICES CO. (See St. Louis, Mo.)

MIDWEST ELCTRN. SALES (See Chicago, Ill.)

PIVAN ENGRG. CO. (See Chicago, Ill.)

REID ASSOCS., INC., 526 Merchants Nat'l. Bank Bldg., (319) 362-6302.

VRBIK, J. CO., 2818 A. Ave. N.E., (319) 365-0461.
Factories: American Magnetics Corp.; Bliley Elec.; Centralab; ETC, Inc.; Electro Assemblies; General Inst.; E. F. Johnson Co.; Spectrol Elctrn.
Selling To: ★ D,I. **Salesmen:** 2
(See Advertisement This Page)

Council Bluffs

PFEIFFER, W. E., 615 Stutsman St., (712) 322-8280.
Branch: 1001 So. 6th St., Council Bluffs, Iowa, (712) 322-2539.
Factories: Deltrol Cont.; Grayline.
Selling To: ★ M,D,I. **Salesmen:** 4
Services: Warehouse

Des Moines

COLLINS CARLSON HEMPE LECTROREPS, INC. (See Kansas City, Mo.)

DOWELL, T. L., INC. (See Overland Park, Kans.)

KELLY-SCHMITZ-WINKLER ASSOCS. (See Kansas City, Mo.)

Fort Dodge

HEIMANN CO., INC. (See Minneapolis, Minn.)

Marion

THOMAS & MODRCIN ASSOCS., INC. (See Shawnee Mission, Kans.)

KANSAS

Kansas City

MACDONALD, B. C. & CO. (See St. Louis, Mo.)

Leawood

LEEMARK ENGINEERS, Box 6175, (913) NI 8-0124.
Branch: 9623 St. Charles Rock Rd., St. Louis, Mo., (314) 423-8700.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

POLY-ONICS, INC., 4434 W. 90 Terr., (913) NI 8-4173. TWX: 910-749-6479.
Branch: 47 Village Sq. Shopping Ctr., Hazelwood, Mo., (314) TE 7-0597. TWX: 910-760-1708.
Factories: Advanced Microwave Labs; Alfred Elctrn.; Avantek; CTS Corp.; Data General; Electronic Assocs.; Industrial Elctrn. Engrs.; Instrument Flight Res.; McLean Engrg. Labs.; Narda Microwave; Parker Inst.; Princeton Applied Res.; Staco, Inc.; Tansitor Elctrn.; Wanlass Elec.; Wavetek.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 2)
Services: Repair

Mission

APPLETON, H. CO. (See Los Angeles, Calif.)

INLAND ASSOCS., 6047 Howe Dr., (913) 362-2366.
Branches: 453 N. Lindbergh, Creve Coeur, Mo., (314) 993-0301; 1136 Pearl St., Boulder, Colo., (303) 442-1336.
Factories: Automatic Metal Prod.; Bel Fuse Inc.; Dodge Ind.; Electronic Modules; Fairchild Cont.; IMC Magnetics; Kurman Inst.; Magnetics Inc.; National Wire & Cable; Norplex Div.; Physical Sciences Corp.; Milton Ross Co.; Sanders Assocs.; Scientific Advances; Wall Mfg.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

PIVAN ENGRG. CO. (See Chicago, Ill.)

TECHNICAL MARKETING ASSOCS., INC. (See St. Louis, Mo.)

Overland Park

LOWELL-KANGAS & ASSOC., INC., Box 4116, (913) TU 8 3200. **Services:** Direct Mail
Selling To: ★ A,D,I. **Salesmen:** 4

DOWELL, T. L. INC., 7208 W. 80th, (913) 649-6069.
Branches: 3300 Williams, Des Moines, Iowa, (515) 266-1283; 4753 Titan Ct., St. Louis, Mo., (314) 892-2859.
Factories: Alliance Mfg. Co.; Allied Cont. Co. Inc.; Augat, Inc.; Clarostat Mfg.; Electro-Voice; Quam-Nichols; H. Sams Co.; Switchcraft, Inc.; Triplett Electrical Instr.; Vaco Products.
Salesmen: 6
(See Advertisement Page 3247)

Prairie Village

ENGRG. SERVICES CO. (See St. Louis, Mo.)

Shawnee Mission

BENSON ENGRG. CO. (See Dallas, Texas)

IBL ENGRG. & SALES (See Dallas, Texas)

KOENIG-MYERS ASSOC., INC., 5500 Buena Vista Dr., (913) 432-8300.
Branches: 2721 Beloit Dr., Bridgeton, Mo., (314) 739-1655; 307 Linn St., Atlanta, Iowa, (712) 243-3342.
Factories: Accurate Spring Mfg.; AKG Microphones Div.; Atlas Sound; Barker Prods.; Bell P/A Prods.; Chicago Miniature Lamp Works; Columbus Elec. Mfg.; Drake Mfg.; Heeger, Inc.; Mosley Elctrn.; Regency Elctrn.; Shepherd Ind.; Talk-A-Phone; Unimetrics, Inc.; Wilco Corp.
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 1)

THOMAS & MODRCIN ASSOCS., INC., 5450 Buena Vista Dr., (913) 432-2131.
Branches: 47 Village Sq., Hazelwood, Mo., (314) 838-6446; 890 17th Ave., Marion, Iowa, (319) 377-6261.
Factories: Beede Elect. Inst.; Cambridge Thermionics; Equipto Elctrn.; Fenwal Elctrn.; G V Contrls.; Hamlin Inc.; Hammarlund Mfg.; JFD Elec.; Kings Elctrn.; Line Elec.; Memcor; Metex Corp.; Panduit Corp.; Rotron Mfg.; Stancor Elect.; Western Microwave.
Selling To: ★ D,I. **Salesmen:** 6 (eng 6)
(See Advertisement Page 3247)

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BENSON ENGRG. CO. (Dallas, Texas)
BETTIS, M. E. CO. (See Kansas City, Mo.)
D & O ENGRG CO., INC., Box 1800, (316) AM 4-7358. TWX: 910-741-6916.
Branch: Box 8433, Dallas, Texas, (214) EM 8-3544.
Factories: Astropolymer Labs.; Flexible Metal Hose Mfg.; Glassco Instr.; Gorn Corp.; Nash Conts. **Services:** Warehouse
Selling To: ★ I. **Salesmen:** 6 (eng 5)
FLORENCE & MEYER, INC. (See Kansas City, Mo.)
KEMCO, INC. (See Irving, Texas)
MACDONALD, B. C. & CO. (See St. Louis, Mo.)
SIMPSON ENTERPRISES, Box 18066, (316) WH 3-0502.
Branch: Box 3873, Kirkwood, Mo., (314) YO 5-1115.
Factories: Airborne Inst. Labs.; Alford Mfg.; B. F. Goodrich Co.; Custom Materials; E & M Labs.; Fenwal Inc.; Laboratory for Elctrns.; Omni Spectra; Roback Corp.; Scanbe Mfg.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

KENTUCKY

Louisville

G. & H. SALES CO. (See Cincinnati, Ohio)
WHITESELL, R. O. & ASSOCS. (See Indianapolis, Ind.)

LOUISIANA

Baton Rouge

HAHN SALES CO., Box 52798, (504) 356-2596.
Factories: Athena Conts.; Electro-Applications; Electro-Mechano; C. S. Gordon Co.; Green Inst.; Hastings-Raydist; Nurnberg Thermometer; P-W Ind. **Services:** Repair, Warehouse
Selling To: ★ D,I. **Salesmen:** 3
PAN-TECH ENGRG. CO. (See Houston, Texas)
TEXPORT CO. (See Dallas, Texas)

Houma

SOMNER, W. L. CO., INC. (See Shreveport, La.)

Metairie

CARTWRIGHT & BEAN, INC. (See Memphis, Tenn.)
HENRY, B. ASSOCS. (See Charlotte, N. C.)
LIEBERMAN, H. SALES CO. (See Houston, Texas)
McKINNEY, J. F. SALES CO. (See Dallas, Texas)
SOMNER, W. L. CO., INC. (See Shreveport, La.)
WARRINER, D. A. INSTR. SALES & SVC. (See New Orleans, La.)

New Orleans

IBL ENGRG. & SALES (See Dallas, Texas)
ORMSBY, S. SALES CO., 7121 Catina St.
Factories: Bauer Div.; Columbia Elctrn. Cables; E-Z Way; GBC-CCTV; Glidelite; Keystone Elctrn.; Premax; Utah; Waber.
Selling To: ★ A,D,I. **Salesmen:** 3 (consultant 1)
PECK, G. V. CO. (See Dallas, Texas)
PEIRCE, G. H., 715 Camp St., (504) 522-1888.
Selling To: ★ M,D,I. **(Salesmen:** 2 (eng 1)
Services: Repair, Warehouse
SPEARS, M. CO. (See Ft. Worth, Texas)
WARRINER, D. A. INSTR. SALES & SVC., 7920 Zimple St.
Branch: Box 73339, Metairie, La., (504) 888-0345.
Factories: The Bastian-Blessing Co.; Beach Precision; Deltron, Inc.; Dynasonics Corp.; Jordan Valve Div.; National Engrg. Prod.; Solon Mfg.; Universal Fluid Dynamics; Versa Prod.; Vicurt.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse

Shreveport

SOMNER, W. L. CO., INC., Box 82, (318) 422-9291.
Branches: Box 145, Tinsley, Miss., (601) 746-4765; Box 2, Brookhaven, Miss., (601) 833-6341; Box 14, Houma, La., (504) 879-3348; Box 9205, Metairie, La., (504) 834-0865; Box 631, Odessa, Texas, (915) 337-5531; Box 2454, Pampa, Texas, (806) MO 4-7469; Box 15364, Houston, Texas, (713) WA 8-3751; Box 2524, Corpus Christi, Texas, (512) 884-3922; Box 45272, Tulsa, Okla., (918) NA 2-0616.
Factories: Allis Chalmers Mfg.; Aeroquip; Gaso Pumps; Goulds Pumps; Marlow Pumps; Minneapolis-Moline Engines; Pulsation Engrg. Stabilizers; Roper Rotary Pumps; Tulsa Pumps.
Selling To: ★ D. **Salesmen:** 28 (eng 12)
Services: Repair, Warehouse

MAINE

Waterville

MORGAN, C. T. CO., INC. (See Hathorne, Mass.)

MARYLAND

Baltimore

A. B. & T. SALES CORP. (See Olney, Md.)
AEROL ASSOCS., INC. (See Jericho, New York)
BROTHERS & CONNEEN ASSOC., 6302 Lincoln Ave., (301) 764-7189.
Branch: 131 Harned Rd., Springfield, Pa., (215) KI 3-8641.
Factories: Amperex Elctrn.; Bogen Comm. Div.; Calcon Mfg.; Electro-Voice; Magnecord; Memcor Components Div.; Metal Works Inc.; Telex; Viking.
Selling To: ★ A,D,I. **Salesmen:** 6
COMPAR CHESAPEAKE INC., 7 Church Lane, (301) 484-5400. TWX: 710-862-0860.
Selling To: ★ M,D. **Salesmen:** 2
DOSS ELCTRN., INC., 6660 Security Blvd., (301) 944-1900. TWX: 710-862-9162.
Branches: 1638 Irvin St., Vienna, Va., (703) 938-9018; 19 River Dr., Severna Pk., Md., (301) 647-8459.
Factories: Acopian; Aertech; Amlabs; Arra; H. H. Eby Co.; Raytheon Semiconductors; RCL Elctrn.; Thermalloy; Trak Microwave.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)
E-A, INC., 1406 Shoemaker Rd., (301) 825-2385.
Branches: District of Columbia, (202) 783-7319; Philadelphia, Pa., Enterprise 6229.
Factories: Ace Mfg.; Ainslie Corp.; Alford Mfg.; Alto Scientific; Avantek, Inc.; B. F. Goodrich; Electro Science Ind.; Hitachi, Ltd.; Measurement Technology; M-O Valve Co.; Micro-Tel; Microwave/Sys.; Ryka Scientific; Valley Microwave; Vector Ind.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
JEFFRIES, S. A. INC. (See Narberth, Pa.)
JOBS & CO., INC. (See Richmond, Va.)
JONES, D. K. & ASSOCS., 2026 Maryland Ave., (301) 752-0577.
Branch: 6520 Rising Sun Ave., Philadelphia, Pa., (215) 342-3990.
Factories: Carpenter; Contact; Hollis Engrg.; James Elctrn.; Macdonald & Co.; Magnetic Shield; Midtex/Aemco Div.; Mitronics, Inc.; Saxonburg Ceramics.
Selling To: ★ I. **Salesmen:** 3 (eng 3)

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LUCE, R. P. & CO., INC. (See Berkeley Hghts., N.J.)
MACDONALD, S. K. INC. (See Philadelphia, Pa.)
MAGUIRE, J. A. & CO. (See Camden, N.J.)
MOLER-FADER ASSOCS. (See Haddonfield, N.J.)
NEWSON, G. H. & ASSOCS. (See Philadelphia, Pa.)
S. & S. ASSOCS., INC. (See King of Prussia, Pa.)
SHEFFER, J. W. CO., 4609 Old Frederick Rd., (301) 233-0606.
Factories: Oak Mfg. Co.; McCoy Elctrn.; Hart-Advance Relay Div.
Selling To: ★ M,D,I.
TAYLOR, M. F. CO., INC. (See Silver Spring, Md.)
WHITCOMB ASSOCS., 730 Deepdene Rd., (301) 889-1245.
Branch: Washington, D.C., (202) 737-0763.
Factories: Aptron; Argonaut Assocs., Inc.; Auto Data; Bailey Co.; Baird-Atomic; Dalmo Victor; Exotic Materials; Monroe Elctrn.; Northeast Scientific, Radio Frequency; Technipower, Inc.
Selling To: ★ M,I,Research. **Salesmen:** 2 (eng 2)
Services: Repair
WHITE, B. & CO., INC., 7 Church La., (301) 484-5400. TWX: 710-862-0860.
Factories: Deutsch/Filtors Ind. Prod.; Fenwal Elctrn.; Filtron Co.; Freed Transformer Co.; Interdyne; Philco-Ford; Tele Coil Co.; Wakefield Engrg.; Welwyn Intl.; Whitso, Inc.
Selling To: ★ M. **Salesmen:** 2
WILKINSON, R. L. (See Towson, Md.)

Beltsville

CLOSS, T. H. CO. (See Towson, Md.)
SNOW, C. E., 10442 Baltimore Ave., (301) 345-2211.
Branches: 258 N. Main St., Ambler, Pa., (215) 224-2626; 3109 N.E. 25th St., Ft. Lauderdale, Fla., (305) 566-5751.
Selling To: ★ M,I. **Salesmen:** 8 (eng 8)

Bethesda

ARA ELCTRN., INC. (See Jenkintown, Pa.)
BROGAN ASSOCS., INC. (See Westbury, N.Y.)
MOUNT, W. CO., 7735 Old Georgetown Rd., (301) 657-9312. TWX: 710-824-0090.
Branch: 700-6 Fox Pavillion, Jenkintown, Pa., (215) TU 6-0383.
Factories: Gulton Industries Inc.; Hughes Aircraft; Markite Corp.; Microdot; Shallcross Mfg.; Texas Inst.; Thermatics Inc.; Torotel; Wire Supply Co.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 3)
Services: Warehouse
ROSEN, G. & ASSOC., INC., 9501 Wadsworth Dr. (301) 365-5113.
Factories: Barzilay Co.; BSR-McDonald; Chassis-Trak; BL Int'l.; Langevin; Russell Ind.; Stanton Magnetics; Vent-Rak. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 2
S. & S. ASSOCS., INC. (See King of Prussia, Pa.)

Bowie

BRADDOCK ASSOC. (See Haddonfield, N.J.)

Chevy Chase

ANDCO SALES ENGRG., INC. (See Philadelphia, Pa.)

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CUESTA, J. E. & CO., INC. (See Valley Forge, Pa.)
JADELECTRONICS ASSOCS. (See Philadelphia, PA.)

Hyattsville

CAIN & CO. (See Encino, Calif.)
LOWERY, L. D., INC. (See Broomall, Pa.)

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MERICAN, J. C., 546 Anchor Dr., (301) 679-6969.
Factories: Carl Cordover Co.; Audiovox Corp.; Game Ind.; Jayell Mfg.; Philmore Mfg.; Pioneer Elect.; TEAC; Telecassette Corp.; Telephone Dynamics.
Selling To: ★ A,D. **Salesmen:** 2

Kensington

ELECTRONIC MKTG. ASSOCS., 11501 Huff Ct., (301) 946-0300. TWX: 710-825-9645.
Branch: 210 Goddard Blvd., King of Prussia, Pa., (215) 265-1600, (510) 660-3130.
Factories: Alfred Elctrn.; Computer Measurements; Dana Labs.; Data Technology; J. Fluke Mfg.; Interdata; IRA Sys.; Kennedy Co.; Melabs; Micro Test; Microwave Elctrn.; Narda Microwave; Philbrick/Nexus Res.; Reaction Inst.; Rentronix; Rutherford Div.; Sorensen; Varian Assocs.; Weinschel Engrg.
Selling To: ★ A,M,I. **Salesmen:** 18 (eng 18)
Services: Repair, Warehouse

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E. C. I. Div. (See Philadelphia, Pa.)

Laurel

VPI ASSOCS., INC., 13001 Mistletoe Rd., (301) 792-7631. TWX: 710-862-569.
Branches: 139 Florida St., Farmingdale, N.Y., (516) 694-1919. TWX: 510-224-6424; 1316 Clarke Rd., Roslyn, Abington, Pa., (215) 659-8483.
Factories: Control Elctrn.; Keltec Fla.; RF Comms.; KMC Semiconductor; Micro-Power, Inc.; Microlab/FXR; Western Microwave Labs.
Selling To: ★ M,I. **Salesmen:** 5 (eng 3)
WILD, J. J. INC. (See Jericho, N.Y.)

Lutherville

EAST COAST LIAISON, Box 243, (301) 252-1288.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)
Services: Direct Mail

Lutherville-Timonium

NAUDAIN ASSOCS. (See Philadelphia, Pa.)

Olney

AB&T SALES CORP., 3311 Olney-Sandy Spring Rd., (301) 924-4976.
Branches: 1334 Halstead Rd., Baltimore, Md., (301) 668-5692; 8921 Turton Dr., Philadelphia, Pa., (215) HO 4-8921.
Factories: Acoustone; Dynaco; Gamber-Johnson; Harman-Kardon; Pageant; Pritec; Tape-Athon; University Sound. **Services:** Direct Mail
Selling To: ★ A,D. **Salesmen:** 3 (eng 1)

Reisterstown

PAR-NEIL SALES CO. (See Feasterville, Pa.)

Rockville

BIECHLER ASSOCS., INC. (See Narberth, Pa.)
BURLINGAME ASSOCS., (See Mount Vernon, N.Y.)
GAWLER-KNOOP CO. (See Roseland, N.J.)
LEE ASSOC., INC. (See Orlando, Fla.)
ROTHENHEBER & CO., INC. (See Ardmore, Pa.)
TEK-REP, INC., 1075 Rockville Pike, (301) 762-7777.
Factories: Astro-Space Labs; Bourns; Colburn Inst.; Computer Prod.; Continental Device Corp.; Control Equipt. Corp.; Electro Fab; Electronic Counters; Incor, Inc.; Kistler Inst.; Midwestern Inst.; Nanofast; Qatron Corp.; Sonex; Whistler Elctrn. **Selling To:** ★ A,M,I.

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BEEMER ENGRG. CO. (See Ft. Washington, Penn.)
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Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)
BRIMBERG ASSOCS., INC., 814 Thayer Ave., (301) 588-7790. TWX: 710-825-9625.
Factories: Americon Corp.; Avco Elctrn. Div.; Datapulse; Ferrotec; Enclosure Corp.; Hallmark Stds.; Holt Inst. Labs.; Logimetrics Div.; LTV-Ling Elctrn.; Merrimac Res. & Dev.; Microwave Dev. Labs.; MaCarr, Inc.; Polarad Elctrn. Inst.; Team Corp.; Tenney Engrg.; Trygon/Trymetrics;; Wayne Kerr Corp. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 8 (eng 6)
PADDOCK-JOSLOW CO., Box 192, (301) 589-6554.
Factories: Agnew Higgins; Barnes Corp.; Biddle, J. G.; Boonton Elctrn.; Electronic Control Sys.; Faul-Coradi; Interstate Elctrn.; Micon Inc.; MVR Corp.; Quan Tech Labs; Theta Inst.; Trompeter Elctrn. **Services:** Repair (minor)
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)
Q. E. D. ELCTRNS., INC. (See Mt. Vernon, N. Y.)
TAYLOR, M. F. CO. INC., Box 111, (301) 589-4002.
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Factories: Jensen Mfg. Div.; Kurz-Kasch, Inc.; Loral Dist. Prod.; Mercury Elctrn.; Newcomb Audio Prod.; North American Phillips; Pickering & Co. Inc.; H. H. Smith, Inc.; Turner Co.; Ungar Div.; Vega Elctrn.; Vidaire Elctrn. Mfg.; Wen Prod., Inc.
Selling To: ★ A,M,D,I. **Salesmen:** 10 (eng 1)
Services: Warehouse
WHITE, L. G. CO., INC., 1110 Fidler La., (301) 585-3141. TWX: 710-825-9635.
Branch: 1014 Brookstown Ave., Winston-Salem, N. C., (919) PArk 5-3612.
Factories: Amco Engrg.; Burroughs, ECD; Birtcher Corp.; Christie Elec.; Data Device Corp.; Deltron Corp.; Digitronics; G-V Conts.; Hart/Advance; Invac Corp.; Unimax Switch.
Selling To: ★ M,I. **Salesmen:** 8 (eng 8)
Services: Warehouse, Distributor

Timonium

BARNHILL & ASSOC., INC., 1931 Greenspring Dr., (301) 252-5610.
Branches: 2713 Green Hill La., Lynchburg, Va., (703) 384-2062; 1306 Cooper St., Beverly, N. J., (609) 877-1350.
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 2)
Services: Direct Mail
(See Advertisement Page 3249)
HELLER FREEDMAN ASSOC., Box 293, (301) 252-4780.
Factories: ACS Ind., Inc.; Applied Engrg. Prod.; Clairex Elctrns. Inc.; Cosmo Plastics; Defiance Circuit; Delta Semiconductors; Engonic Engrg.; Gordos Corp.; Hi-G; Inter-Technical Grp.; Int'l Comp. Corp.; Merrimac Magnetics; TEC Magnetics; Thorn-AEI Radio Valves & Tubes.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

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BURGIN-KREH ASSOCS., INC., Box 9787, (301) 661-1120. TWX: 710-862-0878.
Branch: 2600 Memorial Ave., Lynchburg, Va., (703) 845-5600. **Services:** Direct Mail
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)
CLOSS, T. T., 21 W. Penna. Ave., (301) 825-4445.
Branch: 11352 Maryland Ave., Beltsville, Md., (301) 474-8800.
Factories: Artisan Elctrn.; Computer Inst.; Control Data Corp.; Fenwal, Inc.; Semcor Div.; H. H. Stieht: Trent, Inc.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Fenwal Modification Center
DOUGHERTY, J. A. SALES CO., 320 Hillen Rd., (301) 823-0431.
Factories: American-Micro Sys.; American Precision Ind.; Delevan Elctrn.; Dickson Elctrn.; Electronic Crystals; Kings Elctrn.; Stewart-Warner Microcircuits; Vishay Intertech.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

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HUNT ASSOCS., INC. (See Cherry Hill, N. J.)

J. H. ELCTRN. SALES CO., Box 6844, (301) 825-4440. TWX: 710-232-1816.
Branches: Box 686, Cherry Hill, N. J., (609) 665-6142; Box 123, Poughkeepsie, N. Y., (914) TR 6-4936.
Factories: Metcom, Inc.; Price Elec.; Sarkes Tarzian; Siliconix; Scott Elctrn.; Times Wire & Cable.
Selling To: ★ M,I. **Salesmen:** 6 (eng 3)

JONES, W. W. CO., INC., Box 5490, (301) 823-5721. TWX: 710-232-1838.
Branches: 2317 E. South St., Box 6004B, Orlando, Fla., (305) 424-6298; 2666 Redding Rd. N.E., Atlanta, Ga., (404) 261-8275; 332 S. Forklanding Rd., Maple Shade, N. J., (609) 662-0480.
Factories: Arnold Magnetics Corp.; Black & Webster; Custom Components; Diceon Elctrn.; Dynamic Gear; Holex, Inc.; Int'l. Elctrn. Res.; Magnetico; Nu Tron Elctrn.; Scientific Advances; Tepro of Fla.; Torsion Balance.
Selling To: ★ M,D,I. **Salesmen:** 7
Services: Warehouse

KRAFT ELCTRN. SALES, INC., 510 Woodbine Ave., (301) 828-5838.
Factories: Display Devices; Hitemp. Div.; Hughes Aircraft; Presin Co.; Primec Corp.; Sunbank Elctrn. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

LEFF SALES ASSOCS. (See Pennsauken, N. J.)

RANDALL, K. CO. (See Collingswood, N. J.)

WETTERHAHN, M. CO. (See Pennsauken, N. J.)

WHITE, H. J. CO., INC. (See Cherry Hill, N. J.)

WILKINSON, R. L. INC., 707 Stevenson, La., (301) 377-7800.
Branch: Box 215, Glenside, Pa., (215) 424-8400.
Factories: Dale Elctrn.; Globe Ind.; Rocker Solenoid; Timber Top; Truco.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)
Services: Warehouse

(See Advertisement Page 3247)

Wheaton

EASTRONICS, 2401 Blueridge Ave., (301) 942-2363.
Factories: A. D. Data Sys.; Baldwin-Kongsberg Co.; Bio-Medical Elctrn.; Decitek; Dressen-Barnes; Dynamic Sys.; Edwin Ind. Corp.; Nova Elec. Corp.; Rockland Labs; Spatial Data Sys.; Vega Elctrn.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

LIENAU ASSOCS., INC., 11411 Amherst Ave., (301) 949-6464.
Branches: 15034 Carter Ave., Philadelphia, Pa., (215) HO 4-8148; 160 Pueblo Rd., New Britain, Pa., (215) 345-1691.
Factories: Audio Dynamics; Automatic Radio; British Ind.; D. Clark Co.; Eico; Fisher Radio Corp.; International Rectifier; Oaktron Ind.; Robins; Sonotone; Soundolier; Stancor.
Services: Warehouse
Selling To: ★ A,D,I. **Salesmen:** 7

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E. E. SPECIALISTS, INC., Box 956, (617) 259-9200. Branch: 281 Vera Rd., Bristol, Conn., (203) 584-0077.
Factories: AGAC-Derritron Inc.; Associated Testing Labs.; Aul Inst.; Cabtron Corp.; Computer Guild Inc.; Dynage; Hughes Aircraft; M. P. O'Dell Co.; Protronic Ind.; Ragen Precision Ind.; Roback Corp.; Universal Ad-Yu Elctrn.; White Electromagnetics.
Selling To: ★ M,I. **(Salesmen:** 5 (eng 4)

REIDY, K. ASSOCS., Box 1062, (617) 263-7146.
Fastories: American Aluminum; Dart Nameplate & Label Co.; Dura Process Co.; M M Elctrn; Enclosures; Master Etching Corp.
Selling To: ★ I. **Salesmen:** 2 (eng 1)

Arlington

INSTRUMENT ASSOCS., INC., 30 Park Ave., (617) 648-2922. TWX: 710-389-0464.
Branches: 234 Murphy Rd., Hartford, Conn., (203) 525-9367; 15 Erie Dr., Natick, Mass., (617) 235-9402.
Factories: Anadex Inst.; Astrodata; Bio-Medical Res.; Bolt, Beranek & Newman; B&T Sys.; Cintra Physics Int'l. Co.; CLC Rentals; Computer Peripherals; Dana Labs.; Data Device; Electro Optics Assocs.; Incre-Data; IRA Sys.; Union Carbide Corp.; Kruse-Storke Elctrn.; Medical Technology; Micom; Physio-Contl. Corp.; Precision Inst.; Raytheon; Tally Corp.; Topaz, Inc.; Varian Assocs.
Selling To: ★ A,M,I. **Salesmen:** 15 (eng 11)
Services: Repair, Warehouse, Calibration

Auburndale

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EQUIPT SALES CO., INC. (See Hamden, Conn.)

GREENE, D. ORGANIZATION, INC., Box 290, (617) 275-6400. TWX: 710-326-1644.
Factories: Birtcher Corp.; Dressen-Barnes Elctrn.; Hill Elctrn.; Sunbeam Elctrn.; Triad Transformer Corp.; Utrad Corp.
Selling To: ★ D,I. **Salesmen:** 3 (eng 2)

LESSER, F. R., Box 241, (617) 275-7558.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

Boston

ELECTRICAL APPARATUS CO., INC., 1200 Soldiers Field Rd., (617) 782-7440.
Factories: Curtis Dev. & Mfg.; General Contl.; Heinemann Elec.; Norbatrol Elctrn.; Precision Products & Contls.; Rundel Comp.; Sensitak Inst.; Struthers-Dunn; Transtector Sys.
Selling To: ★ A,M,D,I. **Salesmen:** 7
Services: Direct Mail

P. J. ENGRG. SALES CO., INC., 360 No. Beacon St., (617) 783-0510.
Factories: Ceramaseal Inc.; Delevan Elctrn.; Pyrofilm Resistor; Wesco Electrical.
Selling To: ★ M,I. **Salesmen:** 5 (eng 1)
Services: Warehouse, Mail

REPRESENTATIVES CORP., 10 High St., (617) 426-0541.
Branch: Bethany, Conn., (203) 393-0024.
Factories: Arr-Les Switch; Auto-Swage; Electro-flex Heat; Maxi Switch; Stemco Controls; TOC Div.; Tia Electric Co.; Underwriters Safety Devices.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

Braintree

AEROL ASSOCS., INC. (See Jericho, N.Y.)

BORDEWIECK ENGRG. SALES CO., 221 Grove St., (617) 843-0845.
Factories: Acromag; Central Transformer; Clairex Elctrn.; Electronics, Missiles & Comm.; Firing Circuits; General Equipt. & Mfg.; Georator; Imtra Corp.; Knox Elctrn.; Life Inst.; Magtrol; Marathon; National Sonics; PCA Elctrn.; Pickering & Co.; Tapeswitch Corp.; Transistor Elctrn.
Selling To: A,M,D,I. **Salesmen:** 4 (eng 4)
Services: Warehouse

Brockton

FORSBERG SALES, 646 Summer St., (617) 522-6300. TWX: 710-345-0194.
Branch: 22 Broadway, N. Haven, Conn., (203) 239-5111.
Factories: Chester Cable Co.; Dorsett Elctrn.; Electro Connective Sys.; General RF Fittings; Hughes Aircraft; I.T.T.-Jennings; Kappa Networks; Mutron Corp.; Shallcross Mfg.; Taurus Corp.; Viking Ind., Inc. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 5

Brookline

SEGEL, H. P. INC., 386 Washington St., (617) 232-7525.
Factories: Brown Engrg.; Bud Radio, Inc.; Chicago Switch; Freed Transformer; Grand Transformers; Russell Ind.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 1)
Services: Warehouse, Display Room

SMITH, R. CO., 59 Verndale St., (617) 277-0017.
Branch: 188 Brewster Rd., W. Hartford, Conn., (203) 523-0512.
Selling To: ★ A.D. **Salesmen:** 3

Burlington

B & W ASSOCS., B Street, (617) 275-9177.
Factories: Applied Magnetics; Automatic Metal Prod.; B&W Cable; Crane Elctrn.; Microwave Filter; Times Wire & Cable.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

RESEARCH INST., INC., 87 Terrace Hall Ave., (617) 272-1800.
Factories: Ampex; Anaren Microwave; Beta Inst.; Bissett-Berman; Coleman Engrg.; Kaye Scientific; Maryland Telecomm.; Solar Div.; Trio Labs.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

SCHAAL ASSOCS. INC., Four A St., (617) 272-3250. TWX: 710-332-0246.
Factories: Barry Contrls.; Fairchild Hiller; Jonathan Mfg.; Raychem Corp.; Rayclad Tubes.
Selling To: ★ M,D,I. **Salesmen:** 10 (eng 5)
Services: Warehouse

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Factories: C-E Elctrn.; H. Davies Molding; Genisco Technology Corp.; E. F. Johnson Co.; Midwec Corp.; Pamotor, Inc.; Physical Sciences Corp.; Simpson Elec. Co.; Tepro of Fla.; Wanlass Elec. Co.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 4)
Services: Warehouse

Cohasset

MONTAGUE ASSOCS., 404 Jerusalem Rd., (617) 383-0634.
Factories: CBC Ind.; E-Z Way Prod.; Hy-Gain Elctrn.; Regency Elctrn.; Rye Ind.; Shepherd Ind.
Selling To: ★ A,M,D,I. **Salesmen:** 2

Danvers

NORTHEAST ENGRG. INC. (See Hamden, Conn.)

Dover

PIPER ASSOCS., INC., 10 Haven St., (617) 449-1144.
Branches: Box 21, S. Duxbury, Mass., (617) 934-2498; 42 Juniper La., Framingham, Mass., (617) 877-4519.
Factories: Atlas Sound; Audio Dynamics Corp.; Avid/P M & E; Canon U.S.A.; D. Clark Co.; CM Labs; GBC CCTV Corp.; Martel/Uher; Mohawk Wire & Cable; Nexus; Soundolier, Inc.; TelePro; Vega; Video Comp.; Western Magnetics.
Selling To: ★ A,D,I. **Salesmen:** 3
Services: Direct Mail

E. Longmeadow

GERBER SALES CO., INC. (See Waltham, Mass.)

Framingham

CONOVER, C. E. & CO., INC. (See Fairfield, N.J.)

PIPER ASSOCS., INC. (See Dover, Mass.)

Hathorne

MORGAN, C. T., CO., INC., 500 Maple St., (617) 774-3215.
Branch: Ridge Rd., Waterville, Me., (207) 873-4972.
Factories: Athena Contls.; Atkins Technical; Conax Corp.; Coulter Elctrn.; Met-L-Chek Co.; Nuclear Chicago; Parker Res.; Raytek.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Warehouse

Haverhill

LANCER-KNEELAND, INC., 359 Main St., 373-1313.
Factories: Communication Prod.; Electro Fibre-optics; Electro-Mechanisms; Engineered Wire & Cable; Phelps Dodge Elctrn. Prod.; Technology Inst.; Teleproducts, Inc.
Selling To: ★ M,D,I. **Salesmen:** 2

Lexington

BOEING, J. E. CO., INC., 18 Muzzey St., (617) 862-2500.
Branch: 225 Montowese St., Branford, Conn., (203) 488-8301.
Factories: A.C.I., Inc.; Ballastran; Defiance Circuit; Digital Sensors; Electric Indicator; Film Capacitors; Hi-G, Inc.; Skydyne; Tansitor Elctrn.; Tec Magnetics; Vitramon.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 2)

(See Advertisement Page 3251)

COMPONENTS SALES CORP. (See Hartsdale, N.Y.)

INSTRUMENT SALES CORP. (See Hartsdale, N.Y.)

KITCHEN & KUTCHIN, INC., 17 Waltham St., (617) 862-8230. TWX: 710-326-0597.
Branch: 22 Broadway, No. Haven, Conn., (203) 239-0212.
Factories: Airflyte Elctrn.; Amelco Semiconductor; Ammon Inst.; Babcock Elctrn.; Industrial Elctrn. Eng.; Marshall Ind.; Nytronics; Parelco Elctrn.; RCL Elctrn.; Solid State Prod.; Spectrol Elctrn.; Vernitron; Varo;
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 5)

RICHARD PURINTON, INC., 11 Muzzey St., (617) 862-8300. TWX: 710-326-0524.
Factories: Amphenol Div.; North Elec.; Oak Co.; Texas Inst.
Selling To: ★ D,I. **Salesmen:** 7 (eng 7)

STEVENS, K. C. & CO., Box 24, (617) 862-1812.
Factories: ACS Ind.; Bramco Cont. Div.; Datatotal Inc.; Ledex; Miniclutch Co.; National Union Elctrn.; Power Sys.; Walden Elctrn.; Wilmington Cont. Div.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

Longmeadow

BAHR SALES CO., 91 Woodsley Rd., (413) 567-3488.
Factories: Airco Speer Elctrn.; Gavitt Wire & Cable; Precision Elctrn.; Triwec Transformer; Wirecraft Prod. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 1)

Lowell

ZASLOW SALES CO., INC. (See Bloomfield, Conn.)

Lynn

KEENE SALES CO., 156 Broad St., (617) 595-1001.
Factories: Antronic Corp.; Eby Sales; Electra Corp.; Fairchild Recording Equipt.; Jersey Specialty; Loral Distributor Prod.; McMartin Ind.; Midland Intl.; Mueller Elec.; Oaktron Ind.; Recoton Corp.; South River Metal Prod.; Tech Spray.
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 2)

Melrose

CAIN & CO. (See Encino, Calif.)

HATCH, E. B. CO., 43 Upham St., (617) 665-0055.
Factories: Kester Solder; uma Elec. Equipt.
Selling To: ★ D,I. **Salesmen:** 3 (eng 2)
Services: Sales Office Only

Nahart

HART, F. H., 114 Pond St., (617) 581-0381.
Factories: Varflex Corp.; Varflex Sales Corp.
Selling To: ★ I. **Salesmen:** 2 (eng 2)
Services: Engineering

Natick

INSTRUMENT ASSOCS., INC. (See Arlington, Mass.)

GREGORY, G. ASSOC., 7 Erie Dr., (617) 235-9070.
Branch: Cheshire, Conn., (203) 272-5040.
Factories: Airborne Inst. Lab.; Alto Scientific Co.; Boonton Elctrn.; Energy Sys.; Holt Inst. Labs.; Microwave Elctrn. Corp.; Monsanto Elctrn. Inst.; Polarad Elctrn.; Weinschel Engrg.
Selling To: ★ I. **Salesmen:** 6 (eng 4)

ROSEN, G. CO., INC., 563 Worcester Rd., (617) 655-2211. TWX: 710-386-5983.
Branch: 194 Plymouth St., Stratford, Conn., (203) 375-5456.
Selling To: ★ A,M,D,I. **Salesmen:** 5 (eng 4)
Services: Warehouse

Needham

ADDELCO CORP., 56 Pickering St., (617) 444-4754.
Branch: New Haven, Conn.
Factories: Accutronics; American Elctrn. Labs.; Bar-Ray Prod.; Beckman Inst.; C-COR Elctrn.; COHU Elctrn.; Daytronic Corp.; EMI/Whittaker Corp.; Ferranti-Packard Ltd.; Kistler Inst.; Lebow Assocs.; Optimized Devices; Pacific Photometric Inst.; Sage Lab.; Scientific Engrg. & Mfg.; Servo Corp.; Telonic Inst.; United Control; Venus Scientific; Seifert X-Ray; Westinghouse Elec.
Selling To: ★ A,M,D,I. **Salesmen:** 5 (eng 5)
Services: Repair, Warehouse

APPLETON, H. CO. (See Los Angeles, Calif.)

COAKLEY, BOYD & ABBETT, INC., 1424 Highland Ave., (617) 444-5470.
Branch: 6 Gaywood Dr., Waterbury, Conn., (203) 756-8766.
Factories: Argos Prod. Co.; Borden Chemical; Chassis-Trak, Inc.; Chicago Dynamic Ind., Inc.; Connector Corp.; Easy-Up, Inc.; Eimac, Div.; Electro Prod. Labs.; Enterprise Dev. Corp.; Hudsonlamp; Int'l. Elctrn. Sales; Intl. Wire & Cable Co.; JFD Elctrn. Co.; Kulka Elec. Corp.; Petersen Radio; Quam-Nichols; H. H. Smith; Staco, Inc.; Stanwyck Winding; Talk-A-Phone; Turner; Varian Assocs.; Vent-Rak; Weller Elec.; Xcelite.
Selling To: ★ A,M,D,I. **Salesmen:** 9 (eng 3)
Services: Warehouse

GARRETTSON CO., INC. (See Williston Pk., N. Y.)

HARRIS, S. A. CO., 945 Great Plain Ave., (617) 444-4780.
Factories: Centralab; Columbia Elctrn. Cables; Harman Kardon; Master Appliance; Par-Metal Prod.; H. W. Sams; Shure Bros.; Ungar; UTC.
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 2)
Services: Warehouse

KEYCO ASSOCS., INC. (See Farmington, Conn.)

LAVIN, H. ASSOCS., INC. (See Meriden, Conn.)

WEETON, W. E., CO., Box 77, (617) 444-1012.
Factories: Adar; Astrosystems; Calma; Chalco; Data-Ram; Foto-Mem; Gen. Kinetics; Honeywell; Monitor Sys.; Vermont Res.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

WHITE SALES CO., INC., 20 Chestnut St., (617) 444-3676.
Branch: Box 122, Berlin, Conn., (203) 224-0423.
Factories: Adams & Westlake; Autotron; Barber-Colman; Hamlin; Inter-Market; Line Elec.; Post Elctrn. Prod.; Reed Switch Dev.; Resistors; Simmons Fastener.
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)
(See Advertisement This Page)

WILD, J. J., INC. (See Jericho, N. Y.)

Needham Heights

COWPERTHWAIT & BRODHEAD, 570 Hillside Ave., (617) 444-9410.
Factories: Automatic Timing & Contls. Inc.; J. G. Biddle Co.; Instruments, Inc.; RFL Ind.; Trent, Inc.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)
Services: Repair, Standard Lab.

TODINO ENGRG. SALES INC., 50 Kearney Rd., (617) 444-7925. TWX: 710-325-0126.
Branch: 132 New Haven Ave., Milford, Conn., (203) 874-6643.
Factories: Electro-Mech Comp.; Elpac, Inc.; General Inst.; Gulton Ind.; G-V Contls., Inc.; Kelvin; New Product Engrg.; Rotating Comp.; Sage Elctrn.; Scionics; Varo, Inc.
Selling To: ★ D,I. **Salesmen:** 3 (eng 3)

Newburyport

GILWAY SALES CO., Box 584, (617) 465-7568.
Factories: Aerospace Knob Co.; General Sensors; Kessler Ellis Prod.; Sun Dial and Panel Corp.; Stake Fastener Co.; Valor Inst.; Video Color Corp.; Western Indicator Co.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

Newton

HUNTOON, V. J. ASSOC., (See Springfield, Mass.)

NORMELL ASSOCS., 10 Day St., (617) 969-5478.
Factories: Intellux Inc.; Inter-Technical Grp. Inc.; Lear Siegler Inc.; Monolithic Dielectrics; Technitrol; Thermosen. **Services:** Warehouse
Selling To: ★ I. **Salesmen:** 2

Newton Centre

INGBER, L. K. CO., INC., 842 Commonwealth Ave., (617) 332-8574.
Factories: Advance Stamping Co.; Electro Science Labs.; Kurz-Kasch, Inc.; RB&W Industrial Plastics Prods.; Steel Inds., Inc.; SwissTronics.
Selling To: ★ A,M,D,I.

Newton Highlands

COMPAR NEW ENGLAND, 88 Needham St., (617) 969-7140. TWX: 710-335-1686.
Branch: 2357 Whitney Ave., Hamden, Conn., (203) AT 8-9276.
Factories: Amicon Corp.; Components, Inc.; Coron Corp.; Denes; Eagle Signal; Electro Materials Corp.; Electronized Chemical Corp.; Filtors, Inc.; Frequency Electronics; Hecon Corp.; Helipot Div.; Judd Wire Div.; Kilovac Div.; Paktron; Signetics Corp.; Unitrode Corp.
Selling To: ★ I. **Salesmen:** 6 (eng 5)
Services: Warehouse

Newton Lower Falls

NEW ENGLAND COMPONENT SALES, Box 656, (617) 969-9523.
Factories: Jan Hardware Mfg.; Printact Relay Div.; Scientific Components; Tekna Prod.; United Mineral & Chemical.
Selling To: ★ D,I. **Salesmen:** 2

Newtonville

EDCOM, INC., 815 Washington St., (617) 969-9710. TWX: 710-335-6767.
Branch: 965 Dixwell Ave., New Haven, Conn., (203) 624-7291.
Factories: Aetna Mfg.; Angstrohm Precision; Electrovert; EMC Technology; Equipto Elctrn.; Industrial Contls.; Lenape Equip.; McCormick Automatics; Radar Design; Rowe Ind.; Siliconix; Statham Inst.; Technibilt; Texas Crystals; Voltron Prods..
Selling To: ★ M,I. **Salesmen:** 5 (eng 5)
Services: Repair, Warehouse

SEGEL C. CO., Box 106, (617) 969-6900.
Factories: Dialight; Dialtron; Littlefuse; Microtran. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

SCHUFT, H. J. CO., INC., 815 Washington St., (617) 527-5304. TWX: 710-335-6767.
Branch: 865 Dixwell Ave., New Haven, Conn., (203) 865-1365.
Factories: Beckman Inst.; Conrad-Missimers; Data Technology; Elgar Corp.; ITT/Ind. Prod.; Itron Corp.; Power Designs; Rohde & Schwarz; Siliconix; Singer/Ballantine Labs.; Statham Inst.
Selling To: ★ I. **Salesmen:** 6 (eng 6)
Services: Repair, Warehouse

Norwood

PERRON, R. & CO., INC., 159 Morse St., (617) 762-8114. TWX: 710-336-6347.
Branches: 36 Louis St., Trumbull, Conn., (203) 268-9631; 10 Briarwood Rd., Farmington, Conn., (203) 673-4825; 1 Elm St., Dover, N. H., (603) 742-2321.
Factories: Beauchaine; Beede; Dormeyer; Industrial Condenser; Kepco; Mini-Sys.; L. A. Miniature Prod.; Magnecraft; Measurements; Melcor; Multi-Circuits; Shelly Assocs.; Siliconix Inc.; Vidcor.
Selling To: ★ D,I. **Salesmen:** 8 (eng 6)

ROBINSON, R. H. CO. (See Coventry, Conn.)

Northboro

ZASLOW SALES CO., INC. (See Bloomfield, Conn.)

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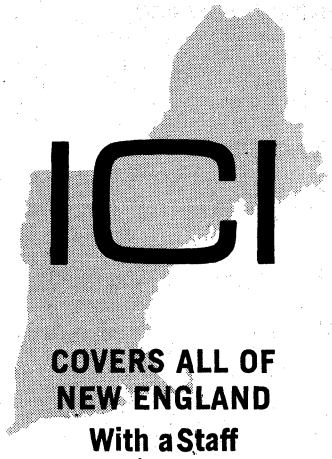

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N. Scituate

HENDRICKSON, W. A. CO., 766 Country Way, (617) 545-0652.
Factories: Blonder-Tongue Labs.; Calcon Mfg.; Cornell-Dubilier Elctrn.; Fidelitone; IRC, Inc.; Mercury Elctrn.; J. W. Miller Co.; RF Sys.; Sonotone Corp.; Turret Elctrn.; UXL.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse, Mailing

Quincy

ADAMS-McGREGOR INC. (See Lincoln, R. I.)

Reading

FEINBERG, J. L. ASSOCS. (See New London, Conn.)

Revere

MANDELL, H. CO., Box 24, (617) 289-3787.
Branch: Box 5473, Hamden, Conn., (203) 248-7441.
Factories: Bradford Components; Dilectron; Heppner Mfg.; Illinois Condenser; Inelco; Mel-Rain; National Tel-Tronics; U.I.D. Elctrn.; Wilco; Woodward-Schumacher Elec.
Selling To: ★ I. **Salesmen:** 3

Scituate

MORTON, G. E., 161 Summer St., (617) 545-0155.
Factories: Hoyt Electrical Inst.; George Risk Ind.; S & D Metal Co.; Gary Wells Co.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

Sharon

REISS, R. S. ASSOC. (See W. Haven, Conn.)

Somerville

NEAR, INC., 99 Highland Ave., (617) 776-2262.
Factories: Amatom Elect. Hdwe.; Cleveland Elctrn.; Davis Elec.; Glasseal Prod.; Grigsby-Barton Inc.; Irish Tape; Quality Transformer.
Selling To: ★ D,I. **Salesmen:** 2

S. Duxbury

PIPER ASSOCS., INC. (See Dover, Mass.)

Springfield

HUNTOON, V. J. ASSOCS. INC., 908 Belmont Ave., (413) 788-8516.
Branch: 272 Centre St., Newton, Mass., (617) 244-5871. TWX: 710-335-0619.
Factories: ADC Prod.; Dexon Inc.; Electro-Mech Inc.; General Semiconductors; M. S. Transistor; F. W. Sickles; Standard Condenser; Sturdilite Prod. **Services:** Direct Mail
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

Sudbury

ARENSTRUP, F. G., 250 Hudson Rd., (617) 443-2992.
Factories: Chem-Fab; Crystal Engrg.; Debcin Co.; Indium Corp.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

I T M ASSOCS., Box 385, (617) 443-8414.
Factories: Applied Perhipheral Sys.; Clary Corp.; Computer Prod.; General Devices; HB Engrg.; Milgo Elctrn.; Qatron Corp.; RF Comm.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

(See Advertisement This Page)

Waban

INSTRUMENT CONSULTANTS, INC., Box 25, (617) 969-9881.
Branch: 2381 Whitney Ave., Hamden, Conn., (203) 248-4174.
Factories: B & K Inst., Inc.; Cunningham Corp.; Datapulse; Julie Res. Labs.; Krohn-Hite Corp.; Matrix Div.; Power/Mate Corp.; Precision Std.; Sangamo Elec.; Singer Metrics; Systron-Donner Corp.; Universal Voltronics Corp.; Zeltex.
Selling To: ★ A,M,I. **Salesmen:** 5 (eng 5)
Services: Repair, Warehouse

(See Advertisement This Page)

INSTRUMENT CONSULTANTS, INC. MICROWAVE DIV., Box 25, (617) 969-3372.
Factories: EMC; Empire Devices; Engelmann Microwave Co.; LogiMetrics; Microdot; Microwave Technology Labs.; Panoramic Div.; Systron Donner Corp.; Texscan Corp.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Repair, Warehouse

Waltham

BURLINGAME ASSOCS., LTD. (See Mt. Vernon, N.Y.)

BROGAN ASSOCS., INC. (See Westbury, N. Y.)

ELECTRONIC COMPONENTS & SERVCS., 611 Trapello Rd., (617) 894-6921.
Factories: Baird-Atomic; F. W. Bell; Buckeye Stamping Co.; Dytronics Co.; Nanmac Corp.; Sprague Elec.; Vari-L Corp.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 1)
Services: Repair, Warehouse

GERBER SALES CO., INC., 176 Second Ave., (617) 891-8040. TWX: 710-324-1937.
Branches: 31 Broadway, New Haven, Conn., (203) SP 7-6279; 26 Maple Ct., E. Longmeadow, Mass., (413) LA 5-3059.
Factories: Aerovox; Alcoswitch; Alpha Wire Corp.; Amperex Elctrn.; Chicago Miniature Lamp Works; Duncan Elctrn.; IMC Magnetics Corp.; Millen Mfg.; Sarkes Tarzian; Standard-Grigsby; United Transformer. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 10 (eng 10)

(See Advertisement Page 3253)

J & J ASSOCS., INC., 225 Crescent St., (617) 899-0160. TWX: 710-324-6356.
Branches: 953 Dixwell Ave., Hamden, Conn., (203) 624-7800; 29 Carriage Dr., Thompsonville, Conn., (203) 749-4421.
Factories: Chronetics, Inc.; Cimron; Enclosure Corp.; Hybrid Sys.; Inet Power; K&M Elctrn.; Kennedy Co.; Microdyne Inst.; Raytheon Computer; Teledyne Telemetry; Test Equipt.; Wavetek.
Selling To: ★ M,I. **Salesmen:** 6 (eng 6)
Services: Repair

TECHNICAL ENTERPRISES, 181 West St., (617) 891-5300.
Factories: Atec, Inc.; Austron, Inc.; Nus Corp.; Sierra Elctrn. Oper.; Tracor, Inc.
Selling To: ★ A,M,I. **Salesman:** 1 (eng 1)
Services: Repair

TOOLS FOR ELECTRONICS, Box 173, (617) 894-7080.
Selling To: ★ A,M,D,I. **Salesmen:** 5 (eng 2)
Services: Repair, Warehouse

Wakefield

DENNING ASSOCS., Box 491, (617) 245-4986.
Branch: Box 475, E. Orange, N. J., (201) 673-7959.
Factories: Carstedt Res.; Permanent Magnet Co.; Infinetics, Inc.; Del-Val Plastics.
Selling To: ★ I. **Salesmen:** 2 (eng 2)
Services: Sales Office

INSTRUMENT DYNAMICS INC., Wakefield Ind. Pk., (617) 245-5100. TWX: 710-348-0428.
Branch: 345 N. Main St., W. Hartford, Conn., (203) 233-5503.

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Selling To: ★ M,I. **Salesmen:** 8 (eng 8)
Services: Repair

KAELBER & MACK INC. (See Manhasset, N.Y.)

MEASUREMENT EQUIPT. CO., INC., 591 North Ave., (617) 245-4870. TWX: 710-348-6717.
Branch: Box 8192, E. Hartford, Conn., (203) 528-8192.
Factories: ACDC Elctrn.; Burr-Brown Res.; CM²; Edo-Western; Jerrold Elctrn.; Printed Motors; Sage Labs.; Theta Inst.; Transformer Elctrn.; Western Microwave Labs.; Whittaker Inst.
Selling To: ★ M,I. **Salesmen:** 5 (eng 4)
Services: Warehouse, Direct Mail

Wellesley

JANSE, E. A., ASSOCS., 892 Worcester St., (617) 235-1623.
Factories: A & M Inst.; American Elctrn.; Deltron, Inc.; Dynacool Mfg.; Midwest Circuits; Sanders Assocs.; Ultra-Courtland Mfg.
Selling To: ★ M,I. **Salesmen:** 3 (eng 1)

MAHAN, R. P., 572 Washington St., (617) 237-1040.
Branches: Hopkins Rd., Watertown, Conn., (203) 274-2363; Box 506, Newtown, Conn., (203) 426-5910.
Factories: Abrams Inst.; Borg-Warner; Conductor-lab; Dzus Fastener Co.; Erdle Perforating; Holex, Inc.; Kent Corp.; L. Frank Markel & Sons; Polyphase Inst.; Milton Ross; Scanbe Mfg.; Western Elec.
Selling To: ★ I. **Salesmen:** 5

Wellesley Hills

JOHNSON ASSOC., INC., 471 Washington St., (617) 235-3977.
Branch: 121 Thimble Island Rd., Stony Creek, Conn.
Factories: Barker & Willaimson; Chicago Etching; Colorado Hickok; Empire Scientific; Hallicrafters Co.; Hickok Electrical Inst.; Milwaukee Resistor; New Tronics Corp.; Pearce Simpson Co.; Sherwood Elctrn.; Superex Elctrn.
Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 4)
Services: Warehouse

SCOTT, M. CO., INC., 20 Walnut St., (617) 235-0102.
Factories: British Ind.; Bogen Comm.; Electro-Voice Inc.; Eico Elctrn. Inst.; Erie Technological Prod.; Essex Wire Corp.; Gray Hill Inc.; Grayhill Moldtronics Inc.; 'Int'l. Rectifier; Kings Elctrn.; North American Philips; Pickering & Co., Inc.; Telex Comm.
Selling To: ★ A,M,D,I. **Salesmen:** 8 (eng 4)

STURDY, R. H. CO., INC., 204 Worcester St., (617) 235-2330. TWX: 710-383-6519.
Factories: Analogic Co.; Collins Radio; Controls Res.; Coral Magnetics; Dynamics Res.; Electronic Arrays, Inc.; Matrix Science; Mite Corp.; Poly-Optics, Inc.; Pulse Engrg.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Direct Mail

W. Concord

SALES ENGRG. CO., Baker Ave., (617) 369-3943.
Branch: Hartford, Conn., (203) 247-4015.
Factories: Bristol Co.; Guardian Elec. Mfg.; MSL-Howard Ind.; Molex Prod. Co.; P. M. P. Co.; Sealectro Corp.; Transitron; Vocaline Co.; Wakefield Engrg. **Services:** Direct Mail
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)

W. Newton

DARBURY CORP., 437 Cherry St., (617) 244-2053. TWX: 710-325-6758.
Factories: Clifton Precision Prods.; Litton Computer Prod. **Services:** Repair, Warehouse
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

PETTIGREW, R. S. & CO. (See W. Hartford, Conn.)

Weston

GOODE, J. J. ASSOC., 44 Ledgewood Rd., (617) 235-3900.
Factories: Alberox Inc.; Cambridge Scientific Ind.; Kavlico; Torotel.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

Wilmington

TECHNICAL INSTRUMENTS, INC., 122 West St., (617) 944-3930.
Branch: 575 Broad St., Bridgeport, Conn., (203) 368-4582.
Factories: Blackstone Ultrasonic; Advanced Technology & Sys.; Crimpco Engrg.; Eubanks Engrg.; Henes Mfg. Co.; Instrumentation Amplifiers & Supplies; Ingersoll Prod.; McLean Engrg. Labs.; Optic-Aire Sys.; Sandifur Engrg.; Tyco; Valid Imagineering; Wanlass Elec.; Watkins; Weldmatic Unitek. **Services:** Repair
Selling To: ★ I. **Salesmen:** 8 (eng 5)

Winchester

HOOKER, S. C., INC., 2 Winchester Pl., (617) 729-5482. TWX: 710-348-1067.
Branch: Box 369, W. Hartford, Conn., (203) 233-8000.
Factories: Bulova Watch Co.; Caddock Elctrn.; H. H. Hilton; Minerva Elctrn. Ind.; Potter Co.; Premier Microwave; Stackpole Carbon; Tapecon; Voltronics.
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 4)

MICHIGAN

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DAILY, R. G. CO., 2801 S. State, (313) 668-6908.
Factories: Amos Molded Plastics; Atlas Plastics; Camfield Fiberglass Plastics; G. Morroll Corp.; Quick Plastics; Vermilion Foam Prod.
Selling To: ★ I. **Salesmen:** 3 (eng 1)

Benton Harbor

WHITESELL, R. O. ASSOCS. (See Indianapolis, Ind.)

Birmingham

COMPONENTS/INSULATION (See Cleveland, Ohio)

ELECTRO-MATION ASSOCS., 1137 Cole St., (313) 564-6517.
Factories: Associated Res., Inc.; Communication Measurements; Corning Glass; Delavan Mfg.; Discon Corp.; Dolan-Jenner Ind.; Electro Prod. Labs.; Indikon Co.; Infrared Contl. Sys.; Jordan Contls.; Lion Res. Corp.; Nuclear Chicago; Seneca Falls Machine; Veeder Root.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)
Services: Repair, Warehouse

OEM Sales Co., Box 68.
Factories: J. C. Dolph; GPS Inst.; Newark Brush Co.; Vacuum Ceramics, Inc.
Salesman: 1

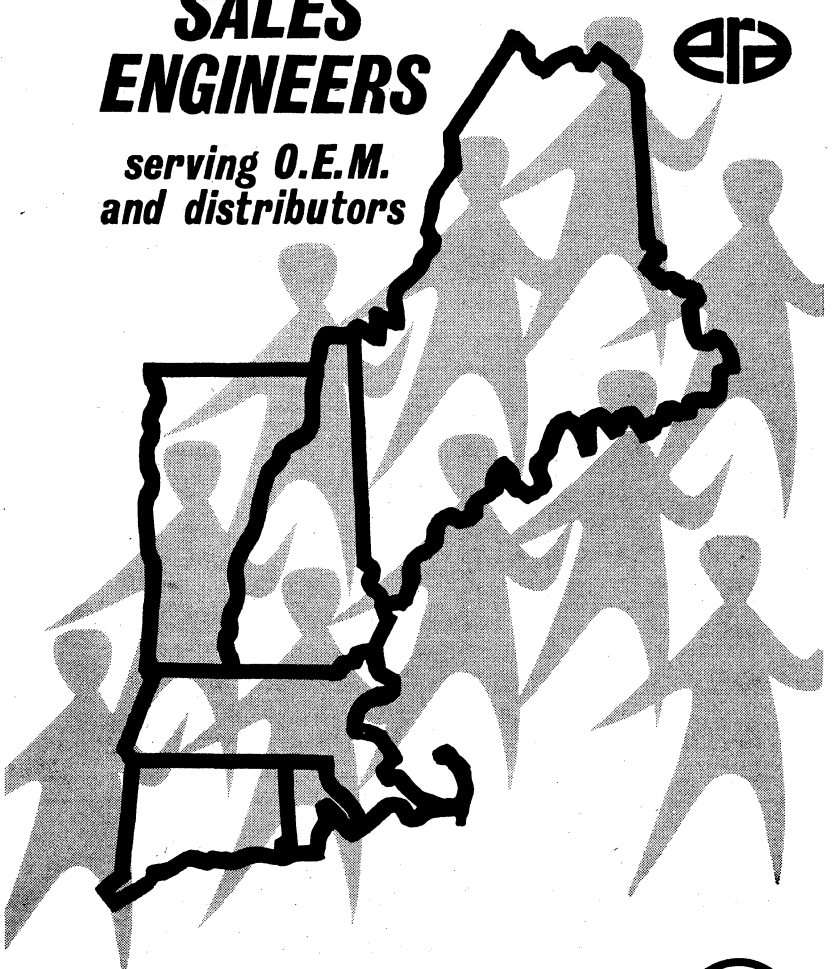
Buchanan

RILEY & PETCHELL SALES, INC. (See Detroit, Mich.)

Dearborn

ANGER ASSOCS., INC., 13126 Michigan Ave., (313) 584-9853.
Branches: 10926 S. Western Ave., Chicago, Ill.,

10 SALES ENGINEERS
serving O.E.M. and distributors



Gerber Sales CO., INC.
Established 1920

Waltham, Mass.
176 Second Ave.
(617) 891-8040

E. Longmeadow, Mass.
24 Maple Court
(413) 525-3059

New Haven, Conn.
29 Whalley Ave.
(203) 777-6279

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(312) 233-2214; 21139 Lorain Rd., Lakewood, Ohio, (216) 333-4180; 3605 N. Dixie Dr., Dayton, Ohio, (513) 278-8311.
Factories: Agac-Derritron; Alpha Scientific; Avco Corp., Tulsa Div.; Bethlehem Corp.; Barnes Engrg.; Edwin Ind.; Geotel; Granville-Phillips; Hastings-Raydist; Ideal-Aerosmith; Librascope Div.; Link Group; Texas Inst.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)

VILLANI-PITCHER, INC., 20233 Ann Arbor Trail, (313) 271-4600. TWX: 810-221-7003.
Factories: Bourns, Inc.; Chicago Miniature Lamp; Licon Div.; PIC Design; Varo, Inc.; Zero Mfg.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)
Services: Warehouse

Detroit

ABM SALES, 10116 Puritan Ave., (313) UN 2-1300.
Factories: Eldema; E. F. Johnson; Langevin; Merit Coil & Transformer; Mura Corp.; Reeves Soundcraft; Sprague Prod.; Victoreen Inst.; University Sound. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 2)

BURCAW CO. & ASSOCS., 18236 W. McNichols Rd.
Factories: Audio Devices; Beede Electrical Inst.; Bell PA Prod.; CTS Knights; Dale Elctrn.; Hammarlund Mfg.; International Wire & Cable; Jerrold Elctrn.; Lowell Mfg.; Meson Elctrn.; Rockford Special Furniture; Sightmaster Cord.
Selling To: ★ A,D,I, Commercial Sound
Salesmen: 3

DICKELMAN, L. H. CO., 13331 Puritan St., (313) 273-0806.
Branch: 28829 Chagrin Blvd., Cleveland, Ohio, (216) 831-1039.
Factories: Allied Cont.; Carlyle Johnson Machine; Farmer Elec. Prod.; Gordos Corp.; Helwig Carbon Prod.; Landis & Gyr, Inc.; Lee Spring Co.; Rustrack Inst. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 4 (eng 2)
(See Advertisement This Page)

DRURY, D. W., 16621 Mark Twain, (313) 836-3732.
Selling To: ★ I. **Salesmen:** 2 (eng 2)
Services: Development

ELECTRO SALES ASSOC. (See Cleveland, Ohio)

ERNEST, R. D. ASSOCS. INC., 12818 Puritan Ave., (313) UN 1-7311.
Factories: Betatronics; Bliss-Eagle Signal; R. B. Denison, Inc.; Edon Ind. Prod.; Electro-Mechano; Fast Heat Mfg.; Montgomery Mfg.; D. P. Mossman; Photomation.
Selling To: ★ D,I. **Salesmen:** 5 (eng 3)
Services: Repair, Warehouse

GARDNER, R. M. CO., 26940 Lyndon St., (313) KE 1-1658.
Factories: Continental Wire & Cable Corp.; Kulka Elec.; Mercury Elctrn.; Tork Time Cont.
Selling To: ★ M,D,I. **Salesman:** 1

HILLTRONICS, INC., 13720 Puritan Ave., (313) 342-3242. TWX: 810-243-4069.
Factories: Agastat Div.; Augat, Inc.; Basler Elec.; Burroughs; Curtis Dev.; E-T-A Prod.; Clairex Elctrn.; Electro Switch; Fenwal Elctrn.; General Radio; Mueller Elec.; Potter & Brumfield; Ripley Co.; Syntron Co.; United Mineral & Chemical; Vitramon. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)

LOHMANN, R. S. CO., 19326 W. McNichols, (313) 535-6144.
Factories: Custom Components; J F D Elctrn.; Sentry Mfg.; Skottie Elctrn.; Slater Elec.; Vishay Resistor Prod.
Selling To: ★ M,D,I. **Salesman:** 1

LOWRY DIETRICH CO. (See Pittsburgh, Pa.)

MERCHANT, R. C. & CO., INC., 18411 W. McNichols Rd., (313) 535-6000.
Branch: 505 Pleasant St., St. Joseph, Mich., (616) 983-7378.
Factories: All Star Prod.; Centralab; Dialight; Kemet Div.; Littelfuse; Pamotor; Phalo Corp.; Simpson Elec.; Sola Elec.; Switchcraft, Inc.
Selling To: ★ A,M,D,I. **Salesmen:** 6 (eng 5)

MILSK, R. CO., 19375 James Couzens Hwy., (313) 342-6660.
Branches: 200 N. Division Ave., Grand Rapids, Mich., (616) 451-0615: 2511 E. 46th St., Indianapolis, Ind., (317) 546-5468; 212 Republic Bldg., Indianapolis, Ind., (502) 585-4880.
Factories: Aerovox Corp.; Astatic Corp.; Atlas Sound Div.; Eico Elctrn.; JFD Elctrn.; Kurz-Kasch; Lectrotech; McMartin Ind.; Howard W. Sams; Soundolier; Ungar Elec. Tools; Waber Elctrn.
Selling To: ★ A,D,I. **Salesmen:** 10
Services: Warehouse

MOORE SALES CO., 401 Margaret W., (313) 883-0218.
Factories: Alrad Corp.; Erie Technological Prod.; Graylock Elctrn.; International Elctrn. Sales; Micro-Com Elctrn.; Parker Metal Goods; Securo-Guard Elctrn.; Vokar Prod.
Selling To: ★ A,D. **Salesman:** 1

RILEY & PETCHELL SALES, INC., 16515 Schoolcraft Ave., (313) 838-9100.
Branch: 401 Chippewa St., Buchanan, Mich., (616) 695-6356.
Factories: Barker Prod.; Bauer Elctrn.; Bogen Comm.; Calcon Mfg.; Concord Comm.; Dynaco, Inc.; Electro-Voice; Fleetwood; Gamber-Johnson; Krylon; Magnacord; Metal Works; Mosley Elctrn.; S&A Elctrn.; Telex Corp.; Viking Tape Recorders.
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 1)
Services: Direct Mail

SCHMIDT, C. H. CO., 16405 W. Eight Mile Rd., (313) BR 3-8500.
Factories: American Radionic; Ardmore Prod.; Beckley Perforating; Engelhard Minerals & Chemical; Heppner Mfg.; C. O. Jelliff Corp.; Positive Connector; Resol Mfg.; Rodney Metals; Turbo Cast Ind.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 1)
Services: 1200 sq. ft. office space

SHAFFER, G. CO., 16530 Greenview Rd., (313) 535-8448. **Services:** Warehouse
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

TECHNITRON INSTRS., INC. (See N. Olmstead, Ohio)

THORPE, J. M. CO., 640 Hidden Lane, (313) 884-4360.
Factories: Bud Radio, Inc.; Bureau of Engraving; Dynage, Inc.; Memcor Div.; Regray Ind.; Scanbe Mfg.; Triad Div.; Wall Mfg.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)

TEPLITZ, H. & CO. (See Dayton, Ohio)

WKM ASSOCS., INC., 1474 E. Outer Dr., (313) 892-2500. TWX: 810-243-4110.
Selling To: ★ M,I. **Services:** Repair

Farmington

ANDERSON, ELCTRN., INC., 30785 Grand River Ave., (313) 476-9161.
Factories: Bytrex; Cipher Data Prod.; Data Device; Datascan; Doric Scientific; Eldorado Elctrn.; Flo-Tron; General Resistance; Information Inst.; Lockheed Elctrn.; Measurement Control Devices; Schaevitz Engrg.; Tenney Engrg.; Theta Inst.; Trygon Elctrn.; Trymetrics; Unholtz-Dickie.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

CARTER, McCORMIC & PEIRCE, INC., 23995 Freeway Park Dr., (313) 477-7700. TWX: 810-242-2986.
Branches: 3691 Lee Rd., Cleveland, Ohio, (216) 921-1360; 3406 N. Main St., Dayton, Ohio, (513) 278-5873. TWX: 810-459-1613; 201 Penn Center Blvd., Pittsburgh, Pa., (412) 824-3760.
Selling To: ★ M,I. **Salesmen:** 10 (eng 6)
Services: Repair

Ferndale

SHALCO, INC., 23529 Woodward Ave., (313) 547-4771. TWX: 810-232-1514.
Branch: 5364 Kimball Ave. S.E., Grand Rapids, Mich., (616) 243-7607.
Factories: Alpha Wire; H. H. Eby Co.; Electrovert; Frazier, Inc.; IRC; James Elctrn.; Kulka Elec. Corp.; LPS; Loral Dist. Prod.; Newcomb Audio Prod.; Norelco; Risk Ind.; H. H. Smith; Thordarson Meissner; Trimm, Inc.
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 3)

TIBY CO. (See Cleveland, Ohio)

Grand Rapids

MILSK, R. CO. (See Detroit, Mich.)

REICHOLD ASSOCS., 14 Weston St. S.E., (616) 459-4445.
Factories: Douglas Randall; Filtron Inc.; Hi-Temp Wire; Hamlin Inc.; Milwaukee Transformer; Pho-Tronics; Scot Inc.
Selling To: ★ M,D,I. **Salesmen:** 2

SHALCO, INC. (See Ferndale, Mich.)

Grosse Ile

MILLER & MILLER, Box 36, (313) 386-0900.
Factories: Bodine Elec.; Hilliard Corp.; Miniclutch Co.; Uppco Inc.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

Jackson

JORDAN, E. H. & ASSOC., INC., 2024 Glen Dr., (517) 782-0694.
Branch: 6811 Grosvenor Pl., Indianapolis, Ind., (317) 632-3321.
Factories: Connector Corp.; Electrical Utilities Co.; Microwave Devices Div.; TRW Elctrn. Components Div.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 2)

Lathrup Village

NORDSTROM, R. C. & CO., Box 32, (313) 444-4417. TWX: 810-232-4928.
Factories: Bramco Controls; Comar Elec.; Ledex; Paktron; Precision Metal Prod.; Resistance Prod.; Spectrol Elctrn.; Texas Inst.; Vernitron Corp.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

SHERIDAN ASSOCS., INC. (See Cincinnati, Ohio)

Middleville

SHARP, F. R. CO., INC. (See Cleveland, Ohio)

Mt. Clemens

BRUST, C. K., Box 182, (313) 463-7386.
Factories: American Dynamics; Armament Comp.; Dumont Aviation; Linco Prod.; Microplus; Stand-and Armaments. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)

MAHER ENGRG. CO. (See Des Plaines, Ill.)

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MEMBER OF THE MICHIGAN CHAPTER

L. H. Dickelman Company

DETROIT, MICHIGAN 48227
13331 Puritan Ave.
313—273-0806

CLEVELAND, OHIO 44122
28829 Chagrin Blvd.
216—831-1039

Oak Park

SPENSER, W. CO., 21500 Greenfield Rd., (313) 398-8005.
Branch: 3238 Curry Ave., Windsor, Ont., Canada, (519) 969-1332.
Factories: Control Knobs; Grand Transformers; Grayline; Industrial Devices; Metallics, Inc.
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 2)

Plymouth

FLORA, J. M. INC., 165 W. Liberty, (313) 453-4296.
Factories: Amplivox; Barzilay; Broadmoor; Certron; Concord; Garrard; JBL; Multicore; Permapower; Raytheon; Robins; Sherwood; Shure; Sonar; Wharfedale.
Selling To: ★ A,D,I. **Salesmen:** 5 (eng 2)
Services: Warehouse, Direct Mail

Royal Oak

COZZENS & CUDAHY, INC. (See Rosemont, Ill.)

SATULLO CO., 4514 N. Woodward, (313) 549-3910.
Branches: 16801 Euclid Ave., Cleveland, Ohio, (216) 486-2800; 2801 Far Hills Ave., Dayton, Ohio; 530 Sixth Ave., Pittsburgh, Pa., (412) 931-5200.
Factories: J. G. Biddle; Compu Dyne; Conrad Missimers; Electronic Modules Corp.; Equipto Elctrn.; Green Inst.; Hastings Raydist; Kepco; Lewis Engrg.; Erik A. Lindgren & Assoc.; London Co.; Magnecraft; Midwestern Inst.; Monsanto Co.; Neff Inst.; Pyrofilm Resistor; Skydyne.
Selling To: ★ M,I. **Salesmen:** 5 (eng 2)
Services: Repair, Warehouse

VOGT, M., 2817 Bamlet Rd., (313) 549-3355.
Factories: Audio Designs & Mfg.; Chassis-Trak; Fairchild Recording Equipt.; Gotham Audio Corp.; Int'l. Electro-Magnetics; Pulse Techniques; Poxy-Lube, Inc.; Scully Recording Inst.; Vent-Rak, Inc.
Selling To: ★ A,M,D,I. **Salesman:** 1 (eng 1)
Services: Warehouse

St. Joseph

R. C. MERCHANT & CO., INC. (See Detroit, Mich.)

Southfield

CARRIER & GABLE, INC., 15565 Northland Dr., (313) 444-8980.
Factories: Aerovox; Rotron.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

G. & H. SALES CO. (See Cincinnati, Ohio)

MONTGOMERY, J. L., INC., 24001 Southfield Rd., (313) 358-2616.
Factories: Better Coil & Transformer; CTS Corp.; Chicago Switch Div.; Circuitron; Diodes Inc.; Keystone Carbon; National Semiconductor; Rogan Bros.; Stewart-Warner; Wakefield Engrg.
Salesmen: 3

STERLING, S. CO., 21250 10½ Mile Rd., (313) 357-3700.
Branches: 5827 Mayfield Rd., Cleveland, Ohio, (216) 442-8080; 2673 Culver Ave., Dayton, Ohio, (513) 298-7573; No. 2 Pkwy. Center, Pittsburgh, Pa., (412) 922-5720; No. 2 Talcott Rd., Ste. 32, Park Ridge, Ill., (312) 775-7883; 11734 Lackland Industrial Dr., St. Louis, Mo., (314) 542-3636.
Factories: Ampex; Alfred; Beckman; Baldwin-Lima-Hamilton; Century; Cohu; Curry-McLaughlin & Len; Dana Lab; Data Disc; Daytronic; Delta Design; Di/An; Digitronics; Ellis; Flow; Ingersoll; Industrial-Electronetics; Invac; Kennedy; Lebow; Ling; Microdot; Potter Aeronautical; Power Instruments; Pyro; PRD; Reaction Instruments; Sorensen; Singer Metrics (EMC Empire, Panoramic, Gertsch, Sensitive Research); Texas Instruments; Time/Data; Thermotron; United Systems; Varian/Data; Watkins-Johnson; Wayne Kerr.
Selling To: ★ A,M,D,I. (eng 20)
Services: Repair

WHITESELL, R. O. & ASSOCS. (See Indianapolis, Ind.)

Ypsilanti

OHIO INSTR. CO. (See Worthington, Ohio)

MINNESOTA

Anoka

AEROL ASSOCS., INC. (See Jericho, N.Y.)

Hopkins

HAMILTON, GRAYDEN & FLEMMER, INC., Hamilton Rd., (612) 941-1120. TWX: 910-576-2861.
Selling To: ★ M,I. **Salesmen:** 3

Minneapolis

ANDERSON, B. & ASSOCS., INC. (See Chicago, Ill.)

ANDERSON, J. E. M. CO., 5231 Humboldt Ave. S., (612) 823-6459.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 1)
Services: Repair, Warehouse, Direct Mail

APPLETON, H. CO. (See Los Angeles, Calif.)

BARD ASSOCS., INC. (See La Grange, Ill.)

BOHLIG, C. E. CO., Box 16095, (612) 922-7011.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

CARLSON ELECTRONIC SALES (See Chicago, Ill.)

COMPAR TWIN CITIES, Box 16095, (612) 922-7011.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

COZZENS & CUDAHY, INC. (See Rosemont, Ill.)

ELECTRIC SALES CORP., 9 E. 22nd St., (612) 335-7734. TWX: 910-576-2755.
Selling To: ★ I. **Salesman:** 1

ELECTRONIC APPARATUS CO., Box 7403, (612) 588-1752. **Services:** Repair
Selling To: ★ I,Research Labs. **Salesman:** 1 (eng 1)

FISHER SALES, INC., 4820 W. 77th St., (612) 920-6577. TWX: 910-576-2712.
Factories: Bogen Comm.; Certron Corp.; Electro-Voice; Garrard; Int'l. Rectifier; Jerrold Elctrn.; Lowell Mfg.; Magnecord; Multicore; Telex Comm. Div.; Thordarson Meissner; Viking; Wharfedale.
Selling To: ★ A,D,I. **Salesmen:** 3
Services: Warehouse

FOSTER, M. CO., INC., 228 S. Cedar Lake Rd., (612) FR 4-2612.
Factories: Astatic Corp.; Augat, Inc.; Bourns; Chicago Dynamic Ind.; Kurz-Kasch; Littelfuse; Nytronics; Pamotor; Phalo Corp.; Quam-Nichols; Simpson Elec.; Switchcraft; Vactec; Weckesser Co.; Wood Elec. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 5 (eng 1)

GIBB, C. R. CO., 1311 W. 25th St., (612) 377-1200.
Selling To: ★ A,D,I. **Salesmen:** 4

GRANT SALES CO., 1415 S. Second St., (612) 332-6955.
Factories: Controls Co.; Ronk Elect. Ind.
Selling To: ★ I. **Salesman:** 1 (eng 1)
Services: Warehouse

GREEN, L. F. ASSOCS. (See Chicago, Ill.)

HMR, INC., 9 E. 22nd St., (612) 335-7734. TWX: 910-576-2755.
Selling To: ★ A,M,D,I. **Salesmen:** 6 (eng 5)

HASSE & ASSOCS., INC., 3825 York Ave., N. (612) 588-0551.
Factories: Anderson Labs.; Chassis-Trak; Crate-Rite; Eastern Air Devices; Film Capacitors; MM Elctrn Enclosures; Markite Corp.; Omtronics Mfg.; Sealectro; Senflex; U. S. Components; Vent-Rak; Vitramon.
Selling To: ★ I, **Salesmen:** 3

HEIMANN CO., 5603 Lyndale Ave. S., (612) 827-5457.
Branch: 236 7th Ave. N., Fort Dodge, Iowa, (515) 576-2374.
Factories: Audio Devices; Beauchaine & Sons; Birtcher Corp.; Carter Precision Elec.; Clairex Elctrn.; Cornish Wire; Edal Ind.; Hallmark Std.; JBT Inst.; JFD; Life Inst.; National Tel-Tronics; Roback; Rustrak Inst.; Triplett; Weston-Lexington Div.; Weston & Stack. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 2)

HILL, F. B. CO., 6110 Excelsior Blvd., (612) 929-6727. TWX: 910-576-2924.
Selling To: ★ D,I. **Salesmen:** 4 (eng 1)

HOLDEN, H. A., 1208 Harmon Pl., (612) 336-5353.
Factories: Helwig Carbon Prod.; Insulation Mfgs.; Potter & Rayfield.
Selling To: ★ I. **Services:** Warehouse

KIRKEBY & ASSOCS., INC. 821—2nd Ave. N., (612) 377-3239.
Factories: Acopian; Acra Electric; Digital Inst.; Electronic Devices; IRD; Mechanical Prod.; Princo; Trimm, Inc.; Ward Leonard Elec.; West Inst. Corp.; Xcelite. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 3 (eng 1)

LAUB, N. J. Co., 3749 W. Broadway, (612) 588-4663.
Factories: Antenna Specialists; Carl Cordover Co.; Hickok Electrical Inst.; Petersen Radio; Stancor.

LEE, J. CO., 4241 S. Toledo Ave., (612) 920-1525.
Factories: CTS Knights; Gefco Mfg. Corp.; Hudson Lamp Co.; Luxo Lamp Corp.; D. Riemer Co.; Transistor Sys.; Wald Sound.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse, Direct Mailing

LEE-NOONAN CO., 4575 W. 77th St., (612) 920-7851.
Factories: American Saw & Mfg.; Atlas Ind.; Buchanan Electrical Prod.; Carlon Prod.; ITT Blackburn; John I. Paulding; Victor Specialties.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 1)
Services: Warehouse

MARSHALL, R. W. CO., 6106 Excelsior Blvd., (612) 929-0457.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 2)

MARSLAND ASSOCS., INC. (See Des Plaines, Ill.)

MEYERS, K. W. CO. (See Chicago, Ill.)

MURPHY, L. F. & ASSOC., INC., 730 Chicago S., (612) 333-4511. TWX: 910-576-3417.
Selling To: ★ I. **Salesmen:** 4

NELSON & SON, 4005 W. 65th St., (612) 920-3414.
Factories: Globe Inds.; Groov-Pin Corp.; Rhodes, M. H., Inc.

NELSON, W. K., 807 13th Ave. S., (612) 333-7203.
Factories: Bendix Corp.; Farrand Conts.
Selling To: ★ I. **Salesmen:** 4 (eng 3)

NORTHERN STATES SALES CO., 1109 W. 78½ St., (612) 866-3468. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 1)

PELLETIER, M. J. CO., 403 Napco Ave. N., (612) 332-4369.
Factories: Barrett Mfg.; Chase & Sons; Elec'l Fittings; Ilsco Corp.; Midwest Elec. Prods.; Whitney Blake Co. **Services:** Warehouse
Selling To: ★ D, I. **Salesmen:** 3 (eng 1)

PETERSON, F. CO., 4501 Minnetonka Blvd., (612) 927-4453. TWX: 910-576-2835.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

PINKNEY & ASSOCS., INC., 957 Winnetka Ave. N., (612) 544-3628.
Factories: Dresser Controls; Dynisco Div.; Esterline Angus Div.; Fairchild Environmental Sys.; Halmar Elctrn.; Magnetic Products Oper.; Pyrometer Inst.; Vishay Resistor Prod.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)
Services: Repair

PIVAN ENGRG. CO. (See Chicago, Ill.)

R-J SALES & ENGRG., 7100 S. France Ave., (612) 922-1425. TWX: 910-576-3411.
Factories: Computer Inst.; Daven Co.; Hamlin Inc.; Intl. Inst.; UID; Universal Voltronics; Technipower. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

RIDGWAY ASSOCS., INC. (See Chicago, Ill.)

RIPLEY, R. & ASSOCS., 11040 Goodrich Circle, (612) 881-8282.
Factories: Acoustone; Columbia Elctrn Cable; Component Specialties; Cornell-Dubilier; Easy-Up; Eico; El-Rad Mfg.; Robins Ind.; Unger Elec. Tools.
Selling To: ★ A,M,D,I. **Salesmen:** 2

ROUZER SALES CO., 2355 Louisiana Ave. N., (612) 544-3145.
Factories: American Switch; Apex Wire & Cable; Circle F Ind.; Eastern Ins. Wire; Ettco Wire & Cable; ExCel Wire & Cable; Gem. Elec. Mfg.; Holub Ind.; Steelduct; M. Stephens Mfg.
Selling To: ★ D,I. **Salesmen:** 2
Services: Warehouse

SCIENTIFIC SALES CORP. (See Chicago, Ill.)

SMITH, H. P. CO., 224 W. Franklin Ave., (612) 335-8911.
Factories: S. H. Couch Co.; Heinemann Elec.; Voltron Prod.
Selling To: ★ I. **Salesman:** 1

STEMM, R. E., INC. (See Addison, Ill.)

SYSTEMS ENGRG. ASSOC., 8633 Harrison S., (612) 881-6386.
Factories: Analog Devices Inc.; Atec Inc.; Cal Inst.; CEA Div.; Cimron Div.; Computer Comm.; Elctrn. Assoc.; Flo-Tron; S. Himmelstein; Ind. Electronics Corp.; Info Inst.; Matrix Corp.; Micro Test; Peripheral Equip.; Remex Elctrn.; RF Comm.; Sangamo Elec.; Shepard Labs.; Technirite Elctrn.; Theta Inst.; Todd Prod.; Transducers Inc. **Services:** Repair, Warehouse
Selling To: ★ M,I. **Salesmen:** 10

TEC SALES, 9906 Chicago Ave. S., (612) 884-1180.
Factories: All-tronics; Artisan Elctrn.
Selling To: ★M,I. **Salesman:** 1 (eng 1)

WARNER, A. J., 4927 34th Ave. S., (612) 729-7371.
Factories: Buckeye Stamping Co.; Carter Motor Co.; Clarostat Mfg.; Electro Products Labs.; General Inst.; Photomation, Inc.; Potter and Brumfield; Soundolier, Inc.
Selling To: ★ A,D,I, **Salesmen:** 3

WENCO SALES, INC., 7728 Morgan Ave. S., (612) 866-3639.
Factories: Beede Elec. Inst. Co.; Bulova Watch Co.; Chicago Min. Lamp; ETA Products; Geanini Voltex; Gordos Corp.; IMC Magnetics; Licon; Presin Co.; Thermalloy Co.; Tri Point Ind.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

WHITMORE ASSOCS., INC. (See Chicago, Ill.)

St. Paul

COUNTRYMAN ASSOCS. CO., 1821 University Ave., Ste. 220 S., (612) 645-9151. TWX: 910-563-3564.
Factories: Alco Elctrn.; Capco Capacitors; Bussco; Elco; Elctrn. Molding; Elctrn. Specialty; Electrovert; Genisco; Electro Connective Sys.; Hill Elctrn.; Industrial Tech.; Infinetics; Michigan Magnetics; Mossman-Elliott; National Radio; Pacific Resistor; Philamon; Primec; Sonotone; Sunbank; Systems Enclosures; Thermal Circuits; Tingstol; Varadyne; Voltronics.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 1)
Services: Warehouse, Direct Mailing

CULLEN, H. A. & ASSOCS., 1595 Selby, (612) 646-7371. TWX: 910-576-2740.
Factories: Acme Elec.; Acton Labs; Admiral Conts. Inc.; Bowmar Inst.; Gulton Ind.; JPM Co.; Jarry Elctrn.; Memcor; Scanbe Mfg.; Technology Inst.; Tansitor Elctrn.; Torotel.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

DeBECK ASSOC., INC., 2119 Grand, (612) 690-1557.
Factories: Accutronics; Astro-Science; Chronolog; Craig Sys.; Canoga Elctrn.; Digital Devices; Information Displays; Kato Engrg.; Librascope Div.
Selling To: ★ I. **Salesman:** 1 (eng 1)

ENGELBRETSON, W. CO., 906 Ottawa Ave., (612) 222-2338.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 1)

HEYDA, B. CO., 3830 Rustic Pl., (612) 484-8531.
Factories: Amco Eng.; Barnes Corp.; Controls Res.; Control Switch Div. CCA; Mac Panel; Technical Wire Prod.
Selling To: ★ M,D,I. **Salesman:** 1

MAGNUSON ASSOC. (See Chicago, Ill.)

In
St. Louis
Kansas City
Wichita

IT'S BUSE SALES CO.

For
Aggressive
Sales and Service
of
Electronic Components
Hardware - Wire & Cable

P.O. Box 68
214 North Second St.
St. Charles, Missouri
63301

Phones:
314 - 725-6667
314 - 739-1613

TWX:
910 - 760-1720

MELIUS, E. & ASSOCS., INC., 3758 Dunlap St. N., (612) 484-8541. TWX: 910-563-3672.
Factories: Assoc. Test Labs; Atohm; Barry Controls; Continental-Wirt; Jeffers-Speer; Jonathan Mfg.; Metex Elec.; Molex Prod.; Richco Plastics; Rowe Ind.; Sage Elec.; Signalite; Struthers-Dunn.
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)
Services: Warehouse, Direct Mail

OSZMAN, E. W., 932 W. Montana Ave., (612) 488-1811.
Factories: Jersey Specialty Co.; Temple Sound Equipment; Tri-Ex Tower Corp.; Workman Elctrn. Prod.
Selling To: ★ D. **Salesman:** 1

RAGON, R. G., INC., 1136 W. Larpenteur Ave., (612) 488-6634. TWX: 910-563-3736.
Selling To: ★ D,I. **Salesmen:** 5 (eng 4)
Services: Warehouse

Wheeler, R. J., Griggs-Midway Bldg., (612) 644-9557.
Factories: Hotpack Corp.; Kewaunee.
Selling To: ★ I. **Salesmen:** 2

MISSISSIPPI

Brookhaven

SOMNER, W. L. CO., INC. (See Shreveport, La.)

Tinsley

SOMNER, W. L. CO., INC. (See Shreveport, La.)

MISSOURI

Berkeley

FLORENCE & MEYER, INC. (See Kansas City, Mo.)

Bridgeton

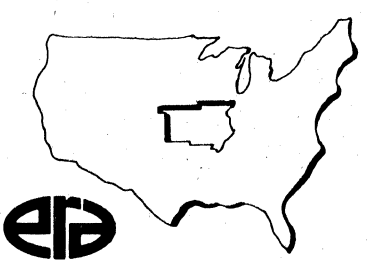
CLEMENSON-LARRABEE CO. (See Kansas City, Mo.)
KOENIG-MYERS ASSOC., (See Shawnee Mission, Kans.)

Creve Coeur

INLAND ASSOCS. (See Mission, Kansas)

R. W. FARRIS CO., INC.
1715 Baltimore Avenue
Kansas City, Mo. 64108
Harrison 1-1751 A.C. 816

DIPRO, INC.
115 Progress Parkway
P.O. Box 1428
Maryland Heights, Mo. 63042
432-3780 A.C. 314



CONCENTRATED AND EXPERIENCED COVERAGE in the "HEART OF MIDWEST AMERICA" SERVING THE DISTRIBUTOR AND MANUFACTURER

Florissant

MARSLAND ASSOCS., INC. (See Des Plaines, Ill.)
O. E. M. SALES CO., INC. (See Indianapolis, Ind.)

Hazelwood

PIVAN ENGRG. CO. (See Chicago, Ill.)
POLY-ONICS, INC. (See Leawood, Kans.)
THOMAS & MODRCIN, (See Shawnee Mission, Kans.)

Jefferson City

VIGNOLA, C. A. ASSOC., 2611 Schellridge Rd., (314) 635-1023.
Branches: 9807 Drury, Kansas City, Mo., (816) 763-3578; 10371 Sannois, St. Louis, Mo., (314) 542-4991; 1508 Bellevue Blvd., Bellevue, Neb., (402) 734-1134. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 1)

Kansas City

AUTOMATIC GENERAL ELECTRIC SALES, INC., 6550-E Troost Ave., (816) 333-8206.
Branch: Box 1006, Richardson, Texas, (214) 235-3577. **Selling To:** ★ M,D,I.

BETTIS, M. E. CO., 3706 Broadway, (816) LO 1-0772.
Branches: 423 N. Fountain, Wichita, Kan., (316) MU 5-7441; 9103 Bessemer, St. Louis, Mo., (314) HA 9-2099.
Factories: Antenna Specialists; Astatic Corp.; Bliley Elec.; CTS Knights Crystals; Clauss Cutlery; Controlonics; Milli-Switch; Reon Resistors; Garrett Elect. & Cable; Schrack Electrical Sales; Seco Elctrn; Taylor Elec.; Torrington Mfg.; Tri-Ex Tower; Union Switch & Signal; Varo Inc.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 3)

BURTON, R. R. SALES CO., INC., 1016 Baltimore Ave., Rm. 312, (816) 471-2850.
Factories: ADC Prod.; CTS Knights; Daven Div.; Gulton Ind.; Nytronics; Weston Inst.
Selling To: ★ I. **Salesmen:** 2 (eng 1)

CLEMENSON-LARRABEE CO., 3709A Summit, (816) 931-0657.
Branch: 2725 Beloit Dr., Bridgeton, Mo., (314) 739-6857.
Factories: Argos Products; Dynascan Corp.; ERA Acoustics; Fedtro; Luxo Lamp; MCI; Peerless Telerad; Perma-Power; Pomona Elctrn.; Trimm, Inc.; Trutone Elctrn.; Turret Elctrn.
Selling To: ★ A,D,I. **Salesmen:** 2

COLLINS-CARLSON-HEMPE-LECTROREPS, INC., Box 10719.
Branches: 4121 75th St., Des Moines, Iowa; No. 6 Bank Sq., E. St. Louis, Ill.
Factories Ampex; Antennacraft; Cornell-Dubilier; Fanon Elctrn; Game Ind.; I. E. Mfg.; Merit Coil; Recoton Corp.; Sencore Inc.; Weller Elec.; Workman Elctrn.
Selling To: ★ A,D. **Salesmen:** 3 (eng 3)

CONROW CO., 3300 Wyoming, (816) 531-6065.
Factories: Chelsea; Eagle Signal; Fenwal; Mackworth Rees; Oven Sys.; Photoswitch; E. L. Wiegand. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 1)

ELLIOTT, L. CO., INC. (See Missouri City, Tex.)

FARRIS, R. W. CO., INC., 1715 Baltimore, (816) 421-1751.
Branch: Box 1428, Maryland, Hghts., Mo., (314) 432-3780. **Services:** Representative
Selling To: ★ A,D,I. **Salesmen:** 6 (eng 2)

(See Advertisement This Page)

FLORENCE & MEYER, INC., 406 W. 34th St., (816) 561-7282. TWX: 910-771-3058.
Branches: 8650A Airport Rd., Berkeley, Mo., (314) JA 1-6800. TWX: 910-760-1625; 2900 Woodland, Wichita, Kan., (316) TE 8-7226.
Factories: Alpha Wire; Bourns, Inc.; Dickson Elctrn.; Dynisco; Electronic Res.; Midwec; Microdot, Inc.; National Semiconductor; Sloan Co.; Staco, Inc.; Sterling Inst.; Terado; Torotel; Viking Ind.
Selling To: D,I. **Salesmen:** 4 (eng 4)

GILBERT, J. M. CO., 131 E. 70th St.,
Factories: Electro Mechano Co.; Electro Products Lab.; Elmwood Sensors; Force Ltd.; United Electric Contls.; Vulcan Elec.; Zero Max Co.
Selling To: ★ I. **Salesman:** 1 (eng 1)

HARRIS-HANSON CO. (See St. Louis, Mo.)
Selling To: ★ D,I,Consumer Products. **Salesmen:** 3
Services: Warehouse

K & M SALES CO., 1627 Main St., (816) 471-1355.

KAY SALES CO., 2600 Grand Ave., (816) 221-8586.
Factories: Continental-Wirt Elctrn.; Curtiss Inst.; E.T.M. Corp.; M.I.A.L. Inc.; Quality Transformers; Rayonic Corp.; Syracuse Elctrn.
Selling To: ★ M,D,I. **Services:** Warehouse

KELLY-SCHMITZ-WINKELER ASSOCS., 7546 Troost Ave., (816) 363-5651.
Branches: 2319 Hampton Ave., St. Louis, Mo., (314) ST 1-6111; 3831 43rd St., Des Moines, Iowa, (515) CR 9-9235.
Selling To: ★ D,I. **Salesman:** 4 (eng 4)

ROES, H. A. & CO., 2601 Cherry, (816) 221-0866.
Factories: Conant Labs.; Dow-Key Co.; Electrical Plastic; Industrial Elec. Hardware; J-B-T Inst.; E. F. Johnson; J. W. Miller Co.; New-tronics; Ohmite Mfg.; P & M E Div.; Richco Plastics; Sonotone Corp.; Worner Elctrn.
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 3)

THRO INDUSTRIAL SALES CO., Box 7244, (913) 362-2533.
Factories: Armstrong Prod.; Brevel Prod.; Cherry Electrical Prod.; Delta Gear Co.; ENM Co.; Fasco Ind.; Truheat Corp.
Selling To: ★ D,I. **Salesmen:** 2

VIGNOLA, C. A. ASSOC. (See Jefferson City, Mo.)

WINSLOW, E. A. (See St. Louis, Mo.)

Kirkwood

SIMPSON ENTERPRISES (See Wichita, Kan.)

Maryland Hgts.

DIPRO, INC., 115 Progress Pkwy., (314) 432-3780.

FARRIS, R. W. CO., INC. (See Kansas City, Mo.)

St. Charles

BUSE SALES CO., 214 N. 2nd St., (314) PE 9-1613. TWX: 910-760-1720.
Factories: Tensolite; Hi-G; Torwico; Digitran; Lockheed; Star-Tronics; Matrix.
Selling To: ★ M,D,I. **Salesmen:** 3
Services: Warehouse

(See Advertisement Page 3256)

St. Louis

AEROL ASSOCS., INC. (See Jericho, N.Y.)

BETTIS, M.E. CO. (See Kansas City, Mo.)

COZZENS & CUDAHY, INC. (See Rosemont, Ill.)

DOUGLAS, C. H., 1110 S. Brentwood Blvd.
Factories: Duncan Elec.; Glenn Pacific; Meter Devices Co.; Sorgel Elec.
Selling To: ★ D,I, Electrical Contractors & Utilities. **Salesmen:** 2 (eng 2)

DOWELL, T. L., INC. (See Overland Park, Kans.)

ENGINEERING SERVICES CO., 6717 Vernon Ave., (314) 726-2233.
Branches: 7924A State Line, Prairie Village, Kan., (913) 649-4000; 1026 3rd Ave. S.E., Cedar Rapids, Iowa, (319) 366-1591.
Factories: Carborundum; Conap Inc.; Cook Elec.; General Inst.; Genisco Technology Corp.; Grand Ind.; Harowe Servo Contls.; Joy Mfg.; Korry Mfg.; Lectro Magnetics; Magnetic Shield Div.; Melcor Elctrn.; Moorlee Mfg.; Thermalloy; Transformer Elctrn.; Voltron Prod.; Weldmatic Div.; S. S. White Ind. Div. **Services:** Warehouse
Selling To: M,I. **Salesmen:** 7 (eng 5)

FIXMAN, G. ENGRG. CO., 8160 Stanford Ave.

HARRIS-HANSON CO., 2814 S. Brentwood Blvd., (314) 962-9895. TWX: 910-760-1650.
Branch: 7916 Paseo St., Kansas City, Mo., (816) 444-9494. TWX: 910-771-2160.
Selling To: ★ M,I. **Salesmen:** 7 (eng 6)
Services: Repair

HILL & CO., 915 Buder Bldg., (314) 621-1818.
Selling To: ★ I. **Salesmen:** 2

KELLY-SCHMITZ-WINKELER ASSOCS. (See Kansas City, Mo.)

KEMCO INC. (See Irving, Texas)

KEMP ENGRG., CO. INC. (See Dallas, Texas)

LEEMARK ENGINEERS INC. (See Leawood, Kan.)

MACDONALD, B. C. & CO., 1265 Research Blvd., (314) 993-2833.
Branches: 510 Southwest Blvd., Kansas City, Kan., (913) AD 6-7434; 1402 W. Douglas, Wichita, Kan., (316) AM 7-9978; 507 E. Markham, Little Rock, Ark., (501) FR 6-6331.
Factories: Beryllium Corp.; Black Drill; Briney Mfg.; Busch Co.; Cadillac Stamp Co.; Cincinnati Milling; Davis Div.—Giddings & Lewis; Detroit Broach; Detroit Reamer & Tool; Dixie Tool; Eclipse Div.—Illinois Tool; Excello-Bryant Div.; Excello-Robbins Div.; Federal Products; Goddard & Goddard; Heli-Coil Corp.; Hellos; Michigan Wire Cloth; Oilite; Ready Tool; Ren Plastics; Rock of Ages; Sandvik "Coromant"; Schaefer Machine; Scherr-Tumico; Severance Tool; Sierra Machine; Thurston; Universal Engineering; Van Keuren Co.; Wheel Trueing Tool; Zephyr Mfg. Co.
Selling To: ★ M,D,I. **Salesmen:** 12
Services: Repair, Warehouse.

MYERS, R. E. & SON, 504 Loudermon Bldg., (314) 621-2743.
Factories: Circle F Ind.; Ideal Ind.; Minerallac Elec.; Precision Conts.; Radix Wire; M. H. Rhodes.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)

OZARK ELCTRN. MKTG INC., 2573 Woodson Rd., (314) 423-7200.
Selling To: ★ I. **Salesman:** 1 (eng 1)

SCIENTIFIC SALES CORP. (See Chicago, Ill.)

SEBRIGHT, R. D. & CO., 7120 W. Florissant, (314) 261-0055.
Factories: Acromag; Bruce Ind. Contls.; Del Elctrn.; Spar Elctrn.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

SHAW, R. CO., 2831 Hampton Ave., (314) 647-8866.
Selling To: ★ A. **Salesman:** 1 (eng 1)

SHERIDAN ASSOCS., INC. (See Cincinnati, Ohio)

S. STERLING CO. (See Southfield, Mich.)

STILL, P., 9415 Old Bonhomme Rd., (314) 993-2077.
Factories: Hitchiner Mfg.; Molex Prod.; Stampings Inc.
Selling To: ★ A,I. **Salesman:** 1 (eng 1)

TECHNICAL MARKETING ASSOCS., INC., 2050 Woodson Rd., (314) 427-3600. TWX: 910-765-0938.
Branch: 5827 Outlook, Mission, Kans., (913) TE 1-2888. TWX: 910-743-6858.
Factories: Alpha Ind.; Atohm; Glasselal; Sage; Sigma Inst.; Schejeldahl; Solid State Prod.; Technipower; Transistor Elctrn.; Zero Mfg. Co.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Warehouse

VIGNOLA, C. A. ASSOCS. (See Jefferson City, Mo.)

WINSLOW, E. A., 206 N. Clay Ave., Rm. 201, (314) 965-5880.
Branch: 1217 Linwood Blvd., Kansas City, Mo., (816) 753-7924.
Factories: Anchor Elec. Div.; National Acme.
Selling To: ★ D,I. **Salesmen:** 2
Services: Warehouse

ZAK & ASSOCS., 230 S. Bemiston, (314) 727-8559.
Selling To: A,M,D,I. **Salesmen:** 5 (eng 5)
Services: Repair, Warehouse

NEBRASKA

Bellevue

VIGNOLA, C. A. ASSOC. (See Jefferson City, Mo.)

Omaha

BANGH, C. R., 524 W. O. W. Bldg., (402) 341-4232.
Factories: Automatic Switch; Duncan Elec.; Flint Steel; Insul-8-Corp.; Knopp, Inc.; Memco Mfg.; Meter Devices; Moloney Elec.; Rochester Inst. Sys.; Solid State Controls.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

NEVADA

Las Vegas

O'HALLORAN ASSOCS. (See N. Hollywood, Calif.)

NEW HAMPSHIRE

Dover

PERRON, R. & CO., INC. (See Norwood, Mass.)

Gilford

YALE ASSOCS., Cherry Valley Rd., (603) 293-2285.
Factories: Dynasil Corp.; Kollmorgen; Link Div.; National Statham; Numerical Contl.; Rock of Ages Corp.; L. S. Starrett; Symbar Corp.; Webber Gage Div.; Wild Heerbrugg Inst.; Gordon Yale Assocs. **Services:** Repair, Engineering
Selling To: ★ M,I. **Salesmen:** 5 (eng 4)

NEW JERSEY

Bergenfield

GRAY, H. ASSOC., INC., 20 Foster St., (201) 384-3643. TWX: 710-991-9772.
Factories: ASM Corp.; Airco Speer Elctrn.; Collins Radio; Elpac Comp.; General Semiconductors; Jan Hardware Mfg.; Laser Optics; Northern Engrg. Labs.; Silicon Transistor; Specialty Connector; Technical Elctrn. Dist.; Thermal Sys.; Victory Engrg.; Wall Mfg.
Selling To ★ M,D,I. **Salesmen:** 4 (eng 2)
Services: Warehouse, Mailing

(See Advertisement This Page)

Berkeley Heights

LUCE, R. P. & CO., INC., 30 Locust Ave., (201) 464-6440. TWX: 710-984-7965.
Branches: 1300 Jericho Tpke., New Hyde Park, N.Y., (516) 437-4550. TWX: 710-984-7965; 8717 Patton Rd., Philadelphia, Pa., (215) 884-8365. TWX: 710-984-7965; 19 E. 21st St., Baltimore, Md., (301) 752-8200. TWX: 710-984-7965.
Factories: Airflyte Elctrn.; Autronics Corp.; Bendix Corp.; Birtcher Corp.; Cedar Engrg. Div.; Electro-Mechanisms; Helical Prods.; Landis & Gyr; Lee Contls.; NSK Corp.; Parker-Hannifin; PCA Elctrn.; SKF Inds.; Taylor Devices; Zero Mfg.
Selling To: ★ M,D,I. **Salesmen:** 9 (eng 6)
Services: Warehouse

Beverly

BARNHILL & ASSOCS., INC. (See Timonium, Md.)



Caldwell

CERF, A. & CO., 512 Bloomfield Ave., (201) 226-2263.
Branches: Ellicott City, Md., (301) 465-1493; Willow Grove, Pa., (215) 657-0282; Hillsdale, N.J., (201) 391-2039.•
Factories: Benjamin Elctrn.; Bussman Mfg. Div.; Enterprise Dev. Corp.; ERA; Euphonics; Grundig Elctrn.; Lectrotech; Lowell Mfg. Co.; Norelco; Superior Insulated Wire Corp.; Terado Co.; Transcriber Co.; Weller Elec.
Selling To: ★ A,D. **Salesmen:** 4
Services: Newsletter & Memo Book

Califon

WILLIAMS, J. ASSOCS., Box 264A, (212) 691-2530.
Branch: 55 Morton St., New York, N.Y., (212) 691-2530.
Factories: Fairlane Elctrn.; Leader Inst.; Space Age Microcircuits. **Services:** Direct Mail
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

Camden

BARRETT, J. N. ASSOCS., INC., 812 Federal St., (609) 365-2680. TWX: 710-891-7379.
Factories: Aerovox; Bendix Semiconductors; Eldre Components; Hartzell Elctrn.; Sherold Crystals; Walbern Devices; Wheelock Signals.
Selling To: ★ M,D,I. **Salesmen:** 2

MAGUIRE, J. A. & CO., 726 Cooper St., (609) 966-3118. TWX: 710-891-7081.
Branches: 5716 York Rd., Baltimore, Md., (301) 433-2613; 705 Park Ave., Rm. 212, Plainfield, N.J., (201) 754-6400; 440 West End Blvd., Winston-Salem, N.C., (919) 723-5980.
Factories: American Enka Corp.; Davis & Hemphill; Electronic Specialty; Electro-Sonics; Elmwood Sensors; Engineered Wire & Cable; Forbes & Wagner; Metal Etching Corp.; Siemens America.
Selling To: ★ M,D,I. **Salesmen:** 8 (eng 3)
Services: Warehouse

(See Adv. This Page, 3248, 3260, 3272)

Q. E. D. ELCTRNS., INC. (See Mt. Vernon, N.Y.)

Carlstadt

HOYT SALES CORP., 440 Bareil Ave., (201) 935-0045.
Factories: Cartriseal Corp.; Clements Mfg.; D. B. Flower Mfg.; Imperial Metals Co.; Peer Bearing Co.; Phoenix Elec. Mfg.; Pure Carbon Co.; Surface Finishes Co.; Technical Components Co.
Selling To: ★ I. **Salesmen:** 3 (eng 2)
Services: Manufacturers/Reps.

Cherry Hill

HUNT ASSOCS., INC., Box 98, (609) 428-6666.
Branch: 19 W. Pennsylvania Ave., Towson, Md., (301) 828-4408.
Factories: Alpha Metal; Argus Engrg.; Cimron; Hexacon Elec.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

J. H. ELCTRN. SALES CO. (See Towson, Md.)

McCOY, J., Box 20, (609) 428-3444.
Factories: Air Pax Elctrn.; Patwin Elctrn.; Potter & Brumfield.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

MID-EASTERN ASSOCS., 1759 Country Club Dr.
Factories: Continental Connector; Filtron Co.; Sterling Transformer; Stewart-Warner Microcircuits. **Services:** Direct Mail
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

MOXON ELCTRNS. CORP. (See Los Angeles, Calif.)

SCHIBLEY ASSOC., INC. (See Fairfax, Va.)

TRINKLE SALES, INC., 500 N. Kings Hwy., (609) 667-3500. TWX: 710-892-0749.
Factories: Nortronics Co.; Perma Power Co.; Quam Nichols Co.; Raytheon; Sprague Prod.; Switchcraft; Thordarson Meissner.
Selling To: ★ D,I. **Salesmen:** 7 (eng 5)
Services: Warehouse, Direct Mail

WHITE, H. J. CO., INC., 302 W. Marlton Pk., (609) 428-2304.
Branch: 320 Hillen Rd., Towson, Md., (301) 828-6373.
Factories: American Radionic; Electronic Res.; E S C Corp.; Ideal Precision Meter; STOP, Inc.; Tansitor Elctrn.
Selling To: ★ I. **Salesmen:** 3

Cinnaminson

MILLER & DIETZ CO., 2122 Meetinghouse Rd., (609) 829-9291.
Branch: 303 G Queensdale Dr., York, Pa.
Factories: R B Dennison Co.; Fast Heat Element Mfg.; Gemco Elec.; Industrial Solid State Contls.; Joy Mfg.; Photomation, Inc.; Tenor Company.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)
Services: Factory Rep.

Clark

DELANEY, H. R. SALES, 78 Sweetbriar Dr., Apt. 6, (201) 382-7643.
Factories: Core-Tronics; Fair-Rite Prod.; General Magnetic; Jamestown Plastics; U.S. Magnet & Alloy Corp.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Clifton

AEROL ASSOCS., INC. (See Jericho, N.Y.)

GRIMM, SIEGEL ASSOCS., INC., 246 Clifton Ave., (201) 773-5010.
Factories: American Machine & Foundry Co.; G-V Contls., Inc.; Micro Devices Corp.; Rundel Components, Inc.; Struthers-Dunn, Inc.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)

Collingswood

RANDALL, K. CO., Box 100, (609) 854-3323.
Branch: 200 Washington Ave., Towson, Md., (301) 823-1970.
Factories: Ammon Inst.; Churchill Corp.; Dexon; Glentronics; Hammarlund Mfg.; High Energy; Multi-Flex Seals; Relay & Control; Servo Dev.; Tel Labs.; Transformer Technicians.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 3)

Cranford

RAY FARA ASSOCS. (See Manhasset, N.Y.)

East Brunswick

SECO INDS., INC. (See Jamaica, N.Y.)

East Orange

DENNING ASSOCS. (See Wakefield, Mass.)

FRIEDMAN ASSOCS., INC., 110 Halsted St., (201) 673-2500.
Branch: 174 Wetheril Rd., Garden City, N.Y., (516) PI 6-5199.
Factories: Associated Res.; American Optical; B & F Inst.; Beckman; Bytrex Div.; Cohu Elctrn.; Delta Design; Gencom Div.; Hughes Electron; Microdot.
Selling To: ★ M,I. **Salesmen:** 5 (eng 4)
Services: Repair, Warehouse

(See Advertisement This Page)

MEASUREMENTS UNLIMITED (See Elkins Pk., Pa.)

Edison

KELLER, L. W. & ASSOCS. (See N. Bellemore, N.Y.)

Englewood

ANDREWS & ANDREWS, INC. (See Huntington, N.Y.)

CENTRAL ASSOC., 44 N. Dean St., (201) 568-0808.
Branch: 11 Commercial St., Plainview, N.Y., (516) 433-0808.
Factories: Alfred Elctrn.; DeMornay-Bonardi; E & M Labs.; Electrochrome; Electro/Data; Jerrold Elctrn.; Measurement Control Devices; Microwave/Sys.; Structural Tech.
Selling To: ★ A,M,I. **Salesmen:** 5 (eng 3)

Englewood Cliffs

TALBE CO., INC., 19 Sylvan Ave., (201) 947-5038.
Branches: 5899 Huberville Ave., Dayton, Ohio, (513) 253-5351; 640 Murray La., Des Plaines, Ill., (312) 956-0316; 38 Barmore Dr., Stamford, Conn., (203) 322-6570; 45 Washington St., Binghamton, N.Y., (607) 723-3521; 60 Route 59, Monsey, N.Y., (914) 352-6422; 4401 Roosevelt St., Hollywood, Fla., (305) 981-7225; 2031 Chippewa Trail, Maitland, Fla., (305) 647-8744.
Factories: KDI Precision Prod.; Pho-Tronics; Poly-Scientific Corp.; Stanford Applied Engrg.; SAE-Advanced Packaging; Teller Ind.; Fredericks Co.
Selling To: ★ M,I. **Salesmen:** 9 (eng 7)

TALCOMP CO., INC., 19 Sylvan Ave., (201) 947-5038.
Factories: Amuneal Mfg.; Lerco Co., Inc.; Triad Transformer; Triad Dist. Div.; Utrad Corp.
Selling To ★ D,I. **Salesmen:** 8 (eng 7)

Fairfield

CONOVER, C. E. & CO., INC., 333 Passaic Ave., (201) 228-1400. TWX: 710-734-4342.
Branches: 83 Concord St., Framingham, Mass., (617) 872-3524; 2800 Bristol Pke., Cornwells Hgts., Pa., (215) 637-0707. TWX: 510-667-1611; 55 Central Ave., E. Farmingdale, N.Y., (516) 293-9332; 5247 N.W. 36th St., Miami Springs, Fla., (305) 887-7443.
Factories: Parker Seal; Resistoflex Corp.
Services: Warehouse

GARTEN, L. A. & ASSOCS., 375 Passaic Ave., (201) 226-7800. TWX: 710-734-4348.
Branch: 947 Old York Rd., Abington, Pa., (215) 927-1200.
Factories: Airborne Inst. Lab.; Dynamic Sys. Elctrn.; Edwin Ind.; Elgar Corp.; Holt Inst. Labs.; Lavoie Labs.; Micro Inst. Co.; Microdyne Inst.; Pacific Electro Magnetics Co.; Rohde & Schwarz;

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Spencer-Kennedy Labs. **Services:** Repair
Selling To: ★ I. **Salesmen:** 8 (eng 8)

KLS ASSOCS., 387 Passaic Ave., (201) 228-2525.
Branch: 332 E. 84th St., New York, N.Y., (212) 233-4849.
Factories: Argus Engrg.; California Sys. Comp.; Datatron; Delta Design; Federal Tool Engrg.; Non Linear Sys.; Shepard Labs.; Stellarmetrics.
Selling To ★ M,I. .... **Salesmen:** 4 (eng 3)
Services: Repair, Spare Parts Stock

Fair Lawn

NEMETH, E. ASSOCS., 13-08 Morlot Ave., (201) 797-7500.
Factories: Mamco Corp.; Varied Indl. Products.
Selling To: ★ I. **Salesmen:** 2

Fort Lee

HUGHES, K. E. CO., INC., 2175 Lemoine Ave., (201) 944-1600. TWX: 710-991-9785.
Factories: Clary Corp.; Computer Inds.; Connecticut Technical; Diversified Numeric Applications; Elasco; Emcor; McLean Engrg. Labs.; Parker Inst.; Raytheon Computer; Taurus; Vero Elctrn.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Warehouse, Mail List

TMC SALES CORP., 2465 Lemoine Ave.

Freehold

METROREP, INC., Box 782, (212) WO 4-2000.
Branch: New York, N.Y., (212) WO 4-2000; Washington, D.C., ENterprise 1-3223.
Factories: American Crown; E. L. Hearn Co.; Stanford Int'l.
Selling To: ★ A,M,D,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse

Glendora

ELECTRONIC DEVICES & CONTROLS CO., 1016 Black Horse Pike, (609) 939-2200.
Factories: Aquatronics; Electronics Corp.; Fairchild Contls.; Taber Inst.
Selling To: ★ M,D,I.
Services: Repair, Warehouse

Glen Rock

RINGER, R. L. CO., Box 114, (201) 444-1434.
Factories: Calabro Plastics; Chassis-Trak; Components Corp.; Green Inst.; Nife, Inc.; Poxylube; Scientific Int'l. Marketing; Vent-Rak.
Selling To: ★ I. **Salesman:** 1 (eng 1)

Hackensack

MOXON ELCTRNS. CORP. (See Los Angeles, Calif.)

RIBBLE, C. H., CO., INC., 31 Di Carolis Ct., (201) 342-2602.
Factories: Anderson Power Prod.; Delavan Mfg. Co.; Dohrman Inst.; Eagle Signal; Fast Heat Element; Gemco Industrial Contl.; General Elec.
Selling To: ★ I. **Salesmen:** 8 (eng 7)
Services: Repair, Warehouse, Panel Dept.

Haddonfield

BRADDOCK ASSOC., Box 305, (609) 429-0087.
Branch: Box 875, Bowie, Md., (301) 262-0741.
Factories: Austin-Craft Co.; Barco, Inc.; Cush Craft; Gold Line Connector; Graphic Elctrn.; Herb Kreckman; Milwaukee Resistor; National Radio; Olektron.
Selling To: ★ I. **Salesman:** 1 (eng 1)

COMPAR PHILADELPHIA, 15 Potter St., (609) 429-1526. TWX: 710-896-0679.
Factories: Denes Co.; Electronized Chemicals Corp.; Electro Materials Corp.; Judd Wire Div.; Signetics Corp.
Selling To: ★ M,I. **Salesmen:** 2

CHURCHILL, F. W., 50 Upland Way, (609) 429-7871.
Factories: Hamilton Hall Res.; Marvel Elec.; Rola Div.; Tech Labs. **Selling To:** ★ A,I.

KEEFE ELCTRN. SALES CO., 15 S. Haddon Ave., (609) 429-4650.
Factories: Alberox Corp.; Ansan Tool & Mfg.; Boker's, Inc.; Chester Cable Corp.; Cimco Wire & Cable Co.; Merit Screw Machine Prod.; Pierce-Roberts Rubber; Risdon Mfg.; Southern Elctrn.; Voltube Corp.
Selling To: ★ I. **Salesmen:** 2

M & S ASSOCS., INC., Box 185, (609) 429-7055.
Branch: Box 267, Sellersville, Pa., (215) BA 9-7575.
Factories: Astrocom Elctrn.; Duffers Assocs.; Electro-Voice; Electronic Precision Circuitry; Goldsman; Gulton Ind.; MM Elctrn. Enclosures; TDX Corp.; TRW, Inc.; Torr Labs.
Selling To: ★ M,I. **Salesmen:** 6 (eng 3)
Services: Stocking Reps.

MILLS, T. M. CO., 13 Tanner St., (609) 429-1005.
Factories: Hughes Connecting Devices; Glenair, Inc.; Hitemp Div.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

MOLER-EADER ASSOCS., Box 240, (609) 428-2440.
Branch: 320 Hillen Rd., Baltimore, Md., (301) 825-1130.
Factories: F.A.E. Inst.; Hitachi; Industrial Devices; Leader Inst.; Line Elec.; Precision Metal Prod.; Skydyne, Inc. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

MOYER-JOHNSON CO., 220 Haddon Ave.
Branch: 4900 Regina Dr., Annandale, Va.
Factories: Bud Radio, Inc.; Cardinal Control; Elpa Mktg.; Fairfax Ind.; Industrial Devices; Sharpe Inst.
Selling To: ★ A,D,I. **Salesmen:** 3

SUNDAY-O'BRIEN, 15 Potter St., (609) 429-4013. TWX: 710-896-0679.
Factories: Components, Inc.; Energy Conversion Devices; Freed Transformer Co.; Interdyne; Spectrol Elctrn.; Trimflex; US&S Div.; Wakefield Eng.
Selling To: ★ M,D,I. **Salesmen:** 2

Harrington Park

METRO TECHNICAL SALES (See Mass. Pk., N.Y.)

Hillsdale

CERF, A. & CO. (See Caldwell, N.J.)

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HANSEN ASSOCS., INC., 215 Brookside Ave., (201) 652-7055.
Factories: Atec; Dynamics Inst.; Elctrn., Assoc.; Elctrn. Engrg.; Electronic Measurements; Ikor; NH Res.; Nuclear Corp.; Towson Labs.; Virgina Panel; Zeltex.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)
Services: Repair, Warehouse

(See Advertisement This Page)

Kenilworth

UNIVERSAL COMPONENTS, Box 112.
Factories: Matsunaga Mfg.; Mitaka Meders; Mulon Micro Switches.
Selling To: ★ I. **Salesmen:** 6 (eng 3)
Services: Custom Modifications

Lavalette

RYABY ASSOCS. (See Passaic, N.J.)

Little Falls

CARBONE ASSOCS., Box 181, (201) 256-9191.
Factories: Electronic Applications; KCB Ind.; London Chemical; Phoenix Data; Tilton Rack Co.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

Livingston

McKEOWN, R. CO., 99 Dorsa Ave., (201) 992-0700.
Branches: 12 Juniper Rd., Trumbull, Conn.; 233 Broadway, New York, N.Y.
Factories: Chicago Printed String; Connecticut Hard Rubber; Cottrell Paper; Dow Corning; Electra Insulation; Fiber Mfg.; General Elec.; Glastic Corp.; Hess, Goldsmith & Co.; Inmanco, Inc.; National Vulcanized Fibre; Permacel Tapes; Owens-Corning Fiberglas; Potter & Rayfield; Rayclad Tubes, Inc.; Rogers; Suflex; Sterling Varnish Co.; Tar Heel Mica Co.
Selling To: ★ A,M,D,I. **Salesmen:** 6
Services: Warehouse, Technical

MURRAY CO., 25 W. Northfield Rd., (201) 992-3169.
Branch: Box 253, Newtown, Pa., (215) WO 8-2497.
Factories: Associated Ceramics & Technology; Beauchaine & Sons; Brand Rex Div.; Columbus Elec. Mfg.; Dano Elec.; ITI Elctrn.; Gordos Corp.; Malco Mfg.; Mohawk Mfg.; Philway Prod.
Selling To: ★ A,M,I. **Salesmen:** 3

VARRELMAN-GORMAN CO., Box 206, (201) 992-2505.
Branch: Box 387, Liverpool, N.Y., (315) 458-4774.
Factories: Airtron; American Elctrn.; Bendix Corp.; Capitol Machine & Switch Co.; Collectron Corp.; Circuit Technology; Dormeyer Ind.; Electralab; Pirgo; North American Printed Circuit; Stampings, Inc.; Thermax Wire; Welch Relay Div.
Selling To: ★ M,I. **Salesmen:** 5 (eng 4)

Lodi

ENGINEERED PROD., 28 Essex St., (201) 845-6668.
Factories: Bergen Labs.; Bonner Vawter; Computer Mechanisms; Icon Corp.; M.F.E.; M. F. Elctrn.; Magnafile; North Hills Elctrn.; R. O. Assocs.; Sealectro; TSI; Vema Ind.; Wyle Sys.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Repair, Warehouse

Long Valley

FAIRLANE ELCTRN., INC., Box 335, (212) 691-2530.
Selling To: ★ I. **Salesman:** 1 (eng 1)
Services: Repair

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JONES, Wm. W. CO., INC. (See Towson, Md.)

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Factories: Chenango Graphics; Robina Ind.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

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Factories: U.S. Arle Co.; Midstate Bolt & Nut Co. Inc.; Perseverance Iron Fdy.
Selling To: ★ I. **Salesman:** 1 (eng 1)
Services: Warehouse, Custom Mfg.

TAYLOR, M. F. CO., INC. (See Silver Springs, Md.)

Medford

MECH-ELEC SALES CO., 16 S. Main, (609) 654-8209.
Factories: Acme Chemicals & Insul.; American Circuit-Tronics; Anchor Plastics; Audiosears Corp.; AVID Corp.; Bond Rubber Corp.; Carolina Narrow Fabric; Fasco Ind.; General Ind.; Hupp Corp.; IXL Mfg.; Moldex, Inc.; Rogate Ind.; Seal-A-Metic, Inc.; Secon Metals Corp.; Ventron Elctrn.; Wells Elctrn.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 2)

Metuchen

BONN ASSOCS., INC., 266 Lake Ave., (201) 549-9573.
Factories: American Elctrn. Labs.; Communication Elctron.; Conrad-Missimer; Electro Mechanisms; Energy Sys.; Gulton Ind.; Hallicrafters; Hyperion Ind.; Inet Power; Johanson Mfg.; Monterey Res.; RMS Engrg.; Spectral Dynamics; Winslow Tele-Tronics.
Selling To: ★ M,I. **Salesmen:** 9 (eng 7)
Services: Warehouse, Duplicators—Direct Mail

(See Advertisement Page 3259)

Montclair

COMPONENT MARKETERS, INC., 151 Valley Rd., (201) 746-6717.
Branch: 571 Sunderland Rd., Teaneck, N. J., (201) TE 6-9595.
Factories: Barker Prod. Co.; BSR USA Ltd.; Datak Corp.; IMC Magnetics; Mercury Record; Murdock Corp.; Nortronics Co.; Packard-Berman Sales; Rockford Special Furniture; H. H. Scott; Telvac Inst. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 5

(See Advertisement This Page)

FREEMAN, L. C. & ASSOC., 484 Bloomfield Ave.
Factories: DAICO; Elctrn. Stds.; Gen'l RF Fittings.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse

Moorestown

ELECTRICAL COMPONENTS, INC., 355 Crider Ave., (609) 235-3012.
Factories: Electromagnetic Prod. Corp. Hamilton Precision Metals; Mullard, Inc.; Sprague Elec.; Standard Wire & Cable; Westinghouse.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Warehouse

FOLEY, A. A. ASSOCS., Box 155, (609) 663-4545.
Factories: Cox & Co.; Eastron Corp.; E-T-A Prod. Co.; Pyroferric Co.; Resistors, Inc.; Rohn Mfg.; SBD Sys.; Spaulding Towers; Winegard.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

Morristown

GRAYDON-SHERMAN, INC., 230 Madison Ave., (201) 538-9246. TWX: 710-541-0241.
Branches: Davis Bldg., Fayetteville, N.Y., (315) ME 7-9861. TWX: 710-541-0241; Great Neck, N.Y., (516) 487-9696; Philadelphia, Pa., (215) MO 4-7316.
Factories: Applied Magnetics Corp.; Hughes Aircraft; KMC Semiconductors; NM Microwave; Omni Spectra, Inc.; Power Mate Corp.; Silliconix; Universal Voltronics; Viking Ind.
Selling To: ★ M,I. **Salesmen:** 10 (eng 10)
Services: Warehouse

SMITH, L., 219 Pitney Pl., (201) 267-3151.
Factories: General Devices; Zimmer Machine.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Mountain Lakes

COMPONENTS FOR ELCTRN. INC., 60 Midvale Rd., (201) 334-2921. TWX: 710-987-8395.
Factories: Carter Precision Elec.; Grant Pulley & Hardware; Grigsgy-Barton; Methode Elctrn.; Standard Grigsgy; Stantron Div.
Selling To: ★ A,M,I. **Salesmen:** 4 (eng 2)

DEARIE, J. P. CO., 239 Boulevard, (201) 334-4848.
Branches: 1434-5 Land Title Bldg., Philadelphia, Pa., (215) 563-1818; 3001 James St., Syracuse, N.Y., (315) 463-4507.
Factories: Air-Vac Eng.; Electrovert Inc.; Heller Ind.; Kinatechnics; Panel Cont. Corp.; Redguro Corp.—MTI; Western Elctrn. Prod. Co.
Selling To: ★ I. **Salesmen:** 10 (eng 9)

NORTON, J., 60 Midvale Rd., (201) 334-2921. TWX: 710-987-8395.
Factories: Carter Precision Elec.; Grant Pulley & Hardware; Grigsby—Barton; Methode Elctrn.; Standard Grigsby; Stantron Div.
Selling To: ★ A,M,I. **Salesmen:** 4 (eng 2)

Mountainside

RICHTER, H. G. INC., 608 Sherwood Pkwy., (201) 233-4615. TWX: 710-997-9581.
Branches: 50 Foxcroft, Fayetteville, N.Y., (315) 637-6713; 2318 Nash St., Clearwater, Fla., (813) 446-5631.
Factories: Adronics; American Plasticraft; Illinois Tool Works, Paktron Div.; JPM Co.; Oak Mfg. Co. Div.; Panelgraphic; TRWE.
Selling To: ★ D,I. **Salesmen:** 7 (eng 5)

Newark

BRAGAR, N. CO., 1060 Broad St., (212) 622-4300.
Factories: Automatic Timing & Controls; Compudyne; Conax; Glenn Pacific; Pillar; West Inst.
Selling To: ★ I. **Salesmen:** 8 (eng 8)
Services: Warehouse

DETWILER, L. K., 443 Broad St., (201) 621-9080.
Factories: Brandywine Fibre Prod.; Case Bros.; Chase-Foster, Inc.; Haysite Corp.; Macallen Co.; Rhopac, Inc.; Stone Paper Tube Co.; Wisconsin Porcelain. **Salesmen:** 4

McKAY ASSOCS., 60 Park Place, (201) 642-3930.
Factories: Consolidated Cont.; Ebbert Engrg.; Gemco Elec.; Hampden Engrg.; Kelek Co.; States.
Selling To: ★ D,I,Educational. **Salesmen:** 3 (eng 1)

Nutley

FALK-BAKER ASSOCS., 382 Franklin Ave., (201) 661-2430. TWX: 710-989-1476.
Factories: Bestcraft Prod.; Electronics; Ledex; Mepco; MIAL USA; Whitewater Elctrn.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 3)
Services: Engineering

GLASSMAN, S. ASSOC., INC. (See Glen Cove, N.Y.)

LANDFEAR ENTERPRISES, Box 68, (201) 667-2900.
Factories: Brand-Rex Div.; Gruenberg Elec.; Lash Labs.; Tel-Inst. Elctrn.; Walden Elctrn.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Palisades Park

TAK INSTRUMENTS, Box 226, (201) 944-3337.
Factories: Avco-Elctrn.; Elin Div.; Resalab, Inc.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)
Services: Repair

Passaic

RYABY ASSOCS., 38 Wall St.
Branch: 2 W. Cove, Ocean Bch., Lavalette, N.J.
Factories: Micromeritics Inst.; Tacussel Elctrn.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Repair

Pennsauken

LEFF SALES, 5900 Westfield Ave., (609) 663-4025.
Branches: 14 E. Main St., Somerville, N.J., (201) 725-9470; 408 York Rd., Towson, Md., (301) 823-0774.
Factories: Astrodyne, Inc.; Borg-Warner Thermoelectrics; Electro-Mechanical Inst.; General Cont.; Inresco; Midway Mfg.; National Circuits; Plastic Capacitors; Positive Connector; Premier Metal Prod.; Semiconductor Prod. **Salesmen:** 5 (eng 2)
Services: Warehouse **Selling To:** ★ M,I.

WETTERHAHN, M. CO., INC., 4420 Crescent Blvd., (609) 662-1611. TWX: 710-892-0762.
Branch: 107 York Rd., Towson, Md., (301) 825-1335.
Factories: Amuneal Mfg.; Atlantic Laminates; Automation Comp.; C & M Corp.; Coil Specialty Co.; Continental Wirt Elctrn.; Elpac, Inc.; Electro-Circuits; Electronic Plastics Corp.; Gardiner Solder Co.; General Illumination; Kurman Inst.; Magnetic Core Corp.; Oxford Elec.; Rayonic, Inc.; Robintech, Inc.; Syntron Co. **Salesman:** 5 (eng 2)
Selling To: ★ D,I. **Services:** Warehouse

Perth Amboy

HOUSER ASSOC., 188 Water St., (201) 442-3159.
Factories: Corbin-Farnsworth; Cormet Labs.; Smith Kline Inst. **Services:** Repair
Selling To: ★ I. **Salesman:** 1

Pine Brook

APPLETON, H. CO. (See Los Angeles, Calif.)

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RICHARDT, J. W. CO., Rt. 46, (201) 227-0600.
Branch: Box 267, Whippany, N.J., (201) 227-0518.
Factories: 3M Corp.; Cincinnati Fan & Ventilator; Eyelet Tool; Henry Radio; Lenox Fugle; National Wire & Cable; Technical Material.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)
Services: Repair, Warehouse

Plainfield

MAGUIRE, J. A. & CO. (See Camden, New Jersey)

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WILD, J. J., INC. (See Jericho, N.Y.)

J. A. Maguire and Co.

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Mic-Lin Company	
Siemens America, Inc.	

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Red Bank

DYNAMIC SALES CO., Box 834, (201) 747-5353.
Factories: Canoga Elctrn.; Dynasciences; Litton—Pot. Div.; Teledyne Tele.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Mail Service

Ridgefield

HY-REL ELCTRN. SALES CO., INC., 753 Bergen Blvd., (201) 945-7511. TWX: 710-992-8970.
Factories: Babcock Relays; Controls Co. of America; Doran Mfg.; JMR Elctrn.; Logitek Inc.; Molon Motor & Coil; Relay Service Co.; Rotamec Inc.; Syracuse Elctrn.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 3)

MOCH, G. M. CO., 595 Broad Ave., (201) 945-0080.
Branch: New York, N.Y., (212) 279-6758.
Factories: Elmwood Sensors; ITT Gremar; LRC Elctrn.; Omega Elec.; Thermolab Corp.; Reeves-Hoffman Div.; United Mineral & Chemical.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)
Services: Warehouse

Ridgewood

BALLOU, INC., 51 N. Broad St., (201) 444-6990.
Factories: Cole Inst.; Firing Circuits; General Control; Heinemann Elec.; Intereletrn.; E. V. Naybor Labs.; Power Conversion Prod.; Precision Switch; Semikron Int'l.; Voltron Prods.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 3)
Services: Direct Mail

DATA-REP ASSOCS., INC., Box 645, (201) 447-0660.
Branches: Box 164, Huntington Sta., N.Y., (516) 423-7677; Box 349, Norristown, Pa., (215) 279-8210.
Factories: California Inst.; Computer Power Sys.; Comtronix-Microtech; Dranetz Engrg.; Gilmore Ind.; Gulton Data-Sys.; I-Tel, Inc.; Medistor Inst.; MVR Corp.; Northeast Scientific; Pacific Measurements; Radiometer; Schlumberger; Simulators; Specific Prods.; Time Sys.; Viking Modules.
Selling To: ★ A,M,I. **Salesmen:** 4 (eng 4)
Services: Repair

(See Advertisement This Page)

ENGEL, G. C. & ASSOCS. INC., 40 W. Ridgewood Ave., (201) 444-1400. TWX: 710-988-5611.
Branch: Box 425, Hatboro, Pa.
Factories: Advanced Measurement Inst.; Anadex Inst.; Astro-Metrix; Beckman Inst.; Data-Control Syst.; DataWest Corp.; Incor; Kruse-Storke Elctrn.; L. D. V. Electro Science Ind.; Midwestern Inst.; Philips Elctrn. Inst.; Wanlass Elec.; Weinschel Engrg. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 6 (eng 6)

FINLAY SALES, 45 North Broad St., (201) 652-0088.
Factories: Argos Prod.; Avanti R & D; E-Z Way Prods.; Fisher-Berkeley Corp.; Hallicrafters Co.; Konel Elctrn.; Linear Syst.; Metropolitan Agencies; Pearce-Simpson; Racon.
Selling To: ★ A,M,D. **Salesmen:** 5 (eng 1)

GILBERT SALES, 70 Glenwood Rd., (201) GI 4-2604.
Factories: Electronic Coils; Glasseal Prod. Co.; Universal Prod.
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)

INSTRUMENTATION SALES CO., Box 403, (201) 445-5210. TWX: 710-988-5609.
Factories: American Astrionics; Christie Elec.; Information Cont.; Newport Inst.; Sequential Info. Sys.; Spellman High Voltage Elctrn.; Technipower, Inc.; Tyco Inst. Div.; Varo, Inc.; Vector Engrg. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

(See Advertisement This Page)

WILLIAMS, H. R. ASSOCS., Box 344, (201) 444-5392.
Branch: Box 247, Weirsdale, Fla., (904) 753-2239.
Selling To: ★ I. **Salesmen:** 4

Roseland

GAWLER-KNOQP CO., 14 Beaufort Ave., (201) CA 6-4545.
Branches: Twining Ford Rd., Richboro, Pa., (215) WA 5-7550; 1751 Rockville Pke., Rockville, Md., (301) 427-3950.
Factories: Applied Microwave Lab.; Ballantine Labs.; Beckman Industrial Ins.; Bolt Beraneck; Fairchild Electro-Metrics; Measurements Div.; Melabs; Microwave Elctrn.; Texas Insts.; Waters Mfg.; Waveline. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 9 (eng 9)

(See Advertisement Page 3262)

Saddle Brook

L & M ASSOC., 511 Victor St., (201) 843-8700.
Branches: 965A Bristol Pke., Andalusia, Pa., (215) 632-0600; 7 Mayflower Ct., Brentwood, N.Y., (516) 231-8363.
Factories: Alban Elctrn.; Alford Mfg.; Baird-Atomic, Inc.; J. G. Biddle Co.; Continental Device; Henes Mfg.; Hughes; Marconi Inst.; Micom; Quan-Tech Labs.; Trompeter Elctrn.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Repair, Warehouse

TEK-SEL, INC., 440 No. Midland Ave., (201) 791-5545. TWX: 710-988-2288.
Factories: Bruce Ind. Cont.; Chadwick-Helmuth Co.; Conic Corp.; Daytronic Corp.; Ircon, Inc.; Kistler Inst.; Lebow Assoc.; Ling Altec; Ling Elctrn. Div.; Robinson-Halpern; Semco, Inc.; Team Corp.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

Somerville

LEFF SALES ASSOCS. (See Pennsauken, N.J.)

So. Orange

JACKSON ELCTRN. SALES CORP., 71 Valley St., (201) 763-7900. TWX: 710-999-5517.
Factories: Texas Crystals; V-M-P, Inc., Weltron.
Selling To: ★ A,M,D,I. **Salesmen:** 17 (eng 9)
Services: Warehouse

SIMBERKOFF SALES, INC., 71 Valley St., (201) 763-7900. TWX: 710-999-5517.
Branches: 35 Niagara St., Lockport, N.Y., (716) 434-4426; 284 Edgewood Ave., Kenmore, N.Y., (716) 834-8119; 58 Homeland Rd., No. Syracuse, N.Y., (315) 458-5469; 37 Parkwood St., Albany, N.Y., (518) 438-0437; 1021 Levick St., Phila., Pa., (215) 743-2512; 1031 E. Phil-Ellena St., Phila., Pa., (215) 224-1905; 420W Arlington Towers, Arlington, Va., (703) 525-5898.
Factories: Aerovox Corp.; Flotron Ind.; Goe Eng.; Jensen Mfg.; Kulka Elec. Corp.; Magnecraft Elec. Co.; Penn-Tran Corp.; Phalo Corp.; Howard W. Sams & Co.; Sarkes-Tarzian, Inc.; Sherwood Elctrn. Labs.; Shure Bros., Inc.; SNC Mfg. Co.; Spar Elctrn., Inc.; Waters Mfg., Inc.
Selling To: ★ A,M,D,I. **Salesmen:** 17 (eng 9)

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Factories: Anderson & Sons, Inc.; Automatic Locking Devices; Bentley-Harris Mfg.; Computer Crafts; De-Sta-Co Corp.; Robicon Corp.
Selling To: ★ I. **Salesmen:** 4 (eng 3)

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Branch: 260 Northern Blvd., Great Neck, N.Y., (516) 487-6447. TWX: 710-983-4439.
Factories: Chicago Miniature Lamp Works; CTS Knights; Licon Div.; Plastic Capacitors; QCI; Rotron; Texas Inst.; Ultronix; Youngwood Elctrn. Metals. **Services:** Direct Mail
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 5)

TALBOT ASSOC., 11 Cleveland Pl., (201) 376-9570.
Factories: Atlantic Casting & Engrg.; Badger Alloys, Inc.; Morris Bean & Co.; Certified Casting & Engrg.; Delta Microwave; Eaton, Yale & Towne, Inc.; Hamilton Foundry; Hitchiner Mfg.; Interstate Drop Forge Co.; Northern Malleable Iron Co.; Piad Precision Casting Corp.; Progress Foundries; Shell Cast Corp.; Steel Ind.; Swedish Crucible Steel Co. **Salesmen:** 8 (eng 8)
Services: Manufacturers Reps.

Teaneck

ABBOTT-GORDON ASSOC. (See Seaford, N.Y.)

BUDD-TRONICS, 71 Grayson Pl., (201) 837-1660.
Factories: Beta Inst.; Kaye Scientific; Meltronics, Inc.; J. Pollak Corp.; Thomas Elctrn.; Transco Motor Mfg.; Warnecke Electron Tubes.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

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FISHER, S. SALES, 161 Cedar La., (201) 836-6661.
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Selling To: ★ A,D. **Salesmen:** 4 (eng 2)
Services: Warehouse, Direct Mail

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Factories: Gichner Mobile Sys.; Insaco, Inc.; Shielding Corp.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

Totowa

BROGAN ASSOCS., INC. (See Westbury, N.Y.)

Trenton

KRIEGNER SALES CO., INC., 1602 Pennington Rd., (609) 882-6330.
Factories: Heineman Elec.; Hardman; Monitor Controller; Schrack Elec. Sales; U.S. Terminals.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

MILLS, W. S., 2 Wilburtha Rd., (609) TU 2-4111.
Factories: Diamonite Products Mfg.; QCI Corp.; D. M. Steward Mfg. **Selling To:** ★ M,I.

Union

SBM ASSOCS., INC. (See Rochester, N.Y.)

Union City

BRESSLER ASSOCS., INC., 4808 Bergenline Ave., (201) 864-9577.
Factories: American Monarch Corp.; Chicago Switch Div.; Danex Corp.; James Elctrn., Inc.; Littelfuse, Inc.; Magnetic Shield Div.; Metex Corp.; Syntronic Inst.; Pamotor, Inc.; Vishay Resistor Prod. **Services:** Direct Mail
Selling To: ★ I. **Salesmen:** 5 (eng 4)

BRESSLER, J. J., INC., 4808 Bergenline Ave., (201) 864-9577.
Branch: New York, N.Y., (212) 695-3727.
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Selling To: ★ A,D. **Salesmen:** 5 (eng 1)
Services: Direct Mail

(See Advertisement Page 3263)

Warren

NLR ASSOCS., 31 Round Top Rd., (201) 647-3390.
Factories: Maplewood Elctrn.
Selling To: ★ A,M,I. **Salesmen:** 4 (eng 4)

Wayne

KAGAN, H. ASSOCS., 18 Tilgham Dr., (201) 684-7682.
Branch: 150-08 87th Ave., Jamaica, N.Y.
Factories: ALA Ind.; Electro Windings & Comp.; Hampden Mfg.; Technitrol.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

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LAWSON, R. ASSOCS., Box 206, (609) 468-5115.
Factories: Eastern Air Devices; Electro-Flex Heat; Northern Precision Labs.; Vibrac Corp.
Selling To: ★ M,I. **Salesman:** 1

West Caldwell

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Branch: 364 Lincoln Pl., Brooklyn, N.Y. (212) 789-9585.
Factories: American Semiconductor; Bartlett Mfg.; Ecco Elctrn. Comp.; Hoyt Elect. Inst.; E. Stanwyck Coil; Marvel Elec.; Precision Resistor; Sampson Co.; Vanguard Relay.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 2)

(See Advertisement This Page)

Westfield

GRAY & REED ASSOCS., INC. (See Huntington Sta., N.Y.)

Westwood

CLARFIELD-STOLLMACK ASSOCS., 175 Westwood Ave., (201) 666-8989.
Factories: Dearborn Elctrn.; Enercon; I.M.C. Magnetics; McCoy Elctrn.; Maurey Instr.; Printed Circuit; Transformer Elctrn.; Triridge Corp.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)
Services: Warehouse

Whippany

RICHARDS, J. W. CO. (See Pine Brook, N..)

Wood-Ridge

PODEYN & SCHMIDT, Box 174, (201) 438-2780.
Branch: 420 Northern Blvd., Great Neck, N.Y., (516) 487-1173.
Factories: Aladdin Elctrn.; Aladdin Controls Div.; Carter Potentiometers; Hope Power Supplies; Metra Inst.; Rustrak Inst.
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Services: Repair, Warehouse

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Selling To: ★ M. **Salesmen:** 3 (eng 3)

ALLGOOD ASSOCS. (See Inglewood, Calif.)

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BISHOP ENTERPRISES, INC. (See Aurora, Colo.)

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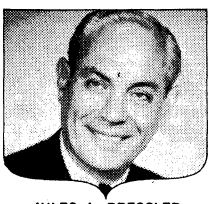

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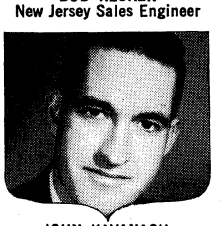

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Selling To: ★ M,I. **Salesmen:** 5 (eng 5)
Services: Repair, Warehouse, Direct Mail

(See Advertisement This Page)

SIMBERKOFF SALES INC. (See So. Orange, N.J.)

Baldwin

BERLIANT, 1024 Garden Place, (516) BA 3-6298.
Branch: 437 7th St., Allentown, Pa., (215) HE 5-9696.
Factories: Component Specialties; Computrain; Dow-Corning; Ed-Berl Prod.; Hiker Corp.; Jackson Audio Prod. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 4 (eng 2)

NATIONAL SALES DEV. CO., 676 Stratford Rd., (516) BA 3-0038. **Salesmen:** 3 (eng 1)

TAYLOR, B. B. CORP., 2270 Grand Ave., (516) 233-8000. TWX: 510-225-7504.
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Selling To: ★ I. **Salesmen:** 4 (eng 4)

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JOHNSON, H. C. AGENCIES (See Rochester, N.Y.)

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Selling To: ★ M,I. **Salesmen:** 3 (eng 2)

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REAGAN, J. A. CO., INC. (See Albany, N.Y.)

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Selling To: ★ I. **Salesmen:** 4

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Selling To: ★ A,D. **Salesmen:** 3

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Selling To: ★ I. **Salesman:** 1

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Selling To: ★ I,Medical **Salesman:** 1 (eng 1)
Services: Repair, Consultant

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Selling To: ★ A,M,D,I. **Salesmen:** 2

Buffalo

BEEMER ENGRG., CO. (See Ft. Washington, Penn.)

DB ASSOCS., INC. (See Dewitt, New York)

CONOVER, C. E. & CO., (See Fairfield, N.J.)

JACKSON, R. W. CO., INC., 4446 Main St., (716) 839-0200.
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Selling To: ★ M,D,I. **Salesmen:** 2

KELLER IND. PRODS., INC. (See Rochester, N.Y.)

LAZOR, J. ASSOCS., INC. (See Rochester, N.Y.)

McDONOUGH, J., 4541 Main St., (716) 839-2044.
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Selling To: ★ A,I. **Salesmen:** 6 (eng 1)

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Branch: 3783 W. River Pkwy., Grand Island, N.Y.
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Selling To: ★ A,D. **Salesmen:** 2

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Selling To: ★ A,M,D,I. **Salesmen:** 14 (eng 8)

ZANG, H. C. AGENCY, 64 Prairie Ave., (716) 877-3677.
Factories: Hevi Duty Elec.; Jody Mfg.; Struthers Dunn. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 4

Camillus

CALLAHAN-FERGUSON CO., 107 Greenhedge Dr., (315) 488-5518.
Selling To: ★ A,D. **Salesmen:** 2

Centerport

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Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Cooperstown

EQUIPT. SALES CO., INC. (See Hamden, Conn.)

De Ruyter

LSM ASSOCS. (See Phelps, N.Y.)

Dewitt

DB ASSOCS., INC., 3307 Erie Blvd.; (315) 446-0220.
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Selling To: ★ A,I. **Salesmen:** 2 (eng 2)

(See Advertisement This Page)

FERGUSON, T. SALES CO., INC. (See Rochester, N.Y.)

ONXY, W. M. CO. (See Mattydale, N.Y.)

STONE, J. L., 110 Terrace Circle, (315) 446-5127.
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Salesman: 1

TAYLOR, F. W. CO., INC., 4455 E. Genesee St., (315) 446-0422.
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Selling To: ★ M,D,I. **Salesmen:** 4 (eng 2)

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Selling To: ★ A,D,I. **Salesmen:** 2
Services: Warehouse

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Selling To: ★ M,D,I. **Salesmen:** 7 (eng 7)
Services: Repair, Warehouse

(See Advertisement This Page)

DIRECTOR, M., 115-62 237 St., (516) 285-6823.
Factories: Finney Co.; M. A. Miller Mfg.; United Elctrn. Mfg.; U.X.L. Corp.
Selling To: ★ A,D. **Salesmen:** 2
Services: Warehouse, Direct Mail

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Factories: Carborundum Co.; Continental-Wirt Elctrn.; Dielectric Sys.; Mark Prod.; Micro Science Assocs.; Oxford Elec.; Rayonic.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)
Services: Repair, Warehouse

SCHMITT, F. E., 311 Meacham Ave., (516) 437-8150.
Factories: Bliley Elec.; Continental-Wirt Elctrn.; Esse Wire Corp.; Hurst Mfg.; E. F. Johnson Co.; Sangamo Elec.; Shure Bros.
Selling To: ★ A,D,I. **Salesmen:** 5 (eng 2)
Services: Warehouse

Endwell

COMPAR ALBANY, INC. (See Albany, N.Y.)

Fairport

COMPAR ALBANY, INC. (See Albany, N.Y.)

Farmingdale

MICHAEL, C., INC. (See Glendale, Calif.)
VPI ASSOCS., INC. (See Laurel, Md.)

Fayetteville

ANDREWS, M. P., INC., 319 Mott Rd., (315) 637-3144. TWX: 710-545-0242.
Selling To: ★ M,D,I. **Salesmen:** 8 (eng 3)
Services: Direct Mail

(See Advertisement This Page)

BEEMER ENGRG. CO. (See Ft. Washington, Penn.)

COMPONENTS FOR INDUSTRY, 416 Franklin St., (315) 637-9601.
Factories: Accuride Co.; Avco Instr. Div.; Instrulab, Inc.; JFD Elctrn.; Marshall R & D Corp.; MB Elctrn.; Optron; Scientific Advances.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

GRAYDON-SHERMAN, INC. (See Morristown, N.J.)

ROBT. W. JACKSON CO., INC. (See Buffalo, N.Y.)

JOHNSON, H. C. AGENCIES (See Rochester, N.Y.)

KENNEDY, R. P. CO., INC. (See Rochester, N.Y.)

MITSCHER, R. W. CO., INC. (See Buffalo, N.Y.)

RICHTER, H. G., INC. (See Mountainside, N.J.)

Floral Park

METROPOLITAN SALES CO., 110 Jericho Tpke., (516) 328-0120.
Factories: Audio Dynamics Corp.; American Tape Duplicators; Benjamin Elctrn. Sound; Certron Corp.; Tape Services. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 1)

PUNT, W. R. CO., 66 So. Tyson Ave.
Factories: Du Co Ceramics; Flexo Wire Div.; Huse Liberty Mica; Niemand Bros.
Selling To: ★ A,M,D,I. **Salesmen:** 6 (eng 2)

Flushing

BETTAN, M. SALES, INC., 77-15 164th St., (212) 657-6659.
Factories: Calcon Wire; Cordover Elctrn.; Galaxy Elctrn.; HyGain Antenna Prod.; JFD Elctrn.; Magnecord; Monarch Elctrn. Int'l.; Telex Acoustics; University Sound; TRI EX Towers; Viking Tape Recorders. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 4

KELLER, L. W. ASSOCS. (See N. Bellmore, N.Y.)

TOBIAS & CO., 49-01 31st Ave., (212) 726-4551.
Factories: Empro Mfg.; J-B-T Inst.; Shurite Meters; Triplett Electrical Inst.; Vamistor.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 1)
Services: Repair, Warehouse

Forest Hills

MILLER, J. CO., 1 Continental Ave., (212) 263-4446.
Factories: Dynamic Components Corp.; Farmer Elec. Prods. Co., Inc.; Queensboro Machinery Corp.; Wacline, Inc. **Services:** Direct Mail
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 2)

Freeport

POSITIVE CONSULTANTS, INC. (See Bellmore, N.Y.)

Fulton

GAY, G. J., INC. (See Brookport, N.Y.)

Garden City

BACH SALES, 78 Wellington Rd., (516) 741-0570.
Factories: Acoustech; Koss Elctrn.; Revox Corp.; Rek-O-Kut.
Selling To: ★ A. **Salesman:** 1 (eng 1)

FRIEDMAN ASSOCS., INC. (See E. Orange, N.J.)

Geneva

SOMERS, J. F. CO., 527 S. Main St., (315) 789-2238.
Branch: 1221 Woodhill Dr., Gibsonia, Pa., (412) 442-3616.
Factories: AEI Telecomm.; Audiosears Corp.; Jet Line Prod.; Plastic Wire & Cable Corp.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 2)

Glen Cove

KUNZE, J. ASSOC., 29 Jefferson St., (516) OR 1-2376.
Factories: B.G. Labs.; Gem Inst.; I.T.T. Federal Labs; Melcor Elctrn.; Positronics Ind.; Parzen Res.; Transdyne Corp.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

SCOTT, G. C. CO., 6 W. Stuart Dr., (516) 676-2088.
Factories: Amerind, Inc.; Chem-Fab Corp.; Dow-Key Co.; Emporium Specialties.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

Glen Head

BREDE, H. W. CO., INC., 689 Greenvale-Glen Cove Rd., (516) 676-4900.
Branch: 712 State Tower Bldg., Syracuse, N.Y., (315) 471-3441.
Factories: Clifton Precision Prod.; Litton Computer Prod.
Selling To: ★ D,I. **Salesmen:** 3 (eng 2)

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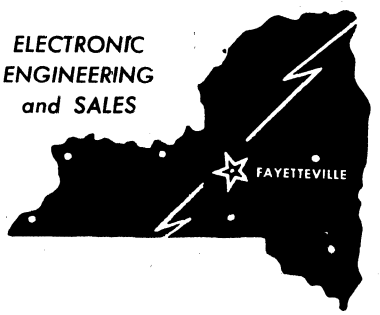

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Great Neck

BREUER, R. E. CO., INC., 1 Barstow Rd., (516) 466-3030. TWX: 510-223-0886.
Factories: Advance Ross Elctrn.; Aeronautical Elec.; Connector Corp.; Croname, Inc.; Electrical Windings; Ensign Div.; Lenz Elec. Mfg.; New-Berg Leather Prod.; Quam-Nichols; Syncro-Capacitor; Telefunken Sales.
Selling To: ★ I. **Salesmen:** 5

E. R. A., INC., 330 Great Neck Rd., (516) 482-9320. TWX: 510-223-0836.
Factories: ADC Prod.; Barry Contls.; Cambridge Thermionic; Churchill Corp.; Dexon, Inc.; Microwave Assocs.; National Semiconductor; Singer Co.-Diehel Div.; Star-Tronics.
Selling To: ★ A,M,D,I. **Salesmen:** 11 (eng 8)

GLASSMAN, S. ASSOC., INC., 28 Prestwick Terr., (516) 676-1039.
Branch: 326 Hillside Ave., Nutley, N.J., (201) 667-0653.
Factories: Audio Accessories Inc.; Current Inc.; Del Electrn.; Edal Ind.; General Reed Co.; Polyphase Inst.; Schrack Elec. Sales.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 2)

GRAYDON-SHERMAN, INC. (See Morristown, N.J.)

HARRIS & ALDRICH SALES, INC., 320 Northern Blvd., (516) 466-4122.
Factories: EBY Sales Co.; Electro Mechanical Instr.; Master Appliance; Philmore Mfg.; Premier Metal Prod.; Waber Elctrn.
Selling To: ★ D,I. **Salesmen:** 3 (eng 1)

KRASNER, H. ASSOCS., INC., 33 Great Neck Rd., (516) 487-0690. TWX: 510-223-0823.
Factories: ACDC Elctrn.; Accutronics; Cabtron Corp.; Data Technology; Elgenco, Inc.; Houston Inst.; Illumination Ind.; Peripheral Equip.; Remex Elctrn.; Scanbe Mfg.; United Telecontrol; WEMS.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Repair

JOSEPH ASSOCS., 6 Grave Ave., (516) HU 7-9395.
Factories: Fourjay Ind.; Marathon Broadcast Sales; McMartin Ind.; Metrotech Corp.; Mueller Elec.
Selling To: ★ A,D,I. **Salesman:** 1

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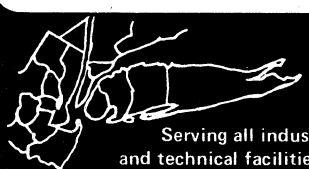

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Factories: All-Tronics; Autodynamics; Automated Environmental Sys.; Brush Inst.; Burns & Towne Sys.; Cimron Div.; Cipher Data Prod.; Datacraft Corp.; Exact Elctrn.; Flow Corp.; Itron Corp.; Ling Elctrn.; Logimetrics; Nelson-Ross Elctrn.; Newport Labs.; Redcor Corp.; Semiconductor Circuits Inc. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 5 (eng 5)

(See Advertisement This Page)

PACENT ENGRG. CORP., 300 Northern Blvd., (516) 482-4678.
Factories: American Rotors; Ammon Inst.; Ballastran Corp.; Lamination Specialties; Moloney Elec.; Pellfacs, Inc.; Tepro Elec.; Tepro of Fla.; Viking Wire Co. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 2)

PODEYN & SCHMIDT (See Woodridge, N.J.)

SYLVESTER, F. F. ASSOCS. (See Springfield, N.J.)

TYLINSKI, F., 338 Northern Blvd., (516) 466-9070.
Factories: Douglas Randall; Electro Switch; Fork Std.; Grayhill, Inc.; Grayhill Moldtronics; Hill Elctrn.; National Radio; Ripley Co.; Weller Elec.; Wood Elec.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 4)

Greenvale

AARON, B. D. & CO., INC., 55 Northern Blvd., (516) 621-0630.
Factories: Bausch & Lomb; Conductron Corp.; Coldspring Instr.; Curtis Inst.; EG & G Inc.; General Microwave; I C Metrics Inc.; Microwave Prod.; Trygon/Trymetrics.
Selling To: ★ M,D,I. **Salesman:** 3 (eng 3)

Hamburg

LSM ASSOCS. (See Phelps, N.Y.)

Hastings On Hudson

WILD, J. J., INC. (See Jericho, N.Y.)

Hartsdale

COMPONENTS SALES CORP., 221 E. Hartsdale Ave., (914) 725-1050.
Branch: 789 Massachusetts Ave., Lexington, Mass., (617) 862-1633.
Factories: Digitronics; Dressen-Barnes Elctrn.; Electro Mec Instr.; Globe Ind.; Patwin Elctrn.; Power Inst.; Precision Mechanisms; Theta Inst.
Services: Sales **Salesmen:** 6 (eng 6)

INSTRUMENT SALES CORP., 221 E. Hartsdale Ave., (914) 725-0800.
Branch: 789 Massachusetts Ave., Lexington, Mass., (617) 862-1633.
Factories: Wagner Digital; Whittaker Corp.
Selling To: ★ I. **Salesmen:** 6 (eng 6)
Services: Sales

ZLOWE, L. CO., INC., 16 North Central Ave., (212) MU 7-7282.
Factories: Dyna Co.; E-Z Way Prod.; Rectilear Res.; Vytec.
Selling To: ★ A. **Salesmen:** 2 (eng 1)

Hempstead

KAHGAN SALES CORP., 556 Peninsula Blvd., (516) 538-2300.
Factories: Amperex Elctrn.; Astatic Corp.; Bel Fuse; Bulova Elctrn.; Computer Diodes; Ferroxcube Corp.; Hopkins Engrg.; IEI.
Selling To: ★ D,I. **Salesmen:** 8 (eng 5)
Services: Warehouse

KUBRICK, D. CO., 456 S. Franklin St., (516) IV 3-7230.
Factories: Acme Lite Prod.; Beltronix Sys.; Kenwood Mfg.; S. & A. Elctrn.; V.P.I. Vari Prod.; Wen Prod.
Selling To: ★ A,D,I. **Salesmen:** 3

Hicksville

SALSBURY ASSOCS., INC., 331 W. John St., (516) 938-1080.
Factories: American; Applied Res.; Control Equip.; Discon Corp.; Ferrotec Inc.; Micro-Power, Inc.; Microwave Devel. Labs.; Ryka Scientific; USM Corp.; VARI-L Co. **Services:** Direct Mail
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

HEFFERNAN, H. J. CO. (See Arlington, Va.)

MEASUREMENTS UNLIMITED (See Elkins Pk., Pa.)

Huntington

ANDREWS & ANDREWS, INC., 140 E. Main St., (516) 692-8686.
Branch: 44 N. Dean St., Englewood, N.J., (201) 569-8800. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)

AUTOMATION SALES, INC., Box 448, (516) 692-6207.
Factories: Automated Computer Entry Sys.; Automated Production; Cable Machinery; Chuxco; Controlamation; Electronic Tab Serv.; Stone Key R&D; Tek Com.; Viva Industries.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)

MAYER, C. R. CO., INC., Box 152, (516) 921-7876.
Factories: American Elec. Cable; FKS Comm.; Frequency Elctrn.; Hardman, Inc.; Mid-Eastern Ind.; Precision Connector Div.; Robinson-Nugent; TIA Elec.; Wakefield Engrg.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 3)

Huntington Station

DATA-REP ASSOCS., INC. (See Ridgewood, N. J.)

GRAY & REED ASSOCS., INC., 9 Dunford St., (516) GE 3-3333.
Branch: 626 Hillcrest Ave., Westfield, N. J., (201) 233-6116.
Factories: Addington Lab.; Ad-Yu Elctrn.; Aertech Ind.; C.D.I., Inc.; Eastern Microwave; E.I.P. Labs; EMC Technology, Inc.; Hitachi; Keltec Fla.; Kinetic Technology; M-G Microwave; Micro-Now Inst.; M-O Valve Co.; Narda Microwave Corp.; Peinsula Microwave Labs.; R.F.D., Inc.; Werlatone, Inc. **Services:** Sales Office
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)

Irvington

SHPRENTZ, H. CO., 126 Deertrack La., (914) 591-7970.
Factories: Ablestik Adhesive; Arvee Engrg; Development Assocs. Contrls.; W. H. Ferwalt, Inc.; IB Inst.; Inso Elctrn. Prod.; Larson Inst.; Linear Networks; T. B. Moore Co.; Parabam, Inc.; Spectrum Inst.; Tidewater Technological.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Ithaca

DEAN, B. INC., 714 W. Clinton, (607) 272-2187. TWX: 510-255-5876.
Factories: American Technical Ceramics; Components Inc.; Coors Porcelain; Grayhill, Inc.; Industrial Timers; N. England Inst.; Solid State Prod. Inc.; Union Carbide/Elctrn.; United Transformer Co.; Varo, Inc.; Wheelock Signals.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 4)
Services: Warehouse

Jackson Heights

LANDIS, C. SALES CO., (212) 458-7900.
Factories: Beauchaine & Sons; Glidelite Ind.; Seco Elctrn.
Selling To: ★ A,D. **Salesman:** 1

Jamaica

KAGAN, H. ASSOCS. (See Wayne, N. J.)

LAZARUS, N., 80-43 190th St., (212) HO 5-2573.
Factories: Fedco Prod.; A K Elec.; Hickory Ind.
Selling To: ★ I. **Salesmen:** 3 (eng 3)
Services: Warehouse

S. A. M. ASSOCS., 150-08 87th Ave., (212) 658-8881.
Branch: 18 Tilghman Dr., Wayne, N. J.
Factories: Applied Design Co.; Chicago Dynamic Ind.; Goldsman Inc.; Milwaukee Transformer; Printact Relay Div.; Technitrol.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 2)
Services: Warehouse

S-J SALES ASSOCS. INC., 148-05 Archer Ave., (212) 291-3232. TWX: 710-582-2635.
Factories: CTS Corp.; HH Eby Co. Inc.; Hamilton-Hall Resistor; Phaostron Inst.; Quality Transformer; Solitron Devices; STM Capacitor; UID Elect.; Wabco Relays.
Selling To: ★ I. **Salesmen:** 10 (eng 7)
Services: Warehouse

SECO IND. INC., 87-66 150th St., (212) 279-1134.
Branch: 44 Lansdown Rd., East Brunswick, N. J., (201) 257-9117.
Selling To: ★ D,I. **Salesmen:** 4 (eng 4)

Jericho

AEROL ASSOCS., INC., 400 Jericho Tpke., (516) 822-0800. TWX: 510-221-1847.
Branches: 2920 Columbia St., Torrance, Calif.; 63 N. Main St., Essex, Conn.; 2400 Wilson Blvd., Arlington, Va.; 466 Central Ave., Northfield, Ill.; 6631 E. Kellogg, Wichita, Kans.; 2926 E. Cold Spring La., Baltimore, Md.; 216 Burroughs Rd., Braintree, Mass.; Rte. 1, Box 230, Anoka, Minn.; 34 N. Brentwood Blvd., St. Louis; 730 Clifton Ave., Clifton, N. J.; 400 Jericho Tpke., Jericho, L. I., N. Y.; Box 21, Avon Lake, Ohio; 5522 Alomar Dr., Cincinnati, Ohio; 474 Thurston Rd., Rochester, N.Y.; 80 Second St. Pke., Southampton, Pa.; 74 Pleasantview Terr., New Cumberland, Pa.; 6115 Denton Dr., Dallas, Texas.
Factories: Aeroflex Labs.; Aerospace Sys.; Allied Res. Assocs.; Arvin Sys.; American Std.; Bobrick Aero Missile Prod.; Canadian Car; Deutsch Co.; Electro-Form, Inc.; Fairchild Contls.; Haydon Switch & Inst.; Int'l. Electro Exchange; MM Elctrn. Enclosures; Panel Contls.; Price Elec.; Pulsation Contls.; Purolator; Pyronetics; Pyrotector; Rocker Solenoid; Rovalco Contls.; Rubber Teck; Sonex; Tectron; Tempo Inst.; Transport Dynamics.
Selling To: ★ M,I. **Salesmen:** 32 (eng 29)
Services: Deal in Service

DAL-TECH DEVICES INC., 366 N. Broadway, (516) 433-7448.
Factories: Anzac Elctrn.; Atlantic Microwave; Ampar; Filmohm Div.; Lundy Elctrn. & Sys.; Minax Devices; Mullard; Royal Microwave Div.; Solitron Microwave; TRF, Inc.
Selling To: ★ I. **Salesmen:** 3 (eng 2)
Services: Stocking Rep.

MILLER, G. E. ASSOC., 47 Birchwood Park Dr., (212) 586-4780.
Branch: 28 Knollwood Ave., Stamford, Conn.
Factories: Micro-Comm.; Minneapolis Speaker; Mortronics; Perry-Briggs Corp.; Pioneer Elctrn.; Tandberg of America; Tape-Athon Inc.; Trutone Elctrn.
Selling To: ★ A,I. **Salesmen:** 2

WILD, J. J., INC., 400 Jericho Tpke., (516) 921-7100.
Branches: 380 Main St., Laurel, Md., (301) 776-7670; 570 Hillside Ave., Needham, Mass., (617) 444-2366; Box 300, Ramsey, N. J., (201) 327-4244; Box 266, Hastings-on-Hudson, N. Y. (914) 963-3803; 80 Second St. Pike, Southampton, Pa., (215) 357-6645.
Factories: Analogic; Bliley Elec.; Chrono-Log; Cognitronics; Concord Cont.; Datamark; Digi-Data; Digital Devices; General Design; Indiana Genl.; Infotechnics; Mac Panel; Milgo Elctrn.; Sanders Assocs.; Texas Inst.; Ultronic Sys. **Salesmen:** 8

Kenmore

LAMB, R. F. CO., INC., 1865 Kenmore Ave., (716) 874-4900. TWX: 710-522-1808.
Branches: 63 Norcrest Dr., Rochester, N. Y., (716) 544-5580; Picard Bldg., E. Molloy Rd., Syracuse, N. Y. (315) 454-2469; Box 661, Uptown Sta., Kingston, N. Y., (914) 338-8833.
Factories: Agastat Div.-ESNA; Delta Design; EG&G; Esterline Angus; Fenwal; Hallmark Standards; Ircon Inc.; Potter & Brumfield; H. Sticht Co.
Selling To: ★ D,I. **Salesmen:** 9 (eng 7)
Services: Repair, Warehouse

SIMBERKOFF SALES, INC. (See So. Orange, N. J.)

Kingston

LABRONICS, INC. (See Syracuse, N. Y.)

LAMB, R. F. Co., INC. (See Kenmore, N. Y.)

Larchmont

FREED, L. & CO., Box 417, (914) TE 4-6510.
Factories: Gavitt Wire & Cable; Sterling Mfg.; William Tell Woodcrafters; Wirecraft Prod.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

MASIN, O. F., INC., 140 Boston Post Rd., (914) 834-7500. TWX: 710-566-1106.
Factories: Computer Components; Electronic Specialty; International Insts.; Life Inst.; Metal Works Inc.; Pickering & Co.; Switchcraft.
Selling To: ★ D,I. **Salesmen:** 4
Services: Representatives

Latham

CARSE, T. SALES CO., INC., Box 71, (518) 785-5844.
Factories: Delavan Mfg.; Hurst Mfg.; Partlow Corp.; Potter & Brumfield; States Co.; Sticht Co.; Vap-Air Div.; Western Electro-Mechanical Co.; Williamson Dev. **Selling To:** ★ I.

Little Neck

CAIN & CO. (See Encino, Calif.)

MILLER, B., Box 72, (212) 229-4673.
Factories: United Transformer.
Selling To: ★ I. **Salesman:** 1

Liverpool

CAIN & CO. (See Encino, Calif.)

NACO ELCTRN. CORP., 119 Luther Ave., (315) 474-7481. TWX: 710-541-0439.
Branches: 74 Park Ave., Rochester, N. Y., (716) 244-4720: 2631 Edgewood Rd., Utica, N. Y., (315) 732-1801; 14 Lori St., Poughkeepsie, N. Y., (914) 462-2730.
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Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Repair, Warehouse

RJC ASSOCS., 219 Oakridge Terr., (315) 457-3220.
Factories: Accutronics; Airborne Inst. Lab.; Beckman Inst.; Dynage, Inc.; Micro Inst.; Optical Elctrn.; Rohde & Schwarz; Spencer-Kennedy Lab.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)
Services: Direct Mail

WADSWORTH MFG. ASSOC., INC., 183 Buckley Rd., (315) 652-2865.
Branches: 71 Parker Ave., Atherton, Calif., (415) 321-3619; 15920 Temecula St., Pacific Palisades, Calif., (213) 454-4313; 1229 Jarvis Ave., Chicago, Ill., (312) 274-0601; 183 Buckley Rd., Liverpool, N. Y., (315) 652-2865; 35 Stauber Dr., Plainview, N. Y., (516) 433-3559; 12 Jamstead Ct., Williamsville, N. Y., (716) 634-8650; 1106 E. 8th St., Eddystone, Pa., (215) 876-8462; 201 S. Dorothy Dr., Richardson, Texas, (214) 231-5971.
Factories: Beckwith Carbon Corp.; Carler Products Corp.; Ceramic Magnetics; Continental Devices Corp.-Special Products; Diamomite Inc.; L & D Inc.; Quality Components; Monolith Inc.; Warren Components Corp.; Western Scientific Inc.
Selling To: ★ I. **Salesmen:** 11 (eng 6)
Services: Warehouse

WARRELMAN-GORMAN CO. (See Livingston, N. J.)

Lockport

SIMBERKOFF SALES, INC. (See So. Orange, N. J.)

Long Island City

BIALEK, S. ASSOCS., INC., 42-15 Crescent St., (212) 786-5562.
Factories: Anderson Elctrn.; Foster Transformer Co.; Rola Div.; Standard Condenser; Winatic.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 2)

Lynbrook

BITTAN ASSOCS., INC., 381 Sunrise Hghwy., (516) 593-3833. TWX: 510-225-8429.
Factories: Alco Elctrn. Prod.; Bramco Contls.; Custom Circuit; Electroid; Integrated Circuit Elctrn.; Keystone Carbon; Rye Ind.; Spectrol Elctrn.; Tel Labs.; Ungar Elec. Tools; Vitramon; Western Magnetics.
Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 3)

PULEO ELCTRN., 39 Hutcheson Pl., (516) 599-4875.

Malverne

ERDE-HAVILAND ASSOCS., INC., 333 Hempstead Ave., (516) 599-6500.
Factories: GBC CCTV Corp.; Irish Elctrn. Ent.; Plastoid Corp.; Setchell Carlson. **Services:** Repair
Selling To: ★ A,D,I. **Salesmen:** 2

Mamaroneck

CANE TECHNICAL SALES, INC., 555 E. Boston Post Rd., (914) 698-4411.
Factories: American Time Prod.; Automation Dynamics; F. W. Bell; Bourns, Inc.; Columbia Res. Labs.; E. I. DuPont; Dytronics Co.; Control Data.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

Manhasset

FARA, R. ASSOCS., 1295 Northern Blvd., (516) MA 7-6428.
Branch: 15 Alden St., Cranford, N. J., (201) 272-5510.
Factories: Agastat Div.; Central Transformer; Electro Mechano; Holtzer Cabot; Judson Bigelow; Redington Counters.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)

HRC ASSOCS., 390 Plandome Rd., (516) 627-4644. TWX: 510-223-0821.
Factories: Ansley Mfg. Co.; Daven-Div.; Dynage; Elec-Trol, Inc.; Fairchild Contls.
Selling To: ★ A,M. **Salesmen:** 3 (eng 3)

KAELBER & MACK, 75 Plandome Rd., (516) 627-6620.
Branch: 37 Hillcrest Rd., Wakefield, Mass., (617) 245-9359.
Factories: Amer. Elec. Heater; Dale Elctrn.; DE Wire Fab; Industrial Devices; Thermal Wire & Elec.; Thomas & Skinner; Wilcox Prod.
Selling To: ★ M,D,I. **Salesman:** 5 (eng 3)

NORTHEAST ENGRG., INC. (See Hamden, Conn.)

SPELLMAN, F. CO., 1295 Northern Blvd., (516) MA 7-3399: TWX: 510-223-0812.
Factories: Central Resistor Corp.; Eldema Div.; Jensen Mfg.; Mel-Rain Corp.; P. R. Mallory Capacitor; Radio Materials.
Selling To: ★ A,M,D,I. **Salesmen:** 2 (eng 1)

Manlius

PERKINS, A. L. CO., Kinlock Plaza, (315) 682-5005.
Factories: Dialight; Ideal Precision Meter; Leecraft Mfg.; Microtran; Republic Elctrn.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

Marietta

MIDSTATE RESEARCH, INC. (See Syracuse, N. Y.)

Massapequa Park

METRO TECHNICAL SALES CORP., 103 Pinewood La., (516) 798-1066.
Branch: 39 Bluefield Ave., Harrington Pk., N. J., (201) 768-8495.
Factories: Astrodyne; Computer Inst.; Connecticut Ind. Elctrn.; Cu Tronics; E-Tronics; Inter-Market; Shelly Assocs.; Sunbeam Elctrn.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

Mattydale

ONYX, W. M. CO., Box 4, (315) 479-6561.
Branch: 101 Pickwick Rd., DeWitt, N. Y., (315) 446-7930.
Factories: J. H. Ambrose; C. M. Hathaway Engrg. Lab.; Hydro Molding Co.; Inter-Lakes Bases; Mandex Mfg. Co.; C. Sjoberg & Son; TA Mfg.
Selling To: ★ A,M,I. **Salesman:** 1 (eng 1)

Mineola

COLUCCI, R. A. Co., 230 Mineola Blvd., (516) 746-0397.
Factories: Penntube Plastics; Philadelphia Insulated Wire; Potter Co.; Spectron Glass & Elctrn.; T & F Fluorocarbon.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

COMTRONIC ASSOCS., 1551 Franklin Ave., (516) PI 1-8966.
Factories: Amelco Semiconductor; Atohm Elctrn.; Bulova Watch Co.; Components Inc.; Hart Advance Relays; R. C. L. Elctrn.; United Transformer.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)

MARS SALES TRONICS, 220 Jericho Tpke., (516) 741-1270.
Factories: Allied Decals; Audiophonics; American Plasticraft; Brown Engrg.; Chatham Nameplate; General Automatic; Ionetics; Keyston; North American Alloy; Star-A-Elec.; Superior Resistor; Trans-Tek; Xexex Corp.
Selling To: ★ A,I. **Salesmen:** 5 (eng 3)

Monsey

TALBE CO., INC. (See Englewood Cliffs, N. J.)

Mount Vernon

BURLINGAME ASSOCS. LTD., 510 S. Fulton Ave., (914) 664-7530. TWX: 710-562-0105.
Branches: 1749 Rockville Pike, Rockville, Md., (301) 427-1255. TWX: 710-828-0784; 1 Belmont Ave., Bala Cynwyd, Pa., (215) 835-2080. TWX: 510-662-5685; E. Molloy Rd., Syracuse, N. Y., (315) 454-2408. TWX: 710-541-0445; 7 Wellington St., Waltham, Mass., (617) 894-1955. TWX: 710-324-0687.
Factories: Beco; Cambridge Elctrn.; Computer Automation Inc.; Control Sys. Res.; Data Graphics; Data Royal; Dytro, Inc.; EMC Inst. Inc.; Electrolab; Federal Scientific; General Microwave; Gertsch Dept.; Lorch Elctrn.; Lorch/Adret; Multimetrics; NJE Corp.; Neff Inst.; Ray Proof Corp.; Singer Co.-Metrics Div.; Standard Logic; Systron-Donner Corp.; Techni-Rite Elctrn.; Texas Inst.
Selling To: ★ M,I. **Salesmen:** 25 (eng 25)
Services: Repair

FRIEDMAN-SMITH ELCTRN. SALES, INC., 519 S. 5th Ave., (914) 664-4866.
Factories: APM-Hexseal; Digilog Elctrn.; Electro-Techniques; ETC Inc.; Microtek Elctrn.; Sealectro; Teledyne Relays; Torsion Balance Co.; Transistor Elctrn.; Truco; Whitso.
Selling To: ★ D,I. **Salesmen:** 4 (eng 4)

(See Advertisement This Page)

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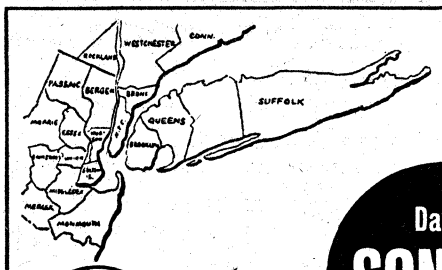

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GROSSMAN, H. ASSOCS., 519 S. Fifth Ave.
Factories: Picot-Michael Procedes; Transtech Co.; Zolomatics. **Services:** Repair, Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 2 (eng 2)

Q.E.D. ELCTRN., INC., 500 Nuber Ave., (914) 664-0080. TWX: 710-560-0014.
Branches: 2916 Federal St., Camden, N. J., (215) 925-8711. TWX: 710-891-7071; 880 Bonifant St., Silver Spring, Md., (301) 588-8134. TWX: 710-825-0073.
Factories: Beckman Inst.; Burr-Brown Res.; Chronetics; Data Technology; Dynamics Res.; Equipto Elctrn.; General Resistance; Hallmark Std.; Isofilm Int'l.; Micro Inst.; Millivac Inst.; Power Designs; Printed Motors; Signetics Corp.; Siliconix, Inc.; Weston Inst.
Selling To: ★ M,I. **Salesmen:** 16 (eng 16)
Services: Repair, Stocking

(See Advertisement This Page)

SONKIN, D. ASSOCS., INC., 10 Fiske Pl., (914) MO 8-9809.
Factories: Augat, Inc.; Aztec Elctrn.; C & K Comp.; Electro-Mechanical Inst.; Griffith Plastic Prod.; Litton-Data Sys.; Practical Automation; Premier Metal Prod.; Presin Co.; Rifa Prod.; Wanlass Elec.
Selling To: ★ M,D,I. **Salesmen:** 3

(See Advertisement This Page)

N. Bellmore

KELLER, L. W. & ASSOCS. INC., 1680 Newbridge Rd., (516) 785-2826.
Branches: 35-12 205th St., Bayside, N. Y., (516) 785-2826; 25-40 Union St., Flushing, N. Y., (516) 785-2826; 32A Woodedge Ave., Edison, N. J., (516) 785-2826.
Factories: Arista Enterprises; Antennacraft; Component Specialties; Dictation Prod.; EBY; N.T.T.; New-Tronics Corp.; Pace Comm.; Sencore; Telephone Dynamics; U.T.C. Sound.
Selling To: ★ A,D,I. **Salesmen:** 5 (eng 1)
Services: Warehouse

New Hartford

REAGAN, J. A. CO., INC. (See Albany, N. Y.)

New Hyde Park

KENNEDY, R. P. CO., INC. (See Rochester, N. Y.)
LUCE, R. P. & CO. (See Berkeley Hghts, N. J.)

New Rochelle

H. A. F. SPECTRUM ASSOCS., INC., 35 Broadfield Rd., (914) NE 2-3800.
Factories: Control Logic; Data Device; Dependable Printed Circuits; Flexible Prod.; Frequency Sources; Gibbs Mfg. Corp.; Megadyne; Pneumafil Design Enclosures; Transitron.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Repair, Warehouse, Mailing

New York

APPELL, L. W. CO., INC., 11 Warren St., (212) WO 4-4255.
Factories: Columbian Vise; Eklind Tool; Slaymaker Lock; Taylor Chain; Ungar Electric; Xcelite, Inc.
Selling To: ★ D. **Salesmen:** 4

BEEMER ENGRG. CO. (See Ft. Washington, Pa.)

BITTAN ASSOCS., INC. (See Lynbrook, N. Y.)

BRESSLER, J. J., INC. (See Union City, N. J.)

CAMBER, M., 1700 York Ave., (212) 369-4222.
Factories: General Inst. Corp.; Merit Coil & Trans.; Nytronics; Owasar Devices.
Selling To: ★ A,M,I. **Salesmen:** 2

CHRISTIE, S. D. ASSOCS., INC., 175 Fifth Ave., (212) 674-9010.
Factories: Atlantic India Rubber Co.; Chicago Rivet & Machine; Great Lakes Screw Corp.; Hindley Mfg. Co.; Kendale Ind.; Midwest Sintered Prods. **Services:** Repair
Selling To: ★ D,I. **Salesmen:** 3

ELLIS-HABER-RAMP CORP., 2315 Broadway, (212) 799-4040.
Factories: Raven Elctrn.; Video Color.
Selling To: ★ D,I. **Salesmen:** 4 (eng 4)

GINSBURY, S. LTD., 72 W. 45th St., (212) 687-3213.
Factories: Arnold Engrg. Co.; Balantine Labs.; C-Cor Elctrn.; Clairex; Clinton Elctrn.; Dynamic Res. Corp.; Electro Prod. Labs.; General Microwave; Hoffman Prod.; Houston Elctrn.; Lavoie Lab. Div.; McCoy Elctrn.; Measurements, Div.; Methode Elctrn.; Milwaukee Resistor; Radio Res.; Solar Sys.; Specific Prod.; Syntronics; Technitrol Inc.; Telemet Co.; Thomas Elctrn.; Waveline.
Selling To: ★ M,I. **Services:** Warehouse

GLASS, E. ASSOC., 250 W. 57th St., (212) JU 6-8440.
Factories: American Comp.; Gulton Ind.; Elctrn. Plastics; Gudeman; Microtran; National Capacitor; Sage Elctrn.; Sloan Co.; Standard Elec.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

KLS ASSOCS. INC. (See Fairfield, N. J.)

MANHATTAN SALES, 17 E. 16th St., (212) 242-8262.

Factories: Fostoria-Fannon, Inc.; Holub Ind.; North American Elec. Lamp Co.; Stocker & Yale.
Selling To: ★ D,I. **Salesmen:** 4
Services: Warehouse

McKEOWN, R. CO., INC. (See Livingston, N. J.)

METROREP, INC. (See Freehold, N. J.)

MOCH, G. M. CO. (See Ridgefield, N. J.)

MORHAN EXPORTING, 458 Broadway, (212) 925-1257.
Factories: Ampex Stereo Tape; B & K Inst.; Benjamin Elect. Sound; Courier Comm.; Dynascan; Freed Transformer; Grommes Precision; Irish Tape Co.; Precision Apparatus; H. H. Smith; Tung-Sol. **Services:** Warehouse, Shipping
Selling To: ★ A,M,D,I.

MORSE, I. SALES, 150 Broadway, (212) CO 7-2913.
Factories: Electro-Mel Ind.; Eng. & Elctrn. Devices; Hunter Tools; Imtro Corp.; M. & M. Metal Prod.; Philmore Mfg.; Nenco Elctrn.
Selling To: ★ D,I. **Salesmen:** 3 (eng 2)
Services: Warehouse

PLASENCIA, J., INC., 521 Fifth Ave., (212) 867-8084.
Factories: Alma Engrg.; Alliance Mfg. Co.; Ball Bros. Res. Corp.; F. W. Bell, Inc.; Calfone Roberts Elctrn., Div.; Dytronics Co.; Galaxy Elctrn.; Marathon Prod.; Packard Bell Elctrn.; Riker Video Ind.; Sinclair Radio Labs.; Superior Continental; Technical Appliance; Tapecaster Elctrn.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

ROBURN AGENCIES, INC., 431-435 Greenwich St., (212) 966-2130. **Services:** Warehouse
Selling To: ★ A,M,D,I. (all export)

ROCKE INT'L. CORP., 13 E. 40th St., (212) 689-0200.
Branches: 53-55 Rue de l'Ete, Bruxelles, Belgium; Tetra Pak House, Lower Richmond Rd., Richmond, Surrey, England; 22 Avenue Emile Zola, Paris, France; Franz-PruNer-Strasse 15, 8000 Munchen, Germany; Via Ennio Quirino Visconti, Rome, Italy; Copenhagen Ind. Centre, Holbergsgade 14, Copenhagen K, Denmark; General Peron, Madrid, Spain; Rua da Emenda 66, Lisbon, Portugal; Box 1502, Tokyo Central, Tokyo, Japan; Nybohovsgrand 56, Stockholm S.V., Sweden; Central America Hq., Box 300, San Jose, Costa Rica; Apartado Aereo No. 20654, Bogota D.E. No. 2, Colombia; Avenida Sao Joao 1086, Sao Paulo, Brazil; Alvaro Obregon No. 189, Mexico 7, D.F. Mexico; Apartado Correos 13378, Caracas, Venezuela; Box 3298, Manila, Philippines. **Selling To:** ★ A,D,I.

ROWLAND, E. W., 90 West St., (212) 964-7188.
Factories: B-W Controller; Precision Prod. & Contls.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)
Services: Engineering (application)

RYWEL SALES, INC. (See Rockville Centre, N. Y.)

SAFTLER, P. ASSOCS., INC., 157 W. 57th St., (212) 247-3855. TWX: 710-581-5887.
Branch: 67 State St., Pittsford, N. Y., (716) 381-2828.
Factories: All Star Prod.; Buckeye Stamping; Chicago Switch; J. Fluke Mfg.; General Ind.; Korry Mfg.; Lion Cords; McGregor Elctrn. Ind.; Molex Prod.; Richco Plastic Co.; Sightmaster Corp.; Solar Mfg.; Sonotone.
Selling To: ★ I. **Salesmen:** 5 (eng 3)

SMITH, H. F., 259 W. 14th St., (212) CH 2-2398.
Factories: Drake Mfg.; Katolight Corp.; Trimm.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 1)

SPRUNG-NUSSBAUM INC., 254 W. 31st St., (212) 565-1820. TWX: 710-581-6116.
Factories: Alcon Metal Prod.; Bradford Inds.; Diodes Inc.; Electra/Midland; Modutec; Nytronics Inc.; Stackpole Carbon Co.; Wilson-Hurd Inc.
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 4)

SWEDGAL, M., 258 Broadway, (212) WO 2-5485.
Factories: Jackson Bros.; May Precision Com.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 1)
Services: Warehouse

TOWER SALES ENGRG. CO., 550 Fifth Ave., (212) 246-7611.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

WEISS, W. W. & ASSOCS., 1780 Broadway.
Factories: Fuji Elec.; Izumi Precision; K A Elctrn.
Selling To: ★ I. **Salesmen:** 5 (eng 3)
Services: Repair, Warehouse

WILLIAMS, J. ASSOCS. (See Califon, N. J.)

Neponsit

ANDREW-DOUGLAS CORP., 222 Beach 145 St., (212) 474-6000.
Factories: Jones-Motrola; Kurman Inst.; Pennsylvania Elctrn. Tech.; Photomation; Pomona Elctrn.; Stow Labs. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

N. Syracuse

COMPAR ALBANY, INC. (See Albany, N. Y.)

SIMBERKOFF SALES, INC. (See So. Orange, N. J.)

Pelham

ROBERTS, P. V. CO., 247 Pelhamdale Ave., (914) 738-2710.
Factories: Engineered Sinterings & Plastics; H & R Plastics Div.; Micromelt Casting; Simonds Steel Div.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

Phelps

LSM ASSOCS., Orchard Pk., (315) 548-4891.
Branches: 218 E. Lake Rd., De Ruyter, N. Y., (315) 662-3296; 54 Puritan Pl., Hamburg, N. Y. (716) 649-8380.
Factories: Blonder Tongue Labs; Centralab; Electrovoice Inc.; J. W. Miller Co.; Motorola; Perma Power Co.; Pickering & Co.; Robins Ind.; Soundolier Inc.; South River Metal; Telex Comm.; Waldom Electronics.
Selling To: ★ A,D. **Salesmen:** 3

Pittsford

MITSCHER, R. W. CO., INC. (See Buffalo, N. Y.)

SAFTLER, P. ASSOC., INC. (See New York, N. Y.)

Plainview

CENTRAL ASSOC., INC. (See Englewood, N. J.)

SBM ASSOCS., INC. (See Rochester, N. Y.)

WADSWORTH MFG. ASSOC., (See Liverpool, N. Y.)

Pleasantville

SBM ASSOCS., INC. (See Rochester, N. Y.)

Port Washington

AARON, P. D. ASSOCS., Box 511, (516) 767-8480. TWX: 510-223-0810.
Factories: Automatic Metal Prod.; Berkshire Elec. Cable; Hughes Aircraft; Isotronics; Marstan Elctrn.; Precision Elctrn. Com.; Tingstol; TRW Capacitor Div.; U. S. Capacitor.
Selling To: ★ D,I. **Salesmen:** 5 (eng 3)

DI BLASI, J. ASSOC., INC., 14 Vanderventer Ave., (516) 767-0470.
Factories: Airpax Elctrn.; Control Knobs; J. Millen Mfg.; Par Ind.; Tranco.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 2)

RYAN ASSOCS., 60 Roger Dr., (516) 767-7958.
Factories: Esson Elctrn.; Hammond Mfg.; Matrix Engrg.; Panduit Corp.; Synvo Corp.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

Poughkeepsie

J. H. ELCTRN. SALES CO. (See Towson, Md.)

NACO ELCTRN. CORP. (See Liverpool, N. Y.)

Red Hook

OSSMANN COMPONENT SALES. (See Rochester, N. Y.)

Rochester

APPLETON, H. CO. (See Los Angeles, Calif.)

BROGAN ASSOCS., INC. (See Westbury, N. Y.)

BROWN, J. ELCTRN. (See Yonkers, N. Y.)

FERGUSON, T. SALES CO., INC., Box 3893, (716) 482-7757.
Branch: Box 126, DeWitt, N. Y., (315) GI 6-3330.
Factories: ADC Prod.; Inc.; Agastat; Barry Contls.; Electro-Craft; Electro Switch; Icore; Midwest Circuits; Omega. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 5 (eng 3)

FISH ASSOCS. (See Utica, N. Y.)

FRANKLIN, W. A. SALES CORP. (See Syracuse, N. Y.)

GISLASON SALES, INC., 617 Case Bldg., (716) 454-4741. TWX: 510-253-2932.
Factories: Electro Cube, Inc.; Hi-Grade Alloy Corp.; Humi Seal Div.; Industrial Mica Div.; L. Frank Markel & Sons; Milwaukee Resistor; Permavolt Transformers; Permonite Mfg.; Positive Connector Co.; Rathbone Corp.; Spin-Rite Corp.
Selling To: ★ I. **Salesmen:** 3 (eng 1)

JOHNSON, H. C. AGENCIES, INC., 111 Mt. Hope Ave., (716) 232-2688.
Branches: RD 3, Ballston Lake, N.Y., (518) 882-6321; Box 215, Fayetteville, N. Y., (315) 637-9383; Box 315, Williamsville, N. Y., (716) 632-7880.
Selling To: ★ M,I. **Salesmen:** 6 (eng 3)
Services: Warehouse

KELLER IND. PRODS., INC., 70 Mt. Hope Ave., (716) 546-4313.
Branches: 126 Pearl St., Buffalo, N. Y., (716) 852-7212; 3650 James St., Syracuse, N. Y., (315) 437-9195.
Factories: A & A Mfg.; Allied Witan Corp.; Bowles Engrg.; Carlyle Johnson Machine Co.; Custom Component Switches; Continental Hydraulics Div.; Delta Power Hydraulic Co.; Fairchild Hiller Corp.; Hannifin Press Co.; Lear Siegler Inc.; Marquette Metal Prods.; Parker Hannifin Corp.; Westinghouse Elec.
Selling To: ★ I. **Salesmen:** 4 (eng 3)
Services: Warehouse

KENNEDY, R. P. CO., INC., 39 Saginaw Dr., (716) 271-6322.
Branches: Box #56, Fayetteville, N. Y., (315) 637-9531; Green Tree Dr., N., Hyde Park, N. Y., (914) 229-2269.
Factories: Aladdin/Magnetics; Associated Testing Labs.; Bowmar Inst.; Fenwal Elctrn.; Ferroxcube; Filtron; Grigsby-Barton; Hamlin; Modutec; Precision Metal; Technipower; Ultronix; Unholtz-Dickie; Whittaker. **Services:** Stocking
Selling To: ★ I. **Salesmen:** 4 (eng 3)

(See Advertisement This Page)

KIRSH, P. L. ASSOC., 223 Windemere Rd., (716) 288-0705.
Factories: Electrical Utilities Co.; Hitemp Wires Div.; Jorita Mfg. Co.; Ottawa Rubber; Tuttle Elec. Prod.
Selling To: ★ I. **Salesman:** 1 (eng 1)

LAMB, R. F. CO., INC. (See Kenmore, N. Y.)

LAZOR, J. ASSOCS., INC., 39 Saginaw Dr., (716) 473-8337.
Factories: Carborundum; Mosaic Div.; Syntron Div.; Tensolite Ins. Wire Div.; Adirondack Wire & Cable. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 3 (eng 3)

MARSEY SALES, 206 Park Ave., (716) 442-9700.
Factories: Alpha Wire; Bud Radio; Empire Scientific; Hammarlund Mfg.; Kurz-Kasch, Inc.; Merit Coil & Transformer; Setchell-Carlson; Turner Co.
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 1)
Services: Warehouse

NACO ELCTRN. CORP. (See Liverpool, N. Y.)

OSSMANN COMPONENT SALES CORP., 39 Saginaw Dr., (716) 442-3290. TWX: 510-253-7685.
Branches: 132 Pickard Bldg., Syracuse, N. Y., (315) 454-4477. TWX: 710-541-1522; 1901 Vestal Parkway, E., Vestal, N. Y., (607) 785-9949. TWX: 510-252-1987; 77 Kelly Rd., Red Hook, N. Y., (914) 297-7773.
Factories: Avantek, Inc.; Babcock Relays; Beede Elec. Inst.; Curtis Dev.; Deltron, Inc.; Fairchild Contls.; Helipot Div.; Industrial Elctrn. Eng.; Microlab/FXR; Pyrofilm Resistor Co.; Sibley Co.; Tel Labs Inc.; Vemaline Prods.; Western Microwave Labs.
Selling To: ★ M,I. **Salesmen:** 6 (eng 4)
Services: Warehouse

REAGAN, J. A. CO., INC. (See Albany, N. Y.)

REED ELCTRN., INC., 2815 Monroe Ave., (716) 473-2767. TWX: 510-253-3246.
Branch: Vestal Pkwy. E., Vestal, N. Y., (607) 748-7391.
Factories: Amperex Elctrn.; ASM Corp.; Duncan Elctrn.; Electronic Com.; Elctrn. Enclosures; Globe Ind.; Helical Prod.; IERC; Jonathan Mfg.; Micro-

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wave Assoc.; Int. Microwave; Muirhead Inst.; Phelps-Dodge Elctrn. Prod. Co.; Price Elec.; Sage Elctrn. Div.; Transistor Devices.
Selling To: ★ A,M,I. **Salesmen:** 4

RYERSON, J. D. ASSOC. INC., 1672 Monroe Ave., (716) 442-1900. TWX: 510-253-0293.
Branch: Box 1400, Syracuse, N. Y., (315) 656-7419.
Factories: Cal-Power Corp.; Daytronic Corp.; Fairchild Instr.; Gertsch; Int'l. Light; Merrimac Res. & Dev.; Microwave Cavity Labs.; Motorola, Inc.; N H Res.; Nuclear Corp.; Pastoriza Elctrn.; Radix Elctrn.; Xenon Corp.
Selling To: ★ A,M,I. **Salesmen:** 4 (eng 4)
Services: Repair

SBM ASSOCS., INC., 800 Linden Ave., (716) 381-8330. TWX: 510-253-6145.
Branches: 1519-A Stuyvesant Ave., Union, N. J., (201) 687-8737. TWX: 710-985-4720; 28 Hobby St., Pleasantville, N. Y. (914) RO 9-1811. TWX: 710-572-2193; 528 Old Country Rd., Plainview, N. Y., (516) 433-1421; 138 Pickard Bldg., 5858 E. Molloy Rd., Syracuse, N. Y., (315) 454-9377.
Factories: Astrodata; Automated Measurements Corp.; Boonton Elctrn.; Dana Labs.; E-H Res. Labs.; Eldorado Elctrn.; J. Fluke Mfg.; IRA Sys.; Incre-Data; Kay Elec. Co.; Kennedy Co.; Micro Test Corp.; Optimation; RF Comm., Inc.; Raytheon Co.; Tally Corp.; Technibilt Corp.; Varian Electrographics Div.; Varian Aerograph Div.
Selling To: ★ M,D,I. **Salesmen:** 10 (eng 10)
Services: Repair

SCHMITZ BROS., 82 St. Paul St., (716) 546-7628.
Factories: Atlas Asbestos Co.; Bentley-Harris Mfg.; Chase-Foster; J. C. Dolph Co.; Electrical Plastics Corp.; Potter Co. **Services:** Sales
Selling To: ★ I. **Salesmen:** 3

SCHOMBURG, E. J. CO., 3100 Monroe Ave., (716) 586-0725.
Factories: Columbus Elec. Mfg.; Oak Mfg. Co.; Planet Mfg. **Services:** Warehouse
Selling To: ★ M,I. **Salesman:** 1

STAMPRESS COMPS. INC., 834 Linden Ave., (716) 381-2620.
Selling To: ★ I. **Salesmen:** 3

TAYLOR, D. A. CO., INC., 2019 Hudson Ave., (716) 342-8881. **Factories:** Tyton Corp.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

YOUNG, F. ASSOCS., INC., 555 Winton Rd. N., (716) 482-1555.
Factories: Circuit Wise, Electro Magnetic Radiation Labs.; Flexible Circuits; General Precision Labs.; Inso Electronic Prods.; Microsonics; Shallcross Mfg.; Solid State Scientific; Sys. Enclosures; Technitrol.
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)

ZIMMERMAN, W. H., INC. (See Syracuse, N.Y.)

Rockville Centre

RYWEL SALES, 100 N. Village Ave., (516) 764-2666.
Branch: New York, N.Y.
Factories: Caddock Elctrn.; Davies Molding.
Selling To: ★ A,M,D,I. **Salesmen:** 2 (eng 1)

(See Advertisement This Page)

WILLGOLD ELCTRN. SALES CORP., 100 N. Village Ave., (516) 764-4022.
Factories: Bristol Motor; Brown Engrg.; Bud Radio; Chomerics; Comar Elec.; Glenair; Hermetic Seal; Premax Prod.; Precision Metal Prod.; Sterling Transformer; Turner Microphone; Underwriters Safety Dev.
Selling To: ★ D,I. **Salesmen:** 4 (eng 2)

Roslyn

HICKS, W. M., INC., 4 Spruce Dr., (516) 627-6150.
Factories: A & N Corp.; National Rivet & Mfg. Co.; Troyonic Co.
Selling To: M,I. **Salesman:** 1 (eng 1)
Services: Warehouse, Mailing

Roslyn Heights

SIR SALES, 35 Powerhouse Rd., (516) MA 1-7485.
Branch: 102 Shore View Dr., Yonkers, N.Y., (914) WO 1-4446.
Factories: American Geloso; Audiovox Corp.; Dict-O-Tape; Dyn Assoc. Imp.; Easy-Up; Electro-Voice; Fasco Ind.; Game Ind.; L.M.B.-Heeger Co.; Martel Elctrn.; On Guard Corp.; Presodial Corp.; Quick Mount Corp.; Veritas Elctrn.; Wald Sound Corp.
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 3)
Services: Warehouse

TRAVCO ASSOCS., 142 Mineola Ave., (516) 621-3223.
Factories: Applied Dynamics; Gerator; Magtrol; Norbatrol Elctrn.; Sonex; Virginia Elctrn.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Repair

Rye

BROGAN ASSOCS., INC. (See Westbury, N.Y.)

Salt Point

MITSCHER, R. W. CO., INC. (See Buffalo, N.Y.)

Scarsdale

BASSIN TECHNICAL SALES CO., 52 Fayette Rd., (914) SC 3-3334.
Factories: Artisan Elctrn.; Compac Engrg.; Eastern Dynamics; Electro-Mech Comps.; Kessler-Ellis Counters; Meca Elctrn; Valor.
Selling To: ★ M,D,I.
Services: Warehouse, Direct Mail

Schenectady

AEROCONOMY AGENCY, 1079 Lexington Ave., (518) 372-8426.
Factories: B.E.C. Inc.; Dayon Mfg.; Oil Center Res.; J. P. Smith Co.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

MADISON OVERSEAS, INC., 433 Liberty St., (518) 372-5841.
Factories: American Components, Inc.; Autotronics; Adar Assocs.; Applied Microwave Dynamics; Caddock Elctrn.; Compton Ind.; Denes Co.; Eastron Corp.; Electrol; Flair Elctrn.; Industrial Electronics; J-Omega Co.; Kinemotive; Lenox Fugle Elctrn.; Nutron Elctrn.; Procedyne Corp.; Pace Setter Prod.; RF Amplifier; Renco Corp.; RFD; Robinson Spicer Elctrn.; Sensor Technology.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 2)
Services: Warehouse

Seaford

ABBOTT-GORDON, 3939 Wicks Ave., (516) 781-5256.
Branch: 628 W. Englewood Ave., Teaneck, N.J. (201) TE 6-3876.
Factories: APW CO; Courtesy Circuits Ind.; Cramer Coil; Eastron; Gentronics; Industrial Condenser; Intermares Ltd.; N.P.C. Elctrn.; Skottie Elctrn.
Selling To: ★ D,I. **Salesmen:** 2

Sodus

DeCEW, A. E. AGENCY, INC., Box F, (315) 483-3261.
Factories: Astrosys.; Inc.; Consolidated Contls.; Cramer Div.; Detroit Coil Co.; Electronic Contls.; Harrel; Hipotronics; Northern Precision Labs.; Schrack Elec.; Unimax Switch Div.; Velonex Div.
Selling To: ★ M,I. **Salesman:** 4 (eng 3)
Services: Repair, Warehouse, Distributorship, AED Distributor Div.

Syosset

SENCOR, INC. (See Philadelphia, Pa.)

Syracuse

BREDE, H. W. CO., INC. (See Glen Head, N.Y.)
BROGAN ASSOCS., INC. (See Westbury, N.Y.)
BURLINGAME ASSOCS., LTD. (See Mt. Vernon, N.Y.)
DB ASSOCS., INC. (See Dewitt, N.Y.)
DEARIE, J. P. CO. (See Mountain Lakes, N.J.)

FLORING, C. W. & MURRAY, H. R., INC., Box 11, (315) 446-5555.
Branch: Box 66, Webster, N.Y., (716) CH 4-1100.
Factories: Airpax; Americon; Cambion; G-V Contls; Hughes; I.T.T. Wire & Cable; Sunbank; Technical Wire Prods.
Selling To: ★ D,I. **Salesmen:** 5 (eng 3)

FRANKLIN, W. A. SALES CORP., 2 Standish Terr., (315) 446-1120. TWX. 710-541-0433.
Branches: 179 Hillary Dr., Rochester, N.Y., (716) 889-4849; 42 Glenridge Rd., Whitesboro, N. Y., (315) 736-5460.
Factories: Bridgeport Insulated Wire; Continental-Wirt Elctrn.; General Inst.; Industrial Elctrn. Hrdwre.; Nucleonic Prod.; Raytheon; Rola Div.; Victor Elctrn Wire Cable.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 2)

(See Advertisement Page 3271)

HOTZE, I. A. CO., INC., 112 Dewitt St., (315) 479-6641. TWX: 710-541-1572.
Factories: Birtcher Corp.; Computor Circuits; Controls Co.; Elctrn Devices; EMC Technology; Kidco Inc.; Penntube Plastics; Sealectro; Spectrol Elctrn.; Teledyne; Union Carbide; Zero Mfg.
Selling To: ★ D,I. **Salesmen:** 3 (eng 2)

KELLER IND. PRODS., INC. (See Rochester, N.Y.)

LAMB, R. F. CO., INC. (See Kenmore, N.Y.)

LABRONICS, INC., 130 Pickard Bldg., (315) 454-9314.
Branches: 3568 Moyer Rd., North Tonawanda, N.Y., (716) 695-1001; 24 Arnold Dr., Kingston, N.Y., (914) 338-1604.
Factories: Analog Devices, Inc.; Atec, Inc.; F. W. Bell, Inc.; Brush Inst.; California Inst.; Columbia Res. Labs.; Doric; Equipto Elctrn.; Jerrold Elctrn.; Julie Res. Labs.; Keltec Florida; Microdot, Inc.; North Atlantic Ind.; PRD Elctrn. Inc.; Todd Prod.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

LANZENDORF O. G. CO., 513 Cumberland Ave., (315) 472-4195.
Factories: Associated American Winding Machinery; Carlton Design & Mfg.; Eraser Co.; Electric Soldering Iron; Hampden Mfg.; Magnetic Core; Wybar Elctrn. Div.
Selling To: ★ A,M,I. **Salesman:** 1

LAZOR J. ASSOCS., Inc. (See Rochester, N.Y.)

LIGHTSTONE CORP., Pickard Bldg., E. Molloy Rd., (315) 454-3209.
Factories: American Elctrn. Labs.; Anzac Elctrn.; Applied Res.; Electromagnetic Technology Corp.; Electro Impulse Lab.; Hyperion Ind.; Measurement Technology; NanoFast; Practical Automation; Presin Co.; Sage Labs.; Schlumberger; Sonex, Inc.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

MIDSTATE RESEARCH, INC. 327 Wellesley Rd.
Branch: 1845 Otisco Lake Rd., Marietta, N.Y. 636-8308.
Factories: Augat Inc.; Canford Mfg.; Cooper, J. & Sons; D-Cemco; Reeves Hoffman Div.; Samarius Inc.; Transtector.
Selling To: ★ M,D,I. **Salesmen:** 3

OSSMANN COMPONENT SALES. (See Rochester, N.Y.)

PASTON-HUNTER, 2002 Teall Ave., (315) 437-2992.
Factories: Amperex Elctrn.; Astatic Corp.; Atlas Sound; Calcon Wire; Hallicrafters; Harman-Kardon; Irish Tape; Jerrold Elctrn.; Krylon, Inc.; North American Philips Co.; Quam Nichols; Sprague Prod. Co.
Selling To: ★ A,D,I. **Services:** Warehouse

REAGAN, J. A. CO., INC. (See Albany, N.Y.)

RYERSON, J. D. ASSOC., INC. (See Rochester, N.Y.)

SBM ASSOCS., INC. (See Rochester, N.Y.)

TAUBER, W. CO., 151 Fayette Blvd., (315) 446-7094.
Factories: Antennacraft Co.; Computron, Inc.; Consolidated Wire; CTS Knights; Hamilton-Hall, Inc.; Hy-Gain Elctrn.; Kenwood Elctrn.; Midland-Int'l.; Sonar Radio; Talk-A-Phone Co.; Waber Elctrn. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 2

TESCO ASSOCS., 2002 Teall Ave., (315) 463-4566.
Factories: Arra, Inc.; C-Cor Elec.; Dico; Herley Ind.; RF Amplifier; Servo Corp.; Statham Inst.; Telonic Engrg.; Telonic Inst.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)
Services: Repair, Direct Mail

ZIMMERMAN, W. H. INC., 112 DeWitt St., (315) 474-4889. TWX: 710-541-1572.
Branch: 3100 Monroe Ave., Rochester, N.Y., (716) 586-4450.
Factories: AirBorn Connectors Div.; Centralab; Industrial Condenser; Neshaminy, Transformer Co.; Phaostron Inst.; RCL Elctrn.; Secon Metals Corp.; Victoreen Inst.; Welch Allyn, Inc.
Selling To: ★ I. **Salesmen:** 3 (eng 3)
Services: Warehouse

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L-C-A SALES, INC., 76 Main St., (914) WO 1-4700. (914) WO 1-4700.
Branches: 32 Rittenhouse Pl., Ardmore, Pa., (215) GR 7-2725; 3505 Epsilon Pl., Annandale, Va., (703) 560-9485.
Factories: Blonder-Tongue Labs.; Computron Inc.; Electrohome Ltd.; Hudson Lamp Co.; IMF Prods.; Int'l. Wire & Cable; Oxford Transducer; PM & E Div.; Sherwood Elctrn. Labs.; Spectra-Strip Corp.; Talk-A-Phone Co.; Worner Elctrn. Devices.
Selling To: ★ A,D,I. **Salesmen:** 8 (eng 3)
Services: Warehouse

STANG SALES, 271 Columbus Ave., (914) 779-6868.
Factories: Bogen Comm.; Eico Elctrn. Inst.; Grado Labs.; JBL Int'l.; Lowell Mfg.; Recoton Corp.; Robins Ind.; United Audio Prod.
Selling To: ★ A,D. **Salesmen:** 4 (eng 1)

Tonawanda

LABRONICS, INC. (See Syracuse, N.Y.)

Utica

FISH ASSOCS., 149 Roosevelt Dr., (315) 732-1008.
Branch: 2111 East Ave., Rochester, N.Y., (716) 244-5428.
Factories: American Elec. Heater; Argus Engrg. Co.; Federal Tool Engrg.; Gardiner Solder Co.; Hunter Ind.; Simonds Machine.
Selling To: ★ M,D,I. **Salesmen:** 2

NACO ELCTRNS. CORP. (See Liverpool, N.Y.)

Valley Stream

AGRESS, M. C., 891 Fulton St., (516) 825-8955.
Factories: Contemporary Elctrn.; Electric Tachometer; Gaylord-Rives; Impectron; Intermark Ind.; New England Trans.
Sold To: ★ I. **Salesman:** 1 (eng 1)

LEVISON SALES CO., INC., Box 242, (516) 561-9696.
Factories: Beede Electrical Inst.; Chicago Dial Co.; Ill. Condenser Sales.; Multi-Flex Seals; Staco, Inc.; Staver Co.
Selling To: ★ D,I. **Salesmen:** 4 (eng 2)

Vestal

OSSMANN COMPONENT SALES. (See Rochester, N.Y.)

REED ELCTRNS., INC. (See Rochester, N.Y.)

Webster

FLORING, C. W. & MURRAY, H. R., INC. (See Syracuse, N.Y.)

Westbury

BROGAN ASSOCS., INC., 80 Urban Ave., (516) 333-6683. TWX: 510-222-4555.
Branches: 22 Purchase St., Rye, N.Y., (914) 967-2612; 780 N. River View Dr., Totowa, N.J., (201) 256-0174; 69 Hickory Dr., Waltham, Mass., (617) 894-3250. TWX: 710-324-0192; 107 W. Ridge Pke., Conshohocken, Pa., (215) 825-0510; 4709 Montgomery La., Bethesda, Md., (301) 652-4300; 202 Arterial Rd., Syracuse, N.Y. (315) 437-2988; 474 Thurston Rd., Rochester, N.Y., (716) 328-2351.
Factories: Cipher Data Prod.; Colorado Inst.; Computer Communications; Computer Mgt.; Corometrics Medical Syst.; Data Comm. Sys.; Data General; Datum, Inc.; Information Displays; Infotec; Link Div.; Litton Ind.; Magna-Head Div.; Magnetic Recording Sys.; Peripheral Data Machines; Perspective, Inc.; Roytron Div.; Sangamo Elec.; Standard Memories.
Selling To: ★ I. **Salesmen:** 20 (eng 20)
Services: Limited Service Facilities

CARDUNER SALES CO., Jericho Tpke., (516) 333-8170. TWX: 510-222-6356.
Factories: Audio Devices; British Ind.; Electro-Voice; IRC. **Services:** Warehouse
Selling To: ★ A,D. **Salesmen:** 5 (eng 2)

MINTHORNE INTERNATIONAL CO., INC., 2200 Shames Dr., (516) 334-3303.
Factories: Allied Control; Alltronics; Antenna Specialists; Ballistic Control; Beaver Labs.; Chicago Dynamics; Brach; H. Dietz; Dolinko & Wilkens; Elctrn. Enterprises; Elctrn. Transistor; EPCO; Federal Elctrns.; Galaxy Elctrns.; Gold Line; C. S. Gordon; Gramer Halldorson; Hallett Mfg.; Hamilton-Hall; Hansen Mfg.; Hartford Battery; Hartman Marine; Haydon Tubes; Hurst Mfg.; Int'l. Graphite & Electrode; Jeffers Elctrns.; JFD Elctrns.; K-R Tubes; Kemtron Electronics; Keystone; Lampkin Labs.; Lewis & Kaufman; Marshall Elctrns.; Mechanical Engraving; Metrotek Elctrns.; Moseley Antennas; National Union Elctrns.; Nuclear Associates; New Hampshire Microwave; Norplex; On Guard; Pace Comm.; Pageant Needles; Pennwood Numechron; Perry Briggs; Philmore Elctrns.; Quick-Mount; Radiation Material Corp.; Radio Condenser; Regency Elctrns.; Resistance Prods. Co.; S-B Mfg.; Saxton Wire & Cable; Semicon; Severance Tool Ind.; Sheppard Ind.; Space Power Assocs.; Spark-O-Matic; Speer Carbon; Steri-Dri Elctrns.; Telephone Components; Teletone; T. C. Thompson; Thordarson Meissner; Transcom; Tri-Ex Towers; U.S. Semcor; Weiler; Zeus Generators.
Selling To: ★ A,M,D,I. **Salesmen:** 67 (eng 22)
Services: Warehouse, Export

Whitesboro

FRANKLIN, W. A. SALES CORP. (See Syracuse, N.Y.)

Williamsville

JOHNSON, H. C. AGENCIES. (See Rochester, N.Y.)

WADSWORTH MFG. ASSOC. (See Liverpool, N.Y.)

Williston Park

GARRETTSON CO., INC., 99 Hillside Ave., (516) 747-6610. TWX: 510-222-4232.
Branches: 92-14 Masland St., Philadelphia, Pa., (215) 464-2275. TWX: 510-222-4232; 10 Kearney Rd., Needham, Mass., (617) 449-2640. TWX: 510-222-4232.
Factories: Avtel Corp.; Computer Devices Corp.; Epsco, Inc.; Filtron Co.; Gamewell Co.; Gladding Keystone Corp.; Maine Res. Co.; North Elec. Co.; Reeves Inst.
Selling To: ★ I. **Salesmen:** 6

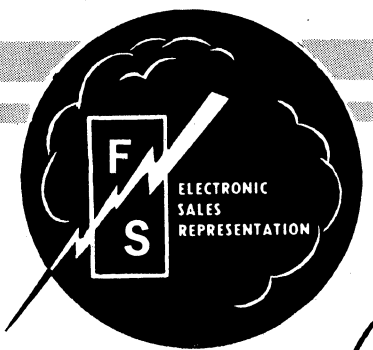
Woodbury

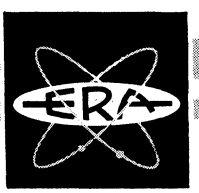
COMPAR NEW YORK, 335 Crossman Pk. Dr., (516) 921-9393. TWX: 510-221-2170.
Factories: Denes Co.; Electronized Chemicals Corp.; Electro Materials; Hathaway Inst.; Powercube; Unitrode. **Services:** Sales Office
Selling To: ★ M,I. **Salesmen** 8 (eng 5)

TECHNICAL ELCTRN. INC., 335 Crossways Park Dr., (516) 921-9393. TWX: 516-221-2170.
Factories: Computer Circuits Corp.; Circuit Technology; Energy Conversion Devices; Film Capacitors; International Comps.; Seal-A-Matic Inc.; Solid State Prods. Inc.; Tempo Inst.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Sales Office

Woodstock

POTTER, N., 191 Shotwell Rd., (914) OR 9-6074.
Selling To: ★ I. **Salesmen:** 4 (eng 1)





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Branch Office in ROCHESTER, N. Y.

Branch Office in UTICA, N. Y.

Yonkers

ADELMAN-PINZ SALES CORP., 570 Yonkers Ave., (914) 423-4747.
Factories: Acoustone; Audio Originals; Elctrn. Publ.; Jensen Mfg. Div.; Lenk; Pickering & Co.; Scientific Audio Elctrn.; Soundolier; Standard Radio. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 1)

BROWN, J. ELCTRN. SALES REPS. INC., 207 Rosedale Rd., (914) 779-7330.
Branches: 157 Rawlinson Rd., Rochester, N.Y., (716) 266-2728; 217 Neck Rd., Bklyn., N.Y., (212) 645-1075.
Factories: Columbia Elctrn. Cable; Dynamic Inst.; Eico; Game Ind.; Gibbs Special Prod.; Gramer Haldorson; Industrial Devices; IRC; Oaktron Ind.; Parker Metal Prods.; H. H. Smith; Yamaha Int'l.
Selling To: ★ A,D. **Salesmen:** 3 (eng 1)
Services: Warehouse

ELECTRONIC FASTENERS CO., 10 Center Place, (914) 423-2900.
Factories: Atlantic Spring Pin; Southern Screw.
Selling To: ★ I. **Salesmen:** 2 (eng 1)
Services: Warehouse

REP, 5 Sadore Lane—Suite L-M, (914) 793-4200.
Factories: Fleetwood Furn. Co.; Harman Kardon; Jerrold Elctrn.; Midland Int'l.; O'Sullivan Ind.; Sarex Corp.; United Tel-Tronics.
Selling To: ★ A,D. **Salesmen:** 4

SHAW, S. A. CO., INC., 361 Central Park Ave.
Factories: Alliance Mfg.; Carbonneau Ind.; Maestro Corp.; Philco-Ford; Quality Comp.
Selling To: ★ D,I. **Salesman:** 1 (eng 1)
Services: Warehouse

SIR SALES, INC., (See Roslyn Heights, N.Y.)

NORTH CAROLINA

Bethania

CANDOR CO. INC., (919) 924-1480.
Factories: Anderson Power Prod.; Barber-Colman; Cambion; Chomerics-Deering Milliken; Components; Electra/Midland Corp.; Hi-G; Hopkins Engrg.; Kearfott-General Precision; National Connector; Poly-Scientific-Litton; G. T. Schjeldahl; Stewart Warner Microcircuits; Vitramon.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)
Services: Warehouse

LEE, LTD., (919) 924-8245.
Factories: Brad Thompson Ind.; Cerac, Inc.; Deltron, Inc.; Kahn & Co.; Laser Nucleonics; Melpar, Inc.; Penn Engrg. & Mfg. Corp.; Spyraflo, Inc.; Thermal Dynamics Corp.; Wells Elctrn.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Burlington

GENTRY ASSOCS., INC. (See Orlando, Fla.)

Charlotte

BEEMER ENGRG., CO. (See Ft. Washington, Penn.)

BROWN & MORRISON, Box 4307, (704) 333-0774.
Factories: Automatic Timing & Controls; Hynes Elec. Heating; Kinney Vac. Div.
Selling To: ★ I. **Salesmen:** 4 (eng 4)

CARTWRIGHT & BEAN, INC. (See Memphis, Tenn.)

CHAPMAN, R. W., Box 4430, (704) 375-4495.
Selling To: ★ D,I. **Salesmen:** 8 (eng 8)

FURMAN, C. M. CO., Box 4208.
Factories: Airmaster Corp.; Big Beam; Fairmount Tools; Griffolyn Co.; Hamco Div.; King Elec.
Selling To: ★ D. **Salesmen:** 2

HENRY, B. ASSOCS., 1043 Providence Rd., (704) 375-8958. TWX: 810-621-0515.
Branches: 1020 Brookstown Rd., Winston Salem, N.C., (919) 723-3069; 247 Phosphor Ave., Metairie, La., (504) 831-1931.
Factories: Babcock Elctrn.; IMC Magnetics; Kent Corp.; Precision Connector Div.; Samarius Elctrn.; Signalite; Solid State Prod.; E. H. Titchener; Trans/Circuits; Waterbury Co.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 5)

HIGHSMITH, J. L. & CO., 3733 Monroe Rd., (704) 333-7743.
Branches: 3322 S. Memorial Pkwy., Huntsville, Ala., (205) 881-3294; 2543 Industrial Blvd., Orlando, Fla., (305) 293-5202; 5003 Brook Rd., Richmond, Va., (703) 266-2060.
Factories: Ace Engrg. & Machine Co.; Boonton Elctrn.; Business Info. Technology; Control Eqp.; Elgar Corp.; Federal Scientific Corp.; Frequency Engrg. Labs.; Globe Ind.; Grayhill; Houston Inst.; Kepco, Inc.; Lorch Elctrn.; Philips Elctrn. Inst.; Singer Co.; Time Sys.; Topaz.
Selling To: ★ M,D,I. **Salesmen:** 8 (eng 8)
Services: Repair

(See Advertisement This Page)

PIEDMONT EQUIP. CO., Box 10037, (704) 334-6823.
Factories: Cleveland Hardware; Eberhard Hardware; Hanson Drills; Parrish Steel; Southco Rivets and Fasteners. **Services:** Warehouse
Selling To: ★ I. **Salesmen:** 3

RANSON, WALLACE & CO., INC., 116½ E. 4th St., (704) 334-4244.
Factories: J. G. Biddle Co.; Conax Corp.; Esterline Angus Inst.; General Transducer; Quindar Elctrn.; Weston Inst.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

RUDISILL, J., 1225 Harding Pl., (704) 377-6901.
Factories: Acopian; Agastat Div.; Columbus Elec. Mfg.; Control Knobs; Dale Elctrn.; Gordos Corp.; Hitemp Div.; Sensitak Inst.; Struthers-Dunn; Technitrol.
Selling To: ★ M,D,I. **Salesmen:** 9 (eng 2)

SMITH, M. K., 1605 Chatham Ave., (704) 372-1026.
Branches: 3258 Cahaba Heights Rd., Birmingham, Ala., (205) 967-3080; 5375 New Peachtree Rd., Chamblee, Ga., (404) 457-1931; Box 8847, Ft. Lauderdale, Fla., (305) 524-0955.
Factories: Benjamin Elctrn. Sound Corp.; Clevite Corp.; Dynascan Corp.; Electro-Voice, Inc.; Kraeuter Tools; TelePro Ind.; Tenna Corp.; Waber Elctrn. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 5

TAYLOR, M. F. CO., INC. (See Silver Springs, Md.)

Gastonia

DIETHERT, R. CO., INC. (See Chicago, Ill.)

Greensboro

ADAMS & ASSOCS., INC., Box 9256, (919) 272-6838.
Branches: Box 877, Decatur, Ga., (404) 288-1799; Box 2171, Orlando, Fla., (305) 424-9491; Maloney Rd., Rte. 3, Knoxville, Tenn., (615) 577-4241.
Factories: Blonder-Tongue Labs.; Eby Sales; Int'l. Rectifier; Intl. Wire & Cable; Midland Intl.; Perma-Power; Planet Mfg.; Premier Metal Prod.; Utah Elctrn.
Selling To: ★ A,D,I. **Salesmen:** 5

BCS ASSOCS., INC. (See Orlando, Fla.)

DUCKETT, C. SALES CO. (See Atlanta, Ga.)

HOLMES, E. G. & ASSOCS. (See Chamblee, Ga.)

MURPHY & COTA (See Atlanta, Ga.)

REYNOLDS & ASSOCS., INC. (See Eau Gallie, Fla.)

TECHNICAL MARKETING, INC. (See Orlando, Fla.)

Jamestown

BEACON ELEC. ASSOCS. (See Maitland, Fla.)

Kernersville

WALLACE, S. K. ASSOC., INC. (See Lutz, Fla.)

Kinston

NICKERSON, F. C. CO., INC. (See Decatur, Ga.)

Matthews

WALLACE, S. K. ASSOC., INC. (See Lutz, Fla.)

Raleigh

ANDREWS, A. B. & CO., 1401 Branch Banking and Trust Co. Bldg., Box 2627, (919) 833-5565.
Branch: 1408 S. Bayshore Dr., (305) 377-2522.
Factories: Amperex; Bliss-Eagle; Bramco; Chatham Elctrn.; Comar Elec.; Fla. Transformer; Grigsby-Barton; Ledex; MIAL; Nat'l Tel-Tronics; Sinclair Radio Labs.; D.M. Steward Mfg.; Tedford Crystal Labs.; Van Dor Coil; Wagner Elec.; Wilmington Controls.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 4)

CARTWRIGHT & BEAN, INC. (See Memphis, Tenn.)

MITSCHER, R. W. CO., INC. (See Buffalo, N.Y.)

Winston-Salem

BROWN, W. A. & ASSOCS., INC. (See Orlando, Fla.)

COL-INS-CO., INC. (See Orlando, Fla.)

HENRY B. ASSOCS. (See Charlotte, N.C.)

LEE ASSOC., INC. (See Orlando, Fla.)

MAGUIRE, J. A. & CO. (See Camden, New Jersey)

MURPHY & COTA (See Atlanta, Ga.)

RADCO CO., 310 W. Fourth St., (919) 722-9671.
Factories: Associated Testing Labs.; Baird Atomic; CML Inc.; Control Logic; Jerrold Elctrn.; Nanofast Corp.; Quantech Labs.; Whire Electromagnetic; Weston Inst.
Selling To: M,I. **Salesman:** 1 (eng 1)

WHITE, L. G. & CO., INC. (See Silver Spring, Md.)

OHIO

Akron

NATALINO, A. ASSOCS., 209 Harmony Hills, (216) 666-1447.
Branches: 333 W. 1st St., Dayton, Ohio, (513) 223-5002; 530 Sixth Ave., Pittsburgh, Pa., (412) 281-8283.
Factories: Central Transformer; Control Switch

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Div.; RCL Elctrn.; Scanbe Mfg. Corp.; Tansitor Elctrn.; Technical Wire Prods.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

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AEROL ASSOCS., INC. (See Jericho, New York)

Berea

PUGH, C. L. & ASSOCS., INC. (See Columbus, Ohio)

Brecksville

NACE, A. CO., INC., Box 156, (216) 526-4323. TWX: 810-427-9161.
Branches: Box 93, Forest Park Br., Dayton, Ohio, (513) 277-8215. TWX: 810-459-1733; Route 3, Galion, Ohio, (419) 468-7641; 1725 Washington Rd., Pittsburgh, Pa., (412) 561-3544.
Factories: Allied Contl. Co.; Augat, Inc.; Daven div.; Hopkins Engrg.; Mag-Con Engrg.; Minco Prod.; Stevens-Arnold; Syntron Div.; Transistor Elctrn.; United Aircraft.
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)

WALDRIP, BLANKENBURG & CO., 7650 Chippewa Rd., (216) 526-1100.
Factories: Atkins Technical; W. C. Dillon & Co.; Esterline-Angus Inst.
Selling To: ★ I. **Salesmen:** 6 (eng 6)

Chagrin Falls

CLARK SALES CO. (See Cleveland, Ohio)

KILROY, J. CORP., Box 365, (216) 247-8997.
Factories: Acromag, Inc.; Amer-Std.; Hurst Mfg.; Inland Contrl.; Inland Motor Corp.; Jordan Contls.; Magtrol; Presin Co.; Syracuse Elctrn.; United Elec. Contrls.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

(See Advertisement Page 3274)

Cincinnati

AEROL ASSOCS., INC. (See Jericho, New York)

BAEHR-GREENLEAF & ASSOCS. (See Cleveland, Ohio)

BEEDLE EQUIP. CO., 6900 Silverton Ave., (513) 793-0140.
Factories: Adams & Westlake; Christie Labs.; CompuDyne; Decco; R. B. Denison; Esterline Angus; Magnetics; Royson Engrg.; H. H. Sticht; Struthers-Dunn; Vulcan Elec.; Weksler Inst.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

CAMPISANO, F. J. & ASSOCS., Box 11043, (513) 662-1616. TWX: 810-461-2578.
Branch: 3453 Nolen Dr., Indianapolis, Ind., (317) 291-4066.
Factories: Aerovox; Alliance Mfg.; Aura Mfg.; Core-Tronics; Del Elctrn.; Evans; Fair-Rite Prod.; Holyoke Wire & Cable; Rola Co.; Rotron, Inc.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 2)
Services: Direct Mail

COMPONENTS INC. (See Cleveland, Ohio)

G & H SALES CO., Box 37416, (513) 761-6185.
Branches: 13690 Fox Hill Dr., Novelty, Ohio, (216) 338-1122; Box 71, Indianapolis, Ind., (317) 637-5048; Box 2268, Fort Wayne, Ind., (219) 744-3072; 24001 Southfield Rd., Southfield, Mich., (313) 358-1910; Box 18178, Louisville, Ky., (502) 239-1162.
Factories: Babcock Relays; Diehl Div.; General Inst.; Hamlin, Inc.; Methode.
Selling To: ★ M,D,I. **Salesmen:** 8 (eng 8)
Services: Warehouse

GALLAGHER CO., 15 Ritchie Ave., (513) 761-1288.
Factories: Anzac Elctrn.; Bentley Harris Mfg.; Electro-Connective Sys.; Gems Co.; Hitemp Wires Co.; Kings Elctrn.
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)

GREENLEAF, H. CO. (See Cleveland, Ohio)

HERRICK, G. L. CO. (See Westlake, Ohio)

KAHSAR, F. E. SALES, INC., 5229 Glenway Ave., (513) 471-9011.
Branch: 47 W. Case, Hudson, Ohio, (216) 655-6808.
Factories: Crufoot Gear Corp.; Karman Rubber; Midtex-Aemeo; National Circuits; Penn Eng. & Mfg.; Plastic Ware Inc.; Russell-Gasket; Triad Transformer, Co.; Utrad Transformer, Co.
Selling To: ★ D,I. **Salesmen:** 3 (eng 1)

KILFOIL, J. F. CO., 9415 Montgomery Rd., (513) 791-6151.
Branch: 5225 New Haven Ave., Ft. Wayne, Ind., (219) 749-0113.
Factories: Airco/Speer Elctrn.; American Semiconductor; Cimastra Div.
Selling To: ★ I. **Salesmen:** 3 (eng 1)

LACKRITZ & QUEHL (See Cleveland, Ohio)

LAKE, H. G. CO. (See Dayton, Ohio)

OLSEN, J. O. CO. (See Cleveland, Ohio)

PHISTER EQUIPT. CO. INC., 921 Federal Reserve Bank Bldg., (513) 421-3850.
Factories: Bergen Wire Rope; Joy Mfg. Co.; Zippertubing.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

PLAGEMAN, L. C., 3334 Meyer Pl., (513) 621-1678.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 3)

SCHLEMMER, 1172 W. Galbraith Rd., (513) 522-8340.
Factories: Atkins Technical, Inc.; J. Chatillon & Sons; W. C. Dillon; Fast Heat Element Mfg.; Fiske Assocs.; Frost Elctrn.; W. L. Gore & Assoc.; Gulton Ind.; Hiram Jones Elctrn.; Ircon, Inc.; Lafayette Quality Prod.; Reotemp Inst.; Ruska Inst.; Western Elctrn. Prods.; West Inst.
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)
Services: Repair, Warehouse

SHARP, F. R. CO., INC. (See Cleveland, Ohio)

SHERIDAN ASSOCS., INC., Box 37646, (513) 761-5432. TWX: 810-461-2670.
Branches: Box 8226, Cleveland, Ohio, (216) 237-9145; Box 423, Dayton, Ohio, (513) 277-8911; Box 128, Lathrup Village, Mich., (313) 358-3333; Box 3997, Jennings Sta., St. Louis, Mo., (314) 524-4800; 201 Penn Ctr. Blvd., Pittsburgh, Pa., (412) 243-6655.
Factories: American Precision Ind.; Bendix/Mosaic; Burr-Brown Res.; NJE; CTS Knights; Electric Indicator; Fabri-Tek, Inc.; Helipot Div.; IERC Div.; Microwave Dev. Labs.; Pneumafil Corp.; Rotamec; Pulse Engrg.; Times Wire & Cable; Vitramon. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 14 (eng 12)

TAYLOR, J. F. SALES, 5410 Julmar Dr., (513) 471-5750.
Factories: Cleveland Vibrators; Debothelat Fans; Jetstream Sys.; Liberty Machine; Young Mchy.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

TRI-STATE MARKETING, INC., 1717 Section Rd., (513) 631-5060. TWX: 810-461-2697.
Branches: 25000 Euclid Ave., Cleveland, Ohio, (216) 731-9207. TWX: 810-421-8550; 3220 Broadway, Fort Wayne, Ind., (219) 456-3567. TWX: 810-332-1517.
Factories: Aladdin Elctrn.; Consolidated Prod.; Flexible Prod.; Grant Pulley & Hardware; Indiana General; New England Inst.; Reeves-Hoffman Div.; Reon Resistor Corp.; Stewart-Warner Microcircuits; Thermatics, Inc.; E. H. Titchener & Co.
Selling To: ★ M,D,I. **Salesmen:** 7

VAL-SKOL SALES, INC., 10515 Margate Terr., (513) 793-4082.
Branches: 12417 Cedar Rd., Cleveland Hts., Ohio, (216) 462-2822; 3556 Luewan Dr., Indianapolis, Ind., (317) 926-5063; Box 13088, Columbus, Ohio, (614) 878-7212; 510 Ft. Wayne Bank Bldg., Ft. Wayne, Ind., (219) 742-9122.
Factories: APM-Hexseal Corp.; Burton-Rogers Co.; Curtis Dev. & Mfg. Co.; Industrial Timer Corp.; Panduit Corp.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 2)

(See Advertisement This Page)

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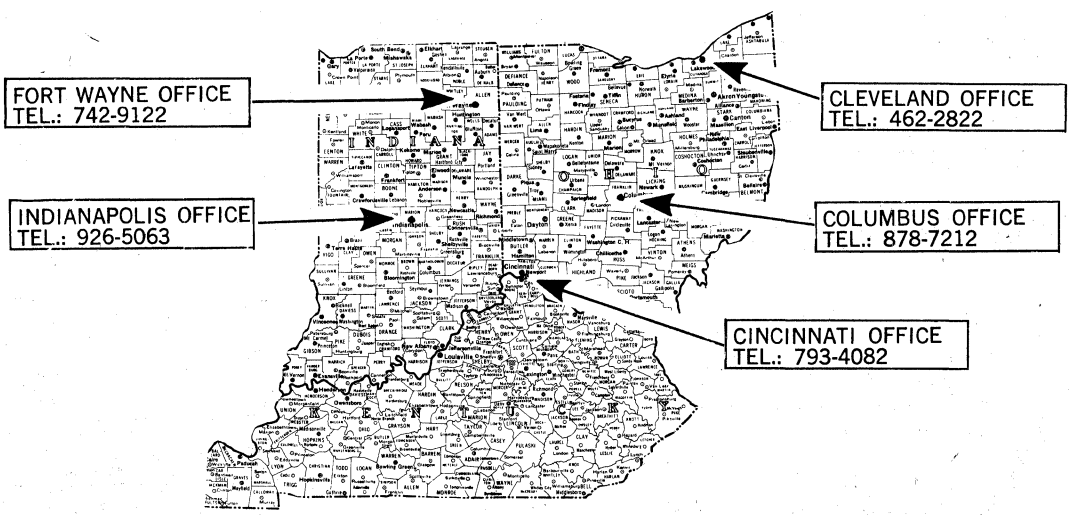

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Factories: Cin-Tran; Datascan Inc.; Gulton Ind.; KMC Semiconductor Co.; Matteson Transformers; P. R. Mallory; Shallcross Mfg.; Simmons Fastener.
Selling To: ★ M,I. **Salesmen:** 4 (eng 3)

WHITESELL, R. O. & ASSOCS. (See Indianapolis, Ind.)

Cleveland

ALLIED ENTERPRISES INC., 7281 Pearl Rd., (216) 234-2606.
Factories: Elmwood Sensors; Hotwatt; Norwalk Thermostat; Still-Man Mfg.
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

APPLETON, H. CO. (See Los Angeles, Calif.)

BAEHR-GREENLEAF & ASSOCS., INC., 14700 Detroit Ave., (216) 221-9030.
Branches: 9505 Montgomery Rd., Cincinnati, Ohio, (513) 891-3826; Box 5722, Columbus, Ohio. (614) 486-4046; 3350 Maplewood Dr., Xenia, Ohio, (513) 426-5485.
Factories: Acme Elec.; CTS; C. P. Clare; Clare Electro-Seal; Clare-Pendar; Cutler Controls; Elco; Holyoke Wire & Cable; IRC Div.; Robinson-Halpern; Simpson Elec.; Ungar Div.; Union Carbide.
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 7)

(See Advertisement This Page)

BURKE, E. F. INC., 5010 Mayfield, (216) 382-3646.
Factories: Alnor Instr. Co.; B-Line Div.-Binkley Co.; Corning Glass Works; Harper Elec. Furnace; Royal Elec. Mfg.; U.S. Safety Trolley.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)

CALHOUN, R. P. & ASSOCS. (See Dayton, Ohio)

CARTER, McCORMIC & PEIRCE, (Farmington, Mich.)

CLARE ELCTRN., 24431 Oak Hill Dr.
Factories: Flair Elctrn.; QPL; Seastrom Mfg.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

CLARK SALES CO., Box 708, (216) 991-2000.
Branch: 16830 Park Circle Dr., Chagrin Falls, Ohio, (216) 543-9848.
Factories: Accurate Elctrn.; Brand Dielectrics; Brand-Rex Div.; Mohawk Mfg.
Selling To: ★ I. **Salesmen:** 2 (eng 1)
Services: Warehouse

COMPONENT/INSULATION CORP., 14235 Detroit Ave., (216) 521-3570.
Branch: 610 N. Woodward Ave., Birmingham, Mich., (313) 644-0087.
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 2)

COMPONENTS INC., 7461 N. Linden La., (216) 842-2737. TWX: 810-427-9151.
Branch: 11820 Knollsprings, Cincinnati, Ohio, (513) 721-2997.
Factories: Birtcher; Chass-Trak; Davis Elec.; Defiance Circuit; Dow Key; H. Eby Co.; Electrofilm; Fairchild Contr.; Gulton Ind.; Gudeman; Harbour Ind.; Hi G; Janco; Omtronics Mfg., Panelgraphic; Quan Tec Labs.; Rotron Mfg.; Texas Instr.; Wac-line; Western Gear.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

DAUGHERTY, F. A. CO., 6025 Mayfield Rd., (216) 449-1122.
Branch: 112 Oakwood Rd., McMurray, Pa., (412) 941-6473.
Factories: Atlas Sound Corp.; Fisher Radio Corp.; Reeves Soundcraft; Regency Elctrn.; United Audio Prod.; Utah Elctrn.; Wen Prod. **Salesmen:** 5
Selling To: ★ A,M,D,I. **Services:** Warehouse

DICKELMAN, L. H. CO. (See Detroit, Mich.)

DOLFUSS, C. H., J. R. & CO., 2108 Payne Ave., (216) 771-1270.
Branch: 1700 Needmore Rd., Ste. 305, Dayton, Ohio, (513) 275-4831.
Factories: Aerovox Corp.; Triplett Elec. Inst. Co.; JBT Inst.; Rola Div.; Solid State Scientific; Network Elctrn.
Selling To: ★ A,M,D,I. **Salesmen:** 5 (eng 1)

ELECTRO SALES, 851 E. 222 St., (216) 5440.
Branches: Overlook Br., Box 3122, Dayton, Ohio, (513) 426-5551; 10745 Morang Dr., Detroit, Mich., (313) 886-2280; 201 Penn Center Blvd., Pittsburgh, Pa. (412) 371-9449.
Factories: Analog Devices; B&K Inst.; Beckman Inst.; Columbia Res. Labs; Data Control Sys.; Dranetz Engrg. Labs; Dynamic Sys. Elctrn.; Elcor Div. of Welex; Electronic Assoc., Inc.; General Oceanology; Itron Corp.; Kaman Nuclear; Krohn-Hite; Lesametric; MVR Corp.; Memory Technology; Shepard Labs.; Spectral Dynamics Corp.; Standard Memories; Taber Div. Teledyne; Wayne George.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Warehouse

GOORY SALES CO., 19555 Henry Rd., (216) 331-2055.
Factories: Drake Mfg.; Mayer, G. J. Co.; Norlake Mfg.; Vulcan Elec.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

GREENLEAF, H. CO., 20412 Center Ridge Rd., (216) 333-5480.
Branch: 4315 Simca La., Cincinnati, Ohio, (513) 661-0969.
Factories: Cole Hersee; Comar Elec.; Electro Switch; Ferro Magnetics; General Cable; Patton MacGuyer Co.; Phillips Prod. Co.; Tower Mfg.; Triangle Connector; Underwriters Safety Device.
Selling To: ★ I. **Salesmen:** 5 (eng 4)

JUBELL ASSOC., 23760 Miles Ave., (216) 662-2884.
Branch: Box 2277, Kettering Sta., Dayton, Ohio, (513) 299-4321.
Factories: Asco Wire & Cable Co.; BEC Pressure Contls.; Carol Cable Co.; Electron, Inc.; Miller Elec.; Protective Contls. Inc.; Premier Mfg.; Revcor, Inc.; M. H. Rhodes; UPCO. Inc.
Selling To: ★ D,I. **Salesmen:** 3 (eng 3)

LACKRITZ & QUEHL, 3691 Lee Rd., (216) 561-6660.
Branch: 8474 Winton Rd., Cincinnati, Ohio, (513) 522-0655.
Factories: Kulka Elec.; Toshiba America, Inc.
Selling To: ★ D,I. **Salesmen:** 6

LOWRY DIETRICH CO. (See Pittsburgh, Pa.)

MARLOW ASSOCS., INC., 1500 S. Green Rd., (216) 381-4500.
Factories: Birnbach Co.; Bud Radio; Russell Ind.; Semitronics; Waldom Elctrn.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 1)

MARTIN-RETTGER, INC., 11955 Shaker Blvd., (216) 791-8787.
Factories: Atlantic Transformer Div.; B. E. C.; Johnson Mold & Mfg.; Kemco Div.; Kurz & Root Co.; Mackworth Rees; Meaker Co.; Semikron Int'l.; Skirpan Elctrn.; States; H. H. Sticht Co.; Trenton Transformer Corp.; TruHeat Corp.; Western Electro-Mechanical Co.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

MICHAELSON, B. L. CO., (See Xenis, Ohio)

MIDLAND ELECT. CO., 2125 Superior Ave., (216) 861-3200.
Factories: APM Hexseal; Anderson Power Prod.; Appleton Elec.; Arrow H & H; Allen Bradley; W. H. Brady; Buchanan Elec.; Bussmann; Chase Shawmut; Crouse Hinds Co.; Durakool; G. E.; Hoffman Engrg.; ITE Circuit Breaker; Industrial Timer; Jefferson Electric Co.; Kellems Co.; Linemaster; Marathon Fuse Blocks; Mercoid; Micro Switch; National Acme; Okonite; Panduit; Superior Elec.; Sylvania Lamps; Thomas & Betts; Western Insulated Wire. **Services:** Warehouse
Selling To: ★ I. **Salesmen:** 12 (eng 2)

MILLER, H. SALES CO., 4087 Meadowbrook, (216) 321-3900.
Branches: Rt. 1, Sabina, Ohio, (513) 453-2240.
Factories: Acoustone, Inc.; Finney Co.; Game Ind.; Hy-Gain; Lectrotech; Monarch; Recoton; Squires-Sanders; Workman.
Selling To: ★ A,D. **Salesmen:** 3
Services: Warehouse

OLSEN, J. O., 16201 Shaker Blvd.; (216) 752-5444.
Branches: 5539 Stokeswood Ct., Cincinnati, Ohio, (513) 922-2176; 104 Elatan Dr., Pittsburgh, Pa., (412) 279-2550.
Factories: Amaton Elctrn. Hrdwr.; Clarostat Mfg.; Consolidated Wire & Assocd.; Coto-Coil Co.; Dixson, Inc.; E-T-A Prod.; Fabricast, Inc.; General Illumination; Kappa Networks; Komak, Inc.; Kryion Dept.; Microtran Co.; National Tel-Tronics; Philadelphia Insulated Wire; PIC Design; RF Interonics; Resistance Prod.; Schauer Mfg.; Trompeter Elctrn.; Waber Elctrn.; Xcelite.
Selling To: ★ A,D,I. **Salesmen:** 8 (eng 3)

PATTIS, B. CO. (See Lincolnwood, Ill.)

PETERS, R. W. CO., 630 E. 222, (216) 261-2330.
Factories: Antronic Corp.; Empire Scientific; Gefco. Mfg.; Gamber-Johnson· Int'l. Elctrn. Sales; Keystone Elctrn.; Kenwood Mfg.; Quietrole Co.; Rheem/Roberts Elctrn.; Sherwood Elctrn. Labs; Ward Prod.
Selling To: ★ A,D,I. **Salesmen:** 2
Services: Repair, Warehouse, Direct Mail

ROBINSON, C. A., 5010 Mayfield Rd., (216) 381-9049.
Branch: 11 West Monument Bldg., (513) 222-0832.
Factories: ADC Products Div.; Autotron, Inc.; Delevan Elctrn.; A. W. Haydon; Keystone Corp.; Price Elec.; Quality Name Plate; Sessions Clock.
Selling To: ★ M,I. **Salesmen:** 4

ROCKFORD CONTROLS OHIO, INC. (See Dayton, Ohio)

ROTH, M. SALES, 678 S. Green Rd., (216) 382-9090.
Factories: Astatic; B & K; Centralab; Fanon; JFD; Premier; Raytheon; Rockford Special Furniture; H. H. Scott; Superior; Tenna; Thordarson; Meissner; Weller.
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 3)

SATULLO CO. (See Royal Oak, Mich.)

SCHROEDER SALES CO., 2084 Noble Rd., (216) 268-3636.
Factories: Altec Lansing; BSR Ltd.; Benjamin Elctrn. Sound; Commercial Music Service; Grado Labs.; Koss Elctrn.; Lahti of Ann Arbor; Langevin; McIntosh Lab.; Perry-Briggs; Telex Comm. Div.; Vega Elctrn. **Services:** Repair, Warehouse
Selling To: ★ A,I. **Salesmen:** 3

SHARP, F. R., 12417 Cedar Rd., (216) 647-8744.
Branches: 1720 Section Rd., Cincinnati, Ohio, (513) 351-5091; Deep Lake Rd., Rte 3, Middleville, Mich., (616) 795-9279; 349 W. First St., Dayton, Ohio, (513) 222-1732.
Factories: Amtron, Inc.; C.M.L., Inc.; Electro Prod. Labs; Missimers. **Services:** Stocking
Selling To: ★ I. **Salesmen:** 6 (eng 4)

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Branches: 3300 So. Dixie Dr., Dayton, Ohio, (513) 293-1194; 1007 Wood St., Pittsburgh, Pa., (412) 242-1476.
Factories: BTU Engr.; Carborundum Co.; Chester Cable Co.; Deltona Transformer; Elec-Trol Reed Relays; Electro Science Labs.; Electronic Measurements; Glasseal Prod.; Hughes Aircraft; Magnetics Inc.; Memcor Div.; San Fernando Elec. Mfg.; Torotel; Victoreen Inst.; Wabco Relay.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 3)

S. STERLING CO. (See Southfiield, Mich.)

TEPLITZ, H. & CO., INC. (See Dayton, Ohio)

TIBY CO., 2245 Warrensville Center Rd., (216) 371-5335.
Branches: 1960 N. Main, Dayton, Ohio, (513) 277-3822; 380 Hilton Rd., Ferndale, Mich., (313) 547-3550.
Factories: Airborne Inst. Lab.; Bay Labs.; Brookdeal of America; Consolidated Ohmic Devices; Develco, Inc.; Measurements; Micro-Now Inst.; Naniloa Corp.; Nelson-Ross Elctrn.; Pacific Photometric Inst.; Viatran Corp.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

TRI-STATE MARKETING, INC. (See Cincinnati, Ohio)

VEREB, S. J. & ASSOC., Box 4424, (216) 271-2066.
Factories: Adams & Westlake; Allis Chalmers; BW Controller; Lundell Controls; RAE Motor.
Services: Repair, Warehouse **Salesmen:** 2 (eng 2)

WKM ASSOCS., INC., 6741 Ridge Rd., (216) 885-5616. TWX: 810-421-8453.
Factories: Analogic Co.; Beckman Elctrn. Inst. Div.; F. W. Bell; Datapulse; Deltron, Inc.; Dumont Oscilloscope Lab.; Genisco Technology; Hallmark Std., Inc.; North Atlantic Inds.; Princeton Applied Rsch.;Rentronix, Inc.; Sangamo Elec.; Systron-Donner; Tally Corp.; Varian Aerograph; Vidar Corp.; Wavetek, Inc. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 7 (eng 7)

WAHL, A. C. & ASSOCS., INC. (See Cincinnati, Ohio)

WHELAN CORP. (See Dayton, Ohio)

WHITESELL, R. & O. ASSOCS. (See Indianapolis, Ind.)

Cleveland Heights

VAL-SKOL SALES, INC. (See Cincinnati, Ohio)

Columbus

ANDERSON, J. B., 59 E. Spring St., (614) 221-6385.
Factories: Dalton Gear; Dynamic Gear.
Selling To: ★ M,D,I. **Salesmen:** 3

BAEHR-GREENLEAF & ASSOCS. (See Cleveland, Ohio)

McFADDEN SALES, INC., 150 E. Broad St., (614) 221-3363. TWX: 810-482-1623.
Factories: Bliley Elec.; Components Inc.; E. F. Johnson Co.; Lenz Elec.; Sealectro Corp.; U. S. Capacitor.
Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 2)

MULLIGAN & MATHIAS CO., 2011 Riverside Dr., (614) 486-2976.
Factories: American Elctrn Labs.; American Zettler; Amperex Elctrn.; Bartlett Mfg.; Better Coil & Transformer; Ferrox Cube; GM Nameplate; Ideal Precision Meter; PCD Div.; Transitron Elctrn.; Wakefield Engrg.

PUGH, C. L. & ASSOCS., INC., 2144 Riverside Dr., (614) 486-9678.
Branches: 512 Crestline Dr., Pittsburgh, Pa., (412) 531-2731; 143 Milton St., Berea, Ohio (216) 243-2717.
Factories: All Tapes; Amperex; Avid; BASF; Bussmann; Craig; Electro Voice; Jayell; Mellotone; Nova Tech; Sams; Spemco; Tenatronics.
Selling To: ★ A,D. **Salesmen:** 4

SEAY, H. H., 1350 Crestwood Ave., (614) 235-0265.
Factories: Buckeye Stamping Co.; Chicago Condenser Corp.; Electrical Windings; Elctrn. Chemical Corp.; Heeger, Inc.; C. E. Hess Enterprises; Mueller Elec.; Universal Supply.
Selling To: ★ A,D,I. **Salesman:** 1

VAL-SKOL SALES, INC. (See Cincinnati, Ohio)

WAHL, A. C. & ASSOCS:, INC. (See Cincinnati, Ohio)

Dayton

AERTRONIC ASSOC., INC., 5899 Huberville Ave., Dayton, Ohio, (513) 253-8144.
Branch: Box 128, Ruffsdale, Pa., (419) 547-6600.
Factories: Beam Tube Corp.; Microwave Elctrn.; Precision Power Ind.; Thiem-Transrex.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

ANGER ASSOCS., INC. (See Dearborn, Mich.)

ASHBY, G. L., 4130 Linden Ave., (513) 252-5627.
Factories: Aero Mechanism; AMF, Inst.; Applied Magnetics; Canoga Video Sys.; Coleman Engrg.; Conductron; Hadron; Infrared Ind.; Laser Optics; Litton Applied Tech.; Motorola Precision Instr.; Philco Ford; Warnecke.
Selling To: ★ M,I. **Salesmen:** 7

BAIER, A. H. CO. (See Willoughby, Ohio)

B. E. K. ASSOC., 1700 Needmore Rd., (513) 278-1343.
Factories: Carter Mfg.; Gorn Corp.; IMC Magnetics; Premier Microwave; United Transformer.
Selling To: ★ M,I. **Salesmen:** 4 (eng 2)

BRAUER, W. J. & ASSOCS. (See Wickliffe, Ohio)

BRUNO, L. D. CO., Box 2044, Kettering Br., (513) 434-1847.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

CALHOUN, R. P. ASSOCS., Box 2275, (513) 299-4144
Branch: 19355 Detroit Ave., Cleveland, Ohio, (216) 221-0450.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

CARTER, McCORMIC & PEIRCE, INC. (See Farmington, Mich.)

DOLFUSS, C. H., JR. & CO. (See Cleveland, Ohio)

ELECTRO SALES ASSOC. (See Cleveland, Ohio)

FEDOTIN, L. S., 3680 Dorset Dr., (513) 275-9345
Factories: Connecticut Telephone & Elec.; Electronic Transistors; Globe Ind.; Jan Hardware Mfg.; Magnecraft Elec.
Selling To: ★ M. **Salesman:** 1

JOHNSON, N. & SONS, 2801 Far Hills Ave., (513) 298-0011.
Factories: American Coil Spring; Auto-Valve; Deerfield Mfg.; Deerfield Screw Machine Prod.; Dynatherm, Inc.; H & H Tube & Mfg.; Quinn-Berry Corp.; H. W. Ruge.
Selling To: ★ I. **Salesmen:** 2

JUBELL ASSOC. (See Cleveland, Ohio)

LAKE, H. G. CO., 1521 N. Main St., (513) 277-8181
Branch: 8486 Concord Hills Circle, Cincinnati, Ohio, (513) 891-0313.
Factories: Auburn Plastics; Bellofram Corp.; Chicago Gasket; Deerfield Mfg.; Delta Die Castings; Haveg Industries; Latronics Corp.; Melray Mfg.; Perfection Spring & Stamping.
Selling To: ★ I. **Salesmen:** 2 (eng 1)

LOWRY DIETRICH CO. (See Pittsburgh, Pa.)

NACE, A. CO., INC. (See Brecksville, Ohio)

NATALINO, A. ASSOCS. (See Akron, Ohio)

NEAL BEAR CORP. (See West Richfield, Ohio)

ROBINSON, C. A., INC. (See Cleveland, Ohio)

REUTLINGER, R. M. & ASSOC., 1755 Big Hill Rd., 293-2155. TWX: 810-459-1756.
Factories: Blocksom & Co.; Davison Chemical Div.; Naran Prod.; Ochard Corp.; Vanpak Prod.
Selling To: ★ M,I. **Salesmen:** 14 (eng 12)

ROCKFORD CONTROLS OHIO, INC., 2077 Embury Pk. Rd., (513) 274-1911. TWX: 810-459-1983.
Branches: 19001 Villaview Rd., N.E., Cleveland, Ohio, (216) 531-4841; 3550 Laketon Rd., Pittsburgh, Pa. (412) 731-4600.
Factories: Duncan Elctrn.; General Magnetic; Gordos Corp.; Harowe Servo Conts.; H. H. Hilton, Inc.; Instrumentation & Contl. Sys.; Fifth Dimension; Licon Div.; Paktron Div.; Struthers-Dunn; Tepro of Fla.; Tri-Tronics.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 4)

SCHMIDT & ASSOC., 1419 Deveraux Dr., (513) 293-6652.
Factories: Aerovox Corp.; J-B-T Inst.; Parelco, Inc.
Selling To: ★ M,D. **Salesman:** 1 (eng 1)

SHARP, F. R. CO., INC. (See Cleveland, Ohio)

SHERIDAN ASSOCS., INC. (See Cincinnati, Ohio)

SIDNELL, R. G. CO., INC. (See Cleveland, Ohio)

SIFF, R. G. & ASSOC., INC., 22 Oxford Ave.
Branch: 14 N. Washington Dr., Sarasota, Fla., (213) 388-3798.
Factories: Ace Elctrn. Assoc.; Airco Elctrn. Comp.; Bradley Semiconductor; Centralab-Div.; Centralab Semiconductor; Delta Coils; Emerson & Cuming; Gudeman; Gulton Ind.; Hammarlund Mfg.; Joy Mfg.; Microtan Co.; Phaostron Inst. & Elctrn.; Sage Elctrn.
Selling To: ★ M. **Salesmen:** 2 (eng 2)

SATULLO CO. (See Royal Oak, Mich.)

S. STERLING CO. (See Southfield, Mich.)

STONE, R. R. & ASSOC., INC. (See Mentor, Ohio)

SWENSON, E. V. & ASSOCS., 1112 Talbott Tower.
Factories: Avien, Inc.; Cooke Engrg.; Dynatech Corp.; Electro Engrg. Works; Flow Corp.; Linair Design Corp.; Magnetika Power Conversion; Micom, Inc.; Spectran/Novatronics; United Contl.; Valcor Engrg.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

TALBE CO., INC. (See Englewood Cliffs, N.J.)

TECHNITRON INSTRS., INC. (See N. Olmstead, Ohio)

TEPLITZ, H., 3718 Salem Ave., (513) 277-9178.
Branches: 3945 Meadowbrook Blvd., Cleveland, Ohio, (216) 371-2044; 26847 Grand River Ave., Detroit, Mich., (313) 537-9058.
Factories: American Optical; Data Inst. Div.; EG&G; Electro-Mechanisms; Film Microelctrn.; Micro Devices; Microwave Assocs.; Polarad; Power Designs; RMS Engrg.; Ray Proof; Rayseel; Waters; Wiitron.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

THAL-MOR ASSOC., INC., 3232 Encrete La., (513) 298-9939.
Factories: Consolidated Controls Corp.; Eagle Signal; Gemco Elec. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 4 (eng 1)

TIBY CO. (See Cleveland, Ohio)

WAHL, A. C. & ASSOC., INC. (See Cincinnati, Ohio)

WHELAN CORP., 2600 Far Hills Ave.
Branches: Box 231, Waterford, Pa.; Cleveland, Ohio, (216) 442-8340; Pittsburgh, Pa., (412) 361-1020.
Factories: Aero Res. Inst.; Axel Elctrn.; Farmer Elec.; Inet Power; Intronics; ITT-Jennings; Magnetic Windings; Solitron Devices; United Elec. Contls.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

WHITESELL, R. O. & ASSOCS. (See Indianapolis, Ind.)

WKM ASSOCS., INC., 5335 Far Hills Ave., (513) 434-7500.
Factories: Beckman Recorder Div.; F. W. Bell; Data Pulse; Deltron; Dumont Labs.; Fairchild Electrometrics; Hallmark Stds.; North Atlantic; Princeton Applied Research; Sangamo; Systron/Donner; Tally Corp.; Varian; Vidor; Wave-Tek.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse

Fairborn

TECHNICAL ASSOC., INC., Box 388,
Branch: 19500 Center Ridge Rd., Rocky River, Ohio, (216) 333-0035.
Factories: Airpax Elctrn.; Bristol Motors; Consolidated Contls. Corp.; G-V Controls Inc.; Globe Ind.; Helical Prod.; Markite Corp.; Micro Science.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

Galion

NACE, A. CO., INC. (See Brecksville, Ohio)

Hudson

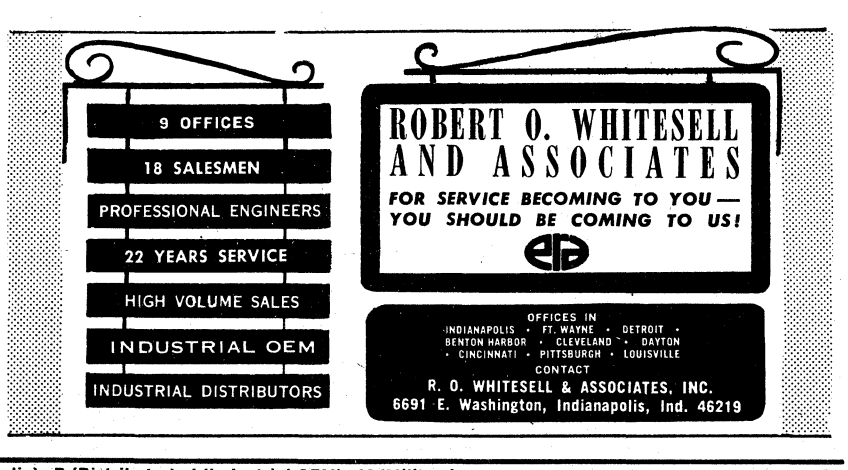
KAHSAR, F. E. SALES, INC. (See Cincinnati, Ohio)

Lakewood

ANGER ASSOCS., INC. (See Dearborn, Mich.)

Lima

OHIO ASSOCS., Box 728, (419) 646-3495.
Factories: Amidon Assocs.; Ava Connectors; Babcock; Calvert-English Electric; E. T. Clegg Co.; Contex, Inc.; Cushcraft; Epsilon Code Course Records; Gam Elctrn.; Gentec; Heights Mfg.; Krackman; Pausan Mars; Polyphase; 73 Magazine; "Village-Twig".
Selling To: ★ M,D,I. **Salesmen:** 3



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STONE, R. R. & ASSOC., INC., Box 47,
Branch: 333 W. First St., Dayton, Ohio, (513) 228-7422.
Factories: Continental Wirt; Couch Ordnance; Dohrman Inst.; Gibson Elec.; Kapitol Magnetic; Shaw Insulator.
Selling To: ★ I. **Salesman:** 1

(See Advertisement This Page)

New Bremen

SHELBY, T. & CO., 17 S. Walnut, (419) 629-6511.
Factories: Chicago Miniature Lamp Works; Concord Elctrn.; Enterprise Dev.; Electron Corp.; J. W. Miller Corp.; United Mineral and Chemical.
Selling To: ★ D,I. **Salesmen:** 3
Services: Warehouse

N. Madison

MILLER, H. SALES CO. (See Cleveland, Ohio)

Novelty

G. H. SALES CO. (See Cincinnati, Ohio)

N. Olmsted

TECHNITRON INST., INC., 23203 Lorain Rd., (216) 734-0960. TWX: 810-421-8694.
Branches: 1250 W. Dorothy La., Dayton, Ohio, (513) 298-9964; 13657 Grand River Ave., Detroit, Mich., (313) 838-7324; 114 Spring Grove Rd., Pittsburgh, Pa., (412) 371-1231.
Factories: Alford Mfg. Co.; Amco Engrg. Co.; Bolt, Beranek & Newman; Cimron Div.; Control Sys. Res.; Data Technology Corp.; Davidson Elctrn. Dev.; Dynamic Instrumentation; Exact Elctrn; J. Fluke Mfg.; Intercontinental Inst.; Microlab/FXR.; Optimation, Inc.; Physio Control; Servo Corp.; Techni-Rite Elctrn.; Viking Modules; Volumetrics; Weldmatic Div.; Zeltex, Inc.
Selling To: ★ M,I. **Salesmen:** 6 (eng 6)

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TEL: 513 299-3566

Rocky River

TECHNICAL ASSOC., INC. (See Fairborn, Ohio)

Sabina

MILLER, H. SALES CO. (See Cleveland, Ohio)

Toledo

ASH, W. J., 4110 Templar Rd., (419) 474-1313.
Factories: COPE; W. F. Curlee Mfg.; Gemco Elec.; Heinemann Elec.; Hendrix Wire & Cable; I.T.T. Jabsco Pump; Lapp Insulator; Preformed Line Prod. **Services:** Sales Only
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

CHILCOTE SALES CO., 2940 W. Lincolnshire, (419) 536-6606.
Factories: Electra Corp.; Fasco Industries, Inc.; Hammarlund Mfg. Co.; Hudson Lamp Co.; Rawn.
Selling To: ★ D. **Salesmen:** 2

VOLENTE, D., 4240 Eaglehurst, (419) 882-2830.
Factories: Ace Engrg. & Machine; Atlee Corp.; Elctrn. Enclosures; Jonathan Mfg.; Kooltronic Fan Co.; Metex Corp.; Micron Gear Co.
Selling To: ★ I. **Salesman:** 1

Trotwood

ATKIND, I., 821 Burman Ave., (513) 837-4750.
Factories: Automatic Coil; Elmag Corp.; Freed Transformer.
Selling To: ★ M. **Salesmen:** 2 (eng 1)

Westlake

HERRICK, G. L., 845 Canterbury, (216) 871-8855.
Branch: 2209 Losantiville Rd., Cincinnati Ohio, (513) 351-4441.
Factories: A.T.M. Plastic; Continental Wirt Elctrn.; Industrial Elctrn. Hardware; Jenny Ind.; Mold Rite Plastics; Positive Terminal & Connector; Seacor; Tingstol; Victor Elec. Wire & Cable.
Selling To: ★ I. **Salesmen:** 3

West Richfield

BEAR, N. CORP., 3435 Streetsboro Rd., (216) 659-3331. TWX: 810-427-9100.
Branch: 1563 E. Dorothy La., Dayton ,Ohio, (513) 299-3566. TWX: 810-459-1848.
Factories: Alpha Wire; Antenna Specialists Co.; Argos Products Co.; Bourns; Electro Cube; Electrovert; Holtzer Cabot; Jensen Mfg. Div.; Kulka Elec.; Littelfuse; M & W Mfg.; Merit Coil & Transformer; New Product Engrg.; Pamotor; Parker Inst.; H. H. Smith; Switchcraft; Syncro Capacitor; Viking Ind.
Selling To: ★ A,M,D,I. **Salesmen:** 9 (eng 4)

(See Advertisement This Page)

Wickliffe

BRAUER, W. J. & ASSOCS., INC., Box 305, (216) 943-0601.
Branches: Box 3085, Overlook Br., Dayton, Ohio, (512) 426-1692; Box 8466, Pittsburgh, Pa., (412) 921-3213.
Factories: Beede Elec. Inst.; Berkshire Elec. Cable; Circuitronics; Electrical Utilities; National Transformer Resistors, Inc.; Sage Elctrn.; Taurus Corp.; U. S. Components; Vacuum Ceramics.
Selling To: ★ M,I. **Salesmen:** 3
Services: Mailing Facilities

Willoughby

BAIER, A. H. CO., 4399 Industrial Pkwy, (216) 946-6080.
Branch: 3300 S. Dixie Dr., Dayton, Ohio, (513) 298-9897.
Factories: Basler Elec.; Cambridge Thermionic; Electro-Craft; Fenwal Elctrn.; Ferranti-Packard; Glenair; Grayhill; Joy Mfg.; Weston-Transicoil Div.
Selling To: ★ A,M,D,I. **Salesmen:** 6 (eng 3)
Services: Warehouse

GAY, G. J., INC. (See Brockport, N.Y.)

Worthington

OHIO INST. CO., 505 Whitney Ave., (614) 885-0743.
Branch: 8928 Nottingham Dr., Ypsilanti, Mich., (313) 484-0778.
Factories: Ballantine Labs.; BCD Co.; Birtcher Corp.; Chrono-Log Corp.; Electro/Data Inc.; Fisher-Akin Co.; Kahn Res. Labs.; Marconi Inst.; Nova Elec. Mfg.; Philips Elctrn Inst.; Schlumberger overseas GMBH; Solartron Elctrn Grp.; Technibilt: Twinco: **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

WELLER ELCTRN. SALES, Box 212, (614) 885-7819.
Factories: Bauer; Blonder-Tongue; GBC; IDI; Johnson Elctrn.; MWI; Phalo; Precision Elctrn.; Raytheon; Setchell-Carlson; South River; Turner.
Selling To: ★ D. **Salesmen:** 3 (eng 1)

Xenia

BAEHR-GREENLEAF & ASSOCS. (See Cleveland, Ohio)

MICHAELSON, B. L. CO., 1053 Arlington Dr., (513) 372-5496.
Branch: 3617 Lee Rd., Cleveland, Ohio, (216) 921-8850.
Factories: Delavan Mfg. Co.; Deltron, Inc.; Dolan-Jenner Ind.; Dryco Prods.; Electran Mfg.; Goring Kerr, Inc.; Hecon Corp.; Williamson Dev.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse

OKLAHOMA

Tulsa

APPLIED SCIENCE ASSOCS. (See Dallas, Texas)

BFA (See Denver, Colo.)

COMPONENTS, INC., Box 50277, (918) 583-9149.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

DATA ENGRG. CORP. (See Richardson, Texas)

GREEN, J. A. CO. (See Dallas, Texas)

IBL ENGRG. & SALES (See Dallas, Texas)

KLICPERA, M. F. (See Houston, Texas)

McKINNEY, J. F. SALES CO. (See Dallas, Texas)

PECK, G. V. CO. (See Dallas, Texas)

RAY, T. J. CO., Box 45191, (918) 627-1515.
Services: M,D,I. **Salesman:** 1

SOMNER, W. L. CO., INC. (See Shreveport, La.)

SOUTHLAND ENGRG. & SALES. (See Houston, Texas)

SOUTHWEST ELCTRNS. INDS. (ee Dallas, Texas)

SOUTHWESTERN CONTROLS (Houston, Texas)

OREGON

Beaverton

SCHULTZ, N. R. CO. (See Belleview, Wash.)

Eugene

TUDOR, J. A. & ASSOC., INC. (See Seattle, Wash.)

Lake Oswego

McMILLAN ELCTRN., 16679 S.W. Maple Circle, (503) 636-6257.
Factories: American Elctrn. Labs.; Certron Corp.; Crown Int'l.; Detak Corp.; ERA Acoustics; Injectorall Elctrn.; Jayell Mfg.; Midland Int'l.; Stanford Int'l.; Trutone Elctrn.
Selling To: ★ A,M,D. **Salesmen:** 2 (eng 1)

Portland

ALLIED NORTHWEST MACHINE TOOL CORP., 3525 S.E. 17th, (503) 234-7513.
Factories: Brown & Sharpe; Elox; Fellows Gear; Fellows Plastic Machines; Federal Prod.; Fosdick; R. T. Gilman; Hammond; Jones & Lamson; Niagara; PeeMess; Portage Double Quick; Sheldon.
Selling To: ★ I. **Salesmen:** 2
Services: Warehouse

ALMAC/STROUM ELCTRNS. (See Seattle, Wash.)

ARVA, INC. (See Seattle, Wash.)

AURICH, F. W. & CO. (See Seattle, Wash.)

BACH, P. ELECTRIC, 1233 N.W. 12th Ave., (503) 227-2173.
Branch: Box 631, Bellevue, Wash., (206) 454-8694.
Selling To: ★ D.

BRANOM INSTRS., CO. (See Seattle, Wash.)

DUDEK, R. C. & CO., INC. (See Los Angeles, Calif.)

EARL & BROWN CO., INC. (See Seattle, Wash.)

ECKERSLEY, J. W. CO., 3150 S.W. Hamilton St., (503) 246-3183.
Factories: Alliance Mfg.; American Elec. Heater; Cleveland Elctrn.; Couch Ordnance; Gold Line Connectors; Heeger, Inc.; Mura Corp.; Pearce-Simpson; Positive Connector Co.; Tenna Corp.; Thurow Elctrn.; Trimm, Inc.; Vantage Prod.
Selling To: ★ M,D,I. **Salesman:** 1

INSTRUMENT LAB., INC. (See Seattle, Wash.)

KEARNS, J. L. CO., 6055 N.E. Glisan St., (503) 236-1165.
Factories: Columbia Elec. Mfg. Co.; Green Inst. Co.; Midland Std. Inc.; Moisture Register Co.; Norton Electrical Inst.; Photomation Inc.; Post Elctrn. Prod. Inc.; Precision Prod. & Contls. Inc.; H. H. Sticht Co.; C. F. Warrick Co.
Selling To: ★ I. **Salesmen:** 2 (eng 1)
Services: Consulting Engr. E.E.

LEGG, R. CO., Box 25327, (503) 292-8824. TWX: 910-464-1510.
Factories: Beckman Inst.; Carol Cable Co.; Columbus Elec.; CTS Corp.; CTS Knights, Inc.; California Resistor; Dexon, Inc.; Instrulab; Measurement Control Devices; New Products Engrg.; Primec Corp.; Siemens America Inc.; Technology/Versatronics; Vanguard Elctrn. Tools; Wabash Magnetics. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 2)

LYNN & BROOKS (See Los Angeles, Calif.)

MARTIGS INC., 5741 N.E. Glisan St., (503) 232-1949.
Branch: 442 Central Bldg., Seattle, Wash., (206) MA 3-6622.
Factories: In-Val-Co.; Research Contls.; Fairchild; Deltron; Data-Master. **Services:** Repair
Selling To: ★ M,D,I. **Salesmen:** 4

MAYDWELL & HARTZELL. (See San Francisco, Calif.)

MERRITT, R. CO. (See Seattle, Wash.)

MINTHORNE R. M. CO., 6565 S.W. Macadam Ave., (503) 246-4556.
Factories: Akro Mils Inc.; Carl Cordover & Co.; Dutrex Ind.; Eby Sales Co.; Electra Corp.; Finney Co.; Game Ind.; Jersey Specialty Co.; Kits Ind.; Milwaukee Resistor; Monarch Elctrn. Int'l.; Newcastle Fabrics; Perma Power Co.; Robins Ind.; Superex Elctrn.; Televac Inc.; Wright Steel & Wire Corp. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 2

MONTGOMERY BROS., INC. (See Burlingame, Calif.)

PACIFIC ELEC. SALES CO., 140 S.E. 28th Ave., (503) 235-4137.
Factories: Heyman Mfg.; Industrial Devices; Jakel Motors; Miller Elec.; Synthane Corp.
Selling To: ★ D,I. **Salesmen:** 2
Services: Warehouse

PETERS-DE LAET, INC. (See Burlingame, Calif.)

POLICH, A. L., 5940 S.W. Hood, (503) 246-5451.
Branch: 2636 Thorndyke Ave. W., Seattle, Wash.
Factories: Agastat Div.; Mektron; Nicad Div.; Ratelco; Unimax Switch Div.; Veeder Root.
Selling To: ★ I. **Salesmen:** 4 (eng 3)
Services: Warehouse

RIGGS, C. E. INC., 422 N.W. 8th, (503) 226-3286.
Branches: 314 Second Ave. S., Seattle, Wash., (206) 623-5707; Box 77, Opportunity Br., Spokane, Wash., (509) 624-7554.
Factories: Associated American Winding Machinery; Carolina Narrow Fabric; Gardiner Solder; Haysite Div.; Macallen Co.; L. Frank Markel & Sons; Niemand Bros.; N. J. Wood Finishing Co.; Sterling Varnish; Westline Div.
Selling To: ★ D,I. **Salesmen:** 5
Services: Warehouse

TUDOR, J. A. & ASSOC., INC. (See Seattle, Wash.)

WEBER, D. G., 516 S.E. Morrison, (503) 234-7671.
Branches: 911 Western Ave., Seattle, Wash., (206) 623-5990; 303 W. 15th Ave., Spokane, Wash., (509) 624-3908.
Factories: Air-Vac Engrg.; Astatic Corp.; J. W. Davis & Co.; Delevan Elctrn.; Electrical Ind.; Erdco Engrg.; General Reed; James Elctrn.; KLH Res. & Dev.; Kurz-Kasch, Inc.; Merit Coil & Transformer; Midtex, Inc.; Rawn Co.; Raytheon; Sprague Prod.; Standard Grigsby; Utah Elctrn.
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 2)
Services: Warehouse

WELLS, W. C., 6055 N.E. Glisan, (503) 235-2437.
Factories: Linemaster Switch; Midwest Elec. Prod.; Nat'l. Acme.
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

W. Linn

NORTHWESTERN AGENCIES. (See Seattle, Wash.)

PENNSYLVANIA

Abington

GARTEN, L. A. & ASSOCS. (See Fairfield, N. J.)

HILLIARD ASSOCS., INC., Box 186, (215) 884-6100.
Factories: Bristol Co.; Circuit-Wise, Inc.; Elco Corp.; Electronic Modules; Gavitt Wire & Cable; Virginia Panel.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 1)
Services: Warehouse, Direct Mail

PEARSON, R. T., SALES, INC., 1125 Old York Rd., (215) 887-0186.
Factories: Arrow Mfg.; Comel Int'l.; Gates Albert, Inc.; Industrial Mica; Iseli Co.; Liverpool Ind.; Mel-Rain Corp.; Radio Wire Mfg.; Tower Mfg.; Tyler Sales; Victor Elec. Wire & Cable; Waterbury Co.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

SAWTELLE, C. E., 2068 E. Maplewood Ave., (215) OL 9-0742.
Selling To: ★ D. **Salesmen:** 3

VPI ASSOCS., INC. (See Laurel, Md.)

Allentown

BEIL & WHITAKER, INC. (See Reading, Pa.)

BERLIANT ASSOCS. (See Baldwin, N. Y.)

Ambler

GRIFFIN-CAMPBELL, INC., 25 Skippack Pike, (215) 646-7535.
Factories: Axel Elctrn.; Electralab, Inc.; NCI, Inc.; North American Printed Circuit; Precision Connectors Div.; Price Elec.; Sessions Inc.; Tensolite Insulated Wire Co.
Selling To: ★ M,D,I. **Salesmen:** 3

HUMES-QUINLAN SALES CO., 242 E. Butler Ave., (215) 646-7250. TWX: 510-661-1585.
Factories: Holyoke Wire & Cable Corp.; Nytronics, Inc.; Peerless Molded Plastics; Standard Grigsby; Thomas & Skinner.
Selling To: ★ I. **Salesmen:** 3

SNOW, C. E. CO. (See Beltsville, Md.)

WYNCOTE INSTRUMENTATION CO., 365 E. Butler Ave., (215) 643-2440.
Factories: Analog Devices; Fifth Dimension; Magnetico; Pastoriza Elctrn.; Varadyne.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Repair

Andalusia

L. & M. ASSOC. (See Saddle Brook, N. J.)

Ardmore

FULLER, L. C., JR., & CO., 32 Rittenhouse Pl., (215) MI 2-2468.
Factories: Electro-Pacific, Inc.; Hafstrom Technical Prod., Inc.; Nine Mile Enterprises.
Selling To: ★ I. **Salesman:** 1 (eng 1)

HELLER FREEDMAN, Box 391, (215) 649-3679.
Factories: ACS Ind.; Applied Engrg. Prod.; Clairex Elctrn.; Cosmo Plastics; Defiance Circuit; Delta Semiconductors; Engonics Engrg.; Gordos Corp.; Hi-G; Inter-Technical Grp.; Int'l. Comp Corp.; Merrimac Magnetics; Tec Magnetics; Thorn-AEI Radio Valves & Tubes.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

L-C-A SALES, INC. (See Tuckahoe, N. Y.)

MARTIN ELECTRIC, 118 Valley Rd., (215) 649-6332.
Factories: Acopian Corp.; Atlantic Semiconductor; Del Elctrn.; Penntube Plastics; Severna Div.; Varflex. **Services:** Direct Mail
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

ROTHENHEBER, 53 Cricket Ave., (215) 642-6911.
Branch: 14211 Chesterfield Rd., Rockville, Md., (301) 929-3388.
Factories: Dearborn Elctrn.; General Semi.; Grand Transformers; Hotwatt; Pennsylvania Elctrn. Tech.; Power Contl.; Quality Comp.; Republic Elctrn.; Skinner Precision Ind.; Stemco Contls.; Syracuse Elctrn.; Thermal Circuits; Wall Mfg.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

Bala Cynwyd

BURLINGAME ASSOCS. (See Mt. Vernon, N. Y.)

CAIN & CO. (See Encino, Calif.)

Broomall

LOWERY, L. D., INC., 2801 W. Chester Pke., (215) EL 6-5300.
Branches: 6200 Annapolis Rd., Hyattsville, Md., (301) 773-4977; 1501 Allison St., Harrisburg, Pa., (717) 233-0917.
Factories: Corning Elctrn. Prods.; Dialight Corp.; Elctrn. Specialty; Erie Tech. Prods.; A. W. Haydon; Industrial Condenser; Kulka Elec.; Leecraft Mfg.; J. Millen Mfg.; Pamotor, Inc.; Phalo Corp.; United Transformer; Varo; Wood Elec.
Selling To: ★ M,D,I. **Salesmen:** 12 (eng 4)
Services: Warehouse

Bryn Mawr

VAUX, G., 320 Caversham Rd., (215) LA 5-4517.
Factories: Harris Mfg.; Pereny Equip.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Camp Hill

TAYLOR, M. F. CO., INC. (See Silver Springs, Md.)

Cheltenham

ARNOLD ASSOCS., 2 Ryers Ave., (215) 742-0600.
Branch: 5076 Yorktown Blvd., Arlington, Va., (301) 828-7666.
Factories: Atohm Elctrn.; Carborundum Elctrn.; Elctrn. Controls; Microtran; R. F. Interonics; Voltronics. **Services:** Direct Mail
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 2)

Chester Springs

CONOVER, L. C. ASSOCS., (215) 827-7261.
Factories: Com-Pak-Ett Mfg.; Dyna Mfg.; Economy Cable Grip; Glowtex Lighting; Jody Mfg.; Knupp Inc.; Lidseen of N. C.; Lutron Elctrn.; Norwell Mfg.; Rapid Elec.; Winders & Geist.
Selling To: ★ D,I. **Salesmen:** 3

Conshohocken

BROGAN ASSOCS., INC. (See Waterbury, N. Y.)

Cornwells Heights

CONOVER, C. E. & CO., INC. (See Fairfield, N. J.)

Devon

B. & A. ASSOCS., 237 Lancaster Ave., (215) MU 8-5173.
Factories: Acromag, Inc.; American Comp.; Barnes Corp.; Beede Electrical Inst.; Dormeyer Ind.; Precision Specialties; Vishay Resistor Prod.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

Dresher

LAIRD EQUIPT. CO., 1029 Twining Rd., (215) 884-8198.
Factories: Cadillac Stamp Co.; Electromark Corp.; Kwikmrk Inc.; New Hermes Engraving Mch.
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)
Services: Warehouse

Drexel Hill

McDAVITT SALES CORP., Box 308, (215) 544-2588.
Factories: Agastat Div.; Applied Motors Inc.; Barber-Colman Co.; Firing Circuits.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

STOBBART, A. J., 4980 State Rd., (215) 259-3881.
Selling To: ★ A,D,I. **Salesman:** 1 (eng 1)

Easton

WC SALES, INC., Box 109, (215) 252-8300.
Factories: Aerospace-Nylok; United States Radium; Vemaline Prod. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 4 (eng 2)

Eddystone

WADSWORTH MFG. ASSOC. (See Liverpool, N.Y.)

Elkins Park

MEASUREMENTS UNLIMITED INC., 529 Shoemaker Rd., (215) 224-1663.
Branches: 11 Sleepy La., Hicksville, N. Y., (516) 735-2432; 19 N. Harrison St., East Orange, N. Y., (201) 677-0100.
Factories: Arvin Freq. Devices; Boonton Elctrn.; Eckel Corp.; Greibach Inst.; Krohn-Hite; MTI Inst.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 3)
Services: Repair

Fairview Village

ACROMATIX ASSOCS., INC., Box 271, 3118 Germantown Pke., (215) 279-0377.
Factories: Atec, Inc.; Chadwick-Helmuth; Colorado Video; Control Data; Dohrmann Instr.; J. Fluke Mfg.; Intrex; Marconi Television; Matrix; North Atlantic Ind.; Nova Electric Mfg.; Optimation; Physio-Control; Rockland Labs.; Scionics; Signal Res. **Services:** Repair
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 3)

Feasterville

PAR-NELL SALES CO., 1135 Bustleton Pke., (215) 357-7230.
Branch: 69 Main St., Reisterstown, Md., (301) 833-6444.
Factories: American Electric Heater; Atlas Connector Technology; Bomar Crystal Co.; Eastern Reproduction; Graphtex; Hamby Corp.; Hermetic Seal; Int'l. Electro Exchange; IRC; J. W. Miller; Minneapolis Speaker; Nortronics Co.; Planet Sales; Sippican; Sonar Radio; Sonobond.
Selling To: ★ D,I. **Salesmen:** 4 (eng 1)
Services: Warehouse—Limited

Ft. Washington

BEEMER ENGRG. CO., (215) MI 6-8440. TWX: 510-661-1654.
Branches: 122 E. 42nd St., New York, N. Y., (212) 964-5057; Cleveland Pl., Springfield, N. J., (201) 376-9570; 67 Oakgrove Dr., Buffalo, N. Y., (716) 632-4363; 108 Dawley Rd., Fayetteville, N. Y., (315) 446-5197; Box 916, Severna Park, Md., (301) 647-1840; 4307 Emory La., Charlotte, N. C., (704) 364-0975.
Factories: Amplex Div.; Halogen Insulator & Seal; Haskel Engrg. & Supply; Metallized Carbon; Plastic & Rubber Products; T.D.I. Div.; Tec Seal; United Aircraft Prod. **Services:** Warehouse
Selling To: ★ I. **Salesmen:** 15 (eng 4)

HEFFERNAN, H. J. CO. (See Arlington, Va.)

Gibsonia

SOMERS, J. F. CO. (See Geneva, N. Y.)

Gladwyne

HEVNER, D. S. CO., 1528 Spring Mill Rd.
Factories: Ajax Hardware; Cleveland Elctrn.; Cord Sets, Inc.; Dixie Wire Co.; Louvre Lux Co.; Perfection Elec. Prod.
Selling To: ★ I. **Salesman:** 1

Glenside

BUERGER CO., 33 Limekiln Pke., (215) 887-5030.
Branches: 1359 Oak La., E. Meadow, N. Y., (516) IV 5-6228; 1932 Elmbrook La., Pittsburgh, Pa., (412) 276-3122.
Factories: Baron-Blakeslee; Chemcut Corp.; Colight; Consul Mutoh; Eastman Kodak; H & M Mfg; Heller Tool; Hydra-Elec.; Infra-Red Sys.; Ramyr Mfg.; Robertson Photo-Mechanix; United Scientific.
Selling To: ★ I. **Salesmen:** 3 (eng 2)
Services: Repair, Warehouse

MID-LANTIC CHAPTER, Electr. Rep. Assoc., 315 Harrison Ave., (215) TU 4-0139.
Selling To: ★ A,M,D,I.

SHELMAR ELCTRN. CORP., Box 254, (215) 885-0800.
Factories: Ark-Les Switch; Hudson Lamp; Kanthal.
Selling To: ★ A,D,I. **Salesman:** 1
Services: Warehouse

SHELPS, G. A. CO., Box 254, (215) 885-0800.
Factories: Ark-Les Switch; Hudson Lamp; Kanthal.
Selling To: ★ D,I. **Salesman:** 1

WILKINSON, R. L., INC. (See Towson, Md.)

Harrisburg

BEIL & WHITAKER, INC. (See Reading, Pa.)

LOWERY, L. D., INC. (See Broomall, Pa.)

Hatboro

ENGEL, G. C. & ASSOCS. INC. (See Ridgewood, N. J.)

Havertown

MASSEY ASSOC., INC., 1325 W. Chester Pke., (215) 789-2320.
Branches: 801 79th St. S., St. Petersburg, Fla., (813) 347-6183; 304 Lake Ave., Maitland, Fla., (305) 855-4510.
Factories: Ace Engineering & Machine Co.; J-B-T Inst., Inc.; Metex Corp.; Nytronics, Inc.; Omni-Spectra; Panelgraphic; Quest Elctrn. Dev.; Precision Tube Co.; Semi-Conductor Concepts; Shurite Meters; Syntronic Inst.; Triplett Elec. Inst.; Vamistor.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 4)

MUSTICO, J. CO., Box 624, (215) HI 6-1961.
Factories: Ava Elctrn. & Machine; Datak Corp.; Electro Prod. Labs; Elec-Trol, Inc.; Trimm, Inc.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

Jenkintown

ARA ELCTRN. INC., 301 York Rd., (215) TU 7-5250. Branch: 7805 Old Georgetown Rd., Bethesda, Md., (301) 657-2585.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

MOUNT, W. CO. (See Bethesda, Md.)

STEIN INSTRUMENTATION CORP., 413 Johnson St., (215) 885-2370.
Factories: American Standard; Consolidated Ohmic Devices; Electro Oceanics; Luminetics; Pioneer Magnetics; PPM, Inc.; Preston Scientific; Renco Corp.; Schaevitz Engrg.; Setra Sys.; United Telecontrol Elctrn.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse, Direct Mail

King of Prussia

DIVERSIFIED DEVICES, Box 241, (215) 265-7925.
Factories: Applied Peripheral Sys.; Bielski Memory Sys.; Computer Prod.; Dictograph Prod.; EMP Elctrn.; Gralex Ind.; Mastech Inc.; Optical Elctrn.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

ELECTRONIC MARKETING. (See Kensington, Md.)

LETRONIX, 251 W. DeKalb Pke., (215) 265-1020.
Factories: American Machine & Foundry; Aritech Corp.; Baldwin-Lima-Hamilton; C.G.S.; Darcy Ind.; Dynamic Precision Contls.; Elcor, Inc.; Electro-Numerics; Exact Elctrn.; Flow Technology; Itron Corp.; Lockheed Elctrn.; Texas Inst.
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)

S & S ASSOCS., Boro Line Rd., (215) 265-3450.
Branches: 7720 Wisconsin Ave., Bethesda, Md., (301) 654-1434; Baltimore Md., (301) 828-8097.
Factories: Aerometrics; Astrosys.; C E A, Div.; Electro-Nuclear Labs.; Gamco Ind.; General Microwave Corp.; Houston Inst., Div.; Incre-Data Corp.; Information Displays; Julie Research Labs; Marconi Inst.; Microdyne Inst.; Nelson-Ross Elctrn.; Omnitec Corp.; Statham Inst.
Selling To: ★ M,I. **Salesmen:** 7 (eng 6)
Services: Repair, Warehouse, Calibration Facility

Lansdowne

SATTERTHWAITE, W. F., Box 191, (215) 623-5100.

McMurray

DAUGHERTY, F. R. CO. (See Cleveland, Ohio)

Montgomery County

HILDERBRAND, R. H., Fairview Village, Box 166, (215) 247-6225. TWX: 510-660-0985.
Factories: Airco Speer Elctrn. Comp.; Coilcraft, Inc.; Cincinnati Milling Machine; Precision Elctrn. Comp.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

Narberth

BIECHLER ASSOCS., INC., Box 414, (215) 667-1827. TWX: 510-662-4844.
Branches: 822 Baltimore Rd., Rockville, Md., (301) 762-6210. TWX: 710-828-0089; 202 W. Pennsylvania Ave., Towson, Md., (301) 825-8222. TWX: 710-232-1850.
Factories: Babcock Relays; Digitran Co.; Duncan Elctrn.; Electronic Hardware; Frequency Elctrn.; Industrial Elctrn. Engrs.; "Kilovac" High Vacuum Elctrn.; Microsemiconductor; Silicon Transistor; Sloan; Staco; Techno Components; Union Carbide.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)

BRESSON, J., 107 Forest Ave., (215) TE 9-6770.
Branch: 5600 Main St., Elkridge, Md.
Factories: Centralab Electr. Div.; Electra-Midland; General Inst.; Phaostron Instr. & Electr.; Solitron Devices. **Services:** Direct Mail
Selling To: ★ I. **Salesmen:** 6 (eng 3)

JEFFRIES, S. A., 105 Forrest Ave., (215) 664-8500.
Branches: 530 Sixth Ave., Pittsburgh, Pa., 391-1100; 500 Overcrest Rd., Baltimore, Md.; 1029 Vermont Ave., N.W., Washington, D.C., (202) 737-7733.
Factories: American Magnetics Corp.; B. E. C.

SAMUEL K. MACDONALD, INC.

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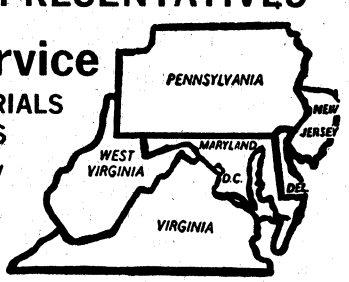

Inc.; Cole Inst.; Electronic Chemical Corp.; Elmag Inc.; Littelfuse; Robinson-Nugent; Sealectro; Seastrom Mfg.; United Mineral & Chemical; Whitso Inc.
Selling To: ★ M,D,I. **Salesmen:** 8 (eng 5)
Services: Warehouse, Sales Engineering

STINSON, 227 Haverford Ave., (215) MO 4-5511-2.
Factories: Antenna Specialists; Cornell-Dubilier; CTS Knights; Motorola; Murdock Co.; Reeves Soundcraft. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 1)

WHITE, L. G., Keystone Inc., Box 246, (215) MO 4-6505.
Factories: Amco Engrg.; Birtcher Corp.; Christie Elec.; Coleman Engrg.; Control Data; Deltron, Inc.; Digitronics Corp.; Enercon; G-V Controls; Invac Corp.; Unimax Switch; Vector Engrg.; Whittaker Corp.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

Neffsville

HATFIELD, R. E., 2680 Lititz Pke., (717) 569-2621.
Factories: Butler Aviation Int'l.; Howell Elec. Motors.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

New Britain

LIENAU ASSOCS., INC. (See Wheaton, Md.)

New Cumberland

AEROL ASSOCS., INC. (See Jericho, N. Y.)

Newton

MURRAY CO. (See Livingston, N. J.)

Newtown Square

HOLDSWORTH & CO., INC., Box 298, (215) 356-8550.
TWX: 510-662-9028.
Factories: Addington Labs.; Electromagnetic Info. Processing Labs.; Elctrn. Measurements; Jerrold Elctrn.; Kinetic Technology; Modutec; Rustrak Inst. **Services:** Repair, Warehouse
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

KAUFHOLZ ASSOCS., Box 227, (215) 356-5000.
Branch: Box 6232, Baltimore, Md., (301) 488-6561.
Factories: Chicago Miniature Lamp Works; Drake Mfg.; Harmonic Drive Div.; Janco Corp.; Licon Div.; North Electric Co.; Ramsey Contls.; Scanbe Mfg.; Technical Wire Prod.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 3)
Services: Direct Mail

Norristown

DATA-REP ASSOCS., INC. (See Ridgewood, N. J.)

Oreland

BROWN-FREDERICK, 88 Penna Ave., (215) 887-1325.
Factories: Gowanda Elctrn.; Semicon, Inc.; Stackpole Carbon; Stackpole Components; TRW Capacitor Div.
Selling To: ★ D,I. **Salesmen:** 2 (eng 2)

Paoli

GRIFFIN, T. CO., 46 Darby Rd., (215) 647-1550.
Factories: APM-Hexseal Corp.; Autotron, Inc.; F. W. Bell; Buckeye Stamping Co.; Clark Crystal Co.; Dytronics Co.; W. L. Gore & Assocs.; Greenray Ind.; Gruenberg Elec.; Hastings-Raydist; Jettron Products; Metric Eng.; Oven Ind.; Parabam.
Selling To: ★ A,M,D,I. **Salesmen:** 7
Services: Sales Office

Philadelphia

A. B. & T. SALES CORP. (See Olney, Md.)

ANDCO SALES ENGRG. INC., 10 E. School House La., (215) VI 4-9100.
Branch: 4700 Davidson Dr., Chevy Chase, Md., (301) 654-6065.
Factories: Amerkind-MacKissic; Chomerics, Inc.; Denes Co.; Hopkins Engrg.; Microwave Filter; Terra Corp.

DEARIE, J. P. CO. (See Mountain Lakes, N. J.)

DENCO INC.-DATA ENGRG. CO., 500A E. Godfrey Ave., (215) 725-9000. TWX: 710-670-9394.
Factories: Computer Automation; Digital Inst.; Dynage, Inc.; Electronics Arrays; Electronic Assocs.; International Computer Prod.; Memory Technology; Microsonics; Peripheral Equipt.; Raytheon Computer; Standard Memories; Vermont Res. Corp.; WEMS; Zeltex. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

E.-A. INC. (See Baltimore, Md.)

E. C. I. DIV., Eastern Components, Inc., 1349 W. Cheltenham Ave., (215) 927-6262.
Branch: 6200 Annapolis Rd., Landover Hills, Md., (301) 322-1412. **Services:** Distributor
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 5)

ERDMAN, K. B. CO., INC., 7906 Montgomery Ave., (215) CA 4-1833.
Factories: Albany Prod.; Cambridge Thermionic; CEM Co.; DZUS Fasteners; HAN-DEE Spring & Mfg.; Krylon; Long-Lok; PIC Design; Schauer Mfg.
Selling To: ★ M,D,I. **Salesmen:** 4

(See Advertisement This Page)

GARRETTSON CO., INC. (See Williston Park, N. Y.)

GRAYDON-SHERMAN, INC. (See Morristown, N. J.)

JADELECTRONICS ASSOCS., INC., Box 5735, (215) GL 5-3355.
Branch: Box 115, Greenbelt, Md., (301) 474-8161.
Factories: Amatom Elctrn. Hardware; Angstrohm Precision; EMC Technology; Electric Indicator; Electronic Moldings; Electro-Science Labs.; Fusite Corp.; National Semiconductors, Ltd.; Torotel.
Selling To: ★ M,D,I. **Salesmen:** 3

JONES, D. K. & ASSOCS. (See Baltimore, Md.)

KIMBERLY-JAMES, INC., 1422 Chestnut S., (215) LO 3-6761-2.
Factories: ARCO Capacitor Co.; Nippon Coil Co.; Taiyo Denki Co.
Selling To: ★ I. **Salesmen:** 162 (eng 88)
Services: Repair, Warehouse

LEBAN, A. D., 218 Lloyd La., (215) 642-9047.
Factories: Loral Dist. Products; RMS Elctrn.; Sonora Corp. of America; Tube Mfg. Corp.
Selling To: ★ D. **Salesman:** 1

LIENAU ASSOCS., INC. (See Wheaton, Md.)

LEWIS, H. CO., 1801 J. F. Kennedy Blvd., (215) LO 7-2068.
Branch: 210 Red Barn Rd., Willow Grove, Pa., (215) OL 9-0704.
Factories: Audiophonics Corp.; Consolidated Wire; Duosonic Corp.; Dynavox Corp.; Fedtro, Inc.; Hamilton Hall; Irish Tape; Lance Ind.; Injectorall; N. T. T. Sales Corp.; Resisco Corp.; Saratoga Ind.; SwingoLite; Tab Books; Waber Elec.; Wald Sound; Ben Wolfe Radio.
Selling To: ★ A,D,I. **Salesmen:** 3
Services: Modified

LINZ, D. S., 238 Shelmire St., (215) 379-0734.
Factories: Barker & Williamson; Cornish Wire Co.; Hammarlund Mfg.; Hy Gain Elctrn.; Keystone Elctrn.; Kraeuter; Metra Elctrn.; Pomona Elctrn.; Semitronics; Tech Spray; Ward Prod.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)
Services: Warehouse

LUCA, R. P. & CO., INC. (See Berkeley Hghts., N. J.)

MacDONALD, S. K., INC., 1531 Spruce St., (215) KI 5-1205.
Branches: 217 Riggs Bank Bldg., 3308 14th St., N.W., Washington, D.C., (202) 265-3938; 5500 Harford Rd., Baltimore, Md., (301) 254-3380; 7805 McKnight Rd., Pittsburgh, Pa. (412) 366-2643.
Factories: Aztec Sound Corp.; Centralab; Consolidated Dist.; Eldema Corp.; Gramer-Halldorson Elctrn.; Lockheed Elctrn.; Ohmite Mfg.; Premax Prod. Co.; Shure Brothers; Simpson Elec.; H. H. Smith.
Selling To: ★ A,M,D,I. **Salesmen:** 10 (eng 6)

(See Advertisement Page 3278)

MALTA, V. S. CO., Box 4007, (215) 836-5122.
Selling To: ★ A,M,D,I. **Salesmen:** 2 (eng 2)

NAUDAIN, 1032 Suburban Sta. Bldg., (215) 564-3194.
Branches: Box 1, Lutherville-Timonium, Md., (301) 252-5378; Box 254, Lynchburg, Va., (703) 846-8044.
Factories: Chemelec Prod.; Curtis Dev. & Mfg.; Electro Switch Corp.; Grayhill, Inc.; Grayhill Moldtronics; Haveg Ind.; Industrial Timer; Jan Hardware Mfg.; Panduit Corp.; Relcoa, Specialty Connector.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)

NOLAN, J. J., 314 W. Sparks St., (215) 924-1595.
Factories: Electrical Windings; Javex Elctrn.; Mellotone Fabrics; Mohawk Wire & Cable Co.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 1)

NEWSON, C. H. & ASSOCS., INC., 627 Bethlehem Pke., (215) 248-3377.
Branches: Baltimore, Md., EN 9-3355; Washington, D.C., EN 1-3355.
Factories: Bulova Watch Co.; Circuitron, Inc.; Flight Connector; General Inst.; Kent Corp.; L. Frank Markel & Sons; Mossman-Elliott Corp.; U. S. Comp.
Selling To: ★ I. **Salesmen:** 4

O'HARA, B., 4952 Wynnefield Ave., (215) 473-3654.
Factories: A. D. C.; Acoustech; Bozak; Grado; Koss; Rek-O-Kut.
Selling To: ★ A. **Salesman:** 1

PARAGON SALES, 111 S. 22nd St., (215) 563-7060.
Factories: Amperex Elctrn.; Astatic Corp.; Bradford Comp.; Chicago Magnet Wire; Connecticut Mfg.; Miller Elec.; Universal Circuits.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

SENCOR, INC., 2222 Glendale St., (215) 342-0223.
TWX: 710-670-7570.
Branch: 131 Eileen Way, Syosset, N. Y., (212) 445-5670.
Factories: A & M Inst.; Allard Inst.; Canrad Precision Ind.; Edcliff Inst.; Keltron Corp.; Orbit Inst. Corp.; Quasar Microsys.; Stable Dynamics; Systron-Donner; Tachtronic Inst.; West Amp, Inc.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

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PHONE (215) CA 4-1833

SIMBERKOFF SALES, INC. (See So. Orange, N. J.)

SLUBIN, L., 2305 Fairmont Ave., (215) CE 6-2072.
Factories: Fenotec; Kenyon Elctrn.; Microwave Dev.; Nurad Inc.; Parametric Ind.; Trenton Transformer Inc.
Services: Warehouse
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

SPRINGEL SALES CO., 325 N. Franklin St., (215) WA 5-7831.
Factories: CalComp; Crest Prods.; Mercury Elec. Prods.; Miller Elec.
Selling To: ★ I. **Salesmen:** 2 (eng 1)
Services: Warehouse, Showrooms

STRATTON, C. H., 7720-A Stenton Ave., (215) 247-7869. **Selling To:** ★ I.
Factories: Simmons Fastener Corp.

TAYLOR, M. F. CO., INC. (See Silver Springs, Md.)

TECHNICRAFT, 7028 Ridge Ave., (215) IV 3-4700.
Factories: Barbour Stockwell Inst.; Couch Ordnance Div. ESB; Ebert Elctrn.; General Automatic; Halmar Elctrn.; Impact-O-Graph; Lake Shore Elec.; Madison Labs.; Torq Engred Prod.; Virginia Elctrn.
Services: Repair, Warehouse
Selling To: ★ M,D,I. (eng 2)

TEST EQUIP. SALES CO., 4447 N. Bodine St., (215) 329-1822.
Factories: Conrad-Missimers; Cox Inst.; Technology/Versatronics; Varo; Whittaker.
Selling To: ★ M,I. **Salesmen:** 4 (eng 1)
Services: Repair

W. C. SALES INC. (See Easton, Pa.)

WEINBERG, M., 1122 E. Clivden St., (215) 549-1122.
Factories: Bogen Comm.; Coleman Cable & Wire; Four-Jay; Midland Int'l.; O'Sullivan Ind.; Packard Bell.
Selling To: ★ A,D,I. **Salesmen:** 5 (eng 2)

Pittsburgh

APPLETON, H. CO. (See Los Angeles, Calif.)

BERG, S., INC., Box 4500, (412) 923-1911.
Factories: Barksdale Valves; Circle Seal Prod.; G. W. Dahl Co.; High Pressure Equip.; Maxon Premix Burner Co.; Norton-Aire Co.; Sprague Engrg. Corp.
Services: Warehouse
Selling To: ★ I. **Salesmen:** 3 (eng 3)

BOLLINGER & BRADFORD, Box 8088, (412) 561-2340.
Factories: Ampex Corp.; Associated Res.; Electro Prod. Labs.; Esterline-Angus Inst.; Royson Engrg.; Veeder-Root, Elctrn. Controls; Whittaker Corp.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

BRAUER, W. J. & ASSOCS., INC. (See Wickliffe, Ohio)

BUERGER CO., INC. (See Glenside, Pa.)

CARTER, McCORMIC & PEIRCE, INC. (See Farmington, Mich.)

CLARK, R. F. CO., 10517 Lindberg Ave., (412) 242-9500.
Factories: Adams & Westlake; Beau Motor Div.; Bramco Contls. Div.; Datascan; R. B. Denison; Elctrn. Corp.; Industrial Elctrn. Engrs.; Industrial Timer Corp.; Magnetics, Inc.; Robert Shaw Controls; Spectrol Elctrn.; Struthers-Dunn.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)

COVERT & NEWMAN CO., 310A, 300 Mt. Lebanon Blvd., (412) 563-0303.
Factories: Cambion; Components, Inc.; Cornell-Dubilier; CB Corp.; Electro Switch Corp.; Grayhill, Inc.; Hunter Tools; IRC, Inc.; Moldtronics, Inc.; Parker Inst.; Stancor.
Services: Direct Mail
Selling To: ★ D,I. **Salesmen:** 2

ELECTRO SALES ASSOC. (See Cleveland, Ohio)

JEFFRIES, S. A. INC. (See Narberth, Pa.)

LOWRY DIETRICH, 90 Clairton Rr., (412) 892-2992.
Branches: 316 Marion Bldg., Cleveland, Ohio, (216) 781-1855; 333 W. First St., Rm. 160, Dayton, Ohio, (513) 223-6042; 600 Michigan Bldg., Detroit, Mich., (313) 961-4540.
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)
Services: Warehouse

MATES, H., 5508 Hobart St., (412) 421-8998.
Factories: American Phono-Ton; BEC; CBC Ind.; Chemtronics; Dictation Prod.; Telephone Dynamics; United Elctrn.; Vevitas Elctrn.
Selling To: ★ A,D.

MacDONALD, S. K., INC. (See Philadelphia, Pa.)

NACE, A. CO., INC. (See Brecksville, Ohio)

NATALINO, A. ASSOCS. (See Akron, Ohio)

OLSEN, J. O. CO. (See Cleveland, Ohio)

PODOLNY, J. H., 5912 Penn Ave., (412) 441-0800.
Factories: Commercial Plastics; Drake Mfg.; Multicore Sales; Mura Inst.
Selling To: ★ A,D,I. **Salesmen:** 4
Services: Warehouse

PUGH, C. L. & ASSOCS., INC. (See Columbus, Ohio)

ROCKFORD CONTROLS OHIO, INC. (See Dayton, Ohio)

ROOT, G. S., 809 Wainwright Dr., (412) 561-4125.
Factories: Aerovox Corp.; Automatic Radio; Daburn Elctrn. & Cable; Hurst Motors; I.M.C.; J-B-T Inst.; Reeves Soundcraft; Risk, Geo. Ind.; Rola Mfg.; Spar Eltcrn.; Triplett Electrical Inst.; United Transformer.
Selling To: ★ A,D,I. **Salesmen:** 3

SATULLO CO. (See Royal Oak, Mich.)

SHERIDAN ASSOCS., INC. (See Cincinnati, Ohio)

SIDNELL, R. G. & CO., INC. (See Cleveland, Ohio)

SHIELDS, W. D. CO., Box 9093, (412) 471-6946.
Selling To: ★ I. **Salesmen:** 2 (eng 2)
Services: Warehouse

S. STERLING CO. (See Southfield, Mich.)

TAYLOR, M. F. CO., INC. (See Silver Springs, Md.)

TECHNITRON INSTRS., INC. (See N. Olmstead, Ohio)

WKM ASSOCS., INC., 90 Clairton Blvd., (412) 892-2953. TWX: 710-667-4858.
Factories: F. W. Bell; Beckman Inst.; Datapulse; Deltron; Dumont Electron Tube Div.; Dumont Oscilloscope Lab.; Fairchild Controls; Fairchild Electrometrics; Genisco Technology; Hallmark Stds.; North Atlantic Ind.; Princeton Applied Res.; Sangamo Elec.; Systron-Donner; Tally; Varian Aerograph; Vidar Corp.; Wavetek, Inc.
Selling To: ★ M,I. **Salesmen:** 7 (eng 7)

WHELAN CORP. (See Dayton, Ohio)

WHITESELL, R. O. & ASSOCS. (See Indianapolis, Ind.)

YARUSSI, F. P., 312 Rockfield Rd., (412) 221-4676.
Factories: Bogen; Electra; Hammarlund; Hudson Lamp Co.; Koss Elctrn.; Quam Nichols; Telefunken; Texas Crystals.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 2)
Services: Limited Warehouse

Radnor

ELECTRO-PLAST, INC., 2 Radnor Station Bldg., (215) MU 8-5581.
Factories: C/P Corp.; Economy Tooling & Insulating Prod.; Gibson Elec.; Haveg Ind.; Wiggins Plastics; Wood-Plastics.
Selling To: ★ I. **Salesmen:** 3 (eng 2)
Services: Sales & Engnr. Office

Reading

BEIL & WHITAKER, INC., 3623 Jacksonwald Ave., (215) 779-2610.
Branches: 1303 N. Troxell St., Allentown, Pa., (215) 434-5220; 5610 Akron Dr., Harrisburg, Pa., (717) 652-0184.
Factories: Acopian Technical; Alpha Wire; Amperex Elctrn.; Clarostat Mfg.; JFD Elctrn.; Littelfuse; Potter & Brumfield Div.; Setchell-Carlson.
Selling To: ★ M,D,I. **Salesmen:** 5
Services: Warehouse

(See Advertisement This Page)

Richboro

GAWLER-KNOOP CO., (See Roseland, N.J.)

Ruffsdale

AERTRONIC ASSOC., INC. (See Dayton, Ohio)

Sellersville

M. & S. ASSOCS., INC. (See Haddonfield, N.J.)

Southampton

AEROL ASSOCS., INC. (See Jericho, N.Y.)
WILD, J. J. INC. (See Jericho, N.Y.)

Springfield

BROTHERS & CONNENN ASSOC. (See Baltimore, Md.)

Valley Forge

CUESTA, J. E., (215) 265-5800. TWX: 510-660-1484.
Branch: 8501 Glendale Rd., Greenbelt, Md., (301) 552-1200.
Factories: Arvin Frequency Devices; Bytrex, Inc.; Columbia Res. Lab.; Computer Ind.; Conic Corp.; Datacraft; Digital Logic; Ferranti Elec.; EMCOR Div.; Kooltronic Fan; Lear Seigler; Ling Elctrn.; Mid-Eastern Elctrn.; Redcor Corp.; RCA Magnetic Prod.; Sangamo Elec.; Sparton Southwest; Spectral Dynamics; Test Equip. Corp.
Selling To: ★ M,I. **Salesmen:** 9 (eng 8)
Services: Repair, Warehouse

Waterford

WHELAN CORP. (See Dayton, Ohio)

Wayne

EMLEN-PETERSON, 34 West Ave., (215) 687-3535.
Factories: Diamond Elctrn. Div.; Electron Technology; General Computers; L.A. Miniature Prod.; Magnuson Engrs.; Remex Elctrn. Div.; RO Assoc.; Shelly Assoc.
Selling To: ★ M,I. **Salesmen: 2**

Willow Grove

CERF, A. & CO. (See Caldwell, N.J.)

ESTERSOHN, 541 Davisville Rd., (215) 657-1414.
Factories: Jerrold Elctrn.; Mura Corp.; Superscope, Inc.; Temple Sound; United Audio.
Selling To: ★ A,D. **Salesmen:** 7
Services: Direct Mail

LEWIS, H. CO. (See Philadelphia, Pa.)

Wyncote

COOPER CLEMENT ASSOC., 835 Glenside Ave., (215) 548-5450.
Factories: Electro Assemblies; Grigsby Barton; Scot Inc.; Worcester Pressed Aluminum.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)

Wynnewood

APPLETON, H. CO. (See Los Angeles, Calif.)

FAIRBANKS, H. J. CO., Box 124, (215) 642-5816.
Factories: Accurate Elctrn.; Avon Gear & Eng.; GM Nameplate Inc.; HJ Elctrn. Seal; JB Elctrn. Transformers; Nassau Corp.; National Wire & Cable; Pioneer Corp.
Selling To: ★ M,I. **Salesman:** 1

GRAHAM, W. ASSOC., 610 Latham Dr., (215) 649-3027/9822.
Factories: Adler Mfg. Co.; Mercury Record Corp.; N.A. Philips Co.; Sansui Elctrn.
Selling To: ★ A,D. **Salesmen:** 2

York

MILLER & DIETZ CO. (See Cinnaminson, N.J.)

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ADAMS-McGREGOR, 66 Lakeview Rd., (401) 726-1300.
Branches: Box 353, Wallingford, Conn., (203) 269-5816; 46 Pearl St., Quincy Mass., (617) 472-7550.
Factories: Datak Corp.; Essex Engrg.; Galaxy Elctrn.; Int'l. Prod.; J-B-T Inst.; Mosley Elctrn.; Shurite Meters; Triplett Elctrl. Inst.; Tri-Ex Tower; Waber Elctrn.; Wall Mfg.
Selling To: ★ D,I. **Salesmen** 3

SOUTH CAROLINA

Aiken

MOORE, E. A. ASSOCS., Box 871, (803) 648-4100.
Branch: Box 672, Ocala, Fla.
Factories: Dynage Inc.; Int'l. Steel; Microwave Assocs.; Trump-Ross Ind.; Controls.
Selling To: ★ M,I. **Salesman** 1 (eng 1)

Greenville

NORMAN, H. C. SALES CO., Box 5185, Sta. B, (803) 244-6254.
Factories: Datak; EICO; Keystone Elctrn.; Minneapolis Speaker; Soundolier, Inc.; Superex Elctrn.
Selling To: ★ A,D. **Salesman:** 1

Greenwood

FAUSETT, F. & CO., INC. (See Smyrna, Ga.)

Spartanburg

TECHNICAL ASSOCS., INC. (See Orlando, Fla.)

TENNESSEE

Chattanooga

JOHNSON, J. P. CO., Box 8162, 3535 Dell Trail, (615) 624-4128.
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

Jackson

SURRATT, S. MFGRS., SALES AGENCY, 231 Cedar St., (901) 422-3623 **Services:** Warehouse
Selling To: ★ A,D. **Salesmen:** 7

Knoxville

ADAMS & ASSOCS., INC. (See Greensboro, N. C.)

Memphis

CARTWRIGHT & BEAN, INC., 560 S. Cooper St., (901) 276-4442.
Branches: Box 5266, Huntsville, Ala., (205) 852-7670; 20100 N.E. 25th Ct., N. Miami Beach, Fla., (305) 945-2962; 601 N. Fern Creek Ave., Orlando, Fla., (305) 425-8284; 779 John Anderson Dr., Ormond Beach, Fla., (904) 677-3480; 3223 Cain's Hill Pl., N.W., Atlanta, Ga., (404) 237-2273; Box 7336, Metairie, La., (504) 887-5225; 625 Harwyn Dr., Charlotte, N. C., (704) 537-7965; 1016 Belfast Dr., Raleigh, N. C., (919) 832-7128.
Factories: Bud Radio; Centralab Elctrn.; Chicago Miniature Lamp Works; Dialight Corp.; Mueller Electric; Ohmite Mfg.; Phalo Corp.; Potter & Brumfield; Radio-Electronic Master; Simpson Elec.; Switchcraft; TRW Elctrn.
Selling To: ★ A,M,D,I. **Salesmen:** 14
Services: Warehouse

CONTROL EQUIPT. CO., INC. (See Atlanta, Ga.)

ENGELMAN, A. CO., Box 12091, (901) 458-6263.
Selling To: ★ A,D,I. **Salesman:** 1 (eng 1)

TEXPORT CO. (See Dallas, Texas)

WALLACE, S. K. ASSOC., INC. (See Lutz, Fla.)

Nashville

MITSCHER, R. W. CO., INC. (See Buffalo, N.Y.)

TEXAS

Addison

CAMPION SALES CO., Box 396, (214) 239-9196.
Selling To: ★ A,D,I. **Salesmen:** 2

ELLIOTT, L. CO., INC. (See Missouri City, Texas)

Arlington

PAN-TECH ENGRG. CO. (See Houston, Texas)

Austin

IBL ENGRG. & SALES (See Dallas, Texas)

Bellaire

AYMOND CO., INC. (See Dallas, Texas)

MARTIN, R. ASSOCS., INC., Box 1002, (713) 468-3877. TWX: 910-881-3630.
Branch: 2626 W. Mockingbird La., Dallas, Texas, (214) 358-3704.
Factories: ACDC Elctrn.; Chassis Trak/Vent Rak, Inc.; Hallmark Stds.; Krohn-Hite; Medistor Inst.; RdF, RdF-West; Signal Analysis Ind.; Spellman; Stoddart Electro Sys.; Texas Inst.; Topaz; Transducers. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

McKINNEY, J. F. SALES CO. (See Dallas, Texas)

Corpus Christi

SOMNER, W. L. CO., INC. (See Shreveport, La.)

Dallas

AIREP ELCTRN., 6300 N. Central, (214) 363-5291.
Branches: 4901 Richmond Ave., Houston, Tex., (713) 621-0955; 6936 San Pedro, San Antonio, Tex., (512) 828-1488.
Factories: Aertech Ind.; Boonton Elctrn.; Chronetics; Dytronics; Fairchild Instr.; Holt Instr.; Hughes/Torrance; Jerrold; Kepco; Kruse-Storke; Pacific Measurements; P E K.
Selling To: ★ M,I. **Salesmen:** 5 (eng 4)
Services: Repair, Direct Mail, Company Airplane

ALLIED COMPONENTS, INC., 10464 E. Northwest Hwy., (214) 348-6660. TWX: 910-861-4925.
Branch: Ste. 288-6400 Westpark Dr., Houston, Texas, (713) 782-5406. TWX: 910-881-3741.
Factories: Bourns; Chemical Micro Milling; Digitran; Elec-Trol; Electronic Specialty; Filtron; Gulton Ind.; Hamlin; Ind. Gen.; Joy Mfg.; Magnetic Metals; Moog Inc.; Olympic Prod.; Penntube Plastics; Vactec; Viking Ind.
Selling To: ★ M,D. **Salesmen:** 8 (eng 4)

(See Advertisement This Page)

ANTLE-SMITH SALES, Box 20361, (214) 357-7279
Selling To: ★ A, D. **Salesmen:** 2 (eng 1)

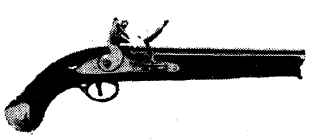
APPLIED SCIENCE, 3707 Rawlins, (214) 526-8316.
Branch: 7966 E. 41st St., Tulsa, Okla., (918) NA 7-6199; 6218 Westheimer, Houston, Texas, (713) 781-1441.
Factories: Ampex; Century; Film Microelectrn.; General Precision Sys.; Honeywell; Integrated Circuit Instr.; Monsanto Elctrn.; Philbrick/Nexus Res.; Power Designs; Preston Scientific; Sigma Sys. **Services:** Repair, Warehouse
Selling To: ★ M,I. **Salesmen:** 6 (eng 6)

AYMOND, 4340 No. Central Expy., (214) 827-8043.
Branch: Box 1064, Bellaire, Texas, (713) 666-1804.
Factories: Babcock Relay Div.; Dale Elctrn.; Equipto Elctrn.; Globe Ind.; Janco Corp.; Microdot; Potter; G. T. Schjeldahl.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 2)

BENSON ENGRG. CO., 9884 Monroe Dr. (214) FL 2-7541
Branches: 519 S. Broadway, Wichita, Kans., (316) 262-6971; 6900 W. 80th St., Shawnee Mission, Kans., (913) 648-2843.
Factories: Bound Brook Bearing; CEM Co., Inc.; Delta Spring Co.; Dixon Corp.; Marlin Rockwell Div.; Roller Bearing Co.; W-L Molding Co.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 6)

BERTHOLD SALES, 4411 Maple Ave., (214) 526-8329.
Factories: Fanon Elctrn. Ind.; Federated Ind.; Gavin Instr.; Loral; Luxo Lamp; N T T Sales; Perma-Power Co.; Tenatronics Ltd.
Selling To: ★ A,D. **Salesmen:** 4
Services: Warehouse

BRYER-ASSOCS., Box 35841, (214) 351-4350.
Factories: Dean Brothers Pumps; Grayloc; Hankison Corp.; In-Val-Co; Sundstrand-Denver Corp.
Selling To: ★ M,I. **Salesman:** 1 (eng 1)
Services: Direct Mail



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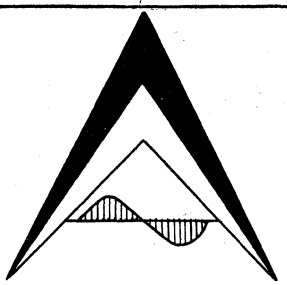

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CAIN & CO. (See Encino, Calif.)

COMMERCIAL PLASTICS & SUPPLY CORP., 2200 Vantage, (214) 631-8170.
Factories: General Electric; Rohm & Haas.
Selling To: ★ D. **Salesmen:** 3
Services: Warehouse

COMPAR SOUTHWEST, 8609 N.W. Plaza Dr., (214) 363-1526. TWX: 910-861-4249.
Branch: 5757 Bellaire Blvd., Houston, Texas, (713) 667-3420.
Factories: Denes Co.; Eagle Signal; Electro Materials; ETC, Inc.; Fairchild Contls.; Filtors; Hathaway Instr.; Hecon Corp.; Kollsman Motor; Paktron; Raytheon; RO Assocs.; Signetics; Solid State Prod.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

COSTELLO, LITTLE & CO. (See Los Angeles, Calif.)

CROCKETT ENGRG. CO., Box 47287, (214) ME 7-6120.
Factories: Affiliated Mfgrs.; Axion Corp.; Beckman Inst.; Birtcher Corp.; Coherent Radiation Labs.; Eldorado Elctrn.; Field Emission Corp.; Micro Inst.; Philips Elctrn. Inst.; Watkins-Johnson Co.; Wells Elctrn. **Services:** Repair, Warehouse
Selling To: ★ I. **Salesmen:** 3 (eng 3)

(See Advertisement Page 3281)

CROCKETT SALES CO., 2204 Griffin, (214) 748-8209.
Factories: Electro Voice; Jersey Specialty; Raytheon; Terina Corp. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 4

D. & O. ENGRG. CO., INC. (See Wichita, Kansas)

DAHLIN ASSOCS., Box 2375, (214) 521-2939.
Factories: Elco Tool & Screw Corp.; Ill. Precise Casting Co.; Lewis Spring & Mfg.; National Rivet & Mfg.; Pollak Corp.; Prestolite Wire & Cable; Wellman Dynamics.
Selling To: ★ I. **Salesmen:** 3 (eng 1)

DANNEMILLER-SMITH, INC., Box 20956, (214) 357-8247. TWX: 910-861-4534.
Branch: 5760 Rice Ave., Houston, Tex., (713) 668-4461. TWX: 910-881-2710.
Factories: Alford Mfg.; Cabtron Corp.; CipherData; Fairchild Contls. Div.; Intronics; Ira Sys.; Neff Inst.; PPM, Inc.; Reaction Inst.; Tally Corp.; Texscan; Trygon Elctrn.; Trymetrics; Ultronic Sys.; Varian Assocs.; Vermont Res.
Selling To: ★ M,I. **Salesmen:** 5 (eng 5)
Services: Repair

GLIDDEN ENGRG. & EQUIP. CO., 8609 Northwest Plaza Dr., (214) 363-6539
Branch: 7728 Longpoint Rd., Houston, Texas, (713) 681-1415.
Fartories: Amprobe Inst.; Chicago Dynamic Ind.; Electro Mech Comp.; E N M Co.; Fifth Dimension; Heinemann Elec.; Kin Line Inc.; Meson Eltcrn.; Monitor Controller; Liberty Contls.; Sanford Miller; Transformer Engrs.; Transtector Sys.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)

GREEN, J. A. CO., 7118 Envoy Ct., (214) 631-7450.
Branches: 3400 Montrose Blvd., Houston, Texas, (713) 526-2959. Box 3209, Tulsa, Okla., (918) 742-4657.
Factories: ADC Prod.; Borg-Warner Thermoelectric; Clark Crystal Corp.; Emcor; Gavitt Wire and Cable; Greenray Ind.; Hughes Aircraft; Kilovolt; McLean Engrg. Lab.; Metric Engrg; Oven Ind.; Servo Corp.; Spencer-Kennedy Lab.; Stevens-Arnold. **Services:** Repair, Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 4 (eng 4)

GUENTHER, J. B. INC., 4533 N. Central Expwy., (214) 528-6286.
Branch: Box 55525, Houston, Texas, (713) 468-0232.
Factories: Alco Elctrn. Prod.; Augat, Inc.; Cimastra Div.; Consolidated Wire; Fusite Corp.; C. T. Gamble Ind.; Hurst Mfg.; Int'l. Inst.; M H & W Int'l.; Potter & Brumfield; Planet Mfg.; Sarkes Tarzian; Signalite.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 1)

(See Advertisement This Page)

IBL ENGRG & SALES, 219 Preston Royal, Ste. 6, (214) 363-2921.
Branches: 3403 Audubon #4, Houston, Texas, (713) JA 3-8360; 1903 W. 34th Street, Austin, Texas, (512) GL 2-2064; 1472 Calhoun St., New Orleans, La., (504) 895-4793; 5149 E. 31st St., Tulsa, Okla., (918) WE 6-6305; 6630 Dearborn Dr. Shawnee Mission, Kans., (913) 292-1374; 429 Buena Ventura Pl., N.E., Albuquerque, N.M., (505) AX 8-2575.
Factories: Bielski Memory Sys.; Computer Devices; Digitronics; Greibach Inst.; Liberty Ind.; Phoenix Data; Research Inst.; Uthe Technology; Wagner Digital.
Selling To: ★ M,I. **Salesmen:** 11 (eng 11)

KSE, INC., Box 35184, (214) 352-8431.
Factories: Co-Tronics; Crystal-X; Electro-Flex Heat; Fabrico Mfg.; Fabrite Metals; Fo-Mac Enterprises; General Plastics; Mafab, Inc.; Morrell Corp.; Moxness Prod.; Navan Prod.; Porth Plastics; Precise of Calif.; Seal Bag Co.; D. M. Steward Mfg.; Wilshire Foam Prod.; Wylie & Green Co. **Services:** R&D
Selling To: ★ A,M,I. **Salesmen:** 2 (eng 1)

KANTENBERGER CO. (See Houston, Texas)

KEMP ENGRG., 2618 Manana Dr., (214) FL 7-6663.

Branches: 6001 Gulf Frwy., Ste. C101, Houston, Texas, (713) 928-5426; 10702 Manchester Rd., St. Louis, Mo., (314) 968-0300; 4306 Governors Dr., Ste. N, Huntsville, Ala., (205) 837-4304.
Factories: Aerometrics; Alcor, Inc.; Astrosystems, Inc.; B & F Inst.; Borg-Warner Contls. Co.: Bytrex; Cahoga Elctrn.; Dynisco Div.; Edcliff Inst.; Flow Technology; General Resistance; Hughes Aircraft; Isofilm Int'l.; Metrophysics; Pioneer Magnetics; Rustrak Inst.; SEMCO, Inc.; Systron-Donner; Techni-Rite Elctrn.; Teledyne Telemetry Co.; Weston-Archbald; Weston Inst.; Weston Newark.
Selling To: ★ M,D,I. **Salesmen:** 10 (eng 10)
Services: Warehouse

KLICPERA, M. F. (See Houston, Texas)

KOCH ENGRG. & SALES CO., 309 Meadows Bldg. (214) 369-5136.
Factories: ACI Inc.; Arthur Ansley Mfg.; Bristol Motors; Digital Sensors, Inc.; Columbia Technical Corp.; General Ind.; Marvel Elec.; Orbit Inst.; Thermatics, Inc. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

LUND & CO., Box 35566, (214) 358-4335.
Branch: 3827 Richmond Ave., Houston, Texas, (713) 665-3440. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 5

MARTIN, R. ASSOCS., INC. (See Bellaire, Texas)

MAYNARD SALES CO., 158 Express, (214) 742-2384.
Factories: Antenna Specialists; JBL Int'l.; JFD Elctrn.; Koss Elctrn.; J. W. Miller; Mellotone, Inc.; Oxford Transducer Co.; Phalo Corp.; Robins Ind.; Terado Corp. **Services:** Warehouse
Selling To: ★ A,D,I. **Salesmen:** 4

McKINNEY, J. F. SALES CO., 1303 Chemical, (214) 631-9450. TWX: 910-861-4232.
Branch: Box 1026, Bellaire, Texas, (713) 665-3653; Box 3958, Tulsa, Okla, (918) 622-2967; 2012 Condon Ave., Metairie, La., (504) 887-1723.
Selling To: ★ A,M,D,I. **Salesmen:** 10 (eng 10)
Services: Warehouse

MICHAEL, C. INC. (See Glendale, Calif.)

MUREEN, R. W. CO., 5523 Dyer St., (214) 369-7561.
Branch: Box 7205, Houston, Texas, (713) 861-1277. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 3 (eng 2)

NESBITT, R. E., 2930 Merrell Rd., (214) FL 7-4601.
Branch: 4208 Mt. Vernon, Houston, Texas, (713) 528-3811.
Factories: Centralab; C. P. Clare & Co.; Chester Cable Corp.; Clare-Pendar, Inc.; Cramer Div.; Daven Div.; E. F. Johnson Co.; Eldema Corp.; Sangamo Elec.; Sola Elec.; Stancor; Technical Devices. **Services:** Warehouse
Selling To: ★ M,D,I. **Salesmen:** 6

NORVELL ASSOCS., INC., 10210 Monroe Dr., (214) 357-6451. TWX: 910-861-4512.
Branch: 6440 Hillcroft Ave., Houston, Texas, (713) 774-2568. TWX: 910-881-2560.
Factories: Burr-Brown Res.; California Microwave; Helipot Div.; Industrial Elctrn. Engrs.; Int'l. Scientific Ltd.; Powercube Corp.; Superior Circuits Div.; Torotel; Trio Labs.; Vitramon.
Selling To: ★ M. **Salesmen:** 6 (eng 6)
Services: Warehouse

PACKARD ASSOCS., INC., Box 20825, (214) 357-5713.
Factories: Beede Elec. Inst.; Berkshire Elec. Cable; Connolly & Co.; Hiram Jones Elctrn.; Peerless Elec. Prod.; Plastic Capacitors; Tingstol.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)
Services: Warehouse

PECK, G. V. CO., 210 Casa Linda Plaza, (214) DA 8-3511. TWX: 910-861-4148.
Branches: Box 8087, New Orleans, La., (504) 282-1553; Box 15671, Tulsa, Okla., (918) 585-5853; 5757 Bellaire Blvd., Houston, Texas, (713) 664-1435. TWX: 910-881-5534.

(See Advertisement This Page)

RIDER, W. N. CO., 6211 Denton, (214) 357-2246.
Factories: Delron Fastener Div.; Humphrey Inc.; Laminated Shim Co.; Yardney Elec. Corp.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

ROBERTSON, E. B. INC., 1339 Plowman Ave., (214) 942-8486. TWX: 910-861-4357.
Branch: 4101 San Jacinto, Houston, Texas, (713) 329-3797.
Factories: Applied Engrg. Prod.; Bentley Harris Mfg.; Burndy Corp.; Ceramaseal Inc.; Giannini Voltex; Icore Electro-Plastics; Modutec Inc.; Stanford Applied Engr.; Sunbank Elctrn.; S. S. White Co. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 3 (eng 2)

SCHOONMAKER, J. Y., Box 20840, (214) 357-8481.
Branches: Box 247, Magnolia, Ark., (501) CE 4-3778; Box 5299, San Antonio, Texas, (512) DI 2-0251; Box 26036, Houston, Texas, (713) 926-9510.
Factories: A. C. S. Ind.; Associated Res.; Birnbach Radio; Chemelec Prod.; Clarostat Mfg.; Cornell-Dubilier Elctrn.; Electro-Craft Corp.; GPS Inst.; Magnecord/Viking; Pamotor Inc.; M. H. Rhodes, Inc.; Simpson Elec.; Telex Acoustics Prods.; United Transformer.
Selling To: ★ A,M,D,I. **Salesmen:** 6 (eng 1)
Services: Warehouse

SMITH, J. E., 1353 Chemical, (214) 631-1727.
Branch: Box 20487, Houston, Texas, (713) 667-6900.
Factories: Cleveland Elctrn.; Columbus Elec.; Daburn Elctrn. & Cable; Eastern Reproduction; Laminaire Corp.; McCormick Automatics; Nuclear

John B. Guenther, Inc.

Manufacturers' Representative

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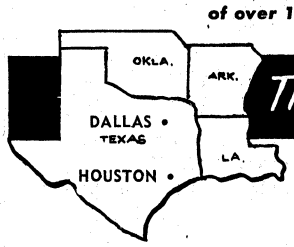

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Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 1)

SOUTHWEST ELCTRN. IND., INC., 621 Meadows Bldg., (214) EM 3-1671.
Branches: 2015 S. Lakewood, Tulsa, Okla., (918) TE 5-2481; 1405 S. Post Oak Rd., Houston, Texas, (713) 621-3760. **Services:** Mail
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 1)

(See Advertisement This Page)

SOUTHWESTERN CONTROLS (See Houston, Texas)

SPACE AGE SALES CO., Box 35625, (214) 357-5714.
Factories: Ionetics Corp.; Mandex Mfg.; Transcon.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

SPACETRONICS, 4515 Prentice St., (214) 368-1215.
Factories: Allen Avionics; Americon Corp.; Applied Microwave Lab.; E & M Labs.; EMF Sys. Inc.; Epsco, Inc.; Olektron Corp.; RLC Elctrn.; Waveline. **Services:** Warehouse, Direct Mail
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

SPEAIRS, M. CO. (See Ft. Worth, Texas)

SYKES, V. J. ASSOCS., INC., 13333 N. Central Expwy., (214) 235-5289.
Factories: Airmaster Div.; Alpha Comp.; Castall Res. Lab.; Chomerics, Inc.; Ericsson Centrum, Inc.; Gould Marathon Battery Co.; Intra-Connections; Locus, Inc.; Masterite Ind.; Mauratron, Inc.; Microdot Magnetics; Monroe Elctrn.; Singer Co.; Tobe Deutschmann Labs.; Voltron Prods.; Wood Elec.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

TEAMWORK, INC., 2646 Andjon Dr., (214) 352-7747.
Factories: American Coldset; Automark; Blackstone Ultrasonics; BTU Engrg.; Dynatech; Ewald Inst.; Precision Sys.; Rejafix Marking; Sippican.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)
Services: Repair, Warehouse

TECHNO, 2324 Shorecrest Dr., (214) 357-9213.
Selling To: ★ M,D,I. **Salesmen:** 5 (eng 4)
Services: Warehouse, Direct Mail

TEXAS AVIONICS, 4515 Prentice St.. (214) 368-3566.
Factories: Applied Res.; EMC Technology; FAM Engrg.; B. F. Goodrich Sponge Prod.; Sage Labs.; Sanders Assoc.; Telonic Engrg.; Telonic Inst.; Vari-L Co.; Vishay Resistor Prod.
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)
Services: Repair

TEXPORT CO., 2411 Farrington, (214) 631-6270.
Branches: 8811 Gaylord, Houston, Texas, (713) 464-2828; 5118 Park Ave., Memphis, Tenn., (901) 683-0880; 1766 Bellrose, Baton Rouge, La., (504) 927-0414.
Factories: Alpha Wire; Amelco; Axel; Cedar Engrg.; Electronic Mold; Hill Magnetics; Int'l. Rectifier; James Elctrn.; Kelvin; Maurey Inst.; Monitor Prod.; Sloan. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 9 (eng 1)

THORSON CO. (See Los Angeles, Calif.)

TECH-SER, INC. (See Burbank, Calif.)

TITAN REPS, 6434 Maple Bldg., (214) 357-8266.
Factories: Firing Circuits, Inc.; Furnas Elec.; ITT Jennings; Nothelfer Windings Labs; PMF Elec.; Power Semiconductors; Tansitor Elctrn.; UOP Norplex; Voltron Prod.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)

VIDAL ELCTRN. CO., 3403 High Bluff Dr., (214) 241-4491.
Factories: Advanced Microwave Labs; Narda Microwave Corp.; Polarad Elctrn. Inst.; RFD, Inc.; Rohde & Schwarz Sales Co.; SAKI Magnetics, Inc.; Specific Products; TRG Div.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 3)
Services: Warehouse, Direct Mail

WEINREICH, G. & ASSOCS., 11554 E. Northwest Hwy., (214) 321-2800.
Factories: Aladdin Elctrn.; American Elctrn. Labs; Amacoil Machinery Co.; Baker Inst., Inc.; Bruce Ind.; Clare-Electroseal; CP Elctrn.; Die-Mate Corp.; Edal Ind.; Electric Soldering Iron; Elctrn. Res. Assocs.; Film Capacitors; Lundell Controls; Multi-Flex Seals; Pickering & Co.; Rayonic Corp.; Tricon Brazing Alloys.
Selling To: ★ I. **Salesmen:** 2 (eng 1)
Services: Warehouse, Company Airplane

WILKS, E. L. CO., Box 34466, (214) 242-5321.
Factories: Argos Prod.; Conant; Hudson Lamp; Johnson-aire SCA; Kaar Elctrn.; Premax; Quam-Nichols; Superior Insulated Wire; Turner; Unimetrics; United Ind.; Waber Elctrn.; Ward Prod.
Selling To: ★ A,D,I. **Salesmen:** 3 (eng 1)
Services: Warehouse

WYBORNY SALES CO., Box 17070, (214) 381-4645.
Factories: Belar Elctrn.; Bell PA Prod.; Fourjay Ind.; Kenwood Elctrn.; Panasonic UTR/CCTV.
Selling To: ★ A,I. **Salesmen:** 3 (eng 2)
Services: Warehouse, Engineering

YOUNT, J. C. CO., Box 17270, (214) 391-4125.
Factories: Electro-Voice; Forbes and Wagner; Hudson Lamp Co.; J. Millen Mfg.; Lowell Mfg.; Solar Textiles Co.; UID Elctrn.
Selling To: ★ I. **Salesmen:** 2
Services: Warehouse, Direct Mail

Denton

C & L SALES CO.. Box 159, (817) 387-8000.
Selling To: ★ A,D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

El Paso

BISHOP ENTERPRISES, INC. (See Aurora, Colo.)

KELLEY ENTERPRISES (See Loveland, Colo.)

STEPCO, INC., Box 9836, (915) 772-5274.
Factories: American Meter Co.; ASCO; ATC; Magnetrol, Inc.; Melotron Corp.; Moore, S. & Co.; RFL Ind.; Schuttle & Koerting Co.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)

Euless

BFA (See Denver, Colo.)

Fort Worth

APPLETON, H. CO. (See Los Angeles, Calif.)

CAREY-WOLF CO., Box 12425, (817) PE 8-1702. TWX: 910-893-5072.
Branch: Box 60338, Houston, Texas, 77060, (713) 643-2114. TWX: 910-881-2575.
Factories: Alfred Elctrn.; API Inst.; F. W. Bell; Bryant Computer Prod.; Datacraft Corp.; Frequency Engrg. Labs.; Interstate Elctrn.; Ling Elctrn. Div.; Potter Inst.; Raytheon Computer; RMS; Semiconductor Circuits, Inc.; Scientific-Atlanta; Team Corp.; Spectral Dynamics Corp.; Tenney Engrg.; Transco Prod.; Zeltex.

ENGINEERING ASSOCS., INC., 2912 Stanley.
Factories: Dixie Wire Corp.; FASCO Ind.; Perfection Elec. Prod.; Spaulding Fibre.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

KENCAR CO., Box 6770, (814) 923-4476.
Factories: Anocut Engrg.; Automation Devices; B&W Precision Prod.; Cycle-Dyne, Inc.; Electrostatic Equip.; Quality Tool Works; Regal Div.
Selling To: ★ M,I. **Salesman:** 1
Services: Sales

SPEAIRS, M., 3881 S. Hills Cir., (817) 923-4657.
Branches: Dallas, Texas, (817) 261-0001; Houston, Texas, (713) 923-7616; San Antonio, Texas, WX 2233; New Orleans, La., WX 3161.
Factories: Coleman Engrg.; DASA Corp.; Dytro Corp.; Electrac, Inc.; Elgenco; Fairchild Contls.; Fisher-Akin; Hyperion Ind.; Infotec, Inc.; Measurement Specialties Lab.; Midwestern Inst.; RC-95; Shielding Corp.
Selling To: ★ M,I. **Salesmen:** 2 (eng 2)

Friendswood

BFA (See Denver, Colo.)

Henderson

MILLER, E. G. INC., Box 929, (214) 657-5049.
Factories: Decker Corp.; E. F. Assocs.; Elcor, Inc.; Frequency Elctrn.; General Oceanographic; Harrel, Inc.; Idalee Elctrn.; E. A. Lindgren & Assocs.; Photobell Co.; Powertronic Equip. Ltd.; TRF, Inc.
Selling To: ★ M,D. **Salesman:** 1 (eng 1)

Houston

AIREP ELCTRNS., INC. (See Dallas, Texas)

ALLIED COMPONENTS, INC. (See Dallas, Texas)

APPLIED SCIENCE ASSOCS. (See Dallas, Texas)

ARNOLD BARNES CO. (See Richardson, Texas)

CAREY-WOLF CO. (See Ft. Worth, Texas)

COMPAR SOUTHWEST (See Dallas, Texas)

DANNEMILLER-SMITH, INC. (See Dallas, Texas)

DATA ENGRG. CORP. (See Richardson, Texas)

FRANKLIN, R. E. CO., 3007 S. Post Oak Rd., (713) 621-5861.

GLIDDEN ENGRG. & EQUIP. CO. (See Dallas, Texas)

GREEN, J. A. CO. (See Dallas, Texas)

GUENTHER, JOHN B., INC. (See Dallas, Texas)

IBL ENGRG. & SALES (See Dallas, Texas)

JD INDS., 226 Faust La., (713) HO 5-8278.
Factories: Paneline, Inc.; Pro-Tech.
Selling To: ★ I. **Salesman:** 1 (eng 1)

KANTENBERGER CO., 1900 Chamber of Commerce Bldg., (713) 223-3637.
Branch: 711 Reverchon Dr., Dallas, Texas, (214) 337-5363.
Factories: Control Data; Digital Contl. Sys. Div.; Supervisory Contl. Div.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

KEMCO, INC. (See Irving, Texas)

KEMP ENGRG. CO., INC. (See Dallas, Texas)

KLICPERA, M. F., Box 2668, (713) 747-3868.
Branches: 1201 Castle St., Dallas, Texas, (214) RI 2-2515; 1554 N. Marion St., Tulsa, Okla., (918) 9-5956.
Factories: Carter Motor Co.; Continental-Wirt Elctrn.; ETA Prods. of America; Peterson Radio; Talk A Phone Co.; Ungar Elec. Tools; Waldom Elctrn - Inc.; Wen Products Co.
Selling To: ★ M,D,I. **Salesmen:** 4
Services: Warehouse

LIEBERMAN, H. SALES, Box 66216, (713) 526-3431.
Branches: 1112 Woodland Way, Richardson, Texas, (214) 231-6698; 4912 Gregoire St., Metairie, La., (504) 888-4703.
Factories: Aerovox; American-Geloso, Inc.; Component Specialties, Inc.; Electronic Specialty Co.; Hammarlund Mfg. Co.; Hi-Tron Co.; Hickok Electrical Instr. Co.; Jontz Mfg. Co.; Judson Res.; Pilot Radio & TV Corp.; RMS Elctrn.; TAB Books; Technical Assoc. **Services:** Warehouse
Selling To: ★A,D,I. **Salesmen:** 4 (eng 1)

LUND & CO. (See Dallas, Texas)

MUREEN, R. W. CO. (See Dallas, Texas)

NESBITT, R. E. CO. (See Dallas, Texas)

NORVELL ASSOCS., INC. (See Dallas, Texas)

PAN-TECH ENGRG. CO., Box 22491, (713) 666-0248.
Branches: 600 Ave. H. East, Arlington, Texas, (817) 261-4111; 5524 Loring, Baton Rouge, La., (504) 344-2791.
Factories: Computer Inst.; Davis Inst.; Gilmore Ind.; Ohmart Corp.; Reliance Inst.; Solidstate Contls.; Transmation; Texas Inst.
Selling To: ★ M,I. **Salesmen:** 6 (eng 4)
Services: Repair, Warehouse

PECK, G. V. CO. (See Dallas, Texas)

ROBERTSON, E. B., INC. (See Dallas, Texas)

SCHOONMAKER, J. Y. CO. (See Dallas, Texas)

SMITH, J. E. CO., INC. (See Dallas, Texas)

SOMNER, W. L. CO., INC. (See Shreveport, La.)

SOUTHLAND ENGRG. & SALES INC., 5810 Schumacher La., (713) 782-4575.
Branches: 777 S. Central Exp., Richardson, Texas, (214) AD 1-2373; 6740 S. 66th East Ave., Tulsa, Okla., (918) 622-4846.
Factories: Adams & Westlake; Autotron; Deutsch Filtors; Howard Ind.; MSL Steel; Omega Elec. Div.; Sodeco; Technibilt Corp.; Tempo Inst.; Thermosen; Unimax Div.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 3)
Services: Warehouse

SOUTHWEST ELCTRNS. INDS., (See Dallas, Texas)

SOUTHWESTERN CONTROLS, Box 22351, (713) MO 6-2801.
Branches: 1804 N. Industrial Blvd., Dallas, Texas, (214) RI 2-6266; 3726 S. Peoria, Tulsa, Okla., (918) RI 2-3883.
Factories: Detroit Coils; Dillion Weighing Sys.; Fenwal; Vulcan Elec. **Services:** Warehouse
Selling To: ★ D,I. **Salesmen:** 7 (eng 5)

SPEAIRS, M. CO. (See Ft. Worth, Texas)

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Selling To: ★ A,D. **Salesmen:** 3

TEXAS SALES REPRESENTATIVES CO., 3311 Montrose Blvd., (713) 523-1675.
Factories: American Elctrn. Labs.; Auth Elec.; Channel Way Inds.; Chelsea Fan & Blower.

TEXPORT CO., (See Dallas, Texas)

THORSON CO. (See Los Angeles, Calif.)

Irving

KEMCO, INC., 2520 W. Irving Blvd., Ste. 203, (214) 637-0163.
Branches: 6440 Hillcroft, Ste. 409, Houston, Texas, (713) 771-1291; 6115 E. 13th St., Wichita, Kansas, (316) MU 4-8224; 6050 Brown Rd., Strother Bldg., Rm. 7, St. Louis, Mo., (314) 524-0820.
Factories: Data Devices; Data Prods. Sales Corp.; Dynamic Sys. Elctrn.; Information Displays; Mergenthaler Linotype; Micro-Power; Omega-T Sys.; Perspective; RFL Ind.; Watkins-Johnson.
Selling To: ★ I. **Salesmen:** 5 (eng 5)
Services: Warehouse

Missouri City

ELLIOTT, L. CO., INC., Box 428, (713) 499-1571.
Branches: 701 N. Dooley, Addison, Texas, (214) AD 9-8533; 437 Law Bldg., Kansas City, Mo., (816) VI 2-4197.
Factories: Airmatic Valve; All Plastics Molding; American Metal Forming; Continental Elec.; Doerr Elec.; Dynamatic Div.; E-I-M Co.; Eagle Signal Co.; Fansteel Metallurgical; Insul-8; Kepner Prod.; Lecor Contls.; Mini-Op; Nelson Elec.; Parr Mfg.; Rae Motor Corp.; Rotary Ram; Universal Silencer Corp.; Ward Leonard Elec.
Selling To: ★ A,M,D,I. **Salesmen:** 8 (eng 4)
Services: Warehouse

Odessa

SOMNER, W. L. CO., INC. (See Shreveport, La.)

Pampa

SOMNER, W. L. CO., INC. (See Shreveport, La.)

Richardson

AUTOMATIC GENERAL ELEC. SALES, INC. (See Kansas City, Mo.)

BARNES, A. CO., 740 S. Sherman St., (214) 235-4541. TWX: 910-867-4710.
Branches: 3230 Mercer St., Houston, Texas, (713) 622-3620. TWX: 910-881-2624; D416 Petroleum Ctr., San Antonio, Texas, (512) 828-1323.
Factories: American Microsystems; B.I.T.; Barnes Engrg.; Burroughs; Cohu; Computer Industries; Control Logic; Data Disc; Data Royal; Delta Design; Peripheral Equip.; Remex; Singer-Empire; Trompeter Elctrn.
Selling To: ★ M,I. **Salesmen:** 9 (eng 8)
Services: Repair, Warehouse

BRANUM SALES, INC., Box J, (214) 231-6148.
Factories: Avanti R & D, Inc.; California Chassis; Cush-Craft; Lectrotech; Mura Corp.; Polytronic Comm.; Rawn Co.; Specialties Mfg.; Switchcraft; Triad Transformer.
Selling To: ★ A,M,D,I. **Salesmen:** 5 (eng 1)
Services: Warehouse, Mailing

DATA ENGRG., 777 S. Central Exp., (214) 231-4846.
Branches: 2120 S. Post Oak Rd., Houston, Texas, (713) 622-2820; 4580 E. 50th St., Tulsa, Okla., (918) 622-3753; 411 E. Martin St., San Antonio, Texas, (512) 226-4342.
Factories: Beckman Inst.; Data General Corp.; Digi-Data Corp.; Houston Inst.; Information Storage; Nelson-Ross Elctrn.; Non-Linear Sys.; PRD Elctrn.; Redcor Corp.; Texas Inst.; Weston-Rotek.
Selling To: ★ M,I. **Salesmen:** 7 (eng 7)
Services: Repair, Warehouse, Training Laboratory

HAYS CO., 777 S. Central Expwy., (214) 231-1426.
Factories: Colorado Hickok; Electrovision Ind.; Kilovac; Piezoelectric Div.; Printed Motors, Inc.; Varo Time & Frequency Prod.
Selling To: ★ I. **Salesmen:** 2

HOFFMAN, C. ASSOCS., INC., 777 S. Central Exp., (214) 235-3600. TWX: 910-867-4727.
Factories: Angstrohm Precision; Barker & Williamson; Eastron Corp.; Electro/Data; Electro Impulse Lab.; Risk Ind.; Skottie Elctrn.; Valpey-Fisher; Wells Elctrn.
Selling To: ★ M,D,I. **Salesmen:** 3 (eng 2)
Services: Warehouse

LAWRENCE SALES CO., Box 1038, (214) 235-5504. TWX: 910-867-4715.
Factories: Atmar Engraving; Dynamic Gear; Precision Tube; General RF Fittings.
Selling To: ★ I. **Salesman:** 1 (eng 1)
Services: Warehouse

LIEBERMAN, H. SALES CO. (See Houston, Texas)

SCANLON, P. J. CO., INC., 724 So. Sherman St., (214) AD 1-4661. TWX: 910-867-4713.
Factories: Alpha Metals; Bendix; Coors Porcelain Co.; Delevan Elctrn.; Esna/Agastat; Electrovert; Fortin Laminating; Hexacon Elctrn.; Microwave Assoc.; Metex Elctrn.; Sigma Inst.; Statham Inst.; Weldmatic/Unitek.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 4)
Services: Repair, Warehouse

(See Advertisement This Page)

SOUTHLAND ENGRG. & SALES (See Houston, Texas)

WADSWORTH MFG. ASSOC. (See Liverpool, N.Y.)

WILLOUGHBY-FOWLER-WRIGHT, ASSOC., Box 486, (214) 235-3664.
Factories: Aberdeen Co.; Benco Television Co.; Eraser Co.; Jensen Mfg.; Pak-Tronics; Quality Prod.; S & A Elctrn.; Sigma Ind.; Telvac Inst.; Vari-Prod.
Selling To: ★ A,M,D,I. **Salesmen:** 3

San Antonio

AIREP ELCTRNS., INC. (See Dallas, Texas)

ARNOLD BARNES CO. (See Richardson, Texas)

BFA (See Denver, Colo.)

DATA ENGRG. CORP. (See Richardson, Texas)

RETZLOFF, W. R. CO., Box 1786, (512) LE 3-7839.
Factories: Kepro Circuit Sys.; Quick Mt. Mfg.; Vaco Prod. **Selling To:** ★ M,D,I.

SCHOONMAKER, J. Y. CO. (See Dallas, Texas)

SPEAIRS, M. CO. (See Ft. Worth, Texas)

UTAH

Granger

HURLBUT, J. F. CO. (See Denver, Colo.)

Salt Lake City

APPLETON, H. CO. (See Los Angeles, Calif.)

BOWEN, R. G. CO., INC. (Denver, Colo.)

ELECTR. MFGRS. CONSULTANTS, INC. (See Colorado Springs, Colo.)

ARROWHEAD SALES CORP., 1966 W. 6255 South.
Branches: 6460 Brentwood, Arvada, Colo., (303) 798-0319; Box 243, Albuquerque, N.M., (505) 268-9706.
Factories: Automatic Metal Prod.; Electronic Memories; E.S.C. Elctrn.; Fortin Laminating; Hunter Ind.; Keystone Elctrn.; Industrial Timer; Line Elec.; Midwest Circuits; Raytheon Semi; Rogan Brothers; Semtech; Staco; Tyton; Vactec.
Selling To: D,I. **Salesmen:** 4 (eng 2)

CONTROL EQUIP. CO., 265 Cross Rd. Sq., (807) 487-7741.
Factories: Alnor Inst.; Automatic Timing & Contls.; Automatic Switch; Conoflow Corp.; Eclipse Fuel Engrg.; Hankison Corp.; Hays Corp.; Magnetrol; Ohmart Corp.; Partlow Corp.; Research Controls Div.; Schutte & Koerting.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 1)
Services: Warehouse

DARGER CO., 211 S. 2nd W., (801) 355-2873.
Factories: Amprobe Inst.; Barns Air King Corp.; Cox & Co.; Polyken Tape; Swivelier; Wakefield Lighting; Zinsco Elect.
Selling To: ★ D. **Salesmen:** 2 (eng 2)

GATES, F. Y. CO., INC., 455 E. 4 S., (801) 359-1101.
Branches: 3300 S. Mill Ave., Tempe, Ariz., (602) 966-5441; 1930 S. Navajo St., Denver, Colo., (303) 761-0591; 2631 Texas, N.E., Albuquerque, N.M., (505) 298-1875.
Factories: Fairchild; Fairchild—DuMont Tube Div.; Frequency Engrg. Lab.; Hughes; McIntosh Lab.; Measurements Corp.; Medistor Inst.; Monsanto; Princeton Applied Res.; Technibilt Corp.; Triplett Electrical Inst.; Venus Scientific; Zero Mfg.
Selling To: ★ D,I. **Salesmen:** 4 (eng 4)

HYER ASSOCS., INC. (See Englewood, Colo.)

HYTRONIC MEASUREMENTS, INC. (See Denver, Colo.)

MONTGOMERY BROS., INC. (See Burlingame, Calif.)

PEARSON, M. & CO. (See Denver, Colo.)

PETERS-DE LAET, INC. (See Burlingame, Calif.)

WILLIAMS-ASSOCS., INC. (See Denver, Colo.)

VERMONT

Grafton

ROBINSON, R. H. CO. (See Coventry, Conn.)

VIRGINIA

Alexandria

BROWN, W. A. & ASSOCS., INC. (See Orlando, Fla.)

Annandale

L-C-A SALES, INC. (See Tuckahoe, N.Y.)

MOYER-JOHNSON CO. (See Haddonfield, N.J.)

Arlington

AEROL ASSOCS., INC. (See Jericho, N.Y.)

ARNOLD ASSOCS., INC. (See Cheltenham, Pa.)

DYNA REP TECHNICAL SERVICES, 5070 Lee Hghwy., (703) 536-5088.
Factories: Applied Peripheral Sys.; Communication Assocs.; Control Sys. Res.; Decca Survey Sys.; Geo Space; Hughes Aircraft; Kinelogic; Vitro Labs.
Selling To: ★ A,M,I. **Salesmen:** 3 (eng 3)

GANS-FRYLING, 2030 16th St. N., (703) 527-3262.
Factories: Bryant Computer Prod.; CML Div.; Chalco Engrg.; Computer Devices; Dranetz Engrg. Labs; Electro Dev.; Lion Res.; NH Res.; Pastoriza Elctrn.; R. O. Assocs.; Servonics; Signal Analysis Ind.; Velonex Div. **Services:** Repair
Selling To: ★ M.I. **Salesmen:** 3 (eng 2)

HEFFERNAN, H. J., 1123 N. Irving St., (703) 522-6666.
Branches: 111 Old Country Rd., Hicksville, N.Y., (516) 433-5418; Box 346, Fort Washington, Pa., (215) VE 6-4411.
Factories: Allied Sys.; Base Ten Sys.; CALMA Co.; Chrono-log; Cooke Engrg.; Data-Ram; Epsco; Inter-Computer Elctrn.; Irtronics; MONITOR Sys., Roytron; Singer; Western Magnetics.
Selling To: ★ A,M,I. **Salesmen:** 4 (eng 4)

SIMBERKOFF SALES, INC. (See So. Orange, N.J.)

WHITNEY, M. E. ASSOCS., INC., 1400 N. Uhle St., (703) 524-5642.
Factories: Concord Contl.; Filtron; Ortronix; Roanwell.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)

Fairfax

SCHIBLEY, 10604 Warwick Ave., (703) 591-3008.
Branch: #I Fellowship Rd., Cherry Hill, N.J., (609) 424-1894.
Factories: Applied Res.; Custom Materials; Eastern Microwave; Electromagnetic Radiation Lab; Electronic Components; Frequency Sources; Hylectronics Corp.; Precision Tube; Relcom; RLC Elctrn.; Zeltex. **Services:** Warehouse
Selling To: ★ M,I. **Salesmen:** 4 (eng 4)

Falls Church

JAY CO., INC., 2914 Annandale Rd., (703) 534-7800.
Factories: Addington Labs.; American Astrionics; Edal Ind.; Jasik Labs.; Jerrold Elctrn.; Lavoie Labs.; Maxwell Labs.; Microwave Prod.; Sage Labs.; Scott Inst. Labs; Solid State Scientific; United Detector Technology; Universal Voltronics; Vectron Labs.
Selling To: ★ M,D,I. **Salesmen:** 4 (eng 4)
Services: Repair, Warehouse

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MARK-LUND ASSOCS., 2828 Mary St., (703) 560-8400.
Factories: Athena Contls.; Digital Elctrn.; ETA Prod. Co.; Farris Chemicals; Gam Rad, Inc.; GAP Inst.; IB Inst.; Larson Inst.; Milletron; Redington Counters; Saki Magnetics; Scientific Columbus; Taber Inst.; Televiso Elctrn.; Testing Machines. **Services:** Repair, Warehouse
Selling To: ★ M,I. **Salesmen:** 3 (eng 3)

Lynchburg

BARNHILL & ASSOCS., INC. (See Timonium, Md.)

BURGIN-KREH ASSOCS., INC. (See Towson, Md.)

NAUDAIN ASSOCS. (See Philadelphia, Pa.)

ROYELEC ELCTRN. REP., 605 Krise Bldg., (703) 846-7117.
Factories: Ark-Les Switch; Bradford Comp.; Dahlstrom Mfg.; Insulating Fabricators; Lundey Assocs.; Molecue Wire; Rogan Bros.; Vactec, Inc.; von Weise Gear.
Selling To: ★ A,M,I. **Salesman:** 1 (eng 1)

Newport News

BROWN, W. A. & ASSOCS., INC. (See Orlando, Fla.)

Norfolk

JOBS & CO., INC. (See Richmond, Va.)

Richmond

HIGHSMITH, J. L. & CO. (See Charlotte, N.C.)

JOBE & CO., INC., 2508 Grenoble Rd., (703 282-6508.
Branches: 2857 Greenmount Ave., Baltimore, Md., (301) 235-3502; 707 Medical Towers Bldg., Norfolk, Va., (703) 625-6643; 308 Second Street, S.W., Roanoke, Va., (703) 344-4997.
Factories: R. P. Adams; Alnor Inst.; Asco; Atkomatic Valve; Automatic Timing & Controls; Buell Engrg.; A. W. Cash Co.; Childers Prod.; Conoflow Corp.; Dean Prod.; D'Este; W. C. Dillon & Co.; F. W. Dwyer Mfg.; Economy Pump Co.; Electro-Devices; A. H. Emery Co.; Fairbanks-Morse Power Sys.; Farris Engrg.; Flexible Valve; Garden City Fan & Blower; Green Fuel Economizer Co.; Kaye & MacDonald; O. C. Keckley Co.; Kelly Machine & Foundry; C. M. Kemp Mfg.; Kopperman Ind.; King Engrg.; LaFavorite Rubber Co.; Magnetrol Valve Corp.; Marsh Inst.; Marshalltown Mfg.; Maxon Premix Burner; Mercoid Corp.; Midland Ind.; Modernair; Northern Blower; Reotemp Inst.; Skinner Solenoid Valve; Weksler Inst.; Trerice Co.; Victor Contls. Div.; Worcester Valve; Yarway Corp.
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 7)

Roanoke

JOBS & CO., INC. (See Richmond, Va.)

Salem

FAUSETT, F. & CO., INC. (See Smyrna, Ga.)

Vienna

DOSS ELCTRNS., INC. (See Baltimore, Md.)

Virginia Beach

MITSCHER, R. W. CO., INC. (See Buffalo, N.Y.)

WASHINGTON

Bellevue

SCHULTZ, N. R. CO., Box 159, (206) 454-5224.
Branch: Box 156, Beaverton, Ore., (503) 646-1345.
Selling To: ★ M,I. **Salesmen:** 3 (eng 1)
Services: Warehouse

BACH P. ELECTRIC (See Portland, Ore.)

BRENNAN ASSOCS., INC., 208 Carlson Bldg., (206) 454-9332. TWX: 910-443-2319.
Factories: Aztec Elctrns.; Applied Microwave; Brown Engrg.; Digi Data; Eldorado Elctrns.; General Resistance; Mosaic Fabrication; N E J Corp.; Non Linear Sys.; Preston Scientific.
Selling To: ★ M. **Salesmen:** 2 (eng 2)
Services: Sales

COHN & SHANE, INC. (See Los Angeles, Calif.)

HARRIS, B. CO. (See Los Angeles, Calif.)

SMITH, A. CO., 405 166th S.E., (206) 746-6770.
Selling To: ★ M,I. **Salesmen:** 2 (eng 1)

Seattle

ACE ASSOCS., 137 S.W. 153rd ST., (206) CH 4-9391
Factories: All-Tronics; CCA Electrn.; Cleveland Elctrn.; Hunt Corp.; R. F. Communications; Standard Elctrn.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)

ALMAC/STROUM ELECTRN., 5811 6th Ave., S., (206) 763-2300. TWX: 910-444-2067.
Branch: 8888 S.W. Canyon Rd., Portland, Ore., (503) 292-3534. TWX: 910-464-6105.
Factories: Beckman Instr.; Clarostat Mfg.; Deltrol Controls; Dialight; Elco; Litton Ind.; RCL Elctrn.; Texas Instr.; Vaco Prod.; Zero Mfg. Co.
Selling To: ★ M,I. **Salesmen:** 8 (eng 8)
Services: Warehouse

ARVA, INC., 1320 Prospect St., (206) MA 2-0177. TWX; 910-444-2022.
Branches: 2035 S.W. 58th Ave., Portland, Ore., (503) 292-8762; Box 759, Anchorage, Alaska, (907) 272-5231.
Factories: Amco Engrg.; Atec, Inc.; Ballantine Labs.; Birtcher Corp.; California Instr.; Century Elctrn.; Cohu Elctrn.; Data Equip.; Data Royal; Daytronic; Dynisco; E-H Research Labs.; Hallmark Stds.; Incre-Data Corp.; Jerrold Elctrn.; Lockheed Elctrn.; Polarad Elctrn. Instr.; P R D Elctrn.; Precision Instr.; Raytheon Co.; Rustrak Instr.; Sierra Elctrn.; S R C Div.; Techni-Rite Elctrn.; Topaz. **Services:** Repair
Selling To: ★ M,I. **Salesmen:** 4 (eng 2)

AVIONICS LIAISON, INC., 6770 Perimeter Rd., So., (206) RO 7-3870. TWX 910-444-2013.
Factories: Analog Devices; Cedar Engrg.; Fairchild Instru.; Krohn-Hite; Princeton Applied Res.; Semiconductor Circuits; Sonex; Valor Instru.
Selling To: ★ I. **Salesmen:** 2 (eng 2)

AURICH, F. W. & CO., 3601 Gilman Ave. W. (206) 284-5561. TWX: 910-444-1333.
Branches: 861 West San Bruno, San Bruno, Calif., (415) 588-1599. TWX: 910-444-1333; 3601 Gliman W., Seattle, Wash., (206) 284-5561; 7816 N. Interstate, Portland, Ore., (503) 222-1754.
Factories: ADT; Air World Mfg.; Amalco; Auburn Mfg.; Barker Prod.; Bliss-Gamewell; Briscoe Mfg.; Bronson Hinge; Component Mfg. Service; Crane Plastics; Eberhard Mfg.; Electronic Applications; Electric Terminal; Flexible Circuits; Floy Tag & Mfg.; Globe Plastics; Greenfield Components; Groov Pin; J/B Elctrn.; Latronics; National Rivet & Mfg.; Precision Shapes; Prestol; Process Gear; Richco Plastic; Milton Ross; Seastrom Mfg.; Soc-Pro; Southco; W. Ga. Mills; Widder.
Selling To: ★ M,D,I. **Salesmen:** 7 (eng 3)
Services: Warehouse

BACKER, J. J. CO., 221 W. Galer, (206) AT 3-6470. TWX: 910-444-1646; **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 7 (eng 2)

BRANOM INSTR. CO., 2137 Second Ave., (206) 622-7320. TWX: 206-032-333.
Branch: 6019 N.E. Union, Portland, Ore., (503) 285-5205. TWX: 503-036-713.
Factories: Brooks Instr.; Conoflow Corp.; Eagle Signal; Ebert Electrn.; Hallikainen Inst.; Hays Corp.; Ideal Aerosmith; Jamesbury Corp.; King Engrg.; King Nutronics; Liquidometer; Marsh Instr.; Mercoid Corp.; Rochester Inst.; Seegers Inst.; Taylor Inst.; West Inst.; Weston Inst. Yarway Corp. **Services:** Repair
Selling To: ★ M,D,I. **Salesmen:** 13 (eng 7)

CAMPBELL, H. D., 3827 Stone Way N., (206) 643-1200.
Factories: R. B. Denison Mfg.; Hart-Advance Relay Div.; Marathon Special Prod.; Marco-Oak Mfg.; McGraw-Edison; Mackworth G. Rees div.; Oak Mfg. Co.; Stahlin Bros, Inc.; Switchmaster.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

CASCADE CHAPTER OR ELECTR. REP., 4206 Rainier Ave., S., (206) 723-5150.

CHAMPLIN, D. CO., INC.,, 12347 Lake City Way N.E., (206) EM 2-0401.
Factories: Audio Originals; Barker Prod.; Benjamin Elctrn. Sound; Delwyn Dynaco JBL Int'l.; J. B. Lansing Sound; Mellotone; Stanton Magnetics; Sunn Musical Equip.
Selling To: ★ A,D,I. **Salesmen:** 2
Services: Warehouse

COMPTRONICS, 3220 16th Ave. W., (206) AT 4-4842. TWX: 910-444-1638.
Factories: API Instr.; Accuride; Astrodata; Computer Logic; L. R. Graham & Co.; Holt Instr. Labs.; Marine Advisers; Molecu-Wire; Philips Elctrn. Instr.; Shepard Labs.; Spar Elctrn.; Vamistor Corp.; Voltronics.
Selling To: ★M,I. **Salesman:** 1 (eng 1)
Services: Repair

DEWAR, 6361 First Ave. S., (206) 763-2233.
Factories: Airborne Inst. Lab.; Anadex Inst.; Baird Atomic; CEA; Clark Crystal Corp.; Colburn Corp.; Dalmo; Douglas Microwave; Dytro Corp.; EG&G; Elgar Corp.; General Atronics: Greenray Ind.; Inst. for Ind.; Kilovolt; Metric Engrg.; Optimax Corp.; Oven Ind.; Radiometer Inst.; RFL Ind.; Redford Corp.; Texscan; White Electromagnetics.
Selling To: ★ M,I. **Salesmen:** 2

DRAKE, R. S., INC., 6133 Maynard Ave. S., (206) 763-2755. TWX: 910-444-2030.
Selling To: ★ I. **Salesmen:** 4 (eng 4)

EARL & BROWN, 422 First Ave. W., (206) 284-1121. Branch: 2041 S.W. 58th, Portland, Ore., (503) 292-9145.
Factories: Alco Elctrn.; Antenna Specialists; Bud Radio; Harmon Kardon; Jerrold Elctrn.; P. R. Mallory; J. W. Miller; Nortronics; Phale Corp.; Regency Elctrn.; H. H. Smith Inc.; Stancor Elctrn.; RBM; RMC; Setchell Carlson; Simpson Elec.; University Sound.
Selling To: ★ A,D,I. **Salesmen:** 5 (eng 2)

EICHER-RICHARDS CO., 2727 N.E. Blakeley St., (206) LA 3-7888.
A & M Inst.; Adams & Westlake; Amprobe Inst.; Associated Res.; B & K Div.; Control Sys.; Cramer Div.; Electronics Corp. Div.; Mid-Eastern Elctrn.; Robertshaw Controls Co.; Sensitak Inst.; Simpson Elec.; Stromberg Prod.; Struthers-Dunn; Telsco Ind.; Trent, Inc.; Triplett Electrical Inst.; Western Electro-Mechanical; Weston Inst.
Selling To: ★ M,D,I.
Services: Repair, Warehouse

GILLETT, G. M., Box 99035, (206) 284-3344.
Factories: Astro Dynamics; Astrodyne; Borg-Warner Thermoelec.; Computer Inst.; Electro Magnetics Measurements; Filton Co.; Lorch-Adret Corp.; Lyn-Tron; National Cathode Corp.; Pickering & Co.; Transmagnetics; Technical Wire Prod.
Selling To: ★ M,I. **Salesman:** 1

HAIGHT, F. H. CO., 3212 Eastlake Ave. E.
Selling To: ★ A,M,D,I. **Salesmen:** 3 (eng 2)
Services: Warehouse

HIRSH, B. CO., 4013 Leary Way, N.W., (206) 783-3423. **Selling To:** ★ M,D,I.

HUGHES, R. S. CO., INC. (See Los Angeles, Calif.)

INSTRUMENT LAB., INC., 934 Elliott Ave., W., (206) AT 3-5850.
Branch: 1316 S.E. 7th Ave., Portland, Ore., (503) 234-6683.
Factories: B.I.F. Ind.; J. G. Biddle; Conax Corp.; Davis Emergency Equip.; Kato Engrg. Co.
Selling To: ★ D,I. **Salesmen:** 9 (eng 9)
Services: Repair, Warehouse

INSTRUMENT SPECIALISTS (See Glendale, Calif.)

JOHNSTON, R. CO., INC., 1011 Northeast 69th, (206) 524-5170. TWX: 910-444-2258.
Factories: Bendix Semiconductor Div.; Day-Ray Prod.; Dickson Elctrn.; Hitemp Div.; Parker Inst.; Potter Brumfield Div.; H. H. Scott; Solid State Prod.; Vitramon. **Services:** Warehouse
Selling To: ★ A,M,D,I. **Salesmen:** 5 (eng 3)

LANPHEAR, W. R., 4031 Stoneway N., (206) 633-4900.
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 2)
Services: Warehouse

LEVINSON, H. CO., 1211 E. Denny Way, (206) 323-5100. TWX: 910-444-2154.
Factories: Alfred Elctrn.; B & K Inst.; Boonton Elctrn.; Datapulse; Data Technology Corp.; FACT Sys.; Kepco; Lear Siegler; Amelco Semiconductor Div.; Teledyne, Inc.; Best Electrics Div.; Diplohmatic Div.; Electro-Cube, Inc.; Globe Industries Div.; TRW, Inc.; Gordos Corp.; JFD Electronics Co.; Hart-Advance Relay Div.; Oak Manufacturing Co.; Microtran Co., Inc.; Microwave Electronics Div.; Teledyne, Inc.; Vishay Intertechnology, Inc.
Selling To: ★ I. **Salesmen:** 3 (eng 3)
Services: Warehouse

MARTIGS, INC. (See Portland, Ore.)

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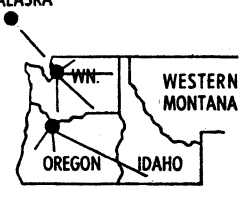

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MERRITT, R. CO., 1320 Prospect St., (206) 682-7337. TWX: 910-444-2022.
Branches: Box 759, Anchorage, Alaska, (907) BR 2-9393; 2035 S.W. 58th Ave., Portland, Ore., (503) 292-8762.
Factories: AKG; ACS; Ammon Inst.: Audio Devices; Aztec Sound; Boker Mfg. Co.; Calcon; Chicago Dynamics; Digilog; EICO; Graphic Elctrn.; Hitachi; I.R.C.; I.E.R.C.; ITT Jennings; Krylon; Mosley; Oxford; Rockford; Sansui; Staco; Switchcraft; Trusonic; United Audio Prod.
Selling To: ★ D,I. **Salesmen:** 5
Services: Repair, Warehouse

(See Advertisement Page 3285)

MONTGOMERY BROS., INC. (See Burlingame, Calif.)

NORTHWEST SALES & ENGRG. SVC., 809 Terminal Sales Bldg.
Branch: 420 Market St., San Francisco, Cal., (415) 392-9154.
Factories: Arvin Frequency Devices; Fusite Corp.; K and H Ind.; Life Inst.; Lundey Assoc.; Nitto Elec.; Vikoa, Inc.
Selling To: ★ D,I. **Salesmen:** 4 (eng 4)

NORTHWESTERN AGENCIES, INC., 4130 1st Ave. South, (206) MA 3-8882.
Branch: 3950 S. Elmran, W. Linn, Ore., CA 4-5007.
Factories: Amprobe Inst.; Atlas Sound Equip.; Bogen Comm. Div.; Carlon Plastic Conduit Co.; Carter Motor Co.; Cornell-Dubilier Elec. Co.; Heinemann Elec. Co.; ITT Wire & Cable Div.; Perry-Briggs Co.; Shure Bros. Co.; Sola Elec. Co.; Sonar Radio; Weller Elec.
Selling To: ★ A,D,I. **Salesmen:** 5 (eng 3)
Services: Warehouse

PARATECH, 2208 N.W. Market St., (206) 783-3900. TWX: 910-444-2002.
Factories: Alford Mfg.; Alto Scientific; Air-Anzac; Cipher Data Prod.; Dynamic Sys.; EDO Western; Kevlin Mfg.; McMartin Ind.; Microlab/FXR; Microwave Assoc.; MKS Inst.; Optical Elctrn.; Pastoriza; Rayproof; Resalab; RHG Elctrn. Labs.; Sage Labs.; Western Microwave Labs.; Transistor Devices.
Selling To: ★ M,I. **Services:** Warehouse

PARSONS, C.B. & CO., 5319 4th Ave., S., (206) 762-7373.
Factories: Automatic Elec.; Autotron; Cole Inst.; Curtis Dev. & Mfg.; Detroit Coil; Electro Switch; G-V Controls: ITT Gen. Contls. Inst.; Industrial Timer; Kessler-Ellis Prod.; Robertshaw Contls.

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Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)
Services: Warehouse

POLICH, A. L. INC. (See Portland, Ore.)

PETERS-DE LAET, INC. (See Burlingame, Calif.)

RIGGS, C. E. INC. (See Portland, Ore.)

SEATRONICS INC., 5616 4th Ave., S., (206) 767-4330. TWX: 910-444-2073.
Factories: Agastat Div.; Barber-Colman; BLH Elctrn.; Fenwal, Inc.; Genisco Tech.; B.F. Goodrich; Grayhill, Inc.; Lectromagnetics, Inc.; Panduit Corp.; Philamon Labs.; Sigma Inst.; Telonic Engrg.; Transistor Elctrn.; Times Wire & Cable Co.; Victoreen Inst.; Ward Leonard Elec.; Wire Co. of America.
Selling To: ★ M,D,I. **Salesmen:** 6 (eng 5)
Services: Repair, Warehouse

SLATER, R. R. CO., 713 Terminal Sales Bldg., (206) 622-3860.
Branch: 420 Market St., San Francisco, CA 9-4111. TWX: 415-392-9154.
Factories: Arvin Frequency Devices; Fusite Corp.; Life Inst.; Lunday Assoc.; Nitto Elec.; Vikoa.
Selling To: ★ I. **Salesmen:** 4 (eng 4)

SIMPLEX WEST INC. (See Compton, Calif.)

SMITH, D. SALES CO., 2320 N. 45th St., (206) ME 3-3160.
Factories: Aerovox Corp.; Airtron; Allied Contl., Co.; Cinch Elctrn. Grp.; Cinch Monadnock; Contact, Inc.; Dit-MCO.; Frazier, Inc.; Grant Pulley & Hardware Co.; Resistance Prod.; B. K. Sweeney; Ucinite Co.; Webster Elec. Co.
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 2)
Services: Warehouse

SOSINE, E. H., 3618 39th Ave. W., (206) 283-9017.
Factories: Goring-Kerr; Hasa Prod.; Kollmorgen Color Sys.; Westline Prod.
Selling To: ★ M,D,I. **Salesman:** 1 (eng 1)

SQUIBB, R. K. INC., 655 N.E. Northlake Pl., (206) 632-2450.
Factories: Fidelitone; Gavin Inst.; Guardian Elec. Mfg.; Keystone Elctrn.; Kings Elctrn.; Mercury Elctrn.; Ohmite Mfg.; Petersen Radio Co.; Pomona Elctrn.; Reeves Inst. Div.; Sonotone; Staco.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 1)
Services: Direct Mail

TECHNICAL SALES CO. INC., 4619 W. Marginal Way S.W., (206) 523-4063.
Selling To: ★ M,D,I. **Salesmen:** 2 (eng 2)
Services: Repair, Warehouse, Direct Mail

TESTCO, Room 219 Admin. Bldg., Boeing Field, (206) RO 2-8220. TWX: 910-444-2148.
Branches: 941 Charleston Road, Palo Alto, Cal., (415) DA 6-5320. TWX: 910-373-1728; 4341 W. Commonwealth Ave., Fullerton, Calif., (714) 521-1842.
Factories: Automated Specialties; Bowmar Inst.; Chelton Ltd.; Grigsby-Barton; Hamlin, Inc.; Ledex, Inc.; Litton Encoder Div.; Smiths Ind. Ltd.
Selling To: ★ M,I,Airframe **Salesmen:** 5 (eng 5)

THORSON CO. (See Los Angeles, Calif.)

TUDOR, J. A. & ASSOC., INC., 2605 Western Ave., (206) 682-7444.
Branches: 14 N.E. Tillamook, Portland, Ore. (503) 288-5154; N. 1413 Division, Spokane, Wash., (509) 327-3328; 1257 W. 6th Ave., Eugene, Ore., (503) 344-9212.
Factories: Allen-Bradley Co.; Anchor Mfg.; Automatic Timing & Controls; Fairbanks Morse; Glenn Pacific; Healy-Ruff Co.; Insul-8-Corp.; Rauland Elec.; Sprague Elec.; Telemotive, Div.
Selling To: ★ D,I. **Salesmen:** 10 (eng 7)

WEBER, D. G. CO. (See Portland, Ore.)

WIDDEKIND, M. K., 815 W. Ewing, (206) 284-8020.
Factories: Argos Prod.; Audio Inst.; Blonder-Tongue Labs.; Canon U.S.A.; Clevite Brush: Columbia Wire; Fanon Elctrn. Ind.; Freed Transformer; Marco-Oak Ind.; McCoy/Delta-F; Millivac Inst.; National Tel-Tronics; Oak/Electro/Netics; Oaktron Ind.; Sarkes-Tarzian; Scala Antennas; Sigma Ind.; Tandberg of America; Tape-Athon; Telephone Comp.; Turner Microphones; Video Comp.; Waber Elctrn.
Selling To: ★ A,D,I. **Salesmen:** 4 (eng 2)
Services: Warehouse

Spokane

PETERS-DE-LAET, INC. (See Burlingame, Calif.)

RIGGS, C. E. INC. (See Portland, Ore.)

TUDOR, J. A. & ASSOC., INC. (See Seattle, Wash.)

WEBER, D. G. CO. (See Portland, Ore.)

WISCONSIN

Brookfield

PIVAN ENGRG. CO. (See Chicago, Ill.)

Cedarburg

HUNTER, T. B. ASSOCS. (See Chicago, Ill.)

Madison

COLE, G. McL. CO. (See Chicago, Ill.)

Milwaukee

BRAUN, W. M. & ASSOCS., INC., 316 E. Silver Spring Dr., (414) 332-1040.
Factories: Hevi-Duty Elec.; Mackworth Rees; Sola Elec.; Daniel Woodhead.
Selling To: ★ D,I. **Salesmen:** 3

DeVOS-PRINZ SALES CORP., 1819 E. Kenilworth, (414) 272-0356.
Factories: ETC Inc.; American Zettler; Westlake Insulated Wire.
Selling To: ★ I. **Salesmen:** 3 (eng 2)

HONKAMP SALES CO., 11120 W. Ruby Ave., (414) 463-2530.
Factories: Grand Ind. Inc.; Illinois Condenser Sales; Life Inst.; Methode E.ctrn.; Resistors.
Selling To: ★ D,I. **Salesmen:** 2 (eng 1)
Services: Sales

JACOBS, M. F. CO., 4160 N. Oakland Ave., (414) 962-7070.
Factories: Associated Res.; Columbia Elec. Mfg.; H. H. Sticht Co.; Vibroscope, Inc.
Selling To: ★ D,I. **Salesman:** 1 (eng 1)

LOEB, E. R. SALES CO., Box 3643, (414) 964-2155.
Factories: Mercury Elctrn.; Sonic Ind.; Toshiba America, Inc.
Selling To: ★ A,D. **Salesman:** 1
Services: Repair, Warehouse

PETERS, W. J., 10031 W. Lisbon Ave., (414) 463-9660.
Factories: Acme Screw Co.; Allied Decals, Inc.; Barwood Mfg.; Gries Reproducer; Jacobson Mfg.; Noble & Westbrook.
Selling To: ★ I. **Salesmen:** 2

POLACHECK, C. S., 4027 W. Downer Ave., (414) 964-5565.
Selling To: ★ I. **Salesman:** 1

Oak Creek

M. Q. & ASSOCS. (See Chicago, Ill.)

Pewaukee

PETITT, G. CO., INC. (See River Forest, Ill.)

Waukesha

DIETHERT, R. CO., INC. (See Chicago, Ill.)

GREEN, L. F. & ASSOCS. (See Chicago, Ill.)

LINCOLN, HODGES & ASSOCS. (See Chicago, Ill.)

MIDWEST ELCTRN. SALES (See Chicago, Ill.)

TWIST, J. G. CO. (See Chicago, Ill.)

SYSTEMS ENGRG. ASSOCS., Box 526, (414) 782-3388.
Factories: Analog Devices, Inc.; Atec, Inc.; Cal Inst.; Cimron Div. Computer Comm.; Elctrn. Assoc.; Flo-Tron; S. Himmelstein; Ind. Electronetics Corp.; Info Inst.; Matrix Corp.; Micro Test; Peripheral Equip.; Remex Elctrn.; R.F. Comm.; Robins Data Devices; Sangamo Elec.; Shepard Labs; Techni-Rite Elctrn.; Theta Inst.; Todd Prod.; Transducers, Inc.
Selling To: ★ M,I. **Salesmen:** 10 (eng 10)
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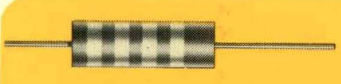

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